
# Hazard Mitigation Plan

Pacific County, Washington

2022

TWORIVERS
EMERGENCY MANAGEMENT

Two Rivers Emergency Management, LLC is pleased to submit this Hazard Mitigation Plan (the "Deliverable") to the Pacific County Emergency Management Agency (the "Client"). The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of other organizations. This Deliverable was developed with input from, and in collaboration with, the Client. It is subject to the terms of the contract dated March 11, 2021 between Two Rivers Emergency Management, LLC and the Client, and constitutes the entire agreement between them. The Contract includes any and all representations, warranties, indemnifications, and remedies on which the Client may rely. Because of the specialized knowledge of the Client about how this Deliverable is to be used, it should be used only by the Client and its affiliates, in a manner that relies on the Client's discretion and expertise, and only for the purposes contemplated by the Contract. This Deliverable is not to be used in any other manner or relied upon by any other person.

# Glossary

BRIC – Building Resilient Infrastructure and Communities
CDBG – Community Development Block Grant Program
CRS – Community Rating System
DNR – Department of Natural Resources
EAP – Emergency Action Plan
EMA – Emergency Management Agency
EOC – Emergency Operations Center
FEMA – Federal Emergency Management Agency
FMA – Flood Mitigation Assistance Grant Program
HMA – Hazard Mitigation Assistance
HMGP – Hazard Mitigation Grant Program
HMP – Hazard Mitigation Plan
NADM – North American Drought Monitor
NFHL – National Flood Hazard Layer
NFIP – National Floodplain Insurance Program
NID – National Inventory of Dams
NOAA – National Oceanic and Atmospheric Administration
NWS – National Weather Service
PCEMA – Pacific County Emergency Management Agency
PDM – Pre-Disaster Mitigation Grant Program
SBRFA – South Beach Regional Fire Authority
SD – School District
SFHA – Special Flood Hazard Area
TREM – Two Rivers Emergency Management
USACE – United States Army Corps of Engineers
USCB – United State Census Bureau
USDA – United States Department of Agriculture
USGS – United States Geological Survey
WA EMD – Washington Emergency Management Division
WUI – Wildland Urban Interface

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# Section 1 – Plan Development

## *Plan Purpose*

The 2021 Pacific County Hazard Mitigation Plan (HMP) revision is threefold in its purpose. Strictly speaking, the Pacific County Hazard Mitigation Plan provides guidance to substantially and permanently reduce Pacific County and its communities' vulnerability to natural hazards.

This plan revision encompasses the continuation and updating of this original mission by incorporating new GIS technologies, improving its risk assessment methodologies, and recalibrating its mitigation strategies based on an assessment of the previous plan, approved in May of 2016, and the previous plan's usefulness over the past five years.

Secondly, participation in and the adoption of this plan grants the adopting entity the ability to apply for multiple grant funding programs through the Federal Emergency Management Agency (FEMA).

Additionally, a tertiary purpose of the plan is to promote sound public policy and support other local, regional, and state planning efforts which have the effects of protecting citizens, critical facilities, infrastructure, private property, and the natural environment. The development of this plan revision does so by increasing public awareness and education, collaborating with other planning organizations and governments engaged in planning efforts, serving as a reference and resource for the public, various governments, and other entities.

## *Plan Organization*

The Pacific County Hazard Mitigation Plan was developed and organized within the rules and regulations established under the 44 Code of Federal Regulation 201.6. This plan contains sections detailing the planning process, Pacific County's communities, other participating entities and the planning area, a hazard vulnerability and risk assessment, capabilities assessment, and a mitigation strategy designed for the purpose of guiding Pacific County and the plan's participants to become more disaster-resilient communities.

## *Plan Financing*

The Pacific County Hazard Mitigation Plan has been financed by Pacific County and a FEMA Hazard Mitigation Grant Program (HMGP) grant administered through the State of Washington's Emergency Management Division (WA EMD). The federal grant provided 75% of the total plan's cost while Pacific County contributes 25%.

## Plan Participation

The Pacific County Hazard Mitigation Plan was developed as the result of an ongoing collaborative effort between the full range of stakeholders in the planning area, local authorities, public school district, municipal jurisdictions, and the State of Washington. This effort was led by the Pacific County Emergency Management Agency.

Concerns, capabilities, interests and historical data were gathered through interviews with stakeholders from within the communities, along with a number of electronic datasets, and ongoing planning committee work sessions. The public were granted opportunities to provide their input, influence, share knowledge, and be active participants in the plan's development. This was accomplished through a number of public outreach campaigns in the form of an on-site meeting and internet accessible surveys. Any comments, questions, and discussions resulting from these activities were given consideration in the development of this plan.

## Approval & Adoption

The Pacific County Hazard Mitigation Plan was submitted for review to the WA EMD on December 31st, 2021. Following the state's review, the plan was submitted to the FEMA Region VI office for federal review. FEMA Region X granted "Approval Pending Adoption" on March 11, 2022.

This plan has officially been adopted by all participating municipalities, school districts, and institutions.

# 1.1 – Planning Process

Pacific County's revision process began in May of 2021 when they contracted Two Rivers Emergency Management to develop their hazard mitigation plan update.

Two planning events were held throughout the planning process. Plan development kicked-off on 29 April 2021. Stakeholders from every municipality, public-school district in the county, numerous stakeholder organizations, and members of the public were invited to attend and participate. Additionally, neighboring EMAs were invited. This meeting was advertised for period of two weeks in advance. This event was held virtually due to COVID-19 restrictions.

This meeting delivered an understanding of the planning processes and steps required to update, including the organizing of resources, assessment of hazards, development of a mitigation plan, and steps to implementing the plan and monitoring its progress. All municipalities in the county actively participated in the process through solicitation, providing input, or participation in meetings. Details and documentation of stakeholder participation can be found in Section 1.2 and Appendix A – Plan Participation.

From December 8th through December 22nd, 2021, the PCEMA held a draft review and comment period that was open to the public. Advertisements were made on social media accounts and the county's website for two weeks. The plan was made available online in PDF format. No members of the public inquired about the plan. The plan draft was also distributed to the plan's primary stakeholders for review and presented to them on December 2nd, 2021.

Throughout the process the public was given opportunities to review plan drafts, ask questions, and provide input on hazards. They were also invited to provide feedback on mitigation project prioritization, hazard identification, and hazard ranking. This was accomplished through their inclusion in the virtual meetings as well as an extensive online outreach campaign. Details and documentation of the public's participation can be found in Section 1.3 and Appendix A – Plan Participation.

The 2021 Pacific County Hazard Mitigation Plan encompasses the following 24 organizations:

*Pacific County*

*City of Ilwaco*
*City of Long Beach*
*City of Raymond*
*City of South Bend*

*Naselle-Grays River Valley School District*
*Ocean Beach School District*
*South Bend School District*
*Willapa Valley School District*

*Ocean Beach Hospital*
*Willapa Harbor Hospital*

*Fire Protection District #1*
*Fire Protection District #2*
*Fire Protection District #3*
*Fire Protection District #4*
*Fire Protection District #6*
*South Beach Regional Fire Authority*

*Port of Chinook*
*Port of Ilwaco*
*Port of Peninsula*
*Port of Willapa Harbor*

*Pacific Transit*
*Pacific County Public Drainage District #1*
*Pacific County Public Utility District #2*

## 1.2 – Stakeholder Engagement

The Pacific County Hazard Mitigation Plan includes the governmental and education entities within Pacific County working together for the development and ongoing maintenance of this plan. The participants are grouped into four categories.

***Municipalities***
This group consists of representatives from municipal governments within the planning area.

***Education Entities***
This group consists of representatives from the public-school districts serving Pacific County.

***Countywide Service Organizations***
This group consists of organizations that provide public services throughout the county such as Pacific Transit, Pacific County Drainage District #1, and Pacific County Public Utility District #2.

***Fire Protection Districts***
These entities are responsible for providing fire protection and prevention in their designated territories.

***Hospitals***
There are two hospitals within Pacific County and their operations are crucial every day as well as after a disaster.

***Ports***
These entities manage and operate the numerous ports throughout Pacific County that are critical to the local economy.

***The Public***
FEMA requires this planning effort to be open to constant input from interested citizens in compliance with the Sunshine Laws. In Washington, public meetings must comply with Washington Open Meetings Law, unless established by statutory exemption. Therefore, any individual citizens who wish to be involved in this effort to mitigate future disasters were encourage to attend the on-site meetings and complete the online mitigation survey to solicit relevant comments and concerns to be incorporated into the content of this plan.

Representatives from each group took part in periodic planning meetings, public meetings and events and individual meetings with TREM and PCEMA staff. Their specific involvement included activities such as collection and development of planning information, providing input into the planning process, reviewing draft editions of the plan and providing written documentation demonstrating their commitment to mitigation and intent to adopt the final approved plan. Although neighboring county EMAs were invited, none participated.

Each participating entity was expected to attend at least one of the on-site meetings, submit required data as requested, participate in the development of general information for the plan as well as their own individual planning information, mitigation strategies and initiatives, participate in a public review process, and submit the plan for formal adoption through their respective governing body. Information was kept on attendance, input and providing requested documentation. In the event an entity did not provide representation to a meeting, individual outreach was conducted to garner their inclusion.

The following table details the plan participants who participated in the hazard mitigation planning process. This list contains all relevant local and state agencies involved in hazard mitigation activities, agencies that have the authority to regulate development, and any appropriate neighboring communities.

**Table 1.1 – Stakeholders**

| Name | Organization | Position |
|---|---|---|
| Scott McDougall | Pacific County Emergency Management Agency | Director |
| Blair Swogger | Pacific County Public Works | GIS Analyst/Parks Manager |
| Todd Strozyk | Pacific County Health & Human Services | Program Director |
| Bruce Walker | Pacific County Assessor's Office | Assessor |
| Edward Heffernan | Pacific County E911 | Director |
| Joyce Kidd | Pacific County | Auditor |
| Andrew Seaman | Pacific County | IT Manager |
| Kathy Spoor | Pacific County | County Administrative Officer |
| Mike Casinelli | City of Ilwaco | Mayor |
| David Glasson | City of Long Beach | Administrator |
| Scott Pearson | City of Raymond Public Works | Administrative Assistant |
| Dennis Houk | City of South Bend | City Director |
| Lisa Nelson | Naselle-Grays River Valley School District | Superintendent |
| Amy Huntley | Ocean Beach School District | Superintendent |
| Barbara Cenci | South Bend School District | Business Manager |
| Jon Tienhaara | South Bend School District | Superintendent |
| Nancy Morris | Willapa Valley School District | Superintendent |
| Jacob Brundage | Fire Protection District #1 | Fire Chief |
| Coty Grote | Fire Protection District #2 | Fire Chief |
| Gary Schwiesow | Fire Protection District #3 | Fire Chief |
| Doug Sandell | Fire Protection District #4 | Fire Chief |
| Hugh Ahanatook | Fire Protection District #6 | Assistant Fire Chief |
| Dennis Benn | South Beach Regional Fire Authority | Fire Chief |
| Jaala Langley | Ocean Beach Hospital | Clinical Nurse Manager |
| Renee Clements | Willapa Harbor Hospital | Chief Operations Office |
| Mike Wagner | Pacific Transit | Executive Director |
| Mike Williams | Pacific Transit | Finance Officer |
| April Hawkinson | Port of Chinook/Port of Ilwaco | Manager |
| Jay Personius | Port of Peninsula | Executive Director |
| Jim Sayce | Port of Willapa Harbor | Manager |
| David Cottrell | Public Drainage District #1 | Commission Chairman |
| Jason Dunsmoor | Public Utility District #2 | General Manager |

Throughout the plan's development, TREM actively engaged stakeholders to solicit their review and feedback. Discussions were held as to what should and should not be considered a critical facility or portion of their infrastructure. This information was the compiled and used to drive the analysis in Sections 2, 3, and 4 of this plan. Additionally, they provided feedback on which hazards they considered to be the most dangerous from a boot-on-the-ground perspective. This perspective was evaluated alongside the statistical approach utilizing federal and state databases. This information provided important insight that was necessary to develop the risk assessment and mitigation strategy portions of the plan.

Stakeholder input was solicited as to the local planning processes, ordinances, codes and capabilities. Stakeholders were also engaged as to how they felt their mitigation plan was used and implemented since the development of their last plan and what could be improved in comparison. TREM collected information from stakeholders as to any mitigation actions and projects that were implemented since the development of their last plan and specifically what their priority projects would be for the next 5-year cycle of this mitigation plan. This input was critical to the development of the mitigation strategy outlined later in this plan.

## 1.3 – Public Engagement

PCEMA provided the opportunity for neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties to be involved in the planning process. The public was notified of open meetings via PCEMA's website, social media accounts, and a local newspaper, the Chinook Observer. Additionally, advertisements for the online public survey were advertised on these sites.

Relevant federal, state, and local governments, private, non-profit, regional organizations, and agencies with the authority to regulate development were invited to provide input and technical expertise through the public notices. They were contacted directly when their expertise was deemed necessary to the success of the plan.

At the public on-site meetings, TREM presented and outlined the mitigation plan update process to the public. During the first stakeholder meeting, TREM presented and outlined the mitigation plan update process and discussed stakeholder participation and expectations. In this meeting, the public and other stakeholders were encouraged to ask questions and provide their input.

The draft of this plan was available for public review via a TREM hosted project for the website during the 2-week draft review period.

### *Continued Public Involvement*

Pacific County is dedicated to involving the public in the continual shaping of its hazard mitigation plan and development of its mitigation projects and activities.

The PCEMA will continue to keep the public informed about its hazard mitigation projects and activities through its website. Additionally, it will work to update its website and eventually provide a "comments/suggestions" option for the public to submit their input.

In the event that this hazard mitigation plan undergoes any major developmental changes over its 5-year life cycle, the PCEMA will inform the public of these changes via a publicized and open forum meeting.

Copies of the Pacific County Hazard Mitigation Plan will be available on their website for public distribution.

# 1.4 – Planning Resources

This plan's content includes and was influenced by numerous documents and technical resources provided by the plan's stakeholders and other relevant entities. The following documents and technical resources were reviewed for applicable information to the development of this plan:

## *Documentation Resources*

***Pacific County Hazard Mitigation Plan (2016)***
Pacific County's latest FEMA approved hazard mitigation plan expired in May of 2021. The plan was thoroughly reviewed and components have been updated and incorporated throughout.

***County and City Municipal Codes***
Each municipality's local ordinances, zoning, land use plans, and comprehensive plans (where available) have been reviewed for provisions relevant to hazard mitigation. This information has been incorporated throughout Section 4 of this plan.

***School District Facility Master Plans***
The latest approved update to this plan was reviewed for demographic and community projection information and their planning process.

***Washington State Enhanced Hazard Mitigation Plan (2018)***
The State of Washington's current hazard mitigation plan was reviewed for general guidance in the cases of their comparative statewide risk assessment, their initial selection of at-risk hazards, and local planning technical assistance and development strategy.

## *Technical Resources*

***FEMA National Flood Hazard Layer (NFHL)***
FEMA's NFHL data was used in mapping floodplain locations and estimating potential flood impacts and loss estimates.

***National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC)***
Weather data and historical events and their narratives were primarily provided by NOAA's NCDC.

***Pacific County Department of Public Works***
The Pacific County Department of Public Works provided the GIS data of the coastal erosion around the North Cove area that is depicted in Section 3.

***USACE National Inventory of Dams (NID)***
The USACE NID is a congressionally authorized database which documents dams in the U.S. and its territories. This database attempts to maintain centralized data for all private and public dams. Information from the NID was used in the development of the Dam Failures hazard profile in this plan.

***United States Census Bureau (USCB)***
The USCB publicly publishes a number of GIS datasets that were used in developing the basemap layers used throughout this plan.

***United State Geologic Survey (USGS)***
USGS services provided historical earthquake data to show the negligible risk associated with the planning area.

***Washington Department of Natural Resources***
The Washington DNR provided access to numerous databases used throughout the risk assessment of this plan. Most importantly they provided landslide, earthquake, and tsunami hazard data.

# 1.5 - Plan Maintenance

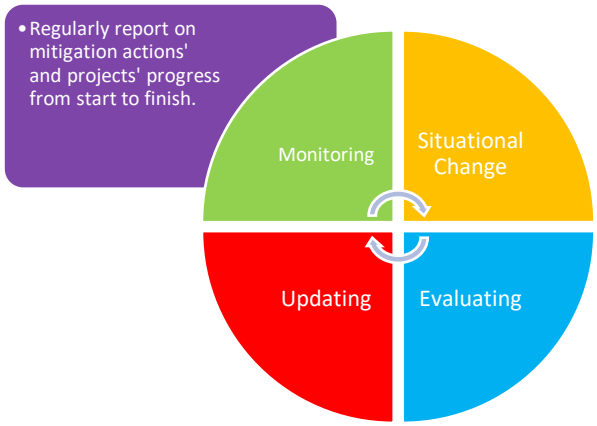
PCEMA has developed a method to ensure monitoring, evaluation, and updating of its HMP. Upon adoption of the Pacific County HMP, the PCEMA will form a subcommittee on mitigation projects comprised of volunteer members from its LEPC. The chair of the subcommittee will be determined by appointment from the PCEMA Director. Additional members may be added based on necessity. The sub-committee will submit an annual report to the County Judge.


Please see the Pacific County HMP Quarterly Report form at the end of this section.

The PCEMA may request a non-scheduled report on the monitoring, evaluation, or updating of any portion of the HMP due to irregular progress on mitigation actions and or projects, in the aftermath of a hazard event, or for any reason deemed appropriate.

## *Plan Monitoring*

Plan monitoring can be defined as the ongoing process by which stakeholders obtain regular feedback on the progress being made towards achieving their goals and objectives. In the more limited approach, monitoring may focus on tracking projects and the use of the agency's resources. In the broader approach, monitoring also involves tracking strategies and actions being taken by partners and non-partners, and figuring out what new strategies and actions need to be taken to ensure progress towards the most important results.




A monitoring report will be written and submitted to the County Board of Commissioners annually during one of their quarterly commission meetings or when triggered by a situation change. The monitoring report will answer the following questions:

- Is the mitigation project under, over, or on budget?
- Is the mitigation project behind, ahead of, or on schedule?
- Are there any changes in Pacific County's capabilities which impact the HMP?
- Are there any changes in Pacific County's hazard risk?
- Has the mitigation action been initiated or its initiation planned?
- If applicable, has participation in a mitigation action's collaboration been regular?
- If any, what plan updates occurred, why they occurred, and what is their impact?

The plan maintenance process is cyclical and maintenance items can operate simultaneously within the process.

## *Plan Evaluating*

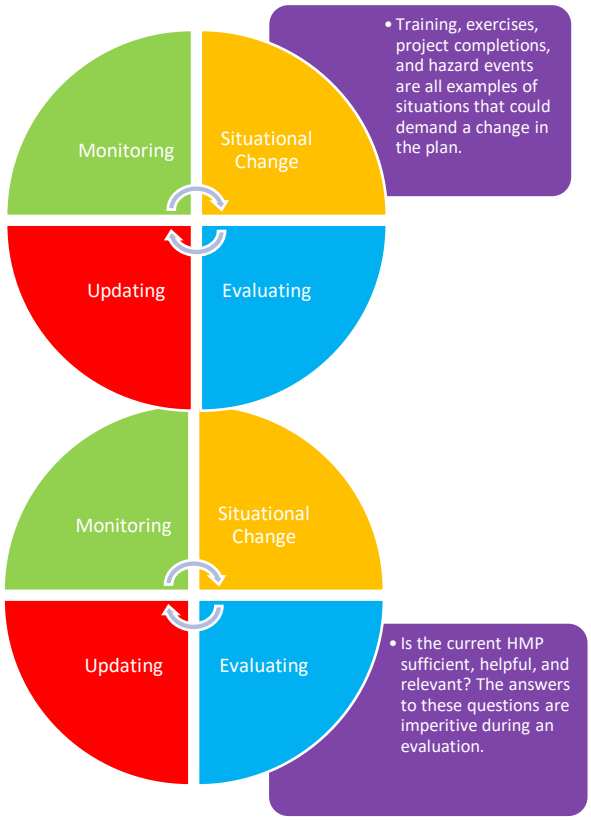
A plan evaluation is a rigorous and independent assessment of either completed or ongoing activities to determine the extent to which they are achieving stated objectives and contributing to decision making.

An evaluation report will be written and submitted to PCEMA's Director when the situation dictates. The following situations are typical examples of when an evaluation will be necessary:

- Post hazard event
- Post training exercise
- Post tabletop or drill exercise
- Significant change or completion of a mitigation project
- Significant change or completion of a mitigation action

An evaluation report will ask the following questions in response to the previously listed events:

- Do the mitigation objectives and goals continue to address the current hazards?
- Are there new or previously unforeseen hazards?
- Are current resources appropriate for implementing a mitigation project?
- Was the outcome of a mitigation action/project expected?
- Are there implementation problems?
- Are there coordination problems?



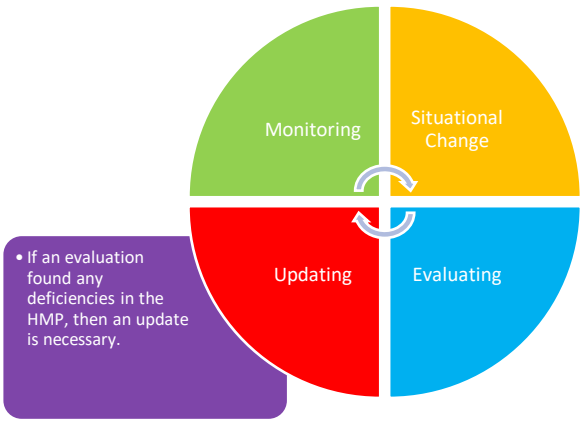

## *Plan Updating*

Typically, a HMP update is initiated upon the completion of a plan evaluation and even then, only when the evaluation determines an update is appropriate. Additionally, when new hazard data becomes available it will be added to the HMP. New data will be confirmed or denied along with the annual HMP report. For whatever reason, a HMP update can be written anytime it is deemed necessary by the Pacific County EMA.

Pacific County will begin their update process three years from this plan's adoption according to FEMA DMA2000 guidelines on local mitigation plan updates under the direction of the PCEMA's Director.

*1.5 – Plan Maintenance*

**Pacific County Mitigation Planning Committee**
**Pacific County Hazard Mitigation Plan Annual Report**



***Hazard Mitigation Plan Sub Committee Chair:***
***Meeting Date:***
***Plan Approval Date:***
***Plan Expiration Date:***

**Have there been any disasters or training events since the last report? If so, list them below:**

| Disaster Number/Training Event | Hazard Type(s) | Was the hazard expected or unforeseen? | Is a plan update required? |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| Example: DR-1000 | Volcanic Eruption | Unforeseen | Yes |
| Example: Annual Training | Flash Flooding | Expected | No |

**Mitigation Projects:**

| Project Name | Participating Jurisdictions | Proposed/Schedules/In Progress/Completed | Behind/Ahead /On-Schedule | Estimated Completion Date |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| Example: Floodproofing | Gallup | In Progress | On-Schedule | 1/1/2020 |

**Miscellaneous Notes:**

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# Section 2 – Community Profiles

This section provides a broad perspective, brief history, socio economic, geographical, and development information on the planning area and all of the plan's participants.

Pacific County was formed in 1851 under the Oregon Territory. It boasts a robust tourism economy, 25% of the American oyster harvest, and an impressively low crime rate. Pacific County contains beautiful, lush, and green mountainous coastline exemplifying the Pacific Northwest. It includes sandy beaches and rock walls along its coast and the Columbia River to its south. Inland, it is primarily mountainous with numerous streams and rivers in its valleys where the majority of it population resides.

Its county seat is the City of South Bend and in full occupies a total land area of 933 square miles. The U.S. Census Bureau estimates the 2020 population of the planning area totals 20,984 people occupying 15,547 residential housing units.

The countywide population has experienced steady growth over the last decade. Each of the municipalities within Pacific County have had similar individual population growth. Whether nor not these demographics characteristics have an impact on hazard vulnerability and risk is discussed in Section 3.

**Table 2.1 – Population Change**

| Year | Estimated Population | Percent Change from 2010 | Percent Change from 2016 |
|---|---|---|---|
| 2010 | 20,920 | - | - |
| 2016 | 21,285 | 1.74% | - |
| 2020 | 22,984 | 9.87% | 7.98% |

**The data are from the U.S. Census Bureau*

The planning area contains an estimated $1,842,569,000 worth of municipal structural inventory broken down into six different structural type classes. The following tables summarize this breakdown.

**Table 2.2 – Municipal Structural Summary**

| Structure Class | Structures | Total Class Value |
|---|---|---|
| Agricultural | 75 | $21,089,000 |
| Commercial | 618 | $387,899,000 |
| Government | 30 | $27,731,000 |
| Industrial | 154 | $84,937,000 |
| Residential | 14,186 | $1,199,610,000 |
| Multi-Unit Residential* | 136 | $121,303,000 |
| Total = | 15,199 | $1,842,569,000 |

**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the Federal Emergency Management Agency*

### Table 2.3– Municipal Structures by Count

| Municipality | Ag | Com | Gov | Ind | Res | Res-M | Total |
|---|---|---|---|---|---|---|---|
| Pacific County | 65 | 296 | 15 | 108 | 10,705 | 59 | 11,248 |
| Ilwaco | 3 | 42 | 3 | 10 | 492 | 9 | 559 |
| Long Beach | 1 | 165 | 2 | 8 | 1,266 | 32 | 1,474 |
| Raymond | 4 | 75 | 2 | 18 | 988 | 27 | 1,114 |
| South Bend | 2 | 40 | 8 | 10 | 735 | 9 | 804 |
| Total = | 75 | 618 | 30 | 154 | 14,186 | 136 | 15,199 |

**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the U.S. Census Bureau and FEMA*

### Table 2.4 – Municipal Structures by Value

| Municipality | Ag | Com | Gov | Ind | Res | Res-M | Total |
|---|---|---|---|---|---|---|---|
| Pacific County | $18,954,000 | $130,866,000 | $13,942,000 | $60,195,000 | $911,548,000 | $5,089,700 | $1,140,594,700 |
| Ilwaco | $444,000 | $39,154,000 | $1,387,000 | $4,273,000 | $40,060,000 | $8,426,000 | $93,744,000 |
| Long Beach | $424,000 | $138,683,000 | $845,000 | $3,545,000 | $105,851,000 | $33,456,000 | $282,804,000 |
| Raymond | $1,000,000 | $48,164,000 | $3,589,000 | $10,576,000 | $81,856,000 | $23,526,000 | $168,711,000 |
| South Bend | $267,000 | $31,032,000 | $7,968,000 | $6,348,000 | $60,295,000 | $4,998,000 | $110,908,000 |
| Total = | $21,089,000 | $387,899,000 | $27,731,000 | $84,937,000 | $1,199,610,000 | $75,495,700 | $1,796,761,700 |

**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the U.S. Census Bureau and FEMA*

The PCEMA has identified a total of 66 critical facilities throughout the planning area. These faciliites are deemed critical either by the nature in which they maintain basic services or that they house a high density of vulnerable populations. A breakdown by facility type of the 66 critical facilities is listed in the table below and shown in the map on the following page.

### Table 2.5 – Critical Facilities, Planning Area

| Facility Type | Critical Facilities |
|---|---|
| Electric Utility | 10 |
| Fire Prevention/EMS | 19 |
| Government | 16 |
| Law Enforcement | 1 |
| Public Works | 5 |
| Water Utility | 15 |
| Total = | 66 |

**The data are from Pacific County*

**Map 2.1 – Community Profile, Washington**

## 2.1 - Pacific County (Unincorporated)

The latest Census Bureau estimate places 15,670 people living in unincorporated areas of Pacific County occupying 11,309 housing units. The unincorporated portions of Pacific County have only grown by a slim percentage since the development of their last plan in 2016.

**Table 2.6 – Population Change, Pacific County (Unincorporated)**

| Year | Estimated Population | Percent Change from 2010 | Percent Change from 2016 |
|---|---|---|---|
| 2010 | 14,073 | - | - |
| 2016 | 14,450 | 2.68% | - |
| 2020 | 15,670 | 11.35% | 8.44% |

**The data are from the U.S. Census Bureau*

The unincorporated portions of Pacific County contain an estimated $1,186,402,000 worth of municipal structural inventory broken down into six different structural type classes. The following table shows this breakdown.

**Table 2.7 – Structural Inventory, Pacific County (Unincorporated)**

| Structure Class | Structures | Total Class Value |
|---|---|---|
| Agricultural | 65 | $18,954,000 |
| Commercial | 296 | $130,866,000 |
| Government | 15 | $13,942,000 |
| Industrial | 108 | $60,195,000 |
| Residential | 10,705 | $911,548,000 |
| Multi-Unit Residential* | 59 | $50,897,000 |
| Total = | 11,248 | $1,186,402,000 |

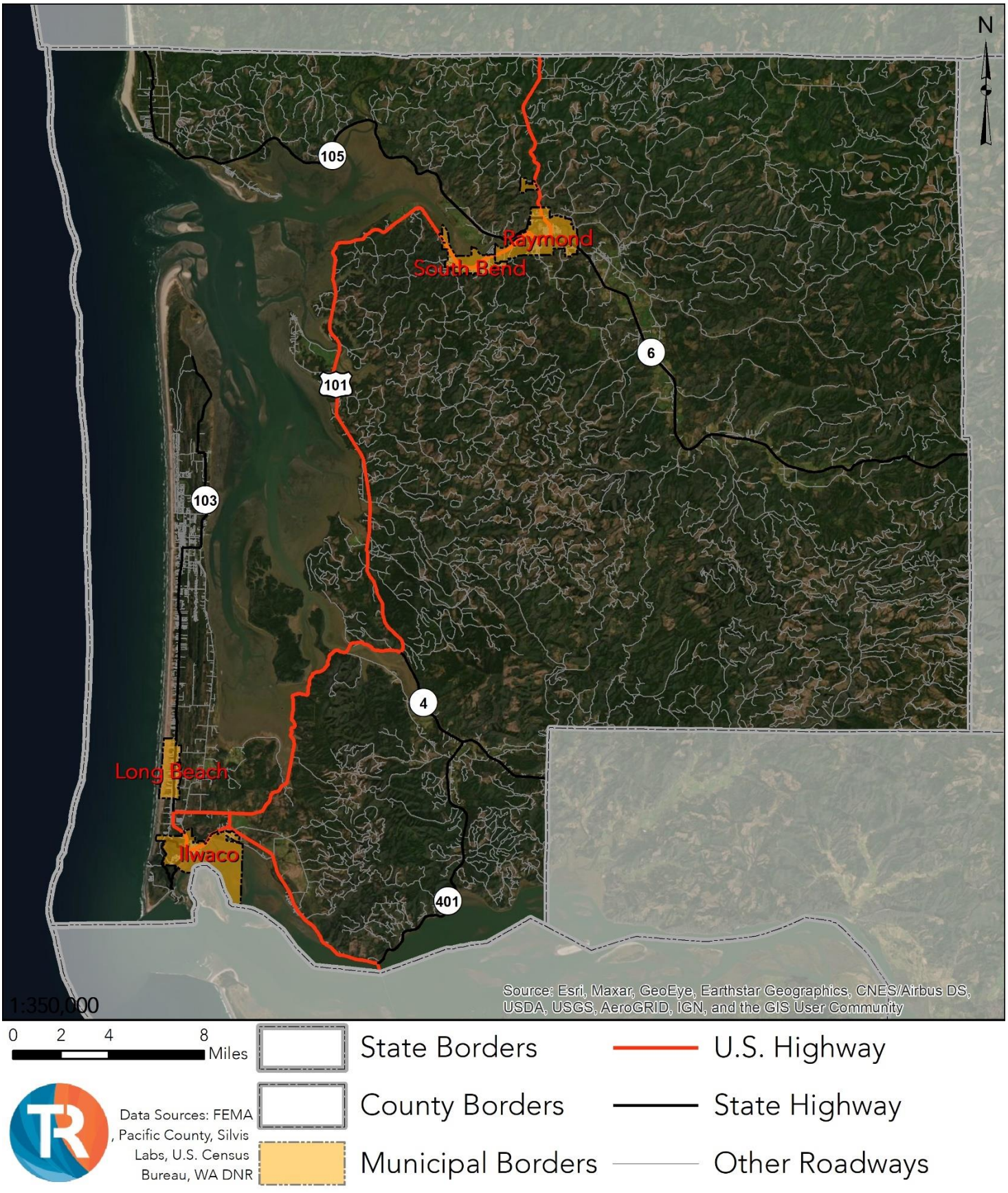
**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the Federal Emergency Management Agency*

Of the 66 critical facilities within the planning area, four are owned and operated by the Pacific County Government. The table below lists these facilities.

**Table 2.8 – Critical Facilities, Pacific County (Unincorporated)**

| Name | Type |
|---|---|
| Pacific County Admin - South County | Local Government |
| Pacific County Administration | Local Government |
| Pacific County Annex - Raymond | Local Government |
| Pacific County Courthouse | Local Government |

**Map 2.2 – Community Profile, Pacific County**



## 2.2 - Ilwaco

The latest Census Bureau estimate places 1,006 people living in Ilwaco occupying 563 housing units. Its population has declined moderately since participation in their last plan in 2016.

**Table 2.9 – Population Change, Ilwaco**

| Year | Estimated Population | Percent Change from 2010 | Percent Change from 2016 |
|---|---|---|---|
| 2010 | 936 | - | - |
| 2016 | 930 | -0.64% | - |
| 2020 | 1,006 | 7.48% | 7.48% |

**The data are from the U.S. Census Bureau*

Ilwaco contains an estimated $93,744,000 worth of municipal structural inventory broken down into six different structural type classes. The following table shows this breakdown.

**Table 2.10 – Structural Inventory, Ilwaco**

| Structure Class | Structures | Total Class Value |
|---|---|---|
| Agricultural | 3 | $444,000 |
| Commercial | 42 | $39,154,000 |
| Government | 3 | $1,387,000 |
| Industrial | 10 | $4,273,000 |
| Residential | 492 | $40,060,000 |
| Multi-Unit Residential* | 9 | $8,426,000 |
| Total = | 559 | $93,744,000 |

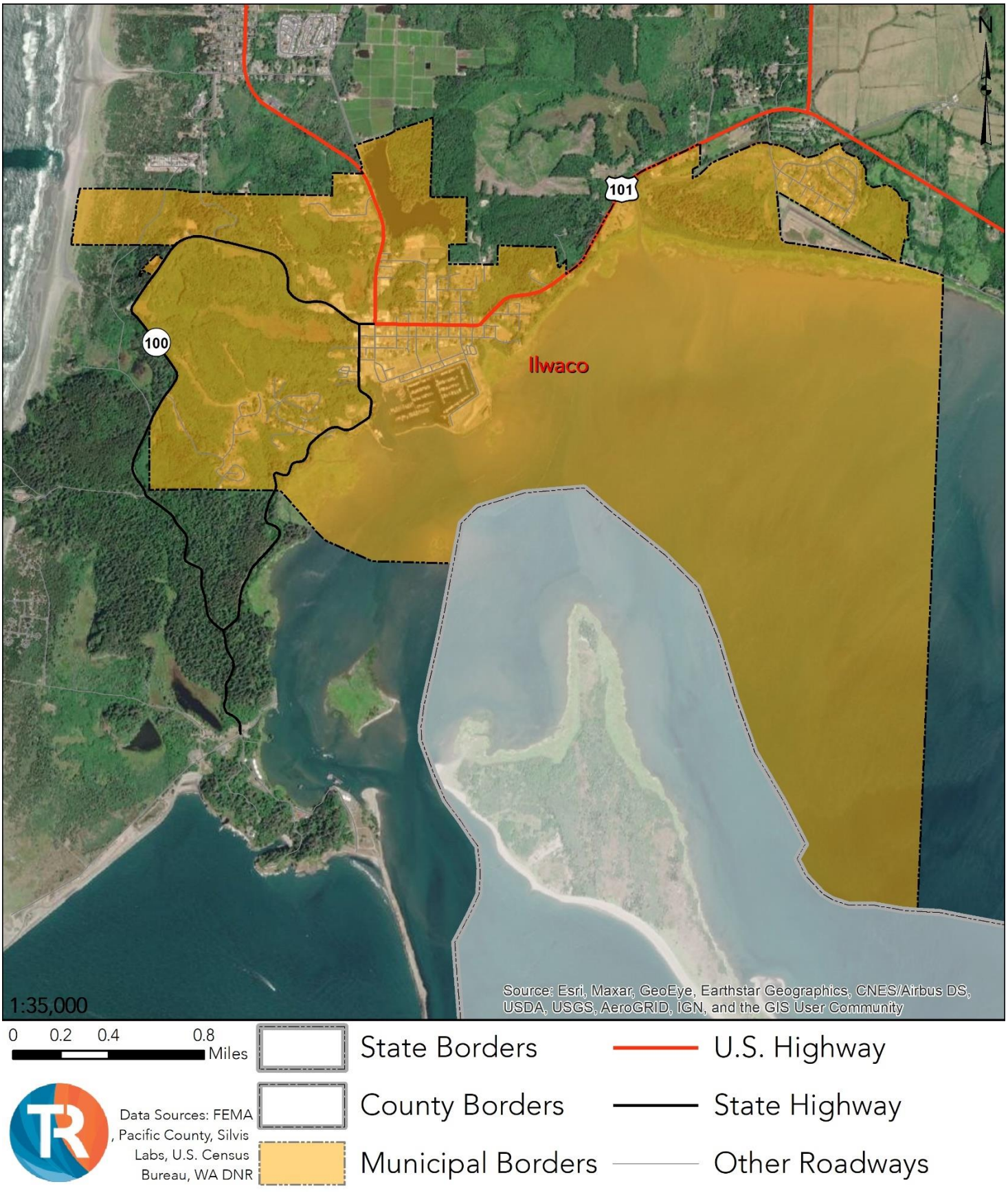
**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the Federal Emergency Management Agency*

Of the 66 critical facilities within the planning area, three are owned and operated by the Ilwaco Government. The table below lists these facilities.

**Table 2.11 – Critical Facilities, Ilwaco**

| Name | Type |
|---|---|
| Ilwaco City Hall | Local Government |
| Ilwaco Fire Department | EMS/Fire Prevention |
| Ilwaco Wasterwater Plant | Water Utility |

**Map 2.3 – Community Profile, Ilwaco**



## 2.3 - Long Beach

The latest Census Bureau estimate places 1,520 people living in Long Beach occupying 1,618 housing units. Its population has grown moderately since participation in their last plan in 2016.

**Table 2.12 – Population Change, Long Beach**

| Year | Estimated Population | Percent Change from 2010 | Percent Change from 2016 |
|---|---|---|---|
| 2010 | 1,392 | - | - |
| 2016 | 1,386 | -0.43% | - |
| 2020 | 1,520 | 9.20% | 9.67% |

**The data are from the U.S. Census Bureau*

Long Beach contains an estimated $282,804,000 worth of municipal structural inventory broken down into six different structural type classes. The following table shows this breakdown.

**Table 2.13 – Structural Inventory, Long Beach**

| Structure Class | Structures | Total Class Value |
|---|---|---|
| Agricultural | 1 | $424,000 |
| Commercial | 165 | $138,683,000 |
| Government | 2 | $845,000 |
| Industrial | 8 | $3,545,000 |
| Residential | 1,266 | $105,851,000 |
| Multi-Unit Residential* | 32 | $33,456,000 |
| Total = | 1,474 | $282,804,000 |

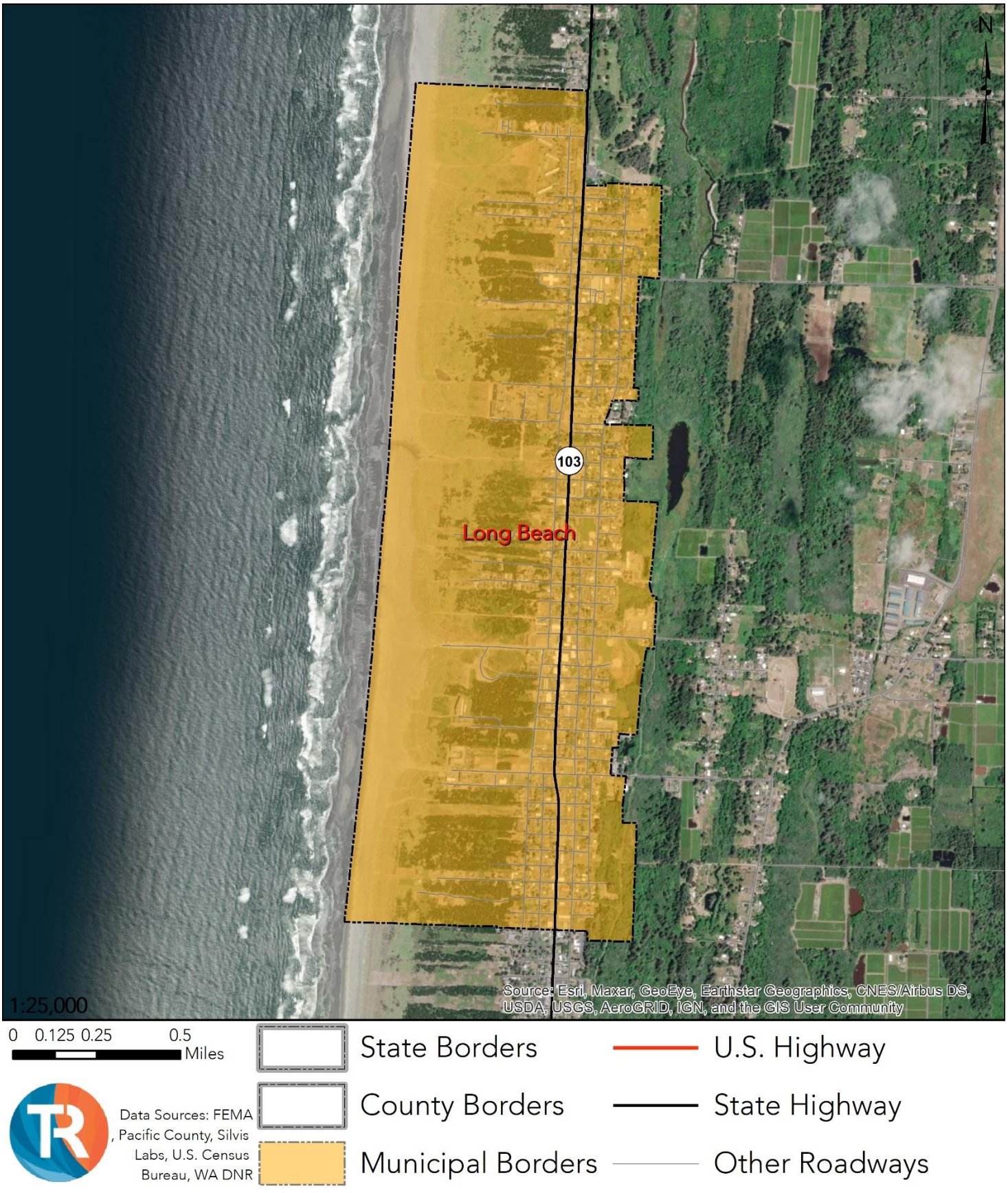
**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the Federal Emergency Management Agency*

Of the 66 critical facilities within the planning area, five are owned and operated by the Long Beach Government. The table below lists these facilities.

**Table 2.14 – Critical Facilities, Long Beach**

| Name | Type |
|---|---|
| Long Beach City Hall | Local Government |
| Long Beach City Shop | Public Works |
| Long Beach Fire Hall | EMS/Fire Prevention |
| Long Beach Wasterwater Plant | Water Utility |
| Long Beach Water Plant | Water Utility |

**Map 2.4 – Community Profile, Long Beach**



## 2.4 - Raymond

The latest Census Bureau estimate places 3,057 people living in Raymond occupying 1,277 housing units. Its population has grown significantly since participation in their last plan in 2016.

**Table 2.15 – Population Change, Raymond**

| Year | Estimated Population | Percent Change from 2010 | Percent Change from 2016 |
|---|---|---|---|
| 2010 | 2,882 | - | - |
| 2016 | 2,882 | 0.00% | - |
| 2020 | 3,057 | 6.07% | 6.07% |

**The data are from the U.S. Census Bureau*

Raymond contains an estimated $168,711,000 worth of municipal structural inventory broken down into six different structural type classes. The following table shows this breakdown.

**Table 2.16 – Structural Inventory, Raymond**

| Structure Class | Structures | Total Class Value |
|---|---|---|
| Agricultural | 4 | $1,000,000 |
| Commercial | 75 | $48,164,000 |
| Government | 2 | $3,589,000 |
| Industrial | 18 | $10,576,000 |
| Residential | 988 | $81,856,000 |
| Multi-Unit Residential* | 27 | $23,526,000 |
| Total = | 1,114 | $168,711,000 |

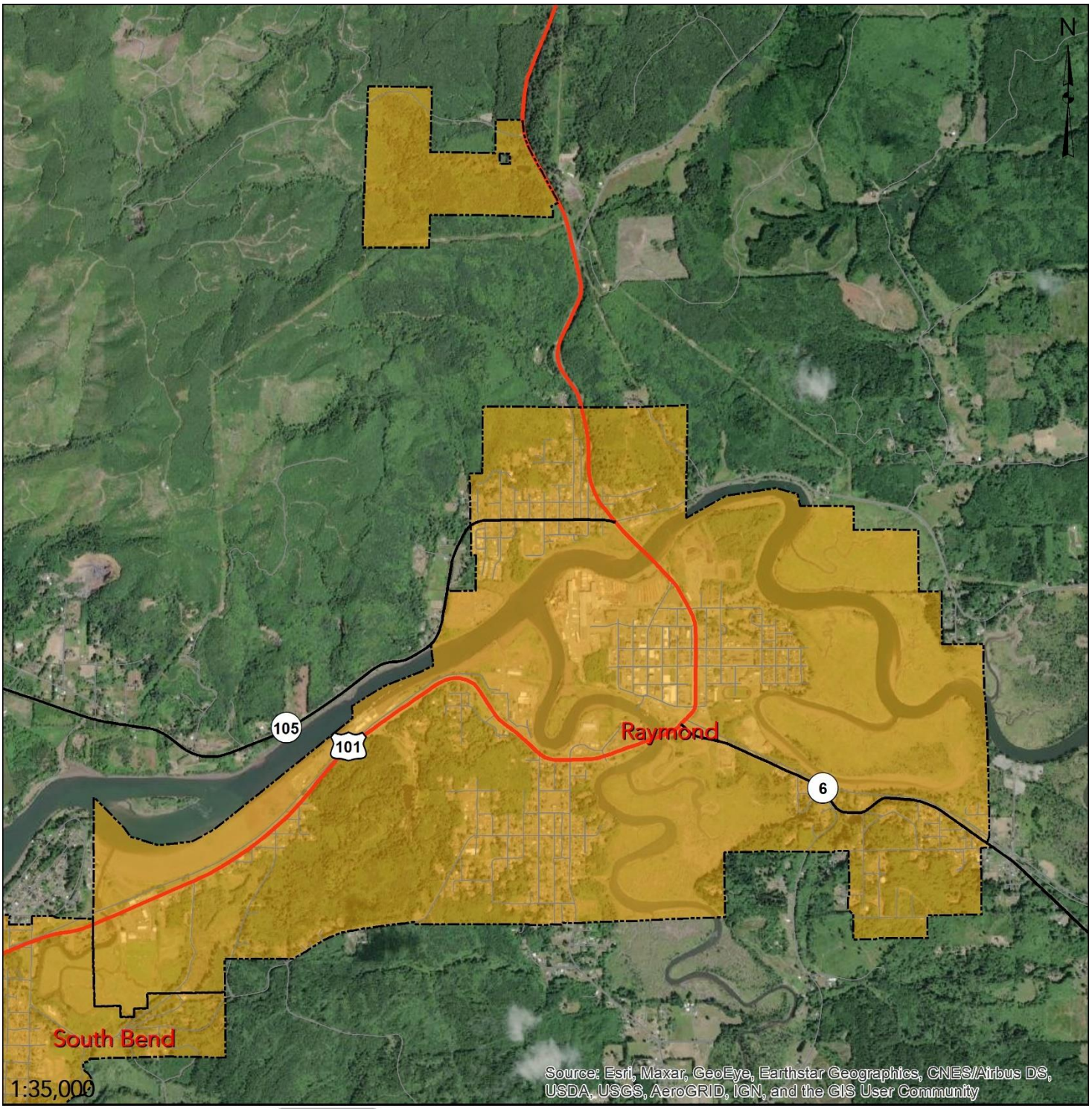
**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the Federal Emergency Management Agency*

Of the 66 critical facilities within the planning area, six are owned and operated by the Raymond Government. The table below lists these facilities.

**Table 2.17 – Critical Facilities, Raymond**

| Name | Type |
|---|---|
| Raymond City Hall | Local Government |
| Raymond Fire Station | EMS/Fire Prevention |
| Raymond Police Station | Law Enforcement |
| Raymond Public Works | Public Works |
| Raymond Sewage Treatment Plant | Water Utility |
| Raymond Water Treatment Plant | Water Utility |

**Map 2.5 – Community Profile, Raymond**



# 2.5 - South Bend

The latest Census Bureau estimate places 1,731 people living in South Bend occupying 780 housing units. Its population has grown moderately since participation in their last plan in 2016.

**Table 2.18 – Population Change, South Bend**

| Year | Estimated Population | Percent Change from 2010 | Percent Change from 2016 |
|---|---|---|---|
| 2010 | 1,637 | - | - |
| 2016 | 1,637 | 0.00% | - |
| 2020 | 1,731 | 5.74% | 5.74% |

**The data are from the U.S. Census Bureau*

South Bend contains an estimated $110,908,000 worth of municipal structural inventory broken down into six different structural type classes. The following table shows this breakdown.

**Table 2.19 – Structural Inventory, South Bend**

| Structure Class | Structures | Total Class Value |
|---|---|---|
| Agricultural | 2 | $267,000 |
| Commercial | 40 | $31,032,000 |
| Government | 8 | $7,968,000 |
| Industrial | 10 | $6,348,000 |
| Residential | 735 | $60,295,000 |
| Multi-Unit Residential* | 9 | $4,998,000 |
| Total = | 804 | $110,908,000 |

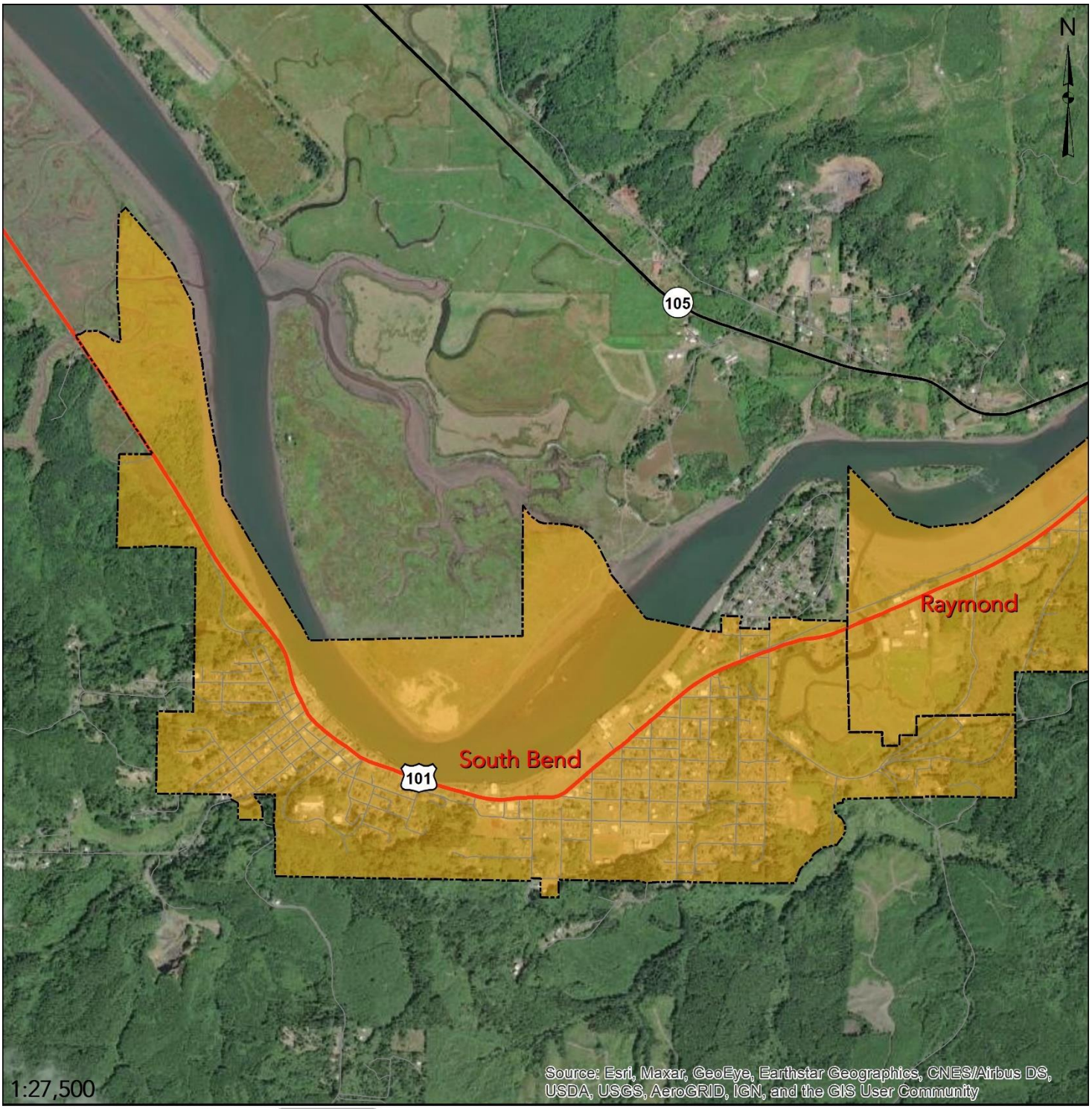
**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the Federal Emergency Management Agency*

Of the 66 critical facilities within the planning area, 11 are owned and operated by the South Bend Government. The table below lists these facilities.

**Table 2.20 – Critical Facilities, South Bend**

| Name | Type |
|---|---|
| East End Fire Hall | EMS/Fire Prevention |
| Rixon Water Tank | Water Utility |
| Smith Greenhouse Road Tanks | Water Utility |
| South Bend City Garage | Public Works |
| South Bend City Hall | Local Government |
| South Bend Parks Building | Local Government |
| South Bend Public Library | Local Government |
| South Bend Stormwater Pumps | Water Utility |
| South Bend Water Treatment Plant | Water Utility |
| West End Fire Hall | EMS/Fire Prevention |
| Willapa Regional Sewer Treatment Plant | Water Utility |

**Map 2.6 – Community Profile, South Bend**



## 2.6 – Fire Protection Districts

Unincorporated areas of Pacific County are served by seven Fire Protection Districts and one Regional Fire Authority. Fire Protection District #5 was absorbed by the South Beach Regional Fire Authority between now and the development of Pacific County's last plan. The fire protection districts serve in a capacity of more than just fire protection and prevention, they serve as hubs for rural communities. They act as a central hub in remote areas when disaster occurs.

Some are all volunteer and some employ both full-time and volunteer firefighters. They are often called outside their designated territories. The fire districts work with neighboring communities across state lines, local tribal governments, and state agencies when necessary.

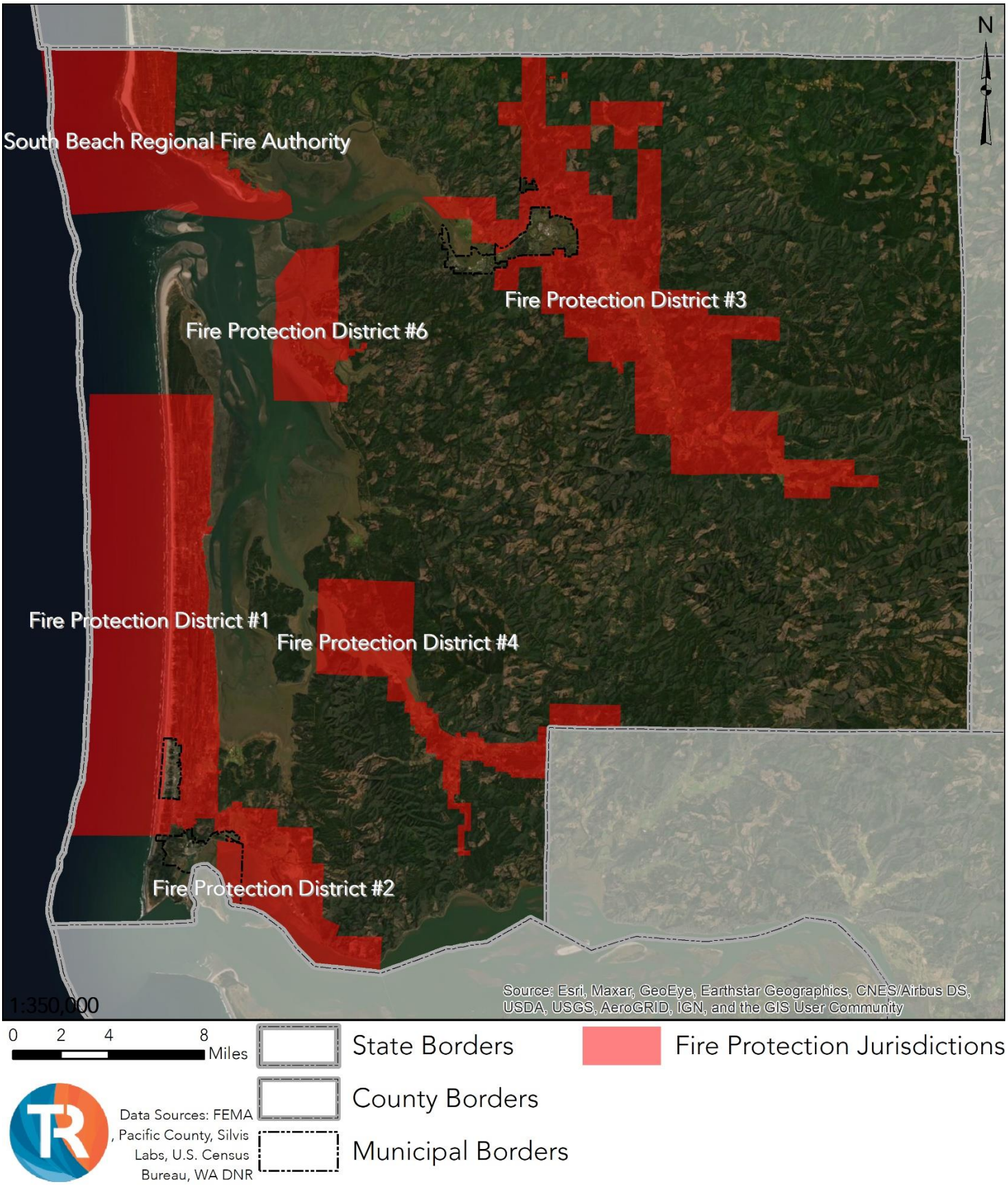
Each of the seven districts and the fire authority are challenged in numerous ways. Communications equipment, shelters, and aging structures are among the long list.

Of the 66 critical facilities within the planning area, 16 are owned and operated by the fire protection districts. The table below lists these facilities.

**Table 2.21 – Critical Facilities, Fire Protection Districts**

| Name | Type | Owner |
|---|---|---|
| FPD #1 Admin Building | Local Government | FPD1 |
| FPD #1 Maintenance Building | Local Government | FPD1 |
| FPD Station #31 | EMS/Fire Prevention | FPD3 |
| FPD Station #32 | EMS/Fire Prevention | FPD3 |
| FPD Station #34 | EMS/Fire Prevention | FPD3 |
| Litchke Fire Station | EMS/Fire Prevention | FPD1 |
| Midway Fire Station | EMS/Fire Prevention | FPD1 |
| Ocean Park Fire Station | EMS/Fire Prevention | FPD1 |
| SBRFA Station 31 | EMS/Fire Prevention | SBRFA |
| SBRFA Station 32 | EMS/Fire Prevention | SBRFA |
| SBRFA Station 33 | EMS/Fire Prevention | SBRFA |
| SBRFA Station 34 | EMS/Fire Prevention | SBRFA |
| SBRFA Station 35 | EMS/Fire Prevention | SBRFA |
| SBRFA Station 36 | EMS/Fire Prevention | SBRFA |
| Seaview Fire Station | EMS/Fire Prevention | FPD1 |
| Surfside Fire Station | EMS/Fire Prevention | FPD1 |

**Map 2.7 – Community Profile, Fire Protection Districts**



# 2.7 – Hospitals

***Ocean Beach Hospital***

Ocean Beach Hospital is a critical access hospital with 25 licensed beds. There are two Operating Rooms and eight Emergency Rooms. There are also two clinics. One clinic is located across from the hospital and the other clinic is 30 miles away in Naselle. The hospital has 146 employees and a large provider staff. The largest population segment in the region is retired, although there is a large tourist influx from spring till fall. The hospital has a governing board made up of five elected commissioners. Ocean Beach Hospital is a public hospital district. It is located on one of the major roads leading into the area and bordered by residential housing with two schools and two churches within a block. The hospital has air transport to outlying hospitals in the northwest. The facility is approximately 44,000 square feet in size. The clinic on-site is approximately 6,000 square feet. The clinic in Naselle is approximately 1,200 square feet. The hospital has two vehicles for travel, a 2005 pickup and 1992 van. The hospital facility is located on a peninsula adjacent to the Pacific Ocean, Willapa Bay, and the Columbia River.

***Willapa Harbor Hospital***

Willapa Harbor Hospital is a critical access hospital with 26 licensed beds. There is one operating room, five Emergency Rooms and two clinics. One clinic is located across from the hospital and one clinic is in the hospital. The hospital has 141 employees and four providers. The largest population segment in the region is retired. The hospital has a governing board made up of five elected commissioners. Willapa Harbor Hospital is a Public Hospital District. It is located off Highway 101 and bordered by residential housing and an assisted living facility. The hospital has air transport to outlying hospitals in the northwest. The facility is approximately 32,000 square feet in size. The clinic on site is approximately 1,000 square feet. The clinic across from the hospital is approximately 2,400 square feet. The hospital has two vehicles for travel, a 2007 pickup and 2006 van.

**Map 2.8 – Community Profile, Hospitals**

## 2.8 - Pacific Transit

The Pacific Transit began providing services in January 1980. Since its inception, the service has continually developed throughout Pacific County to include the expansion of regular routes and the establishment of Dial-a-Ride service, which provides transportation to ADA-Certified individuals. Dial-a-Ride service also includes transportation for individuals in the rural areas of Pacific County who are not on regular bus routes. Pacific Transit also provides intercity service to Aberdeen, WA in Grays Harbor County and to Astoria, OR. The Pacific Transit System has 24 employees, including drivers, maintenance personnel and management. It derives its funding from a Public Transportation Benefit Area (PTBA) with additional funding coming from sales tax in Pacific County and from federal and state grants.

The biggest threat is a major tsunami. There is not much that could be done structurally, so planning is being done for moving personnel and equipment to safe areas if there is a threat to Transit System operations from any hazard. There are plans in place and priorities are set if there is a tsunami warning. Plans are being developed for a no notice event. It is a very reliable system that has provided over 35 years of uninterrupted transportation services to the citizens of Pacific County. To date, Pacific Transit has traveled over 11 million miles and provided over 5 million passenger trips.

Of the 66 critical facilities within the planning area, two are owned and operated by Pacific Transit. The table below lists these facilities.

**Table 2.22 – Critical Facilities, Pacific Transit**

| Name | Type |
|---|---|
| Raymond Office | Local Government |
| Seaview Facility | Local Government |

# 2.9 – Ports

Pacific County is home to four port operators across nine coastal locations. These ports and integral to the planning area's economy.

***Port of Chinook***
On February 5, 1951, the Pacific County Board of Commissioners passed a resolution establishing the Port of Chinook. The port, located just upriver on the Columbia from Ilwaco, was formed to serve commercial and recreational fishing boats. The Port operates a 250-slip marina, boat hoist, a boat ramp, and has approximately five leased properties, which include a cannery, bait shop, and coffee shop.

***Port of Ilwaco***
The Port of Ilwaco was formed by a vote of the people in 1928. It is governed by three elected Commissioners who serve six-year terms. It is one of four public ports located in Pacific County, WA. The Port District includes Ilwaco, Seaview, Naselle and a strip along the east side of the Long Beach Peninsula. The Port operates an 800-slip fishing marina, a self-service boat yard, a 40-ton boat haul-out, a smaller boat hoist, a boat ramp and has approximately 25 leased properties which are home to restaurants, galleries, fishing charters, gift shops, marine supply, a sanitation company, a bank, a community college campus, a cannery and a large fish processor. The Port of Ilwaco boatyard services commercial vessels and pleasure craft up to 50 tons. The Port also operates a general aviation airport.

***Port of Peninsula***
The Port of Peninsula was formed in 1928. It is governed by three elected Commissioners who serve six-year terms. It is one of four public ports located in Pacific County, Washington. The Port District includes Long Beach, Ocean Park, Klipsan Beach, Surfside, and other areas of unincorporated Pacific County. The Port operates an 80-slip commercial and recreational marina, an 8 ton boat haul-out, product hoists, a fuel dock, a pump out station, a boat ramp, an Interpretive Center, and has upland and tideland leases.

***Port of Willapa Harbor***
The Port of Willapa Bay was formed by the vote of the people of North Pacific County on May 31, 1928. The construction of the Port Dock between the cities of Raymond and South Bend soon followed with the dedication ceremony on October 8, 1930. The primary function of the Port was to provide docking facilities and service for shipping logs and lumber in Raymond, and to support commercial fishing and oystering in Tokeland and Bay Center. In the intervening years the Port has expanded to include the Willapa Harbor Airport, the Dick Taylor Industrial Park and the Stan Hatfield South Fork Industrial Park. The Port currently has 31 industrial and commercial tenants, and provides moorage to 85 boats.

The Raymond Port Dock is located on the Willapa River on US 101. Port facilities at this location include an historic 25,000 square foot, 'high' dock, which services an array of commercial vessels. In addition, there are 600 feet of floating docks which are available for moorage. The port dock area has nine

industrial buildings which are leased to commercial/industrial tenants. The Port also has an industrial wastewater treatment plant. The Port facilities on the south bank of the Willapa River occupy 27 acres.
The Port acquired a 30-acre former sawmill site and is currently working on a mixed-use redevelopment of the property located within the Stan Hatfield South Fork Industrial Park. The triangular shaped park is located just north of US 101 in Raymond and is accessed from Wilson Street. This location is also bounded to the east by the South Fork of the Willapa River and to the northwest by the Willapa River. The Port leases a dry kiln and planer facilities to a local sawmill. The former mill machine shop has been completely renovated and now accommodates a recreational marijuana producer, a beauty boutique, and a saw shop.

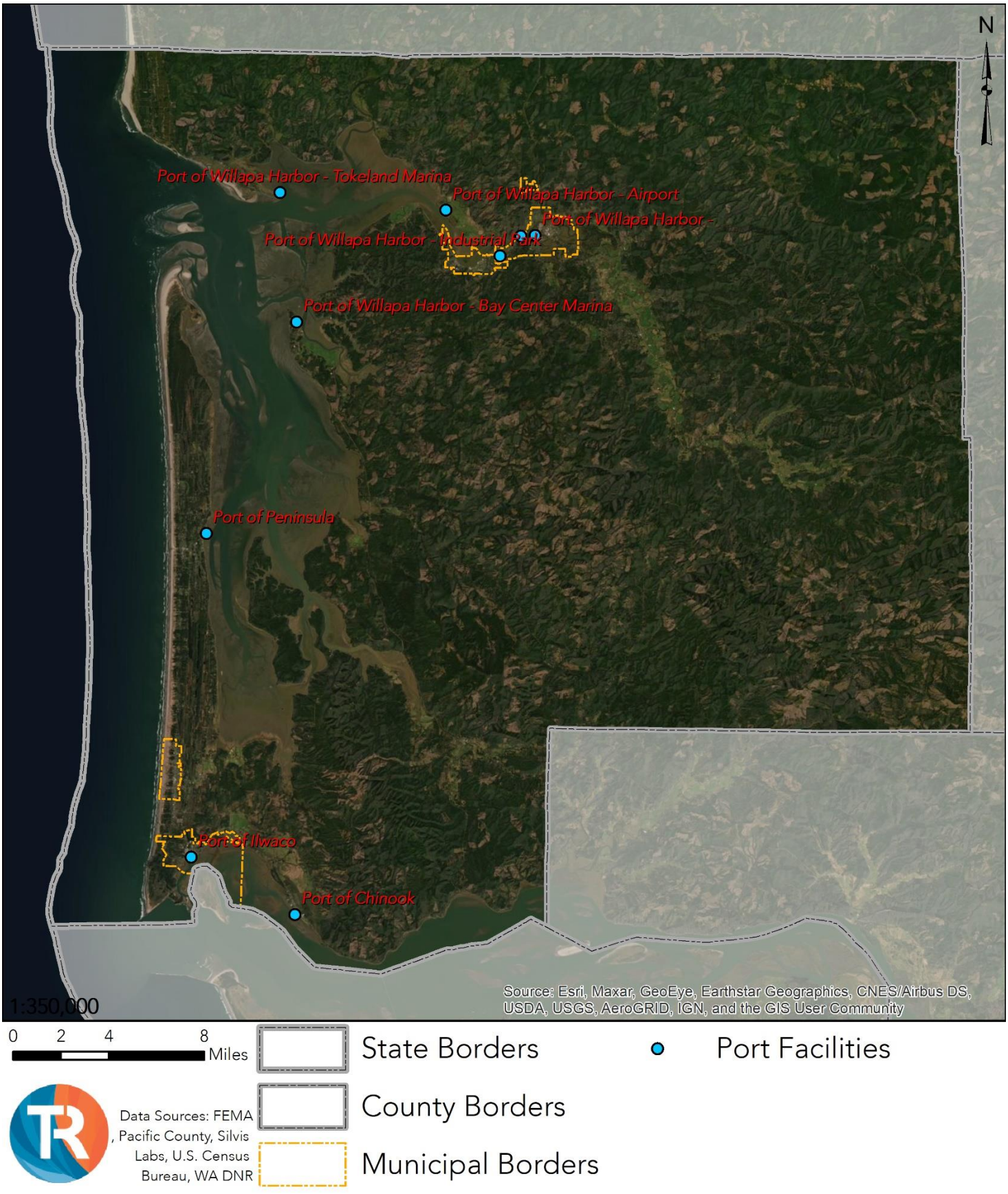
The Dick Taylor Industrial Park is located on a 30-acre parcel fronting US 101 in Raymond. Approximately 10 acres has have developed for light industrial use. The park is also connected to the industrial wastewater pretreatment plant located at the main Port dock via a pumping station and force main. There are currently four industrial buildings and a retail store on the site. The port also owns the former Dennis Company warehouse located directly across SR 101 from the industrial park.

The Tokeland marina is located in the unincorporated community of Tokeland at the north of Willapa Bay. Tokeland is primarily a residential community with a population of 417. Tokeland is also the site of the Shoalwater Bay Indian Reservation, which is home to approximately 70 tribal members. The tribe owns and operates a small casino and health clinic. The Tokeland marina offers both recreational and commercial moorage. The Port facilities are on 40 acres and include two seafood servicing buildings, a light industrial building leased to Ambrosia Technologies, a public fishing pier, a high dock, and RV Park and boat ramp. A fish processing plant is located blocks away from the main Port dock. Port dock facilities provide local fishing and aquaculture industries access between land and water.

Bay Center is an unincorporated community located approximately 16 miles south of South Bend. Bounded by the Palix River and Willapa Bay, Bay Center is the geometric center of Willapa Bay and home to several commercial oyster-growing operations. In this community, commercial fishing and aquaculture dominates the marina. The Port facilities accommodate a thriving shell fish and crabbing industry. The current population of Bay Center is 317. A growing residential community will present a number of opportunities for the Port and the community in the coming years. The Port owns no upland property in Bay Center.

The airport was built in 1946 and is located on SR105 five miles west of Raymond. It features an asphalt paved, 3000'-long, 52'-wide general aviation service runway on an East-West orientation with rotating beacon and radio-activated runway lights. Privately owned hanger space is available, along with tie-downs for five aircraft, self-service fuel, and a pilot ready room with phone and rest room.

**Map 2.9 – Community Profile, Ports**



## 2.10 – Public Drainage District #1

The history of the flood control developments on the Long Beach Peninsula began in 1910 when the Wallicut Diking District No. 1 was established. This was followed a few years later by the formation of Drainage Districts No. 2 and 3. The formation of Flood Control District No. 1 in 1961 included the Long Beach Peninsula as well as a separate zone near Chinook. During the 1960s and 1970s, several modifications to the zone boundaries and designations occurred and various existing diking and drainage districts were dissolved or consolidated.

In 1985, a Surface Water Management Citizens Advisory Committee was formed by the Board of County Commissioners, which, following significant study and public involvement, made recommendation to the Board of County Commissioners to form a Flood Control Zone District. On May 5, 1986, the Board of County Commissioners recognized and established Flood Control Zone District No. 1 of Pacific County (hereinafter referred to as the district) under the provisions of Chapter 86.15 RCW to address flood control and stormwater control issues.

The district consists of two active subzones: the North Long Beach Peninsula Flood Control Subzone and the South Long Beach Peninsula Flood Control Subzone. The district is comprised of seven major drainage basins: Tarlatt Slough, South Main, East Main, Loomis Lake, South Willapa, Hines-Whiskey, and Surfside. The current boundaries of District, its north and south subzones, and the major drainage basins are shown on the attached map.

## 2.11 – Public Utility District #2

The district is a municipal corporation incorporated in 1940 to serve the citizens of Pacific County, Washington. A three-member board of locally elected commissioners, independent of county government, governs the district. The district manages and operates an Electric Distribution System and three Water Distribution Systems. Public Utility District #2 of Pacific County provides reliable electric service to the district's 17,100 customers. The district also provides water service to another-301 customers in the communities of Bay Center, Lebam and Wilson Point.

A General Manager, appointed by the Board, administers the district's day to day operations. The district employs 58 employees and operates on a $27.6 million annual electrical operating budget. The district offers programs to help customers use energy more efficiently and to support policies that promote resource conservation.

The district provides electrical service to most but not all of Pacific County. Currently, the District does not provide service to the unincorporated areas of Tokeland, North Cove and Grayland, in the northwest corner of the County. The Grays Harbor County PUD provides electrical service to these areas. Wholesale power is supplied to the district through purchased power contracts with the Bonneville Power Administration (BPA). Weather and economic conditions are the primary influences on electricity sales.

Of the 66 critical facilities within the planning area, 19 are owned and operated by PUD #2. The table below lists these facilities.

**Table 2.23 – Critical Facilities, Pacific Transit**

| Name | Type |
|---|---|
| Bay Center Well #1 | Water Utility |
| Bay Center Well #2 | Water Utility |
| Hagen Substation | Electric Utility |
| Henkle St. Substation | Electric Utility |
| Lebam Well #1 | Water Utility |
| Lebam Well #2 | Water Utility |
| Long Beach Substation | Electric Utility |
| Naselle Substation | Electric Utility |
| Ocean Park Substation | Electric Utility |
| Oxbow Substation | Electric Utility |
| Oysterville Substation | Electric Utility |
| POC Office | Local Government |
| PUD2 Storage Yard | Public Works |
| Skidmore Substation | Electric Utility |
| Stendlund Corner Storage Yard | Public Works |
| Tarlett Substation | Electric Utility |
| Willapa River Substation | Electric Utility |
| Wilson Point Water | Water Utility |
| WOC Office | Local Government |

## 2.12 – School Districts

Pacific County is serviced by six public school districts, four of which are participants in this plan. These school districts provide education to 2,370 students provided by 401 teachers, administrators, and support staff.

**Table 2.24 – Community School District Demographics Summary**

| School District | Staff | Students | Total |
|---|---|---|---|
| Naselle-Grays River Valley | 64 | 325 | 389 |
| Ocean Beach | 147 | 1,045 | 1,192 |
| South Bend | 106 | 600 | 706 |
| Willapa Valley | 84 | 400 | 484 |
| Total = | 401 | 2,370 | 2,771 |

**The data are from the school districts.*

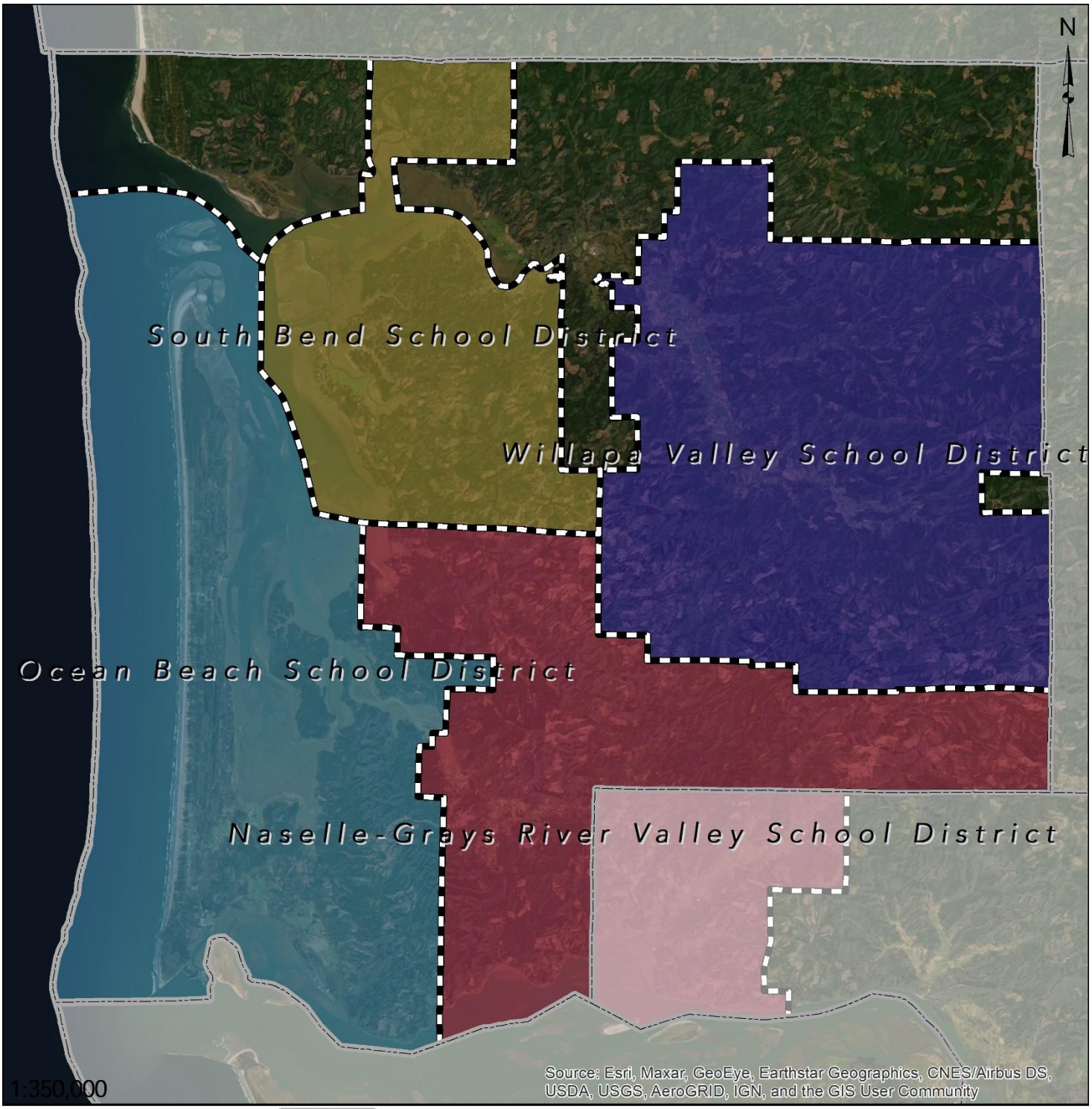
The total insured value of their structures and contents is $109,183,686 as shown in the table below.

**Table 2.25 – School District Structural Summary**

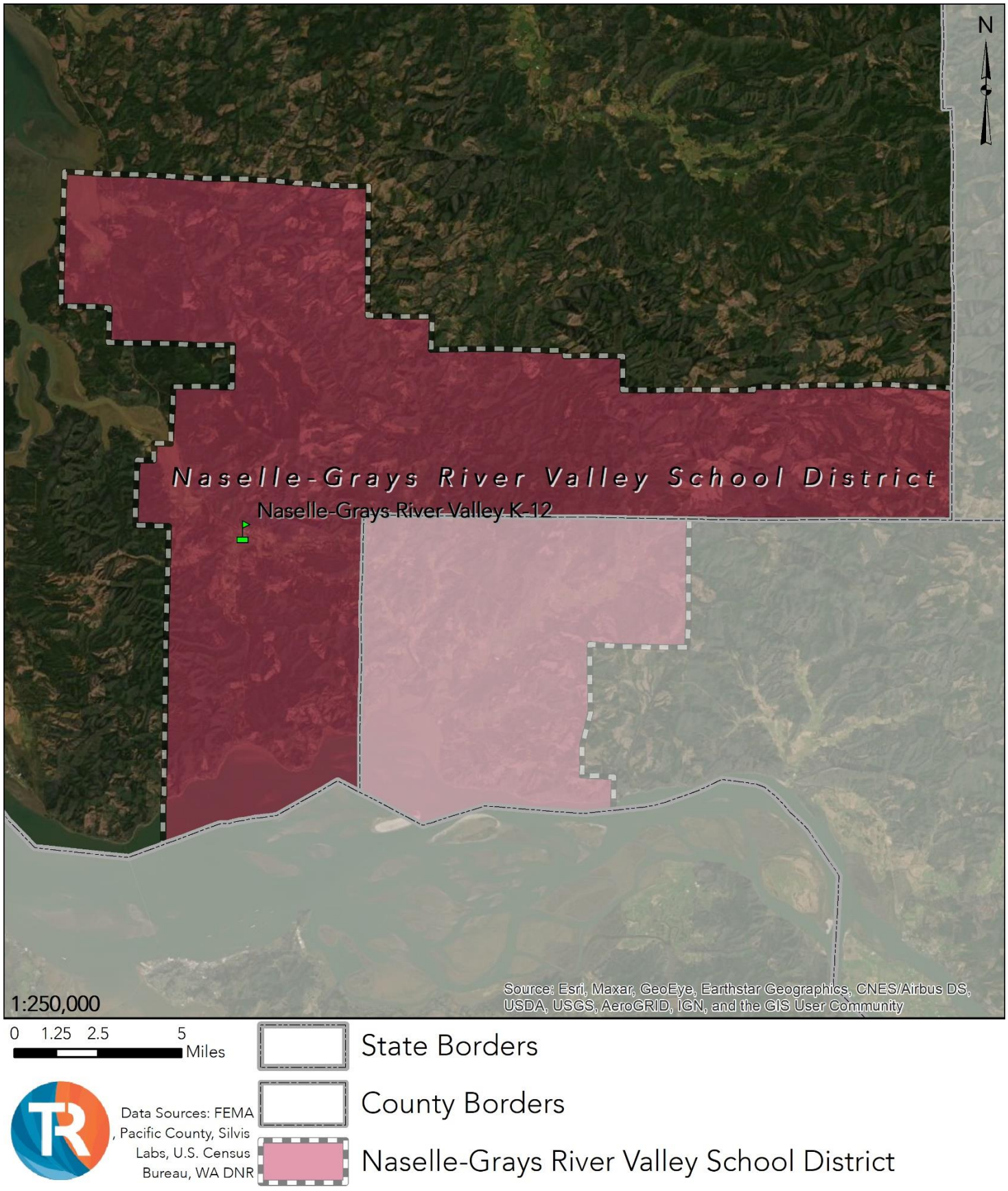
| School District | Locations | Structures | Structural Value |
|---|---|---|---|
| Naselle-Grays River Valley | 1 | 3 | $10,169,255 |
| Ocean Beach | 3 | 12 | $42,346,600 |
| South Bend | 1 | 15 | $35,435,331 |
| Willapa Valley | 3 | 10 | $21,232,500 |
| Total = | 8 | 40 | $109,183,686 |

**The data are from the school districts.*

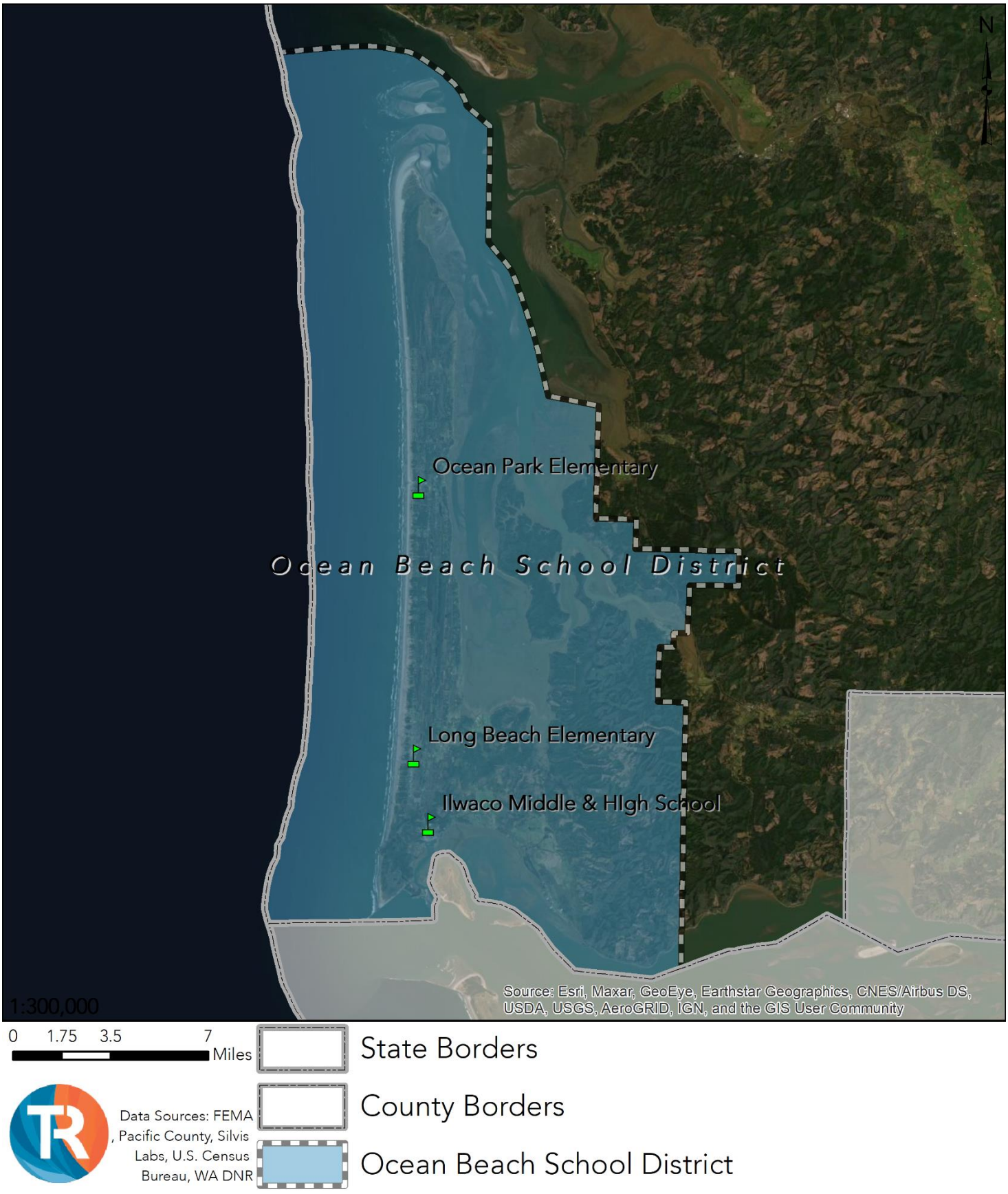
**Map 2.10 – School Districts**



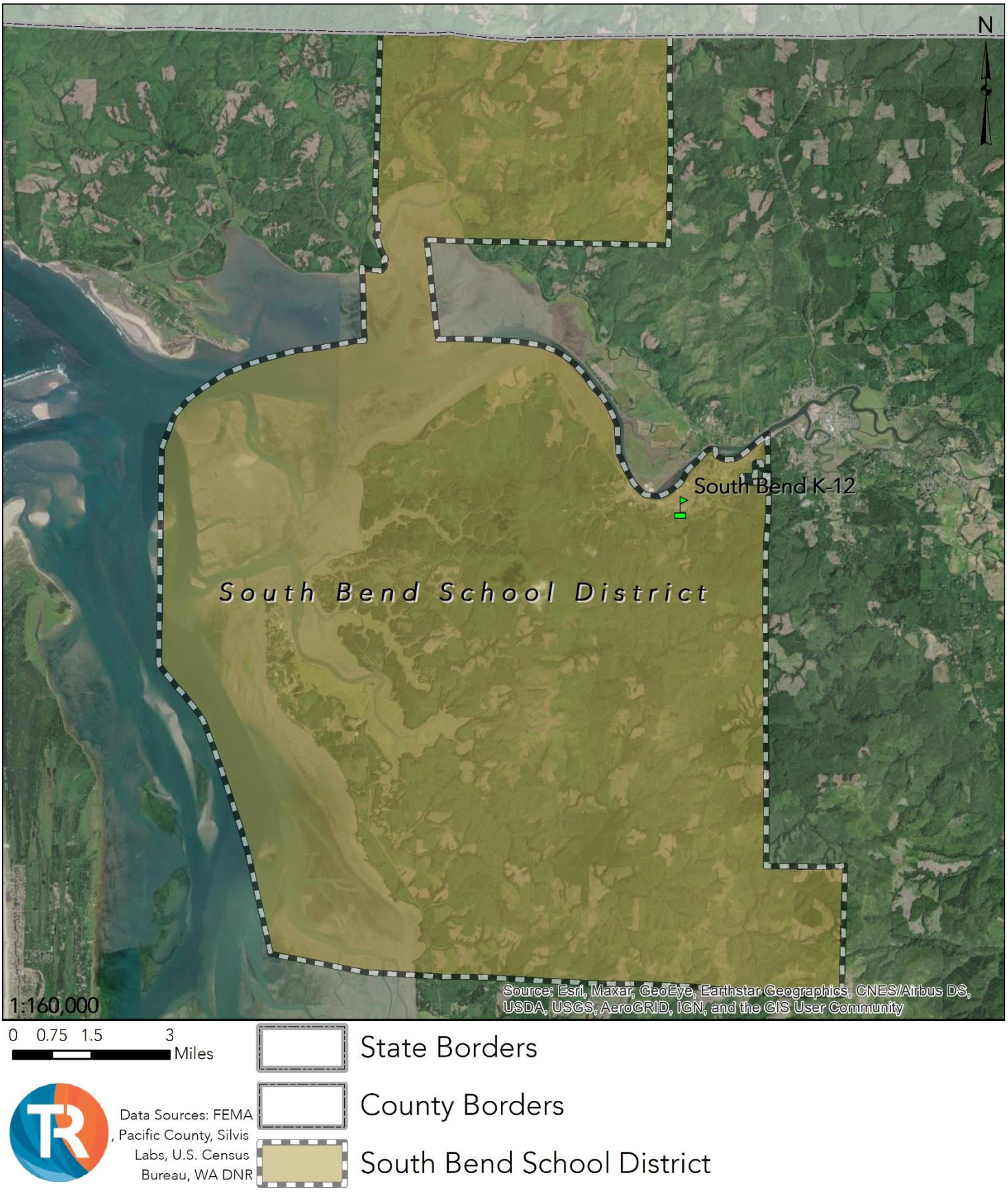
**Map 2.11 – Naselle-Grays River Valley School District**



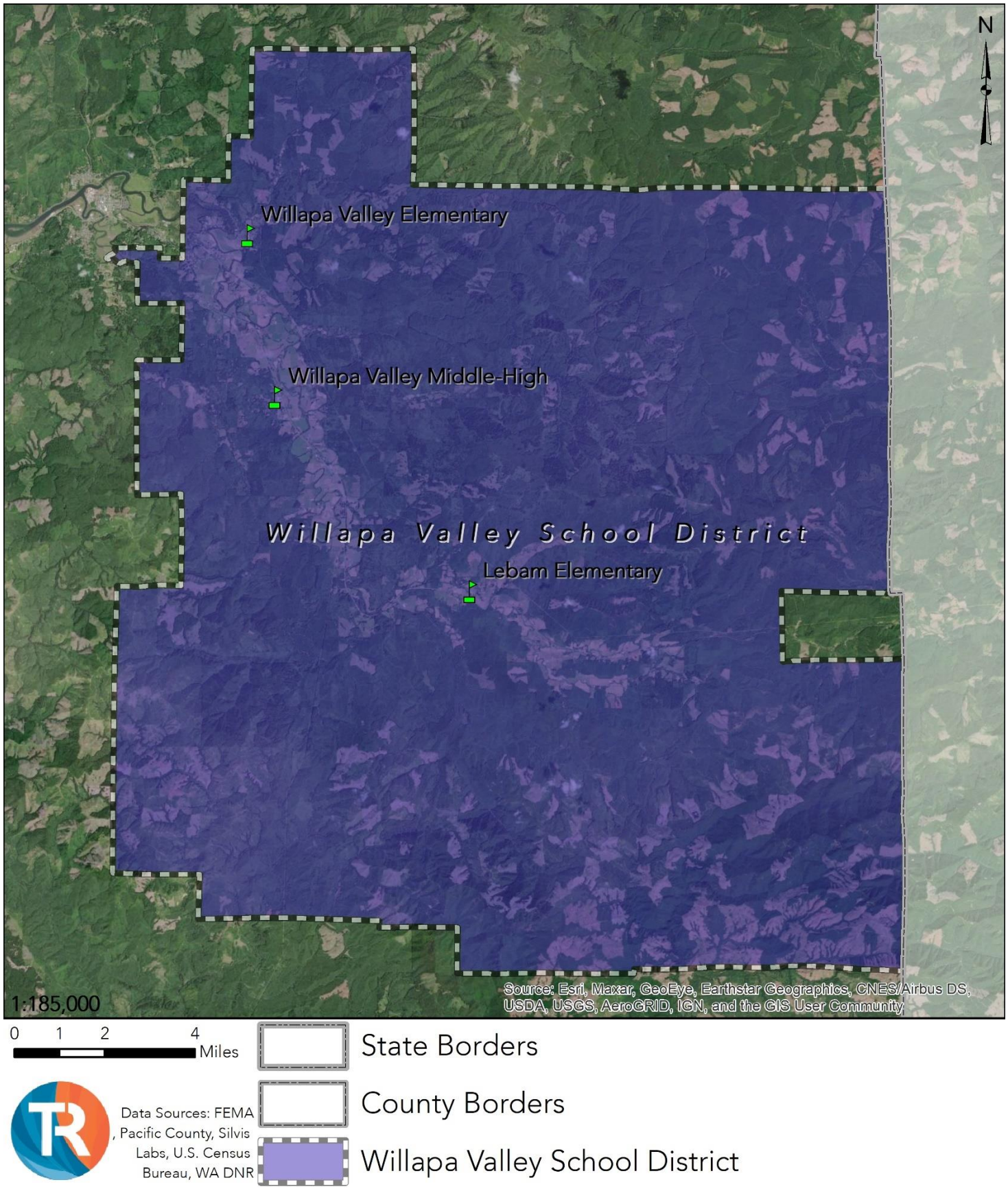
**Map 2.12 – Ocean Beach School District**



**Map 2.13 – South Bend School District**



**Map 2.14 – Willapa Valley School District**



### *Purpose*

This hazard mitigation plan's risk assessment depicts each participating entity's risk to each of the profiled hazards. These calculated risks serve as the justifying basis for the proposed mitigation activities and projects found in Section 4. Additionally, this risk assessment can further serve Pacific County and the plan's participating entities by aiding in decision making processes of other planning initiatives.

### *Intent*

The hazards profiled within this section were identified and selected based on their ability to reasonably affect the entire planning area or portions of Pacific County and its communities. If a hazard has been excluded or removed, justification has been given.

To properly and accurately depict each hazard's risk, Two Rivers Emergency Management employed various methodologies appropriately tailored by hazard application. Generally, each hazard profile; describes the type, location, and extent the hazard; includes information on previous occurrences of hazard events and estimates on future occurrence; describes a hazard's estimated impact; assesses each participating entity's vulnerability to a hazard; and analyzes how changes in development have affected an area since the development of Pacific County's last hazard mitigation plan.

Each hazard profile conforms to FEMA's requirements as set forth in its Local Mitigation Plan Review Guide, Elements B1 through B3, and B4 and D1 where applicable.

## 3.1 – Methodology

The natural characteristics of each hazard dictate that not one single approach works to accurately depict risk. In general, the hazard profiled in this plan can be categorized as either area-wide hazards or those with discretely identified hazard areas.

### *Area-Wide Hazards*

Area-wide hazards indiscriminately impact the entire planning. Since it is beyond scientific measurement where an area-wide hazard, such as winter storms, will impact, and likely it will impact everywhere, it is reasonable to assume any significant growth and development will increase vulnerability and risk. Additionally, a hazard such as a tornado, will impact a specific path, but we are unable to predict where exactly it will begin. Thus, having any increase in growth or development increases the chance that a tornado will strike a developed segment of a jurisdiction. For this plan, this is relevant for droughts, earthquakes, flash flooding, tornadoes, severe storms, and winter storms.

### *Hazards with Identified Hazard Areas*

If a jurisdiction grows or develops into an established dam spillway, floodplain, WUI zone, or an area with greater linear extensibility, that jurisdiction's vulnerability and risk increase by an amount equal to

the development or growth that now exists in that identified hazard area. For this plan, this is relevant for riverine flooding and wildfires.

## 3.2 – Hazard Selection

Appropriately identifying and selecting which natural hazards will be assessed is the first step in developing a risk assessment. The State of Washington Emergency Management Division profiles ten natural and one human-caused hazards in its statewide hazard mitigation plan. Of those hazards, this plan profiles eight of those hazards.

Pacific County has been designated as an affected area by federal declaration 18 times. These declarations show a broad picture of the which hazards pose the greatest threat to the planning area. The table below lists each federal disaster declaration, the hazards which caused the impact, and the dates of the events:

**Table 3.1 – Disaster Declarations**

| Designation | Declaration | Hazards | Start Date | End Date |
|---|---|---|---|---|
| DR-4593 | 4/8/2021 | Floods, Landslides, Winds, Winter Storms | 12/29/2020 | 1/16/2021 |
| DR-4539 | 4/23/2020 | Flooding, Landslides | 1/20/2020 | 2/10/2020 |
| DR-4418 | 3/4/2019 | Floods, Landslides, Winds, Winter Storms | 12/10/2018 | 12/24/2018 |
| DR-4253 | 2/2/2016 | Floods, Landslides, Winds, Winter Storms | 12/1/2015 | 12/14/2015 |
| DR-1825 | 3/2/2009 | Winter Storm | 12/12/2008 | 1/5/2009 |
| DR-1817 | 1/30/2009 | Flooding, Landslides, Winter Storms | 1/6/2009 | 1/16/2009 |
| DR-1734 | 12/8/2007 | Flooding, Landslides, Severe Storms | 12/1/2007 | 12/17/2007 |
| DR-1682 | 2/14/2007 | Landslides, Winter Storms | 12/14/2006 | 12/15/2006 |
| DR-1641 | 5/17/2006 | Flooding, Landslides, Severe Storms | 1/27/2006 | 2/4/2006 |
| DR-1361 | 3/1/2001 | Earthquake | 2/28/2001 | 3/16/2001 |
| DR-1172 | 4/2/1997 | Flooding, Landslides, Severe Storms | 3/18/1997 | 3/28/1997 |
| DR-1159 | 1/17/1997 | Flooding, Winter Storms | 12/26/1996 | 2/10/1997 |
| DR-1079 | 1/3/1996 | Flooding, Severe Storms Winds | 11/7/1995 | 12/18/1995 |
| DR-883 | 11/26/1990 | Flooding, Severe Storms | 11/9/1990 | 12/20/1990 |
| DR-623 | 5/21/1980 | Volcanic Eruption** | - | - |
| DR-545 | 12/10/1977 | Flooding, Severe Storms | - | - |
| DR-322 | 2/1/1972 | Flooding, Severe Storms | - | - |
| DR-185 | 12/29/1964 | Flooding | - | - |

**The data are from the Federal Emergency Management Agency*
***These disasters did not impact or damage the life or property within the county, but are declared due to overwhelming response and recovery operations.*

Selecting only hazards that pose a reasonable risk to the planning area allows the mitigation strategy found in Section 4 to focus Pacific County's capabilities and resources where they are needed most and can be the most effective. We found those hazards to be: Coastal Erosion, Earthquakes, Floods (Coastal and River), Landslides, Tsunamis, Wildfires, Windstorms, and Winter Storms.

The table below lists all of the natural hazards included in the statewide plan, whether they are included in this plan, and if excluded, a summary justification of why it has been excluded. A lengthier justification for exclusion can be found later in this section, 3.11 – Excluded Hazards.

**Table 3.2 – Hazard Inclusion**

| Hazard | Determination | Summary Justification |
|---|---|---|
| Avalanches | Excluded | No reasonable risk |
| Coastal Hazards | Included (Coastal Erosion) | Disaster History |
| Dam & Levee Failure | Excluded | No High Hazard Dams |
| Droughts | Excluded | No reasonable risk |
| Earthquakes | Included | Hazard Areas Identified/History |
| Floods | Included | Hazard Areas Identified/History |
| Landslides | Included | Hazard Areas Identified/History |
| Tsunamis | Included | Hazard Areas Identified |
| Severe Weather | Included (Windstorms) | Disaster History |
| Volcanoes | Excluded | No reasonable risk |
| Wildfires | Included | Rising Risk |

**Winter Storms are not profiled in the statewide plan, but is included in this plan due to Pacific County's disaster history.*

# 3.3 – Coastal Erosion

Coastal Erosion is a chronic problem along almost every shoreline in the United States. On average, American shorelines lose anywhere from 10 to 30 feet of coast per year. It is estimated that by 2100 over 3,000 square miles of land will be lost. The economic and negative environmental externalities are incalculable.

Coastal erosion is defined as the removal of coastal sediment and rock by a number of complex environmental factors. Typically, this occurs over a period of decades to centuries and is as much a function of natural occurrence as it is human interference.

***Natural Factors***

1.) Chemical Corrosion: A high pH level ocean or sea will slowly wear away at costal rocks and sediment further compounding other natural factors.
2.) High Speed Winds: High speed winds will cause abrasive forces against sediment and rock slowly weathering them away.
3.) Major Natural Disasters: Hurricanes, coastal floods, tsunamis, and severe inland flooding which drains out to sea can remove significant amounts of beach and coastal sediment in a short period of time.
4.) Sediment Accumulation: River deltas transport sediment out to sea over time increasing or recharging nearby beaches and coasts' supply of sediment. This rate of recharge is known as progradation.
5.) Shoreline Vegetation: Certain types of vegetation reduce the ability of water and air to erode rock and sediment.
6.) Wave & Tidal Currents: Weathering caused by water will slowly reduce a coastline's sand and sediment by force of abrasion.

***Human Factors***

1.) Dams: The construction of dams upstream of river deltas significantly hinders the river's natural ability to transport sand and sediment to nearby beaches and coasts thereby reducing its progradation rate.
2.) Jetties: The construction of jetties for tourism, maritime navigation, or local erosion control alters the tidal and current patterns of an area, increasing the vulnerability of erosion farther down the shoreline.
3.) Motorized Maritime Vessels: The use of motorized maritime vessels produces a wake creating increased wave activity.
4.) Reduction in Shoreline Vegetation: Development of shorelines can reduce the amount and density of its vegetation, increasing its vulnerability to water and air.

## *Location & Extent*

For hundreds of years, the Columbia River's delta has fed sand and sediment to coasts of Pacific County negating any significant erosion. Since settlement, multiple jetties have been built along the Columbia River for the purposes of maintaining a navigable waterway. These jetties significantly disrupt



the tidal and wave systems around the river's delta and increase the erosive capacity on the planning area. Additionally, the Columbia River has a significant number of dams restricting

sediment flow to the river's delta and hindering the progradation rate of Pacific County's coast.

Pacific County lies on the north bank of the Columbia River and to the east of the Pacific Ocean. The county's western coastline is comprised of sediment and sandy beaches, notably the Long Beach Peninsula and the North Cove area (Washaway Beach), across the Willapa Bay from the Long Beach Peninsula, and around Bay Center within Willapa Bay. The North Cove area (Washaway Beach) and Bay Center experience constant yearly erosion of its coast. The Long Beach Peninsula experiences long term progradation, but varies highly from year to year with some years seeing shoreline growth and others experiencing a significant decrease in its shoreline.

Since 1926, the average rate of shoreline change on the Long Beach Peninsula has been measured at positive 2.7 meters per year with a range of negative 18.7 meters per year to positive 23.2 meters per year. The North Cove area (Washaway Beach) has been eroding at an average rate of negative 1.9 meters per year with a highly variable rate of between negative 28.6 to a positive 6.6 meters per year. The Bay Center erosion area of Willapa Bay is slowly eroding, but is not measured by the USGS or the State of Washington.

Please see the maps on the following pages for a geographic depiction of the identified erosion areas.

## *History & Probability*

The rate of coastal erosion has, overall, increased significantly as more jetties have been built in the Columbia River and more dams were constructed upstream.

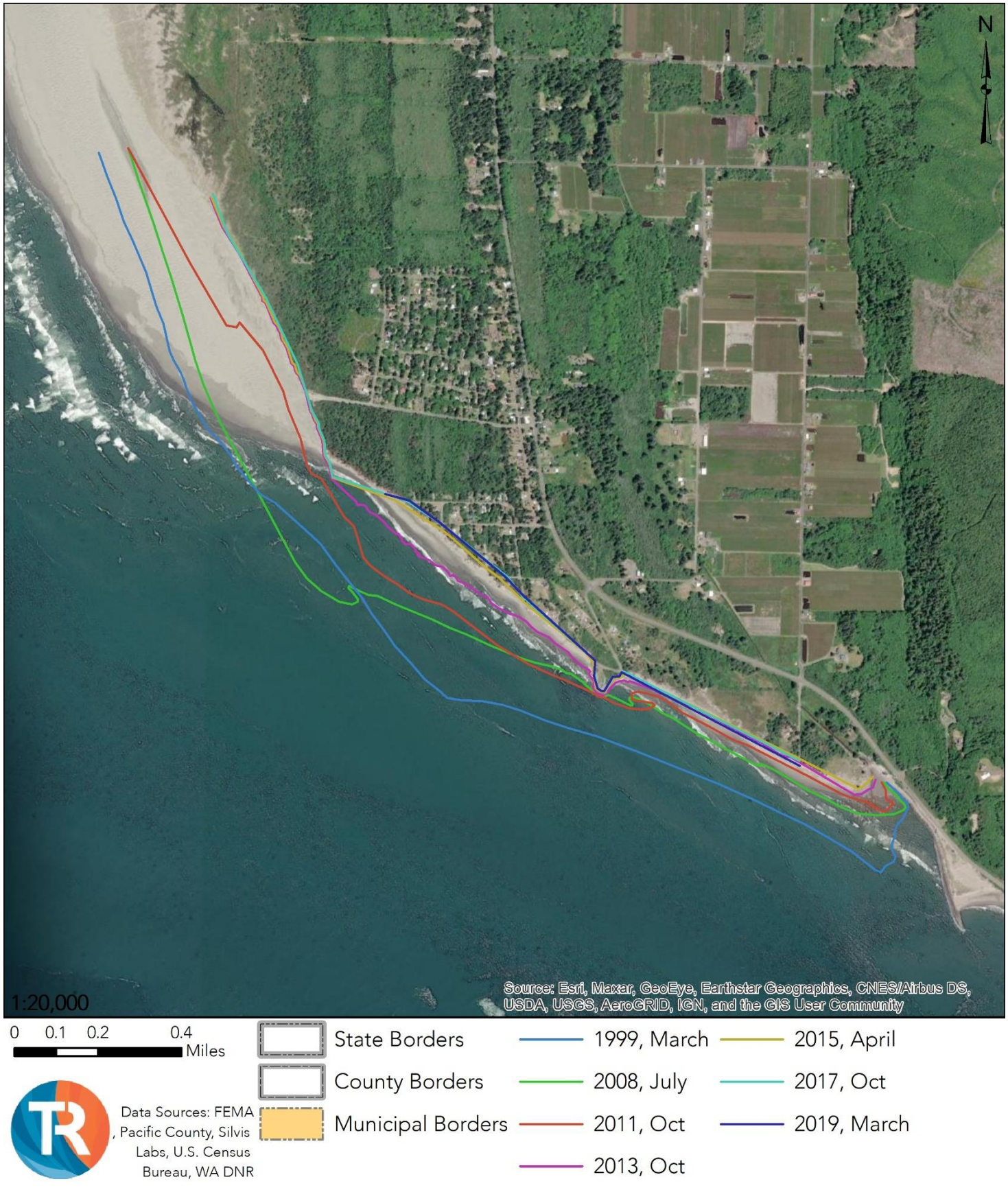
Shoreline measurement began in 1926 in Pacific County. The Long Beach Peninsula's shoreline has been increasing over the long-term with periods of erosion scattered throughout the years while the North Cove Area has been decreasing over long-term. The Bay Center area's shoreline has been steadily decreasing, but at a very slow rate.

## *Vulnerability of and Impact on Facilities*

Pacific County and its jurisdiction's structural vulnerability to coastal erosion is based strictly on location. The three identified areas are located near the North Cove area (encompassing the unincorporated towns of North Cove and Tokeland that exist within the county), and the Long Beach Peninsula (encompassing the City of Long Beach and the unincorporated towns of Ocean Park and Seaview that exist within the county), and the unincorporated Town of Bay Center.

Houses and other structures within these identified areas are at risk for being completely lost to the Pacific Ocean. When erosion has eroded the shoreline to the structure, it will be swept away and considered a total loss.

**Map 3.1 – Coastal Erosion – Washaway Beach/North Cove Area**



Historically, 161 structures have been lost to coastal erosion in the North Cove Area (Washaway Beach), zero structures have been lost on the Long Beach Peninsula. Zero structures have been lost around Bay Center, but a few have been relocated under state programs to prevent them from being lost to coastal erosion.

## *Vulnerability of and Impact on Population*

Due to the slow working nature of erosion, it is not reasonable that the planning area's populations would be vulnerable to death or injury from coastal erosion.

Historically, there are no recorded incidents of death or injury from coastal erosion in Pacific County or any of its participating jurisdictions.

## *Vulnerability of and Impact on Systems*

Pacific County's shorelines are some of its most precious resources drawing tourists and permanent residents alike. If its shoreline continues to erode at its current rate, Pacific County could be left with a significantly decreased population and decreased tourism. This lapse in commercial income and public taxes will have a significant effect on its economy and ability to maintain a hazard resilient community.

## *Key Considerations*

None of the non-municipal stakeholders are at any immediate risk to coastal erosion. However, there is a long-term risk, especially for the ports and the South Beach Regional Fire Authority. The ports by their nature of being shorebound will likely face structural challenges for obvious reasons. The South Beach Regional Fire Authority does have a facility near the North Cove area that could potentially be at risk in the years to come.

# 3.4 - Earthquakes

An earthquake is the result of a sudden release of energy in the Earth's crust that creates seismic waves. In the most general sense, the word earthquake is used to describe any event that generates seismic waves. Earthquakes are typically caused by the rupturing of geological faults. Occasionally, they are also caused by other events such as volcanic activity, landslides, mine blasts, tsunamis, and nuclear tests. Tsunamis are covered later in this risk assessment. An earthquake's point of initial rupture is called its focus or hypocenter. The epicenter is the point at ground level directly above the hypocenter.

At the Earth's surface, earthquakes manifest themselves by shaking and sometimes displacement of the ground. When the epicenter of a large earthquake is located offshore, the seabed may be displaced sufficiently to cause a tsunami. Earthquakes can also trigger landslides, and occasionally volcanic activity. The shallower an earthquake, the more damage to structures it causes, if all other factors are equal.

Oceanic earthquakes have the ability to cause damage to property and threaten life in much the same as an earthquake with an epicenter below a continent. As previously mentioned, an oceanic earthquake has the potential to create a tsunami, compounding the negative effects and emergency operations after an event.

An earthquake's effect can be compounded by the soil type underlying a community's buildings and infrastructure. If the soil is not composed of bedrock and consists of clays, silts, and other types of sand, the pressure generated by an earthquake can force brittle soil and water up towards the surface. These upward forced materials will then destabilize buildings and infrastructure, causing damage anywhere from cracks in roadways to the full displacement and destruction of a building. Smaller upward forced materials can destabilize slopes and building foundations further compounding the potential damage to a community.

## *Location & Extent*

The State of Washington and Pacific County lie east of the Cascadia subduction zone where the North American Plate collides with a number of smaller plates, the Juan De Fuca plate being the largest.

Earthquakes from the Cascadia subduction zone can strike suddenly and without warning, occur at any time of the year, and at any time of the day. There is not definitive way of predicting an earthquake. The duration of shaking can last anywhere from a second to a period of minutes.

There are numerous characteristics measured when observing earthquake activity, however: its force, depth, peak ground acceleration, and the distance to the epicenter are the most influential factors in determining damage. Two scales are used when referring to earthquake activity; estimating the total force of the earthquake, the Richter Scale, and the observed damage from an earthquake, the Modified Mercalli Intensity Scale. Please see the figures on the following pages for both scales and their estimated matching equivalent index.

Earthquakes of magnitude 5.0 or greater are considered potentially threatening to Pacific County and its jurisdictions, as this is the point at which structures can become unusable due to structural and foundation damage. Any earthquake felt at this magnitude or greater would likely be cause for cessation of operations until sight inspections can take place.

The entire planning area is at risk from the Cascadia subduction zone. The map on the following page depicts the USGS's potential peak ground acceleration values in the event of a catastrophic earthquake. The northern portion of the planning area is in a USGS designated 25-30% peak ground acceleration value while most of the planning area is designated as likely to experience 20-25% peak ground acceleration. These values translate, via the tables on the following page, to a Richter Scale around 5.5 and a Mercalli Scale value of VII: General Alarm, Walls and Plaster Crack.

An earthquake with an epicenter near Seattle-Tacoma or Olympia will likely impact Pacific

***THE CASCADIA SUBDUCTION ZONE IN CROSS-SECTION:***

**New crust forms at spreading ridges between the Pacific Plate and the Juan de Fuca, Gorda, and Explorer plates. As these three plates are pushed east-ward, they are forced to subduct beneath the North American Plate. Strain builds up where they have become stuck (locked) and will be released one day in a great earthquake.**

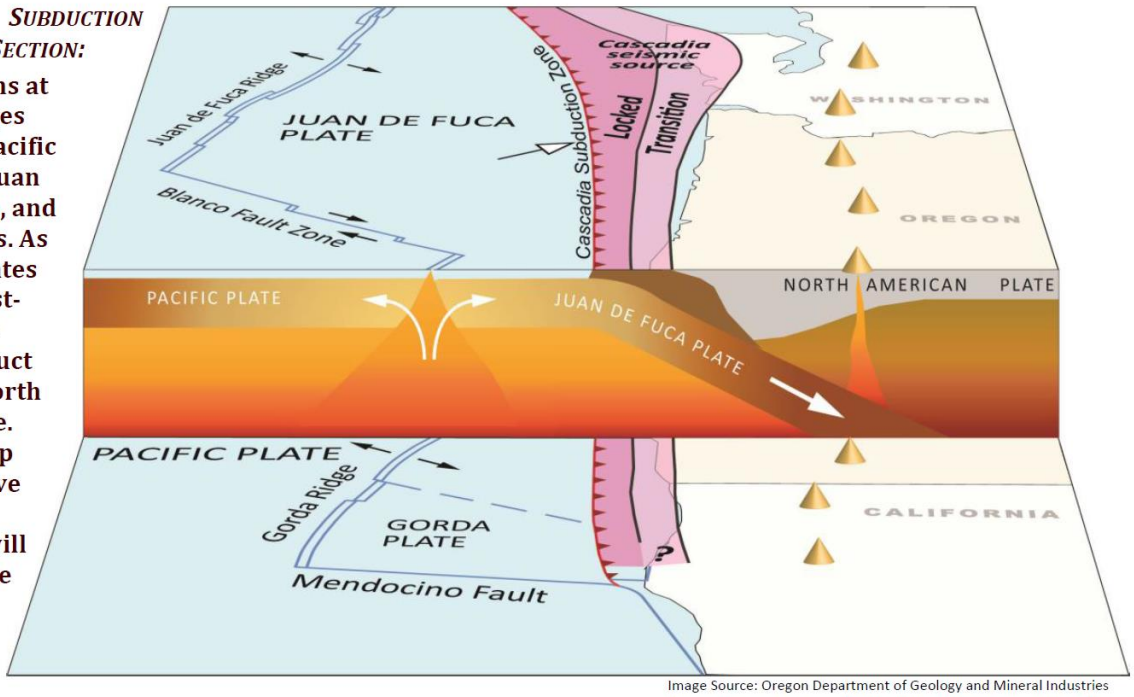



Image Source: Oregon Department of Geology and Mineral Industries

County and its participating jurisdictions as it has in the past, very minimally. However, a catastrophic quake from the Cascadia Subduction Zone could have extremely adverse impacts.

A high magnitude earthquake in the Cascadia Subduction Zone would likely create a tsunami. This is covered in 4.3TS – Tsunami. The Cascadia Region Earthquake Workgroup published a comprehensive assessment labeled: Cascadia Subduction Zone Earthquakes: A Magnitude 9.0 Earthquake Scenario, updated in 2013. The assessment asserts the Cascadia Subduction Zone will rupture in a series of earthquakes between 8.0 and 8.5 on the Richter Scale over a period of years. Further, the study asserts the series of earthquakes will be similar in character to that of the 2011, 9.0 magnitude earthquake that occurred off the eastern coast of Japan. Fortunately, the study claims the devastation to the Pacific

Northwest will not be as great as it was in Japan. The economic impact is estimated at roughly $49,000,000 in the State of Washington, out of a total $70,000,000 compared to $309,000,000 from Japan.

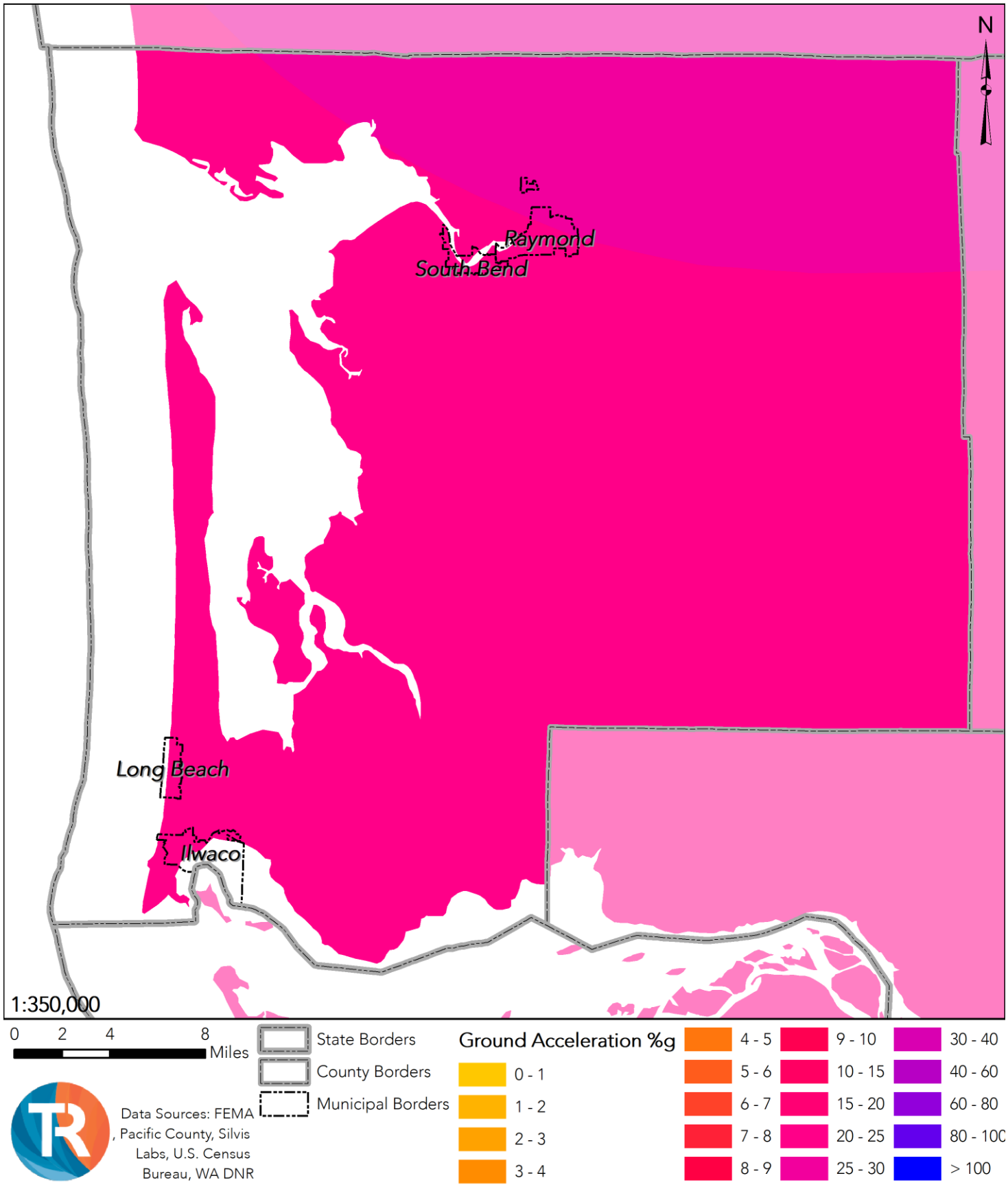
**Table 3.3 – Modified Mercalli Scale Vs. Richter Scale**

| Category | Effects | Richter Scale (approximate) |
|---|---|---|
| I. Instrumental | Not felt | 1-2 |
| II. Just perceptible | Felt by only a few people, especially on upper floors of tall buildings | 3 |
| III. Slight | Felt by people lying down, seated on a hard surface, or in the upper stories of tall buildings | 3.5 |
| IV. Perceptible | Felt indoors by many, by few outside; dishes and windows rattle | 4 |
| V. Rather strong | Generally felt by everyone; sleeping people may be awakened | 4.5 |
| VI. Strong | Trees sway, chandeliers swing, bells ring, some damage from falling objects | 5 |
| VII. Very strong | General alarm; walls and plaster crack | 5.5 |
| VIII. Destructive | Felt in moving vehicles; chimneys collapse; poorly constructed buildings seriously damaged | 6 |
| IX. Ruinous | Some houses collapse; pipes break | 6.5 |
| X. Disastrous | Obvious ground cracks; railroad tracks bent; some landslides on steep hillsides | 7 |
| XI. Very disastrous | Few buildings survive; bridges damaged or destroyed; all services interrupted (electrical, water, sewage, railroad); severe landslides | 7.5 |
| XII. Catastrophic | Total destruction; objects thrown into the air; river courses and topography altered | 8 |

**Table 3.4 – Peak Ground Acceleration Vs. Mercalli & Richter Scale**

| Mercalli Scale Intensity | Richter Scale | Minimum %g | Maximum %g |
|---|---|---|---|
| I | 1 – 2 | 0.00% | 0.17% |
| II – III | 3 – 3.5 | 0.17% | 1.40% |
| IV | 4 | 1.40% | 3.90% |
| V | 4.5 | 3.90% | 9.20% |
| VI | 5 | 9.20% | 18.00% |
| VII | 5.5 | 18.00% | 34.00% |
| VIII | 6 | 34.00% | 65.00% |
| IX | 6.5 | 65.00% | 124.00% |
| X+ | 7+ | 124.00% | - |

**Map 3.2 – Seismic Zones, Pacific County**



## *History & Probability*

Pacific County and its participating jurisdictions have experienced two minor earthquakes with epicenters inside their borders. These were a magnitude 3.1 and a magnitude 3.3 earthquake in September of 1981 and March of 2012 respectively. Maps on the following page depicts earthquakes recorded and documented by the USGS within a 200-mile buffer of Pacific County.

These earthquakes were not cause for alarm. They were felt, but did not incur any damage or loss of life. Additionally, there is no record in the past century of loss of life or significant property damage from an earthquake in Pacific County. More threatening earthquakes are likely to have epicenters far away from Pacific County, but be of such a high magnitude that they affect the planning area.

***Nisqually Earthquake – 28 February 2001***

Commonly referred to as the "Ash Wednesday Quake," the Nisqually Earthquake occurred on February 28, 2001. It measured 6.8 on the Richter Scale with its epicenter under Anderson Island just northeast of Olympia, Washington. This is a distance of roughly 65 miles from the center of Pacific County. Its effects were felt halfway into central Oregon and as far north as Vancouver and were reported to last a total of 45 seconds.

Although around 400 people were injured in Olympia and the total property damage and economic loss has been reported at $2,000,000, Pacific was fortunate to feel only minor shaking and not sustain any injury and only minor damage.

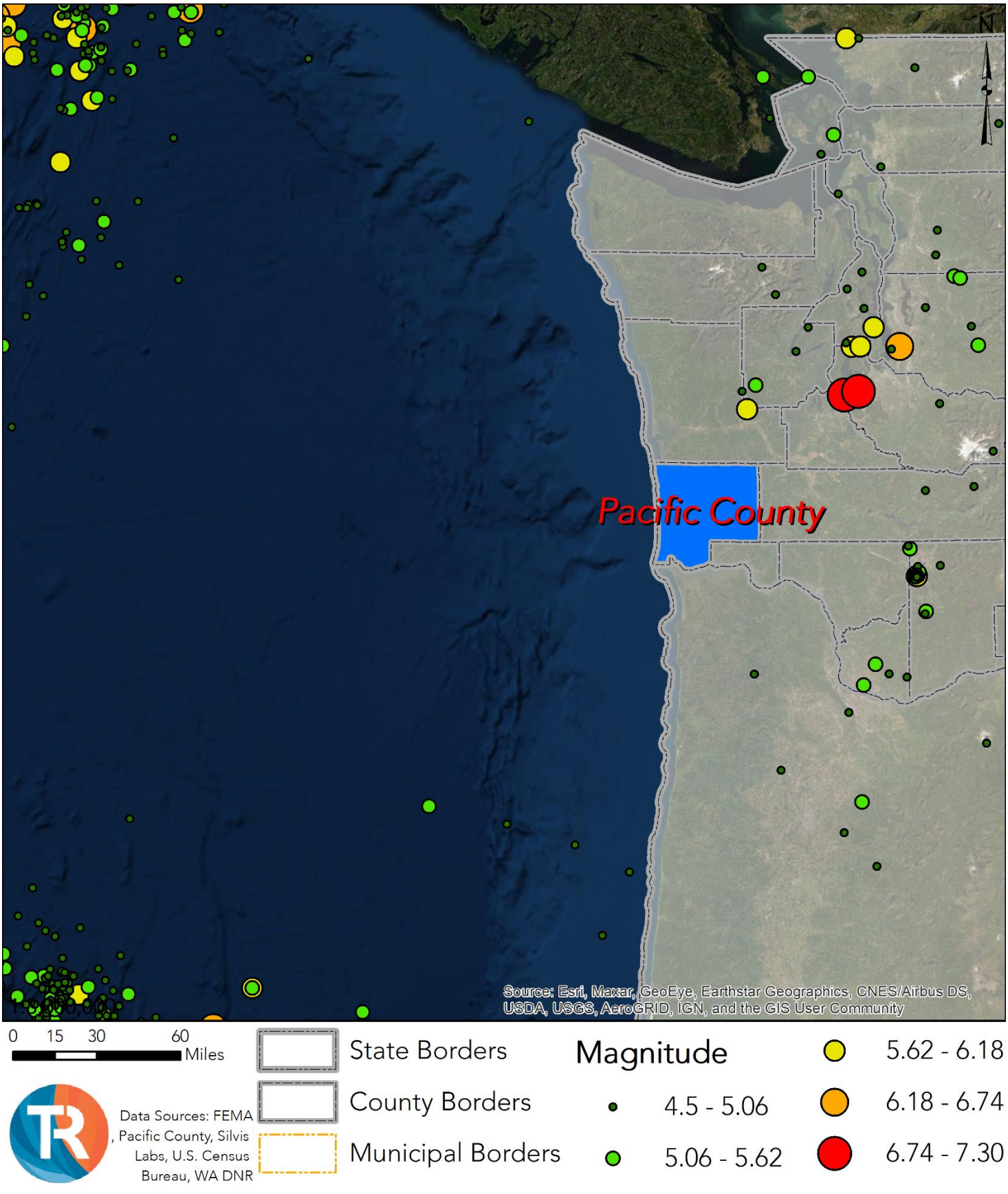
Maps on the following pages depict the USGS's official "shakemap" of the incident. From this map, one can see the recorded peak ground acceleration experienced by Pacific County and its participating jurisdictions was between 9.2 and 18, under the USGS's predicted potential peak ground acceleration 20-30.

There have been other large earthquakes in the State of Washington, such as the Seattle-Tacoma 6.5 magnitude earthquake in 1965, and an Olympia 7.1 magnitude earthquake originating around the same location as the Nisqually earthquake. However, the results and impacts where similar to those of the Nisqually earthquake.

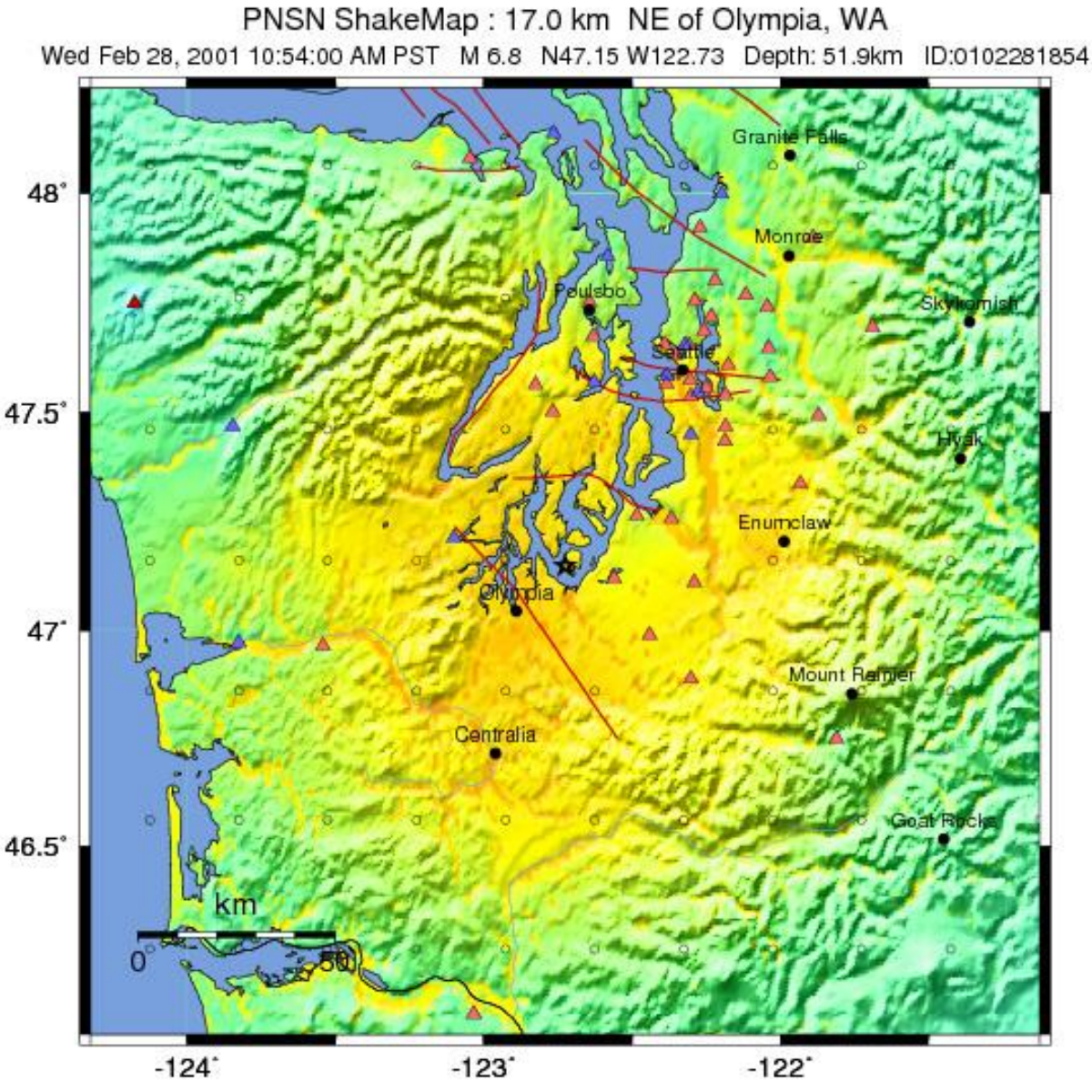
Although minor earthquake activity occurs on a daily basis in the State of Washington, damaging earthquakes are infrequent. The estimated probability of occurrence for an earthquake similar to the magnitude 6.5 Seattle-Tacoma event that occurred in 1965 is approximately once every 35 years. The probability of occurrence of an earthquake similar to the magnitude 7.1 Olympia earthquake that occurred in 1949 is once every 110 years. Since 1970 there have been four earthquakes in Western Washington of greater than 4.0 Magnitude.

The approximate occurrence rate for a magnitude 9 earthquake in the Cascadia Subduction Zone is once every 350 to 500 years. Considering the recurrence interval and history of earthquakes felt in Pacific County, the probability of occurrence of a damaging earthquake is "rare."

**Map 3.3 – Historic Earthquakes, Pacific County**



**Map 3.4 – USGS Shakemap, Nesqually Earthquake**




| PERCEIVED SHAKING | Not felt | Weak | Light | Moderate | Strong | Very strong | Severe | Violent | Extreme |
|---|---|---|---|---|---|---|---|---|---|
| POTENTIAL DAMAGE | none | none | none | Very light | Light | Moderate | Moderate/Heavy | Heavy | Very Heavy |
| PEAK ACC.(%g) | *<.17* | *.17-1.4* | *1.4-3.9* | *3.9-9.2* | *9.2-18* | 18-34 | 34-65 | 65-124 | >124 |
| PEAK VEL.(cm/s) | <0.1 | 0.1-1.1 | 1.1-3.4 | 3.4-8.1 | *8.1-16* | *16-31* | *31-60* | *60-116* | *>116* |
| INSTRUMENTAL INTENSITY | I | II-III | IV | V | VI | VII | VIII | IX | X+ |

## *Vulnerability of and Impact on Facilities*

Pacific County and its jurisdictions' structural vulnerability to earthquakes vary based on the construction quality, construction material, soil and foundation, and earthquake resilience of each structure. The State of Washington has been incredibly pro-active in updating, increasing, and enforcing its seismic resilient building codes. However, a high magnitude earthquake will still damage or destroy structures.

The planning area's most vulnerable structures are those which are older, have not been subject to new and improved building codes, are built over unstable soil, and those susceptible to secondary hazards such as landslides or tsunamis. The vast majority of the planning area's inhabited areas are over lands that are susceptible to liquefaction. The following map depicts the soil locations where the planning area is most susceptible to liquefaction.

Historically, the planning area has sustained $60,141 in property damage from the Nisqually earthquake, but has no other recorded damage from earthquakes.

All structures within the planning area are considered highly vulnerable to earthquakes. There is a difference in vulnerability between the two seismic zones identified and the areas of liquefaction. These differences are outlined in the following tables for the planning area's municipal inventory.

**Table 3.5 – Vulnerable Municipal Structures by Count, Seismic Zones 20-25%g**

| Municipality | Ag | Com | Gov | Ind | Res | Res-M | Total |
|---|---|---|---|---|---|---|---|
| Pacific County | 2 | 16 | 0 | 9 | 763 | 7 | 2 |
| Ilwaco | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Long Beach | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Raymond | 0 | 8 | 0 | 1 | 314 | 9 | 0 |
| South Bend | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total = | 2 | 24 | 0 | 10 | 1,077 | 16 | 2 |

**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the U.S. Census Bureau and FEMA*

**Table 3.6 – Vulnerable Municipal Structures by Value, Seismic Zones 20-35%g**

| Municipality | Ag | Com | Gov | Ind | Res | Res-M | Total |
|---|---|---|---|---|---|---|---|
| Pacific County | 18,336,000 | 123,096,000 | 13,942,000 | 57,332,000 | 850,692,000 | 44,310,000 | $1,107,708,000 |
| Ilwaco | $444,000 | $39,154,000 | $1,387,000 | $4,273,000 | $40,060,000 | $8,426,000 | $93,744,000 |
| Long Beach | $424,000 | $138,683,000 | $845,000 | $3,545,000 | $105,851,000 | $33,456,000 | $282,804,000 |
| Raymond | 1,000,000 | 45,201,000 | 3,589,000 | 9,293,000 | 57,305,000 | 15,260,000 | $131,648,000 |
| South Bend | $267,000 | $31,032,000 | $7,968,000 | $6,348,000 | $60,295,000 | $4,998,000 | $110,908,000 |
| Total = | $20,471,000 | $377,166,000 | $27,731,000 | $80,791,000 | $1,114,203,000 | $106,450,000 | $1,726,812,000 |

**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the U.S. Census Bureau and FEMA*

### Table 3.7 – Vulnerable Municipal Structures by Count, Seismic Zones 25-30%g

| Municipality | Ag | Com | Gov | Ind | Res | Res-M | Total |
|---|---|---|---|---|---|---|---|
| Pacific County | 63 | 280 | 15 | 99 | 9,942 | 52 | 63 |
| Ilwaco | 3 | 42 | 3 | 10 | 492 | 9 | 3 |
| Long Beach | 1 | 165 | 2 | 8 | 1,266 | 32 | 1 |
| Raymond | 4 | 67 | 2 | 17 | 674 | 18 | 4 |
| South Bend | 2 | 40 | 8 | 10 | 735 | 9 | 2 |
| Total = | 73 | 594 | 30 | 144 | 13,109 | 120 | 73 |

**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the U.S. Census Bureau and FEMA*

### Table 3.8 – Vulnerable Municipal Structures by Value, Seismic Zones 25-30%g

| Municipality | Ag | Com | Gov | Ind | Res | Res-M | Total |
|---|---|---|---|---|---|---|---|
| Pacific County | $618,000 | $7,770,000 | $0 | $2,863,000 | $60,856,000 | $6,587,000 | $78,694,000 |
| Ilwaco | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Long Beach | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Raymond | $0 | $2,963,000 | $0 | $1,283,000 | $24,551,000 | $8,266,000 | $37,063,000 |
| South Bend | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| Total = | $618,000 | $10,733,000 | $0 | $4,146,000 | $85,407,000 | $14,853,000 | $115,757,000 |

**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the U.S. Census Bureau and FEMA*

All of the participating school district's structures are within the 20-25%g seismic zone as are the ports, harbors, and its critical facilities. However, many of the area's structures are also within identified liquefaction areas. These include, all ports, both hospitals, and every school district structure with the exception of the Ocean Beach School District's Middle and High School location.

### Table 3.9 – Vulnerable Municipal Structures by Count, Liquefaction

| Municipality | Ag | Com | Gov | Ind | Res | Res-M | Total |
|---|---|---|---|---|---|---|---|
| Pacific County | 57 | 243 | 13 | 81 | 9,656 | 50 | 57 |
| Ilwaco | 3 | 29 | 1 | 6 | 304 | 4 | 3 |
| Long Beach | 1 | 165 | 2 | 8 | 1,266 | 32 | 1 |
| Raymond | 4 | 74 | 2 | 16 | 801 | 26 | 4 |
| South Bend | 2 | 40 | 8 | 10 | 735 | 9 | 2 |
| Total = | 67 | 551 | 26 | 121 | 12,762 | 121 | 67 |

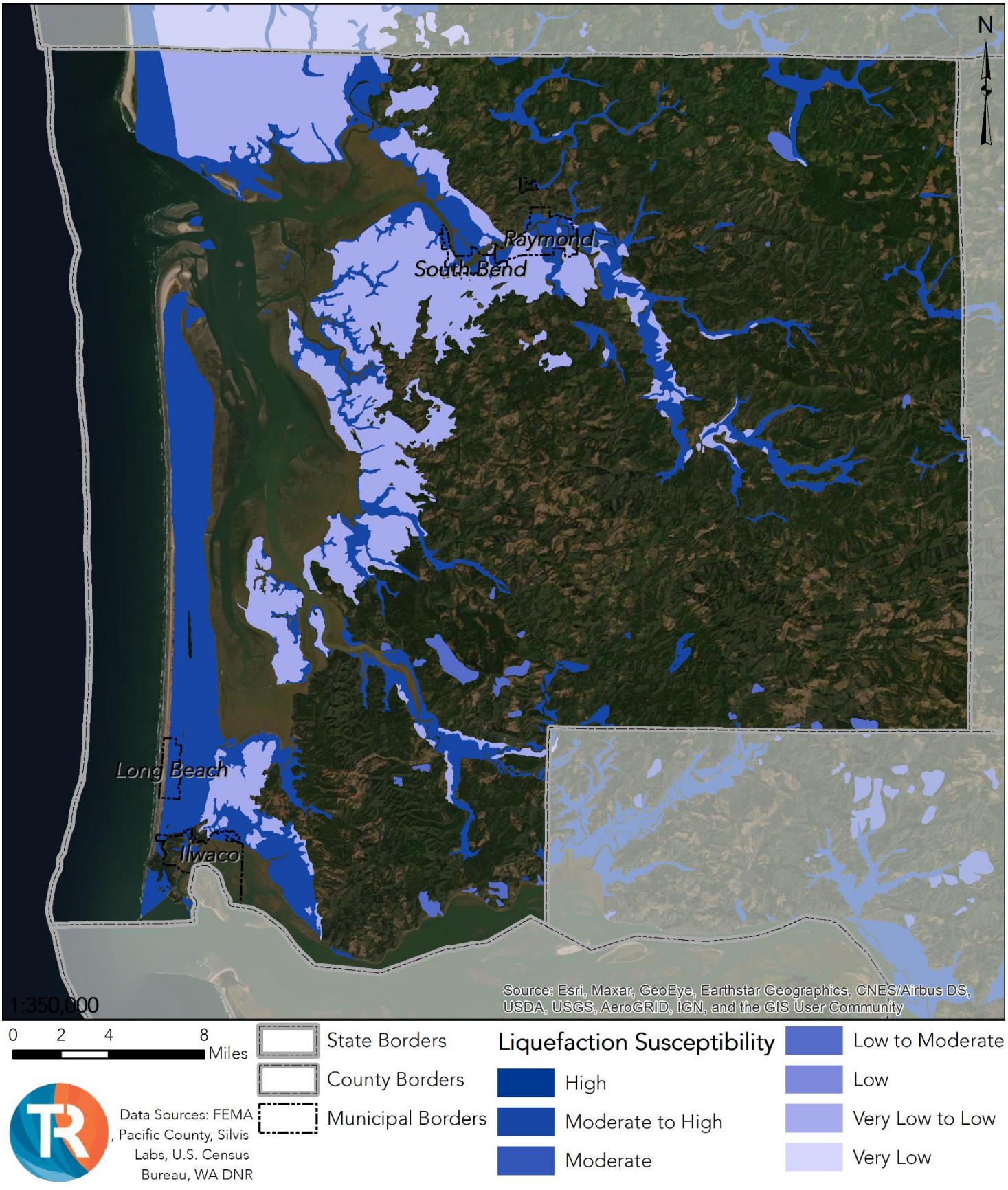
**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the U.S. Census Bureau and FEMA*

### Table 3.10 – Vulnerable Municipal Structures by Value, Liquefaction

| Municipality | Ag | Com | Gov | Ind | Res | Res-M | Total |
|---|---|---|---|---|---|---|---|
| Pacific County | $16,090,000 | $109,160,000 | $12,991,000 | $48,857,000 | $807,535,000 | $44,989,000 | $1,039,622,000 |
| Ilwaco | $374,000 | $29,924,000 | $516,000 | $1,927,000 | $24,664,000 | $3,728,000 | $61,133,000 |
| Long Beach | $424,000 | $138,683,000 | $845,000 | $3,545,000 | $105,851,000 | $33,456,000 | $282,804,000 |
| Raymond | $948,000 | $47,816,000 | $3,440,000 | $10,183,000 | $64,948,000 | $22,949,000 | $150,284,000 |
| South Bend | $267,000 | $31,032,000 | $7,968,000 | $6,348,000 | $60,295,000 | $4,998,000 | $110,908,000 |
| Total = | $18,103,000 | $356,615,000 | $25,760,000 | $70,860,000 | $1,063,293,000 | $110,120,000 | $1,644,751,000 |

**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the U.S. Census Bureau and FEMA*

**Map 3.5 – Liquefaction, Pacific County**



## Vulnerability of and Impact on Population

Pacific County and the vulnerability of its jurisdictions' population to earthquakes is largely dependent on its vulnerability to facilities. An earthquake will shake objects off a wall or shake off parts of a structure which has the potential to hurt the population. Additionally, there is the risk of a facility partially or fully collapsing which would injure or kill the inhabitants. Any number of residents are vulnerable in relation to the structures in which they live, work, and visit.

Historically, there are no recorded incidents of death or injury from earthquakes in Pacific County nor any of its participating jurisdictions.

All people, students, and staff within the planning area are considered highly vulnerable to earthquakes. There is a difference in vulnerability between the two seismic zones identified and the areas of liquefaction. These differences are outlined in the following tables for the planning area's populations and housing units.

**Table 3.11 – Vulnerable Municipal Populations, Seismic Zones 20-25%g**

| Municipality | Housing Units | Population |
|---|---|---|
| Pacific County | 10,478 | 13,887 |
| Ilwaco | 563 | 1,006 |
| Long Beach | 1,618 | 1,520 |
| Raymond | 871 | 2,086 |
| South Bend | 780 | 1,731 |
| Total = | 14,310 | 20,230 |

**The data are from the U.S. Census Bureau and FEMA*

**Table 3.12 – Vulnerable Municipal Populations, Seismic Zones 25-30%g**

| Municipality | Housing Units | Population |
|---|---|---|
| Pacific County | 831 | 1,783 |
| Ilwaco | 0 | 0 |
| Long Beach | 0 | 0 |
| Raymond | 406 | 971 |
| South Bend | 0 | 0 |
| Total = | 1,237 | 2,754 |

**The data are from the U.S. Census Bureau and FEMA*

**Table 3.13 – Vulnerable Municipal Populations, Liquefaction**

| Municipality | Housing Units | Population |
|---|---|---|
| Pacific County | 10,240 | 11,708 |
| Ilwaco | 338 | 597 |
| Long Beach | 1,618 | 1,520 |
| Raymond | 1,081 | 2,410 |
| South Bend | 780 | 1,731 |
| Total = | 14,057 | 17,966 |

**The data are from the U.S. Census Bureau and FEMA*

3.4 – Earthquakes

## Vulnerability of and Impact on Systems

If an earthquake damages any part of Pacific County or its jurisdictions, it is highly likely the entire planning area will be similarly damaged due to the geographic scale of earthquakes. A high magnitude event would likely cripple the planning area, destroying buildings and infrastructure, starting fires, incurring widespread loss of power and basic services, and hampering local emergency management and response services from coordinating or providing the necessary assistance.

If a high magnitude earthquake originates from the Cascadia Subduction Zone it is likely the entire region will be dramatically affected and emergency services from local, regional, state, and the federal government will be spread thin among the region. A high magnitude earthquake will not only yield these direct and immediate effects, but will likely hurt Pacific County and its jurisdictions' economy and scar its population for years.

## *Key Considerations*

***Fire Protection Districts***

The fire districts' services are an integral part to the planning areas emergency operations before, during, and after an event. The participating fire districts are vulnerable to earthquakes. An earthquake that damages the fire districts' capabilities will have dramatic negative effects on the planning area's ability to respond to and recover from the earthquake.

***Hospitals***

Both hospitals are themselves directly vulnerable and at high risk from an earthquake event. Not only would they themselves be damaged, but their ability to provide its services to the community would be all but eliminated.

***Ports***

The ports of Chinook, Ilwaco, Peninsula, and Willapa Harbor are significantly vulnerable to earthquakes. Although the resiliency of its structures are not known, any destruction of critical equipment, docks, or mooring facilities could shut down the port for weeks to months. Additionally, depending on what was damaged or destroyed, debris could fall into the water making the facility unnavigable. The communities of Pacific County rely on these ports for commercial and economic stability and prosperity making them of extreme value in terms of mitigation and recovery.

***Public Drainage & Utility District***

Both districts infrastructure is at significant risk to strong earthquakes. Power lines, delivery substations, and water utility infrastructure above ground can be damaged in the same way as any above ground structure. Power lines that are buried can become dislodged, disjoined, or broken due to shifts in the earth and soil. This poses a serious problem for response and recovery operations following a sizable earthquake.



***Transportation & Pacific Transit***

The roadways and bus routes of Pacific County are highly vulnerable to earthquakes. The complexity and multitude of valleys in which its roadways are constructed make it especially vulnerable to closures from landslides caused by earthquakes. This is covered in more detail in

Section 4.3LS - Landslides. Additionally, movement from the earth can displace roadways, making any quick and easy repairs impossible. Damaged structures or other falling debris can block these roadways, further delaying any return to normal service of a roadway. Long term closures and restrictions from an earthquake have the potential to damage the local economy, hamper commerce, and limit the delivery of basic services.

# 3.5 - Floods

Flooding is the most prevalent and costly disaster in the United States. Flooding occurs when water, due to dam failures, rain, or melting snows, exceeds the absorptive capacity of the soil and the flow capacity of rivers, streams or coastal areas. At this point, the water concentration hyper extends the capacity of the flood way and the water enters the floodplain. Floods are most common in seasons of rain and thunderstorms.

Intense rainfall, accompanying large thunderstorms in the planning area, may result in water flowing rapidly from higher elevations, exceeding river flow capacity, collecting in agricultural areas, inadequate municipal stormwater drainage, or inadequate soil absorption capacity caused by urban and suburban development.

## *Location & Extent*

Various types of floods can happen quickly, under an hour, in the form of a flash flood, or accumulate seasonally over a period of weeks as is the case in a riverine flood. Flooding can occur anytime throughout the year, but typically happens in April, May, and October. A variety of factors affect the severity of flash and riverine flooding. These include topography, weather characteristics, development, and geology. Intense flooding will create havoc in any jurisdiction affected. The predicative magnitude of flash and riverine floods varies greatly.

Flash flooding is unpredictable and can occur anywhere throughout the planning area. Pacific County, its municipalities, and the school districts are generally equally likely to experience flash flooding in low-lying areas, areas of poor drainage, or suburban sprawl. However, the NWS and NOAA have not recorded any significant flash floods in the planning area.

Coastal and riverine flooding throughout the planning area varies, but is more limited to specific identified floodplains. Special Flood Hazard Areas (SFHA) were identified via effective NFHL maps produced by FEMA and are located later in this hazard profile. FEMA identified floodplains exist in numerous places throughout unincorporated Pacific County and every participating municipality. None of the participating school districts have structures in identified floodplains.

Road closures are common after flooding events. Flooding records show it is extremely common for rural roads and older bridges to be damaged or completely washed away. Many records report specific incidents where water flowed over or covered highways. Reports cite coastal surges having left highways 101, 103, and 401 under water in past events. One report cited an accumulation of two feet of water in downtown Raymond and there are multiple reports of roads being washed out. Coastal surges have been recorded in excess of five feet.

**Table 3.14 – Floodplain Classifications**

| Zone Class | Description |
|---|---|
| A | Areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply. |
| AE | Areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. Base Flood Elevations (BFEs) are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply. |
| AO | Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are between one and three feet. Some Zone AO have been designated in areas with high flood velocities such as alluvial fans and washes. Communities are encouraged to adopt more restrictive requirements for these areas. |
| B | Areas subject to inundation by 0.2-percent-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown. |
| VE | Areas subject to inundation by the 1-percent-annual-chance flood event with additional hazards due to storm-induced velocity wave action. |

## *History & Probability*

Since 1996, NOAA has recorded 32 floods (10 coastal and 22 riverine) in the planning area.

These floods have caused no recorded injuries or fatalities in the planning area per NWS and NOAA records, as well as, local reports. They have caused $15,776,000 in property damage. For a complete list of NOAA recorded flash and riverine floods, please reference Appendix C.

All FEMA identified SFHAs classified as primary zone A floodplains meaning they are subject to inundation at a rate of 1% per year, while those identified as zone B are subject to riverine flood at 0.2% per year. Please see the table above for the various floodplain classifications that exist throughout the planning area.

## *Vulnerability of and Impact on Facilities*

Pacific County and the participating jurisdictions have agricultural, commercial, industrial, and residential structures in floodplains. Flooding can cause minimal or complete damage to any of these types of facilities taking them offline for days to years depending on the resources available and remediation costs after an event.

The average flood in Pacific County costs $493,000. The existing range of a single incident has been from $0 to $10,000,000. The planning area has incurred a total of $15,776,000 in property damage from coastal and riverine floods.

The planning areas municipal and school district structures are valued at $1,951,752,686 ($1,842,569,000 municipal, $109,183,686 school district). A GIS analysis of FEMA's identified SFHAs puts a total of



$358,510,000 worth of the planning area's municipal structural inventory exposed to riverine flooding. None of the school districts' structures are vulnerable to coastal and riverine flooding.

**Table 3.15 – Vulnerable Municipal Structures by Count, Floods**

| Municipality | Ag | Com | Gov | Ind | Res | Res-M | Total |
|---|---|---|---|---|---|---|---|
| Pacific County | 6 | 23 | 1 | 8 | 529 | 0 | 567 |
| Ilwaco | 0 | 1 | 0 | 3 | 116 | 0 | 120 |
| Long Beach | 1 | 165 | 2 | 8 | 1,266 | 32 | 1,474 |
| Raymond | 0 | 0 | 0 | 1 | 15 | 1 | 17 |
| South Bend | 0 | 6 | 1 | 0 | 2 | 0 | 9 |
| Total = | 7 | 195 | 4 | 20 | 1,928 | 33 | 2,187 |

**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the U.S. Census Bureau and FEMA*

**Table 3.16 – Vulnerable Municipal Structures by Value, Floods**

| Municipality | Ag | Com | Gov | Ind | Res | Res-M | Total |
|---|---|---|---|---|---|---|---|
| Pacific County | $1,514,000 | $7,947,000 | $496,000 | $3,206,000 | $44,765,000 | $6,000 | $57,934,000 |
| Ilwaco | $0 | $309,000 | $0 | $555,000 | $9,469,000 | $0 | $10,333,000 |
| Long Beach | $424,000 | $138,683,000 | $845,000 | $3,545,000 | $105,851,000 | $33,456,000 | $282,804,000 |
| Raymond | $0 | $108,000 | $0 | $511,000 | $1,213,000 | $105,000 | $1,937,000 |
| South Bend | $0 | $4,281,000 | $1,034,000 | $10,000 | $177,000 | $0 | $5,502,000 |
| Total = | $1,938,000 | $151,328,000 | $2,375,000 | $7,827,000 | $161,475,000 | $33,567,000 | $358,510,000 |

**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the U.S. Census Bureau and FEMA*

## *Vulnerability of and Impact on Population*

If evacuation is not heeded, or flood waters rise quickly enough, Pacific County and its participating jurisdictions' population can drown or become trapped on rooftops or points of high elevations. Being trapped will expose them to elements and deprive them of basic needs and services.

As described previously, water that is long lasting and slow to drain will encourage the growth of mold and other bio-hazardous material, rendering a facility unusable until remediation is finished. Extra care, assessment, and sanitization are required before anyone can reinhabit or utilize a structure for any prolonged period of time. Assisted care facilities housing vulnerable populations can take longer to evacuate. Additionally, the potential presence of mold after a flood requires extra care to be taken before their population can re-inhabit an assisted care facility where the inhabitants are at greater risk of infection. The planning area has incurred no injuries or fatalities from flooding.

2,456 residents in 2,301 housing units are currently identified as exposed and vulnerable to riverine and coastal floods. Of the school district locations identified, none of them are within the geographic range that would reasonably put any of their students, staff, or faculty at risk to riverine or coastal flooding.



**Table 3.17 – Vulnerable Municipal Populations, Floods**

| Municipality | Housing Units | Population |
|---|---|---|
| Pacific County | 546 | 749 |

| | | |
|---|---|---|
| Ilwaco | 118 | 209 |
| Long Beach | 1,618 | 1,440 |
| Raymond | 16 | 52 |
| South Bend | 3 | 6 |
| Total = | 2,301 | 2,456 |

**The data are from the U.S. Census Bureau and FEMA*

## *Vulnerability of and Impact on Systems*

Flash flooding does not often cause widespread damage to property or infrastructure and is limited in its ability to impact systems. Even when roads have been swept away, the problem is often limited to secondary roadways. However, catastrophic riverine or coastal flooding can cause significant damage to a community's systems.

Extensive riverine or coastal flooding can significantly impact local governments' ability to provide basic goods and services to their communities either by losing essential facilities or by blocked infrastructure. This can take the form of lost law enforcement, fire prevention, medical, or water treatment facilities.

Significant damage to residential and or commercial structures can irrevocably damage a community and its economy creating refugees and economic hardship. If a chemical facility is significantly
impacted it is possible the chemicals stored at the facilities can wash away with the flood waters and have detrimental effects on the local environment.

As previously discussed, both riverine and coastal flooding has closed down numerous transportation routes within the planning area causing temporary limitations of the planning area's residents and business to go about their daily lives.

## *Key Considerations*

### *Fire Protection Districts*

The fire districts' services are an integral part of the planning area's emergency operations before, during, and after an event. The participating fire districts are minimally vulnerable to flooding. The random nature of flash flooding is unlikely to damage an entire fire district in a way that would significantly reduce its overall capabilities.

### *Hospitals*

Neither hospital is located in an identified coastal or riverine floodplain.



### *Ports*

The ports of Chinook, Ilwaco, Peninsula, and Willapa Harbor are significantly vulnerable to riverine and coastal flooding. In the event flood waters rise, the ports' docks, machinery, heavy equipment, and vessels could be significantly damaged. The communities of Pacific County rely on these ports for commercial and economic stability and prosperity making them of extreme value in terms of mitigation and recovery.

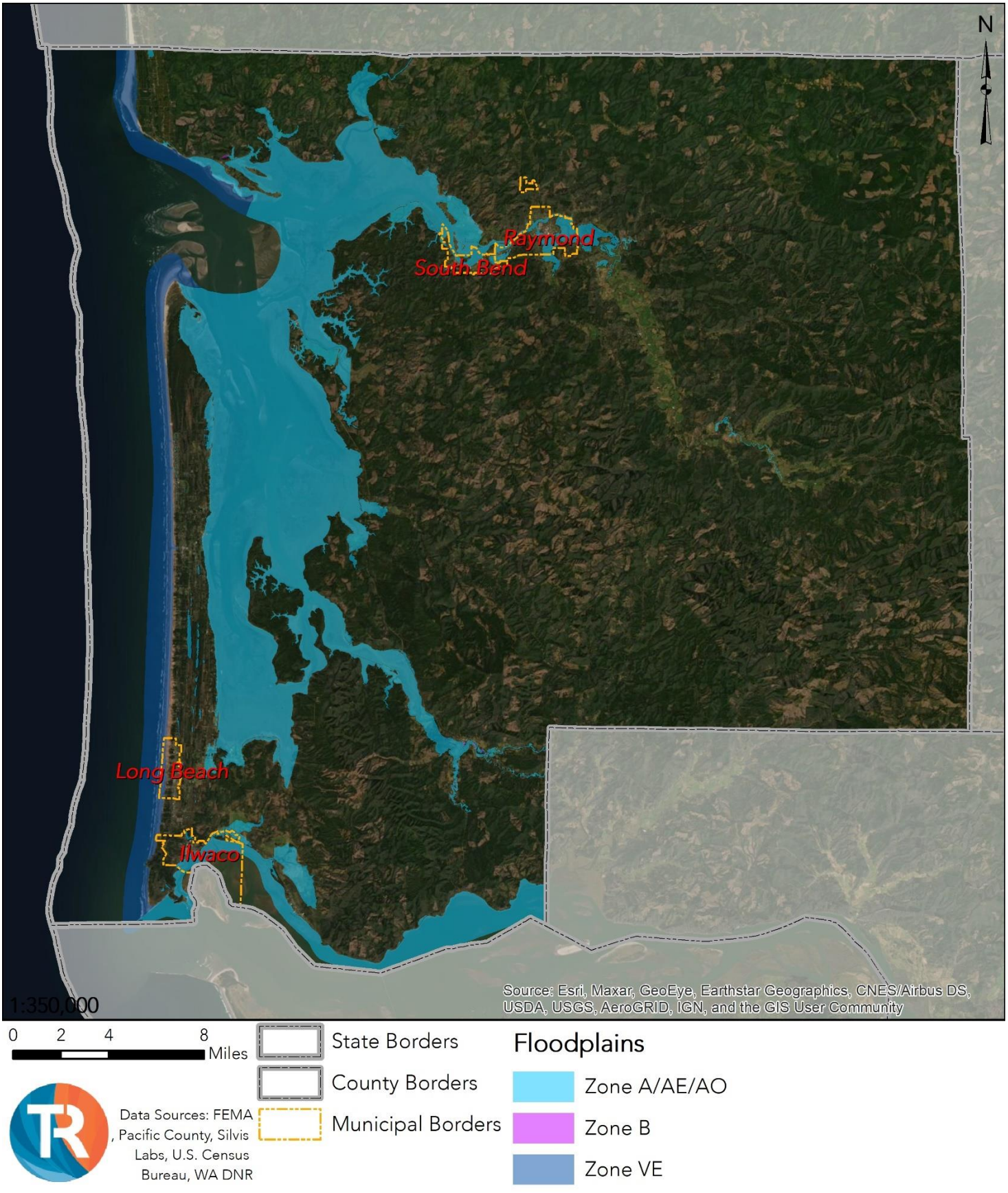
### *Public Drainage & Utility Districts*

Public Utility District #2 serves the entire planning area. PUD #2 does not generate any power of its own, but provides and maintains the energy grid necessary to delivery electricity to the planning area. PDD #1 and PUD #2' are at minimal direct risk to flooding.

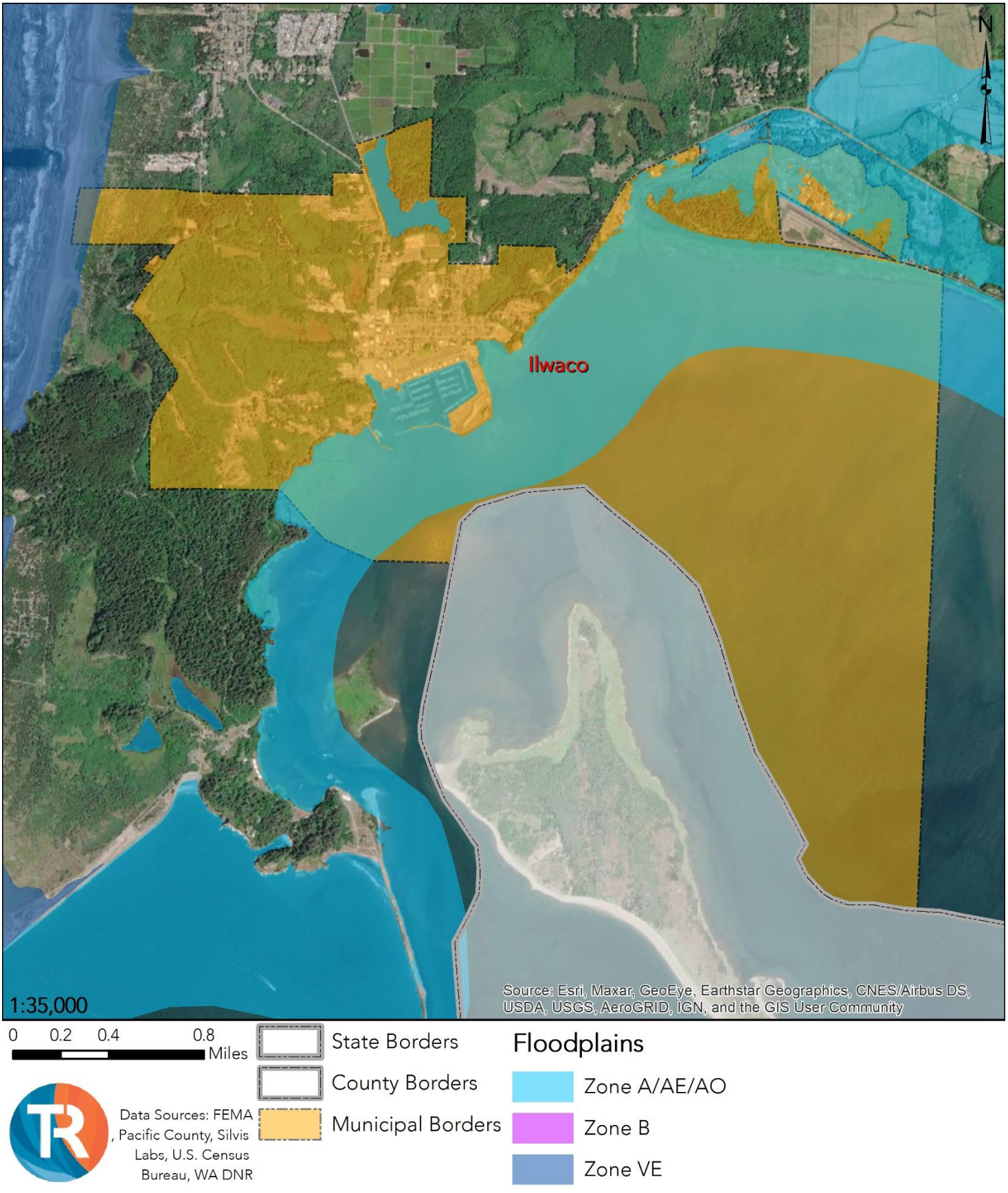
***Transportation & Pacific Transit***

The roadways and bus routes of Pacific County are highly vulnerable to riverine flooding. The complexity and multitude of valleys in which its roadways are constructed make it especially vulnerable to closures from flooding. Any major roadway closures can cut off communities from basic services. Additionally, long term closures from flooding have the potential to damage the local economy and hamper commerce for years.

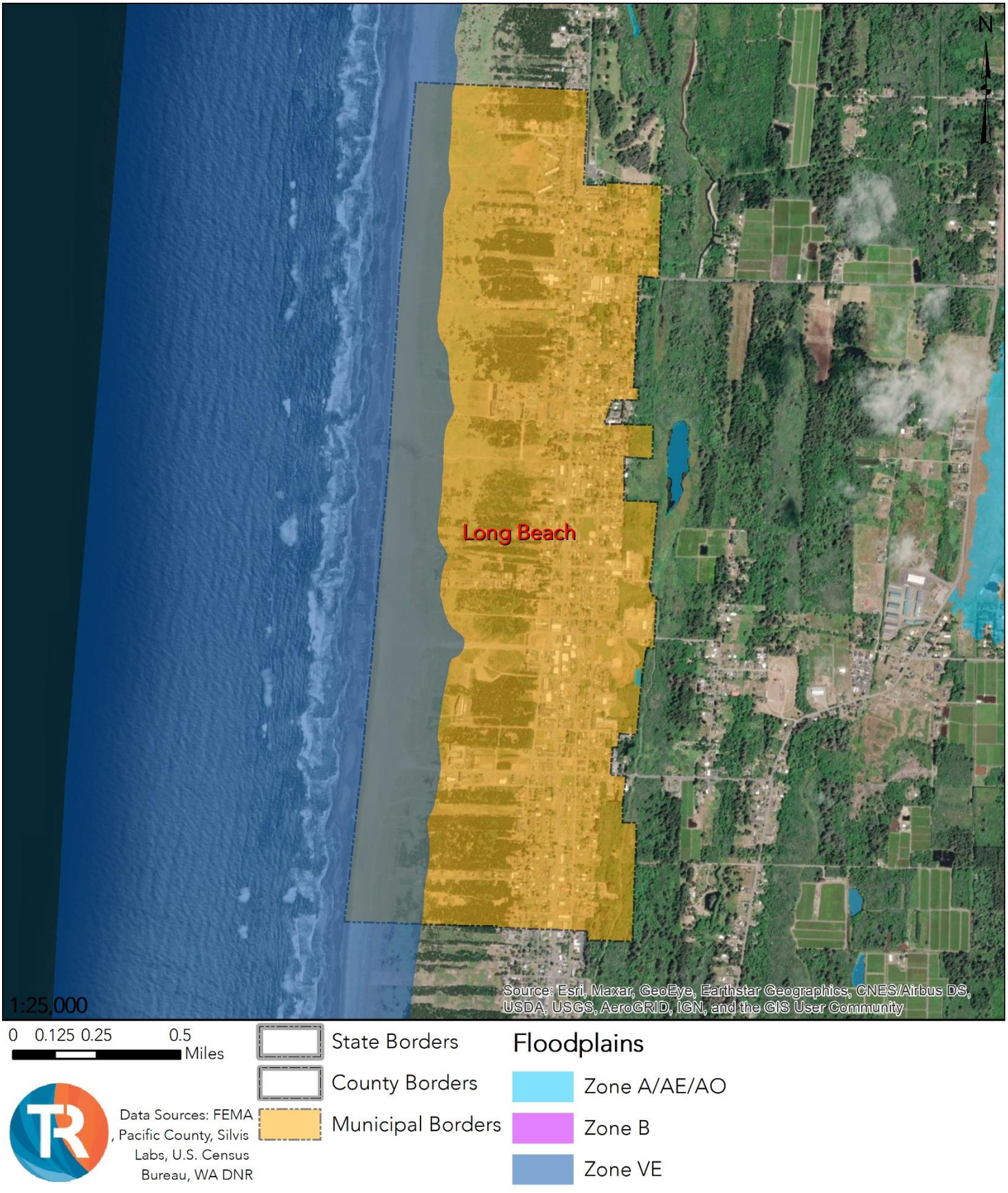
**Map 3.6 – Floodplains, Pacific County**



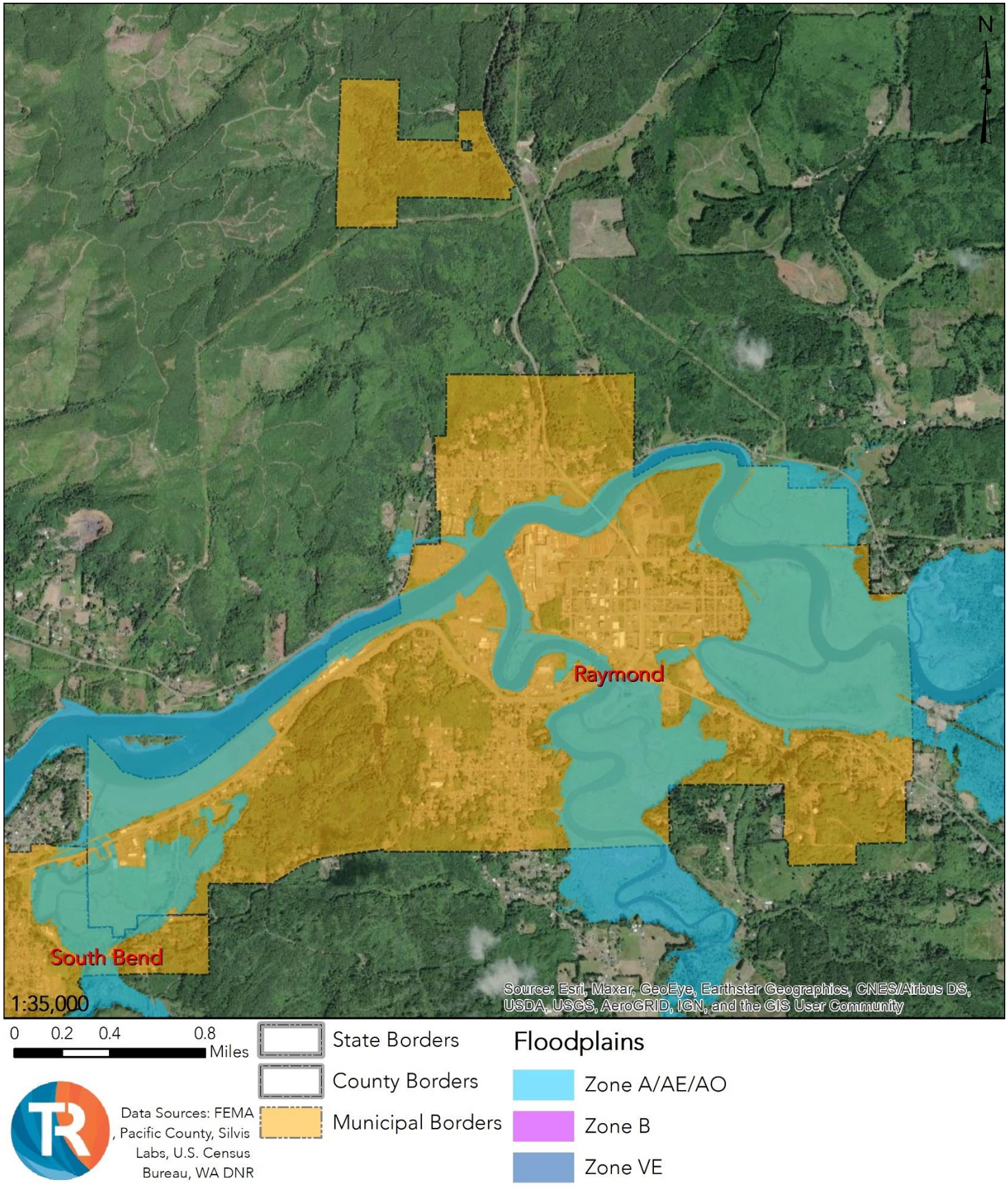
**Map 3.7 – Floodplains, Ilwaco**



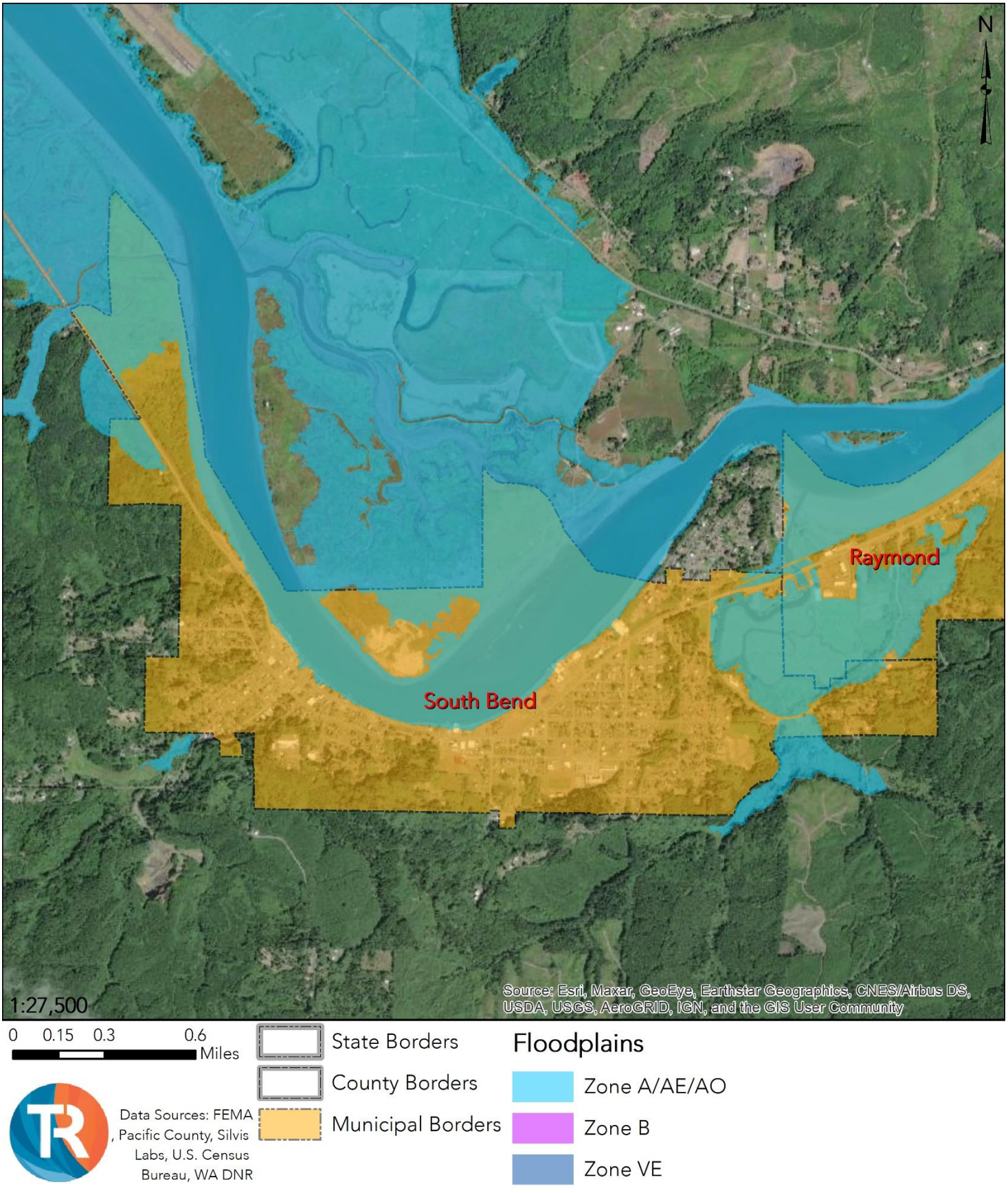
**Map 3.8 – Floodplains, Long Beach**



**Map 3.9 – Floodplains, Raymond**



**Map 3.10 – Floodplains, South Bend**



# 3.6 - Landslides

Landslides are the downward and outward movement of slopes. Landslides include a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. Although gravity acting on and over steepened slopes is the primary reason for a landslide, landslides are often prompted by the occurrence of other disasters. Other contributing factors include the following: erosion; steep slopes; rain and snow; and earthquakes.

Slope material often becomes saturated with water and may develop a debris or mudflow. If the ground is saturated, the water weakens the soil and rock by reducing cohesion and friction between particles. Cohesion (which is the tendency of soil particles to "stick" to each other) and friction affect the strength of the material in the slope and contribute to a slope's ability to resist-down slope movement. Saturation also increases the weight of the slope materials and, like the addition of material on the upper portion of a slope, increases the gravitational force on the slope. Undercutting of a slope reduces the slope's resistance to the force of gravity by removing much-needed support at the base of the slope. Alternating cycles of freeze and thaw can result in a slow, virtually imperceptible loosening of rock, thereby weakening the rock and making it susceptible to slope failure. The resulting slurry of rock and mud can pick up trees, houses, and cars, and block bridges and tributaries, causing flooding along its path. Additionally, removal of vegetation can leave a slope much more susceptible to superficial landslides because of the loss of the stabilizing root systems.

## *Location & Extent*

Landslides have the potential to destroy structures and infrastructure or block transportation in mountainous valleys. Although the overall risk is limited, its potential varies throughout Pacific County, with sporadic risk zones identified by the State of Washington's Department of Natural Resources.

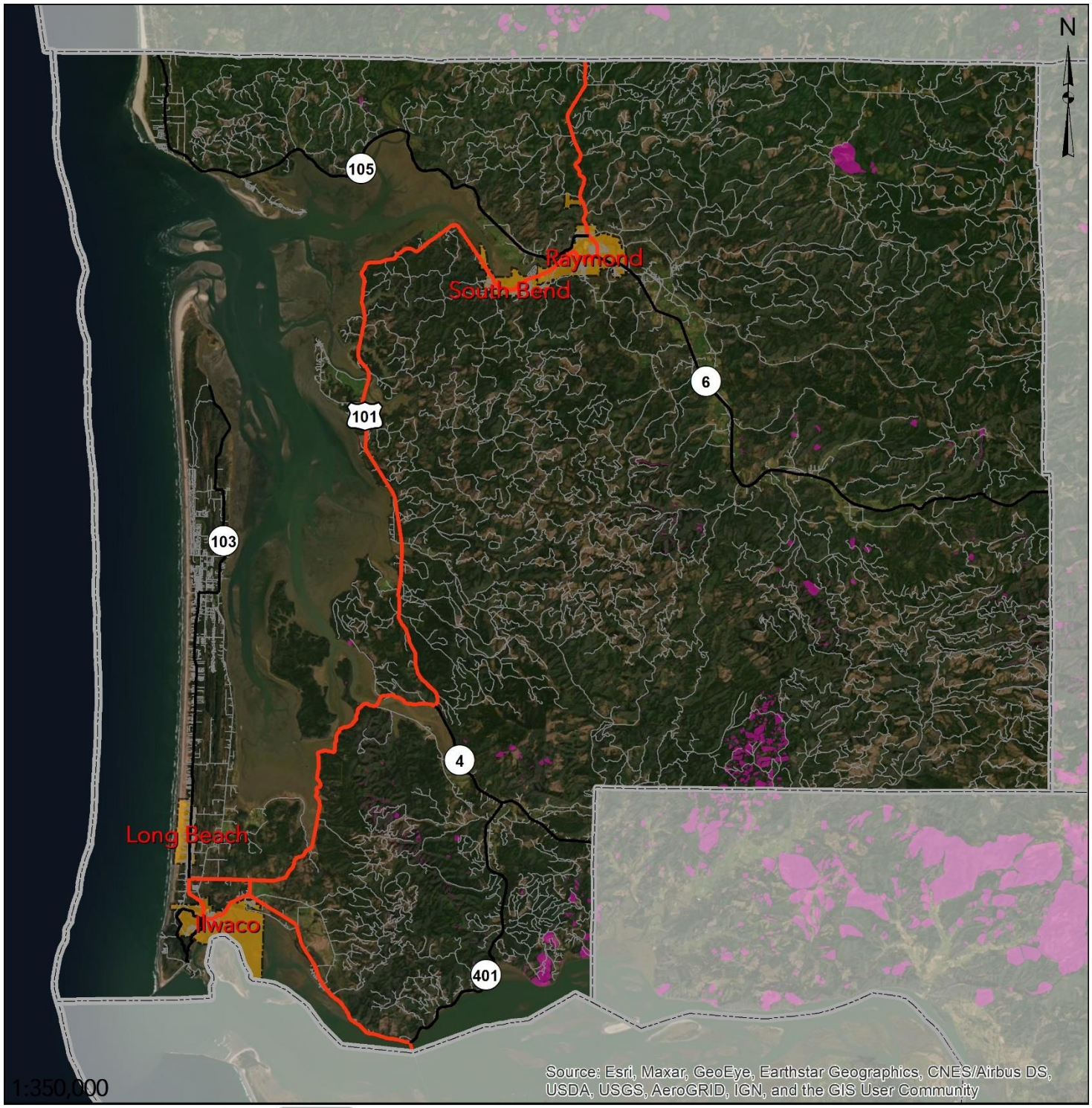
Landslides have been reported along highway 101 in the southern portion of the county, but this area is not marked by the State of Washington's Department of Natural Resources. None of the participating jurisdictions in the plan are at risk with the exception of the county at large. The identified risk zones are not a danger to Pacific County's densely populated areas. Please see the maps on the following pages for the State of Washington's identified risk zones and the location of highway 101 as it runs through the county.

## *History & Probability*

Landslides can occur without the presence of another hazard event, but often occur as a secondary hazard. Incidents of heavy rain, melting snow, earthquakes, and land subsidence are their primary cause. Hence, their future occurrences are highly dependent on the likelihood of the mentioned hazards. Pacific County does not have a history of significant or threatening landslides, yet is has experienced minor landslides that have blocked roadways and damaged smaller sections or roadways.

Pacific County and its participating jurisdictions do not have any documented cases of significantly damaging landslides. It has experienced minor landslides bordering on what would be considered a "nuisance hazard." Given the identified hazard areas, there is still a future risk of a significantly

**Map 3.11 – Landslide Risk Zones, Pacific County**



damaging and life-threatening landslide, and thus its probability of future occurrence is classified as "rare."

## Vulnerability of and Impact on Facilities

Landslides can have minimal or devastating impacts on facilities. The degree of vulnerability depends on the specifics of the landslide itself. Pacific County and its participating jurisdictions do not have any developed areas or structures located next to the identified risk zones.

## Vulnerability of and Impact on Population

Landslides pose a minimal risk to Pacific County and its participating jurisdictions' population. None of its municipalities are located along the identified hazard risk zones. That being said, it is possible for a landslide to impact traveling motorists on its roadways. Depending on the topography and circumstances of the landslide, this could simply immobilize a vehicle, cover it in debris, or cause serious to mortal bodily harm to the vehicle's inhabitants.

Pacific County and its participating jurisdictions do not have any recorded deaths or injuries from landslide events.

## Vulnerability of and Impact on Systems

Pacific County and its participating jurisdictions' systems are minimally vulnerable to landslides. A landslide has the potential to temporarily block a major highway or transportation network for weeks at a time. Additionally, if the landslide occurs in tandem with another hazard, such a severe storm event, the blocking of a major route will have compounded effects on response and recovery operations. Emergency personnel may have to use far, out of the way routes, delaying necessary aid to Pacific County and its participating jurisdictions.

Given the occurrences (although rare) of roadway blocking landslides, Pacific County can be sure that in the future more roadways will be blocked by landslides with the potential to slightly damage or disturb commuter traffic through the county.

## Key Considerations

Given that the vast majority of the geographic areas affected by landslides are remote roadways and some primary roadways, it is unlikely that a landslide will directly affect the FPDs, hospitals, ports or public districts. However, all four of these non-municipal stakeholders will likely be indirectly affected by a landslide at one point or another. Each relies on transportation to carry out it's day-to-day services whether it is emergency response, maintenance and repair, shipping.

### Fire Protection Districts

FPD 2, 3, and 4 are the most likely of the FPDs to encounter problems from a landslide. Inherently, their ability to perform their duty requires a quick response time, whether it is for a medical reason or to fight a wildfire. Blocked transportation routes could cause too slow of a medical response time or allow a wildfire to grow out of control.

3.6 – Landslides

### Hospitals

The Willapa Harbor Hospital is largely in an area of the county where landslides shouldn't be an issue for their response time. However, the Ocean Beach Hospital is reliant on many of the transportation routes that exist within identified landslide risk zones. Delay in their response to a patient due to a landslide blocking a transportation route could mean the difference between life or death.

***Ports***

An indirect affect of shipping by a port will likely cost the port money, but fortunately not significantly alter the port.

***Public Drainage & Utility District***

Both districts maintain and repair a large network of infrastructure. Slight delays from a landslide won't significantly change their operations. However, in the event that a windstorm and flooding accompany a landslide, it could significantly delay the repair of basic services to some rural areas of the county.

***Transportation & Pacific Transit***

Part of Pacific County's transportation network is vulnerable to landslides. The previous map depicted in this section, overlays major roadways in the planning area with the identified risk zones. State Highways 4 and 401 run alongside some of the identified risk zones. Additionally (although risk zones are alongside not marked) Highway 101 has experienced landslides and is therefore vulnerable.

Landslides are rare in the area, but it is possible that a series of landslides could occur at both major roadways and, cutting off Washington's access to the south western portion of the county. Access to Oregon could be threatened, especially if the landslides are a result of a major earthquake, response and recovery operations could be significantly deterred.

# 3.7 – Tsunamis

Tsunami is a Japanese word for a sea wave of local or distant origin that results from large-scale seafloor displacements usually associated with large earthquakes. This displacement of earth moves columns of water above the rupture point and the result is a series of waves that travel outwards in all directions from the place where the uplift occurred.

Tsunami waves have extremely long wavelengths containing a greater volume of water than damaging waves from a coastal storm. In this way, they behave less like a wave and more like an autonomous influx of water. Tsunamis can travel great distances across the entirety of the Pacific Ocean at speeds of 500 miles per hour. In the deep ocean, they can pass underneath ships without hinting of their existence. Once they approach shallower depths the excessive volume of water begins to elevate and the tsunami slows down.

A tsunami can move inland for just feet or miles, depending on the strength of the tsunami and the land's topography. A tsunami can take up to an hour to reach its peak while moving inland and can also be accompanied by smaller tsunami, waves which begin to build up once they move inland. If a tsunami hits at high tide, it will move farther inland and elevate higher, as the converse is also true for low tide. Additionally, if the originating earthquake causes a greater drop in land elevation than is modeled, a tsunami could have more devastating effects that were previously discussed or modeled.

## *Location & Extent*

A high magnitude earthquake originating in the Cascadia Subduction Zone will produce a tsunami. Additionally, there is the possibility that an earthquake near Alaska (or even Japan) will form a tsunami that impacts the planning area. A tsunami created near Alaska or Japan would give hours of warning time for evacuation and preparation while a tsunami created by the Cascadia Subduction Zone could give anywhere between 20 and 30 minutes and as long as 4 hours. Subsequent event-related tsunamis can continue to arrive for hours. The Washington DNR predicts that a Cascadia event could produce a tsunami as high as 120 feet.

The State of Washington's Department of Natural Resources has modeled two likely tsunami scenarios which are depicted in the maps on the following pages. These depict a scenario modelled after a tsunami that occurred in 1700 A.D. and another study that attempts to predict a larger event that is estimated to occur at 2,500-year intervals. The newer study uses updated topographical data and digital elevation maps accurate to 1/3 arc seconds. As expected, the areas closest to the coast and those near the mouths of rivers are highly exposed, while the jurisdictions inland are not exposed.

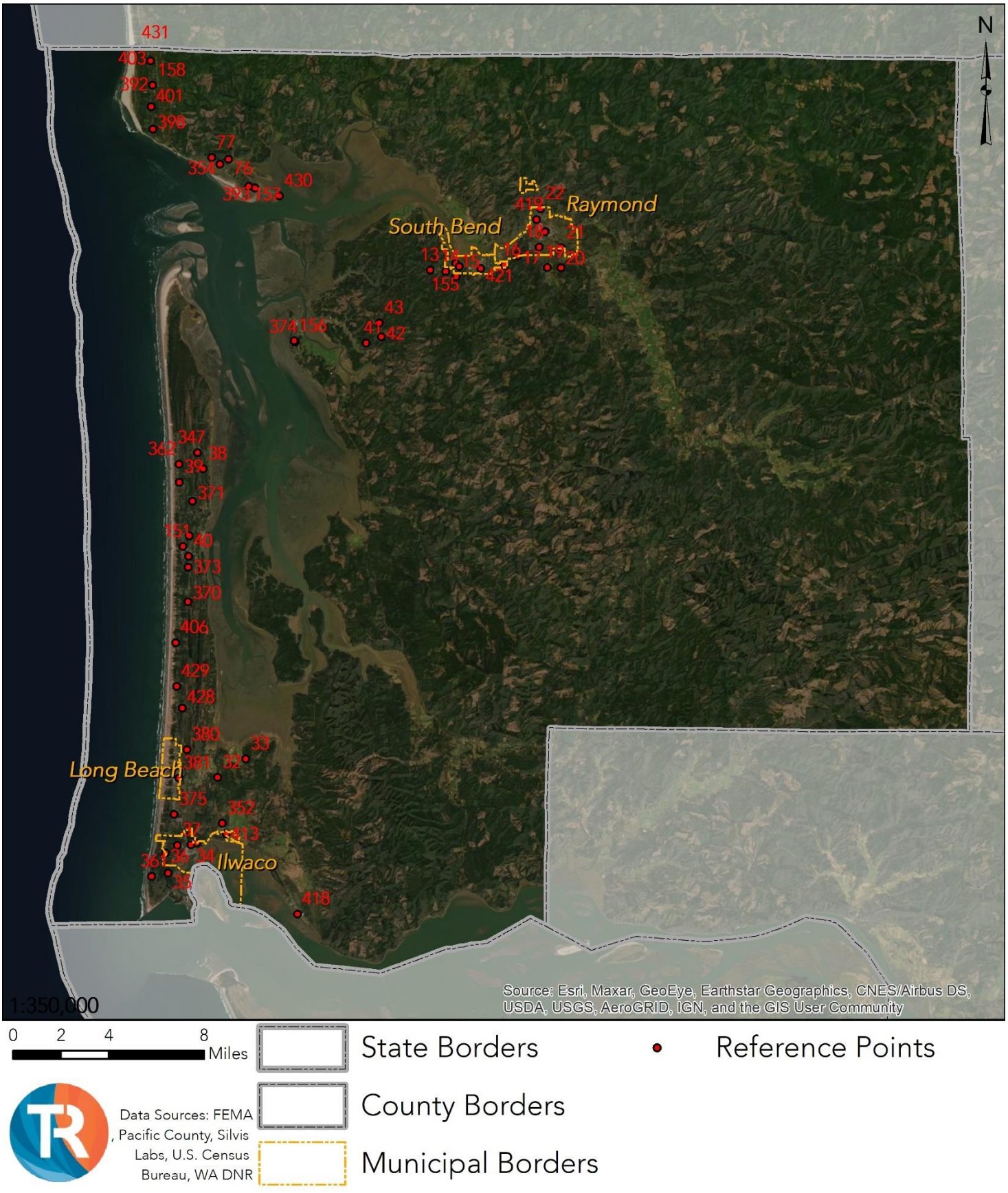
Additionally, these models estimate the peak crest height of each tsunami at certain points along the coast. The peak crest points are shown in a table and a map on the following pages. Please see the table below for the estimated tsunami crest height at each location.

## Table 3.18 – Tsunami Model Reference Points

| ID | Site Name | Site Description | Latitude | Longitude | Elevation (Ft.) |
|---|---|---|---|---|---|
| 13 | South Bend-Palix Rd | N/A | 46.66137525 | -123.8350415 | 27 |
| 14 | South Bend-Palix Rd | N/A | 46.66065027 | -123.821499 | 27 |
| 15 | Rixon Rd | N/A | 46.65761471 | -123.812019 | 302 |
| 16 | Raymond-South Bend Rd | N/A | 46.66496088 | -123.7696846 | 112 |
| 17 | Raymond-South Bend Rd | N/A | 46.67044582 | -123.7582852 | 112 |
| 18 | Jackson Ave | N/A | 46.67609201 | -123.7395295 | 39 |
| 19 | Fowler Rd | N/A | 46.66365015 | -123.7318647 | 40 |
| 20 | Bloomhardt Rd | N/A | 46.66363539 | -123.720064 | 31 |
| 21 | Bloomhardt Rd | N/A | 46.67573473 | -123.7197613 | 31 |
| 22 | US Highway 101 | N/A | 46.69920701 | -123.7386581 | 115 |
| 32 | Long Beach Assembly Area | Along 67th Pl-Honeymoon Rd | 46.35241149 | -124.0164706 | 76 |
| 33 | Willapa Wildlife Refuge HQ | Rekola Rd | 46.36389544 | -123.9921024 | 66 |
| 34 | School Hill | Along NE Brumback Ave | 46.31131551 | -124.0389688 | 75 |
| 35 | North Head Rd #3 | Along State Highway 100-Robert Gray Dr | 46.29396346 | -124.0587576 | 120 |
| 36 | North Head Rd #2 | Along State Highway 100-Robert Gray Dr | 46.30626238 | -124.0612092 | 120 |
| 37 | North Head Rd #1 | Along State Highway 100-N. Head Rd | 46.3109741 | -124.0509859 | 120 |
| 38 | Douglas Dr | Along Douglas Dr | 46.53937266 | -124.0328181 | 33 |
| 39 | Surfside Inn | Surfside Inn and Golf Course parking area | 46.53103304 | -124.0533859 | 30 |
| 40 | U St | Along U Street | 46.48627738 | -124.0442983 | 25 |
| 41 | South Bend-Palix Rd | Along South Bend-Palix Rd | 46.61668203 | -123.8906418 | 27 |
| 42 | South Bend-Palix Rd | Along South Bend-Palix Rd | 46.62061765 | -123.8774432 | 27 |
| 43 | South Bend-Palix Rd | Along South Bend-Palix Rd | 46.62910095 | -123.8792395 | 27 |
| 76 | N/A | High ground along State Route 105 | 46.72726025 | -124.0138092 | 104 |
| 77 | Eagle Hill Rd | Assemble along Eagle Hill road | 46.7280918 | -124.0286241 | 116 |
| 151 | Fire Station | N/A | 46.4921166 | -124.0493637 | 25 |
| 152 | Fire Station | N/A | 46.68551129 | -123.7340134 | 12 |
| 153 | Police Station | N/A | 46.68537408 | -123.7343168 | 13 |
| 154 | Police Station | N/A | 46.66553389 | -123.8128929 | 14 |
| 155 | Police Station | N/A | 46.66382704 | -123.8095099 | 68 |
| 156 | Fire Station | N/A | 46.61768393 | -123.9540586 | 46 |
| 157 | Fire Station | N/A | 46.71096304 | -123.9959616 | 15 |
| 158 | Fire Station | N/A | 46.77131253 | -124.081644 | 19 |
| 347 | Oysterville Rd high ground | N/A | 46.5491131 | -124.0378606 | 19 |
| 352 | China Hill | N/A | 46.32468989 | -124.0117748 | 40 |
| 354 | Shoalwater 1 | 4112 Hwy 105 | 46.72404385 | -124.0212477 | 12 |
| 360 | Ilwaco 1 | 510 Whealdon Street | 46.31240865 | -124.0342655 | 140 |
| 361 | Cape Disappointment St Pk | Near Campsite 90 | 46.29178 | -124.07317 | 19 |
| 362 | Surfside (Ocean Park 1) | 33104 J Place | 46.54201113 | -124.0540471 | 44 |
| 370 | Ocean Park 5 | 21611 V Ln | 46.45855225 | -124.0444632 | 25 |
| 371 | Ocean Park 2 | 300th Pl and W St, NE Corner | 46.51964829 | -124.0415013 | 20 |
| 372 | Ocean Park 3 | 27033 U St at 272nd | 46.49870462 | -124.0440829 | 25 |
| 373 | Ocean Park 4 | 245th and U St, NE Corner | 46.47953153 | -124.0444762 | 25 |
| 374 | Bay Center | 408 Bay Center Rd | 46.61681384 | -123.9532295 | 43 |
| 375 | Seaview | 3801 N Place | 46.32960823 | -124.0541209 | 20 |
| 380 | Longbeach 1 | Pacific Park, 9211 X St | 46.36902624 | -124.0437215 | 19 |
| 381 | Longbeach 2 | 319 2nd St | 46.35175109 | -124.0503626 | 18 |
| 392 | North Cove | 2829 SR 105 at PAC Fire District 5 | 46.77135003 | -124.0816306 | 18 |
| 393 | Shoalwater 2 | 2880 Kindred Ave | 46.71004474 | -123.9903311 | 12 |
| 398 | Grayland-Pac | 3543 Seabreeze Ave | 46.74481641 | -124.0809254 | 23 |
| 401 | Willapa Bay Grange | 3198 SR-105 | 46.7584151 | -124.082589 | 19 |
| 403 | Grayland - Lutheran Church | 2418 SR 105 | 46.78613942 | -124.0836258 | 17 |
| 406 | Loomis Lake State Park | 184th Place | 46.43380448 | -124.0548644 | 26 |
| 407 | South Bend Fire Station | 211 Willapa Avenue | 46.66520351 | -123.8123806 | 18 |
| 408 | Raymond Fire Station | 212 Commercial Street | 46.68556 | -123.73437 | 12 |
| 413 | Ilwaco 2 | 6801 Ortelius Drive | 46.31826395 | -124.00837 | 10 |
| 418 | Port Of Chinook | Port of Chinook - 743 Water Street | 46.27018056 | -123.9452576 | 14 |
| 419 | Raymond - Sa Anderson Field | SA Anderson Field - 922 Willapa St | 46.69261956 | -123.7419885 | 15 |
| 421 | South Bend East End Fire Station | 103 Madison Street South | 46.66265541 | -123.7906249 | 11 |
| 428 | Pacific Park | 1778 Cranberry Rd | 46.394084 | -124.048251 | 25 |
| 429 | Pacific Park | 1380 145th PL | 46.407344 | -124.05343 | 25 |
| 430 | Shoalwater 3 | 3297 Kindred Ave | 46.705345 | -123.968658 | 13 |
| 431 | Grayland Beach State Park | 925 Cranberry Beach Rd | 46.794092 | -124.095805 | 21 |

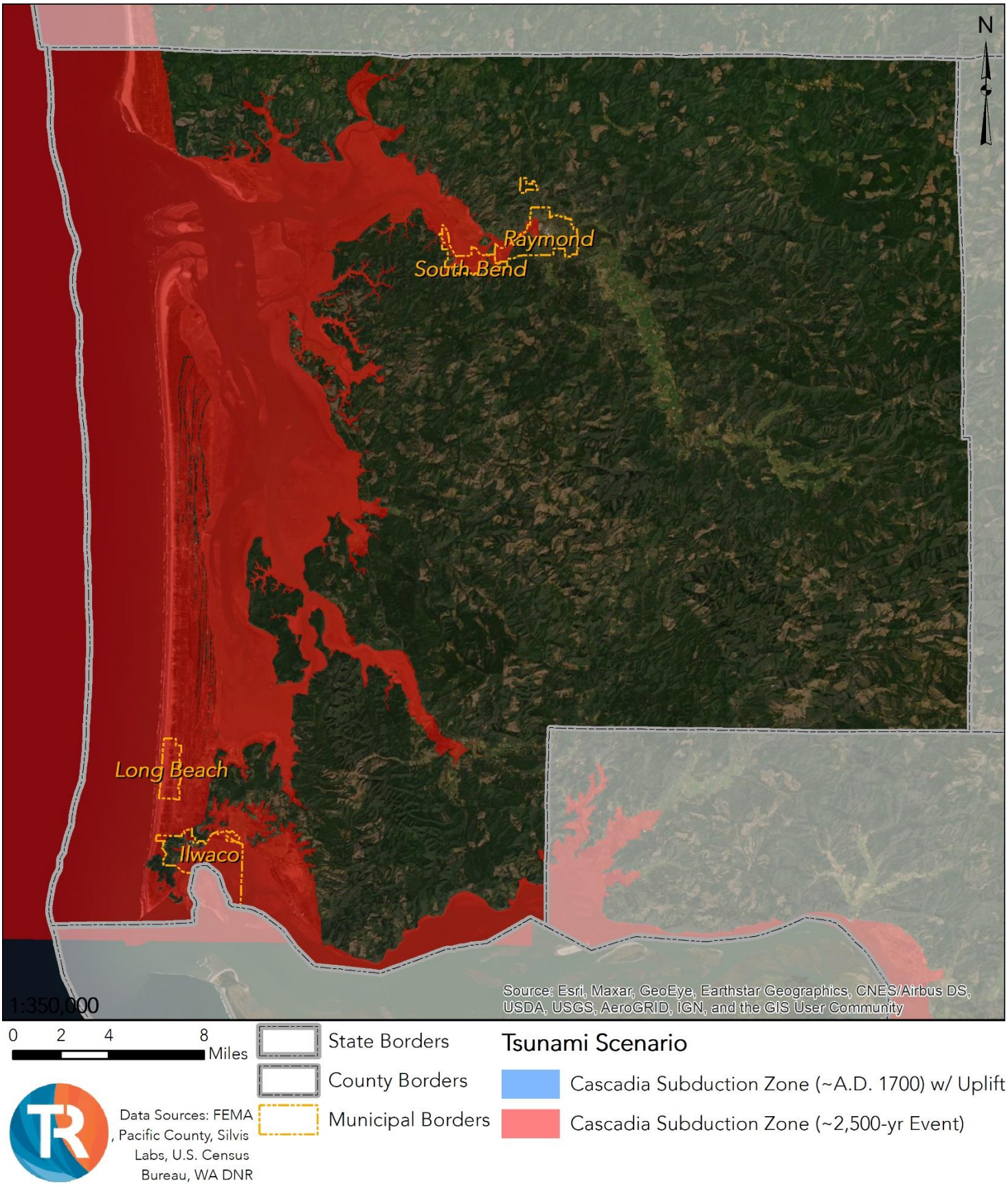
**The data are from the Washington Department of Natural Resources.*

**Map 3.12 – Tsunami Scenario Reference Points**

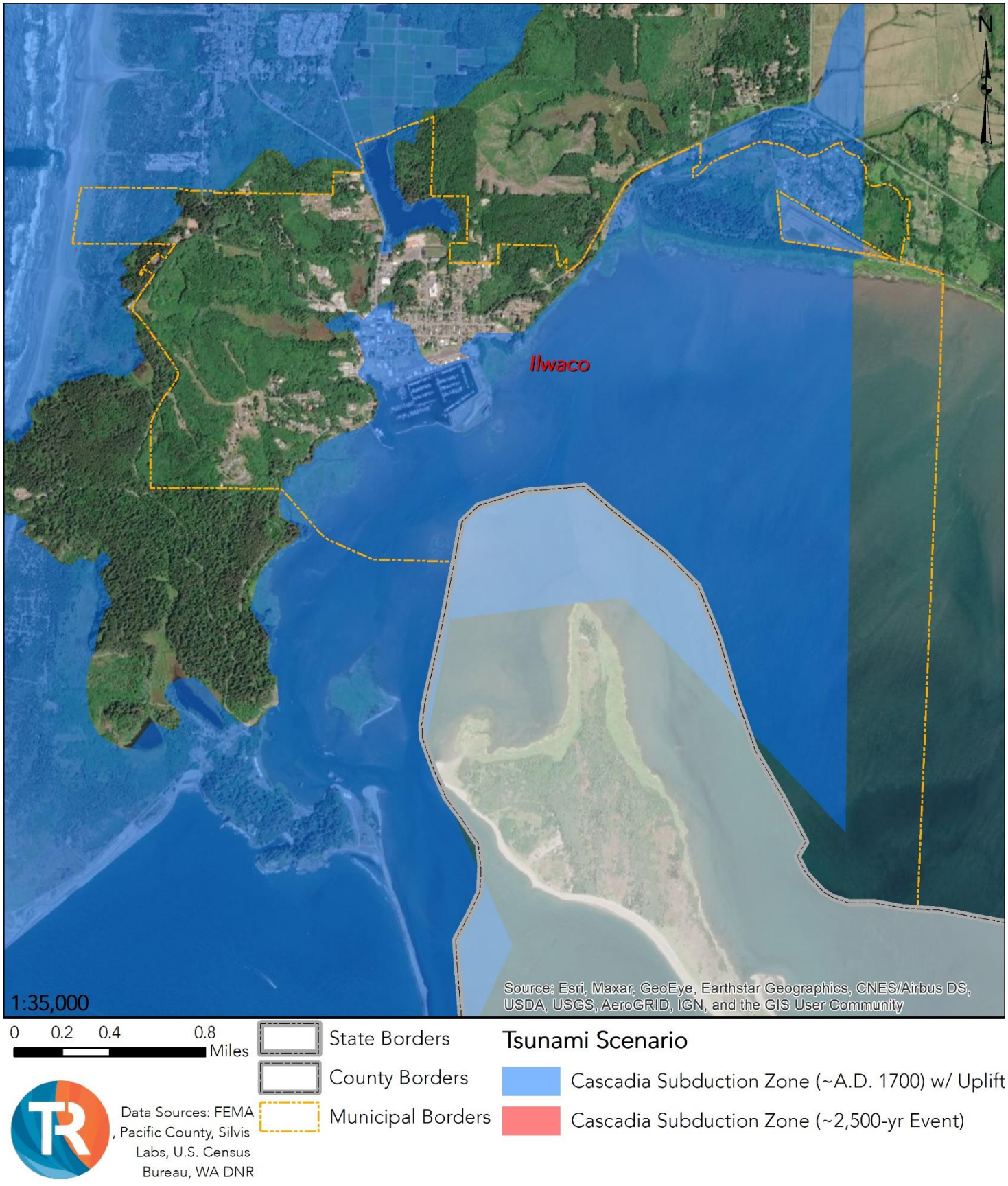


**Map 3.13 – Cascadia Subduction Tsunami ~A.D. 1700 w/ Uplift, Pacific County**

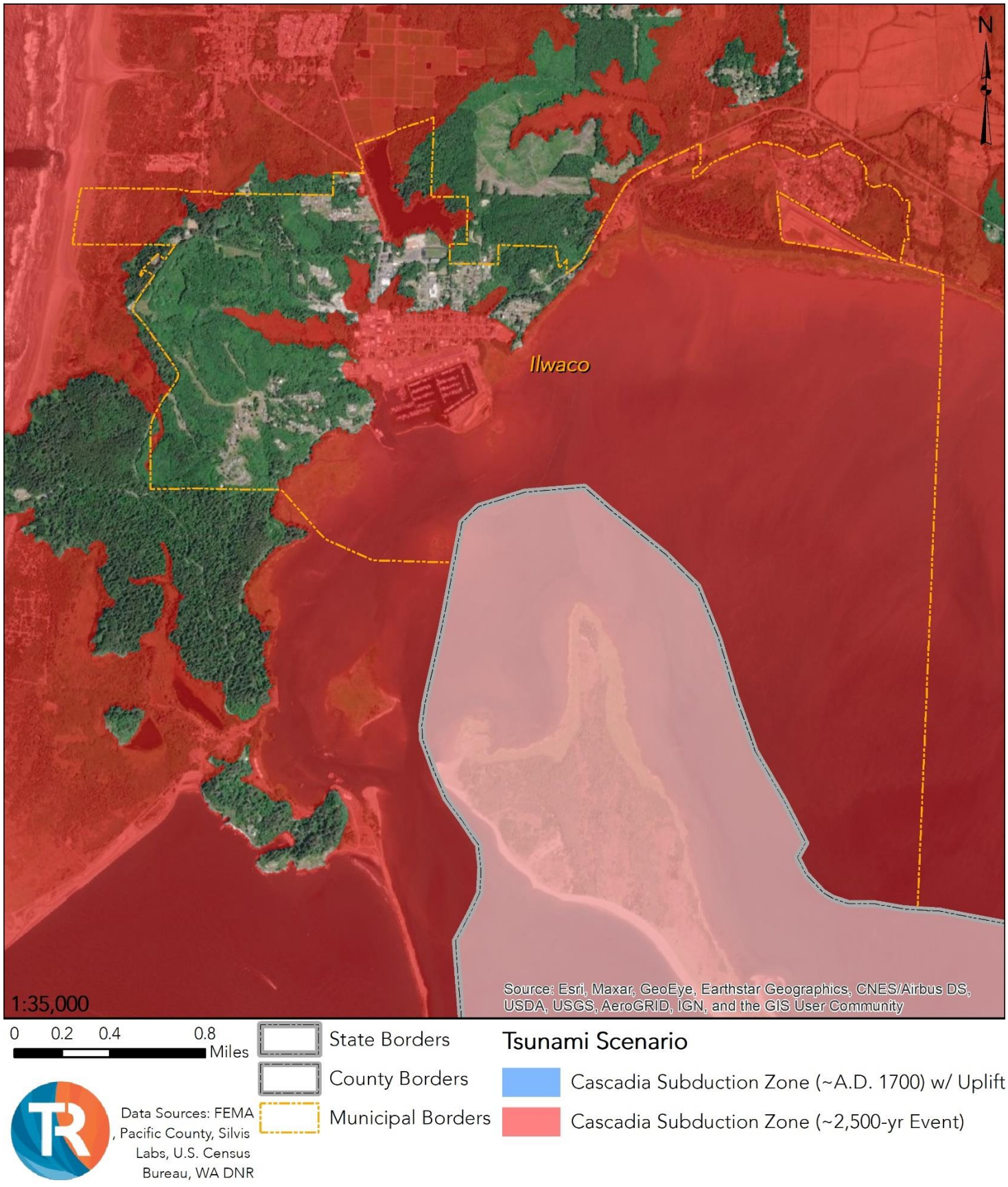
**Map 3.14 – Cascadia Subduction Tsunami ~2,500 Year Event, Pacific County**



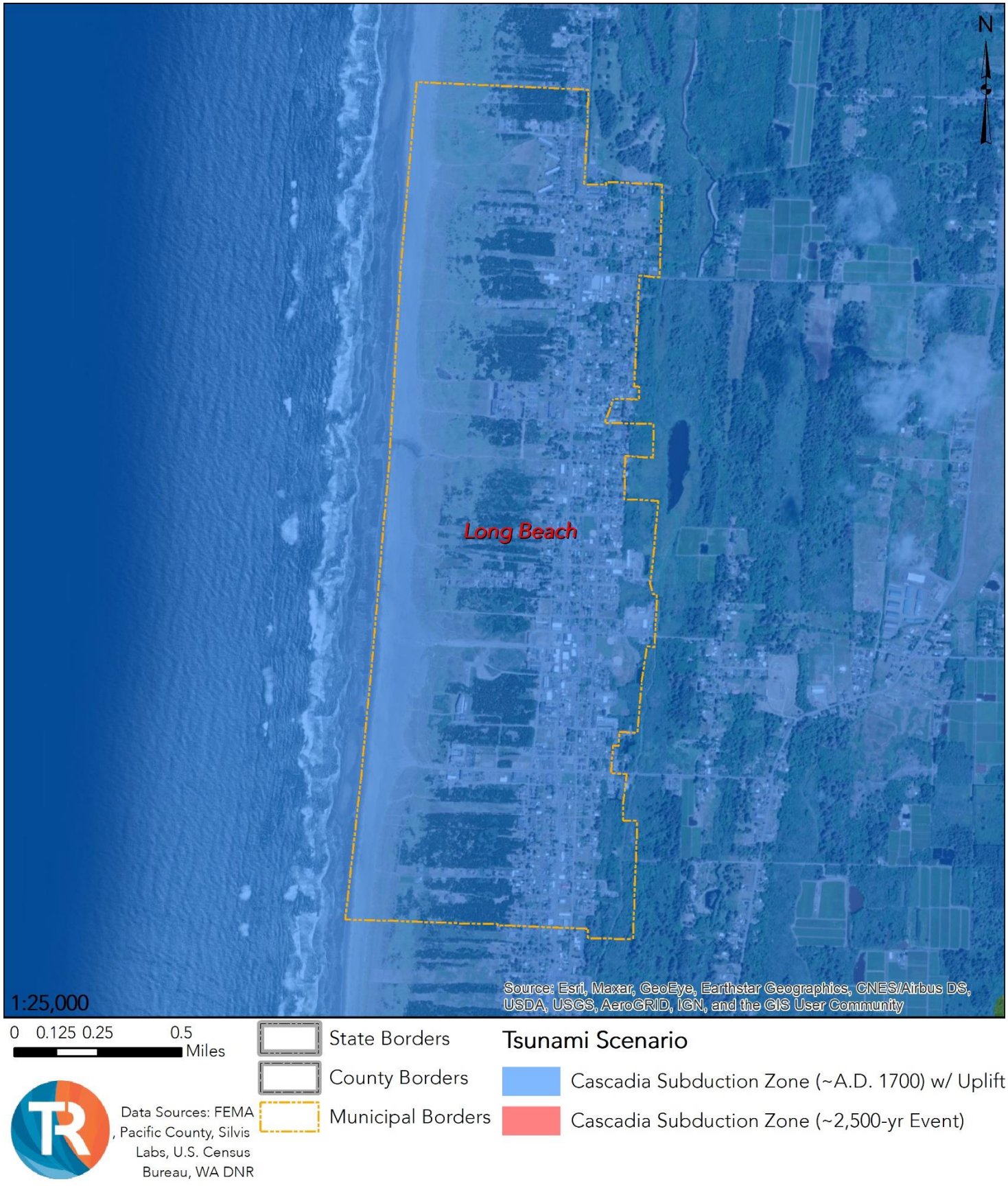
**Map 3.15 – Cascadia Subduction Tsunami ~A.D. 1700 w/ Uplift, Ilwaco**



**Map 3.16 – Cascadia Subduction Tsunami ~2,500 Year Event, Ilwaco**

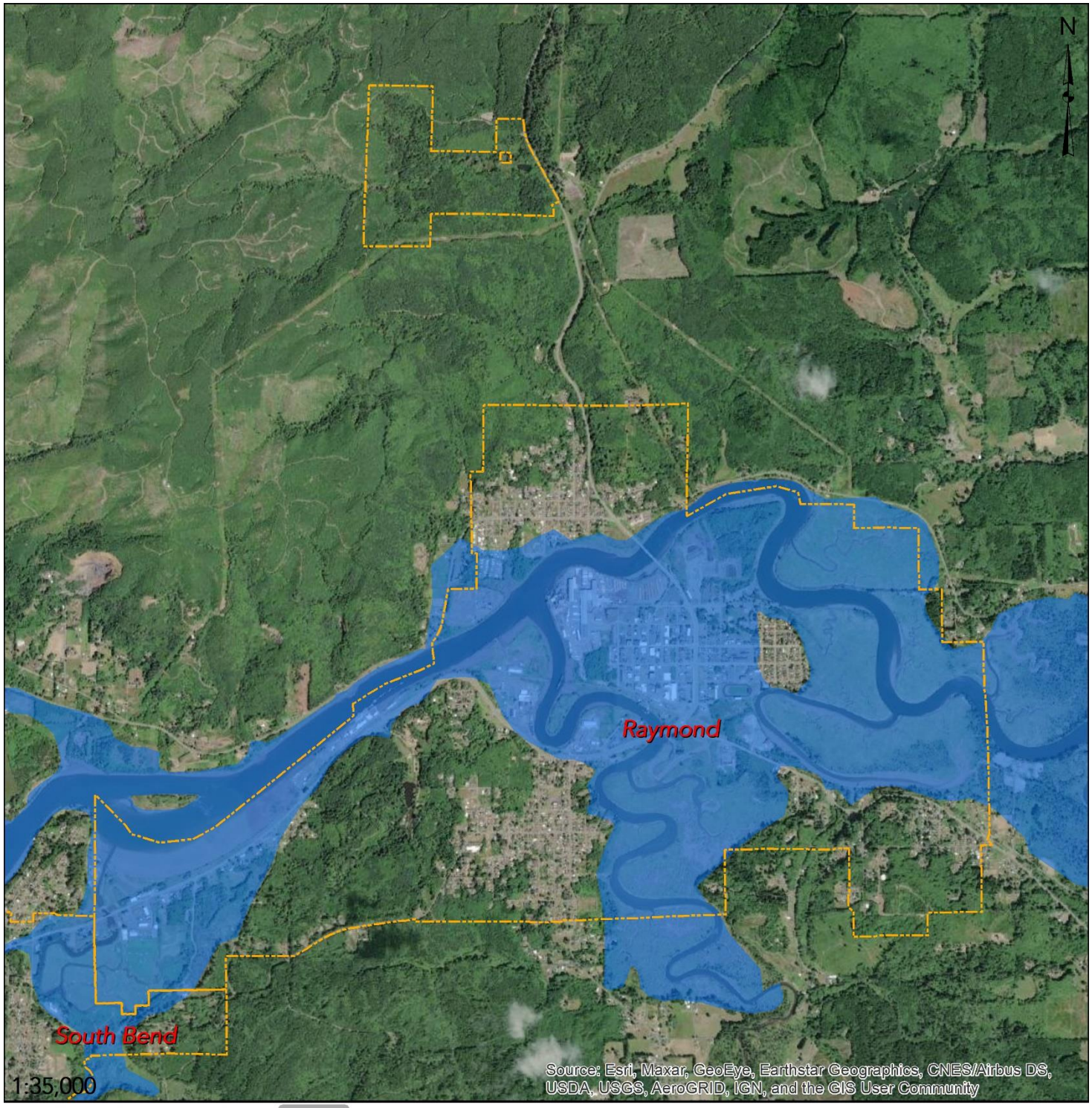


**Map 3.17 – Cascadia Subduction Tsunami ~A.D. 1700 w/ Uplift, Long Beach**

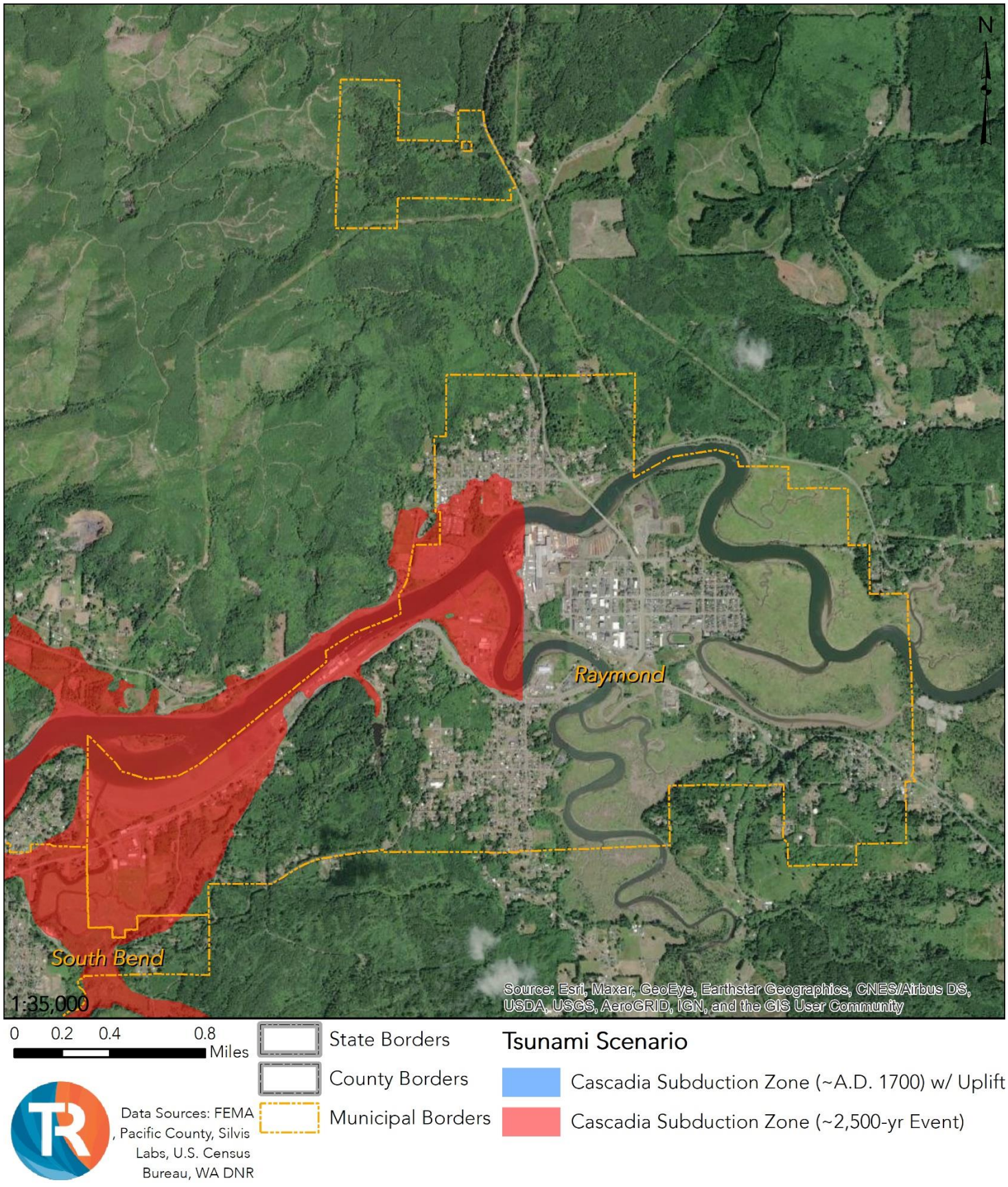


**Map 3.18 – Cascadia Subduction Tsunami ~2,500 Year Event, Long Beach**

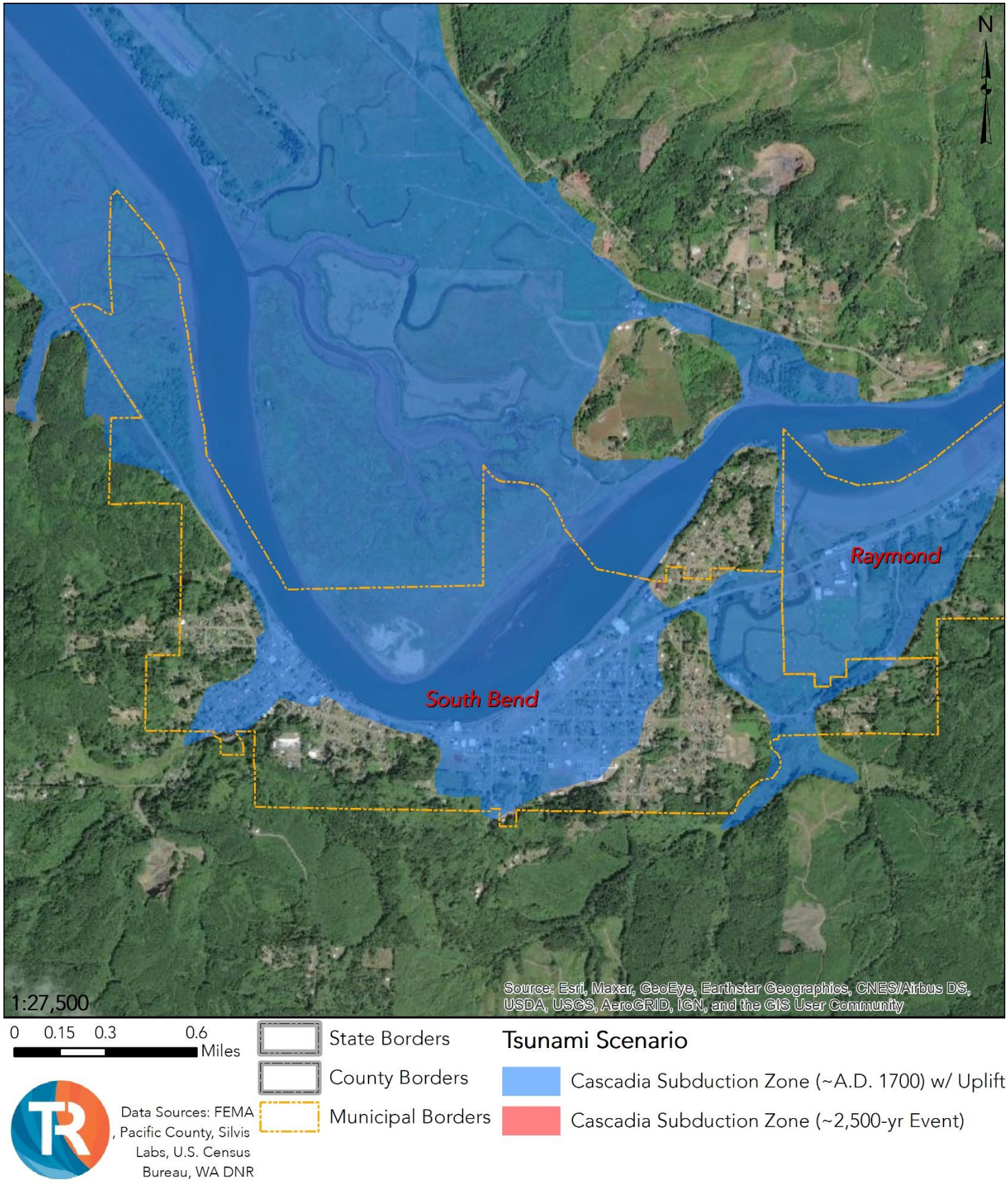
**Map 3.19 – Cascadia Subduction Tsunami ~A.D. 1700 w/ Uplift, Raymond**



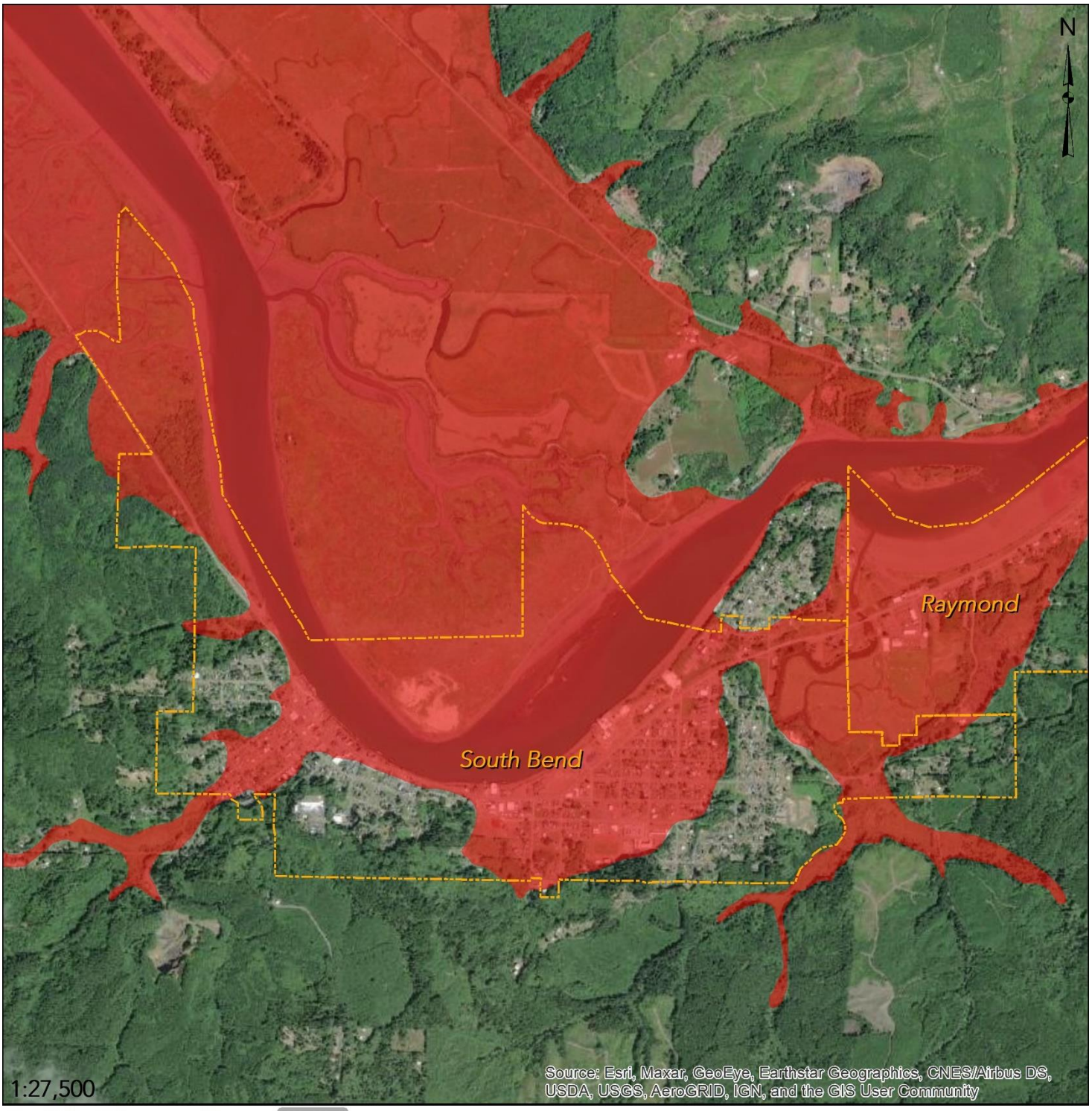
**Map 3.20 – Cascadia Subduction Tsunami ~2,500 Year Event, Raymond**



**Map 3.21 – Cascadia Subduction Tsunami ~A.D. 1700 w/ Uplift, South Bend**



**Map 3.22 – Cascadia Subduction Tsunami ~2,500 Year Event, South Bend**



## History & Probability

The Cascadia Subduction Zone is believed to have had a catastrophic, high magnitude earthquake around 1700 AD. As the area did not have modern developments at the time, its historic impacts are unknown, although it is known that the tsunami reached inland to the Willapa Bay area. In terms of tsunamis created by earthquakes across the Pacific Ocean, over 500 have been created since 1900, but none have had significant impacts on Pacific County or its participating jurisdictions.

Seismologists believe an event like this or worse, necessary to create a tsunami, has a return interval of roughly 2500 years. Therefore, a catastrophic tsunami originating from the Cascadia Subduction Zone has 0.04% of occurring in any given year.

Tsunamis originating from faults across the Pacific Ocean are more likely to occur, but are incredibly more difficult to predict quantitatively. Tsunamis cause by earthquakes in the Cascadia Subduction Zone and across the Pacific Ocean are both categorized as "rare" events.

## Vulnerability of and Impact on Facilities

Structural vulnerability to tsunamis will vary based on their location, that being how far inland they are, what is their elevation, their cardinal orientation, and foundation strength. A strong enough flowing tsunami could completely wash away a structure, damage or rip apart portions of the structure, or cause flooding and significant damage to a structure's interior and making it unsafe to inhabit until costly cleanup operations are finished. Additionally, debris, including flowing vehicles, can become caught by structures and sustain damage.

Pacific County and its participating jurisdictions have not had any property damage from tsunamis.

The planning areas municipal and school district structures are valued at $1,951,752,686 ($1,842,569,000 municipal, $109,183,686 school district). A GIS analysis of the DNR's modelled scenarios puts a total of $1,092,270,000 and $1,295,150,000 worth of municipal inventory vulnerable to the 1700 A.D. and 2500-year event scenarios respectively. Only the Ocean Beach SD's Long Beach Elementary location's structures are vulnerable to the 1700 A.D. scenario worth $7,927,400. However, the 2500-year event scenario shows the Ocean Beach SD's Long Beach Elementary, Ocean Park Elementary, and all of the South Bend SD's structures are vulnerable. This list is valued at $368,456,831. The following tables show in greater detail the results of the GIS analysis per scenario.

**Table 3.19 – Vulnerable Municipal Structures by Count, Tsunamis – 1700 A.D Scenario**

| Municipality | Ag | Com | Gov | Ind | Res | Res-M | Total |
|---|---|---|---|---|---|---|---|
| Pacific County | 30 | 128 | 4 | 37 | 5,905 | 36 | 30 |
| Ilwaco | 1 | 21 | 0 | 5 | 198 | 2 | 1 |
| Long Beach | 1 | 165 | 2 | 8 | 1,266 | 32 | 1 |
| Raymond | 2 | 54 | 2 | 12 | 244 | 19 | 2 |
| South Bend | 1 | 27 | 2 | 9 | 394 | 4 | 1 |
| Total = | 35 | 395 | 10 | 71 | 8,007 | 93 | 35 |

**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the U.S. Census Bureau and FEMA*

**Table 3.20 – Vulnerable Municipal Structures by Value, Tsunamis – 1700 A.D. Scenario**

| Municipality | Ag | Com | Gov | Ind | Res | Res-M | Total |
|---|---|---|---|---|---|---|---|
| Pacific County | $9,335,000 | $61,088,000 | $4,984,000 | $24,378,000 | $494,503,000 | $37,614,000 | $631,902,000 |
| Ilwaco | $137,000 | $11,999,000 | $111,000 | $1,144,000 | $16,305,000 | $1,667,000 | $31,363,000 |
| Long Beach | $424,000 | $138,683,000 | $845,000 | $3,545,000 | $105,851,000 | $33,456,000 | $282,804,000 |
| Raymond | $725,000 | $40,000,000 | $3,440,000 | $8,718,000 | $19,775,000 | $15,319,000 | $87,977,000 |
| South Bend | $133,000 | $17,765,000 | $1,254,000 | $5,766,000 | $32,067,000 | $1,239,000 | $58,224,000 |
| Total = | $10,754,000 | $269,535,000 | $10,634,000 | $43,551,000 | $668,501,000 | $89,295,000 | $1,092,270,000 |

**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the U.S. Census Bureau and FEMA*

**Table 3.21 – Vulnerable Municipal Structures by Count, Tsunamis – 2500 Year Event**

| Municipality | Ag | Com | Gov | Ind | Res | Res-M | Total |
|---|---|---|---|---|---|---|---|
| Pacific County | 41 | 194 | 7 | 65 | 8,090 | 48 | 41 |
| Ilwaco | 3 | 30 | 1 | 6 | 315 | 4 | 3 |
| Long Beach | 1 | 165 | 2 | 8 | 1,266 | 32 | 1 |
| Raymond | 2 | 10 | 0 | 5 | 114 | 3 | 2 |
| South Bend | 1 | 31 | 3 | 10 | 447 | 5 | 1 |
| Total = | 48 | 430 | 13 | 94 | 10,232 | 92 | 48 |

**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the U.S. Census Bureau and FEMA*

**Table 3.22 – Vulnerable Municipal Structures by Value, Tsunamis – 2500 Year Event**

| Municipality | Ag | Com | Gov | Ind | Res | Res-M | Total |
|---|---|---|---|---|---|---|---|
| Pacific County | $12,270,000 | $95,092,000 | $6,582,000 | $38,569,000 | $657,732,000 | $42,526,000 | $852,771,000 |
| Ilwaco | $374,000 | $30,478,000 | $516,000 | $1,928,000 | $25,551,000 | $3,728,000 | $62,575,000 |
| Long Beach | $424,000 | $138,683,000 | $845,000 | $3,545,000 | $105,851,000 | $33,456,000 | $282,804,000 |
| Raymond | $681,000 | $8,976,000 | $0 | $5,815,000 | $8,891,000 | $894,000 | $25,257,000 |
| South Bend | $133,000 | $23,291,000 | $2,145,000 | $6,342,000 | $36,476,000 | $3,356,000 | $71,743,000 |
| Total = | $13,882,000 | $296,520,000 | $10,088,000 | $56,199,000 | $834,501,000 | $83,960,000 | $1,295,150,000 |

**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the U.S. Census Bureau and FEMA*

## *Vulnerability of and Impact on Population*

Populations living and working within the identified inundation zones are vulnerable to injury and death by a tsunami. Tsunamis move with incredible force, washing away buildings and vehicles without issue. It will have no problem forcefully carrying the weight of an individual. The water is likely to be filled with debris that can injure or hurt an individual as well as cause bodily harm by trapping them and forcing them against structures.



It is estimated that coastal communities of Pacific County will have a total of 30 minutes to evacuate or reach a safe elevation; however, since this is after an earthquake and five

minutes should be subtracted from that number to take into account shock and reorientation following the initiating earthquake. Additionally, evacuation planning should take into account that roadways will likely be damaged or blocked by landslides, damaged infrastructure and buildings, or trees and power lines.

Pacific County and its participating jurisdictions do not have any recorded deaths or injuries from tsunamis.

Pacific County and its participating stakeholders have a total population of 22,984 in 15,547 housing units. The Washington DNR's 1700 A.D. scenario identifies 9,773 people and 9,018 housing units as vulnerable while the 2500-year event shows 11,976 people and 11,195 housing units vulnerable to a tsunami. In the 1700 A.D. scenario, only the students and staff at the Long Beach Elementary location are vulnerable while the Ocean Park Elementary, Ocean Beach Elementary, and all of the South Bend SD's students and staff are vulnerable. The tables below show a breakdown of the municipal populations and housing units vulnerable per DRN scenario.

**Table 3.23 – Vulnerable Municipal Populations, Tsunamis – 1700 A.D. Scenario**

| Municipality | Housing Units | Population |
|---|---|---|
| Pacific County | 6,337 | 6,203 |
| Ilwaco | 215 | 366 |
| Long Beach | 1,618 | 1,520 |
| Raymond | 430 | 811 |
| South Bend | 418 | 873 |
| Total = | 9,018 | 9,773 |

**The data are from the U.S. Census Bureau, FEMA.*

**Table 3.24 – Vulnerable Municipal Populations, Tsunamis – 2500 Year Event**

| Municipality | Housing Units | Population |
|---|---|---|
| Pacific County | 8,627 | 8,572 |
| Ilwaco | 350 | 614 |
| Long Beach | 1,618 | 1,520 |
| Raymond | 124 | 254 |
| South Bend | 476 | 1,016 |
| Total = | 11,195 | 11,976 |

**The data are from the U.S. Census Bureau, FEMA.*

## *Vulnerability of and Impact on Systems*

Systems that are exposed to the identified inundation areas are extremely vulnerable. It is likely that a major tsunami will severely impair or destroy most of what is in its path. This will also be true for any systems in its path or any systems that rely on infrastructure or facilities. A tsunami of any significant size would wreak havoc on Pacific County and its transportation, infrastructure, and economics systems.



## *Key Considerations*

A tsunami of any significant size would have varying effects on the non-municipal stakeholders of this plan. Of course, it varies widely based on their geographic locations, but no stakeholder would be left untouched by the destruction.

***Fire Districts***

The fire districts' services are an integral part of the planning area's emergency operations before, during, and after an event. The scenarios and models used in the previous plan's development indicated that some of the FPDs were not vulnerable to a tsunami. The newer models used in this plan's development show otherwise. All of the participating FPDs are vulnerable and at risk to a tsunami. That being the case, a tsunami is likely to do significant damage to these fire districts and all but eliminate their ability to respond to and assist in the recovery from a tsunami.

***Hospitals***

If a tsunami follows the modelled inundation of the 1700 A.D. event, neither hospital will likely be directly affected. However, the 2500-year event identifies the cusp of inundation reaching just feet from the Ocean Beach Hospital. It is possible that such minuscule differences would exist in an event like this and therefore could likely damage the Ocean Beach Hospital beyond safe use. This is problematic, as after an event like either modelled tsunami, both hospitals would likely be one of the few remaining central service locations for the surviving population. This of course, is compounded by the hospitals operating in their normal emergency operations.

***Ports***

The ports of Chinook, Ilwaco, Peninsula, and Willapa Harbor are all within the identified inundation areas. A tsunami has the potential to completely destroy these ports. If a tsunami does not destroy these ports' facilities, it will likely damage their docking and mooring capabilities along with much of their equipment. A tsunami will give under 30 minutes of warning, which is not enough time to evacuate any expensive equipment. This will render the ports non-operational for weeks, months, and even years to come.

***Public Drainage & Utility Districts***

In the event of a Cascadia Subduction Zone earthquake and resulting tsunami, it is estimated that any and all electrical grid and drainage infrastructure in the inundation areas should be assumed inoperable for weeks to months.

***Transportation & Pacific Transit***

Roadways in the identified inundation areas are very vulnerable to tsunamis. It is safe to assume that they would already be damaged from the preceding earthquake, and when the tsunami hits, it will likely wash away much of the remaining infrastructure, creating hazardously damaging debris in the



tsunami's flow. In the event of a Cascadia Subduction Zone earthquake and resulting tsunami, it is estimated that any and all roadways in the inundation areas should be assumed to be impassable by standard vehicles.

# 3.8 – Wildfires

The NWS defines a wildfire as: Any free burning uncontainable wildland fire not prescribed for the area which consumes the natural fuels and spreads in response to its environment. They can occur naturally, by human accident, and on rare occasions by human action. Typically, their point of origin is far from human development with the exception of roads, power lines, and similar rural infrastructure. There is a constant threat to hikers, campers, and other people engaging in outdoor activities. Significant danger to life and property occurs when human development meets and becomes intertwined with wildland's vegetation. The threat of wildfire and grass fires increases in areas prone to intermittent drought, or are generally arid or dry.

Population de-concentration in the U.S. has resulted in rapid development in the outlying fringe of metropolitan areas and in rural areas with attractive recreational and aesthetic amenities, especially forests, communities bordering forests and prairies where fires branch off. This demographic change is increasing the size of the wildland-urban interface (WUI), defined as the area where structures and other human development meet or intermingle with undeveloped wildland. Its expansion has increased the likelihood that wildland and grass fires will threaten life and property.

## *Location & Extent*

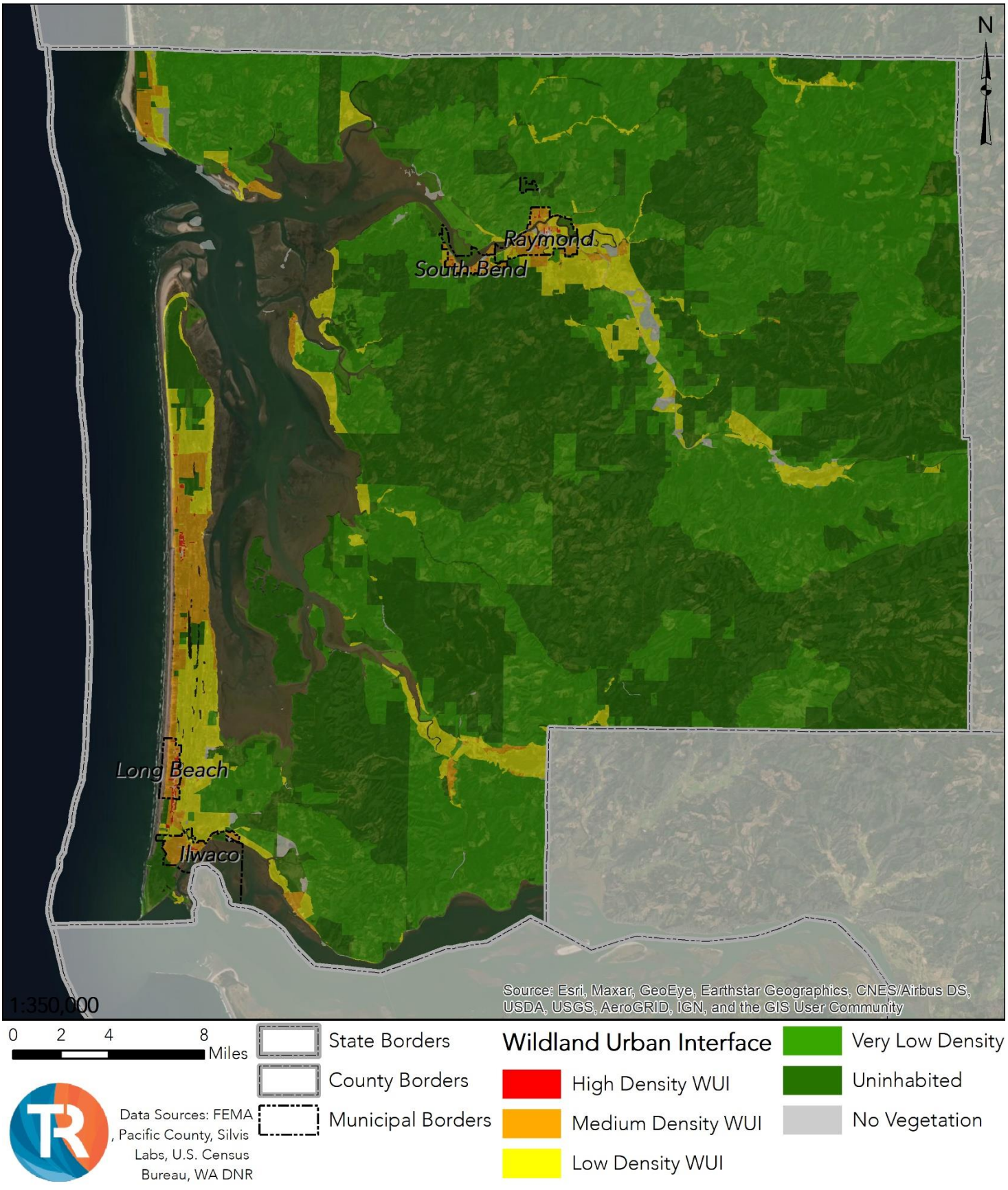
Most wildfires occur without warning and spread quickly but the event depends upon a number of conditions. Wind can turn a small flame into a multi-acre grassfire within a matter of minutes, while this can be further compounded by the level of moisture and available fuel based on the area's land use.
Pacific County and the planning area's fire response efforts are confronted with both open land brushfires as well as difficult to reach and extinguish rural-based wildfires.

Nearly every acre of undeveloped land in the planning area is covered in by some form of vegetation that could act as fuel for a fire.

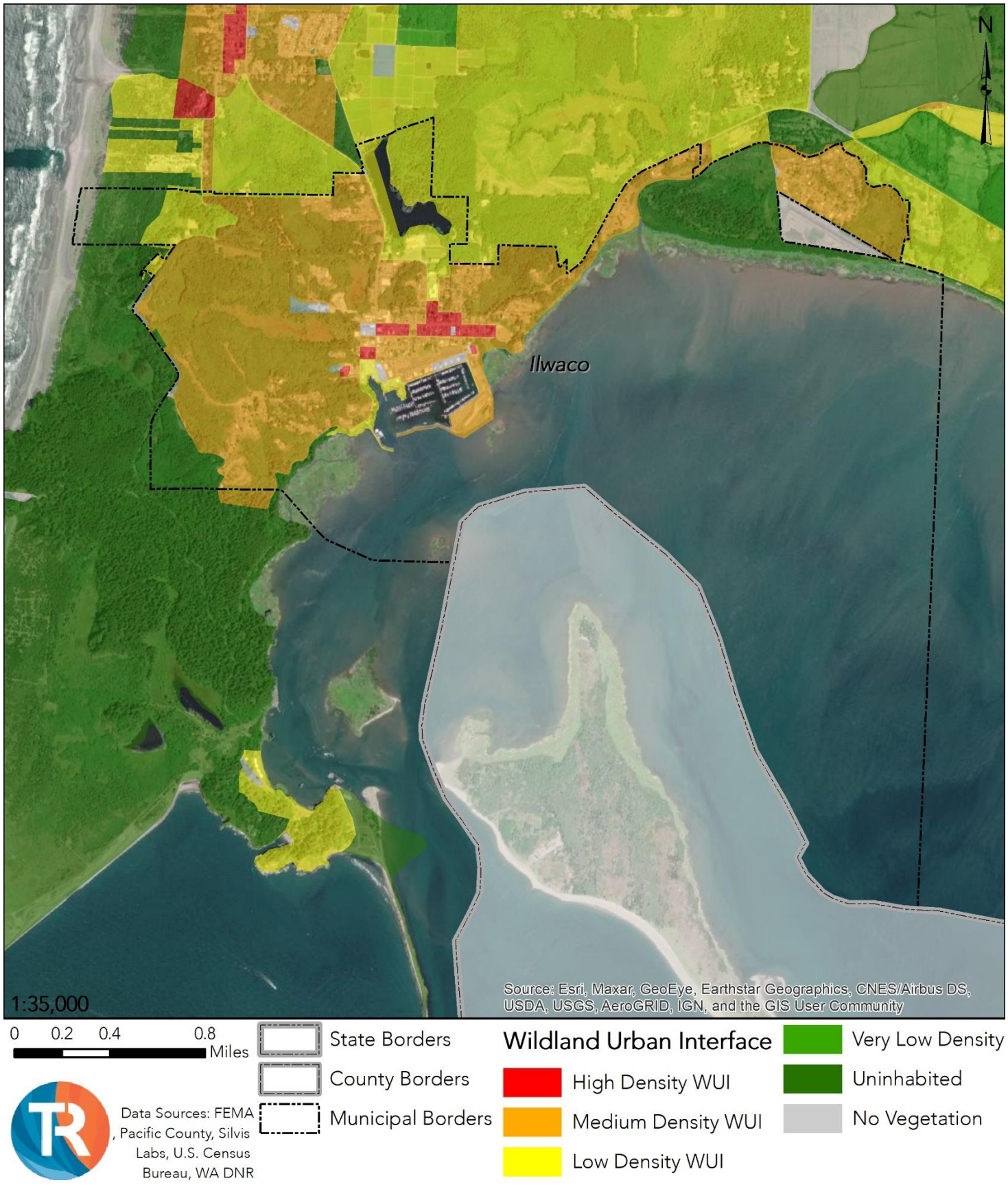
The planning area experiences sporadic brush fires along its coastal areas. These fires are typically small and burn less area as they are mostly fed by grass and brush versus heavily forested areas. Additionally, although wildland and grass fires can occur almost anywhere throughout the planning area, the damp and humid climate conditions typically help prevent and contain wildfires. However, the planning area has been experiencing drier and conditions since the development of its last HMP and thus has been experiencing more and larger, more intense wildfires.

WUI zones exist throughout the county. In general, these interfaces are more common along the coastal and river basins of the planning area. The maps on the following pages depict the WUI zones throughout the planning area.

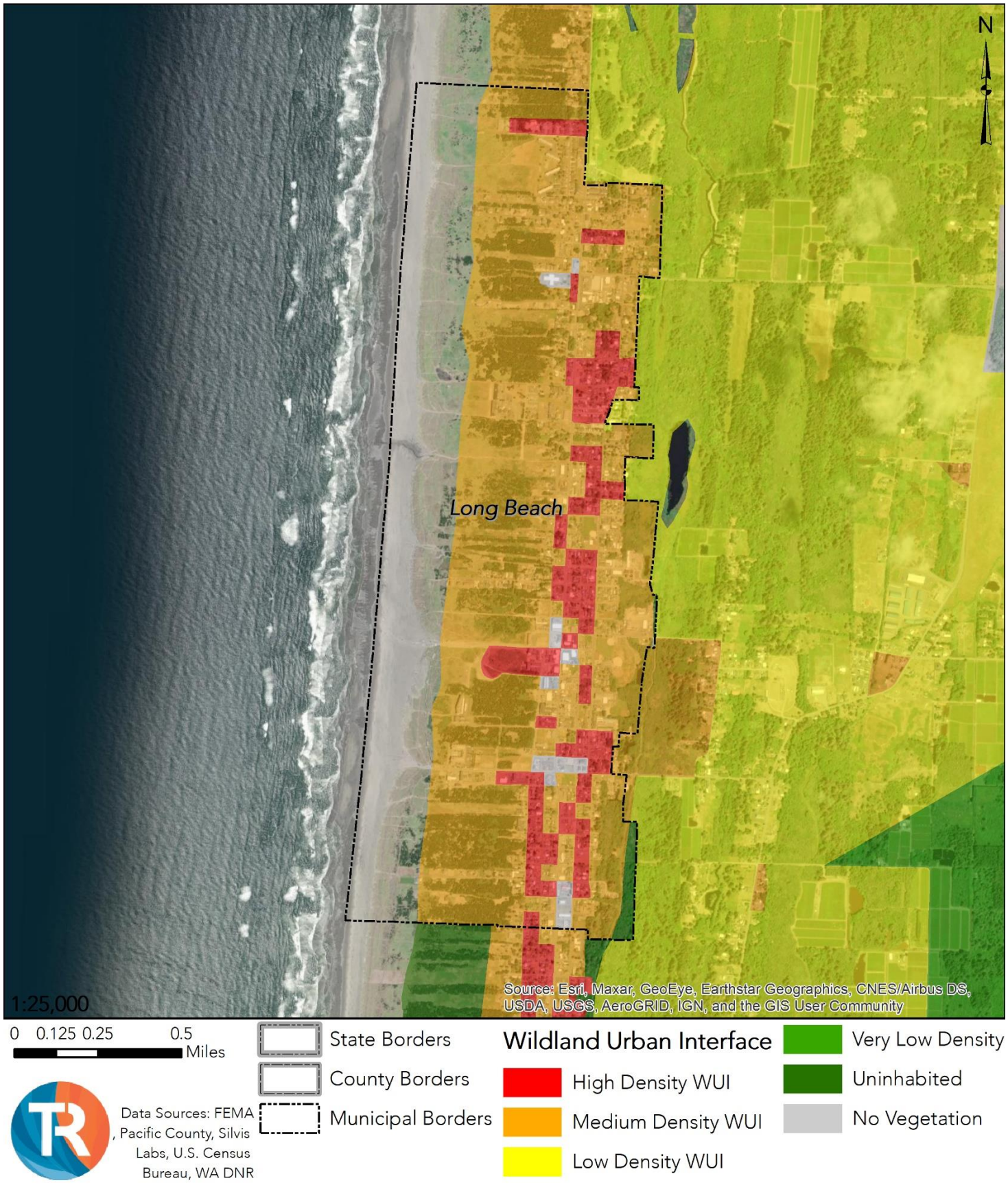
**Map 3.23 – WUI, Pacific County**



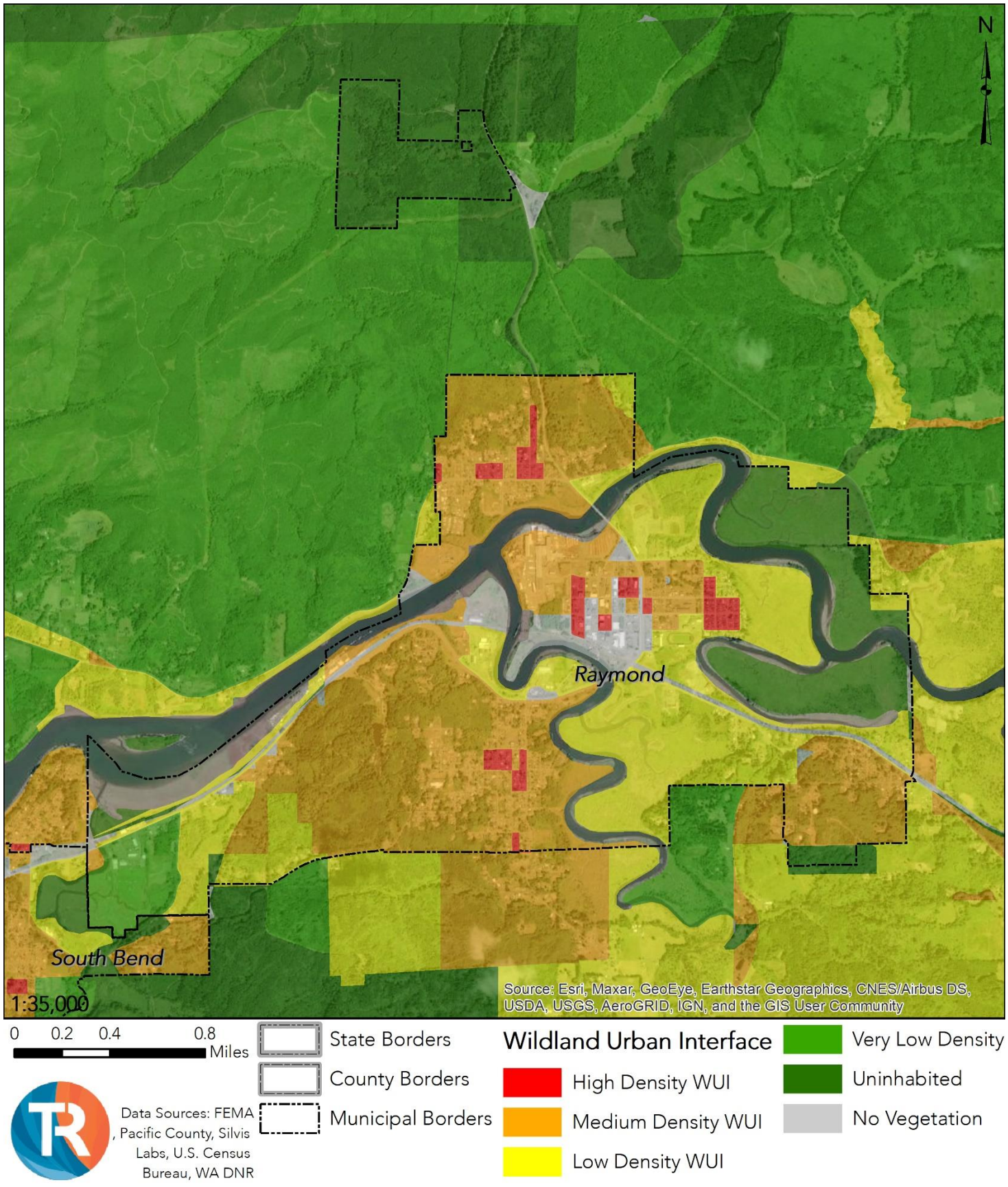
**Map 3.24 – WUI, Ilwaco**



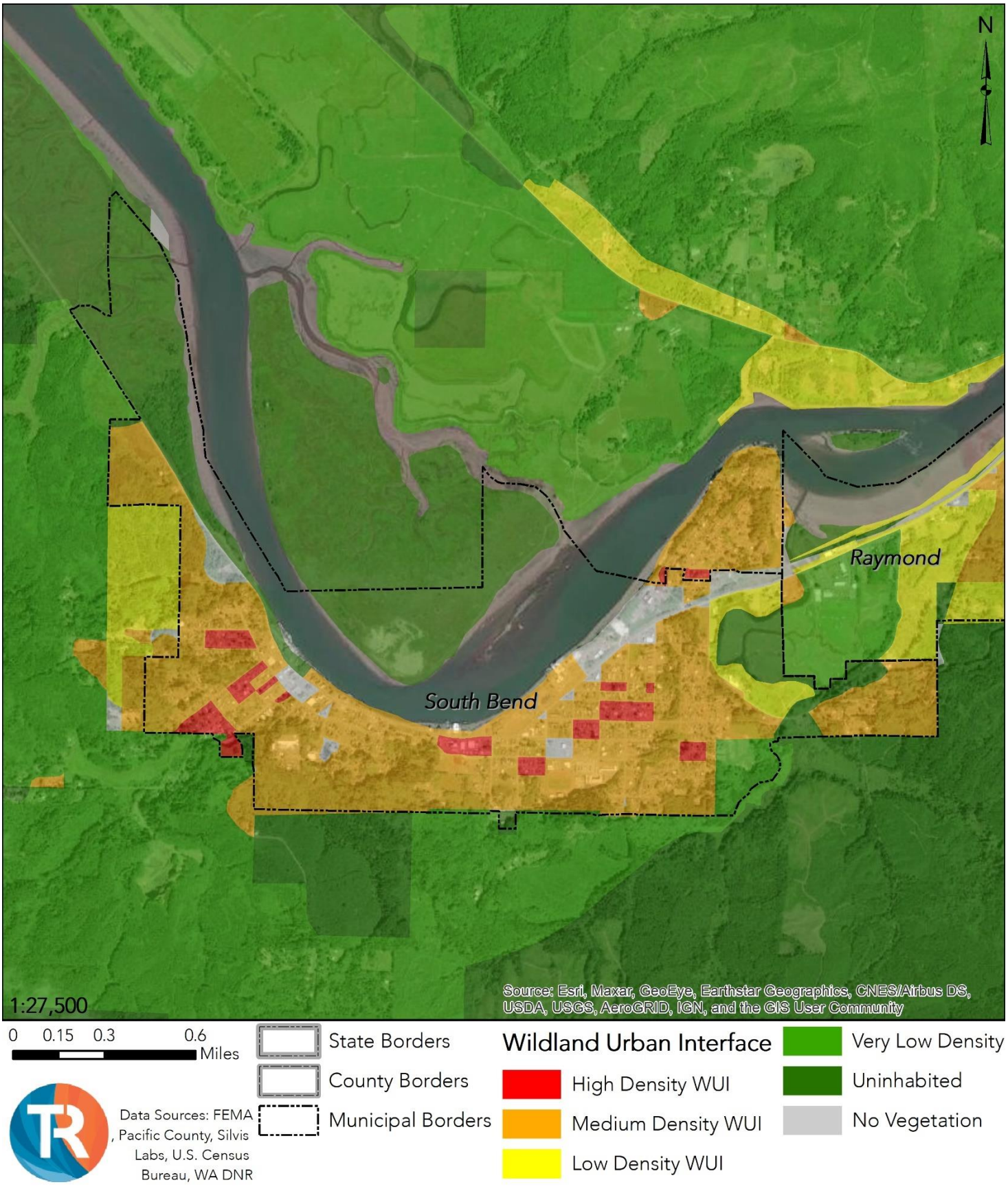
**Map 3.25 – WUI, Long Beach**



**Map 3.26 – WUI, Raymond**



**Map 3.27 – WUI, South Bend**



Given these conditions, a wildfire occurring outside the forested areas previously mentioned should expect wildfires to occur at a rank 0 to 1 on the burn severity index, while major wildfires that originate anywhere in the forested regions previously mentioned can likely occur anywhere from 0 to 2 on the burn severity index. Based on historical data, the planning area should expect its wildfires to average around 4.7226 acres per wildfire, but should expect most to burn below 10 acres with a rare outlier burning in excess of 50 acres.

**Table 3.25 – Burn Severity Index**

| BURN SEVERITY | RANK | DESCRIPTION | CHARACTERISTICS |
|---|---|---|---|
|  Unburned | RANK 0 | Fire extinguished before reaching microsite | • Leaf litter from previous years intact and uncharted<br>• No evidence of char around base of trees and shrubs<br>• Pre-burn seedlings and herbaceous vegetation present |
|  Low Severity Burn | RANK 1 | Surface fire which consumes litter yet has little effect on trees and understory vegetation | • Burned with partially consumed litter present<br>• Evidence of low flame heights around base of trees and shrubs (<0.5 m)<br>• No significant decreases in overstory & understory basal area, diversity or species richness from pre-burn assessments<br>• Usually burning below 80 degrees Celcius |
|  Medium-Low Severity Burn | RANK 2 | No significant differences in overstory density and basal area, & no significant differences in species richness. However, understory density, basal area, and species richness declined. | • No litter present and 100% of the area covered by duff<br>• Flame lengths < 2 m<br>• Understory mortality present, little or no overstory mortality |
|  Medium-High Severity Burn | RANK 3 | Flames that were slightly taller than those of Medium-low intensity fires, but these fires had occasional hot spots that killed large trees, with a significant reduction in the understory. | • Soil exposure on 1-50% of the area<br>• Flame lengths < 6 m<br>• High understory mortality with some overstory trees impacted |
|  High Severity Burn | RANK 4 | Crown fires, usually a stand-replacing burn with relatively high overstory mortality. | • Soil exposure > 50%<br>• Flame lengths > 6m<br>• Higher overstory mortality 20%<br>• Usually burning above 800 degrees Celcius |

## History & Probability

Since 2014, the planning area has experienced 68 wildfires. In total, these wildfires have burned 321.14 acres of land. They occur at a yearly rate of 8.5 wildfires per year in which an average of 40.1425 acres will be burnt per year. The map on the following page depicts these fires.

**Table 3.26 – Historical Wildfires**

| Year | Fires | Acres |
|---|---|---|
| 2014 | 2 | 143 |
| 2015 | 8 | 105.2 |
| 2016 | 6 | 14.3 |
| 2017 | 6 | 4.4 |
| 2018 | 8 | 7.52 |
| 2019 | 19 | 23.75 |
| 2020 | 9 | 5.6 |
| 2021 | 10 | 17.37 |
| Total = | 68 | 321.14 |

**The data are from the National Fire Incident Reporting System*

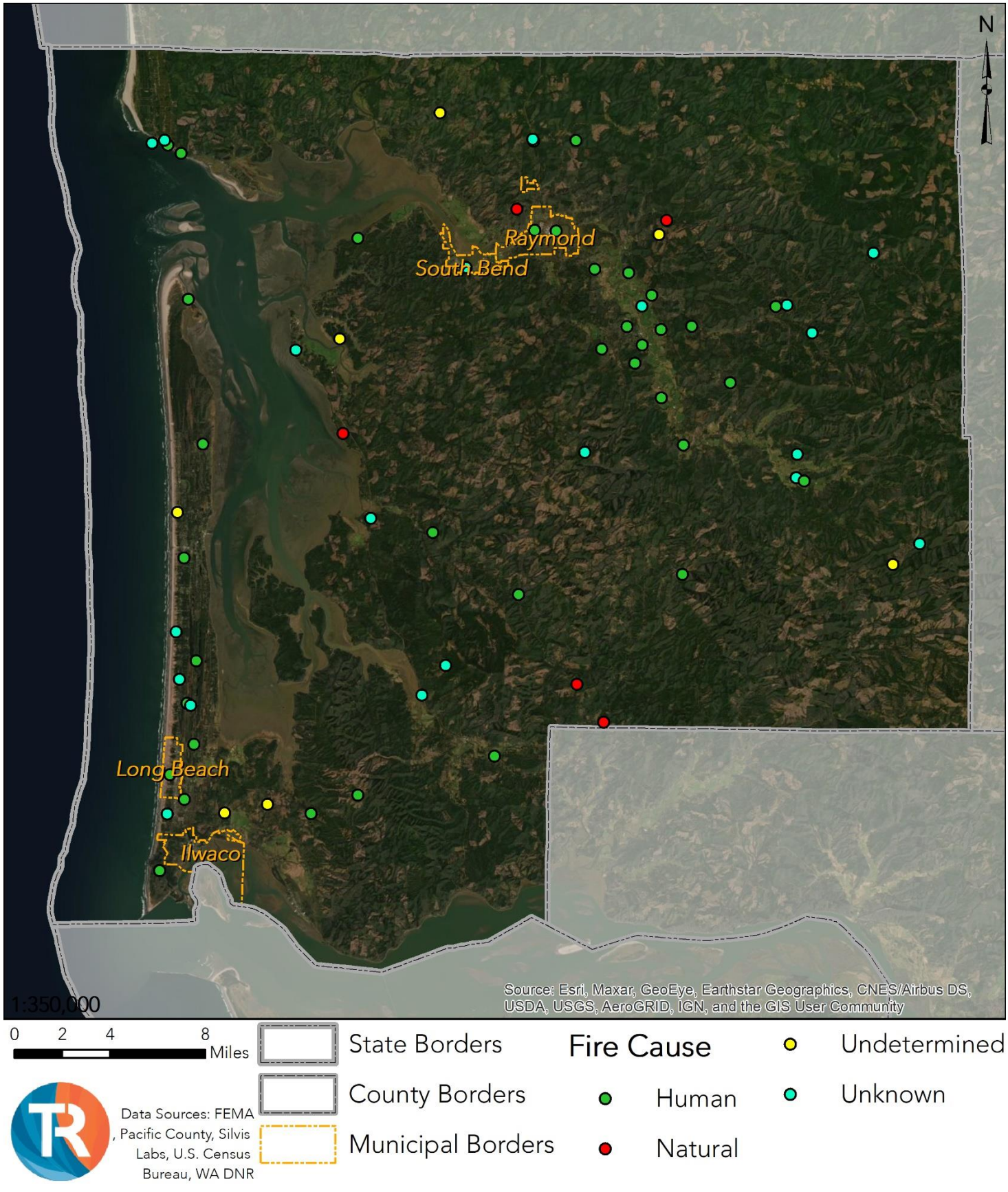
## Vulnerability of and Impact on Facilities

A wildfire burning near a jurisdiction may cover it in soot, cause secondary fires from traveling coals, or directly engulf facilities burning them to the ground. Properties located in some rural areas can prove more difficult to reach by first responders. Additionally, many of these rural locations do not have adequate water supplies for first responders to utilize in extinguishing these fires, causing them to spread farther than they normally would. Facilities can be protected by creating defensible spaces or buffer zones, maintaining a fuel free environment, and structural modifications to prevent the growth of a wildland fire.

Wildfires threaten almost every structure that exists in a vegetated area as depicted in maps previously posted in this section. Pacific County and the participating municipalities structures are valued at $1,842,569,000. A GIS analysis of the identified WUI puts a total of 13,984 of the planning area's municipal structural inventory worth $1,658,483,000 vulnerable to and at high risk to wildfires. Please see the following tables for a breakdown of these values by jurisdiction and maps located previously in this hazard profile for depictions of the WUI zones.

Of the school districts, all of the school district sites were identified within low, medium, or high WUI zones. These structures values total to $109,183,686.

**Map 3.28 – Historical Wildfires**



**Map 3.29 – Mean Fire Return Interval**

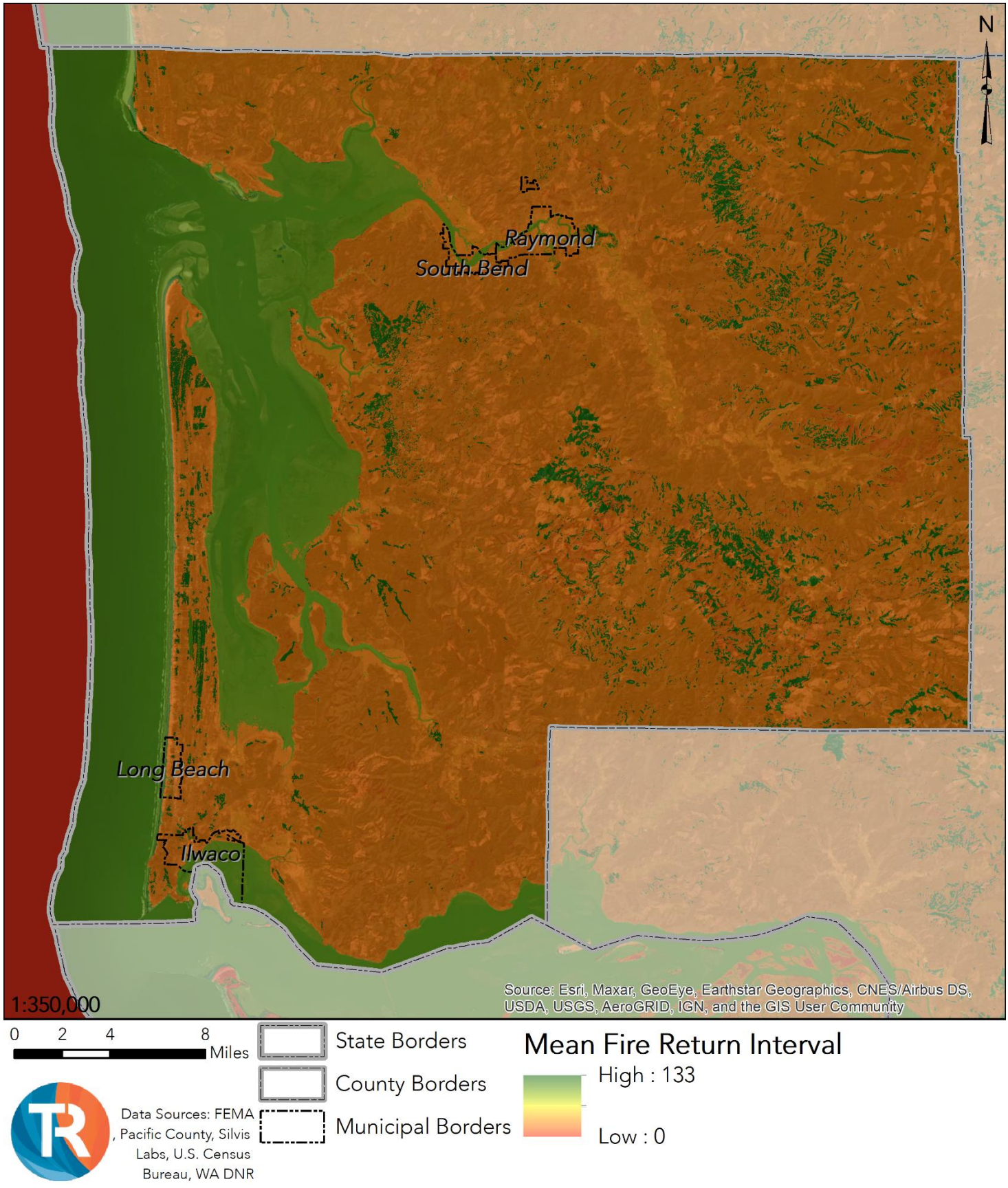


**Table 3.27 – Vulnerable Municipal Structures by Count, Wildfires**

| Municipality | Ag | Com | Gov | Ind | Res | Res-M | Total |
|---|---|---|---|---|---|---|---|
| Pacific County | 48 | 244 | 11 | 79 | 9,664 | 48 | 10,094 |
| Ilwaco | 3 | 37 | 3 | 10 | 492 | 9 | 554 |
| Long Beach | 1 | 159 | 2 | 8 | 1,262 | 31 | 1,463 |
| Raymond | 3 | 55 | 0 | 12 | 987 | 24 | 1,081 |
| South Bend | 2 | 32 | 4 | 10 | 735 | 9 | 792 |
| Total = | 57 | 527 | 20 | 119 | 13,140 | 121 | 13,984 |

**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the U.S. Census Bureau and FEMA*

**Table 3.28 – Vulnerable Municipal Structures by Value, Wildfires**

| Municipality | Ag | Com | Gov | Ind | Res | Res-M | Total |
|---|---|---|---|---|---|---|---|
| Pacific County | $13,819,000 | $106,133,000 | $9,342,000 | $46,544,000 | $817,277,000 | $44,892,000 | $1,038,007,000 |
| Ilwaco | $436,000 | $36,484,000 | $1,224,000 | $4,116,000 | $40,060,000 | $8,409,000 | $90,729,000 |
| Long Beach | $424,000 | $136,810,000 | $845,000 | $3,538,000 | $105,554,000 | $33,298,000 | $280,469,000 |
| Raymond | $707,000 | $32,060,000 | $132,000 | $7,494,000 | $81,768,000 | $23,187,000 | $145,348,000 |
| South Bend | $267,000 | $25,892,000 | $6,140,000 | $6,338,000 | $60,295,000 | $4,998,000 | $103,930,000 |
| Total = | $15,653,000 | $337,379,000 | $17,683,000 | $68,030,000 | $1,104,954,000 | $114,784,000 | $1,658,483,000 |

**Multi-Unit Residential is defined as a structure with 5 or more residential units*
***The data are from the U.S. Census Bureau and FEMA*

## *Vulnerability of and Impact on Population*

An inability to properly evacuate is a populations greatest vulnerability. They can be caught off guard due to improper warning systems and become trapped in a growing wildfire. Pacific County and its municipalities have a population 22,984 of which 18,694 are considered vulnerable and at risk to wildfires. Similarly, of the total 15,547 housing units in the planning area, 14,478 are considered vulnerable and at risk to wildfires.

Given the school districts locations located in WUI zones, all 2,370 students and 401 staff are considered vulnerable and at risk to wildfires.

**Table 3.29 – Vulnerable Municipal Populations, Wildfires**

| Municipality | Housing Units | Population |
|---|---|---|
| Pacific County | 10,247 | 11,828 |
| Ilwaco | 562 | 928 |
| Long Beach | 1,613 | 1,434 |
| Raymond | 1,276 | 2,867 |
| South Bend | 780 | 1,637 |
| Total = | 14,478 | 18,694 |

**The data are from the U.S. Census Bureau, FEMA.*

## *Vulnerability of and Impact on Systems*

It is unlikely that a single wildfire will grow large enough to cause significant or long-lasting damage to Pacific County and its communities' economies, education services, or hinder the local governments'

ability to provide services to their more demographically dense communities. However, a potent enough incident may cause short-term problems for their transportation systems in regards to response operations. Additionally, even a low-level wildfire can provide significant problems for pockets of rural, outlying unincorporated communities.

In the event a wildfire begins to burn and grow, evacuation routes may become blocked by the fire or by other people attempting to evacuate. The impingement of the local transportation system makes appropriate warning and information paramount in mitigating Pacific County and its communities' systems vulnerability to wildfires. It is unlikely that any of the public-school districts' buses would become trapped by wildfires since exceptional care will be taken by the pertinent emergency services to reroute these buses.

## *Key Considerations*

As of now, the planning area has not been impacted by any significant wildfires, but the threat continues to grow as their weather patterns change. At this point, without more predictable information as to how bad the planning area's wildfire problem changes, it would not be prudent to predict which areas specifically would affect the non-municipal stakeholders of this plan and therefore one should not predict how the non-municipal stakeholders could be affected.

# 3.9 – Windstorms

Windstorms comprise the hazardous and damaging weather effects often found in violent storm fronts. They are common and usually not hazardous, but on occasion they can pose a threat to life and property.

This plan defines Windstorms as a combination of the following severe weather effects as defined by NOAA and the NWS.

*High/Strong Wind:* Sustained wind speeds of 40 miles per hour or greater lasting for 1 hour or longer, or winds of 58 miles per hour or greater for any duration. Often referred to as straight line winds to differentiate from rotating or tornado associated wind.

*Thunderstorm Winds:* The same classification as high or strong winds, but accompanies a thunderstorm. It is also referred to as a straight-line wind to differentiate from rotating or tornado associated wind.

For consistency with the NWS and NOAA, high and strong winds are shown separate from thunderstorm winds when raw, collected data is displayed. However, for their impacts and probability, they are combined and referred to simply as "wind" events. Undoubtedly, numerous more lightning strikes have occurred in the planning area throughout recorded history. However, for the purposes of assessing the planning area's vulnerabilities and risk, only the strikes recorded by the NWS and NOAA are considered.

## *Location & Extent*

Windstorms are an area-wide hazard as they can strike anywhere in the planning area. Wind, severe or not, are often predicted within a day or multiple days in advance.

The severity of a storm is not as easily predicted and when it is, the window of notification is up to a few hours to under an hour. When a storm is imminent, it is unknown whether damaging winds will occur until after an incident has been reported. Since windstorms typically affect an area the size of a region, the expected intensity is the same throughout the planning area. Windstorms typically last less than an hour. The portions of this timeframe where each storm classification would be considered "severe" should last less than 30 minutes.

Strong, high, and thunderstorm winds are classified as winds which occur between 40 and 70 miles per hour lasting for 1 hour or greater or of 58 miles per hour for any duration. The Beaufort Scale shown on the next page displays the ranges of wind speed and correlates them with their typical effects. At a
level 7 and 8 citizens should remain indoors and anywhere above a level 8 will cause damage to structures. Damage to any amount of structures can cause serious disruption to the participating governments and school district. The scope of damage can range from one residential house up to widespread destruction of homes and reinforced buildings throughout the planning area. The planning area occasionally receives wind events between 50 and 65 miles per hour or a Beaufort level between 9 and 10.

**Table 3.30 – Beaufort Scale**

| Beaufort Number | Wind Speed (MpH) | Seaman's Term | Effects |
|---|---|---|---|
| 0 | Under 1 | Calm | Calm, smoke rise vertically |
| 1 | 1 – 3 | Light Air | Smoke drift indicates wind direction, but vanes do not move |
| 2 | 4 – 7 | Light Breeze | Wind felt on face, leaves rustle, vanes begin to move |
| 3 | 8 – 12 | Gentle Breeze | Leaves, small twigs in constant motion, light flags extended |
| 4 | 13 – 18 | Moderate Breeze | Dust, leaves, and loose paper raised up, small branches move |
| 5 | 19 – 24 | Fresh Breeze | Small trees begin to sway |
| 6 | 25 – 31 | Strong Breeze | Large branches of trees in motion, whistling heard in wires |
| 7 | 32 – 38 | Moderate Gale | Whole trees in motion, resistance felt in walking against the wind |
| 8 | 39 – 46 | Fresh Gale | Twigs and small branches brake off of trees |
| 9 | 47 – 54 | Strong Gale | Slight structural damage occurs, slate blown from roofs |
| 10 | 55 – 63 | Whole Gale | Trees broken, structural damage occurs |
| 11 | 64 – 72 | Storm | Widespread damage |
| 12 | 73 or Higher | Hurricane Force | Violence and destruction |

## *History & Probability*

Since 1996, NOAA has recorded 269 windstorms in the planning area. Most of these events have been measured at between 55 to 60 miles per hour, but have a few have been measured in the 80s and one was clocked at 86. There are no recorded injuries and 1 fatality from these windstorms. Windstorms have caused a total of $16,618,500 in property damage throughout the planning area.

Based on the data recorded by NOAA, the planning area should expect roughly 11 windstorms per year or at a rate of 10.76 events per year.

For a complete list of NOAA recorded high wind, strong wind, and thunderstorm winds, please reference Appendix C.

## *Vulnerability of and Impact on Facilities*

Structural vulnerability to windstorms is the same throughout the planning area. Windstorms create flying debris which can damage infrastructure and buildings. Strong enough wind can cause structure damage to older, poorly constructed buildings, even toppling or leveling them. A FEMA Code 361 Tornado Safe Room will provide more than sufficient protection and resistance to any form of severe storm as they are designed and constructed above the standard metrics of a severe storm. NOAA records catalog that the planning area regularly reports severe storm damage to roofs and power lines while also uprooting and downing trees.

Significant changes to national building codes were implemented in 1999, and structures built before then are considered to be more vulnerable than those constructed afterwards.



The average windstorm in the planning area costs $61,779, while the existing range of a single incident has been from $0 to $6,000,000.

Pacific County and its participating jurisdictions' municipal structures are valued at $1,842,569,000 and their school district structures are valued at $109,183,686, for a total value of $1,951,752,686. Since windstorms threaten the entire planning area equally, all municipal and school district structures are considered exposed and vulnerable.

## *Vulnerability of and Impact on Population*

As long as a structure is able to maintain its integrity during high-speed winds, it will protect people from wind injury or death. However, old or poorly constructed facilities are not good shelters as previously mentioned, flying debris can break windows or cause structural damage. Either of these instances have the potential to seriously injure or kill anyone taking shelter in older, less well constructed building.

Pacific County and its municipalities have a total population of 22,984 in 15,547 housing units all of which are vulnerable and at risk to windstorms. Similarly, all of the school districts' 2,370 students and their 401 staff and faculty are vulnerable and at risk.

Historically, there have been no recorded injuries and one fatality as a result of windstorms in the planning area.

## *Vulnerability of and Impact on Systems*

The planning area's assets and systems' vulnerability to severe storms is directly correlated to its population density throughout the planning area with its power grid being the most likely to suffer damage. Where there are people, there are power related infrastructure.

Windstorms can destroy and damage multiple structures and points of infrastructure. It has the potential to significantly impact a community's power grid compounding the effects of other hazards such as winter storms.

## *Key Considerations*

Since severe storms strike over large areas and indiscriminately, there is not any particular portion of the planning area that is more likely than another to experience a severe storm. However, there are portions of the planning area that are more vulnerable to hail and wind related damage due to the age of a significant portion of their building stock.

As previously mentioned, the majority of the planning area's structures were built prior to 1999 and thus are more vulnerable and at risk to windstorms.



### *Fire Protection Districts*

The fire districts' services are an integral part of the planning areas emergency operations before, during, and after an event. The participating fire districts are vulnerable to severe storms. A windstorm is unlikely to damage an entire fire district in a way that would significantly reduce its overall capabilities.

### *Hospitals*

Both hospitals share a moderate risk to windstorms. Although they are of newer construction, damage could still be inflicted from a windstorm via travelling airborne debris. Additionally, windstorms pose the risk of denying the hospitals power due to downed power lines.

***Ports***

The ports of Chinook, Ilwaco, Peninsula, and Willapa Harbor have limited vulnerability to severe storms. High velocity blowing winds are likely to temporarily shut down operations, but without any facility damage, they are unlikely to have any lasting effects. In the event structural damage is incurred, commerce will slow down, but it is unlikely that the port would close for a period of days or weeks. Historically, windstorms have not had a significant impact on these ports.

***Public Drainage & Utility Districts***

Public Drainage District #1 and Public Utility District #2 serves the entire planning area. PUD #2 does not generate any power of its own, but provides and maintains the energy grid necessary to delivery electricity to the planning area. PUD #2's infrastructure is at risk from the high winds that accompany a severe storm. These winds can knock down electrical poles and wires directly or cause trees and other debris to knock them down denying power to Pacific County and its participating jurisdictions' residents. PDD #1 has minimal direct risk from a windstorm.

***Transportation & Pacific Transit***

The roadways and bus routes of Pacific County are not significantly or directly vulnerable to windstorms. Although windstorms will present an immediate danger to traveling motorists, they do not have the power to inhibit the infrastructure's functionality in the long term. They have, however, had an impact in the medium-term. The only scenario in which the transportation infrastructure is hindered is in the event of a tree or other vegetation debris blocking a roadway. Historically, this type of event has caused road closure for three days.

# 3.10 – Winter Storms

A winter storm encompasses multiple effects caused by winter weather. Included are ice storms, heavy or prolonged snow, sleet, and extreme temperatures.

This plan defines severe winter storms as a combination of the following winter weather effects as defined by NOAA and the NWS.

> *Ice Storm: An ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility lines resulting in loss of power and communication. These accumulations of ice make walking and driving extremely dangerous. Significant ice accumulations are usually accumulations of ¼" or greater.*
>
> *Heavy Snow: This generally means snowfall accumulating to 4" or more in depth in 12 hours or less; or snowfall accumulating to 6" or more in depth in 24 hours or less. In forecasts, snowfall amounts are expressed as a range of values, e.g., "8 to 12 inches." However, in heavy snow situations where there is considerable uncertainty concerning the range of values, more appropriate phrases are used, such as "...up to 12 inches..." or alternatively "...8 inches or more."*
>
> *Winter Storm: Hazardous winter weather in the form of heavy snow, heavy freezing rain, or heavy sleet. May also include extremely low temperatures and increased wind.*

## *Location & Extent*

Winter storms are an area-wide hazard as they can strike anywhere in the planning area. Winter storms can range from moderate snow over a few hours to blizzard conditions with high winds, freezing rain or sleet, heavy snowfall with blinding wind-driven snow and extremely cold temperatures that last several days.

Winter storms typically form with warning and are often anticipated. Like other large storm fronts, the severity of a storm is not as easily predicted and when it is, the window of notification is up to few hours to under an hour. Although meteorologists estimate the amount of snowfall a winter storm will drop, it is not known exactly how many feet of snow will fall, whether or not it will form an ice storm, or how powerful the winds will be until the storm is already affecting a community.

Pacific County and this plan's participants will typically receive 6 to 8 inches of snow during a winter storm in the lowlands and 10 to 20 inches in the highlands, but a single storm in the planning area has managed to accumulate up to a reported 10 inches in a single event. It has been recorded that snow from a winter storm can fall at a rate of 1 inch per hour.

## *History & Probability*

Since 1996, NOAA has recorded 14 winter storms in the planning area. Snowfall from winter storms typically leaves between six to eight inches of snow.

These winter storms have not caused any recorded direct injuries or fatalities. The NWS and NOAA have recorded $859,000 in property damage as a result of winter storms. For a complete list of NOAA recorded winter storms, please reference Appendix C.

Based on the data recorded by NOAA, the planning area should expect a winter storm at a rate of 0.56 per year.

## *Vulnerability of and Impact on Facilities*

Structural vulnerability to winter storms is the same throughout Pacific County and its participating jurisdictions. Heavy snow accumulation can cause roofing to collapse on old or poorly constructed facilities. Ice storms will coat a facility's exterior, but is unlikely to cause anything more than superficial damage. Prolonged, extremely cold temperatures can cause significant damage to poorly insulated or heated facilities. The cold temperatures can cause a facility's water pipes and plumbing systems to freeze. As the water in these systems turns to ice it expands and eventually will cause pipes to burst.

Pacific County and its participating jurisdictions' municipal structures are valued at $1,842,569,000 and their school district structures are valued at $109,183,686 for a total value of $1,951,752,686. Since winter storms threaten the entire planning area equally, all municipal and school district structures are considered exposed and vulnerable.

The NWS and NOAA has recorded $859,000 in property damage as a result of winter storms ranging from $0 to $691,000 for a single event. The average cost in property damage per storm is $61,357.

## *Vulnerability of and Impact on Population*

Pacific County and its participating jurisdictions' population are equally vulnerable throughout the planning area. Pacific County and its participating jurisdictions' citizens are at risk from prolonged, cold temperatures if they fail to be sheltered in an adequately heated structure or are unable to reach shelter. Some structures are dependent on electricity or steam for their heating making them vulnerable if a winter storm causes a power outage. Additionally, if a winter storm restricts travel,
people may become immobile on roadways and be at the mercy of their vehicle's fuel supply. Exposure from winter storms in any of these cases can lead to frostbite and hypothermia. Both of these conditions if untreated can lead to death.

Pacific County and its participating jurisdictions have a total population of 22,984 in 15,547 housing units all of which are vulnerable and at risk to severe winter storms. Additionally, all 2,370 school district students and their 401 staff and faculty are considered exposed and vulnerable. The school districts'
students, staff, and faculty are considered at slightly lesser vulnerable than the population at-large since winter storms often arrive with warning and school would likely be cancelled.

Historically, there have been no recorded fatalities or injuries relating to winter storms across region wide fronts in Pacific County.

## *Vulnerability of and Impact on Systems*

Pacific County and its participating jurisdictions' assets and systems vulnerability to winter storms is roughly same throughout the planning area. Winter storms create havoc on roads impacting travel from decreased speeds and traffic jams to an ice storm or blowing snow drifts making any travel impossible

or extremely dangerous. Given the sloping terrain of the planning area, driving during these conditions is incredibly dangerous. Additionally, ice storms and snow accumulation can directly bring down power lines or bring down vegetation onto power lines. From these scenarios, Pacific County and its participating stakeholders can suffer power outages making it difficult to heat structures and exposing its citizens to prolonged cold temperatures. Winter storms can cause a problem for school districts in lost education days and transportation to and from their schools. Winter storms can trap students and staff on roadways exposing them to hazardous conditions and cold temperature. Winter storms have been recorded as leaving thousands of residents without power.

## *Key Considerations*

Winter storms have ability to affect a portion of or the entire planning area. Unfortunately, there is no way to predict ahead of time which areas will likely be more or less adversely directly affected. In regards to winter storm impacts, communities, residents, and businesses that are more rural are reliant on a less centralized power grid with fewer redundancies. Structure in these areas will likely be without power for a greater period.

### *Fire Protection Districts*

The fire districts' services are an integral part of the planning area's emergency operations before, during, and after an event. The participating fire districts are only slightly vulnerable to winter storms. A winter storm is unlikely to damage an entire fire district in a way that would significantly reduce its overall capabilities.

### *Hospitals*

Winter storm conditions will likely make it very difficult for patients to make it to the hospital if need be. Additionally, the potential for the loss of power makes is absolutely necessary that the hospitals have stored basic supplies, food, water, and fuel (to operate backup generators) in the event of prolonged loss of power.

### *Ports*

The ports of Chinook, Ilwaco, Peninsula, and Willapa Harbor have limited vulnerability to winter storms. A winter storm has the potential to temporarily slow or shut down commercial operations. If a storm knocks out power, operations could be delayed further. Historically, none of these events have been of significant impact to the ports.

### *Public Drainage & Public Utility Districts*

Public Utility District #2 serves the entire planning area. PUD #2 does not generate any power of its own, but provides and maintains the energy grid necessary to deliver electricity to the planning area. As previously mentioned, a winter storm had knocked out power to 500 of the planning area's residents. PUD #2 is vulnerable to future winter storms, but unless they impact at a larger scale, PUD #2 is not considered highly vulnerable. PDD #1 is not at specific risk to the storm itself, but if it is accompanied by low temperatures, its smaller pipe infrastructure could be at risk.



### *Transportation & Pacific Transit*

The roadways and bus routes of Pacific County are temporarily vulnerable to winter storms. A winter storm can temporarily restrict roadway transportation between the planning area's

communities, hindering response and recovery operations. Additionally, closed roadways can leave motorists trapped and exposed to the elements.

## 3.11 – Excluded Hazards

There exists a slim chance that any type of natural hazard could occur in any location throughout the United States. However, the probability of them occurring is so infinitesimally small and their impact so slight that it is not considered reasonable to develop a fully-profiled risk assessment for them. Additionally, without historical information or data to drive an analysis, it is unlikely that their conclusions would yield functional or practical strategies to mitigate them.

### *Avalanche*

Avalanches do not occur within the planning area. The Washington State Enhanced Hazard Mitigation Plan does not include Pacific County within an identified avalanche hazard area.

### *Dam Failures*

Pacific County's prior HMP profiled the planning area's dams. The prior HMP and the USACE verify that there are no dams of reasonable risk within the planning area.

### *Droughts*

Due to the extremely wet and humid climatic conditions that exist year-round in Pacific County, the planning area does not suffer from droughts.

### *Hail and Lightning*

Disaster history for hail incidents in Pacific County are extremely rare. Additionally, although lightning does strike, there is no plurality of impacts from disaster strikes in the planning area warranting a hazard profile.

### *Volcanoes*

The Washington State Enhanced Hazard Mitigation Plan includes sophisticated analyses of Washington's volcanoes. Theses analyses do not include Pacific County within the identified hazard risk areas.

## 3.12 – Risk Summary

The table below outlines each participating jurisdiction's general risk to this plan's profiled hazards. The rankings are based on a composite evaluation of this plan's risk assessment, namely, a hazard's probability of occurring in the future, the vulnerability of a jurisdiction to a particular hazard, the intensity of past hazard impacts, and a joint evaluation of local experts and stakeholders.

Each participating jurisdiction was assessed against each hazard on a scale of 0 to 6, 0 meaning there is no reasonable risk, 1 being the lowest level of reasonable risk, and 6 being the highest level of risk.

**Table 3.31 – Hazard Risk Summary**

| Stakeholder | Coastal Erosion | Earthquakes | Floods | Landslides | Tsunamis | Wildfires | Windstorms | Winter Storms |
|---|---|---|---|---|---|---|---|---|
| Pacific County | 5 | 4 | 3 | 2 | 4 | 2 | 3 | 2 |
| Ilwaco | 2 | 2 | 3 | | 3 | 2 | 3 | 2 |
| Long Beach | 3 | 4 | 3 | | 3 | 2 | 3 | 2 |
| Raymond | 2 | 4 | 4 | | 3 | 2 | 3 | 2 |
| South Bend | 2 | 4 | 4 | | 3 | 2 | 3 | 2 |
| Naselle-Grays River Valley SD | | 4 | | | | 2 | 3 | 2 |
| Ocean Beach SD | | 4 | | | 4 | 2 | 3 | 2 |
| South Bend SD | | 4 | | | 3 | 2 | 3 | 2 |
| Willapa Valley SD | | 3 | | | | 2 | 3 | 2 |
| FPD1 | | 3 | | | 4 | 2 | 3 | 2 |
| FPD2 | | 3 | | | 3 | 2 | 3 | 2 |
| FPD3 | | 3 | | | | 2 | 3 | 2 |
| FPD4 | | 3 | | | | 2 | 3 | 2 |
| FPD5 | 4 | 3 | | | 4 | 2 | 3 | 2 |
| FPD6 | | 3 | | | 4 | 2 | 3 | 2 |
| Ocean Beach Hosp. | | 2 | | | 3 | 2 | 3 | 2 |
| Willapa Harbor Hosp. | | 4 | | | 3 | 2 | 3 | 2 |
| Port of Chinook | 4 | 4 | 4 | | 4 | 2 | 3 | 2 |
| Port of Ilwaco | 4 | 4 | 4 | | 4 | 2 | 3 | 2 |
| Port of Peninsula | 4 | 4 | 4 | | 4 | 2 | 3 | 2 |
| Port of Willapa Bay | 4 | 4 | 4 | | 4 | 2 | 3 | 2 |
| Pacific Transit | 4 | 3 | | | | 2 | 3 | 2 |
| PDD1 | | 4 | | | 3 | 2 | 3 | 2 |
| PUD2 | | 4 | | | 3 | 2 | 4 | 3 |

# Section 4 – Mitigation Strategy

A mitigation strategy is a set of mitigation actions meant to prevent the potential impacts of hazards. There are several types of mitigation actions with a different method of reducing vulnerability.

Pacific County and this plan's stakeholders have identified the sustained, proposed, and completed mitigation actions for each of the hazards identified as having the potential to affect the jurisdiction. For proposed mitigation actions, the planning team in each jurisdiction considered each type of mitigation action before identifying mitigation actions to include their final mitigation strategy. The mitigation strategy of each jurisdiction is included in this section of the plan.

## 4.1 – Mitigation Capabilities

Each type of stakeholder provides a set of capabilities, in some cases broad and in some cases narrow, by which they can increase the planning area's resiliency. The broadest form of mitigation capabilities come from the county and the municipal governments. Their inherent legal authority allows them to institute the greatest regulatory and developmental changes.

The school districts have broad authority over their campuses and although budgets may be tight, they are more far reaching than some of the smaller organizations. Additionally, the necessity to protect the planning area's children grants them greater influence and political capital to institute change.

### *Fiscal Capability*

The planning area's municipal governments are not unique in the issues felt by small governments to retain the staff and resources necessary to accomplish the strategies necessary to mitigate hazards. However, those entities are aware of potential diverse funding sources available to communities for, assisting in the fiscal needs required to implement local hazard mitigation plans, including both government and private programs.

While federal and state programs carry out the bulk of disaster relief programs that provide funds for mitigation, local governments are able to search for alternative funding sources to supplement the local hazard mitigation budget. The participants in the mitigation planning process are aware that before effective mitigation strategies can be applied, stable funding sources and effective incentives must be established on a per project basis to encourage participation by the private and public sectors.

Pacific County and this plan's municipal governments should seek out FEMA grant funding from the Building Resilient Infrastructure and Communities (BRIC), Hazard Mitigation Grant Program (HMGP), and the Flood Mitigation Assistance Grant Program (FMA). Given the size of the municipalities involved in this plan and the pocketed areas of significant flood risk, municipal governments should have access to the United States Department of Housing and Urban Development's Community Development Block Grant Program (CDBG) which occasionally will award grants to assist with projects that fall under hazard mitigation. Smaller participating organizations may have to use bonds for financing larger projects similar to the standard practice of the school districts.

## Institutional Capability

Pacific County as a whole community is capable of implementing the strategies identified herein. In addition, they are capable of promoting the mitigation process and educating the public about the hazards prevalent to their area, as well as mitigation process necessary to mitigate those hazards.

In an emergency, the county and each municipality's response is an extraordinary extension of responsibility and action, coupled with normal day-to-day activity. Normal governmental duties will be
maintained, with emergency operations carried out by those agencies assigned specific emergency functions. The county and each municipality are certified StormReady and TsunamiReady communities.

## Political Capability

During the process of the development of this plan, opposition to mitigation measures was not evident in any the plan's participants. The primary limiting factor is funding, which is made more difficult by the current situation in the local, state, and national economies.

The county, cities, and their partnerships with the participating agencies are well-organized and responsive to community needs. Leadership is informed and remains up-to-date on the hazards that threaten the area. Citizens who did participate in the public meetings and presentations showed an interest in doing things to promote a safer community. Therefore, the county and cities (the governing
board, staff, and citizen population) appear willing to promote the economic efficiency and social utility of the mitigation measures contained in this plan, if appropriate funding can be identified.

Each of the participating municipalities undergoes budget reviews that begin with departmental reviews taking place in late spring to early summer. Preliminary submissions and budget refinement follow this review with budgets then finalized and published in the late fall. This process varies slightly from year-to-year depending on a variety of factors.

## General Authority & Regulations

State of Washington law provides the legal authority for local governments to implement regulatory measures. The basis for much of this authority is the local government power designed to protect public health, safety and welfare. This authority enables local government to enact and enforce ordinances, and to define and abate nuisances. Hazard mitigation is a form of protecting public health, safety, and welfare, and falls under the general regulatory powers of local government. This also extends to building codes and inspections, land use, acquisition, and floodplain development regulation.

## Building Codes & Inspection

Building codes and inspections provide local governments with the means to maintain county structures that are resilient to natural hazards. Pacific County and every municipality has

adopted the 2009 International Building and Fire Prevention Codes. These codes prescribe minimum standards for



building construction, which ensures that new buildings and structures are built to standards that are seismically sound, fire resistant and developed within flood-proofing measures. These codes also
require appropriate hazard code updating and compliance when certain thresholds are met for remodel and renovation of existing buildings. These codes also authorize local governments to carry out building inspections to ensure local structures adhere to the minimum state building standards.
Municipal officials have the primary role of enforcement of the International Building Code structural regulations. Fire departments also take part in the inspection process for fire and general public safety inspections. They enforce the appropriate codes both at the plan approval stage and the site
inspection stage. Pacific County and this plan's municipal governments are committed to the high standards of building provided through the respective codes, and requires that the same codes and the same enforcement procedures apply during routine permitting procedures as well as following a disaster.

It is recommended that more municipalities adopt the 2015 or 2020 International Building and Fire Prevention Codes.

## *Land Use Planning*

Through land use regulatory powers granted by the state, local governments can control the location, density, type and timing of land use and development in the community. Provisions of the land use plans are implemented through regulatory tools that include zoning and subdivision ordinances, and taxation. Table 4.1 outlines the various planning measures and documents that each municipality uses to govern its growth.

## *Taxation*

Taxation can be a powerful mitigation tool by providing local governments with a way to guide development. Tax abatements may be used to encourage landowners and developers to integrate mitigation measures into the process of building new developments and retrofitting existing properties in the floodplain. These tools can be especially effective in encouraging the mitigation of existing structures. Additionally, school districts have the ability to levy revenue through referendums for specific projects whether it is mitigation related or not. There is little a community or school district can do to increase their fiscal resources through taxation other than to grow or increase their tax rate. It is outside the scope of this plan to make recommendations on this subject.

**Table 4.1 – Budget Reviews & Planning Documents**

| Municipality | Budget Reviews | Zoning Ordinance | Comprehensive Plan | Shoreline Master Plan |
|---|---|---|---|---|
| Pacific County | November | Yes | Yes | Yes |
| Ilwaco | October/November | Yes | No | No |
| Long Beach | October | Yes | Yes | Yes |
| Raymond | October/November | Yes | Yes | Yes |
| South Bend | October | Yes | Yes | Yes |

## Floodplain Programs

Floodplain management is the operation of a community program of measures for reducing flood damage. These measures take a variety of forms; and generally, include zoning plans, subdivision, or building requirements, and special-purpose floodplain ordinances. Pacific County and each of the 4 municipal governments employ their own floodplain administrators.

In order to build or modify a structure in an identified Zone A, the builder must apply for a development certificate requiring the lowest level of the structure (that includes the basement) to be built 1 foot above BFE.

Each of the participating municipal governments participates in the NFIP.

**Table 4.2 – Floodplain Administrators**

| Municipality | Floodplain Administrator |
|---|---|
| Pacific County | Shawn Humphreys |
| Ilwaco | Crest |
| Long Beach | Ariel Smith |
| Raymond | Eric Weiberg |
| South Bend | Dennis Houk |

## Repetitive Loss Properties

The planning area does not have any repetitive loss properties.

## 4.2 – Mitigation Goals

The mitigation goals for Pacific County and this plan's participating jurisdictions were established based upon results from the local and state risk assessments, stakeholder meetings, and input from an extensive public survey. These goals represent the plan's participants' long-term vision for the continued reduction of hazard risks and the enhancement of their mitigation capabilities.

*Goal 1: Reduce the risk from natural hazard events utilizing community cooperation and an all-hazards approach.*

*Goal 2: Pursue additional, complete, and accurate data in support of mitigation planning, disaster preparedness, disaster response, and disaster recovery operations.*

*Goal 3: Integrate the hazard mitigation plan's findings into the planning, and decision-making processes for all current and future emergency management and preparedness related activities.*

*Goal 4: Minimize the risk to property from coastal erosion*

*Goal 5: Minimize the risk to life and property from earthquakes.*

*Goal 6: Minimize the risk to life and property from floods.*

*Goal 7: Minimize the risk to life and property from landslides.*

*Goal 8: Minimize the risk to life and property from tsunamis.*

*Goal 9: Minimize the risk to life and property from wildfires.*

*Goal 10: Minimize the risk to life and property from windstorms*

*Goal 11: Minimize the risk to life and property from winter storms.*

# 4.3 – Mitigation Projects

This plan identifies a comprehensive range of 25 possible and unique mitigation projects and 2 possible and unique mitigation actions. The selected set carefully takes an all-hazards approach to mitigation while simultaneously addressing each of the individual eight profiled hazards.

The projects and actions were selected based upon their potential to reduce the risk to life and property with an emphasis on new and existing infrastructure, ease of implementation, community and departmental support, consistency with other relevant plans and capabilities, available funding, vulnerability, and total risk. For further information on evaluation criteria, please see Section 4.4. The full list of mitigation projects and their descriptions can be found in Appendix D.

Some projects and actions mitigate risk and vulnerability to multiple hazards. Some of these projects and actions list participating jurisdictions that are only at risk from one or a few of the mitigation hazards. For example, the project: "Backup Generators" mitigates against multiple hazards. All participating jurisdictions are interested in this project, but some will not be using it to mitigate against riverine flooding. Instead, they will be using it to mitigate against severe storms and severe winter storms.

**Table 4.5 – Mitigation Projects Summary**

| Project/Action | Organizations |
|---|---|
| Backup Generators | All Participants |
| Bionets | Pacific County |
| Bury Utility Lines, Pipes, and Tanks | All Participants |
| Debris & Natural Fuels Reductions | All Participants |
| Defensible Spaces & Buffer Zones | All Participants |
| Elevate Structures | All Municipalities, Ocean Beach SD, South Bend SD, All Hospitals, All Ports, FPD1, FPD2, FPD5, FPD6, PDD1, PUD2 |
| Floodproofing | All Municipalities, All Ports |
| Flood Level Monitoring System | All Municipalities, All Ports |
| Greenbelts | All Municipalities, All Ports, FPD5, Pacific Transit |
| Insulation & Energy Efficiency | All Participants |
| Interior Furnishing Hazard Reduction | All Participants |
| Looped Grid Power Systems | All Participants |
| Raise Transportation Infrastructure | All Municipalities, All Ports |
| Reinforce Jetties/Seawalls | All Municipalities, All Ports, FPD5, Pacific Transit |
| Relocate or Buyout Vulnerable Structures | All Municipalities, All Ports |
| Seismic Structural Retrofit | All Participants |
| Shoreline Stabilization | All Municipalities, All Ports, FPD5, Pacific Transit |
| Slope Reinforcement & Modification | Pacific County |
| Snow Fences | All Participants |
| Storm Water Drainage System Upgrade | All Municipalities, All Ports |
| Storm Water Pump Stations | All Municipalities, All Ports |
| Tsunami Shelters | All Municipalities, Ocean Beach SD, South Bend SD, All Hospitals, All Ports, FPD1, FPD2, FPD5, FPD6, PDD1, PUD2 |
| Water Line Insulation | All Participants |
| Wildfire Structural Retrofit | All Participants |
| Wind Resistance Structural Retrofit | All Participants |

**Table 4.6 – Mitigation Actions Summary**

| Project/Action | Lead Agency |
|---|---|
| Public Awareness & Education | PCEMA |
| SKYWARN Storm Spotter Training | PCEMA |

## *Mitigation Project Updates*

Pacific County's prior approved mitigation plan (2016) contained suggested projects and actions that are no longer considered qualified mitigation projects or actions, rather, they classify as response, recovery, preparedness, or mere basic emergency management functions. Examples of these items include the development of basic emergency plans, risk assessments that are already part of mitigation planning, and basic municipal functions. If a project or action that was included in Pacific County's prior plan is not listed below or listed as "carried forward" in Appendix D, it has been deleted. The table below lists the mitigation projects that have been completed or initiated since the development of their last hazard mitigation plan.

**Table 4.7 – Mitigation Project Updates**

| Mitigation Project | Organization | Status | Notes |
|---|---|---|---|
| Backup Generator | FPD #5 | Completed | - |
| Backup Generator | Long Beach | Completed | - |
| Backup Generator | Port of Peninsula | Completed | - |
| Erosion Partnership | Pacific County | Ongoing | - |
| Shoreline Stabilization | PDD #1 | Completed | 1.8 Miles |
| Storm Water Drainage System Upgrade | South Bend | Completed | Line Replacement (Central Ave.) |
| Storm Water Drainage System Upgrade | South Bend | Completed | Culvert Replacement (Kendrick St.) |
| Storm Water Drainage System Upgrade | South Bend | Completed | Tide Gate (Washington St.) |
| Storm Water Drainage System Upgrade | South Bend | Completed | Comprehensive (Willapa Ave.) |
| Storm Water Drainage System Upgrade | South Bend | Completed | Comprehensive (W. Water St.) |
| Storm Water Pump Stations (Upgrades) | Long Beach | Completed | - |

## 4.4 - Project Evaluation, Implementation, & Administration

Situational changes will likely occur throughout the 5-year life cycle of a mitigation plan. This can happen due to any number of factors such as public influence, local and grant funding allotments, changing demographics, other developmental changes, and numerous more. These factors and many others have great influence over how activities and projects will need to be evaluated for feasibility and demand. Therefore, a flexible methodology will serve Pacific County and this plan's participants best when determining what, when, and where to engage an activity or project.

At large, there have not been any major changes to Pacific County, the participating municipalities, or school districts that have altered their priorities as it pertains to disaster or hazard risk.

### *Project Evaluation*

Pacific County and this plan's participants will utilize the STAPLE+E method of assessing mitigation actions, projects, and alternatives. Upon deciding to move forth with a mitigation project, according to decision-making process of the participating jurisdiction, the decision-making body will use the form on the following page. Preliminary evaluations, per hazard, per project, per jurisdiction are found in Appendix D and are a composite of the STAPLE+E methodology and the composite risk for from each hazard for each jurisdiction.

The evaluations were conducted according the definitions in the table below:

**Table 4.8– STAPLE+E**

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

1.) Fill in the name of the mitigation action or project followed by two other viable alternatives which address the same hazards.
2.) For each consideration, indicate a plus ( + ) for favorable or negative ( - ) for less favorable. If the consideration does not apply, leave it blank.
3.) Compare the total number of pluses and negatives to the alternative actions. Some considerations may carry more weight than others, so a simple tally does not necessarily indicate a more viable or feasible action or project.

**Table 4.9 – STAPLE+E Sample Form**

| Criteria | Considerations | Action/Project | Alternative 1 | Alternative 2 |
|---|---|---|---|---|
| **Social** | Community Acceptance | | | |
| | Effect on Segment of the Population | | | |
| **Technical** | Technical Feasibility | | | |
| | Long-Term Solution | | | |
| | Secondary Impacts | | | |
| **Administrative** | Staffing | | | |
| | Funding Allocated | | | |
| | Maintenance/Operations | | | |
| **Political** | Political Support | | | |
| | Local Champion | | | |
| | Public Support | | | |
| **Legal** | State Authority | | | |
| | Existing Local Authority | | | |
| | Political Legal Challenge | | | |
| **Economic** | Benefit of Action | | | |
| | Cost of Action | | | |
| | Contributes to Economic Goals | | | |
| **Environmental** | Effect on Land or Water | | | |
| | Effect on Endangered Species | | | |
| | Effect on HAZMAT Waste Sites | | | |
| | Consistent with Environmental Goals | | | |
| | Consistent with Federal Laws | | | |
| | **Total =** | | | |

## Project Implementation

Each organization participating in this plan has their own decision-making bodies that are free to implement the mitigation strategies found in this plan as they see fit. Each decision-making body will choose municipal departments to head up implementation efforts appropriate for that municipal department's area of responsibility.

The activity and project evaluation methodology described in this section serves as an aid for them to enhance their decision-making. It is highly suggested that the county coordinates with the other municipal governments as well as the non-municipal plan participants to work towards an organized and concentrated effort when implementing activities and projects. That is, it would better serve their implementation effectiveness to work as a whole community when deciding how to allocate staff and funding resources when implementing mitigation activities and projects.

The participating school districts will be in complete sole control of what, when, and where to implement mitigation activities or projects. Its decision-making bodies that are free to implement as they see fit. The activity and project evaluation methodology provide earlier in this section acts as an aid for them to best apply the prescribed mitigation strategy found in this plan.

## Project Administration

Pacific County will be self-administering each project through its own government departments. The department chosen to administer a project will vary depending on the characteristics of each activity or project whereas public works would be better suited for some projects while county records and risk management would be better suited for others. For each of the participating municipalities, they have the option and flexibility to administer their own activities and projects if they so choose. However, for the purpose of efficiency and governmental scale, activities and projects will default to be administered by PCEMA.

Each school district will administer activities and projects inhouse with individuals designated administrative responsibility on an ad-hoc, per project basis. Individual will be designated on a case-by-case basis as seen most fitting by the organization according to the specific characteristics of the project or activity as oversight and administration duties can vary wildly among these organizations. Each public-school district reported near similar processes which includes, contacting construction companies and architects for consultation, school board approval, further evaluation, and community input via public meetings.

# 4.5 - Planning Integration

Mitigation doesn't end at plan approval. Plan approval is only the beginning. The successful implementation of any number mitigation activities and projects requires the coordination and collaboration of a number of local agencies, departments, and organizations. Each group has varying decision-making processes and authorities governing their actions. This plan, once approved, must be integrated into their decision-making processes as a tool for improving their respective resiliencies. Other than the county's EOP, their last hazard mitigation plan was not integrated into any other plans.

This plan is not only useful for implementing mitigation activities and projects, but is also critical in making development plans and capital improvement projects. The risk assessment in this plan can prevent unmanaged and dangerous development into identified hazard areas or other portions of the planning area that decrease a community's overall resiliency.

## *Comprehensive Land Use Planning*

As of now, some of the participating municipal governments have comprehensive land use plans. Most of the municipalities maintain a set of ordinances, but as of yet does not have comprehensive plans. These plans typically detail building codes, ordinances, zoning, and other land use measures as they relate to hazard risk reduction. In the event any of the participating municipalities develop a comprehensive land use plan, the Pacific County HMP shall be integrated into it in a manner as they see fit in accordance and appropriate to the complexity of their comprehensive land use plan. This shall be done in a manner where the Pacific County HMP serves as a guide for reducing their hazard risk.

Since this is theoretical, there is not an established person or department that would be designated as the responsible party for the development of a comprehensive land use plan.

## *Democratic Governments & Boards*

All the participating jurisdictions use some form of a democratic voting process. These organizations rely on agenda proposals, deliberation and discussion, and voting to solidify their decision-making.

All participating jurisdictions engage in capital improvement, infrastructure, and other various projects on an ad hoc basis. For these stakeholders, this plan should be integrated into agenda proposal's designs and cross-referenced during deliberation and discussion of proposed activities and projects. By using this plan's risk assessment, development and capital improvement projects can be appropriately implemented taking into consideration a community's resiliency.

Since the mentioned projects are ad hoc, there is not a set timeframe for them. In the event hazard risk is relevant to a project, it's the responsibility of the PCEMA to bring the HMP to attention of the City Council, School Board, County Commissioners, or other organizational body that is deliberating over a project.

## *Emergency Management Planning*

Any and all emergency management related planning will at a minimum cross reference this document during its production. In some instances, this plan or portions of it will be fully integrated depending on the circumstances and nature of the planning document.

### *Emergency Operations Plans*

Pacific County's next EOP update will reflect the most probable and dangerous hazard event scenarios from the plan's risk assessment. Additionally, the plan will be referenced in its entirety as an appendix to the EOP. This revision is the responsibility of the PCEMA for all of the jurisdictions participating in this plan. Upon revision completion, all participating jurisdictions and appropriate emergency services will be notified of the revisions and sent out new copies of the EOP.

The PCEMA revises their EOP on a yearly basis, but not at a set time of the year. The schedule varies as their staffing resources vary according to disasters and other unforeseen emergency events. During each revision it is their own responsibility to integrate the HMP into the EOP and to decide to what extent it shall be integrated.

### *Hospital Disaster Planning*

Both the Ocean Beach Hospital and the Willapa Harbor Hospital have active and regularly updated disaster plans. When this plan is revised, this HMP will be considered for valuable information that can be integrated into each hospital's disaster plan.

### *State of Washington Emergency Management Division*

WA EMD has a FEMA approved mitigation plan current as of 2018 and is updated every 5 years. The state's mitigation plan is required by FEMA regulation to include a discussion and summary of local hazard mitigation plans. The process of integrating this plan is already an established process and is managed by WA EMD.

## *Facilities Master Plans*

Every school district in Washington is responsible for maintaining a facilities master plan and updating it at 2-year intervals. These are submitted on February 1st of each even number year while they are also required to submit a preliminary plan on February 1st of each odd number year. Each participating school district has an approved facilities master plan from 2019.

Their current plan outlines enrollment projections and facilities needs and capabilities, and capital improvement planning. Upon FEMA approval and school district adoption, this plan needs to be integral in the next update of each facilities master plan. The integration is the responsibility of each school district's superintendent.

*4.5 – Planning Integration*

These plans' outlined planning process entails four primary steps to updating their plan, the second of which is "Inventory/Analysis of Conditions." Review of this plan's risk assessment and mitigation strategy needs to be considered during this phase of their planning process as it

can help guide their decision-making process to better plan their capital improvement projects to incorporate hazard mitigating measures and thus increasing their resiliency.

Each public-school district approves the master plan prior to sending it out to the state for approval.


Pacific County Emergency Management Agency
April 21 at 2:00 PM ·
Good afternoon!
My name is Tony Gertz and I will be leading the development of Pacific County's Hazard Mitigation Plan and hosting the kick-off meetings scheduled on April 29th, 2021. At Two Rivers Emergency Management we're looking forward to working with Scot and PCEMA and I am personally looking forward to working with everyone in Pacific County once again.
During the first phase of the plan's development process it will be critical that I am able to collect as much inf... See More
PACIFIC COUNTY
PCEMA
EMERGENCY MANAGEMENT AGENCY
TWORIVERSEM.FORMSTACK.COM
Pacific County, WA - Formstack
Thank you for your interest in participating in the update of the Pacific County Multi-Jurisdictional Hazard Mitigation Plan update. This survey will help us capture important information for the development of the plan an...
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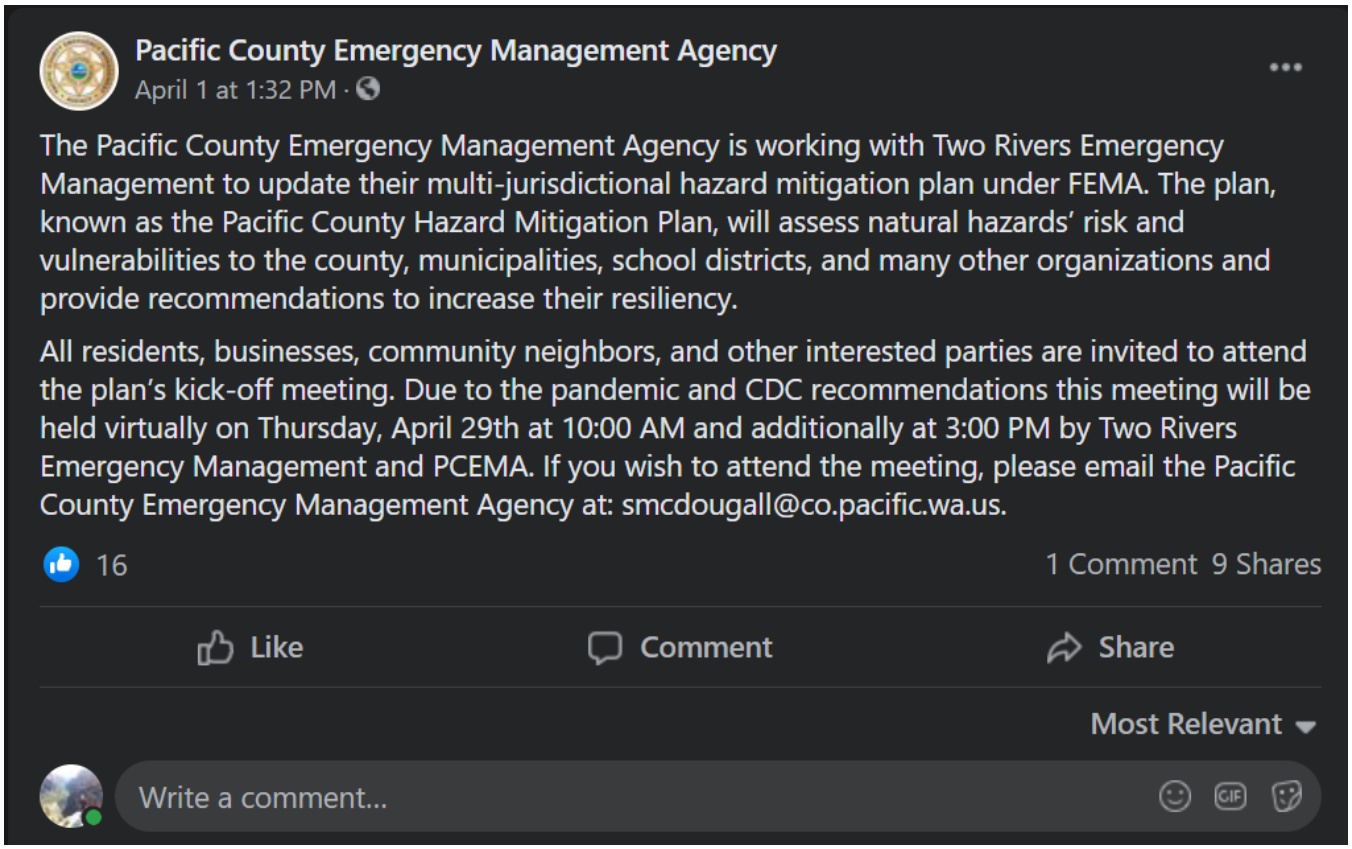
Pacific County Emergency Management Agency
April 1 at 1:32 PM ·
The Pacific County Emergency Management Agency is working with Two Rivers Emergency Management to update their multi-jurisdictional hazard mitigation plan under FEMA. The plan, known as the Pacific County Hazard Mitigation Plan, will assess natural hazards' risk and vulnerabilities to the county, municipalities, school districts, and many other organizations and provide recommendations to increase their resiliency.
All residents, businesses, community neighbors, and other interested parties are invited to attend the plan's kick-off meeting. Due to the pandemic and CDC recommendations this meeting will be held virtually on Thursday, April 29th at 10:00 AM and additionally at 3:00 PM by Two Rivers Emergency Management and PCEMA. If you wish to attend the meeting, please email the Pacific County Emergency Management Agency at: smcdougall@co.pacific.wa.us.
16
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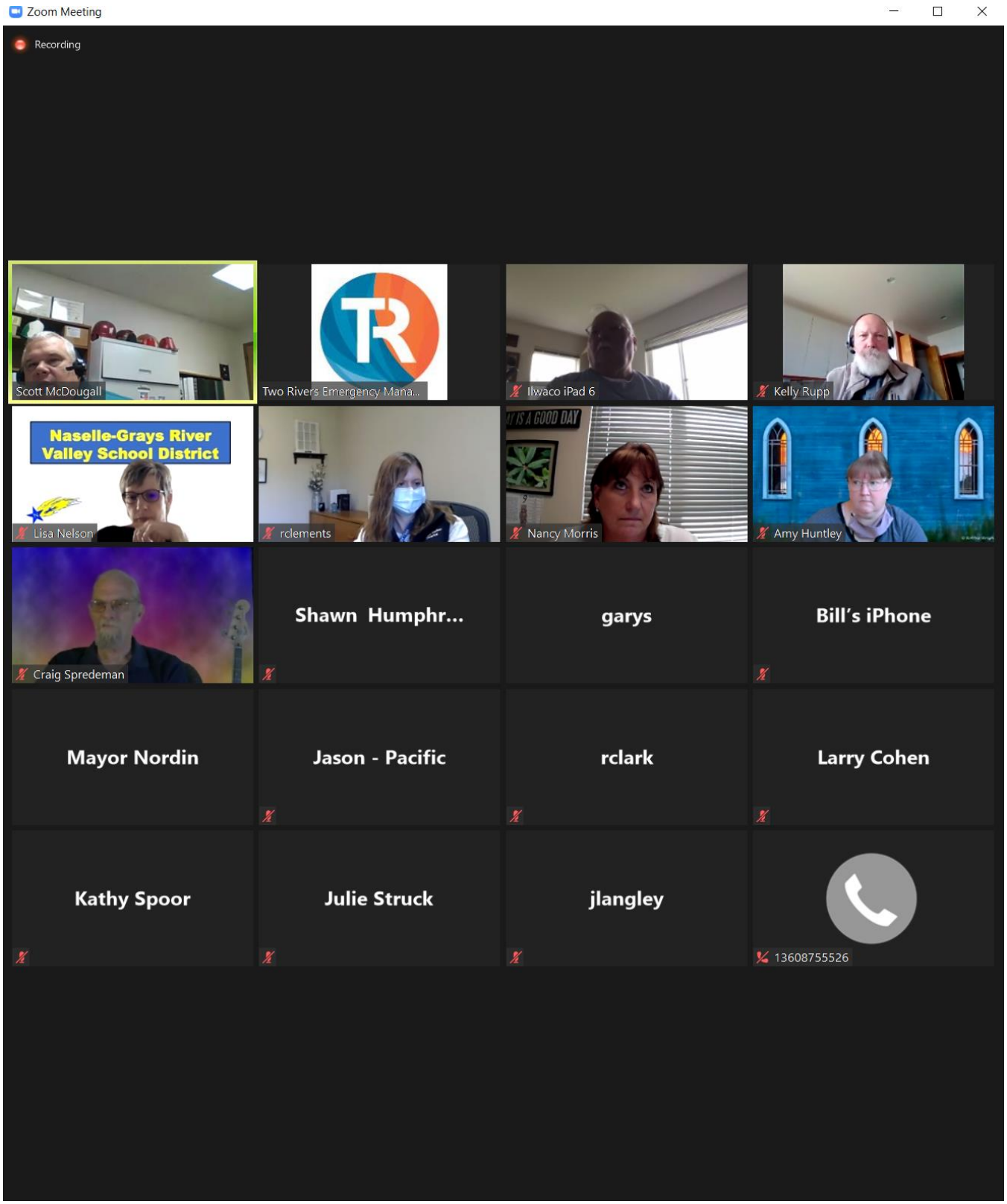
Zoom Meeting
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Naselle-Grays River Valley School District
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Nancy Morris
Amy Huntley
Craig Spredeman
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Mayor Nordin
Jason - Pacific
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Larry Cohen
Kathy Spoor
Julie Struck
jlangley
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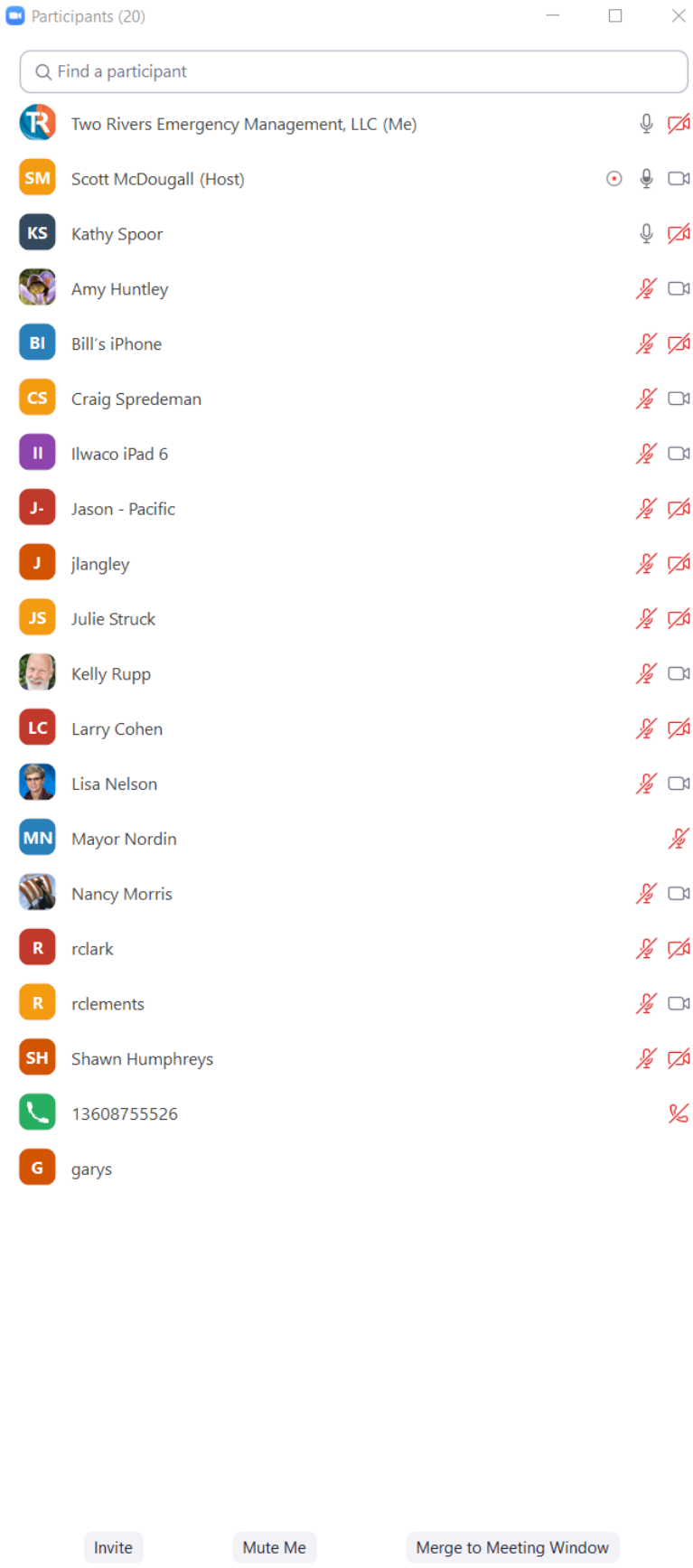
Participants (20)
Find a participant
Two Rivers Emergency Management, LLC (Me)
Scott McDougall (Host)
Kathy Spoor
Amy Huntley
Bill's iPhone
Craig Spredeman
Ilwaco iPad 6
Jason - Pacific
jlangley
Julie Struck
Kelly Rupp
Larry Cohen
Lisa Nelson
Mayor Nordin
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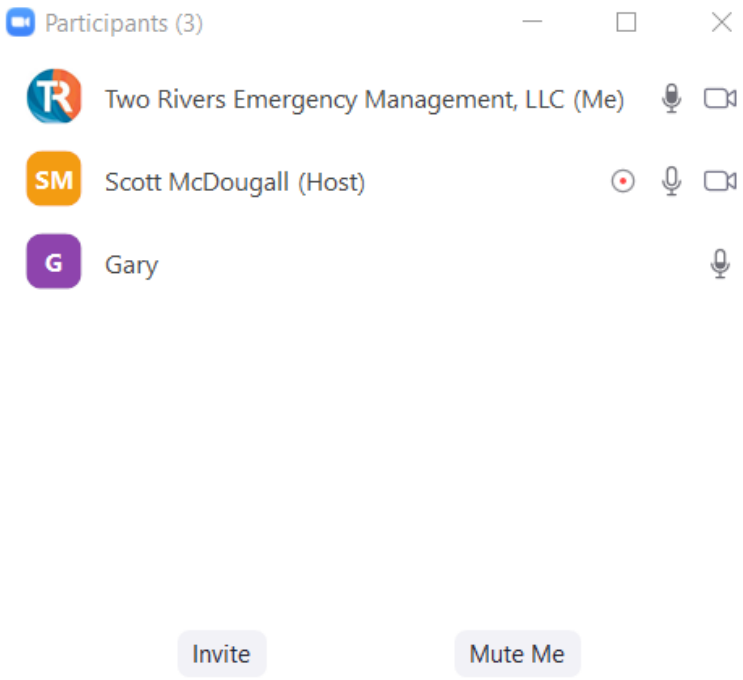
Participants (3)
Two Rivers Emergency Management, LLC (Me)
SM
Scott McDougall (Host)
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Gary
Invite
Mute Me

The Pacific County Emergency Management Agency is finalizing its **Hazard Miti-gation Plan** draft prior to submission to the Washington Emergency Management Division and FEMA for review and approval. The plan assesses natural hazards' risks and vulnerabilities to the county, its municipalities, school districts, and nu-merous other stakeholders. It provides recommendations to increase their hazard resiliency and reduce risk. In doing so, these actions aim to protect property and those who reside within the county.

The draft plan will be available for questions and review for a **two week period from December 8th to December 22nd via request**. If you're interested in reviewing the plan, please contact Scott McDougall or Tony Gertz at smcdou-gall@co.pacific.wa.us or tony@tworiversem.com respectively. We invite you to take this two week period to review the draft plan, provide any input you may have, or ask any related questions. Please direct all plan specific inquiries to: tony@tworiversem.com.

Published Dec. 1, Dec. 8 and Dec. 15, 2021
Legal No. 333-21

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# Appendix B – School District Facilities

### Table B.1 – Facilities, Naselle-Grays River Valley School District

| Structure | Location | Structural Value |
|---|---|---|
| Bus Garage | Primary | $311,798 |
| K-12 Buildings | Primary | $8,882,049 |
| Music & Shop Building | Primary | $975,408 |
| | Total = | $10,169,255 |

**The data are from the Naselle-Grays River Valley School District.*

### Table B.2 – Facilities, Ocean Beach School District

| Structure | Location | Structural Value |
|---|---|---|
| Bus Barn | High School | $844,300 |
| District Office | Long Beach Elem. | $648,300 |
| Early Childhood Center | Long Beach Elem. | $710,100 |
| Hilltop Middle School | High School | $8,673,200 |
| Ilwaco High School | High School | $16,116,200 |
| Ilwaco High School Stadium | High School | $1,764,200 |
| Kaino Gym | High School | $252,400 |
| Long Beach Elementary | Long Beach Elem. | $6,335,800 |
| Maintenance Shop | High School | $378,200 |
| Ocean Park Elementary | Ocean Park Elem. | $6,175,100 |
| Oysterville School | Long Beach Elem. | $233,200 |
| Technology Building | High School | $215,600 |
| | Total = | $42,346,600 |

**The data are from the Ocean Beach School District.*

### Table B.3 – Facilities, South Bend School District

| Structure | Location | Structural Value |
|---|---|---|
| Administrative Building | Primary | $1,658,900 |
| Bus Garage/ Grounds Building | Primary | $1,200,400 |
| Concession Stand | Primary | $182,000 |
| District Office | Primary | $500,000 |
| Early Childhood Building B | Primary | $325,000 |
| Football Locker Room | Primary | $446,309 |
| Grandstand | Primary | $857,000 |
| Gym/Music Building | Primary | $4,238,200 |
| Main Building Elementary | Primary | $450,000 |
| Mike Morris Elementary | Primary | $10,613,418 |
| Modular Building | Primary | $140,000 |
| Play shed | Primary | $2,010,000 |
| Shop Building | Primary | $1,790,000 |
| South Bend High School | Primary | $10,974,104 |
| Track Storage Building | Primary | $50,000 |
| | Total = | $35,435,331 |

**The data are from the South Bend School District.*

## Table B.4 – Facilities, Willapa Valley School District

| Structure | Location | Structural Value |
|---|---|---|
| Bus Garage | High School | $140,000 |
| Elementary Gym | Elementary | $1,943,000 |
| Elementary School | Elementary | $3,113,000 |
| Grandstands | High School | $800,000 |
| Greenhouse | High School | $80,000 |
| Lebam Gym | Lebam Elem. | $100,000 |
| Lebam School | Lebam Elem. | $200,000 |
| Middle & High School | High School | $13,820,000 |
| Modular Classrooms | High School | $500,000 |
| Transportation Facility | High School | $536,500 |
| | Total = | $21,232,500 |

**The data are from the Willapa Valley School District.*

## Table C.1 – Coastal Flood Records

| Location | Event Date | Injuries | Deaths | Property Damage |
|---|---|---|---|---|
| W Pacific (Zone) | 1/29/2006 | 0 | 0 | $0 |
| South Coast (Zone) | 12/3/2007 | 0 | 0 | $5,000,000 |
| South Coast (Zone) | 10/24/2010 | 0 | 0 | $150,000 |
| South Coast (Zone) | 12/10/2015 | 0 | 0 | $115,000 |
| South Coast (Zone) | 1/17/2018 | 0 | 0 | $0 |
| South Coast (Zone) | 11/15/2020 | 0 | 0 | $0 |
| South Coast (Zone) | 11/17/2020 | 0 | 0 | $0 |
| South Coast (Zone) | 11/17/2020 | 0 | 0 | $0 |
| South Coast (Zone) | 12/13/2020 | 0 | 0 | $0 |
| South Coast (Zone) | 1/12/2021 | 0 | 0 | $0 |
| | Totals = | 0 | 0 | $5,265,000 |

**The data are from the NOAA NCDC Storm Events Database.*

## Table C.2 – High Wind Records

| Location | Event Date | Wind Speed (MpH) | Injuries | Deaths | Property Damage |
|---|---|---|---|---|---|
| South Coast (Zone) | 11/30/1996 | 40 | 0 | 0 | $0 |
| South Coast (Zone) | 12/4/1996 | 45 | 0 | 0 | $0 |
| South Coast (Zone) | 12/29/1996 | 45 | 0 | 0 | $0 |
| South Coast (Zone) | 12/30/1996 | 35 | 0 | 0 | $0 |
| South Coast (Zone) | 1/1/1997 | 35 | 0 | 0 | $0 |
| South Coast (Zone) | 1/18/1997 | 37 | 0 | 0 | $0 |
| W Pacific (Zone) | 3/30/1997 | | 0 | 0 | $10,000 |
| W Pacific (Zone) | 12/1/1998 | 45 | 0 | 0 | $0 |
| W Pacific (Zone) | 12/5/1998 | 55 | 0 | 0 | $0 |
| W Pacific (Zone) | 12/7/1998 | 38 | 0 | 0 | $0 |
| W Pacific (Zone) | 12/12/1998 | 37 | 0 | 0 | $0 |
| W Pacific (Zone) | 12/25/1998 | 45 | 0 | 0 | $0 |
| W Pacific (Zone) | 12/27/1998 | 45 | 0 | 0 | $0 |
| W Pacific (Zone) | 1/15/1999 | 40 | 0 | 0 | $0 |
| W Pacific (Zone) | 1/17/1999 | 35 | 0 | 0 | $0 |
| W Pacific (Zone) | 1/28/1999 | 48 | 0 | 0 | $0 |
| W Pacific (Zone) | 2/1/1999 | 35 | 0 | 0 | $0 |
| W Pacific (Zone) | 2/5/1999 | 43 | 0 | 0 | $0 |
| W Pacific (Zone) | 2/18/1999 | 39 | 0 | 0 | $0 |
| W Pacific (Zone) | 2/23/1999 | 56 | 0 | 0 | $0 |
| W Pacific (Zone) | 3/2/1999 | 76 | 0 | 0 | $1,500 |
| E Pacific/W Lewis/Wahkiakum (Zone) | 3/2/1999 | 61 | 0 | 0 | $0 |
| South Coast (Zone) | 1/16/2000 | 95 | 0 | 0 | $0 |
| E Pacific/W Lewis/Wahkiakum (Zone) | 1/16/2000 | 66 | 0 | 0 | $0 |
| South Coast (Zone) | 12/13/2000 | 57 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 12/14/2000 | 77 | 0 | 0 | $0 |
| W Pacific (Zone) | 2/1/2001 | 35 | 0 | 0 | $0 |
| W Pacific (Zone) | 11/27/2001 | 52 | 0 | 0 | $0 |
| W Pacific (Zone) | 11/30/2001 | 64 | 0 | 0 | $0 |
| W Pacific (Zone) | 12/1/2001 | 64 | 0 | 0 | $0 |
| W Pacific (Zone) | 12/12/2001 | 48 | 0 | 0 | $0 |
| W Pacific (Zone) | 12/15/2001 | 70 | 0 | 0 | $0 |
| South Coast (Zone) | 11/12/2002 | 52 | 0 | 0 | $0 |
| W Pacific (Zone) | 11/15/2002 | 46 | 0 | 0 | $0 |
| W Pacific (Zone) | 12/13/2002 | 52 | 0 | 0 | $0 |
| W Pacific (Zone) | 12/15/2002 | 52 | 0 | 0 | $0 |
| W Pacific (Zone) | 12/24/2002 | 53 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 12/26/2002 | 57 | 0 | 0 | $0 |
| South Coast (Zone) | 12/26/2002 | 57 | 0 | 0 | $0 |
| W Pacific (Zone) | 1/1/2003 | 61 | 0 | 0 | $0 |
| W Pacific (Zone) | 11/16/2003 | 50 | 0 | 0 | $0 |
| South Coast (Zone) | 12/15/2003 | 60 | 0 | 0 | $0 |
| W Pacific (Zone) | 3/19/2005 | 60 | 0 | 0 | $0 |
| W Pacific (Zone) | 11/3/2005 | 53 | 0 | 0 | $0 |
| W Pacific (Zone) | 11/5/2005 | 55 | 0 | 0 | $0 |



| | | | | | |
|---|---|---|---|---|---|
| South Coast (Zone) | 12/24/2005 | 59 | 0 | 0 | $0 |

| | | | | | |
|---|---|---|---|---|---|
| W Pacific (Zone) | 1/1/2006 | 51 | 0 | 0 | $0 |
| South Coast (Zone) | 2/3/2006 | 63 | 0 | 0 | $100,000 |
| South Coast (Zone) | 3/7/2006 | 51 | 0 | 0 | $75,000 |
| Southwest Interior (Zone) | 11/10/2006 | 52 | 0 | 0 | $0 |
| South Coast (Zone) | 11/10/2006 | 50 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 11/12/2006 | 55 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 11/12/2006 | 74 | 0 | 0 | $0 |
| South Coast (Zone) | 11/12/2006 | 50 | 0 | 0 | $0 |
| South Coast (Zone) | 11/12/2006 | 52 | 0 | 0 | $0 |
| South Coast (Zone) | 11/12/2006 | 58 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 11/19/2006 | 57 | 0 | 0 | $0 |
| South Coast (Zone) | 12/14/2006 | 68 | 0 | 0 | $0 |
| South Coast (Zone) | 12/14/2006 | 52 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 12/14/2006 | 66 | 0 | 0 | $0 |
| South Coast (Zone) | 10/18/2007 | 60 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 10/18/2007 | 61 | 0 | 0 | $0 |
| South Coast (Zone) | 11/12/2007 | 67 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 11/12/2007 | 60 | 0 | 0 | $0 |
| South Coast (Zone) | 12/2/2007 | 90 | 0 | 0 | $10,140,000 |
| Southwest Interior (Zone) | 12/2/2007 | 68 | 0 | 0 | $140,000 |
| South Coast (Zone) | 12/19/2007 | 54 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 12/19/2007 | 60 | 0 | 0 | $0 |
| South Coast (Zone) | 1/3/2008 | 42 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 1/4/2008 | 55 | 0 | 0 | $0 |
| South Coast (Zone) | 1/4/2008 | 56 | 0 | 0 | $0 |
| South Coast (Zone) | 1/29/2008 | 56 | 0 | 0 | $0 |
| South Coast (Zone) | 2/6/2008 | 59 | 0 | 0 | $0 |
| South Coast (Zone) | 12/12/2008 | 61 | 0 | 0 | $0 |
| South Coast (Zone) | 12/26/2008 | 54 | 0 | 0 | $0 |
| South Coast (Zone) | 1/4/2009 | 36 | 0 | 0 | $0 |
| South Coast (Zone) | 1/7/2009 | 40 | 0 | 0 | $0 |
| South Coast (Zone) | 3/15/2009 | 35 | 0 | 0 | $0 |
| South Coast (Zone) | 5/4/2009 | 62 | 0 | 0 | $0 |
| South Coast (Zone) | 11/5/2009 | 35 | 0 | 0 | $0 |
| South Coast (Zone) | 11/9/2009 | 55 | 0 | 0 | $0 |
| South Coast (Zone) | 11/16/2009 | 56 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 11/16/2009 | 61 | 0 | 0 | $0 |
| South Coast (Zone) | 11/18/2009 | 59 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 11/22/2009 | 72 | 0 | 0 | $0 |
| South Coast (Zone) | 11/22/2009 | 59 | 0 | 0 | $0 |
| South Coast (Zone) | 1/11/2010 | 39 | 0 | 0 | $0 |
| South Coast (Zone) | 1/15/2010 | 62 | 0 | 0 | $0 |
| South Coast (Zone) | 1/17/2010 | 63 | 0 | 0 | $0 |
| South Coast (Zone) | 2/11/2010 | 50 | 0 | 0 | $0 |
| South Coast (Zone) | 3/12/2010 | 56 | 0 | 0 | $0 |
| South Coast (Zone) | 3/28/2010 | 67 | 0 | 0 | $0 |
| South Coast (Zone) | 4/2/2010 | 64 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 4/2/2010 | 63 | 0 | 0 | $0 |
| South Coast (Zone) | 5/19/2010 | 62 | 0 | 0 | $0 |
| South Coast (Zone) | 10/23/2010 | 59 | 0 | 0 | $0 |
| South Coast (Zone) | 11/1/2010 | 51 | 0 | 0 | $0 |
| South Coast (Zone) | 11/17/2010 | 39 | 0 | 0 | $0 |
| South Coast (Zone) | 11/22/2010 | 53 | 0 | 0 | $0 |
| South Coast (Zone) | 11/30/2010 | 56 | 0 | 0 | $0 |
| South Coast (Zone) | 12/11/2010 | 37 | 0 | 0 | $0 |
| South Coast (Zone) | 12/17/2010 | 41 | 0 | 0 | $0 |
| South Coast (Zone) | 1/12/2011 | 50 | 0 | 0 | $0 |
| South Coast (Zone) | 1/14/2011 | 39 | 0 | 0 | $0 |
| South Coast (Zone) | 2/12/2011 | 53 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 2/12/2011 | 55 | 0 | 0 | $0 |
| South Coast (Zone) | 2/14/2011 | 55 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 2/14/2011 | 52 | 0 | 0 | $0 |
| South Coast (Zone) | 2/27/2011 | 54 | 0 | 0 | $0 |
| South Coast (Zone) | 3/2/2011 | 63 | 0 | 0 | $0 |
| South Coast (Zone) | 3/9/2011 | 59 | 0 | 0 | $0 |
| South Coast (Zone) | 3/10/2011 | 45 | 0 | 0 | $0 |



| | | | | | |
|---|---|---|---|---|---|
| South Coast (Zone) | 3/13/2011 | 62 | 0 | 0 | $0 |
| South Coast (Zone) | 3/15/2011 | 44 | 0 | 0 | $0 |
| South Coast (Zone) | 9/26/2011 | 56 | 0 | 0 | $0 |
| South Coast (Zone) | 11/16/2011 | 36 | 0 | 0 | $0 |
| South Coast (Zone) | 11/21/2011 | 53 | 0 | 0 | $0 |
| South Coast (Zone) | 11/21/2011 | 57 | 0 | 0 | $0 |
| South Coast (Zone) | 11/22/2011 | 65 | 0 | 0 | $0 |
| South Coast (Zone) | 11/24/2011 | 59 | 0 | 0 | $0 |

| | | | | | |
|---|---|---|---|---|---|
| Southwest Interior (Zone) | 11/24/2011 | 67 | 0 | 0 | $0 |
| South Coast (Zone) | 11/27/2011 | 35 | 0 | 0 | $0 |
| South Coast (Zone) | 12/25/2011 | 59 | 0 | 0 | $0 |
| South Coast (Zone) | 12/27/2011 | 50 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 12/27/2011 | 66 | 0 | 0 | $0 |
| South Coast (Zone) | 12/28/2011 | 37 | 0 | 0 | $0 |
| South Coast (Zone) | 1/2/2012 | 68 | 0 | 0 | $0 |
| South Coast (Zone) | 1/4/2012 | 55 | 0 | 0 | $0 |
| South Coast (Zone) | 1/20/2012 | 58 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 1/20/2012 | 56 | 0 | 0 | $0 |
| South Coast (Zone) | 1/22/2012 | 60 | 0 | 0 | $0 |
| South Coast (Zone) | 3/11/2012 | 65 | 0 | 0 | $0 |
| South Coast (Zone) | 3/14/2012 | 38 | 0 | 0 | $0 |
| South Coast (Zone) | 3/15/2012 | 63 | 0 | 0 | $0 |
| South Coast (Zone) | 3/28/2012 | 70 | 0 | 0 | $0 |
| South Coast (Zone) | 11/11/2012 | 37 | 0 | 0 | $0 |
| South Coast (Zone) | 11/18/2012 | 69 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 11/19/2012 | 67 | 0 | 0 | $0 |
| South Coast (Zone) | 12/4/2012 | 60 | 0 | 0 | $0 |
| South Coast (Zone) | 12/16/2012 | 73 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 12/16/2012 | 64 | 0 | 0 | $0 |
| South Coast (Zone) | 12/19/2012 | 58 | 0 | 0 | $0 |
| South Coast (Zone) | 3/19/2013 | 54 | 0 | 0 | $0 |
| South Coast (Zone) | 9/28/2013 | 53 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 9/28/2013 | 78 | 0 | 0 | $0 |
| South Coast (Zone) | 9/29/2013 | 51 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 9/29/2013 | 70 | 0 | 0 | $0 |
| South Coast (Zone) | 11/2/2013 | 39 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 11/2/2013 | 59 | 0 | 0 | $0 |
| South Coast (Zone) | 11/18/2013 | 50 | 0 | 0 | $0 |
| South Coast (Zone) | 1/10/2014 | 69 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 1/11/2014 | 36 | 0 | 0 | $0 |
| South Coast (Zone) | 2/11/2014 | 57 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 2/12/2014 | 56 | 0 | 0 | $0 |
| South Coast (Zone) | 2/15/2014 | 61 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 2/15/2014 | 75 | 0 | 0 | $0 |
| South Coast (Zone) | 2/16/2014 | 62 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 2/16/2014 | 79 | 0 | 0 | $0 |
| South Coast (Zone) | 2/18/2014 | 35 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 2/18/2014 | 51 | 0 | 0 | $0 |
| South Coast (Zone) | 3/5/2014 | 63 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 3/6/2014 | 54 | 0 | 0 | $0 |
| South Coast (Zone) | 3/8/2014 | 55 | 0 | 0 | $0 |
| South Coast (Zone) | 10/25/2014 | 65 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 10/25/2014 | 50 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 11/21/2014 | 50 | 0 | 0 | $0 |
| South Coast (Zone) | 11/21/2014 | 37 | 0 | 0 | $0 |
| South Coast (Zone) | 12/8/2014 | 39 | 0 | 0 | $0 |
| South Coast (Zone) | 12/10/2014 | 40 | 0 | 0 | $0 |
| South Coast (Zone) | 12/11/2014 | 55 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 12/20/2014 | 53 | 0 | 0 | $0 |
| South Coast (Zone) | 1/17/2015 | 38 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 1/18/2015 | 56 | 0 | 0 | $0 |
| South Coast (Zone) | 2/5/2015 | 54 | 0 | 0 | $0 |
| South Coast (Zone) | 2/5/2015 | 56 | 0 | 0 | $0 |
| South Coast (Zone) | 2/7/2015 | 56 | 0 | 0 | $0 |
| South Coast (Zone) | 3/15/2015 | 65 | 0 | 0 | $5,000 |
| Southwest Interior (Zone) | 3/15/2015 | 54 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 10/10/2015 | 63 | 0 | 0 | $0 |



| | | | | | |
|---|---|---|---|---|---|
| South Coast (Zone) | 10/10/2015 | 55 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 10/31/2015 | 63 | 0 | 0 | $0 |
| South Coast (Zone) | 10/31/2015 | 37 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 11/17/2015 | 78 | 0 | 0 | $17,000 |
| South Coast (Zone) | 11/17/2015 | 55 | 0 | 0 | $0 |
| South Coast (Zone) | 12/3/2015 | 40 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 12/5/2015 | 37 | 0 | 0 | $0 |
| South Coast (Zone) | 12/5/2015 | 36 | 0 | 0 | $0 |
| South Coast (Zone) | 12/6/2015 | 49 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 12/6/2015 | 63 | 0 | 0 | $0 |
| South Coast (Zone) | 12/7/2015 | 49 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 12/7/2015 | 72 | 0 | 0 | $0 |
| South Coast (Zone) | 12/8/2015 | 45 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 12/8/2015 | 65 | 0 | 0 | $6,000,000 |
| South Coast (Zone) | 12/10/2015 | 58 | 0 | 0 | $0 |

| | | | | | |
|---|---|---|---|---|---|
| South Coast (Zone) | 12/12/2015 | 56 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 12/12/2015 | 68 | 0 | 0 | $0 |
| South Coast (Zone) | 12/20/2015 | 54 | 0 | 0 | $0 |
| South Coast (Zone) | 12/21/2015 | 51 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 12/21/2015 | 56 | 0 | 0 | $0 |
| South Coast (Zone) | 12/22/2015 | 54 | 0 | 0 | $0 |
| South Coast (Zone) | 1/28/2016 | 53 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 2/28/2016 | 57 | 0 | 0 | $0 |
| South Coast (Zone) | 3/1/2016 | 54 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 3/1/2016 | 60 | 0 | 0 | $0 |
| South Coast (Zone) | 3/5/2016 | 36 | 0 | 0 | $0 |
| South Coast (Zone) | 3/9/2016 | 69 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 3/9/2016 | 56 | 0 | 0 | $0 |
| South Coast (Zone) | 3/13/2016 | 67 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 3/13/2016 | 56 | 0 | 0 | $0 |
| South Coast (Zone) | 10/6/2016 | 56 | 0 | 0 | $0 |
| South Coast (Zone) | 10/13/2016 | 63 | 0 | 0 | $0 |
| South Coast (Zone) | 10/15/2016 | 79 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 10/15/2016 | 55 | 0 | 0 | $0 |
| South Coast (Zone) | 11/12/2016 | 39 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 11/24/2016 | 52 | 0 | 0 | $0 |
| South Coast (Zone) | 11/24/2016 | 50 | 0 | 0 | $0 |
| South Coast (Zone) | 12/19/2016 | 41 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 12/19/2016 | 53 | 0 | 0 | $0 |
| South Coast (Zone) | 1/17/2017 | 61 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 1/17/2017 | 68 | 0 | 0 | $0 |
| South Coast (Zone) | 2/9/2017 | 39 | 0 | 0 | $0 |
| South Coast (Zone) | 2/14/2017 | 56 | 0 | 0 | $0 |
| South Coast (Zone) | 2/15/2017 | 58 | 0 | 0 | $0 |
| South Coast (Zone) | 3/17/2017 | 54 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 4/7/2017 | 60 | 0 | 0 | $0 |
| South Coast (Zone) | 4/7/2017 | 67 | 0 | 0 | $0 |
| South Coast (Zone) | 10/18/2017 | 41 | 0 | 0 | $0 |
| South Coast (Zone) | 10/21/2017 | 37 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 10/22/2017 | 55 | 0 | 0 | $0 |
| South Coast (Zone) | 11/13/2017 | 65 | 0 | 0 | $0 |
| South Coast (Zone) | 11/19/2017 | 54 | 0 | 0 | $0 |
| South Coast (Zone) | 11/25/2017 | 52 | 0 | 0 | $0 |
| South Coast (Zone) | 12/19/2017 | 55 | 0 | 0 | $0 |
| South Coast (Zone) | 12/29/2017 | 58 | 0 | 0 | $0 |
| South Coast (Zone) | 1/11/2018 | 56 | 0 | 0 | $0 |
| South Coast (Zone) | 1/17/2018 | 60 | 0 | 0 | $0 |
| South Coast (Zone) | 1/21/2018 | 54 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 1/21/2018 | 55 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 1/23/2018 | 57 | 0 | 0 | $0 |
| South Coast (Zone) | 1/23/2018 | 55 | 0 | 0 | $0 |
| South Coast (Zone) | 1/27/2018 | 55 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 1/27/2018 | 58 | 0 | 0 | $0 |
| South Coast (Zone) | 3/8/2018 | 40 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 3/8/2018 | 50 | 0 | 0 | $0 |
| South Coast (Zone) | 4/7/2018 | 56 | 0 | 0 | $0 |
| South Coast (Zone) | 4/10/2018 | 53 | 0 | 0 | $0 |



| | | | | | |
|---|---|---|---|---|---|
| South Coast (Zone) | 11/26/2018 | 68 | 0 | 0 | $0 |
| South Coast (Zone) | 12/11/2018 | 57 | 0 | 0 | $0 |
| South Coast (Zone) | 12/14/2018 | 58 | 0 | 0 | $5,000 |
| South Coast (Zone) | 12/17/2018 | 59 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 12/17/2018 | 53 | 0 | 0 | $0 |
| South Coast (Zone) | 12/20/2018 | 63 | 0 | 0 | $0 |
| South Coast (Zone) | 1/3/2019 | 59 | 0 | 0 | $0 |
| South Coast (Zone) | 1/5/2019 | 60 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 1/6/2019 | 73 | 0 | 0 | $0 |
| South Coast (Zone) | 1/3/2020 | 52 | 0 | 0 | $0 |
| South Coast (Zone) | 11/12/2020 | 51 | 0 | 0 | $0 |
| South Coast (Zone) | 11/13/2020 | 52 | 0 | 0 | $0 |
| South Coast (Zone) | 11/17/2020 | 53 | 0 | 0 | $0 |
| South Coast (Zone) | 11/17/2020 | 40 | 0 | 0 | $0 |
| South Coast (Zone) | 11/17/2020 | 44 | 0 | 0 | $0 |
| South Coast (Zone) | 12/19/2020 | 56 | 0 | 0 | $0 |
| South Coast (Zone) | 12/21/2020 | 59 | 0 | 0 | $0 |
| South Coast (Zone) | 1/2/2021 | 59 | 0 | 0 | $0 |
| | | Totals = | 0 | 0 | $16,493,500 |

**The data are from the NOAA NCDC Storm Events Database.*

## Table C.3 – Riverine Flood Records

| Location | Event Date | Injuries | Deaths | Property Damage |
|---|---|---|---|---|
| South Coast (Zone) | 1/9/1996 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 1/9/1996 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 12/26/1996 | 0 | 0 | $0 |
| South Coast (Zone) | 12/26/1996 | 0 | 0 | $0 |
| W Pacific (Zone) | 11/25/1998 | 0 | 0 | $0 |
| Southwest Interior (Zone) | 11/26/1998 | 0 | 0 | $0 |
| W Pacific (Zone) | 12/2/1998 | 0 | 0 | $0 |
| E Pacific/W Lewis/Wahkiakum (Zone) | 12/27/1998 | 0 | 0 | $500,000 |
| W Pacific (Zone) | 12/27/1998 | 0 | 0 | $0 |
| W Pacific (Zone) | 2/16/1999 | 0 | 0 | $10,000 |
| W Pacific (Zone) | 3/2/1999 | 0 | 0 | $1,000 |
| Southwest Interior (Zone) | 6/11/2000 | 0 | 0 | $0 |
| South Coast (Zone) | 6/11/2000 | 0 | 0 | $0 |
| Willapa | 1/10/2006 | 0 | 0 | $0 |
| Willapa | 1/29/2006 | 0 | 0 | $0 |
| Willapa | 12/3/2007 | 0 | 0 | $10,000,000 |
| Naselle | 1/7/2009 | 0 | 0 | $0 |
| Willapa | 1/7/2009 | 0 | 0 | $0 |
| Raymond | 11/19/2012 | 0 | 0 | $0 |
| Naselle | 1/5/2015 | 0 | 0 | $0 |
| Willapa | 11/17/2015 | 0 | 0 | $0 |
| Willapa | 1/3/2021 | 0 | 0 | $0 |
| | Totals = | 0 | 0 | $10,511,000 |

**The data are from the NOAA NCDC Storm Events Database*

## Table C.4 – Strong Wind Records

| Location | Event Date | Wind Speed (MpH) | Injuries | Deaths | Property Damage |
|---|---|---|---|---|---|
| Southwest Interior (Zone) | 2/3/2006 | 43 | 0 | 1 | $75,000 |
| Southwest Interior (Zone) | 3/7/2006 | 45 | 0 | 0 | $50,000 |
| | | Totals = | 0 | 1 | $125,000 |

**The data are from the NOAA NCDC Storm Events Database*

## Table C.5 – Thunderstorm Wind Records

| Location | Event Date | Wind Speed (MpH) | Injuries | Deaths | Property Damage |
|---|---|---|---|---|---|
| Long Beach | 12/13/2010 | 55 | 0 | 0 | $0 |
| Ilwaco | 10/14/2016 | 55 | 0 | 0 | $0 |
| Ilwaco | 1/18/2018 | 58 | 0 | 0 | $0 |
| | | Totals = | 0 | 0 | $0 |

**The data are from the NOAA NCDC Storm Events Database*

## Table C.6 – Wildfire Records

| Location/Incident Identifier | Event Date | Cause | Acres Burned |
|---|---|---|---|
| Fork Peak | 9/12/2014 | Undetermined | 126 |
| Grassy Island | 11/19/2014 | Human | 17 |
| Wilson Creek | 7/30/2015 | Undetermined | 0.7 |
| Vernon | 7/31/2015 | Human | 0.1 |
| Pioneer | 8/9/2015 | Human | 4 |
| Hawk | 8/15/2015 | Natural | 0.1 |
| Willapa | 8/30/2015 | Natural | 0.1 |
| A 100 | 9/5/2015 | Natural | 0.1 |
| Palix | 9/28/2015 | Undetermined | 0.1 |
| Coho | 11/28/2015 | Human | 100 |
| 347 | 6/4/2016 | Human | 12.1 |
| 205Th | 7/6/2016 | Human | 1.5 |
| South Fork 2 | 7/21/2016 | Human | 0 |
| Walberg | 7/31/2016 | Human | 0.5 |
| Riverdale Park | 8/17/2016 | Human | 0.1 |
| X 600 | 8/30/2016 | Undetermined | 0.1 |
| Disappointment | 6/27/2017 | Human | 0.1 |
| 12Th Street | 7/5/2017 | Human | 1 |
| Jolly Roger | 7/14/2017 | Undetermined | 0.1 |
| Pacific Way Ii | 7/16/2017 | Human | 0.1 |
| Washaway | 7/17/2017 | Human | 3 |
| Smith Creek Rd | 8/9/2017 | Human | 0.1 |
| Pne 20 | 6/4/2018 | Human | 2.4 |
| Seaview | 6/24/2018 | Unknown | 0.2 |
| Chinook Final | 6/27/2018 | Human | 0.25 |
| Bullard Rd | 7/13/2018 | Human | 0.1 |
| 7320 | 7/28/2018 | Unknown | 2 |
| Hm 200 | 7/29/2018 | Unknown | 2.37 |
| Mc 8000 | 8/13/2018 | Unknown | 0.1 |
| Elk Prairie | 10/11/2018 | Human | 0.1 |
| Willie Keils | 3/18/2019 | Unknown | 4 |
| Oxbow Rd | 3/19/2019 | Human | 10 |
| Fern Hill | 3/20/2019 | Human | 0.2 |
| Strozyk | 3/24/2019 | Unknown | 0.5 |
| Saw Blade | 3/31/2019 | Human | 1.5 |
| Alexander | 3/31/2019 | Human | 0.1 |
| Cabin | 6/2/2019 | Human | 0.25 |
| O Line | 6/17/2019 | Human | 0.1 |
| 41St. Street | 7/4/2019 | Human | 0.1 |
| Marsh 2 | 7/31/2019 | Unknown | 0.1 |
| Wash Away | 8/14/2019 | Human | 0.3 |
| Piling | 8/21/2019 | Human | 0 |
| Mc Landing | 8/26/2019 | Human | 0.1 |
| Nemah | 8/27/2019 | Unknown | 0.2 |
| Salmon Creek | 9/29/2019 | Natural | 0.1 |
| Salmon Creek 5000 | 9/29/2019 | Natural | 0.1 |
| Rock Creek | 10/10/2019 | Unknown | 0.1 |
| Nemah 510 | 11/8/2019 | Human | 6 |
| Burn Permit Pc20190396 | 11/14/2019 | Unknown | 0 |
| 184Th | 4/13/2020 | Unknown | 2 |
| Gailie Hill | 6/26/2020 | Human | 0.3 |
| Upper Naselle | 7/26/2020 | Human | 0.2 |

Appendix C – Hazard Records

| | | | |
|---|---|---|---|
| Western Lake | 7/29/2020 | Unknown | 0.1 |
| Mc100 | 9/6/2020 | Unknown | 0.1 |
| Birch Rd | 9/8/2020 | Unknown | 0.1 |
| Bay Lane | 9/9/2020 | Unknown | 1 |

| | | | |
|---|---|---|---|
| Washaway | 9/10/2020 | Unknown | 1.5 |
| Paynes Alley | 9/11/2020 | Unknown | 0.3 |
| Butte Creek | 4/13/2021 | Human | 0.5 |
| Mile Post 63 | 4/15/2021 | Unknown | 1.5 |
| 151 | 4/17/2021 | Unknown | 4.37 |
| Naselle River | 4/18/2021 | Unknown | 0.3 |
| Nallpee | 6/26/2021 | Human | 0.1 |
| Wheaton | 7/18/2021 | Human | 0.1 |
| Bear Ridge | 7/19/2021 | Undetermined | 0.3 |
| Penny | 7/25/2021 | Human | 0.1 |
| 53 | 7/26/2021 | Human | 0.1 |
| Green Acres | 7/29/2021 | Undetermined | 10 |
| | | Totals = | 321.14 |

**The data are from the National Interagency Fire Center.*

## Table C.7 – Winter Storm Records

| Location | Event Date | Storm Type | Injuries | Deaths | Property Damage |
|---|---|---|---|---|---|
| South Coast (Zone) | 11/13/2001 | Winter Storm | 0 | 0 | $0 |
| W Pacific (Zone) | 1/6/2002 | Winter Storm | 0 | 0 | $0 |
| E Pacific/W Lewis/Wahkiakum (Zone) | 11/17/2003 | Winter Storm | 0 | 0 | $0 |
| W Pacific (Zone) | 11/17/2003 | Winter Storm | 0 | 0 | $0 |
| Southwest Interior (Zone) | 1/6/2004 | Winter Storm | 0 | 0 | $0 |
| South Coast (Zone) | 1/6/2004 | Winter Storm | 0 | 0 | $0 |
| South Coast (Zone) | 3/8/2006 | Winter Storm | 0 | 0 | $0 |
| Southwest Interior (Zone) | 3/8/2006 | Winter Storm | 0 | 0 | $0 |
| Southwest Interior (Zone) | 12/12/2008 | Winter Storm | 0 | 0 | $0 |
| South Coast (Zone) | 12/20/2008 | Winter Storm | 0 | 0 | $168,000 |
| Southwest Interior (Zone) | 12/20/2008 | Winter Storm | 0 | 0 | $691,000 |
| Southwest Interior (Zone) | 12/24/2008 | Winter Storm | 0 | 0 | $0 |
| Southwest Interior (Zone) | 2/11/2021 | Winter Storm | 0 | 0 | $0 |
| South Coast (Zone) | 2/12/2021 | Winter Storm | 0 | 0 | $0 |
| | | Totals = | 0 | 0 | $859,000 |

**The data are from the NOAA NCDC Storm Events Database.*

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| Backup Generators | |
|---|---|
| Backup generators provide critical facilities with electricity in the event a community's electrical transmission grid is either damaged by a disaster or overloaded by excessive use during an event. | |
| **Hazard/s Addressed** | Earthquakes, Floods, Landslides, Tsunamis, Wildfires, Windstorms, Winter Storms |
| **Effectiveness** | Medium |
| **Timeframe** | 1 – 2 Years |
| **Lead Organization** | Pacific County (Relevant Building Department), SD Facilities Departments, Municipal Public Works, FPD Boards, Hospital Boards, Port Boards, Transit Board, District Boards |
| **Funding Sources** | BRIC, HMGP, Local Budgets |

| Bionets | |
|---|---|
| Bionets installed in strategic locations will prevent the erosion of slopes subject to surface wash. The containment reinforcement of the exposed ground reduces the impact of heavy rain and mud. | |
| **Hazard/s Addressed** | Landslides |
| **Effectiveness** | Medium |
| **Timeframe** | 1 – 2 Years |
| **Lead Organization** | PCEMA, Pacific County Public Works |
| **Funding Sources** | BRIC, FMA, HMGP, Local Budgets |

| Bury Utility Lines, Pipes, and Tanks | |
|---|---|
| Transferring existing utilities lines, pipes, and chemical storage tanks from above ground to below ground will significantly reduce the amount of property damage incurred from wind, ice, and snow related events. | |
| **Hazard/s Addressed** | Windstorms, Winter Storms |
| **Effectiveness** | Medium |
| **Timeframe** | 1 – 5 Years |
| **Lead Organization** | Pacific County Public Works, SD Facilities Departments, Municipal Public Works, FPD Boards, Hospital Boards, Port Boards, Transit Board, District Boards |
| **Funding Sources** | BRIC, HMGP, Local Budgets |

| Debris & Natural Fuels Reduction | |
|---|---|
| Reducing the amount of debris and natural fuels in a community will deprive wildfires of the material it requires to spread and prevent high winds from launching deadly and damaging debris around during a severe storm or tornado. This project will be implemented in high risk areas as identified in this plan's WUI maps and well-known to burn areas as determined by the participating jurisdictions and appropriate local agencies. | |
| **Hazard/s Addressed** | Windstorms, Wildfires |
| **Effectiveness** | Medium |
| **Timeframe** | 1 Year |
| **Lead Organization** | PCEMA, SD Facilities Departments, Municipal Fire Departments, FPD Commissions, Hospital Boards, Port Boards, Transit Board, District Boards |
| **Funding Sources** | BRIC, HMGP, Local Budgets |

| Defensible Spaces & Buffer Zones | |
|---|---|
| Creating defensible spaces and buffer zones void of vegetative fuel and covered with gravel or rock helps prevent the spread of wildfire as well as creating an area in which local emergency response serviced can safely operate. This 2-pronged approach directly mitigates damage to property and protects lives, but also indirectly mitigates the threat to life and property in the area at large. This project will be implemented in high risk areas as identified in this plan's WUI maps and well-known to burn areas as determined by the participating jurisdictions and appropriate local agencies. | |
| **Hazard/s Addressed** | Wildfires |
| **Effectiveness** | Medium |
| **Timeframe** | 1 Year |
| **Lead Organization** | PCEMA, SD Facilities Departments, Municipal Fire Departments, FPD Commissions, Hospital Boards, Port Boards, Transit Board, District Boards |
| **Funding Sources** | BRIC, HMGP, Local Budgets |

| Elevate Structures | |
|---|---|
| Structures located within identified flood zones or tsunami risk zones can be elevated above base flood elevation or predicted other predicted flood inundation levels. | |
| **Hazard/s Addressed** | Floods, Tsunamis |
| **Effectiveness** | High |
| **Timeframe** | 1 – 3 Years |
| **Lead Organization** | PCEMA, Pacific County Public Works, SD Facilities Departments, Municipal Public Works, FPD Boards, Hospital Boards, Port Boards, District Boards |
| **Funding Sources** | BRIC, FMA, HMGP, Local Budgets |

| Floodproofing | |
|---|---|
| This technique is often used when relocation or buying out is not an option as is the case with a historic building or it would require astronomical funding that is not available. Floodproofing projects constitute any combination of structural and non-structural additions, changes, or adjustments to structures which reduce or eliminate flood damage. Wet floodproofing reduces property damage counteracting hydrostatic pressure on walls or other support structures by equalizing the pressure between the interior and exterior of a structure. | |
| **Hazard/s Addressed** | Floods |
| **Effectiveness** | Medium |
| **Timeframe** | 1 – 3 Years |
| **Lead Organization** | Pacific County (Relevant Building Department), SD Facilities Departments, Municipal Public Works, Port Boards |
| **Funding Sources** | BRIC, FMA, HMGP, Local Budgets |

| Flood Level Monitoring System | |
|---|---|
| Strategically installing water monitoring stations will assist in measuring the severity of an existing or impending drought, the real-time and historical levels of flooding, as well as dam failures. Accurately measuring water levels will allow the community to take the necessary conservation and regulatory measures to mitigate the droughts, flood, and dam failure effects. This project should be implemented in all major basins and water retention, rivers and streams prone to flooding, natural and man-made, areas throughout the planning area. Additionally, having precise historical data from past floods will enhance the planning area's ability to develop future mitigation planning actions and projects. | |
| **Hazard/s Addressed** | Floods |
| **Effectiveness** | Low |
| **Timeframe** | 1 – 3 Years |
| **Lead Organization** | PCEMA, Municipal Public Works, Port Boards |

| | |
|---|---|
| **Funding Sources** | BRIC, FMA, HMGP, Local Budgets |



| **Greenbelts** | |
|---|---|
| Strips or layers of native vegetation along shorelines act as a buffer between development and water. They help reduce acidic chemicals in the water reducing erosion as well as providing a stable root structure that also serves to slow down erosive forces. | |
| **Hazard/s Addressed** | Coastal Erosion |
| **Effectiveness** | Low |
| **Timeframe** | 1 – 3 Years |
| **Lead Organization** | Pacific County, Municipal Public Works, FPD Boards, Port Boards, Transit Board |
| **Funding Sources** | BRIC, HMGP, Local Budgets |

| **Insulation & Energy Efficiency** | |
|---|---|
| Upgrading a facility's windows, windows frames, roofing, and insulation will allow it to better maintain a desired warm or cool temperature during prolonged extreme heat or winter storms. Additionally, it decreases the energy load necessary to do so, decreasing the burden on the local energy grid. | |
| **Hazard/s Addressed** | Winter Storms |
| **Effectiveness** | Low |
| **Timeframe** | 1 – 3 Years |
| **Lead Organization** | Pacific County (Relevant Building Department), SD Facilities Departments, Municipal Public Works, FPD Boards, Hospital Boards, Port Boards, Transit Board, District Boards |
| **Funding Sources** | BRIC, HMGP, Local Budgets |

| **Interior Furnishing Hazard Reduction** | |
|---|---|
| Fastening, removing, or modifying interior furnishing prevent them from shaking, becoming unstable, or falling loose into people and other objects during seismic events. | |
| **Hazard/s Addressed** | Earthquakes |
| **Effectiveness** | Low |
| **Timeframe** | 1 – 3 Years |
| **Lead Organization** | Pacific County (Relevant Building Department), SD Facilities Departments, Municipal Public Works, FPD Boards, Hospital Boards, Port Boards, Transit Board, District Boards |
| **Funding Sources** | BRIC, HMGP, Local Budgets |

| **Looped Grid Power Systems** | |
|---|---|
| Linear power grids have single points of failure that are vulnerable to a number of hazards. Looped power grids operate in parallel and are thus significantly more resistant to damage allowing the utilities to maintain power after an event. | |
| **Hazard/s Addressed** | Earthquakes, Floods, Landslides, Tsunamis, Windstorms, Winter Storms |
| **Effectiveness** | Medium |
| **Timeframe** | 1 – 5 Years |
| **Lead Organization** | Pacific County (Relevant Building Department), SD Facilities Departments, Municipal Public Works, FPD Boards, Hospital Boards, Port Boards, Transit Board, District Boards |
| **Funding Sources** | BRIC, HMGP, Local Budgets |

| Public Awareness & Education | |
|---|---|
| A campaign will inform and educate the public on hazard risks, allowing them to better protect their property through preparation and their lives through appropriate evacuation and survival procedures. | |
| **Hazard/s Addressed** | Coastal Erosion, Earthquakes, Floods, Landslides, Tsunamis, Wildfires, Windstorms, Winter Storms |
| **Effectiveness** | Low |
| **Timeframe** | 1 Year |
| **Lead Organization** | PCEMA |
| **Funding Sources** | Local Budgets |

| Raise Transportation Infrastructure | |
|---|---|
| To combat uncontrollable waters emanating from a dam or levee failure, flash flood, or riverine flood, transportation infrastructure may be raised to allow its continued use in a disaster as well as a partial earthen berm to protect a neighboring lower elevation area. Additionally, the increased elevation of road or railway bridges can prevent the buildup of debris during incidents of high floodwaters and preventing further water buildup. | |
| **Hazard/s Addressed** | Floods |
| **Effectiveness** | High |
| **Timeframe** | 1 – 5 Years |
| **Lead Organization** | Pacific County Public Works Department, Municipal Public Works, Transit Board |
| **Funding Sources** | BRIC, FMA, HMGP, Local Budgets |

| Relocate or Buyout Vulnerable Structures | |
|---|---|
| Some structures may be able to be relocated from identified floodplains or dam inundation zones. Removing them from identified hazard area will eliminate their risk. | |
| **Hazard/s Addressed** | Floods |
| **Effectiveness** | High |
| **Timeframe** | 1 – 5 Years |
| **Lead Organization** | PCEMA, Pacific County Public Works Department, Municipal Public Works, Port Boards |
| **Funding Sources** | BRIC, FMA, HMGP, Local Budgets |

| Seismic Structural Retrofit | |
|---|---|
| An earthquake vulnerability assessment will detail a jurisdiction's high-risk facilities, infrastructure, and make retrofit recommendations. Using the assessment, a jurisdiction can retrofit their facilities and infrastructure there by reducing their structural vulnerabilities to seismic events. | |
| **Hazard/s Addressed** | Earthquakes |
| **Effectiveness** | High |
| **Timeframe** | 1 – 5 Years |
| **Lead Organization** | Pacific County (Relevant Building Department), SD Facilities Departments, Municipal Public Works, FPD Boards, Hospital Boards, Port Boards, Transit Board, District Boards |
| **Funding Sources** | BRIC, FMA, HMGP, Local Budgets |

| Shoreline Stabilization | |
|---|---|
| Artificial reefs and other natural barriers constructed in strategic locations will curtail coastal erosion by decreasing the amount of tidal and wave forces on a shoreline. | |
| **Hazard/s Addressed** | Coastal Erosion |
| **Effectiveness** | Low |
| **Timeframe** | 1 – 5 Years |
| **Lead Organization** | Pacific County Public Works Department, Municipal Public Works, FPD Boards, Transit Board |
| **Funding Sources** | BRIC, FMA, HMGP, Local Budgets |

| SKYWARN Storm Spotter Training | |
|---|---|
| The NWS' SKYWARN Storm Spotter training program educates and delivers basic weather identification, spotting, and reporting information to any concerned citizens. Educating citizens in this program helps increase specific awareness and creates a skillset that helps the NWS create more accurate and timely warnings for tornadoes, severe storms, flash flooding, and other severe weather. | |
| **Hazard/s Addressed** | Floods, Windstorms, Winter Storms |
| **Effectiveness** | Low |
| **Timeframe** | 1 – 2 Years |
| **Lead Organization** | PCEMA |
| **Funding Sources** | Local Budgets |

| Snow Fences | |
|---|---|
| Snow fences force drifting snow to accumulate in a desired place minimizing the amount of snowdrift on roads and railways. Controlling snow accumulation decreases the danger to a jurisdiction's citizens traveling during and after a winter storm. This project should be implemented along major transportation routes throughout the planning area. | |
| **Hazard/s Addressed** | Winter Storms |
| **Effectiveness** | Low |
| **Timeframe** | 1 – 2 Years |
| **Lead Organization** | Pacific County (Relevant Building Department), SD Facilities Departments, Municipal Public Works, FPD Boards, Hospital Boards, Port Boards, Transit Board, District Boards |
| **Funding Sources** | BRIC, HMGP, Local Budgets |

| Storm Water Drainage System Upgrade | |
|---|---|
| Significant flood damage in developed communities can be prevented by upgrading their storm water drainage system by way of increasing culvert sizes, installing debris blocking grates, and weir dams. This mitigation measure will allow flood waters to drain quicker and prevent excess accumulation. This project should be implemented in older drainage systems and any expanding areas throughout the planning area. | |
| **Hazard/s Addressed** | Floods |
| **Effectiveness** | Medium |
| **Timeframe** | 1 – 4 Years |
| **Lead Organization** | Pacific County Public Works, Municipal Public Works, Port Boards |
| **Funding Sources** | BRIC, FMA, HMGP, Local Budgets |

| Storm Water Pump Stations | |
|---|---|
| Storm water pump stations help protect areas by pumping away large volumes of water therefore preventing or decreasing the level of a flood. Pump stations can vary in size and design, allowing them to be tailored to the needs of a specific floodplain, region, or site-specific facility. | |
| **Hazard/s Addressed** | Floods |
| **Effectiveness** | Medium |
| **Timeframe** | 1 – 4 Years |
| **Lead Organization** | Pacific County Public Works, Municipal Public Works, Port Boards |
| **Funding Sources** | BRIC, FMA, HMGP, Local Budgets |

| Water Line Insulation | |
|---|---|
| Insulating a facility's water pipes helps prevent them from freezing and bursting due to sudden and prolonged low temperatures during winter storms. The planning area should implement this project in conjunction with their school districts and critical facilities standard maintenance cycles. | |
| **Hazard/s Addressed** | Winter Storms |
| **Effectiveness** | Low |
| **Timeframe** | 1 Year |
| **Lead Organization** | Pacific County (Relevant Building Department), SD Facilities Departments, Municipal Public Works, FPD Boards, Hospital Boards, Port Boards, Transit Board, District Boards |
| **Funding Sources** | BRIC, HMGP, Local Budgets |

| Wildfire Structural Retrofit | |
|---|---|
| Retrofitting structures with screened vent enclosures, double paned glass, and spark arrestors will reduce the chances of a structure igniting from a wildfire as well as a wildfire's chance of spreading. | |
| **Hazard/s Addressed** | Wildfires |
| **Effectiveness** | Medium |
| **Timeframe** | 1 – 2 Years |
| **Lead Organization** | Pacific County (Relevant Building Department), SD Facilities Departments, Municipal Public Works, FPD Boards, Hospital Boards, Port Boards, Transit Board, District Boards |
| **Funding Sources** | BRIC, Local Budgets, PDM |

| Wind Resistance Structural Retrofit | |
|---|---|
| Enhancing a structure's wind resistance according to FEH bronze, silver, or gold specifications will significantly reduce probability of a structure incurring damage and potentially hurting its occupants during a wind related event. Efforts to do so are, but not limited to, strengthening gable anchorages, soffits, roof sheathing, anchoring attached structures such as porches or carports, replacing thing windows, enhancing the integrity of building openings, and developing continuous load paths throughout a structure. | |
| **Hazard/s Addressed** | Windstorms |
| **Effectiveness** | Medium |
| **Timeframe** | 1 – 5 Years |
| **Lead Organization** | Pacific County (Relevant Building Department), SD Facilities Departments, Municipal Public Works, FPD Boards, Hospital Boards, Port Boards, Transit Board, District Boards |
| **Funding Sources** | BRIC, HMGP, Local Budgets |

# Appendix E – Plan Adoption Resolutions

<Placeholder>

U.S. Department of Homeland Security
FEMA Region 10
130 228th Street, SW
Bothell, WA 98021-8627

FEMA

October 24, 2022

The Honorable Lisa Olsen
Chair, Pacific County Board of County Commissioners
P.O. Box 187
South Bend, WA 98586

Dear Chair Olsen:

On October 20, 2022, the United States Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region 10, approved the Pacific County Hazard Mitigation Plan as a multi-jurisdictional local plan as outlined in Code of Federal Regulations Title 44 Part 201. This approval provides the below jurisdictions eligibility to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's, Hazard Mitigation Assistance grants projects through October 19, 2027, through your state:

| | | |
|---|---|---|
| Willapa Valley School District | City of Long Beach | City of Raymond |
| City of South Bend | City of Ilwaco | Ocean Beach Hospital |
| Ocean Beach School District | Pacific County | Pacific County Fire District 1 |
| Pacific County Fire District 3 | Pacific Transit System | Port of Chinook |
| South Bend School District | Port of Peninsula | Port of Willapa Harbor |
| Public Utility District 2 | Port of Ilwaco | Naselle Grays River School District |
| Willapa Harbor Hospital-Public Hospital 2 | South Beach Regional Fire Authority | |

FEMA individually evaluates all application requests for funding according to the specific eligibility requirements of the applicable program. Though a specific mitigation activity or project identified in the plan may meet the eligibility requirements, it may not automatically receive approval for FEMA funding under any of the programs.

Over the next five years, we encourage your communities to follow the plan's schedule for monitoring and updating, and to develop further mitigation actions. To continue eligibility, jurisdictions must review, revise as appropriate, and resubmit the plan within five years of the original approval date.

www.fema.gov

Chair Olson
October 24, 2022
Page 2

If you have questions regarding your plan's approval or FEMA's mitigation grant programs, please contact Kevin Zerbe, State Mitigation Strategist with Washington Emergency Management Division, at (253) 512-7467, who coordinates and administers these efforts for local entities.

Sincerely,

KRISTEN C MEYERS Digitally signed by KRISTEN C MEYERS
Date: 2022.10.24 07:34:15 -07'00'

Kristen Meyers, Director
Mitigation Division

cc: Tim Cook, State Hazard Mitigation Officer