OREGON PARKS AND RECREATION DEPARTMENT
OCEAN SHORE PERMIT APPLICATION AND INSTRUCTIONS

SHORELINE PROTECTION STRUCTURE

In accordance with ORS 390.640, 390.715, and 390.725, no person shall make an alteration, or construct a pipeline, cable line or conduit or remove any natural product on any property that is within the ocean shore, without first obtaining a permit to do so from the Department.

Permit Instructions

An application is considered complete only when all required materials are received. This includes a completed Ocean Shore Permit Application and all additional required supporting documents, reports, drawings, affidavits, and fees. Incomplete applications will not be processed and will be returned to the applicant.

An Ocean Shore Permit Application and City/County Planning Department Affidavit shall be submitted for each individual tax lot and project.

To assist in submitting a complete application, please follow these step-by-step instructions:

Section 1. Proposed Project

Check appropriate box for the type of project. If the type of alteration project is not listed, provide a brief description on the line next to "Other."

Provide a brief description of the project in the box provided.

Provide estimated start and completion dates.

Section 2. Applicant Information

Owner: Provide the name, mailing address, phone number, fax number, and email address of the person who legally owns the property.

Agent: An agent is a person who is authorized by the owner to represent their interest during the permitting process with Oregon Parks and Recreation Department (OPRD). Examples of an agent may be another property owner, consultant, attorney or contractor. *Agents are optional*.

Primary Contact: If the legal owner has chosen to include an agent, indicate which party will act as the primary contact; owner or agent. This is the person OPRD will contact for any application questions or concerns.

Section 3. Property Location and Information

Provide situs address (physical address) of property. Provide the township, range, section, subsection, and tax lot number. (Do not list multiple tax lots in this section, as each individual tax lot requires a separate Ocean Shore Permit Application.)

Check the appropriate box to indicate the current use of the property.

Provide the zoning designation, the year in which the main structure was built.

Provide all lot dimensions and setbacks from property lines.

Provide the names, situs and mailing addresses of oceanfront landowners with property boundaries common to those of the property described in the application. For projects involving multiple tax lots, the most northern and southern oceanfront landowners of the entire project are all that is required.

If you do not know this information, it may be obtained from the county tax assessor's office and/or local planning office.

Section 4. Project Justification and Impacts

There shall be adequate justification for the proposed project to occur and alter the ocean shore area.

Provide a detailed description of the hazard and the threat it poses to the property to justify your request for alteration of the ocean shore area.

Describe all potential impacts this project may have in the short and long-term to neighboring properties, to recreation, scenic, safety, and natural resources of the ocean shore.

List the measures that will be taken to minimize those potential impacts. All projects will have some impact on the ocean shore; a "no impact" conclusion is not an appropriate answer.

Section 5. Project Details

Provide the total for the entire project, (this will include totals for all properties if the project includes multiple tax lots). Total length, height, width and slope specifics, and the total volume of all material and average rock size.

Your contractor or geologist should assist you with the specifics of all project materials, type, source, size, and amount.

Section 6. Analysis Of Hazard Avoidance

The application shall be accompanied by an analysis of hazard avoidance alternatives, including the relocation of existing buildings or other infrastructure. This analysis shall also describe why potential hazard avoidance alternatives are not feasible, or if tried why they were not successful. Relevant factors may include topographic limitations, the limitations of the area for relocation, or the cost. If the cost of moving a building or infrastructure is listed as a factor, the report shall include a cost estimate(s) from a licensed contractor specializing in building relocation.

Section 7. Geologic Report

Projects greater than 50 feet in length require a geologic report from a registered professional geologist experienced in coastal processes. This report should include:

- The potential impacts from the proposed project on sand source, supply, and movement on the affected beach as well as within the same littoral cell;
- The bank or bluff stability and erosion rates on the subject property and adjacent properties and the potential impacts of the proposed project on bluff stability and erosion rates on the subject and adjacent properties;
- A review of potential non-structural solutions, including, but not limited to, vegetative stabilization, non-structural dynamic revetments, and foredune enhancement. The review shall describe reasons why non-structural solutions were unsuccessful, if tried, or why they were considered unfeasible;
- The known or suspected geologic and seismic hazards in the project area and how the proposed project may affect or be impacted by those geologic and seismic hazards.

Section 8. Additional Permit Requirements

List any additional necessary permits and/or authorizations required by local, state, or federal agencies. Additional agencies may include city/county planning departments, Oregon Department of State Lands and/or U. S. Army Corps of Engineers.

Section 9. Signature Requirement

The owner's signature is required for acknowledgment and completion of the application. If an agent has been included, check the box authorizing the agent to act on your behalf with OPRD.

If an agent has been authorized, the agent's signature is also required for acknowledgment and completion of the application.

Section 10. Required Drawings

The application shall include a plot plan and a cross-section of the project, drawn to scale. Drawings shall be clear and concise and follow the format specifications outlined.

Section 11. Application Fees and Calculation Worksheet

Each application filed under ORS 390.640, for an alteration on the ocean shore shall be accompanied by a processing fee for the purpose of partial recovery to the department of its administrative costs.

The fee shall be determined according to the construction value of the project. Evidence the Department may consider in establishing the construction value of a project shall include: Itemized estimates from licensed, bonded, contractors; construction values accepted by the county or city for purposes of issuing local permits; itemized costs of equipment rental and other such charges if the project is completed by the property owner; estimates that reflect unit costs typically associated with the type, quality and standards of construction proposed in the application.

Complete the calculation worksheet based on construction value.

Additionally, the Department may require a cash bond, or other security acceptable to the Department, to ensure that the permittee complies with the terms of the permit.

City/County Planning Department Affidavit

Applicant and Property Details: The applicant shall complete all information in this section before submitting the affidavit to the appropriate city or county planning department for review and signature.

Planning Department Certification: This section is to be taken to the appropriate city or county Planning Department for completion and signature.

OREGON PARKS AND RECREATION DEPARTMENT
OCEAN SHORE PERMIT APPLICATION

SHORELINE PROTECTION STRUCTURES

FOR OFFICIAL USE ONLY
OPRD PERMIT #:
APPLICATION DATE:
DATE POSTED:
COORDINATOR:
60 DAY DUE DATE:

Section 1. Proposed Project

Project type:

☒ Riprap Revetment	☐ Vegetative Stabilization
☐ Seawall	☐ Other

Provide a brief description of the project:
The project involves constructing a new Shoreline Protection Structure (SPS) to protect an adjacent bluff that is beginning to undercut Beach Grass Lane. The SPS footprint will extend across the northern 150 linear feet of the existing bluff.

Estimated project start date	Estimated project completion date

Section 2. Applicant Information

Owner	Salishan Leaseholders Inc.			Agent	Certerra Northwest, LLC (Tyler Pierce)		
Mailing Address	855 SW Yates Ave, Unit 202			Mailing Address	2411 SE 8th Ave		
City	Bend	State	OR	Zip 97702	City Camas	State WA	Zip 98607
Phone	(541) 389-3172	Fax		Phone	(360) 567-1806	Fax	
Email	kanderson@aperionmgmt.com			Email	tpierce@certerra.com		

Primary Contact ☐ Owner ☒ Agent

Section 3. Property Location and Information

Situs Address	Beach Grass Lane Common Area, west and south of Beach Grass Lane				
City/Town	Gleneden Beach		County	Lincoln County	
Township 08S	Range 11W	Section 09	Subsection AD	Tax Lot 00235	

Current Use

☐ Residential	☐ Commercial/Industrial	☐ Public
☐ Vacant (unbuilt)	☒ Other (explain)	Mapped as "Park" on Lincoln County GIS

City/County Zoning Designation Lincoln County: R-1 PD	Year main structure was built NA

Lot Dimensions

Lot Size	1.97	Oceanfront footage (in feet)	290
Street front footage (in feet)	226	East-West footage (in feet)	379

Setbacks

Distance from eastern (or landward) property line to nearest building (in feet)	NA
Distance from seaward dune crest or bluff edge to nearest building (in feet)	NA
Approximate height of oceanfront bluff, dune or escarpment (in feet)	8 to 13

List the names, situs and mailing addresses of oceanfront landowners with property boundaries common to those of the property or properties described in the application.

Name	Property situs address	Mailing address
Trisha & Kyle Freres Tstee	20 Beach Grass Lane, Gleneden Beach, OR 97388	20 Beach Grass Lane, Gleneden Beach, OR 97388
William Munsey	20 Beach Grass Place, Gleneden Beach, OR 97388	2926 Hunter Way, West Linn, OR 97068
Kimberly Lynch	22 Beach Grass Pl, Gleneden Beach, OR 97388	PO Box 1101 Gleneden Beach, OR 97388
Cherylann Tonkin	20 Kinglet Ridge, Gleneden Beach, OR 97388	5020 SW Windsor Court, Portland, OR 97221
William Gaines	22 Kinglet Ridge, Gleneden Beach, OR 97388	10700 NE 4th St, Unit 1904 Bellevue, WA 98004

Section 4. Project Justification and Impacts

Provide a detailed explanation of the hazards and threat to property:
See Supplemental Application Narrative, narrative attachments, and Revised Geotechnical Investigation and Design Report dated January 12, 2026 by Certerra.

(Include documented supporting evidence, i.e. photographs, and/or chronology of bank retreat)

Attach additional pages as necessary

Describe all potential impacts:
See Supplemental Application Narrative, narrative attachments, and Revised Geotechnical Investigation and Design Report dated January 12, 2026 by Certerra.

Attach additional pages as necessary

Describe measures that will be taken to minimize the impacts identified above:
See Supplemental Application Narrative, narrative attachments, and Revised Geotechnical Investigation and Design Report dated January 12, 2026 by Certerra.

Attach additional pages as necessary

Section 5. Project Details

Total Length along shoreline (in feet) ~150	Height (in feet) ~18-24 (including ~10' subsurface)
Total width of project (in feet) ~40	
Slope (ratio-horizontal to vertical) 2H:1V	Total volume of all material(s) (cubic yards) 3,500

Riprap Specifications:

Armor stone type Basalt	Armor stone source Knife River Seaside Quarry or similar
Diameter of armor stone (in feet) 3-8	Amount of armor stone (cubic yards) 3,000
Type of filter fabric Mirafi Filterweave 700, or equivalent	Type of backing fill material filter blanket
The amount of backing fill material (cubic yards) 500	Will toe be keyed into bedrock? ☐ Yes ☒ No
Elevation of toe trench ~8' above msl (NAVD 88)	Depth of toe trench *keyed into med dense sand ~8'

Section 6. Analysis Of Hazard Avoidance

Please verify that the attached hazard avoidance analysis includes:

☒ A list of hazard avoidance alternatives	
☒ A description of why hazard avoidance alternatives are not feasible	☐ If an alternative was tried, explain why it did not succeed

☐ Is the relocation cost estimate included? ***(If the cost of moving the building is listed as an unfeasible factor.)***

Section 7. Geologic Report

Please provide the following information:

Date of Report 1/12/26		Company Certerra Northwest, LLC	
Geologist Name Adam Reese		Geologist Certifications R.G., C.E.G. (OR)	
Mailing Address 2411 SE 8th Ave			
City Camas	State WA	Zip 98607	
Phone (360) 567-1806	Fax	Email address adamr@certerra.com	

Please verify your geologic report contains all of the following information:

☒ The potential impacts from the proposed project on the sand source, supply, and movement on the affected beach as well as within the same littoral cell.	☒ A review of potential non-structural solutions, including, but not limited to: vegetative stabilization; non-structural dynamic revetments and foredune enhancement.
☒ The known or suspected geologic and seismic hazards in the project area and how the proposed project may affect or be impacted by those geologic and seismic hazards.	☒ The bank or bluff stability and erosion rates on the subject property and adjacent properties.

Section 8. Additional Permit Requirements

List the agency and type of permit required:

Lincoln County Floodplain Development Permit (attached)

OPRD Drive on Beach Permit

No permit is required from USACE or Oregon DSL.

☐ **No additional agency permit required**

Section 9. Signature Requirement

The application is hereby made for the ocean shore alteration described within this application. I certify that I am familiar with the information contained in this application, and, to the best of my knowledge and belief, this information is true, complete and accurate. I further certify that I possess the authority to undertake the proposed alteration.

I understand that the granting of an OPRD permit does not release me from obtaining any additional permits from any/all local, state, and/or federal agencies that may be required before commencing the project.

I understand that the payment of required OPRD processing fee does not guarantee the issuance of an approved permit.

[redacted] May 6, 2026

Owner Signature Date

☒ *I (Owner) authorize the Agent included in this application to act on my behalf during this application process.*

[redacted] May 6, 2026

[redacted] Date

[redacted]

Section 10. Required Drawings

The submitted application shall be accompanied by a plan view and a cross-section of the proposed project. Neatness and accuracy are important in order for those reviewing the application to clearly understand the proposal. Copies of county assessor's maps may not be used as site plan maps.

For consistency and quality please follow these format specifications:

- **All Drawings shall be:**
  - On 8.5 X 11 inch white paper
  - In black ink or clear legible photocopy of plan(s)
  - Printed or typed (no cursive) minimum size 10 point font
  - Drawn with a straight-edge and not freehanded.
  - Drawn accurately to scale
  - Be labeled appropriately

- **Plan view drawing shall include:**
  - Scale of drawing and north arrow
  - All lot lines with dimensions
  - Existing structures
  - Roads, driveways, etc. (existing, proposed, or temporary access roads)
  - Setback distance from nearest structure or infrastructure to upper edge of bluff or dune edge
  - Location of proposed improvements in relation to Statutory Vegetation Line and Actual Vegetation Line
  - Location of proposed project in relation to all property lines
  - Location of the proposed project in relation to the top of the bluff or dune and the existing toe of bluff or dune

- **Cross-section (side view) drawing shall include:**
  - Scale of drawing
  - Location of the existing base of bluff or dune
  - Location of top of bluff or dune
  - Location of proposed project in relation to base and top of bluff or dune
  - Approximate length, in feet, the project will occupy beyond the existing toe of bluff or dune, include buried toe of proposed shoreline protection structure.
  - Depth of toe trench or footing
  - Slope of the project (width/height ratio (i.e. 2:1))
  - Overall height of the project from bottom of buried toe to the top
  - Armor stone layer with rock size accurately depicted
  - Thickness of armor stone
  - Backing fill layer with thickness accurately depicted
  - Type of filter fabric, if applicable

OCEAN SHORE ALTERATION APPLICATION FEE WORKSHEET

Section 11. Application Fees and Calculation Worksheet

Instructions for fees

- OPRD recommends fees be submitted once an application is verified complete. Refund options are outlined in OAR 736-020-0004.
- Once construction value has been verified by staff, applicants will be provided instruction on how to pay the fee (Online if under $10,000).
- Under each heading below include a description of the project related activities or items included in the costs for that heading.
- Add in the total cost for each heading. Similar or associated items may be lumped, so long as the documentation clearly supports the cost.
- Attach documentation behind this form and add to application packet as a separate appendix. Once documentation is attached, check the box for "Documentation included". Acceptable evidence of construction value may be found in OAR 736-020-0004.
- Construction Value "means the costs of labor, equipment, materials, and all contractor fees, where those costs are incurred by the applicant or the applicant's agent(s)" (OAR 736-020-0002).
- If you are a public agency looking for a reduced fee, check the appropriate box(s) on lines 13 and 14 and enter the amount on line 13.

Line #	Describe itemized cost. (Briefly list item, vendor, and describe scope of cost)	Total Cost	Documentation included
1	Investigations, surveys, and assessments Certerra Investigation = $4,400 DKE Investigation = $2,200	$ 6,200.00	☑
2	Consulting and design Certerra investigation and design report (excluding investigation fees) = $14,350 Certerra supplemental consulting during permitting phase = $5,500	$ 19,850.00	☑
3	Construction Activities Kauffman Excavating estimate for construction = $372,469 Estimate is attached Certerra inspection estimate = $10,000	$ 382,469.00	☑
4	Site revegetation and rehabilitation	$ 0.00	☐
5	Monitoring and Maintenance of vegetation and rehabilitation	$ 0.00	☐
6	Other:	$ 0.00	☐
7	Total construction value (Auto calculates total of sections 1 through 6 above)	$ 408,519.00	
8	Base construction value	$2,500	
9	Net construction value (Auto calculates. If line 7 is greater than $2,500, subtract line 8 from line 7)	$ 406,019.00	
10	Construction value fee (Auto calculates. If line 9 is greater than $0, multiply line 9 by 0.03)	$ 12,180.57	
11	Base Application Fee	$400	
12	TOTAL APPLICATION FEE (Auto calculates total of lines 10 and 11)	12,580.57	
	STOP. lines 13 and 14 are only for public body or tribal agency undertaking actions to benefit the ocean shore.		
13	A fee reduction may be available if all three of these are met: ☐ You are a public body or Tribal Agency. ☐ One of the scenarios below applies to this project (check appropriate box in line 14) ☐ You have verified with OPRD Ocean Shore staff that a fee reduction will be provided. Enter amount of fee reduction agreed to by OPRD to the right.		
14	Scenarios (select appropriate box) ☐ Restoring, conserving or protecting the natural, resource, scenic, recreational, cultural or economic values of the ocean shore. ☐ Restoring native beach or dune habitat contributing to the recovery of sensitive species, including state and federally listed threatened or endangered species. ☐ Improving native biological values of the ocean shore. ☐ Improving, maintaining, repairing, or replacing public access.		

CITY/COUNTY PLANNING DEPARTMENT AFFIDAVIT

Applicant

Last	First	MI
Salishan Leaseholders Inc.	NA	NA

Property Details

Township	Range	Section	Subsection
08	11	09	~~AD~~- AA

Tax Lot 00235

County

☐ Clatsop	☐ Tillamook	☒ Lincoln	☐ Lane
☐ Douglas	☐ Coos	☐ Curry	

Project Type

☒ Shorefront Protection	☐ Access/Other Misc.	☐ Sand Alteration
☐ Pipeline/Cable/Conduit	☐ Natural Product Removal	

Planning Department Certification
(To be completed by local planning official)

Part I

In accordance with Statewide Planning Goal #18, Beaches and Dunes alteration permits for beachfront protective structures may be issued only where development existed on January 1, 1977, or where an exception to this Goal 18 implementation requirement has been approved by the appropriate local jurisdiction. For the purpose of this requirement, the definition of "development" means houses, commercial and industrial buildings, and vacant subdivision lots which are physically improved through the construction of streets and provisions of utilities to the lot.

Above property meets Goal 18 Eligibility? ☒ Yes ☐ No ☐ Not Applicable

Part II

I have reviewed the proposed project application and have determined that:

☐ This project is not regulated by the local comprehensive plan and zoning ordinances.

☒ This project has been reviewed and **is consistent** with the local comprehensive plan and zoning ordinance.

☐ This project has been reviewed and **is not consistent** with the local comprehensive plan and zoning ordinance.

☐ The consistency of this project with the local planning ordinance cannot be determined until the following local approvals are obtained:

☐ Conditional Use Approval ☐ Zone Change ☐ Plan Amendment
☐ Development Permit ☐ Other (Specify) _____

Comments:

This project is consistent with Lincoln County development standards as approved through Floodplain Development Permit #29-FP-26.

John O'Leary — Senior Planner

Local Planner [redacted] (Please Print) — Title

[redacted] — Date

The completed/signed form shall be submitted with the completed Ocean Shore Permit Application

CERTERRA
EARTH ENGINEERS

Materially Better™

Salishan Leaseholders, Inc.
PO Box 354 Gleneden Beach, Oregon 97388
Email: dennis.osterlund@gmail.com
Attention: Katie Anderson

January 12, 2026
Report No. 10-242036-01-R2

Subject: **Revised Geotechnical Investigation and Design Report**
Proposed Shoreline Protection Structure
Beach Grass Lane Common Area – North Segment
Lincoln County Tax Lots 08-11-09-AA-00235-00
Gleneden Beach, Lincoln County, Oregon

Dear Katie Anderson,

Certerra Northwest, LLC ("Certerra"), formerly Earth Engineers, is pleased to transmit our Revised Geotechnical Investigation and Design Report for the above referenced project. The attached report includes the results of the field investigation and laboratory testing, an evaluation of geotechnical and geologic factors that may influence the proposed construction, recommendations for shoreline protection structure design, and recommendations for revetment construction.

We appreciate the opportunity to perform this geotechnical study and look forward to continued participation during the permitting and construction phases of this project. If you have any questions pertaining to this report, or if we may be of further service, please contact our office.

Respectfully [redacted]
Certerra

[redacted]

Collin Sauer
Project Geologist

Tyler Pierce, P.E.
Associate Geotechnical Engineer

Adam Reese, R.G., G.E.G.
Principal Engineering Geologist

Attachment: Geotechnical Investigation and Design Report

Distribution (electronic copy only): Addressee
Katie Anderson
Michael Paquin

CERTERRA
EARTH ENGINEERS

Materially Better™

REVISED GEOTECHNICAL INVESTIGATION AND DESIGN REPORT

for the

Proposed Shoreline Protection Structure
Beach Grass Lane Common Area – North End
Lincoln County Tax Lots 08-11-09-AA-00235-00
Gleneden Beach, Lincoln County, Oregon

Prepared for

Salishan Leaseholders, Inc.
PO Box 354
Gleneden Beach, Oregon 97388

Prepared by

Certerra Northwest, LLC
2411 Southeast 8th Avenue
Camas, Washington 98607
Telephone (360) 567-1806

Certerra Report No. 10-242036-01-R1
January 12, 2026



Tyler Pierce, P.E.
Associate Geotechnical Engineer



Adam Reese, R.G., C.E.G.
Principal Engineering Geologist



Collin Sauer
Project Geologist

Table of Contents

1.0 PROJECT INFORMATION 1
1.1 Project Authorization 1
1.2 Project Description 1
1.3 Purpose and Scope of Services 5
2.0 SITE AND SUBSURFACE CONDITIONS 7
2.1 Site Location and Description 7
2.2 Mapped Soils and Geology 9
2.3 Geologic Hazards 10
2.3.1 Coastal Erosion Hazard 10
2.3.2 Earthquake and Tsunami Hazard 13
2.3.3 Landslide Hazard 15
2.4 Subsurface Conditions 16
2.5 Groundwater Information 18
3.0 GEOTECHNICAL EVALUATION AND RECOMMENDATIONS 19
3.1 Bluff Slope Erosion Factors of Influence 19
3.2 Riprap Revetment Recommendation 21
3.2.1 Subgrade Preparation and Excavation 21
3.2.2 Installation of Filter System 21
3.2.3 Armor Rock Placement and Revetment Slope 22
3.2.4 Maintenance Considerations 22
4.0 CONSTRUCTION INSPECTIONS AND CONSIDERATIONS 25
4.1 Recommended Geotechnical Inspections 25
4.2 Construction Considerations 25
5.0 POTENTIAL IMPACTS AND ADDITIONAL CONSIDERATIONS 27
5.1 Impacts to Sand Source, Supply, and Movement 27
5.2 Analysis of Hazard Avoidance 27
5.2.1 Vegetative Stabilization Structures 27
5.2.2 Cobble Berm 28

5.2.3 Sand Alteration 29
5.2.4 Relocation of Existing Buildings or Infrastructure 29
5.2.5 Other Solutions 30
5.2.6 Conclusion 30
5.3 Other Considerations 30
6.0 REPORT LIMITATIONS 33

APPENDICES:
Appendix A – Site Location Plan
Appendix B – Exploration Location Plan
Appendix C – Exploration Logs
Appendix D – Soil Classification Legend
Appendix E – Proposed Revetment Plan
Appendix F – Proposed Revetment Profile

1.0 PROJECT INFORMATION

1.1 Project Authorization

Certerra Northwest, LLC ("Certerra"), formerly Earth Engineers, has completed a Geotechnical Investigation and Design Report for the proposed shoreline protection structure construction located at the north end of the Beach Grass Lane Common Area on Lincoln County Tax Lots 08-11-09-AA-00235-00, in Gleneden Beach, Lincoln County, Oregon. Our original services were authorized by Suzanne Maresh, Chairwoman (former) of Salishan Leaseholders, Inc. by signing EE Proposal No. 10-24-P166 issued on May 14, 2024 and continued services for the north end improvements described in Certerra agreement 10-242036-02A.

1.2 Project Description

Our current understanding of the project is based on correspondence between Salishan Leaseholders Incorporated (SLI) and Certerra Principal Engineering Geologist, Adam Reese, R.G., C.E.G., and Certerra Associate Geotechnical Engineer, Tyler Pierce, P.E. Our scope includes evaluating shoreline protection for the northern approximate 150-foot segment of the shoreline bluff. The purpose of constructing this segment is to protect the Beach Grass Lane roadway infrastructure from coastal erosion impacts. The northern portion of the Beach Grass Lane common area supports the western end of the Beach Grass Lane roadway and portions of the residence at 20 Beach Grass Lane. While we recommend the entire length of the Beach Grass Lane Common area beach front should be protected from future erosion, it is our recommendation that protecting the northern 150 feet of the beach front should be priority to protect the nearby structures and local infrastructure.

See Figure 1 below for the approximate extent of our evaluation.

certerra.com 2411 Southeast 8th Avenue, Camas, WA 98607 T: 360.567.1806

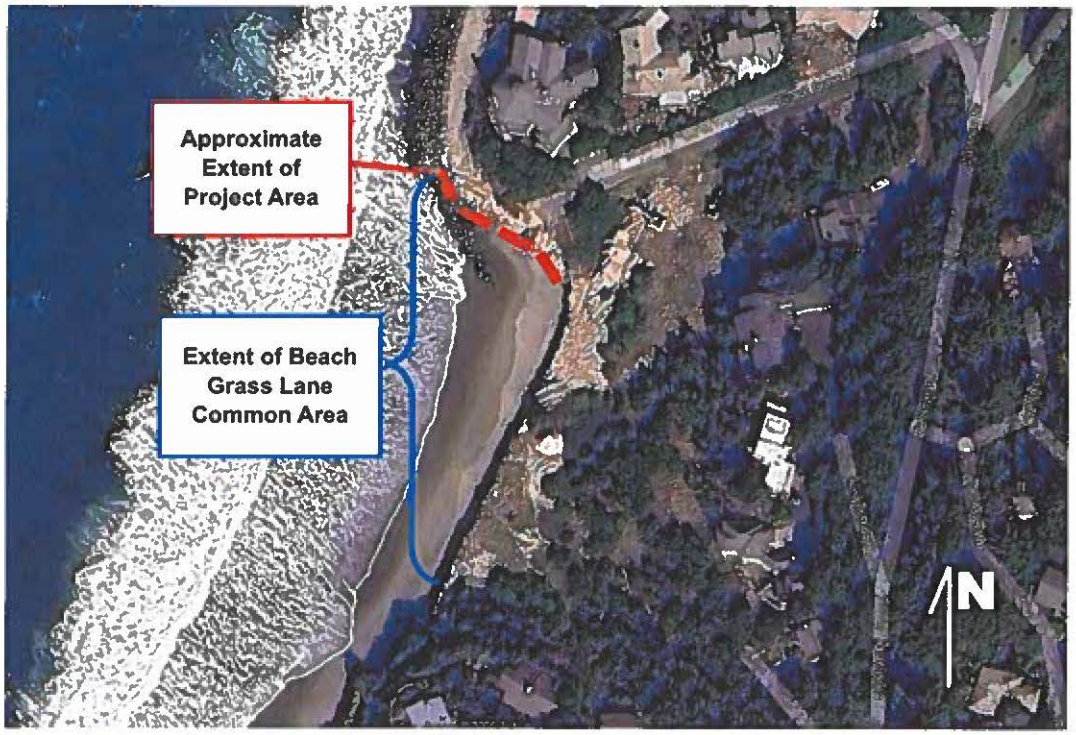


Figure 1: Project vicinity, showing the extent of the Beach Grass Lane Common Area beachfront, as well as the approximate extent of the Project Area (i.e., the northernmost 150 feet of the Common Area. Base map source: Google Maps

On February 9th, 2024, Certerra Project Geologist, Matt Enos, R.G., visited the subject property for a preliminary reconnaissance of the property's beachfront and to assess the current extent of erosion that had recently occurred. During the site visit, we observed that significant erosion had impacted the toe of the bluff (shown in Photo 1 below), posing an imminent risk to the adjacent developed properties and associated structures. We understand that the mass erosion continued throughout February, resulting in an estimated retreat of approximately 100 and 150 feet into the adjacent bluff.

The Beach Grass Lane Common Area has beach frontage of approximately 320 feet. As previously stated, the scope of work of this report focuses on the northernmost approximate 150 feet of the Beach Grass Lane Common Area, which will be referred to herein as the "Project Area". Currently, the Project Area lacks bluff protection, except for a temporary breakwater structure placed shortly after the erosion event in January (shown in Photo 1 below) that at this time has been removed. The height of the bluff ranges from approximately 8 and 13 feet. The upland area to the east of the bluff is relatively level and is vegetated with low-lying brush and semi-mature deciduous trees.

The Project Area is in close proximity to Beach Grass Lane, critical infrastructure for the community because it provides public beach access as well as access the driveway for the residence at 20 Beach Grass Lane. Beach Grass Lane is beginning to become undermined, caused by the erosion events. While the remaining 250 feet of

frontage to the south would also benefit from shoreline protection, the northern approximate 150 feet is being prioritized at this time.



Photo 1: Erosion observed at Beach Grass Lane during our February 2024 site visit looking south from Beach Grass Lane across beach frontage of Beach Grass Lane common area. Temporary rip-rap placed as a breakwater can be seen on photo right.

Given (1) the recent significant erosion events occurring on the subject property, and (2) the proximity of key local infrastructure (i.e. the Beach Grass Lane roadway), we consider there to be a heightened risk of imminent impact to both local infrastructure and private development. Accordingly, we recommend the construction of a new shoreline protection structure (SPS) along the northern approximate 150 feet of the Beach Grass Lane Common Area. It is our professional opinion that in the absence of this minimum extent of permanent shoreline protection, bluff regression will continue and will impact the Beach Grass Lane roadway. Without stabilization and protection of the bluff toe from wave attack, ongoing slope retreat and associated structural risk should be anticipated. For the purposes of this report, the terms "riprap," "revetment," and "SPS" are used interchangeably.

Certerra recommends that a rip-rap revetment structure will provide the minimum level of protection necessary to mitigate coastal erosion at this location, and is a durable and cost-effective solution that is feasible under current regulatory constraints. Although a solid seawall might be more protective, such structures are generally not approved in Oregon for protecting local infrastructure. In addition to its purpose of presenting the geotechnical investigation and design information for the SPS, this report is also presented as supporting information for a future OPRD Ocean Shore Alteration Permit Application, and the local permit applications.

It should be noted, for a property to be eligible for structural shoreline protection, it must be Goal 18 eligible, which requires properties to be developed prior to January 1, 1977. In addition, we understand that the Salishan community has a unique classification. Planned development of the Salishan Spit began in the mid-1960s, and

subject project sites have been identified as Goal 18 eligible due to exception according to the Oregon Coastal Atlas Ocean Shores webpage (see Figure 2). Eligibility has been verified by Onno Husing, Director of Lincoln County Planning and Development. Megan Hoff, Associate Planner, verifies permit applications from Salishan as part of the "Salishan Exception Area." Therefore, the subject property may be eligible for improved shoreline stabilization. The eligibility for constructing future SPS, and locations of existing SPS (referred to as Beachfront Protective Structures) are depicted on Figure 2 below.

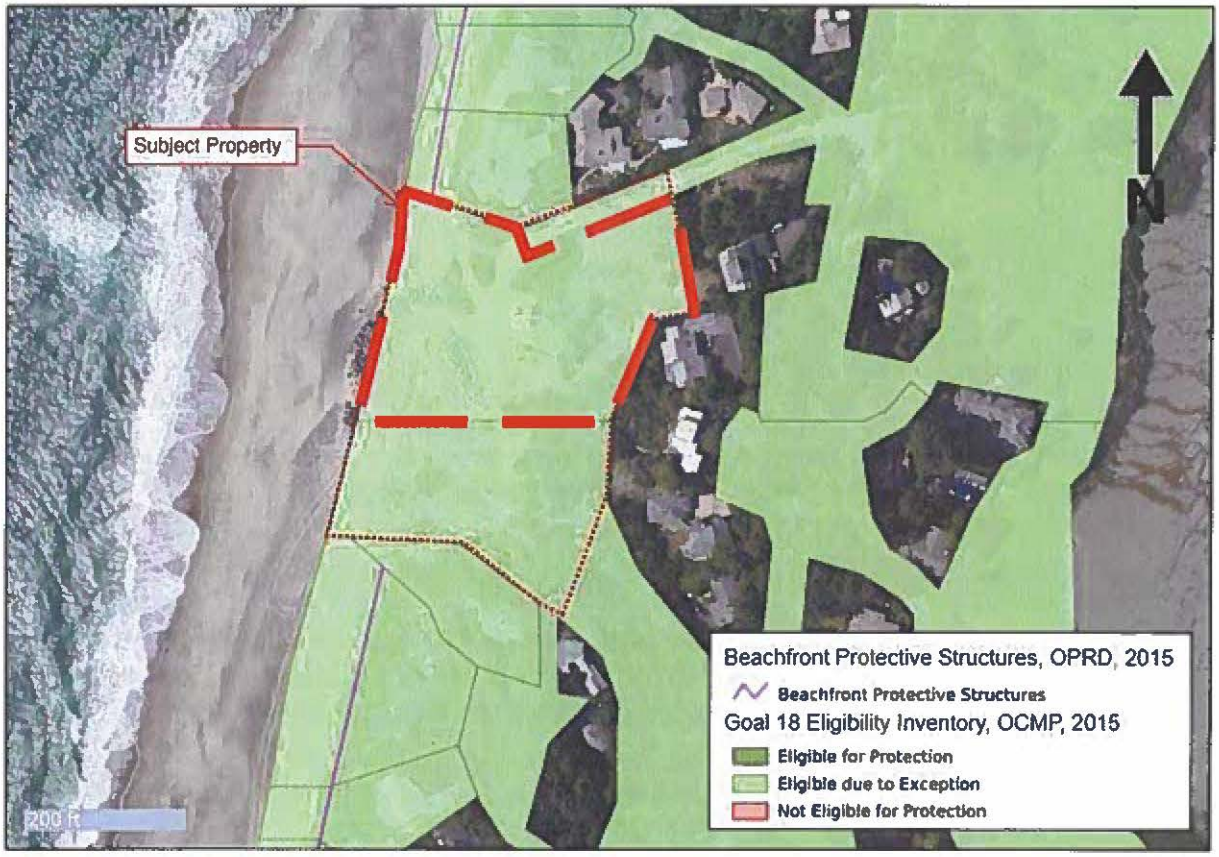


Figure 2: Existing Shoreline Armoring and Goal 18 Eligibility. Base map source: Ocean Shores Viewer, Oregon Coastal Atlas; https://www.coastalatlas.net/oceanshores/.

As a part of our background research, we also reviewed the following document publicly available on the Salishan Leaseholders, Inc. (SLI) website:

- **Report titled "Engineering Geologic Investigation for Oceanfront Protection Along Siletz Spit between Tax Lot 156, Map 08-11-09DD, and Tax Lot 200, Map 07-11-34CB, Lincoln County, Oregon" prepared by H.G. Schlicker & Associates dated December 20, 2019.** This report performed an analysis of the oceanfront lots across the Salishan community, to identify whether the properties would benefit from the construction of SPS (or the replacement of the existing SPS). After their analysis, HGSA concluded that they recommend a new riprap revetment be constructed (and the existing SPS be

replaced) across the subject area. The report recommended the bottom of the revetment be embedded into the beach sand at an elevation of approximately 6 feet above msl. HGSA also recommended the top of revetments be raised to 33 feet above msl (minimum) to mitigate waves overtopping the revetments along the properties. We reviewed the HGSA report and factored in the historical context described to our analysis and design.

1.3 Purpose and Scope of Services

The purpose of our services was to explore the subsurface conditions at the site to better define the existing soil, rock, and groundwater properties in order to provide geotechnical related recommendations for the proposed SPS. Our site investigation consisted of advancing 8 test pits (TP-1 through TP-8) supplemented with drive probe testing for assessing the conditions of the Beach Grass Lane Common Area beachfront. The test pits were advanced on the beach, and on top of the subject bank. The most relevant of these explorations in proximity to the Project Area (i.e., the northernmost approximate 150 feet of the Beach Grass Lane Common Area) are test pits TP-1 to TP-3, and TP-8. Grab samples were obtained from each stratum encountered for laboratory testing. Laboratory testing was accomplished in general accordance with ASTM procedures.

This report briefly outlines the testing procedures, presents available project information, describes the site and subsurface conditions, and presents recommendations regarding the following:

- A discussion of subsurface conditions encountered including pertinent soil and rock properties and groundwater conditions.
- Geotechnical related recommendations and design for the proposed riprap revetment. This includes material specifics for the armoring/filter rock, filter fabric and pit run, and a maximum revetment slope angle.
- Qualitative assessment of bluff slope stability (i.e. a visual reconnaissance combined with our limited hand tool exploration data).
- Recommendations for revetment foundation subgrade preparation.
- Wet and dry weather construction recommendations.
- Drafted cross-section and site plan showing the proposed SPS conditions at the subject property, required for permitting.
- Discussions on geotechnical issues that may impact the project

As stated above, the scope of services for this report is limited to the northernmost approximate 150 feet of shoreline where the proposed shoreline protection has been proposed, not the site in its entirety. It should also be noted that our current scope does not include any surveying or structural engineering. Finally, our scope of services does not include a detailed seismic hazard study or liquefaction analysis. We are available to provide these services upon request.

Our currently authorized scope of services is concluded upon submittal of our finalized investigation-design report. Additional services required to support permitting of the structure (e.g., providing additional information to address OPRD application evaluation criteria [such as assessment of location-specific erosion or coastal processes, hazard avoidance alternatives, detailed alternatives assessment, etc.], attending meetings and/or hearings, coordination with OPRD, etc.) are not included in our current scope of services, but can be provided on a time and materials basis subsequent to submittal of our geotechnical investigation report and design. In addition, our current scope of services does not include a construction staging and/or maintenance plan.

certerra.com 2411 Southeast 8th Avenue, Camas, WA 98607 T: 360.567.1806

2.0 SITE AND SUBSURFACE CONDITIONS

2.1 Site Location and Description

The location of the proposed shoreline protection structure is at the northern portion of the Beach Grass Lane Common Area, which is adjacent to and south of Beach Grass Lane in the Salishan Neighborhood, Gleneden Beach, Oregon. The subject property is labeled as "Park" on the Lincoln County Tax Maps. The property is bordered by single-family residences to the north, south, east, and the beach and the Pacific Ocean to the west.

The property is currently occupied by the open beach and sand dunes with grasses and trees growing throughout. The subject property has not been developed with structures, aside from Beach Grass Lane. The Beach Grass Lane easement runs east-west through the property and provides access to nearby residences. The easement terminates immediately adjacent to the eroded bluff where the proposed revetment is proposed. As a result, the subject property is eligible for shoreline stabilization consistent with Goal 18 due to the exception reference in Section 1.2 above. The locations of existing Beachfront Protective Structures (also known as SPS) and eligibility for constructing future SPS are depicted on Figure 2 above. It should be noted, as shown in Figure 2 above, the length of properties immediately to the north and south of the subject property are currently armored with SPS, with exception of a portion of a site to the south that recently experienced an erosion event that caused a failure at the base of a slope.

As stated above, the subject bluff is located adjacent to the Beach Grass Lane roadway and the roadway is at imminent risk of undermining due to the recent costal erosion. The area of the site east of the bluff and south of Beach Grass Lane is generally flat. The oversteepened bluff slope stands at approximately 1H:1V (Horizontal:Vertical) to near-vertical. It should be noted, we consider soil slopes steeper than 2H:1V to be oversteepened. Therefore, we consider the bluff slope to be oversteepened and prone to sloughing and erosion. This risk of erosion is further exacerbated as the sea level rises.

The conditions of the property's coastline at the time of our initial investigation (November 1, 2024) can be seen in Photos 2 through 4. At the time of our visit, we observed erosion occurring at the toe of the bluff (see Photos 3 and 4). The bluff face, ranging in height from 6 to 13 feet, is composed of light brown medium grained sand and has become oversteepened due to continuous ocean wave erosion. In addition, cobbles and boulders were observed at the base and top of the bluff, as well as approximately 6 feet below grade in TP-1. These materials are understood to be remnants of a prior staging area used for construction of revetments along adjacent properties (see Photos 2 and 4).



Photo 2: Site conditions at the time of our November 2024 investigation, showing the erosion along the approximately 6- to 13-foot-tall coastal bluff and boulders placed at the toe of the slope adjacent to Beach Grass Place (facing south).



Photo 3: Site conditions at the time of our November 2024 investigation, showing the erosion at the toe of the subject property's coastal bluff (facing north).



Photo 4: Site conditions at the time of our November 2024 investigation, showing the top of the bluff and scattered boulders staged from shoreline revetment projects along other parts of the beach.

2.2 Mapped Soils and Geology

The project site is located on the Salishan Spit within the coastal lowlands region of the Oregon Coast Range geomorphic province. The coastal lowlands typically contain low marine terraces, marine estuaries, beaches, sand dunes, and coastal lakes. The geologic formations associated with the coastal lowlands are Quaternary terrace deposits, beach and dune sands, and alluvium. along the Ocean coast. In general, the Oregon coastal region has been uplifted as a result of plate convergence from the Cascadia subduction zone located about 150 to 200 km west of the coast range[1]. The region is underlain by a framework of Miocene aged (23 to 5 million years ago) volcanic rocks and Oligocene (33 to 23 million years ago) to Miocene aged marine sedimentary deposits that have been deposited over a basement rock of Eocene-aged (60 to 33 million years ago) volcanic arc deposits. Overlying this framework are Quaternary–aged (1.8 million years ago to present) marine terrace deposits, beach and dune deposits and landslide deposits.

[1] Kelsey, H.M., and J.G. Bockheim, Coastal landscape evolution as a function of eustasy and surface uplift rate, Cascadia margin, southern Oregon, Geol. Soc. Am. Bull., 106, 840-854, 1994.

The project area was mapped by Parke D. Snavely, Jr. and others of the U.S. Geological Survey in 1976. Within the project vicinity, the underlying geologic unit is mapped as beach, bar, and dune sand (Qbs)[2]. This unit consists of beach sand and gravel and bar and active dune sands from the Holocene epoch. Tertiary basaltic bedrock along the shoreline may be exposed seasonally.

The United States Department of Agriculture (USDA) Soil Survey provides geographical information of the soils in Lincoln County as well as summarizing various properties of the soils. The USDA shows the native soils on the subject property as the Waldport fine sand on 0 to 30 percent slopes. This excessively drained unit forms on dunes from a parent material of eolian sands derived from mixed sources. A typical profile consists of slightly to moderately decomposed plant material overlying fine sand.[3]

2.3 Geologic Hazards

The Oregon Department of Geology and Mineral Resources (DOGAMI) maps various geologic hazards such as 100-year flooding, earthquake ground shaking, coastal erosion, tsunamis, and landslides. DOGAMI presents hazard levels derived from this mapping in an interactive geographic information system (GIS), generally referred to as Oregon HazVu.[4] HazVu presents the primary geologic hazard levels associated with the subject property as follows:

- Low to very high (active) coastal erosion hazard zones.
- Tsunami inundation hazard area.
- Low to high landslide hazard area.
- Severe Cascadia earthquake expected shaking.
- Violent crustal earthquake expected shaking.
- Low to very high liquefaction (soft soil) hazard area.

General geologic hazard information is presented in this section to show the range of related hazard risk that the common area shoreline is subject to. The most pertinent to this study is coastal erosion (described extensively within this report); however, SPS design and construction would also substantially need to account for earthquake, tsunami, and slope stability (landslide) hazard risk levels for this property.

2.3.1 Coastal Erosion Hazard

Since the primary purpose of this study is to address coastal erosion, we assessed the site location relative to Coastal Erosion Hazard Zones. From east to west, the Oregon HazVu mapping shows that portions of the site fall within the low, moderate, high, and very high (active) coastal erosion hazard zones. See Figure 3 below. As

[2] Snavely Jr., P. D., MacLeod, N. S., Wagner, H. C., and Rau, W.W., 1976. Geologic Map of the Cape Foulweather and Euchre Mountain Quadrangles, Lincoln County, Oregon. United States Geological Survey. Miscellaneous Investigations Series Map I-868, Plate 1.

[3] Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/ accessed 11/16/2024.

[4] Oregon HazVu: Statewide Geohazards Viewer, available online at: http://www.oregongeology.org/sub/hazvu/ accessed 11/16/2024.

shown below, the Project Area is mapped entirely within the very high (active) coastal erosion hazard area. Mapping within this erosion hazard zone means that the area is either currently experiencing significant erosion or is highly likely to erode during storm events (reflecting both past erosion trends and future risks to the area). Because of this, there is a high risk of rapid shoreline retreat in these areas.

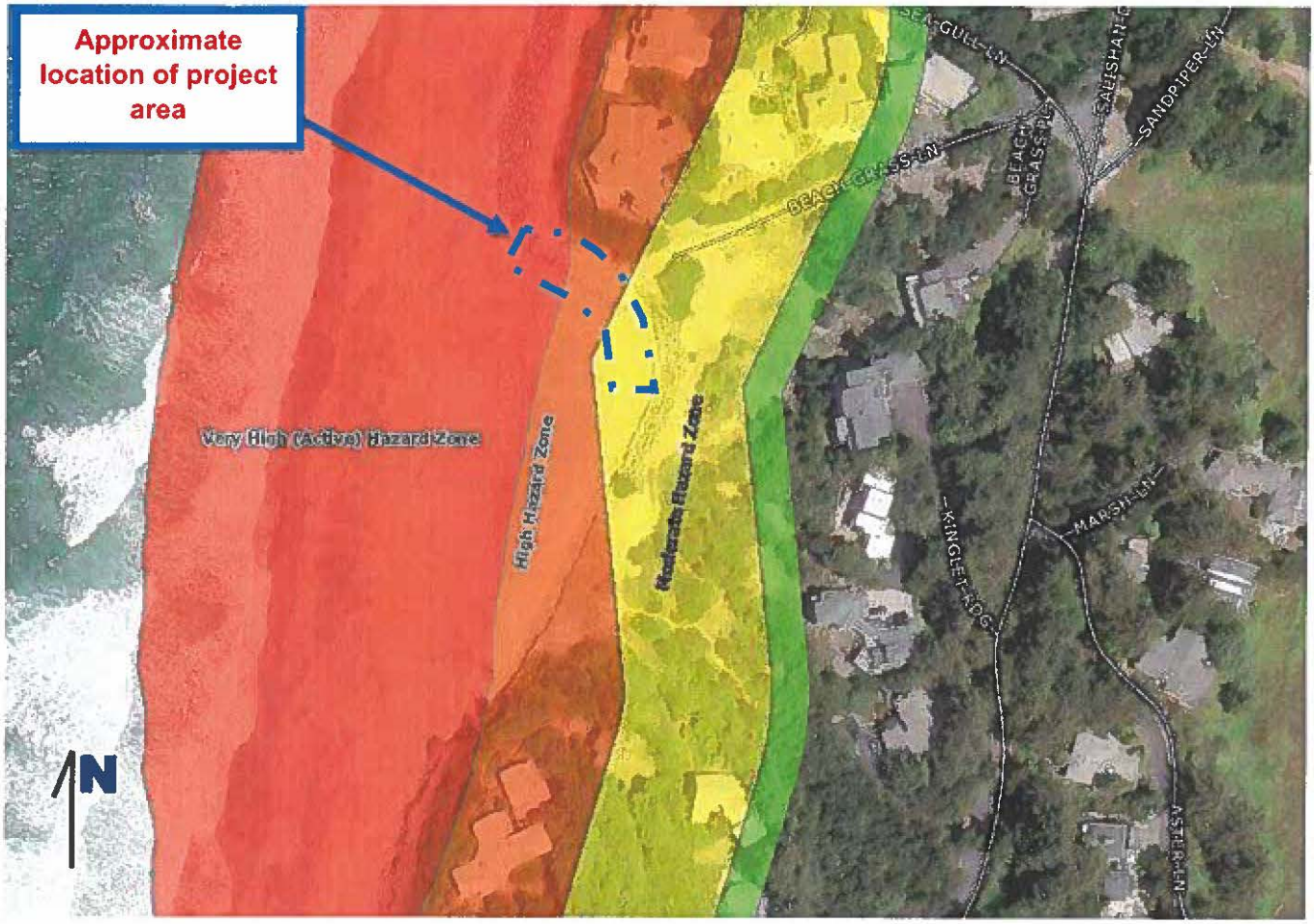


Figure 3: Coastal Erosion Hazard Zone provided by DOGAMI HazVu.

During the past quarter century, there has been a general increase in ocean wave erosion observed along much of the Oregon coast. These conditions have been attributed to an increased frequency of relatively severe global climatic episodes, such as El Niño and La Niña periods. The severe storms along the northern Oregon coast during these extremes have resulted increased wave heights and more substantial beachfront erosion than what has been seen in prior recorded history. The severity and frequency of these episodes is expected to increase in the future, and there is near certainty that the rate of sea-level rise will also increase as a result of global warming.

Offsetting recent historical sea level rise, the regional tectonic processes on the northern Oregon coast result in emergence (gradual uplift). This negates the short-term effects of sea-level rise in areas like Gleneden Beach. However, according to a national scale report prepared by the National Oceanic and Atmospheric Administration (NOAA), the sea level rise is outpacing the tectonic lift.[5] As a result, there will be more substantial impacts caused by the rising trend in future years compared to the past (along with the overall trending rate of sea level rise increases), exacerbating the coastal erosion impacts compared to what has been seen historically. The rise in sea level causes the waves to break closer to the shore and run up further inland.

In addition to the climate changes, the configuration of offshore reefs and currents can direct ocean waves to particular stretches of the beach in the form of rip embayments. As described above, this destructive condition appears to be occurring at present (January 2024) at the subject property shoreline location. Rip embayment conditions have historically resulted in the loss of residential structures on the Salishan Spit, as occurred in the winter of 1972-1973.

On a geologic time scale (thousands of years), much of the Oregon coast is in the process of receding eastward, and it should be expected that continued erosion and recession of the coastline will occur in the future. Dune-back beaches fluctuate seaward and landward over time, but the net result is a loss of ground to the ocean. Bluff-backed beaches undergo the same erosion cycles but regress more slowly without the seaward fluctuations of dune-backed beaches.

Because much of the Salishan Spit has existing rip rap structures resulting from measures taken after many of the severe erosional episodes, the erosion rate for the entire spit at the time of a study done by Priest et al. (1994)[6] was assumed to be near zero. However, to the south of the site near Gleneden Beach where much of the beach are bluff-backed and lacked protective structures at the time of the study, the erosion rate was determined to be an average of 0.62 ± 0.76 feet per year. Komar and Rae's study of the winter 1972 to 1973 erosion on the Spit concluded that the presence of rip currents and rip embankments are the primary cause of the erosion of the Salishan Spit, and that at least 50 meters (164 feet) of the foredune can be removed at any time.[7]

The subject property has been exposed to the erosion cycles noted above. As discussed in this report, there was a mass erosion event that occurred between January and February 2024 which caused the bluff on the subject property to recede by approximately 100 to 150 feet.

[5] Sweet, W.V., et al. 2022. Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along U.S. Coastlines. NOAA Technical Report. National Oceanic and Atmospheric Administration, National Ocean Service, Silver Spring, MD.

[6] Priest, G. R., Saul, I., and Diebenow, J., 1994, Explanation of chronic geologic hazard maps and erosion rate database, coastal Lincoln County, Oregon: Salmon River to Seal Rock: Oregon Department of Geology and Mineral Industries, Open-File Report 0-94-11.

[7] Komar, Paul D., and Rea, C. Cary, 1976, Beach Erosion on Siletz Spit, Oregon. https://ir.library.oregonstate.edu/concern/administrative_report_or_publications/zw12z959h

During this period, higher-than-normal tides, intensified by offshore winds, led to severe erosion. According to SLI representatives, these waves "carved an 18-20 deep escarpment on the western length of Beach Grass Lane. As the waves tunneled into the base of the foredune, 40 to 50 feet of surface total collapsed [during a single event]." Based on a review of historical aerial images, it appears as though 100 to 150 feet of the shoreline receded at the common area between January and February 2024.

The conditions observed suggest that a localized rip embayment has formed along the Beach Grass Lane common area, channeling ocean waves toward this part of the Salishan shoreline. Rip embayments, which can form randomly along the coast, are particularly destructive because they create deeper troughs in the nearshore sand deposits, concentrating wave energy on the bluffs and dunes. This can cause rapid and extensive erosion, as seen historically in other parts of the Salishan Spit. As such, this property faces an imminent risk of ongoing erosion and potential damage to the residential drainage infrastructure and roadway above.

While the entire length of the Beach Grass Lane common area is at risk of severe erosion from a localized rip embayment, it is our opinion that the most critical area is the northern section of the beach front. The remaining southern portion of the beach front should be protected in the future to protect against further inundation towards the lower elevations, but there are not any critical structural or infrastructure related elements located east of that portion.

2.3.2 Earthquake and Tsunami Hazard

Oregon's position at the western margin of the North American Plate and its location relative to the Pacific and Juan de Fuca plates have had a major impact on the geologic development of the state. The interaction of the three plates has created a complex set of stress regimes that influence the tectonic activity of the state. The western part of Oregon is heavily impacted by the influence of the active subduction zone formed by the Juan de Fuca Oceanic Plate converging upon and subducting beneath the North American Continental Plate off the Oregon coastline.

The Cascadia Subduction Zone, located approximately 100 kilometers off of the Oregon and Washington coasts, is a potential source of earthquakes large enough to cause significant ground shaking at the subject site. Research over the last several years has shown that this offshore fault zone has repeatedly produced large earthquakes, on average, every 300 to 700 years. It is generally understood that the last great Cascadia Subduction Zone earthquake occurred about 300 years ago, in 1700 AD. Although researchers do not necessarily agree on the likely magnitude, it is widely believed that an earthquake moment magnitude (M_w) of 8.5 to 9.5 is possible. The duration of strong ground shaking is estimated to be greater than 1 minute, with minor shaking lasting on the order of several minutes. In general, settlement, liquefaction, and landsliding of earth material (e.g., dune slopes), and tsunami inundation are anticipated to occur in conjunction with this type of major seismic event. Based on these conditions, when factoring anticipated future conditions into alternatives evaluation, we recommend that structural shoreline protection (e.g., riprap revetments) will have greater durability than non-structural alternatives and are therefore more likely to provide some level of continued coastal erosion protection at the critical time following a major earthquake.

Additionally, earthquakes resulting from movement in upper plate local faults are considered a possibility. Crustal earthquakes are relatively shallow, occurring within 10 to 20 kilometers of the surface. Oregon has experienced at least two significant crustal earthquakes in the past decade—the Scotts Mills (Mt. Angel) earthquake (M_w 5.6) on March 25, 1993 and the Klamath Falls earthquake (M_w 5.9) on September 20, 1993. Based on limited data available in Oregon, it would be reasonable to assume a M_w 6.0 to 6.5 crustal earthquake may occur in Oregon every 500 years (recurrence rate of 10 percent in 50 years).

We reviewed the USGS Quaternary Fault and Fold Database of the United States for information on nearby faults[10]. This database indicates that the Siletz Bay faults lay approximately 1.6 miles to the south of the property (at its closest expression). The Siletz Bay faults are a group of northwestern trending faults with a normal sense of movement, with a slip rate of less than 0.2mm/year, and the most recent prehistoric deformation occurring in the late Quaternary (<130,000 years ago)[11]. It should be noted that this group of faults are inferred, and not shown on some geological maps of the area.

A Cascadia Subduction Zone earthquake or other strong seismic event could result in severe seismic ground shaking on the subject property lasting for several minutes. Based on geologic deposits from past CSZ earthquake it is possible that broad areas of the coastline, including the low lying town of Gleneden Beach and the Salishan Spit, could experience rapid co-seismic subsidence or down dropping as accumulated tectonic stress is released during the earthquake. Many low-lying coastal areas may subside below sea level or into flood ways of estuaries and tsunamis, which could change erosional patterns of the area. A subduction zone earthquake would also likely result in soil liquefaction and lateral spreading in loose, saturated sand deposits along the coast and bays.

In addition, we reviewed the Tsunami Inundation Map for Gleneden Beach, Oregon[12] for information on the tsunami hazard in the project vicinity. As shown below in Figure 4, the property is mapped to be in a zone that is expected to be impacted by a "medium-sized" Cascadia Subduction Zone earthquake of magnitude ~8.9 or greater. Additionally, Oregon HazVu mapping indicates that the property is within a local tsunami excavation zone.

[10] USGS U.S. Quaternary Faults Interactive Map, https://www.arcgis.com/apps/mapviewer/index.html?webmap=3dfcfb7a9bf6496fa4e622664c859c5b.

[11] Personius, S.F., compiler, 2002, Fault number 883, Siletz Bay faults, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults, accessed 12/14/2020 03:14 PM.

[12] Zhang, J., 2013, Local Source (Cascadia Subduction Zone) Tsunami Inundation Map, Gleneden Beach – Siletz River, Oregon. Oregon Dept. of Geology and Mineral Industries Tsunami Inundation Map TIM-Linc-03, Plate 1, scale 1:12,000. Available online at: https://pubs.oregon.gov/dogami/tim/p-TIM-Linc-03.htm accessed 8/16/2024.

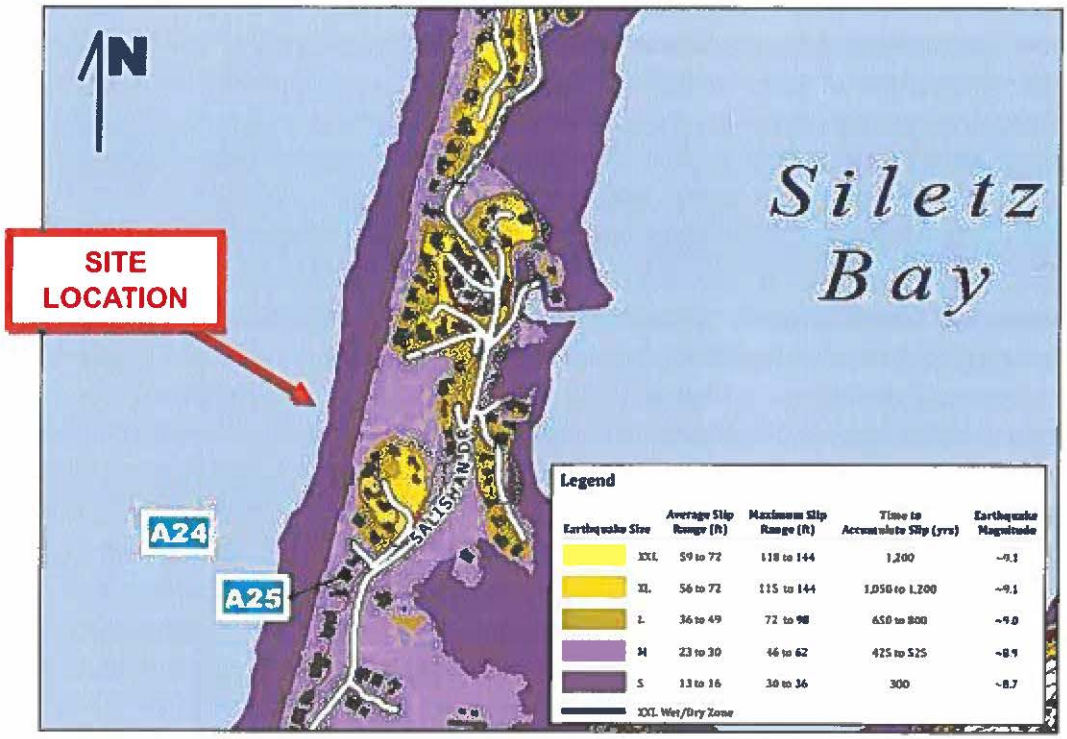


Figure 4: Tsunami hazard map for Gleneden Beach provided by DOGAMI.

As stated above, Oregon HazVu mapping indicates the subject property is mapped in a low to very high liquefaction susceptibility area. It should be noted; we anticipate the sandy soils in the project area to be liquefiable due to the presumed presence of shallow groundwater.

2.3.3 Landslide Hazard

As stated above, we reviewed DOGAMI's HazVu database which indicated that the project area is mapped within a low to high landslide hazard area based solely on topography. A landslide susceptibility hazard map is shown below in Figure 5. It should be noted that the database does not map the subject properties in close proximity to any mapped landslides. This is primarily due to the geologic makeup and topographic characteristics of the Siletz Spit landform.

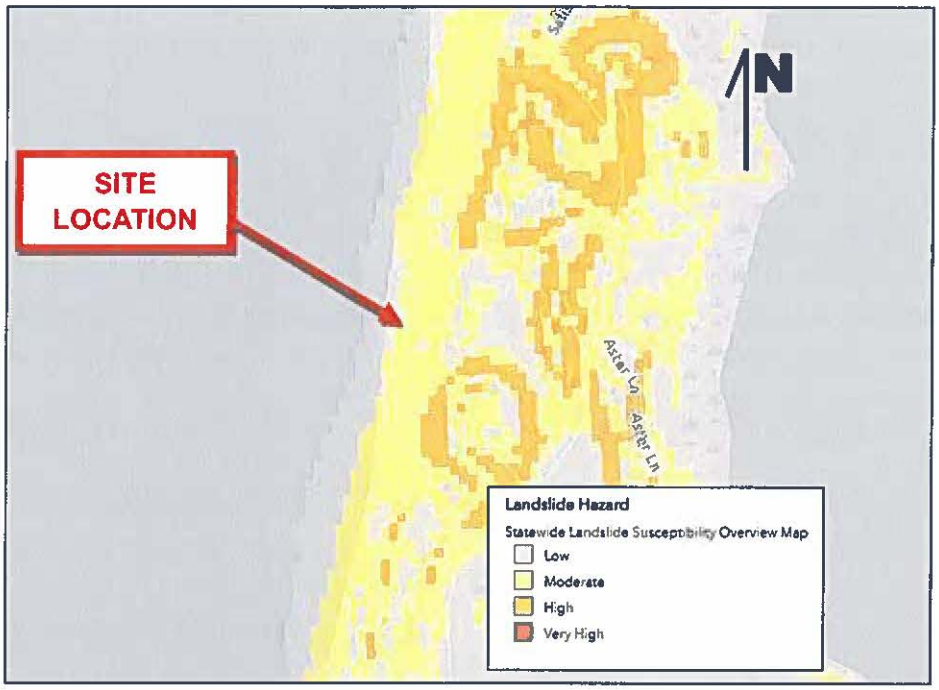


Figure 5: Landslide susceptibility map provided by DOGAMI's HazVu.

We also reviewed the DOGAMI Statewide Landslide Information Database for Oregon (SLIDO) for more information on landslides in the project vicinity. The SLIDO map shows no mapped landslides around or near the subject property. The nearest mapped landside deposit is located approximately 0.85 miles southeast of the subject property. However, when considering bluff slope stability on unprotected portions of shoreline in Gleneden Beach and on the Salishan Spit, it has been our observation that landslides are prevalent. This is primarily due to the reduction in resisting forces as a result of bluff toe erosion.

Based on the current near vertical geometry of the bluff located west of Beach Grass Lane, the risk of a local landslide should be considered high. Continued erosion of the bluff and continued recession towards the east will continue to increase the risk of local slope instability that will likely undercut the western portion of the local access road.

2.4 Subsurface Conditions

In order to better define the subsurface conditions for the overall site, we advanced eight test pit explorations (TP-1 through TP-8) located on the beach and on the bluff of the Beach Grass Lane Common Area. The test pits were excavated to depths ranging from 9 to 10.5 feet below ground surface (bgs). For approximate exploration locations see the Exploration Location Plan in Appendix B. The test pits were advanced by Dan Kauffman Excavating LLC (DKE) using an excavator with a 4- foot and a 6-foot-wide smooth bucket. Soil samples were collected at the discretion of the Geotechnical Engineer's representative and transported to our laboratory for testing.

We supplemented five test pits with drive probe testing. The drive probe testing extended to a depth of 12 to 21 feet bgs. The drive probe test is based on a "relative density" exploration device used to determine the distribution and to estimate strength of the subsurface soil units. The resistance to penetration is measured in blows-per-½-foot of an 11-pound hammer which free falls roughly 39 inches driving a 3/4-inch outside diameter pipe with a 1-inch diameter endcap into the ground. This measure of resistance to penetration can be used to estimate relative density of soils. For a more detailed description of this geotechnical exploration method, please refer to the Slope Stability Reference Guide for National Forests in the United States, Volume I, USDA, EM-7170-13, August 1994, P 317-321. Results of the drive probe tests are reported in Appendix C.

Select soil samples were tested in the laboratory to determine material properties for our evaluation. Laboratory testing was accomplished in general accordance with ASTM procedures. The testing performed included moisture content testing (ASTM D2216) and fines content determination (ASTM D1140). The test results have been included on the Exploration Logs in Appendix C.

As mentioned earlier, test pits TP-1 to TP-3 and TP-8 are the most relevant for the current proposed extent of the SPS (i.e., the northernmost approximate 150 feet of the Beach Grass Lane Common Area). In general, we encountered two sand layers with different characteristics: a medium-grained sand overlying yellow brown fine- to medium-grained sand which extended to the terminal depths of the explorations. Each of the strata we encountered in our explorations are described below:

Two separate layers of coarse-grained soils were observed in the test pits. In TP-1, TP-3, andTP-8 (beach and bluff test pits), we encountered a light brown medium-grained sand. Laboratory moisture content testing on samples obtained within this stratum ranged from 4 to 15 percent indicating a moist to wet condition. Fines content laboratory testing for a sample obtained within this stratum yielded a result of less than one percent passing the #200 sieve. Based on drive probe testing and excavator digging effort, this stratum was generally loose. This stratum extended to a depth of 8 to 10 feet bgs in TP-1 and TP-3 and to the extent explored in TP-8. TP-1 encountered a boulder at 6 feet in depth that is from previous revetment efforts on the adjacent property.

Underlying the layer described above was a yellow brown fine- to medium-grained sand that was observed in TP-1 and TP-3. Laboratory moisture content testing on samples obtained within this stratum ranged from 5 to 21 percent indicating a wet to saturated condition. Fines content laboratory testing for samples obtained within this stratum was less than one percent passing the #200 sieve. Based on drive probe testing and excavator digging effort, this stratum was generally medium dense. This stratum extended to the maximum depths explored in TP-1 and TP-3 (beach test pits) and wasn't observed in any of the bluff test pits (TP-8).

The classifications noted above were made in accordance with the Unified Soil Classification System (USCS) as shown in Appendix D. The above subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The exploration logs included in Appendix C should be reviewed for specific information at specific locations. These records include soil descriptions, stratifications, and locations of the samples. The stratifications shown on the logs represent the conditions only

at the actual exploration locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual. Water level information obtained during field operations is also shown on these logs.

2.5 Groundwater Information

We encountered groundwater at depth of approximately 8 to 10 feet bgs in TP-1 through TP-5 at the time of our explorations (test pits located on the beach). We did not encounter groundwater in TP-6 through TP-8 (test pits located above the bluff).

It should be noted that groundwater conditions can fluctuate based on changes in land use, seasonally changing climatic conditions, and/or ocean tidal conditions.

3.0 GEOTECHNICAL EVALUATION AND RECOMMENDATIONS

3.1 Bluff Slope Erosion Factors of Influence

Based on the information provided to us, as well as our subsurface investigation and literature review, it is our professional opinion that the primary factors influencing the stability of the bluff slope, as well as future impacts to the Project Area and existing structures, include the following:

1. **Erosional Retreat** – Coastal erosion is the primary hazard affecting this property, particularly from tidal and wave impacts during seasonal storm events. Notably, a mass erosion event between January and February 2024 resulted in the loss of approximately 100 to 150 feet of beach frontage across the Project Area. The conditions observed suggest that a localized rip embayment has formed along the Beach Grass Lane common area, channeling ocean waves toward this part of the Salishan shoreline.

   Rip embayments, which can form randomly along the coast, are particularly destructive because they create deeper troughs in the nearshore sand deposits, concentrating wave energy on the bluffs and dunes. This can cause rapid and extensive erosion, as seen historically in other parts of the Salishan Spit. Due to the rip embayments, the Project Area faces an imminent risk of ongoing erosion and potential structural damage. The current presence of a rip embayment suggest that the Project Area is subject to focused and ongoing erosion, posing an imminent risk to the bluff, the Beach Grass Lane access road, and adjacent residential properties.

   It is important to note that while the riprap revetment is designed for durability, coastal processes are inherently dynamic. Without regular monitoring and maintenance, riprap structures are susceptible to damage from persistent wave activity. However, with proper design, upkeep, and timely repairs, erosion below the top elevation of the revetment can be effectively minimized.

   Given the property's history of severe erosion, the proximity of vulnerable infrastructure, and the increased flooding risk associated with sea level rise and climate variability, there is a reasonable need for robust permanent shoreline protection. We recommend armoring the shoreline with riprap revetment to stabilize the bluff toe, dissipate wave energy, and reduce the potential for continued bluff regression and slope failure. **In our opinion, this measure is essential for protecting local and private infrastructure, reducing future erosion hazards, and enhancing the long-term resilience of the site. While the southern portion will remain unprotected at this time, the imminent risk of structures is not present compared to the proposed project area. If substantial erosion is observed in the southern portion of the beach front emergency action can be performed to protect the area until the entirety of the Beach Grass Lane common area beach front can be protected with the SPS.**

2. **Regional Seismic Hazard** – Peripheral to the coastal erosion hazard, the change in conditions that would result from a regional seismic event would likely exacerbate coastal erosion impacts. Abundant evidence indicates that a series of large earthquake related to the Cascadia Subduction Zone (CSZ) have occurred

along the coastline of the Pacific Northwest over thousands of years. The Oregon Department of Emergency Management reports on their website that the calculated possibility of a CSZ earthquake will occur in the next 50 years ranges from 7 to 15 percent for a rare great earthquake (i.e. 9.0+ magnitude), to about 37 percent for a major earthquake (i.e. 7.0 to 7.9 magnitude). **It should be noted, it is our professional opinion, the proposed project will not contribute to or exacerbate regional seismic hazards.**

A CSZ earthquake or other strong seismic event could trigger a tsunami, potentially damaging the proposed riprap revetment. In addition, a design level earthquake could result in severe seismic ground shaking on the subject property lasting for several minutes. Based on geologic deposits from past CSZ earthquake it is possible that broad areas of the coastline could experience rapid co-seismic subsidence or down dropping as accumulated tectonic stress is released during the earthquake. Many low-lying coastal areas may subside below sea level or into flood ways of estuaries and tsunamis, which could change erosional patterns of the area. A subduction zone earthquake would also likely result in soil liquefaction and lateral spreading in loose, saturated sand deposits along the coast and bays.

It is important to note that designing the riprap revetment to withstand seismic forces is not practical. The revetment is intended to mitigate erosion, but it cannot prevent damage from large-scale seismic events or the associated coastal changes.

3. **Climate Change** – Also peripheral to the coastal erosion hazard, climate change will likely contribute to increased coastal erosion impacts to the property. Despite offsetting effects of tectonic uplift, sea levels are rising on the northern Oregon coast and global climate models are projecting increasing rates of rise in the future (Guidebook on Erosion Control Practices on the Oregon Coast, State of Oregon Department of Land Conservation and Development [DLCD], 2021). The potential impacts of sea level rise on the subject property include flooding, increased wave heights, and erosion of the beach and bluff. As with seismic considerations, climate change is a factor that will only exacerbate the current state of erosional susceptibility of the subject property. This is additional justification for installing the more robust structural shoreline protection solution (riprap) for this property.

   The impacts of climate change will likely necessitate increased monitoring and maintenance of the revetment to ensure its continued effectiveness. The proposed project aligns with these considerations and will not negatively affect the evolving hazard conditions. **Instead, it provides a proactive solution to safeguard the subject properties against future climate-driven challenges.**

4. **Slope Stability Hazard** – As noted in Section 2.3.3, the site is mapped within a Low to High Susceptibility to Landsliding Area. Additionally, the current slope geometry has a near vertical cut located just west of Beach Grass Lane that has undergone erosion to the toe of the bluff. Given the current condition of the bluff, a landslide event would likely cause a considerable loss of useable ground surface at the top of the bluff, where Beach Grass Lane is currently located.

The construction of the proposed revetment will provide protection of the bluff by providing a buttress for the over-steepened bluff as well as reducing the likelihood of future erosion to the toe of the bluff.

Given the property's history of significant erosion and wave overtopping, as well as the increasing risks associated with seismic activity and climate change, we strongly recommend the construction of an approximate 150-foot-long, robustly engineered SPS (i.e. riprap revetment). This structure is intended to protect the Project Area from anticipated ocean processes and ongoing coastal erosion impacts.

In the absence of permanent shoreline protection, continued bluff regression, wave overtopping, and erosion are expected to accelerate. These processes pose an imminent threat to the adjacent Beach Grass Lane roadway and significantly increase the potential for flooding, which could result in severe damage to nearby residences and potentially compromise Salishan Drive.

3.2 Riprap Revetment Recommendation

To mitigate future ocean wave erosion and the resulting bluff recession, we recommend constructing a riprap revetement at the base of the subject northern section of the bluff. The proposed revetment will extend approximately 150 feet in length covering the northern section of the Beach Grass Lane Common Area beachfront, as shown in Appendix E. The revetment will be composed of several layers: armor rock on the surface, underlain by filter rock, pit run, and filter fabric. Typical cross-section details and specifications for the revetment are provided in Appendix F.

3.2.1 Subgrade Preparation and Excavation

Prior to the start of revetment construction, any loose debris at the base of the bluff should be removed (e.g., sloughed soil, boulders, etc.). Then, revetment construction should begin with the overexcavation of loose surface sands to expose the underlying medium dense sand. A minimum 2-foot-deep key trench should then be excavated into the medium dense sand. Based on these conditions, we recommend setting the bottom of the SPS at an elevation of approximately 6 feet above msl. The trench depth must be approved by a Certerra representative during construction. Excess sand from the excavation can be spread uniformly over the beach, ensuring it remains above the Mean High Water (MHW) level and is no thicker than 1 foot.

3.2.2 Installation of Filter System

We recommend placing a woven filter fabric (Mirafi Filterweave® 700 or equivalent) from the top of the slope down to the bottom of the key trench, wrapping the lowermost armor stones within the trench. This fabric provides separation and prevents migration of fines.

A 6-inch-thick layer of pit run (4-inch minus) should be placed over the filter fabric and lightly compacted, followed by a 1.5-foot-thick layer of filter rock (12-inch minus). This bedding layer should provide a stable transition between the pit run and the armor rock and reduce the risk for settlement between the armor layer. All fill and

bedding materials should be placed carefully to avoid tearing the filter fabric, and lightly compacted using appropriate equipment (e.g., excavator bucket or jumping jack).

In areas where voids exist between the bluff face and the revetment (if any), pit run should be used as backfill, placed and compacted in 1-foot-thick lifts. Total backfill thickness may reach up to 8 feet, depending on site conditions. Structural fill should be moisture conditioned to within 3 percent below to 2 percent above optimum moisture content (per ASTM D1557) and compacted to a minimum of 92 percent of Modified Proctor maximum dry density. Each lift should be tested for density and approved by Certerra prior to placing subsequent lifts.

3.2.3 Armor Rock Placement and Revetment Slope

Overlying the filter system, the armor rock can then be placed. The armor rock layer should consist of individual rock ranging from approximately 3 to 8 feet in diameter, with a minimum overall thickness of 7 feet. Rocks should be placed in an interlocking fashion, with at least three points of contact, starting at the toe of the structure and progressing upward. When placing the armor rock, the largest diameter rocks should be positioned on the structure's outer face to resist wave impact. During installation, the armor rock should be moderately compacted (i.e. "knuckled" into place) using a backhoe or excavator to ensure proper interlocking.

The slope of the revetment should not exceed 2H:1V to maintain stability while providing effective protection against coastal erosion. We recommend the revetment extend to an elevation of **33 feet** above msl or to the top of the existing bluff (whichever is lower). In areas where topographic constraints prevent reaching this elevation, we recommend extending the revetment laterally by an additional 15 feet inland (where feasible) to mitigate potential scouring and undermining at the crest of the structure. This inland extension will further protect against future erosion that could compromise the revetment.

Where possible, the new revetment should be keyed into and integrated with adjacent existing shoreline protection structures to maintain continuity and minimize flanking or end-around erosion. We understand constructing the proposed revetment within the Special Flood Hazard Area (SFHA) located west of the proposed revetment, will require special permitting that will likely take additional time for public comment. To allow construction to proceed as early as possible, we recommend the revetment be constructed up to the SFHA zone mapped on the Lincoln County GIS maps and shown on Appendix E.

3.2.4 Maintenance Considerations

While the riprap revetment is designed for durability, it is important to recognize that coastal processes are dynamic. Regular maintenance and occasional repairs will be necessary to ensure the revetment's effectiveness. Additionally, although the revetment will reduce erosion at the toe of the bluff and improve overall slope stability, oversteepened slopes remain susceptible to erosion and sloughing. As such, there is still a risk of instability along the oversteepened slope. We recommend regular monitoring of the slope for signs of slope movement or instability.

3.3 Summary of Hazards and Project Interaction

This section summarizes the known and suspected geologic and seismic hazards present within the project area and describes how the proposed SPS may affect, or be affected by, those hazards. This summary is intended to consolidate hazard-related discussions presented elsewhere in this report for clarity and regulatory review.

3.3.1 Coastal Erosion Hazard

The project area is mapped entirely within the Very High (Active) Coastal Erosion Hazard Zone, indicating ongoing and future exposure to high-energy wave attack, elevated water levels, and storm-driven shoreline retreat. These processes subject the proposed revetment to cyclic wave loading, armor stone displacement, likely requiring long-term maintenance of the proposed revetment.

The proposed riprap revetment is specifically designed to mitigate coastal erosion by armoring the bluff toe, dissipating wave energy, and reducing direct wave attack on the oversteepened bluff face. While the revetment will not eliminate regional shoreline retreat or alter long-term coastal geomorphic trends, it is expected to substantially reduce the rate of erosion at the project area, limit bluff recession, and decrease the likelihood of roadway undermining. The revetment does not create new erosion hazards but rather addresses an existing, active hazard condition.

3.3.2 Earthquake, Liquefaction and Tsunami Hazards

The project area is subject to severe ground shaking from Cascadia Subduction Zone (CSZ) and local crustal earthquake, susceptible to liquefaction during strong seismic shaking, and is located within a mapped tsunami inundation zone. Strong seismic shaking could cause liquefaction, settlement, lateral spreading, or deformation of underlying sandy soils, potentially resulting in localized displacement or distortion of the revetment. Tsunami inundation and post-seismic coastal reconfiguration could damage armor stone placement or alter beach elevations adjacent to the structure.

The proposed revetment will not increase seismic, liquefaction, or tsunami hazards and does not influence earthquake occurrence, tsunami generation, or inundation extent. While the SPS is not designed to resist or prevent earthquake or tsunami forces, its mass and flexibility are expected to perform more robustly than non-structural alternatives in the aftermath of a seismic event. By continuing to provide bluff toe protection following an earthquake, the revetment may reduce secondary erosion and slope instability during post-event recovery periods.

3.3.3 Landslide and Bluff Stability Hazard

The existing bluff is oversteepened due to ongoing erosion and is susceptible to localized sloughing or shallow slope failures, posing an imminent risk to the roadway above. Such failures could introduce additional load or debris against the revetment face, potentially increasing maintenance needs but not compromising overall structural stability if properly maintained.

certerra.com 2411 Southeast 8th Avenue, Camas, WA 98607 T: 360.567.1806

The proposed revetment will function as a buttress to the oversteepened slope, significantly reducing toe erosion (the primary driver of slope instability at this site). By stabilizing the bluff, the SPS reduces the likelihood of slope failures that could otherwise threaten Beach Grass Lane. While minor surficial sloughing of the upper bluff may still occur, the revetment is expected to substantially lower overall landslide risk associated with marine erosion.

3.3.4 Climate Change and Sea Level Rise

Projected sea level rise and increasing storm intensity are expected to increase wave run-up, inundation frequency, and erosive forces over time, placing additional long-term stress on the revetment and increasing the need for monitoring and maintenance.

The proposed revetment does not contribute to climate change or sea level rise but serves as an adaptive response to these evolving conditions. The SPS is intended to provide durable, long-term erosion protection under changing coastal conditions, recognizing that periodic maintenance may be required to maintain effectiveness as hazard intensity increases.

3.3.5 Overall Hazard Interaction and Project Effect

The proposed shoreline protection structure will not create, worsen, or transfer geologic or seismic hazards. Instead, it mitigates an existing, active erosion and slope stability hazard threatening critical infrastructure. While the revetment cannot prevent damage from extreme seismic or tsunami events, it provides a reasonable, site-appropriate level of hazard reduction consistent with current regulatory guidance and site constraints.

certerra.com 2411 Southeast 8th Avenue, Camas, WA 98607 T: 360.567.1806

4.0 CONSTRUCTION INSPECTIONS AND CONSIDERATIONS

4.1 Recommended Geotechnical Inspections

Certerra should be retained to perform geotechnical construction inspections to verify construction complies with the geotechnical engineering recommendations contained in this report. Certerra cannot accept responsibility for any conditions that deviate from those described in this report, if not engaged to also provide construction observation for this project.

At a minimum, we recommend the following "Special Inspections" be performed by Certerra during construction.

1. Observation of subgrade preparation beneath the proposed revetment footprint, including the 2-foot deep key.
2. Observation of filter fabric, filter rock, and armor rock placement (verify material type, thickness, and inclination).
3. Placement and compaction of pit run to fill any voids between the existing bluff slope and the proposed revetment structure.
4. Final revetment inspection.

Note that the construction team and/or governing jurisdiction may require additional inspections.

4.2 Construction Considerations

We are providing the following construction considerations for the subject project:

1. **Site Access and Equipment Staging** – Construction equipment, materials, and workers will need to access the site from the beach, depending on tides and site conditions. A detailed plan for equipment staging, material storage, and access routes should be developed by the contractor to minimize disruption to the surrounding environment and ensure safety.

2. **Sequencing of construction activities** – The sequencing of the revetment construction can be performed in a phased approach so that only small section of the subject revetment are constructed at a time.

3. **Managing tidal influences and weather conditions** – Construction should be planned around tidal cycles, with activities scheduled during low tide to reduce the risk of seawater inundation. Coastal weather patterns, particularly storm forecasts, must be closely monitored to avoid construction during adverse conditions. Temporary water control measures, such as berms or barriers, may be necessary to prevent wave overtopping or flooding during excavation activities near the shoreline.

4. **Material handling and placement** – Armor rock must be placed carefully to ensure proper interlocking, with at least three points of contact between each rock to resist displacement from wave action. Filter fabric must be handled carefully during installation to prevent tearing or gaps, ensuring proper prevention of fine material migration.

5. **Erosion control during construction** – Temporary erosion control measures, such as silt fences, sandbags, or straw wattles, should be employed to prevent soil erosion and sediment runoff during construction.

6. **Environmental and regulatory compliance** – All construction activities must comply with local, state, and federal regulations. Ensuring that the necessary permits are in place and that all regulatory requirements are met is critical.

It should be noted, the construction means and methods are ultimately up to the contractor.

5.0 POTENTIAL IMPACTS AND ADDITIONAL CONSIDERATIONS

5.1 Impacts to Sand Source, Supply, and Movement

Sand supplies along the Oregon coast are derived primarily from two sources: (1) from sediments carved by streams and rivers that discharge to coastal areas; and (2) from erosion of bluffs, headlands, and dunes. Due to their relative hardness, the bluff and headland sand supplies are minor compared to those derived from dunes and streams.

During El Niño events, the entire sand supply may be removed from portions of a littoral cell and deposited elsewhere, usually at the northern end, exposing the bluffs and dunes to rapid erosion. The bluff material and talus eroded during the storm events will also disappear, generally by moving offshore, then gradually returning during summer months. When conditions return to normal, it may be several years before the beaches and dunes recover their pre-El Niño configurations. The areal distribution of the bluff and talus material removed during an El Niño event is nearly impossible to determine, and estimating the amount of sand supply loss to the coastal system by this particular structure is very difficult. Like other areas of the northern coast, the beaches in the Salishan area have historically gone through periods of severe erosion and minor dune construction, and the historical record is not sufficient to infer the overall trend. The variability in erosion and deposition of sands is influenced by general ocean currents, waves, rip currents, jetties, spits, and other structures and phenomena, but is ultimately controlled by global climate conditions and the relative elevation of the sea level.

As stated above, we are proposing to construct a new SPS along the northernmost approximate 150 feet of the Beach Grass Lane Common Area to protect the critical infrastructure in its vicinity. By reducing the supply of erodible material (in this case, the fine-grained exposed bluff soils), there is also inherently a reduction of material supply within the littoral cell. However, based on the relative width of the proposed SPS (150 feet), the quantity of material that would have been transported from the subject property is a nominal volume relative to the scale of the littoral cell.

5.2 Analysis of Hazard Avoidance

Alternatives to the recommended hazard avoidance measure (SPS construction) considered include each of the non-structural and structural shoreline protection described in the "Guidebook on Erosion Control Practices on the Oregon Coast" (referred to herein as the Guidebook).[13] This includes vegetative stabilization (including burrito structures), dynamic cobble berms, and sand alteration.

5.2.1 Vegetative Stabilization Structures

One of the alternatives to the SPS construction we considered in our analysis is vegetative stabilization (also referred to as soil or sand burrito structures, or burrito terraces). This approach can range from simply planting

[13] Hailey Bond, *Guidebook on Erosion Control Practices of the Oregon Coast* (2021), Oregon Department of Land Conservation & Development.

vegetation along the shoreline – potentially in combination with minor regrading, placement of fill, or use of planting media such as topsoil – to more involved methods such as constructing non-structural bank stabilization features (e.g., "burrito" berms made of sand, clay, or soil wrapped in geotextile fabric), which are then planted with native vegetation.

While vegetative stabilization may be effective in low-energy environments or areas with limited erosion potential, it is not well-suited to high-energy coastal sites like this one, where wave action and ongoing bluff retreat are too severe to allow for the successful establishment of vegetation or to prevent erosion of the underlying terraced soil structure. In such conditions, these measures are unlikely to provide adequate protection against continued erosion impacts.

It is our understanding that the only attempted implementation of soil burrito structures along the Oregon coast are located in Cannon Beach, where several vegetated clay burrito structures have been installed to varying levels of observed success. As a basic concept of coastal erosion, unconsolidated fine-grained soil (silt and clay) and sand will erode relatively quickly when impacted by ocean waves. From both a geotechnical and coastal erosion control standpoint, the purpose the vegetated soil burrito structure is twofold: (1) the purpose of the soil burritos is to support the slope; and (2) the purpose of the soil-covered, vegetated surface is to try to allow vegetation to take hold and add surficial cover to try to prevent the erosion of the soil burrito structure. Vegetative stabilization can be an alternative to the more robust structural solutions in some areas of the Oregon Coast; however, it is not suited to areas where the erosion conditions are too severe to allow establishment of vegetation, or to prevent erosion of the underlying terraced soil structure.

It is our professional opinion that the use of vegetated sand or soil burrito structures at the project location will not work, and is not an appropriate shoreline protection alternative for this location based on the site specific erosion and wave energy conditions. This is due to site-specific challenges including high-energy wave impact and ongoing observed bluff erosion. Pursuing the engineered riprap shoreline protection structure is recommended as a durable and effective shoreline protection measure to safeguard the property against the severe coastal processes present at this site.

5.2.2 Cobble Berm

Another non-structural solution we considered in our analysis is a cobble berm (also referred to as a dynamic revetment). Cobble berms are engineered beaches made of cobblestones between 2.5 and 10 inches in diameter, constructed at a low slope angle (e.g., on the order of 11 degrees), and require a substantial footprint to be effective. Given the cobble berm is an engineered beach, not a structure or other mitigation improvement fixed in place for the protection of an individual property, they are not effective at the scale of an individual property.

The effectiveness of a cobble berm is directly tied to its expansive footprint. The most comprehensive study on the potential use of cobble berms on the Oregon coast was prepared by professional geologists/coastal geomorphologists at the Oregon Department of Geology and Mineral Industries (DOGAMI) for the Oregon

Department of Transportation.[14] Based on their comprehensive analysis of natural and engineered cobblestone beaches, the authors concluded that dynamic revetments should have a minimum crest elevation of at least 23 feet[15] and width of 66 feet.[16] Furthermore, the only two dynamic cobble revetments on Oregon beaches expand a length of greater than 1,000 feet.[17] The necessary footprint of dynamic cobble berm revetments would not work on this site. Because the rocks are designed to move, they would be quickly pushed off the relatively small site.

Finally, as recognized in the DOGAMI study and state Guidebook, cobble berms are not recommended in developed areas because the cobblestones may become projectiles during severe storms.[18] This would be a risk to the public.

It is our professional opinion that the subject property is too small on an individual scale for a cobble berm to be effective. In addition, it is our professional opinion that the high energy waves in this area would remove the stabilizing effects of the cobbles in a short period of time.

5.2.3 Sand Alteration

Another stabilization method outlined in the Guidebook is sand alteration. Sand alteration is fairly common on the east coast of the U.S. where the wave climate is significantly milder; however, this has only been attempted in a few areas of the west coast such as San Diego, California. The process involves moving hundreds of thousands of cubic yards of sand within littoral cells or bringing sand from other sources in attempts to encourage dune building and to shore-up erosion-damaged areas. Typically, this involves large amounts of government spending and long-term commitments. The reality is that intense climatic events such as El Niño and La Niña, or in recent cases, an unusually severe storm or rip embayment, can remove hundreds of thousands of cubic yards of material in a few days' time, again exposing the shorelines to intense erosion. The practice of sand alteration usually requires vast areas of beach to be even moderately effective, so this would not be a viable solution for the small subject property.

5.2.4 Relocation of Existing Buildings or Infrastructure

As described above, the erosion of the bluff will begin to impact the access road Beach Grass Lane, which runs in the east to west direction. The access road provides beach access to the SLI community as well as primary access to the residence at 20 Beach Grass Lane. Residential structures border Beach Grass Lane to the north, which does not allow for relocating the access road further north to move it further away from the receding bluff. Relocating Beach Grass Lane to the south would not prevent future loss of support from the receding bluff. **In**

14 Jonathan C. Allan, Ron Geitgey, & Roger Hart, *Dynamic Revetments for Coastal Erosion in Oregon* (Aug. 2005) available at https://www.oregon.gov/odot/Programs/ResearchDocuments/DynamicRevetments.pdf.

15 *Id.* at 64.

16 *Id.* at 69, 71.

17 *Id.* at 25.

18 Guidebook at 40.

our opinion, based on the location and local topography of the access road, Certerra does not consider relocation of the road as a viable solution.

5.2.5 Other Solutions

As described above, vegetative stabilization, cobble berms, and sand alteration are not sufficient at the subject property to resist the high-energy wave attack in order to substantially slow or halt erosion, and prevent the continued eastward movement of wave runup/flooding.

In addition, we do not believe softer solutions such as sand bags, gravel mounds, logs, or composite revetments would prove effective. Sand tubes have been used on the Atlantic coast with some success by placement offshore, which causes waves to break early and lose energy before reaching the shorelines. However, because of the extremely high wave energy, these structures have not been shown to have acceptable performance during severe storm events and over longer periods of time along the west coast. We do not believe these softer solutions have been satisfactorily proven to work in the type of coastal environment found at the site.

5.2.6 Conclusion

Based on our evaluation of non-structural shoreline protection alternatives outlined in the DLCD Guidebook, including vegetative stabilization, dynamic cobble berms, and sand alteration, it is our professional opinion that none of these approaches are a viable or effective solutions for mitigating erosion along the subject bluff. While non-structural and nature-based alternatives can be effective in lower-energy environments or in combination with other measures, they do not provide sufficient protection under the high-energy coastal conditions observed at this site. Evidence of ongoing erosion, bluff retreat, and slope instability suggests that the site is subject to persistent wave impact and extreme seasonal conditions, which exceed the performance capacity of non-structural measures. Accordingly, a robust, engineered structural solution, such as the proposed shoreline protection structure (SPS), is warranted to protect the subject property and associated infrastructure from ongoing and future erosion hazards.

5.3 Other Considerations

The following discusses the general concerns that OPRD and the reviewing agencies and groups generally consider when evaluating an SPS Permit Application:

1. **Public Rights** – The proposed SPS will be constructed on private property owned by the SLI group and no public beach access will be obstructed or lost as part of the revetment installation.

2. **Public Laws** – The project meets Statewide Planning Goal 18 criteria allowing beachfront protective structures to be permitted within the Salishan Exception Area, which the subject property has been confirmed to be located in. Therefore, the subject property may be eligible for shoreline stabilization. To proceed with the SPS permit application, a Land Use Compatibility Statement (LUCS) is planned to be obtained from the Lincoln County Planning Department. In addition, we understand a Floodplain

Development Permit is also required and will need to be requested from the Lincoln County Planning Department. Regarding compliance with other federal and state law, a permit from the U.S. Army Corps of Engineers (USACE) or the Oregon Department of State Lands (DSL) is not required for this project.

3. **Public Costs** – The proposed SPS will be constructed on private property and maintained by the Applicant. Therefore there are no substantive public costs associated with this project. Further, SLI will bear all costs for the revetment construction, and for any construction restoration activities performed after the revetment has been completed. There will be no direct indirect cost to the public as a result of the SPS construction.

4. **Scenic Concerns** – The project will closely follow existing bluff profiles in the area and will not alter any major landforms. Most lots surrounding the project site already have an SPS in place, therefore this structure would not stand out from the existing beach front. The structure will not obstruct views of the ocean or beach from adjacent properties and will be consistent with other revetments in the area.

5. **Recreational Usage** – During the worst of conditions, high tides and storm waves cover the beach up to the base of the existing revetments and beachfront slopes. During normal and summer conditions, the beach may be as much as 200 feet wide at low tide. This structure will not alter or worsen the existing conditions. During normal seasonal weather patterns, the usage of the beach in this area will not change because of this structure. No important public access routes within the ocean shore area will be blocked.

6. **Neighboring Properties** – Several lots in the project vicinity already have an SPS in place. Based on the principles of sand source, supply, and movement within a littoral cell, the presence of these other revetments has increased the potential for future wave erosion and continued rapid bluff retreat on the subject property. The continued erosion at the subject property without a SPS could negatively impact the neighboring properties by exacerbating erosion along the bluff slope and potential flooding of the property vicinity. This could eventually breach Salishan Drive, which is critical infrastructure to the community. The proposed revetment will protect the properties and provide a smooth line of shoreline protection along the beachfront in this area, graded to match the current embankment slope of the neighboring properties. Constructing an SPS to protect the subject property is unlikely to have a measurable negative effect on the neighboring properties.

7. **Impacts from the construction activities and measures to minimize the impacts** – Impacts to the beach in the project vicinity can result from SPS construction. These may include impacts to public access, public recreation opportunities, public safety, and surrounding ecosystems. Among these, the primary applicable impacts are construction-related safety hazards and limitations of public access due to construction work. Given accessibility limitations, the proposed construction will need to occur from the beach level. As such, a detailed Construction, Staging, and Safety Plan should be prepared (typically by the contractor) that addresses the potential for temporary limitations to public access or recreation, and safety risks that could result from the construction work (if unmitigated). Aside from the revetment

construction itself, no substantial or permanent physical alterations to the beach are required for staging or construction activities.

certerra.com
2411 Southeast 8th Avenue, Camas, WA 98607
T: 360.567.1806

6.0 REPORT LIMITATIONS

As is standard practice in the geotechnical industry, the conclusions contained in our report are considered preliminary because they are based on assumptions made about the soil, rock, and groundwater conditions exposed at the site during our subsurface investigation. A more complete extent of the actual subsurface conditions can only be identified when they are exposed during construction. Therefore, Certerra should be retained as your consultant during construction to observe the actual conditions and to provide our final conclusions. If a different geotechnical consultant is retained to perform geotechnical inspection during construction, then they should be relied upon to provide final design conclusions and recommendations, and should assume the role of geotechnical engineer of record.

The subject property is located on a foredune fronting the Pacific Ocean. This property is subject to very dynamic forces (i.e. powerful winter storms, ocean currents, and earthquakes). The conditions of the subject property could change drastically in the future due to these forces and cannot be entirely predicted, nor can they be fully mitigated. These risks are common to other similar properties in the area.

The geotechnical recommendations presented in this report are based on the available project information and the subsurface materials described in this report. If any of the noted information is incorrect, please inform Certerra in writing so that we may amend the recommendations presented in this report if appropriate and if desired by the client. Certerra will not be responsible for the implementation of its recommendations when it is not notified of changes in the project.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

The subsurface explorations performed for this geotechnical study represent the subsurface conditions at discrete locations on the project site. The number of explorations were sufficient to provide geotechnical engineering recommendations for the proposed retaining wall project, but may not be sufficient to eliminate all risk of differing or unanticipated subsurface conditions elsewhere along the proposed retaining wall alignment. When developing the construction schedule and budget, it should be assumed that the subsurface could conditions may vary across the site. To reduce the risk of encountering differing or unanticipated conditions during construction, we are available to perform additional subsurface explorations upon request.

This report has been prepared for the exclusive use of Salishan Leaseholders Inc. for the specific application to the proposed riprap revetment located at the northernmost approximate 150 feet of the Beach Grass Lane Common Area shoreline on Tax Lots 08-11-09-AA-00235-00, in Gleneden Beach, Lincoln County, Oregon. Certerra does not authorize the use of the advice herein nor the reliance upon the report by third parties without prior written authorization by Certerra.

APPENDICES

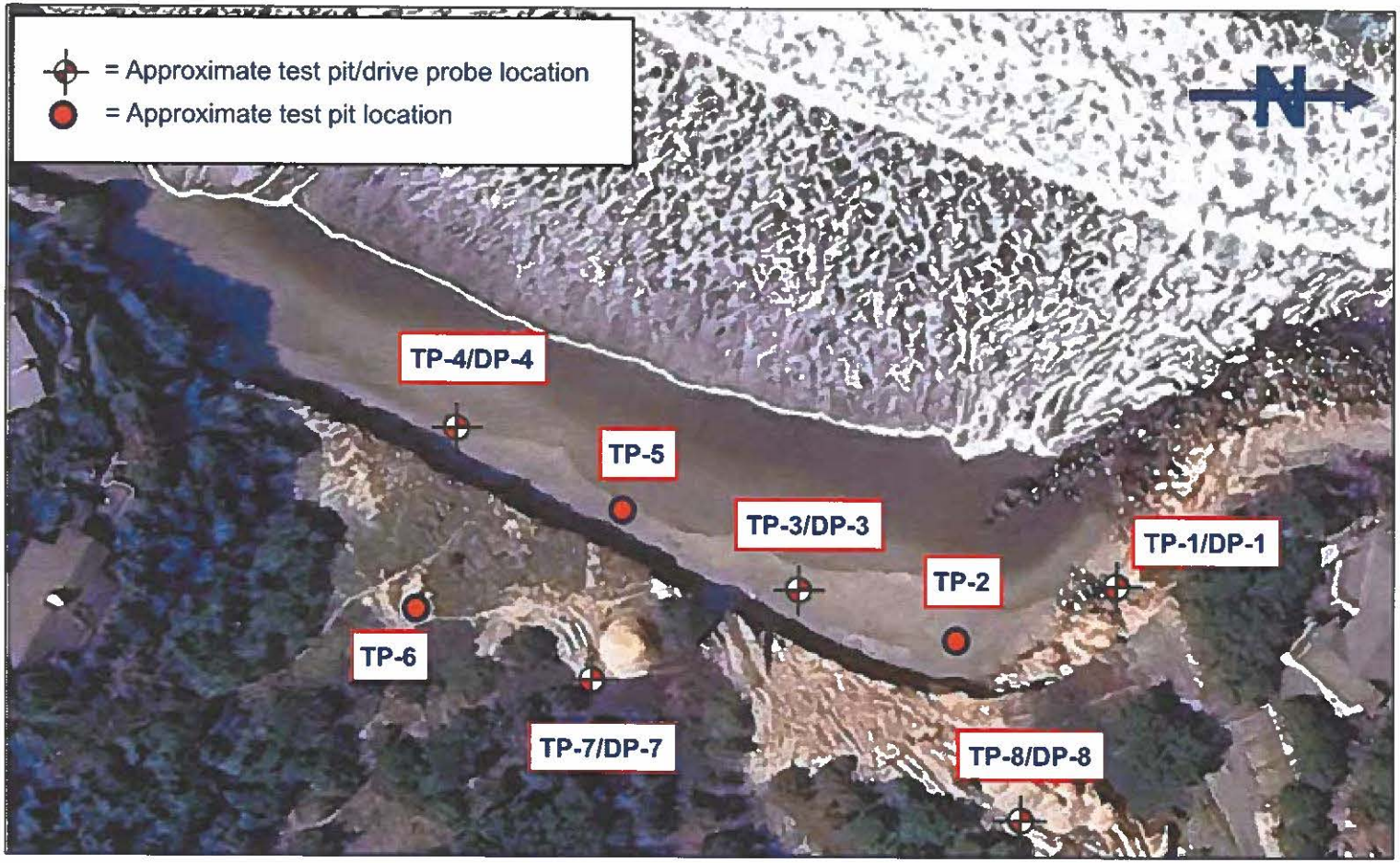
APPENDIX A – SITE LOCATION PLAN



Base map sources: https://google.com/maps/, accessed 9/16/2024

CERTERRA EARTH ENGINEERS	**Proposed Shoreline Protection Structure Beach Grass Lane Common Area Gleneden Beach, Lincoln County, Oregon**	**Report No. 10-242036-1-R2**	**January 12, 2026**

APPENDIX B – EXPLORATION LOCATION PLAN



Base plan source: Google Earth aerial image dated February 23, 2024.

CERTERRA
EARTH ENGINEERS

Appendix C: Test Pit TP-1

Client: Salishan Leaseholders Inc
Project: Beach Grass Lane Common Area Revetment
Site Address: Beach Grass Lane
Gleneden Beach, Lincoln County, Oregon
Location of Exploration: See Appendix B
Logged By: Matt Enos, R.G.

Report Number: 10-242036-01
Excavation Contractor: Dan Kauffman Excavation, Inc
Excavation Method: Excavator
Excavation Equipment: Komatsu PC 360 LC, 48" bucket
Approximate Ground Surface Elevation (ft msl): 17-19
Date of Exploration: 11/1/24

Depth (ft)	Water Level	Lithology: Lithologic Symbol	Lithology: Geologic Description of Soil and Rock Strata	Sampling Data: Sample Number	Sampling Data: Drive Probe (0 50 100)	Sampling Data: Moisture Content (%)	Sampling Data: % Passing #200 Sieve	Sampling Data: Liquid Limit	Sampling Data: Plastic Limit	Remarks
0			SAND (SP); light brown; moist; very loose to medium dense; medium grained; poorly graded		1					
1					3					
2					3					
3					3					
4					4					
5					6					
6					7					
7					12					
8				GRAB-1	11	8				
9					12					
10					11					
11					9					
12					11					
13					7					
14					7					
15					11					
16					13					
17					15					
18					13					
19					10					
20			basalt boulder (remnant revetment structure)							severe caving
21										
22										
23										
24										
25										
10	▼		SAND (SP), yellow brown; wet; medium dense; fine to medium grained; poorly graded	GRAB-2	10	20	1			
11					10					
12					11					
13					12					
14					14					
15					14					
16					11					
17					13					
18					15					
19					15					
20					20					
21					18					
22					22					
23					19					
24					24					
25					28					
					33					
					39					
					42					

Notes: Test pit terminated at approximately 10.5 feet bgs. Groundwater was encountered at approximately 10 feet bgs at the time of exploration. Test pit backfilled with excavated material and compacted on 11/1/24. Approximate elevation from Google Earth.

CERTERRA
EARTH ENGINEERS

Appendix C: Test Pit TP-2

Client: Salishan Leaseholders Inc
Project: Beach Grass Lane Common Area Revetment
Site Address: Beach Grass Lane
Gleneden Beach, Lincoln County, Oregon
Location of Exploration: See Appendix B
Logged By: Matt Enos, R.G.

Report Number: 10-242036-01
Excavation Contractor: Dan Kauffman Excavation, Inc
Excavation Method: Excavator
Excavation Equipment: Komatsu PC 360 LC, 48" bucket
Approximate Ground Surface Elevation (ft msl): 17-19
Date of Exploration: 11/1/24

Depth (ft)	Water Level	Lithology: Lithologic Symbol	Lithology: Geologic Description of Soil and Rock Strata	Sampling Data: Sample Number	Sampling Data: Drive Probe (0 50 100)	Sampling Data: Moisture Content (%)	Sampling Data: % Passing #200 Sieve	Sampling Data: Liquid Limit	Sampling Data: Plastic Limit	Remarks
0–9			SAND (SP); light brown; moist; very loose to medium dense; medium grained; poorly graded	GRAB-1		6				severe caving
10	▼			GRAB-2		20				
10–10.5			SAND (SP), yellow brown; wet; medium dense; fine to medium grained; poorly graded							
11–25										

Notes: Test pit terminated at approximately 10.5 feet bgs. Groundwater was encountered at approximately 10 feet bgs at the time of exploration. Test pit backfilled with excavated material and compacted on 11/1/24. Approximate elevation from Google Earth.

CERTERRA
EARTH ENGINEERS

Appendix C: Test Pit TP-3

Client: Salishan Leaseholders Inc
Project: Beach Grass Lane Common Area Revetment
Site Address: Beach Grass Lane
Gleneden Beach, Lincoln County, Oregon
Location of Exploration: See Appendix B
Logged By: Matt Enos, R.G.

Report Number: 10-242036-01
Excavation Contractor: Dan Kauffman Excavation, Inc
Excavation Method: Excavator
Excavation Equipment: Komatsu PC 360 LC, 48" bucket
Approximate Ground Surface Elevation (ft msl): 17-19
Date of Exploration: 11/1/24

Depth (ft)	Water Level	Lithology: Lithologic Symbol	Lithology: Geologic Description of Soil and Rock Strata	Sampling Data: Sample Number	Sampling Data: Drive Probe (0 50 100)	Sampling Data: Moisture Content (%)	Sampling Data: % Passing #200 Sieve	Sampling Data: Liquid Limit	Sampling Data: Plastic Limit	Remarks
0–7			SAND (SP); light brown; moist; very loose to medium dense; medium grained; poorly graded	GRAB-1		15	1			severe caving
8	▼		SAND (SP), yellow brown; wet; medium dense; fine to medium grained; poorly graded	GRAB-2		21				
12					3					
13					4					
13					3					
14					4					
14					5					
15					5					
15					6					
16					7					
16					9					
17					7					
17					8					
18					10					
18					10					
19					10					
19					15					
20					17					
21					32					
21					35					
21					50					

Notes: Test pit terminated at approximately 9 feet bgs. Groundwater was encountered at approximately 8 feet bgs at the time of exploration. Test pit backfilled with excavated material and compacted on 11/1/24. Approximate elevation from Google Earth.

CERTERRA
EARTH ENGINEERS

Appendix C: Test Pit TP-4

Client: Salishan Leaseholders Inc
Project: Beach Grass Lane Common Area Revetment
Site Address: Beach Grass Lane
Gleneden Beach, Lincoln County, Oregon
Location of Exploration: See Appendix B
Logged By: Matt Enos, R.G.

Report Number: 10-242036-01
Excavation Contractor: Dan Kauffman Excavation, Inc
Excavation Method: Excavator
Excavation Equipment: Komatsu PC 360 LC, 48" bucket
Approximate Ground Surface Elevation (ft msl): 17-19
Date of Exploration: 11/1/24

Depth (ft)	Water Level	Lithology: Lithologic Symbol	Lithology: Geologic Description of Soil and Rock Strata	Sampling Data: Sample Number	Sampling Data: Drive Probe (0 50 100)	Sampling Data: Moisture Content (%)	Sampling Data: % Passing #200 Sieve	Sampling Data: Liquid Limit	Sampling Data: Plastic Limit	Remarks
0			SAND (SP); light brown; moist; very loose to medium dense; medium grained; poorly graded		1					
1					3					
2					7					
3					8					
4				GRAB-1	8	5				
5					6					
6					5					
7					8					
8	▼				14					severe caving
9			SAND (SP), yellow brown; wet; medium dense; fine to medium grained; poorly graded	GRAB-2	13	18				
10					10					
11					9					
12					8					
13					11					
14					11					
15					15					
16					20					
17					30					
18					33					
19					30					
20					19					
21					17					
22					18					
23					16					
24					24					
25					39					
					32					
					40					
					50					

Notes: Test pit terminated at approximately 9 feet bgs. Groundwater was encountered at 8 feet bgs at the time of exploration. Test pit backfilled with excavated material and compacted on 11/1/24. Approximate elevation from Google Earth.

CERTERRA
EARTH ENGINEERS

Appendix C: Test Pit TP-5

Client: Salishan Leaseholders Inc
Project: Beach Grass Lane Common Area Revetment
Site Address: Beach Grass Lane
Gleneden Beach, Lincoln County, Oregon
Location of Exploration: See Appendix B
Logged By: Matt Enos, R.G.

Report Number: 10-242036-01
Excavation Contractor: Dan Kauffman Excavation, Inc
Excavation Method: Excavator
Excavation Equipment: Komatsu PC 360 LC, 48" bucket
Approximate Ground Surface Elevation (ft msl): 17-19
Date of Exploration: 11/1/24

Depth (ft)	Water Level	Lithology: Lithologic Symbol	Lithology: Geologic Description of Soil and Rock Strata	Sampling Data: Sample Number	Sampling Data: Drive Probe (0 50 100)	Sampling Data: Moisture Content (%)	Sampling Data: % Passing #200 Sieve	Sampling Data: Liquid Limit	Sampling Data: Plastic Limit	Remarks
0			SAND (SP); light brown; moist; very loose to medium dense; medium grained; poorly graded							
1										
2										
3										
4				GRAB-1		4				
5										
6										
7										severe caving
8	▼		SAND (SP), yellow brown; wet; medium dense; fine to medium grained; poorly graded	GRAB-2		22	1			
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										

Notes: Test pit terminated at approximately 9 feet bgs. Groundwater was encountered at approximately 8 feet bgs at the time of exploration. Test pit backfilled with excavated material and compacted on 11/1/24. Approximate elevation from Google Earth.

CERTERRA
EARTH ENGINEERS

Appendix C: Test Pit TP-6

Client: Salishan Leaseholders Inc
Project: Beach Grass Lane Common Area Revetment
Site Address: Beach Grass Lane
Gleneden Beach, Lincoln County, Oregon
Location of Exploration: See Appendix B
Logged By: Matt Enos, R.G.

Report Number: 10-242036-01
Excavation Contractor: Dan Kauffman Excavation, Inc
Excavation Method: Excavator
Excavation Equipment: Komatsu PC 360 LC, 48" bucket
Approximate Ground Surface Elevation (ft msl): 26-30
Date of Exploration: 11/1/24

Depth (ft)	Water Level	Lithology: Lithologic Symbol	Lithology: Geologic Description of Soil and Rock Strata	Sampling Data: Sample Number	Sampling Data: Drive Probe	Sampling Data: Moisture Content (%)	Sampling Data: % Passing #200 Sieve	Sampling Data: Liquid Limit	Sampling Data: Plastic Limit	Remarks
0			SAND (SP); light brown; moist; very loose to medium dense; medium grained; poorly graded		1					
1					3					
2					4					
3					5					
4					8					
5					9					
6					12					
7					11					
8				GRAB-1	10	5				
9					12					
10					13					
11					11					
12					16					
13					12					
14					15					
15					17					
16					14					
17					12					
18					17					
19					27					severe caving
20				GRAB-2	25	6				
21					31					
22					33					
23					34					
24										
25										

Notes: Test pit terminated at approximately 10.5 feet bgs. Groundwater was not encountered at the time of exploration. Test pit backfilled with excavated material and compacted on 11/1/24. Approximate elevation from Google Earth.

CERTERRA
EARTH ENGINEERS

Appendix C: Test Pit TP-7

Client: Salishan Leaseholders Inc
Project: Beach Grass Lane Common Area Revetment
Site Address: Beach Grass Lane
Gleneden Beach, Lincoln County, Oregon
Location of Exploration: See Appendix B
Logged By: Matt Enos, R.G.

Report Number: 10-242036-01
Excavation Contractor: Dan Kauffman Excavation, Inc
Excavation Method: Excavator
Excavation Equipment: Komatsu PC 360 LC, 48" bucket
Approximate Ground Surface Elevation (ft msl): 26-30
Date of Exploration: 11/1/24

Depth (ft)	Water Level	Lithology: Lithologic Symbol	Lithology: Geologic Description of Soil and Rock Strata	Sampling Data: Sample Number	Sampling Data: Drive Probe	Sampling Data: Moisture Content (%)	Sampling Data: % Passing #200 Sieve	Sampling Data: Liquid Limit	Sampling Data: Plastic Limit	Remarks
0			SAND (SP); light brown; moist; very loose to medium dense; medium grained; poorly graded		2					
1					3					
2					10					
3					10					
4				GRAB-1	11	5	<1			
5					14					
6					15					
7					24					
8					24					
9					27					
10				GRAB-2	24	6	<1			severe caving
11					13					
12					14					
13					17					
14					13					
15					14					
16					18					
17					22					
18					19					
19					14					
20					13					
21					17					
22					14					
23					16					
24					17					
25					19					
					14					
					14					
					14					
					13					
					12					
					21					
					36					
					41					
					46					

Notes: Test pit terminated at approximately 10.5 feet bgs. Groundwater was not encountered at the time of exploration. Test pit backfilled with excavated material and compacted on 11/1/24. Approximate elevation from Google Earth.

CERTERRA
EARTH ENGINEERS

Appendix C: Test Pit TP-8

Client: Salishan Leaseholders Inc
Project: Beach Grass Lane Common Area Revetment
Site Address: Beach Grass Lane
Gleneden Beach, Lincoln County, Oregon
Location of Exploration: See Appendix B
Logged By: Matt Enos, R.G.

Report Number: 10-242036-01
Excavation Contractor: Dan Kauffman Excavation, Inc
Excavation Method: Excavator
Excavation Equipment: Komatsu PC 360 LC, 48" bucket
Approximate Ground Surface Elevation (ft msl): 26-30
Date of Exploration: 11/1/24

Depth (ft)	Water Level	Lithology: Lithologic Symbol	Lithology: Geologic Description of Soil and Rock Strata	Sampling Data: Sample Number	Sampling Data: Drive Probe	Sampling Data: Moisture Content (%)	Sampling Data: % Passing #200 Sieve	Sampling Data: Liquid Limit	Sampling Data: Plastic Limit	Remarks
0			SAND (SP); light brown; moist; very loose to medium dense; medium grained; poorly graded		1					
1					5					
2					6					
3					8					
4				GRAB-1	10	5				
5					9					
6					7					
7					8					
8					7					
9					8					
10				GRAB-2	10	5				severe caving
11					10					
12					8					
13					14					
14					8					
15					9					
16					12					
17					12					
18					10					
19					12					
20					12					
21					11					
22					13					
23					12					
24					14					
25					17					
					14					
					17					
					20					

Notes: Test pit terminated at approximately 10.5 feet bgs. Groundwater was not encountered at the time of exploration. Test pit backfilled with excavated material and compacted on 11/1/24. Approximate elevation from Google Earth.

APPENDIX D: SOIL CLASSIFICATION LEGEND

APPARENT CONSISTENCY OF COHESIVE SOILS (PECK, HANSON & THORNBURN 1974, AASHTO 1988)				
Descriptor	**SPT N_{60} (blows/foot)***	**Pocket Penetrometer, Qp (tsf)**	**Torvane (tsf)**	**Field Approximation**
Very Soft	< 2	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	2 – 4	0.25 – 0.50	0.12 – 0.25	Easily penetrated several inches by thumb
Medium Stiff	5 – 8	0.50 – 1.0	0.25 – 0.50	Penetrated several inches by thumb w/moderate effort
Stiff	9 – 15	1.0 – 2.0	0.50 – 1.0	Readily indented by thumbnail
Very Stiff	16 – 30	2.0 – 4.0	1.0 – 2.0	Indented by thumb but penetrated only with great effort
Hard	> 30	> 4.0	> 2.0	Indented by thumbnail with difficulty

* Using SPT N_{60} is considered a crude approximation for cohesive soils.

APPARENT DENSITY OF COHESIONLESS SOILS (AASHTO 1988)	
Descriptor	**SPT N_{60} Value (blows/foot)**
Very Loose	0 – 4
Loose	5 – 10
Medium Dense	11 – 30
Dense	31 – 50
Very Dense	> 50

MOISTURE (ASTM D2488-06)	
Descriptor	**Criteria**
Dry	Absence of moisture, dusty, dry to the touch, well below optimum moisture content (per ASTM D698 or D1557)
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table, well above optimum moisture content (per ASTM D698 or D1557)

PERCENT OR PROPORTION OF SOILS (ASTM D2488-06)	
Descriptor	**Criteria**
Trace	Particles are present but estimated < 5%
Few	5 – 10%
Little	15 – 25%
Some	30 – 45%
Mostly	50 – 100%
Percentages are estimated to nearest 5% in the field. Use "about" unless percentages are based on laboratory testing.	

SOIL PARTICLE SIZE (ASTM D2488-06)	
Descriptor	**Size**
Boulder	> 12 inches
Cobble	3 to 12 inches
Gravel - Coarse Fine	¾ inch to 3 inches No. 4 sieve to ¾ inch
Sand - Coarse Medium Fine	No. 10 to No. 4 sieve (4.75mm) No. 40 to No. 10 sieve (2mm) No. 200 to No. 40 sieve (.425mm)
Silt and Clay ("fines")	Passing No. 200 sieve (0.075mm)

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2488)				
Major Division			**Group Symbol**	**Description**
Coarse Grained Soils (more than 50% retained on #200 sieve)	**Gravel** (50% or more retained on No. 4 sieve)	Clean Gravel	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravel with fines	GM	Silty gravels and gravel-sand-silt mixtures
			GC	Clayey gravels and gravel-sand-clay mixtures
	Sand (> 50% passing No. 4 sieve)	Clean sand	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly-graded sands and gravelly sands, little or no fines
		Sand with fines	SM	Silty sands and sand-silt mixtures
			SC	Clayey sands and sand-clay mixtures
Fine Grained Soils (50% or more passing #200 sieve)	**Silt and Clay** (liquid limit < 50)		ML	Inorganic silts, rock flour and clayey silts
			CL	Inorganic clays of low-medium plasticity, gravelly, sandy & lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silt and Clay (liquid limit > 50)		MH	Inorganic silts and clayey silts
			CH	Inorganic clays or high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, muck and other highly organic soils

EARTH ENGINEERS
An RMA Company

GRAPHIC SYMBOL LEGEND		
GRAB	⊠	Grab sample
SPT	■	Standard Penetration Test (2" OD), ASTM D1586
ST	■	Shelby Tube, ASTM D1587 (pushed)
DM	■	Dames and Moore ring sampler (3.25" OD and 140-pound hammer)
CORE	■	Rock coring

APPENDIX D: ROCK CLASSIFICATION LEGEND

WEATHERING DESCRIPTORS FOR INTACT ROCK (USBR, 2001)

Descriptor	Chemical Weathering-Discoloration-Oxidation		Mechanical Weathering and Grain Boundary Conditions	Texture and Solutioning		General Characteristics
	Body of Rock	Fracture Surfaces		Texture	Solutioning	
Fresh	No discoloration, not oxidized	No discoloration or oxidation	No separation, intact (tight)	No change	No solutioning	Hammer rings when crystalline rocks are struck
Slightly Weathered	Discoloration or oxidation limited to surface or short distance from fractures; some feldspar crystals are dull	Minor or complete discoloration or oxidation of most surfaces	No visible separation, intact (tight)	Preserved	Minor leaching of some soluble minerals may be noted	Hammer rings when crystalline rocks are struck; body of rock not weakened
Moderately Weathered	Discoloration or oxidation extends from fractures usually throughout; Fe-Mg minerals are "rusty," feldspar crystals are "cloudy"	All fracture surfaces are discolored or oxidized	Partial separation of boundaries visible	Generally preserved	Soluble minerals may be mostly leached	Hammer does not ring when rock is struck; body of rock is slightly weakened
Intensely Weathered	Discoloration or oxidation throughout; all feldspars and Fe-Mg minerals are altered to clay to some extent or chemical alteration produces in-situ disaggregation	All fracture surfaces are discolored or oxidized; surfaces are friable	Partial separation; rock is friable; granitics are disaggregated in semi-arid conditions	Altered by chemical disaggregation such as via hydration or argillation	Leaching of soluble minerals may be complete	Dull sound when struck with hammer; usually can be broken with moderate to heavy manual pressure or by light hammer blow; rock is significantly weakened
Decomposed	Discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay		Complete separation of grain boundaries (disaggregation)	Resembles a soil; partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete		Can be granulated by hand; resistant minerals such as quartz may be present as "stringers" or "dikes"

RQD DESCRIPTION (ASTM D6032-96)

RQD %	Description
0-25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

BEDDING SPACING (modified USBR, 2001)

Descriptor	Thickness or Spacing
Massive	> 10 feet
Very thickly bedded	3 to 10 feet
Thickly bedded	1 to 3 feet
Moderately bedded	3-5/8 inches to 1 foot
Thinly Bedded	1-1/4 inches to 3-5/8 inches
Very thinly bedded	3/8 inch to 1-1/4 inches
Laminated	< 3/8 inch

CORE RECOVERY CALCULATION (%)

= length of recovered core pieces x 100%
total length of core run

RQD CALCULATION (%)

= length of intact core pieces > 4 in x 100%
total length of core run (inches)

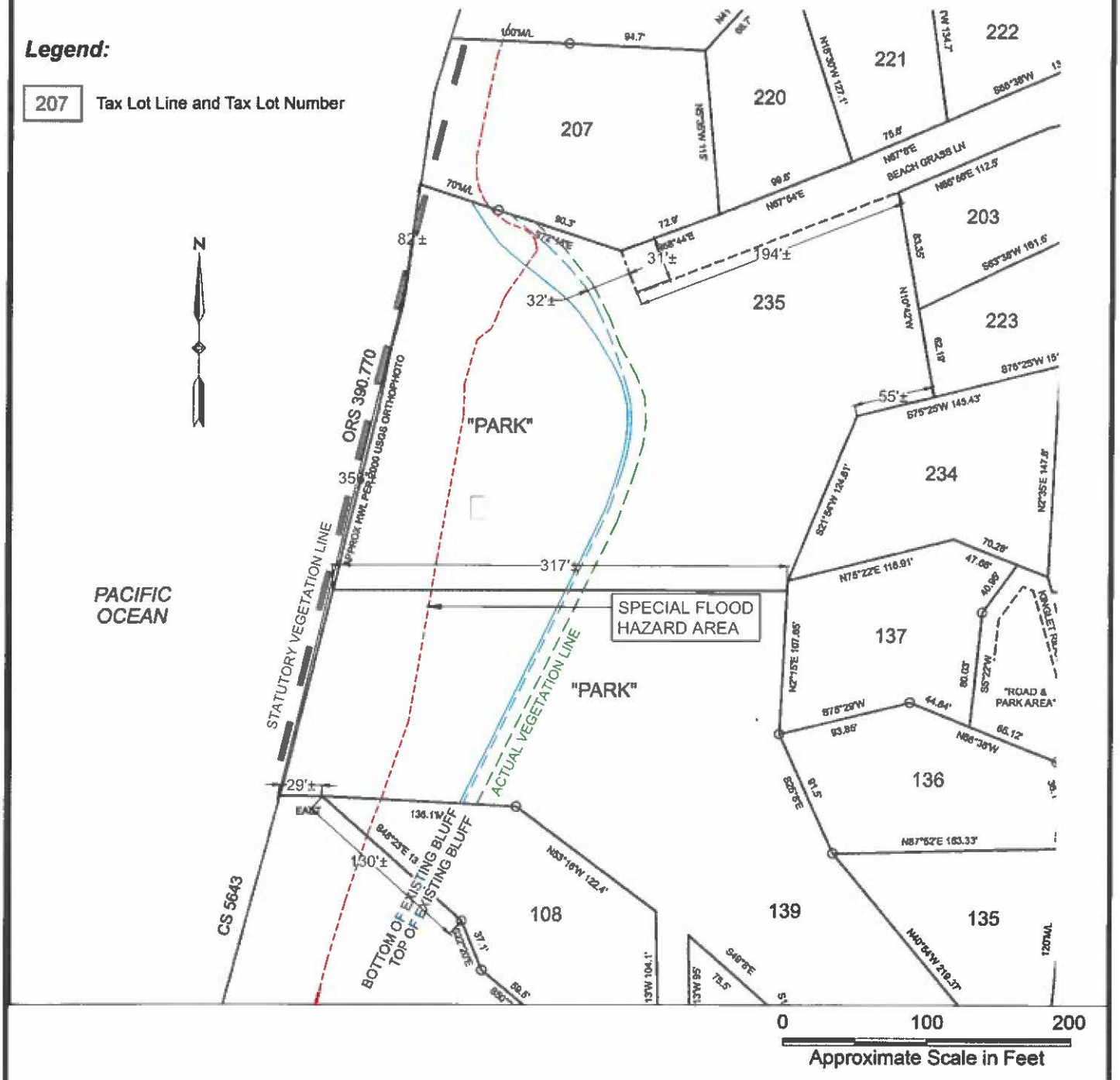
EARTH ENGINEERS
An RMA Company

ROCK HARDNESS (ISRM, 1978)

Descriptor	Grade	Criteria	Uniaxial Compressive Strength (psi)
Very soft	R0	Indented by thumbnail	<100
Soft	R1	Crumbles under firm blows with geological hammer. Can be peeled with a pocket knife.	100-1,000
Moderately soft	R2	Can be peeled with a pocket knife with difficulty. Shallow indentations made by firm blow with geological hammer.	1,000-4,000
Moderately hard	R3	Cannot be scraped or peeled with pocket knife. Can be fractured with a single blow of geological hammer.	4,000-8,000
Hard	R4	Requires more than one blow of geological hammer to fracture it.	8,000-16,000
Very hard	R5	Requires many blows of geological hammer to fracture it.	16,000-36,000
Extremely hard	R6	Can only be chipped with geological hammer.	>36,000

APPENDIX E – Plan View

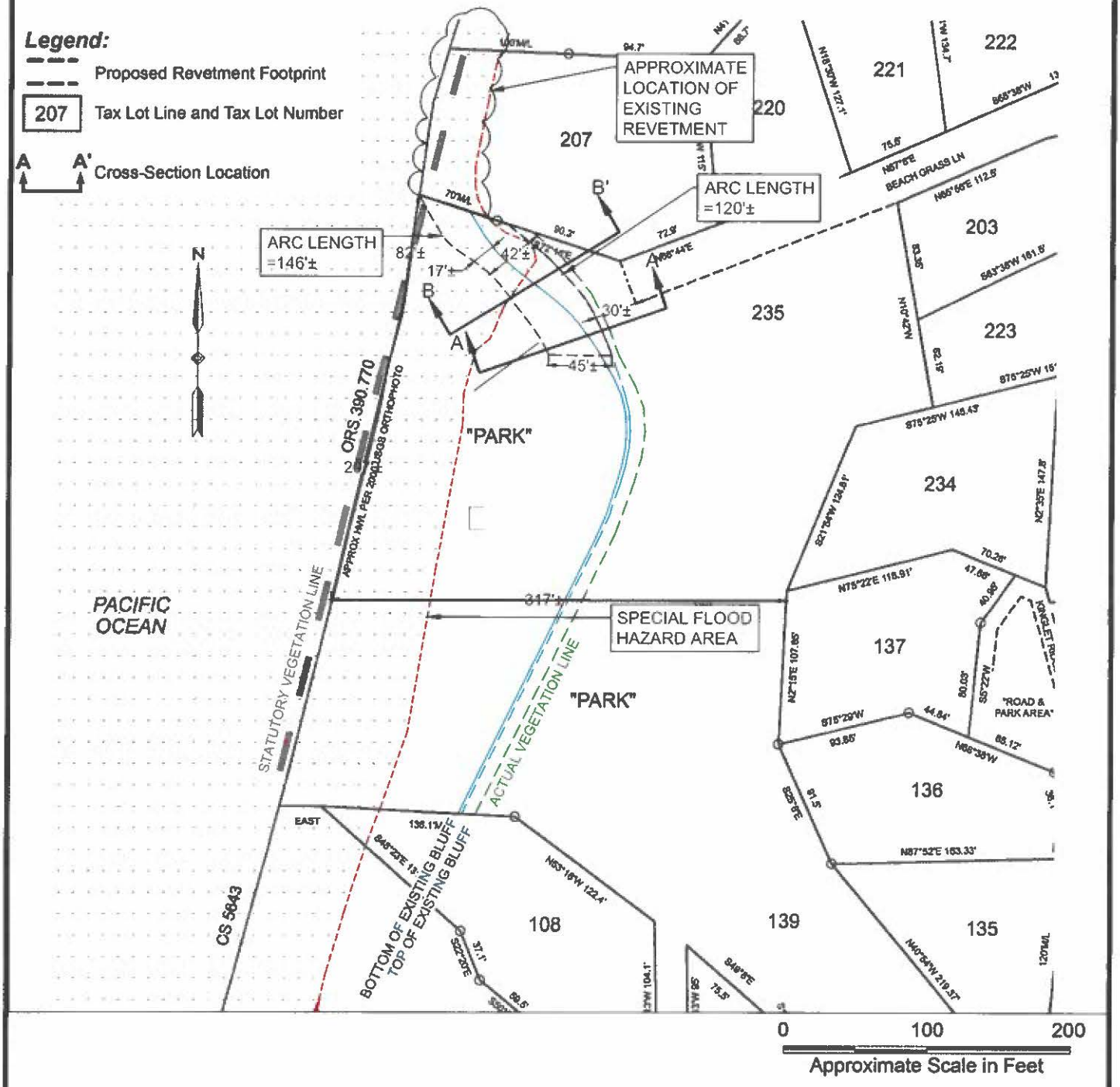
EXISTING CONDITIONS - PLAN VIEW



NOTE: Base map prepared from Lincoln County Taxmaps 08s11w09aa and 08s11w09ad. All locations and features are approximate.

CERTERRA	**Beach Grass** **Proposed Coastal Revetment** **Gleneden Beach, Oregon**	**Report No.** **10-242036**	**January 12, 2026**

PROPOSED CONDITIONS - PLAN VIEW

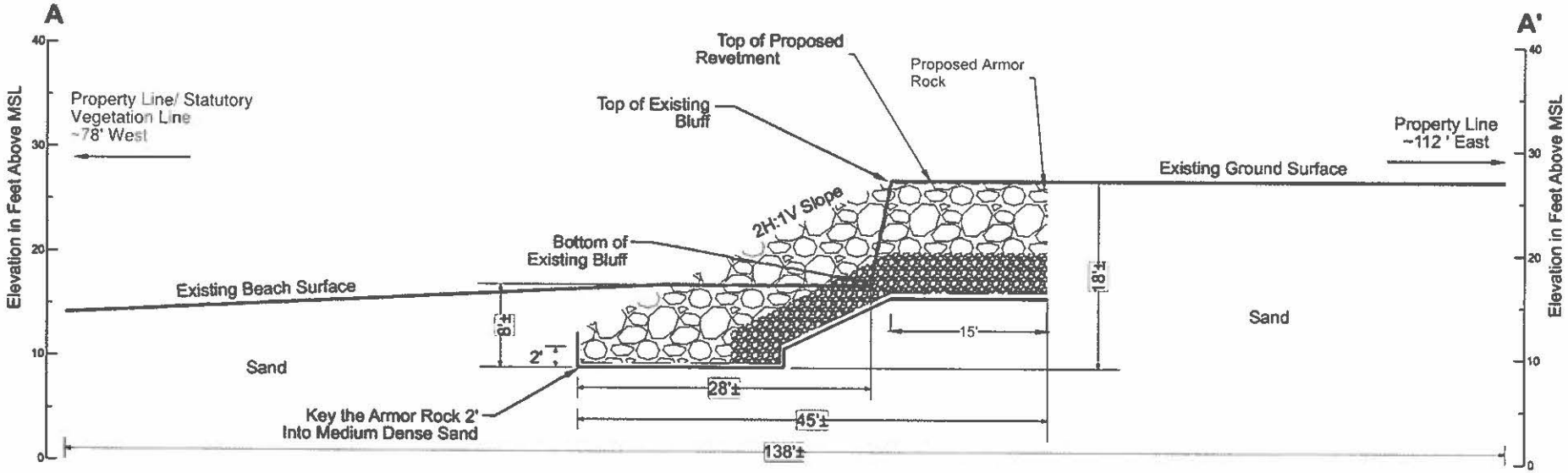


NOTE: Base map prepared from Lincoln County Taxmaps 08s11w09aa and 08s11w09ad. All locations and features are approximate.

CERTERRA	Beach Grass Proposed Coastal Revetment Gleneden Beach, Oregon	Report No. 10-242036	January 12, 2026

APPENDIX F - Proposed Conditions – Profile View

Proposed Revetment Improvements - Cross-Section View



NOTES:

THE BASE OF THE RIPRAP SHOULD BE EMBEDDED AT LEAST 2 FEET INTO THE MEDIUM DENSE SAND (I.E. AT AN ELEVATION OF APPROX. 10' ABOVE MSL). IF MINIMUM EMBEDMENT CANNOT BE ACHIEVED DUE TO HEAVING OR FLOWING SANDS, THEN DEWATERING WILL BE NECESSARY.

WOVEN FILTER FABRIC (MIRAFI FILTERWEAVE 700, OR EQUIVALENT SHOULD BE PLACED BETWEEN THE NATIVE SOILS AND THE SPS FILTER ROCK.

OVERLYING THE FILTER FABRIC, A FILTER BLANKET SHOULD BE PLACED THAT CONSISTS OF A 6-INCH-THICK LAYER OF PIT RUN (APPROXIMATELY 4-INCH MINUS) UNDERLYING A 1.5-FOOT-THICK LAYER OF FILTER ROCK (APPROXIMATELY 12-INCH MINUS) PLACED AT A SLOPE ANGLE OF APPROXIATMELY 2H:1V. NOTE THAT THE ARMOR ROCK FROM THE EXISTING, DAMAGED SPS CAN BE REPROCESSED AND USED AS FILTER ROCK.

OVERLYING THE FILTER ROCK, ARMOR ROCK (3 TO 8 FEET IN DIAMETER) SHOULD BE PLACED. RIPRAP SHOULD CONSIST OF HARD, DURABLE, NON-WEATHERED BASALT ROCK, INTERLOCKED WITH A MINIMUM OF THREE POINTS OF CONTACT. THE EXISTING, DAMAGED SPS ARMOR ROCK IS NOT APPROPRIATE FOR USE AS ARMOR ROCK IN THE PROPOSED STRUCTURE. THE MINIMUM THICKNESS OF THE ARMOR STONE LAYER IS 7 FEET.

RIPRAP SLOPES EXPOSED TO WAVE ACTION SHOULD BE ON THE ORDER OF 2H:1V (HORIZONTAL:VERTICAL).

THE TOP OF THE REVETMENT SHOULD MATCH THE ELEVATION OF THE EXISTING BLUFF. IN AREAS WHERE THE ELEVATION IS LESS THAN 33 FEET ABOVE MSL, THE REVETMENT SHOULD EXTEND BACK LATERALLY AT LEAST 15 FEET FROM WHERE THE REVETMENT REACHES ITS HIGHEST ELEVATION (WHERE TOPOGRAPHY ALLOWS).

Legend:

Proposed Armor Rock

Proposed Filter Rock with Filter Fabric

NOTE: All locations and features are approximate.

0 15 30

Approximate Scale in Feet

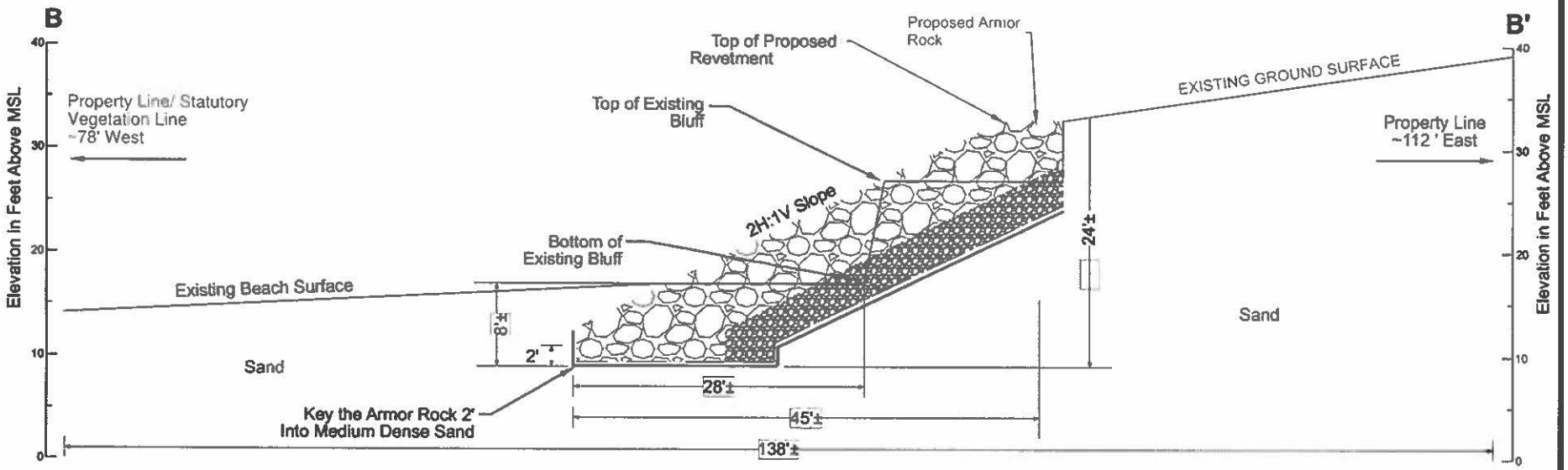
CERTERRA

Beach Grass
Proposed Coastal Revetment
Gleneden Beach, Oregon

Report No. 10-242036

January 12, 2026

Proposed Revetment Improvements - Cross-Section View



NOTES:
THE BASE OF THE RIPRAP SHOULD BE EMBEDDED AT LEAST 2 FEET INTO THE MEDIUM DENSE SAND (I.E. AT AN ELEVATION OF APPROX. 10' ABOVE MSL). IF MINIMUM EMBEDMENT CANNOT BE ACHIEVED DUE TO HEAVING OR FLOWING SANDS, THEN DEWATERING WILL BE NECESSARY.

WOVEN FILTER FABRIC (MIRAFI FILTERWEAVE 700, OR EQUIVALENT SHOULD BE PLACED BETWEEN THE NATIVE SOILS AND THE SPS FILTER ROCK.

OVERLYING THE FILTER FABRIC, A FILTER BLANKET SHOULD BE PLACED THAT CONSISTS OF A 6-INCH-THICK LAYER OF PIT RUN (APPROXIMATELY 4-INCH MINUS) UNDERLYING A 1.5-FOOT-THICK LAYER OF FILTER ROCK (APPROXIMATELY 12-INCH MINUS) PLACED AT A SLOPE ANGLE OF APPROXIATMELY 2H:1V. NOTE THAT THE ARMOR ROCK FROM THE EXISTING, DAMAGED SPS CAN BE REPROCESSED AND USED AS FILTER ROCK.

OVERLYING THE FILTER ROCK, ARMOR ROCK (3 TO 8 FEET IN DIAMETER) SHOULD BE PLACED. RIPRAP SHOULD CONSIST OF HARD, DURABLE, NON-WEATHERED BASALT ROCK, INTERLOCKED WITH A MINIMUM OF THREE POINTS OF CONTACT. THE EXISTING, DAMAGED SPS ARMOR ROCK IS NOT APPROPRIATE FOR USE AS ARMOR ROCK IN THE PROPOSED STRUCTURE. THE MINIMUM THICKNESS OF THE ARMOR STONE LAYER IS 7 FEET.

RIPRAP SLOPES EXPOSED TO WAVE ACTION SHOULD BE ON THE ORDER OF 2H:1V (HORIZONTAL:VERTICAL).

THE REVETMENT SHOULD EXTEND TO AN ELEVATION OF 33 FEET ABOVE MSL

Legend:

Proposed Armor Rock

Proposed Filter Rock with Filter Fabric

NOTE: All locations and features are approximate.

0 15 30

Approximate Scale in Feet

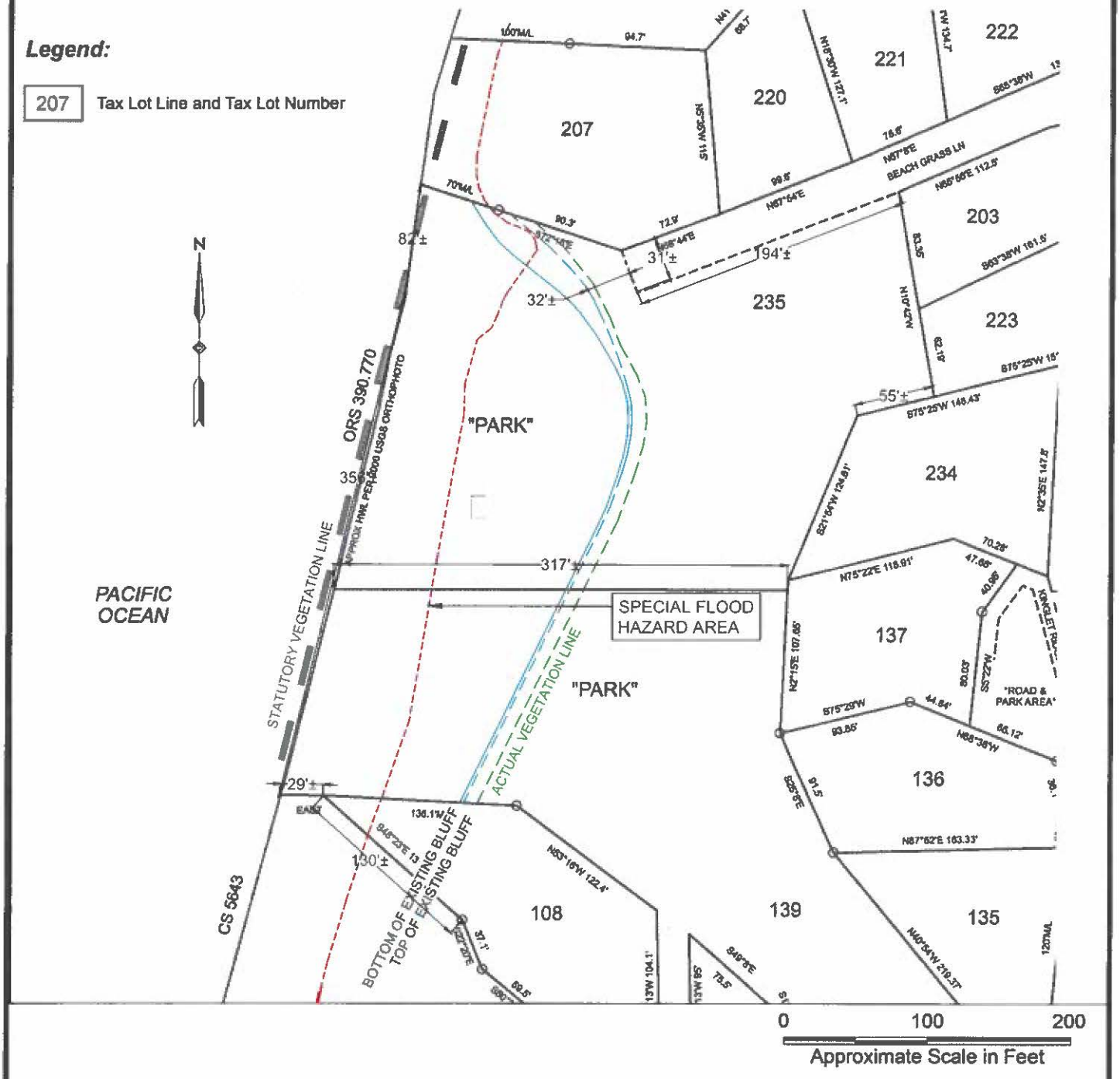
CERTERRA

Beach Grass
Proposed Coastal Revetment
Gleneden Beach, Oregon

Report No. 10-242036

January 12, 2026

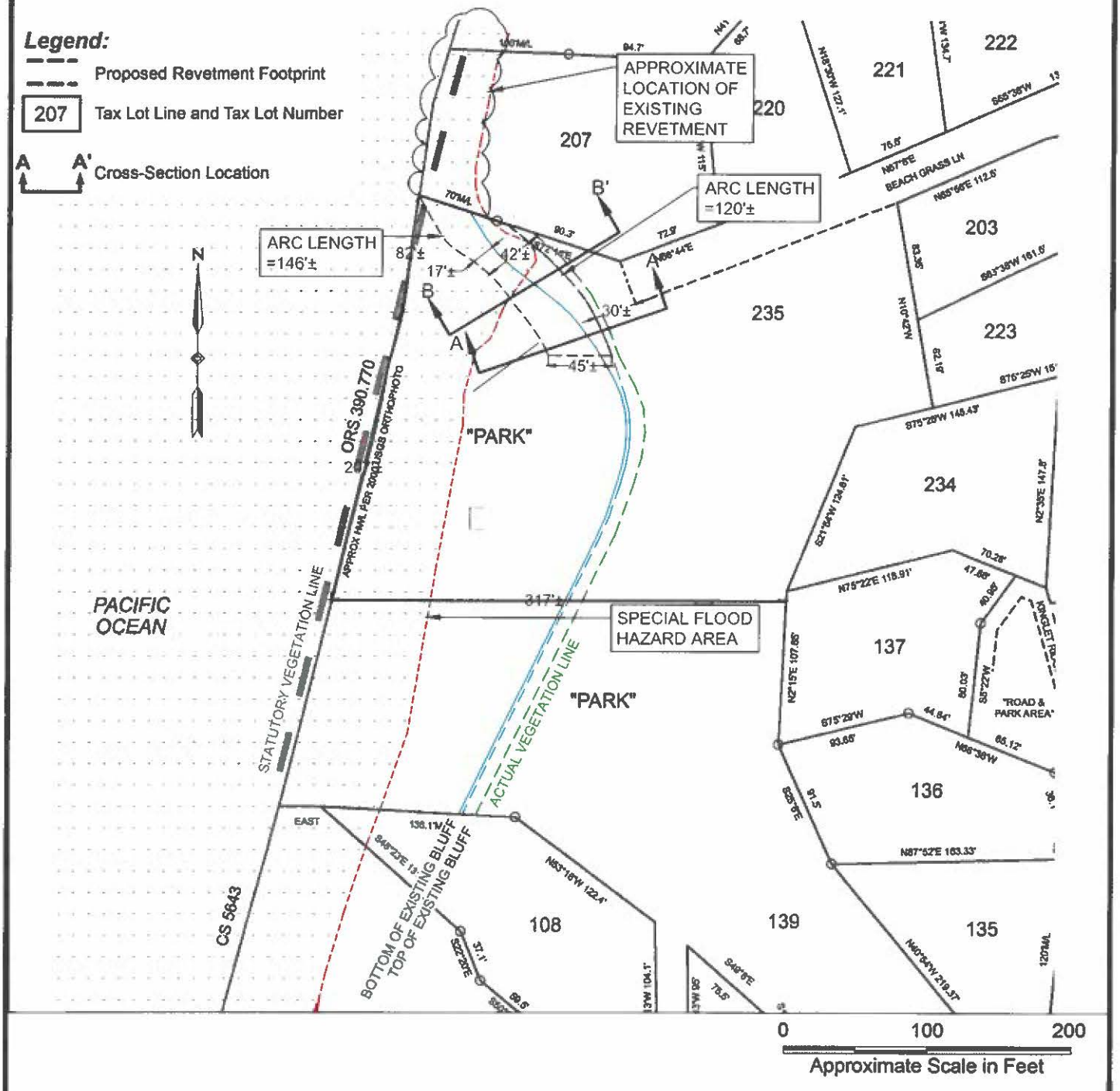
EXISTING CONDITIONS - PLAN VIEW



NOTE: Base map prepared from Lincoln County Taxmaps 08s11w09aa and 08s11w09ad. All locations and features are approximate.

CERTERRA	**Beach Grass** **Proposed Coastal Revetment** **Gleneden Beach, Oregon**	**Report No.** **10-242036**	**January 12, 2026**

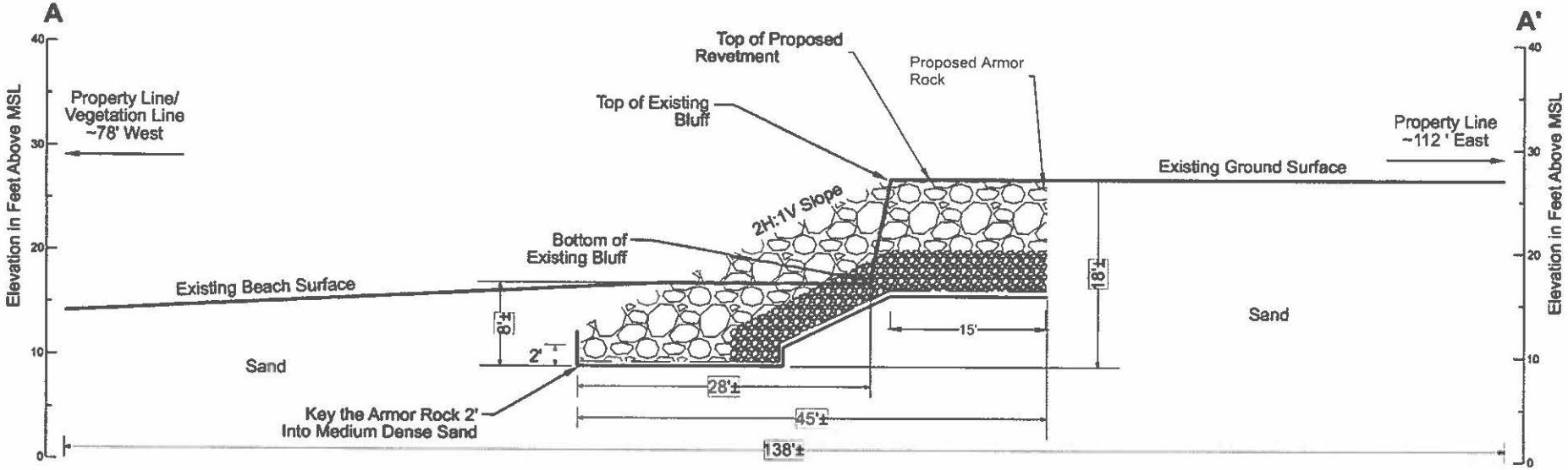
PROPOSED CONDITIONS - PLAN VIEW



NOTE: Base map prepared from Lincoln County Taxmaps 08s11w09aa and 08s11w09ad. All locations and features are approximate.

CERTERRA	Beach Grass Proposed Coastal Revetment Gleneden Beach, Oregon	Report No. 10-242036	January 12, 2026

Proposed Revetment Improvements - Cross-Section View



NOTES:

THE BASE OF THE RIPRAP SHOULD BE EMBEDDED AT LEAST 2 FEET INTO THE MEDIUM DENSE SAND (I.E. AT AN ELEVATION OF APPROX. 10' ABOVE MSL). IF MINIMUM EMBEDMENT CANNOT BE ACHIEVED DUE TO HEAVING OR FLOWING SANDS, THEN DEWATERING WILL BE NECESSARY.

WOVEN FILTER FABRIC (MIRAFI FILTERWEAVE 700, OR EQUIVALENT SHOULD BE PLACED BETWEEN THE NATIVE SOILS AND THE SPS FILTER ROCK.

OVERLYING THE FILTER FABRIC, A FILTER BLANKET SHOULD BE PLACED THAT CONSISTS OF A 6-INCH-THICK LAYER OF PIT RUN (APPROXIMATELY 4-INCH MINUS) UNDERLYING A 1.5-FOOT-THICK LAYER OF FILTER ROCK (APPROXIMATELY 12-INCH MINUS) PLACED AT A SLOPE ANGLE OF APPROXIATMELY 2H:1V. NOTE THAT THE ARMOR ROCK FROM THE EXISTING, DAMAGED SPS CAN BE REPROCESSED AND USED AS FILTER ROCK.

OVERLYING THE FILTER ROCK, ARMOR ROCK (3 TO 8 FEET IN DIAMETER) SHOULD BE PLACED. RIPRAP SHOULD CONSIST OF HARD, DURABLE, NON-WEATHERED BASALT ROCK, INTERLOCKED WITH A MINIMUM OF THREE POINTS OF CONTACT. THE EXISTING, DAMAGED SPS ARMOR ROCK IS NOT APPROPRIATE FOR USE AS ARMOR ROCK IN THE PROPOSED STRUCTURE. THE MINIMUM THICKNESS OF THE ARMOR STONE LAYER IS 7 FEET.

RIPRAP SLOPES EXPOSED TO WAVE ACTION SHOULD BE ON THE ORDER OF 2H:1V (HORIZONTAL:VERTICAL).

THE TOP OF THE REVETMENT SHOULD MATCH THE ELEVATION OF THE EXISTING BLUFF. IN AREAS WHERE THE ELEVATION IS LESS THAN 33 FEET ABOVE MSL, THE REVETMENT SHOULD EXTEND BACK LATERALLY AT LEAST 15 FEET FROM WHERE THE REVETMENT REACHES ITS HIGHEST ELEVATION (WHERE TOPOGRAPHY ALLOWS).

Legend:

Proposed Armor Rock

Proposed Filter Rock with Filter Fabric

NOTE: All locations and features are approximate.

0 15 30

Approximate Scale in Feet

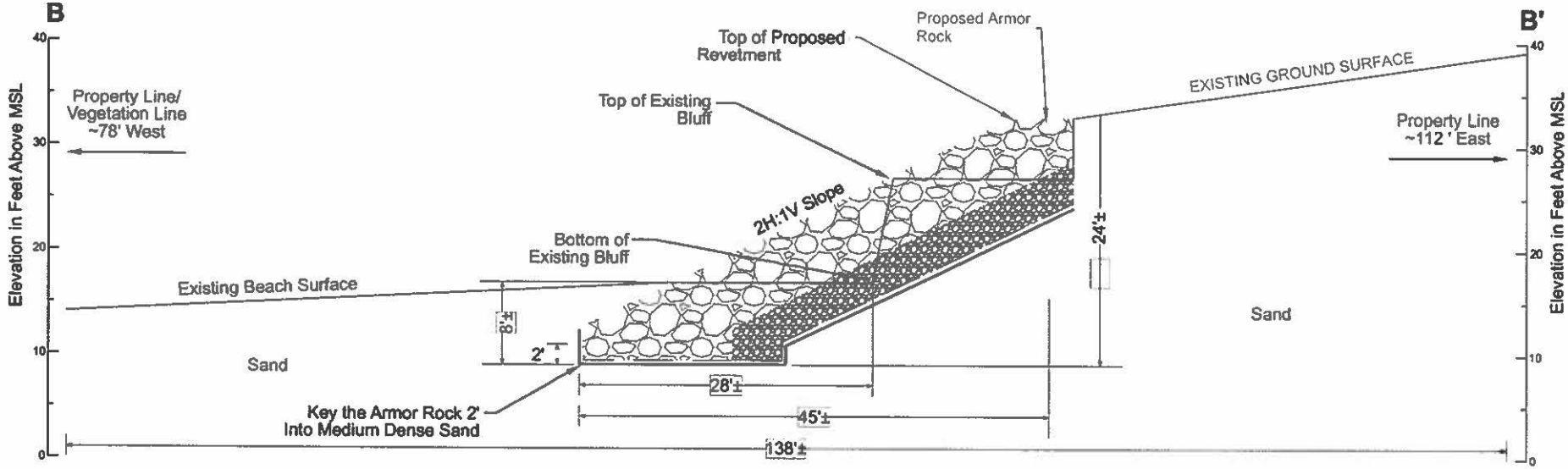
CERTERRA

Beach Grass
Proposed Coastal Revetment
Gleneden Beach, Oregon

Report No. 10-242036

January 12, 2026

Proposed Revetment Improvements - Cross-Section View



NOTES:
THE BASE OF THE RIPRAP SHOULD BE EMBEDDED AT LEAST 2 FEET INTO THE MEDIUM DENSE SAND (I.E. AT AN ELEVATION OF APPROX. 10' ABOVE MSL). IF MINIMUM EMBEDMENT CANNOT BE ACHIEVED DUE TO HEAVING OR FLOWING SANDS, THEN DEWATERING WILL BE NECESSARY.

WOVEN FILTER FABRIC (MIRAFI FILTERWEAVE 700, OR EQUIVALENT SHOULD BE PLACED BETWEEN THE NATIVE SOILS AND THE SPS FILTER ROCK.

OVERLYING THE FILTER FABRIC, A FILTER BLANKET SHOULD BE PLACED THAT CONSISTS OF A 6-INCH-THICK LAYER OF PIT RUN (APPROXIMATELY 4-INCH MINUS) UNDERLYING A 1.5-FOOT-THICK LAYER OF FILTER ROCK (APPROXIMATELY 12-INCH MINUS) PLACED AT A SLOPE ANGLE OF APPROXIATMELY 2H:1V. NOTE THAT THE ARMOR ROCK FROM THE EXISTING, DAMAGED SPS CAN BE REPROCESSED AND USED AS FILTER ROCK.

OVERLYING THE FILTER ROCK, ARMOR ROCK (3 TO 8 FEET IN DIAMETER) SHOULD BE PLACED. RIPRAP SHOULD CONSIST OF HARD, DURABLE, NON-WEATHERED BASALT ROCK, INTERLOCKED WITH A MINIMUM OF THREE POINTS OF CONTACT. THE EXISTING, DAMAGED SPS ARMOR ROCK IS NOT APPROPRIATE FOR USE AS ARMOR ROCK IN THE PROPOSED STRUCTURE. THE MINIMUM THICKNESS OF THE ARMOR STONE LAYER IS 7 FEET.

RIPRAP SLOPES EXPOSED TO WAVE ACTION SHOULD BE ON THE ORDER OF 2H:1V (HORIZONTAL:VERTICAL).

THE REVETMENT SHOULD EXTEND TO AN ELEVATION OF 33 FEET ABOVE MSL

Legend:

Proposed Armor Rock

Proposed Filter Rock with Filter Fabric

NOTE: **All locations and features are approximate.**

0 15 30

Approximate Scale in Feet

CERTERRA

Beach Grass
Proposed Coastal Revetment
Gleneden Beach, Oregon

Report No. 10-242036

January 12, 2026

Supplemental Application Narrative

Ocean Shore Permit Application

Beach Grass Lane Common Area – North End

Lincoln County Tax Lots 08-11-09-AA-00235-00

Gleneden Beach, Lincoln County, Oregon

January 12, 2026

This narrative supplements the above-referenced application to the Oregon Parks and Recreation Department (OPRD) for an ocean shore permit to allow the construction of a new Shoreline Protection Structure (SPS) to protect the northernmost approximate 150 feet of the oceanfront property located at the public beach adjacent to Beach Grass Lane in Gleneden Beach, Lincoln County, Oregon ("subject property"). It should be noted; the proposed project involves constructing a new properly constructed SPS to protect the adjacent bluff from further erosion. The purpose of constructing the SPS at the northernmost approximate 150 feet of the oceanfront property is to protect the Beach Grass Lane roadway infrastructure from coastal erosion impacts, as well as the adjacent residence located at 20 Beach Grass Lane. This narrative presents that there is (1) a need for shoreline protection for this property and (2) that the type of protection proposed (riprap revetment) is the alternative with the least impact among reasonable shoreline protection alternatives that would be viable at this location.

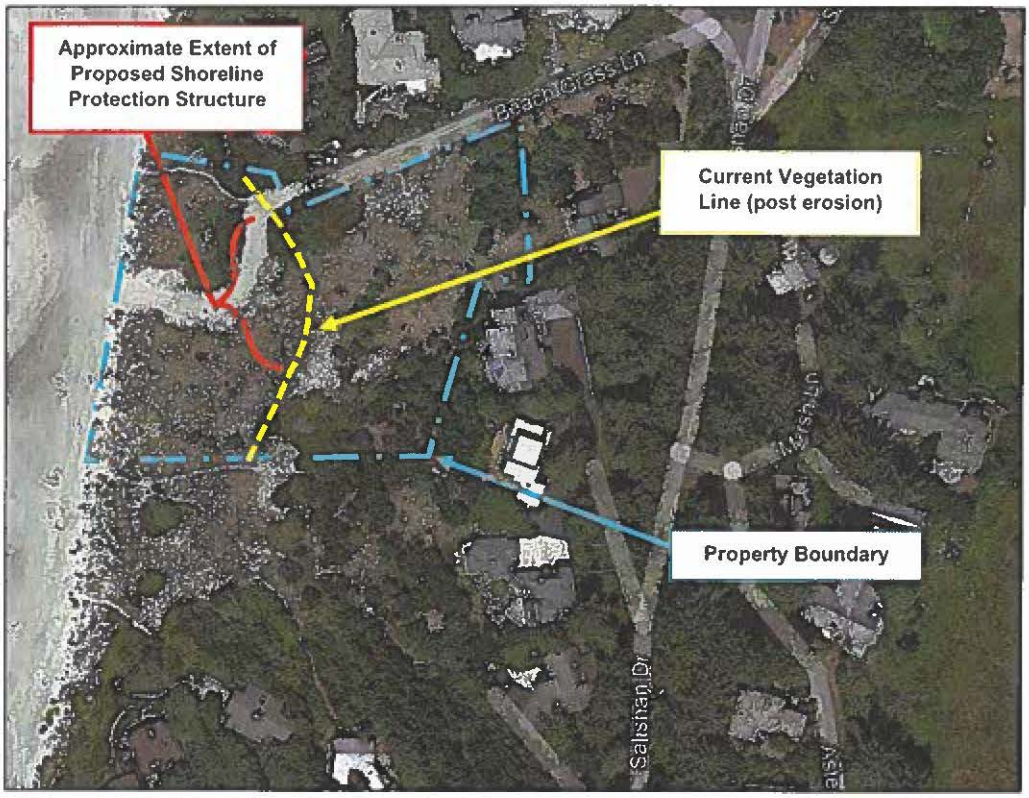


Figure 1: Historic Aerial image from Google Earth dated July 24, 2019. This image shows the subject property prior to the mass erosion event. The approximate extent of erosional retreat is outlined in yellow.

1.0 SITE DESCRIPTION

The above referenced property is located in Lincoln County north of Gleneden Beach on the Salishan/Siletz Spit (note: Salishan Spit and Siletz Spit are interchangeable). More specifically, the property is located approximately 2.15 miles south of the northern tip of the Salishan Spit. The subject property is zoned Residential Planned Development ("R-1 PD") as shown on the excerpt from the Lincoln County municipal map pictured below.

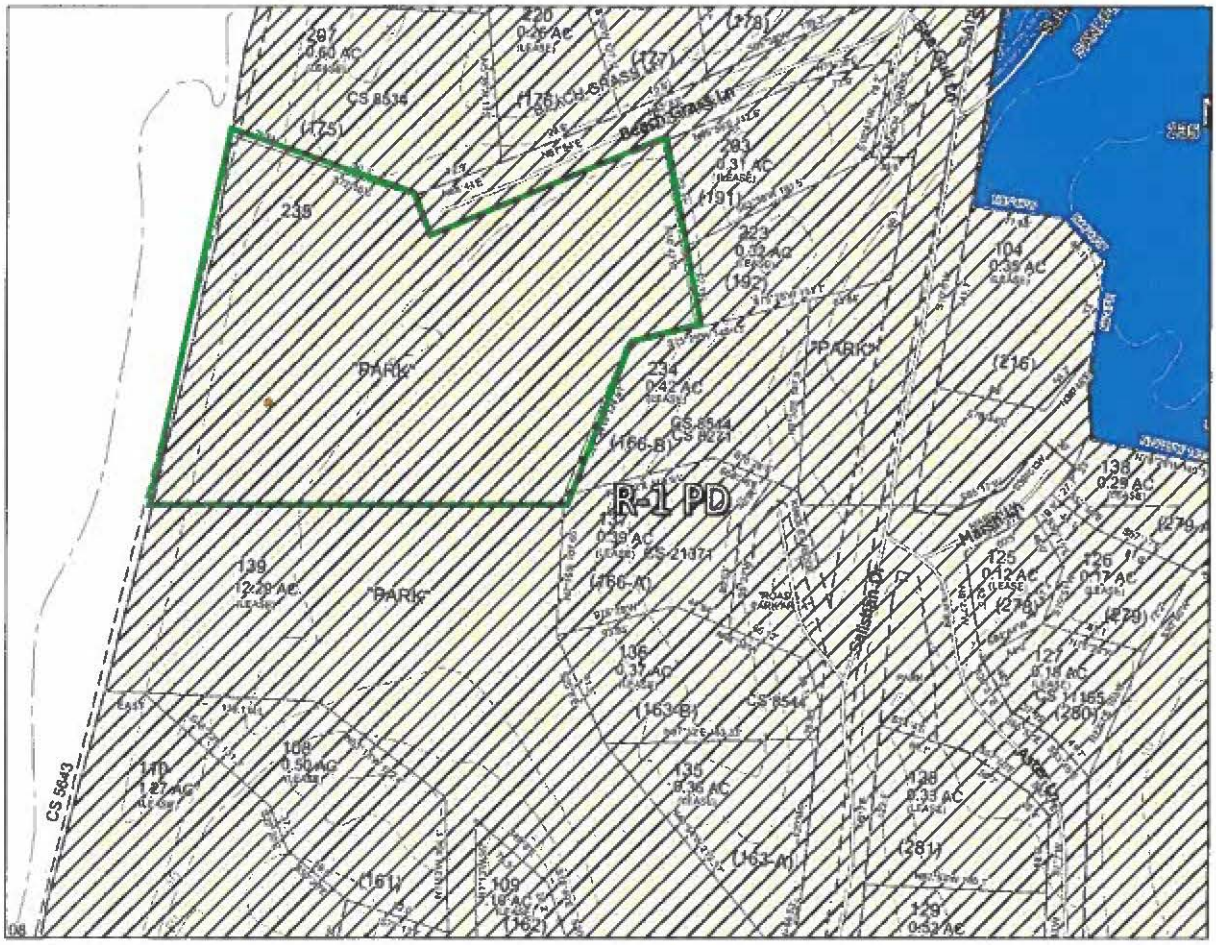


Figure 2: Map showing the subject property (outlined in blue) and zoning of the surrounding area. ("R-1 PD" = Residential Planned Development). Base map source: Lincoln County Webmaps.

The subject property is bordered by single-family residences to the north and east; property classified as "Park" to the south; and the beach and the Pacific Ocean to the west. The subject property has beach frontage of approximately 320 feet. At this time the decision has been made to focus on the northern portion of the subject property (approximately 150 feet in length) where the most intense erosion has been observed where the eroding slope is advancing towards the access road, Beach Grass Lane. The elevation of the bluff slope at this property location ranges from 29 to 34 feet above MSL.

2.0 PROJECT OVERVIEW

For a property to be eligible for structural shoreline protection, it must be Goal 18 eligible, which requires properties to be developed prior to January 1, 1977. With regard to this, the Salishan community has a unique classification. Planned development of the Salishan Spit began in the mid-1960s, and subject project sites have been identified as Goal 18 eligible due to exception according to the Oregon Coastal Atlas Ocean Shores webpage (see Figure 2). Eligibility has been verified by Onno Husing, Director of Lincoln County Planning and Development. Megan Hoff, Associate Planner, verifies permit applications from Salishan as part of the "Salishan Exception Area." The adjacent lots inland of the subject site are developed and if erosion rates continue, the adjacent properties could be at risk of destabilization.

On February 9th, 2024, Certerra Project Geologist, Matt Enos, R.G., visited the subject property for a preliminary reconnaissance of the property's beachfront and to assess the current extent of erosion that had recently occurred. While on site, we observed that major erosion had impacted the toe of the bluff and was presenting imminent risk to the adjacent developed properties and associated structures. We understand that the heavy erosion continued through February causing between 100 and 150 feet of erosion into the adjacent bluff.

The subject property (Beach Grass Lane Common Area) has a beach frontage that is approximately 320 feet in length. As stated above, this permit application focuses on the northernmost approximate 150 feet of the Beach Grass Lane Common Area, prioritized to protect critical infrastructure including Beach Grass Lane. The northernmost 150 feet of the Beach Grass Lane Common Area will be referred to hereafter as the "Project Area" unless otherwise specified.

Currently, the Project Area lacks bluff protection. The height of the bluff ranges from approximately 6 and 13 feet measured from the current beach elevation to the crest of the bluff. The oversteepened bluff slope stands at approximately 1H:1V (Horizontal:Vertical) to near-vertical. It should be noted, we consider soil slopes steeper than 2H:1V to be oversteepened. Therefore, we consider the bluff slope to be oversteepened and prone to sloughing and erosion. This risk of erosion is further exacerbated as the sea level rises. The upland area to the east of the bluff is relatively level and is vegetated with low-lying brush and semi-mature deciduous trees. Further back from the bluff, east of the level area, single-family residences are situated at an elevation approximately 10 feet higher than the bluff crest.

The subject bluff is located adjacent to Beach Grass Lane, which has started to become undermined due to the recent costal erosion. Beach Grass Lane is critical infrastructure for the Salishan Community as it provides beach access as well as access to the driveway for the residence at 20 Beach Grass Lane. While the remaining 250 feet of frontage to the south would also benefit from shoreline protection, the northern approximate 150 feet is being prioritized at this time.

Given (1) the recent significant erosion events occurring on the subject property, and (2) the proximity of key local infrastructure (i.e. the Beach Grass Lane roadway), we consider there to be a heightened risk of imminent impact to both local infrastructure and private development. Accordingly, we recommend the construction of a new shoreline protection structure (SPS) along the northern approximate 150 feet of the Beach Grass Lane Common Area. It is our professional

opinion that in the absence of this minimum extent of permanent shoreline protection, bluff regression will continue and will impact the Beach Grass Lane roadway. Without stabilization and protection of the bluff toe from wave attack, ongoing slope retreat and associated structural risk should be anticipated.

The proposed SPS will be armored with riprap, and will be approximately 150 feet long, up to 50 feet wide, and up to 24 feet in height at a slope of 2 Horizontal to 1 Vertical (2H:1V) in accordance with the Certerra report. The design of the revetment is meant to accomplish several objectives, including preventing further bluff erosion and landward retreat, minimizing risk of slope failure and flooding, avoiding adverse impacts on the shoreline of adjacent properties, and ensuring compliance with all applicable regulations. As outlined in the narrative detail below, this Application meets the standards and criteria for approval of a shoreline stabilization permit. For the purposes of this narrative, the terms "rip rap", "revetment", and "SPS" are interchangeable.

3.0 PROJECT JUSTIFICATION AND IMPACTS (APPLICATION SECTION 4)

The following narrative addresses each of the items specified in Section 4 of the OPRD Ocean Shore Permit Application for Shoreline Protection Structure.

3.1 Provide a detailed explanation of the hazards and threat to property:

The purpose of this section is to provide a description of the hazard and the threat it poses to the property, as justification for the request for authorization to alter the ocean shore area by constructing a Shoreline Protection Structure (SPS). A complete hazard analysis, design specifications, and considerations are provided in Certerra's Geotechnical Investigation and Design Report. The following are the applicable hazards:

1. **Erosional Retreat** – Coastal erosion is the primary hazard affecting this property, particularly from tidal and wave impacts during seasonal storm events. Notably, a mass erosion event between January and February 2024 resulted in the loss of approximately 100 to 150 feet of beach frontage across the Project Area. The conditions observed suggest that a localized rip embayment has formed along the Beach Grass Lane common area, channeling ocean waves toward this part of the Salishan shoreline.

   Rip embayments, which can form randomly along the coast, are particularly destructive because they create deeper troughs in the nearshore sand deposits, concentrating wave energy on the bluffs and dunes. This can cause rapid and extensive erosion, as seen historically in other parts of the Salishan Spit. Due to the rip embayments, the Project Area faces an imminent risk of ongoing erosion and potential structural damage. The current presence of a rip embayment suggest that the Project Area is subject to focused and ongoing erosion, posing an imminent risk to the bluff and the Beach Grass Lane roadway.

   Given the property's history of severe erosion, the proximity of vulnerable infrastructure, and the increased flooding risk associated with sea level rise and climate variability, there is a reasonable need for robust permanent shoreline protection. We recommend armoring the shoreline with riprap revetment to stabilize the bluff toe, dissipate wave energy, and

reduce the potential for continued bluff regression and slope failure. In our opinion, this measure is essential for protecting public and private infrastructure, reducing future erosion hazards, and enhancing the long-term resilience of the site.

2. **Regional Seismic Hazard** – In addition to erosion-related threats, the property is also exposed to regional seismic hazards associated with the Cascadia Subduction Zone (CSZ). A CSZ event could result in severe ground shaking lasting over one minute, followed by tsunami inundation and possible co-seismic subsidence. According to the Oregon Department of Emergency Management, the probability of a CSZ event within the next 50 years ranges from 7 to 15 percent for a full-margin rupture, and up to 37 percent for a partial rupture along the southern margin. A strong seismic event could trigger tsunami waves, damage shoreline structures, and result in rapid land-level changes, potentially altering erosion patterns at the site. In addition, liquefaction and lateral spreading may occur in loose, saturated sandy soils, particularly near the beach.

3. **Climate Change** – The effects of climate change are expected to further exacerbate erosion and flood risks at the subject property. Although tectonic uplift may offset sea level rise in parts of the Oregon coast, the Waldport area lies in a tectonically neutral to subsiding zone. Consequently, the site is more vulnerable to relative sea level rise, increased storm surge, and higher wave run-up.

   According to the *Guidebook on Erosion Control Practices on the Oregon Coast* (DLCD, 2021), climate change will result in more frequent and severe coastal storms, accelerating beach loss, dune erosion, and bluff instability. These anticipated conditions reinforce the need for durable shoreline armoring, such as riprap, to proactively protect vulnerable infrastructure.

   The impacts of climate change will likely necessitate increased monitoring and maintenance of the revetment to ensure its continued effectiveness. The proposed project aligns with these considerations and will not negatively affect the evolving hazard conditions. Instead, it provides a proactive solution to safeguard the subject properties against future climate-driven challenges.

To address these hazards and threats, the SLI is requesting authorization from OPRD to construct a shoreline protection structure (i.e., riprap revetment) along the northernmost approximate 150 feet of the subject property. In the absence of the proposed shoreline protection, continued bluff regression and wave overtopping are expected to accelerate. These processes pose an imminent threat to the adjacent Beach Grass Lane roadway and significantly increase the potential for flooding, which could result in severe damage to nearby residences and potentially compromise Salishan Drive.

3.2 Describe all potential impacts:

The purpose of this section is to describe all potential impacts this project may have in the short

and long-term to neighboring properties, to recreation, scenic, safety, and natural resources of the ocean shore. The potential impacts, including impacts from the SPS and impacts from the construction activities, are as follows:

1. **Impacts from the SPS and measures to minimize the impacts.**

   In terms of impacts, the inherent purpose of the revetment construction is to stop the occurrence of bluff erosion at the subject property to mitigate undermining of Beach Grass Lane, and the risks associated with the potential flooding of the project vicinity which would impact nearby residences and public infrastructure.

   We are proposing to construct a new SPS at the currently unprotected subject property. By reducing the supply of erodible material (in this case, the fine-grained exposed bluff soils), there is also inherently a reduction of material supply within the littoral cell. However, based on the relative width of the proposed SPS (approximately 150 feet), the quantity of material that would have been transported from the subject property is a nominal volume relative to this scale of the littoral cell. Section 5.1 of Certerra's Geotechnical Design Report discusses this in detail.

   Impacts of shoreline protection can also include changes in aesthetic value, public use of the beach, and impacts to natural resources. The proposed SPS will consist of a rip rap slope, typical of the shoreline in the Salishan community.

   The structure will not obstruct views of the ocean or beach from adjacent properties and will be consistent with other revetments in the project vicinity. Lastly, there are no substantive natural resource impacts that will result from the revetment construction. The riprap structure is designed to avoid negatively affecting other properties, the surrounding environment, and shoreline appearance.

2. **Impacts from the construction activities and measures to minimize the impacts.**

   Impacts to the beach in the project vicinity can result from SPS construction. These may include impacts to public access, public recreation opportunities, public safety, and surrounding ecosystems. Among these, the primary applicable impacts are construction-related safety hazards and limitations of public access due to construction work. Given accessibility limitations, the proposed construction will need to occur from the beach level. As such, a detailed Construction, Staging, and Safety Plan should be prepared (by the contractor) that addresses the potential for temporary limitations to public access or recreation, and safety risks that could result from the construction work (if unmitigated). Aside from the revetment construction itself, no substantial or permanent physical alterations to the beach are required for staging or construction activities.

4.0 ANALYSIS OF HAZARD AVOIDANCE (APPLICATION SECTION 6)

Alternatives to the recommended hazard avoidance measure (rip-rap revetment construction) are

presented in Certerra's Geotechnical Investigation and Design Report. Alternatives considered include each of the nonstructural and structural shoreline protection described in Guidebook on Erosion Control Practices on the Oregon Coast (Oregon DLCD, 2021), including vegetative stabilization, sand alteration, sand burrito, and dynamic cobble berms. These protection measures are not sufficient given the severe storm conditions observed along the project area.

Vegetative stabilization can be an alternative to the more robust structural solutions in some areas of the Oregon Coast; however, it is not suited to areas where the erosion conditions are too severe to allow establishment of vegetation, or to prevent erosion of the underlying terraced soil structure. Due to the high wave energy and relatively steep beach slopes, vegetation has not been effective as shoreline bluff stabilization in the Salishan area.

Sand alteration is fairly common on the east coast where the wave climate is significantly milder; however, this has only been attempted in a few areas of the west coast such as San Diego, California. The process involves moving hundreds of thousands of cubic yards of sand within littoral cells or bringing sand from other sources in attempts to encourage dune building and to shore-up erosion-damaged areas. Typically, this involves large amounts of government spending and long-term commitments. The reality is that intense climatic events such as El Niño and La Niña, or in recent cases, an unusually severe storm or rip embayment, can remove hundreds of thousands of cubic yards of material in a few days' time, again exposing the shorelines to intense erosion. The practice of sand alteration usually requires vast areas of beach to be even moderately effective, so this would not be a viable solution for the small subject property.

Cobble berms are similar to sand alteration in that they involve moving material around on the beaches from areas of low potential damage to areas of high potential damage. Normally these require an extensive source of cobbles on the beach, or very close by (not readily available at this site). Cobble berms are constructed at a low slope angle (e.g., on the order of 11 degrees), and therefore require a larger footprint for placement. They are also sensitive to areas with severe wave attack, as observed across Salisha. The lack of cobble sources, and high-energy waves in this area combine to eliminate a cobble berm solution. It is likely that in this location, wave attack would remove the stabilizing effects of the cobbles within a short period of time.

As outlined in Section 5.2 of the Geotechnical Investigation and Design Report, none of these alternatives are effective solutions for mitigation of the significant coastal erosion conditions affecting the subject property.

In addition, softer solutions such as sand bags, gravel mounds, logs, or composite revetments would not prove effective for the subject property. Sand tubes have been used on the Atlantic coast with some success by placement offshore, which causes waves to break early and lose energy before reaching the shorelines. However, because of the extremely high wave energy, these structures have not been shown to have acceptable performance during severe storm events and over longer periods of time along the west coast.

Given the scope of this project the alternatives discussed are neither practical nor effective in mitigating the severe coastal erosion observed in the project area. Due to the high-energy storm

conditions and the specific site constraints, these softer and non-structural solutions fail to meet the necessary performance standards. As such, a riprap revetment is the alternative with the least impact among reasonable shoreline protection alternatives that would be viable at this location.

5.0 FULFILLMENT OF OREGON BEACH CONSTRUCTION/ALTERATION STANDARDS

The proposed rip-rap revetment construction fulfills each of the OAR Chapter 736, Division 20 "Beach Construction/Alteration Standards", including the General Standards (OAR 736-020-0010), Scenic Standards (OAR 736-020-0015), Recreation Use Standards (OAR 736-020-0020), Safety Standards (OAR 736-020-0030), and Natural and Cultural Resource Standards (OAR 736-020-0030). The following sections address each of the applicable standards:

5.1 General Standards OAR 736-020-0010

1. **Project Need - There shall be adequate justification for the project to occur on and alter the ocean shore area.**

   Based on the observed conditions, mass erosion potential, and risk of flooding, there is a clear and justifiable need for constructing the proposed SPS. The SPS is expected to significantly reduce erosion hazards, protect the slope from wave attack, prevent continued scouring along the beachfront beneath the existing Beach Grass Lane roadway, and protect from severe storm events. In the absence of the SPS, the area will remain vulnerable to continued erosion and storm-related damage.

   The conditions observed in the subject area suggest that a localized rip embayment has formed in this area, which can cause rapid and severe erosion. This condition poses an imminent threat to nearby infrastructure, including the Beach Grass Lane roadway and the low-lying areas further inland, which could be subject to flooding, potentially impacting the surrounding residences and Salishan Drive. On that basis, it is recommended by Certerra to install a new SPS along the northern approximately 150 feet of the subject property.

   With regard to the construction approach, access and excavation constraints preclude construction from the upland side. There is insufficient working area to facilitate installation to the required depths from the upland property. Therefore, construction will need to occur from the beach. A need for shoreline protection exists at this property, and the proposed SPS meets that need. As such, the requirements for demonstrating necessity are satisfied in both respects.

2. **Protection of Public Rights - Public ownership of or use-easement rights on the ocean shore shall be adequately protected.**

   The proposed SPS will be constructed on property owned by the SLI, which is currently utilized as public beach. The installation of the SPS will serve to protect and preserve the public beach access. As discussed above, a Construction, Staging, and Safety Plan should be prepared to limit impacts to the public beach access and recreation. The designated work area will be clearly delineated with access to the Oregon Coast to be maintained during construction (e.g., a minimum 10-feet-wide delineated easement will be maintained between the ocean and the work area at high tide) and OPRD will be notified of the construction activities on the beach. For these reasons, the project is protective of public rights and this criterion is met.

3. **Public Laws - The applicant shall comply with federal, state, and local laws and regulations affecting the project.**

   The project meets Statewide Planning Goal 18 criteria, therefore the subject property is eligible for a shoreline protective structure to be permitted. A request for Construction Equipment and Staging on the Ocean Shore is planned to be submitted with the permit application. In addition, the Lincoln County Planning Department will be contacted to execute the affidavit required for this application, and a Floodplain Development Permit will be obtained as part of the Lincoln County permitting process.

   Regarding compliance with other federal and state law, a permit from the U.S. Army Corps of Engineers (USACE) or the Oregon Department of State Lands (DSL) is not required for this project. As such, the project will be in compliance with applicable federal, state, and local laws, and therefore this criterion is met.

4. **Alterations and Project Modifications - There are no reasonable alternatives to the proposed activity or project modifications that would better protect the public rights, reduce or eliminate the detrimental effects on the ocean shore, or avoid long-term cost to the public.**

   As described in Section 4.0 above (Analysis of Hazard Avoidance), alternative protective measures were considered and none of these alternatives are recommended as effective or practical solutions for mitigation of the severe erosion affecting the subject property. As previously described in this narrative, there is a need for the SPS at this location, the subject property is eligible for a structural solution, and the proposed solution (rip-rap revetment construction) is the lowest impact "reasonable" alternative. In terms of the structural solution proposed, the structure is designed to stay within the subject property boundaries. Based on the alternatives analysis and findings, this criterion is met.

5. **Public Costs - There are no reasonable special measures which might reduce or eliminate significant public costs. Prior to submission of the application, the applicant shall consider alternatives such as nonstructural solutions, provision for ultimate removal responsibility for structures when no longer needed, reclamation of excavation pits, mitigation of project damages to public interests, or a time limit on project life to allow for changes in public interest.**

   The proposed SPS will be constructed on property owned by SLI and maintained by SLI. Therefore, there are no public costs associated with this project. Further, SLI and other lease holders will bear all costs for the revetment construction, and for any construction restoration activities performed after the revetment has been completed. Non-structural alternatives have been considered and are not recommended, as previously described. There will be no cost to the public as a result of the SPS construction, and therefore this criterion is met.

6. **Compliance with LCDC Goals - The proposed project shall be evaluated against the**

applicable criteria included within Statewide Planning Goals administered by the Department of Land Conservation and Development.

As described above, the project may be eligible for shoreline stabilization because the property was developed prior to January 1, 1977. In addition, the Salishan community falls within the exception area (i.e. the Salishan Exception Area) of the Statewide Planning Goal 18 criteria. This criterion is met.

5.2 Scenic Standards (OAR 736-020-0015)

Projects on the ocean shore shall be designed to minimize damage to the scenic attraction of the ocean shore area. The following attractions of the ocean shore area have been considered and are addressed as follows:

1. **Natural Features – The project shall retain the scenic attraction of key natural features, for example, beaches, headlands cliffs, sea stacks, streams, tide pools, bedrock formations, fossil beds and ancient forest remains.**

   In general, the majority of the properties along the Salishan Spit are protected by riprap revetments. The proposed SPS will consist of a riprap slope, typical of the shoreline in the Salishan community. The project will closely follow adjacent revetments and slope profile in the area and will not substantively alter any other landforms. The project will not affect the scenic attraction in the vicinity of the Subject Properties, and therefore this criterion is met.

2. **Shoreline Vegetation – The project shall retain or restore existing vegetation on the ocean shore when vital to scenic values.**

   Any vegetation removal will be minimized to the areas absolutely necessary for the construction of the SPS. In addition, the proposed SPS will prevent continued erosion along the existing bluff and oversteepened slope located on the subject property. As a result of these conditions, and proposed SPS design and construction measures, this criterion is met.

3. **View Obstruction – The project shall avoid or minimize obstruction of existing views of the ocean and beaches from adjacent properties.**

   The proposed SPS construction will not obstruct views of the ocean or beach from adjacent properties and will be consistent with the profile of the other revetments in the project area. As such, this criterion is met.

4. **Compatibility with Surroundings – The project shall blend in with the existing shoreline scenery (type of construction, color, etc.).**

   As noted above, the majority of the properties in the project vicinity are protected by existing riprap revetments. The proposed SPS construction will closely follow existing

revetments and slope profile in the area, and the appearance of each property's shoreline will not be altered significantly. The project is compatible with the surrounding properties, and on that basis this criterion is met.

5.3 Recreation Use Standards (OAR 736-020-0020):

The following recreation use standards shall be applied, where applicable, to each application for an ocean shore permit.

1. **Recreation Use – The project shall not be a detriment to public recreation use opportunities within the ocean shore area except in those cases where it is determined necessary to protect sensitive biological resources such as state or federally listed species.**

   The proposed SPS will be constructed on private property owned by the Salishan Leaseholders HOA, and the future existence of this structure would correspondingly not be a detriment to public recreation use opportunities. Construction activities will be conducted on weekdays and will not occur during peak summer months (June, July, or August) to facilitate minimal impact to public beach users. In addition, the project will require a relatively limited staging area during active construction based on the relatively small scale of the construction, and strategy of only importing the volume of material that will be used on a daily basis. Finally, the construction area will be clearly delineated. On this basis, this criterion is met.

2. **Recreation Access – The project shall avoid blocking off or obstructing public access routes within the ocean shore area except in those cases where it is determined necessary to protect sensitive biological resources such as state or federally listed species.**

   The proposed SPS will not impact any existing public access routes, in fact the construction of the SPS will help preserve the public access to the beach front from further erosion and allow access to the public beach. During the worst of conditions, high tides and storm waves cover the beach up to the base of the existing revetments and beachfront slopes. During normal and summer conditions, the beach may be as much as 300 feet wide at low tide. This structure will not alter or worsen the existing conditions. During normal seasonal weather patterns, the usage of the beach in this area will not change because of this structure. The Construction, Staging, and Safety Plan should define that construction activities are being sequenced and timed to minimize impacts to public beach access. This criterion is met.

5.4 Safety Standards (OAR 736-020-0030):

The project shall be designed to avoid or minimize safety hazards to the public and shoreline properties. The following safety standards shall be applied, where applicable, to each application for an ocean shore permit.

1. **Structural Safety – The project shall not be a safety hazard to the public due to inadequate structural foundations, lack of bank stability, or the use of weak materials subject to rapid ocean damage.**

   The proposed SPS construction was designed by a Certified Engineering Geologist and Licensed Geotechnical Engineer in accordance with current engineering standards. The design is for a robust structure with heavy armor rock that is intended to withstand extreme conditions of coastal erosion and wave overtopping. Periodic inspection will be conducted by the engineer of record (Certerra) during construction to confirm that the structure is constructed in accordance with the design, with inspections documented in daily field reports and a Final Summary Report at the end of construction. The design is structurally safe and proper implementation will be verified by the engineer of record during construction, therefore this criterion is met.

2. **Obstruction Hazards – The project shall minimize obstructions to pedestrians or vehicles going onto or along the ocean shore area.**

   As described in the sections above, the SPS will be constructed on private property and will therefore not obstruct public access. As noted above, construction activities will be sequenced and timed to minimize temporary obstructions to public beach access and public movement on the adjacent beach. Based on the conditions presented, this criterion is met.

3. **Neighboring Properties – The project shall be designed to avoid or minimize ocean erosion or safety problems for neighboring properties.**

   Given the neighboring properties are currently armored with revetments and the scale of the construction is minimal, the project will not have a measurable additional negative effect on the neighboring properties, and therefore this criterion is met.

4. **Property Protection – Beachfront property protection projects shall be designed to accomplish a reasonable degree of increased safety for the on-shore property to be protected.**

   As presented above, the proposed SPS will improve the safety of the subject property by mitigating future erosion, scouring, recession, and potential slope failure of the subject bluff. The project improves the protection of the subject property, and on that basis this criterion is met.

5.5 Natural and Cultural Resource Standards (OAR 736-020-0030):

Projects on the ocean shore shall avoid or minimize damage to the following natural resources, habitat, or ocean shore conditions, and where applicable, shall not violate state standards.

1. **Fish and wildlife resources including rare, threatened or endangered species and fish and wildlife habitats.**

It is anticipated that the proposed project, including the proposed SPS and the related construction activities, will not substantively alter the habitat of any fish and wildlife resources (including that of rare, threatened or endangered species).
A FEMA Floodplain Habitat Assessment was prepared by AKS Engineering & Forestry, LLC to evaluate potential effects to ESA-listed species and floodplain habitat functions. The assessment determined that the proposed revetment will not result in a net loss of key floodplain functions, will not impact designated critical habitat, and will not affect fish or wildlife habitat within the project area. No vegetation removal within regulated floodplain or riparian buffer areas is proposed, and the project does not provide spawning, rearing, or migratory habitat for listed fish species. The AKS Floodplain Habitat Assessment is included as an attachment to this narrative.

In addition, the Oregon Department of Fish and Wildlife (ODFW) will be informed of this application during the review process to verify the presumed absence of rare, threatened, or endangered fish or wildlife species at the project site to ensure that this criterion is met.

2. **Estuarine values and navigation interests.**

The eastern portion of the Salishan Spit borders the Siletz Bay Estuary. Since the Subject Properties are located on the western portion of the Salishan Spit and does not border the waters of the estuary (Figure 3), it will not substantially affect the estuarine values and navigational interests of the area. The Oregon Department of Land Conservation and Development (ODLCD) will be informed of this application during the review process to verify and ensure that the delicate ecosystem of the estuary is not threatened or endangered by the construction at the project site to ensure that this criterion is met.

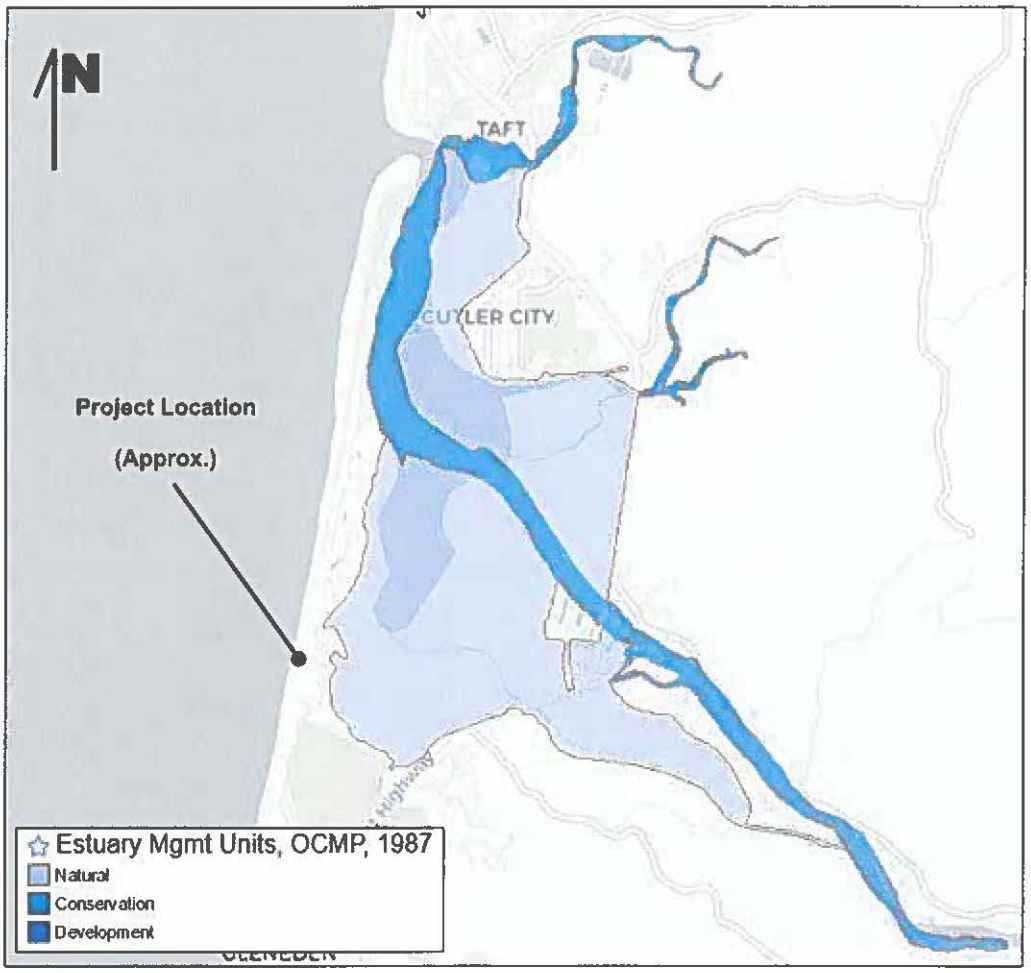


Figure 3: Estuary Plan Map from the Oregon Coastal Atlas showing the estuary classifications of the Siletz Bay Estuary (https://www.coastalatlas.net/index.php/tools/planners/63-estuary-data-viewer).

3. **Historic, cultural and archeological sites.**

   It is anticipated that the implementation of the proposed project (i.e. the construction of the new SPS) will not encounter or impact historic, cultural or archaeological resources. Beyond the presumption of the absence of these resources, the applicants acknowledge the requirement that these resources must not be impacted as a result of this project. If historic, cultural, or archeological artifacts are inadvertently discovered during construction, the project will cease, and the Oregon State Historic Preservation Office will be contacted. During the application review, notice and opportunity for comment will be provided to the Oregon State Historic Preservation Office, as well as the indigenous tribe that included the northern and central Oregon coast within their homelands (the Confederated Tribes of Siletz Indians and the Confederated Tribes of Grand Ronde), in order to ensure that this criterion is met.

4. **Natural areas (vegetation or aquatic features).**

Vegetation removal will be minimized to the areas absolutely necessary for the construction of the SPS construction. No aquatic areas or features will be impacted by the proposed structure. As such, this criterion is met.

5. **Air and water quality of the ocean shore area.**

   The proposed SPS, as well as the construction activities, will not impact the air and water quality of the ocean shore. Measures to ensure this will include verifying that construction materials are brought to the site free of debris, and equipment will not be fueled or maintained on the beach. Based on the planned adherence to these measures, this criterion is met.

6. **Areas of geologic interest, fossil beds, ancient forest remnants.**

   The subject property is not in a known area of geologic interest, fossil bed, or ancient forest remnant. If evidence of such features is identified by construction workers or EE geologists onsite during construction inspections, the project will cease, and the Oregon Department of Geology and Mineral Industries (DOGAMI) will be contacted. Based on these conditions, this criterion is met.

7. **When necessary to protect native plant communities or fish and wildlife habitat on the subject or adjacent properties, only native, non-invasive, plant species shall be used for revegetation.**

   The proposed design does not involve revegetation of plant species, therefore this criterion is met.

6.0 CONCLUSION

For the reasons stated above, the Oregon Parks and Recreation Department can find that all applicable criteria are met and approve the Application.

PROPOSAL

This Proposal Estimate was made as of April 21, 2026

Salishan Leaseholders (SLI)

Beach Grass common Area

Scope of work:

Building Riprap Protection per Certerra report addendum Report 10-242036 Dated January 12th, 2026 from MSL 10 to MSL 33 approximately spanning 146' Linear Feet on the west most arc. DKE took into account the two cross sections "A" and "B", along with the proposed conditions plan view page 5 of 66 in the report as basis for this pricing.

DKE has taken into account the boulders that have already been staged at the BGL common area for this project.

All material, all fabric, labor, and equipment using the Certerra Report.

All the above work is to be completed in a substantial and workmanship-like manner according to standard practices for the price stated below.

Any alteration or deviation from the above specifications involving extra cost to material or labor will be executed only upon written orders for the same and will become an extra charge over the sum mentioned in this proposal.

All agreements must be made in writing.

Upon acceptance, please supply the property owners' legal name, address, and/or legal description and this quote will be processed into a contract for the owner's signature.

Total Estimate $372,469.00

NOTE: Beach grass planting by others.

Owners Signature:_____ **Date:**_____

PO Box 79
Lincoln City OR 97367
541-994-8584, Office
541-994-6466, Fax
office@dankauffmanexcavating.com
CCB #246204

SALISHAN DKE Construction Impacts, Staging and Public Safety Plan
Beach Grass Common Area in the vicinity of Salishan Drive and Beach Grass Lane

1. Potential impacts during construction of the revetment and measures to minimize.

The construction of a shoreline revetment can have detrimental impacts on the surrounding beach while it is being built. These can include disruption of public access, interference with public recreation opportunities, creation of hazards to public safety and harm to surrounding ecosystems. The potential impacts from construction of the new revetment are the temporary interference with public access/recreation and creation of safety risks.

The following Public Safety Plan will take measures to minimize potential impacts.

Salishan Ocean Shores Construction Impacts, Staging, and Public Safety Plan

The requested ocean shore permit for the construction of a modern revetement structure is critically necessary to protect the common area oceanfront infrastructure from severe erosion along 146' ft. of oceanfront.

In the report from the engineering firm the recommendation was made that the modern revetment structure:

- provide an adequate area east of the revetment to protect the houses and supporting infrastructure.
- terminate at the southern end of BGL in a configuration appropriate for the continuation of construction of a modern continuous revetment to the South in the future.
- Access to the beach is necessary to build the toe portion of the protection to ensure that the engineered MSL depth is met. Once this phase of construction is completed the remaining majority of the construction is completed from the upland portion of this project area, minimizing the impact the access points and distance traveled along the beach.

In this construction plan, as the construction moves from the beach to upland, this mitigates the disruption of public access and interference with public recreation opportunities.

- Access points for public and private access are impacted minimally, due to BGL being already closed due to erosion conditions. The existing signage by SLI at this construction area should remain during the duration of this construction.
- DKE, while the beach phase is taking place, will post signs as needed. (see signage portion of this construction plan)

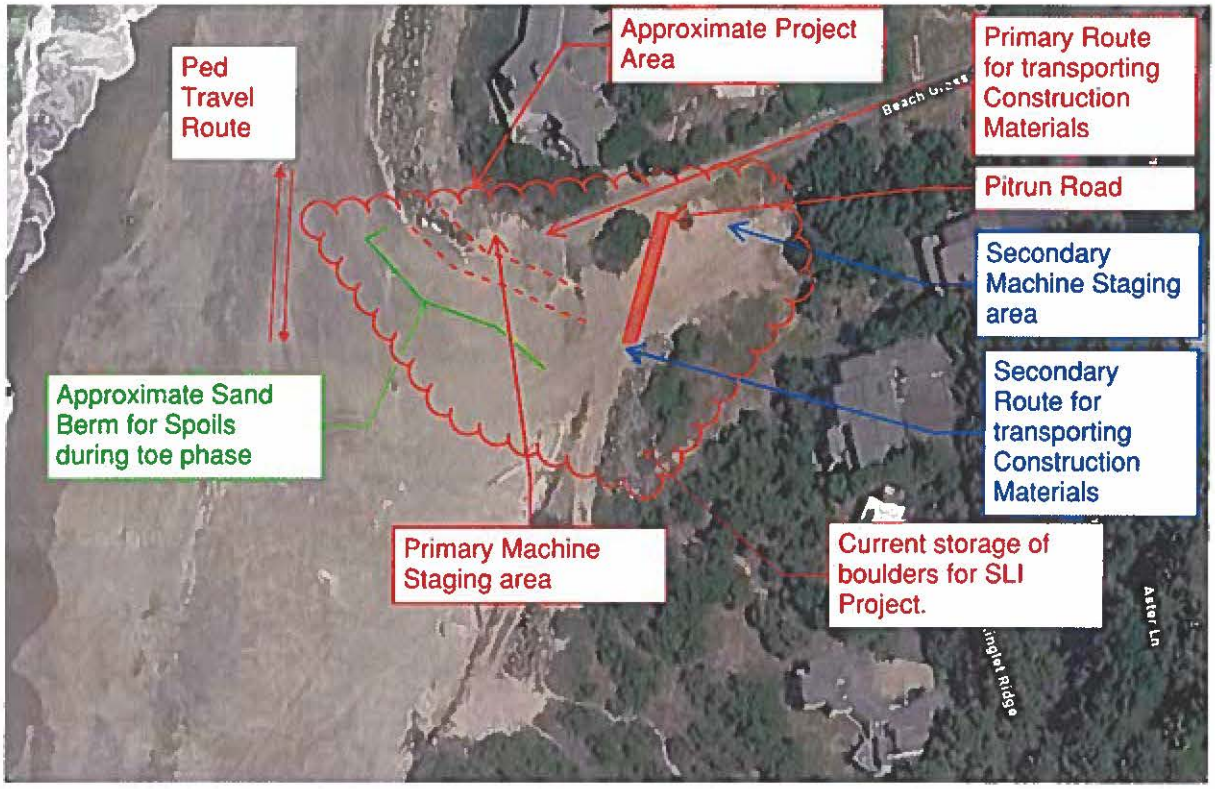


Photo 1: Aerial view of construction site with red line indicating where new revetment will be constructed. The roads from Salishan Drive to beach accesses & equip/materials storage. (Photo: Dan Kauffman Excavating DKE)

- **Observe Work Conditions and Inform Community**

Through the Oceanfront Committee, DKE will inform the Salishan Leaseholders Board and community of the construction activity at BGL Common Area. This will include the Sites involved, haul roads, staging areas and timeline. DKE will observe the rules of the Salishan Community for construction e.g. work will occur Monday through Friday 8:00 a.m. and finish by 5:00p.m. DKE will request through Salishan Leaseholders Board in writing to amend these if needed.

DKE will use the designated Salishan point of contact along with a weekly RIPRAP report to communicate progress, updates, or delays. When initiated, construction will proceed without delay weather permitting, until the revetment is complete.

- **Sequence of Events**

The sequence of construction events will occur in multiple stages:

(Mobilization) DKE will mobilize and demobilize equipment to the construction area via Laurel Street to Beach Grass Lane Common Area under a drive on beach permit. See Photo 1b. A Secondary Mobilization location has been identified at Wallace Street to the south of Laurel Street.



Photo 1b: Aerial view of Mobilization Route.
(Photo: Dan Kauffman Excavating DKE)

(1) Backfill to mitigate the impact of erosion, as needed
(2) Build from the toe rock on the beach to a height of 20 feet approximately.
    - Excavate trench for placement of toe rock
    - Place small amounts of sand as needed to prevent water intrusion and clearly delineate the construction area from the public to the west and south along the toe rock placement area
    - Place fabric
    - Sequence of materials: pit run materials, underlayer stone ("chunky rock"), then armor stone

- Materials to be transported to the construction site using "on road" dump trucks on Beach Grass Lane Road at BGL common area. This is the primary means of delivery and dumping of materials. Pit Run Road is an alternative location to transport materials to the construction area. This minimizes the "on beach" activities by having two alternatives for getting construction materials near the location where they will be permanently placed.
- The Pitrun road is proposed to be covered by sand at the conclusion of this project to support future projects in the vicinity.
- Small amounts of construction materials may be placed on a temporary basis adjacent to the construction area to support sorting activities for placement.

(3) Work from the upland side, build the top 13 feet to finish the revetment

- Continuing placement of stone from upland
- Construction materials to be transported from Beachgrass Lane Road across the top of the newly build revetment wall north and south to build up the north and south wall to the engineered elevation. Finishing the last portion of the wall in the middle from the Beach Grass lane road
- Finish the top of the revetment with 2-foot-thick layer of sand topping the armor stone above the severe wave splash elevation at 33 feet (NAVD 88)

- **Unscheduled incidents or developments**
  - In the unlikely event of a machine breakdown, long lasting weather impacts, and public interference with construction. DKE is to notify OPRD immediately.
- **Timeline/schedule**

Following the issuing of the permit from OPRD, DKE will follow the sequence above.

DKE uses an algorithm to calculate the time to completion for the entire project:
<u>146 lineal feet shoreline / average of 5 feet completed per day = approx 30 working days</u>

  - Calculation includes the sequence of construction activities above as well as movement of equipment, construction of access roads, hauling materials, inspections and restoration of the site following final inspection
  - A pre construction meeting will be scheduled for SLI, DKE, and OPRD within the week prior to construction beginning
  - 30 Work-days completion recognizes Salishan community restrictions and excludes Sundays and Saturdays
  - Timely granting of OPRD "on the beach permit" and completion of Certerra inspections is necessary
  - Weather and storm conditions will impact schedule and excavation equipment on the beach

- **Identify Haul Route and Staging Areas**

Staging area for temporarily removed sand along with construction materials are to be contained in the designated construction area depicted in Photo 1. Sand removed from the toe construction will be placed west of the dig site, providing a pathway for pedestrian traffic in low to mid tide conditions. Upland staging to the south includes the location around the previously staged boulders for this project.

Salishan Drive runs the length of the Spit and provides the only access road and haul route to the Subject Sites. The upland staging areas and temporary access roads at BGL and hauls routes on Salishan Drive have been designed to minimize any interference with public access and recreation. The temporary access road at BGL (see photo 1) will be restored at the conclusion of construction work for BGL Salishan Drive.

A upland main boulder staging area has been identified by DKE off the property of Salishan.



Photo 2: Aerial view of rock stockpile.
(Photo: Dan Kauffman Excavating DKE)

- **Place Signage to Direct and Protect**

DKE will install large signs, as needed, at the Upland Staging Area.

DKE intends to install large signs at the northern and southern most lines of the Work area as needed. See visual examples below.

In addition, along the Western edge of the Work Area Facing the ocean, approximately every 50 feet, as needed.



OR



Both signs above are standard construction signs approved by various jurisdictions and understood by the public. All cones and signs will be placed, as needed, before work starts each morning.

A sign will be posted illustrating detours as follows (In the appropriate directions):



OR

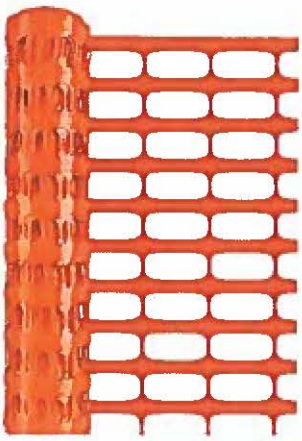


OR



DKE will fence off the worksite to protect the public if/when needed at the end of every workday and on weekends using Safety Fence below or equivalent. Safety Fencing will be unrolled at the start of each workday.

Safety Fence - Heavy Duty, 4 x 100', Orange



Control pedestrian and vehicle traffic around temporary hazards.

- Recommended for construction sites, parking lots or warehouses.
- Easy to install and remove. Rolls up for easy transport.
- 50% stronger for windy, snowy winter conditions.
- Safety Fence Post sold separately.

- **Secure Equipment to be used**

Construction equipment and vehicles will be staged upland from the beach when not in use. Equipment will be on the beach only during active work times. Maintenance and fueling will occur upland; and spill kits will be readily available on site. For constructing up to 146 ft of contiguous rip rap at Beach Grass Lane common area , two excavators will be used. Four to seven dump trucks will haul 15- 20 loads per day from the staging area to the revetment site. Each dump truck will haul 12 yards of rip rap rock. An "off highway" dump truck may be used as needed to haul 22 yards of rip rap rock north and south on the beach from the beach access area. This construction plan minimizes the potential for "off highway" dump trucks with the multiple access points to the construction area.

EARTH ENGINEERS
An RMA Company

2411 Southeast 8th Avenue • Camas • WA 98607
Phone: 360-567-1806
www.earth-engineers.com

May 14, 2024

Salishan Leaseholders Incorporated
Attn: Katie Anderson, Aperion Management Group Email: kanderson@aperionmgmt.com

Subject: Proposal for Geotechnical Investigation and Revetment Design
Proposed Shoreline Protection Structure
Beach Grass Lane Common Area
Gleneden Beach, Lincoln County, Oregon
EE Proposal No. 10-24-P160

Dear Katie

As requested, **Earth Engineers** (EE) is pleased to submit our proposal to provide geotechnical engineering services for the above referenced project. This proposal outlines our project understanding, proposed scope of services, schedule, fees, and General Conditions that will apply.

PROJECT UNDERSTANDING

Our current understanding of the project is based on correspondence between Salishan Leaseholders Incorporated (SLI) and EE Principal Engineering Geologist, Adam Reese, RG, CEG. Briefly, we understand that the subject lot (Beach Grass Lane common area) has beach frontage of approximately 400 linear feet. The shoreline is presently unprotected from coastal erosion.

We understand that you wish to construct a Shoreline Protection Structure (SPS) to mitigate impacts from anticipated future coastal erosion. Among SPS alternatives, we understand that you would prefer to construct a riprap revetment.

On February 9th, 2024, EEI Project Geologist, Matt Enos, R.G., visited the subject property for a preliminary reconnaissance and to assess the current extent of erosion that had recently occurred. While on site, we observed that major erosion had impacted the toe of the bluff (shown in Photo 1 below) and was presenting imminent risk to the adjacent developed properties and associated structures. We understand that the heavy erosion continued through February.

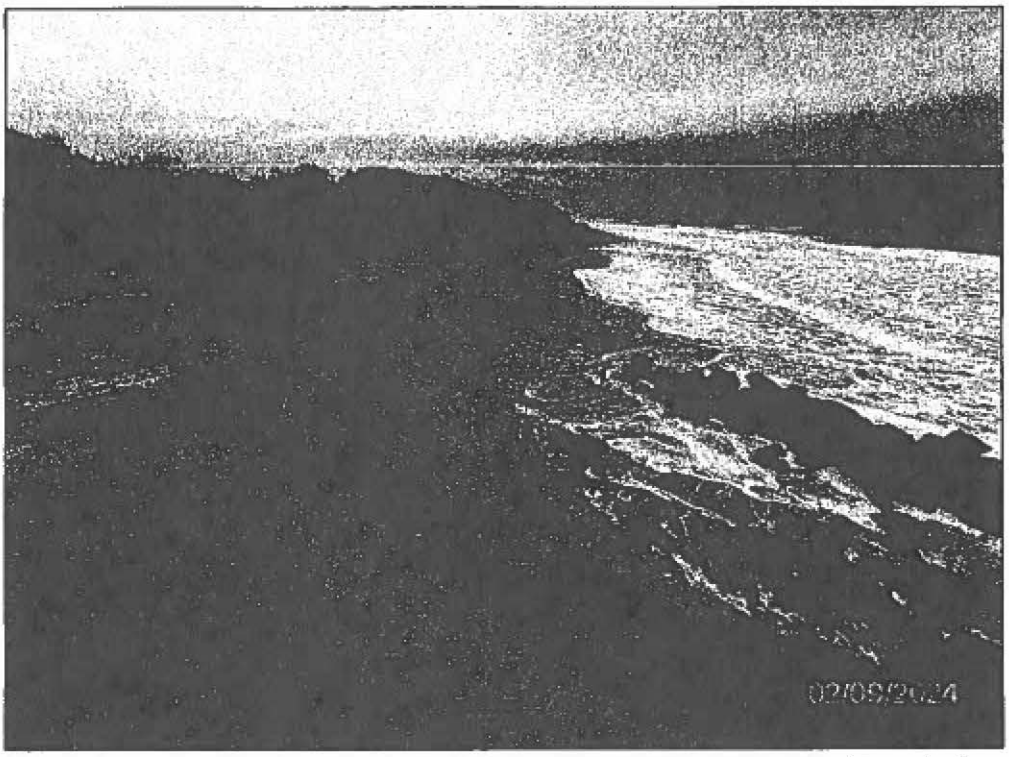


Photo 1: Looking south from Beach Grass Place across beach frontage of Beach Grass Lane common area. Older temporary rip-rap placed can be seen on the right side of the photo.

SCOPE OF SERVICES

Our scope of work is to provide a geotechnical investigation and design for a riprap revetment that protects the Beachgrass Lane common area (i.e. one structure along the 400 feet of shoreline to the west of the undeveloped common area). In order for us to provide geotechnical recommendations for the proposed Riprap Revetment structures, we propose to perform subsurface explorations to evaluate the sand/soil and bedrock conditions within the proposed footprint of the structure. Given the scope and size of the project, we recommend conducting 8 test pit explorations within the planned location of the structure at the subject property's shoreline. **This scope of work and fee proposal assumes that Dan Kauffman Excavation, Inc. will excavate the test pits, and their costs will be billed directly to Salishan Landowners Incorporated (SLI) (I.e. the costs for test pit excavation are not included in this lump sum budget).**

The explorations are planned for depths of up to 10 to 15 feet below the surface, or less if dense marine sedimentary bedrock is encountered. In addition, drive probe tests will be performed at select test pit locations to evaluate the subsurface soil strength. Grab samples will be obtained from the explorations at the discretion of the Geotechnical Engineer for laboratory testing.

In addition, in order to characterize the soils along the approximately 20-foot-high bluff above and behind the proposed riprap revetment structure, we recommend supplementing the test pits with hand tool explorations on the slope. This information will be used to assess the forces that may be affecting the land side of the revetment, as well as providing a limited assessment of bluff slope stability. We recommend advancing a minimum of 6 hand auger explorations with supplemental drive probe testing located along the bluff. The drive probe explorations will be advanced to depths of up to 16 feet bgs, or refusal (whichever occurs first). Disturbed samples will be obtained from the explorations at the discretion of the Geotechnical Engineer for laboratory testing.

Prior to performing the subsurface investigation, we will locate *public* underground utilities by contacting Oregon's Utility Notification Center. Our client will be responsible for locating all private underground utilities. We will not be responsible for damage caused by our subsurface investigation to unmarked underground utilities or structures.

It should be noted that once we begin the subsurface investigation and determine the soil and bedrock conditions present, it may be necessary to modify the planned number, type and depths of explorations to better evaluate the site conditions. If extremely poor conditions are encountered, we would contact you to discuss how to proceed and whether authorization is given to increase the project budget.

After completion of the field investigation, we will perform laboratory testing that will include moisture content and particle size analyses (#200 Wash). Atterberg Limits testing will also be performed if cohesive samples are encountered.

At the conclusion of our field and laboratory work, the data will be analyzed by our designated project Geotechnical Engineer and a report will be prepared. The report will include the following:

- A discussion of subsurface conditions encountered including pertinent soil and rock properties (and groundwater conditions, if encountered).
- Geotechnical related recommendations and design for the proposed riprap revetment.
- 2019 Oregon Structural Specialty Code seismic design criteria (if required).
- Recommendations for the overall suitability of the in-situ soils for use as utility backfill and structural fill.
- Qualitative assessment of bluff slope stability (i.e. a visual reconnaissance combined with our limited hand tool exploration data). In addition, quantitative slope stability modeling using our SLIDE2 slope modeling software will be performed, where required.
- Structural fill requirements, including gradation and compaction.
- Recommendations for revetment foundation subgrade preparation.
- Wet and dry weather construction recommendations.
- Discussions on geotechnical issues that may impact the project

Our investigation and design will address only the shoreline area in which the SPS has been proposed, not the site in its entirety. As part of our report, we will include a site plan sketch (overlay of SPS layout on a Google Earth image) and also simple, non-scaled cross-section sketches for the recommended SPS. It should also be noted that our current scope does not include any surveying, structural engineering, or the preparation of scaled drawings (e.g., CAD drawings, site plan, etc.). If other detailed construction/design drawings are required for permitting, these can be provided at an additional fee. Unless requested otherwise, our report will be distributed electronically in PDF format.

Please note that this proposal is for the geotechnical investigation and design of the riprap revetment and our proposed scope of services will be concluded upon submittal of our finalized investigation-design report. Additional services required to support permitting of the structure (e.g., providing additional information to address OPRD application evaluation criteria, such as assessment of location-specific erosion or coastal processes, hazard avoidance alternatives, detailed alternatives assessment, etc.) are not included in this proposal, but can be provided on a time and materials basis subsequent to submittal of our geotechnical investigation report and design.

Our currently proposed scope does not include a detailed seismic hazard study or liquefaction analysis. We are available to provide these services upon request.

SCHEDULE AND FEE

We are available to start your project about 2 weeks after we receive written authorization to proceed and the requested deposit below. Our fieldwork is estimated to take one day on site; however, a Beach Access Permit will need to be submitted by Dan Kauffman Excavation, Inc. and approved by OPRD before conducting the test pit explorations. In addition, OPRD is now requiring submittal of an Ocean Shore Permit Application to perform test pit explorations on the beach, requiring additional EE level of effort and adding substantial additional time to the approval process. This permit preparation and approval process can take several weeks to more than a month. Once these preliminary permits have been approved and our explorations have been completed, the final written report will be submitted within approximately 4-6 weeks of completing the exploration program.

Our geotechnical investigation report will be completed for a base lump sum fee of $18,750.00. Additional fees to attend meetings, support permitting, and construction inspection fees would be charged on a time and material basis according to the following 2024 unit rates:

Principal Engineer/Geologist	**$210.00** per hour
Project Engineer/Geologist	**$160.00** per hour
Engineering or Geology Staff	**$130.00** per hour

Geotechnical Special Inspector	**$120.00** per hour
Sample Pickup	**$95.00** per hour
Mileage	**$0.80** per mile
Proctor Lab Test	**$305.00** each
Nuclear Density Gauge	**$80.00** per day

Note that these rates are applicable through December 31, 2024. After that date, our standard unit rates for the current year will apply.

Construction inspection services have a 3-hour minimum charge. Overtime rates (1.5 times the normal rates) apply to inspection services provided on weekends, holidays and after exceeding 8 hours in a work day. To be clear, our lump sum fee above does not include SPS permit support and geotechnical construction inspection services during construction.

PROPOSAL ACCEPTANCE

By signing below, you hereby authorize Earth Engineers, an RMA Company to proceed with services outlined in this proposal or requested by you and agree that all services and anything arising out of or in any way related to this proposal will be governed by Earth Engineers, an RMA Company's General Conditions which are attached hereto and are incorporated herein by reference. This authorization to proceed constitutes an agreement between you and Earth Engineers, an RMA Company and is made in consideration of the mutual promises and covenants contained herein and for other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged.

Thank you for the opportunity to submit this proposal. We look forward to working with you on this project. If you have any questions regarding this proposal, please contact the undersigned.

Authorized By:

Client

SCI

S.B. Marsh Chair

Respectfully submitted,

Earth Engineers, an RMA Company

Mailing Address: PO Box 354 Glenedon Beach

Telephone: 503-806-2256

E-mail: sbmarsh@gmail.com

Signed By (print): Suzanne H. B. Marsh

Title: Chairwoman, SCI

Date [redacted]

PROPOSAL

This Proposal Estimate was made as of April 21, 2026

Salishan Leaseholders (SLI)

Beach Grass common Area

Scope of work:

Building Riprap Protection per Certerra report addendum Report 10-242036 Dated January 12th, 2026 from MSL 10 to MSL 33 approximately spanning 146' Linear Feet on the west most arc. DKE took into account the two cross sections "A" and "B", along with the proposed conditions plan view page 5 of 66 in the report as basis for this pricing.

DKE has taken into account the boulders that have already been staged at the BGL common area for this project.

All material, all fabric, labor, and equipment using the Certerra Report.

All the above work is to be completed in a substantial and workmanship-like manner according to standard practices for the price stated below.

Any alteration or deviation from the above specifications involving extra cost to material or labor will be executed only upon written orders for the same and will become an extra charge over the sum mentioned in this proposal.

All agreements must be made in writing.

Upon acceptance, please supply the property owners' legal name, address, and/or legal description and this quote will be processed into a contract for the owner's signature.

Total Estimate $372,469.00

NOTE: Beach grass planting by others.

Owners Signature:_____ **Date:**_____

PO Box 79
Lincoln City OR 97367
541-994-8584, Office
541-994-6466, Fax
office@dankauffmanexcavating.com
CCB #246204

GEOTECHNICAL SCOPE OF SERVICES AMENDMENT

This Geotechnical Scope of Services Amendment ("Amendment") is entered into between Salishan Leaseholders Inc. ("Client") and Certerra Northwest, LLC ("Consultant"). Client engages Consultant to provide an Amendment to our previously agreed upon services in connection with the following project:

Geotechnical Investigation and Revetment Design for the Proposed Shoreline Protection Structure at the Beach Grass Lane Common Area in Gleneden Beach, Lincoln County, Oregon.

SCOPE OF SERVICES AMENDMENT. As an amendment to the scope of services outlined in Proposal No. 10-24-160P ("Proposal"), which was authorized by Suzanne Maresh, Consultant shall perform the following additional services:

To date, the Consultant has completed the Scope of Work specified in the above-referenced lump sum proposal. A draft Geotechnical Investigation and Design Report for the proposed Beach Grass Lane Common Area shoreline protection was provided in December 2024. Subsequently, a portion of the project has been approved to move forward prior to the remainder of the project, which includes the following:

1. **North Revetment Design and Report (segment protecting the Beach Grass Lane roadway only):** We understand that SLI plans to construct a partial (150-foot long) revetment on the north end of the Beach Grass Lane Common Area bluff in order to protect the Beach Grass Lane roadway. SLI requested that Certerra provide design figure updates for this segment of the revetment, in addition to a modified version of the draft Geotechnical Investigation and Design Report. In addition, Certerra will support SLI with preliminary design information to assist with their contractor procurement. At the request of SLI, consultant has already prepared preliminary figures (site plan and cross section) for the proposed segment and has participated in informal meetings and performed a site visit to confirm the segment length.

2. **North Revetment Segment – Permit Application Support:** SLI has requested Certerra's support with geotechnical services during permitting. We have been requested to prepare the necessary permit applications for the project. Our services include completing all sections of the Oregon Parks and Recreation Department (OPRD) Ocean Shore permit application, including the supplemental permit narrative that addresses the project justification and impacts, as well as the hazard avoidance alternatives analysis.

   The complete permit application will also include the specifications of the proposed construction (i.e. dimensions of the proposed SPS), the required drawings, a construction value estimate, and the approved County Planning Department Affidavit (with the approved LUCS and Floodplain Development permit application). Our services will also include completing the LUCS and Floodplain Development permit applications through the County. Finally, our services will include coordinating with the contractor to obtain their Construction, Staging, and Safety Plan (required for the OPRD permit application), and communicating with State and County officials throughout the process.

Client agrees that services not specifically described above, nor included in the prior Proposal, are not included in the Scope of Services provided by Consultant.

COMPENSATION. Client shall compensate Consultant for the additional project services outlined above as follows:

The requested services will be charged on a T&M basis in accordance with the following 2025-unit rates: Principal Geotechnical Engineer or Engineering Geologist - $220 per hour; Project; Associate Geotechnical Engineer - $195 per hour; Geotechnical Engineer or Engineering Geologist - $165 per hour; Geotechnical Project Manager - $165 per hour; Geotechnical Staff - $135 per hour; Mileage - $0.80 per mile. Future inspection services during the

construction phase (provided at the request of the Client) to be charged on a T&M basis in accordance with these unit rates. _____

Based on the above referenced billing rates and the anticipated scope of work, the Consultant proposed T&M (not-to-exceed without prior authorization budget for the scope of services described herein is $5,500.

GENERAL CONDITIONS. The Client and Consultant have each read, understand and agree to the General Conditions attached to Proposal No. 10-24-160P, and agree that those General Conditions are incorporated into this Amendment by reference.

By signing below, each party agrees to the terms above.

Client:_____

By (print):_____

Signature:_____

Title: _____ Date:_____

CERTERRA NORTHWEST, LLC

By (print): _____

Signature:_____

Title: _____ Date:_____

Dan Kauffman Excavating LLC
PO Box 79
Lincoln City OR 97367
541-994-8584
office@dankauffmanexcavating.com
Oregon CCB 246204

Invoice

Date	Invoice #
11/1/2024	2024-222

Bill To

EARTH ENGINEERS
4660 MAIN STREET, SUITE 100
SPRINGFIELD OR 97478

PO #	Project	Terms
	Tax Lot 08-11-09-AA-00235 Tax Lot 08-11-09-AD-00139	net 10th

Serviced	Item	Qty.	Description	Rate	Amount
11/1/2024	EX-360	8	HOURS EX-360 EXCAVATOR (JON - DIG TEST HOLES - 5 TEST HOLES ON TAX LOT 08-11-09-AA-00235 AND 3 TEST HOLES ON TAX LOT 08-11-09-AD-00139)	275.00	2,200.00

Please make your check out to Dan Kauffman Excavating LLC or DKE LLC. Thank you!

Total	$2,200.00
Payments/Credits	$0.00
Balance Due	$2,200.00