Islands Trust

MEMORANDUM

File No.: PLDP20240057 - 239 Quarry Dr.
X-Ref File: PLDP20240056 - 235 Quarry Dr.
PLDP20240058 - 431 Baker Rd.

DATE:	May 8, 2025
TO:	Legislative Clerk Salt Spring Island Team
FROM:	Stefan Cermak, Director, Planning Services
COPY:	Oluwashogo Garuba, A/Planner 2 Chris Hutton, Regional Planning Manager, Salt Spring
SUBJECT:	Delegated Development Permit Application Applicant: Bradley Fossen Location: 239 Quarry Drive, Salt Spring Island, BC

PURPOSE

The purpose of this memo is to not approve issuance of development permit PLDP20240056 (Fossen) pursuant to Land Use Permit Delegation Bylaw 534.

I have reviewed the staff report and professional reports (Attachment 1) and have concluded that the proposed development activities are not consistent with the objectives and guidelines of the development permit area. Specifically, the proposed sparse placement of boulders and installation of beach sediments conflict with Salt Spring Island Official Community Plan (OCP) Bylaw No. 434, 2008 objectives E.3.3.1 and E.3.3.2 and guidelines E.3.4.1; E.3.4.2; E.3.4.9; E.3.4.21; and E.3.4.22.

The applicant may have the decision to not approve issuance reconsidered by the Salt Spring Island Local Trust Committee by submitting a written request for reconsideration to the Deputy Secretary/Legislative Clerk within thirty days after the decision is delivered to or made available to the applicant.

The request for reconsideration must include the following:

- The applicant's address for receiving correspondence related to the request for reconsideration;
- A copy of the written decision;
- Reasons why the applicant wishes the decision to be reconsidered by the Local Trust Committee;
- The decision which the applicant requests be made by the Local Trust Committee;
- Reasons in support of the decision requested from the Local Trust Committee; and
- A copy of any documents which support the applicant's request for reconsideration by the Local Trust Committee.

Each reconsideration request shall be placed on the agenda of a regular Local Trust Committee meeting and shall include a copy of the materials that were considered by the Director of Planning Services in making the decision that is to be reconsidered, and any further materials delivered by the applicant.

The Local Trust Committee may consider any presentations made by the applicant and may either:

- confirm all or part of the delegate’s decision,
- set aside all or part of the delegate’s decision; or
- amend the delegate’s decision or make a new decision.

NEXT STEPS

Director of Planning Services to contact applicant to inform them of decision. Applicant to consider appeal within 30 days. Deputy Secretary/Legislative Clerk to place appeal and relevant materials on regular Local Trust Committee agenda if applicable. Director to inform Local Trust Committee of decision once applicant has been informed. Planner to update file and/or direct Planning Team Assistant to update electronic file.

Submitted By:	Stefan Cermak, Director, Planning Services	May 8, 2025

ATTACHMENTS

1. Staff Report dated April 29, 2025 – with attachments

Islands Trust

STAFF REPORT

File No.: PLDP20240057(Fossen)

DATE:	April 22, 2025
TO:	Stefan Cermak, Director of Planning Services
FROM:	Oluwashogo Garuba, A/Planner 2 Salt Spring Island Team
COPY:	Chris Hutton, Regional Planning Manager
SUBJECT:	Delegated Development Permit Application Applicant: Bradley Fossen Location: 239 Quarry Drive, Salt Spring Island, BC

RECOMMENDATION

1. **That the Director of Planning Services deny issuance of PLDP20240057 (Fossen) as the proposed activities are not consistent with several Development Permit Area 3 (DPA 3) guidelines within the Salt Spring Island Official Community Plan (OCP) Bylaw No. 434, 2008.**

REPORT SUMMARY

This report is to consider issuance of a delegated Development Permit (DP) application for the proposed beach erosion mitigation activity within the **Development Permit Area 3 – Shoreline Zones** located at 239 Quarry Drive, SSI (009-555-731). The application is supported by a letter of advice from the Department of Fisheries and Oceans and the following reports:

- Marine shoreline characteristics report.
- Geohazard assessment report.
- Environmental assessment report.

These reports and the proposal have been assessed by staff against the guidelines for development in DPA 3 as outlined in the Salt Spring Island Official Community Plan (OCP) Bylaw No. 434, 2008 and were found not to be substantially in accordance with the objectives and guidelines of DPA 3. Staff therefore recommends denying issuance of the requested DP.

BACKGROUND

The 1.38 hectares (3.42 acres) property, zoned Rural (R) is located at 239 Quarry Drive, SSI. The applicant has proposed shoreline stabilization works due to the identified bluff failure at the subject property which is occurring as a result of upland conveyance of rainwater contributing to pore water pressure in the soils/surficial material wedge sitting atop bedrock coastal bluffs and wave action creating toe erosion (bedrock) or undercutting (sediments). Because of this, the owner of this property has proposed the following mitigation activities based on the recommendations of the professional Geophysicist and the reports of the geohazard and environmental assessments that were carried out:

1. Backshore planting of grasses and sedge to create clumps on the backshore terrace in order to encourage sediment accumulation;
2. Coastline planting of salt tolerant woody species of trees;
3. Planting of hydrophilic species common to the Douglas-fir-arbutus woodland species understory;
4. Sparse placement of boulders to accomplish wave deflection along the low-tide terrace to mimic and enhance the natural process;
5. Installation of beach sediments in order to dissipate incoming wave energy by changing the plunging breaker wave type (higher erosion) occurring under storm event conditions to a surging breaker wave type (lower erosion).

According to the Salt Spring Island Official Community Plan (OCP) Bylaw No. 434, 2008 guidelines for development within the DPA 3, the construction of shoreline stabilization works is not exempt from the requirement to obtain a development permit (Section E.3.1.2) in order to achieve the objectives of the DPA 3.

Therefore, a DP application is required for the proposed construction of shoreline stabilization works within the DPA 3. The Salt Spring Island Delegation Bylaw No. 534, 2022 delegates the consideration of this application and its issuance to the Director of Planning Services.

Figure 1: Subject property

Figure 2: Ortho photo of subject property

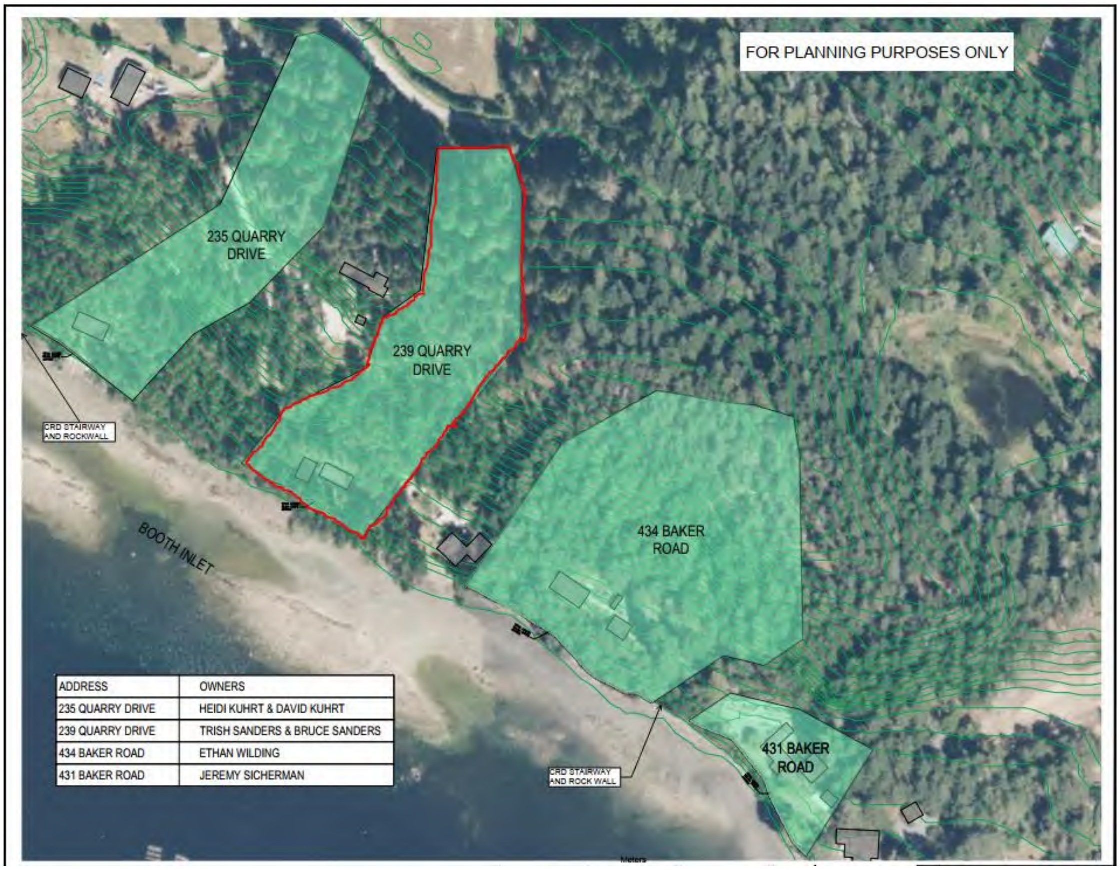

Figure 3 – Site Plan (area highlighted in red)

Professional reports submitted and attached:

- Geohazard Assessment report, October 15, 2023, prepared by Thomas R Elliot, PhD P.Geo P.Ag.
- Assessment of Marine Shoreline Characteristics, December 18, 2023, prepared by Thomas R Elliot, PhD P.Geo P.Ag.
- Summary of Baker Beach Shoreline Erosion Mitigation Recommendations, January 25, 2024, prepared by Thomas R Elliot, PhD P.Geo P.Ag.
- Environmental Assessment report, December 2023, prepared by Erin Vekic, R.P.Bio, M.Sc.

The DPA 3 checklist can be found as Attachment 2. The assessment reports listed above can be found as Attachments 3, 4, 5 and 6. The geotechnical assessment report indicates that the proposed erosion mitigation development activities do not increase the hazard rating to the existing single family dwelling or the use of the subject property and also contains preliminary mitigation measures for the proposed beach nourishment activities. Staff have evaluated the proposed erosion mitigation activities and determined that they do not meet all of the DPA 3 objectives and guidelines.

ANALYSIS

Policy/Regulatory

Official Community Plan:

The Salt Spring Island Official Community Plan No. 434 designates the subject property as Rural Neighbourhood (RL) and the marine area as Marine Other. Staff note that a rock outcrop is approximately 50m from the natural boundary immediately adjacent to the subject property (Figure 3). This rock outcrop and another southeast of the subject property is designated as Parks and Recreation. The designation highlights one aspect of the public value of the area as a recreational site.

Land Use Bylaw:

The subject property is zoned Rural (R) in the Salt Spring Island Land Use Bylaw (LUB) No. 355, 1999 while the proposed erosion mitigation activities will be taking place within Shoreline 6 (S6) zone. The rock outcrops approximately 50m from the natural boundary are zoned Parks and Reserve 6.

The proposed development has been recommended by Thomas R Elliot, P. Geo (Geohazard Assessment report, 2023) to protect the marine environment from erosional geohazard.

Development Permit Area 3 – Shoreline (DPA 3)

The subject property is within DPA 3. This includes all the area of land covered by water between the natural boundary of the sea and a line drawn parallel to and 300 m seaward of the natural boundary of the sea. It also encloses the land within 10m of the natural boundary of the sea (measured horizontally) in areas where the marine environment has been identified as being particularly sensitive to development impacts.

This Development Permit Area includes shoreline waters and natural fish and wildlife habitat that could be subject to degradation due to development. It also includes areas of land that lie adjacent to and influence the island's most sensitive shoreline environments. Shoreline areas and beaches may contain unstable slopes and soils subject to erosion, land slip and rock falls. There are also high aesthetic values along shoreline areas.

The objectives of DPA 3 (Section E.3.3) are:

- To protect the quality of the tidal waters that surround Salt Spring Island.
- To protect fish and wildlife habitat.
- To prevent erosion and hazardous conditions that could result from interrupting the natural geo-hydraulic processes along the shoreline.
- To protect development from hazardous conditions.
- To protect the natural beauty of the island's shoreline areas where commercial and industrial developments are allowed. To ensure such development is unobtrusive and contributes to the natural, public character of the Crown foreshore.

As per subsection E.3.1.2 article (f), DPA 3 is applicable when there is a construction of shoreline stabilization works.

2024 DPA 3 Assessment Report

1. ***Environmental Assessment Report:*** was prepared by Erin Vekic, R.P. Bio, M. Sc. for this proposed development. According to Erin Vekic, the environmental assessment (EA) was designed to comply with the DPA 3 guidelines outlined in the OCP. Although several mitigation measures were proposed in the report, the potential impact of the activities were not identified in the report. Also, the report did not specify how the fine gravel and sediments proposed for erosion control will remain in place

in order to control the erosion. The report also did not indicate the potential impact to the eelgrass beds and forage fish spawning areas.

2. ***Geohazard Assessment Report***: was prepared and submitted by Thomas R Elliot, PhD P. Geo P. Ag. The report indicated that there is a low risk of landslide hazard impacting the single-family dwelling but there is a high risk of erosional geohazard impacting the marine environment in an ongoing and progressive manner. The proposed erosion mitigation activities according to the report do not increase the hazard rating to the existing single-family dwelling.

3. ***Final Summary Report on Mitigation:*** was prepared and submitted by Thomas R Elliot, PhD P. Geo P. Ag., dated January, 2024. The report indicated that the erosion mitigation activities to be carried out to minimize the impact of the erosion happening on the shoreline. The report however did not indicate how long the beach nourishment will be able to dissipate the incoming wave energy before the sediments get dispersed.

Development Permit

Staff has not attached a draft permit at this time as the proposed development activities do not meet the DPA 3 guidelines. However, staff may report back with a draft Development Permit if the Director determines that the DPA 3 guidelines are met.

Rationale for Recommendation

The recommendations on page 1 are supported as:

- the proposed activities are not consistent with the following guidelines of DPA 3:

  E.3.4.1: All work that takes place below the natural boundary of the sea should be done in a way that minimizes degradation of water quality and disturbance of the substrate. - There is potential for disturbance of substrate arising from the proposed sediment deposit and use of machinery.

  E.3.4.2: All work that takes place on land within 10 m of the natural boundary of the sea should be planned and carried out in a way that is consistent with the Land Development Guidelines for the Protection of Aquatic Habitat (Appendix 7).

  - The deposit of sediments is likely to have negative impact on the fish habitat and the applicant has neither provided information on the likely impacts of this activity nor provided mitigation measure to minimize these potential impacts.

  E.3.4.9: The shoreline should not be filled in to create additional land, except minor areas of fill necessary to complete the boardwalk section of the Ganges Public Pathway System in Ganges Harbour.

  - The proposed activity includes the deposit of 434.4m^2 of aggregate materials, over about 300m of shoreline and at an initial height of 1.0 m above existing grade level.

  E.3.4.21: Applications for shoreline stabilization should include a report, prepared by a Professional Engineer with experience in geotechnical engineering, which describes the proposed modification and shows:

  a. The need for the proposed modification to protect existing structures.

b. Where the modification is proposed to protect new structures, the locations on the property where those structures could be built and not require shoreline modification.
c. If any natural hazards, erosion, or interruption of geohydraulic processes may arise from the proposal modification, including at sites on other properties or foreshore locations.
d. The cumulative effect of shoreline stabilization works along the drift sector where the works are proposed.
e. Whether there will be any degradation of water quality or loss of fish or wildlife habitat because of the modification.
f. Whether conditions should be incorporated into the development permit to achieve the objectives of this Development Permit Area.

– It is unclear what damage to the existing structure that the proposed activities is preventing and as a result of the increased turbidity from sediment supplementation, there could be a negative impact on the fish habitat.

E.3.4.22: Shoreline stabilization should be limited to that necessary

a. To prevent damage to existing structures or an established use on adjacent upland.
b. To prevent damage to a proposed public land use.

New upland structures or additions should be located and designed to avoid or reduce the need for shoreline stabilization. Shoreline stabilization should not interrupt natural processes solely to reduce erosion of undeveloped land, except agricultural land. – The public use of the land is not considered as damaging by the naturally occurring slow sediment erosion.

- the proposed development activities are not consistent with some of the relevant objectives of the DPA 3:
  - E.3.3.1: To protect the quality of the tidal waters that surround Salt Spring Island.
  - E.3.3.2: To protect fish and wildlife habitat.
- -- The proposed activities are likely to negatively impact the quality of tidal water as well as the fish and wildlife habitat through the changes to the sediment transport and water flow as a result of the sediment supplementation.

ALTERNATIVES

The Director may consider the following alternatives to the staff recommendations:

1. **Request further information**

   The Director of Planning Services may request further information prior to making a decision. If selecting this alternative, the LTC should describe the specific information needed and the rationale for this request.

2. **Approve the application**

   The Director of Planning Services may determine that the guidelines are met and approve the application. If selecting this alternative, staff will return with a draft DP for consideration.

Submitted By:	Oluwashogo Garuba, A/Planner 2	April 22, 2025
Concurrence:	Chris Hutton, Regional Planning Manager	May 7, 2025

ATTACHMENTS

1. Site Context
2. DPA Guideline Checklist
3. Geohazard Assessment Report
4. Marine shoreline Characteristics Assessment Report
5. Summary of Baker Beach Shoreline Erosion Mitigation Recommendations Report
6. Environmental Assessment Report
7. DP Delegation Checklist (Staff only)

ATTACHMENT 1 – SITE CONTEXT

LOCATION

Legal Description	LOT 3, SECTIONS 6 AND 7, RANGE 1 WEST, NORTH SALT SPRING ISLAND, COWICHAN DISTRICT, PLAN 46155
PID	009-555-731
Civic Address	239 Quarry Drive, Salt Spring Island, BC
Lot Size	13,840.26m^2 | 1.38 ha

LAND USE

Current Land Use	R – Rural
Surrounding Land Use	Parks and Reserves 5 - PR (5), Parks and Reserves 6 - PR (6), Rural - R

HISTORICAL ACTIVITY

File No.	Purpose
SS-DP-2005.5	To permit the removal of trees, the installation of stairs and decks to provide access to the beach and the installation of plant material

POLICY/REGULATORY

Official Community Plan Designations	Salt Spring Island OCP No. 434, 2008 Designations: **Rural Neighbourhoods - RL;** **Development Permit Areas: DPA 3 - SHORELINE**
Land Use Bylaw	Salt Spring Island LUB No. 355, 1999: **Rural (R)**
Covenants	Lease of Coal 5023D; Undersurface Rights 70453G; Undersurface Rights 337530G; Easement EC133685; Easement EC133687; Statutory Right of Way EL102374; Statutory Right of Way EL102375; Covenant S137231
Bylaw Enforcement	SS-BE-2005.61 - Setback Siting violation

SITE INFLUENCES

Islands Trust Conservancy	The Islands Trust Conservancy does not have any consideration for the application.
Regional Conservation Strategy	The Islands Trust Conservancy regional conservation plan has a high priority for conservation of eelgrass bed located at the shoreline areas of the proposed development activities.
Species at Risk	None currently mapped
Sensitive Ecosystems	Woodland, Mature Forest
Hazard Areas	Moderate and Low risk steep slopes.
Archaeological Sites	Remote Access to Archaeological Data (RAAD) information indicates there are no archaeological sites on the property. However, there are areas of archaeological potential mapped on the property and therefore the applicant will been sent the Islands Trust Chance Find Protocol and

	provincial guidance on archaeological sites upon development permit review. By copy of this report, the owners and applicant should be aware that unrecorded archaeological material is protected under the *Heritage Conservation Act*. If such material is encountered during development, all work should cease and Archaeology Branch should be contacted immediately as a *Heritage Conservation Act* permit may be needed before further development is undertaken. This may involve the need to hire a qualified archaeologist to monitor the work.
Climate Change Adaptation and Mitigation	No additional impacts to GHG emissions anticipated as a result of this application.
Shoreline Classification	Low rock/Boulders
Shoreline Data in TAPIS	N/A

Attachment 2

Salt Spring Island
OCP Bylaw No. 434, 2008
Development Permit Area 3 - Shoreline (DPA 3)
Guideline Checklist

Guideline	Complies Yes	Complies No	Complies N/A	Staff Comments
E.3.4.1: All work that takes place below the natural boundary of the sea should be done in a way that minimizes degradation of water quality and disturbance of the substrate.	☐	☒	☐	Thomas R. Elliot, PhD P. Geo, has indicated that the proposed activity is taking place below the natural boundary of the sea – foreshore area. There is potential for disturbance of substrate arising from the proposed sediment deposit and use of machinery.
E.3.4.2: All work that takes place on land within 10 m of the natural boundary of the sea should be planned and carried out in a way that is consistent with the Land Development Guidelines for the Protection of Aquatic Habitat (Appendix 7).	☐	☒	☐	According to the Land Development Guidelines for the Protection of Aquatic Habitat, the deposit of sediments is likely to have negative impact on the fish habitat and the applicant has neither provided information on the likely impacts of this activity nor provided mitigation measure to minimize these potential impacts.
E.3.4.3: Native vegetation and trees are to be retained or replaced to control erosion, protect banks and protect fish and wildlife habitat.	☒	☐	☐	Proposed activity involves removal of invasive species and also the planting of native species of vegetation as outlined in the project description.
E.3.4.4: New roads and septic systems should not be located in this Development Permit Area. If such a location cannot be avoided, then the design and construction of the road or septic system should be supervised by a qualified professional to ensure that the objectives and guidelines of this Area are met	☐	☐	☒	
E.3.4.5: Structures should provide for the thorough flushing of all enclosed water areas and should not restrict the movement of aquatic life or interfere with natural shoreline processes.	☐	☐	☒	The proposed boulders and could potentially interfere with natural shoreline processes such as sediment transportation and therefore not in compliance with this guideline.
E.3.4.6 Open pile or floating breakwater designs are preferred. Solid breakwaters should not be used, except facilities that will accommodate a marina.	☒	☐	☐	Solid breakwater has not been proposed to be used in the application and therefore in compliance with this guideline.

Guideline	Complies			Staff Comments
	Yes	No	N/A	
E.3.4.7: New boating facilities that provide transient moorage should not be constructed unless access is available to adequate and convenient facilities for pump-out, holding and treating of sewage from boats. New boating facilities should be designed, located, and operated in a way that ensures there will be no discharge of toxic material from boats (for example: fuels, oils, maintenance by-products).	☐	☐	☒	
E.3.4.8: There should be no dredging to create new facilities. Maintenance dredging of existing facilities should be limited to the minimum area necessary to maximize the capacity of the existing facility. Dredging should be done with the use of silt curtains to prevent siltation of adjacent areas.	☐	☐	☒	
E.3.4.9: The shoreline should not be filled in to create additional land, except minor areas of fill necessary to complete the boardwalk section of the Ganges Public Pathway System in Ganges Harbour.	☐	☒	☐	The proposed activity does involve the filling of the shoreline. The proposed activity includes the deposit of 704.5m^2 of aggregate materials, over about 300m of shoreline and at an initial height of 1.0 m above existing grade level (Report for Coastal Erosion Mitigation prepared by Thomas R Elliot TRE Environmental Services Pg. 6 & 7).
E.3.4.10: No parking areas should be located over the surface of the water, on land created by fill, or on accretion shoreforms.	☐	☐	☒	
E.3.4.11: Boat launch ramps should be located on stable, non-erosional banks where a minimum amount of substrate disturbance or stabilization is necessary. Ramps should be kept flush with the slope of the foreshore to minimize interruption of geo-hydraulic processes.	☐	☐	☒	

Guideline	Complies			Staff Comments
	Yes	No	N/A	
E.3.4.12: Preference is to be given to the placement of mooring buoys and floats instead of docks. It is also to be given to the construction of joint use docks rather than individual ones. Multifamily and strata-titled developments are to construct joint use dock facilities. No more than one facility for mooring boats is to be located next to any parcel. An exception could be made if more than one joint facility is to be located next to the common property of a strata development.	☐	☐	☒	
E.3.4.13: Docks should not be located over shellfish beds or lead to the removal of any kelp or eel grass beds.	☐	☐	☒	
E.3.4.14: Large residential docks should be located and designed to avoid the need for shore defence works, or breakwaters. If a bulkhead is to be constructed as a base for a dock, it should be constructed landward of the natural boundary of the sea.	☐	☐	☒	
E.3.4.15: Structures in contact with the water should be constructed of stable materials, including finishes and preservatives that will not degrade water quality.	☐	☐	☒	Boulders have been proposed for the project.
E.3.4.16: Piers should use the minimum number of pilings necessary, with preference to large spans over more pilings.	☐	☐	☒	
E.3.4.17: Piers should be constructed with a minimum clearance of 0.5 m above the elevation of the natural boundary of the sea.	☐	☐	☒	
E.3.4.18: All docks should be constructed so that they do not rest on the bottom of the foreshore at low water levels.	☐	☐	☒	
E.3.4.19: Any plastic foams or other non-biodegradable materials used in construction of floats and docks should be well contained to prevent escape into the natural environment.	☐	☐	☒	

Guideline	Complies Yes	Complies No	Complies N/A	Staff Comments
E.3.4.20: Residential docks should not extend from shore any further than necessary to accommodate a small pleasure craft. Residential docks should not accommodate boats with a draft greater than 2.2 m or have floats more than 35 m2 total surface area unless more than two parcels have legal access to the dock.	☐	☐	☒	
E.3.4.21: Applications for shoreline stabilization should include a report, prepared by a Professional Engineer with experience in geotechnical engineering, which describes the proposed modification and shows: a. The need for the proposed modification to protect existing structures. b. Where the modification is proposed to protect new structures, the locations on the property where those structures could be built and not require shoreline modification. c. If any natural hazards, erosion, or interruption of geohydraulic processes may arise from the proposal modification, including at sites on other properties or foreshore locations. d. The cumulative effect of shoreline stabilization works along the drift sector where the works are proposed. e. Whether there will be any degradation of water quality or loss of fish or wildlife habitat because of the modification. f. Whether conditions should be incorporated into the development permit to achieve the objectives of this Development Permit Area.	☐	☒	☐	The Geotechnical report states that the purpose of erosion mitigation is to reduce risk of GU 4. The Geotechnical report submitted by the applicant indicated that the building location is safe for the use intended. The proposed erosion mitigation activities could potentially bring about an interruption of the geohydraulic process as a result of the interference with the shoreline sediment transportation. Potential water degradation could occur as a result of increased turbidity from the sediment supplementation, this could also impact the fish habitat negatively by the changes to the sediment transport and water flow as a result of the proposed erosion mitigation activities.

Guideline	Complies Yes	Complies No	Complies N/A	Staff Comments
E.3.4.22: Shoreline stabilization should be limited to that necessary a. To prevent damage to existing structures or an established use on adjacent upland. b. To prevent damage to a proposed public land use. New upland structures or additions should be located and designed to avoid or reduce the need for shoreline stabilization. Shoreline stabilization should not interrupt natural processes solely to reduce erosion of undeveloped land, except agricultural land.	☐	☒	☐	The Geotechnical report submitted by the applicant indicated that the building location is safe for the use intended. The Geotechnical report identified a high incremental risk of geohazards for GU4.
E.3.4.23: Shoreline stabilization works should use natural means such as vegetative stabilization or protective berms rather than structural solutions such as concrete or large riprap. Applications for structural stabilization works should provide an explanation as to the need for structural solutions. Structural solutions should not be employed in the Shoreline Conservation Designation, unless an existing building is threatened by wave erosion and cannot be protected by other means.	☒	☐	☐	Applicant has confirmed that structural solutions are not considered for the proposed activity. The proposed activity will only include vegetative stabilization/restoration along with energy dissipation by sparsely placing boulders (0.5 – 1.2m boulders, sandstone or low sulphide granite, rounded to sub-rounded (no blast rock)) along the low tide terrace within the foreshore area, these will be placed at intervals and therefore considered to be consistent with this guideline. Geotechnical report provided by applicant indicates that there are no up-slope hazards likely to impact the existing single family dwelling (pg. 11).
E.3.4.24: Materials used for shoreline stabilization should consist of inert materials. Stabilization materials should not consist of debris or contaminated material that could result in pollution of tidal waters.	☒	☐	☐	QEP (Bradley Fossen) indicated that the proposed materials do not consist of debris or contaminated material as the applicant has indicated that the materials for the beach nourishment will be clean undisturbed quarry materials. Therefore, the activities will not consist of materials capable of polluting the tidal waters.

Guideline	Complies			Staff Comments
	Yes	No	N/A	
E.3.4.25: Rock weirs, groins and jetties should not be constructed. An exception could be made if it can be shown that they are part of a larger system that will reduce the need for overall shoreline modification and that they are intended to prevent damage to existing structures. They should not be proposed to protect new structures.	☐	☐	☒	
E.3.4.26: Bulkheads should only be constructed if no other alternative exists. Where bulkheads are proposed, they should not to be located where geohydraulic processes are critical to shoreline conservation. Feeder bluffs, marshes, wetlands, spits or hooks should be avoided. Bulkheads should be located parallel to and landward of the natural boundary of the sea, as close to any natural bank as possible. Bulkheads should allow the passage of surface or groundwater without causing ponding or saturation. They should be constructed of stable, non-erodible materials that preserve natural shoreline characteristics. Adequate toe protection including proper footings and retention mesh should be included. Beach materials should not be used for fill behind bulkheads.	☐	☐	☒	
E.3.4.27: Where revetments are proposed, they should not result in the loss of riparian vegetation or fish habitat. The size and quantity of materials used should be limited to that necessary to withstand the estimated energy of the location's hydraulic action and prevent collapse. Filter cloth should be used to aid drainage.	☐	☐	☒	Thomas R Elliot has indicated that no revetments will be used for the proposed activity.
E.3.4.28: Where this Area includes unique native species dependent on a marine shoreline habitat which have been identified by a qualified professional as worthy of particular protection, their habitat areas should be left undisturbed. If development is permitted in these areas, it should be undertaken only under the supervision of a professional who is qualified in environmental protection, with advice from the Ministry of Environment, the Department of Fisheries and Oceans, or Environment Canada.	☒	☐	☐	The Environmental Assessment report (prepared by Erin Vekic, Corvidae Environmental Consulting Inc.) indicated the project area has some native species dependent on marine shoreline habitat and the project therefore needs to be supervised by a Qualified Environmental Professional or Registered Professional Biologist. This condition has been incorporated into the Draft Permit.

Guideline	Complies			Staff Comments
	Yes	No	N/A	
E.3.4.29 To assist in the preparation of development permits for larger projects, the Local Trust Committee could request an applicant to provide a report, prepared by a qualified professional with experience in the protection of the natural environment. The report should indicate the type of conditions that should be incorporated into the development permit to achieve the objectives and comply with the guidelines of this Development Permit Area.	☐	☐	☐	This may be considered a "larger project" due to its multiple properties involved and the overall impact to a community recreation area. I will not request this. However, the LTC may.
E.3.4.30: Buildings built over the water surface in areas zoned for commercial and general employment use in Ganges and Fulford Harbour should accommodate continuous pedestrian passage along the waterfront. Developments in Ganges should contribute to the development of the Ganges Public Pathway System, including the seawalk portion, shown on Map 17. New sections of the seawalk should be built in a way that is consistent with existing portions, ensuring barrier-free access along the entire route. For public safety, light fixtures should be provided at a consistent height and design.	☐	☐	☒	
E.3.4.31: Buildings built over the water surface should not exceed the heights allowed in the local zoning bylaw. Building form in Ganges and Fulford harbours should be consistent with the guidelines in Section E.1.6.	☐	☐	☒	
E.3.4.32: Lighting of commercial and general employment developments built over the water surface should be kept to the minimum necessary for safety and visibility. Light fixtures on such sites should be simple and unobtrusive in design. They should be carefully chosen to focus light on the area to be illuminated and avoid spillage of light into other areas. Fixtures should not result in glare when viewed from areas that overlook the sea. Low-glare fixtures with a high cut-off angle should be used. Full-spectrum fixtures are preferred. Neon lighting should not be used outside buildings.	☐	☐	☒	

Guideline	Complies			Staff Comments
	Yes	No	N/A	
E.3.4.33: Signs on commercial and general employment developments built over the water surface should not exceed the size or total area allowed by local bylaw. Signs on such sites should not move or be audible and should not incorporate lighting that moves or flashes or gives the impression of doing so.	☐	☐	☒	

Attachment 3

Geohazard Assessment of Lands

As pertaining to land parcel:

PID 009-555-706

235 QUARRY DRIVE, SALT SPRING ISLAND

LOT 1, SECTIONS 6 AND 7, RANGE 1 WEST, NORTH SALT SPRING ISLAND, COWICHAN DISTRICT, VIP46155

Report for Coastal Erosion Mitigation

Developed for: Heidi Kuhrt, David Kuhrt (Landowners)

235 Quarry Drive

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1. Synopsis

The subject land parcel, with PID 009-555-706 and legal description of Lot 1, Plan VIP46155 (Site), is situated on the lower southwest-facing flank of a slope which terminates to the Salt Spring Island ocean-shoreline in a coastal bluff. The Site is proposed to undergo coastal erosion mitigation development activities within the Shoreline Development Permit Area[1] (DPA 3) of the Islands Trust (IT), which prompted this geohazard assessment to identify mechanisms contributing to erosion of the coastal bluff that would create hazardous conditions for existing single-family dwelling (SFD) and the natural environment.

The Site consists of a moderate-steep benching bedrock slope with a veneer to mantle of stoney sandy loam to loamy sand. There is a veneer of colluvial boulders to stones accumulated below bedrock outcropping. The slope descends from a ~58m above sea level (asl) elevation regional northwest-southeast aligned bedrock ridge. The bedrock ridge is sandstone at elevation and transitions to shale and metamorphic deposits of the Nanaimo Sedimentary Group closer to sea level. At ~10m asl elevation, a metamorphic-rock coastal bluff rises above the natural boundary and is capped with a 2 – 4m thick mantle of gravelly sandy loam.

While there is no ephemeral or permanent surface watercourse observed at Site, the presence of near-surface groundwater is apparent where bedrock outcrops force phreatic water to surface.

The erosion and sediment mass-wasting observed on Site primarily consists of two concurrent processes:

Wave action — a culmination of mechanical wave-action, daily sunlight-driven thermal oscillation, and saturating water-spray promotes decomposition and failure of fine-grained metamorphic bedrock situated in the lower 6 - 7m of coastal bluff. This results in toe erosion which, over time, destabilizes the portion of coastal bluff above.

Pore water — sufficient pore water pressure below the phreatic surface can acts as a destabilizing factor to overcome cohesion, friction angle and soil weight – entirely independent of toe erosion. While the majority of episodic pore water pressure erosion occurs during the rainy season, localized increases in pore water pressure can also lead to instability during otherwise drought conditions.

Through assessment of the Site subject to Shoreline DPA, Thomas R Elliot PhD P.Geo P.Ag has determined a Low risk of landslide geohazard impacting the SFD. However, there is a High risk of erosional geohazard impacting marine environment in an ongoing and progressive manner.

[1] IT Bylaw 488 - https://islandstrust.bc.ca/wp-content/uploads/2020/10/SS-BL-434_2020-10_OCP_Vol1-2.pdf

This determination is based on geophysical indicators on Site, regional frequency of historic landslide in the area, as well as assessment of Site surficial materials, hydrologic regime, topography and slope failure mechanics, as detailed through this report.

The proposed erosion mitigation development activities do not increase the hazard rating to the existing SFD or occupancy of Site.

2. Introduction

Development activity within the IT is being pursued on the subject land parcel with PID 009-555-706 (the 'Site', see Figure 1 – Appendix 1). The R (Rural) zoned land parcel is located on a southwest-facing flank of a slope which terminates to a coastal bluff ocean-shoreline. The Site is accessible via Quarry Road arriving from the north, at top of the slope, where a private roadway has been established.

This report includes assessment of pre-existing and field-gathered data which informs a geohazard risk assessment and guides proposed erosion mitigation measures.

There exists DPA 3 requirements for non-exempt development activities within 10m landward and 300m seaward of the marine-shoreline natural boundary. Due to land parcel configuration there is currently 10m setback from the natural boundary and existing SFD, resulting in a requirement to obtain DP if proposed erosion mitigation activities are occurring in this setback. Therefore, proposed landward erosion mitigation activities will be considered in context of existing structures, near-surface water management and erosion processes observed at the coastal bluff.

This report is a cumulative evaluation of existing and field-based data toward determining risk to SFD and natural environment associated with geohazards present on Site, and impact of proposed erosion mitigation measures on identified geohazards.

2.1. Author Qualifications

Thomas R Elliot PhD is a Qualified Professional (QP) Geoscientist [# 43570] and Professional Agrologist [# 3045] registered within the Province of British Columbia and in good standing with both professional associations. The QP has 16 years of geohazard, soil science, near surface groundwater and aquifer hydrogeology practice. In the last 9 years, Thomas R Elliot has primarily worked on Vancouver Island and the Lower Mainland of British Columbia in the practice areas of [Geoscience]: Hydrogeology, Geohazard mitigation assessments, Soils/Groundwater management; and [Agrology] Soil science, Agriculture, and Contaminant detection, mitigation and remediation.

3. Scope, Context & Motivation

The proposed development activities are erosion mitigation measures for identified geohazards toward reducing risk to the existing SFD and natural environment on Site.

This report does not determine the specific erosion mitigation activities due to a requirement for comprehensive assessment of near shore environments prior to identification of suitable measures. A comprehensive assessment includes this geohazard report in addition to an evaluation of beach and wave characteristics that will collectively inform suitable erosion mitigation activities through the Marine Shoreline Design Guidelines[2] that have been broadly adopted by Province of BC and Federal Department of Fisheries and Oceans.

The motivation to produce this report is to provide IT record of existing geohazard conditions on Site; predicted impact of proposed development activities; and if the proposed development activities – in context of existing or novel geohazards – allows for safe Rural-residential use of the land, as intended.

4. Regulatory Context

This section is dedicated to review of applicable Regulations and Acts, as governing legislation for individual and group risk of harm/death related to land use, as well as general permitting and authorization requirements of intended land use and proposed erosion mitigation development activities.

Further, the Department of Fisheries and Oceans would also be requested to conduct review of proposed activities in conjunction with the local IT DPA 3 permitting requirements.

4.1. IT Shoreline DPA

The geohazard assessment for the proposed works is warranted under MA Section 879 (1)(a) and (b) which prompts IT to protect the natural environment and to protect development from hazardous conditions; as specifically governed by IT Bylaw 434, V 2, S E.3 Development Permit Area 3 – Shoreline (enacted through IT Bylaw 488).

IT Bylaw 488, DPA 3 – Shoreline requires development permit applications be submitted for activities occurring 10m landward in areas where the marine environment has been identified as being particularly sensitive to development impacts.

If the proposed erosion mitigation works are to include: breakwater, weir, groin or jetty; bulkheads; placement of fill; removal of trees with diameter greater than 20cm OR removal of vegetation that results in the exposure of a total area of bare soil more than 9m^2 in area – then there is requirement for IT approved Development Permitting.

[2] Johannessen, J.[1], A. MacLennan[1], A. Blue[1], J. Waggoner[1], S. Williams[1], W. Gerstel[2], R. Barnard[3], R. Carman[3], and H. Shipman[4]. 2014. Marine Shoreline Design Guidelines. Washington Department of Fish and Wildlife, Olympia, Washington. **1** Coastal Geologic Services Inc.; **2** Qwg Applied Geology; **3** Washington State Department of Fish and Wildlife; **4** Washington State Department of Ecology

4.2. DFO Authorization

Pursuant to the *Fisheries Act*, should a requested DFO project review determine that proposed development activities are likely to cause the death of fish and/or harmful alteration, disruption or destruction of fish habitat – then authorization would be required.

Since the development activity (i.e. erosion mitigation measures) are currently undefined, this report is unable to establish whether DFO authorization will be required.

5. Site Conditions: Existing and Field Data

5.1. Slope, Geology, Soils & Surficial Materials

At shoreline, the Site has a ~8 – 12m coastal bluff consisting of siltstone and shale at base and capped with 1 – 2m of surficial material. Above which there are three distinct slope sections of the Site. The lowest is a gently sloping (~5 - 15%) bench above the coastal bluff where the SFD on Site exists, above which is a bedrock-controlled section of 30 – 35%. This second benching section does not exceed the angle of repose for local loamy soils, above which local sediment has increased likelihood of instability. The last slope section crests at a ridge-top and drops in elevation to Quarry Drive.

Soil associations on Site were previously mapped[3] in elevation-limited bands which correspond to the changes in slope, which is consequent to change in sea level during glaciation and inter-glacial periods. Starting at present day marine shoreline and ascending up slope, the soil associations present on Site include a typically <2m thick veneer of well drained loam Galiano soil, which are derived from colluvium[4], on the lowest slope.

At higher elevation, a band of thin <2m veneer of Saturna well draining sandy loam soils with prominent bedrock outcropping ascend to an elevation of ~58m asl. This portion of the land parcel is the source of boulders and other large loose rock masses which form sparse accumulations at lower elevations.

At upper elevations, Haslam well draining sandy loam soils are prevalent and functionally attenuate precipitation as it infiltrates to near surface bedrock.

The bedrock on Site was mapped as belonging to the Nanaimo Group[5], with sparse details on the surficial rock type in existing records. On Site, the mid and upper elevation presented sandstone at surface, while at lower elevations a change from shale transitioning to siltstone

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[3] Soil Information Finder Tool. https://governmentofbc.maps.arcgis.com/apps/MapSeries/index.html?appid=cc25e43525c5471ca7b13d639bbcd7aa
[4] Soils of Southern Vancouver Island. MOE Technical Report 17. https://sis.agr.gc.ca/cansis/publications/surveys/bc/bc44/index.html
[5] Vancouver Island Geology. https://www.gac-cs.ca/publications/FT_Geology_of_Vancouver_Island.pdf

at coastal bluff occurred. The rock types identified on Site are characteristically found in the Nanaimo Group.

5.2. Surface & Groundwater

There are no identified or observed watercourse on Site. However, accumulation of rainwater and drainage from the access road does present areas of increased surface water discharge to forest floor. These areas are demarcated by accumulation of debris moved by the flow of surface water, increased annual vegetation growth, and an infiltrative surface – the extent of which is related to volume of accumulated rainwater.

Infiltration of each soil association on Site is unrestricted by soil texture, meaning that in areas where water does accumulate at surface there is a low-permeability limiting layer (i.e. bedrock) which prevents continuous downward migration. Instead, as infiltrating water reaches bedrock, lateral dispersion becomes dominant and results in a phreatic surface (i.e. perched groundwater table) establishing within the thin <2m veneer of surficial earth materials.

Where bedrock outcrops to surface, the veneer of surface material thins and 'pinches out', resulting in emergence of phreatic water. These 'weeps' or 'springs' are not to be conflated with artesian conditions, as these waters do not enter a confined aquifer and pore water pressure does not exceed atmospheric pressure. While not individually significant to Site surface hydrology, the irregular bedrock surface accumulates these phreatic weeps to a subsurface non-contiguous perched water table within the veneer of well-draining surface material.

Due to this accumulation mechanism, there is an increased depth of perched water table at lower elevations of the Site. Therefore, it is warranted to conduct specific geohazard assessment of areas where surficial materials convey the accumulated depth of perched water table due to an increased pore water pressure forcing erosion at the coastal bluff.

6. Geohazard Assessment

This landslide risk assessment was largely conducted according to the Engineers and Geoscientists of BC document *Guidelines for Legislated Landslide Assessments for Proposed Residential Developments in BC*[6]. The landslide risk assessment methods that were utilized includes all aspects of landslide hazard analysis, such as regional frequency and historic evidence to inform current and future landslide hazards; as well as evaluation of hazard likelihood, and consequence of landslide impact, to formulate a relative risk matrix which is comparable with levels of landslide safety adopted by the approving jurisdiction.

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[6] EGBC Guidelines for Legislated Landslide Assessments for Proposed Residential Developments in BC. https://www.egbc.ca/getmedia/5d8f3362-7ba7-4cf4-a5b6-e8252b2ed76c/APEGBC-Guidelines-for-Legislated-Landslide-Assessments.pdf.aspx

The assessment was restricted to the Site, as indicated in Figure 1, and specifically includes bedrock of the coastal bluff.

6.1. Investigation of Historic Failures in Area & Seismic Compliance

A review of historic aerial imagery was conducted on the surrounding area to determine frequency and spatial distribution of natural and induced landslides.

There were no mid-slope landslide scarps, transport paths, or deposit zones identified in proximity to Site or on similar colluvium slopes within the region within historical aerial imagery.

Through this lack of landslide evidence, and the existing evidentiary record of significant seismic events over the past ~500 years, there is no suggestion that natural slopes on Site would fail under seismic disturbances.

For example, a seismic event occurred at 10:13 a.m. on Sunday June 23, 1946 which measured at 7.3 on the richter scale, and was considered a significant seismic event which exceeds the 2% in 50 years magnitude. Therefore, as the Site and surrounding slopes exhibits no evidence of displacement consequent to ground motion, this historic record demonstrates compliance with seismic design at existing or proposed slopes of lower angle.

The presence of loose boulders (up to 1.2m in diameter were observed) on mid-slopes above the non-habitated (i.e. driveway, not SFD) lower slope on Site does suggest an increased likelihood of injury or death of an individual (i.e. consequence) while posing no likelihood for harm to the natural environment. However, the likelihood co-location of an individual within the increased consequence pathway is very remote and therefore does not contribute to overall risk considered herein.

6.2. Field Investigation

On Sept 17th, 2023 Thomas R Elliot PhD P.Geo P.Ag attended to Site as a QP with declared competency in geohazards, hydrology and soil science to evaluate the geohazards, ground and surface waters present on Site.

Field data was acquired according to, and through the implements noted in Table 1 below.

Table 1 – Summary of Field Work

Project ID:	2023.900	**Project Name:**	Baker Beach Erosion Mitigation
Project Type:	Erosion Mitigation (Geohazard)	**Lead Investigator:**	Thomas R Elliot PhD P.Geo P.Ag
Client:	Aurora Professional Group	**Client Contact:**	Brad Fossen P.Eng
Site Boundary Type:	Land Parcel	**Site Common Address:**	235 Quarry Drive

Site Legal Description:	VIP46155, LOT 1	**Site PID #**	009-555-706
Site Land Use:	Rural residential	**Site Condition:**	Secondary growth
Development Activity:	Erosion mitigation measures	**Project Stage:**	Assessment
DPA:	DPA3 – Shoreline	**Provincial/Federal:**	DFO review
Equipment Used:	- Clinometer - Compass - Engineer's tape - GPS tracking	- Field soils kit - Range finder - Shovel and hand tools - Soil probe - Camera	
Summary of Site Activities:	• Site and Soils Assessments • Evaluate Terrain Stability & Geohazard • Document visible erosion mechanisms, ground and surface water		

6.3. Geohazard Units

Based on self-similar geophysical and hydrologic characteristics of the Site, a number of Geohazard Units (GU) were defined by the attending QP. Each GU has been assigned a respective Geohazard, or relative likelihood of a landslide event occurring, based on the documented geophysical and hydrologic characteristics.

The incremental change in Geohazard within a GU consequent to the proposed Development Activity is evaluated by the QP in order to arrive at impact of said Development Activity. The subsequent QP interpretation and recommendations are intended to fulfil requirements of the IT Shoreline DPA.

6.4. Wave Action and Erosion Hazard

Along the coastal bluff in proximity to Site there were numerous small-scale mass-wasting scarps consequent to erosion. Of those observed on Site, those occurring at base of the coastal bluff also had ongoing erosion of the sediment cap at top of the coastal bluff – suggesting a classic toe erosion mechanism. The bedrock toe erosion is driven by a combination of mechanical factors (e.g. wave-impact, thermal expansion, wedging/sediment jacking of fractures, etc.) and chemical factors (e.g. dissolution of binding carbonates, salt/crystal growth, etc.). The most prevalent of which appears to be wave-impact, which – due to orientation of metamorphic rock laminae and wave-direction – peels the friable bedrock during storm events.

Otherwise, erosion occurring at mid or upper portion of the coastal bluff was based in surficial material – the mechanism of which is explored in the Groundwater and Erosion Hazard section of this report.

6.5. Groundwater and Erosion Hazard

There exists a transient erosion hazard consequent to high pore water pressure conditions within the veneer of surficial Galiano soils at base of the slope on Site, as a component of the failing coastal bluff.

Under adverse climatic conditions, this hazard would result in a limited mass wasting failure which would mobilize and entrain the full depth of surficial material. With standard climatic conditions, this mechanism is not as likely to result in such mass failure – instead, punctuated failure events will see progressive steepening and erosion at base of the surficial material cap atop the coastal bluff. This steepening will progress until a larger landslide failure event re-establishes at angle of repose – migrating the erosion front landward, toward the SFD.

Therefore, since the erosion of surficial material – over the long term – could impact the SFD, there are recommended mitigation measures which can be found is Section 7 of this report.

6.6. Hazard Rating

There was no pre-existing geohazard rating established through QP assessment and reporting, to the awareness of the author at time of writing.

The Site natural slopes were less than the angle of repose for moist gravelly sandy loam to loamy sand colluvium earth materials (35 - 45% or 19° - 24°)[7] above which slope-failure becomes more probable.

The landslide hazard rating for the entire Site was lower due to strong bedrock control at upper elevations, with shallow depth to bedrock for the remainder of Site, and therefore limited surficial material which would mobilize.

However, the surface sediments capping the coastal bluff have an increased erosional hazard due to presence of a perched water table in the lower slopes.

Consequent to these observations and slope gradients, GU on Site were assigned a VERY LOW to LOW hazard ratings outside of the coastal bluff, which classified as HIGH.

As per Appendix 2 – Geohazards and Risk, the GU defined on Site are summarized in Table 2, below.

Map imagery of GU delineation is found in Appendix 2 and is a recommended reading accompaniment to this section.

[7] H. Al-Hashemi, O. Al-Amoudi. A review on the angle of repose of granular materials. Powder Technology Volume 330, 1 May 2018, Pages 397-417. https://doi.org/10.1016/j.powtec.2018.02.003

Table 2 – GU Hazard Rating and Risk

Geohazard Unit	**Hazard Rating and Risk**			
	Slope Characteristics	***Hazard Rating***	***Consequence***	***Incremental Risk Rating***
1	**Cv | Br benching ± 35 - 40%**	**VERY LOW**	**LOW**	**Very Low**
2	**Cv / Br planar ±25 – 35%**	**LOW–MODERATE**	**LOW**	**Very Low**
3	**Cm planar ±5 – 15%**	**VERY LOW**	**LOW**	**Very Low**
4	**Cv / Br planar ±150 – 180%**	**HIGH**	**HIGH**	**High**

Geohazard Shorthand Notation

Br – Bedrock
C – Colluvium
A – Aeolian
L – Lacustrine
GF – Glaciofluvial
GT – Glacial till
M – Marine

v – veneer (.1 – 2m)
m – mantle (2 – 5m)
b – blanket (>5m)
/ - overlying
| - equal surface exposure
benching – slope interrupted by bedrock
planar – linear slope

6.7. Consequence of Geohazard Event

The Consequence of a geohazard incident was evaluated by the QP based on downslope receptors, predicted size and volume of geohazard event, and a simplistic Farböschung assessment – as detailed in Appendix 2 – Geohazards and Risk.

The most active failure mechanism on Site is punctuated landslide erosion of surficial materials at the coastal bluff (GU 4). The mobilized material would deposit directly to the marine environment, resulting in HIGH consequence.

Outside of which, the second likely failure mechanism on Site would be a mid-slope (GU 2) failure within a colluvium filled relic bedrock draw where a perched water table decreases shear resistance. However, due to the veneer of surficial material in the initiation area, any landslide would impact a limited area due to lack of transportable surficial materials from the initiating area or on low gradient receiving slope (GU 3). The low gradient receiving slope has sufficient width to retain mobilized material, resulting in a LOW consequence.

Summarily, the most likely geohazard results in a HIGH consequence while the remainder of Site has a LOW consequence.

6.8. Incremental Risk Imposed by Development Activity

The purpose of proposed erosion mitigation development activities is to reduce the geohazard risk of GU 4. This report has identified the active failure mechanisms resulting in erosion of the coastal bluff, from which mitigation measures can be evaluated.

6.9. Suitability of Lands for Use Intended (SFD)

There are no up-slope hazards likely to impact the SFD location.

While GU 4 has a High risk rating, the progressive-over-time nature of failure mechanisms for this area would provide opportunity to conduct more specific geotechnical review, and/or implement mitigation or emergency measures prior to impacting the SFD and ~3m of surrounding liveable space.

With no off-Site hazards and a LOW likelihood of failure above an existing SFD – the building location is **SAFE FOR THE USE INTENDED** (Residential Single Family Dwelling).

7. Geohazard Mitigation Recommendations

Due to the HIGH incremental risk of geohazards for GU 4, there are mitigation recommendations intended to reduce the risk to LOW.

7.1. Erosion and Sediment Control

All proposed activities will require Erosion and Sediment Control planning which meets IT regulatory requirements. Any such plan should be developed toward acquiring a Development Permit from the IT for the proposed activities and shall be submitted alongside any additional required paperwork.

There are two identified erosion mechanisms:

Pore water sufficient pore water pressure below the phreatic surface can acts as a destabilizing factor to overcome cohesion, friction angle and soil weight – entirely independent of toe erosion. While the majority of episodic pore water pressure erosion occurs during the rainy season, localized increases in pore water pressure can also lead to instability during otherwise drought conditions.

Mitigation options include, but are not limited to:

- Annual monitoring of erosional regression of surficial materials at the coastal bluff;
- Groundwater intercept and redirection to non-erosive receiving environment;

- o Bioengineering and selective planting of native species toward increasing shear strength of surficial materials;
- o Re-contour of the surficial materials to allow for emergence of groundwater without erosion;
- o Selective removal of shoreline trees deemed hazardous due to toe erosion.

Wave action a culmination of mechanical wave-action, daily sunlight-driven thermal oscillation, and saturating water-spray promotes decomposition and failure of fine-grained metamorphic bedrock situated in the lower 6 - 7m of coastal bluff. This results in toe erosion which, over time, destabilizes the portion of coastal bluff above.

Mitigation options include, but are not limited to:

- o Monitoring rate of erosion so as to establish a predictive timeline of coastal bluff regression;
- o Bioengineering and selective planting of native species toward dissipated wave-impact on coastal bluff face;
- o Wave deflection within intertidal area;
- o Beach nourishment to dissipate wave energy;

The suitability, efficacy and ease of implementation and maintenance of these recommended mitigation options should be carefully considered in context of Marine Shoreline Design Guidelines which will require an integrated assessment of geohazards (this report), wave and beach dynamics, and ecosystem characteristics.

8. Safety and Suitability

This report has been prepared in accordance with standard geotechnical hazard assessment practices, and at the expense of Heidi and David Kuhrt. Thomas R Elliot PhD P.Geo P.Ag has not acted for or as agent of the Islands Trust in the preparation of this report.

Thomas R Elliot PhD P.Geo P.Ag certifies that the land is safe for the use intended (Residential Single Family Dwelling and Driveway) if the land is used in accordance with the conditions specified in this report.

Thomas R Elliot PhD P.Geo P.Ag acknowledges that this report may be used by the Islands Trust as a precondition to the issuance of a permit and that this report and any conditions contained in this report may be included in a restrictive covenant and filed against the title to this subject property.

9. Summary

The land parcel with PID 009-555-706 situated on the southwest flank of a bedrock ridge forming a benching slope down to a coastal bluff is proposed to undergo permissible Development Activities within the Shoreline DPA of the IT.

Through assessment of these DPA requirements, Thomas R Elliot PhD P.Geo P.Ag as a QP capable of conducting the works, has determined a **High Risk of erosion geohazard** impacting the local environment. This determination is based on geophysical indicators on Site and regional frequency of historic landslide in the area.

The proposed development activities do not increase the Risk, however specific design of erosion mitigation measures will have to be completed prior to establishing a post-development Risk. There are sufficient pre-existing long term erosional processes on Site to warrant mitigation measures.

Qualified Professional of Record	THOMAS R. ELLIOT PhD P.Geo, P.Ag Name	 Sign

Thomas R Elliot PhD P.Geo. P.Ag.

Digital reproduction, original available upon request.

Date: November 6, 2023

10.Closure and Limitations

The QP signatory to this assessment and report assures accuracy of existing and field observation, and evaluation of technical geohazard according to best practices of the Engineers and Geoscientists of BC. The content of this report are applicable to the subject land parcel, and specifically the Site as defined in this report. Any extension of the evaluation to areas outside of the defined area assessed are not valid.

The report has been conducted according to guidelines and reporting standards of similarly qualified professionals, given similar time and budget. At time of writing, the report meets due diligence and investigatory reporting requirements to provide QP recommendations with declared competency in the subject areas. Therefore, the author of this report does not maintain liability insurance for actions taken based on the reporting, and only accepts error and omission liability up to the value of this report. The receipt, utilization and any planning, further studies or development actions undertaken by the recipient of this report are based on their acceptance of their own liability therein.

Appendix I

Maps and Figures

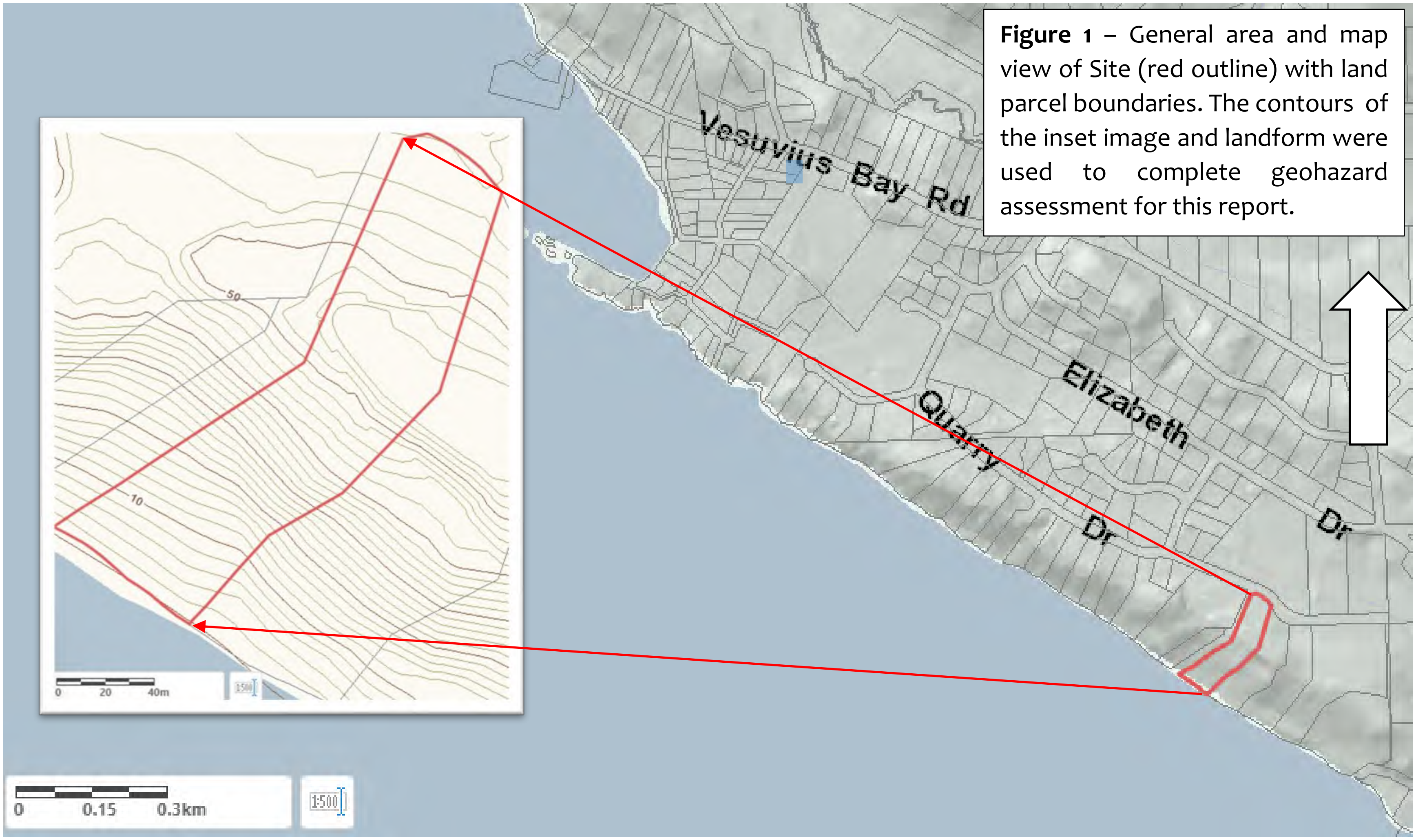

Figure 1 – General area and map view of Site (red outline) with land parcel boundaries. The contours of the inset image and landform were used to complete geohazard assessment for this report.

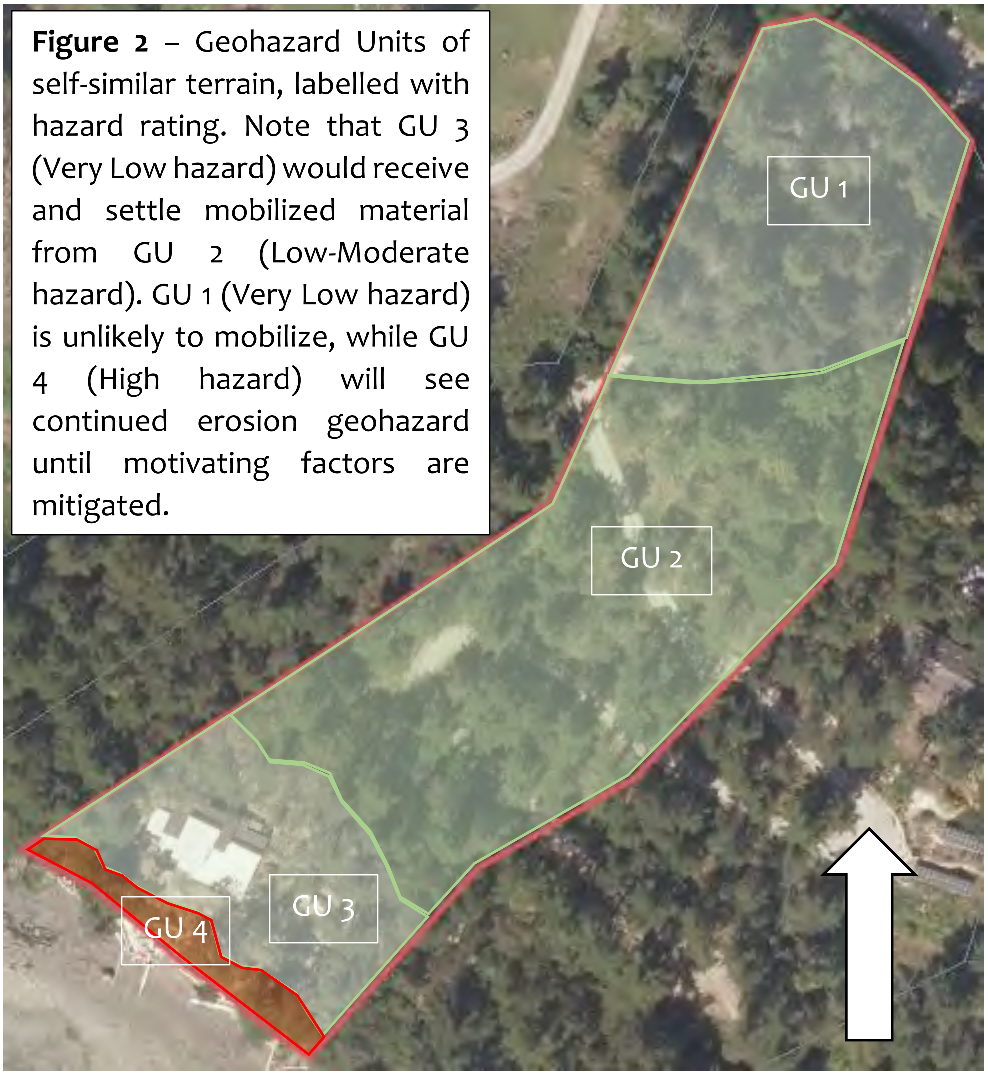

Figure 2 – Geohazard Units of self-similar terrain, labelled with hazard rating. Note that GU 3 (Very Low hazard) would receive and settle mobilized material from GU 2 (Low-Moderate hazard). GU 1 (Very Low hazard) is unlikely to mobilize, while GU 4 (High hazard) will see continued erosion geohazard until motivating factors are mitigated.

Appendix II

Geohazards and Risk

Geohazards

This assessment is partially based on local historic rates of landslide failure. The rating hazard of failures occurring in a given area under the classification system shown in Table II_a, below. By determining the likelihood of historic failures based on spatial density, the number of failures per unit area can be predicted. The likelihood of historic failures is determined through review of historic aerial imagery and general area observations while on the way to or from Site.

By establishing failure spatial density in the local area, in conjunction with Table II, the hazard rating can be estimated for areas undergoing development activities that impact terrain stability.

The hazard ratings were defined based on pre-existing practice by geoscientists and engineers for the natural resources sector, and adapted to best suit development activities governed by responsible municipal partners toward meeting those partner-organization risk tolerance policies.

Please note that, differing from resource sector terrain stability assessments, this evaluation of hazard includes failures smaller than 0.05 ha area (initiation, transport and deposit area). This is consequent to resource sector activities, and typically remote locations, being more tolerant of small-scale geohazard events. For this location, due to proximity to populated areas, and responsibility to meet municipal risk tolerance policies, the total area of a failure may be less than 0.05 ha in order to contribute to the hazard rating.

Table II_a: Definitions of hazard categories

Hazard Category	# of failures per geohazard unit size
VERY HIGH	>1 failure per 2 ha
HIGH	1 failure per 2 to 10 ha
MODERATE	1 failure per 10 to 50 ha
LOW-MODERATE	1 failure per 50 to 250 ha
LOW	1 failure per 250 to 1250 ha
VERY LOW	<1 failure per 1250 ha

Once the natural hazard of landslide for the area has been established, the probability of at least one failure occurring in a geohazard unit can be determined from Figure II_A.

Figure II_1 is based on the assumption that the probability of a specified number of failures occurring within a polygon is related to the size of the polygon by a cumulative normal distribution.

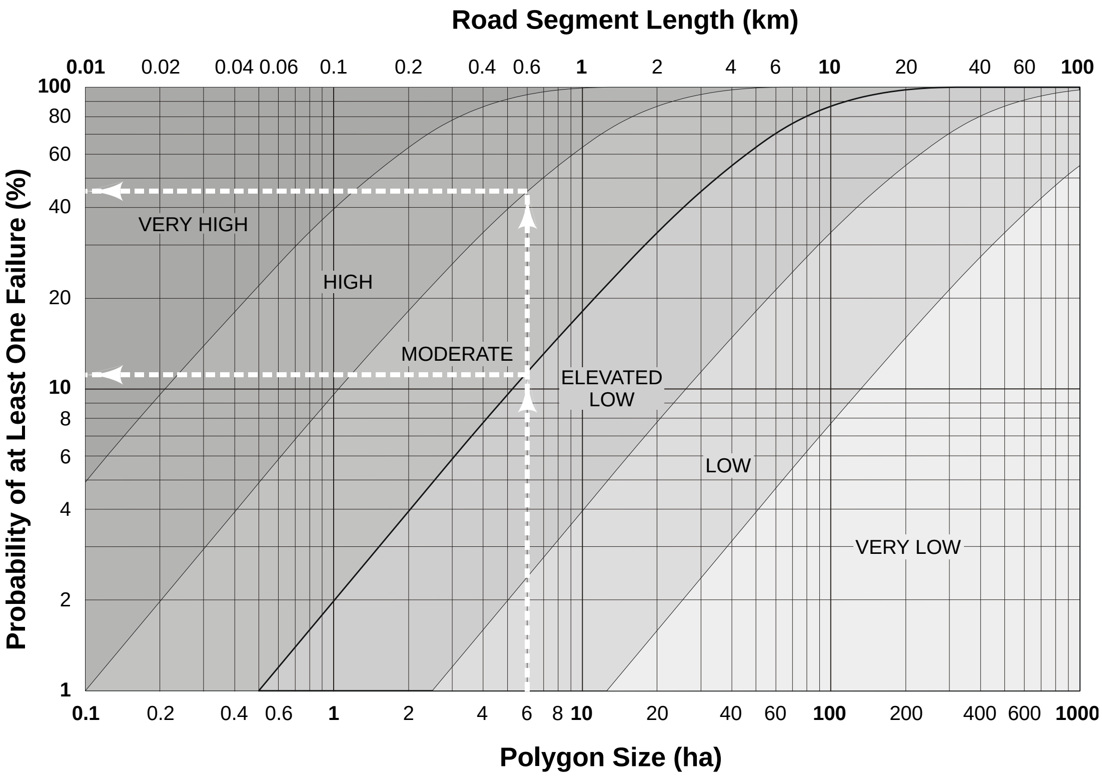

Figure II_1 – Probability of at least one failure based on a geohazard unit (GU) assessment area size or road length. This figure has been adopted from BC Forestry practices and is based on a single forestry harvest cycle, typically lasting 60 years within Coastal BC.

Figure II_1 has an example sketched with dashed white lines. The example indicates probability of failure for a ***6 ha*** *geohazard unit area with a* ***moderate*** *hazard rating. The probability of at least one failure occurring within the assessed geohazard unit area over the period of one forestry harvest cycle is between ~12 – 45%.*

Consequence

Simplistic Farböschung Evaluation

Whether or not a Site will be impacted by a geohazard is a component of determining consequence to potential landslide failures and/or debris flows. A simplistic assessment of transport and deposition zone locations can be accomplished through a 'Farböschung' evaluation. This is best exemplified through Figure II_B, which demonstrates how a sliding mass (block on right hand side) has potential to transport some distance from point of initiation based on a simplistic assignment of Farböschung angle.

For this assessment, a Farböschung angle of 45% was used based on heuristic practice for these coastal environments and gravelly loam surficial material. By standing on Site at highest point of initiation, the QP was able to establish the approximate run-out distance to edge of the deposit zone.

A more Site specific example is provided in Figure II_C, which shows a benching bedrock terrain where a thin veneer of surface material is mobilized, and has limited transport and deposit distances based on the Farböschung angle.

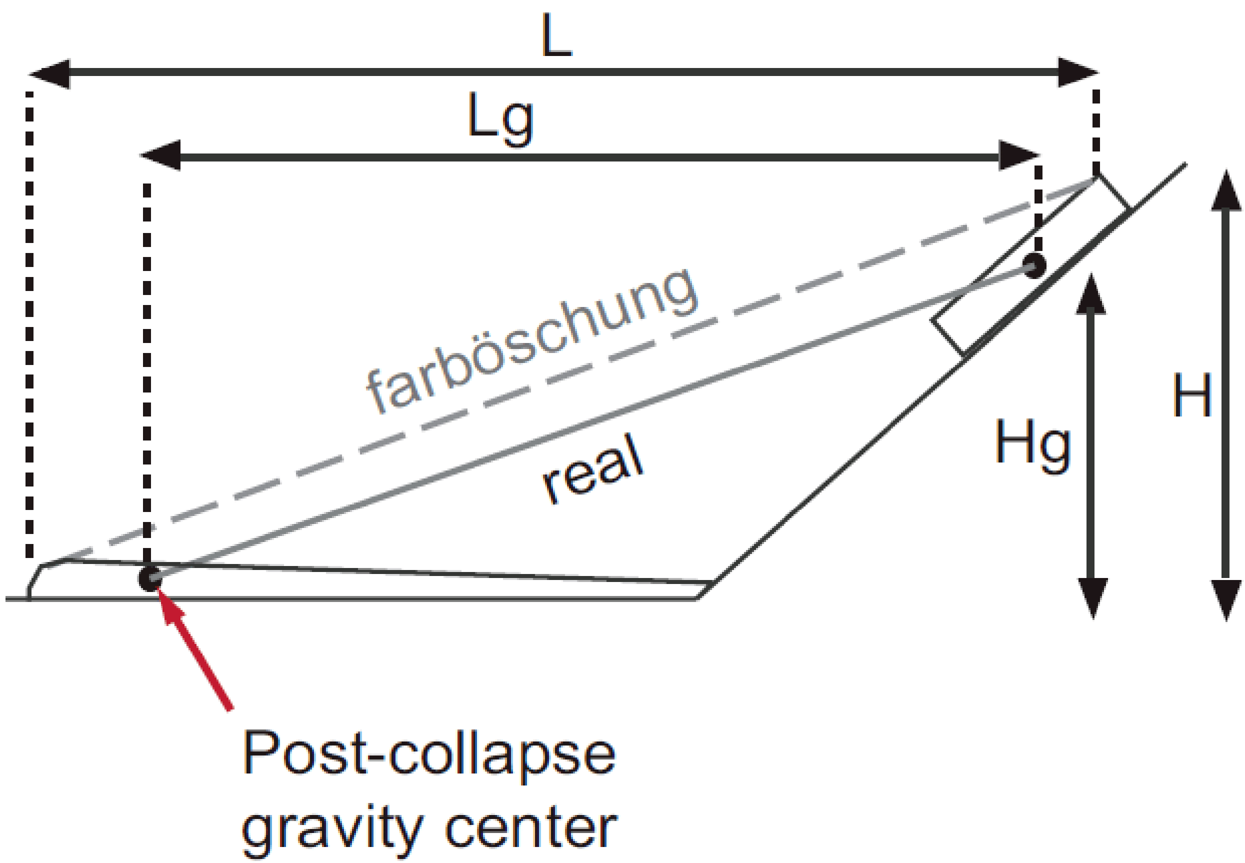

Figure II_B – Farböschung angle functionality for sliding masses on a slope. The specific mathematics of which are not supplied here for brevity.

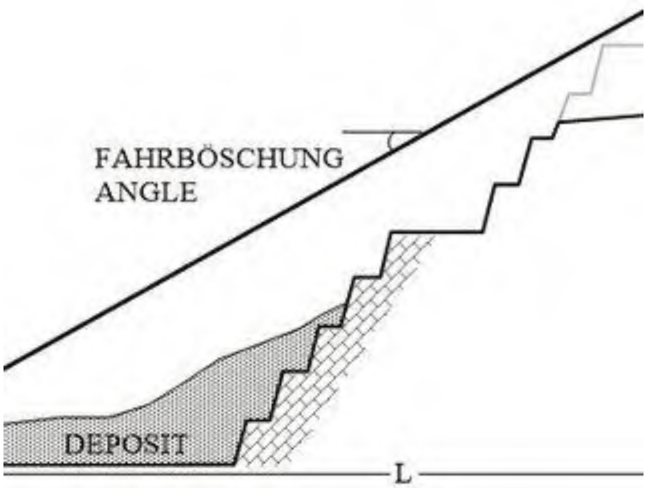

Figure II_C – An example of landslide runout and deposit area of potential geohazards on Site based on simplistic Farböschung assessment.

Table II_b: Consequence

Consequence	Criteria
HIGH	Landslide material would directly enter fish habitat (stream, lake, or marine waters); water intake for domestic consumption; jeopardize lives of the public; impact major public infrastructure; or other property owner. Landslide would enter non-fish stream within 500 m of fish habitat.
MODERATE	Landslide material enters non-fish stream > 500 m and < 3000 m from fish habitat, OR there is a slope < 20% for < 100 m below landslide to fish habitat; potable water intake; a public area; or other property owner.
LOW	Run-out slope < 20% for 100-200 m below landslide deposit area. At time of event, suspended sediment may reach fish habitat; potable water intake; public area, or other property owner
VERY LOW	Run-out slope < 20% for > 200 m below landslide. Landslide material is unlikely to reach stream or potable water intake at time of event. A landslide would not be a public safety concern; would not impact any infrastructure nor other property owner.

Post Development Activities Summary Table of Geohazards, Consequence and Risk on Site

Risk

Very Low	Low	GEOHAZARD				
Moderate	High	VERY LOW	LOW	LOW - MODERATE	MODERATE	HIGH
GEOMORPHIC CONSEQUENCE	VERY LOW					
	LOW	1	3	2		
	MODERATE					
	HIGH					4

Attachment 4

Assessment of Marine Shoreline Characteristics

As pertaining to areas seaward of land parcels:

235 Quarry Drive PID 009-555-706

239 Quarry Drive PID 009-555-731

434 Baker Road PID 009-555-781

431 Baker Road PID 000-014-656

SALT SPRING ISLAND

Report for Coastal Erosion Mitigation

Developed for: Aurora Professional Group

c/o Bradley Fossen P.Eng

338 Lower Ganges Rd UNIT 202

Salt Spring Island, BC V8K 2V3

Developed by: Thomas R Elliot PhD P.Geo P.Ag

TRE Environmental Services

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TRE Environmental Services

1. Synopsis

This assessment of marine shoreline was conducted using field, analytic and existing data to determine wave and sediment dynamics associated with erosion management of the coastline, as well as transport control of mobile sediments. These determinations are used to inform size distribution for sediment suitable for beach nourishment methods of erosion mitigation and transport control.

There are ~670m of hard armouring, or ~28.5% of the 2,350m shoreline within the drift-cell. Within the study area, there are ~70m of riprap and concrete, creating a ~14% hard-armoured coastline within the Site. This amount is considered to be moderate, where further erosion mitigation hard armouring would be discouraged by regulatory authorities.

There were two zones with distinct sediment size characteristics spread across the Site, for which there were sediment/gravel mixtures identified as being suitable for beach nourishment.

Lastly, the suitability of erosion mitigation and sediment transport control in context of Site factors and dynamics was evaluated. This evaluation encourages both continued monitoring and beach nourishment as suitable activities to pursue as part of erosion mitigation and sediment transport control.

2. Introduction

Landowners of four parcels adjacent to Baker Beach on Salt Spring Island have observed increased occurrence of punctuated erosion (e.g. landslide and landslip/tree-topple) and progressive erosion (e.g. plucking, thermal-jacking, or overland flow sediment mobilization). These landowners requested an assessment of the ~40m x 600m Site (Figure 1 – Appendix A), including existing foreshore and backshore characteristics, which informs sediment and wave dynamics. The assessment of foreshore and backshore dynamics will generate a drift-cell model for the Site. The drift-cell model will be used to evaluate suitability of proposed erosion mitigation measures at the end of this report.

This report is applicable to the foreshore and backshore seaward of the following land parcels:

Common Address	Parcel Identification
235 Quarry Drive	PID 009-555-706
239 Quarry Drive	PID 009-555-731
434 Baker Road	PID 009-555-781
431 Baker Road	PID 000-014-656

This report was written using existing and field-based data that provides spatial layout of the Baker Beach foreshore and backshore, generalized coastal zone sediment budget, beach particle size assessment and a drift-cell model summary.

2.1. Author Qualifications

Thomas R Elliot PhD is a Qualified Professional (QP) Geoscientist [# 43570] and Professional Agrologist [# 3045] registered within the Province of British Columbia and in good standing with both professional associations. The QP has 16 years of geohazard, soil science, near surface groundwater and hydrology. In the last 9 years, Thomas R Elliot has primarily worked on Vancouver Island and the Lower Mainland of British Columbia in the practice areas of [Geoscience]: Hydrogeology, Geohazard mitigation assessments, Soils/Groundwater management; and [Agrology] Soil science, Agriculture, and Contaminant detection, mitigation and remediation.

3. Standards of Practice for Marine Shorelines Management

The marine shorelines of British Columbia are subject to overlapping jurisdictional claims from municipal, provincial and federal government agencies. Despite the regulatory oversight, there are few guidance documents produced from Canadian sources that demonstrate best management practices from an integrated perspective which includes geophysical, ecologic and social/land use.

Some governmental agencies, such as Islands Trust (IT), who have adopted customized or standard guidance documents from Washington State Department of Fish and Wildlife[1]. Other non-governmental organizations have supported investigatory methods for detecting vulnerabilities and existing health status of shoreline environments[2].

This Assessment relies on existing guidance and approach methods that have been referenced by governmental agencies as being suitable for development planning and implementation practices within the BC coastal marine environment. Specifically, the determination and classification of marine shoreline and coastline dynamics, and consequentially which mitigation opportunities are suitable – is from the Marine Shore Design Guidelines[3]. Additionally, assessment and mitigation pathways identified have been considered in context of a Coastal Marine Strategy for British Columbia Policy Intentions

[1] Your Marine Waterfront (Canadian Edition): https://islandstrust.bc.ca/document/your-marine-waterfront-guide-2023/ Accessed 11/2023.

[2] BC Parks Shoreline Sensitivity to Sea Level Rise Model: User Guide: https://a100.gov.bc.ca/pub/acat/documents/r42825/BCPark_SS_user_guide_1403632673820_3629261453.pdf supported by the SeaChange Marine Conservation Society (https://seachangesociety.com/resources/). Accessed 11/2023.

[3] Washington Department of Fish & Wildlife Marine Shore Design Guidelines: https://wdfw.wa.gov/publications/01583. Accessed: 09/2023

Paper issued in December 2022[4]. In this report, the six outcomes identified in the Intentions Paper informed the assessment and mitigation options considered.

4. Scope, Context & Motivation

The purpose of this assessment is characterization of shoreline that will inform suitable marine coastline erosion mitigation measures which can be pursued on Site.

The motivation for this evaluation is to use sediment analysis and a drift-cell model in conjunction with reporting on ecology and geohazards to guide planning of erosion mitigation measures. The planning will be provided in subsequent reporting.

Additionally, there exists IT DPA 3 – Shoreline requirements for non-exempt development activities within 10m landward and 300m seaward of the marine-shoreline natural boundary. Therefore, if erosion mitigation recommendations are to occur within this DPA 3 area, there is a requirement to conduct characterization of existing conditions alongside demonstrably supportable recommendations for erosion mitigation.

The motivation to produce this report is to provide IT record of existing shoreline conditions, in partial or completion of IT DPA – 3 Shoreline requirements.

5. Shoreline Terminology, Site Delineation and Erosion Mechanisms

The shoreline area, as per IT DPA 3 definition, consists of a 300m coastal zone from the coastline, above which it extends into 10m of the uplands.

The Site includes the area of Baker Beach, as bracketed by public access, in addition to self-similar shoreline at both extents for a total ~600m of coastline (Figure 1 – Appendix A).

To best align this document with existing map products of shoreline delineation by IT, such as Saltspring Is. North Map 1 of 3: Distribution of Shoreline Types, Figure 3 was generated with identical classification and colour scheme.

Of the erosion mechanisms identified on Site from previous geohazard reports, the following are of note:

- Pore pressure/Groundwater Seepage from surficial soils, reducing cohesion and resulting in landward progression of the crest through continuous or punctuated mobilization of sediment.

[4] A Coastal Marine Strategy for British Columbia. https://engage.gov.bc.ca/app/uploads/sites/121/2022/12/Coastal-Marine-Strategy-Intentions-Paper.pdf. Accessed 11/2023.

- Toe-erosion of bedrock, or undercutting of shoreline sediment, which decreases stability of all materials above, often resulting in narrow failures from crest to base of coastal bluff.
- Landslip/Tree-topple is occurring on Site wherein trees near, or overhanging, the coastal bluff mobilize consequent to soil creep, pore pressure or toe-erosion. These failures result in a larger volume of surficial sediment during failure than toe-erosion instability reaching the crest. Consequent to root reinforcement or friability of bedrock, landslip is likely to mobilize underlying shale and siltstone.
- Landslide is a moderate to large scale failure event which can mobilize bedrock and overlying surficial sediment. Coastal landslide are often consequent to a history of toe-erosion, bedrock fracture and an increase in pore pressure (i.e. saturated soils & rock-fractures during a storm event) which has destabilized the coastal bluff in that area.

6. Shoreline Characteristics and Dynamics

This section presents details on the existing composition and quantifiable characteristics of the assessed marine shoreline. The following is a summary table of global characteristics, acquired from previous geohazard reporting[5], while details of each area are reviewed in subsequent relevant sections. Field assessment methods provided in Appendix A of this report.

TABLE 1. GENERAL SHORELINE CHARACTERISTICS FROM PREVIOUS REPORTING

Geology & Geomorphology	
Geology	Siltstone to mudstone in upland, sandstone within coastal zone, of the Nanaimo group – which is an elevation-banded sedimentary and metamorphic rock assemblage.
Surficial Sediment	Well to rapidly drained sandy loam to loam belonging to the Galiano soil association is present at the coastline.
Landslide/Landslip activity frequency	Concentrated within areas of accelerated erosion, with a Site wide occurrence of 1 per ~40m of coastline.
Shore & beach type and beach features	*Shore type:* Rocky coastline bluff with variable elevation bedrock resulting in low rock/boulders, boulder/cobble and sea cliff natural coastline. There are structurally altered (i.e. hard armour) coastline up-drift, within and downdrift of the assessment area. *Beach type:* The presence of bedrock within the coastal bluff and foreshore results in the Site being typified as a high tide reflective beach face fronted by intertidal rock flats (i.e. bedrock low-tide terrace).

[5] Geohazard assessment for each land parcel, completed by TRE Environmental Services under separate cover. For reference and details, please refer to those reports.

	Features: There exist two bedrock outcropping, nearly 40 – 50m from coastline at seaward extent of the low-tide terrace, which are in line with two ridges descending from uplands and consistent with the benching morphology of this shoreline geology.
Ground and Surface Water	
Watershed conditions	Single benching slope above the assessment area results in small-scale flow accumulations. There are no identified streams, albeit there was some evidence of overland flow associated with high volume precipitation events.
Groundwater	Limited infiltration to bedrock results in perched water table within the veneer to mantle of surficial materials. Perched water table causes increase pore water pressure at soil interface with air, decreasing soil stability.

6.1. Hard Armouring

At respective distances of 115m and 490m northwest of Site, there are ~200m of groyne and ~300m of coastline-riprap hard armouring installations. Of these anthropogenic foreshore modifications, the groynes may be encouraging some sediment accumulation along the beach face by diffracting wave energy, albeit that poor installation has resulted in low sediment retention; while the riprap has reduced kinetic wave action on the shale and siltstone coastline, reducing supply from upland to the local coastal zone sediment system.

Down-drift from Site is ~80m of coastline-riprap on a sediment bar at the mouth of Booth Inlet. This hard-armouring restricts both progressive and punctuated sediment mobilization from the area by constricting flow to a narrowed channel, thus reducing fine-sediment supply to local shoreline.

There are three additional sections of hard armouring within Site: coastline-riprap placed at the northwest (10m) and southeast (30m) CRD access points, as well as along the coastline of 241 Quarry Rd (30m) – creating a ~14% hard-armoured coastline within the Site.

In total, the ~2,350m long drift-cell (see Section 6) – extending from Vesuvius Bay to the mouth of Booth Inlet – has ~670m of hard armouring, or ~28.5% of the local area shoreline.

6.2. Backshore

Indicators of a backshore are the presence of accumulated fine sediment and clasts, large littoral debris, sparse vegetation, and an area that is dry under normal conditions but exposed to wave action during storm events coinciding with high-tide. With this criterion, the backshore on Site was determined to have limited extent, often less than 1m in width and non-existent in some areas where there is continuous bedrock outcrop to the coastal bluff.

The backshore does not have sufficient width to create dunes or other geomorphic sediment accumulations. However, there exists minor clastic terrace deposits above the wrack line in sections of backshore that were contiguous with the beach face. There is sparse littoral and flotsam debris accumulated within the backshore, which is in contrast with the common to frequent presence of accumulated debris along up-drift sections of shoreline which have been historically armoured by rock groynes.

Sediment supply from uplands is principally delivered to the backshore as progressive erosion of coastline bedrock bluff. Sediment deposits from punctuated toe-erosion, landslip and landslide failures were also present in the backshore – some of which hosted perennial salt-tolerant vegetation, suggesting a multi-year existence. The persistence of these deposits through prior year storm-season (i.e. high wave energy and storm events) is a component of continuous sediment supply to Baker Beach.

6.3. Foreshore

The bedrock transition from shorerise to a ~3° gradient low-tide terrace is notably marked by the presence of two bedrock rises which present as 'barrier islands' for a portion of Baker Beach (see Figure 1). Under high tide conditions, these outcrops are fully submerged. The low-tide terrace is a wave-cut rock platform in siltstone and shale bedrock. The wave-cut platform has been created over the most recent eustatic sea level, in existence since the end of the last ice age ~8,000ybp.

Within the low-tide terrace there is a mixture of sediment and bedrock coverage, as shown in Figures 3 & 4 – Appendix A. The accumulation of sediment is facilitated by undulating bedrock surface, with depressions readily infilled. The infill presented cobbles and gravel surface armouring, with fine sediments captured and retained underneath. There is a typical progressive reduction in the amount of mobile gravel toward the seaward extent of low-tide terrace.

The 10 – 25m width of ~5° gradient continuous beach face across the Site is demarcated by a grading of accumulated sediment, from sparse cobbles and coarse gravel atop sand at the low-tide terrace interface, to fine gravel and sand at the backshore interface. Generally, there is a surface layer of mobile gravel which accumulates to greater depths toward the backshore interface. There is a wrack layer at the upper extent of the beach face, with accumulation of littoral debris by normal wave and tide-action.

The beach sediment is a broad mixture of boulder erratics emerging from sedimentary bedrock or upland surficial material through weathering, to gravel, coarse sand and limited fines. Further information on beach sediment is found in the Section 5.5 – Beach sediment analysis.

6.4. Wave dynamics

Wind-driven wave generation is largest in the west to northwest direction, creating acute incidence of approach. However, windrose diagrams (Figure 4) demonstrate a predominantly southwest to southeast winds that reach moderate velocity (≥6.0m/s). These predominant winds would form waves over a maximum 4.6km fetch. There are rarely occurring strong northerly to northwesterly winds recorded for the autumn period which would incur the maximum possible 13.5km fetch for the Site. The reference marine shoreline development guidelines recommend differentiating between Low, Moderate and High energy waves when fetch exceeds 1.6km & 8.0km (respectively) – therefore wind-driven wave energy on Site is determined to be Moderate.

Vessel-wake wave energy is predominantly from the most transited paths through the Sansum Narrows, and the regular Vesuvius-Crofton ferry. While there is large cargo vessel traffic to the nearby Crofton Mill, the lower frequency and low-speed manoeuvring does not contribute significantly to wave-energy delivered to Baker Beach. Due to the predominant angle of incidence, the vessel-wake do contribute to alongshore drift, moving fine sediment within the Drift cell.

Using equation 3 from Appendix B, typical wave velocity at high-tide across the rising low-tide terrace is determined to be 1.98m/s (7.12 km/h) resulting in a surging breaker classification. Surging breaker waves involve a progressive transfer of potential to kinetic energy across the coastal zone of Site.

Under storm event conditions where wind energy increases wave speed, wave type shifts to plunging breakers at steep shorerise, with the resulting whitewater traveling across the low-tide terrace and beach face as turbulent motion.

Based on sediment deposition patterns and distance from deep water, tidal currents do not have an apparent influence on wave dynamics at Site. Further, Booth Inlet – immediately east of the Site – is an ebb-tide delta with observable fine sediment accumulation. There is little evidence of increased fine sediment accumulation from the ebb-tide delta within the Site, demonstrated through beach sediment analysis, reinforcing that the drift-cell transports alongshore from northwest to southeast.

6.5. Beach sediment analysis and Beach Nourishment Sizing

Sediment analysis of the coastal zone samples were evaluated for size fraction (See Appendix C). Sediment analysis provides distribution across distinct size ranges for samples from the following delineated coastal zones: Coastline, Backshore terrace, Backshore face/wrack, Foreshore beach, and Nearshore crest.

Within the study area, the most consistent sediment size-composition (Graph C1) was found across the well sorted foreshore beach face (Figure 2). After which, the backshore face and backshore terrace demonstrate good size consistency (Graph C2, C3) across the Site. There is a clustered distribution of sediment composition for the nearshore samples (Graph C4), which demonstrate a zonation along the drift cell.

To better understand the zonation, sediment size was charted for each property (Graph C5 – C9) to determine if there are alongshore effects to be accounted for in beach nourishment sizing. This identified grouping of sediment sizes between property 1 and 5, as well as 3 and 6; suggesting similar wave action and resulting sediment transport processes in these areas.

Generalized Sediment Budget

The Site is of limited spatial area, and therefore can only receive sediment from a limited section of the coastline and intertidal terrace erosion. While there is some alongshore sediment transport within the drift-cell, the mobile size fraction – being fine sand to silts – was most prevalent in the nearshore adjacent land parcels further along in the drift-cell. This distribution indicates a fine sediment deposition zone in the eastern portion of the Site, which agrees well with geomorphic factors – such as the nearby confluence of Booth Inlet.

Coarse sand to stones are most readily supplied to Site by erosion of surficial materials in the coastline and uplands, accomplished through overland transport or failure of the coastal bluff. These sediment sources are limited in volume prior to when their transport to beach would encroach on built structure geohazard setbacks. As such, we can state that there will be a decrease in sediment supply from uplands, trending to zero in the long term, should safe use of the built structures be prioritized.

Sparse gravel coverage along the low tide terrace and beach face demonstrates a low supply and low loss environment. The deposits present were found to be armoured at surface with large clasts, finding sand and silt content deeper within the sediment profile. This suggests there is reworking of sediment within the drift-cell, but there does not appear to be sufficient force to transport the larger size range of sediment present out of the drift-cell.

In context, the drift-cell generalized sediment budget is low input/output, with primary loss – being fine sands to silts – through evacuation to off-shore. There is reworking of gravel present, although observed armouring and stratification of beach sediment profile indicates a heavily conserved higher clastic fragment size range.

From this generalized sediment budget, beach nourishment planning can be better focused on the larger sediment size ranges to ensure conservation of materials while including coarse sand to help stratification and armouring processes occurring on the beach face.

Beach Nourishment Sizing

Determining sediment size suitable for beach nourishment within the Site becomes more complex in context of a drift cell, where materials deposited to a portion of the Coastal Zone (Figure 2.) will disperse to adjacent zones and alongshore within the drift cell. This is a factor in determining both target-zone, and size range for beach nourishment. One suitable approach is to determine sediment size composition for beach nourishment through averaging of existing sediment within zones that will ultimately receive the material, weighted for the target deposition area.

Based on Client motivation, the target deposition area within Site would be the backshore face, where it is anticipated that there will be transport to backshore terrace and foreshore beach face. Additionally, there is no intention of placing easily transportable material – meaning that there will be no purposeful addition of silt to the beach nourishment, and coarse sand will be the smallest size fraction identified for placement.

Due to the previously identified zonation, there are two size ranges suitable for beach nourishment at the backshore face – as follows:

Zone 1: Property 1 & 5

Percent Composition	Size Range	Common Name
60%	4.8mm+	(30%) 20mm washed drain rock, (40%) 40mm washed crushed rock, (25%) 60mm washed crushed rock, (5%) 10 - 20cm round cobbles
20%	1.8mm to 4.7mm	10mm washed rounded gravel
20%	1.7mm-	Fine to coarse sand

Zone 2: Property 3 & 6

Percent Composition	Size Range	Common Name
45%	4.8mm+	(30%) 20mm washed drain rock, (40%) 40mm washed crushed rock, (25%) 60mm washed crushed rock, (5%) 10 - 20cm round cobbles
20%	1.8mm to 4.7mm	10mm washed rounded gravel
35%	1.7mm-	Fine to coarse sand

7. Drift Cell Model - Interpretation and Summary of Marine Shoreline Dynamics

The drift-cell of Baker Beach extends 2,350m from the rocky outcrops at south Vesuvius Bay to the mouth of Booth Inlet. This drift-cell is designated based on a common alongshore drift-current that transport sediments and has been generated by consistent waves approaching at oblique angles to the shoreline.

Baker Beach is currently supply limited, resulting in discontinuous sections of beach face, with long-term coastline retreat driven by wave, water and weathering erosion mechanisms. The beach features a bedrock intertidal terrace, over which a moderate alongshore drift-cell current provides low-volume sediment transport.

Consequently, the primary source of sediment for Baker Beach are sections of the adjacent upland coastal bluff, which contribute silt, sand, gravel and limited larger clastics up to boulders.

The delivery of sediment is through progressive erosion mechanisms and punctuated erosion mechanisms. Bedrock erosion produces angular to sub-angular coarse to fine gravel which is highly susceptible to further breakdown due to the fissility of shale – the predominant bedrock type. A variable mantle of ~0.5 – 3m of surficial material contributes sandy to silty loams, with clastic fragment (e.g. gravel, cobbles, stones) content up to 20% by volume. There are sparse stones to boulders on the beach which have weathered out of bedrock during formation of the low-tide terrace, or through erosion of the surficial uplands sediment mantle.

Sediment discharge from the drift-cell includes evacuation of mobilized sediment to off-shore depths, and limited wind-driven loss of fine sediment fraction from the backshore and uplands.

Alongshore sediment movement is facilitated by the low-tide terrace having a gentle slope and predominantly bedrock surface. Outside of the submerged low-tide terrace, alongshore sediment movement is very limited.

8. Suitability of Erosion Mitigation and Sediment Transport Management Recommendations

Previous reporting on geohazards[5] identified erosion mechanisms and developed recommendations for mitigation. This report has assessed shoreline and sediment processes, culminating in a drift-cell model which differentiates between prevalent kinetic forces (i.e. wave, wind, current & weathering) and results in a generalized sediment budget for Baker Beach.

In this section, the recommended erosion mitigation options are evaluated for suitability in context of existing conditions and drift-cell model. Suitability is a high, moderate and low ranking based on evidence gathered through this and preceding reporting.

The following table is evaluation of activity suitability for mitigation of erosion and management of sediment transport in the Site foreshore.

TABLE 2. SUITABILITY OF EROSION MITIGATION AND SEDIMENT TRANSPORT RECOMMENDATIONS MADE UNDER PREVIOUS GEOHAZARD REPORTING.

	Suitability			
Mitigation or Management Activity	**Foreshore**	**Backshore**	**Wave Dynamics**	**Sediment Supply**
Monitoring rate of erosion	High Monitoring captures multi-seasonal natural cycles.	High Monitoring captures multi-seasonal natural cycles.	High Direct capture of data.	High Capture seasonal fluctuation in sediment transport.
Bioengineering and selective planting	Low Very challenging establishment conditions.	Moderate Shelter and stabilization of sloughed surficial material and bedrock. Challenging establishment conditions.	Moderate Bioengineered and root reinforcement of sedimentary coastline. Overhanging vegetation would shelter bedrock from weathering.	Low Mitigation activity would reduce primary sediment supply to beach.
Wave deflection	Moderate Reduces incident wave energy reaching backshore. Close placement to be uniformly effective.	Low Would constitute hard armouring in coverage required to be effective.	Moderate Moderate energy wave conditions and presence of discontinuous backshore de-prioritizes this option.	Moderate Reduces incident wave energy reaching backshore. Reduces amount of sediment supplied to beach.
Beach Nourishment	High Post-placement in the backshore, natural transport of sediment would supply the foreshore.	High Placement in the backshore would reduce wave energy reaching coastline.	Moderate Moderate wave energy would evacuate some of placed sediment.	Moderate Subsidize existing natural supply, reduces natural sediment supply. Would need re-supply in future.

The interaction with Site ecology, efficacy and ease of implementation and maintenance of these recommended mitigation options should be carefully considered in context of Marine Shoreline Design Guidelines.

9. Summary

This assessment of Baker Beach and surrounding area marine shoreline has characterized shoreline, wave dynamics, erosion and sediment supply of the area which constitutes a drift-cell. Within Site, detailed foreshore and backshore characteristics were established from field and existing data.

Analysis of beach sediments has identified a zonated drift-cell with deposition of fine sediments in the eastern portion of the Site. The drift-cell generalized sediment budget is low input/output, with primary loss – being fine sands to silts – through evacuation to off-shore. There were two distinct sediment-size distributions identified that would be suitable for beach nourishment activities.

A drift-cell model was developed for the Site, which establishes sediment supply and transport mechanisms present. Using the drift-cell model, a suitability evaluation of erosion mitigation and transport management activities was undertaken for the Site with explanatory rationale demonstrating whether particular recommendations would be viable in context.

Despite moderate energy wave conditions on Site, a limited sediment supply exists due to the low amount of global sediment movement brought about by tidal currents and lack of up-drift sediment sources.

A comparison of activity suitability from this assessment with a similar suitability evaluation based on geohazards and ecology would be instrumental when applying the reference Marine Shoreline Development Guidelines.

Qualified Professional of Record	THOMAS R. ELLIOT PhD P.Geo, P.Ag Name	Sign

Thomas R Elliot PhD P.Geo. P.Ag.

Date: December 18, 2023

Digital reproduction, original available upon request.

Closure and Limitations

The QP signatory to this assessment and report assures accuracy of existing and field observation, and evaluation of technical geohazard according to best practices of the Engineers and Geoscientists of BC. The content of this report are applicable to the subject land parcels, and specifically the Site as defined in this report. Any extension of the evaluation to areas outside of the defined area assessed are not valid.

The report has been conducted according to guidelines and reporting standards of similarly qualified professionals, given similar time and budget. At time of writing, the report meets due diligence and investigatory reporting requirements to provide QP recommendations with declared competency in the subject areas. Therefore, the author of this report does not maintain liability insurance for actions taken based on the reporting, and only accepts error and omission liability up to the value of this report. The receipt, utilization and any planning, further studies or development actions undertaken by the recipient of this report are based on their acceptance of their own liability therein.

Appendix A

Maps and Figures

Figure 1. Assessment area

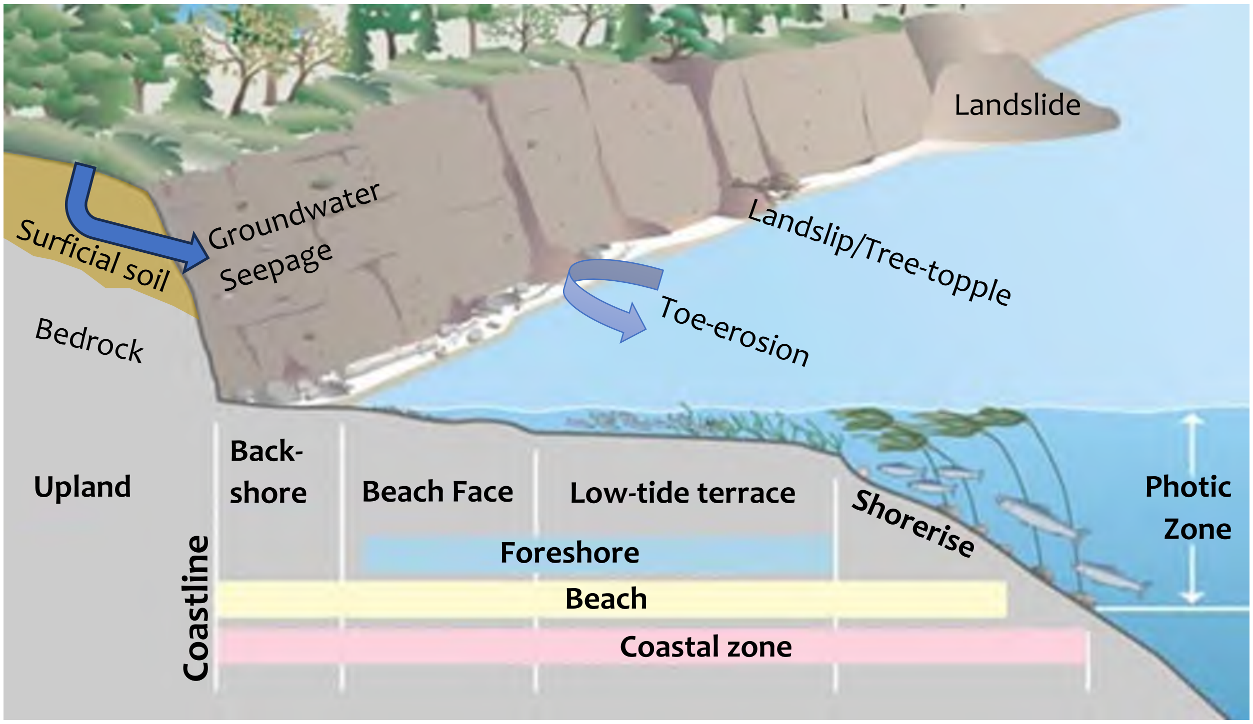
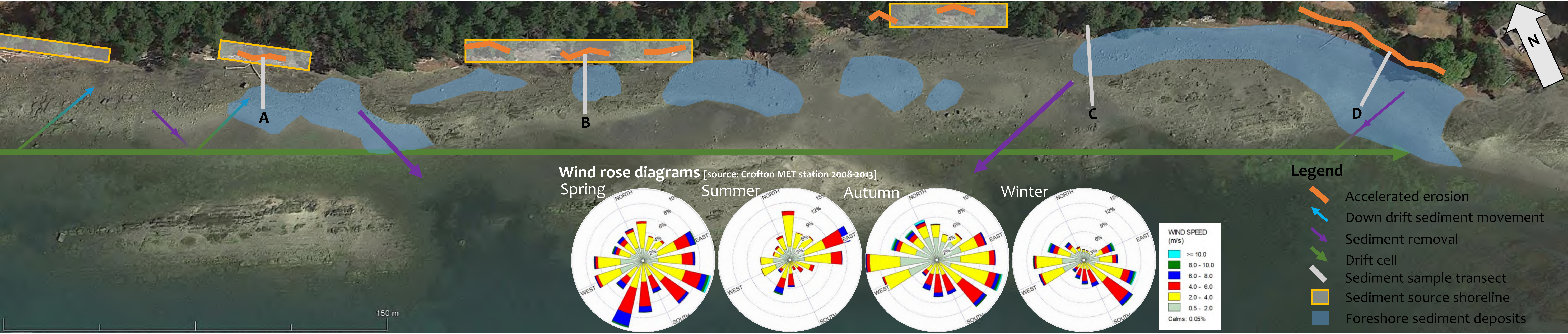


FIGURE 2. CONTEXTUAL DELINEATION OF THE SITE WITH RELEVANT TERMINOLOGY TO ASSIST WITH READING OF THIS REPORT. THE COMPONENTS OF THE COASTAL ZONE AND UPLANDS ARE INDICATED ALONG WITH ACTIVE EROSION MECHANISMS. ADAPTED FROM: KING COUNTY NEARSHORE ENVIRONMENTS, CENTRAL PUGET SOUND, WASHINGTON STATE.

Figure 3. Shoreline types, sediment transects and bedrock outcroppings

Figure 4. Sediment dynamics, drift-cell current, and windrose diagrams



Appendix B

Methods and Rationale

Field and Analytic Methods

Field Methods

Two field days were used to characterize the Site.

Day One: Characterization of geology, geomorphology, wave dynamics, sediment dynamics, and documentation of soil and bedrock erosion/evidence of groundwater.

Day Two: foreshore delineation and beach sediment sampling along Transects A – D, as shown in Figure 3 & 4.

Beach sediment sampling

Sediment samples were collected using appropriate tools, ensuring they represent the area of interest accurately.

A 250mL silicon container was used to collect uniform volume of trowel-excavated (to a depth of 10cm where existent) grab samples from beach sediments at specific locations, as follows: backshore, beach face, low-tide terrace, and shorerise.

The distance from coastline to each sample location was measured alongside multiple GPS enabled photographs which are used to document the precise location.

Each sample was codified, and placed in a sample bag.

The samples were retained in a cool environment until analytic testing (see below).

Analytic Methods

The process of drying and fractioning sediment typically involves the following standard methods:

Drying: The collected sediment samples are spread out in thin layers and set to air dry at a low temperature (usually around 105°C). This process removes moisture from the samples without significantly altering the composition.

Sieving: Dried sediment is sieved through various mesh sizes to fractionate the particles based on their size. This can range from very fine sieves for clay particles to coarser sieves for sand and gravel fractions.

Particle Size Analysis: After sieving, the fractions are weighed and analyzed to determine the percentage of different particle sizes in each fraction. This analysis may involve techniques such as sedimentation, laser diffraction, or microscopic examination to precisely determine particle size distribution.

Organic Matter and Mineral Content Analysis: Sediment fractions were not evaluated for organic content. Mineral composition was determined by hand-lens heuristic assessment to general rock type.

Data Interpretation: The results obtained from these analyses are used to characterize the sediment, understand its properties, and make inferences about its origin, quality, and potential uses or impacts in various contexts.

Rationale

Wave Dynamics

Wave generation proximal to Site is by two mechanisms: wind and vessel-wake. Wind-generated waves are formed off-shore, above deeper water, oriented in the predominant wind direction of the area, which is shown for Site in Figure 4 seasonal windrose diagrams[6].

Vessel-wake waves are generated by marine traffic, forming short-period, steep sided wave-trains with moderate height that move quickly across open waters. Larger vessels initiate wave-trains that compound to amplify height, which can exceed wind-generated waves in areas with short-fetch.

Waves generated by wind above deep water are typically short-period, with steep sides, with relatively tall height that move slower during wind-driven generation. Transition to swell waves occurs as the proto-waves concatenate in the orientation of predominant wind as modified by any coastal-reflection. Swell waves are longer, faster and uniformly spaced as they approach coastal environments, whereupon contact with the rising bedrock causes them to shoal and break. The contact with bedrock in shallow waters also starts to re-orients the incoming swell waves to be more perpendicular to the coastline due to refractive waves.

The potential energy contained within swell waves are released as kinetic energy through this shoal and break mechanism. Typically, the wave height (H, trough to crest), period (T, time for crest to crest to pass), length (L), and velocity (C) are related to each other through the following equations:

[6] It should be noted that the weather-station which acquired wind data for the windrose diagrams shown in Figure 4 is situated at the coastline of Crofton, on the west side of Sansum Narrows – opposite to Site at a distance of 3.8km, and as such the weather-station location will be subject to a wind regime modified by local topography that over-represents winds coming from off-shore – although general trends in wind direction would be consistent for both the meteorological station and Baker Beach.

Eq. 1	L = 1.56 T	wave length
Eq. 2	$C = 1.56\ T^2$	off-shore wave velocity
Eq. 3	C = sq.rt.(g*d)	near-shore wave velocity, where g is gravitational constant, d is depth of water

wherefrom velocity can be used as general proxy for mechanical energy conveyed by waves.

Transferral of wave potential energy to kinetic energy at the foreshore and coastline is, in part, dependent on the angle of incidence (α), as the measurement of wave alignment to perpendicular from coastline. When waves enter the break and swash zone at oblique angles, the momentum gradient in the alongshore direction produces an alongshore current typically known as a drift current. This current advects sediment mobilized by a combination of wave motion and turbulent motion in the alongshore direction. The alongshore current forms the fundamental component of a Drift Cell, which is a representation of wave, current, tidal and transport processes – ultimately determining distribution of sediment within the Site.

Tides influence waves and kinetic energy delivered to coastlines by altering the shoal and break mechanism through adjustment of the water depth in the foreshore (i.e. high vs. low tide). Exceptionally high tides, typically corresponding to full or new moons, are contributory to backshore composition and configuration due to this increased depth and concurrent wave activity which can reach the backshore.

Tidal currents are critical to supply of fine sediment for drift cells, and within regional proximity to Site there are Department of Fisheries and Oceans current predictions[7] which indicate a low to moderate tidal effect throughout the Gulf Islands on the east coast of Vancouver Island. Due to Site being off-set from a main tidal channel, the influence on sediment budget is anticipated to have a lesser effect than a similar site more exposed to tidal current.

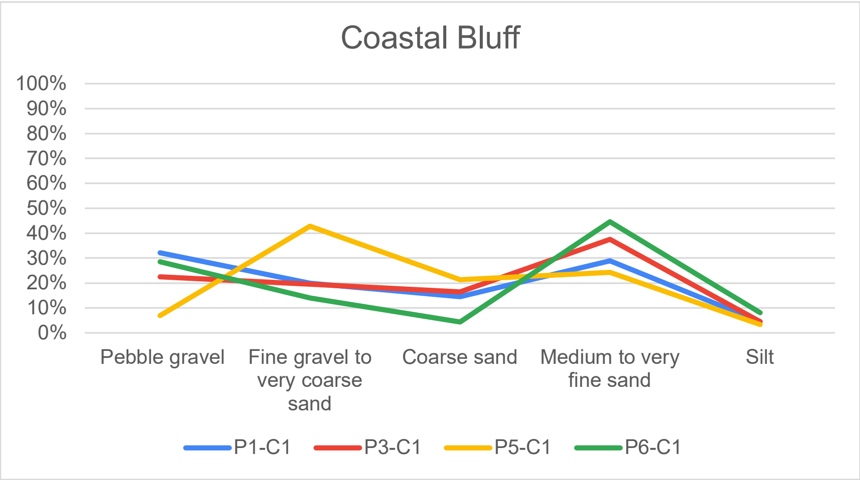
The angle of waves incidental to Site is such that a considerable amount of wave-energy is reflected, or disrupted, from Baker Beach during high tide – resulting in a reduction to incoming moderate wave energy and therefore less kinetic erosion on bedrock and sediment coastline, as well as lower energy evacuation of water from the shoreline. During low-tide conditions, the shoreline bedrock terrace is above sea level, restricting the amount of kinetic energy transferred to the bedrock and sediment coastline.

[7] Canada Department of Fisheries and Oceans. Current Predictions by Station: https://tides.gc.ca/en/current-predictions-station utilizing Gabriola Passage [43km distant], Porlier Pass [17km distant] as indicators. Accessed October 2023.

Appendix C

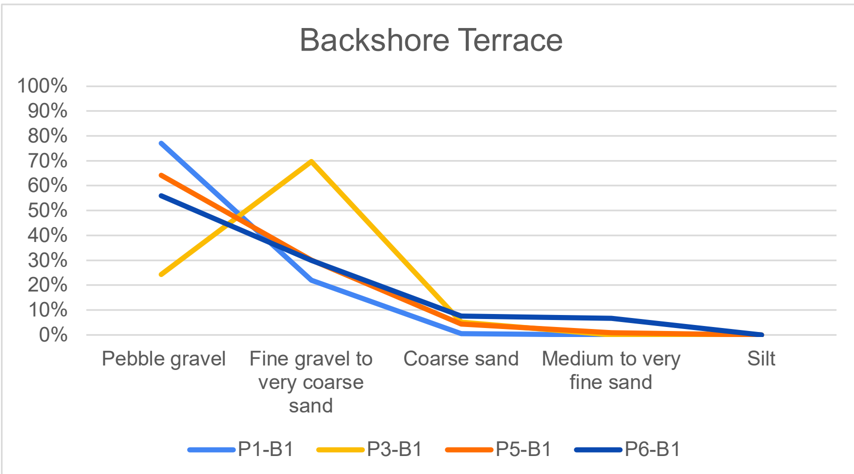
Sediment Analysis

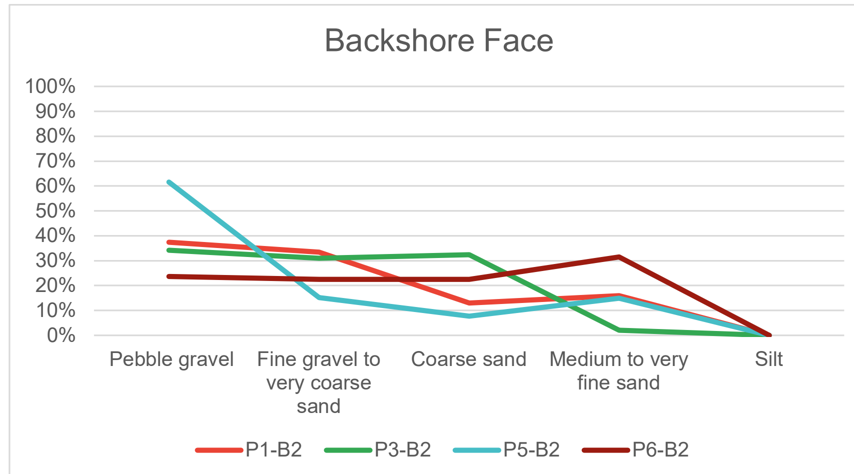
Date	Sector	m	Wet Weigl	Dry Weigh	XL(g)	Pebble gr	L (g)	Fine grave	M(g)	Coarse sa	S(g)	Medium tc	XS(g)	Silt	Notes
	P1-C1	n/a	221	221	71	32%	44	20%	32	14%	64	29%	10	5%	
	P3-C1	n/a	204	200	45	23%	39	20%	33	17%	75	38%	9	5%	
	P5-C1	n/a	280	271	19	7%	116	43%	58	21%	66	24%	9	3%	
	P6-C1	n/a	193	186	53	28%	26	14%	8	4%	83	45%	15	8%	



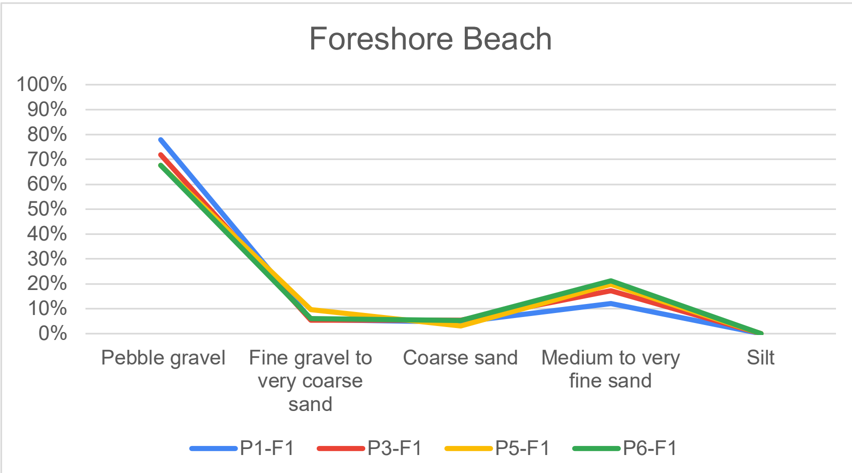
	Size Range (mm)		Wentworth Classification
XL		4.7498	Pebble Gravel
L	4.7497	1.8288	Granule Gravel to Very Coarse Sand
M	1.8287	0.762	Coarse Sand
S	0.7619	0.0737	Medium sand to very fine sand
XS	0.0736		Silt

Date	Sector	m	Wet Weigh	Dry Weight	XL(g)	Pebble gra	L (g)	Fine gravel	M(g)	Coarse sar	S(g)	Medium to	XS(g)	Silt	Notes
	P1-B1	0.65	322	322	248	77%	71	22%	2	1%	0	0%	0	0%	
	P1-B2	2.9	352	337	126	37%	113	34%	44	13%	54	16%	0	0%	
	P3-B1	2.26	367	367	89	24%	256	70%	19	5%	0	0%	0	0%	
	P3-B2	5.09	346	333	114	34%	103	31%	108	32%	7	2%	0	0%	
	P5-B1	1.71	316	316	203	64%	95	30%	14	4%	3	1%	0	0%	
	P5-B2	4.54	375	375	231	62%	57	15%	29	8%	56	15%	0	0%	
	P6-B1	1.71	355	343	192	56%	103	30%	26	8%	23	7%	0	0%	
	P6-B2	4.66	332	317	75	24%	71	22%	71	22%	100	32%	0	0%	

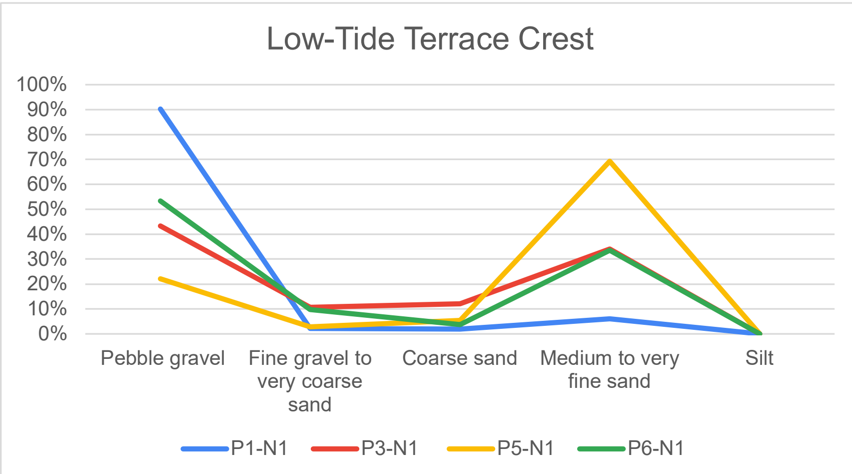




Date	Sector	m	Wet Weigh	Dry Weight	XL(g)	Pebble gra	L (g)	Fine gravel	M(g)	Coarse sar	S(g)	Medium to	XS(g)	Silt	Notes
	P1-F1	9.63	424	404	315	78%	23	6%	19	5%	49	12%	0	0%	
	P3-F1	8.64	462	442	318	72%	24	5%	24	5%	76	17%	0	0%	
	P5-F1	10.95	408	390	264	68%	38	10%	12	3%	77	20%	0	0%	
	P6-F1	10.88	482	457	309	68%	28	6%	24	5%	97	21%	0	0%	



Date	Sector	m	Wet Weigh	Dry Weight	XL(g)	Pebble gra	L (g)	Fine gravel	M(g)	Coarse sar	S(g)	Medium to	XS(g)	Silt	Notes
	P1-N1	15.7	569	556	502	90%	12	2%	11	2%	33	6%	0	0%	
	P3-N1	17.98	465	422	183	43%	45	11%	51	12%	144	34%	0	0%	
	P5-N1	15.18	353	284	63	22%	8	3%	15	5%	197	69%	0	0%	
	P6-N1	18.87	466	439	234	53%	43	10%	16	4%	147	33%	0	0%	



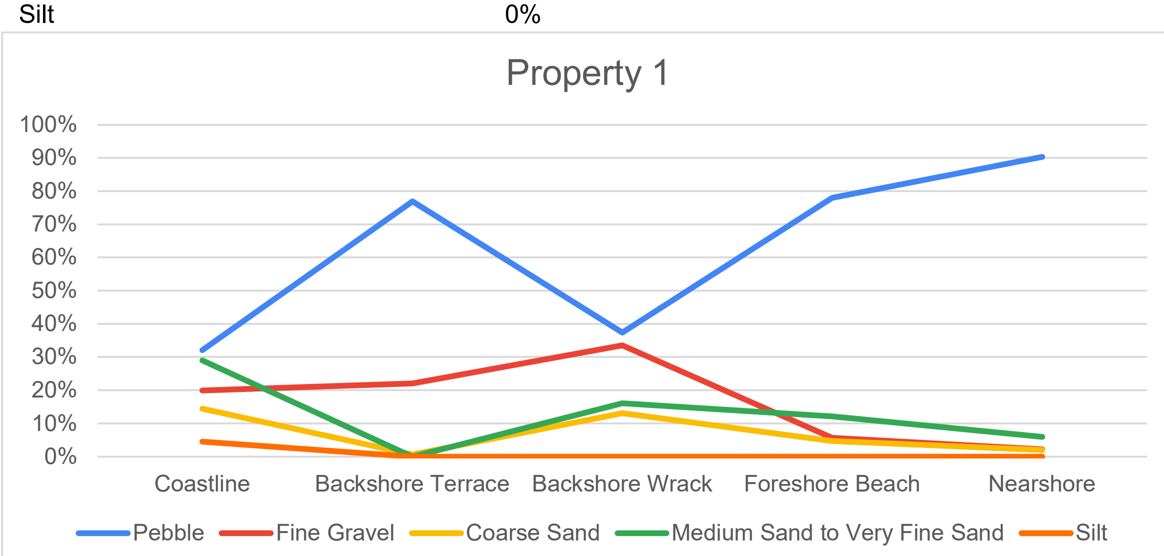
Deposit Area Weighting Scheme:	Weight	Areas impacted by deposit
	10	Backshore Terrace
	60	Backshore Face
	30	Foreshore Beach Face

Aggregate Mix #1 (Property 1 & 5)		
59%	4.8mm+	Drain
20%	1.8 to 4.7mm	pea
22%	fine to coarse sand	fine to coarse sand

Property 1

	Coastline	Backshore	Backshore	Foreshore	Nearshore
Pebble	32%	77%	37%	78%	90%
Fine Gravel	20%	22%	34%	6%	2%
Coarse Sand	14%	1%	13%	5%	2%
Medium Sand to Very Fine Sand	29%	0%	16%	12%	6%
Silt	5%	0%	0%	0%	0%

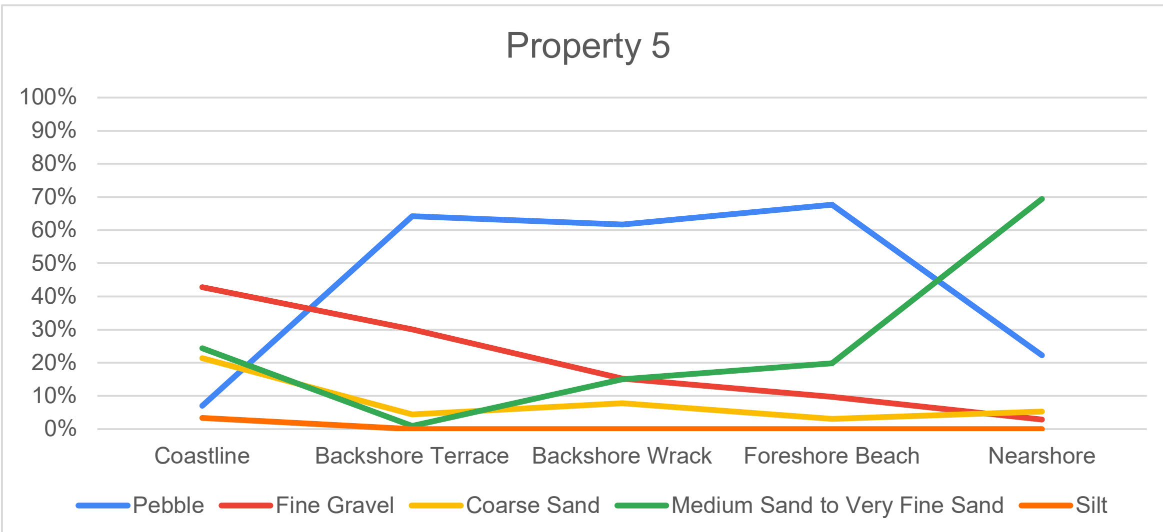
Recommended Composition	
Pebble	54%
Fine Gravel	24%
Coarse Sand	9%
Medium Sand to Very Fine Sand	13%
Silt	0%



Property 5

	Coastline	Backshore	Backshore	Foreshore	Nearshore
Pebble	7%	64%	62%	68%	22%
Fine Gravel	43%	30%	15%	10%	3%
Coarse Sand	21%	4%	8%	3%	5%
Medium Sand to Very Fine Sand	24%	1%	15%	20%	69%
Silt	3%	0%	0%	0%	0%

Recommended Composition	
Pebble	64%
Fine Gravel	15%
Coarse Sand	6%
Medium Sand to Very Fine Sand	15%
Silt	0%



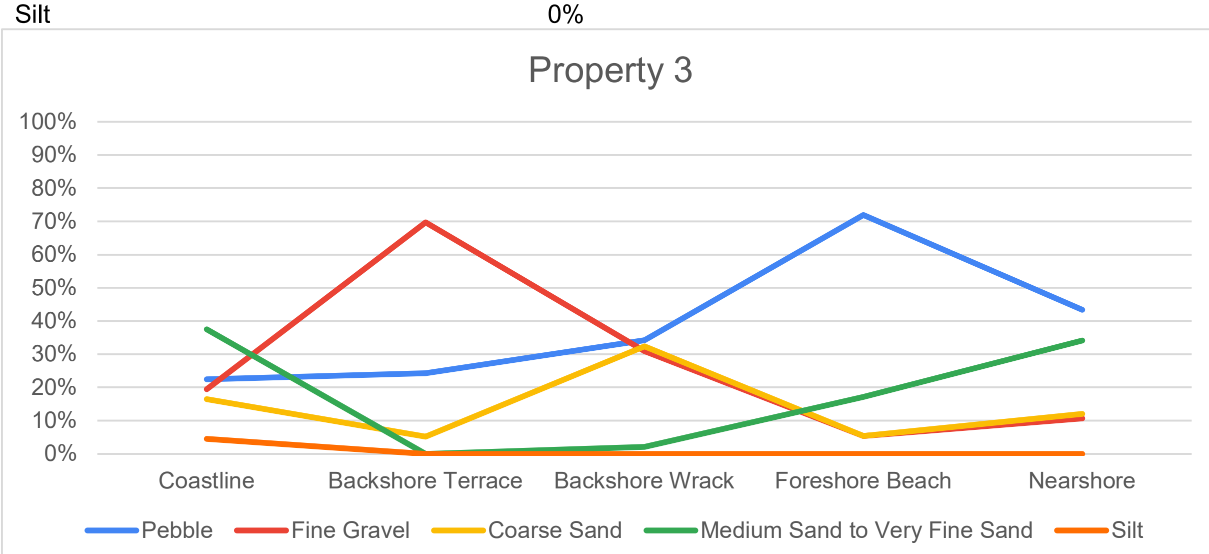
Sediment Size Range (mm)		Wentworth Classification
+	4.7498	Pebble Gravel
4.7497	1.8288	Granule Gravel to Very Coarse Sand
1.8287	0.762	Coarse Sand
0.7619	0.0737	Medium sand to very fine sand
0.0736	-	Silt

Aggregate Mix #2 (Property 3 & 6)		
42%	4.8mm+	Drain
23%	1.8 to 4.7mm	pea
35%	fine to coarse sand	fine to coarse sand

Property 3

	Coastline	Backshore	Backshore	Foreshore	Nearshore
Pebble	23%	24%	34%	72%	43%
Fine Gravel	20%	70%	31%	5%	11%
Coarse Sand	17%	5%	32%	5%	12%
Medium Sand to Very Fine Sand	38%	0%	2%	17%	34%
Silt	5%	0%	0%	0%	0%

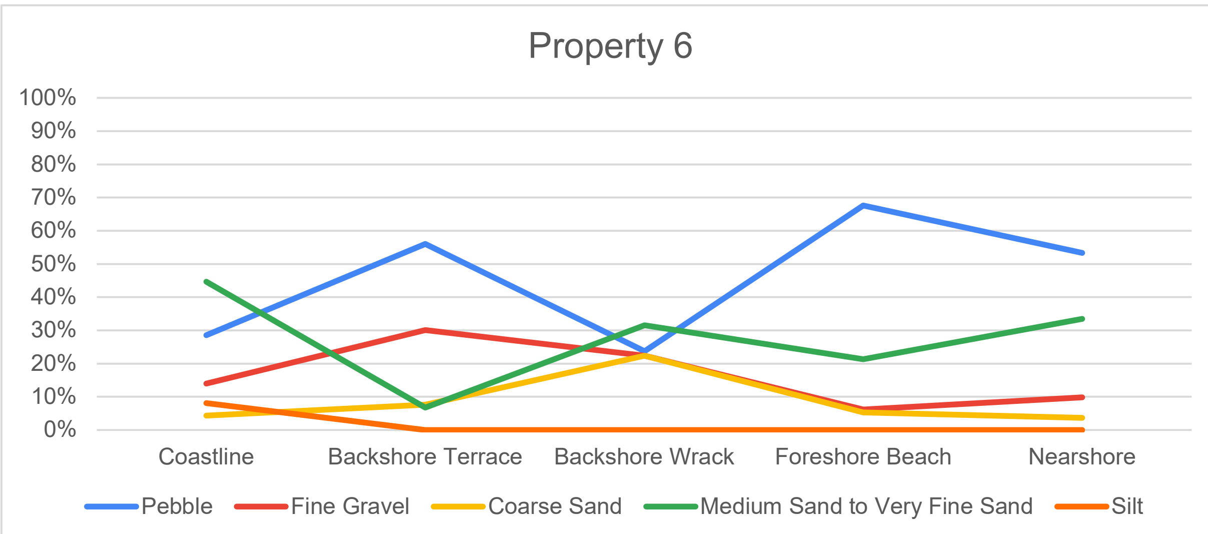
Recommended Composition	
Pebble	45%
Fine Gravel	27%
Coarse Sand	22%
Medium Sand to Very Fine Sand	6%
Silt	0%



Property 6

	Coastline	Backshore	Backshore	Foreshore	Nearshore
Pebble	28%	56%	24%	68%	53%
Fine Gravel	14%	30%	22%	6%	10%
Coarse Sand	4%	8%	22%	5%	4%
Medium Sand to Very Fine Sand	45%	7%	32%	21%	33%
Silt	8%	0%	0%	0%	0%

Recommended Composition	
Pebble	40%
Fine Gravel	18%
Coarse Sand	16%
Medium Sand to Very Fine Sand	26%
Silt	0%



Attachment 5

Summary of Baker Beach Shoreline Erosion Mitigation Recommendations

As pertaining to areas seaward of land parcels:

235 Quarry Drive PID 009-555-706

239 Quarry Drive PID 009-555-731

434 Baker Road PID 009-555-781

431 Baker Road PID 000-014-656

SALT SPRING ISLAND

Developed for: Aurora Professional Group
c/o Bradley Fossen P.Eng
338 Lower Ganges Rd UNIT 202
Salt Spring Island, BC V8K 2V3

Developed by: Thomas R Elliot PhD P.Geo P.Ag
TRE Environmental Services
tom@elliot.org

TRE Environmental Services

1. Introduction

This summary report and preceding investigations were conducted within the intentions of A Coastal Marine Strategy for British Columbia[1], and we specifically acknowledge that our work spans Halalt and Penelakut Tribe First Nation territories. We are grateful for the knowledge, teachings and holistic worldviews contained within. These holistic worldviews were, and are, foundational to how First Nation Peoples steward the lands, water, seabed, air and resources that sustain them.

This summary report presents climate resilient shoreline erosion mitigation opportunities for Bakers Beach, Salt Spring Island. The existing geohazards, ecologic, and marine characteristics of Bakers Beach and surrounding area have been assessed in previous reporting which is the result of field and desktop investigations. Those investigations have guided the identification of suitable and effective mitigation measures for the area in context of local shoreline processes.

The suitability of mitigation measures was guided by the Stewardship Centre for British Columbia Green Shores for Homes[2] program, including the assessment approach and our best practices for erosion management. Suitability is based on site characteristics evaluated during assessment of upland geohazards and surface hydrology[3]; shoreline and coastal sediment dynamics[4]; and Environmental Assessment[5].

The recommendations within this report are generalized, with Site specific design pending support of concept by participating property owners and local government.

2. Shoreline and Upland Characteristics

There were no significant geohazards identified within upland of the assessed areas, ensuring no overriding natural hazard would affect the recommended mitigation measures. There is both natural and ditched concentration of stormwater flow to pre-existing natural catchments. A consistent upland terrace across the assessed area has sparse areas where stormwater flow concentrates, creating localized soil wetness, fostering wet-soil vegetation

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[1] A Coastal Marine Strategy for British Columbia Policy Intentions Paper (December 2022). https://engage.gov.bc.ca/app/uploads/sites/121/2022/12/Coastal-Marine-Strategy-Intentions-Paper.pdf Accessed 11/2023

[2] Stewardship Centre of BC. Green Shores for Homes. 2023. https://stewardshipcentrebc.ca/PDF_docs/greenshores/Resources/GSHCreditsandRatingsGuide.pdf

[3] Geohazard Assessment of Lands. Pertaining to upland area from the shoreline of 235, 239 Quarry Drive and 431, 434 Baker Rd. TRE Environmental Services. File: 2023.900_A – D

[4] Assessment of Marine Shoreline Characteristics: Report for Coastal Erosion Mitigation. TRE Environmental Services. File: 2023.900_E

[5] Environmental Assessment: 235, 239 QUARRY DRIVE & 434, 431 BAKER ROAD SALT SPRING ISLAND. Corvidae Environmental Consulting Inc.

and affecting downslope coastal bluff erosion. Vegetation of the upland terrace and slopes above are typic of the red-listed Douglas-fir – arbutus ecological community, which is at risk of being lost in BC.

The coastal bluff trends from bedrock-dominant in the northwest, downward (dipping) to the southeast whereby the low gradient backshore and coastline is predominantly fine gravel and sand (respectively). Vegetation along the coastal bluff was characterized by Douglas-fir – arbutus woodland species, with lesser amounts of shore pine and Garry oak. Understory species included pink (hairy) honeysuckle, grasses, weeds, evergreen huckleberry, and numerous invasive species. The shoreline and uplands are habitat for river otter, belted kingfisher, and a variety of yellow listed bird species.

The majority of foreshore area is dominated by a low-tide terrace, which results in retention of the sediment that forms the beach face and backshore sediment terrace. The beach face is predominantly gravel and sands with frequent cobble to boulder coarse fragments. The southeastern foreshore, in front of 431 Baker Road is dominated by the beach face, which trends toward finer sediment with sparse stones and boulders. The backshore has limited grasses, with minor occurrence of landslip depositing sufficient mineral soil on the backshore terrace to foster salt tolerant woody species – although these deposits are at risk of removal under unmitigated storm wave-action.

There are areas of the foreshore mapped as surf smelt and Pacific sand lance spawning habitat. Off-shore, there are mapped eelgrass beds which support herring and forage fish. Additionally, there are known plainfin midshipman rearing grounds off-shore – which draws raptors and sea-birds to the annual food source. Intersecting these off-shore area is a mollusc lease parcel, which has seen intermittent operation in recent history.

Any recommended mitigation options will maintain critical awareness of these habitat to maintain a healthy and productive coast that sustains ecosystems with abundant fisheries and marine wildlife.

3. Summary of Management and Mitigation Options

One of the easiest and most effective management options is monitoring the rate of erosion. A suitable method for monitoring is static-location imagery, with conscious effort to reproduce both location and visibility-conditions to provide comparable results. Timing of monitoring should be once per year at minimum, with updated imagery after significant storm events so as to capture occurrence of punctuated erosion.

3.1. Bioengineering and Revegetation

Bioengineering and selective planting of the backshore, coastline and upland terrace are recommended in the areas indicated in Figure 1 of this document. Each shading colour in Figure 1 indicates differing goals and motivation for planting, as follows:

- Backshore planting: Primarily planting grasses and sedge due to a lack of accumulated mineral soil that would support larger woody species. Planting would intend to create ‘clumps’ on the backshore terrace to encourage sediment accumulation.
- Coastline planting: Planting is viable in the upper surficial materials which cap the bedrock coastal bluff. The coarse soil texture and south-facing exposure results in an anticipated attrition of planting-stock due to drought conditions, or consistent irrigation during drought season. Where appropriate along the coastal bluff implementing a succession tree-planting program would benefit the relatively even-aged population of existing trees. There is opportunity for pole planting of salt-tolerant woody species along the southeastern coastline fronting 431 Baker Road. Invasive management is recommended for the coastline of 431 Baker Road as part of the revegetation process.
- Upland terrace planting: Planting of wetted soils would increase evapotranspiration, reducing long-term groundwater erosion of the coastal bluff. In these areas, it would be suitable to plant hydrophilic species common to the Douglas-fir – arbutus woodland species understory. Extending additional deeper-rooted plantings from these wetted areas to the coastal bluff would increase soil cohesion of the area likely to fail.

3.2. Wave Deflection

Wave deflection is recommended, in areas shown in Figure 2, to disperse the persistent wake from vessel traffic, which contributes to sediment loss from the foreshore. An effective way to accomplish wave deflection is by sparse placement of boulders along the low-tide terrace so as to provide relatively uniform coverage from the predominant wave direction (west, for vessel wake). These boulders would be submerged at high tide, and as such would assist in disrupting plunging breaker wave action, prompting transition to surging breaker wave which better distributes (i.e. lessen the peak) erosion forces. The shoreline already has sparse coverage of large glacial erratics, weathered nodular boulders emerging from bedrock, and stones to boulders from upland till and bedrock exposures. Placement of boulders would look to mimic and enhance this natural process to accomplish erosion mitigation goals.

3.3. Beach Nourishment

Beach nourishment, as a concept, is an exaggeration of existing natural sediment supply processes which primarily uses coarse sediment due to mobility – and therefore loss – of fine sand and smaller particles. The installation of sediment for beach nourishment also attenuates with natural conditions through localized re-distribution within the backshore, foreshore beach face and low-tide terrace.

The intention of a beach nourishment program for the assessed area is to increase the width and elevation of backshore terrace, as shown in Figure 3, approaching the coastal bluff in most areas. This supplement to the sediment budget is intended to dissipate incoming wave energy by changing the plunging breaker wave type (higher erosion) occurring under storm event conditions to a surging breaker wave type (lower erosion).

The beach nourishment program will supplement long-term sediment deficiency resulting from hard armouring within the drift-cell and coastal bluff erosion mitigation activities. As the preceding assessments have accounted for our changing climate and sea level rise[6], the recommended beach nourishment meets a number of climate change resilience objectives as explored through the following sections of this document.

4. Applicable Potential Green Shores Credits Scoring

The following evaluates the recommended measures and associated activities under the Green Shores for Homes credit scheme, wherefrom categories which have no applicability have been excluded from the following table.

Green Shore for Homes Credit Categories	Possible Score	Potential Project Score
Shoreline physical processes		
1.2 Setback/Impact Avoidance (110m/600m does not qualify)	9	7
1.5 Nature-Based Erosion and Flood Management	13	13
Shoreline habitat		
2.1 Enhance Bird Habitat Stewardship	8	8
2.2 Riparian and Emergent Vegetation	13	13
2.3 Trees and Snags	5	4
2.4 Invasive Plants	4	2
2.5 Organic Material	6	5
2.6 Overwater Structures	6	4
Water Quality		
3.2 Reduce and Treat Runoff	9	7
3.5 Aesthetic Vegetation Chemical Control	3	3
3.6 On-Site Sewage Treatment	4	3
Shoreline stewardship		

[6] Natural Resources Canada. James *et al.* 2021. Relative sea-level projections for Canada based on the IPCC Fifth Assessment Report and the NAD83v70VG national crustal velocity model. https://geoscan.nrcan.gc.ca/text/geoscan/fulltext/of_8764.pdf

4.1 Shoreline Collaboration	8	8
4.2 Public Information and Education	3	3
4.3 Conservation Easement or Covenant	6	2
4.4 Shoreline Stewardship Participation	2	2
Total	**99**	**84**

Of note is that Potential Project Score is optimal, and performance should be based on the Project aspiring to secure all 84 credits while recognizing that the Green Shores for Homes Gold rating is a minimum 40 points, of which a minimum 20 points (collectively) are acquired from Shoreline Process and Shoreline Habitat credit categories.

5. BC Marine Strategy Intentions

In this section, the recommended mitigation measures are generally evaluated under the 30 intentions of the BC Marine Strategy – as presented in the table below with the following ranking method:

Intention Met **No Reasonable Affect** **Detracts from Intention**

BC Marine Strategy Intention	Bioengineering and Revegetation	Wave Deflection	Beach Nourishment
Healthy and Productive Coast			
A-1 Wild salmon			
A-2 Monitor health			
A-3 Prevent pollution			
A-4 Protect habitat			
A-5 Recover S.A.R.			
Resilience to Climate Change			
B-1 Safe communities			
B-2 Support seafood			
B-3 Nature-based solutions			
B-4 Mitigate acidification			
B-5 Protect carbon sinks			
Trusting, Respectful Relationships			
C-1 Respect FN rights			
C-2 Engage British Columbians			
C-3 Collaborative stewardship			
C-4 Coastal legislation			
Holistic Learning and Knowledge Sharing			
D-1 Weave Traditional and Western			
D-2 Value the Ocean			

D-3 Enhance spatial data			
D-4 Improve data access			
Community Well-Being			
E-1 Create steady employment			
E-2 Diverse workforce			
E-3 Support FN cultural revitalization			
E-4 Improve community resilience			
E-5 Develop marine use plans			
E-6 Improve access to nature			
A Sustainable, Thriving Ocean Economy			
F-1 Invest and Diversify			
F-2 Co-develop FN opportunities			
F-3 Support marine fisheries			
F-4 Advance sustainable aquaculture			
F-5 Support regenerative marine tourism			
F-6 Manage cumulative effects			

Broadly, the recommended erosion mitigation is meeting the intentions of the BC Marine Strategy, with areas of Community Well-Being and Sustainable, Thriving Ocean Economy remaining challenging intentions to meet through the limited size of this project.

6. Conclusion and Next Steps

Due to the low-tide terrace and low gradient foreshore beach-face within the assessed area, there is an opportunity to manage the consequence of sea level rise through a hybrid soft-shores erosion mitigation program that includes upland water management and riparian vegetation enhancement.

The scoped mitigation program includes three distinct options: Bioengineering and revegetation; Wave deflection; and Beach nourishment which can be implemented in the areas indicated in Figures 1 - 3.

The evaluation of the recommended measures was conducted under the Green Shores for Homes credit scheme, wherefrom a score of 84/99 possible credits was determined to be reasonably accomplished. Additionally, the alignment with BC's Marine Strategy Intentions was determined to be meeting most intentions or having no affect. There was no adverse impact to BC Marine Strategy Intentions consequent to the recommended mitigation measures identified through this evaluation.

The next steps in this process are to work under the Shoreline Stewardship credit categories as well as Intentions C – D (as shown above) to secure local government, stewardship, community and First Nation support. With support, permit applications will be required prior to implementation. Additional technical detail beyond what has been provided in this report, including detailed survey and cross-sections of proposed alterations, will be necessary for permit applications.

7. Closure

The undersigned certifies that the above recommendations are based on best practices, guidance and professional experience to the capacity of the qualified professional of record – under similar constraints. There is reasonable expectation of professional product to be of sufficient quality and accuracy to be acceptable by receiving landowners, agency and governments. However, revision is an acceptable practice – one that I encourage and embrace. Should any requests for changes be made, please contact the undersigned.

Qualified Professional of Record	THOMAS R. ELLIOT PhD P.Geo, P.Ag Name	Tom Elliot Signature

Thomas R Elliot PhD P.Geo. P.Ag.

PROFESSIONAL
PROVINCE OF
Dr. T. ELLIOT
43570
BRITISH COLUMBIA
GEOSCIENTIST
TRE

Digital copy of physical stamps, original available upon request.

Date: January 5 2024

Limitations

The QP signatory to this assessment and report assures accuracy of existing and field observation, and evaluation of technical geohazard according to best practices of the Engineers and Geoscientists of BC. The content of this report are applicable to the subject land parcels, and specifically the Site as defined in this report. Any extension of the evaluation to areas outside of the defined area assessed are not valid.

The report has been conducted according to guidelines and reporting standards of similarly qualified professionals, given similar time and budget. At time of writing, the report meets due diligence and investigatory reporting requirements to provide QP recommendations with declared competency in the subject areas. Therefore, the author of this report does not maintain liability insurance for actions taken based on the reporting, and only accepts error and omission liability up to the value of this report. The receipt, utilization and any planning, further studies or development actions undertaken by the recipient of this report are based on their acceptance of their own liability therein.

Figure 1. Areas recommend to undergo riparian and coastline revegetation

Figure 2. Areas recommended for wave deflection installations

Figure 3. Areas recommended to receive beach nourishment

Attachment 6

  

ENVIRONMENTAL ASSESSMENT

235, 239 QUARRY DRIVE & 434, 431 BAKER ROAD
SALT SPRING ISLAND

PREPARED FOR:
BRADLEY FOSSEN
AURORA PROFESSIONAL GROUP INC.
SALT SPRING ISLAND, BC

AND

ISLANDS TRUST - SALT SPRING ISLAND
500 LOWER GANGES RD #1
SALT SPRING ISLAND, BC, V8K 2N8

AND

DEPARTMENT OF FISHERIES AND OCEANS CANADA
65 FRONT STREET
NANAIMO, BC V9R 5H9

CORVIDAE
ENVIRONMENTAL CONSULTING INC

6526 WATER STREET, SOOKE, BC

SOLUTION ORIENTED. PROTECTION OF THE ENVIRONMENT. ABSOLUTE INTEGRITY. OPEN COMMUNICATION. RESPECT.

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CAVEAT

This Environmental Assessment (EA) has been prepared with the best information available at the time of writing, including the Salt Spring Island Official Community Plan, communications with the client, a site visit, review of site plans and design drawings and other documentation relevant to the project. This EA has been developed to assist the project in remaining in compliance with relevant environmental regulations, acts and laws pertaining to the project and to identify sensitive environmental features that may require mitigation and consideration during future phases of the project.

Report Prepared By:

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1 INTRODUCTION

Corvidae Environmental Consulting Inc. (Corvidae) is pleased to provide this Environmental Assessment (EA) for the properties located at 235, 239 Quarry Drive and 434, 431 Baker Road, Salt Spring Island (the Site)(Figure 1)(Table 1). The Site includes four shoreline lots that are zoned as Rural (R). The Site occurs within the Shoreline Development Permit Area (DPA) 3 as outlined in the Salt Spring Island Official Community Plan (OCP) and shown on Map 20. DPA 3 includes upland areas within 10 metres of the natural boundary and the marine environment 300 m seaward of the natural boundary (measured horizontally).

Table 1. Site details

Civic Address	PID	Legal description	Current Zoning
235 Quarry Drive	009-555-706	LOT 1, PLAN VIP46155, SECTION 6, RANGE 1W, COWICHAN LAND DISTRICT, PORTION NORTH SALT SPRING, & SEC 7	R
239 Quarry Drive	009-555-731	LOT 3, PLAN VIP46155, SECTION 6&7, RANGE 1W, COWICHAN LAND DISTRICT, PORTION NORTH SALT SPRING	R
434 Baker Road	009-555-781	LOT 5, PLAN VIP46155, SECTION 6, RANGE 1W, COWICHAN LAND DISTRICT, PORTION NORTH SALT SPRING	R
431 Baker Road	000-014-656	LOT AM2, PLAN VIP7144, SECTION 6, RANGE 1W, COWICHAN LAND DISTRICT, PORTION NORTH SALT SPRING, EXCEPT PLAN 40042, EXC PT IN PL 40042	R

This EA is provided in support of proposed coastal erosion mitigation development activities (the project) at the Site within the shoreline DPA. The project is proposed in response to identified bluff failure that is occurring due to the following mechanisms: 1) upland conveyance of rainwater contributing to pore water pressure in the soils/surficial material wedge sitting atop bedrock coastal bluffs, and 2) wave action creating toe erosion (bedrock) or undercutting (sediments). These issues and mechanisms have been outlined in detail within Geohazard Assessment Reports that were completed for each property listed in Table 1 by a Qualified Professional (QP) (submitted separately).

Design mechanisms are currently being developed; it is planned that a beach nourishment technique will be applied to the Site. This is determined by following the marine shoreline design guidelines decision tree (Johannessen et al. 2014). This technique involves the strategic placement of material (e.g., sand, gravel) to reduce erosion of upper beach and backshore areas. Placement of gravel and limited fines creates porosity and air space to decrease wave energy along the shoreline. Materials sourced for the proposed beach nourishment would be brought in via barge and applied to specific areas at the Site, as directed by a QP.

This EA document, in combination with the Geohazard Assessment Reports, will be utilized to inform future coastal erosion mitigation development activities, as determined by a QP, to target the identified bluff failure at the Site. This EA will be updated to include potential environmental effects of the proposed project and recommended environmental protection measures once formalized project design details have been received. All future proposed coastal erosion mitigation development activities must be completed in accordance with the Salt Spring Island Official Community Plan (OCP) Bylaw No. 434 as well as relevant provincial and federal legislation.

Site Location

Property Boundary

N

0 25 50 100 150 200 Meters

Project: 235 Quarry Road, 239 Quarry Road, 431 Baker Road &434 Baker Road
Sources: Capital Regional District

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Figure 1

1.1 REGULATORY FRAMEWORK

This environmental assessment is designed to comply with the provisions set out in the Salt Spring Island Official Community Plan (OCP) Volume 2 Part E for development permit areas (DPAs) and for compliance with the provisions for environmental protection contained in the following relevant legislation:

Municipal

Salt Spring Island OCP, Bylaw No. 434 (Salt Spring Island Local Trust Committee 2008)

DPA 3 - Shoreline

> "*Development Permit Area 3 is shown on Map 20. It is all that area of land covered by water between the natural boundary of the sea and a line drawn parallel to and 300 m seaward of the natural boundary of the sea. It also encloses the land within 10 m of the natural boundary of the sea (measured horizontally) in areas where the marine environment has been identified as being particularly sensitive to development impacts.*
>
> *Development Permit Area 3 is designated according to Section 879 (1)(a) of the Municipal Act to identify objectives and guidelines for the form and character of the commercial and general employment development allowed on the water surface. It is also designated according to Section 879 (1)(a) and (b) to protect the natural environment and to protect development from hazardous conditions*."

Objectives for DPA 3 include the following:

- "To protect the quality of the tidal waters that surround Salt Spring Island.
- To protect fish and wildlife habitat.
- To prevent erosion and hazardous conditions that could result from interrupting the natural geohydraulic processes along the shoreline.
- To protect development from hazardous conditions. BL488 (07/20)
- To protect the natural beauty of the island's shoreline areas where commercial and general employment developments are allowed.
- To ensure such development is unobtrusive and contributes to the natural, public character of the Crown foreshore."

The development permit areas are show in Figure 2. The guiding principle for the use of Development Permits is found within the *Local Government Act*. Development Permit Areas can be designated for purposes such as, but not limited to: protects, enhances and restores the biodiversity and ecological values and functions of environmentally sensitive areas; fosters compatibility between development, existing land uses and environmentally sensitive areas; maintains connectivity between sensitive ecosystems; and protects water quality and quantity.

Provincial

- Wildlife Act (1996)
- Invasive Species Council of BC
- *Weed Control Act* (1996, current as of October 2016)

Federal

- Migratory Birds Convention Act (1994)
- Species at Risk Act (SARA) (2002)
- Fisheries Act (2019)
- Canadian Environmental Protection Act (CEPA) (1999)
- Canadian Navigable Waters Act (1985)

Guidelines

Washington State Aquatic Habitat Guidelines Program: Marine Shoreline Design Guidelines (2014) https://wdfw.wa.gov/sites/default/files/publications/01583/wdfw01583.pdf

Development Permit Area 3 - Shoreline

- Shoreline - Forshore
- Shoreline - On-land portion
- Property Boundary

N

0 25 50 100 150 200 Meters

Project: 235 Quarry Road, 239 Quarry Road, 431 Baker Road &434 Baker Road
Sources: Capital Regional District

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Figure 2

2 SCOPE OF WORK

Corvidae completed an environmental assessment for the aforementioned properties listed in Table 1. The environmental assessment documented the ecological features on the Site with a focus on the shoreline and foreshore areas. Background information was reviewed, including applicable databases. During the assessment, the following features were documented in this report:

- Areas of sensitivity, including the marine shoreline environment.
- Areas of habitat and biodiversity values.
- Plant communities and plant species on site.
- Potential wildlife presence and wildlife habitat.
- Soil types and terrain.
- Surface water flow patterns.

3 METHODS

3.1 DESKTOP REVIEW

Baseline biophysical conditions were compiled by reviewing the best available data and information including existing reports for the area and conducting searches of online provincial and federal databases:

- BC Conservation Data Centre (BC CDC 2023a and 2023b).
- BC HabitatWizard (Province of BC 2023).
- Aerial photographs of the property (Google Earth 2023).
- CRD mapping system and database (CRD 2021).
- MapIT application (Islands Trust 2023)
- Salt Spring Island Official Community Plan Bylaw No. 434 (Salt Spring Island Local Trust Committee 2008).

3.2 FIELD ASSESSMENT

A field assessment of the property was completed by a Qualified Environmental Professional (QEP) from Corvidae. The assessment included characterization of vegetation and habitat types, wildlife sign and species observations, wildlife habitat, and assessed the current conditions of the Site.

4 ENVIRONMENTAL SITE ASSESSMENT

Corvidae completed a site visit on May 30th, 2023. Site photos are included as Appendix A.

4.1 CLIMATE AND BIOGEOCLIMATIC ZONE

The project is located within the Coastal Douglas-fir (CDF) biogeoclimatic zone, specifically in the Moist Maritime Coastal Douglas-fir Subzone (CDFmm) (BC CDC 2021b). The CDFmm occurs at low elevations (<150 m) along southeast Vancouver Island, the southern Gulf Islands, and part of the Sunshine Coast.The CDFmm has the mildest climate in Canada. This subzone has a long growing season with warm, dry summers and mild, wet winters.

4.2 TERRAIN AND SOILS

Soils in the CDF biogeoclimatic zone, generally derived from morainal, colluvial, and marine deposits, are typically Brunisols, grading with increased precipitation to Humo-Ferric Podzols (Nuszdorfer et al. 1991). Soils on the Site are generally comprised of loam, well-draining, Orthic Dystric Brunisol soils. (GALIANO soil association) (BC SIFT 2018). The Site slopes moderately to steeply from northeast to southwest in the direction of the shoreline.

4.3 VEGETATION

South-facing, dry banks along the shoreline and immediate backshore area were forested and characterized by a Douglas-fir – arbutus woodland with lesser amounts of shore pine and Garry oak. The structural stage was observed to be young forest with larger (mid-seral) trees occurring intermittently. Species observed are consistent with the red-listed Douglas-fir – arbutus ecological community, which is an ecological community that is at risk of being lost (extirpated, endangered or threatened) in BC. Understory species in the immediate backshore included predominantly low growth of salal and dull Oregon-grape. Banks along the shoreline were characterized by pink (hairy) honeysuckle, grasses, weeds, evergreen huckleberry, and invasive species. The moss layer was very poorly developed near the shoreline.

All vegetation species detected during the site assessment are listed in Table 2. Six invasive species were observed, including English ivy, scotch broom, Himalayan blackberry, bull thistle, oxeye daisy, and spurge-laurel. All are listed as Control Species according to the Capital Regional District, whereby established infestations of these species are common and widespread throughout the Capital Region. Control should be focused in high value conservation areas[1].

[1] Capital Regional District. 2019. Status List for Priority Invasive Plants in the Capital Region. Available at: https://www.crd.bc.ca/docs/default-source/default-document-library/2019-03--regional-priority-invasive-species-list.pdf?sfvrsn=836aceca_0.

Table 2. Plant species observed on site during the field visit on May 30, 2023.

Common Name	Scientific Name	BC Provincial Status[1]	*SARA* Schedule 1 Status[2]
Arbutus	*Arbutus menziesii*	Yellow	--
Baldhip rose	*Rosa gymnocarpa*	Yellow	--
Balsam poplar	*Populus balsamifera*	Unknown	--
Bigleaf maple	*Acer macrophyllum*	Yellow	--
Blue wildrye	*Elymus glaucus*	Yellow	--
Bracken fern	Pteridium aquilinum	Yellow	--
Broadleaf stonecrop	*Sedum spathulifolium*	Yellow	--
Bull thistle	*Cirsium vulgare*	**Invasive**; Exotic	--
Common lamb's-quarters	*Chenopodium album*	Exotic	--
Common snowberry	*Symphoricarpos albus*	Yellow	--
Common sow-thistle	*Sonchus oleraceus*	Exotic	--
Douglas-fir	*Pseudotsuga menziesii*	Yellow	--
Dull Oregon-grape	*Mahonia nervosa*	Yellow	--
Evergreen huckleberry	*Vaccinium ovatum*	Yellow	--
English ivy	*Ilex aquifolium*	**Invasive**; Exotic	--
Field elm	*Ulmus minor*	Exotic	--
Garry oak	*Quercus garryana var. garryana*	Yellow	--
Himalayan blackberry	*Rubus armeniacus*	**Invasive**; Exotic	--
Oceanspray	*Holodiscus discolor var. discolor*	Yellow	--
Oxeye daisy	*Leucanthemum vulgare*	**Invasive**; Exotic	--
Pacific crab apple	*Malus fusca*	Yellow	--
Perennial sow-thistle	*Sonchus arvensis*	Exotic	--
Pink honeysuckle	*Lonicera hispidula*	Yellow	--
Red alder	*Alnus rubra*	Yellow	--
Salal	*Gaultheria shallon*	Yellow	--
Scotch broom	*Cytisus scoparius*	**Invasive**; Exotic	--
Scouler's willow	*Salix scouleriana*	Yellow	--
Slough sedge	*Carex obnupta*	Yellow	--
Spurge laurel	*Daphne laureola*	**Invasive**; Exotic	--
Trailing blackberry	*Rubus ursinus*	Yellow	--
Tufted hairgrass	*Deschampsia cespitosa*	Yellow	--
Western redcedar	*Thuja plicata*	Yellow	--
Willow dock	*Rumex transitorius*	Yellow	--

[1] BC CDC 2023a

[2] Government of Canada 2023a

4.4 WILDLIFE

The trees on the Site and within surrounding areas provide nesting and roosting habitat for birds, including migratory songbirds, year-round resident species, raptors, and owls. Understory shrubs, although lacking in density overall, may provide nesting habitat for birds and small mammals. One bald eagle nest is mapped by the Wildlife Stewardship Atlas (WiTS) approximately 400-500 m northwest of the Site (Nest ID BAEA-101-433), however, there are no trees shown at this mapped location based on available aerial imagery. No nests were observed during the site assessment.

South-facing slopes may provide suitable habitat for reptiles and forested areas are likely frequented by both large and small mammals. The marine environment is also anticipated to support many species (e.g., river otter, plainfin midshipman, shorebirds, waterfowl, marine mammals, etc.) given the presence of eel grass beds and surf smelt and Pacific sandlance spawning habitat that are mapped in proximity to the proposed project area (MapIT 2023). Belted kingfisher nesting burrows were observed in several locations along the proposed project area (Photo 4). The species listed in Table 3 were observed on or near the Site during the assessment.

Table 3. Wildlife Species observed on site during the field visit on May 30, 2023.

Common Name	Scientific Name	BC Provincial Status[1]	*SARA* Schedule 1 Status[2]
American robin	*Turdus migratorius*	Yellow	--
Bald eagle	*Haliaeetus leucocephalu*	Yellow	--
Brown creeper	*Certhia americana*	Yellow	--
Chestnut-backed chickadee	*Poecile rufescens*	Yellow	--
Dark-eyed junco	*Junco hyemalis*	Yellow	--
Orange-crowned warbler	*Vermivora celata*	Yellow	--
Red breasted nuthatch	*Sitta canadensis*	Yellow	--
Spotted towhee	*Pipilo maculatus*	Yellow	--

[1] BC CDC 2023a

[2] Government of Canada 2023a

4.5 MARINE ENVIRONMENT

The shoreline type within the proposed project area is classified as low rock/boulder (Islands Trust n.d.). As per Map 11 of the Salt Spring Island OCP, a portion of the shoreline near 431 and 434 Baker Road is classified as an 'Environmentally Sensitive Shoreline Area' (Figure 3). Suitable forage fish spawning habitat is mapped in this area for surf smelt and Pacific sand lance. These species are an important food source for marine predators. Other notable marine environmental features include the presence of mapped eelgrass beds (flat, continuous) and patches just offshore in proximity to the Site that provide habitat for herring and forage fish (Map 13b, Galiano Conservancy 2014).

Sensitive Shoreline Area

- Sensitive Shoreline Area
- Property Boundary

Forage Fish Spawning Habitat

- Surf Smelt
- Surf Smelt/Pacific Sandlance

Eelgrass Meadow (2022)

- Dense
- Moderate
- Undetermined

N

0 100 200 400 600 Meters

Project: 235 Quarry Road, 239 Quarry Road, 431 Baker Road &434 Baker Road
Sources: Capital Regional District

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Figure 3

4.6 SPECIES AT RISK

A query of the BC CDC iMap tool yielded occurrences of 5 species and 5 ecological communities at risk within a two-kilometer radius of the property, including one (1) masked occurrence (BC CDC 2023b). Species are listed in Table 3 and the location of occurrences in relation to the property is provided in Figure 4.

One ecosystem at risk overlaps the Site boundary: the Garry oak / California brome (*Quercus garryana / Bromus carinatus*) ecological community (red-listed). This occurrence is based on Terrestrial Ecosystem Mapping (TEM) and has not been confirmed on the ground (Province of BC 2023). This ecological community was not detected during the site assessment. Species observed near the shoreline within the Site most closely characterize the Douglas-fir / arbutus ecological community (coniferous woodland habitat) which is also red-listed but is not mapped in this area by the CDC. This community has been impacted through disturbance associated with residential development along the shoreline.

No other species or ecosystems listed in Table 4 were detected on the Site during the assessment. Suitable habitat was not identified on the Site for the species listed in Table 4.

Table 4. Species at risk that may occur in the vicinity of the Site.

Common Name	Scientific Name	BC Provincial Status[1]	*SARA* Schedule 1 Status[2]
Species			
Threaded vertigo	*Vertigo rowellii*	Blue	Special Concern
Painted Turtle - Pacific Coast Population	*Chrysemys picta* pop. 1	Red	Threatened
Macrae's clover	*Trifolium dichotomum*	Red	n/a
Leafless wintergreen	*Pyrola aphylla*	Blue	n/a
Western screech-owl, *kennicottii* subspecies	*Megascops kennicottii kennicottii*	Blue	Threatened
Ecological Community			
Garry oak / oceanspray	*Quercus garryana / Holodiscus discolor*	Red	n/a
Garry oak / California brome	*Quercus garryana / Bromus carinatus*	Red	n/a
Grand fir / dull Oregon-grape	*Abies grandis / Mahonia nervosa*	Red	n/a
Douglas-fir / dull Oregon-grape	*Pseudotsuga menziesii / Mahonia nervosa*	Red	n/a
Trembling aspen / Pacific crab apple / slough sedge	*Populus tremuloides / Malus fusca / Carex obnupta*	Red	n/a

[1] BC CDC 2023a

[2] Government of Canada 2023a

A query of the Fisheries and Oceans Canada Species at Risk Distribution Map (Government of Canada 2023b) yielded the following marine species at risk that have the potential to occur in proximity to the project:

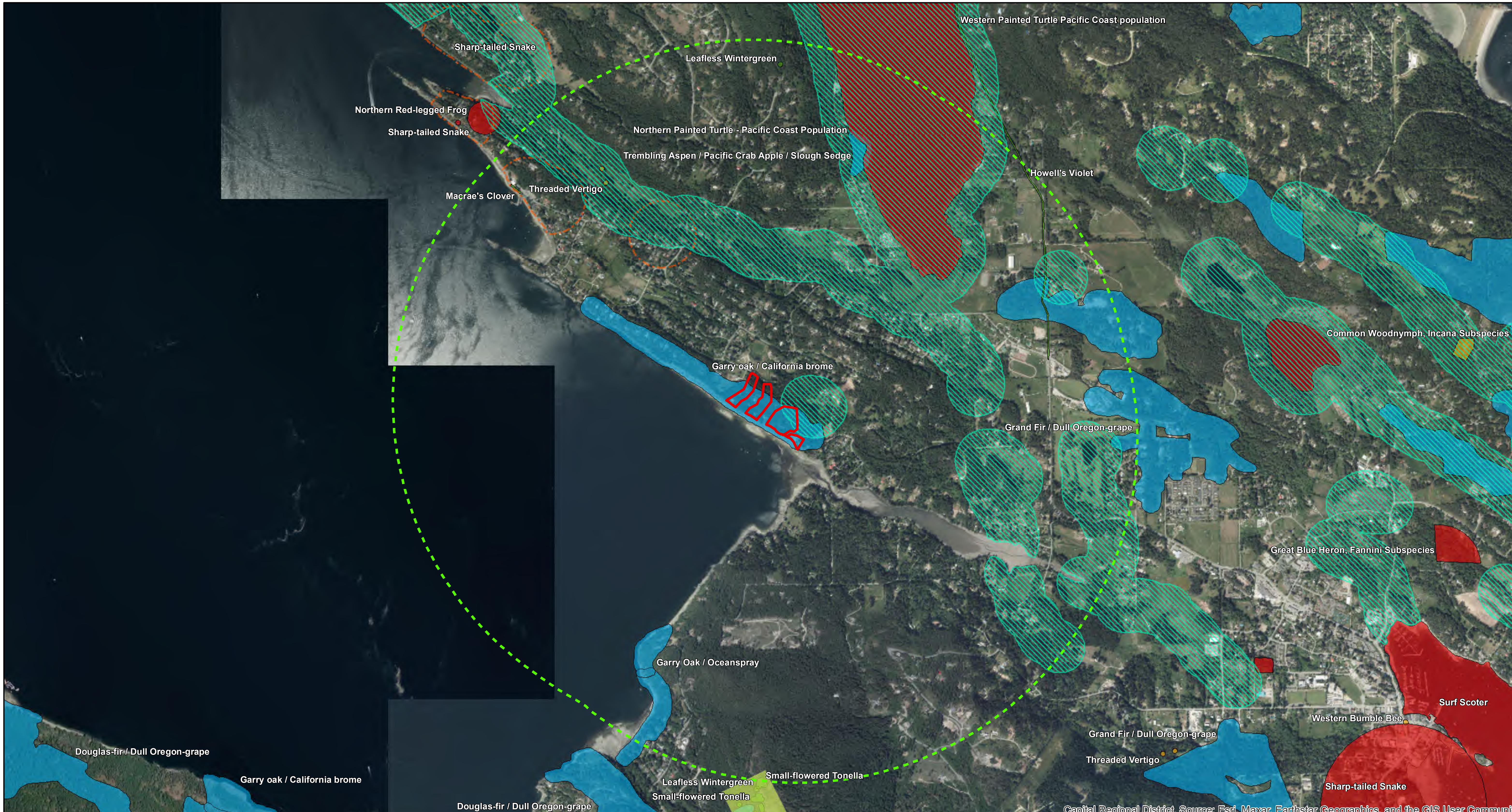
Table 5. Aquatic species at risk that may occur in the vicinity of the Site.

Common Name	Scientific Name	*SARA* Schedule 1 Status[1]
Steller Sea Lion	*Eumetopias jubatus*	Special Concern
Killer Whale (Northeast Pacific southern resident population)	*Orcinus orca*	Endangered
Killer Whale (Northeast Pacific transient population)	*Orcinus orca*	Threatened
Humpback Whale	*Megaptera novaeangliae*	Special Concern
Harbour Porpoise	*Phocoena phocoena*	Special Concern
Grey Whale (Eastern North Pacific population)	*Eschrichtius robustus*	Special Concern
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered
Northern Abalone	*Haliotis kamtschatkana*	Endangered
Yelloweye Rockfish	*Sebastes ruberrimus*	Threatened
Tope	*Galeorhinus galeus*	Special Concern

[1] Government of Canada 2023a

CRITICAL HABITAT

A mapped western painted turtle critical habitat polygon overlaps the northeastern corner of 434 Quarry Road (Province of BC 2023b; Figure 4). Critical habitat mapping is based on known occurrences and potential occurrences of suitable aquatic habitat features. Critical habitat may include lakes, ponds, marshes, river channels, roadside or drainage ditches, sluggish streams, and sloughs, and up to 150m of terrestrial habitat surrounding the aquatic feature, as most Western painted turtles in B.C. are typically found within 150m from water (Environment and Climate Change Canada 2018). The critical habitat polygon is associated with an unnamed lake that is located upslope of the project area. The project area includes only the immediate shoreline area which is not considered suitable habitat for western painted turtle.



SAR and critical habitat within 2 km of the site

Critical Habitat

- Property Boundary
- 2 km area around property boundary
- Sharp-tailed Snake
- Small-flowered Tonella
- Western Painted Turtle Pacific Coast population

Species at Risk

- Ecological Community
- Invertebrate Animal
- Vascular Plant
- Vertebrate Animal

N

0 500 1,000 2,000 Meters

Project: 235 Quarry Road, 239 Quarry Road, 431 Baker Road &434 Baker Road
Sources: DataBC, Capital Regional District

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Figure 4

5 POTENTIAL ENVIRONMENTAL IMPACTS AND RECOMMENDED ENVIRONMENTAL PROTECTION MEASURES

A list of environmental considerations is provided below based on current project design. This list may be updated in future should the design plans change.

- Impacts on sensitive terrestrial ecosystem areas, such as upland woodland habitat.
- Impacts on sensitive marine features, such as mapped suitable forage fish spawning habitat.
- Impacts on existing shoreline sediment delivery systems.
- Impacts on benthic organisms.
- Impacts that could compromise archaeological, First Nations cultural, historical, heritage sites or significant or outstanding landscape features.
- Spread of invasive plant species.
- Changes in wildlife habitat availability and wildlife mortality risk.
- Sediment movement in the project area.

Preliminary mitigation measures for the proposed beach nourishment works includes the following:

- Construction will be completed during periods of low tide (work in the dry).
- Ensure that works are overseen by an Environmental Monitor (EM)
- Enhancement of backshore vegetation through planting of native species, particularly overhanging species such as Oceanspray. This is included in the detailed design plan with specific plant species, locations, spacing, methods of planting and maintenance.
- Apply suitable substrate for forage fish spawning in the upper reaches of the beach profile where feasible.
- Match borrowed substrate with native sediments within the project area (mimic natural conditions).
- Maintain the current natural beach slope to the extent possible.
- Execute beach nourishment activities when birds or other mobile organisms are the least active.
- Avoid mapped suitable spawning forage fish habitat and ensure that the timing of project works does not interfere with forage fish spawning.
- Install belted kingfisher nest boxes.
- Remove invasive species along the backshore and re-plant with native species.

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APPENDIX A – SITE PHOTOGRAPHS

Photo 1. Close-up of foreshore ground, looking southeast. May 30, 2023.

Photo 2. West view of the foreshore environment. May 30, 2023

Photo 3. Invasive species infestation near 431 Quarry Road, looking north. May 30, 2023.

Photo 4. Northeast view of belted kingfisher nesting burrows. May 30, 2023.

Photo 5. North view of upland forested habitat. May 30, 2023.

Photo 6. View of cliff/shoreline bank, looking west. May 30, 2023.

Photo 7. Southwest view of backshore environment at 235 Quarry Road. May 30, 2023.

Photo 8. North view of riprap placement at CRD beach access near 431 Baker Road. May 30, 2023.