File: 2022.68

Via: email

Date:	March 07, 2025
Attention:	Celine Coschizza, Authorizations Specialist, Ministry of Water, Land and Resource Stewardship
Re:	Crown Land Tenure Application (Tracking Number 100439391) Land / Foreshore Use Application: Shoreline Erosion Mitigation Information Request IR-004

This document package is submitted on behalf of the Applicants detailed in Table 1 ("the Owner Group") who seek approval for a shoreline erosion mitigation project ("the Project") concerning their properties as indicated ("the Subject Parcels.")

Table 1: Owner Group and Subject Parcels

Address	PID	Legal Description	Owners
235 Quarry Dr, Salt Spring Island	009-555-706	LOT 1 SECTIONS 6 AND 7 RANGE 1 WEST NORTH SALT SPRING ISLAND COWICHAN DISTRICT PLAN 46155	HEIDI KUHRT AND DAVID DEMNER
239 Quarry Dr, Salt Spring Island	009-555-731	LOT 3, SECTIONS 6 AND 7, RANGE 1 WEST, NORTH SALT SPRING ISLAND, COWICHAN DISTRICT, PLAN 4615	PAT AND BRUCE SANDERS
434 Baker Rd, Salt Spring Island	009-555-781	LOT 5, SECTION 6, RANGE 1 WEST, NORTH SALT SPRING ISLAND, COWICHAN DISTRICT, PLAN 46155	ETHAN WILDING

We note that 431 Baker Rd (PID 000-014-656) is no longer moving forward with its foreshore application.

A Crown Land Tenure Application (the "Application") was submitted on behalf of the Owner Group on March 12, 2024, by their Agent, Aurora Professional Group Inc. In preparation for the Application, the Owner Group engaged qualified professionals to oversee application scopes, as detailed in Table 2, herein referred to as the "Consultant Team."

Table 2: Project Team and Related Scope

Consultant	Lead Contact	Scope
Aurora Professional Group Inc. ("ENG")	Bradley Fossen P.Eng.,QEP t. 778.400.3375 e. brad@thinkapg.com	Coordinating QP
CORVIDAE Environmental Consulting Inc. ("RPBIO")	Julie Bugden BSc, RPBio, QEP m. 250.415.8553 e. julieb@corvid.pro	Habitat Assessments QEP, Vegetation Enhancements Design

Consultant	Lead Contact	Scope
Millennia Research Ltd. ("ARCH")	Thea Sawin MA t. 250.360.0919 e. thea@millennia-research.com	Archeological Permitting and Monitoring
Polaris Land Surveying Inc. ("SURVEY")	Jordan Litke P.Surv, BCLS m. 250.686.0278 e. jlitke@plsi.ca	Property Survey, Topography
TRE Environmental Services ("GEO")	Thomas R Elliot PhD P.Geo P.Ag, QEP m. 250.732.9004 e. tom@elliot.org	Geo-assessments, Coastal Processes QP, and Design Bases

INFORMATION REQUEST RESPONSES

Ministry of Water, Land and Resource Stewardship, via the FrontCounter BC Crown Land Tenure Application, has requested information to support the Application. The Consultant Team has prepared this submission in response to the request.

Information Request No. 4: WLRS Letter dated 20-Dec-2024, file 1415573, Questions 1.1 through 3.3

Response IR-004.01.01 (GEO/RPBIO): The attached document includes our response to Questions 1.1 through 3.3 and details changes to the project following the withdrawal of 431 Baker Rd.

DISCLAIMERS

This document, prepared by Aurora Professional Group Inc., represents a technical submission for the Project. The information contained herein is based on the best available data, expertise of engaged professionals, and adherence to applicable standards and regulatory requirements at the time of preparation.

It is important to note that engineering, environmental science, and regulatory landscapes are subject to change. Therefore, while every effort has been made to ensure the accuracy and relevance of the information provided, Aurora Professional Group Inc. does not warrant the completeness or accuracy of the information, nor does it assume any liability for errors or omissions. Decisions based on information contained in this document are the sole responsibility of the user.

Furthermore, this document does not constitute an exhaustive treatment of the subject matter and should be used in conjunction with professional judgement and after consultation with appropriate regulatory authorities. The recommendations and findings presented are specific to the conditions encountered at the project site at the time of assessment and are intended for use by qualified professionals familiar with the nuances of shoreline erosion mitigation.

Any use of this document by third parties, or for purposes other than those for which it is specifically intended, is prohibited without the express written permission of Aurora Professional Group Inc. Modifications to the project design or deviations from the recommendations contained herein should only be made by qualified professionals with full knowledge of the specific conditions and requirements of the project site.

ATTACHMENTS

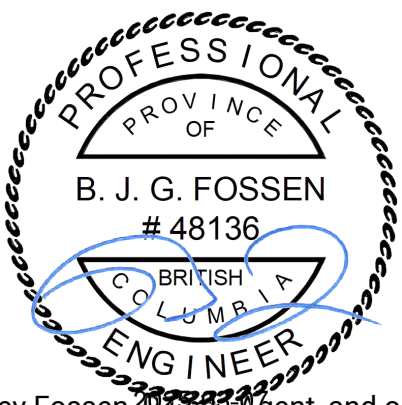
1. **TRE & CORVIDAE: QEP RESPONSE TO WLRS 2024-12-20 QUESTIONS**

SIGN OFF

By this submission, the Applicants have attempted to provide all relevant information to the approving authority to support the expedited permit process.

Please feel free to contact the undersigned or Consultant Team directly if you have any questions or concerns.

Per:



Bradley Fossen, P.Eng., Agent, and on behalf of the Consultant Team

Managing Director | Aurora Professional Group Inc.

E: brad@thinkapg.com | T: 778-400-3375

CC: CORVIDAE, TRE, OWNERS, FILE

Nature Based Erosion Mitigation for Baker Beach and Upland Areas

The current stewards of uplands rising above Baker Beach, Salt Spring Island, have observed an unrelenting landward retreat of the fragile coastal bluff which connects land to seashore.

Assessment of this accelerating rate of erosion has identified the integrated nature-based management of groundwater, vegetation and beach sediment as a suitable mitigation approach to the compounding human-induced challenges of climate change and rising sea level.

The proposed activities include:

- Management of groundwater and stormwater to ensure drainage of soils and surficial material occurs without increasing the likelihood of landslip, surficial or plucking erosion.
- Re-vegetation of the coastal bluff using indigenous vegetation.
- Select and progressive removal of invasive vegetation that will be replaced with indigenous vegetation.
- Placement of wave-disrupting rock clusters on outcropping bedrock of the tidal terrace.
- Placement of suitably up-scaled gravel and cobble in the backshore beach, above the wrack line, that will replenish the beach-sediment supply that has been constrained by human activities in up-drift areas of the coastal Drift-Cell (north and west of the project area).

The predicted erosion mitigation outcomes from these integrated activities will prevent loss of land-based ecologic habitat (e.g. coastal bluff nesting birds and reptiles), and ensure retreat of the coastal bluff crest will not impact existing dwellings throughout the projected 75 year lifecycle.

By timing implementation of the above activities, there are no predicted impacts to the gravel-beach habitat used by spawning fish, watercraft-landing areas on gravel beaches, and near-shore clam harvest areas or eelgrass beds.

2025-02-15 UPDATE

The landowner of 431 Baker Road has withdrawn their land-parcel from the proposal submitted for consideration by WLRS.

This change in scope has resulted in the following considerations to the proposed Baker Beach nature-based erosion mitigation program:

- The withdrawn land parcel is the only area with contiguous foreshore gravel beach along a sloping tidal terrace.
- For proponents continuing the application, the foreshore tidal terrace is comprised of mixed bedrock with shallow gravel deposits.
- The withdrawn land parcel was intended to receive beach nourishment placed at the shoreline to support the undercut sediment and root mass being eroded by wave action.
- Beach nourishment placement is proposed within the backshore to beach face area of remaining proponents, anchoring existing woody debris through partial to complete burial.
- Consequent to the modified scope, there would be a ~95.0 m^3 reduction in volume of beach nourishment for a proposed total 673.4 m^3 across three areas.
- There is no change in proposed placement of rock clusters.
- The invasive management and re-vegetation proposed for the withdrawn land parcel will not proceed under the existing application.
- The withdrawn land parcel is most proximal to clam harvest areas, resulting in a lower likelihood of deleterious impact consequent to the proposed beach nourishment.
- The recommended scope of archaeology investigations is undergoing review.

Summary of Proposal

The Baker Beach Erosion Mitigation application is a nature-based approach to mitigating erosion of a rocky shoreline which rises above a tidal terrace situated on the southerly-facing flank of Salt Spring Island, BC. The application looks to support land-owner interests in maintaining the long-term ecology, public aesthetic value, and integrity of the coastal bluff and shoreline through a combination of re-vegetation using native species; upland water management; and augmenting the disrupted sediment supply of Baker Beach.

The following are responses to WLRS requests for clarification and/or additional information pertaining to File 1415573. Thomas R Elliot PhD P.Geo P.Ag has provided partial or complete response to all questions except for Q2.3. Contributions from other QEP are noted in line within the following response framework.

Q1.1. Are the immediate upland properties at risk from erosion in the short term?

- The QEP feel that the imperative for 'demonstrated need to protect existing permanent structures' in the short term as a pre-condition for consideration of the application to be an unsuitable reactive-approach to management of natural environments known to be facing increased long-term erosive forces consequent to our changing climate.
    - The QEP recommend that a 'demonstrated value to protecting ecosystem services, existing permanent structures, and public enjoyment of the accessible areas' be considered as a pre-condition for the application.
- The QEP have identified factors outside of the proposed project area which degrade the shore habitat through disruption of sediment supply within the Drift-Cell (i.e. the along-shore and foreshore area within which sediment is mobilized, conveyed and deposited by natural marine currents and wave action).
    - The identified factors include upland development, historic hard armouring of the shoreline and construction of 'groyne'-like structures using natural-materials starting within 130 m northwest of the project area.
    - Conversely, the proposed nature-based approach to erosion mitigation within the project area are intended to forestall any 'demonstrated need to protect existing permanent structures' while restoring the disrupted sediment supply within the Drift-Cell through beach nourishment using suitably sized clastic fragments.

Q1.2. What is the rate of erosion at the project site?

- The rate of erosion at the project site is variable depending on highly localized composition (e.g. fissile shale & mudstone vs massive shale & sandstone) and form resulting from metamorphic geologic-processes (e.g. folding of shale-stone laminae, and induction of fractures/joints/faults).
- Small to medium scale erosion events resulting from combined undermining and tree-topple result in rapid recession of the coastal-bluff crest within localized areas, many of which are proximal to existing permanent structures.
    - The likelihood and consequence of these occurrences can be estimated on a case-by-case basis (e.g. determine Risk consequent to each tree subject to

potential topple within 5, 10 and 20-year timeframes). Although this would potentially result in hundreds of multi-disciplinary (arborist & geoscientist) assessments within the project area.

- A generalized rate of coastal erosion for the project area is difficult to quantify through estimates from available data.
- The rate of erosion for marine-exposed cliffs has been reviewed within published scientific literature, with an order of magnitude rate of erosion for shale being 10^{-2} m/year, as reported by Sunamura, T. (2005) in Cliffs, Lithology Versus Erosion Rates. In: Schwartz, M.L. (eds) Encyclopedia *of* Coastal Science. Encyclopedia of Earth Science Series. Springer, Dordrecht. https://doi.org/10.1007/1-4020-3880-1_72.
    - Heuristic data from terrain stability assessments for similar shale geologic formations on the flank of Mount Tzouhalem (near the opposing shoreline to Site, on Vancouver Island) have demonstrated 10^{-2} m/year weathering rate in areas not exposed to a marine environment.
    - This heuristic data suggests that the similar geologic materials found on Site will see a higher rate of progression when subject to wave action and increased salt-water exposure.
    - **Therefore, a minimum generalized rate of erosion for the Site is predicted to be 10^{-2} m/year.**
- Factors in the erosion of coastal cliffs under temperate climate are found below (adapted from Prieto, F.J.G. 2022, The Complexity of Studying Coasts: From Forms and Processes to Management):

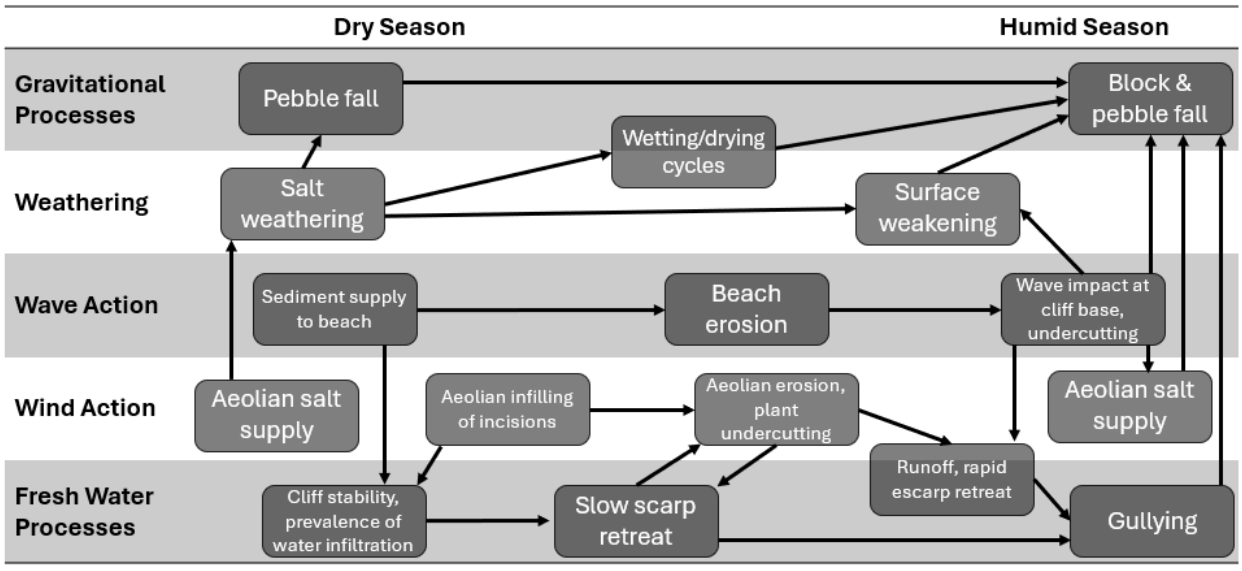


Figure 1. Factors in the erosion of coastal cliffs under temperate climate.

Q1.3 Please clarify the mitigation measures recommended in the Coastal Reports and Crown Lands Application as per the rationale below.

- Monitoring in advance of there being 'demonstrated need to protect existing permanent structures' would better document the progressive and event-based erosion occurring within the proposed project area.
    - The landowners have provided a consistent narrative with photographic and anecdotal evidence which constitutes non-QEP/officiated monitoring.
    - The proposed project area does experience progressive erosion which concurrently enhances the likelihood of small to medium scale punctuated erosion events.
    - Monitoring in advance of implementing the proposed erosion mitigation activities would develop a more accurate generalized rate of erosion.
    - Monitoring will not affect retreat of the coastal bluff crest.
- Post mitigation activity monitoring would inform both the efficacy of current activities, and identify future requisite efforts that would conserve the natural landscape
    - Specific to placement of beach nourishment, monitoring would be able to evaluate the residence time and progressive dispersion of placed sediment. This data would inform the potential future of Baker Beach erosion management activities while determining the drift-cell transport potential under current meteorologic conditions.

Q1.4 To what degree does wave action contribute to the rate of erosion? To what degree does wave action contribute to geohazard risk for the coastal bluffs and SFDs?

<u>Wave Action</u>

- Wave action is one of the main factors driving coastal bluff and foreshore erosion within the proposed project area (See Figure 1 above).
- The wave action can be divided by origin, energetics and receiving environment to better understand contribution to erosion.
- Coastal bluff are often more or less susceptible to erosive energy with angles of applied force which align to planes of weakness within the geologic material. In this case, wave action is arriving from one generalized direction, and therefore the consequence of each type of wave action is comparable and can be summarized as follows:
    - The most consistent wave action is wind driven, resulting in the largest net contribution of erosive energy.
    - The most energetic wave action result from storm events, but the low frequency of storm events results in a moderate contribution to total wave action energy.

    - Vessel wake wave action is largely aligned with incidental wind driven wave action, which lowers the potential for 'unique' erosive energy to impact the receiving environment from non-natural sources.
- Further complexity is realized when local bedrock types are susceptible to weathering from cyclic-processes. For example, the fissile shale present within the proposed project area coastal bluff is susceptible to salt weathering, jointing and thermal expansion weathering – mechanisms resulting in erosion of shale at surface.
    - Wave action accelerates the weathering process through repeated wetting and removal of susceptible components, exposing novel bedrock surfaces which experience a more rapid rate of weathering.

Wave Type

- Wave type dictates the delivery of wave action erosive energy to the receiving environment.
    - Surging breaker waves are the most common and least intensive form.
    - Plunging breaker waves occur when the tidal terrace is submerged and/or during storm events, resulting in a higher likelihood that wave action impacts the backshore and shoreline.

Storm Events

- Storm Events result in landward erosion which depends on many factors, including distance from the storm center, storm-surge heights, wave characteristics, direction of storm movement, angle of wave approach, forward speed and duration of the storm, and tidal stage during storm landfall.
- The amplitude of storm event wave action can result in 'unique' erosive energy and/or rapid erosion of susceptible components (e.g. heavily jointed surface of shale bedrock) of the receiving environment.
- Most erosion from beach environments occurs consequent to evacuation of sediment during wave-outwash, pulling sediment deeper into the ocean.
- Storm events intensify outwash while increasing the landward rate of erosion due to enhanced wave action energetics.
- For bedrock coastal bluffs and gravel beaches, such as those within the project area, landward migration in shoreline position over time largely occurs during storm events[1].
    - The mechanism for landward migration of shoreline within the project area includes cumulative impact of typic coastal weathering/erosion as well as storm event wave-action, tree-topple and localized landslide consequent to concurrent wind and precipitation.

[1] Morton, R.A. 1988. An Overview of Coastal Land Loss: With Emphasis on the Southeastern United States. https://pubs.usgs.gov/of/2003/of03-337/landloss.pdf

Summary

- In geophysical context of the proposed project area, wind and vessel wake driven wave action result in weakening/weathering of the tidal terrace and shoreline/coastal bluff. Localized landslide and landward migration of the shoreline during storm events is enhanced by preceding cumulative impact of wave action and factors which contribute to weathering/erosion.
- Geohazard risk to existing structures and coastal shoreline environment, including sea bird nesting habitats, increases with progressive weathering/erosion. Storm event wave action further increases this geohazard risk due to the punctuated landward migration of the shoreline.

Q2.1 Please comment on the appropriateness of the proposed placement, volume, and grain size of beach nourishment sediments – specifically regarding eel grass, forage fish habitat and clam beds on the intertidal area.

- The proposed project area has had the drift cell sediment supply from alongshore and upland sources reduced by human activity outside of the proposed project area.
- The intention to re-establish sediment supply to drift cell through proposed beach nourishment will mimic a landslide event (i.e. beach nourishment is intended to be of a volume that would be mobilized by a series of medium coastal bluff and/or upland landslide).
    - The grain size of beach nourishment sediments is based on sediment sampled from the existing beach.
    - Due to proximal eel grass, forage fish and clam beds, the proposed beach nourishment has the fine fraction of grain size distribution (i.e. clay, silt and fine sand) excluded – resulting in no introduction or transport of fine sediment to the tidal terrace backshore environment.
    - To increase likelihood that beach nourishment remains within the backshore on the tidal terrace, the grain size distribution was adjusted to be 20% larger that what is currently found on the beach.

Q2.2 How will beach nourishment impact the known clam harvesting areas that overlap with the project area? What mitigation measures are proposed?

- The clam harvesting areas are largely at the eastern extent of the original project area where near-shore (intertidal) sand substrate accumulated through outwash from Booth Inlet.
- The updated project area, where 431 Baker Road land parcel is no longer participatory, has limited, if any, overlap with clam harvesting areas.

    - The bedrock tidal terrace of the updated project area does foster oyster colonies, but the lack of sizeable sand-deposits does limit the presence of clams.
- Due to the truncated grain size distribution and placement plan, it is not anticipated that beach nourishment will transport to the clam harvesting area.
    - However, storm event can increase outwash energy. In circumstances where storm-event wave action evacuates sediment placed in the backshore, the volume of beach nourishment is small when compared to the beach and clam harvest areas. The outcome of a high-outwash storm event is anticipated to result in negligible coverage (i.e. impact) of the clam harvest area.

Q2.3 The Provincial Aquatic Plants team requires copies of any photos, surveys, or biological reports that have been conducted, or will be conducted related to the presence/absence of eelgrass, or the impact of the project on eelgrass within the project area or near to the project area. Please forward these surveys, photos, or biological reports to AquaticPlants.Program@gov.bc.ca.

- As noted below (Q2.4), there are no direct effects anticipated to eelgrass beds. Biological surveys of eelgrass were not conducted as part of the application process. The sites for deposition were chosen in the backshore, away from sensitive marine habitat including eelgrass meadows. These meadows are mapped.

Q2.4 Eelgrass beds grow in fine sediments. Regarding the eelgrass beds offshore from the project area, where do they obtain their current sediment supply? How would a reduction in natural sediment impact these eelgrass beds?

- The eelgrass beds are formed by fine sediment outwash from Booth Inlet.
- There is no anticipated reduction in natural sediment supply to the eelgrass beds consequent to the proposed works.

Q3.1 The Rationale for Design Sea Level Report states it applied a design sea level of 75 years to match the lifespan of the existing structures. Does this mean that the proposed project design is expected to be effective in preventing structural damage on the properties for ~75 years? If not, can you estimate lifespan in that regard?

- The proposed project design is intended to mitigate erosive wave action under predicted conditions of the year 2100.
- The long-term presence of beach nourishment within the project area backshore will reduce the coastal bluff general rate of erosion.

- Reducing the general rate of erosion will forestall/prevent damage to structures on the properties within suitable timeframe.
- The placement of beach nourishment is predicted to diffuse wave action energy up to the DSL.
    - However, storm events are anticipated to intensify and become more frequent as sea level rises – meaning that the proposed design may be subject to unanticipated wave/storm action evacuation that could reduce the volume of beach nourishment in the backshore.
    - Monitoring will determine if significant volumes of beach nourishment sediment have been removed from the tidal terrace. In such circumstance, a re-evaluation of remaining volume should be undertaken to determine if design goals are still being met.
- Design Sea Level (DSL) for the year 2100 also aligns with most available predictions of climate change induced sea level rise for the Salish Sea.

Q3.2 The proposed placement of wave deflection boulders has the potential to change the navigability of the waters just off Baker Beach by both members of the public, and members of Penelakut Seafoods. What mitigation measures would you propose to reduce the impacts and notify boaters of the changes?

- After consult with Penelakut members who confirmed that standard shoreline access is achieved via gravel or sand beaches, there are no anticipated impacts to navigation or landing access due to the placement of rock clusters on tidal terrace bedrock.

Q3.3 What would be the main components of a monitoring plan for the beach nourishment and wave energy dissipation boulders?

- The main components of monitoring are:
    - Beach nourishment volume tracking by way of sediment depth and grain size measurements at defined locations along and up the beach-face.
    - Assessment of coastal bluff/shoreline status in areas sheltered by beach nourishment placement.
    - Vegetation survey and plantings survival assessments.