ENVIRONMENTAL IMPACT ASSESSMENT

LAZO ROAD PROTECTION PROJECT

- COMOX, BC -

June 24th, 2015

Report prepared for:

Wedler Engineering Ltd
#211-2459 Cousins Ave.
Courtenay BC, V9N 3N6

Report prepared by:

Current Environmental Ltd.
244 4th Street, Unit H
Courtenay, BC, V9N 1G6

current ENVIRONMENTAL

TABLE OF CONTENTS

1 INTRODUCTION

Wedler Engineering Ltd. (WEL) has retained Current Environmental Ltd. (CEL) to provide support on environmentally-specific aspects of a proposed shoreline defense project at Lazo Road between the Queen's Ditch watercourse and the intersection of Lazo Road and Sand Pines Drive (Figure 1, 2). This assessment is required pursuant to the Fisheries and Oceans Canada *Fisheries Act* 2012 and several Town of Comox Environmentally Sensitive Area Development Permits.

1.1 OBJECTIVES

The objectives of this assessment are as follows:

1. Inform a "Request for Review" submission to Fisheries and Oceans Canada (FOC).
2. Meet requirements for a QEP assessment of the project as per the Town of Comox (ToC) Environmentally Sensitive Area Development Permits.
3. Identify and map Valued Ecosystem Components (VEC) and potential environmental constraints associated with the project.
4. Based on the inventory results, provide additional recommendations on how to preserve or enhance ecological function on the site, and mitigate potential environmental harm during future project work.

1.2 STUDY AREA

The subject shoreline faces the Strait of Georgia and extends over a distance of 700 m. The beach is owned by the Town of Comox and is exposed to waves approaching from the southeast, with a long fetch extending into the Strait. A dominant feature of this section of shoreline is the immediate proximity of Lazo Road, which parallels the shoreline at a distance of between 4 to 10 m from the edge of the backshore. Currently, with the exception of several sections of shoreline that have been top-dressed with cobbles, this section of shoreline is the last remaining unprotected piece of shoreline between Cape Lazo and Goose Spit – a distance of 5 km (Figure 1). Land use in the vicinity of the project is predominantly larger lot residential homes, with some recreational values associated with the shoreline (boat launch, walking, picnic sites).

The area resides in the Coastal Western Hemlock – Very Dry Maritime (CWHxm1) biogeoclimatic zone. This zone is found at lower elevations along the east side of Vancouver Island, and is characterized by warm, dry summers and moist, mild winters with relatively little snowfall. The project site is approximately centered at the UTM coordinates 10U 364968 E 5505876 N.

In general, the site has been substantially modified by the intimate presence of the road, foot traffic, vehicle traffic to the intertidal, powerline development, placement of fill, and native vegetation removal/colonization by invasive species. There are no significant trees on the site, however there is a bald eagle nest located approximately 175 m from the site. Additional biophysical details are provided later in this document.

Figure 1. Overview map showing approximate location of project and extent of existing riprap.

1.3 PERMITTING

The project will require the following environmentally-related permits:

1.3.1 Fisheries and Oceans Canada (FOC) Project Review

The *Fisheries Act* was amended on June 29, 2012. As of November 25, 2013 the new fisheries protection provisions of the Act came into force. The Fisheries Protection Policy describes the changes to the *Fisheries Act* made in 2012. The focus is now on the productivity of commercial, recreational and Aboriginal fisheries; the institution of enhanced compliance and protection tools that facilitate enforcement; provide clarity, certainty and consistency of regulatory requirements; and enable enhanced partnerships with other agencies of government and local groups to ensure a comprehensive approach to fisheries protection.

As this project will involve the placement of permanent fill below the high water mark, the project must undergo a DFO review for approval.

1.3.2 Town Of Comox Environmentally Sensitive Area Development Permits

The proposed project has been considered under the Town of Comox Environmentally Sensitive Area Development Permit (ESADP) directives ofthe Official Community Plan[1]. The following ESADP's had the highest relevance to the proposed work and are outlined here:

Marine Foreshore (DPA #14).

The project site lies within the Marine Foreshore ESADP designation of the OCP. The purpose of DPA #14 is to protect the natural environment, its ecosystems and the biological diversity in relation to the marine foreshore. As the proposed work involves the "*Construction, repair or maintenance of works by the Town its authorized agents or contractors*", a development permit from the Town of Comox is not required for the proposed work.

Bald Eagle and Great Blue Heron Nesting Sites (ESADPA #10)

The project site lies within 175 m of a confirmed eagle nest tree. Though the site is not indicated as an "affected area" on the ESADPA #10 Map, nesting eagles will be considered within this study.

Garry Oak Habitat (ESADPA #12).

There are no Garry oaks located on the site, nor is the site indicated as an "affected area" on the ESADPA #12 Map. As such, this ESADP will not be considered in this study.

Riparian Areas (ESADPA#7)

Queen's Ditch lies immediately adjacent to the project works. However the project lies within the tidally influenced portion of this watercourse. As such, the BC Riparian Areas Regulation and ESADPA#7 does not apply to this project.

2 METHODS

The methods used to determine the occurrence and distribution of VECs for this study are provided here. Several field assessments were conducted for this study; the primary dates of assessment were November 14th and December 1st, 2014 and May 3rd, 2015.

2.1 BACKGROUND/EXISTING INFORMATION

Information on VECs including sensitive ecosystems and species within and adjacent to the subject property were obtained from the following sources:

1. Conservation Data Center (CDC);
2. Wildlife Tree Stewardship Atlas (WiTS);
3. Sensitive Ecosystem Inventory (SEI);

[1] Bylaw 1685

4. Sensitive Habitat Inventory and Mapping (SHIM);
5. Forage Fish Atlas and Data Management System;
6. CVRD iMap online mapping application;
7. Species at Risk Act (SARA) database;
8. Species at Risk & Local Government database;
9. Department of Fisheries cumulative herring spawn records;
10. Satellite Imagery.

2.2 MARINE SHORELINE

The marine shoreline assessments were timed to coincide with relatively low (~0.4-0.6 m CGD) tides. There was no forage fish/egg presence sampling completed as part of this assessment. Methodologies to complete the marine shoreline assessment were based primarily on those outlined in *Develop with Care – Environmental Guidelines for Urban and Rural Land Development in British Columbia*[2] and on methodologies modified from the *BC Green Shores Development Rating System*[3].

2.3 TERRESTRIAL HABITATS AND SPECIES

Survey methods for terrestrial VEC's included those outlined in *Environmental Objectives, Best Management Practices and Requirements for Land Developments*[4], *Environmental Best Management Practices for Urban and Rural Land Development in British Columbia*[5], and the *Field Manual for Describing Terrestrial Ecosystems*[6].

2.4 BALD EAGLE NEST TREE

Reconnaissance level field sampling was completed in accordance with methods adapted from *Guidelines for Raptor Conservation during Urban and Rural Land Development in BC*[7], *Resource Inventory Committee (RIC) Inventory Methods for Raptors*[8] and *Bald Eagle Monitoring Guidelines*[9]. Specific survey methods include:

1. Researching the nest tree location and historical survey information using the WiTS Atlas**Error! Bookmark not defined.**;
2. Ascertaining proximity buffers of WiTS-validated nesting sites to the site using Geographic Information System (GIS) tools;
3. Confirming the location of the known bald eagle tree (BAEA-106-323) using ground level reconnaissance, and geo-referencing the nesting site using a Garmin 60cx handheld GPS unit;

---

[2] BC Ministry of Environment. (2012). <http://www.env.gov.bc.ca/wld/documents/bmp/devwithcare2012/>.

[3] Green Shores Development Rating Credits v1. Green Shores Technical Working Group, 2008.

[4] BC Ministry of Environment Lands and Parks, 2001

[5] BC Ministry of Environment, Draft 2004. <http://www.env.gov.bc.ca/wld/documents/bmp/urban_ebmp/urban_ebmp.html>.

[6] BC Ministry of Environment and BC Ministry of Forests and Range. (2010). <http://www.for.gov.bc.ca/hfd/pubs/docs/Lmh/Lmh25-2.htm>.

[7] Ministry of Forests, Lands, and Natural Resource Operations. (2013). Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia. Accessed from <http://www.env.gov.bc.ca/wld/documents/bmp/raptor_conservation_guidelines_2013.pdf>.

[8] Resource Inventory Committee. (2001). Inventory Methods for Raptors - Version 2.0. Standards for Components of British Columbia's Biodiversity No. 11. Ministry of Sustainable Resource Management. Environmental Inventory Branch of the Terrestrial Ecosystems Taskforce. Retrieved from <www.ilmb.gov.bc.ca/risc/pubs/tebiodiv/raptors/version2/rapt_ml_v2.pdf>.

[9] United States Fish and Wildlife Service. (2007). Bald Eagle Monitoring Guidelines. North Florida Ecological Services Office. Retrieved from <http://www.fws.gov/northflorida/BaldEagles/2007-BE-Monitoring-Guidelines-without-figures.htm>.

4. Establishing current nest usage patterns (i.e. perching, nest building, feeding, egg incubation, etc.) by ground-level reconnaissance.

2.5 SPECIES AT RISK

An office-based assessment of Species at Risk occurrences on the subject property was completed using the *CDC Mapped Known Locations of Species and Ecological Communities at Risk*[10], *BC Species and Ecosystems Explorer*[11], and the *Federal Species at Risk Public Registry*[12].

The on-site assessment of Species at Risk was completed concurrent with the other inventory efforts mentioned above and was based primarily on methods outlined in *Environmental Best Management Practices for Urban and Rural Land Development*[13].

2.6 DESIGN

The shoreline protection design was informed by a wave climate analysis[14] that used long-term local wind and wave data to estimate appropriate design water levels for defensive treatments. A geotechnical assessment was also conducted for the site[15]. These supporting documents provide a strong technical foundation for the project designs. As much as possible, ”soft” engineering techniques were integrated into the final project designs. The wave analysis considered a sea level rise of 30 cm over the next 30 years. The use of alternative methods of treatment was limited by the close proximity of the Lazo Road prism and somewhat aggressive wave climate resulting from the high exposure of the site.

3 RESULTS

This study focuses primarily on biophysical attributes and processes on the shoreward side of Lazo Road. This is due to the fact that the road itself effectively disconnects shoreline processes from upland or terrestrial influences.

3.1 MARINE SHORELINE

This Lazo shoreline consists of two main morphological features:

1. Foreshore, which extends from Lower Low Water (LLW) to Higher High Water (HHW) and consists of a gravel and cobble beach having a typical width of 50 m. The upper portion of the beach has a slope of 1V:20H and is frequently covered by logs and large woody debris (LWD). Portions of the lower beach berm include midden-type materials (mainly sandy gravel and shell fragments) and are being actively undercut by wave erosion (e.g. Photos 1, 9, 12). The foreshore includes the intertidal and supralittoral zones.

---

[10] http://www.env.gov.bc.ca/atrisk/ims.htm

[11] http://a100.gov.bc.ca/pub/eswp/

[12] http://www.sararegistry.gc.ca/species/default_e.cfm

[13] BC Ministry of Water, Land and Air Protection. Draft 2004. Section 6. Special Wildlife and Species at Risk. Accessed from <http://www.for.gov.bc.ca/hfd/library/documents/bib96812.pdf>.

[14] From NHC, 2014. Lazo Road Shoreline Protection Wave Climate Assessment. Prepared for Wedler Engineering. 17 pp.

[15] INSERT REFERENCE

2. Backshore, which extends up to 4 m above HHW (to elevation 6 m CGD) and consists mainly of sandy dune-like deposits and berms, covered by grasses and shrubs (Photo 2). The backshore dunes materials that are easily erodible and are subject to gullying from wave run-up, spray, runoff and foot traffic.

Table 1. Summary of tide elevations (NHC, 2014)

Tide Condition	Abbreviation	Ocean Level	
		Chart Datum (CD m)	Geodetic Datum[1] (CGD m)
Higher High Water Large Tide	HHWLT	5.4	2.1
Higher High Water Mean Tide	HHWMT	4.8	1.5
Mean Water Level	MSL	3.3	0.0
Lower Low Water Mean Tide	LLWMT	1.2	-2.1
Lower Low Water Large Tide	LLWLT	0.0	-3.3

For the purposes of this study, the marine shoreline has been divided into seven “shorezones” of similar habitat and morphological character (Figure 2). For each shorezone (SZ), results are presented in main categories: foreshore, backshore, erosion, and forage fish spawning potential. A list of vegetation species observed in each SZ is provided in Appendix E. General comments on these shoreline zones, processes and habitats are presented here followed by specific details for each of the SZ’s. Biophysical attributes of each SZ are summarized in Table 2.

3.1.1 Foreshore - Supralittoral Zone

Functional supralittoral vegetation communities provide potential nesting and forage habitat for passerine shoreline birds and other animals, shade, litter fall, and insect drop for near-shore fish species[16], and improving bank stability against erosive marine forces. Embedded LWD in this zone provides important retention of finer substrates, wave energy dissipation, and microhabitat (moisture, thermal, shelter, etc.) for organisms.

3.1.2 Foreshore - Forage Fish Habitat/Intertidal

Forage fish are small, schooling fish that are ubiquitous along the temperate coastline of the Pacific Ocean. The spawning habitats of forage fish are sensitive to shoreline land uses and modification activities. In the context of this report, the term “forage fish” is specific to three main species: Pacific Sand Lance (*Ammodytes hexapterus*), Surf Smelt (*Hypomesus pretiosus*), and Pacific Herring (*Clupea pallasi*). These species are considered a critical link in the food chain and form a significant portion of the prey base for marine fish (including salmon), seabirds, and marine mammals. Forage fish typically spawn in the upper one-third of the intertidal zone.

Embedded LWD in this zone also provides important retention of finer substrates, wave energy dissipation, and microhabitat (moisture, thermal, shelter, etc.) for organisms.

There were no eelgrass beds observed in the intertidal or shallow subtidal areas along the project location. An assessment was conducted at a low tide of -2.3 m CGD on June 1st, 2015.

---

16 Overhanging vegetation helps prevent dessication of forage fish eggs.

A detailed discussion of the habitat preferences of shore spawning/forage fish is presented in Appendix C. The key conclusions of this assessment are:

1. The un-protected, active, and somewhat narrow sand beach character of the project shoreline supports less than 5% of occurrences of surf smelt and sandlance activity.
2. Based on the SHI estimate for the distribution of herring egg depositions along BC coastal waters the expected occurrence of herring spawning activity near the project footprint is moderate to high.

3.1.3 Backshore Zone

The backshore zone plays several critical roles in maintaining ecological function along marine shorelines:

1. Shade and microclimate.
2. Food production.
3. Shoreline stabilization.
4. Pollutant filtration removal.
5. Organic Matter and LWD recruitment.

Full vegetation species list for each shorezone are provided in Appendix E; a summary table for the biophysical attributes and ecological function is provided in Table 2.

3.2 LITTORAL DRIFT

The site sits roughly perpendicular to the dominant (SE) storm system, and the drift system appears to be quite weak at this location due to the low longshore velocity component[17]. As such, there is more onshore-offshore movement with localized rips than would be experienced at a site defined by long-shore drift.

[17] Dave McLean, NHC, personal communication, June, 2015.

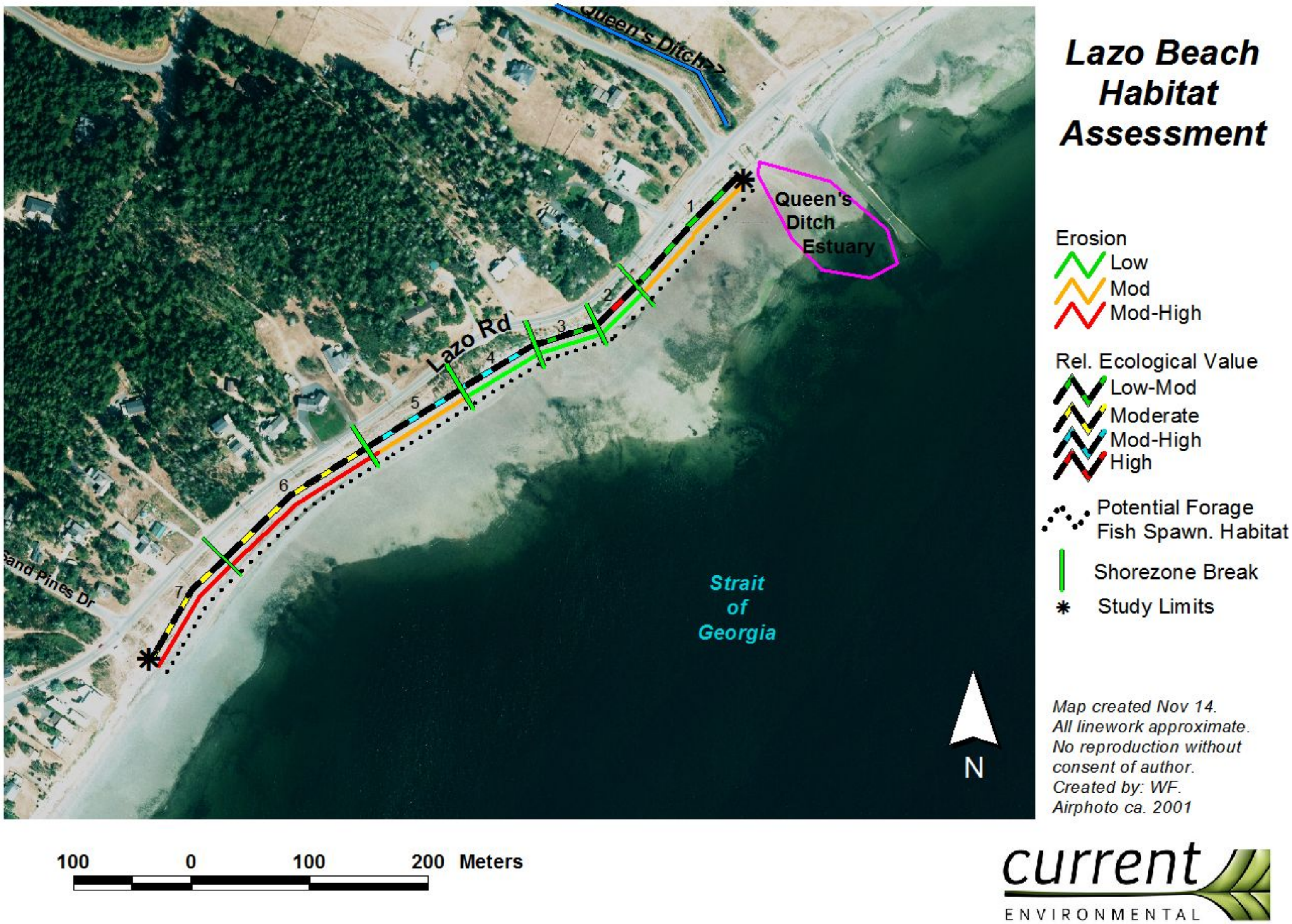


Figure 2. Overview map of the project site including division of marine shoreline into seven "shorezones" of similar habitat and morphological character.

3.2.1 Shorezone #1

3.2.1.1 SZ1 Foreshore

The foreshore of SZ1 is quite thin due to the proximity of the road and low elevation of the landform in this area (Photo 1). As such, there is very little vegetation in this section. Patches of small, embedded and free LWD, and large accumulations of small woody debris were noted in the high intertidal zone. There was a short (~8 m) section of riprap noted in this SZ – likely placed to protect the power pole. Small, thin, and discontinuous patches of dune wildrye and beach pea were noted in this section. Erosion was moderate in the area and appeared to be largely caused by wave action and foot traffic to a lesser extent.

Forage fish spawning potential in this section is low to moderate; substrates were generally coarse (medium-sized gravels) with fewer fines that are integral to functional spawning habitat. Both the supralittoral and beach berm were very small in this section.

3.2.1.2 SZ1 Backshore

The backshore in this SZ is also very small due to the intimate proximity of Lazo Road and low elevation. Sparse vegetation was dominated exclusively by herbaceous species (mostly orchard grass, silver burweed, and curled dock).

3.2.2 Shorezone #2

3.2.2.1 SZ2 Foreshore

This shorezone is somewhat unique from the others in the study area in that it has a well developed dune wildrye berm and densely vegetated backshore with little to no erosion (Photo 2). This may be a result of the shallower intertidal landform that extends into the Strait of Georgia along the axis of dominant wave exposure (Figure 2). Pedestrian traffic has been excluded from this area as a result of the dense thicket vegetation; pedestrians walk along Lazo Road or along the intertidal section of this SZ. There is a small, tidally inundated depression behind the dune wildrye berm in this section that is likely a good food source for marine animals. As mentioned, vegetation in the supralittoral was comprised of dense, thicket-like communities of Nootka rose and snowberry interspersed with Himalayan blackberry, and trailing blackberry. Younger black hawthorne and a Sitka spruce tree were also observed in this section. The high intertidal zone featured an excellent berm populated with large continuous patches of dune wildrye and beach pea and a good density of embedded LWD.

Forage fish spawning potential in this section is low to moderate; substrates were generally coarse (medium-sized gravels; Photo 3) with fewer fines that are integral to functional spawning habitat. The overhanging vegetation of the berm and supralittoral zone would provide good shading over spawning substrates in the event this reach is used by sandlance or surf smelt.

3.2.2.2 SZ2 Backshore

As mentioned, this SZ has a well developed backshore populated with a dense community of vegetation. However the backshore is also populated with patches of invasive Himalayan blackberry and is not very wide (~ 7 m) due to the close proximity of the road.

3.2.3 Shorezone #3

3.2.3.1 SZ3 Foreshore

The foreshore of this section of the project site features a reasonably shallow beach and supralittoral slope that forms the transition to the wider dune-like formations in the backshore found in SZ4 (Photo 4). There is no significant berm or dune wildrye community, and the density of LWD is low.

Forage fish spawning potential in this section is low to moderate; substrates were generally coarse (medium-sized gravels; Photo 3) with fewer fines that are integral to functional spawning habitat. There was very little dune wildrye of meaningful vegetation to provide shade to spawning habitat.

3.2.3.2 SZ3 Backshore

The backshore of SZ3 is comprised of a relatively thin (4-7 m wide) sandy duneform. The backshore area has been colonized by invasive, weedy grass species and lacks a significant or functional riparian community. As such, this area is a good candidate for restoration works that improve riparian function (see revegetation plan in Appendix B).

3.2.4 Shorezone #4

3.2.4.1 SZ4 Foreshore

This shorezone is somewhat similar to SZ2 in that it has a well developed dune wildrye berm and wide foreshore/supralittoral area with a densely vegetated backshore and shows little to no erosion (Photo 5). Pedestrian traffic has been excluded from this area as a result of the dense thicket vegetation; pedestrians walk along Lazo Road or along the intertidal section of this SZ. There is also a small, tidally inundated depression behind the dune wildrye berm in this section that is likely a good food source for marine animals. Vegetation in the supralittoral was comprised of dense, thicket-like communities of Nootka rose, Scotch broom and non-native grasses. Younger black hawthorne and a wind-whipped Sitka spruce tree were also observed in this section. The high intertidal zone featured a moderate-sized berm populated with large continuous patches of dune wildrye and beach pea and low to moderate density of LWD that was poorly embedded.

Forage fish spawning potential in this section is moderate; substrates were slightly coarse (medium-sized gravels) with some patchy distributions of finer substrates that would provide functional forage fish spawning habitat. The good overhanging vegetation of the berm and supralittoral zone would provide good shading to spawning substrates in the event this reach is used by sandlance or surf smelt.

3.2.4.2 SZ4 Backshore

As mentioned, this SZ has a well developed backshore populated with a dense community of vegetation. The backshore is somewhat thin (~5 m wide) and populated with some larger patches of invasive Himalayan blackberry.

3.2.5 Shorezone #5

3.2.5.1 SZ5 Foreshore

The foreshore of this section of the project site features a prominent berm populated with dune wildrye and beach pea integrated into coarser cobble substrates, while vegetation in the supralittoral (seashore lupine, gumweed, grasses) was simplified as a result of the presence of non-native grasses (Photo 6, 8). The high intertidal zone featured a well-functioning berm populated with patches of dune wildrye and beach pea and moderate density of embedded LWD.

Forage fish spawning potential in this section is low to moderate; substrates were generally coarse (cobbles and larger gravels; Photo 6, 8) with fewer fines that are integral to functional spawning habitat.

3.2.5.2 SZ5 Backshore

The backshore in SZ5 is quite wide (~10-13 m) and has been impacted by human foot traffic and the presence of non-native grasses with some bracken fern (Photo 7, 8). The wide backshore lacks a significant or functional riparian community. As such, this area is a good candidate for restoration works that improve riparian function (see revegetation plan in Appendix B). Erosion of the backshore in this section is moderate, with patches of marked erosion. There is also a loose placement of cobble riprap on the slope of the supralittoral and backshore areas.

3.2.6 Shorezone #6

3.2.6.1 SZ6 Foreshore

The foreshore of this section of the project site has been heavily impacted by pedestrian traffic and road/upslope runoff that has caused marked erosion in the supralittoral zone and loss of riparian vegetation (Photo 9). Vegetation in the supralittoral was simplified as a result of the erosion and foot traffic and consisted of non-native grasses, gumweed, silver burweed, and brome. The high intertidal zone featured a well-functioning berm populated with sparse and discontinuous patches of dune wildrye and beach pea with a moderate density of embedded LWD.

Forage fish habitat in this section is considered to have a relatively high potential due to the wide beach and prevalence of fine substrates. It is possible that the higher accumulations of finer substrates are partially a result of the pronounced erosion of the supralittoral and backshore areas of this SZ resulting from foot traffic and road runoff. The wide beach (Photo 10) and moderate density of embedded LWD in this SZ also function to dissipate wave energy in this area.

3.2.6.2 SZ6 Backshore

The backshore of SZ6 is very thin (~2-4 m; Photo 11) as a result of the immediate proximity of Lazo Road. As with the supralittoral zone of this SZ, the backshore has been highly impacted by human foot traffic and uncontrolled road runoff. The backshore area has been colonized by invasive, weedy grass species and lacks a significant or functional riparian community. As such, this area is a good candidate for restoration works that improve riparian function (see revegetation plan in Appendix B).

3.2.7 Shorezone #7

3.2.7.1 SZ7 Foreshore

The foreshore of this section of the project site has been heavily impacted by pedestrian traffic and road/upslope runoff that has caused marked erosion in the supralittoral zone and loss of riparian vegetation. Signs of vehicle traffic down to the intertidal zone were also noted in this section (Photos 12 and 13). Vegetation in the supralittoral was simplified as a result of the erosion and foot traffic and consisted exclusively of non-native grasses. The high intertidal zone featured a well-functioning berm populated with patches of dune wildrye and beach pea and good density of embedded LWD.

Forage fish habitat in this section is considered to have a relatively high potential due to the berm and depth and size of substrates. It is possible that the higher accumulations of finer substrates are partially a result of the pronounced erosion of the supralittoral and backshore areas of this SZ resulting from foot traffic, road runoff and vehicle access to the intertidal zone. The wide beach (Photo 15) and good density of embedded LWD in this SZ also function to dissipate wave energy in this area.

3.2.7.2 SZ7 Backshore

As with the supralittoral zone of this SZ, the backshore has been highly impacted by human foot and vehicle traffic and uncontrolled road runoff (Photo 14). The wide backshore (~ 10 m wide) area has been colonized by invasive, weedy grass species and lacks a significant or functional riparian community. As such, this area is a good candidate for restoration works that improve riparian function (see revegetation plan in Appendix B).

Table 2. Biophysical attributes of seven shorezones (SZ) within the marine shoreline of the project area…

Shorezone	Length (m)	Forage Fish	LWD	Erosion	Riparian Vegetation	Ecological Value	Comments
1	129	Low-Mod	Mod	Mod	Poor	Low-Mod	- Very close proximity to road (~2 m; Photo 1). - Small area of riprap. - Some patches of embedded LWD - Queen's Ditch estuary/freshwater input at northern extent of shorezone.
2	51	Low-Mod	Low-Mod	Low	Mod	High	- Thicket with abundance of native vegetation. - Small tidally inundated depression behind berm (dune slack?). - Good but small area of wildlife habitat. - Red listed Beach pea/dunegrass community at bermed transition to supralittoral.
3	60	Low-Mod	Low	Low	Poor	Low-Mod	- Non-native grass dune form. - Shore is stable.
4	80	Mod	Low-Mod	Low	Mod	Mod-High	- Patchy thicket with well developed berm (poorly embedded LWD). - tidally inundated depression (slack). - Model for riparian habitat design - Red listed Beach pea/dunegrass community at bermed transition to supralittoral.
5	98	Low-Mod	Low-Mod	Mod	Poor	Mod-High	- Remnant dune form/wide backshore. - Well developed bench with beach pea/dunegrass and LWD (not embedded). - Some fill placed during road construction? - Backshore is non-native grass dominated community. - Appears stable. - Coarse cobble band in berm helping dissipate energy? - Model for slope design? -Good distribution of red listed Beach pea/dunegrass community at bermed transition to supralittoral.
6	159	High	Mod	High	Poor	Moderate	- Good quality forage fish spawning habitat a result of erosion? - Power poles exposed. - Abundance of public access issues. - Restore beach pea/dunegrass community. - Narrow backshore and riparian a result of proximity to road. - Wide berm/beach area to work with. -Thin and patchy red-listed Beach pea/dunegrass community at bermed transition to supralittoral.
7	115	High	High	High	Poor	Mod-High	- Weedy grass community on wider backshore/dune form. - Good quality forage fish spawning habitat a result of erosion? - Wide beach to work with. - Well-functioning berm with embedded LWD and dunegrass zone. - Significant erosion/rilling from road runoff noted in several areas. - Public access also causing significant erosion (including vehicle tracks. -Good but patchy distribution of red listed Beach pea/dunegrass community at bermed transition to supralittoral. - High potential for restoration.

General Comments

- Entire shore provides important forage fish spawning habitat. Emphasis on softer approach to maintain finer substrates should occur if feasible.
- Road runoff and public access contributing to shore erosion - particularly at SW end.
- In riprap areas, encourage development of berm (transition between beach to riprap slope) through use of embedded LWD and placement of fill.
- Opportunities to enhance riparian vegetation through planting native vegetation in backshore - including riprap area.

- Native beachgrass/beach pea dominated ecological community located at berm transition to supralittoral is red-listed by the BC Conservation Data Centre (Leymus mollis Lathyrus japonicus herbaceous vegetation; S1). However, most occurrences in the study are narrow and affected by fragmentation and non-native species
- No other species at risk were identified during fall 2014 surveys; study limited by timing of inventory.

3.3 TERRESTRIAL HABITAT AND SPECIES

The terrestrial habitat associated with the study area is comprised solely of the relatively thin backshore zone that parallels Lazo Road. The dense shrub thickets in some sections would provide good foraging habitat for passerine birds and small mammals. There were a total of four small trees noted within the study area, thus limiting the utility of the survey area by many species.

3.3.1 Dune Habitat

A sign indicating the presence of sand dune ecosystem habitat was noted in the backshore of SZ6. Discussions with the Canada Wildlife Service indicate this sign was not placed by that agency despite the fact that the sign indicates otherwise[18]. While portions of the site indicate remnant dune forms, the immediate proximity of Lazo Road eliminates natural processes that would maintain dune habitats. Furthermore, the very narrow backshore (maximum width ~ 15 m) and highly disturbed nature of the site (including prevalence of invasive species and pedestrian traffic) precludes the existence of real dune ecosystem habitat. There were no rare plants observed in these areas.

3.3.2 Garry Oak Habitat

As mentioned, there are very few trees in the project site, none of which were Garry oak trees. Larger stands of Garry oak were noted on properties adjacent to Lazo Road in the surrounding area, however these trees are located at least 30 m from the project site and will not be impacted by the project works.

3.4 BALD EAGLE NEST TREE

Validated bald eagle nest tree BAEA-106-323 is located approximately 175 m north of the closest section of the site (Figure 3). Considering the distance of the tree from the site and the fact that no large trees will be removed[19], the proposed work is not expected to have a significant impact on nesting eagles. No other eagle, heron or raptor nest trees were noted in proximity to the site during field assessment.

---

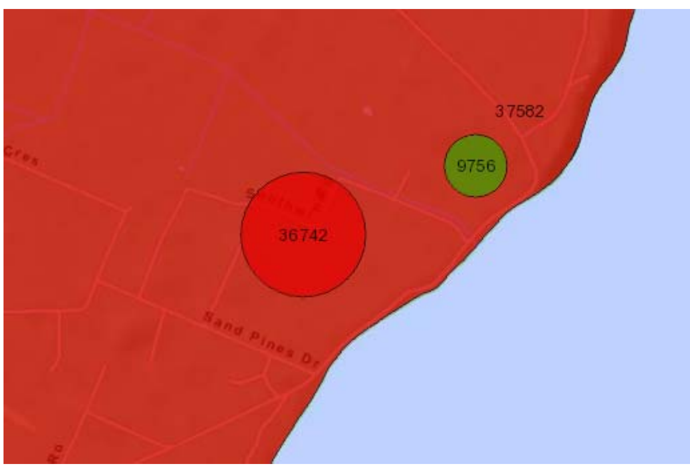
[18] See email from Ken Brock provided in Appendix D.

[19] Tree removal and foot or machine traffic in close proximity to the tree is known to be highly disturbing to nesting eagles.

Figure 3. Known raptor nest sites in proximity to the project. From the Wildlife Tree Stewardship Atlas.

3.5 SPECIES AT RISK

The CDC online mapping resource[20] did not show any known occurrences of species-at-risk in the immediate project area (**Error! Reference source not found.**4). Three known occurrences/polygons were provided on the BC Ecosystem Explorer (Figure below) these are provided here:



Polygon 36742 = Western screech owl – *Megascops kennicottii kennicottii*

Polygon 9756 = Yellow montaine violet - *Viola praemorsa ssp. Praemorsa*

Encompassing red polygon = Ermine – anguinae subspecies Mustela erminea anguinae

Due to the habitat preferences of these species, the proposed work will not have a significant impact on these at-risk species.

The dune wildrye/beach pea ecological community is a provincially red-listed[21] community that was noted throughout the project site in the high intertidal and supralittoral zones of the shoreline.

---

[20] http://www.env.gov.bc.ca/atrisk/ims.htm
[21] Provincial status: S1/S2

4 PROPOSED WORK

The overarching objective of the proposed work is to defend Lazo Road from the very high energy erosive wave forces related to the direct, perpendicular exposure to southeast storms from the Strait of Georgia. As well, the project works are designed to provide controlled public access and runoff conveyance from upland areas, to prevent other intrusions onto the shoreline, and to restore and improve the riparian vegetation community of the shoreline.

As much as possible, soft engineering techniques promoted by the Greenshores program have been employed for the defensive shoreline structures, however, the tight proximity of the Lazo Road prism, extreme wave conditions related to the perpendicular orientation of the shoreline and large fetch limit practical soft options.

Project designs are presented in Appendix A.

4.1 SHORELINE STABILIZATION

As mentioned, the project designs were based on a detailed wave analysis[22] that reviewed longterm wind and wave data, extreme tides and storm surge levels to estimate appropriate design water levels at the site. Based on this information, a "hybrid" of soft and hard engineering approaches has been prescribed. Riprap placement along most of the shoreline forms the basis of the design with additional elements implemented to improve ecological function at the site. These softer elements include:

1. The use and placement of ballasted LWD at elevations between 3.2 to 4.4 m CGD.
    a. LWD is employed to dissipate wave rollup energy and to trap finer sediments for the establishment of vegetation.
2. Use of planted vegetation and ballasted LWD at elevations greater than 4.4 m CGD.
3. Non-treatment of stable sections.
    a. A section in SZ4 was deemed to be secure from attack based on wave analysis – no treatment of this section is proposed.
4. Maintenance of shallow slope on shoreline faces to minimize refractive energy on shorelines and enable natural colonization and revegetation efforts.
    a. This entails using higher volumes of rock.
5. Salvage and replacement of native substrates on top of and at the toe of rip placement.
    a. Once finished, substrates will be replaced to restore the beach profile at the toe of the slope and at the top of riprap.
    b. Once finished, the extent of exposed riprap will be quite small (see cross sections of project designs: Appendix A).
6. Intensive vegetation management and restoration plan (Appendix B).
    a. Salvage and replacement of vegetation – particularly the dune wildrye/beach pea community at the toe of the slope. This will be salvaged and replaced as construction proceeds.

[22] November, 2014. Northwest Hydraulic Consultants. *Lazo Road Shoreline Protection Wave Climate Analysis.* Prepared for the Town of Comox.

The riprap and LWD placements vary with the elevation of the shoreline features and exposure to waves. It is anticipated that, with the shallow shore slope and low littoral velocities, the habitat function of the beach will remain intact.

4.2 PUBLIC ACCESS

To provide safe public access to the site and to mitigate shoreline erosion and destruction of riparian vegetation, a pedestrian pathway has been integrated into the project design. The path averages 3.5 m in width and will be top dressed with crushed gravel.

Furthermore, a series of eight public access stairways to the shoreline will be constructed from crushed gravel and logs. Finally, bollards, fencing, and curbs will be used to prevent vehicle access to the shoreline. Details are provided in Appendix A.

4.3 ROAD RUNOFF

Swales have been designed to convey flows from areas of concentrated road runoff to the intertidal zone. Details are provided in Appendix A.

4.4 VEGETATION MANAGEMENT PLAN

An intensive vegetation management plan (VMP) has been designed for this project (Appendix B). The objectives of the vegetation plan are as follows:

1. Establish a functional vegetation community along the shoreline.
2. Replace invasive species with native vegetation.
3. Minimize foot traffic into non-designated areas.
4. Protect existing vegetation through salvage and replanting.

The VMP breaks down the shoreline vegetation management into four primary types of treatment: Thicket, Beachgrass Planting, Beachgrass Salvage, and Meadow. The plan involves an intensive salvage and replacement program for the dune wildrye/beach pea community and a delayed replanting schedule founded on the desire to allow observations of the site performance over a winter storm cycle so that stable areas can be identified. The VMP entails the planting of 21,584 plants and is provided in Appendix B. Treatment polygons are indicated on the project designs in Appendix A.

5 DISCUSSION

As much as possible, the project team has integrated “soft” approaches to defending Lazo Road from powerful wave attack related to the perpendicular exposure of the site to intense storms and sea level rise. The intensity of storms at this location is reflected by the fact that, with the exception of the project site, the entire shoreline between Cape Lazo and Goose Spit has been armored with riprap (Figure 1).

Potential impacts to environmental values and mitigation measures employed to mitigate them are presented here.

5.1 FORAGE FISH

Overall, forage fish habitat at the project site is low-moderate due to the generally coarse substrates and the exposed nature of Lazo beach and significantly stronger preference for protected shorelines (Appendix C). The forage fish potential is higher in SZ's 6 and 7 as a result of the wider beach and significant erosion contributing finer substrates to the intertidal zone. Potential impacts of the proposed work on forage fish habitat include the cutting off of finer sediment inputs to the drift system and increased local reflected wave energy that could result in a coarsening of beach substrates. The project designs and construction methods to address these issues include:

1. Maintaining shallow shoreline faces (minimum slope 2:1) to encourage trapping of finer sediments and to reduce reflective wave energy.
2. Excavation and replacement of native fill at the toe and on top of placed riprap. This, with vegetation salvage mentioned below will help maintain existing beach berms.
3. Salvage and intensive planting of dune wildrye and beach pea vegetation in high intertidal zone.
4. Use of ballasted LWD to trap finer sediments and facilitate the establishment of riparian vegetation.

It should be noted, that as previously discussed the littoral drift system is relatively weak at the site; substrates are expected to move more inshore/offshore rather than laterally along the shore. The higher composition of finer substrates at shorezones 6 and 7 supports the assertion. The un-protected, active, and somewhat narrow sand beach character of the project shoreline supports less than 5% of occurrences of surf smelt and sandlance activity (Appendix C).

Avoiding the mechanical destruction of forage fish eggs in intertidal substrates will be managed through the implementation of BMP's based on sampling the beach for the presence of eggs prior to the commencement of construction (outlined in the Construction Environmental Management Plan (CEMP) – Appendix D).

5.2 LOSS OF VEGETATION AND SPREAD OF INVASIVE SPECIES

The potential impacts on riparian vegetation associated with the proposed work include the following risks:

1. Mechanical destruction of vegetation.
2. Introduction and/or spread of invasive species.
3. Loss of planting sites related to placement of riprap.

The vegetation management program (Appendix B) will involve the planting of over 21,000 plants to create a more functional riparian community comprised of native vegetation rather than the ubiquitous non-native grasses that dominate the backshore and supra littoral zones. Furthermore, existing, valued vegetation such as the dune wildrye and beach community will be salvaged and replaced during construction. Invasive species will be removed from work areas and disposed of at an appropriate facility as per direction under the CEMP.

5.3 CONSTRUCTION-RELATED IMPACTS

Construction-related impacts include spills, mechanical destruction of wildlife, forage fish eggs, and vegetation, destruction of vegetation, compaction of substrates, damage and loss of integrated LWD, and release of large volumes of sediment to marine habitats. The management of these risks will be accomplished through the implementation of a Construction Environmental Management Plan (CEMP) under the supervision of an Environmental Monitor. The CEMP for this work is provided in Appendix D.

5.4 SUMMARY OF IMPACTS AND MITIGATION MEASURES

While the Lazo shoreline is an aesthetically stunning and locally cherished area, the ecological productivity of the site is limited by the immediate proximity of Lazo Road and resultant shortened backshore, prevalence of invasive species, accelerated erosion related to human use and wave action. Lazo Road eliminates natural sediment transport processes that might support dune formation, precludes the possibility of a functional backshore, and introduces deleterious runoff onto the shore. With the exception of the dune wildrye and beach pea community observed along the toe of slope in sections, there were no rare species or habitats in the area.

Forage fish spawning habitat across the site is functional in most areas, and constitutes the most important ecosystem component of the site. The weak littoral drift of the area, replacement of beach berms and vegetation during construction, intensive vegetation plantings, hybrid LWD, and low slope riprap placement designs that anticipate sea level rise are designed to maintain this habitat as much as possible. The highly dynamic nature of shoreline areas with exposures such as that found at the project site, coupled with the uncertainties of sea level rise, make it difficult to determine the longterm function of the site.

With the mitigation measures proposed, it is anticipated that the proposed work will not result in serious harm to fish habitat or other ecosystem components on the site.

6 CLOSURE

We trust this assessment has satisfied your requirements. Please contact the undersigned if you have any queries.

Current Environmental

Warren Fleenor, R.P.Bio.

7 DISCLAIMER

This report was prepared exclusively for Wedler Engineering Ltd by Current Environmental Ltd.. The quality of information, conclusions and estimates contained herein is consistent with the level of effort expended and is based on: i) information available at the time of preparation; ii) data collected by the authors and/or supplied by outside sources; and iii) the assumptions, conditions and qualifications set forth in this report. This report is intended to be used by Wedler Engineering Ltd only, subject to the terms and conditions of its contract or understanding with by Current Environmental Ltd.. The Town of Comox may use this document for planning purposes specific to this project. Other use or reliance on this report by any third party is at that party’s sole risk.

8 PHOTOS

Photo 1. Shorezone 1 (SZ1) – note close proximity of road, thin backshore, and dense accumulations of LWD.

Photo 2. SZ2. Note well developed berm with dune wildrye and functional backshore vegetation.

Photo 3. SZ2 – note coarser substrates in the high intertidal and well developed beachgrass berm.


Photo 4. SZ3


Photo 5. SZ4 .


Photo 6. Foreshore of SZ5.

Photo 7. Backshore of SZ5. Note footpath and dominant, weedy, non-native grasses.

Photo 8. SZ5 – Note footpath and dune wildrye berm.

Photo 9. SZ6 – Note sever erosion resulting from foot traffic, exposed power poles, and thin backshore resulting from close proximity of the road.


Photo 10. Wide beach of SZ6.

Photo 11. Eroding and thin backshore of SZ6.

Photo 12. SZ7 – foreshore.

Photo 13. SZ#7: vehicle traffic onto foreshore and backshore – erosion.

Photo 14. SZ7: Backshore. Note start of defensive riprap in front of residence and erosion related to road runoff.

Photo 15. Wide beach and berm in SZ's 6 and 7

9 APPENDIX A – PROJECT DESIGNS

APPENDIX B – VEGETATION MANAGEMENT PLAN

APPENDIX C - SHORE SPAWNERS AND THE LAZO ROAD SITE

PACIFIC HERRING

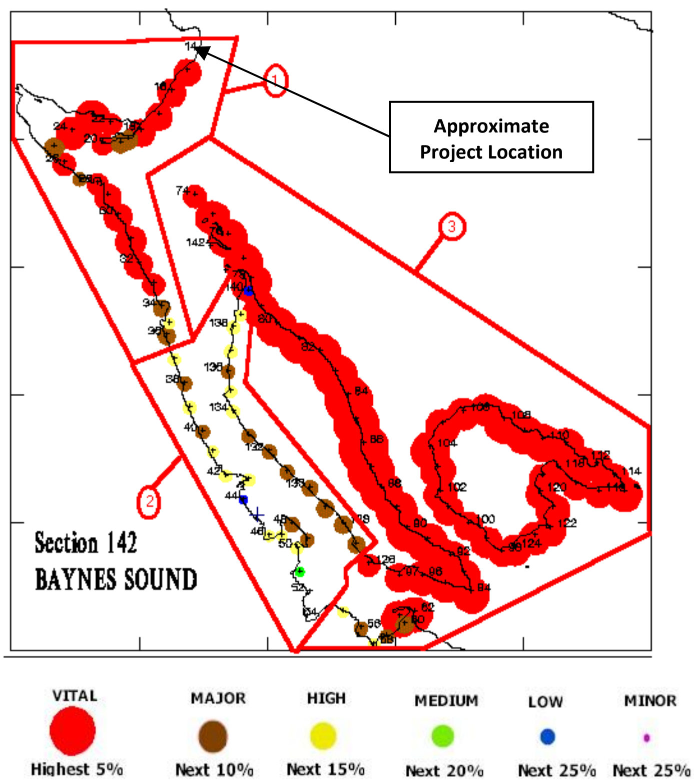
Pacific herring migrate from their open ocean summer feeding grounds to inshore waters in preparation for spawning each year. The migration towards relatively shallow inlets and bays along the coast occurs during the fall and winter, and spawning in the spring.

Herring are an important species on the B.C. coast that help support the diets of many other forms of life through the winter including a wide variety of pelagic, intertidal, and avian predators.

From an anthropogenic standpoint, herring are considered a valuable food and bait fishery. Herring are caught in commercial fisheries and are processed to produce oil and meal, bait for sports fishermen, and food for human consumption. Herring roe is also a valuable market commodity when collected from kelp and salted to be sold, predominantly to Asian markets.

Herring Spawn Activity

Herring are known to spawn at, or in very close proximity to the project site.



As mentioned, there were no eelgrass beds noted in the intertidal or shallow subtidal areas in the project site, nor were there any significant kelp communities in the area that could be potentially impacted by the project work.

Figure 3C. Cumulative herring spawn map showing mean usage of shoreline habitat near the subject property between 1928-2013.

Spawning Habitat Preferences

Herring spawning habitat preferences include areas colonized by marine vegetation such as rockweed, kelp or brown algae, red algae, green algae, and sea grasses. Spawning grounds of Pacific herring are typically in sheltered inlets, sounds, bays, and estuaries rather than along open coastlines such as the Lazo Beach area.[23]

Historical Distribution

The DFO has conducted surveys of herring spawning activity along the B.C. coast since 1928. The data gathered during these surveys is treated to become an estimate of the distribution of herring egg depositions per kilometer of shoreline and is summed separately over all survey years from 1928 – 2013. One of the results of this treatment is the herring Spawn Habitat Index (SHI) that is re-calculated annually and plotted digitally on maps (**Error! Reference source not found.**3C**Error! Reference source not found.**). In simple terms, the index is a measure of shoreline utilization by spawning herring. According to the SHI, revised to the current year, the herring spawn classification for the area very close to the project footprint is considered vital, or the highest 5 % (**Error! Reference source not found.**).

Timing

If spawning were to occur near the project site it would be expected to happen between the beginning of March to middle of April according to historical records for Baynes Sound. Otherwise, the generalized spawning season for herring along the East Coast of Vancouver Island is Jan. 1 – Apr. 30. However, spawning can also occur from May 1 - Dec 31. Spawning occurring during the May – Dec. period had often represented significant proportions of total annual herring observed prior to 1982 but after 1982 such events are considered negligible. According to Lassuy (1989) "spawning peaks in February and March in the Pacific Northwest".[24] Average incubation time for herring roe is 14 days in British Columbia.[25]

Work Site Occurrence Potential

Based on the SHI estimate for the distribution of herring egg depositions along BC coastal waters the expected occurrence of herring spawning activity near the project footprint is moderate to high.

PACIFIC SANDLANCE

Similarly to Pacific herring, sand lance plays an important role in the food web of a myriad of species that frequent B.C.'s coastal waters. Conversely, sand lances are of little commercial interest to humans and as such are not directly threatened by us. However, they are susceptible to pollution and habitat destruction that result from human activities such as shoreline development.

---

[23] Haegele, C., and Schweigert, J. (1985). Estimation of egg numbers in Pacific herring spawns on giant kelp. N. Am. J. Fish. Manage. 565-71.

[24] Lassuy, D.R. (1989). Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Northwest)-- Pacific herring. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.126). U.S. Army Corps of Engineers, TR-EL-82-4. 18 pp

[25] Bishop, M. & Green, S. (2008). Predation on Pacific herring (*Clupea pallasi*) spawn by birds in Prince William Sound, Alaska. Fisheries Oceanography. Volume 10, Issue Supplement s1, pages 149–158.

Spawning Habitat Preferences

Sand lance prefer to reproduce in sandy sediments, leaving shallow scoured depressions (pits) that measure <50 mm deep, up to 0.4 m in diameter, and from 2 to 5 m above the low tide line located in the high intertidal zone.[26] According to Robards et al. (1999) "sand lance eggs are cryptic and blend in well with small fragments of shell and gravel [...] eggs were observed on the sand surface of spawning pits at a density of up to 7/cm^2 and within the substratum to a depth of about 30 mm. Eggs were demersal, slightly adhesive, translucent, and almost spherical in shape (mean diameter of 1.02 mm [...]). Some eggs were adhered to sand grains or each other, but many others were found individually and unattached within the gravel."[26]

It is believed that sand lance have a high affinity to specific spawning grounds and will use the same sites year after year for decades. An important factor for spawning site selection for sand lance is an upper beach shallowly covered with water.[27] The slope of the subject area is consistent with this requirement. Harper and Ward (2001) found that sand lance prefer very-protected to semi-exposed shoreline types with a strong (>70%) preference for protected sites (Figure 44C and 6C).[28] **Error! Bookmark not defined.** Although, sediment types and beach slope are supportive of sand lance spawning requirements, less than 5% of occurrences are noted along shorelines that share exposure characteristics with the project area.

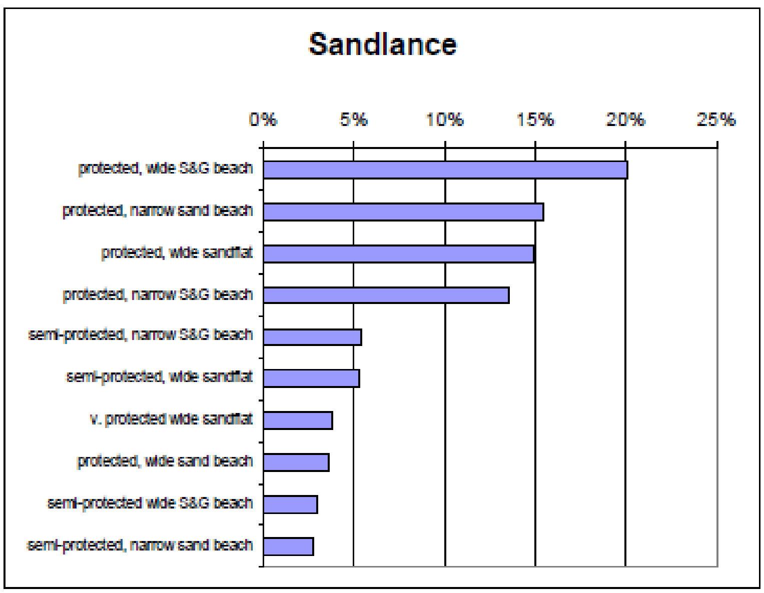


Figure 4C. Percentage occurrence of sand lance against exposure/beach type. Exposed sites such as the Lazo site are not shown due to low selection of these sites. See Figure 6C

[26] Puget Sound Sea Life. Pacific Sand Lance. Retrieved Jan 1 2011 from <http://www.pugetsoundsealife.com/habitats+sealife/Pacific_Sand_Lance.html>.

27 Penttila, R. (2007). Marine Forage Fishes in Puget Sound. Nearshore Habitat. Pacific Sand Lance. Technical Report 2007-03. Washington Department of Fish and Wildlife. Pp 10.

28 Harper, J. & Ward, S. (2001). Comparison of Washington State Department of Fish and Wildlife Beach Spawning Data to Shore Zone Data. Coastal & Ocean Resources Inc. Sidney, BC. Accessed from https://salishsearestoration.org/images/5/5e/Harper_%26_Ward_2001_beach_spawning_fish_and_shorezone_types.pdf

Historical Distribution

In B.C., with no commercial fishery of sand lance, there is no management plan and little research has been completed to determine their distribution along the shores of the Strait of Georgia. However, the likelihood of determining presence/absence may be inferred: based on high site-fidelity for historical spawning beaches and preferred habitat types (). The closest recorded occurrence of spawning was recorded approximately 3 km to the southwest of the proposed project footprint at Goose Spit.[29]

Timing

Spawning typically occurs in late September and October whereas late autumn/winter spawning in the intertidal is considered unusual as eggs and larvae would be exposed to harsh winter conditions that would lead to prolonged incubation and hatching periods.[30] Incubation times are highly variable and depend on ambient temperatures and oxygen levels[31]; in general, eggs are expected to reach maturity between two weeks and two months, at which time the larvae hatch and become members of the plankton community.

Work Site Occurrence Potential

The ground-level reconnaissance survey showed that there are portions of the work area that are consistent with preferred sand lance spawning substrates of coarse sand, gravel, and shell fragments; as well as an upper beach being shallowly covered with water during periods of high tide. However, the un-protected and limited sand beach character categorizes the proposed work area as supporting less than 5% of occurrences of sand lance activity (Figure 4). In addition, it is believed that sand lance have a high affinity to specific spawning grounds and being that there is no confirmed spawning beach located within a concerning distance from the work area there is a reasonably low likelihood that the work area could see spawning activity.

SURF SMELT

Like herring and sand lance, surf smelts are an important forage fish on the B.C. coast. The commercial catch of surf smelt was undertaken from the early 1900s, peaking in 1904, where they were caught primarily in small batches and for local consumption. In recent years the commercial fishery has all but disappeared giving way to a growing recreational fishery during the spring and summer.

Spawning Habitat Preferences

[29] Thuringer, P. (2003). Documenting Pacific Sand Lance (*Ammodytes hexapterus*) Spawning Habitat in Baynes Sound and the Potential Interactions with Intertidal Shellfish Aquaculture. Archipelago Marine Research Ltd. Retrieved from <https://www.for.gov.bc.ca/tasb/slrp/marine/south_island/baynes/docs/sandlance/Baynes_sandlance_%20draftreport.pdf>.

[30] Therriault, T., McDiarmid, A., Wulff, W., and Hay, D. (2002). Review of Surf Smelt (*Hypomesus pretiosus*) biology and fisheries, with suggested management options for British Columbia. Department of Fisheries and Oceans. Science Branch.

[31] Winslade, P. (1971). Behavioral and embryological investigations of the lesser sandeel, *Ammodytes marinus* Raitt. PhD. Thesis, Univ. East Anglia, Norwich, England.

It is believed that juveniles and adults both dwell in near shore pelagic waters. According to Therriault et al. (2002) "spawning time is affected by tidal and lunar cycles with marked increases in the number of spawners during high evening tides during full moons. During the spawning season, surf smelt concentrate just offshore, adjacent to spawning beaches of fine to coarse gravel (1-7 mm diameter)." Winter spawning does not occur on exposed beaches, and "eggs that are kept moist and cool during low tides and/or high temperatures and have increased water circulation around developing embryos have improved egg survival rates".[32]

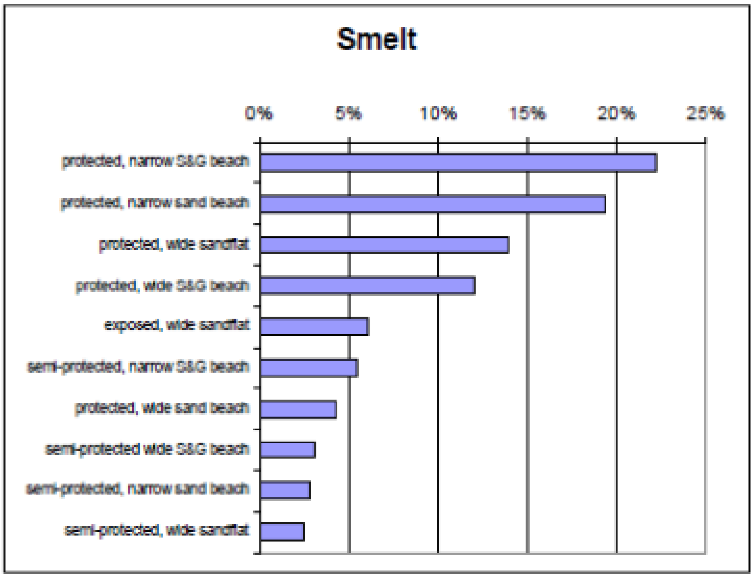


Figure 5C. Percentage occurrence of surf smelt against exposure/beach type.

Harper and Ward (2001) found that surf smelt prefer very-protected to semi-protected as well as exposed shoreline types with a strong (>70%) preference for protected sites (**Error! Reference source not found.**5C)28[28]. Surf smelt eggs typically reside attached to beach substrates for 10 days before hatching to become planktonic larvae.

Historical Distribution

Despite a small local fishery having been undertaken in B.C., predominantly in Burrard Inlet, for more than 100 years, surf smelt distribution and abundance has been poorly described, and local spawning beaches have not been fully determined.[32]

Timing

In general, surf smelt appear to have distinct spawning seasons as well as a year round spawning stock. Surf smelt spawning seasons can be classified as May-October, fall/winter as September-March, or year round[33].

Work Site Occurrence Potential

Similarly to sand lance, the un-protected narrow sand beach character of the project shoreline supports less than 5% of occurrences of surf smelt activity (**Error! Reference source not found.**C). Winter spawning does not occur at all on exposed beaches as surf smelt prefer very-protected to semi-protected with a strong (>70%) preference for protected sites (Figure 6C).

---

[32] Therriault, T., McDiarmid, A., Wulff, W., and Hay, D. (2002). Review of Surf Smelt (*Hypomesus pretiosus*) biology and fisheries, with suggested management options for British Columbia. Department of Fisheries and Oceans. Science Branch.

[33] Ramona deGraaff, personal communication, 2011.

There are isolated pockets of fine to coarse gravel (1-7 mm diameter) near the work area that are consistent with preferred spawning substrates of surf smelt; however, the dominant substrate type is gravel to cobble (> 20 mm). Considering that the beach exposure and substrate size, as well as lack of known historical spawning usage, suggests that the project footprint has low potential to support surf smelt spawning activity.

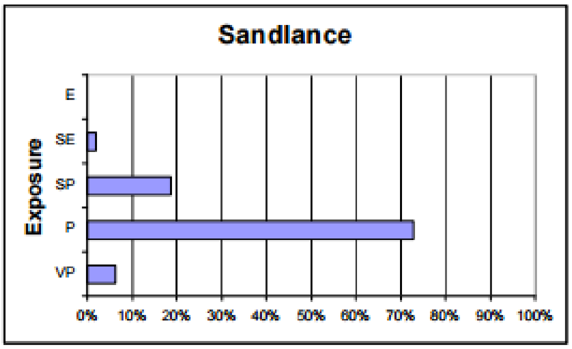


Figure 2 Occurrence of sandlance habitat with exposure (based on 96 km of comparison)

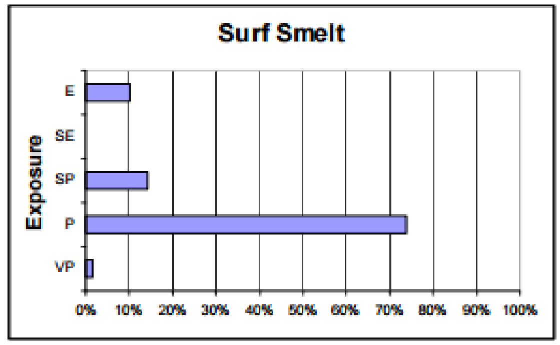


Figure 3 Occurrence of surf smelt habitat with exposure (based on 303 km of shoreline)

Figure 6C. Surf smelt and sandlance spawning habitat preference for protected sites.[34]

[34] Harper, J. 2001. Comparison of Washington State Department of Fish and Wildlife Beach Spawning Data to Shore Zone Data. 13 pp.

APPENDIX C – CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

Construction Environmental Management Plan
For the Lazo Shoreline Protection Project

This CEMP is provided to ensure that construction related impacts are minimized through the effective implementation of Best Management Practises (BMP's) and mitigation measures.

Potential construction-related impacts to environmentally sensitive features include:

1. Spills
2. Mechanical destruction of wildlife, forage fish eggs, and vegetation.
3. Compaction of substrates.
4. Damage and loss of integrated LWD in the shoreline.
5. Release of sediment to marine habitats.
6. Encroachment into sensitive areas.

The management of these risks will be accomplished through the implementation of this plan under the supervision of an Environmental Monitor.

9.1 ENVIRONMENTAL MONITOR

A "third party" Environmental Monitor (EM) should be contracted to implement the CEMP and to oversee certain components of the proposed work to ensure that environmental impacts are minimized through appropriate mitigation measures. The amount of time the EM will need to dedicate to the project will vary significantly with the timing and method of construction and the diligence and experience of the contractor.

The QEP must be a biologist, applied scientist, or technologist who is registered and in good standing with the BC College of Applied Biology and have a minimum of 2 years experience in environmental monitoring.

9.1.1 Authority of the Environmental Monitor

The environmental monitor will have the authority to halt construction and direct construction personnel and equipment to implement mitigation measures necessary to protect environmental resources before resuming work.

9.1.2 Responsibilities of the Environmental Monitor

The responsibilities of the EM are as follows:

1. Monitor construction activities to ensure compliance with the CEMP, and federal, provincial, and municipal regulations.
2. Ensure adequate environmental mitigation supplies (spill kits, filter fabric, etc.) are on hand and readily available.
3. Ensure the project crew is familiar with the requirements of the CEMP and that emergency response procedures are understood.

4. Maintain a log of construction activities, mitigation measures, and observed impacts or enhancements noted during the course of the project construction.
5. Communicate on a frequent basis with the Construction Supervisor to ensure ongoing implementation of mitigation requirements, to discuss any environmental management issues, and to address upcoming issues that could cause project delays.
6. Liaise with municipal staff, DFO, MELP, and other parties regarding environmental aspects of the project.
7. Contact appropriate environmental agency personnel in the event of a significant environmental impact.
8. If required, prepare a final report documenting the project activities, mitigation measures employed, environmental impacts incurred, and any restoration or enhancement activities completed if required.

A pre-construction meeting between the contractor, EM, and Project Engineer must be completed prior to the commencement of construction. This meeting is to ensure key construction personnel aware of the environmental scope of work, the directives of the CEMP, general environmental concerns, contingency measures, and any rules and regulations applicable to the construction area.

9.2 TIMING OF WORKS

To minimize risks to aquatic habitats and other VEC's, the project works are to be completed during the least risk work window for DFO Area 14 are as follows:

Summer Window: June 1 - September 1

Winter Window: December 1 - February 15

9.3 IDENTIFICATION AND PROTECTION OF SENSITIVE AREAS

Prior to construction, the EM or contractor is to clearly mark the boundaries of the work area to identify machinery access and egress routes, "no fly zones", and areas of vegetation or LWD to be salvaged/replaced or avoided.

9.4 SEDIMENT AND EROSION CONTROL

Erosion control measures that prevent sediment from entering the marine environment in the vicinity of the construction site are a critical element of the project and shall be implemented by the Contractor. Construction activities will be managed to ensure compliance with Sections 35 and 36 of the *Fisheries Act*. Water samples should be tested onsite for turbidity with handheld meters. Water quality monitoring should to be done as determined by the EM or contractor on the basis of visual monitoring of water clarity, with turbidity wedge measurements taken if deemed necessary, as well as following precipitation events in excess of 35 mm. Water quality monitoring sites should be established at settling feature outlets.

As a guideline, the BC Water Quality Guidelines (BCWQG) (2001) for protection of aquatic life stipulates an acceptable increase of 8 NTU when background levels are between 8 and 80 NTU, and a 10% increase when background levels exceed 80 NTU. In the event the established limit is exceeded the, the EM should be consulted to determine whether additional impact mitigation measures are required.

The implementation and maintenance of sediment control measures and related equipment and supplies are the responsibility of the construction contractor, and will be designed, constructed, and maintained as required by the Environmental Monitor. Construction activities will not commence until proper sediment control measures are in place. Regular inspection of sediment control measures during construction will ensure these are functioning and maintained as required.

Specific measures to control sediment during construction will include:

1. No machinery is to work "in the wet" at any time without the permission of the Environmental Monitor.
2. Excavation will be stopped during intense rainfall events or whenever surface erosion occurs affecting the marine environment. This will be at the discretion of the EM.
3. Excavation and earthworks will be completed in an incremental manner to minimize the length of time that soils are exposed. Vegetation in adjoining areas will not be disturbed.
4. Disturbed areas of the site shall be secured against erosion during any periods of construction inactivity or shutdown.

9.5 PROTOCOL TO MITIGATE IMPACTS TO FORAGE FISH SPAWNING

In light of the fact that surf smelt are known to spawn throughout the year, there is no definitive "reduced risk work window" within which works can proceed without risk to these species. As such, the recommended approach is to complete forage fish spawning surveys at proposed project locations prior to commencing work to limit disruption to spawning activity or loss of incubating eggs. These surveys are to determine if spawning has recently occurred or if forage fish embryos are present in the area. These surveys must be conducted by a Qualified Environmental Professional (QEP) with proven experience in forage fish spawning habitat surveys. Surveys at the project location are to follow standard protocols (below).

Note that, in general, the majority of shoreline work should be completed during the summer season due to the longer daylight hours within which to work and the occurrence of stronger low tides during daytime hours than in winter.

9.5.1 Working in or Around Potential Intertidal Forage Fish Spawning Habitat

These guidelines apply to foreshore areas where data are deficient or non-existent with respect to the presence of forage fish spawning and/or duration of spawning period; and these beaches have been identified as suitable for intertidal spawning forage fish following a habitat suitability assessment by a QEP with proven experience in forage fish spawning habitat surveys. Sand lance are known to spawn at Goose Spit in December. There are currently no known forage fish spawning areas in the Campbell River area; this is due to a lack of sampling and assessment work in the area.

Prohibited work periods at potential spawning beaches:

1. Works may be permitted if it commences within 7 days after the location is inspected by a QEP with proven experience in forage fish spawning habitat surveys and it is determined that no spawning is occurring or has recently occurred, and that no incubating embryos are present. The project may be further conditioned to require completion within a particular time.
    a. If no embryos are detected, the area must be resurveyed for the presence of spawning activity (eggs detected) every 7 days during the duration of the works.
    b. If spawning activity is detected in subsequent surveys, works will be delayed until surveys show no spawning is occurring, has recently occurred and no incubating embryos are present.

9.5.2 Sampling Protocols

1. Spawning surveys are to be conducted by a QEP with proven experience in forage fish spawning habitat surveys and experienced in conducting field sampling according to Washington Department Fish and Wildlife protocols, recently adopted by and in use in British Columbia.
   - Specifically, surveys for spawning activity must encompass the entire beach length. Sampling will occur at the project location and along the beach length according to standard protocols (200 – 300 m sampling stations). This is to ensure that spawning is detected throughout the entire spawning "bed" which generally encompasses an area of suitable habitat larger than the footprint of individual project works. The number of samples and area of sampling will be determined by the biologist in charge.
2. *In situ* or lab analysis of field collected sediments are to be conducted by a QEP with proven experience in forage fish spawning habitat surveys and experienced in conducting species verification, embryological classification, and brood analysis.
3. Egg incubation periods can be extrapolated following embryological classification and verified by a biologist experienced in conducting these analyses.
4. Spawning duration can be extrapolated through a brood analysis of collected embryos.

9.6 VEGETATION AND LWD MANAGEMENT

1. Work areas must be walked by the EM and Project Supervisor to identify key vegetation and LWD to be salvaged and replaced upon completion of the days work.
2. Vegetation to be preserved must be flagged prior to the commencement of work.
3. Salvaged vegetation must be treated gently and as much as possible root structure should be maintained (with soil intact).
4. Work MUST proceed in an incremental manner to ensure suitable management of vegetation is feasible and implemented.
5. LWD must be embedded to the same degree that it was prior to construction work.
6. Fill material must be certified to be free of invasive species.

9.7 GENERAL MITIGATION MEASURES

1. Excavators must be outfitted with an environmentally friendly fluids package.
2. Excavator-related disturbances to intertidal and "above tide" substrates are to be minimized at all times. This includes: a) minimizing the footprint of excavator work, b) employing "bucket assisted" turns (rather than track turns) as much as possible, c) and limiting access to and from the site to a single location that is as high up in the intertidal as possible.
3. Upon finishing excavator works in the intertidal zone, areas with compacted substrates should be rehabilitated by lightly "stirring" substrates with the excavator bucket and replacing larger cobble and boulder substrates previously cleared for access.
4. Machine operators are to be advised of the sensitivity of the shoreline.
5. The shoreline access location (for machinery) and all other footprint areas are to be fully restored to pre-construction condition after the completion of works. This includes replacement of destroyed vegetation.
6. If required, concrete will be poured as soon as possible on dropping tides to maximize curing times. Wet concrete will be covered with poly sheeting to minimize exposure of aquatic organisms.
7. All machinery is to be clean and free of leaks.
8. As much as possible, mechanical harm to animals should be avoided. Larger organisms should be relocated prior to any disturbance.

9.8 SPILL RESPONSE

The accidental release of petroleum, oils, hydraulic fluids, lubricants, concrete additives, anti-freeze or other hazardous materials onto land surfaces or into the marine environment may result in degradation of habitat quality and could be a threat to human health. Environmental protection procedures for handling and storage of fuels and hazardous materials shall include the following items:

1. A spill kit of appropriate capacity to contain the largest possible spill is to be on-hand at all times.
2. Smaller spill kits are to be maintained on all machinery.
3. Refuelling of equipment is to occur only at designated fuelling stations located away from the shoreline.
4. All fuel, chemicals, and hazardous materials will be clearly marked.
5. Fire extinguishers are to be located on all machinery.
6. If accidental mixing of fuels, chemicals, and hazardous materials does occur, the waste product will be removed to an approved disposal/recycling facility.
7. Jerry cans are to be used/placed on poly sheeting and sorbent pads to contain spills.
8. Used oil, filters, and grease cartridge lubrication containers and other products of equipment maintenance will be collected and kept in a secure receptacle for later disposal.
9. In the event of a spill, the following guidelines should be followed:

    - Spills need to be immediately reported to the EM and the construction supervisor. Spills to the receiving environment are to be reported to the BC Provincial Emergency Program (1-800-663-3456) if they exceed the reportable limits (e.g. 100 litres of fuel or oil).
    - Immediately apply sorbent pads and booms as necessary.
    - Dispose of all contaminated debris, cleaning materials, and absorbent material by placing in an approved disposal site.
    - Debrief all site personnel on the incident and take additional precautions to ensure that similar accidents will not recur.

10. There are to be daily, documented inspections of impact mitigation measures, fire prevention and spill recovery supplies and any equipment working in and around watercourses.
11. A safety and emergency response plan will be completed and implemented prior to beginning work and appropriate spill recovery supplies will be on-site during the project.

9.9 COMMUNICATIONS

1. The project contractor is to maintain frequent communications with the EM throughout the progress of the work.
2. Fisheries and Oceans Canada staff are to be notified one week prior to the commencement of any construction activity.

APPENDIX D - EMAIL FROM CANADA WILDLIFE SERVICE

How intriguing.

Note the "s" on the end of Canadian Wildlife Service. This is not an official sign and it was not done by Canadian Wildlife Service (note the lack of 's'). If it were one of ours it would not be plain white, it would be blue. And it would have either or both the loon or Canada word mark on it. Someone, possibly the municipality?, is taking our name in vain.

That isn't to say that there may not be sensitive dune ecosystems there. Have you checked the sensitive ecosystems inventory? It's a bit dated, but still possibly of value. You can find that layer on iMap or EcoCat (both available through the provincial MoE).

I'd be interested to know if you find out who put that sign up.

kdb

From: Warren Fleenor [mailto:wfleenor@shaw.ca]
Sent: December 1, 2014 11:03 AM
To: Brock,Ken [PYR]
Subject: RE: Lazo Road Erosion Protection

Here's a photo of the actual sign Ken.

Warren

CURRENT ENVIRONMENTAL
Warren Fleenor, R.P.Bio
244 - 4th Street
Courtenay, BC
V9N 1G6
c:250.703.3355
p:250.871.1944
w: currentenvironmental.ca

From: Warren Fleenor [mailto:wfleenor@shaw.ca]
Sent: November 27, 2014 2:35 PM
To: Brock,Ken [PYR]
Subject: Lazo Road Erosion Protection

Hi Ken.

We are completing some erosion protection work on Lazo Road in Comox BC. See attached map and photo. The photo shows the sign in the mid-upper-left near the power pole.

I've noticed a CWS sign indicating the presence of sensitive vegetation on a small "duneform" (for lack of a better term) that is immediately adjacent to Lazo Road at the site.

I'm wondering if you may be able to provide additional information on this. I've been to the site over the past couple of weeks and have not noted anything rare with the exception of a small beach pea (*Lathyrus japonicus)*/Dune wildrye (*Leymus mollis)* community, though I recognize the timing is not ideal for inventory. The work is for the Town of Comox.

We are currently at the design stage - I'm arming up to try and push for the implementation of softer engineering approaches rather than a blanket of riprap along the area. There's also restoration of some areas that are eroding due to significant foot and vehicle traffic. Would you have any information on the area that might be of use or would you know of someone on the CWS that would?

With thanks,

Warren

CURRENT ENVIRONMENTAL
Warren Fleenor, R.P.Bio
244 - 4th Street
Courtenay, BC
V9N 1G6
c:250.703.3355
p:250.871.1944
w: currentenvironmental.ca

APPENDIX E – VEGETATION SPECIES FOUND IN SHOREZONES

Vegetation Species		
Shorezone	**Common**	***Scientific***
1	silver burweed	*Ambrosia chamissonis*
	Entire-leaved Gumweed	*Grindelia stricta*
	Himalayan blackberry	*Rubus armeniacus*
	Slender plantain	*Plantago elongata*
	Dune wildrye	*Leymus mollis*
	Common dandelion	*Taraxacum officinale*
	curled dock	*Rumex crispus*
	orchard grass	*Dactylis glomerata*
	Bull thistle	*Cirsium vulgare*
	Beach pea	*Lathyrus japonicus*
	hybrid wildrye	*Leymus x vancouverensis*
2	Black hawthorne	*Crataegus douglasii*
	Nootka rose	*Rosa nutkana*
	Himalayan blackberry	*Rubus armeniacus*
	Trailing blackberry	*Rubus ursinus*
	Dune wildrye	*Leymus mollis*
	Slender plantain	*Plantago elongata*
	Bull thistle	*Cirsium vulgare*
	Sitka spruce	*Sitka stichensis*
	snowberry	*Symphoricarpos albus*
3	Sheep sorrel	*Ambrosia chamissonis*
	Nootka rose	*Rosa nutkana*
	Non-native grass	*Poa spp.*
	Hairy cats ear	*Hypochaeris radicata*
	Scotch broom	*Cytisus scoparius*
	Beach pea	*Lathyrus japonicus*
	Yarrow	*Achillea millefolium*
4	silver burweed	*Ambrosia chamissonis*
	Non-native grass	*Zoa. Spp*
	Dune wildrye	*Leymus mollis*
	Beach pea	*Lathyrus japonicus*
	Slender plantain	*Plantago elongata*
	Nootka rose	*Rosa nutkana*
	Black hawthorne	*Crataegus douglasii*
	Scotch broom	*Cytisus scoparius*
	Sitka spruce	*Sitka stichensis*
	Bracken fern	*Pteridium aquilinum*
	Wild carrot	*Daucus carota*
5	silver burweed	*Ambrosia chamissonis*
	Non-native grass	*Zoa. Spp*
	Dune wildrye	*Leymus mollis*
	Beach pea	*Lathyrus japonicus*
	Nootka rose	*Rosa nutkana*
	Scotch broom	*Cytisus scoparius*
	Bracken fern	*Pteridium aquilinum*
	Entire-leaved Gumweed	*Grindelia stricta*
	Trailing blackberry	*Rubus ursinus*
	Bracken fern	*Pteridium aquilinum*
	Seashore lupine	*Lupinus littoralis*
	Moss species	*Racomitrium*
6	silver burweed	*Ambrosia chamissonis*
	Non-native grass	*Zoa. Spp*
	Dune wildrye	*Leymus mollis*
	Beach pea	*Lathyrus japonicus*
	Slender plantain	*Plantago elongata*
	Large-headed sedge	*Carex macrocephela*
	Entire-leaved Gumweed	*Grindelia stricta*
	Brome	*Bromus spp*
	Moss species	*Racomitrium*
7	Non-native grass	*Zoa. Spp*
	Dune wildrye	*Leymus mollis*
	Beach pea	*Lathyrus japonicus*

APPENDIX F – HISTORICAL EAGLE NEST USAGE OBSERVATIONS

Nest ID	BAEA-106-323
Tree Status	Tree Standing
Nest Name	Southwind Road

Nest Observations

Nest ID	Date of Observation	Survey Type	Nest Site Status	Nest Tended	Adult Incubating	Adults perched on the nest	Adults perched on the nest tree	Adults perched within 50m	Adults perched within 200m	Number of chicks
BAEA-106-323	21/06/2013	G	1C			0	0	0	1	1
BAEA-106-323	8/9/2011	G	N/A	Yes		0	0	0	0	0
BAEA-106-323	9/5/2011	G	A	Yes						
BAEA-106-323	28/04/2011	G	N/A	No	No	0	0	0	0	
BAEA-106-323	11/10/2009	G	A	Yes		2				
BAEA-106-323	11/8/2009	G	N/A							
BAEA-106-323	20/04/2008	G	N/A	No	No	0	0	0		
BAEA-106-323	23/03/2008	G	N/A	No	No	0	0	0		
BAEA-106-323	2/3/2008	G	OT	No	No	0	0	0	1	
BAEA-106-323	31/08/2007	P	0C	Yes						0
BAEA-106-323	15/03/2007	A	A	Yes				2		
BAEA-106-323	31/08/2006	G	A							