

Habitat Assessment

Sterling Shipyard Remediation and Infill Project

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Vancouver Fraser Port Authority

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Table of Contents

Signature Page

<hr/>	
Notice to Reader	i
<hr/>	
1 Introduction	1
<hr/>	
2 Project Overview	2
<hr/>	
2.1 Project Title	2
2.2 Project Location	2
2.3 Project Dates	2
2.4 Project Rationale	3
<hr/>	
3 Project Description	4
<hr/>	
3.1 Project Scope	4
3.1.1 Site Preparation	4
3.1.2 Rock Berm Construction	4
3.1.3 Remedial Excavation	5
3.1.4 Infilling and Rough Grading	5
3.1.5 Grading and compaction of the newly placed engineered fill.Habitat Offsetting	5
3.1.6 EConcrete Pilot Study	6
<hr/>	
4 Description of Existing Environment	7
<hr/>	
4.1 Methods	7
4.1.1 Desktop Review	7
4.1.2 Terrestrial Field Survey	8
4.1.3 Intertidal Field Survey	8
4.1.4 Subtidal Dive Survey	9
4.2 Results	9
4.2.1 Desktop Review	9
4.2.1.1 General Site Description	9
4.2.1.2 Site Contamination	10
4.2.1.3 Vegetation Resources	10

Table of Contents (Cont'd)

4.2.1.3.1	Invasive Species	10
4.2.1.4	Wildlife Resources.....	11
4.2.1.5	Fisheries Resources.....	11
4.2.1.5.1	Salmon	12
4.2.1.5.2	Herring.....	12
4.2.1.5.3	Groundfish.....	12
4.2.1.5.4	Surf Smelt	12
4.2.1.5.5	Sand Lance	13
4.2.1.5.6	Invertebrates	13
4.2.1.6	Marine Mammals.....	13
4.2.1.7	Aquatic Vegetation	13
4.2.1.8	Intertidal Fish Habitat	14
4.2.1.9	Subtidal Fish Habitat	14
4.2.1.10	Species at Risk.....	15
4.2.1.10.1	Terrestrial Wildlife and Mammals.....	15
4.2.1.10.2	Birds	15
4.2.1.10.3	Marine Fish and Invertebrates	17
4.2.1.10.4	Marine Mammals.....	19
4.2.2	Terrestrial Field Survey.....	19
4.2.2.1	General Site Description	19
4.2.2.2	Vegetation Resources	20
4.2.2.2.1	Invasive Vegetation.....	21
4.2.2.3	Wildlife Resources.....	22
4.2.3	Intertidal Field Survey	22
4.2.3.1	Cobble Beach Habitat	23
4.2.3.2	Riprap Breakwater Habitat	25
4.2.4	Subtidal Field Survey	26
4.3	Summary of Existing Environment and Habitat Maps.....	26

5 Impacts and Residual Effects

27

Table of Contents (Cont'd)

5.1	Vegetation	29
5.1.1	Marine Riparian Habitat	29
5.1.2	Native Vegetation	29
5.1.3	Aquatic Vegetation	29
5.1.4	Invasive Vegetation	30
5.2	Wildlife	30
5.2.1	Birds	30
5.2.2	Terrestrial Mammals	31
5.3	Marine Fish Habitat	31
6	Mitigation Measures	32
6.1	Habitat Offsetting	32
7	Environmental Monitoring	33
8	Summary and Conclusions	34
9	References	35

In-Text Tables

Table 1:	Project Coordinates	2
Table 2:	Features and properties neighboring the Site	2
Table 3:	Project Least-Risk Timing Windows	2
Table 4:	Gantt Chart for Least-Risk Project Construction Periods	3
Table 5:	Substrate Classification Categories for Field Surveys	9
Table 6:	Bird Species at Risk with Potential to Occur on the Site	15
Table 7:	Federally-Listed Species at Risk with Potential to Occur on the Site (DFO, 2019)	17
Table 8:	Federally-Listed Marine Mammal Species at Risk with Potential to Occur on the Site (DFO, 2019)	19
Table 9:	Native Vegetation Occurring on the Site	21
Table 10:	Invasive Vegetation Occurring on the Site	21
Table 11:	Summary of Project Impacts and Residual Effects	27

Table of Contents (Cont'd)

In-Text Figures

Figure 1: Cobble beach	23
Figure 2: Riprap breakwater	23
Figure 3: Concrete lock-block wall	23

Appendices

I: Drawings	
› Drawing 1 – Site Location	
› Drawing 2 – Vegetation/Tree Removal	
› Drawing 3 – Location of Intertidal and Subtidal Survey Transects, Surveyed on May 13, 2021	
› Drawing 4 – Map Showing the Distribution of the Observed Habitats on May 13, 2021	
II: Site Photographs	
III: Intertidal Survey Transect Summary	
IV: Subtidal Dive Survey	

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1 Introduction

The Vancouver-Fraser Port Authority ('The Port Authority') is proposing a remedial excavation and infilling at the former Sterling Shipyard facility (the 'Site') located at 2089 – 2095 Commissioner Street, Vancouver, BC. The Site is currently contaminated with metals, polycyclic aromatic hydrocarbons (PAH) and polychlorinated biphenyls (PCBs) up to approximately 4 metres (m) depth. The purpose of the proposed excavation is to address the ecological risk associated with subsurface contamination, as well as to create new port industrial land. For the purposes of this report, 'the Project' refers to the Sterling Shipyard Remediation and infill and 'Project Area' refers to the Project footprint. Project drawings can be found in **Appendix I**. The Project Area is shown in **Drawing 1**. Preliminary Project components are shown in **Drawing 2**.

The Port Authority has retained SNC-Lavalin Inc. (SNC-Lavalin) to support environmental permitting and assessment works for the Project, including the preparation of a Category C Project Environmental Review (PER) submission to the Port Authority and a Fisheries Act Authorization (FAA) application. To support the permitting process, SNC-Lavalin was retained to conduct assessments of Project effects on marine and terrestrial resources, as well as to identify Project mitigation measures.

The scope of this combined marine and terrestrial Habitat Assessment report includes the terrestrial portion of the Site (the 'Upland Area'), the marine riparian area the intertidal area and the shallow subtidal area fronting the Site. This report has been prepared in accordance to VFPA's *Project & Environmental Review Guidelines – Habitat Assessment* (VFPA, 2015), environmental assessment best practices and SNC-Lavalin's professional understanding and expertise.

2 Project Overview

2.1 Project Title

The title of this Project is 'Sterling Shipyard Remediation and Infill'.

2.2 Project Location

The Project is located at 2089-2095 Commissioner Street, Vancouver, BC, on the southern shoreline of the Central Vancouver Harbour, within the Burrard Inlet, at the former Sterling Shipyard. The Site is located within Port Authority jurisdiction in the northern portion of the City of Vancouver, BC. The Site comprises an upland terrestrial area, an intertidal beach area and a subtidal water lot. The coordinates of the Site are presented in Table 1 below.

Table 1: Project Coordinates

Latitude	Longitude
49° 17' 12.5" N	123° 03' 52.7" W

The Project Area encompasses the area of excavation and infilling required as part of the Project scope, approximately 90 m in length and 65 m in width at its widest extent. Table 2 presents the features and properties that bound the Site.

Table 2: Features and properties neighboring the Site

Direction	Feature or Property
North	Vancouver Harbour
East	Lafarge North America
South	Port Authority Grounds, Commissioner Street, CP Railway
West	Parking area

2.3 Project Dates

The Project construction timeline is expected to start in Q2 2022 and conclude by Q1, 2023.

The least-risk work dates applicable to the Project are presented in Table 3 and Table 4.

Table 3: Project Least-Risk Timing Windows

Least-Risk Period	Start Date	End Date
Fisheries and Oceans Canada (DFO) Least-Risk work window for Burrard Inlet ¹	August 16	February 28
Outside of the General Bird Nesting Period for Nesting Zone A1 ²	August 16	March 15
Raptor Nesting Season ³	January 5	August 31

¹ DFO. 2014. British Columbia Marine/Estuarine Timing Windows for the Protection of Fish and Fish Habitat - South Coast and Lower Fraser Areas.

² Government of Canada. 2018. Nesting Periods.

³ BC Ministry of Environment and Climate Change Strategy. 2013. Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia.

Table 4: Gantt Chart for Least-Risk Project Construction Periods

Period	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
DFO Least-risk window												
General Bird Nesting period												
Raptor Nesting Season												

Unshaded areas represent least-risk periods

Initial Site preparation and construction activities are planned to start outside of least-risk periods. Ground disturbance activities (e.g., vegetation removal, wood debris removal) will not commence until a silt curtain has been installed around the work area. Vegetation/tree removal activities will not commence within the general nesting period prior to a songbird nesting survey conducted by a Qualified Environmental Professional (QEP). Additionally, if raptors are observed within 200 m of the Site, appropriate no-disturbance buffers will be established.

In-water works will be kept within the DFO least-risk work window for Burrard Inlet as much as possible. Due to the long-term nature of the Project, in-water works outside the least-risk window will occur. In-water works will not occur until a fish salvage has been completed by a QEP. If in-water works are planned outside of the DFO least-risk period, additional monitoring and mitigation measures will be implemented to prevent impacts to species during sensitive life stages, at the discretion of the Project Environmental Monitor. Vegetation clearing and noise-generating activity will be coordinated to take place outside of bird and raptor nesting seasons as much as feasible. In the event that nesting periods cannot be accommodated, additional mitigation measures will be implemented to minimize impacts.

Please refer to the Project Construction Environmental Management Plan (CEMP; Document No. 677011-0000-4ERA-0003) for detailed mitigation measures to be undertaken during the Project.

2.4 Project Rationale

The Project aims to undertake a brownfield redevelopment to create new port industrial land on the Site. The majority of Project works will take place within the Site’s intertidal zone, of which approximately 80% is considered to be contaminated. The Site substrate is contaminated with industrial woodwaste, metals, PAHs and PCBs up to approximately 4 m depth. The redevelopment of the Site will include remedial excavation of contaminated sediment to address current unacceptable ecological risks, followed by infilling with clean engineered fill material.

A rock berm will be installed in the low intertidal area of the Site to provide revetment for the development. The rock berm will be 100 m in length (east to west) with a maximum elevation of 7.7 m. The remedial excavation will occur at an average depth of 3.5 m in the intertidal area consisting of approximately 11,300 m³ by shored excavation and at an average depth of 1.7 m in the subtidal area consisting of approximately 5,475 m³ by dredging.

The excavation will be backfilled with engineered fill, which will be compacted after placement. Engineered fill will also be placed on the upland area of the Site. The finished surface of the Site will be graded gravel.

3 Project Description

3.1 Project Scope

Based on information available as of the date of this report, the following Project scope is anticipated:

- 1) Site Preparation.
- 2) Rock Berm Construction.
- 3) Remedial Excavation.
- 4) Infilling and Rough Grading.
- 5) Habitat Offsetting.
- 6) EConcrete Pilot Study

SNC-Lavalin understands that the Project scope is subject to change based on the Port's needs and engineering design considerations. Details of the above scope are presented in the following sections.

3.1.1 Site Preparation

The following tasks are anticipated for Site preparation:

- › Establishment of Site access points and routes;
- › Removal of trees and other vegetation, including management of noxious weeds, on the southern portion of the Site;
- › Establishment of the laydown area, stockpiling location, equipment storage and any other areas required for Project works;
- › Installation of erosion and sediment control measures (ESC) on the upland area of the Site;
- › Installation of a silt curtain around the in-water work area;
- › Establishment of water quality monitoring sites upstream and downstream of the work area;
- › Demolition of existing infrastructure;
- › Mobilization of machinery, materials, and equipment onto the Site; and
- › Initial dredging up to a depth of 3 m within the in-water work area to provide clearance for barges, if determined to be necessary.

3.1.2 Rock Berm Construction

The following tasks are anticipated for dredging of the rock berm footprint:

- › Dredging of the rock berm footprint to remove a liquefiable sand layer in order to provide rock berm stability:

- Dredging to an average depth of 1.7 m below existing seabed surface in the subtidal area, removing approximately 5,475 m³ of subtidal material.
- Dredging to be conducted using a barge-mounted clamshell dredge. Dredge material to be loaded onto a barge into water-proof containment and then transported off-site.
- › Dredge material to be offloaded on-site or transported to a permitted disposal facility:
 - Dredge material destined for the Site will be decanted via settling tanks and/or basins; and
 - Dredge material destined for off-site disposal will be disposed as contaminated material.
- › Placement of rock and riprap materials onto seabed:
 - Materials to be lowered into berm footprint from barge via clamshell bucket or grapple from a barge-mounted crane.

3.1.3 Remedial Excavation

The following tasks are anticipated for remedial excavation:

- › Excavation of substrate from the intertidal and subtidal area of the Site, up to an average depth of 3.5 m below Site grade;
- › Excavation is to take place in wetted conditions from both barge and land;
- › Sampling and testing of excavated substrate;
- › Management of dredge decant water; and

Disposal of contaminated substrate.

3.1.4 Infilling and Rough Grading

The following tasks are anticipated for backfilling and grading:

- › Placement of engineered fill on the Site:
 - Backfilling the excavation site with 41,000 m³ of engineered fill; and
 - Placement of additional engineered fill to elevate Site grade to approximately 6 m elevation.

3.1.5 Grading and Compaction of the Newly Placed Engineered Fill. Habitat Offsetting

A Habitat Offsetting Plan will be implemented after construction is completed. A Habitat Offsetting Plan, which will include specific offsetting measures, their specifications, and their methodology of implementation, will be provided to the Port Authority in order to support the Project *Fisheries Act* Authorization application. The Plan will include a comprehensive monitoring program to be implemented in order to manage the inherent uncertainties associated with habitat restoration and establishment after offsetting measures have been implemented. Specific mitigation measures to be undertaken during the implementation of habitat offsetting, as well as the requirements for post-implementation effectiveness monitoring, will also be defined in the Habitat Offsetting Plan.

3.1.6 EConcrete Pilot Study

A pilot study will be conducted as part of this Project to evaluate the effectiveness of EConcrete in creating viable fish habitat.

4 Description of Existing Environment

This section characterizes terrestrial, riparian, intertidal and subtidal habitat in the project area using desktop studies and field surveys, including:

- › A desktop review of fisheries and biological resources in the area using available literature and databases, including characterization of potential species at risk occurring in the Project Area;
- › A terrestrial field survey to determine general site conditions, wildlife, vegetation, and habitat potential on site;
- › An intertidal field survey to determine substrates, habitat type, species presence, including dominant species, and presence of sensitive species such as kelps and/or eelgrass;
- › A subtidal field survey using SCUBA divers to determine substrates, habitat type, species presence, including dominant species, and presence of sensitive species such as kelps and/or eelgrass; and
- › Preparation of a habitat map to show the habitat types in the Site footprint.

4.1 Methods

4.1.1 Desktop Review

Previous habitat assessments conducted on the Site, as well as information sources related to projects taking place near the Site (on the southern shoreline of Central Vancouver Harbour) were reviewed. Additionally, large-scale habitat assessments conducted in Burrard Inlet were available for review. The following information sources were consulted as part of this habitat assessment:

- › BC Conservation Data Centre (CDC). Locations of known occurrences of species at risk.
- › BC Conservation Data Centre. 2021. BC Species and Ecosystems Explorer. BC Ministry of Environment Victoria, B.C.
- › BC Conservation Data Centre: CDC iMap [web application]. 2021. Victoria, British Columbia, Canada.
- › British Columbia Coastal Resource Information System (CRIMS).
- › Butler, R. W., Couturier, A. R., & Dickson, E. 2015. *Status and Distribution of Marine Birds and Mammals in Burrard Inlet and Indian Arm, British Columbia*. Pacific Wildlife Foundation & Bird Studies Canada. Unpublished Report. Port Moody, BC and Port Rowan, Ontario.
- › Coastal Ocean Research Institute. 2016. *Mariner's guide to whales, dolphins, and porpoises of Western Canada*. Prepared by the Coastal Ocean Research Science Institute, Vancouver Aquarium Marine Science Centre. 62 pp.
- › Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Various dates. Species at risk assessments and update reports.
- › DFO. Various dates. Various information sources, including: Integrated Fisheries Management Plans (IFMPs), species and habitat-specific sources, tidal and bathymetric information, geospatial tools.

- › Haggarty, D. 2001. *An evaluation of fish habitat in Burrard Inlet, British Columbia*. M.Sc. Thesis, Department of Zoology, University of British Columbia.
- › Hay, D.E., P.B. McCarter, R. Kronlund and C. Roy. 1989. Spawning areas of British Columbia herring: a review, geographical analysis and classification. Volumes 1-6. Can. MS Rep. *Fish. Aquat. Sci.* 2019.
- › Hemmera Envirochem Inc. 2016. *Aquatic Effects Assessment Vancouver Harbour Response Base 2800 Commissioner Street Wharf*. Prepared for Western Canada Marine Response Corporation.
- › Ivanochko, Tara. 2018. *Birds, barks, and boats in Burrard Inlet: A spatial analysis of winter marine bird communities and recreational disturbances along the Kitsilano shoreline*.
- › Province of British Columbia. Fish Inventories Data Queries (FIDQ).
- › SNC-Lavalin. 2014. *Fish and fish habitat assessment for Sterling Shipyard intertidal reclamation. Prepared for Port Metro Vancouver*. Prepared for the Vancouver Fraser Port Authority.
- › Tsleil-Waututh Nation. 2017. *Burrard Inlet Action Plan*.

Additional supplemental sources were reviewed as referenced throughout the sections below.

4.1.2 Terrestrial Field Survey

A Site visit focusing on the terrestrial and intertidal environment of the Site was conducted on October 26, 2020 by a QEP accompanied by a project scientist. The weather on the day of the assessment was 10°C and sunny. A foot traverse of the Site was conducted, and notable features were noted and documented. During this visit, the following Site characteristics were investigated:

- › General Site conditions;
- › Native vegetation;
- › Invasive vegetation;
- › Wildlife presence;
- › Terrestrial habitat quality; and
- › Potential for wildlife to use the Site.

The tide at the time of assessment is presumed to have been close to low tide. According to DFO's 7 days Tidal Predictions, the tide between 8:42 AM and 3:44 PM on October 26, 2020 was predicted to be between 1.8 m and 4.4 m Chart Datum (CD) (DFO, 2020b). It is presumed that, at 10:20 AM, the water level was close to low tide, providing access to a large portion of the Site's intertidal zone.

4.1.3 Intertidal Field Survey

The intertidal survey was conducted as the tide was receding on May 13, 2021, to coincide with the lowest tide of the day (0.8 m CD at 1343h) (DFO, 2020b). The intertidal survey methodology was guided by DFO's Marine Foreshore Environmental Assessment Procedures (DFO, 2002). Six survey transects were established perpendicular to the waterline within the Site using a measuring tape that extended from the terrestrial zone to the waterline (Transection Locations are shown on **Drawing 3**). Photographs were recorded along the entire length of each transect (See **Appendix II**, Photos 17 through 32) and GPS coordinates recorded at each end of the transect, as well as at changes in predominant habitat type. Each transect was surveyed by QEPs supported by two project scientists who walked the length of the transect to observe and record habitat bands.

The intertidal zone in the Pacific Northwest shows strong ‘vertical zonation’ in the form of habitat bands. Habitat bands are defined as ‘repeatable assemblages of intertidal biota that usually have a unique colour signature and intertidal position’ (Howes, 2001). The start and end of each habitat band was recorded and the habitat within the band was characterized by substrate type present (see Table 5), as well as the presence and relative abundance of vegetation/algae and invertebrates.

Habitat bands were used to create a habitat map of the surveyed area with substrates described following the classification in Table 5 below following DFO, 2002.

Table 5: Substrate Classification Categories for Field Surveys

Substrate Type	Definition
Bedrock	Solid, continuous rock
Boulder	Rocks greater than ~25 cm in diameter
Cobble	Moderate to small-sized rocks, ~6 to 25 cm in diameter
Gravel	Small stones between ~2 mm and 6 cm in diameter
Fines	Fine deposits < 2 mm, including mud, clay and shell fragments
Shell Hash	Dominant presence (>50%) of shell fragments in substrate
Wood	Dominant presence (>50%) of wood in substrate

4.1.4 Subtidal Dive Survey

In addition to the intertidal survey, a subtidal dive survey was conducted to assess the subtidal marine habitat likely to be affected by dredging, revetment installation and/or installation of habitat offsetting features. The survey was completed by Foreshore Marine & Environmental Services on May 17, 2021. As part of the subtidal dive survey, two subtidal transects were established perpendicular to the shoreline and surveyed to assess the physical and biological features of the Site (shown on **Drawing 3**). Transect 1 was anchored at the sheet pile wall and extended perpendicularly offshore for 60 m. Transect 2 was anchored at a depth of approximately +1m CD and extended perpendicular to the shoreline to offshore. Quadrats were taken in the different habitat zones of each transect. Photographs illustrating site substrate and biota conditions were recorded. Specific survey methodology is described in the subtidal dive survey report in **Appendix IV**.

4.2 Results

4.2.1 Desktop Review

4.2.1.1 General Site Description

The Site is located at the former Sterling Shipyard, on the southern shore of the Central Vancouver Harbour, within Burrard Inlet. The majority of the Site surface is intertidal in nature, being re-submerged on a daily basis. DFO Tide Station 7735 (Vancouver), located approximately 3.4 km east of the Site, indicates that the average daily mean water level between October 1, 2015 and October 1, 2020 was 3.13 m CD. Between October 1, 2019 and October 1, 2020, the highest recorded water level was 5.25 m CD on

January 16, 2020, at 10:00 AM. The lowest recorded water level was 0.22 m CD in February 8, 2020, at 11:00 PM (DFO, 2020a).

The Site is located within the Coastal Western Hemlock (CWH) biogeoclimatic (BGC) zone and the dry maritime (dm) subzone (Meidinger & Pojar, 1991). The CWH BGC zone receives high amounts of precipitation and has a cool mesothermal climate (Meidinger & Pojar, 1991). The average annual precipitation within CWHdm is 1,827 mm per year. Within the CWH BGC zone, the wettest period occurs in December. The CWH BGC zone has an average maximum annual snowfall of 841 mm, with snowfall occurring within three months of the year (Meidinger & Pojar, 1991). The mean annual ambient air temperature within CWHdm is 9.8° C, with the average temperature during the coldest month being 1.9° C and the average temperature during the warmest months being 17.6° C (Meidinger & Pojar, 1991).

Previous reviews conducted by SNC-Lavalin indicate that the Site surface is covered by fine gravel and hosts a marine riparian vegetation along its southern boundary (SNC-Lavalin, 2014).

4.2.1.2 Site Contamination

Previous studies have identified contamination in sediment and pore water/seepage water across the upland, intertidal and subtidal areas of the Site, particularly in areas containing debris, wood waste and/or former shipyard-associated facilities (SNC-Lavalin, 2018). The contaminated fill layer ranges in thickness from 4 m to over 8 m and overlies native marine sands and glacial till. Within the Site footprint, approximately 80% of surface sediments are contaminated with metals, PAHs, and/or PCBs that occur at concentrations above applicable provincial and federal criteria/guidelines. Additionally, metals, petroleum hydrocarbons (PHCs) and PAHs have been identified in porewater/seepage water collected from the Site intertidal zone at concentrations greater than applicable provincial and federal guidelines for protection of marine aquatic life (CCME, 2021).

Within the upland area, a human health risk assessment (HHRA) confirmed that a future development scenario of infilling of the intertidal area posed no unacceptable risks (Golder, 2009). However, shallow soil contamination (metals, hydrocarbons, PAH) and wood waste fill material remain present across the upland area which may impose constraints for future development (i.e., additional disposal costs, limitations on building design or placement of utilities, generation of methane gas requiring subslab ventilation under buildings) (Golder, 2009).

4.2.1.3 Vegetation Resources

The representative vegetation community within the CWH BGC zone is comprised of Western Hemlock (*Tsuga heterophylla*), Douglas fir (*Pseudotsuga menziesii*), and western redcedar (*Thuja plicata*) trees, with Amabilis fir (*Abies amabilis*) and yellowcedar (*Cupressus nootkatensis*) trees commonly occurring within the wetter reaches of the zone (Meidinger & Pojar, 1991). Specific information relating to vegetation occurring on the Site was not available in desktop information sources. Within CWHdm, Douglas fir, Western Hemlock, flat moss (*Plagiothecium undulatum*) and western redcedar dominate vegetation cover (Meidinger & Pojar, 1991). Field observations of vegetation occurring on the Site are discussed in **Section 4.2.2.2.**

4.2.1.3.1 Invasive Species

The BC Invasive Alien Plant Program map (IAPP, 2021) was reviewed in order to locate reported incidences of invasive weed growth within 1 km the Site. The review had found four (4) incidences within 1 km of the Site:

- › Bohemian Knotweed (*Fallopia x bohemica*): 2 occurrences.
- › Japanese knotweed (*Reynoutria japonica*): 2 occurrences.

Site-specific information relating to invasive vegetation occurring on the Site was not available in desktop information sources. Field observations of vegetation occurring on the Site are discussed in **Section 4.2.2.2**.

4.2.1.4 Wildlife Resources

Vancouver Harbour is part of an Important Bird Area (IBA) designated by BirdLife International. The English Bay, Burrard Inlet & Howe Sound (BC020) IBA supports many bird species (IBA, 2020), including Barrow's Goldeneye (*Bucephala islandica*), as well as species at risk, such as the Western Grebe (*Aechmophorus occidentalis*), Surf Scoter (*Melanitta perspicillata*) and Great Blue Heron (*Ardea herodias fannini*).

Bald Eagles have been observed in the area (BC Ministry of Environment and Climate Change Strategy [ENV], n.d.), with repeated observations of Bald Eagle between 2008 and 2009 on the lot neighbouring the Site to the east. The Hancock Wildlife Foundation (HWF) has tracked nesting of eagles at the Lafarge Canada property neighbouring the Site to the east, indicating that nesting had occurred in on-site trees as recently as 2014, until the last tree on the property had been damaged by a windstorm. The HWF reported in August 2018, that Bald Eagles previously resident to the Lafarge site had established nests in trees located "several blocks away". (HWF, 2018).

Several bird species at risk have been identified as having potential to occur on the Site and are discussed in **Section 4.2.1.10.2**.

4.2.1.5 Fisheries Resources

The Project Site is located within Vancouver Harbour, which is located within DFO Management Area 28, Subarea 28-10. Subarea 28-10 is defined as "those waters of Burrard Inlet lying easterly of a line from [49° 19.023' N 123° 08.230' W] to [49° 18.796' N 123° 08.440' W] and westerly of a line from [49° 17.959' N 123° 01.590' W] to [49° 17.561' N 123° 01.582' W]" under the Pacific Management Area Regulations. DFO Subarea 28-10 comprises the Burrard Inlet between the First Narrows and Second Narrows.

Burrard Inlet supports a variety of fish species, including all five species of Pacific Salmon, Pacific Herring, Surf smelt, sand lance, sculpin and rockfish. Burrard Inlet itself is closed to commercial and recreational fishing due to navigational closure but is important to supporting the populations of nearby fisheries by providing rearing, feeding and spawning habitat. The Site has shallow and rocky substrate within the intertidal and shallow subtidal zones and is therefore considered potential breeding habitat for surf smelt and sand lance. The site's intertidal zone and waterlot are considered to be too shallow to be preferable habitat for rockfish species. Invertebrate species, including Dungeness crabs, barnacles and shrimp/prawn (Pacific Spot Prawn, Humpback Shrimp, Pink Shrimp) are also abundant in Burrard Inlet (DFO, 2020d; DFO, 2018b; Haggarty, 2001; SNC-Lavalin, 2014).

While Vancouver Harbour is closed to fishing, DFO Subarea 28-10 hosts fish species which contribute to surrounding fisheries. A previous habitat assessment completed by SNC-Lavalin evaluated the Project Site as a migration area for Pacific Salmon smolts, as well as a foraging area for Pacific Salmon smolts, Pacific Herring, Lingcod, Seaperches, Dungeness crabs and Intertidal bivalves. The site was also classified as a rearing area for Rockfish, Lingcod, Seaperches, Dungeness crabs and Flatfishes (SNC-Lavalin, 2014).

In a 2001 survey, juvenile lingcod were caught from the Burrard Inlet at Portside and New Brighton Parks. It is likely that the Project Site could be used by juvenile lingcod for foraging (SNC-Lavalin, 2014).

4.2.1.5.1 *Salmon*

Pacific Salmon utilize Burrard Inlet for rearing and migration, including Chinook salmon (*Oncorhynchus tshawytscha*), chum salmon (*Oncorhynchus keta*), coho salmon (*Oncorhynchus kisutch*), cutthroat trout (*Oncorhynchus clarki*), pink salmon (*Oncorhynchus gorbuscha*), sockeye salmon (*Oncorhynchus nerka*), and steelhead salmon (*Oncorhynchus mykiss*), with juvenile pink, chum and Chinook salmon being the most abundant (Tsleil-Waututh Nation, 2017; Haggarty, 2001). Vancouver Harbour itself is closed to salmon fishing due to navigational closure. However, contributes to nearby fisheries by providing habitat for Pacific Salmon. A previous habitat assessment completed by SNC-Lavalin evaluated the Project Site as a migration area for Pacific Salmon smolts (SNC-Lavalin, 2014).

The nearest salmon-bearing streams which flow into Burrard Inlet are located across Vancouver Harbour from the Site (BC Gov, 2021):

- › Lynn Creek: Confluence approximately 2.3 km northeast of the Site;
- › Seymour River: Confluence approximately 3.3 km northeast of the Site;
- › Mosquito Creek: Confluence approximately 3.6 km northwest of the Site; and
- › Mackay Creek: Confluence approximately 4 km northwest of the Site.

4.2.1.5.2 *Herring*

Burrard Inlet supports Pacific Herring and vital spawning areas have been identified within Howe Sound, near Horseshoe Bay, approximately 16 km northwest of the Site (DFO, 2015a; Hay et al., 1989). Vancouver Harbour itself is closed to Herring fisheries but falls under the Strait of Georgia stock and fishing area (DFO, 2018a). Herring spawning occurs within the northern coastal areas of Howe Sound approximately 15 km northwest of the Site (DFO, 2015a). Burrard Inlet is assumed to provide spawning habitat for Pacific Herring, which contributes to nearby fisheries. Pacific Herring utilizes intertidal and shallow subtidal areas of BC's coastal waters for spawning (DFO, 2015a) and could therefore be encountered along the shores of Vancouver Harbour.

4.2.1.5.3 *Groundfish*

DFO Area 28-10 is located within Groundfish Management Area 4B (DFO, 2021). The Pacific Region IFMP for groundfish includes seven commercial groundfish sectors: Groundfish trawl, Halibut, Sablefish, Inside Rockfish, Outside Rockfish, Lingcod, and Dogfish fisheries. Recreational fishing for groundfish occurs with a valid Tidal Waters Sport Fishing licence (~300,000), which is required for the recreational harvest of all species of fish.

Vancouver Harbour is closed to commercial and recreational groundfish fishing due to navigation restrictions. Since 2002, Rockfish Conservation Areas (RCA) have been established by DFO in order to protect coastal BC's rockfish (*Sebastes* spp.) populations from decline. No RCAs exist within Vancouver Harbour. The closest RCA is located within the Burrard Inlet at the Second Narrows (DFO, 2015b), located approximately 4.8 km east of the Site.

4.2.1.5.4 *Surf Smelt*

Surf smelt is considered a forage fish species (Boldt et al., 2019; Tsleil-Waututh Nation, 2017) and is fished recreationally and commercially within Burrard Inlet (DFO, 2012). First Nations fisheries for surf smelt also exist within Burrard Inlet (DFO, 2012). The surf smelt fishery is considered modest (DFO, 2016). A closure

is in effect between June 15 and August 15 to restrict fishing during the peak spawning period. Commercial and recreational fisheries are scheduled throughout the week, with commercial fishery occurring between Monday and Thursday and recreational fishery occurring between Friday to Sunday (DFO, 2016). In DFO Area 28, surf smelt is fished via seine net and gill net (DFO, 2016). The Site has shallow and rocky substrate within the intertidal and shallow subtidal zones and is therefore considered viable breeding habitat for surf smelt (SNC-Lavalin, 2014).

4.2.1.5.5 Sand Lance

Sand lance is considered a forage fish species (Boldt et al., 2019; Tsleil-Waututh Nation, 2017). At the present time, there is no fishery for sand lance in Canada and their relative abundance in Burrard Inlet is unknown (Tsleil-Waututh Nation, 2017). The Site has shallow and rocky substrate within the intertidal and shallow subtidal zones and is therefore considered viable breeding habitat for sand lance (SNC-Lavalin, 2014).

4.2.1.5.6 Invertebrates

DFO Area 28-10 is located within the Crab Management Area (CMA) I. Harvesting of crab is closed year-round in Subarea 28-10 due to navigational closure. The Pacific Region crab-by-trap fishery includes the harvest of Dungeness crab (*Metacarcinus magister*), Red Rock crab (*Cancer productus*), Red King crab (*Paralithodes camtschatic*) and Golden King crab (*Lithodes aequispinus*) (DFO, 2020c). The Site hosts Dungeness crabs within its intertidal and shallow subtidal areas (SNC-Lavalin, 2014).

Burrard Inlet hosts a variety of shellfish fisheries, including clams, oysters, mussels, scallops and prawns/shrimp (DFO, 2020d; SNC-Lavalin, 2014; Tsleil-Waututh Nation, 2017). The closest prawn and shrimp fishery near the Site occurs at Howe Sound (DFO, 2020d). Intertidal and shallow subtidal habitats along the shores of Vancouver Harbour contribute to surrounding fisheries, and invertebrates such as prawn and shrimp are considered likely to occur on the Site. Encrusting invertebrates such as barnacles were also observed to be abundant on-Site during field studies undertaken in 2021, 2020 and 2014 (SNC-Lavalin, 2014).

4.2.1.6 Marine Mammals

Burrard Inlet hosts a variety of marine mammal species, including whales, seals and sea lions (Coastal Ocean Research Institute, 2016; Tsleil-Waututh Nation, 2017). The most common marine mammal in the Burrard Inlet is the Harbour Seal (*Phoca vitulina*). During the Site visit conducted on October 26, 2020, one Harbour Seal was observed in the water, approximately 300 m offshore of the Site. No marine mammals were observed during the intertidal habitat survey on May 13, 2021. Several marine mammal species at risk have been identified as having the potential to occur on the Site and are discussed in **Section 4.2.1.10.4**.

4.2.1.7 Aquatic Vegetation

Aquatic vegetation is considered to be a vital part of the marine environment, the loss of which has been associated as a key driver of declines in populations of fish, birds, invertebrates and marine mammals. Aquatic vegetation, such as kelp forests consisting of bull kelp (*Nereocystis luetkeana*) are linked to significant fisheries and the abundance of forage fish (Tsleil-Waututh Nation, 2017). Geospatial information relating to the location and density of kelp beds, eelgrass and other important aquatic vegetation is sparse. The collection and publication of such information is considered a priority by the Tsleil-Waututh Nation as part of restoring Burrard Inlet's habitat functions (Tsleil-Waututh Nation, 2017).

During a 2014 habitat assessment on the Site, rockweed and sea lettuce were observed to dominate the mid-intertidal region. The nearshore subtidal area was observed to contain small brown kelp (*Laminaria* sp.). Algae was observed to be uncommon below -3.5 m depth (SNC-Lavalin, 2014). A review of the FREMP-BIEAP Habitat Atlas, compiled as part of the BC Community Mapping Network (CMN) identified a bed of bull kelp located adjacent to the Site's waterlot to the east (CMN, 2020).

4.2.1.8 Intertidal Fish Habitat

SNC-Lavalin's 2014 field study indicated that the intertidal habitat of the Site was observed to be an armoured shoreline with a gently sloping beach comprised mainly of cobble and pebble within the middle intertidal, transitioning into mud in the lower intertidal and shallow subtidal areas. Barnacles, rockweed (*Fucus gardneri*) and sea lettuce (*Ulva* spp.) were observed to dominate the mid-intertidal, with an abundance of shore crabs (*Carcinus* spp.). Riprap extending into the shallow subtidal was observed to be covered with small brown kelp species, sea stars (*Astroidea* spp.) and crabs (SNC-Lavalin, 2014).

A 2016 study conducted on a nearby Site (2800 Commissioner Street; approximately 1.5 km northeast of the Site) provided a description of the local intertidal habitat (Hemmera Envirochem Inc., 2016). The intertidal zone of 2800 Commissioner Street was characterized by a steep slope, highly disturbed backshore vegetation and boulder-sized riprap transitioning to a mixture of sand and pebbles towards the lower intertidal zone. A small sandy/gravelly beach with a gradual slope was also present on that site. Macroalgae and invertebrates were scarce on this site, with brown algae (*Fucus* sp.) and sea lettuce being observed. Within the lower intertidal zone, rockweed and acorn barnacles were also observed (Hemmera Envirochem Inc., 2016).

4.2.1.9 Subtidal Fish Habitat

SNC-Lavalin's 2014 field study indicated that subtidal substrate to about -3.5 m CD was observed to consist of mud with occasional cobble, shell and debris. The lower intertidal and shallow subtidal contained a mixture of seersucker kelp and sugarwrack kelp. Sugarwrack covered nearly 100% of the seabed and different species of crabs and fish (e.g., sea perch) were observed beneath the algal cover. Dungeness crabs were mainly observed in the muddy subtidal. Below about -3.5 m, algae was uncommon. Bivalve (cockle and clam) shells and holes were observed in the subtidal zone.

The 2016 study at 2800 Commissioner Street (1.5 km northeast of the Site; Hemmera Envirochem Inc., 2026) indicated subtidal substrate of pebbles mixed with sand and shell fragments, with some small boulders present and patches of organic detritus. Bull Kelp, sea lettuce, fringed colander kelp (*Agarum fimbriatum*) and sea sorrel (*Desmarestia aculeata*) were observed and identified as providing viable understory habitat for marine fish and invertebrates (Hemmera Envirochem Inc., 2016). Red rock crab (*Cancer productus*), sea star species (*Dermasterias imbricate* and *Luidia folioata*), white-plumed anemones (*Metridium facimen*) and feather duster worms (*Eudistylia vancouveri*) were observed to inhabit the subtidal zone. During this survey, sculpin and unidentified fish were also observed incidentally (Hemmera Envirochem Inc., 2016).

4.2.1.10 Species at Risk

Species at risk include those that are listed as endangered, threatened, or special concern by either the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or under the federal *Species at Risk Act*¹ (SARA), or those species that are listed under the *British Columbia Wildlife Act*² (WLA).

Federally, species at risk are covered by the *Canada Wildlife Act* and are ranked by COSEWIC as follows: extinct, endangered, extirpated, threatened, special concern, not at risk and data deficient. COSEWIC rankings are recommendations to the federal government, following which the government then decides on whether or not the species will be listed under the SARA. Species listed in Schedule 1 of SARA are species officially at risk in Canada and are protected under the SARA. Schedule 2 and 3 species are not officially protected under SARA and are not considered in this section of this report.

Provincially, the red list includes any indigenous species that is extirpated, endangered, or threatened in British Columbia (BC Gov, 2021b). The blue list includes any indigenous species that is of special concern in British Columbia. The yellow list includes uncommon, common, declining and increasing species of least concern. Yellow list species are not considered in this section of this report.

4.2.1.10.1 Terrestrial Wildlife and Mammals

No occurrences of wildlife species at risk or their critical habitat have been identified on the Site (BC CDC, 2020). However, literature review identified several species that occur within Vancouver Harbour, or in locations that are nearby and share habitat similarities with the Site. This section details species at risk that have reasonable likelihood to occur on the Site in some capacity, based on literature review. All potential for use by wildlife species at risk is considered to be temporary and transient in nature, with no permanent nesting or residence on the Site, due to the Site's isolated nature and the surrounding level of human industrial activity.

Although terrestrial mammals were not observed on the Site during field investigations, the marine riparian vegetated area may support foraging by the little brown myotis (*Myotis lucifugus*), a bat species listed as Endangered on SARA's Schedule 1. The young forest on the Site is not considered to be suitable for roosting by this species, therefore only uses of a transient nature are considered to have the potential to occur.

4.2.1.10.2 Birds

Several bird species at risk have the potential to occur on the Site. The identified species are listed in Table 6.

Table 6: Bird Species at Risk with Potential to Occur on the Site

English Name	Scientific Name	Species at Risk Act Schedule 1 Designation	BC List
Barn Swallow	<i>Hirundo rustica</i>	Threatened	Blue
California Gull	<i>Larus californicus</i>	No Status	Blue
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	No Status	Blue
Great Blue Heron	<i>Ardea herodias fannini</i>	Special Concern	Blue

¹ *Species at Risk Act* (SARA), S.C. 2002, c. 29, last amended on February 3, 2022.

² *Wildlife Act* (WLA) [RSBC 1996] Chapter 488.

Table 6 (Cont'd): Bird Species at Risk with Potential to Occur on the Site

English Name	Scientific Name	Species at Risk Act Schedule 1 Designation	BC List
Horned Grebe	<i>Podiceps auritus</i>	Special Concern	Yellow
Long-tailed Duck	<i>Clangula hyemalis</i>	No Status	Blue
Surf Scoter	<i>Melanitta perspicillata</i>	No Status	Blue
Western Grebe	<i>Aechmophorus occidentalis</i>	Special Concern	Red

Based on Information from: Butler, 1995; Butler *et al.*, 2015; BC CDC, 2020; IBA, 2020; and Stanley Park Ecology Society, 2014

Barn Swallow

Barn Swallows are listed as threatened under the federal SARA and are provincially Blue-Listed. Barn Swallows are common in urban environments and may use the vertical surfaces of nearby structures and man-made features, such as dock and railyard infrastructure, for nesting (COSEWIC, 2011). Due to the lack of or man-made structures on the Site, Barn Swallow nests are unlikely to be encountered. However, Barn Swallows travel significant distances from nesting areas to forage (COSEWIC, 2011) and may therefore occur on the Site to forage.

California Gull

The California Gull is a provincially Blue-listed seabird known to occur within Burrard Inlet. Individual gulls have been observed foraging within 10 km of the Site (Butler *et al.*, 2015). California Gulls are known to forage up to 17.4 km from nesting colonies (BC CDC, 1994) and may therefore occur within the Site's waterlot to forage. Colonies of California Gulls have not been documented within Burrard Inlet (BC Breeding Bird Atlas, 2021), therefore, it is considered unlikely that California Gull colonies would nest on the Site.

Double-crested Cormorant

The Double-crested Cormorant is provincially Blue-listed and forage by diving into marine waters up to 20 km from their roost site (BC CDC, 1995). They nest on small rocky islands, man-made structures overhanging water (such as bridges) and on steep rocky cliffs, generally between 4 metres and 17 metres above the high-tide line (Zevit, 2010). Double-crested Cormorant foraging habitat has been identified within 2 km of the Site (Butler *et al.*, 2015). Double-crested Cormorants have also been observed to nest on Iron Workers Memorial Bridge, located 2 km east of the Site (Butler *et al.*, 2015).

Due to the lack of man-made overhanging structures and exposed rocky surfaces 4 metres above the high-tide line on the Site, Double-crested Cormorant nesting is considered unlikely to occur on the Site. However, Double-crested Cormorant may forage within the waterlot of the Site.

Great Blue Heron

A review of the BC Community Mapping Project's Great Blue Heron Atlas (GBHA, n.d.), information from the Stanley Park Ecology Society (2014), and surveys conducted within Vancouver Harbour (Butler *et al.*, 2015), indicates that Great Blue Heron colonies occur in Stanley Park, located approximately 4 km northwest of the Site. An observation of a Great Blue Heron nest was made in March 2020 at Hastings Park, approximately 1.8 km southeast of the Site (iMap BC, 2020).

The Great Blue Heron is listed as Special Concern under SARA and is BC Blue-listed. The project is within 5 km of a Great Blue Heron breeding colony (GBHA, n.d.; Stanley Park Ecology Society, 2014). Great Blue

Hérons may forage up to 10 km from their colonies (Stanley Park Ecology Society, 2014) and may therefore forage within the waterlot of the Site.

Horned Grebe

The Horned Grebe is listed as Special Concern under SARA. Horned Grebes primarily nest in freshwater environments (Butler et al., 2015; COSEWIC, 2009), therefore nesting is considered unlikely to occur on the Site. Horned Grebes are known to overwinter in coastal areas of BC and individuals have been identified within 1 km of the Site (Butler et al., 2015). Therefore, Horned Grebes may overwinter near the Site and forage within the Site’s waterlot.

Surf Scoter

Surf Scoters are provincially Blue-listed and commonly overwinter within coastal regions of BC (Butler et al., 2015). Surf Scoter commonly migrate north to reproduce within inland areas, away from the coast (Butler et al., 2015), therefore nesting is unlikely to occur on the Site. During autumn and winter seasons, overwintering Surf Scoters can occur within Burrard Inlet in large numbers to forage within shallow marine coastlines characteristic of the Site. The Surf Scoter is also one of the most commonly occurring waterfowl in Burrard Inlet (Buter et al., 2015) and is therefore considered likely to occur within the Site’s waterlot or intertidal zone.

Western Grebe

Western Grebes are listed as Special Concern under SARA and are BC Red-listed. Western Grebe breeding habitat occurs within inland freshwater environments away from the marine coast (COSEWIC, 2014), therefore Western Grebe nesting is considered unlikely to occur on the Site. However, Western Grebes overwinter on BC coasts (COSEWIC, 2014) and have been observed to forage in dense numbers within the Site’s waterlot (Butler et al., 2015). Therefore, overwintering Western Grebes are considered likely to occur to forage within the Site’s waterlot during construction.

4.2.1.10.3 Marine Fish and Invertebrates

A review of DFO’s Aquatic Species at Risk map (DFO, 2019) indicated eight species at risk with potential to occur in the marine habitat of the Burrard Inlet. The identified species at risk are listed in Table 7.

Table 7: Federally-Listed Species at Risk with Potential to Occur on the Site (DFO, 2019)

English Name	Scientific Name	<i>Species at Risk Act</i> Schedule 1 Designation	BC List
Northern Abalone	<i>Haliotis kamtschatkana</i>	Endangered	Red
Basking Shark (Pacific)	<i>Cetorhinus maximus</i>	Endangered	No Status
Bluntnose Sixgill Shark	<i>Hexanchus griseus</i>	Special Concern	No Status
Tope	<i>Galeorhinus galeus</i>	Special Concern	No Status
Yelloweye Rockfish	<i>Sebastes ruberrimus</i>	Special Concern	No Status
Longspine Thornyhead	<i>Sebastolobus altivelis</i>	Special Concern	No Status
Rougheye Rockfish Type I	<i>Sebastes</i> sp. type I	Special Concern	No Status
Rougheye Rockfish Type II	<i>Sebastes</i> sp. type II	Special Concern	No Status

Basking Shark (Pacific Population)

Although the Basking Shark is not considered likely to occur within Vancouver Harbour, there is potential for it to occur in any shallow Pacific waters off the coast of BC (COSEWIC, 2007e). The Basking shark is a large fish, reaching up to 12.2 m in size (COSEWIC, 2007e), and is therefore considered unlikely to occur within the shallow waters of the Site. Additionally, the substrate of the Site is abundant in suspended organics and silt, making it less preferable habitat.

Northern Abalone

The range for Northern Abalone is commonly found along coastal BC waters, but the Site is not considered suitable as the Northern Abalone's primary habitat is bedrock and/or cobble with an absence of gravel and mud (COSEWIC, 2009), both of which are abundant in the Site substrate. Therefore, it is not considered likely that the Northern Abalone utilizes the Site.

Bluntnose Sixgill Shark

The Site is an intertidal and shallow subtidal zone, considered to be too shallow to be part of Bluntnose Sixgill Shark range. The upper limit of Bluntnose Sixgill shark range is identified to be 91 m below ocean surface (CO-SEWIC, 2007a). Therefore, it is not considered likely that Bluntnose Sixgill Shark will be encountered on-site during construction.

Tope Shark

It is possible that Tope may occur within Burrard Inlet, although it has not been documented to date. Tope habitat has been described as "coastal pelagic, often well offshore but not oceanic" (COSEWIC, 2007d). The closest reported incidental catches in fishing trawls have occurred off the western coast of Vancouver Island, 95% of which were at depths between 47 m and 285 m below sea surface (COSEWIC, 2007d). Given the shallow and intertidal nature of the Site, occurrence of Tope in and around the Project Site is considered unlikely.

Yelloweye Rockfish

Yelloweye rockfish may likewise potentially occur within Burrard Inlet and have been caught in fisheries trawls as close to the Site as Howe Sound, at relatively shallow depths (COSEWIC, 2008). However, Yelloweye Rockfish habitat preference is documented to be for substrates that are "hard, complex and have some vertical relief, such as broken rock, rock reefs, ridges, overhangs, crevices, caves, cobble and boulder fields" (COSEWIC, 2008, p. 24), whereas the Site's substrate primarily consists of sand, gravel and mud. Therefore, due to the nature of the Site substrate, occurrence of Yelloweye rockfish on-Site is not considered likely.

Longspine Thornyhead

The upper limits of Longspine Thornyhead range are identified to be 500 m below sea surface (COSEWIC, 2007b), therefore the Longspine Thornyhead is very unlikely to be encountered in the shallow waters associated with the Site.

Rougheye Rockfish

Rougheye Rockfish may occur within the Burrard Inlet but are not considered likely to be encountered on the Site, as 95% of incidental fishing trawl catches occurred at depths between 170 and 650 m below sea surface (CO-SEWIC, 2007c). It is possible that Rougheye Rockfish occur at shallower depths, but their preferred habitat is identified to be in "areas with frequent boulders" (COSEWIC, 2007c), which is uncharacteristic of the Site.

4.2.1.10.4 Marine Mammals

A review of DFO’s Aquatic Species at Risk map (DFO, 2019) indicated six Species at Risk with potential to occur in the marine habitat of the Burrard Inlet. The identified species at risk are listed in Table 8.

Table 8: Federally-Listed Marine Mammal Species at Risk with Potential to Occur on the Site (DFO, 2019)

English Name	Scientific Name	Species at Risk Act Schedule 1 Designation	BC List
Harbour Porpoise	<i>Phocoena phocoena vomerina</i>	Special Concern	Blue
Steller Sea Lion	<i>Eumetopias jubatus</i>	Special Concern	Blue
Grey Whale	<i>Eschrichtius robustus</i>	Special Concern	Blue
Humpback Whale	<i>Megaptera novaeangliae</i>	Special Concern	Blue
Killer Whale (Transient)	<i>Orcinus orca</i>	Threatened	Red
Killer Whale (Resident)	<i>Orcinus orca</i>	Endangered	Red

Transient and resident Killer Whale (*Orcinus Orca*) are known to enter Burrard Inlet and Vancouver Harbour (Butler et al, 2015; Coastal Ocean Research Institute, 2016; Tsleil-Waututh Nation, 2017). Relative abundance of Grey Whale (*Eschrichtius robustus*) and Humpback Whale (*Megaptera novaeangliae*) is considered to be low in Burrard Inlet (Coastal Ocean Research Institute, 2016), but occasional observations of Grey Whale are made within Central Vancouver Harbour (Butler et al, 2015; Tsleil-Waututh Nation, 2017). Harbour Porpoise (*Phocoena phocoena vomerina*) are known to forage at the outer western Burrard Inlet and has been observed within Vancouver Harbour east of the First Narrows (Butler et al, 2015, Coastal Ocean Research Institute, 2016; Tsleil-Waututh Nation, 2017). Given this above information, there is potential for marine mammal species at risk to occur near the Project Site.

4.2.2 Terrestrial Field Survey

4.2.2.1 General Site Description

The Site surface is sloped to the north, towards Burrard Inlet. A steep and densely vegetated slope, sloping down towards Burrard Inlet from the parking area south of the Site, runs along the southern boundary of the beach (Photograph 1). A wooden log retaining wall runs north to south along the western boundary of the Site, the upper (western) side of which is vegetated with Himalayan blackberry (*Rubus armeniacus*) (Photograph 2). A stone-covered slope (sloping down towards the beach), the upper limits of which host blackberry bushes, runs north to south along the eastern portion of the Site (Photograph 3). The intertidal beach of the Site is topographically depressed from the west, south and east sides. The Site’s beach substrate is comprised of stones approximately three to five centimetres in length, along with sand and gravel (Photograph 4). The shoreline water was observed to be turbid and silty during the terrestrial habitat assessment taking place on October 26, 2020 as well as the intertidal habitat survey taking place on May 13, 2021.

In general, the entire surface of the Site is covered by historic and recently deposited debris and refuse. Rusted metal components of the former shipyard are abundant on the surface of the entire Site, as well as old line (rope) and wooden remnants. Numerous cut off decaying wooden posts (i.e., remains of pilings)

are present on the northwest portion of the Site, along with other embedded wooden remnants of the Site's former infrastructure (Photograph 5). Logs and large items of waste timber are abundant on the upper limits of the intertidal zone, forming a linear feature running east to west (Photograph 6). During the terrestrial habitat assessment Site visit conducted on October 26, 2020, a blade of eelgrass was observed to be washed up in the intertidal zone, indicating nearby growth.

Site photos can be found in **Appendix II**.

4.2.2.2 Vegetation Resources

A marine riparian/terrestrial area exists within the southern boundary of the intertidal beach of the Site. The southern terrestrial area is mostly covered by grass and shrubs, with vegetation being most dense along the southern edge of the Site's beach, which is densely vegetated and dominated by cottonwood trees. The upland marine riparian portion of the Site also hosts several invasive vegetation species, including blackberry shrubs and knotweed. At present, 1,555 m² of the Site is considered to be marine riparian and to provide biological function to the marine habitat associated with the Site. This area is dominated by black cottonwood trees along the southern edge of the Site, under which are many species of native and invasive vegetation (Photograph 7). Blackberry shrubs and smaller herbaceous plants are abundant along this sloped area, with vegetation becoming sparse towards the intertidal zone.

The vegetated area along the southern portion of the Site is considered to be marine riparian in nature due to its composition and proximity to the Site's high-water mark. The relatively tall cottonwood trees provide shade to the marine habitat associated with the Site during high tide, while the dense shrubbery underneath and just north of the cottonwood trees provide organic material and food for fish. Additionally, during the intertidal field survey conducted on May 13, 2021, common orache (*Atriplex* sp.) was observed within the substrate on the upper limits of the intertidal zone.

A search of BC CDC's known occurrences of vegetation species at risk did not identify any known occurrences of vegetation species at risk, their critical habitat, or ecological communities at risk on or within 1 km of the Site. Table 9 below lists native vegetation observed on or within the southern portion of the Site. It should be noted that the timing of the terrestrial habitat field visit (late fall) was not optimum for identifying vegetation species, and that some plants on the Site could not be identified due to senescence.

At the present time, 24 small-to-medium and large black cottonwood trees are located on the Site and will be removed as part of the Project. Additionally, several more (approximately 15) small young cottonwood trees are also located on the Site. Of these trees, 13 are mature, with a diameter at breast height (DBH) ranging between 12 cm and 54 cm and height ranging from 16 m to 21 m. Additionally, 11 trees are smaller, with a DBH ranging from 7 cm to 55 cm (including combined DBH of smaller split trunks) and height ranging from 2 m to 6 m. The small young trees have a DBH of under 7 cm and height ranging between 2 m to 6 m.

Other trees are present on the Site, including two (2) paper birch trees with a DBH of 15 cm and height of 6 m. A row of non-native ornamental trees runs along the eastern boundary of the Site, including 10 cedar trees and 6 pine trees with DBH ranging between 20 cm and 25 cm, and height ranging between 4 m and 6 m. It is anticipated that all of the trees on the Site will be removed. The area of vegetation and tree removal on the Site is shown on **Drawing 2**.

Table 9: Native Vegetation Occurring on the Site

English Name	Scientific Name	Notes
Black cottonwood	<i>Populus balsamifera trichocarpa</i>	Trees dominating the southern vegetated portion of the Site, concentrated along the southern Site boundary. Twenty-four trees with a DBH exceeding 7 cm are present on the Site, along with approximately 15 with a DBH under 7 cm.
Pearly everlasting	<i>Anaphalis margaritacea</i>	Sporadic on the southeast portion of the Site.
Horsetail	<i>Equisetum</i> sp.	Sporadic in the southern portion of the Site.
Fireweed	<i>Chamaerion angustifolium</i>	Within dense shrubbery of blackberry on the southern portion of the Site.
Paper birch	<i>Betula papyrifera</i>	Two small trees located on the Site.
Common Orache	<i>Atriplex</i> sp.	Within the substrate in the higher limits of the intertidal zone.

Based on observations made during a terrestrial field visit conducted by SNC-Lavalin on October 26, 2020 and May 13, 2021.

4.2.2.2.1 Invasive Vegetation

A number of invasive plant species were observed to inhabit the Site. Most prominently, Bohemian knotweed (*Fallopia x bohemica*), designated as a noxious weed under the BC *Weed Control Act*, was found in the southern portion of the Site (Photograph 12). Invasive plants identified on the Site are listed in Table 10 below.

Table 10: Invasive Vegetation Occurring on the Site

English Name	Scientific Name	Notes
Butterfly-bush	<i>Buddleja davidii</i>	One small bush observed on the southern portion of the western retaining wall, one large bush observed on the northern portion of the western retaining wall.
Bohemian knotweed	<i>Fallopia x bohemica</i>	Abundantly growing on the central southern portion of the Site.
English ivy	<i>Hedera helix</i>	Observed on the southern central portion of the Site.
Himalayan blackberry	<i>Rubus armeniacus</i>	Abundant along the western, eastern and southern property boundary.
Bindweed	<i>Convolvulus</i> sp.	One plant observed on the central southern portion of the Site.
Tree-of-heaven	<i>Ailanthus altissima</i>	One tree observed in the southwest corner of the Site.
Scotch broom	<i>Cytisus scoparius</i>	Observed on the southeastern portion of the Site.
White sweetclover	<i>Melilotus albus</i>	Abundant within the southern portion of the Site.
Red clover	<i>Trifolium pratense</i>	Observed sporadically throughout the southern portion of the Site.
Nightshade	<i>Solanum</i> sp.	One plant observed on the central southern portion of the Site.
Ribwort plantain	<i>Plantago lanceolata</i>	Observed sporadically throughout the southern portion of the Site.
Curled dock	<i>Rumex crispus</i>	One plant observed on the southwest portion of the Site.

Based on observations made during a terrestrial field visit conducted by SNC-Lavalin on October 26, 2020.

In general, the Site's marine riparian area is abundant in invasive vegetation. While these species are invasive, they create a dense strip of shrubbery that contributes to the terrestrial and marine riparian habitat on the Site. Most significantly, Himalayan blackberry shrubs dominate much of the vegetated surface of the Site. Dense shrubbery can create refuge for wildlife and potential nesting habitat for small bird species. American Robin (*Turdus migratorius*) and various sparrow species are known to nest in invasive Himalayan blackberry bushes, which are abundant on the Site. However, no wildlife has been observed within shrubbery during Site visits. Management of invasive vegetation is discussed in the Project CEMP. The area of vegetation and tree removal on the Site is shown on **Drawing 2**.

4.2.2.3 Wildlife Resources

The Site is abundant in bird activity and is used by gulls, Bald Eagle (*Haliaeetus leucocephalus*), ducks, Rock Pigeons (*Columba livia*) and Northwestern Crows (*Corvus caurinus*). Canada Geese (*Branta canadensis*) are abundant on the Site. Several relatively large black cottonwood trees exist along the southern boundary of the Site and may be used for nesting.

A nearby animal waste rendering plant, located approximately 350 m west of the Site, may be contributing to attracting wildlife to the Site due to emitting odor and its storage of containers of animal waste. During the field visit conducted on October 26, 2020, crows were observed throughout the surrounding area and the Site. A single harbour seal was also observed approximately 300 m north of the Site's beach during the field visit undertaken on October 26, 2020.

Canada Geese were observed on the Site and in the surrounding parking area (Photograph 8). An abandoned intact egg was found on the southwest portion of the Site (Photograph 9). The egg's coloration and dimensions were observed to be consistent with Canada Goose. No connectivity via corridors of trees and shrubs to any nearby potential habitats was observed. Bird nests were not observed in the trees on the Site, but an artificial nest platform (likely intended for Bald Eagles) was observed on the neighboring lot to the east, which did not have visible evidence of occupation at the time of assessment (Photograph 10). Information from the HWF indicates that the platform had not been used for nesting but is regularly used by Bald Eagles for perching. Feathers consistent with the wing feathers of Bald Eagle were found sporadically on the Site. Small purple shore crabs (*Hemigrapsus nudus*) were observed in the intertidal substrate (Photograph 11) and may provide foraging opportunities for species such as gulls and crows.

It is not believed that the Site is suitable for terrestrial mammal use, aside from occasional sporadic use. Invasive mammal species that may reside on the Site include brown rat (*Rattus norvegicus*) and roof rat (*Rattus rattus*). Common urban species, such as racoons (*Procyon lotor*), may traverse through the area. The Site is considered to have low habitat value for terrestrial mammals. No connectivity to other habitats exists on the Site and due to the heavily developed nature of the surrounding area. The vegetation present on the Site is itself surrounded by heavily-travelled roadways, fully paved parking areas and industrial properties.

4.2.3 Intertidal Field Survey

Results of the intertidal field survey are discussed below; Site photos can be found in **Appendix II** and a summary table of the survey can be found in **Appendix III**. The transects established for this study can be found depicted in **Drawing 3**. The intertidal zone within the proposed project footprint can be divided into two distinct areas (Photograph 17):

- › **Cobble Beach:** the majority of the Site's intertidal zone consists of a historically contaminated cobble beach where the former Sterling Shipyard operated; 5 survey transects were surveyed in this habitat type.
- › **Riprap Breakwater:** the eastern shore of the site consists of a riprap breakwater; 1 survey transect was surveyed in this habitat type.

Note that along the eastern boundary of the site is a vertical wall consisting of concrete lock-blocks. While transects were not possible in this habitat type, the area was photographed for vertical zonation and habitat type.

These habitat types are shown in Figure 1 through Figure 3 below.



Figure 1: Cobble beach



Figure 2: Riprap breakwater



Figure 3: Concrete lock-block wall

4.2.3.1 Cobble Beach Habitat

'Vertical zonation' in the form of habitat bands was observed in the surveys of cobble beach within the Project area. The following habitat types were observed:

Marine riparian habitat band: The marine riparian habitat band (Photograph 18) consisted of a strip of vegetation between the foreshore and port industrial lands. The southern terrestrial area is mostly covered by grass and shrubs, with vegetation being most dense along the southern edge of the Site, which is densely vegetated and dominated by cottonwood trees. The upland marine riparian portion of the Site also hosts several invasive vegetation species, including blackberry shrubs and knotweed.

Backshore habitat band: The backshore habitat band (Photograph 19) was comprised of large and small driftwood pieces sitting upon sand/silt substrate, with dense collections of woody, industrial and plastic litter debris such as metal pieces, trash and plastic drums mixed among the driftwood. Invertebrates observed here included sand hoppers (unidentified marine amphipod), terrestrial woodlouse (unidentified isopod) and introduced earwig species (likely *Anisolabis maritima*). Both species were observed under driftwood when disturbed. Vegetation present in this habitat band included saltbush (*Atriplex* spp.), sporadic grass and small weeds that were unidentified due to senescence.

Supralittoral (splash zone) habitat band: The supralittoral habitat band (Photograph 19) was similar to the backshore habitat band except it had less woody debris and was scattered with beach wrack indicating regular tidal inundation (unlike the backshore habitat band). Invertebrates observed here included sand hoppers (unidentified marine amphipod) and terrestrial woodlouse (unidentified isopod). Vegetation present in this habitat band was limited to sparse amounts of saltbush (*Atriplex* spp.)

Upper intertidal unvegetated habitat band: The upper intertidal unvegetated habitat band (Photograph 20) was comprised of sand and gravel, with occasional cobbles, on top of silt. Invertebrates observed here were limited to sand hoppers (unidentified marine amphipod). No vegetation or algae was observed in this habitat band. Significant collections of metal/industrial debris were observed in this band.

Barnacle habitat band: The barnacle habitat band (Photograph 21) was located between the upper intertidal unvegetated habitat band and the rockweed band in the mid-high intertidal zone. Substrates consisted of gravel and cobble on top of sand and shell hash with some bedrock. Algae and seaweeds were not present in this band, with the exception of sparse assemblages of Rockweed (*Fucus gardneri*), and Turkish washcloth leafy and crustose phases (*Mastocarpus papillatus*) which occurred only on the bases of cut-off piles which were located predominantly along the eastern side of the site. Invertebrates observed in this habitat band included abundant acorn barnacles (*Balanus glandula*), periwinkles (*Littorina spp.*), limpets (*Lottia spp.* and *Tectura spp.*), shore crabs (*Hemigrapsus nudus* and *H. oregonensis*), sand hoppers (unidentified marine amphipod) and nematodes. Blue mussels (*Mytilus edulis*) were present in low densities along the western Lock-Block wall.

On the westernmost transect, a small patch of *Ulva intestinalis* green seaweed was observed in the barnacle band (Photograph 25); this is typically indicative of a persistent freshwater runoff or seep in this location.

Rockweed habitat band: The rockweed habitat band (Photograph 22) was located between the barnacle habitat band and the sea lettuce band in the mid-intertidal zone. Substrates consisted of gravel and cobble on top of sand/shell hash with remnants of former infrastructure throughout the area including numerous cut-off piles and footings with significant amounts of metal and wood waste. Patches of obvious chemical contamination were present throughout this band (Photograph 27). Turkish washcloth leafy and crustose phases (*Mastocarpus papillatus*) occurred in this band with rockweed (*Fucus gardneri*) (Photograph 26), cover at approximately 5 to 15%. In addition, sea lettuce (*Ulva spp.*) was present in this band in low density. Invertebrates observed in this habitat band included abundant acorn barnacles (*B. glandula*) (Photograph 30), periwinkles (*Littorina spp.*) (Photograph 29), limpets (*Lottia spp.* and *Tectura spp.*) (Photographs 29 and 30), shore crabs (*H. nudus* and *H. oregonensis*) and nematodes. Blue mussels (*Mytilus edulis*) (Photograph 31), sand hoppers (unidentified marine amphipod), pacific oysters (*Crassostrea gigas*) were commonly observed in this band but in relatively low densities (higher densities of these species were observed along the western Lock-Block wall) (Photograph 28).

Sea lettuce habitat band: The sea lettuce habitat band (Photograph 23) was located between the rockweed habitat band and the sparse kelp habitat band in the mid-low intertidal zone. Substrates consisted of gravel and cobble on top of sand/shell hash with remnants of former infrastructure throughout the area including numerous cut-off piles and footings with significant amounts of metal and wood waste. Patches of obvious chemical contamination were present throughout this band. Sea lettuce (*Ulva sp.*) was the dominant alga in this band with cover ranging from 5% to 25%. Other species of algae were present in this band including Turkish washcloth leafy and crustose phases (*M. papillatus*), and rockweed (*F. gardneri*). Invertebrates observed in this habitat band included abundant acorn barnacles (*B. glandula*), periwinkles (*Littorina spp.*), limpets (*Lottia spp.* and *Tectura spp.*), shore crabs (*H. nudus* and *H. oregonensis*) and nematodes. Blue mussels (*Mytilus edulis*) and pacific oysters (*Crassostrea gigas*) were commonly observed in this band but in relatively low densities (higher densities of these species were observed along the western Lock-Block wall). Topsnails (*Calliostoma spp.*), and hermit crabs (*Pagarus spp.*) were present at low densities in this habitat band.

Low intertidal habitat band: The low intertidal habitat band (Photograph 24) was located between the sea lettuce habitat band and waterline in the low intertidal zone (approx. 0.8 m above chart datum). Substrates consisted of gravel and cobble on top of mud and shellhash with some boulders, and remnants of former infrastructure throughout the area. Seaweeds observed in this band included sparse assemblages of sugar kelp (*Laminaria spp.*) with some sea lettuce (*Ulva sp.*) and Turkish washcloth crustose phase (*Petrocelis*); sargassum was also present but uncommon. Invertebrates observed in this habitat band included abundant acorn barnacles (*B. glandula*), limpets (*Lottia spp.* and *Tectura spp.*), shore crabs (*H. nudus* and *H. oregonensis*), pacific oysters (*Crassostrea gigas*). Green urchins (*Strongylocentrotus droebachiensis*), blue mussels (*M. edulis*), hermit crabs (*Pagarus spp.*), ochre seastars (*Pisaster ochraceous*) (Photograph 32), mottled seastars (*Evasterias troschellii*), tubeworms (*Eudistylia vancouverii*), scale worms (*Halosydna spp.*) were also present at low densities.

Metal/Wood waste band: The Metal/Wood Waste habitat type was located in the lower intertidal zone (approx. 0.8 m above chart datum) on the eastern side of the site. This area was comprised of soft silt/mud sediments and cobbles with metal and wood waste. No seaweed or vegetation was observed here. Invertebrates were sparse and limited to barnacles. An abandoned crab trap with a large ochre seastar (*P. ochraceous*) inside was found here.

4.2.3.2 Riprap Breakwater Habitat

Riprap breakwater habitat has similar 'vertical zonation' and habitat bands that were observed in the surveys of cobble beach, though the substrate was riprap allowing for more seaweed and encrusting organism attachment. Moreover, the steeper incline of this area compared to the cobble beach lead to small and more pronounced habitat bands. The following habitat types were observed:

Marine riparian habitat band: The riparian habitat band consisted of a strip of vegetation between the revetment and port industrial lands. Riparian vegetation was comprised of overhanging vegetation which was predominantly Cottonwood trees, blackberry shrubs and knotweed.

Supralittoral (splash zone) habitat band: The supralittoral habitat band was comprised of unvegetated riprap boulders. Vegetation was sparse with only some lichen present. No invertebrates were observed in this habitat band.

Upper intertidal unvegetated habitat band: The upper intertidal unvegetated habitat band was comprised of unvegetated riprap boulders. No vegetation or invertebrates were observed in this band. This band differed from the Supralittoral (Splash Zone) Habitat Band only in that it was below the Higher High Water, Large Tide (HHWLT).

Barnacle habitat band: The barnacle habitat band was located between the upper intertidal unvegetated habitat band and the rockweed band in the mid-high intertidal zone. Substrates consisted of riprap boulder. Algae and seaweeds were not present in this band. The only invertebrates observed in this habitat band were acorn barnacles (*B. glandula*), which occurred in abundance.

Rockweed habitat band: The rockweed habitat band was located between the barnacle habitat band and the waterline in the mid-intertidal zone. Substrates consisted of riprap boulders. Rockweed (*F. gardneri*), and Turkish washcloth leafy and crustose phases (*M. papillatus*) occurred in this band with rockweed with cover approximately 25 to 50%. In addition, sea lettuce (*Ulva spp.*) was present in this band in low density. Invertebrates observed in this habitat band included abundant acorn barnacles (*B. glandula*), periwinkles (*Littorina spp.*), limpets (*Lottia spp.* and *Tectura spp.*), shore crabs (*H. nudus* and *H. oregonensis*), blue mussels (*Mytilus edulis*), pacific oysters (*Crassostrea gigas*).

4.2.4 Subtidal Field Survey

Results of the subtidal field survey are discussed below; the detailed subtidal survey report, including Site photos can be found in **Appendix IV**. The subtidal zone within the proposed project footprint did not show significant vertical zonation or distinct areas and is therefore discussed as one habitat type.

The subtidal area was comprised of cobbles and pebbles in shallower areas and gradually transitioned to sands and silts with shell hash. Woody debris and anthropogenic materials, such as cut-off piles, steel plates, piles of rope and other miscellaneous debris, were found on both transects. Two stepped rows of concrete lock-blocks were observed fronting the sheet pile wall on Transect 1. The sheet pile wall and concrete blocks start in the southwest corner of the survey area and extend 37 m east and then continue 90 degrees south inshore.

Seaweeds observed in the subtidal area included sugar kelp (*Laminaria* spp.), *Sargassum*, sea lettuce (*Ulva* sp.), seersucker kelp (*Costaria costata*), broad acid weed (*Desmarestia herbacea*), rockweed (*Fucus* sp.), and unidentified red filamentous algae.

Invertebrates observed in this habitat band included abundant acorn barnacles (*B. glandula*), Dungeness crab (*Metacarcinus magister*), red rock crab (*Cancer productus*), graceful crab (*Cancer gracilis*), graceful decorator crab (*Oregonia gracilis*), mussels (*Mytilus* sp.), ochre seastars (*Pisaster ochraceous*), mottled seastars (*Evasterias troschelii*), leather stars (*Dermasterias imbricata*), red sea cucumbers (*Cucumaria miniata*), tubeworms (*Eudistylia* sp.), giant plumose anemone (*Metridium farcimen*), short plumose anemone (*Metridium senile*), painted anemone (*Urticina crassicornis*), and transparent tunicate (*Corella willmeriana*). Unidentified flatfish were also observed in the subtidal zone within the Site.

4.3 Summary of Existing Environment and Habitat Maps

The Site occurs in a marine environment that has been significantly contaminated by years of anthropogenic use as an industrial shipyard.

The desktop review indicated that species at risk and biological resources have the potential to occur in the Site, and also indicated that fisheries generally do not occur within 5 km of the Site, with the exception of small-scale surf smelt fisheries. The field surveys indicated that the riparian zone consisted mostly invasive and some native vegetation. The foreshore area was composed of cobbles, cut off piles and old industrial footings surrounded by sand and shell hash. The subtidal area was comprised of cobbles and pebbles in shallower areas and gradually transitioned to sands and silts with shell hash. Woody debris and anthropogenic materials, such as cut-off piles, steel plates, piles of rope and other miscellaneous debris, were found throughout the subtidal area.

While the Site is home to numerous species of seaweed and invertebrates, no particularly sensitive habitats or sensitive species were observed. Conversely, industrial debris, scrap, waste and contamination is visible and pervasive throughout the Site. As such, the intertidal areas within the Site boundaries are of limited value as fish habitat and contamination radiating from site could potentially affect fish habitat quality off-site. Subtidal areas within the Site boundary are similarly contaminated, although some presence of kelp bed habitat and a community of seaweeds, invertebrates, and fish was observed.

A map showing the distribution of the observed habitats is provided as **Drawing 4**. Note that habitat types outside of observation points have been interpolated based on nearby observations and professional judgement and may not reflect exactly what is on the seabed.

5 Impacts and Residual Effects

This section summarizes temporary and permanent impacts to habitat potentially affected by the Project. A summary of impacts and residual effects is presented in Table 11, with detailed overviews presented in following subsections. For the purposes of this report, the following definitions are used:

- › “Extent” is defined as the geographical location that the potential impact is anticipated to affect.
- › “Duration” is defined as the period of time during which the potential impact is anticipated to persist.
 - “Permanent” duration is defined as an impact that will persist indefinitely after construction is completed.
 - “Temporary” duration is defined as an alteration that is limited to the time frame of construction or is not expected to persist for a long-term period after construction is completed.

Table 11: Summary of Project Impacts and Residual Effects

Affected Component	Impact	Extent	Duration	Notes
Land-based Impacts				
Marine Riparian Habitat	Approximately 1,555 m ³ of marine riparian habitat will either be removed or otherwise lose its riparian function.	Project Area	Permanent	Impacts to the marine riparian are most relevant to fish habitat and will be offset in the Project Habitat Offsetting Plan.
Native Terrestrial Vegetation	Trees and vegetation are expected to be removed.	Project Area	Permanent	
	Removal of native vegetation may lead to spread of invasive vegetation.	Project Area	Temporary (During construction)	Mitigations in the Project CEMP will control the spread of invasive species.
Invasive Terrestrial Vegetation	All invasive vegetation will be removed.	Project Area	Permanent	Invasive vegetation will be removed to prevent the spread of weeds, including noxious weeds under the <i>BC Weed Control Act</i> .
Birds	Migratory birds and raptors, as well as their nests, may be affected by vegetation clearing.	Project Area	Permanent	This impact is considered permanent. Impacts will be minimized by following the mitigations in the Project CEMP.
	Migratory birds, raptors and seabirds, as well as bird nesting, may be affected by construction, noise and air quality impacts.	Project Area	Temporary (During construction)	Noise and air quality impacts will be mitigated by following the Project CEMP.

Table 11 (Cont'd): Summary of Project Impacts and Residual Effects

Affected Component	Impact	Extent	Duration	Notes
Land-based Impacts (Cont'd)				
Terrestrial Wildlife	Common urban species such as racoons may be affected by vegetation clearing, Site excavation, and infilling.	Project Area	Permanent	Potential impacts on common urban wildlife are considered to be negligible. Mitigations within the Project CEMP will prohibit harming any wildlife occurring on the Site.
	Bat species at risk, such as little brown myotis, may lose foraging habitat due to vegetation removal.	Project Area	Permanent	It is not known whether the Site is currently used by this species.
	Common controlled species such as racoons may be affected by construction, noise and air quality impacts.	Project Area	Temporary (During construction)	Potential impacts on controlled wildlife are considered to be negligible.
Marine-based Impacts				
Aquatic Vegetation	Approximately 2,835 m ² of subtidal seabed will be disturbed by dredging, with 2,020 m ² of that area being permanently covered by rock berm revetment. This location contains some kelp bed habitat and a limited community of seaweeds.	Project Area	Temporary (during construction): 815 m ² Permanent: 2,020 m ²	These impacts are inevitable due to the nature of the Project. However, any additional seabed disturbance will be avoided and minimized by following the mitigations outlined in the Project CEMP. These impacts will be offset in the Project Habitat Offsetting Plan.
Marine Fish Habitat	Microfauna, Infauna and Macrofauna (e.g., shore crabs, bivalves) will be destroyed by crushing/burial within the intertidal and subtidal zone during dredging, rock berm construction and remedial excavation and infilling.	Project Area	Permanent	These impacts are inevitable due to the nature of the Project. However, any additional disturbance to the seabed will be avoided and minimized by following the mitigations outlined in the CEMP. Large motile wildlife (e.g., crustaceans) will be salvaged prior to construction. These impacts will be offset in the Project Habitat Offsetting Plan.

Table 11 (Cont'd): Summary of Project Impacts and Residual Effects

Affected Component	Impact	Extent	Duration	Notes
Marine-based Impacts (Cont'd)				
Marine Fish Habitat (Cont'd)	Approximately 2,835 m ² of subtidal and 4,870 m ² of intertidal fish habitat will be disturbed, with only 815 m ² of the disturbance being temporary disruption (subtidal).	Project Area	Temporary (during construction): 815 m ² subtidal Permanent: 4,870 m ² intertidal; and 2,020 m ² subtidal	These impacts are inevitable due to the nature of the Project. However, any additional disturbance to the seabed will be avoided and minimized by following the mitigations outlined in the CEMP. Additionally, individual fish are not anticipated to be killed as a pre-construction fish salvage will be conducted, and the Site will be isolated with a silt curtain. These impacts will be offset in the Project Habitat Offsetting Plan.
	Underwater pressure and noise potentially causing barotrauma to marine mammal species at risk.	Project Area	Temporary (during construction)	These impacts will be avoided by utilizing a Marine Mammal Observer (MMO) on the Site (please refer to the Project CEMP).

5.1 Vegetation

5.1.1 Marine Riparian Habitat

Approximately 1,555 m² of marine riparian habitat exists on the Site. The habitat is comprised of black cottonwood, with a mix of native and invasive shrubs and grasses covering the surface (refer to **Section 4.2.2.2**). During high-tide periods, this vegetation interacts with Vancouver Harbour, contributing shade and organic debris for fish, as well as filtration of potential runoff originating from upland areas. The Project will remove all vegetation on the Site and offset the existing high-water mark approximately 80 m to the north. Approximately 1,555 m² of marine riparian habitat will be lost as a result of the Project. The area of vegetation and tree removal on the Site is shown on **Drawing 2**.

5.1.2 Native Vegetation

All trees and native shrubs will be removed from the southern portion of the Site as part of the Project scope. All Black cottonwood trees, including 13 large trees, will be cleared, removing potential nesting habitat for bird species. Removal of native vegetation and trees from the Site surface may increase the likelihood of invasive species that already occur on the Site spreading into newly cleared areas. The area of vegetation and tree removal on the Site is shown on **Drawing 2**.

5.1.3 Aquatic Vegetation

Approximately 2,835 m² of subtidal seabed will be disturbed by dredging, with 2,020 m² of that area being permanently covered by rock berm revetment and only 815 m² of the subtidal disturbance being temporary disruption during construction. The subtidal portion of the Site location contains some kelp bed habitat and

a limited community of seaweeds. Impacts to aquatic vegetation will be offset as part of the FAA Application which includes a Habitat Offsetting Plan (please refer to Document No. 677011-0000-4EER-0003), the implementation of which will create significant colonizable surface area for aquatic vegetation, which will also be monitored for several years to ensure successful colonisation and establishment.

5.1.4 Invasive Vegetation

The vegetated upland area of the Site is dense in invasive vegetation (refer to Table 10). While these species are invasive, they create a dense strip of shrubbery that contributes to the terrestrial and marine riparian habitat on the Site. Most significantly, Himalayan blackberry shrubs dominate much of the vegetated surface of the Site. Dense shrubbery can create refuge for wildlife and some nesting habitat for small bird species. All invasive vegetation on the upland area of the Site will be removed during Project works, including Bohemian knotweed, which is designated as a noxious weed under the *BC Weed Control Act*. Management of invasive vegetation during construction is discussed in the Project CEMP.

5.2 Wildlife

5.2.1 Birds

Birds and bird habitat may be affected by the Project. A vacant Bald Eagle artificial nest platform was observed on the property adjacent to the east of the Site, indicating there is potential for this species to nest nearby. The presence of a goose egg on the Site indicates that Canada Geese have previously nested on the Site. Geese have some degree of nest site fidelity and it is likely that the Site could be re-used in following years. Multiple bird species were observed around the Site, and songbirds could nest in the Site's vegetation. Several species of seabirds, including species at risk, have the potential to occur in the marine environment of the Project Area.

- › Mortality of birds or eggs or destruction of active bird nests is considered unlikely but has the potential to occur during vegetation clearing and tree removal activities if those activities are carried out during the nesting season.
- › The Project will involve the removal of all blackberry bushes on the Site, as well as the removal of all trees and vegetation within the marine riparian area of the Site, resulting in a loss of nesting habitat for birds. A total of 13 large cotton wood trees will be removed.
 - The exact scope of tree removal and non-invasive vegetation clearing is discussed in the Project CEMP. The area of vegetation and tree removal on the Site is shown on **Drawing 2**.
- › Noise generated during Project activity may disturb bird species and could affect nesting birds. Project activities will occur in close proximity to the Bald Eagle nesting platform. Project noise may cause birds to avoid the area. However, Project noise is limited to construction as the Site will become an infilled and graded surface after Project implementation.
- › Air quality impacts resulting from Project works may temporarily cause bird species to avoid the area.

5.2.2 Terrestrial Mammals

The potential for impacts to terrestrial mammal habitat is considered to be unlikely due to the Site lacking connectivity to nearby habitats and the highly anthropogenic nature of the Site. It is not believed that the Site is suitable for extensive terrestrial mammal use, other than occasional sporadic use. The following impacts to terrestrial mammals are anticipated:

- › Habitat for invasive mammal species that may reside on the Site (E.g., brown rat and roof rat) will be removed;
- › Habitat for common urban species, such as racoons, which may presently traverse through the area, will be removed; and
- › Project tree and vegetation removal activity will remove potential bat foraging habitat.

5.3 Marine Fish Habitat

Permanent and temporary HADD will be caused by the project in the intertidal and subtidal zones. It is expected that infauna, microfauna and macrofauna will be destroyed by burial/crushing during dredging, rock berm construction, remedial excavation and infilling activities. Fish and large crustaceans will be salvaged during a pre-construction fish salvage and are not expected to be harmed during construction. Temporary effects, including increases in sediment concentrations and increases in contaminant concentrations (due to disturbance of contaminated seabed sediments) are expected to occur within the construction area, behind a silt fence. Potential underwater noise/pressure impacts to marine mammal species at risk is expected to be mitigated by utilizing MMO protocols.

Approximately 2,835 m² of subtidal and 4,870 m² of intertidal fish habitat will be disturbed, with only 815 m² of the subtidal disturbance being temporary disruption during construction. These permanent impacts will be offset by implementing a Habitat Offsetting Plan, which is part of the Fisheries Act Authorization Application (Document No. 677011-0000-4EER-0003) for a detailed overview of impacts to fish and fish habitat.

6 Mitigation Measures

Mitigation measures for this Project will include but are not limited to:

- › Water quality control and monitoring;
- › Environmental construction monitoring;
- › Erosion and sediment control;
- › Nest surveys for vegetation removal during nesting season; and
- › Adherence to least-risk timing windows.

Detailed mitigations for each Project component are discussed and outlined in the Project Construction Environmental Management Plan. Please refer to the Project CEMP for details relating to mitigation measures to be undertaken during Project works.

6.1 Habitat Offsetting

A Preliminary Habitat Offsetting plan for has been developed for this Project as part of permit application under the federal *Fisheries Act*³ (FA). Habitat offsetting will follow guidelines from Fisheries and Oceans Canada (DFO) in order to create new fish habitat off Site, in order to compensate for fish habitat lost as a result of the Project. The Plan may include the establishment of new marine riparian vegetation, which will provide foraging habitat for seabirds and little brown myotis. The scope, extent and type of offsetting that will be conducted will be developed during subsequent Project stages as part of the Project Habitat Offsetting Plan.

³ *Fisheries Act* (FA), RSC 1985, c.F-14, last amended on August 28, 2019.

7 Environmental Monitoring

The duties and responsibilities of the Project Environmental Monitor (Project EM), including key construction periods and activities during which environmental monitoring will be required, are outlined in the Project CEMP. Please refer to the Project CEMP for details relating to environmental monitoring to be undertaken during Project works.

8 Summary and Conclusions

In total, the project has the potential to result in the following impacts to vegetation, wildlife, fish and fish habitat:

- › 1,555 m² of marine riparian habitat will be permanently lost; foraging habitat for birds and bats will be lost as a result of the planned vegetation and tree removal.
- › 4,870 m² of contaminated intertidal habitat will be permanently lost; habitat for marine seaweeds, invertebrates and fish will be lost as a result of the planned berm construction, remedial excavation and infilling.
- › 815 m² of contaminated subtidal habitat will be temporarily disrupted; habitat for marine seaweeds, invertebrates and fish will be disrupted as a result of the planned dredging.
- › 2,020 m² of contaminated subtidal habitat will be permanently altered; habitat for marine seaweeds, invertebrates and fish will be lost as a result of the planned berm construction, remedial excavation and infilling and construction of habitat offsetting measures (subtidal reef complexes).

Mitigation and impact avoidance measures have been proposed to reduce likelihood and significance of the potential impacts; however, there is still unavoidable and immitigable harmful alteration, disruption, or destruction of fish habitat (HADD) associated with the works. Therefore, a detailed Habitat Offsetting Plan will be developed and implemented to counterbalance the unavoidable death of fish and HADD resulting from a work with the goal of protecting and conserving fish and fish habitat.

9 References

- BC Community Mapping Network (CMN). 2020. FREMP – BIEAP habitat atlas. Available: <https://www.cmnbc.ca/atlasgallery/fremp-bieap-habitat-atlas/> [Accessed October 29, 2020].
- BC Conservation Data Centre (CDC). 1994. Species Summary: *Larus californicus*. BC Ministry of Environment. Available: <https://a100.gov.bc.ca/pub/eswp/> [Accessed April 8, 2021].
- BC Conservation Data Centre (CDC). 1995. Species Summary: *Phalacrocorax auritus*. BC Ministry of Environment. Available: <https://a100.gov.bc.ca/pub/eswp/> [Accessed April 8, 2021].
- BC Conservation Data Centre (CDC). 2020. BC Species and Ecosystems Explorer. B.C. Minist. of Environ. Victoria, B.C. Available: <https://a100.gov.bc.ca/pub/eswp/> [Accessed October 29, 2020].
- BC Conservation Data Centre. 2020. Species Summary: *Cetorhinus maximus*. B.C. Minist. of Environment. Available: <https://a100.gov.bc.ca/pub/eswp/> [Accessed November 18, 2020].
- BC Great Blue Heron Atlas. N.d. Available: <https://cmnmaps.ca/GBHE/> [Accessed October 29, 2020].
- BC Invasive Alien Plant Program. 2021. IAAP Map Display. Available: <https://maps.gov.bc.ca/ess/hm/iapp/> (Accessed March 1, 2021).
- BC Ministry of Environment and Climate Change Strategy (ENV). N.d. 1980-2011 - Bald Eagle Repeated Nest Vis-its - MOE Region1 - Nanaimo - Ministry of Environment. Available: <http://a100.gov.bc.ca/pub/siwe/details.do?projectId=4169>
- Boldt, J., Gauthier, S., & King, S. 2019. Proceedings of the national workshop on filling in the forage fish gap. *Canadian Technical Report of Fisheries and Aquatic Sciences* 3287.
- Butler, R. W., Couturier, A. R., & Dickson, E. 2015. Status and Distribution of Marine Birds and Mammals in Burrard Inlet and Indian Arm, British Columbia. Pacific Wildlife Foundation & Bird Studies Canada. Unpublished Report. Port Moody, BC and Port Rowan, Ontario. Available: <https://pwlf.ca/wp-content/uploads/2019/04/mbbi.pdf>
- Butler, R.W. 1995. The patient predator: foraging and population ecology of the Great Blue Heron in British Columbia. *Canadian Wildlife Services Occasional Paper* No. 86.
- Canadian Council of Ministers of the Environment (CCME). 2021. Water Quality Guidelines for the Protection of Aquatic Life, Marine. Available: ccme.ca/en/summary-table [Accessed March 1, 2021].
- Coastal Ocean Research Institute. 2016. Mariner's guide to whales, dolphins, and porpoises of Western Canada. Prepared by the Coastal Ocean Research Science Institute, Vancouver Aquarium Marine Science Centre. 62 pp.
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2011. COSEWIC Assessment and Status Report on the Barn Swallow (*Hirundo rustica*) in Canada.
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2009. COSEWIC Assessment and Status Report on the Horned Grebe (*Podiceps auritus*) in Canada.
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2014. COSEWIC Assessment and Status Report on the Western Grebe (*Aechmophorus occidentalis*) in Canada.

- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2007a. *COSEWIC assessment and status report on the bluntnose sixgill shark *Hexanchus griseus* in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa. Available: <https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/bluntnose-sixgill-shark.html>
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2007b. *COSEWIC assessment and status report on the longspine thornyhead *Sebastolobus altivelisin* Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa. Available: <https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/longspine-thornyhead.html>
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2007c. *COSEWIC assessment and status report on the rougheye rockfish *Sebastes* sp. type I and *Sebastes* sp. type II in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa. Available: <https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/rougheye-rockfish-species-types-1-2.html>
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2007d. *COSEWIC assessment and status report on the tope *Galeorhinus galeus* in Canada. Committee on the Status of Endangered Wildlife in Canada*. Ottawa. Available: <https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/tope.html>
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2007e. *COSEWIC assessment and status report on the basking shark *Cetorhinus maximus* (Pacific population) in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa. Available: <https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/basking-shark-pacific.html>
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2008. *COSEWIC assessment and status report on the Yelloweye Rockfish *Sebastes ruberrimus*, Pacific Ocean inside waters population and Pacific Ocean outside waters population, in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa. Available: https://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_yelloweye_rockfish_0809_e.pdf
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2009. *COSEWIC assessment and update status report on the Northern Abalone *Haliotis kamtschatkana* in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa. Available: https://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_northern_abalone_0809_e.pdf
- Fisheries and Oceans Canada (DFO). 2002. Marine Foreshore Environmental Assessment Procedures. Prince Rupert BC.
- Fisheries and Oceans Canada (DFO). 2012. Pacific Region Integrated Fisheries Management Plan Surf Smelt April 1, 2012 to December 31, 2014.
- Fisheries and Oceans Canada (DFO). 2015a. Herring Spawning Areas of British Columbia. Available: <https://www.pac.dfo-mpo.gc.ca/science/especes/pelagic-pelagique/herring-hareng/herspawn/pages/project-eng.html>

- Fisheries and Oceans Canada (DFO). 2015b. Rockfish Conservation Areas - Area 28. Available: <https://www.pac.dfo-mpo.gc.ca/fm-gp/maps-cartes/rca-acs/areas-secteurs/28-eng.html>
- Fisheries and Oceans Canada (DFO). 2016. Surf Smelt - *Hypomesus pretiosus*. Available: <https://www.dfo-mpo.gc.ca/species-especes/profiles-profilsmelt-eperlan-eng.html>
- Fisheries and Oceans Canada (DFO). 2018a. Pacific Herring 2017 to 2018 Integrated Fisheries Management Plan summary. Available: <https://www.pac.dfo-mpo.gc.ca/fm-gp/mplans/herring-hareng-ifmp-pgip-sm-eng.html>
- Fisheries and Oceans Canada (DFO). 2018b. Shrimp and Prawn Biology. Available: <https://www.pac.dfo-mpo.gc.ca/fm-gp/commercial/shellfish-mollusques/shrimp-pcrevette/biol-eng.html> [Accessed November 18, 2020]
- Fisheries and Oceans Canada (DFO). 2019. Aquatic species at risk map. Available: <https://www.dfo-mpo.gc.ca/species-especes/sara-lep/map-carte/index-eng.html> [Accessed October 29, 2020]
- Fisheries and Oceans Canada (DFO). 2020a. Station Inventory Data – Station 7735. Available: <http://www.isdm-gdsi.gc.ca/isdm-gdsi/twl-mne/inventory-inventaire/sd-ds-eng.asp?no=7735&user=isdm-gdsi®ion=PAC> [Accessed October 30, 2020]
- Fisheries and Oceans Canada (DFO). 2020b. 7 days Tidal Predictions. Available: <https://www.tides.gc.ca/eng/station?sid=7735> [Accessed October 26, 2020]
- Fisheries and Oceans Canada (DFO). 2020c. Crab by trap, Pacific Region April 1, 2020 to March 31, 2021, Integrated Fisheries Management Plan. Available: <https://www.pac.dfo-mpo.gc.ca/fm-gp/mplans/crab-crabe-ifmp-pgip-sm-eng.html>
- Fisheries and Oceans Canada (DFO). 2020d. Prawn and shrimp by trap, Pacific Region 2020 to 2021 Integrated Fisheries Management Plan summary. Available: <https://www.pac.dfo-mpo.gc.ca/fm-gp/mplans/prawnshrimp-trap-crevette-casier-ifmp-pgip-sm-eng.html>
- Fisheries and Oceans Canada (DFO). 2020e. Station Inventory Data – Station 7735. Available: <http://www.isdm-gdsi.gc.ca/isdm-gdsi/twl-mne/inventory-inventaire/sd-ds-eng.asp?no=7735&user=isdm-gdsi®ion=PAC> [Accessed October 30, 2020]
- Fisheries and Oceans Canada (DFO). 2021. Integrated fisheries management plan summary: Groundfish - Pacific Region, 2021.
- Golder Associates Ltd. 2009. *Supplementary Detailed Site Investigation Risk Assessment and Remedial Plan – Former Sterling Shipyard Site* – Vancouver Fraser Port Authority.
- Government of BC (BC Gov). 2021a. Habitat Wizard [Web Application]. Available: Stream Reports. Available at: <http://www.env.gov.bc.ca/habwiz/>. Accessed: November 2016.
- Government of BC (BC Gov). 2021b. Red, Blue & Yellow Lists. Available: <https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre/explore-cdc-data/red-blue-yellow-lists> [Accessed May 20, 2021]
- Government of Canada. 2011. Species Profile - Great Blue Heron *fannini* subspecies. Available: https://wildlife-species.canada.ca/species-risk-registry/species/speciesDetails_e.cfm?sid=292 [Accessed April 8, 2021]
- Haggarty, D. 2001. An evaluation of fish habitat in Burrard Inlet, British Columbia. M.Sc. Thesis, Department of Zoology, University of British Columbia, 161 pp.

- Hancock Wildlife Foundation (HWF). 2018. Lafarge Nest Information. Available: <https://hancockwildlife.org/lafarge-cam/>
- Hay, D.E., P.B. McCarter, R. Kronlund and C. Roy. 1989. Spawning areas of British Columbia herring: a review, geographical analysis and classification. Volumes 1-6. Can. MS Rep. Fish. Aquat. Sci. 2019.
- Hemmera Envirochem Inc. 2016. Aquatic Effects Assessment Vancouver Harbour Response Base 2800 Commissioner Street Wharf. Prepared for Western Canada Marine Response Corporation.
- Howes, D. 2001. *BC biophysical shore-zone mapping system – A systematic approach to characterize coastal habitats in the Pacific Northwest*. Proceedings of Puget Sound Research 2001 – the 5th Puget Sound Research Conference. 12-14 February 2001, Bellevue, Washington. Olympia, Washington: Puget Sound Action.
- Important Bird Areas Canada (IBA). Site summary: English Bay, Burrard Inlet & Howe Sound Vancouver, British Columbia. Available: <https://www.ibacanada.org/site.jsp?siteID=BC020> [Accessed October 29, 2020]
- Ivanochko, Tara. 2018. Birds, barks, and boats in Burrard Inlet: A spatial analysis of winter marine bird communities and recreational disturbances along the Kitsilano shoreline. Research Project. Available: <https://open.library.ubc.ca/cIRcle/collections/undergraduateresearch/52966/items/1.0366220>
- Meidinger, D. & Pojar, J. 1991. *Ecosystems of British Columbia*. Special Report Series 6. BC ministry of Forests.
- SNC-Lavalin. 2014. Fish and fish habitat assessment for Sterling Shipyard intertidal reclamation. Prepared for Port Metro Vancouver.
- SNC-Lavalin. 2018. Remedial Options Evaluation – former Sterling Shipyard. Prepared for Vancouver Fraser Port Authority.
- Stanley Park Ecology Society. 2014. Great Blue Heron FAQ. Available: http://stanleyparkecology.ca/wp-content/uploads/downloads/2015/03/Heron-FAQ-for-website_branded.pdf
- Stanley Park Ecology Society. 2014. Great Blue Heron FAQ. Available: http://stanleyparkecology.ca/wp-content/uploads/downloads/2015/03/Heron-FAQ-for-website_branded.pdf
- Tsleil-Waututh Nation. 2017. Burrard Inlet Action Plan. Available: <https://twnsacredtrust.ca/read-burrard-inlet-action-plan/>
- Tsleil-Waututh Nation. 2017. Burrard Inlet Action Plan. Available: <https://twnsacredtrust.ca/read-burrard-inlet-action-plan/>
- Zevit, P. 2010. BC's Coast Region: Species & Ecosystems of Conservation Concern Double-crested Cormorant.

Appendix I

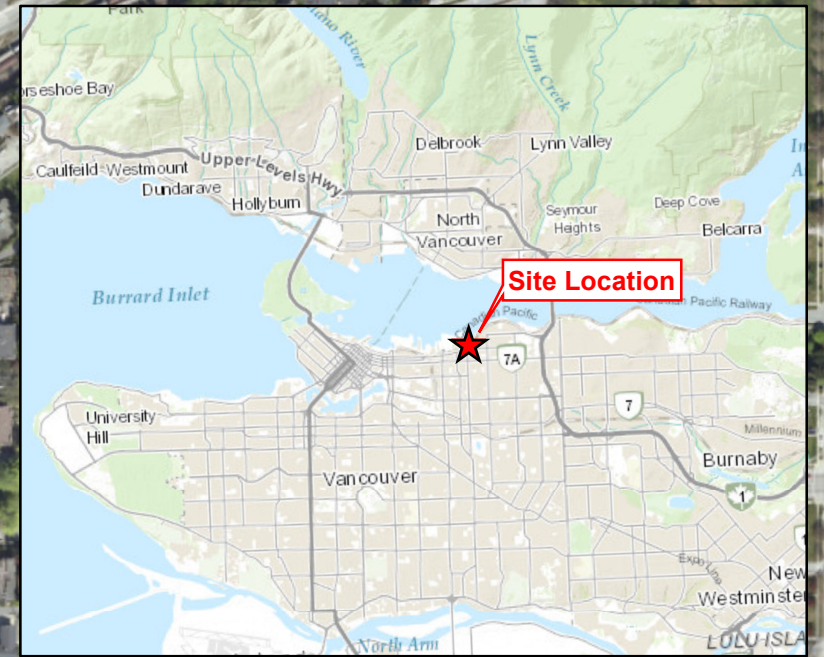
Drawings

- › Drawing 1 – Site Location
- › Drawing 2 – Vegetation/Tree Removal
- › Drawing 3 – Location of Intertidal and Subtidal Survey Transects, Surveyed on May 13, 2021
- › Drawing 4 – Map Showing the Distribution of the Observed Habitats on May 13, 2021





Vancouver Harbour



Legend

- Site Location
- Site Boundary (Approximate)

REFERENCES:

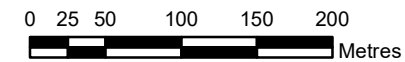
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 Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

NOTES:

1. Original in colour.
2. Numerical scale reflects full-size print. Print scaling will distort this scale, however scale bar will remain accurate.
3. Intended for illustration purposes, accuracy has not been verified for construction or navigation purposes.
4. Site boundary is approximate and may be subject to change.

REVISIONS:

0 - AM - 2021-04-01 - DRAFT - BL



CLIENT:
Vancouver-Fraser Port Authority

PROJECT LOCATION:
Former Sterling Shipyard Site,
Vancouver, BC



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Site Location

BY: AM	SCALE: 1:5,000	DATE: 2021-04-01	REF No:	REV: 0
CHKD: BL	Proj Coord Sys: NAD 1983 UTM Zone 10N		677011-001	





Legend

-  Site Boundary (Approximate)
-  Vegetation/Tree Removal

REFERENCES:

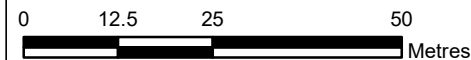
1. Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

NOTES:

1. Original in colour.
2. Numerical scale reflects full-size print. Print scaling will distort this scale, however scale bar will remain accurate.
3. Intended for illustration purposes, accuracy has not been verified for construction or navigation purposes.
4. Site boundary is approximate and may be subject to change.
5. Laydown areas, site access points, spill kit locations, locations of water quality sampling, refueling areas, fuel storage areas, hazardous material storage areas are to be determined and will be included in a later revision.

REVISIONS:

0 - AM - 2021-05-21 - DRAFT - BL



CLIENT:
Vancouver-Fraser Port Authority

PROJECT LOCATION:
Former Sterling Shipyard Site,
Vancouver, BC

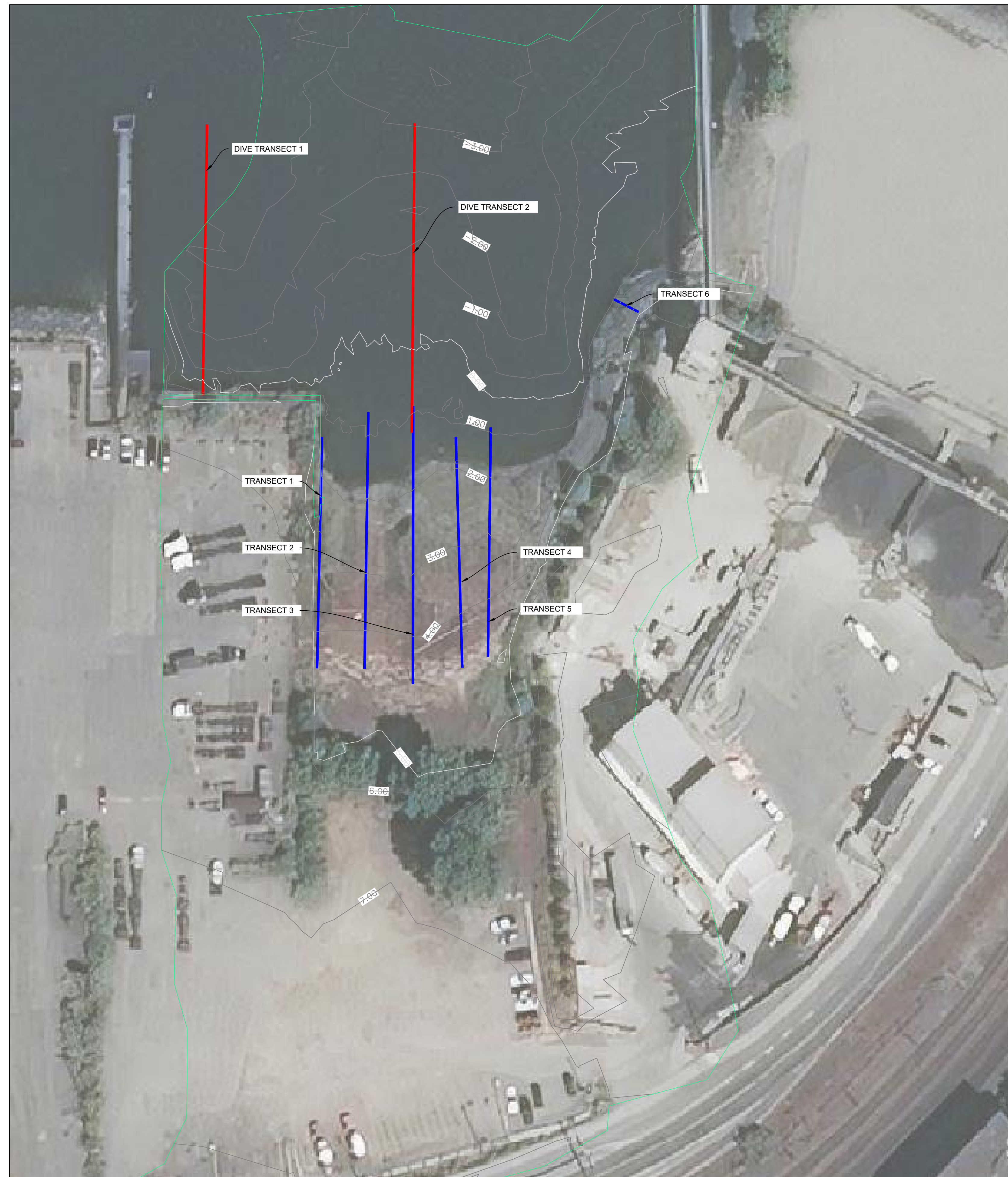


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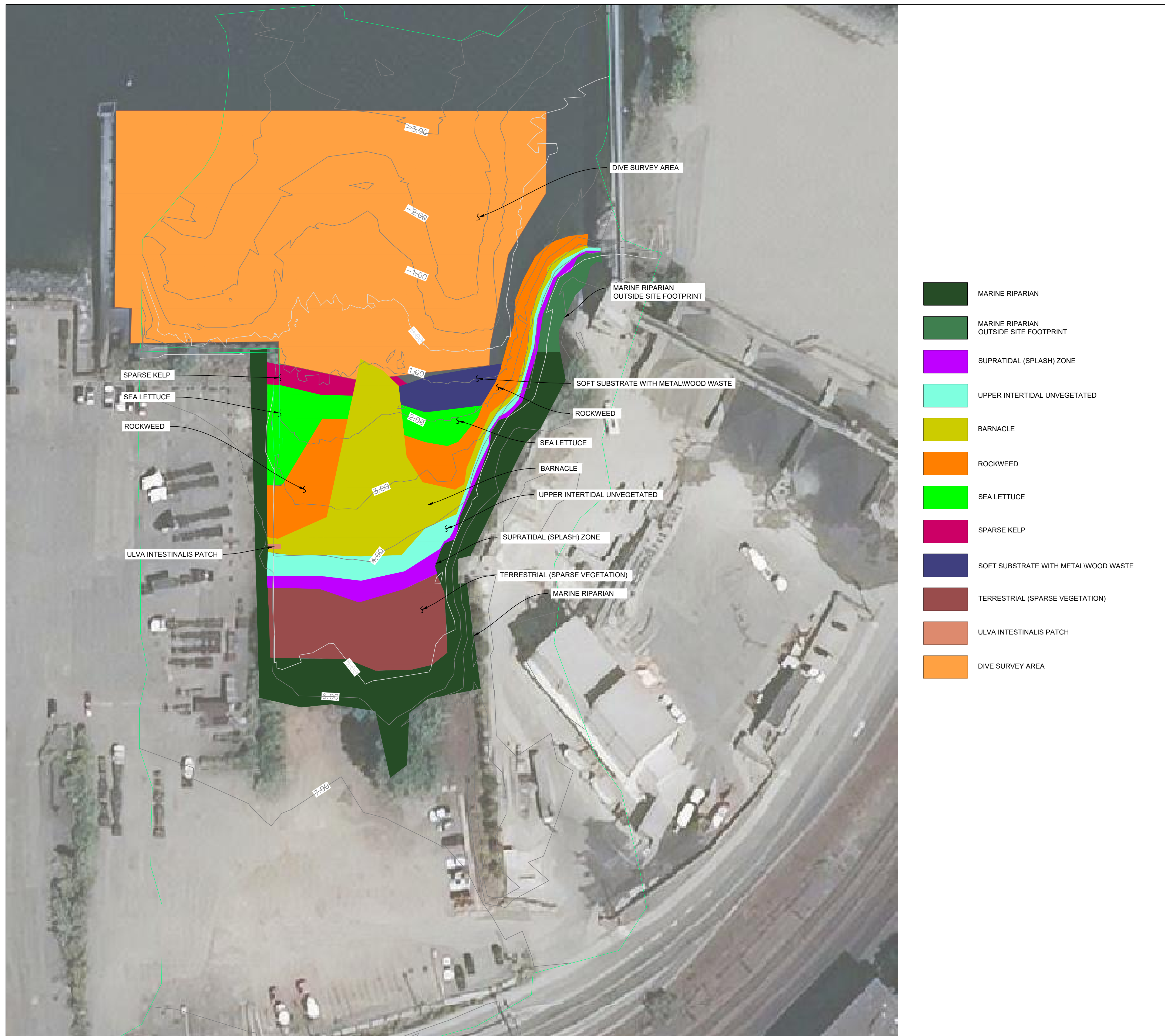
Vegetation/Tree Removal

BY: AM	SCALE: 1:1,000	DATE: 2021-05-21	REF No:	REV: 0
CHKD: BL	Proj Coord Sys: NAD 1983 UTM Zone 10N		677011-002	





Drawing 3 - Location of Intertidal and Subtidal Survey Transects, Surveyed on May 13, 2021



Drawing 4 - Map Showing the Distribution of the Observed Habitats on May 13, 2021

Appendix II

Site Photographs

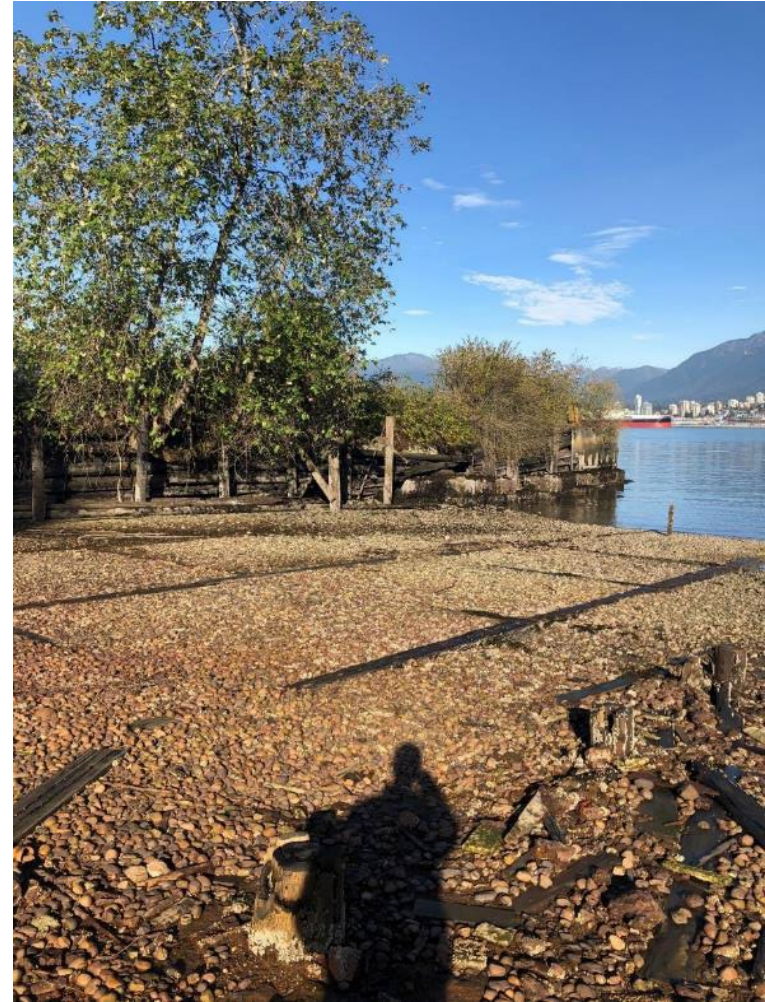




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Photograph 1: Marine riparian area on the southern portion of the Site, facing southwest (SNC-Lavalin, October 26, 2020).



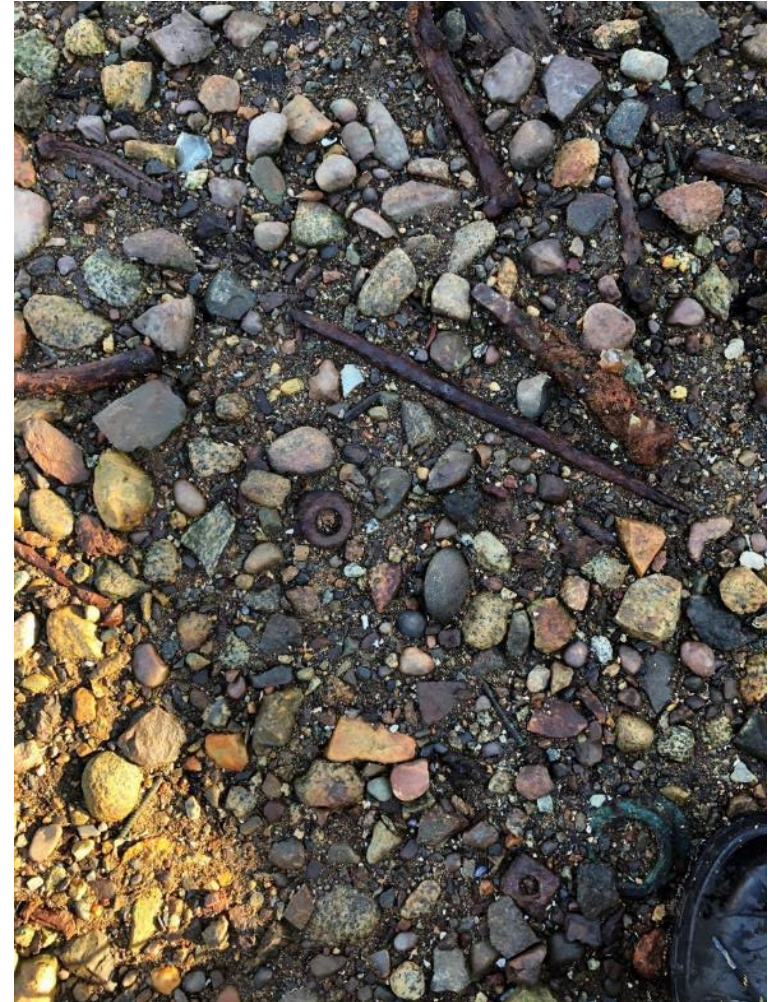
Photograph 2: Western Retaining Wall, facing northwest (SNC-Lavalin, October 26, 2020).



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Photograph 3: Eastern Retaining Wall, facing northeast (SNC-Lavalin, October 26, 2020).



Photograph 4: Site substrate and rusted metal components of the former shipyard (SNC-Lavalin, October 26, 2020).



Photograph 5: Remnants of wooden shipyard infrastructure embedded in Site's intertidal zone. Marine riparian area visible in the background. Facing southwest. (SNC-Lavalin, October 26, 2020).



Photograph 6: Logs along the intertidal area of the Site. Invasive curled dock visible in foreground. Facing northeast (SNC-Lavalin, October 26, 2020).



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Photograph 7: Cottonwood trees within the marine riparian area of the site. Noxious Bohemian knotweed visible in foreground. Facing southeast (SNC-Lavalin, October 26, 2020).



Photograph 8: Canada Geese in western adjacent parking lot, facing west (SNC-Lavalin, October 26, 2020).



Photograph 9: Intact egg, potentially Canada Goose, found in western portion of the Site's marine riparian area (SNC-Lavalin, October 26, 2020).



Photograph 10: Vacant nesting platform observed on lot neighbouring the Site to the east, potentially intended for Bald Eagle, facing east (SNC-Lavalin, October 26, 2020).



Photograph 11: Small shore crabs located within the Site's intertidal substrate (SNC-Lavalin, October 26, 2020).



Photograph 12: Noxious weed Bohemian knotweed within the marine riparian area of the Site, facing southwest (SNC-Lavalin, October 26, 2020).



Photograph 13: The Site, viewed south to north, from the Site's marine riparian area (SNC-Lavalin, October 26, 2020).



Photograph 14: The Site, viewed southeast to northwest. The western retaining wall is visible (SNC-Lavalin, October 26, 2020).



Photograph 15: Logs, wood debris and refuse on Site (SNC-Lavalin, October 26, 2020).



Photograph 16: Logs, wood debris on Site, viewed southeast to northwest (SNC-Lavalin, October 26, 2020).



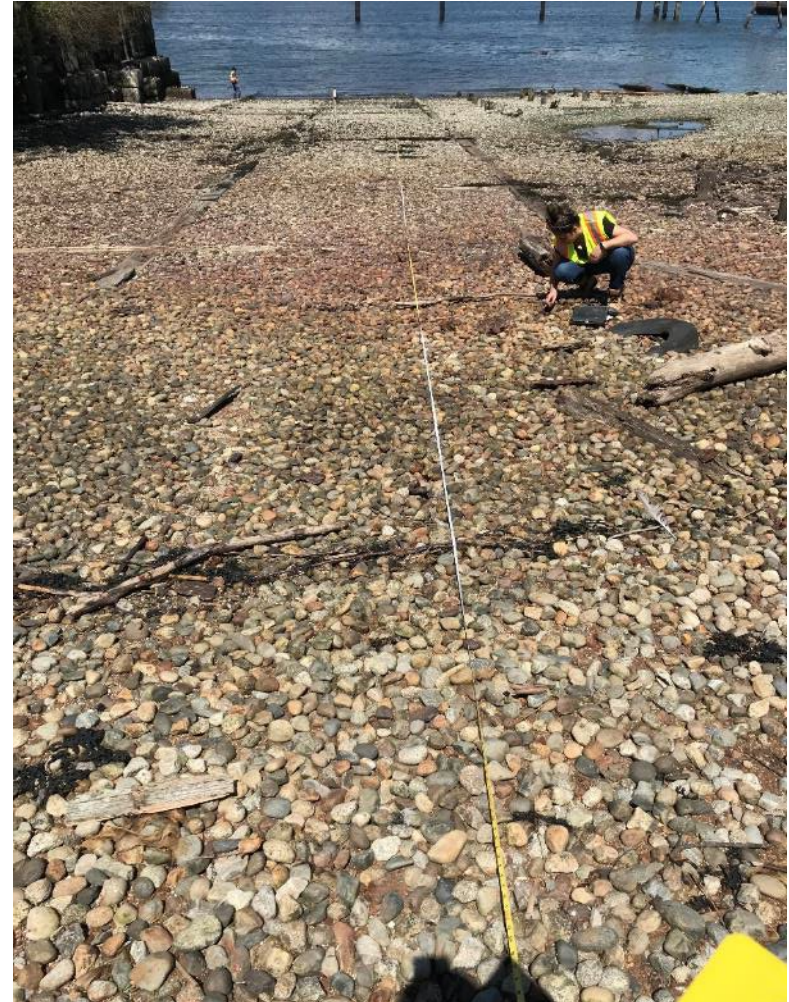
Photograph 17: Overview of marine intertidal zone as observed during intertidal habitat assessment on May 13, 2021.



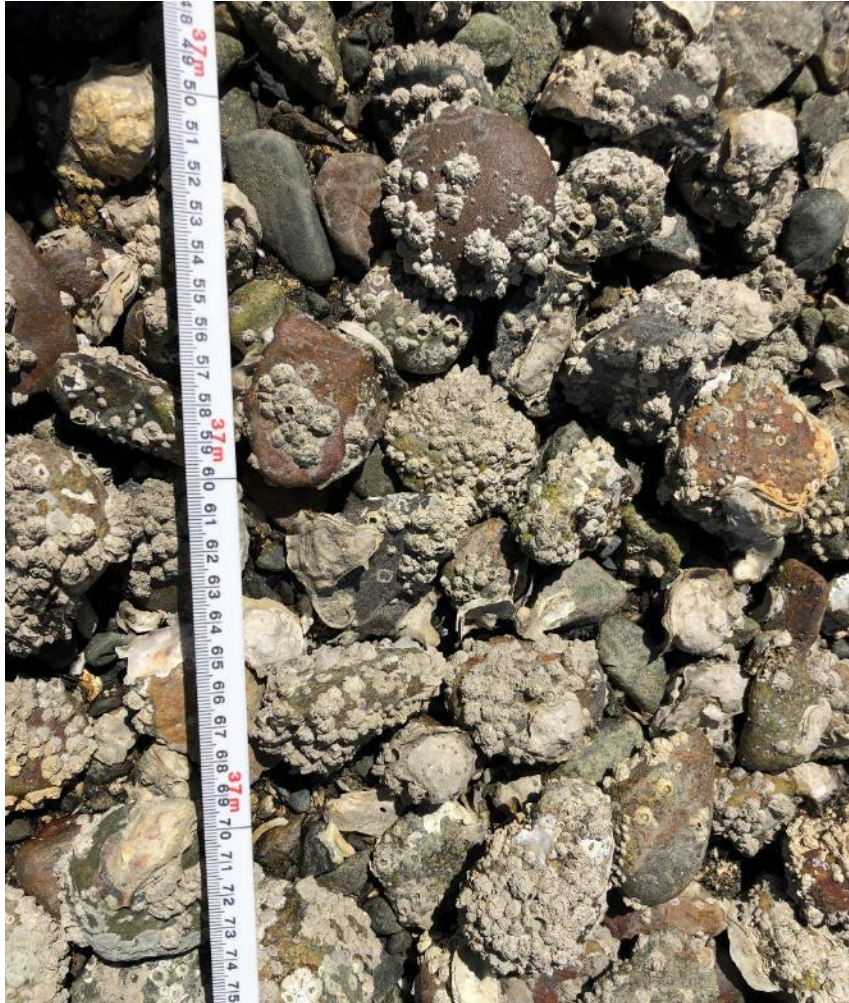
Photograph 18: Marine Riparian Habitat Band (background) and Backshore Habitat Band (foreground) as observed May 13, 2021.



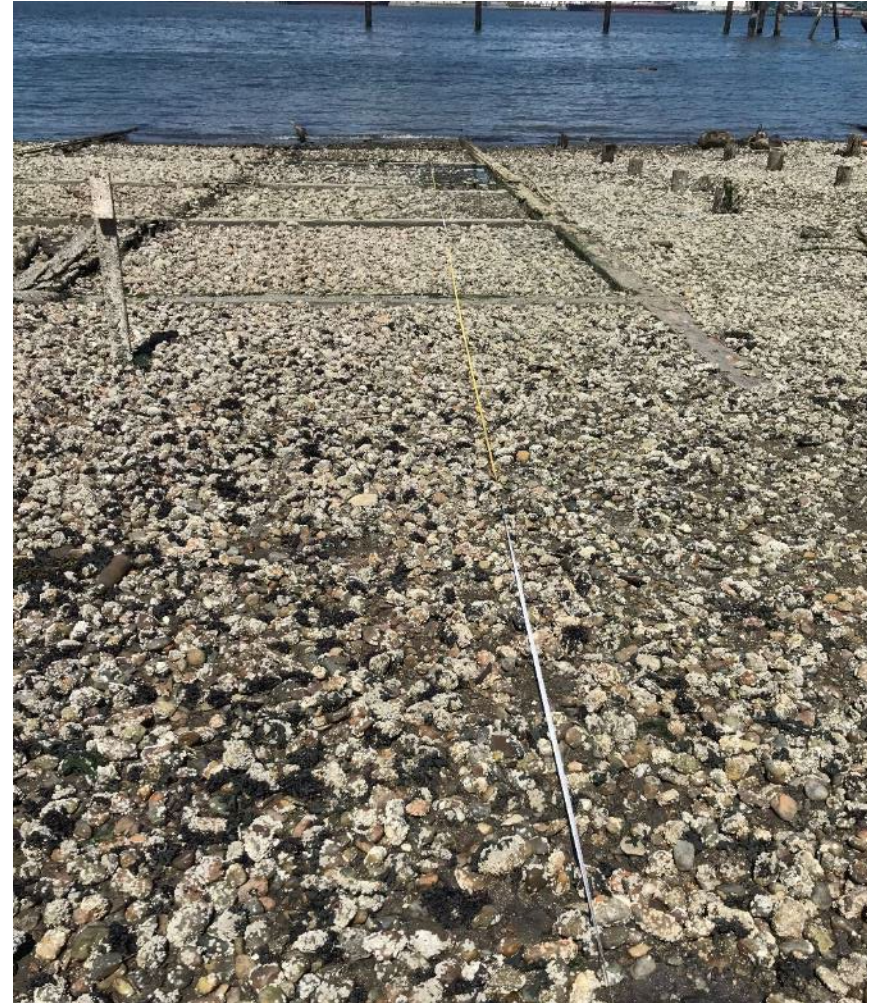
Photograph 19: Transect 1 (background) and Supralittoral (Splash Zone) Habitat Band (foreground) as observed May 13, 2021.



Photograph 20: Upper Intertidal Unvegetated Habitat Band as observed May 13, 2021.



Photograph 21: Barnacle Habitat Band as observed May 13, 2021.



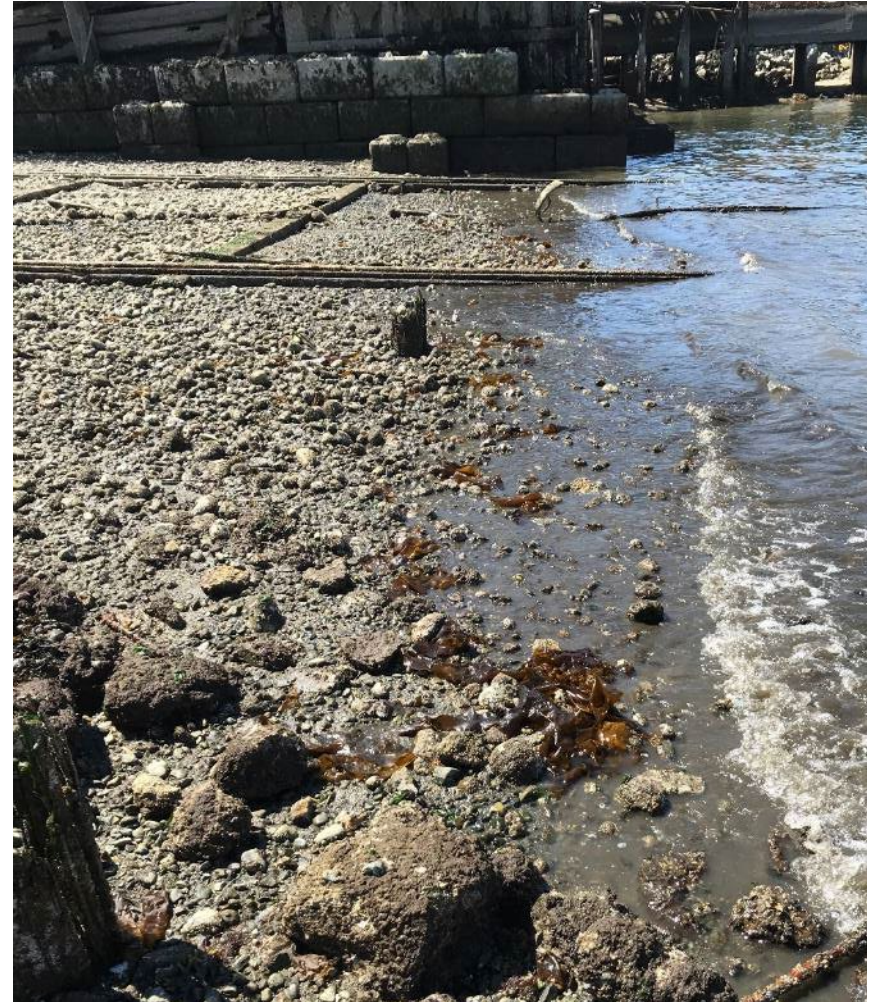
Photograph 22: Rockweed Habitat Band (foreground) as observed May 13, 2021.



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Photograph 23: Sea Lettuce Habitat Band as observed May 13, 2021.



Photograph 24: Low Intertidal Habitat Band as observed May 13, 2021.



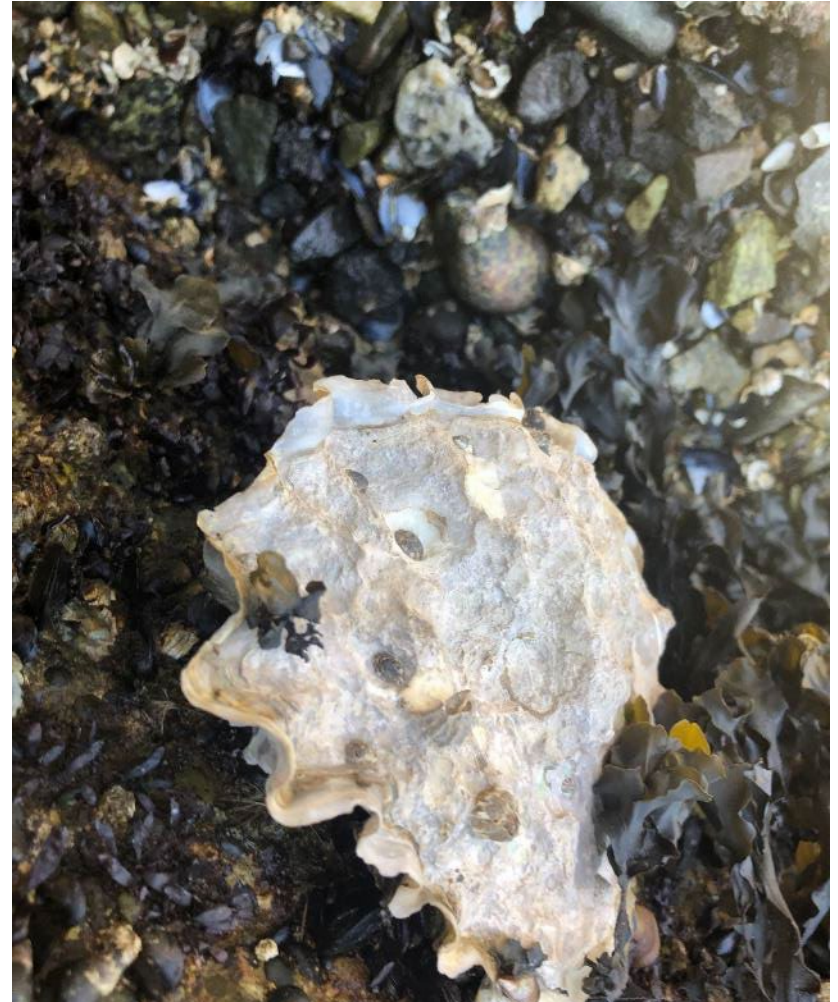
Photograph 25: *Ulva intestinalis* observed on May 13, 2021.



Photograph 26: Rockweed (*Fucus gardneri*) growing on wood waste observed on May 13, 2021.



Photograph 27: Industrial waste and contamination observed on May 13, 2021.



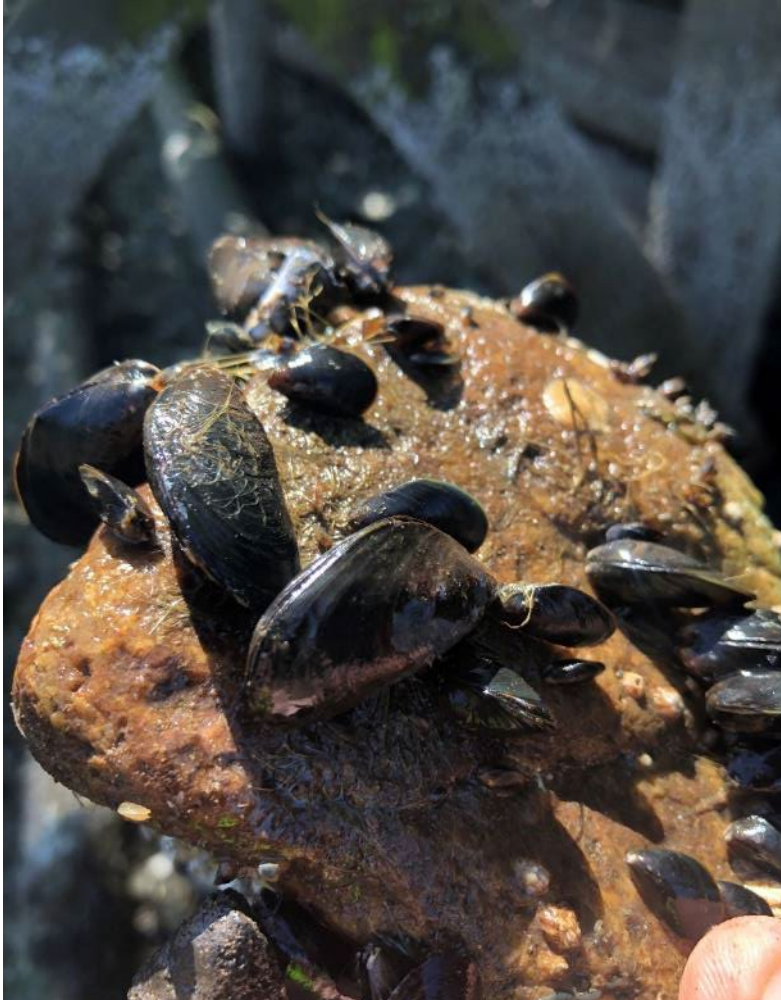
Photograph 28: Pacific Oyster (*Crassostrea gigas*) observed on May 13, 2021.



Photograph 29: Sea lettuce (*Ulva sp.*), limpet (*Lottia sp.*), and periwinkles (*Littorina spp.*), observed on May 13, 2021.



Photograph 30: Limpet (*Tectura sp.*), acorn barnacles (*Balanus glandula*) and periwinkles (*Littorina spp.*), observed on May 13, 2021.



Photograph 31: Blue mussels (*Mytilus edulis*), observed on May 13, 2021.



Photograph 32: Ochre seastars (*Pisaster ochraceus*), and tubeworm (*Eudistylia vancouverii*) observed on May 13, 2021.

Appendix III

Intertidal Survey Transect Summary





TRANSECT 1



Photograph 1: Transect 1 taken from start of transect towards the waterline.

Photograph 2: Transect 1 taken from waterline toward shore.

Transect Measurement	Habitat Band	Substrate	Observed species and Relative Abundance		
0-3.5 m	Supralittoral (Splash Zone)	Sand/silt with gravel	Abundant	Common	Present
			Sand hopper (unidentified amphipod)		Saltbush (<i>Atroplex</i> sp.)
3.5-9.1 m	Upper Intertidal Unvegetated	sand and gravel, with occasional cobbles, on top of silt	Abundant	Common	Present
			Sand hopper		
9.1-12.5 m	Barnacle	Gravel on sand/silt	Abundant	Common	Present
			Acorn Barnacles (<i>Balanus glandula</i>) Green seaweed (<i>Ulva intestinalis</i>) Unidentified nematodes Sand hopper		Shore crabs (<i>Hemigrapsus nudus</i> and <i>H. oregonensis</i>) Limpets (<i>Lottia</i> spp. and <i>Tectura</i> spp.) Blue mussels (<i>Mytilus edulis</i>) Periwinkles (<i>Littorina</i> spp.)
12.5-23.5 m	Rockweed	Gravel, with cobbles, on top of Sand and Shell hash	Abundant	Common	Present
			Acorn Barnacles (<i>Balanus glandula</i>) Periwinkles (<i>Littorina</i> spp.) Sand hopper Shore crabs (<i>Hemigrapsus nudus</i> and <i>H. oregonensis</i>)	Turkish washcloth leafy phase (<i>Mastocarpus papillatus</i>) Rockweed (<i>Fucus gardneri</i>) Blue mussels (<i>Mytilus edulis</i>)	Butter Clam (<i>Saxidomus gigantea</i>)

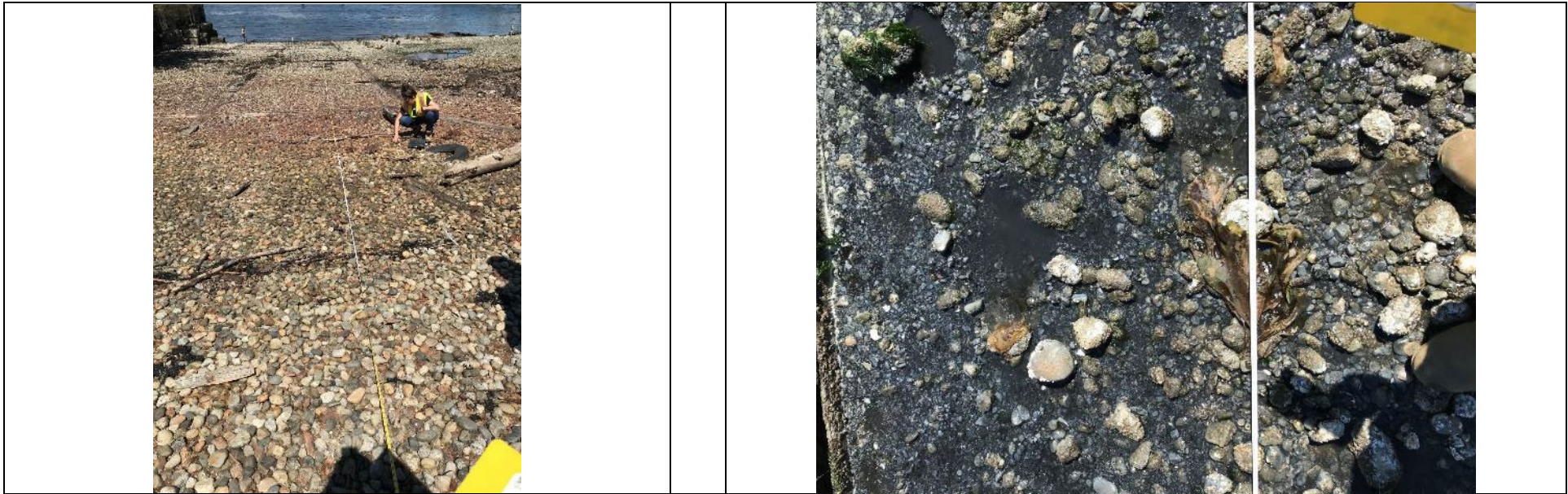


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23.5-51.5 m	Sea Lettuce	Gravel, with cobbles, on top of Sand and Shell hash	Abundant	Common	Present
			Turkish washcloth leafy and crustose phases (<i>Mastocarpus papillatus</i>) Rockweed (<i>Fucus gardneri</i>) Sea Lettuce (<i>Ulva spp.</i>) Acorn Barnacles (<i>Balanus glandula</i>) Periwinkles (<i>Littorina spp.</i>) Shore crabs (<i>Hemigrapsus nudus</i> and <i>H. oregonensis</i>)	Blue mussels (<i>Mytilus edulis</i>) Pacific oysters (<i>Crassostrea gigas</i>) Limpets (<i>Lottia spp.</i> and <i>Tectura spp.</i>)	
51.5-55 m	Low Intertidal	Cobble on mud and shell hash	Abundant	Common	Present
			Rockweed (<i>Fucus gardneri</i>) Sea Lettuce (<i>Ulva spp.</i>) Acorn Barnacles (<i>Balanus glandula</i>) Periwinkles (<i>Littorina spp.</i>) Shore crabs (<i>Hemigrapsus nudus</i> and <i>H. oregonensis</i>) Pacific oysters (<i>Crassostrea gigas</i>) Limpets (<i>Lottia spp.</i> and <i>Tectura spp.</i>)	Sea Lettuce (<i>Ulva spp.</i>) Turkish washcloth leafy and crustose phases (<i>Mastocarpus papillatus</i>)	Sugar Kelp (<i>Laminaria spp.</i>) Green urchin (<i>Strongylocentrotus droebachiensis</i>) Scaleworm (<i>Halosydna spp.</i>) ochre seastars (<i>Pisaster ochraceous</i>)



TRANSECT 2



Photograph 3: Transect 2 taken from start of transect towards the waterline.

Photograph 4: Patch of visible contamination observed on Transect 2.

Transect Measurement	Habitat Band	Substrate	Observed species and Relative Abundance		
0 to 2.2 m	Supralittoral (Splash Zone)	Gravel on sand/silt	Abundant	Common	Present
			Sand hopper (unidentified amphipod)		Saltbush (<i>Atroplex</i> spp.)
2.2-8.0 m	Upper Intertidal Unvegetated	sand and gravel, with occasional cobbles, on top of silt	Abundant	Common	Present
			Sand hopper		
8.0-13.0 m	Barnacle	Gravel on sand/silt	Abundant	Common	Present
			Acorn Barnacles (<i>Balanus glandula</i>) Shore crabs (<i>Hemigrapsus nudus</i> and <i>H. oregonensis</i>) Sand hopper Periwinkles (<i>Littorina</i> spp.)		
13.0- 39.0 m	Rockweed	Gravel, with cobbles, on top of Sand and Shell	Abundant	Common	Present
			Acorn Barnacles (<i>Balanus glandula</i>) Periwinkles (<i>Littorina</i> spp.)	Turkish washcloth leafy phase (<i>Mastocarpus papillatus</i>) Rockweed (<i>Fucus gardneri</i>)	Blue mussels (<i>Mytilus edulis</i>) Sea Lettuce (<i>Ulva</i> spp.) <i>Porphyra</i> spp.



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		hash, visible contamination	Shore crabs (<i>Hemigrapsus nudus</i> and <i>H. oregonensis</i>) Pacific oysters (<i>Crassostrea gigas</i>)		
39.0-47.0 m	Sea Lettuce	Gravel, with cobbles, on top of Sand and Shell hash	Abundant	Common	Present
			Acorn Barnacles (<i>Balanus glandula</i>) Sea Lettuce (<i>Ulva spp.</i>) Pacific oysters (<i>Crassostrea gigas</i>) Periwinkles (<i>Littorina spp.</i>) Shore crabs (<i>Hemigrapsus nudus</i> and <i>H. oregonensis</i>)	Blue mussels (<i>Mytilus edulis</i>) Pacific oysters (<i>Crassostrea gigas</i>) Limpets (<i>Lottia spp.</i> and <i>Tectura spp.</i>)	Topsnail (<i>Calliostoma sp.</i>)
47.0-55.0 m	Low Intertidal	Cobble on mud and shell hash	Abundant	Common	Present
			Acorn Barnacles (<i>Balanus glandula</i>) Shore crabs (<i>Hemigrapsus nudus</i> and <i>H. oregonensis</i>)	Sea Lettuce (<i>Ulva spp.</i>) Sugar Kelp (<i>Laminaria spp.</i>) Blue mussels (<i>Mytilus edulis</i>) Pacific oysters (<i>Crassostrea gigas</i>)	<i>Sargassum sp.</i>



TRANSECT 3



Photograph 5: Transect 3 taken from waterline toward shore.

Photograph 6: Transect 3 taken from start of transect towards the waterline.

Transect Measurement	Habitat Band	Substrate	Observed species and Relative Abundance		
0-3 m	Supralittoral (Splash Zone)	Gravel on sand/silt, driftwood	Abundant	Common	Present
			Sand hopper (unidentified amphipod)		Saltbush (<i>Atroplex</i> sp.)
3.0-11.5 m	Upper Intertidal Unvegetated	sand and gravel, with occasional cobbles, cut-off pilings	Abundant	Common	Present
			Sand hopper		
11.5-62.0 m	Barnacle	Gravel on sand/silt, much metal scrap	Abundant	Common	Present
			Acorn Barnacles (<i>Balanus glandula</i>) Shore crabs (<i>Hemigrapsus nudus</i> and <i>H. oregonensis</i>) Sand hopper Periwinkles (<i>Littorina</i> spp.)		
	Approx. 5 m Sea Lettuce Patch within barnacle band	Gravel, with cobbles, on top of Sand and Shell hash	Abundant	Common	Present
			Acorn Barnacles (<i>Balanus glandula</i>) Sea Lettuce (<i>Ulva</i> spp.) Pacific oysters (<i>Crassostrea gigas</i>) Periwinkles (<i>Littorina</i> spp.) Shore crabs (<i>Hemigrapsus nudus</i> and <i>H. oregonensis</i>)	Blue mussels (<i>Mytilus edulis</i>) Pacific oysters (<i>Crassostrea gigas</i>) Limpets (<i>Lottia</i> spp. and <i>Tectura</i> spp.)	Topsnail (<i>Calliostoma</i> sp.)



TRANSECT 4



Photograph 7: Transect 4 taken from waterline toward shore.

Photograph 8: Transect 4 taken from shore to waterline.

Transect Measurement	Habitat Band	Substrate	Observed species and Relative Abundance		
0-5.0 m	Supralittoral (Splash Zone)	Gravel on sand/silt, driftwood	Abundant	Common	Present
			Sand hopper (unidentified amphipod)	Earwigs Wood louse	Saltbush (<i>Atroplex</i> spp.)
5-12.0 m	Upper Intertidal Unvegetated	sand and gravel, with occasional cobbles, cut-off pilings	Abundant	Common	Present
			Sand hopper		
12.0-55.0	Barnacle	Gravel on sand/silt, much metal scrap	Abundant	Common	Present
			Acorn Barnacles (<i>Balanus glandula</i>) Shore crabs (<i>Hemigrapsus nudus</i> and <i>H. oregonensis</i>) Sand hopper Periwinkles (<i>Littorina</i> spp.)	Rockweed and Turkish washcloth (on cut off piles only)	
< 55 m	Low Intertidal	Cobble on mud and shell hash	Abundant	Common	Cobble on mud and shell hash
			Acorn Barnacles (<i>Balanus glandula</i>) Shore crabs (<i>Hemigrapsus nudus</i> and <i>H. oregonensis</i>)	Sea Lettuce (<i>Ulva</i> spp.) Sugar Kelp (<i>Laminaria</i> spp.) Blue mussels (<i>Mytilus edulis</i>) Pacific oysters (<i>Crassostrea gigas</i>)	Hermit Crabs (<i>Pagurus</i> spp.) Tube worms (<i>Eudisyllia vancouverii</i>) ochre seastars (<i>Pisaster ochraceous</i>) mottled seastars (<i>Evasterias troscheli</i>)



TRANSECT 5



Photograph 9: Transect 5 taken from waterline toward shore.

Photograph 10: Transect 5 taken from shore to waterline.

Transect Measurement	Habitat Band	Substrate	Observed species and Relative Abundance		
0-7 m	Supralittoral (Splash Zone)	Sand and shell hash	Abundant	Common	Present
			Sand hopper (unidentified amphipod)		Saltbush (<i>Atroplex</i> sp.)
7-12.5 m	Upper Intertidal Unvegetated	sand and gravel, with occasional cobbles, on top of silt	Abundant	Common	Present
			Sand hopper		
12.5-21.5 m	Barnacle	Gravel on sand/silt	Abundant	Common	Present
			Acorn Barnacles (<i>Balanus glandula</i>) Shore crabs (<i>Hemigrapsus nudus</i> and <i>H. oregonensis</i>) Sand hopper Periwinkles (<i>Littorina</i> spp.)		
21.5-33.0 m	Rockweed	Gravel, with cobbles, on top of Sand and Shell hash, visible contamination	Abundant	Common	Present
			Acorn Barnacles (<i>Balanus glandula</i>) Periwinkles (<i>Littorina</i> spp.) Shore crabs (<i>Hemigrapsus nudus</i> and <i>H. oregonensis</i>) Pacific oysters (<i>Crassostrea gigas</i>)	Turkish washcloth leafy phase (<i>Mastocarpus papillatus</i>) Rockweed (<i>Fucus gardneri</i>)	Blue mussels (<i>Mytilus edulis</i>) Sea Lettuce (<i>Ulva</i> spp.) <i>Porphyra</i> spp.



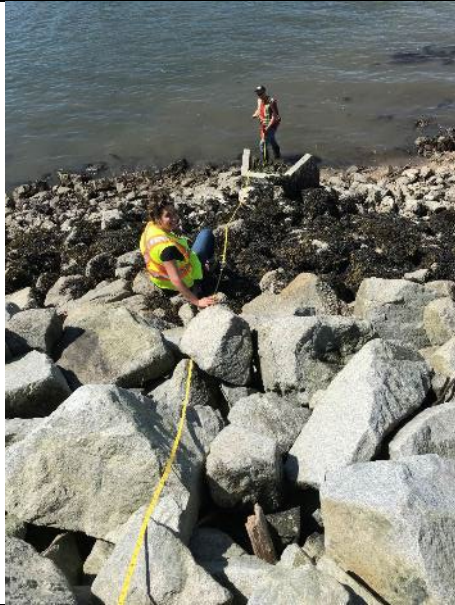
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33-43.5 m	Sea Lettuce	Gravel, with cobbles, on top of Sand and Shell hash	Abundant	Common	Present
			Acorn Barnacles (<i>Balanus glandula</i>) Periwinkles (<i>Littorina spp.</i>) Shore crabs (<i>Hemigrapsus nudus</i> and <i>H. oregonensis</i>)		Sea Lettuce (<i>Ulva spp.</i>)
43.5-51 m	Metal/Wood Waste	Cobble on mud with contamination and waste	Abundant	Common	Present
			Acorn Barnacles (<i>Balanus glandula</i>) Rockweed (<i>Fucus gardneri</i>) Sea Lettuce (<i>Ulva spp.</i>) Limpets (<i>Lottia spp.</i> and <i>Tectura spp.</i>)		



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TRANSECT 6



Photograph 11: Transect 6 taken from start of transect towards the waterline.



Photograph 12: Typical riprap breakwater habitat observed on-site.

Transect Measurement	Habitat Band	Substrate	Observed species and Relative Abundance		
0-1.0 m	Supralittoral (Splash Zone)	Bare riprap	Abundant	Common	Present
			None		
1.0 to 3.0 m	Upper Intertidal Unvegetated	Bare riprap	Abundant	Common	Present
			None		
3.0-3.8 m	Barnacle	Riprap	Abundant	Common	Present
			Acorn Barnacles (<i>Balanus glandula</i>)		
3.8-8.0 m	Rockweed	Riprap	Abundant	Common	Present
			Acorn Barnacles (<i>Balanus glandula</i>) Rockweed (<i>Fucus gardneri</i>) Sea Lettuce (<i>Ulva spp.</i>) Limpets (<i>Lottia spp. and Tectura spp.</i>) Periwinkles (<i>Littorina spp.</i>) Blue mussels (<i>Mytilus edulis</i>)		

Appendix IV

Subtidal Dive Survey



May 25, 2021

Foreshore File No.: 9307-R-01.1

Brian Lynch, MSc, RPBio.
SNC Lavalin
8648 Commerce Ct, Burnaby, BC
V5A 4N6

Via E-Mail: brian.lynch2@snclavalin.com

Re: Biophysical Survey of Sterling Shipyards, Vancouver, B.C.

Brian,

Please find below the results of Foreshore's biophysical survey of the Sterling Shipyards located in Vancouver, British Columbia (see Photo 1).

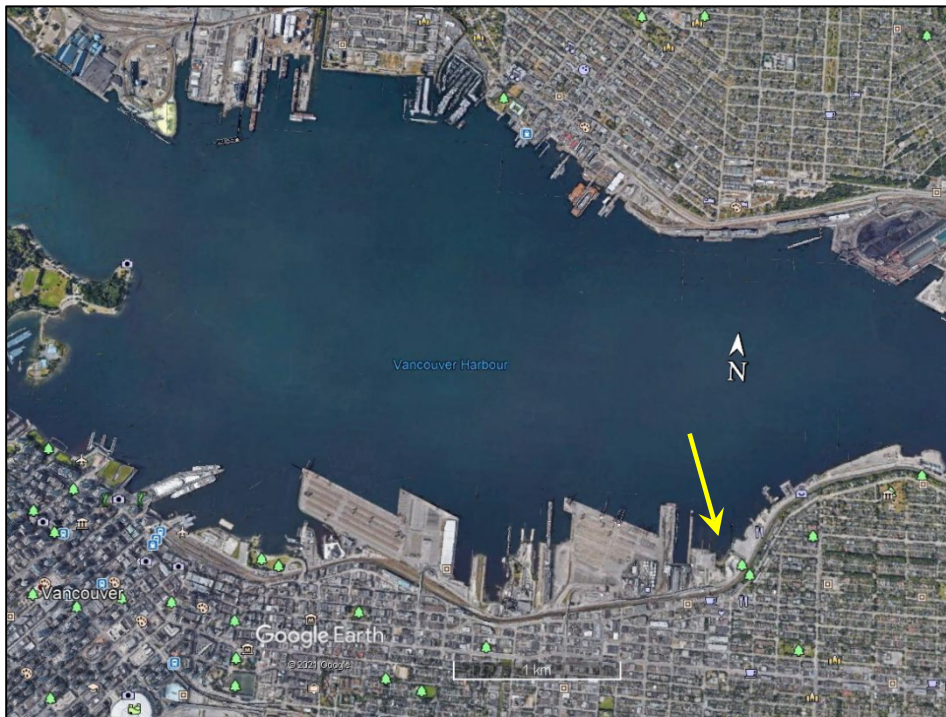


Photo 1. Location of the Sterling Shipyards in Vancouver Harbor.

1 Introduction

Foreshore Technologies Incorporated (Foreshore) was engaged by SNC Lavalin (Client) to perform a biophysical survey of an area within Sterling Shipyards (Project).

2 Biophysical Survey Methodology

2.1 General

Foreshore's Qualified Environmental Professionals (QEPs), with knowledge and experience of the local aquatic environment, performed an underwater biophysical survey of the Project site on May 17th, 2021.

Two transect locations were chosen to identify the physical and biological features of the area shown in Figure 1. Transect 1 was anchored at the sheet pile wall and extended perpendicularly offshore for 60m. Transect 2 was anchored at a depth of approximately +1m CD and extended perpendicular to the shoreline to 70m offshore.

Quadrats were taken in the different habitat zones of each transect. See Table 4 for quadrat observations.

Photographs illustrating site substrate and biota conditions were recorded and are included in the body of the report.

Figure 1. Survey Area and Transect Locations



2.2 Substrate and Biota

The survey included the mapping of surface substrates and biota as well as their abundance, elevation and distribution. Substrate conditions were identified on the basis of the following criteria (Fisheries and Oceans Canada, 1990):

Table 1. Substrate Categories

Substrate Type	Diameter (mm)
Silt	<0.625
Sand	0.625 to <2
Pebble	2 to <64
Cobble	64 to < 255
Boulder	>255
Riprap (angular rock)	>255

Additional substrate conditions noted during the survey included any significant build-up of shell hash, woody debris and/or anthropogenic materials.

Species and biota groups chosen for surveying were selected by the QEPs at the time of the survey as those that best represented the environmental and habitat conditions present. The abundance levels of selected species or biota groups were based on the Table 2 criteria:

Table 2. Abundance Categories

Abundance Category	Percent Areal Coverage (PAC)	Individuals / Quadrat (IPQ)
Rare	<5%	1
Sparse	5% to 25%	2 to 5
Few	26% to 50%	6 to 10
Common	51% to 75%	11 to 30
Abundant	>75%	> 30

Abundance categories were adapted from the Department of Fisheries and Oceans’ Coastal/Estuarine Fish Habitat Description and Assessment Manual (1990). Percent areal coverage refers specifically to areas along transects where a species was observed.

2.3 Elevations

Elevations within the surveyed area were recorded relative to Canadian Hydrographic Service (CHS) Chart Datum (CD) and were referred to the Vancouver Reference Station. All elevations are displayed in metres (m) CD. The survey area included approximately 7,500m² of seabed from an elevation of +1.0m CD down to -3.5m CD.

3 Biophysical Observations

3.1 Biological Conditions

Generally, rocky substrates such as cobble and pebble were found inshore becoming sparser with depth, see Photo 2. Fine substrates, such as sand and silt, were found throughout the survey area, see Photo 3.

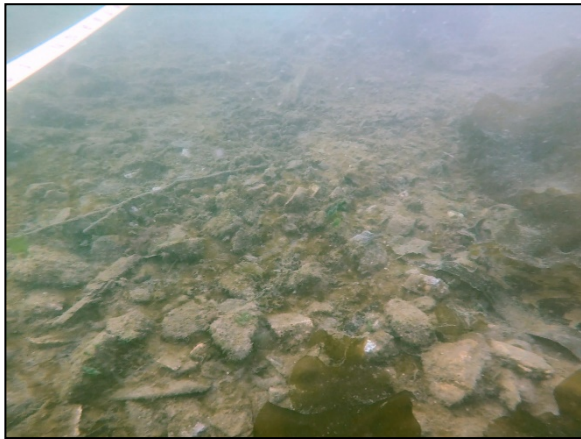


Photo 2: Cobble and pebble substrates in the submerged intertidal on Transect 1.

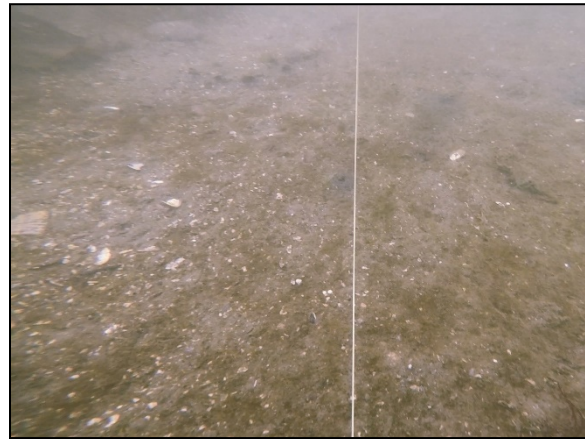


Photo 3: Sand/Silt substrate on the subtidal seabed of Transect 2.

Woody debris and shell hash were found throughout the survey area, see Photo 4. Anthropogenic materials, such as cut off piles, steel plates, piles of rope and other miscellaneous debris, were found on both transects, see Photo 5.



Photo 4: Example of woody debris and shell hash found throughout the survey area.



Photo 5: Derelict steel pile on Transect 1.

Two stepped rows of concrete lock blocks were observed fronting the sheet pile wall on Transect 1. The sheet pile wall and concrete blocks start in the southwest corner of the survey area and extend 37m east and then continue 90 degrees south inshore. For detailed substrate distribution, see Table 3.

Table 3. Substrate Distribution and Elevations

Transect Number	Transect distance (m)	Substrate Type			Elevation (m CD)	Notes
		Cobble	Pebble	Sand/Silt		
1	0	20	40	40	0.2	Lock block steps end at 2m
	5	15	70	15	-0.8	
	10	30		70	-1.8	
	15	30		70	-2.4	At 16m changes to 100% silt
	20			100	-2.7	
	25			100	-2.7	
	30			100	-3.0	
	35	10		90	-3.0	
	40	10		90	-3.0	
	45	10		90	-3.0	Scattered steel plates
	50	10		90	-3.3	Broken steel pile at 52m
	55	10		90	-3.3	
	60	10		90	-3.4	
2	0	40	60		1.3	Shell hash
	5	35	55	10	0.7	
	10	35	55	10	-0.5	
	15	25	25	50	0.1	
	20			100	-0.2	
	25			100	-0.3	
	30			100	-0.6	
	35			100	-0.6	
	40			100	-1.3	
	45			100	-1.3	
	50			100	-1.6	Large submerged log
	55			100	-1.9	Old timber pile at 58m
	60			100	-2.5	
65			100	-2.8		
70			100	-3.1		

3.2 Biological Conditions

The greatest abundance of biota was observed on stable substrates (cobble or derelict piles). Marine invertebrates observed included crabs, sea stars, anemones and unidentified burrowing species, see Photos 6 through 8. Marine flora observed included wireweed, broad-leaf kelps and various red algal species, see Photo 9 through 11. See Table 4 for a list of the primary biota observed.

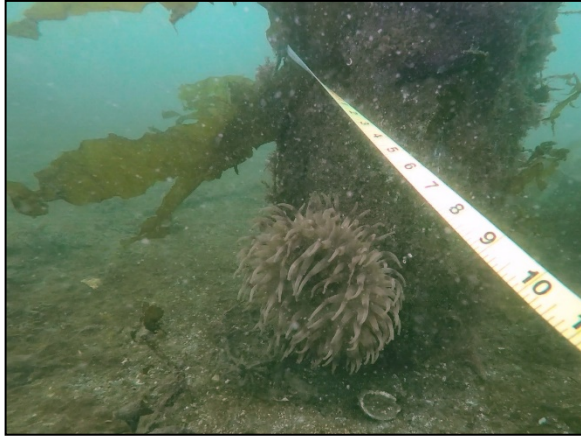


Photo 6: Painted anemone on cut off timber piling.



Photo 7: Dungeness crab adjacent to sugar wrack kelp.



Photo 8: Ochre stars on cut off steel pile.



Photo 9: Broad leaf kelps and wireweed common on rocky substrates.



Photo 10: Red algae with sea lettuce and broad leafed kelps.



Photo 11: Red filamentous algae with sugar wrack kelp and decorator crab on cement lock blocks.

Table 4. Quadrat Observations

Transect Number	Quadrat Number	Transect Distance (m)	Depth (m CD)	Substrate Type	Substrate Coverage (%)	Biota	Abundance
						(Common name)	
T1	1	5	-0.8	Cobble	15	Sugar Wrack Kelp	10%
				Pebble	70	Sea Lettuce	5%
				Sand/Silt	15		
	2	15	-2.4	Cobble	30	Sugar Wrack Kelp	20%
				Sand/Silt	70	Sea Lettuce	5%
	3	30	-3.0	Sand/Silt	100	Sugar Wrack Kelp	5%
					Dungeness Crab	1	
T2	1	10	-0.5	Cobble	35	Sea Lettuce	5%
				Pebble	55	Acorn Barnacle	60%
				Sand/Silt	10	Red filamentous algae	5%
	2	20	-0.2	Sand/Silt	100	Dungeness Crab	1
						Flatfish	1
						Leather star	1
	3	60	-2.5	Sand/Silt	100	Dungeness Crab	1
						Siphon	1
						Red filamentous algae	2%

Table 5. Species List and Locations

COMMON NAME	SCIENTIFIC NAME	LOCATION	
		T1	T2
MARINE ALGAE			
Sugar Wrack Kelp	<i>Saccharina latissima</i>	✓	✓
Red filamentous algae	<i>Unidentified</i>	✓	✓
Wireweed	<i>Sargassum muticum</i>	✓	✓
Seersucker Kelp	<i>Costaria costata</i>	✓	
Broad Acid Weed	<i>Desmarestia herbacea</i>	✓	✓
Sea Lettuce	<i>Ulva spp.</i>	✓	✓
Rockweed	<i>Fucus distichus</i>	✓	
ARTHROPODS			
Dungeness Crab	<i>Cancer magister</i>	✓	✓
Red Rock Crab	<i>Cancer productus</i>	✓	✓
Graceful Crab	<i>Cancer gracilis</i>	✓	
Graceful Decorator Crab	<i>Oregonia gracilis</i>	✓	✓
Common Acorn Barnacle	<i>Balanus glandula</i>	✓	✓
MOLLUSCS			
Pacific Blue Mussel	<i>Mytilus trossulus</i>	✓	
Siphons	<i>Unidentified</i>		✓
ECHINODERMS			
Mottled Star	<i>Evasterias troschelii</i>	✓	✓
Ochre Star	<i>Pisaster ochraceus</i>	✓	✓
Red Sea Cucumber	<i>Cucumaria miniata</i>	✓	
Leather Star	<i>Dermasterias imbricata</i>	✓	✓
WORMS			
Roll-Top Tubeworm	<i>Eudistylia catherinae</i>	✓	✓
CNIDARIANS			
Giant Plumose Anemone	<i>Metridium farcimen</i>	✓	
Short Plumose Anemone	<i>Metridium senile</i>	✓	
Painted Anemone	<i>Urticina crassicornis</i>		✓
TUNICATES			
Transparent Tunicate	<i>Corella willmeriana</i>	✓	
VERTEBRATES – FIN FISH			
Flatfish	<i>Unidentified</i>	✓	

4 Clarifications and Limitations

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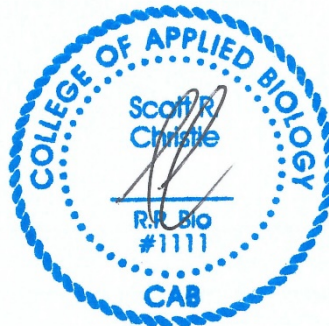


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Original Signed and Sealed



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