Technical Data Report—Marine Resources

Ksi Lisims LNG – Natural Gas Liquefaction Facility and Marine Terminal

June 2024

Prepared for:

KSI LISIMS LNG

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Executive Summary

The Nisga'a Nation, Rockies LNG Limited Partnership (**Rockies LNG**) and Western LNG LLC (via its subsidiary, Western LNG) (each a Proponent and collectively referred to herein as the **Proponents**), are proposing to jointly develop an energy project, the Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal Project (the **Project**), a floating liquefied natural gas (**FLNG**) production, storage and offloading facility, with supporting upland infrastructure and a marine terminal. The Project site (**Site**) is located at Wil Milit, on the northern end of Pearse Island, British Columbia (**BC**), approximately 15 kilometres (**km**) west of the Nisga'a community of Gingolx. The Site is located on Category A fee simple land as defined in the Nisga'a Final Agreement (**Nisga'a Treaty**). The marine terminal is located in a proposed Water Lot (DL 5431) at the northern end of Pearse Island in Portland Canal.

Construction, operation, and decommissioning phases of the Project have the potential to affect marine resources, which are of cultural, ecological, and economic importance. This Technical Data Report (**TDR**) provides a summary of information on Marine Resources (marine mammals, marine fish and invertebrates, marine vegetation, marine water, and sediment quality) in the field survey areas and the overall Marine Resources Study Area for the Project.

Information gathered through a review of existing data was augmented with Project-specific field studies completed in 2021–2022. The desktop study collected information from publicly available scientific literature, government reports, and spatial data, as well as Indigenous knowledge from Nisga'a Nation, Lax Kw'alaams Band, Metlakatla First Nation, Kitsumkalum First Nation, Kitselas First Nation, Gitxaała Nation, Gitga'at First Nation. Information was also solicited from Haida Nation and the Métis Nation British Columbia; however, no traditional use studies were provided by these nations. The field studies were designed to collect Site-specific information on Marine Resources in areas potentially affected by the Project. Field surveys completed by Stantec Consulting Ltd. (**Stantec**) in 2021 and 2022 included intertidal, subtidal, marine fish, marine water quality, marine sediment quality, marine mammal, and remote sensing. The specific methods and results for each survey are described in their respective sections. An additional field program, led by JASCO Applied Sciences, involved the collection of existing underwater noise levels. In addition to the field programs, two predictive models were completed; a sediment scour model was completed by Stantec and an underwater noise model was completed by JASCO Applied Sciences (modelled extent of elevated underwater noise during the construction and operation phases).

The intertidal and subtidal marine habitats observed during the field surveys were consistent with the general description for these habitats across the North Coast of BC and included a mix of rocky shorelines, rock/gravel/sand beaches, and subtidal rocky features as well as large expanses of fine sediment seabed. A number of biologically sensitive areas were observed during field surveys including one glass sponge reef (Class *Hexactinellida*) observed off the west side of Pearse Island, several small eelgrass patches (*Zostera* spp.), and a fringing band of bull kelp (*Nereocystis luetkeana*) growing along the exposed rocky shorelines of Pearse Island.

Intertidal zones were dominated by coarse substrates (i.e., boulder, cobble, and gravel) along east and west Pearse Island as well as at Whiskey Bay. East and west Pearse Island substrates were also dominated by bedrock with increasing percentages of fines lower in the intertidal zones. In contrast, no bedrock substrates were observed in Whiskey Bay, and fines increased in percent cover in the mid and low intertidal areas. Taxa richness (organisms identified to lowest practicable taxonomic level) was highest in the marine terminal location (east Pearse Island) with 59 taxa observed, including 33 algal taxa, 3 aggregating invertebrate taxa, 19 solitary invertebrate taxa, and 4 fish taxa. Several taxa of algae were observed including harvested species. Brown (kelp [Order Laminariales], rockweed [*Fucus* spp.]), green (sea lettuce [*Ulva* spp.]), red (sea brush [*Odonthalia* spp.] and red rock crust [*Hildenbrandia* spp.]) algal taxa were observed in east and west Pearse Island as well as in Whiskey Bay. Barnacles and mussels were the most commonly observed aggregating invertebrate taxa. East Pearse Island had higher taxa richness for algae compared to solitary invertebrates, whereas in west Pearse Island and Whiskey Bay solitary invertebrates represented the group with the highest taxa richness. In general, quadrats in the high intertidal areas had lower species richness than those in the mid and low intertidal elevations. Intertidal digs revealed six species of bivalves, including cockles (*Clinocardium* spp.), butter clams (*Saxidomus gigantea*), soft shell clams (*Mya arenaria*), Manila clams (*Venerupis philippinarum*), Pacific littleneck clams (*Protothaca staminea*), and Pacific gapers (*Tresus nuttallii*). No northern abalone, or any other species at risk, were observed during intertidal surveys.

Subtidal substrates were dominated by fines (sand or mud < 2 millimetre [mm] diameter) in the three depth bins surveyed (i.e., shallow [≤ 50 metres [m]], intermediate [51–100m], and deep [> 100 m]). Substrates were mostly fine in the deeper waters of the subtidal transects and transitioned to a mix of fines, gravel (2–64 mm diameter), and cobble (64–256 mm diameter) in shallower areas. Taxa richness was highest in the marine terminal location (east Pearse Island) with 84 taxa observed, including 7 taxa of algae, 60 taxa of invertebrates, and 17 taxa of fish. Sea lettuce, rockweed, and kelp (Order Laminariales) were the most abundant algae species in all three subareas. Marine invertebrates had the highest taxa richness of the three biota groups at east and west Pearse Island and Whiskey Bay, and taxa such as sea stars, urchins, and crabs were observed in each subarea. Marine fish such as flatfish, rockfish (*Sebastes* spp., sculpin (Family Cottidae), and poachers (Family Agonidae) were observed in all three subareas, but more marine fish taxa were observed at east and west Pearse Island than in Whiskey Bay. Rockfish were only observed in the east and west Pearse Island subareas with one species of conservation concern (quillback rockfish [*Sebastes maliger*]) observed off the northeastern side of Pearse Island. This species is currently listed as Threatened by the Committee on the Status of Endangered Wildlife in Canada (**COSEWIC**) (SARA 2022).

Marine fish surveys were conducted to determine fish taxa presence, abundance, and distribution. A total of 1,602 fish were captured during the beach seine and trawl surveys, representing a total of 27 taxa. Juvenile salmon were observed at all subareas during the March and June surveys, with the highest abundance of juvenile salmonids observed during the summer at west and east Pearse Island. Groundfish were observed only in the three subareas during the June and September surveys, with the highest abundance in Whiskey Bay during the fall survey. Forage fish (i.e., Pacific herring and Pacific sand lance) were also observed at all three survey areas, with the greatest abundances observed at west Pearse Island during the summer survey. A survey in late March was specifically timed to coincide

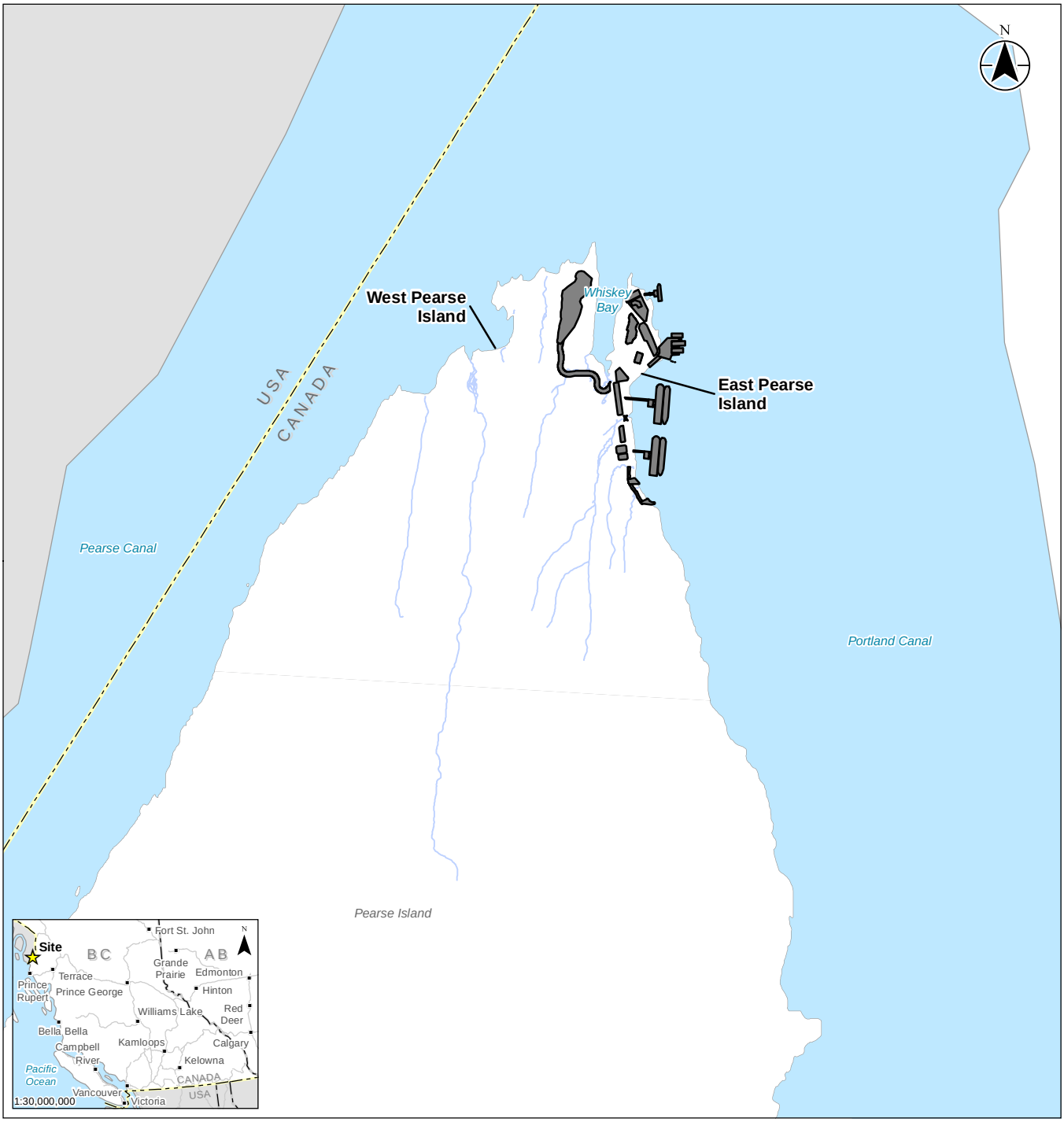
with eulachon returning to spawn in the Nass River. Hydroacoustic transects detected small shoals of fish near the seafloor along east Pearse Island, near Ramsey Point, west of the entrance to Iceberg Bay along the shore, across the channel west of Gingolx, and along the shore opposite of Gingolx. While eulachon presence could not be positively confirmed, based on the acoustic signature of the fish observed it is possible the small shoals included eulachon.

Baseline water quality and sediment quality surveys were conducted to characterize the overall conditions within the Marine Resources Study Area. Six water quality sampling locations were selected and distributed within and adjacent to the in-water footprint of the marine terminal. In situ measurements of physical parameters (e.g., temperature and salinity) and water collection for laboratory analysis of physical and chemical parameters were collected. Water quality parameters varied with depth and season in the Marine Resource Study Area (e.g., salinity was lowest at the surface and increased with depth in June and September, when a distinct halocline was present). Water quality samples were compared to BC and Canadian Council of Ministers of the Environment (**CCME**) Water Quality Guidelines for the protection of Marine Aquatic Life (**WQG-MAL**); with the exception of boron, parameters were below guidelines or detection limits in each of the samples. Concentrations of boron exceeded the long-term BC WQG-MAL in the flood and ebb tide samples for both sampling events. Concentrations of boron in seawater are naturally high (4.5 mg/L) (Moss and Nagpal 1981).

Sediment quality samples were collected from a total of 15 stations within the marine terminal area (East Pearse Island), targeting areas where proposed Project infrastructure will be constructed. Sediment quality samples were analyzed for particle size, total organic carbon (**TOC**), total metals, polycyclic aromatic hydrocarbons (**PAH**), and benzene, ethylbenzene, toluene, xylene (collectively referred to as **BTEX**). Sediment quality results were compared to Working Sediment Quality Guidelines (**WSQG**). Total metal and PAH concentrations, with the exception of arsenic, copper, and nickel, were below the WSQG in the sediment samples. Given the low levels of human activity in the area, it is assumed the elevated arsenic, copper, and nickel levels in sediment are natural in origin. Arsenic and copper, for example, are present at levels higher than WQSG in sediments from other areas, including Prince Rupert (Stantec Consulting Ltd., 2016).

A review of existing information in the Marine Resources Study Area, including Indigenous knowledge, revealed that marine mammals are abundant on the North Coast of BC and that several species overlap with the marine shipping area as either permanent or seasonal/transitory residents to the area. Six vessel-based and seven aerial-based line-transect marine mammal surveys were conducted within the Marine Mammal Vessel and Aerial Survey Areas. These surveys identified several species of marine mammals, including killer whale, minke whale, humpback whale, harbour seal, Steller sea lion, harbour porpoise, and Dall's porpoise. No sea turtles were observed during field surveys.

Marine birds have been grouped with terrestrial birds and are discussed in the separate Wildlife and Wildlife Habitat Technical Data Report (Appendix 7.07A).



International Boundary
Project Mapped Stream
Marine Terminal
Ocean
USA

0 0.5 1 1.5 2 Kilometers
1:50,000 (at original document size of 8.5x11)

KSI LISIMS LNG

Stantec

Notes
1. Coordinate System: NAD 1983 BC Environment Albers
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada

Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by SMOSS on 20220712
Requested by CMCCRACKEN on 20220711
Checked by TQUILICHINI on 20220712

Client/Project/Report

Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.

i

Title

Pearse Island and Marine Terminal Location

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1 Abbreviations

°C	Degrees Celsius
ADCP	Acoustic doppler current profiler
ADFG	Alaska Department of Fish and Game
BC	British Columbia
BC CDC	British Columbia Conservation Data Centre
BC CSN	British Columbia Cetacean Sightings Network
BC EAA	British Columbia *Environmental Assessment Act*
CCME	Canadian Council of Ministers of the Environment
cm	Centimetre
CPUE	Catch-per-Unit-Effort
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CTD	Conductivity, Temperature, Depth
dB	Decibel
DFO	Fisheries and Oceans Canada
DL	Detection Limit
DO	Dissolved Oxygen
EA	Environmental assessment
FLNG	floating liquefied natural gas production, storage and offloading facility
FSC	Food, Social, And Ceremonial Fisheries
GRVI	green-red vegetation index
GPS	Global Positioning System
HD	Hyrdodynamic

hz	Hertz
IA	Impact assessment
IAA	Federal *Impact Assessment Act*
IK	Indigenous knowledge
IPHC	International Pacific Halibut Commission
IQR	Interquartile Range
kg	Kilogram
kHz	Kilohertz
km	Kilometre
km^2	Square kilometres
kts	Knots
lbs	Pounds
LNG	Liquefied Natural Gas
m	metre
m^2	Square metres
m^3	Cubic metres
m^3/s	Cubic metres per second
MCTS	Marine Communication and Traffic Services
mg/L	Milligrams per litre
mm	Millimetre
MMO	Marine Mammal Observer
MOF	Material off-loading facility
MT	Mud transport
MVBS	Mean Volume Backscattering Strength
NFWD	Nisga'a Fisheries and Wildlife Department

NIR	near-infrared
Nisga'a Treaty	Nisga'a Final Agreement
NOAA	National Oceanic and Atmospheric Administration
NTU	Nephelometric Turbidity Unit
OBDFO	object-based image analysis
PAH	Polycyclic Aromatic Hydrocarbons
ppm	Parts per million
ppt	Parts per thousand
PRISMM	Pacific Region International Survey of Marine Megafauna
the Project	Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal
PSU	Practical Salinity Units
ROV	Remotely Operated Vehicle
RPD	Relative Percent Difference
SARA	*Species at Risk Act*
SD	Standard Deviation
Site	The Project Site
SW	Spectral Wave
Stantec	Stantec Consulting Ltd.
t	tonnes
the Project	Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal Project
the Proponents	Nisga'a Nation, LNG Limited Partnership and Western LNG
TDR	Technical Data Report
TDS	Total Dissolved Solids
TOC	Total Organic Carbon

TS	Target Strength
µS/cm	Microsiemens per centimetre
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
VC	Valued Components
VOC	Volatile Organic Compounds
VTS	Vessel Traffic Services
WQ	Water Quality
WQG-MAL	Water Quality Guidelines for the Protection of Marine Aquatic Life
WSC	Water Survey Canada
WSQG	Working Sediment Quality Guidelines

1

1.0 INTRODUCTION

The Nisga'a Nation, Rockies LNG Limited Partnership (**Rockies LNG**) and Western LNG LLC (via its subsidiary, Western LNG) (each a Proponent and collectively referred to herein as the **Proponents**), are proposing to jointly develop an energy project, the Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal Project (the **Project**), a floating liquefied natural gas (**FLNG**) production, storage and offloading facility, with supporting upland infrastructure and a marine terminal. The Project site (**Site**) is located at Wil Milit, on the northern end of Pearse Island, British Columbia (**BC**), approximately 15 kilometres (**km**) west of the Nisga'a community of Gingolx (Figure 1–1). The Project is located on Category A fee simple land as defined in the Nisga'a Final Agreement (**Nisga'a Treaty**) and is adjacent to a proposed water lot located on the east side of the Site, in Portland Canal.

The Project is designed to produce up to 12 million tonnes (**t**) per annum of liquefied natural gas (**LNG**). At full build-out (i.e., two FLNGs), the LNG export facility will receive between 1.7 to 2.0 billion cubic feet per day (i.e., 56.6 million cubic metres [**m^3**] per day) of natural gas and temporarily store it between LNG carrier loadings on permanently installed FLNGs designed with an internal storage capacity of approximately 490,000 m^3 of LNG. Temporary and permanent infrastructure will include floating accommodation for construction workers, a materials off-loading facility, jetties, FLNGs, and supporting terrestrial infrastructure (Figure 1–2). The Project will connect to the BC Hydro grid for renewable power supply; however, in the event that connection to the BC Hydro grid is delayed, the Project will initially use temporary floating power barges that will use natural gas to provide power for the Project.

Liquefied natural gas carriers will travel to and from the Project's marine terminal along the established deep-sea shipping route from the BC Coast Pilots boarding location to the Site (Figure 1–3). LNG carriers are anticipated to enter Canadian waters from the west through Dixon Entrance north of Haida Gwaii and will travel east, south of the Dundas Island group, and then travel north through Chatham Sound, Main Passage, Portland Inlet and then northeast into Portland Canal.

The Project is subject to an environmental assessment (**EA**) under the British Columbia *Environmental Assessment Act* (**BC EAA**) and an impact assessment (**IA**) under the federal *Impact Assessment Act* (**IAA**). The Government of BC requested substitution of the provincial review process for the federal impact assessment process from the federal Minister of Environment and Climate Change. The federal Minister of Environment and Climate Change approved the request for substitution. Given the location of the Project on Category A Lands owned by the Nisga'a Nation, the Application will also meet requirements of Chapter 10, paragraph 8 of the Nisga'a Treaty. Accordingly, an Application that focuses on a suite of valued components (**VC**) has been prepared. VCs are components of the natural and human environment that are considered by the Proponents, public, Indigenous nations and Métis Nation British Columbia, scientists and other technical specialists, and government agencies involved in the assessment process to have scientific, ecological, economic, social, cultural, archaeological, historical, or other importance. This Technical Data Report (**TDR**) presents the existing conditions for the Marine Resources VC to support the Application and permitting requirements. Marine Resources considered include marine fish and fish habitat, marine mammals, and sea turtles that may occur

along the northern coast of British Columbia (**BC**). Marine fish are defined in the *Fisheries Act* as: (a) parts of fish, (b) shellfish, crustaceans, marine animals, and any parts of shellfish, crustaceans, or marine animals, and (c) the eggs, sperm, spawn, larvae, spat, and juvenile stages of fish, shellfish, crustaceans, and marine animals.

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KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 BC Environment Albers
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada

- Populated Place
- Site
- Highway
- International Boundary
- Railway
- Watercourse
- Canada
- United States of America
- First Nations Reserve
- Provincial Park, Ecological Reserve, Protected Area, or Conservancy Area
- Waterbody

0 25 50 75 100 km
1:4,000,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC
Project Number: 123221820
Prepared by TQUILICHINI on 20220606
Requested by CMCCRACKEN on 20220601
Checked by SMOSS on 20220606

Client/Project/Report

Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
1-1

Title
Project Location

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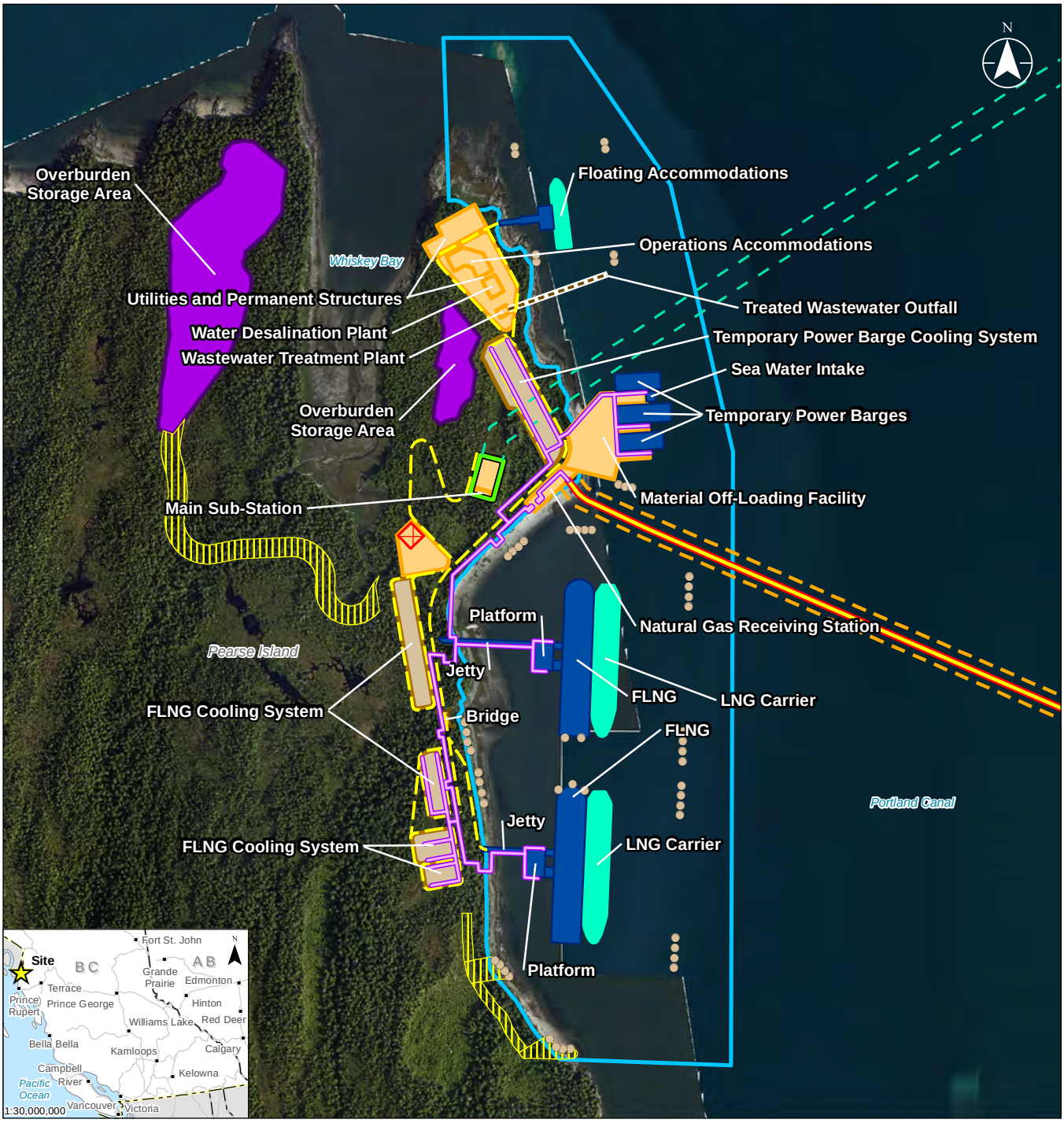

KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

- Mooring Anchor
- Proposed Access
- Feed Gas Pipeline
- Feed Gas Pipeline Right-of-Way
- Powerline Right-of-Way from Mainland
- Utility Line
- Wastewater Treated Effluent Pipeline

Footprint Component
- Access Corridor
- Bridge
- Buildings and Utilities
- Cooling Structures
- Helicopter Pad
- Marine Component (Fixed)
- Marine Component (Not Fixed)
- Marine Footprint
- Overburden Storage
- Switchyard

0 75 150 225 300 375 m
1:12,500 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC
Project Number: 123221820
Prepared by TQUILICHINI on 20220611
Requested by CMCCRACKEN on 20220601
Check by SMOSS on 20220613

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
1-2

Title
Marine Terminal Location and Conceptual Layout

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KSI LISIMS LNG

Site
Marine Shipping Route
Open Water Marine Shipping Route
Materials and Supply Shipping Route
International Boundary

0 20 40 60 km
1:1,500,000 (at original document size of 8.5x11)

Stantec

Notes
1. Coordinate System: NAD 1983 BC Environment Albers
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada, Maxar, Rockies LNG
3. NTS Sheets: 103I, 103J, 103O, 103P

Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20220606
Requested by CMCCRACKEN on 20220601
Checked by SMOSS on 20220606

Client/Project/Report

Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.

1-3

Title

Marine Shipping Route

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2.0 SURVEY AND STUDY AREAS

The Project is located at Wil Milit on the northern end of Pearse Island, approximately 15 km west of the Nisga'a community of Gingolx on the North Coast of BC (Figure 1–1). Information presented in this TDR encompasses the areas where data were compiled and collected to allow for an understanding of baseline conditions and includes the geographic areas within which relevant Project components and activities are expected to occur (throughout all Project phases). Data collected will be used to support the Project-specific effects assessment and cumulative effects assessment. Field survey efforts focused on areas where data gaps were identified and where potential Project-related effects are considered to be greatest (i.e., near the marine terminal location) as well as areas highlighted through feedback from regulators and stakeholders and local Indigenous nations. Focused, discipline-specific survey areas, covered during field surveys, are described in their respective sections below.

In addition to the individual, targeted survey areas, data were compiled over a larger geographic area, referred to as the Marine Resources Study Area, which overlapped the marine shipping route and relied on a desktop review of available literature to provide background information on the existing and historical conditions. The Marine Resources Study Area extends from northern Pearse Island (Wil Milit), east to Nass Bay, southwest through Portland Inlet into Chatham Sound, west of the BC Coast Pilot boarding station near Triple Island, west through Dixon Entrance, and across the north end of Haida Gwaii to the Canadian Territorial Sea boundary (Figure 2–1).

KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

- Site
- Triple Island Pilot Station
- Marine Shipping Route
- Open Water Marine Shipping Route
- Materials and Supply Shipping Route
- Marine Resources Study Area
- Highway
- International Boundary
- Watercourse

0 10 20 30 40 50 km

1:1,500,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20220606
Requested by EWATERFIELD on 20220601
Checked by SMOSS on 20220606

Client/Project/Report

Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.

2-1

Title

Marine Resources Study Area

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3.0 REVIEW OF EXISTING DATA

A desktop review of available literature was completed to provide background information on the existing and historical conditions within the study areas. This included oceanographic and anthropogenic influences as well as information on marine habitats, fish and invertebrates, marine mammals, and sea turtles. This information was combined with Indigenous knowledge (**IK**) provided by Nisga'a Nation, Lax Kw'alaams Band, Metlakatla First Nation, Kitsumkalum First Nation, Kitselas First Nation, Gitxaała Nation, and Gitga'at First Nation. Information was also solicited from Haida Nation and the Métis Nation British Columbia; however, no traditional use studies were provided by these nations.

Information presented in technical data reports for other VCs that may be of interest to the review of existing marine resources data include the following:

1. Vegetation technical data report (riparian vegetation; Appendix 7.6A)
2. Wildlife technical data report (marine birds; Appendix 7.7A)
3. Freshwater fish technical data report (freshwater stages of anadromous species; Appendix 7.8A)

3.1 REGIONAL SETTING

The marine terminal is located in a proposed Water Lot (DL 5431) at the northern end of Pearse Island in Portland Canal, approximately 15 km west of the Nisga'a community of Gingolx on the North Coast of BC. Pearse Island is 210 square kilometres (**km^2**), and it is separated from mainland Alaska by Pearse Canal (Canada-United States Border) on the northwestern side of the island. Portland Canal is along the northeastern side of the island and Portland Inlet borders the eastern and southeastern side of Pearse Island (Figure 1–1). Portland Inlet directly connects to Chatham Sound and the open Pacific Ocean and is one of the largest and deepest fjords in the province. It has an average width of 5.3 km and deepens evenly from a relatively shallow 60 metre (**m**) depth at its northern end to its deepest point of 715 m at its southern end (Ricker and McDonald 1992; Stacey 1984).

Prince Rupert, Terrace, and Kitimat are the largest communities in northwest BC, with Kitimat and Prince Rupert ports having the highest rates of marine traffic among northern coastal ports (Johannessen et al. 2007). Project LNG carriers will transit nearshore marine waters, including Portland Canal, Portland Inlet, and Chatham Sound (Figure 1–3), before heading offshore towards final ports of call in Asia. Vessels associated with the construction phase of the Project will be limited to inshore waters from Prince Rupert and Nass Bay to the marine terminal location.

The Project is situated in the Coast and Mountains Ecoprovince, which is a large area that extends from southeast Alaska to the northern Cascade Mountains in Washington (Demarchi 2011). The climate in this area is primarily driven by frontal systems arriving from the Pacific Ocean and the lifting of those systems over coastal mountains. Within this larger Ecoprovince, the marine terminal location (Wil Milit) is located in the Nass Basin Ecosection, which includes the Nass River watershed and a series of coastal streams that drain into Portland Inlet, Portland Canal, and Observatory Inlet (Demarchi 2011). This area is

dominated by the Coastal Western Hemlock Biogeoclimatic Zone and is considered the most productive, and wettest, forest region in BC (British Columbia Ministry of Forests 1991).

The Nass River drains into Nass Bay approximately 20 km from Wil Milit. This river is approximately 400 km long with a basin area of 20,500 km^2. The Nass River flows south and southwest from its headwaters in the Skeena Mountains before entering the Pacific Ocean via Nass Bay and Portland Inlet (Fissel et al. 2017).

3.2 INFORMATION SHARED BY THE NISGA'A NATION

3.2.1 Methods

Nisga'a Fisheries Program Reports and IK were reviewed to characterize marine species that are important to the Nisga'a Nation. This review included 23 reports from 1997 to 2020 (Nisga'a Fisheries and Wildlife Department [**NFWD**] 1997, 1998, 2000–2020), focus groups with Nisga'a Elders (Nisga'a Nation 2022), and interviews (BRA 2023; Nisga'a Museum n.d.).

3.2.2 Results

The Nisga'a Nation harvests sockeye salmon (*Oncorhynchus nerka*), chinook salmon (*O. tshawytscha*), coho salmon (*O. kisutch*), pink salmon (*O. gorbuscha*), and chum salmon (*O. keta*) throughout the Nass River and its confluents (NFWD 2019).

The Nisga'a eulachon (*Thaleichthys pacificus*) fishery is one of the most important for Nisga'a communities. The arrival of this species signals the end of winter and the beginning of the harvest season. The products of the harvest include fresh, dried, smoked, salted, and frozen whole fish. Additionally, the greatest product from the eulachon harvest is the oil extracted from this fish, which has a cultural, economic, nutritional, and social value (Committee on the Status of Endangered Wildlife in Canada [**COSEWIC**] 2013).

Non-salmon harvests primarily occur out of Gingolx with the most commonly reported species being Dungeness crab (*Metacarcinus magister*), Pacific halibut (*Hippoglossus stenolepis*), sablefish (*Anoplopoma fimbria*), red rockfish (*Sebastes* spp.), Pacific cod (*Gadus macrocephalus*), lingcod (*Ophiodon elongatus*), Nuttall's cockle (*Clinocardium nuttallii*), clams, and Steller sea lion (*Eumetopias jubatus*) (NFWD 2020). Dungeness crab is caught primarily in Iceberg Bay and Observatory Inlet (Nass estuary). Other important crab species in the area include red king crab (*Paralithodes camtschaticus*), golden king crab (*Lithodes aequispinus*), red rock crab (*Cancer productus*), and tanner crab (*Chionoecetes bairdi.)* (NFWD 2020 and 2019). Dungeness crab were the highest retained non-salmon species by the Nisga'a over the past five years with an average of 20,628 crabs (NFWD 2020). An average of 82 Steller sea lions were also harvested by the Nisga'a during that time (NFWD 2020).

Other catches in smaller quantities (sometimes as by-catch) include Pacific spiny dogfish (*Squalus suckleyi*), longnose skate (*Raja rhina*), big skate (*R. binoculata*), spotted ratfish (*Hydrolagus colliei)*, tiger rockfish (*Sebastes nigrocinctus*), rougheye rockfish (*S. aleutianus*), octopus (*Octopus* spp.*)*, and seaweed (NFWD 2020).

The Nisga'a community prawns/shrimp harvest mainly consists of spot prawns (*Pandalus platyceros)* and occurs at Iceberg Bay (Echo Cove), Portland Inlet, Wales Passage, Winter Inlet, and Pearse Canal employing traps at shallow and deeper depths (NFWD 2020).

The bivalve harvest includes Nuttall's cockle, sea prunes, abalone, and other species of clams and mussels (NFWD 2020; Nisga'a Museum n.d.).

Pacific halibut, sablefish, red snapper (*Sebastes* spp.), Pacific cod, and lingcod are harvested through hook and line and occur in Portland Canal (NFWD 2020).

Marine plants are known to be harvested by the Nisga'a; however, information received grouped all harvesting efforts into a single category of "seaweeds" so specific species could not be identified (NFWD 2020).

Seagulls, seals, and sea lions are also harvested seasonally (Nisga'a Museum n.d.).

Concerns of Nisga'a Nation are potential threats to their ability to undertake marine resource harvesting and fishing, impacts to quality and health of marine resources (e.g., halibut, cockles, and salmon), underwater noise, and the potential impacts to marine wildlife health and behavior as a result of the Project, commercial fishing, marine traffic, and pollution.

3.3 INDIGENOUS KNOWLEDGE AND TRADITIONAL USE

In addition to being located within Nisga'a Lands as defined in the Nisga'a Treaty, the Project is located (marine terminal) or will pass through (marine shipping) the traditional territory of Lax Kw'alaams Band, Metlakatla First Nation, Kitsumkalum First Nation, Kitselas First Nation, Gitxaała Nation, Gitga'at First Nation, Haida Nation, and the Métis Nation British Columbia.

3.3.1 Methods

The proponents collected IK and traditional use information from seven of the nine potentially affected Indigenous nations for the Project. Two nations did not provide traditional use studies: Haida Nation and the Métis Nation British Columbia. Mechanisms to collect this information included the Project's Indigenous Engagement Program, facilitation and funding of Project-specific IK and Use studies, Technical Advisory Committee meetings, and opportunities to validate data complied through secondary research techniques (desktop research). Indigenous knowledge information obtained through the Project's Indigenous Engagement Program was reviewed and was used to identify fish species of cultural importance that occur within the Marine Resources Study Area.

3.3.2 Results

3.3.2.1 Lax Kw'alaams Band

Lax Kw'alaams Band use the Marine Resources Study Area for seasonal and year-round marine harvesting and fishing. Marine harvesting and fishing provide members with a source of income, allows members to support family-wide food security and contribute towards winter food stores. Key areas for Lax Kw'alaams Band rain harvesting values and activities include, but are not limited to Pearl Harbour, Lax Kwaxl/Dundas and Melville Islands Conservancy, Big Bay, Zayas Island, Portland Inlet, Wales Island, Chatham Sound, Pearse Canal, Sommerville Island, the mouth of the Nass River, Nasoga Gulf, and Dundas Island (Lax Kw'alaams Band 2023).

Lax Kw'alaams Band foreshore harvesting values include seaweeds, chiton, clams, mussels, octopus, sea cucumber, sea urchin. Marine harvesting also encompasses fishing (black cod, coho salmon, sockeye salmon, Chinook salmon, halibut, red snapper, prawn, and eulachon), crabbing (king crab and Dungeness crab), and prawning, along with waterfowl, seal, and sealion hunting (Lax Kw'alaams Band 2023).

Concerns of Lax Kw'alaams Band include potential impacts to marine resources, including marine sediment quality, changes in baseline underwater noise levels with effects to marine fish, invertebrates, and mammals from Project activities, introduction of invasive species from marine shipping, increased marine vessel traffic, and inorganic carbon impacts to invertebrate shells (Lax Kw'alaams Band 2023). Lax Kw'alaams Band has observed a decline in former marine resource abundance (e.g., marine species, marine habitat) due to industrialization of fisheries, pollution, and DFO's closures and limitations over their lifetime. Lax Kw'alaams Band have concern that the proposed Project will further impact the ability to secure traditional foods, earn a living, and access traditional marine harvesting resources and sites (Lax Kw'alaams Band 2023).

3.3.2.2 Metlakatla First Nation

Marine harvesting in Chatham Sound is crucial for Metlakatla First Nation members. Harvesting various marine resources allows members to earn a living, have access to healthy and traditional foods, and feel a sense of enjoyment and connection while out on the water (Metlakatla First Nation 2022). Several important fishing areas for Metlakatla First Nation exist within Chatham Sound.

Metlakatla First Nation harvest marine resources year-round within the Marine Resources Study Area (Metlakatla First Nation 2022). Year-round harvesting, preparation, sharing, trading and consumption of seaweed is culturally important. In the spring, eulachon, seaweeds and herring roe (from kelp beds) are harvested. Later in the spring, marine mammals are hunted, plants are gathered and eggs are harvested. In the early summer months, the Nine Tribes of the Coast Tsimshian travel to their fishing villages along the Skeena River and its estuaries to begin harvesting coho, chinook, pink, sockeye and chum salmon (Metlakatla First Nation 2022). This harvesting lasts until October. Throughout the winter, Metlakatla First Nation members reside in permanent winter villages near intertidal flats and harvest marine invertebrates and shellfish as well as fish and hunt various species

(Metlakatla First Nation 2022). Intertidal species harvested include clams, cockles, octopus, sea urchin, sea cucumber, chiton, geoduck.

Of particular concern to Metlakatla First Nation are potential threats to their ability to harvest marine resources such as fish stock declines, commercial and recreational fishing, pollution, invasive species and climate change (Metlakatla First Nation 2022).

3.3.2.3 Kitsumkalum First Nation

Kitsumkalum First Nation actively harvest a wide range of marine resources in Portland Canal, Portland Inlet, Nass and Skeena Rivers, and surrounding areas which provide Kitsumkalum's food security, fishing rights, and a distinctive way of life. The Marine Resource Study Area provides substance harvesting areas for fish and shellfish including butter clams, cockles, crabs, prawns, halibut, cod, salmon, steelhead, rockfish, abalone, red snapper, and seaweed harvesting areas (Kitsumkalum First Nation 2022). Kitsumkalum First Nation's commercial fishing activities provide both personal economic security and food security/sovereignty for the community (Kitsumkalum First Nation 2022). Traditional food species used by Kitsumkalum First Nation include salmon (five species: coho, pink, sockeye, spring, and chum), grey cod, black cod, lingcod, rockfish, halibut, flounder, sole, herring, herring, eulachon, steelhead clams, cockles, mussels, geoducks, rock scallops, swimming scallops, abalone, Dungeness and red rock crabs, box crabs (tanner/king), chitons, sea cucumber, urchin (green, red, and purple), barnacles, shrimp species, prawns, octopus, seal, and sea lion (Kitsumkalum First Nation 2022).

Concerns of Kitsumkalum First Nation include impacts to their commercial and traditional fisheries, access to important marine harvesting areas, and effects to sensitive marine habitats (e.g., kelp habitats in Portland Canal) from Project activities, pollution, and marine traffic (Kitsumkalum First Nation 2022).

3.3.2.4 Kitselas First Nation

Salmon are important for sustenance and ceremonies for the Kitselas First Nation. Within the Marine Resources Study Area, the Kitselas First Nation harvests five species of salmon: coho, pink, sockeye, spring, and chum. Additionally, they harvest halibut, steelhead, trout, lingcod, rockfish, flounder, seals, sea lions, black ducks, and mallards within the area (Kitselas First Nation 2022).

During the spring season, the Kitselas people harvest eulachon after they migrate up the Skeena and Nass rivers after mid-February. The Skeena River eulachon are considered to be of lower quality than those that return to the Nass. However, the eulachon migration occurs at least two weeks earlier in the Skeena than the Nass (Kitselas First Nation 2022). The fish are harvested from March to May from the Nass and from March to early May near Port Essington at the mouth of the Skeena around the Brown Lake area. Seaweed, herring eggs, shellfish, and halibut are also harvested on the coast during the springtime. Herring eggs are harvested by setting seaweed or branches in spawning areas at Big Bay and northern Porcher Island (Kitselas First Nation 2022). The small islands off the northern end of Porcher Island and southern Stephens Island are also key nearshore harvesting areas for herring, shellfish, and crabs (Kitselas First Nation 2022).

Crabs, clams, cockles, sea cucumbers, urchins, octopus, seaweed, and seals are harvested from the intertidal areas. The channels and passages between islands at the mouth of the Skeena River have sandbars where seals haul out, which provide good seal hunting spots for the Kitselas. Crabs and prawns are also harvested using traps or pots set in sheltered bays and channels (Kitselas First Nation 2022).

In addition, Kitselas First Nation harvest crabs, cockles, abalone, seaweed, urchins, and sea cucumbers from the shorelines of Chatham Sound and the mouth of Skeena River for personal use, trade, and distribution to community members (Kitselas First Nation 2022). The members also gather clams, cockles, seaweed, and other species in multiple areas, including intertidal areas on either side of Edye Passage, Welcome Harbour, Prescott Island, the northern tip of Stephens Island, Rachael Islands, Creak Islands, islets off the northern end of Porcher Island, Smith Island, Kennedy Island, and Telegraph Passage (Kitselas First Nation 2022).

All the above-mentioned resources are harvested by the Kitselas community members within the Marine Resources Study Area as they become available. Outer coastal areas such as Edye Passage, Stephens Island bays, Tugwell Island, Digby Island, and parts of the Tree Nob Group are also important fishing grounds for them (Kitselas First Nation 2022). Additional productive fishing grounds of importance to the Kitselas people include the waters around Lucy and Rachael Islands, western and eastern shorelines of Chatham Sound, the mouth of the Skeena River at Veitch Point and south into Telegraph Passage, around Kennedy Island, De Horsey Island, Smith Island, and Inverness Passage (Kitselas First Nation 2022).

Before industrial activities and urban development, the Kitselas people had been harvesting nearshore species in Prince Rupert Harbour and Port Edward. Travel routes in the area are still used for fishing, clam and cockle harvesting, gull egg collecting, and transiting between communities such as Prince Rupert, Port Edward, Kitkatla, Hartley Bay, and others (Kitselas First Nation 2022). Industry and other developments have affected Kitselas First Nation's ability to gather traditional food due to limited access to traditional harvesting areas (e.g., pollution, fishing closures).

3.3.2.5 Gitxaała Nation

Of particular concern to Gitxaała Nation are the potential effects to traditional harvesting, changes in marine mammal and marine fish behavior due to underwater noise and marine shipping, and the discharge of effluent into the marine environment.

3.3.2.6 Gitga'at First Nation

Access to marine resources year-round is important for Gitga'at First Nation's maintenance of family and community connections, language and cultural traditions, and overall food security (Gitga'at First Nation 2022). Chatham Sound is an important region for harvesting marine resources. Gitga'at First Nation harvest many marine species including seals, sea lions, halibut, salmon, steelhead, ling cod, black cod, red snapper, quillback rockfish, kelp greenling, skate, herring, herring eggs, octopus, abalone, clams, cockles, chitons, mussels, sea cucumbers, sea anemone, chiton, barnacles, seaweed, King crab, Dungeness crab, prawns and shrimp (Gitga'at First Nation 2022). These harvests are used for immediate

or later home consumption, distribution to family members, for community or ceremonial gatherings, and for trading with neighbouring First Nations.

Access to marine resource harvesting for Gitga'at First Nation has been decreasing with increased government protection laws, industrial activity, pollution, fishing restrictions, competition and depletion by commercial and recreational users (Gitga'at First Nation 2022).

3.4 LITERATURE REVIEW

3.4.1 Introduction

Publicly available scientific literature, government reports, and spatial data were reviewed to characterize the Marine Resources (oceanography, vegetation, invertebrates, fishes, and mammals) in the Marine Resources Study Area. A section describing geographic and oceanographic conditions within and around the Marine Resources Study Area is included to provide regional context for the marine environment.

The following is a non-exhaustive list of key information sources on existing conditions that were reviewed:

- Indigenous nation traditional use reports including those provided by:
  - Gitga'at First Nation
  - Gitxaała Nation
  - Nisga'a Nation
  - Kitselas First Nation
  - Kitsumkalum First Nation
  - Lax Kw'alaams Band
  - Metlakatla First Nation
- Fisheries and Oceans Canada (**DFO**)'s Federal Science Libraries Network: https://science-libraries.canada.ca/eng/fisheries-oceans/
  - DFO Aquatic Species at Risk Map: https://www.dfo-mpo.gc.ca/species-especes/sara-lep/map-carte/index-eng.html
  - Pacific Region Integrated Fisheries Management Plans: https://www.pac.dfo-mpo.gc.ca/fm-gp/ifmp-eng.html
  - Pacific North Coast Integrated Management Area Plan: https://www.dfo-mpo.gc.ca/oceans/publications/pncima-zgicnp/index-eng.html
  - Pacific Region International Survey of Marine Megafauna (PRISM)
- DFO Canadian Science Advisory Secretariat (**CSAS**) publications: http://www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm
- Environment and Climate Change Canada (**ECCC**) publications

- Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessments and status reports: https://www.cosewic.ca/index.php/en-ca/
- Species at Risk Public Registry: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html
- Government of BC publications
- Marine Plan Partnership SeaSketch: https://legacy.seasketch.org/#projecthomepage/50e58ab28aba4075183f8fc0
- BC Conservation Data Centre (**BC CDC**): http://a100.gov.bc.ca/pub/eswp/
- United States National Oceanic and Atmospheric Administration (**NOAA**) publications
- BC Species and Ecosystems Explorer: https://a100.gov.bc.ca/pub/eswp/
- BC Cetacean Sightings Network (**BC CSN**): https://wildwhales.org/
- Salmon Watersheds Program: https://www.salmonexplorer.ca/#!/
- Peer-reviewed literature

See Section 7.0 for a complete list of references and data sources.

3.4.2 Physical Oceanography

The coastal environment of the Marine Resources Study Area is heavily influenced by freshwater input from two major rivers, the Nass River to the north and the Skeena River to the south (Figure 3.4–1) (Trites 1953). The Skeena River, located south of Prince Rupert, is a large river which transports considerable amounts of freshwater and sediment from the greater Skeena Watershed, which encompasses an area of approximately 53,000 km^2 (BC Water Tool 2022). On average, this river delivers 1,560 cubic metres per second **(m^3/s)** of freshwater into Chatham Sound; however, this number ranges as low as 369 m^3/s during late winter to as high as 4,109 m^3/s during peak spring freshet (BC Water Tool 2022). The Skeena River contributes sediment-laden water into Chatham Sound as far north as Tugwell Island, though most of its effects are localized to the southeastern parts of Chatham Sound near Smith Island (Trites 1953). Sediment discharge is greatest during freshet, which typically peaks in May and June in the Marine Resources Study Area. During normal flow, the vast majority (up to 70%) of freshwater from the Skeena River moves north into Chatham Sound, merging with the Nass River water at the mouth of Portland Inlet. Only 30% of the outflow from the Skeena River exits Chatham Sound through southern passages (Trites 1953).

North of the Skeena River lies Prince Rupert Harbour (Figure 1–1). Partially isolated from the deep, saline waters of Chatham Sound by a shallow channel entrance, these waters typically have slightly lower salinity than the open ocean due to freshwater input from rain and runoff. Though it fluctuates seasonally, salinity in the harbour near the mouth is typically between 20 and 25 practical salinity units (**PSU**) (Stucchi and Orr 1992). The harbor lacks a defined thermocline or halocline, as both temperature and salinity profiles follow a more linear gradient (Stucchi and Orr 1992). Stucchi and Orr (1992) found that dissolved oxygen (**DO**) levels are generally near saturation with some seasonal fluctuation. In general, DO in deep water here typically ranges from 5 to 9 parts per million (**ppm**) while DO in shallow water

ranges from 7 (September) to 13 ppm (July). Further inland from the harbour mouth, waters have lower DO measurements due to longer replacement time with the outside waters (Stucchi and Orr 1992). Seasonal surface temperature fluctuations are at their highest in summer months with average temperatures anywhere between 6 and 15 degrees Celsius (**°C**). Fall surface water temperatures typically range between 8 and 10 °C, winter from 7 to 8 °C and spring from 6 to 7 °C (Lin and Fissel 2018).

In the northern portion of Chatham Sound, oceanic conditions are most heavily influenced by the flow of the Nass River, which terminates at the northern end of Portland Inlet near Gingolx (Trites 1953). Though smaller than the Skeena River, the Nass River contributes a mean annual discharge of 813 m^3/s to Portland/Observatory Inlet and ultimately to Chatham Sound and the Hecate Strait (NFWD 2021). Like the Skeena River, discharge from the Nass River fluctuates seasonally, with the lowest output in March (204 m^3/s) and the highest output in June (2,508 m^3/s) (BC Water Tool 2022). During freshet, surface water salinity in northeastern Chatham Sound also drops to between 14 and 20 PSU, primarily due to enhanced riverine input (Trites 1953). Dissolved oxygen levels in Chatham Sound generally stay near saturation (9 ppm) except for the months of August to October when they decrease to a general minimum of 6.5 ppm (Trites 1953). During peak freshet, the Nass River contains suspended sediments which correspond to 10 to 15 Nephelometric Turbidity Units (**NTU**); however, turbidity is more consistently around 5 NTU during the rest of the year (Fissel et al. 2017). During its lowest discharge, the sediment plume is confined to nearby Nass Bay; however, the plume can be observed reaching over 40 km into Portland Inlet and Canal during peak discharge times. By August, the plume typically recedes to 15 to 20 km past the mouth of Nass Bay (Fissel et al. 2017). Tidal action plays a major role in determining the directional flow of sediment-laden water, either north into Observatory Inlet (during incoming tide) or south into Portland Inlet (during an outgoing tide) (Fissel et al. 2017). Some of the greatest tidal ranges in BC coastal waters can be found in the eastern Dixon Entrance adjacent to Chatham Sound. The semi-diurnal tide has an amplitude of 4.9 m and can reach peak values of up to 7.7 m near Prince Rupert (Lin and Fissel 2018). Tidal currents in Chatham Sound are generally strong, particularly in the south and western areas. Northern and eastern Chatham Sound have weak tidal surface currents, apart from Brown Passage to Finlayson Island (Lin and Fissel 2018). The west coast of BC within the Project Marine Resources Study Area receives lesser wave action relative to most of the north coast due to protection from the open ocean provided by Haida Gwaii (Thomson 1981). Waves in Chatham Sound are typically less than 1 m in height with a period of two to five seconds (Thomson 1981).

Within Portland Inlet in the immediate vicinity of the marine terminal, there is a lack of existing literature on water quality and oceanographic conditions due to the remoteness of the Site and lack of historical development of the area. The tidal heights in the Gingolx (Kincolith) station (09422) have tidal ranges from a lower low water mean tide of 1.3 m to a higher high water mean tide of 6.12 m, with a mean water level of 3.8 m (Government of Canada 2023). Section 4.4 includes data collected by Stantec Consulting Ltd. (Stantec) for the Project and addresses some of these knowledge gaps.

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Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada

- Site
- Populated Place
- International Boundary
- Highway
- Watercourse
- Waterbody

0 8 16 24 32 40 km
1:1,550,000 (at original document size of 8.5x11)

Stantec

Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20220615
Requested by CMCCRACKEN on 20220601
Check by SMOSS on 20220615

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
3.4-1

Title
Physical Oceanography Features

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Due to its proximity to the outlet of the Nass River, Nass Bay experiences large fluctuations in oceanographic conditions. Fissel et al. (2017) provides a detailed description of the oceanographic trends and seasonality of this area. In late spring to early summer, there is significant stratification in the water column, with a halocline around 2 to 3 m depth and thermocline near 5 m depth. Salinity ranges from 8 to 32 PSU along a vertical gradient during peak freshet. Surface water at this time may be as warm as 14°C while water at depth in Nass Bay can be as cool as 8°C. Turbidity in surface water ranges from 7 to 15 NTU during freshet. Towards late summer and as freshet decreases, stratification in the water column also decreases. By October, the vertical stratification of salinity in the water column ranges from 15 to 32 PSU and temperature ranges from 8 to 11°C, with surface turbidity between 7 and 15 NTU. Vertical stratification continues to decline into the winter months, with January salinity measurements ranging from 25 to 32 PSU, temperature ranging from 4 to 7°C and turbidity decreasing to 0 to 6 NTU at the surface (Fissel et al. 2017). In early spring, the annual cycle restarts with widening salinity gaps appearing (ranging from 19 to 32 PSU); however, temperature ranges remain small (7 to 10°C), and turbidity remains low (0 to 2 NTU) (Fissel et al. 2017).

Waters of the Dixon Entrance are consistently colder than those in Chatham Sound and Hecate Strait due to their exposure to, and replacement with, the open ocean (Thomson 1981). Despite the distance from both the Nass and Skeena Rivers, Dixon Entrance is also impacted by the freshwater input by these systems, and consequently experiences seasonal fluctuation of salinity consistent with the other areas of the Marine Resources Study Area closer in proximity to the rivers (Thomson 1981). The mean tidal range in the Dixon Entrance is moderate at an average of 3.5 m (Thomson 1981).

Major currents in the Marine Resources Study Area vary with the season. During the winter, the Haida current runs north along the western coast of Haida Gwaii. This current is driven by the wind and is typically one or two degrees Celsius warmer than the surrounding waters (PNCIMA 2011). In the summer, the direction of this current changes and it flows south due to changing wind and pressure conditions (PNCIMA 2011). Within the Hecate Strait, winter currents are driven north through the strait and west out to sea to the north of Haida Gwaii. Summer currents within the northern Hecate Strait are more highly variable and do not follow a set pattern (PNCIMA 2011).

3.4.3 Anthropogenic Activity

There is a relative absence of industrial development around Pearse Island and the terminal itself. The closest major industrial sites are the Kitsault Mine, over 70 km from the marine terminal location, and a closed mine in Anyox, approximately 48 km from the marine terminal location. The Project and its marine shipping route fall within the Canadian Coast Guard's Marine Communication and Traffic Services **(MCTS)** Prince Rupert Vessel Traffic Services **(VTS)** extends from Cape Caution to the Alaska border and south and west to encompass the Tofino VTS Zone. With respect to Project activities, while the marine terminal itself falls outside this zone, the Prince Rupert VTS encompasses much of the marine shipping (i.e., transit as well as the materials and supply shipping) route from Portland inlet, westward. Table 3.4–1 presents a list of managed vessel movements recorded within the MCTS Prince Rupert VTS Zone from 2017 to 2021. There was an annual average of 38,660 vessel transits within the Prince Rupert

VTS Zone from 2017 to 2021, excluding 2020, which was an anomaly year due to the COVID-19 pandemic.

Table 3.4–1 MCTS Prince Rupert Vessel Traffic Services Zone, All Vessel Transits from 2017 to 2021

Vessel Type	Year				
	2017	2018	2019	2020	2021
Coast Guard Vessels	906	867	696	835	771
DFO Vessels	292	282	265	220	203
Excursion Vessels	286	258	345	89	481
Fishing Vessels	3,145	3,223	2,963	3,066	2,540
Merchant Vessels[a]	18,927	17,928	18,156	14,931[b]	15,571[b]
Pleasure Crafts	719	761	539	267	490
Self-Propelled Barges	759	624	572	493	533
Special Purpose Vessels	2,836	3,083	3,227	3,528	3,289
Tankers	1,713	1,871	1,826	1,726	1,772
Tugs	9,172	9,284	10,268	11,196	12,886
US Coast Guard Vessels	105	60	70	49	70
Other	0	1	1	2	4
Total Vessels					

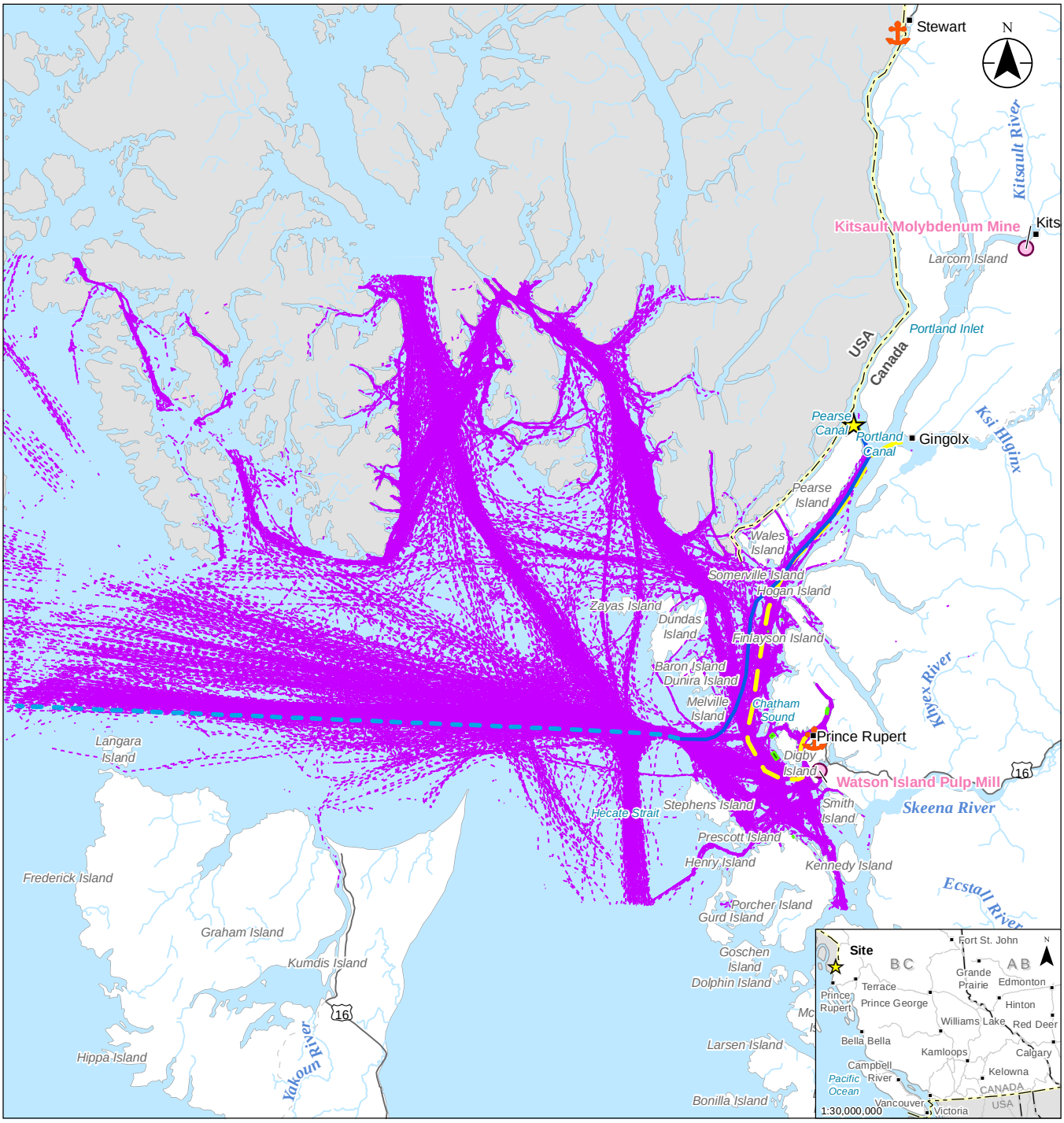
NOTES:

a Merchant vessels include passenger, ferries, coastal, rail container vessels. Special purpose vessels include research, supply, survey, and training vessels.

b The decrease in vessel transits in 2020 was likely due to the indirect, direct, and induced effects of the COVID-19 pandemic.

SOURCE: DFO 2022a

The Port of Prince Rupert has been identified as the largest area of existing marine contamination within the Marine Resources Study Area (Johannessen et al. 2007). The Port of Prince Rupert is the largest and busiest port on the North Coast of BC and is popular for its proximity to Asia (Johannessen et al. 2007). The main commercial approach to the Port of Prince Rupert is via the Dixon Entrance, Brown Passage, and Chatham Sound passing Lucy Island, Rachael Islands, and Kinahan Island (Prince Rupert Port Authority 2020; MarineTraffic 2022) (Figure 3.4–2). The Port of Prince Rupert handles container, coal, grain, propane, wood pellets, logs, specialty products, and product cargo (Prince Rupert Port Authority 2020). Due to the high volume of ship traffic, water quality at the Port of Prince Rupert is a concern due to localized elevated levels of marine hydrocarbons, tributyltin (a historic antifouling compound that was commonly applied to the hull of ships which has been called “the most toxic substance ever deliberately introduced into natural waters and has since been banned from application or reapplication” [Stewart and Thompson 1994]) and chromated copper arsenate (used to prolong the life of wooden structures) among others (Johannessen et al. 2007; Haggarty et al. 2003).



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Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. MarineTraffic.com
4. U.S. Coast Guard Navigation Center - AIS vessel data via BOEM & NOAA

- Port Location
- Project of Interest Location
- AIS Vessel Route (2020)
- Marine Shipping Route
- Open Water Marine Shipping Route
- Materials and Supply Shipping Route
- Aquaculture Tenure
- Site
- Populated Place
- International Boundary
- Highway
- Resource Road
- Watercourse
- Waterbody

0 8 16 24 32 40 km
1:1,500,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC
Project Number: 123221820
Prepared by TQUILICHINI on 20220616
Requested by CMCCRACKEN on 20220601
Check by SMOSS on 20220616

Client/Project/Report
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Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
3.4-2

Title
Anthropogenic Activities

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The number of deep-sea vessels calling to the Port of Prince Rupert has followed an upward trend, despite the challenges associated with the COVID-19 pandemic (Prince Rupert Port Authority 2021). In addition, large commercial vessels such as cruise ships, BC Ferries, and Alaska State Ferries (i.e., Alaska Marine Highway System), regularly call to the Port of Prince Rupert. Coastal tug and barge operation, commercial fishing vessels, charter fishing vessels, and private pleasure craft are also numerous in the Prince Rupert area, with increased activity during the summer season (i.e., July to September) (Prince Rupert Port Authority 2020). Less frequently than Prince Rupert, deep-sea vessels travel up Portland Canal past the terminal location to the smaller ports of Hyder, Alaska, and Stewart, BC.

The regular functioning of marine vessels have been shown to have a number of impacts on the marine environment. Chronic oil pollution caused by the regular function of marine vessel traffic has been shown to contribute more to the contamination of the marine environment than acute oil spills (Haggarty et al. 2003). Chronic oil pollution is known to occur accidentally as well as through intentional releases, such as dumping of oily bilge water (Johannessen et al. 2007). Another source of marine impacts due to shipping includes the dumping of wastewater from cruise ships. Cruise ships are known to dump untreated sewage and grey water into the marine environment, which has been shown to introduce chemicals, hydrocarbons, metals, bacteria, and pharmaceuticals into the marine environment (Nowell and Kwan 2001). The regular function of marine vessels also creates airborne contaminants which can be deposited into the marine environment. Regularly produced airborne pollution by marine ships includes a number of contaminants, notably polycyclic aromatic hydrocarbons (**PAH**s), which are deposited into the marine environment (Johannessen et al. 2007).

While the Port of Prince Rupert is the largest port, there are a number of smaller craft harbours and marinas within the Marine Resources Study Area. These include the Gingolx, Port Simpson, Rushbrook, Fairview Bay, Cow Bay and Dodge Cove, Port Edward, Hunts Inlet, Oona River, and Kitkatla harbours (Johannessen et al. 2007). These small harbours are at increased risk of oil and chemical waste spills during maintenance (Johannessen et al. 2007). Small craft vessels typically do not have sewage treatment systems or holding tanks and often result in raw sewage being directly introduced into the marine environment (Haggarty et al. 2003). Stewart, BC is located approximately 100 km north of the marine terminal location at the head of Portland Canal and is home to Stewart Bulk Terminals and Stewart World Port. Vessels frequenting these facilities transit through the Marine Resources Study Area and pass directly by the marine terminal location.

Prince Rupert is also the site of a historical pulp mill located on Watson Island, which operated from 1955 to 2001 (Kurjata 2017). After its bankruptcy, the facility was turned over to the City of Prince Rupert where it is currently being leased as a site for a propane export terminal (Kurjata 2017). During its operation, the pulp mill likely had significant impacts on the marine environment, but major residual impacts are unlikely today (Johannessen et al. 2007).

Kitsault Molybdenum Mine operated just south of the head of Alice Arm nearly 70 km from the Site (Avanti Kitsault Mine Ltd. 2022). The Kitsault mine was in operation between 1967 and 1972 as well as 1981 and 1982 (Johannessen et al. 2007). During its operation, the mine discharged tailings both directly into Alice Arm as well as Lime Creek, which is directly connected to Alice Arm (Burd et al. 2000). The discharge of these effluents is known to have caused persistent increases in heavy metal content of ocean sediments and biological tissues (Johannessen et al. 2007).

The Anyox Mine and Smelter were opened in 1914 in response to copper deposits found in Granby Bay in the late 1800s (Johannessen et al. 2007). Both the mine and smelter operated until 1936, during which time they deposited a slag pile covering 51 acres and weighing several million tons onto the shore and intertidal zone of Granby Bay (Goyette and Christie 1982). Additionally, tailings from the mine were disposed of in tailing ponds behind the smelter; however, the contamination likely leached into nearby Hidden Creek and resulted in decreased pH (2.2–2.6) as well as high iron, copper, and zinc concentrations (Odhiambo et al. 1996). The slag deposit is thought to be the cause of continuing elevated levels of copper, zinc, cadmium, and iron in the nearby marine sediments (Johannessen et al. 2007). Elevated metal concentrations have been found in the sediments of Observatory Inlet and are attributed to the Anyox mine (Johannessen et al. 2007).

Dolly Varden silver mine operated in Alice Arm, northeast of the Kitsault mine, between 1948 and 1959 (Johannessen et al. 2007). During this time, barium rich tailings were discharged into the Kitsault river and subsequently into Alice Arm (Johannessen et al. 2007). Odhiambo et al. (1996) found that high concentrations of cadmium, zinc, and lead were correlated with elevated barium concentrations and suggest the silver mine as the origin. Studies suggest that effects caused by tailing discharge have been restricted to Alice Arm (Guthrie 1985). Metal contamination is estimated to affect half the area of Alice Arm today (Johannessen et al. 2007).

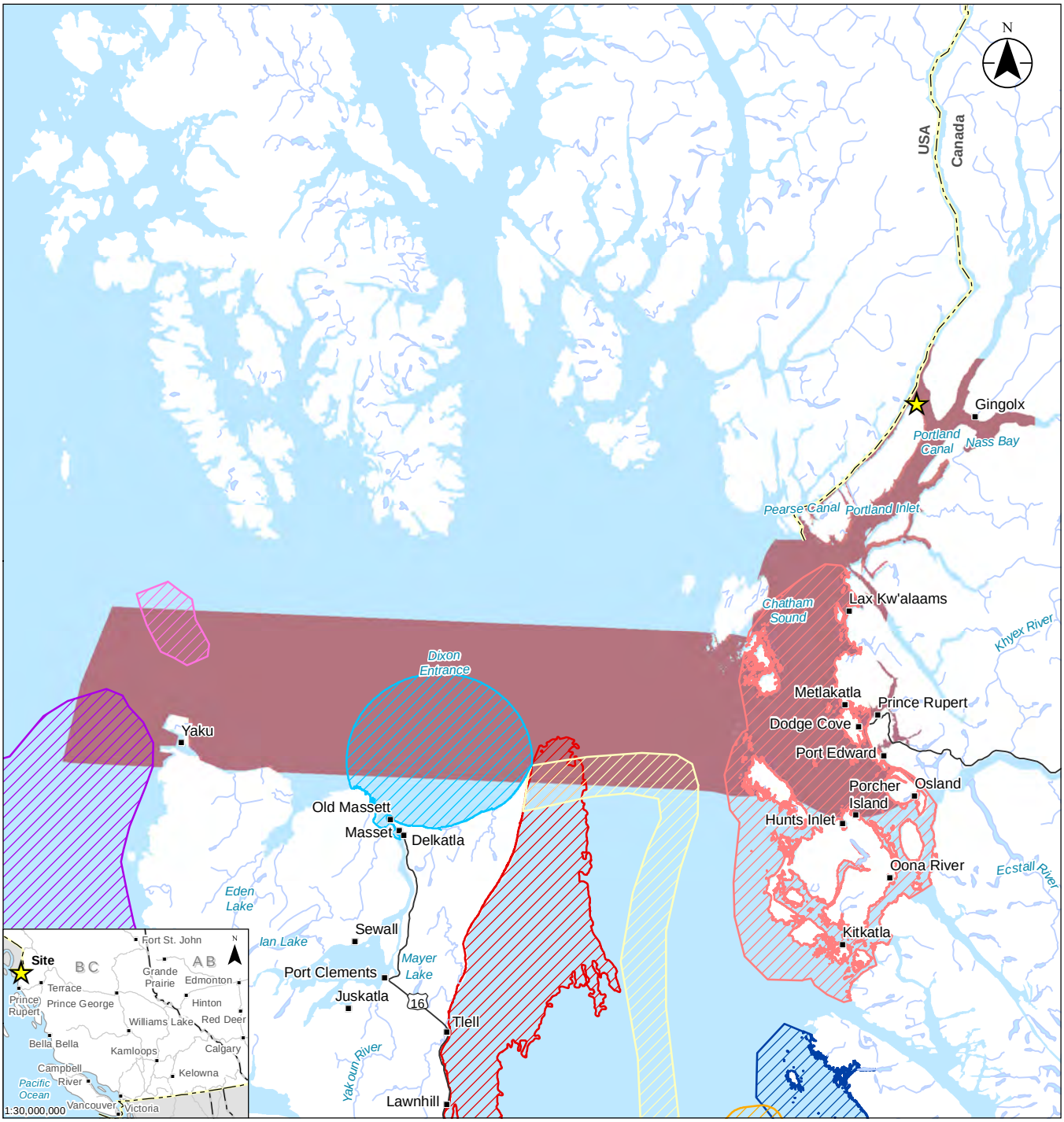
Several coastal aquaculture facilities exist within the Marine Resources RSA in proximity to Prince Rupert Harbour (Figure 3.4–2). These include five active shellfish facilities which farm a variety of marine organisms including Pacific scallop (*Patinopecten caurinus*), manilla clam (*Venerupis philippinarum*), Pacific oyster (*Crassostrea gigas*), geoduck clam (*Panopea generosa*), Japanese scallop (*Mizuhopecten yessoensis*) and weathervane scallop (*Patinopecten caurinus*) (MAPP 2022).

3.4.4 Ecologically and Biologically Significant Areas (EBSAs), Important Areas (DFO Important Areas), and DFO Management Areas

Ecologically and Biologically Significant Areas (**EBSA**) are areas that have relatively higher ecological or biological significance than surrounding areas (DFO 2004). EBSAs are established based on their uniqueness, special importance for life history, importance for threatened species, sensitivity/vulnerability to disturbance, productivity, and biodiversity (Rubidge et al. 2018). EBSAs are broken down spatially in the North Pacific into 18 areas, of which six are located, at least partially, within the Marine Resources Study Area. These EBSA's include Learmonth Bank, McIntyre Bay, Hecate Strait Front, Dogfish Bank, Shelf Break, and Chatham Sound EBSAs (Figure 3.4–3). EBSAs are fixed geographically and can be identified as important for individual species within them. EBSAs are important areas that contribute to the healthy functioning of the marine ecosystem (Rubidge et al. 2018).

A DFO important area is a specialized EBSA that is specific to one species or feature (Rubidge et al. 2018). The boundaries of these areas are dependent on the species or feature they are specialized to. There are several DFO important areas for different marine species in and around the marine terminal (Figure 3.4–4) and within the broader Marine Resources Study Area (Figure 3.4–5). EBSAs and DFO important areas do not have special legal status, but they do connotate areas that require special consideration and increased risk aversion (DFO 2004).

The Pacific Fishery Management Area Regulations (2007) breaks down the areas of Canada's marine ecosystems into Management Areas and Subareas which help to further characterize and effectively regulate the marine environment. Relevant management areas that overlap with the Marine Resources Study Area are shown in Figure 3.4–6.



KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Site

Ecologically and Biologically Significant Areas
- CM - Central mainland
- CS - Chatham Sound
- DB - Dogfish Bank
- HSF - Hecate Strait front
- LB - Learmonth Bank
- MB - McIntyre Bay
- SB - Shelf Break
- SR - Sponge Reef

- Marine Resources Study Area
- Highway
- International Boundary
- Watercourse
- Waterbody

0 10 20 30 40 50 km
1:1,500,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC
Project Number: 123221820
Prepared by NFORRESTER on 20220831
Requested by NBENEDICTUS on 20220831
Check by SMOSS on 20220831

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Technical Data Report - Marine Resources

Figure No.
3.4-3

Title
Ecologically and Biologically Significant Areas

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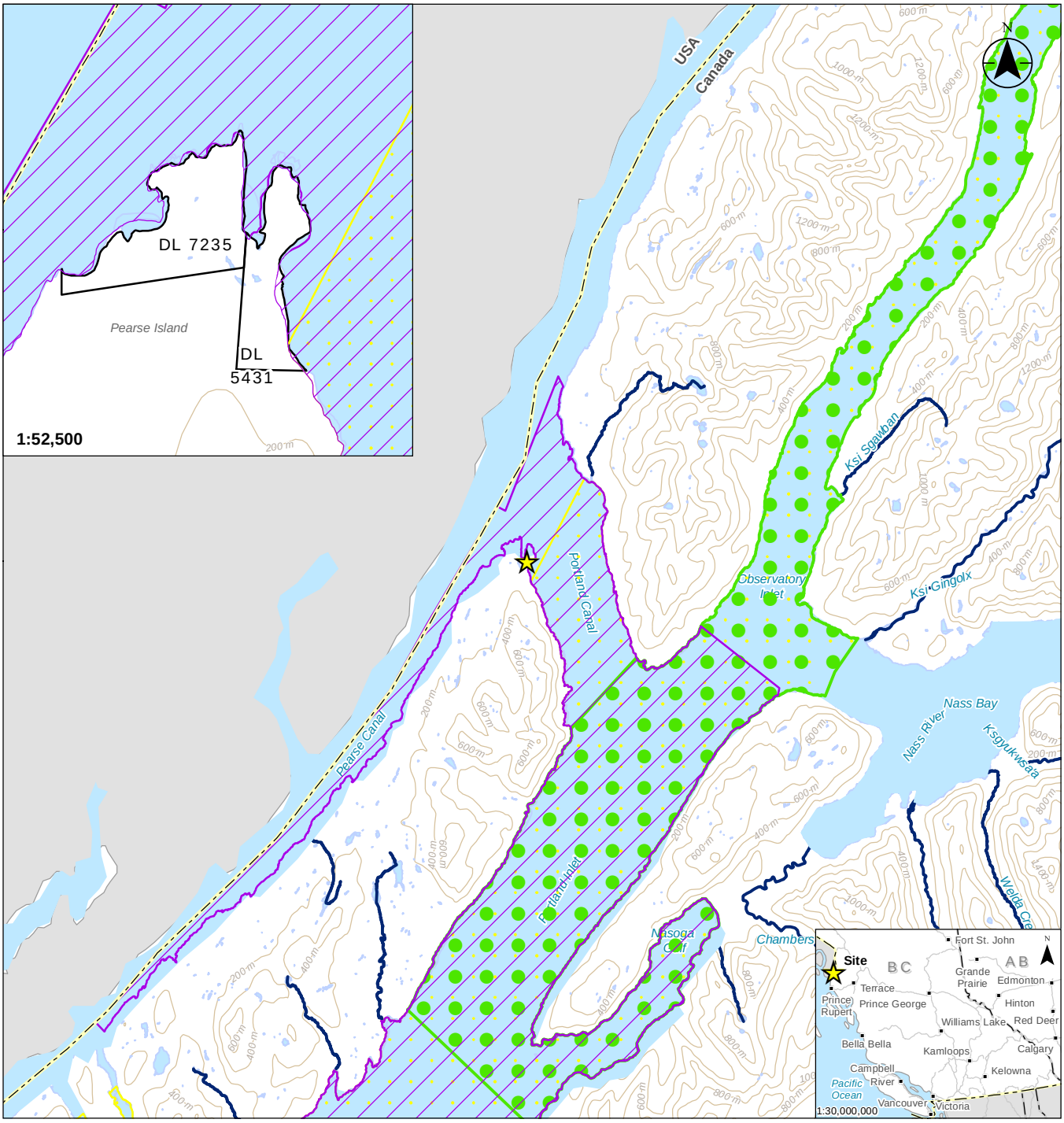

KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada

- Site
- Pacific Salmon Spawning River
- Boundaries of District Lots 7235 and 5431
- DFO Important Area for Eulachon
- DFO Important Area for Pollock
- DFO Important Area for Tanner Crab
- International Boundary
- Topographic Contour
- Waterbody

0 2 4 6 8 10 km
1:250,000 (at original document size of 8.5x11)

Stantec

Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by SMOSS on 20220617
Requested by CMCCRACKEN on 20220601
Check by TQUILICHINI on 20220617

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
3.4-4

Title
DFO Important Areas for Invertebrates and Fish near the Marine Terminal

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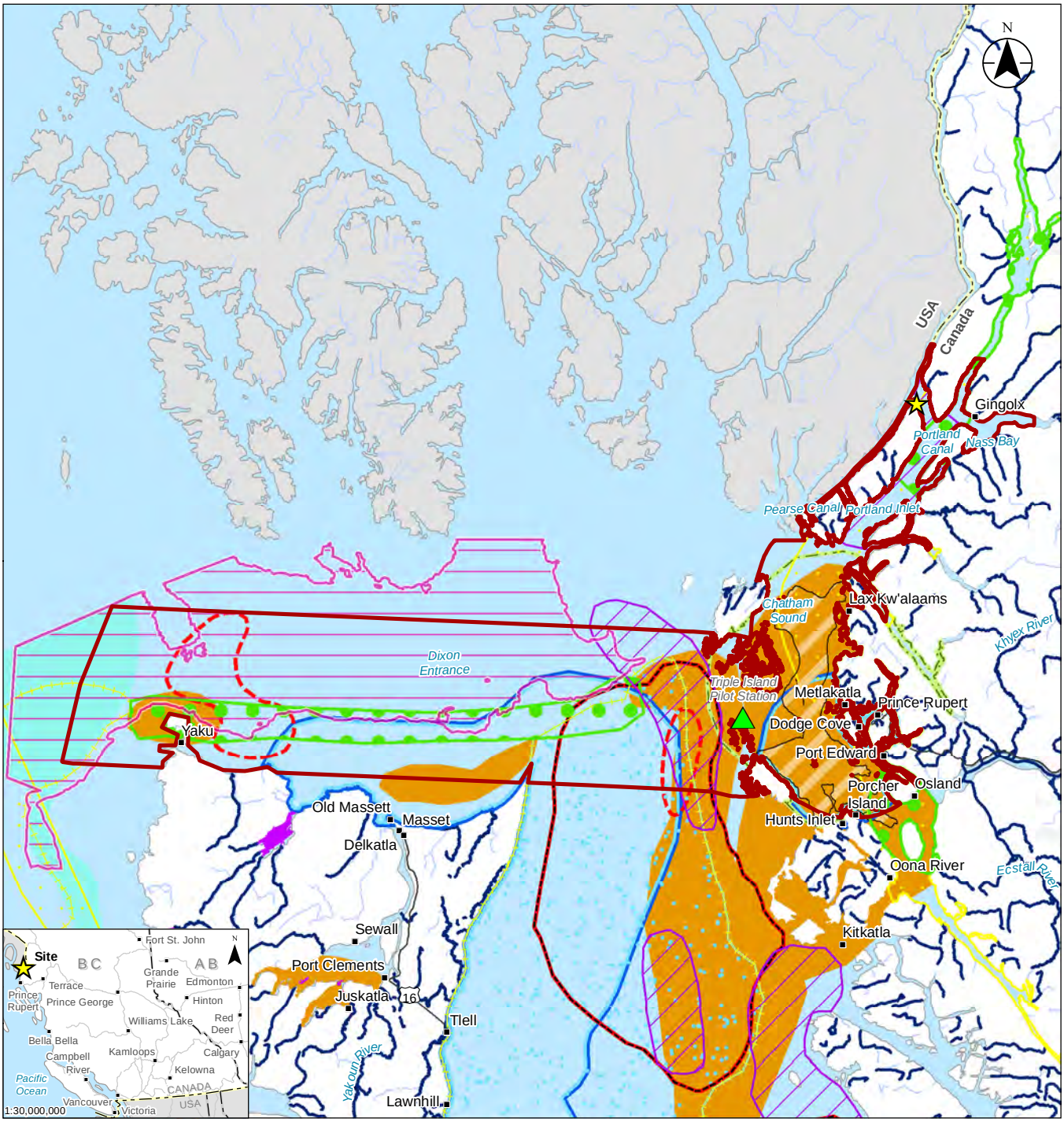

KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

- Site
- Triple Island Pilot Station
- Pacific Salmon Spawning River
- DFO Important Area for Coral Sponge
- DFO Important Area for Dungeness Crab
- DFO Important Area for Eulachon
- DFO Important Area for Green Sea Urchin
- DFO Important Area for Hake
- DFO Important Area for Herring
- DFO Important Area for Pacific Cod
- DFO Important Area for Pollock
- DFO Important Area for Rockfish
- DFO Important Area for Sablefish
- DFO Important Area for Shrimp
- DFO Important Area for Sole
- DFO Important Area for Tanner Crab
- Herring Spawning Area
- Marine Resources Study Area
- Highway
- International Boundary
- Watercourse

0 10 20 30 40 50 km
1:1,500,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC
Project Number: 123221820
Prepared by SMOSS on 20220617
Requested by CMCCRACKEN on 20220601
Check by TQUILICHINI on 20220617

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
3.4-5

Title
DFO Important Areas for Invertebrates and Fish along the Shipping Route

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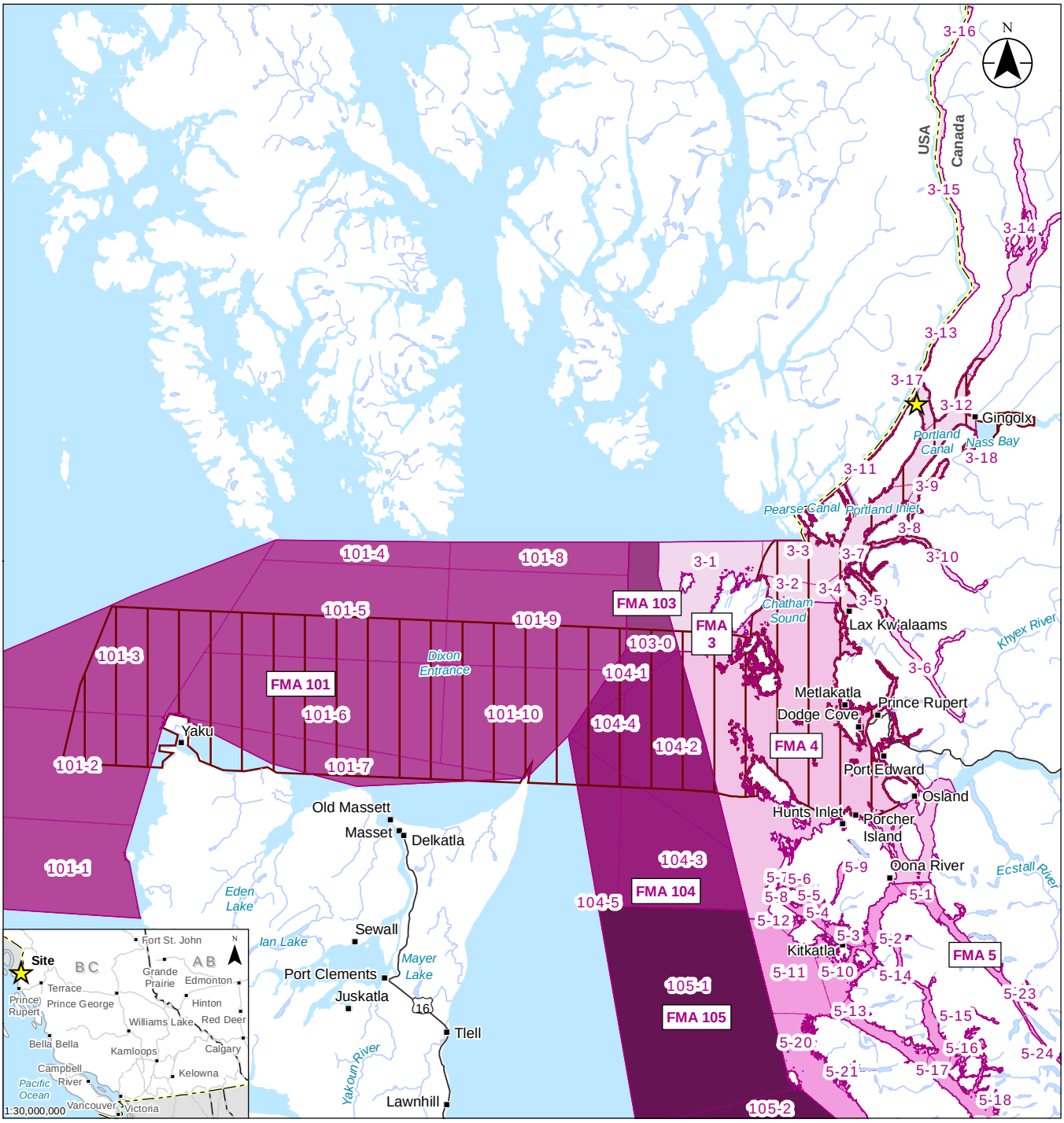

KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3.

Site

DFO Fisheries Management Area
- 3
- 4
- 5
- 101
- 103
- 104
- 105

Marine Resources Study Area
Highway
International Boundary
Watercourse
Waterbody

0 10 20 30 40 50 km
1:1,500,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC
Project Number: 123221820
Prepared by NFORRESTER on 20220615
Requested by CMCCRACKEN on 20220615
Check by TQUILICHINI on 20220615

Client/Project/Report
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Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
3.4-6

Title
DFO Fisheries Management Areas/Sub Areas within the Marine Resources Study Area

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3.4.5 Marine Plankton

Plankton can be classified as either phytoplankton (plants and bacteria) or zooplankton (animals) (DFO 2018b). Plankton are an essential component of the marine food web as they constitute the lowest and most foundational trophic level and support a wide variety of larger species (NOAA 2021a). Plankton are extremely sensitive to changes in temperature, salinity, pH, and nutrient concentrations in their environments (NOAA 2021a). Due to their foundational nature in the marine trophic structure, fluctuations in plankton abundance can have widespread consequences that affect all marine species (NOAA 2021a).

Phytoplankton are microscopic plants that exist primarily in the photic zone (less than 200 m depth) of the world's oceans. Like terrestrial plants, phytoplankton perform photosynthesis, which converts the sun's energy and carbon dioxide into energy and oxygen. Phytoplankton abundance is highly variable and dependent on several environmental factors, including the degree of turbulent mixing, water chemistry, nutrient availability (e.g., phosphate, nitrogen, and iron), temperature, wind, currents, and sunlight (Niu et al. 2017; Reynolds 1998; Raven and Maberly 2009). In turn, phytoplankton influence their environment by altering the thermal structure of the water column through light absorption during photosynthesis (Mackay et al. 2021). Changes in nutrient availability and light levels contribute to seasonal phytoplankton blooms, which can have adverse consequences for other organisms in the surrounding ecosystem. The localized rapid increase in a population of dinoflagellates causes the phenomenon known as "red tide", which can be toxic to fish and other marine organisms and cause illness in humans (DFO 2018b). In general, the coast of BC supports large quantities of phytoplankton, in part due to nutrient input from river runoff and increased upwelling, particularly in the summer months (Lucas et al. 2007).

Zooplankton are microscopic animals that exist throughout the world's oceans. Zooplankton include the larvae of many species, including invertebrates and fish, as well as some species that remain planktonic for their entire lives such as copepods and krill (NOAA 2021a). Zooplankton are a step above phytoplankton in the global trophic structure. Zooplankton feed on phytoplankton and other organic matter and are strongly influenced by their abundance (NOAA 2021a). Zooplankton are a diverse group and include many organisms that are weak swimmers whose movements are heavily influenced by ocean currents and tides. Many types of zooplankton are capable of some movement and undergo a daily migration from deep water habitats to shallow water where they forage on phytoplankton (NOAA 2021a). Zooplankton are an important source of food for many species ranging in size from invertebrates and fishes to baleen whales (NOAA 2021a).

While plankton do not have designated DFO important areas and EBSAs, several EBSAs within the Project Marine Resources Study Area are known to contain a significant diversity of plankton. The McIntyre Bay EBSA is known to contain high zooplankton diversity (Clarke and Jamieson 2006). The Learmonth Bank EBSA is known to concentrate a wide diversity of plankton in the nearby waters (Clarke and Jamieson 2006). Finally, the Chatham Sound EBSA has significant riverine input and strong tidal mixing, which are known to support high phytoplankton biomass and productivity (Clarke and Jamieson 2006).

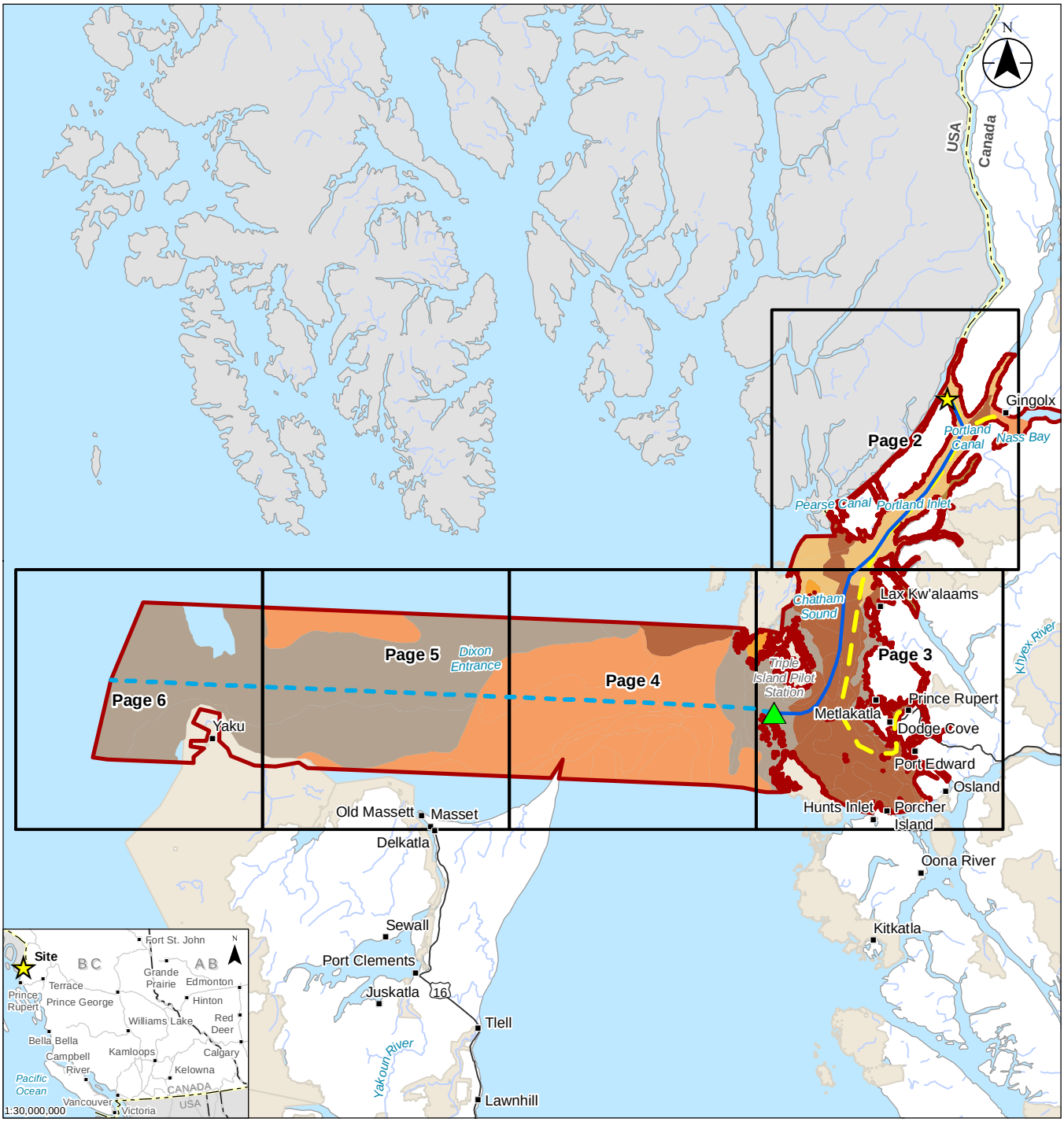
3.4.6 Marine Habitat and Substrate

The northern coast of BC provides a mosaic of habitat units for marine species and is rich in ecological diversity. The Marine Resources Study Area encompasses a large geographic area that supports a wide range of marine habitats from riparian through intertidal and into deep subtidal waters. Habitats found in these areas include rocky shorelines, rock/gravel/sand beaches, and sand/gravel flats (Figure 3.4–7). Each of these important habitats provides unique ecological functions and habitat requirements for many species (Jamieson and Davies 2004). Marine fish and invertebrates rely on these habitats for food, shelter, nursing/rearing, and protection from predation. Marine habitats can also provide important ecological services such as carbon sequestration and nutrient recycling (Plummer et al. 2013). The Marine Resources Study Area includes several particularly important habitats which have been identified as conservation areas (Figure 3.4–8). The following sections describe the biological and physical characteristics of these habitats and their associated community assemblages.

3.4.6.1 Shoreline and Benthic Habitats

A review of shore zone classifications within the Marine Resources Study Area was completed using publicly available data through the Government of BC data portal (Figure 3.4–7). Shore zones along the confined channel of Portland Inlet leading to the marine terminal location are a mix of rock cliff, rock with gravel beach, sand and gravel flat, and gravel beach. Areas of estuary, marsh or lagoon are found in numerous bays and at the head of inlets within this area. A similar make-up of shore zone classifications is found in the shorelines surrounding Chatham Sound with a more variable makeup in the areas on the eastern (mainland) side which contrast with the greater proportions of rock, sand and gravel beach as well as rock cliff areas found on the island shorelines to the west. The northern end of Haida Gwaii includes large stretches of sand beach around Rose Spit which transition to more variable mixtures of substrates including sand and gravel flat, sand flat, rock sand and gravel beach, rock with gravel beach and rock platform areas extending to the western edge of the Marine Resources Study Area. Additional details on the specific intertidal habitats located around the marine terminal location are provided in Section 4.1 (Intertidal Surveys) and Section 4.7 (Remote Sensing).

Information on the benthic substrates within the Marine Resources Study Area were evaluated using publicly available data from Coastal Resource Information Management System (Government of BC) (Figure 3.4–7). The majority of the substrates within Portland Inlet are classified as muddy sloping (5-20% slope) which transition to muddy flat (0-5% slope) substrates in Chatham Sound. Areas of hard flat (0-5% slope) substrate dominate near the shorelines in Chatham Sound and extend offshore before transitioning to soft flat substrates across the northeastern side of Haida Gwaii. Benthic substrates off the northern end of Haida Gwaii and heading offshore to the west transition to predominantly hard flat substrates. Additional details on the subtidal habitats located around the marine terminal location are provided in Section 4.2 (Subtidal Survey).



KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3.

- Site
- Triple Island Pilot Station
- Marine Shipping Route
- Open Water Marine Shipping Route
- Materials and Supply Shipping Route
- Marine Resources Study Area

Benthic Classes
- Hard Flat (0-5%)
- Hard Sloping (5-20%)
- Muddy Flat (0-5%)
- Muddy Sloping (5-20%)
- Soft Flat (0-5%)
- Soft Sloping (5-20%)
- Highway
- International Boundary
- Watercourse
- Conservancy Area

0 10 20 30 40 50 km
1:1,500,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC
Project Number: 123221820
Prepared by SMOSS on 20220617
Requested by CMCCRACKEN on 20220601
Check by TQUILICHINI on 20220617

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
3.4-7
Page 1 of 6

Title
Marine Substrates and Benthos within the Marine Resources Study Area

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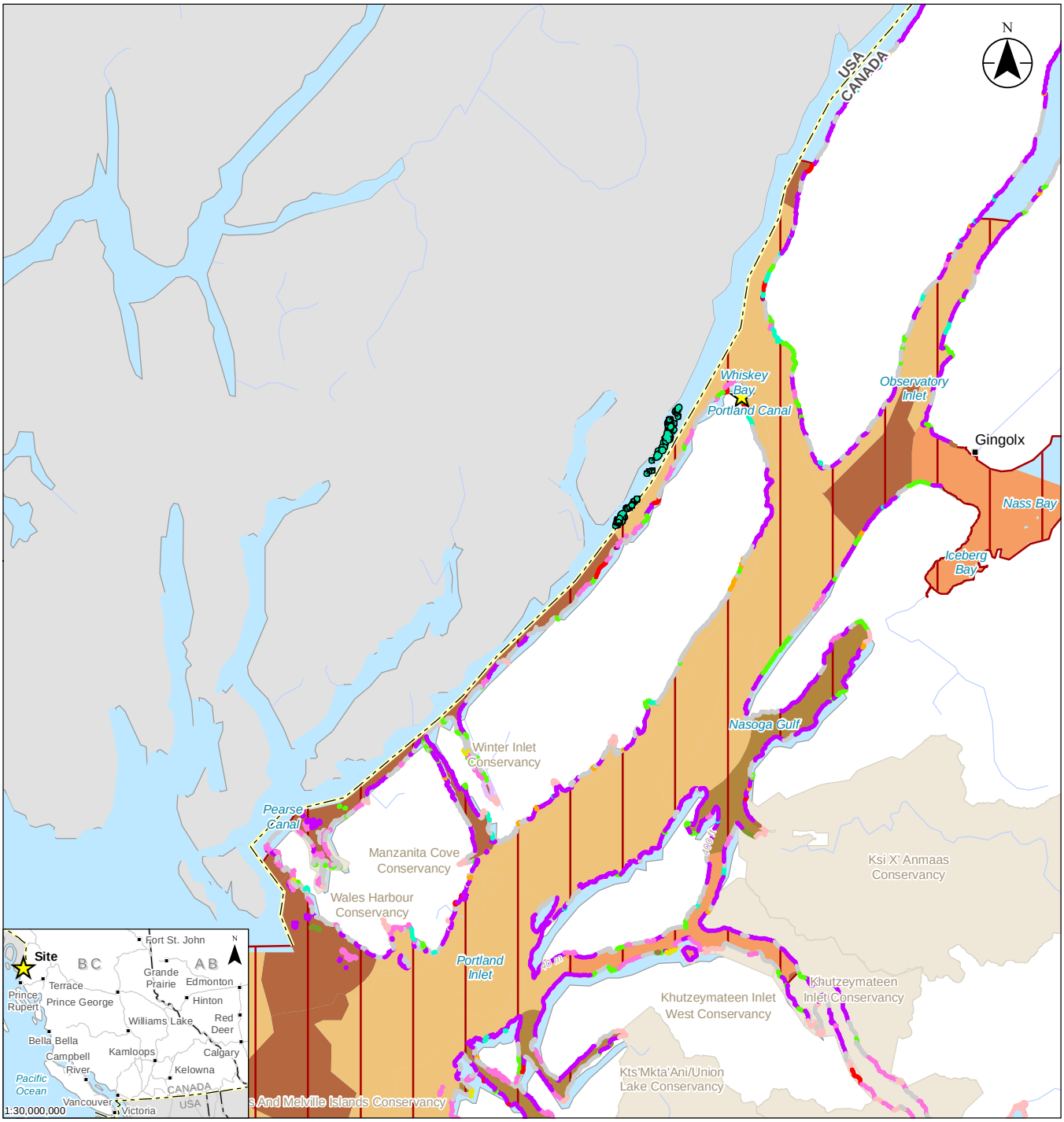

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Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

- Site
- Marine Resources Study Area

Benthic Classes
- Hard Sloping (5-20%)
- Muddy Flat (0-5%)
- Muddy Sloping (5-20%)
- Soft Flat (0-5%)
- Soft Sloping (5-20%)
- Sponge Reef Area
- International Boundary
- Topographic Contour
- Watercourse
- Conservancy Area

Shore Unit Classification (Shorezone)
- Estuary, Marsh or Lagoon
- Gravel Beach
- Gravel Flat
- Man-made
- Mud Flat
- Rock Cliff
- Rock with Gravel Beach
- Rock with Sand Beach
- Rock, Sand and Gravel Beach
- Sand Beach
- Sand Flat
- Sand and Gravel Beach
- Sand and Gravel Flat

0 5 10 15 km
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Project Number: 123221820
Prepared by SMOSS on 20220617
Requested by CMCCRACKEN on 20220601
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Figure No.
3.4-7

Title
Marine Substrates and Benthos within the Marine Resources Study Area

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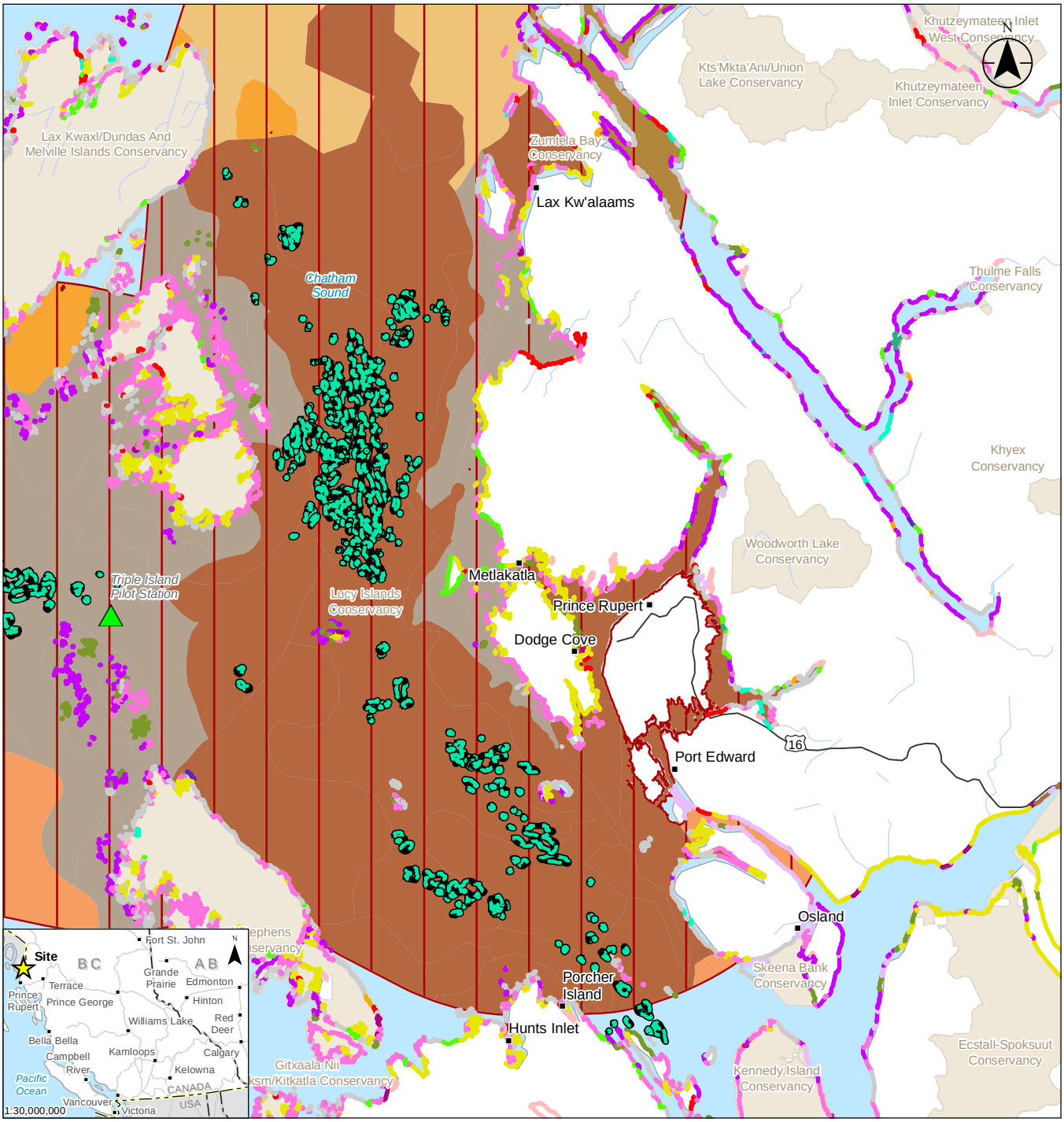

KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

- Triple Island Pilot Station
- Marine Resources Study Area

Benthic Classes
- Hard Flat (0-5%)
- Hard Sloping (5-20%)
- Muddy Flat (0-5%)
- Muddy Sloping (5-20%)
- Soft Flat (0-5%)
- Soft Sloping (5-20%)
- Sponge Reef Area
- Topographic Contour
- Highway
- Watercourse
- Conservancy Area

Shore Unit Classification (Shorezone)
- Channel
- Estuary, Marsh or Lagoon
- Gravel Beach
- Gravel Flat
- Man-made
- Mud Flat
- Rock Cliff
- Rock Platform
- Rock with Gravel Beach
- Rock with Sand Beach
- Rock, Sand and Gravel Beach
- Sand Beach
- Sand Flat
- Sand and Gravel Beach
- Sand and Gravel Flat

0 5 10 15 km
1:375,000 (at original document size of 8.5x11)

Stantec

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Project Number: 123221820
Prepared by SMOSS on 20220617
Requested by CMCCRACKEN on 20220601
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Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
3.4-7

Title
Marine Substrates and Benthos within the Marine Resources Study Area

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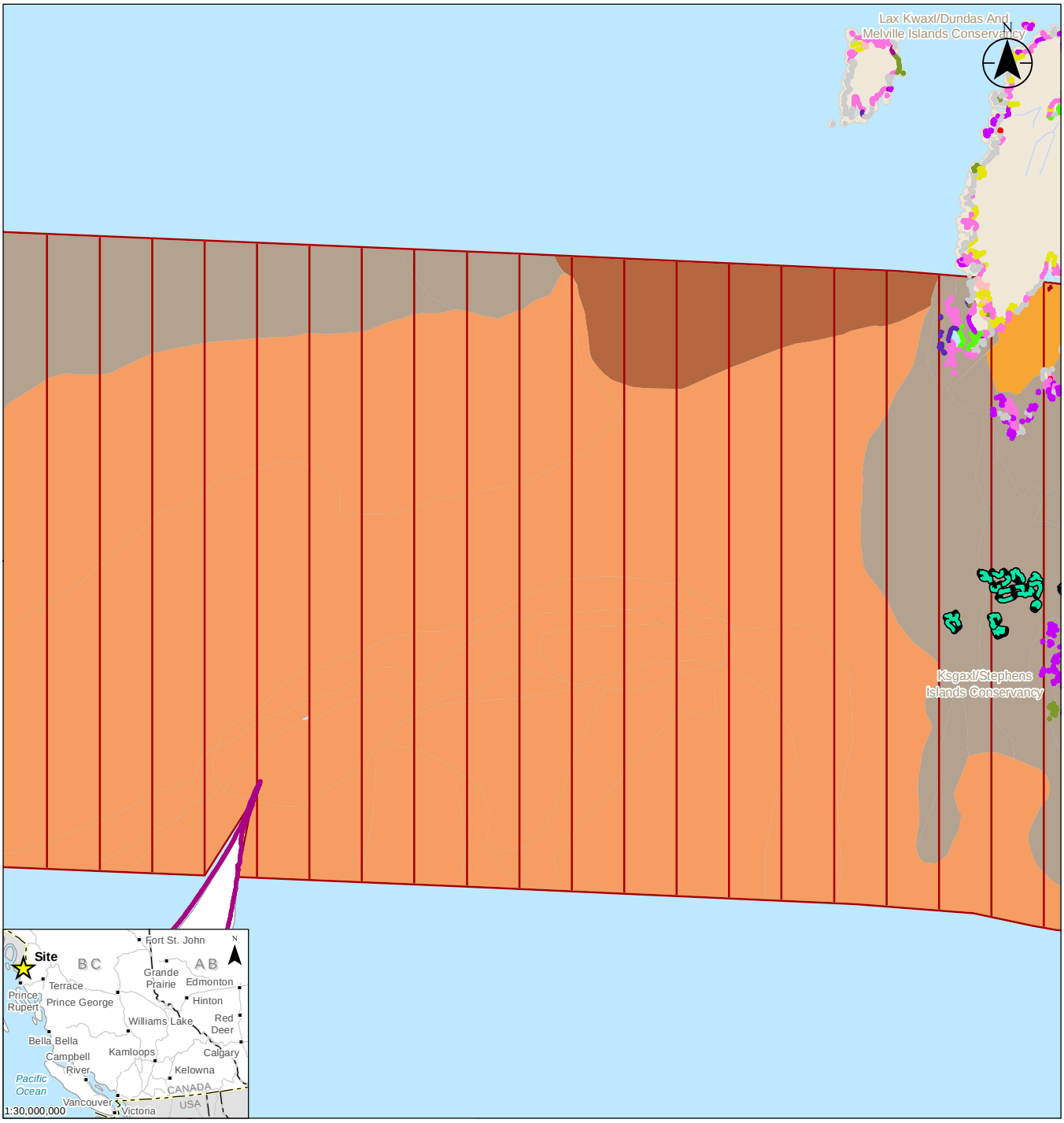

KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Marine Resources Study Area

Benthic Classes
- Hard Flat (0-5%)
- Hard Sloping (5-20%)
- Muddy Flat (0-5%)
- Muddy Sloping (5-20%)
- Soft Flat (0-5%)
- Sponge Reef Area
- Topographic Contour
- Conservancy Area

Shore Unit Classification (Shorezone)
- Estuary, Marsh or Lagoon
- Rock Cliff
- Rock Platform
- Rock with Gravel Beach
- Rock with Sand Beach
- Rock, Sand and Gravel Beach
- Sand Beach
- Sand Flat
- Sand and Gravel Beach
- Sand and Gravel Flat

0 5 10 15 km
1:375,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC
Project Number: 123221820
Prepared by SMOSS on 20220617
Requested by CMCCRACKEN on 20220601
Check by TQUILICHINI on 20220617

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Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
3.4-7

Title
Marine Substrates and Benthos within the Marine Resources Study Area

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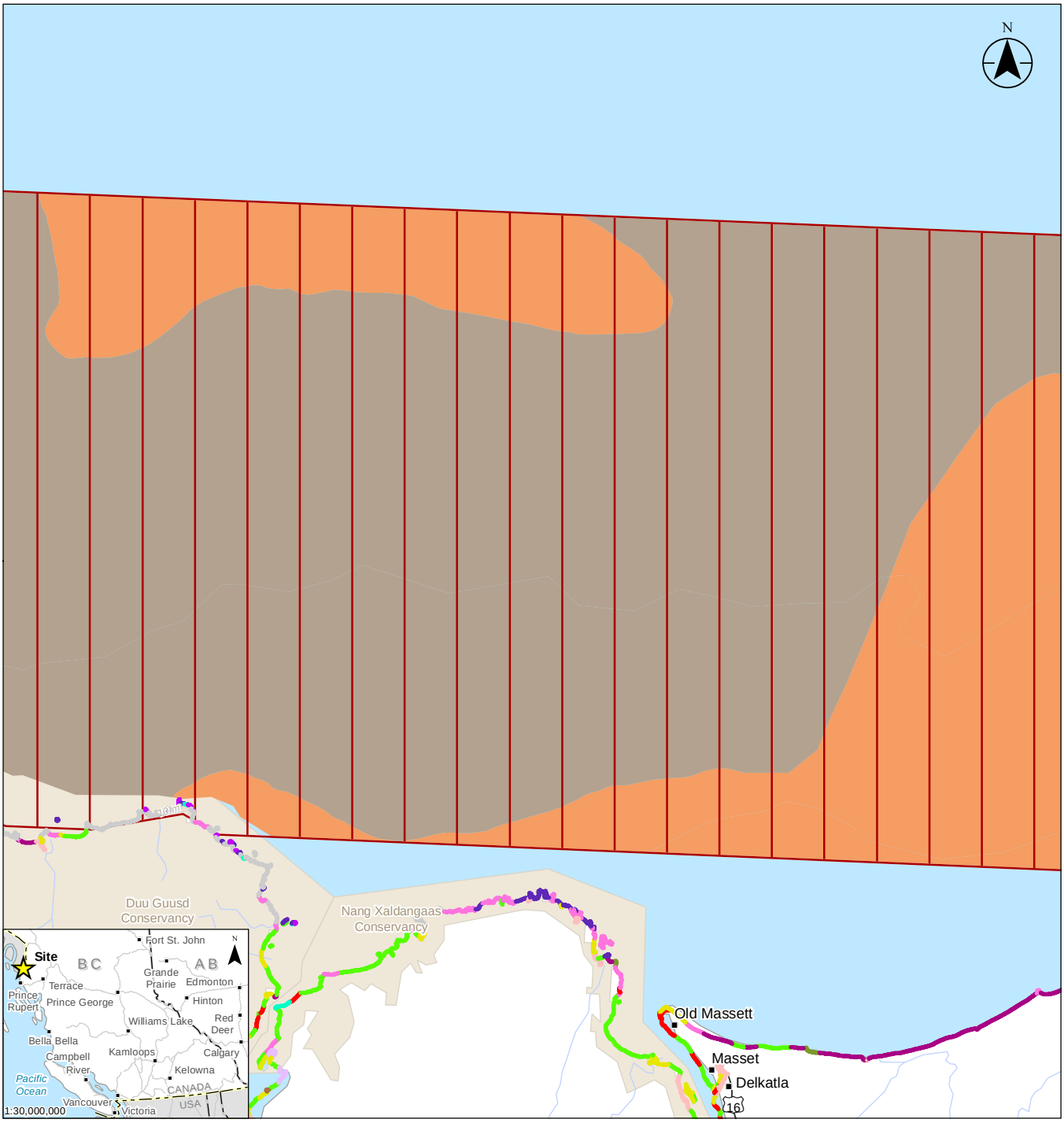

KSI LISIMS LNG

Marine Resources Study Area

Benthic Classes
- Hard Flat (0-5%)
- Soft Flat (0-5%)
- Topographic Contour
- Conservancy Area

Shore Unit Classification (Shorezone)
- Estuary, Marsh or Lagoon
- Gravel Beach
- Gravel Flat
- Man-made
- Mud Flat
- Rock Cliff
- Rock Platform
- Rock with Gravel Beach
- Rock with Sand Beach
- Rock, Sand and Gravel Beach
- Sand Beach
- Sand Flat
- Sand and Gravel Beach
- Sand and Gravel Flat

0 5 10 15 km

1:375,000 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Stantec

Project Location: Pearse Island, BC

Project Number: 123221820
Prepared by SMOSS on 20220617
Requested by CMCCRACKEN on 20220601
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Figure No.
3.4-7

Title
Marine Substrates and Benthos within the Marine Resources Study Area

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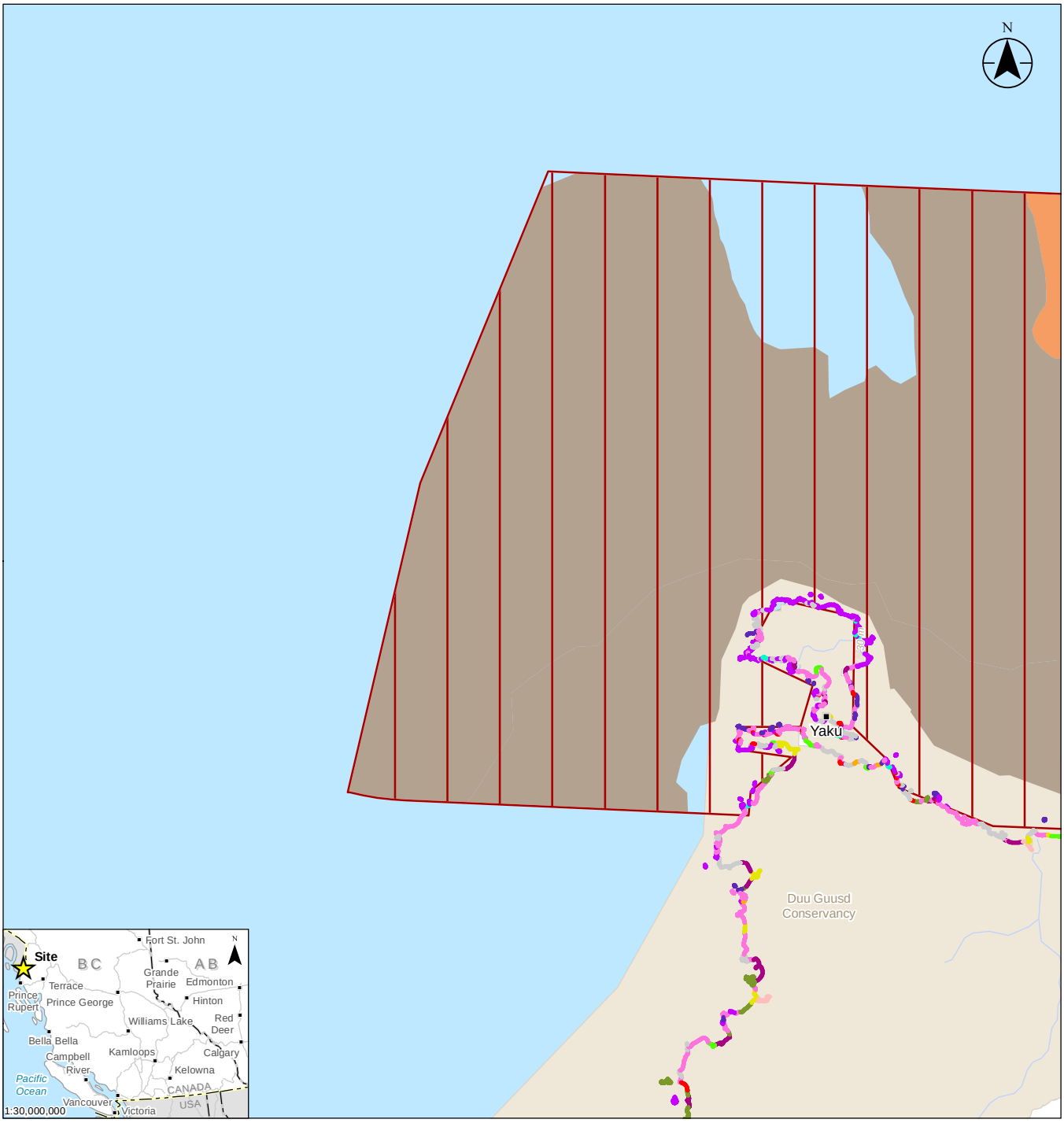

KSI LISIMS LNG

Marine Resources Study Area

Benthic Classes
- Hard Flat (0-5%)
- Soft Flat (0-5%)
- Topographic Contour
- Watercourse
- Conservancy Area

Shore Unit Classification (Shorezone)
- Estuary, Marsh or Lagoon
- Gravel Beach
- Gravel Flat
- Rock Cliff
- Rock Platform
- Rock with Gravel Beach
- Rock with Sand Beach
- Rock, Sand and Gravel Beach
- Sand Beach
- Sand Flat
- Sand and Gravel Beach
- Sand and Gravel Flat

0 5 10 15 km

1:375,000 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Stantec

Project Location: Pearse Island, BC

Project Number: 123221820
Prepared by SMOSS on 20220617
Requested by CMCCRACKEN on 20220601
Check by TQUILICHINI on 20220617

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Figure No.
3.4-7

Title
Marine Substrates and Benthos within the Marine Resources Study Area

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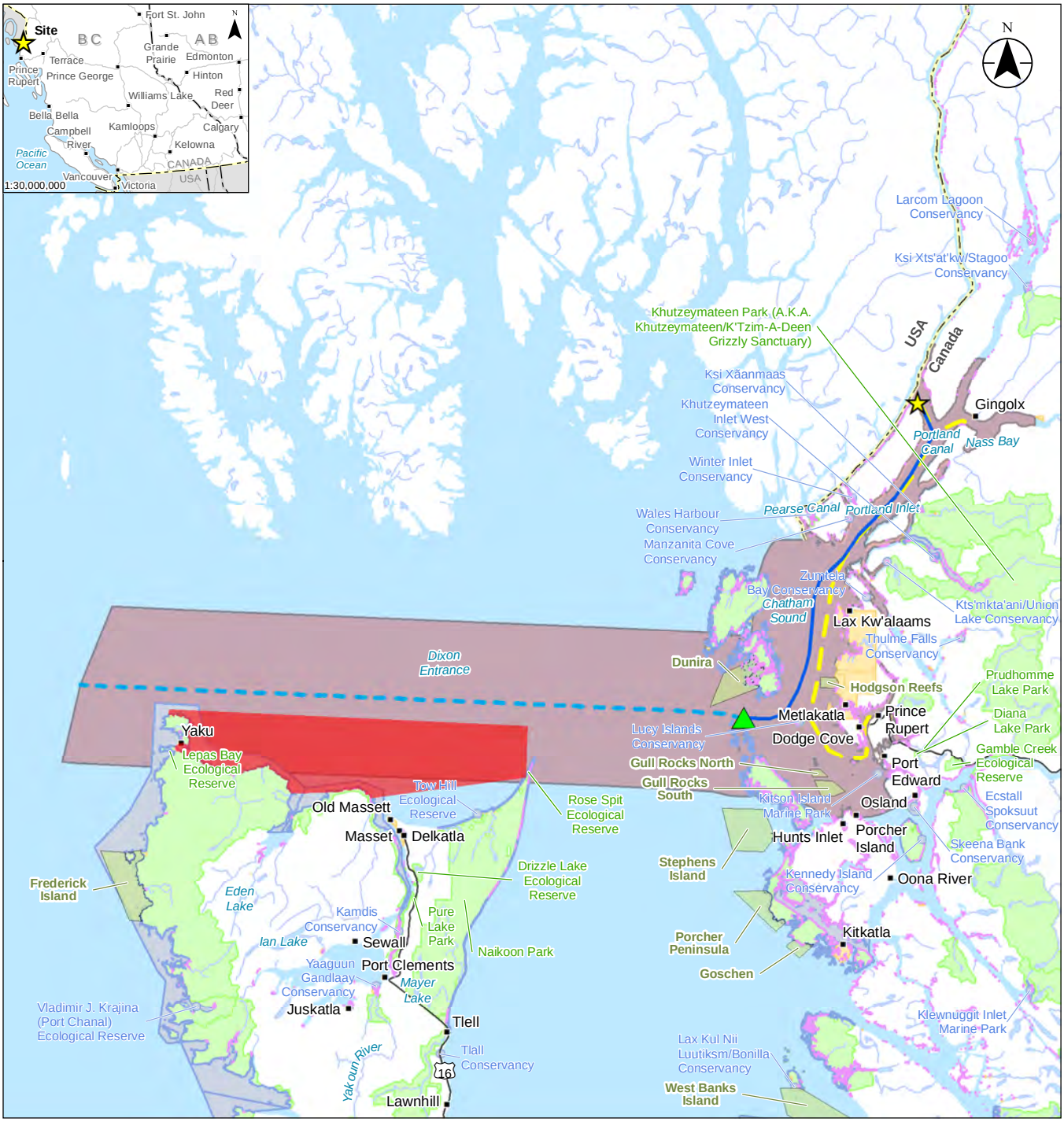
3.4.6.2 Parks, Conservancies and Critical Habitat

The Marine Resources Study Area contains a number of parks, conservancies, and one area of designated critical habitat (Figure 3.4–8). Conservancies including Khutzeymateen Inlet West, Winter Inlet, Wales Harbour, Manzanita Cove, Zumtela Bay, Kitson Island, and Lucy Islands are located throughout Portland Inlet and Chatham Sound. The Lepas Bay Ecological Reserve is situated along the northwestern shoreline of Haida Gwaii towards the western-most extent of the Marine Resources Study Area. In addition, four rockfish conservation areas (Dunira, Hodgson Reefs, Gull Rocks North, and Gull Rocks South) have been established in Chatham Sound. Designated critical habitat for northern resident killer whale exists along the north end of Haida Gwaii and extends approximately 90 km east to west (Figure 3.4–8).



KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3.

- Site
- Triple Island Pilot Station
- Marine Shipping Route
- Open Water Marine Shipping Route
- Materials and Supply Shipping Route
- Salt Marsh Bioband
- Killer Whale Critical Habitat
- Marine Resources Study Area
- Rockfish Conservation Area
- Highway
- International Boundary
- Watercourse
- Marine Park, Ecological Reserve, Protected Area or Conservancy Area
- Reserve Land
- Terrestrial Park, Ecological Reserve, Protected Area or Conservancy Area
- Waterbody

0 10 20 30 40 50 km
1:1,500,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC
Project Number: 123221820
Prepared by TQUILICHINI on 20220610
Requested by CMCCRACKEN on 20220601
Check by SMOSS on 20220610

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
3.4-8

Title
Parks, Conservation Areas, and Critical Habitat within the Marine Resources Study Area

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3.4.6.3 Riparian Vegetation

Riparian areas are the interface between aquatic and terrestrial ecosystems and play an important role in shoreline ecology by facilitating many important ecological effects. Riparian areas are some of the most biodiverse ecosystems in the world, and are home to a wide variety of plants, amphibians, mammals, reptiles, birds, and more (Fish & Wildlife Compensation Program 2021). Riparian vegetation contributes to ecosystems by:

- Building and maintaining bank integrity
- Storing floodwater and reducing water energy and flow rates
- Recharging groundwater
- Filtering nutrients from the water
- Maintaining biodiversity
- Supporting primary production
- Sequestering carbon
- Moderating water temperature by providing cover and protection from the sun (Ministry of Water, Land and Air Protection 2022)

Diversity of riparian vegetation is dependent on a variety of factors (e.g., average rainfall, temperature, marine/freshwater environments, sunlight) and in BC can include coniferous and deciduous trees, as well as a variety of shrubs and grasses. Common riparian vegetation in the Marine Resources Study Area includes western red cedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), Douglas fir (*Pseudotsuga menziesii*), Sitka spruce (*Picea sitchensis*), red alder (*Alnus rubra*), and black cottonwood (*Populus trichocarpa*), as well as many more trees, shrubs, epiphytes, mosses, lichens, and ferns (PSKF 1998).

3.4.6.4 Marsh and Meadows

Tidal water wetlands occur in the intertidal zone of the sea coast (NWWG 1997). These wetlands are saline or brackish and occur within coastal zones where the mean tide water level is less than 2 m deep (NWWG 1997). Estuarine and tidal wetlands include estuarine meadows and marshes, eelgrass tidal flats, and tidal water wetlands with boulder/gravel/cobble substrates, unknown substrates, and mudflat/sandflats. Estuarine meadows and marshes are areas that are vegetated by grasses, shrubs, and herbs that border saline waterbodies and are subject to frequent tidal flooding (Adam 1990; Tiner and Milton 2016;). These estuarine communities occur along the shoreline of the Marine Resource Study Area (Figure 3.4–8) and are predominant along the edges of Whiskey Bay near the marine terminal location (Figure 4.7–3).

Estuarine meadows and marshes are dynamic environments and provide many important functions. These intertidal habitats protect shorelines from erosion by buffering wave action and trapping sediments, reducing flooding, and protecting water quality by filtering runoff. Estuarine meadows and marshes also

provide essential refuge, nursery, and foraging habitats for numerous fish and invertebrate species (NOAA 2023).

3.4.6.5 Kelp Beds

Kelp beds are widespread in temperate waters globally and play important roles in the marine environments in which they exist. In the Marine Resources Study Area (including within the terminal area), kelp beds are widely distributed throughout the coast, notably including the northern side of Portland Canal/Inlet, around the coasts of Dundas and Stephen's Islands, and on the north shore of Haida Gwaii (Figure 3.4–9).

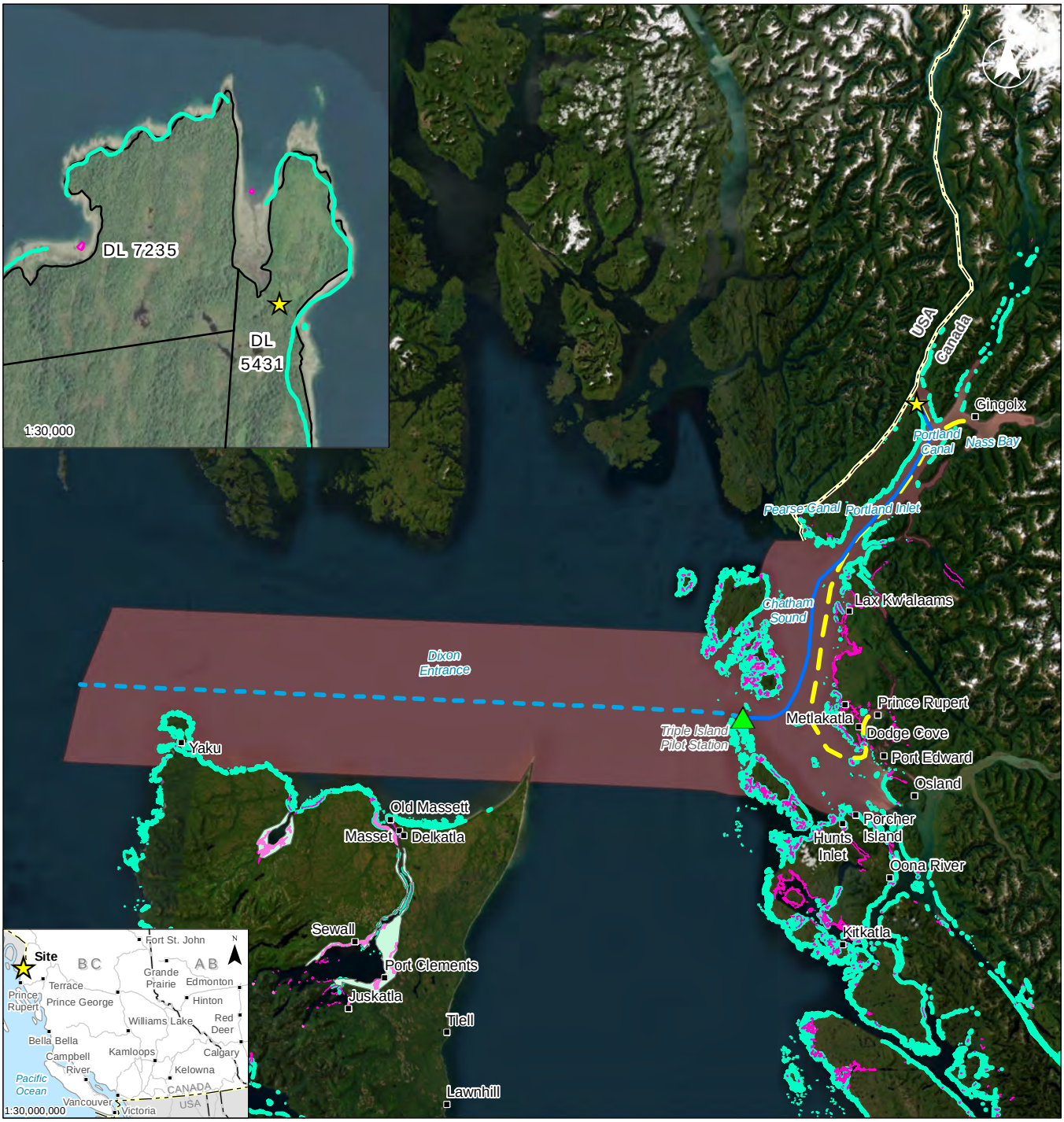
Kelp beds are highly productive and dynamic ecosystems that provide structurally complex habitat for a variety of marine organisms, including commercially, recreationally, and culturally important species (Lucas et al. 2007) such as Pacific salmon, Pacific herring (*Clupea pallasii*), rockfish (*Sebastes* spp.), forage fish (e.g., eulachon, surf smelt, and sand lance), sea urchins, and sea otters *(Enhydra lutris*). Kelp beds serve as a foraging, spawning, and refuge habitat. They also provide nursery habitat for juvenile fish by supporting their prey species and providing protection from predators (Lucas et al. 2007).

Throughout the world's temperate coastal waters, kelp forests dominate rocky reefs and subtidal habitats (Steneck et al. 2002). Kelp forests are foundational to these coastal ecosystems, and contribute to biodiversity, primary production, carbon storage, wave energy dissipation, and macronutrient dynamics (Pfister et al. 2017). These subtidal forests consist of both canopy and understory forming species. On BC's Pacific coast, kelp canopies are dominated by bull kelp (*Nereocystis luetkeana*) and giant kelp (*Macrocystis pyrifera*) while stipitate and prostate kelps (e.g., Order Laminariales) form the understory layer (Lucas et al. 2007). Kelp species grow on hard substrates such as boulders, bedrock, and cobble in nearshore waters from the low intertidal zone down to depths of 40 m, and prefer nutrient-rich waters that are cool in temperature and clear to allow for maximum light penetration (Duggins et al. 1990). Bull kelp is known to inhabit areas up to 20 m depth and giant kelp up to 30 m depth in the Pacific northwest (Lamb and Hanby 2005).

3.4.6.6 Eelgrass Beds

Eelgrass (*Zostera* spp.) is an important marine plant which plays a foundational role in coastal and estuarine environments. It is widely distributed in the northern hemisphere in temperate coastal ecosystems. Eelgrass beds occur in several coastal areas within the Marine Resources Study Area (including small patches around the terminal location), including south of Lax Kw'alaams to Prince Rupert, as well as isolated areas off the south coast of Dundas Island and around Stephens Island (Figure 3.4–9).

Eelgrass has a unique, matted rhizome system, which prefers fine sediment substrates such as silt and sand, with less than 5% organic matter (Phillips 1985). Eelgrass is a rooted plant, which performs a vital function of stabilizing coastal sediment to reduce erosion (Phillips 1985). Eelgrass typically colonizes substrates with moderate wave action in subtidal and intertidal waters of sheltered bays, estuaries, and lagoons (Phillips 1985).



KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

- Site
- Triple Island Pilot Station
- Marine Shipping Route
- Open Water Marine Shipping Route
- Materials and Supply Shipping Route
- Eelgrass
- Kelp Bed
- Marine Resources Study Area
- International Boundary

0 10 20 30 40 50 km

1:1,500,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20220610
Requested by CMCCRACKEN on 20220601
Check by SMOSS on 20220610

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
3.4-9

Title
Kelp and Eelgrass Distribution within the Marine Resources Study Area

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S:\1232\projects\123221820\figures\report\TDR\Marine\Fig3_4-9_123221820_132_kelp_eel_marine_sa.mxd Revised: 2023-09-06 By: tquilichini

Vegetated ecosystems, such as eelgrass meadows (large, dense areas of eelgrass), act as important carbon sinks through carbon dioxide uptake during photosynthesis. These ecosystems store organic carbon in the form of living biomass and capture particulate and detrital forms of carbon in buried sediments (Prentice et al. 2020). Eelgrass absorbs nutrients from the sediment, which stimulates leaf formation and growth. When leaf blades fall from the plants they are broken down by various mechanical and microbial processes. This process adds organic and inorganic materials to the sediment, which stimulates shoot density, adds more leaf litter, and forms a dense rhizome-root mat, which binds to and stabilizes the substrate (Phillips 1985).

Throughout coastal BC, there are two species of eelgrass: *Zostera marina* and *Zostera japonica*. There are subtle differences between the two species, including taller, wider leaves in the *Z. marina* and greater shoot density in *Z. japonica* (Sugimoto et al. 2017). In addition, there are three ecotypes observed for *Z. marina,* including *typica*, *latifolia*, and *phillipsi*, each of which have different morphologies and habitat requirements. As such, there is variation in the maximum depth at which eelgrass grows. In general, eelgrass growth in BC ranges from intertidal to 10 m depth, while some plants might grow at greater depths in clear water (Duarte 1991).

Eelgrass beds provide valuable habitat for many commercially, recreationally, and culturally important species, including Pacific salmon, Pacific herring, and Dungeness crab (Plummer et al. 2013). Pacific salmon use eelgrass beds as a nursery, providing protection from predators, food, and shelter. Chinook salmon are particularly reliant on eelgrass beds, as they utilize estuaries as rearing and foraging habitat as juveniles for the longest period, compared to other Pacific salmon species (Semmens 2008). Eelgrass meadows also support avifauna by providing a direct food source, where eelgrass shoots are directly consumed. Eelgrass meadows are also known to increase both the abundance and diversity of benthic invertebrates, which also provides an indirect food source for marine birds (Unsworth et al. 2021). In addition to providing foraging, rearing, and refugia for a variety of marine species, eelgrass beds also provide many ecosystem functions, including nutrient and carbon sequestration, and primary and secondary production (Phillips 1985; Plummer et al. 2012).

3.4.6.7 Surfgrass

Surfgrasses (*Phyllospadix* spp.) are an important species of seagrass found from rocky intertidal to shallow subtidal ecosystems (DFO 2020a). In the Marine Resources Study Area, surfgrasses are known to exist near the mouth of Portland Inlet, along the coast of Dundas Island, and sporadically down the south coast to Prince Rupert (Strait of Georgia Data Center 2022). There are three species of surfgrass, *P. torreyi, P. scouleri, and P. serrulatus,* which exhibit varying morphology and habitat preference. Surfgrasses are known to occur in large meadows which can cover up to 80% of a benthic surface, outcompeting other benthic plants (DFO 2020a). These meadows are highly productive areas, but can be vulnerable to, and slow to recover after, disturbance (DFO 2020a).

Surfgrasses are important to ecosystems as they protect the shoreline from erosion and provide habitat for small marine organisms (DFO 2020a). Surfgrass roots also protect shorelines from erosion not only by stabilizing the nearby sediment, but also by increasing sedimentation via retention of sediment deposited within their canopy (DFO 2020a). Surfgrass meadows can provide significant habitat for invertebrates looking to escape the high energy intertidal system. Sediment trapped by the surfgrasses also provides habitat for infaunal organisms, allowing them to survive in places they otherwise could not (DFO 2020a).

While important and long lived, disturbed surfgrasses exhibit slow recovery times (often greater than three years) due to slow growth rates and poor seed survival (DFO 2020a). Surfgrasses are particularly vulnerable to desiccation, heat stress, sewage, hydrocarbon pollution, shoreline armouring, and eutrophication (DFO 2020a).

3.4.6.8 Habitat-Forming Invertebrates (Sponge Reefs)

Sponge reefs are large biogenic structures that play a key role in carbon, nitrogen, and silica cycling, and support diverse and abundant faunal communities (Archer et al. 2020). There are approximately 250 different species of cold-water sponges on the Pacific coast of Canada. With approximately 500 species existing all over the world, sponge reefs can be found at depths of up to 600 m (Leys et al. 2007). Sponge reefs have been found in BC waters at depths from 30 to 250 m in fjords and shelf waters (Conway et al. 1991; Jamieson and Chew 2002; Leys et al. 2004; Marliave et al. 2009). Sponge reef development is enhanced by a number of environmental factors, including moderate tidal currents, high silicate nutrient concentrations, and exposed glacially derived substrate (Conway et al. 2005; Whitney et al. 2005). Sponge reefs are important components of marine habitats as they provide structural habitat for many fish and invertebrate species (DFO 2010c). Coldwater sponges can live up to 2000 years, but grow at a slow rate, around 1 cm/year (DFO 2010c). A Cold-water Coral and Sponge Conservation Strategy was developed in 2010 in recognition that these organisms are extremely sensitive to both human and natural disturbances, including fishing, log dumps, climate change, pollution, and ocean acidification (DFO 2010c).

Glass sponges are the oldest surviving metazoans. Glass sponges (Class Hexactinellida) are a unique group of marine invertebrates that filter dissolved silica (glass) from the water to develop spicules which compose the skeleton of the sponge. Glass sponges typically grow as individuals or in clusters (gardens) on rocky substrates. More rarely, dense reef-like structures form on soft bottom habitats known as bioherms (DFO 2010c). Reefs are formed when a sponge dies, and sediment gets deposited onto the dead skeletons. New juvenile sponges settle and grow on the dead skeletons and eventually rise above the seabed to form a reef complex. Glass sponge reefs are the largest known reefs in the world covering approximately 390 km^2.

The North Coast of BC is an area of importance for sponge reefs. Sponge reefs are known to exist within the Marine Resources Study Area in Chatham Sound as well in close proximity to the terminal in Pearse Canal (Figure 3.4–7) (Rubidge et al. 2018). In the Hecate Strait, glass sponge reefs have existed for roughly 9,000 years (DFO 2010c). In the Chatham Sound region, hexactinellid sponge reefs are a significant component of the seafloor mosaic (Shaw et al. 2018). The largest reef grouping in Chatham Sound has an area of roughly 29 km^2 (Shaw et al. 2018) (Figure 3.4–7). The Chatham Sound EBSA is known to contain sponge reefs within the Project Marine Resources Study Area (Rubidge et al. 2018).

3.4.7 Marine Invertebrates

The Marine Resources Study Area is situated in the highly productive northeastern Pacific Ocean, which is host to rich communities of marine invertebrates, including echinoderms, mollusks, crustaceans, sponges, and others (DFO 2017a). These invertebrates comprise many of the lower levels of the trophic ecosystem in the area, supporting populations of animals ranging from fishes to large marine mammals. There are many species of marine invertebrates that are likely to be found within the Marine Resources Study Area (Table 3.4–2) Several species of marine invertebrates have DFO important areas within the Marine Resources Study Area, including Dungeness crab, tanner crab, green sea urchin, shrimp, gorgonian coral, and sea pen (Figure 3.4–4; Figure 3.4–5).

Table 3.4–2 Culturally and Commercially Important Marine Invertebrate Species Found Within the Marine Resources Study Area

Group	Common Name	Nisga'a Names	Scientific Name	COSEWIC Status	SARA Schedule 1 Status	BC Status
Crustacean	Dungeness crab	K'almoos (crab)	*Metacarcinus magister*	–	–	–
	Red king crab		*Paralithodes camtschaticus*	–	–	–
	Golden king crab		*Lithodes aequispinus*	–	–	–
	Red rock crab		*Cancer productus*	–	–	–
	Tanner crab		*Chionoecetes bairdi*	–	–	–
	Humpback shrimp	–	*Pandalus hypsinotus*	–	–	–
	Sidestripe shrimp	–	*Pandalopsis dispar*	–	–	–
	Smooth pink shrimp	–	*Pandalus jordani*	–	–	–
	Spot prawn	–	*Pandalus platyceros*	–	–	–
Echinoderm	Red sea urchin	Ts'ikw'its' (sea urchin)	*Mesocentrotus franciscanus*	–	–	–
	Purple sea urchin		*Strongylocentrotus purpuratus*	–	–	–
	Green sea urchin		*Strongylocentrotus droebachiensis*	–	–	–
	Giant California sea cucumber	–	*Apostichopus californicus*	–	–	–
Mollusk	Northern abalone	Bilaa (abalone)	*Haliotis kamtschatkana*	Endangered	Endangered	Red
	Geoduck	–	*Panopea generosa*	–	–	–
	Cockles	Gabook	*Clinocardium* spp.	–	–	–
	Manila clam	Ts'ak (clam)	*Venerupis philippinarum*	–	–	–
	Butter clam		*Saxidomus gigantea*	–	–	–
	Littleneck clam		*Leukoma staminea*	–	–	–
	Mussels	Gals	*Mytilus* spp.	–	–	–
	Chiton	Ýaans (black chiton)	Class Polyplacophora	–	–	–

Table 3.4–2 Culturally and Commercially Important Marine Invertebrate Species Found Within the Marine Resources Study Area

Group	Common Name	Nisg̲a'a Names	Scientific Name	COSEWIC Status	SARA Schedule 1 Status	BC Status
Mollusk (cont'd)	Giant pacific octopus	Hats'alt̀ (octopus)	*Enteroctopus dofleini*	–	–	–
	Opalescent squid	–	*Doryteuthis opalescens*	–	–	–

NOTES:
SARA – *Species at Risk Act.*
COSEWIC – Committee on the Status of Endangered Wildlife in Canada.
COSEWIC/SARA Ranks:
Extinct: A species that no longer exists.
Extirpated: A species that no longer exists in the wild in Canada but occurring elsewhere.
Endangered: A species facing imminent extirpation or extinction.
Threatened: A species that is likely to become endangered if limiting factors are not reversed.
Special concern: A species particularly sensitive to human activities or natural events.
Data Deficient: A species that has insufficient scientific data to support a designation.
BC Status:
Red-listed: Any species or ecosystem that is at risk of being lost (extirpated, endangered, or threatened).
Blue-listed: Any species or ecosystem that is of special concern.
Yellow-listed: Any species or ecosystem that is apparently secure or secure.
Unknown: Any species with extreme uncertainty about population size
Accidental: Any species that can occur infrequently and unpredictably outside their usual range in BC.
–: Not listed

SOURCES:
Species at Risk Public Registry (Government of Canada 2022)
BC Species and Ecosystems Explorer (BC CDC 2022a)
Nisg̲a'a (Version 2.1) (First Peoples Heritage Language and Culture Council 2017)
Nisg̲a'a Fisheries Program: Final Report of Funded Projects ([NFWD] 1997–2019)

3.4.7.1 Crustaceans

Dungeness Crab

Dungeness crab is not listed by COSEWIC or Schedule 1 of SARA (Government of Canada 2022) and is provincially unranked (BC CDC 2022b). Dungeness crab is distributed along the west coast of North America from the Aleutian Islands to southern California and occurs from the low intertidal zone to depths of 250 m (DFO 2017a). This species inhabits both marine and estuarine waters throughout their life cycle, and can be found in substrates comprised of sand, mud, silt, and/or eelgrass beds (DFO 2020b). Dungeness crabs move inshore to shallower water during the spring months and then back into deeper waters during late summer or early winter, with adult males and females remaining segregated throughout the migration (DFO 2020b).

The diet of a Dungeness crab depends on its life stage. Larvae feed offshore in the water column on zooplankton and phytoplankton; juveniles forage in littoral habitats on clams and mussels, small fish, mollusks, shrimp, and other crabs (DFO 2020b). Adults feed on clams and mussels, crustaceans, worms, and other fish (DFO 2020b). Dungeness crabs are ecologically important as both prey and predator throughout their life stages. They are preyed upon by demersal fish, finfish, whales, seabirds, and other crabs.

Dungeness crabs are a major component of fisheries in BC, accounting for the majority (99%) of commercial crab harvest (DFO 2020b). Dungeness crab is captured throughout BC waters (DFO 2022i), including within the Marine Resources Study Area. Nisga'a Treaty fisheries currently harvest large numbers of Dungeness crab in the Nass estuary in proximity to the marine terminal (NFWD 2020). The Marine Resources Study Area overlaps with two crab management areas (Crab Area A & B) in management areas 3, 4, 101, 103, and 104 to 110 (Figure 3.4–6) (DFO 2013), and historical catch records exist throughout the Marine Resources Study Area (DFO 2022j). Dungeness captured within Pearse Canal, Portland Inlet, and Portland Canal are also managed under the Nisga'a Fisheries Management Program (Nisga'a Lisims Government 2015). The McIntyre Bay and Chatham Sound EBSAs are important for Dungeness crab aggregation within the Marine Resources Study Area (Figure 3.4–3) (Rubidge et al. 2018). There are also two DFO important areas for Dungeness crab within the Marine Resources Study Area (Figure 3.4–5).

King Crab

Two species of king crab, red king crab and golden king crab, occur on the west coast of BC. Neither species is listed by COSEWIC or Schedule 1 of SARA (Government of Canada 2022), and they are both provincially unranked (BC CDC 2022b). Red king crab has a larger range and is found from BC to Japan, whereas the golden king crab is found in the Pacific from Northern BC to the Aleutian Islands (ADFG 2022a; b). Adult red king crabs are found from the intertidal zone to depths around 200 m, inhabiting sand, and mud substrates (ADFG 2022b). Golden king crabs are found in deeper waters, often exceeding depths of 550 m, occupying steep-sided ocean bottoms (ADFG 2022a). King crabs migrate to shallow waters to mate in late winter and back to their deep-water feeding grounds in the spring

(ADFG 2022a; b). After hatching, larvae will drift with the ocean's tides and currents, feeding on plant and animal plankton for several months before undergoing several molts and settling to the ocean floor (ADFG 2022a; b).

The king crab is a generalist omnivore and consumes almost anything it can crush with its claws, including algae, worms, clams, mussels, sea stars, and fish among others (NOAA 2022b). King crab is vulnerable to predation by fish, octopus, sea otters, and other king crabs after a molt occurs (NOAA 2022b).

Both species of king crab are commercially harvested in BC (Jamieson & Sloan 1985). Golden king crab populations were commercially exploited in K'alii Ts'im Gits'oohl (Alice Arm) sometime prior to 1986 (NFWD 2018). Nisga'a treaty fisheries harvest both species of king crab today (NFWD 2021). The Marine Resources Study Area overlaps with two crab management areas (Crab Area A & B) in management areas 3, 4, 101, 103, and 104 to 110 (Figure 3.4–6) (DFO 2013), and historical catch records exist throughout the Marine Resources Study Area (DFO 2022j). No important EBSA or DFO important areas for king crab have been defined within the Marine Resources Study Area (Rubidge et al. 2018).

Red Rock Crab

Red rock crab is not listed by COSEWIC or on Schedule 1 of SARA (Government of Canada 2022) and is provincially unranked (BC CDC 2022b). Red rock crab is native to the Pacific Ocean and can be found along the west coast of North America from Alaska to southern California (DFO 2016). This species is typically found from the low intertidal zone to depths around 90 m but have been found as deep at 230 m (DFO 2016). Red rock crab inhabits rock, gravel, or kelp beds within bays, estuaries, and rocky areas of the ocean, often sheltering and burying itself in sand or rocks to avoid predators (DFO 2016). Age-based habitat stratification is found in this species with young crabs primarily found buried in shell gravel and sand substrates within intertidal habitats. Larger crabs leave this nursery habitat in favor of larger hiding places and deeper waters but may return to the intertidal zone during their foraging migrations (Yamada & Groth 2016).

Adult crabs are extremely mobile and predate upon on a variety of species, including mussels, barnacles, sea cucumbers, clams, and oysters (Yamada & Groth 2016). They are an important food source to predators such as river otters, sea otters, large fish, and other crabs (DFO 2016).

Red rock crab is captured throughout BC waters, including in both commercial crab management areas (A & B) in management areas 3, 4, 101, 103, and 104 to 110 (Figure 3.4–6). Recreational harvest of this species occurs within large sections of the Project Area, including the Portland Canal and Nass Bay (DFO 2022j). Chatham Sound is currently not open for commercial capture (DFO 2022j). Red rock crab capture within Pearse Canal, Portland Inlet, and Portland Canal is also managed under the Nisga'a Fisheries Management Program (Nisga'a Lisims Government 2015). No EBSA or DFO important areas that are important for red rock crab exist within the Marine Resources Study Area (Rubidge et al. 2018).

Tanner Crab

Tanner crab is not listed by COSEWIC or on Schedule 1 of SARA (Government of Canada 2022) and is provincially unranked (BC CDC 2022b). Tanner crab is found in the Pacific Ocean from the Sea of Japan, the Sea of Okhotsk, the Bering Sea, the Gulf of Alaska, and along the west coast of North America to California (DFO 2017b). Tanner crab is known to frequent the shallow subtidal zone to depths of approximately 4,600 m (ADFG 1994; Fong and Dunham 2007; DFO 2017b). Adults are typically found in mud-sand substrates, with females remaining buried during daylight hours and only becoming active at night (DFO 2017b). Tanner crab dispersal is heavily influenced by water quality, including temperature, salinity, currents, and upwelling, which impact its survival (Kraus et al. 2001). Mating migrations occur in the spring, when adult male and female crabs aggregate at depths of approximately 150 m.

Tanner crabs are opportunistic feeders that consume a wide assortment of prey, including mollusks, crustaceans, fish, and decaying fish (DFO 2017b). Tanner crab is an important prey species for other invertebrates, fish, and marine mammals, and serves as an important food source for Pacific cod in particular (DFO 2017b).

Tanner crab was fished commercially until 1993 and attempts to re-establish a commercial fishery in BC have been unsuccessful (DFO 2017b). Tanner crab capture has been recorded in Portland Canal, Portland Inlet, Pearse Canal, Nass Bay, and Chatham Sound (Krause et al. 2001). Recreational capture of tanner crab is not regulated in BC and within the province there is no commercial fishery for Tanner crab; however, they are harvested in food, social, and ceremonial (**FSC**) fisheries in treaty fisheries (DFO 2022j; NFWD 2021). The Shelf Break EBSA is an important EBSA for Tanner crab aggregation within the Project Area. There is also a large DFO important area for tanner crab in the Marine Resources Study Area (Figure 3.4–5).

Shrimp and Prawn

Several species of pandalid shrimp and prawn, including humpback (*Pandalus hypsinotus*), sidestripe (*Pandalopsis dispar*), and smooth pink shrimp (*Pandalus jordani*), as well as spot prawn, may be found within the Marine Resources Study Area (DFO 2022b). These species are not listed by COSEWIC or on Schedule 1 of SARA (Government of Canada 2022) and are provincially unranked (BC CDC 2022b). Pandalid shrimp are distributed throughout the northeast Pacific from California to the Bering Sea and occupy a variety of habitats from rocky to mud bottoms. Chatham Sound supports a diversity of pandalid shrimp (DFO 2016a). They are found in depths ranging from shallow intertidal to greater than 1,300 m and inhabit both inshore and offshore areas (DFO 2022c).

Pandalids are opportunistic foraging detritivores who consume fresh or decaying organic material (DFO 2022c). Pandalid shrimp settle in benthic habitats where they are often preyed upon by benthic fish (DFO 2022c).

Sidestripe shrimp, smooth pink shrimp, and humpback shrimp have all been captured within the Marine Resources Study Area (DFO 2016a). The commercial shrimp fishery in BC was estimated to have produced $25,668,000 in 2020 (DFO 2021h). Prawn capture has been reported in the Nass Area in 2015, 2019, and 2020 in areas close to the marine terminal location, including Portland Inlet and Pearse Canal (NFWD 2021). The Chatham Sound EBSA has been identified as an important EBSA for shrimp in the Marine Resources Study Area (Figure 3.4–3) (Rubidge et al. 2018). There is also one DFO important area for shrimp within the Project Marine Resources Study Area (Figure 3.4–4).

3.4.7.2 Echinoderms

Urchin

Red (*Mesocentrotus franciscanus*), green (*Strongylocentrotus droebachiensis*), and purple (*Strongylocentrotus purpuratus*) sea urchins are found in BC and are known to be present in the Marine Resources Study Area (DFO 2018f). These species are not listed by COSEWIC or on Schedule 1 of SARA (Government of Canada 2022) and are provincially unranked (BC CDC 2022b). Province-wide extirpation of sea otters resulted in a dramatic increase in sea urchin population in the mid 1900's but following the reintroduction of sea otters along the coast of BC around 1970, the urchin populations decreased. Despite this, sea urchin populations in BC are still considered to be artificially high (DFO 2018f).

Red sea urchin can be found along the west coast of North America from California to Alaska (DFO 1999a) and typically occurs in shallow waters in rocky intertidal zones and at depths ranging from 50–125 m (DFO 1999a).

Green sea urchin is found in cool waters of the Atlantic and Pacific Oceans (Scheibling & Hatcher 2007; Scheibling et al. 2020). Green sea urchin inhabits sandy, rocky, gravel, or shelled substrates and can be found from the intertidal zone to depths over 300 m, though it is most commonly located at depths of 0–50 m. (Scheibling & Hatcher, 2007; Scheibling et al. 2020).

Purple urchins are a common echinoderm that inhabit rocky substrates along the west coast of North America (DFO 1999b). This species prefers depths greater than those of the red urchin and can be found from intertidal zones to depths greater than 160 m (Azad 2011; Rogers-Bennett 2007).

Sea urchins are benthic marine invertebrates that primarily feed on marine algae and plants, particularly bull kelp. The green sea urchin is omnivorous and may consume invertebrates and microbes as well as marine plants (DFO 2021a; Scheibling & Hatcher 2007). Sea urchins are important intertidal organisms and a large dietary component of several species of sea stars, numerous fish species, and sea otters (Azad 2011; DFO 1999b).

In BC, both green and red sea urchins are harvested for their roe (DFO 2018f). Commercial harvest of red sea urchin is limited by quotas (DFO 2021a). The commercial urchin fishery in BC was estimated to have produced $2,683,000 in 2020 (DFO 2021h). Recreational harvest of green sea urchin occurs coast wide and is limited by quotas, but no commercial harvest of green sea urchin occurs in the North Coast Region. While in the past the purple sea urchin was harvested for roe, it is no longer harvested

commercially in BC (DFO 2018f). Sea urchins are important to Indigenous peoples and are harvested for FSC purposes in many of these cultures (DFO 2021b). Indigenous fishing of red and green sea urchin for FSC occurs along the BC coast throughout the year where authorized, including within the Project Marine Resources Study Area, though quotas have been established (DFO 2021a; DFO 2021b).

Purple sea urchin are less abundant than other urchin species in BC. The range extension of sea otters along the west coast where purple sea urchin is primarily found is expected to have contributed to the reduced abundance (DFO 2018f). Purple sea urchin presence has been reported within the Marine Resources Study Area at Stephens Island and the Moffatt Islands (Ocean Ecology 2013).

The Marine Resources Study Area overlaps with one urchin management area (Red Sea Urchin Area North) in management areas 3 and 4 (Figure 3.4–6) (DFO 2013). The Chatham Sound EBSA has been identified as an important EBSA for green sea urchin aggregation (Figure 3.4–3) (Rubidge et al. 2018). There are no important EBSAs for purple sea urchin within the shipping Marine Resources Study Area (Rubidge et al. 2018). There is one DFO important area for green sea urchin within the Marine Resources Study Area (Figure 3.4–5.).

Sea Cucumber

The giant California sea cucumber (*Apostichopus californicus*) is not listed by COSEWIC or on Schedule 1 of SARA (Government of Canada 2022) and is provincially unranked (BC CDC 2022b). The giant California sea cucumber is found ranging from the Gulf of Alaska to Southern California, in water depths from intertidal to 250 m (DFO 2021c). This species occupies a variety of substrates but is most abundant in areas with a moderate current on complex boulder or bedrock substrates (DFO 2021c). Juveniles have been observed in many different habitats but will typically seek refuge under rocks or in mats of stringy red algae (DFO 2002).

Sea cucumbers are detritivores who feed on benthic organic debris. This species performs the important ecological function of nutrient recycling (DFO 2021f). Adult sea cucumbers have few predators with the exception of sea otters and several species of sea star (DFO 2021f).

The giant California sea cucumber is the largest of over 40 sea cucumber species in BC and is the only one that is commercially harvested (DFO 2021c). The commercial sea cucumber fishery in BC was estimated to have produced $5,878,000 in 2020 (DFO 2021h). Recreational harvest of sea cucumber is currently occurring within the Marine Resources Study Area but is believed to be minimal (DFO 2021i). Sea cucumbers are important to coastal Indigenous peoples, who harvest them for FSC purposes (DFO 2021i). Commercial harvest of sea cucumber is limited by quotas. The Marine Resources Study Area overlaps with one sea cucumber commercial management area (Sea Cucumber Area P) in management areas 3 and 4 (Figure 3.4–6) (DFO 2013). Due to their widespread abundance, it is likely that sea cucumbers will be present in the Project Area. There are no important EBSAs or DFO important areas for giant California sea cucumber within the Marine Resources Study Area (Rubidge et al. 2018).

3.4.7.3 Mollusks

Northern Abalone

The northern abalone (*Haliotis kamtschatkana*) is listed as endangered by COSEWIC, endangered on Schedule 1 of SARA (Government of Canada 2022), and is provincially red-listed (BC CDC 2022b). This marine mollusk that can be found with a patchy distribution along the west coast from Alaska to Baja California and is the only abalone species commonly found along the coast of BC. The northern abalone can typically be found in shallow areas with high salinity (> 30 PSU), firm substrate, and significant tidal current (COSEWIC 2009a). These conditions are common in both sheltered bays and exposed coastlines. The northern abalone typically avoids areas with significant freshwater input or estuarine/brackish conditions.

As the sole abalone species occurring in BC, the northern abalone holds a significant role in the society of local Indigenous peoples. Not only is it an important dietary staple, but it also has both spiritual and cultural significance. Abalone fishery closures resulted in the loss of access to this valuable resource, which is highly valued for its meat by commercial harvesters and recreational divers alike (COSEWIC 2009a). As a result, many First Nation communities began collaborating with provincial and federal agencies in the stewardship and recovery of abalone populations within their traditional territories (DFO 2012a). Many communities are applying marine traditional knowledge to help with stewardship, marine planning, and species recovery initiatives. Northern abalone is captured under the Nisga'a Treaty as an unallocated species, and the Nisga'a Fisheries Program participates in the northern abalone recovery program (DFO 2012a).

Due to its tendency to gather in shallow water, this species can often be easily accessible to harvesters (COSEWIC 2009a). This led to severe overfishing in the late 1970's and its current COSEWIC/SARA designations (COSEWIC 2009a). There are no DFO important areas, critical habitat, or EBSAs for this species within the Marine Resources Study Area.

Geoduck

The Pacific geoduck (*Panopea generosa*) is not listed by COSEWIC or on Schedule 1 of SARA (Government of Canada 2022) and is provincially unranked (BC CDC 2022b). The Pacific geoduck is the largest and deepest burrowing species of clam. They are found from the Gulf of California to Alaska, occupying the intertidal zone to depths of at least 110 m.

Geoducks bury themselves up to 1 m deep in sand, silt, gravel, and other soft substrates (DFO 2022d). The defining feature of the Geoduck is the long neck-like appendage known as a siphon, which connects the buried clam to the substrate surface (Feldman et al. 2004; OPC 2019). The geoduck siphon can reach up to 1 m in length, with the tip often being the only portion that is visible when a Geoduck is buried (OPC 2019). The geoduck uses its siphon to filter phytoplankton, pelagic crustaceans, and fish larvae out of the water for consumption (OPC 2019). Geoduck is predated upon on by crabs, sea stars, flatfishes, and sea otters (OPC 2019).

Geoduck is primarily harvested through commercial dive fisheries in BC but are sometimes caught recreationally as well (DFO 2022d). The Marine Resources Study Area overlaps with one geoduck commercial management area (Geoduck Area North) in areas 3 and 4 (Figure 3.4–6) (DFO 2013). There are no DFO important areas or EBSAs for this species within the Project Marine Resources Study Area.

Cockles

The Nuttall's cockle is not listed by COSEWIC or on Schedule 1 of SARA (Government of Canada 2022) and is provincially unranked (BC CDC 2022b). Nuttall's cockle is a wide-ranging bivalve inhabiting coastal pacific waters from the Bering Sea to southern California as well as coastal Japan. The habitat preference of this species typically includes areas with muddy/fine grained sediment which it uses to bury itself. It is also commonly found in eelgrass beds (Cowles 2005).

Like most bivalves, Nuttall's cockles have a small siphon which is used for respiration and plankton consumption (Cowles 2005). The Nuttall's cockle is predated upon by starfish, crabs, and gulls in its natural habitat (Cowles 2005).

Historically, cockles have been harvested by Indigenous nations, including the Nisga'a Nation, along the west coast (NFWD 2020). There is no fishery for cockles in BC in recent years (DFO 2021h). In recent years, easy to access intertidal cockle populations have been relatively depleted leading to decreased harvest. Under the Nisga'a Treaty, Nisga'a have beaches protected from the commercial harvest of cockles, clams, and other intertidal bivalves; however, none of these are within the Marine Resources Study Area. No important EBSAs or DFO important areas for cockle exists within the Marine Resources Study Area (Rubidge et al. 2018).

Clams

Three main species of intertidal clams comprise the major portion of harvesting in commercial, recreational, and Indigenous FSC fisheries, including Manila (V*enerupis philippinarum*), littleneck (*Leukoma staminea*), and butter clams (S*axidomus gigantea)* within the Marine Resources Study Area *(*CINE 2017b; DFO 2022e). None of the three species of clam are listed by COSEWIC or on Schedule 1 of SARA (Government of Canada 2022) and are provincially unranked (BC CDC 2022b). These species of clam are typically found stratified by habitat. Manila clams are found in the upper half of the intertidal zone, occupying mixed substrates of mud, sand, and gravel (DFO 2022e). Littleneck clams are generally found in the lower intertidal zone, occupying mixed gravel, sand, and mud substrates (DFO 2022e). Butter clams are also found in the lower intertidal zone but inhabit more stable substrates, burrowing up to 30 cm in depth in sand, broken shell, and small gravel (DFO 2022e).

Clams are filter feeders who use their siphons to filter plankton out of the water column. Clams are a vital prey species for many marine animals, including cephalopods, fish, crabs, marine mammals, and birds (CINE 2017b).

Historically, Indigenous cultures on the west coast of Canada utilized clams for many purposes, including decoration, food, and tool making (CINE 2017b). Many coastal cultures depended heavily on clams for their survival, including the Nisga'a Nation (CINE 2017b). Today, clams are still an important fishery for

commercial, recreational, and Indigenous FSC use, including within the Marine Resources Study Area (DFO 2022e). The commercial clam fishery in BC was estimated to have produced $36,959,000 in 2020 (DFO 2021h). Recreational and Indigenous fisheries exist coast-wide in BC (DFO 2022e). Commercial intertidal clams are harvested by hand digging during low tide cycles (DFO 2022e). No important EBSA or DFO important areas for clam exists within the Marine Resources Study Area (Rubidge et al. 2018).

Mussels

The BC coast is dominated by two major groups of mussels, the Pacific blue mussel (*Mytilus spp*.) and the California mussel (*Mytilus californianus*) (Moss and Erlandson 2010). Neither group of mussels is listed by COSEWIC or on Schedule 1 of SARA (Government of Canada 2022) and both are provincially unranked (BC CDC 2022b). Both mussels can be found in the western Pacific from northern Mexico to northern Alaska (Moss & Erlandson 2010).

Mussels are some of the most common organisms found in the intertidal zone in BC. Mussels can typically be found from fully submerged, to partially exposed by tidal action in the intertidal zone (Moss & Erlandson 2010). Mussels are typically found in groups on hard substrate, including rocky shorelines, gravel, and cobble substrates; however, they can also be found in softer sediments in areas protected from wave action. Mussels utilize byssal threads to anchor themselves against wave action, allowing them to survive in the intertidal zone (Mathieson et al. 2014). Mussel beds are known to be resilient to the effects of physical and biological disturbances and usually exhibit significant tolerance to disturbance (Gosling 1992).

The Pacific blue mussel (also known as bay mussel) is comprised of three species, *Mytilus edulis, M. trossulus, and M. galloprovincialis*; however, these species are morphologically identical and only differentiable by genetic testing (White et al. 2014). Of the three mussel species in BC only *M. trossulus* is native, while *M. edulis* and *M. galloprovincialis* were introduced from the Atlantic Ocean and Mediterranean coast, respectively (White et al. 2014). The Pacific Blue mussel is typically found in semi-isolated, calm waters with relatively low salinity (as low as 6–7 PSU for some species) due to freshwater riverine input (Moss & Erlandson 2010).

The California mussel prefers habitats with higher salinity and more wave action compared to the Pacific blue Mussel (Moss and Erlandson 2010). This species can also be found at depths of up to 100 m (Mathieson et al. 2014).

Mussels are filter feeders who use their siphon to filter plankton out of the water column for consumption. Mussels constitute important prey species for many species such as crabs, sea stars, birds, and otters.

Mussels were used historically by Indigenous Peoples within the Marine Resources Study Area to guard against famine and were primarily collected in winter to avoid against shellfish poisoning (CINE 2017c). Additionally, Pacific blue mussel and California mussel were collected for use in creating tools (CINE 2017c). Today mussels are collected recreationally, commercially, and harvested through Indigenous fisheries, including within the Marine Resources Study Area. No important EBSA or DFO important areas for mussel exists within the Marine Resources Study Area (Rubidge et al. 2018).

Chiton

A variety of chiton species can be found in BC waters, none of which are of conservation concern (BC CDC 2022b). Chiton species can be found worldwide on hard substrates in the intertidal and shallow subtidal, with many species also occupying deep sea habitats up to 7,000 m water depth (Liu et al. 2022; Ponder et al. 2020).

Chiton species are important ecosystem influencers as they often occur in high densities, with many species co-existing, and control algal biomass (Carey et al. 2013). Most chitons are herbivores, although a few species are omnivorous and eat small crustaceans. Differing species of chiton are subject to differing predation. Species like the black katy chiton (*Katharina tunicata*) is predated upon by sea urchins and birds, while the giant Pacific chiton (*Cryptochiton stelleri*) is mainly predated upon by sea snails.

Chiton was historically utilized for food for coastal Indigenous peoples in BC in the Project Marine Resources Study Area (CINE 2017a). Chiton constituted a consistent food source even in winter when other food sources were scarce (CINE 2017a). No important EBSA or DFO important areas for chiton exists within the Marine Resources Study Area (Rubidge et al. 2018).

Octopus

The giant Pacific octopus (*Enteroctopus dofleini)* is not listed by COSEWIC or on Schedule 1 of SARA (Government of Canada 2022) and is provincially unranked (BC CDC 2022b). The giant Pacific octopus occupies habitats on the west coast of North America from California to Alaska, with its range extending across the Pacific to Japan (High 1976). This species is typically found at depths ranging from intertidal to 100 m where they utilize their habitat by hiding in natural refuges (crevices, dens, or shells) on the sea floor (Gillespie et al. 1998).

Giant Pacific octopus diet is wide ranging and consists of crabs, clams, and fish, all of which can be captured alive and held with their suction cups until the octopus is ready to feed (High 1976). Adult octopuses are predated upon by large fishes, marine mammals, and other octopuses (Gillespie et al. 1998).

Nine species of octopuses have been recorded within BC; however, the giant Pacific octopus is the only species of commercial interest due to its size and abundance (Gillespie et al. 1998). This species has historically been fished in the Pacific through the use of diving, traps, and longline fishing (Province of BC 1991). Harvested octopus in BC were often exported to Japan, Hong Kong, Singapore, and Malaysia (Province of BC 1991). No important EBSA or DFO important areas for giant Pacific octopus exist within the Marine Resources Study Area (Rubidge et al. 2018).

Opalescent Squid

The opalescent squid (*Doryteuthis opalescens*) is not listed by COSEWIC or on Schedule 1 of SARA (Government of Canada 2022) and is provincially unranked (BC CDC 2022b). Opalescent squid is found in both nearshore and offshore waters throughout the southern Gulf of Alaska to Southern California (DFO 1999c). Opalescent squid spawn between December and September, during which time they

migrate to sheltered bays and inlets where they lay their eggs in large congregations comprised of hundreds or thousands of squid (Walthers and Gillespie 2002; DFO 1999c). Squid will attach their egg masses to solid objects and die after spawning (DFO 1999c).

Opalescent squid are carnivorous and feed mostly on crustaceans. The opalescent squid is a significant part of many food chains, representing an important food source for many finfishes, marine mammals, and seabirds (Walthers & Gillespie 2002).

Opalescent squid is fished primarily as bait for sablefish, crab, and halibut fisheries (DFO 1999c). Most opalescent squid are caught off the west coast of Vancouver Island, and BC is near the northern end of opalescent squid distribution leading to decreased catches in the north of the province (DFO 1999c). No important EBSA or DFO important areas for opalescent squid exist within the Marine Resources Study Area (Rubidge et al. 2018).

3.4.7.4 Other Invertebrates

Corals

There are over 80 species of cold-water corals on the west coast of BC (Gardner 2009). Corals can exist in both shallow and deep waters and have varying habitat requirements depending on the species (Diaz et al. 2003). Many corals can be found in the Marine Resources Study Area, but DFO has recorded the main concentrations of Alcyonacea coral (a soft coral gorgonian group) in Dixon Entrance and Chatham Sound at an average depth of 369 m, making them extremely likely to be present but not encountered in the Marine Resources Study Area (Finney and Boutillier 2010).

Cold water corals are highly diverse and an integral component of marine habitats in BC and have structures which range from single individuals to large reef ecosystems. While coral provides structure and ecosystem complexity, it is also a living entity which is protected by the *Fisheries Act* (DFO 2010). Corals serve many ecosystem functions, including providing habitat and ecosystem engineering (by altering hydrodynamics, sedimentation, currents, etc.) among others (DFO 2010).

Corals, by their nature, are sensitive species, and generally lack resilience to changing water quality (e.g., temperature change, sedimentation, pH change, etc.) (Jamieson et al. 2007). Anthropogenic impacts can affect corals both directly and indirectly. Direct impacts on corals occur when physical destruction takes place, often caused by things like pipeline and cable placement or benthic trawls (DFO 2010). Indirect impacts also occur and stem from anthropogenic sources, which lead to water quality deterioration or change (DFO 2010).

Orange sea pen (*Ptilosarcus gurneyi*) can be found along the west coast of North America from Alaska to southern California (Shimek 2011). This species can be found most commonly in the shallow subtidal region but also in deep water to 135 m depth (Shimek 2011). Orange sea pen filter feeds on suspended plankton and is predated upon by sea stars and nudibranchs (Best 1988). Orange cup coral (*Balanophyllia elegans*) can be found along the west coast of North America from Alaska to Mexico, including Haida Gwaii, at depths ranging from the intertidal to 100 m (Boutillier et al. 2019). Tan cup coral (*Caryophyllia alaskensis*) can be found in nearshore and offshore areas of the BC coast from the

Aleutian Islands to the Strait of Georgia (Cairns 1994). Tan cup coral can be found at depths of up to 1600 m, though most are found above 200 m (Boutillier et al. 2019). Gorgonian coral is a cosmopolitan coral species which is found worldwide off continental margins at depths of 200–1000 m (Lacharite and Metaxas 2013). Gorgonian coral is a diverse group and includes many species of coral found in BC, including sea whip (*Halipteris willemoesi*). Gorgonian corals are typically colorful, have a central stalk, and can be fan-like, feathery, or encrusting. They are a habitat-forming species which are closely connected to the entire marine community (Cairns 1994).

The Learmonth Bank EBSA has been identified as important for coral aggregation (Figure 3.4–3) (Rubidge et al. 2018). A gorgonian coral DFO important area exists within the Marine Resources Study Area at the northwestern corner of Haida Gwaii (Figure 3.4–5) There is also a sea pen DFO important area inside the Marine Resources Study Area off the northwest coast of Stephens Island (Figure 3.4–5).

3.4.8 Marine Fish

Over 400 species of marine fish live in the coastal waters along the northeast Pacific Ocean (Klinkenberg 2021). Some of the most significant of these have been broken down into three groups, including anadromous (river-spawning), pelagic (open water), and demersal/benthic (bottom-dwelling) (Table 3.4–3). All these groups are important and contribute to a healthy marine ecosystem. Many of these species are important to Indigenous peoples, as well as commercial and recreational fisheries. These species exhibit a wide variety of habitat preferences as well as life histories and adaptations. Several species of marine fish have DFO important areas within the Marine Resources Study Area, including eulachon, herring, pollock, sole, rockfish, halibut, cod, hake, lingcod, and sablefish (Figure 3.4–4; Figure 3.4–5).

Table 3.4–3 Conservation Status of Culturally and Commercially Important Marine Fish Species found within the Marine Resources Study Area

Group	Common Name(s)	Nisg̲a'a Name(s)	Scientific Name	COSEWIC Status	SARA Schedule 1 Status	BC Status
Anadromous	Green sturgeon	–	*Acipenser medirostris*	Special Concern	Special Concern	Blue
	Eulachon (Nass/Skeena population)	–	*Thaleichthys pacificus*	Special Concern	–	–
	Chinook salmon	Hoon (fish especially salmon)	*Oncorhynchus tshawytscha*	–	–	–
	Chum salmon		*Oncorhynchus keta*	–	–	–
	Coho salmon	Eek	*Oncorhynchus kisutch*	–	–	–
	Pink salmon	Sdiḿoon	*Oncorhynchus gorbuscha*	–	–	–
	Sockeye salmon	Miso'o	*Oncorhynchus nerka*	–	–	–
	Cutthroat trout (sea-run)	Laaxw (trout)	*Oncorhynchus clarkii clarkii*	–	–	Blue
	Dolly Varden trout		*Salvelinus malma*	–	–	Yellow
	Steelhead trout	Milit	*Oncorhynchus mykiss*	–	–	Yellow
Pelagic	Basking shark	K'aat (shark)	*Cetorhinus maximus*	Endangered	Endangered	–
	Tope shark		*Galeorhinus galeus*	Special Concern	Special Concern	–
	Pacific herring	Sga	*Clupea pallasii*	–	–	–
	Walleye pollock	–	*Theragra chalcogramma*	–	–	–
Demersal/ benthic	Bluntnose sixgill shark	K'aat (shark)	*Hexanchus griseus*	Special Concern	Special Concern	–
	English sole	–	*Parophrys vetulus*	–	–	–
	Bocaccio	–	*Sebastes paucispinis*	Endangered	–	–
	Canary rockfish	–	*Sebastes pinniger*	Threatened	–	–
	Darkblotched rockfish		*Sebastes crameri*	Special Concern	–	–
	Longspine thornyhead	–	*Sebastolobus altivelis*	Special Concern	Special Concern	–
	Quillback rockfish		*Sebastes maliger*	Threatened	–	–
	Rougheye rockfish (Type I)	–	*Sebastes sp. Type I*	Special Concern	Special Concern	–
	Rougheye rockfish (Type II)	–	*Sebastes sp. Type II*	Special Concern	Special Concern	–

Table 3.4–3 Conservation Status of Culturally and Commercially Important Marine Fish Species found within the Marine Resources Study Area

Group	Common Name(s)	Nisg̲a'a Name(s)	Scientific Name	COSEWIC Status	SARA Schedule 1 Status	BC Status
Demersal/ benthic (cont'd)	Yelloweye rockfish	–	*Sebastes ruberrimus*	Threatened	Special Concern	–
	Pacific halibut	Txux	*Hippoglossus stenolepis*	–	–	–
	Pacific cod	–	*Gadus macrocephalus*	–	–	–
	Pacific hake	–	*Merluccius productus*	–	–	–
	Pacific sand lance	–	*Ammodytes hexapterus*	–	–	–
	Lingcod	–	*Ophiodon elongatus*	–	–	–
	Sablefish	–	*Anoplopoma fimbria*	–	–	–

NOTES:
SARA – *Species at Risk Act.*
COSEWIC – Committee on the Status of Endangered Wildlife in Canada.
COSEWIC/SARA Ranks:
Extinct: A species that no longer exists.
Extirpated: A species that no longer exists in the wild in Canada but occurring elsewhere.
Endangered: A species facing imminent extirpation or extinction.
Threatened: A species that is likely to become endangered if limiting factors are not reversed.
Special concern: A species particularly sensitive to human activities or natural events.
Data Deficient: A species that has insufficient scientific data to support a designation.
BC Status:
Red-listed: Any species or ecosystem that is at risk of being lost (extirpated, endangered, or threatened).
Blue-listed: Any species or ecosystem that is of special concern.
Yellow-listed: Any species or ecosystem that is apparently secure or secure.
Unknown: Any species with extreme uncertainty about population size
Accidental: Any species that can occur infrequently and unpredictably outside their usual range in BC
–: Not listed

SOURCES:
Species at Risk Public Registry (Government of Canada 2022)
BC Species and Ecosystems Explorer (BC CDC 2022a)
Nisg̲a'a (Version 2.1) (First Peoples Heritage Language and Culture Council 2017)
Nisg̲a'a Fisheries Program: Final Report of Funded Projects ([NFWD] 1997–2019)

3.4.8.1 Anadromous Fish

Anadromous fish live in marine environments but return to natal freshwater streams and rivers to spawn. Anadromous behavior allows fish to benefit from rich nutrient sources in productive marine environments that benefits growth and size within the population. Migration positively influences energy stores, size, and reproductive outputs. However, costs to migration include an increased age of maturity and increased chance of mortality, especially for those fish travelling long distances (Gallagher et al. 2019).

Green Sturgeon

Green sturgeon (*Acipenser medirostris*) is listed as special concern by both COSEWIC and on Schedule 1 of SARA (COSEWIC 2004) and is provincially blue-listed (BC CDC 2022b). Green sturgeon can be found continuously along the entire west coast of North America from Mexico to southern Alaska (Moser et al. 2016). Green sturgeon is a long-lived anadromous fish that utilizes a wide variety of habitats through its different life stages, including freshwater rivers, estuaries, streams, and marine environments. Green sturgeon spawn in deep pools of rivers or estuaries with cobble substrate (Adams et al. 2002). Juvenile green sturgeon remain in small streams and estuaries for 2–3 years on average to grow and develop before migrating to the ocean (Adams et al. 2002).

Green sturgeon are benthic feeders who use their ventral-facing mouths to ingest marine invertebrates from the ocean floor (Fitch and Lavenberg 1971). Green sturgeon is known to be predated upon by some marine mammals, but few other species (Fitch and Lavenburg 1971).

Green sturgeon populations have suffered significantly in recent years as a result of bycatch as well as the destruction and alteration of their habitat (NOAA 2022a). No EBSAs or DFO important areas for green sturgeon exist within the Marine Resources Study Area (Rubidge et al. 2018).

Eulachon

The Nass/Skeena River eulachon population is designated as special concern by COSEWIC and is provincially not reviewed (BC CDC 2022b). Eulachon marine habitat spans from the northern Bering Sea into the northeast Pacific Ocean. Eulachon spawn in freshwater rivers spanning the coast of Alaska to Northern California. A total of 38 spawning rivers have been recorded in BC, with only 12 of these rivers recorded as having regular spawning (Hay and McCarter 2000). Over the last four decades a downward trend can be observed in eulachon spawning runs, with long-term studies showing spawning runs in the majority of traditional areas are less than 10% of what they once were (COSEWIC 2011a). The Nass River is one of the 12 rivers in BC where regular spawning is recorded and is known to support one of the largest eulachon runs in BC (Hay and McCarter 2000; LGL and NFWD 2012; COSEWIC 2013).

Eulachon diet is mainly composed of krill but can be supplemented with copepods and other small shrimp (NOAA 2022c). The nutrient rich nature of the eulachon makes it an important prey species for a variety of wildlife, including mammals, birds, and both marine and freshwater fish, as it provides them with energy during the spring when food can be scarce (NOAA 2022c).

The Nass is known for its Treaty eulachon fisheries, and in the past, it was fished commercially (DFO 2022g). Today, sustenance fisheries are only being conducted by local Indigenous groups, including the Nisga'a and Kitselas First Nations (Kitselas First Nation 2022; NFWD 2019). Nass eulachon is considered a critical food source and holds significant cultural and social value to local Indigenous communities (Kitselas First Nation 2022; NFWD 2021). Eulachon is often referred to as the savior fish as it arrives to harvest grounds in late February or early March, often providing sustenance to Indigenous communities that are running low on previsions after a long winter (Hay and McCarter 2000; Noble and Challenger 2015). The high oil content of the fish has supported the economies of many Indigenous communities, with trading once occurring between communities along paths referred to as 'grease trails.' No EBSAs that are important for eulachon exist within the Marine Resources Study Area (Rubidge et al. 2018). There are several Eulachon DFO important areas within the Marine Resources Study Area (Figure 3.4–4; Figure 3.4–5).

Pacific Salmon

The five species of Pacific salmon (*Oncorhynchus* spp.) in Canada are known to occur within the Project Marine Resources Study Area and belong to the genus Oncorhynchus. These species constitute major portions of BC fisheries and include Chinook salmon , Chum salmon, Coho salmon, Pink salmon, and Sockeye salmon. No Pacific salmon species returning to the watersheds in the Marine Resources Study Area are listed by COSEWIC, on Schedule 1 of SARA, or are provincially listed (BC CDC 2022b). Pacific salmon occur in an estimated 1,300 to 1,500 rivers and streams in BC and Yukon (DFO 2001). Three of the most important rivers for Pacific salmon in BC, the Skeena River and Nass River in the north and the Fraser River in the south, together account for 75% of the salmon population in the province (DFO 2001).

Pacific salmon are anadromous and semelparous (i.e., terminal spawners) fish that exhibit great variation in life-history patterns among and within species. Pacific salmon are ecologically significant as they form a large portion of the fish biomass in both freshwater and marine systems and play a key role in the transfer of nutrients from the rich marine environment to nutrient-poor river systems (Gende et al. 2002), and enrichment of surrounding riparian areas (Helfield and Naiman 2001). Generally speaking, the life history of each Pacific salmon species consist of: adults returning to a river; in-river migration and spawning; egg incubation and alevin emergence; freshwater rearing; downstream migration and smoltification; estuarine use; and ocean migration. The timing and duration of each of these stages is highly species-specific with Pacific salmon spending between one and seven years in the ocean before returning to their natal stream to spawn (DFO 2001). Some key life history timing for Pacific salmon within the Marine Resources Study Area shown in Table 3.4–4. Several known Pacific salmon spawning areas occur within the Marine Resources Study Area (Figure 3.4–4; Figure 3.4–5).

Table 3.4–4 Life History Timing of Pacific Salmon Within the Marine Resources Study Area

Common Name	Scientific Name	Spawning	Outbound Juvenile Migration	Nearshore Rearing
Chinook[1,2,3,11,12]	*Oncorhynchus tshawytscha*	July to September	Migrate downstream in March-April (stream-type) and May-June (ocean type) to estuaries from mid-May to mid-August	Freshwater rearing for three months (ocean-type) to one year (stream-type)
Chum[3,4,5,12]	*Oncorhynchus keta*	July to September	Migrate to estuary from May to mid- August	Immediate migration to estuary following fry emergence (mid-March to mid-May)
Coho[2,6,7,12]	*Oncorhynchus kisutch*	October to January	Migrate to estuary from mid-May to end of June	Freshwater rearing for two to four winters
Pink[3,8,9]	*Oncorhynchus gorbuscha*	September and October	Mid-May to mid-June	Immediate migration to estuary following fry emergence (mid-April to mid-May)
Sockeye[3,10]	*Oncorhynchus nerka*	August to November	May and June to early July	Rear in a lake for one to two years

NOTES:
[1] Healey 1991
[2] Alexander et al. 1994
[3] Higgins and Schouwenberg 1973
[4] NFWD 2020
[5] Salo 1991
[6] Sandercock 1991
[7] Quinn 2005
[8] Heard 1991
[9] Carr-Harris and Moore 2013
[10] Burgner 1991
[11] DFO 2001
[12] DFO 2018i

Pacific salmon constitute the most socio-economically valuable fish resource in BC. The social, economic, and traditional culture of the Canadian west coast has depended on the Pacific salmon for thousands of years. Pacific salmon stocks on the west coast of BC have historically constituted a world renowned commercial and recreational fishery (DFO 2001). Pacific salmon species, including sockeye, chinook, coho, pink, and chum salmon, are harvested today by the Nisga'a and Kitselas First Nation throughout the Nass River and estuary (NFWD 2019; Kitselas First Nation 2022). The Salmon Allocation Program is a regional policy provides operational guideline for the allocation of Pacific salmon among First Nations, commercial, and recreational harvest groups.

The Marine Resources Study Area overlaps with three salmon commercial management areas (Salmon Areas A Seine, C Gill Net and F Troll) in management areas 3, 4, 101, 103, and 104 (Figure 3.4–6) (DFO 2013). The commercial salmon fishery in BC was estimated to have produced $22,081,000 in 2020 (DFO 2021h). Pacific salmon productivity on the BC north coast is predicted to be below historical averages based on biological data from 2017-2021 (Hyatt et al. 2007; DFO 2022p). No important EBSA or DFO important areas for Pacific salmon are located within the Marine Resources Study Area (Rubidge et al. 2018).

Chinook salmon is commonly found in the Skeena River and Nass River, among other rivers entering Portland Inlet (NFWD 2020). Chinook have a more complex life cycle compared to other Pacific salmon. The chinook life cycle can be separated into two different types known as “stream” and “ocean”. Stream type chinook will spend one to two years in their freshwater natal streams or mainstem rivers before travelling to the ocean. Chinook with an ocean life cycle will only spend up to 90 days in freshwater, after emerging from the gravels, before heading towards the ocean. Spawning can vary from several weeks to months, occurring between July and September (Healey 1991; DFO 2001). Chinook salmon is one of the most valuable salmon to fisheries due to their large size and it is harvested commercially, traditionally, and in recreational fisheries. Chinook salmon run size decreased by 27% in the Nass River between 2008 and 2017 (Pacific Salmon Explorer 2022).

Chum salmon is the most widely distributed salmon species in North America where its range spans from the coastal streams of Alaska to northern California, including the Mackenzie River and Yukon River. Chum salmon spawning occurs in over 880 coastal streams and rivers throughout the Yukon and BC. Chum will travel directly to the ocean after emerging from the gravels in small coastal streams, while in larger river systems will remain in freshwater up to several months. The majority of chum will spend 2–3 years in the ocean before heading back to their natal streams to spawn (DFO 2001). Nass chum escapements have been low. Between 2007 to 2019, returning chum numbers were 76% lower than average returns between 1980 and 2006. While chum stocks in the Nass have not yet indicated recovery, there are signs of improvement. Escapements in 2015, 2018, and 2020 were the highest they have been since 2006 (Noble et al. 2020). With pale flesh and little fat content, chum salmon wasn’t harvested commercially until the 1930’s. While many commercial fishermen considered them the least desirable species of salmon, Indigenous peoples have always considered chum to be traditionally and culturally significant. Chum salmon run size decreased by 54% in the Nass River between 2008 and 2017 (Pacific Salmon Explorer 2022).

Coho salmon is found throughout the Pacific coast from Alaska to California, where the majority can be found spawning in streams between Cook Inlet in Alaska and the Columbia River. In BC and the Yukon alone, over 750 streams have been recorded as coho spawning grounds (DFO 2019a). Coho feed on plankton, a variety of insects, and even other fish. (DFO 2001; DFO 2019a). Coho do not venture into the open ocean like the other salmon species; instead, this species remains in waters along the coast. Indigenous fisheries also traditionally harvest coho using nets, gaffs, weirs, as well as hook and line. While commercial fisheries historically trolled for coho, population instabilities resulted in the introduction of restrictions in 1998 (DFO 2019a). Coho salmon run size increased by 37% in the Nass River between 2005 and 2014 (Pacific Salmon Explorer 2022).

Pink salmon is the smallest and most abundant of all the salmon species. Despite its small size, pink salmon travels lengthy distances to complete its feeding migration routes (DFO 2001). Along the Pacific northwest coast, pink can be found dispersed between the Mackenzie River mouth and California. Major pink salmon spawning grounds occur between Bristol Bay, Alaska and Puget Sound, Washington (DFO 2019a). Pink salmon are important in the Indigenous and recreational fishery as well, with a commercial fishery targeting this species to sell fresh, frozen, and canned. Pink salmon caught using trolling gear are often sold fresh or frozen, while fish caught by gillnets or purse seine are canned (DFO 2019a). Pink salmon run size in the Nass region has increased by 92% between 2008 to 2017 (Pacific Salmon Explorer 2022).

Sockeye salmon spawning grounds usually occur in rivers that feed or drain lakes. Sockeye spawn on both the Asian and North American coast and can travel up to 1,600 km upstream from the ocean in order to reach their spawning grounds. In the Marine Resources Study Area, important spawning runs can be found in the both the Nass and Skeena (DFO 2001). Often referred to as the “best known Pacific salmon”, sockeye salmon is a dietary favorite due to rich color and oil content. Sockeye is significant to Indigenous fisheries and was the first salmon species to be harvested in the Pacific commercial fisheries. Sockeye run sizes declined by 33% in the Nass River between 2008 and 2017 (Pacific Salmon Explorer 2022).

Three close relatives of these Pacific salmon are also known to inhabit the Marine Resources Study Area and include coastal cutthroat trout (*Oncorhynchus clarkia clarkii*), steelhead trout (*Oncorhynchus mykiss*), and Dolly Varden trout (*Salvelinus malma*). These species are not listed by COSEWIC, are not listed on Schedule 1 of SARA, and have differing provincial listings (BC CDC 2022b). No important EBSA or DFO important areas occur within the Marine Resources Study Area for any of these three species (Rubidge et al. 2018).

Coastal cutthroat trout is not listed by COSEWIC, is not listed on Schedule 1 of SARA, but is provincially blue-listed (BC CDC 2022b). Cutthroat trout have an extensive distribution, ranging from Alaska to Northern California. This species is found throughout the Nass River and its tributaries (LGL Limited & Nisga'a Lisims Government 2020). The spawning and rearing habitat of cutthroat trout is composed of streams which are extremely vulnerable. These habitats tend to be overlooked when planning and developing residential, agricultural, and industrial areas. Anglers and predators can also greatly impact cutthroat trout populations (BC Ministry of Fisheries 2022).

Dolly Varden trout is not listed by COSEWIC, is not listed on Schedule 1 of SARA, but is provincially yellow-listed (BC CDC 2022b). Dolly Varden is a widely distributed species, ranging from Washington State throughout the Northeast Pacific coast to Asia. Dolly Varden is present in the majority of streams and rivers throughout the Nass, including the Nass River watershed, Portland Inlet, Portland Canal, and Observatory Inlet. They can occupy a variety of habitats, including rivers, streams, coastal marine habitats, and lakes (LGL Limited & Nisga'a Lisims Government 2020).

Steelhead trout is not listed by COSEWIC, is not listed on Schedule 1 of SARA, and is provincially yellow-listed (BC CDC 2022b). Steelhead trout are found widespread throughout the eastern Pacific Ocean. Steelhead remain in freshwater for 1–3 years before migrating to the ocean. Steelhead are found throughout the Nass River tributaries (LGL Limited & Nisga'a Lisims Government 2020). Both

winter and summer run steelhead reside within the Nass River watershed, with the mouth of the Nass River draining into Portland Inlet (Bocking et al. 2005).

3.4.8.2 Pelagic Fish

Pelagic fish can be found in the mid to upper reaches of the water column. In order to protect themselves from predation, pelagic fish often swim in large schools or shoals. However, this defense mechanism can leave them more vulnerable to biomass fluctuations and stock collapse. Resource management is critical as natural fluctuations in the population, as well as oceanic and environmental conditions, can easily impact species abundance (DFO 2001).

Tope Shark

Tope shark (*Galeorhinus galeus*) is designated special concern by COSEWIC and is listed as special concern on Schedule 1 of SARA, but is not provincially listed (BC CDC 2022b). The tope shark is a widely distributed shark that can be found in most oceans and is found on the Pacific west coast of North America from northern BC to the waters of Peru and Chile (Barraclough 1948). Tope sharks prefer cool, temperate habitats and are found in both nearshore and offshore environments, though most mature individuals inhabit offshore environments at depths of up to 470 m (Ebert 2003). Historical observations of the tope shark indicate the reach of their northern Pacific distribution ends at the southern end of Dixon Entrance around the north coast of Haida Gwaii within the Marine Resources Study Area (Barraclough 1948).

Tope shark is an opportunistic predator which feeds on fish species and has been known to switch between pelagic and benthic foraging as necessitated by food availability (West and Stevens 2001). Tope shark itself is prey to several other species of shark, including the white shark (*Carcharodon carcharias*) and broadnose seven gill shark (*Notorynchus cepedianus*), as well as killer whale (*Orcinus orca)* (Ebert 2003; Rogers et al. 2017).

The eastern coast of Haida Gwaii was a historically significant fishery for tope shark, which led to population depletion in the area (Barraclough 1948). In recent years both commercial and research catch in this area indicate some species recovery in the Hecate Strait, though it is likely depletion persists today (COSEWIC 2021b). No important EBSA or DFO important areas for tope shark are located within the Project Marine Resources Study Area (Rubidge et al. 2018).

Basking Shark

Basking shark (*Cetorhinus maximus*) is designated as endangered by COSEWIC, endangered on Schedule 1 of SARA, but is not provincially listed (BC CDC 2022b). The basking shark population has experienced significant decline and sightings are exceedingly rare in Canadian waters, due to life history traits (low fecundity and surface behavior) and adverse interactions with humans (Compagno 2001; McFarlane et al. 2009). Basking sharks are located circumglobally in temperate waters near the coastal shelf, often foraging around frontal systems and other oceanographic features that contain high densities of plankton (Compagno 2001). The Pacific population of basking shark appears to migrate from BC to

California during the winter (Compagno 2001). Evidence suggests this species utilizes deep water (depths greater than 1000 m) for its primary habitat, although it often surfaces to feed (Compagno 2001).

Basking sharks are filter feeders who primarily feed on marine zooplankton. Due to their large size, basking sharks have few known predators besides humans (DFO 2021g; McFarlane et al. 2009).

Due to their size and basking behavior, basking sharks have an increased risk of collision with fishing boats and entanglement in fishing gear (Wallace and Gisborne 2006). The Marine Resources Study Area includes known basking shark distribution; however, sightings are extremely rare, with only six reliable sightings on the coast of BC between 1994 and 2007 (Wallace and Gisborne 2006). No important EBSA or DFO important areas for basking shark occur within the Marine Resources Study Area (Rubidge et al. 2018).

Pacific Herring

Pacific herring is not designated by COSEWIC, is not listed on Schedule 1 of SARA, and is not provincially listed (BC CDC 2022b). Pacific herring is a small, widely distributed pelagic fish found in both the coastal and open waters of the northeastern Pacific, spanning from the Beaufort Sea to California. Pacific herring spawn in shallow subtidal or intertidal waters in sheltered estuaries, bays, or inlets. Spawning times vary with latitude, with northern stocks spawning as late as July (Lassuy 1989).

Pacific herring consume a variety of plankton, but their chief importance lies in their significance as a prey species who are considered to play a critical role in many ecosystems. Pacific herring support a variety of significant species, including several marine mammals, seabirds, and fish (DFO 2022h).

Pacific herring spawn in the shallow intertidal or subtidal waters of sheltered bays and estuaries (Hay and McCarter 2013). Pacific herring spawn across the BC coast including an estimated 18% of the total coastline of the province (Hay and McCarter 2013). Spawning locations tend to be inconsistent year to year, with only 1-2% used repetitively for spawning and constituting importing spawning habitat (Hay and McCarter 2013). Historical data include herring spawn records widespread throughout the Project Marine Resources Study Area including major and vitally ranked habitat along the coast between Prince Rupert and Finlayson Island (MAPP 2022). Additionally, spawning habitat designated as minor is found throughout the Marine Resources Study Area including within Portland Inlet (MAPP 2022).

In the past, herring were considered a low value fish, processed only for fishmeal and fish oil (DFO 2001). However, over the last 100 years the Pacific herring has become an important species in the commercial fisheries industry. The Canadian Pacific herring fishery has operated along the coast of BC since 1877 and is managed in two minor and five major stock areas (DFO 2022h; Schweigert et al. 2010). The major Project-relevant stocks are identified as the Prince Rupert District, Central Coast, and Haida Gwaii stocks (DFO 2001). Portland Inlet and the surrounding area falls within the Prince Rupert District stock. Currently, commercial harvesting is closed in order to allow for population regrowth. However, the Nisga'a Treaty and other section 35 fisheries are open for food, as well as for FSC purposes. The Marine Resources Study Area overlaps with the herring fisheries, Food and Bait Herring North, Herring Gill Net Prince Rupert, and Roe Herring Prince Rupert, in management areas 3 and 4

(Figure 3.4–6) (DFO 2013). The population of Pacific herring in this area are low but slow population growth is occurring (DFO 2022h). The commercial herring fishery in BC was estimated to have produced $8,312,000 in 2020 (DFO 2021h).

The McIntyre Bay EBSA has been designated as important for Pacific herring feeding and the Chatham Sound EBSA has been designated important for spawning/breeding/rearing within the Marine Resources Study Area (Figure 3.4–3) (Rubidge et al. 2018). Additionally, the Hecate Strait Front EBSA has been designated important for Pacific herring (Rubidge et al. 2018). There are also large DFO important areas for Pacific herring within the Marine Resources Study Area (Figure 3.4–5).

Walleye Pollock

Walleye pollock (*Theragra chalcogramma*) is not designated by COSEWIC, is not listed on Schedule 1 of SARA, and is not provincially listed (BC CDC 2022b). In the Pacific, pollock are distributed from the Sea of Japan to Alaska and south across the coast of BC to southern California (DFO 2018g). Walleye pollock are known to remain along the coastline and have major population centers in the Sea of Okhotsk and the Bering Sea (DFO 2018g). In BC, pollock are known to spawn in several areas in and around the Marine Resources Study Area, including Dixon Entrance/north Hecate Strait and Queen Charlotte Sound (DFO 2018g).

Walleye pollock feed primarily on marine zooplankton and small fish, and are predated upon by larger fish, marine mammals, and sea birds (Lowry et al. 1996). Evidence suggests that walleye pollock are an extremely important dietary component for many marine mammals, including several seal species (Lowry et al. 1996).

Walleye pollock fisheries exist in BC today and are part of the commercial groundfish fishery (DFO 2018g). The commercial pollock fishery in BC was estimated to have produced $3,122,000 in 2020 (DFO 2021h). Walleye pollock are targeted through midwater trawl but are also caught as bycatch in benthic trawls (DFO 2018g). Within the Marine Resources Study Area, the Chatham Sound EBSA has been identified as an important EBSA for the fitness of walleye pollock (Figure 3.4–3) (Rubidge et al. 2018). There are also two walleye pollock DFO important areas within the Marine Resources Study Area (Figure 3.4–5).

3.4.8.3 Demersal/Benthic Fish

Demersal or benthic fish reside near or along the ocean floor. Also commonly referred to as groundfish, species that fall into the category include rockfish, sablefish, lingcod, perch, and many species of flatfish (DFO 2001). The groundfish commercial fishery in BC began in the 1940s. It was not until 1979 that DFO began implementing management measures in order to regulate the harvest of west coast stocks. Measures include imposing closures based on species/area/times, license limitations, and establishing total allowable catches (DFO 2001). Every year, based on current biological data and conservative approaches, a management plan is established in order to make sure management efforts reflect the state of the stocks (DFO 2001).

Rockfish

Thirty-seven species of rockfish are known to reside in the coastal waters of BC. Rockfish are distributed across the northeast Pacific, where they live in intertidal to subtidal habitats in water depths up to 143 m (COSEWIC 2009b; c; DFO 2019b). Of the 37 species, several are considered inshore species and most likely to be found nearshore in comparatively shallower water. These species are the most likely to overlap with Project activities (particularly during the construction phase) and include yelloweye (*Sebastes ruberrimus*), quillback (*S. maliger*), copper (*S. caurinus*), china (*S. nebulosus*), tiger (*S. nigrocinctus*), yellowtail (*S. flavidus*), deacon (*S. diaconus*), canary (*S. pinniger*) and black (*S. melanops*) rockfish. Rockfish are found primarily in rocky outcroppings that provide complex habitat structure in crevices, caves, boulder fields, and rock ledges (DFO 2019b). Kelp forests are also prime rockfish habitat as they provide foraging habitat for rockfish species. Various life stages of rockfish species can be found in nearshore habitat both subtidally and intertidally (DFO 2019b).

Rockfish are dietary generalists, and they consume shrimp, small fish, jellyfish, crab, sea snails, and worms. Rockfish are an important food source for marine birds, mammals, and other large marine fish (DFO 2019b).

All species of rockfish are of some conservation concern in BC due to their status as a popular recreational sport fish and life history characteristics (i.e., slow growth, late maturation, and low natural mortality) that make them vulnerable to population decline and recovery difficult (DFO 2019b). A number of rockfish populations in BC have been overfished, and fishing is considered the primary threat to rockfish. In an effort to conserve rockfish populations, DFO has established rockfish conservation areas (RCAs) throughout BC coastal waters where commercial and recreational fishing activities are prohibited year-round to conserve rockfish populations. A total of 164 RCAs have been established in BC to date, which together account for an estimated 30% of inshore rockfish habitat in the province (DFO 2019b). There are four rockfish conservation areas within the Marine Resources Study Area, including Dunira, Hodgson Reefs, Gull Rocks North, and Gull Rocks South (Figure 3.4–8) (DFO 2015).

Indigenous elders have observed the decline of rockfish populations at traditional fishing grounds across the BC coast. Kitselas and Nisga'a Nation treaty fisheries today commonly harvest rockfish (Kitselas First Nation 2022; NFWD 2021). Culturally important species such as the yelloweye and red rockfish are significant in their traditional diet (Frid et al. 2016; NFWD 2021). Within RCAs, rockfish are protected from mortality by commercial and recreational fisheries (DFO 2021d). The Marine Resources Study Area overlaps with one rockfish commercial management area (Rockfish Area Outside) in areas 3, 4, 101, 103, and 104 (Figure 3.4–6) (DFO 2013). The Shelf Break EBSA is an important EBSA for yellowmouth rockfish aggregation within the Marine Resources Study Area (Figure 3.4–3). (Rubidge et al. 2018). There are four rockfish conservation areas within the Marine Resources Study Area (Figure 3.4–8). Additionally, there is a large DFO important area for this species that runs along the west coast of Haida Gwaii and extends to the north, where it overlaps the Marine Resources Study Area (Figure 3.4–5).

Bocaccio rockfish (*Sebastes paucispinis*) is listed as endangered by COSEWIC but is not listed provincially or under Schedule 1 of SARA (BC CDC 2022b). Boccacio are found throughout the coast of

BC and assumed to be one designatable stock unit (Stanley et al. 2009). This rockfish is semi-pelagic aggregating species that favours high-relief bottom, including using caves and crevices for shelter (Love et al. 2002). Little is known about the distribution of young bocaccio in BC waters although they have been captured in nearshore sub-tidal depths (DFO 2009a). Female bocaccio mature at about 7 years of age with a generation time of about 20 years.

Canary rockfish is listed as threatened by COSEWIC but is not listed provincially or under Schedule 1 of SARA (BC CDC 2022b). This species ranges from the Gulf of Alaska to Baja California and is an important part of the commercial trawl fishery in BC (DFO 1999d). Canary rockfish mature between 5 and 14 years of age with a lifespan of up to 60 years (DFO 1999d) and are considered to be a semi-pelagic and aggregating species (DFO 2009b).

Darkblotched rockfish (*Sebastes crameri*) is listed as special concern by COSEWIC but is not listed provincially or under Schedule 1 of SARA (BC CDC 2022b). This species ranges from Alaska to Southern California and is long-lived with a maximum age of 100 years (COSEWIC 2009c). Darkblotched rockfish are pelagic and occur offshore in surface waters. Juveniles settle into benthic habitat and may be associated with either soft muddy or rocky bottom habitat (COSEWIC 2009c).

Longspine thornyhead rockfish (*Sebastolobus altivelis*) is designated special concern by COSEWIC, listed as special concern on Schedule 1 of SARA, but is not provincially listed (BC CDC 2022b). Longspine thornyhead is found across the Pacific coast of North America from Mexico to Southern Alaska (Love et al. 2002). This species is found along the continental slope at depths of 500–1600 m (Love et al. 2002). This species is well adapted for survival at intense pressure, low DO, and low productivity. Longspine thornyhead is typically found on soft sand or mud substrates and inhabit small depressions formed near rocks and sponges (Love et al. 2002). The diet of adult longspine thornyhead is mostly composed of brittle stars and other benthic organisms, while juveniles primarily consume krill (Love et al. 2002). Juvenile longspine thornyhead are predated upon by the shortspine thornyhead (*S. alascanus*) and other fish species (Love et al. 2002). Longspine thornyhead are one of the predominant fish species in the deep-sea benthos and likely play a significant role in the ecology of this zone (COSEWIC 2007d). This species has historically been subject to overfishing, although there is still some uncertainty about population size in the Pacific (Schnute et al. 2004; COSEWIC 2007d).

Rougheye rockfish types I and II are both currently designated as special concern by COSEWIC, special concern on Schedule 1 of SARA, but are not provincially listed (BC CDC 2022b). Rougheye rockfish are found in the Pacific Ocean north of Japan from the Kamchatka Peninsula to the Bering Sea, Gulf of Alaska, and West Coast of BC down to southern California (Love et al. 2002). In BC, this species occurs along the continental slope at depths of 170–660 m. They exhibit preference for soft substrate that contains boulder fields which are likely used as territory markers (Love et al. 2002). There is some evidence to suggest Type I is more prevalent in the northeastern Pacific and in deeper water (Gharrett et al. 2005; Hawkins et al. 2005).

Quillback rockfish is listed as threatened by COSEWIC but is not listed under Schedule 1 of SARA or provincially (BC CDC 2022b). This species ranges from the Gulf of Alaska to Southern California in depths less than 200 m (COSEWIC 2009d). Quillback rockfish prefer hard, complex substrates that have

some vertical relief, such as broken rock, rock reefs, ridges and crevices. This species matures at around 11 years of age and is long-lived with quillback rockfish aged to 95 years.

Yelloweye rockfish is listed as threatened by COSEWIC, special concern on Schedule 1 of SARA, but is not provincially listed (BC CDC 2022b). Yelloweye rockfish is known to be present in all coastal BC waters and ranges from the Gulf of Alaska to Northern Mexico (Love et al. 2002). Most of the adults of this species are found in cooler temperate waters at depths of up to 700 m (Love et al. 2002). Juvenile yelloweye rockfish spend significantly more time in shallow waters, typically less than 100 m deep (DFO 2018e). This species is mainly found in complex habitats such as caves, ledges, and overhangs above cobble substrates (Love et al. 2002).

Bluntnose Sixgill Shark

Bluntnose sixgill shark (*Hexanchus griseus*) is listed as special concern by COSEWIC, as well as on Schedule 1 of SARA. This species has been recorded in temperate and tropical marine environments across the globe in the Pacific, western Atlantic, northeastern Atlantic, and Indian Oceans near Madagascar and Mozambique (Larson & Lowry 2017). In Canada, bluntnose sixgill shark is poorly studied due to its preference for deep water environments; however, it is believed to be widespread across the Pacific coast of western Canada (Mecklenburg et al. 2002). This shark inhabits benthic areas of deep-water environments (typically below 91 m), though it can be found in inlets and shallow areas during young and adolescent life stages, as well as to spawn (Ebert 2003).

The bluntnose sixgill shark is a dietary generalist feeder whose diet ranges from invertebrates to teleosts to small marine mammals and carrion (Andrews et al. 2009; Larson & Lowry 2017). Predators of the bluntnose sixgill shark include larger marine mammals such as Steller sea lion, elephant seal and killer whale, as well as other shark species such as the white shark (*Carcharodon carcharias*) (Ebert 1986).

Bluntnose sixgill shark has historically been targeted by commercial fisheries in Canada, recreational fisheries in California, and others. Today, no bluntnose sixgill shark fisheries exist in Canada, though it is often caught as bycatch (DFO 2012b). No important EBSA or DFO important areas for bluntnose sixgill shark have been identified within the Marine Resources Study Area (Rubidge et al. 2018).

Pacific Halibut

Pacific halibut is not designated by COSEWIC, is not on Schedule 1 of SARA, and is not provincially listed (BC CDC 2022b). This species is found distributed along the eastern Pacific coast from Alaska to California. Mature adults migrate up to 1,600 km from shallow summer feeding grounds to deeper spawning grounds in the winter (Hart 1973). Spawning usually occurs from November to January at 275–412 m depth, including known spawning habitat in the Hecate (IPHC 2017).

Juvenile Pacific halibut remain in nearshore habitat where they feed on krill and small fish. At five to seven years of age, juveniles move offshore to deeper waters where they become opportunistic feeders on cod, sablefish, pollock, other flatfish, herring, and octopus (Hart 1973).

Pacific halibut are a significant species in the commercial, recreational, and traditional fisheries in BC (IPHC 2017). The commercial halibut fishery in BC was estimated to have produced $33,257,000 in 2020 (DFO 2021h). Pacific halibut are also harvested in treaty fisheries by the Nisga'a Nation in Portland Canal and are an important resource for the Nisga'a Nation (NFWD 2020; 2021). Kitselas First Nation also harvests Pacific halibut (Kitselas First Nation 2022). Portland Inlet and surrounding area is a recorded regulatory area (2B) where Pacific halibut numbers have been reasonably stable allowing for the annual operation of all three fisheries (IPHC 2017). The McIntyre Bay EBSA constitutes an important feeding area for Pacific halibut (Figure 3.4–3) The Hecate Strait Front EBSA is also an important EBSA for Pacific halibut. A Pacific halibut DFO important area exists off the northwest coast of Haida Gwaii within the Marine Resources Study Area (Figure 3.4–5).

Pacific Cod

Pacific cod is not designated by COSEWIC, is not on Schedule 1 of SARA, and is not provincially listed (BC CDC 2022b). Pacific cod is distributed throughout the North Pacific Ocean, primarily along the continental shelf (Cohen et al. 1990; Forrest et al. 2020). Pacific cod in the Hecate Strait is found primarily at depths of less than 150 m (Forrest et al. 2020). Pacific cod spawn in winter and early spring in protected bays and the outer continental shelf in the warmer waters (Dunn & Matarese 1987; Cohen et al. 1990).

Pacific cod is an indiscriminate feeder with a vast diet consisting of fish, octopuses, and large crustaceans (Cohen et al. 1990). It is also an important dietary component for Pacific halibut, spiny dogfish, seabirds, and many marine mammals (Forrest et al. 2020).

Due to the lowering of quotas in the early 2000s, the commercial catch has tapered off in recent years (DFO 2021e). The commercial cod fishery in BC was estimated to have produced $751,000 in 2020 (DFO 2021h). Historically, Pacific cod was one of the most important trawl-caught bottom fishes in BC (Cohen et al. 1990). Pacific cod are also harvested in Treaty fisheries by the Nisga'a Nation in Portland Canal (NFWD 2021). The Hecate Strait Front and McIntyre Bay EBSAs are important for Pacific cod within the Project Marine Resources Study Area (Figure 3.4–3) (Rubidge et al. 2018). There is also one large DFO important area for Pacific Cod in the Marine Resources Study Area (Figure 3.4–5).

Pacific Hake

Pacific hake (*Merluccius productus*) is not designated by COSEWIC, is not on Schedule 1 of SARA, and is not provincially listed (BC CDC 2022b). Three stocks of hake occur on the BC coast, with the migratory coastal stock having the potential to occur within the Marine Resources Study Area (NOAA 2022d). This stock ranges from southern California to Queen Charlotte Sound within the Marine Resources Study Area (NOAA 2022d). Pacific hake are known to occur along the continental shelf and slope for both migration and foraging (NOAA 2022d). Adult hake form pelagic schools during the day at depths between 50 and 500 m and migrate vertically in the water column at dusk to feed on fish and zooplankton (Hamel et al. 2015).

Pacific hake are opportunistic feeders, particularly when it comes to aggregations of their prey. Large juveniles and adults mainly feed on euphausiids, fish, and pandalid shrimp (Hamel et al. 2015).

Pacific hake is a major fisheries component in BC and regularly constitutes the largest proportion of total value of all groundfish species harvested in a given year (DFO 2022d). The commercial hake fishery in BC was estimated to have produced $22,025,000 in 2020 (DFO 2021h). In BC, hake are fished recreationally, commercially, and by Indigenous fisheries, including within the Marine Resources Study Area (DFO 2022l). There are no established EBSAs for this species in the Marine Resources Study Area; however, there is one large DFO important area that exists to the north of Haida Gwaii within the Marine Resources Study Area (Figure 3.4–5).

Pacific Sand Lance

Pacific sand lance (*Ammodytes hexapterus*) is not designated by COSEWIC, is not listed on Schedule 1 of SARA, and is not provincially listed (BC CDC 2022b). The Pacific sand lance is widely distributed across the globe, ranging from the Arctic Ocean to Southern California in the Pacific (Orr et al. 2015). This species is found in intertidal, nearshore, and offshore habitats at depths up to 100 m, although they have been known to exist as deep as 275 m (Orr et al. 2015). Sand lance is known to occur in large schools and often buries itself in sand to avoid predation (Robinson et al. 2013).

Pacific sand lance spawn on sand and pebble beaches from November to February in BC (BC Gov 2014). Optimal sand lance spawning habitat includes coarse sand and pebble substrates in nearshore shallow (<80m) waters including the intertidal zone (Huard et al. 2022). Spawning habitat is typically found within 5 km of burying habitat and Pacific sand lance are known to exhibit site fidelity, utilizing the same spawning habitat year after year (Huard et al. 2022). After spawning, fertilized eggs remain attached to substrate for up to three months until hatching occurs (Huard et al. 2022). Locations across the Salish Sea are known to support Pacific sand lance spawning habitat, but no areas within the Project Marine Resources RSA have been identified as known spawning habitat to date. Pacific sand lance were captured in Project marine fish surveys and it is possible that the areas in and around the Marine Resources Study Area constitute Pacific sand lance spawning habitat. Further discussion on Pacific sand lance capture can be found in Section 4.0.

Pacific sand lance plays an important role in the trophic structure of the Pacific. During the day, it forages for zooplankton such as copepods in the water column. During periods of low food availability, it is believed to estivate in suitable substrate (Robinson et al. 2013). The Pacific sand lance is a cornerstone prey species to over 100 species of fish, seabirds, and marine mammals (Robinson et al. 2013).

No important EBSAs or DFO important areas have been identified within the Project Marine Resources Study Area for this species (Rubidge et al. 2018).

English Sole

English sole (*Parophrys vetulus*) is not designated by COSEWIC, is not listed on Schedule 1 of SARA, and is not provincially listed (BC CDC 2022b). It is found from Baja California to the Bering Sea, with young English sole occurring at depths of 10–40 m and adults occupying deeper ranges from 40–150 m

(DFO 1998). Adult English sole is generally found in offshore sand and sand-mud substrates and is almost entirely absent from coastal bays and estuaries (Lassuy 1989). There is little overall migration for adults; however, small seasonal north-south migrations occur (Pearson and Owen 2001). Spawning generally occurs over sand and sand-mud bottoms, at depths ranging from 60–110 m (Lassuy 1989). English sole spawn year-round with a peak in the winter months (Lassuy 1989).

Juvenile English sole feed on copepods, segmented worms, brittle stars, and other small invertebrates for 1–2 years before migrating to deeper offshore waters. Adults are opportunistic feeders and prey on worms, small crustaceans, clams, and occasionally small fish, crabs, and shrimp (Pearson & Owen 2001).

English sole is one of the important flatfishes harvested in the commercial trawl fishery in BC (DFO 1998). The commercial flatfish fishery in BC was estimated to have produced $6,418,000 in 2020 (DFO 2021h). The Hecate Strait Front EBSA is an important EBSA for English sole in the Marine Resources Study Area (Rubidge et al. 2018). There is also one English sole DFO important area within the Marine Resources Study Area (Figure 3.4–5).

Lingcod

Lingcod is not designated by COSEWIC, is not on Schedule 1 of SARA, and is not provincially listed (BC CDC 2022b). Lingcod are only found on the west coast of North America and are distributed along the coast from Alaska to California (DFO 2018c). Lingcod typically live in water depths between 10–100 m and reside along the rocky bottom of the ocean floor (DFO 2018c). Lingcod spawn from December to March in areas of strong current, on ledges, or in the crevices of rocks. Juveniles can often be found in eelgrass beds and sandy substrates (DFO 2018c).

Adult lingcod are voracious predators who consume almost anything they can ingest, including other lingcod (DFO 2018c). Lingcod nests are vulnerable to predation and are often guarded by the male parent. Rockfish, starfish, sculpins, kelp greenling, and cod will all predate upon lingcod eggs (DFO 2018c). Adult lingcod are predated upon mainly by seals and sea lions (DFO 2018c).

Lingcod have been historically harvested for commercial recreational and Indigenous fisheries in Portland Canal (DFO 2018c; Kitselas First Nation 2022; NFWD 2019). Offshore lingcod stocks are considered to be stable and moderately abundant, and Hecate Strait and the northwestern coast of Haida Gwaii produce significant lingcod catches in recent years. With an extensive history in the fisheries industry, lingcod are recorded by Indigenous nations as a food source as far back as 5,000 years ago. Beginning in approximately 1860, the commercial fishery for lingcod supplied markets on Vancouver Island and in Victoria. Prior to the trawl fishery, lingcod were one of the few sources of fish that was available year-round, making it economically significant like salmon and herring (DFO 2018c). No designated important EBSAs for this species are found within the Marine Resources Study Area (Rubidge et al. 2018).

Sablefish

Sablefish is not designated by COSEWIC, is not listed on Schedule 1 of SARA, and is not provincially listed (BC CDC 2022b). Sablefish are found ranging in the Pacific from the Bering Sea to Baja California and Japan. The majority of the population resides over the continental shelf and slope waters at depths up to 1500 m (DFO 2018d). Sablefish spawn at depths over 1000 m between the months of January and March. During the months of April and May the larval fish can be found swimming close to the surface of the water.

Sablefish diet consists of a variety of fish, cephalopods, and crustaceans. Young sablefish primarily consume krill for sustenance. Juvenile sablefish are predated upon by seabirds, salmon, and other large fish, while adults are prey for sperm whales (DFO 2018d).

Sablefish have historically contributed significantly to fisheries in BC and are harvested in Treaty fisheries by the Nisga'a nation, which catches this species in the Portland Canal (NFWD 2021). No important EBSAs for this species have been identified; however, there is one sablefish DFO important area within the Marine Resources Study Area (Figure 3.4–5).

3.4.9 Marine Mammals

Many species of marine mammals occur in the North Pacific, and several of these have DFO important areas within the Marine Resources Study Area (Figure 3.4–10; Table 3.4–5; Table 3.4–6). Through the early to mid-1900s, populations of cetaceans around the world declined significantly due to the effects of commercial whaling (Gregr et al. 2005). Many large populations of marine mammals that once thrived in BC waters were hunted to near extinction, with some populations decreasing by up to 99% (Surma and Pitcher 2015). Studies on historical abundance reconstruction suggest that populations of marine mammal species located around Haida Gwaii suffered even more extensive depletion than in the North Pacific as a whole (Surma and Pitcher 2015). Today, marine mammals are protected in BC by legislation and the cessation of widespread commercial whaling; however, they still face many other anthropogenic threats, including underwater noise, pollution, vessel strikes, entanglement in fishing gear, reduced prey availability, bycatch, and habitat alteration (Gregr et al. 2005; COSEWIC 2003).
Fatal collisions of whales with ships were first recorded in the late 1800s, and the frequency of these occurrences has been rising rapidly due to increased marine traffic worldwide (Laist et al. 2001). Larger vessels (over 80 m), and fast-moving vessels (over 14 knots) are known to inflict the greatest proportion of serious and fatal injuries when strikes occur (Laist et al. 2001).

Important marine mammal species located in and around the Marine Resources Study Area were broken up into two categories for discussion in this report. The first category includes species likely to be found in nearshore and confined channel environments (Table 3.4–5). The second category includes primarily offshore and pelagic species (Table 3.4–6), which are more likely to be encountered in open water in the further reaches of the Marine Resources Study Area. These groups were broken down further by grouping based on life history, as outlined below.

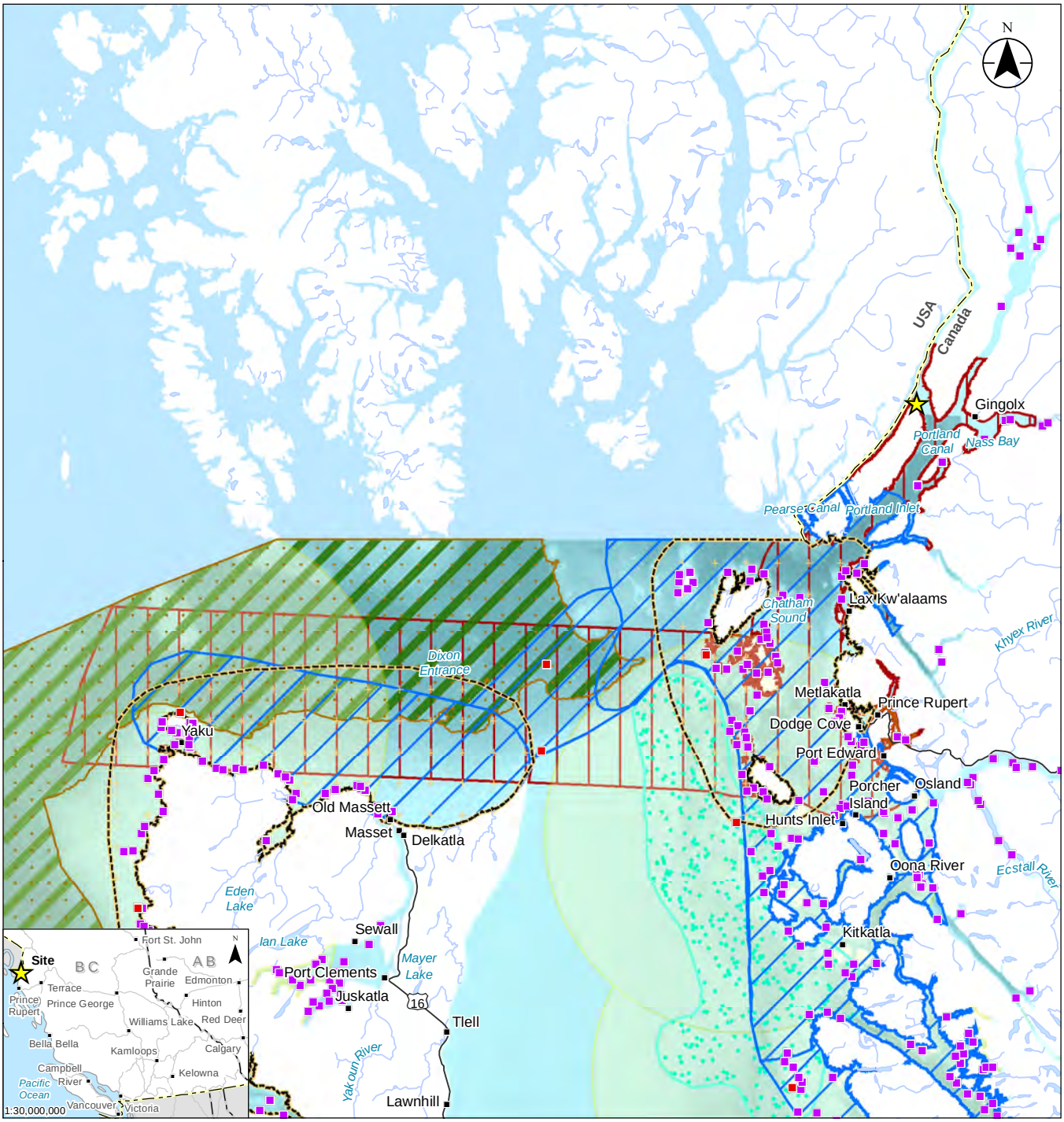
Odontocetes are toothed whales and include species such as sperm whales, beaked whales, and all dolphins and porpoises (DFO 2022m). Odontocetes primarily consume fish and cephalopods (e.g., squids and octopus) (DFO 2022m). Despite the cessation of targeted commercial whaling, anthropogenic activities still heavily impact odontocetes (Culik 2011). The largest existing threat to odontocetes is by-catch and entrapment in nets and other fishing gear, which can lead to suffocation (Culik 2011). Mortality caused by entanglement in fishing gear is identified as a major threat to 86% of toothed whale species worldwide (Culik 2011). Additionally, odontocetes are particularly vulnerable to anthropogenic noise, since they rely on underwater vocalizations to communicate amongst conspecifics and use echolocation to locate and hunt the pelagic prey that composes their diets (Culik 2011). Many species of odontocetes are inadequately studied, leading to significant challenges in facilitating their conservation; of 72 species of known odontocetes worldwide, the IUCN considers 10 data deficient (IUCN 2023).

Mysticetes are baleen whales and include humpback, fin, minke, and grey whales, among others (DFO 2022m). Mysticetes have no teeth but use stiff strips of baleen to filter food from the water (DFO 2022m). Mysticetes are generally larger than odontocetes and sustain themselves on small fish and zooplankton like krill (DFO 2022m). Evidence suggests that these large and slow-moving whales are at the greatest risk of ship strikes due to their limited ability to avoid ships quickly (Laist et al. 2001).

Pinnipeds include seals and sea lions which use both ocean and land environments for purposes specific to the resources they contain. Pinnipeds use the marine environment primarily to hunt for food and move to the terrestrial environment in areas called haulouts, for resting and mating (Kovacs et al. 2012). Established pinniped haulouts for Steller sea lion and harbour seal occur within the Project Marine Resources Study Area (Figure 3.4–10). Many pinnipeds exhibit site fidelity, returning to the same breeding grounds and territory throughout their lifetimes (Lunn and Boyd 1991). Historically, many pinniped species have been the subject of targeted fisheries that brought many to the brink of extinction (Kovacs et al. 2012). At present, the predominant threat to pinniped species in the Marine Resources Study Area is incidental take in fishing gear, predation (killer whales and humans), pollution, reduction of prey species caused by overfishing, disease and anthropogenic noise (Kovacs et al. 2012; COSEWIC 2003).

There are only two species of marine fissipeds (sea otter and polar bear) (NOAA 2019) Of these, only sea otter has the potential to occur within BC and the Marine Resources Study Area.

Two main datasets were utilized to estimate cetacean abundance in the Project Area and are described in further detail below.



KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3.

- Site
- Steller Sea Lion Haulout Location
- Harbour Seal Haulout Location
- Marine Resources Study Area
- DFO Important Area for Blue Whale
- DFO Important Area for Northern Resident Killer Whale
- DFO Important Area for Fin Whale
- DFO Important Area for Humpback Whale
- DFO Important Area for Fur Seal
- DFO Important Area for Steller Sea Lion

- Highway
- International Boundary
- Watercourse
- Waterbody

Bathymetry (m)
Value
- High : 1
- Low : -550

0 10 20 30 40 50 km
1:1,500,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC
Project Number: 123221820
Prepared by NFORRESTER on 20220615
Requested by CMCCRACKEN on 20220615
Check by TQUILICHINI on 20220615

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
3.4-10

Title
DFO Important Areas for Marine Mammals within the Marine Resources Study Area

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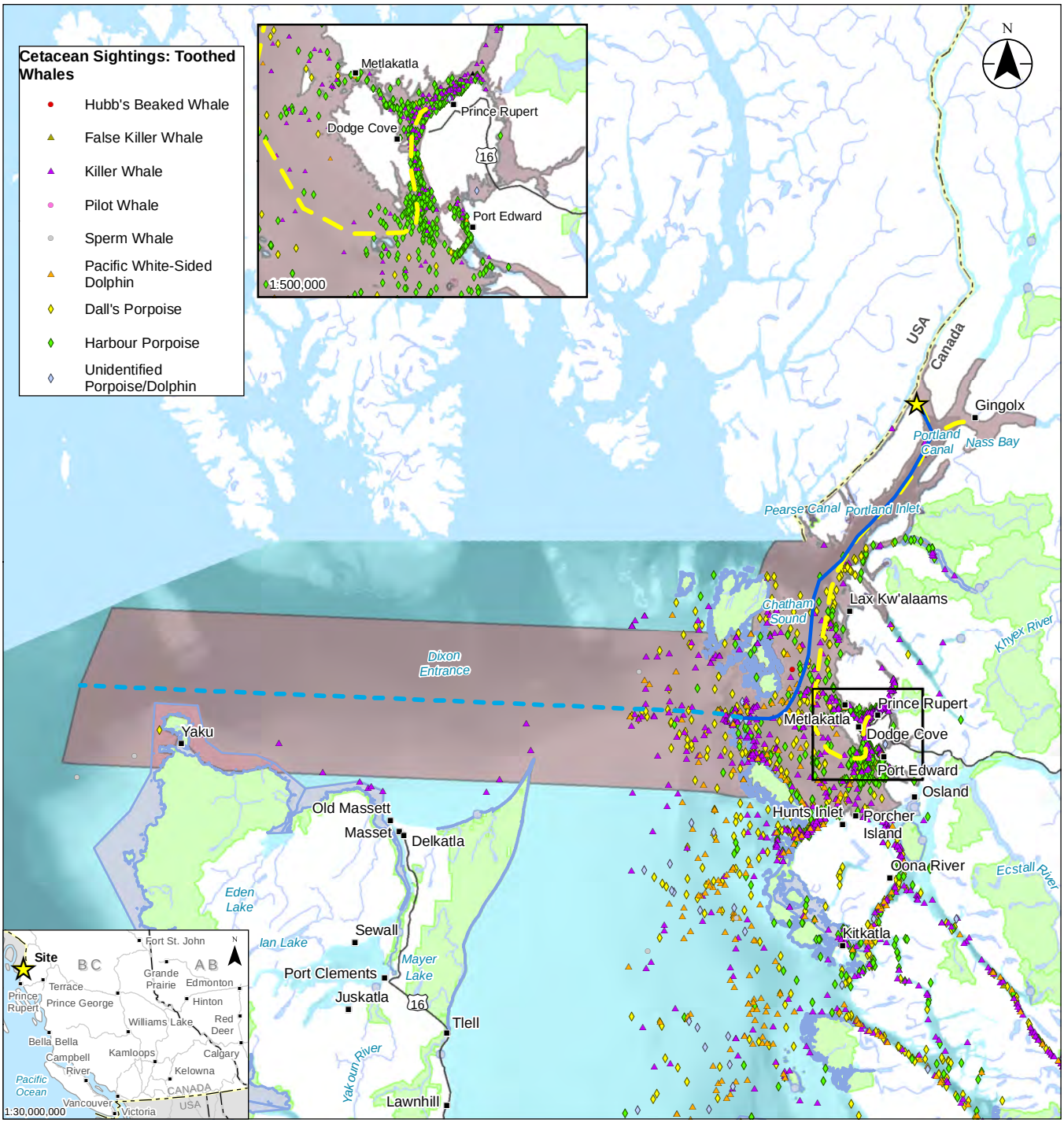
S:\123\2\projects\123221820\figures\report\TDR\Marine\fig3_4-10_123221820_239_dfo_marine_mammals.mxd Revised: 2023-09-06 By: tquilichini

3.4.9.1 BC Cetacean Sightings Network

The BCCSN collects and maintains a database of opportunistic sightings of various cetaceans through voluntary submittals by the general public. Due to the nature of opportunistic sightings, there is inherent bias toward areas more frequented by humans, and a lack of reported sightings should not be interpreted as a lack of presence. It is also important to note that BCCSN sightings do not differentiate between different ecotypes of the same species (e.g., between ecotypes of killer whales). BCCSN only includes sightings of cetaceans (whales and dolphins) and does not include any data about pinnipeds (seals and sea lions) or fissipeds.

“Data obtained from the B.C. Cetacean Sightings Network were collected opportunistically with limited knowledge of the temporal or spatial distribution of observer effort. As a result, absence of sightings at any location does not demonstrate absence of cetaceans or sea turtles.” (British Columbia Cetacean Sightings Network)

Stantec submitted a data request to BCCSN for cetacean sightings in the Marine Resources Study Area and received data ranging from 2017 current to June 23, 2022. BCCSN data is represented in Figure 3.4–11 and Figure 3.4–12.



KSI LISIMS LNG

Site
Marine Shipping Route
Open Water Marine Shipping Route
Materials and Supply Shipping Route
Marine Resources Study Area
Marine Park, Ecological Reserve, Protected Area or Conservancy Area
Park or Protected Area

Bathymetry (m)
High : 1
Low : -550

Highway
International Boundary
Watercourse
Waterbody

0 10 20 30 40 50 km
1:1,500,000 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada, B.C. Cetacean Sightings Network
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
4. Sightings data supplied by the B.C. Cetacean Sightings Network. Sightings are opportunistic and not corrected for effort. Absence of sightings at any location does not demonstrate absence of cetaceans.

Stantec

Project Location: Pearse Island, BC
Project Number: 123221820
Prepared by DR on 20220617
Requested by CMCCRACKEN on 20220617
Check by TQUILICHINI on 20220617

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
3.4-11

Title
B.C. Cetacean Sightings Network - Toothed Whale Sightings (2017 - 2022)

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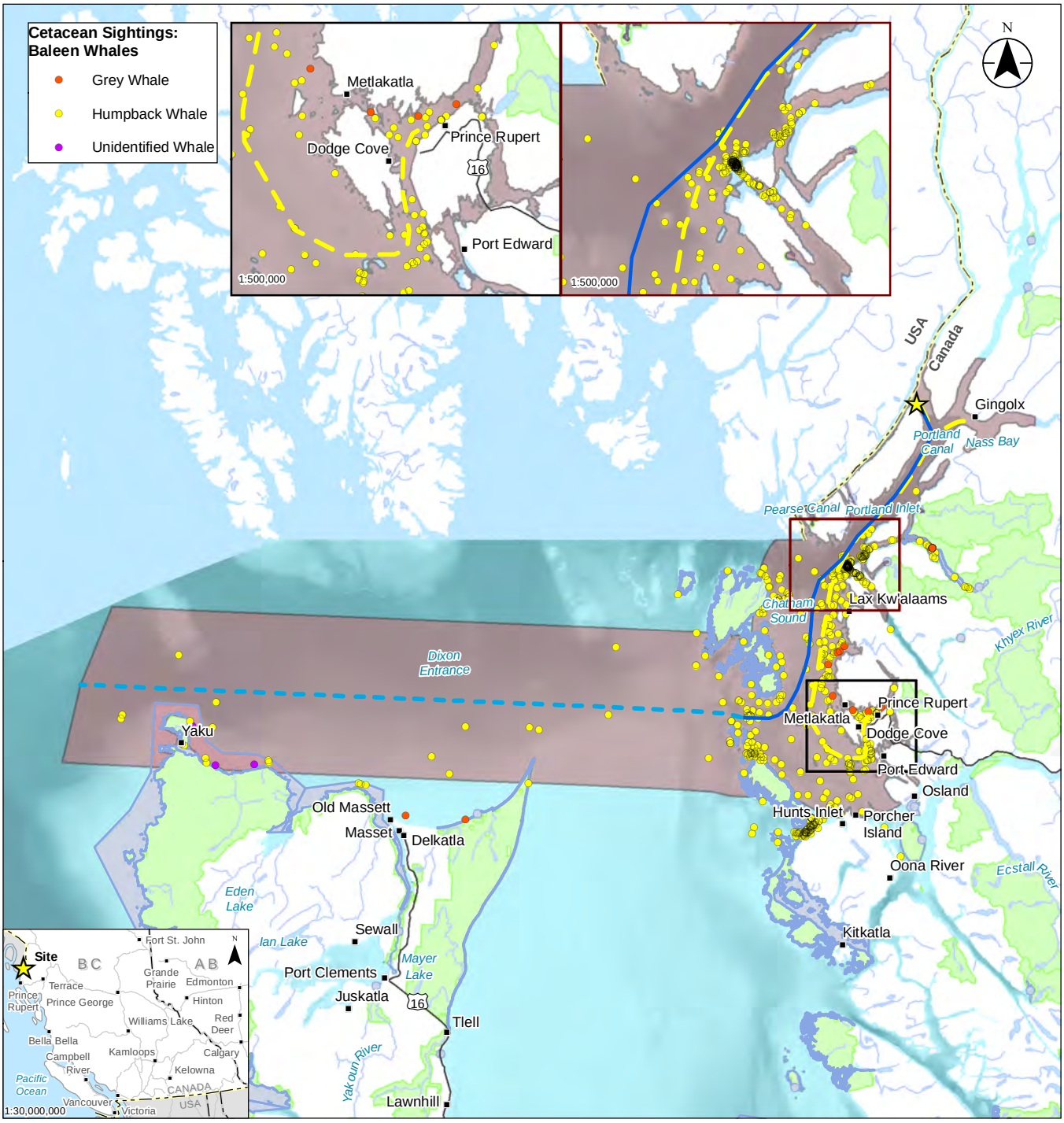
S:\123\20\projects\123221820\figures\report\TDR\Marine\Fig3_4-11_123221820_241_bc_cetacean_sightings_toothed.mxd Revised: 2023-09-06 By: tquilichini



Site
Marine Shipping Route
Open Water Marine Shipping Route
Materials and Supply Shipping Route
Marine Resources Study Area
Marine Park, Ecological Reserve, Protected Area or Conservancy Area
Park or Protected Area

Bathymetry (m)
High : 1
Low : -550

Highway
International Boundary
Watercourse
Waterbody

0 10 20 30 40 50 km
1:1,500,000 (at original document size of 8.5x11)

KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada, B.C. Cetacean Sightings Network
3.
4. Sightings data supplied by the B.C. Cetacean Sightings Network. Sightings are opportunistic and not corrected for effort. Absence of sightings at any location does not demonstrate absence of cetaceans.

Stantec

Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by DR on 20220617
Requested by CMCCRACKEN on 20220617
Check by TQUILICHINI on 20220617

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
3.4-12

Title
B.C. Cetacean Sightings Network - Baleen Whale Sightings (2017 - 2022)

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S:\1232\projects\123221820\figures\report\TDR\Marine\Fig3.4-12_123221820_240_bc_cetacean_sightings_baleen.mxd Revised: 2023-09-06 By: tquilichini

3.4.9.2 Pacific Region International Survey of Marine Megafauna

In 2018, DFO conducted the Pacific Region International Survey of Marine Megafauna (**PRISMM**) study, with the goal of obtaining updated abundance and distribution data for large marine species in the Canadian Pacific waters (Wright et al. 2021). Density surface modelling was used to extrapolate population size and density for several species of cetacean based on surface sightings (Wright et al. 2021). The results of this study were abundance and density extrapolations broken down into strata based on physical oceanography and geographic features (Wright et al. 2021). Only four species of cetacean were encountered with enough frequency to apply the density surface model to estimate population size (Wright et al. 2021).

Strata outlined by the study that are relevant to the Project include the North Coast (coastal) and Offshore strata. The Marine Resources Study Area is located mostly within the North Coast stratum; however, a small portion of the Marine Resources Study Area also extends slightly into the Offshore stratum. Within both of these strata, the Marine Resources Study Area constitutes a small portion of the overall strata. Thus, population relative abundance estimates for the entirety of these stratum should not be considered accurate representations of population sizes within the Marine Resources Study Area.

The North Coast stratum is delineated as an area ranging from the north end of the Strait of Georgia to the border with Alaska (Wright et al. 2021). Its east-west boundaries are defined as the interior of Haida Gwaii eastward to the coast of mainland BC (Wright et al. 2021). The North Coast stratum encompasses an area of 72,621 km^2 (Wright et al. 2021). The entirety of the Marine Resources Study Area covers an area of approximately 7,321.8 km^2 and is located mostly within the North Coast stratum; however, it constitutes only a small part of the entire stratum (roughly 10%).

The Offshore stratum covers an area ranging from the northern border with Alaska to the south at Port Renfrew (Wright et al. 2021). It extends east from the west coast of Haida Gwaii and Vancouver Island a significant distance into the Pacific Ocean (Wright et al. 2021). The Offshore stratum encompasses an area of 353,489 km^2 (Wright et al. 2021). The Marine Resources Study Area extends slightly into a small portion of the Offshores stratum to the northwest of Haida Gwaii.

3.4.9.3 Key Marine Mammal Species

Many species of marine mammals utilize differing environments based on their life history requirements. Species included in this section have a relatively high likelihood of occurring in the nearshore areas of the Project. They will likely be encountered the most frequently by Project activities and are presented as key species in Table 3.4–5.

Table 3.4–5 Key Marine Mammal Species and their Conservation Status

Group	Common Name(s) (populations)	Nisga'a Name(s)	Scientific Name	COSEWIC Status	SARA Schedule 1 Status	BC Status
Odontocetes (toothed whales)	Killer whale (northeast Pacific northern resident)	Ṅeekhl	*Orcinus orca*	Threatened	Threatened	Red
	Killer whale (Bigg's or northeast Pacific transient)		*Orcinus orca*	Threatened	Threatened	Red
	Killer whale (northeast Pacific offshore)		*Orcinus orca*	Threatened	Threatened	Red
	Harbour porpoise	–	*Phocoena phocoena vomerina*	Special Concern	Special Concern	Blue
	Dall's porpoise	–	*Phocoenoides dalli*	Not at Risk	–	Yellow
	Pacific white-sided dolphin	Jiixw (dolphin)	*Lagenorhynchus obliquidens*	Not at Risk	–	Yellow
Mysticetes (baleen whales)	Humpback whale (North Pacific)	Hlbin	*Megaptera novaeangliae*	Special Concern	Special Concern	Blue
	Fin whale (Pacific)	–	*Balaenoptera physalus*	Special Concern	Threatened	Red
	Minke whale (North Pacific subspecies)	–	*Balaenoptera acutorostrata (scammonii)*	Not at Risk	–	Yellow
	Grey whale (northern Pacific migratory)	–	*Eschrichtius robustus*	Not at Risk	–	Blue
	Grey whale (Pacific coast feeding group)	–	*Eschrichtius robustus*	Endangered	–	Blue
	Grey whale (western Pacific population)	–	*Eschrichtius robustus*	Endangered	–	Blue
Pinnipeds (seals and sea lions)	Steller sea lion	T'ibin (sea lion)	*Eumetopias jubatus*	Special Concern	Special Concern	Blue
	California sea lion	T'ibin (sea lion)	*Zalophus californianus*	Not at Risk	–	Yellow
	Harbour seal	Ilx (seal)	*Phoca vitulina (richardsi)*	Not at Risk	–	Yellow
	Northern fur seal		*Callorhinus ursinus*	Threatened	–	Red

Table 3.4–5 Key Marine Mammal Species and their Conservation Status

Group	Common Name(s) (populations)	Nisg̲a'a Name(s)	Scientific Name	COSEWIC Status	SARA Schedule 1 Status	BC Status
Fissipeds	Sea otter	–	*Enhydra lutris*	Special Concern	Special Concern	Blue

NOTES:
SARA – *Species at Risk Act.*
COSEWIC – Committee on the Status of Endangered Wildlife in Canada.
COSEWIC/SARA Ranks:
Extinct: A species that no longer exists.
Extirpated: A species that no longer exists in the wild in Canada but occurring elsewhere.
Endangered: A species facing imminent extirpation or extinction.
Threatened: A species that is likely to become endangered if limiting factors are not reversed.
Special concern: A species particularly sensitive to human activities or natural events.
Data Deficient: A species that has insufficient scientific data to support a designation.
BC Status:
Red-listed: Any species or ecosystem that is at risk of being lost (extirpated, endangered, or threatened).
Blue-listed: Any species or ecosystem that is of special concern.
Yellow-listed: Any species or ecosystem that is apparently secure or secure.
Unknown: Any species with extreme uncertainty about population size
Accidental: Any species that can occur infrequently and unpredictably outside their usual range in BC
–: Not listed

SOURCES:
Species at Risk Public Registry (Government of Canada 2022)
BC Species and Ecosystems Explorer (BC CDC 2022a)
Nisg̲''a (Version 2.1) (First Peoples Heritage Language and Culture Council 2017)
Nisg̲a'a Fisheries Program: Final Report of Funded Projects ([NFWD] 1997–2019)

Odontocetes

Killer Whale

There are three genetically distinct ecotypes and four populations of killer whales in BC, separated primarily by prey preference and hunting behaviour. Three of the four populations are likely to occur in the Marine Resources Study Area, including the Northeast Pacific northern resident, Northeast Pacific transient (west coast Bigg's), and Northeast Pacific offshore killer whales.

Killer whales are the largest species of dolphin, and like other oceanic dolphins they belong to the mid-frequency (**MF**) functional hearing group (NOAA 2015). They are particularly vulnerable to noise pollution because of their reliance on acoustic cues for a variety of ecological and societal functions (Ford et al. 1994; Money and Trites 1998). Killer whales communicate with a large acoustic repertoire,

including pulsed calls, clicks, and whistles (tonal sounds) (Ford 1989; Thomsen et al. 2001). Pulsed calls are considered to be broadband (multiple frequencies) and tend to land between 250 Hz to 2 kHz (Ford 1989), while their tonal sounds (whistles) have frequencies between 1.5 kHz to 18 kHz (Ford 1989; Thomsen et al. 2001).

Recorded BCCSN sightings of killer whales are not distinguished between ecotype and are extremely abundant within the Marine Resources Study Area. The greatest density of sightings have been reported in waters surrounding Prince Rupert, as well as off the south coast of the Dundas Islands, and the channel between Prescott and Porcher Island. There have been relatively few killer whale sightings reported near the marine terminal (Figure 3.4–11).

Within the Marine Resources Study Area, the McIntyre Bay EBSA is an important EBSA for killer whales (Figure 3.4–3). Additionally, the Chatham Sound EBSA is important for killer whale feeding (Rubidge et al. 2018).

Northern resident killer whales are designated as threatened by COSEWIC, are listed as threatened on Schedule 1 of SARA (Government of Canada 2022), and are provincially red-listed (BC CDC 2022b). The northern resident killer whale is a genetically-distinct population of killer whales that forage exclusively on fish, primarily salmonids, in the coastal waters of BC (Bigg et al. 1990; Ford et al. 1998; Baird 2001b; Barrett-Lennard and Ellis 2001). Northern resident killer whale population is small, with a low potential rate of increase (Baird 2001b; Barrett-Lennard and Ellis 2001). This is influenced by prey availability (they have a dietary specialization for chinook salmon); however, the population has been experiencing steady growth since the 1970s (Baird 2001b; Barrett-Lennard and Ellis 2001; Ford and Ellis 2006). This slow but steady growth rate in the population has resulted in a threatened designation, despite the species' meeting the criteria for endangered (COSEWIC 2008). In 2017, the northern resident killer whale population in BC consisted of an estimated 300 individuals (DFO 2018a), up from 220 individuals in 1997 and 244 individuals in 2006 (DFO 2018a).

Northern resident killer whales are present year-round in the coastal waters of BC (Ford et al. 2000), but their distribution is highly seasonal and tends to reflect prey availability. The entire range of northern resident killer whales extends from Glacier Bay, Alaska to Gray's Harbour, Washington, and includes nearshore waters to approximately 50 km from the shore (Ford et al. 2000; DFO 2011a). From spring through fall (May to November), the northern resident population tends to concentrate in the nearshore migratory corridors that chinook salmon follow while returning to their natal streams (Ford 2006; Ford and Ellis 2006; Ford et al. 2010b), from Dixon Entrance to central Vancouver Island (Ford et al. 2010a; DFO 2011a). Northern resident killer whales frequent the waters of the north coast of BC primarily from May to mid-July, which coincides with the migration of the Skeena and Nass River chinook salmon (Ford 2006; Ford and Ellis 2006). In the mid-summer, this ecotype travels further down the coast towards Johnstone Strait to feed on other aggregations of migrating salmon species, primarily Fraser River Chinook salmon (Ford and Ellis 2006; Ford 2006). In the winter, northern resident killer whales spread out over the outer coast, with irregular and brief visits to their summer areas (Ford 2014).

Northern resident killer whales are one of several marine mammal species that have DFO important areas within the Marine Resources Study Area (Figure 3.4–10). Experts identified this DFO important area as an area used for northern resident killer whale socialization, migration, and foraging for chinook salmon, which constitutes the majority of this species' diet during the summer months (Ford 2006; Rubidge et al. 2018). The northern resident killer whale DFO important area overlaps almost all of the Marine Resources Study Area along the coastline of the mainland from Portland Inlet to the southernmost point at Hunt's Inlet and Porcher Island (DFO 2017d). The DFO important area also extends out to the northeast corner of Haida Gwaii, which is the start of listed critical habitat for this ecotype (Figure 3.4–8).

Critical habitat includes habitat vital to species' survival or recovery (DFO 2022c). Critical habitat protection is of the utmost importance as these habitats are associated with important life history functions such as breeding, nursing, and/or feeding (DFO 2020c). Activities likely to result in the destruction of critical habitat include reduction of prey availability, oil spills, industrial development in confined passages, environmental contaminants, acoustic disturbance from human activities, and physical disturbance from vessels (Ford et al. 2012).

Western Dixon Entrance is designated critical habitat for northern resident killer whales and overlaps the Marine Resources Study Area in the coastal waters north of Haida Gwaii and the McIntyre Bay EBSA (Figure 3.4–8) (DFO 2017d; Rubidge et al. 2018). This critical habitat is particularly important due to several notable features, including large quantities of prey, sufficient water quality, and an underwater acoustic environment that does not interfere with communication or echolocation (DFO 2017d). DFO states that "there is no other known area within the range of the population that is frequented as often, as regularly, by northern resident killer whale groups as western Dixon Entrance" (2017).

West Coast transient (Bigg's) killer whales are designated as threatened by COSEWIC (COSEWIC 2008), are listed as threatened on Schedule 1 of SARA (Government of Canada 2022), and are provincially red-listed (BC CDC 2022b). Unlike northern resident killer whales, transient killer whales feed exclusively on marine mammals (Ford et al. 1998; Baird 2001b; Barrett-Lennard and Ellis 2001). Similar to the northern resident population, transient killer whales have a small population size with a low potential rate of increase, but since the mid-1990s, they have been experiencing a steady growth rate of 2% per year, which is likely the result of a stable prey base of pinnipeds and small cetaceans (Baird 2001b; DFO 2007; COSEWIC 2008). In 2018, the West Coast population consisted of roughly 381 individuals and the population has been consistently growing since the 1970's (Towers et al. 2019).

Transient killer whales are encountered year-round in the coastal waters of BC (Ford and Ellis 1999) and are found along the exposed outer coast and the protected inshore waters (e.g., channels, straits, and inlets) (Ford et al. 2013b). Transient killer whales frequent BC waters, with a range extending from Oregon State to Glacier Bay, Alaska (DFO 2007; Ford and Ellis 1999; Ford et al. 2013b, Ford 2014).

Transient killer whales are highly mobile and tend to utilize much of their overall population range. Still, many individuals demonstrate site fidelity, repeatedly returning to particular coastal regions (Ford et al. 2013b). Gained knowledge of the area might give them a hunting advantage (DFO 2007). Transient killer whales move through areas within their range relatively quickly, unlike resident

killer whales that might remain in an area for an extended period of time due to salmon runs. These quick transits are likely the result of highly mobile and evasive marine mammal prey (DFO 2007).

Unlike northern resident killer whales, transient killer whale travels in smaller groups, produces clicks less often, and tends to be acoustically quiet, relying on stealth to locate its marine mammal prey (Barrett-Lennard et al. 1996; Deecke et al. 2005; DFO 2007; Ford and Ellis 1999; Ford et al. 2013b). Bigg's killer whales have a small variety of known calls without significant variations (Deecke et al. 2005; Ford et al. 2013b).

Transient killer whales do not have any designated critical habitat; however, Ford et al. postulate that all nearshore habitats in BC (within 3 km from shore) constitute areas that meet the requirements of critical habitat for this ecotype (2012). This includes coastal Haida Gwaii, the Portland Inlet, nearly all of Chatham Sound, and portions of the Hecate Strait within the Marine Resources Study Area. There are no DFO important areas for this ecotype within the Marine Resources Study Area.

Northeast Pacific offshore killer whales are designated as threatened by COSEWIC, are listed as threatened on Schedule 1 of SARA (Government of Canada 2022), and are provincially red-listed (BC CDC 2022b). Like resident killer whales, offshore killer whales are believed to be fish eaters but also shark specialists (COSEWIC 2008). The population of offshore killer whales is believed to be relatively stable and comprised of roughly 300 individuals (Ford et al. 2014).

This ecotype has a larger acoustic repertoire and is typically more vocal than northern residents, however, it is known to produce fewer clicks for the purpose of echolocation than other ecotypes (DFO 2018h).

Northeast Pacific offshore killer whales have been encountered frequently in coastal waters ranging from Alaska south to Mexico, however, 70% of their acoustic encounters have been documented in BC (DFO 2018h). This ecotype is believed to have the widest range of any killer whale ecotype in the North Pacific (DFO 2018h). As its name suggests, offshore killer whales are found less commonly in nearshore environments and have a strong preference for offshore pelagic environments in deeper waters (Ford et al. 2014). Due to this habitat preference, offshore killer whales are the least studied of the ecotypes. In recent years, an increasing trend of offshore killer whales being found in nearshore environments has been the cause of some concern. When found in nearshore environments, this ecotype often remains near the heads of inlets for extended periods of time, though the purpose for this behaviour is not known (Ford et al. 2014).

This ecotype does not have any designated critical habitat or DFO important areas within the Marine Resources Study Area.

Harbour Porpoise

Harbour porpoises are designated as special concern by COSEWIC (COSEWIC 2016), are listed as special concern on Schedule 1 of SARA (Government of Canada 2022), and are provincially blue-listed (BC CDC 2022b). Limited information on population trends for harbour porpoises is available because they tend to avoid vessels, making them difficult to document. An estimated 6,600 to 8,000 harbour

porpoises occupy the waters of BC; of these, approximately 2,500 to 3,500 are in the Queen Charlotte Basin (Best and Halpin 2011).

Harbour porpoises can be observed year-round along the BC coast, generally in shallow waters (depths ≤ 200 m) close to shore (< 20 km), although some observations have been made in deeper offshore waters (Baird 2003; DFO 2009c; Ford et al. 2010a). Harbour porpoises are not believed to migrate; however, seasonal changes in abundance have been documented, with the possible movement of porpoises to deeper, offshore waters during winter (Carretta et al. 2009). They are primarily sighted around Vancouver Island, Haida Gwaii, and mainland inlets (Ford et al. 2010a; Best and Halpin 2011).

Harbour porpoises are sensitive to human activities, particularly the continued development and use of their prime habitat. They are extremely shy and easily displaced by underwater noise, thus are rarely seen in highly developed areas (Baird 2003; Embling et al. 2010). Harbour porpoises are also known to be impacted by other anthropogenic activities such as vessel traffic, pollution, and bycatch in salmon gillnet fisheries, dogfish drift gillnet fishery, hake and salmon trawl fisheries (Baird 2003). Harbour porpoises are in the high-frequency functional hearing group (NOAA 2013). Their narrow-band high-frequency echolocation clicks assist harbour porpoises in navigating, communicating, orienting, and hunting (Villadsgaard et al. 2006; Clausen et al. 2010). Harbour porpoise echolocation clicks have a peak frequency range of 130–145 kHz and a mean source level of 191dB re 1µPa at 1 m (Villadsgaard et al. 2006), with a relatively constant inter-click interval of 60 µs (Teilmann et al. 2002; Villadsgaard et al. 2006).

No EBSAs or DFO important areas have been identified within the Marine Resources Study Area as important for harbour porpoises (Rubidge et al. 2018).

Recorded BCCSN sightings of harbour porpoises within the Marine Resources Study Area are abundant and include sightings near the mouth of Portland Inlet, off the south coast of the Dundas Islands, and a significant number of sightings on the south coast of Digby Island. Additionally, there are a large number of sightings of harbour porpoise throughout the Marine Resources Study Area, with the most sightings in and around Prince Rupert Harbour and off the coast of Port Edward (Figure 3.4–11).

PRISMM sightings of harbour porpoises include 246 sightings totaling 403 individuals, which were mostly observed in the North Coast stratum (Wright et al. 2021). Due to limited sightings in the Offshore stratum, PRISMM data concludes there is no abundance of harbour porpoise in the Offshore stratum (Wright et al. 2021). Conversely, abundance in the North Coast stratum is estimated at 1,314 individuals (Wright et al. 2021). Within the Marine Resources Study Area, the PRISMM study suggests the highest density of harbour porpoise at the mouth of Portland Inlet, Dogfish Bank (Chatham Sound off the northeast point of Haida Gwaii), and northern Hecate Strait, with an estimated density of one to two individuals per km^2 (Wright et al. 2021). Additionally, PRISMM analysis suggests that Dixon Entrance and Portland Inlet may constitute important areas for harbour porpoise (Wright et al. 2021).

Dall's Porpoise

Dall's porpoise are designated as not at risk by COSEWIC (Government of Canada 2022), are not listed under SARA (Government of Canada 2022), and are yellow-listed in BC (BC CDC 2022b). Abundance estimates of Dall's porpoise in the nearshore waters of BC range from 5,500 to 6,200 individuals. Of these, 4,000 to 4,500 individuals are estimated to occur in the Queen Charlotte Basin (Best and Halpin 2011).

Dall's porpoise are endemic to the North Pacific and is abundant year-round along the coast of BC (Jefferson 1990). This species is often observed in deep water (700 m average depth) in both nearshore and offshore areas and frequently in groups of four to five individuals (Ford et al. 2010a). Predictions of distribution suggest that their abundance will be higher in areas east of Haida Gwaii and central Hecate Strait (Best and Halpin 2011). Dall's porpoise demonstrates a seasonal population distribution shift, with an increase in offshore abundance in the summer, likely in response to prey availability (Jefferson 1990).

Dall's porpoises use echolocation to detect prey and navigate. Their echolocation signals tend to be narrow-band high-frequency sounds (i.e., clicks above 100 kHz in energy) with a long signal duration; peak frequency range is 120–160 kHz lasting 180–400 µs (Nakamura et al. 1998).

There are no DFO important areas or EBSAs identified as significant for Dall's porpoise within the Marine Resources Study Area (Rubidge et al. 2018).

Recorded BCCSN sightings of Dall's porpoise within the Marine Resources Study Area are common and include sightings near the mouth of Portland Inlet, Chatham Sound, and the Hecate Strait (Figure 3.4–11).

PRISMM data on Dall's porpoise include 287 sightings totaling 845 individuals, which were mostly observed in the Offshore stratum (Wright et al. 2021). Based on their model, DFO estimated Dall's porpoise abundance in the Offshore stratum at 17,934 individuals and North Coast stratum abundance of 5,178 individuals (Wright et al. 2021). Within the Marine Resources Study Area, the majority of Dall's porpoise PRISMM sightings occurred at the mouth of Portland Inlet; however, there were also sightings off the south coast of the Dundas Islands and off the west coast of Finlayson Island (Wright et al. 2021). Data from the PRISMM study suggests Dall's porpoise abundance within the Marine Resources Study Area to be highest outside the mouth of Portland Inlet with the highest density estimated at one to two individuals per km^2 (Wright et al. 2021).

Pacific White-Sided Dolphin

Pacific white-sided dolphin are designated not at risk by COSEWIC (Government of Canada 2022), are not listed under SARA (Government of Canada 2022), and are yellow-listed in the province of BC (BC CDC 2022b). The Pacific white-sided dolphin is the most abundant pelagic species of dolphin in these waters (Stacey and Baird 1991; Black 2009). An estimated 22,000 to 32,500 individuals inhabit the

Pacific waters of BC; of these, 20,000 to 29,000 individuals occur in Queen Charlotte Basin (Best and Halpin 2011).

Pacific white-sided dolphins are year-round residents of BC's pelagic and coastal waters (Ford et al. 2010a). They are a highly social species, found in large groups that can exceed 1,000 individuals, but tend to be observed in smaller groups in the nearshore waters (Heise et al. 2007; Ford et al. 2010a). Pacific white-sided dolphins do not migrate but seasonal shifts in distribution have been recorded, with dolphins occupying offshore waters during the spring and summer, and inshore waters during the fall through spring (Stacey and Baird 1991). Rechsteiner (2012) found that these seasonal movements from offshore to nearshore waters tend to be concurrent with BC herring spawning times on the BC coast.

Pacific white-sided dolphins are a highly vocal species with a wide repertoire of sounds. These include echolocation clicks with a frequency range of 20 to over 100 kHz, burst pulses, and buzzes used for foraging and communication. Pacific white-sided dolphins are in the MF functional hearing group, with hearing between 150 Hz to 160 kHz (NOAA 2015), but with greatest sensitivities from 2 to 128 kHz for sound levels less than 90 dB re 1µPa (Tremel et al. 1998).

There are no DFO important areas or significant EBSAs for Pacific white-sided dolphin within the Marine Resources Study Area (Rubidge et al. 2018).

Recorded BCCSN sightings of Pacific white-sided dolphin within the Marine Resources Study Area are relatively common throughout Chatham Sound and Hecate Strait (Figure 3.4–11).

Mysticetes

Humpback Whale

Humpback whales are designated special concern by COSEWIC (COSEWIC 2011c), are listed as special concern on Schedule 1 of SARA (Government of Canada 2022), and are provincially blue-listed (BC CDC 2022b). In 2006, approximately 18,000 to 22,000 humpback whales were estimated to occupy the North Pacific (Calambokidis et al. 2008; Ford et al. 2009; Barlow et al. 2011), of which up to approximately 3,900 humpback whales regularly occurred in BC waters (Rambeau 2008). An estimated 1,000 to 1,400 individuals occur in Queen Charlotte Basin (Best and Halpin 2011).

Humpback whales are globally distributed and can be observed in a wide variety of marine habitats, from fjords to offshore areas (Ford et al. 2010a). They generally spend the winter months breeding in warm low-latitude waters, such as Hawaii and Mexico (Calambokidis et al. 2008), and migrate to high latitudes to feed from spring to fall (Ford et al. 2010a). In BC waters, they are most abundant from May to October (Rambeau 2008), although some humpback whales are considered to be year-round residents.

Humpback whales are vocal animals, producing a wide variety of sounds. These vocalizations include megapclicks, with peak frequencies of approximately 800 Hz and 1,700 Hz (Stimpert et al. 2007), and a variety of sounds, including grunts and moans, with frequencies ranging from 20 Hz to 2,000 Hz and source levels from 162 to 192 dB re 1 µPa (Thompson et al. 1986). When singing, humpback whales may

hear frequencies as high as 24 kHz and produce source levels from 151 to 173 dB re 1 µPa (Au et al. 2006).

Humpback whales have two important DFO areas within the Marine Resources Study Area. These DFO important areas were identified as significantly important for humpback whale feeding activities (Rubidge et al. 2018). The first of the two humpback whale DFO important areas extends from Portland Inlet out past Dundas Island, south to Porcher Island (Rubidge et al. 2018). The second DFO important area begins to the northeast of Haida Gwaii and covers the entirety of the north coast of the island (Rubidge et al. 2018). Within the Marine Resources Study Area, the Chatham Sound, McIntyre Bay, and Shelf Break EBSAs have been designated important EBSAs for humpback whale feeding (Rubidge et al. 2018).

Recorded BCCSN sightings of humpback whales within the Marine Resources Study Area are the most numerous of the baleen whales. Sightings include a significant number of sightings in mid-Chatham Sound and a large number of sightings off the coast of Digby Island and into Port Edward. Sightings of humpback whales within the Marine Resources Study Area are common and widespread and vastly outnumber BCCSN sightings of other Mysticetes in the area. The densest areas of reported humpback whale sightings include Port Edward, and off the north coast of Stephens Island. There are also sporadic sightings through Hecate Strait and Dixon Entrance (Figure 3.4–12).

PRISMM sightings of humpback whales include 767 sightings totaling 1,145 individuals, which were mostly observed in the offshore stratum (Wright et al. 2021). Based on sightings, DFO estimated humpback whale abundance in the offshore stratum as 4,935 individuals and north coast stratum abundance of 1,816 individuals (Wright et al. 2021). Within the Marine Resources Study Area, the PRISIMM study estimated the greatest density of humpback whale sightings at the mouth of Portland Inlet (Wright et al. 2021). Data from the PRISMM study suggests the density of humpback whales within the Marine Resources Study Area as one individual per 25 km^2 at its densest in Chatham Sound (Wright et al. 2021). The abundance estimate of humpbacks from the PRISMM study suggests an increase in the population from either population growth or the immigration of new individuals (Wright et al. 2021).

Fin Whale

Fin whales are designated as special concern by COSEWIC (COSEWIC 2019), are listed as threatened on Schedule 1 of SARA (Government of Canada 2022), and are provincially red-listed (BC CDC 2022b). The fin whale was one of the most abundant baleen whales on the BC coast before commercial whaling in the 1900s significantly impacted the population, with pre-whaling abundance estimates of 40,000 to 45,000 whales (COSEWIC 2019; Ford et al. 2010a). An estimated 250 to 750 individuals are thought to remain in BC coastal waters, most of which occur in the Queen Charlotte Basin (Best and Halpin 2011).

Although the population structure of fin whales in the eastern North Pacific is unclear, they are known to frequent Canadian Pacific waters year-round, with most sightings recorded during the summer months (Gregr et al. 2006). Fin whales are suspected to migrate between high-latitude summer feeding grounds and low-latitude winter breeding grounds (Gregr et al. 2000, 2006; Mizroch et al. 2009). In summer,

fin whales likely enter BC waters to feed along the shelf edge and on-shelf waters, taking advantage of consistent euphausiid (shrimp-like, planktonic crustaceans) aggregations (Flinn et al. 2002; COSEWIC 2019). Gregr and Trites conclude that coastal waters are important for fin whales, primarily in July and August (2001).

Fin whales are classified in the low-frequency functional hearing group (NOAA 2015). They produce distinct, geographically-variable low-frequency, high-intensity, short sounds (Širovic et al. 2007; Castellote et al. 2012). Their most common sounds include down sweep calls ranging from approximately 28 to 15 Hz (Watkins et al. 1987 cited in Castellote et al. 2012), with source levels between 159 and 184 dB re: 1µPa at 1 m (Watkins 1981 cited in Šorvić et al. 2007; Watkins et al. 1987 cited in Šorvić et al. 2007; Charif et al. 2002).

Fin whale has one large DFO important area within the Marine Resources Study Area. This DFO important area was identified as a significantly important aggregation area for the species (Rubidge et al. 2018). The fin whale DFO important area in the Marine Resources Study Area covers a large offshore area to the north of Haida Gwaii from the middle of the Hecate Strait out to the western end of the Marine Resources Study Area past Haida Gwaii (Figure 3.4–10).

Learmonth Bank EBSA has been identified as important for fin whale aggregations within the Marine Resources Study Area. Additionally, the Shelf Break EBSA has been identified as important for fin whale (Figure 3.4–3) (Rubidge et al. 2018).

Recorded BCCSN sightings of fin whales within the Marine Resources Study Area include a singular sighting off the west coast of Digby Island. Sightings of fin whales within the Marine Resources Study Area are sporadic with the only other sighting off the southwest coast of Digby Island (Figure 3.4–12).

PRISMM sightings of fin whales include 235 sightings totaling 357 individuals, which were mostly observed in the offshore stratum (Wright et al. 2021). Based on their model, DFO estimated fin whale abundance in the offshore stratum as 2,732 individuals and in the north coast stratum as 161 individuals (Wright et al. 2021). Within the Marine Resources Study Area, only a single fin whale sighting occurred off the north coast of Haida Gwaii and Graham Island (Wright et al. 2021). Data from the PRISMM study suggests fin whale abundance to be low within the Marine Resources Study Area, with the highest density estimated at 0.2 individuals per 25 km^2 off the north coast of Graham Island (Wright et al. 2021).

Minke Whale

Minke whales are designated not at risk by COSEWIC (COSEWIC 2006a), are not listed on Schedule 1 of SARA (Government of Canada 2022) and are provincially yellow-listed (BC CDC 2022b). In BC, minke whales' most recent abundance estimate was 250 to 720 individuals in nearshore waters (Best and Halpin 2011), with primary sightings in Hecate Strait (Ford et al. 2010a).

Minke whales occupy both coastal and offshore waters, but tend to occur primarily in shallower, nearshore waters (Shirihai and Jarrett 2006; Perrin and Brownell Jr. 2009; Ford et al. 2010a). In the winter, the northeastern Pacific minke whale frequents warmer waters in lower latitudes

(Dorsey et al. 1990; Shirihai and Jarrett 2006; Zerbini et al. 2006; Perrin and Brownell Jr. 2009; Towers et al. 2013), as evidenced by the presence of ecological markers on individual animals (e.g., scars created by warm water species) (Towers et al. 2013). Minke whales tend to move north in the summer to forage (Dorsey et al. 1990; Shirihai and Jarrett 2006; Zerbini et al. 2006; Perrin and Brownell Jr. 2009; Towers et al. 2013) and show intra-annual movement within BC waters (Towers et al. 2013). They can be found in the waters of BC year-round, but are more prevalent in the spring, summer, and fall (Dorsey et al. 1990; Ford et al. 2010a; Towers et al. 2013), with the highest rates of sightings in July and August (Towers et al. 2013; Ford 2014).

Minke whales are in the low-frequency cetacean functional hearing group (NOAA 2015). They are capable of producing a wide range of sounds, including grunts and thumps (Gedamke et al. 2001; Perrin and Brownell Jr. 2009; Oswald et al. 2011), which may be seasonally and geographically specific. In the North Pacific, minke whales produce a “boing” sound, which has been recorded seasonally from October to February (Rankin and Barlow 2005; Oswald et al. 2011; Delarue et al. 2013). The “boing” sound consists of a pulse sound centered at 1.4 kHz and a source level over 150 dB re 1µPa at 1 m (Gedamke et al. 2001).

No DFO important areas or EBSAs within the Marine Resources Study Area have been designated as important for minke whales (Rubidge et al. 2018).

Recorded BCCSN sightings of minke whales within the Marine Resources Study Area include two sightings off the north and northwest coast of Stephens Island as well as one sighting off the west coast of Metlakatla, and two sightings off the southwest coast of Port Edward (Figure 3.4–12).

Grey Whale

There are two ecotypes of grey whales in BC, which are separated by habitat preference and distribution (COSEWIC 2017). The east North Pacific population (composed of the North Pacific migratory population and the Pacific Coast Feeding Group (PCFG), and the Western Pacific population. These are discussed separately below.

Within the Marine Resources Study Area, Learmonth Bank and Shelf Break EBSAs have been identified as important EBSAs for grey whale migration (Figure 3.4–3) (Rubidge et al. 2018). Grey whale also has two designated DFO important areas within the Marine Resources Study Area; one along the east coast of Haida Gwaii, and one along the west (Figure 3.4–10).

BCCSN sightings of grey whales within the Marine Resources Study Area include a handful of sightings near the coast of the mainland from Prince Rupert to Lax Kw’alaams (Figure 3.4–12).

Nineteenth century pre-whaling estimates of the eastern North Pacific grey whale differ widely—from 15,000–20,000 whales to 30,000–40,000 whales (Jones and Swartz 1984). According to multiple models, commercial whaling reduced the grey whale population to a few thousand individuals (Jones and Swartz 2009). In 2016, the abundance estimate for the eastern North Pacific grey whale was roughly 27,000 individuals (NOAA 2021b).

Grey whales are in the low-frequency functional hearing group (NOAA 2015). They produce a variety of calls, with a pulsing sound being the most prevalent vocalization (Dahlheim 1987). These vocalizations may be used for reproduction, communication among individuals, or during migration (Watkins et al. 1987; Crane and Lashkari 1996). The frequency of a grey whale call ranges from roughly 20 to 2000 Hz, but most calls contain significant energy below 500 Hz (Dahlheim 1987; Stafford et al. 2007). Sightings of grey whales within the Marine Resources Study Area include roughly 10 sightings, primarily off the coast between Lax Kw'alaams and Metlakatla as well as off the southwest coast of the Dundas Islands.

The North Pacific migratory population of grey whales is designated as not at risk by COSEWIC (COSEWIC 2017), listed as not at risk on Schedule 1 of SARA (Government of Canada 2022), but is provincially blue-listed (BC CDC 2022b). The majority of the eastern North Pacific population of grey whales migrates between their summer feeding grounds in the Bering, Chukchi, and Beaufort Seas and their winter breeding grounds in Baja, California (Frasier et al. 2011; Ford et al. 2013a). The coastal waters of BC are part of the migratory corridor for grey whales, with non-breeding animals (i.e., pregnant females, mature males, and juveniles) migrating through BC from approximately March through April (Ford et al. 2013a). Ford et al. (2013a) determined that these individuals preferentially migrate along the eastern side of Hecate Strait, waters adjacent to and overlapping with the Marine Resources Study Area, with some individuals recorded along the strait's western side. Migration of cow-calf pairs occurs later (April through May), and approximately 90% travel within 200 m of the shore, alone or in pairs (Jones and Swartz 2009; Ford 2014). Ford et al. (2013a) note that the exact migration route for cow-calf pairings through BC remains undetermined. Migration in the opposite direction towards wintering ground occurs in the fall (NOAA 2021b).

The Pacific Coast Feeding Group (**PCFG**) of grey whales is designated endangered by COSEWIC (COSEWIC 2017), is not on Schedule 1 of SARA (Government of Canada 2022) and is provincially blue-listed (BC CDC 2022b). These whales include approximately 200 individuals in the eastern North Pacific who do not migrate to the Bering Sea and northward in summer but instead feed along the coasts of Washington state, USA, and BC (Calambokidis et al. 2002). The PCFG is genetically distinct insofar as there is a consistent pattern of mitochondrial DNA differentiation (Frasier et al. 2011). The presence of PCFG whales along the entire west coast of Vancouver Island is well documented (Darling et al. 1998; Dunham and Duffus 2001, 2002), and they are also often seen along the north coast of Vancouver Island from Cape Scott to Cape Sutil, as well as along the BC mainland from Shelter Bay to Cape Caution (Deecke 1996; COSEWIC 2017; Ford 2014).

Reports of feeding grey whales in the summer months come from the west coasts of Calvert Island as well as Dundas and Aristazabal Islands and known PCFG whales have been photographed in the McMullin Group, as well as Sitka Sound, southeastern Alaska (Deecke 1996, 2003; Calambokidis et al. 2002; COSEWIC 2017). PCFG whales have also been sighted in the inside waterways of BC, primarily in Boundary Bay (Deecke 1996; Ford 2014), and occasionally in Haro Strait and the Strait of Georgia (COSEWIC 2017).

The Western Pacific population of grey whales is designated endangered by COSEWIC (COSEWIC 2017), is not on Schedule 1 of SARA (Government of Canada 2022) and is provincially blue-listed (BC CDC 2022b). The Western Pacific population of grey whales occur primarily in waters off Sakhalin Island, Russia during the summer autumn period and migrate to unknown waters during winter-spring, likely the South China Sea (COSEWIC 2017). Some of the western grey whales that spend the summer and autumn in Russia migrate across the Okhotsk and Bering seas and the Gulf of Alaska, joining the eastern migration stream in BC and Washington State to overwinter in Mexico (COSEWIC 2017).

Pinnipeds

Steller Sea Lion

Steller sea lions are designated as special concern by COSEWIC (COSEWIC 2013a), are listed as special concern on Schedule 1 of SARA (Government of Canada 2022), and are provincially blue-listed (BC CDC 2022b). Best estimates for the abundance of this species in BC is approximately 20,000 to 28,000 individuals (DFO 2008), with 2,500 to 4,000 in the Queen Charlotte Basin (Best and Halpin 2011).

Steller sea lions are distributed throughout southeastern Alaska, BC, Washington, and Oregon. Within Canada there are three main breeding areas for Steller sea lions, off the southern tip of Haida Gwaii (rookeries on the Kerouard Islands), off the northern mainland coast (rookeries on North Danger Rocks), and off the northeastern tip of Vancouver Island (rookeries on Maggot, Triangle, and Sartine Islands) (COSEWIC 2003). In the Marine Resources Study Area, four non-breeding haulout locations exist in Hecate Strait and Dixon Entrance (Figure 3.4–10) (DFO 2022n). Steller sea lion is considered non-migratory but can disperse considerable distances from their breeding sites (COSEWIC 2013a). The offshore distribution of the species appears to have a seasonal element, with individuals foraging within 60 km of the shore in the summer, while ranging approximately 200 km in the winter (DFO 2010a). Steller sea lions are part of the Otariidae family (eared seals) of pinnipeds, which has a functional hearing range of 100 Hz to 40 kHz (NOAA 2013). They are highly vocal with a wide repertoire of sounds, such as belches, growls, and snorts, produced in the air and underwater (Kastelein et al. 2005). In-air vocalizations are important at crowded rookeries; mature males vocalize to maintain breeding territories, while females and pups vocalize to locate one another at the rookeries (Muslow and Reichmuth 2010). Female Steller sea lion calls range from 30 Hz to 3 kHz in frequency, with peak frequencies between 150 Hz to 1 kHz (Campbell et al. 2002). Steller sea lions hearing sensitivity falls between 1–25 kHz in water, with the sensitivity to sound decreasing outside this range (Kastelein et al. 2005).

Steller sea lions have been historically harvested in Treaty fisheries with an average of 82 individuals taken per year between 2010 and 2020 (NFWD 2021).

Within the Marine Resources Study Area, no EBSAs have been designated as important for Steller sea lion, but Rubidge et al. found that the Shelf Break EBSA was likely important for this species (2018). Steller sea lion has two DFO important areas within the Marine Resources Study Area (Rubidge et al. 2018). Both DFO important areas are relatively large; the western DFO important area ranges from Old Massett on Graham Island to the western edge of the Marine Resources Study Area off

the northwest coast of Haida Gwaii (Rubidge et al. 2018). The eastern DFO important area begins north of Metlakatla and extends south beyond the southern terminus of the Marine Resources Study Area. It also extends west, encompassing nearly the entire width of the Hecate Strait between these points (Figure 3.4–10) (Rubidge et al. 2018).

California Sea Lion

California sea lions are designated as not at risk by COSEWIC, are not listed on Schedule 1 of SARA (Government of Canada 2022), and are provincially yellow-listed (BC CDC 2022b). They are widely distributed in the Pacific from Mexico to Alaska (Maniscalco et al. 2004). California sea lion breeding grounds in the Pacific include areas off the coast of Mexico and California; however, individuals of this species are also known to inhabit areas off the coast of Japan and the Galapagos Islands (Maniscalco et al. 2004). California sea lions occur frequently in southern BC, though they are believed to extend their feeding range further north (Bigg 1988). California sea lions are considered a coastal predator and are found in both coastal nearshore and pelagic offshore environments (Rosas-Hernandez et al. 2019). The California sea lion population faces a number of historical and existing threats. This species was originally hunted for oil and hides and also had its populations significantly impacted by culling to reduce its interference with fisheries (Helling 1984). The rise in sea surface temperature has also caused challenges for this species. DeLong et al. found that young California sea lion survivability decreases by 50% for each 1°C temperature increase in sea surface temperatures (2017). There are no designated DFO important areas or important EBSAs for this species within the Marine Resources Study Area (Rubidge et al. 2018).

Harbour Seal

Harbour seals are designated as not at risk by COSEWIC (Government of Canada 2022), are not listed on Schedule 1 of SARA (Government of Canada 2022), and are provincially yellow-listed (BC CDC 2022b). Harbour seals are frequently observed along the BC coast. After undergoing exponential increases between the 1970s and 1980s, the population appears to have stabilized, displaying moderate growth through the 1990s (DFO 2010b). During a survey of the Queen Charlotte Basin, harbour seals were recorded as the most frequently sighted marine mammal, with abundance estimates from 17,400 to almost 25,000 individuals, with an estimated 2,500 to 4,000 seals in the Queen Charlotte Basin (Best and Halpin 2011).

Harbour seals haul out on rocks, islets and islands, and sand bars along the BC coast. Some of these haulout sites are also used for pupping (Heise et al. 2007). There are a large number of established haulout locations across the Marine Resources Study Area (Figure 3.4–10) (DFO 2022o). Harbour seals are known to undergo extensive movements; they are not considered migratory and will often return repeatedly to specific sites or areas, demonstrating considerable site fidelity (Baird 2001a). They are typically observed in nearshore waters (Best and Halpin 2011). In the water, they are typically solitary or occur in small groups, whereas they occur in larger groups on land (Baird 2001a).

Harbour seals are part of the Phocidae family (earless or true seals) of pinnipeds, which has a functional hearing range of 75 Hz to 100 kHz (NOAA 2013). Male harbour seals vocalize underwater to attract mates and compete against other male suitors by producing an underwater roar (Van Parijs et al. 2003). The underwater roar is a broadband pulsed vocalization, with major sound energy between 0.4 and 2 kHz, lasting between 1 to 10 seconds (Kastelein et al. 2009). Harbour seal hearing sensitivity falls between 0.5 to 40 kHz in water, with the sensitivity to sound decreasing outside this range (Kastelein et al. 2009).

Seals are harvested in Treaty fisheries by Nisga'a First Nation, with an average of 19 individuals harvested from 2015 to 2019 (NFWD 2021).

No DFO important areas or EBSAs within the Marine Resources Study Area have been designated important for harbour seal.

Northern Fur Seal

Northern fur seals (*Callorhinus ursinus*) are designated as threatened by COSEWIC (COSEWIC 2010), are not listed on Schedule 1 of SARA (Government of Canada 2022), but are provincially red-listed (BC CDC 2022b). The population of northern fur seals was estimated at roughly 3 million in 1867, however that quickly declined with the onset of commercial harvesting of the species for its pelt, which reduced the population by roughly 90% by the year 1910 (Trites 1992). By the 1940s, the population had recovered significantly to roughly 1.5 million animals; however, a cull of females between 1956 and 1968 led to a major population crash and subsequent long-term general decline due to juvenile and female mortality (Trites 1992). Most recent estimates (2004) put the global population of northern fur seals at around 630,000 animals (COSEWIC 2010).

The northern fur seal is widely distributed in the North Pacific and Bering Sea. During the summer, they are commonly found at four main breeding grounds on the Pribilof (roughly 75% of the total population), Commander, Tuleny, and Kuril Islands, as well as smaller haulouts on the Aleutian, Robben, and San Miguel Islands (ADFG 2008; Horimoto et al. 2016; COSEWIC 2010). A large shift in fur seal distribution occurs in late autumn as fur seals from the North Pacific leave their breeding grounds in search of overwintering habitat (Horimoto et al. 2016). Through winter, the population splits and segregates based on age, gender, and location, with adult males spending time at higher latitudes, females spending more time along the coast, and juveniles spending the majority of the winter in the open ocean (Horimoto et al. 2016). Fur seals from the Pribilof and Aleutian Islands migrate to BC waters and overwinter along the coast of North America, while those from Tuleny Island and Kuril Islands overwinter off the coast of Japan (Horimoto et al. 2016). Fur seals rarely haul out on land during winter, but rather spend most of their overwintering at sea (Horimoto et al. 2016).

The northern fur seal belongs to the Otariidae family, which has a functional hearing range of 100 Hz to 40 kHz (NOAA 2013). Like other Otariids, northern fur seals use vocalizations for intraspecific competition, attraction of mates, and communication. Northern fur seal hearing sensitivity falls between 2–32 kHz in water, with the sensitivity to sound decreasing outside this range (NOAA 2018).

No designated important EBSAs exist for this species within the Marine Resources Study Area (Rubidge et al. 2018). Northern fur seal has one large DFO important area within the Marine Resources Study Area, which covers an area of the Hecate Strait southwest of Dundas Island to Stephens Island (Figure 3.4–10) (Rubidge et al. 2018).

Fissipeds

Sea Otter

Sea otters are designated as special concern by COSEWIC, are listed as special concern on Schedule 1 of SARA (Government of Canada 2022), and are provincially blue-listed (BC CDC 2022b). Unlike the other species discussed in this section, sea otters are typically found in shallow coastal waters 1 to 2 km from shore in areas less than 40 m deep (Nichol et al. 2020). Female sea otters display strong site fidelity and occupy small home ranges (Nichol et al. 2020). In the 1700s and 1800s, the sea otter was hunted globally to near extinction, with the remaining population severely fragmented (Kenyon 1969). In BC, large numbers of sea otters were harvested from the waters around Haida Gwaii (Maynard 1898 in Kenyon 1969). Harvesting of sea otters led to their extirpation in BC in the 1920s; however, they were reintroduced from Alaska into Checleset Bay beginning in 1969 and the population grew rapidly thereafter (Kenyon 1969; Bigg and MacAskie 1978). Today, established rafts of otters in BC are distributed along Vancouver Island and on the central mainland coast to Aristazabal Island (over 150 km from the Marine Resources Study Area). However, the range of the southeast Alaska population of sea otters includes Alaskan coastal waters in northern Dixon Entrance, and thus, while the potential for overlap with Project activities is unlikely, this species has been included here for completeness. There are no designated DFO important areas or important EBSAs for this species within the Marine Resources Study Area (Rubidge et al. 2018).

3.4.9.4 Offshore and Pelagic Waters of the Marine Resources Study Area

Many species of marine mammals are expected to primarily utilize the more offshore waters in the Marine Resources Study Area (i.e., Dixon Entrance and Hecate Strait); below is a high-level overview of 19 additional species that may be encountered these waters.

Table 3.4–6 Offshore and Pelagic Marine Mammal Species and their Conservation Status

Group	Common Name(s) (populations)	Nisg̲a'a Name(s)	Scientific Name	COSEWIC Status	SARA Schedule 1 Status	BC Status
Odontocetes (toothed whales)	Short-finned pilot whale	–	*Globicephala macrorhynchus*	Not at Risk	–	Unknown
	Baird's beaked whale	–	*Berardius bairdii*	Not at Risk	–	Unknown
	Stejneger's beaked whale	–	*Mesoplodon stejnegeri*	Not at Risk	–	Unknown
	Hubb's beaked whale	–	*Mesoplodon carlhubbsi*	Not at Risk	–	Unknown
	Cuvier's beaked whale	–	*Ziphius cavirostris*	Not at Risk	–	Unknown
	False killer whale	–	*Pseudorca crassidens*	Not at Risk	–	Accidental
	Striped dolphin	Jiixw (dolphin)	*Stenella coeruleoalba*	Not at Risk	–	Accidental
	Short-beaked common dolphin		*Delphinus delphis*	Not at Risk	–	Accidental
	Risso's dolphin		*Grampus griseus*	Not at Risk	–	Accidental
	Pygmy sperm whale	–	*Kogia breviceps*	Not at Risk	–	Accidental
	Dwarf sperm whale	–	*Kogia sima*	Data Deficient	–	Accidental
	Sperm whale	–	*Physeter macrocephalus*	Not at Risk	–	Blue
	Northern right-whale dolphin	–	*Lissodelphis borealis*	Not at Risk	–	Blue
Mysticetes (baleen whales)	Blue whale	–	*Balaenoptera musculus*	Endangered	Endangered	Red
	Sei whale	–	*Balaenoptera borealis*	Endangered	Endangered	Red
	North Pacific right whale	–	*Eubalaena japonica*	Endangered	Endangered	Red
Pinnipeds (seals and sea lions)	Northern elephant seal	Ilx (seal)	*Mirounga angustirostris*	Not at Risk	–	Red

Table 3.4–6 Offshore and Pelagic Marine Mammal Species and their Conservation Status

Group	Common Name(s) (populations)	Nisg̲a'a Name(s)	Scientific Name	COSEWIC Status	SARA Schedule 1 Status	BC Status
NOTES: SARA – *Species at Risk Act* COSEWIC – Committee on the Status of Endangered Wildlife in Canada COSEWIC/SARA Ranks: Extinct: A species that no longer exists. Extirpated: A species that no longer exists in the wild in Canada but occurring elsewhere. Endangered: A species facing imminent extirpation or extinction. Threatened: A species that is likely to become endangered if limiting factors are not reversed. Special concern: A species particularly sensitive to human activities or natural events. Data Deficient: A species that has insufficient scientific data to support a designation. BC Status: Red-listed: Any species or ecosystem that is at risk of being lost (extirpated, endangered, or threatened). Blue-listed: Any species or ecosystem that is of special concern. Yellow-listed: Any species or ecosystem that is apparently secure or secure. Unknown: Any species with extreme uncertainty about population size. Accidental: Any species that can occur infrequently and unpredictably outside their usual range in BC. –: Not listed						
SOURCES: Species at Risk Public Registry (Government of Canada 2022) BC Species and Ecosystems Explorer (BC CDC 2022a) *Nisg̲a'a* (Version 2.1) (First Peoples Heritage Language and Culture Council 2017) *Nisg̲a'a Fisheries Program: Final Report of Funded Projects* ([NFWD] 1997–2019)						

Offshore and Pelagic Odontocetes

Short-finned pilot whales are designated as not at risk by COSEWIC, are not listed on SARA Schedule 1 (Government of Canada 2022) and are provincially listed as unknown due to extreme uncertainty regarding population size (BC CDC 2021). This species is found in deep-water offshore areas and is typically only found as far north as Vancouver Island, though it has been observed as far north as the Alaskan peninsula, outside its normal range (Taylor et al. 2008a). Short-finned pilot whales are still fished off the coast of Japan, although catch numbers have declined significantly in recent years (Olsen 2009). There are no designated DFO important areas or important EBSAs for this species within the Marine Resources Study Area (Rubidge et al. 2018).

Baird's beaked whale are designated as not at risk by COSEWIC, are not listed on SARA Schedule 1 (Government of Canada 2022), and are provincially listed as unknown (BC CDC 2021). This species is primarily found near the continental slope and oceanic seamounts (Jeffersen et al. 1993). It is distributed throughout the temperate waters of the North Pacific as far north as the Bering Sea and Gulf of Alaska (Rice 1998). Baird's beaked whale is still harvested in limited numbers in Japan. Heavy boat traffic may also contribute to the disruption of migration routes used by this species (Reyes 1991). There are no designated DFO important areas or important EBSAs for this species within the Marine Resources Study Area (Rubidge et al. 2018).

Stejneger's beaked whales are designated as not at risk by COSEWIC, are not listed on SARA Schedule 1 (Government of Canada 2022), and are provincially listed as unknown (BC CDC 2021). This species is found along the west coast of North America ranging from central California up to the Bering Sea, and southwest to Japan (Pitman and Brownell 2020). Stejneger's beaked whale is particularly sensitive to entrapment in deep-water gillnets and fishing gear (Pitman and Brownell 2020). There are no designated DFO important areas or important EBSAs for this species within the Marine Resources Study Area (Rubidge et al. 2018).

Hubb's beaked whales are designated as not at risk by COSEWIC, are not listed on SARA Schedule 1 (Government of Canada 2022), and are provincially listed as unknown (BC CDC 2021). This species has been recorded along the west coast of Canada and the United States ranging from California to Prince Rupert (Rice 1998). Hubb's beaked whales have been reported to be the subject of harpoon-based fishing off the coast of Japan, but almost nothing is known of their existing abundance or population trends (Jefferson et al. 1993; 2008). There are no designated DFO important areas or important EBSAs for this species within the Marine Resources Study Area (Rubidge et al. 2018). BCCSN records a single sighting of Hubb's beaked whale in Chatham Sound within the Marine Resources Study Area in Chatham Sound (Figure 3.4–11).

Cuvier's beaked whales are designated as not at risk by COSEWIC, are not listed on SARA Schedule 1 (Government of Canada 2022), and are provincially listed as unknown (BC CDC 2021). This species is the most cosmopolitan of the beaked whales and is found around the globe with the exception of Arctic waters below 10°C (Carwardine 1995). Cuvier's beaked whale is known to inhabit the waters surrounding oceanic islands as well as nearshore in submarine canyons and deep coastal waters (Carwardine 1995). Cuvier's beaked whale appears to be especially sensitive to anthropogenic noise, with several historical mass strandings relating to naval sonar tests (Waring et al. 2001). There are no designated DFO important areas or important EBSAs for this species within the Marine Resources Study Area (Rubidge et al. 2018).

False killer whales are designated as not at risk by COSEWIC, are not listed on Schedule 1 of SARA (Government of Canada 2022), and are provincially listed as accidental (BC CDC 2021). This species is distributed equatorially around the globe and is primarily found within 50° latitude north and south (Jefferson et al. 1993). This species is also known to occur outside its normal range as far north as the Bering Sea (Carwardine 1995). False killer whale is found primarily in deep offshore and coastal waters at depths of less than 3000 ft (Baird et al. 2008). False killer whale has historically been harvested occasionally for food (Jefferson et al. 1993) and caught as by-catch (Yang et al. 1999). From 1965 to

1980, efforts to reduce false killer whale impacts on fisheries in Japan resulted in the hunting and death of over 900 individuals (Jefferson et al. 1993; Odell and McClune 1999). There are no designated DFO important areas or important EBSAs for this species within the Marine Resources Study Area (Rubidge et al. 2018).

Striped dolphin are designated not at risk by COSEWIC, are not listed on Schedule 1 of SARA (Government of Canada 2022), and are provincially listed as accidental (BC CDC 2021). This species is found worldwide in tropical and temperate waters; in the Pacific, they range from Argentina to the top of Washington state (Archer and Perrin 1999; Hammond et al. 2008). Striped dolphin are also known to occur outside its typical range, with records as far north as Greenland and the Faroe Islands (Syvertsen and Isaksen 1999). Historically, striped dolphin has been harvested globally for consumption and to scare them away from fishing areas (Reyes 1991). Pollution is also known to be a significant threat to striped dolphin populations in some areas. Studies from individuals captured in the Mediterranean found tissue levels of heavy metals, organochlorine compounds, and selenium high enough to cause adverse effects (Aguilar 2000). There are no designated DFO important areas or important EBSAs for this species within the Marine Resources Study Area (Rubidge et al. 2018).

Short-beaked common dolphin are designated as not at risk by COSEWIC, are not listed on Schedule 1 of SARA (Government of Canada 2022), and are provincially listed as accidental (BC CDC 2021). This species is distributed widely throughout the Pacific and Atlantic's temperate and tropical waters (Culik 2011). In the Pacific, short-beaked common dolphin is found ranging from Chile in the south, to southern BC in the north (Hammond et al. 2008; Evans 1994). This species is usually found at surface temperatures of 10 to 20°C and may follow warm water currents beyond its normal range (Carwardine 1995). It is known to occur over the continental shelf in offshore waters over 180 m (Carwardine 1995). Short-beaked common dolphin was historically hunted globally, notably in Peru where it is used for food; an estimated 15,000–20,000 were killed in 1993 (Culik 2011). This species is also one of the most common by-catch species globally and is frequently found in drift net and purse-seines (Culik 2011). Short-beaked common dolphin was also the subject of targeted culling in the Black Sea in an effort to reduce their effect on fisheries (Reyes 1991). Additionally, the global short-beaked common dolphin population is significantly impacted by overfishing of their prey species, and pollution of their habitats (Bearzi et al. 2005; Evans 1994). There are no designated DFO important areas or important EBSAs for this species within the Marine Resources Study Area (Rubidge et al. 2018).

Risso’s dolphin are designated as not at risk by COSEWIC, are not listed on Schedule 1 of SARA (Government of Canada 2022), and are provincially listed as accidental (BC CDC 2021). This species is found primarily between 60° north and south where surface waters are above 10° (Kruse et al. 1999). In BC, it has been sighted near Stuart Island, and are known to be found as far north as the Gulf of Alaska (Rice 1998). Risso’s dolphin is a pelagic species occurring offshore past the continental slope (Culik 2011). Risso’s dolphin distribution closely follows that of their prey species, which leads to patchy distribution in areas of upwelling and high productivity (Kruse et al. 1999). Risso’s dolphin has been regionally hunted commercially for food in both Sri Lanka and Japan, resulting in the depression of the local populations there (Kruse Et al. 1999). There are no designated DFO important areas or important EBSAs for this species within the Marine Resources Study Area (Rubidge et al. 2018).

Pygmy sperm whale are designated as not at risk by COSEWIC, are not listed on Schedule 1 of SARA (Government of Canada 2022), and are provincially listed as accidental (BC CDC 2021). This species is a widely distributed species that exists in tropical and temperate waters worldwide (Taylor et al. 2008b). In the Pacific, the pygmy sperm whale is primarily found in offshore habitats from Chile to the northernmost portion of Washington state (Taylor et al. 2008a). Despite never being commercially hunted, this species is known to be impacted by by-catch, pollution, and anthropogenic noise pollution (Kaufman 2005; Waring et al. 2007). There are no designated DFO important areas or important EBSAs for this species within the Marine Resources Study Area (Rubidge et al. 2018).

Dwarf sperm whales are listed as data deficient by COSEWIC, are not listed on Schedule 1 of SARA (Government of Canada 2022), and are provincially listed as accidental (BC CDC 2021). Dwarf sperm whales are known to occur over the continental slope and shelf in tropical and temperate waters worldwide (Rice 1998). In the Pacific, dwarf sperm whale is known to occur from Vancouver Island, south to Chile (Rice 1998). Caldwell and Caldwell (1989) postulate that dwarf sperm whale is likely found near the edge of the continental shelf in areas of high zooplankton biomass (Baumgartner et al. 2001). While records exist of mortality in this species due to ingestion of plastic bags, dwarf sperm whale has never been the subject of a significant fishery, and accidental capture data suggests this is a rare occurrence (Waring et al. 2007). There are no designated DFO important areas or important EBSAs for this species within the Marine Resources Study Area (Rubidge et al. 2018).

Sperm whales are designated as not at risk by COSEWIC, are not listed on Schedule 1 of SARA (Government of Canada 2021), and are provincially blue-listed (BC CDC 2021). Sperm whale is a cosmopolitan species with distribution spanning oceans across the globe and are typically found in areas of high productivity (Whitehead 2009). This species separates spatially based on sex, with females typically found far from shore over seamounts and near islands in waters over 1000 m deep (Whitehead 2009). Males tend to remain at higher latitudes in productive waters near deep sea canyons but can also be found in the Atlantic in shallow waters around 300 m deep (Whitehead 2009). Sperm whales have been hunted since the 1500s, with more intensive whaling beginning in the early 1700s, peaking in the 1950s when an estimated 25,000 sperm whales were killed per year (Whitehead 2009). While commercial whaling ceased in 1989, the population had already suffered significant depletion (Culik 2011). Sperm whales are also known to be prone to ship strikes due to their large size and “rafting behavior”, during which they remain at the surface for long periods of time between dives (Jacquet et al. 1998). Within the Marine Resources Study Area, the Shelf Break EBSA has been identified as important for sperm whales (Figure 3.4–3) (Rubidge et al. 2018). There are no DFO important areas for this species within the Marine Resources Study Area; however, there is a sperm whale DFO important area just outside the western boundary of the Marine Resources Study Area along the west coast of Haida Gwaii. Recorded BCCSN sightings of sperm whales within the Marine Resources Study Area are infrequent and limited to Hecate Strait (Figure 3.4–11).

Northern right-whale dolphin are designated as not at risk by COSEWIC, are not listed on Schedule 1 of SARA (Government of Canada 2022), and are provincially blue-listed (BC CDC 2021). This species is found in temperate and subarctic waters of the Pacific with a normal range of northern Mexico to Vancouver Island, BC (Hammond et al. 2008). This species is also known to extend its range north in

summer, evidenced by sightings as far north as the Gulf of Alaska near the Aleutian Islands (Carwardine 1995). Northern right-whale dolphin habitat typically includes deep offshore waters over the continental shelf in temperatures of 8–9°C. This species is also found in the nearshore around underwater canyons and in areas of deep nearshore water (Jefferson et al. 1994; Carwardine 1995). One of the largest challenges facing northern-right whale dolphin populations is by-catch mortality, which cost the global population 24–73% of its pre-exploitation size (Mangel 1993; Ferrero et al. 2002). There are no designated DFO important areas or important EBSAs for this species within the Marine Resources Study Area (Rubidge et al. 2018).

Offshore and Pelagic Mysticetes

Blue whales are designated as endangered by COSEWIC, are listed as endangered on Schedule 1 of SARA (Government of Canada 2022), and are provincially red-listed (BC CDC 2022b). Blue whales were among the earliest populations targeted by the whaling industry and suffered early population loss (Gregr et al. 2005). In the Northeast Pacific, the blue whale population appears to have stabilized and is in slow recovery despite significant depletion (Gregr et al. 2005; Surma and Pitcher 2015). The blue whale can be found in coastal and pelagic habitats in the Pacific and ranges from California through BC to Alaska (Gregr et al. 2005). Individuals of this species are known to undertake seasonal migrations, moving from low latitude overwintering to higher latitude feeding areas in the summer (Gregr et al. 2005). Due to their large size, the blue whale must ingest several tonnes of zooplankton on a daily basis (Sears and Calambokidis 2002). Warming sea surface temperatures can cause depression in zooplankton abundance and constitute a threat to the entirety of the population (Roemmich and McGowan 1995; Venrick et al. 1987). Within the Marine Resources Study Area, the Shelf Break EBSA has been designated as important for blue whales (Figure 3.4–3) (Rubidge et al. 2018). Blue whale also has one designated DFO important area, which spans the north coast of Haida Gwaii westward and south around the island's west coast (Figure 3.4–10).

Sei whales are designated as endangered by COSEWIC, are listed as endangered on Schedule 1 of SARA (Government of Canada 2022), and are provincially red-listed (BC CDC 2022b). Due to a lack of population data and reliable sightings, the sei whale range in the North Pacific is currently unknown (Gregr et al. 2005). Sei whales are known to occur more commonly in coastal waters where they opportunistically feed on zooplankton (Kawamura 1982). Like blue whales, sei whales migrate from low latitude overwintering sites to higher latitude feeding sites in the winter (COSEWIC 2013b). The Sei whale was hunted secondarily to the blue and right whales due to the sei whales' smaller size (DFO 2005); however, this species was not protected until 1976 and, though once the most abundant of baleen whales, sei whales are now considered rare in the Pacific (Gregr et al. 2005). The 2013 COSEWIC report determined that there are few, if any, mature individuals remaining in BC waters. There are no designated important EBSAs or DFO important areas for this species within the Marine Resources Study Area; however, there is a DFO important area just outside the western range of the Marine Resources Study Area off the west coast of Haida Gwaii (Rubidge et al. 2018).

North Pacific right whales are designated as endangered by COSEWIC, are listed as endangered on Schedule 1 of SARA (Government of Canada 2022), and are provincially red-listed (BC CDC 2022b). North Pacific right whale distribution information is extremely scarce due to the rarity of sightings in the Pacific; however, two individuals were sighted off the coast of BC (one near Haida Gwaii and the other off southwestern Vancouver Island) in 2013, confirming its range includes BC waters (Cetacean Research Program, Pacific Biological Station, DFO Pacific, unpublished data in COSEWIC 2015). The North Pacific right whale was hunted from the mid- to late-1800s, leading to a massive population decline from an estimated 11,000 to 37,000 animals to only a handful today (DFO 2011b). No right whales have been observed in Canadian waters since 1970 (Wada 1975) and best estimates place the population in the North Pacific at around 60 individuals (Wade et al. 2010). Right whales may be particularly vulnerable to ship strikes due to behaviors such as skim feeding, nursing, and mating, which occur at the surface (Laist et al. 2001). Between 1970 and 1989, at least 20% of the North Pacific right whales found dead exhibited ship strike injuries (Laist et al. 2001). Due to the limited size of the population, this species likely faces recovery challenges resulting from a lack of genetic diversity (LeDuc et al. 2012). There are no designated DFO important areas or important EBSAs for this species within the Marine Resources Study Area (Rubidge et al. 2018).

Offshore and Pelagic Pinnipeds

Northern elephant seal are designated as not at risk by COSEWIC, are not listed on Schedule 1 of SARA (Government of Canada 2022) but are provincially red-listed (BC CDC 2022b). This species is found only in the northern hemisphere, particularly in the east and central North Pacific (Le Boeuf et al. 2000). In the Pacific, they are found ranging from Mexico north to the eastern Aleutian Islands in Alaska (Le Boeuf and Laws 1994). Like most pinnipeds, the northern elephant seal splits its time between resting, mating, and molting on land at historic haulouts/rookeries and foraging in the open ocean for prey (Le Boeuf et al. 2000). La Boeuf et al. found that the northern elephant seal hunts along the continental margin offshore during large scale seasonal migrations (2000). Due to significant commercial harvest, the northern elephant seal was bordering on extinction by the late 1800s (Steward et al. 1994). Throughout the 1900s the remaining individuals began to recolonize areas previously abandoned and significant population growth occurred, leading to an existing population size of over 200,000 animals in the Pacific (Lowery et al. 2014). Despite the recovery success of the northern elephant seal, the effects of the once near extinct population contribute to a continuing lack of genetic diversity among present day populations (Hoelzel et al. 1993). There are no designated DFO important areas or important EBSAs for this species within the Marine Resources Study Area (Rubidge et al. 2018).

3.4.10 Sea Turtles

Sea turtles are pelagic marine reptiles that live in most oceans around the globe. Sea turtles live most of their lives in the ocean, but females return to the same beach where they were born to lay eggs (DFO 2022k). Sea turtles are of global conservation concern and many populations are still in a state of decline today due to anthropogenic impacts like pollution, poaching, bycatch, and entanglement in fishing gear (DFO 2022k). Canadian waters are home to five species of sea turtle, however only the leatherback sea turtle (*Dermochelys coriacea*) has the potential to overlap with the Marine Resources Study Area (DFO 2022k) (Table 3.4–7).

Table 3.4–7 Sea Turtle Species and their Conservation Statuses

Group	Common Name(s)	Nisg̲a'a Names	Scientific Name	COSEWIC Status	SARA Schedule 1 Status	BC Status
Sea Turtles	Leatherback sea turtle	–	*Dermochelys coriacea*	Endangered	Endangered	Red

NOTES:
SARA – *Species at Risk Act.*
COSEWIC – Committee on the Status of Endangered Wildlife in Canada.
COSEWIC/SARA Ranks:
Endangered: A species facing imminent extirpation or extinction.
BC Status:
Red-listed: Any species or ecosystem that is at risk of being lost (extirpated, endangered, or threatened).

SOURCES:
Species at Risk Public Registry (Government of Canada 2022)
BC Species and Ecosystems Explorer (BC CDC 2022a)
Nisg̲a'a (Version 2.1) (First Peoples Heritage Language and Culture Council 2017)
Nisg̲a'a Fisheries Program: Final Report of Funded Projects ([NFWD] 1997–2019)

The Leatherback sea turtle is listed as endangered by COSEWIC, on Schedule 1 of SARA (COSEWIC 2012), and is provincially red-listed (BC CDC 2022b). The Pacific population has suffered a considerable decline, with studies indicating a nesting population decline of over 95% (Lewison et al. 2004). Leatherback sea turtle distribution is wide-ranging globally, and they are typically found in temperate to tropical waters around the globe in the Pacific, Atlantic, and Indian Oceans (DFO 2017c). The extent of leatherback sea turtle use of coastal BC waters is relatively unknown, with only 126 confirmed sightings in BC between 1931 and 2009 (DFO 2006a). Females nest on low-latitude beaches; however, the rest of their lives are spent in the ocean. Leatherback sea turtles are not known to nest in Canada; however, data indicates individuals can complete significant migrations and regularly occur in cold temperate waters in high latitudes (Spaven et al. 2009).

Leatherback sea turtles are often referred to as gelatinivores because their diet consists solely of jellyfish and other gelatinous invertebrates like salps, sea squirts, and tunicates (DFO 2006a). Leatherback sea turtles are subject to a variety of predation through their different life stages. Eggs are often predated upon by pigs and feral dogs, while sea birds, fish, and some marine mammals hunt juveniles. Adults experience less predation but are still predated upon by large sharks and killer whales (DFO 2006a). Anthropogenic threats constitute the most significant source of leatherback sea turtle mortality as they are often victims of bycatch, marine debris, climate change, and nesting beach habitat loss (DFO 2006a).

Leatherback sea turtles are protected in Canada and are not legally fished in Canadian waters today. Historically, Indigenous groups along the coast of BC have been recorded utilizing leatherback sea turtles for food (Ellis and Swan 1981). Observations of leatherback sea turtles are minimal in western Canada, with most sightings occurring between July and September (Spaven et al. 2009). A handful of historical sightings have occurred within the Project Marine Resources Study Area, including one sighting in Chatham Sound and seven sightings off the northwest coast of Haida Gwaii (DFO 2014). Most of Chatham Sound and Portland Inlet areas are considered moderate to highly suitable foraging habitat for leatherback sea turtles (DFO 2014). McAlpine (2004) classifies the leatherback sea turtle in BC as an uncommon seasonal resident. Due to their infrequent use of BC waters and low population, the leatherback sea turtle is unlikely to be encountered by the Project. No important EBSAs for leatherback sea turtle occur within the Marine Resources Study Area (Rubidge et al. 2018), but there is a DFO important area for this species along the west coast of Haida Gwaii overlapping part of the Marine Resources Study Area (Figure 3.4–10).

4.0 FIELD STUDIES

Additional studies were conducted in the vicinity of the marine terminal and/or marine shipping route as appropriate to provide additional information about marine resources in the Marine Resources Study Area. Field studies include intertidal, subtidal, marine fish, water quality, sediment quality, and marine mammal surveys. In addition, remote sensing, hydrophone recording analysis, underwater noise modelling, and sediment scour modelling were conducted. The results of these additional studies are presented in the following sections.

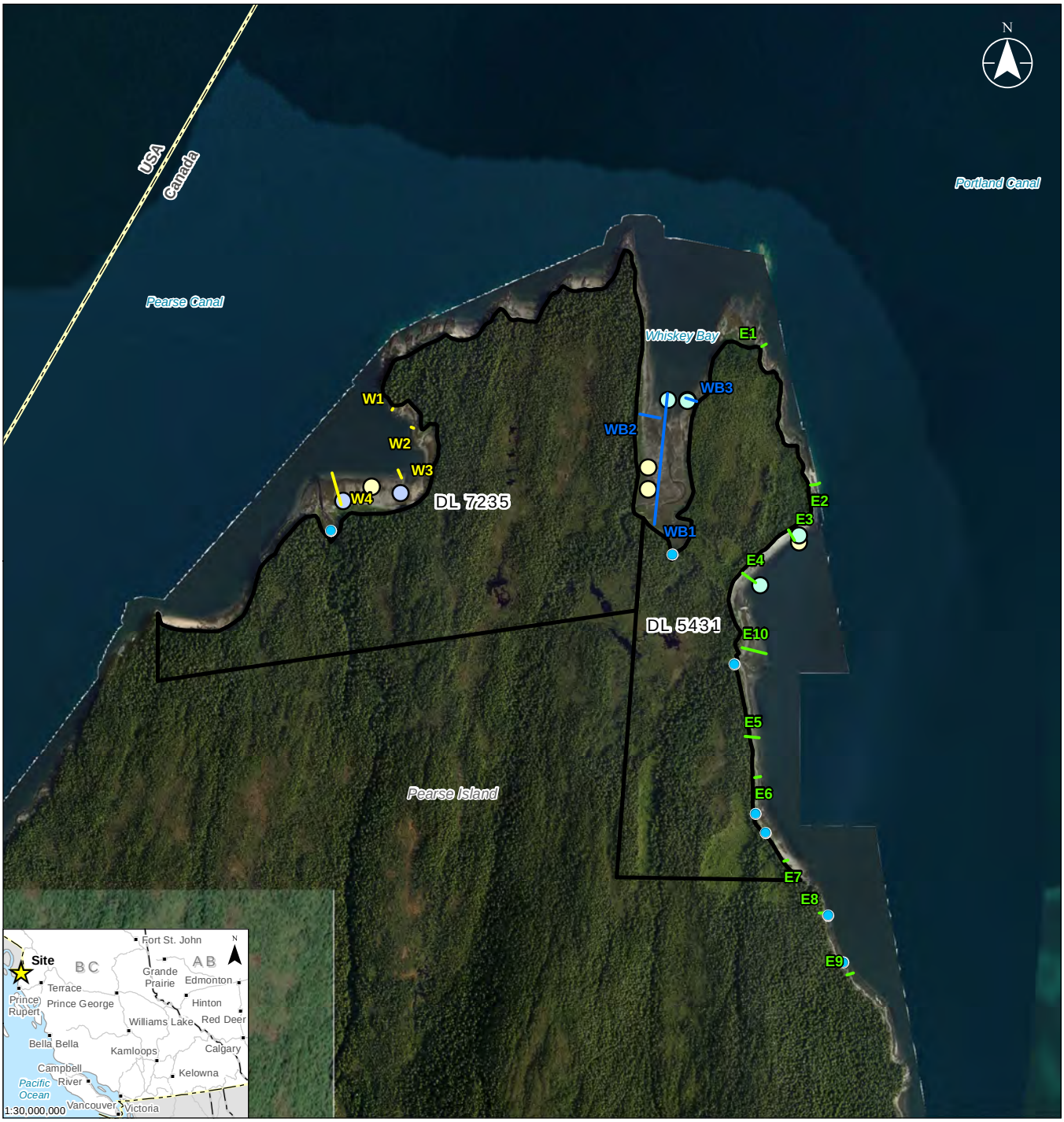
4.1 INTERTIDAL SURVEYS

4.1.1 Introduction

Project activities are anticipated to extend through the marine riparian to the subtidal and offshore areas. To better understand how these activities may affect the physical habitats and the resident organisms, an intertidal survey was conducted to characterize the substrates present as well as the taxa richness, abundance, and diversity of marine vegetation (algae and plants), invertebrates, and fish.

4.1.2 Methods

A five-day intertidal survey was conducted on July 22–26, 2021, which coincided with lowest low tides. The survey used transects to guide the placement of quadrats. The overall survey area was divided into three subareas: east Pearse Island, Whiskey Bay, and west Pearse Island (Figure 4.1–1). Quadrats were placed along 17 transects distributed throughout the three main subareas. Intertidal transect locations were selected to encompass proposed Project infrastructure locations and to represent the varying habitat types expected within the Intertidal Survey Area. Transect locations were modified in the field as necessary to capture the range of habitat types present, to collect information representative of the Intertidal Survey Area, or due to safety considerations associated with the originally delineated transect. A list of the surveyed intertidal transects and their locations is provided in Table 4.1–1.



KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Bivalve Dig Site
- Bivalve Dig
- Cockle Shell
- Incidental Dig
- Freshwater Input
- Pearse Island East Intertidal Survey Transect
- Pearse Island West Intertidal Survey Transect
- Whiskey Bay Intertidal Survey Transect
- Boundaries of District Lots 7235 and 5431
- International Boundary

0 150 300 450 600 750 m
1:20,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC
Project Number: 123221820
Prepared by TQUILICHINI on 20220615
Requested by CMCCRACKEN on 20220601
Check by SMOSS on 20220615

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.1-1

Title
Intertidal Survey Area Transects

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Table 4.1–1 Intertidal Transect Locations

Subarea	Transect	Transect Start		Transect End		Length (m)
		Easting	Northing	Easting	Northing	
East Pearse	E1	424440	6098830	424455	6098838	17
	E2	424604	6098364	424634	6098370	31
	E3	424530	6098214	424550	6098177	42
	E4	424375	6098068	424420	6098035	56
	E5	424384	6097519	424431	6097514	48
	E6	424417	6097381	424437	6097384	20
	E7	424515	6097099	424527	6097101	12
	E8	424634	6096924	424662	6094924	28
	E9	424726	6096716	424748	6096723	24
	E10	424374	6097817	424454	6097797	83
					Total Length	**361**
Whiskey Bay	WB1	424079	6098231	424123	6098671	443
	WB2	424031	6098603	424098	6098559	69
	WB3	424221	6098645	424185	6098657	38
					Total Length	**550**
West Pearse	W1	423199	6098621	423197	6098617	5
	W2	423270	6098554	423260	6098558	10
	W3	423230	6098388	423217	6098416	30
	W4	423026	6098297	422995	6098405	111
					Total Length	**156**

NOTE:
All coordinates are in Universal Transverse Mercator (**UTM**) Zone 9.

At each intertidal transect location, a transect tape was placed perpendicular to the shoreline from the high-water mark to the lowest exposed intertidal area. The slope of each transect was recorded using a clinometer. A random number generator was used to assign locations along the transect tape to three 0.5 x 0.5 m (0.25 square metres [**m^2**]) quadrats within each intertidal elevation (high, mid, and low). Marine vegetation, invertebrate, and fish presence within each quadrat were recorded using a custom data collection application developed by Stantec. Eelgrass and kelp beds were delineated using the same custom data collection application, either by walking around the edge while tracking using GPS or by drawing the extent of each bed on an iPad. Organisms were identified to the lowest practicable taxonomic level and their abundance was quantified as either percent cover (algae and aggregating invertebrate species [e.g., mussels, barnacles]) or individual counts (solitary invertebrates [e.g., limpets and shore crabs] and fish). Substrates within each quadrat were classified according to the categories shown in Table 4.1–2 and the total percentage of each category was assessed visually and recorded. No invertebrate or fish species were collected or retained. Global Positioning System (**GPS**) coordinates, a photo of each quadrat, and representative species photos were collected; photos are presented in Appendix A.

Table 4.1–2 Substrate Classification

Substrate Category	Description	Representative Photograph
Bedrock	Solid, continuous rock greater than 4,000 mm in diameter	
Boulder	Rock ranging from 256 mm to 4,000 mm in diameter	
Cobble	Ranging from 64 mm to 256 mm in diameter	
Gravel	Ranging from 2 mm to 64 mm in diameter	

Table 4.1–2 Substrate Classification

Substrate Category	Description	Representative Photograph
Fines	Sand or mud, ranging from less than 2 mm diameter	
Organics	Woody debris or algae detritus*	
Shell	Bivalve shell fragments	
NOTES: * Algae detritus shown in photo amongst blue mussel. 0.5 m x 0.5 m quadrat shown in photos Classification categories adapted from: DFO 1990; RISC 2001		

1

Photos were taken of the riparian community and a brief description of the dominant trees, shrubs, and grasses was included. A more fulsome description of riparian vegetation communities can be found in the Vegetation and Wetlands Technical Data Report (Appendix 7.6A).

In addition to the biophysical data collection on the surface, bivalve digs were conducted to characterize the richness and abundance of infaunal invertebrates present within the intertidal survey area. Shovels (21.5 cm blade width) were used to dig to 12 cm depth within the 0.25 m^2 quadrats. Bivalve digs were conducted as time permitted and when suitable substrates were present (i.e., fines, gravel). The presence of bivalve species and other infaunal organisms larger than 5 cm within the Intertidal Survey Area was recorded. Additional bivalve digs were conducted at random, when time and substrates permitted, to provide additional insight into the infaunal organisms present within the intertidal study area.

Statistical analyses were conducted in R Statistical Software Version 4.0.2 (R Core Team, 2020). Taxa observed were grouped into algae, aggregating invertebrates, solitary invertebrates, and fish. Species richness was calculated as the number of distinct taxa observed across a particular intertidal zone (high, mid or low) or within a specified subarea (East Pearse Island, Whiskey Bay or West Pearse Island). For each transect, the abundance of algae (measured as percent cover), aggregating invertebrates (measured as percent cover), solitary invertebrates (measured by count), and fish (measured by count) was calculated. These calculations were made by first totaling the percent cover of all algae or aggregating invertebrates in each quadrat, or by totaling the number of solitary invertebrates or fish (per m^2) in each quadrat and then dividing that sum by the combined search area of all quadrats per intertidal elevation and per transect. Abundance was then used to calculate Shannon-Wiener diversity, an index that is widely used to describe the species diversity of a given area (Shannon and Weaver 1949; Spellerberg and Fedor 2003). Shannon-Wiener diversity is calculated as:

$$H' = -\sum_{i=1}^{n} p_i \ln p_i$$

where H' is the diversity index, *i* is a species, *n* is the number of species seen in the sampling unit (quadrat), and p_i is the proportion of observations within that quadrat that are of species *i*. Since p_i is the relative abundance of species *i* within that sampling unit, it is unit sensitive; therefore, separate diversity estimates were calculated for aggregating (percent cover) and solitary (individual counts) invertebrates.

Summary statistics for intertidal substrate types were calculated for each surveyed area, including mean, standard deviation, medium, and interquartile range. The interquartile range is a measure of statistical dispersion of the dataset (i.e., the difference between the 25th and 75th percentiles of the data).

4.1.3 Results

4.1.3.1 Marine Riparian Community

Riparian communities along the shoreline of the intertidal study area are dominated by species such as western redcedar, western hemlock, salal (*Gaultheria shallon*), Sitka spruce, skunk cabbage (*Lysichiton americanus*), and Lyngbye's sedge (*Carex lyngbyei*). The red-listed Arctic daisy (*Arctanthemum arcticum* ssp. *Arcticum*) was also observed in riparian communities along the intertidal study area. A detailed description of vegetation species is presented in the Vegetation and Wetlands Technical Data Report (Appendix 7.6A).

A total of seven freshwater watercourses that flow from Pearse Island to the ocean were observed; five across east Pearse Island, one in Whiskey Bay, and one in west Pearse Island (Figure 4.1–1). Additional details and a more fulsome discussion of these watercourses can be found in the Freshwater Fish and Fish Habitat Technical Data Report (Appendix 7.8A).

4.1.3.2 East Pearse Island

East Pearse Island is characterized by three distinct intertidal areas: the northern end is exposed and characterized by bedrock substrates (Transects E1 and E2), the middle area is slightly more sheltered and characterized by gravel substrates (Transects E3 and E4), and the southern end is exposed and characterized by cobble, gravel, and boulder substrates (Transects E5 to E10). The middle area of east Pearse Island is a potential erosional area due to the lack of fine substrates observed and the presence of smoother gravel than in the other two areas. Slope in the east Pearse Island subarea was 12.8 ± 6.5 degrees (mean ± SD). Photos of each quadrat are presented in Appendix A. Note that there is no photo of quadrat one in the high intertidal for transect E11.

Substrates

Bedrock, boulder, cobble, and gravel-dominated areas were observed across all three intertidal elevations (Table 4.1–3; Figure 4.1–2). Substrate size decreased with intertidal elevation, with bedrock dominating the high intertidal (e.g., Appendix A, Photos 1 and 2) and boulder/cobble dominating the mid to lower intertidal elevations (e.g., Appendix A, Photos 22 to 27). Subdominant substrates of fines, organics, and shell were also observed (e.g., Appendix A, Photos 64 and 65). While not the dominant substrate, fines were most commonly observed at low intertidal elevations and organics were least observed at all elevations.

Table 4.1–3 Percentages of Substrate Types Observed by Intertidal Elevation for East Pearse Island

Substrate Type	High Mean ± SD Median (IQR)	Mid Mean ± SD Median (IQR)	Low Mean ± SD Median (IQR)	Overall Mean ± SD Median (IQR)
Bedrock	32.8 ± 45.1 0.0 (0.0–88.5)	15.5 ± 34.5 0.0 (0.0–0.0)	9.8 ± 27.9 0.0 (0.0–0.0)	19.9 ± 37.8 0.0 (0.0–0.0)
Boulder	19.0 ± 29.2 0.0 (0.0–32.5)	30.8 ± 30.3 20.0 (0.0–57.5)	23.6 ± 27.9 10.0 (0.0–40.0)	24.6 ± 30.3 10.0 (0.0–40.0)
Cobble	15.9 ± 24.5 6.5 (0.0–18.8)	18.6 ± 20.8 15.0 (0.0–27.5)	26.9 ± 27.2 15.0 (5.0–45.0)	20.1 ± 24.2 10.0 (0.0–28.8)
Gravel	27.4 ±34.4 10.0 (0.3–88.5)	21.5 ± 28.0 5.0 (0.0–0.0)	20.4 ± 18.9 17.0 (5.0–20.0)	23.2 ± 28.1 10.0 (0.0–0.0)
Fines	2.5 ± 7.6 0.0 (0.0–0.0)	10.5 ± 14.3 3.0 (0.0–17.5)	12.6 ± 17.7 5.0 (0.0–15.0)	8.3 ± 14.1 0.0 (0.0–11.8)
Organics	0.0 0.0 (0.0–0.0)	0.2 ± 1.0 0.0 (0.0–0.0)	0.0 0.0 (0.0–0.0)	0.1 ± 0.6 0.0 (0.0–0.0)
Shell	2.3 ± 3.1 0.0 (0.0–0.0)	2.9 ± 3.7 2.0 (0.0–5.0)	6.7 ± 6.1 5.0 (2.0–10.0)	3.8 ± 4.7 2.0 (0.0–5.0)

NOTES:
SD = standard deviation; IQR = interquartile range.
Calculations are made from 29 high, 31 mid, and 24 low quadrats surveyed on 10 transects (84 quadrats in total).

1

Taxa Richness

Overall, 59 taxa were observed during the intertidal survey of east Pearse Island (Table 4.1–4; Figure 4.1–2). Species richness was highest for algae, followed by solitary invertebrates, marine fish, then aggregating invertebrates. When comparing the intertidal elevations, species richness was highest in the low and mid intertidal elevations, which had approximately twice the taxa observed in the high intertidal elevation. A complete list of taxa observed is provided in Appendix B.

Thirty-three taxa of algae were found across the three intertidal elevations, with mid and low elevations having twice the number of taxa found at high elevation. Brown algae (Phylum Ochrophyta) observed included rockweed (*Fucus* spp.), sea cauliflower (*Leathesia* spp.), and sea fungus (*Ralfsia* spp.). Several species of kelp (e.g., *Laminaria* spp., *Saccharina* spp., *Alaria marginata*) were observed at mid to low intertidal elevations. Bull kelp was not observed within the intertidal quadrats; however, it was observed in shallow waters along east Pearse Island during the intertidal survey and was recorded as an incidental observation (Figure 4.1–2). Green algae (Phylum Chlorophyta), including several species of sea lettuce *(Ulva* spp.), encrusting codium (*Codium* spp.), and green rope algae (*Acrosiphonia* spp.), were observed. Red algae (Phylum *Rhodophyta*) was the most diverse algal group observed on east Pearse Island with 15 taxa recorded. This group included filamentous species such as sea brush (*Odonthalia* spp.), sea lace (*Microcladia* spp.), and sea moss (*Endocladia muricata*); bladed species such as laver (*Porphyra* spp.); and encrusting species such as pink rock crust (Order Corallinales), red rock crust (*Hildenbrandia* spp.), and Turkish washcloth (*Mastocarpus papillatus*).

Three species of aggregating invertebrates were observed across the three intertidal elevations, including two barnacle taxa (*Balanus* spp.) and mussels. A total of 19 solitary invertebrate species were observed in the intertidal area, including 8 taxa of solitary invertebrates in the high intertidal elevation, 12 in the mid intertidal, and 14 in the low intertidal elevation. Taxa recorded included northern feather duster worm (*Eudistylia vancouveri*), green urchin, purple shore crab (*Hemigrapsus nudus),* hermit crab (*Pagarus* spp.), rockweed isopod (*Idotea wosnesenskii*), red velvet mite (*Neomolgus littoralis*), limpets (*Lottia* spp.), checkered periwinkles (*Littorina* spp.), and an unidentified anemone (Class Anthozoa).

During quadrat surveys and bivalve digs, cockles, butter clams, soft shell clams (*Mya arenaria*), Manila clams, Pacific littleneck clams (*Protothaca staminea*), and Pacific gapers (*Tresus nuttallii*) were observed. Bivalve digs at east Pearse Island were conducted in the mid intertidal elevation.

Four taxa of marine fish were observed across the mid and low intertidal elevations. These taxa included penpoint gunnel (*Apodichthys flavidus*), crescent gunnel (*Pholis laeta*), an unidentified gunnel (*Pholis* sp.), and an unidentified sculpin (Family Cottidae). Of note, a Pacific sand lance was uncovered during a random bivalve dig just northeast of Transect E3 (Figure 4.1–2).

No species at risk (including northern abalone) were observed during the intertidal survey in east Pearse Island subarea.

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Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

*Kelp Beds displayed are approximate representations.

Bivalve Dig Site
- Bivalve Dig
- Incidental Dig
- Freshwater Input
- Pacific Sand Lance
- Pearse Island East Intertidal Survey Transect
- Whiskey Bay Intertidal Survey Transect
- Boundaries of District Lots 7235 and 5431
- Eelgrass
- Kelp Bed*

0 40 80 120 160 200 m
1:5,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC
Project Number: 123221820
Prepared by TQUILICHINI on 20220615
Requested by CMCCRACKEN on 20220601
Check by SMOSS on 20220615

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Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.1-2

Title
Pearse Island East Intertidal Transects

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Freshwater Input
Bivalve
Pearse Island East Intertidal Survey Transect
Boundaries of District Lots 7235 and 5431
Kelp Bed*

0 40 80 120 160 200 m
1:5,000 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
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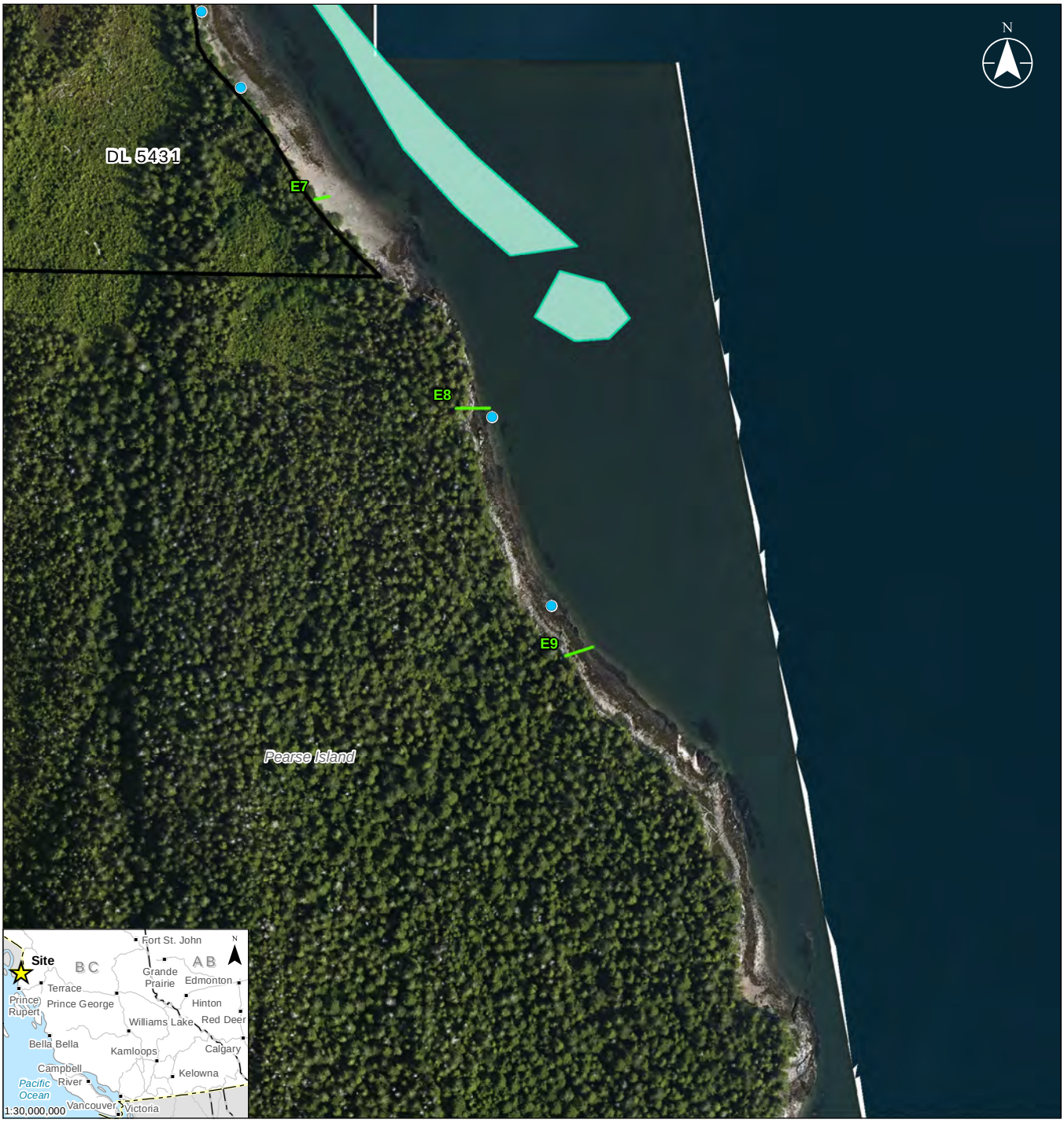

KSI LISIMS LNG

Freshwater Input

Pearse Island East Intertidal Survey Transect

Boundaries of District Lots 7235 and 5431

Kelp Bed*

0 40 80 120 160 200 m

1:5,000 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
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Pearse Island East Intertidal Transects

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Table 4.1–4 Richness (Number of taxa) Observed by Elevation During Intertidal Surveys in East Pearse Island

	High	Mid	Low	Overall
Algae	11	22	23	33
Aggregating invertebrate	2	3	2	3
Solitary invertebrates	8	12	14	19
Marine fish	0	1	3	4
Total	**21**	**38**	**42**	**59**

NOTES:
Species-level resolution not always possible; lowest practicable taxonomic resolution was reported.
Calculations are made from 29 high, 31 mid, and 24 low quadrats surveyed on 10 transects (84 quadrats in total).

Abundance

Abundance of taxonomic groups are shown in Table 4.1–5 and abundance values for individual taxa are provided in Appendix B.

The most abundant algal taxa in the east Pearse Island subarea was *Fucus* spp., a brown algae. Kelp species (*Laminaria* spp., *Saccharina* spp., and *Alaria marginata*) were also present in low abundance at mid intertidal elevations. Green algae in east Pearse Island was dominated by sea lettuce, and red algae was dominated by red rock crust, both of which were observed at all three tidal elevations. The highest overall percent cover of an algae taxa was of *Fucus* spp. at low intertidal elevations.

Mussels and barnacles were the only taxa of aggregating invertebrate species observed at east Pearse Island, and they were observed at all three intertidal elevations. Mean mussel abundance increased from high to low intertidal elevations, whereas mean barnacle abundance remained relatively constant.

Solitary invertebrates were dominated by limpets and periwinkles and were observed at all three intertidal elevations. All other species were present in numbers less than one individual/m^2, except hermit crabs and dogwinkles (*Nucella* spp.) at mid and low intertidal elevations and anemones at mid intertidal elevations.

Fish were observed at mid and low intertidal elevations, and all taxa were observed at abundances of 0.3 individuals per m^2 or less.

Table 4.1–5 Abundance Across All Quadrats and Elevations for East Pearse Island

	High Mean ± SD Median (IQR)	Mid Mean ± SD Median (IQR)	Low Mean ± SD Median (IQR)	Overall Mean ± SD Median (IQR)
Algae[1]	2.8 ± 23.6 0.0 (0.0–0.0)	4.8 ± 25.8 0.0 (0.0–0.0)	3.2 ± 15.3 0.0 (0.0–0.0)	0.9 ± 5.6 0.0 (0.0–0.0)
Aggregating invertebrates[1]	20.8 ± 58.7 0.0 (0.0–0.0)	40.3 ± 81.1 0.0 (0.0–0.0)	28.8 ± 60.0 0.0 (0.0–0.0)	7.6 ± 17.1 0.0 (0.0–2.0)
Solitary invertebrates[2]	5.3 ± 34.3 0.0 (0.0–0.0)	10.4 ± 54.3 0.0 (0.0–0.0)	6.1 ± 39.9 0.0 (0.0–0.0)	7.4 ± 44.0 0.0 (0.0–0.0)
Marine fish[2]	0.0 0.0 (0.0–0.0)	0.03 ± 0.4 0.0 (0.0–0.0)	0.2 ± 1.0 0.0 (0.0–0.0)	0.1 ± 0.6 0.0 (0.0–0.0)

NOTES:
[1] Abundance is estimated as % cover
[2] Abundance is estimated as # individuals/m^2
SD = standard deviation; IQR = interquartile range
Species-level resolution not always possible; lowest practicable taxonomic resolution was reported.
Calculations are made from 29 high, 31 mid, and 24 low quadrats surveyed on 10 transects (84 quadrats in total).

Diversity

When comparing the overall diversity between groups in east Pearse Island, algae were highest followed by solitary and then aggregating invertebrates. Marine fish diversity was 0 ± 0 in the intertidal area of east Pearse Island because although multiple fish species were observed, only one fish species was observed in a quadrat, resulting in diversity values of zero (Table 4.1–6). Mean algal diversity was highest in the low intertidal elevation, aggregating invertebrates had equally high diversity values in the mid and low intertidal elevations, and solitary invertebrate diversity was highest in the mid intertidal elevation. For all species groups observed, diversity values were lowest in the high intertidal elevation (Table 4.1–6).

Table 4.1–6 Diversity of Species Groups Observed by Elevation and Overall for East Pearse Island

	High Mean ± SD Median (IQR)	Mid Mean ± SD Median (IQR)	Low Mean ± SD Median (IQR)	Overall Mean ± SD Median (IQR)
Algae	0.3 ± 0.4 0.2 (0–0.6)	0.7 ± 0.5 0.6 (0.2–1.2)	0.9 ± 0.6 1 (0.5–1.3)	0.6 ± 0.5 0.6 (0–1.1)
Aggregating invertebrate	0.3 ± 0.3 0.1 (0–0.6)	0.5 ± 0.2 0.6 (0.3–0.7)	0.5 ± 0.2 0.6 (0.5–0.7)	0.4 ± 0.3 0.6 (0.1–0.7)
Solitary invertebrates	0.4 ± 0.3 0.4 (0–0.7)	0.7 ± 0.4 0.7 (0.4–1)	0.5 ± 0.4 0.5 (0.2–0.7)	0.5 ± 0.4 0.5 (0–0.8)
Marine fish	0 ± 0 0 (0–0)	0 ± 0 0 (0–0)	0 ± 0 0 (0–0)	0 ± 0 0 (0–0)

NOTES:
SD = standard deviation; IQR = interquartile range
Calculations are made from 29 high, 31 mid, and 24 low quadrats surveyed on 10 transects (84 quadrats in total).

4.1.3.3 Whiskey Bay

Whiskey Bay is a highly sheltered area that has a large intertidal area with a gradual slope in the north-south direction (1 degree). One long transect was surveyed in the north-south direction (WB1: 443 m) as well as two shorter transects on the east and west sides of the bay (WB2: 69 m and WB3: 38 m). The overall slope of Whiskey Bay was 4 ± 3 degrees (mean ± SD), including the two other transects surveyed. A freshwater channel was observed that ran along the length of the exposed intertidal area to the marine environment at low tide. Photos of each quadrat are presented in Appendix A.

Substrates

Overall, substrates in the Whiskey Bay subarea were dominated by gravel (Figure 4.1–3; e.g., Table 4.1–7; Appendix A, Photo 91). Boulder substrates were the second most commonly observed substrate in the high intertidal area, and the percentage of boulder substrate decreased from 32.8 ± 34.8% in the high intertidal elevation to 3.6 ± 9.4 % in the low intertidal elevation (e.g., Appendix A, Photos 107 and 108). Conversely, the percentage of fines observed increased from 0.0 ± 0.0 % in the high intertidal elevation to 36.4 ± 27.8 % in the low intertidal elevation. No bedrock substrates were observed in the intertidal areas of Whiskey Bay.

Table 4.1–7 Percentages of Substrate Types Observed by Elevation and Overall for Whiskey Bay

Substrate Type	High Mean ± SD Median (IQR)	Mid Mean ± SD Median (IQR)	Low Mean ± SD Median (IQR)	Overall Mean ± SD Median (IQR)
Bedrock	0.0 0.0 (0.0–0.0)	0.0 0.0 (0.0–0.0)	0.0 0.0 (0.0–0.0)	0.0 0.0 (0.0–0.0)
Boulder	32.8 ± 34.8 30.0 (0.0–40.0)	11.8 ± 21.5 0.0 (0.0–12.5)	3.6 ± 9.4 0.0 (0.0–0.0)	16.7 ± 26.8 0.0 (0.0–27.5)
Cobble	14.8 ± 14.3 15.0 (0.0–25.0)	15.6 ± 11.2 20.0 (7.5–23.5)	10.7 ± 9.8 10.0 (2.5–17.5)	14.1 ± 11.8 15.0 (1.5–25.0)
Gravel	46.9 ± 38.0 30.0 (25.0–80.0)	43.0 ± 31.0 30.0 (20.0–35.0)	32.9 ± 18.5 25.0 (22.5–37.5)	41.7 ± 30.4 30.0 (20.0–71.0)
Fines	0.0 0.0 (0.0–0.0)	22.8 ± 20.8 15.0 (10.0–32.5)	36.4 ± 27.8 25.0 (15.0–60.0)	18.7 ± 23.6 10.0 (0.0–22.5)
Organics	2.2 ± 6.7 0.0 (0.0–0.0)	2.5 ± 7.5 0.0 (0.0–0.0)	0.0 0.0 (0.0–0.0)	1.8 ± 6.0 0.0 (0.0–0.0)
Shell	3.3 ± 5.0 0.0 (0.0–0.0)	4.2 ± 4.8 4.0 (0.0–5.0)	16.4 ± 8.0 15.0 (10.0–20.0)	4.7 ± 7.1 5.0 (0.0–10.0)

NOTES:
SD = standard deviation; IQR = interquartile range
Calculations are made from 9 high, 11 mid, and 9 low quadrats surveyed on 3 transects (29 quadrats in total).

Taxa Richness

Overall, 32 taxa were observed throughout the intertidal survey of Whiskey Bay (Table 4.1–8). Species richness was highest in solitary invertebrates, followed by algae and then aggregating invertebrates. No species of marine fish were observed. Species richness was highest in the low intertidal elevation and decreased successively with increasing intertidal elevation. A complete list of taxa observed is provided in Appendix B.

Thirteen algal taxa were found across the three intertidal elevations in Whiskey Bay (Table 4.1–8). Five taxa of brown algae were observed, including rockweed and ribbon kelp, with *Fucus* spp. Being observed in all three tidal elevations but ribbon kelp only being observed at the mid intertidal elevation. Four taxa of green algae were observed, including sea lettuce and gut weed (*Ulva intestinalis*). Green algae were found at all three intertidal elevations. Four taxa of red algae were observed, including sea brush, Turkish washcloth (blade phase), and red rock crust. Red rock crust was observed at all three intertidal elevations, whereas both sea brush and Turkish washcloth were only observed in the mid intertidal elevation. Overall, five taxa were observed at high intertidal elevations, six were observed at mid intertidal elevations, and eight were observed at low intertidal elevations.

Four taxa of aggregating invertebrates were observed during the intertidal surveys. Three of these taxa were barnacles, and the other was a mussel. Two species were found in the high and three in the mid intertidal elevation (Table 4.1–8). At least one species of barnacle and mussels was observed at all three intertidal elevations.

Fifteen solitary invertebrate taxa were observed in Whiskey Bay. Five solitary invertebrate taxa were recorded in the high elevation, seven were recorded at the mid, and 14 were recorded in the low. One cnidarian taxa (anemone; Order Anthozoa); six crustacean taxa, including amphipods (Order Amphipoda), bay ghost shrimp (*Neotrypaea californiensis*), hermit crabs, and isopods (Order Isopoda); six mollusk taxa, including periwinkles, chiton, limpets, and bivalves (Class Bivalvia); one tunicate taxa (broadbase tunicate; *Cnemidocarpa finmarkiensis*); and one worm taxa (Class Polychaeta) were observed in Whiskey Bay. Fourteen of the fifteen total taxa observed in Whiskey Bay were observed at low intertidal elevations.

During quadrat and bivalve digs, butter clams, soft shell clams, and Manila clams were observed. Bivalve digs in Whiskey Bay were conducted at mid and low intertidal elevations.

No marine fish were observed during intertidal surveys in Whiskey Bay.

No species at risk (including northern abalone) were observed during the intertidal survey in Whiskey Bay.

One sparse patch of eelgrass was observed near transect WB1 but was not captured within the sampling quadrats (Figure 4.1–4).

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Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

*Kelp Beds displayed are approximate representations.

Bivalve Dig Site
- Bivalve Dig
- Incidental Dig
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- Pearse Island East Intertidal Survey Transect
- Whiskey Bay Intertidal Survey Transect
- Boundaries of District Lots 7235 and 5431
- Eelgrass
- Kelp Bed*

0 40 80 120 160 200 m
1:5,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC
Project Number: 123221820
Prepared by TQUILICHINI on 20220615
Requested by CMCCRACKEN on 20220601
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Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.1-3

Title
Whiskey Bay Intertidal Transects

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S:\123\2\projects\123221820\figures\reports\TDR\Marine\Fig4_1_3_123221820_222_intertidal_whiskey_bay.mxd Revised: 2023-09-06 By: tquilichini

Table 4.1–8 Richness (Number of taxa) Observed by Elevation During Intertidal Surveys in Whiskey Bay

	High	Mid	Low	Overall
Algae	5	6	8	13
Aggregating invertebrate	2	3	4	4
Solitary invertebrates	5	7	14	15
Marine fish	0	0	0	0
Total	**12**	**16**	**26**	**32**

NOTES:
Species-level resolution not always possible; lowest practicable taxonomic resolution was reported.
Calculations are made from 9 high, 11 mid, and 9 low quadrats surveyed on 3 transects (29 quadrats in total).

Abundance

Abundance of taxa groups are shown in Table 4.1–9 and abundance values for individual taxa are provided in Appendix B.

The most abundant algal taxa in Whiskey Bay was the brown algae *Fucus* spp., which was observed at all three tidal elevations. Ribbon kelp was the only kelp species observed in Whiskey Bay and was only observed at mid intertidal elevations. Sea lettuce dominated the green algae observed in Whiskey Bay but was only observed at mid and low intertidal elevations. Red algae was dominated by sea brush.

Aggregating invertebrate taxa were dominated by barnacles, with mussels also present at lower abundance. While mean mussel abundance increased from high to low intertidal elevations, mean barnacle abundance was relatively constant between intertidal elevations.

Periwinkles and limpets were the most abundant solitary invertebrates and were present at all three intertidal elevations. All other species were present in numbers of less than one individual/m^2, except hermit crabs, isopods, and polychaete worms at mid intertidal elevations.

No marine fish were observed in the Whiskey Bay subarea.

Table 4.1–9 Summary Abundance Across All Quadrats and Elevations for Whiskey Bay

	High Mean ± SD Median (IQR)	Mid Mean ± SD Median (IQR)	Low Mean ± SD Median (IQR)	Overall Mean ± SD Median (IQR)
Algae[1]	2.8 ± 25.5 0.0 (0.0–0.0)	3.1 ± 19.0 0.0 (0.0–0.0)	2.4 ± 10.8 0.0 (0.0–0.0)	0.69 ± 4.8 0.0 (0.0–0.0)
Aggregating invertebrates[1]	17.3 ± 52.7 0.0 (0.0–0.0)	25.6 ± 45.1 0.0 (0.0–40.0)	17.5 ± 38.0 0.0 (0.0–10.0)	5.1 ± 11.4 0.0 (0.0–2.8)
Solitary invertebrates[2]	4.3 ± 34.6 0.0 (0.0–0.0)	7.0 ± 40.5 0.0 (0.0–0.0)	5.1 ± 35.5 0.0 (0.0–0.0)	5.6 ± 37.2 0.0. (0.0–0.0)
Marine fish[2]	0.0 0.0 (0.0–0.0)	0.0 0.0 (0.0–0.0)	0.0 0.0 (0.0–0.0)	0.0 0.0 (0.0–0.0)

NOTES:
[1] Abundance is estimated as %
[2] Abundance is estimated as # individuals/m^2
SD = standard deviation; IQR = interquartile range
Calculations are made from 9 high, 11 mid, and 9 low quadrats surveyed on 3 transects (29 quadrats in total).

Diversity

Species diversity for solitary invertebrates and algae increased from high to low elevations. However, for aggregating invertebrate species diversity was greatest at the mid intertidal elevation. For all four groups, diversity was lowest at the high intertidal elevation (Table 4.1–10). No fish were observed in the intertidal surveys conducted in Whiskey Bay.

Table 4.1–10 Diversity of Each Species Group by Elevation and Overall for Whiskey Bay

	High Mean ± SD Median (IQR)	Mid Mean ± SD Median (IQR)	Low Mean ± SD Median (IQR)	Overall Mean ± SD Median (IQR)
Algae	0 ± 0.1 0 (0–0)	0.2 ± 0.2 0.2 (0.1–0.4)	0.8 ± 0.5 1 (0.5–1.1)	0.3 ± 0.4 0.2 (0–0.6)
Aggregating invertebrates	0.2 ± 0.3 0.1 (0–0.3)	0.7 ± 0 0.7 (0.6–0.7)	0.4 ± 0.3 0.5 (0.2–0.6)	0.4 ± 0.3 0.6 (0.2–0.7)
Solitary invertebrates	0.2 ± 0.3 0 (0–0.3)	0.4 ± 0.3 0 (0.1–0.6)	0.6 ± 0.6 0.5 (0.2–0.7)	0.4 ± 0.4 0.4 (0–0.6)
Marine fish	0 ± 0 0 (0–0)	0 ± 0 0 (0–0)	0 ± 0 0 (0–0)	0 ± 0 0 (0–0)

NOTES:
SD = standard deviation; IQR = interquartile range
Calculations are made from 9 high, 11 mid, and 9 low quadrats surveyed on 3 transects (29 quadrats in total).

4.1.3.4 West Pearse Island

The intertidal areas of west Pearse Island were dominated by bedrock substrates on the northern transects (W1 and W2) and gravel and cobble substrates on the southern transects (W3 and W4). The bedrock-dominated area had a steeper slope than the gravel- and cobble-dominated areas and the overall slope for west Pearse Island was 8.5 ± 4.7 degrees (mean ± SD). The surveyed area of west Pearse Island is in a small bay. Transect W1 sits near the north end of the bay and appeared to be the most exposed of the four transects. Transect W4 was surveyed immediately northeast of a relatively large freshwater output. Photos of each quadrat are presented in Appendix A.

Substrates

Substrates in the west Pearse Island subarea were dominated by bedrock across all three tidal elevations (Table 4.1–11; Figure 4.1–4; e.g., Appendix A: Photos 114 to 120). Cobble and gravel were the subdominant substrates at all three intertidal elevations. Small amounts of fine and shell substrates were observed, but no organic substrates were recorded within quadrat surveys.

Table 4.1–11 Percentages of Substrate Types Observed by Elevation and Overall for West Pearse Island

Substrate Type	High Mean ± SD Median (IQR)	Mid Mean ± SD Median (IQR)	Low Mean ± SD Median (IQR)	Overall Mean ± SD Median (IQR)
Bedrock	33.6 ± 38.9 17.5 (0.0–64.5)	49.8 ± 52.0 48.5 (52.0–48.5)	33.3 ± 50.0 0.0 (0.0–100.0)	39.4 ± 46.2 0.0 (0.0–100.0)
Boulder	15.8 ± 25.8 0.0 (0.0–28.8)	5.8 ± 13.6 0.0 (0.0–0.0)	9.6 ± 14.9 0.0 (0.0–20.0)	10.5 ± 19.2 0.0 (0.0–20.0)
Cobble	20.0 ± 16.4 15.0 (11.3–31.3)	14.6 ± 21.8 2.5 (0.0–21.3)	26.3 ± 23.9 25.0 (0.0–50.0)	19.8 ± 20.5 15.0 (0.0–35.0)
Gravel	27.9 ± 29.3 22.5 (3.8–42.5)	17.8 ± 24.8 1.5 (0.0–30.0)	19.8 ± 18.4 15.0 (0.0–30.0)	22.0 ± 24.7 15.0 (0.0–30.0)
Fines	1.8 ± 4.4 0.0 (0.0–0.5)	6.8 ± 10.3 2.0 (0.0–10.5)	6.1 ± 8.2 0.0 (0.0–15.0)	4.8 ± 8.1 0.0 (0.0–7.0)
Organics	0.0 ± 0.0 0.0 (0.0–0.0)	0.0 ± 0.0 0.0 (0.0–0.0)	0.0 ± 0.0 0.0 (0.0–0.0)	0.0 ± 0.0 0.0 (0.0–0.0)
Shell	0.8 ± 1.6 0.0 (0.0–0.5)	5.3 ± 10.2 2.5 (0.0–3.0)	4.9 ± 8.3 0.0 (0.0–5.0)	3.6 ± 7.6 0.0 (0.0–3.0)

NOTES:
SD = standard deviation; IQR = interquartile range
Calculations are made from 11 high, 12 mid, and 9 low quadrats surveyed on 4 transects (32 quadrats in total).

Taxa Richness

Overall, 28 taxa were observed during the intertidal survey of west Pearse Island (Table 4.1–12; Figure 4.1–4). Species richness was highest for solitary invertebrates followed by algae and then aggregating invertebrates. No fish were observed during intertidal surveys at west Pearse Island. Overall taxa richness increased from high to low intertidal elevations. A complete list of taxa observed is provided in Appendix B.

Eleven taxa of algae were recorded, with the highest number observed in the mid elevation. Brown algae observed at west Pearse Island included *Fucus* spp. and sea fungus, green algae taxa included gut weed and sea lettuce, and red algae taxa included red rock crust, sea brush, and Turkish washcloth (blade phase).

Only three taxa of aggregating invertebrates were observed throughout the intertidal elevations, and all three taxa were recorded at both the low and mid intertidal elevations. The three taxa were two species of mussel and one species of barnacle. Only barnacles were observed at the high intertidal elevation (Table 4.1–12).

Overall, 14 solitary invertebrate taxa were observed in the intertidal area, with 13 of these taxa being observed at the low intertidal elevation. Taxa richness decreased to six in the mid intertidal and three in the high intertidal elevations. Species observed include periwinkles, whelks, limpets, amphipods, hermit crabs, isopods, and green urchins.

No quadrat or bivalve digs were conducted in the west Pearse Island subarea; however, cockle shells were observed incidentally in the mid and low intertidal elevations.

No marine fish were observed during intertidal surveys in west Pearse Island.

No species at risk (including northern abalone) were observed during the intertidal survey in west Pearse Island.

One sparse patch of eelgrass was observed near transect W3 but was not captured within the sampling quadrats (Figure 4.1–4).

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Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

*Kelp Beds displayed are approximate representations.

Bivalve Dig Site
- Bivalve Dig
- Cockle Shell
- Freshwater Input
- Pearse Island West Intertidal Survey Transect
- Boundaries of District Lots 7235 and 5431
- Eelgrass
- Kelp Bed*

0 40 80 120 160 200 m
1:5,000 (at original document size of 8.5x11)

Stantec

Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20220615
Requested by CMCCRACKEN on 20220601
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Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.1-4

Title
West Pearse Island Intertidal Transects

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Table 4.1–12 Richness (Number of taxa) Observed by Elevation During Intertidal Surveys in West Pearse Island

	High	Mid	Low	Overall
Algae	5	9	8	11
Aggregating invertebrates	1	2	3	3
Solitary invertebrates	3	6	13	14
Marine fish	0	0	0	0
Total	**9**	**17**	**24**	**28**

NOTES:
Species-level resolution not always possible; lowest practicable taxonomic resolution was reported.
Calculations are made from 11 high, 12 mid, and 9 low quadrats surveyed on 4 transects (32 quadrats in total).

Abundance

Abundance of taxa groups are shown in Table 4.1–13 and abundance values for individual taxa are provided in Appendix B.

Fucus spp. dominated algal taxa observed in west Pearse Island and was highest in abundance in the low intertidal elevation. Green algae taxa such as gut weed and sea lettuce were also present, as well as red rock crust, sea brush, and Turkish washcloth. Abundance of algae was lower in the high intertidal elevation than in the mid or low.

Aggregating invertebrate species observed were mussels and barnacles, and abundance of barnacles increased from high to low intertidal elevations. Mussel abundance was highest in the mid intertidal elevation.

Solitary invertebrate abundance was dominated by periwinkles and limpets, with other species of note, including green urchins and anemones, present in moderate abundances in the mid intertidal elevation. No marine fish were observed in the west Pearse Island subarea.

Table 4.1–13 Summary Abundance Across All Quadrats and Elevations for West Pearse Island

	High Mean ± SD Median (IQR)	Mid Mean ± SD Median (IQR)	Low Mean ± SD Median (IQR)	Overall Mean ± SD Median (IQR)
Algae[1]	0.9 ± 6.1 0.0 (0.0–0.0)	5.3 ± 33.6 0.0 (0.0–0.0)	2.2 ± 11.5 0.0 (0.0–0.0)	0.7 ± 5.5 0.0 (0.0–0.0)
Aggregating invertebrates[1]	15.5 ± 38.4 0.0 (0.0–0.0)	43.0 ± 82.3 0.0 (0.0–0.0)	58.1 ± 106.3 0.0 (0.0–0.0)	9.4 ± 20.1 0 (0–4.3)
Solitary invertebrates[2]	4.0 ± 21.8 0.0 (0.0–0.0)	15.0 ± 67.4 0.0 (0.0–0.0)	2.9 ± 15.5 0.0 (0.0–0.0)	7.8 ± 44.3 0.0 (0.0–0.0)
Marine fish[2]	0.0 0.0 (0.0–0.0)	0.0 0.0 (0.0–0.0)	0.0 0.0 (0.0–0.0)	0.0 0.0 (0.0–0.0)

NOTES:
[1] Abundance is estimated as %
[2] Abundance is estimated as # individuals/m^2
SD = standard deviation; IQR = interquartile range
Calculations are made from 9 high, 11 mid, and 9 low quadrats surveyed on 3 transects (29 quadrats in total).

Diversity

Solitary invertebrates and algae had the same overall diversity mean and median (Table 4.1–14). While diversity for solitary and aggregating invertebrates increased from high to low intertidal elevations, algae diversity was greater in the high intertidal elevation than the mid intertidal elevation and increased again in the low intertidal elevation (Table 4.1–14). No fish were observed in the intertidal surveys conducted in west Pearse Island.

Table 4.1–14 Diversity of Species Groups by Elevation and Overall for West Pearse Island

	High Mean ± SD Median (IQR)	Mid Mean ± SD Median (IQR)	Low Mean ± SD Median (IQR)	Overall Mean ± SD Median (IQR)
Algae	0.5 ± 0.4 0.6 (0.1–0.7)	0.3 ± 0.3 0.3 (0.1–0.5)	0.6 ± 0.6 0.7 (0–1)	0.5 ± 0.4 0.5 (0–0.7)
Aggregating Invertebrate	0 ± 0 0 (0–0)	0.4 ± 0.2 0.5 (0.4–0.6)	0.5 ± 0.2 0.5 (0.4–0.6)	0.3 ± 0.3 0.3 (0–0.6)
Solitary Invertebrates	0.4 ± 0.3 0.5 (0–0.7)	0.6 ± 0.3 0.6 (0.4–0.8)	0.7 ± 0.6 0.5 (0.3–1)	0.5 ± 0.4 0.5 (0.3–0.8)
Marine Fish	0 ± 0 0 (0–0)	0 ± 0 0 (0–0)	0 ± 0 0 (0–0)	0 ± 0 0 (0–0)

NOTES:
SD = standard deviation; IQR = interquartile range
Calculations are made from 11 high, 12 mid, and 9 low quadrats surveyed on 4 transects (32 quadrats in total).

4.1.3.5 Summary

Dominant substrates varied among the three subareas surveyed. Pearse East was dominated mostly by bedrock, boulder, cobble, and gravel substrates with increasing percentages of fines in the low intertidal elevation. East Pearse was also the most exposed subarea of the three, with almost every transect having direct exposure to prevailing wind and currents through Portland Canal except for E3 and E4, which were located around a slight bend in the coastline. In contrast, no bedrock substrates were observed in Whiskey Bay, but boulder, cobble, and gravel were dominant in the high and mid intertidal and fines increased in percent cover in the mid and low intertidal areas. The percentages of fines in the low intertidal areas were higher in Whiskey Bay than in east Pearse Island, likely because Whiskey Bay is much more sheltered. West Pearse Island was dominated by similar substrates to east Pearse Island, with bedrock, boulder, cobble, and gravel dominating the substrate types observed. Also similar to east Pearse Island, west Pearse Island is relatively exposed, although a slight embayment provided a small degree of shelter. Percentages of organics and shell substrates were low but consistent between subareas, except in west Pearse Island where no organic substrate was observed.

Taxa richness was highest in the east Pearse Island subarea, with a total of 59 taxa observed compared to 32 in Whiskey Bay and 28 in west Pearse Island. These differences could be the result of higher surveying effort in east Pearse Island than in the other two subareas, which leads to a greater probability of observing more taxa. Although Whiskey Bay had the greatest total length surveyed (550 m), this length is driven mostly by transect WB1, which was 443 m in length. These differences could also have to do with different levels of exposure and substrates providing different habitat suitability between the three subareas. Brown algal taxa, including rockweed and kelp, were observed at all three subareas. Green and red algae taxa were also consistently observed, with taxa such as sea lettuce, sea brush, and red rock crust observed in all three subareas. In all three subareas, species of barnacles and mussels were the only two aggregating invertebrate taxa observed. Nineteen solitary invertebrate taxa were observed in east Pearse Island, and 15 and 14 were observed in Whiskey Bay and west Pearse Island respectively. In the east Pearse Island subarea, taxa richness for algae exceeded that of solitary invertebrates, but in the other two subareas solitary invertebrates represented the group with the highest taxa richness. In general, quadrats in the high intertidal areas had lower species richness than in the mid and low intertidal elevations in the three subareas. Solitary invertebrate richness increased from high to low intertidal elevation in all three subareas. Algae and aggregating invertebrate richness was also lowest in the high intertidal area, but the mid and low intertidal elevations had similar richness values as opposed to increasing again from mid to low elevations. Four fish species were observed, and fish were only observed in east Pearse Island. Intertidal digs revealed several bivalve species in the east Pearse Island and Whiskey Bay subareas, including cockles, butter clams, soft shell clams, Manila clams, Pacific littleneck clams, and Pacific gapers. Cockle shells were observed in the west Pearse Island subarea, so it is assumed that bivalves are also present.

Abundance of taxa groups was relatively consistent between the three subareas, with large ranges in overall percent cover and individuals/m^2. *Fucus* spp. was by far the most abundant algae taxa observed in all three subareas, and algae was more abundant in the mid and low intertidal elevations than in the high. Mussels and barnacles were consistently abundant across the subareas, but abundance increased

from high to low intertidal areas, whereas barnacle abundance remained relatively constant except in the west Pearse Island subarea where the same high to low increasing trend was observed. The most abundant solitary invertebrates in all three subareas were periwinkles and limpets. Other species of note that were observed include green urchins in low abundances at east and west Pearse Island. Bivalves were observed in low abundances, but this result may be underestimated due to the limited presence of appropriate digging substrates and time limitations of low tide surveying.

Overall, taxa diversity was relatively consistent between the three subareas with east Pearse Island having slightly higher overall diversity values compared to the other two areas.

4.2 SUBTIDAL SURVEY

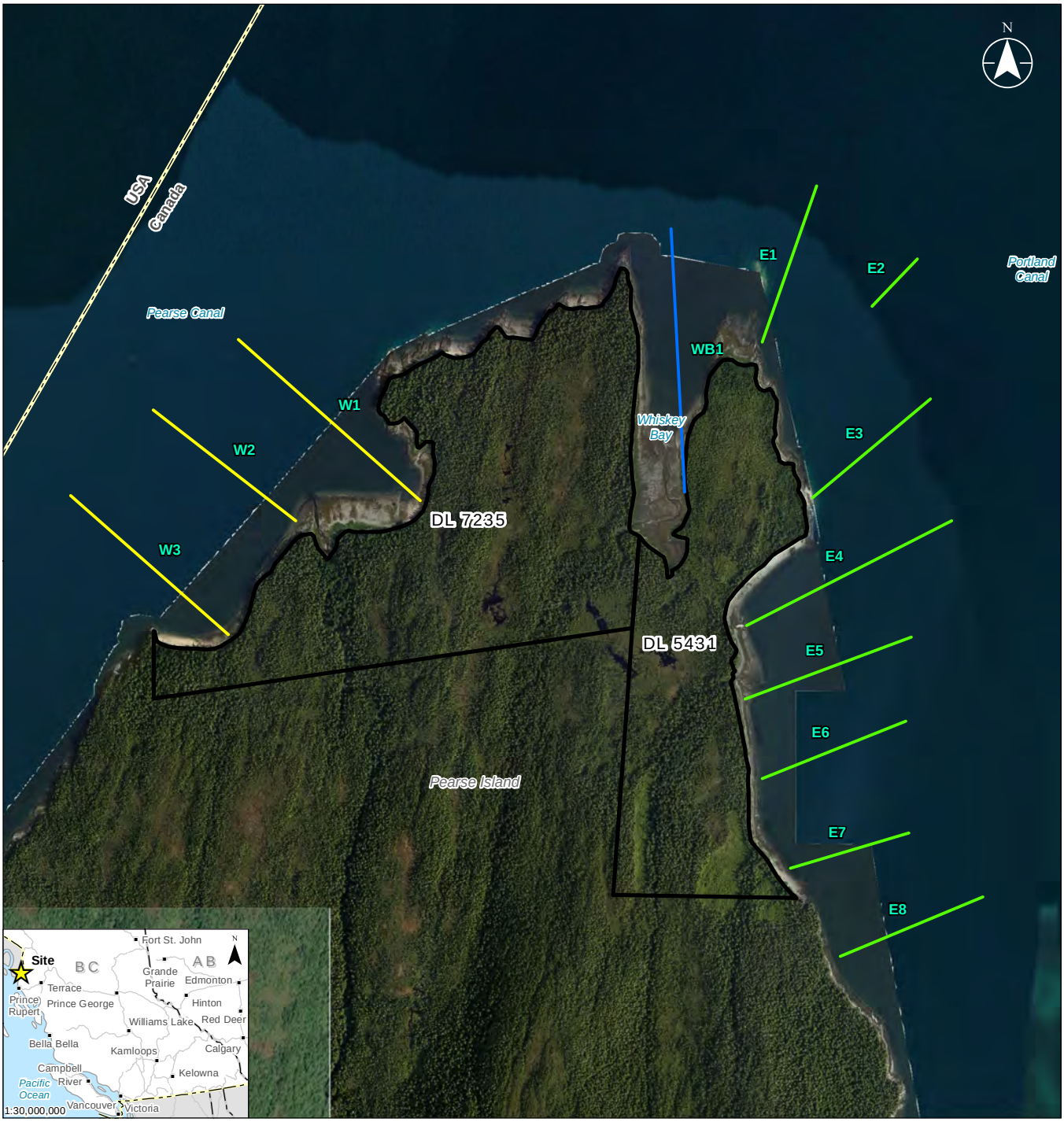
4.2.1 Introduction

Project activities will overlap with the subtidal environment. To better understand how these activities may affect the physical habitats and the resident organisms, a subtidal survey was conducted to characterize the substrates present as well as the taxa richness and abundance of marine vegetation (algae and plants), invertebrates, and fish.

4.2.2 Methods

4.2.2.1 Subtidal Survey

A field team of five persons (two Ocean Dynamics Inc. crew and three Stantec biologists) conducted a four-day remotely operated vehicle (**ROV**) survey from September 7–10, 2021. Using a Seaeye Falcon ROV rated to 300 m depth, the team collected data across 12 transects distributed throughout three subareas of the overall Subtidal Survey Area: east Pearse Island, west Pearse Island, and Whiskey Bay (Figure 4.2–1). The total length as well as the start and end coordinates of each transect are listed in Table 4.2–1. The ROV was operated from the 34’ MV Crown Royal and flown along predetermined transects oriented perpendicular to the shore. Transects were spaced approximately 500 m apart and extended from the greatest operation depth of the ROV (approximately 300 m depth) to the shoreline (or shallowest accessible depth). The ROV was equipped with a 1080p video camera (with zoom capabilities) and video was recorded with GPS coordinates, date, time, depth, and bearing overlayed for each frame. At the start of each transect the date, time, depth, GPS coordinates, weather (temperature, wind speed), and water conditions (visibility, current, tide) were recorded. At the end of each transect the time, depth, and GPS coordinates were recorded. While conducting the survey the video signal was displayed in real-time, allowing the pilot to adjust the speed and flight path of the ROV if biophysical features of interest or obstacles were observed while underway. High-intensity external lighting provided illumination in low light conditions and parallel scaling lasers (15 cm apart) allowed for size estimation of organisms or other objects observed. The ROV and support vessel used a Simrad HS80A differential GPS system, AML Oceanographic sound velocity profiler, and a Trackpoint 3 ultrashort baseline (**USBL**) navigation suite with Edgetech hydrophone to provide GPS tracks of all ROV transects as they were flown. One of the planned transects (E2) had to be shortened due to strong currents preventing forward movement of the ROV.



KSI LISIMS LNG

East Pearse Island Subtidal Survey Transect

West Pearse Island Subtidal Survey Transect

Whiskey Bay Subtidal Survey Transect

Boundaries of District Lots 7235 and 5431

0 150 300 450 600 750 m

1:20,000 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
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Project Location:
Pearse Island, BC

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Figure No.
4.2-1

Title
Subtidal Survey Area and Transects

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Table 4.2–1 Subtidal Transect Locations

Subarea	Transect	Transect Start		Transect End		Length (m)
		Easting	Northing	Easting	Northing	
East Pearse	E1	424638	6099431	424455	6098904	557
	E2	424976	6099185	424823	6099026	220
	E3	425021	6098714	424625	6098381	518
	E4	425089	6098351	424408	6097952	789
	E5	424956	6097913	424396	6097705	567
	E6	424937	6097630	424455	6097437	519
	E7	424948	6097259	424552	6097136	415
	E8	425197	6097039	424717	6096839	519
					Total Length	**4,104**
Whiskey Bay	WB1	424149	6099287	424194	6098401	887
					Total Length	**887**
West Pearse	W2	422693	6098914	423305	6098372	817
	W3	422408	6098673	422886	6098304	606
	W4	422129	6098389	422660	6097922	707
					Total Length	**2,130**

NOTE:
All coordinates are in UTM Zone 9

4.2.2.2 Video Analysis

Remotely operated vehicle videos from the 12 transects were reviewed post-survey from start to finish. Depth (not corrected to chart datum), time, date, and substrate observations were recorded along the length of each transect. Dominant and subdominant (if applicable) substrate types were recorded as per the categories shown in Table 4.1–2. Substrates were recorded at the start of each transect and updated with any persistent changes in substrate composition (defined as changes for longer than 10 seconds of ROV flight).

Substrates classification was aided by two onboard scaling laser pointers visible in the videos. Biotic observations of marine vegetation (algae and eelgrass), fish, and invertebrates were recorded along with their surrounding substrate type(s). Individual organisms were identified to the lowest practicable taxonomic level, counted throughout the video, or assigned percent cover when counting them as individuals was not practical due to large numbers (e.g., thousands of shrimp along a transect). Algae taxa were also recorded as percent cover. Representative screenshots of substrates and taxa present were taken during the video analysis.

Dominant and subdominant substrates for each subarea were summarized over three depth bins: ≤ 50 m, 51–100 m, and > 100 m. The one exception to this was in Whiskey Bay where surveyed depths were limited to ≤ 50 m due to relatively shallow water in the surveyed area. These depth bins were used to capture visual differences observed between substrates in different depth areas on transects.

Table 4.2–2 Substrate Classification

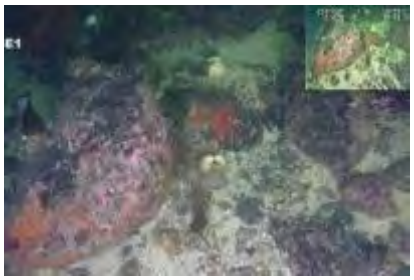
Substrate Category	Description	Representative Photo
Bedrock	Solid, continuous rock greater than 4,000 mm in diameter	
Boulder	Rock ranging from 256–4,000 mm in diameter	
Cobble	Ranging from 64–256 mm in diameter	
Gravel	Ranging from 2–64 mm in diameter	

Table 4.2–2 Substrate Classification

Substrate Category	Description	Representative Photo
Fine	Sand or mud, ranging from less than 2 mm diameter	
Shell	Bivalve shell fragments	
NOTE: Classification categories adapted from: DFO 1990; RISC 2001		

4.2.2.3 Data Analysis

Statistical analyses were conducted in R Statistical Software Version 4.0.2 (R Core Team 2020). Taxa observed were grouped into algae and aggregating invertebrates (those measured as percent cover), and solitary invertebrates and fish (those measured by count). Richness was calculated as the number of distinct taxa observed for each transect and was also combined for each subarea to provide a total richness estimate for the three subareas. Richness was standardized among transects by dividing the total number of species observed by the length (m) of the transect surveyed. Abundance of each taxa group was calculated by first totaling the number of organisms in each transect and then dividing that sum by the length of the transect. Richness and abundance were calculated for transects, not for individual depth bins.

Abundance information was used to calculate Shannon-Wiener diversity (Shannon and Weaver 1949; Spellerberg and Fedor 2003) for each grouping. Shannon-Wiener diversity calculation is provided in Section 4.1.2.

4.2.3 Results

Summary results of flora and fauna taxa richness throughout the subtidal survey area are presented in Table 4.2–3 (marine vegetation), Table 4.2–4 (invertebrates), and Table 4.2–5 (marine fish).

Additional descriptions on the biophysical characteristics observed are arranged and summarized by subarea and depth. In total, 7.15 km of the subtidal environment was surveyed during the subtidal survey.

A photolog of representative taxa and habitats observed during the subtidal survey is provided in Appendix C. A complete summary of taxa richness and abundance summary tables can be found in Appendix D.1 to D.3.

Table 4.2–3 Marine Vegetation Observed During Subtidal Surveys

Family	Common Name	Scientific Name	East Pearse Island	Whiskey Bay	West Pearse Island
Green Algae (Phylum Chlorophyta)	Sea lettuce	*Ulva* spp.	X	X	X
Red Algae (Phylum Rhodophyta)	Filamentous red algae	Phylum Rhodophyta	X	–	–
Brown Algae (Phylum Ochrophyta)	Rockweed	*Fucus* spp.	X	X	X
	Unidentified kelp	Order Laminariales	X	X	X
	Ribbon kelp	*Alaria marginata*	X	–	–
	Fringed sea colander kelp	*Agarum fimbriatum*	X	–	–
	Unidentified brown algae	Class Phaeophyceae	X	–	–
Marine Flowering Plants	Eelgrass	*Zostera* spp.	–	–	X

Table 4.2–4 Marine Invertebrates Observed During Subtidal Surveys

Family	Common Name	Scientific Name	East Pearse Island	Whiskey Bay	West Pearse Island
Annelids	Unidentified tubeworm	Family Serpulidae	X	–	–
Bryozoans	Kelp-encrusting bryozoan	*Membranipora serrilamella*	–	–	X
Cnidarians	Unidentified anemone	Class Anthozoa	X	–	X
	Crimson anemone	*Cribrinopsis fernaldi*	X	–	–
	Giant plumose anemone	*Metridium farcimen*	–	–	X
	Pom pom anemone	*Liponema* sp.	X	–	–
	Unidentified coral	Class Anthozoa	X	–	X
	Orange cup coral	*Balanophyllia elegans*	X	–	X
	Unidentified soft coral	Order Alcyonacea	X	–	–
	Tan cup coral	*Caryophyllia alaskensis*	X	–	–
	Unidentified hydroid	Class Hydrozoa	X	–	X
	Unidentified gorgonian coral	Order Alcyonacea	X	–	–
	Orange sea pen	*Ptilosarcus gurneyi*	X	–	–
	Unidentified sea pen	Family Pennatulidae	X	–	–
	Sea whip	*Halipteris willemoesi*	X	–	–
	White branching hydrocoral	*Stylaster campylecus*	X	–	–
	Unidentified zoanthid	Order Zoantharia	X	–	X
Crustaceans	Unidentified crab	Infraorder Brachyura	X	X	X
	Brown box crab	*Lopholithodes foraminatus*	–	–	X
	Hermit crab	Superfamily Paguroidea	X	–	X
	Unidentified shrimp	Order Decapoda	X	–	X
	Sidestripe shrimp	*Pandalopsis dispar*	X	–	X
	Squat lobster	*Munida quadrispina*	X	–	X
	Tanner crab	*Chionoecetes bairdi*	–	–	X

Table 4.2–4 Marine Invertebrates Observed During Subtidal Surveys

Family	Common Name	Scientific Name	East Pearse Island	Whiskey Bay	West Pearse Island
Echinoderms	Unidentified sea star	Class Asteroidea	X	X	X
	Bat star	*Asterina miniate*	X	–	–
	Brittle star	Order Ophiuroidea	X	–	–
	Cookie star	*Ceramaster patagonicus*	X	X	X
	Feather star	*Florometra serratissima*	X	–	X
	Mottled star	*Evasterias troschelii*	X	X	X
	Rainbow star	*Orthasterias koehleri*	X	X	X
	Spiny red star	*Hippasteria spinosa*	X	–	–
	Sunflower star	*Pycnopodia helianthoides*	X	X	X
	Velcro star	*Stylasterias forreri*	X	X	X
	Vermilion star	*Mediaster aequalis*	X	X	X
	Basket star	*Gorgonocephalus eucnemis*	X	–	–
	Blood star	*Henricia leviuscula*	X	X	–
	Fat blood star	*Henricia sanguinolenta*	X	–	–
	Morning sun star	*Solaster dawsoni*	X	–	–
	Northern sun star	*Solaster endeca*	X	X	–
	Rose star	*Crossaster papposus*	X	X	X
	Striped sun star	*Solaster stimpsoni*	–	–	X
	Sandstar	*Luidia foliolata*	–	–	X
	Unidentified sea cucumber	Class Holothuroidea	X	–	–
	Giant California sea cucumber	*Apostichopus californicus*	X	X	X
	Red sea cucumber	*Cucumaria miniata*	–	X	X
	Unidentified urchin	*Strongylocentrotus* spp.	X	–	–
	Green urchin	*Strongylocentrotus droebachiensis*	X	X	X
	Heart urchin	*Brisaster latifrons*	X	–	–
	Pink urchin	*Strongylocentrotus fragilis*	X	–	X
	Purple urchin	*Strongylocentrotus purpuratus*	X	–	–
	White urchin	*Strongylocentrotus pallidus*	X	X	X

Table 4.2–4 Marine Invertebrates Observed During Subtidal Surveys

Family	Common Name	Scientific Name	East Pearse Island	Whiskey Bay	West Pearse Island
Mollusks	Unidentified mollusk	Phylum Mollusca	X	–	–
	Unidentified mussel	*Mytilus* spp.	–	–	X
	Unidentified nudibranch	Order Nudibranchia	X	–	X
	Lemon peel nudibranch	*Tochuina gigantea*	X	–	–
	Unidentified snails and slugs	Class Gastropoda	X	–	–
	Unidentified squid	Class Teuthida	X	–	–
	Stubby squid	*Rossia pacifica*	X	–	X
	Unidentified sponge	Phylum Porifera	X	–	–
Poriferans	Cloud sponge	*Aphrocallistes vastus*	X	–	X
	Fingered goblet sponge	*Heterochone calyx*	X	–	–
	Funnel sponge	*Semisuberites cribrosa*	X	–	X
	Unidentified glass sponges	Class Hexactinellida	X	–	X
	Unidentified *Farrea* sponge	*Farrea* sp.	–	–	X
	Round lipped boot sponge	*Staurocalyptus dowlingi*	X	–	–
	Sharp lipped boot sponge	*Rhabdocalyptus dawsoni*	X	–	X
Tunicates	Unidentified tunicate	Subphylum Tunicata	–	–	X

Table 4.2–5 Marine Fish Observed During Subtidal Surveys

Family	Common Name	Scientific Name	East Pearse Island	Whiskey Bay	West Pearse Island
N/A	Unidentified fish	Unidentified fish	X	X	X
Agonidae	Unidentified poacher	Family Agonidae	X	X	X
	Sturgeon poacher	*Podothecus accipenserinus*	–	–	X
Chimaeridae	Ratfish	*Hydrolagus colliei*	X	–	X
Cottidae	Unidentified sculpin	Family Cottidae	X	X	X
	Rosylip sculpin	*Ascelichthys rhodorus*	–	–	X
	Spinyhead sculpin	*Dasycottus setiger*	–	–	X
Gadidae	Unidentified cod	Family Gadidae	X	–	X
	Pacific cod	*Gadus macrocephalus*	X	–	–
Hexagrammidae	Whitespotted greenling	*Hexagrammos stelleri*	X	–	–
Pleuronectidae	Unidentified righteye flounder	Family Pleuronectidae	X	X	X
	C-O sole	*Pleuronichthys coenosus*	–	–	X
	Dover sole	*Microstomus pacificus*	–	–	X
	Halibut	*Hippoglossus stenolepis*	–	–	X
	Rex sole	*Glyptocephalus zacharias*	–	–	X
	Starry flounder	*Platichthys stellatus*	X	X	–
Rajidae	Unidentified skate	Family Rajidae	X	–	X
	Sandpaper skate	*Bathyraja interrupta*	–	–	X
Sebastidae	Unidentified rockfish	*Sebastes* spp.	X	–	X
	Copper rockfish	*Sebastes caurinus*	X	–	–
	Quillback rockfish	*Sebastes maliger*	X	–	–
	Sharpchin rockfish	*Sebastes zacentrus*	X	–	–
	Yellowtail rockfish	*Sebastes flavidus*	X	–	X
Stichaeidae	Unidentified prickleback	Family Stichaeidae	X	–	X
	Snake prickleback	*Lumpenus sagitta*	–	–	X
Zoarcidae	Blackbelly eelpout	*Lycodes pacificus*	X	–	X

4.2.3.1 East Pearse Island

The subtidal environment in the east Pearse Island subarea is relatively consistent from the north to south ends. The trends observed in intertidal substrates, where some areas appeared more exposed and some more sheltered, was not observed on subtidal transects except at the most shallow areas where tidal conditions caused the intertidal areas to be below the water line where they were captured by the ROV. Fine substrates dominated in deeper water in all transects and persisted into water less than 100 m deep (e.g., Appendix C Photos 7, 8 and 9), except in the shallower portions of transects cobble was also observed (e.g., Appendix B-1 Photo 16). Irregular areas of exposed bedrock were observed on several transects and communities of invertebrate taxa were observed on the bedrock substrate.

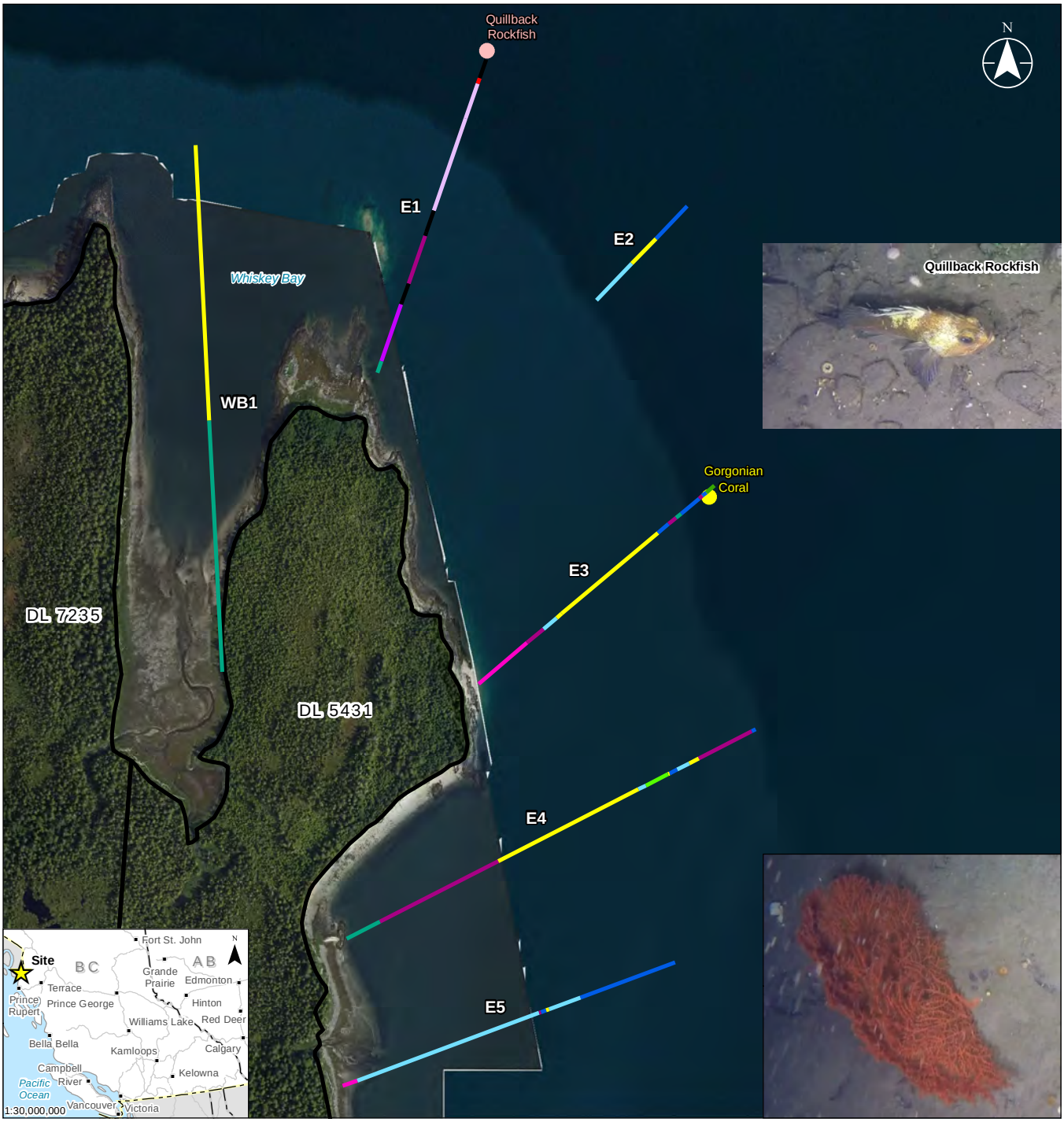
Substrates

The dominant substrate observed across all depths on east Pearse Island was fine sediment (Table 4.2–6 e.g., Appendix C, Photo 7). The most commonly observed subdominant substrate was fine in the shallow (≤ 50 m) and deep (> 100 m) depth bins and cobble in the intermediate (51–100 m) depth bin. The distribution of the dominant and subdominant substrates along the east Pearse Island transects are shown in Figure 4.2–2.

Table 4.2–6 Substrate Summary for East Pearse Island

Depth (m)	Dominant Substrate	Subdominant Substrate
≤ 50	Fine	Fine
51–100	Fine	Cobble
> 100	Fine	Fine

NOTES:
Cobble: Ranging from 64–256 mm in diameter.
Fine: Sand or mud, ranging from less than 2 mm diameter.



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Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Substrate Change (Primary Substrate, Secondary Substrate)
- Bedrock, Fine
- Cobble, Boulder
- Cobble, Fine
- Fine, Bedrock
- Fine, Boulder
- Fine, Cobble
- Fine, Fine
- Fine, Gravel
- Fine, Shell
- Gravel, Boulder
- Gravel, Cobble
- Gravel, Fine

- Boundaries of District Lots 7235 and 5431
- Gorgonian Coral
- Quillback Rockfish

0 90 180 270 360 450 m

1:10,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20220615
Requested by CMCCRACKEN on 20220601
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Figure No.
4.2-2

Title
Subtidal Substrates in East Pearse Island

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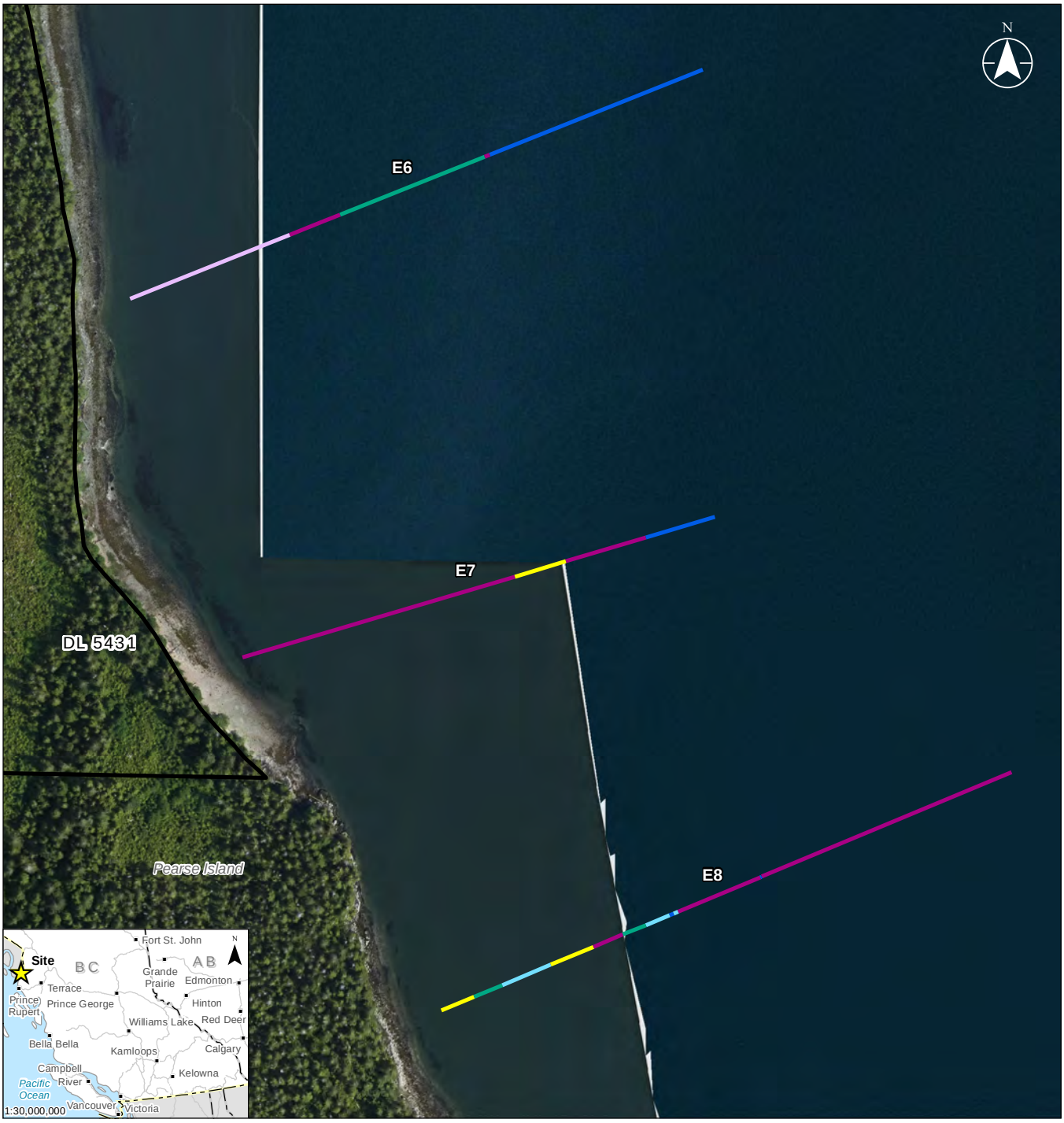

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Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Substrate Change (Primary Substrate, Secondary Substrate)
- Bedrock, Fine
- Fine, Cobble
- Fine, Fine
- Fine, Gravel
- Fine, Shell
- Gravel, Cobble

Boundaries of District Lots 7235 and 5431

0 40 80 120 160 200 m
1:5,000 (at original document size of 8.5x11)

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Taxa Richness

Seven taxa of marine vegetation were observed in the east Pearse Island subarea (Table 4.2–3). The most observed taxa of marine vegetation were kelp, rockweed, and sea lettuce.

Sixty taxa of marine invertebrates were observed at east Pearse Island (Table 4.2–4). Sidestripe and unidentified shrimp were the most commonly observed invertebrates and had to be recorded in percent cover due to their ubiquitous distribution along the deeper areas of transects on east Pearse Island. White urchin (*Strongylocentrotus pallidus*), green urchin, feather star (*Florometra serratissima*), zoanthid (Order Zoantharia), orange cup coral ,and giant California sea cucumber were the most observed marine invertebrates.

A total of 17 species of marine fish were observed at east Pearse Island (Table 4.2–5). Rockfish, right eye flounder (*Pleuronectidae* spp.), blackbelly eelpout (*Lycodes pacificus*), and yellowtail rockfish were the most abundant species observed across the transects. Other marine fish observed included ratfish, starry flounder (*Platichthys stellatus*), one species of skate (Family Rajidae), and an unidentified poacher (Family Agonidae). A skate egg was also observed on cobbles at 48 m depth at east Pearse Island.

One fish species of conservation concern was observed at east Pearse Island: quillback rockfish (Table 4.2–5). This species is currently listed as threatened under COSEWIC (SARA 2022). A single individual was observed at the western edge of east Pearse Island (Transect E1) swimming amongst cobble substrates (Appendix C).

Abundance

The abundance of marine organisms observed during the subtidal surveys are shown in Appendix D.2. Kelp and rockweed were the most abundant algae species. The most abundant invertebrate taxa observed at east Pearse Island was white urchin, followed by green urchin, feather star, zoanthids (Class Anthozoa), orange cup coral, and squat lobster (*Munida quadrispina*). Abundance of invertebrate taxa recorded as percent cover were dominated by brittle stars (Order Ophiuroidea) and tubeworms (Order Serpulidae). The most abundant fish taxa observed at east Pearse Island were right eye flounder and rockfish.

Diversity

Marine organism diversity observed during subtidal surveys is shown in Appendix D.3. In the east Pearse Island subarea, diversity was highest for solitary invertebrate taxa, followed by marine fish, then aggregating invertebrates and algae.

4.2.3.2 Whiskey Bay

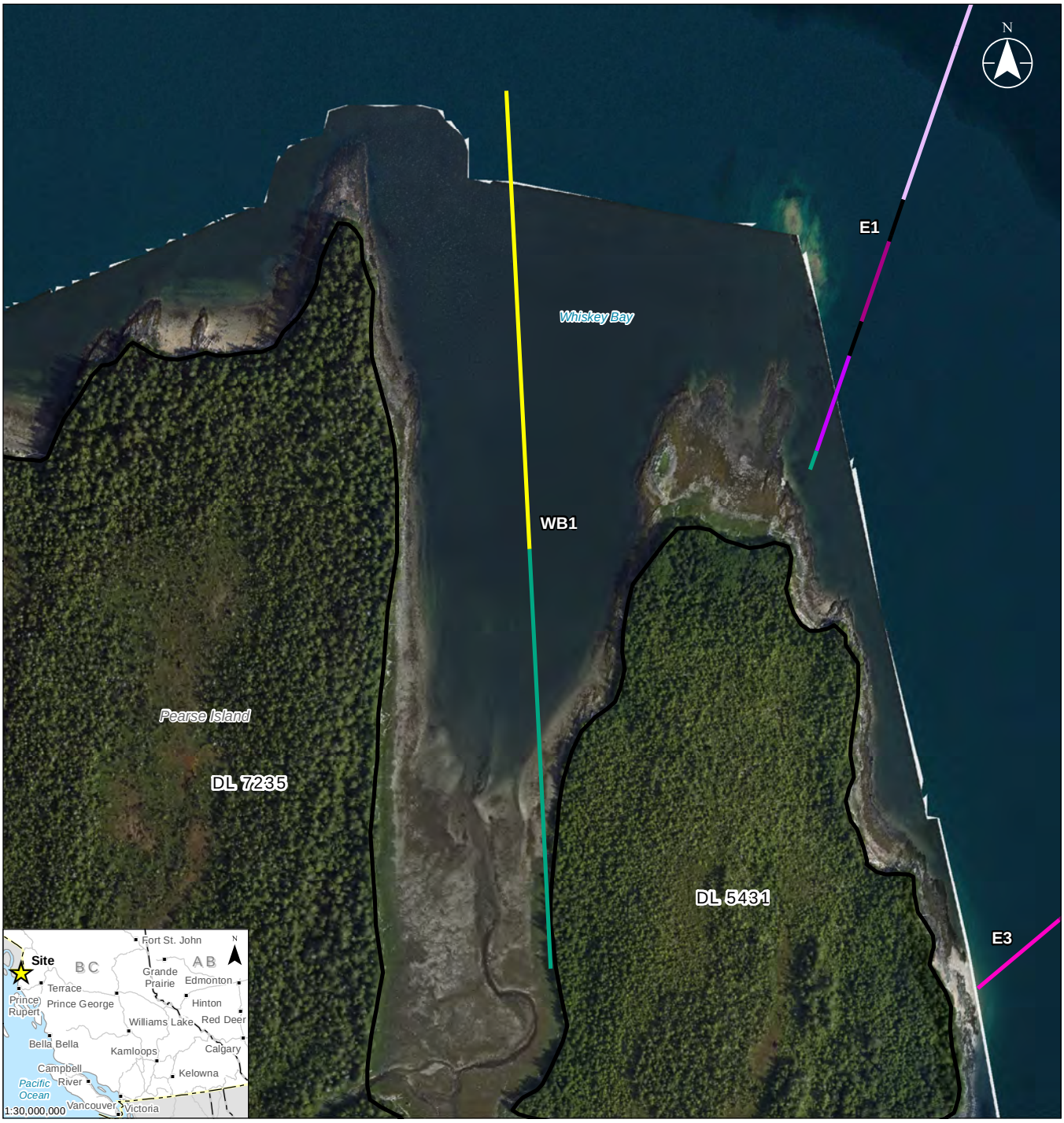
The subtidal area of Whiskey Bay is characterized by areas of cobble and gravel at the north end of the bay where the area is more exposed to wind and currents. Water depths in this subarea all fell within the shallowest depth bin (≤50 m). Fine substrates then dominate the remainder of the transect where they would be sheltered. The subtidal transect in Whiskey Bay overlapped with the intertidal survey area because the transect was surveyed near high tide when much of the intertidal area was underwater. These overlapping areas were dominated by rockweed.

Substrates

The dominant substrate observed along the single transect in Whiskey Bay (WB1) was comprised of fine material (Table 4.2–7). The distribution of the dominant and subdominant substrates along the Whiskey Bay transect is shown is shown in Figure 4.2–3.

Table 4.2–7 Substrate Summary for Whiskey Bay from the ROV Analysis

Depth (m)	Dominant Substrate	Subdominant Substrate
≤50	Fine	Cobble
NOTES: Cobble: Ranging from 64–256 mm in diameter. Fine: Sand or mud, ranging from less than 2 mm diameter.		



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Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Substrate Change (Primary Substrate, Secondary Substrate)
- Bedrock, Fine
- Cobble, Fine
- Fine, Cobble
- Fine, Shell
- Gravel, Boulder
- Gravel, Cobble
- Gravel, Fine

Boundaries of District Lots 7235 and 5431

0 50 100 150 200 250 m
1:6,000 (at original document size of 8.5x11)

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Taxa Richness

Three taxa of marine vegetation were observed in Whiskey Bay: kelp, sea lettuce, and rockweed (Table 4.2–3). Rockweed was the most abundant species, followed by sea lettuce, with only sparse observations of kelp.

Fifteen taxa of marine invertebrates were observed in Whiskey Bay (Table 4.2–4; Table 4.2–5). Green urchin, giant California sea cucumber, mottled star (*Evasterias troschelii*), and white urchin were the most observed species. Marine invertebrate species known to be of commercial fishery and harvesting importance observed during the survey include green urchin and giant California sea cucumber.

Five species of marine fish were observed in Whiskey Bay, including unidentified right eye flounders, sculpins, and poachers (Table 4.2–5). Right eye flounder species were the most abundant species observed at Whiskey Bay.

No marine species of conservation concern were observed in Whiskey Bay during the subtidal survey.

Abundance

The abundance of marine organisms observed during the subtidal surveys are shown in Appendix D.2. Rockweed and sea lettuce were the most abundant algae species observed in Whiskey Bay. Invertebrate taxa abundance was dominated by green urchins, giant California sea cucumbers, mottled stars, and white urchins. Righteye flounders were the most abundant fish taxa observed.

Diversity

Marine organism diversity observed during subtidal surveys is shown in Appendix D.3. In the Whiskey Bay subarea, diversity was highest for solitary invertebrate taxa, followed by marine fish, then algae and aggregating invertebrates.

4.2.3.3 West Pearse Island

The subtidal area of west Pearse Island is characterized by fine substrates with areas of gravel or cobble that were relatively consistent between the three transects surveyed (e.g., Appendix C, Photo 15). A glass sponge reef was observed near the seaward side of the northernmost subtidal transect and a small eelgrass bed was observed on the shoreward side (Figure 4.2–4).

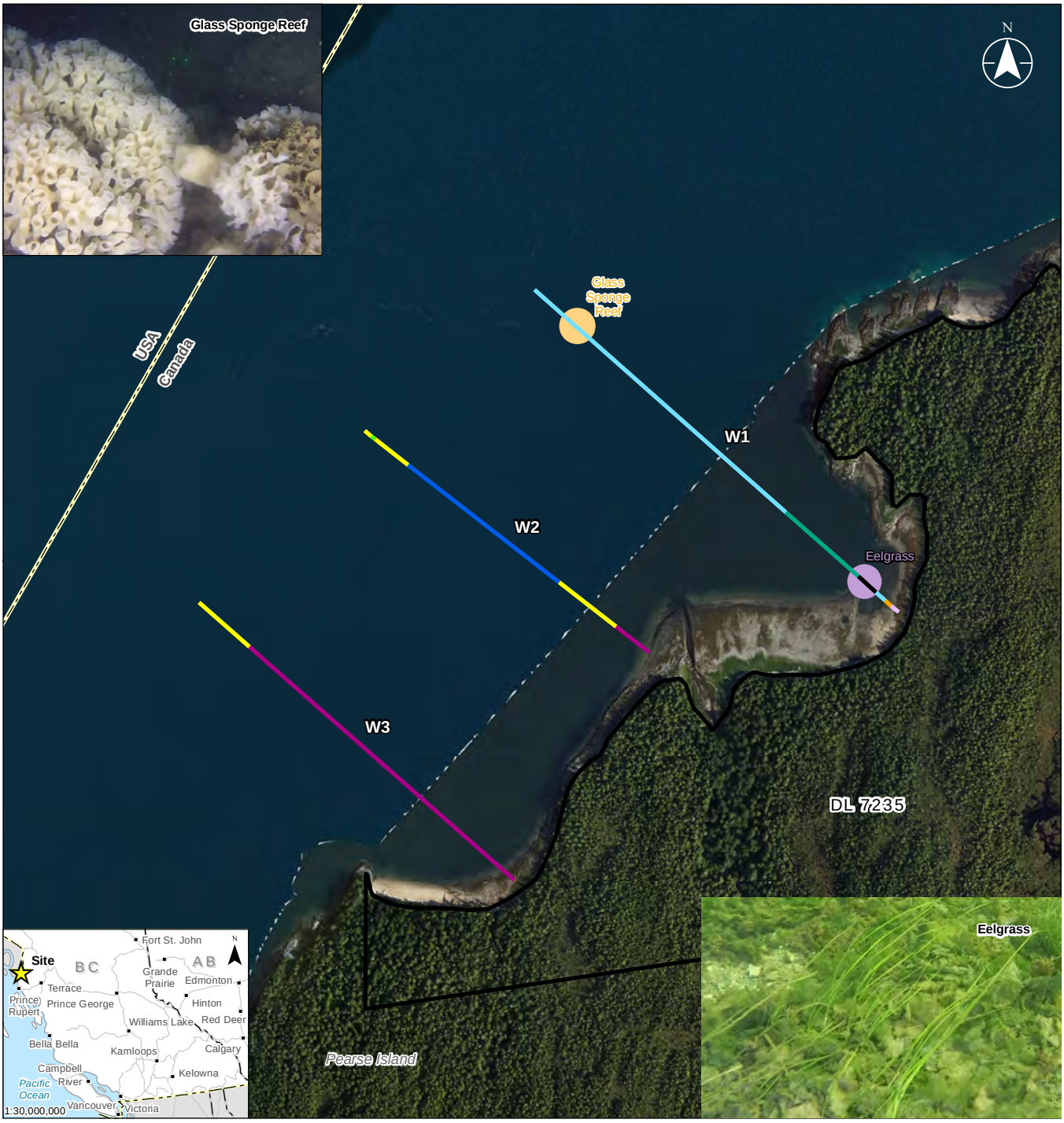
Substrates

The dominant substrate observed across all depths on west Pearse Island was fine (Table 4.2–8). The most commonly observed subdominant substrate was gravel in shallow depths (≤ 50 m), cobble in intermediate depths (51–100 m), and fine in deep depths (> 100 m). The distribution of the dominant and subdominant substrates along the west Pearse Island transects are shown in Figure 4.2–4.

Table 4.2–8 Substrate Summary for West Pearse Island from the ROV Analysis

Depth (m)	Dominant Substrate	Subdominant Substrate
≤ 50	Fine	Gravel
51–100	Fine	Cobble
> 100	Fine	Fine

NOTES:
Cobble: Ranging from 64–256 mm in diameter.
Gravel: Ranging from 2–64 mm in diameter.
Fine: Sand or mud, ranging from less than 2 mm diameter.



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Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Substrate Change (Primary Substrate, Secondary Substrate)
- Bedrock, Fine
- Boulder, Cobble
- Cobble, Fine
- Cobble, Gravel
- Fine, Boulder
- Fine, Cobble
- Fine, Fine
- Fine, Gravel
- Fine, Shell
- Gravel, Cobble

- Boundaries of District Lots 7235 and 5431
- Eelgrass
- Glass Sponge Reef

0 90 180 270 360 450 m
1:10,000 (at original document size of 8.5x11)

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Taxa Richness

Four taxa of marine vegetation were observed on west Pearse Island (Table 4.2–3): rockweed, sea lettuce, unidentified kelp, and eelgrass . Sea lettuce and rockweed were the most abundant. Of note, a small patch of eelgrass (approximately 10 m^2) was observed on Transect W2 at depth of 6 m on cobble substrates with subdominant fines (Figure 4.2–4).

Forty taxa of marine invertebrates were observed at West Pearse Island (Table 4.2–4). Sidestripe and unidentified shrimp were the most commonly observed invertebrates and had to be recorded in percent cover due to their ubiquitous distribution along the deeper areas of transects on west Pearse Island. Feather star and brittle star, were the next most abundant species.

A total of 20 taxa of marine fish were observed at west Pearse Island (Table 4.2–5). Unidentified poacher, rockfish, right eye flounder, and blackbelly eelpout were the most abundant fish taxa observed across the transects. Other fish species observed included Pacific halibut, ratfish, skate, snake prickleback (*Lumpenus sagitta*), and various sculpin species.

No marine species of conservation concern were observed at west Pearse Island during the subtidal surveys.

Abundance

The abundance of marine organisms observed during the subtidal surveys are shown in Appendix D.2. Algae species observed were dominated by rockweed and sea lettuce. Marine invertebrate species with the greatest abundances were feather stars, shrimp, and vermilion star (*Mediaster aequalis*). Invertebrate recorded as percent cover were dominated by mussels and glass sponges (*Farrea* spp.).

Diversity

Marine organism diversity observed during subtidal surveys is shown in Appendix D.3. In the west Pearse Island subarea, diversity was highest for solitary invertebrate taxa, followed by marine fish, then aggregating invertebrates and algae.

4.2.3.4 Summary

Substrates in the subtidal areas of the three subareas were dominated by fines. This trend persisted in the three depth bins surveyed. In general, substrates were mostly fine in the deeper waters of subtidal transects and transitioned to a mix of fines, gravel, and cobble in shallower areas. Irregular patches of bedrock were observed on most transects.

Taxa richness was highest in the east Pearse Island subarea (84 taxa) and lowest in Whiskey Bay (23 taxa). Sixty-four taxa were observed in the west Pearse Island subarea. Similar to trends observed in the intertidal surveys, the differences in taxa richness may be reflective of the greater amount of survey effort conducted in the three subareas. Eight transects were surveyed in the east Pearse Island subarea compared to only one in Whiskey Bay and three in west Pearse Island. Sea lettuce , rockweed , and kelp

were the three marine vegetation taxa observed in all three subareas. Eelgrass was observed on Transect W1 at west Pearse Island. Marine invertebrates had the highest taxa richness of the three species groups at all three subareas and taxa such as sea stars, urchins, and crabs were observed on at least one transect in each subarea. Shrimp were abundant along the deeper areas of transects on both east and west Pearse Island. Cnidarians, mollusks, and poriferans were observed at both east and west Pearse Island, but not in Whiskey Bay. Marine fish such as flatfish, rockfish, sculpin, and poachers were observed on at least one transect in all three subareas, but more marine fish taxa were observed at east and west Pearse Island than in Whiskey Bay. The largest number of marine fish taxa observed was 20 at west Pearse Island. The only taxa of conservation concern observed was a quillback rockfish (listed as Threatened under COSEWIC) on Transect E1. A glass sponge reef that may provide habitat to fish and invertebrate species was observed at west Pearse Island.

Sea lettuce , rockweed, and kelp were the most abundant algae species in all three subareas. Green urchins were one of the most abundant taxa in the east Pearse Island and Whiskey Bay subareas and were also observed at west Pearse Island, although in lower abundance. In general, marine fish abundance was higher in east and west Pearse Island than in Whiskey Bay. Rockfish were observed in the east and west Pearse Island subareas, but not in Whiskey Bay.

Diversity was highest for solitary invertebrates followed by marine fish in all three subareas. Algae species had the lowest diversity in east and west Pearse Island, and aggregating invertebrate diversity was only lower in Whiskey Bay because it had a value of zero. The low diversity of algae species is not surprising given that the photic zone supporting algal growth only comprised a small portion of each transect's length (approximately 30 m).

4.3 MARINE FISH SURVEY

4.3.1 Introduction

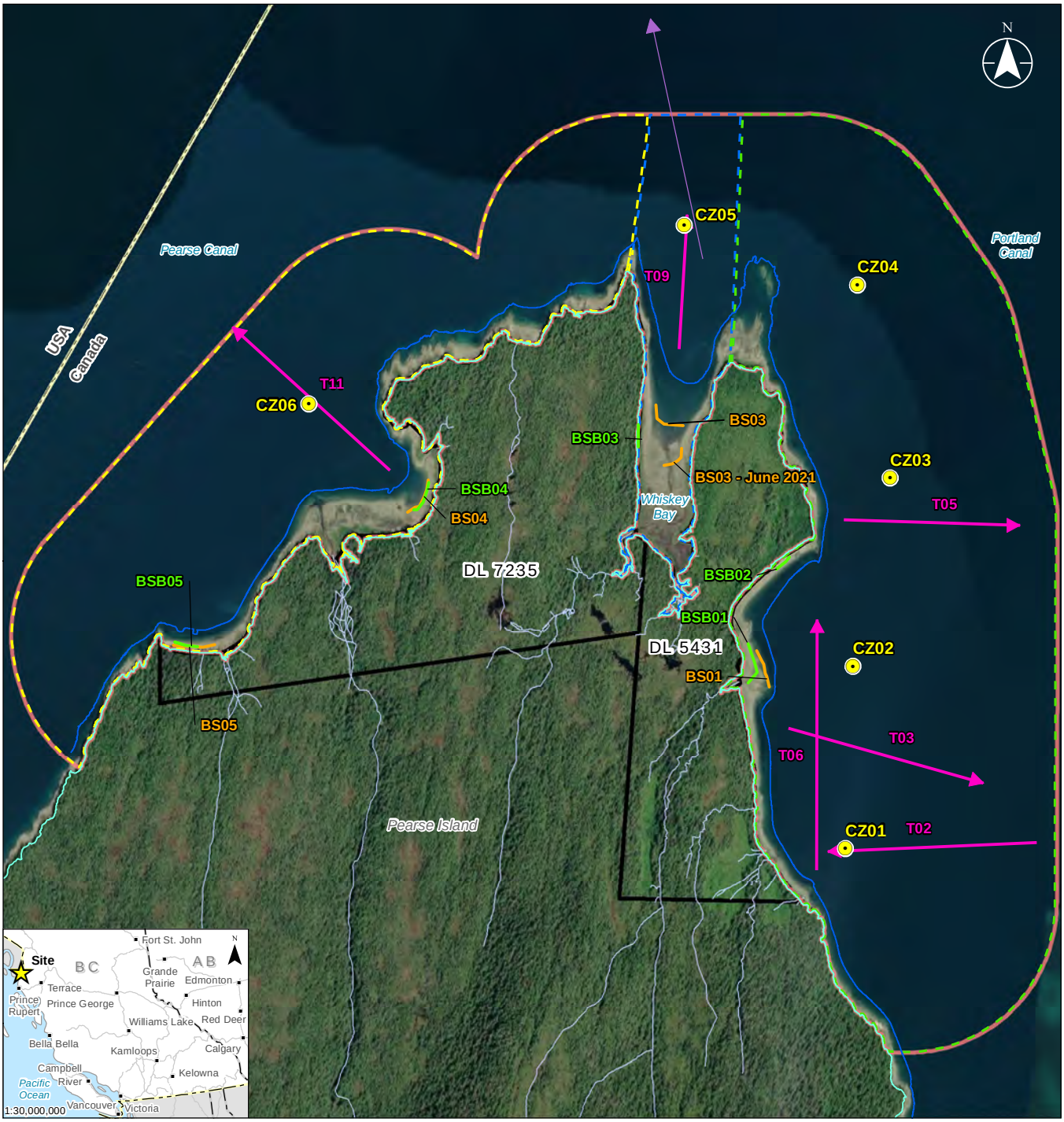
The objective of the marine fish surveys was to characterize seasonal marine fish diversity, presence, and taxa abundance within the Marine Fish Survey Area, which encompasses the individual, targeted survey areas for marine fish data collection from the marine terminal area (East Pearse Island), across Whiskey Bay, and on West Pearse Island (Figure 4.3–1). Data collected included intertidal and subtidal fish collection counts, lengths, weights, and catch-per-unit-effort (**CPUE**), as well as relative fish biomass, density, and distribution as assessed by hydroacoustic echosounder. Zooplankton samples were collected and have been held for future analysis, if required. Survey methods and results are described in Sections 4.3.2 and 4.3.3.

4.3.2 Methods

Four marine fish surveys were conducted in each of June 2021, September 2021, November 2021, and February/March 2022, with the objective to capture seasonal fish presence in the Marine Fish Survey Area. While slightly outside of the formal calendar seasons, the surveys were timed to overlap with key biological events. June surveys captured summer species of interest, while September, November and February/March surveys represent fall, winter, and spring species of interest, respectively. The surveys included beach seine and zooplankton sampling activities (all four surveys), surface trawls (June survey), and hydroacoustic echosounder transects (all four surveys) (Figure 4.3–1). As a ground-truthing method for potential species observed in hydroacoustic data, June survey surface trawls were paired with a subset of hydroacoustic transects. Remaining June hydroacoustic transects were not paired with trawls due to unsuitable depths for equipment, obstacles to vessel maneuverability while actively fishing, or limited time with suitable tide and current conditions. Hydroacoustic coverage was expanded during the February/March survey to extend into the Nass Estuary to target fish returning to the Nass River to spawn. Survey timing targeted the following fish presence windows:

- Juvenile salmon migration from the Nass River (June and July)
- Local distribution of adult spawning Pacific herring, larval and juvenile herring (mid to late summer)
- Surf smelt migration and movement patterns (mid to late summer)
- Seasonal migration of adult eulachon into the Nass River (February to March)

Each of the three- to four-day surveys included data collection on fish presence, distribution, and habitats within the Marine Fish Survey Area. Survey locations encompassed Project infrastructure within the Marine Fish Survey Area with sampling methods varying by survey locations (Figure 4.3–1). Stantec prioritized sampling in areas suspected to support important ecological processes, such as potential spawning, migration, or juvenile holding areas in addition to a variety of marine fish habitats found within the Marine Fish Survey Area.



KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

- CTD and Zooplankton Station
- Beach Seine Foot-led
- Beach Seine Boat-led
- Test Trawl Transect
- Trawl Transect
- High Water Mark
- Low Water Mark
- Watercourse (Project Mapped)
- Boundaries of District Lots 7235 and 5431
- Marine Fish Survey Area

Local Study Area Sub-Areas
- East Pearse Island
- West Pearse Island
- Whiskey Bay

0 150 300 450 600 750 m
1:20,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC
Project Number: 123221820
Prepared by TQUILICHINI on 20220614
Requested by CMCCRACKEN on 20220601
Check by SMOSS on 20220614

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.3-1

Title
Marine Fish, CTD and Zooplankton Sampling Locations

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S:\123\2\projects\123221820\figures\reports\TDR\Marine\Fig4_3-1_123221820_215_marine_fish_CTD_zooplankton.mxd Revised: 2023-09-06 By: tquilichini

Fish captured during the surveys were transferred to containers of fresh seawater and identified to the lowest practicable taxonomic level. Fork length or total length (dependent on species) and weights were taken for the first ten individuals captured per species and per haul (i.e., beach seine set or trawl set), while the remainder were counted. External conditions, including parasites, lesions, and missing fins, were documented and any mortalities recorded. Collected invertebrates were also identified to the lowest practicable taxonomic level and counted. Representative photographs of captured individuals were taken to confirm field identification and for reporting records (Appendix E). Collected fish and invertebrates were returned unharmed near their capture location. During replicate beach seines, fish were released after the subsequent haul was started to avoid recollection and the potential for double counting individuals.

Thirty-three fin clips from captured salmonids were taken during the June survey for Nisga'a Fish and Wildlife Department for independent genetic analysis.

Sampling locations were chosen to overlap with the preliminary Project design footprint and adjacent areas. Efforts were also made to distribute sampling locations across the different habitat types in the Marine Fish Survey Area.

4.3.2.1 Beach Seine

Nearshore fish communities in the intertidal and shallow subtidal were quantified using beach seine surveys completed at mid-ebbing to low slack and mid-flooding tides. Beach seines were completed June 3, 5–7, September 1, 5–6, and November 6–7, 2021, and March 4–5, 2022. Five beach seine sites were sampled each survey either with a foot-led or boat-led beach seine, or both methods (Figure 4.3–1; Table 4.3–1). Seine locations and methods were selected based on substrate type (fines, sand, gravel), shoreline gradient, and accessibility (Appendix E, Photos 1 to 6).

Table 4.3–1 Beach Seine Survey Locations

Subarea	Survey Month	Site ID	Method	Location	
				Easting	Northing
East Pearse Island	June	BSB01	Boat-led	424389	6097904
		BSB02	Boat-led	424527	6098186
	September	BS01	Foot-led	424483	6098156
		BSB02	Boat-led	424400	6097815
	November	BS01	Foot-led	424392	6097370
		BSB02	Boat-led	424497	6098181
	March	BS01	Foot-led	424459	6097759
		BSB02	Boat-led	424489	6098153

Table 4.3–1 Beach Seine Survey Locations

Subarea	Survey Month	Site ID	Method	Location	
				Easting	Northing
Whiskey Bay	June	BS03	Foot-led	424164	6098562
	September	BS03	Foot-led	424077	6098746
	November	BS03	Foot-led	424058	6098738
		BSB03	Boat-led	424018	6098640
	March	BS03	Foot-led	424069	6098756
		BSB03	Boat-led	424030	6098565
West Pearse Island	June	BSB04	Boat-led	423264	6098355
		BSB05	Boat-led	422443	6097907
	September	BS04	Foot-led	423251	6098340
		BS05	Foot-led	422451	6097903
	November	BS04	Foot-led	423328	6098457
		BSB05	Boat-led	422459	6097892
		BS05	Foot-led	422590	6097880
	March	BS04	Foot-led	423313	6098454
		BS05	Foot-led	422595	6097901
		BSB05	Boat-led	422537	6097895

Foot-Led Beach Seine

Foot-led beach seines were conducted across a 30 m distance measured along the shoreline. Seine nets were extended perpendicular to shore with one side of the net led from the shore and the other end led at the limit of walkable depth (approximately 1.5 m) (Appendix E, Photo 7). The seine net was pulled parallel to shore, then pursed on shore at the 30 m mark. A minimum of two and up to three hauls were conducted per site, with the length of available beach at the time of sampling being the determining factor. One exception occurred at BS03 where four hauls were completed during the March survey. Ratings (1 to 5) were assigned to each haul based on consistency of net movement and the overall likelihood of catching fish within the netted area. Lower ratings indicated a less than perfect set (e.g., if the net caught or snagged on rocks or debris, or if fish appeared to escape the net).

Foot-led beach seines were completed at sites BS01, BS03, BS04, and BS05, using either a 12.5 m x 1.5 m single panel seine (3 mm mesh; September and March surveys), 23 m x 4.5 m three-panel seine (10 mm mesh wings with 3 mm mesh bunt; June survey only), or a 10 x 1.22 m single panel net (6.4 mm mesh; November survey due to equipment error). The 12.5 m x 1.5 m single panel seine with 3 mm mesh was used to target smaller intertidal taxa while the 23 m x 4.5 m three-panel seine targeted shallow subtidal schooling species as well as slightly larger intertidal species where site access permitted use.

Boat-Led Beach Seine

Boat-led beach seines during the June survey were conducted in the same manner as the foot-led beach seines, except that the offshore end of the net was pulled via a 6 m aluminum skiff (Appendix E, Photo 8). Boat-led beach seine methods were modified for the remaining surveys (September, November, and March) to increase shallow subtidal coverage. For these surveys, a rope attached to one end of the seine net was held onshore while the net was parsed out at depth parallel to shore from a rigid hulled inflatable vessel or skiff (Appendix E, Photo 9). Once the net was fully extended in the water, the remaining rope end was brought to shore and both ends of the net were pulled into shore consecutively.

Boat-led beach seines were conducted at all five sites with a 23 m x 4.5 m net comprised of 3 panels (10 mm mesh wings with 3 mm mesh bunt). One to three hauls were completed at each site.

4.3.2.2 Surface Trawl

Surface trawls were paired with the June hydroacoustic survey with the objective of ground-truthing fish taxa recorded in the upper water column. Paired trawls were not used on subsequent hydroacoustic surveys due to a lack of suitable equipment available to sample fish in deeper waters (e.g., over 50 m deep).

Surface trawls were completed during the June 4–6, 2021 survey across six transects; T02, T03, T05, T06, T09, and T11 (Table 4.3–2), with one test trawl completed on June 3, 2021 to verify equipment efficiency and set methods (Figure 4.3–1).

Table 4.3–2 Surface Trawl Locations

Trawl ID	Transect Start		Transect End		Trawl Distance (m)
	Easting	Northing	Easting	Northing	
T02	425358	6097235	424655	6097205	708
T03	424515	6097477	425185	6097581	678
T05	424708	6098321	425305	6098303	597
T06	424621	6097142	424618	6097985	852
T09	424154	6098893	424180	6099348	464
T11	423184	6098488	422651	6098968	718
Test Trawl	424061	6100007	424236	6099198	830

NOTE:
All coordinates are in UTM Zone 09 U.

The surface trawl, an Ocean Fish Lift (**OFL**) trawl net, was modified from an Ocean Fish Lift Atlantic salmon smolt net (Holst and McDonald 2000) designed to collect juvenile salmon. A live capture floating aquarium box replaced a typical cod-end of the net to collect smaller pelagic fish, such as juvenile salmonids, with limited harm. Fish entering the trawl continuously flowed into the aquarium (an aluminum box held near the surface with floats) through a net tunnel which runs from the open end of the net

(Appendix E, Photo 10). Fish remained free swimming in the low turbulence aquarium and were released via a removable grid after the net was hauled in. The trawl net was 18 m long with an opening 5 m wide by 4.6 m high which was held open with two, 2 x 0.5 m aluminum trawl doors outfitted with floats. Approximately 4 kg of weight was attached to the lead line of each side of the net, which was towed approximately 75 to 100 m behind a 17 m vessel (MV Active Pass). The vessel travelled at an average speed of 3 knots (**kts**) to facilitate concurrent use of the paired hydroacoustic echosounder.

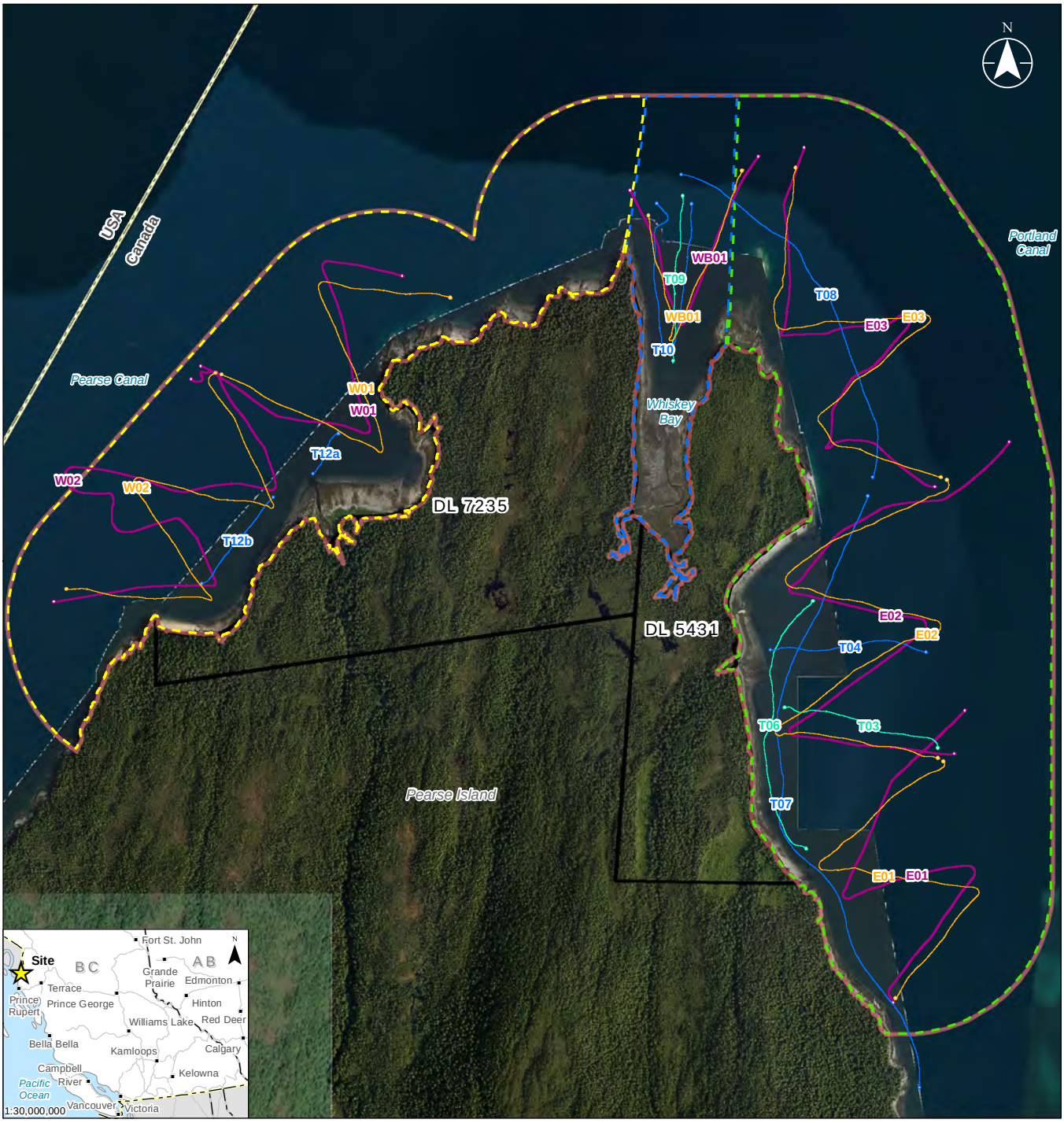
The trawl was launched by initial deployment of the aquarium from the stern of the boat using a winch. The net was fed through a steel drum and aluminum doors were attached to the lead and float lines after the net mesh was fully deployed. Additional line was released to each door to allow sufficient trawl distance from the vessel and to facilitate proper positioning of the aluminum doors (Appendix E, Photo 11). Trawl durations varied across transects from 8 to 13 minutes. Trawl sets were assigned a rating (1–5) based on the success of the trawl (e.g., whether doors remained open and untangled for the duration of the trawl, the net was set straight and not twisted, or the aquarium box remained at depth without surfacing above the water).

4.3.2.3 Hydroacoustic Transects

Hydroacoustic transects were conducted to estimate relative fish biomass, density, and distribution across the four seasonal surveys within the Marine Fish Survey Area (Figure 4.3–2). Additional transects were completed during the February/March survey, targeting potential eulachon presence from the Marine Fish Survey Area through the Nass Estuary (Figure 4.3–3).

A BioSonics Inc. 120 kilohertz (**kHz**) DT-X scientific echosounder was used during the hydroacoustic surveys. A pole mount was used to deploy the echosounder from the starboard gunwale of a 6 m aluminum skiff for the June survey, but a tow fish (an aluminum underwater glider which houses the echosounder transducer; Appendix E, Photos 12 and 13) was used for transducer deployment for the remaining surveys.

BioSonics Visual Acquisition (v6.3.1.10980) software was used during data collection. The software recorded and provided a live echogram, which is a visual representation of hydroacoustic data echoes, for real-time and post-field review and processing. The echosounder was calibrated with a transducer-specific 33.2 mm standard tungsten-carbide calibration sphere following manufacturer recommended methods (BioSonics Inc. 2015). Seawater salinity (PSU) and temperature (°C) were measured using a YSI EXO 2 multiparameter water quality sonde at the transducer face during calibration and entered into the software prior to data collection to inform the speed of sound calculation. Data collection parameters, including a collection threshold of -130 decibels (**dB**) to capture a wide range of echo strengths, are listed in Table 4.3–3 False bottoms, echo artefacts that appear as a second bottom above the true seafloor, are often produced in deep waters (i.e., over 200 m) by multiple sound reflections between the bottom and surface. To reduce the occurrence of false bottoms, the transducer ping rate and pulse duration settings varied from 2 to 5 pings per second and 0.4 to 0.5 milliseconds, respectively.



KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Hydroacoustic Transects
- June 2021
- June 2021 - with Paired Trawl
- November 2021
- February 2022

Boundaries of District Lots 7235 and 5431
Marine Fish Survey Area

Local Study Area Sub-Areas
- East Pearse Island
- West Pearse Island
- Whiskey Bay

0 150 300 450 600 750 m
1:20,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC
Project Number: 123221820
Prepared by TQUILICHINI on 20220614
Requested by CMCCRACKEN on 20220601
Check by SMOSS on 20220614

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.3-2

Title
Hydroacoustic Seasonal Transects

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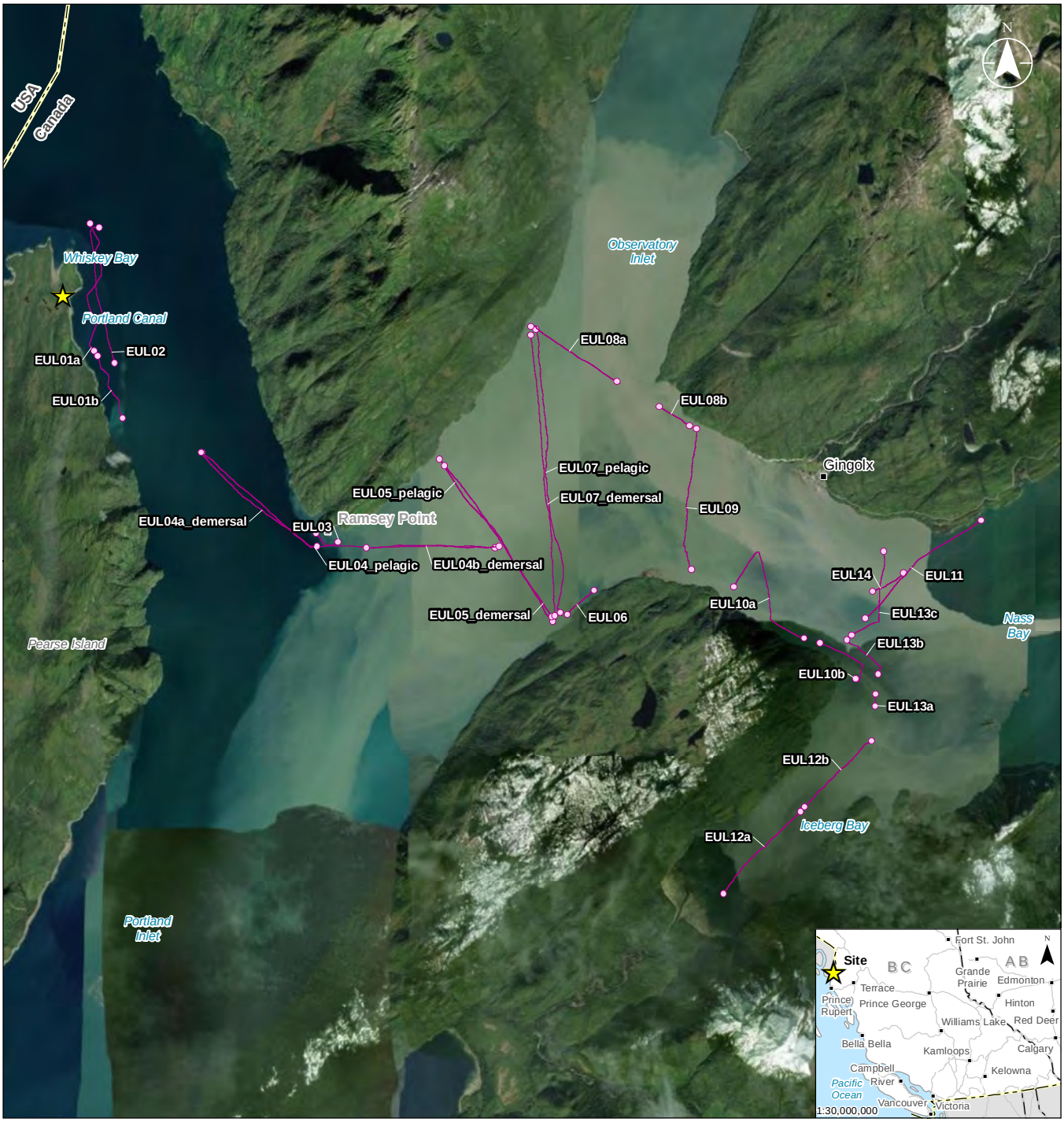

KSI LISIMS LNG

Ramsey Point
Site
Hydroacoustic Transects Track
Populated Place
International Boundary

0 1 2 3 4 km
1:115,000 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Stantec

Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20220707
Requested by CMCCRACKEN on 20220705
Check by SMOSS on 20220818

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.3-3

Title
Eulachon Hydroacoustic Transects (Pearse Island through Nass Estuary)

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S:\123\20\projects\123221820\figures\reports\TDR\Marine\Fig4_3-3_123221820_250_eulachon_hydroacoustic_transects.mxd Revised: 2023-09-06 By: tquilichini

Table 4.3–3 Hydroacoustic Echosounder Specifications and Data Collection Settings

BioSonics DT-X Scientific Echosounder	
Type	Split-beam
Orientation	Downward-facing
Frequency	120 kHz
Beam Width	8.2º
Collection Threshold	-130 decibel (dB)
Ping Rate	2 to 5 per second
Pulse Duration	0.4 to 0.5 millisecond
Sampling Rate	41667 hertz

Seasonal Survey

Across the three subareas, a total of 12 hydroacoustic transects were completed during the June survey; 7 transects during the November survey and 6 transects during the February/March survey. Additional transects were completed during the September survey; however, the data were unusable due to a transducer malfunction. Of the 25 transects completed, 21 were analyzed (Table 4.3–4) while the remaining 4 transects (all collected in June; T01, T02, T05, and T11) were unusable due to either a transducer malfunction or recording error. Transect locations were chosen based on areas where Project infrastructure was expected to be placed, by environmental conditions (i.e., water depths, current directions and speeds, aquatic plant absence), and by safe access for the vessel. Transect lines were surveyed in depths ranging from 39 m to the 200 m depth limit of the echosounder (Table 4.3–4).

Table 4.3–4 Seasonal Hydroacoustic Transect Locations and Maximum Depths

Subarea	Survey Month	Site ID	Start Location		End Location		Transect Length (m)	Maximum Depth (m)
			Easting	Northing	Easting	Northing		
East Pearse Island	June	T03	424521	6097622	425039	6097484	579	> 200
		T04	424473	6097821	425008	6097812	559	> 200
		T06	424604	6097149	424626	6097989	977	45
		T07	424807	6098344	424980	6096341	2244	70
		T08	424172	6099418	424821	6098394	1336	> 60
	November	E01	424892	6096628	425136	6097622	1797	> 200
		E02	425103	6097472	425285	6098525	2590	> 200
		E03	425038	6098368	424593	6099516	2091	> 200
	February	E01	425055	6097451	424895	6096643	1602	> 200
		E02	425065	6098396	425047	6097454	2498	> 200
		E03	424561	6099448	425058	6098398	2095	167

Table 4.3–4 Seasonal Hydroacoustic Transect Locations and Maximum Depths

Subarea	Survey Month	Site ID	Start Location		End Location		Transect Length (m)	Maximum Depth (m)
			Easting	Northing	Easting	Northing		
Whiskey Bay	June	T09	424148	6098786	424184	6099355	618	41
		T10	424212	6099328	424092	6099328	1120	40
	November	WB01	424442	6099486	424003	6099373	1137	46
	February	WB01	424388	6099436	424065	6099288	1083	49
West Pearse Island	June	T12a	423032	6098546	422937	6098407	181	52
		T12b	422810	6098339	422558	6098044	400	39
	November	W01	423246	6099076	422556	6098775	1508	134
		W02	422528	6098737	422062	6097981	2672	136
	February	W01	423406	6099000	422627	6098749	1685	114
		W02	422618	6098751	422103	6098023	2012	108

NOTE:
All coordinates are in UTM Zone 09 U.

Paired Trawl Survey

A subset of surface trawls was conducted concurrently with hydroacoustics transects during the June survey to ground-truth the hydroacoustic data, in an effort to identify fish observed in the echograms. Additional paired trawls were planned for the remaining three seasonal surveys (September, November, and February); however, appropriate gear and vessel availability, and health and safety concerns, limited this activity. The hydroacoustic transducer collected data during the trawl set for each of six transects lines (T02, T03, T05, T06, T09, and T11). Paired set locations were chosen based on areas where Project infrastructure was expected to be placed, by environmental conditions (i.e., water depths, current directions and speeds, aquatic plant absence), and by safe access for the trawl vessel. Four of the paired sets occurred on the east side of Pearse Island (T02, T03, T05, and T06), one in Whiskey Bay (T09), and one on the west side of Pearse Island (T11). Due to transducer malfunctions and a data recording error, only three of the six paired hydroacoustics transects were analyzed (Table 4.3–5; Figure 4.3–2).

Table 4.3–5 Paired Trawl Hydroacoustics Transect Locations and Maximum Depths

Subarea	Site ID	Start Location		End Location		Transect Length (m)	Maximum Depth (m)
		Easting	Northing	Easting	Northing		
East Pearse Island	T03	424521	6097622	425039	6097484	579	> 200
	T06	424604	6097149	424626	6097989	977	45
Whiskey Bay	T09	424148	6098786	424184	6099355	618	41
NOTE: All coordinates are in UTM Zone 09 U.							

Eulachon Survey

Every year, eulachon travel through Portland Inlet and the Nass Estuary prior to moving up the Nass River to spawn. Though large numbers of fish move through the general area, knowledge is limited on where and for how long eulachon might stage in the area prior to moving into the freshwater system. During the February/March survey prior to the expected peak eulachon return, hydroacoustic transects were conducted from east Pearse Island south past Ramsey Point and east to the Nass Estuary (Figure 4.3–3). Transect locations were designed to cover a variety of habitats, including nearshore and mid channel areas. While transects were constrained by shallow depths near Gingolx, depths exceeded 200 m in the mid channel of Portland Inlet and east of Ramsey Point (Table 4.3–6). The 120 kHz transducer was operated in split-beam mode, which detects fish direction of movement and collects data that inform individual fish target strengths. Target strength, measured in decibels, is a logarithmic-scale representation of the amount of acoustic energy a target reflects to the echosounder and can inform relative fish sizes. The split-beam mode limited data collection to a 200 m vertical depth window. Therefore, when a transect was observed to not detect bottom on the live echogram, the transect was labelled as ‘pelagic’, and an additional ‘demersal’ transect was conducted across the same line with the depth window set from mid water column to the expected bottom depth. A single transect was conducted in single-beam mode (Transect Eul02), which neither tracks fish movement nor collects the data required for target strength analyses but did allow full view of the water column from surface to nearly 300 m depth. Additional transects were not completed in single-beam mode due to the known data analysis limitations inherent with this method. Transects were also split into a, b, and c portions when transects were paused to change settings (e.g., to avoid or reduce a false bottom), or in post processing when a section of acoustic noise was removed. Transect lines split into multiple sections during data collection or post-processing were combined into a single transect datafile whenever possible.

Table 4.3–6 Hydroacoustic Eulachon Transect Locations

Transect ID	Start Location		End Location		Maximum Depth (m)	Transect Length (m)
	Easting	Northing	Easting	Northing		
Eul01a	424976	6099416	424889	6096962	188	2920
Eul_01b	424890	6096961	425438	6095652	157	1500
Eul02	424728	6099497	425275	6096717	280	2900
Eul03	429120	6093529	429613	6093354	76	650
Eul04_pelagic	432667	6093201	426903	6095086	>200	6510
Eul04_demersal	426900	6095100	429236	6093224	303	3080
Eul04b_demersa	430069	6093208	432751	6093225	235	2740
Eul_05_pelagic	431513	6094975	433766	6091737	>200	4000
Eul_05_demersal	433744	6091822	431602	6094840	275	3740
Eul06	433991	6091855	434576	6092420	55	840
Eul07_pelagic	433897	6091894	433381	6097487	>200	5830
Eul_07_demersal	433300	6097372	433769	6091832	260	5610
Eul08a	433277	6097430	435024	6096389	194	2140
Eul08b	435731	6095958	436418	6095531	72	820
Eul09	436523	6095555	436386	6092732	184	3000
Eul10a	437205	6092384	438647	6091437	132	3080
Eul10b	438833	6091380	439568	6090728	40	1500
Eul11	439733	6091794	442060	6093755	17	3100
Eul12a	436991	6086470	438558	6088142	73	2370
Eul12b	438558	6088142	439931	6089508	66	2020
Eul13a	440011	6090706	439448	6091474	16	360
Eul13b	439456	6091478	440127	6093191	33	1180
Eul13c	439733	6091794	442060	6093755	13	2120
Eul14	439876	6092329	440560	6092758	10	850

NOTE:
All coordinates are in UTM Zone 09 U.

4.3.2.4 Zooplankton Sampling

Zooplankton samples were collected during all four seasonal surveys on June 6, 2021, September 5, 2021, November 10, 2021, and March 4, 2022. Sampling locations were paired with six conductivity, temperature, and depth (**CTD**) profiles and water quality sampling stations distributed throughout the Marine Fish Survey Area (Figure 4.3–1, Table 4.3–7).

A 336-micron mesh conical plankton net was hauled vertically through the water column to collect samples, which were transferred to jars with 10% formalin for preservation and archived for potential future analyses.

Table 4.3–7 Zooplankton Sampling Locations

Site ID	Easting	Northing
CZ01	424715	6097216
CZ02	424740	6097829
CZ03	424866	6098461
CZ04	424756	6099111
CZ05	424173	6099312
CZ06	422911	6098711
NOTE: All coordinates are in UTM Zone 09 U		

4.3.2.5 Data Analysis

Beach Seine and Trawl

Catch-per-unit-effort provides an estimate of taxa abundance by standardizing catch data according to fishing effort. CPUE was calculated for each taxa collected during the marine fish surveys and was summarized by both area and fishing method to provide a measure of abundance for each taxa among the sampling areas.

Beach seine CPUE was calculated as the number of fish captured per 100 m^3 seined using net length and height multiplied by the distance seined. For each site location, effort was pooled for further analysis by combining haul data from the same site and summarizing in order to produce a CPUE value for each site location.

Trawl CPUE was calculated as the number of fish collected per 100 m^3 trawled using net height and width multiplied by the distance sampled. CPUE was also calculated for functional taxa groups for both surface trawl and beach seine data, in order to demonstrate an overall summary of taxa abundance and distribution throughout the Project Area.

Fish taxa were grouped into the following four categories for additional CPUE calculations:

- Juvenile salmonids (chinook, coho, sockeye, chum and pink salmon, as well as Dolly Varden)
- Groundfish (English sole, Pacific cod, northern rock sole, starry flounder, great sculpin [*Myoxocephalus polyacanthocephalus],* and staghorn sculpin [*Leptocottus armatus*])
- Other Forage Fish (Pacific herring, Pacific sand lance, crescent gunnel, penpoint gunnel, saddleback gunnel [*Pholis ornata*], and shiner perch)
- Other (snailfishes [Family Liparidae], snake prickleback*,* threespine stickleback [*Gasterosteus aculeatus*], and tubesnout [*Aulorhynchus flavidus*])

Taxa richness was determined by the number of taxa observed during all the beach seine hauls and surface trawl sets across the four surveys at each of the subareas (east Pearse Island, Whiskey Bay, and west Pearse Island).

Hydroacoustics

Forty-four hydroacoustic transects were completed during the four seasonal surveys and the February/March eulachon survey (Figure 4.3–2 and Figure 4.3–3). Three separate analyses were completed, the first comparing seasonal trends from transects completed along the eastern and western shores of Pearse Island and in Whiskey Bay. The second analysis incorporated surface trawl catch species information across the same three subareas of Pearse Island into paired hydroacoustic transect analyses to inform species likely observed in the echograms. The final analysis was completed on transects completed from the east side of Pearse Island through the Nass Estuary, including Iceberg Bay, and focused on potential eulachon staging areas.

Visual representations of acoustic data (echograms) were processed using BioSonics Inc. Visual Analyzer (v4.3.0.9020) software. Calibration correction values were applied in the software prior to analysis (+0.44 dB in June, +0.37 dB in November, -1.00 dB in February/March). Either a -60 dB or -66 dB analysis threshold was applied, depending on the survey, to limit the inclusion of plankton and other small non-targeted organisms in the data output. Echo integration, a method for estimating target density (BioSonics Inc. 2004), was also performed in Visual Analyzer.

Acoustic noise disturbances can be caused by interactions between environmental conditions, biological echoes, and echosounder limitations, and should be removed prior to analysis. These noise disturbances can include entrained air from waves and other surface noise sources, plankton aggregations, background noise, side lobe interference, and false bottoms. Due to software limitations in isolating and removing regions of acoustic noise, echogram upper and lower (bottom line) analysis boundaries were chosen to exclude these noise regions as effectively as possible. In some cases, surface noise or plankton aggregations extended deep into the water column and could not be resolved with adjustment of the surface or bottom line. These vertical sections were extracted from the echograms to allow analysis of the remainder of the transect.

While the upper boundary of analysis is determined manually from echogram inspection, echogram bottom lines were auto-assessed with a 0.5 m buffer by the software and manually edited as required.

Bottom lines were modified to continue above potential aquatic vegetation (e.g., Appendix F.5, Photo 7), seafloor features (Appendix F.5, Photo 8), and zooplankton aggregations where required (e.g., Appendix F.5, Photo 4), as well as to limit background noise (e.g., Appendix F.5, Photo 2), side lobe interference (e.g., Appendix F.5, Photos 8 and 14), and false bottoms (e.g., Appendix F.5, Photo 10), as described below.

Acoustic noise from entrained air is common within the top of the water column, while zooplankton aggregations can be present at any depth in the water column. To remove these noise sources, the top 3 to 25 m of the echograms were excluded from the data analysis, depending on the depth of noise penetration. November transect WB01 was an exception, which required the removal of the top 34 m of the water column due to zooplankton aggregations. However, additional analyses were completed on the removed section of the echogram not directly impacted by zooplankton aggregations to confirm no targets of interest were present in the removed band.

Background noise is made up of signals from non-target sources that can inhibit analysis of targets of interest (i.e., fish). In this case, the echogram is considered background noise-limited (B. Moore, BioSonics Inc., pers. Comm.). Limiting background noise was common in east Pearse Island echograms in regions with depths over 100 m. Potential fish acoustic signatures could not be assessed below the start of the limiting background noise due to the presence of background noise above the applied analysis threshold (i.e., -60 dB or -66 dB).

Side lobe interference is a result of seafloor slopes interacting with the transducer beam side lobes and results in areas of acoustic noise along the seafloor (B. Moore, BioSonics Inc., pers. Comm.). This interference was present in all except two echograms during the seasonal surveys and present in eleven echograms during the eulachon survey.

All transects were analyzed from the lower limit of their respective acoustic surface noise boundary to their applied bottom line.

Echo integration was completed with Visual Analyzer in-software algorithms with a standard Time Varied Gain of 20log(range [m]) applied. The analyses results include measurements of acoustic energy return (i.e., mean volume backscattering strength [**MVSBS**, $\mathbf{S_v}$], target strength [**TS**], and fish per cubic metre).

Mean volume backscattering strength, measured in dB re 1 m^{-1}, is a measure of the mean acoustic biological energy reflected back to the echosounder per unit volume and is often used as a proxy for biomass (Simmonds and MacLennan 2005, Boswell et al. 2011). When MVBS values required mathematical manipulation (i.e., additional averaging), MVBS values were first converted to their linear form, volume backscattering coefficient ($\mathbf{s_v}$), with Equation 1.

Equation 1 $\mathbf{s_v = 10^{(S_v/10)}}$

Averaging was completed and the s_v values were then converted back to MVBS (S_v) with Equation 2.

Equation 2 $\mathbf{S_v = 10*log_{10}(s_v)}$

A target's size shape, density (including the presence of a swim bladder), and physical orientation relative to the echosounder transducer (tilt angle) can cause target strength to vary over a 25 dB range (Gaulthier and Horne 2004). The presence of a swim bladder can also present a stronger TS, with fish such as Pacific herring having much greater TS in comparison with fish without a swim bladder, such as eulachon (De Robertis et al. 2010). Generally, fish that are larger and have a greater difference in density compared to the surrounding water have higher TS values than smaller fish or those with a lower difference in density compared to water. Using a variation of Love's (1971) equation (Equation 3; Egerton et al. 2018, Guo et al. 2019, BioSonics Inc. 2004):

Equation 3 $\mathbf{TS = 19.1 * Log_{10}(TL) - 0.9*Log_{10}(f) - 62}$

where TL is total length (cm) and f is transducer frequency (kHz). For example, a 3 cm long fish would have an estimated TS of -55 dB, while a 20 cm long fish would have an estimated TS of -39 dB, both of which would be included in the -60 dB analysis threshold. Smaller organisms such as zooplankton or shrimp generally produce TS values in the range of -120 dB to – 70 dB (Lavery et al. 2007), which are below the analysis threshold of -60 dB, and therefore generally excluded from the analysis. Aggregations of planktonic organisms can result in higher measured target strengths due to density effects; however, and regions of zooplankton aggregations were manually removed from the echogram analysis, as previously discussed.

Twenty-five hydroacoustic transects were completed across three surveys (June, November, and February), 21 of which were usable and analyzed for MVBS through echo integration (Figure 4.3–2). Hydroacoustic data files for June transects T01, T02, T05, and T11 were unusable due to transducer malfunction or recording error.

Prior to echo integration, each echogram was assigned three horizontal depth layers to encompass surface (top 20 m of water column), demersal (10 m above seafloor to bottom), and pelagic (region between surface and demersal layers) layers. The surface layer is meant to encompass habitat occupied by juvenile anadromous fish such as juvenile salmon. The demersal layer covers habitat occupied by demersal fish which reside on or close to the seafloor, including flatfish and sculpin. The pelagic layer includes schooling or shoaling fish species, such as Pacific herring and feeding Pacific sand lance.

Separate echo integration analyses were performed on each of the surface, pelagic, and demersal layers, as well as for the entire water column (labelled as 'combined depth layers') of the seasonal echograms. Mean volume backscattering strength values were compared across seasonal survey months and depth layers to give an estimate of relative fish biomass distribution and trends.

Paired Trawl Survey

A total of six OFL trawls sets were paired with hydroacoustic transects during the June survey (Transects T02, T03, T05, T06, T09 and T11; Figure 4.3–2). Of the six paired trawl transects, three hydroacoustic files were unusable due to transducer malfunction or recording error (Transects T02, T05, and T11) and no fish were caught during the T11 trawl. The remaining three trawl set catches (T03, T06 and T09) were used to ground-truth their respective paired hydroacoustic transects.

Minimum, maximum, mean, and standard deviation of total lengths were calculated for each fish species or taxon group caught by trawl during the paired trawl and hydroacoustics sets. This included juvenile salmonids, Pacific herring, and Pacific sand lance. One unidentified larval fish was also caught during the paired trawl set T03; however, no length was recorded and therefore it was not included in the analysis.

Fish taxa minimum, maximum, and mean total lengths were then converted to expected TS values with Equation 3.

Fish length sample sizes varied from 1 (salmonids on Transect T09) to 28 individuals (salmonids on Transect T03) measured depending on catch and taxa included in analyzed groups. Taxon groups with low sample sizes are expected to have a larger error in range of lengths and converted TS values for the echo integration analysis. However, the surface trawl-caught taxa still inform the potential identities of fish likely observed in upper regions of the paired echograms.

Where only fish fork lengths were available, total lengths were assessed from field photos that included a measuring board and averaged across remaining samples when required. Minimum expected TS values were reduced an additional 6 dB to account for targets that would be within the threshold range after accounting for their non-ideal position within the transducer beam (Parker and Stetter 2009). The final minimum and maximum TS values were used as a ranged threshold during echo integration across depth layers (surface, pelagic, demersal, combined depth layers). Mean volume backscattering strength could not be calculated for targets within a specific TS range due to software limitations (B. Moore, BioSonics Inc. pers. Comm.). Instead, fish density values (fish per cubic metre), as calculated with in-software processes during echo integration, were used to represent targets within each assigned taxon TS range on paired trawl hydroacoustic transects. Fish density values were multiplied by 100 to give a fish per 100 m^3 value for easier interpretation of small values.

Eulachon Survey

Twenty-four hydroacoustic transects were completed during the February/March eulachon survey. Three transects were completed on the east side of Pearse Island, while twenty-one were completed between Portland Inlet west of Ramsey Point and the entrance to the Nass River (Figure 4.3–3). All echograms were visually inspected for potential eulachon acoustic signatures. Pre-spawn eulachon schools have been described as having “diffused rounded edges with low acoustic scattering strength” (Sigler et al. 2004) that were often near the seabed (M. Sigler pers. Comm. Cited in Mudge et al. 2022), while aggregations of spawning eulachon moving up the Fraser River were observed not as dense schools, but as aggregations of individuals near the river bottom (Stables et al 2005; Mudge et al. 2022). Echograms were visually inspected for acoustic signatures matching these descriptions as well as for fish schools or shoals of other shapes and aggregations of fish tracks.

Echo integration was performed on selected echograms visually determined to have acoustic signatures potentially consistent with fish shoals or aggregations of fish tracks. Expected minimum and maximum Nass River eulachon lengths (Noble et al. 2012) of 140 mm and 235 mm, respectively, were used to calculate the expected TS range based on a marine eulachon specific TS calculation for a 120 kHz transducer (Equation 4; Gauthier and Horne 2004a),

Equation 4 TS = 15.3*log (TL) -77.6

where TL = total length in cm. The resulting TS range was -60.0 dB to -56.6 dB, which aligns closely with published *in situ* TS measurements of -53.26 dB (+-1.29 dB) for eulachon migrating up the Fraser River (Stables et al. 2005) after consideration that TS values are on average 3–4 dB higher in freshwater than in seawater (Gauthier and Horne 2004a). Using calculations from a study modelling eulachon TS near the mouths of spawning rivers in the Gulf of Alaska (Gauthier and Horne 2004b), a TS of -53.4 dB was calculated for a 16 cm eulachon using a 125 kHz transducer (Karpouzi and Philips 2021). A TS of -53.4 dB is over 3 dB higher than the upper limit of expected eulachon TS range at -56.6 dB. The Alaska modelling could have accounted for lower salinity and higher freshwater concentrations at the immediate mouth of rivers, resulting in a higher modelled TS. Though the eulachon specific survey did occur across the Nass Estuary, the majority of the transects were reasonably far from the mouth of the Nass River and eulachon in those higher salinity areas would be expected to have a TS value 3-4 dB lower than in freshwater (Gauthier and Horne 2004a), which could account for the discrepancy. An additional 6 dB was subtracted from the lowest TS range value to account for targets positioned at the edge of the transducer beam (Parker and Stetter 2009) resulting in a final TS analysis range of -66.0 dB to -56.6 dB.

Mean volume backscattering strength could not be calculated for targets within the specific eulachon TS range due to software limitations (B. Moore, BioSonics Inc., pers. Comm.). Instead, fish density values (fish per cubic metre), as calculated with in-software processes during echo integration, were used to represent potential eulachon targets in eulachon survey echograms. Fish density values were multiplied by 100 to give a fish per 100 m^3 value for easier interpretation of small values. Resulting fish per cubic metre values were compared to determine relative density of targets matching eulachon acoustic signatures between transects.

Data Limitations and Assumptions

Transducers have limited ability to detect fish near surface and seafloor boundaries due to transducer position and orientation, nearfield restrictions, and bottom dead zones. The transducer was mounted in a down-looking orientation -1.8 m (Appendix E, Photo 13) below the sea surface, resulting in the inability to account for fish present above it. The nearfield range, a region in which target strength is highly variable, extends from the transducer face down approximately 1 m deep and was not included in analyses. Bottom dead zones occur due to the inability of the transducer signal to decipher between fish and the strong bottom signal below, requiring the application of a buffer above the seafloor (i.e., the applied 0.5 m). Any fish present in the removed surface layer to lower boundary of the nearfield range and bottom dead zones are not accounted for in analyses.

Environmentally- and biologically-produced noise disturbances, combined with transducer and software limitations, constrained echogram quantitative data analyses. Software employed for the data analyses was limited in removal of noise disturbances (i.e., entrained air, background noise, side lobe interference, false bottoms, and zooplankton aggregations; B. Moore, BioSonics Inc., pers. Comm.), which resulted in larger areas of the echogram being removed. Echo integration analyses were restricted to depth layers not limited by noise disturbances, which resulted in the removal of 16 depth layers from the seasonal hydroacoustic survey analyses, including demersal layers from 12 transects and surface layers from

3 transects (Table 4.3–8). Analysis for transect T06 did not have a pelagic nor demersal layer due to insufficient depths (17 m vertical depth analyzed). These layers were also excluded from echo integrations analyzing MVBS and fish per cubic metre across combined depth layers, which likely resulted in underestimates of fish biomass (MVBS) and fish density (fish per cubic metre) values.

Table 4.3–8 Hydroacoustic Seasonal Transect Depth Layer Analyses

Survey Month	Transect ID	Depth Layer		
		Surface	Pelagic	Demersal
June	T03	—	x	—
	T04	x	x	—
	T06	x	—	—
	T07	x	x	x
	T08	x	x	—
	T09	x	x	x
	T10	x	x	x
	T12a	x	x	x
	T12b	x	x	x
November	E01	x	x	—
	E02	x	x	—
	E03	—	x	—
	WB01	—	x	x
	W01	x	x	—
	W02	x	x	—
February	E01	x	x	—
	E02	x	x	—
	E03	x	x	—
	WB01	x	x	x
	W01	x	x	x
	W02	x	x	x

NOTES:
Surface = top 20 m of water column.
Pelagic = between surface and demersal layers.
Demersal = bottom 10 m of water column.
X indicates depth layer was analyzed.
— indicates depth layer was not analyzed.
Absence of analysis for a water column layer means either maximum depth was 30 m or shallower (no pelagic layer) or unremovable noise was present throughout either the top 20 m of the water column (no surface layer) or extending from 10 m above the seafloor to the bottom (no demersal layer). Noise examples include surface disturbance, plankton masses or limiting background noise.

Biological echoes identified as zooplankton aggregations (Appendix F.5, Photo 4) were identified manually by discerning visual features on the echograms. It was assumed that these echoes were produced by zooplankton aggregations, though the presence or absence of zooplankton could not be confirmed with certainty and as such may have included fish echoes.

With exception of the eulachon survey, which included one single-beam transect (March, Transect E02) and four demersal specific transects, fish presence was not recorded below 200 m due to the split-beam echosounder's 200 m depth window limit. Within the 200 m window, echosounder signal reach decreased with increased depth, which meant that weaker signals (smaller fish) deeper in the water column may not have been recorded. The increased background noise with increased depth impeded echosounder analyses as well, as these affected areas had to be removed entirely, which reduced fish biomass and density estimates.

Mean volume backscattering strength, as calculated during echo integration, was used as a proxy for fish density but is not a direct measurement of fish density. Additionally, echoes included in the echo integration analyses passed a series of requirements (i.e., minimum echo strength, echo shape correlation, minimum and maximum echo size) to be classified as potential fish echoes; however, this process cannot guarantee only fish echoes are included. A subset of echoes identified as fish could have been produced by non-target taxa (i.e., plankton) or an environmental source (i.e., entrained air), both of which would lead to a potential overestimate of fish biomass (MVBS values) and fish density (fish per cubic metre values).

Trawl survey catch used to ground-truth paired hydroacoustic transects was limited, with sometimes only one fish caught (trawl set T09) or few of a given taxa. Fish length ranges, and their equivalent calculated TS ranges, decrease in confidence with decreased catch. Therefore, TS range thresholds used for the paired trawl analyses were likely narrower than the actual size range of fish observed in the echogram, which would result in an underestimate of a given taxa's density. Fish echo TS was calculated during echo integration and can be biased by low fish presence, high density aggregations of fish, and multiple fish targets appearing as one. These factors may have resulted in over- or under-estimates of individual fish target strengths and therefore fish per cubic metre values used for the paired trawl hydroacoustic survey analyses.

Due to data limitations and assumptions, all analyses results should be considered qualitative.

4.3.3 Results

4.3.3.1 Beach Seine Surveys

A total of 57 beach seine hauls were completed across the five beach seine sites over the four seasonal surveys (Appendix E, Photos 1 to 9). At east Pearse Island 17 hauls were completed at two sites; at Whiskey Bay 15 hauls were completed at one site; and at west Pearse Island 25 hauls were completed at two sites (Table 4.3–9). During the beach seine surveys, 1,226 fish were captured, representing a total of 27 taxa (Table 4.3–10). For each survey, a summary of beach seining effort, taxa collected, and taxa abundance (CPUE) per 100 m^3 is presented in Appendix F.1**;** Table 4.3–9 and Figure 4.3–4.

Table 4.3–9 Beach Seine Haul Locations, Area Seined, and Fish CPUE (per 100 m^3) by Subarea and Seasonal Survey

Subarea	Survey Month	Site ID	Method	Date	Location		Dominant Substrates	Number of Hauls	Area Seined (m^3)	CPUE[a]
					Easting	Northing				
East Pearse Island	June	BSB01	Boat	5-Jun-21	424389	6097904	Cobble/Gravel	3	2580	0.02
		BSB02	Boat	6-Jun-21	424527	6098186	Cobble/Boulder	1	1800	0.01
	September	BS01	Walk	5-Sep-21	424483	6098156	Cobble/Gravel	3	1023	0.06
		BSB02	Boat	1-Sep-21	424400	6097815	Cobble/Gravel	1	1500	0.14
	November	BS01	Walk	6-Nov-21	424392	6097370	Cobble/Pebble	3	723	—
		BSB02	Boat	6-Nov-21	424497	6098181	Gravel	2	4725	0.01
	March	BS01	Walk	4-Mar-22	424459	6097759	Cobble/Gravel	3	963	<0.01
		BSB02	Boat	5-Mar-22	424489	6098153	Cobble	1	1980	—
Whiskey Bay	June	BS03	Walk	5-Jun-21	424164	6098562	Cobble/Sand	3	525	0.03
	September	BS03	Walk	6-Sep-21	424077	6098746	Sand	3	576	0.08
	November	BS03	Walk	7-Nov-21	424058	6098738	Cobble	3	815	0.14
		BSB03	Boat	7-Nov-21	424018	6098640	-	1	2363	—
	March	BS03	Walk	5-Mar-22	424069	6098756	Gravel/Cobble	4	675	0.01
		BSB03	Boat	5-Mar-22	424030	6098565	Cobble	1	1584	<0.01

Table 4.3–9 Beach Seine Haul Locations, Area Seined, and Fish CPUE (per 100 m^3) by Subarea and Seasonal Survey

Subarea	Survey Month	Site ID	Method	Date	Location		Dominant Substrates	Number of Hauls	Area Seined (m^3)	CPUE[a]
					Easting	Northing				
West Pearse Island	June	BSB04	Boat	3-Jun-21	423264	6098355	Gravel/Cobble	3	2,700	0.05
		BSB05	Boat	7-Jun-21	422443	6097907	Gravel	2	3,600	0.13
	September	BS04	Walk	6-Sep-21	423251	6098340	Gravel/Cobble	3	792	0.01
		BS05	Walk	6-Sep-21	422451	6097903	Gravel	3	825	0.03
	November	BS04	Walk	7-Nov-21	423328	6098457	Pebble/Sand	3	738	<0.01
		BSB05	Boat	6-Nov-21	422459	6097892	Pebble	2	4,950	<0.01
		BS05	Walk	7-Nov-21	422590	6097880	Pebble	3	612	0.01
	March	BS04	Walk	4-Mar-22	423313	6098454	Gravel/Fines	3	840	0.01
		BS05	Walk	4-Mar-22	422595	6097901	Gravel	3	512	<0.01
		BSB05	Boat	5-Mar-22	422537	6097895	Gravel	2	3,168	<0.01
							Totals	**59**	**40,569**	**0.03**

NOTES:
- indicates dominant substrate not recorded.
— indicates a zero value
CPUE[a] calculated as the number of fish caught per 100 m^3 seined

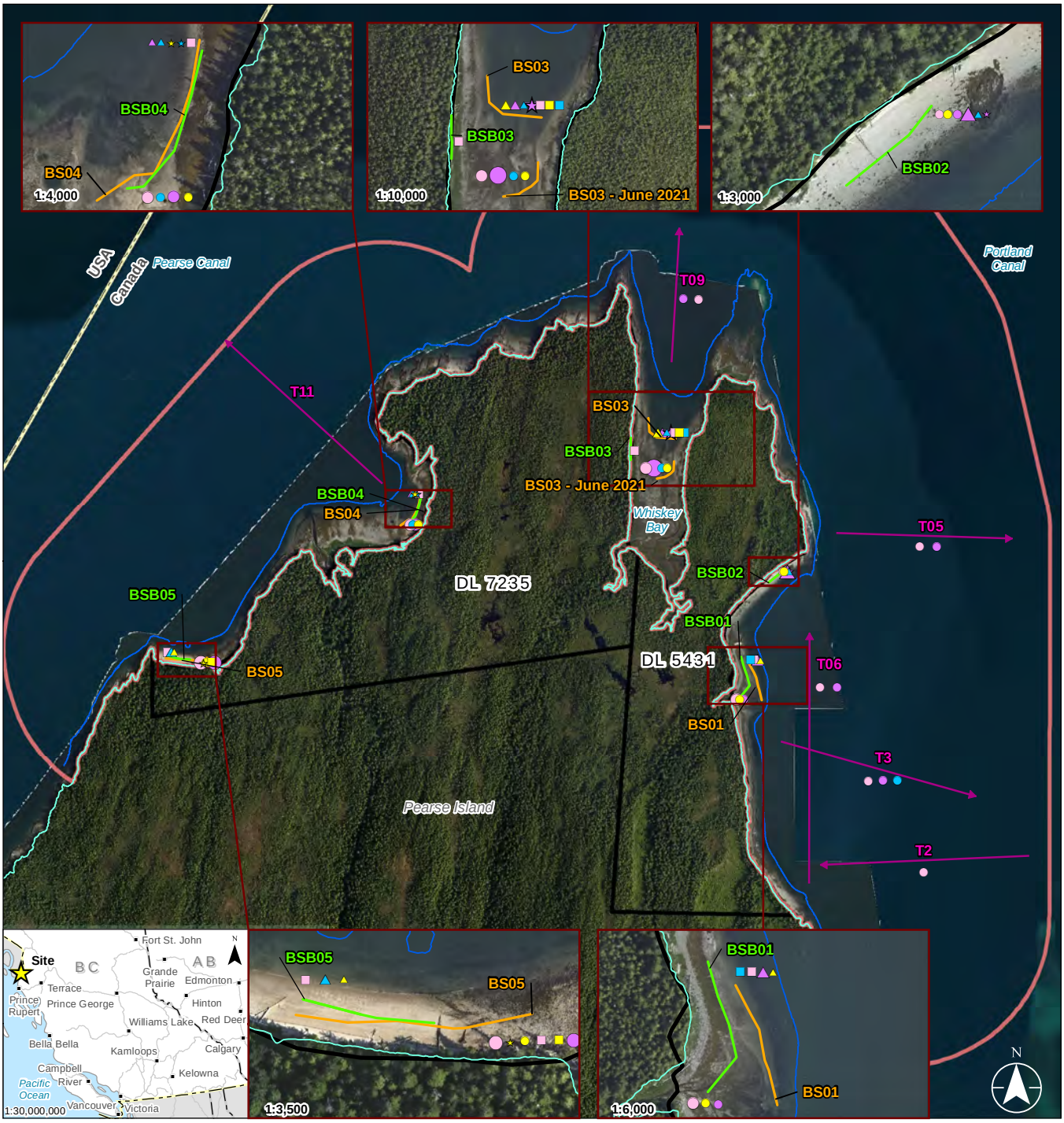
Table 4.3–10 Fish and Invertebrate Taxa by Area Collected During Beach Seine Surveys

Common Name	Scientific Name	East Pearse Island	Whiskey Bay	West Pearse Island	No. of Individuals Collected
Fish					
Buffalo sculpin	*Enophrys bison*	1	11	3	15
Chinook salmon	*Oncorhynchus tshawytscha*	2	—	4	6
Chum salmon	*Oncorhynchus keta*	6	12	9	27
Cod	Family Gadidae	1	—	—	1
Coho salmon	*Oncorhynchus kisutch*	3	—	96	99
Crescent gunnel	*Pholis laeta*	2	8	3	13
Dolly Varden	*Salvelinus malma*	2	—	128	130
English sole	*Parophrys vetulus*	—	—	1	1
Great sculpin	*Myoxocephalus polyacanthocephalus*	—	—	1	1
Northern rock sole	*Lepidopsetta polyxystra*	—	—	1	1
Pacific herring	*Clupea pallasii*	—	118	326	444
Pacific sand lance	*Ammodytes hexapterus*	54	—	4	58
Penpoint gunnel	*Apodichthys flavidus*	1	2	—	3
Pink salmon	*Oncorhynchus gorbuscha*	15	9	9	33
Saddleback gunnel	*Pholis ornata*	—	1	3	4
Salmon spp.	*Oncorhynchus spp.*	1	—	1	2
Sculpin spp.	Family Cottidae	10	2	25	37
Shiner perch	*Cymatogaster aggregata*	269	6	4	279
Snailfish	Family Liparidae	—	4	1	5
Snake prickleback	*Lumpenus sagitta*	—	—	1	1
Sockeye salmon	*Oncorhynchus nerka*	4	2	—	6

Table 4.3–10 Fish and Invertebrate Taxa by Area Collected During Beach Seine Surveys

Staghorn sculpin	*Leptocottus armatus*	—	13	4	17
Starry flounder	*Platichthys stellatus*	—	4	7	11
Threespine stickleback	*Gasterosteus aculeatus*	1	2	26	29
Tubesnout	*Aulorhynchus flavidus*	—	—	2	2
Unidentified larval fish	Class Teleostei	1	—	—	1
				Total number of fish collected	**1,226**
Invertebrates					
Amphipod	Order Amphipoda	—	2	3	5
Barnacle eating nudibranch	*Onchidoris bilamellata*	—	50	—	50
Chiton	Class Polyplacophora	—	2	—	2
Crangon shrimp	*Crangon* spp.	—	20	2	22
Dire whelk	*Lirabuccinum dirum*	—	1	—	1
Green urchin	*Strongylocentrotus droebachiensis*	1	10	—	11
Hairy shore crab	*Hemigrapsus oregonensis*	1	—	—	1
Hermit crab (pagurus)	*Pagurus* spp.	8	88	11	107
Kelp isopod	*Idotea wosnesenskii*	1	7	—	8
Lacuna Snail	*Lacuna* sp.	—	4	—	4
Littorina snail	*Littorina* sp.	—	—	1	1
Sea angel	Class Gymnosomata	—	—	5	5
Topsnail	*Calliostoma* spp.	—	5	—	5
Worm	Phylum Annelida	—	1	—	1
Unidentified shrimp	Infraorder Caridea	1	5	—	6
				Total number of invertebrates collected	**229**

1



KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Survey Month
- June
- September
- November
- March

Survey Taxon
- Juvenile Salmonid
- Other Forage Fish
- Groundfish
- Other Fish

- Beach Seine Foot-led
- Beach Seine Boat-led
- Trawl Survey Transect
- High Water Mark
- Low Water mark
- Boundaries of District Lots 7235 and 5431
- Marine Fish Survey Area

CPUE Value
(CPUE per 100 m³ in point label)
- 0.01 - 1.00
- 1.01 - 5.00
- 5.01 - 10.00
- 10.01 - 15.00

0 150 300 450 600 750 m
1:20,000 (at original document size of 8.5x11)

Stantec

Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by DSPRY on 20220823
Requested by MLONG on 20220823
Check by SMOSS on 20220823

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.3-4

Title
Distribution of Catch Per Unit Effort (CPUE) for Seine and Trawl Surveys by Taxon Group, Site and Season

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East Pearse Island

Over the four surveys, 373 marine fish were collected by beach seine at east Pearse Island (Table 4.3–11, Appendix E, Photos 1, 2, 7, and 8), representing 15 fish taxa.

Fish abundance varied between the four surveys, with the greatest abundance of fish collected at east Pearse Island during the September survey (a total of 272 fish captured, and CPUE of 10.78 individuals/100 m^3) (Appendix F.1). The lowest abundance of fish collected was during the March survey, with only four fish collected, and a CPUE of 0.42 individuals/100 m^3.

Taxon abundance also varied between the sampling seasons. Shiner perch (*Cymatogaster aggregata*) were the most abundant taxon caught during the September survey with 268 individuals and a CPUE of 10.62 individuals/100 m^3. During the June survey, juvenile salmonids were the most abundant taxon group observed (Appendix E, Photos 14, 15, and 16), with 30 individuals and a CPUE of 0.68 individuals/100 m^3 (Appendix F.1, Pacific sand lance (Appendix E, Photo 17) were the most abundant taxon observed during the November survey with 29 individuals and a CPUE of 0.53 individuals/100 m^3.

1 **Table 4.3–11 Abundance of Fish Collected During Beach Seine Surveys at East Pearse Island**

Survey Month	Site ID	Area Seined (m^3)	Cod (Family Gadidae)		Gunnel (Family Pholidae)		Pacific Sand Lance (*Ammodytes hexapterus*)		Salmonids (Family Salmonidae)		Sculpin (Family Cottidae)		Shiner Perch (*Cymatogaster aggregata*)		Threespine Stickleback (*Gasterosteus aculeatus*)		Unidentified Larval Fish (Class Teleostei)		Totals	
			Catch	CPUE [a]	Catch	CPUE [a]	Catch	CPUE [a]	Catch	CPUE [a]	Catch	CPUE [a]	Catch	CPUE [a]	Catch	CPUE [a]	Catch	CPUE [a]	Catch	CPUE [a]
June	BSB01	2,580	1	0.04	1	0.04	25	0.97	26	1.01	5	0.19	—	—	—	—	—	—	58	2.25
	BSB02	1,800	—	—	1	0.06	—	—	4	0.22	4	0.22	1	0.06	—	—	—	—	10	0.56
	Total	4,380	1	0.02	2	0.05	25	0.57	30	0.68	9	0.21	1	0.02	—	—	—	—	68	1.55
September	BS01	1,023	—	—	1	0.10	—	—	—	—	2	0.20	62	6.06	—	—	—	—	65	6.35
	BSB02	1,500	—	—	—	—	—	—	—	—	—	—	206	13.73	1	0.07	—	—	207	13.80
	Total	2,523	—	—	1	0.04	—	—	—	—	2	0.08	268	10.62	1	0.04	—	—	272	10.78
November	BS01	723	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	BSB02	4,725	—	—	—	—	29	0.61	—	—	—	—	—	—	—	—	—	—	29	0.61
	Total	5,448	—	—	—	—	29	0.53	—	—	—	—	—	—	—	—	—	—	29	0.53
March	BS01	963	—	—	—	—	—	—	3	0.31	—	—	—	—	—	—	1	0.10	4	0.42
	BSB02	1,980	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total	2,943	—	—	—	—	—	—	3	0.10	—	—	—	—	—	—	1	0.03	4	0.14
Totals		**15,294**	**1**	**0.01**	**3**	**0.02**	**54**	**0.35**	**33**	**0.22**	**11**	**0.07**	**269**	**1.76**	**1**	**0.01**	**1**	**0.01**	**373**	**2.44**

NOTES:
— indicates a zero value.
[a] CPUE is calculated as the number of fish caught per 100 m^3 seined.

2

Overall east Pearse Island taxon richness was 16 marine fish taxa and 4 invertebrate taxa. Taxon richness of marine fish was highest in June with 11 taxa observed and lowest in November with one taxon observed (Table 4.3–12). Taxon richness of incidentally caught invertebrates was low at east Pearse Island and ranged between zero and two taxa between the four surveys (Table 4.3–12). Invertebrate taxa caught at East Pearse Island included hairy shore crab *(Hemigrapsus oregonensis),* hermit crab (*Pagurus* spp.), and rockweed isopod *(Idotea wosnesenskii).*

Table 4.3–12 Taxon Richness Observed During Beach Seine Surveys at East Pearse Island

Taxon	Survey Month			
	June	September	November	March
Marine Fish	11	5	1	3
Invertebrates	2	1	0	2

All five species of Pacific salmon (chinook, chum, coho, pink, and sockeye) and Dolly Varden were collected during beach seine surveys at east Pearse Island. No marine fish taxa of conservation concern were observed.

Whiskey Bay

A total of 194 fish were captured from Whiskey Bay during the four surveys, representing a total of 14 taxa (Appendix E, Photos 3, 4 and 9).

Fish abundance varied between the four seasonal surveys at Whiskey Bay. The highest abundance of fish was captured during the November survey with 118 fish and a CPUE of 1.72 individuals/100 m^3 (Table 4.3–13). March had the lowest fish collection, with only 15 fish captured and a CPUE of 0.66 individuals/100 m^3.

Similar to east Pearse Island, the most abundant fish species captured was different among the seasons. During the November survey, Pacific herring were the most abundant fish captured with 118 individuals captured and a CPUE of 1.72 individuals/100 m^3. For the March survey, salmonids were the most abundant fish captured with 13 individuals caught and a CPUE value 0.58 individuals/100 m^3. Sculpin were the most abundant group captured during the September survey with 25 individuals and a CPUE of 2.78 individuals/100 m^3 (Table 4.3–13).

Overall Whiskey Bay taxon richness was 14 marine fish taxa and 13 invertebrate taxa. Fish taxon richness was highest in September with nine taxa observed and lowest in November with one taxon observed. Taxon richness of incidentally caught invertebrates was higher at Whiskey Bay compared to East Pearse, with eight taxa observed in each of September and March (Table 4.3–14). The most abundant taxa of incidentally caught invertebrates were barnacle eating nudibranchs *(Onchidoris bilamellata)* with 50 individuals caught, and green urchin and topsnail (*Calliostoma* spp.) with 6 and 5 individuals caught, respectively.

Table 4.3–13 Abundance of Fish Collected During Beach Seine Surveys Whiskey Bay

Survey Month	Site ID	Area Seined (m^3)	Flatfish (Family Pleuronectidae)		Gunnel (Family Pholidae)		Pacific Herring (*Clupea pallasii*)		Salmonids (Family Salmonidae)		Sculpin (Family Cottidae)		Shiner Perch (*Cymatogaster aggregata)*		Snailfish (Family Liparidae)		Threespine Stickleback (*Gasterosteus aculeatus*)		Totals	
			Catch	CPUE[a]	Catch	CPUE[a]	Catch	CPUE[a]	Catch	CPUE[a]	Catch	CPUE[a]	Catch	CPUE[a]	Catch	CPUE[a]	Catch	CPUE[a]	Catch	CPUE[a]
June	BS03	525	2	0.38	1	0.19	—	—	10	1.90	—	—	—	—	—	—	2	0.38	15	2.86
	Total	525	2	0.38	1	0.19	—	—	10	1.90	—	—	—	—	—	—	2	0.38	15	2.86
September	BS03	576	2	0.35	10	1.74	—	—	—	—	25	4.34	6	1.04	3	0.52	—	—	46	7.99
	Total	**900**	**2**	**0.22**	**10**	**1.11**	**—**	**—**	**—**	**—**	**25**	**2.78**	**6**	**0.67**	**3**	**0.33**	**—**	**—**	**46**	**5.11**
November	BS03	815	—	—	—	—	118	14.47	—	—	—	—	—	—	—	—	—	—	118	14.47
	BSB03	2,363	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total	**3,178**	**—**	**—**	**—**	**—**	**118**	**3.71**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**118**	**3.71**
March	BS03	675	—	—	—	—	—	—	6	0.89	1	0.15	—	—	1	0.15	—	—	8	1.19
	BSB03	1,584	—	—	—	—	—	—	7	0.44	—	—	—	—	—	—	—	—	7	0.44
	Total	**2,259**	—	—	—	—	—	—	13	0.58	1	0.04	—	—	1	0.04	—	—	15	0.66
All Seasons Total		**6,862**	**4**	**0.06**	**11**	**0.16**	**118**	**1.72**	**23**	**0.34**	**26**	**0.38**	**6**	**0.09**	**4**	**0.06**	**2**	**0.03**	**194**	**2.83**

NOTES:
— indicates a zero value.
[a] CPUE is calculated as the number of fish caught per 100 m^3 seined.

Table 4.3–14 Taxon Richness Observed During Beach Seine Surveys in Whiskey Bay

Taxon	Survey Month			
	June	September	November	March
Marine Fish	5	9	1	4
Invertebrates	1	8	0	8

Salmonid taxa captured at Whiskey Bay included chum salmon, pink salmon, sockeye salmon, Pacific herring, and starry flounder. No marine fish taxa of conservation concern were observed in Whiskey Bay during the beach seine surveys.

West Pearse Island

Over the four seasonal surveys, 659 fish were captured at west Pearse Island, representing a total of 22 taxa (Table 4.3–15; Figure 4.3–4 Appendix E, Photos 5 and 6).

Fish abundance varied between the four seasonal surveys at west Pearse Island. June had the greatest abundance of fish, with 605 of the total 659 fish captured and a CPUE of 9.60 individuals/100 m^3 (Appendix F.1). March and November had the lowest catch of the four surveys, with 11 and 12 fish caught and CPUE values 0.24 and 0.19 individuals/100 m^3, respectively.

Taxon abundance also varied between sampling seasons at west Pearse Island. Pacific herring and salmonids (Appendix E, Photos 14, 15, 16, and 18) were captured in the greatest abundance during the June survey, with 326 and 247 individuals captured, and CPUE values of 1.74 and 1.32 individuals/100 m^3, respectively. Of the 326 Pacific herring, 255 were captured during a single beach seine haul (BSB05-2) in the June survey. In the same haul, 209 of the 237 salmonids were captured. Three-spine stickleback were the most abundant taxa observed in the September survey with 26 and a CPUE of 1.61 individuals/100 m^3; sculpin species (10 individuals; 0.16 individuals/100 m^3) were the most abundant taxa during the November survey; and, salmonids (10 individuals; 0.22 individuals/100 m^3) during the March survey (Appendix F.1, Table 4.3–15).

1 **Table 4.3–15 Abundance of Fish Collected During Beach Seine Surveys at West Pearse Island**

Survey Month	Site ID	Area Seined (m^3)	Flatfish (Family Pleuronectidae)		Gunnel (Family Pholidae)		Pacific Herring (*Clupea pallasii*)		Pacific Sand Lance (*Ammodytes hexapterus*)		Salmonids (Family Salmonidae)		Sculpin (Family Cottidae)		Shiner Perch (*Cymatogaster aggregata*)		Snailfish (Family Liparidae)		Snake Prickleback (*Lumpenus sagitta*)		Threespine Stickleback (*Gasterosteus aculeatus*)		Tubesnout (*Aulorhynchus flavidus*)		Totals	
			Catch	CPUE [a]	Catch	CPUE [a]	Catch	CPUE [a]	Catch	CPUE [a]	Catch	CPUE [a]	Catch	CPUE [a]	Catch	CPUE [a]	Catch	CPUE [a]	Catch	CPUE [a]	Catch	CPUE [a]	Catch	CPUE [a]	Catch	CPUE [a]
June	BSB04	2,700	7	0.26	5	0.19	71	2.63	—	—	28	1.04	11	0.41	1	0.04	1	0.04	—	—	—	—	—	—	124	4.59
	BSB05	3,600	2	0.06	1	0.03	255	7.08	4	0.11	209	5.81	9	0.25	—	—	—	—	1	0.03	—	—	—	—	481	13.36
	Total	**6,300**	**9**	**0.14**	**6**	**0.10**	**326**	**5.17**	**4**	**0.06**	**237**	**3.76**	**20**	**0.32**	**1**	**0.02**	**1**	**0.02**	**1**	**0.02**	**—**	**—**	**—**	**—**	**605**	**9.60**
September	BS04	792	—	—	—	—	—	—	—	—	—	—	—	—	3	0.38	—	—	—	—	6	0.76	—	—	9	1.14
	BS05	825	—	—	—	—	—	—	—	—	—	—	2	0.24	—	—	—	—	—	—	20	2.42	—	—	22	2.67
	Total	**1,617**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**2**	**0.12**	**3**	**0.19**	**—**	**—**	**—**	**—**	**26**	**1.61**	**—**	**—**	**31**	**1.92**
November	BS04	746	—	—	—	—	—	—	—	—	—	—	1	0.13	—	—	—	—	—	—	—	—	2	0.27	3	0.40
	BS05	622	—	—	—	—	—	—	—	—	—	—	6	0.96	—	—	—	—	—	—	—	—	—	—	6	0.96
	BSB05	4,950	—	—	—	—	—	—	—	—	—	—	3	0.06	—	—	—	—	—	—	—	—	—	—	3	0.06
	Total	**6,318**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**10**	**0.16**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**2**	**0.03**	**12**	**0.19**
March	BS04	840	—	—	—	—	—	—	—	—	6	0.71	—	—	—	—	—	—	—	—	—	—	—	—	6	0.71
	BS05	512	—	—	—	—	—	—	—	—	2	0.39	—	—	—	—	—	—	—	—	—	—	—	—	2	0.39
	BSB05	3,168	—	—	—	—	—	—	—	—	2	0.06	1	0.03	—	—	—	—	—	—	—	—	—	—	3	0.09
	Total	**4,520**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**10**	**0.22**	**1**	**0.02**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**11**	**0.24**
All Seasons Total		**18,755**	**9**	**0.05**	**6**	**0.03**	**326**	**1.74**	**4**	**0.02**	**247**	**1.32**	**33**	**0.18**	**4**	**0.02**	**1**	**0.01**	**1**	**0.01**	**26**	**0.14**	**2**	**0.01**	**659**	**3.51**

NOTES:
— indicates a zero value.
[a] CPUE is calculated as the number of fish caught per 100 m^3 seined.

2

Overall west Pearse Island taxon richness was 22 marine fish taxa and 6 invertebrate taxa. Taxon richness was highest in June, with a total of 20 taxa observed, and lowest in November, with one taxon group observed (sculpin) (Table 4.3–16). Invertebrate taxa incidentally caught at west Pearse Island included amphipods (Order Amphipoda) and snails *(Littorina* sp.).

Table 4.3–16 Taxon Richness Observed During West Pearse Beach Seine Surveys

Taxon	Survey Month			
	June	September	November	March
Marine Fish	20	3	2	3
Invertebrates	1	2	0	3

Salmonid taxa captured at west Pearse Island during the beach seine surveys included chinook, chum, coho, pink, and Dolly Varden. Forage and groundfish species captured included Pacific herring, English sole, northern rock sole (*Lepidopsetta polyxystra*), and starry flounder. No marine fish species of conservation concern were captured at west Pearse Island during the beach seine surveys.

4.3.3.2 Surface Trawl Survey

Surface trawl surveys were conducted June 4 to 6, 2021 with a total of six hauls completed, four at east Pearse Island (T02, T03, T05, T06), one at Whiskey Bay (T09), and one at west Pearse Island (T11) (Table 4.3–17, Figure 4.3–1, Appendix E, Photos 10 and 11). A test trawl was conducted on June 3, 2021, the results of which are included in taxa lists and richness calculations, but not otherwise included in trawl results calculations due to inconsistent methods during the test run preventing CPUE calculations. Trawl sets T06 at east Pearse Island and T11 at west Pearse Island had twists in the net leading up to the aquarium box upon trawl retrieval. Fish were captured during set T06 but not T11 (Table 4.3–17).

During the trawl survey 376 fish were captured, representing 11 taxa (Table 4.3–18), including the 51 fish and one additional taxa (Pacific sandfish) captured during the test trawl outside Whiskey Bay. For each survey, a summary of surface trawl effort, taxa captured, and taxa abundance (CPUE) per 100 m^3 is presented in Appendix F.2.

Table 4.3–17 Surface Trawl Set Subareas, Haul Details and Total Fish Captured

Subarea	Trawl ID	Date	Duration	Set Details				Fish Collected (no.)
				Max Height	Max Width	Distance	Area Trawled	
			(min)	(m)	(m)	(m)	(m^3)	
East Pearse Island	T-02	4-Jun-21	11	4.6	5	704	16,192	8
	T-03	4-Jun-21	13	4.6	5	682	15,686	95
	T-05	5-Jun-21	8	4.6	5	594	13,662	80
	T-06	6-Jun-21	13	4.6	5	844	19,412	141
Whiskey Bay	T-test	3-Jun-21	15	4.6	5	827	19,021 [a]	51
	T-09	6-Jun-21	13	4.6	5	453	10,419	1
West Pearse Island	T-11	5-Jun-21	11	4.6	5	716	16,468	0
					Totals	**4,820**	**110,860**	**376**

NOTE:
[a] indicates area trawled is approximate due to inconsistent test trawl methods.

Table 4.3–18 Fish and Invertebrate Taxa Collected by Trawl Marine Fish Surveys

Common Name	Scientific Name	East Pearse Island	Whiskey Bay	West Pearse Island	Fish Collected (no.)
Chinook salmon	*Oncorhynchus tshawytscha*	1	—	—	1
Chum salmon	*Oncorhynchus keta*	8	1	—	9
Coho salmon	*Oncorhynchus kisutch*	8	—	—	8
Dolly Varden	*Salvelinus malma*	1	—	—	1
Pacific herring	*Clupea pallasii*	5	5	—	10
Pacific sand lance	*Ammodytes hexapterus*	256	—	—	256
Pacific sandfish	*Trichodon trichodon*	—	1	—	1
Pink salmon	*Oncorhynchus gorbuscha*	18	43	—	61
Salmon spp.	*Oncorhynchus spp.*	24	2	—	26
Sockeye salmon	*Oncorhynchus nerka*	2	—	—	2
Unidentified larval fish	Class Teleostei	1	—	—	1
Total number of fish collected				**376**	

NOTE:
— indicates a zero value.

No fish were captured during the single trawl (T11) at west Pearse Island when the trawl net malfunctioned (Table 4.3–19), and time restraints prevented completion of an additional trawl at this location. The single trawl at Whiskey Bay (T09) captured 1 juvenile salmonid, but the test trawl outside Whiskey Bay captured 45 juvenile salmonids, 5 Pacific herring, and 1 Pacific sandfish. The highest abundance of fish captured was at east Pearse with a total of 324 observed fish during the 4 trawl sets (T02, T03, T05, and T06). Of the 324 fish captured, 62 were juvenile salmonids, 5 were Pacific herring, 256 were juvenile Pacific sand lance, and one was an unidentified larval fish. Their respective CPUE values in East Pearse were 0.95 individuals/100 m^3 (juvenile salmonids), 0.008 individuals/100 m^3 (Pacific herring), 0.4 individuals/100 m^3 (juvenile Pacific sand lance), and 0.002 individuals/100 m^3 (unidentified larval fish).

Taxon richness was highest at East Pearse Island where 10 fish taxa were observed. There were five fish taxa captured at Whiskey Bay during both the test and transect hauls (Table 4.3–19). No fish were captured at West Pearse Island (Figure 4.3–4; Table 4.3–19).

Table 4.3–19 Taxa Abundance (CPUE; number per 100 m^3) Observed During Marine Fish Trawl Survey

Subarea	Trawl ID	Area Trawled (m^3)	Pacific Herring (*Clupea pallasii*)		Pacific Sand Lance (*Ammodytes hexapterus*)		Salmonids (Family Salmonidae)		Unidentified Larval Fish (Class Teleostei)		Totals	
			Catch	CPUE [a]	Catch	CPUE [a]	Catch	CPUE [a]	Catch	CPUE [a]	Catch	CPUE[a]
East Pearse Island	T-02	16,192	—	—	—	—	8	0.05	—	—	8	0.05
	T-03	15,686	3	0.02	62	0.40	29	0.18	1	0.01	95	0.61
	T-05	13,662	2	0.01	57	0.42	21	0.15	—	—	80	0.59
	T-06	19,412	—	—	137	0.71	4	0.02	—	—	141	0.73
	Total	**64,952**	**5**	**0.01**	**256**	**0.39**	**62**	**0.10**	**1**	**<0.01**	**324**	**0.50**
Whiskey Bay	T-09	10,419	—	—	—	—	1	0.01	—	—	1	0.01
	Total	**10,419**	—	—	—	—	1	0.01	—	—	1	0.01
West Pearse Island	T-11	16,468	—	—	—	—	—	—	—	—	—	—
	Total	**16,468**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	
All Sites Total		**91,839**	**5**	**0.01**	**256**	**0.28**	**63**	**0.07**	**1**	**<0.01**	**325**	**0.35**

NOTES:
— indicates a zero value.
[a] CPUE is calculated as the number of fish caught per 100 m^3 seined.

1

4.3.3.3 Hydroacoustic Surveys

Summary results for the seasonal, paired trawl, and eulachon hydroacoustic surveys are presented below. Seasonal hydroacoustic survey echograms and eulachon hydroacoustic survey echograms are presented in Appendix F.5 and Appendix F.6, respectively.

Seasonal Surveys

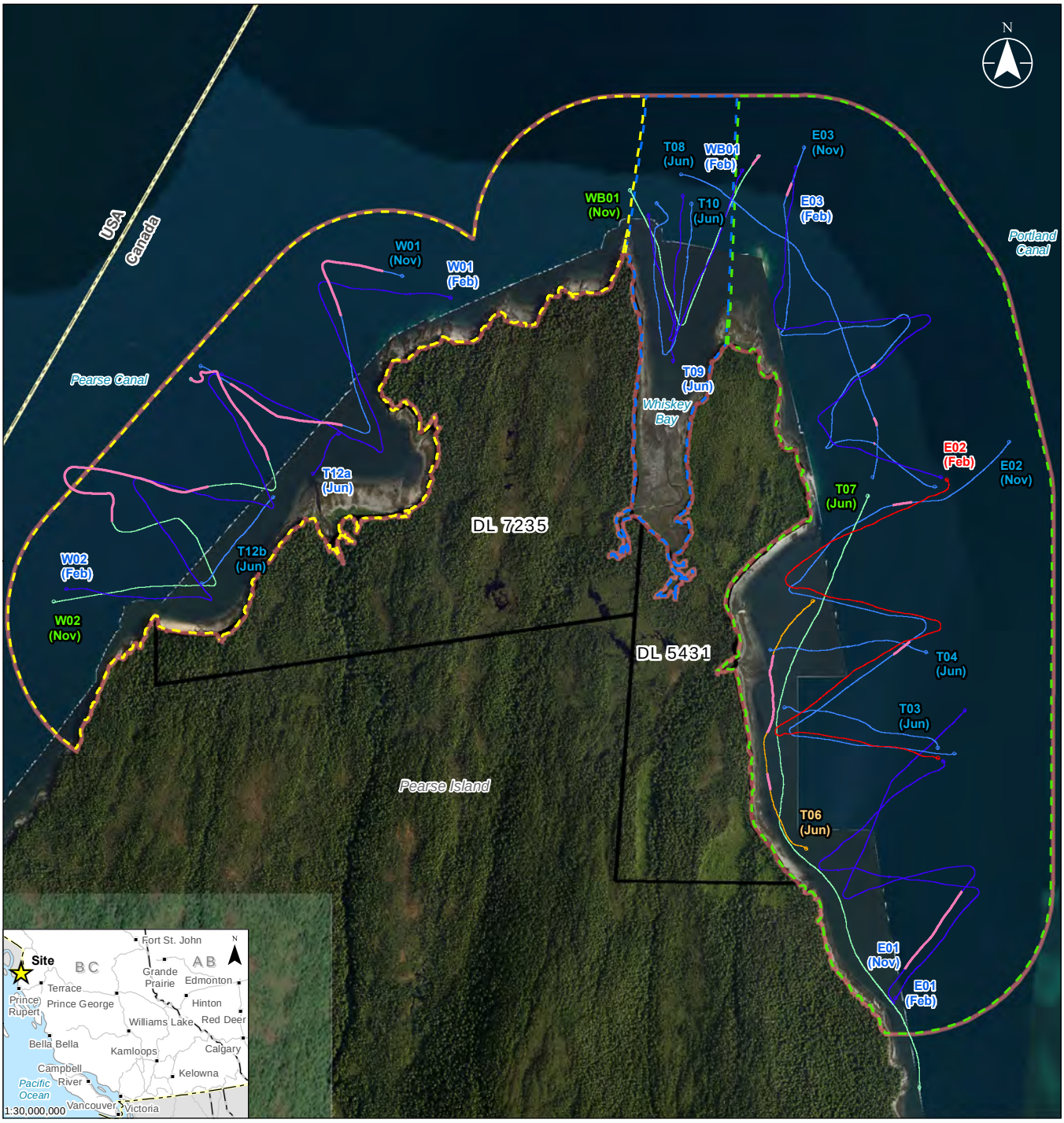
Twenty-one seasonal hydroacoustic transects from across east and west Pearse Island and Whiskey Bay were analyzed for relative fish biomass and distribution across depth layers. Eleven of these transects were completed on the east side of Pearse Island, four were in Whiskey Bay, and six on the west side of Pearse Island (Table 4.3–4).

Transect combined depth layer MVBS values averaged within each survey subarea and survey month indicate east Pearse Island consistently had the highest relative biomass across all surveys, while west Pearse Island had the lowest (Table 4.3–20). Averaged MVBS values were not consistently higher or lower during any particular season. East Pearse Island highest and lowest averaged MVBS values were in February and June, respectively. Whiskey Bay and west Pearse Island averaged MVBS values were highest in November and lowest in February. Whiskey Bay, however, only had one transect during each of the November and February surveys.

Table 4.3–20 Pearse Island Seasonal Transects Averaged MVBS by Subarea and Survey Month

Subarea	Survey Month	Averaged Mean Volume Backscattering Strength (S_v) (dB re 1 m^{-1})
East Pearse Island	June	-76.70
	November	-68.30
	February	-64.05
Whiskey Bay	June	-89.68
	November	-72.09
	February	-98.78
West Pearse Island	June	-91.64
	November	-87.11
	February	-98.97

Analyzed MVBS values by survey month, transect, and depth layers, and locations of echogram observed potential fish shoals or aggregations are presented in Figure 4.3–5 (Pages 1–4). Transect E02 (February) on the east side of Pearse Island had the highest combined depth layer MVBS, while W02 (February) on the west side of Pearse Island had the lowest. With consideration of separate depth layers (surface, pelagic, demersal), Transect E02 (February) surface layer had the highest MVBS, while E03 pelagic layer (February) had the lowest measurable MVBS, both on the east side of Pearse Island (Figure 4.3–5 pages 2 and 3). Transects T09, T12 (June), and E02 (November) had MVBS values of zero for the pelagic, demersal, and surface layers, respectively, indicating no fish biomass within the analyzed range (greater than -60 dB TS) in those layers.



KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Hydroacoustic Transect (Combined Depth Layers) Mean Volume Backscattering Strengths (dB re 1 m^{-1})
- -90 to -100
- -80 to -90
- -70 to -80
- -60 to -70
- -50 to -60

Fish Aggregation(s) or Shoal(s)

Marine Fish Survey Sub-Area
- East Pearse Island
- West Pearse Island
- Whiskey Bay

Marine Fish Survey Area

Boundaries of District Lots 7235 and 5431

0 150 300 450 600 750 m

1:20,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC

Project Number: 123221820
Prepared by SMOSS on 20220825
Requested by MLONG on 20220818
Check by TQUILICHINI on 20220825

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.3-5

Title
Pearse Island Seasonal Hydroacoustic Transects MVBS by Depth Layer – Combined Depth Layers

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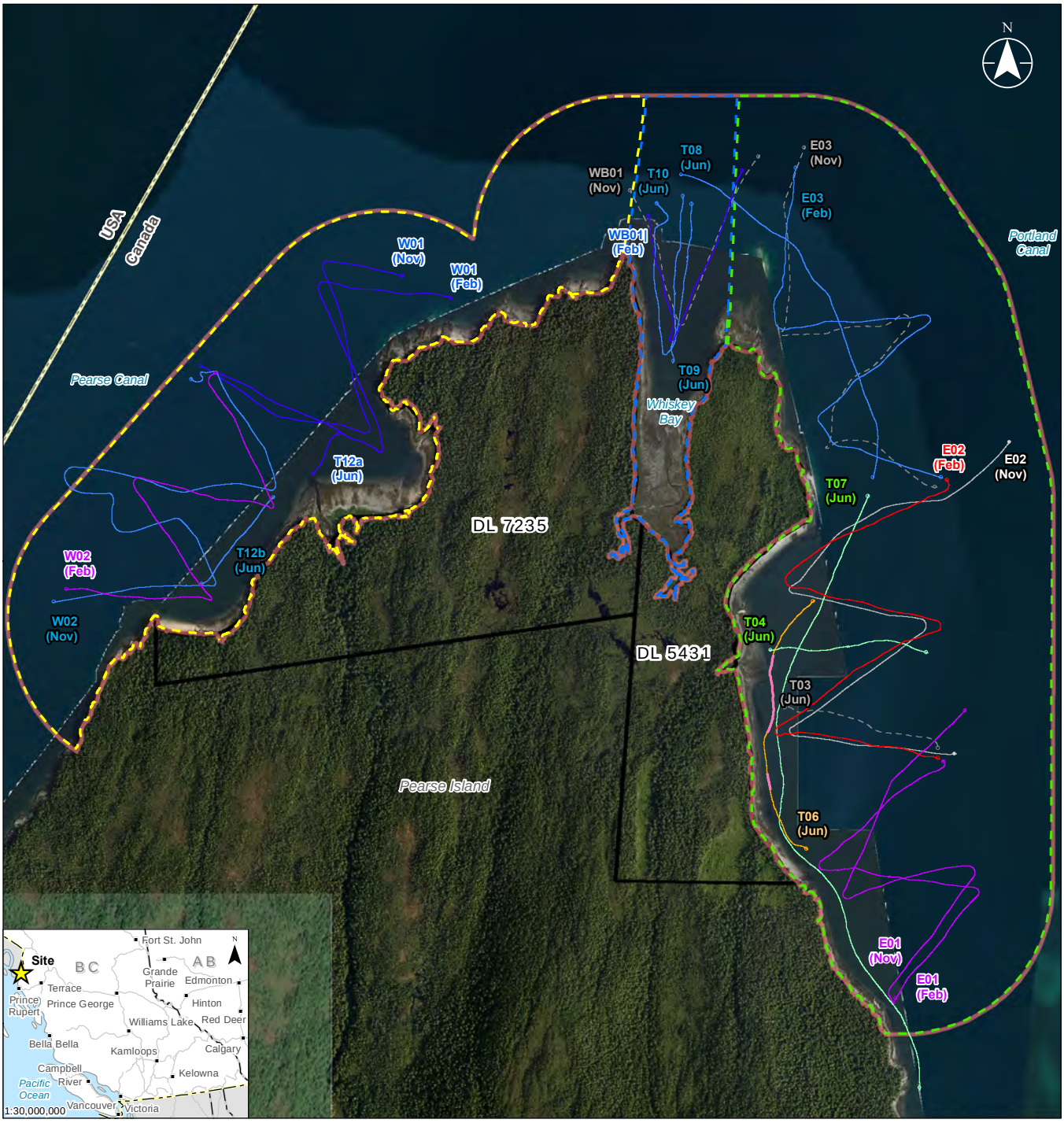
S:\123\20\projects\123221820\figures\report\TDR\Marine\Fig4_3-5a_123221820_285_transects_backscattering_alldepthstrata.mxd Revised: 2023-09-06 By: tquilichini



KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Hydroacoustic Transect (Surface - Top 20 m) Mean Volume Backscattering Strengths (dB re 1 m^{-1})

- -100 to -110
- -90 to -100
- -80 to -90
- -70 to -80
- -60 to -70
- -50 to -60
- 0
- Not Analyzed

- Fish Aggregation(s) or Shoal(s)

Marine Fish Survey Sub-Area

- East Pearse Island
- West Pearse Island
- Whiskey Bay
- Marine Fish Survey Area
- Boundaries of District Lots 7235 and 5431

0 150 300 450 600 750 m

1:20,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC

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Check by TQUILICHINI on 20220825

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Figure No.
4.3-5

Title
Pearse Island Seasonal Hydroacoustic Transects MVBS by Depth Layer – Surface (Top 20 m)

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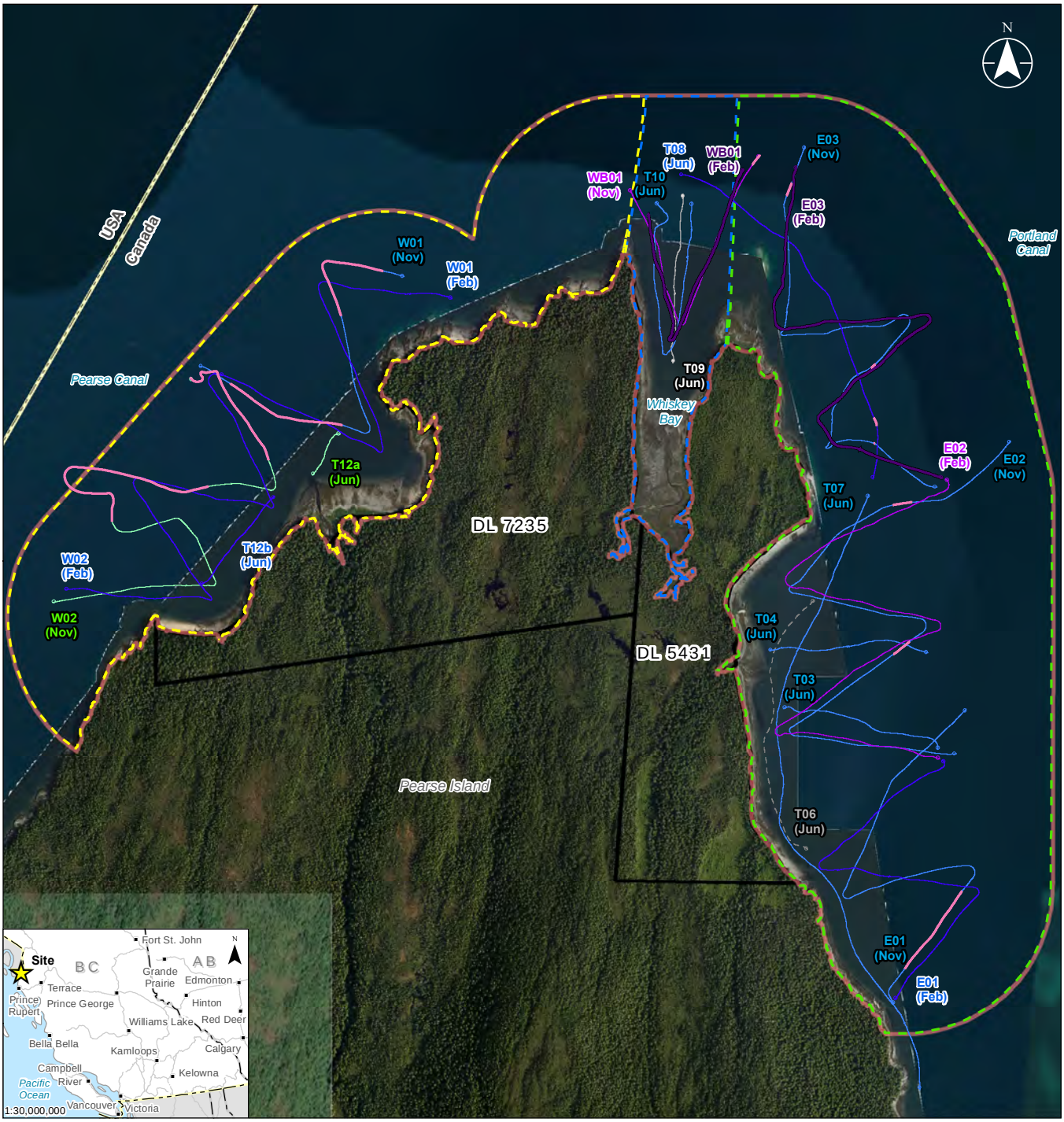

KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Hydroacoustic Transect (Pelagic) Mean Volume Backscattering Strengths (dB re 1 m^{-1})
- -110 to -120
- -100 to -110
- -90 to -100
- -80 to -90
- -70 to -80
- 0
- Not Analyzed

- Fish Aggregation(s) or Shoal(s)

Marine Fish Survey Sub-Area
- East Pearse Island
- West Pearse Island
- Whiskey Bay
- Marine Fish Survey Area
- Boundaries of District Lots 7235 and 5431

0 150 300 450 600 750 m
1:20,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC
Project Number: 123221820
Prepared by SMOSS on 20220825
Requested by MLONG on 20220818
Check by TQUILICHINI on 20220825

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.3-5

Title
Pearse Island Seasonal Hydroacoustic Transects MVBS by Depth Layer – Pelagic

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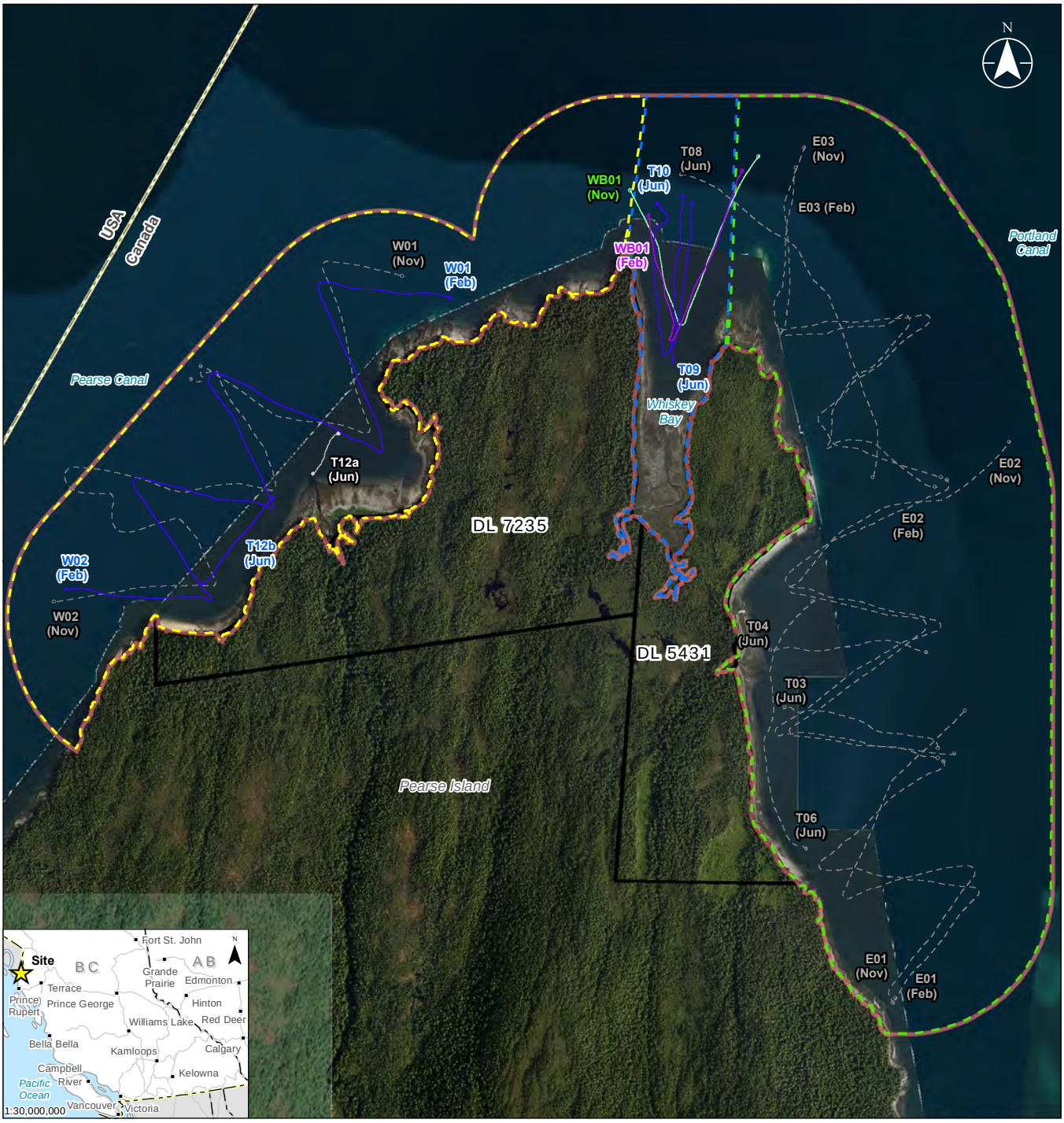

KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Hydroacoustic Transect (Demersal - Bottom 10 m) Mean Volume Backscattering Strengths (dB re 1 m^{-1})
- -100 to -110
- -90 to -100
- -70 to -80
- 0
- Not Analyzed

Marine Fish Survey Sub-Area
- East Pearse Island
- West Pearse Island
- Whiskey Bay
- Marine Fish Survey Area
- Boundaries of District Lots 7235 and 5431

0 150 300 450 600 750 m
1:20,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC
Project Number: 123221820
Prepared by SMOSS on 20220825
Requested by MLONG on 20220818
Check by TQUILICHINI on 20220825

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.3-5

Title
Pearse Island Seasonal Hydroacoustic Transects MVBS by Depth Layer – Demersal (Bottom 10 m)

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East Pearse Island

East Pearse Island transects had the highest averaged MVBS (biomass) across each survey month, though the subarea also had the largest sample size with 11 of the 21 total analyzed transects. Biomass peaked in February and was at its lowest in June (Table 4.3–20). Fish biomass was generally highest in the surface layers with the exception of November, during which biomass was highest in the pelagic layers. In June, fish aggregations or shoals were observed along T03 close to shore in depths less than 10 m (Figure 4.3–5 Page 2).

Biomass generally decreased with increased depth layers, with the exception of the November survey in which the opposite was true (Table 4.3–21). Fish aggregations or shoals were observed in seven areas along the East Pearse Island pelagic transects, six were observed in November and one in June (Figure 4.3–5 Page 3). The largest aggregation or shoal of fish at East Pearse Island was observed in the south end at transect E01.

The November and February surveys, did not have demersal layers analyzed due to background noise limitations, and so depth trends were based on pelagic and surface layers.

Table 4.3–21 East Pearse Island Averaged MVBS by Depth Layer

Survey Month	Water Column Depth Layer	Averaged Mean Volume Backscattering Strength (S_v) (dB re 1 m^{-1})
June	Surface	-68.77
	Pelagic	-83.28
	Demersal	-113.84
November	Surface	-100.65
	Pelagic	-87.37
	Demersal	—
February	Surface	-57.92
	Pelagic	-102.16
	Demersal	—

NOTES:
Surface = top 20 m of water column.
Pelagic = between surface and demersal layer.
Demersal = bottom 10 m of water column.
— = layer not analyzed.
Absence of analysis for a water column layer means either maximum depth was 30 m or shallower (no pelagic layer) or unremovable noise was present throughout either the top 20 m of the water column (no surface layer) or extending from 10 m above the seafloor to the bottom (no bottom layer). Noise examples include surface disturbance, plankton masses or limiting background noise.

Fish biomass (MVBS value) was generally higher on the east side of Pearse Island during the November survey than during the February survey, with the exception of Transect E02 (Figure 4.3–6). The June transects were graphed separately (Figure 4.3–7) as they do not follow the same transect paths as E01, E02, and E03, and are therefore not directly comparable. Transect T06, which was conducted parallel to a kelp bed, had the highest MVBS of the June survey and the second highest of all survey months on east Pearse Island. Of all transects on the east side of Pearse Island, February E02 had the highest fish biomass, while E01 of the same survey month had the lowest biomass.

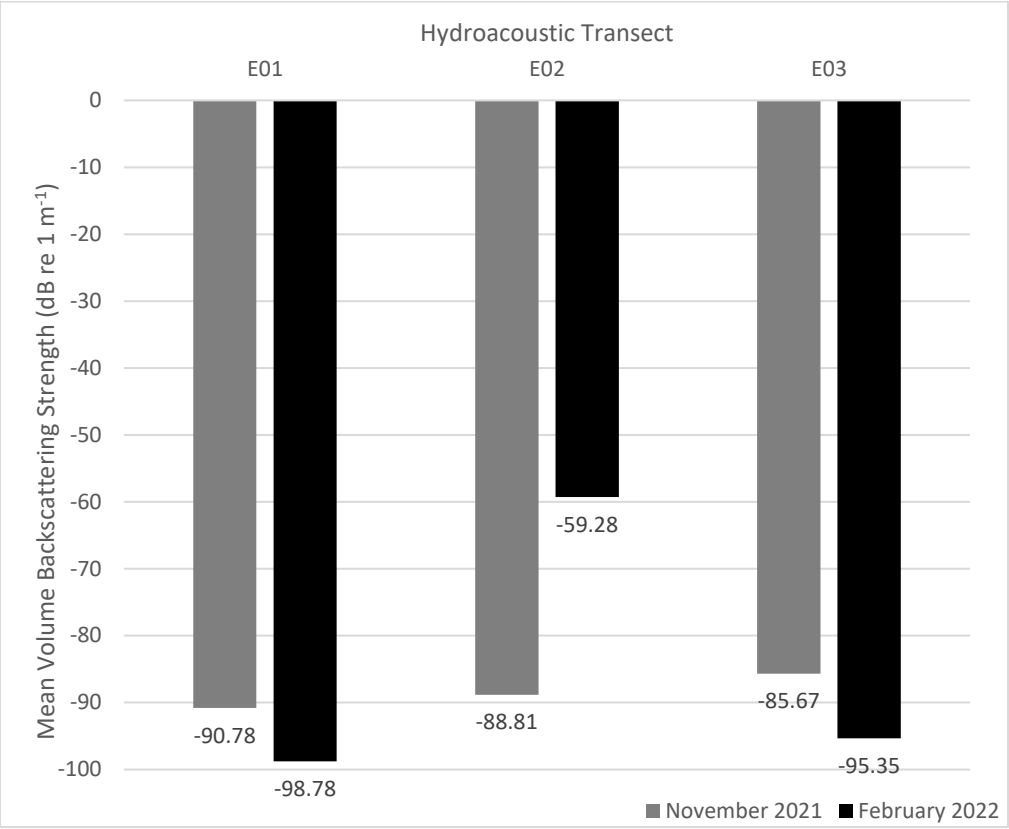


Figure 4.3–6 East Pearse Island Seasonal Comparison of Mean Volume Backscattering Strength by Hydroacoustic Recurrent Transect

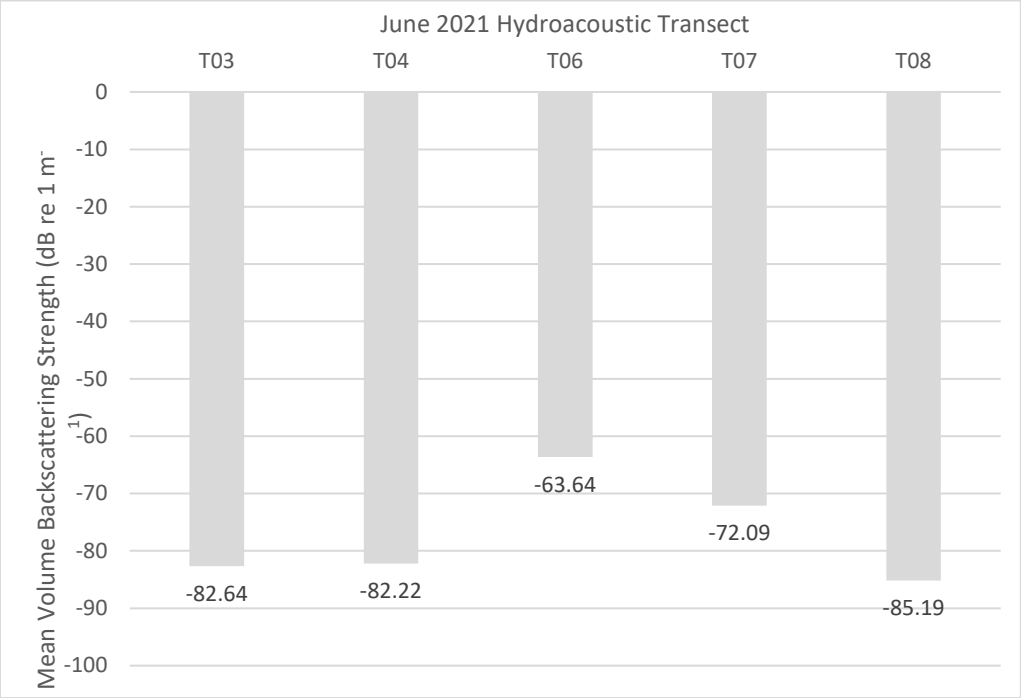


Figure 4.3–7 East Pearse Island Mean Volume Backscattering Strength by Hydroacoustic Non-recurrent June 2021 Transect

Whiskey Bay

Whiskey Bay transects account for 4 of the 21 analyzed seasonal hydroacoustic transects. Biomass peaked in November and was at its lowest in February (Table 4.3–20), though both these surveys included one transect in Whiskey Bay, whereas the June survey included two transects. Fish biomass was generally highest in the surface layer except for the November survey, during which it was highest in the demersal layer. During the November survey, one aggregation or shoal of fish were observed on a Whiskey Bay pelagic transect (WB01; Figure 4.3-5 Page 3); however, this was at the end of the transect where it strayed across the border into the East Pearse Island subarea.

The surface layer was not analyzed, however, for the November Whiskey Bay transect due to acoustic noise through the top 33 m of the water column. Biomass generally decreased with increased depth layer, except for the November transect, in which the opposite was true (Table 4.3–22).

Table 4.3–22 Whiskey Bay Averaged MVBS by Depth Layer

Survey Month	Water Column Depth Layer	Averaged Mean Volume Backscattering Strength (S_v) (dB re 1 m^{-1})
June	Surface	-87.77
	Pelagic	-88.92
	Demersal	-93.19
November	Surface	—
	Pelagic	-107.40
	Demersal	-72.34
February	Surface	-97.03
	Pelagic	-112.17
	Demersal	-103.31

NOTES:
Surface = top 20 m of water column.
Pelagic = between surface and demersal layers.
Demersal = bottom 10 m of water column.
— = depth layer not analyzed.
Absence of analysis for a water column layer means either maximum depth was 30 m or shallower (no pelagic layer) or unremovable noise was present throughout either the top 20 m of the water column (no surface layer) or extending from 10 m above the seafloor to the bottom (no bottom layer). Noise examples include surface disturbance, plankton masses or limiting background noise.

Transect WB01 and T10 follow similar paths (Figure 4.3–2) and therefore could be directly compared in Figure 4.3–8. November WB01 showed the highest biomass while February WB01 had the lowest. June Transect T09 was not included in Figure 4.3–8 as it did not follow the same spatial path (Figure 4.3–2); however, it had a MVBS (-90.65 dB) which was within the upper and lower MVBS values range of T10 and WB01.

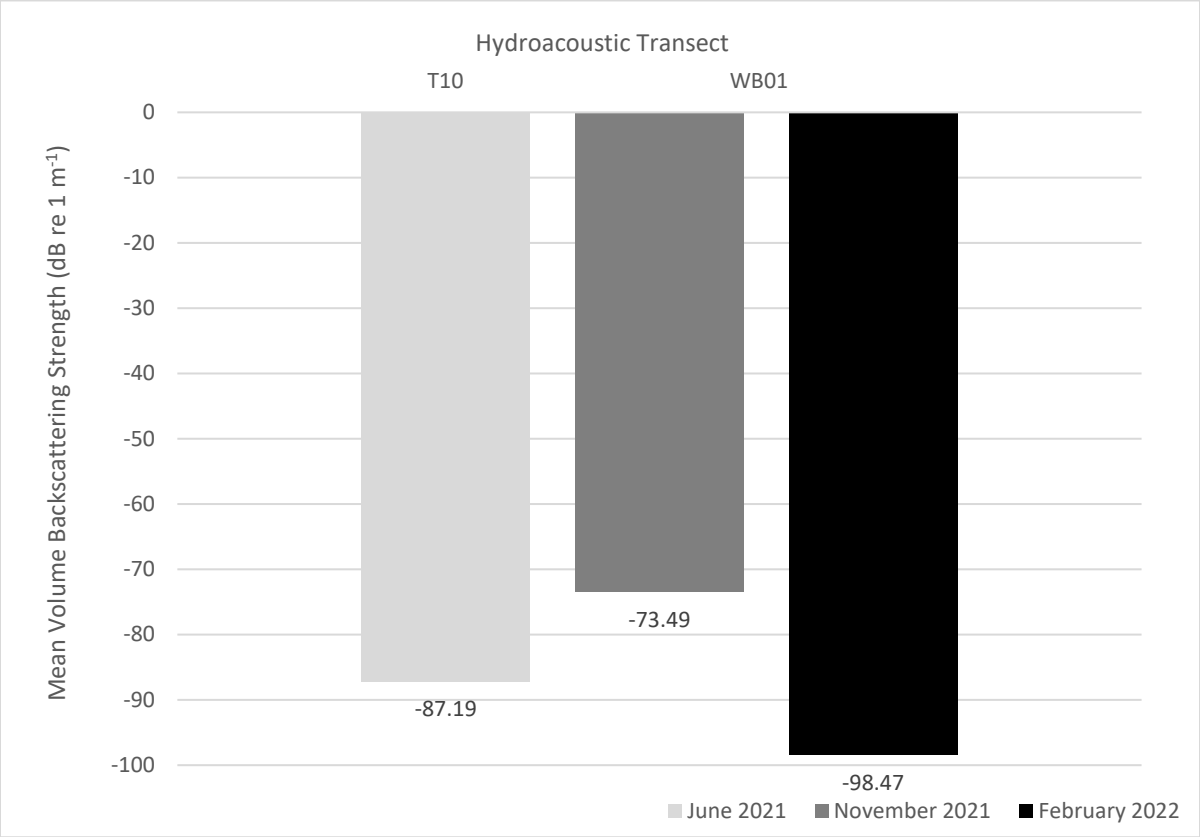


Figure 4.3–8 Whiskey Bay Seasonal Comparison of Mean Volume Backscattering Strength by Hydroacoustic Recurrent Transect

West Pearse Island

Six of the 21 analyzed seasonal transects were completed on the west side of Pearse Island. Biomass peaked on western Pearse Island in November and was at its lowest in February (Table 4.3–20, Figure 4.3–5 Pages 1-4). Averaged biomass increased with increased depth layers across all surveys except June, in which biomass peaked in the surface layer (Table 4.3–23). Four aggregations or shoals of fish were observed at two of the pelagic transects in November (W01 and W02; Figure 4.3-5 Page 3). The aggregation or shoals of fish observed on the west side of Pearse Island were the largest of the three subareas.

The demersal layer was not analyzed for the November transects due to background noise limitations.

Table 4.3–23 Whiskey Bay Averaged MVBS by Depth Layer

Survey Month	Water Column Depth Layer	Averaged Mean Volume Backscattering Strength (Sv) (dB re 1 m^{-1})
June	Surface	-89.97
	Pelagic	-94.58
	Demersal	-90.41
November	Surface	-87.90
	Pelagic	-74.17
	Demersal	—
February	Surface	-98.98
	Pelagic	-95.18
	Demersal	-91.43

NOTES:
Surface = top 20 m of water column.
Pelagic = between surface and demersal layers..
Demersal = bottom 10 m of water column
— = depth layer not analyzed.
Absence of analysis for a water column layer means either maximum depth was 30 m or shallower (no pelagic layer) or unremovable noise was present throughout either the top 20 m of the water column (no surface layer) or extending from 10 m above the seafloor to the bottom (no bottom layer). Noise examples include surface disturbance, plankton masses or limiting background noise.

West Pearse Island November transects showed higher relative biomass compared to February transects (Figure 4.3–9). June west Pearse Island Transects T12a and T12b were included in a separate figure (Figure 4.3–10), as they did not follow the same path as the February and November Transects W01 and W02. Both June transects had MVBS values between the upper and lower ranges of W01 and W02 MVBS values.

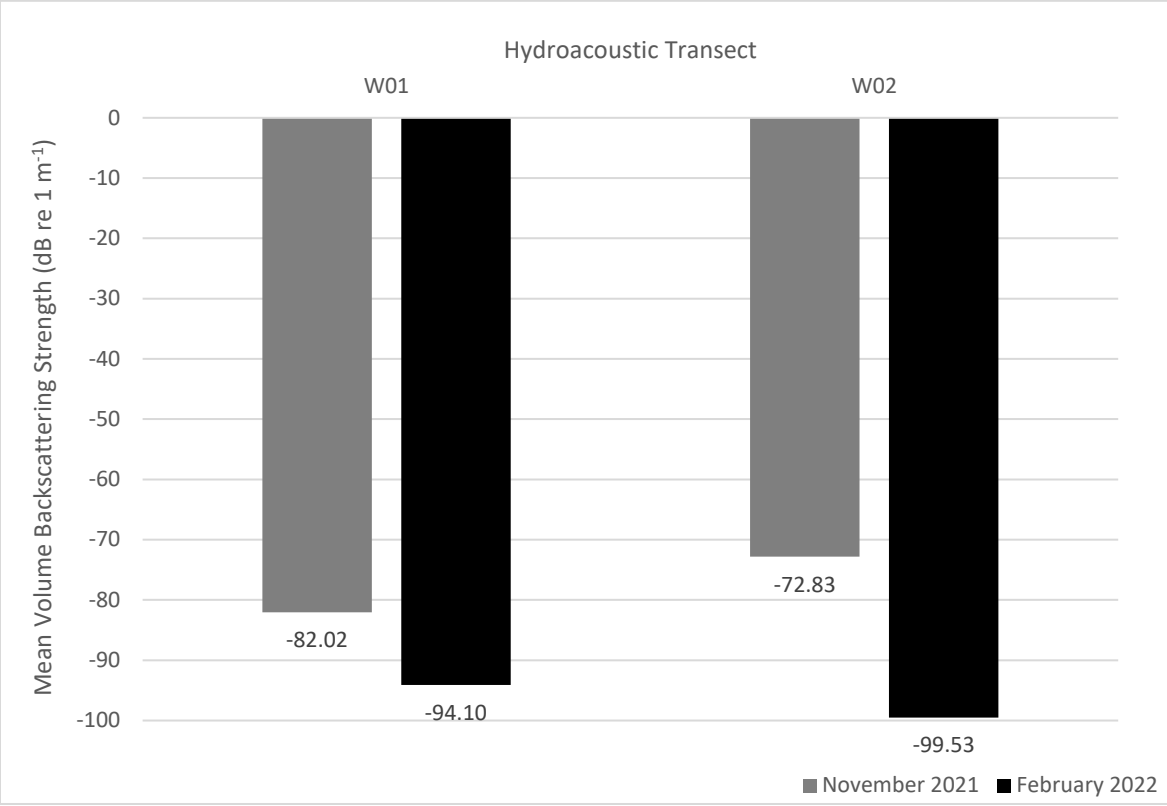


Figure 4.3–9 West Pearse Island Seasonal Comparison of Mean Volume Backscattering Strength by Hydroacoustic Recurrent Transect

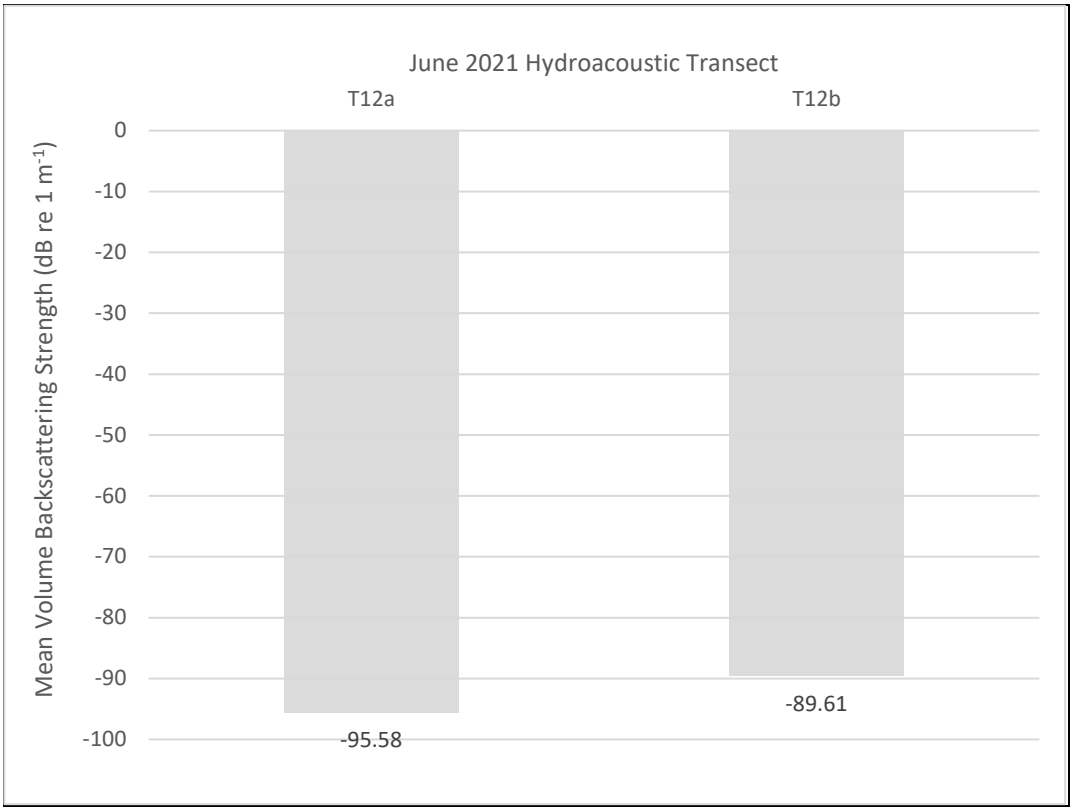


Figure 4.3–10 West Pearse Island Mean Volume Backscattering Strength by Hydroacoustic Non-recurrent Transect

Paired Trawl Survey

Paired trawl hydroacoustic transect analyses revealed juvenile Pacific herring (Transect T03) had the highest maximum and minimum calculated TS value estimates of -39.4 dB and -40.1 dB, respectively, while juvenile Pacific sand lance (Transect T03) had the lowest maximum and minimum TS value estimates at -47.4 dB and -50.0, respectively (Table 4.3–24).

Table 4.3–24 Paired Trawl Catch Mean Fish Lengths and Target Strength Estimates

Subarea	Transect ID	Common Name	Scientific Name	Fish Sampled (No.)	Minimum Length (mm)	Maximum Length (mm)	Mean Length (mm)	Standard Deviation (mm)	Minimum TS (dB)	Mean TS (dB)	Maximum TS (dB)
East Pearse Island	T03	Pacific herring	*Clupea pallasii*	3	163	192	175.3	15.0	-40.7	-40.1	-39.4
	T03	Pacific sand lance	*Ammodytes hexapterus*	10	53	73	62.3	5.1	-50.0	-48.7	-47.4
	T03	Salmonids	Family Salmonidae	28	65	119	88.1	13.0	-48.3	-45.8	-43.3
	T06	Pacific sand lance	*Ammodytes hexapterus*	10	58	75	65.2	5.3	-49.3	-48.7	-47.2
	T06	Salmonids	Family Salmonidae	4	110	153	131.3	131.4	-44.0	-42.5	-41.2
Whiskey Bay	T09	Salmonids	Family Salmonidae	1	137	137	137.0	0.0	-42.2	-42.2	-42.2

With the additional 6 dB subtracted from the lower TS range value, most taxon group minimum and maximum TS ranges overlapped, with the exception of Pacific herring in Transect T03, which only marginally overlapped with Pacific sand lance in Transect T03 and T06 at exactly 47.0 dB (Table 4.3–25). Echo integration for each taxon-specific analyses likely included some amount of each taxon overlapping in TS analysis range for a given transect. For example, the T03 salmonid analysis had a TS analysis range of -54 dB to -43 dB, while the T03 Pacific herring had a range of -47 dB to -39 dB, which overlaps 4 dB (-47 dB to -43 dB). Pacific herring, which was caught in higher numbers than salmonids in trawl set T03, likely contributed to the salmonids fish density value.

Echo integration analyses were not feasible across all depth layers of each paired trawl transect due to noise in the echograms, including background noise and plankton aggregations. The only transect that could be analyzed for combined depth layers was T09 (Whiskey Bay). Transect T03 was only analyzed for the pelagic layer due to noise in the surface and bottom layers, while transect T06 was only analyzed for the surface layer due to biological noise (plankton aggregation) within the pelagic and bottom layers (Appendix F.5:Photo ID 3; Table 4.3–25).

Pacific sand lance in the Transect T06 surface layer had the highest fish density of the paired trawl transects with 2.929 fish per 100 m^3. The higher surface layer fish density is supported by the 13 juvenile sand lance caught during surface trawl T06. Transect T06 was also conducted adjacent a kelp bed on east Pearse Island (Figure 4.3–1) and so there is a chance that echoes from kelp have inflated the fish density numbers. Marine vegetation is not evident in the echogram; however, there are aggregations of echoes suggesting small shoals of fish are present through the top 8 m of the water column (Appendix F.5: Photo ID 3, Figure 4.3–5 page 2).

Salmonids, again within the surface layer of Transect T06, were less abundant in the trawl catch and had a lower density than Pacific sand lance, but had the second highest fish density of all the paired trawl transects (Table 4.3–25). Only four salmonids were caught in the T06 trawl set, yet their fish per 100 m^3 value of 0.750 was orders of magnitude higher than Pacific sand lance and salmonids in the pelagic layer of Transect T03, during which 62 and 29 individuals were caught, respectively. Only the pelagic layer could be analyzed for Transect T03, however, and the trawl catch was limited to the top 5 to 6 m of the water column. It is likely the majority of the juvenile Pacific sand lance and salmonids were only present in the top 20 m of the water column (surface layer) and as such would not be reflected in the pelagic layer analyses. Whiskey Bay transect T09 had the lowest fish density with zero fish per 100 m^3 across combined depth layers and a coinciding trawl catch of one salmonid.

Table 4.3–25 Paired Trawl Hydroacoustic Analysis Results

Subarea	Transect ID	Common Name	Scientific Name	Fish Collected (No.)	Water Column Layer	TS Analysis Range (dB)	Fish Per 100 m^3
East Pearse Island	T03	Pacific herring	*Clupea pallasii*	3	Pelagic	-47 to -39	0.007
	T03	Pacific sand lance	*Ammodytes hexapterus*	62	Pelagic	-56 to -47	0.049
	T03	Salmonids	Family Salmonidae	29	Pelagic	-54 to -43	0.016
	T06	Pacific sand lance	*Ammodytes hexapterus*	137	Surface	-55 to -47	2.929
	T06	Salmonids	Family Salmonidae	4	Surface	-50 to -41	0.750
Whiskey Bay	T09	Salmonids	Family Salmonidae	1	Combined Depth Layers	-48 to -42	0

NOTES:

Surface = top 20 m of water column.

Pelagic = between surface and demersal layers.

Demersal = bottom 10 m of water column.

Absence of analysis for a water column layer means either maximum depth was 30 m or shallower (no pelagic layer) or unremovable noise was present throughout either the top 20 m of the water column (no surface layer) or extending from 10 m above the seafloor to the bottom (no bottom layer). Noise examples include surface disturbance, plankton masses and background noise.

Eulachon Survey

The eulachon survey transects were conducted to investigate where eulachon were and were not potentially staging relative to the Project Site and surrounding areas, prior to movement up the Nass River to spawn. There were no clear acoustic signatures suggesting large scale eulachon staging across the transects completed in February and March 2022. Though small aggregations and shoals of fish were present, as expected, targets could not be verified as eulachon or not, and there were not any clear potential eulachon staging areas.

Fish densities were low across all transects and any targets identified as potential fish aggregations or shoals were observed low in the water column, typically within 10 to 20 m of the bottom. Transect Eul10a was an exception with potential fish shoals closer to mid-water column within a canyon (Appendix F.6; Photo 15). Areas of moderately dense fish tracks (transects with over 50 distinct tracks which differ from the more densely packed echoes observed in fish aggregations and shoals) appeared to be associated with water depth as opposed to geographical location such as proximity to the Nass River mouth. Moderately dense fish tracks were observed in waters over 200 m deep, except for transect Eul10a which showed dense fish tracks near the bottom of a canyon reaching 132 m deep. Potential fish aggregations and shoals; however, were observed less than 100 m deep for all but one transect (Eul09), with no clear geographical trend.

Six of twenty-four hydroacoustic transect echograms were visually determined to potentially have fish shoals or aggregations of individual targets. Of these six transects, five transect files were echo integrated using the previously established expected TS range of Nass Bay eulachon (-66 dB to -56 dB) to determine the fish per cubic metre values of targets within range for each given transect. The remaining transect file could not be analyzed due to high levels of background noise, likely partly due to entrained air echoes (Transect Eul09).

Transect Eul09, located across the channel and west of Gingolx (Figure 4.3–3), was difficult to decipher. Acoustic signals aggregated in towers extending from the seafloor (down to 118 m depths) through 10 m from the surface could be due to fish; however, strong current and tidal flow occurred during data collection (Figure 4.3–11). A portion or most of the acoustic signatures could be due to abiotic factors such as sediment disturbance, gases escaping sediment on the seafloor, or entrapped air churned into deeper waters escaping to the surface. As such, the source of the acoustic signatures in this echogram cannot be determined with certainty for this location. The tower shaped acoustic signatures could also belong to fish, however the diffuse nature of the signal suggests otherwise. The echogram also shows a background noise boundary starting at approximately 64 m, which further masks acoustic signal attributes.

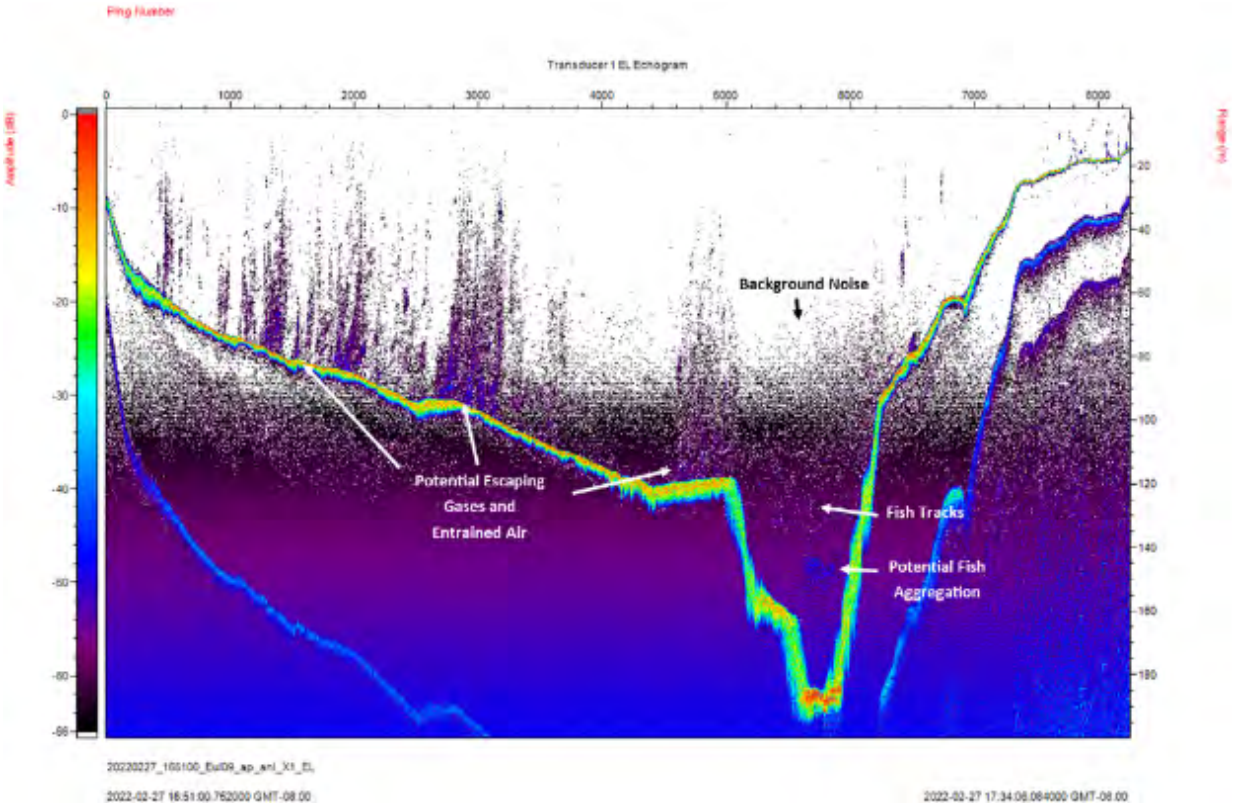


Figure 4.3–11 Transect Eul09 Echogram Recorded on February 27, 2022 in Nass Bay

Densities of fish targets within the expected eulachon TS range were low across all analyzed transects with the highest fish density (Transect Eul08b, Figure 4.3–12) located near shore, east of the entrance to Observatory Inlet (Table 4.3–26, Figure 4.3–3). With 0.509 fish per 100 m^3, the highest fish density was less than one fish per 100 m^3. The Eul08b echogram showed aggregations of targets with TS values within the expected eulachon range. The fish aggregations are small, which align with expectations for eulachon shoals; however, they are also sparse in this echogram, indicating if they are eulachon, they are not present in high numbers that might be expected for eulachon staging prior to movement up-river to spawn. A few of the acoustic traces may also be due to escaping gases, as suggested by their consistent movement upwards in a column.

Table 4.3–26 Hydroacoustic Eulachon Survey Echo Integration Results

Subarea	Transect ID	Analysis Depth Start (m)	Analysis Depth End (m)	Analysis Vertical Distance (m)	Fish Per 100 m^3
Ramsey Point	Eul03	25	73	48	0.370
Observatory Inlet	Eul08b	8	72	64	0.509
Nass Bay	Eul10a	10	62	52	0.476
Iceberg Bay	Eul12a	12	72	60	0.401
Iceberg Bay	Eul12b	3	64	61	0.087

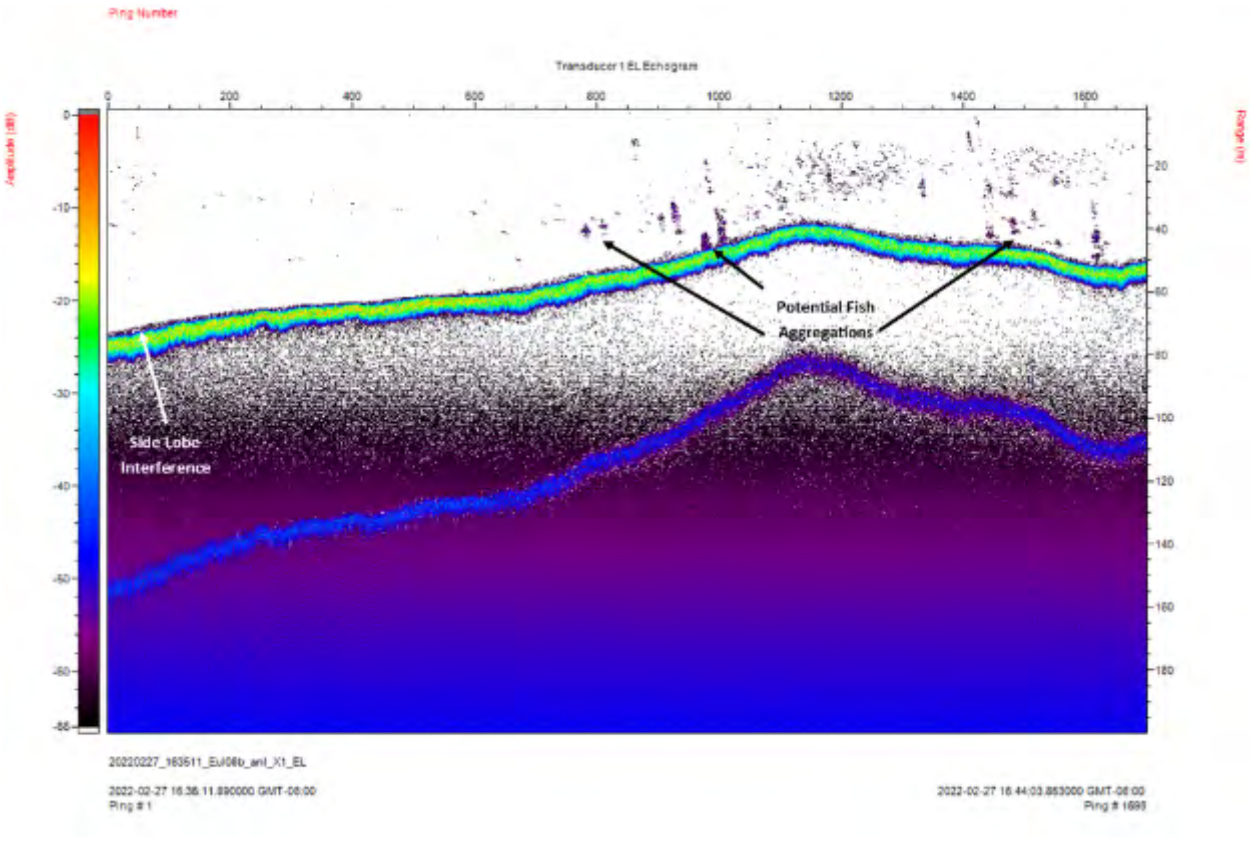


Figure 4.3–12 Transect Eul08b Echogram Recorded on February 27, 2022 near Observatory Inlet

Fish tracks were visible in multiple transects in areas that could not be analyzed due to abundant background noise, which was common in depths over 80 m. Thirteen transects were affected by background noise and five of those transects appeared to have moderate numbers of fish tracks (> 50 tracks) within the affected area (i.e., Eul02, Eul04_pelagic, Eul04a_demersal, Eul04b_demersal, and Eul10a; see example Eul04a_demersal, Figure 4.3–13). Transect Eul02 was located on the east side of Pearse Island, while Eul04–Eul04b were located south of Ramsey Point and Eul10a in Nass Bay

(Figure 4.3–3). Six transect echograms had low numbers of tracks (approximately 10 to 50 tracks; i.e. transects Eul01a_pelagic, Eul01b_pelagic, Eul05_pelagic, Eul05_demersal, Eul07_pelagic, Eul07_demersal, Eul08a, and Eul09; see example Eul08a, Figure 4.3–14). These areas of visually high-density fish tracks commonly started at approximately 120 m depth and continued deeper. Considering eulachon have been observed aggregating in small shoals near the seafloor (Sigler et al. 2004; M. Sigler pers. Comm. Cited in Mudge et al. 2022), the location of these tracks within the water column suggest they could be from eulachon acoustic signatures. However, other fish species with similar distributional behaviours (i.e., semi-demersal fish) cannot be ruled out.

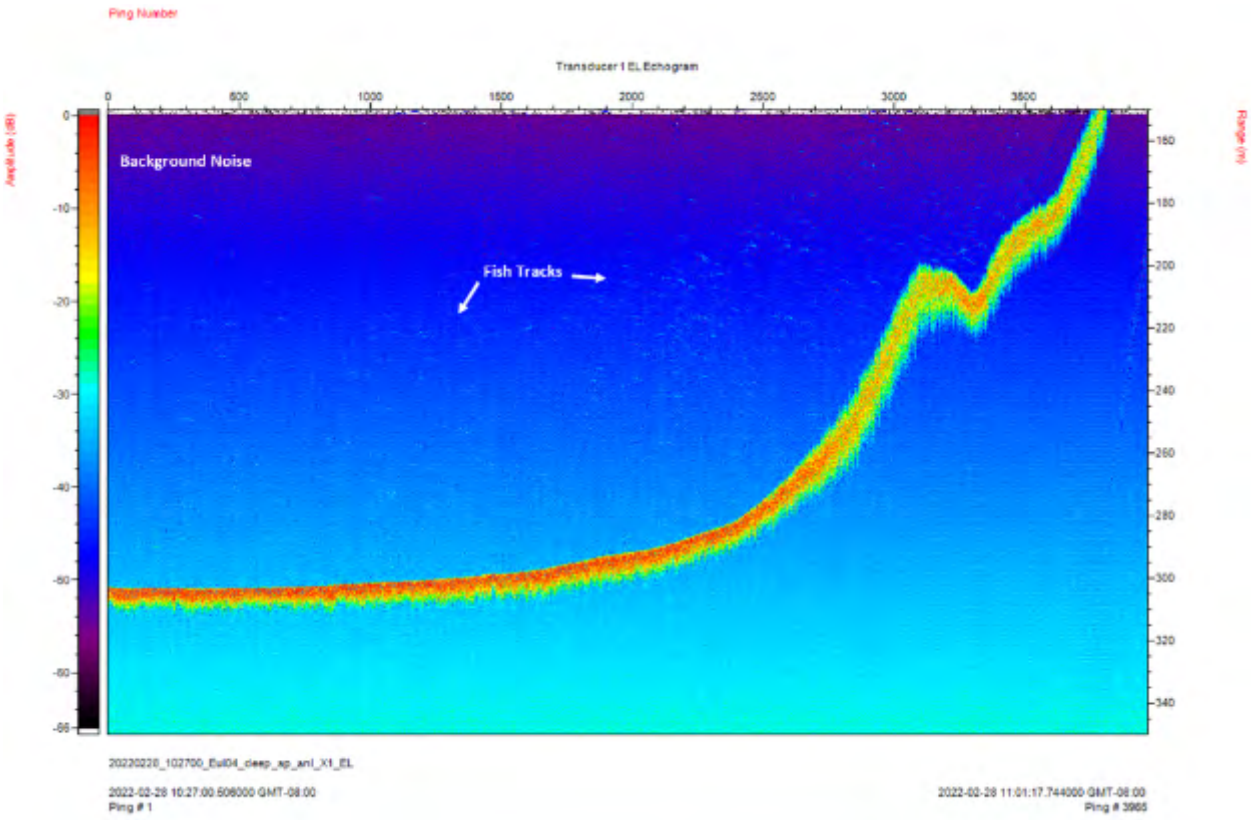


Figure 4.3–13 Transect Eul04a_demersal Echogram Recorded on February 28, 2022 near Ramsey Point

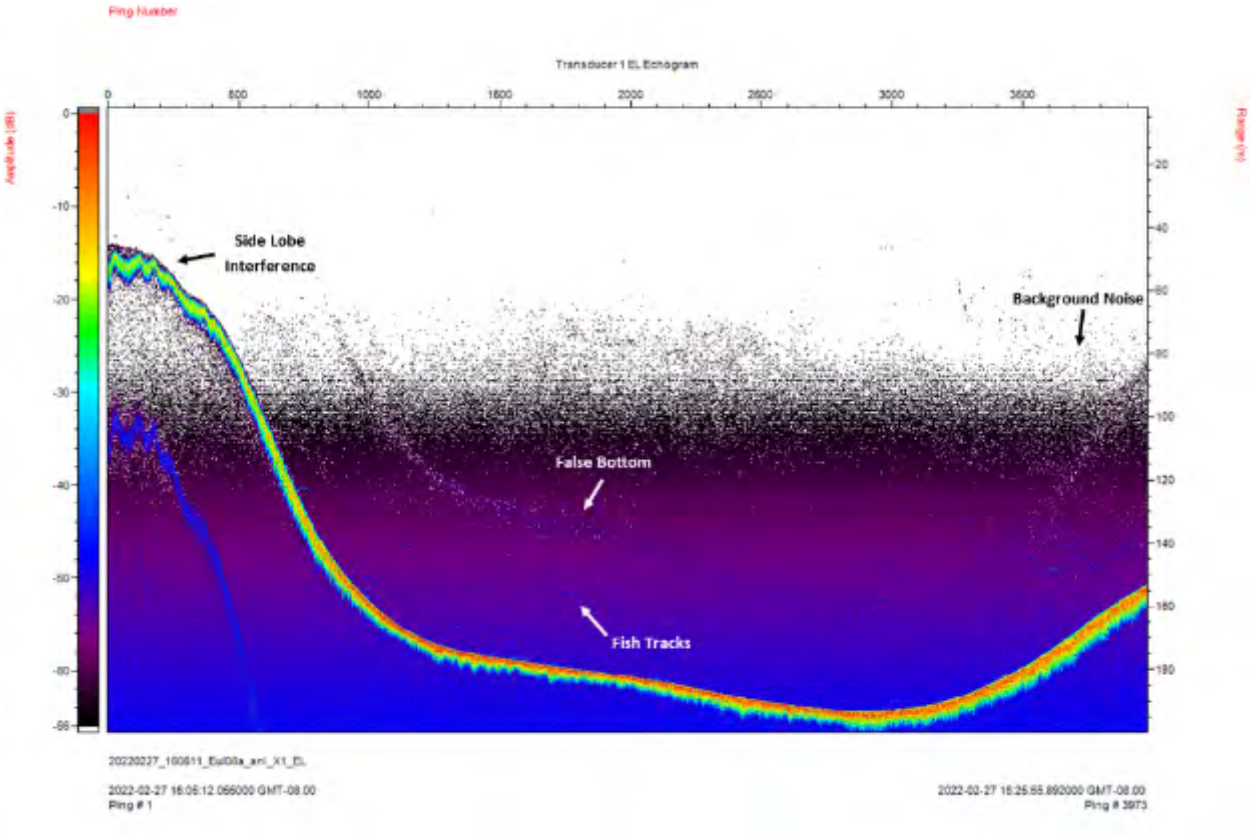


Figure 4.3–14 Transect Eul08a Echogram Recorded on February 27, 2022 near Observatory Inlet

With the exception of Transect Eul12b, the analyzed eulachon transects all had similar fish densities with a difference of 0.140 fish per 100 m^3 between the highest and lowest transect fish densities (Table 4.3–26). Transect Eul03 showed one small fish shoal approximately 5 m tall starting at approximately 63 m depth (Figure 4.3–15). Transect Eul08b had approximately 1 small aggregation of echoes appearing to be fish, from approximately 8 m deep to near bottom at 45 m (Figure 4.3–12). Transect Eul10a showed some areas of targets that may again be escaping gases, while also showing clear fish tracks and a few small shoals approaching 7 m tall below the background noise boundary (Figure 4.3–16). Transect Eul12a (Figure 4.3–17) showed a potential shoal up to approximately 5.5 m high along the seafloor; however, it was difficult to decipher between bottom features and potential fish echoes in this region, and therefore the echoes were conservatively included below the modified bottom line and not included in the fish density analysis. The long narrow shoal shape of the potential fish shoal is characteristic of Pacific hake (Alverson and Larkins 1969) and walleye pollock (Kang et al. 2006), both demersal species that could be present in the area. Transect Eul12a also showed a few sparser aggregations of targets starting at approximately 60 m depth (Figure 4.3–17), which did contribute to the fish density value. Considering the nearby larger aggregation of echoes along the seafloor could denote a school of Pacific hake or walleye pollock, it follows that the nearby more diffuse aggregations could also

belong to those species. Young of the year Pacific hake and walleye pollock both have TS ranges within the expected eulachon range and if present, would result in an over-estimate of eulachon within that TS range (Mudge et al. 2022).

The data collected represent a snapshot of fish presence in the survey area. Additional surveys would be required to inform a conclusion about eulachon presence and staging in the Project Area and through the Nass Estuary.

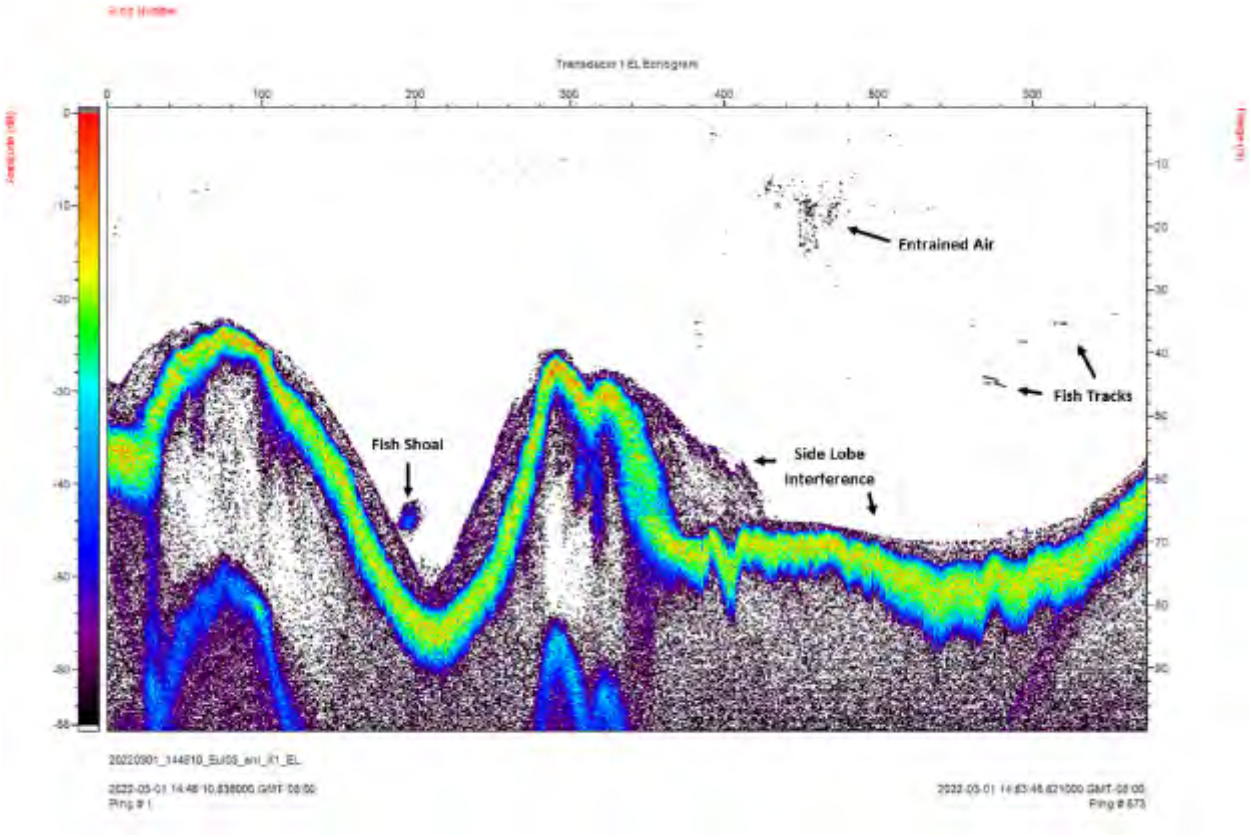


Figure 4.3–15 Transect Eul03 Echogram Recorded on March 1, 2022 near Ramsey Point

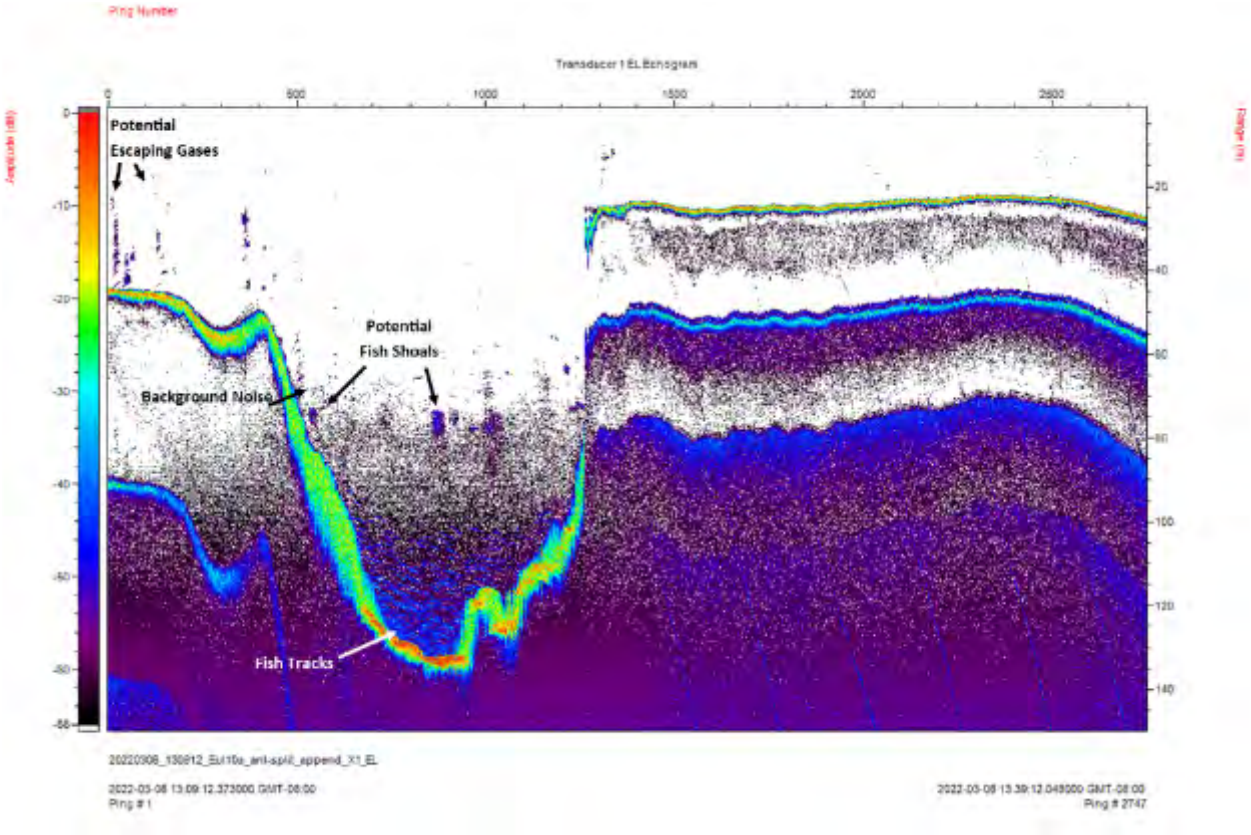


Figure 4.3–16 Transect Eul10a Echogram Recorded on March 6, 2022 in Nass Bay

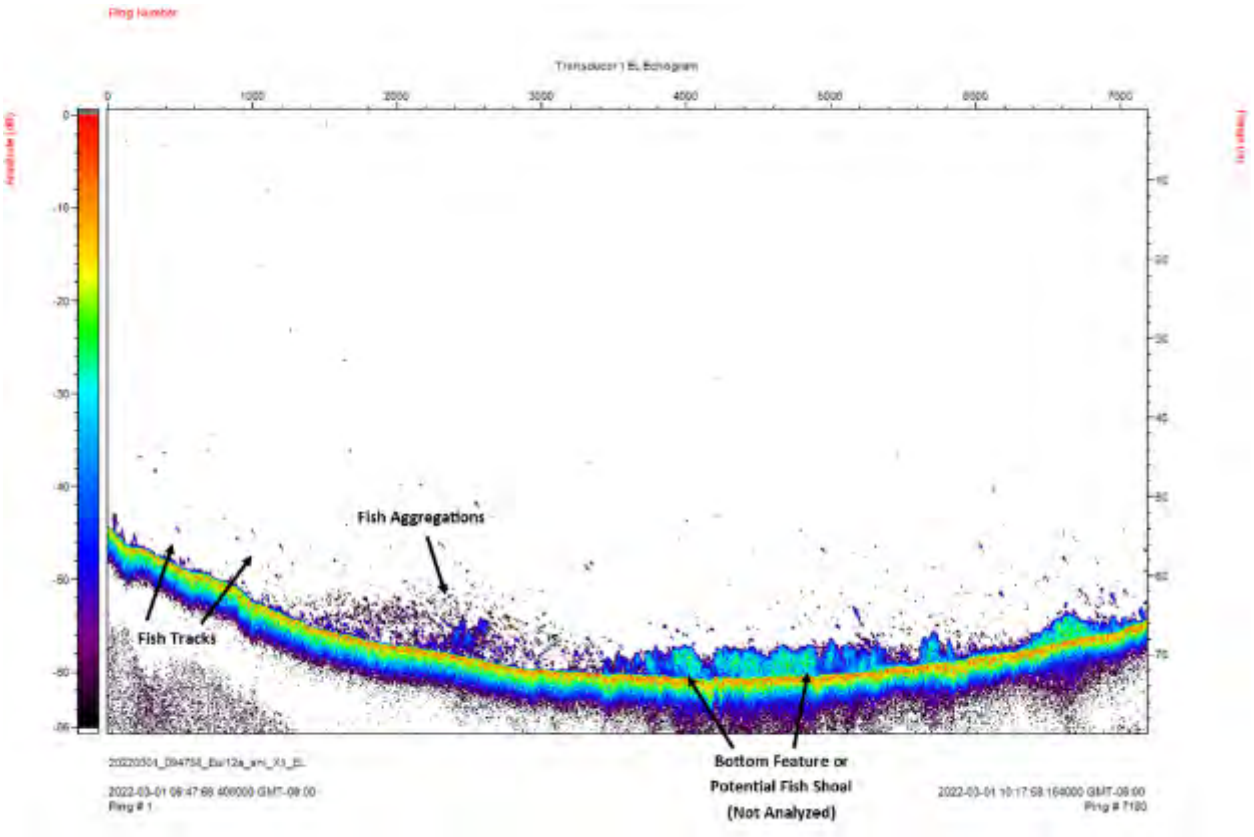


Figure 4.3–17 Transect Eul12a Echogram Recorded on March 1, 2022 in Iceberg Bay

4.3.3.4 Summary

Beach seine and trawl surveys were conducted to determine the fish taxa presence, taxa abundance, and distribution in the Marine Fish Survey Area. Results are presented for the three survey subareas of east Pearse Island, Whiskey Bay, and west Pearse Island and over four seasons (June, September, November, March) (Appendix F.1–Appendix F.4).

Juvenile salmonids were observed during March and June surveys at all three survey areas. The highest abundance of juvenile salmonids was observed during the summer (June) survey at west Pearse Island, which likely coincided with the juvenile salmon migration from the Nass River. Highest abundance of juvenile salmonids, comparative to Whiskey Bay and west Pearse Island, was also reported at east Pearse Island during the surface trawl undertaken in June. No adult salmonids were captured during the marine fish surveys; however, adult salmon were incidentally observed leaping out of the water consistently during the June survey.

Groundfish were also observed in the three survey areas. West Pearse Island reported high numbers of groundfish in June, with the highest abundance encountered in Whiskey Bay during the September survey. No groundfish were observed at east Pearse Island during the November or March surveys.

Other forage fish such as Pacific herring and Pacific sand lance were also observed in the three survey areas. The highest abundance of forage fish was observed at west Pearse Island during the June survey. No forage fish were observed during the March or November surveys at west Pearse Island or during any season at east Pearse Island. Forage fish were observed at east Pearse Island during the November survey. Smaller numbers of Pacific sand lance were also reported during seining efforts in June.

Hydroacoustic surveys conducted included seasonal surveys, paired trawl surveys, and an eulachon-specific survey. East Pearse Island had the highest biomass across all seasonal surveys, while Whiskey Bay had the lowest biomass. No general biomass trend was observed across seasons, though east Pearse Island had the highest biomass in February and the lowest in June. Whiskey Bay and west Pearse Island both had their highest biomass in November and lowest in February; however, these are based on one transect for each of these surveys.

Across all seasons and survey subareas, averaged fish biomass peaked in the surface layer (top 20 m) at east Pearse Island in June and February. East Pearse Island also had the lowest averaged fish biomass of all seasons and survey subareas, which occurred in June within the demersal layer (bottom 10 m). June surveys showed a decrease in fish biomass with increased depth across east and west Pearse Island, while the November survey showed the opposite trend across all survey subareas.

Transect T06 on east Pearse Island had the highest fish per 100 m^3 value of the paired trawl transects. The dominant species observed on the hydroacoustic echograms was likely to be juvenile Pacific sand lance, though juvenile salmonids likely contributed as well. Whiskey Bay transect WB01 had a fish per 100 m^3 value of zero, which was supported by the paired surface trawl catch of one salmonid, which may have been caught above depth of the transducer.

Eulachon survey echograms showed fish aggregations and tracks along east Pearse Island, near Ramsey Point, west of the entrance to Iceberg Bay along the shore, across the channel west of Gingolx, and along the shore opposite of Gingolx. Presence of fish shoals, aggregations and tracks correlated with depth more than with any geographical trend. Larger groups of loosely spaced fish that may have been eulachon were associated with deeper waters (over 200 m deep) whereas smaller, denser groups of fish were associated with shallower depths (less than 100 m deep). None of the echograms showed conclusive evidence of eulachon staging; however, small shoals of fish were observed near the seafloor which may have included eulachon. Additional surveys would be required to inform a conclusion about eulachon presence and staging within and near the Project Area.

4.4 WATER QUALITY SURVEY

4.4.1 Introduction

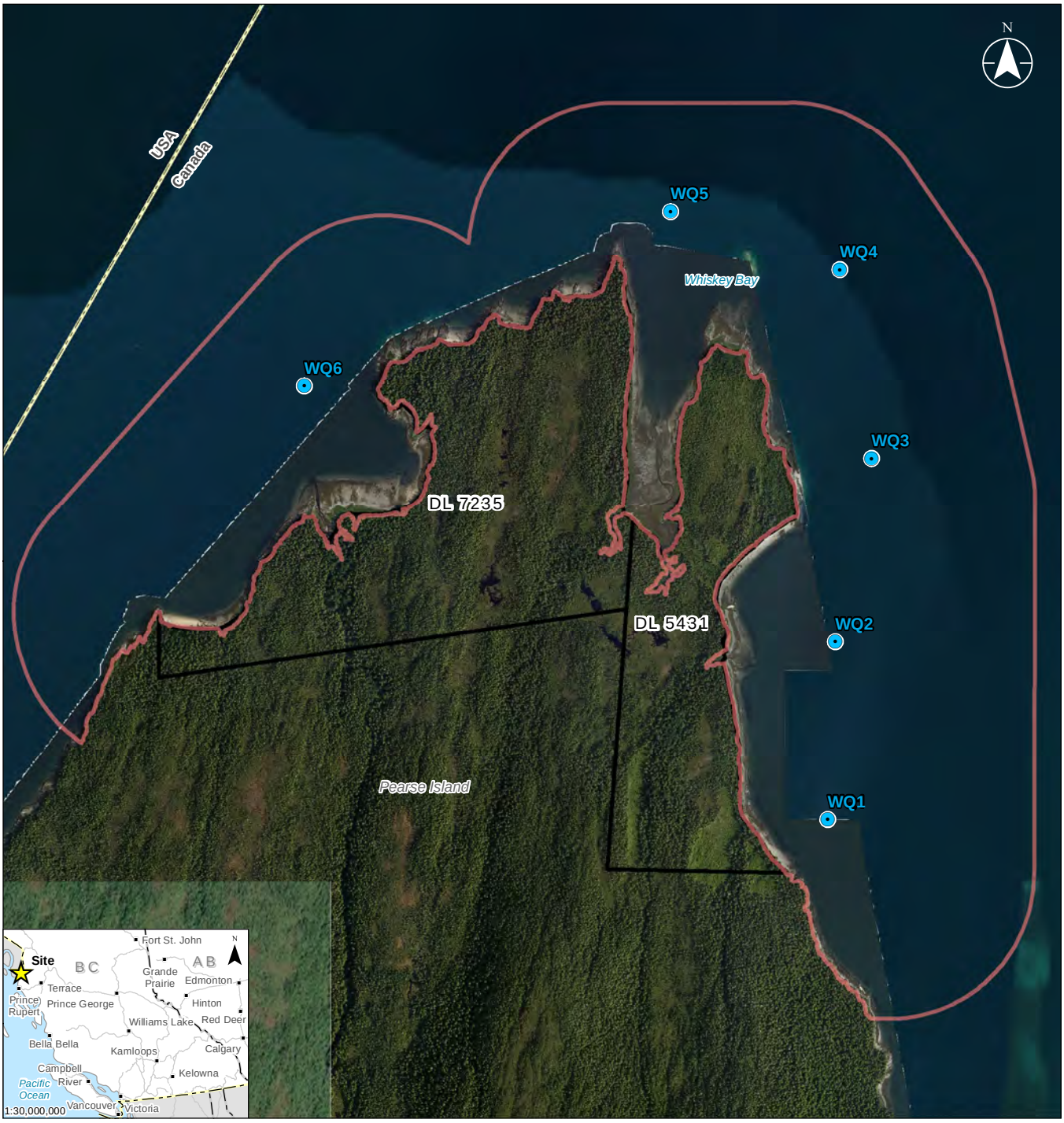
A marine water quality sampling program was conducted to collect information on physical and chemical parameters. Sample collection occurred across four seasons to capture seasonal variations in water quality throughout the year and to characterize the overall conditions within the Marine Resources Study Area.

4.4.2 Methods

Six water quality sampling locations were selected and distributed within and adjacent to the in-water footprint of the marine terminal (Table 4.4–1; Figure 4.4–1). Sampling occurred in June, September, and November 2021 and March 2022, and consisted of both real-time, in situ measurements of physical parameters such as temperature and salinity (June, September, November, and March) and water collection for laboratory analysis of physical and chemical parameters (June and November).

Table 4.4–1 Water Quality Sampling Locations

Site ID	Subarea	UTM Zone 9		Sample Collection Type	
		Easting	Northing	In Situ	Chemical Analysis
WQ 1	East Pearse Island	424715	6097216	X	X
WQ 2	East Pearse Island	424740	6097829	X	-
WQ 3	East Pearse Island	424866	6098461	X	X
WQ 4	East Pearse Island	424756	6099111	X	-
WQ 5	Whiskey Bay	424173	6099312	X	X
WQ 6	West Pearse Island	422911	6098711	X	X



KSI LISIMS LNG

Water Quality Sampling Location

Boundaries of District Lots 7235 and 5431

Marine Water Quality Survey Area

0 150 300 450 600 750 m

1:20,500 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Stantec

Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20220611
Requested by CMCCRACKEN on 20220601
Check by SMOSS on 20220613

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.4-1

Title
Water Quality Sampling Locations

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4.4.2.1 In Situ Water Quality Profiles

In situ water quality profiles were collected at the six water quality locations using a YSI EXO2 sonde lowered to 1 m above the seafloor and retrieved at a rate of approximately 1 m/s while continuously logging data. Profiles were collected on June 7, September 6, and November 9–10, 2021 and March 4, 2022. Parameters measured included conductivity, temperature, depth, salinity, DO, turbidity, chlorophyll, and pH.

4.4.2.2 Water Sample Collection

Water samples were collected at four sampling locations in June and November 2021 using a line-mounted water sampling device (Van Dorn). WQ1, WQ3, and WQ5 were distributed along the eastern side of Pearse Island and WQ6 was on the western side of Pearse Island. During each sampling event, water was collected from two depths (1 m below the surface and mid-water column) and at two tidal states (ebb and flood tides) resulting in a total of 16 samples per sampling event (n=32 total). Mid-water column samples were taken below the pycnocline where one was identified.

Water samples were sent to ALS Environmental, a Canadian Association for Laboratory Accreditation-certified laboratory for analysis of total and dissolved metals, anions, nutrients, PAHs, and petroleum hydrocarbons. Results of laboratory analysis were compared BC and Canadian Council of Ministers of the Environment (**CCME**) Water Quality Guidelines for the protection of Marine Aquatic Life (**WQG-MAL**).

4.4.3 Results

4.4.3.1 In Situ Water Quality

Depth profiles resulting from CTD casts and raw CTD data are presented in Appendix G.1 and G.2. Results are presented below, combined for the three subareas because no consistent differences were observed among sites on east Pearse Island, Whiskey Bay, and west Pearse Island. Minimum and maximum values for temperature, salinity, conductivity, pH, DO, turbidity, and chlorophyll-a are presented in Table 4.4–2.

Table 4.4–2 Minimum and Maximum Values from Seasonal In Situ Water Quality Profiles

Month	Temperature (°C)		Salinity (ppt)		pH		Dissolved Oxygen (mg/L)		Turbidity (NTU)		Chlorophyll-a (RFU)	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
June	6.7	11.4	8.93	32.2	7.65	8.38	**5.21**	10.85	0.18	8.54	0.0	5.0
September[1]	6.7	11.7	16.5	32.4	–	–	**3.92**	9.23	–	–	0.0	1.6
November	8.3	9.9	29.2	31.7	7.70	8.07	**6.07**	8.15	0.02	1.91	0.0	0.3
March[2]	4.9	6.5	27.7	31.2	7.80	8.11	**7.04**	9.48	0.24	0.65	–	–

NOTES:
Bold text indicates exceedance of CCME water quality guidelines.
[1] pH and turbidity measurements were not collected in September due to a probe malfunction.
[2] Chlorophyll-a measurements were not collected in March due to a probe malfunction.

Water quality parameters varied with depth and season in the Marine Resources Study Area (Appendix G.1 and G.2):

- Temperature was highest at the surface and decreased with depth, and a clear thermocline was visible in June and September. In November and March, temperature varied little with depth and was higher in November (8.3 to 9.8 °C) than in March (4.9 to 6.5°C)
- Salinity was lowest at the surface and increased with depth in June and September, when a distinct halocline was present. In November and March, salinity was relatively constant throughout the water column
- Measurements of pH were relatively consistent with depth and season and were within the BC and CCME WQG-MAL of 7.0 to 8.7
- Dissolved oxygen decreased with depth and this trend was most pronounced in June and September. Minimum DO values were below the CCME recommended minimum concentration of DO in marine and estuarine waters (8.0 mg/L) at depth and were above 8.0 mg/L at the surface
- Turbidity was relatively consistent with depth and was low at all sites. In June, turbidity was higher at the surface and decreased with depth, potentially due to an influx of fresh, turbid water during freshet
- Chlorophyll-a concentrations were higher at the surface than at depth, and this trend was most pronounced in June. The top 10 m of the water column in June had higher concentrations of chlorophyll a, likely due to phytoplankton blooms during the spring season

4.4.3.2 Analytical Results

Physical Parameters

Physical parameters measured during the June and November sampling periods included hardness ($CaCO_3$), pH, total dissolved solids (**TDS**), total suspended solids (**TSS**), and turbidity (NTU).

Hardness ranged from 1,770 to 4,990 mg/L in June and was generally higher at greater depths, during both ebb and flood tides. In November, hardness ranged from 5,290 to 5,670 mg/L; less variation at greater depths was observed compared to June sampling.

The pH ranged from 7.84 to 7.99 in June and from 7.72 to 7.78 in November. June and November sampling results for pH were within the BC and CCME WQG-MAL of 7.0–8.7.

The TDS ranged from 9,680 to 34,400 mg/L in June, and was higher at greater depths, at both ebb and flood tides. In November, TDS ranged from 22,220 mg/L to 33,900 mg/L.

The TSS ranged from <2.0 mg/L (below the detection limit [**DL**]) to 13.3 mg/L in June and from <2.0 mg/L to 9.9 mg/L in November. TSS was higher at the surface than in deep water in June, and the reverse in November.

Turbidity ranged from 0.38 NTU to 16.5 NTU in June, and at WQ1 and WQ2 values were elevated at 1 m flood tides. In November, values were lower than in June and ranged below the DL of <0.10 to 0.21 NTU. Turbidity tended to be higher at the surface than in deep water in June and was similar at the two depths in November.

Complete laboratory results can be found in Appendix G.3 and G.4.

Anions, Nutrients, and Carbon

Eight anions and nutrients were analyzed. Of the eight, ammonia and nitrate (as N) have BC and CCME WQG-MAL. BC and CCME guidelines for ammonia are salinity, temperature, and pH dependent. Nitrate and nitrite (as N) were below the DLs (0.5 and 0.1 mg/L, respectively) at the four sampling sites during June and November. Ammonia (as N) ranged from below the DL (0.005 mg/L) to 0.0379 mg/L in June (higher in deep than surface water) and was below the DL in November (the four sites, both depths and tidal conditions).

Total phosphorus ranged from 0.0106 to 0.0531 mg/L in June (higher in deep than surface water) and from 0.0560 to 0.0863 mg/L in November (no consistent trend with depth).

Total organic carbon (**TOC**) ranged from 0.84 to 2.44 mg/L in June (higher at surface than deep water) and from 0.73 to 2.02 mg/L in November (no consistent trend with depth).

See Appendix G.3 and G.4 for laboratory results.

Total and Dissolved Metals

Of the 43 metals analyzed, 15 had total and dissolved concentrations below their DLs at the four sampling sites during June and November sampling periods, and at both depths and at both tidal conditions (antimony, beryllium, bismuth, cesium, gallium, mercury, rhenium, selenium, silver, tellurium, thorium, tin, tungsten, yttrium, zirconium).

Parameters with either or both BC or CCME WQG-MAL for total concentrations are arsenic, boron, cadmium, chromium, copper, lead, selenium, zinc, and silver. The parameters total antimony, beryllium, manganese, nickel, and vanadium have working BC WQG-MAL These parameters, except for boron, had concentrations below guidelines or DLs in each of the samples. Total cadmium concentrations were higher in samples collected at greater depths, regardless of tidal condition.

Results for metals that have BC and/or CCME WQG-MAL were as follows:

- Total antimony was below the DL of <0.0010 mg/L in all samples collected in June and November; concentrations were below the long-term BC WQG-MAL of 0.27 mg/L
- Total arsenic ranged from 0.0008 to 0.00172 mg/L in June and 0.00154 and 0.00173 mg/L in November. Maximum values were nearly an order of magnitude lower than the long-term BC and CCME guidelines of 0.0125 mg/L
- Total boron ranged from 1.26 to 4.05 mg/L in June and 3.87 to 4.29 mg/L in November. Concentrations exceeded the long-term BC WQG-MAL of 1.2 mg/L in the samples at flood and ebb tide and was generally higher in deep water samples than surface samples. This was true for both June and November sampling events. Concentrations of boron in seawater are naturally high (4.5 mg/L; Moss and Nagpal 1981)
- Total cadmium ranged from 0.000035 to 0.000069 mg/L in June and 0.000056 to 0.000070 mg/L in November and was below the BC and CCME WQG-MAL of 0.00012 mg/L in each of the samples collected
- Total chromium ranged from < DL (0.0005 mg/) to 0.00165 mg/L in June and was below the DL in November; concentrations were below the long-term BC and CCME WQG-MAL for chromium III (0.056 mg/L) and one concentration was just above the WQG-MAL for chromium VI (0.0015 mg/)
- Total copper was below the DL of 0.00050 mg/L in 21 of the 32 samples collected in June and November samples, with a maximum concentration of 0.0181 mg/L; concentrations were below the long-term and short-term BC WQG-MAL of 0.002 and 0.003 mg/L respectively
- Total manganese ranged from 0.00357 to 0.0376 mg/L in June and 0.00375 to 0.00452 mg/L in November; concentrations were below the long-term BC WQG-MAL of 0.10 mg/L
- Total nickel ranged from < DL (0.00050 mg/L) to 0.00225 mg/L in June and below the DL for all samples in November; concentrations were below the long-term BC WQG-MAL of 0.0083 mg/L

- Total lead ranged from less than the DL (0.00005 mg/L) to 0.000282 mg/L in June and was below the DL in November; concentrations were below the long-term and short-term BC WQG-MAL of 0.002 and 0.14 mg/L respectively
- Total selenium concentrations were below the DL (0.0005 mg) in the 32 samples analyzed and were below the long-term BC WQG-MAL of 0.002 mg/L
- Total silver concentrations were below the DL (0.00001 mg) in the 32 samples analyzed and were below the long-term and short-term BC WQG-MAL of 0.0015 mg/L and 0.003 mg/L, respectively
- Total zinc was below the DL of 0.0030 mg/L in 30 of the 32 samples collected, with a maximum value of 0.0060 mg/L in June. Concentrations were below the long-term and short-term BC WQG-MAL of 0.010 mg/L and 0.055 mg/L, respectively

Volatile Organic Compounds

Six volatile organic compounds (**VOC**s) were analyzed at the four sampling locations during June and November sampling periods. These were benzene, ethylbenzene, toluene, xylene (collectively referred to as BTEX), styrene, and methyl-tert-butyl ether. Each of the VOCs were below DLs and below BC and CCME WQG-MAL.

Hydrocarbons

Polycyclic aromatic hydrocarbons and petroleum hydrocarbons were analyzed in samples collected at each of the four site locations. Measured concentrations of short- and long-chain petroleum hydrocarbons and PAHs were below DLs with one exception (methylnaphthalens, 2+1 just above the DL in one sample). Naphthalene was below the long-term CCME WQG-MAL of 1.4 µg/L in all 32 samples analyzed. Acenaphthene, benzo(a)pyrene, chrysene, fluorene, and naphthalene were all below BC WQG-MAL for all 32 samples analyzed.

Quality Assurance and Quality Control

A duplicate sample and field blank were collected and analyzed with the water samples. For the duplicate and parent sample, relative percent differences (**RPD**) were calculated for parameters with greater than five times the detection limit and compared to the data quality objective of less than 20% (BC ENV 2021). The RPD calculations for the duplicates are provided in Appendix G.3. During the June sampling period there were 18 instances, out of a total number of 142 duplicates calculated, where the RPD exceeded 20%. In November, there were 4 instances from a total number of 142 duplicates calculated where the RPD exceeded 20%.

In June, there were some instances where samples were analyzed past the recommended hold time, which was a result of shipping and transport delays. These included the following analytes: nitrate, pH, and turbidity, for both ebb and flood tides at all WQ sampling stations. In November, pH taken at all sites was analyzed past the recommended hold time of 0.25 hours. Turbidity and pH measurements were taken in situ, as these analytes have shorter hold times and require in-field measurements. The lab indicated that for samples identified above as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

There were no recorded instances where the laboratory method blank exceeded the ALS Environmental data quality objectives in June, and one instance in November. The one exceedance was for total tellurium, in which the data quality objective was marginally exceeded. The lab indicated that this sample should still be considered reliable.

4.5 SEDIMENT QUALITY SURVEY

4.5.1 Introduction

The objective of the sediment quality survey was to collect baseline physical and chemical data on sediment quality along the eastern side of Pearse Island in the Marine Resources Study Area. Data were collected for particle size, TOC, total metals, PAHs, and BTEX.

4.5.2 Methods

Sediment quality sampling occurred at east Pearse Island in the Marine Resources Study Area on May 19–20, 2022. A total of 15 locations were sampled, targeting areas along east Pearse Island where proposed Project infrastructure will be constructed. Due to the coarse and rocky substrate, particularly the stations in the north portion of east Pearse Island, several sampling locations had to be moved until suitable soft sediments were located (Table 4.5–1; Figure 4.5–1).

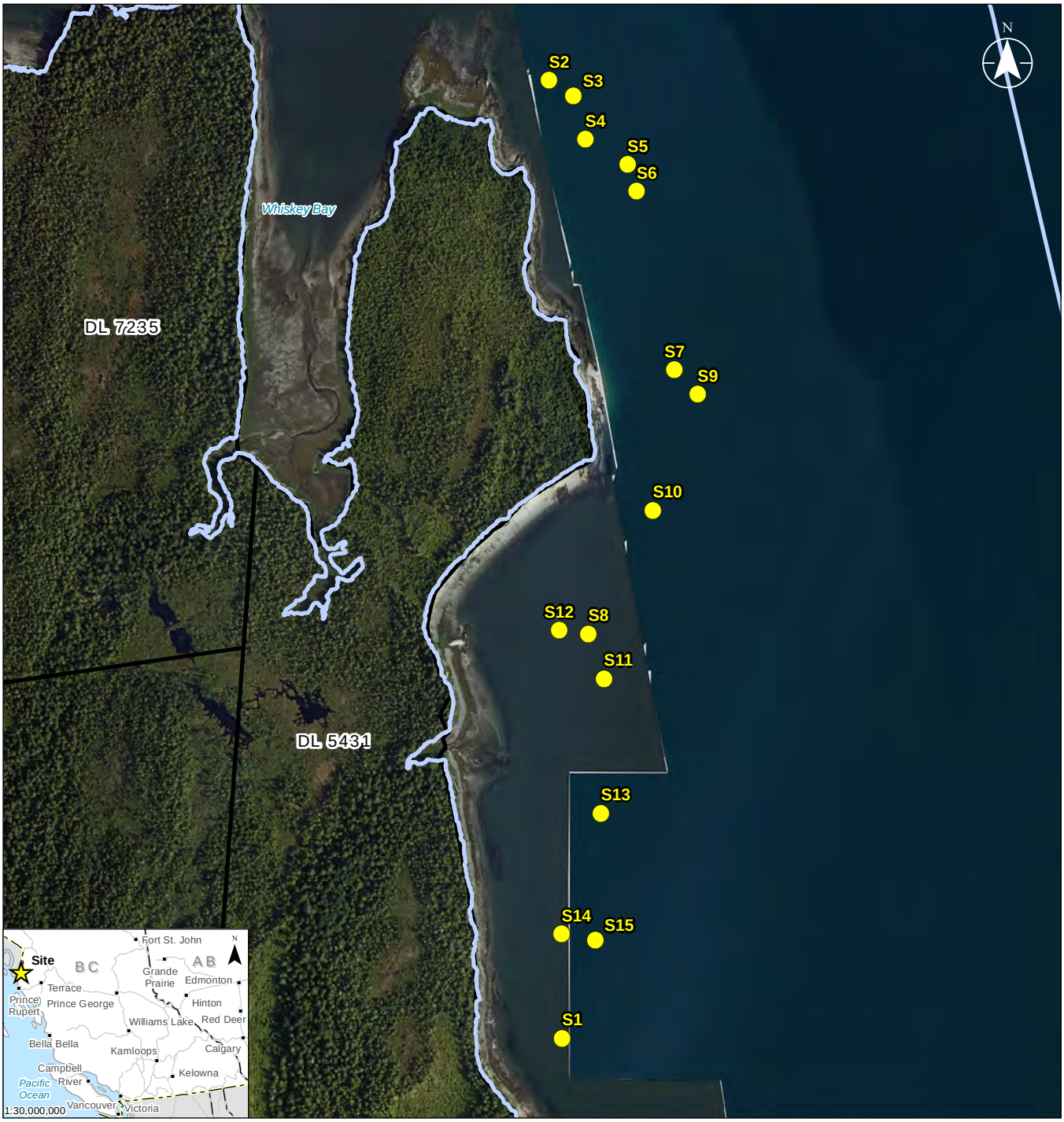
Table 4.5–1 East Pearse Island Sediment Sampling Locations

Location ID	UTM Coordinates (Zone 9U)		Approximate Depth (m)
	Easting	Northing	
PEI-SED-01	424555	6097285	36
PEI-SED-02	424533	6098896	31
PEI-SED-03[1]	424574	6098870	28
PEI-SED-04	424594	6098797	24
PEI-SED-05	424665	6098754	36
PEI-SED-06	424680	6098710	41
PEI-SED-07[1]	424744	6098409	39
PEI-SED-08[1]	424599	6097965	32
PEI-SED-09	424783	6098368	67
PEI-SED-10	424707	6098173	54
PEI-SED-11	424625	6097890	58
PEI-SED-12	424550	6097971	22
PEI-SED-13	424620	6097664	34
PEI-SED-14[1]	424554	6097460	30
PEI-SED-15	424611	6097450	48

NOTE:

[1] Sediment samples were comprised of only two replicates. Incomplete triplicate replicates were a result of change in tidal conditions and current dragging the grab sampler past the sampling station, and/or minimal suitable sediment present at the sampling station despite repeated attempts in different locations (e.g., bedrock/boulder substrate, or grab comprised of only cobble, shells, or invertebrates.

1
2



Sediment Sampling Location

Boundaries of District Lots 7235 and 5431

Marine Sediment Survey Area

0 75 150 225 300 375 m

1:10,000 (at original document size of 8.5x11)

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Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Project Location: Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20220611
Requested by CMCCRACKEN on 20220601
Check by SMOSS on 20220613

Client/Project/Report

Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.

4.5-1

Title

Sediment Sampling Locations

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4.5.2.1 Sample Collection

Sediment sampling followed standards in the *BC Field Sampling Manual* (BC ENV 2020), *Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators* (BC Ministry of Environment 2016) and *Marine Monitoring Guidance* (BC ENV 2019).

Prior to use, the equipment in contact with sediment (i.e., grab sampler, tubs, spoons) was cleaned with Alconox® and then rinsed with marine water to reduce the likelihood of cross-contamination between locations. Sediment samples were collected using a stainless-steel standard Ponar (0.052 m^2 sampling area). At each location, three grabs were collected to create a composite sample consisting of the topfive cm of sediment[1] (Photo 1). The contents of each grab were inspected to confirm adequate substrate was present. Sampler success rate and contents were recorded on the field data sheets. Sediment from each replicate was homogenized using a stainless-steel spoon and transferred into labelled sediment collection containers provided by the laboratory (i.e., object bag or glass sediment jar). The sediment containers were then closed tight, and the excess sediment washed off the outside of the container. Samples were stored on ice packs in a cooler and then transferred to a refrigerator at the end of day.

Physical description of the sediment grab sample, such as colour, odour, particle size, texture and biological content, and depth of sediment sample were recorded on the field data sheet. Photographs of each grab sample were taken to provide visual documentation; example photos are included below (Photo 2, Photo 3, and Photo 4). Other supporting measures, such as water depth, weather conditions, and final location UTM coordinates were also recorded at each location.

[1] Station 3, 7, 8, and 14 were comprised of only two grabs. This was a result from a change in tidal condition, which caused the ponar grab sampler to drag past the station and/or minimal suitable sediment present at the sampling station despite repeated sample attempts in different locations (e.g., bedrock/boulder substrate, or grab comprised of only cobble, shells, or invertebrates).

Photo 1 **Failed grab attempt at Location 8, several invertebrates and cobble collected**

Photo 2 **Grab replicate sample from Location 6, lots of small shells and shell pieces present in grab**

Photo 3 **Grab replicate sample from Location 2, cobble and shells present**

Photo 4 **Composite sample from Location 14 consisting of fine substrates (sand, silt, clay)**

1
2

4.5.2.2 Laboratory Analysis

Sediment samples were sent to ALS Environmental (ALS; Burnaby, BC), a Canadian Association for Laboratory Accreditation Inc.-accredited analytical laboratory. Sediment samples were analyzed for the following parameters:

- Particle size
- Conventional parameters (i.e., laboratory-measured pH, moisture content, and TOC)
- Total metals (i.e., aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, lithium, magnesium, manganese, mercury, molybdenum, nickel, phosphorus, potassium, selenium, silver, sodium, strontium, thallium, tin, titanium, tungsten, uranium, vanadium, zinc, and zirconium)
- PAHs, index of additive cancer risk, and benzo(a)pyrene

The ALS laboratory report is provided in Appendix H. Results of laboratory analysis were compared to Sediment Quality Guidelines for the Protection of Marine Aquatic Life (BC ENV 2022).

4.5.2.3 Quality Assurance and Quality Control

Quality assurance and quality control (**QA/QC**) were applied to the field sampling, laboratory analyses, data analysis, and report preparation. Specific work instructions outlining field sampling protocols, equipment, and sample shipment were provided to the field personnel. To avoid cross-contamination, experienced field personnel collected samples with nitrile gloves and the sediment equipment (i.e., grab sampler, tubs, spoons) was cleaned with Alconox® and then rinsed with marine water. Detailed field notes were recorded in waterproof field books and on preprinted waterproof field data sheets in pencil. Data sheets and sample labels were checked at the end of each field day for completeness and accuracy and were scanned into electronic copies at the completion of the field program. Samples were labelled, preserved, and shipped according to standard protocols. Chain-of-custody forms were used to track shipment and receipt of samples. In addition, three duplicate sediment samples were collected, accounting for 10% of the total number of samples submitted to the laboratory for analysis. The RPD were calculated for samples and their field duplicate. Parameter concentrations in the duplicate sample differed by less than 35%, and therefore the results met data quality objectives.

Sediment samples were subject to industry standard QC analyses (i.e., method blanks, laboratory control samples, spiked samples using certified reference materials, and laboratory duplicates) to assess precision and accuracy of analytical methods. The QC report of the laboratory certificate of analysis was reviewed upon receipt to confirm that the appropriate QA/QC information had been reported and that the laboratory data quality objectives had been met. The QC analyses met the laboratory DQOs (Appendix H).

4.5.3 Results

4.5.3.1 Physical Parameters

Physical parameters measured were moisture content and pH. Moisture content ranged from 27.2% (PEI-SED-10) to 41.5% (PEI-SED-09). Sediment pH was measured by diluting the sediment in water at a 1:2 ratio (soil: water). Sample pH ranged between 8.11 (PEI-SED-13 and 15) and 8.35 (PEI-SED-8 and 10).

4.5.3.2 Particle Size

Grain size analysis was reported as percent gravel (grain size > 2 mm), sand (five sub-categories based on particle size with an overall grain size range from 0.063–2 mm), silt (two sub-categories based on particle size with an overall grain size range from 0.004–0.063 mm), and clay (grain size < 0.004 mm). Overall, the largest sediment component across sampling sites was sand with a grain size range of 0.125 to 0.25 mm. Clay (with a grain size of < 0.004 mm) was the second most common constituent in the overall sediment composition of samples. Silt (with a grain size range of 0.0312–0.063 mm) was the least commonly found sediment size in the overall sample set.

The grain size composition of the sediment sampled at each site was highly variable, and individual site grain size proportions can be found in Appendix H.

4.5.3.3 Total Organic Carbon

The TOC concentrations in the samples ranged from the DL (0.67%) to 1.09%.

4.5.3.4 Metals

The BC government has established Working Sediment Quality Guidelines (**WSQG**) for 9 of the 35 metals analyzed. Concentrations between the lower and upper WSQG are occasionally associated with biological effects and concentrations exceeding the upper WSQG are frequently associated with adverse biological effects (BC ENV 2021). These nine metals with WSQG are arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc. Of these, arsenic and copper concentrations fell between the lower and upper limits of the WSQG and nickel concentrations were higher than the upper limit in one or more samples:

- Arsenic concentrations were higher than the lower limit (7.24 mg/kg) and below the upper limit (42.0 mg/kg) in four samples (PEI-SED-11, 13, 14 and 15; 8.23 to 10.5 mg/kg)
- Copper concentrations were higher than the lower limit (18.7 mg/kg) and below the upper limit (108 mg/kg) in 9 samples (PEI-SED-03, 06, 09, 10, 11, 12, 13, 14, 15; 20.4 mg/kg to 31.8 mg/kg
- Nickel concentrations were higher than the lower WSQG (30 mg/kg) in seven samples (PEI-SED-03, 05, 06, 07, 10, 12, and 14; 32.1 mg/kg to 49.3 mg/kg) and the upper WSQG (50 mg/kg) in four samples (PEISED-09, 11, 13, and 15; 50.1 mg/kg to 60.6 mg/kg)

Elevated concentrations of arsenic, copper, and nickel are consistent with other marine sediment data collected in Nass Bay (Stantec 2014). Elevated concentrations of arsenic and copper have also been recorded in multiple sediment sampling programs in the Prince Rupert area (Stantec 2016). Furthermore, naturally elevated arsenic, copper, and nickel levels are documented for terrestrial soils in the Skeena region (e.g., BC MoE 2010). This consistency of elevated metal concentrations across a widespread area, plus the low levels of anthropogenic activity near the marine terminal location, indicate the elevated arsenic, copper, and nickel levels in sediment are not anthropogenic in origin.

The following metals were analyzed but have no recorded WSQG: aluminum, antimony, barium, beryllium, bismuth, boron, calcium, cobalt, iron, lithium, magnesium, manganese, molybdenum, phosphorus, potassium, selenium, sodium, strontium, sulfur, thallium, tin, titanium, tungsten, uranium, vanadium, and zirconium.

4.5.3.5 Volatile Organic Compounds

Six VOCs were analyzed in the samples benzene, ethylbenzene, toluene, xylene, methyl-tert-butyl ether, and styrene. Concentrations were below DLs in these samples.

4.5.3.6 Polycyclic Aromatic Hydrocarbons

Results were compared to the lower and upper limits for WSQG, which were available for 13 of the 22 PAHs analyzed (BC ENV 2021). The PAH concentrations were low (below the DL or below the lower WSQG) in the sediment samples. Total PAH concentrations (for the 22 PAHs) ranged from 0.01 mg/kg to 0.105 mg/kg.

One PAH (phenanthrene) had detectable levels in the 15 samples. Eleven samples had only this one PAH above DL, three samples had two PAHs above the DL, and one sample (PEI-SED-09) six PAHs above the DL.

Fifteen PAHs had concentrations below the DL: acenaphthylene, acridine, anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b+j+k)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-c,d)pyrene, 1-methylnaphthalene, and quinoline.

Four PAHs had concentrations just above the DL and below the lower WSQG in one or more samples:

- Benzo(b+j)fluoranthene in PEI-SED-09 had a concentration of 0.011 mg/L, below the lower WQSG of 2.3 mg/L
- Naphthalene in PEI-SED-09 had a concentration of 0.012 mg/L, below the lower WSQG of 0.0346 mg/L
- Phenanthrene in samples from the 15 sites sampled had concentrations ranging from 0.01 mg/L to 0.04 mg/L, lower than the lower WSQG of 0.0867 mg/L
- Pyrene in PEI-SED-09 had a concentration of 0.012 mg/kg, below the lower WSQG of 0.153 mg/kg

Detectable PAHs with no WSQG for comparison were 2-methylnaphalene (PEI-SED-9; 0.15 mg/kg) and acenaphthene (PEI-SED-03; 0.0056 mg/kg), in one sample each.

4.6 MARINE MAMMAL SURVEY

4.6.1 Introduction

Fourteen marine mammal line-transect surveys were conducted between July 2021 and October 2022 to collect a combination of qualitative and quantitative data on marine mammal presence near the marine terminal location as well as in Portland Inlet, Pearse Canal, Portland Canal, and into Chatham Sound (together forming the 'Marine Mammal Vessel Survey Area' and 'Marine Mammal Aerial Survey Area'). These surveys provide seasonal information on marine mammal occurrence in the Marine Mammal Vessel and Aerial Survey Areas to supplement existing data.

4.6.2 Methods

Vessel and aerial surveys were completed by Stantec's marine mammal observers (MMOs) using distance sampling methods. A team of two MMOs and two data recorders conducted the vessel surveys, whereas a team of two MMOs conducted aerial surveys. Environmental variables, including weather, wind, Beaufort sea state, visibility, and sun glare, were recorded at the beginning and end of each transect, when a marine mammal was sighted, and when conditions notably changed (Table 4.6–1; Table 4.6–2). MMOs used environmental variables to assign a qualitative level of sightability (i.e., how reliably an MMO would be able to detect a marine mammal under the given conditions; Table 4.6–3). The behaviour of marine mammals at the time of the sighting was also recorded (Table 4.6–3).

Table 4.6–1 Environmental Variables

Environmental Variable	Description
Weather	Clear, partly cloudy, overcast, fog, mist, light rain, moderate rain, heavy rain, or snow.
Wind	Wind direction and speed (in kts).
Beaufort sea state	0 to 12; these numbers rank sea state based on the Beaufort scale.
Visibility	1. Zero 2. <500 m (very low visibility) 3. 500 m–1,000 m (low visibility) 4. 1,000 m–2,500 m (moderate visibility) 5. 2,500 m–5,000 m (high visibility) 6. 5,000 m–10,000 m (very high visibility) 7. >10,000 m (excellent visibility)
Sun glare	None, weak, strong, or variable. If glare is identified, the clock face angle of the start and end of the glare within the field of view is recorded.
Sightability	Nil, poor, medium, high, or very high; this variable takes into account the visibility, weather, sea state and sun glare to determine how well the MMOs can spot marine mammals.

Table 4.6–2 Beaufort Wind Force Scale

Beaufort Wind Force (Bf)	Wind Speed (kts)	Descriptive Term	Effects Observed at Sea
0	less than 1	calm	Sea surface like a mirror, but not necessarily flat.
1	1–3	light air	Ripples with the appearance of scales are formed, but without foam crests.
2	4–6	light breeze	Small wavelets, still short but more pronounced. Crests do not break. When visibility is good, horizon line is always clear.
3	7–10	gentle breeze	Large wavelets. Crests begin to break. Foam has a glassy appearance. Perhaps scattered whitecaps.
4	11–16	moderate breeze	Small waves, becoming longer. Fairly frequent whitecaps.
5	17–21	fresh breeze	Moderate waves, taking a more pronounced long form. Many whitecaps are formed. Chance of some spray.
6	22–27	strong breeze	Large waves begin to form. The white foam crests are more extensive everywhere. Probably some spray.
7	28–33	near gale	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of the wind.
8	34–40	gale	Moderately high waves of greater length. Edges of crests begin to break into the spindrift. The foam is blown in well-marked streaks along the direction of the wind.
9	41–47	strong gale	High waves. Dense streaks of foam along the direction of the wind. Crests of waves begin to topple, tumble, and roll over. Spray may affect visibility.
10	48–55	storm	High waves with long overhanging crests. Dense white streaks of foam. Surface of the sea takes a white appearance. The tumbling of the sea becomes heavy and shock-like. Visibility affected.
11	56–63	violent storm	Exceptionally high waves. Sea completely covered with long white patches of foam. Visibility affected.
12	≥64	Hurricane force	Sea is completely white with driving spray; visibility seriously affected.
SOURCE: Environment Canada (2011)			

1

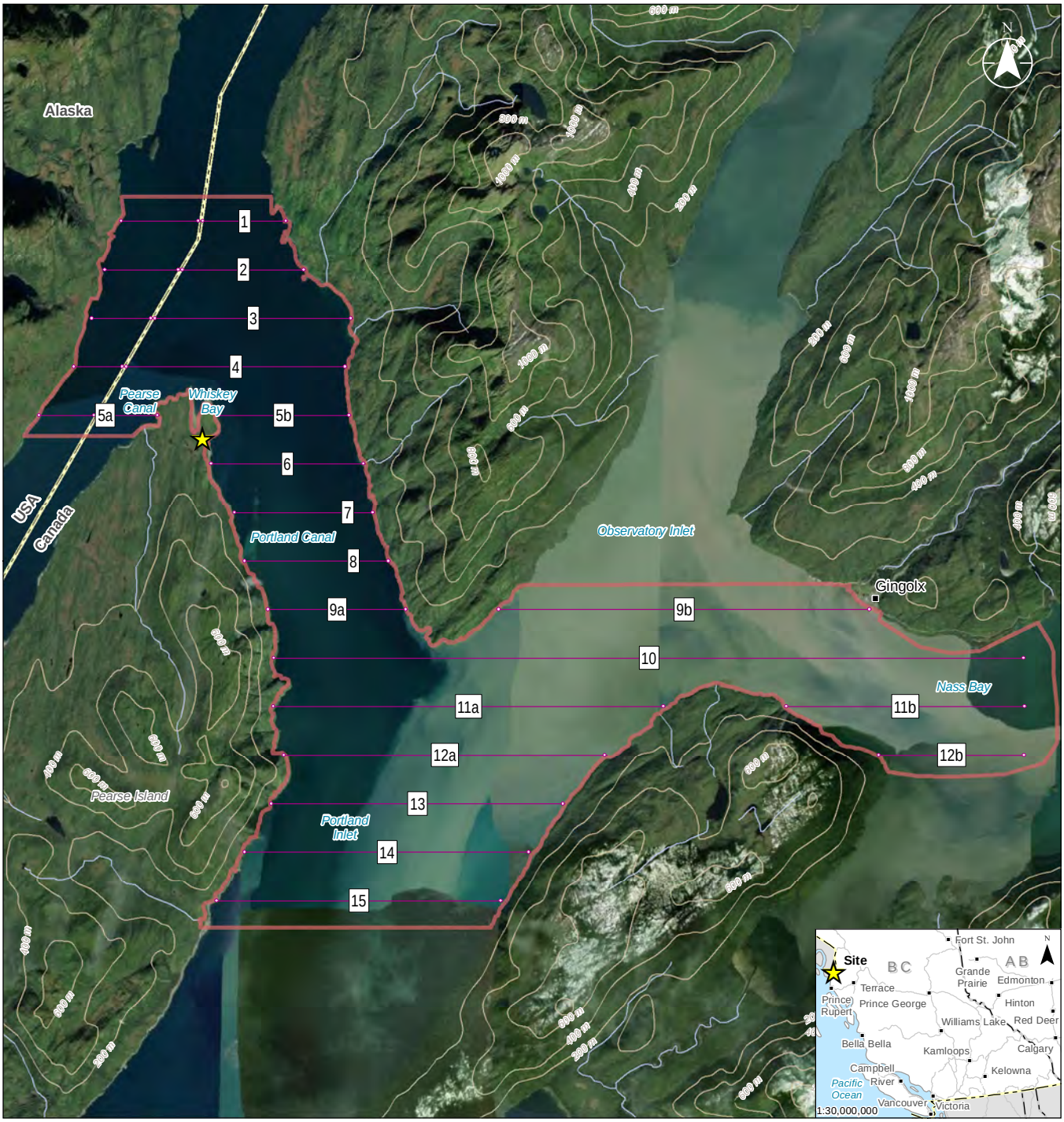
Table 4.6–3 Marine Mammal Behaviours

Behaviour	Description
Breach	Whale leaps out of the water and slams its body on the surface of the water.
Fin slap/Lobtailing	Marine mammal slaps its pectoral fin or fluke against the surface of the water.
Spyhop	Marine mammal raises its head vertically out of the water.
Resting	Marine mammal is at the surface of the water and not travelling.
Milling	Marine mammal swims in no particular direction in a limited area.
Looking	Marine mammal looks at the vessel with its head out of the water.
Rafting	Group of marine mammal are in a horizontal position at the surface of the water.
Porpoising	Marine mammal leaps near the surface of the water as it travels.
Bow Riding	Marine mammal swims in front of the bow of a vessel.
Wake Riding	Marine mammal swims in the wake created by a vessel.
Feeding	Marine mammal is feeding.

Three types of sightings were recorded during marine mammal surveys: on-effort, off-effort, and incidental. On-effort was used for sightings made while the vessel or floatplane was travelling on a planned transect, off-effort for sightings made while transiting between transects, and incidental for sightings made at any other time while on the boat or plane for marine mammal surveys (e.g., travelling to and from different parts of the survey areas or at the beginning or end of a survey day). Incidental marine mammal sightings were also recorded during other surveys conducted near the marine mammal survey areas (e.g., intertidal or marine fish surveys).

4.6.2.1 Vessel Surveys

Six vessel-based surveys were conducted between July 2021 and July 2022. One two-day survey was conducted in July, September, and November 2021 in March, May, and July 2022 (Figure 4.6–1). During each survey,15 transects were surveyed from the area immediately north of Pearse Island through Portland Canal, east into Nass Bay, and south through the northern portion of Portland Inlet (Figure 4.6–2). Surveys were conducted from the *M/V Miss Marlee* except the September 2021 and July 2022 surveys, which were conducted from the *M/V Dorothy Rose*. During surveying, the vessel speed was between 8 and 9 kts to maintain consistent temporal effort and ensure the vessel travelled faster than marine mammals swimming in the same direction (Dawson et al. 2008). Surveys were conducted during conditions with Beaufort wind force (Bf) ≤4 and when visibility was >2.5 km.



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Site
Transect
Marine Mammal Vessel Survey Area
Topographic Contour
Watercourse

0 1 2 3 4 5 km
1:130,000 (at original document size of 8.5x11)

Stantec

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20230203
Requested by MLONG on 20230203
Check by SLEMAY on 20230203

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.6-1

Title
Planned Marine Mammal Vessel Survey Transects

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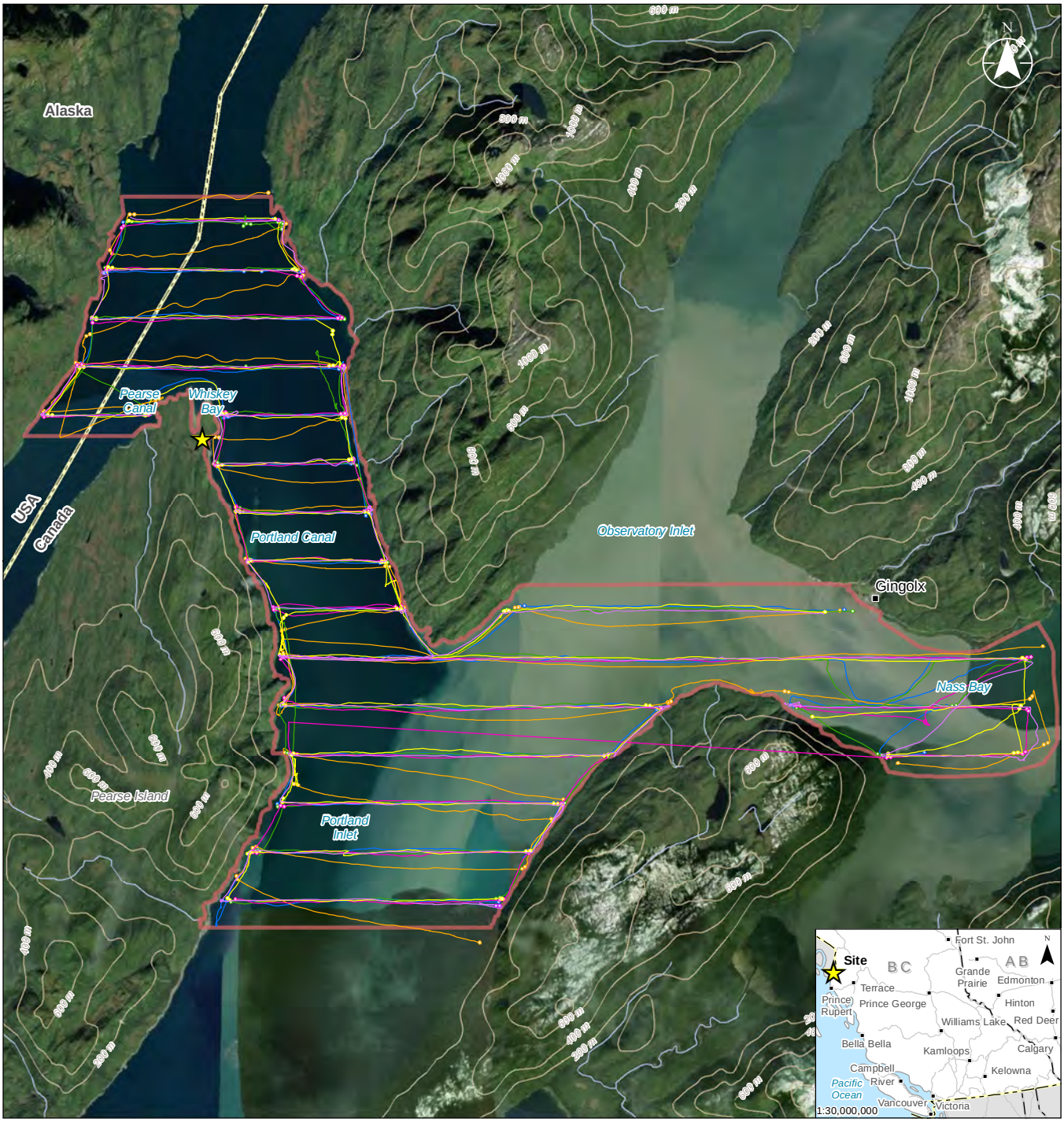

KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Site

Survey Transect Coverage

2021
- July
- September
- November

2022
- March
- May
- July

Marine Mammal Vessel Survey Area
Topographic Contour
Watercourse

0 1 2 3 4 5 km
1:130,000 (at original document size of 8.5x11)

Stantec

Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20230203
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Check by SLEMAY on 20230203

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.6-2

Title
Marine Mammal Vessel Survey Coverage

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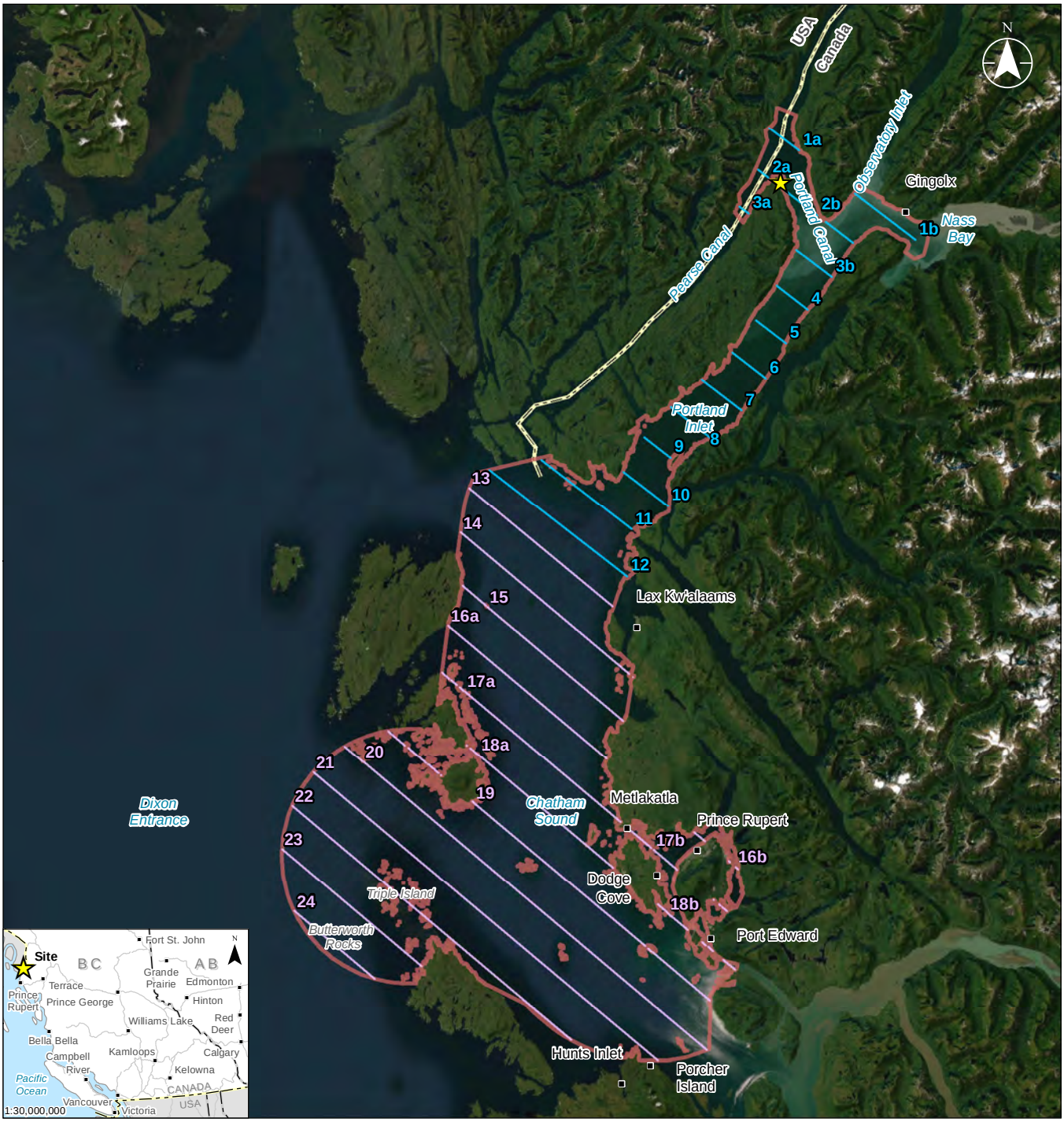
Standard distance sampling protocols from Buckland et al. 2001 were used to collect marine mammal data. Two MMOs were positioned at the bow of the survey vessel and continuously scanned their entire field of view for marine mammal sightings on the port and starboard sides of the boat, respectively. Two data recorders documented sighting information. MMOs used 7 x 50 weatherproof reticle binoculars (Bushnell and Optisan) to confirm species identification and estimate the number of reticles from the horizon or shoreline to the sighting. MMOs also estimated distances to the sighting in metres and measured the angle to the sighting using a pelorus. This information as well as the species, number of individuals, behaviour, direction of travel, and environmental data was communicated to data recorders. A GPS waypoint was also taken using a Garmin handheld GPS. Photos of the observed marine mammal(s) were taken using a single-lens reflex camera when possible. If a group of closely associating marine mammals was observed, the geographic centre of the group was used as the reference point for measurements, and the encounter was considered a single sighting. If required, surveying was paused to further observe the individual or group and record the necessary information.

4.6.2.2 Aerial Surveys

Two MMOs conducted eight aerial surveys between July 2021 and October 2022. Surveys were conducted in July, September, and December 2021, as well as in March, May, July, August, and October 2022. A de Havilland Canada Beaver floatplane was used to survey 12 transects spanning Portland Canal, Portland Inlet, and into Nass Bay. Beginning in March 2022, in response to requests from Indigenous nations, the Marine Mammal Aerial Survey Area was expanded beyond the mouth of Portland Inlet, to extend farther south into Chatham Sound. This resulted in an additional 12 aerial survey transects, for a total of 24 transects per survey, for the remainder of the program (i.e., through October 2022).

Aerial surveys were conducted during daylight and in conditions with a Beaufort wind force (Bf) ≤4 and visibility >2.5 km. The float plane travelled at speeds between 70 and 105 kts and at an altitude of 305 m (1,000 ft). Occasional deviations from these speeds and altitudes were made due to visibility reductions as a result of weather, such as low-lying clouds.

MMOs continuously scanned from the nose of the plane to 90 degrees from the transect line and recorded observations using a digital voice recorder. A Garmin handheld GPS was used to track the plane's path along transects, and a waypoint was recorded when a sighting was lined up at a 90-degree angle from the plane. MMOs recorded the vertical angle to sightings using a clinometer and recorded additional information (species, number of individuals, behaviour, direction of travel, and environmental data).



KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

- Site
- Aerial Transect
- Aerial Transect Extended (2022)
- Marine Mammal Aerial Survey Area
- International Boundary

0 5 10 15 20 25 Kilometers

1:700,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20230203
Requested by MLONG on 20230203
Check by SLEMAY on 20230203

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.6-3

Title
Planned Marine Mammal Aerial Survey Transects

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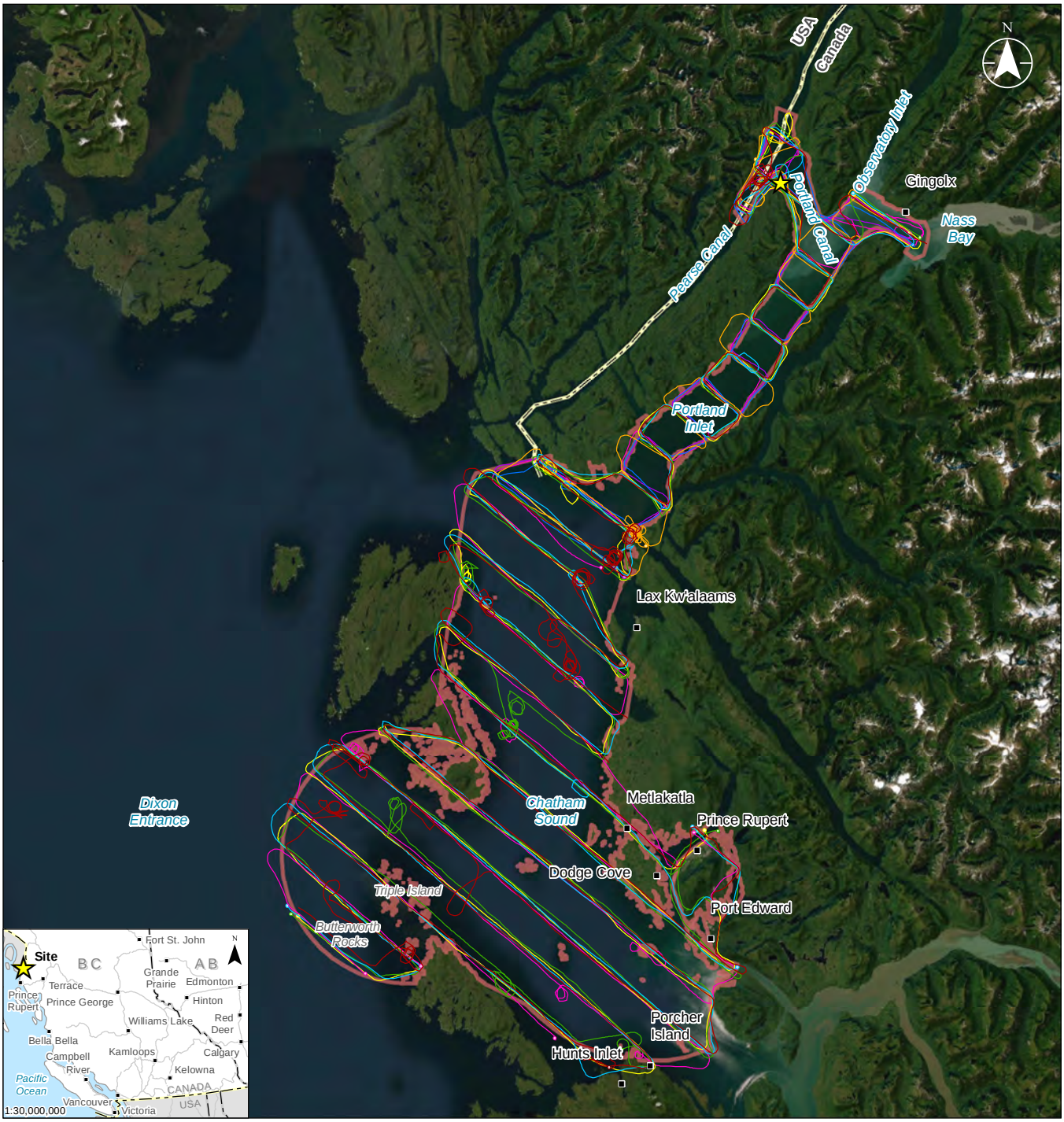

KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Site

Survey Transect Coverage

2021
- July
- September
- December

2022
- March
- May
- July
- August
- October

Marine Mammal Aerial Survey Area

International Boundary

0 5 10 15 20 25 Kilometers

1:700,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20230203
Requested by MLONG on 20230203
Check by SLEMAY on 20230203

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.6-4

Title
Marine Mammal Aerial Survey Coverage

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4.6.3 Results

Six vessel-based and eight aerial-based line-transect surveys were completed between July 2021 and October 2022. The surveys were designed to provide information on seasonal presence of marine mammals in the Marine Mammal Vessel and Aerial Survey Areas.

Total distances travelled from the start of the first transect to the end of the last are included in Table 4.6–4 for each survey. On-effort distances travelled based on distance travelled on transects only are also included in the table, along with the number of weather days experienced during the survey periods.

Table 4.6–4 Marine Mammal Survey Details

Date	Platform	Number of Transects	Total Distance Travelled (km)	On-Effort Distance Travelled[2] (km)	Number of Weather Days[3]
July 19–20, 2021	*M/V Miss Marlee*	15	152.1	97.1	0
July 21, 2021	*Beaver floatplane*	12	184.9	106.9	0
September 2, 2021	*Beaver floatplane*	12	281.2	108.8	0
September 3–4, 2021	*M/V Dorothy Rose*	15	150.5	100.6	0
November 8–10, 2021	*M/V Miss Marlee*	15	178.7	103.3	0.5
December 8, 2021	*Beaver floatplane*	12	188.6	102.6	2[1]
March 2–3, 2022	*M/V Miss Marlee*	15	162.7	101.1	0
March 8–9, 2022	*Beaver floatplane*	24	865.3	543.4	0
May 17–18, 2022	*M/V Miss Marlee*	15	133.7	98.4	0
May 21–22, 2022	*Beaver floatplane*	24	744.8	528.2	0
July 9–10, 2022	*M/V Dorothy Rose*	15	139.3	101.4	0
July 12–13, 2022	*Beaver floatplane*	24	749.5	550.5	0
August 30–31, 2022	*Beaver floatplane*	24	824.2	559.7	0
October 4–5, 2022	*Beaver floatplane*	24	1,057.7	665.4	0

NOTES:

[1] Survey was moved to early December due to poor weather conditions in November when originally scheduled.

[2] On-Effort Distance Travelled includes any additional kilometres travelled confirming species identifications and numbers of individuals for on-transect sightings.

[3] 'Weather days' refers to planned survey days where environmental conditions were determined to be either unfavourable to sighting marine mammals or unsafe for floatplane operations, or both. These included conditions such as, Beaufort sea state of more than 4 and visibility of less than 2.5 km.

4.6.3.1 Survey Sighting Summaries (in Chronological Order)

Distance sampling requires a minimum of 30–40 sightings of groups for proper fitting of the detection function and to obtain an estimate of the true density, and it is preferable to have at least 60–80 sightings to minimize the error around the estimate (Buckland et al. 1993, 2001). Given the limited number of sightings of most species of marine mammals in the Marine Mammal Vessel and Aerial Survey Areas, predictive densities were not calculated from the survey data. Marine mammal individuals sighted are summarized in Table 4.6–5 below. Table values represent the total number of individuals observed for each species, not the number of times a species was sighted (either as an individual or as part of a group). Though 68 individual humpback whales were observed across the surveys, there were only 29 humpback whale sightings, which falls short of the preferable number of sightings to calculate predictive densities. Similarly, 431 individual Steller sea lions were observed in-water across 56 sightings. Generally, higher numbers of humpback whales were observed in July and August 2022, with the peak in October 2022. Larger groups of Steller sea lions were also observed in March, May, August, and October 2022. However, lack of sightings should not be considered an indication of absence for any particular species at any time of the year as these surveys only provide a brief snapshot of marine mammal occurrence.

Table 4.6–5 Marine Mammal Individuals Sighted Summary

Date	Platform	Killer Whale	Minke Whale	Humpback Whale	Harbour Porpoise	Dall's Porpoise	Harbour Seal	Steller Sea Lion		Northern Elephant Seal	Total
							In-Water	In-Water	On-Land	On-Land	
July 19–20, 2021	*M/V Miss Marlee*	4	–	–	–	–	3	–	–	–	**7**
July 21, 2021	*Beaver floatplane*	–	–	–	–	–	–	–	–	–	**0**
September 2, 2021	*Beaver floatplane*	–	–	1	–	–	–	12		–	**13**
September 3–4, 2021	*M/V Dorothy Rose*	–	2	–	–	7	4	–	–	–	**13**
November 8–10, 2021	*M/V Miss Marlee*	5	–	–	–	–	4	–	–	–	**9**
December 8, 2021	*Beaver floatplane*	–	–	–	–	–	–	–	–	–	**0**
March 2–3, 2022	*M/V Miss Marlee*	–	–	–	5	3	1	202	–	–	**211**
March 8–9, 2022	*Beaver floatplane*	3	–	5	–	–	1	130	120	–	**259**
May 17–18, 2022	*M/V Miss Marlee*	3	1	1	–	–	6	2	–	–	**13**
May 21–22, 2022	*Beaver floatplane*	–	–	2	–	–	1	60	–	–	**63**
July 9–10, 2022	*M/V Dorothy Rose*	–	–	–	1	2	14	–	–	–	**17**
July 12–13, 2022	*Beaver floatplane*	–	–	8	–	–	–	–	260	–	**268**

Table 4.6–5 Marine Mammal Individuals Sighted Summary

Date	Platform	Killer Whale	Minke Whale	Humpback Whale	Harbour Porpoise	Dall's Porpoise	Harbour Seal	Steller Sea Lion		Northern Elephant Seal	Total
							In-Water	In-Water	On-Land	On-Land	
August 30–31, 2022	*Beaver floatplane*	–	–	10	–	–	–	4	235	1	**250**
October 4–5, 2022	*Beaver floatplane*	–	–	42	–	–	1	21	135	–	**199**
Totals		**15**	**3**	**69**	**6**	**12**	**35**	**431**	**750**	**1**	**1322**

July 19–20, 2021 Vessel Survey Sightings Summary:

The July 19–20, 2021 vessel survey included the first set of vessel-based transects for the Project within the Marine Mammal Vessel Survey Area. A total of 13 hours and 42 minutes were spent over two days to complete 15 transects. The survey occurred during sea state between 1 and 3 on the Beaufort scale, and visibility ranged from moderate to excellent. Skies were mostly overcast with moderate rain or partly cloudy periods and occasional weak glare. Three harbour seals were observed, including one near the kelp beds off the point on the western side of Whiskey Bay. Four transient killer whales (Photo 5 and Photo 6) were observed (Figure 4.6–5) around Ramsey Point briefly before slowly travelling up Portland Canal.

Photo 5 Four Transient Killer Whales in Portland Canal July 19, 2021

Photo 6 Adult Male Transient Killer Whale in Portland Canal July 19, 2021

July 21, 2021 Aerial Survey Sightings Summary:

The July 21, 2021 aerial survey was completed in 1 hour and 46 minutes with medium to very high sightability conditions. Twelve transects were conducted in consistently overcast environmental conditions with no glare and a sea state of 1 to 4 on the Beaufort scale. No marine mammals were observed.

September 2, 2021 Aerial Survey Sightings Summary:

The September 2, 2021 aerial survey of 12 transects was completed in 1 hour and 29 minutes. Environmental conditions included overcast skies with periodic light rain and no glare. Sightability ranged from high to very high and the sea state was between 1 and 3 on the Beaufort scale. A total of 12 Steller sea lions were observed, including a group of 8 near the western end of transect 11 (Figure 4.6–6). The remaining 2 individual sea lions were sighted on either end of transect 11. A single humpback whale was also observed (Figure 4.6–6, Photo 7) travelling close to the entrance of Work Channel.

Photo 7 Humpback Whale Near Entrance to Work Channel September 2, 2021

September 3–4, 2021 Vessel Survey Sightings Summary:

The September 3–4, 2021 vessel survey was completed over two days spanning 13 hours and 4 minutes to complete 15 transects. There was light to moderate rain on day one of the vessel surveys, changing to heavy rain on the morning of day two. Survey environmental conditions included a sea state between 1 and 3 on the Beaufort scale with less than 5 kts of wind from the northeast increasing to 10 to 15 kts from the east. No glare was present, and the visibility started out low to high, increasing to very high on the second day. Two minke whales were observed: one north of Pearse Island (Figure 4.6–6) and the other at the northern end of Portland Inlet (Figure 4.6–6). Both minke whales swam at a moderate speed, one away from the vessel and one in the same direction as the vessel. A total of seven Dall's porpoises were observed, including a probable sighting of an individual on transect 15, four (including two juveniles) on transect 4 in Portland Canal, and two in Portland Inlet. Three individual harbour seals were also observed off the northern end of Pearse Island on transect 4 and one was observed in Portland Canal off transect 5B.

November 8–10, 2021 Vessel Survey Sightings Summary:

The November 8–10, 2021 vessel survey was completed with sea state between 1 and 3 on the Beaufort scale with partly cloudy or overcast conditions and a short period of light snow. Winds ranged from 1 to 12 kts, predominantly from the northeast. The glare was variable and the visibility ranged from very high

to excellent. The 15 transects were completed in 12 hours and 48 minutes, and four harbour seals and five killer whales (unidentified ecotypes) were observed (Figure 4.6–5). The five killer whales, including three adults, were observed swimming at a moderate speed in Pearse Canal. One of the killer whales exhibited breaching and tail-slapping behaviours while travelling.

December 8, 2021 Aerial Survey Sightings Summary:

The December 8, 2021 aerial survey's environmental conditions were overcast with distant fog, periods of snow, and no glare. A total of 12 transects were completed over 1 hour and 3 minutes. The sea state was 2 to 4 on the Beaufort scale and sightability ranged from moderate to very high with a two-minute period of poor sightability. No marine mammals were observed during this survey.

March 2–3, 2022 Vessel Survey Sightings Summary:

The March 2–3, 2022 vessel survey coincided with a portion of the eulachon run in the Nass Valley. A total of 12 hours and 19 minutes of effort were spent in sea states 1 and 2 on the Beaufort scale to complete 15 transects. Variable winds ranging between 1 to 7 kts predominantly from the northeast were present throughout the survey. Environmental conditions consisted of overcast to partly cloudy skies with periods of light rain and some fog with variable glare. Visibility ranged from high to very high.

Approximately 202 Steller sea lions were observed, including multiple groups ranging in size from 2 to 50 in Portland Inlet, a group of 7 in Portland Canal, two groups of 12 in Portland Canal, a group of 5 outside Whiskey Bay, and a group of 20 near Gingolx (Figure 4.6–5). Many of the sea lions appeared to be feeding together, possibly on schools of eulachon, in the Nass Bay area. Others were observed resting or rafting in groups with pectoral fins held in the air or milling. One harbour porpoise was observed porpoising along east Pearse Island while four were observed porpoising in Portland Inlet (Figure 4.6–6). A single Dall's porpoise and a separate group of 2 were observed porpoising in Pearse Canal. One harbour seal was also sighted in Pearse Canal.

March 8–9, 2022 Aerial Survey Sightings Summary:

The March 8–9, 2022 aerial survey occurred over 4 hours and 55 minutes and was the first time 24 transects were surveyed . Environmental conditions consisted of clear skies with glare varying from none to high. Sea states ranged from 1 to 5 on the Beaufort scale and sightability from poor to very high. A sea state of 5 was recorded intermittently on transects 5, 6, 9, 10, 11, 12, 13, 14, 15, 16, and 16A. A sea state between 5 and 6 on the Beaufort scale was also noted for the end of transect 15. A total of 2 humpback whales were observed close to Gingolx and 3 additional humpbacks (Photo 9) were observed in Chatham Sound. Approximately 250 Steller sea lions were observed, including 20 individuals hauled out on islets in Chatham Sound (Figure 4.6–6, Photo 8) and 100 individuals hauled out on Butterworth Rocks, near Triple Islands (Figure 4.6–6). A group of 3 killer whales (unidentified ecotype) was also observed surfacing briefly below the plane near Butterworth Rocks (Figure 4.6–6), then not observed again. A single harbour seal was also observed opposite Watson Island near Port Edward.

Photo 8 **Steller Sea Lions Hauled Out on Islet in Chatham Sound March 9, 2022**

Photo 9 **Humpback Whale Surfacing and Two Footprints in Chatham Sound March 9, 2022**

May 17–18, 2022 Vessel Survey Sightings Summary:

The May 17–18, 2022 vessel survey was completed over 11 hours and 8 minutes. Environmental conditions consisted of a sea state of 0 to 3 on the Beaufort scale, 1 to 12 kts of wind predominantly from the northeast, overcast to partly cloudy skies with periods of light to moderate rain, and occasional weak glare on the water with excellent visibility. Three killer whales (unidentified ecotype), including one juvenile, were observed slowly travelling northwest in Portland Inlet along the east side of Pearse Island (Figure 4.6–5). Additionally, one humpback whale was observed possibly feeding along the shoreline close to the western end of transect 1. One minke whale was observed diving multiple times close to the northeast shore of Pearse Island (Figure 4.6–5). One Steller sea lion was observed feeding in Nass Bay and one unidentified deceased sea lion was observed on the east side of Portland Inlet. Four harbour seals were observed in Nass Bay, two along east Pearse Island, and one in northeastern Portland Canal.

May 21–22, 2022 Aerial Survey Sightings Summary:

The May 21–22, 2022 aerial survey occurred over a total of 4 hours and 30 minutes to complete 24 transects. Environmental conditions consisted of clear skies with occasional overcast conditions and periodic weak glare on the water. Sightability ranged from poor to very high and Beaufort wind force was between 0 and 4 with a sea state of 5 on the Beaufort scale for 10 minutes of the survey, between transects 23 and 24. A total of 60 Steller sea lions were observed, including one group of 20 along the western half of transect 11 and one group of 16 along its eastern half. A total of 2 humpback whales were also observed diving, one diving off the western end of transect 15 and the other along the shoreline of western Portland Canal off transect 1a. A single harbour seal was observed towards the eastern end of transect 21 (Figure 4.6–6).

July 9–10, 2022 Vessel Survey Sightings Summary:

The July 9–10, 2022 vessel survey was completed over 11 hours and 21 minutes. Environmental conditions consisted of a sea state of 1 to 3 on the Beaufort scale, 0 to 8 kts of wind from variable directions and overcast skies with periods of light to moderate rain and periodic light fog. Visibility ranged from predominantly very high to excellent. A total of 2 Dall’s porpoise were observed porpoising; one was travelling southwest along the eastern end of transect 15, and the other was travelling west along the eastern end of transect 14. A single harbour porpoise was observed swimming slowly southwest at the eastern end of transect 10 in the Nass Estuary. A total of 14 individual harbour seals were observed with varying behaviours including diving, swimming slowly and milling, from the eastern end of transect 3 and transect 13, to in front of Gingolx, with the majority observed in Nass Bay (Figure 4.6–5).

July 12–13, 2022 Aerial Survey Sightings Summary:

The July 12–13, 2022 aerial survey entailed 24 transects completed over 6 hours and 10 minutes. Environmental conditions consisted of overcast skies with no glare on the water. Sightability ranged from poor to very high and Beaufort wind force was between 0 and 4 with a sea state of 5 for 26 minutes between transect 20 and 24. A total of 260 Steller sea lions were observed resting on Butterworth Rocks between transects 23 and 24 (Figure 4.6–6; Photo 10). A group of 4 humpback whales were observed travelling northwest out of Work Channel at the eastern end of transect 11 and 3 humpback whales were observed travelling up Work Channel near a whale-watching vessel hours later. A single humpback whale was observed travelling south near the western end of transect 15 (Figure 4.6–6).

Photo 10 **Steller Sea Lions Hauled Out on Butterworth Rocks in Dixon Entrance**
July 13, 2022

August 30–31, 2022 Aerial Survey Sightings Summary:

The August 30–31, 2022 aerial survey entailed 24 transects completed over 5 hours and 1 minute. Environmental conditions consisted of predominantly overcast skies with partly cloudy or clear conditions and periodic weak glare on the water. Sightability ranged from poor to excellent and Beaufort wind force was between 0 and 4 with a sea state of 5 to 6 for 47 minutes between transect 19 and 24. A total of 10 humpback whales were observed across 5 sightings with 1 to 3 individuals per sighting (Photo 11). The humpback whales were predominantly observed travelling either northwest or west. A single humpback whale was observed near the eastern end of transect 11; 2 individuals were observed at the western end of transect 15;, 3 individuals were observed in the middle of both transects 16 and 17; and a single humpback whale was observed after a breach or pectoral fin-slap (splash was observed post activity) at the eastern end of transect 22. A group of 4 Steller sea lions were observed swimming up Work Channel past the eastern end of transect 11, while a group of 235 Steller sea lions and 1 possible northern elephant seal were observed resting on Butterworth Rocks between transects 23 and 24 (Figure 4.6–6).

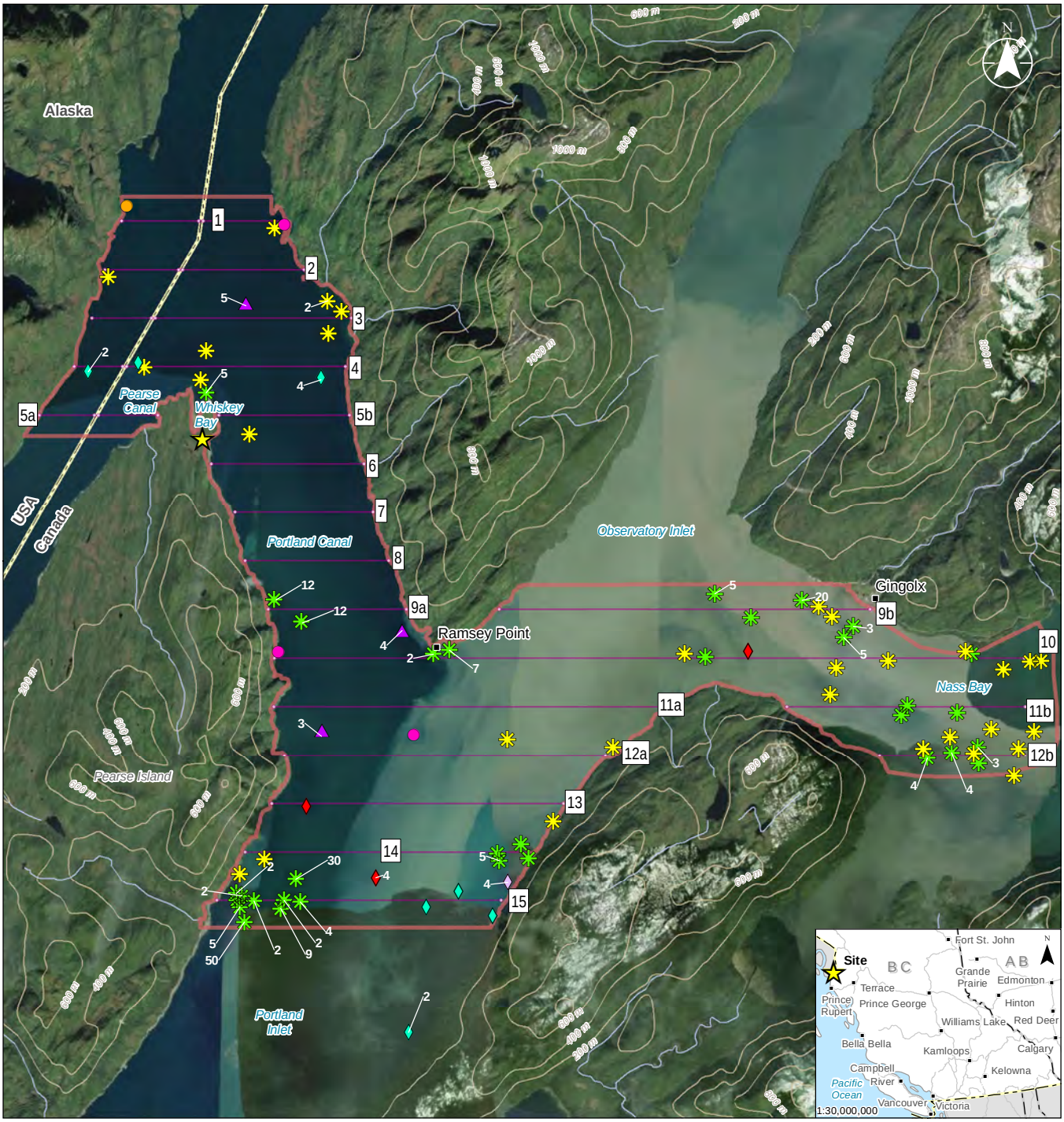
Photo 11 Humpback Whale in Chatham Sound August 30, 2022

October 4–5, 2022 Aerial Survey Sightings Summary:

The October 4–5, 2022 aerial survey entailed 24 transects completed over 6 hours and 17 minutes. Environmental conditions consisted of overcast skies with partly overcast and clear periods and periodic weak to strong glare on the water. Sightability ranged from poor to excellent and Beaufort wind force was between 1 and 4 with a sea state of 5 to 6 for 23 minutes between transect 3B and 12. A total of 42 humpback whales were observed, ranging in group size from 1 to 14. The whales were predominantly resting, slowly travelling or diving throughout Chatham Sound. One group of 2 humpbacks was observed feeding at the eastern end of transect 23, while a larger group of 9 was observed feeding at the western end of transect 22 (Figure 4.6–6, Photo 12, Photo 13). A total of 156 Steller sea lions were observed, including one group of 15 at the eastern end of transect 11, one group of 5 milling along the edge of an islet at the western end of transect 15, and a group of 35 individuals near the western end of transect 20 (13 sea lions resting on a rocky islet while 22 sea lions milled nearby in the water. The remaining 100 observed Steller sea lions were resting on Butterworth Rocks between transects 23 and 24. A single harbour seal was observed towards the eastern end of transect 14 (Figure 4.6–6).

Photo 12 Humpback Whales feeding in Chatham Sound October 5, 2022

Photo 13 Humpback Whales feeding in Chatham Sound October 5, 2022



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Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Site

Species Sighted Vessels

(# Label Indicates Individuals Observed for Group Sizes >1)

- Humpback Whale
- Minke Whale
- Killer Whale
- Dall's Porpoise
- Harbour Porpoise
- Unidentified Porpoise
- Harbour Seal
- Steller Sea Lion

- Transect
- Marine Mammal Vessel Survey Area
- Topographic Contour
- Watercourse

0 1 2 3 4 5 km

1:130,000 (at original document size of 8.5x11)

Stantec

Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20230203
Requested by MLONG on 20230203
Check by SLEMAY on 20230203

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.6-5

Title
Marine Mammal Vessel Survey Estimated Sighting Locations

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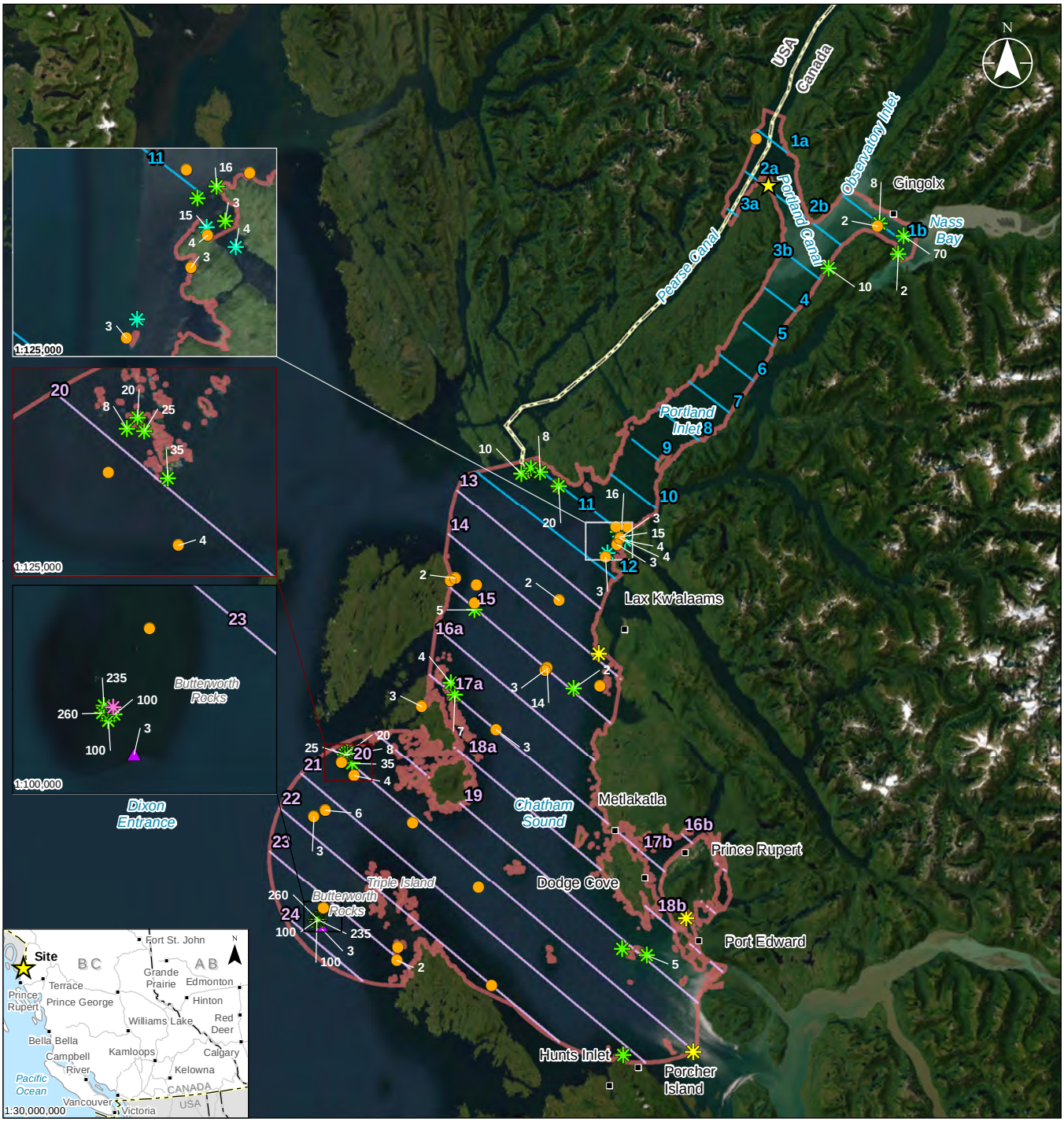

KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Site

Species Sighted

(# Label Indicates Individuals Observed for Group Sizes >1)

- Humpback Whale
- Killer Whale
- Harbour Seal
- Northern Elephant Seal
- Sea Lion
- Steller Sea Lion

- Aerial Transect
- Aerial Transect Extended (2022)
- Marine Mammal Aerial Survey Area
- International Boundary

0 5 10 15 20 25 Kilometers

1:700,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20230203
Requested by MLONG on 20230203
Check by SLEMAY on 20230203

Client/Project/Report

Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.

4.6-6

Title

Marine Mammal Aerial Survey Estimated Sighting Locations

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Incidental Sightings Summary:

Incidental sightings of marine mammals were recorded between marine mammal survey transects and other types of surveys throughout the year (Table 4.6–6). Approximately 4 killer whales (unidentified ecotype) were observed slowly travelling into Prince Rupert Harbour in June 2021, 3 were observed along the northeast side of Pearse Island in Portland Canal in September 2021, and 6 were reported near Pearse Island by observers on other boats in the area in March 2022. A single harbour seal was observed in Whiskey Bay while 2 others were observed at unknown locations in June 2021. A single harbour seal was also observed outside the Gingolx municipal dock and another was observed outside Whiskey Bay in September 2021. A total of 16 harbour seals were recorded in Whiskey Bay in February 2022, and 14 were recorded in March 2022. Of the 14 seals, 9 were observed around the northern end of Pearse Island. A single harbour seal was observed in July 2022 in Nass Bay.
In June 2021, 1 or 2 humpback whales (specific number could not be determined) were observed travelling slowly past the Whiskey Bay shoreline and 5, including 1 in Nass Bay and 1 near Observatory Inlet, were observed in March 2022 (Photo 13, Photo 14 and Photo 15). Between 7 and 9 humpback whales split into three groups were observed in August 2022 in Chatham Sound.
Approximately 169 to 175 Steller sea lions, including two groups totaling 90 sea lions, were recorded from late February to early March 2022. One of the Steller sea lion groups (Photo 16) observed in Nass Bay near Gingolx on March 3, 2022, with approximately 40 individuals, likely included multiple individuals sighted on-effort earlier in the day. A second large group of approximately 50 Steller sea lions was observed along the shore near the western side of Portland Inlet on March 2, 2022. There were 3 harbour porpoises sighted in Observatory Inlet in February 2022, 8 Dall's porpoises were feeding east of Pearse Island in November 2021, and 4 unidentified porpoises were observed swimming southwards slowly along the eastern side of Portland Inlet in March 2022. A total of 4 dolphins or porpoises were observed in October 2022 in Pearse Canal at the northwest end of Pearse Island.

Table 4.6–6 Incidental Marine Mammal Sightings

Month	Killer Whale	Humpback Whale	Harbour Porpoise	Dall's Porpoise	Porpoise (Unidentified Species)	Dolphin or Porpoise (Unidentified Species)	Harbour Seal	Steller Sea Lion
June 2021	~4	1–2	–	–	–	–	3	10–15
September 2021	3	–	–	–	–	–	2	1
November 2021	–	–	–	8	–	–	–	–
February 2022	–	–	3	–	–	–	16	41–45
March 2022	6	5	–	–	4	–	14	128–130
July 2022	–	–	–	–	–	–	1	–
August 2022	–	7-9	–	–	–	–	–	–
October 2022	–	–	–	–	–	4	–	–

Photo 14 Humpback Whale Blow March 5, 2022

Photo 15 Two Humpback Whales Surfacing March 5, 2022

Photo 16 Humpback Whale Diving March 5, 2022

Photo 17 Steller Sea Lions in Nass Bay March 3, 2022

4.7 REMOTE SENSING

4.7.1 Introduction

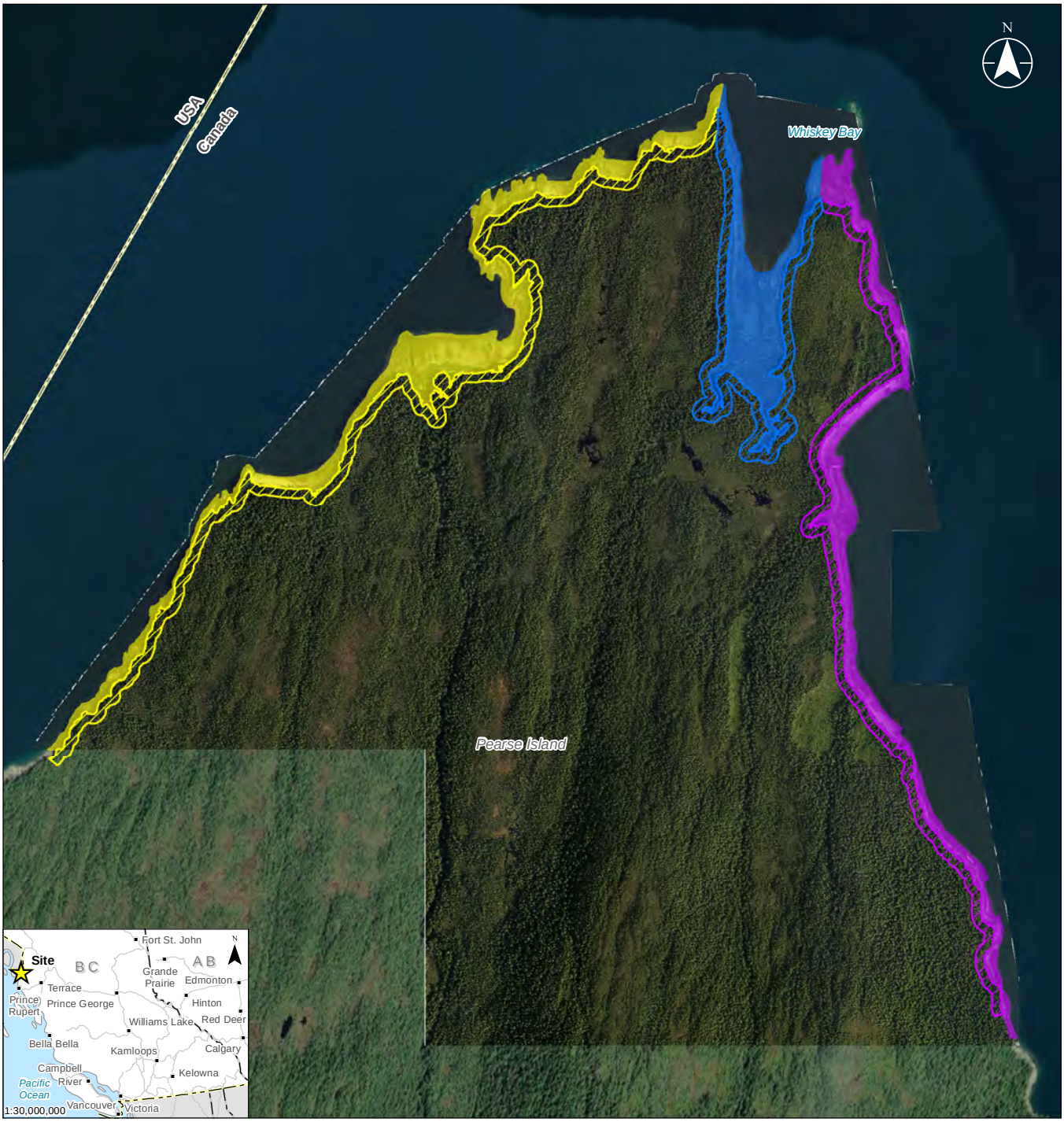
Aerial imagery was collected at the marine terminal location on the northern end of Pearse Island (Figure 4.7–1). The imagery dataset was used to provide a high-level overview of the biological and physical conditions within the marine riparian and intertidal zone to provide information on the habitat types that may be affected by proposed Project infrastructure and activities. The imagery was captured on June 29, 2021 at a low tide of approximately 1.3 m (chart datum). Using remote sensing methodologies, classification algorithms were tailored to automatically identify and classify physical and biological categories from the red, green, and blue bands of the aerial imagery.

4.7.2 Methods

An object-based image analysis (OBDFO important area) was applied to the data using the image classification toolset in ArcGIS Pro. OBDFO important area segments the imagery into like parts (objects), based on user-defined attributes, such as size, shape, colour, and texture. The objective of segmentation is to convert the imagery into a layer of recognizable features; in this case, individual marine vegetation types. After segmentation, these objects have a newly created set of statistics for size, shape, colour, and texture that can be used to distinguish one species from another during classification.

Separate classification techniques for the physical (substrates) and biological (flora and fauna) categories were necessary due to the differing spatial and spectral properties of these classes. For the physical analysis, a supervised classification process using ArcGIS Imagery Classification Wizard (ESRI) and information collected during field surveys was used to assign a substrate category at a given location. The polygons were then manually checked and smoothed for visual aesthetics and polygons were aggregated to ensure a minimum size of 150 m^2 for any given area. A total of eight categories were observed and are defined in Table 4.7–1. Areas where substrate classification was not possible due to overhanging trees were given a designation of *unclassified*.

For the biological analysis, an unsupervised classification technique was applied using the Iso Cluster tool in ArcGIS. In this method, the computer decided the number classes present in the image based on statistical differences in the spectral characteristics of objects. The unsupervised classification algorithm was an iterative self-organizing cluster equation, with objects assigned to a group based on the statistical probability that they belong. The process was run until all objects were assigned to a category. Areas with flora or fauna were identified and isolated though the use of a green-red vegetation index (**GRVI**), a normalized difference equation applied using the spectral response from the green and red bands. Ideally the near-infrared (**NIR**) band would be used instead of the red band; however, the NIR band was not available. Biological classes were then assigned their real-world names through a combination desktop review by field personnel and a review of *in situ* field data collected during other surveys completed within the photographed area. These data were used to verify results and to extrapolate localized physical and biological characteristics for the full extent of the imagery. A total of seven categories were observed and are defined in Table 4.7–1. Areas where vegetation classes could not be determined were given a designation of *other*.



KSI LISIMS LNG

East Pearse Island Remote Sensing Classification Range
West Pearse Island Remote Sensing Classification Range
Whiskey Bay Remote Sensing Classification Range
East Pearse Island Riparian Study Area
West Pearse Island Riparian Study Area
Whiskey Bay Riparian Study Area

0 150 300 450 600 750 m

1:20,000 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Stantec

Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20220610
Requested by CMCCRACKEN on 20220601
Check by SMOSS on 20220610

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.7-1

Title
Remote Sensing Classification Boundaries and Riparian Study Areas

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The unsupervised classification described above identified most flora and fauna types but failed to accurately detect bull kelp. Therefore, a second unsupervised classification using the same methods was applied to only the marine areas not already assigned to a flora or fauna type. This second, localized classification accurately identified the extent of bull kelp beds.

A post-processing step included review of the imagery classes and manual editing of areas with cloud or shadow that may not have been assigned to the correct class. At this stage, a mean filter was applied to reduce areas causing speckle (mixed classes). During this step, the resulting classification was also converted from raster to a polygon file.

Table 4.7–1 Remote Sensing Classifications

Category	Classification	Description
Biological	Estuarine marsh	An intertidal ecosystem that is flooded diurnally and has simple communities dominated by salt-tolerant emergent graminoids and succulents. These marshes occur in the middle to upper tidal zones of estuaries where saltwater influences predominate.
	Estuarine meadow	Occurs in the high intertidal and supratidal zones of estuaries, where tidal flooding occurs less frequently than daily and is tempered by freshwater mixing. Species composition is relatively diverse, typically with a mix of graminoids and forbs.
	Brown algae	Algae belonging to Phylum Ochrophyta primarily consisting of rockweed.
	Bull Kelp	Canopy-forming kelp species *Nereocystis leutkaena*.
	Green Algae	Algae belonging to Phylum Chlorophyta primarily consisting of sea lettuce.
	Mussel Bed	Dense areas of mussel aggregations.
	Other	Vegetated area that did not fall into the previously listed categories.
Physical	Bedrock	Solid, continuous rock greater than 4,000 mm in diameter.
	Boulder	Rock ranging from 256 mm to 4,000 mm in diameter.
	Cobble	Ranging from 64 mm to 256 mm in diameter.
	Gravel	Ranging from 2 mm to 64 mm in diameter.
	Fines	Sand or mud, ranging from less than 2 mm diameter.
	Shell	Bivalve shell fragments.
	Open water	Lakes or ponds.
	Shoreline fringe unclassified	Analysis could not determine substrate class due to visual impairment (e.g., tree canopy cover).

NOTES:
Biological categories (vegetation) taken from Mackenzie and Moran 2004.
Classification categories adapted from: DFO 1990; RISC 2001.

4.7.3 Results

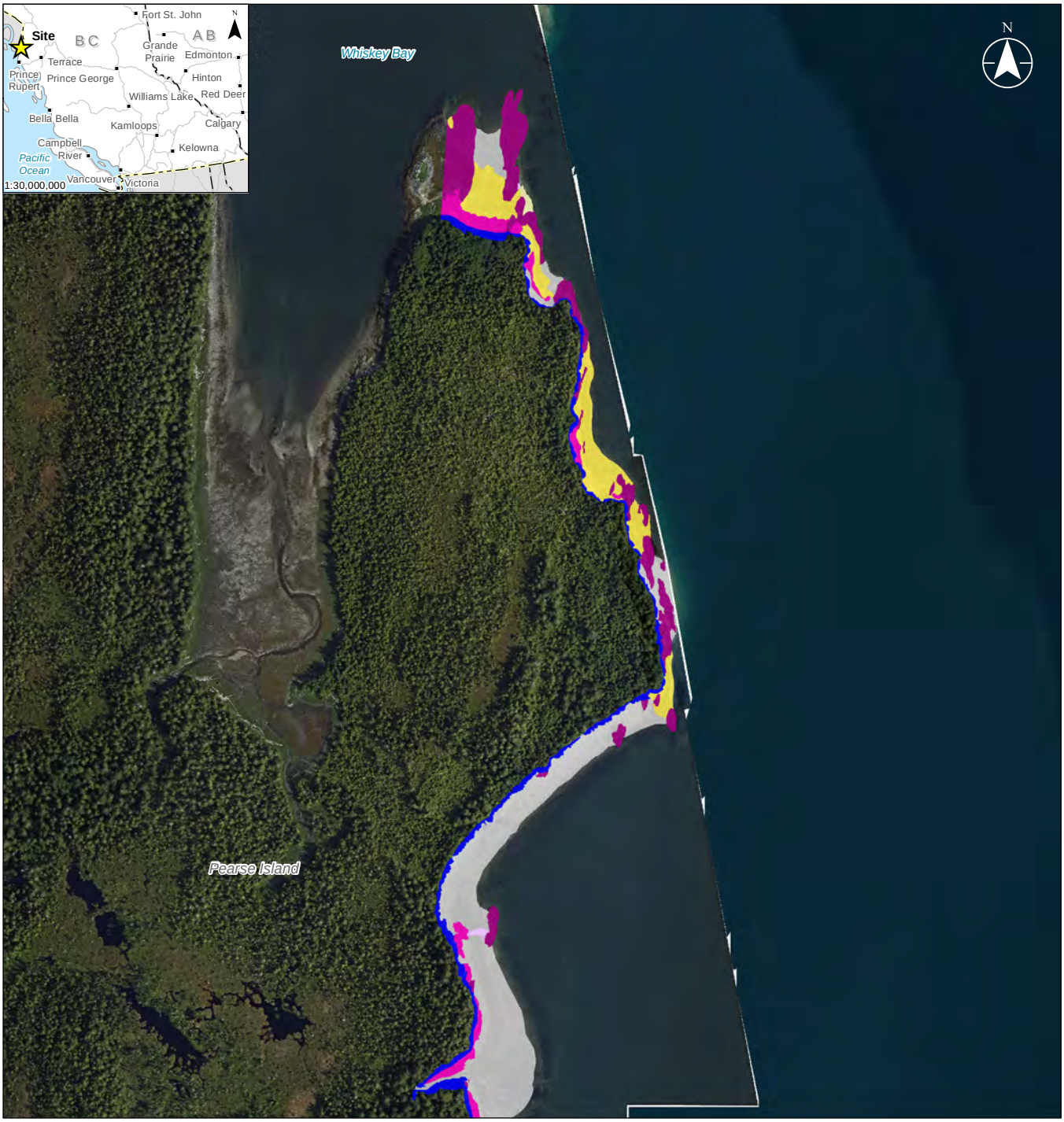
A summary of the physical analysis by area is presented in Table 4.7–2 and Figure 4.7–2 through Figure 4.7–4. A summary of the biological analysis by area is presented in Table 4.7–3 and Figure 4.7–5.

Table 4.7–2 Remote Sensing Physical Analysis Results

Substrate Type	East Pearse Island		Whiskey Bay		West Pearse Island		Substrate Total	
	m²	%	m²	%	m²	%	m²	%
Boulder Dominated	301	0.3	–	–	–	–	301	0.1
Cobble Dominated	19,487	17.7	12,895	10.8	56,223	35	88,604	22.7
Cobble Dominated with Some Boulders	–	–	3,176	2.7	4,272	3	7,448	1.9
Estuarine Marsh	–	–	10,699	8.9	1,958	1	12,657	3.2
Estuarine Meadow	6,533	5.9	19,758	16.5	18,902	12	45,193	11.6
Exposed Bedrock	16,726	15.2	9,114	7.6	30,927	19	56,767	14.5
Fines (shell)	244	0.2	–	–	–	–	244	0.1
Fines Dominated with Boulders	–	–	24,187	20.2	–	–	24,187	6.2
Gravel Dominated	52,695	47.9	30,080	25.1	28,993	18	111,768	28.6
Open Water	–	–	774	0.6	–	–	774	0.2
Shoreline Fringe–-Unclassified	13,970	12.7	8,961	7.5	19,785	12	42,716	10.9
Study Area Total (m²)	**109,955**	**100.0**	**119,643**	**100.0**	**161,059**	**100**	**390,658**	**100.0**

Table 4.7–3 Remote Sensing Biological Analysis Results

Flora and Fauna Type	East Pearse Island		Whiskey Bay		West Pearse Island		Flora and Fauna Total	
	m²	%	m²	%	m²	%	m²	%
Brown Algae	21,111	60.0	22,793	57.4%	39,240	79.6	83,143	67.0
Brown Algae with shells	–	–	8,937	22.5%	158	0.3	9,094	7.3
Bull Kelp	3,273	9.3	34	0.1%	711	1.4	4,018	3.2
Green Algae	89	0.3	–	–	224	0.5	314	0.3
Mussel Bed	10,168	28.9	1,350	3.4%	4,864	9.9	16,382	13.2
Other	528	1.5	6,554	16.5%	1,723	3.5	8,806	7.1
Sparse Brown Algae	–	–	36	0.1%	2,369	4.8	2,405	1.9
Study Area Total (m²)	**35,169**	**100.0**	**39,703**	**100.0%**	**49,289**	**100**	**124,161**	**100.0**



KSI LISIMS LNG

Substrate Type

- Boulder Dominated
- Cobble Dominated
- Estuarine Meadow
- Exposed Bedrock
- Fines (shell)
- Gravel Dominated
- Shoreline Fringe - Unclassified

0 50 100 150 200 250 m

1:7,500 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Stantec

Project Location: Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20220614
Requested by CMCCRACKEN on 20220601
Check by SMOSS on 20220614

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.7-2

Title
East Pearse Island Substrates

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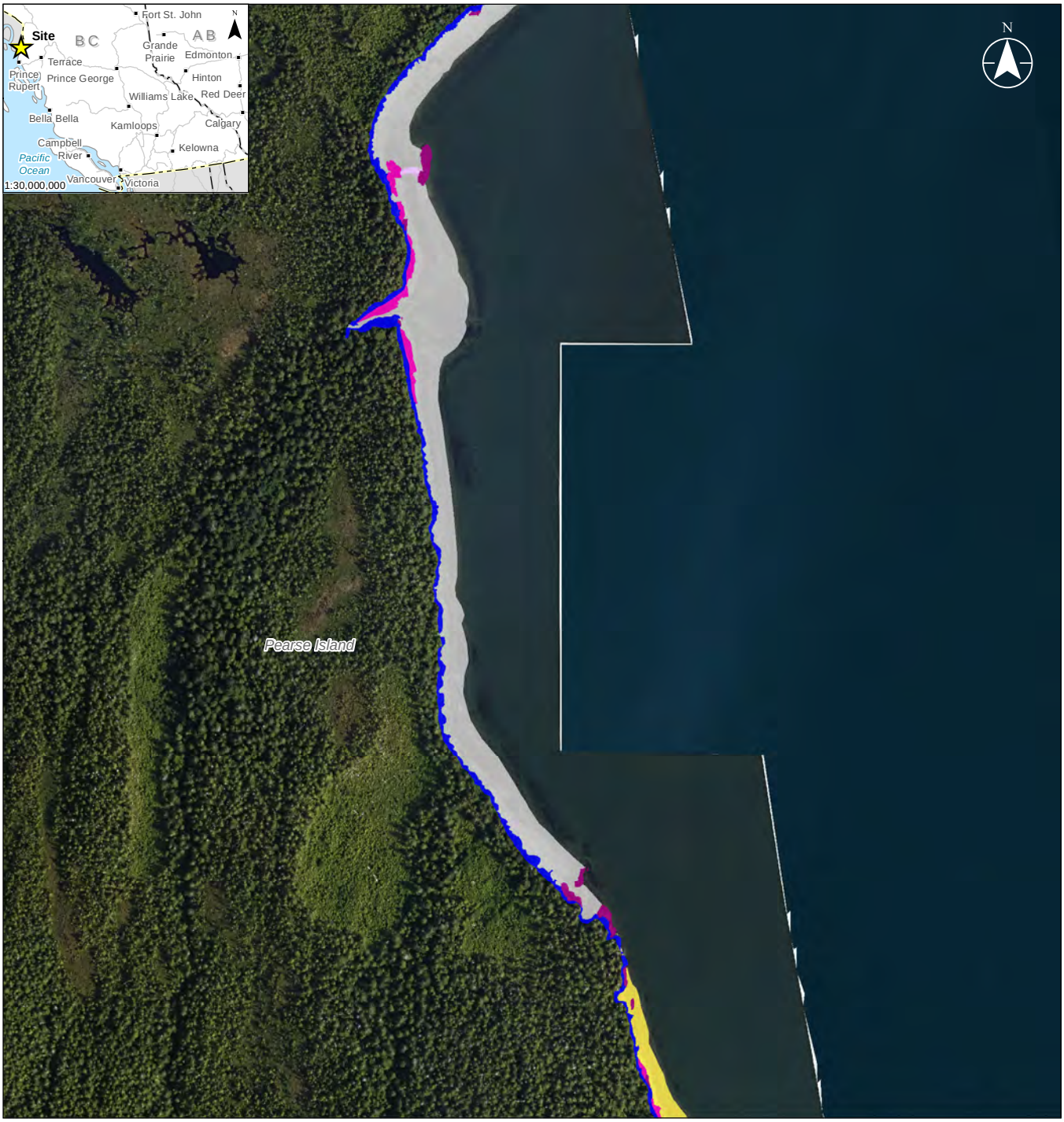

KSI LISIMS LNG

Substrate Type

- Cobble Dominated
- Estuarine Meadow
- Exposed Bedrock
- Fines (shell)
- Gravel Dominated
- Shoreline Fringe - Unclassified

0 50 100 150 200 250 m

1:7,500 (at original document size of 8.5x11)

Notes

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Check by SMOSS on 20220614

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Technical Data Report - Marine Resources

Figure No.

4.7-2

Title

East Pearse Island Substrates

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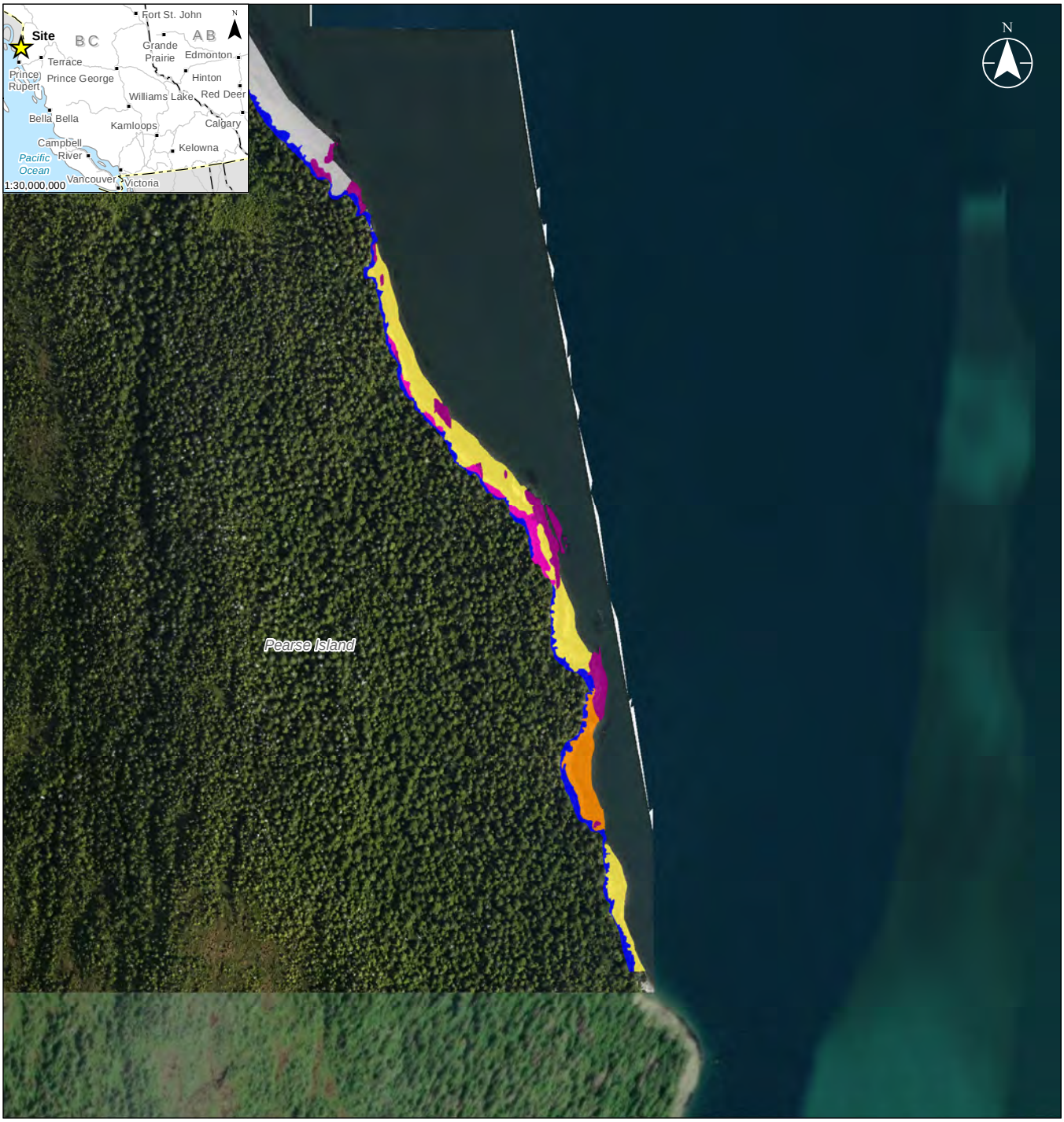

KSI LISIMS LNG

Substrate Type

- Cobble Dominated
- Cobble Dominated with Some Boulders
- Estuarine Meadow
- Exposed Bedrock
- Gravel Dominated
- Shoreline Fringe - Unclassified

0 50 100 150 200 250 m

1:7,500 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
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3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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Check by SMOSS on 20220614

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Figure No.
4.7-2

Title
East Pearse Island Substrates

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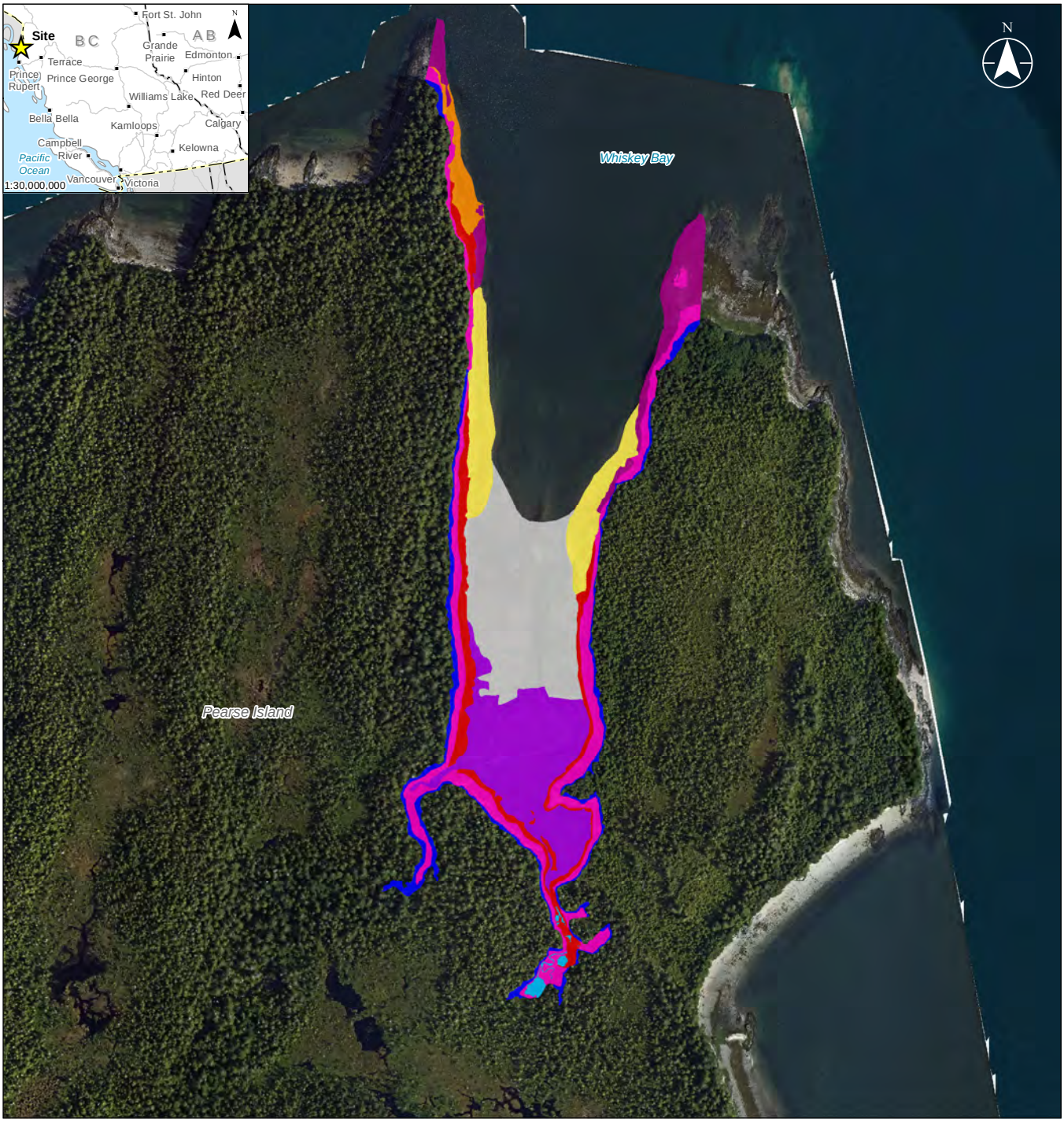

Substrate Type

- Cobble Dominated
- Cobble Dominated with Some Boulders
- Estuarine Marsh
- Estuarine Meadow
- Exposed Bedrock
- Fines Dominated with Boulders
- Gravel Dominated
- Open water
- Shoreline Fringe - Unclassified

0 50 100 150 200 250 m

1:7,500 (at original document size of 8.5x11)

KSI LISIMS LNG

Stantec

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Project Location: Pearse Island, BC

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Prepared by TQUILICHINI on 20220614
Requested by CMCCRACKEN on 20220601
Check by SMOSS on 20220614

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Figure No.
4.7-3

Title
Whiskey Bay Substrates

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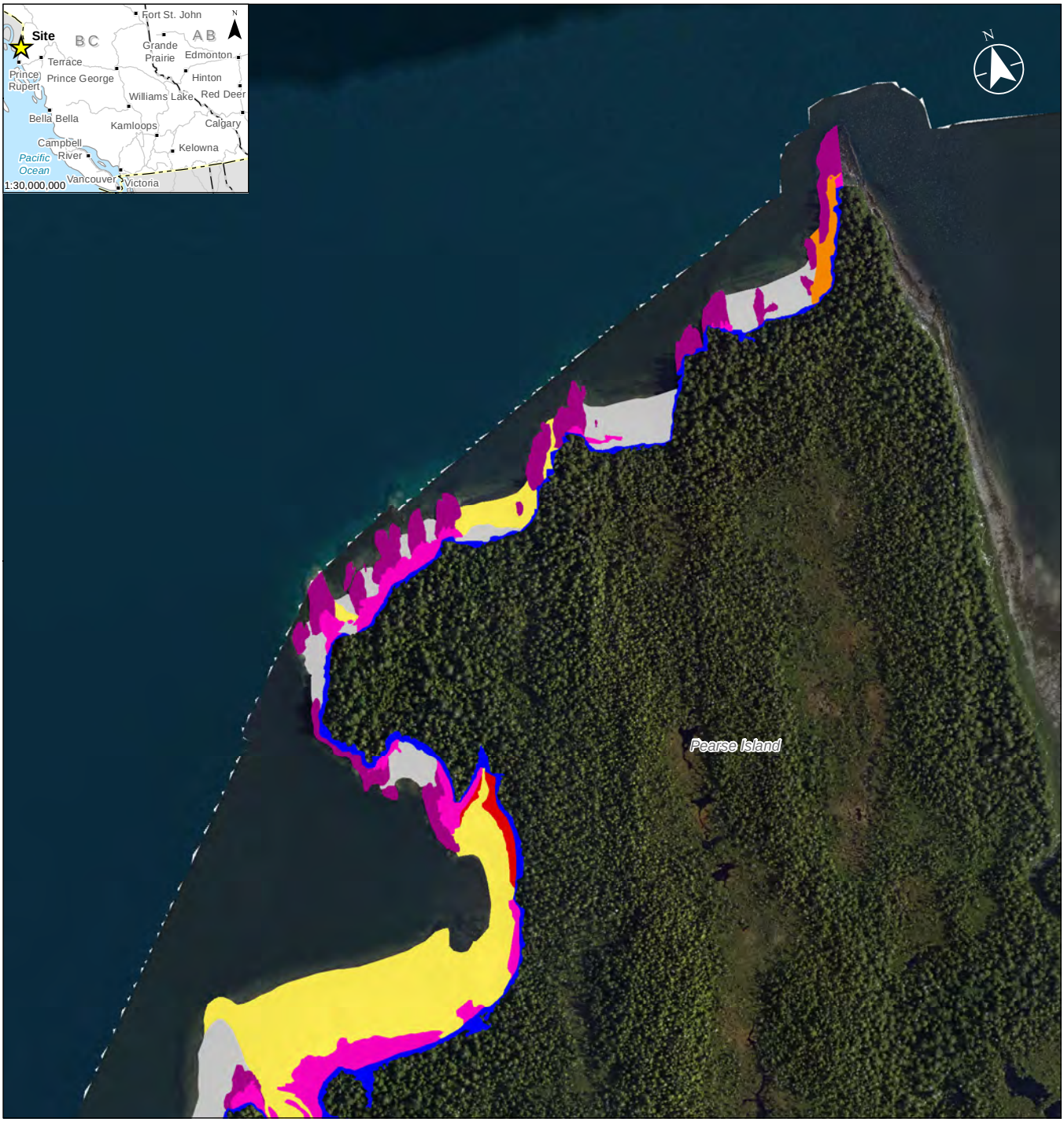

KSI LISIMS LNG

Substrate Type

- Cobble Dominated
- Cobble Dominated with Some Boulders
- Estuarine Marsh
- Estuarine Meadow
- Exposed Bedrock
- Gravel Dominated
- Shoreline Fringe - Unclassified

0 50 100 150 200 250 m

1:7,500 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20220614
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Figure No.
4.7-4

Title
West Pearse Island Substrates

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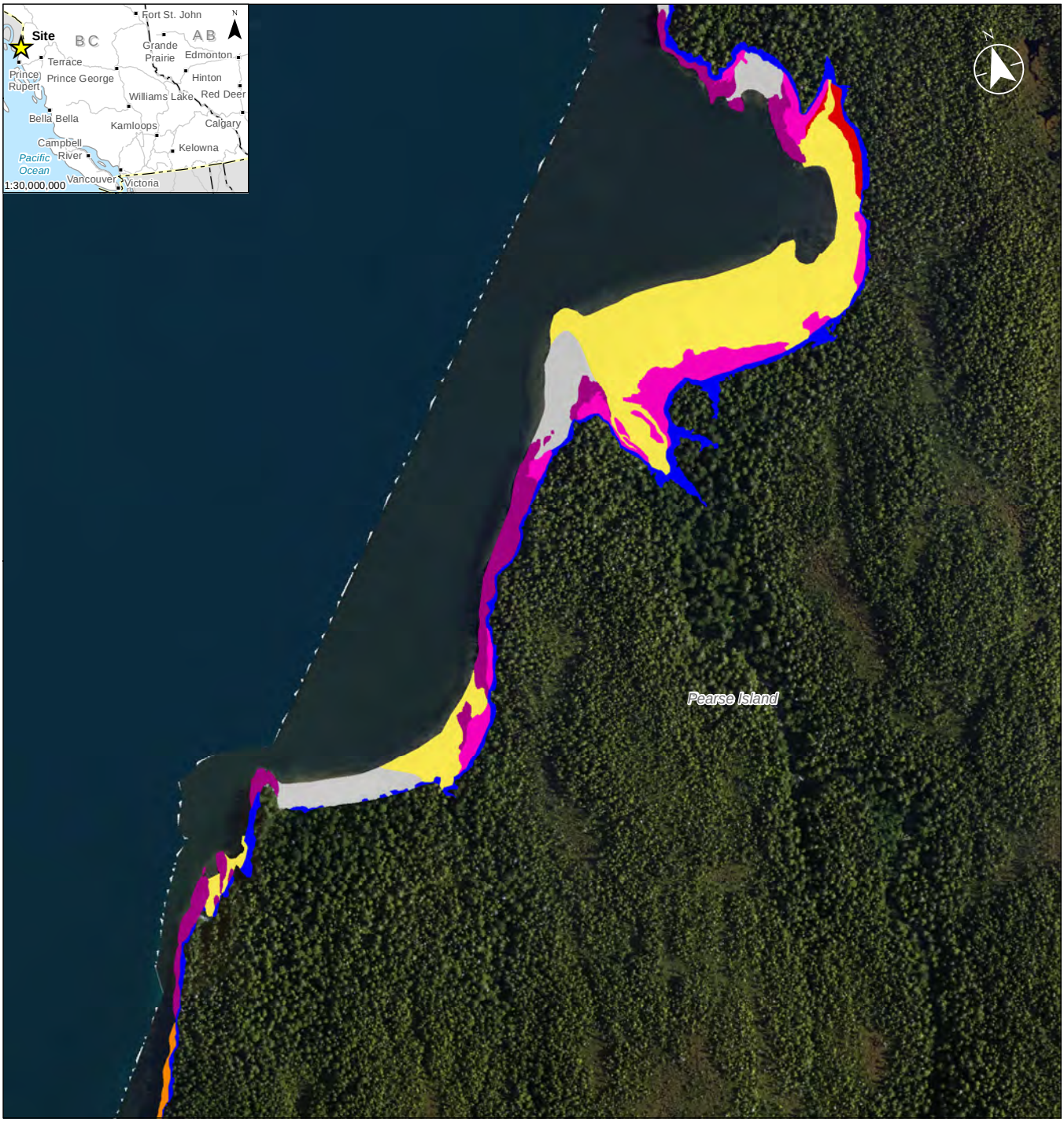

KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Substrate Type
- Cobble Dominated
- Cobble Dominated with Some Boulders
- Estuarine Marsh
- Estuarine Meadow
- Exposed Bedrock
- Gravel Dominated
- Shoreline Fringe - Unclassified

0 50 100 150 200 250 m
1:7,500 (at original document size of 8.5x11)

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Figure No.
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Title
West Pearse Island Substrates

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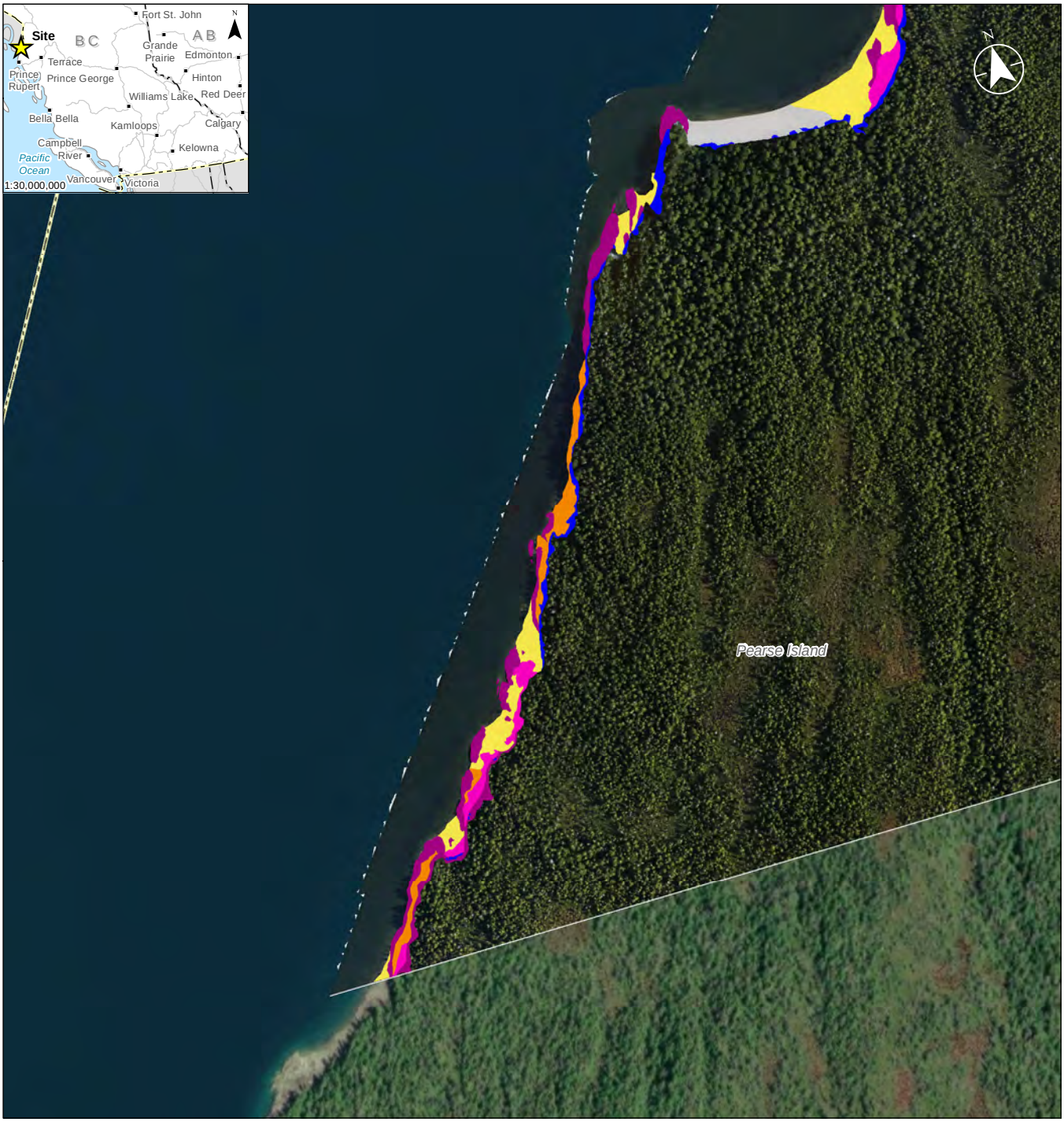

KSI LISIMS LNG

Substrate Type

- Cobble Dominated
- Cobble Dominated with Some Boulders
- Estuarine Meadow
- Exposed Bedrock
- Gravel Dominated
- Shoreline Fringe - Unclassified
- International Boundary

0 50 100 150 200 250 m

1:7,500 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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Figure No.
4.7-4

Title
West Pearse Island Substrates

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KSI LISIMS LNG

Low Water Mark
High Water Mark

Classification

Brown Algae
Sparse Brown Algae
International Boundary

0 60 120 180 240 300 m

1:7,000 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
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Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20220706
Requested by CMCRACKEN on 20220701
Check by SLEMAY on 20220706

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Natural Gas Liquefaction and Marine Terminal
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Figure No.
4.7-5

Title
Marine Biological Classification

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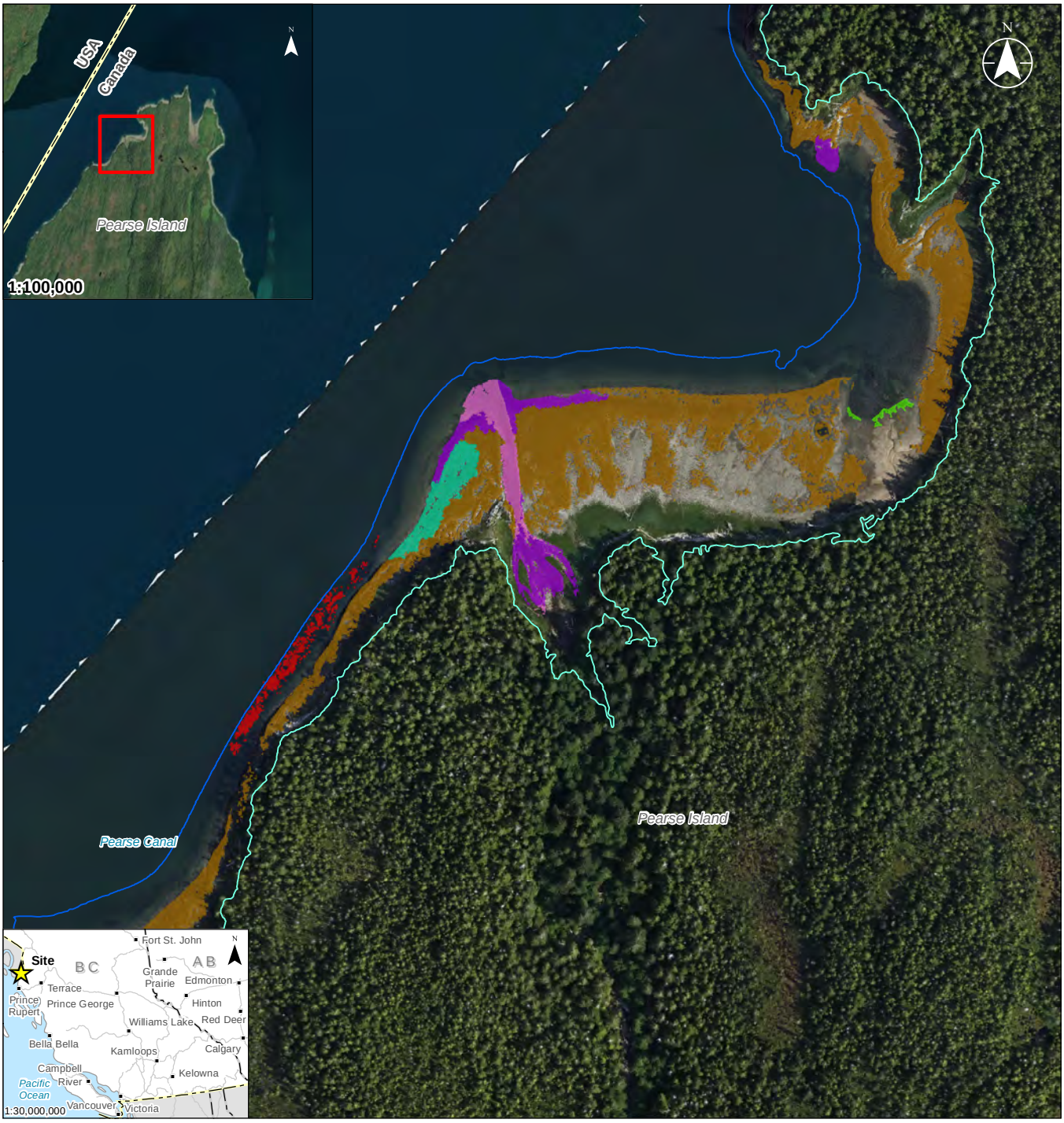

KSI LISIMS LNG

Notes
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3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

- Low Water Mark
- High Water Mark

Classification
- Brown Algae
- Bull Kelp
- Green Algae
- Mussel Bed
- Other
- Sparse Brown Algae
- International Boundary

0 40 80 120 160 200 m

1:5,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20220706
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Figure No.
4.7-5

Title
Marine Biological Classification

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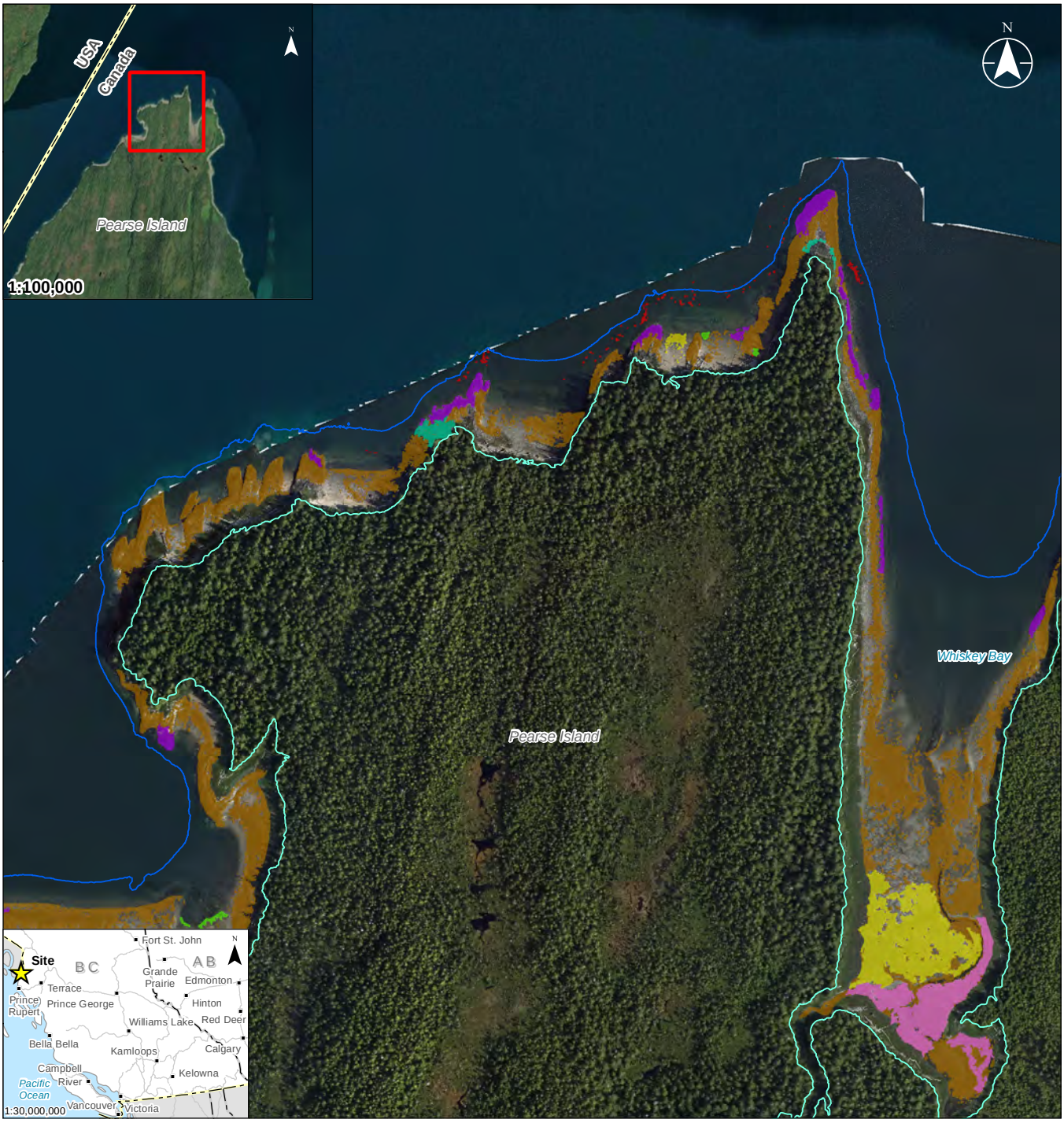

KSI LISIMS LNG

Notes
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3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

- Low Water Mark
- High Water Mark

Classification
- Brown Algae
- Brown Algae with Shells
- Bull Kelp
- Green Algae
- Mussel Bed
- Other
- Sparse Brown Algae
- International Boundary

0 60 120 180 240 300 m

1:7,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20220706
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Figure No.
4.7-5

Title
Marine Biological Classification

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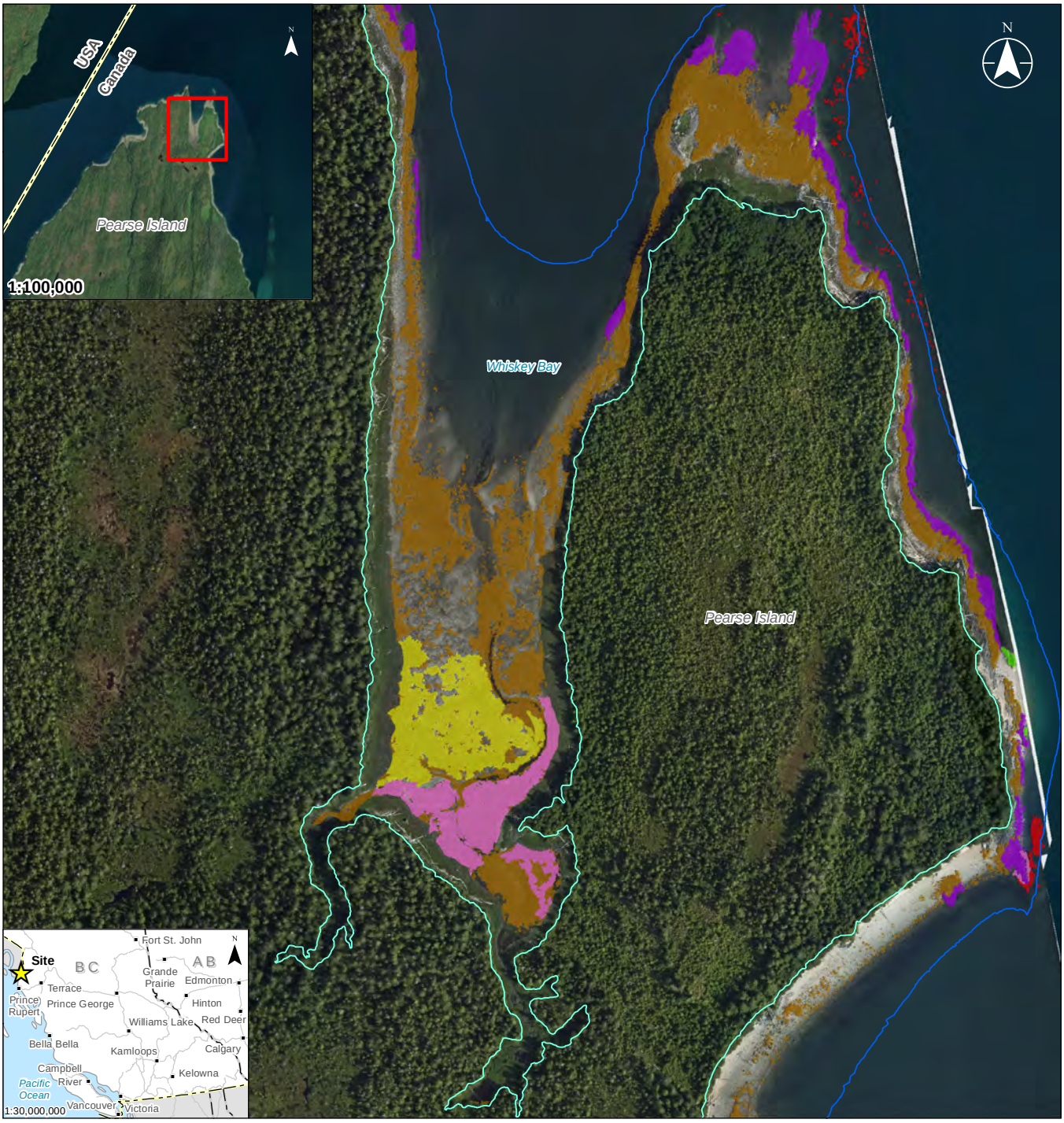

KSI LISIMS LNG

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- High Water Mark

Classification
- Brown Algae
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- International Boundary

0 50 100 150 200 250 m
1:5,500 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC
Project Number: 123221820
Prepared by TQUILICHINI on 20220706
Requested by CMCRACKEN on 20220701
Check by SLEMAY on 20220706

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.7-5

Title
Marine Biological Classification

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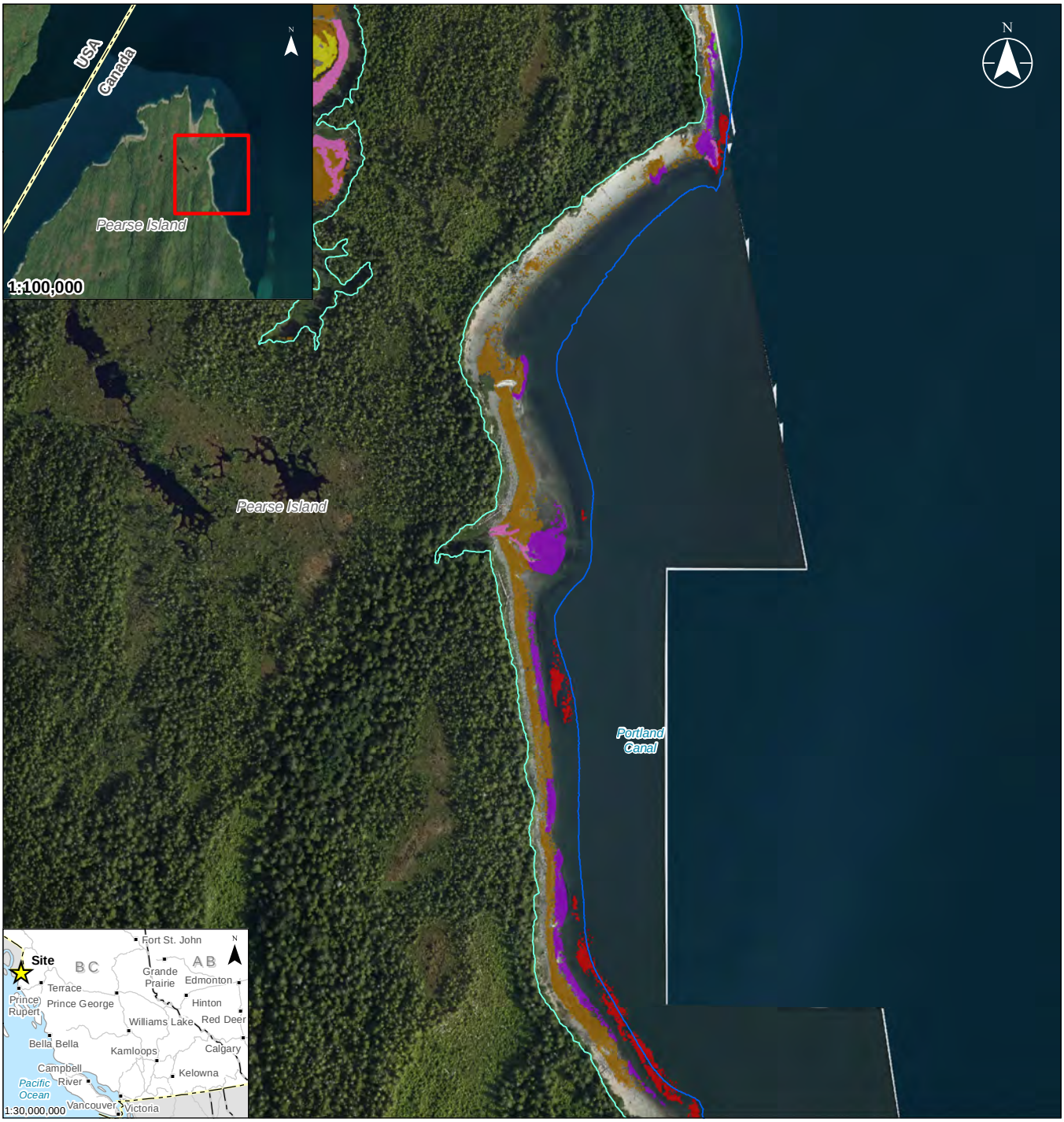
S:\123\2\projects\123221820\figures\reports\TDR\Marine\Fig4_7-5_123221820_248_rs_marine_vegetation.mxd Revised: 2023-09-07 By: tquilichini



KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

- Low Water Mark
- High Water Mark

Classification
- Brown Algae
- Brown Algae with Shells
- Bull Kelp
- Green Algae
- Mussel Bed
- Other
- International Boundary

0 60 120 180 240 300 m
1:7,000 (at original document size of 8.5x11)

Stantec

Project Location: Pearse Island, BC
Project Number: 123221820
Prepared by TQUILICHINI on 20220706
Requested by CMCRACKEN on 20220701
Check by SLEMAY on 20220706

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.7-5

Title
Marine Biological Classification

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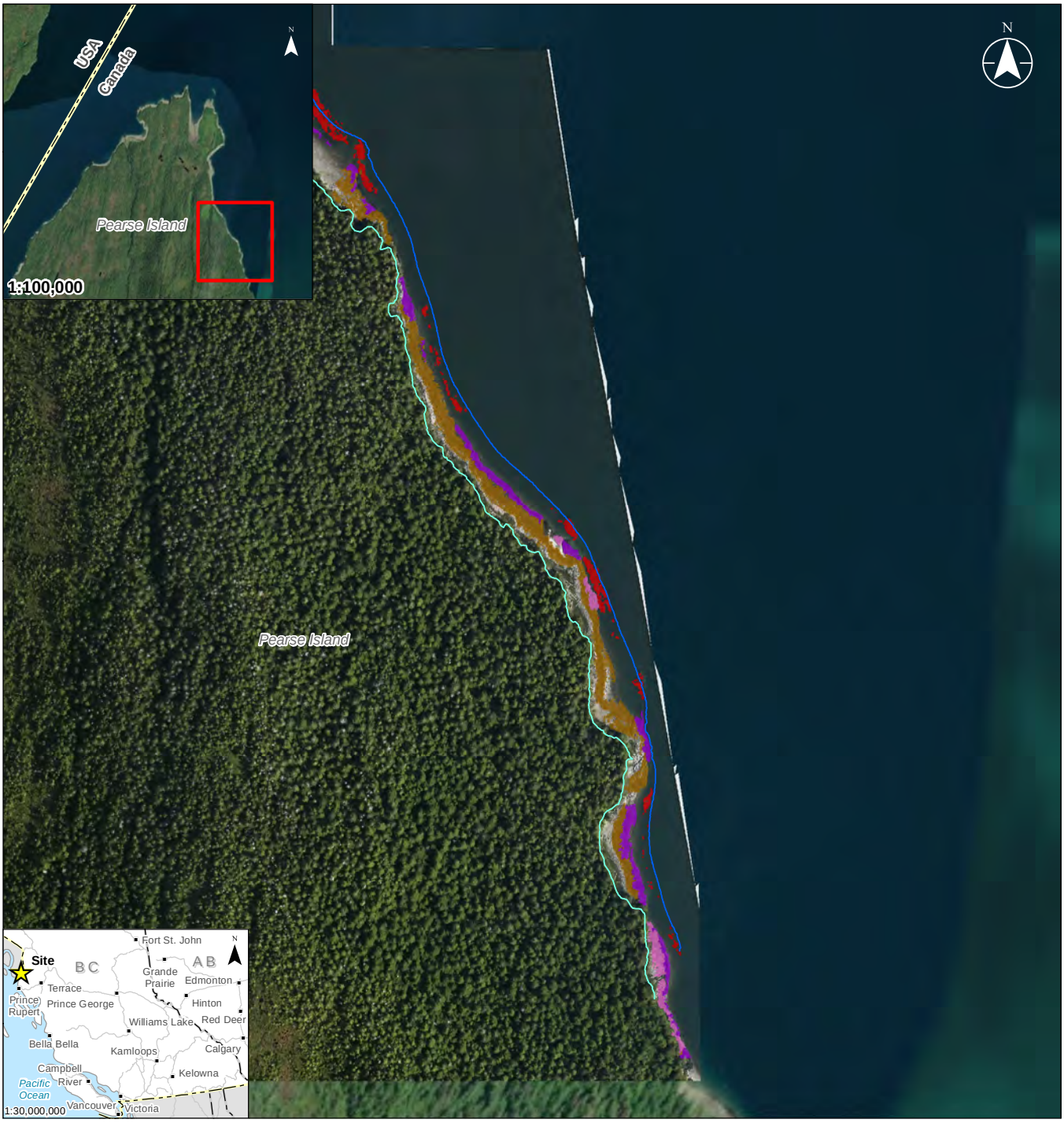

KSI LISIMS LNG

Low Water Mark
High Water Mark

Classification

- Brown Algae
- Bull Kelp
- Mussel Bed
- Other

International Boundary

0 60 120 180 240 300 m

1:7,000 (at original document size of 8.5x11)

Notes

1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
3. Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Stantec

Project Location:
Pearse Island, BC

Project Number: 123221820
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Requested by CMCRACKEN on 20220701
Check by SLEMAY on 202200706

Client/Project/Report

Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.

4.7-5

Title

Marine Biological Classification

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4.8 UNDERWATER ACOUSTIC RECORDINGS

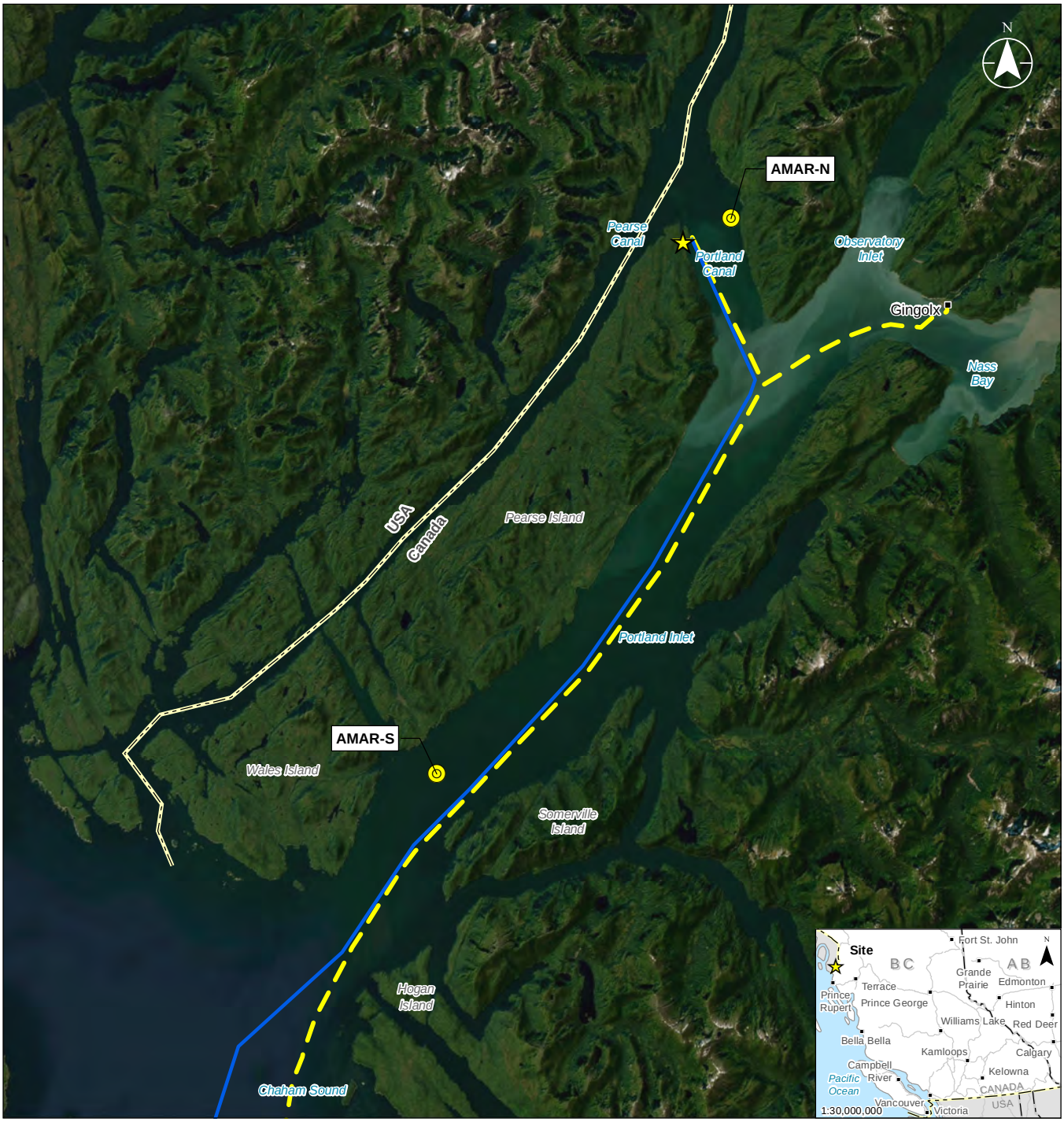
4.8.1 Introduction

JASCO Applied Sciences (JASCO) deployed two acoustic recorders at the northern end of Pearse Island and near the mouth of Portland Inlet. The acoustic recorders were deployed over two consecutive monitoring periods from June 2021 to August 2022 to characterize the underwater soundscape and the acoustic occurrence of marine mammals in the area. The Projects Underwater Noise Monitoring Report (JASCO 2022a) is provided in Appendix I, the methods and results from this report are summarize below.

4.8.2 Methods

Underwater acoustics was recorded using calibrated Autonomous Multichannel Acoustic Recorders – Generation 4-5.1 (AMAR G4-5.1). The acoustic recorders were deployed at two stations in Portland Inlet: one acoustic recorder (AMAR-N) was deployed in June 2021 approximately 40 km up from the mouth of the inlet (55.03513° N, -130.145° W) near to the proposed FLNG export facility (Figure 4.8–1) and the second (AMAR-S) was deployed in August 2021 near the mouth of the inlet (54.7545° N, -130.38° W), adjacent to Wales Passage.

The recorded data was analyzed to quantify the area's underwater soundscape, detect vessel noise and marine mammals (see Appendix J for detailed Ambient Data Analysis).



KSI LISIMS LNG

Acoustic Recorder Deployment Location

Site

Marine Shipping Route

Materials and Supply Shipping Route

International Boundary

0 2 4 6 8 10 km

1:330,000 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada

Stantec

Project Location:
Pearse Island, BC

Project Number: 123221820
Prepared by TQUILICHINI on 20220615
Requested by CMCCRACKEN on 20220601
Check by SMOSS on 20220615

Client/Project/Report
Ksi Lisims LNG
Natural Gas Liquefaction and Marine Terminal
Technical Data Report - Marine Resources

Figure No.
4.8-1

Title
Acoustic Recorder Deployment Locations

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4.8.3 Results

4.8.3.1 Ambient Sound

The overall broadband sound levels for the two stations are provided in Table 4.8–1. The largest contributor to the soundscape at both stations was at low frequency (below 100 Hz) and was a combination of flow noise and vessel traffic. Tide-induced flow noise was highest at AMAR-N than at AMAR-S and AMAR-S had lower sound levels on the flood than on the ebb tide whereas tidal flow was consistent during flood and ebb at AMAR-N. Vessel traffic was also a soundscape contributor and increase sounds levels in the 40 to 315 Hz range and demonstrates that both stations are near a minor shipping lane.

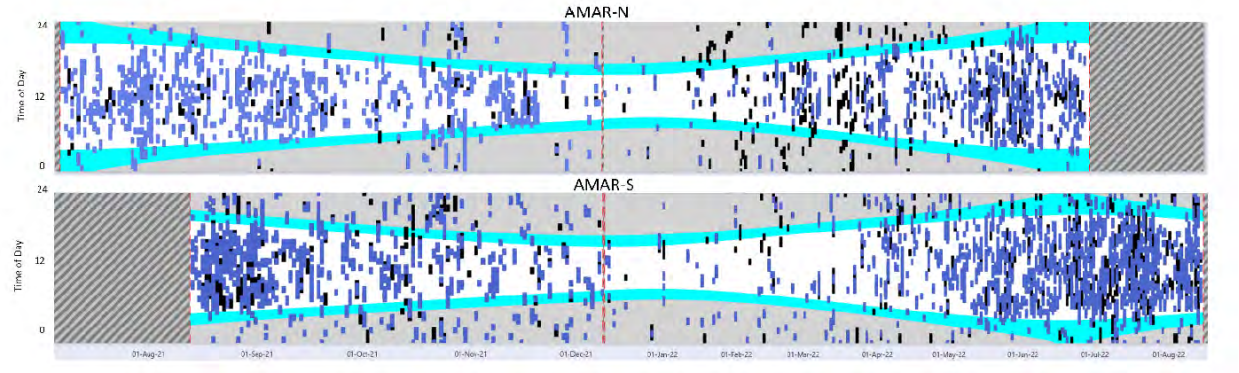
Rainfall noise is apparent at both stations but was greater at AMAR-N due to the shallower deployment depth. Wind and precipitation levels were higher in October to April than in the summer, which drove sound level in the 10 to 10,000 Hz range.

Table 4.8–1 Broadband Percentile Levels for Each Deployment

Percentile Level	AMAR-N		AMAR-S	
	Deployment 1	Deployment 2	Deployment 1	Deployment 2
Min	78.9	80.3	78.9	79.8
L_5	81.5	81.8	82.2	82.1
L_{25}	88.3	87.3	92.5	90.5
L_{50}	96.9	96.8	99.4	97.8
L_{75}	106.2	108.2	105.9	107.5
L_{95}	122.7	126.8	128.7	134.9
Max	142.9	147.1	145.2	159.9
Mean	116.8	120.6	120.8	130.1

4.8.3.2 Vessel Noise Detection

Vessel detections were continuous throughout the monitoring period at both stations, with a trend showing a decrease during nighttime hours. At both stations, vessel detection was greatest in the summer months and decreased from October to May (Figure 4.8–2). Days with the greatest number of vessel passes at AMAR-N were likely during the baseline marine mammal and fish surveys conducted for the Project. The other vessel activity at that location is likely from fishing and recreational activities. Vessel detection at AMAR-S is likely associated with fishing, recreational, and tourism activities. Both stations also experience occasional commercial traffic transiting to and from Stewart, BC.



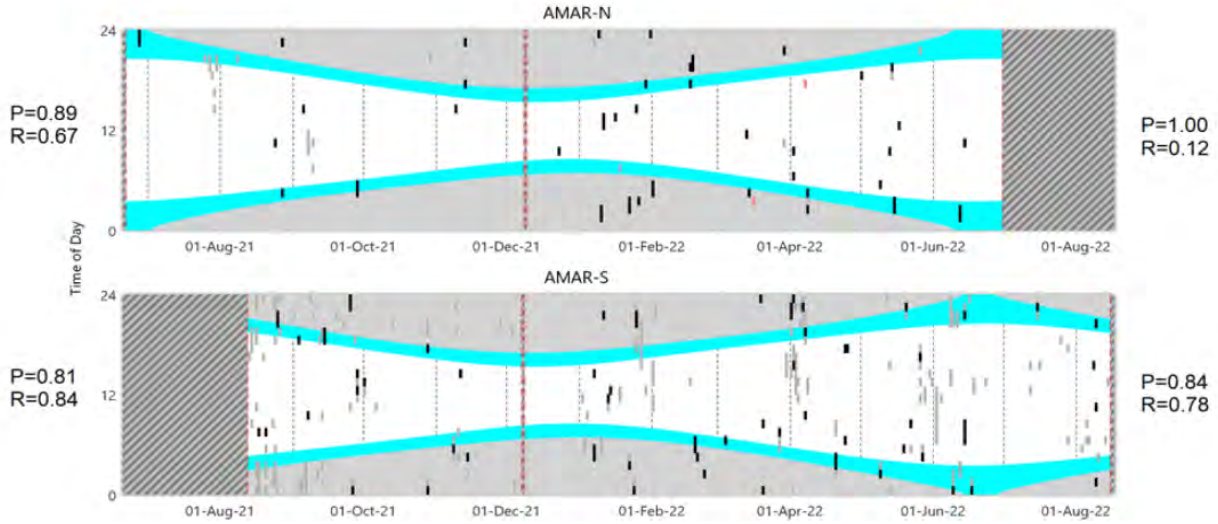
Note: Blacked out hours indicate automated detections of vessels, blue indicate boats. Red dashed lines indicate recorder deployment and retrieval dates. Shaded areas indicate hours of darkness from sunset to sunrise (data from Ocean Time Series Group 2009).

Figure 4.8–2 (Top) AMAR-N and (bottom) AMAR-S: Half hourly occurrence of vessels at the monitoring locations in Portland Inlet from Jun 2021 until Aug 2022.

4.8.3.3 Marine Mammals

Killer whales, harbour porpoises, harbour seals, and humpback whales acoustic signals were detected at both stations. No sea lions, grey whales, or Pacific white-sided dolphins were detected.

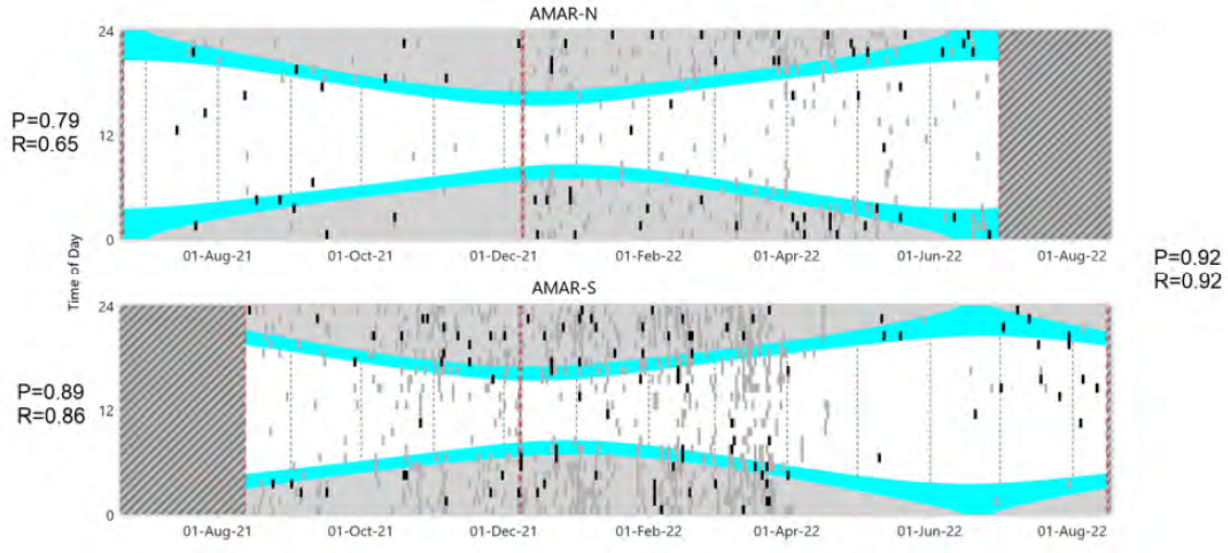
Killer whale clicks and tonal vocalization were detected at both stations. The detections occurred in pulses throughout the recording period, with no seasonal patterns or temporal trend observed. A few clusters of detection suggest that the same pod of killer whales were observed at both stations (e.g., January and early April; Figure 4.8–3). Killer whale detections were greater at AMAR-S, however the performance of the whistle detector was lower at AMAR-N and likely underrepresented the occurrence of killer whales.



Note: Greyed out hours indicate automated detections. Blacked out hours indicate confirmed occurrence. Red hours indicate possible detections. Red dashed lines indicate recorder deployment and retrieval dates. Shaded areas indicate hours of darkness from sunset to sunrise (data from Ocean Time Series Group 2009). Automated detector results for Deployment 1 are on the left and Deployment 2 on the right for both stations.

Figure 4.8–3 Killer whales: Daily and hourly occurrence of whistles during the recording period (June 2021 to August 2022) at (top) AMAR-N and (bottom) AMAR-S.

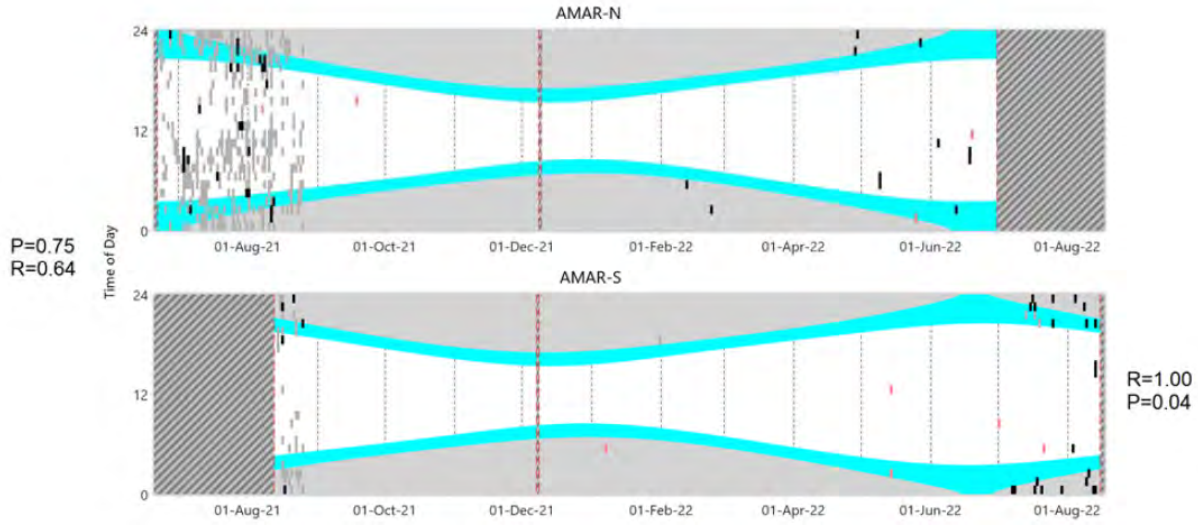
At AMAR-N, Dall's porpoises signals were detected sporadically during the first recording period and became more common and stable during the second recording period. Click detections were higher at AMAR-S than AMAR-N, and had a clear seasonal signal. Click detections increased in late October and through to the end of March when they abruptly stopped with only sporadic detections after (Figure 4.8–4). At both stations, detections were biased towards nighttime hours.



Note: Greyed out hours indicate automated detections. Blacked out hours indicate confirmed occurrence. Red dashed lines indicate recorder deployment and retrieval dates. Shaded areas indicate hours of darkness from sunset to sunrise (data from Ocean Time Series Group 2009). Automated detector results for Deployment 1 are on the left for both stations and combined for Deployment 2 on the right.

Figure 4.8–4 Harbour or Dall's porpoises: Daily and hourly occurrence of clicks during the first recording period (June 2021 to August 2022) at (top) AMAR-N and (bottom) AMAR-S.

Harbour seal vocalizations were predominately detected in July and August at both stations, with sporadic detections in May and June (Figure 4.8–5). Harbour seal roars displayed a diel pattern with vocalizations occurring primarily during nighttime at AMAR-S (Figure 4.8–5).



Note: Greyed out hours indicate automated detections. Blacked out hours indicate confirmed occurrence. Red hours indicate possible detections. Red dashed lines indicate recorder deployment and retrieval dates. Shaded areas indicate hours of darkness from sunset to sunrise (data from Ocean Time Series Group 2009). Automated detector results are combined for both stations for Deployment 1 on the left and Deployment 2 on the right for AMAR-S.

Figure 4.8–5 Harbour seals: Daily and hourly occurrence of vocalizations during the first recording period (June 2021 to August 2022) at (top) AMAR-N and (bottom) AMAR-S.

5.0 PREDICTIVE MODELLING

5.1 UNDERWATER NOISE MODELLING

5.1.1 Introduction

JASCO Applied Sciences Ltd. performed an underwater acoustic modelling study to predict the underwater sound levels generated by impact pile driving during construction, and by vessel transiting and berthing during Project operation. The goal of this study was to predict the extent of underwater ensonification (i.e., additional noise) from these activities and to define zones of potential effects on marine fauna based on sound level thresholds for auditory injury and behavioural disturbance. The complete report including full methods and results is included in Appendix J.

5.1.2 Methods

Sound propagation models were applied to assess underwater noise exposure of marine mammals and fish during marine terminal construction activities, as well as from terminal operation and marine traffic activities. This study applied both fish and marine mammal injury and behavioural disturbance criteria for impulsive and non-impulsive noise produced by various Project activities. JASCO's Marine Operation Noise Model was used to model acoustic fields from continuous noise sources (i.e., FLNG facility, drilling and vessels) whereas the full waveform modelling approach was used for impulsive sounds (JASCO 2022; see Appendix J for detailed modelling methods). The following scenarios were modeled:

1) Pile installation:
    a. Material off-loading facility (**MOF**) drilling and pile installation with bubble curtain
    b. Down the hole drilling for mooring anchors
2) Typical FLNG operation (FLNG noise only)
3) FLNG operation combined with noise during LNG carrier berthing (3 tugs)
4) One LNG carrier and one untethered escort tug transiting through Portland Inlet (opposite Work Channel) at a speed of 14 kts (Figure 5.1–1)
5) One LNG carrier transiting along the marine shipping route in upper Hecate Strait/eastern Dixon Entrance at a speed of 16 kts (Figure 5.1–1)

The results of underwater noise modelling are conservative because the worst-case noise production was used in each scenario. For example, although vibratory methods will be used for pile installation wherever possible, modelling was completed for impact hammer methods to provide a conservative estimate of noise. In addition, the maximum possible impact hammer strikes for pile installation within a 12-hour working period (2,250 for three piles at two locations per day) were assumed; JASCO 2022). Acoustic models of predicted sound were compared to underwater noise threshold values to determine the radius within which underwater noise exceeds thresholds for marine fish or marine mammals.

Model outputs are expressed as R_{max} (the maximum distance at which thresholds are exceeded) and $R_{95\%}$ (the maximum range at which thresholds are exceeded after 5% of the farthest points are excluded). $R_{95\%}$ is considered a more precise measure because it is less affected by potential outliers.

5.1.3 Results

Underwater noise modelling for marine fish was modeled only for Scenario 1A (pile installation at the MOF with bubble curtain mitigation because the existing thresholds are for impulsive noise sources (JASCO 2022). Distance to threshold of 210 dB re 1µPa (PK) for marine fish is 16 m (NMFS 2018; Table 5.1–1). Species-specific radii for mortality and potential mortal injury, recoverable injury and temporary threshold shifts are presented in Appendix J.

Table 5.1–1 Distance (m) to Underwater Noise Thresholds for Fish

Scenario		Threshold[1]	R_{max} (m)	$R_{95\%}$ (m)
1a	Pile installation (MOF) with bubble curtain	210 dB re 1µPa (PK)	16	16

NOTE:
[1] Best Management Practices for Pile Driving and Related Operation in BC (DFO 2003).

Underwater noise modelling for marine mammals was modeled for all five scenarios. The distance from underwater noise sources to threshold values for each modeled scenario are presented in Table 5.1–2. The threshold values are 160 dB re 1µPa (rms SPL) for impulsive noise (i.e. pile installation) and 120 dB re 1µPa (rms SPL) for non-impulsive noise (NMFS 2018). Species-specific radii for mortality and potential mortal injury, recoverable injury and temporary threshold shifts are presented in Appendix J.

Table 5.1–2 Distance (m) to Underwater Noise Thresholds for Marine Mammals

Scenario		Threshold[1]	R_{max} (m)	$R_{95\%}$ (m)
1a	Pile installation (MOF) with bubble curtain	160 dB re 1µPa (rms SPL)	5,330	3,450
		120 dB re 1µPa (rms SPL)	7,470	5,580
1b	Down the hole drilling for mooring anchors	120 dB re 1µPa (rms SPL)	6,410	4,963
2	Typical FLNG operation (FLNG noise only)	120 dB re 1µPa (rms SPL)	5,483	3,509
3	FLNG operation combined with noise during LNG carrier berthing (3 tugs)	120 dB re 1µPa (rms SPL)	13,630	11,540
4	One LNG carrier and one untethered escort tug transiting through Portland Inlet (opposite Work Channel) at a speed of 14 kts	120 dB re 1µPa (rms SPL)	37,850	28,220
5	One LNG carrier transiting along the marine shipping route in upper Hecate Strait/eastern Dixon Entrance at a speed of 16 kts.	120 dB re 1µPa (rms SPL)	24,500	20,790

NOTE:
[1] Thresholds are 160 dB re 1µPa (rms SPL) for impulsive and 160 dB re 1µPa (rms SPL) for non-impulsive noise (NMFS 2018).

KSI LISIMS LNG

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N
2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada

- Site
- LNG Carrier and Escort Tug (Portland Inlet, 14 knots)
- LNG Carrier (Dixon Entrance, 16 knots)
- International Boundary
- Highway
- Marine Shipping Route
- Open Water Marine Shipping Route
- Materials and Supply Shipping Route

0 7 14 21 28 35 km

1:1,000,000 (at original document size of 8.5x11)

Stantec

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Pearse Island, BC

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Prepared by TQUILICHINI on 20220907
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Figure No.
5.1-1

Title
Underwater Noise Vessel Transit Scenario Locations

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5.2 SEDIMENT SCOUR MODELLING

5.2.1 Introduction

5.2.1.1 Objectives

The objective of the sediment erosion modelling is to evaluate the effects of the proposed in-water Project footprint consisting of the MOF, FLNG loading platforms, and personnel dock piers on wave and current induced scour near the proposed structure and piers, and to understand the potential scour depth due to the Project footprint.

5.2.1.2 Methods

A two-dimensional (**2D**) hydrodynamic and sediment transport modelling was developed within the study area to evaluate the effects of the proposed LNG facility layout on hydrodynamic conditions and scour near the study area. The 2D hydrodynamic and sediment transport modelling was conducted in the MIKE 21/3 Coupled Model, which is a 2D hydrodynamic model with an integrated sediment transport modelling approach. The MIKE 21/3 Coupled model integrates Hydrodynamic (**HD**), Spectral Wave (**SW**), and Mud Transport (**MT**) modules to simulate various aspects of the integrated hydrodynamic process of tidal and wind induced currents, wind waves, river discharges, and sediment transport. The model was implemented using a flexible mesh (an unstructured triangular mesh) technique that allows for different spatial resolution as needed, in particular near and along the shoreline and in the vicinity of the proposed structures. The computational mesh consists of a horizontal domain. In the horizontal domain a finer mesh was applied near the shoreline and the proposed structures. The model was first calibrated using available physical oceanographic data consisting of waves, water levels, currents from historical observations, and Project field measurements. The calibrated model was used to model scour near the proposed structures under a storm condition.

5.2.1.3 Study Area

A large study area was selected for the purpose of the hydrodynamic modelling to allow for wind-wave growth and to eliminate model boundary effects on current, wave, and sediment transport processes. The extent of the study area was selected based on available bathymetric information and measured Project oceanographic data. Figure 5.2–1 shows the study area extending approximately 26.7 km by 44.7 km encompassing Nass Bay entrance, Portland Canal, Portland Inlet, Pearse Canal, and Observatory Inlet. Table 5.2–1 provides coordinates of the selected study area in UTM Zone 9.

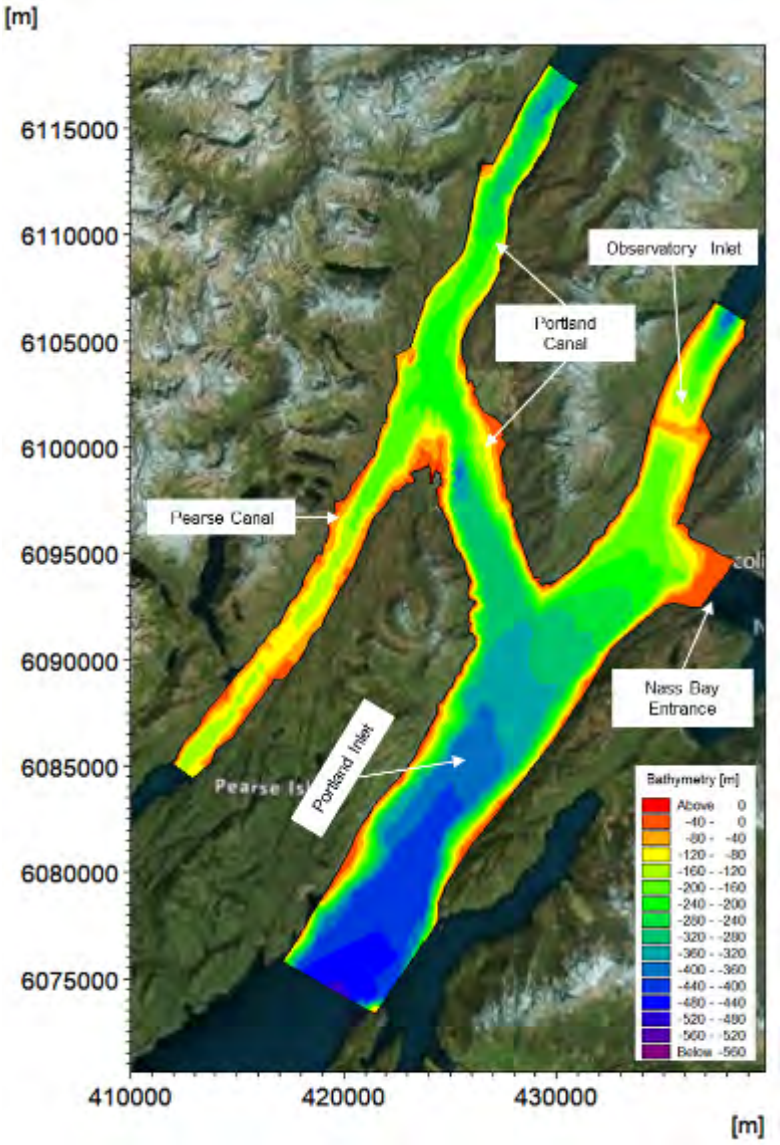

Figure 5.2–1 Study Area and 2D Model Domain (Bathymetry Are Shown With Respect to the Chart Datum)

Table 5.2–1 Extent of the Study Area

Extent	Coordinates (UTM NAD 83 Zone 9)	
	Easting (m)	Northing (m)
West	411837	6085058
South	421500	6073320
East	438575	6094722
North	429507	6118020

5.2.2 Methods

5.2.2.1 Existing Available Data

Bathymetry

Bathymetry is required to represent seabed elevations and shoreline features in the model domain. The following bathymetric data sources were used for the hydrodynamic modelling and to develop a 2D model computational model domain shown on Figure 5.2–1:

- Project bathymetric data provided by Allnorth in June 2021
- Canadian Hydrographic Service (CHS) NONNA 10 data and charts 3920 and 3994

Tide and Water Level

The tides along the coast of BC near this area are classified as mixed, mainly semi-diurnal with successive highs and lows of unequal heights. The tides in the area also have a spring-neap cycle where the tidal ranges that occur during the spring tides are approximately double that which occurs during the neap tides. CHS navigational charts provide tide levels due to astronomical tides. Table 5.2–2 summarizes predicted tidal levels within the study area at DFO station #9422 at Gingolx (Kincolith) near the entrance of Nass Bay and DFO station #9418 at Ranger Islet in Portland Inlet.

Table 5.2–2 Tide Levels Within the Study Area (Source From 2022 Tide Tables)

Tides	DFO Station #9422 (m, CD)	DFO Station #9418 (m, CD)
Highest Astronomical Tide	7.27	7.23
Higher High Water Large Tide (HHWLT)	7.19	7.12
Higher High Water Mean Tide (HHWMT)	6.12	5.95
High Water Level (HWL)	5.84	5.69
Mean Water Level (MWL)	3.81	3.73
Low Water Level (LWL)	1.76	1.78
Lower Low Water Mean tide (LLWMT)	1.30	1.33
Lower Low Water Large Tide (LLWLT)	0.08	0.05
Lowest Astronomical Tide	-0.07	-0.07

Wind

Accurate wind data is required for the purpose of hydrodynamic modelling. A meteorological station was installed for the purpose of the Project in August 2021 at Pearse Island. Figure 5.2–5 presents rose plot of wind speed and direction (from) for the period of August 2021 through August 2022, which indicates that the dominant wind directions are from the north, northeast, and southeast. Hourly average wind speed at this station varied between 0 and 9.3 m/s with an average of 1.7 m/s, and maximum hourly wind speed varied between 0 and 17.6 m/s with an average of 4.3 m/s. A review of average monthly wind speeds indicates that December and January had the highest average winds.

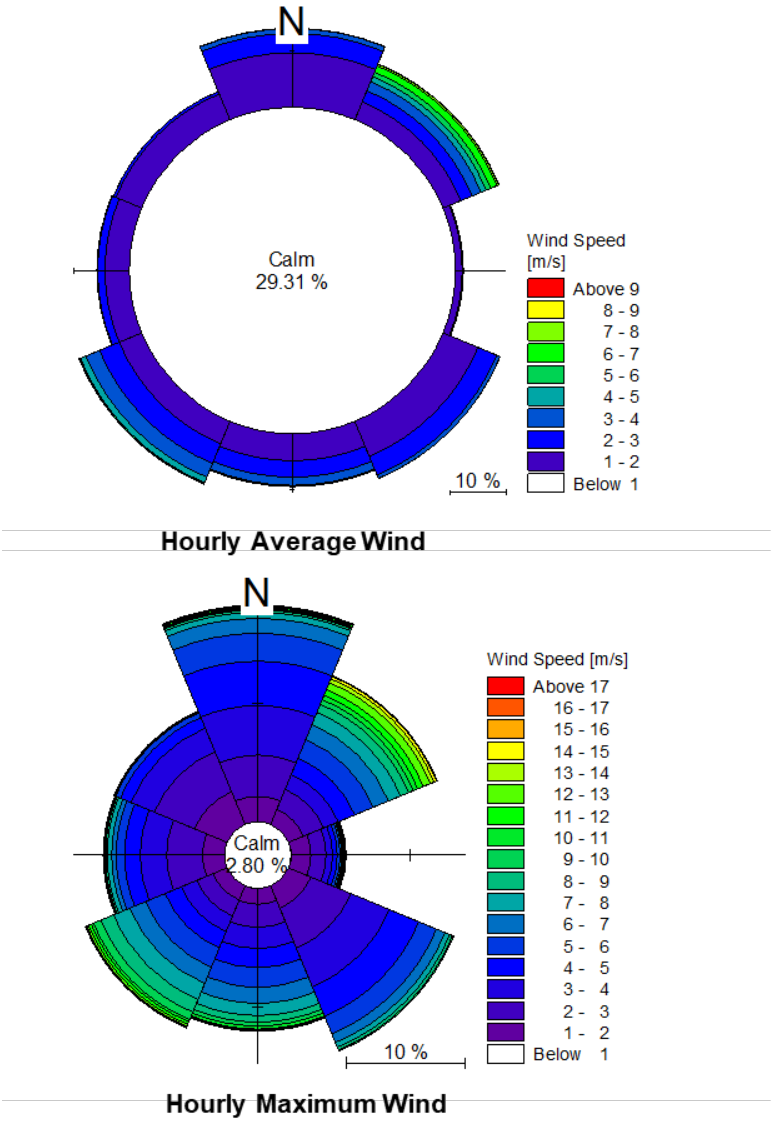

Figure 5.2–2 Wind Rose of Hourly Average and Maximum Wind Speed and Wind Direction (From) at the Project Climate Station at Pearse Island for the Period from August 2021 through August 2022

Wave and Current

Wave and current data were collected using an acoustic doppler current profiler (**ADCP**) for the period from June 2021 to February 2022 near the proposed MOF structure. Table 5.2–3 summarizes available current and wave data at this location.

Figure 5.2–3 shows a rose plot of significant wave height (Hs) and wave direction at 2 hours intervals for the period from June 2021 to February 2022. Hs varied between 0 and 0.76 with an average Hs of 0.14 m during this period. The dominant wave directions were from the north and southeast. The maximum Hs of 0.76 m was observed on January 3, 2022. Figure 5.2–4 shows time series of measured Hs during the period from June 2021 to February 2022.

Figure 5.2–5 shows rose plot of depth averaged current speed and near surface current direction at 30 minutes intervals for the period from June 2021 to February 2022. Current speed varied between 0 m/s and 0.91 m/s with an average current speed of 0.24 m/s. The dominant current directions near the surface were toward the north and south. Figure 5.2–5 shows time series of measured current speed during the period from June 2021 to February 2022.

Table 5.2–3 Project Wave and Current Data

Station Name	Coordinates		Available Data Records
	Easting (m)	Northing (m)	
Project ADCP	424689	6098330	• Wave data from 2021/06 to 2022/02 at 2 hours intervals. • Current data from 2021/06 to 2022/02 at 30 minutes intervals.

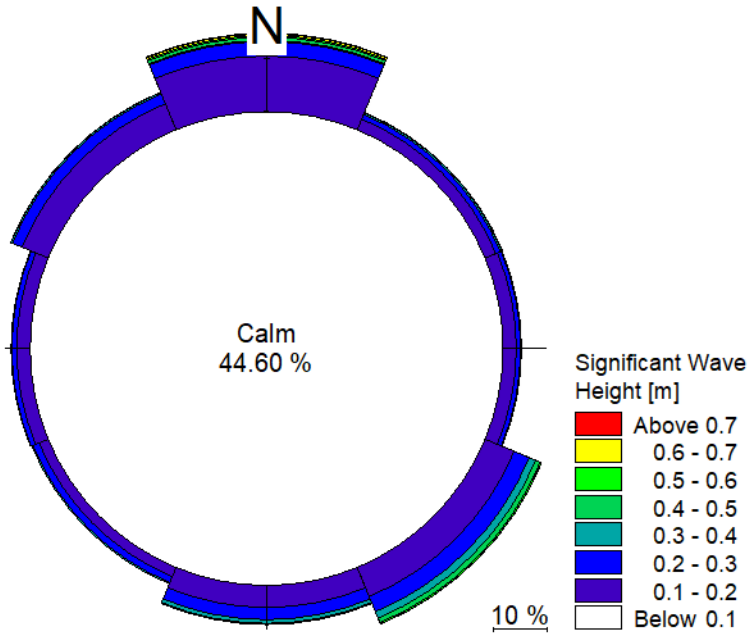

Figure 5.2–3 Rose Plot of Measured Significant Wave Height and Wave Direction (From) for the Period from June 2021 to February 2022

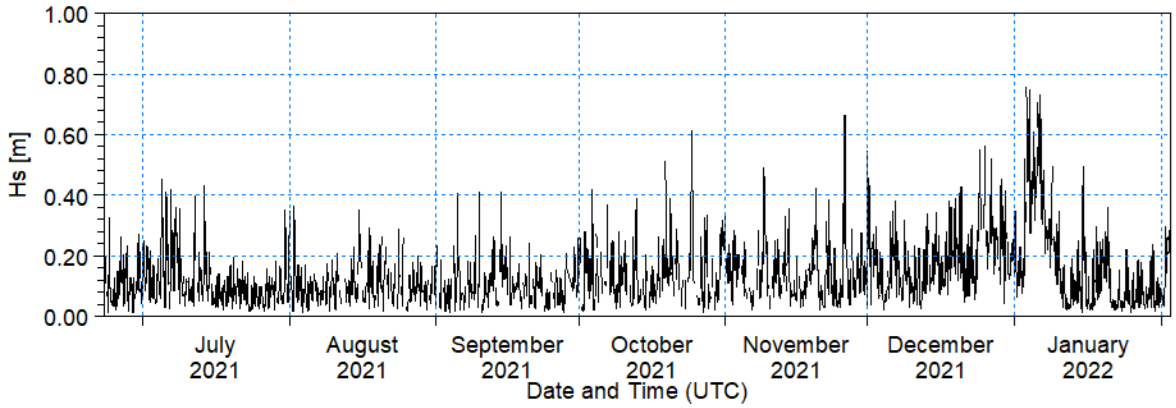

Figure 5.2–4 Time Series of Measured Significant Wave Height for the Period from June 2021 to February 2022

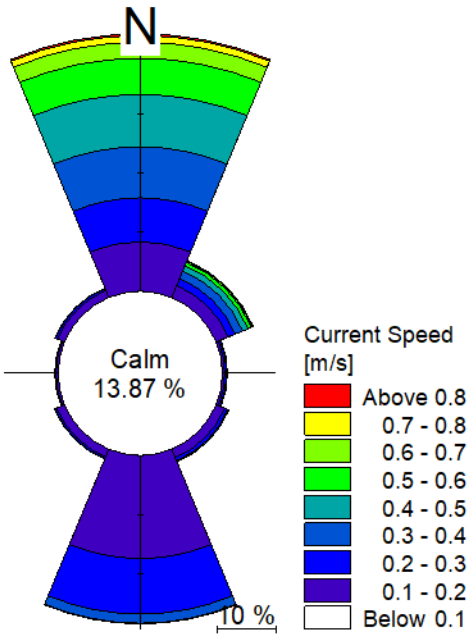

Figure 5.2–5 Rose Plot of Measured Current Speed and Direction (Toward) for the Period from June 2021 to February 2022

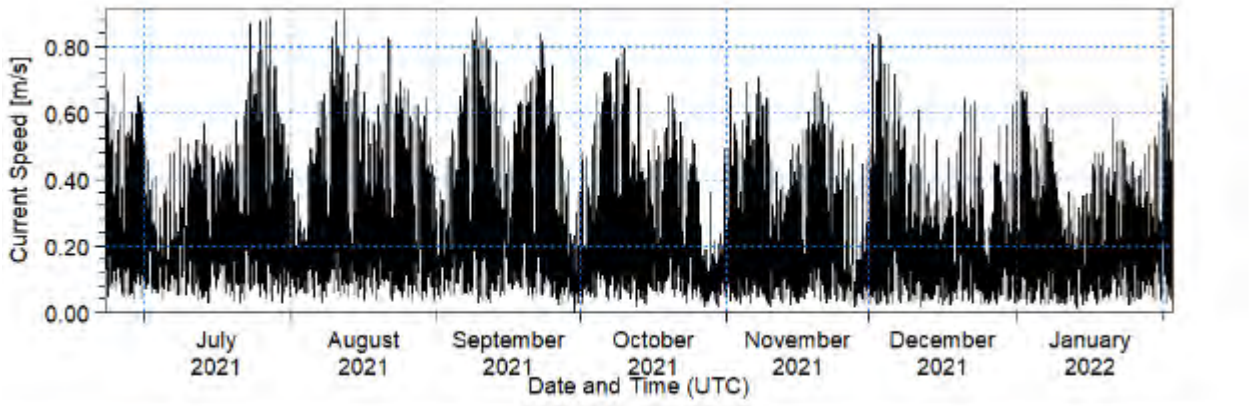

Figure 5.2–6 Time Series of Measured Current Speed for the Period from June 2021 to February 2022

Rivers Discharge

The Nass River and Bear River are the two main rivers draining into the study area. Table 5.2–4 summarizes data obtained from Water Survey of Canada (**WSC**) for the purpose of modelling.

The Nass River watershed is the third largest watershed in BC, covering an area of 20,700 km^2 and extending 380 km from the Coast Mountains to Portland Canal on the Pacific Coast (Connors et al. 2019). The Nass River drains into the study area at entrance of Nass Bay. Discharge data in the river has been monitored at WSC station 08DB001 above Shumal Creek since 1929. Watershed area of the Nass River at this station is 18,400 km^2. Figure 5.2–7 presents statistics of the mean monthly and minimum and maximum daily discharge in the river for the period from 1929 through 2020. Daily discharge at this station varied between 24.4 m^3/s and 9,460.0 m^3/s with an average daily discharge of 806.8 m^3/s. The minimum and maximum daily discharge were observed on March 16, 1948 and October 15 and 16, 1961, respectively. A review of mean monthly discharge in the river indicates that overall, low flows occur from December to April; flow in the river rises in May and June due to spring freshet. Figure 5.2–8 shows real-time flow data at 5 minutes intervals for the period of 2021 through August 2022, which indicates that a high flow event occurred on June 3, 2021 with the peak flow of 5,450 m^3/s.

WSC station 08DC006 on the Bear River above Bitter Creek monitored discharge in the river for the period of April 1967 through March 1999. This station is located approximately 15 km upstream of Portland Inlet and has a watershed area of 350 km^2. Figure 5.2–9 presents statistics of the mean monthly and minimum and maximum daily discharge in the river for the period of 1967 through 1999. Daily discharge at this station varied between 0.9 m^3/s and 225.0 m^3/s with an average daily discharge of 25.4 m^3/s. Since no recent discharge records were available at this station, daily discharge in the Nass River at WSC station 08DB001 was compared with daily discharge in the Bear River at WSC station 08DC006 for the period of April 1967 to March 1999. Figure 5.2–10 shows results of this comparison and indicates that there is a satisfactory relationship between daily discharge in the rivers with a coefficient of determination (R^2) of 0.61.

Table 5.2–4 Nass River and Bear River Discharge Records

Station Name	Station ID	Coordinates		Available Data Records
		Easting (m)	Northing (m)	
Nass River Above Shumal Creek	08DB001	494528	6124161	• Daily discharge from 1929/06 through 2020/31. • 5 minutes discharge from 2021/01 through 2022/08.
Bear River Above Bitter Creek	08DC006	442374	6211227	• Daily discharge from 1967/04 through 1999/03.

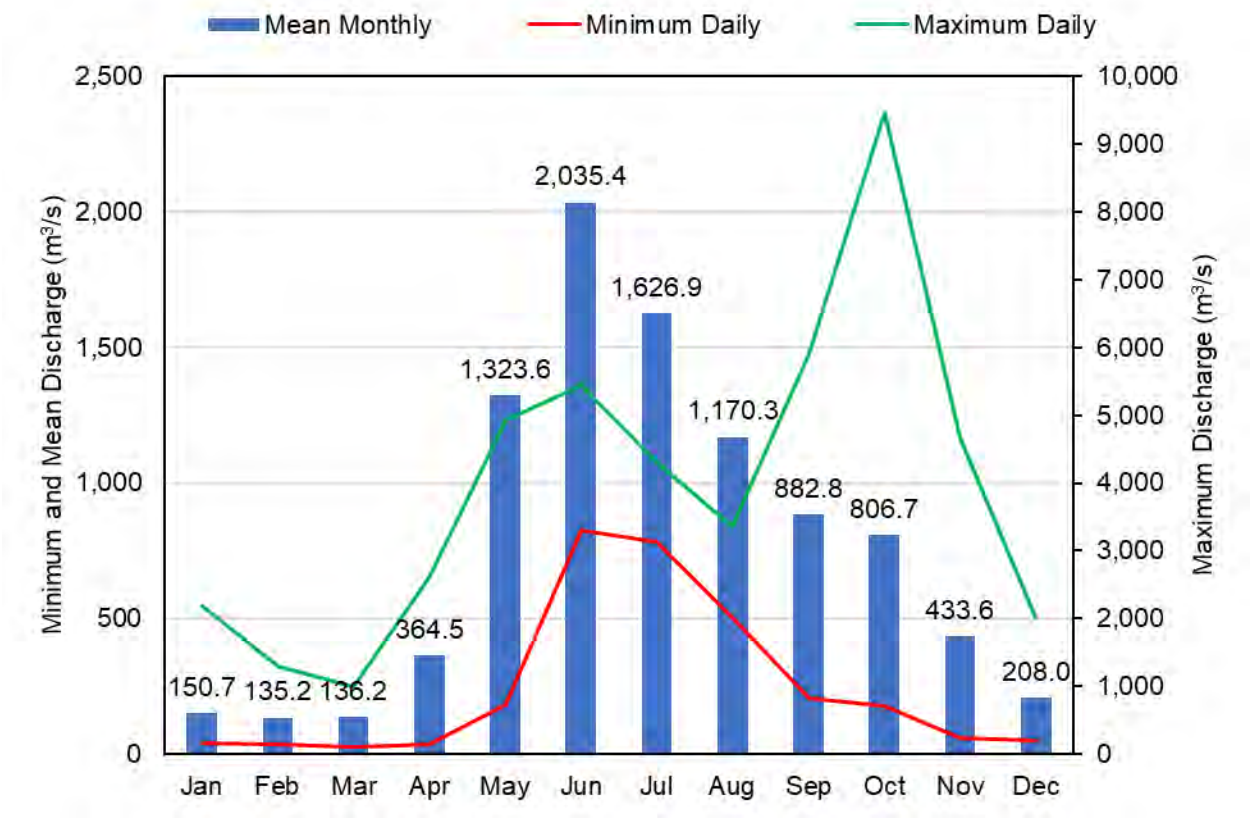

Figure 5.2–7 Mean Monthly, Minimum and Maximum Daily Discharge in the Nass River at WSC 08DB001 above Shumal Creek for the Period from 1929 through 2020

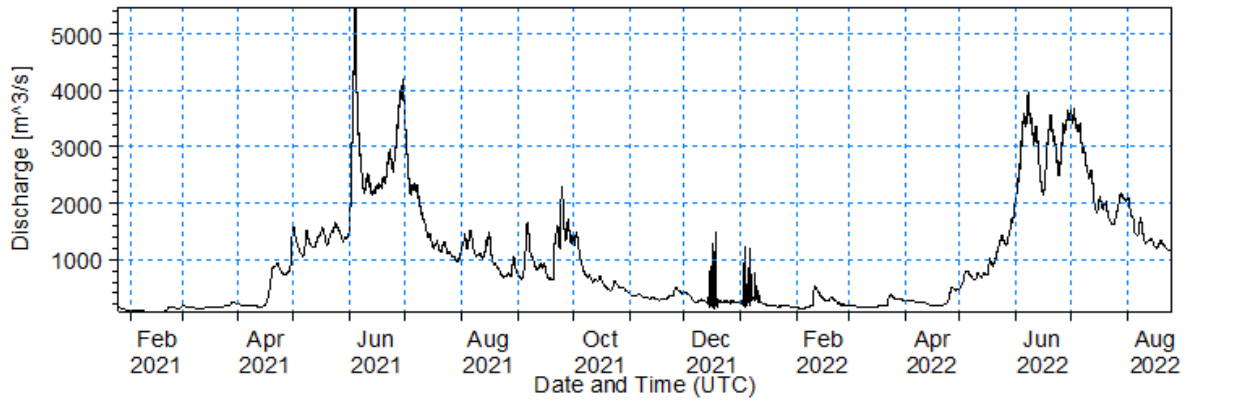

Figure 5.2–8 Discharge in the Nass River at 5 Minutes Intervals at WSC 08DB001 Above Shumal Creek for the Period from 2021 Through 2022

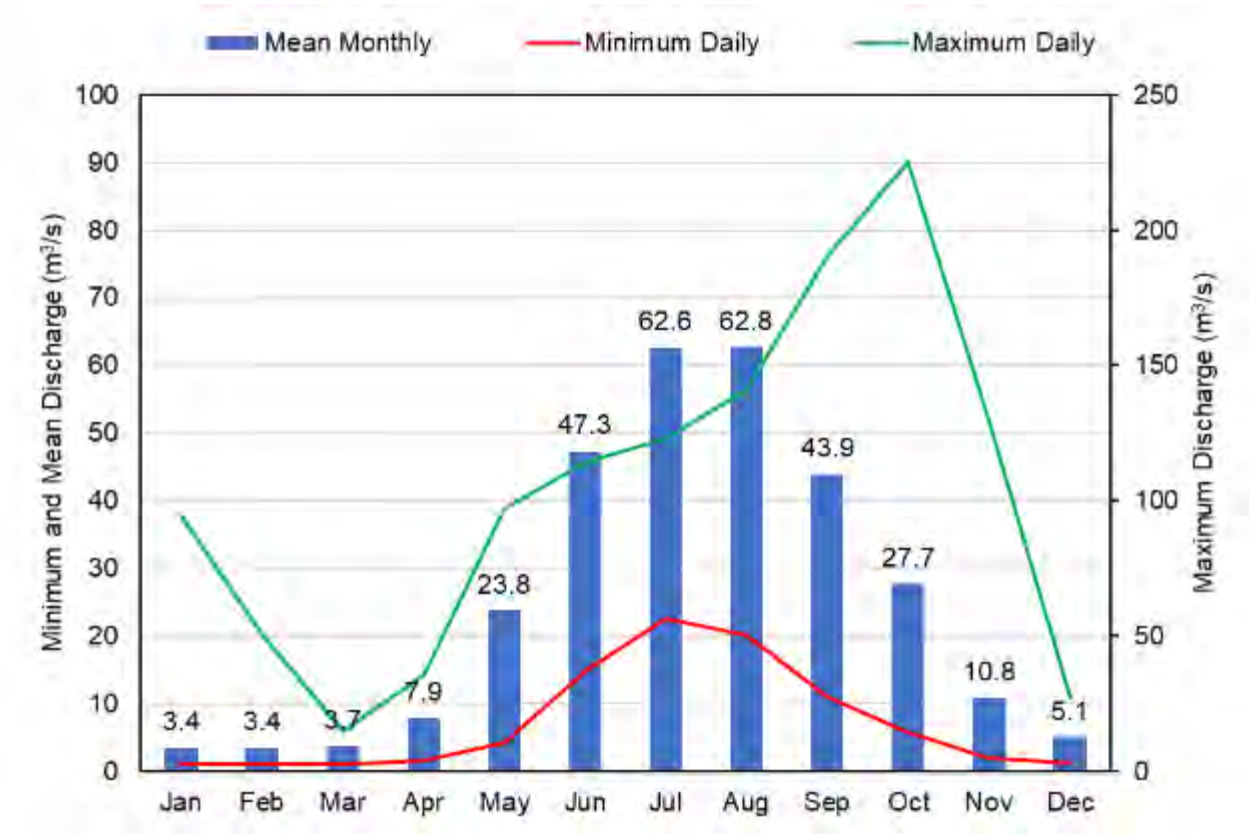

Figure 5.2–9 Mean Monthly, Minimum and Maximum Daily Discharge in the Bear River at WSC 08DC006 above Bitter Creek for the Period from 1967 through 1999

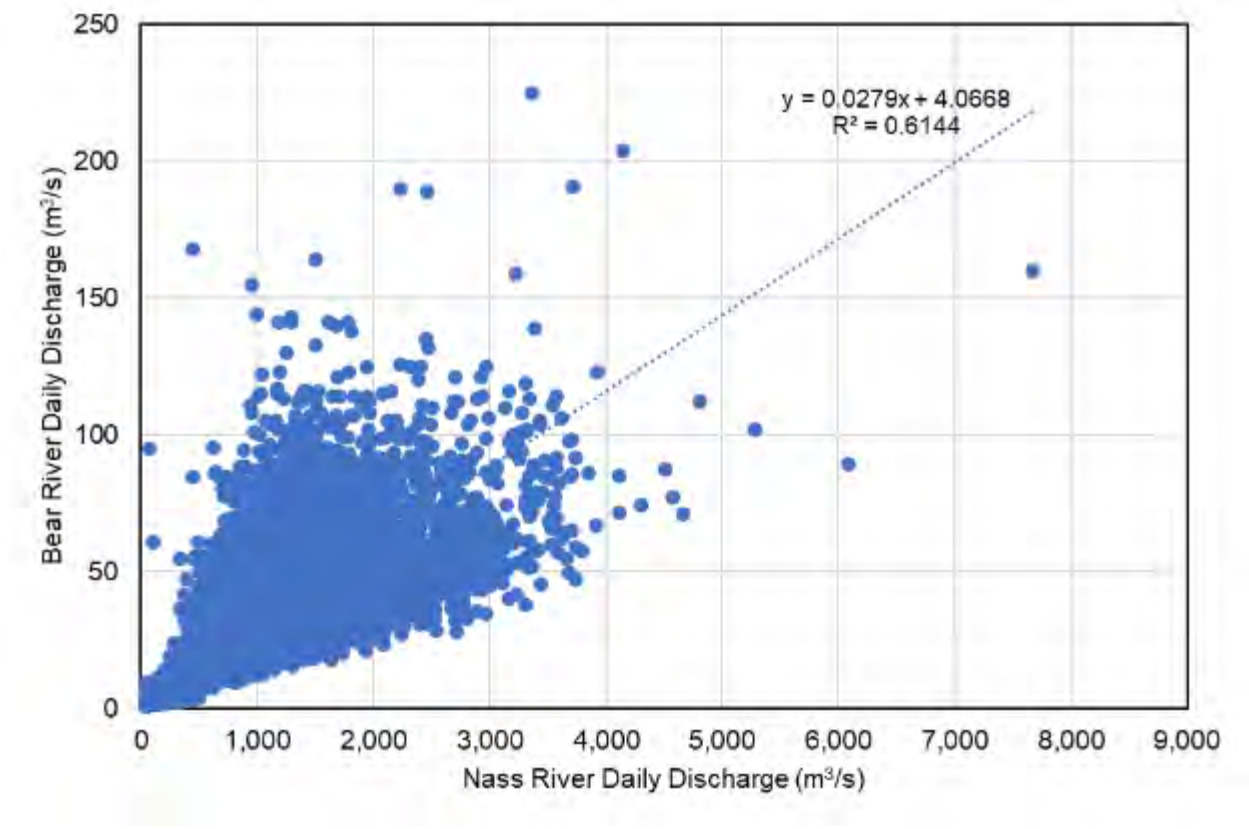

Figure 5.2–10 Daily Discharge in the Nass River Versus Bear River

Sediment

The sediment samples collected in May 2022 were analyzed for grain size distribution. It is important to note that the samples were collected from the surface and represent surficial bed composition. The median grain size (D50) of the sediment samples varied between 0.125 to 0.3 mm, indicating that the near surface bed sediment within the study area mainly consists of fine sand. The average sediment fractions consist of 17% clay, 18% silt, 58% sand, and 7% gravel. To evaluate scour, critical shear stress and erosion rate of bed are required. As a conservative assumption, the smallest D50 of 0.125 mm was used to calculate critical shear stress of bed. According to the United States Geological Survey (**USGS**) (2008), a critical shear stress of 0.145 Pa was estimated for bed based on D50 of 0.125 mm. Since the samples consist of fine sediment (i.e., silt and clay), the following modified Simon et al. (2011) equation was used to estimate erosion rate (k) as a function of critical shear stress (τ_c):

$$k = 1.62\tau_c^{-0.838}$$

The erosion rate of bed material is estimated to be 8.2 cm^3/(N.s). Resistance of fine sand against current and wave induced erosion is low. Results of the geotechnical investigation consisting of boreholes are required to characterize existing bed material over depth. Results of this investigation are not available at the time of writing; however, a review of preliminary Project design drawings indicates that a bedrock layer exists within approximately 4–5 m of the existing seabed and the proposed piers consisting of steel piles will be tie-in into the bedrock layer. Bedrock layers have a high resistance against erosion. Stokes' Law was used to calculate settling velocity for the sediment based on D50 of 0.125 mm. A constant settling velocity of 0.014 m/s was estimated based on D50.

5.2.2.2 Model Setup and Calibration

The MIKE 21 Coupled Model was used to simulate hydrodynamic and wave conditions and sediment transport within the study area. Hydrodynamic (HD), SW, and MT modules in the MIKE 21/3 Coupled Model were used to simulate various aspects of the integrated hydrodynamic process of water levels, wave and wind climates, and sediment transport, including deposition and erosion processes. The following are a brief description of each module used in this study:

- HD Module – simulates unsteady flow, taking into account density variations, bathymetry, and external forcings in rivers, lakes, estuaries, and coastal areas. The modelling system is based on a numerical solution of the 2D incompressible Reynolds averaged Navier-Stokes equations, subject to the assumptions of Boussinesq and hydrostatic pressure. Thus, the model consists of continuity and momentum equations, and it is closed by a turbulent closure scheme (DHI 2019a). The HD module can be extended to simulate interactions of currents, waves, and sediment transport processes
- SW module – a third generation spectral wind-wave model that simulates the growth, decay, and transformation of wind-generated waves and swells in offshore and coastal areas. The model includes the following physical phenomena: wave growth by action of wind, non-linear wave interaction, dissipation due to white-capping, bottom friction and breaking, refraction and shoaling due to depth variation, and wave-current interaction
- MT Module – simulates the erosion, transport, settling, and deposition of fine sediment in marine, brackish, and freshwater environments. The MT module also takes into account fine-grained and noncohesive material. The MT module is an add-on module to the HD module. The main features of the MT module are multiple sediment fractions, multiple bed layers, flocculation, hindered settling, inclusion of non-cohesive sediments, bed shear stress from combined currents and waves, consolidation, morphological update of bed, and tracking sediment spills (DHI, 2019b)

Available bathymetric data was used to create a model domain using a flexible mesh technique. The following sections describe computational model domain creation and model inputs and boundary conditions.

Computational Domain and Mesh

A well-structured computational mesh based on available Project and CHS data was developed for the study area. Figure 5.2–11 shows model domain and generated mesh near the proposed Project location. The generated mesh contains 8,002 nodes and 15,197 elements. Resolution of the mesh and time-step governs the Courant number developed in the model set-up. The Courant number affects the numerical stability of the model. The mesh was optimized based on the level of details required in the vicinity of the Project footprints in the ocean and the amount of computational time necessary to run the model.

Key parameters for the domain and boundaries of the coupled model were set up as follows:

- Model domain – The MIKE 21 model is based on flexible mesh approach. In this study, in the horizontal domain an unstructured mesh was used
- Coastal boundary – The coastal boundary was defined by the shoreline. The model treated this boundary as solid, with no wave or current transmission
- Offshore boundary – The offshore upstream boundaries were set in Observatory Inlet and Portland Canal and the downstream boundaries were set in Pearse Canal and Portland Inlet, as shown on Figure 5.2–1. The boundary conditions were tide and rivers discharge
- Nass and Bear rivers discharge – The river boundaries were set at the entrance of Nass Bay and upstream boundary of Portland Canal for the Nass River and Bear River, respectively. The boundary conditions were defined as discharge rate
- Domain wind forcing – Measured wind speed and direction data at the Project's meteorological station were used to simulate wind-driven waves and currents. Wind speed and direction were applied as constant values in the domain and varied in time
- Domain bed resistance – The bed resistance in the hydrodynamic modelling was defined using Manning's roughness coefficient
- Coriolis forcing – Coriolis forcing is included in the modelling and varied in the domain
- Piers – Proposed piers in the Portland Canal were modelled using the MIKE 21 pier feature. Piers location, diameter, and height were input parameters

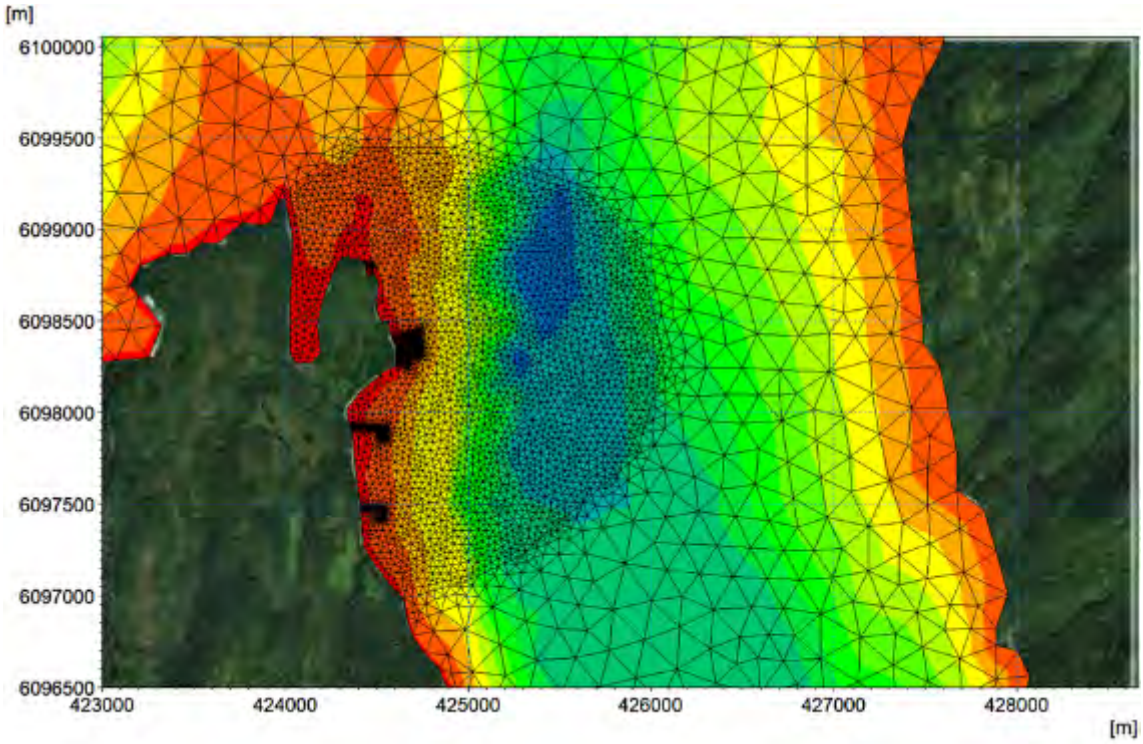

Figure 5.2–11 Close-up of Computational Mesh Nera the Proposed Project Footprint in Portland Canal

Global Tide Model Setup and Calibration

The MIKE 21 Global Tide Model (**GTM**) can generate predicted tide data at specific locations. The GTM is available on a 0.125ºx0.125º resolution grid for ten major constituents in the tidal spectrum. The model uses the latest 17 years of multi-mission measurements from TOPEX/Poseidon, Jason-1, and Jason-2 satellite altimetry for sea level residuals analysis. Using these measurements, harmonic coefficients were calculated. The provided constituents consider the semidiurnal M2, S2, K2, N2, the diurnal S1, K1, O1, P1, Q1, and the shallow water constituent M4. A global set of tide gauge readings has been defined by the TOPEX/Poseidon ocean tide subcommittee for the investigation of ocean tide models on a common basis (Le Prevost et al. 1994). The GTM was validated by this set of tide gauges constructed from 102 tide gauges (42 in the Atlantic Ocean, 18 in the Indian Ocean, and 42 in the Pacific Ocean).

Based on the GTM, a time series of water levels for any period and any position on the globe can be extracted to create boundary conditions for local or regional models. The time zone for the extracted time series is given in UTC. According to needs of application, the timing can be adjusted to local time.

The GTM was used in this study to define tidal variations at the downstream boundaries of Pearse Canal and Portland Inlet and upstream boundary of Observatory inlet. The GTM model output was calibrated to predicted tides in 2021 at DFO station #9422 at Gingolx near the entrance of Nass Bay and DFO station #9418 at Ranger Islet in Portland Inlet. Figure 5.2–12 shows predicted tides by DFO and GTM at DFO stations 9422 and 9418 for the period of June 1 to December 31, 2021. Table 5.2–5 summarizes statistics of predicted tides at DFO stations 9422 and 9418 and indicates that there is a good agreement between predicted tides by DFO and GTM at these two locations with a coefficient of determination (R^2) of 0.99 and root mean square error (RMSE) of 0.1-0.2 m.

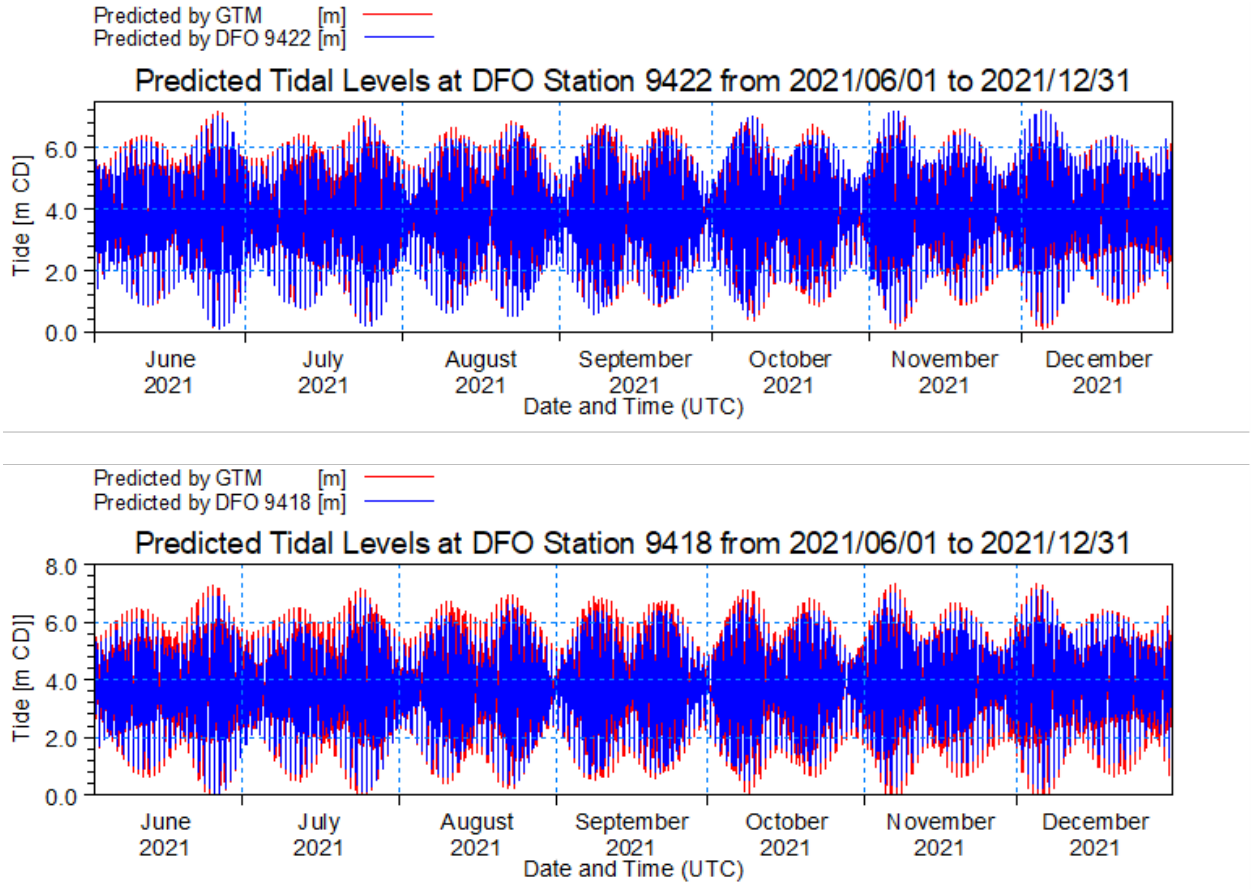

Figure 5.2–12 Predicted Tidal Levels by DFO and GTM for the Period of June 2021 Through December 2021 at DFO Stations 9422 and 9418

Table 5.2–5 Statistics of Predicted Tide by DFO and GTM at DFO Stations 9422 and 9418 for the Period from January 2021 through December 2021

Location	Minimum (m CD)	Maximum (m CD)	Mean (m CD)	R^2	RMSE (m)
Predicted at DFO #9422	0.10	7.20	3.80	0.99	0.1
GTM at DFO #9422	0.03	7.21	3.81		
Predicted at DFO #9418	0	7.10	3.73	0.99	0.2
GTM at DFO #9418	-0.026	7.31	3.74		

Spectral Wave Model Setup and Calibration

The MIKE 21 SW model simulates wind-driven waves and the process of wave generation, growth, propagation, and transformation. The wave model was constructed using available baseline mesh and available Project wind data. The wave model was calibrated to the measured significant wave height by the Project ADCP for the period from December 15, 2021 to January 12, 2022, when the maximum wave height was observed during the ADCP deployment period from June 2021 to February 2022. Figure 5.2–13 shows the simulated and measured significant wave height near the proposed MOF. Table 5.2–6 presents statistics of the measured and simulated wave heights near the proposed MOF for the period of simulation and indicates a good agreement between measured and simulated wave heights with an RMSE of 0.1 m. The following are the final parameters in the calibrated wave model:

- Bottom friction: the bottom friction in the wave model was defined using a Nikuradse roughness (kn). A kn value of 0.04 m was used in the calibrated model
- Steepness-induced dissipation: steepness-induced dissipation, also known as white capping, was used in the SW module. The default SW module values were used in the calibrated model

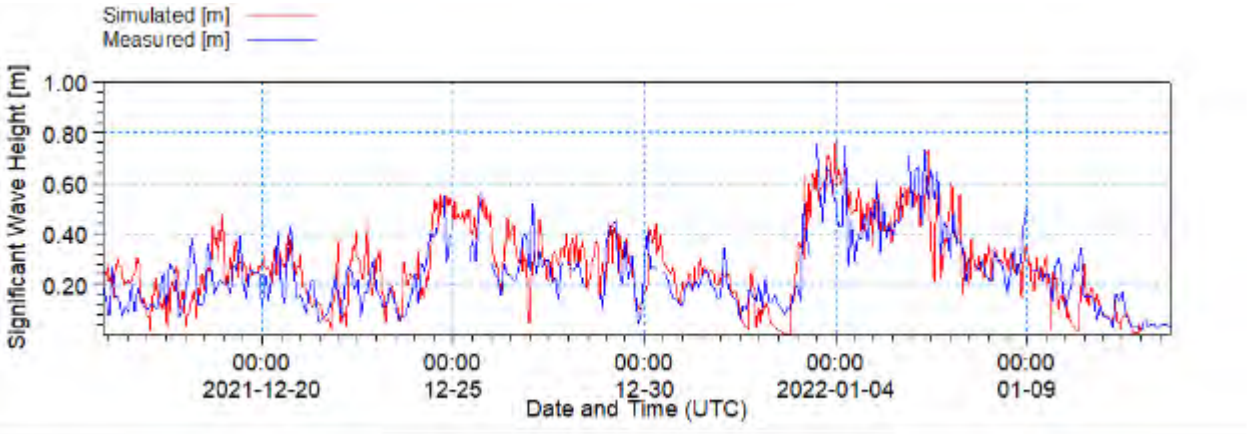

Figure 5.2–13 Simulated and Measured Significant Wave Height near the Proposed MOF for the Period from December 15, 2021 to January 12, 2022

Table 5.2–6 Statistics of Measured and Simulated Significant Wave Hight Near the Proposed MOF for the Period from December 15, 2021 to January 12, 2022

	Minimum (m)	Mean (m)	Maximum (m)	RMSE (m)
Measured	0	0.24	0.76	0.1
Simulated	0	0.27	0.78	

Hydrodynamic Model Setup and Calibration

Model calibration was conducted for the simulation period of December 15, 2021 to January 12, 2022. The 2D hydrodynamic model was calibrated to the depth-averaged measured Project current speed near the proposed MOF. Figure 5.2–14 shows simulated and measured current speed near the proposed MOF. Table 5.2–7 presents statistics of the measured and simulated wave heights near the proposed MOF for the period of simulation and indicates a good agreement between measured and simulated current speed with an RMSE of 0.12 m/s. The following are the final parameters in the calibrated hydrodynamic model:

- Time step: The choice of time step requires consideration of numerical stability and solution accuracy. A time step of 30 seconds was chosen for the model runs
- Courant number: The numerical stability and computing time depend not only on the number of nodes and mesh elements and the simulation time step, but also the resulting Courant numbers which needs to be less than 1. A critical Courant number of 0.8 was adopted in this study
- Flood and dry: The dry and wet depths were set to 0.005 and 0.1 m respectively (i.e., if water depth was ≤ 0.005 m the surface was considered dry and, if water depth was > 0.005 m and ≤ 0.1 m the surface was considered flooded and only mass fluxes area calculated and if water depth was > 0.1 m the surface was considered wet and both mass fluxes and momentum fluxes are calculated)
- Bed roughness: An average Manning number of 40 which is a reciprocal form of the Manning's roughness coefficient (n) of 0.025 was adopted in this study
- Eddy viscosity: The eddy viscosity in the MIKE 21 is based on a Smagorinsky formulation (DHI, 2019a). The default value of 0.28 was used in the calibrated model

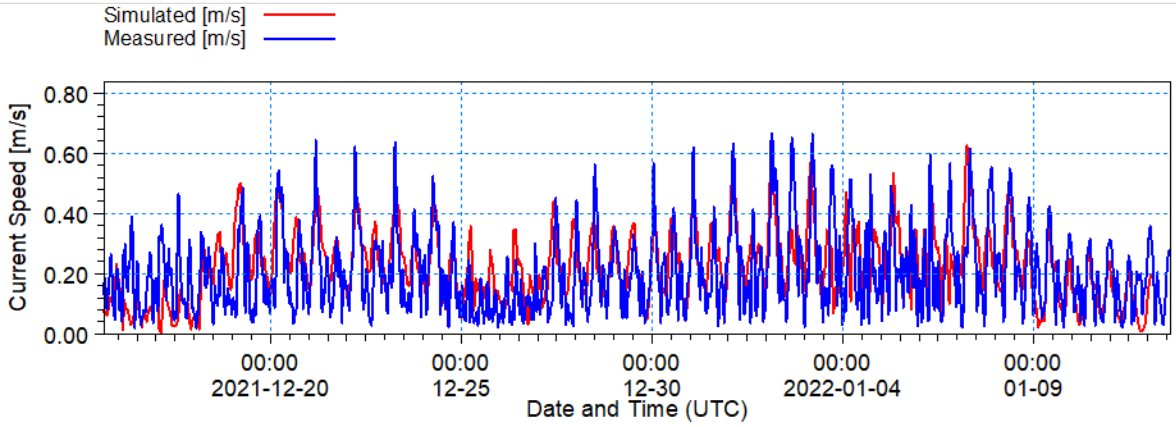

Figure 5.2–14 Simulated and Measured Current Speed near the Proposed MOF for the Period from December 15, 2021 to January 12, 2022

Table 5.2–7 Statistics of Measured and Simulated Current Speed Near the Proposed MOF for the Period from December 15, 2021 to January 12, 2022

	Minimum (m/s)	Mean (m/s)	Maximum (m/s)	RMSE (m/s)
Measured	0.02	0.21	0.66	0.12
Simulated	0.01	0.23	0.63	

5.2.3 Results

5.2.3.1 Approaches and Scenarios

The objective of the hydrodynamic, wave, and sediment transport modelling was to quantify the potential scour near the proposed Project's footprint. The MT module was integrated into the calibrated hydrodynamic model to carry out the fully coupled hydrodynamic and sediment transport modelling for a storm event period to characterize the circulation patterns and indications of sediment scour and deposition near the Project's footprint. The Project's footprint is shown on Figure 5.2–15. The Project footprint is susceptible to wave-induced scour due to available fetch from the north and southeast; therefore, the storm event should consider the effects of waves approaching from the north and southeast. Since the Project's meteorological station is only active for a period of one year, available hourly wind data from 1955 to 2022 at ECCC climate station in Prince Rupert, located approximately 83 km southeast of the study area, was analyzed to define a storm for the purpose of the analysis. Based on result of this assessment, a wind speed of 102 km/hr with a return period of 50 year was estimated at this station. The model scenarios were defined as the period of one week from January 1 to 8, 2022 when

the maximum wave height was recorded by the ADCP; however, the following was included in model setup:

- 3 hours storm with winds coming from the north and with the 50-year speed of 102 km/hour
- 3 hours storm with winds coming from the southeast and with 50-year speed of 102 km/hour

Figure 5.2–16 and Figure 5.2–17 summarize model inputs. In addition, 2D wave model outputs consisting of wave radiation stresses, significant wave height, wave direction, and peak wave period were included in the HD and MT modules. The MT module simulates applied shear stress and sediment transport process (i.e., erosion and deposition) under a combined currents and waves conditions using Soulsby et al. (1993) formulations. Sediment data used for the purpose of modelling is summarized in Section 4.5.

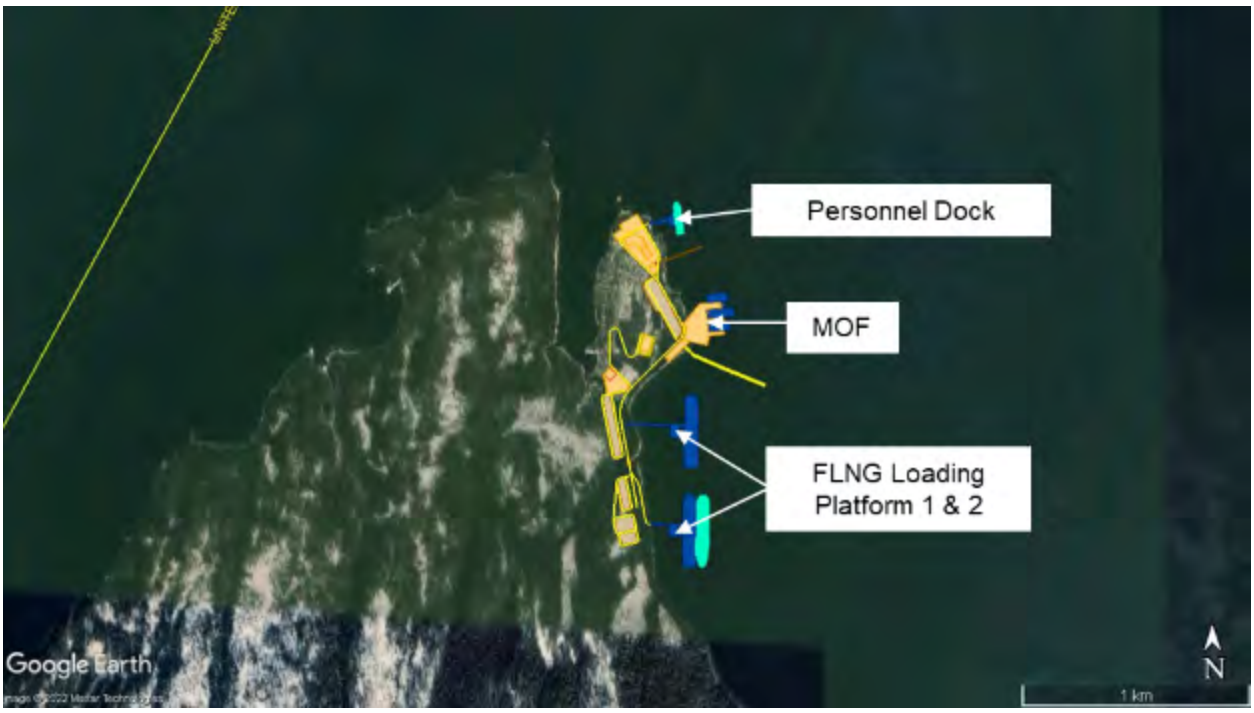

Figure 5.2–15 Project Footprint

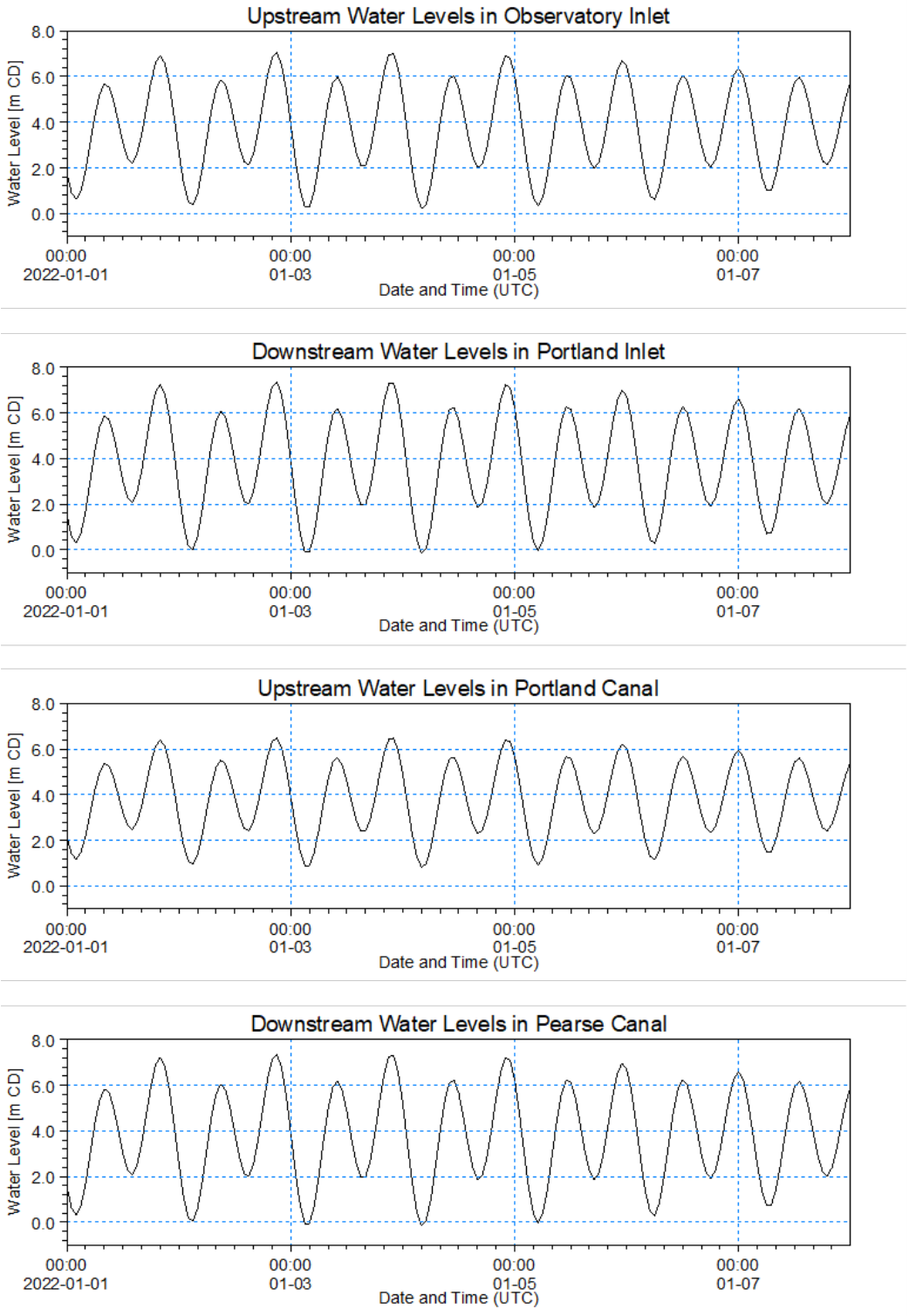

Figure 5.2–16 Water Levels Within the Study Area for the Period of Simulation

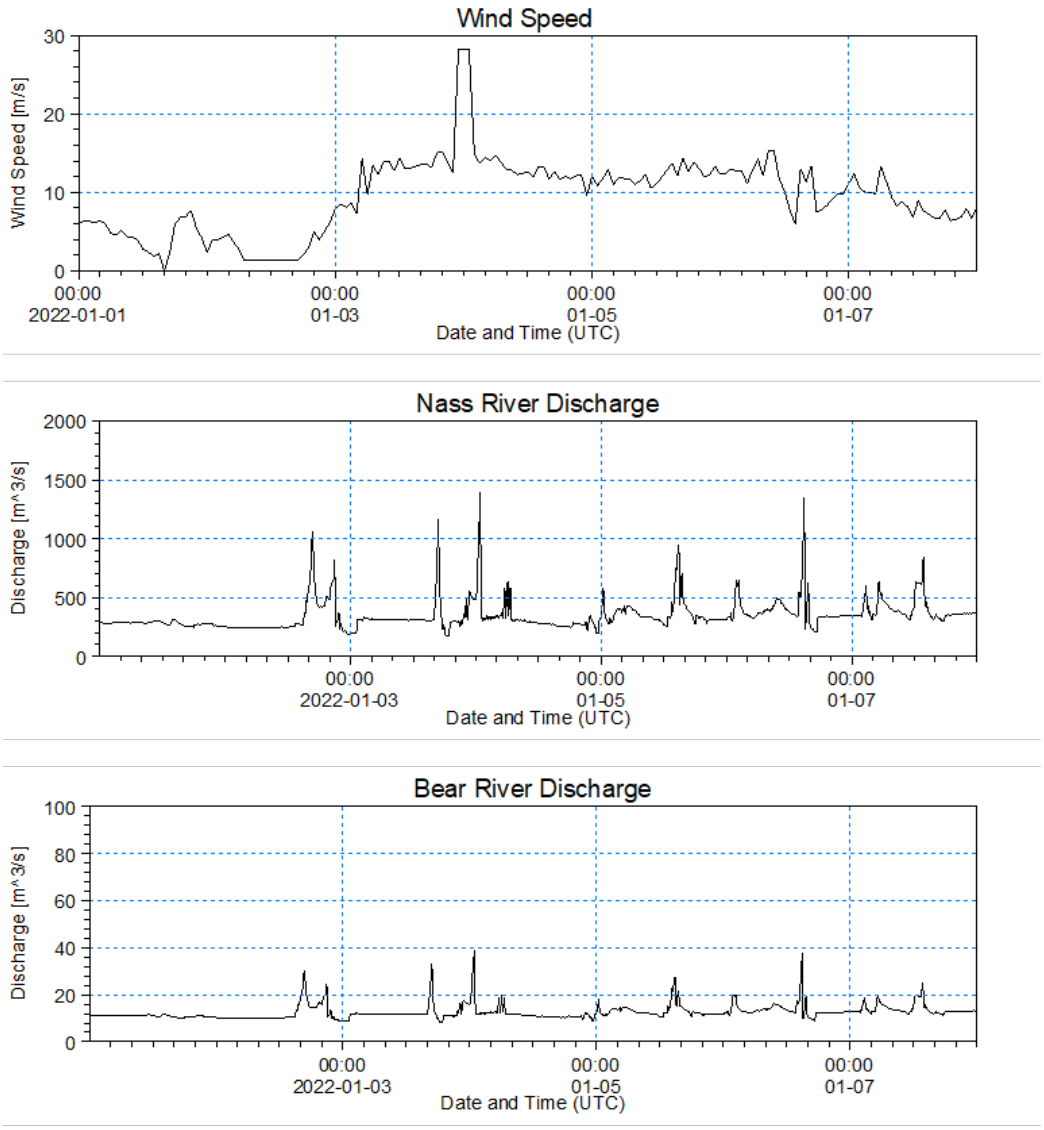

Figure 5.2–17 Wind Speed and Rivers Discharge for the Period of Simulation

5.2.3.2 Modelling Results

Figure 5.2-18 and Figure 5.2–19-19 show spatial variations of significant wave height within the Project's footprint for baseline and proposed conditions for the 50-year wave approaching from the southeast and north, respectively. A review of the results indicates that wave energy dissipates when passing the piers and approaching the shoreline. Although the proposed MOF walls reflect waves and result in an increase in nearby wave heights, this structure results in reduction of wave heights near the FLNG loading platforms 1 and 2 when waves are coming from the north. Overall, the impacts of the Project's footprint on wave conditions are local and does not affect areas beyond the footprint.

Table 5.2–8 and Table 5.2–9 summarize the maximum significant wave heights for each modelling scenario and indicate the following:

- Maximum simulated significant wave height near the FLNG loading platform 1 is 2.19 m and 1.32 m for the 50-year waves approaching from the southeast and north, respectively
- Maximum simulated significant wave height near the FLNG loading platform 2 is 1.96 m and 1.55 m for the 50-year waves approaching from the southeast and north, respectively
- Maximum simulated significant wave height near the MOF is 2.91 m and 2.36 m for the 50-year waves approaching from the southeast and north, respectively
- Maximum simulated significant wave height near the personnel dock is 2.91 m and 2.36 m for the 50-year waves approaching from the southeast and north, respectively

Figure 5.2–20 and Figure 5.2–21 show spatial variations of current speed within the Project's footprint for baseline and proposed conditions for the 50-year wave approaching from the southeast and north, respectively. Overall, high wind and wave induced current zones were observed near the shoreline. Table 5.2–8 and Table 5.2–9 summarize maximum current speed for each modelling scenario and indicate the following:

- Maximum current speed near the FLNG loading platform 1 is 1.07 m/s and 0.75 m/s for the 50-year waves approaching from the southeast and north, respectively
- Maximum simulated current speed near the FLNG loading platform 2 is 1.55 m/s and 1.51 m/s for the 50-year waves approaching from the southeast and north, respectively
- Maximum simulated current speed near the MOF is 1.19 m/s and 0.86 m/s for the 50-year waves approaching from the southeast and north, respectively
- Maximum simulated current speed near the personnel dock is 0.81 m/s and 1.59 m/s for the 50-year waves approaching from the southeast and north, respectively

Figure 5.2–22 and Figure 5.2–23 show spatial variations of bed shear stress and bed thickness change within the Project's footprint for baseline and proposed conditions for the 50-year wave approaching from the southeast and north, respectively. Figure 5.2–24 to Figure 5.2–27 show the bed thickness change near the proposed Project's structures. These figures show the total bed thickness change after the one week of simulation from January 1 to 8, 2022. Positive and negative bed thickness change values indicate deposition and erosion, respectively. A review of the results indicates that high scour amounts occur near the shallower water area as these areas mainly impacted by a higher combined wave and current-induced bed shear stress during the 50-year event storm compared to deeper areas. A review of sediment erosion and deposition pattern indicates that the eroded material will deposit after the storm within the deeper sections with lower shear stress and adjacent to the eroded areas. Table 5.2–8 and Table 5.2–9 summarize the maximum current speed for each modelling scenario and indicate the following:

- Maximum applied shear stress and scour depth near the FLNG loading platform 1 is 24.58 N/m^2 and 7.63 N/m^2 for the 50-year waves approaching from the southeast and north, respectively. Maximum scour depth after one-week of simulation is -0.87 m and -0.29 m, for the waves from the southeast and north, respectively
- Maximum simulated shear stress near the FLNG loading platform 2 is 27.97 N/m^2 and 29.55 N/m^2 for the 50-year waves approaching from the southeast and north, respectively. Maximum scour depth one-week of simulation is -1.19 m and -0.78 m, for the waves from the southeast and north, respectively
- Maximum simulated shear stress near the MOF is 42.90 N/m^2 and 13.81 N/m^2 for the 50-year waves approaching from the southeast and north, respectively. Maximum scour depth one-week of simulation is -1.77 m and -0.94 m, for the waves from the southeast and north, respectively
- Maximum simulated shear stress near the personnel dock is 16.49 N/m^2 and 24.18 N/m^2 for the 50-year waves approaching from the southeast and north, respectively. Maximum scour depth one-week of simulation is -0.21 m and -0.68 m, for the waves from the southeast and north, respectively

The simulated scour depths are based on characteristics of surficial sediment available at the time of the assessment. It is expected that the bedrock layer approximately 4–5 m below the seabed is not affected by wave and current induced scour and can protect the piers' base in the ocean. It is recommended to design appropriate scour protection around the structures to assist with maintaining the integrity of the structures and avoid undermining. In addition, local scour due to propeller action from LNG facility vessels should be evaluated and considered in scour protection design within berthing areas.

Table 5.2–8 Results of Wave, Hydrodynamic, and Scour Modelling for 50-Year Wave and Wind from the Southeast

Project Footprint	Significant Wave Height (m)	Current Speed (m/s)	Bed Shear Stress (N/m^2)	Scour Depth (m)
FLNG Loading Platform 1	2.19	1.07	24.58	-0.87
FLNG Loading Platform 2	1.96	1.55	27.97	-1.19
MOF	2.91	1.19	42.9	-1.77
Personnel Dock	1.39	0.81	16.49	-0.21

Table 5.2–9 Results of Wave, Hydrodynamic, and Scour Modelling for 50-Year Wave and Wind from the North

Project Footprint	Significant Wave Height (m)	Current Speed (m/s)	Bed Shear Stress (N/m^2)	Scour Depth (m)
FLNG Loading Platform 1	1.32	0.75	7.63	-0.29
FLNG Loading Platform 2	1.55	1.51	29.55	-0.78
MOF	2.36	0.86	13.81	-0.94
Personnel Dock	1.64	1.59	24.18	-0.68

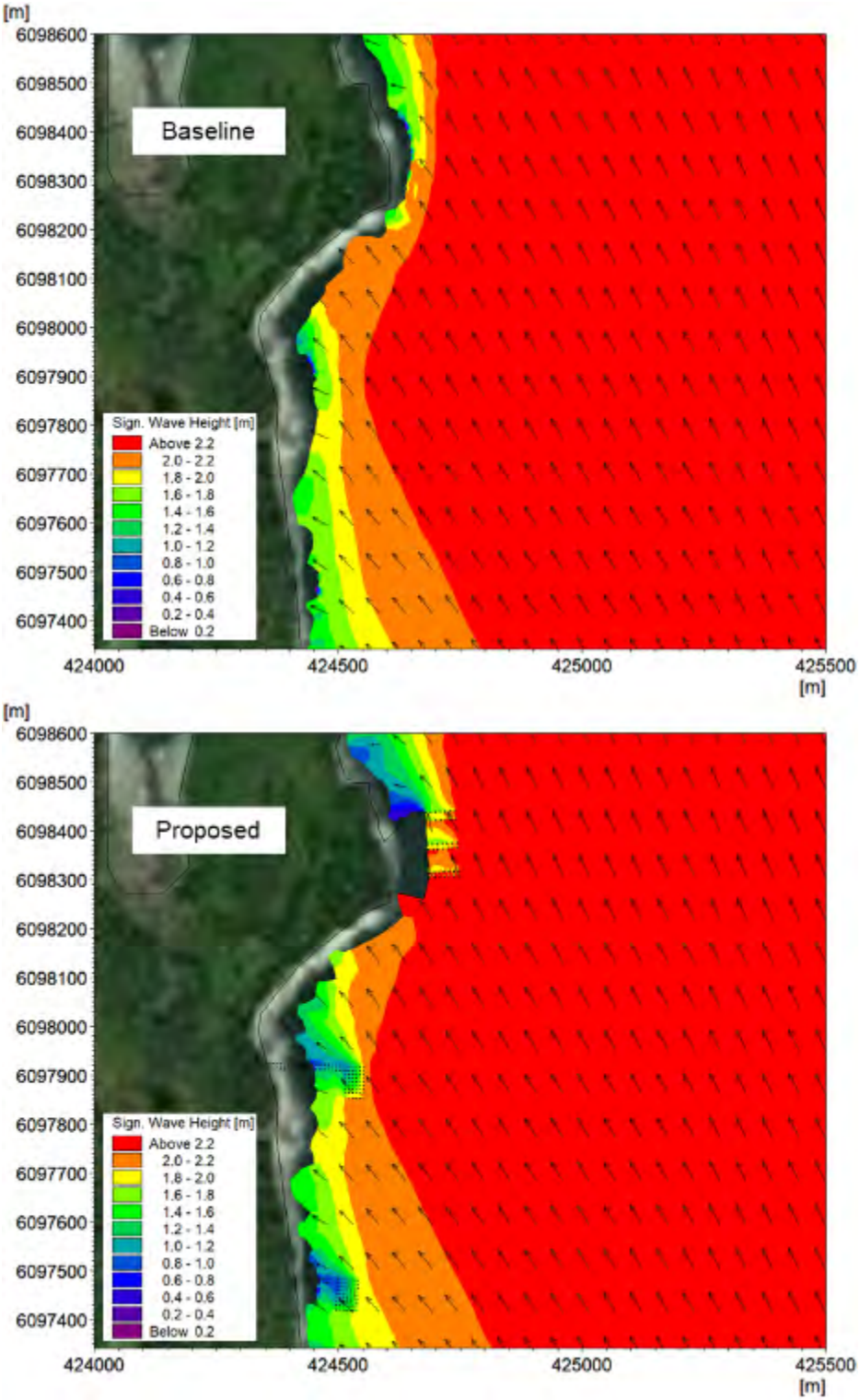

Figure 5.2–18 Spatial Variations of Significant Wave Height During the 50-Year Wind Event from the Southeast

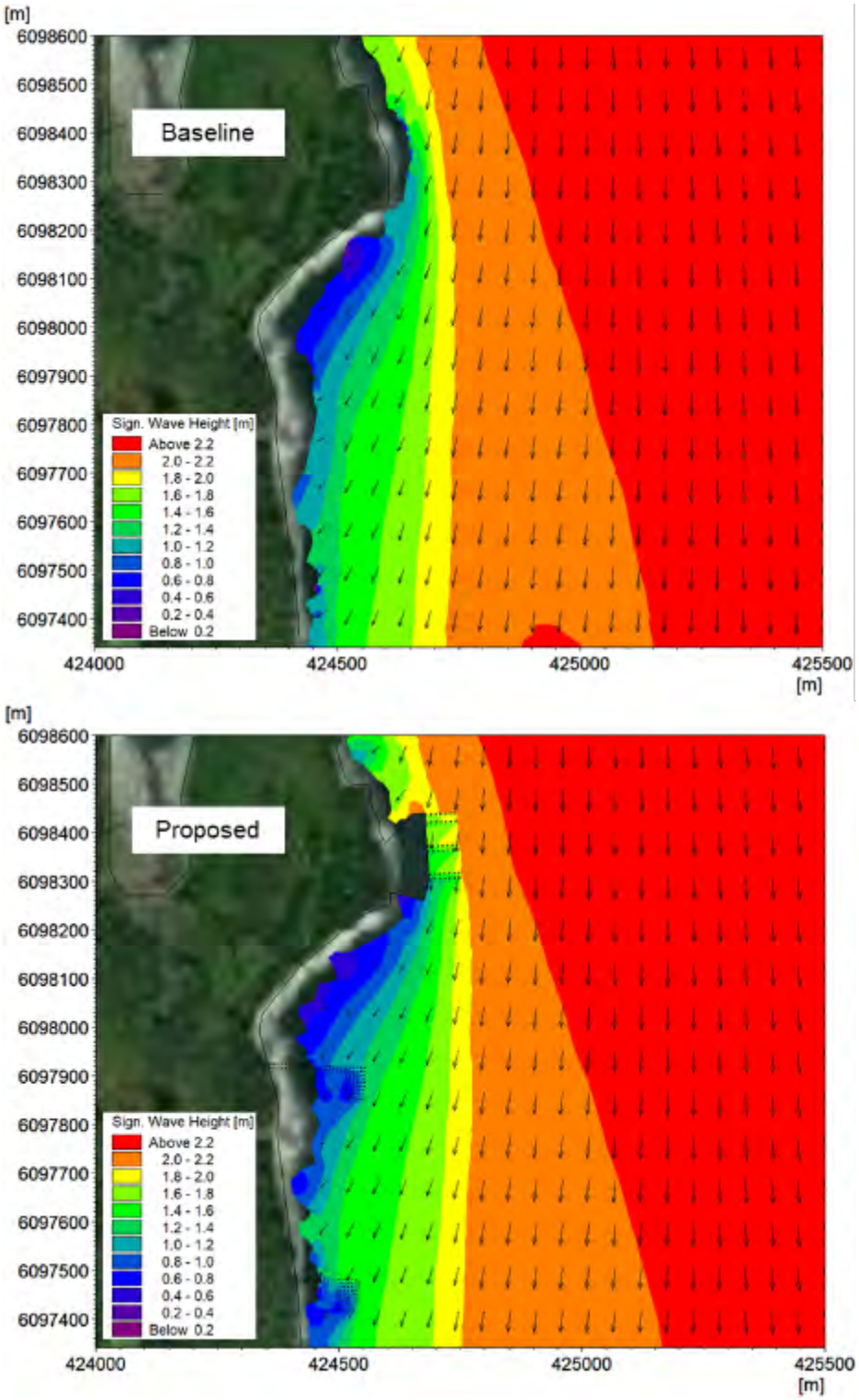

Figure 5.2–19 Spatial Variations of Significant Wave Height During the 50-Year Wind Event from the North

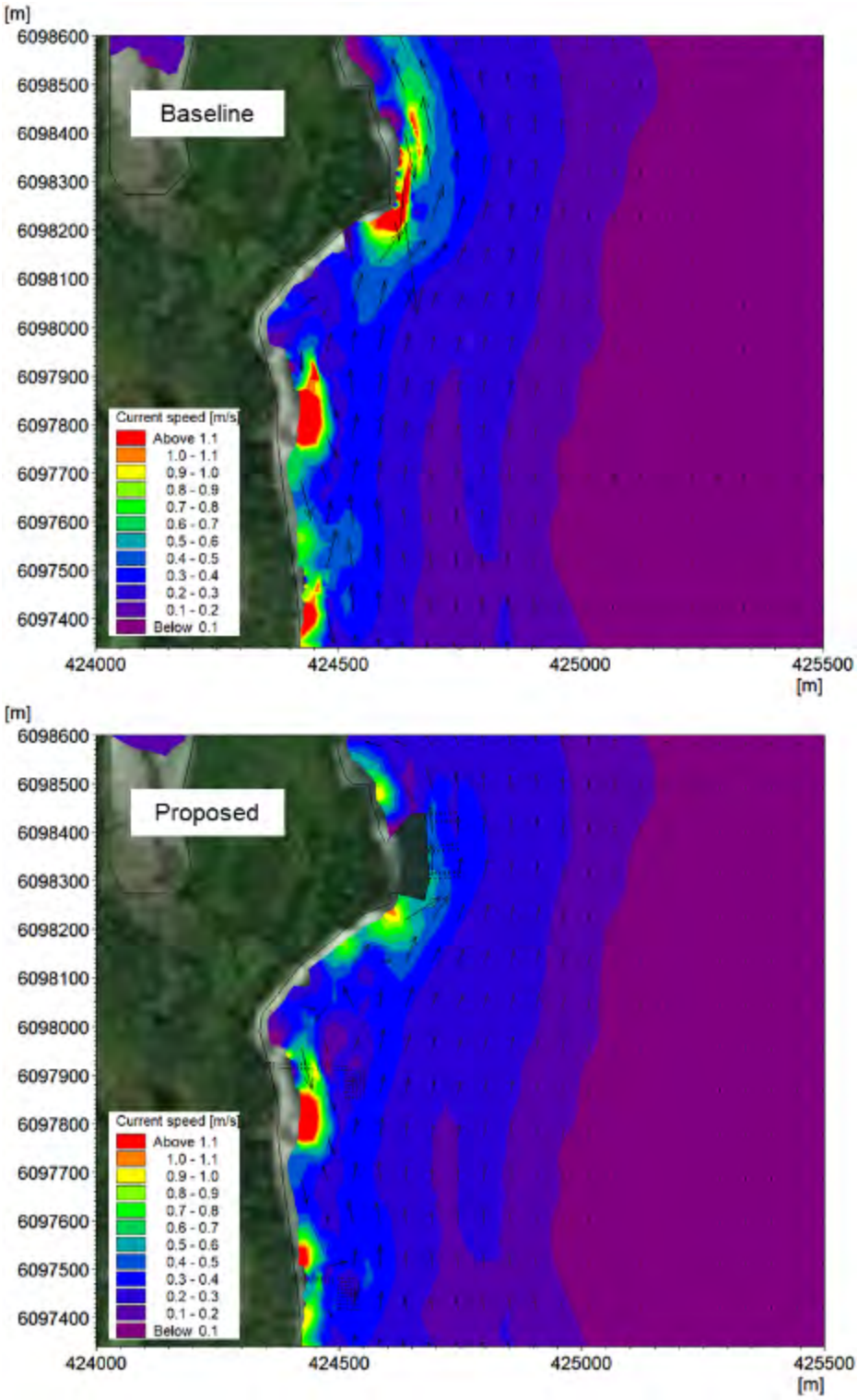

Figure 5.2–20 Spatial Variations of Current Speed During the 50-Year Wave and Wind Event from the Southeast

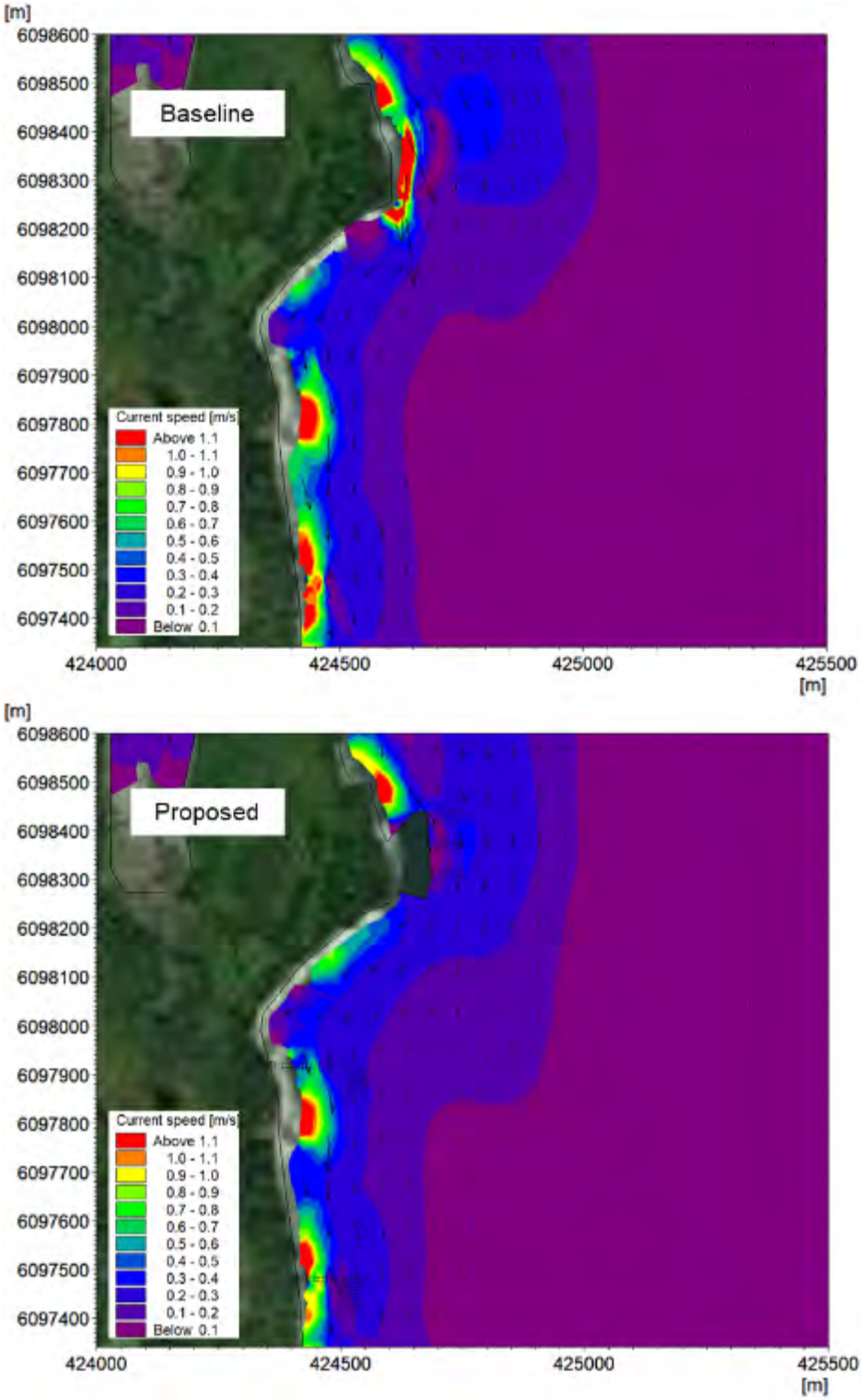

Figure 5.2–21 Spatial Variations of Current Speed During the 50-Year Wave and Wind Event from the North

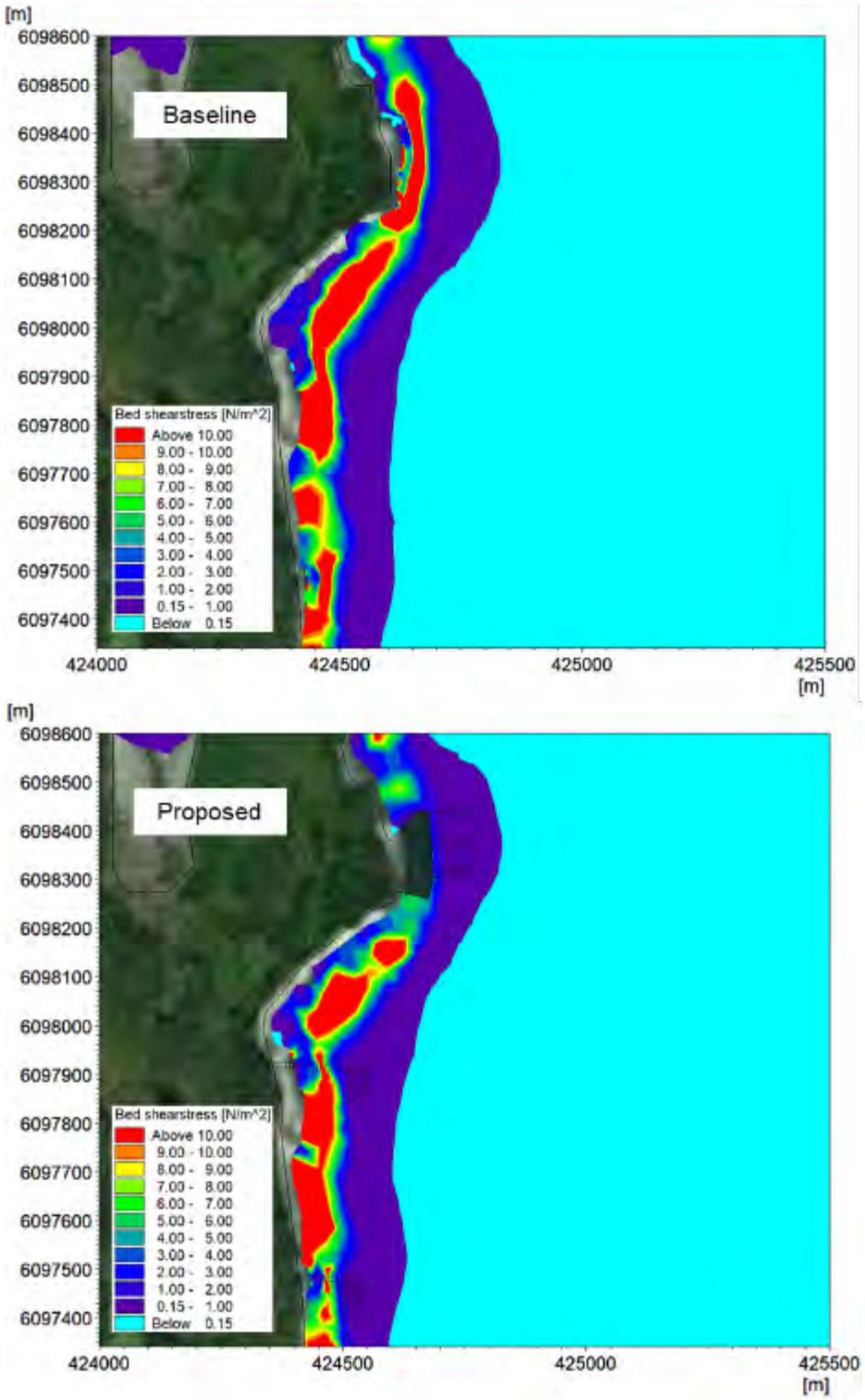

Figure 5.2–22 Spatial Variations of Bed Shear Stress During the 50-Year Wave and Wind Event from the Southeast

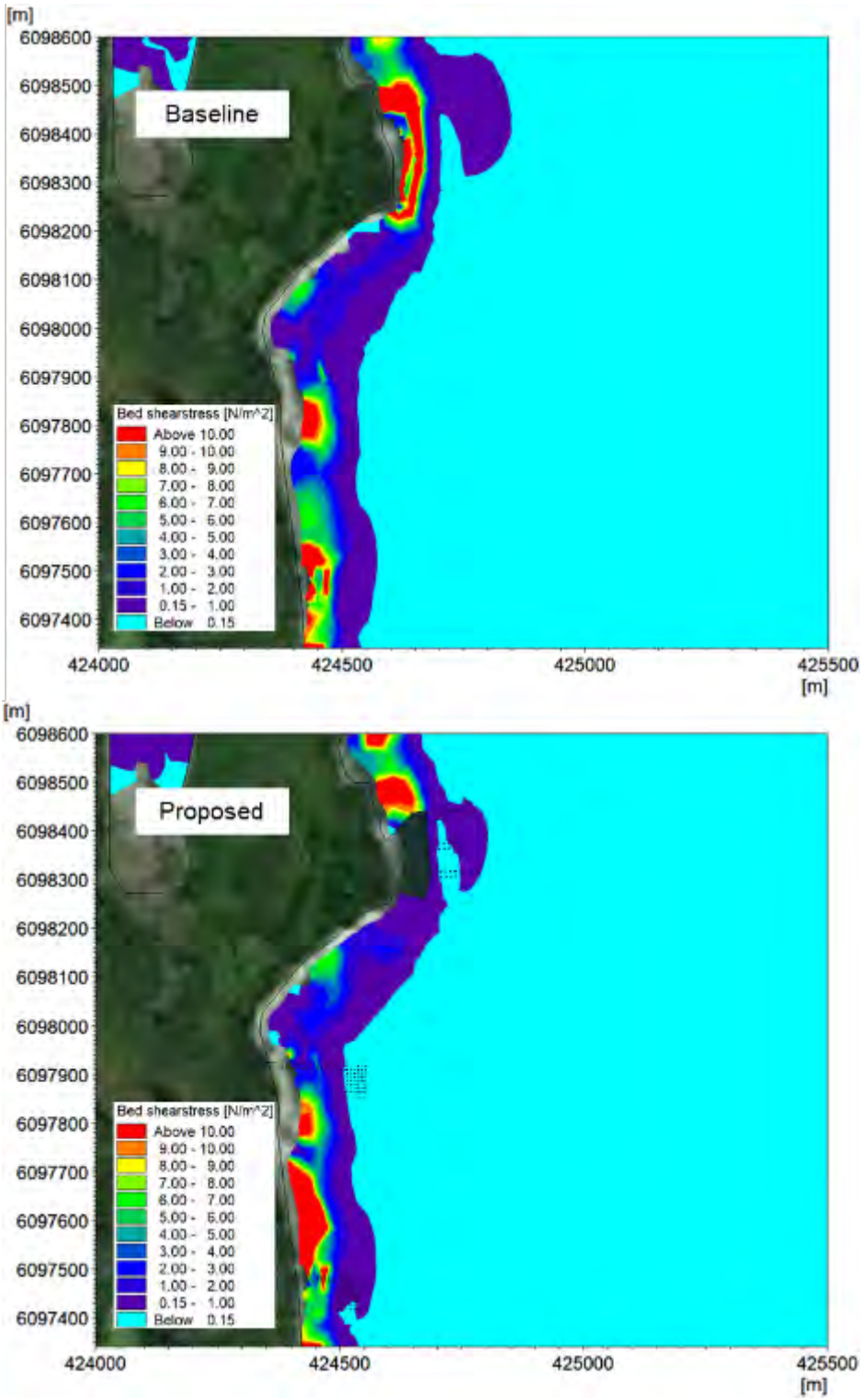

Figure 5.2–23 Spatial Variations of Bed Shear Stress During the 50-Year Wave and Wind Event from the North

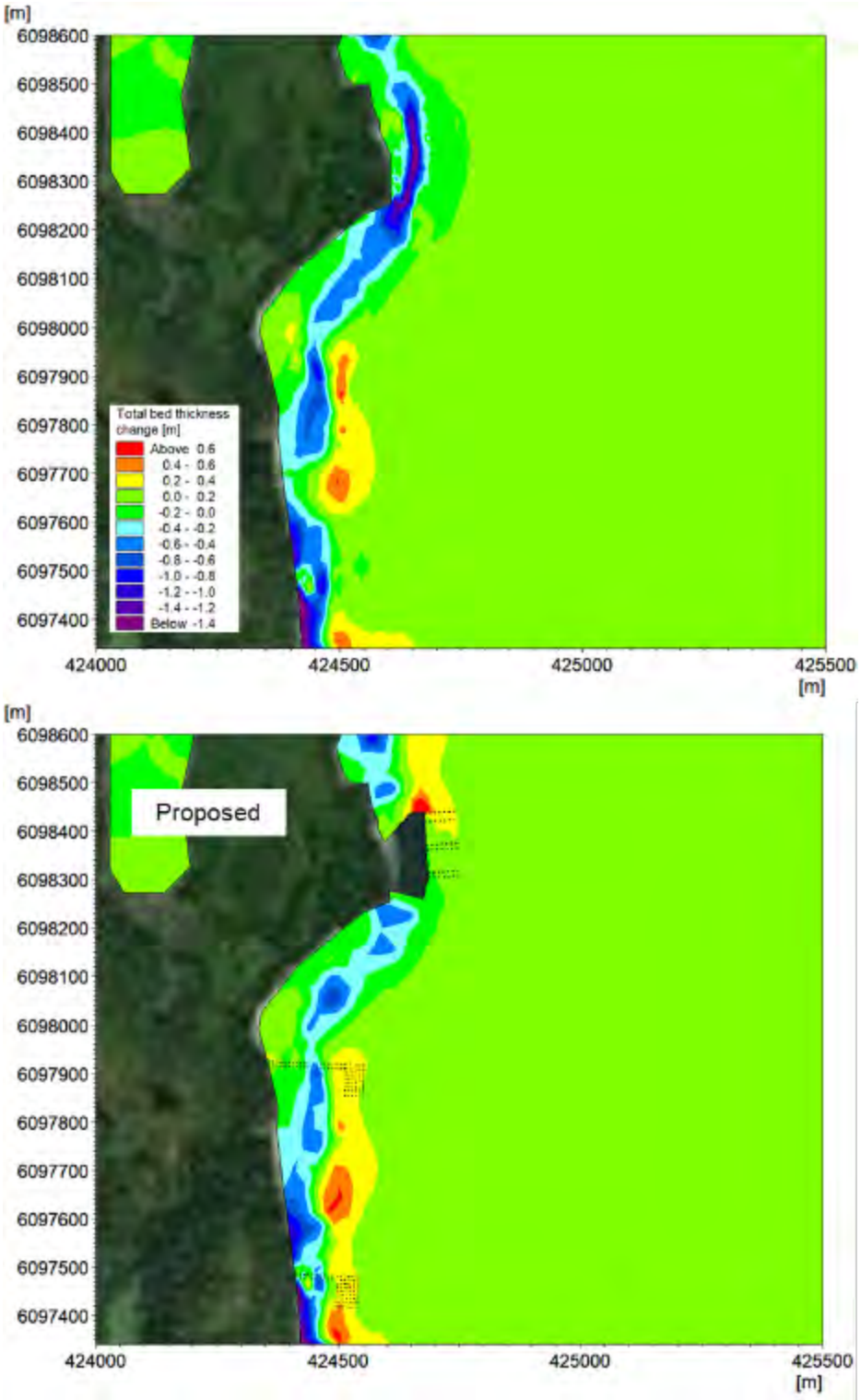

Figure 5.2–24 Spatial Variations of Total Bed Thickness Change During the 50-Year Wave and Wind Event from the Southeast

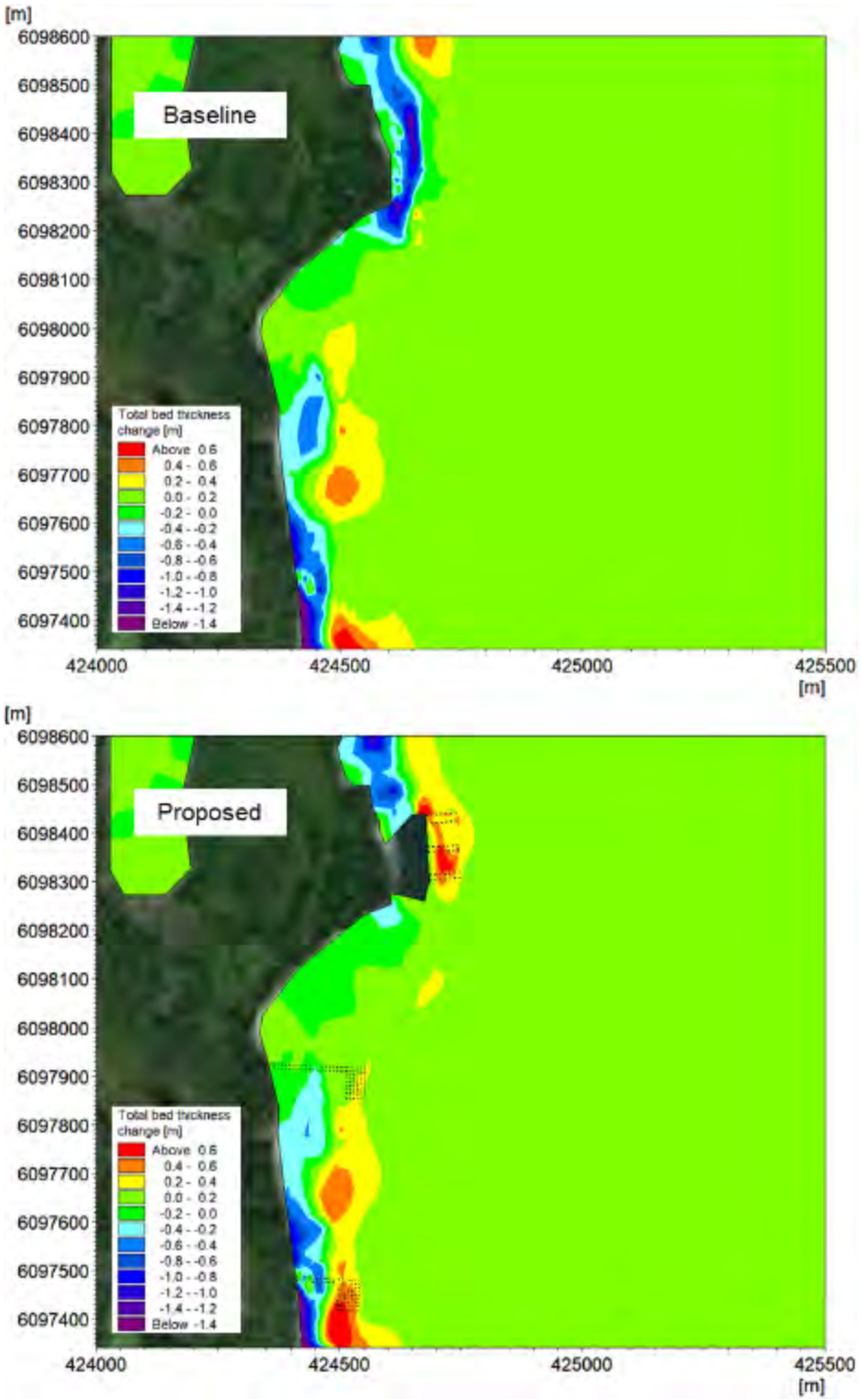

Figure 5.2–25 Spatial Variations of Total Bed Thickness Change During the 50-Year Wave and Wind Event from the North

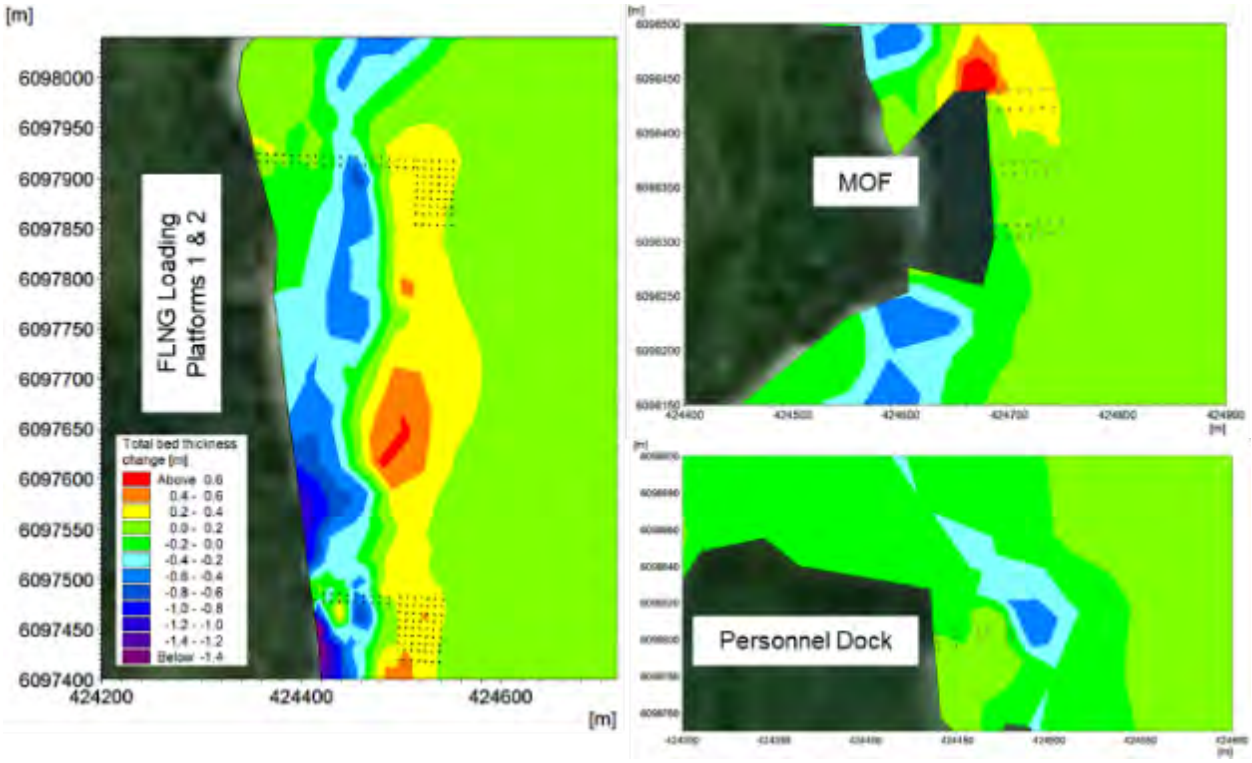

Figure 5.2–26 Spatial Variations of Total Bed Thickness Change Near the Project's Footprint During the 50-Year Wave and Wind Event from the Southeast

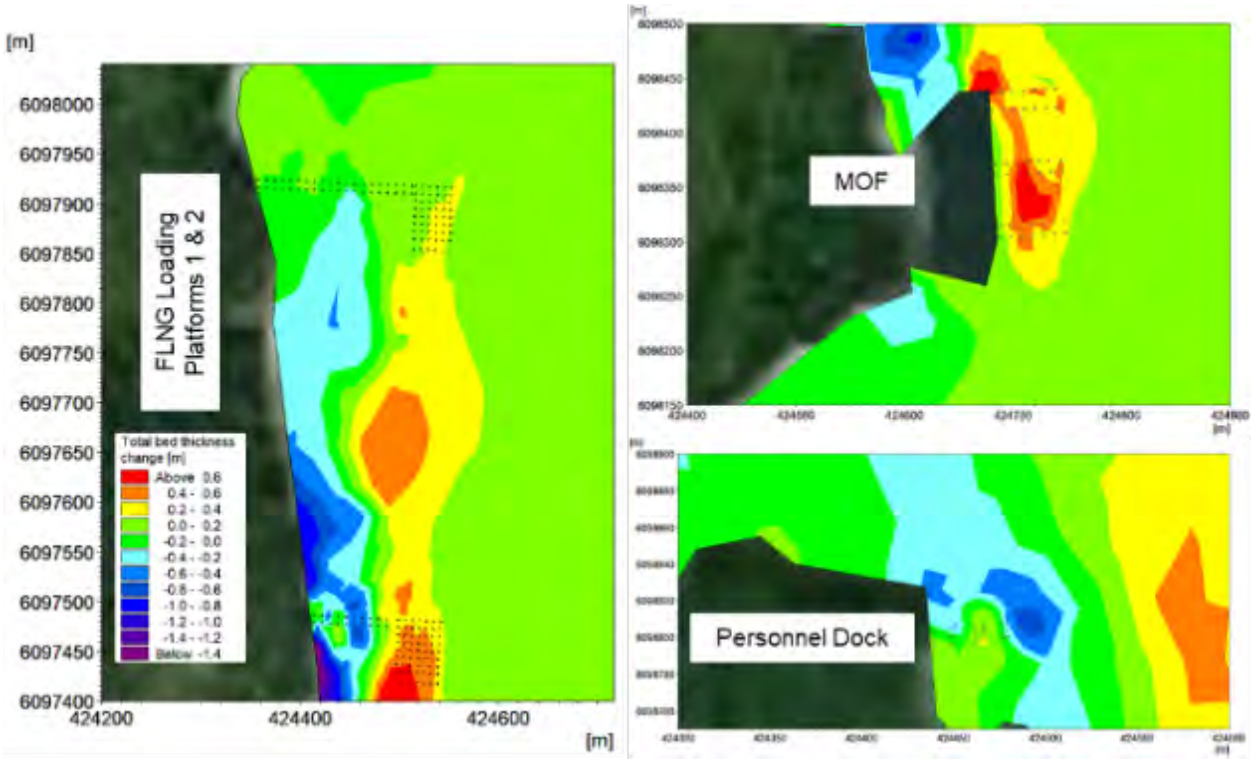

Figure 5.2–27 Spatial Variations of Total Bed Thickness Change Near the Project's Footprint During the 50-Year Wave and Wind Event from the North

6.0 CLOSURE

This TDR was prepared for the sole benefit of the Proponents for the Ksi Lisims LNG Project to describe the existing conditions within the Project study areas for the Marine Resources VC.

Respectfully submitted,

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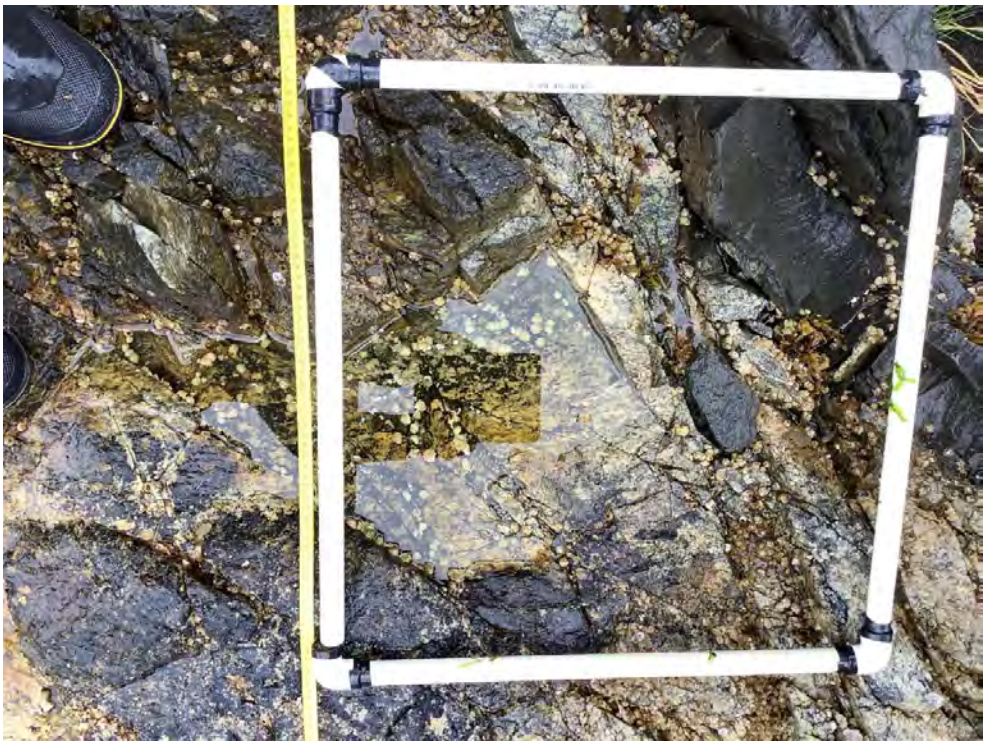
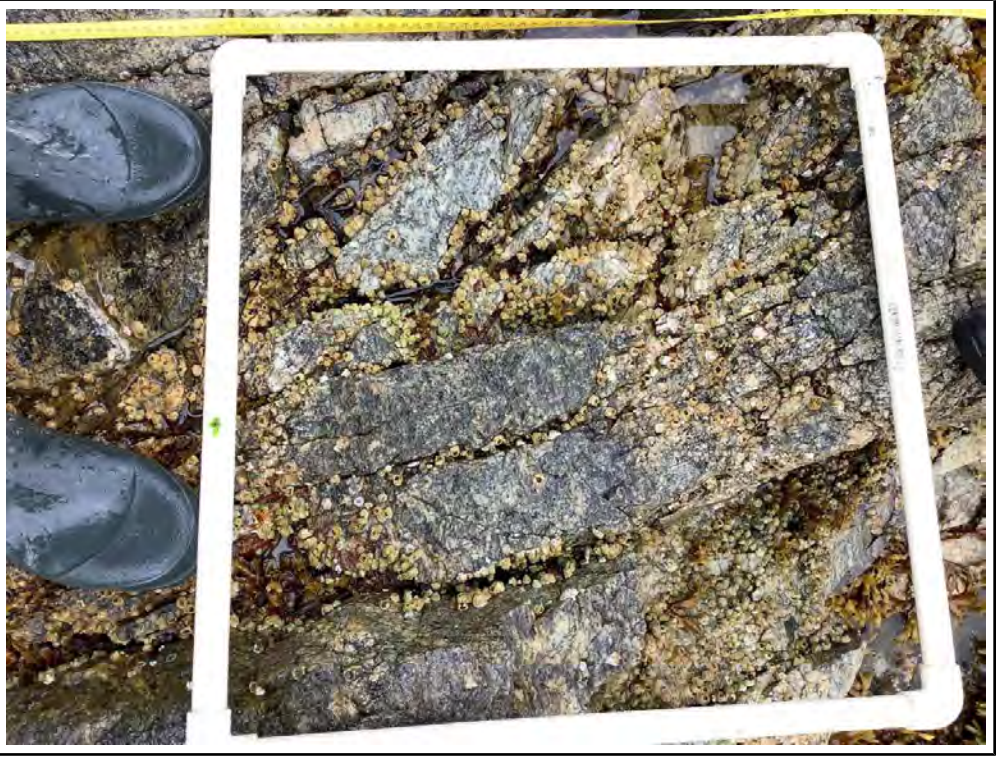
Appendix A INTERTIDAL SURVEY PHOTOLOG

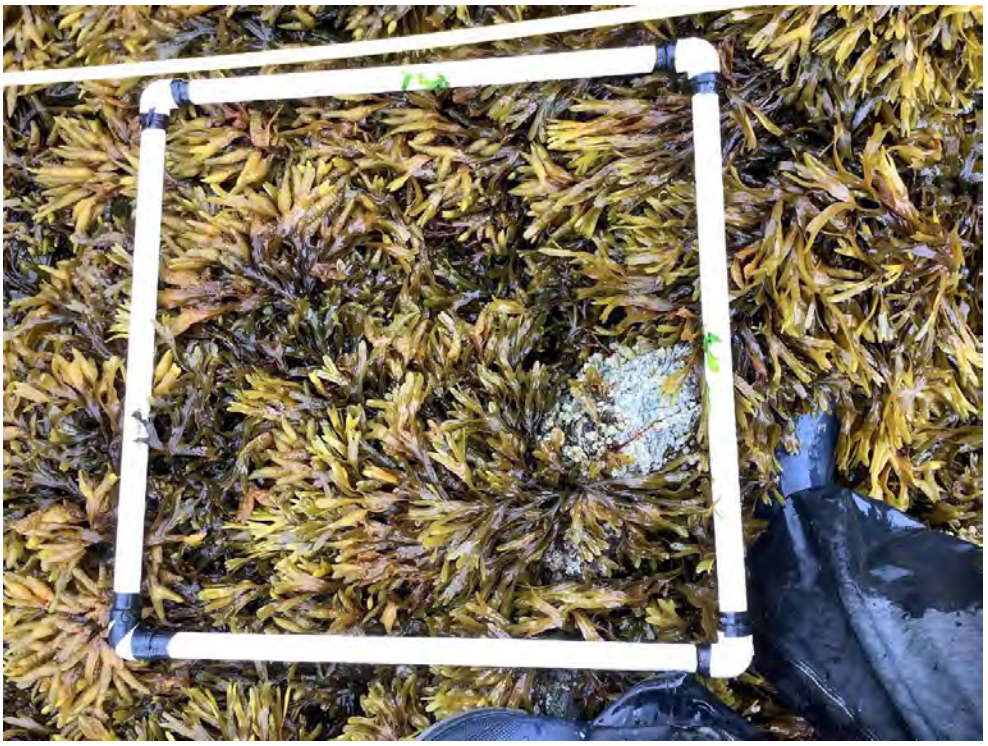
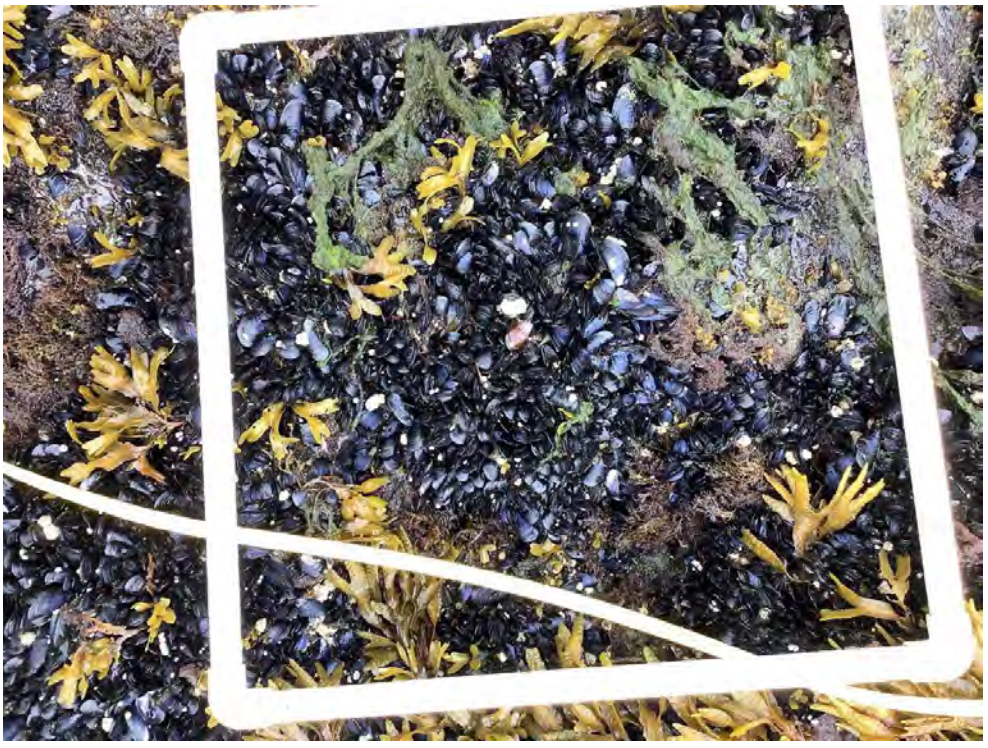
Stantec

Photographic Log

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 1 **Photo Location:** Pearse East - Transect E1 **Survey Date:** 7/26/2021 **Comments:** High Intertidal - Quadrat 1	
Photograph ID: 2 **Photo Location:** Pearse East - Transect E1 **Survey Date:** 7/26/2021 **Comments:** High Intertidal - Quadrat 2	

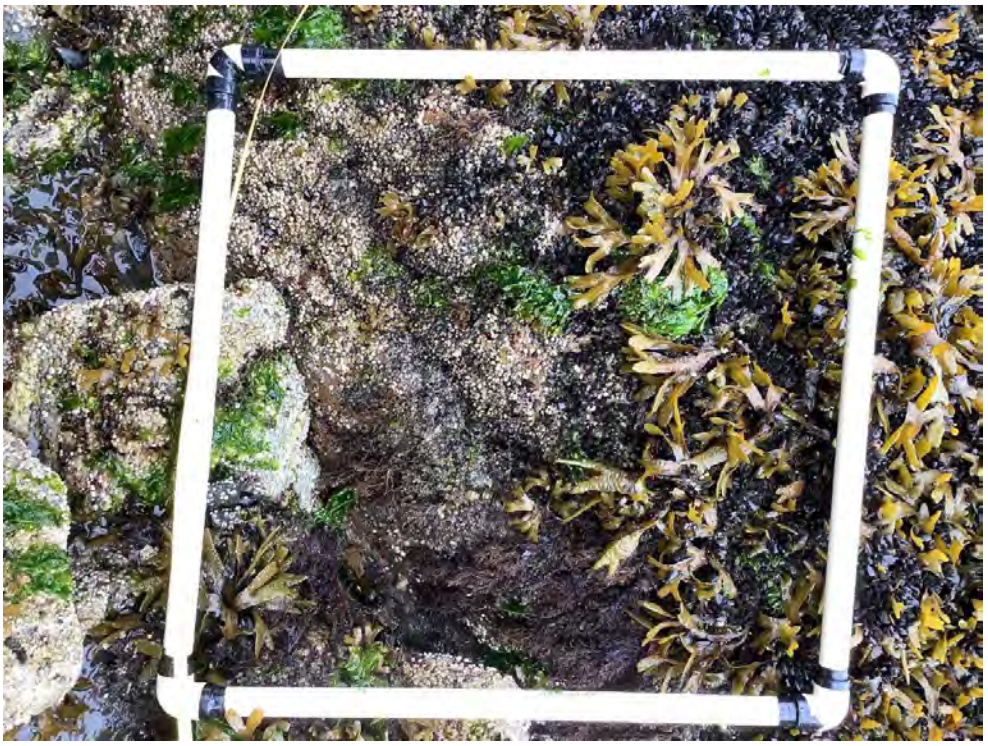
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 3 **Photo Location:** Pearse East - Transect E1 **Survey Date:** 7/26/2021 **Comments:** High Intertidal - Quadrat 3	
Photograph ID: 4 **Photo Location:** Pearse East - Transect E1 **Survey Date:** 7/26/2021 **Comments:** Mid Intertidal - Quadrat 1	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 5 **Photo Location:** Pearse East - Transect E1 **Survey Date:** 7/26/2021 **Comments:** Mid Intertidal - Quadrat 2	
Photograph ID: 6 **Photo Location:** Pearse East - Transect E1 **Survey Date:** 7/26/2021 **Comments:** Mid Intertidal - Quadrat 3	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 7 **Photo Location:** Pearse East - Transect E1 **Survey Date:** 7/26/2021 **Comments:** Low Intertidal - Quadrat 1	
Photograph ID: 8 **Photo Location:** Pearse East - Transect E1 **Survey Date:** 7/26/2021 **Comments:** Low Intertidal - Quadrat 2	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 9 **Photo Location:** Pearse East - Transect E1 **Survey Date:** 7/26/2021 **Comments:** Low Intertidal - Quadrat 3	
Photograph ID: 10 **Photo Location:** Pearse East - Transect E2 **Survey Date:** 7/25/2021 **Comments:** High Intertidal - Quadrat 1	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 11 **Photo Location:** Pearse East - Transect E2 **Survey Date:** 7/25/2021 **Comments:** High Intertidal - Quadrat 2	
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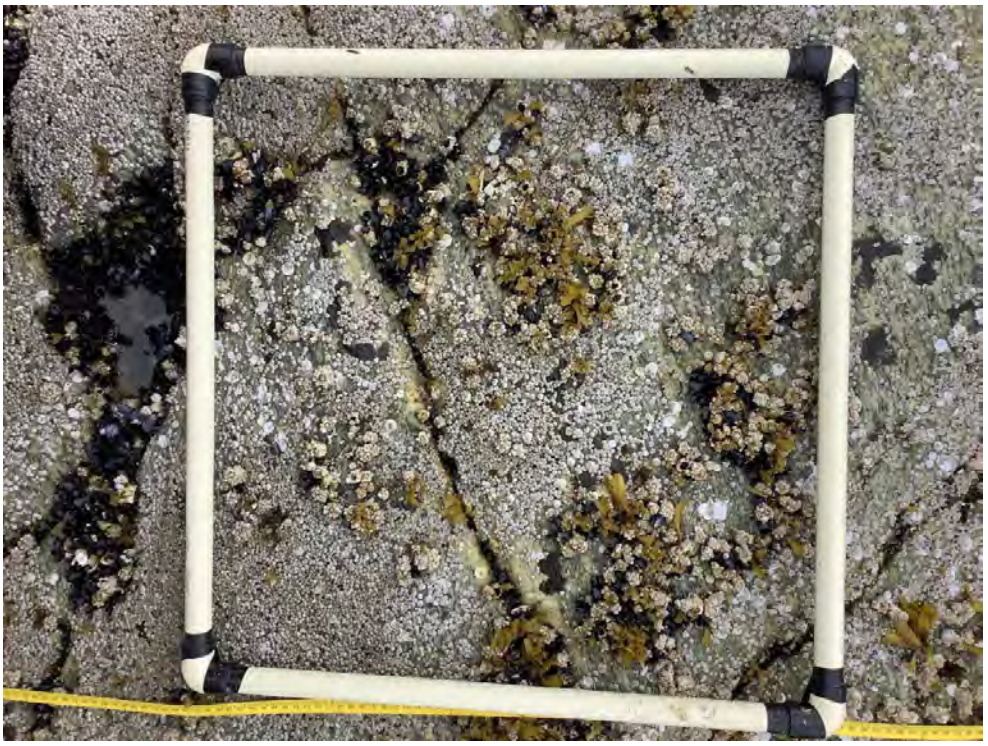
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 13 **Photo Location:** Pearse East - Transect E2 **Survey Date:** 7/25/2021 **Comments:** Mid Intertidal - Quadrat 1	
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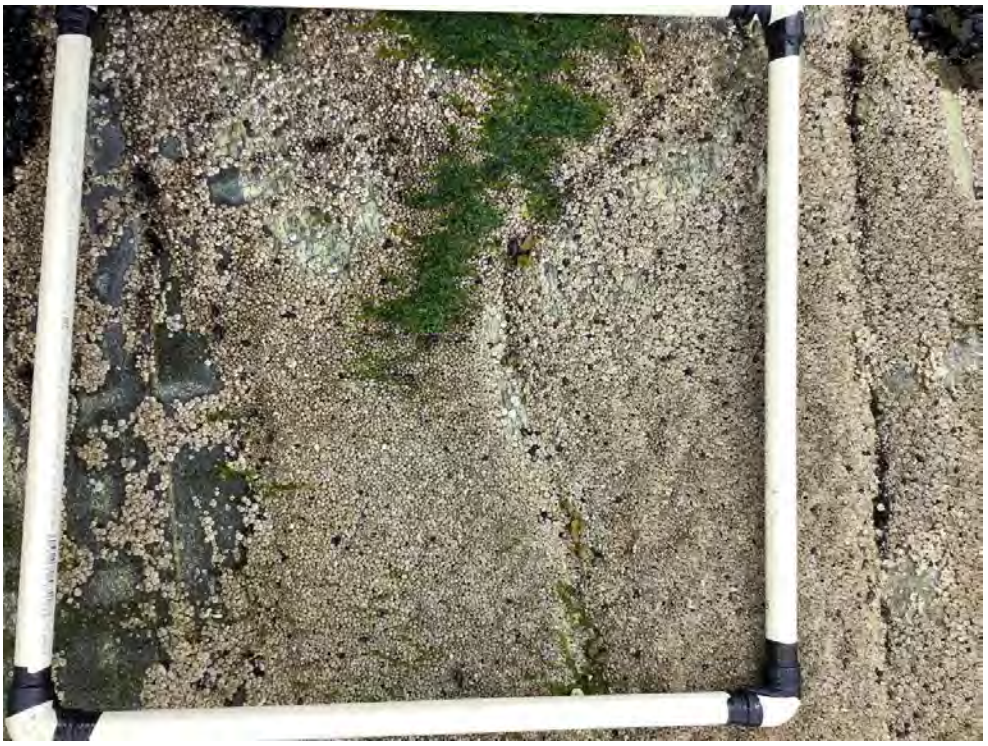
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 15 **Photo Location:** Pearse East - Transect E2 **Survey Date:** 7/25/2021 **Comments:** Mid Intertidal - Quadrat 3	
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Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 17 **Photo Location:** Pearse East - Transect E2 **Survey Date:** 7/26/2021 **Comments:** Low Intertidal - Quadrat 2	
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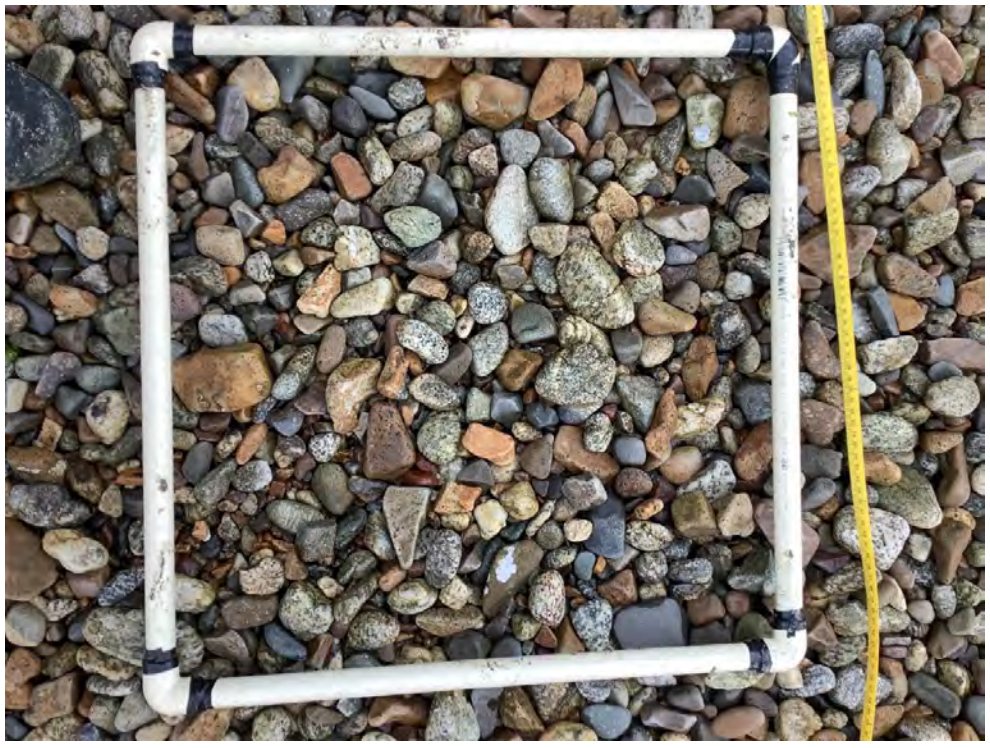
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 19 **Photo Location:** Pearse East - Transect E3 **Survey Date:** 7/25/2021 **Comments:** High Intertidal - Quadrat 1	
Photograph ID: 20 **Photo Location:** Pearse East - Transect E3 **Survey Date:** 7/25/2021 **Comments:** High Intertidal - Quadrat 2	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

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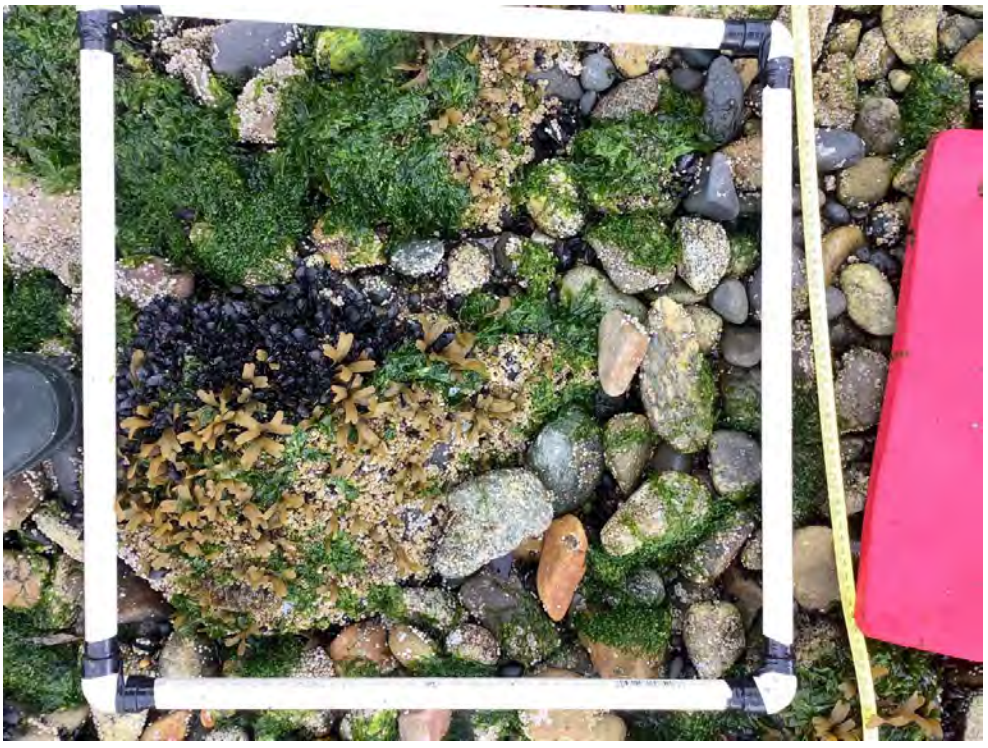
Photograph ID: 22 **Photo Location:** Pearse East - Transect E3 **Survey Date:** 7/25/2021 **Comments:** Mid Intertidal - Quadrat 1	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

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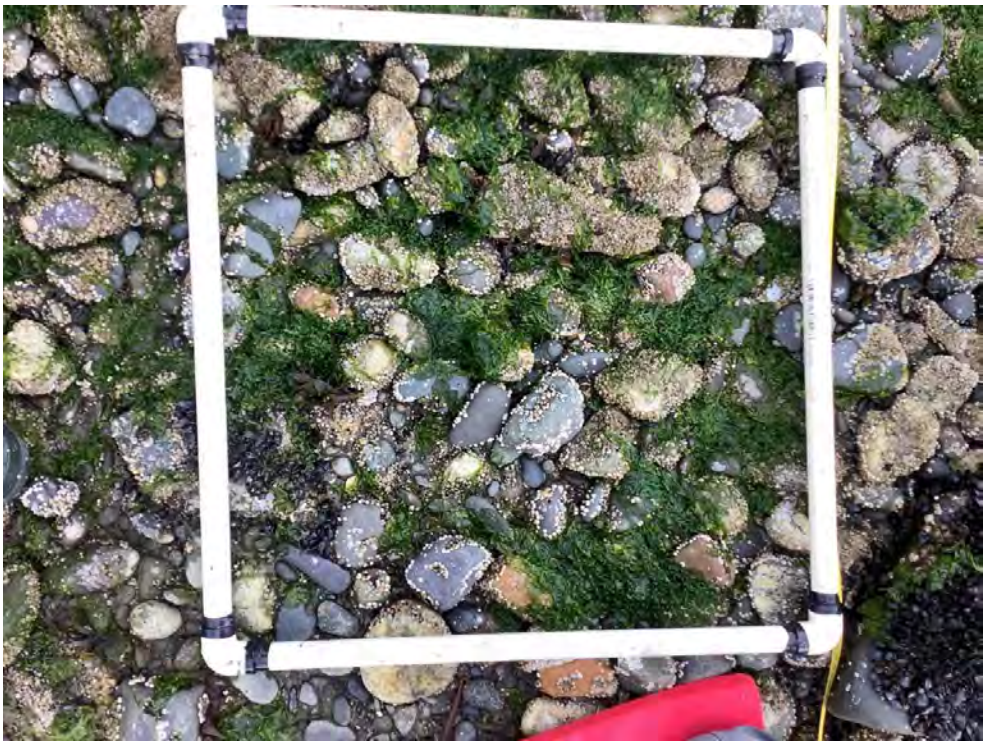
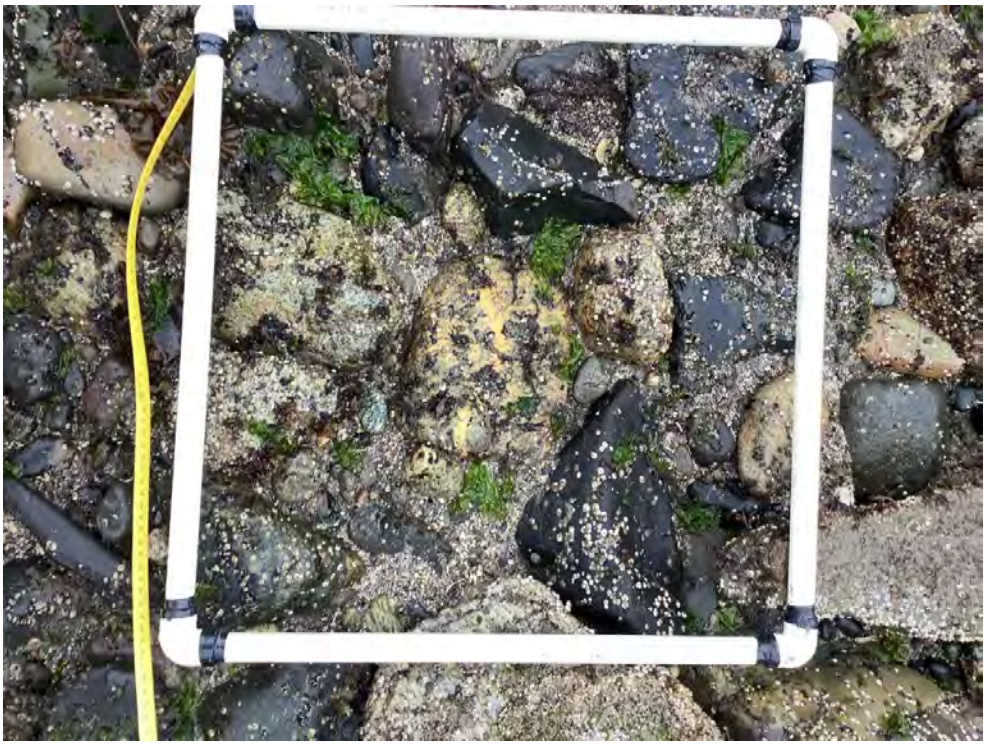
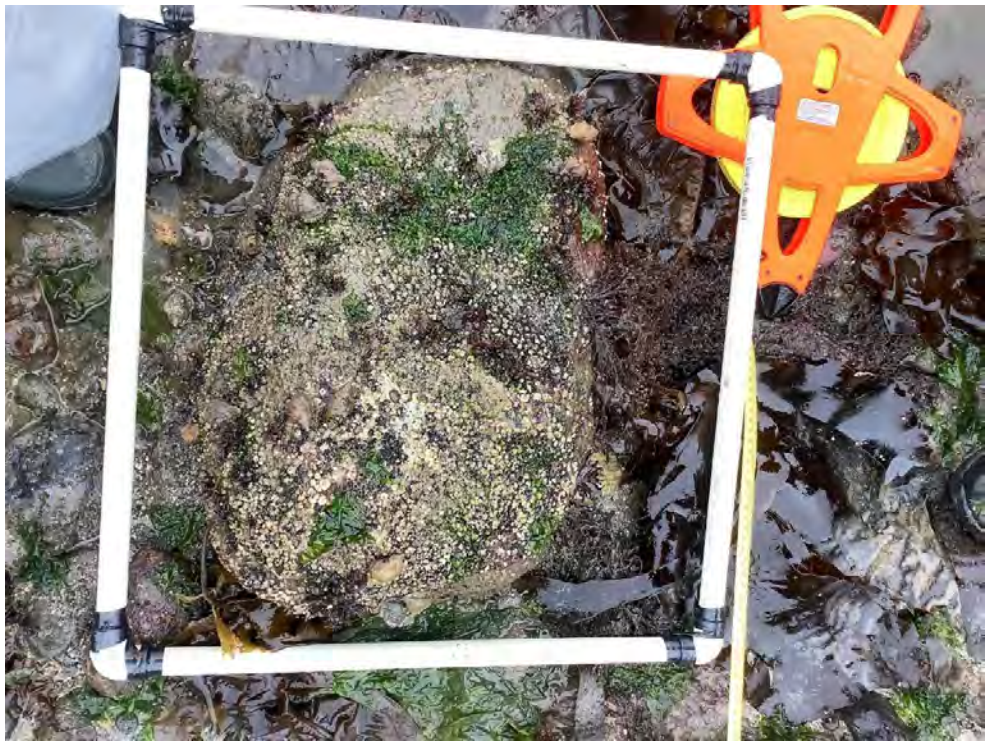
Photograph ID: 24 **Photo Location:** Pearse East - Transect E3 **Survey Date:** 7/25/2021 **Comments:** Mid Intertidal - Quadrat 3	

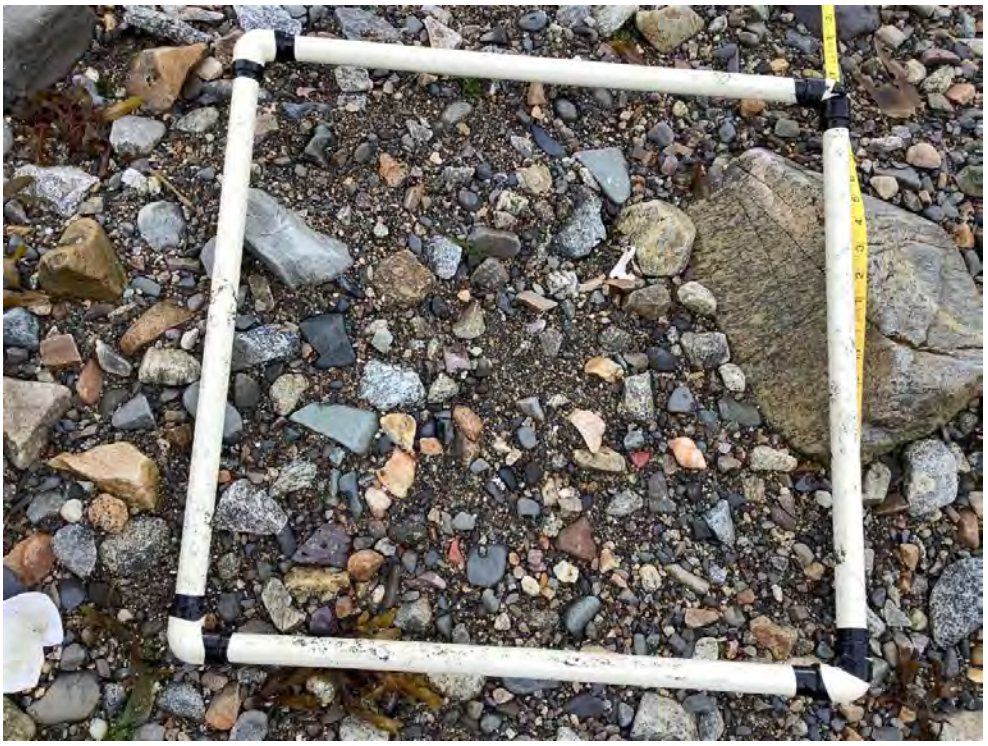
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 25 **Photo Location:** Pearse East - Transect E3 **Survey Date:** 7/25/2021 **Comments:** Low Intertidal - Quadrat 1	
Photograph ID: 26 **Photo Location:** Pearse East - Transect E3 **Survey Date:** 7/25/2021 **Comments:** Low Intertidal - Quadrat 2	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 27 **Photo Location:** Pearse East - Transect E3 **Survey Date:** 7/25/2021 **Comments:** Low Intertidal - Quadrat 3	
Photograph ID: 28 **Photo Location:** Pearse East - Transect E6 **Survey Date:** 7/22/2021 **Comments:** High Intertidal - Quadrat 1	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 29 **Photo Location:** Pearse East - Transect E5 **Survey Date:** 7/25/2021 **Comments:** High Intertidal - Quadrat 1	
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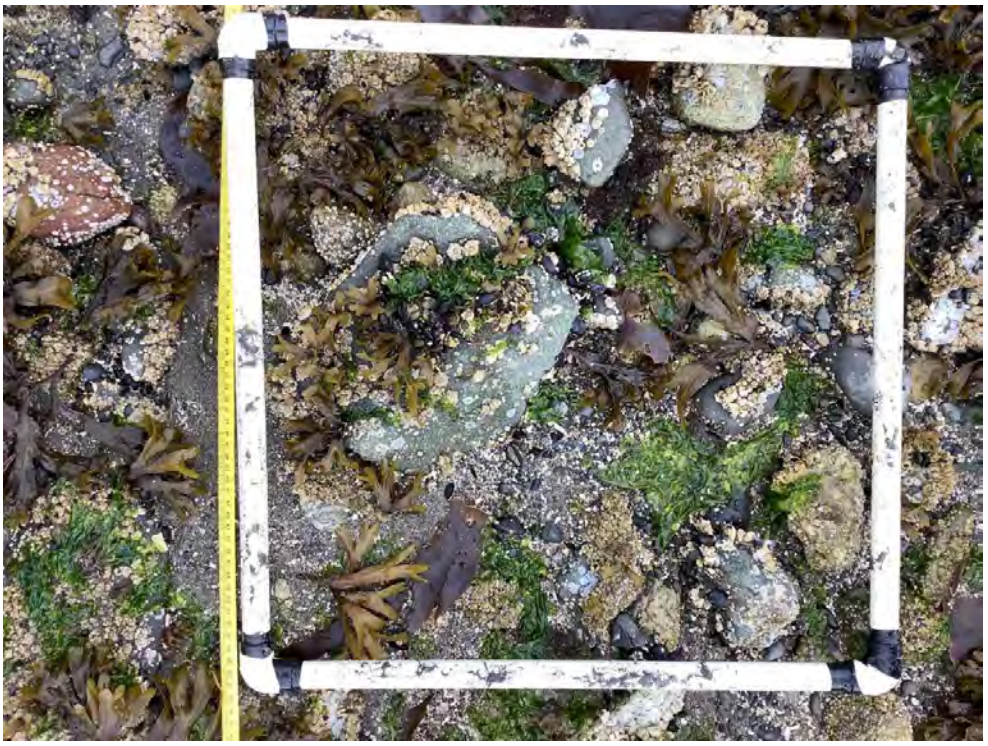
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 31 **Photo Location:** Pearse East - Transect E5 **Survey Date:** 7/25/2021 **Comments:** Mid Intertidal - Quadrat 2	
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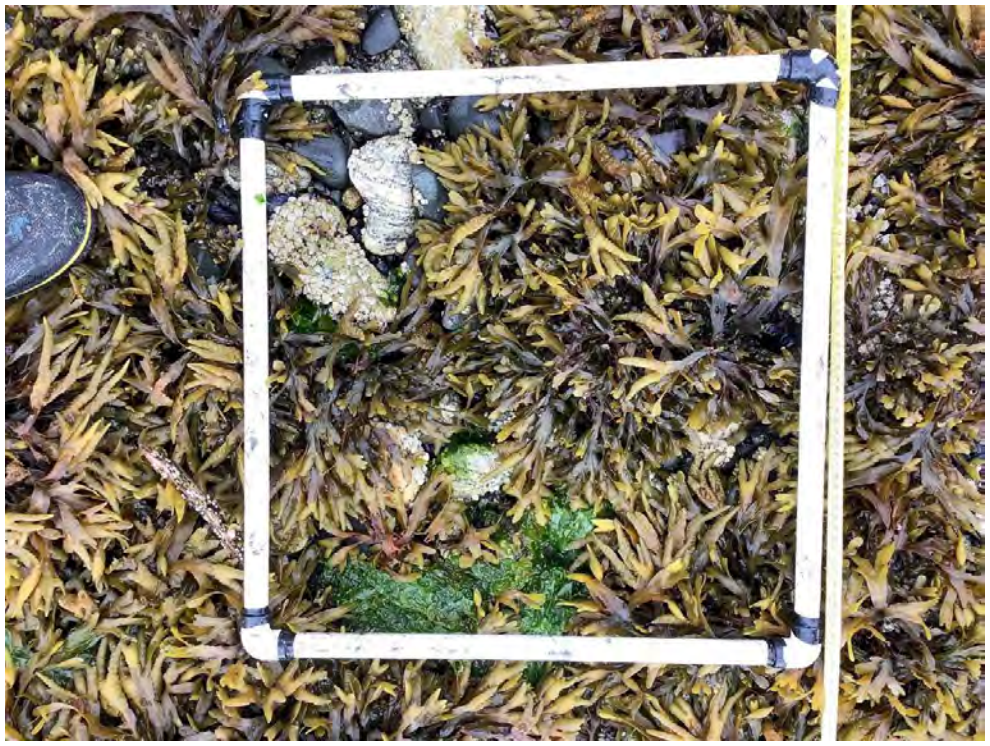
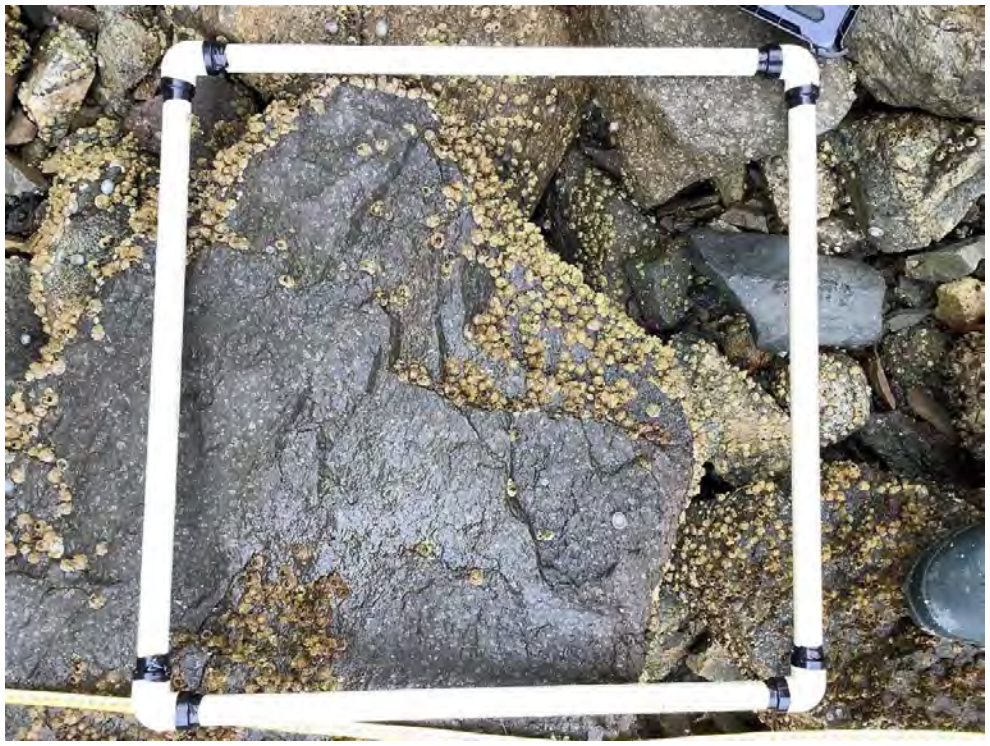
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 33 **Photo Location:** Pearse East - Transect E5 **Survey Date:** 7/25/2021 **Comments:** Low Intertidal - Quadrat 3	
Photograph ID: 34 **Photo Location:** Pearse East - Transect E5 **Survey Date:** 7/25/2021 **Comments:** Low Intertidal - Quadrat 2	

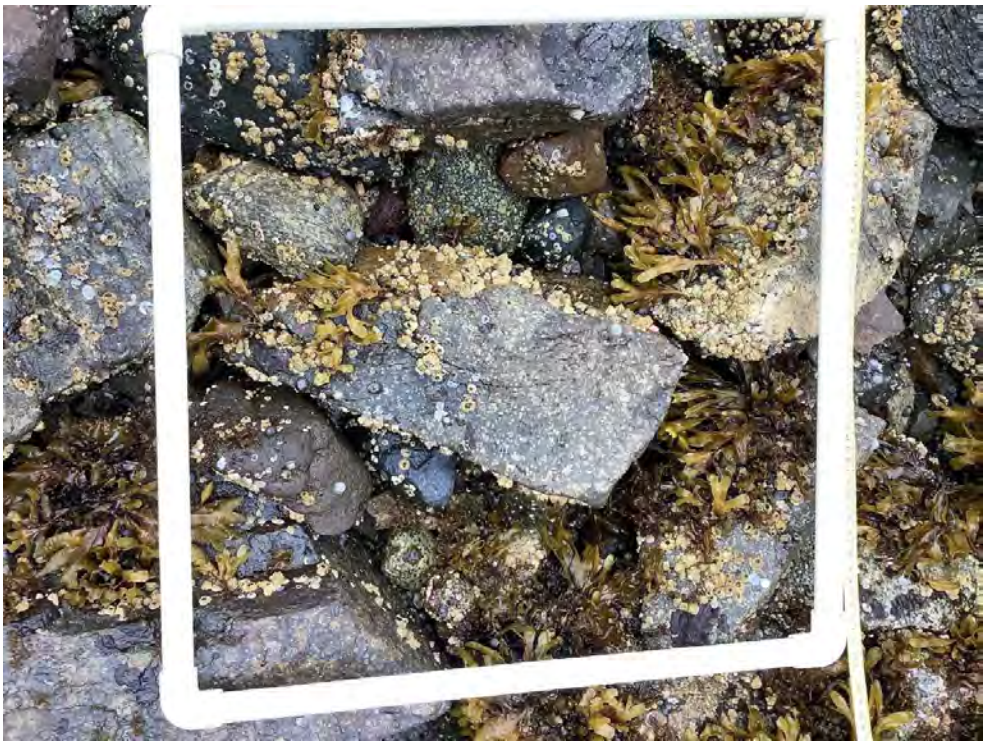
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 35 **Photo Location:** Pearse East - Transect E5 **Survey Date:** 7/25/2021 **Comments:** Low Intertidal - Quadrat 1	
Photograph ID: 36 **Photo Location:** Pearse East - Transect E5 **Survey Date:** 7/25/2021 **Comments:** High Intertidal - Quadrat 3	

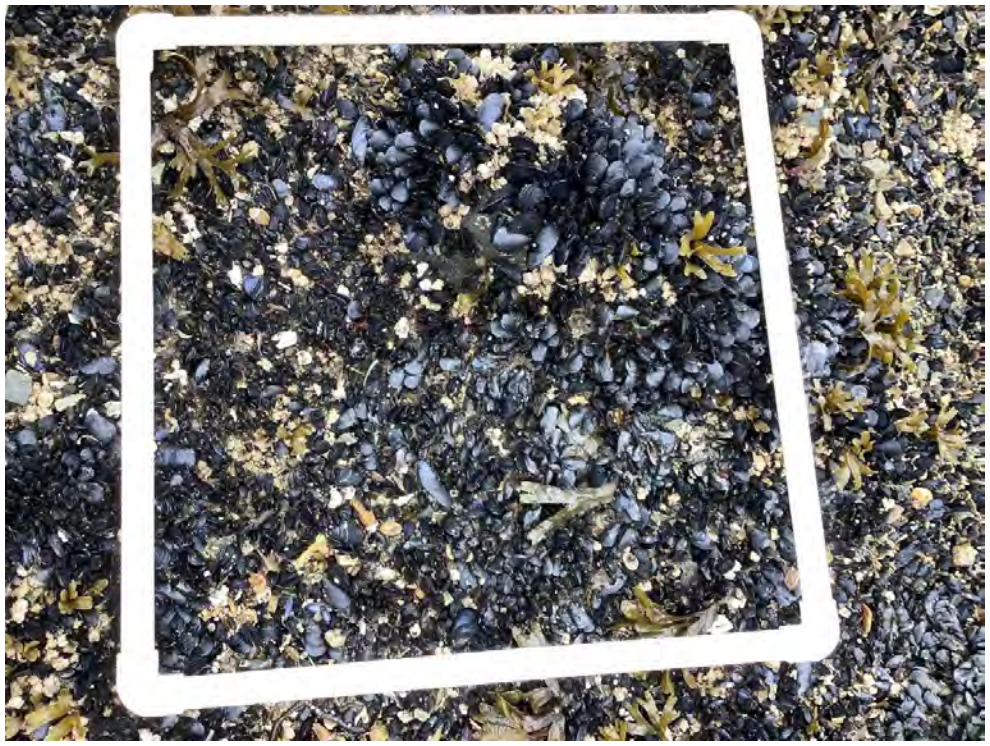
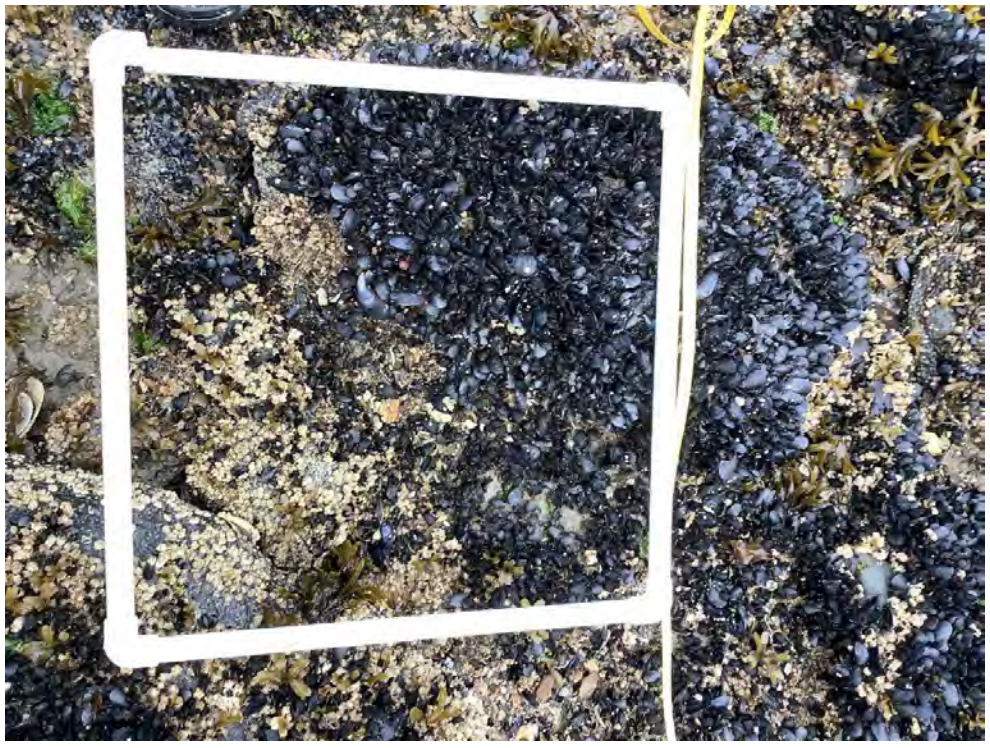
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 37 **Photo Location:** Pearse East - Transect E5 **Survey Date:** 7/25/2021 **Comments:** High Intertidal - Quadrat 2	
Photograph ID: 38 **Photo Location:** Pearse East - Transect E6 **Survey Date:** 7/22/2021 **Comments:** High Intertidal - Quadrat 2	

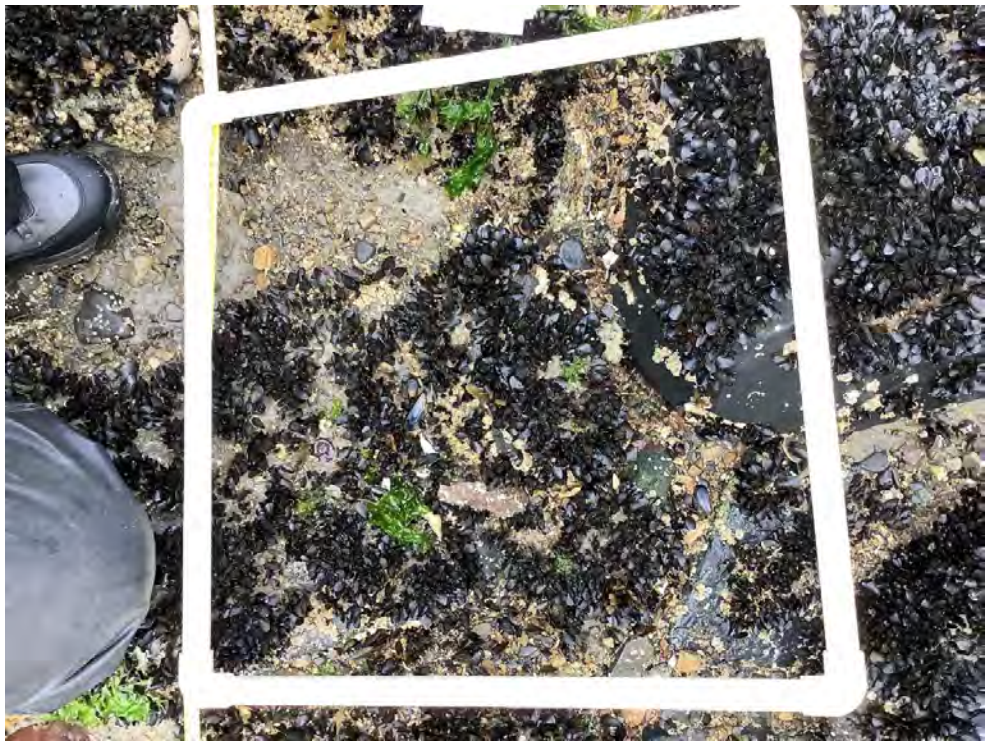
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 39 **Photo Location:** Pearse East - Transect E6 **Survey Date:** 7/22/2021 **Comments:** High Intertidal - Quadrat 3	
Photograph ID: 40 **Photo Location:** Pearse East - Transect E6 **Survey Date:** 7/22/2021 **Comments:** Mid Intertidal - Quadrat 1	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 41 **Photo Location:** Pearse East - Transect E6 **Survey Date:** 7/22/2021 **Comments:** Mid Intertidal - Quadrat 2	
Photograph ID: 42 **Photo Location:** Pearse East - Transect E6 **Survey Date:** 7/22/2021 **Comments:** Mid Intertidal - Quadrat 3	

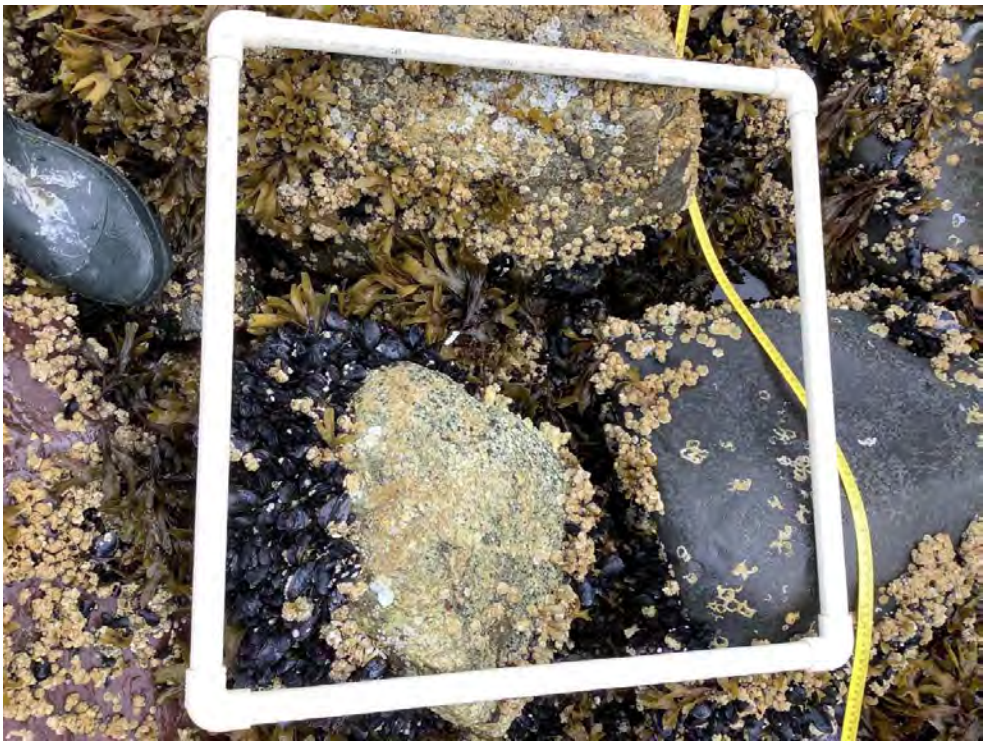
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 43 **Photo Location:** Pearse East - Transect E6 **Survey Date:** 7/22/2021 **Comments:** Low Intertidal - Quadrat 1	
Photograph ID: 44 **Photo Location:** Pearse East - Transect E6 **Survey Date:** 7/22/2021 **Comments:** Low Intertidal - Quadrat 2	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 45 **Photo Location:** Pearse East - Transect E6 **Survey Date:** 7/22/2021 **Comments:** Low Intertidal - Quadrat 3	
Photograph ID: 46 **Photo Location:** Pearse East - Transect E7 **Survey Date:** 7/22/2021 **Comments:** Mid Intertidal - Quadrat 1	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 47 **Photo Location:** Pearse East - Transect E7 **Survey Date:** 7/22/2021 **Comments:** Mid Intertidal - Quadrat 2	
Photograph ID: 48 **Photo Location:** Pearse East - Transect E7 **Survey Date:** 7/22/2021 **Comments:** Mid Intertidal - Quadrat 3	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 49 **Photo Location:** Pearse East - Transect E7 **Survey Date:** 7/22/2021 **Comments:** High Intertidal - Quadrat 1	
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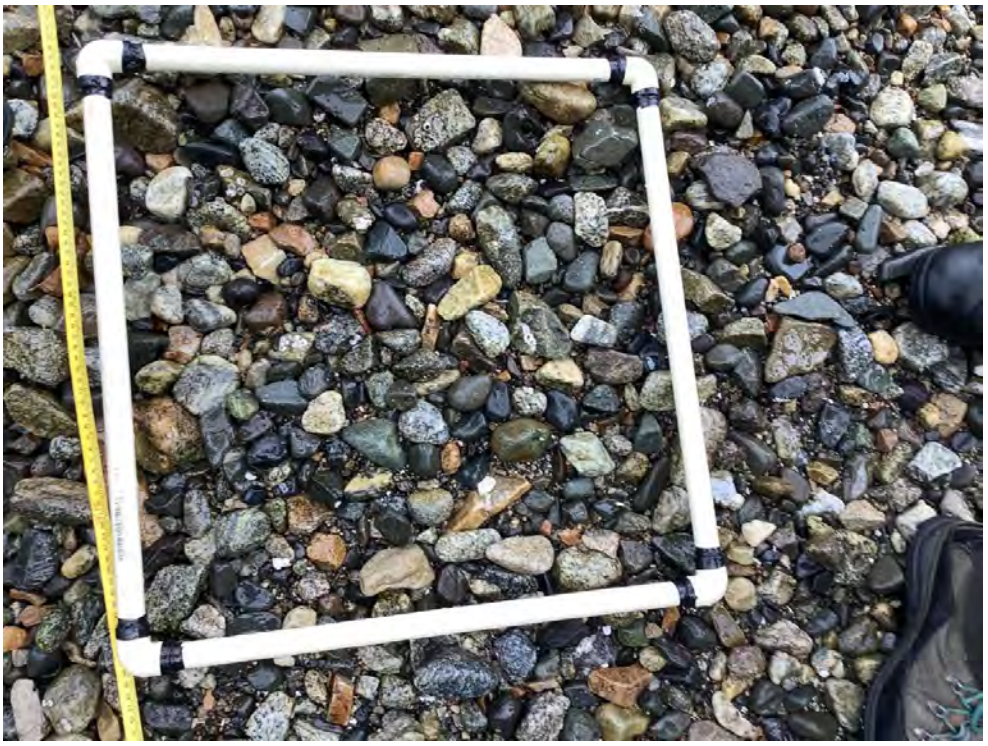
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 51 **Photo Location:** Pearse East - Transect E7 **Survey Date:** 7/22/2021 **Comments:** High Intertidal - Quadrat 3	
Photograph ID: 52 **Photo Location:** Pearse East - Transect E9 **Survey Date:** 7/22/2021 **Comments:** High Intertidal - Quadrat 1	

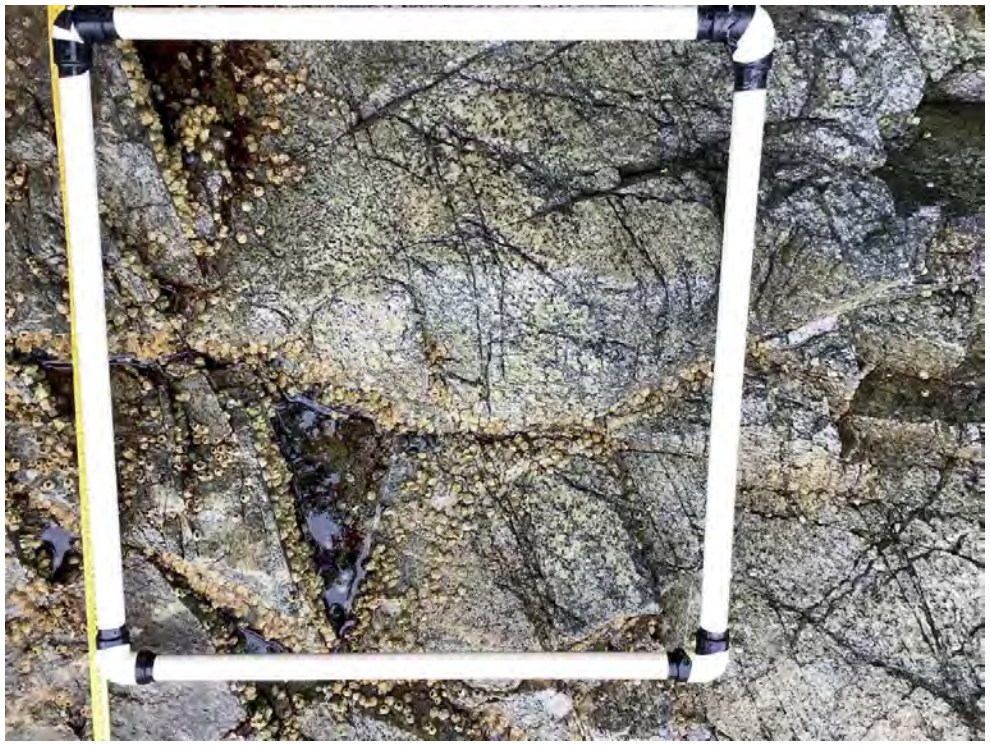
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 53 **Photo Location:** Pearse East - Transect E9 **Survey Date:** 7/22/2021 **Comments:** High Intertidal - Quadrat 2	
Photograph ID: 54 **Photo Location:** Pearse East - Transect E9 **Survey Date:** 7/22/2021 **Comments:** High Intertidal - Quadrat 3	

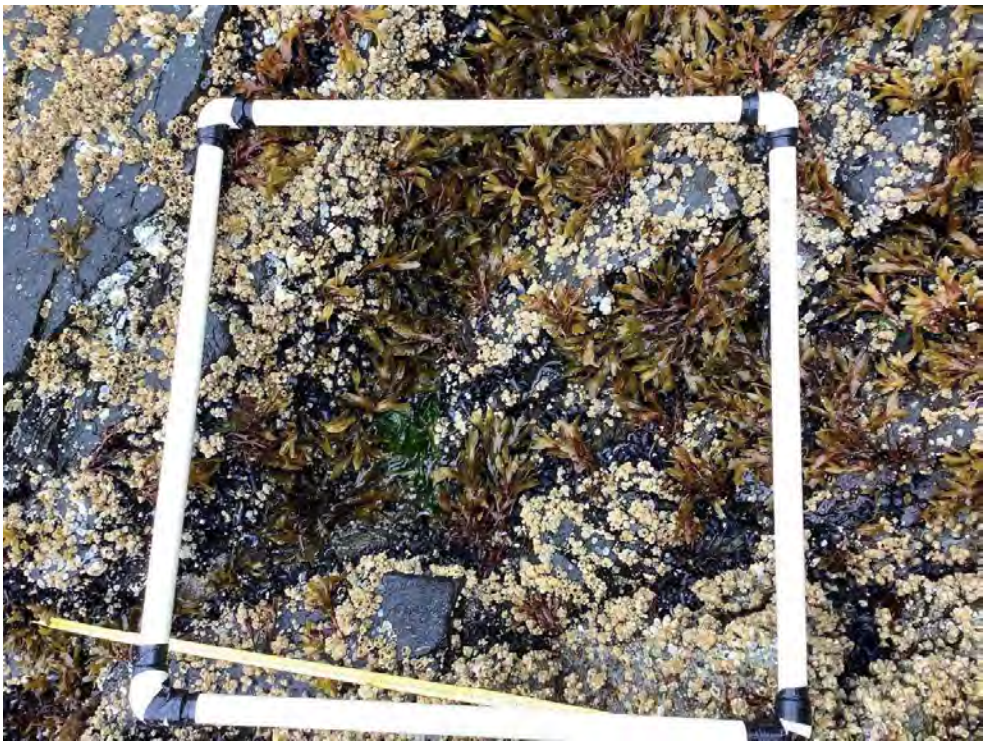
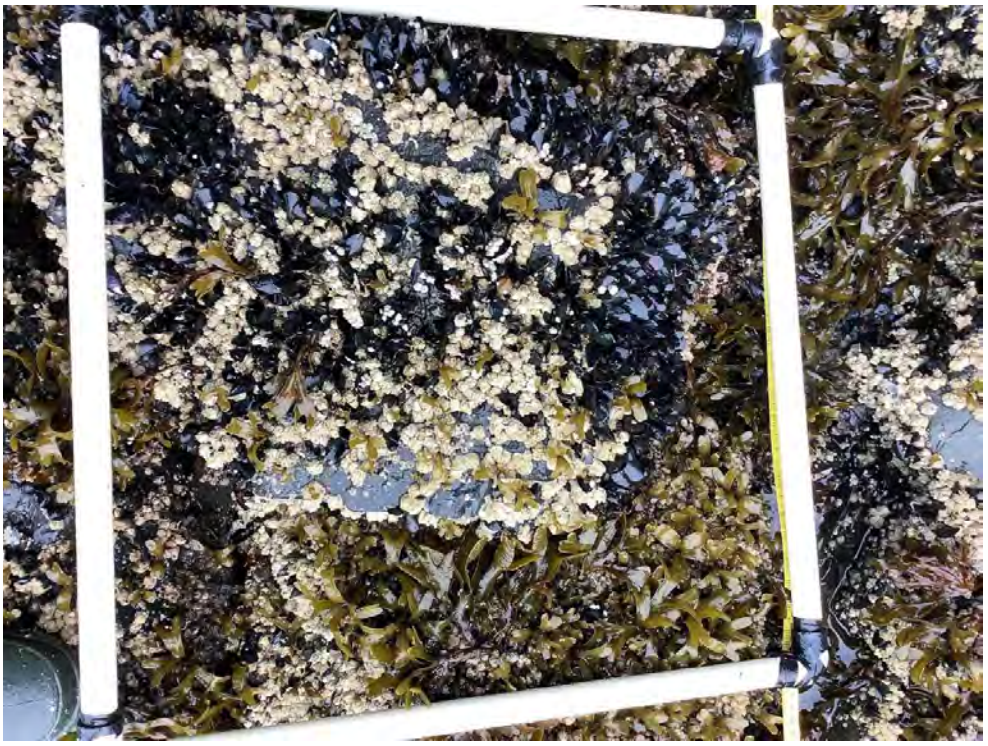
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 55 **Photo Location:** Pearse East - Transect E9 **Survey Date:** 7/22/2021 **Comments:** Mid Intertidal - Quadrat 1	
Photograph ID: 56 **Photo Location:** Pearse East - Transect E9 **Survey Date:** 7/22/2021 **Comments:** Mid Intertidal - Quadrat 2	

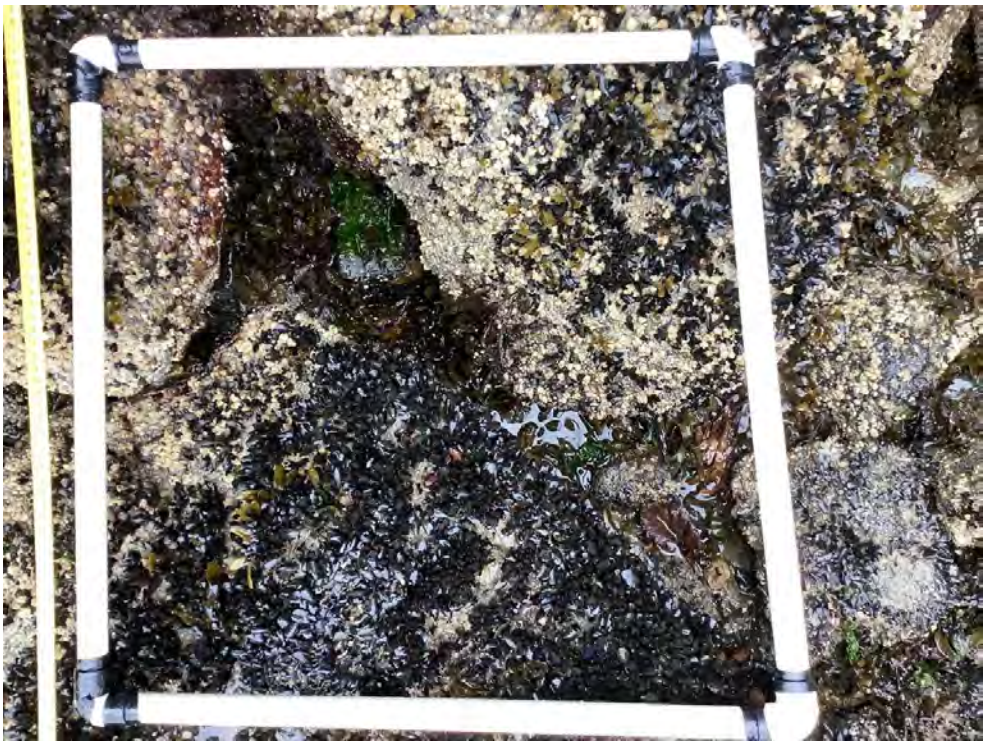
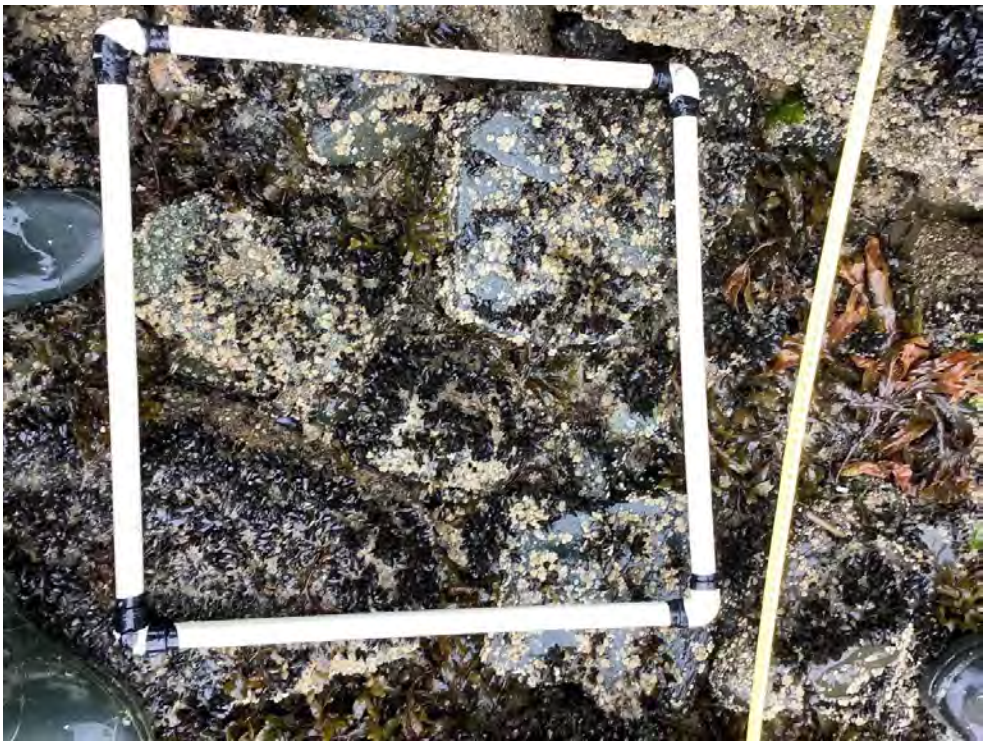
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 57 **Photo Location:** Pearse East - Transect E9 **Survey Date:** 7/22/2021 **Comments:** Mid Intertidal - Quadrat 3	
Photograph ID: 58 **Photo Location:** Pearse East - Transect E10 **Survey Date:** 7/26/2021 **Comments:** High Intertidal - Quadrat 1	

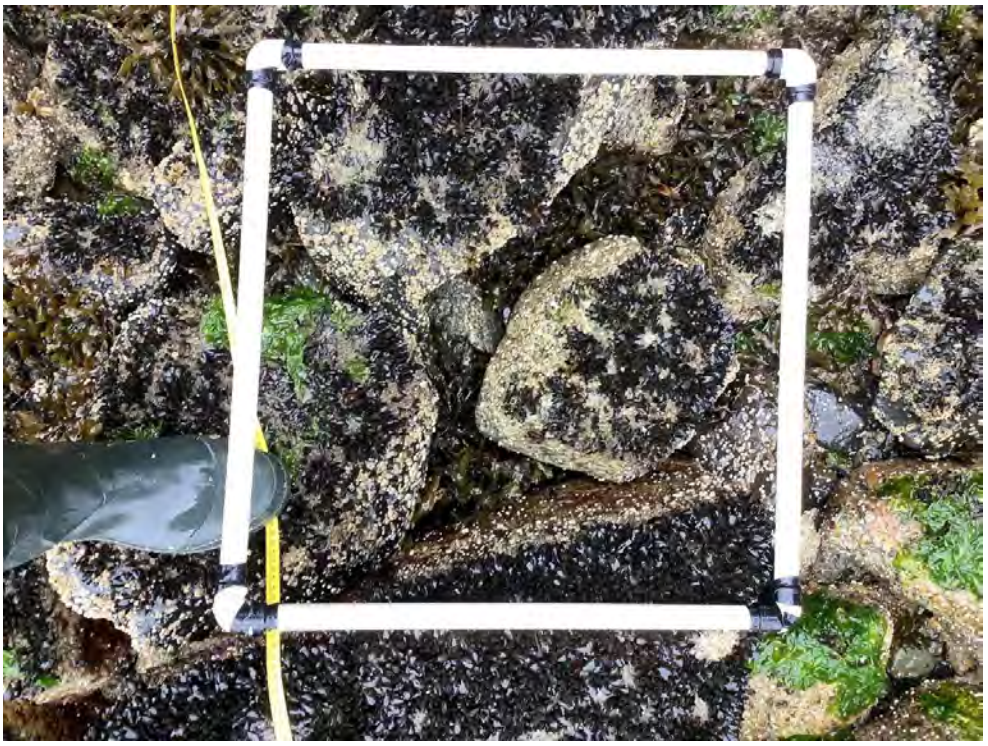
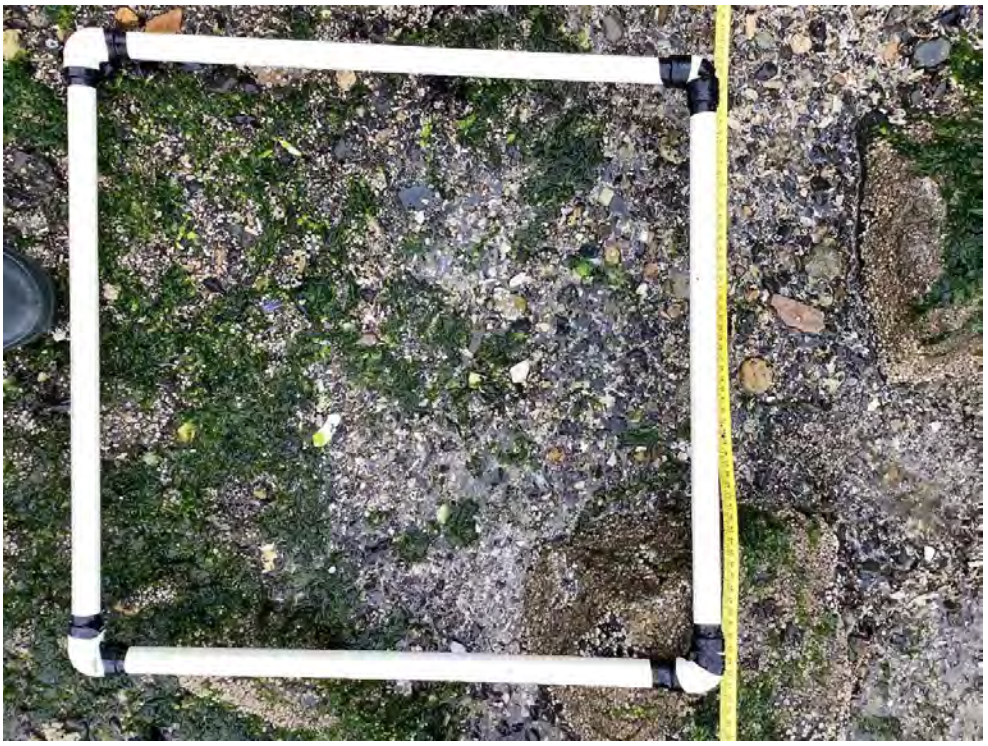
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 59 **Photo Location:** Pearse East - Transect E10 **Survey Date:** 7/26/2021 **Comments:** High Intertidal - Quadrat 2	
Photograph ID: 60 **Photo Location:** Pearse East - Transect E10 **Survey Date:** 7/26/2021 **Comments:** High Intertidal - Quadrat 3	

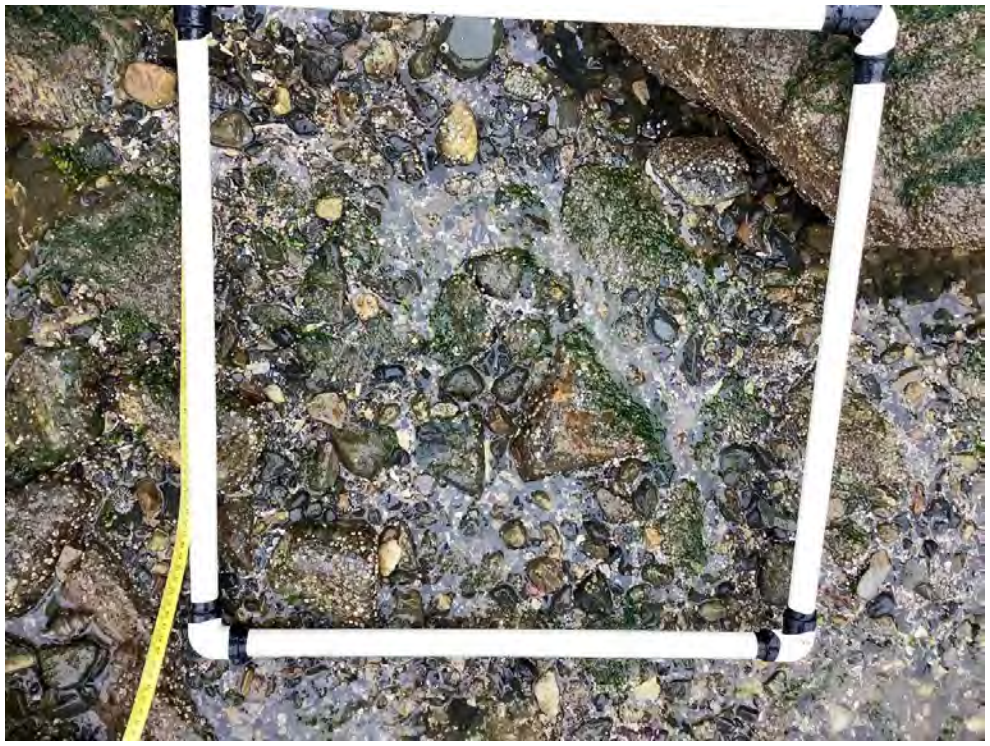
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 61 **Photo Location:** Pearse East - Transect E10 **Survey Date:** 7/26/2021 **Comments:** Mid Intertidal - Quadrat 1	
Photograph ID: 62 **Photo Location:** Pearse East - Transect E10 **Survey Date:** 7/26/2021 **Comments:** Mid Intertidal - Quadrat 2	

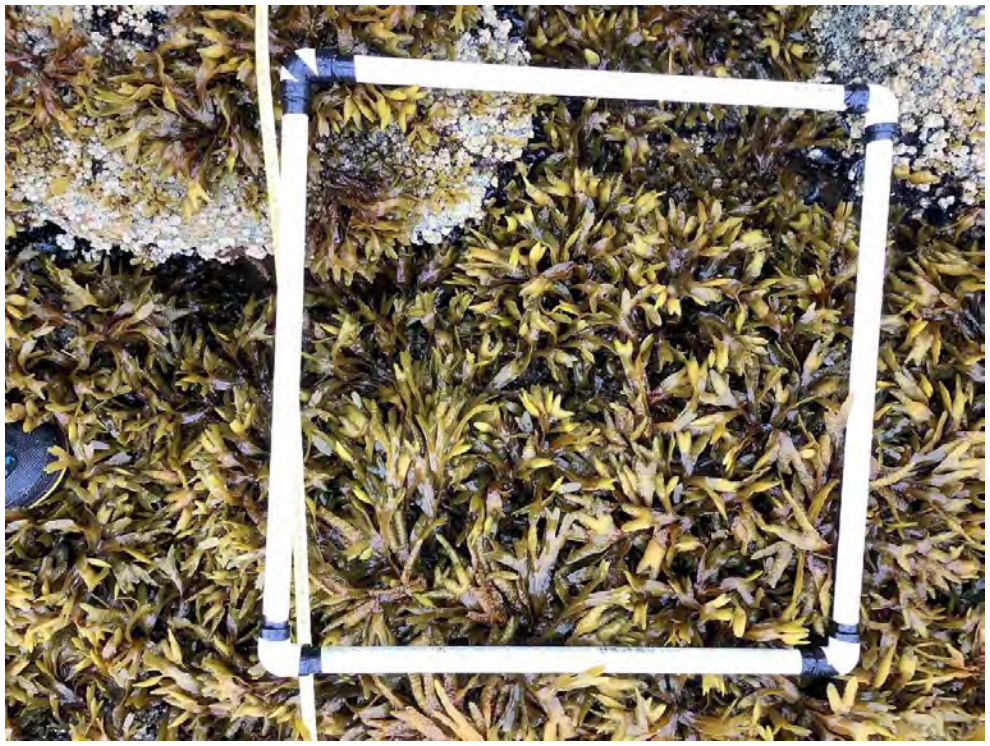
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 63 **Photo Location:** Pearse East - Transect E10 **Survey Date:** 7/26/2021 **Comments:** Mid Intertidal - Quadrat 3	
Photograph ID: 64 **Photo Location:** Pearse East - Transect E10 **Survey Date:** 7/26/2021 **Comments:** Low Intertidal - Quadrat 1	

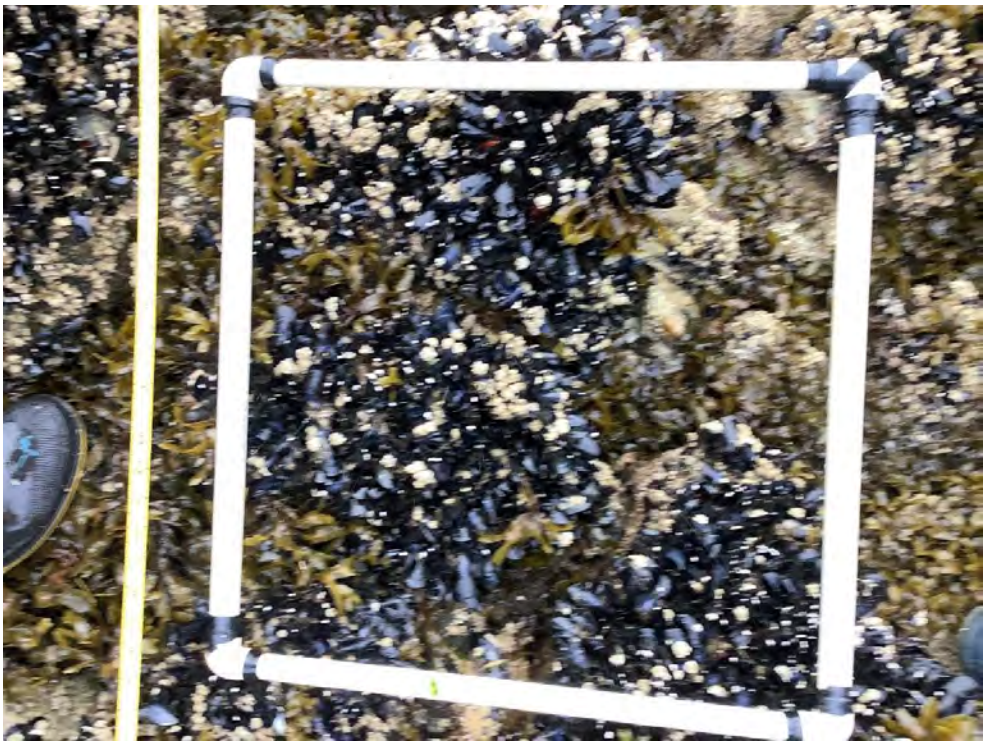
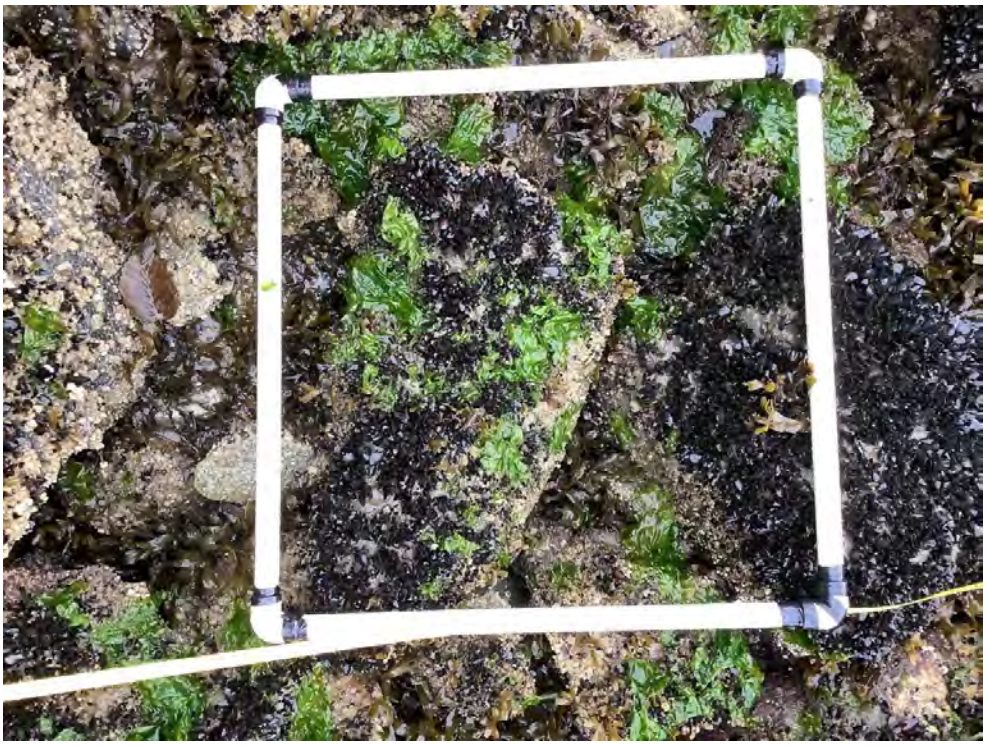
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 65 **Photo Location:** Pearse East - Transect E10 **Survey Date:** 7/26/2021 **Comments:** Low Intertidal - Quadrat 2	
Photograph ID: 66 **Photo Location:** Pearse East - Transect E10 **Survey Date:** 7/26/2021 **Comments:** Low Intertidal - Quadrat 3	

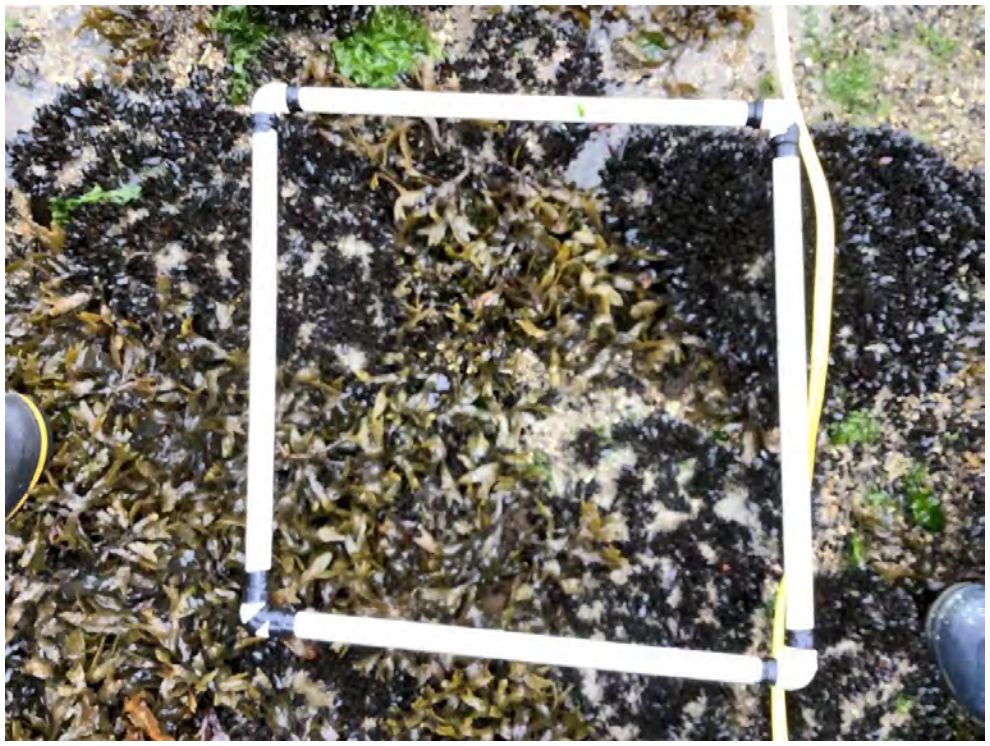
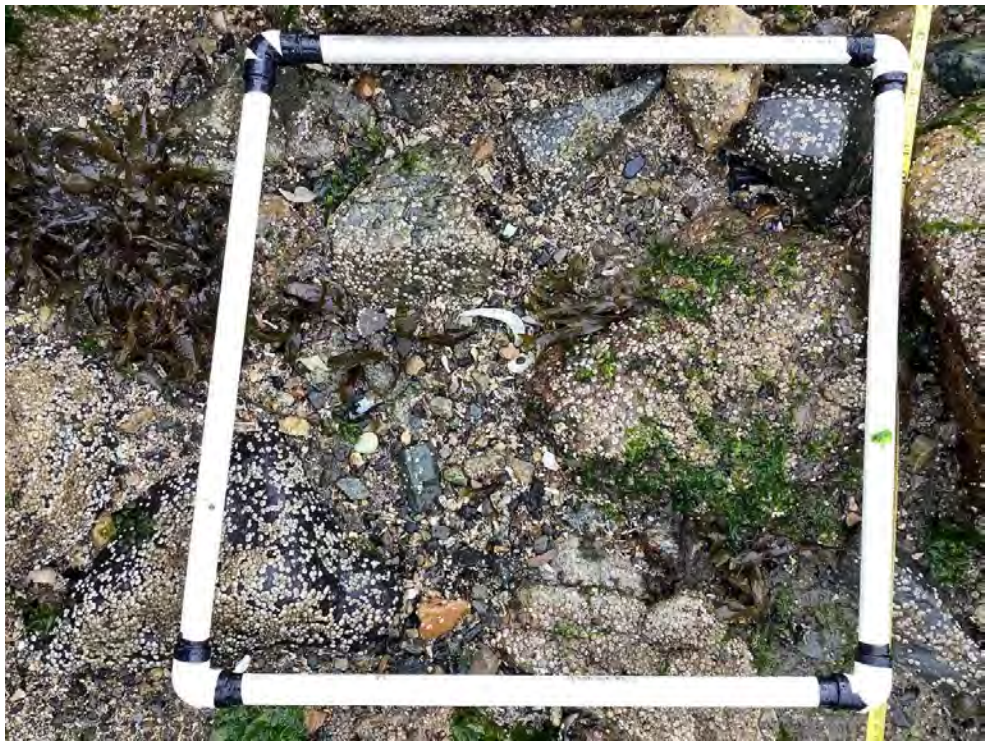
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 67 **Photo Location:** Pearse East - Transect E11 **Survey Date:** 7/26/2021 **Comments:** High Intertidal - Quadrat 2	
Photograph ID: 68 **Photo Location:** Pearse East - Transect E11 **Survey Date:** 7/26/2021 **Comments:** High Intertidal - Quadrat 3	

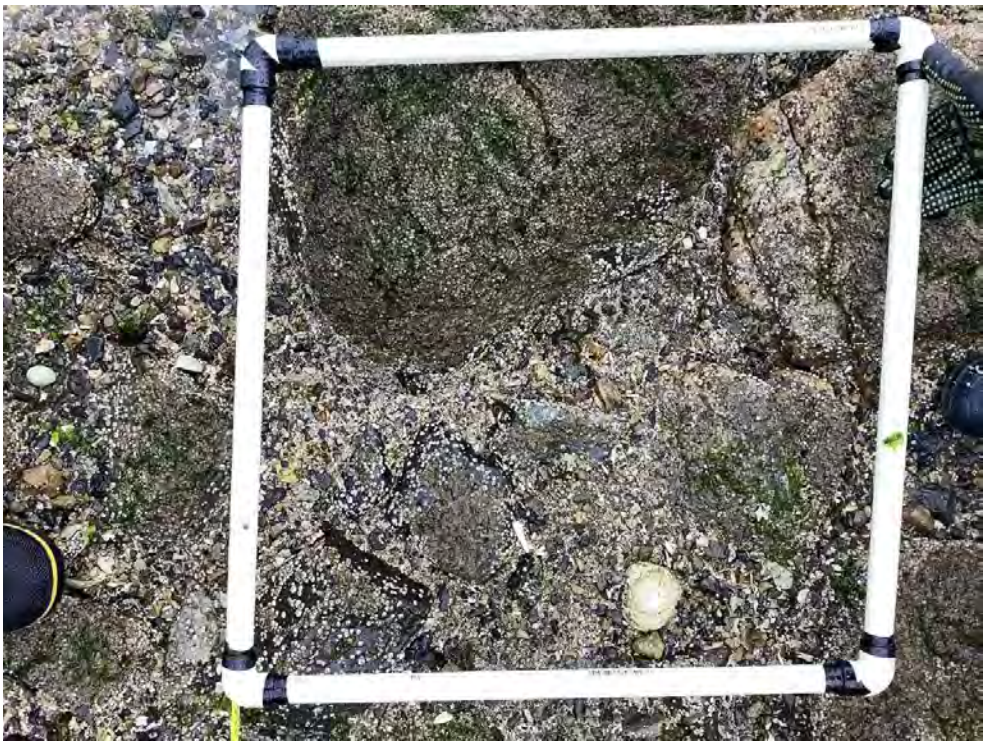
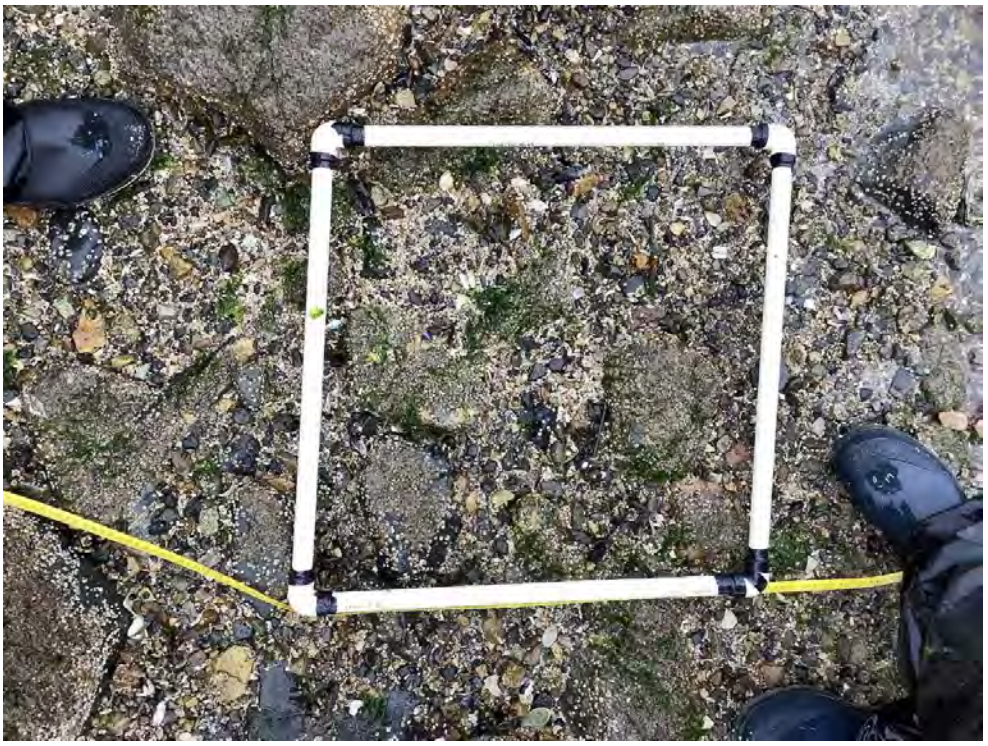
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 69 **Photo Location:** Pearse East - Transect E11 **Survey Date:** 7/26/2021 **Comments:** Mid Intertidal - Quadrat 1	
Photograph ID: 70 **Photo Location:** Pearse East - Transect E11 **Survey Date:** 7/26/2021 **Comments:** Mid Intertidal - Quadrat 2	

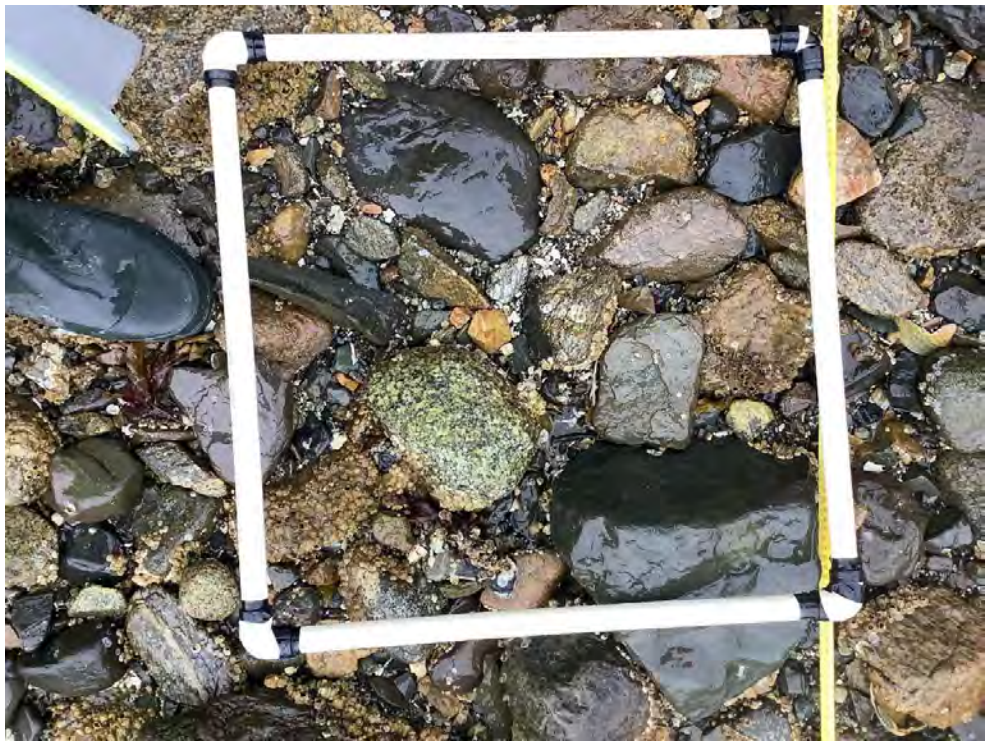
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 71 **Photo Location:** Pearse East - Transect E11 **Survey Date:** 7/26/2021 **Comments:** Mid Intertidal - Quadrat 3	
Photograph ID: 72 **Photo Location:** Pearse East - Transect E11 **Survey Date:** 7/26/2021 **Comments:** Low Intertidal - Quadrat 1	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 73 **Photo Location:** Pearse East - Transect E11 **Survey Date:** 7/26/2021 **Comments:** Low Intertidal - Quadrat 2	
Photograph ID: 74 **Photo Location:** Pearse East - Transect E11 **Survey Date:** 7/26/2021 **Comments:** Low Intertidal - Quadrat 3	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 75 **Photo Location:** Pearse East - Transect E12 **Survey Date:** 7/25/2021 **Comments:** High Intertidal - Quadrat 1	
Photograph ID: 76 **Photo Location:** Pearse East - Transect E12 **Survey Date:** 7/25/2021 **Comments:** High Intertidal - Quadrat 2	

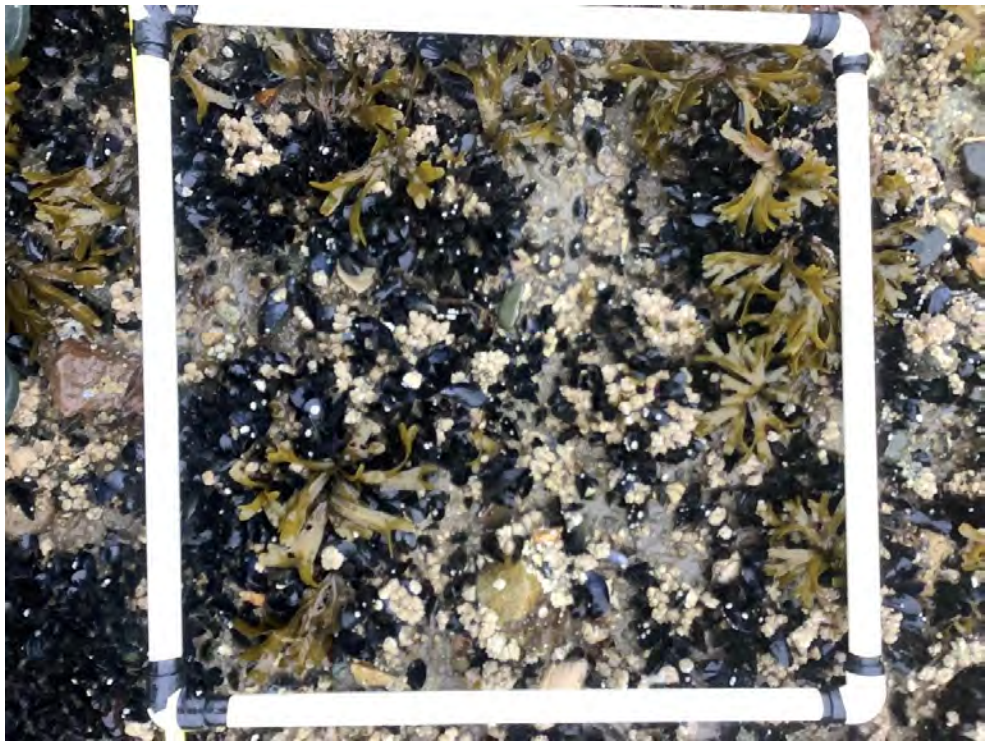
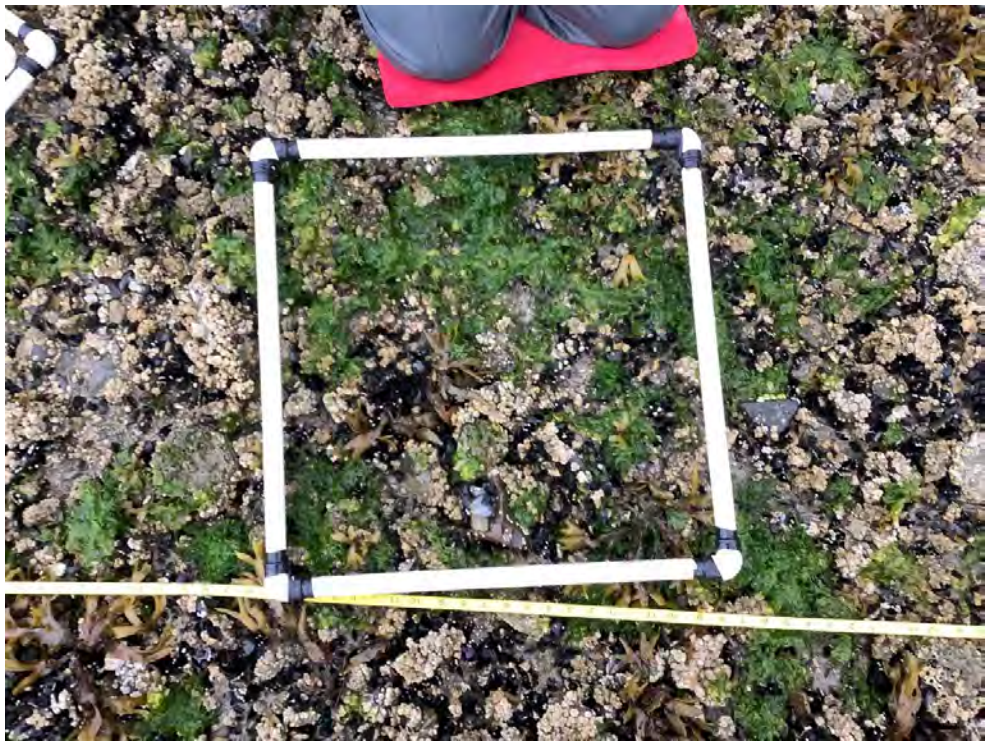
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 77 **Photo Location:** Pearse East - Transect E12 **Survey Date:** 7/25/2021 **Comments:** High Intertidal - Quadrat 3	
Photograph ID: 78 **Photo Location:** Pearse East - Transect E12 **Survey Date:** 7/25/2021 **Comments:** Mid Intertidal - Quadrat 1	

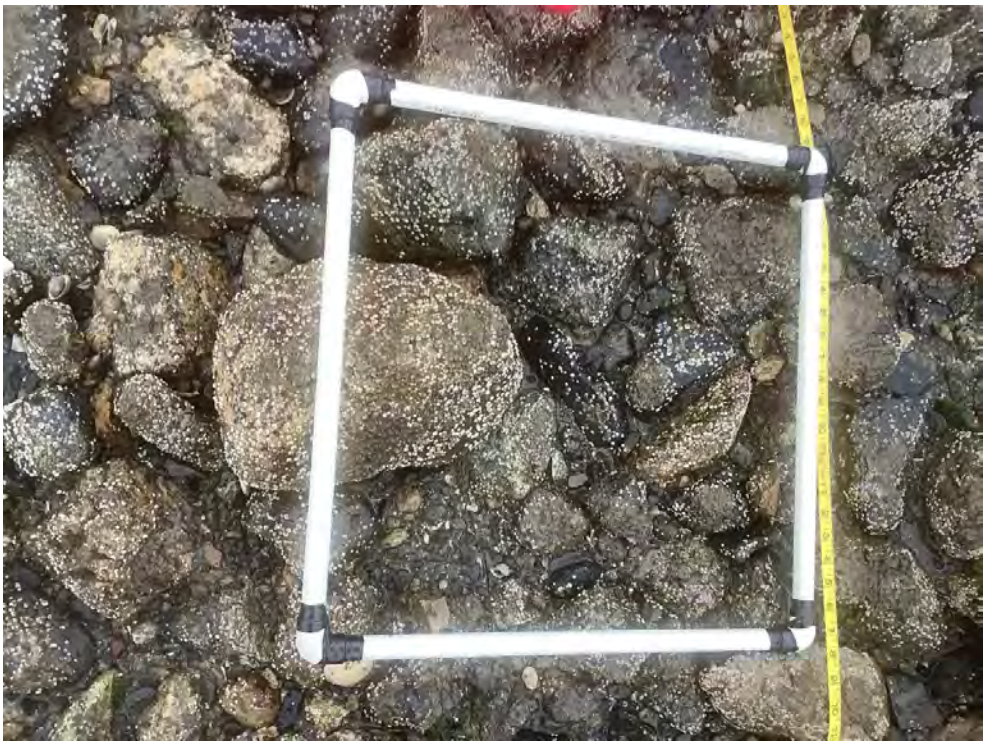
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 79 **Photo Location:** Pearse East - Transect E12 **Survey Date:** 7/25/2021 **Comments:** Mid Intertidal - Quadrat 2	
Photograph ID: 80 **Photo Location:** Pearse East - Transect E12 **Survey Date:** 7/25/2021 **Comments:** Mid Intertidal - Quadrat 3	

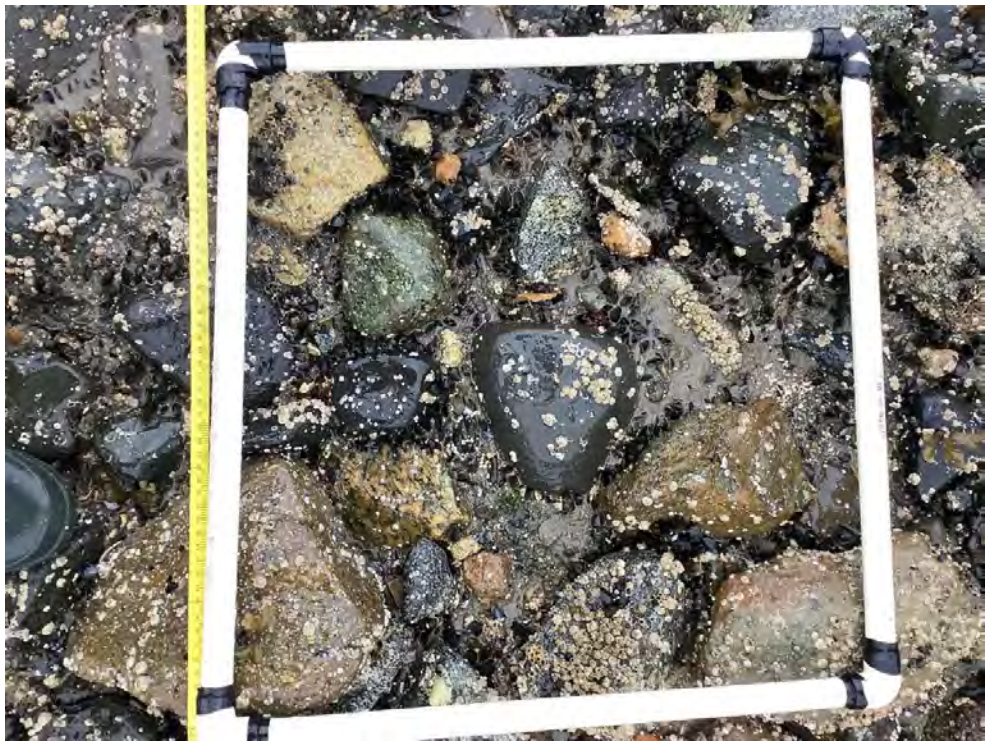
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 81 **Photo Location:** Pearse East - Transect E12 **Survey Date:** 7/25/2021 **Comments:** Mid Intertidal - Quadrat 4	
Photograph ID: 82 **Photo Location:** Pearse East - Transect E12 **Survey Date:** 7/25/2021 **Comments:** Mid Intertidal - Quadrat 5	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 83 **Photo Location:** Pearse East - Transect E12 **Survey Date:** 7/25/2021 **Comments:** Low Intertidal - Quadrat 1	
Photograph ID: 84 **Photo Location:** Pearse East - Transect E12 **Survey Date:** 7/25/2021 **Comments:** Low Intertidal - Quadrat 2	

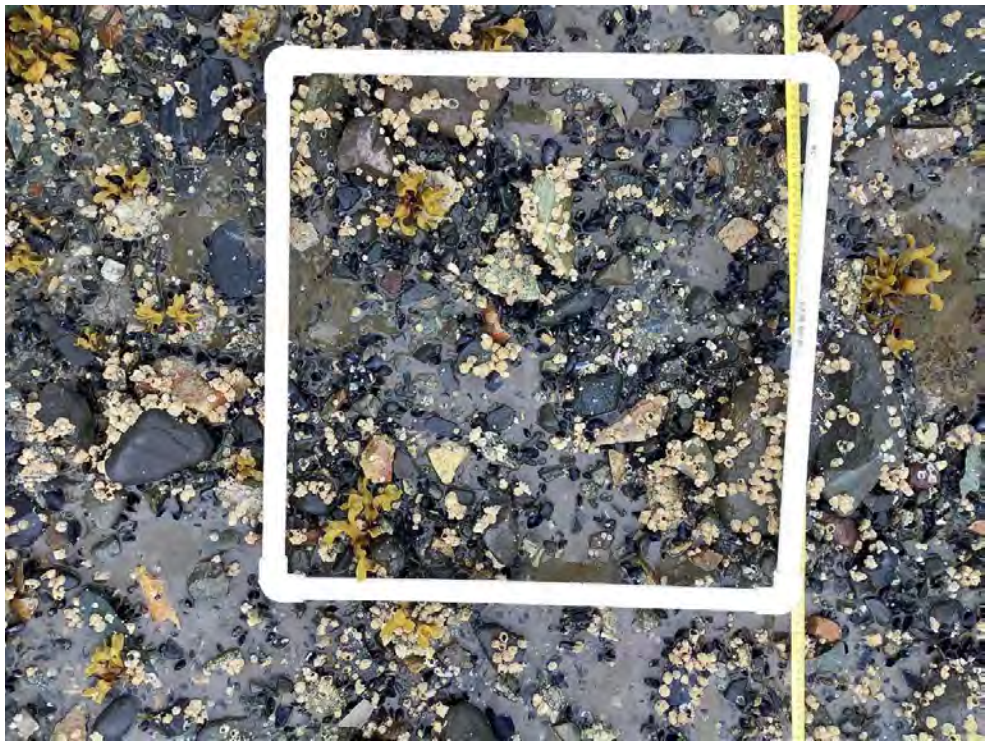
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 85 **Photo Location:** Pearse East - Transect E12 **Survey Date:** 7/25/2021 **Comments:** Low Intertidal - Quadrat 3	
Photograph ID: 86 **Photo Location:** Whiskey Bay - Transect WB1 **Survey Date:** 7/24/2021 **Comments:** High Intertidal - Quadrat 1	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 87 **Photo Location:** Whiskey Bay - Transect WB1 **Survey Date:** 7/24/2021 **Comments:** High Intertidal - Quadrat 2	
Photograph ID: 88 **Photo Location:** Whiskey Bay - Transect WB1 **Survey Date:** 7/24/2021 **Comments:** High Intertidal - Quadrat 3	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 89 **Photo Location:** Whiskey Bay - Transect WB1 **Survey Date:** 7/24/2021 **Comments:** Mid Intertidal - Quadrat 1	
Photograph ID: 90 **Photo Location:** Whiskey Bay - Transect WB1 **Survey Date:** 7/24/2021 **Comments:** Mid Intertidal - Quadrat 2	

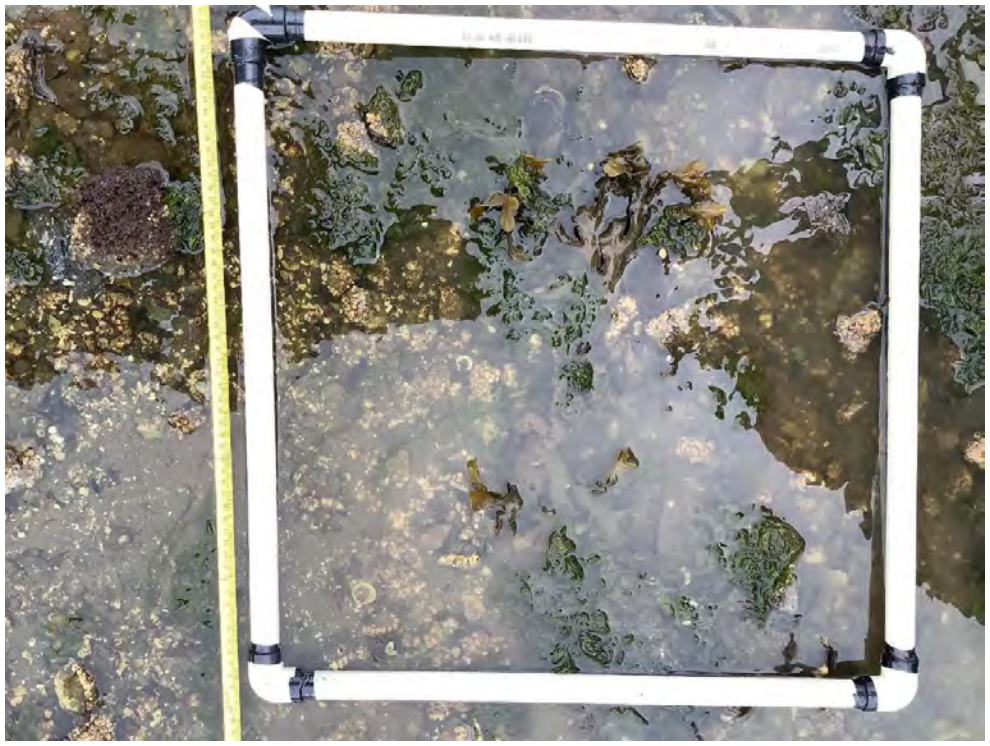
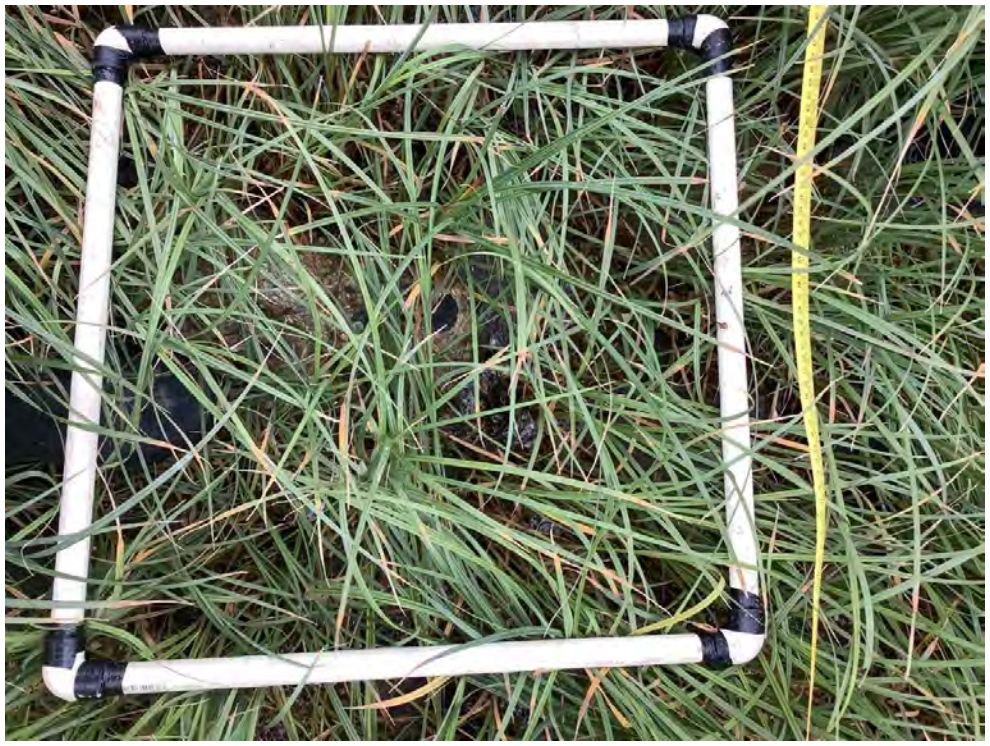
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 91 **Photo Location:** Whiskey Bay - Transect WB1 **Survey Date:** 7/24/2021 **Comments:** Mid Intertidal - Quadrat 3	
Photograph ID: 92 **Photo Location:** Whiskey Bay - Transect WB1 **Survey Date:** 7/24/2021 **Comments:** Mid Intertidal - Quadrat 4	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 93 **Photo Location:** Whiskey Bay - Transect WB1 **Survey Date:** 7/24/2021 **Comments:** Mid Intertidal - Quadrat 5	
Photograph ID: 94 **Photo Location:** Whiskey Bay - Transect WB1 **Survey Date:** 7/24/2021 **Comments:** Low Intertidal - Quadrat 1	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 95 **Photo Location:** Whiskey Bay - Transect WB1 **Survey Date:** 7/24/2021 **Comments:** Low Intertidal - Quadrat 2	
Photograph ID: 96 **Photo Location:** Whiskey Bay - Transect WB2 **Survey Date:** 7/24/2021 **Comments:** High Intertidal - Quadrat 1	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 97

Photo Location:
Whiskey Bay - Transect WB2

Survey Date:
7/24/2021

Comments:
High Intertidal - Quadrat 2

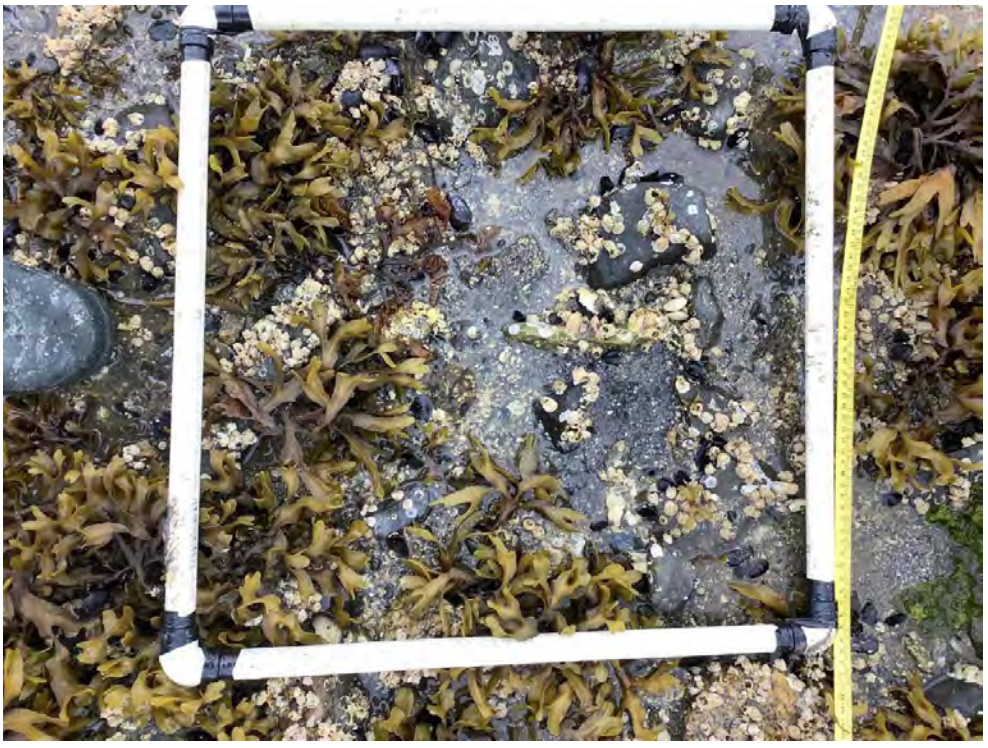
Photograph ID: 98

Photo Location:
Whiskey Bay - Transect WB2

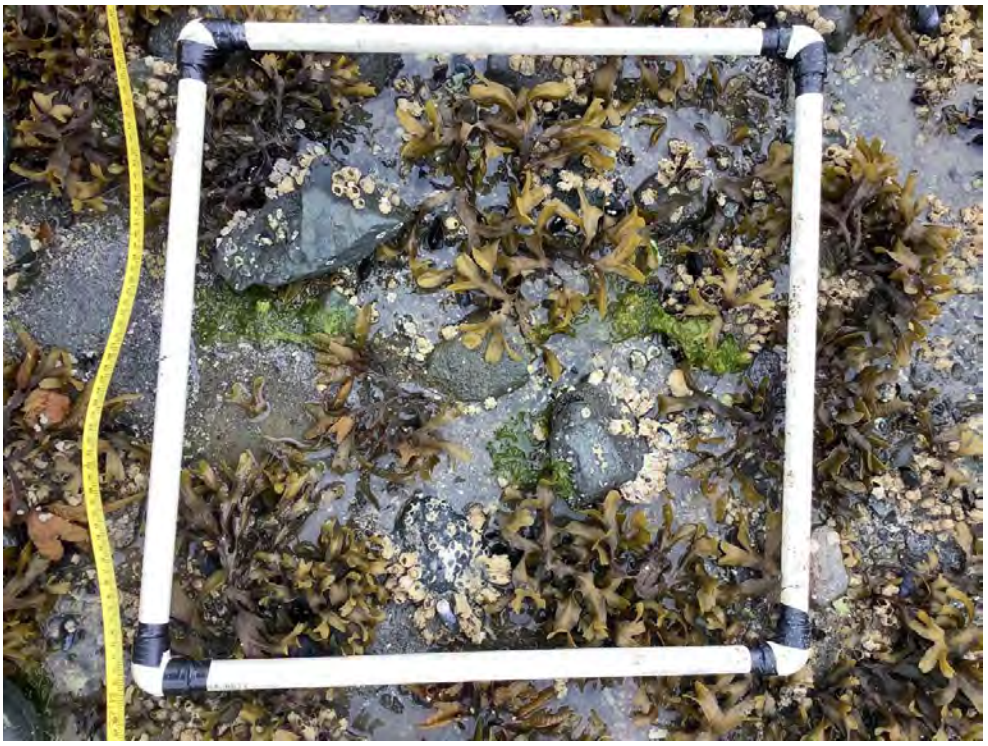
Survey Date:
7/24/2021

Comments:
High Intertidal - Quadrat 3

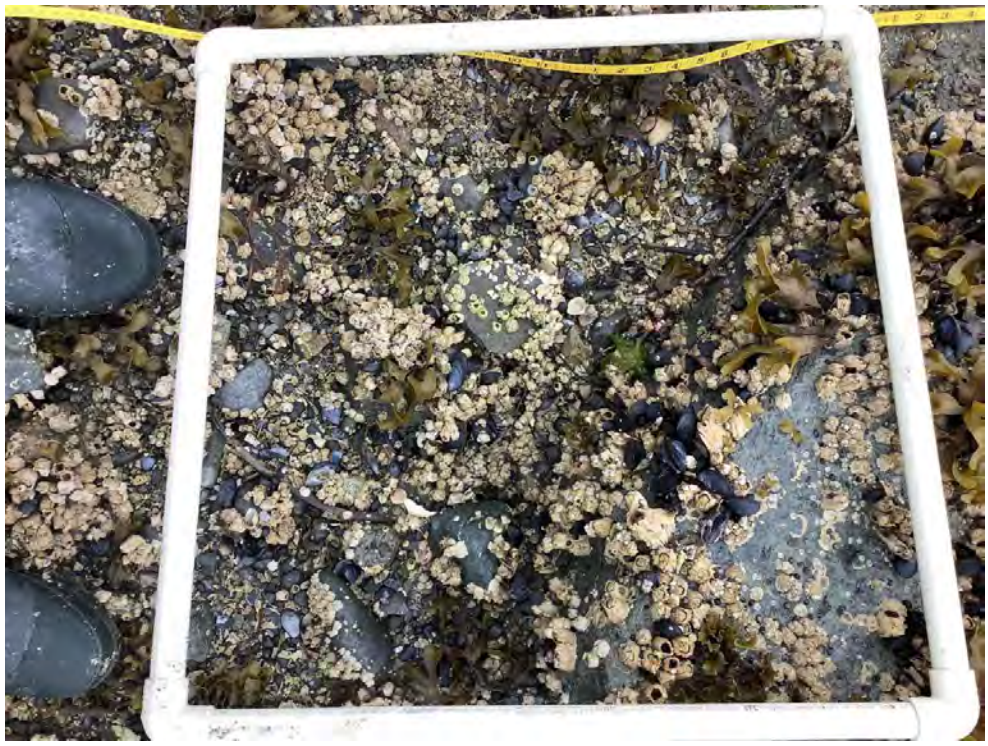
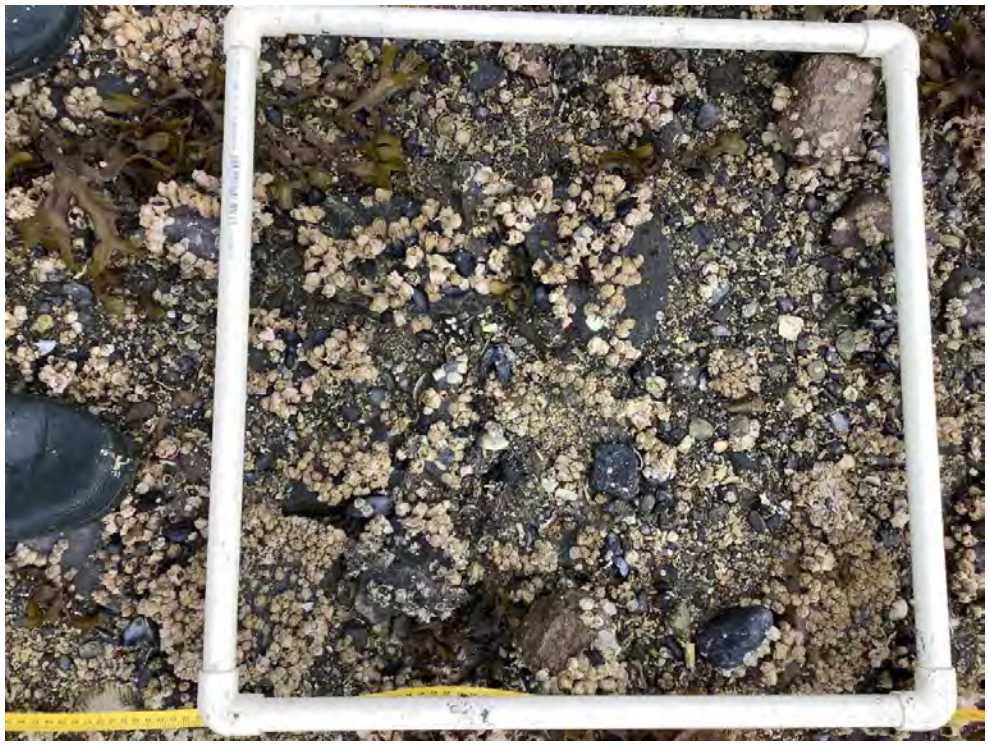
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 99 **Photo Location:** Whiskey Bay - Transect WB2 **Survey Date:** 7/24/2021 **Comments:** Mid Intertidal - Quadrat 1	
Photograph ID: 100 **Photo Location:** Whiskey Bay - Transect WB2 **Survey Date:** 7/24/2021 **Comments:** Mid Intertidal - Quadrat 2	

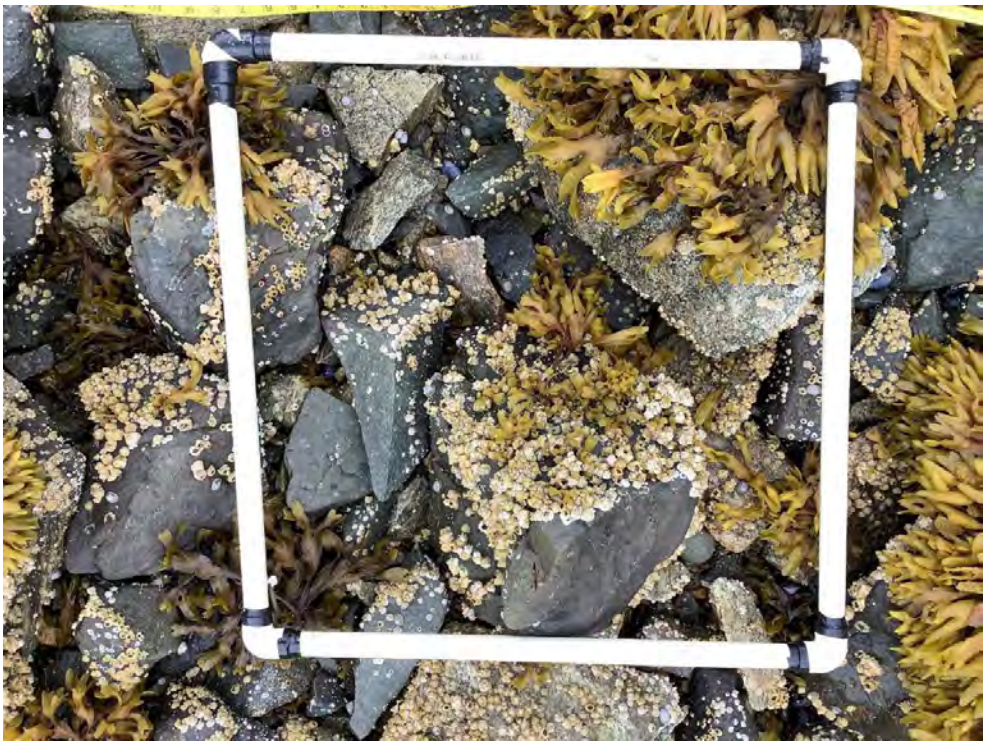
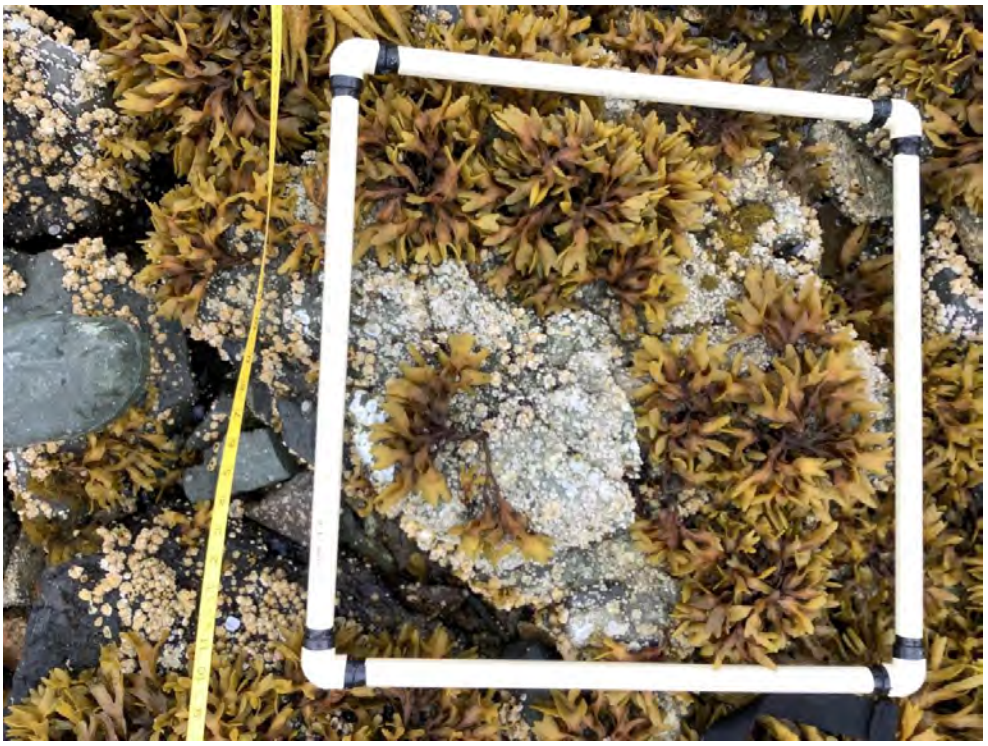
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 101 **Photo Location:** Whiskey Bay - Transect WB2 **Survey Date:** 7/24/2021 **Comments:** Mid Intertidal - Quadrat 3	
Photograph ID: 102 **Photo Location:** Whiskey Bay - Transect WB2 **Survey Date:** 7/24/2021 **Comments:** Low Intertidal - Quadrat 1	

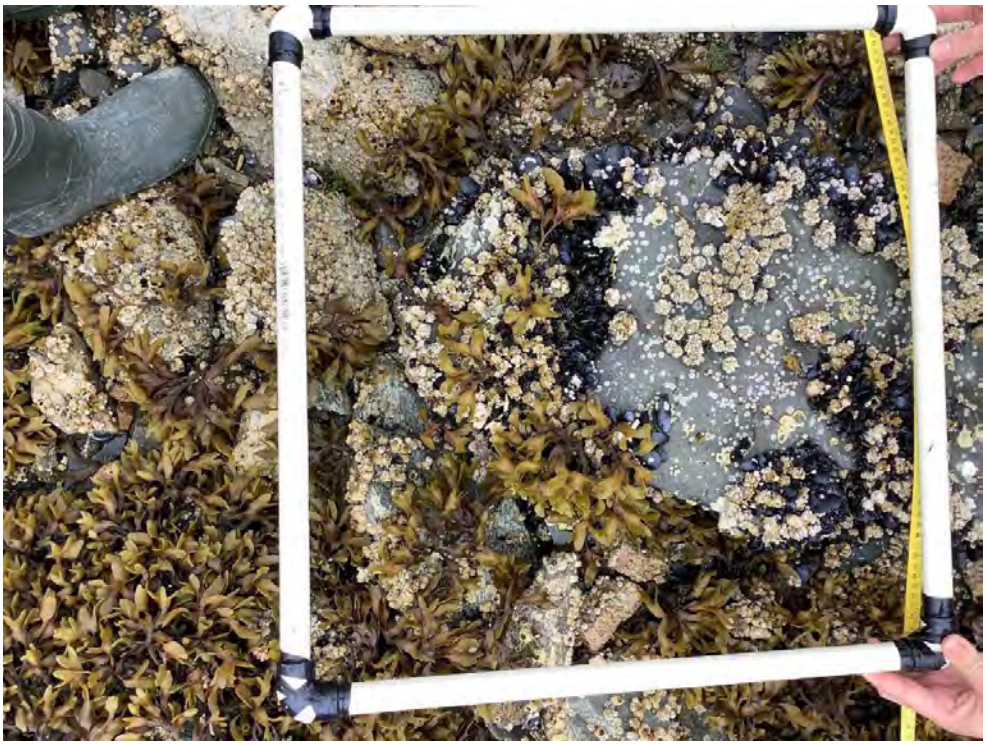
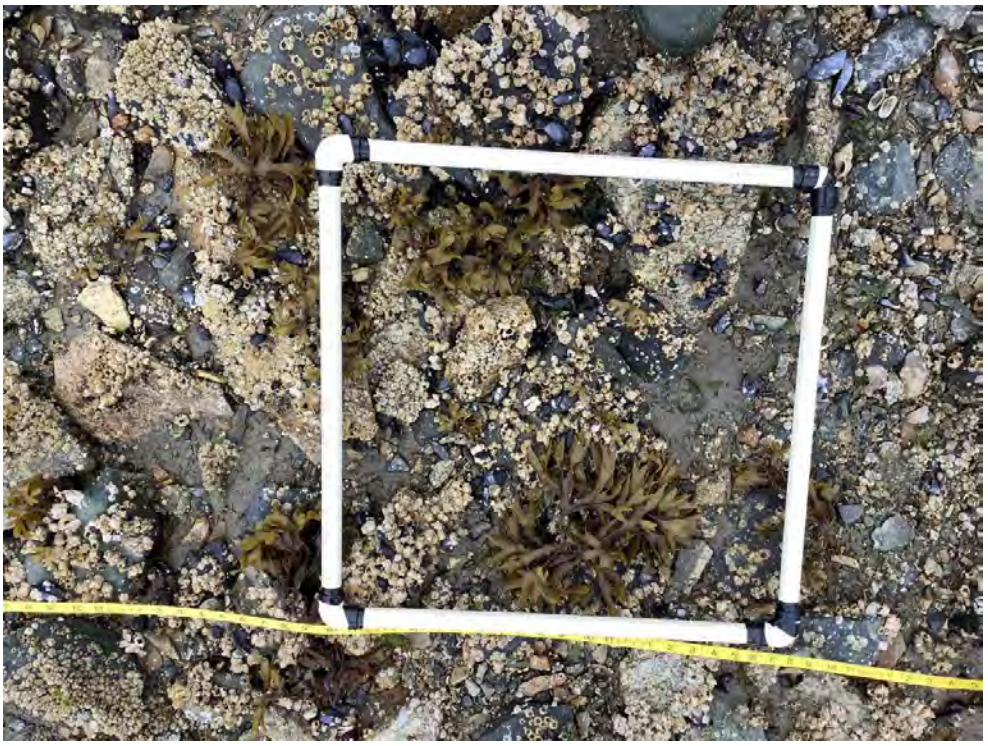
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 103 **Photo Location:** Whiskey Bay - Transect WB2 **Survey Date:** 7/24/2021 **Comments:** Low Intertidal - Quadrat 2	
Photograph ID: 104 **Photo Location:** Whiskey Bay - Transect WB2 **Survey Date:** 7/24/2021 **Comments:** Low Intertidal - Quadrat 3	

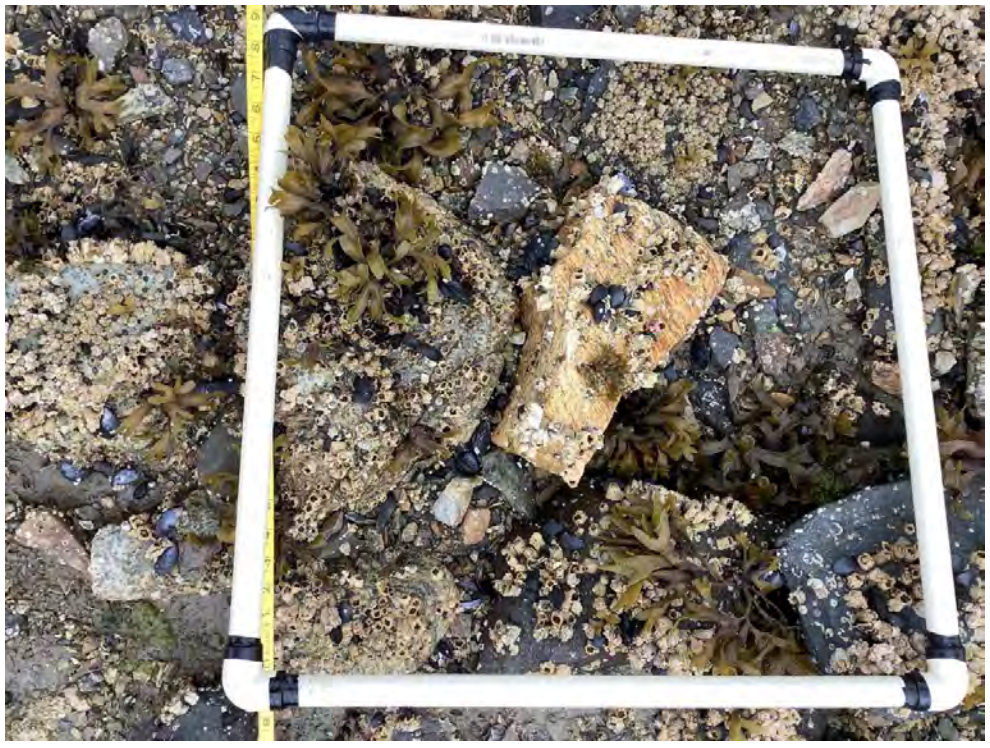
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 105 **Photo Location:** Whiskey Bay - Transect WB3 **Survey Date:** 7/24/2021 **Comments:** High Intertidal - Quadrat 1	
Photograph ID: 106 **Photo Location:** Whiskey Bay - Transect WB3 **Survey Date:** 7/24/2021 **Comments:** High Intertidal - Quadrat 2	

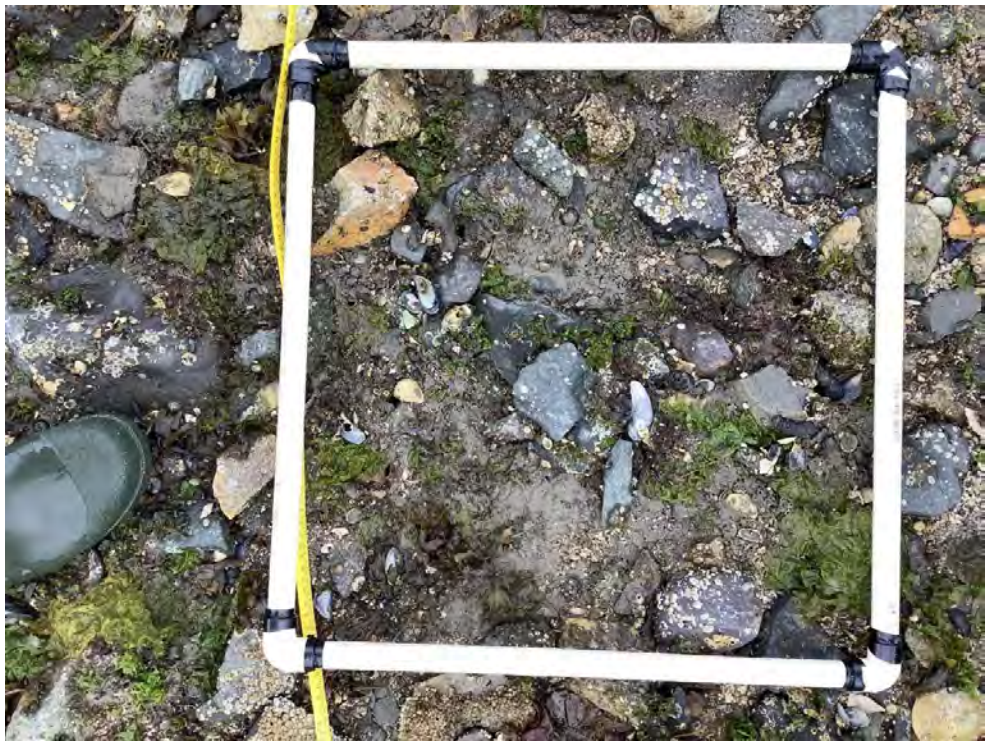
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 107 **Photo Location:** Whiskey Bay - Transect WB3 **Survey Date:** 7/24/2021 **Comments:** High Intertidal - Quadrat 3	
Photograph ID: 108 **Photo Location:** Whiskey Bay - Transect WB3 **Survey Date:** 7/24/2021 **Comments:** Mid Intertidal - Quadrat 1	

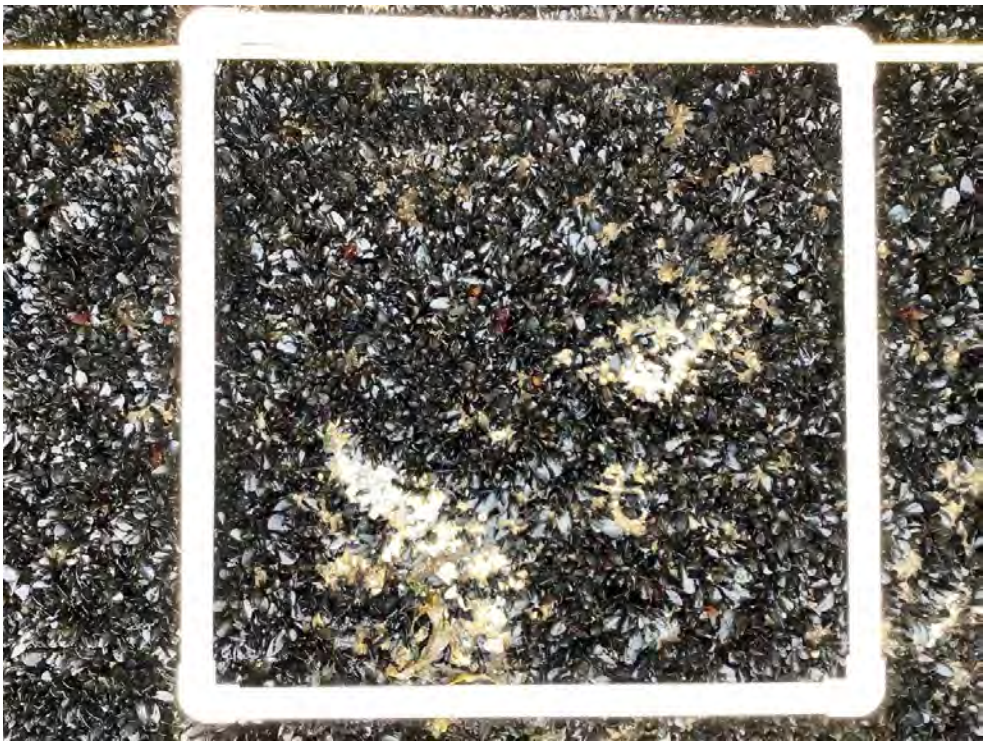
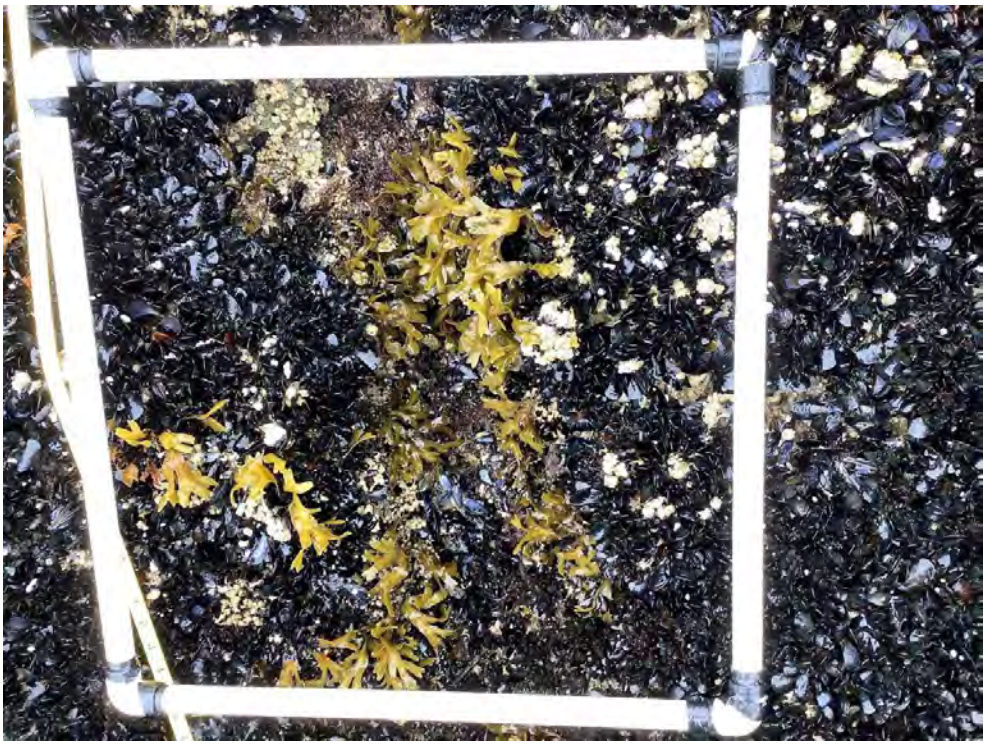
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 109 **Photo Location:** Whiskey Bay - Transect WB3 **Survey Date:** 7/24/2021 **Comments:** Mid Intertidal - Quadrat 2	
Photograph ID: 110 **Photo Location:** Whiskey Bay - Transect WB3 **Survey Date:** 7/24/2021 **Comments:** Mid Intertidal - Quadrat 3	

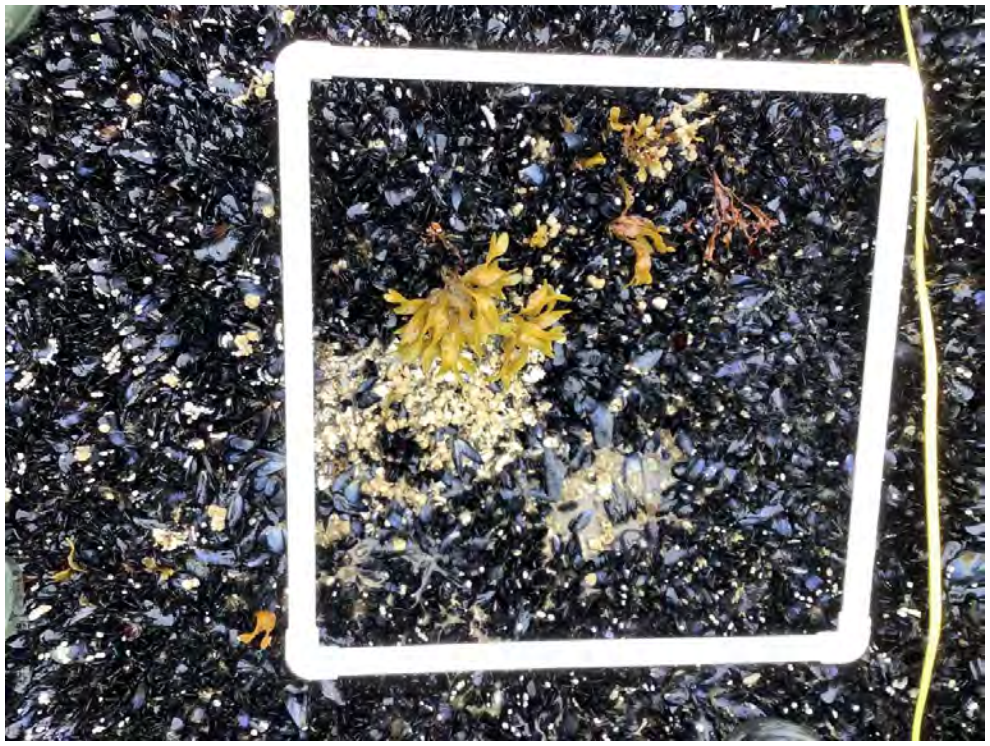
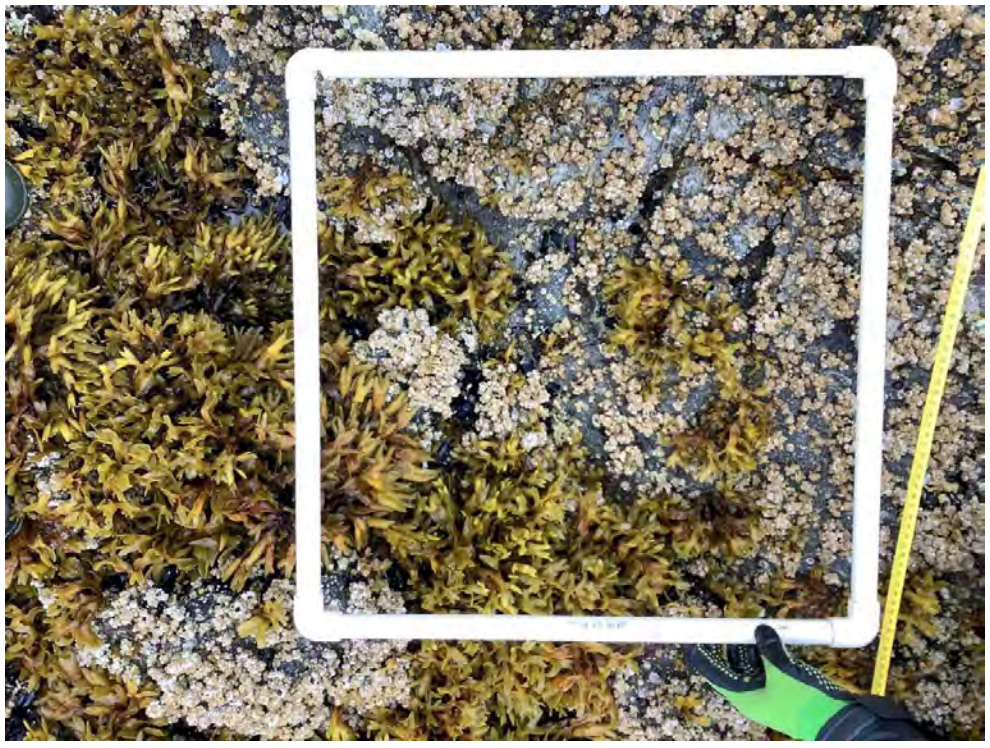
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 111 **Photo Location:** Whiskey Bay - Transect WB3 **Survey Date:** 7/24/2021 **Comments:** Low Intertidal - Quadrat 1	
Photograph ID: 112 **Photo Location:** Whiskey Bay - Transect WB3 **Survey Date:** 7/24/2021 **Comments:** Low Intertidal - Quadrat 2	

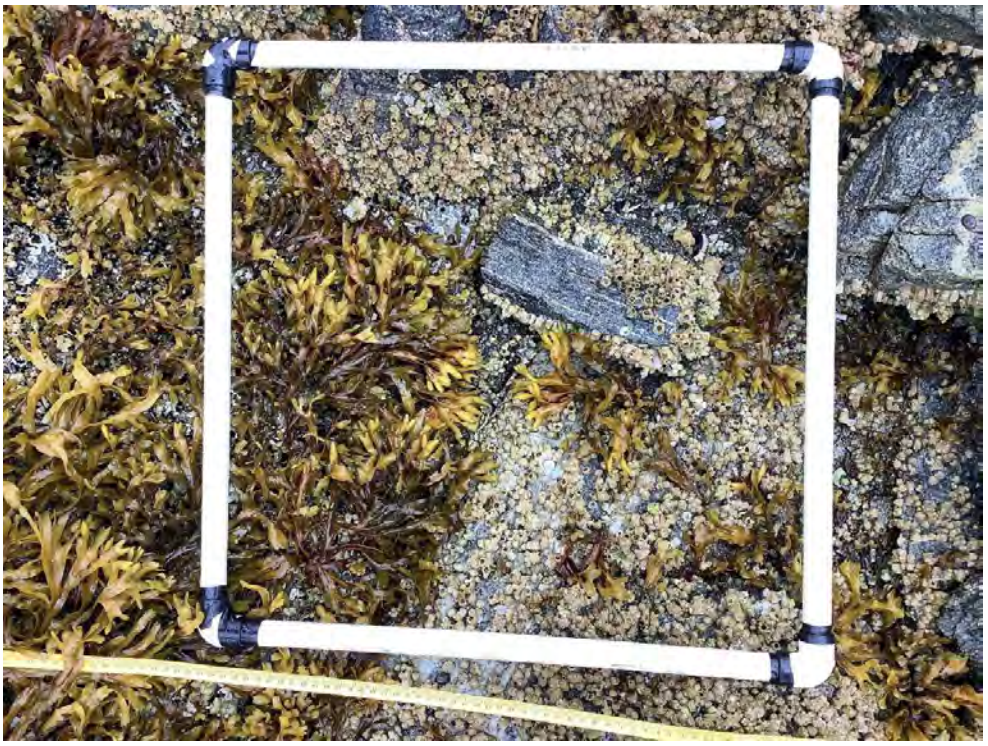
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 113 **Photo Location:** Pearse West - Transect W1 **Survey Date:** 7/23/2021 **Comments:** Low Intertidal - Quadrat 1	
Photograph ID: 114 **Photo Location:** Pearse West - Transect W1 **Survey Date:** 7/23/2021 **Comments:** Low Intertidal - Quadrat 2	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 115 **Photo Location:** Pearse West - Transect W1 **Survey Date:** 7/23/2021 **Comments:** Low Intertidal - Quadrat 3	
Photograph ID: 116 **Photo Location:** Pearse West - Transect W1 **Survey Date:** 7/23/2021 **Comments:** Mid Intertidal - Quadrat 3	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 117 **Photo Location:** Pearse West - Transect W1 **Survey Date:** 7/23/2021 **Comments:** Mid Intertidal - Quadrat 2	
Photograph ID: 118 **Photo Location:** Pearse West - Transect W1 **Survey Date:** 7/23/2021 **Comments:** Mid Intertidal - Quadrat 1	

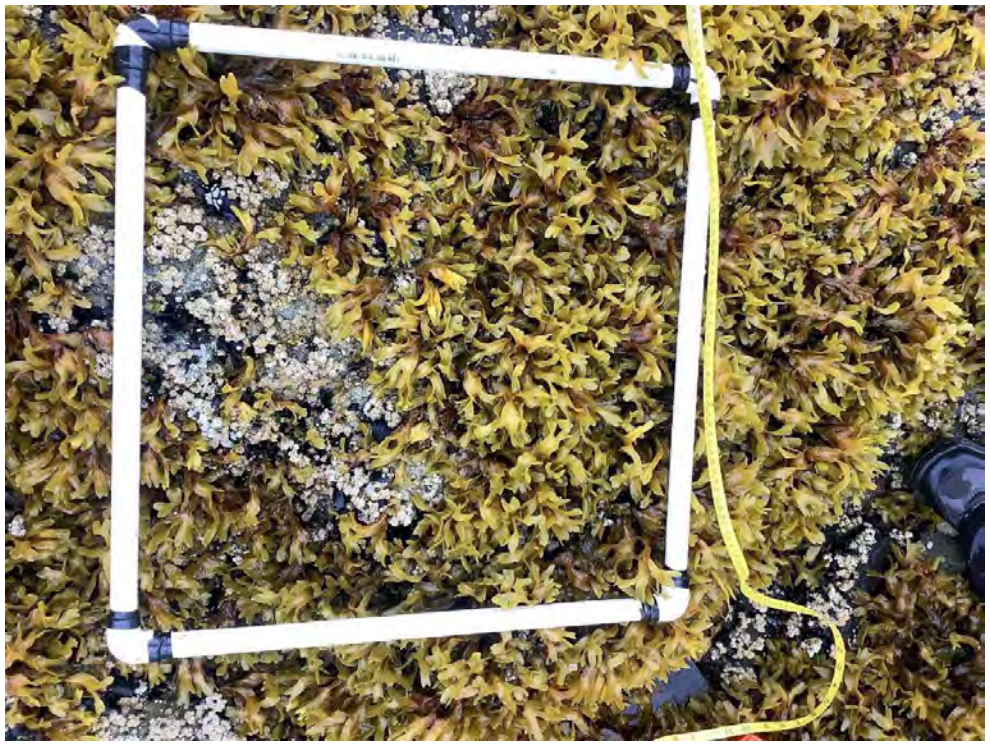
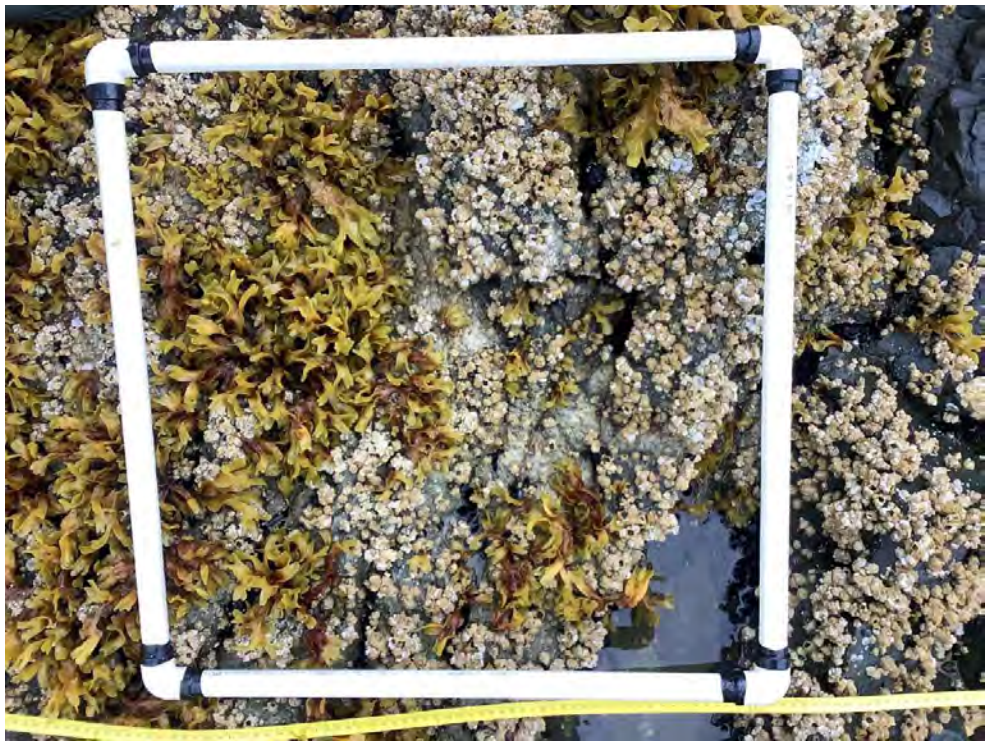
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 119 **Photo Location:** Pearse West - Transect W1 **Survey Date:** 7/23/2021 **Comments:** High Intertidal - Quadrat 3	
Photograph ID: 120 **Photo Location:** Pearse West - Transect W1 **Survey Date:** 7/23/2021 **Comments:** High Intertidal - Quadrat 2	

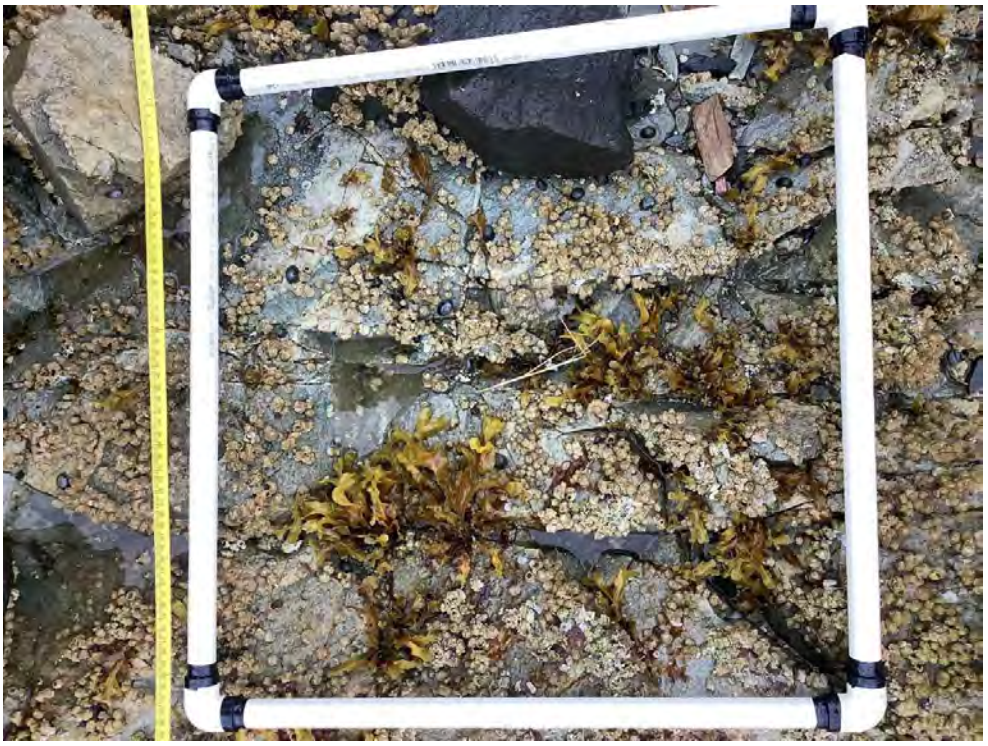
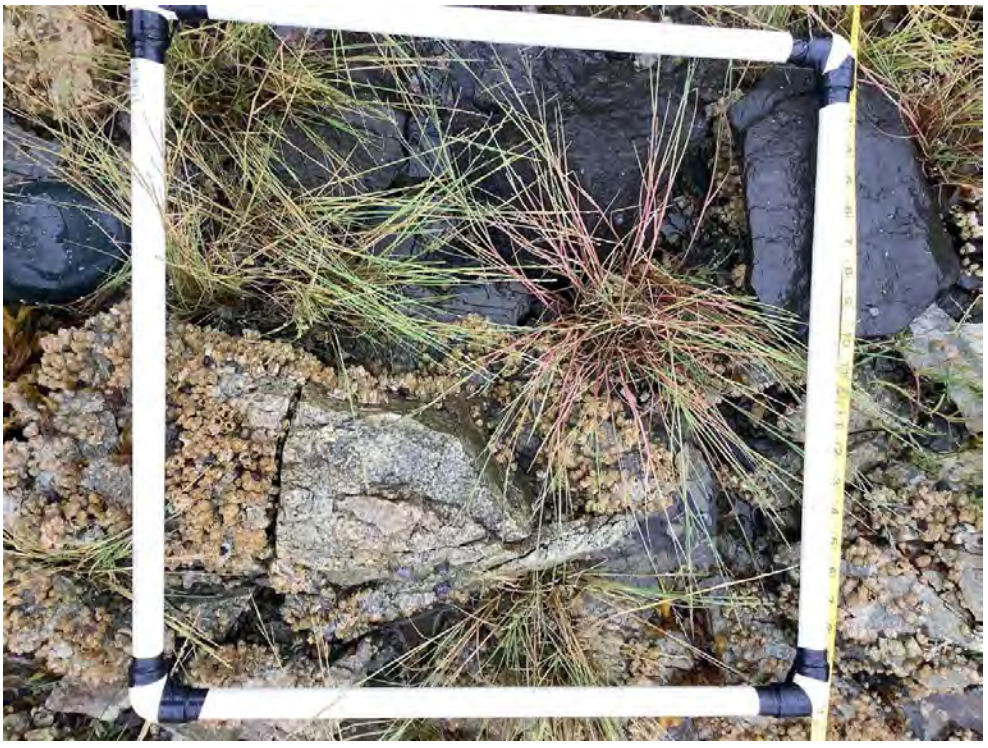
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 121 **Photo Location:** Pearse West - Transect W1 **Survey Date:** 7/23/2021 **Comments:** High Intertidal - Quadrat 3	
Photograph ID: 122 **Photo Location:** Pearse West - Transect W3 **Survey Date:** 7/23/2021 **Comments:** Mid Intertidal - Quadrat 3	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 123 **Photo Location:** Pearse West - Transect W3 **Survey Date:** 7/23/2021 **Comments:** Mid Intertidal - Quadrat 2	
Photograph ID: 124 **Photo Location:** Pearse West - Transect W3 **Survey Date:** 7/23/2021 **Comments:** Mid Intertidal - Quadrat 1	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 125 **Photo Location:** Pearse West - Transect W3 **Survey Date:** 7/23/2021 **Comments:** High Intertidal - Quadrat 3	
Photograph ID: 126 **Photo Location:** Pearse West - Transect W3 **Survey Date:** 7/23/2021 **Comments:** High Intertidal - Quadrat 2	

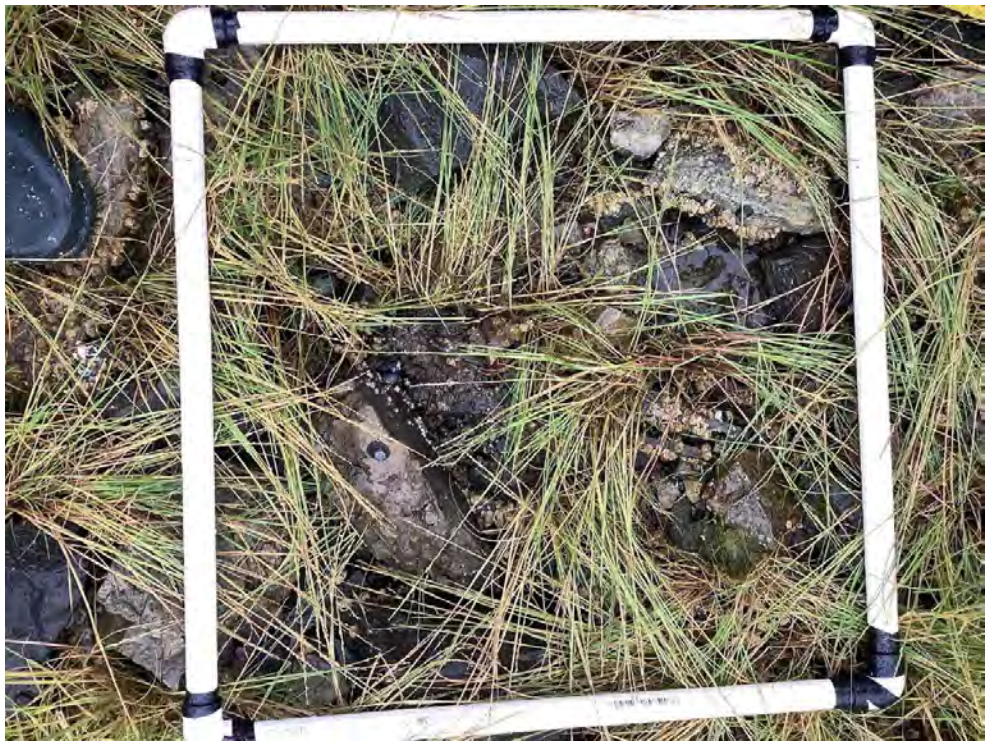
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 127

Photo Location:
Pearse West - Transect W3

Survey Date:
7/23/2021

Comments:
High Intertidal - Quadrat 1

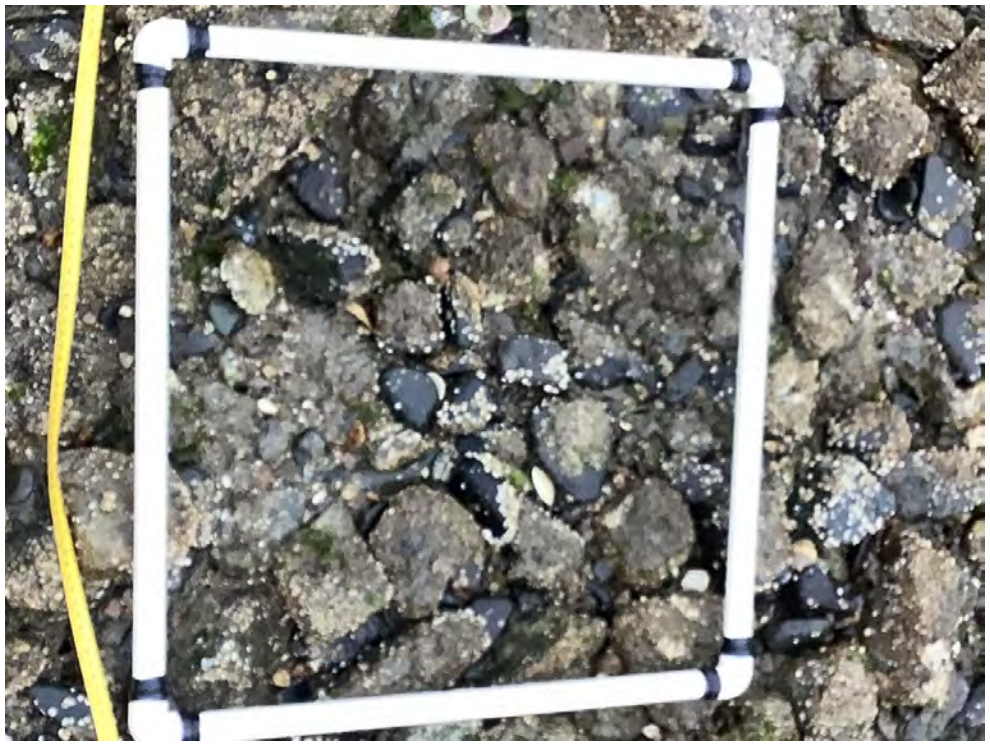


Photograph ID: 128

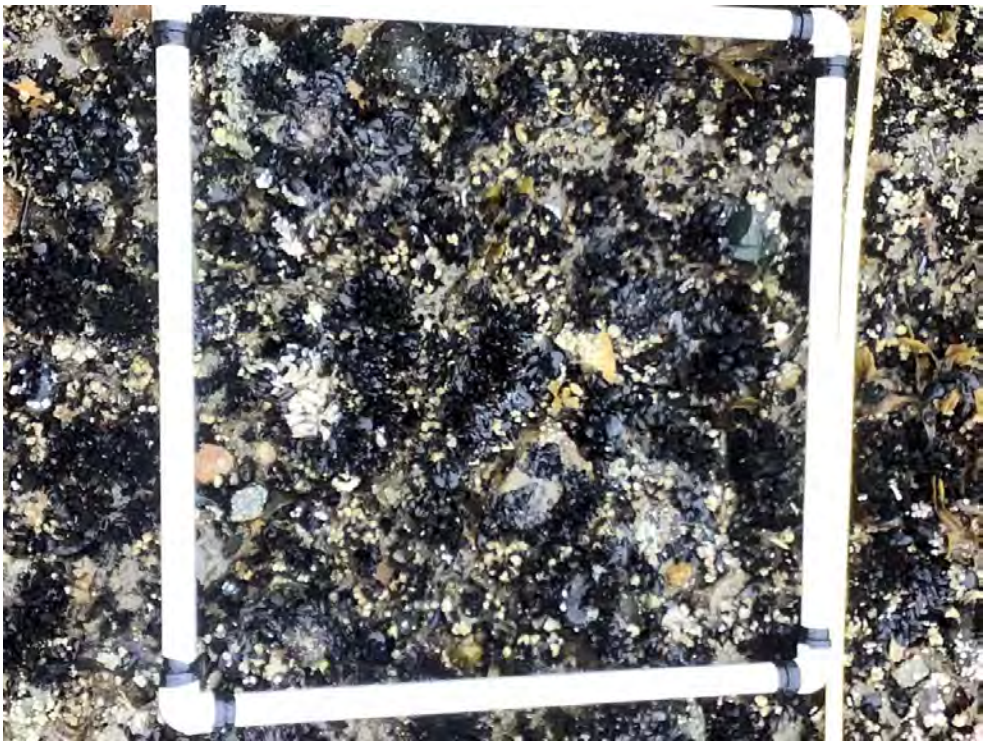
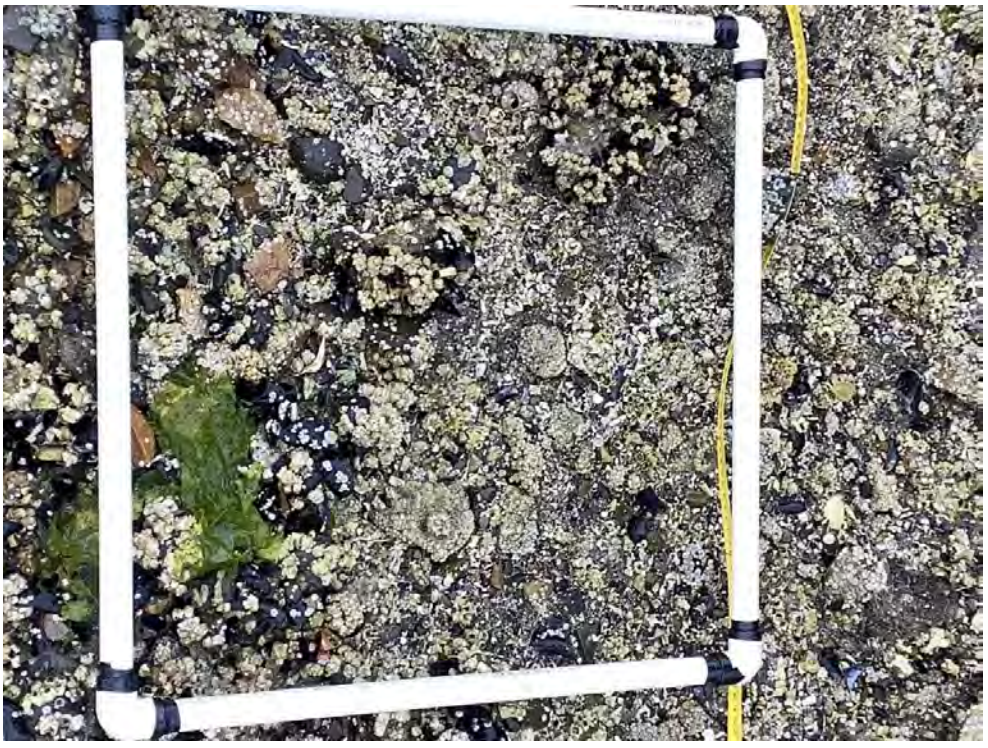
Photo Location:
Pearse West - Transect W4

Survey Date:
7/23/2021

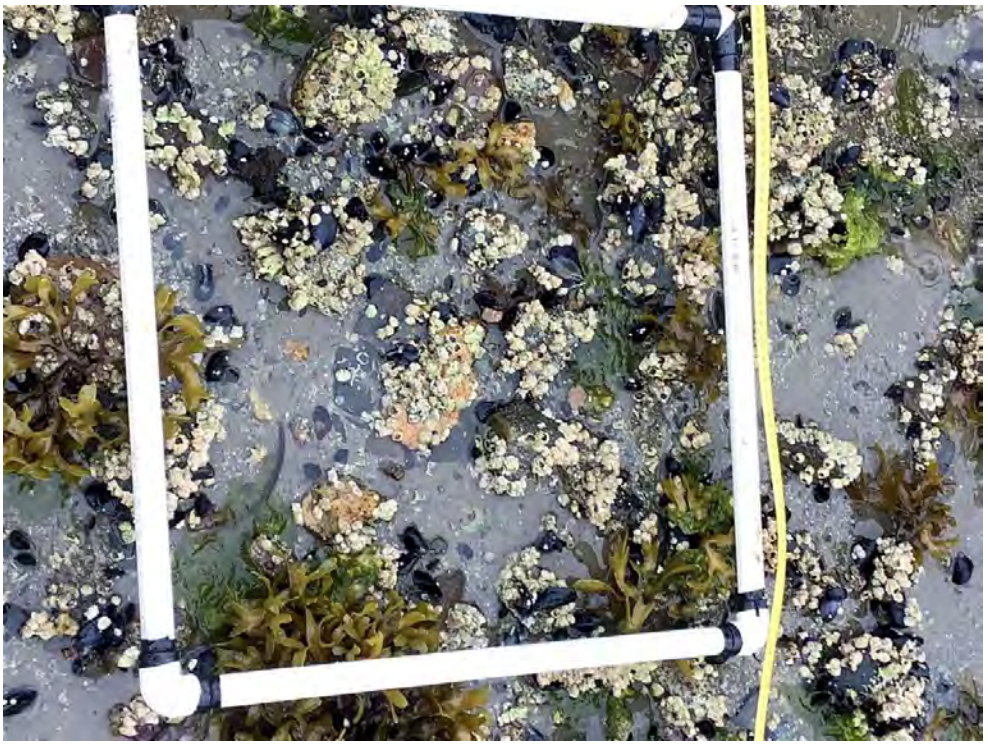
Comments:
Low Intertidal - Quadrat 3



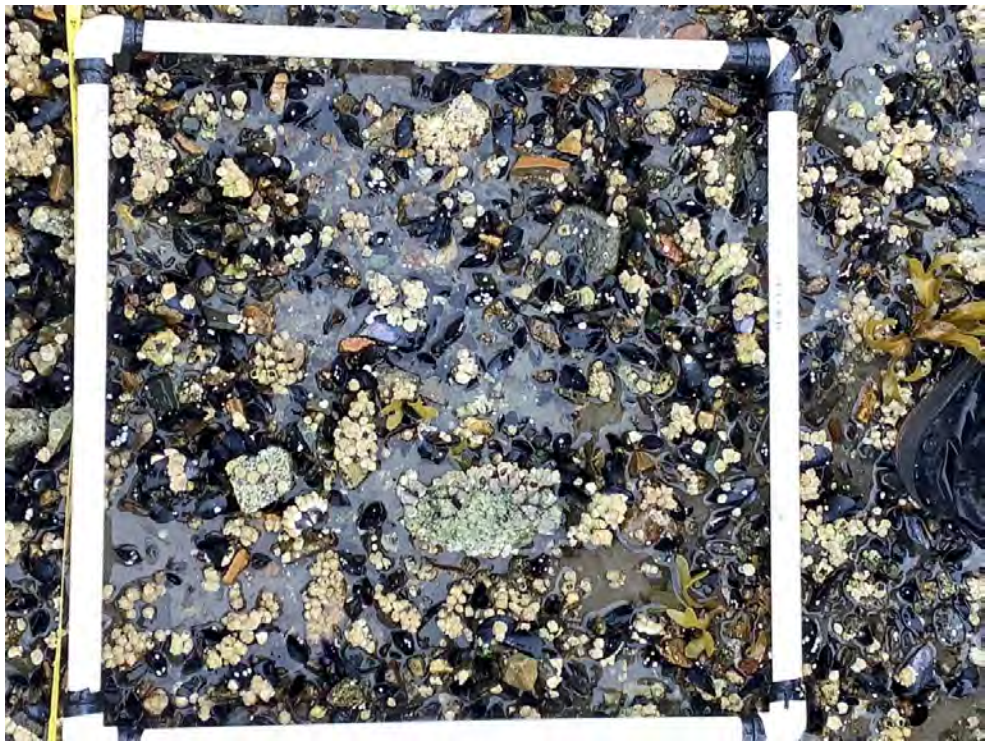
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 129 **Photo Location:** Pearse West - Transect W4 **Survey Date:** 7/23/2021 **Comments:** Low Intertidal - Quadrat 2	
Photograph ID: 130 **Photo Location:** Pearse West - Transect W4 **Survey Date:** 7/23/2021 **Comments:** Low Intertidal - Quadrat 1	

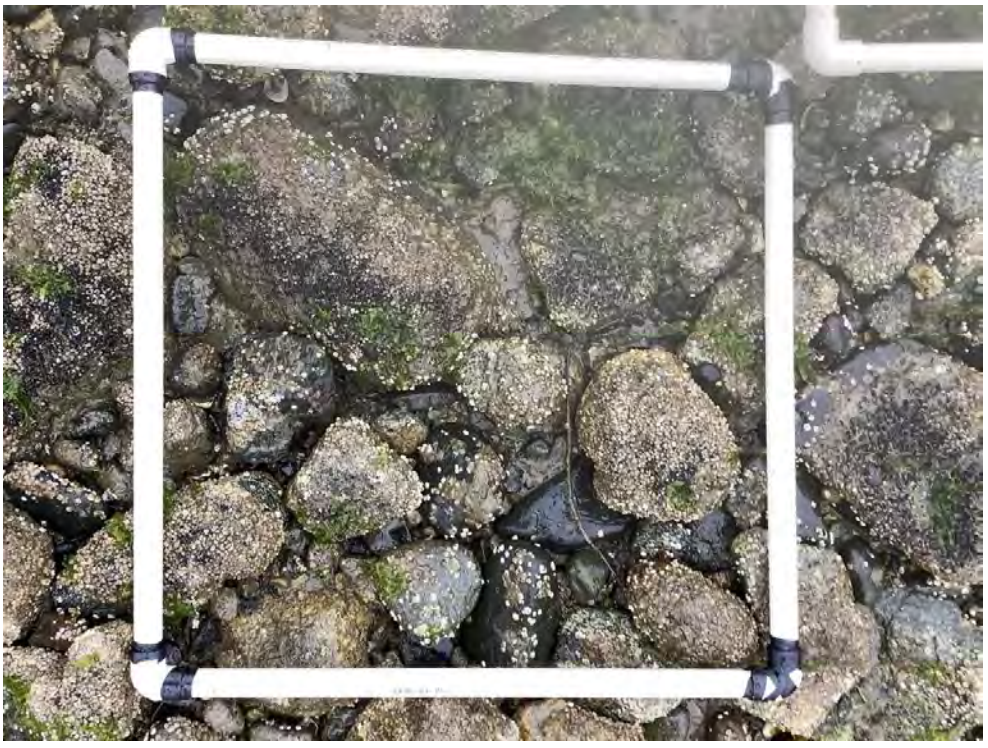
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 131 **Photo Location:** Pearse West - Transect W4 **Survey Date:** 7/23/2021 **Comments:** Mid Intertidal - Quadrat 3	
Photograph ID: 132 **Photo Location:** Pearse West - Transect W4 **Survey Date:** 7/23/2021 **Comments:** Mid Intertidal - Quadrat 2	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 133 **Photo Location:** Pearse West - Transect W4 **Survey Date:** 7/23/2021 **Comments:** Mid Intertidal - Quadrat 1	
Photograph ID: 134 **Photo Location:** Pearse West - Transect W4 **Survey Date:** 7/23/2021 **Comments:** High Intertidal - Quadrat 2	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 135 **Photo Location:** Pearse West - Transect W4 **Survey Date:** 7/23/2021 **Comments:** High Intertidal - Quadrat 1	
Photograph ID: 136 **Photo Location:** Pearse West - Transect W5 **Survey Date:** 7/23/2021 **Comments:** Low Intertidal - Quadrat 3	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 137

Photo Location:
Pearse West - Transect W5

Survey Date:
7/23/2021

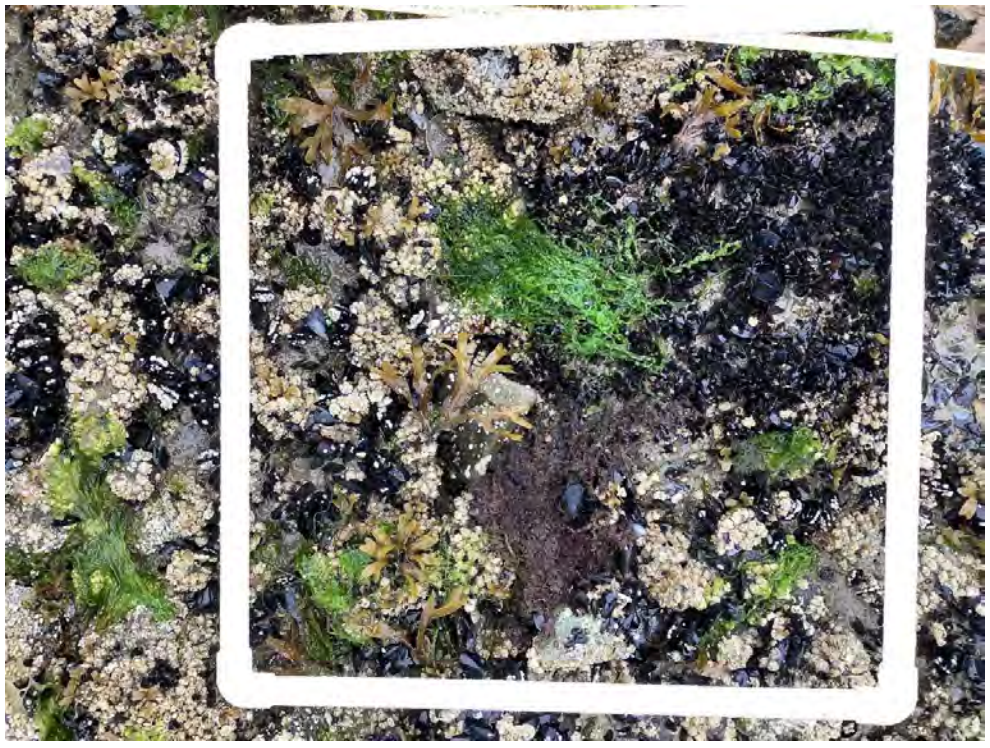
Comments:
Low Intertidal - Quadrat 2

Photograph ID: 138

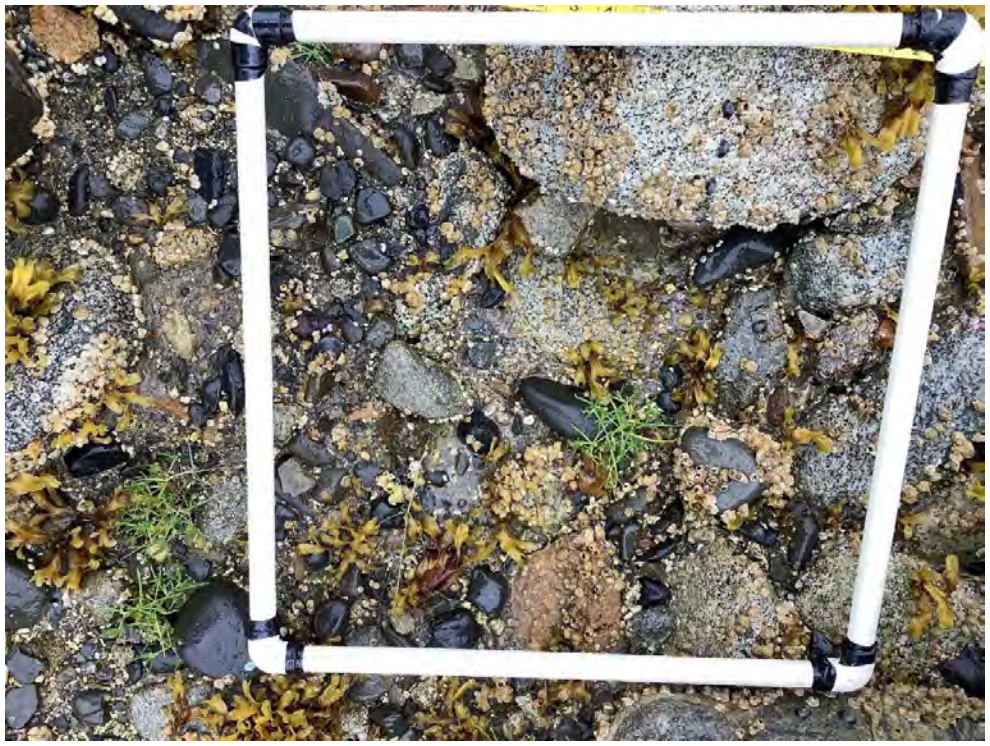
Photo Location:
Pearse West - Transect W5

Survey Date:
7/23/2021

Comments:
Low Intertidal - Quadrat 1



Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 139 **Photo Location:** Pearse West - Transect W5 **Survey Date:** 7/23/2021 **Comments:** Mid Intertidal - Quadrat 2	
Photograph ID: 140 **Photo Location:** Pearse West - Transect W5 **Survey Date:** 7/23/2021 **Comments:** Mid Intertidal - Quadrat 1	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 141 **Photo Location:** Pearse West - Transect W5 **Survey Date:** 7/23/2021 **Comments:** Mid Intertidal - Quadrat 3	
Photograph ID: 142 **Photo Location:** Pearse West - Transect W5 **Survey Date:** 7/23/2021 **Comments:** High Intertidal - Quadrat 3	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 143 **Photo Location:** Pearse West - Transect W5 **Survey Date:** 7/23/2021 **Comments:** High Intertidal - Quadrat 2	
Photograph ID: 144 **Photo Location:** Pearse West - Transect W5 **Survey Date:** 7/23/2021 **Comments:** High Intertidal - Quadrat 1	

Appendix B INTERTIDAL ABUNDANCE SUMMARY TABLES

Table B.1 – Estimate of Taxa Abundance by Intertidal Elevation for East Pearse Island

Taxonomic Group	Common Name	Scientific Name	Data Type	Intertidal Elevation			
				High Mean ± Std Dev Median (IQR)	Mid Mean ± Std Dev Median (IQR)	Low Mean ± Std Dev Median (IQR)	Overall Mean ± Std Dev Median (IQR)
Brown Algae	False Kelp	*Petalonia fascia*	Percent	0 ± 0 0 (0 - 0)	0 ± 0.2 0 (0 - 0)	0 ± 0 0 (0 - 0)	0 ± 0.1 0 (0 - 0)
	Filamentous Brown Algae	Phylum Ochrophyta	Percent	0 ± 0 0 (0 - 0)	0.1 ± 0.4 0 (0 - 0)	0 ± 0 0 (0 - 0)	0 ± 0.2 0 (0 - 0)
	Kelp	*Laminaria* spp.	Percent	0 ± 0 0 (0 - 0)	0.4 ± 1.4 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.8 0 (0 - 0)
	Rockweed	*Fucus* spp.	Percent	16.6 ± 29.2 0.5 (0 - 15)	3.6 ± 6.9 1 (0 - 3)	22.1 ± 25.3 15 (4 - 27.5)	14.8 ± 24.2 3 (0 - 15)
	Sea Cauliflower	*Leathesia* spp.	Percent	0 ± 0 0 (0 - 0)	0 ± 0.2 0 (0 - 0)	0.2 ± 0.9 0 (0 - 0)	0.1 ± 0.6 0 (0 - 0)
	Sea Fungus	*Ralfsia* spp.	Percent	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	1.1 ± 4.8 0 (0 - 0)	0.4 ± 2.9 0 (0 - 0)
	Studded Sea Balloon	*Soranthera ulvoidea*	Percent	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.5 0 (0 - 0)	0 ± 0.3 0 (0 - 0)
	Sugar Kelp	*Saccharina* spp.	Percent	0 ± 0 0 (0 - 0)	0.4 ± 2 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 1.1 0 (0 - 0)
	UnID Brown Algae	Phylum Ochrophyta	Percent	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.4 ± 1.8 0 (0 - 0)	0.1 ± 1.1 0 (0 - 0)
	Winged Kelp	*Alaria marginata*	Percent	0 ± 0 0 (0 - 0)	0.3 ± 1.1 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.6 0 (0 - 0)
Green Algae	Encrusting codium	*Codium* spp.	Percent	0.3 ± 1 0 (0 - 0)	0.1 ± 0.3 0 (0 - 0)	0.1 ± 0.4 0 (0 - 0)	0.2 ± 0.6 0 (0 - 0)
	Filamentous Green Algae	Phylum Chlorophyta	Percent	0.1 ± 0.6 0 (0 - 0)	0 ± 0 0 (0 - 0)	0 ± 0.2 0 (0 - 0)	0.1 ± 0.4 0 (0 - 0)
	Flat-tube Sea Lettuce	*Ulva linza*	Percent	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.5 0 (0 - 0)	0 ± 0.3 0 (0 - 0)
	Green Rope	*Acrosiphonia* spp.	Percent	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.8 ± 4.5 0 (0 - 0)	0.3 ± 2.7 0 (0 - 0)
	Gut Weed	*Ulva intestinalis*	Percent	0 ± 0 0 (0 - 0)	4 ± 9 0 (0 - 3)	2.8 ± 6.6 0 (0 - 0)	2.2 ± 6.4 0 (0 - 0)
	Sea Lettuce	*Ulva* spp.	Percent	1.1 ± 4 0 (0 - 0)	9.1 ± 12 4 (1 - 15)	6.1 ± 12 0 (0 - 10)	5.2 ± 10.4 0 (0 - 5)
	UnID Green Algae	Phylum Chlorophyta	Percent	0 ± 0 0 (0 - 0)	0.1 ± 0.3 0 (0 - 0)	0 ± 0 0 (0 - 0)	0 ± 0.2 0 (0 - 0)
Red Algae	Black Larch	*Neorhodomela* spp.	Percent	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.5 ± 2.7 0 (0 - 0)	0.2 ± 1.6 0 (0 - 0)
	Bladed Red	Phylum Rhodophyta	Percent	0 ± 0 0 (0 - 0)	0.3 ± 1.3 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.7 0 (0 - 0)
	Encrusting Red Algae	Phylum Rhodophyta	Percent	0 ± 0 0 (0 - 0)	0.2 ± 0.6 0 (0 - 0)	0 ± 0 0 (0 - 0)	0 ± 0.3 0 (0 - 0)
	Filamentous Red Algae	Phylum Rhodophyta	Percent	0.1 ± 0.7 0 (0 - 0)	2.2 ± 8.4 0 (0 - 0)	0.5 ± 2 0 (0 - 0)	0.9 ± 4.7 0 (0 - 0)
	Laver	*Porphyra* spp.	Percent	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	0 ± 0.2 0 (0 - 0)	0 ± 0.1 0 (0 - 0)
	Northern Mazza Weed	*Mazzaella oregona*	Percent	0 ± 0 0 (0 - 0)	0.1 ± 0.4 0 (0 - 0)	0 ± 0 0 (0 - 0)	0 ± 0.2 0 (0 - 0)
	Pink Rock Crust	Order Corallinales	Percent	0 ± 0 0 (0 - 0)	0 ± 0.2 0 (0 - 0)	0 ± 0 0 (0 - 0)	0 ± 0.1 0 (0 - 0)
	Rainbow Leaf	*Mazzaella* spp.	Percent	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	0 ± 0.2 0 (0 - 0)	0 ± 0.1 0 (0 - 0)
	Red Rock Crust	*Hildenbrandia* spp.	Percent	3.1 ± 6.5 1 (0 - 3)	2 ± 4 0 (0 - 1)	1.4 ± 3.7 0 (0 - 1)	2.1 ± 4.9 0 (0 - 2)
	Sea Brush	*Odonthalia* spp.	Percent	0 ± 0 0 (0 - 0)	2.4 ± 4.7 0 (0 - 2)	1 ± 4 0 (0 - 0)	1.1 ± 3.6 0 (0 - 0)
	Sea Lace	*Microcladia* spp.	Percent	0.1 ± 0.4 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.4 0 (0 - 0)	0 ± 0.3 0 (0 - 0)
	Sea Moss	*Endocladia muricata*	Percent	0.1 ± 0.5 0 (0 - 0)	0.1 ± 0.3 0 (0 - 0)	0.1 ± 0.2 0 (0 - 0)	0.1 ± 0.4 0 (0 - 0)
	Turkish Washcloth (Blade)	*Mastocarpus papillatus* (blade)	Percent	0.7 ± 2.1 0 (0 - 0)	0.7 ± 1.1 0 (0 - 1)	1.5 ± 3.5 0 (0 - 1)	1 ± 2.5 0 (0 - 1)
	Turkish Washcloth (Crust)	*Mastocarpus papillatus* (crust)	Percent	1.4 ± 4.5 0 (0 - 0)	0.2 ± 0.6 0 (0 - 0)	0.9 ± 2.8 0 (0 - 0.5)	0.9 ± 3.2 0 (0 - 0)
	UnID Red Algae	Phylum Rhodophyta	Percent	0.1 ± 0.5 0 (0 - 0)	0.1 ± 0.3 0 (0 - 0)	0.6 ± 2.7 0 (0 - 0)	0.3 ± 1.7 0 (0 - 0)
Algae	UnID Algae	UnID Algae	Percent	0 ± 0 0 (0 - 0)	0 ± 0.2 0 (0 - 0)	0 ± 0 0 (0 - 0)	0 ± 0.1 0 (0 - 0)
Cnidarian	Anemone	Order Anthozoa	Count	0 ± 0 0 (0 - 0)	4.7 ± 8.5 0 (0 - 5)	0 ± 0 0 (0 - 0)	1.4 ± 5.1 0 (0 - 0)

Table B.1 – Estimate of Taxa Abundance by Intertidal Elevation for East Pearse Island

Taxonomic Group	Common Name	Scientific Name	Data Type	Intertidal Elevation			
				High Mean ± Std Dev Median (IQR)	Mid Mean ± Std Dev Median (IQR)	Low Mean ± Std Dev Median (IQR)	Overall Mean ± Std Dev Median (IQR)
Mollusk	Checkered Periwinkle	*Littorina scutulata*	Count	101.8 ± 123.2 72 (4 - 184)	9.2 ± 40.7 0 (0 - 0)	101.2 ± 136.8 48 (12 - 140)	73.1 ± 117.8 12 (0 - 106)
	Chiton	*Mopalia* spp.	Count	0 ± 0 0 (0 - 0)	0.3 ± 1.1 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.6 0 (0 - 0)
	Dire Whelk	*Lirabuccinum dirum*	Count	0 ± 0 0 (0 - 0)	0.3 ± 1.1 0 (0 - 0)	0.1 ± 0.7 0 (0 - 0)	0.2 ± 0.8 0 (0 - 0)
	Dog Whelk	*Nucella lapillus*	Count	0 ± 0 0 (0 - 0)	5.2 ± 14.4 0 (0 - 4)	0.1 ± 0.7 0 (0 - 0)	1.6 ± 8.2 0 (0 - 0)
	Dogwinkle	*Nucella* spp.	Count	0.2 ± 0.8 0 (0 - 0)	1.7 ± 6.1 0 (0 - 0)	1.4 ± 6.1 0 (0 - 0)	1.1 ± 5 0 (0 - 0)
	Fingered Limpet	*Lottia digitalis*	Count	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.7 0 (0 - 0)	0.1 ± 0.5 0 (0 - 0)
	Limpet	*Lottia* spp.	Count	81.4 ± 108.6 40 (12 - 132)	142.3 ± 154.5 80 (15 - 227)	184.7 ± 175.5 136 (40 - 280)	138.6 ± 154.5 76 (21 - 200)
	Mussel	*Mytilus* spp.	Percent	8.6 ± 15.5 0.5 (0 - 8.75)	17.8 ± 17.4 15 (5 - 25)	28.9 ± 26.9 20 (10 - 40)	18.6 ± 22.3 10 (1 - 28.75)
	Periwinkle	*Littorina* spp.	Count	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	2.9 ± 15.6 0 (0 - 0)	1.1 ± 9.5 0 (0 - 0)
	Sitka Periwinkle	*Littorina sitkana*	Count	6.6 ± 17.8 0 (0 - 0)	16.7 ± 73.3 0 (0 - 0)	38.1 ± 62.8 24 (0 - 48)	21.4 ± 57.6 0 (0 - 20)
	Soft-shell Clam	*Mya arenaria*	Count	0 ± 0 0 (0 - 0)	0.5 ± 2.4 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.2 ± 1.4 0 (0 - 0)
Arthropod	Red Velvet Mite	*Neomolgus littoralis*	Count	0.2 ± 0.8 0 (0 - 0)	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.5 0 (0 - 0)
Crustacean	Amphipod	Class Amphipoda	Count	0.3 ± 1.6 0 (0 - 0)	0.3 ± 1.6 0 (0 - 0)	0.4 ± 2.2 0 (0 - 0)	0.4 ± 1.8 0 (0 - 0)
	Barnacle	*Balanus* spp.	Percent	22.6 ± 25.5 15 (2 - 30)	25.4 ± 20.3 20 (15 - 40)	31.6 ± 23.5 30 (17.5 - 40)	26.7 ± 23.4 20 (5 - 40)
	Giant Acorn Barnacle	*Balanus nubilus*	Percent	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.4 0 (0 - 0)	0 ± 0.2 0 (0 - 0)
	Hermit Crab	*Pagurus* spp.	Count	0.6 ± 1.9 0 (0 - 0)	5.7 ± 9.9 4 (0 - 8)	4.8 ± 8.4 0 (0 - 4)	3.7 ± 7.8 0 (0 - 4)
	Purple Shore Crab	*Hemigrapsus nudus*	Count	0.3 ± 1.1 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.7 0 (0 - 0)	0.2 ± 0.8 0 (0 - 0)
	Rockweed Isopod	*Idotea wosnesenskii*	Count	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.7 0 (0 - 0)	0.1 ± 0.5 0 (0 - 0)
Echinoderm	Green Urchin	*Strongylocentrotus droebachiensis*	Count	0 ± 0 0 (0 - 0)	0.5 ± 1.4 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.2 ± 0.8 0 (0 - 0)
Worm	Northern Feather Duster Worm	*Eudistylia vancouveri*	Count	0 ± 0 0 (0 - 0)	0.2 ± 0.8 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.5 0 (0 - 0)
	Sediment Tubeworm	Class Polychaeta	Count	0 ± 0 0 (0 - 0)	0.3 ± 1.6 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.9 0 (0 - 0)
Fish	Crescent Gunnel	*Pholis laeta*	Count	0 ± 0 0 (0 - 0)	0.2 ± 0.8 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.5 0 (0 - 0)
	Gunnel	*Pholis* spp.	Count	0 ± 0 0 (0 - 0)	0.3 ± 1.6 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.9 0 (0 - 0)
	Penpoint Gunnel	*Apodichthys flavidus*	Count	0 ± 0 0 (0 - 0)	0.2 ± 0.8 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.5 0 (0 - 0)
	Sculpin	Family Cottidae	Count	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.7 0 (0 - 0)	0.1 ± 0.5 0 (0 - 0)

NOTES:
Abundance estimates were estimated from 0.5 x 0.5 m quadrats
IQR= Interquartile range
Species-level resolution was not always possible; lowest practicable taxonomic resolution is reported.

Table B.2 – Estimate of Taxa Abundance by Intertidal Elevation for Whiskey Bay

Taxonomic Group	Common Name	Scientific Name	Data Type	Intertidal Elevation			
				High Mean ± Std Dev Median (IQR)	Mid Mean ± Std Dev Median (IQR)	Low Mean ± Std Dev Median (IQR)	Overall Mean ± Std Dev Median (IQR)
Brown Algae	Filamentous Brown Algae	Phylum Ochrophyta	Percent	0.1 ± 0.3 0 (0 - 0)	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	0 ± 0.2 0 (0 - 0)
	Ribbon Kelp	*Alaria marginata*	Percent	0 ± 0 0 (0 - 0)	0.4 ± 0.7 0 (0 - 1)	0 ± 0 0 (0 - 0)	0.1 ± 0.4 0 (0 - 0)
	Rockweed	*Fucus* spp.	Percent	17.5 ± 18.5 20 (0 - 25)	6.3 ± 7.9 1 (1 - 15)	14.6 ± 12.5 15 (2 - 25)	12.9 ± 13.9 12 (1 - 25)
	Sea Fungus	*Ralfsia* spp.	Percent	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	3.6 ± 8.4 0 (0 - 0)	1.4 ± 5.3 0 (0 - 0)
	UnID Brown Algae	Phylum Ochrophyta	Percent	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.3 0 (0 - 0)	0 ± 0.2 0 (0 - 0)
Green Algae	Filamentous Green Algae	Phylum Chlorophyta	Percent	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.2 ± 0.6 0 (0 - 0)	0.1 ± 0.4 0 (0 - 0)
	Gut Weed	*Ulva intestinalis*	Percent	0.4 ± 1.3 0 (0 - 0)	0.8 ± 1.6 0 (0 - 1)	0 ± 0 0 (0 - 0)	0.4 ± 1.2 0 (0 - 0)
	Sea Lettuce	*Ulva* spp.	Percent	0 ± 0 0 (0 - 0)	8.3 ± 8 8 (2 - 10)	2.3 ± 4.5 0 (0 - 2)	3.4 ± 6.2 0 (0 - 5)
	UnID Green Algae	Phylum Chlorophyta	Percent	0.1 ± 0.3 0 (0 - 0)	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	0 ± 0.2 0 (0 - 0)
Red Algae	Red Rock Crust	*Hildenbrandia* spp.	Percent	0.2 ± 0.7 0 (0 - 0)	0.2 ± 0.7 0 (0 - 0)	0.3 ± 0.9 0 (0 - 0)	0.2 ± 0.7 0 (0 - 0)
	Sea Brush	*Odonthalia* spp.	Percent	0 ± 0 0 (0 - 0)	2.6 ± 4.8 1 (0 - 3)	0 ± 0 0 (0 - 0)	0.8 ± 2.8 0 (0 - 0)
	Turkish Washcloth (Blade)	*Mastocarpus papillatus (blade)*	Percent	0 ± 0 0 (0 - 0)	0.4 ± 1.3 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.7 0 (0 - 0)
	UnID Red Algae	Phylum Rhodophyta	Percent	0 ± 0 0 (0 - 0)	0.4 ± 1 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.6 0 (0 - 0)
Cnidarian	Anemone	Class Anthozoa	Count	0 ± 0 0 (0 - 0)	0.9 ± 1.8 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.3 ± 1.1 0 (0 - 0)
Mollusk	Checkered Periwinkle	*Littorina scutulata*	Count	78 ± 127.3 14 (0 - 97)	4.4 ± 9.7 0 (0 - 0)	56 ± 43.5 40 (24 - 86)	43.2 ± 70.2 20 (0 - 55)
	Chiton	*Mopalia* spp.	Count	0 ± 0 0 (0 - 0)	0.9 ± 1.8 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.3 ± 1.1 0 (0 - 0)
	Limpet	*Lottia* spp.	Count	108.7 ± 165.8 48 (21 - 87)	116 ± 164.2 4 (0 - 260)	146.2 ± 162.1 128 (34 - 166)	127.1 ± 157.9 52 (4 - 179)
	Manila Clam	*Venerupis philippinarum*	Count	0 ± 0 0 (0 - 0)	0.4 ± 1.3 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.2 ± 0.8 0 (0 - 0)
	Mussel	*Mytilus* spp.	Percent	4.3 ± 9.8 1 (0 - 2)	5.7 ± 7.1 3 (1 - 5)	15 ± 7.5 15 (10 - 20)	8.8 ± 9.3 5 (1 - 15)
	Sitka Periwinkle	*Littorina sitkana*	Count	4 ± 6.2 0 (0 - 9)	13.8 ± 24.4 0 (0 - 16)	6.5 ± 18.1 0 (0 - 0)	8.5 ± 18.6 0 (0 - 9)
	UnID Bivalve	Class Bivalvia	Count	0 ± 0 0 (0 - 0)	0.4 ± 1.3 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.2 ± 0.8 0 (0 - 0)
Crustacean	Acorn Barnacle	*Balanus glandula*	Percent	0 ± 0 0 (0 - 0)	0.6 ± 1.7 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.2 ± 0.9 0 (0 - 0)
	Amphipod	Order Amphipoda	Count	0.7 ± 1.6 0 (0 - 0)	0.9 ± 1.8 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.5 ± 1.3 0 (0 - 0)
	Barnacle	*Balanus* spp.	Percent	21.6 ± 25.2 15 (3 - 30)	18.9 ± 15 20 (10 - 25)	23.2 ± 14.2 20 (12.5 - 32.5)	21.3 ± 17.9 20 (10 - 30)
	Bay Ghost Shrimp	*Neotrypaea californiensis*	Count	0 ± 0 0 (0 - 0)	0.4 ± 1.3 0 (0 - 0)	0.4 ± 1.2 0 (0 - 0)	0.3 ± 1.1 0 (0 - 0)
	Hermit Crab	*Pagurus* spp.	Count	0.7 ± 1.6 0 (0 - 0)	1.8 ± 2.1 0 (0 - 4)	0.7 ± 2.4 0 (0 - 0)	1.1 ± 2.1 0 (0 - 0)
	Isopod	Order Isopoda	Count	0 ± 0 0 (0 - 0)	10.2 ± 13.6 0 (0 - 20)	0.4 ± 1.2 0 (0 - 0)	3.7 ± 9.1 0 (0 - 0)
	Jumping Amphipod	Order Amphipoda	Count	0 ± 0 0 (0 - 0)	0.9 ± 2.7 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.3 ± 1.6 0 (0 - 0)
	Rockweed Isopod	*Idotea wosnesenskii*	Count	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.4 ± 1.2 0 (0 - 0)	0.2 ± 0.8 0 (0 - 0)
	Thatched barnacle	*Semibalanus cariosus*	Percent	0 ± 0 0 (0 - 0)	1.1 ± 3.3 0 (0 - 0)	0.2 ± 0.6 0 (0 - 0)	0.4 ± 1.9 0 (0 - 0)

Table B.2 – Estimate of Taxa Abundance by Intertidal Elevation for Whiskey Bay

Taxonomic Group	Common Name	Scientific Name	Data Type	Intertidal Elevation			
				High Mean ± Std Dev Median (IQR)	Mid Mean ± Std Dev Median (IQR)	Low Mean ± Std Dev Median (IQR)	Overall Mean ± Std Dev Median (IQR)
Worm	Polychaete Worm	Class Polychaeta	Count	0 ± 0 0 (0 - 0)	1.8 ± 2.9 0 (0 - 4)	0 ± 0 0 (0 - 0)	0.6 ± 1.9 0 (0 - 0)
Tunicate	Broadbase Tunicate	*Cnemidocarpa finmarkiensis*	Count	0 ± 0 0 (0 - 0)	0.4 ± 1.3 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.2 ± 0.8 0 (0 - 0)

NOTES:
Abundance estimates were estimated from 0.5 x 0.5 m quadrats
IQR= Interquartile range
Species-level resolution was not always possible; lowest practicable taxonomic resolution is reported.

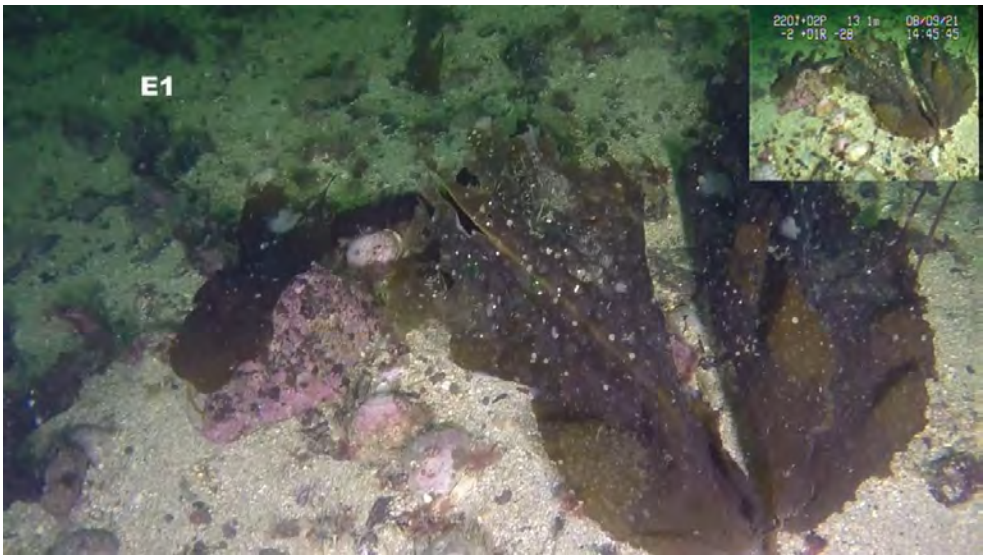
Table B.3 – Estimate of Taxa Abundance by Intertidal Elevation for West Pearse Island

Taxonomic Group	Common Name	Scientific Name	Data Type	Intertidal Elevation			
				High Mean ± Std Dev Median (IQR)	Mid Mean ± Std Dev Median (IQR)	Low Mean ± Std Dev Median (IQR)	Overall Mean ± Std Dev Median (IQR)
Brown Algae	Rockweed	*Fucus* spp.	Percent	4.1 ± 7.5 2 (0 - 2.5)	5.2 ± 7.3 1 (0 - 5)	38.8 ± 31.1 35 (13.75 - 66.25)	17.4 ± 25.6 5 (0.75 - 21.25)
	Sea Fungus	*Ralfsia* spp.	Percent	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.4 ± 1.4 0 (0 - 0)	0.2 ± 0.9 0 (0 - 0)
Green Algae	Filamentous Green Algae	Phylum Chlorophyta	Percent	0.7 ± 2.4 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.2 ± 0.6 0 (0 - 0)	0.3 ± 1.4 0 (0 - 0)
	Gut Weed	*Ulva intestinalis*	Percent	0 ± 0 0 (0 - 0)	5.6 ± 10.1 0 (0 - 10)	0 ± 0 0 (0 - 0)	1.6 ± 5.7 0 (0 - 0)
	Sea Lettuce	*Ulva* spp.	Percent	0 ± 0 0 (0 - 0)	4.1 ± 4.6 3 (0 - 10)	3 ± 6.9 0 (0 - 0.25)	2.3 ± 5 0 (0 - 1)
	UnID Green Algae	Phylum Chlorophyta	Percent	0.4 ± 0.9 0 (0 - 0)	0.1 ± 0.3 0 (0 - 0)	0.4 ± 1.4 0 (0 - 0)	0.3 ± 1 0 (0 - 0)
Red Algae	Red Rock Crust	*Hildenbrandia* spp.	Percent	1.8 ± 1.5 1 (1 - 3)	0.3 ± 0.7 0 (0 - 0)	1.5 ± 2.8 0.5 (0 - 1.25)	1.3 ± 2 1 (0 - 2)
	Sea Brush	*Odonthalia* spp.	Percent	0 ± 0 0 (0 - 0)	1.2 ± 3.3 0 (0 - 0)	0.1 ± 0.3 0 (0 - 0)	0.4 ± 1.8 0 (0 - 0)
	Turkish Washcloth (Blade)	*Mastocarpus papillatus* (blade)	Percent	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.3 ± 0.9 0 (0 - 0)	0.1 ± 0.6 0 (0 - 0)
	UnID Red Algae	Phylum Rhodophyta	Percent	0 ± 0 0 (0 - 0)	1.3 ± 3.3 0 (0 - 1)	0.2 ± 0.6 0 (0 - 0)	0.4 ± 1.8 0 (0 - 0)
Other	UnID Algae	UnID Algae	Percent	0.3 ± 0.9 0 (0 - 0)	0.1 ± 0.3 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.6 0 (0 - 0)
Cnidarian	Anemone	Class Anthozoa	Count	0 ± 0 0 (0 - 0)	3.1 ± 4.4 0 (0 - 4)	0 ± 0 0 (0 - 0)	0.9 ± 2.7 0 (0 - 0)
Mollusk	Blue Topsnail	*Calliostoma ligatum*	Count	0 ± 0 0 (0 - 0)	1.8 ± 4.1 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.5 ± 2.3 0 (0 - 0)
	Checkered Periwinkle	*Littorina scutulata*	Count	82.2 ± 80 76 (8 - 152)	7.6 ± 17.1 0 (0 - 4)	283 ± 155.9 296 (145 - 400)	140.1 ± 161.3 106 (0 - 228)
	Dog Whelk	*Nucella lapillus*	Count	0 ± 0 0 (0 - 0)	2.2 ± 5.3 0 (0 - 0)	0.3 ± 1.2 0 (0 - 0)	0.8 ± 3 0 (0 - 0)
	Limpet	*Lottia* spp.	Count	58.7 ± 46.3 36 (32 - 88)	56.9 ± 62.1 44 (20 - 68)	133.3 ± 140.3 90 (31 - 175)	88 ± 102.7 44 (25 - 100)
	Margarite Snail	*Margarites pupillus*	Count	0 ± 0 0 (0 - 0)	4 ± 12 0 (0 - 0)	0 ± 0 0 (0 - 0)	1.2 ± 6.6 0 (0 - 0)
	Mussel	*Mytilus* spp.	Percent	0 ± 0 0 (0 - 0)	47.8 ± 36.4 35 (25 - 85)	19.9 ± 24.3 12.5 (8 - 21.25)	20.9 ± 30.3 10 (0 - 25)
	Purple Butter Clam	*Saxidomus purpurata*	Count	0 ± 0 0 (0 - 0)	0.4 ± 1.3 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.7 0 (0 - 0)
	Sitka Periwinkle	*Littorina sitkana*	Count	5.3 ± 7.2 0 (0 - 8)	0.9 ± 2.7 0 (0 - 0)	30 ± 62.7 8 (0 - 20)	13.9 ± 41.1 0 (0 - 8)
	UnID Bivalve	Class Bivalvia	Count	0 ± 0 0 (0 - 0)	0.4 ± 1.3 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.7 0 (0 - 0)
	UnID Mussel	*Mytilus* spp.	Percent	0 ± 0 0 (0 - 0)	6.7 ± 20 0 (0 - 0)	0 ± 0 0 (0 - 0)	1.9 ± 10.6 0 (0 - 0)
Crustacean	Amphipod	*Amphipoda*	Count	0 ± 0 0 (0 - 0)	2.2 ± 6.7 0 (0 - 0)	1.7 ± 5.8 0 (0 - 0)	1.3 ± 5.1 0 (0 - 0)
	Barnacle	*Balanus* spp.	Percent	23.2 ± 10.3 25 (20 - 30)	32.7 ± 23.6 40 (20 - 40)	44.6 ± 17.9 42.5 (32.5 - 52.5)	33.9 ± 19.4 32.5 (23.75 - 41.25)
	Hermit Crab	*Pagurus* spp.	Count	0 ± 0 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.7 ± 2.3 0 (0 - 0)	0.3 ± 1.5 0 (0 - 0)
	Isopod	Order Isopoda	Count	0 ± 0 0 (0 - 0)	1.3 ± 4 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.4 ± 2.2 0 (0 - 0)
Echinoderm	Green Urchin	*Strongylocentrotus droebachiensis*	Count	0 ± 0 0 (0 - 0)	4.4 ± 13.3 0 (0 - 0)	0 ± 0 0 (0 - 0)	1.3 ± 7.3 0 (0 - 0)
Polychaete	UnID Polychaete	UnID Polychaete	Count	0 ± 0 0 (0 - 0)	0.4 ± 1.3 0 (0 - 0)	0 ± 0 0 (0 - 0)	0.1 ± 0.7 0 (0 - 0)

NOTES:
Abundance estimates were estimated from 0.5 x 0.5 m quadrats
IQR= Interquartile range
Species-level resolution was not always possible; lowest practicable taxonomic resolution is reported.

Appendix C SUBTIDAL SURVEY PHOTOLOG

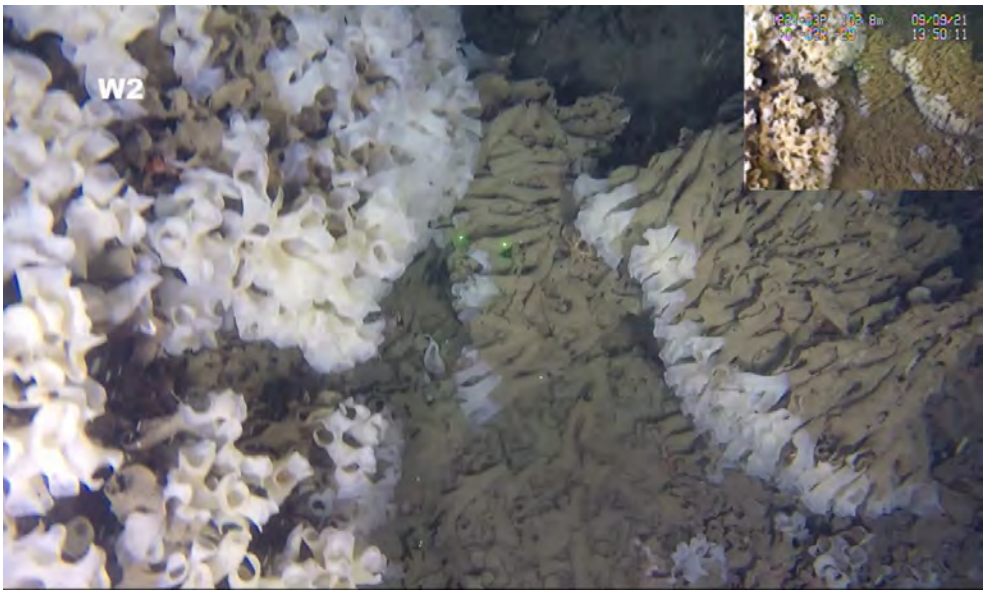
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 1 **Photo Location:** MV Crown Royal **Comments:** The Seaeye Falcon ROV used for the subtidal surveys.	
Photograph ID: 2 **Photo Location:** East Pearse Island **Comments:** Fringed sea colander kelp (*Agarum fimbriatum*) on transect E1 on September 8, 2021.	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 3 **Photo Location:** East Pearse Island **Comments:** Sharp lipped boot sponge (*Rhabdocalyptus dawsoni*) on transect E4 on September 8, 2021	
Photograph ID: 4 **Photo Location:** West Pearse Island **Comments:** Eelgrass (*Zostera* sp.) on transect W2 on September 9, 2021.	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 5 **Photo Location:** West Pearse Island **Comments:** Unidentified *Farrea* sp. on transect W2 on September 9, 2021.	
Photograph ID: 6 **Photo Location:** East Pearse Island **Comments:** Lemon peel nudibranch (*Tochuina gigantea*) on transect E1 on September 8, 2021.	

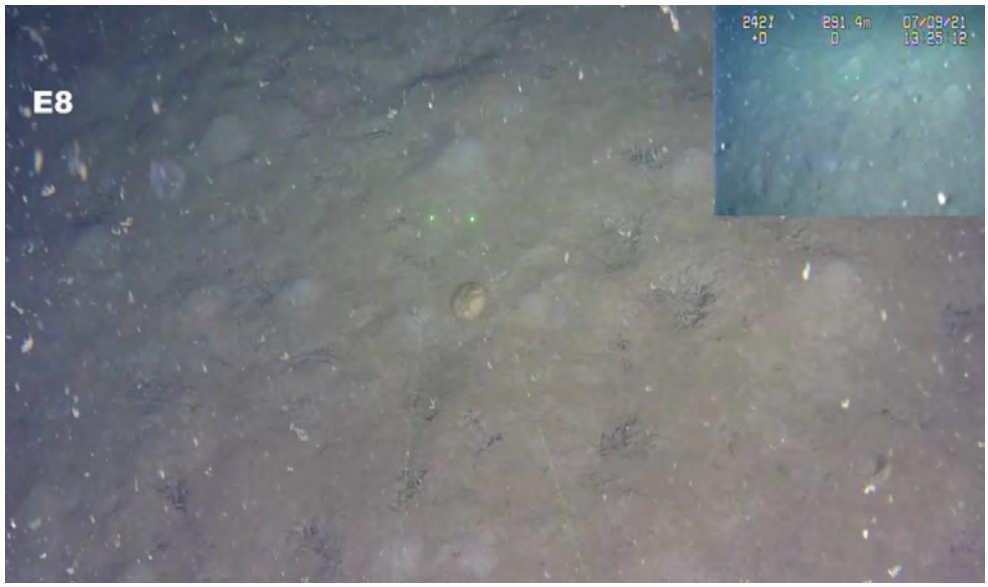
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 7 **Photo Location:** East Pearse Island **Comments:** Pink urchin (*Strongylocentrotus fragilis*) on transect E7 on September 9, 2021.	
Photograph ID: 8 **Photo Location:** East Pearse Island **Comments:** Unidentified gorgonian coral (Order Alcyonacea) on transect E3 on September 9, 2021.	

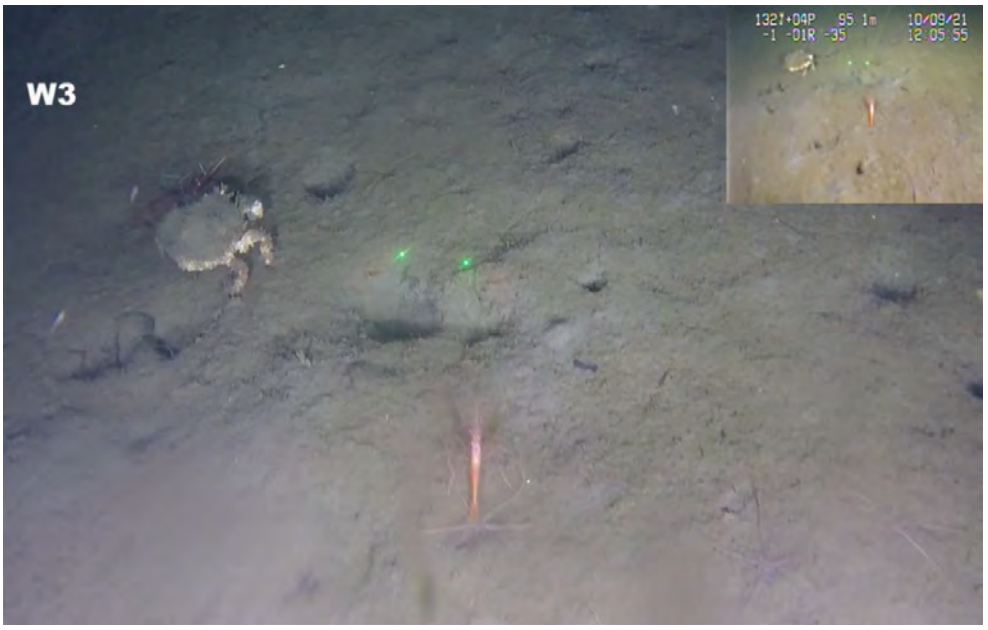
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 9 **Photo Location:** East Pearse Island **Comments:** Stubby squid (*Rossia Pacifica*) on transect E4 on September 8, 2021.	
Photograph ID: 10 **Photo Location:** East Pearse Island **Comments:** White branching hydrocoral (*Stylaster campylecus*) on transect E4 on September 8, 2021.	

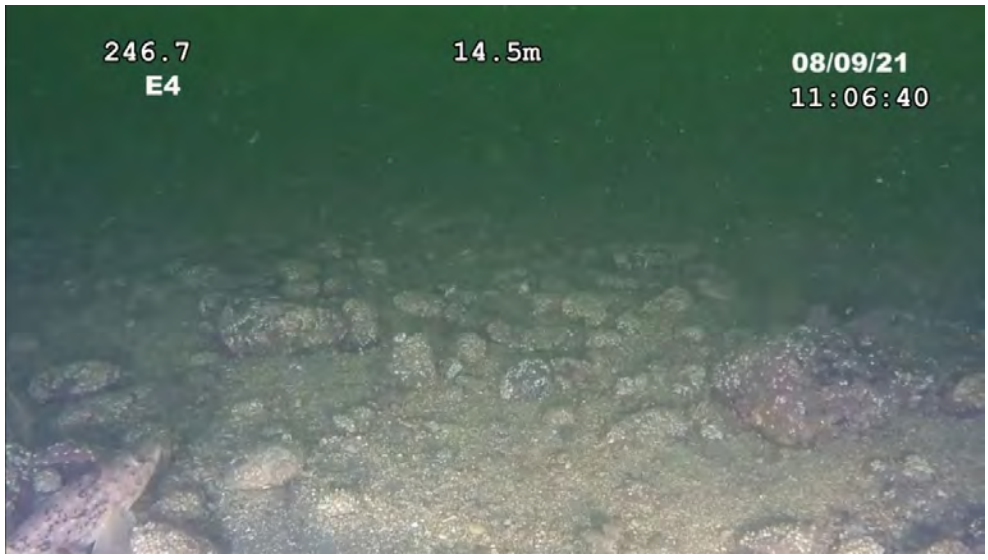
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 11 **Photo Location:** East Pearse Island **Comments:** Heart urchin (*Brisaster latifrons*) on transect E8 on September 7, 2021.	
Photograph ID: 12 **Photo Location:** East Pearse Island **Comments:** Sunflower seastars (*Pycnopodia helianthoides*) on transect E8 on September 7, 2021.	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 13 **Photo Location:** West Pearse Island **Comments:** Brown box crab (*Lopholithodes foraminatus*) on transect W3 on September 10, 2021.	
Photograph ID: 14 **Photo Location:** West Pearse Island **Comments:** Velcro star (*Stylasterias forreri)* on transect W3 on September 10, 2021.	

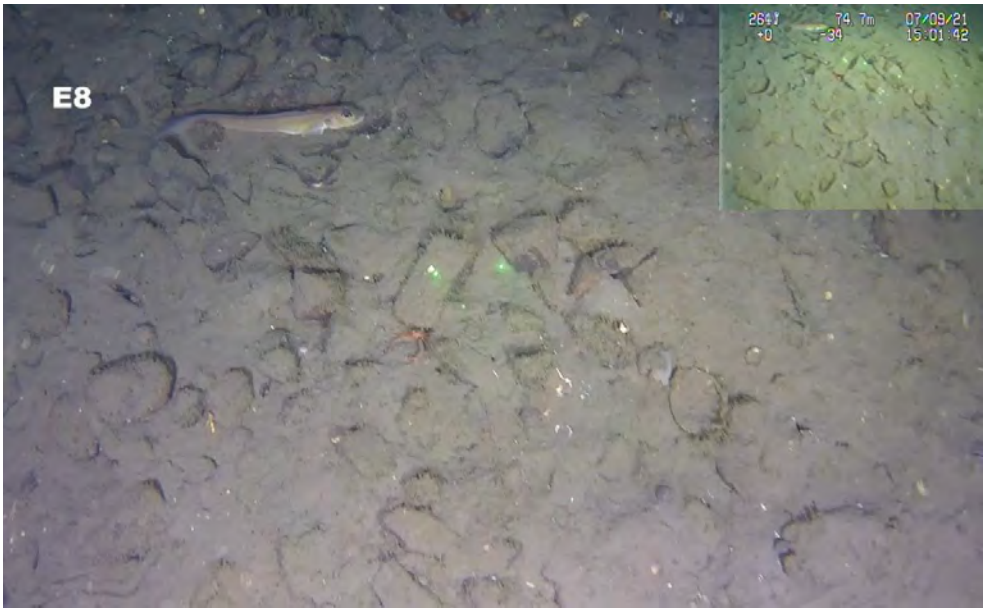
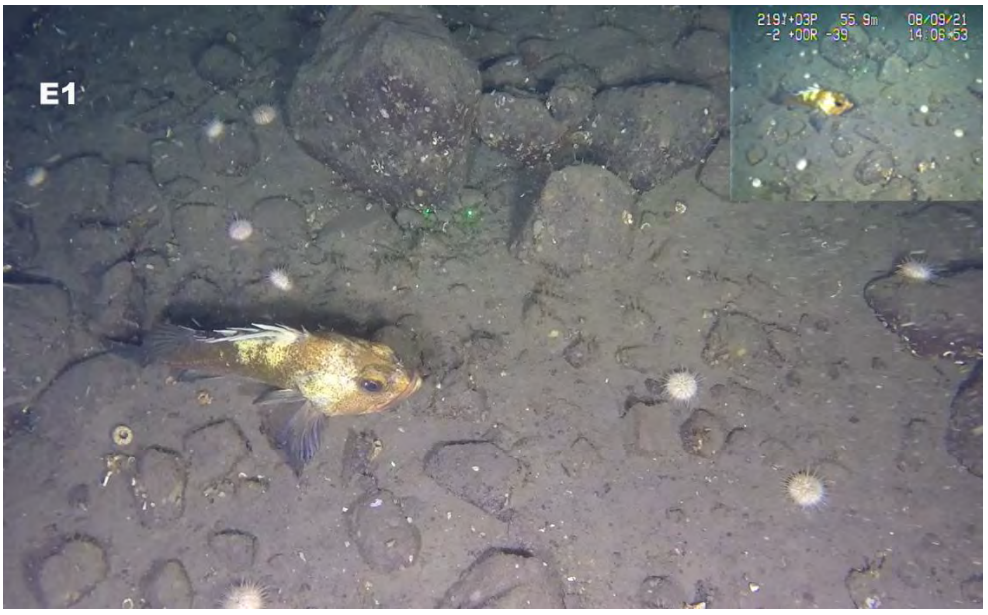
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 15 **Photo Location:** West Pearse Island **Comments:** Tanner crab (C*hionoecetes bairdi)* on transect W4 on September 9, 2021.	
Photograph ID: 16 **Photo Location:** East Pearse Island **Comments:** Whitespotted greenling (*Hexagrammos stelleri)* on transect E4 on September 8, 2021.	

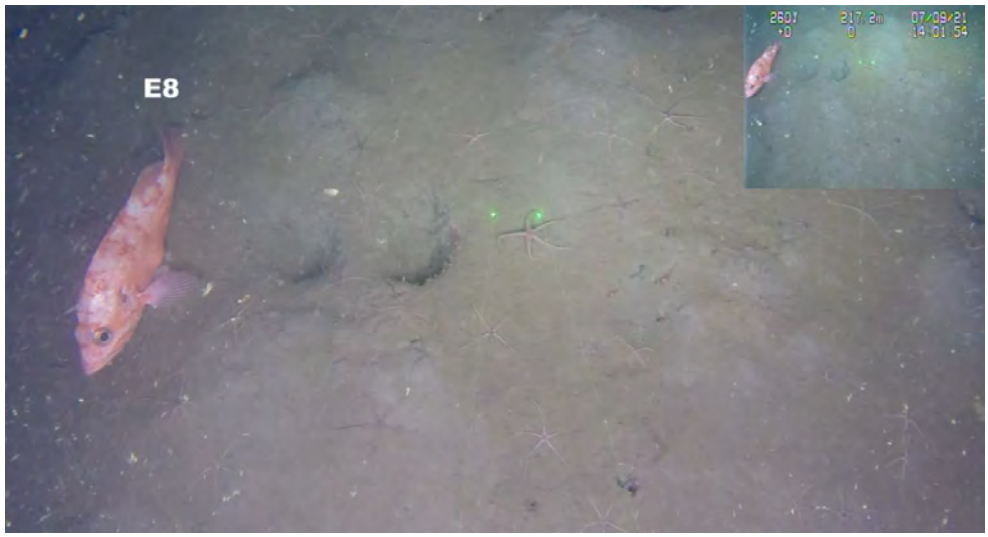
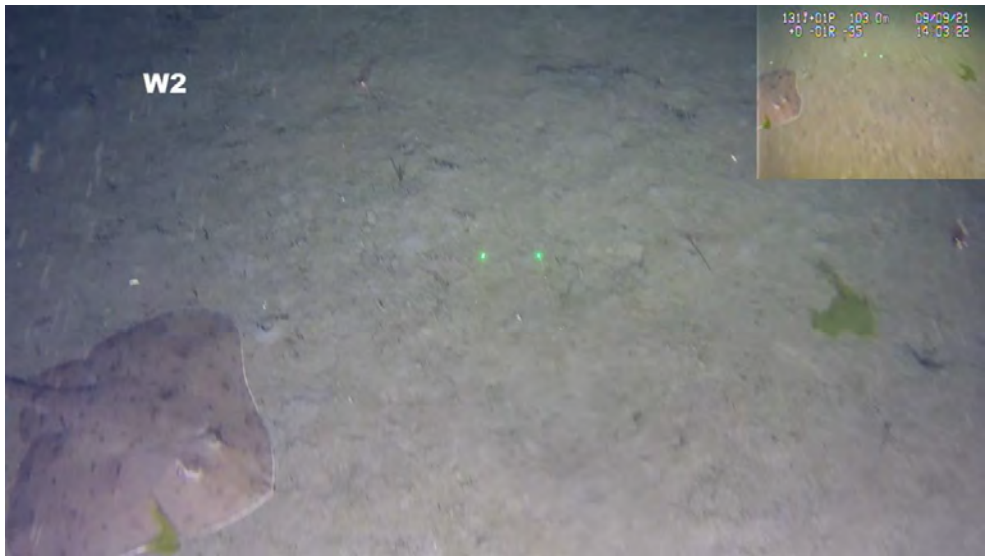
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 17 **Photo Location:** East Pearse Island **Comments:** Pacific cod (*Gadus macrocephalus*) on transect E2 on September 10, 2021.	
Photograph ID: 18 **Photo Location:** East Pearse Island **Comments:** Ratfish (*Hydrolagus colliei*) on transect E4 on September 8, 2021.	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 19 **Photo Location:** East Pearse Island **Comments:** Blackbelly eelpout (*Lycodes Pacificus)* on transect E8 on September 7, 2021.	
Photograph ID: 20 **Photo Location:** East Pearse Island **Comments:** Quillback rockfish (*Sebastes maliger*) on transect E1 on September 8, 2021.	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 21 **Photo Location:** East Pearse Island **Comments:** Sharpchin rockfish (*Sebastes zacentrus*) on transect E8 on September 7, 2021.	
Photograph ID: 22 **Photo Location:** West Pearse Island **Comments:** Sandpaper skate (*Bathyraja interrupta*) on transect W2 on September 9, 2021.	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 23 **Photo Location:** West Pearse Island **Comments:** C-O sole (*Pleuronichthys coenosus*) on transect W4 on September 9, 2021.	
Photograph ID: 24 **Photo Location:** West Pearse Island **Comments:** Dover sole (*Microstomus Pacificus*) on transect W4 on September 9, 2021.	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 25 **Photo Location:** West Pearse Island **Comments:** Halibut (*Hippoglossus stenolepis*) on transect W4 on September 9, 2021.	
Photograph ID: 26 **Photo Location:** West Pearse Island **Comments:** Rosylip sculpin (*Ascelichthys rhodorus*) on transect W4 on September 9, 2021.	

Appendix D SUBTIDAL ABUNDANCE SUMMARY TABLES

Taxa Richness Observed during the Subtidal ROV Survey

	Marine Fish		Solitary Invertebrates		Aggregrating Invertebrates		Algae	
Transect	**Richness (#)**	**Richness (# species / m)**	**Richness (#)**	**Richness (# species / m)**	**Richness (#)**	**Richness (# species / m)**	**Richness (#)**	**Richness (# species / m)**
East Pearse Island								
E1	7	0.01	21	0.04	0	0.00	5	0.01
E2	5	0.02	14	0.06	3	0.01	0	0.00
E3	3	0.01	21	0.04	3	0.01	1	0.00
E4	6	0.01	26	0.04	4	0.01	2	0.00
E5	6	0.01	14	0.02	2	0.00	2	0.00
E6	9	0.02	25	0.05	1	0.00	0	0.00
E7	3	0.01	13	0.03	3	0.01	0	0.00
E8	6	0.01	25	0.05	4	0.01	1	0.00
Whiskey Bay								
WB1	5	0.01	15	0.02	0	0.00	3	0.00
West Pearse Island								
W2	10	0.01	20	0.02	3	0.00	2	0.00
W3	9	0.01	19	0.03	3	0.00	2	0.00
W4	15	0.02	18	0.03	2	0.00	2	0.00

Abundance (# / 100 m) of Marine Fish and Motile Invertebrates Observed during the East Pearse Island Subtidal Survey

Common Name	Scientific Name	Mean (± SD)	Median (IQR)	Total Count
Marine Fish				
Blackbelly eelpout	*Lycodes pacificus*	0.30 (0.40)	0.18 (0 - 0.41)	13
Copper rockfish	*Sebastes caurinus*	0.02 (0.07)	0 (0 - 0)	1
Pacific cod	*Gadus macrocephalus*	0.06 (0.16)	0 (0 - 0)	1
Quillback rockfish	*Sebastes maliger*	0.02 (0.06)	0 (0 - 0)	1
Ratfish	*Hydrolagus colliei*	0.2 (0.23)	0.14 (0 - 0.4)	8
Unidentified rockfish	*Sebastes* spp.	0.47 (0.46)	0.32 (0.14 - 0.82)	21
Sharpchin rockfish	*Sebastes zacentrus*	0.02 (0.07)	0 (0 - 0)	1
Starry flounder	*Platichthys stellatus*	0.05 (0.14)	0 (0 - 0)	3
Unidentified cod	Family Gadidae	0.05 (0.08)	0 (0 - 0.04)	2
Unidentified fish	Unidentified Fish	0.66 (0.51)	0.72 (0.29 - 1.1)	30
Unidentified poacher	Family Agonidae	0.02 (0.07)	0 (0 - 0)	1
Unidentified prickleback	Family Stichaedae	0.27 (0.36)	0.09 (0 - 0.49)	10
Unidentified right eye flounder	Family Pleuronectidae	0.5 (0.32)	0.53 (0.3 - 0.74)	19
Unidentified sculpin	Family Cottidae	0.08 (0.15)	0 (0 - 0.06)	3
Unidentified skate	Family Rajidae	0.02 (0.06)	0 (0 - 0)	1
Whitespotted greenling	*Hexagrammos stelleri*	0.04 (0.08)	0 (0 - 0.03)	2
Yellowtail rockfish	*Sebastes flavidus*	0.34 (0.95)	0 (0 - 0)	15
Invertebrates				
Basket star	*Gorgonocephalus eucnemis*	0.14 (0.14)	0.15 (0 - 0.2)	6
Bat star	*Asterina miniata*	0.02 (0.07)	0 (0 - 0)	1
Blood star	*Henricia leviuscula*	0.02 (0.07)	0 (0 - 0)	1
Cloud sponge	*Aphrocallistes vastus*	0.15 (0.23)	0 (0 - 0.28)	6
Cookie star	*Ceramaster patagonicus*	0.05 (0.09)	0 (0 - 0.05)	2
Crimson anemone	*Cribrinopsis fernaldi*	0.08 (0.16)	0 (0 - 0.04)	2
Fat blood star	*Henricia sanguinolenta*	0.05 (0.09)	0 (0 - 0.05)	2
Feather star	*Florometra serratissima*	11.78 (27. 27)	0.1 (0 - 6.7)	491
Fingered goblet sponge	*Heterochone calyx*	0.08 (0.17)	0 (0 - 0.05)	2
Funnel sponge	*Phakellia* spp.	0.05 (0.1)	0 (0 - 0.05)	2
Giant california sea cucumber	*Apostichopus californicus*	2.42 (1.93)	2.34 (1.19 - 2.73)	108
Green urchin	*Strongylocentrotus droebachiensis*	17.3 (38.42)	0.1 (0 - 8.95)	726
Heart urchin	*Brisaster latifrons*	0.12 (0.34)	0 (0 - 0)	5
Hermit crab	*Pagurus* spp.	0.21 (0.48)	0 (0 - 0.09)	12
Lemon peel nudibranch	*Tochuina gigantea*	0.02 (0.06)	0 (0 - 0)	1
Morning sunstar	*Solaster dawsoni*	0.02 (0.07)	0 (0 - 0)	1
Mottled star	*Evasterias troscheli*	0.48 (1.12)	0 (0 - 0.23)	22
Northern sun star	*Solaster endeca*	0.13 (0.16)	0.07 (0 - 0.22)	6
Orange cup coral	*Balanophyllia elegans*	4.07 (4.98)	2.07 (0 - 7.27)	189
Orange sea pen	*Ptilosarcus gurneyi*	0.26 (0.45)	0.16 (0 - 0.21)	11
Pink urchin	*Strongylocentrotus fragilis*	0.21 (0.32)	0.07 (0 - 0.28)	6
Pom pom anemone	*Liponema* spp.	0.26 (0.67)	0 (0 - 0.05)	15
Purple urchin	*Strongylocentrotus purpuratus*	0.05 (0.14)	0 (0 - 0)	2
Rainbow star	*Orthasterias koehleri*	0.23 (0.34)	0.09 (0 - 0.35)	9
Rose star	*Crossaster papposus*	0.92 (0.72)	0.91 (0.34 - 1.38)	41
Round lipped boot sponge	*Staurocalyptus dowlingi*	0.02 (0.05)	0 (0 - 0)	1
Sea whip	*Halipteris willemoesi*	0.22 (0.41)	0 (0 - 0.2)	11
Sharp lipped boot sponge	*Rhabdocalyptus dawsoni*	0.03 (0.1)	0 (0 - 0)	2

Spiny red star	*Hippasteria spinosa*	0.03 (0.1)	0 (0 - 0)	2
Squat lobster	*Munida quadrispina*	2.21 (5.06)	0 (0 - 0.89)	79
Stubby squid	*Rossia Pacifica*	0.06 (0.09)	0 (0 - 0.14)	3
Sunflower star	*Pycnopodia helianthoides*	1.05 (0.96)	0.77 (0.47 - 1.25)	46
Tan cup coral	*Caryophyllia alaskensis*	0.12 (0.34)	0 (0 - 0)	5
Unidentified anemone	Class Anthozoa	0.94 (1.22)	0.7 (0 - 1.11)	30
Unidentified coral	Class Anthozoa	0.02 (0.05)	0 (0 - 0)	1
Unidentified crab	Order Decapoda	0.09 (0.19)	0 (0 - 0.05)	4
Unidentified snails and slugs	Class Gastropoda	0.02 (0.07)	0 (0 - 0)	1
Unidentified glass sponges	Class Hexactinellida	1.41 (1.39)	0.87 (0.67 - 1.91)	61
Unidentified gorgonian coral	Class Hexacorallia	0.02 (0.07)	0 (0 - 0)	1
Unidentified hermit crab	Family Paguroidea	0.14 (0.41)	0 (0 - 0)	6
Unidentified hydroid	Class Hydrozoa	0.04 (0.08)	0 (0 - 0.04)	2
Unidentified mollusk	Phylum Mollusca	0.16 (0.31)	0 (0 - 0.17)	4
Unidentified nudibranch	Order Nudibranchia	0.02 (0.05)	0 (0 - 0)	1
Unidentified sea cucumber	Class Holothuroidea	0.06 (0.11)	0 (0 - 0.04)	3
Unidentified sea pen	Order Pennatulacea	0.19 (0.47)	0 (0 - 0.04)	8
Unidentified sea star	Class Asteroidea	0.37 (0.54)	0.07 (0 - 0.56)	16
Unidentified shrimp	Order Decapoda	1.38 (3.19)	0 (0 - 0.48)	30
Unidentified soft coral	Order Alcyonacea	0.02 (0.07)	0 (0 - 0)	1
Unidentified sponge	Phylum Porifera	0.4 (0.62)	0.19 (0 - 0.45)	12
Unidentified squid	Superorder Decapodiformes	0.02 (0.07)	0 (0 - 0)	1
Unidentified zoanthid	Order Zoantharia	8.23 (20.19)	0 (0 - 2.22)	319
Unidentified urchin	*Strongylocentrotus* spp.	0.08 (0.17)	0 (0 - 0.05)	2
Velcro star	*Stylasterias forreri*	0.54 (0.49)	0.52 (0.14 - 0.74)	22
Vermilion star	*Mediaster aequalis*	1.06 (0.84)	1.35 (0.25 - 1.59)	48
White urchin	*Strongylocentrotus pallidus*	20.47 (32.58)	7.25 (2.12 - 22.79)	848

Relative Abundance (% / 100 m) of Aggregating Invertebrates and Algae Observed during the East Pearse Island Subtidal Survey

Common Name	Scientific Name	Mean (± SD)	Median (IQR)
Invertebrates			
Brittle star	Order Ophiurida	2.8 (3.14)	1.97 (0.90 - 3.38)
Sidestripe shrimp	*Pandalopsis dispar*	0.24 (0.68)	0 (0 - 0)
Unidentified farrea	*Farrea* spp.	0.14 (0.14)	0.15 (0 - 0.21)
Unidentified tubeworm	Family Serpulidae	2.02 (5.41)	0 (0 - 0.32)
White branching hydrocoral	*Stylaster campylecus*	0.84 (1.14)	0.35 (0 - 1.35)
Algae			
Filamentous red algae	Phylum Rhodophyta	0.02 (0.05)	0 (0 - 0)
Fringed sea colander kelp	*Agarum fimbriatum*	0.11 (0.32)	0 (0 - 0)
Ribbon kelp	*Alaria marginata*	0.45 (1.27)	0 (0 - 0)
Unidentified brown algae	Phylum Ochrophyta	0.24 (0.68)	0 (0 - 0)
Unidentified Fucus	*Fucus* spp.	1.08 (2.37)	0 (0 - 0.49)
Unidentified kelp	Order Laminariales	2.69 (7.62)	0 (0 - 0)
Unidentified Ulva spp.	*Ulva* spp.	0.47 (0.67)	0.07 (0 - 0.87)

NOTES:

SD = Standard Deviation, IQR = Interquartile range

Abundance (# / 100 m) of Marine Fish and Motile Invertebrates Observed during the Whiskey Bay Subtidal Survey

Common Name	Scientific Name	Transect	Mean	Median (IQR)	Total Count
		WB1			
Marine Fish					
Starry flounder	Platichthys stellatus	0.11	0.11	0.11 (0.11 - 0.11)	1
Unidentified fish	Unidentified Fish	0.45	0.45	0.45 (0.45 - 0.45)	4
Unidentified poacher	Family Agonidae	0.23	0.23	0.23 (0.23 - 0.23)	2
Unidentified right eye flounder	Family Pleuronectidae	0.68	0.68	0.68 (0.68 - 0.68)	6
Unidentified sculpin	Family Cottidae	0.11	0.11	0.11 (0.11 - 0.11)	1
Invertebrates					
Blood star	*Henricia leviuscula*	0.11	0.11	0.11 (0.11 - 0.11)	1
Cookie star	*Ceramaster patagonicus*	0.11	0.11	0.11 (0.11 - 0.11)	1
Giant california sea cucumber	*Apostichopus californicus*	6.65	6.65	6.65 (6.65 - 6.65)	59
Green urchin	*Strongylocentrotus droebachiensis*	13.53	13.53	13.53 (13.53 - 13.53)	120
Mottled star	*Evasterias troscheli*	5.30	5.30	5.3 (5.3 - 5.3)	47
Northern sun star	*Solaster endeca*	0.11	0.11	0.11 (0.11 - 0.11)	1
Rainbow star	*Orthasterias koehleri*	0.23	0.23	0.23 (0.23 - 0.23)	2
Red sea cucumber	*Cucumaria miniata*	0.34	0.34	0.34 (0.34 - 0.34)	3
Rose star	*Crossaster papposus*	0.23	0.23	0.23 (0.23 - 0.23)	2
Sunflower star	*Pycnopodia helianthoides*	1.35	1.35	1.35 (1.35 - 1.35)	12
Unidentified crab	Order Decapoda	0.68	0.68	0.68 (0.68 - 0.68)	6
Unidentified sea star	Class Asteroidea	0.23	0.23	0.23 (0.23 - 0.23)	2
Velcro star	*Stylasterias forreri*	0.11	0.11	0.11 (0.11 - 0.11)	1
Vermilion star	*Mediaster aequalis*	0.34	0.34	0.34 (0.34 - 0.34)	3
White urchin	*Strongylocentrotus pallidus*	4.51	4.51	4.51 (4.51 - 4.51)	40

Abundance (% / 100 m) of Aggregating Invertebrates and Algae Observed during the Whiskey Bay Subtidal Survey

Common Name	Latin Name	Transect	Mean	Median (IQR)
		WB1		
Algae				
Rockweed	Fucus gardneri	11.28	11.28	11.28 (11.28 - 11.28)
Unidentified kelp	Order Laminariales	0.56	0.56	0.56 (0.56 - 0.56)
Unidentified Ulva spp.	*Ulva* spp.	7.89	7.89	7.89 (7.89 - 7.89)

NOTES:

SD = Standard Deviation, IQR = Interquartile range

Abundance (# / 100 m) of Marine Fish and Motile Invertebrates Observed during the West Pearse Subtidal Survey

Common Name	Scientific Name	Mean (± SD)	Median (IQR)	Total Count
Marine Fish				
Blackbelly eelpout	*Lycodes pacificus*	0.55 (0.39)	0.42 (0.33 - 0.71)	11
C-O sole	*Pleuronichthys coenosus*	0.05 (0.08)	0 (0 - 0.07)	1
Dover sole	*Microstomus Pacificus*	0.14 (0.25)	0 (0 - 0.21)	3
Sandpaper skate	*Bathyraja interrupta*	0.22 (0.19)	0.28 (0.14 - 0.32)	5
Halibut	*Hippoglossus stenolepis*	0.09 (0.16)	0 (0 - 0.14)	2
Ratfish	*Hydrolagus colliei*	0.3 (0.33)	0.24 (0.12 - 0.45)	6
Rex sole	*Glyptocephalus zacharius*	0.05 (0.08)	0 (0 - 0.07)	1
Unidentified rockfish	*Sebastes* spp.	0.86 (0.96)	0.49 (0.32 - 1.23)	20
Rosylip sculpin	*Ascelichthys rhodorus*	0.05 (0.08)	0 (0 - 0.07)	1
Snake prickleback	*Lumpenus sagitta*	0.05 (0.08)	0 (0 - 0.07)	1
Spinyhead sculpin	*Dastcottus setiger*	0.15 (0.14)	0.16 (0.08 - 0.22)	3
Sturgeon poacher	*Podothecus accipenserinus*	0.08 (0.14)	0 (0 - 0.12)	2
Unidentified cod	Family Gadidae	0.04 (0.07)	0 (0 - 0.06)	1
Unidentified fish	Unidentified Fish	0.61 (0.05)	0.61 (0.59 - 0.64)	13
Unidentified poacher	Family Agonidae	2.14 (3.44)	0.16 (0.15 - 3.14)	52
Unidentified prickleback	Family Stichaedae	0.09 (0.16)	0 (0 - 0.14)	2
Unidentified right eye flounder	Family Pleuronectidae	0.65 (0.08)	0.66 (0.61 - 0.7)	14
Unidentified sculpin	Family Cottidae	0.09 (0.08)	0.12 (0.06 - 0.13)	2
Unidentified skate	Family Rajidae	0.11 (0.19)	0 (0 - 0.16)	2
Yellowtail rockfish	*Sebastes flavidus*	0.44 (0.76)	0 (0 - 0.66)	8
Invertebrates				
Brown box crab	*Lopholithodes foraminatus*	0.05 (0.1)	0 (0 - 0.08)	1
Cloud sponge	*Aphrocallistes vastus*	0.1 (0.09)	0.12 (0.06 - 0.14)	2
Cookie star	*Ceramaster patagonicus*	0.36 (0.4)	0.14 (0.13 - 0.48)	7
Feather star	*Florometra serratissima*	9.43 (16.33)	0 (0 - 14.15)	200
Sand star	*Luidia foliolata*	0.04 (0.07)	0 (0 - 0.06)	1
Funnel sponge	*Phakellia* spp.	0.04 (0.07)	0 (0 - 0.06)	1
Giant california sea cucumber	*Apostichopus californicus*	0.34 (0.22)	0.33 (0.23 - 0.45)	7
Giant plumose anemone	*Metridium farcimen*	0.04 (0.07)	0 (0 - 0.06)	1
Green urchin	*Strongylocentrotus droebachiensis*	0.82 (1.43)	0 (0 - 1.24)	15
Mottled star	*Evasterias troscheli*	0.43 (0.63)	0.14 (0.07 - 0.65)	8
Orange cup coral	*Balanophyllia elegans*	0.85 (0.63)	0.98 (0.57 - 1.2)	19
Pink urchin	*Strongylocentrotus fragilis*	0.05 (0.1)	0 (0 - 0.08)	1
Rainbow star	*Orthasterias koehleri*	0.14 (0.25)	0 (0 - 0.21)	3
Red sea cucumber	*Cucumaria miniata*	0.34 (0.45)	0.16 (0.08 - 0.51)	7
Rose star	*Crossaster papposus*	0.05 (0.08)	0 (0 - 0.07)	1
Sharp lipped boot sponge	*Rhabdocalyptus dawsoni*	0.41 (0.6)	0.14 (0.07 - 0.62)	10
Squat lobster	*Munida quadrispina*	0.82 (1.41)	0 (0 - 1.22)	20
Striped sunstar	*Solaster stimpsoni*	0.05 (0.08)	0 (0 - 0.07)	1
Stubby squid	*Rossia Pacifica*	0.18 (0.18)	0.16 (0.08 - 0.27)	4
Sunflower star	*Pycnopodia helianthoides*	0.41 (0.18)	0.33 (0.31 - 0.47)	9
Tanner crab	*Chionoecetes bairdi*	0.2 (0.11)	0.14 (0.13 - 0.24)	4
Unidentified anemone	Class Anthozoa	0.05 (0.08)	0 (0 - 0.07)	1
Unidentified coral	Class Anthozoa	0.08 (0.14)	0 (0 - 0.12)	2
Unidentified crab	Order Decapoda	0.11 (0.19)	0 (0 - 0.16)	2
Unidentified glass sponges	Class Hexactinellida	0.35 (0.34)	0.16 (0.15 - 0.45)	8
Unidentified hermit crab	Family Paguroidea	0.08 (0.14)	0 (0 - 0.12)	2
Unidentified hydroid	Class Hydrozoa	0.08 (0.14)	0 (0 - 0.12)	2
Unidentified nudibranch	Order Nudibranchia	0.05 (0.08)	0 (0 - 0.07)	1
Unidentified sea star	Class Asteroidea	0.05 (0.08)	0 (0 - 0.07)	1
Unidentified shrimp	Order Decapoda	2.87 (3.5)	1.84 (0.92 - 4.3)	56
Unidentified tunicate	Class Ascidiacea	0.38 (0.67)	0 (0 - 0.58)	7

Unidentified zoanthid	Order Zoantharia	0.2 (0.35)	0 (0 - 0.31)	5
Velcro star	*Stylasterias forreri*	0.14 (0.12)	0.16 (0.08 - 0.2)	3
Vermilion star	*Mediaster aequalis*	2.19 (1.29)	2.31 (1.58 - 2.87)	48
White urchin	*Strongylocentrotus pallidus*	0.1 (0.09)	0.14 (0.07 - 0.15)	2

Relative Abundance (% / 100 m) of Aggregating Invertebrates and Algae Observed during the West Pearse Subtidal Survey

Common Name	Latin Name	Mean (± SD)	Median (IQR)
Invertebrates			
Brittle star	Order Ophiurida	0.11 (0.19)	0 (0 - 0.16)
Kelp-encrusting bryozoan	*Membranipora serrilamella*	0.27 (0.48)	0 (0 - 0.41)
Sidestripe shrimp	*Pandalopsis dispar*	0.22 (0.21)	0.24 (0.12 - 0.33)
UnID farrea	*Farrea* sp.	7.1 (12.29)	0 (0 - 10.64)
UnID mussel	*Mytilus* spp.	9.33 (2.03)	9.9 (8.48 - 10.45)
Algae			
Eelgrass	*Zostera* spp.	1.63 (2.83)	0 (0 - 2.45)
Rockweed	*Fucus spp.*	5.89 (6.42)	4.95 (2.47 - 8.84)
Unidentified kelp	Order Laminariales	2.88 (4.85)	0.16 (0.08 - 4.33)
Unidentified Ulva spp.	*Ulva* spp.	5.51 (9.54)	0 (0 - 8.26)

NOTES:

SD = Standard Deviation, IQR = Interquartile range

Diversity Observed during the East Pearse Subtidal ROV Survey (mean ± SD)

Transect	Marine Fish	Solitary Invertebrates	Aggregating Invertebrates	Algae
E1	1.34	1.20	0.00	1.31
E2	1.56	1.88	0.69	0.00
E3	1.06	1.04	0.38	0.00
E4	1.6	2.26	0.69	0.00
E5	1.42	2.02	0.00	0.35
E6	1.82	1.07	0.00	0.00
E7	1.01	1.56	0.69	0.00
E8	1.42	1.39	0.73	0.00
Mean ± SD Median (IQR)	1.40 ± 0.27 1.42 (1.26 – 1.57)	1.55 ± 0.46 1.47 (0.17 – 1.92)	0.40 ± 0.35 0.53 (0.00 – 0.69)	0.21 ± 0.46 0.00 (0.00 – 0.09)

Diversity Observed during the Whiskey Bay Subtidal ROV Survey (mean ± SD)

Transect	Marine Fish	Solitary Invertebrates	Aggregating Invertebrates	Algae
WB1	1.38	1.72	0.00	0.82
Mean ± SD	-	-	-	-

Diversity Observed during the West Pearse Subtidal ROV Survey (mean ± SD)

Transect	Marine Fish	Solitary Invertebrates	Aggregating Invertebrates	Algae
W2	1.38	2.40	0.68	0.00
W3	1.89	2.11	0.00	0.14
W4	2.42	0.88	0.22	0.67
Mean ± SD	1.90 ± 0.52	1.80 ± 0.81	0.30 ± 0.35	0.27 ± 0.36
Median (IQR)	1.89 (1.63 – 2.16)	2.11 (1.50 – 2.26)	0.22 (0.11 – 0.45)	0.14 (0.07 – 0.41)

1 Appendix E MARINE FISH SURVEY PHOTOLOG

APPENDIX E

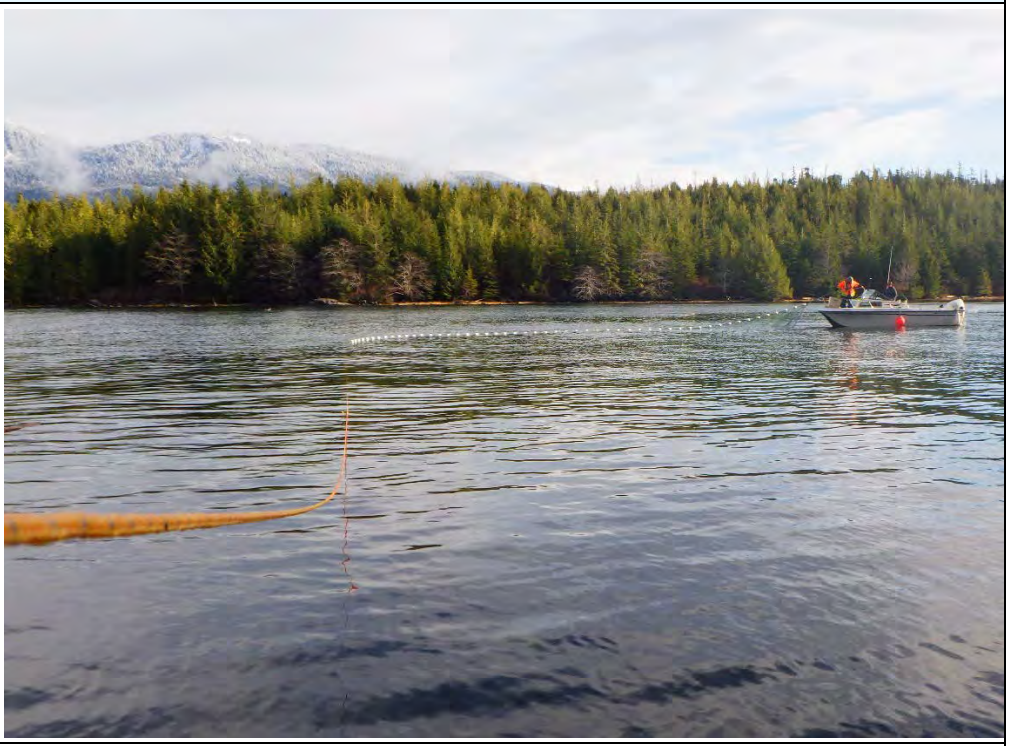
Marine Fish Survey Photolog

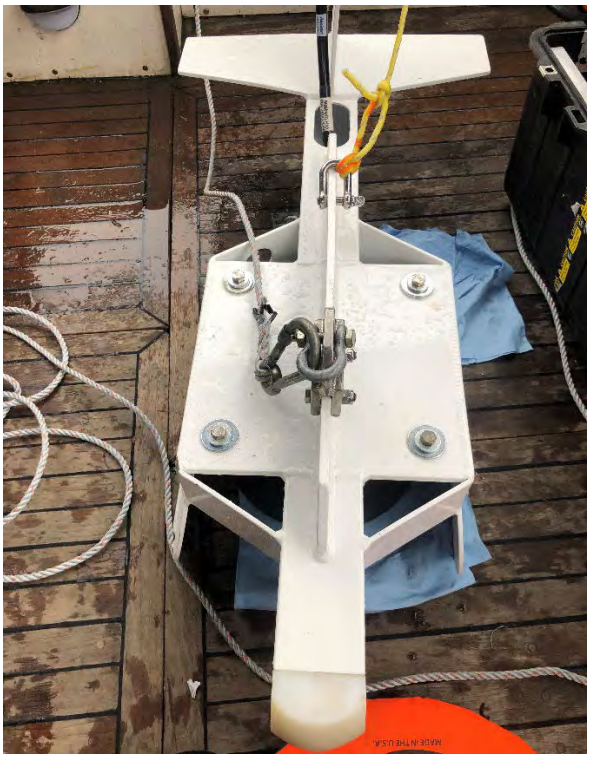
Client: Ksi Lisims LNG	**Project: Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location: Pearse Island, BC	
Photograph ID: 1 **Photo Location:** East Pearse Island **Comments:** Shoreline photo taken June 5, 2021, facing south at BS01.	
Photograph ID: 2 **Photo Location:** East Pearse Island **Comments:** Shoreline photo taken June 5, 2021, facing northeast at BS01.	

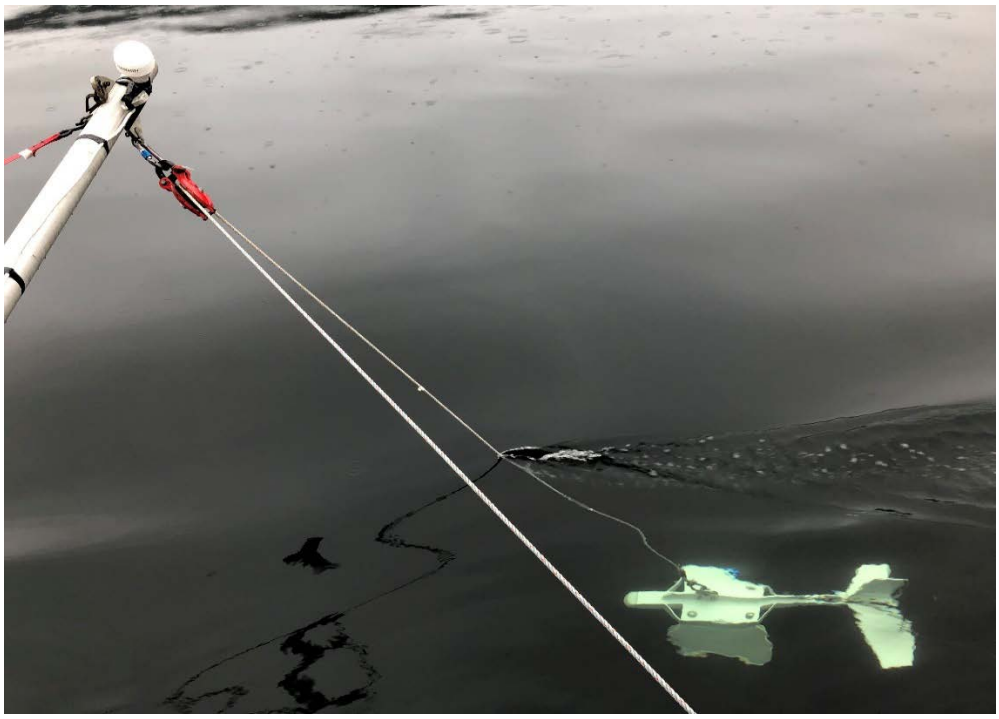
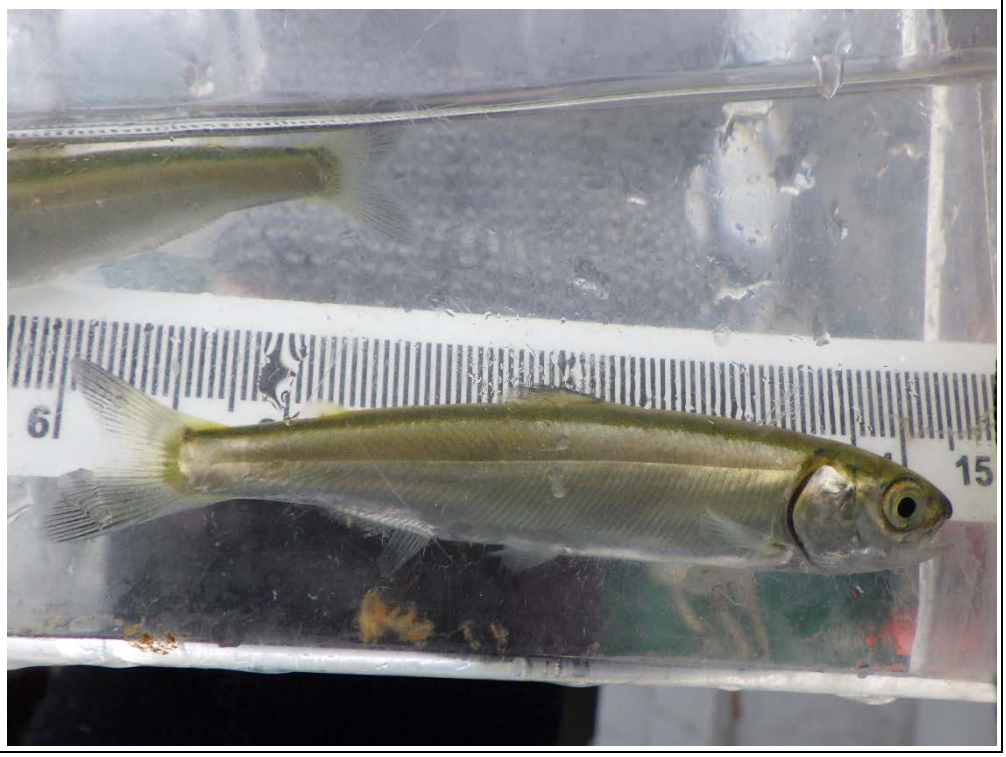
Client: Ksi Lisims LNG	**Project: Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location: Pearse Island, BC	
Photograph ID: 3 **Photo Location:** Whiskey Bay **Comments:** Shoreline photo taken March 5, 2022, facing northwest at BS03.	
Photograph ID: 4 **Photo Location:** Whiskey Bay **Comments:** Shoreline photo taken March 5, 2021, facing south at BS03.	

Client: Ksi Lisims LNG	**Project: Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location: Pearse Island, BC	
Photograph ID: 5 **Photo Location:** West Pearse Island **Comments:** Shoreline photo taken June 3, 2021, facing southeast at BS04.	
Photograph ID: 6 **Photo Location:** West Pearse Island **Comments:** Shoreline photo taken June 3, 2021, facing southwest at BS04.	

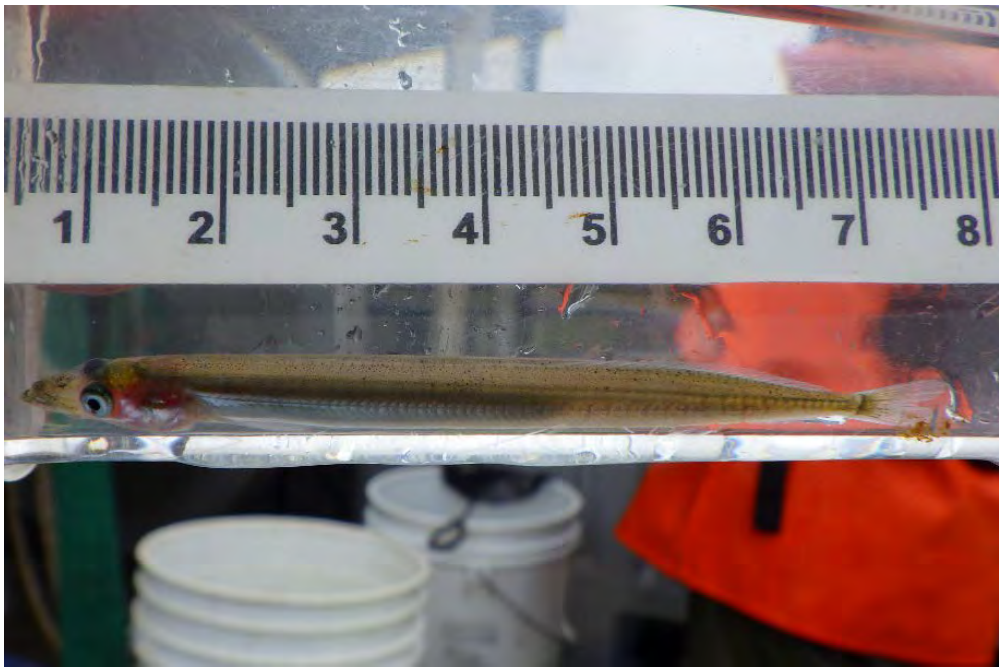
Client: Ksi Lisims LNG	**Project: Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location: Pearse Island, BC	
Photograph ID: 7 **Photo Location:** East Pearse Island **Comments:** Photo of the foot-led beach seine taken March 4, 2022, facing east at site BS01.	
Photograph ID: 8 **Photo Location:** East Pearse Island **Comments:** Photo of the boat-led beach seine taken June 5, 2021, facing northeast at BSB01.	

Client: Ksi Lisims LNG **Site Location: Pearse Island, BC**	**Project: Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Photograph ID: 9 **Photo Location:** Whiskey Bay **Comments:** Photo of boat-led beach seine taken November 7, 2021, facing east at BSB03.	
Photograph ID: 10 **Photo Location:** Whiskey Bay **Comments:** Ocean Fish Lift (OFL) trawl aquarium box, June 3, 2021.	

Client: Ksi Lisims LNG **Site Location: Pearse Island, BC**	**Project: Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Photograph ID: 11 **Photo Location:** North of Whiskey Bay **Comments:** OFL test trawl deployed, June 6, 2021, traveling northeast.	
Photograph ID: 12 **Photo Location:** Pearse Island **Comments:** Hydroacoustic echosounder tow fish.	

Client: Ksi Lisims LNG	**Project: Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location: Pearse Island, BC	
Photograph ID: 13 **Photo Location:** East Pearse Island **Comments:** Hydroacoustic echosounder tow fish deployed at east Pearse Island.	
Photograph ID: 14 **Photo Location:** Whiskey Bay **Comments:** Juvenile Pink Salmon (*Oncorhynchus gorbuscha*) captured by surface trawl on June 3, 2021, during the test trawl at Whiskey Bay.	

Client: Ksi Lisims LNG	**Project: Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location: Pearse Island, BC	
Photograph ID: 15	
Photo Location: West Pearse Island	
Comments: Juvenile coho salmon (*Oncorhynchus kisutch*) captured by seine on June 3, 2021, at BSB04, haul 2 with a maximum depth of 1.5 meters.	
Photograph ID: 16	
Photo Location: West Pearse Island	
Comments: Juvenile Dolly Varden (*Salvelinus malma*) captured by seine on June 3, 2021, at BSB04, haul 3 with a maximum depth of 1.5 meters.	

Client: Ksi Lisims LNG	**Project: Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location: Pearse Island, BC	
Photograph ID: 17	
Photo Location: East Pearse Island	
Comments: Pacific sand lance (*Ammodytes hexapterus*) captured by OFL surface trawl on June 4, 2021, at transect T03 traveling east.	
Photograph ID: 18	
Photo Location: East Pearse Island	
Comments: Photo of Pacific Herring (*Clupea pallasii*) captured by OFL surface trawl on June 5, 2021, at transect T05 travelling east.	

Appendix F MARINE FISH RESULTS

Appendix F.1 Marine Fish Catch Per Unit Effort from Seine Surveys

Subarea	Survey Month	Site ID-Haul	UTM (NAD83, 9U) Start Easting	Start Northing	End Easting	End Northing	Date	Start Time	End Time	Net Dimensions Type	Max Width (m)	Max Depth (m)	Distance (m)	Area Seined (m^3)	Cod (Family Gadidae) Catch	Cod CPUE[a]	Flatfish (Family Pleuronectidae) Catch	Flatfish CPUE[a]	Gunnel (Family Pholidae) Catch	Gunnel CPUE[a]	Pacific Herring (*Clupea pallasii*) Catch	Pacific Herring CPUE[a]	Pacific Sand Lance (*Ammodytes hexapterus*) Catch	Pacific Sand Lance CPUE[a]	Salmonids (Family Salmonidae) Catch	Salmonids CPUE[a]	Sculpin (Family Cottidae) Catch	Sculpin CPUE[a]	Shiner Perch (*Cymatogaster aggregata*) Catch	Shiner Perch CPUE[a]	Snailfish (Family Liparidae) Catch	Snailfish CPUE[a]	Snake Prickleback (*Lumpenus sagitta*) Catch	Snake Prickleback CPUE[a]	Threespine Stickleback (*Gasterosteus aculeatus*) Catch	Threespine Stickleback CPUE[a]	Tubesnout (*Aulorhynchus flavidus*) Catch	Tubesnout CPUE[a]	Unidentified Larval Fish (Class Teleostei) Catch	Unidentified Larval Fish CPUE[a]	Total Catch	Total CPUE[a]	Invertebrates Catch	Invertebrates CPUE[a]
East Pearse Island	June	BSB0 1-1	424389	6097904	424399	6097869	5-Jun-21	18:28	18:32	Boat	20	1.5	30	900	1	0.11	—	—	—	—	—	—	25	2.78	2	0.22	1	0.11	—	—	—	—	—	—	—	—	—	—	—	—	**29**	**3.22**	—	—
		BSB01-2	424410	6097841	424418	6097808	5-Jun-21	18:55	18:57	Boat	20	1.5	30	900	—	—	—	—	—	—	—	—	—	—	23	2.56	2	0.22	—	—	—	—	—	—	—	—	—	—	—	—	**25**	**2.78**	6	0.01
		BSB01-3	424410	6097794	424389	6097773	5-Jun-21	19:26	19:30	Boat	20	1.3	30	780	—	—	—	—	1	0.13	—	—	—	—	1	0.13	2	0.26	—	—	—	—	—	—	—	—	—	—	—	—	**4**	**0.51**	1	<0.01
		BSB02-1	424527	6098186	424515	6098176	6-Jun-21	17:51	17:59	Boat	20	3.0	30	1800	—	—	—	—	1	0.06	—	—	—	—	4	0.22	4	0.22	1	0.06	—	—	—	—	—	—	—	—	—	—	**10**	**0.56**	—	—
												Totals	**120**	**4380**	**1**	**0.02**	**—**	**—**	**2**	**0.05**	**—**	**—**	**25**	**0.57**	**30**	**0.68**	**9**	**0.21**	**1**	**0.02**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**68**	**1.55**	**7**	**<0.01**
	September	BSB02-1	424459	6097975	424637	6098180	1-Sep-21	14:35	14:45	Boat	20	3.0	25	1500	—	—	—	—	—	—	—	—	—	—	—	—	—	—	206	13.73	—	—	—	—	1	0.07	—	—	—	—	**207**	**13.80**	—	—
		BS01-1	424389	6097904	424399	6097869	5-Sep-21	10:10	10:18	Walk	10	1.1	30	330	—	—	—	—	—	—	—	—	—	—	—	—	—	—	20	6.06	—	—	—	—	—	—	—	—	—	—	**20**	**6.06**	—	—
		BS01-2	424410	6097841	424418	6097808	5-Sep-21	10:21	10:27	Walk	9	1.5	30	405	—	—	—	—	—	—	—	—	—	—	—	—	1	0.25	10	2.47	—	—	—	—	—	—	—	—	—	—	**11**	**2.72**	1	<0.01
		BS01-3	424410	6097794	424389	6097773	5-Sep-21	10:39	10:43	Walk	12	0.8	30	288	—	—	—	—	1	0.35	—	—	—	—	—	—	1	0.35	32	11.11	—	—	—	—	—	—	—	—	—	—	**34**	**11.81**	—	—
												Totals	**115**	**2523**	**—**	**—**	**—**	**—**	**1**	**0.04**	**—**	**—**	**—**	**—**	**—**	**—**	**2**	**0.08**	**268**	**10.62**	**—**	**—**	**—**	**—**	**1**	**0.04**	**—**	**—**	**—**	**—**	**272**	**10.78**	**1**	**<0.01**
	November	BS01-1	424392	6097370	424376	6097908	6-Nov-21	11:31	11:37	Walk	8	1.1	30	264	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**—**	**—**	—	—
		BS01-2	424395	6097812	424400	6097850	6-Nov-21	11:16	11:19	Walk	9	1.1	30	297	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**—**	**—**	—	—
		BS01-3	424395	6097775	424402	6097800	6-Nov-21	11:07	11:08	Walk	9	0.6	30	162	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**—**	**—**	—	—
		BSB02-1	424497	6098181	424517	609819	6-Nov-21	12:30	12:42	Boat	21	4.5	25	2363	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**—**	**—**	—	—
		BSB02-2	424520	6098193	424529	609821	6-Nov-21	12:50	12:56	Boat	21	4.5	25	2363	—	—	—	—	—	—	—	—	29	1.23	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**29**	**1.23**	—	—
												Totals	**140**	**5448**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**29**	**0.53**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**29**	**0.53**	**—**	**—**
	March	BS01-1	424459	6097759	424450	6097794	4-Mar-22	8:38	8:42	Walk	10	1.0	30	300	—	—	—	—	—	—	—	—	—	—	1	0.33	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**1**	**0.33**	1	<0.01
		BS01-2	424447	6097805	424441	6097835	4-Mar-22	9:03	9:06	Walk	10	1.0	30	300	—	—	—	—	—	—	—	—	—	—	2	0.67	—	—	—	—	—	—	—	—	—	—	1	0.33	**3**	**1.00**	—	—
		BS01-3	424433	6097850	424417	6097880	4-Mar-22	9:23	9:27	Walk	11	1.1	30	363	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**—**	**—**	2	0.01
		BSB02-1	424489	6098153	424516	6098176	5-Mar-22	11:13	11:19	Boat	20	4.5	22	1980	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**—**	**—**	—	—
												Totals	**112**	**2943**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**3**	**0.10**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**1**	**0.03**	**4**	**0.14**	**3**	**<0.01**
												All Survey Months Totals	**487**	**15294**	**1**	**0.01**	**—**	**—**	**3**	**0.02**	**—**	**—**	**54**	**0.35**	**33**	**0.22**	**11**	**0.07**	**269**	**1.76**	**—**	**—**	**—**	**—**	**1**	**0.01**	**—**	**—**	**1**	**0.01**	**373**	**2.44**	**11**	**<0.01**
Whiskey Bay	June	BS03-1	424164	6098562	424163	6098531	5-Jun-21	16:25	16:27	Walk	18	0.5	30	270	—	—	1	0.37	—	—	—	—	—	—	6	2.22	—	—	—	—	—	—	—	—	2	0.74	—	—	—	—	**9**	**3.33**	—	—
		BS03-2	424147	6098529	424139	6098513	5-Jun-21	17:00	17:04	Walk	15	0.3	30	135	—	—	—	—	1	0.74	—	—	—	—	2	1.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**3**	**2.22**	3	0.02
		BS03-3	424132	6098508	424106	6098504	5-Jun-21	17:30	17:32	Walk	20	0.2	30	120	—	—	1	0.83	—	—	—	—	—	—	2	1.67	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**3**	**2.50**	—	—
												Totals	**90**	**525**	**—**	**—**	**2**	**0.38**	**1**	**0.19**	**—**	**—**	**—**	**—**	**10**	**1.90**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**2**	**0.38**	**—**	**—**	**—**	**—**	**15**	**2.86**	**3**	**0.01**
	September	BS03-1	424164	6098562	424163	6098531	6-Sep-21	8:12	8:15	Walk	12	0.5	30	180	—	—	—	—	2	1.11	—	—	—	—	—	—	11	6.11	—	—	1	0.56	—	—	—	—	—	—	—	—	—	—	**14**	**7.78**	66	0.37
		BS03-2	424147	6098529	424139	6098513	6-Sep-21	8:54	8:59	Walk	12	0.5	30	180	—	—	1	0.56	3	1.67	—	—	—	—	—	—	4	2.22	4	2.22	1	0.56	—	—	—	—	—	—	—	—	—	—	**13**	**7.22**	80	0.44
		BS03-3	424132	6098508	424106	6098504	6-Sep-21	9:30	9:36	Walk	12	0.6	30	216	—	—	1	0.46	2	0.93	—	—	—	—	—	—	10	4.63	2	0.93	1	0.46	—	—	—	—	—	—	—	—	—	—	**16**	**7.41**	17	0.08
												Totals	**90**	**576**	**—**	**—**	**2**	**0.35**	**7**	**1.22**	**—**	**—**	**—**	**—**	**—**	**—**	**25**	**4.34**	**6**	**1.04**	**3**	**0.52**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**43**	**7.47**	**163**	**0.28**
	November	BS03-1	424058	6098738	424059	6098707	7-Nov-21	9:24	9:27	Walk	9	1.2	30	329	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**—**	**—**	—	—
		BS03-2	424058	6098651	424055	6098620	7-Nov-21	9:40	9:46	Walk	9	1.0	30	270	—	—	—	—	—	—	118	43.70	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**118**	**43.70**	—	—
		BS03-3	424079	6098538	424091	6098519	7-Nov-21	10:11	10:16	Walk	9	0.8	30	216	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**—**	**—**	—	—
		BSB03-1	424018	6098640	424019	6098607	7-Nov-21	13:25	13:30	Boat	21	4.5	25	2363	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**—**	**—**	—	—
												Totals	**115**	**3178**	**—**	**—**	**—**	**—**	**—**	**—**	**118**	3.71	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**118**	**3.71**	**—**	**—**
	March	BS03-1	424069	6098756	424075	6098725	5-Mar-22	8:44	8:46	Walk	10	0.7	30	210	—	—	—	—	—	—	—	—	—	—	3	1.43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**3**	**1.43**	9	0.04
		BS03-2	424075	6098724	424073	6098691	5-Mar-22	9:02	9:05	Walk	10	0.6	30	180	—	—	—	—	—	—	—	—	—	—	1	0.56	—	—	—	—	1	0.56	—	—	—	—	—	—	—	—	**2**	**1.11**	11	0.06
		BS03-3	424105	6098643	424082	6098662	5-Mar-22	9:53	9:56	Walk	9	0.5	30	135	—	—	—	—	—	—	—	—	—	—	1	0.74	1	0.74	—	—	—	—	—	—	—	—	—	—	—	—	**2**	**1.48**	6	0.04
		BS03-4	424142	6098637	424170	6098637	5-Mar-22	9:34	9:37	Walk	10	0.5	30	150	—	—	—	—	—	—	—	—	—	—	1	0.67	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**1**	**0.67**	3	0.02
		BSB03-1	424030	6098565	424031	6098594	5-Mar-22	13:59	14:02	Boat	16	4.5	22	1584	—	—	—	—	—	—	—	—	—	—	7	0.44	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**7**	**0.44**	—	—
												Totals	**142**	**2259**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**13**	**0.58**	**1**	**0.04**	**—**	**—**	**1**	**0.04**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**15**	**0.66**	**29**	**0.01**
												All Survey Months Totals	**437**	**6538**	**—**	**—**	**4**	**0.06**	**8**	**0.12**	**118**	1.80	**—**	**—**	**23**	**0.35**	**26**	**0.40**	**6**	**0.09**	**4**	**0.06**	**—**	**—**	**2**	**0.03**	**—**	**—**	**—**	**—**	**191**	**2.92**	**195**	**0.03**
West Pearse Island	June	BSB04-1	423264	6098355	423275	6098356	5-Jun-21	16:25	16:27	Boat	20	1.5	30	900	—	—	—	—	3	0.33	1	0.11	—	—	10	1.11	8	0.89	—	—	—	—	—	—	—	—	—	—	—	—	**22**	**2.44**	1	<0.01
		BSB04-2	423296	6098380	423307	6098414	5-Jun-21	17:00	17:04	Boat	20	1.5	30	900	—	—	5	0.56	2	0.22	70	7.78	—	—	3	0.33	2	0.22	1	0.11	—	—	—	—	—	—	—	—	—	—	**83**	**9.22**	1	<0.01
		BSB04-3	423307	6098416	423314	6098447	5-Jun-21	17:30	17:32	Boat	20	1.5	30	900	—	—	2	0.22	—	—	—	—	—	—	15	1.67	1	0.11	—	—	1	0.11	—	—	—	—	—	—	—	—	**19**	**2.11**	—	—
		BSB05-1	422443	6097907	422451	6097909	7-Jun-21	17:25	17:28	Boat	15	4.0	30	1800	—	—	—	—	—	—	4	0.22	17	0.94	5	0.28	—	—	—	—	1	0.06	—	—	—	—	—	—	—	—	**27**	**1.50**	—	—
		BSB05-2	422463	6097912	422497	6097903	7-Jun-21	17:49	17:51	Boat	15	4.0	30	1800	—	—	2	0.11	1	0.06	255	14.17	—	—	192	10.67	4	0.22	—	—	—	—	—	—	—	—	—	—	—	—	**454**	**25.22**	—	—
												Totals	**150**	**6300**	**—**	**—**	**9**	**0.14**	**6**	**0.10**	**326**	5.17	**4**	**0.06**	**237**	**3.76**	**20**	**0.32**	**1**	**0.02**	**1**	**0.02**	**1**	**0.02**	**—**	**—**	**—**	**—**	**—**	**—**	**605**	**9.60**	**2**	**<0.01**
	September	BS04-1	423251	6098340	423281	6098348	6-Sep-21	10:43	10:49	Walk	11	1.1	30	363	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6	1.65	—	—	—	—	**6**	**1.65**	—	—
		BS04-2	423300	6098368	423313	6098393	6-Sep-21	11:09	11:15	Walk	7	1.1	30	231	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	1.30	—	—	—	—	—	—	—	—	—	—	**3**	**1.30**	3	0.01
		BS04-3	423323	6098427	423330	6098458	6-Sep-21	11:25	11:30	Walk	6	1.1	30	198	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**—**	**—**	9	0.05
		BS05-1	422451	6097903	422483	6097899	6-Sep-21	12:02	12:07	Walk	7	1.1	30	231	—	—	—	—	—	—	—	—	—	—	—	—	2	0.87	—	—	—	—	—	—	1	0.43	—	—	—	—	**3**	**1.30**	—	—
		BS05-2	422499	6097896	422529	6097886	6-Sep-21	12:19	12:22	Walk	8	1.1	30	264	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	12	4.55	—	—	—	—	**12**	**4.55**	—	—
		BS05-3	422560	6097887	422587	6097884	6-Sep-21	12:36	12:41	Walk	10	1.1	30	330	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7	2.12	—	—	—	—	**7**	**2.12**	—	—
												Totals	**180**	**1617**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**2**	**0.12**	**3**	**0.19**	**—**	**—**	**—**	**—**	**26**	**1.61**	**—**	**—**	**—**	**—**	**31**	**1.92**	**12**	**0.01**
	November	BS04-1	423328	6098457	423325	6098428	7-Nov-21	11:15	11:17	Walk	7	1.2	30	252	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**—**	**—**	—	—
		BS04-2	423314	6098386	423305	6098354	7-Nov-21	11:27	11:30	Walk	6	1.2	30	216	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	0.93	—	—	**2**	**0.93**	—	—
		BS04-3	423292	6098338	423271	6098320	7-Nov-21	11:43	11:47	Walk	9	1.0	30	270	—	—	—	—	—	—	—	—	—	—	—	—	1	0.37	—	—	—	—	—	—	—	—	—	—	—	—	**1**	**0.37**	—	—
		BS05-1	422590	6097880	422557	6097884	7-Nov-21	12:16	12:18	Walk	7	1.2	30	252	—	—	—	—	—	—	—	—	—	—	—	—	5	1.98	—	—	—	—	—	—	—	—	—	—	—	—	**5**	**1.98**	—	—
		BS05-2	422538	6097885	422525	6097885	7-Nov-21	12:36	12:38	Walk	5	1.2	30	180	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**—**	**—**	—	—
		BS05-3	422500	6097890	422469	6097889	7-Nov-21	12:41	12:43	Walk	5	1.2	30	180	—	—	—	—	—	—	—	—	—	—	—	—	1	0.56	—	—	—	—	—	—	—	—	—	—	—	—	**1**	**0.56**	—	—
		BSB05-1	422459	6097892	422445	6097898	6-Nov-21	13:42	13:48	Boat	22	4.5	25	2475	—	—	—	—	—	—	—	—	—	—	—	—	3	0.12	—	—	—	—	—	—	—	—	—	—	—	—	**3**	**0.12**	—	—
		BSB05-2	422484	6097898	422465	6097901	6-Nov-21	13:58	14:02	Boat	22	4.5	25	2475	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**—**	**—**	—	—
												Totals	**230**	**6300**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**10**	**0.16**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**2**	**0.03**	**—**	**—**	**12**	**0.19**	**—**	**—**
	March	BS04-1	423313	6098454	423307	6098423	4-Mar-22	10:26	10:31	Walk	10	1.0	30	300	—	—	—	—	—	—	—	—	—	—	1	0.33	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**1**	**0.33**	—	—
		BS04-2	423300	6098400	423282	6098365	4-Mar-22	10:38	10:41	Walk	10	1.0	30	300	—	—	—	—	—	—	—	—	—	—	1	0.33	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**1**	**0.33**	—	—
		BS04-3	423269	6098363	423243	6098346	4-Mar-22	10:47	10:50	Walk	8	1.0	30	240	—	—	—	—	—	—	—	—	—	—	4	1.67	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**4**	**1.67**	6	0.03
		BS05-1	422595	6097901	422555	6097892	4-Mar-22	11:26	11:29	Walk	6	1.1	30	198	—	—	—	—	—	—	—	—	—	—	1	0.51	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**1**	**0.51**	—	—
		BS05-2	422549	6097892	422516	6097896	4-Mar-22	11:34	11:35	Walk	5	1.1	30	165	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**—**	**—**	—	—
		BS05-3	422487	6097895	422456	6097900	4-Mar-22	11:41	11:43	Walk	4.5	1.1	30	149	—	—	—	—	—	—	—	—	—	—	1	0.67	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**1**	**0.67**	3	0.02
		BSB05-1	422537	6097895	422503	6097898	5-Mar-22	12:40	12:43	Boat	16	4.5	22	1584	—	—	—	—	—	—	—	—	—	—	—	—	1	0.06	—	—	—	—	—	—	—	—	—	—	—	—	**1**	**0.06**	—	—
		BSB05-2	422494	6097900	422460	6097909	5-Mar-22	12:58	13:02	Boat	16	4.5	22	1584	—	—	—	—	—	—	—	—	—	—	2	0.13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**2**	**0.13**	—	—
												Totals	**224**	**4520**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**10**	**0.22**	**1**	**0.02**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**11**	**0.24**	**9**	**<0.01**
												All Survey Months Totals	**784**	**18737**	**—**	**—**	**9**	**0.05**	**6**	**0.03**	**326**	**1.74**	**4**	**0.02**	**247**	**1.32**	**33**	**0.18**	**4**	**<0.01**	**1**	**0.01**	**1**	**0.01**	**26**	**0.14**	**2**	**0.01**	**—**	**—**	**659**	**3.52**	**23**	**<0.01**
All Sites All Survey Months Totals													**1708**	**40568**	**—**	**—**	**13**	**0.03**	**17**	**0.04**	**444**	**1.09**	**58**	**0.14**	**303**	**0.75**	**70**	**0.17**	**279**	**0.01**	**5**	**0.01**	**1**	**<0.01**	**29**	**0.07**	**2**	**<0.01**	**1**	**<0.01**	**1223**	**3.01**	**229**	**0.01**

NOTES: — Indicates a zero value

CPUE[a] Calculated as the number of fish caught per 100 m^3 seined

Appendix F.2 Catch Per Unit Effort for June 2021 Trawl Survey Results

Subarea	Trawl Set	UTM (NAD83, 9U)				Date	Start Time	End Time	Net Dimensions			Distance Trawled	Area Trawled	Pacific Herring (*Clupea pallasii*)		Pacific Sand Lance (*Ammodytes hexapterus*)		Salmonids (Family Salmonidae)		Unidentified Larval Fish (Class Teleostei)		Totals	
		Start		End					Height (m)	Width (m)	Length (m)			Catch	CPUE[a]	Catch	CPUE[a]	Catch	CPUE[a]	Catch	CPUE[a]	Catch	CPUE[a]
		Easting	Northing	Easting	Northing							(m)	(m^2)										
East Pearse Island	T-02	424976	6097882	425357	6097624	4-Jun-21	14:49	14:59	4.6	5	18	704	16192	—	—	—	—	8	0.05	—	—	8	<0.01
	T-03	424515	6097477	425185	6097581	4-Jun-21	16:36	16:49	4.6	5	18	682	15686	3	0.02	62	0.40	29	0.18	1	0.01	95	0.01
	T-05	424708	6098321	425305	6098303	5-Jun-21	13:35	13:43	4.6	5	18	594	13662	2	0.01	57	0.42	21	0.15	—	—	80	0.01
	T-06	424621	6097141	424618	6097985	6-Jun-21	14:26	14:39	4.6	5	18	844	19412	—	—	137	0.71	4	0.02	—	—	141	0.01
											Totals	**2824**	**64952**	**5**	**0.01**	**256**	**0.39**	**62**	0.10	**1**	**0.00**	324	<0.01
Whiskey Bay	T-09	424154	6098893	424180	6099348	6-Jun-21	12:07	12:20	4.6	5	18	453	10419	—	—	—	—	1	0.01	—	—	1	<0.01
											Totals	**453**	**10419**	**—**	**—**	**—**	**—**	**1**	0.01	**—**	**—**	1	<0.01
West Pearse Island	T-11	423184	6098488	422651	6098968	5-Jun-21	9:48	9:59	4.6	5	18	716	16468	—	—	—	—	—	—	—	—	—	—
											Totals	**716**	**16468**	**—**	**—**	**—**	**—**	**—**	—	**—**	**—**	—	—
											All Trawls Totals	**3993**	**91839**	**5**	**0.01**	**256**	**0.28**	**63**	**0.07**	**1**	**0.00**	**325**	**<0.01**

NOTES:
— Indicates a zero value
CPUE[a] Calculated as the number of fish caught per 100 m^3 seined

Appendix F.3 Number of Fish Caught by Location, Taxa Group and Survey Month

Subarea	Survey Month	Cod (*Gadus marcocephalus*)	Flatfish (Family Pleuronectidae)	Gunnel (Family Pholidae)	Pacific Herring (*Clupea pallasii*)	Pacific Sandfish (*Trichodon trichodon*)	Pacific Sand Lance (*Ammodytes hexapterus*)	Salmonids (Family Salmonidae)	Sculpin (Family Cottidae)	Shiner Perch (*Cymatogaster aggregata*)	Snailfish (Family Liparidae)	Snake Prickleback (*Lumpenus sagitta*)	Threespine Stickleback (*Gasterosteus aculeatus*)	Tubesnout (*Aulorhynchus flavidus*)	Unidentified Larval Fish (Class Teleostei)	Total Catch
East Pearse Island	June	1	—	2	5	—	281	92	9	1	—	—	—	—	1	**391**
	September	—	—	1	—	—	—	—	2	268	—	—	1	—	—	**272**
	November	—	—	—	—	—	29	—	—	—	—	—	—	—	—	**29**
	March	—	—	—	—	—	—	3	—	—	—	—	—	—	1	**4**
Whiskey Bay	June	—	9	1	5	1	—	69	—	—	—	—	2	—	—	**653**
	September	—	—	10	—	—	—	—	25	6	3	—	—	—	—	**31**
	November	—	—	—	118	—	—	—	—	—	—	—	—	—	—	**12**
	March	—	—	—	—	—	—	13	1	—	1	—	—	—	—	**11**
West Pearse Island	June	—	9	6	326	—	4	237	20	1	1	1	—	—	—	**20**
	September	—	—	—	—	—	—	—	2	3	—	—	26	—	—	**46**
	November	—	—	—	—	—	—	—	10	—	—	—	—	2	—	**118**
	March	—	—	—	—	—	—	10	1	—	—	—	—	—	—	**15**

NOTE: — indicates a zero value

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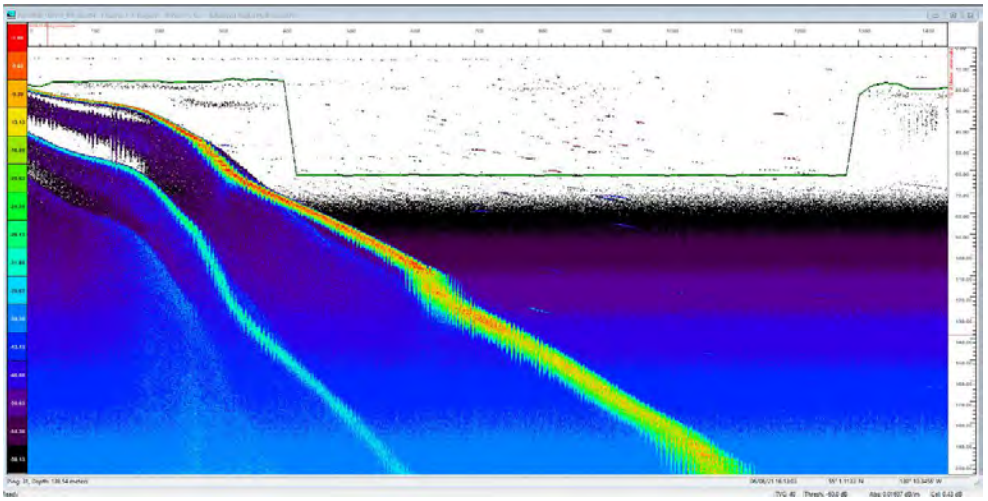
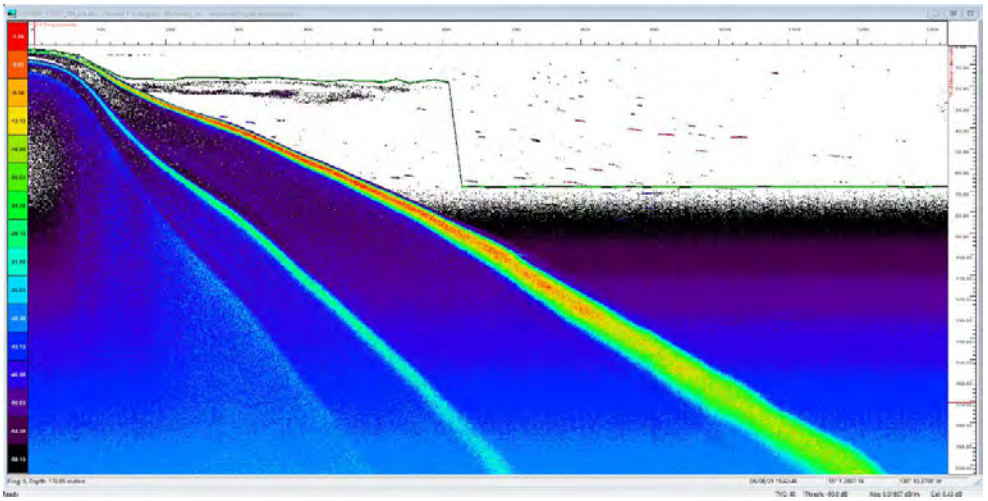
Appendix F.4 Length and Weight Measurements from Fish Captured in Beach Seines and Trawls During the Marine Fish Survey, 2021 to 2022

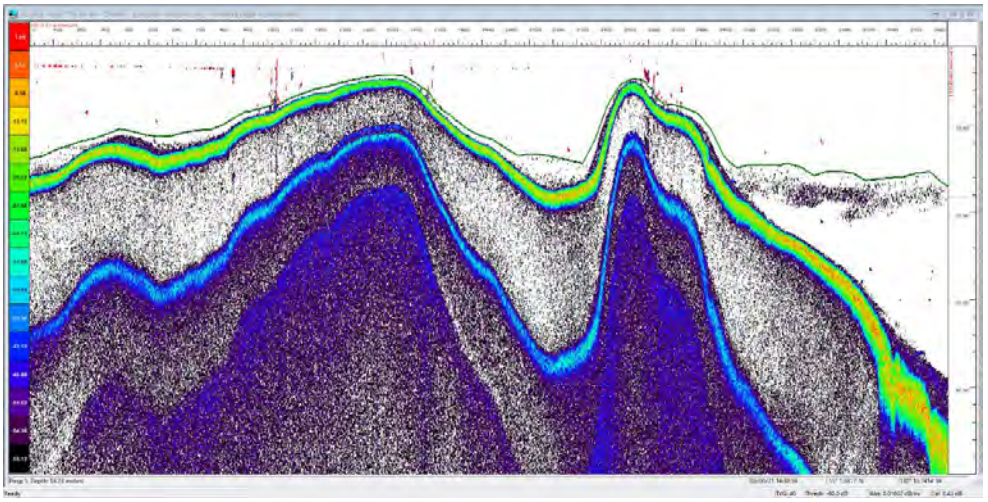
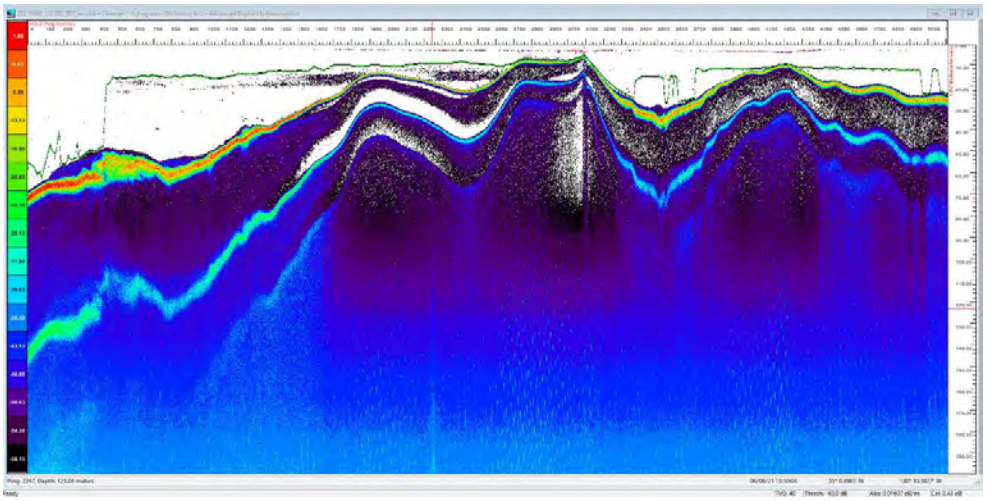
Survey Type	Species Common	Species Scientific	Min Length (mm)	Max Length (mm)	Mean Length (mm)	Median Length (mm)	Length STDEV (mm)	Length IQR (mm)	Min Weight (g)	Max Weight (g)	Mean Weight (g)	Median Weight (g)	Weight STDEV (g)	Weight IQR (mm)
Beach Seine	Buffalo Sculpin	*Enophrys bison*	36.0	196.0	73.3	59.0	39.7	29.0	1.0	210.0	20.7	3.0	53.4	6.5
	Chinook Salmon	*Oncorhynchus tshawytscha*	50.0	120.0	94.0	111.0	32.5	48.5	1.0	22.0	13.2	17.5	9.2	13.0
	Chum Salmon	*Oncorhynchus keta*	31.0	150.0	57.2	63.5	24.7	30.0	0.5	11.0	2.4	2.0	2.1	2.0
	Coho Salmon	*Oncorhynchus kisutch*	42.0	132.0	102.6	103.0	17.7	18.5	1.0	24.0	11.5	11.0	5.0	5.0
	Crescent Gunnel	*Pholis laeta*	63.0	170.0	116.3	109.0	33.2	47.0	2.0	19.0	7.0	7.0	4.9	5.0
	Dolly Varden	*Salvelinus malma*	100.0	298.0	134.4	123.0	36.7	28.5	10.0	100.0	25.5	17.0	18.6	13.5
	English Sole	*Parophrys vetulus*	97.0	97.0	97.0	97.0	—	—	9.0	9.0	9.0	9.0	—	—
	Great Sculpin	*Myoxocephalus polyacanthocephalus*	204.0	204.0	204.0	204.0	—	—	142.0	142.0	142.0	142.0	—	—
	Larval Cod	*Gadus marcocephalus*	25.0	25.0	25.0	25.0	—	—	0.5	0.5	0.5	0.5	—	—
	Northern Rock Sole	*Lepidopsetta polyxystra*	135.0	135.0	135.0	135.0	—	—	33.0	33.0	33.0	33.0	—	—
	Pacific Herring	*Clupea pallasii*	64.0	135.0	98.8	105.0	19.8	35.5	3.0	18.0	6.4	5.0	3.9	7.0
	Pacific Sand Lance	*Ammodytes hexapterus*	58.0	87.0	77.8	83.0	10.2	13.5	1.5	2.0	1.9	2.0	—	—
	Penpoint Gunnel	*Apodichthys flavidus*	64.0	250.0	132.7	84.0	102.1	93.0	1.0	67.0	23.3	2.0	37.8	33.0
	Pink Salmon	*Oncorhynchus gorbuscha*	30.0	73.0	46.7	45.0	14.6	25.8	0.3	5.0	1.5	1.0	1.2	1.1
	Saddleback Gunnel	*Pholis ornata*	68.0	82.0	73.3	71.5	6.7	8.8	0.5	6.0	3.1	3.0	2.1	1.3
	Sculpin Spp.	Family Cottidae	5.0	190.0	48.0	42.0	31.9	16.0	0.5	94.0	5.8	1.5	16.0	2.0
	Shiner Perch	*Cymatogaster aggregata*	43.0	148.0	82.2	68.0	29.8	49.5	1.0	55.0	78.2	67.0	15.4	21.5
	Snailfish	Family Liparidae	16.0	67.0	50.8	57.0	20.1	8.0	0.5	4.0	2.5	3.0	1.5	1.5
	Snake Prickleback	*Lumpenus sagitta*	202.0	202.0	202.0	202.0	—	—	20.0	20.0	20.0	20.0	—	—
	Sockeye Salmon	*Oncorhynchus nerka*	48.0	150.0	76.5	64.5	37.0	12.3	1.5	5.0	3.8	4.0	1.0	—
	Staghorn Sculpin	*Leptocottus armatus*	46.0	171.0	111.5	114.0	32.9	35.0	2.0	59.0	23.3	22.5	15.5	21.3
	Starry Flounder	*Platichthys stellatus*	54.0	296.0	106.6	86.0	66.0	31.0	2.0	315.0	39.0	9.0	91.9	16.7
	Threespine Stickleback	*Gasterosteus aculeatus*	15.0	60.0	26.3	24.0	10.2	10.0	0.5	3.0	1.3	1.5	0.6	—
	Tubesnout	*Aulorhynchus flavidus*	71.0	100.0	85.5	85.5	20.5	14.5	1.0	1.0	1.0	1.0	—	—
	UnID Salmon	*Oncorhynchus* spp.	60.0	60.0	60.0	60.0	—	—	1.0	1.0	1.0	1.0	—	—
Trawl	Chinook Salmon	*Oncorhynchus tshawytscha*	122.0	122.0	122.0	122.0	—	—	19.0	19.0	19.0	19.0	—	—
	Chum Salmon	*Oncorhynchus keta*	80.0	126.0	108.3	119.0	18.2	33.0	5.0	17.0	11.6	14.0	4.9	10.0
	Coho Salmon	*Oncorhynchus kisutch*	60.0	141.0	104.4	103.0	24.3	15.0	11.0	31.0	16.0	12.0	7.4	4.0
	Dolly Varden	*Salvelinus malma*	142.0	142.0	142.0	142.0	—	—	28.0	28.0	28.0	28.0	—	—
	Pacific Herring	*Clupea pallasi*	85.0	182.0	133.1	130.5	32.8	46.8	5.0	78.0	30.2	19.5	25.8	42.3
	Pacific Sand Lance	*Ammodytes hexapterus*	52.0	74.0	64.1	63.5	4.8	5.8	1.5	1.5	1.5	1.5	—	—
	Pacific Sandfish	*Trichodon trichodon*	155.0	155.0	155.0	155.0	—	—	38.0	38.0	38.0	38.0	—	—
	Pink Salmon	*Oncorhynchus gorbuscha*	47.0	75.0	61.8	60.5	7.2	7.0	1.0	4.0	2.0	2.0	0.8	0.5
	Sockeye Salmon	*Oncorhynchus nerka*	95.0	102.0	98.5	98.5	4.9	3.5	8.0	10.0	9.0	9.0	1.4	1.0
	UnID Larval Fish	Class Teleostei	-	-	-	-	-	-	-	-	-	-	-	-
	UnID Salmon	*Oncorhynchus* spp.	65.0	110.0	83.2	82.0	10.6	12.0	2.0	12.0	5.2	5.0	2.6	3.0

NOTE: — Indicates a zero value

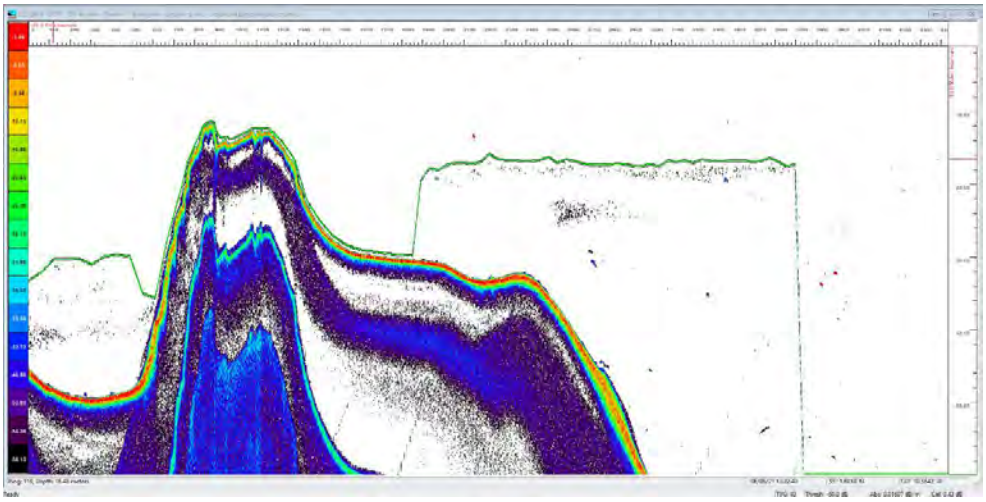
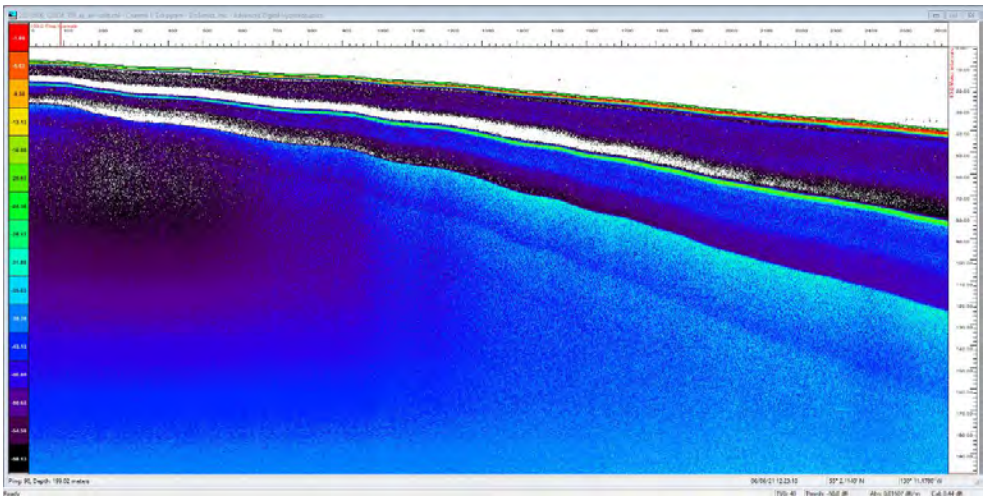
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island**		

Photograph ID: 1 **Photo Location:** East Pearse Island **Survey Date:** 06 Jun 2021 **Comments:** Transect T03 with bottom line in green. Bottom line modified to exclude acoustic noise disturbances including side lobe interference, background noise and potential zooplankton aggregations.	
Photograph ID: 2 **Photo Location:** East Pearse Island **Survey Date:** 06 Jun 2021 **Comments:** Transect T04 with bottom line in green. Bottom line modified to exclude acoustic noise disturbances including side lobe interference, background noise and potential zooplankton aggregations.	

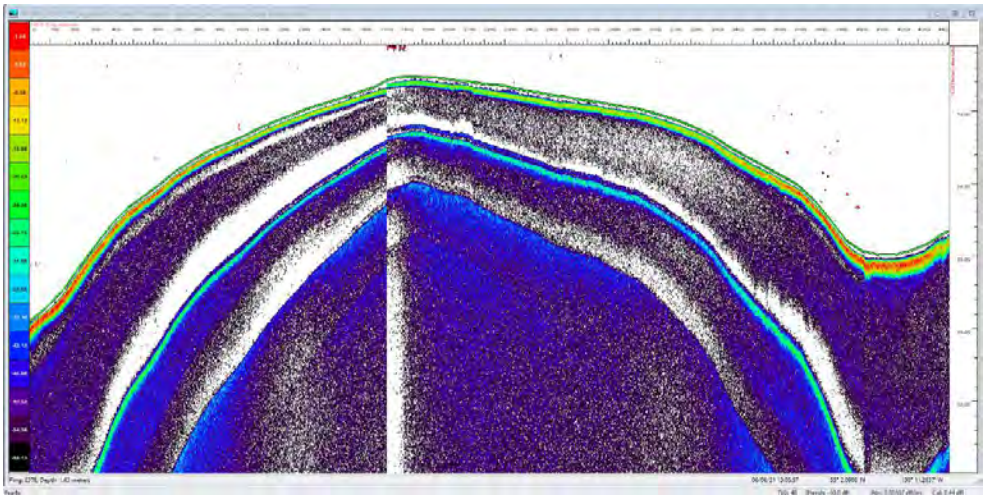
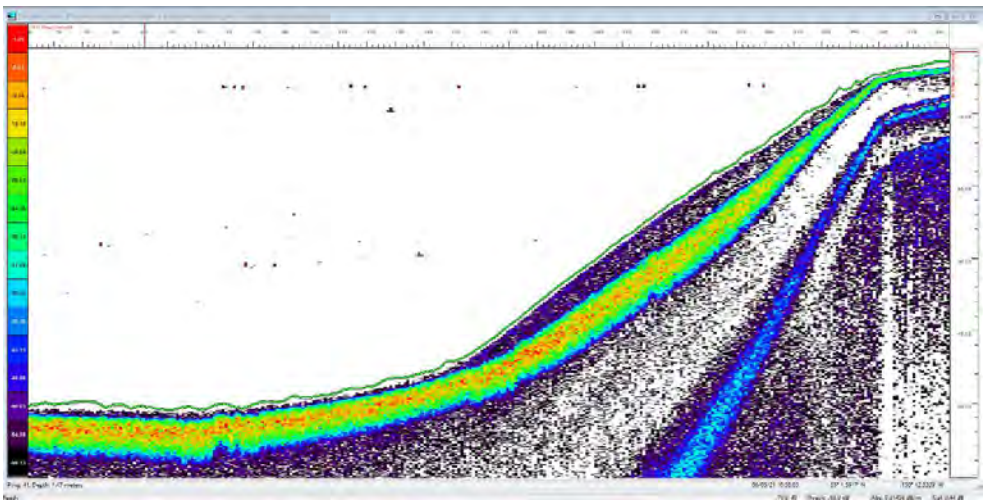
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island**		

Photograph ID: 3 **Photo Location:** East Pearse Island **Survey Date:** 06 Jun 2021 **Comments:** Transect T06 with bottom line in green. Bottom line modified to exclude acoustic noise disturbances including side lobe interference and potential zooplankton aggregations.	
Photograph ID: 4 **Photo Location:** East Pearse Island **Survey Date:** 06 Jun 2021 **Comments:** Transect T07 with bottom line in green. Bottom line modified to exclude acoustic noise disturbances including side lobe interference and potential zooplankton aggregations.	

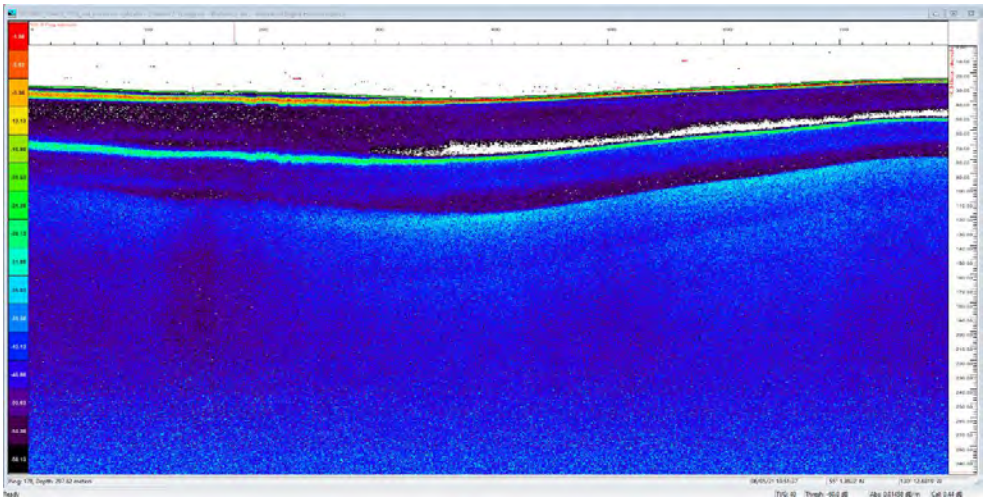
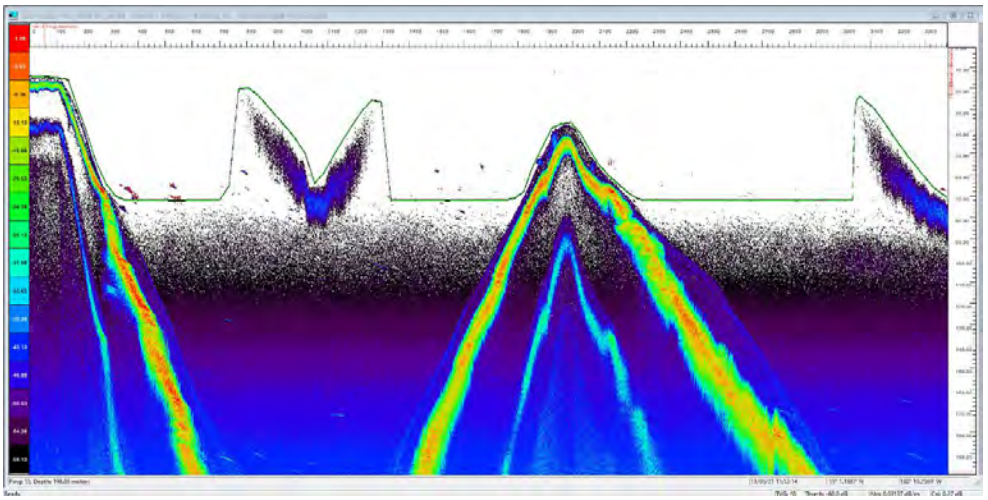
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island**		

Photograph ID: 5 **Photo Location:** East Pearse Island **Survey Date:** 06 Jun 2021 **Comments:** Transect T08 with bottom line in green. Bottom line modified to exclude acoustic noise disturbances including side lobe interference and potential zooplankton aggregations.	
Photograph ID: 6 **Photo Location:** Whiskey Bay **Survey Date:** 06 Jun 2021 **Comments:** Transect T09 with bottom line in green.	

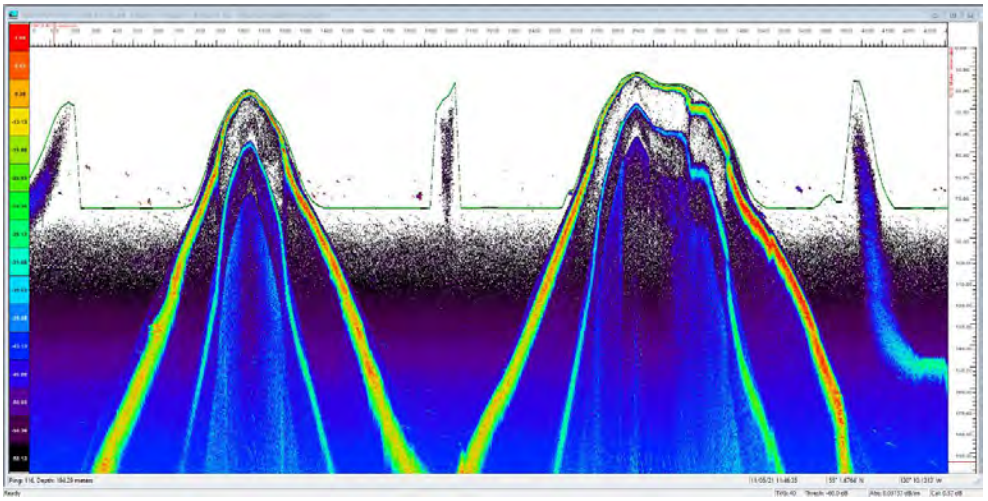
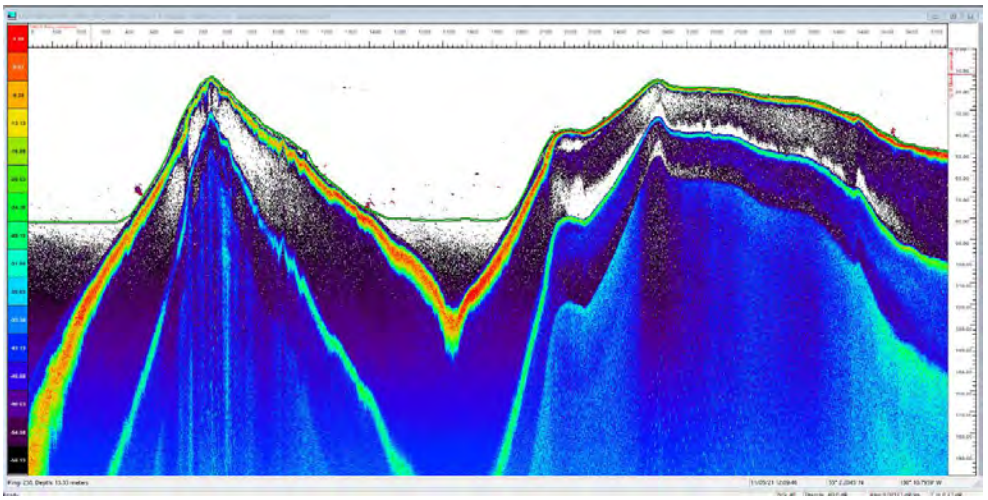
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island**		

Photograph ID: 7 **Photo Location:** Whiskey Bay **Survey Date:** 06 Jun 2021 **Comments:** Transect T10 with bottom line in green. Bottom line modified to exclude potential aquatic vegetation.	
Photograph ID: 8 **Photo Location:** West Pearse Island **Survey Date:** 05 Jun 2021 **Comments:** Transect T12a with bottom line in green. Bottom line modified to exclude side lobe interference and bottom features.	

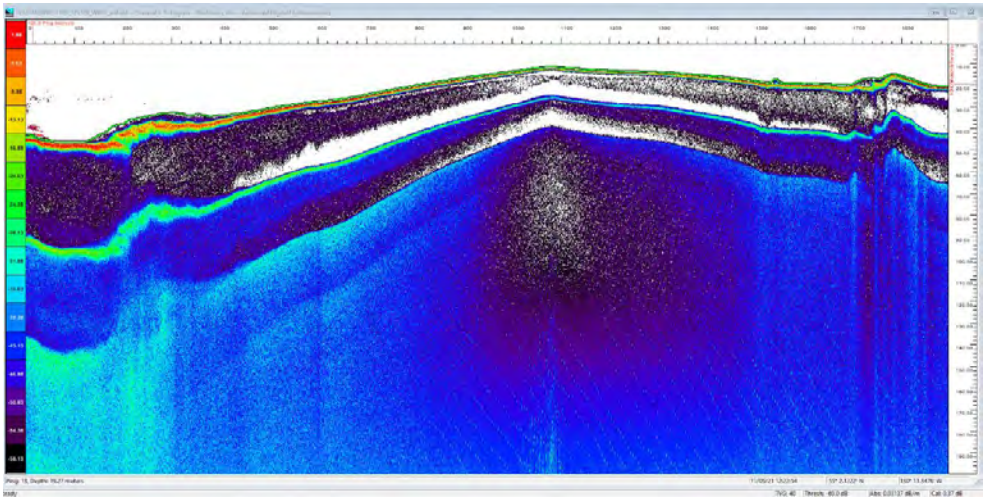
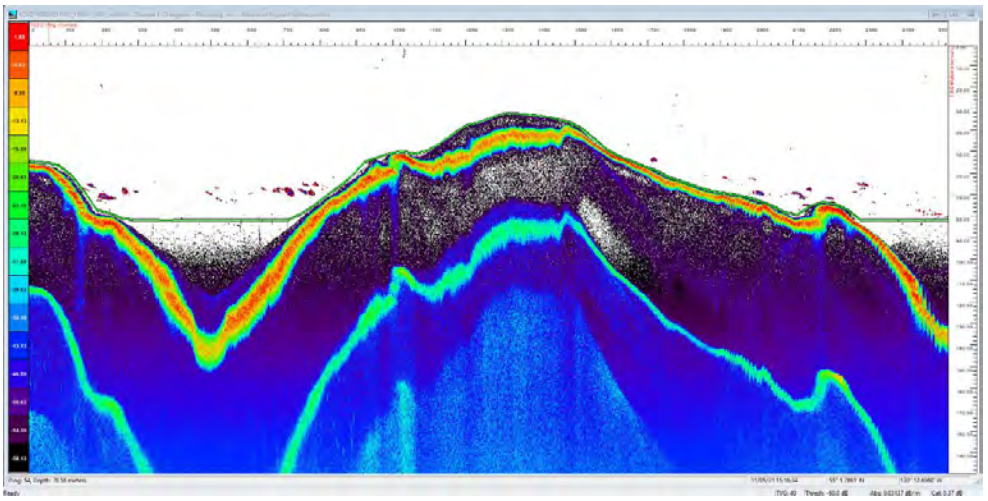
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island**		

Photograph ID: 9 **Photo Location:** West Pearse Island **Survey Date:** 05 Jun 2021 **Comments:** Transect T12b with bottom line in green. Bottom line modified to exclude side lobe interference.	
Photograph ID: 10 **Photo Location:** East Pearse Island **Survey Date:** 05 Nov 2021 **Comments:** Transect E01 with bottom line in green. Bottom line modified to exclude acoustic noise disturbances including side lobe interference, background noise and false botttoms.	

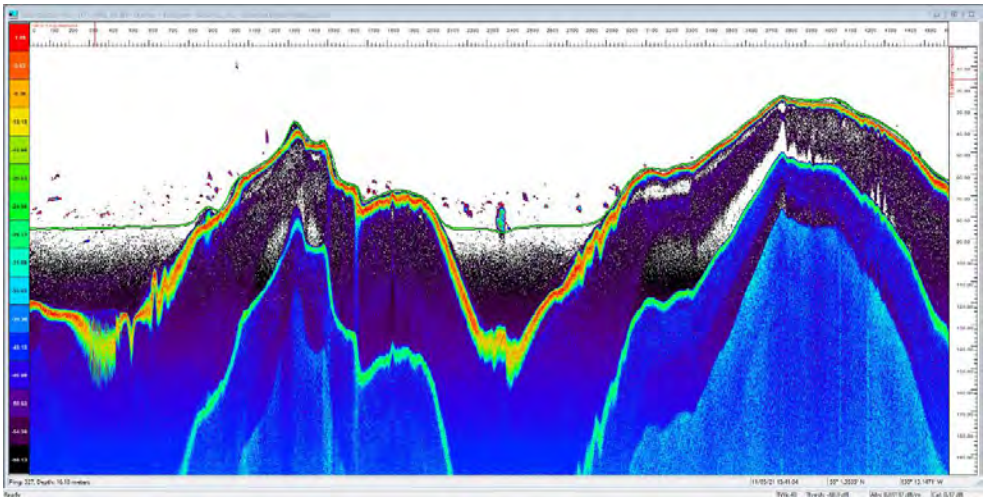
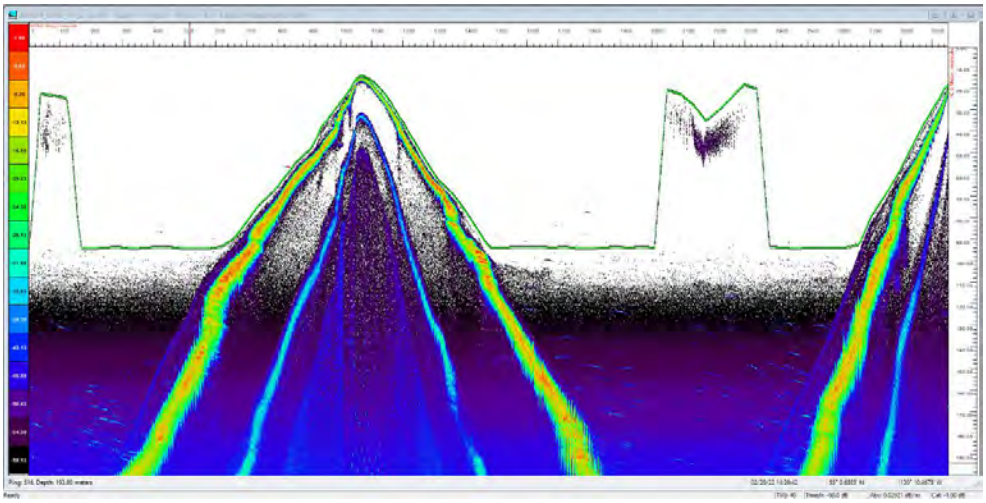
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island**		

Photograph ID: 11 **Photo Location:** East Pearse Island **Survey Date:** 05 Nov 2021 **Comments:** Transect E02 with bottom line in green. Bottom line modified to exclude acoustic noise disturbances including side lobe interference, background noise and false bottoms.	
Photograph ID: 12 **Photo Location:** East Pearse Island **Survey Date:** 05 Nov 2021 **Comments:** Transect E03 with bottom line in green. Bottom line modified to exclude acoustic noise disturbances including side lobe interference and background noise.	

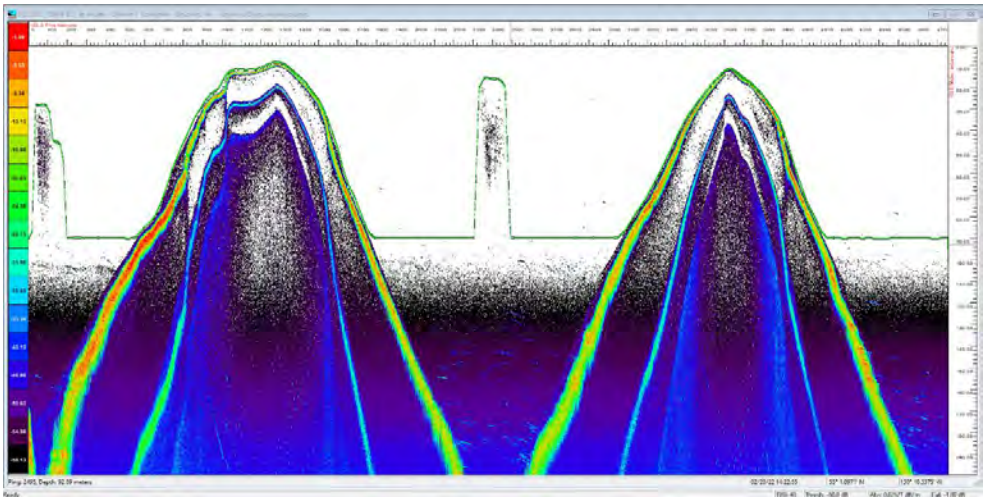
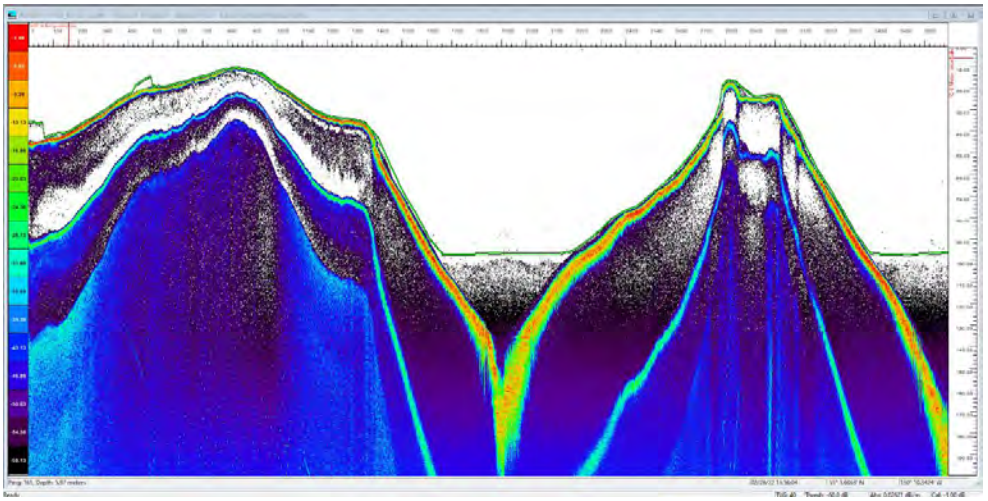
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island**		

Photograph ID: 13 **Photo Location:** Whiskey Bay **Survey Date:** 05 Nov 2021 **Comments:** Transect WB01 with bottom line in green. Bottom line modified to exclude side lobe interference and bottom features.	
Photograph ID: 14 **Photo Location:** West Pearse Island **Survey Date:** 05 Nov 2021 **Comments:** Transect W01 with bottom line in green. Bottom line modified to exclude acoustic noise disturbances including side lobe interference and background noise.	

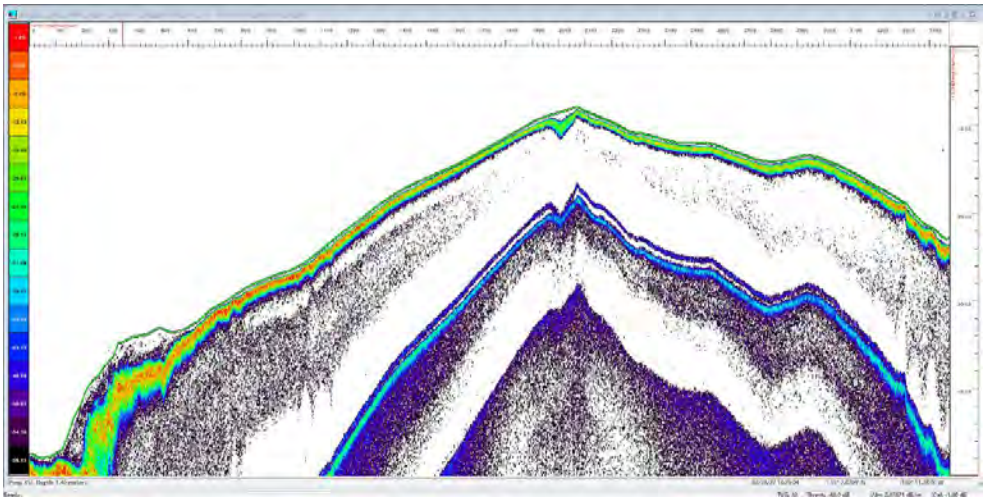
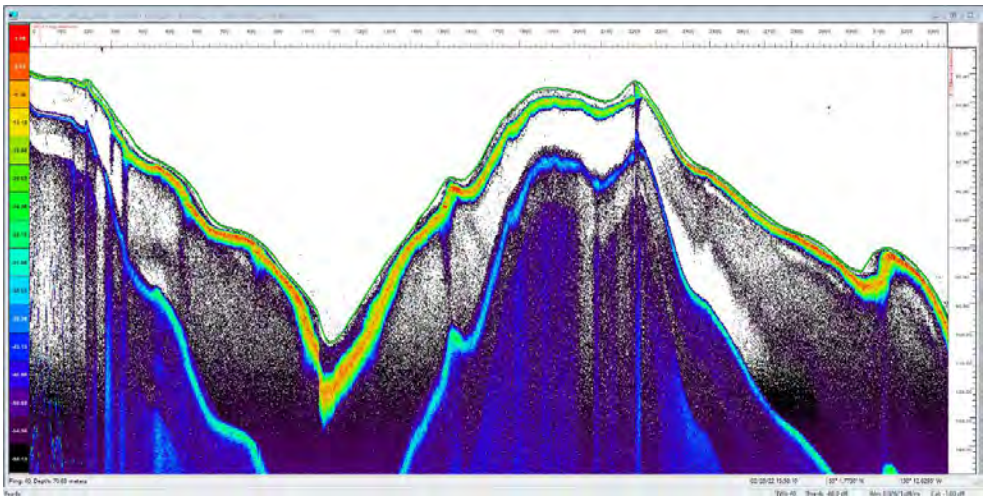
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island**		

Photograph ID: 15 **Photo Location:** West Pearse Island **Survey Date:** 05 Nov 2021 **Comments:** Transect W02 with bottom line in green. Bottom line modified to exclude acoustic noise disturbances including side lobe interference and background noise.	
Photograph ID: 16 **Photo Location:** East Pearse Island **Survey Date:** 28 Feb 2022 **Comments:** Transect E01 with bottom line in green. Bottom line modified to exclude acoustic noise disturbances including side lobe interference, background noise and false bottoms.	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island**		

Photograph ID: 17 **Photo Location:** East Pearse Island **Survey Date:** 28 Feb 2022 **Comments:** Transect E02 with bottom line in green. Bottom line modified to exclude acoustic noise disturbances including side lobe interference, background noise and false bottoms.	
Photograph ID: 18 **Photo Location:** East Pearse Island **Survey Date:** 28 Feb 2022 **Comments:** Transect E03 with bottom line in green. Bottom line modified to exclude acoustic noise disturbances including side lobe interference, background noise and potential zooplankton aggregations.	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island**		

Photograph ID: 19 **Photo Location:** Whiskey Bay **Survey Date:** 28 Feb 2022 **Comments:** Transect WB01 with bottom line in green. Bottom line modified to exclude side lobe interference.	
Photograph ID: 20 **Photo Location:** West Pearse Island **Survey Date:** 28 Feb 2022 **Comments:** Transect W01 with bottom line in green. Bottom line modified to exclude side lobe interference.	

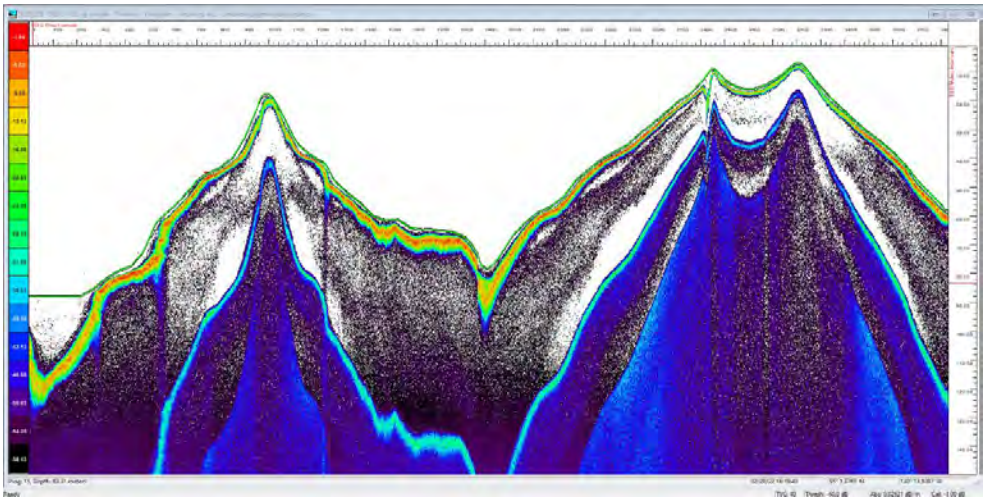
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island**		

Photograph ID: 21

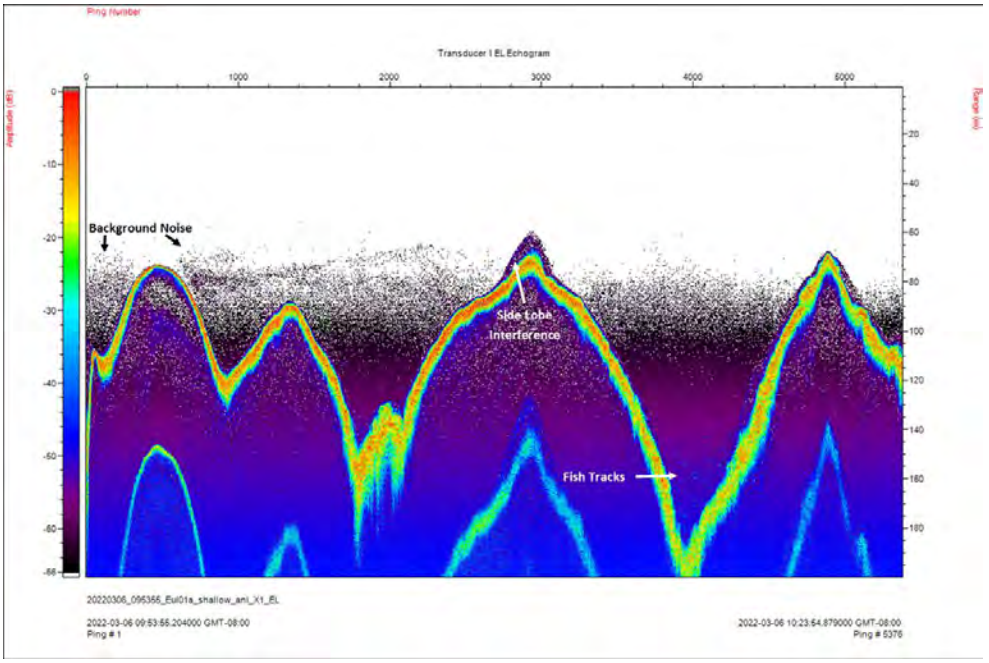
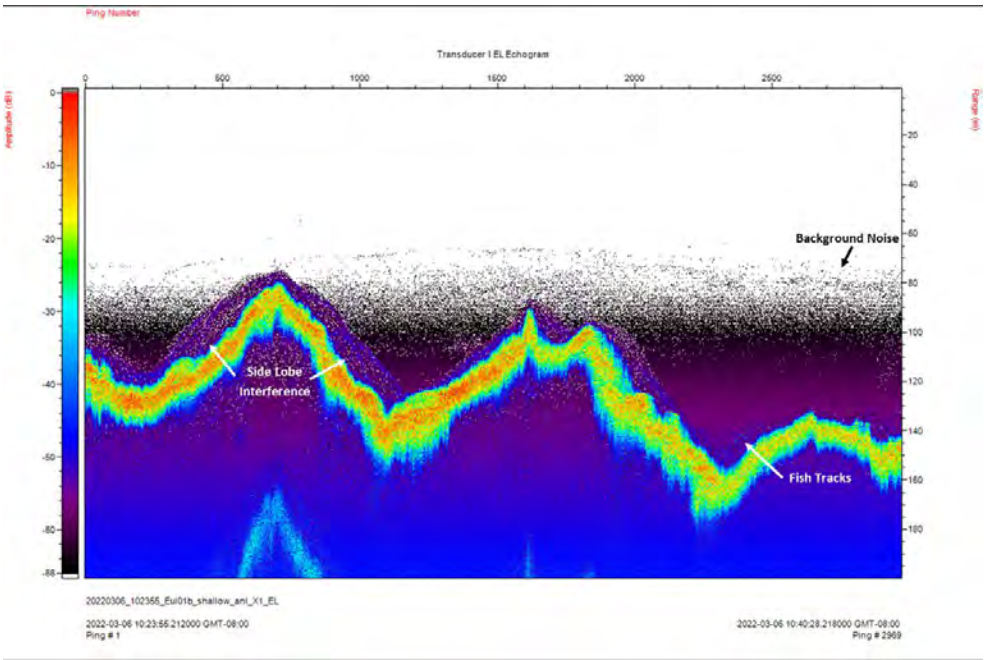
Photo Location:
West Pearse Island

Survey Date:
28 Feb 2022

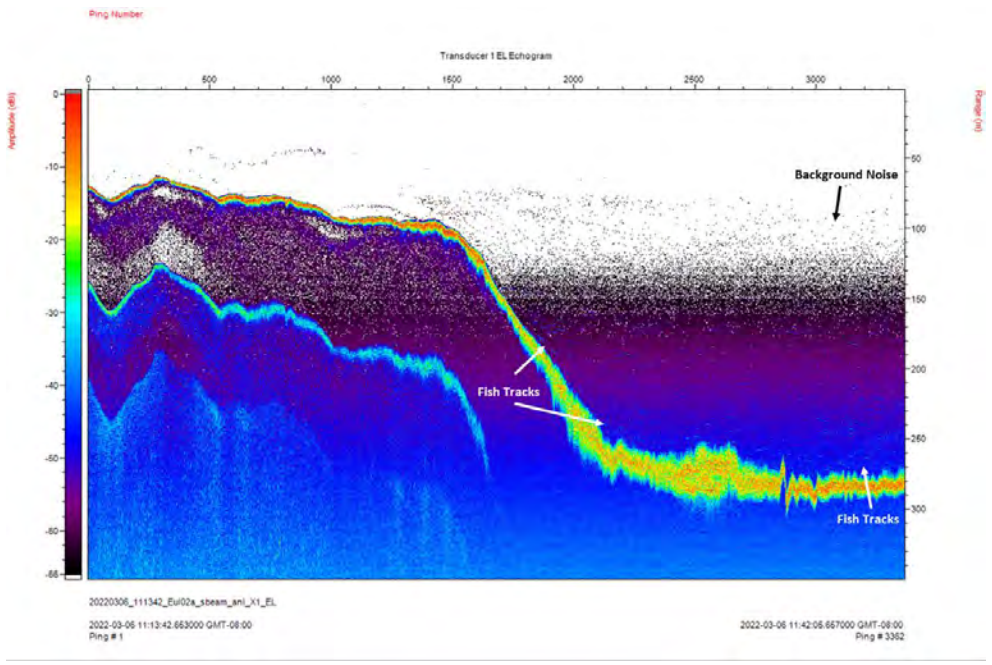
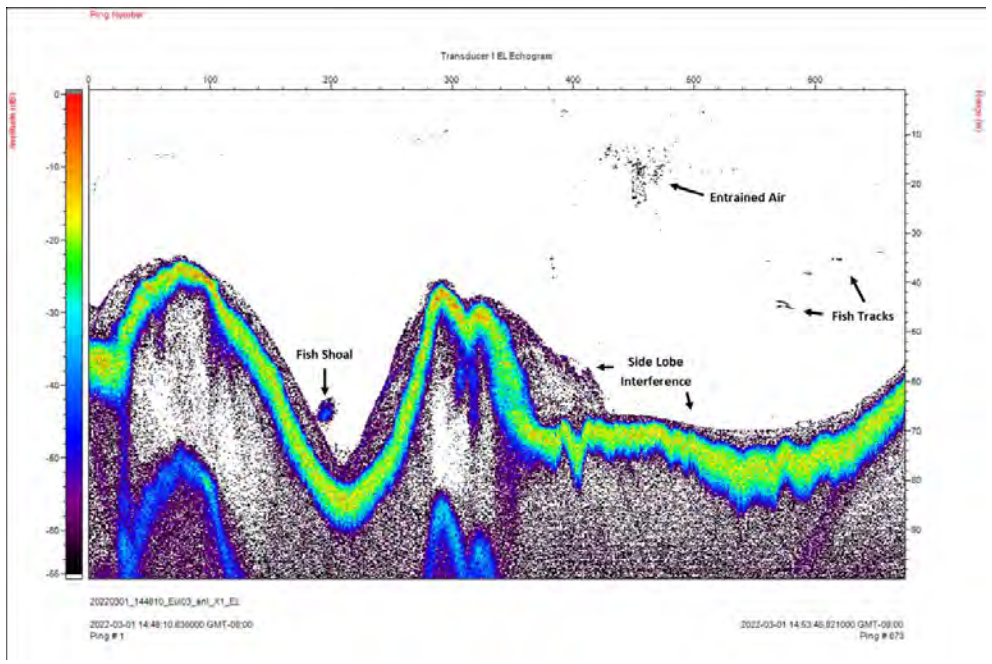
Comments:
Transect W02 with bottom line in green. Bottom line modified to exclude acoustic noise disturbances including side lobe interference, background noise and potential zooplankton aggregations.



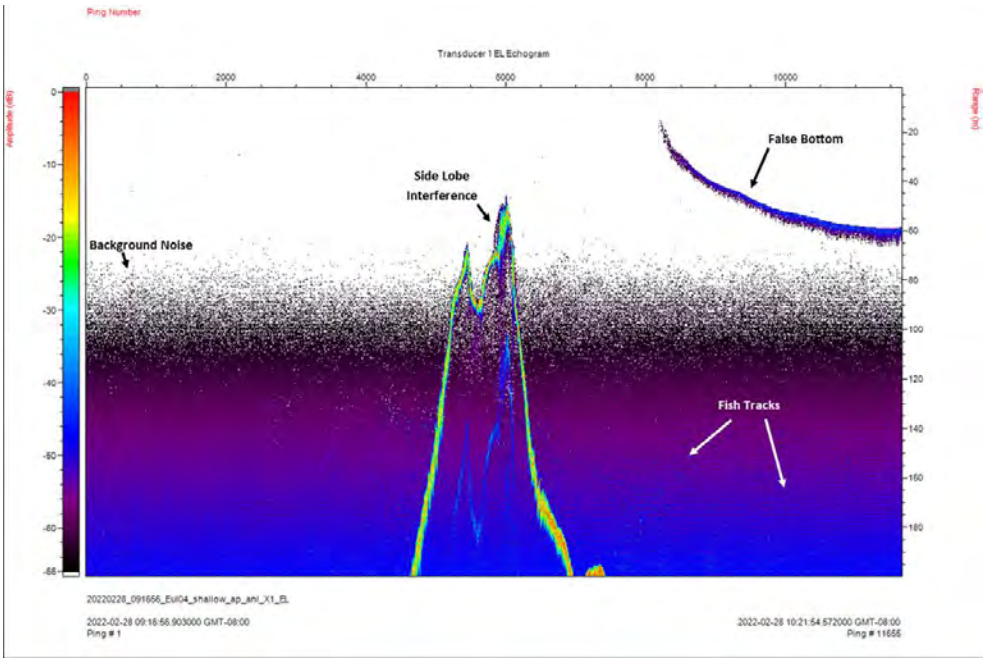
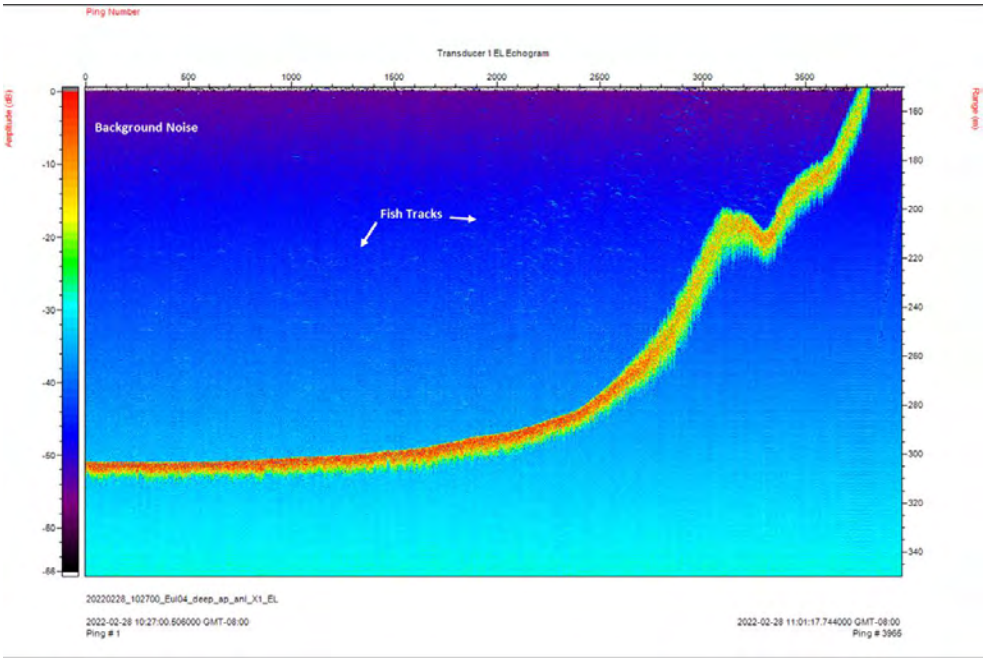
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 1 **Photo Location:** East Pearse Island **Survey Date:** 06 Mar 2022 **Comments:** Transect Eul01a_pelagic. Fish tracks, side lobe intereference and background noise indicated.	
Photograph ID: 2 **Photo Location:** East Pearse Island **Survey Date:** 06 Mar 2022 **Comments:** Transect Eul01b_pelagic. Fish tracks, side lobe interference and background noise indicated.	

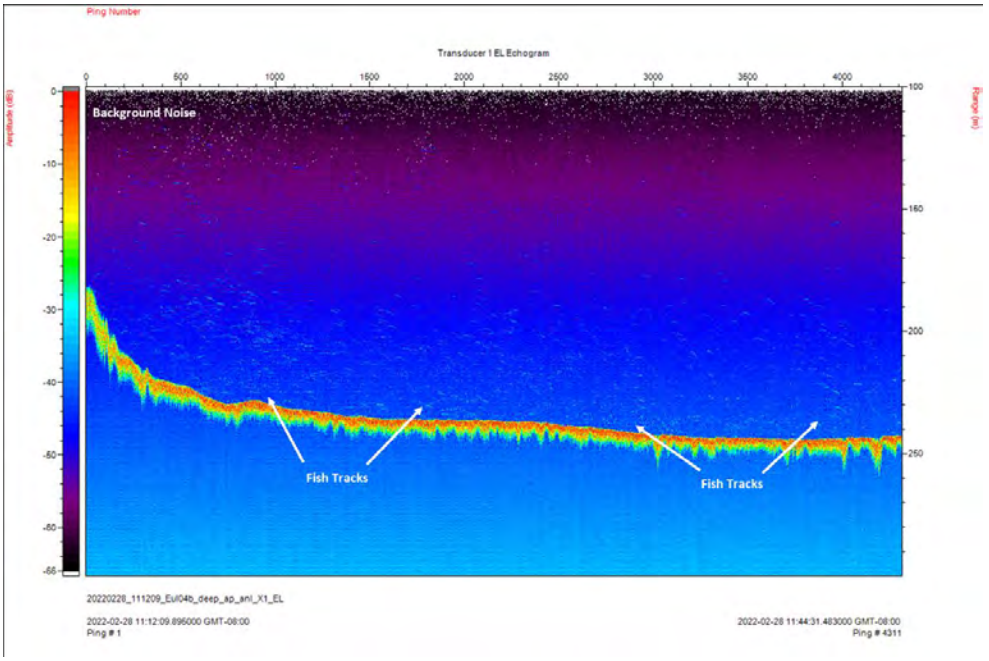
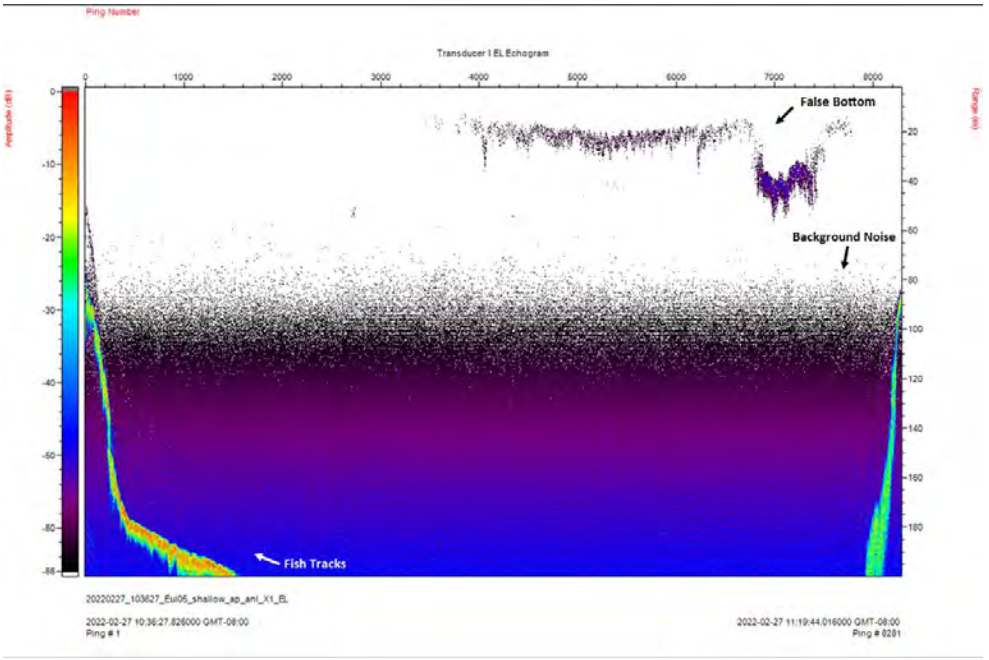
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 3 **Photo Location:** East Pearse Island **Survey Date:** 06 Mar 2022 **Comments:** Transect Eul02. Fish tracks and background noise indicated.	
Photograph ID: 4 **Photo Location:** Ramsey Point **Survey Date:** 01 Mar 2022 **Comments:** Transect Eul03. Fish tracks, fish shoal, entrained air and side lobe interference indicated.	

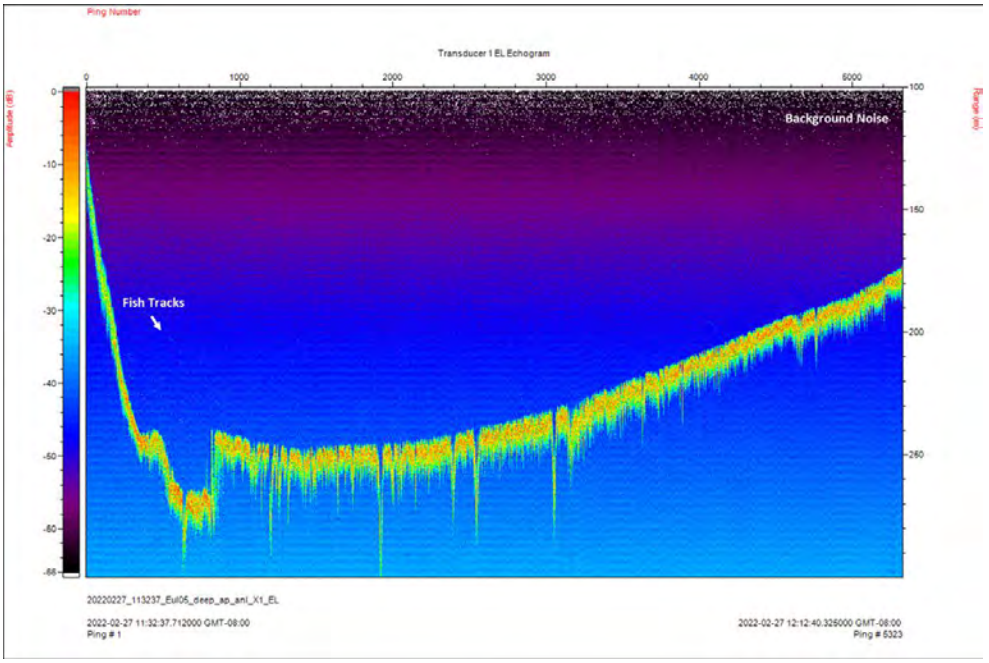
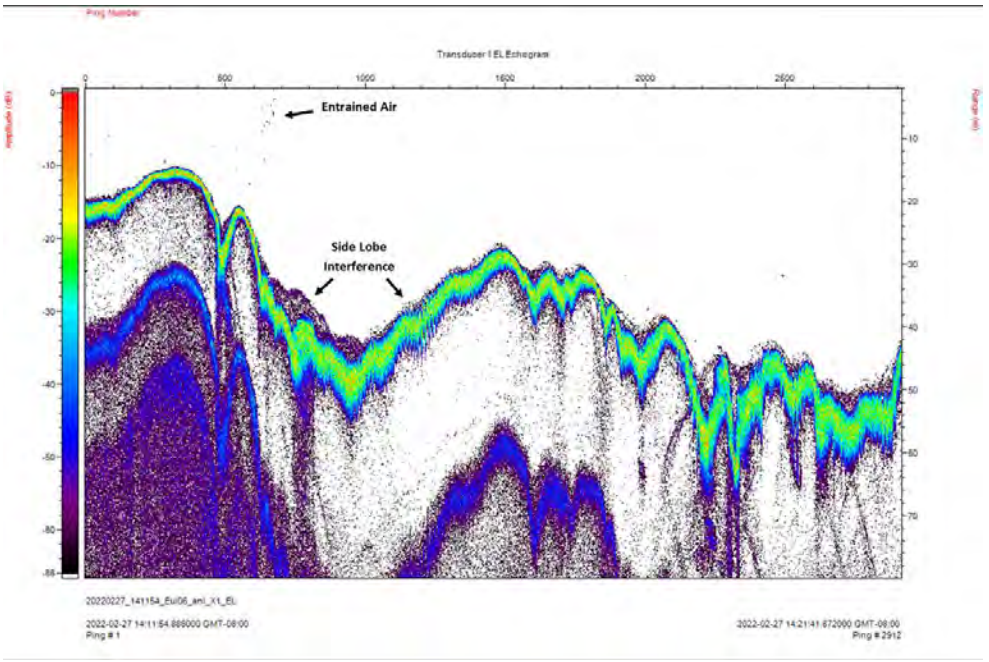
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 5 **Photo Location:** Ramsey Point **Survey Date:** 28 Feb 2022 **Comments:** Transect Eul04_pelagic. Fish tracks, side lobe interference, false bottom and background noise indicated.	
Photograph ID: 6 **Photo Location:** Ramsey Point **Survey Date:** 28 Feb 2022 **Comments:** Transect Eul04a_demersal. Fish tracks and background noise indicated.	

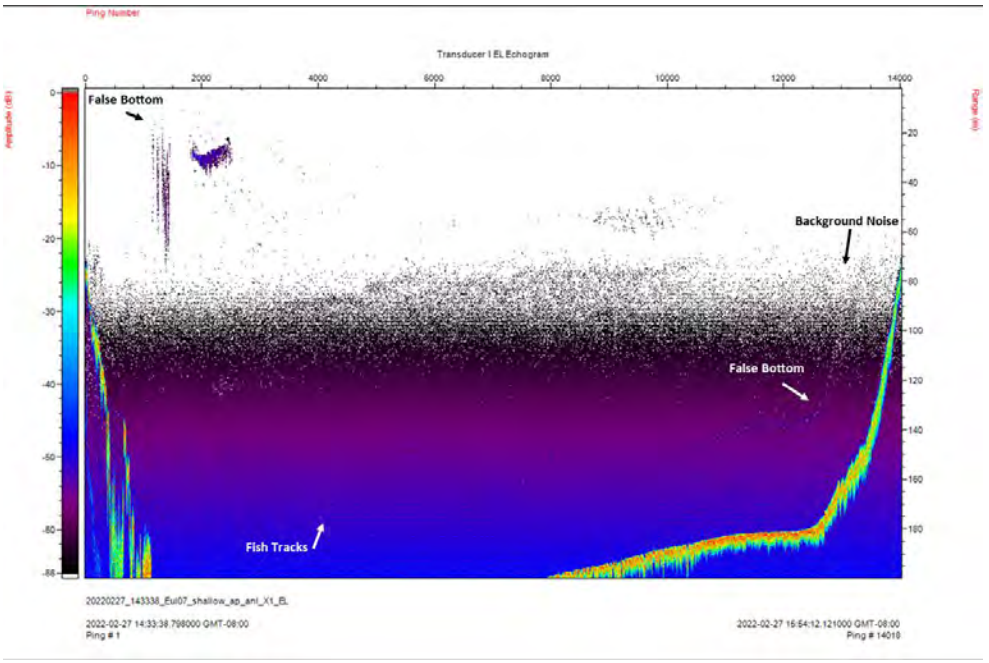
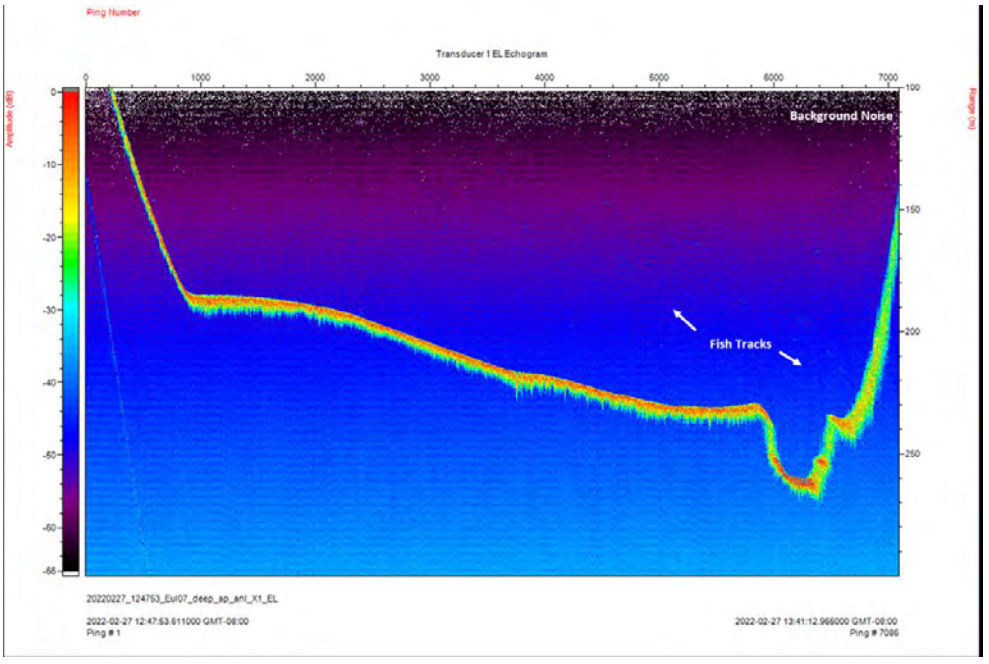
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 7 **Photo Location:** Ramsey Point **Survey Date:** 28 Feb 2022 **Comments:** Transect Eul04b_demersal. Fish tracks and background noise indicated.	
Photograph ID: 8 **Photo Location:** Ramsey Point **Survey Date:** 27 Feb 2022 **Comments:** Transect Eul05_pelagic. Fish tracks, false bottom and background noise indicated.	

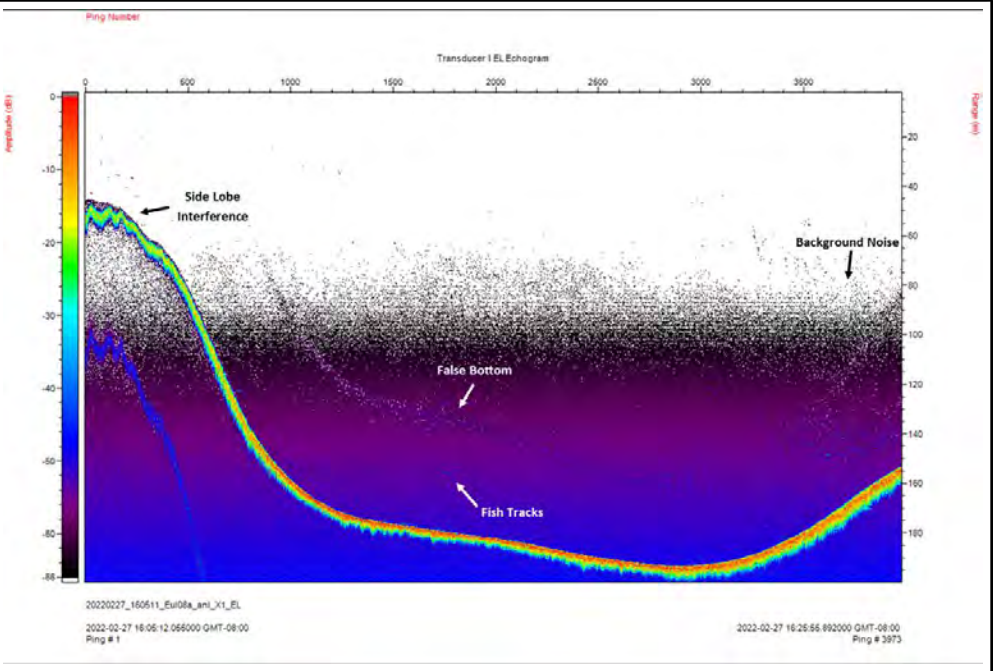
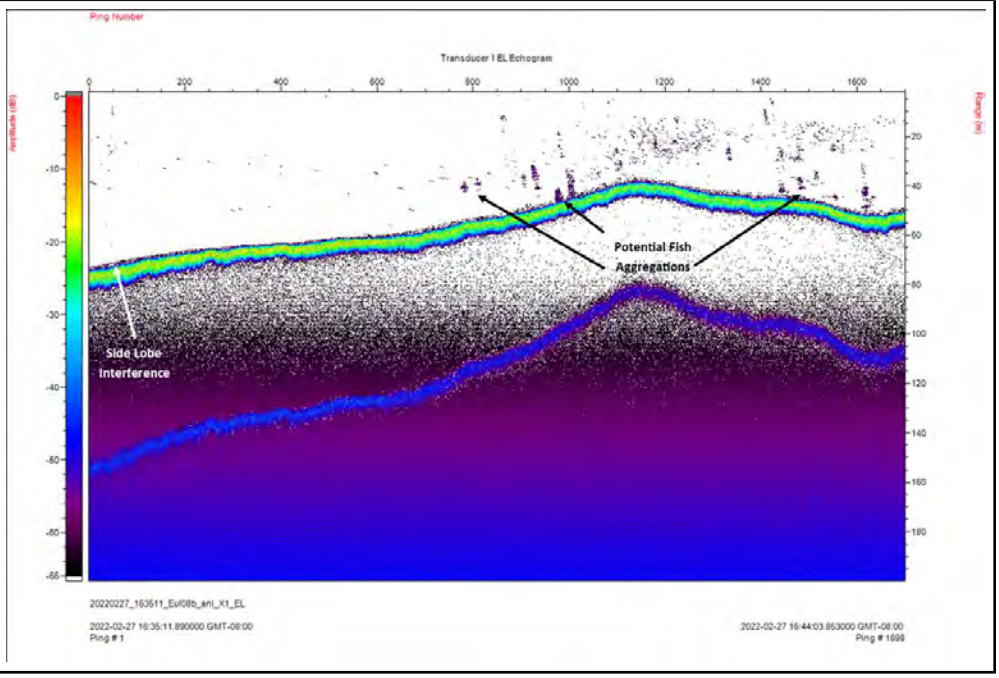
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 9 **Photo Location:** Nass Bay **Survey Date:** 27 Feb 2022 **Comments:** Transect Eul05_demersal. Fish tracks and background noise indicated.	
Photograph ID: 10 **Photo Location:** Nass Bay **Survey Date:** 27 Feb 2022 **Comments:** Transect Eul06. Entrained air and side lobe interference indicated.	

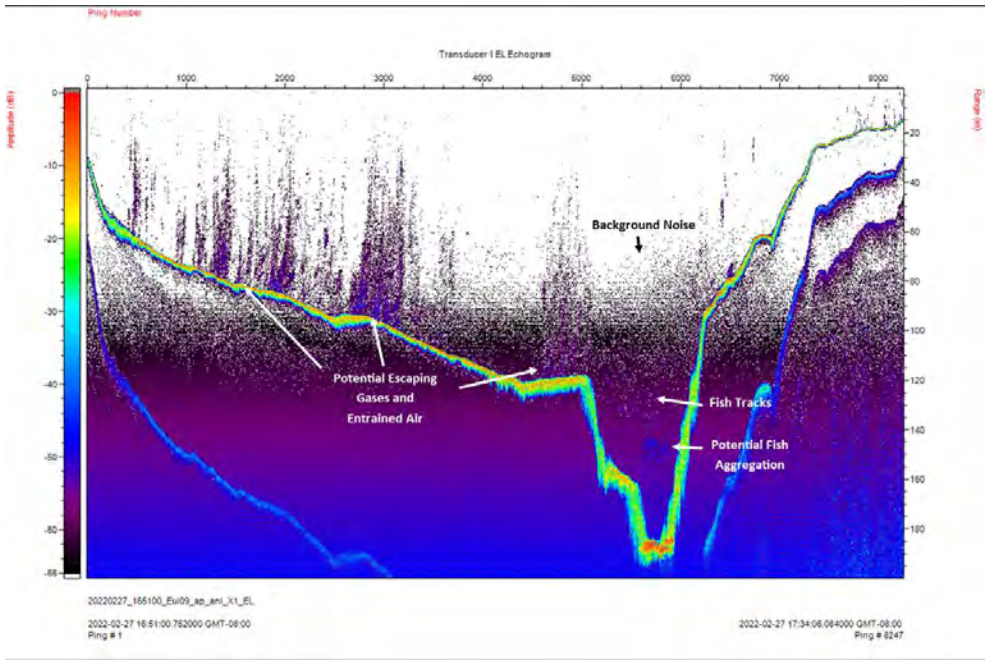
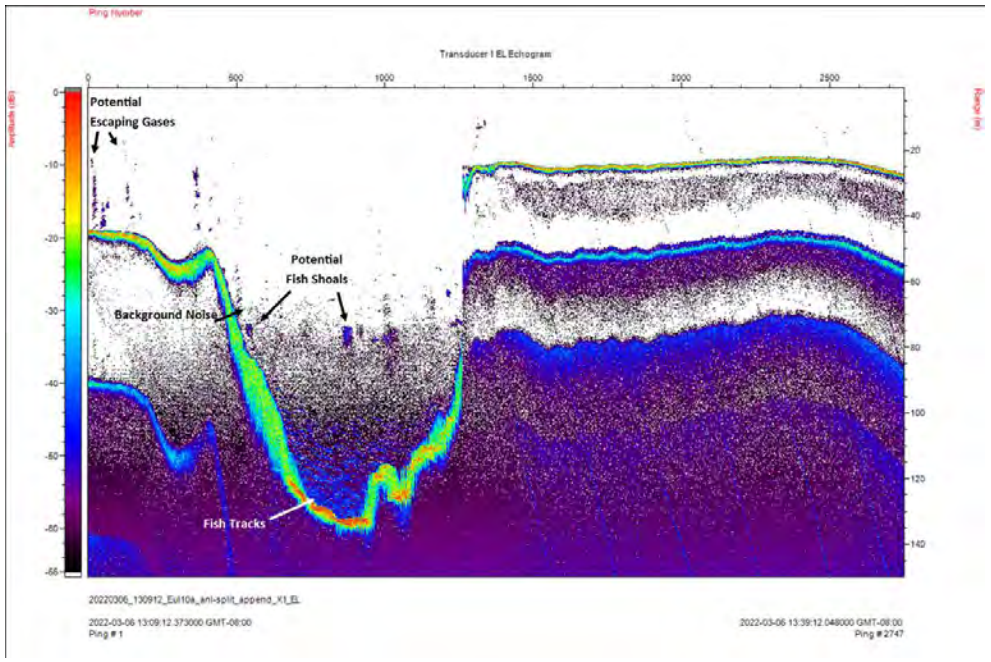
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 11 **Photo Location:** Nass Bay **Survey Date:** 27 Feb 2022 **Comments:** Transect Eul07_pelagic. Fish tracks, false bottoms and background noise indicated.	
Photograph ID: 12 **Photo Location:** Nass Bay **Survey Date:** 27 Feb 2022 **Comments:** Transect Eul07_demersal. Fish tracks and background noise indicated.	

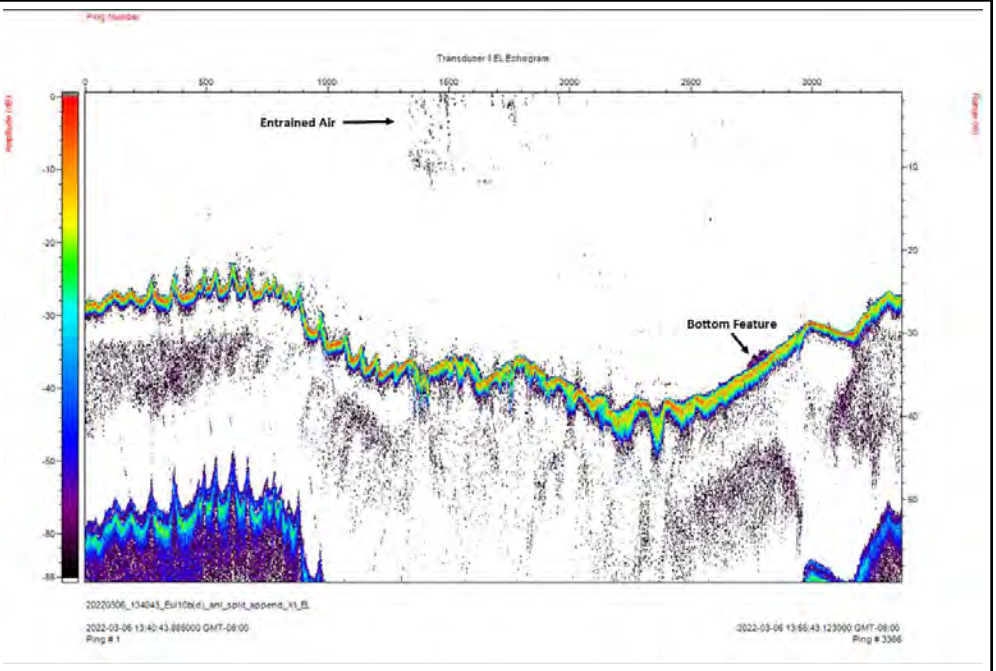
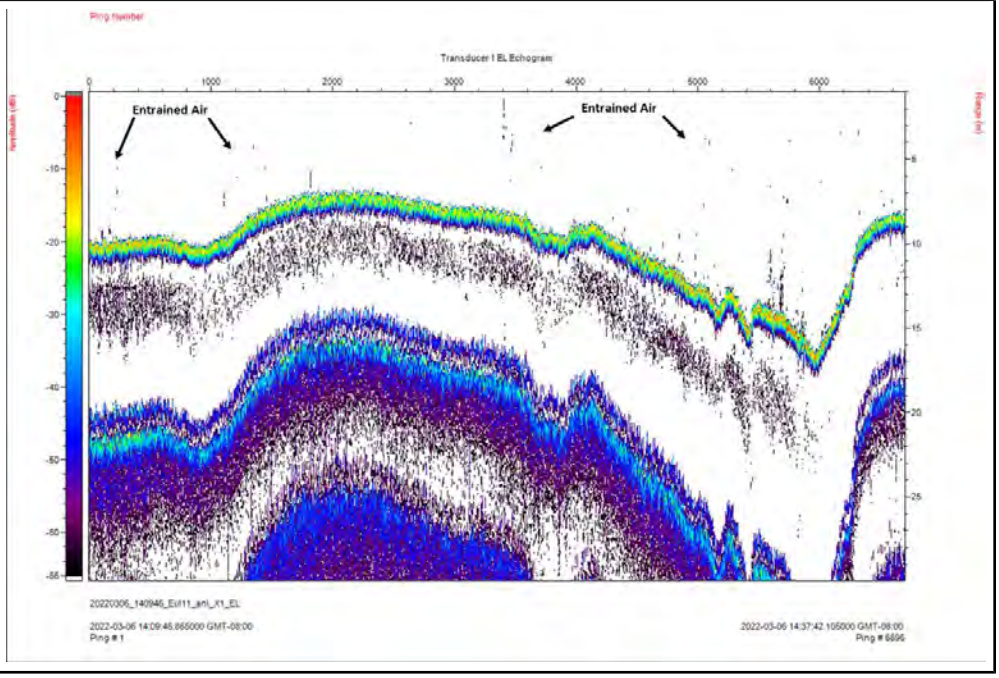
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 13 **Photo Location:** Observatory Inlet **Survey Date:** 27 Feb 2022 **Comments:** Transect Eul08a. Fish tracks, side lobe interference, false bottom and background noise indicated.	
Photograph ID: 14 **Photo Location:** Observatory Inlet **Survey Date:** 27 Feb 2022 **Comments:** Transect Eul08b. Potential fish aggregations and side lobe interference indicated.	

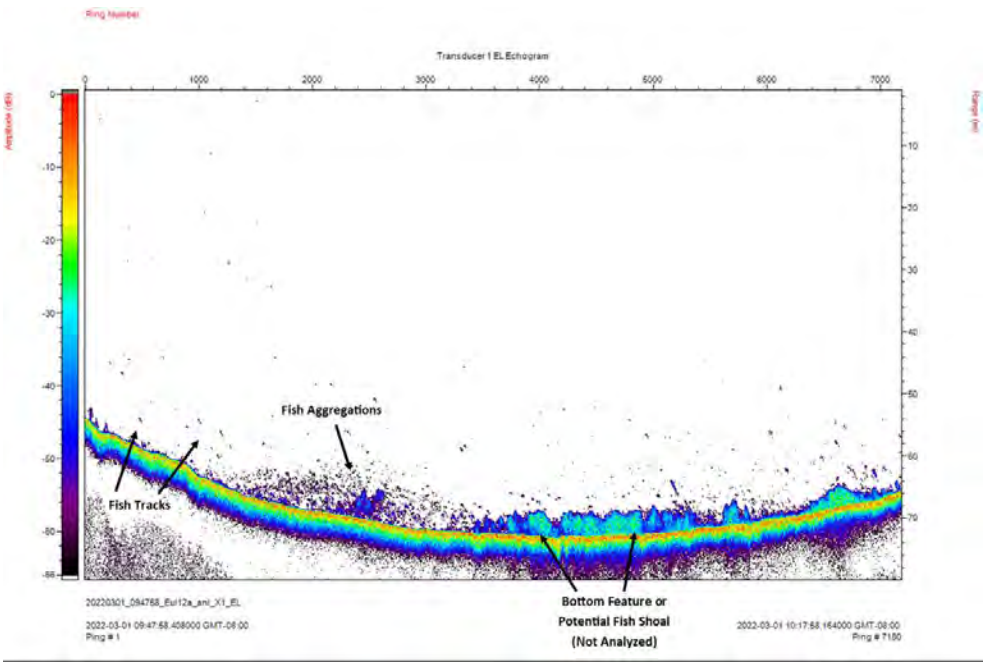
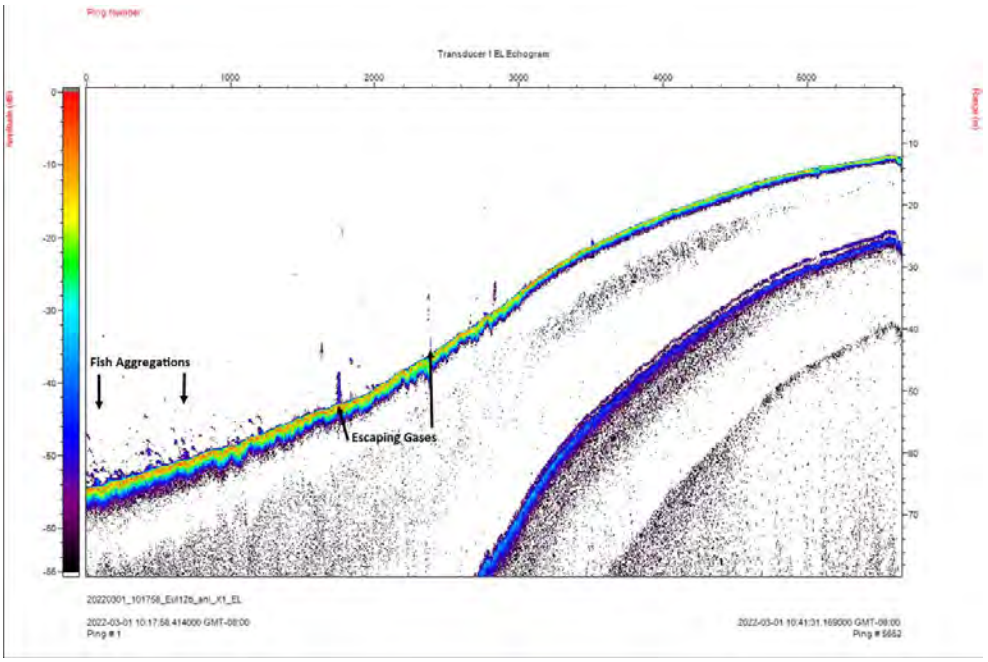
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 15 **Photo Location:** Nass Bay **Survey Date:** 27 Feb 2022 **Comments:** Transect Eul09. Fish tracks, potential fish aggregations, potential escaping gases and entrained air and background noise indicated.	
Photograph ID: 16 **Photo Location:** Nass Bay **Survey Date:** 06 Mar 2022 **Comments:** Transect Eul10a. Fish tracks, potential fish shoals, potential escaping gases and background noise indicated.	

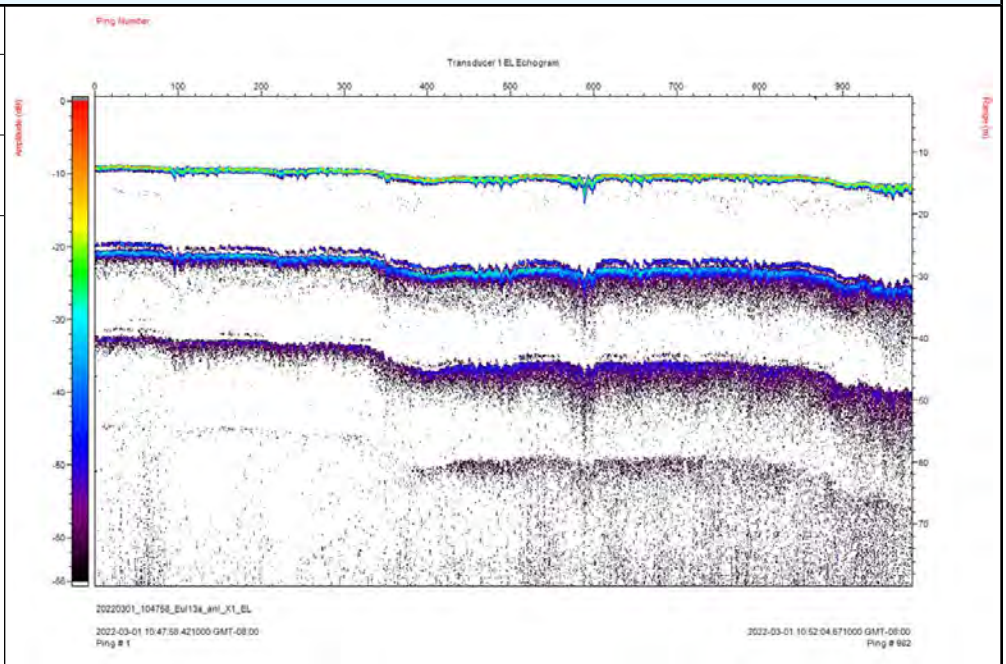
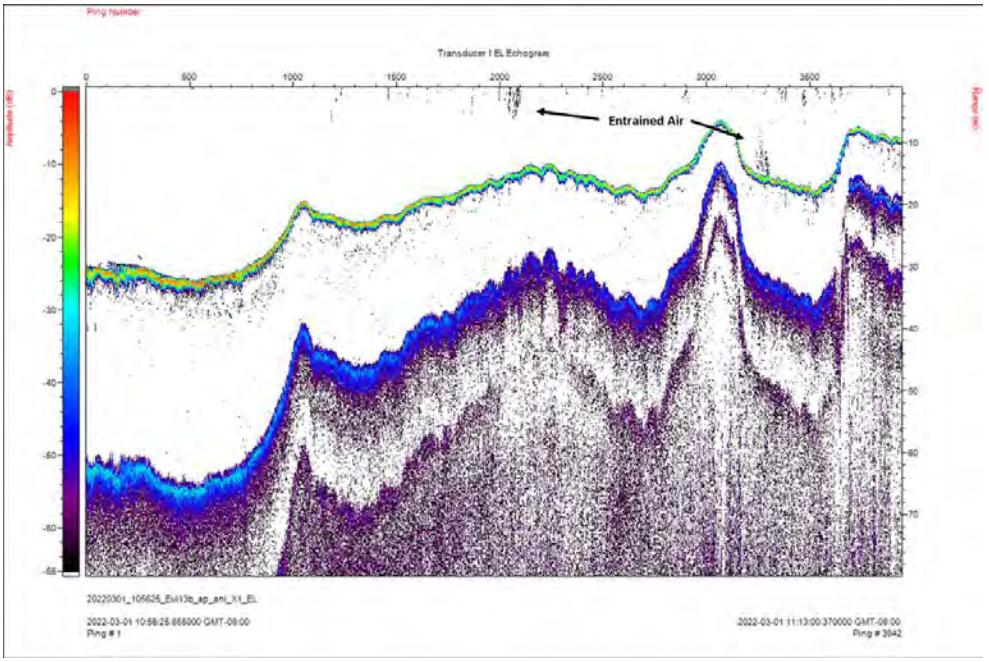
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 17 **Photo Location:** Nass Bay **Survey Date:** 06 Mar 2022 **Comments:** Transect Eul10b. Bottom feature and entrained air indicated.	
Photograph ID: 18 **Photo Location:** Nass Bay **Survey Date:** 06 Mar 2022 **Comments:** Transect Eul11. Entrained air indicated.	

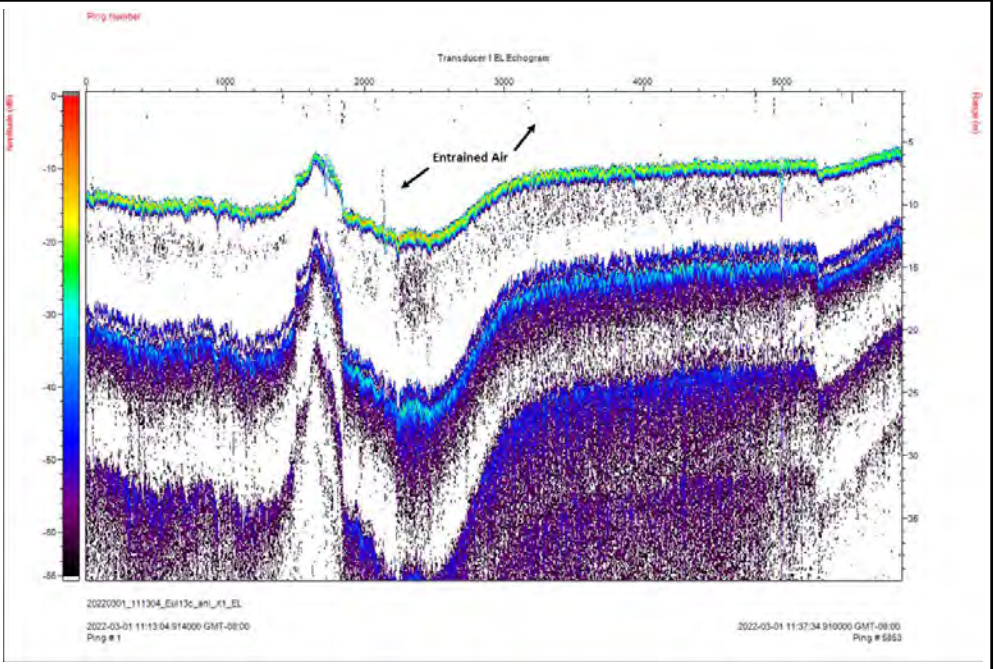
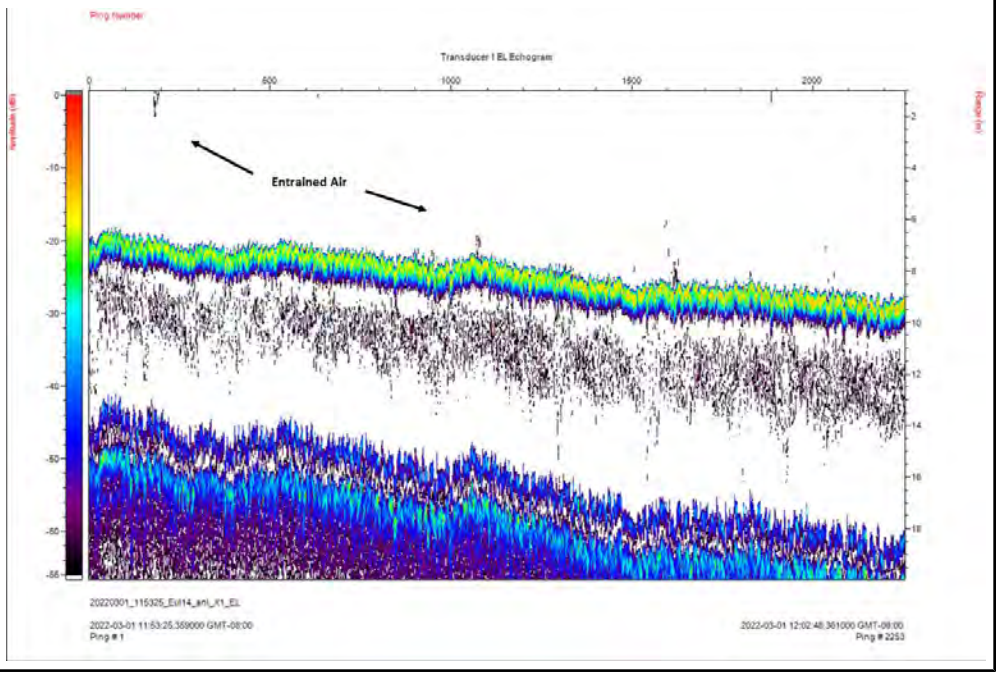
Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 19 **Photo Location:** Iceberg Bay **Survey Date:** 01 Mar 2022 **Comments:** Transect Eul12a. Fishtracks, fish aggregations and bottom feature or potential fish shoal (not included in echo integration analysis) indicated.	
Photograph ID: 20 **Photo Location:** Iceberg Bay **Survey Date:** 01 Mar 2022 **Comments:** Transect Eul12b. Fish aggregations and escaping gases indicated.	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 21 **Photo Location:** Nass Bay **Survey Date:** 01 Mar 2022 **Comments:** Transect Eul13a. No fish or features to indicate.	
Photograph ID: 22 **Photo Location:** Nass Bay **Survey Date:** 01 Mar 2022 **Comments:** Transect Eul13b. Entrained air indicated.	

Client:	**Ksi Lisims LNG**	**Project:**	**Ksi Lisims LNG – Natural Gas Liquefaction and Marine Terminal**
Site Location:	**Pearse Island, BC**		

Photograph ID: 23 **Photo Location:** Nass Bay **Survey Date:** 01 Mar 2022 **Comments:** Transect Eul13c. Entrained air indicated.	
Photograph ID: 24 **Photo Location:** Nass Bay **Survey Date:** 01 Mar 2022 **Comments:** Transect Eul14. Entrained air indicated.	

Appendix G WATER QUALITY RESULTS

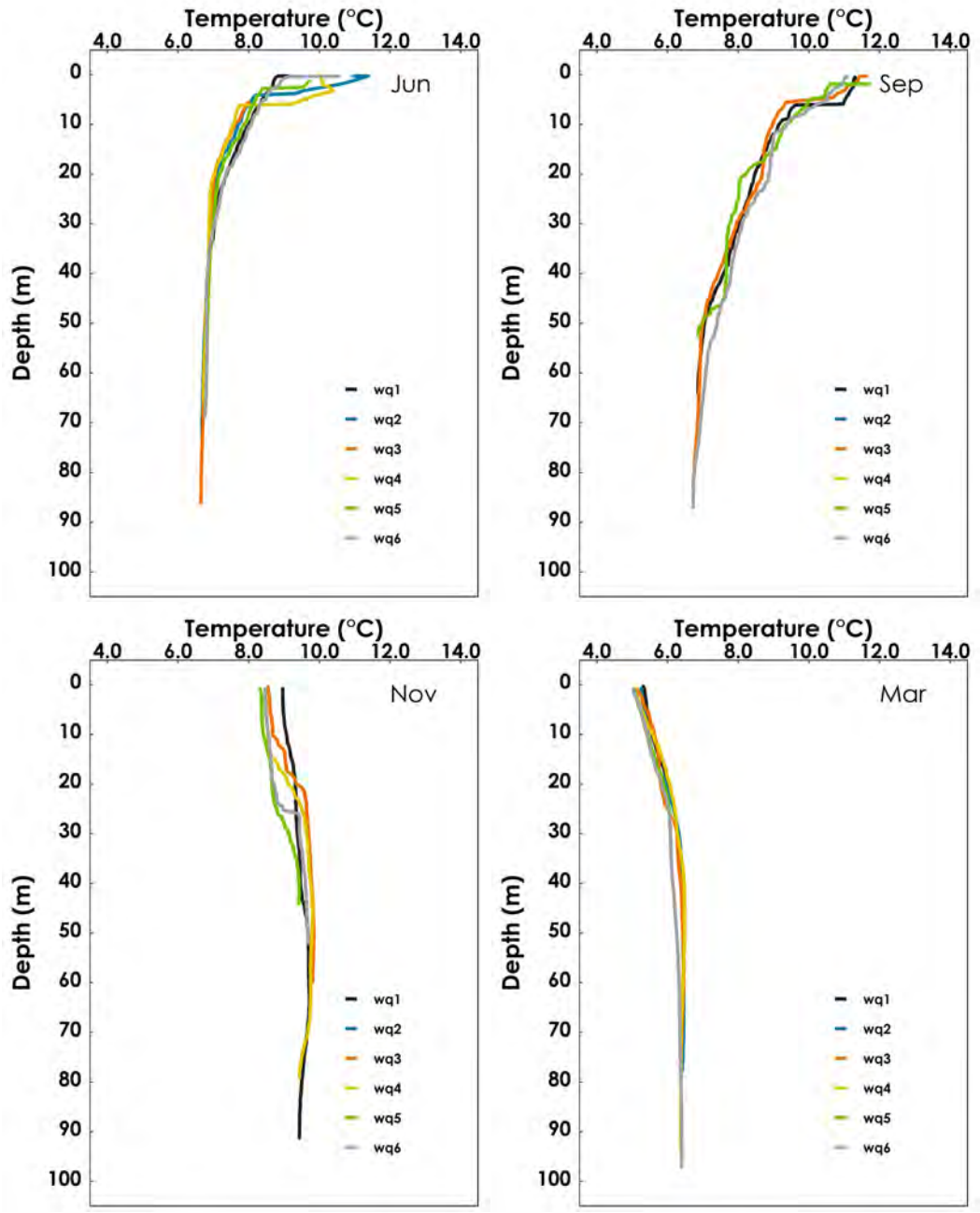


Figure G.1 Temperature profiles collected at six water quality stations in June, September and November 2021 and March 2022

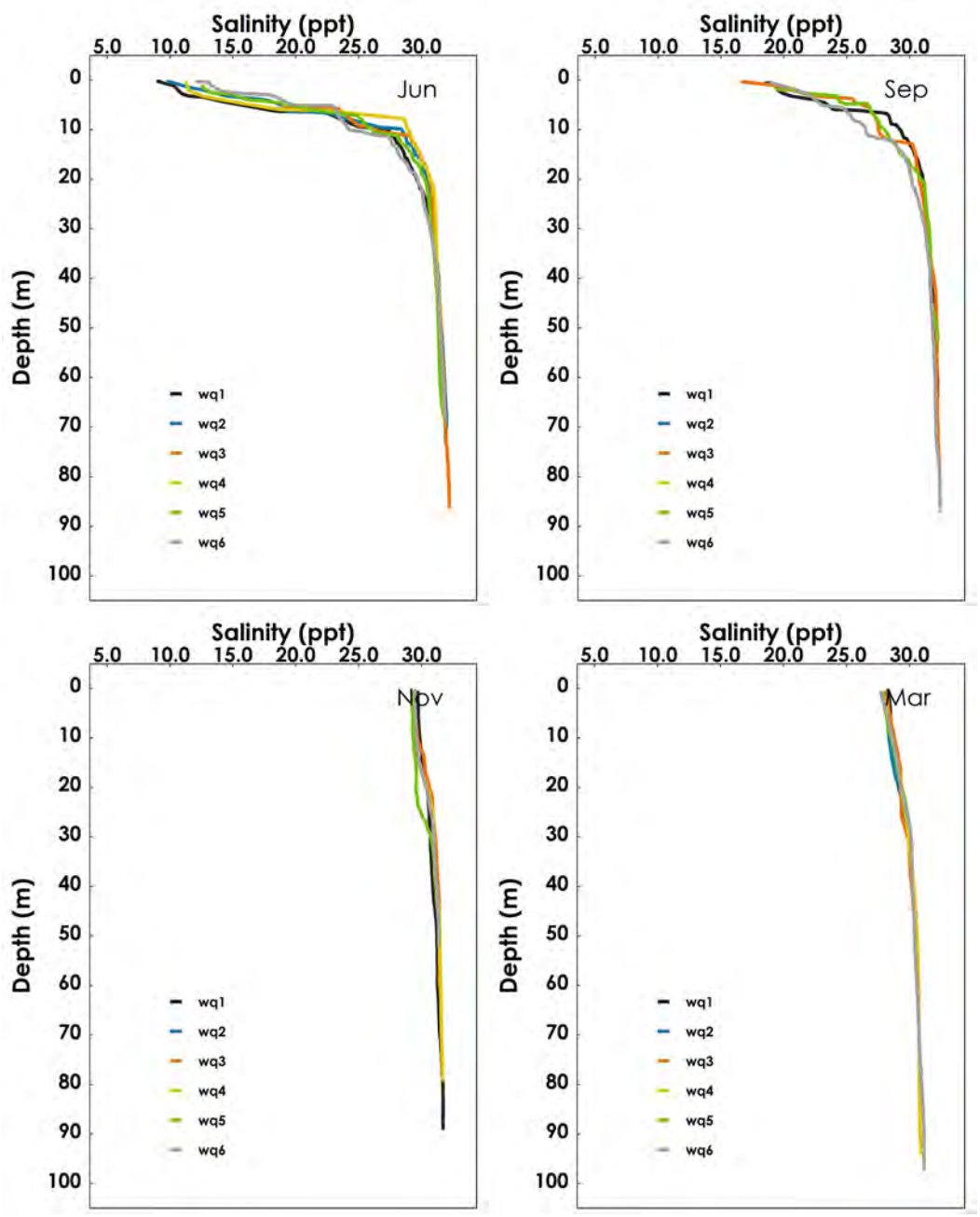


Figure G.2 Salinity profiles collected at six water quality stations in June, September and November 2021 and March 2022

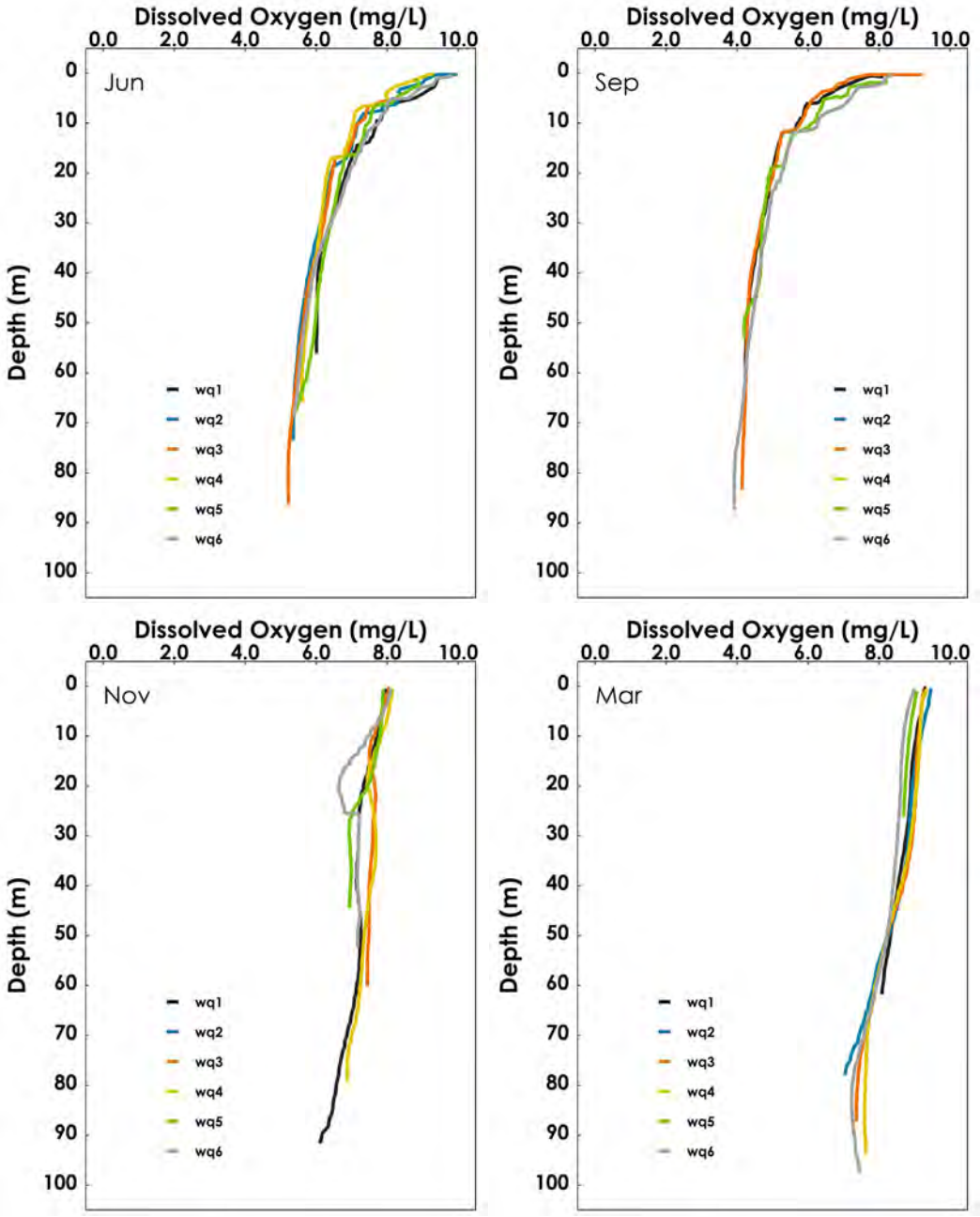


Figure G.3 **Dissolved oxygen profiles collected at six water quality stations in June, September and November 2021 and March 2022**

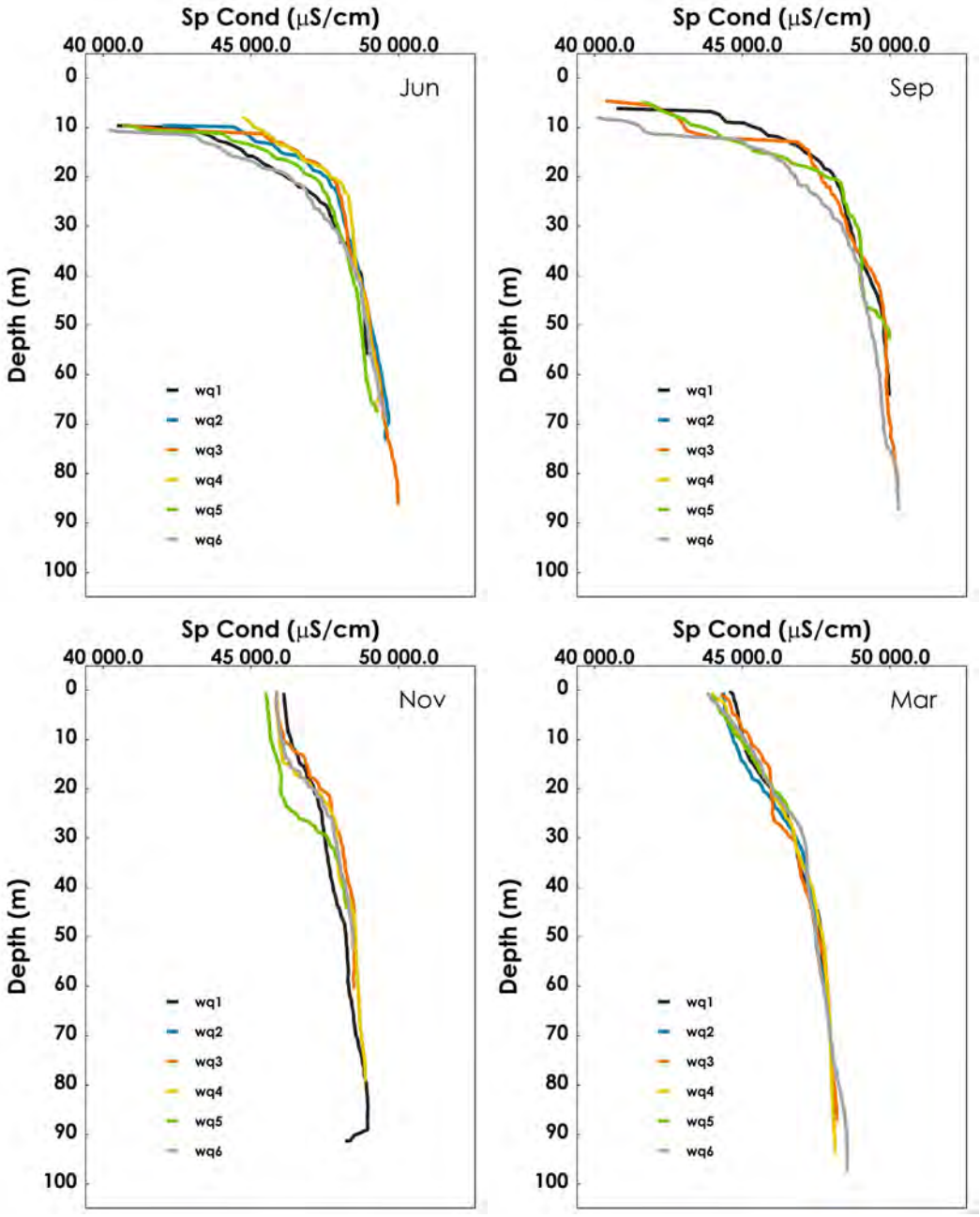


Figure G.4 **Specific conductivity profiles collected at six water quality stations in June, September and November 2021 and March 2022**

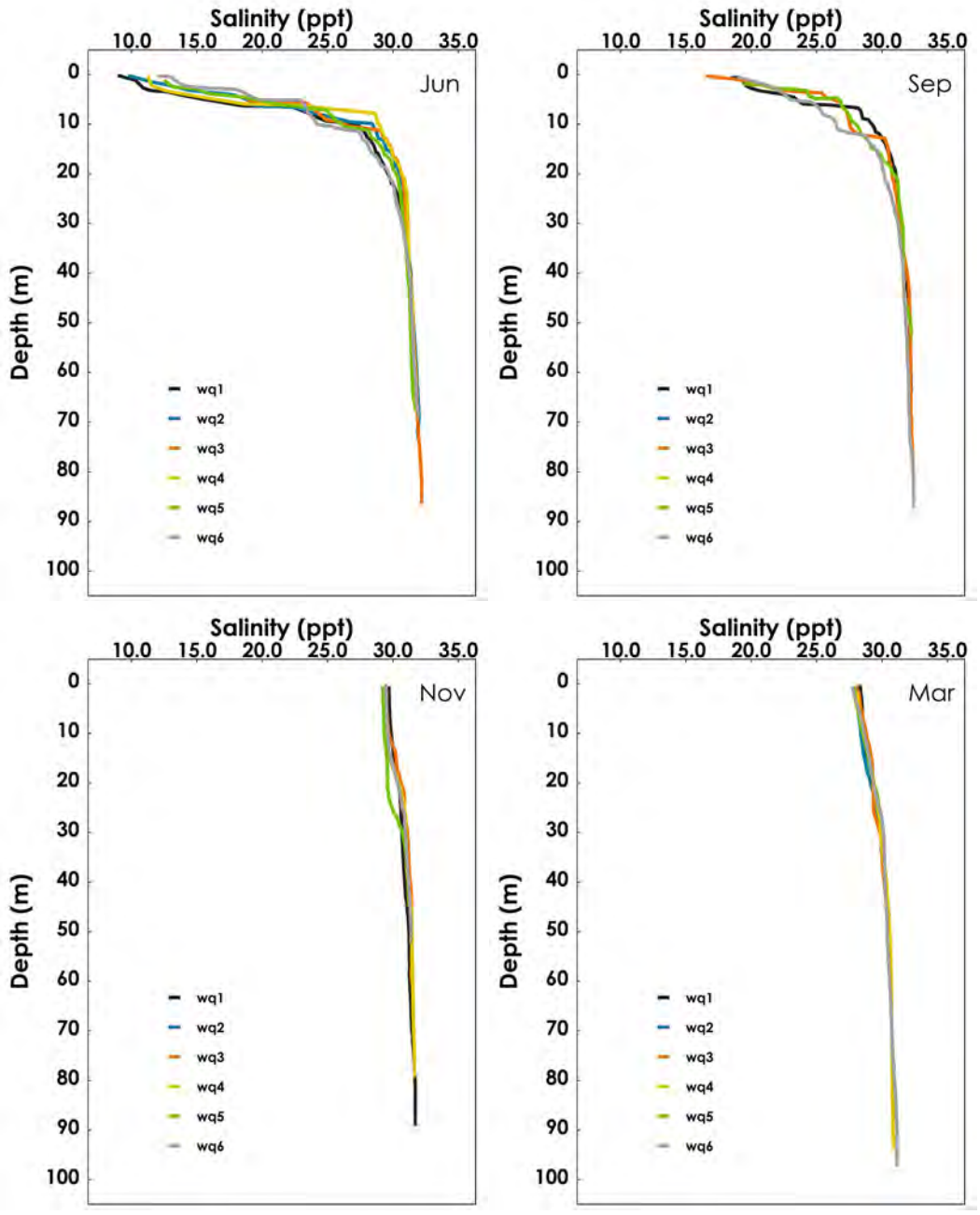


Figure G.5 Salinity profiles collected at six water quality stations in June, September and November 2021 and March 2022

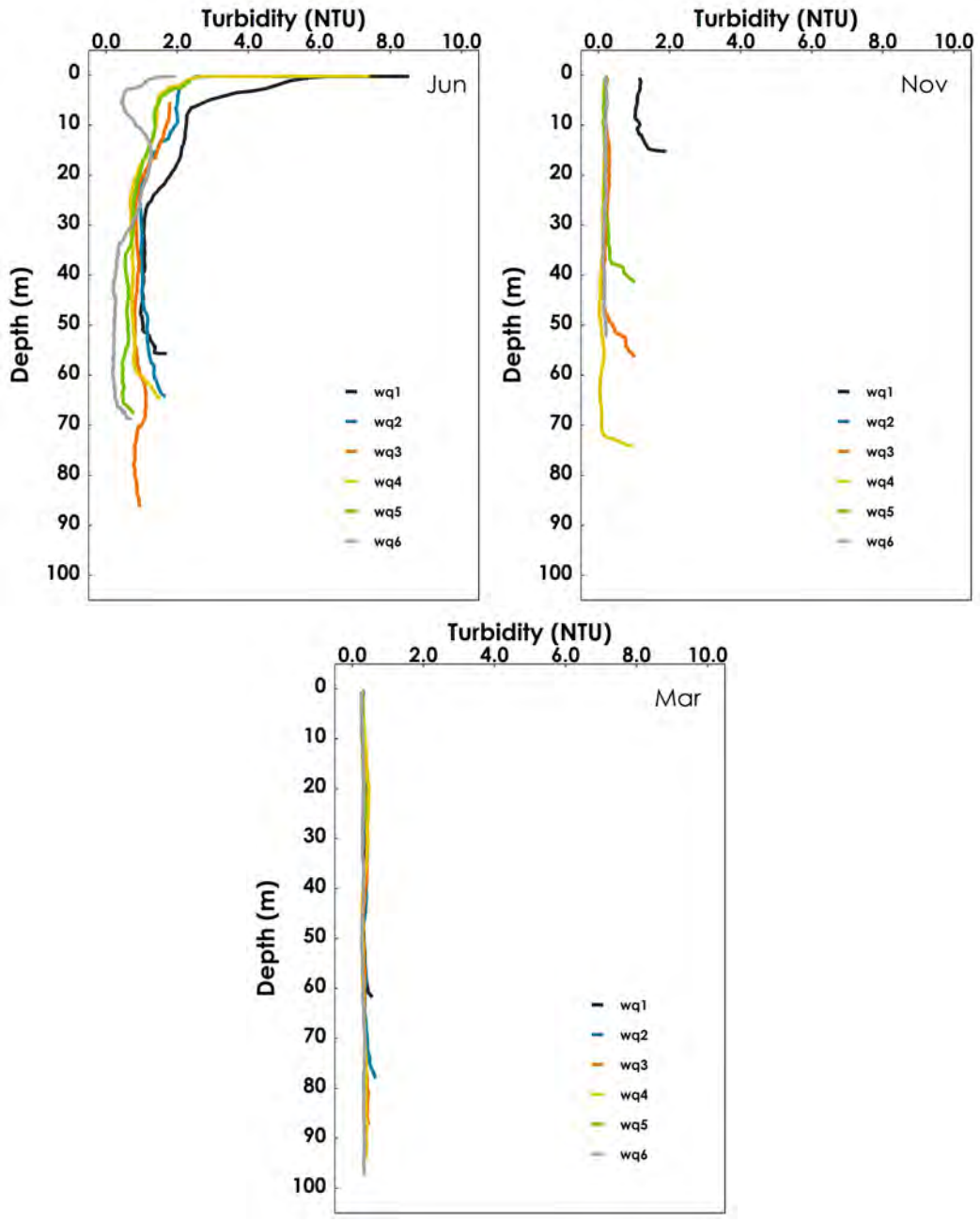


Figure G.6 **Turbidity profiles collected at six water quality stations in June and November 2021 and March 2022. Note that there are no turbidity profile data for September due to a probe malfunction.**

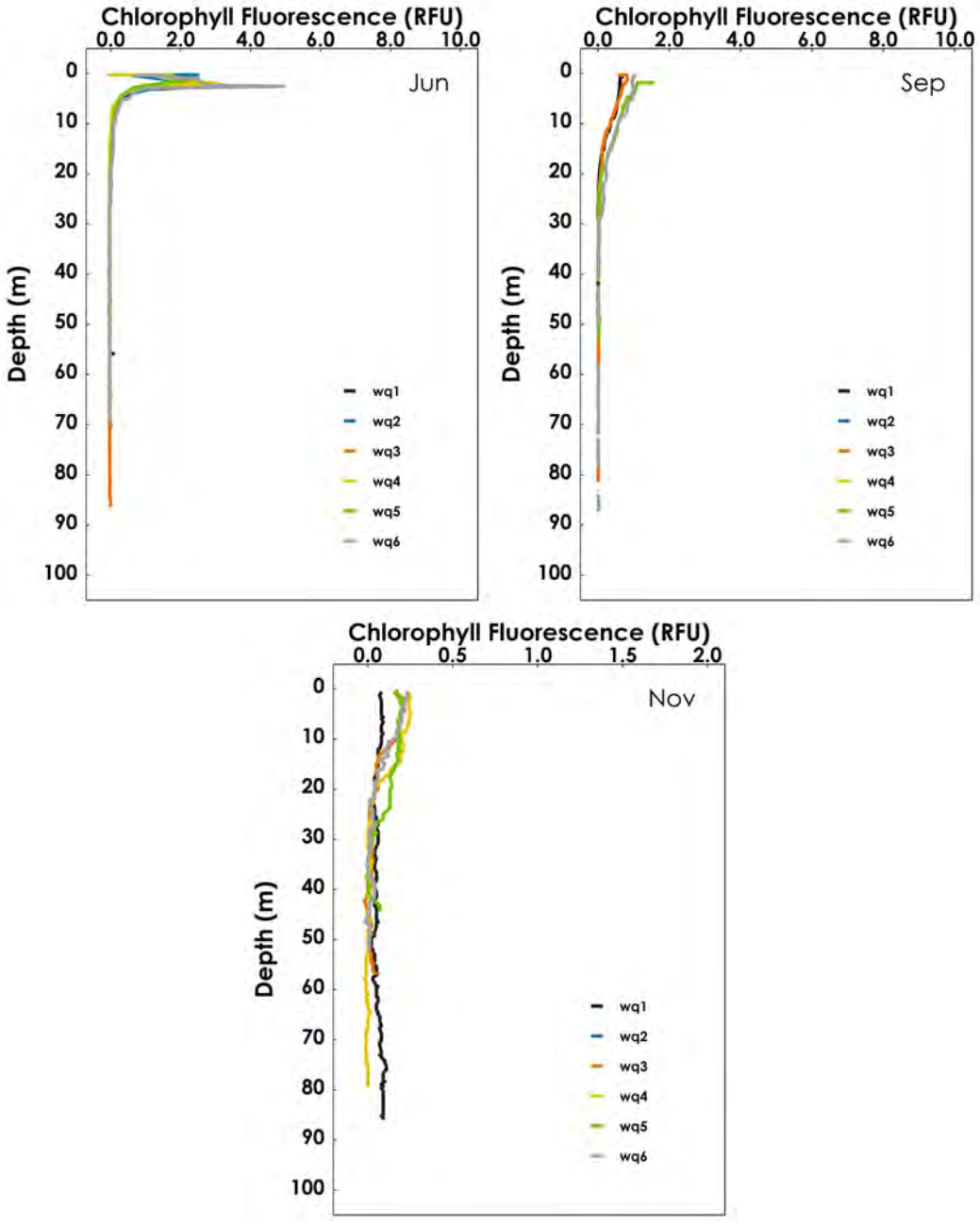


Figure G.7 **Chlorophyll profiles collected at six water quality stations in June, September and November 2021. Note that there are no chlorophyll profile data for March 2022 due to a probe malfunction.**

Table G.2-1: CTD Profiles for Water Quality Stations, June 2021

Date	Site	Time	Depth (m)	Temp (°C)	DO (%)	DO (mg/L)	SPC (µS/cm)	C (µS/cm)	TDS (mg/L)	SAL (ppt)	pH	Turbidity (NTU)	Chl (RFU)
6/7/2021	WQ1	10:09:10	56.08	6.80	60.6	6.01	48922	31915	31799	31.47	7.69		0.1
6/7/2021	WQ1	10:09:17	55.50	6.80	60.6	6.01	48910	31907	31792	31.46	7.69	1.36	-0.02
6/7/2021	WQ1	10:09:18	54.27	6.80	60.6	6.01	48906	31905	31789	31.46	7.70	1.38	-0.03
6/7/2021	WQ1	10:09:20	53.43	6.80	60.6	6.01	48896	31901	31782	31.45	7.70	1.29	-0.03
6/7/2021	WQ1	10:09:21	53.18	6.80	60.6	6.01	48891	31899	31779	31.45	7.70	1.27	-0.03
6/7/2021	WQ1	10:09:23	52.47	6.81	60.6	6.02	48881	31894	31772	31.44	7.70	1.23	-0.03
6/7/2021	WQ1	10:09:25	51.40	6.81	60.7	6.02	48875	31891	31768	31.44	7.70	1.09	-0.02
6/7/2021	WQ1	10:09:27	50.81	6.81	60.7	6.02	48870	31889	31765	31.44	7.70	1.02	-0.03
6/7/2021	WQ1	10:09:29	49.31	6.81	60.7	6.02	48865	31886	31762	31.43	7.70	1.03	-0.03
6/7/2021	WQ1	10:09:31	48.52	6.81	60.7	6.02	48860	31884	31759	31.43	7.70	1.01	-0.02
6/7/2021	WQ1	10:09:33	47.89	6.81	60.7	6.02	48854	31881	31755	31.43	7.70	0.97	-0.02
6/7/2021	WQ1	10:09:35	46.19	6.81	60.7	6.02	48847	31877	31751	31.42	7.70	0.99	-0.03
6/7/2021	WQ1	10:09:38	45.34	6.81	60.7	6.03	48833	31870	31741	31.41	7.70	1.02	-0.03
6/7/2021	WQ1	10:09:41	44.87	6.82	60.8	6.03	48813	31860	31729	31.40	7.70	1.05	-0.04
6/7/2021	WQ1	10:09:42	43.26	6.82	60.8	6.03	48806	31857	31724	31.40	7.70	1.02	-0.04
6/7/2021	WQ1	10:09:43	42.79	6.82	60.8	6.03	48799	31854	31719	31.39	7.70	1.01	-0.04
6/7/2021	WQ1	10:09:45	41.98	6.82	60.9	6.04	48778	31844	31706	31.38	7.70	1.04	-0.04
6/7/2021	WQ1	10:09:47	40.27	6.83	61.0	6.05	48753	31833	31689	31.36	7.71	1.05	-0.04
6/7/2021	WQ1	10:09:49	39.41	6.84	61.1	6.06	48711	31813	31662	31.33	7.71	1.05	-0.04
6/7/2021	WQ1	10:09:51	38.76	6.85	61.3	6.08	48641	31782	31617	31.28	7.71	1.08	-0.04
6/7/2021	WQ1	10:09:52	37.55	6.86	61.4	6.09	48606	31766	31594	31.26	7.71	1.08	-0.03
6/7/2021	WQ1	10:09:54	36.25	6.88	61.6	6.11	48522	31728	31539	31.20	7.72	1.06	-0.03
6/7/2021	WQ1	10:09:56	35.01	6.90	61.9	6.14	48425	31684	31476	31.14	7.72	1.08	-0.02
6/7/2021	WQ1	10:09:57	34.53	6.91	62.1	6.16	48368	31658	31439	31.10	7.72	1.07	-0.02
6/7/2021	WQ1	10:09:59	33.47	6.94	62.5	6.20	48262	31610	31370	31.02	7.72	1.06	-0.02
6/7/2021	WQ1	10:10:05	32.09	7.00	63.8	6.33	47996	31490	31197	30.84	7.74	1.06	-0.03
6/7/2021	WQ1	10:10:06	31.34	7.00	64.1	6.36	47957	31472	31172	30.82	7.74	1.05	-0.03
6/7/2021	WQ1	10:10:09	30.31	7.03	64.8	6.42	47838	31418	31095	30.73	7.75	1.07	-0.03
6/7/2021	WQ1	10:10:10	29.06	7.04	65.0	6.45	47799	31400	31069	30.71	7.75	1.07	-0.03
6/7/2021	WQ1	10:10:11	28.61	7.05	65.3	6.47	47764	31385	31046	30.68	7.75	1.08	-0.03
6/7/2021	WQ1	10:10:13	27.86	7.06	65.7	6.52	47688	31350	30997	30.63	7.76	1.10	-0.03
6/7/2021	WQ1	10:10:15	26.31	7.09	66.2	6.56	47599	31310	30939	30.57	7.76	1.15	-0.02
6/7/2021	WQ1	10:10:17	25.39	7.11	66.6	6.60	47461	31245	30850	30.48	7.76	1.24	-0.01
6/7/2021	WQ1	10:10:19	23.94	7.16	67.1	6.65	47204	31122	30682	30.30	7.77	1.34	-0.01
6/7/2021	WQ1	10:10:20	23.42	7.19	67.3	6.68	47078	31064	30601	30.21	7.77	1.42	-0.01
6/7/2021	WQ1	10:10:22	22.19	7.25	67.9	6.73	46799	30932	30419	30.02	7.78	1.57	0
6/7/2021	WQ1	10:10:23	21.98	7.29	68.3	6.77	46616	30844	30300	29.89	7.78	1.62	0
6/7/2021	WQ1	10:10:25	20.20	7.36	68.9	6.83	46255	30671	30066	29.65	7.79	1.79	0
6/7/2021	WQ1	10:10:26	19.38	7.40	69.3	6.87	46082	30587	29953	29.53	7.79	1.85	0
6/7/2021	WQ1	10:10:27	18.88	7.44	69.7	6.91	45868	30483	29814	29.38	7.80	1.92	0
6/7/2021	WQ1	10:10:29	17.31	7.53	70.5	6.99	45436	30270	29533	29.08	7.80	2.03	0.01
6/7/2021	WQ1	10:10:30	16.44	7.57	70.9	7.02	45246	30176	29410	28.95	7.81	2.08	0.01
6/7/2021	WQ1	10:10:32	15.71	7.64	71.7	7.11	44882	29995	29173	28.70	7.81	2.11	0
6/7/2021	WQ1	10:10:33	14.45	7.67	72.2	7.15	44680	29893	29042	28.56	7.82	2.13	0.01
6/7/2021	WQ1	10:10:35	13.01	7.77	76.1	7.54	44167	29630	28709	28.21	7.83	2.20	0.03
6/7/2021	WQ1	10:10:36	12.69	7.82	76.6	7.59	43913	29498	28543	28.03	7.83	2.22	0.05
6/7/2021	WQ1	10:10:37	11.57	7.87	77.0	7.63	43601	29334	28341	27.82	7.84	2.22	0.05
6/7/2021	WQ1	10:10:39	10.16	7.97	77.5	7.69	42963	28988	27926	27.38	7.85	2.25	0.07
6/7/2021	WQ1	10:10:41	9.36	8.07	78.0	7.82	39368	26637	25589	24.87	7.86	2.26	0.1
6/7/2021	WQ1	10:10:42	7.99	8.13	78.3	7.88	37557	25448	24412	23.62	7.87	2.27	0.14
6/7/2021	WQ1	10:10:43	7.27	8.18	78.5	7.97	36692	24905	23850	23.03	7.87	2.33	0.16
6/7/2021	WQ1	10:10:44	6.54	8.25	78.9	8.02	35697	24269	23203	22.35	7.97	2.40	0.2
6/7/2021	WQ1	10:10:46	4.97	8.38	83.0	8.79	25493	17396	16570	15.48	8.07	2.90	0.33
6/7/2021	WQ1	10:10:47	4.28	8.45	83.9	8.96	23288	15928	15137	14.03	8.10	3.27	0.53
6/7/2021	WQ1	10:10:48	3.49	8.54	85.0	9.14	21316	14610	13856	12.75	8.13	3.68	0.76
6/7/2021	WQ1	10:10:50	2.71	8.66	86.0	9.33	18386	12646	11951	10.87	8.16	4.50	2.59
6/7/2021	WQ1	10:10:51	1.17	8.71	86.6	9.42	17506	12060	11379	10.31	8.16	5.17	1.59
6/7/2021	WQ1	10:10:52	0.53	8.77	87.3	9.54	16003		10402	9.35	8.17	5.73	0.93
6/7/2021	WQ1	10:10:54	0.27	8.91	91.9	10.06	15361	10639	9985	8.95	8.17	6.82	0.63
6/7/2021	WQ2	15:10:05	73.43	6.68	53.9	5.35	49564	32220	32217	31.91	7.65	-	-
6/7/2021	WQ2	15:10:07	72.79	6.68	53.9	5.35	49549	32212	32207	31.90	7.65	-	-
6/7/2021	WQ2	15:10:08	71.55	6.68	53.9	5.35	49545	32209	32204	31.89	7.65	-	-
6/7/2021	WQ2	15:10:10	70.38	6.68	53.9	5.35	49602	32247	32241	31.94	7.65	-	0.02
6/7/2021	WQ2	15:10:12	69.42	6.68	53.9	5.35	49667	32292	32284	31.98	7.66	-	-0.02
6/7/2021	WQ2	15:10:13	68.48	6.69	54.0	5.35	49660	32288	32279	31.98	7.66	-	-0.02
6/7/2021	WQ2	15:10:14	67.25	6.69	54.0	5.35	49641	32278	32266	31.97	7.66	-	-0.03
6/7/2021	WQ2	15:10:15	66.72	6.69	54.1	5.36	49622	32267	32254	31.95	7.66	-	-0.02
6/7/2021	WQ2	15:10:17	65.37	6.69	54.2	5.37	49582	32245	32228	31.92	7.66	-	-0.02
6/7/2021	WQ2	15:10:18	64.55	6.70	54.2	5.38	49561	32233	32215	31.91	7.66	-	-0.03
6/7/2021	WQ2	15:10:20	63.63	6.70	54.4	5.39	49516	32208	32185	31.88	7.66	1.55	-0.03
6/7/2021	WQ2	15:10:21	62.67	6.70	54.4	5.40	49493	32196	32170	31.86	7.66	1.49	-0.03
6/7/2021	WQ2	15:10:24	60.59	6.71	54.7	5.42	49431	32163	32130	31.82	7.67	1.36	-0.03
6/7/2021	WQ2	15:10:25	59.70	6.71	54.7	5.43	49415	32154	32120	31.81	7.67	1.34	-0.02
6/7/2021	WQ2	15:10:27	57.97	6.72	54.9	5.45	49361	32125	32085	31.77	7.67	1.34	-0.03
6/7/2021	WQ2	15:10:29	57.46	6.72	55.1	5.47	49316	32102	32056	31.74	7.67	1.27	-0.03
6/7/2021	WQ2	15:10:30	56.04	6.73	55.2	5.48	49286	32086	32036	31.72	7.67	1.22	-0.03
6/7/2021	WQ2	15:10:31	54.88	6.73	55.3	5.49	49259	32072	32018	31.70	7.68	1.19	-0.03
6/7/2021	WQ2	15:10:32	54.23	6.74	55.4	5.50	49240	32063	32006	31.69	7.68	1.18	-0.03
6/7/2021	WQ2	15:10:33	53.72	6.74	55.5	5.51	49201	32043	31981	31.66	7.68	1.17	-0.03
6/7/2021	WQ2	15:10:34	52.58	6.75	55.7	5.52	49172	32028	31962	31.64	7.68	1.15	-0.03
6/7/2021	WQ2	15:10:36	50.81	6.76	55.9	5.55	49108	31996	31920	31.60	7.68	1.15	-0.02
6/7/2021	WQ2	15:10:38	50.34	6.77	56.2	5.57	49052	31968	31884	31.56	7.68	1.15	-0.03
6/7/2021	WQ2	15:10:39	48.54	6.77	56.4	5.59	49011	31948	31857	31.53	7.69	1.17	-0.03
6/7/2021	WQ2	15:10:40	47.54	6.78	56.5	5.61	48985	31936	31840	31.52	7.69	1.13	-0.03
6/7/2021	WQ2	15:10:42	46.87	6.79	56.8	5.64	48935	31912	31808	31.48	7.69	1.06	-0.04
6/7/2021	WQ2	15:10:43	45.21	6.79	57.0	5.66	48894	31892	31781	31.46	7.69	1.04	-0.04
6/7/2021	WQ2	15:10:44	44.72	6.80	57.2	5.68	48874	31883	31768	31.44	7.70	1.02	-0.03

Date	Site	Time	Depth (m)	Temp (°C)	DO (%)	DO (mg/L)	SPC (µS/cm)	C (µS/cm)	TDS (mg/L)	SAL (ppt)	pH	Turbidity (NTU)	Chl (RFU)
6/7/2021	WQ2	15:10:45	43.74	6.80	57.4	5.69	48843	31868	31748	31.42	7.70	1.01	-0.03
6/7/2021	WQ2	15:10:47	42.09	6.82	57.8	5.73	48783	31840	31709	31.38	7.70	1.02	-0.04
6/7/2021	WQ2	15:10:48	41.16	6.83	58.0	5.75	48751	31826	31688	31.36	7.70	1.02	-0.04
6/7/2021	WQ2	15:10:49	40.39	6.84	58.2	5.78	48702	31805	31656	31.32	7.71	1.03	-0.04
6/7/2021	WQ2	15:10:50	40.07	6.84	58.4	5.80	48675	31794	31639	31.31	7.71	1.02	-0.05
6/7/2021	WQ2	15:10:51	38.45	6.85	58.7	5.82	48632	31776	31611	31.28	7.71	0.99	-0.04
6/7/2021	WQ2	15:10:52	37.34	6.87	59.0	5.85	48581	31754	31577	31.24	7.72	1.00	-0.04
6/7/2021	WQ2	15:10:53	36.53	6.87	59.2	5.88	48545	31738	31554	31.22	7.72	0.99	-0.04
6/7/2021	WQ2	15:10:55	36.03	6.89	59.7	5.92	48481	31710	31513	31.17	7.72	0.98	-0.04
6/7/2021	WQ2	15:10:56	34.31	6.90	60.0	5.95	48438	31691	31485	31.15	7.73	0.99	-0.04
6/7/2021	WQ2	15:10:57	33.52	6.91	60.3	5.98	48397	31672	31458	31.12	7.73	1.00	-0.04
6/7/2021	WQ2	15:10:59	32.48	6.93	61.0	6.05	48300	31628	31395	31.05	7.73	1.01	-0.03
6/7/2021	WQ2	15:11:00	31.22	6.94	61.2	6.07	48269	31615	31375	31.03	7.74	1.01	-0.03
6/7/2021	WQ2	15:11:01	30.39	6.94	61.5	6.10	48235	31599	31353	31.01	7.74	0.99	-0.03
6/7/2021	WQ2	15:11:03	29.29	6.96	62.2	6.16	48165	31564	31307	30.96	7.74	0.98	-0.03
6/7/2021	WQ2	15:11:04	28.14	6.96	62.4	6.19	48137	31550	31289	30.94	7.75	0.98	-0.03
6/7/2021	WQ2	15:11:05	27.63	6.96	62.6	6.21	48110	31537	31272	30.92	7.75	0.98	-0.03
6/7/2021	WQ2	15:11:06	26.33	6.97	62.9	6.24	48069	31516	31245	30.89	7.75	0.96	-0.03
6/7/2021	WQ2	15:11:08	25.54	6.98	63.4	6.29	48004	31484	31203	30.85	7.75	0.95	-0.03
6/7/2021	WQ2	15:11:09	23.65	6.99	63.6	6.31	47943	31455	31163	30.81	7.76	0.95	-0.03
6/7/2021	WQ2	15:11:11	22.18	7.02	64.0	6.35	47821	31399	31084	30.72	7.76	0.99	-0.03
6/7/2021	WQ2	15:11:12	21.99	7.04	64.3	6.37	47728	31355	31023	30.66	7.76	1.02	-0.02
6/7/2021	WQ2	15:11:13	20.19	7.07	64.6	6.41	47595	31294	30937	30.57	7.77	1.05	-0.03
6/7/2021	WQ2	15:11:14	19.56	7.10	64.9	6.44	47435	31219	30833	30.46	7.77	1.08	-0.02
6/7/2021	WQ2	15:11:16	18.61	7.17	65.5	6.50	47104	31066	30618	30.23	7.77	1.18	-0.02
6/7/2021	WQ2	15:11:17	17.15	7.22	68.9	6.84	46935	30986	30508	30.12	7.78	1.23	-0.02
6/7/2021	WQ2	15:11:18	16.56	7.24	69.3	6.87	46771	30909	30401	30.00	7.78	1.27	-0.02
6/7/2021	WQ2	15:11:19	15.55	7.31	70.1	6.95	46484	30773	30215	29.81	7.79	1.33	-0.01
6/7/2021	WQ2	15:11:21	15.06	7.41	70.6	7.00	46040	30561	29926	29.50	7.79	1.43	0
6/7/2021	WQ2	15:11:22	13.34	7.46	70.9	7.03	45725	30410	29721	29.28	7.80	1.53	0
6/7/2021	WQ2	15:11:25	12.82	7.59	71.6	7.09	45147	30127	29345	28.88	7.81	1.74	0.02
6/7/2021	WQ2	15:11:26	11.42	7.63	71.8	7.12	44889	29998	29178	28.71	7.82	1.81	0.03
6/7/2021	WQ2	15:11:28	10.36	7.69	72.2	7.15	44594	29846	28986	28.50	7.82	1.91	0.04
6/7/2021	WQ2	15:11:30	9.55	7.77	72.7	7.21	42001	28179	27300	26.69	7.84	2.01	0.05
6/7/2021	WQ2	15:11:31	8.12	7.82	72.9	7.32	39000	26195	25350	24.60	7.84	2.00	0.05
6/7/2021	WQ2	15:11:32	7.47	7.85	76.7	7.82	37381	25135	24298	23.48	7.85	1.99	0.07
6/7/2021	WQ2	15:11:33	6.65	7.91	77.3	7.90	36284	24437	23585	22.73	7.96	1.96	0.11
6/7/2021	WQ2	15:11:34	6.26	8.01	79.2	8.25	31329	21160	20364	19.36	8.01	1.99	0.17
6/7/2021	WQ2	15:11:35	4.82	8.11	79.5	8.32	30290	20511	19688	18.67	8.07	2.01	0.3
6/7/2021	WQ2	15:11:37	3.79	9.34	80.8	8.32	27466	19243	17853	16.82	8.09	2.03	0.75
6/7/2021	WQ2	15:11:39	2.00	10.54	87.1	8.99	20902	15051	13586	12.52	8.23	2.10	2.57
6/7/2021	WQ2	15:11:40	1.40	10.90	88.4	9.06	19067	13933	12393	11.34	8.29	2.21	1.76
6/7/2021	WQ2	15:11:41	0.45	11.31	90.7	9.32	17115	12630	11125	10.09	8.29	2.50	0.65
6/7/2021	WQ2	15:11:42	0.26	11.39	91.5	9.41	16523	12227	10740	9.72	8.21	2.97	2.04
6/7/2021	WQ3	13:56:04	86.32	6.65	52.7	5.22	49976	32459	32485	32.19	7.65	0.94	0
6/7/2021	WQ3	13:56:05	85.67	6.65	52.7	5.22	49975	32458	32484	32.19	7.65	0.93	-0.01
6/7/2021	WQ3	13:56:06	84.57	6.65	52.7	5.22	49973	32457	32482	32.19	7.65	0.92	-0.01
6/7/2021	WQ3	13:56:09	83.79	6.65	52.6	5.21	49964	32452	32476	32.18	7.65	0.87	-0.03
6/7/2021	WQ3	13:56:10	82.00	6.65	52.6	5.21	49958	32449	32473	32.18	7.65	0.86	-0.03
6/7/2021	WQ3	13:56:11	81.34	6.65	52.6	5.21	49950	32444	32467	32.18	7.66	0.85	-0.02
6/7/2021	WQ3	13:56:13	80.58	6.66	52.6	5.21	49920	32428	32448	32.15	7.66	0.83	-0.02
6/7/2021	WQ3	13:56:14	80.26	6.66	52.6	5.21	49899	32417	32435	32.14	7.66	0.81	-0.03
6/7/2021	WQ3	13:56:15	78.68	6.66	52.6	5.21	49880	32407	32422	32.13	7.66	0.81	-0.03
6/7/2021	WQ3	13:56:17	77.46	6.67	52.6	5.22	49839	32385	32395	32.10	7.66	0.78	-0.03
6/7/2021	WQ3	13:56:19	76.89	6.67	52.7	5.22	49789	32358	32363	32.07	7.66	0.81	-0.03
6/7/2021	WQ3	13:56:20	75.10	6.68	52.8	5.23	49756	32341	32341	32.04	7.66	0.81	-0.03
6/7/2021	WQ3	13:56:21	74.74	6.68	52.8	5.24	49725	32324	32321	32.02	7.66	0.81	-0.03
6/7/2021	WQ3	13:56:22	73.69	6.68	52.9	5.24	49691	32306	32299	32.00	7.66	0.81	-0.03
6/7/2021	WQ3	13:56:25	71.91	6.69	53.1	5.27	49612	32263	32248	31.94	7.67	0.86	-0.03
6/7/2021	WQ3	13:56:26	71.06	6.69	53.2	5.28	49587	32250	32232	31.93	7.67	0.88	-0.03
6/7/2021	WQ3	13:56:28	70.26	6.70	53.4	5.30	49545	32226	32204	31.90	7.67	0.97	-0.03
6/7/2021	WQ3	13:56:29	69.69	6.70	53.5	5.31	49525	32215	32191	31.88	7.67	1.01	-0.04
6/7/2021	WQ3	13:56:31	68.11	6.71	53.7	5.33	49485	32194	32166	31.86	7.67	1.10	-0.03
6/7/2021	WQ3	13:56:33	67.00	6.71	54.0	5.35	49462	32181	32150	31.84	7.68	1.10	-0.03
6/7/2021	WQ3	13:56:34	66.70	6.71	54.1	5.36	49452	32176	32144	31.83	7.68	1.12	-0.03
6/7/2021	WQ3	13:56:35	65.48	6.71	54.2	5.37	49443	32171	32138	31.83	7.68	1.12	-0.04
6/7/2021	WQ3	13:56:37	64.06	6.71	54.4	5.39	49421	32159	32123	31.81	7.68	1.12	-0.04
6/7/2021	WQ3	13:56:38	63.46	6.72	54.5	5.40	49409	32153	32116	31.81	7.68	1.12	-0.04
6/7/2021	WQ3	13:56:40	62.96	6.72	54.6	5.42	49388	32142	32102	31.79	7.68	1.10	-0.04
6/7/2021	WQ3	13:56:41	61.31	6.72	54.7	5.43	49375	32135	32093	31.78	7.68	1.07	-0.03
6/7/2021	WQ3	13:56:43	60.33	6.73	54.9	5.45	49339	32116	32070	31.76	7.69	1.00	-0.03
6/7/2021	WQ3	13:56:44	60.07	6.73	55.0	5.46	49316	32104	32055	31.74	7.69	0.95	-0.03
6/7/2021	WQ3	13:56:45	58.77	6.73	55.1	5.46	49295	32094	32042	31.73	7.69	0.93	-0.03
6/7/2021	WQ3	13:56:46	58.17	6.73	55.2	5.47	49271	32081	32026	31.71	7.69	0.90	-0.03
6/7/2021	WQ3	13:56:47	57.53	6.74	55.3	5.48	49250	32070	32012	31.70	7.69	0.88	-0.03
6/7/2021	WQ3	13:56:49	56.91	6.74	55.5	5.50	49204	32047	31983	31.67	7.69	0.88	-0.03
6/7/2021	WQ3	13:56:50	55.68	6.75	55.6	5.51	49181	32035	31967	31.65	7.69	0.86	-0.03
6/7/2021	WQ3	13:56:52	54.53	6.75	55.8	5.54	49138	32013	31940	31.62	7.69	0.84	-0.03
6/7/2021	WQ3	13:56:55	53.97	6.76	56.1	5.57	49088	31988	31907	31.59	7.70	0.80	-0.03
6/7/2021	WQ3	13:56:57	52.25	6.77	56.4	5.59	49066	31977	31893	31.57	7.70	0.81	-0.03
6/7/2021	WQ3	13:56:58	51.43	6.77	56.5	5.60	49056	31971	31886	31.56	7.70	0.81	-0.03
6/7/2021	WQ3	13:57:00	50.18	6.77	56.7	5.63	49037	31962	31874	31.55	7.70	0.81	-0.02
6/7/2021	WQ3	13:57:01	49.61	6.77	56.8	5.64	49028	31957	31868	31.55	7.70	0.81	-0.02
6/7/2021	WQ3	13:57:03	48.46	6.78	57.1	5.66	49003	31945	31852	31.53	7.71	0.82	-0.01
6/7/2021	WQ3	13:57:05	47.09	6.78	57.3	5.68	48972	31930	31832	31.51	7.71	0.80	-0.02
6/7/2021	WQ3	13:57:06	46.36	6.79	57.4	5.69	48951	31920	31818	31.49	7.71	0.81	-0.02
6/7/2021	WQ3	13:57:07	45.58	6.79	57.5	5.71	48929	31909	31804	31.48	7.71	0.82	-0.02
6/7/2021	WQ3	13:57:09	44.30	6.80	57.8	5.73	48883	31887	31774	31.45	7.71	0.84	-0.02
6/7/2021	WQ3	13:57:11	43.17	6.81	58.1	5.76	48829	31863	31739	31.41	7.72	0.87	-0.02
6/7/2021	WQ3	13:57:13	42.45	6.82	58.4	5.79	48769	31836	31700	31.37	7.72	0.87	-0.02

Date	Site	Time	Depth (m)	Temp (°C)	DO (%)	DO (mg/L)	SPC (µS/cm)	C (µS/cm)	TDS (mg/L)	SAL (ppt)	pH	Turbidity (NTU)	Chl (RFU)
6/7/2021	WQ3	13:57:14	41.48	6.83	58.5	5.81	48740	31823	31681	31.35	7.72	0.88	-0.02
6/7/2021	WQ3	13:57:15	40.76	6.84	58.7	5.82	48705	31808	31658	31.33	7.72	0.88	-0.02
6/7/2021	WQ3	13:57:18	39.45	6.86	59.3	5.88	48597	31761	31588	31.25	7.73	0.89	-0.03
6/7/2021	WQ3	13:57:20	38.04	6.88	59.8	5.93	48526	31730	31542	31.20	7.73	0.92	-0.03
6/7/2021	WQ3	13:57:21	37.49	6.89	60.0	5.95	48488	31713	31517	31.18	7.74	0.93	-0.02
6/7/2021	WQ3	13:57:23	36.70	6.90	60.5	6.00	48422	31684	31474	31.13	7.74	0.91	-0.03
6/7/2021	WQ3	13:57:25	35.10	6.92	60.9	6.04	48364	31658	31437	31.09	7.74	0.89	-0.03
6/7/2021	WQ3	13:57:26	34.39	6.92	61.2	6.07	48338	31646	31420	31.08	7.75	0.87	-0.04
6/7/2021	WQ3	13:57:28	33.55	6.93	61.7	6.12	48290	31623	31388	31.04	7.75	0.86	-0.04
6/7/2021	WQ3	13:57:29	32.37	6.93	61.9	6.14	48273	31615	31378	31.03	7.75	0.86	-0.04
6/7/2021	WQ3	13:57:30	31.49	6.94	62.1	6.16	48261	31609	31370	31.03	7.75	0.85	-0.04
6/7/2021	WQ3	13:57:31	30.65	6.94	62.3	6.18	48247	31602	31360	31.02	7.76	0.86	-0.03
6/7/2021	WQ3	13:57:33	30.01	6.94	62.7	6.22	48217	31587	31341	30.99	7.76	0.84	-0.04
6/7/2021	WQ3	13:57:34	28.62	6.95	62.9	6.24	48203	31581	31332	30.99	7.76	0.84	-0.04
6/7/2021	WQ3	13:57:36	27.15	6.95	63.3	6.28	48166	31564	31308	30.96	7.76	0.83	-0.04
6/7/2021	WQ3	13:57:38	26.58	6.97	63.6	6.31	48116	31541	31276	30.93	7.77	0.83	-0.03
6/7/2021	WQ3	13:57:39	25.14	6.97	63.8	6.33	48089	31528	31258	30.91	7.77	0.84	-0.03
6/7/2021	WQ3	13:57:40	24.41	6.98	64.0	6.34	48061	31515	31240	30.89	7.77	0.85	-0.03
6/7/2021	WQ3	13:57:41	23.83	6.98	64.1	6.36	48025	31497	31216	30.86	7.77	0.87	-0.03
6/7/2021	WQ3	13:57:43	22.14	7.00	64.5	6.39	47950	31462	31168	30.81	7.77	0.90	-0.03
6/7/2021	WQ3	13:57:44	21.45	7.01	64.6	6.41	47903	31438	31137	30.78	7.77	0.94	-0.03
6/7/2021	WQ3	13:57:45	20.61	7.02	64.8	6.43	47822	31399	31084	30.73	7.77	0.99	-0.03
6/7/2021	WQ3	13:57:47	19.03	7.07	65.3	6.47	47588	31286	30932	30.56	7.78	1.11	-0.03
6/7/2021	WQ3	13:57:48	18.24	7.10	65.5	6.50	47437	31214	30834	30.46	7.78	1.17	-0.03
6/7/2021	WQ3	13:57:49	17.25	7.13	65.8	6.53	47254	31127	30715	30.33	7.78	1.24	-0.02
6/7/2021	WQ3	13:57:51	16.44	7.22	69.4	6.88	46816	30917	30430	30.03	7.79	1.39	-0.02
6/7/2021	WQ3	13:57:52	14.75	7.28	70.0	6.94	46582	30806	30279	29.87	7.79	1.45	-0.01
6/7/2021	WQ3	13:57:54	13.02	7.39	71.0	7.05	46022	30538	29914	29.49	7.80	1.55	0
6/7/2021	WQ3	13:57:55	12.78	7.45	71.3	7.06	45702	30383	29706	29.27	7.81	1.59	0
6/7/2021	WQ3	13:57:56	11.25	7.52	71.6	7.10	45397	30231	29508	29.06	7.81	1.63	0.01
6/7/2021	WQ3	13:57:57	10.38	7.58	71.9	7.13	41959	27997	27273	26.64	7.82	1.68	0.02
6/7/2021	WQ3	13:57:58	9.46	7.65	72.3	7.30	40702	27210	26457	25.77	7.82	1.72	0.04
6/7/2021	WQ3	13:58:00	7.78	7.81	73.0	7.42	38571	25900	25071	24.30	7.95	1.77	0.08
6/7/2021	WQ3	13:58:01	6.75	7.88	73.4	7.46	37817	25453	24581	23.79	7.97	1.78	0.12
6/7/2021	WQ3	13:58:03	5.42	8.05	78.5	8.16	30572	20674	19872	18.85	7.98	1.77	0.26
6/7/2021	WQ4	15:36:21	65.90	6.72	56.7	5.63	49250	32058	32012	31.69	7.67	-	-
6/7/2021	WQ4	15:36:25	64.60	6.72	56.6	5.61	49342	32114	32072	31.76	7.67	1.53	-
6/7/2021	WQ4	15:36:27	63.05	6.72	56.5	5.60	49365	32130	32087	31.77	7.67	1.34	-0.01
6/7/2021	WQ4	15:36:29	62.08	6.72	56.5	5.60	49361	32129	32084	31.77	7.67	1.25	-0.02
6/7/2021	WQ4	15:36:31	61.56	6.73	56.5	5.60	49332	32115	32066	31.75	7.67	1.18	-0.02
6/7/2021	WQ4	15:36:33	59.93	6.73	56.5	5.60	49289	32092	32038	31.72	7.67	0.98	-0.02
6/7/2021	WQ4	15:36:35	58.82	6.74	56.6	5.61	49246	32070	32010	31.69	7.67	0.82	-0.02
6/7/2021	WQ4	15:36:38	57.06	6.75	56.7	5.63	49182	32038	31969	31.65	7.68	0.78	-0.02
6/7/2021	WQ4	15:36:39	56.43	6.75	56.8	5.63	49164	32029	31956	31.64	7.68	0.76	-0.03
6/7/2021	WQ4	15:36:42	54.95	6.76	57.0	5.65	49111	32003	31922	31.60	7.68	0.81	-0.03
6/7/2021	WQ4	15:36:43	54.26	6.76	57.1	5.66	49091	31993	31909	31.59	7.68	0.80	-0.03
6/7/2021	WQ4	15:36:44	53.71	6.77	57.1	5.67	49076	31985	31899	31.58	7.68	0.80	-0.04
6/7/2021	WQ4	15:36:45	53.63	6.77	57.2	5.68	49059	31976	31889	31.57	7.68	0.81	-0.04
6/7/2021	WQ4	15:36:47	52.55	6.77	57.4	5.69	49032	31962	31871	31.55	7.68	0.80	-0.04
6/7/2021	WQ4	15:36:50	51.51	6.78	57.6	5.72	48997	31944	31848	31.52	7.69	0.77	-0.04
6/7/2021	WQ4	15:36:51	50.59	6.78	57.7	5.73	48985	31938	31840	31.52	7.69	0.77	-0.03
6/7/2021	WQ4	15:36:52	49.76	6.78	57.8	5.73	48974	31932	31833	31.51	7.69	0.76	-0.04
6/7/2021	WQ4	15:36:54	48.56	6.78	58.0	5.75	48956	31923	31821	31.50	7.69	0.75	-0.04
6/7/2021	WQ4	15:36:56	46.87	6.79	58.1	5.77	48939	31914	31811	31.49	7.69	0.73	-0.03
6/7/2021	WQ4	15:36:57	46.23	6.79	58.2	5.78	48921	31905	31798	31.47	7.69	0.73	-0.03
6/7/2021	WQ4	15:36:59	45.46	6.80	58.4	5.80	48876	31883	31770	31.44	7.70	0.73	-0.04
6/7/2021	WQ4	15:37:01	44.07	6.81	58.7	5.82	48816	31853	31730	31.40	7.70	0.72	-0.04
6/7/2021	WQ4	15:37:02	42.94	6.81	58.8	5.83	48786	31839	31711	31.38	7.70	0.73	-0.05
6/7/2021	WQ4	15:37:04	42.48	6.83	59.1	5.86	48720	31808	31668	31.34	7.70	0.74	-0.04
6/7/2021	WQ4	15:37:05	41.14	6.83	59.2	5.88	48687	31792	31646	31.31	7.70	0.75	-0.04
6/7/2021	WQ4	15:37:06	40.39	6.84	59.4	5.89	48657	31778	31627	31.29	7.71	0.75	-0.04
6/7/2021	WQ4	15:37:09	39.08	6.86	59.9	5.94	48567	31736	31569	31.23	7.71	0.76	-0.04
6/7/2021	WQ4	15:37:10	37.66	6.86	60.1	5.96	48551	31728	31558	31.22	7.71	0.75	-0.04
6/7/2021	WQ4	15:37:12	36.65	6.87	60.4	6.00	48524	31716	31541	31.20	7.71	0.73	-0.04
6/7/2021	WQ4	15:37:14	35.96	6.87	60.7	6.03	48511	31710	31532	31.19	7.72	0.74	-0.03
6/7/2021	WQ4	15:37:15	34.54	6.87	60.9	6.04	48505	31707	31528	31.19	7.72	0.75	-0.03
6/7/2021	WQ4	15:37:17	33.34	6.87	61.1	6.07	48485	31697	31516	31.18	7.72	0.73	-0.03
6/7/2021	WQ4	15:37:19	32.62	6.88	61.4	6.09	48465	31688	31503	31.16	7.72	0.72	-0.03
6/7/2021	WQ4	15:37:20	31.06	6.88	61.5	6.10	48456	31683	31496	31.16	7.73	0.70	-0.03
6/7/2021	WQ4	15:37:21	30.53	6.88	61.6	6.11	48446	31678	31490	31.15	7.73	0.70	-0.04
6/7/2021	WQ4	15:37:23	29.59	6.88	61.9	6.14	48420	31666	31473	31.13	7.73	0.70	-0.03
6/7/2021	WQ4	15:37:24	28.42	6.89	62.0	6.15	48404	31658	31463	31.12	7.73	0.70	-0.04
6/7/2021	WQ4	15:37:26	27.18	6.89	62.2	6.17	48376	31645	31444	31.10	7.73	0.70	-0.04
6/7/2021	WQ4	15:37:28	26.37	6.90	62.4	6.20	48348	31631	31426	31.09	7.73	0.69	-0.04
6/7/2021	WQ4	15:37:29	25.15	6.90	62.6	6.21	48337	31626	31419	31.08	7.73	0.68	-0.03
6/7/2021	WQ4	15:37:30	24.56	6.90	62.7	6.22	48326	31621	31412	31.07	7.73	0.68	-0.03
6/7/2021	WQ4	15:37:32	23.44	6.91	62.9	6.24	48265	31591	31373	31.03	7.73	0.71	-0.02
6/7/2021	WQ4	15:37:34	21.55	6.95	63.2	6.27	48104	31516	31268	30.92	7.74	0.76	-0.02
6/7/2021	WQ4	15:37:36	20.23	7.00	63.5	6.30	47839	31392	31095	30.74	7.74	0.84	-0.02
6/7/2021	WQ4	15:37:38	18.68	7.07	64.0	6.35	47530	31249	30895	30.52	7.75	0.91	-0.02
6/7/2021	WQ4	15:37:40	17.54	7.14	64.5	6.40	47175	31084	30663	30.28	7.75	1.00	-0.02
6/7/2021	WQ4	15:37:42	16.72	7.23	68.2	6.77	46782	30901	30408	30.01	7.76	1.12	-0.02
6/7/2021	WQ4	15:37:43	15.13	7.28	68.8	6.82	46591	30812	30284	29.88	7.77	1.16	-0.02
6/7/2021	WQ4	15:37:44	14.43	7.32	69.4	6.88	46370	30709	30141	29.73	7.77	1.20	-0.02
6/7/2021	WQ4	15:37:45	13.59	7.37	69.6	6.90	46174	30616	30013	29.59	7.77	1.25	-0.01
6/7/2021	WQ4	15:37:47	11.92	7.46	70.3	6.97	45716	30392	29715	29.28	7.78	1.33	0
6/7/2021	WQ4	15:37:48	11.12	7.50	70.6	7.00	45487	30280	29567	29.12	7.79	1.36	0.01
6/7/2021	WQ4	15:37:49	10.28	7.54	70.9	7.03	45309	30193	29451	29.00	7.80	1.38	0.02
6/7/2021	WQ4	15:37:50	9.96	7.57	71.1	7.05	45114	30096	29324	28.86	7.80	1.41	0.02
6/7/2021	WQ4	15:37:51	8.77	7.61	71.4	7.07	44946	30013	29215	28.75	7.81	1.42	0.02

Date	Site	Time	Depth (m)	Temp (°C)	DO (%)	DO (mg/L)	SPC (µS/cm)	C (µS/cm)	TDS (mg/L)	SAL (ppt)	pH	Turbidity (NTU)	Chl (RFU)
6/7/2021	WQ4	15:37:52	7.81	7.64	71.6	7.10	44724	29896	29071	28.59	7.81	1.43	0.03
6/7/2021	WQ4	15:37:53	6.82	7.69	71.8	7.26	39409	26373	25616	24.88	7.82	1.44	0.06
6/7/2021	WQ4	15:37:55	5.91	9.21	77.7	8.07	30119	20990	19578	18.59	8.00	1.44	0.18
6/7/2021	WQ4	15:37:56	4.21	9.87	78.1	7.95	24056	17104	15636	14.57	8.09	1.48	0.35
6/7/2021	WQ4	15:37:57	3.31	10.39	78.9	8.09	21089	15191	13708	12.64	8.15	1.64	0.6
6/7/2021	WQ4	15:37:59	2.12	10.11	81.3	8.49	19281	13801	12532	11.47	8.24	2.06	3.1
6/7/2021	WQ4	15:38:00	0.84	10.06	85.7	8.98	19064	13623	12392	11.33	8.26	2.34	1.44
6/7/2021	WQ4	15:38:01	0.28	10.05	87.5	9.18	18855	13471	12256	11.19	8.27	2.64	1.75
6/7/2021	WQ5	13:36:48	67.71	6.76	55.0	5.45	49289	32117	32038	31.72	7.68	0.78	-0.03
6/7/2021	WQ5	13:36:50	66.30	6.77	55.2	5.47	49198	32068	31979	31.66	7.69	0.61	-0.02
6/7/2021	WQ5	13:36:54	65.57	6.78	55.8	5.53	49086	32006	31906	31.58	7.69	0.49	-0.03
6/7/2021	WQ5	13:36:56	64.30	6.79	56.1	5.56	49046	31983	31880	31.55	7.70	0.47	-0.03
6/7/2021	WQ5	13:36:58	63.44	6.79	56.4	5.59	49018	31968	31862	31.53	7.70	0.47	-0.03
6/7/2021	WQ5	13:37:01	62.36	6.79	56.8	5.63	48981	31946	31837	31.51	7.70	0.50	-0.03
6/7/2021	WQ5	13:37:03	61.52	6.80	57.1	5.66	48956	31933	31821	31.49	7.71	0.48	-0.03
6/7/2021	WQ5	13:37:09	60.15	6.80	57.8	5.74	48904	31905	31787	31.46	7.71	0.47	-0.03
6/7/2021	WQ5	13:37:11	59.48	6.80	58.1	5.76	48891	31899	31779	31.45	7.71	0.46	-0.03
6/7/2021	WQ5	13:37:14	58.19	6.81	58.4	5.79	48870	31888	31766	31.43	7.71	0.47	-0.03
6/7/2021	WQ5	13:37:16	57.45	6.81	58.6	5.81	48859	31882	31758	31.43	7.71	0.45	-0.03
6/7/2021	WQ5	13:37:20	56.57	6.81	58.9	5.85	48837	31870	31744	31.41	7.72	0.50	-0.03
6/7/2021	WQ5	13:37:22	55.53	6.81	59.1	5.86	48825	31863	31736	31.40	7.72	0.53	-0.03
6/7/2021	WQ5	13:37:26	54.54	6.82	59.4	5.89	48802	31853	31721	31.39	7.72	0.59	-0.03
6/7/2021	WQ5	13:37:29	53.68	6.82	59.6	5.92	48791	31849	31714	31.38	7.72	0.61	-0.03
6/7/2021	WQ5	13:37:32	52.59	6.82	59.8	5.94	48776	31842	31704	31.37	7.72	0.62	-0.03
6/7/2021	WQ5	13:37:35	51.01	6.83	60.0	5.95	48750	31830	31688	31.35	7.72	0.61	-0.03
6/7/2021	WQ5	13:37:37	50.31	6.83	60.1	5.97	48731	31820	31675	31.34	7.72	0.61	-0.03
6/7/2021	WQ5	13:37:39	49.66	6.83	60.3	5.98	48712	31810	31662	31.33	7.72	0.61	-0.04
6/7/2021	WQ5	13:37:40	48.64	6.84	60.3	5.99	48702	31805	31656	31.32	7.72	0.60	-0.04
6/7/2021	WQ5	13:37:43	47.56	6.84	60.5	6.00	48672	31791	31637	31.30	7.73	0.58	-0.04
6/7/2021	WQ5	13:37:45	46.86	6.85	60.6	6.02	48653	31783	31625	31.29	7.73	0.58	-0.04
6/7/2021	WQ5	13:37:47	45.30	6.85	60.8	6.03	48639	31777	31615	31.28	7.73	0.60	-0.03
6/7/2021	WQ5	13:37:50	44.34	6.86	60.9	6.05	48615	31767	31599	31.26	7.73	0.63	-0.03
6/7/2021	WQ5	13:37:52	43.21	6.86	61.1	6.06	48593	31757	31585	31.25	7.73	0.62	-0.03
6/7/2021	WQ5	13:37:54	42.36	6.87	61.2	6.07	48564	31744	31567	31.23	7.73	0.62	-0.03
6/7/2021	WQ5	13:37:58	41.67	6.88	61.5	6.11	48479	31698	31511	31.17	7.74	0.60	-0.02
6/7/2021	WQ5	13:37:59	40.68	6.88	61.6	6.11	48456	31686	31497	31.15	7.74	0.58	-0.02
6/7/2021	WQ5	13:38:02	39.52	6.89	61.9	6.15	48398	31653	31459	31.11	7.74	0.55	-0.02
6/7/2021	WQ5	13:38:04	38.35	6.89	62.2	6.17	48360	31632	31434	31.09	7.74	0.54	-0.02
6/7/2021	WQ5	13:38:06	37.15	6.89	62.4	6.19	48328	31615	31413	31.07	7.74	0.54	-0.02
6/7/2021	WQ5	13:38:08	36.91	6.90	62.6	6.21	48303	31603	31397	31.05	7.75	0.54	-0.02
6/7/2021	WQ5	13:38:10	35.36	6.91	62.9	6.24	48277	31592	31380	31.03	7.75	0.59	-0.03
6/7/2021	WQ5	13:38:13	34.53	6.93	63.2	6.27	48203	31562	31332	30.98	7.75	0.65	-0.04
6/7/2021	WQ5	13:38:15	33.22	6.94	63.5	6.30	48142	31536	31293	30.94	7.76	0.71	-0.04
6/7/2021	WQ5	13:38:17	32.22	6.96	63.7	6.32	48078	31508	31251	30.90	7.76	0.74	-0.04
6/7/2021	WQ5	13:38:19	31.68	6.97	64.0	6.35	48013	31481	31209	30.85	7.76	0.74	-0.04
6/7/2021	WQ5	13:38:21	30.03	6.99	64.4	6.39	47949	31452	31167	30.81	7.77	0.75	-0.04
6/7/2021	WQ5	13:38:22	29.69	7.00	64.5	6.40	47919	31440	31148	30.79	7.77	0.76	-0.04
6/7/2021	WQ5	13:38:25	28.74	7.01	65.1	6.45	47854	31413	31105	30.74	7.77	0.77	-0.03
6/7/2021	WQ5	13:38:26	27.62	7.02	65.3	6.47	47834	31404	31092	30.73	7.77	0.76	-0.03
6/7/2021	WQ5	13:38:29	26.22	7.04	65.8	6.53	47731	31358	31025	30.66	7.78	0.77	-0.03
6/7/2021	WQ5	13:38:30	25.88	7.05	66.0	6.54	47688	31339	30997	30.63	7.78	0.77	-0.03
6/7/2021	WQ5	13:38:31	24.69	7.06	66.2	6.56	47646	31321	30970	30.60	7.78	0.79	-0.03
6/7/2021	WQ5	13:38:33	23.44	7.08	66.6	6.60	47554	31280	30910	30.54	7.79	0.83	-0.03
6/7/2021	WQ5	13:38:35	22.72	7.11	66.9	6.63	47447	31232	30841	30.47	7.79	0.85	-0.03
6/7/2021	WQ5	13:38:36	21.36	7.13	67.1	6.65	47360	31191	30784	30.41	7.79	0.88	-0.03
6/7/2021	WQ5	13:38:37	20.63	7.15	67.3	6.67	47265	31146	30722	30.34	7.80	0.90	-0.03
6/7/2021	WQ5	13:38:39	19.67	7.21	67.8	6.72	47000	31021	30550	30.16	7.80	0.96	-0.02
6/7/2021	WQ5	13:38:41	17.83	7.28	68.3	6.77	46629	30843	30309	29.90	7.81	1.01	0
6/7/2021	WQ5	13:38:43	16.48	7.38	69.0	6.84	46146	30608	29995	29.57	7.81	1.08	0.01
6/7/2021	WQ5	13:38:45	14.84	7.49	72.8	7.22	45581	30330	29628	29.18	7.82	1.17	0.02
6/7/2021	WQ5	13:38:47	13.42	7.61	73.6	7.29	44974	30027	29233	28.76	7.83	1.24	0.04
6/7/2021	WQ5	13:38:49	12.69	7.72	74.0	7.34	44379	29726	28846	28.35	7.84	1.32	0.05
6/7/2021	WQ5	13:38:50	11.16	7.77	74.3	7.37	44036	29545	28623	28.12	7.85	1.35	0.06
6/7/2021	WQ5	13:38:51	10.53	7.83	74.5	7.39	41256	27721	26816	26.17	7.85	1.38	0.06
6/7/2021	WQ5	13:38:53	9.56	7.95	75.0	7.52	40645	27399	26420	25.75	7.86	1.37	0.09
6/7/2021	WQ5	13:38:54	8.07	7.99	75.3	7.56	39894	26934	25931	25.23	7.87	1.35	0.1
6/7/2021	WQ5	13:38:55	7.17	8.04	75.5	7.59	39324	26581	25560	24.84	7.87	1.37	0.12
6/7/2021	WQ5	13:38:56	6.39	8.09	75.8	7.72	35818	24246	23282	22.42	7.98	1.41	0.16
6/7/2021	WQ5	13:38:58	4.59	8.21	80.3	8.31	30220	20529	19643	18.62	8.04	1.53	0.27
6/7/2021	WQ5	13:38:59	3.88	8.30	81.4	8.53	26190	17831	17023	15.94	8.09	1.65	0.42
6/7/2021	WQ5	13:39:01	2.53	9.55	83.1	8.92	21888	14989	14227	13.12	8.15	2.12	0.93
6/7/2021	WQ5	13:39:02	1.09	9.73	83.8	8.80	20850	14770	13552	12.47	8.18	2.37	2.37
6/7/2021	WQ6	12:27:06	68.95	6.76	54.3	5.38	49551	32283	32208	31.91	7.67	-	-0.01
6/7/2021	WQ6	12:27:12	67.60	6.77	54.4	5.38	49534	32283	32197	31.90	7.67	0.51	-0.03
6/7/2021	WQ6	12:27:18	66.46	6.78	54.7	5.41	49451	32243	32143	31.84	7.68	0.37	-0.03
6/7/2021	WQ6	12:27:22	65.08	6.79	54.9	5.44	49401	32217	32111	31.81	7.68	0.30	-0.03
6/7/2021	WQ6	12:27:24	64.66	6.79	55.0	5.45	49373	32202	32092	31.79	7.68	0.26	-0.03
6/7/2021	WQ6	12:27:27	63.75	6.80	55.2	5.47	49341	32186	32072	31.76	7.68	0.25	-0.03
6/7/2021	WQ6	12:27:29	62.51	6.80	55.3	5.48	49316	32172	32055	31.75	7.68	0.24	-0.03
6/7/2021	WQ6	12:27:32	61.61	6.80	55.5	5.50	49272	32147	32027	31.72	7.68	0.23	-0.03
6/7/2021	WQ6	12:27:33	60.60	6.80	55.6	5.50	49254	32137	32015	31.71	7.68	0.20	-0.04
6/7/2021	WQ6	12:27:36	59.29	6.81	55.7	5.52	49200	32105	31980	31.67	7.69	0.18	-0.03
6/7/2021	WQ6	12:27:38	58.75	6.81	55.9	5.53	49158	32079	31952	31.64	7.69	0.19	-0.03
6/7/2021	WQ6	12:27:40	57.11	6.81	56.0	5.55	49117	32055	31926	31.61	7.69	0.20	-0.03
6/7/2021	WQ6	12:27:41	56.57	6.81	56.1	5.56	49100	32044	31915	31.60	7.69	0.20	-0.03
6/7/2021	WQ6	12:27:45	55.87	6.81	56.3	5.58	49049	32012	31882	31.56	7.69	0.22	-0.03
6/7/2021	WQ6	12:27:46	54.51	6.81	56.4	5.59	49039	32005	31875	31.56	7.69	0.21	-0.03
6/7/2021	WQ6	12:27:50	53.57	6.81	56.7	5.62	49003	31980	31852	31.53	7.69	0.22	-0.04
6/7/2021	WQ6	12:27:51	52.64	6.81	56.7	5.63	48995	31974	31847	31.53	7.69	0.22	-0.04

Date	Site	Time	Depth (m)	Temp (°C)	DO (%)	DO (mg/L)	SPC (µS/cm)	C (µS/cm)	TDS (mg/L)	SAL (ppt)	pH	Turbidity (NTU)	Chl (RFU)
6/7/2021	WQ6	12:27:55	51.60	6.81	57.0	5.65	48965	31952	31827	31.50	7.69	0.22	-0.04
6/7/2021	WQ6	12:27:56	50.70	6.81	57.1	5.66	48958	31947	31823	31.50	7.69	0.23	-0.03
6/7/2021	WQ6	12:28:00	49.58	6.81	57.3	5.68	48927	31926	31803	31.48	7.70	0.22	-0.03
6/7/2021	WQ6	12:28:04	48.50	6.81	57.6	5.71	48886	31898	31776	31.45	7.70	0.23	-0.04
6/7/2021	WQ6	12:28:09	47.63	6.81	57.9	5.75	48835	31864	31743	31.41	7.70	0.26	-0.05
6/7/2021	WQ6	12:28:11	46.59	6.80	58.1	5.77	48815	31850	31730	31.40	7.70	0.24	-0.05
6/7/2021	WQ6	12:28:14	45.48	6.80	58.3	5.79	48791	31834	31714	31.38	7.70	0.27	-0.04
6/7/2021	WQ6	12:28:19	44.43	6.81	58.7	5.83	48762	31816	31695	31.36	7.71	0.25	-0.03
6/7/2021	WQ6	12:28:22	43.63	6.81	58.9	5.85	48743	31805	31683	31.35	7.71	0.21	-0.03
6/7/2021	WQ6	12:28:23	42.63	6.81	59.0	5.85	48736	31800	31678	31.34	7.71	0.21	-0.03
6/7/2021	WQ6	12:28:26	41.41	6.81	59.1	5.87	48692	31776	31650	31.31	7.71	0.22	-0.03
6/7/2021	WQ6	12:28:31	40.74	6.83	59.6	5.92	48586	31721	31581	31.24	7.72	0.25	-0.04
6/7/2021	WQ6	12:28:32	39.63	6.83	59.7	5.93	48562	31709	31565	31.22	7.72	0.26	-0.04
6/7/2021	WQ6	12:28:35	38.60	6.84	60.1	5.97	48486	31671	31516	31.17	7.72	0.27	-0.04
6/7/2021	WQ6	12:28:38	37.75	6.86	60.6	6.01	48404	31631	31463	31.12	7.73	0.30	-0.04
6/7/2021	WQ6	12:28:39	36.81	6.86	60.7	6.03	48382	31621	31448	31.10	7.73	0.30	-0.04
6/7/2021	WQ6	12:28:40	36.57	6.87	60.9	6.05	48358	31609	31433	31.08	7.73	0.31	-0.04
6/7/2021	WQ6	12:28:41	36.02	6.87	61.1	6.07	48335	31598	31417	31.07	7.73	0.33	-0.04
6/7/2021	WQ6	12:28:43	35.71	6.88	61.5	6.10	48280	31572	31382	31.03	7.74	0.34	-0.03
6/7/2021	WQ6	12:28:47	33.48	6.92	62.3	6.19	48142	31511	31292	30.94	7.75	0.39	-0.03
6/7/2021	WQ6	12:28:51	32.00	6.96	63.3	6.28	47991	31457	31194	30.83	7.76	0.53	-0.03
6/7/2021	WQ6	12:28:52	31.38	6.98	63.6	6.31	47952	31444	31169	30.81	7.76	0.57	-0.02
6/7/2021	WQ6	12:28:55	30.46	7.02	64.4	6.39	47826	31398	31087	30.72	7.77	0.68	-0.03
6/7/2021	WQ6	12:28:57	29.30	7.05	64.9	6.44	47702	31344	31006	30.64	7.77	0.74	-0.02
6/7/2021	WQ6	12:28:59	28.57	7.08	65.5	6.49	47571	31287	30921	30.55	7.78	0.84	-0.03
6/7/2021	WQ6	12:29:01	27.46	7.11	66.1	6.55	47434	31225	30832	30.46	7.79	0.88	-0.03
6/7/2021	WQ6	12:29:03	26.48	7.14	66.6	6.61	47297	31161	30743	30.36	7.79	0.92	-0.02
6/7/2021	WQ6	12:29:06	25.29	7.18	67.4	6.69	47091	31063	30609	30.22	7.80	0.95	-0.02
6/7/2021	WQ6	12:29:07	24.58	7.19	67.7	6.72	47034	31036	30572	30.18	7.80	0.96	-0.01
6/7/2021	WQ6	12:29:09	23.98	7.22	68.3	6.77	46927	30991	30503	30.11	7.81	0.98	-0.01
6/7/2021	WQ6	12:29:11	22.39	7.26	68.8	6.82	46801	30941	30421	30.02	7.81	1.04	-0.01
6/7/2021	WQ6	12:29:12	21.53	7.28	69.1	6.85	46707	30897	30359	29.96	7.81	1.08	-0.01
6/7/2021	WQ6	12:29:15	19.75	7.36	70.0	6.94	46272	30685	30077	29.66	7.82	1.18	0
6/7/2021	WQ6	12:29:16	19.08	7.40	70.3	6.97	46089	30597	29958	29.53	7.82	1.20	0.01
6/7/2021	WQ6	12:29:18	18.44	7.50	71.1	7.05	45637	30378	29664	29.22	7.83	1.21	0.02
6/7/2021	WQ6	12:29:20	17.02	7.60	71.9	7.12	45135	30126	29338	28.87	7.84	1.25	0.04
6/7/2021	WQ6	12:29:21	16.40	7.66	72.3	7.16	44818	29964	29132	28.66	7.84	1.25	0.05
6/7/2021	WQ6	12:29:23	15.80	7.74	73.1	7.25	44366	29733	28838	28.34	7.85	1.26	0.07
6/7/2021	WQ6	12:29:24	14.50	7.79	73.5	7.29	44038	29561	28625	28.12	7.85	1.26	0.07
6/7/2021	WQ6	12:29:25	13.77	7.82	73.9	7.33	43886	29481	28526	28.01	7.86	1.24	0.07
6/7/2021	WQ6	12:29:27	12.99	7.91	74.7	7.41	43376	29211	28195	27.66	7.87	1.17	0.08
6/7/2021	WQ6	12:29:29	11.45	7.96	75.5	7.49	42926	28952	27902	27.35	7.87	1.04	0.08
6/7/2021	WQ6	12:29:31	10.48	8.02	76.2	7.64	40176	27141	26114	25.43	7.88	0.92	0.08
6/7/2021	WQ6	12:29:34	8.98	8.11	77.2	7.81	38079	25793	24752	23.98	7.90	0.77	0.13
6/7/2021	WQ6	12:29:36	8.00	8.18	77.9	7.88	37590	25511	24433	23.65	7.91	0.64	0.17
6/7/2021	WQ6	12:29:38	7.41	8.26	78.7	7.95	37216	25315	24190	23.39	7.92	0.53	0.22
6/7/2021	WQ6	12:29:39	6.35	8.30	79.0	7.99	37054	25228	24085	23.28	7.92	0.50	0.25
6/7/2021	WQ6	12:29:41	5.39	8.37	79.8	8.07	36689	25035	23848	23.04	7.93	0.43	0.33
6/7/2021	WQ6	12:29:45	3.92	8.53	85.0	8.78	30423	20849	19775	18.77	8.06	0.49	0.64
6/7/2021	WQ6	12:29:47	2.94	8.64	86.4	8.96	29030	19960	18870	17.84	8.11	0.58	1.01
6/7/2021	WQ6	12:29:50	2.33	8.85	87.9	9.30	23323	16124	15160	14.07	8.16	0.97	2.68
6/7/2021	WQ6	12:29:51	1.06	8.93	88.4	9.40	22046	15279	14330	13.23	8.18	1.14	2.49
6/7/2021	WQ6	12:29:52	0.62	9.04	92.6	9.83	21853	15184	14204	13.11	8.32	1.33	1.32
6/7/2021	WQ6	12:29:56	0.27	10.61	96.0	9.89	20129	14598	13084	12.02	8.38	1.95	0.72

Notes: Temp = temperature; DO = dissolved oxygen; SPC = specific conductivity; C = conductivity; TDS = total dissolved solids; SAL = salinity; Chl = chlo

Table G.2-2 CTD Profiles for Water Quality Stations, September 2021

Date	Site	Time	Depth (m)	Temp (°C)	DO (%)	DO (mg/L)	SPC (µS/cm)	C (µS/cm)	SAL (ppt)	pH	Turbidity (NTU)	TSS (mg/L)	Chl (RFU)
9/6/2021	WQ1	17:13:05	64.24	6.86	42.90	4.23	49958	32644	32.21	-4.88	0.15	0.12	-
9/6/2021	WQ1	17:13:06	63.56	6.86	42.90	4.23	49974	32656	32.22	-4.88	0.67	0.26	-
9/6/2021	WQ1	17:13:08	61.48	6.87	42.90	4.23	49944	32645	32.20	-4.88	-0.01	0.10	-
9/6/2021	WQ1	17:13:09	60.69	6.87	42.90	4.23	49945	32653	32.21	-4.88	-0.14	0.09	-
9/6/2021	WQ1	17:13:11	59.48	6.90	43.00	4.24	49905	32648	32.18	-4.88	-0.17	0.09	-
9/6/2021	WQ1	17:13:12	57.97	6.91	43.00	4.24	49905	32659	32.18	-4.88	-0.17	0.09	0.01
9/6/2021	WQ1	17:13:13	57.07	6.92	43.10	4.24	49887	32659	32.17	-4.88	-0.15	0.09	0.00
9/6/2021	WQ1	17:13:14	56.25	6.93	43.10	4.24	49859	32652	32.15	-4.88	-0.16	0.09	-0.01
9/6/2021	WQ1	17:13:16	54.34	6.96	43.20	4.25	49843	32669	32.14	-4.88	-0.23	0.08	-0.01
9/6/2021	WQ1	17:13:17	53.54	6.98	43.30	4.26	49815	32666	32.13	-4.88	-0.26	0.08	-0.01
9/6/2021	WQ1	17:13:19	52.45	7.01	43.40	4.27	49798	32683	32.12	-4.87	-0.29	0.08	-0.01
9/6/2021	WQ1	17:13:20	50.89	7.02	43.50	4.27	49796	32695	32.12	-4.87	-0.29	0.08	-0.01
9/6/2021	WQ1	17:13:21	49.96	7.04	43.60	4.28	49792	32710	32.12	-4.87	-0.30	0.08	0.00
9/6/2021	WQ1	17:13:23	48.69	7.09	43.80	4.30	49760	32742	32.10	-4.87	-0.32	0.08	0.00
9/6/2021	WQ1	17:13:24	47.34	7.14	43.90	4.30	49720	32752	32.08	-4.87	-0.35	0.07	0.00
9/6/2021	WQ1	17:13:25	46.40	7.18	44.00	4.32	49689	32778	32.06	-4.87	-0.37	0.07	0.00
9/6/2021	WQ1	17:13:26	45.66	7.22	44.20	4.33	49662	32796	32.05	-4.87	-0.39	0.07	-0.01
9/6/2021	WQ1	17:13:28	43.96	7.32	44.50	4.35	49576	32830	31.99	-4.86	-0.46	0.07	0.00
9/6/2021	WQ1	17:13:30	42.28	7.44	45.00	4.39	49442	32848	31.91	-4.86	-0.49	0.07	0.00
9/6/2021	WQ1	17:13:31	41.67	7.49	45.20	4.40	49385	32869	31.88	-4.85	-0.51	0.07	0.00
9/6/2021	WQ1	17:13:32	40.45	7.55	45.50	4.42	49319	32877	31.83	-4.85	-0.49	0.07	0.00
9/6/2021	WQ1	17:13:33	39.63	7.61	45.70	4.44	49241	32883	31.79	-4.85	-0.51	0.07	0.01
9/6/2021	WQ1	17:13:34	38.62	7.67	46.00	4.47	49170	32883	31.74	-4.85	-0.51	0.07	0.02
9/6/2021	WQ1	17:13:36	36.77	7.74	46.50	4.51	49040	32869	31.65	-4.84	-0.54	0.07	0.02
9/6/2021	WQ1	17:13:38	35.13	7.79	47.00	4.55	48948	32852	31.59	-4.84	-0.58	0.07	0.01
9/6/2021	WQ1	17:13:40	34.53	7.85	47.40	4.59	48836	32835	31.52	-4.84	-0.55	0.07	0.02
9/6/2021	WQ1	17:13:41	33.36	7.87	47.70	4.61	48795	32829	31.49	-4.84	-0.57	0.07	0.02
9/6/2021	WQ1	17:13:42	32.65	7.89	47.90	4.63	48777	32833	31.48	-4.84	-0.58	0.07	0.02
9/6/2021	WQ1	17:13:44	31.69	7.94	48.30	4.67	48724	32841	31.45	-4.84	-0.56	0.07	0.01
9/6/2021	WQ1	17:13:46	30.20	8.00	48.70	4.70	48665	32861	31.41	-4.83	-0.57	0.07	0.01
9/6/2021	WQ1	17:13:47	29.50	8.03	49.00	4.72	48631	32870	31.39	-4.83	-0.62	0.07	-0.01
9/6/2021	WQ1	17:13:49	28.38	8.10	49.40	4.76	48566	32892	31.35	-4.83	-0.64	0.07	0.00
9/6/2021	WQ1	17:13:51	26.82	8.17	49.90	4.80	48502	32914	31.31	-4.83	-0.65	0.07	0.00
9/6/2021	WQ1	17:13:52	26.23	8.21	50.10	4.82	48473	32921	31.30	-4.82	-0.67	0.07	0.00
9/6/2021	WQ1	17:13:54	25.07	8.27	50.50	4.85	48427	32945	31.27	-4.82	-0.70	0.07	0.01
9/6/2021	WQ1	17:13:55	24.79	8.30	50.70	4.87	48412	32967	31.26	-4.82	-0.71	0.07	0.01
9/6/2021	WQ1	17:13:56	23.45	8.33	50.90	4.89	48378	32972	31.24	-4.82	-0.72	0.07	0.01
9/6/2021	WQ1	17:13:58	22.02	8.39	51.40	4.92	48296	32967	31.18	-4.82	-0.73	0.07	0.02
9/6/2021	WQ1	17:13:59	21.75	8.41	51.50	4.94	48239	32957	31.15	-4.82	-0.74	0.07	0.03
9/6/2021	WQ1	17:14:00	20.64	8.44	51.70	4.95	48180	32941	31.11	-4.81	-0.75	0.07	0.03
9/6/2021	WQ1	17:14:02	19.16	8.52	52.20	4.99	48031	32903	31.01	-4.81	-0.73	0.07	0.05
9/6/2021	WQ1	17:14:04	18.30	8.60	52.70	5.04	47793	32818	30.84	-4.81	-0.71	0.07	0.06
9/6/2021	WQ1	17:14:05	17.08	8.65	53.00	5.07	47653	32767	30.75	-4.81	-0.72	0.07	0.09
9/6/2021	WQ1	17:14:06	16.30	8.70	53.30	5.10	47501	32703	30.64	-4.80	-0.72	0.07	0.10
9/6/2021	WQ1	17:14:07	15.49	8.74	53.60	5.12	47319	32626	30.52	-4.80	-0.72	0.07	0.12
9/6/2021	WQ1	17:14:09	13.86	8.85	54.30	5.18	46917	32440	30.24	-4.80	-0.70	0.07	0.17
9/6/2021	WQ1	17:14:11	12.49	8.95	55.00	5.25	46443	32204	29.91	-4.79	-0.69	0.07	0.22
9/6/2021	WQ1	17:14:12	11.84	9.01	55.40	5.29	46195	32081	29.74	-4.79	-0.69	0.07	0.25
9/6/2021	WQ1	17:14:13	11.62	9.07	58.90	5.62	45881	31922	29.52	-4.79	-0.69	0.07	0.30
9/6/2021	WQ1	17:14:14	10.29	9.13	59.50	5.68	45614	31784	29.33	-4.79	-0.67	0.07	0.35
9/6/2021	WQ1	17:14:15	9.71	9.19	60.30	5.75	45309	31626	29.12	-4.78	-0.67	0.07	0.35
9/6/2021	WQ1	17:14:16	9.06	9.26	60.60	5.78	45063	31505	28.95	-4.78	-0.65	0.07	0.39
9/6/2021	WQ1	17:14:18	8.84	9.41	61.50	5.86	44451	31210	28.52	-4.77	-0.62	0.07	0.45
9/6/2021	WQ1	17:14:19	7.40	9.45	61.80	5.89	44229	31096	28.37	-4.77	-0.61	0.07	0.51
9/6/2021	WQ1	17:14:20	6.76	9.52	62.20	5.92	43959	30954	28.18	-4.77	-0.59	0.07	0.53
9/6/2021	WQ1	17:14:22	5.94	10.96	66.40	6.29	37828	27675	23.94	-4.72	-0.55	0.07	0.54
9/6/2021	WQ1	17:14:23	4.56	11.06	68.00	6.46	36782	26985	23.22	-4.71	-0.50	0.07	0.58
9/6/2021	WQ1	17:14:25	3.26	11.17	71.10	6.79	32937	24234	20.57	-4.70	-0.32	0.08	0.60
9/6/2021	WQ1	17:14:27	2.34	11.26	73.40	7.10	31522	23250	19.61	-4.70	-0.06	0.09	0.61
9/6/2021	WQ1	17:14:28	0.99	11.27	77.90	7.56	30996	22868	19.25	-4.70	0.09	0.11	0.62
9/6/2021	WQ1	17:14:29	0.53	11.30	80.20	7.79	30486	22505	18.91	-1.48	0.26	0.13	0.66
9/6/2021	WQ3	16:42:31	83.27	6.71	42.00	4.15	50276	32709	32.41	-4.89	-0.44	0.07	-0.01
9/6/2021	WQ3	16:42:35	82.96	6.72	42.00	4.14	50265	32716	32.41	-4.89	-0.46	0.07	-0.01
9/6/2021	WQ3	16:42:37	81.37	6.73	42.00	4.14	50256	32719	32.40	-4.89	-0.45	0.07	0.00
9/6/2021	WQ3	16:42:38	80.65	6.74	42.00	4.14	50268	32731	32.41	-4.89	-0.45	0.07	0.00
9/6/2021	WQ3	16:42:41	79.72	6.76	42.00	4.15	50203	32707	32.37	-4.89	-0.49	0.07	0.00
9/6/2021	WQ3	16:42:42	77.84	6.76	42.00	4.15	50170	32693	32.35	-4.88	-0.49	0.07	0.01
9/6/2021	WQ3	16:42:43	77.21	6.77	42.10	4.15	50147	32685	32.33	-4.88	-0.48	0.07	0.01
9/6/2021	WQ3	16:42:45	76.38	6.78	42.10	4.16	50156	32704	32.34	-4.88	-0.48	0.07	0.01
9/6/2021	WQ3	16:42:46	75.99	6.79	42.20	4.16	50118	32686	32.31	-4.88	-0.49	0.07	0.01
9/6/2021	WQ3	16:42:47	74.45	6.80	42.20	4.17	50117	32692	32.31	-4.88	-0.49	0.07	0.00
9/6/2021	WQ3	16:42:49	73.33	6.81	42.30	4.17	50063	32670	32.28	-4.88	-0.48	0.07	0.00
9/6/2021	WQ3	16:42:51	72.68	6.83	42.40	4.18	50015	32653	32.25	-4.88	-0.49	0.07	-0.01
9/6/2021	WQ3	16:42:53	70.87	6.84	42.50	4.19	50034	32675	32.26	-4.88	-0.47	0.07	-0.01
9/6/2021	WQ3	16:42:54	70.24	6.84	42.50	4.20	50024	32674	32.25	-4.88	-0.46	0.07	-0.01
9/6/2021	WQ3	16:42:55	69.58	6.85	42.60	4.20	49994	32660	32.23	-4.88	-0.47	0.07	-0.02
9/6/2021	WQ3	16:42:57	68.39	6.86	42.70	4.21	49968	32653	32.22	-4.88	-0.48	0.07	-0.02
9/6/2021	WQ3	16:42:59	67.10	6.87	42.80	4.22	49934	32641	32.19	-4.88	-0.49	0.07	-0.02
9/6/2021	WQ3	16:43:01	66.24	6.88	42.90	4.22	49930	32649	32.19	-4.88	-0.50	0.07	-0.02
9/6/2021	WQ3	16:43:03	64.15	6.89	42.90	4.23	49894	32634	32.17	-4.88	-0.51	0.07	-0.01
9/6/2021	WQ3	16:43:04	63.37	6.89	43.00	4.24	49897	32640	32.17	-4.88	-0.52	0.07	-0.02
9/6/2021	WQ3	16:43:06	62.52	6.90	43.10	4.24	49874	32633	32.16	-4.88	-0.52	0.07	-0.01
9/6/2021	WQ3	16:43:07	61.24	6.90	43.10	4.25	49871	32634	32.16	-4.88	-0.52	0.07	-0.01
9/6/2021	WQ3	16:43:08	60.36	6.91	43.10	4.25	49895	32653	32.17	-4.88	-0.53	0.07	-0.01
9/6/2021	WQ3	16:43:09	59.48	6.91	43.20	4.25	49890	32653	32.17	-4.88	-0.51	0.07	0.01
9/6/2021	WQ3	16:43:11	57.96	6.92	43.20	4.26	49896	32665	32.18	-4.88	-0.46	0.07	0.01
9/6/2021	WQ3	16:43:12	57.43	6.92	43.30	4.26	49870	32651	32.16	-4.88	-0.46	0.07	0.02

Date	Site	Time	Depth (m)	Temp (°C)	DO (%)	DO (mg/L)	SPC (µS/cm)	C (µS/cm)	SAL (ppt)	pH	Turbidity (NTU)	TSS (mg/L)	Chl (RFU)
9/6/2021	WQ3	16:43:13	56.59	6.93	43.30	4.27	49869	32653	32.16	-4.88	-0.45	0.07	0.01
9/6/2021	WQ3	16:43:15	55.62	6.93	43.40	4.27	49861	32655	32.15	-4.88	-0.41	0.07	0.02
9/6/2021	WQ3	16:43:16	54.12	6.94	43.40	4.27	49868	32663	32.16	-4.88	-0.39	0.07	0.01
9/6/2021	WQ3	16:43:17	53.25	6.94	43.40	4.28	49874	32670	32.17	-4.88	-0.38	0.07	0.01
9/6/2021	WQ3	16:43:18	52.43	6.94	43.50	4.28	49859	32665	32.16	-4.88	-0.38	0.07	0.02
9/6/2021	WQ3	16:43:21	50.01	6.99	43.60	4.29	49829	32682	32.14	-4.88	-0.40	0.07	0.02
9/6/2021	WQ3	16:43:22	49.12	7.01	43.60	4.29	49820	32703	32.14	-4.87	-0.42	0.07	0.02
9/6/2021	WQ3	16:43:23	48.61	7.04	43.70	4.30	49814	32719	32.13	-4.87	-0.42	0.07	0.01
9/6/2021	WQ3	16:43:25	46.69	7.09	43.90	4.31	49766	32737	32.11	-4.87	-0.49	0.07	0.01
9/6/2021	WQ3	16:43:27	45.11	7.15	44.10	4.32	49723	32768	32.08	-4.87	-0.55	0.07	0.01
9/6/2021	WQ3	16:43:28	44.93	7.19	44.20	4.33	49714	32798	32.08	-4.87	-0.58	0.07	0.01
9/6/2021	WQ3	16:43:29	43.38	7.23	44.30	4.34	49683	32812	32.06	-4.87	-0.60	0.07	0.00
9/6/2021	WQ3	16:43:30	42.76	7.27	44.50	4.35	49653	32838	32.05	-4.86	-0.62	0.07	0.00
9/6/2021	WQ3	16:43:31	41.60	7.32	44.70	4.36	49603	32848	32.02	-4.86	-0.64	0.07	-0.01
9/6/2021	WQ3	16:43:34	39.14	7.48	45.30	4.41	49394	32861	31.88	-4.86	-0.66	0.07	-0.01
9/6/2021	WQ3	16:43:35	38.40	7.52	45.50	4.43	49318	32850	31.83	-4.85	-0.66	0.07	-0.01
9/6/2021	WQ3	16:43:36	37.97	7.56	45.70	4.45	49221	32827	31.77	-4.85	-0.65	0.07	-0.01
9/6/2021	WQ3	16:43:38	36.18	7.63	46.20	4.49	49078	32799	31.67	-4.85	-0.64	0.07	0.00
9/6/2021	WQ3	16:43:39	35.42	7.67	46.40	4.51	48999	32775	31.62	-4.85	-0.63	0.07	0.00
9/6/2021	WQ3	16:43:41	34.55	7.75	46.90	4.55	48836	32744	31.51	-4.84	-0.61	0.07	0.01
9/6/2021	WQ3	16:43:42	33.08	7.80	47.20	4.58	48768	32743	31.47	-4.84	-0.60	0.07	0.01
9/6/2021	WQ3	16:43:43	32.23	7.85	47.50	4.60	48689	32733	31.42	-4.84	-0.59	0.07	0.01
9/6/2021	WQ3	16:43:44	31.31	7.89	47.80	4.63	48604	32716	31.36	-4.84	-0.59	0.07	0.01
9/6/2021	WQ3	16:43:45	30.95	7.92	48.00	4.65	48567	32718	31.34	-4.84	-0.58	0.07	0.02
9/6/2021	WQ3	16:43:46	29.65	7.96	48.30	4.67	48525	32733	31.31	-4.83	-0.58	0.07	0.01
9/6/2021	WQ3	16:43:48	28.09	8.07	48.90	4.72	48437	32776	31.26	-4.83	-0.60	0.07	0.01
9/6/2021	WQ3	16:43:50	27.26	8.20	49.50	4.77	48349	32832	31.21	-4.83	-0.63	0.07	0.01
9/6/2021	WQ3	16:43:51	25.50	8.28	49.90	4.80	48287	32854	31.17	-4.82	-0.65	0.07	0.02
9/6/2021	WQ3	16:43:52	24.66	8.36	50.20	4.82	48196	32874	31.11	-4.82	-0.67	0.07	0.01
9/6/2021	WQ3	16:43:54	23.53	8.48	50.90	4.88	48029	32877	31.00	-4.81	-0.69	0.07	0.03
9/6/2021	WQ3	16:43:56	21.99	8.57	51.60	4.94	47859	32842	30.89	-4.81	-0.68	0.07	0.04
9/6/2021	WQ3	16:43:58	21.04	8.65	52.30	5.00	47727	32823	30.80	-4.81	-0.69	0.07	0.07
9/6/2021	WQ3	16:44:00	19.06	8.69	52.90	5.05	47596	32768	30.71	-4.80	-0.69	0.07	0.08
9/6/2021	WQ3	16:44:01	18.41	8.71	53.20	5.08	47533	32738	30.67	-4.80	-0.68	0.07	0.10
9/6/2021	WQ3	16:44:03	17.54	8.73	53.60	5.12	47385	32657	30.56	-4.80	-0.65	0.07	0.11
9/6/2021	WQ3	16:44:04	16.07	8.73	53.80	5.14	47314	32609	30.51	-4.80	-0.65	0.07	0.12
9/6/2021	WQ3	16:44:05	15.35	8.73	54.00	5.16	47273	32579	30.48	-4.80	-0.65	0.07	0.11
9/6/2021	WQ3	16:44:06	14.51	8.74	54.30	5.19	47227	32558	30.45	-4.80	-0.65	0.07	0.13
9/6/2021	WQ3	16:44:08	12.86	8.80	54.70	5.23	46875	32368	30.21	-4.80	-0.63	0.07	0.18
9/6/2021	WQ3	16:44:10	11.17	8.89	58.50	5.66	43406	30046	27.75	-4.80	-0.65	0.07	0.26
9/6/2021	WQ3	16:44:11	10.57	8.95	59.30	5.74	43116	29891	27.55	-4.79	-0.64	0.07	0.33
9/6/2021	WQ3	16:44:12	9.30	9.01	60.30	5.84	42991	29861	27.47	-4.79	-0.63	0.07	0.37
9/6/2021	WQ3	16:44:13	8.48	9.08	61.10	5.91	42888	29840	27.40	-4.79	-0.62	0.07	0.42
9/6/2021	WQ3	16:44:14	7.44	9.14	61.40	5.93	42716	29779	27.28	-4.79	-0.60	0.07	0.46
9/6/2021	WQ3	16:44:15	6.81	9.24	62.20	6.01	42370	29606	27.04	-4.78	-0.60	0.07	0.51
9/6/2021	WQ3	16:44:16	5.56	9.35	63.10	6.09	42010	29451	26.80	-4.78	-0.59	0.07	0.56
9/6/2021	WQ3	16:44:17	4.60	10.68	66.20	6.26	40357	29296	25.70	-4.72	-0.58	0.07	0.62
9/6/2021	WQ3	16:44:19	3.27	11.00	70.20	6.71	35518	25994	22.34	-4.71	-0.52	0.07	0.67
9/6/2021	WQ3	16:44:21	2.00	11.30	72.80	7.03	31936	23567	19.89	-4.70	-0.38	0.07	0.77
9/6/2021	WQ3	16:44:22	1.17	11.39	74.00	7.15	31486	23299	19.59	-4.69	-0.28	0.08	0.83
9/6/2021	WQ3	16:44:23	0.31	11.44	79.70	7.70	26937	19957	16.52	-4.69	-0.12	0.09	0.80
9/6/2021	WQ5	16:14:40	52.79	6.86	42.60	4.20	49963	32651	32.22	-4.88	-0.23	0.08	0.01
9/6/2021	WQ5	16:14:46	51.79	6.87	42.50	4.19	49972	32671	32.23	-4.88	-0.20	0.08	0.01
9/6/2021	WQ5	16:14:52	50.55	6.92	42.60	4.19	49924	32680	32.20	-4.88	-0.25	0.08	0.03
9/6/2021	WQ5	16:14:58	49.25	7.01	42.80	4.21	49791	32684	32.12	-4.87	-0.31	0.08	0.04
9/6/2021	WQ5	16:15:03	48.50	7.10	43.20	4.24	49662	32685	32.03	-4.87	-0.43	0.07	0.03
9/6/2021	WQ5	16:15:08	47.26	7.23	43.80	4.29	49546	32727	31.96	-4.87	-0.51	0.07	0.02
9/6/2021	WQ5	16:15:13	46.59	7.41	44.70	4.36	49321	32749	31.82	-4.86	-0.60	0.07	0.01
9/6/2021	WQ5	16:15:18	45.24	7.56	45.60	4.44	49152	32772	31.71	-4.85	-0.63	0.07	0.01
9/6/2021	WQ5	16:15:23	44.54	7.61	46.40	4.51	49122	32803	31.70	-4.85	-0.63	0.07	0.02
9/6/2021	WQ5	16:15:28	43.37	7.62	46.90	4.56	49110	32806	31.69	-4.85	-0.62	0.07	0.00
9/6/2021	WQ5	16:15:34	42.49	7.64	47.30	4.60	49060	32790	31.66	-4.85	-0.63	0.07	-0.01
9/6/2021	WQ5	16:15:37	41.54	7.65	47.50	4.62	49034	32780	31.64	-4.85	-0.66	0.07	0.00
9/6/2021	WQ5	16:15:44	40.61	7.66	47.80	4.65	48997	32772	31.62	-4.85	-0.66	0.07	0.01
9/6/2021	WQ5	16:15:48	39.36	7.66	47.90	4.66	49004	32778	31.62	-4.85	-0.67	0.07	0.01
9/6/2021	WQ5	16:15:54	38.54	7.66	48.10	4.67	49030	32792	31.64	-4.85	-0.66	0.07	0.02
9/6/2021	WQ5	16:15:57	37.48	7.66	48.10	4.67	49048	32800	31.65	-4.85	-0.67	0.07	0.00
9/6/2021	WQ5	16:16:03	36.59	7.66	48.10	4.68	49032	32791	31.64	-4.85	-0.65	0.07	0.01
9/6/2021	WQ5	16:16:06	35.35	7.66	48.20	4.68	49020	32788	31.63	-4.85	-0.62	0.07	0.01
9/6/2021	WQ5	16:16:11	34.51	7.68	48.20	4.68	48995	32782	31.62	-4.85	-0.66	0.07	0.02
9/6/2021	WQ5	16:16:15	33.20	7.68	48.30	4.69	49004	32792	31.63	-4.85	-0.64	0.07	0.01
9/6/2021	WQ5	16:16:19	32.59	7.69	48.30	4.69	48988	32787	31.62	-4.85	-0.64	0.07	0.02
9/6/2021	WQ5	16:16:24	31.96	7.71	48.40	4.70	48970	32796	31.60	-4.84	-0.60	0.07	0.03
9/6/2021	WQ5	16:16:26	30.64	7.73	48.50	4.70	48933	32789	31.58	-4.84	-0.61	0.07	0.03
9/6/2021	WQ5	16:16:31	29.54	7.80	48.70	4.72	48830	32782	31.51	-4.84	-0.61	0.07	0.03
9/6/2021	WQ5	16:16:32	28.60	7.81	48.80	4.73	48795	32777	31.49	-4.84	-0.62	0.07	0.04
9/6/2021	WQ5	16:16:37	27.46	7.91	49.20	4.76	48610	32746	31.37	-4.84	-0.64	0.07	0.03
9/6/2021	WQ5	16:16:39	26.18	7.95	49.40	4.78	48557	32741	31.33	-4.83	-0.64	0.07	0.04
9/6/2021	WQ5	16:16:41	25.40	7.98	49.60	4.80	48505	32731	31.30	-4.83	-0.63	0.07	0.05
9/6/2021	WQ5	16:16:44	24.85	8.01	49.90	4.82	48442	32720	31.26	-4.83	-0.64	0.07	0.05
9/6/2021	WQ5	16:16:46	23.49	8.02	50.10	4.84	48427	32720	31.25	-4.83	-0.63	0.07	0.06
9/6/2021	WQ5	16:16:50	22.55	8.03	50.30	4.86	48386	32703	31.22	-4.83	-0.63	0.07	0.05
9/6/2021	WQ5	16:16:52	21.29	8.04	50.50	4.87	48343	32685	31.19	-4.83	-0.64	0.07	0.07
9/6/2021	WQ5	16:16:54	20.68	8.08	50.60	4.89	48260	32657	31.13	-4.83	-0.66	0.07	0.08
9/6/2021	WQ5	16:16:57	19.99	8.22	51.20	4.94	47837	32501	30.84	-4.82	-0.64	0.07	0.11
9/6/2021	WQ5	16:16:59	18.54	8.39	54.70	5.27	47447	32382	30.58	-4.82	-0.65	0.07	0.14
9/6/2021	WQ5	16:17:02	17.58	8.64	56.00	5.37	46889	32233	30.20	-4.81	-0.66	0.07	0.24
9/6/2021	WQ5	16:17:04	16.24	8.79	56.20	5.38	46488	32093	29.93	-4.80	-0.65	0.07	0.27
9/6/2021	WQ5	16:17:06	15.38	8.92	56.50	5.41	46047	31906	29.62	-4.80	-0.66	0.07	0.32
9/6/2021	WQ5	16:17:09	14.78	9.07	57.10	5.46	45417	31594	29.19	-4.79	-0.65	0.07	0.39

Date	Site	Time	Depth (m)	Temp (°C)	DO (%)	DO (mg/L)	SPC (µS/cm)	C (µS/cm)	SAL (ppt)	pH	Turbidity (NTU)	TSS (mg/L)	Chl (RFU)
9/6/2021	WQ5	16:17:11	13.15	9.14	57.50	5.50	44996	31363	28.89	-4.79	-0.67	0.07	0.46
9/6/2021	WQ5	16:17:13	12.34	9.19	58.00	5.56	44562	31103	28.59	-4.78	-0.67	0.07	0.45
9/6/2021	WQ5	16:17:15	10.97	9.24	62.50	5.98	44101	30825	28.26	-4.78	-0.66	0.07	0.55
9/6/2021	WQ5	16:17:16	10.26	9.30	63.40	6.07	43822	30680	28.07	-4.78	-0.66	0.07	0.55
9/6/2021	WQ5	16:17:18	9.53	9.48	64.90	6.21	43272	30444	27.69	-4.77	-0.66	0.07	0.61
9/6/2021	WQ5	16:17:19	8.35	9.58	65.40	6.25	43034	30347	27.53	-4.77	-0.68	0.07	0.64
9/6/2021	WQ5	16:17:21	7.33	9.75	66.40	6.34	42577	30170	27.22	-4.76	-0.67	0.07	0.70
9/6/2021	WQ5	16:17:23	6.53	9.91	67.20	6.40	42187	30022	26.95	-4.75	-0.69	0.07	0.73
9/6/2021	WQ5	16:17:24	5.33	9.99	67.60	6.43	41931	29910	26.78	-4.75	-0.68	0.07	0.80
9/6/2021	WQ5	16:17:28	4.58	10.34	73.30	7.01	38866	27982	24.64	-4.74	-0.63	0.07	0.92
9/6/2021	WQ5	16:17:32	3.23	10.48	74.70	7.15	38245	27639	24.22	-4.73	-0.62	0.07	1.05
9/6/2021	WQ5	16:17:33	2.77	10.53	75.20	7.19	35131	25414	22.06	-4.73	-0.61	0.07	1.06
9/6/2021	WQ5	16:17:40	1.92	11.72	85.90	8.25	31124	23227	19.35	-0.59	-0.37	0.07	1.27
9/6/2021	WQ6	15:32:52	87.12	6.69	39.70	3.93	50284	32701	32.42	-4.89	-0.55	0.07	0.01
9/6/2021	WQ6	15:33:03	86.91	6.72	39.70	3.92	50278	32728	32.42	-4.89	-0.59	0.07	0.02
9/6/2021	WQ6	15:33:05	85.40	6.73	39.70	3.92	50277	32729	32.42	-4.89	-0.60	0.07	0.02
9/6/2021	WQ6	15:33:06	84.61	6.73	39.70	3.92	50264	32721	32.41	-4.89	-0.62	0.07	0.01
9/6/2021	WQ6	15:33:10	83.55	6.73	39.70	3.92	50238	32708	32.39	-4.89	-0.60	0.07	-0.01
9/6/2021	WQ6	15:33:11	82.30	6.73	39.70	3.92	50253	32719	32.40	-4.89	-0.59	0.07	-0.01
9/6/2021	WQ6	15:33:12	81.64	6.74	39.70	3.92	50236	32711	32.39	-4.89	-0.58	0.07	-0.01
9/6/2021	WQ6	15:33:16	80.46	6.75	39.70	3.92	50235	32728	32.39	-4.89	-0.55	0.07	-0.02
9/6/2021	WQ6	15:33:17	79.06	6.76	39.80	3.93	50216	32721	32.38	-4.88	-0.55	0.07	-0.01
9/6/2021	WQ6	15:33:19	78.42	6.77	39.80	3.93	50195	32721	32.37	-4.88	-0.53	0.07	0.00
9/6/2021	WQ6	15:33:22	77.47	6.80	40.00	3.94	50133	32707	32.32	-4.88	-0.52	0.07	0.01
9/6/2021	WQ6	15:33:24	75.99	6.82	40.10	3.95	50057	32678	32.27	-4.88	-0.53	0.07	0.00
9/6/2021	WQ6	15:33:26	75.07	6.84	40.30	3.97	49977	32645	32.22	-4.88	-0.55	0.07	0.01
9/6/2021	WQ6	15:33:28	74.58	6.86	40.50	3.99	49906	32617	32.17	-4.88	-0.53	0.07	0.00
9/6/2021	WQ6	15:33:31	72.79	6.89	40.80	4.02	49851	32601	32.13	-4.88	-0.55	0.07	0.00
9/6/2021	WQ6	15:33:33	72.17	6.90	41.00	4.04	49810	32588	32.11	-4.88	-0.56	0.07	-0.01
9/6/2021	WQ6	15:33:35	71.62	6.91	41.30	4.07	49810	32599	32.11	-4.88	-0.59	0.07	0.00
9/6/2021	WQ6	15:33:36	70.70	6.92	41.40	4.08	49780	32584	32.09	-4.88	-0.60	0.07	0.00
9/6/2021	WQ6	15:33:39	69.61	6.93	41.70	4.10	49792	32605	32.10	-4.88	-0.61	0.07	0.01
9/6/2021	WQ6	15:33:42	68.80	6.95	41.90	4.13	49769	32609	32.08	-4.88	-0.61	0.07	0.00
9/6/2021	WQ6	15:33:43	67.50	6.96	42.00	4.14	49748	32602	32.07	-4.88	-0.63	0.07	0.01
9/6/2021	WQ6	15:33:45	66.41	6.97	42.20	4.15	49727	32602	32.06	-4.88	-0.64	0.07	0.00
9/6/2021	WQ6	15:33:48	65.72	7.00	42.40	4.17	49708	32613	32.05	-4.87	-0.63	0.07	0.00
9/6/2021	WQ6	15:33:49	64.52	7.01	42.50	4.18	49703	32620	32.04	-4.87	-0.62	0.07	0.00
9/6/2021	WQ6	15:33:51	63.42	7.03	42.70	4.20	49703	32639	32.05	-4.87	-0.62	0.07	0.00
9/6/2021	WQ6	15:33:55	61.22	7.06	43.00	4.22	49645	32632	32.01	-4.87	-0.61	0.07	0.01
9/6/2021	WQ6	15:33:57	60.59	7.08	43.10	4.24	49647	32649	32.01	-4.87	-0.62	0.07	0.01
9/6/2021	WQ6	15:33:58	59.69	7.08	43.20	4.24	49642	32654	32.01	-4.87	-0.63	0.07	0.01
9/6/2021	WQ6	15:34:00	58.60	7.10	43.30	4.25	49604	32644	31.99	-4.87	-0.62	0.07	0.00
9/6/2021	WQ6	15:34:03	57.53	7.12	43.50	4.27	49568	32643	31.96	-4.87	-0.60	0.07	-0.01
9/6/2021	WQ6	15:34:04	56.40	7.13	43.60	4.28	49544	32636	31.95	-4.87	-0.61	0.07	-0.01
9/6/2021	WQ6	15:34:06	55.51	7.15	43.80	4.29	49527	32644	31.94	-4.87	-0.60	0.07	-0.01
9/6/2021	WQ6	15:34:09	54.80	7.19	44.00	4.31	49495	32659	31.92	-4.87	-0.63	0.07	-0.02
9/6/2021	WQ6	15:34:11	53.43	7.23	44.20	4.33	49462	32675	31.90	-4.87	-0.65	0.07	-0.01
9/6/2021	WQ6	15:34:15	52.67	7.32	44.60	4.36	49426	32737	31.88	-4.86	-0.66	0.07	-0.01
9/6/2021	WQ6	15:34:17	51.33	7.36	44.90	4.38	49372	32733	31.85	-4.86	-0.65	0.07	-0.01
9/6/2021	WQ6	15:34:19	50.66	7.38	45.10	4.40	49347	32739	31.83	-4.86	-0.67	0.07	-0.01
9/6/2021	WQ6	15:34:22	49.27	7.41	45.40	4.43	49325	32754	31.82	-4.86	-0.67	0.07	0.00
9/6/2021	WQ6	15:34:24	48.27	7.43	45.50	4.44	49292	32747	31.80	-4.86	-0.66	0.07	0.00
9/6/2021	WQ6	15:34:25	48.11	7.44	45.70	4.45	49283	32753	31.80	-4.86	-0.66	0.07	0.00
9/6/2021	WQ6	15:34:27	47.64	7.48	45.90	4.47	49240	32759	31.77	-4.85	-0.66	0.07	0.01
9/6/2021	WQ6	15:34:28	46.43	7.50	46.00	4.48	49217	32765	31.75	-4.85	-0.66	0.07	0.02
9/6/2021	WQ6	15:34:30	45.58	7.55	46.20	4.50	49187	32790	31.74	-4.85	-0.68	0.07	0.02
9/6/2021	WQ6	15:34:35	43.30	7.69	46.90	4.55	49085	32854	31.68	-4.85	-0.72	0.07	0.01
9/6/2021	WQ6	15:34:37	42.52	7.74	47.10	4.57	49045	32871	31.66	-4.84	-0.73	0.07	0.01
9/6/2021	WQ6	15:34:40	41.11	7.77	47.50	4.60	49056	32910	31.67	-4.84	-0.73	0.07	0.00
9/6/2021	WQ6	15:34:41	40.45	7.78	47.60	4.61	49041	32908	31.66	-4.84	-0.74	0.07	0.00
9/6/2021	WQ6	15:34:44	39.48	7.80	47.80	4.63	48984	32893	31.62	-4.84	-0.74	0.07	0.00
9/6/2021	WQ6	15:34:46	38.01	7.82	48.00	4.65	48958	32897	31.60	-4.84	-0.74	0.07	0.00
9/6/2021	WQ6	15:34:47	37.55	7.84	48.10	4.66	48938	32894	31.59	-4.84	-0.74	0.07	0.00
9/6/2021	WQ6	15:34:50	36.53	7.88	48.40	4.69	48823	32860	31.51	-4.84	-0.72	0.07	0.02
9/6/2021	WQ6	15:34:53	34.53	7.94	48.90	4.72	48703	32826	31.43	-4.84	-0.74	0.07	0.02
9/6/2021	WQ6	15:34:56	33.81	7.99	49.30	4.77	48608	32811	31.37	-4.83	-0.73	0.07	0.03
9/6/2021	WQ6	15:34:57	32.73	8.00	49.50	4.78	48586	32812	31.36	-4.83	-0.73	0.07	0.03
9/6/2021	WQ6	15:35:00	31.46	8.06	50.00	4.82	48481	32798	31.29	-4.83	-0.73	0.07	0.03
9/6/2021	WQ6	15:35:02	30.98	8.10	50.30	4.85	48429	32793	31.25	-4.83	-0.73	0.07	0.03
9/6/2021	WQ6	15:35:04	29.45	8.13	50.50	4.87	48338	32761	31.19	-4.83	-0.74	0.07	0.03
9/6/2021	WQ6	15:35:06	28.67	8.18	50.70	4.89	48191	32705	31.09	-4.83	-0.73	0.07	0.07
9/6/2021	WQ6	15:35:09	26.92	8.29	51.00	4.91	48000	32676	30.96	-4.82	-0.70	0.07	0.14
9/6/2021	WQ6	15:35:11	26.08	8.37	51.30	4.93	47861	32657	30.87	-4.82	-0.70	0.07	0.14
9/6/2021	WQ6	15:35:13	25.56	8.45	51.60	4.95	47722	32634	30.78	-4.81	-0.70	0.07	0.16
9/6/2021	WQ6	15:35:14	24.50	8.49	51.80	4.97	47643	32619	30.73	-4.81	-0.69	0.07	0.16
9/6/2021	WQ6	15:35:17	23.38	8.63	52.50	5.02	47429	32590	30.58	-4.81	-0.69	0.07	0.13
9/6/2021	WQ6	15:35:20	22.85	8.73	53.30	5.09	47263	32576	30.47	-4.80	-0.68	0.07	0.14
9/6/2021	WQ6	15:35:22	21.72	8.78	53.80	5.14	47125	32522	30.38	-4.80	-0.70	0.07	0.17
9/6/2021	WQ6	15:35:27	20.34	8.86	54.90	5.24	46840	32396	30.18	-4.80	-0.70	0.07	0.23
9/6/2021	WQ6	15:35:29	19.51	8.88	55.30	5.28	46750	32354	30.12	-4.80	-0.71	0.07	0.21
9/6/2021	WQ6	15:35:32	18.15	8.90	55.70	5.32	46579	32257	30.00	-4.79	-0.72	0.07	0.23
9/6/2021	WQ6	15:35:34	17.28	8.91	56.00	5.35	46444	32170	29.90	-4.79	-0.74	0.07	0.23
9/6/2021	WQ6	15:35:36	16.67	8.92	56.30	5.38	46280	32067	29.79	-4.79	-0.72	0.07	0.27
9/6/2021	WQ6	15:35:38	15.33	8.95	56.60	5.42	45989	31892	29.58	-4.79	-0.72	0.07	0.31
9/6/2021	WQ6	15:35:40	14.46	8.97	57.00	5.45	45688	31700	29.37	-4.79	-0.70	0.07	0.36
9/6/2021	WQ6	15:35:43	13.81	8.98	57.50	5.51	45196	31367	29.02	-4.79	-0.71	0.07	0.41
9/6/2021	WQ6	15:35:45	12.24	9.01	57.90	5.56	44807	31118	28.75	-4.79	-0.70	0.07	0.47
9/6/2021	WQ6	15:35:47	11.51	9.10	61.60	5.97	42641	29681	27.22	-4.79	-0.68	0.07	0.49
9/6/2021	WQ6	15:35:50	10.75	9.31	64.60	6.25	41677	29190	26.56	-4.78	-0.66	0.07	0.53
9/6/2021	WQ6	15:35:51	9.65	9.40	65.00	6.28	41529	29144	26.46	-4.78	-0.66	0.07	0.57

Date	Site	Time	Depth (m)	Temp (°C)	DO (%)	DO (mg/L)	SPC (µS/cm)	C (µS/cm)	SAL (ppt)	pH	Turbidity (NTU)	TSS (mg/L)	Chl (RFU)
9/6/2021	WQ6	15:35:54	8.30	9.72	66.90	6.45	40370	28588	25.67	-4.76	-0.68	0.07	0.76
9/6/2021	WQ6	15:35:55	7.93	9.86	67.50	6.50	40063	28462	25.46	-4.76	-0.68	0.07	0.79
9/6/2021	WQ6	15:35:57	6.59	10.11	72.60	6.97	39486	28244	25.07	-4.75	-0.67	0.07	0.82
9/6/2021	WQ6	15:36:00	5.51	10.42	74.60	7.14	38707	27925	24.54	-4.73	-0.65	0.07	0.87
9/6/2021	WQ6	15:36:02	3.88	10.56	75.70	7.31	35680	25842	22.44	2.17	-0.62	0.07	0.95
9/6/2021	WQ6	15:36:05	2.59	10.79	81.10	7.83	34606	25209	21.71	4.14	-0.56	0.07	0.98
9/6/2021	WQ6	15:36:07	1.99	10.94	83.80	8.10	33535	24523	20.98	4.35	-0.47	0.07	0.96
9/6/2021	WQ6	15:36:08	0.64	11.02	84.40	8.23	30812	22584	19.12	4.39	-0.43	0.07	0.98
9/6/2021	WQ6	15:36:09	0.39	11.12	86.00	8.39	30470	22386	18.89	4.45	-0.39	0.07	1.07

Notes: Temp = temperature; DO = dissolved oxygen; SPC = specific conductivity; C = conductivity; TSS = total suspended solids; SAL = salinity; Chl

Table G.2-3 CTD Profiles for Water Quality Stations, November 2021

Date	Site	Time	Depth (m)	Temp (°C)	DO (%)	DO (mg/L)	SPC (µS/cm)	SAL (ppt)	pH	Chl (RFU)
11/9/2021	1:13:46	WQ1	91.29	9.43	64.8	6.07	48188	-	7.70	1.88
11/9/2021	1:13:50	WQ1	90.17	9.43	65.8	6.15	48485	-	7.71	1.32
11/9/2021	1:13:52	WQ1	89.33	9.44	66.3	6.19	48824	-	7.71	1.09
11/9/2021	1:13:55	WQ1	88.55	9.44	67.4	6.29	48954	31.71	7.71	1.08
11/9/2021	1:13:57	WQ1	88.10	9.44	68.0	6.34	48943	31.70	7.71	1.04
11/9/2021	1:13:58	WQ1	86.64	9.44	68.2	6.37	48945	31.70	7.71	1.02
11/9/2021	1:14:02	WQ1	85.58	9.45	69.0	6.44	48946	31.71	7.71	0.74
11/9/2021	1:14:03	WQ1	85.19	9.45	69.2	6.45	48951	31.71	7.71	0.71
11/9/2021	1:14:04	WQ1	84.95	9.46	69.3	6.46	48957	31.71	7.71	0.72
11/9/2021	1:14:05	WQ1	83.43	9.46	69.5	6.48	48952	31.71	7.71	0.74
11/9/2021	1:14:08	WQ1	82.35	9.47	69.8	6.51	48939	31.70	7.72	0.75
11/9/2021	1:14:11	WQ1	81.49	9.49	70.2	6.55	48926	31.70	7.72	0.74
11/9/2021	1:14:12	WQ1	80.12	9.49	70.3	6.56	48913	31.69	7.72	0.75
11/9/2021	1:14:14	WQ1	79.18	9.50	70.6	6.58	48895	31.68	7.72	0.72
11/9/2021	1:14:17	WQ1	78.54	9.52	70.9	6.61	48866	31.66	7.73	0.74
11/9/2021	1:14:20	WQ1	76.57	9.54	71.3	6.64	48825	31.63	7.73	0.74
11/9/2021	1:14:23	WQ1	75.60	9.57	71.7	6.68	48782	31.60	7.73	0.83
11/9/2021	1:14:25	WQ1	74.46	9.58	72.0	6.70	48764	31.59	7.74	0.78
11/9/2021	1:14:27	WQ1	73.49	9.59	72.3	6.73	48728	31.56	7.74	0.71
11/9/2021	1:14:31	WQ1	72.56	9.62	72.9	6.78	48665	31.52	7.75	0.69
11/9/2021	1:14:33	WQ1	71.04	9.63	73.2	6.81	48628	31.50	7.75	0.66
11/9/2021	1:14:34	WQ1	70.57	9.64	73.4	6.83	48606	31.48	7.75	0.64
11/9/2021	1:14:37	WQ1	69.86	9.66	73.9	6.87	48550	31.44	7.76	0.71
11/9/2021	1:14:39	WQ1	68.66	9.67	74.2	6.90	48524	31.42	7.76	0.70
11/9/2021	1:14:42	WQ1	67.51	9.69	74.8	6.95	48492	31.40	7.77	0.67
11/9/2021	1:14:44	WQ1	66.09	9.70	75.1	6.98	48477	31.39	7.77	0.64
11/9/2021	1:14:45	WQ1	65.87	9.71	75.2	6.99	48474	31.39	7.77	0.66
11/9/2021	1:14:49	WQ1	64.36	9.72	75.8	7.05	48434	31.37	7.77	0.60
11/9/2021	1:14:52	WQ1	62.32	9.72	76.2	7.08	48380	31.33	7.77	0.60
11/9/2021	1:14:56	WQ1	61.34	9.71	76.6	7.12	48327	31.29	7.78	0.58
11/9/2021	1:14:57	WQ1	60.33	9.71	76.7	7.13	48312	31.28	7.78	0.57
11/9/2021	1:15:00	WQ1	59.34	9.70	76.9	7.16	48292	31.26	7.78	0.60
11/9/2021	1:15:03	WQ1	58.55	9.70	77.2	7.18	48283	31.26	7.78	0.51
11/9/2021	1:15:04	WQ1	58.03	9.70	77.2	7.19	48289	31.26	7.78	0.50
11/9/2021	1:15:05	WQ1	57.58	9.70	77.3	7.19	48294	31.27	7.78	0.49
11/9/2021	1:15:08	WQ1	56.86	9.70	77.5	7.21	48292	31.27	7.78	0.58
11/9/2021	1:15:10	WQ1	55.31	9.70	77.6	7.22	48278	31.26	7.78	0.56
11/9/2021	1:15:12	WQ1	54.60	9.70	77.6	7.22	48265	31.25	7.78	0.50
11/9/2021	1:15:14	WQ1	53.44	9.69	77.7	7.23	48260	31.24	7.78	0.54
11/9/2021	1:15:16	WQ1	52.55	9.69	77.7	7.24	48256	31.24	7.78	0.51
11/9/2021	1:15:19	WQ1	51.55	9.69	77.9	7.25	48234	31.22	7.78	0.44
11/9/2021	1:15:20	WQ1	50.53	9.69	77.9	7.26	48226	31.22	7.78	0.44
11/9/2021	1:15:22	WQ1	49.52	9.68	78.0	7.26	48219	31.21	7.78	0.47
11/9/2021	1:15:24	WQ1	49.08	9.67	77.9	7.26	48202	31.20	7.77	0.53
11/9/2021	1:15:26	WQ1	48.54	9.66	77.8	7.25	48188	31.19	7.77	0.54
11/9/2021	1:15:27	WQ1	47.43	9.65	77.8	7.25	48177	31.18	7.77	0.58
11/9/2021	1:15:30	WQ1	46.49	9.63	77.7	7.25	48117	31.14	7.77	0.59
11/9/2021	1:15:33	WQ1	44.92	9.59	77.4	7.23	48034	31.08	7.77	0.58
11/9/2021	1:15:35	WQ1	44.03	9.56	77.1	7.21	47981	31.04	7.77	0.56
11/9/2021	1:15:36	WQ1	43.89	9.54	77.0	7.20	47955	31.02	7.77	0.57
11/9/2021	1:15:37	WQ1	43.61	9.53	76.9	7.20	47932	31.00	7.77	0.57
11/9/2021	1:15:38	WQ1	43.27	9.51	76.9	7.19	47907	30.98	7.77	0.53
11/9/2021	1:15:39	WQ1	42.07	9.50	76.8	7.19	47881	30.96	7.77	0.53
11/9/2021	1:15:40	WQ1	41.54	9.49	76.7	7.18	47855	30.94	7.77	0.55
11/9/2021	1:15:41	WQ1	41.09	9.48	76.5	7.17	47833	30.93	7.76	0.56
11/9/2021	1:15:43	WQ1	40.55	9.46	76.2	7.14	47791	30.90	7.76	0.57
11/9/2021	1:15:44	WQ1	39.55	9.46	76.1	7.14	47775	30.89	7.76	0.54
11/9/2021	1:15:46	WQ1	38.60	9.46	76.1	7.13	47737	30.86	7.76	0.54
11/9/2021	1:15:49	WQ1	37.72	9.45	76.2	7.15	47695	30.83	7.76	0.56
11/9/2021	1:15:50	WQ1	36.47	9.45	76.2	7.15	47681	30.82	7.76	0.55
11/9/2021	1:15:52	WQ1	35.46	9.45	76.2	7.15	47646	30.79	7.76	0.53
11/9/2021	1:15:54	WQ1	34.94	9.44	76.3	7.17	47615	30.77	7.76	0.54
11/9/2021	1:15:56	WQ1	33.13	9.42	76.5	7.18	47583	30.75	7.76	0.55
11/9/2021	1:15:57	WQ1	32.65	9.41	76.5	7.19	47564	30.73	7.76	0.54
11/9/2021	1:15:59	WQ1	31.29	9.40	76.5	7.19	47538	30.71	7.76	0.57
11/9/2021	1:16:00	WQ1	30.73	9.39	76.5	7.19	47523	30.70	7.76	0.60
11/9/2021	1:16:03	WQ1	29.50	9.37	76.5	7.20	47485	30.68	7.76	0.60
11/9/2021	1:16:04	WQ1	28.41	9.36	76.5	7.20	47465	30.66	7.76	0.60
11/9/2021	1:16:06	WQ1	27.30	9.35	76.5	7.20	47437	30.64	7.76	0.59
11/9/2021	1:16:08	WQ1	26.76	9.34	76.6	7.21	47414	30.62	7.77	0.58
11/9/2021	1:16:09	WQ1	25.62	9.34	76.6	7.21	47409	30.62	7.77	0.58
11/9/2021	1:16:11	WQ1	24.58	9.34	76.7	7.22	47386	30.60	7.77	0.52
11/9/2021	1:16:14	WQ1	23.60	9.33	76.9	7.25	47303	30.55	7.77	0.54
11/9/2021	1:16:15	WQ1	22.32	9.33	77.0	7.26	47274	30.53	7.77	0.51
11/9/2021	1:16:17	WQ1	21.25	9.33	77.3	7.28	47224	30.49	7.78	0.52
11/9/2021	1:16:19	WQ1	20.83	9.32	77.6	7.32	47162	30.44	7.78	0.54
11/9/2021	1:16:20	WQ1	19.58	9.32	77.8	7.34	47123	30.42	7.78	0.52
11/9/2021	1:16:22	WQ1	18.34	9.31	78.3	7.39	47018	30.34	7.79	0.56
11/9/2021	1:16:24	WQ1	17.85	9.28	78.7	7.44	46909	30.26	7.79	0.54
11/9/2021	1:16:25	WQ1	16.52	9.26	78.9	7.46	46869	30.23	7.79	0.56
11/9/2021	1:16:27	WQ1	15.26	9.23	79.4	7.51	46767	30.16	7.80	0.60
11/9/2021	1:16:29	WQ1	14.75	9.20	79.8	7.56	46647	30.07	7.80	0.62
11/9/2021	1:16:30	WQ1	13.46	9.17	80.0	7.59	46593	30.03	7.81	0.62
11/9/2021	1:16:31	WQ1	12.69	9.15	80.2	7.61	46539	29.99	7.81	0.62
11/9/2021	1:16:33	WQ1	11.92	9.10	80.6	7.66	46428	29.91	7.81	0.66
11/9/2021	1:16:35	WQ1	10.00	9.07	80.9	7.71	46358	29.86	7.82	0.70
11/9/2021	1:16:36	WQ1	9.40	9.05	81.1	7.73	46325	29.83	7.82	0.68
11/9/2021	1:16:38	WQ1	8.56	9.02	81.5	7.77	46263	29.79	7.82	0.70

Date	Site	Time	Depth (m)	Temp (°C)	DO (%)	DO (mg/L)	SPC (µS/cm)	SAL (ppt)	pH	Chl (RFU)
11/9/2021	1:16:39	WQ1	7.36	9.01	81.7	7.79	46233	29.77	7.83	0.69
11/9/2021	1:16:40	WQ1	6.58	9.00	81.9	7.81	46216	29.75	7.83	0.72
11/9/2021	1:16:42	WQ1	5.59	8.98	82.2	7.85	46200	29.74	7.83	0.71
11/9/2021	1:16:44	WQ1	3.95	8.97	82.6	7.88	46172	29.72	7.83	0.70
11/9/2021	1:16:45	WQ1	3.31	8.97	82.7	7.90	46159	29.71	7.84	0.69
11/9/2021	1:16:46	WQ1	2.69	8.97	82.9	7.92	46150	29.71	7.84	0.68
11/9/2021	1:16:48	WQ1	1.33	8.96	83.2	7.95	46128	29.69	7.85	0.67
11/9/2021	1:16:49	WQ1	0.54	8.96	83.4	7.96	46112	29.68	7.86	0.69
11/10/2021	2:30:20	WQ3	60.19	9.81	80.3	7.44	48508	31.43	7.97	-
11/10/2021	2:30:22	WQ3	59.38	9.81	80.2	7.44	48483	31.41	7.97	-
11/10/2021	2:30:28	WQ3	58.52	9.81	80.2	7.44	48460	31.39	7.97	-
11/10/2021	2:30:30	WQ3	57.41	9.81	80.2	7.44	48471	31.40	7.97	-
11/10/2021	2:30:34	WQ3	56.55	9.82	80.2	7.44	48506	31.43	7.97	0.53
11/10/2021	2:30:36	WQ3	55.45	9.82	80.3	7.44	48499	31.42	7.97	0.50
11/10/2021	2:30:39	WQ3	54.58	9.82	80.3	7.45	48497	31.42	7.97	0.46
11/10/2021	2:30:43	WQ3	52.89	9.83	80.4	7.45	48499	31.42	7.97	0.44
11/10/2021	2:30:46	WQ3	52.07	9.84	80.5	7.46	48515	31.44	7.97	0.40
11/10/2021	2:30:48	WQ3	51.60	9.84	80.6	7.47	48513	31.44	7.97	0.36
11/10/2021	2:30:50	WQ3	50.51	9.84	80.7	7.47	48519	31.44	7.97	0.37
11/10/2021	2:30:53	WQ3	49.65	9.85	80.8	7.48	48507	31.43	7.97	0.41
11/10/2021	2:30:56	WQ3	48.22	9.84	80.8	7.49	48495	31.42	7.97	0.41
11/10/2021	2:30:58	WQ3	47.40	9.83	80.8	7.49	48487	31.42	7.97	0.43
11/10/2021	2:31:02	WQ3	46.47	9.83	80.8	7.49	48489	31.42	7.97	0.44
11/10/2021	2:31:05	WQ3	44.63	9.82	80.8	7.49	48493	31.42	7.97	0.36
11/10/2021	2:31:08	WQ3	43.42	9.81	80.7	7.49	48473	31.41	7.96	0.33
11/10/2021	2:31:10	WQ3	42.49	9.81	80.7	7.49	48453	31.39	7.96	0.31
11/10/2021	2:31:13	WQ3	41.65	9.79	80.7	7.49	48407	31.36	7.95	0.34
11/10/2021	2:31:14	WQ3	40.65	9.79	80.7	7.49	48382	31.34	7.95	0.36
11/10/2021	2:31:16	WQ3	39.69	9.78	80.7	7.49	48343	31.31	7.94	0.37
11/10/2021	2:31:19	WQ3	38.93	9.77	80.8	7.51	48288	31.27	7.93	0.39
11/10/2021	2:31:21	WQ3	37.35	9.76	80.9	7.51	48249	31.25	7.93	0.43
11/10/2021	2:31:24	WQ3	36.50	9.75	81.0	7.53	48204	31.21	7.92	0.46
11/10/2021	2:31:26	WQ3	35.13	9.75	81.1	7.54	48185	31.20	7.91	0.47
11/10/2021	2:31:28	WQ3	34.33	9.74	81.3	7.56	48177	31.20	7.90	0.46
11/10/2021	2:31:31	WQ3	33.56	9.73	81.4	7.57	48130	31.16	7.90	0.46
11/10/2021	2:31:32	WQ3	32.62	9.72	81.4	7.58	48122	31.16	7.90	0.48
11/10/2021	2:31:34	WQ3	31.69	9.72	81.5	7.58	48107	31.14	7.90	0.45
11/10/2021	2:31:37	WQ3	30.94	9.70	81.5	7.59	48057	31.11	7.89	0.44
11/10/2021	2:31:39	WQ3	29.39	9.69	81.5	7.59	48014	31.08	7.89	0.43
11/10/2021	2:31:42	WQ3	28.55	9.67	81.5	7.60	47920	31.01	7.89	0.45
11/10/2021	2:31:44	WQ3	27.29	9.66	81.5	7.60	47879	30.98	7.89	0.42
11/10/2021	2:31:46	WQ3	26.44	9.66	81.6	7.61	47836	30.95	7.89	0.42
11/10/2021	2:31:49	WQ3	25.69	9.64	81.8	7.63	47780	30.91	7.89	0.41
11/10/2021	2:31:52	WQ3	23.99	9.63	81.9	7.65	47736	30.88	7.89	0.42
11/10/2021	2:31:55	WQ3	23.13	9.61	82.0	7.66	47721	30.86	7.89	0.44
11/10/2021	2:31:57	WQ3	22.58	9.60	82.0	7.67	47697	30.85	7.89	0.47
11/10/2021	2:31:58	WQ3	21.54	9.58	82.0	7.67	47665	30.82	7.89	0.50
11/10/2021	2:32:01	WQ3	20.60	9.47	81.7	7.66	47504	30.70	7.89	0.55
11/10/2021	2:32:04	WQ3	19.85	9.34	81.2	7.64	47327	30.56	7.88	0.61
11/10/2021	2:32:06	WQ3	18.41	9.26	80.7	7.62	47216	30.48	7.88	0.62
11/10/2021	2:32:10	WQ3	17.43	9.10	79.8	7.57	47011	30.32	7.88	0.60
11/10/2021	2:32:12	WQ3	16.03	9.05	79.5	7.55	46944	30.27	7.87	0.58
11/10/2021	2:32:14	WQ3	15.40	9.04	79.2	7.53	46909	30.25	7.87	0.57
11/10/2021	2:32:19	WQ3	14.64	9.02	78.9	7.50	46848	30.20	7.86	0.61
11/10/2021	2:32:21	WQ3	13.45	9.01	78.8	7.50	46787	30.16	7.86	0.63
11/10/2021	2:32:25	WQ3	12.58	8.92	78.6	7.50	46562	29.99	7.86	0.74
11/10/2021	2:32:29	WQ3	11.21	8.81	78.7	7.54	46354	29.84	7.87	0.88
11/10/2021	2:32:32	WQ3	10.57	8.74	78.9	7.57	46185	29.71	7.87	0.98
11/10/2021	2:32:37	WQ3	9.90	8.68	79.5	7.65	46099	29.65	7.87	1.06
11/10/2021	2:32:39	WQ3	8.73	8.68	79.7	7.67	46079	29.63	7.87	1.07
11/10/2021	2:32:40	WQ3	8.51	8.67	79.9	7.68	46068	29.62	7.87	1.08
11/10/2021	2:32:46	WQ3	7.76	8.66	80.4	7.74	46010	29.58	7.87	1.15
11/10/2021	2:32:48	WQ3	6.69	8.65	80.6	7.76	45980	29.56	7.87	1.12
11/10/2021	2:32:55	WQ3	5.78	8.61	81.5	7.85	45914	29.51	7.87	1.18
11/10/2021	2:32:58	WQ3	4.50	8.60	81.8	7.89	45885	29.49	7.87	1.22
11/10/2021	2:33:02	WQ3	3.67	8.59	82.3	7.94	45869	29.48	7.89	1.23
11/10/2021	2:33:04	WQ3	2.43	8.59	82.4	7.95	45855	29.47	7.89	1.22
11/10/2021	2:33:06	WQ3	1.68	8.58	82.6	7.97	45859	29.47	7.90	1.20
11/10/2021	2:33:17	WQ3	0.51	8.55	83.4	8.05	45865	29.47	7.95	1.05
11/11/2021	1:54:58	WQ4	79.38	9.44	73.7	6.88	48870	31.65	7.84	0.35
11/11/2021	1:54:59	WQ4	78.14	9.44	73.7	6.88	48874	31.66	7.85	0.36
11/11/2021	1:55:01	WQ4	77.35	9.45	73.7	6.88	48863	31.65	7.85	0.38
11/11/2021	1:55:04	WQ4	76.74	9.47	73.7	6.88	48859	31.65	7.85	0.38
11/11/2021	1:55:05	WQ4	75.36	9.48	73.8	6.88	48851	31.64	7.85	0.36
11/11/2021	1:55:07	WQ4	74.35	9.51	73.9	6.89	48835	31.63	7.86	0.33
11/11/2021	1:55:09	WQ4	73.89	9.54	74.1	6.90	48817	31.62	7.86	0.33
11/11/2021	1:55:11	WQ4	72.35	9.58	74.4	6.92	48794	31.61	7.87	0.33
11/11/2021	1:55:13	WQ4	71.48	9.63	74.7	6.95	48763	31.59	7.87	0.33
11/11/2021	1:55:15	WQ4	70.88	9.66	75.1	6.98	48747	31.58	7.88	0.33
11/11/2021	1:55:16	WQ4	69.78	9.67	75.3	7.00	48741	31.58	7.88	0.33
11/11/2021	1:55:18	WQ4	68.68	9.70	75.8	7.04	48712	31.56	7.88	0.34
11/11/2021	1:55:22	WQ4	67.64	9.73	76.5	7.10	48689	31.55	7.89	0.36
11/11/2021	1:55:23	WQ4	66.41	9.73	76.7	7.12	48684	31.54	7.89	0.36
11/11/2021	1:55:25	WQ4	65.49	9.74	77.0	7.14	48673	31.54	7.89	0.36
11/11/2021	1:55:26	WQ4	65.41	9.74	77.1	7.15	48672	31.54	7.90	0.39
11/11/2021	1:55:28	WQ4	63.87	9.75	77.3	7.18	48660	31.53	7.90	0.39
11/11/2021	1:55:31	WQ4	62.55	9.75	77.6	7.20	48653	31.53	7.90	0.34
11/11/2021	1:55:33	WQ4	61.29	9.75	77.8	7.22	48639	31.52	7.90	0.34
11/11/2021	1:55:35	WQ4	60.26	9.75	78.0	7.24	48630	31.51	7.90	0.33
11/11/2021	1:55:38	WQ4	59.48	9.75	78.2	7.26	48613	31.50	7.91	0.32

Date	Site	Time	Depth (m)	Temp (°C)	DO (%)	DO (mg/L)	SPC (µS/cm)	SAL (ppt)	pH	Chl (RFU)
11/11/2021	1:55:39	WQ4	58.47	9.75	78.2	7.26	48607	31.49	7.91	0.33
11/11/2021	1:55:41	WQ4	57.44	9.75	78.4	7.27	48590	31.48	7.91	0.31
11/11/2021	1:55:44	WQ4	56.63	9.75	78.5	7.29	48579	31.48	7.91	0.34
11/11/2021	1:55:45	WQ4	55.29	9.75	78.6	7.29	48573	31.47	7.91	0.32
11/11/2021	1:55:47	WQ4	54.17	9.76	78.7	7.30	48570	31.47	7.91	0.34
11/11/2021	1:55:49	WQ4	53.73	9.76	78.8	7.31	48563	31.47	7.91	0.34
11/11/2021	1:55:50	WQ4	52.49	9.77	78.9	7.32	48556	31.46	7.91	0.36
11/11/2021	1:55:52	WQ4	51.55	9.78	79.0	7.33	48553	31.46	7.91	0.37
11/11/2021	1:55:54	WQ4	50.81	9.78	79.2	7.35	48547	31.46	7.91	0.35
11/11/2021	1:55:56	WQ4	49.30	9.79	79.4	7.36	48543	31.46	7.92	0.38
11/11/2021	1:55:57	WQ4	48.55	9.80	79.5	7.37	48537	31.45	7.92	0.38
11/11/2021	1:56:00	WQ4	47.74	9.81	79.8	7.40	48512	31.43	7.92	0.40
11/11/2021	1:56:01	WQ4	46.45	9.81	79.9	7.41	48504	31.43	7.92	0.40
11/11/2021	1:56:03	WQ4	45.44	9.81	80.1	7.43	48485	31.42	7.92	0.41
11/11/2021	1:56:06	WQ4	43.91	9.81	80.4	7.45	48441	31.38	7.92	0.39
11/11/2021	1:56:08	WQ4	43.00	9.80	80.6	7.47	48363	31.33	7.92	0.41
11/11/2021	1:56:09	WQ4	42.44	9.79	80.6	7.48	48320	31.30	7.93	0.42
11/11/2021	1:56:11	WQ4	41.94	9.78	80.8	7.51	48248	31.25	7.93	0.40
11/11/2021	1:56:13	WQ4	40.37	9.76	81.0	7.53	48172	31.19	7.93	0.40
11/11/2021	1:56:16	WQ4	39.36	9.74	81.5	7.58	48067	31.11	7.93	0.45
11/11/2021	1:56:17	WQ4	39.18	9.73	81.6	7.59	48040	31.09	7.93	0.47
11/11/2021	1:56:18	WQ4	37.78	9.72	81.7	7.61	48003	31.07	7.93	0.43
11/11/2021	1:56:22	WQ4	36.53	9.70	82.1	7.65	47960	31.04	7.94	0.42
11/11/2021	1:56:23	WQ4	35.33	9.70	82.2	7.66	47955	31.03	7.94	0.46
11/11/2021	1:56:25	WQ4	34.30	9.69	82.3	7.67	47946	31.03	7.94	0.45
11/11/2021	1:56:28	WQ4	33.60	9.68	82.4	7.68	47937	31.02	7.94	0.41
11/11/2021	1:56:29	WQ4	32.49	9.68	82.4	7.68	47929	31.01	7.94	0.40
11/11/2021	1:56:31	WQ4	31.51	9.66	82.4	7.68	47914	31.00	7.94	0.38
11/11/2021	1:56:33	WQ4	30.84	9.64	82.3	7.68	47901	30.99	7.94	0.35
11/11/2021	1:56:35	WQ4	29.11	9.62	82.2	7.68	47893	30.99	7.94	0.38
11/11/2021	1:56:36	WQ4	28.58	9.61	82.1	7.67	47893	30.99	7.94	0.36
11/11/2021	1:56:39	WQ4	26.98	9.58	81.9	7.65	47868	30.97	7.94	0.40
11/11/2021	1:56:40	WQ4	26.56	9.58	81.8	7.64	47857	30.96	7.94	0.41
11/11/2021	1:56:41	WQ4	25.84	9.55	81.6	7.63	47807	30.92	7.94	0.45
11/11/2021	1:56:44	WQ4	24.32	9.47	81.1	7.60	47705	30.84	7.93	0.47
11/11/2021	1:56:45	WQ4	23.90	9.45	80.9	7.59	47683	30.83	7.93	0.46
11/11/2021	1:56:49	WQ4	22.38	9.30	79.9	7.53	47453	30.65	7.92	0.49
11/11/2021	1:56:50	WQ4	21.49	9.27	79.8	7.52	47403	30.61	7.92	0.49
11/11/2021	1:56:52	WQ4	20.48	9.19	79.2	7.49	47251	30.50	7.92	0.52
11/11/2021	1:56:55	WQ4	19.82	9.10	78.7	7.46	47075	30.37	7.91	0.58
11/11/2021	1:56:56	WQ4	18.62	9.06	78.5	7.45	46975	30.29	7.91	0.63
11/11/2021	1:56:59	WQ4	17.48	8.93	78.2	7.45	46687	30.08	7.91	0.78
11/11/2021	1:57:02	WQ4	15.82	8.81	78.3	7.50	46426	29.89	7.91	0.94
11/11/2021	1:57:03	WQ4	15.53	8.78	78.4	7.51	46373	29.85	7.91	0.99
11/11/2021	1:57:06	WQ4	14.79	8.67	78.9	7.59	46146	29.68	7.91	1.12
11/11/2021	1:57:08	WQ4	13.32	8.60	79.4	7.64	46052	29.61	7.91	1.16
11/11/2021	1:57:09	WQ4	12.57	8.58	79.7	7.68	46024	29.58	7.91	1.19
11/11/2021	1:57:12	WQ4	11.60	8.55	80.6	7.78	45995	29.56	7.91	1.19
11/11/2021	1:57:14	WQ4	10.06	8.54	81.1	7.83	45986	29.56	7.92	1.19
11/11/2021	1:57:15	WQ4	9.36	8.54	81.3	7.85	45979	29.55	7.92	1.18
11/11/2021	1:57:18	WQ4	8.50	8.53	81.9	7.91	45960	29.54	7.92	1.25
11/11/2021	1:57:22	WQ4	7.00	8.51	82.6	7.98	45929	29.51	7.93	1.32
11/11/2021	1:57:23	WQ4	6.59	8.51	82.7	7.99	45923	29.51	7.93	1.35
11/11/2021	1:57:24	WQ4	6.30	8.50	82.8	8.01	45919	29.51	7.93	1.36
11/11/2021	1:57:25	WQ4	5.82	8.50	83.0	8.02	45913	29.50	7.93	1.39
11/11/2021	1:57:26	WQ4	5.53	8.50	83.1	8.03	45909	29.50	7.93	1.38
11/11/2021	1:57:27	WQ4	5.27	8.49	83.2	8.05	45904	29.50	7.93	1.37
11/11/2021	1:57:28	WQ4	4.24	8.49	83.4	8.06	45898	29.49	7.93	1.38
11/11/2021	1:57:29	WQ4	3.57	8.49	83.5	8.07	45893	29.49	7.93	1.35
11/11/2021	1:57:30	WQ4	3.14	8.48	83.6	8.08	45894	29.49	7.93	1.35
11/11/2021	1:57:32	WQ4	2.63	8.48	83.8	8.11	45889	29.48	7.94	1.34
11/11/2021	1:57:35	WQ4	0.90	8.48	84.1	8.14	45886	29.48	7.94	1.36
11/11/2021	1:57:36	WQ4	0.54	8.48	84.2	8.15	45885	29.48	7.94	1.35
11/10/2021	3:08:25	WQ5	44.35	9.42	74.1	6.94	48235	31.21	7.83	0.67
11/10/2021	3:08:26	WQ5	43.64	9.42	74.1	6.94	48235	31.21	7.83	0.65
11/10/2021	3:08:31	WQ5	42.43	9.43	74.2	6.95	48183	31.17	7.83	0.53
11/10/2021	3:08:32	WQ5	41.44	9.43	74.2	6.95	48171	31.17	7.83	0.46
11/10/2021	3:08:34	WQ5	40.54	9.43	74.3	6.96	48156	31.16	7.83	0.38
11/10/2021	3:08:38	WQ5	39.56	9.42	74.4	6.97	48128	31.14	7.82	0.40
11/10/2021	3:08:39	WQ5	38.33	9.42	74.4	6.98	48109	31.12	7.82	0.38
11/10/2021	3:08:41	WQ5	37.52	9.40	74.5	6.98	48086	31.11	7.82	0.34
11/10/2021	3:08:44	WQ5	36.77	9.38	74.5	6.99	48037	31.07	7.82	0.36
11/10/2021	3:08:46	WQ5	35.24	9.35	74.3	6.98	47999	31.04	7.82	0.39
11/10/2021	3:08:48	WQ5	34.52	9.32	74.2	6.97	47957	31.01	7.82	0.38
11/10/2021	3:08:50	WQ5	33.93	9.28	74.0	6.96	47886	30.96	7.82	0.37
11/10/2021	3:08:52	WQ5	32.41	9.25	73.9	6.96	47821	30.91	7.82	0.42
11/10/2021	3:08:56	WQ5	31.40	9.17	73.5	6.94	47678	30.80	7.82	0.46
11/10/2021	3:08:57	WQ5	30.37	9.16	73.4	6.94	47636	30.77	7.82	0.47
11/10/2021	3:08:59	WQ5	29.59	9.12	73.3	6.93	47549	30.70	7.81	0.49
11/10/2021	3:09:03	WQ5	28.60	9.01	73.1	6.94	47240	30.48	7.81	0.53
11/10/2021	3:09:04	WQ5	27.52	8.99	73.0	6.94	47169	30.42	7.81	0.54
11/10/2021	3:09:07	WQ5	26.49	8.90	73.1	6.96	46889	30.22	7.81	0.63
11/10/2021	3:09:13	WQ5	24.44	8.75	73.8	7.08	46360	29.83	7.81	0.82
11/10/2021	3:09:16	WQ5	23.59	8.71	74.6	7.17	46226	29.73	7.82	0.88
11/10/2021	3:09:18	WQ5	22.37	8.69	75.3	7.23	46153	29.68	7.82	0.89
11/10/2021	3:09:21	WQ5	21.58	8.67	76.1	7.33	46061	29.61	7.82	0.92
11/10/2021	3:09:25	WQ5	20.08	8.66	77.2	7.43	46003	29.57	7.83	0.91
11/10/2021	3:09:27	WQ5	19.54	8.66	77.6	7.47	46007	29.57	7.83	0.95
11/10/2021	3:09:32	WQ5	18.70	8.64	78.4	7.55	46019	29.58	7.84	0.93
11/10/2021	3:09:34	WQ5	17.37	8.64	78.6	7.57	46017	29.58	7.84	0.90
11/10/2021	3:09:39	WQ5	16.50	8.62	79.1	7.62	46000	29.57	7.84	0.98

Date	Site	Time	Depth (m)	Temp (°C)	DO (%)	DO (mg/L)	SPC (µS/cm)	SAL (ppt)	pH	Chl (RFU)
11/10/2021	3:09:41	WQ5	15.45	8.61	79.2	7.63	45971	29.55	7.84	1.03
11/10/2021	3:09:46	WQ5	14.49	8.57	79.5	7.67	45921	29.51	7.85	1.09
11/10/2021	3:09:50	WQ5	13.12	8.53	79.7	7.70	45855	29.46	7.85	1.07
11/10/2021	3:09:53	WQ5	12.56	8.51	79.8	7.72	45809	29.43	7.86	1.11
11/10/2021	3:09:58	WQ5	11.14	8.47	80.1	7.75	45741	29.37	7.87	1.10
11/10/2021	3:10:02	WQ5	10.45	8.43	80.3	7.78	45693	29.34	7.87	1.14
11/10/2021	3:10:07	WQ5	9.10	8.40	80.5	7.80	45655	29.31	7.88	1.11
11/10/2021	3:10:09	WQ5	8.67	8.39	80.5	7.81	45657	29.31	7.89	1.11
11/10/2021	3:10:15	WQ5	7.93	8.38	80.7	7.83	45629	29.29	7.89	1.10
11/10/2021	3:10:18	WQ5	6.40	8.38	80.8	7.84	45627	29.29	7.90	1.10
11/10/2021	3:10:22	WQ5	5.87	8.37	80.9	7.85	45602	29.27	7.91	1.13
11/10/2021	3:10:25	WQ5	4.52	8.37	80.9	7.86	45587	29.26	7.93	1.16
11/10/2021	3:10:30	WQ5	3.64	8.36	81.0	7.87	45561	29.24	7.95	1.20
11/10/2021	3:10:31	WQ5	2.67	8.36	81.1	7.87	45555	29.24	7.95	1.16
11/10/2021	3:10:35	WQ5	1.60	8.35	81.1	7.88	45536	29.22	7.97	1.15
11/10/2021	3:10:40	WQ5	0.68	8.30	81.1	7.89	45473	29.18	7.99	1.00
11/11/2021	12:48:42	WQ6	52.32	9.67	76.9	7.15	48439	31.37	8.01	0.41
11/11/2021	12:48:45	WQ6	51.25	9.67	77.0	7.16	48445	31.38	8.01	0.40
11/11/2021	12:48:49	WQ6	50.59	9.67	77.1	7.17	48453	31.38	8.01	0.39
11/11/2021	12:48:53	WQ6	49.23	9.67	77.1	7.17	48445	31.38	8.01	0.42
11/11/2021	12:48:58	WQ6	48.49	9.67	77.1	7.18	48434	31.37	8.01	0.45
11/11/2021	12:49:02	WQ6	47.24	9.66	77.4	7.20	48404	31.35	8.01	0.40
11/11/2021	12:49:06	WQ6	46.51	9.65	77.6	7.23	48382	31.33	8.01	0.32
11/11/2021	12:49:10	WQ6	45.23	9.64	77.6	7.23	48350	31.31	8.01	0.36
11/11/2021	12:49:12	WQ6	44.53	9.64	77.5	7.22	48322	31.29	8.01	0.40
11/11/2021	12:49:14	WQ6	43.71	9.63	77.3	7.20	48307	31.28	8.01	0.41
11/11/2021	12:49:15	WQ6	42.27	9.62	77.2	7.20	48290	31.26	8.01	0.42
11/11/2021	12:49:18	WQ6	41.56	9.61	77.0	7.18	48256	31.24	8.01	0.53
11/11/2021	12:49:21	WQ6	39.27	9.60	76.8	7.16	48189	31.19	8.01	0.51
11/11/2021	12:49:23	WQ6	38.60	9.59	76.6	7.15	48163	31.17	8.01	0.51
11/11/2021	12:49:29	WQ6	37.70	9.56	76.7	7.16	48073	31.11	8.01	0.42
11/11/2021	12:49:30	WQ6	36.81	9.56	76.7	7.16	48053	31.09	8.01	0.41
11/11/2021	12:49:33	WQ6	35.46	9.54	76.7	7.17	48017	31.07	8.01	0.36
11/11/2021	12:49:36	WQ6	34.83	9.52	76.8	7.18	47990	31.05	8.01	0.36
11/11/2021	12:49:38	WQ6	33.29	9.51	76.8	7.19	47970	31.03	8.01	0.36
11/11/2021	12:49:41	WQ6	32.61	9.49	76.8	7.19	47934	31.00	8.01	0.44
11/11/2021	12:49:43	WQ6	31.29	9.47	76.7	7.19	47903	30.98	8.01	0.39
11/11/2021	12:49:46	WQ6	30.43	9.45	76.6	7.18	47867	30.95	8.01	0.45
11/11/2021	12:49:50	WQ6	29.68	9.44	76.7	7.19	47827	30.93	8.01	0.41
11/11/2021	12:49:52	WQ6	28.39	9.44	76.7	7.20	47808	30.91	8.01	0.41
11/11/2021	12:49:57	WQ6	27.54	9.44	76.8	7.20	47780	30.89	8.01	0.45
11/11/2021	12:49:59	WQ6	26.53	9.44	76.9	7.21	47774	30.89	8.01	0.51
11/11/2021	12:50:06	WQ6	25.59	9.23	76.3	7.19	47670	30.80	8.01	0.49
11/11/2021	12:50:12	WQ6	24.47	8.94	71.5	6.79	47557	30.70	8.00	0.47
11/11/2021	12:50:19	WQ6	23.58	8.81	70.8	6.75	47465	30.62	7.98	0.43
11/11/2021	12:50:22	WQ6	22.47	8.79	70.5	6.73	47418	30.59	7.98	0.42
11/11/2021	12:50:29	WQ6	21.63	8.76	69.7	6.66	47293	30.50	7.97	0.52
11/11/2021	12:50:33	WQ6	20.52	8.74	69.5	6.64	47211	30.44	7.97	0.54
11/11/2021	12:50:40	WQ6	19.60	8.68	69.3	6.64	47000	30.28	7.97	0.53
11/11/2021	12:50:44	WQ6	18.53	8.66	69.5	6.66	46893	30.21	7.98	0.55
11/11/2021	12:50:52	WQ6	17.66	8.65	70.2	6.73	46703	30.07	7.98	0.60
11/11/2021	12:50:56	WQ6	16.52	8.64	70.6	6.78	46630	30.02	7.99	0.59
11/11/2021	12:51:06	WQ6	15.64	8.63	72.0	6.93	46365	29.83	8.00	0.72
11/11/2021	12:51:10	WQ6	14.40	8.63	72.7	6.99	46307	29.79	8.00	0.71
11/11/2021	12:51:23	WQ6	13.53	8.60	74.5	7.17	46169	29.69	8.01	0.77
11/11/2021	12:51:26	WQ6	12.55	8.59	75.0	7.23	46143	29.67	8.01	0.80
11/11/2021	12:51:36	WQ6	11.76	8.58	76.5	7.37	46110	29.65	8.02	0.82
11/11/2021	12:51:40	WQ6	10.47	8.58	76.8	7.40	46080	29.62	8.03	0.87
11/11/2021	12:51:50	WQ6	9.73	8.54	78.0	7.52	46011	29.57	8.03	1.04
11/11/2021	12:51:53	WQ6	8.53	8.53	78.5	7.58	46002	29.57	8.04	1.05
11/11/2021	12:52:01	WQ6	7.77	8.51	79.9	7.72	45954	29.53	8.05	1.12
11/11/2021	12:52:05	WQ6	6.51	8.50	80.6	7.79	45941	29.52	8.05	1.16
11/11/2021	12:52:10	WQ6	5.85	8.49	81.4	7.87	45920	29.51	8.06	1.19
11/11/2021	12:52:13	WQ6	4.43	8.48	81.9	7.92	45908	29.50	8.06	1.19
11/11/2021	12:52:19	WQ6	3.63	8.47	82.8	8.01	45876	29.47	8.07	1.20
11/11/2021	12:52:20	WQ6	2.66	8.47	83.0	8.03	45868	29.47	8.07	1.24
11/11/2021	12:52:24	WQ6	1.53	8.46	83.5	8.08	45874	29.47	8.07	1.30
11/11/2021	12:52:25	WQ6	0.57	8.46	83.6	8.09	45881	29.48	8.07	1.30

Notes: Temp = temperature; DO = dissolved oxygen; SPC = specific conductivity; C = conductivity; SAL = salinity; Chl = chlorophyll; "-"measurement not recorded

Table G.2-4 CTD Profiles for Water Quality Stations, November 2021

Date	Site	Time	Depth (m)	Temp (°C)	DO (%)	DO (mg/L)	SPC (µS/cm)	C (µS/cm)	TDS (mg/L)	SAL (ppt)	pH	Turbidity (NTU)	Chl (RFU)
3/5/2022	WQ1	15:40:22	61.73	6.45	80.4	8.08	47855	30895	31106	30.67	7.96	0.56	-0.18
3/5/2022	WQ1	15:40:23	60.75	6.45	80.5	8.09	47837	30885	31094	30.66	7.96	0.45	-0.18
3/5/2022	WQ1	15:40:25	59.25	6.45	80.8	8.12	47800	30865	31070	30.64	7.96	0.41	-0.17
3/5/2022	WQ1	15:40:26	57.97	6.45	80.9	8.14	47782	30855	31058	30.62	7.97	0.39	-0.17
3/5/2022	WQ1	15:40:27	57.07	6.45	81.1	8.15	47761	30843	31045	30.61	7.97	0.39	-0.16
3/5/2022	WQ1	15:40:28	56.17	6.46	81.2	8.17	47742	30831	31032	30.60	7.97	0.37	-0.16
3/5/2022	WQ1	15:40:29	55.63	6.46	81.5	8.19	47727	30823	31023	30.59	7.98	0.36	-0.15
3/5/2022	WQ1	15:40:30	54.47	6.46	81.7	8.21	47715	30815	31014	30.58	7.98	0.35	-0.15
3/5/2022	WQ1	15:40:31	53.96	6.46	81.9	8.24	47700	30806	31005	30.57	7.98	0.35	-0.15
3/5/2022	WQ1	15:40:33	52.34	6.46	82.2	8.27	47676	30790	30990	30.55	7.98	0.34	-0.14
3/5/2022	WQ1	15:40:34	51.13	6.46	82.5	8.30	47665	30782	30982	30.54	7.98	0.33	-0.13
3/5/2022	WQ1	15:40:35	50.40	6.46	82.6	8.31	47655	30776	30976	30.54	7.99	0.32	-0.13
3/5/2022	WQ1	15:40:36	49.24	6.46	82.8	8.34	47643	30767	30968	30.53	7.99	0.32	-0.13
3/5/2022	WQ1	15:40:37	48.38	6.45	83.0	8.35	47631	30759	30960	30.52	7.99	0.31	-0.13
3/5/2022	WQ1	15:40:38	47.10	6.45	83.2	8.37	47617	30749	30951	30.51	7.99	0.31	-0.14
3/5/2022	WQ1	15:40:39	46.22	6.45	83.4	8.39	47606	30741	30944	30.50	7.99	0.32	-0.14
3/5/2022	WQ1	15:40:41	45.29	6.45	83.7	8.43	47574	30717	30923	30.48	7.99	0.32	-0.16
3/5/2022	WQ1	15:40:42	44.28	6.45	83.9	8.44	47535	30691	30897	30.45	8.00	0.35	-0.16
3/5/2022	WQ1	15:40:43	43.48	6.44	84.0	8.46	47479	30652	30862	30.41	8.00	0.35	-0.16
3/5/2022	WQ1	15:40:44	42.53	6.44	84.1	8.48	47424	30613	30826	30.38	8.00	0.36	-0.17
3/5/2022	WQ1	15:40:45	41.81	6.43	84.3	8.50	47350	30557	30777	30.32	8.00	0.37	-0.18
3/5/2022	WQ1	15:40:46	40.68	6.42	84.5	8.52	47267	30492	30723	30.26	8.00	0.38	-0.17
3/5/2022	WQ1	15:40:47	39.92	6.41	84.6	8.54	47212	30448	30688	30.22	8.00	0.38	-0.18
3/5/2022	WQ1	15:40:48	38.83	6.40	84.8	8.56	47148	30396	30646	30.18	8.01	0.39	-0.18
3/5/2022	WQ1	15:40:49	38.07	6.38	84.9	8.58	47076	30337	30599	30.13	8.01	0.40	-0.18
3/5/2022	WQ1	15:40:50	36.87	6.37	85.1	8.61	47015	30285	30560	30.08	8.01	0.40	-0.18
3/5/2022	WQ1	15:40:51	35.86	6.35	85.3	8.63	46938	30218	30509	30.03	8.01	0.39	-0.18
3/5/2022	WQ1	15:40:52	34.54	6.34	85.5	8.66	46912	30192	30493	30.01	8.01	0.38	-0.18
3/5/2022	WQ1	15:40:53	33.86	6.33	85.7	8.68	46875	30155	30469	29.98	8.01	0.37	-0.18
3/5/2022	WQ1	15:40:54	32.56	6.31	85.9	8.71	46839	30120	30445	29.95	8.01	0.37	-0.18
3/5/2022	WQ1	15:40:55	31.60	6.30	86.1	8.73	46806	30089	30424	29.93	8.01	0.37	-0.17
3/5/2022	WQ1	15:40:56	30.38	6.28	86.3	8.75	46764	30048	30397	29.90	8.01	0.37	-0.17
3/5/2022	WQ1	15:40:57	29.60	6.27	86.5	8.77	46738	30021	30379	29.88	8.01	0.36	-0.17
3/5/2022	WQ1	15:40:58	28.45	6.26	86.6	8.79	46701	29984	30356	29.85	8.01	0.36	-0.16
3/5/2022	WQ1	15:40:59	27.66	6.24	86.7	8.81	46667	29949	30333	29.83	8.01	0.36	-0.16
3/5/2022	WQ1	15:41:00	26.67	6.23	86.8	8.83	46619	29903	30303	29.79	8.01	0.37	-0.17
3/5/2022	WQ1	15:41:02	24.95	6.19	87.0	8.85	46488	29785	30217	29.70	8.01	0.34	-0.16
3/5/2022	WQ1	15:41:04	23.14	6.14	87.0	8.87	46352	29653	30129	29.60	8.02	0.33	-0.15
3/5/2022	WQ1	15:41:05	22.54	6.11	87.0	8.88	46273	29579	30077	29.54	8.01	0.33	-0.14
3/5/2022	WQ1	15:41:06	21.19	6.08	87.0	8.89	46145	29468	29994	29.44	8.01	0.34	-0.14
3/5/2022	WQ1	15:41:07	20.08	6.04	86.9	8.89	46015	29355	29909	29.35	8.01	0.33	-0.13
3/5/2022	WQ1	15:41:08	19.06	5.99	86.8	8.90	45872	29224	29817	29.24	8.02	0.33	-0.13
3/5/2022	WQ1	15:41:09	18.35	5.95	86.8	8.91	45749	29107	29737	29.15	8.02	0.32	-0.12
3/5/2022	WQ1	15:41:10	17.11	5.90	86.7	8.92	45611	28973	29647	29.05	8.02	0.31	-0.11
3/5/2022	WQ1	15:41:11	16.04	5.85	86.7	8.93	45483	28843	29564	28.96	8.01	0.32	-0.10
3/5/2022	WQ1	15:41:12	15.01	5.79	86.6	8.94	45380	28735	29497	28.88	8.01	0.32	-0.10
3/5/2022	WQ1	15:41:13	14.21	5.74	86.6	8.96	45266	28615	29423	28.79	8.01	0.32	-0.08
3/5/2022	WQ1	15:41:14	13.07	5.69	86.7	8.98	45181	28520	29368	28.73	8.01	0.33	-0.08
3/5/2022	WQ1	15:41:15	12.02	5.64	86.7	9.00	45114	28433	29324	28.68	8.01	0.31	-0.09
3/5/2022	WQ1	15:41:16	10.96	5.60	86.8	9.02	45080	28376	29302	28.65	8.01	0.30	-0.08
3/5/2022	WQ1	15:41:17	10.08	5.56	87.0	9.05	45038	28315	29275	28.62	8.01	0.30	-0.08
3/5/2022	WQ1	15:41:18	8.83	5.53	87.1	9.07	44994	28261	29246	28.58	8.01	0.29	-0.07
3/5/2022	WQ1	15:41:19	7.80	5.50	87.2	9.09	44948	28205	29216	28.55	8.01	0.29	-0.06
3/5/2022	WQ1	15:41:20	6.86	5.47	87.4	9.12	44921	28167	29199	28.53	8.01	0.29	-0.05
3/5/2022	WQ1	15:41:22	5.98	5.43	87.7	9.17	44873	28097	29167	28.49	8.01	0.29	-0.03
3/5/2022	WQ1	15:41:23	4.30	5.41	87.9	9.19	44842	28063	29147	28.47	8.01	0.28	-0.03
3/5/2022	WQ1	15:41:24	3.37	5.39	88.0	9.21	44799	28021	29119	28.43	8.01	0.28	-0.03
3/5/2022	WQ1	15:41:25	2.43	5.37	88.1	9.23	44764	27986	29096	28.41	8.01	0.29	-0.02
3/5/2022	WQ1	15:41:26	2.13	5.36	88.3	9.25	44723	27945	29070	28.38	8.01	0.29	-0.02
3/5/2022	WQ1	15:41:27	0.90	5.34	88.4	9.26	44690	27912	29049	28.35	8.01	0.30	-0.01
3/5/2022	WQ1	15:41:28	0.58	5.33	88.5	9.28	44646	27869	29020	28.32	8.01	0.29	-0.02
3/5/2022	WQ2	15:59:57	77.87	6.42	70.1	7.04	48213	31103	31338	30.92	7.96	0.65	-0.18
3/5/2022	WQ2	15:59:58	76.78	6.42	70.3	7.06	48172	31078	31312	30.89	7.97	0.59	-0.18
3/5/2022	WQ2	16:00:00	75.74	6.43	70.8	7.11	48099	31036	31265	30.84	7.98	0.52	-0.17
3/5/2022	WQ2	16:00:02	75.06	6.43	71.5	7.18	48042	31005	31228	30.80	8.00	0.49	-0.17
3/5/2022	WQ2	16:00:03	73.42	6.44	71.9	7.23	48020	30993	31213	30.78	8.00	0.48	-0.17
3/5/2022	WQ2	16:00:04	72.88	6.44	72.3	7.27	48009	30990	31206	30.78	8.01	0.44	-0.17
3/5/2022	WQ2	16:00:07	71.29	6.45	73.6	7.40	47981	30979	31187	30.76	8.02	0.43	-0.17
3/5/2022	WQ2	16:00:08	69.98	6.45	74.0	7.43	47971	30974	31181	30.75	8.02	0.42	-0.17
3/5/2022	WQ2	16:00:09	69.06	6.45	74.4	7.47	47959	30967	31174	30.74	8.02	0.41	-0.18
3/5/2022	WQ2	16:00:10	68.10	6.45	74.7	7.51	47949	30961	31167	30.74	8.02	0.39	-0.18
3/5/2022	WQ2	16:00:12	67.08	6.45	75.3	7.57	47926	30946	31152	30.72	8.03	0.38	-0.18
3/5/2022	WQ2	16:00:13	66.08	6.45	75.7	7.61	47913	30939	31143	30.71	8.03	0.37	-0.18
3/5/2022	WQ2	16:00:14	65.20	6.45	75.9	7.63	47902	30932	31136	30.70	8.03	0.35	-0.17
3/5/2022	WQ2	16:00:16	64.65	6.45	76.5	7.69	47882	30919	31123	30.69	8.03	0.34	-0.17
3/5/2022	WQ2	16:00:17	63.20	6.45	76.8	7.72	47875	30914	31119	30.69	8.03	0.35	-0.16
3/5/2022	WQ2	16:00:18	62.50	6.45	77.1	7.75	47867	30909	31113	30.68	8.03	0.35	-0.15
3/5/2022	WQ2	16:00:20	61.36	6.45	77.6	7.80	47853	30899	31105	30.67	8.04	0.35	-0.16
3/5/2022	WQ2	16:00:21	60.60	6.45	77.8	7.82	47843	30892	31098	30.67	8.04	0.35	-0.15
3/5/2022	WQ2	16:00:22	59.60	6.45	78.0	7.85	47826	30880	31087	30.65	8.04	0.36	-0.15
3/5/2022	WQ2	16:00:24	58.45	6.45	78.4	7.89	47771	30842	31051	30.61	8.04	0.39	-0.16
3/5/2022	WQ2	16:00:25	57.33	6.44	78.7	7.91	47741	30821	31032	30.59	8.04	0.39	-0.15
3/5/2022	WQ2	16:00:26	56.38	6.44	78.9	7.94	47704	30795	31008	30.57	8.05	0.38	-0.15
3/5/2022	WQ2	16:00:27	55.80	6.44	79.1	7.96	47670	30772	30986	30.54	8.05	0.36	-0.16
3/5/2022	WQ2	16:00:29	54.31	6.44	79.7	8.03	47595	30720	30937	30.49	8.06	0.34	-0.16
3/5/2022	WQ2	16:00:30	53.65	6.44	80.0	8.06	47564	30699	30917	30.47	8.06	0.34	-0.16
3/5/2022	WQ2	16:00:31	52.81	6.44	80.4	8.10	47534	30679	30897	30.45	8.06	0.31	-0.15

Date	Site	Time	Depth (m)	Temp (°C)	DO (%)	DO (mg/L)	SPC (µS/cm)	C (µS/cm)	TDS (mg/L)	SAL (ppt)	pH	Turbidity (NTU)	Chl (RFU)
3/5/2022	WQ2	16:00:33	51.25	6.43	81.2	8.18	47501	30657	30876	30.43	8.07	0.28	-0.16
3/5/2022	WQ2	16:00:34	50.30	6.43	81.5	8.22	47491	30650	30869	30.42	8.07	0.28	-0.16
3/5/2022	WQ2	16:00:36	49.32	6.44	82.3	8.30	47479	30644	30861	30.41	8.08	0.27	-0.17
3/5/2022	WQ2	16:00:37	48.19	6.44	82.8	8.34	47473	30641	30857	30.41	8.08	0.28	-0.17
3/5/2022	WQ2	16:00:38	47.49	6.44	83.1	8.37	47466	30637	30853	30.40	8.08	0.30	-0.17
3/5/2022	WQ2	16:00:39	46.67	6.44	83.5	8.41	47454	30630	30845	30.39	8.08	0.32	-0.17
3/5/2022	WQ2	16:00:41	45.04	6.44	84.1	8.47	47426	30611	30827	30.37	8.09	0.35	-0.18
3/5/2022	WQ2	16:00:42	44.42	6.44	84.4	8.50	47408	30598	30815	30.36	8.09	0.37	-0.17
3/5/2022	WQ2	16:00:43	43.52	6.43	84.6	8.53	47389	30584	30803	30.35	8.09	0.37	-0.17
3/5/2022	WQ2	16:00:44	42.79	6.43	84.9	8.56	47365	30567	30787	30.33	8.09	0.38	-0.17
3/5/2022	WQ2	16:00:45	41.61	6.43	85.1	8.58	47343	30551	30773	30.32	8.09	0.40	-0.17
3/5/2022	WQ2	16:00:46	40.86	6.43	85.4	8.61	47315	30529	30755	30.30	8.09	0.39	-0.17
3/5/2022	WQ2	16:00:47	39.98	6.42	85.6	8.63	47286	30507	30736	30.28	8.09	0.39	-0.17
3/5/2022	WQ2	16:00:49	38.86	6.41	86.0	8.68	47214	30451	30689	30.23	8.09	0.40	-0.17
3/5/2022	WQ2	16:00:50	37.34	6.41	86.2	8.71	47175	30420	30664	30.20	8.09	0.39	-0.17
3/5/2022	WQ2	16:00:51	36.46	6.40	86.4	8.73	47145	30394	30644	30.18	8.10	0.39	-0.16
3/5/2022	WQ2	16:00:52	35.52	6.39	86.6	8.75	47116	30368	30625	30.16	8.10	0.40	-0.16
3/5/2022	WQ2	16:00:54	33.63	6.37	86.9	8.79	47069	30322	30595	30.12	8.10	0.42	-0.16
3/5/2022	WQ2	16:00:55	32.68	6.36	87.1	8.80	47038	30295	30575	30.10	8.10	0.41	-0.15
3/5/2022	WQ2	16:00:57	31.10	6.34	87.2	8.82	46902	30185	30486	30.00	8.10	0.39	-0.15
3/5/2022	WQ2	16:00:58	30.05	6.32	87.3	8.84	46833	30127	30442	29.95	8.10	0.38	-0.15
3/5/2022	WQ2	16:00:59	29.23	6.30	87.3	8.85	46757	30059	30392	29.90	8.10	0.38	-0.14
3/5/2022	WQ2	16:01:00	28.22	6.28	87.3	8.86	46684	29994	30345	29.84	8.10	0.38	-0.14
3/5/2022	WQ2	16:01:01	27.69	6.26	87.3	8.86	46585	29906	30280	29.77	8.10	0.39	-0.14
3/5/2022	WQ2	16:01:02	26.54	6.22	87.3	8.87	46491	29822	30219	29.70	8.10	0.37	-0.14
3/5/2022	WQ2	16:01:03	25.77	6.19	87.2	8.88	46371	29715	30141	29.61	8.10	0.39	-0.14
3/5/2022	WQ2	16:01:04	24.73	6.16	87.2	8.88	46272	29621	30077	29.54	8.09	0.37	-0.14
3/5/2022	WQ2	16:01:05	23.99	6.12	87.2	8.89	46181	29528	30017	29.47	8.09	0.37	-0.14
3/5/2022	WQ2	16:01:07	22.40	6.05	87.2	8.91	46028	29367	29918	29.36	8.09	0.41	-0.14
3/5/2022	WQ2	16:01:08	21.72	6.01	87.1	8.92	45939	29283	29860	29.29	8.09	0.42	-0.13
3/5/2022	WQ2	16:01:10	20.57	5.94	87.1	8.94	45735	29093	29728	29.14	8.09	0.42	-0.13
3/5/2022	WQ2	16:01:11	19.35	5.91	87.1	8.95	45654	29014	29675	29.08	8.09	0.41	-0.13
3/5/2022	WQ2	16:01:12	18.46	5.88	87.1	8.96	45548	28910	29606	29.00	8.09	0.41	-0.12
3/5/2022	WQ2	16:01:14	17.90	5.79	87.1	8.99	45349	28712	29477	28.86	8.09	0.39	-0.10
3/5/2022	WQ2	16:01:15	16.56	5.75	87.1	9.00	45260	28621	29419	28.79	8.09	0.38	-0.10
3/5/2022	WQ2	16:01:16	15.88	5.71	87.1	9.02	45167	28521	29358	28.72	8.09	0.35	-0.09
3/5/2022	WQ2	16:01:18	14.45	5.62	87.1	9.05	45025	28355	29266	28.61	8.09	0.32	-0.07
3/5/2022	WQ2	16:01:20	12.70	5.54	87.3	9.10	44890	28205	29178	28.51	8.09	0.30	-0.07
3/5/2022	WQ2	16:01:21	11.72	5.51	87.5	9.12	44826	28136	29137	28.46	8.09	0.29	-0.06
3/5/2022	WQ2	16:01:23	10.56	5.45	87.8	9.18	44719	28025	29068	28.38	8.09	0.27	-0.06
3/5/2022	WQ2	16:01:24	9.26	5.43	88.0	9.20	44666	27974	29033	28.34	8.09	0.28	-0.06
3/5/2022	WQ2	16:01:25	8.28	5.41	88.2	9.23	44608	27919	28995	28.30	8.09	0.26	-0.06
3/5/2022	WQ2	16:01:26	7.46	5.39	88.4	9.25	44562	27875	28965	28.27	8.09	0.26	-0.06
3/5/2022	WQ2	16:01:28	5.70	5.36	88.7	9.30	44493	27803	28920	28.22	8.09	0.27	-0.05
3/5/2022	WQ2	16:01:30	4.55	5.33	89.1	9.35	44446	27747	28890	28.18	8.09	0.29	-0.03
3/5/2022	WQ2	16:01:32	4.06	5.30	89.4	9.39	44412	27701	28868	28.15	8.09	0.29	-0.02
3/5/2022	WQ2	16:01:33	2.54	5.29	89.6	9.41	44396	27679	28858	28.14	8.09	0.29	-0.01
3/5/2022	WQ2	16:01:34	1.86	5.27	89.7	9.43	44383	27661	28849	28.13	8.09	0.29	0.00
3/5/2022	WQ2	16:01:35	1.31	5.26	89.8	9.45	44370	27641	28840	28.12	8.09	0.29	0.00
3/5/2022	WQ2	16:01:36	0.66	5.25	90.0	9.46	44357	27622	28832	28.11	8.09	0.31	0.00
3/5/2022	WQ2	16:01:37	0.47	5.24	90.1	9.48	44347	27607	28825	28.10	8.09	0.30	0.00
3/4/2022	WQ3	15:20:59	87.25	6.38	73.2	7.36	48205	31063	31334	30.90	7.97	0.46	-0.18
3/4/2022	WQ3	15:21:00	85.59	6.38	73.2	7.36	48194	31055	31326	30.89	7.97	0.41	-0.19
3/4/2022	WQ3	15:21:01	84.62	6.38	73.2	7.36	48186	31050	31321	30.89	7.97	0.41	-0.19
3/4/2022	WQ3	15:21:03	83.52	6.38	73.2	7.36	48169	31039	31310	30.88	7.97	0.42	-0.19
3/4/2022	WQ3	15:21:05	81.60	6.38	73.3	7.37	48149	31025	31297	30.86	7.97	0.44	-0.20
3/4/2022	WQ3	15:21:07	80.51	6.38	73.4	7.38	48127	31011	31283	30.85	7.98	0.44	-0.20
3/4/2022	WQ3	15:21:09	79.61	6.38	73.6	7.40	48103	30995	31267	30.83	7.98	0.42	-0.20
3/4/2022	WQ3	15:21:10	78.05	6.38	73.7	7.41	48091	30988	31259	30.83	7.98	0.42	-0.20
3/4/2022	WQ3	15:21:11	77.56	6.38	73.7	7.42	48079	30980	31251	30.82	7.98	0.41	-0.20
3/4/2022	WQ3	15:21:12	76.55	6.38	73.9	7.43	48068	30973	31244	30.81	7.99	0.40	-0.19
3/4/2022	WQ3	15:21:14	74.85	6.38	74.1	7.46	48043	30958	31228	30.79	7.99	0.39	-0.18
3/4/2022	WQ3	15:21:16	73.40	6.39	74.5	7.49	48019	30946	31212	30.78	7.99	0.35	-0.17
3/4/2022	WQ3	15:21:18	72.49	6.39	74.9	7.53	47997	30938	31198	30.76	8.00	0.37	-0.17
3/4/2022	WQ3	15:21:19	70.98	6.40	75.1	7.56	47985	30934	31190	30.75	8.00	0.35	-0.18
3/4/2022	WQ3	15:21:20	70.35	6.40	75.4	7.58	47974	30931	31183	30.75	8.01	0.35	-0.18
3/4/2022	WQ3	15:21:21	69.36	6.41	75.6	7.61	47966	30929	31178	30.74	8.01	0.35	-0.17
3/4/2022	WQ3	15:21:23	67.88	6.41	76.1	7.66	47951	30928	31168	30.73	8.02	0.34	-0.18
3/4/2022	WQ3	15:21:25	66.58	6.42	76.7	7.71	47940	30929	31161	30.73	8.02	0.34	-0.19
3/4/2022	WQ3	15:21:27	65.68	6.43	77.2	7.76	47933	30931	31156	30.72	8.02	0.32	-0.18
3/4/2022	WQ3	15:21:28	64.54	6.43	77.5	7.79	47929	30932	31154	30.72	8.02	0.33	-0.17
3/4/2022	WQ3	15:21:29	63.65	6.44	77.7	7.81	47925	30933	31152	30.72	8.03	0.34	-0.17
3/4/2022	WQ3	15:21:31	62.42	6.44	78.2	7.86	47914	30931	31144	30.71	8.03	0.34	-0.18
3/4/2022	WQ3	15:21:32	61.47	6.45	78.4	7.88	47904	30928	31138	30.71	8.03	0.35	-0.17
3/4/2022	WQ3	15:21:33	61.04	6.45	78.6	7.90	47894	30924	31131	30.70	8.03	0.33	-0.16
3/4/2022	WQ3	15:21:34	59.84	6.45	78.8	7.92	47884	30919	31125	30.69	8.03	0.33	-0.16
3/4/2022	WQ3	15:21:36	58.75	6.45	79.2	7.96	47856	30903	31107	30.68	8.04	0.34	-0.16
3/4/2022	WQ3	15:21:37	57.76	6.45	79.4	7.98	47836	30890	31093	30.66	8.04	0.34	-0.16
3/4/2022	WQ3	15:21:38	56.81	6.45	79.6	8.01	47817	30877	31081	30.65	8.04	0.34	-0.16
3/4/2022	WQ3	15:21:40	55.64	6.45	80.0	8.05	47780	30851	31057	30.62	8.04	0.34	-0.18
3/4/2022	WQ3	15:21:41	54.67	6.45	80.2	8.07	47761	30837	31044	30.61	8.04	0.32	-0.16
3/4/2022	WQ3	15:21:43	53.48	6.44	80.6	8.11	47722	30808	31020	30.58	8.05	0.33	-0.17
3/4/2022	WQ3	15:21:45	52.08	6.44	81.0	8.16	47663	30765	30981	30.54	8.05	0.33	-0.17
3/4/2022	WQ3	15:21:46	51.22	6.44	81.2	8.18	47633	30743	30962	30.52	8.05	0.31	-0.17
3/4/2022	WQ3	15:21:47	50.40	6.43	81.5	8.20	47599	30717	30940	30.50	8.05	0.32	-0.18
3/4/2022	WQ3	15:21:49	49.13	6.42	82.0	8.26	47538	30671	30900	30.45	8.06	0.29	-0.18
3/4/2022	WQ3	15:21:50	48.26	6.42	82.2	8.28	47506	30647	30879	30.43	8.06	0.31	-0.18
3/4/2022	WQ3	15:21:51	47.48	6.42	82.5	8.31	47475	30624	30859	30.41	8.06	0.32	-0.17
3/4/2022	WQ3	15:21:53	46.91	6.41	83.1	8.38	47412	30578	30818	30.36	8.07	0.30	-0.16
3/4/2022	WQ3	15:21:54	45.53	6.41	83.4	8.41	47388	30560	30802	30.35	8.07	0.29	-0.17

Date	Site	Time	Depth (m)	Temp (°C)	DO (%)	DO (mg/L)	SPC (µS/cm)	C (µS/cm)	TDS (mg/L)	SAL (ppt)	pH	Turbidity (NTU)	Chl (RFU)
3/4/2022	WQ3	15:21:55	44.65	6.41	83.8	8.45	47370	30546	30790	30.33	8.08	0.30	-0.16
3/4/2022	WQ3	15:21:57	43.55	6.40	84.4	8.52	47317	30508	30756	30.29	8.08	0.32	-0.16
3/4/2022	WQ3	15:21:58	42.66	6.40	84.7	8.55	47278	30480	30731	30.27	8.08	0.34	-0.16
3/4/2022	WQ3	15:22:00	41.34	6.39	85.3	8.62	47197	30418	30678	30.21	8.09	0.34	-0.15
3/4/2022	WQ3	15:22:03	39.25	6.36	86.1	8.70	47081	30320	30603	30.13	8.09	0.39	-0.16
3/4/2022	WQ3	15:22:04	38.48	6.35	86.3	8.72	47045	30288	30579	30.10	8.09	0.40	-0.16
3/4/2022	WQ3	15:22:06	37.80	6.33	86.6	8.77	46985	30230	30540	30.06	8.09	0.40	-0.16
3/4/2022	WQ3	15:22:07	36.59	6.32	86.8	8.79	46966	30208	30528	30.04	8.08	0.41	-0.16
3/4/2022	WQ3	15:22:09	35.35	6.30	87.0	8.82	46945	30180	30514	30.03	8.08	0.41	-0.14
3/4/2022	WQ3	15:22:10	35.05	6.30	87.1	8.83	46933	30167	30506	30.02	8.08	0.40	-0.14
3/4/2022	WQ3	15:22:11	34.68	6.29	87.3	8.85	46915	30152	30495	30.00	8.08	0.41	-0.15
3/4/2022	WQ3	15:22:15	32.57	6.28	87.7	8.90	46853	30102	30454	29.96	8.09	0.42	-0.14
3/4/2022	WQ3	15:22:17	30.99	6.28	88.0	8.92	46813	30071	30429	29.93	8.09	0.41	-0.15
3/4/2022	WQ3	15:22:18	30.44	6.27	88.0	8.93	46755	30030	30391	29.89	8.09	0.41	-0.15
3/4/2022	WQ3	15:22:20	29.65	6.25	88.1	8.95	46580	29902	30277	29.77	8.09	0.41	-0.14
3/4/2022	WQ3	15:22:22	28.20	6.21	88.1	8.96	46402	29751	30161	29.64	8.09	0.41	-0.14
3/4/2022	WQ3	15:22:23	27.58	6.18	88.1	8.97	46327	29680	30112	29.58	8.09	0.41	-0.15
3/4/2022	WQ3	15:22:26	26.61	6.08	88.0	8.99	46093	29440	29960	29.41	8.08	0.40	-0.15
3/4/2022	WQ3	15:22:27	25.43	6.04	87.9	9.00	46034	29367	29922	29.36	8.08	0.41	-0.15
3/4/2022	WQ3	15:22:29	24.43	5.97	87.9	9.01	46016	29291	29910	29.34	8.08	0.40	-0.16
3/4/2022	WQ3	15:22:31	23.98	5.91	87.9	9.02	46025	29246	29916	29.34	8.07	0.40	-0.15
3/4/2022	WQ3	15:22:33	22.28	5.87	87.8	9.03	46009	29198	29906	29.33	8.07	0.38	-0.15
3/4/2022	WQ3	15:22:34	21.57	5.85	87.8	9.03	46001	29178	29901	29.32	8.07	0.37	-0.14
3/4/2022	WQ3	15:22:36	20.82	5.82	87.8	9.04	45984	29139	29890	29.30	8.07	0.36	-0.14
3/4/2022	WQ3	15:22:37	19.70	5.81	87.8	9.04	45974	29120	29883	29.30	8.07	0.34	-0.13
3/4/2022	WQ3	15:22:39	18.44	5.79	87.8	9.04	45957	29090	29872	29.28	8.07	0.33	-0.12
3/4/2022	WQ3	15:22:41	17.56	5.77	87.8	9.05	45949	29071	29867	29.28	8.07	0.32	-0.12
3/4/2022	WQ3	15:22:42	16.47	5.76	87.8	9.05	45938	29058	29860	29.27	8.07	0.33	-0.12
3/4/2022	WQ3	15:22:44	15.19	5.75	87.8	9.06	45868	29005	29814	29.22	8.07	0.36	-0.11
3/4/2022	WQ3	15:22:46	14.41	5.74	87.8	9.07	45730	28904	29724	29.12	8.07	0.36	-0.09
3/4/2022	WQ3	15:22:47	13.25	5.72	87.8	9.07	45659	28849	29678	29.07	8.07	0.35	-0.10
3/4/2022	WQ3	15:22:48	12.42	5.71	87.8	9.08	45571	28780	29621	29.01	8.07	0.37	-0.09
3/4/2022	WQ3	15:22:50	11.42	5.67	87.8	9.09	45412	28648	29518	28.89	8.07	0.37	-0.09
3/4/2022	WQ3	15:22:52	9.92	5.63	87.8	9.11	45270	28519	29425	28.79	8.08	0.35	-0.09
3/4/2022	WQ3	15:22:53	9.23	5.60	87.9	9.13	45218	28467	29392	28.75	8.08	0.34	-0.08
3/4/2022	WQ3	15:22:54	8.44	5.58	87.9	9.14	45145	28399	29344	28.69	8.08	0.31	-0.08
3/4/2022	WQ3	15:22:56	7.85	5.52	87.9	9.16	44986	28252	29241	28.58	8.08	0.30	-0.09
3/4/2022	WQ3	15:22:57	6.43	5.49	87.9	9.16	44909	28174	29191	28.52	8.08	0.30	-0.08
3/4/2022	WQ3	15:22:58	5.66	5.45	87.9	9.17	44852	28110	29154	28.48	8.07	0.29	-0.07
3/4/2022	WQ3	15:23:01	4.53	5.34	87.8	9.20	44660	27891	29029	28.33	8.07	0.25	-0.08
3/4/2022	WQ3	15:23:02	3.08	5.30	87.8	9.21	44606	27826	28994	28.29	8.07	0.25	-0.07
3/4/2022	WQ3	15:23:03	2.38	5.26	87.7	9.21	44563	27764	28966	28.26	8.07	0.26	-0.08
3/4/2022	WQ3	15:23:05	1.69	5.19	87.7	9.23	44478	27652	28911	28.19	8.07	0.26	-0.09
3/4/2022	WQ3	15:23:08	0.81	5.11	87.9	9.28	44252	27447	28764	28.02	8.07	0.26	-0.10
3/4/2022	WQ4	15:01:12	93.57	6.38	76.0	7.65	48136	31014	31289	30.85	8.00	0.41	-0.18
3/4/2022	WQ4	15:01:15	91.82	6.38	75.8	7.62	48134	31013	31287	30.85	7.99	0.39	-0.19
3/4/2022	WQ4	15:01:16	91.23	6.38	75.7	7.62	48130	31010	31285	30.85	7.99	0.41	-0.18
3/4/2022	WQ4	15:01:17	90.24	6.38	75.6	7.61	48124	31006	31281	30.84	7.99	0.39	-0.19
3/4/2022	WQ4	15:01:19	89.56	6.38	75.5	7.60	48108	30996	31270	30.83	8.00	0.39	-0.19
3/4/2022	WQ4	15:01:20	88.00	6.38	75.5	7.60	48099	30990	31265	30.83	8.00	0.40	-0.18
3/4/2022	WQ4	15:01:21	86.91	6.38	75.5	7.59	48089	30984	31258	30.82	8.00	0.39	-0.18
3/4/2022	WQ4	15:01:23	85.70	6.38	75.5	7.59	48069	30971	31245	30.81	8.00	0.38	-0.17
3/4/2022	WQ4	15:01:24	84.20	6.38	75.5	7.59	48059	30965	31239	30.80	8.00	0.38	-0.17
3/4/2022	WQ4	15:01:25	82.90	6.38	75.5	7.60	48050	30959	31232	30.79	8.00	0.38	-0.17
3/4/2022	WQ4	15:01:27	81.62	6.38	75.6	7.60	48035	30949	31223	30.78	8.00	0.38	-0.17
3/4/2022	WQ4	15:01:29	79.29	6.38	75.6	7.61	48024	30942	31216	30.78	8.01	0.38	-0.17
3/4/2022	WQ4	15:01:30	77.98	6.38	75.7	7.62	48020	30939	31213	30.77	8.01	0.38	-0.17
3/4/2022	WQ4	15:01:32	77.01	6.38	75.8	7.63	48013	30934	31209	30.77	8.01	0.39	-0.17
3/4/2022	WQ4	15:01:33	75.71	6.38	75.8	7.63	48011	30932	31207	30.77	8.01	0.39	-0.18
3/4/2022	WQ4	15:01:34	74.31	6.38	75.9	7.64	48008	30930	31205	30.77	8.01	0.39	-0.17
3/4/2022	WQ4	15:01:35	73.56	6.38	75.9	7.64	48005	30927	31203	30.77	8.01	0.38	-0.17
3/4/2022	WQ4	15:01:37	72.96	6.37	76.0	7.65	47997	30922	31198	30.76	8.01	0.37	-0.16
3/4/2022	WQ4	15:01:38	71.40	6.38	76.0	7.66	47994	30921	31196	30.76	8.01	0.35	-0.16
3/4/2022	WQ4	15:01:39	70.48	6.38	76.1	7.66	47990	30918	31193	30.76	8.01	0.36	-0.16
3/4/2022	WQ4	15:01:40	69.73	6.38	76.2	7.67	47984	30916	31189	30.75	8.01	0.35	-0.16
3/4/2022	WQ4	15:01:42	68.92	6.38	76.4	7.69	47971	30914	31181	30.74	8.02	0.34	-0.16
3/4/2022	WQ4	15:01:43	67.41	6.39	76.5	7.70	47961	30911	31175	30.74	8.02	0.34	-0.16
3/4/2022	WQ4	15:01:44	66.46	6.39	76.7	7.72	47953	30910	31170	30.73	8.02	0.33	-0.16
3/4/2022	WQ4	15:01:45	65.85	6.40	76.9	7.73	47943	30909	31163	30.73	8.03	0.33	-0.16
3/4/2022	WQ4	15:01:47	64.99	6.41	77.3	7.78	47920	30903	31148	30.71	8.03	0.32	-0.17
3/4/2022	WQ4	15:01:48	63.19	6.41	77.5	7.80	47908	30900	31140	30.71	8.04	0.32	-0.17
3/4/2022	WQ4	15:01:49	62.71	6.42	77.8	7.82	47896	30897	31132	30.70	8.04	0.31	-0.18
3/4/2022	WQ4	15:01:50	61.93	6.42	78.0	7.85	47885	30894	31125	30.69	8.04	0.31	-0.18
3/4/2022	WQ4	15:01:51	60.26	6.43	78.3	7.87	47872	30889	31117	30.68	8.04	0.31	-0.18
3/4/2022	WQ4	15:01:52	59.66	6.43	78.6	7.90	47860	30886	31109	30.68	8.05	0.29	-0.19
3/4/2022	WQ4	15:01:53	58.82	6.44	78.8	7.93	47850	30883	31103	30.67	8.05	0.29	-0.18
3/4/2022	WQ4	15:01:55	58.01	6.44	79.4	7.98	47836	30882	31094	30.66	8.05	0.28	-0.17
3/4/2022	WQ4	15:01:56	56.35	6.45	79.7	8.01	47832	30883	31091	30.66	8.06	0.28	-0.17
3/4/2022	WQ4	15:01:57	55.45	6.45	80.0	8.04	47827	30884	31088	30.66	8.06	0.30	-0.17
3/4/2022	WQ4	15:01:58	54.32	6.46	80.3	8.07	47819	30883	31082	30.65	8.06	0.29	-0.16
3/4/2022	WQ4	15:02:00	52.54	6.47	80.8	8.13	47791	30875	31064	30.63	8.07	0.29	-0.16
3/4/2022	WQ4	15:02:01	51.98	6.47	81.1	8.15	47774	30867	31053	30.62	8.07	0.29	-0.16
3/4/2022	WQ4	15:02:02	50.96	6.48	81.4	8.18	47750	30855	31038	30.61	8.07	0.29	-0.16
3/4/2022	WQ4	15:02:04	48.95	6.48	82.0	8.24	47692	30822	31000	30.57	8.08	0.28	-0.16
3/4/2022	WQ4	15:02:06	47.16	6.48	82.6	8.31	47618	30776	30952	30.52	8.08	0.29	-0.16
3/4/2022	WQ4	15:02:07	46.91	6.48	82.9	8.34	47586	30755	30931	30.49	8.09	0.29	-0.17
3/4/2022	WQ4	15:02:08	45.55	6.48	83.3	8.38	47552	30732	30909	30.47	8.09	0.28	-0.17
3/4/2022	WQ4	15:02:09	44.81	6.48	83.5	8.40	47525	30712	30891	30.45	8.09	0.28	-0.17
3/4/2022	WQ4	15:02:11	43.28	6.48	84.3	8.49	47475	30677	30859	30.41	8.10	0.27	-0.16
3/4/2022	WQ4	15:02:12	42.85	6.47	84.6	8.52	47449	30658	30842	30.40	8.10	0.28	-0.16

Date	Site	Time	Depth (m)	Temp (°C)	DO (%)	DO (mg/L)	SPC (µS/cm)	C (µS/cm)	TDS (mg/L)	SAL (ppt)	pH	Turbidity (NTU)	Chl (RFU)
3/4/2022	WQ4	15:02:13	41.12	6.47	84.9	8.55	47415	30634	30820	30.37	8.10	0.29	-0.16
3/4/2022	WQ4	15:02:14	40.28	6.47	85.4	8.60	47387	30613	30802	30.35	8.11	0.30	-0.16
3/4/2022	WQ4	15:02:15	39.44	6.46	85.7	8.64	47347	30583	30776	30.32	8.11	0.31	-0.16
3/4/2022	WQ4	15:02:17	37.71	6.45	86.3	8.70	47230	30493	30700	30.24	8.11	0.33	-0.15
3/4/2022	WQ4	15:02:19	36.15	6.42	86.7	8.75	47122	30402	30629	30.16	8.11	0.38	-0.15
3/4/2022	WQ4	15:02:20	35.77	6.41	86.9	8.77	47062	30349	30590	30.12	8.11	0.39	-0.15
3/4/2022	WQ4	15:02:21	34.33	6.38	87.1	8.80	46982	30276	30538	30.06	8.10	0.40	-0.16
3/4/2022	WQ4	15:02:22	33.69	6.37	87.2	8.82	46936	30233	30509	30.03	8.10	0.41	-0.16
3/4/2022	WQ4	15:02:24	32.62	6.33	87.4	8.85	46840	30137	30446	29.96	8.10	0.43	-0.16
3/4/2022	WQ4	15:02:25	31.37	6.31	87.5	8.86	46810	30102	30427	29.93	8.10	0.43	-0.16
3/4/2022	WQ4	15:02:27	30.15	6.28	87.7	8.89	46782	30056	30408	29.91	8.10	0.44	-0.16
3/4/2022	WQ4	15:02:28	29.69	6.27	87.7	8.90	46766	30036	30398	29.90	8.10	0.43	-0.16
3/4/2022	WQ4	15:02:30	28.02	6.25	87.9	8.93	46717	29989	30366	29.86	8.10	0.42	-0.16
3/4/2022	WQ4	15:02:31	27.49	6.25	88.0	8.94	46675	29956	30339	29.83	8.10	0.42	-0.15
3/4/2022	WQ4	15:02:32	26.66	6.24	88.1	8.95	46614	29907	30299	29.79	8.10	0.43	-0.14
3/4/2022	WQ4	15:02:34	25.88	6.21	88.2	8.98	46488	29804	30217	29.70	8.10	0.44	-0.13
3/4/2022	WQ4	15:02:35	24.60	6.19	88.3	8.99	46415	29743	30170	29.64	8.10	0.45	-0.13
3/4/2022	WQ4	15:02:36	23.80	6.18	88.3	9.00	46347	29685	30126	29.60	8.10	0.45	-0.14
3/4/2022	WQ4	15:02:38	22.49	6.13	88.4	9.02	46194	29550	30026	29.48	8.10	0.46	-0.13
3/4/2022	WQ4	15:02:39	22.09	6.11	88.5	9.04	46123	29482	29980	29.43	8.10	0.46	-0.12
3/4/2022	WQ4	15:02:40	20.71	6.08	88.5	9.05	46076	29431	29950	29.40	8.10	0.46	-0.12
3/4/2022	WQ4	15:02:41	20.00	6.06	88.5	9.06	46039	29383	29925	29.37	8.10	0.46	-0.12
3/4/2022	WQ4	15:02:42	19.41	6.03	88.6	9.07	46004	29340	29903	29.34	8.10	0.46	-0.13
3/4/2022	WQ4	15:02:44	18.55	5.98	88.6	9.08	45854	29201	29805	29.23	8.10	0.43	-0.13
3/4/2022	WQ4	15:02:45	17.16	5.96	88.5	9.09	45768	29120	29750	29.17	8.10	0.43	-0.12
3/4/2022	WQ4	15:02:46	16.42	5.92	88.5	9.10	45696	29048	29702	29.11	8.10	0.42	-0.12
3/4/2022	WQ4	15:02:47	15.58	5.89	88.5	9.11	45612	28963	29648	29.05	8.10	0.40	-0.11
3/4/2022	WQ4	15:02:49	13.98	5.81	88.4	9.12	45452	28800	29544	28.93	8.10	0.39	-0.12
3/4/2022	WQ4	15:02:50	13.24	5.78	88.4	9.13	45366	28711	29488	28.87	8.10	0.40	-0.12
3/4/2022	WQ4	15:02:51	12.27	5.74	88.3	9.14	45279	28624	29431	28.80	8.10	0.39	-0.12
3/4/2022	WQ4	15:02:53	11.67	5.65	88.2	9.15	45084	28425	29304	28.66	8.09	0.37	-0.12
3/4/2022	WQ4	15:02:54	10.32	5.60	88.1	9.15	45004	28330	29252	28.60	8.09	0.36	-0.12
3/4/2022	WQ4	15:02:55	9.66	5.55	88.0	9.16	44936	28247	29208	28.55	8.09	0.36	-0.12
3/4/2022	WQ4	15:02:57	8.49	5.45	87.8	9.17	44814	28085	29129	28.45	8.09	0.34	-0.12
3/4/2022	WQ4	15:02:58	7.47	5.40	87.7	9.17	44743	27996	29083	28.39	8.08	0.33	-0.11
3/4/2022	WQ4	15:02:59	6.56	5.35	87.6	9.18	44676	27916	29040	28.34	8.08	0.32	-0.11
3/4/2022	WQ4	15:03:00	5.80	5.31	87.5	9.18	44587	27818	28982	28.28	8.08	0.31	-0.10
3/4/2022	WQ4	15:03:02	4.91	5.22	87.5	9.20	44493	27684	28920	28.20	8.08	0.29	-0.09
3/4/2022	WQ4	15:03:03	3.32	5.18	87.5	9.21	44442	27620	28887	28.16	8.08	0.28	-0.08
3/4/2022	WQ4	15:03:04	2.55	5.15	87.5	9.23	44387	27561	28852	28.12	8.08	0.28	-0.08
3/4/2022	WQ4	15:03:05	2.03	5.13	87.6	9.24	44299	27483	28794	28.06	8.08	0.28	-0.08
3/4/2022	WQ4	15:03:06	1.89	5.10	87.7	9.26	44215	27412	28740	28.00	8.09	0.28	-0.07
3/4/2022	WQ4	15:03:08	1.39	5.06	88.0	9.31	44051	27274	28633	27.88	8.09	0.28	-0.08
3/4/2022	WQ4	15:03:09	0.48	5.04	88.2	9.34	43976	27211	28584	27.82	8.09	0.28	-0.09
3/4/2022	WQ5	14:33:33	26.05	6.06	85.3	8.70	46738	29833	30380	29.86	8.02	0.40	-0.14
3/4/2022	WQ5	14:33:35	24.50	6.02	85.3	8.71	46559	29683	30263	29.73	8.02	0.37	-0.13
3/4/2022	WQ5	14:33:36	22.83	6.00	85.2	8.71	46462	29601	30201	29.66	8.02	0.36	-0.13
3/4/2022	WQ5	14:33:37	21.77	5.97	85.2	8.72	46338	29494	30120	29.57	8.02	0.35	-0.14
3/4/2022	WQ5	14:33:39	20.52	5.89	85.1	8.74	46096	29278	29962	29.39	8.02	0.33	-0.14
3/4/2022	WQ5	14:33:40	19.03	5.86	85.0	8.74	45958	29153	29873	29.29	8.02	0.33	-0.14
3/4/2022	WQ5	14:33:41	18.07	5.81	85.0	8.75	45835	29039	29793	29.20	8.02	0.31	-0.13
3/4/2022	WQ5	14:33:42	17.06	5.76	84.9	8.76	45725	28925	29721	29.12	8.02	0.31	-0.13
3/4/2022	WQ5	14:33:43	16.77	5.71	84.9	8.77	45628	28826	29658	29.05	8.02	0.30	-0.12
3/4/2022	WQ5	14:33:44	15.37	5.67	84.8	8.78	45515	28711	29585	28.96	8.02	0.29	-0.11
3/4/2022	WQ5	14:33:45	14.35	5.62	84.8	8.79	45424	28615	29525	28.89	8.02	0.29	-0.11
3/4/2022	WQ5	14:33:46	13.26	5.58	84.8	8.81	45327	28512	29463	28.82	8.02	0.28	-0.11
3/4/2022	WQ5	14:33:47	12.81	5.53	84.8	8.82	45244	28423	29408	28.76	8.02	0.29	-0.10
3/4/2022	WQ5	14:33:48	11.31	5.49	84.8	8.83	45121	28307	29329	28.67	8.02	0.29	-0.10
3/4/2022	WQ5	14:33:49	10.26	5.44	84.8	8.85	44997	28195	29248	28.58	8.02	0.27	-0.10
3/4/2022	WQ5	14:33:50	9.49	5.40	84.8	8.86	44856	28066	29157	28.47	8.02	0.27	-0.09
3/4/2022	WQ5	14:33:51	8.85	5.36	84.9	8.88	44736	27955	29078	28.38	8.02	0.28	-0.09
3/4/2022	WQ5	14:33:52	7.30	5.31	84.9	8.90	44605	27832	28993	28.29	8.02	0.28	-0.09
3/4/2022	WQ5	14:33:53	6.18	5.27	85.0	8.93	44478	27712	28910	28.19	8.02	0.28	-0.08
3/4/2022	WQ5	14:33:54	4.88	5.22	85.1	8.95	44366	27607	28838	28.11	8.03	0.29	-0.08
3/4/2022	WQ5	14:33:55	4.42	5.18	85.2	8.98	44254	27497	28765	28.03	8.03	0.29	-0.07
3/4/2022	WQ5	14:33:56	2.98	5.13	85.4	9.01	44158	27403	28703	27.96	8.03	0.29	-0.07
3/4/2022	WQ5	14:33:57	1.84	5.09	85.5	9.04	44065	27307	28642	27.89	8.03	0.29	-0.07
3/4/2022	WQ5	14:33:58	1.07	5.05	85.8	9.08	43997	27234	28598	27.84	8.03	0.28	-0.08
3/4/2022	WQ6	14:12:30	97.32	6.40	74.6	7.49	48555	31301	31560	31.15	7.80	0.33	-0.15
3/4/2022	WQ6	14:12:33	95.44	6.40	73.9	7.42	48552	31300	31558	31.15	7.81	0.33	-0.16
3/4/2022	WQ6	14:12:35	94.04	6.40	73.5	7.37	48548	31298	31556	31.14	7.81	0.33	-0.16
3/4/2022	WQ6	14:12:36	93.48	6.40	73.3	7.35	48545	31297	31554	31.14	7.81	0.33	-0.17
3/4/2022	WQ6	14:12:37	92.98	6.40	73.1	7.34	48541	31294	31552	31.14	7.81	0.33	-0.16
3/4/2022	WQ6	14:12:38	90.75	6.40	72.9	7.32	48536	31291	31549	31.14	7.81	0.34	-0.17
3/4/2022	WQ6	14:12:39	89.86	6.40	72.7	7.30	48530	31287	31544	31.13	7.81	0.34	-0.17
3/4/2022	WQ6	14:12:41	88.43	6.40	72.4	7.27	48503	31269	31527	31.11	7.81	0.33	-0.17
3/4/2022	WQ6	14:12:42	86.72	6.40	72.2	7.25	48480	31253	31512	31.10	7.82	0.33	-0.18
3/4/2022	WQ6	14:12:43	85.62	6.40	72.1	7.24	48452	31234	31494	31.08	7.82	0.32	-0.18
3/4/2022	WQ6	14:12:44	84.25	6.39	72.0	7.23	48426	31215	31477	31.06	7.82	0.32	-0.18
3/4/2022	WQ6	14:12:45	83.67	6.39	72.0	7.23	48396	31194	31457	31.04	7.82	0.32	-0.18
3/4/2022	WQ6	14:12:47	81.24	6.38	72.0	7.23	48325	31142	31411	30.99	7.83	0.33	-0.18
3/4/2022	WQ6	14:12:48	80.37	6.38	72.1	7.24	48281	31111	31383	30.96	7.84	0.32	-0.17
3/4/2022	WQ6	14:12:49	79.00	6.38	72.1	7.25	48242	31083	31357	30.93	7.84	0.31	-0.16
3/4/2022	WQ6	14:12:50	78.97	6.37	72.3	7.27	48201	31053	31331	30.90	7.85	0.31	-0.16
3/4/2022	WQ6	14:12:51	77.52	6.37	72.5	7.29	48172	31032	31312	30.88	7.85	0.31	-0.16
3/4/2022	WQ6	14:12:52	76.67	6.37	72.7	7.31	48143	31010	31293	30.86	7.86	0.33	-0.15
3/4/2022	WQ6	14:12:53	75.62	6.36	72.9	7.34	48118	30991	31277	30.84	7.86	0.34	-0.15
3/4/2022	WQ6	14:12:55	74.77	6.36	73.5	7.40	48069	30955	31245	30.81	7.87	0.33	-0.15
3/4/2022	WQ6	14:12:56	73.52	6.36	73.8	7.43	48052	30942	31234	30.80	7.87	0.34	-0.14

Date	Site	Time	Depth (m)	Temp (°C)	DO (%)	DO (mg/L)	SPC (µS/cm)	C (µS/cm)	TDS (mg/L)	SAL (ppt)	pH	Turbidity (NTU)	Chl (RFU)
3/4/2022	WQ6	14:12:57	72.57	6.36	74.1	7.46	48039	30932	31226	30.79	7.87	0.34	-0.15
3/4/2022	WQ6	14:12:58	71.64	6.35	74.3	7.48	48025	30921	31216	30.78	7.87	0.34	-0.15
3/4/2022	WQ6	14:13:01	70.43	6.35	75.2	7.57	47979	30888	31186	30.75	7.88	0.35	-0.16
3/4/2022	WQ6	14:13:02	68.61	6.35	75.4	7.60	47965	30878	31177	30.74	7.88	0.34	-0.16
3/4/2022	WQ6	14:13:04	67.31	6.35	76.0	7.65	47936	30857	31158	30.72	7.89	0.34	-0.16
3/4/2022	WQ6	14:13:06	66.78	6.34	76.5	7.71	47902	30833	31136	30.69	7.89	0.32	-0.16
3/4/2022	WQ6	14:13:07	65.35	6.34	76.8	7.74	47886	30821	31126	30.68	7.89	0.31	-0.16
3/4/2022	WQ6	14:13:08	64.86	6.34	77.0	7.76	47873	30812	31118	30.67	7.89	0.32	-0.15
3/4/2022	WQ6	14:13:10	63.78	6.34	77.5	7.81	47843	30790	31098	30.65	7.90	0.31	-0.16
3/4/2022	WQ6	14:13:11	62.46	6.34	77.7	7.84	47821	30773	31083	30.64	7.90	0.30	-0.16
3/4/2022	WQ6	14:13:13	61.01	6.33	78.2	7.89	47769	30735	31050	30.60	7.90	0.29	-0.17
3/4/2022	WQ6	14:13:14	60.41	6.33	78.4	7.91	47746	30717	31035	30.58	7.90	0.30	-0.17
3/4/2022	WQ6	14:13:15	59.38	6.32	78.6	7.94	47721	30697	31018	30.57	7.91	0.30	-0.18
3/4/2022	WQ6	14:13:16	58.86	6.32	78.9	7.96	47697	30677	31003	30.55	7.91	0.31	-0.18
3/4/2022	WQ6	14:13:17	57.90	6.31	79.1	7.99	47677	30661	30990	30.53	7.91	0.31	-0.17
3/4/2022	WQ6	14:13:18	57.19	6.31	79.4	8.01	47653	30641	30975	30.52	7.91	0.29	-0.17
3/4/2022	WQ6	14:13:19	56.94	6.30	79.6	8.04	47633	30624	30962	30.50	7.91	0.28	-0.16
3/4/2022	WQ6	14:13:20	55.54	6.30	79.8	8.06	47608	30604	30945	30.48	7.92	0.29	-0.16
3/4/2022	WQ6	14:13:21	54.62	6.30	80.1	8.09	47584	30585	30930	30.47	7.92	0.29	-0.16
3/4/2022	WQ6	14:13:22	53.67	6.29	80.3	8.11	47560	30564	30914	30.45	7.92	0.29	-0.17
3/4/2022	WQ6	14:13:24	52.41	6.28	80.7	8.16	47527	30530	30892	30.43	7.92	0.27	-0.16
3/4/2022	WQ6	14:13:25	51.36	6.27	80.9	8.18	47513	30515	30883	30.42	7.92	0.26	-0.16
3/4/2022	WQ6	14:13:26	50.53	6.26	81.1	8.20	47497	30497	30873	30.40	7.92	0.27	-0.16
3/4/2022	WQ6	14:13:28	49.05	6.25	81.4	8.24	47471	30466	30856	30.38	7.92	0.27	-0.17
3/4/2022	WQ6	14:13:29	48.31	6.24	81.6	8.26	47458	30450	30847	30.38	7.93	0.28	-0.18
3/4/2022	WQ6	14:13:30	47.50	6.23	81.7	8.28	47451	30440	30843	30.37	7.93	0.27	-0.18
3/4/2022	WQ6	14:13:31	46.65	6.22	81.9	8.29	47438	30425	30834	30.36	7.93	0.27	-0.18
3/4/2022	WQ6	14:13:33	44.95	6.21	82.1	8.32	47387	30380	30802	30.32	7.93	0.28	-0.18
3/4/2022	WQ6	14:13:34	44.27	6.20	82.2	8.34	47360	30356	30784	30.30	7.93	0.29	-0.18
3/4/2022	WQ6	14:13:35	43.38	6.19	82.3	8.35	47330	30327	30764	30.28	7.93	0.30	-0.18
3/4/2022	WQ6	14:13:36	42.83	6.18	82.4	8.36	47301	30300	30746	30.26	7.93	0.30	-0.18
3/4/2022	WQ6	14:13:37	41.28	6.17	82.5	8.37	47271	30271	30726	30.24	7.93	0.31	-0.18
3/4/2022	WQ6	14:13:38	40.78	6.16	82.6	8.38	47250	30247	30712	30.22	7.93	0.31	-0.17
3/4/2022	WQ6	14:13:40	39.16	6.14	82.7	8.41	47212	30203	30688	30.20	7.93	0.30	-0.17
3/4/2022	WQ6	14:13:41	38.07	6.13	82.8	8.42	47206	30189	30684	30.19	7.93	0.31	-0.17
3/4/2022	WQ6	14:13:42	37.37	6.12	82.9	8.43	47203	30179	30682	30.19	7.93	0.32	-0.17
3/4/2022	WQ6	14:13:43	36.44	6.11	83.0	8.44	47200	30170	30680	30.18	7.93	0.31	-0.16
3/4/2022	WQ6	14:13:44	35.85	6.10	83.1	8.45	47195	30162	30677	30.18	7.93	0.31	-0.16
3/4/2022	WQ6	14:13:45	34.72	6.10	83.2	8.46	47191	30155	30674	30.18	7.93	0.31	-0.16
3/4/2022	WQ6	14:13:47	33.16	6.09	83.4	8.49	47177	30140	30665	30.17	7.93	0.28	-0.17
3/4/2022	WQ6	14:13:48	32.45	6.09	83.5	8.50	47159	30125	30653	30.16	7.94	0.28	-0.16
3/4/2022	WQ6	14:13:49	31.25	6.09	83.6	8.51	47137	30109	30639	30.14	7.94	0.29	-0.16
3/4/2022	WQ6	14:13:50	30.48	6.08	83.7	8.52	47103	30084	30617	30.12	7.94	0.29	-0.15
3/4/2022	WQ6	14:13:51	29.58	6.08	83.7	8.52	47062	30054	30590	30.09	7.94	0.29	-0.15
3/4/2022	WQ6	14:13:52	28.85	6.07	83.8	8.53	47014	30018	30559	30.05	7.94	0.28	-0.14
3/4/2022	WQ6	14:13:54	27.10	6.06	83.9	8.55	46886	29923	30476	29.96	7.95	0.29	-0.15
3/4/2022	WQ6	14:13:55	26.12	6.05	84.0	8.56	46797	29856	30418	29.90	7.95	0.29	-0.14
3/4/2022	WQ6	14:13:56	25.02	6.03	84.0	8.57	46669	29759	30335	29.81	7.95	0.29	-0.15
3/4/2022	WQ6	14:13:57	24.84	6.01	84.0	8.58	46565	29678	30267	29.73	7.95	0.31	-0.15
3/4/2022	WQ6	14:13:58	23.38	5.97	83.9	8.59	46414	29551	30169	29.62	7.95	0.30	-0.16
3/4/2022	WQ6	14:13:59	22.46	5.94	83.9	8.59	46292	29440	30090	29.53	7.95	0.30	-0.16
3/4/2022	WQ6	14:14:00	21.49	5.90	83.9	8.60	46195	29345	30026	29.46	7.95	0.31	-0.17
3/4/2022	WQ6	14:14:02	19.64	5.82	83.7	8.61	46002	29156	29901	29.32	7.94	0.31	-0.18
3/4/2022	WQ6	14:14:03	18.66	5.78	83.6	8.61	45887	29039	29827	29.23	7.94	0.31	-0.17
3/4/2022	WQ6	14:14:05	17.48	5.68	83.4	8.62	45729	28854	29724	29.11	7.93	0.30	-0.16
3/4/2022	WQ6	14:14:06	16.11	5.63	83.3	8.62	45689	28792	29698	29.08	7.93	0.31	-0.16
3/4/2022	WQ6	14:14:07	15.05	5.60	83.3	8.63	45631	28718	29660	29.03	7.93	0.30	-0.15
3/4/2022	WQ6	14:14:08	14.31	5.56	83.2	8.64	45556	28639	29611	28.98	7.93	0.30	-0.14
3/4/2022	WQ6	14:14:09	13.78	5.52	83.2	8.64	45468	28558	29554	28.91	7.93	0.30	-0.14
3/4/2022	WQ6	14:14:10	12.42	5.50	83.2	8.65	45363	28464	29486	28.84	7.93	0.29	-0.13
3/4/2022	WQ6	14:14:11	11.51	5.46	83.2	8.66	45265	28378	29422	28.76	7.93	0.29	-0.11
3/4/2022	WQ6	14:14:12	10.65	5.44	83.2	8.68	45149	28278	29347	28.68	7.93	0.30	-0.11
3/4/2022	WQ6	14:14:13	9.88	5.40	83.3	8.69	45055	28194	29286	28.61	7.94	0.30	-0.10
3/4/2022	WQ6	14:14:14	8.63	5.37	83.3	8.71	44947	28098	29215	28.53	7.94	0.28	-0.10
3/4/2022	WQ6	14:14:15	7.81	5.34	83.4	8.73	44843	28007	29148	28.46	7.94	0.29	-0.09
3/4/2022	WQ6	14:14:17	6.20	5.27	83.6	8.77	44612	27805	28998	28.29	7.94	0.27	-0.08
3/4/2022	WQ6	14:14:18	5.01	5.24	83.7	8.80	44476	27687	28909	28.19	7.95	0.26	-0.07
3/4/2022	WQ6	14:14:19	4.30	5.20	83.8	8.82	44345	27575	28825	28.10	7.95	0.27	-0.06
3/4/2022	WQ6	14:14:20	3.44	5.16	84.0	8.86	44209	27453	28736	28.00	7.95	0.26	-0.05
3/4/2022	WQ6	14:14:21	2.50	5.11	84.1	8.89	44101	27353	28666	27.92	7.96	0.25	-0.05
3/4/2022	WQ6	14:14:23	0.91	5.03	84.7	8.97	43878	27144	28521	27.75	7.96	0.25	-0.03
3/4/2022	WQ6	14:14:24	0.58	5.00	85.0	9.02	43801	27069	28471	27.70	7.97	0.24	-0.04

Notes: Temp = temperature; DO = dissolved oxygen; SPC = specific conductivity; C = conductivity; TDS = total dissolved solids; SAL = salinity; Chl = chlorophyll

Appendix G.3 Laboratory Results

Parameter	Units	BC Marine Aquatic Life Guidelines[1]		Canadian Council of Ministers of Environment (CCME) Guidelines		June																			Lowest Detection Limit
						WQ1				WQ3				WQ5				WQ6				QAQC					
		Short Term	Long Term	Short Term	Long Term	Ebb- 1m	Flood- 1m	Ebb- 10m	Flood- 10m	Ebb- 1m	Flood- 1m	Ebb- 15m	Flood- 6m	Ebb- 1m	Flood- 1m	Flood- 27m	Ebb- 10m	Ebb- 1m	Flood- 1m	Flood- 12m	Ebb- 12m	WQ1 Ebb- 1m	Duplicate	RPD	Field Blank	Equipment Blank	
Physical Tests (Matrix: Water)																										
hardness (as CaCO3), dissolved	mg/L	-	-	-	-	1800	1620	4430	4990	2080	1770	4920	4210	2280	2660	5390	4650	1970	2170	4600	4190	1800	2230	**21%**	2240	<1.00	0.50
hardness (as CaCO3), from total Ca/Mg	mg/L	-	-	-	-	1780	1530	4110	4750	2010	1760	5030	3970	2160	2620	5210	4480	2030	2140	4410	3930	1780	2050	14%	2280	<1.00	0.60
pH	pH units	-	7.0-8.7	-	7.0-8.7	7.86	7.84	7.95	7.94	7.98	7.88	7.93	7.94	7.98	7.94	7.92	7.95	7.99	7.94	7.94	7.93	7.86	7.92	1%	7.94	6.33	0.10
solids, total dissolved [TDS]	mg/L	-	-	-	-	11200	9680	25200	29400	13500	12000	33600	26200	14900	17100	34400	29500	13200	13800	28500	25600	11200	12600	12%	14700	<10	10
solids, total suspended [TSS]	mg/L	Change from background of 25 mg/L at any one time for a duration of 24 h in all waters during clear flows or in clear waters. Change from background of 10 mg/L at any time when background is 25 - 100 mg/L during high flows or in turbid waters. Change from background of 10% when background is > 100 mg/L at any time during high flows or in turbid waters.	Change from background of 5 mg/L at any one time for a duration of 30 d in all waters during clear flows or in clear waters.	Clear flow, short-term (<24 hrs): maximum increase of 25 mg/L from background High flow, background 25 - 250 mg/L: max increase of 25 mg/L from background. High flow, background >250 mg/L: max increase <10% of background.	Clear flow, long term (>24 hrs): maximum increase of 5 mg/L from background.	5.9	10.7	3.3	5.0	5.0	13.3	5.0	2.2	3.1	4.9	<2.0	<2.0	4.5	3.9	3.2	4.4	5.9	7.8	**28%**	4.3	<2.0	2.0
turbidity	NTU	Change from background of 8 NTU at any one time for a duration of 24 h in all waters during clear flows or in clear waters. Change from background of 5 NTU at any time when background is 8 - 50 NTU during high flows or in turbid waters. Change from background of 10% when background is > 50 NTU at any time during high flows or in turbid waters.	Change from background of 2 NTU at any one time for a duration of 30 d in all waters during clear flows or in clear waters.	Clear flow, short-term (<24 hrs): maximum increase of 8 NTUs from background High flow, background 8 - 80 NTUs: max increase of 8 NTUs from background. High flow, background >80 NTUs: max increase <10% of background.	Clear flow, long term (>24 hrs): maximum increase of 2 NTUs from background.	9.79	16.5	2.93	2.36	6.20	16.3	1.96	2.82	3.55	4.82	1.22	1.63	5.19	3.42	1.06	0.38	10	8	14%	5.21	<0.10	0.10

Notes: SU = Standard units; µS/cm = microSiemens per centimetre; NTU = nephelometric turbidity units; RPD = Relative percent difference

[1] Indicates a working BC Working Water Quality Guidelines for Aquatic Life (BC WQG-MAL), all other guidelines are approved BC WQG-MAL.

< = The analyte was not detected above the laboratory estimated quantitation limit.

Bold and italicized text indicates exceedance of and approved BC WQG-MAL whereas bold and underlined text indicates exceedance of CCME Water Quality Guidelines for marine aquatic life

Bold text in the RPD column indicates exceedance of acceptable value (20%)

(1) Value for 30 ppt at 15°C and individual sample pH values used for comparison to guidelines.

Appendix G.3 Laboratory Results

Parameter	Units	BC Marine Aquatic Life Guidelines[1]		Canadian Council of Ministers of Environment (CCME) Guidelines		June																		
						WQ1				WQ3				WQ5				WQ6				QAQC					Lowest Detection Limit
		Short Term	Long Term	Short Term	Long Term	Ebb- 1m	Flood- 1m	Ebb- 10m	Flood- 10m	Ebb- 1m	Flood- 1m	Ebb- 15m	Flood- 6m	Ebb- 1m	Flood- 1m	Flood- 27m	Ebb- 10m	Ebb- 1m	Flood- 1m	Flood- 12m	Ebb- 12m	WQ1 Ebb- 1m	Duplicate	RPD	Field Blank	Equipment Blank	
Anions and Nutrients (Matrix: Water)																										
ammonia, total (as N)	mg/L	Salinity, temperature and pH dependent (1)	Salinity, temperature and pH dependent (1)	-	-	0.0051	0.0133	0.0355	0.0332	<0.0050	0.0079	0.0304	0.0379	<0.0050	0.0150	0.0135	0.0364	<0.0050	<0.0050	0.0341	0.0317	0.0051	<0.0050	nc	<0.0050	<0.0050	0.0050
bromide	mg/L	-	-	-	-	20.3	17.7	45.2	47.4	23.1	21.4	56.3	45.8	25.0	30.3	60.3	50.4	22.3	23.2	49.5	40.3	20.3	23.7	15%	23.9	<5.0	5.0
chloride	mg/L	-	-	-	-	5980	5330	13500	14100	6880	6340	16400	13500	7600	9120	17700	15000	6830	7090	14700	12100	5980	7050	16%	7060	<50	50
fluoride	mg/L	1.5	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	nc	<1.0	<1.0	1.0
nitrate (as N)	mg/L	-	3.7	1500	200	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	nc	<0.50	<0.50	0.50
nitrite (as N)	mg/L	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	nc	<0.10	<0.10	0.10
phosphorus, total	mg/L	-	-	-	-	0.0177	0.0326	0.0331	0.0475	0.0106	0.0176	0.0418	0.0390	0.0134	0.0167	0.0531	0.0333	0.0104	0.0186	0.0426	0.0309	0.0177	0.0181	2%	0.0180	<0.0020	0.0020
sulfate (as SO4)	mg/L	-	-	-	-	847	748	1910	2000	970	888	2340	1920	1070	1300	2530	2130	969	1010	2080	1710	847	1000	17%	961	<30	30
Organic / Inorganic C																										
carbon, dissolved organic [DOC]	mg/L	-	-	-	-	3.24	1.77	1.11	2.55	1.85	2.16	1.42	1.53	2.06	1.65	1.21	1.28	2.10	1.94	1.37	1.23	3.24	3.43	6%	2.00	1.79	0.50
carbon, total organic [TOC]	mg/L	-	-	-	-	2.00	1.69	1.27	1.21	2.44	2.15	0.99	1.16	2.13	1.78	0.85	1.05	2.09	2.21	1.10	1.44	2.00	2.17	8%	2.47	<0.50	0.50
Total Metals (Matrix:																										
aluminum, total	mg/L	-	-	-	-	0.374	0.557	0.124	0.110	0.203	0.637	0.093	0.137	0.140	0.194	0.050	0.069	0.184	0.146	0.045	0.036	0.374	0.308	19%	0.158	<0.0050	0.0050
antimony, total	mg/L	-	0.27 [1]	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	nc	<0.0010	<0.0010	0.0010
arsenic, total	mg/L	-	0.0125	-	0.0125	0.00093	0.00096	0.00142	0.00161	0.0008	0.00108	0.00166	0.00142	0.00088	0.00104	0.00172	0.00158	0.00089	0.00085	0.00154	0.00143	0.00093	0.00098	5%	0.00091	<0.00040	0.00040
barium, total	mg/L	-	-	-	-	0.0256	0.0326	0.0109	0.0093	0.0203	0.0309	0.0094	0.0117	0.0158	0.0172	0.0082	0.0098	0.0215	0.0184	0.0096	0.0096	0.0256	0.0218	16%	0.0187	<0.0010	0.0010
beryllium, total	mg/L	-	0.1 [1]	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
bismuth, total	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
boron, total	mg/L	-	1.2	-	-	***1.36***	***1.26***	***3.22***	***3.58***	***1.63***	***1.41***	***3.83***	***3.13***	***1.79***	***2.15***	***4.05***	***3.50***	***1.75***	***1.80***	***3.53***	***3.14***	***1.36***	1.67	**20%**	1.71	<0.30	0.30
cadmium, total	mg/L	-	0.00012	-	0.00012	0.000053	0.000053	0.000064	0.000061	0.000041	0.000049	0.000066	0.000069	0.000039	0.000051	0.000066	0.000043	0.000035	0.000038	0.000054	0.000057	0.000053	0.000048	10%	0.000043	<0.000010	0.000010
calcium, total	mg/L	-	-	-	-	125	115	293	328	147	128	348	285	160	194	372	323	152	158	322	282	125	150	18%	151	<1.0	1.0
cesium, total	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
chromium, total	mg/L	-	0.0015 (Cr(IV)); 0.056 (Cr(III)) [1]	-	0.0015 (Cr(IV)); 0.056 (Cr(III))	0.00091	0.00141	<0.00050	<0.00050	<0.00050	0.00165	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00091	0.00074	**21%**	<0.00050	<0.00050	0.00050
cobalt, total	mg/L	-	-	-	-	0.000323	0.000475	0.000106	0.000109	0.000195	0.000518	0.000079	0.000106	0.000110	0.000172	<0.000050	0.000080	0.000166	0.000115	0.000054	<0.000050	0.000323	0.000251	**25%**	0.000145	<0.000050	0.000050
copper, total	mg/L	0.003	0.002	-	-	0.00129	0.00181	0.00052	<0.00050	0.00079	0.00186	<0.00050	0.00053	0.00057	0.00073	<0.00050	<0.00050	0.00082	0.00062	<0.00050	<0.00050	0.00129	0.00146	12%	0.00065	<0.00050	0.00050
gallium, total	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
iron, total	mg/L	-	-	-	-	0.519	0.851	0.167	0.160	0.269	0.995	0.117	0.182	0.167	0.262	0.073	0.091	0.239	0.184	0.053	0.036	0.519	0.417	**22%**	0.197	<0.010	0.010
lead, total	mg/L	0.14	80% of values ≤ 0.002	-	-	0.00021	0.000346	0.000058	0.000066	0.000105	0.000282	0.000061	0.000075	0.000053	0.000107	<0.000050	<0.000050	0.000113	0.000074	<0.000050	<0.000050	0.00021	0.000143	**38%**	0.000076	<0.000050	0.000050
lithium, total	mg/L	-	-	-	-	0.046	0.042	0.120	0.130	0.055	0.049	0.140	0.115	0.060	0.072	0.151	0.129	0.058	0.062	0.130	0.116	0.046	0.056	**20%**	0.059	<0.020	0.020
magnesium, total	mg/L	-	-	-	-	356	302	821	955	399	349	1010	792	427	520	1040	891	400	425	876	783	356	406	13%	463	<1.0	1.0
manganese, total	mg/L	-	0.1 [1]	-	-	0.0258	0.0359	0.00763	0.00704	0.0159	0.0376	0.0057	0.00853	0.0104	0.0135	0.00377	0.00562	0.0157	0.0127	0.00434	0.00357	0.0258	0.0202	**24%**	0.0130	<0.00020	0.00020
mercury, total	mg/L	-	-	-	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	nc	<0.0000050	<0.0000050	0.0000050
molybdenum, total	mg/L	-	-	-	-	0.00368	0.00338	0.00770	0.00855	0.00391	0.00358	0.00887	0.00747	0.00426	0.00508	0.00938	0.00837	0.00406	0.00424	0.00841	0.00740	0.00368	0.00432	16%	0.00424	<0.00010	0.00010
nickel, total	mg/L	-	0.0083 [1]	-	-	0.00128	0.00207	<0.00050	<0.00050	0.00056	0.00225	<0.00050	<0.00050	<0.00050	0.00052	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	0.00128	0.00094	**31%**	<0.00050	<0.00050	0.00050
phosphorus, total	mg/L	-	-	-	-	<0.050	<0.050	0.068	0.063	<0.050	0.052	0.089	<0.050	<0.050	<0.050	0.061	0.065	<0.050	<0.050	0.085	<0.050	<0.050	<0.050	nc	<0.050	<0.050	0.050
potassium, total	mg/L	-	-	-	-	115	95.9	272	322	130	113	338	263	141	175	359	315	136	142	308	276	115	129	11%	143	<1.0	1.0
rhenium, total	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
rubidium, total	mg/L	-	-	-	-	0.0349	0.0289	0.079	0.0906	0.0378	0.033	0.096	0.0765	0.0422	0.0499	0.102	0.0883	0.0388	0.0414	0.0876	0.0772	0.0349	0.0395	12%	0.0412	<0.0050	0.0050
selenium, total	mg/L	-	0.002	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
silicon, total	mg/L	-	-	-	-	1.3	1.8	<1.0	<1.0	<1.0	1.8	1.0	1.2	<1.0	<1.0	1.2	1.0	<1.0	<1.0	1.0	<1.0	1.3	<1.0	nc	<1.0	<1.0	1.0
silver, total	mg/L	0.003	0.0015	0.0075	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	nc	<0.00010	<0.00010	0.00010
sodium, total	mg/L	-	-	-	-	3640	3120	8320	9490	3970	3560	9840	7860	4440	5270	10500	9200	4010	4110	8680	7710	3640	4030	10%	4100	<2.5	2.5
strontium, total	mg/L	-	-	-	-	2.23	2.03	5.30	5.91	2.62	2.25	6.22	5.10	2.78	3.40	6.72	5.90	2.63	2.82	5.91	5.17	2.23	2.72	**20%**	2.78	<0.010	0.010
sulfur, total	mg/L	-	-	-	-	281	252	742	852	334	289	908	716	368	457	1010	854	356	370	838	739	281	350	**22%**	362	<5.0	5.0
tellurium, total	mg/L	-	-	-	-	<0.00050	<0.00050	0.00089	0.00105	<0.00050	<0.00050	0.00117	0.00093	<0.00050	0.00056	0.00138	0.00112	<0.00050	<0.00050	0.00119	0.00098	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
thallium, total	mg/L	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	nc	<0.000050	<0.000050	0.000050
thorium, total	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
tin, total	mg/L	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	nc	<0.0010	<0.0010	0.0010
titanium, total	mg/L	-	-	-	-	0.0070	0.0107	<0.0050	<0.0050	<0.0050	0.0127	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0070	0.0051	**31%**	<0.0050	<0.0050	0.0050
tungsten, total	mg/L	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	nc	<0.0010	<0.0010	0.0010
uranium, total	mg/L	-	-	-	-	0.00094	0.00086	0.00198	0.00228	0.00104	0.00089	0.00225	0.00198	0.00115	0.00130	0.00248	0.00215	0.00102	0.00108	0.00212	0.00188	0.00094	0.00110	16%	0.00108	<0.000050	0.00005
vanadium, total	mg/L	-	0.05 [1]	-	-	0.00164	0.00214	0.00176	0.00189	0.00141	0.00249	0.00194	0.00184	0.00132	0.00167	0.00217	0.00178	0.00139	0.00129	0.00180	0.00171	0.00164	0.00160	2%	0.00142	<0.00050	0.00050
yttrium, total	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050

Appendix G.3 Laboratory Results

Parameter	Units	BC Marine Aquatic Life Guidelines[1]		Canadian Council of Ministers of Environment (CCME) Guidelines		June																			
						WQ1				WQ3				WQ5				WQ6				QAQC					Lowest Detection Limit
		Short Term	Long Term	Short Term	Long Term	Ebb- 1m	Flood- 1m	Ebb- 10m	Flood- 10m	Ebb- 1m	Flood- 1m	Ebb- 15m	Flood- 6m	Ebb- 1m	Flood- 1m	Flood- 27m	Ebb- 10m	Ebb- 1m	Flood- 1m	Flood- 12m	Ebb- 12m	WQ1 Ebb- 1m	Duplicate	RPD	Field Blank	Equipment Blank	
zinc, total	mg/L	55	10	-	-	<0.0030	0.0060	<0.0030	<0.0030	<0.0030	0.0035	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	nc	<0.0030	<0.0030	0.0030
zirconium, total	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050

Notes: SU = Standard units; µS/cm = microSiemens per centimetre; NTU = nephelometric turbidity units; RPD = Relative percent difference

[1] Indicates a working BC Working Water Quality Guidelines for Aquatic Life (BC WQG-MAL), all other guidelines are approved BC WQG-MAL.

< = The analyte was not detected above the laboratory estimated quantitation limit.

Bold and italicized text indicates exceedance of and approved BC WQG-MAL whereas bold and underlined text indicates exceedance of CCME Water Quality Guidelines for marine aquatic life

Bold text in the RPD column indicates exceedance of acceptable value (20%)

(1) Value for 30 ppt at 15°C and individual sample pH values used for comparison to guidelines.

Appendix G.3 Laboratory Results

Parameter	Units	BC Marine Aquatic Life Guidelines[1]		Canadian Council of Ministers of Environment (CCME) Guidelines		June																		Lowest Detection Limit
						WQ1				WQ3				WQ5				WQ6				QAQC					
		Short Term	Long Term	Short Term	Long Term	Ebb- 1m	Flood- 1m	Ebb- 10m	Flood- 10m	Ebb- 1m	Flood- 1m	Ebb- 15m	Flood- 6m	Ebb- 1m	Flood- 1m	Flood- 27m	Ebb- 10m	Ebb- 1m	Flood- 1m	Flood- 12m	Ebb- 12m	WQ1 Ebb- 1m	Duplicate	RPD	Field Blank	Equipment Blank	
Dissolved Metals (Matrix: Water)																										
aluminum, dissolved	mg/L	-	-	-	-	0.0254	0.0198	0.0142	0.0097	0.0249	0.0226	0.0096	0.0176	0.0264	0.0244	0.0053	0.0101	0.0230	0.0254	0.0111	0.0145	0.0254	0.0258	2%	0.0248	<0.0050	0.0050
antimony, dissolved	mg/L	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	nc	<0.0010	<0.0010	0.0010
arsenic, dissolved	mg/L	-	-	-	-	0.00062	0.00059	0.00128	0.00146	0.00064	0.00055	0.00137	0.00125	0.00074	0.00083	0.00149	0.00132	0.00062	0.00066	0.00130	0.00119	0.00062	0.00069	11%	0.00073	<0.00040	0.00040
barium, dissolved	mg/L	-	-	-	-	0.0234	0.0285	0.0103	0.0089	0.0199	0.0268	0.0088	0.0114	0.0158	0.0162	0.0083	0.0094	0.0198	0.0182	0.0096	0.0099	0.0234	0.0192	**20%**	0.0174	<0.0010	0.0010
beryllium, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
bismuth, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
boron, dissolved	mg/L	-	-	-	-	1.39	1.11	3.07	3.38	1.57	1.37	3.35	3.01	1.72	1.99	3.63	3.22	1.51	1.63	3.15	2.95	1.39	1.52	9%	1.61	<0.30	0.30
cadmium, dissolved	mg/L	-	-	-	-	0.000040	0.000049	0.000058	0.000070	0.000035	0.000039	0.000072	0.000048	0.000036	0.000052	0.000073	0.000054	0.000026	0.000032	0.000053	0.000048	0.00004	0.000044	10%	0.000037	<0.000010	0.000010
calcium, dissolved	mg/L	-	-	-	-	127	108	282	318	139	123	322	280	156	185	361	312	141	148	309	284	127	142	11%	152	<1.0	1.0
cesium, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
chromium, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	0.00059	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
cobalt, dissolved	mg/L	-	-	-	-	0.000086	0.000098	<0.000050	<0.000050	0.000061	0.000092	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000067	<0.000050	<0.000050	<0.000050	0.000086	0.000068	**23%**	0.000052	<0.000050	0.000050
copper, dissolved	mg/L	-	-	-	-	0.00054	0.00066	0.00027	0.00025	0.00040	0.00057	0.00022	0.00029	0.00031	0.00036	<0.00020	0.00025	0.00039	0.00035	<0.00020	<0.00020	0.00054	0.00044	**20%**	0.00036	<0.00020	0.00020
gallium, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
iron, dissolved	mg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
lead, dissolved	mg/L	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	nc	<0.000050	<0.000050	0.000050
lithium, dissolved	mg/L	-	-	-	-	0.050	0.040	0.115	0.132	0.056	0.047	0.126	0.112	0.060	0.077	0.140	0.123	0.059	0.059	0.122	0.110	0.050	0.056	11%	0.058	<0.020	0.020
magnesium, dissolved	mg/L	-	-	-	-	361	329	905	1020	421	356	1000	852	458	533	1090	940	394	437	930	845	361	455	**23%**	452	<1.0	1.0
manganese, dissolved	mg/L	-	-	-	-	0.0126	0.0170	0.00237	0.00138	0.00909	0.0144	0.00118	0.00330	0.00610	0.00677	0.00060	0.00174	0.00907	0.00732	0.00167	0.00177	0.0126	0.00942	**29%**	0.00731	<0.00010	0.00010
mercury, dissolved	mg/L	-	-	-	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	nc	<0.0000050	<0.0000050	0.0000050
molybdenum, dissolved	mg/L	-	-	-	-	0.00365	0.00323	0.00758	0.00831	0.00387	0.00347	0.00858	0.00762	0.00440	0.00497	0.00948	0.00824	0.00400	0.00423	0.00796	0.00716	0.00365	0.00404	10%	0.00428	<0.00010	0.00010
nickel, dissolved	mg/L	-	-	-	-	<0.00050	0.00053	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
phosphorus, dissolved	mg/L	-	-	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.055	<0.050	<0.050	<0.050	nc	<0.050	<0.050	0.050
potassium, dissolved	mg/L	-	-	-	-	119	97.0	296	329	134	112	339	283	145	179	373	321	134	145	315	287	119	138	15%	140	<1.0	1.0
rhenium, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
rubidium, dissolved	mg/L	-	-	-	-	0.0350	0.0291	0.0835	0.0960	0.0382	0.0328	0.0936	0.0783	0.0411	0.0500	0.105	0.0893	0.0384	0.0412	0.0878	0.0798	0.035	0.04	13%	0.0396	<0.0050	0.0050
selenium, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
silicon, dissolved	mg/L	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	nc	<1.0	<1.0	1.0
silver, dissolved	mg/L	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	nc	<0.00010	<0.00010	0.00010
sodium, dissolved	mg/L	-	-	-	-	3210	2850	7320	8260	3500	3100	8660	6950	3780	4590	9130	8160	3430	3600	7660	6890	3210	3720	15%	3820	<2.5	2.5
strontium, dissolved	mg/L	-	-	-	-	2.31	1.99	5.17	5.78	2.54	2.18	5.95	5.24	2.88	3.27	6.58	5.70	2.56	2.78	5.55	5.04	2.31	2.58	11%	2.79	<0.010	0.010
sulfur, dissolved	mg/L	-	-	-	-	283	239	741	852	324	276	826	708	367	443	917	786	324	355	779	711	283	329	15%	348	<5.0	5.0
tellurium, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
thallium, dissolved	mg/L	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	nc	<0.000050	<0.000050	0.000050
thorium, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
tin, dissolved	mg/L	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	nc	<0.0010	<0.0010	0.0010
titanium, dissolved	mg/L	-	-	-	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	nc	<0.0050	<0.0050	0.0050
tungsten, dissolved	mg/L	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	nc	<0.0010	<0.0010	0.0010
uranium, dissolved	mg/L	-	-	-	-	0.000966	0.000869	0.00202	0.00237	0.00104	0.000899	0.00220	0.00198	0.00110	0.00134	0.00241	0.00211	0.00101	0.00108	0.00208	0.00186	0.000966	0.00111	14%	0.00110	<0.000050	0.000050
vanadium, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	0.00113	0.00128	<0.00050	<0.00050	0.00125	0.00100	0.00078	0.00068	0.00152	0.00120	<0.00050	0.00056	0.00119	0.00117	<0.00050	0.00052	nc	0.00077	<0.00050	0.00050
yttrium, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
zinc, dissolved	mg/L	-	-	-	-	<0.0010	0.0014	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	nc	<0.0010	<0.0010	0.0010
zirconium, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050

Notes: SU = Standard units; µS/cm = microSiemens per centimetre; NTU = nephelometric turbidity units; RPD = Relative percent difference

[1] Indicates a working BC Working Water Quality Guidelines for Aquatic Life (BC WQG-MAL), all other guidelines are approved BC WQG-MAL.

< = The analyte was not detected above the laboratory estimated quantitation limit.

Bold and italicized text indicates exceedance of and approved BC WQG-MAL whereas bold and underlined text indicates exceedance of CCME Water Quality Guidelines for marine aquatic life

Bold text in the RPD column indicates exceedance of acceptable value (20%)

(1) Value for 30 ppt at 15°C and individual sample pH values used for comparison to guidelines.

Appendix G.3 Laboratory Results

Parameter	Units	BC Marine Aquatic Life Guidelines[1]		Canadian Council of Ministers of Environment (CCME) Guidelines		June																					
						WQ1				WQ3				WQ5				WQ6				QAQC					Lowest Detection Limit
		Short Term	Long Term	Short Term	Long Term	Ebb- 1m	Flood- 1m	Ebb- 10m	Flood- 10m	Ebb- 1m	Flood- 1m	Ebb- 15m	Flood- 6m	Ebb- 1m	Flood- 1m	Flood- 27m	Ebb- 10m	Ebb- 1m	Flood- 1m	Flood- 12m	Ebb- 12m	WQ1 Ebb- 1m	Duplicate	RPD	Field Blank	Equipment Blank	
Volatile Organic Compounds [Fuels] (Matrix: Water)																											
benzene	µg/L	-	110	-	110	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	nc	<0.50	<0.50	0.50
ethylbenzene	µg/L	-	250	-	250	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	nc	<0.50	<0.50	0.50
methyl-tert-butyl ether [MTBE]	µg/L	440	-	-	5000	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	nc	<0.50	<0.50	0.50
styrene	µg/L	-	-	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	nc	<0.50	<0.50	0.50
toluene	µg/L	-	-	-	215	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	nc	<0.50	<0.50	0.50
xylene, m+p-	µg/L	-	-	-	-	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	nc	<0.40	<0.40	0.40
xylene, o-	µg/L	-	-	-	-	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	nc	<0.30	<0.30	0.30
xylenes, total	µg/L	-	-	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	nc	<0.50	<0.50	0.50
Hydrocarbons (Matrix: Water)																											
F1 (C6-C10)	µg/L	-	-	-	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	nc	<100	<100	100
F2 (C10-C16)	µg/L	-	-	-	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	nc	<100	<100	100
F2-naphthalene	µg/L	-	-	-	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	nc	<100	<100	100
F3 (C16-C34)	µg/L	-	-	-	-	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	nc	<250	<250	250
F3-PAH	µg/L	-	-	-	-	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	nc	<250	<250	250
F4 (C34-C50)	µg/L	-	-	-	-	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	nc	<250	<250	250
F1-BTEX	µg/L	-	-	-	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	nc	<100	<100	100
Hydrocarbons Surrogates (Matrix: Water)																											
bromofluorobenzene, 4-	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dichlorotoluene, 3,4-	%	-	-	-	-	82.4	85.8	86.2	89.3	83.8	89.2	85.4	85.7	94.1	86.8	82.9	91.3	88.1	101	78.2	98.5	82.4	91.6	11%	105	76.7	1.0
Polycyclic Aromatic Hydrocarbons (Matrix: Water)																											
acenaphthene	µg/L	-	6	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
acenaphthylene	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
acridine	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
anthracene	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
benz(a)anthracene	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
benzo(a)pyrene	µg/L	-	0.01	-	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	nc	<0.0050	<0.0050	0.0050
benzo(b+j)fluoranthene	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
benzo(b+j+k)fluoranthene	µg/L	-	-	-	-	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	nc	<0.015	<0.015	0.015
benzo(g,h,i)perylene	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
benzo(k)fluoranthene	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
chrysene	µg/L	-	0.1	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
dibenz(a,h)anthracene	µg/L	-	-	-	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	nc	<0.0050	<0.0050	0.0050
fluoranthene	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
fluorene	µg/L	-	12	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
indeno(1,2,3-c,d)pyrene	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
methylnaphthalene, 1-	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
methylnaphthalene, 2-	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
methylnaphthalenes, 1+2-	µg/L	-	-	-	-	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	nc	<0.015	<0.015	0.015
naphthalene	µg/L	-	1	-	1.4	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	nc	<0.050	<0.050	0.050
phenanthrene	µg/L	-	-	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	nc	<0.020	<0.020	0.020
pyrene	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
quinoline	µg/L	-	-	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	nc	<0.050	<0.050	0.050
B(a)P total potency equivalents [B(a)PTPE]	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010

Notes: SU = Standard units; µS/cm = microSiemens per centimetre; NTU = nephelometric turbidity units; RPD = Relative percent difference

[1] Indicates a working BC Working Water Quality Guidelines for Aquatic Life (BC WQG-MAL), all other guidelines are approved BC WQG-MAL.

< = The analyte was not detected above the laboratory estimated quantitation limit.

Bold and italicized text indicates exceedance of and approved BC WQG-MAL whereas bold and underlined text indicates exceedance of CCME Water Quality Guidelines for marine aquatic life

Bold text in the RPD column indicates exceedance of acceptable value (20%)

(1) Value for 30 ppt at 15°C and individual sample pH values used for comparison to guidelines.

Appendix G.3 Laboratory Results

Parameter	Units	BC Marine Aquatic Life Guidelines[1,2]		Canadian Council of Ministers of Environment (CCME) Guidelines		November																			
						WQ1				WQ3				WQ5				WQ6				QAQC					Lowest Detection Limit
		Short Term	Long Term	Short Term	Long Term	Ebb-1m	Ebb-20m	Flood-1m	Flood-20m	Ebb-1m	Ebb-20m	Flood-1m	Flood-20m	Ebb-1m	Ebb-20m	Flood-1m	Flood-20m	Ebb-1m	Ebb-20m	Flood-1m	Flood-20m	WQ 6 Flood-20m	WQ6 Flood - 20m-DUP	RPD	Field Blank	Equipment Blank	
Physical Tests (Matrix: Water)																											
hardness (as CaCO3), dissolved	mg/L	-	-	-	-	5550	5290	5310	5470	5610	5580	5440	5460	5480	5470	5330	5420	5480	5490	5670	5450	5450	5290	3%	<1.00	<1.00	0.50
hardness (as CaCO3), from total Ca/Mg	mg/L	-	-	-	-	5430	5590	5670	5720	5540	5580	5700	5870	5460	5580	5620	5820	5740	5730	5650	5620	5620	5700	1%	<1.00	<1.00	0.60
pH	pH units	-	7.0-8.7	-	7.0-8.7	7.72	7.76	7.78	7.78	7.77	7.77	7.78	7.77	7.76	7.78	7.78	7.78	7.78	7.75	7.77	7.77	7.77	7.79	0%	6.10	5.72	0.10
solids, total dissolved [TDS]	mg/L	-	-	-	-	28500	24800	25800	33900	28700	29200	30300	31400	28000	26500	31300	22200	29800	26000	26400	28700	28700	22600	**24%**	<10	<10	10
solids, total suspended [TSS]	mg/L	Change from background of 25 mg/L at any one time for a duration of 24 h in all waters during clear flows or in clear waters. Change from background of 10 mg/L at any time when background is 25 - 100 mg/L during high flows or in turbid waters. Change from background of 10% when background is > 100 mg/L at any time during high flows or in turbid waters.	Change from background of 5 mg/L at any one time for a duration of 30 d in all waters during clear flows or in clear waters.	Clear flow, short-term (<24 hrs): maximum increase of 25 mg/L from background High flow, background 25 - 250 mg/L: max increase of 25 mg/L from background. High flow, background >250 mg/L: max increase <10% of background.	Clear flow, long term (>24 hrs): maximum increase of 5 mg/L from background.	8.5	<2.0	8.5	5.6	2.5	<2.0	<2.0	8.0	7.2	3.7	2.0	8.7	2.5	5.1	3.9	9.9	9.9	4.1	**83%**	<2.0	<2.0	2.0
turbidity	NTU	Change from background of 8 NTU at any one time for a duration of 24 h in all waters during clear flows or in clear waters. Change from background of 5 NTU at any time when background is 8 50 NTU during high flows or in turbid waters. Change from background of 10% when background is > 50 NTU at any time during high flows or in turbid waters.	Change from background of 2 NTU at any one time for a duration of 30 d in all waters during clear flows or in clear waters.	Clear flow, short-term (<24 hrs): maximum increase of 8 NTUs from background High flow, background 8 - 80 NTUs: max increase of 8 NTUs from background. High flow, background >80 NTUs: max increase <10% of background.	Clear flow, long term (>24 hrs): maximum increase of 2 NTUs from background.	0.13	0.11	0.21	0.15	0.11	0.11	0.20	0.19	0.12	0.12	0.19	<0.10	0.13	0.11	0.20	0.12	0.12	0.12	0%	<0.10	<0.10	0.10

Notes: SU = Standard units; µS/cm = microSiemens per centimetre; NTU = nephelometric turbidity units; RPD = Relative percent difference

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Bold text in the RPD column indicates exceedance of acceptable value (20%)

(1) Value for 30 ppt at 15°C and individual sample pH values used for comparison to guidelines.

Appendix G.3 Laboratory Results

Parameter	Units	BC Marine Aquatic Life Guidelines[1,2]		Canadian Council of Ministers of Environment (CCME) Guidelines		November																			Lowest Detection Limit
						WQ1				WQ3				WQ5				WQ6				QAQC				
		Short Term	Long Term	Short Term	Long Term	Ebb-1m	Ebb-20m	Flood-1m	Flood-20m	Ebb-1m	Ebb-20m	Flood-1m	Flood-20m	Ebb-1m	Ebb-20m	Flood-1m	Flood-20m	Ebb-1m	Ebb-20m	Flood-1m	Flood-20m	WQ 6 Flood-20m	WQ6 Flood - 20m-DUP	RPD	Field Blank	Equipment Blank	
Anions and Nutrients (Matrix: Water)																										
ammonia, total (as N)	mg/L	Salinity, temperature and pH dependent (1)	Salinity, temperature and pH dependent (1)	-	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	nc	<0.0050	<0.0050	0.0050
bromide	mg/L	-	-	-	-	48.1	61.8	43.2	48.0	53.5	44.0	51.3	45.0	44.4	40.3	44.7	48.8	49.2	51.4	49.5	50.6	50.6	52.2	3%	<5.0	<5.0	5.0
chloride	mg/L	-	-	-	-	14500	17600	12700	14100	15600	12800	14900	12900	12900	11500	13000	14200	13900	14900	14500	14600	14600	15200	4%	<50	<50	50
fluoride	mg/L	1.5	-	-	-	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	nc	<1.0	<1.0	1.0
nitrate (as N)	mg/L	-	3.7	1500	200	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	nc	<0.50	<0.50	0.50
nitrite (as N)	mg/L	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	nc	<0.10	<0.10	0.10
phosphorus, total	mg/L	-	-	-	-	0.0599	0.0600	0.0863	0.0696	0.0569	0.0577	0.0811	0.0787	0.0560	0.0594	0.0803	0.0619	0.0726	0.0624	0.0719	0.0657	0.0657	0.0654	0%	<0.0040	0.0064	0.0020
sulfate (as SO4)	mg/L	-	-	-	-	1960	2420	1700	1900	2120	1700	2020	1720	1720	1510	1740	1920	1870	2010	1960	1940	1940	2060	6%	<30	<30	30
Organic / Inorganic Carbon (Matrix: Water)																										
carbon, dissolved organic [DOC]	mg/L	-	-	-	-	1.11	0.88	0.81	1.00	1.07	0.81	0.72	0.85	1.07	1.10	1.14	1.09	0.89	0.87	0.86	0.86	0.86	0.83	4%	<0.50	<0.50	0.50
carbon, total organic [TOC]	mg/L	-	-	-	-	0.81	0.97	1.05	1.64	2.02	0.88	0.77	0.79	1.04	1.11	0.83	0.90	1.60	1.09	0.84	0.73	0.73	0.99	**30%**	<0.50	<0.50	0.50
Total Metals (Matrix: Water)																										
aluminum, total	mg/L	-	-	-	-	0.0132	0.0154	0.0158	0.0152	0.0144	0.0148	0.0142	0.015	0.0152	0.0146	0.018	0.0153	0.0146	0.0138	0.0148	0.0142	0.0142	0.017	18%	<0.0050	<0.0050	0.0050
antimony, total	mg/L	-	0.27 [1]	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	nc	<0.0010	<0.0010	0.0010
arsenic, total	mg/L	-	0.0125	-	0.0125	0.00154	0.00159	0.00168	0.00165	0.00166	0.0016	0.00167	0.00173	0.0016	0.00159	0.00159	0.00168	0.00167	0.00171	0.00163	0.00161	0.00161	0.00166	3%	<0.00040	<0.00040	0.00040
barium, total	mg/L	-	-	-	-	0.0101	0.0105	0.0104	0.0096	0.0102	0.0104	0.0103	0.0097	0.0103	0.0105	0.0102	0.0107	0.0105	0.0100	0.0103	0.0099	0.0099	0.0101	2%	<0.0010	<0.0010	0.0010
beryllium, total	mg/L	-	0.1 [1]	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
bismuth, total	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
boron, total	mg/L	-	1.2	-	-	***3.94***	***4.04***	***4.00***	***4.21***	***4.09***	***4.00***	***3.99***	***4.04***	***3.98***	***3.90***	***4.12***	***4.04***	***4.29***	***3.99***	***4.32***	***4.17***	***4.17***	***3.87***	7%	<0.30	<0.30	0.30
cadmium, total	mg/L	-	0.00012	-	0.00012	0.000061	0.000067	0.000064	0.000066	0.000056	0.000064	0.000063	0.000064	0.000058	0.000061	0.000059	0.000070	0.000060	0.000060	0.000057	0.000058	0.000058	0.000058	0%	<0.000010	<0.000010	0.000010
calcium, total	mg/L	-	-	-	-	362	375	375	393	373	370	370	371	372	370	372	370	403	383	366	371	371	371	0%	<1.0	<1.0	1.0
cesium, total	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
chromium, total	mg/L	-	0.0015 (Cr(IV)); 0.056 (Cr(III)) [1]	-	0.0015 (Cr(IV)); 0.056 (Cr(III))	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
cobalt, total	mg/L	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	nc	<0.000050	<0.000050	0.000050
copper, total	mg/L	0.003	0.002	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00118	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00165	nc	<0.00050	<0.00050	0.00050
gallium, total	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
iron, total	mg/L	-	-	-	-	0.014	0.017	0.016	0.018	0.015	0.017	0.015	0.017	0.019	0.016	0.020	0.015	0.017	0.015	0.015	0.014	0.014	0.027	**63%**	<0.010	<0.010	0.010
lead, total	mg/L	0.14	80% of values ≤ 0.002	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	nc	<0.000050	<0.000050	0.000050
lithium, total	mg/L	-	-	-	-	0.147	0.147	0.149	0.154	0.151	0.152	0.146	0.157	0.148	0.148	0.161	0.152	0.159	0.151	0.168	0.162	0.162	0.145	11%	<0.020	<0.020	0.020
magnesium, total	mg/L	-	-	-	-	1100	1130	1150	1150	1120	1130	1160	1200	1100	1130	1140	1190	1150	1160	1150	1140	1140	1160	2%	<1.0	<1.0	1.0
manganese, total	mg/L	-	0.1 [1]	-	-	0.00395	0.00440	0.00427	0.00419	0.00392	0.00430	0.00425	0.00398	0.00414	0.00416	0.00415	0.00408	0.00413	0.00452	0.00375	0.00397	0.00397	0.00418	5%	<0.00020	<0.00020	0.00020
mercury, total	mg/L	-	-	-	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	nc	<0.0000050	<0.0000050	0.0000050
molybdenum, total	mg/L	-	-	-	-	0.00968	0.00953	0.00939	0.0100	0.00936	0.00932	0.00959	0.00981	0.00926	0.00945	0.00959	0.00973	0.0100	0.00966	0.00931	0.00943	0.00943	0.00933	1%	<0.00010	<0.00010	0.00010
nickel, total	mg/L	-	0.0083 [1]	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00343	nc	<0.00050	<0.00050	0.00050
phosphorus, total	mg/L	-	-	-	-	0.087	0.069	0.100	0.094	0.075	0.075	0.095	0.112	0.083	0.084	0.096	0.082	0.114	0.082	0.090	0.082	0.082	0.095	15%	<0.050	<0.050	0.050
potassium, total	mg/L	-	-	-	-	374	386	382	388	378	390	386	396	377	386	379	400	391	406	373	378	378	384	2%	<1.0	<1.0	1.0
rhenium, total	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
rubidium, total	mg/L	-	-	-	-	0.101	0.104	0.104	0.105	0.101	0.104	0.104	0.110	0.101	0.103	0.104	0.108	0.105	0.106	0.102	0.103	0.103	0.104	1%	<0.0050	<0.0050	0.0050
selenium, total	mg/L	-	0.002	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
silicon, total	mg/L	-	-	-	-	1.4	1.3	1.0	1.2	1.3	1.2	1.1	1.1	1.4	1.2	1.1	1.1	1.4	1.3	<1.0	1.1	1.1	1.1	0%	<1.0	<1.0	1.0
silver, total	mg/L	0.003	0.0015	0.0075	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	nc	<0.00010	<0.00010	0.00010
sodium, total	mg/L	-	-	-	-	9220	9030	9900	10100	9170	9450	9860	10400	8930	9200	9250	9640	9390	9320	10200	9580	9580	9540	0%	<2.5	<2.5	2.5
strontium, total	mg/L	-	-	-	-	6.64	6.66	6.75	7.10	6.67	6.66	6.85	7.01	6.70	6.84	6.67	6.73	7.13	6.87	6.39	6.59	6.59	6.51	1%	<0.010	<0.010	0.010
sulfur, total	mg/L	-	-	-	-	896	958	840	878	928	919	856	862	926	929	847	861	937	916	874	878	878	855	3%	<5.0	<5.0	5.0
tellurium, total	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
thallium, total	mg/L	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	nc	<0.000050	<0.000050	0.000050
thorium, total	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
tin, total	mg/L	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	nc	<0.0010	<0.0010	0.0010
titanium, total	mg/L	-	-	-	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	nc	<0.0050	<0.0050	0.0050
tungsten, total	mg/L	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	nc	<0.0010	<0.0010	0.0010
uranium, total	mg/L	-	-	-	-	0.00257	0.00262	0.00266	0.00280	0.00251	0.00258	0.00262	0.00272	0.00255	0.00256	0.00263	0.00270	0.00272	0.00261	0.00273	0.00266	0.00266	0.0026	2%	<0.000050	<0.000050	0.000050
vanadium, total	mg/L	-	0.05 [1]	-	-	0.00164	0.00169	0.00164	0.00171	0.00166	0.00165	0.00169	0.00177	0.00164	0.00167	0.00165	0.00175	0.00167	0.00173	0.00167	0.00164	0.00164	0.00166	1%	<0.00050	<0.00050	0.00050
yttrium, total	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
zinc, total	mg/L	55	10	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	nc	<0.0030	<0.0030	0.0030
zirconium, total	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050

Notes: SU = Standard units; µS/cm = microSiemens per centimetre; NTU = nephelometric turbidity units; RPD = Relative percent difference

[1] Indicates a working BC Working Water Quality Guidelines for Aquatic Life (BC WQG-MAL), all other guidelines are approved BC WQG-MAL.

< = The analyte was not detected above the laboratory estimated quantitation limit.

Bold and italicized text indicates exceedance of and approved BC WQG-MAL whereas bold and underlined text indicates exceedance of CCME Water Quality Guidelines for marine aquatic life

Bold text in the RPD column indicates exceedance of acceptable value (20%)

(1) Value for 30 ppt at 15°C and individual sample pH values used for comparison to guidelines.

Appendix G.3 Laboratory Results

Parameter	Units	BC Marine Aquatic Life Guidelines[1,2]		Canadian Council of Ministers of Environment (CCME) Guidelines		November																			
						WQ1				WQ3				WQ5				WQ6				QAQC				Lowest Detection Limit
		Short Term	Long Term	Short Term	Long Term	Ebb-1m	Ebb-20m	Flood-1m	Flood-20m	Ebb-1m	Ebb-20m	Flood-1m	Flood-20m	Ebb-1m	Ebb-20m	Flood-1m	Flood-20m	Ebb-1m	Ebb-20m	Flood-1m	Flood-20m	WQ 6 Flood-20m	WQ6 Flood - 20m-DUP	RPD	Field Blank	Equipment Blank	
Dissolved Metals (Matrix: Water)																										
aluminum, dissolved	mg/L	-	-	-	-	0.0059	0.0059	0.0059	<0.0050	0.0062	0.0062	0.0057	<0.0050	0.0062	0.0065	0.0073	0.0064	0.0061	0.0059	0.0061	0.0059	0.0059	0.0050	17%	<0.0050	<0.0050	0.0050
arsenic, dissolved	mg/L	-	-	-	-	0.00157	0.00161	0.00160	0.00164	0.00156	0.00154	0.00158	0.00161	0.00156	0.00156	0.00150	0.00163	0.00162	0.00162	0.00159	0.00166	0.00166	0.00155	7%	<0.00040	<0.00040	0.00040
barium, dissolved	mg/L	-	-	-	-	0.0101	0.0103	0.0100	0.0097	0.0105	0.0103	0.0105	0.0095	0.0100	0.0102	0.0102	0.0105	0.0105	0.0099	0.0107	0.0101	0.0101	0.0098	3%	<0.0010	<0.0010	0.0010
beryllium, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
bismuth, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
boron, dissolved	mg/L	-	-	-	-	3.98	3.67	3.72	3.73	3.84	3.82	3.60	3.65	3.74	3.77	3.67	3.71	3.72	3.80	3.71	3.60	3.60	3.63	1%	<0.30	<0.30	0.30
cadmium, dissolved	mg/L	-	-	-	-	0.000061	0.000062	0.000060	0.000077	0.000076	0.000061	0.000064	0.000059	0.000057	0.000065	0.000066	0.000068	0.000074	0.000062	0.000067	0.000066	0.000066	0.000066	0%	<0.000010	<0.000010	0.000010
calcium, dissolved	mg/L	-	-	-	-	358	370	377	375	366	371	363	374	363	362	369	374	364	368	375	367	367	372	1%	<1.0	<1.0	1.0
cesium, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
chromium, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
cobalt, dissolved	mg/L	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	nc	<0.000050	<0.000050	0.000050
copper, dissolved	mg/L	-	-	-	-	<0.00020	0.00024	0.00020	<0.00020	<0.00020	0.00030	0.00044	<0.00020	0.00020	0.00021	<0.00020	0.00023	0.00025	0.00039	0.00023	<0.00020	<0.00020	<0.00020	nc	<0.00020	<0.00020	0.00020
gallium, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
iron, dissolved	mg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
lead, dissolved	mg/L	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	nc	<0.000050	<0.000050	0.000050
lithium, dissolved	mg/L	-	-	-	-	0.152	0.138	0.144	0.147	0.146	0.142	0.139	0.144	0.140	0.143	0.139	0.145	0.145	0.141	0.146	0.143	0.143	0.142	1%	<0.020	<0.020	0.020
magnesium, dissolved	mg/L	-	-	-	-	1130	1060	1060	1100	1140	1130	1100	1100	1110	1110	1070	1090	1110	1110	1150	1100	1100	1060	4%	<1.0	<1.0	1.0
manganese, dissolved	mg/L	-	-	-	-	0.00240	0.00255	0.00258	0.00228	0.00232	0.00258	0.00256	0.00182	0.00256	0.00244	0.00251	0.00234	0.00256	0.00232	0.00241	0.00225	0.00225	0.00226	0%	<0.00010	<0.00010	0.00010
mercury, dissolved	mg/L	-	-	-	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	nc	<0.0000050	<0.0000050	0.0000050
molybdenum, dissolved	mg/L	-	-	-	-	0.00927	0.00928	0.00910	0.00960	0.00934	0.00937	0.00955	0.00954	0.00919	0.00928	0.00904	0.00913	0.00934	0.00945	0.00933	0.00924	0.00924	0.00945	2%	<0.00010	<0.00010	0.00010
nickel, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
phosphorus, dissolved	mg/L	-	-	-	-	0.071	0.064	0.105	0.096	0.073	0.065	0.079	0.096	0.067	0.074	0.072	0.069	0.076	0.069	0.090	0.084	0.084	0.077	9%	<0.050	<0.050	0.050
potassium, dissolved	mg/L	-	-	-	-	377	371	370	390	388	390	393	382	386	379	372	380	380	387	397	385	385	374	3%	<1.0	<1.0	1.0
rhenium, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
rubidium, dissolved	mg/L	-	-	-	-	0.102	0.102	0.102	0.106	0.105	0.104	0.108	0.105	0.102	0.104	0.101	0.104	0.104	0.105	0.107	0.104	0.104	0.104	0%	<0.0050	<0.0050	0.0050
selenium, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
silicon, dissolved	mg/L	-	-	-	-	1.1	1.1	1.2	1.1	<1.0	1.2	<1.0	<1.0	1.1	1.0	1.2	1.1	<1.0	1.2	1.1	1.0	1.0	1.1	10%	<1.0	<1.0	1.0
silver, dissolved	mg/L	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	nc	<0.00010	<0.00010	0.00010
sodium, dissolved	mg/L	-	-	-	-	9260	9540	9530	9910	9430	9500	9250	9800	9300	9590	9040	9340	9210	9570	9550	9260	9260	9380	1%	<2.5	<2.5	2.5
strontium, dissolved	mg/L	-	-	-	-	6.55	6.65	6.50	6.77	6.67	6.69	6.60	6.82	6.49	6.64	6.52	6.48	6.55	6.70	6.60	6.65	6.65	6.66	0%	<0.010	<0.010	0.010
sulfur, dissolved	mg/L	-	-	-	-	894	965	920	1010	959	942	946	938	934	960	940	930	949	947	960	929	929	902	3%	<5.0	<5.0	5.0
tellurium, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
thallium, dissolved	mg/L	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	nc	<0.000050	<0.000050	0.000050
thorium, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
tin, dissolved	mg/L	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	nc	<0.0010	<0.0010	0.0010
titanium, dissolved	mg/L	-	-	-	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	nc	<0.0050	<0.0050	0.0050
tungsten, dissolved	mg/L	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	nc	<0.0010	<0.0010	0.0010
uranium, dissolved	mg/L	-	-	-	-	0.00261	0.00254	0.00262	0.00272	0.00256	0.00255	0.00258	0.00263	0.00251	0.00261	0.00256	0.00265	0.00259	0.00255	0.00260	0.00256	0.00256	0.00261	2%	<0.000050	<0.000050	0.000050
vanadium, dissolved	mg/L	-	-	-	-	0.00154	0.00154	0.00154	0.00163	0.00159	0.00156	0.00156	0.00161	0.00155	0.00154	0.00148	0.00161	0.00155	0.00159	0.00159	0.00155	0.00155	0.00158	2%	<0.00050	<0.00050	0.00050
yttrium, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050
zinc, dissolved	mg/L	-	-	-	-	0.0015	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	nc	<0.0010	<0.0010	0.0010
zirconium, dissolved	mg/L	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	0.00050

Notes: SU = Standard units; µS/cm = microSiemens per centimetre; NTU = nephelometric turbidity units; RPD = Relative percent difference

[1] Indicates a working BC Working Water Quality Guidelines for Aquatic Life (BC WQG-MAL), all other guidelines are approved BC WQG-MAL.

< = The analyte was not detected above the laboratory estimated quantitation limit.

Bold and italicized text indicates exceedance of and approved BC WQG-MAL whereas bold and underlined text indicates exceedance of CCME Water Quality Guidelines for marine aquatic life

Bold text in the RPD column indicates exceedance of acceptable value (20%)

(1) Value for 30 ppt at 15°C and individual sample pH values used for comparison to guidelines.

KSI LISIMS LNG

Appendix G.3 Laboratory Results

Parameter	Units	BC Marine Aquatic Life Guidelines[1,2]		Canadian Council of Ministers of Environment (CCME) Guidelines		November																				
						WQ1				WQ3				WQ5				WQ6				QAQC				Lowest Detection Limit
		Short Term	Long Term	Short Term	Long Term	Ebb-1m	Ebb-20m	Flood-1m	Flood-20m	Ebb-1m	Ebb-20m	Flood-1m	Flood-20m	Ebb-1m	Ebb-20m	Flood-1m	Flood-20m	Ebb-1m	Ebb-20m	Flood-1m	Flood-20m	WQ 6 Flood-20m	WQ6 Flood - 20m-DUP	RPD	Field Blank	Equipment Blank	
Volatile Organic Compounds [Fuels] (Matrix: Water)																										
benzene	µg/L	-	110 [2]	-	110	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	nc	<0.50	<0.50	0.50
methyl-tert-butyl ether [MTBE]	µg/L	440 [2]	-	-	5000	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	nc	<0.50	<0.50	0.50
styrene	µg/L	-	-	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	nc	<0.50	<0.50	0.50
toluene	µg/L	-	-	-	215	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	nc	<0.50	<0.50	0.50
xylene, m+p-	µg/L	-	-	-	-	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	nc	<0.40	<0.40	0.40
xylene, o-	µg/L	-	-	-	-	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	nc	<0.30	<0.30	0.30
xylenes, total	µg/L	-	-	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	nc	<0.50	<0.50	0.50
Hydrocarbons (Matrix: Water)																										
F1 (C6-C10)	µg/L	-	-	-	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	nc	<100	<100	100
F2 (C10-C16)	µg/L	-	-	-	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	nc	<100	<100	100
F2-naphthalene	µg/L	-	-	-	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	nc	<100	<100	100
F3 (C16-C34)	µg/L	-	-	-	-	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	nc	<250	<250	250
F3-PAH	µg/L	-	-	-	-	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	nc	<250	<250	250
F4 (C34-C50)	µg/L	-	-	-	-	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	nc	<250	<250	250
F1-BTEX	µg/L	-	-	-	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	nc	<100	<100	100
Hydrocarbons Surrogates (Matrix: Water)																										
bromofluorobenzene, 4-	%	-	-	-	-	87.5	91.4	87.9	86.7	89.2	89.5	87.9	86.0	88.4	94.8	85.7	87.4	94.6	77.4	89.0	90.6	90.6	88.3	3%	75.0	90.0	1.0
dichlorotoluene, 3,4-	%	-	-	-	-	105.0	89.8	107.0	93.0	95.4	99.4	73.6	100.0	102.0	88.6	95.2	95.2	89.0	99.6	92.8	99.1	99.1	95.5	4%	93.6	102.0	1.0
Polycyclic Aromatic Hydrocarbons (Matrix: Water)																										
acenaphthene	µg/L	-	6	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
acenaphthylene	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
acridine	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
anthracene	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
benz(a)anthracene	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
benzo(a)pyrene	µg/L	-	0.01	-	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	nc	<0.0050	<0.0050	0.0050
benzo(b+j)fluoranthene	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
benzo(b+j+k)fluoranthene	µg/L	-	-	-	-	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	nc	<0.015	<0.015	0.015
benzo(g,h,i)perylene	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
benzo(k)fluoranthene	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
chrysene	µg/L	-	0.1	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
dibenz(a,h)anthracene	µg/L	-	-	-	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	nc	<0.0050	<0.0050	0.0050
fluoranthene	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
fluorene	µg/L	-	12	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
indeno(1,2,3-c,d)pyrene	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
methylnaphthalene, 1-	µg/L	-	-	-	-	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	nc	<0.015	<0.015	0.015
methylnaphthalene, 2-	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
methylnaphthalenes, 1+2-	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
naphthalene	µg/L	-	1	-	1.4	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	nc	<0.050	<0.050	0.050
phenanthrene	µg/L	-	-	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	nc	<0.020	<0.020	0.020
pyrene	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010
quinoline	µg/L	-	-	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	nc	<0.050	<0.050	0.050
B(a)P total potency equivalents [B(a)P TPE]	µg/L	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010	<0.010	0.010

Notes: SU = Standard units; µS/cm = microSiemens per centimetre; NTU = nephelometric turbidity units; RPD = Relative percent difference

[1] Indicates a working BC Working Water Quality Guidelines for Aquatic Life (BC WQG-MAL), all other guidelines are approved BC WQG-MAL.

< = The analyte was not detected above the laboratory estimated quantitation limit.

Bold and italicized text indicates exceedance of and approved BC WQG-MAL whereas bold and underlined text indicates exceedance of CCME Water Quality Guidelines for marine aquatic life

Bold text in the RPD column indicates exceedance of acceptable value (20%)

(1) Value for 30 ppt at 15°C and individual sample pH values used for comparison to guidelines.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA21B1579**	Page	: 1 of 27
Client	: **Stantec Consulting Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Jenny Minford	Account Manager	: Brent Mack
Address	: # 11 - 2042 Mills Road Sidney BC Canada V8L 5X4	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: 778-370-3279
Project	: ----	Date Samples Received	: 09-Jun-2021 17:20
PO	: ----	Date Analysis Commenced	: 11-Jun-2021
C-O-C number	: 20-917635,20-917636	Issue Date	: 28-Jun-2021 15:33
Sampler	: ----		
Site	: ----		
Quote number	: VA21-STAC100-005		
No. of samples received	: 19		
No. of samples analysed	: 19		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Annabelle Prasad	Analyst	Metals, Burnaby, British Columbia
Cindy Tang	Team Leader - Inorganics	Inorganics, Burnaby, British Columbia
Dee Lee	Analyst	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Ophelia Chiu	Department Manager - Organics	Organics, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Tracy Harley	Supervisor - Water Quality Instrumentation	Inorganics, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
µg/L	micrograms per litre
mg/L	milligrams per litre
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
HTDC	*Hold time exceeded for dilution or re-analysis. Reported results are consistent with initial results (tested within hold time), and are valid and defensible.*
RRV	*Reported result verified by repeat analysis.*

Page : 3 of 27
Work Order : VA21B1579
Client : Stantec Consulting Ltd.
Project : ----

Analytical Results

Sub-Matrix: **Seawater**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ1-1-EBB	WQ1-1-Flow	WQ1-1-EBB2	WQ1-10-Flow	WQ1-10-EBB
					Client sampling date / time	07-Jun-2021 14:30	07-Jun-2021 10:59	07-Jun-2021 14:30	07-Jun-2021 10:30	07-Jun-2021 14:44
						VA21B1579-001	VA21B1579-002	VA21B1579-003	VA21B1579-004	VA21B1579-005
						Result	Result	Result	Result	Result
Physical Tests										
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		1800	1620	2230	4990	4430
pH	----	E108	0.10	pH units		7.86	7.84	7.92	7.94	7.95
solids, total dissolved [TDS]	----	E162S	10	mg/L		11200	9680	12600	29400	25200
solids, total suspended [TSS]	----	E160S	2.0	mg/L		5.9	10.7	7.8	5.0	3.3
turbidity	----	E121	0.10	NTU		9.79	16.5	8.49	2.36	2.93
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.60	mg/L		1780	1530	2050	4750	4110
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		0.0051	0.0133	<0.0050	0.0332	0.0355
bromide	24959-67-9	E235S.Br	5.0	mg/L		20.3	17.7	23.7	47.4	45.2
chloride	16887-00-6	E235S.Cl	50	mg/L		5980	5330	7050	14100	13500
fluoride	16984-48-8	E235S.F	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	<1.0
nitrate (as N)	14797-55-8	E235S.NO3	0.50	mg/L		<0.50	<0.50	<0.50	<0.50	<0.50
nitrite (as N)	14797-65-0	E235S.NO2	0.10	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L		0.0177	0.0326	0.0181	0.0475	0.0331
sulfate (as SO4)	14808-79-8	E235S.SO4	30	mg/L		847	748	1000	2000	1910
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		3.24	1.77	3.43	2.55	1.11
carbon, total organic [TOC]	----	E355-L	0.50	mg/L		2.00	1.69	2.17	1.21	1.27
Total Metals										
aluminum, total	7429-90-5	E468S	0.0050	mg/L		0.374	0.557	0.308	0.110	0.124
antimony, total	7440-36-0	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
arsenic, total	7440-38-2	E468S	0.00040	mg/L		0.00093	0.00096	0.00098	0.00161	0.00142
barium, total	7440-39-3	E468S	0.0010	mg/L		0.0256	0.0326	0.0218	0.0093	0.0109
beryllium, total	7440-41-7	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
bismuth, total	7440-69-9	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
boron, total	7440-42-8	E468S	0.30	mg/L		1.36	1.26	1.67	3.58	3.22
cadmium, total	7440-43-9	E468S	0.000010	mg/L		0.000053	0.000053	0.000048	0.000061	0.000064
calcium, total	7440-70-2	E468S	1.0	mg/L		125	115	150	328	293
cesium, total	7440-46-2	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
chromium, total	7440-47-3	E468S	0.00050	mg/L		0.00091	0.00141	0.00074	<0.00050	<0.00050

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Analytical Results

Sub-Matrix: **Seawater**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ1-1-EBB	WQ1-1-Flow	WQ1-1-EBB2	WQ1-10-Flow	WQ1-10-EBB
					Client sampling date / time	07-Jun-2021 14:30	07-Jun-2021 10:59	07-Jun-2021 14:30	07-Jun-2021 10:30	07-Jun-2021 14:44
						VA21B1579-001	VA21B1579-002	VA21B1579-003	VA21B1579-004	VA21B1579-005
						Result	Result	Result	Result	Result
Total Metals										
cobalt, total	7440-48-4	E468S	0.000050	mg/L		0.000323	0.000475	0.000251	0.000109	0.000106
copper, total	7440-50-8	E468S	0.00050	mg/L		0.00129	0.00181	0.00146	<0.00050	0.00052
gallium, total	7440-55-3	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
iron, total	7439-89-6	E468S	0.010	mg/L		0.519	0.851	0.417	0.160	0.167
lead, total	7439-92-1	E468S	0.000050	mg/L		0.000210	0.000346	0.000143	0.000066	0.000058
lithium, total	7439-93-2	E468S	0.020	mg/L		0.046	0.042	0.056	0.130	0.120
magnesium, total	7439-95-4	E468S	1.0	mg/L		356	302	406	955	821
manganese, total	7439-96-5	E468S	0.00020	mg/L		0.0258	0.0359	0.0202	0.00704	0.00763
mercury, total	7439-97-6	E508S	0.0000050	mg/L		<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
molybdenum, total	7439-98-7	E468S	0.00010	mg/L		0.00368	0.00338	0.00432	0.00855	0.00770
nickel, total	7440-02-0	E468S	0.00050	mg/L		0.00128	0.00207	0.00094	<0.00050	<0.00050
phosphorus, total	7723-14-0	E468S	0.050	mg/L		<0.050	<0.050	<0.050	0.063	0.068
potassium, total	7440-09-7	E468S	1.0	mg/L		115	95.9	129	322	272
rhenium, total	7440-15-5	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
rubidium, total	7440-17-7	E468S	0.0050	mg/L		0.0349	0.0289	0.0395	0.0906	0.0790
selenium, total	7782-49-2	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
silicon, total	7440-21-3	E468S.NaSi	1.0	mg/L		1.3	1.8	<1.0	<1.0	<1.0
silver, total	7440-22-4	E468S	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
sodium, total	17341-25-2	E468S.NaSi	2.5	mg/L		3640	3120	4030	9490	8320
strontium, total	7440-24-6	E468S	0.010	mg/L		2.23	2.03	2.72	5.91	5.30
sulfur, total	7704-34-9	E468S	5.0	mg/L		281	252	350	852	742
tellurium, total	13494-80-9	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	0.00105	0.00089
thallium, total	7440-28-0	E468S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
thorium, total	7440-29-1	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
tin, total	7440-31-5	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
titanium, total	7440-32-6	E468S	0.0050	mg/L		0.0070	0.0107	0.0051	<0.0050	<0.0050
tungsten, total	7440-33-7	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
uranium, total	7440-61-1	E468S	0.000050	mg/L		0.000939	0.000858	0.00110	0.00228	0.00198
vanadium, total	7440-62-2	E468S	0.00050	mg/L		0.00164	0.00214	0.00160	0.00189	0.00176
yttrium, total	7440-65-5	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
zinc, total	7440-66-6	E468S	0.0030	mg/L		<0.0030	0.0060	<0.0030	<0.0030	<0.0030

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Analytical Results

Sub-Matrix: **Seawater**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ1-1-EBB	WQ1-1-Flow	WQ1-1-EBB2	WQ1-10-Flow	WQ1-10-EBB
					Client sampling date / time	07-Jun-2021 14:30	07-Jun-2021 10:59	07-Jun-2021 14:30	07-Jun-2021 10:30	07-Jun-2021 14:44
						VA21B1579-001	VA21B1579-002	VA21B1579-003	VA21B1579-004	VA21B1579-005
						Result	Result	Result	Result	Result
Total Metals										
zirconium, total	7440-67-7	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Dissolved Metals										
aluminum, dissolved	7429-90-5	E469S	0.0050	mg/L		0.0254	0.0198	0.0258	0.0097	0.0142
antimony, dissolved	7440-36-0	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
arsenic, dissolved	7440-38-2	E469S	0.00040	mg/L		0.00062	0.00059	0.00069	0.00146	0.00128
barium, dissolved	7440-39-3	E469S	0.0010	mg/L		0.0234	0.0285	0.0192	0.0089	0.0103
beryllium, dissolved	7440-41-7	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
bismuth, dissolved	7440-69-9	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
boron, dissolved	7440-42-8	E469S	0.30	mg/L		1.39	1.11	1.52	3.38	3.07
cadmium, dissolved	7440-43-9	E469S	0.000010	mg/L		0.000040	0.000049	0.000044	0.000070	0.000058
calcium, dissolved	7440-70-2	E469S	1.0	mg/L		127	108	142	318	282
cesium, dissolved	7440-46-2	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
chromium, dissolved	7440-47-3	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	0.00059	<0.00050
cobalt, dissolved	7440-48-4	E469S	0.000050	mg/L		0.000086	0.000098	0.000068	<0.000050	<0.000050
copper, dissolved	7440-50-8	E469S	0.00020	mg/L		0.00054	0.00066	0.00044	0.00025	0.00027
gallium, dissolved	7440-55-3	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
iron, dissolved	7439-89-6	E469S	0.010	mg/L		<0.010	<0.010	<0.010	<0.010	<0.010
lead, dissolved	7439-92-1	E469S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
lithium, dissolved	7439-93-2	E469S	0.020	mg/L		0.050	0.040	0.056	0.132	0.115
magnesium, dissolved	7439-95-4	E469S	1.0	mg/L		361	329	455	1020	905
manganese, dissolved	7439-96-5	E469S	0.00010	mg/L		0.0126	0.0170	0.00942	0.00138	0.00237
mercury, dissolved	7439-97-6	E509S	0.0000050	mg/L		<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
molybdenum, dissolved	7439-98-7	E469S	0.00010	mg/L		0.00365	0.00323	0.00404	0.00831	0.00758
nickel, dissolved	7440-02-0	E469S	0.00050	mg/L		<0.00050	0.00053	<0.00050	<0.00050	<0.00050
phosphorus, dissolved	7723-14-0	E469S	0.050	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050
potassium, dissolved	7440-09-7	E469S	1.0	mg/L		119	97.0	138	329	296
rhenium, dissolved	7440-15-5	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
rubidium, dissolved	7440-17-7	E469S	0.0050	mg/L		0.0350	0.0291	0.0400	0.0960	0.0835
selenium, dissolved	7782-49-2	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
silicon, dissolved	7440-21-3	E469S.NaSi	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	<1.0
silver, dissolved	7440-22-4	E469S	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

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Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ1-1-EBB	WQ1-1-Flow	WQ1-1-EBB2	WQ1-10-Flow	WQ1-10-EBB
					Client sampling date / time	07-Jun-2021 14:30	07-Jun-2021 10:59	07-Jun-2021 14:30	07-Jun-2021 10:30	07-Jun-2021 14:44
						VA21B1579-001	VA21B1579-002	VA21B1579-003	VA21B1579-004	VA21B1579-005
						Result	Result	Result	Result	Result
Dissolved Metals										
sodium, dissolved	17341-25-2	E469S.NaSi	2.5	mg/L		3210	2850	3720	8260	7320
strontium, dissolved	7440-24-6	E469S	0.010	mg/L		2.31	1.99	2.58	5.78	5.17
sulfur, dissolved	7704-34-9	E469S	5.0	mg/L		283	239	329	852	741
tellurium, dissolved	13494-80-9	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
thallium, dissolved	7440-28-0	E469S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
thorium, dissolved	7440-29-1	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
tin, dissolved	7440-31-5	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
titanium, dissolved	7440-32-6	E469S	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
tungsten, dissolved	7440-33-7	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
uranium, dissolved	7440-61-1	E469S	0.000050	mg/L		0.000966	0.000869	0.00111	0.00237	0.00202
vanadium, dissolved	7440-62-2	E469S	0.00050	mg/L		<0.00050	<0.00050	0.00052	0.00128	0.00113
yttrium, dissolved	7440-65-5	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
zinc, dissolved	7440-66-6	E469S	0.0010	mg/L		<0.0010	0.0014	<0.0010	<0.0010	<0.0010
zirconium, dissolved	7440-67-7	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
dissolved mercury filtration location	----	EP509	-	-		Laboratory	Laboratory	Laboratory	Laboratory	Laboratory
dissolved metals filtration location	----	EP421	-	-		Laboratory	Laboratory	Laboratory	Laboratory	Laboratory
Volatile Organic Compounds [Fuels]										
benzene	71-43-2	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
ethylbenzene	100-41-4	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
styrene	100-42-5	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
toluene	108-88-3	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
xylene, m+p-	179601-23-1	E611A	0.40	µg/L		<0.40	<0.40	<0.40	<0.40	<0.40
xylene, o-	95-47-6	E611A	0.30	µg/L		<0.30	<0.30	<0.30	<0.30	<0.30
xylenes, total	1330-20-7	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
Hydrocarbons										
F1 (C6-C10)	----	E581.VH+F1	100	µg/L		<100	<100	<100	<100	<100
F1-BTEX	----	EC580	100	µg/L		<100	<100	<100	<100	<100
F2 (C10-C16)	----	E601	100	µg/L		<100	<100	<100	<100	<100
F2-naphthalene	----	EC600	100	µg/L		<100	<100	<100	<100	<100
F3 (C16-C34)	----	E601	250	µg/L		<250	<250	<250	<250	<250

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Client : Stantec Consulting Ltd.
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Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ1-1-EBB	WQ1-1-Flow	WQ1-1-EBB2	WQ1-10-Flow	WQ1-10-EBB
					Client sampling date / time	07-Jun-2021 14:30	07-Jun-2021 10:59	07-Jun-2021 14:30	07-Jun-2021 10:30	07-Jun-2021 14:44
						VA21B1579-001	VA21B1579-002	VA21B1579-003	VA21B1579-004	VA21B1579-005
						Result	Result	Result	Result	Result
Hydrocarbons										
F3-PAH	----	EC600	250	µg/L		<250	<250	<250	<250	<250
F4 (C34-C50)	----	E601	250	µg/L		<250	<250	<250	<250	<250
Hydrocarbons Surrogates										
dichlorotoluene, 3,4-	97-75-0	E581.VH+F1	1.0	%		82.4	85.8	91.6	89.3	86.2
Polycyclic Aromatic Hydrocarbons										
acenaphthene	83-32-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
acenaphthylene	208-96-8	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
acridine	260-94-6	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
anthracene	120-12-7	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benz(a)anthracene	56-55-3	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(a)pyrene	50-32-8	E641A	0.0050	µg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
benzo(b+j)fluoranthene	----	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(b+j+k)fluoranthene	----	E641A	0.015	µg/L		<0.015	<0.015	<0.015	<0.015	<0.015
benzo(g,h,i)perylene	191-24-2	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(k)fluoranthene	207-08-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
chrysene	218-01-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
dibenz(a,h)anthracene	53-70-3	E641A	0.0050	µg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
fluoranthene	206-44-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
fluorene	86-73-7	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 1-	90-12-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 2-	91-57-6	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalenes, 1+2-	----	E641A	0.015	µg/L		<0.015	<0.015	<0.015	<0.015	<0.015
naphthalene	91-20-3	E641A	0.050	µg/L		<0.050	<0.050	<0.050	<0.050	<0.050
phenanthrene	85-01-8	E641A	0.020	µg/L		<0.020	<0.020	<0.020	<0.020	<0.020
pyrene	129-00-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
quinoline	6027-02-7	E641A	0.050	µg/L		<0.050	<0.050	<0.050	<0.050	<0.050
B(a)P total potency equivalents [B(a)P TPE]	----	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010

Please refer to the General Comments section for an explanation of any qualifiers detected.

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Work Order : VA21B1579
Client : Stantec Consulting Ltd.
Project : ----

Analytical Results

Sub-Matrix: **Seawater**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ3-1-EBB	WQ3-1-Flow	WQ3-15-EBB	WQ3-6-Flow	WQ5-1-EBB
					Client sampling date / time	07-Jun-2021 14:08	07-Jun-2021 11:08	07-Jun-2021 14:17	07-Jun-2021 11:08	07-Jun-2021 13:52
						VA21B1579-006	VA21B1579-007	VA21B1579-008	VA21B1579-009	VA21B1579-010
						Result	Result	Result	Result	Result
Physical Tests										
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		2080	1770	4920	4210	2280
pH	----	E108	0.10	pH units		7.98	7.88	7.93	7.94	7.98
solids, total dissolved [TDS]	----	E162S	10	mg/L		13500	12000	33600	26200	14900
solids, total suspended [TSS]	----	E160S	2.0	mg/L		5.0	13.3	5.0	2.2	3.1
turbidity	----	E121	0.10	NTU		6.20	16.3	1.96	2.82	3.55
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.60	mg/L		2010	1760	5030	3970	2160
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		<0.0050	0.0079	0.0304	0.0379	<0.0050
bromide	24959-67-9	E235S.Br	5.0	mg/L		23.1	21.4	56.3	45.8	25.0
chloride	16887-00-6	E235S.Cl	50	mg/L		6880	6340	16400	13500	7600
fluoride	16984-48-8	E235S.F	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	<1.0
nitrate (as N)	14797-55-8	E235S.NO3	0.50	mg/L		<0.50	<0.50	<0.50	<0.50	<0.50
nitrite (as N)	14797-65-0	E235S.NO2	0.10	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L		0.0106	0.0176	0.0418	0.0390	0.0134
sulfate (as SO4)	14808-79-8	E235S.SO4	30	mg/L		970	888	2340	1920	1070
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		1.85	2.16	1.42	1.53	2.06
carbon, total organic [TOC]	----	E355-L	0.50	mg/L		2.44	2.15	0.99	1.16	2.13
Total Metals										
aluminum, total	7429-90-5	E468S	0.0050	mg/L		0.203	0.637	0.0925	0.137	0.140
antimony, total	7440-36-0	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
arsenic, total	7440-38-2	E468S	0.00040	mg/L		0.00080	0.00108	0.00166	0.00142	0.00088
barium, total	7440-39-3	E468S	0.0010	mg/L		0.0203	0.0309	0.0094	0.0117	0.0158
beryllium, total	7440-41-7	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
bismuth, total	7440-69-9	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
boron, total	7440-42-8	E468S	0.30	mg/L		1.63	1.41	3.83	3.13	1.79
cadmium, total	7440-43-9	E468S	0.000010	mg/L		0.000041	0.000049	0.000066	0.000069	0.000039
calcium, total	7440-70-2	E468S	1.0	mg/L		147	128	348	285	160
cesium, total	7440-46-2	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
chromium, total	7440-47-3	E468S	0.00050	mg/L		<0.00050	0.00165	<0.00050	<0.00050	<0.00050
cobalt, total	7440-48-4	E468S	0.000050	mg/L		0.000195	0.000518	0.000079	0.000106	0.000110

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Client : Stantec Consulting Ltd.
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Analytical Results

Sub-Matrix: **Seawater**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ3-1-EBB	WQ3-1-Flow	WQ3-15-EBB	WQ3-6-Flow	WQ5-1-EBB
					Client sampling date / time	07-Jun-2021 14:08	07-Jun-2021 11:08	07-Jun-2021 14:17	07-Jun-2021 11:08	07-Jun-2021 13:52
						VA21B1579-006	VA21B1579-007	VA21B1579-008	VA21B1579-009	VA21B1579-010
						Result	Result	Result	Result	Result
Total Metals										
copper, total	7440-50-8	E468S	0.00050	mg/L		0.00079	0.00186	<0.00050	0.00053	0.00057
gallium, total	7440-55-3	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
iron, total	7439-89-6	E468S	0.010	mg/L		0.269	0.995	0.117	0.182	0.167
lead, total	7439-92-1	E468S	0.000050	mg/L		0.000105	0.000282	0.000061	0.000075	0.000053
lithium, total	7439-93-2	E468S	0.020	mg/L		0.055	0.049	0.140	0.115	0.060
magnesium, total	7439-95-4	E468S	1.0	mg/L		399	349	1010	792	427
manganese, total	7439-96-5	E468S	0.00020	mg/L		0.0159	0.0376	0.00570	0.00853	0.0104
mercury, total	7439-97-6	E508S	0.0000050	mg/L		<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
molybdenum, total	7439-98-7	E468S	0.00010	mg/L		0.00391	0.00358	0.00887	0.00747	0.00426
nickel, total	7440-02-0	E468S	0.00050	mg/L		0.00056	0.00225	<0.00050	<0.00050	<0.00050
phosphorus, total	7723-14-0	E468S	0.050	mg/L		<0.050	0.052	0.089	<0.050	<0.050
potassium, total	7440-09-7	E468S	1.0	mg/L		130	113	338	263	141
rhenium, total	7440-15-5	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
rubidium, total	7440-17-7	E468S	0.0050	mg/L		0.0378	0.0330	0.0960	0.0765	0.0422
selenium, total	7782-49-2	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
silicon, total	7440-21-3	E468S.NaSi	1.0	mg/L		<1.0	1.8	1.0	1.2	<1.0
silver, total	7440-22-4	E468S	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
sodium, total	17341-25-2	E468S.NaSi	2.5	mg/L		3970	3560	9840	7860	4440
strontium, total	7440-24-6	E468S	0.010	mg/L		2.62	2.25	6.22	5.10	2.78
sulfur, total	7704-34-9	E468S	5.0	mg/L		334	289	908	716	368
tellurium, total	13494-80-9	E468S	0.00050	mg/L		<0.00050	<0.00050	0.00117	0.00093	<0.00050
thallium, total	7440-28-0	E468S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
thorium, total	7440-29-1	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
tin, total	7440-31-5	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
titanium, total	7440-32-6	E468S	0.0050	mg/L		<0.0050	0.0127	<0.0050	<0.0050	<0.0050
tungsten, total	7440-33-7	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
uranium, total	7440-61-1	E468S	0.000050	mg/L		0.00104	0.000887	0.00225	0.00198	0.00115
vanadium, total	7440-62-2	E468S	0.00050	mg/L		0.00141	0.00249	0.00194	0.00184	0.00132
yttrium, total	7440-65-5	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
zinc, total	7440-66-6	E468S	0.0030	mg/L		<0.0030	0.0035	<0.0030	<0.0030	<0.0030
zirconium, total	7440-67-7	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050

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Client : Stantec Consulting Ltd.
Project : ----

Analytical Results

Sub-Matrix: **Seawater**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ3-1-EBB	WQ3-1-Flow	WQ3-15-EBB	WQ3-6-Flow	WQ5-1-EBB
					Client sampling date / time	07-Jun-2021 14:08	07-Jun-2021 11:08	07-Jun-2021 14:17	07-Jun-2021 11:08	07-Jun-2021 13:52
						VA21B1579-006	VA21B1579-007	VA21B1579-008	VA21B1579-009	VA21B1579-010
						Result	Result	Result	Result	Result
Dissolved Metals										
aluminum, dissolved	7429-90-5	E469S	0.0050	mg/L		0.0249	0.0226	0.0096	0.0176	0.0264
antimony, dissolved	7440-36-0	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
arsenic, dissolved	7440-38-2	E469S	0.00040	mg/L		0.00064	0.00055	0.00137	0.00125	0.00074
barium, dissolved	7440-39-3	E469S	0.0010	mg/L		0.0199	0.0268	0.0088	0.0114	0.0158
beryllium, dissolved	7440-41-7	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
bismuth, dissolved	7440-69-9	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
boron, dissolved	7440-42-8	E469S	0.30	mg/L		1.57	1.37	3.35	3.01	1.72
cadmium, dissolved	7440-43-9	E469S	0.000010	mg/L		0.000035	0.000039	0.000072	0.000048	0.000036
calcium, dissolved	7440-70-2	E469S	1.0	mg/L		139	123	322	280	156
cesium, dissolved	7440-46-2	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
chromium, dissolved	7440-47-3	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
cobalt, dissolved	7440-48-4	E469S	0.000050	mg/L		0.000061	0.000092	<0.000050	<0.000050	<0.000050
copper, dissolved	7440-50-8	E469S	0.00020	mg/L		0.00040	0.00057	0.00022	0.00029	0.00031
gallium, dissolved	7440-55-3	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
iron, dissolved	7439-89-6	E469S	0.010	mg/L		<0.010	<0.010	<0.010	<0.010	<0.010
lead, dissolved	7439-92-1	E469S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
lithium, dissolved	7439-93-2	E469S	0.020	mg/L		0.056	0.047	0.126	0.112	0.060
magnesium, dissolved	7439-95-4	E469S	1.0	mg/L		421	356	1000	852	458
manganese, dissolved	7439-96-5	E469S	0.00010	mg/L		0.00909	0.0144	0.00118	0.00330	0.00610
mercury, dissolved	7439-97-6	E509S	0.0000050	mg/L		<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
molybdenum, dissolved	7439-98-7	E469S	0.00010	mg/L		0.00387	0.00347	0.00858	0.00762	0.00440
nickel, dissolved	7440-02-0	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
phosphorus, dissolved	7723-14-0	E469S	0.050	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050
potassium, dissolved	7440-09-7	E469S	1.0	mg/L		134	112	339	283	145
rhenium, dissolved	7440-15-5	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
rubidium, dissolved	7440-17-7	E469S	0.0050	mg/L		0.0382	0.0328	0.0936	0.0783	0.0411
selenium, dissolved	7782-49-2	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
silicon, dissolved	7440-21-3	E469S.NaSi	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	<1.0
silver, dissolved	7440-22-4	E469S	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
sodium, dissolved	17341-25-2	E469S.NaSi	2.5	mg/L		3500	3100	8660	6950	3780
strontium, dissolved	7440-24-6	E469S	0.010	mg/L		2.54	2.18	5.95	5.24	2.88

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Analytical Results

Sub-Matrix: **Seawater**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ3-1-EBB	WQ3-1-Flow	WQ3-15-EBB	WQ3-6-Flow	WQ5-1-EBB
					Client sampling date / time	07-Jun-2021 14:08	07-Jun-2021 11:08	07-Jun-2021 14:17	07-Jun-2021 11:08	07-Jun-2021 13:52
						VA21B1579-006	VA21B1579-007	VA21B1579-008	VA21B1579-009	VA21B1579-010
						Result	Result	Result	Result	Result
Dissolved Metals										
sulfur, dissolved	7704-34-9	E469S	5.0	mg/L		324	276	826	708	367
tellurium, dissolved	13494-80-9	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
thallium, dissolved	7440-28-0	E469S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
thorium, dissolved	7440-29-1	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
tin, dissolved	7440-31-5	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
titanium, dissolved	7440-32-6	E469S	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
tungsten, dissolved	7440-33-7	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
uranium, dissolved	7440-61-1	E469S	0.000050	mg/L		0.00104	0.000899	0.00220	0.00198	0.00110
vanadium, dissolved	7440-62-2	E469S	0.00050	mg/L		<0.00050	<0.00050	0.00125	0.00100	0.00078
yttrium, dissolved	7440-65-5	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
zinc, dissolved	7440-66-6	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
zirconium, dissolved	7440-67-7	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
dissolved mercury filtration location	----	EP509	-	-		Laboratory	Laboratory	Laboratory	Laboratory	Laboratory
dissolved metals filtration location	----	EP421	-	-		Laboratory	Laboratory	Laboratory	Laboratory	Laboratory
Volatile Organic Compounds [Fuels]										
benzene	71-43-2	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
ethylbenzene	100-41-4	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
styrene	100-42-5	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
toluene	108-88-3	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
xylene, m+p-	179601-23-1	E611A	0.40	µg/L		<0.40	<0.40	<0.40	<0.40	<0.40
xylene, o-	95-47-6	E611A	0.30	µg/L		<0.30	<0.30	<0.30	<0.30	<0.30
xylenes, total	1330-20-7	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
Hydrocarbons										
F1 (C6-C10)	----	E581.VH+F1	100	µg/L		<100	<100	<100	<100	<100
F1-BTEX	----	EC580	100	µg/L		<100	<100	<100	<100	<100
F2 (C10-C16)	----	E601	100	µg/L		<100	<100	<100	<100	<100
F2-naphthalene	----	EC600	100	µg/L		<100	<100	<100	<100	<100
F3 (C16-C34)	----	E601	250	µg/L		<250	<250	<250	<250	<250
F3-PAH	----	EC600	250	µg/L		<250	<250	<250	<250	<250
F4 (C34-C50)	----	E601	250	µg/L		<250	<250	<250	<250	<250

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Work Order : VA21B1579
Client : Stantec Consulting Ltd.
Project : ----

Analytical Results

Sub-Matrix: **Seawater**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ3-1-EBB	WQ3-1-Flow	WQ3-15-EBB	WQ3-6-Flow	WQ5-1-EBB
					Client sampling date / time	07-Jun-2021 14:08	07-Jun-2021 11:08	07-Jun-2021 14:17	07-Jun-2021 11:08	07-Jun-2021 13:52
						VA21B1579-006	VA21B1579-007	VA21B1579-008	VA21B1579-009	VA21B1579-010
						Result	Result	Result	Result	Result
Hydrocarbons Surrogates										
dichlorotoluene, 3,4-	97-75-0	E581.VH+F1	1.0	%		83.8	89.2	85.4	85.7	94.1
Polycyclic Aromatic Hydrocarbons										
acenaphthene	83-32-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
acenaphthylene	208-96-8	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
acridine	260-94-6	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
anthracene	120-12-7	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benz(a)anthracene	56-55-3	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(a)pyrene	50-32-8	E641A	0.0050	µg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
benzo(b+j)fluoranthene	----	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(b+j+k)fluoranthene	----	E641A	0.015	µg/L		<0.015	<0.015	<0.015	<0.015	<0.015
benzo(g,h,i)perylene	191-24-2	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(k)fluoranthene	207-08-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
chrysene	218-01-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
dibenz(a,h)anthracene	53-70-3	E641A	0.0050	µg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
fluoranthene	206-44-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
fluorene	86-73-7	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 1-	90-12-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 2-	91-57-6	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalenes, 1+2-	----	E641A	0.015	µg/L		<0.015	<0.015	<0.015	<0.015	<0.015
naphthalene	91-20-3	E641A	0.050	µg/L		<0.050	<0.050	<0.050	<0.050	<0.050
phenanthrene	85-01-8	E641A	0.020	µg/L		<0.020	<0.020	<0.020	<0.020	<0.020
pyrene	129-00-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
quinoline	6027-02-7	E641A	0.050	µg/L		<0.050	<0.050	<0.050	<0.050	<0.050
B(a)P total potency equivalents [B(a)P TPE]	----	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010

Please refer to the General Comments section for an explanation of any qualifiers detected.

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Work Order : VA21B1579
Client : Stantec Consulting Ltd.
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Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ5-1-Flow	WQ5-27-Flow	WQ5-10-EBB	WQ6-1-EBB	WQ6-1-Flow
					Client sampling date / time	07-Jun-2021 11:25	07-Jun-2021 11:43	07-Jun-2021 16:00	07-Jun-2021 16:15	07-Jun-2021 12:00
						VA21B1579-011	VA21B1579-012	VA21B1579-013	VA21B1579-014	VA21B1579-015
						Result	Result	Result	Result	Result
Physical Tests										
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		2660	5390	4650	1970	2170
pH	----	E108	0.10	pH units		7.94	7.92	7.95	7.99	7.94
solids, total dissolved [TDS]	----	E162S	10	mg/L		17100	34400	29500	13200	13800
solids, total suspended [TSS]	----	E160S	2.0	mg/L		4.9	<2.0	<2.0	4.5	3.9
turbidity	----	E121	0.10	NTU		4.82	1.22	1.63	5.19	3.42
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.60	mg/L		2620	5210	4480	2030	2140
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		0.0150	0.0135	0.0364	<0.0050	<0.0050
bromide	24959-67-9	E235S.Br	5.0	mg/L		30.3	60.3	50.4	22.3	23.2
chloride	16887-00-6	E235S.Cl	50	mg/L		9120	17700	15000	6830	7090
fluoride	16984-48-8	E235S.F	1.0	mg/L		<1.0	1.0	<1.0	<1.0	<1.0
nitrate (as N)	14797-55-8	E235S.NO3	0.50	mg/L		<0.50	<0.50	<0.50	<0.50	<0.50
nitrite (as N)	14797-65-0	E235S.NO2	0.10	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L		0.0167	0.0531	0.0333	0.0104	0.0186
sulfate (as SO4)	14808-79-8	E235S.SO4	30	mg/L		1300	2530	2130	969	1010
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		1.65	1.21	1.28	2.10	1.94
carbon, total organic [TOC]	----	E355-L	0.50	mg/L		1.78	0.85	1.05	2.09	2.21
Total Metals										
aluminum, total	7429-90-5	E468S	0.0050	mg/L		0.194	0.0502	0.0691	0.184	0.146
antimony, total	7440-36-0	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
arsenic, total	7440-38-2	E468S	0.00040	mg/L		0.00104	0.00172	0.00158	0.00089	0.00085
barium, total	7440-39-3	E468S	0.0010	mg/L		0.0172	0.0082	0.0098	0.0215	0.0184
beryllium, total	7440-41-7	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
bismuth, total	7440-69-9	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
boron, total	7440-42-8	E468S	0.30	mg/L		2.15	4.05	3.50	1.75	1.80
cadmium, total	7440-43-9	E468S	0.000010	mg/L		0.000051	0.000066	0.000043	0.000035	0.000038
calcium, total	7440-70-2	E468S	1.0	mg/L		194	372	323	152	158
cesium, total	7440-46-2	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
chromium, total	7440-47-3	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
cobalt, total	7440-48-4	E468S	0.000050	mg/L		0.000172	<0.000050	0.000080	0.000166	0.000115

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Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ5-1-Flow	WQ5-27-Flow	WQ5-10-EBB	WQ6-1-EBB	WQ6-1-Flow
					Client sampling date / time	07-Jun-2021 11:25	07-Jun-2021 11:43	07-Jun-2021 16:00	07-Jun-2021 16:15	07-Jun-2021 12:00
						VA21B1579-011	VA21B1579-012	VA21B1579-013	VA21B1579-014	VA21B1579-015
						Result	Result	Result	Result	Result
Total Metals										
copper, total	7440-50-8	E468S	0.00050	mg/L		0.00073	<0.00050	<0.00050	0.00082	0.00062
gallium, total	7440-55-3	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
iron, total	7439-89-6	E468S	0.010	mg/L		0.262	0.073	0.091	0.239	0.184
lead, total	7439-92-1	E468S	0.000050	mg/L		0.000107	<0.000050	<0.000050	0.000113	0.000074
lithium, total	7439-93-2	E468S	0.020	mg/L		0.072	0.151	0.129	0.058	0.062
magnesium, total	7439-95-4	E468S	1.0	mg/L		520	1040	891	400	425
manganese, total	7439-96-5	E468S	0.00020	mg/L		0.0135	0.00377	0.00562	0.0157	0.0127
mercury, total	7439-97-6	E508S	0.0000050	mg/L		<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
molybdenum, total	7439-98-7	E468S	0.00010	mg/L		0.00508	0.00938	0.00837	0.00406	0.00424
nickel, total	7440-02-0	E468S	0.00050	mg/L		0.00052	<0.00050	<0.00050	0.00050	<0.00050
phosphorus, total	7723-14-0	E468S	0.050	mg/L		<0.050	0.061	0.065	<0.050	<0.050
potassium, total	7440-09-7	E468S	1.0	mg/L		175	359	315	136	142
rhenium, total	7440-15-5	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
rubidium, total	7440-17-7	E468S	0.0050	mg/L		0.0499	0.102	0.0883	0.0388	0.0414
selenium, total	7782-49-2	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
silicon, total	7440-21-3	E468S.NaSi	1.0	mg/L		<1.0	1.2	1.0	<1.0	<1.0
silver, total	7440-22-4	E468S	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
sodium, total	17341-25-2	E468S.NaSi	2.5	mg/L		5270	10500	9200	4010	4110
strontium, total	7440-24-6	E468S	0.010	mg/L		3.40	6.72	5.90	2.63	2.82
sulfur, total	7704-34-9	E468S	5.0	mg/L		457	1010	854	356	370
tellurium, total	13494-80-9	E468S	0.00050	mg/L		0.00056	0.00138	0.00112	<0.00050	<0.00050
thallium, total	7440-28-0	E468S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
thorium, total	7440-29-1	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
tin, total	7440-31-5	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
titanium, total	7440-32-6	E468S	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
tungsten, total	7440-33-7	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
uranium, total	7440-61-1	E468S	0.000050	mg/L		0.00130	0.00248	0.00215	0.00102	0.00108
vanadium, total	7440-62-2	E468S	0.00050	mg/L		0.00167	0.00217	0.00178	0.00139	0.00129
yttrium, total	7440-65-5	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
zinc, total	7440-66-6	E468S	0.0030	mg/L		<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
zirconium, total	7440-67-7	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050

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Analytical Results

Sub-Matrix: **Seawater**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ5-1-Flow	WQ5-27-Flow	WQ5-10-EBB	WQ6-1-EBB	WQ6-1-Flow
					Client sampling date / time	07-Jun-2021 11:25	07-Jun-2021 11:43	07-Jun-2021 16:00	07-Jun-2021 16:15	07-Jun-2021 12:00
						VA21B1579-011	VA21B1579-012	VA21B1579-013	VA21B1579-014	VA21B1579-015
						Result	Result	Result	Result	Result
Dissolved Metals										
aluminum, dissolved	7429-90-5	E469S	0.0050	mg/L		0.0244	0.0053	0.0101	0.0230	0.0254
antimony, dissolved	7440-36-0	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
arsenic, dissolved	7440-38-2	E469S	0.00040	mg/L		0.00083	0.00149	0.00132	0.00062	0.00066
barium, dissolved	7440-39-3	E469S	0.0010	mg/L		0.0162	0.0083	0.0094	0.0198	0.0182
beryllium, dissolved	7440-41-7	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
bismuth, dissolved	7440-69-9	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
boron, dissolved	7440-42-8	E469S	0.30	mg/L		1.99	3.63	3.22	1.51	1.63
cadmium, dissolved	7440-43-9	E469S	0.000010	mg/L		0.000052	0.000073	0.000054	0.000026	0.000032
calcium, dissolved	7440-70-2	E469S	1.0	mg/L		185	361	312	141	148
cesium, dissolved	7440-46-2	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
chromium, dissolved	7440-47-3	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
cobalt, dissolved	7440-48-4	E469S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	0.000067	<0.000050
copper, dissolved	7440-50-8	E469S	0.00020	mg/L		0.00036	<0.00020	0.00025	0.00039	0.00035
gallium, dissolved	7440-55-3	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
iron, dissolved	7439-89-6	E469S	0.010	mg/L		<0.010	<0.010	<0.010	<0.010	<0.010
lead, dissolved	7439-92-1	E469S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
lithium, dissolved	7439-93-2	E469S	0.020	mg/L		0.077	0.140	0.123	0.059	0.059
magnesium, dissolved	7439-95-4	E469S	1.0	mg/L		533	1090	940	394	437
manganese, dissolved	7439-96-5	E469S	0.00010	mg/L		0.00677	0.00060	0.00174	0.00907	0.00732
mercury, dissolved	7439-97-6	E509S	0.0000050	mg/L		<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
molybdenum, dissolved	7439-98-7	E469S	0.00010	mg/L		0.00497	0.00948	0.00824	0.00400	0.00423
nickel, dissolved	7440-02-0	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
phosphorus, dissolved	7723-14-0	E469S	0.050	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050
potassium, dissolved	7440-09-7	E469S	1.0	mg/L		179	373	321	134	145
rhenium, dissolved	7440-15-5	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
rubidium, dissolved	7440-17-7	E469S	0.0050	mg/L		0.0500	0.105	0.0893	0.0384	0.0412
selenium, dissolved	7782-49-2	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
silicon, dissolved	7440-21-3	E469S.NaSi	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	<1.0
silver, dissolved	7440-22-4	E469S	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
sodium, dissolved	17341-25-2	E469S.NaSi	2.5	mg/L		4590	9130	8160	3430	3600
strontium, dissolved	7440-24-6	E469S	0.010	mg/L		3.27	6.58	5.70	2.56	2.78

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Analytical Results

Sub-Matrix: **Seawater**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ5-1-Flow	WQ5-27-Flow	WQ5-10-EBB	WQ6-1-EBB	WQ6-1-Flow
					Client sampling date / time	07-Jun-2021 11:25	07-Jun-2021 11:43	07-Jun-2021 16:00	07-Jun-2021 16:15	07-Jun-2021 12:00
						VA21B1579-011	VA21B1579-012	VA21B1579-013	VA21B1579-014	VA21B1579-015
						Result	Result	Result	Result	Result
Dissolved Metals										
sulfur, dissolved	7704-34-9	E469S	5.0	mg/L		443	917	786	324	355
tellurium, dissolved	13494-80-9	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
thallium, dissolved	7440-28-0	E469S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
thorium, dissolved	7440-29-1	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
tin, dissolved	7440-31-5	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
titanium, dissolved	7440-32-6	E469S	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
tungsten, dissolved	7440-33-7	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
uranium, dissolved	7440-61-1	E469S	0.000050	mg/L		0.00134	0.00241	0.00211	0.00101	0.00108
vanadium, dissolved	7440-62-2	E469S	0.00050	mg/L		0.00068	0.00152	0.00120	<0.00050	0.00056
yttrium, dissolved	7440-65-5	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
zinc, dissolved	7440-66-6	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
zirconium, dissolved	7440-67-7	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
dissolved mercury filtration location	----	EP509	-	-		Laboratory	Laboratory	Laboratory	Laboratory	Laboratory
dissolved metals filtration location	----	EP421	-	-		Laboratory	Laboratory	Laboratory	Laboratory	Laboratory
Volatile Organic Compounds [Fuels]										
benzene	71-43-2	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
ethylbenzene	100-41-4	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
styrene	100-42-5	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
toluene	108-88-3	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
xylene, m+p-	179601-23-1	E611A	0.40	µg/L		<0.40	<0.40	<0.40	<0.40	<0.40
xylene, o-	95-47-6	E611A	0.30	µg/L		<0.30	<0.30	<0.30	<0.30	<0.30
xylenes, total	1330-20-7	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
Hydrocarbons										
F1 (C6-C10)	----	E581.VH+F1	100	µg/L		<100	<100	<100	<100	<100 HTDC
F1-BTEX	----	EC580	100	µg/L		<100	<100	<100	<100	<100
F2 (C10-C16)	----	E601	100	µg/L		<100	<100	<100	<100	<100
F2-naphthalene	----	EC600	100	µg/L		<100	<100	<100	<100	<100
F3 (C16-C34)	----	E601	250	µg/L		<250	<250	<250	<250	<250
F3-PAH	----	EC600	250	µg/L		<250	<250	<250	<250	<250
F4 (C34-C50)	----	E601	250	µg/L		<250	<250	<250	<250	<250

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Client : Stantec Consulting Ltd.
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Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ5-1-Flow	WQ5-27-Flow	WQ5-10-EBB	WQ6-1-EBB	WQ6-1-Flow
					Client sampling date / time	07-Jun-2021 11:25	07-Jun-2021 11:43	07-Jun-2021 16:00	07-Jun-2021 16:15	07-Jun-2021 12:00
						VA21B1579-011	VA21B1579-012	VA21B1579-013	VA21B1579-014	VA21B1579-015
						Result	Result	Result	Result	Result
Hydrocarbons Surrogates										
dichlorotoluene, 3,4-	97-75-0	E581.VH+F1	1.0	%		86.8	82.9	91.3	88.1	101
Polycyclic Aromatic Hydrocarbons										
acenaphthene	83-32-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
acenaphthylene	208-96-8	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
acridine	260-94-6	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
anthracene	120-12-7	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benz(a)anthracene	56-55-3	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(a)pyrene	50-32-8	E641A	0.0050	µg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
benzo(b+j)fluoranthene	----	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(b+j+k)fluoranthene	----	E641A	0.015	µg/L		<0.015	<0.015	<0.015	<0.015	<0.015
benzo(g,h,i)perylene	191-24-2	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(k)fluoranthene	207-08-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
chrysene	218-01-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
dibenz(a,h)anthracene	53-70-3	E641A	0.0050	µg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
fluoranthene	206-44-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
fluorene	86-73-7	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 1-	90-12-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 2-	91-57-6	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalenes, 1+2-	----	E641A	0.015	µg/L		<0.015	<0.015	<0.015	<0.015	<0.015
naphthalene	91-20-3	E641A	0.050	µg/L		<0.050	<0.050	<0.050	<0.050	<0.050
phenanthrene	85-01-8	E641A	0.020	µg/L		<0.020	<0.020	<0.020	<0.020	<0.020
pyrene	129-00-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
quinoline	6027-02-7	E641A	0.050	µg/L		<0.050	<0.050	<0.050	<0.050	<0.050
B(a)P total potency equivalents [B(a)P TPE]	----	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010

Please refer to the General Comments section for an explanation of any qualifiers detected.

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Work Order : VA21B1579
Client : Stantec Consulting Ltd.
Project : ----

Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ6-12-Flow	WQ6-12-EBB	Field Blank	Equipment Blank	----
					Client sampling date / time	07-Jun-2021 12:18	07-Jun-2021 16:26	07-Jun-2021 14:17	07-Jun-2021 09:30	----
						VA21B1579-016	VA21B1579-017	VA21B1579-018	VA21B1579-019	--------
						Result	Result	Result	Result	----
Physical Tests										
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		4600	4190	2240	----	----
pH	----	E108	0.10	pH units		7.94	7.93	7.94	----	----
solids, total dissolved [TDS]	----	E162S	10	mg/L		28500	25600	14700	----	----
solids, total suspended [TSS]	----	E160S	2.0	mg/L		3.2	4.4	4.3	----	----
turbidity	----	E121	0.10	NTU		1.06	0.38	5.21 RRV	----	----
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.60	mg/L		4410	3930	2280	----	----
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		0.0341	0.0317	<0.0050	----	----
bromide	24959-67-9	E235S.Br	5.0	mg/L		49.5	40.3	23.9 RRV	----	----
chloride	16887-00-6	E235S.Cl	50	mg/L		14700	12100	7060 RRV	----	----
fluoride	16984-48-8	E235S.F	1.0	mg/L		<1.0	<1.0	<1.0 RRV	----	----
nitrate (as N)	14797-55-8	E235S.NO3	0.50	mg/L		<0.50	<0.50	<0.50 RRV	----	----
nitrite (as N)	14797-65-0	E235S.NO2	0.10	mg/L		<0.10	<0.10	<0.10 RRV	----	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L		0.0426	0.0309	0.0180 RRV	----	----
sulfate (as SO4)	14808-79-8	E235S.SO4	30	mg/L		2080	1710	961 RRV	----	----
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		1.37	1.23	2.00 RRV	1.79 RRV	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L		1.10	1.44	2.47	----	----
Total Metals										
aluminum, total	7429-90-5	E468S	0.0050	mg/L		0.0449	0.0360	0.158	----	----
antimony, total	7440-36-0	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	----	----
arsenic, total	7440-38-2	E468S	0.00040	mg/L		0.00154	0.00143	0.00091	----	----
barium, total	7440-39-3	E468S	0.0010	mg/L		0.0096	0.0096	0.0187	----	----
beryllium, total	7440-41-7	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
bismuth, total	7440-69-9	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
boron, total	7440-42-8	E468S	0.30	mg/L		3.53	3.14	1.71	----	----
cadmium, total	7440-43-9	E468S	0.000010	mg/L		0.000054	0.000057	0.000043	----	----
calcium, total	7440-70-2	E468S	1.0	mg/L		322	282	151	----	----
cesium, total	7440-46-2	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
chromium, total	7440-47-3	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
cobalt, total	7440-48-4	E468S	0.000050	mg/L		0.000054	<0.000050	0.000145	----	----

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Work Order : VA21B1579
Client : Stantec Consulting Ltd.
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Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ6-12-Flow	WQ6-12-EBB	Field Blank	Equipment Blank	----
					Client sampling date / time	07-Jun-2021 12:18	07-Jun-2021 16:26	07-Jun-2021 14:17	07-Jun-2021 09:30	----
						VA21B1579-016	VA21B1579-017	VA21B1579-018	VA21B1579-019	--------
						Result	Result	Result	Result	----
Total Metals										
copper, total	7440-50-8	E468S	0.00050	mg/L		<0.00050	<0.00050	0.00065	----	----
gallium, total	7440-55-3	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
iron, total	7439-89-6	E468S	0.010	mg/L		0.053	0.036	0.197	----	----
lead, total	7439-92-1	E468S	0.000050	mg/L		<0.000050	<0.000050	0.000076	----	----
lithium, total	7439-93-2	E468S	0.020	mg/L		0.130	0.116	0.059	----	----
magnesium, total	7439-95-4	E468S	1.0	mg/L		876	783	463	----	----
manganese, total	7439-96-5	E468S	0.00020	mg/L		0.00434	0.00357	0.0130	----	----
mercury, total	7439-97-6	E508S	0.0000050	mg/L		<0.0000050	<0.0000050	<0.0000050	----	----
molybdenum, total	7439-98-7	E468S	0.00010	mg/L		0.00841	0.00740	0.00424	----	----
nickel, total	7440-02-0	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
phosphorus, total	7723-14-0	E468S	0.050	mg/L		0.085	<0.050	<0.050	----	----
potassium, total	7440-09-7	E468S	1.0	mg/L		308	276	143	----	----
rhenium, total	7440-15-5	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
rubidium, total	7440-17-7	E468S	0.0050	mg/L		0.0876	0.0772	0.0412	----	----
selenium, total	7782-49-2	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
silicon, total	7440-21-3	E468S.NaSi	1.0	mg/L		1.0	<1.0	<1.0	----	----
silver, total	7440-22-4	E468S	0.00010	mg/L		<0.00010	<0.00010	<0.00010	----	----
sodium, total	17341-25-2	E468S.NaSi	2.5	mg/L		8680	7710	4100 RRV	----	----
strontium, total	7440-24-6	E468S	0.010	mg/L		5.91	5.17	2.78	----	----
sulfur, total	7704-34-9	E468S	5.0	mg/L		838	739	362	----	----
tellurium, total	13494-80-9	E468S	0.00050	mg/L		0.00119	0.00098	<0.00050	----	----
thallium, total	7440-28-0	E468S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	----	----
thorium, total	7440-29-1	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
tin, total	7440-31-5	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	----	----
titanium, total	7440-32-6	E468S	0.0050	mg/L		<0.0050	<0.0050	<0.0050	----	----
tungsten, total	7440-33-7	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	----	----
uranium, total	7440-61-1	E468S	0.000050	mg/L		0.00212	0.00188	0.00108	----	----
vanadium, total	7440-62-2	E468S	0.00050	mg/L		0.00180	0.00171	0.00142	----	----
yttrium, total	7440-65-5	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
zinc, total	7440-66-6	E468S	0.0030	mg/L		<0.0030	<0.0030	<0.0030	----	----
zirconium, total	7440-67-7	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----

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Work Order : VA21B1579
Client : Stantec Consulting Ltd.
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Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ6-12-Flow	WQ6-12-EBB	Field Blank	Equipment Blank	----
					Client sampling date / time	07-Jun-2021 12:18	07-Jun-2021 16:26	07-Jun-2021 14:17	07-Jun-2021 09:30	----
						VA21B1579-016	VA21B1579-017	VA21B1579-018	VA21B1579-019	--------
						Result	Result	Result	Result	----
Dissolved Metals										
aluminum, dissolved	7429-90-5	E469S	0.0050	mg/L		0.0111	0.0145	0.0248 RRV	----	----
antimony, dissolved	7440-36-0	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	----	----
arsenic, dissolved	7440-38-2	E469S	0.00040	mg/L		0.00130	0.00119	0.00073 RRV	----	----
barium, dissolved	7440-39-3	E469S	0.0010	mg/L		0.0096	0.0099	0.0174 RRV	----	----
beryllium, dissolved	7440-41-7	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
bismuth, dissolved	7440-69-9	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
boron, dissolved	7440-42-8	E469S	0.30	mg/L		3.15	2.95	1.61 RRV	----	----
cadmium, dissolved	7440-43-9	E469S	0.000010	mg/L		0.000053	0.000048	0.000037 RRV	----	----
calcium, dissolved	7440-70-2	E469S	1.0	mg/L		309	284	152 RRV	----	----
cesium, dissolved	7440-46-2	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
chromium, dissolved	7440-47-3	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
cobalt, dissolved	7440-48-4	E469S	0.000050	mg/L		<0.000050	<0.000050	0.000052 RRV	----	----
copper, dissolved	7440-50-8	E469S	0.00020	mg/L		<0.00020	<0.00020	0.00036 RRV	----	----
gallium, dissolved	7440-55-3	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
iron, dissolved	7439-89-6	E469S	0.010	mg/L		<0.010	<0.010	<0.010	----	----
lead, dissolved	7439-92-1	E469S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	----	----
lithium, dissolved	7439-93-2	E469S	0.020	mg/L		0.122	0.110	0.058 RRV	----	----
magnesium, dissolved	7439-95-4	E469S	1.0	mg/L		930	845	452 RRV	----	----
manganese, dissolved	7439-96-5	E469S	0.00010	mg/L		0.00167	0.00177	0.00731 RRV	----	----
mercury, dissolved	7439-97-6	E509S	0.0000050	mg/L		<0.0000050	<0.0000050	<0.0000050	----	----
molybdenum, dissolved	7439-98-7	E469S	0.00010	mg/L		0.00796	0.00716	0.00428 RRV	----	----
nickel, dissolved	7440-02-0	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
phosphorus, dissolved	7723-14-0	E469S	0.050	mg/L		0.055	<0.050	<0.050	----	----
potassium, dissolved	7440-09-7	E469S	1.0	mg/L		315	287	140 RRV	----	----
rhenium, dissolved	7440-15-5	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
rubidium, dissolved	7440-17-7	E469S	0.0050	mg/L		0.0878	0.0798	0.0396 RRV	----	----
selenium, dissolved	7782-49-2	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
silicon, dissolved	7440-21-3	E469S.NaSi	1.0	mg/L		<1.0	<1.0	<1.0	----	----
silver, dissolved	7440-22-4	E469S	0.00010	mg/L		<0.00010	<0.00010	<0.00010	----	----
sodium, dissolved	17341-25-2	E469S.NaSi	2.5	mg/L		7660	6890	3820	----	----
strontium, dissolved	7440-24-6	E469S	0.010	mg/L		5.55	5.04	2.79 RRV	----	----

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Work Order : VA21B1579
Client : Stantec Consulting Ltd.
Project : ----

Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ6-12-Flow	WQ6-12-EBB	Field Blank	Equipment Blank	----
					Client sampling date / time	07-Jun-2021 12:18	07-Jun-2021 16:26	07-Jun-2021 14:17	07-Jun-2021 09:30	----
						VA21B1579-016	VA21B1579-017	VA21B1579-018	VA21B1579-019	--------
						Result	Result	Result	Result	----
Dissolved Metals										
sulfur, dissolved	7704-34-9	E469S	5.0	mg/L		779	711	348 RRV	----	----
tellurium, dissolved	13494-80-9	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
thallium, dissolved	7440-28-0	E469S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	----	----
thorium, dissolved	7440-29-1	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
tin, dissolved	7440-31-5	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	----	----
titanium, dissolved	7440-32-6	E469S	0.0050	mg/L		<0.0050	<0.0050	<0.0050	----	----
tungsten, dissolved	7440-33-7	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	----	----
uranium, dissolved	7440-61-1	E469S	0.000050	mg/L		0.00208	0.00186	0.00110 RRV	----	----
vanadium, dissolved	7440-62-2	E469S	0.00050	mg/L		0.00119	0.00117	0.00077 RRV	----	----
yttrium, dissolved	7440-65-5	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
zinc, dissolved	7440-66-6	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	----	----
zirconium, dissolved	7440-67-7	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	----	----
dissolved mercury filtration location	----	EP509	-	-		Laboratory	Laboratory	Laboratory	----	----
dissolved metals filtration location	----	EP421	-	-		Laboratory	Laboratory	Laboratory	----	----
Volatile Organic Compounds [Fuels]										
benzene	71-43-2	E611A	0.50	µg/L		<0.50	<0.50	<0.50	----	----
ethylbenzene	100-41-4	E611A	0.50	µg/L		<0.50	<0.50	<0.50	----	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.50	µg/L		<0.50	<0.50	<0.50	----	----
styrene	100-42-5	E611A	0.50	µg/L		<0.50	<0.50	<0.50	----	----
toluene	108-88-3	E611A	0.50	µg/L		<0.50	<0.50	<0.50	----	----
xylene, m+p-	179601-23-1	E611A	0.40	µg/L		<0.40	<0.40	<0.40	----	----
xylene, o-	95-47-6	E611A	0.30	µg/L		<0.30	<0.30	<0.30	----	----
xylenes, total	1330-20-7	E611A	0.50	µg/L		<0.50	<0.50	<0.50	----	----
Hydrocarbons										
F1 (C6-C10)	----	E581.VH+F1	100	µg/L		<100	<100 HTDC	<100 HTDC	----	----
F1-BTEX	----	EC580	100	µg/L		<100	<100	<100	----	----
F2 (C10-C16)	----	E601	100	µg/L		<100	<100	<100	----	----
F2-naphthalene	----	EC600	100	µg/L		<100	<100	<100	----	----
F3 (C16-C34)	----	E601	250	µg/L		<250	<250	<250	----	----
F3-PAH	----	EC600	250	µg/L		<250	<250	<250	----	----
F4 (C34-C50)	----	E601	250	µg/L		<250	<250	<250	----	----

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Work Order : VA21B1579
Client : Stantec Consulting Ltd.
Project : ----

Analytical Results

Sub-Matrix: **Seawater**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ6-12-Flow	WQ6-12-EBB	Field Blank	Equipment Blank	----
					Client sampling date / time	07-Jun-2021 12:18	07-Jun-2021 16:26	07-Jun-2021 14:17	07-Jun-2021 09:30	----
						VA21B1579-016	VA21B1579-017	VA21B1579-018	VA21B1579-019	--------
						Result	Result	Result	Result	----
Hydrocarbons Surrogates										
dichlorotoluene, 3,4-	97-75-0	E581.VH+F1	1.0	%		78.2	98.5	105	----	----
Polycyclic Aromatic Hydrocarbons										
acenaphthene	83-32-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	----	----
acenaphthylene	208-96-8	E641A	0.010	µg/L		<0.010	<0.010	<0.010	----	----
acridine	260-94-6	E641A	0.010	µg/L		<0.010	<0.010	<0.010	----	----
anthracene	120-12-7	E641A	0.010	µg/L		<0.010	<0.010	<0.010	----	----
benz(a)anthracene	56-55-3	E641A	0.010	µg/L		<0.010	<0.010	<0.010	----	----
benzo(a)pyrene	50-32-8	E641A	0.0050	µg/L		<0.0050	<0.0050	<0.0050	----	----
benzo(b+j)fluoranthene	----	E641A	0.010	µg/L		<0.010	<0.010	<0.010	----	----
benzo(b+j+k)fluoranthene	----	E641A	0.015	µg/L		<0.015	<0.015	<0.015	----	----
benzo(g,h,i)perylene	191-24-2	E641A	0.010	µg/L		<0.010	<0.010	<0.010	----	----
benzo(k)fluoranthene	207-08-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	----	----
chrysene	218-01-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	----	----
dibenz(a,h)anthracene	53-70-3	E641A	0.0050	µg/L		<0.0050	<0.0050	<0.0050	----	----
fluoranthene	206-44-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	----	----
fluorene	86-73-7	E641A	0.010	µg/L		<0.010	<0.010	<0.010	----	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.010	µg/L		<0.010	<0.010	<0.010	----	----
methylnaphthalene, 1-	90-12-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	----	----
methylnaphthalene, 2-	91-57-6	E641A	0.010	µg/L		<0.010	<0.010	<0.010	----	----
methylnaphthalenes, 1+2-	----	E641A	0.015	µg/L		<0.015	<0.015	<0.015	----	----
naphthalene	91-20-3	E641A	0.050	µg/L		<0.050	<0.050	<0.050	----	----
phenanthrene	85-01-8	E641A	0.020	µg/L		<0.020	<0.020	<0.020	----	----
pyrene	129-00-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	----	----
quinoline	6027-02-7	E641A	0.050	µg/L		<0.050	<0.050	<0.050	----	----
B(a)P total potency equivalents [B(a)P TPE]	----	E641A	0.010	µg/L		<0.010	<0.010	<0.010	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Page : 23 of 27
Work Order : VA21B1579
Client : Stantec Consulting Ltd.
Project : ----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	Equipment Blank	----	----	----	----
					Client sampling date / time	07-Jun-2021 09:30	----	----	----	----
					VA21B1579-019	--------	--------	--------	--------
					Result	----	----	----	----
Physical Tests										
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		<1.00	----	----	----	----
pH	----	E108	0.10	pH units		6.33	----	----	----	----
solids, total dissolved [TDS]	----	E162S	10	mg/L		<10	----	----	----	----
solids, total suspended [TSS]	----	E160S	2.0	mg/L		<2.0	----	----	----	----
turbidity	----	E121	0.10	NTU		<0.10	----	----	----	----
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.60	mg/L		<1.00	----	----	----	----
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		<0.0050	----	----	----	----
bromide	24959-67-9	E235S.Br	5.0	mg/L		<5.0	----	----	----	----
chloride	16887-00-6	E235S.Cl	50	mg/L		<50	----	----	----	----
fluoride	16984-48-8	E235S.F	1.0	mg/L		<1.0	----	----	----	----
nitrate (as N)	14797-55-8	E235S.NO3	0.50	mg/L		<0.50	----	----	----	----
nitrite (as N)	14797-65-0	E235S.NO2	0.10	mg/L		<0.10	----	----	----	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L		<0.0020	----	----	----	----
sulfate (as SO4)	14808-79-8	E235S.SO4	30	mg/L		<30	----	----	----	----
Organic / Inorganic Carbon										
carbon, total organic [TOC]	----	E355-L	0.50	mg/L		<0.50	----	----	----	----
Total Metals										
aluminum, total	7429-90-5	E468S	0.0050	mg/L		<0.0050	----	----	----	----
antimony, total	7440-36-0	E468S	0.0010	mg/L		<0.0010	----	----	----	----
arsenic, total	7440-38-2	E468S	0.00040	mg/L		<0.00040	----	----	----	----
barium, total	7440-39-3	E468S	0.0010	mg/L		<0.0010	----	----	----	----
beryllium, total	7440-41-7	E468S	0.00050	mg/L		<0.00050	----	----	----	----
bismuth, total	7440-69-9	E468S	0.00050	mg/L		<0.00050	----	----	----	----
boron, total	7440-42-8	E468S	0.30	mg/L		<0.30	----	----	----	----
cadmium, total	7440-43-9	E468S	0.000010	mg/L		<0.000010	----	----	----	----
calcium, total	7440-70-2	E468S	1.0	mg/L		<1.0	----	----	----	----
cesium, total	7440-46-2	E468S	0.00050	mg/L		<0.00050	----	----	----	----
chromium, total	7440-47-3	E468S	0.00050	mg/L		<0.00050	----	----	----	----
cobalt, total	7440-48-4	E468S	0.000050	mg/L		<0.000050	----	----	----	----
copper, total	7440-50-8	E468S	0.00050	mg/L		<0.00050	----	----	----	----

Page : 24 of 27
Work Order : VA21B1579
Client : Stantec Consulting Ltd.
Project : ----

Analytical Results

Sub-Matrix: **Water** (Matrix: **Water**)					Client sample ID	**Equipment Blank**	----	----	----	----
					Client sampling date / time	07-Jun-2021 09:30	----	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**VA21B1579-019**	--------	--------	--------	--------	
					Result	----	----	----	----	
Total Metals										
gallium, total	7440-55-3	E468S	0.00050	mg/L	<0.00050	----	----	----	----	
iron, total	7439-89-6	E468S	0.010	mg/L	<0.010	----	----	----	----	
lead, total	7439-92-1	E468S	0.000050	mg/L	<0.000050	----	----	----	----	
lithium, total	7439-93-2	E468S	0.020	mg/L	<0.020	----	----	----	----	
magnesium, total	7439-95-4	E468S	1.0	mg/L	<1.0	----	----	----	----	
manganese, total	7439-96-5	E468S	0.00020	mg/L	<0.00020	----	----	----	----	
mercury, total	7439-97-6	E508S	0.0000050	mg/L	<0.0000050	----	----	----	----	
molybdenum, total	7439-98-7	E468S	0.00010	mg/L	<0.00010	----	----	----	----	
nickel, total	7440-02-0	E468S	0.00050	mg/L	<0.00050	----	----	----	----	
phosphorus, total	7723-14-0	E468S	0.050	mg/L	<0.050	----	----	----	----	
potassium, total	7440-09-7	E468S	1.0	mg/L	<1.0	----	----	----	----	
rhenium, total	7440-15-5	E468S	0.00050	mg/L	<0.00050	----	----	----	----	
rubidium, total	7440-17-7	E468S	0.0050	mg/L	<0.0050	----	----	----	----	
selenium, total	7782-49-2	E468S	0.00050	mg/L	<0.00050	----	----	----	----	
silicon, total	7440-21-3	E468S.NaSi	1.0	mg/L	<1.0	----	----	----	----	
silver, total	7440-22-4	E468S	0.00010	mg/L	<0.00010	----	----	----	----	
sodium, total	17341-25-2	E468S.NaSi	2.5	mg/L	<2.5	----	----	----	----	
strontium, total	7440-24-6	E468S	0.010	mg/L	<0.010	----	----	----	----	
sulfur, total	7704-34-9	E468S	5.0	mg/L	<5.0	----	----	----	----	
tellurium, total	13494-80-9	E468S	0.00050	mg/L	<0.00050	----	----	----	----	
thallium, total	7440-28-0	E468S	0.000050	mg/L	<0.000050	----	----	----	----	
thorium, total	7440-29-1	E468S	0.00050	mg/L	<0.00050	----	----	----	----	
tin, total	7440-31-5	E468S	0.0010	mg/L	<0.0010	----	----	----	----	
titanium, total	7440-32-6	E468S	0.0050	mg/L	<0.0050	----	----	----	----	
tungsten, total	7440-33-7	E468S	0.0010	mg/L	<0.0010	----	----	----	----	
uranium, total	7440-61-1	E468S	0.000050	mg/L	<0.000050	----	----	----	----	
vanadium, total	7440-62-2	E468S	0.00050	mg/L	<0.00050	----	----	----	----	
yttrium, total	7440-65-5	E468S	0.00050	mg/L	<0.00050	----	----	----	----	
zinc, total	7440-66-6	E468S	0.0030	mg/L	<0.0030	----	----	----	----	
zirconium, total	7440-67-7	E468S	0.00050	mg/L	<0.00050	----	----	----	----	
Dissolved Metals										

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Work Order : VA21B1579
Client : Stantec Consulting Ltd.
Project : ----

Analytical Results

Sub-Matrix: **Water** (Matrix: **Water**)					Client sample ID	**Equipment Blank**	----	----	----	----
					Client sampling date / time	07-Jun-2021 09:30	----	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**VA21B1579-019**	--------	--------	--------	--------	
					Result	----	----	----	----	
Dissolved Metals										
aluminum, dissolved	7429-90-5	E469S	0.0050	mg/L	<0.0050	----	----	----	----	
antimony, dissolved	7440-36-0	E469S	0.0010	mg/L	<0.0010	----	----	----	----	
arsenic, dissolved	7440-38-2	E469S	0.00040	mg/L	<0.00040	----	----	----	----	
barium, dissolved	7440-39-3	E469S	0.0010	mg/L	<0.0010	----	----	----	----	
beryllium, dissolved	7440-41-7	E469S	0.00050	mg/L	<0.00050	----	----	----	----	
bismuth, dissolved	7440-69-9	E469S	0.00050	mg/L	<0.00050	----	----	----	----	
boron, dissolved	7440-42-8	E469S	0.30	mg/L	<0.30	----	----	----	----	
cadmium, dissolved	7440-43-9	E469S	0.000010	mg/L	<0.000010	----	----	----	----	
calcium, dissolved	7440-70-2	E469S	1.0	mg/L	<1.0	----	----	----	----	
cesium, dissolved	7440-46-2	E469S	0.00050	mg/L	<0.00050	----	----	----	----	
chromium, dissolved	7440-47-3	E469S	0.00050	mg/L	<0.00050	----	----	----	----	
cobalt, dissolved	7440-48-4	E469S	0.000050	mg/L	<0.000050	----	----	----	----	
copper, dissolved	7440-50-8	E469S	0.00020	mg/L	<0.00020	----	----	----	----	
gallium, dissolved	7440-55-3	E469S	0.00050	mg/L	<0.00050	----	----	----	----	
iron, dissolved	7439-89-6	E469S	0.010	mg/L	<0.010	----	----	----	----	
lead, dissolved	7439-92-1	E469S	0.000050	mg/L	<0.000050	----	----	----	----	
lithium, dissolved	7439-93-2	E469S	0.020	mg/L	<0.020	----	----	----	----	
magnesium, dissolved	7439-95-4	E469S	1.0	mg/L	<1.0	----	----	----	----	
manganese, dissolved	7439-96-5	E469S	0.00010	mg/L	<0.00010	----	----	----	----	
mercury, dissolved	7439-97-6	E509S	0.0000050	mg/L	<0.0000050	----	----	----	----	
molybdenum, dissolved	7439-98-7	E469S	0.00010	mg/L	<0.00010	----	----	----	----	
nickel, dissolved	7440-02-0	E469S	0.00050	mg/L	<0.00050	----	----	----	----	
phosphorus, dissolved	7723-14-0	E469S	0.050	mg/L	<0.050	----	----	----	----	
potassium, dissolved	7440-09-7	E469S	1.0	mg/L	<1.0	----	----	----	----	
rhenium, dissolved	7440-15-5	E469S	0.00050	mg/L	<0.00050	----	----	----	----	
rubidium, dissolved	7440-17-7	E469S	0.0050	mg/L	<0.0050	----	----	----	----	
selenium, dissolved	7782-49-2	E469S	0.00050	mg/L	<0.00050	----	----	----	----	
silicon, dissolved	7440-21-3	E469S.NaSi	1.0	mg/L	<1.0	----	----	----	----	
silver, dissolved	7440-22-4	E469S	0.00010	mg/L	<0.00010	----	----	----	----	
sodium, dissolved	17341-25-2	E469S.NaSi	2.5	mg/L	<2.5	----	----	----	----	
strontium, dissolved	7440-24-6	E469S	0.010	mg/L	<0.010	----	----	----	----	

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Work Order : VA21B1579
Client : Stantec Consulting Ltd.
Project : ----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	Equipment Blank	----	----	----	----
					Client sampling date / time	07-Jun-2021 09:30	----	----	----	----
						VA21B1579-019	--------	--------	--------	--------
						Result	----	----	----	----
Dissolved Metals										
sulfur, dissolved	7704-34-9	E469S	5.0	mg/L		<5.0	----	----	----	----
tellurium, dissolved	13494-80-9	E469S	0.00050	mg/L		<0.00050	----	----	----	----
thallium, dissolved	7440-28-0	E469S	0.000050	mg/L		<0.000050	----	----	----	----
thorium, dissolved	7440-29-1	E469S	0.00050	mg/L		<0.00050	----	----	----	----
tin, dissolved	7440-31-5	E469S	0.0010	mg/L		<0.0010	----	----	----	----
titanium, dissolved	7440-32-6	E469S	0.0050	mg/L		<0.0050	----	----	----	----
tungsten, dissolved	7440-33-7	E469S	0.0010	mg/L		<0.0010	----	----	----	----
uranium, dissolved	7440-61-1	E469S	0.000050	mg/L		<0.000050	----	----	----	----
vanadium, dissolved	7440-62-2	E469S	0.00050	mg/L		<0.00050	----	----	----	----
yttrium, dissolved	7440-65-5	E469S	0.00050	mg/L		<0.00050	----	----	----	----
zinc, dissolved	7440-66-6	E469S	0.0010	mg/L		<0.0010	----	----	----	----
zirconium, dissolved	7440-67-7	E469S	0.00050	mg/L		<0.00050	----	----	----	----
dissolved mercury filtration location	----	EP509	-	-		Laboratory	----	----	----	----
dissolved metals filtration location	----	EP421	-	-		Laboratory	----	----	----	----
Volatile Organic Compounds [Fuels]										
benzene	71-43-2	E611A	0.50	µg/L		<0.50	----	----	----	----
ethylbenzene	100-41-4	E611A	0.50	µg/L		<0.50	----	----	----	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.50	µg/L		<0.50	----	----	----	----
styrene	100-42-5	E611A	0.50	µg/L		<0.50	----	----	----	----
toluene	108-88-3	E611A	0.50	µg/L		<0.50	----	----	----	----
xylene, m+p-	179601-23-1	E611A	0.40	µg/L		<0.40	----	----	----	----
xylene, o-	95-47-6	E611A	0.30	µg/L		<0.30	----	----	----	----
xylenes, total	1330-20-7	E611A	0.50	µg/L		<0.50	----	----	----	----
Hydrocarbons										
F1 (C6-C10)	----	E581.VH+F1	100	µg/L		<100	----	----	----	----
F1-BTEX	----	EC580	100	µg/L		<100	----	----	----	----
F2 (C10-C16)	----	E601	100	µg/L		<100	----	----	----	----
F2-naphthalene	----	EC600	100	µg/L		<100	----	----	----	----
F3 (C16-C34)	----	E601	250	µg/L		<250	----	----	----	----
F3-PAH	----	EC600	250	µg/L		<250	----	----	----	----
F4 (C34-C50)	----	E601	250	µg/L		<250	----	----	----	----

Page	:	27 of 27
Work Order	:	VA21B1579
Client	:	Stantec Consulting Ltd.
Project	:	----

Analytical Results

Sub-Matrix: **Water** (Matrix: **Water**)					Client sample ID	**Equipment Blank**	----	----	----	----
					Client sampling date / time	07-Jun-2021 09:30	----	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*		**VA21B1579-019**	--------	--------	--------	--------
						Result	----	----	----	----
Hydrocarbons Surrogates										
dichlorotoluene, 3,4-	97-75-0	E581.VH+F1	1.0	%		76.7	----	----	----	----
Polycyclic Aromatic Hydrocarbons										
acenaphthene	83-32-9	E641A	0.010	µg/L		<0.010	----	----	----	----
acenaphthylene	208-96-8	E641A	0.010	µg/L		<0.010	----	----	----	----
acridine	260-94-6	E641A	0.010	µg/L		<0.010	----	----	----	----
anthracene	120-12-7	E641A	0.010	µg/L		<0.010	----	----	----	----
benz(a)anthracene	56-55-3	E641A	0.010	µg/L		<0.010	----	----	----	----
benzo(a)pyrene	50-32-8	E641A	0.0050	µg/L		<0.0050	----	----	----	----
benzo(b+j)fluoranthene	----	E641A	0.010	µg/L		<0.010	----	----	----	----
benzo(b+j+k)fluoranthene	----	E641A	0.015	µg/L		<0.015	----	----	----	----
benzo(g,h,i)perylene	191-24-2	E641A	0.010	µg/L		<0.010	----	----	----	----
benzo(k)fluoranthene	207-08-9	E641A	0.010	µg/L		<0.010	----	----	----	----
chrysene	218-01-9	E641A	0.010	µg/L		<0.010	----	----	----	----
dibenz(a,h)anthracene	53-70-3	E641A	0.0050	µg/L		<0.0050	----	----	----	----
fluoranthene	206-44-0	E641A	0.010	µg/L		<0.010	----	----	----	----
fluorene	86-73-7	E641A	0.010	µg/L		<0.010	----	----	----	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.010	µg/L		<0.010	----	----	----	----
methylnaphthalene, 1-	90-12-0	E641A	0.010	µg/L		<0.010	----	----	----	----
methylnaphthalene, 2-	91-57-6	E641A	0.010	µg/L		<0.010	----	----	----	----
methylnaphthalenes, 1+2-	----	E641A	0.015	µg/L		<0.015	----	----	----	----
naphthalene	91-20-3	E641A	0.050	µg/L		<0.050	----	----	----	----
phenanthrene	85-01-8	E641A	0.020	µg/L		<0.020	----	----	----	----
pyrene	129-00-0	E641A	0.010	µg/L		<0.010	----	----	----	----
quinoline	6027-02-7	E641A	0.050	µg/L		<0.050	----	----	----	----
B(a)P total potency equivalents [B(a)P TPE]	----	E641A	0.010	µg/L		<0.010	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA21B1579**	Page	: 1 of 59
Client	: **Stantec Consulting Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Jenny Minford	Account Manager	: Brent Mack
Address	: # 11 - 2042 Mills Road Sidney BC Canada V8L 5X4	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: 778-370-3279
Project	: ----	Date Samples Received	: 09-Jun-2021 17:20
PO	: ----	Issue Date	: 28-Jun-2021 15:34
C-O-C number	: 20-917635,20-917636		
Sampler	: ----		
Site	: ----		
Quote number	: VA21-STAC100-005		
No. of samples received	: 19		
No. of samples analysed	: 19		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers occur - please see following pages for full details.

Page	: 2 of 59
Work Order	: VA21B1579
Client	: Stantec Consulting Ltd.
Project	: ----

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
Equipment Blank	E298	07-Jun-2021	11-Jun-2021	----	5 days	✓	11-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
Field Blank	E298	07-Jun-2021	11-Jun-2021	----	5 days	✓	11-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ1-10-EBB	E298	07-Jun-2021	11-Jun-2021	----	5 days	✓	11-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ1-10-Flow	E298	07-Jun-2021	11-Jun-2021	----	5 days	✓	11-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ1-1-EBB	E298	07-Jun-2021	11-Jun-2021	----	5 days	✓	11-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ1-1-EBB2	E298	07-Jun-2021	11-Jun-2021	----	5 days	✓	11-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ1-1-Flow	E298	07-Jun-2021	11-Jun-2021	----	5 days	✓	11-Jun-2021	28 days	1 days	✓

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Work Order	: VA21B1579
Client	: Stantec Consulting Ltd.
Project	: ----

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ3-15-EBB	E298	07-Jun-2021	11-Jun-2021	----	5 days	✓	11-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ3-1-EBB	E298	07-Jun-2021	11-Jun-2021	----	5 days	✓	11-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ3-1-Flow	E298	07-Jun-2021	11-Jun-2021	----	5 days	✓	11-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ3-6-Flow	E298	07-Jun-2021	11-Jun-2021	----	5 days	✓	11-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ5-10-EBB	E298	07-Jun-2021	11-Jun-2021	----	5 days	✓	11-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ5-1-EBB	E298	07-Jun-2021	11-Jun-2021	----	5 days	✓	11-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ5-1-Flow	E298	07-Jun-2021	11-Jun-2021	----	5 days	✓	11-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ5-27-Flow	E298	07-Jun-2021	11-Jun-2021	----	5 days	✓	11-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ6-12-EBB	E298	07-Jun-2021	11-Jun-2021	----	5 days	✓	11-Jun-2021	28 days	1 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ6-12-Flow	E298	07-Jun-2021	11-Jun-2021	----	5 days	✓	11-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ6-1-EBB	E298	07-Jun-2021	11-Jun-2021	----	5 days	✓	11-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ6-1-Flow	E298	07-Jun-2021	11-Jun-2021	----	5 days	✓	11-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE										
WQ6-12-EBB	E235S.Br	07-Jun-2021	----	----	----		14-Jun-2021	28 days	7 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE										
WQ6-1-EBB	E235S.Br	07-Jun-2021	----	----	----		14-Jun-2021	28 days	7 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE										
Equipment Blank	E235S.Br	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE										
Field Blank	E235S.Br	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE										
WQ1-10-EBB	E235S.Br	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE										
WQ1-10-Flow	E235S.Br	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Bromide in Seawater by IC										
HDPE										
WQ1-1-EBB	E235S.Br	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE										
WQ1-1-EBB2	E235S.Br	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE										
WQ1-1-Flow	E235S.Br	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE										
WQ3-15-EBB	E235S.Br	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE										
WQ3-1-EBB	E235S.Br	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE										
WQ3-1-Flow	E235S.Br	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE										
WQ3-6-Flow	E235S.Br	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE										
WQ5-10-EBB	E235S.Br	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE										
WQ5-1-EBB	E235S.Br	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Bromide in Seawater by IC										
HDPE WQ5-1-Flow	E235S.Br	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE WQ5-27-Flow	E235S.Br	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE WQ6-12-Flow	E235S.Br	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE WQ6-1-Flow	E235S.Br	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Chloride in Seawater by IC										
HDPE WQ6-12-EBB	E235S.Cl	07-Jun-2021	----	----	----		14-Jun-2021	28 days	7 days	✓
Anions and Nutrients : Chloride in Seawater by IC										
HDPE WQ6-1-EBB	E235S.Cl	07-Jun-2021	----	----	----		14-Jun-2021	28 days	7 days	✓
Anions and Nutrients : Chloride in Seawater by IC										
HDPE Equipment Blank	E235S.Cl	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Chloride in Seawater by IC										
HDPE Field Blank	E235S.Cl	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Chloride in Seawater by IC										
HDPE WQ1-10-EBB	E235S.Cl	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Chloride in Seawater by IC										
HDPE WQ1-10-Flow	E235S.Cl	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Chloride in Seawater by IC										
HDPE WQ1-1-EBB	E235S.Cl	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Chloride in Seawater by IC										
HDPE WQ1-1-EBB2	E235S.Cl	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Chloride in Seawater by IC										
HDPE WQ1-1-Flow	E235S.Cl	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Chloride in Seawater by IC										
HDPE WQ3-15-EBB	E235S.Cl	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Chloride in Seawater by IC										
HDPE WQ3-1-EBB	E235S.Cl	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Chloride in Seawater by IC										
HDPE WQ3-1-Flow	E235S.Cl	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Chloride in Seawater by IC										
HDPE WQ3-6-Flow	E235S.Cl	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Chloride in Seawater by IC										
HDPE WQ5-10-EBB	E235S.Cl	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Chloride in Seawater by IC										
HDPE										
WQ5-1-EBB	E235S.Cl	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Chloride in Seawater by IC										
HDPE										
WQ5-1-Flow	E235S.Cl	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Chloride in Seawater by IC										
HDPE										
WQ5-27-Flow	E235S.Cl	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Chloride in Seawater by IC										
HDPE										
WQ6-12-Flow	E235S.Cl	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Chloride in Seawater by IC										
HDPE										
WQ6-1-Flow	E235S.Cl	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE										
WQ6-12-EBB	E235S.F	07-Jun-2021	----	----	----		14-Jun-2021	28 days	7 days	✓
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE										
WQ6-1-EBB	E235S.F	07-Jun-2021	----	----	----		14-Jun-2021	28 days	7 days	✓
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE										
Equipment Blank	E235S.F	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE										
Field Blank	E235S.F	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE WQ1-10-EBB	E235S.F	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE WQ1-10-Flow	E235S.F	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE WQ1-1-EBB	E235S.F	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE WQ1-1-EBB2	E235S.F	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE WQ1-1-Flow	E235S.F	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE WQ3-15-EBB	E235S.F	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE WQ3-1-EBB	E235S.F	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE WQ3-1-Flow	E235S.F	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE WQ3-6-Flow	E235S.F	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE WQ5-10-EBB	E235S.F	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE WQ5-1-EBB	E235S.F	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE WQ5-1-Flow	E235S.F	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE WQ5-27-Flow	E235S.F	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE WQ6-12-Flow	E235S.F	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE WQ6-1-Flow	E235S.F	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ6-12-EBB	E235S.NO3	07-Jun-2021	----	----	----		14-Jun-2021	3 days	7 days	× EHTL
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ6-1-EBB	E235S.NO3	07-Jun-2021	----	----	----		14-Jun-2021	3 days	7 days	× EHTL
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE Equipment Blank	E235S.NO3	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE Field Blank	E235S.NO3	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ1-10-EBB	E235S.NO3	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ1-10-Flow	E235S.NO3	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ1-1-EBB	E235S.NO3	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ1-1-EBB2	E235S.NO3	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ1-1-Flow	E235S.NO3	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ3-15-EBB	E235S.NO3	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ3-1-EBB	E235S.NO3	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ3-1-Flow	E235S.NO3	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ3-6-Flow	E235S.NO3	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ5-10-EBB	E235S.NO3	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ5-1-EBB	E235S.NO3	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ5-1-Flow	E235S.NO3	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ5-27-Flow	E235S.NO3	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ6-12-Flow	E235S.NO3	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ6-1-Flow	E235S.NO3	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE WQ6-12-EBB	E235S.NO2	07-Jun-2021	----	----	----		14-Jun-2021	3 days	7 days	× EHTL
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE WQ6-1-EBB	E235S.NO2	07-Jun-2021	----	----	----		14-Jun-2021	3 days	7 days	× EHTL

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE										
Equipment Blank	E235S.NO2	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE										
Field Blank	E235S.NO2	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE										
WQ1-10-EBB	E235S.NO2	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE										
WQ1-10-Flow	E235S.NO2	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE										
WQ1-1-EBB	E235S.NO2	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE										
WQ1-1-EBB2	E235S.NO2	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE										
WQ1-1-Flow	E235S.NO2	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE										
WQ3-15-EBB	E235S.NO2	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE										
WQ3-1-EBB	E235S.NO2	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE WQ3-1-Flow	E235S.NO2	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE WQ3-6-Flow	E235S.NO2	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE WQ5-10-EBB	E235S.NO2	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE WQ5-1-EBB	E235S.NO2	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE WQ5-1-Flow	E235S.NO2	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE WQ5-27-Flow	E235S.NO2	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE WQ6-12-Flow	E235S.NO2	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE WQ6-1-Flow	E235S.NO2	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE WQ6-12-EBB	E235S.SO4	07-Jun-2021	----	----	----		14-Jun-2021	28 days	7 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ6-1-EBB	E235S.SO4	07-Jun-2021	----	----	----		14-Jun-2021	28 days	7 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
Equipment Blank	E235S.SO4	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
Field Blank	E235S.SO4	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ1-10-EBB	E235S.SO4	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ1-10-Flow	E235S.SO4	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ1-1-EBB	E235S.SO4	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ1-1-EBB2	E235S.SO4	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ1-1-Flow	E235S.SO4	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ3-15-EBB	E235S.SO4	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE WQ3-1-EBB	E235S.SO4	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE WQ3-1-Flow	E235S.SO4	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE WQ3-6-Flow	E235S.SO4	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE WQ5-10-EBB	E235S.SO4	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE WQ5-1-EBB	E235S.SO4	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE WQ5-1-Flow	E235S.SO4	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE WQ5-27-Flow	E235S.SO4	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE WQ6-12-Flow	E235S.SO4	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE WQ6-1-Flow	E235S.SO4	07-Jun-2021	----	----	----		14-Jun-2021	28 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid)										
Equipment Blank	E372-U	07-Jun-2021	11-Jun-2021	----	5 days	✓	12-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid)										
Field Blank	E372-U	07-Jun-2021	11-Jun-2021	----	5 days	✓	12-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid)										
WQ1-10-EBB	E372-U	07-Jun-2021	11-Jun-2021	----	5 days	✓	12-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid)										
WQ1-10-Flow	E372-U	07-Jun-2021	11-Jun-2021	----	5 days	✓	12-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid)										
WQ1-1-EBB	E372-U	07-Jun-2021	11-Jun-2021	----	5 days	✓	12-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid)										
WQ1-1-EBB2	E372-U	07-Jun-2021	11-Jun-2021	----	5 days	✓	12-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid)										
WQ1-1-Flow	E372-U	07-Jun-2021	11-Jun-2021	----	5 days	✓	12-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid)										
WQ3-15-EBB	E372-U	07-Jun-2021	11-Jun-2021	----	5 days	✓	12-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid)										
WQ3-1-EBB	E372-U	07-Jun-2021	11-Jun-2021	----	5 days	✓	12-Jun-2021	28 days	1 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid) WQ3-1-Flow	E372-U	07-Jun-2021	11-Jun-2021	----	5 days	✓	12-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid) WQ3-6-Flow	E372-U	07-Jun-2021	11-Jun-2021	----	5 days	✓	12-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid) WQ5-10-EBB	E372-U	07-Jun-2021	11-Jun-2021	----	5 days	✓	12-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid) WQ5-1-EBB	E372-U	07-Jun-2021	11-Jun-2021	----	5 days	✓	12-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid) WQ5-1-Flow	E372-U	07-Jun-2021	11-Jun-2021	----	5 days	✓	12-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid) WQ5-27-Flow	E372-U	07-Jun-2021	11-Jun-2021	----	5 days	✓	12-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid) WQ6-12-EBB	E372-U	07-Jun-2021	11-Jun-2021	----	5 days	✓	12-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid) WQ6-12-Flow	E372-U	07-Jun-2021	11-Jun-2021	----	5 days	✓	12-Jun-2021	28 days	1 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid) WQ6-1-EBB	E372-U	07-Jun-2021	11-Jun-2021	----	5 days	✓	12-Jun-2021	28 days	1 days	✓

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Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid)										
WQ6-1-Flow	E372-U	07-Jun-2021	11-Jun-2021	----	5 days	✓	12-Jun-2021	28 days	1 days	✓
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
HDPE dissolved (nitric acid)										
Field Blank	E509S	07-Jun-2021	20-Jun-2021	----	13 days	✓	20-Jun-2021	----	1 days	
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
HDPE dissolved (nitric acid)										
WQ1-10-EBB	E509S	07-Jun-2021	20-Jun-2021	----	13 days	✓	20-Jun-2021	----	1 days	
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
HDPE dissolved (nitric acid)										
WQ1-10-Flow	E509S	07-Jun-2021	20-Jun-2021	----	13 days	✓	20-Jun-2021	----	1 days	
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
HDPE dissolved (nitric acid)										
WQ1-1-EBB	E509S	07-Jun-2021	20-Jun-2021	----	13 days	✓	20-Jun-2021	----	1 days	
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
HDPE dissolved (nitric acid)										
WQ1-1-EBB2	E509S	07-Jun-2021	20-Jun-2021	----	13 days	✓	20-Jun-2021	----	1 days	
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
HDPE dissolved (nitric acid)										
WQ1-1-Flow	E509S	07-Jun-2021	20-Jun-2021	----	13 days	✓	20-Jun-2021	----	1 days	
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
HDPE dissolved (nitric acid)										
WQ3-15-EBB	E509S	07-Jun-2021	20-Jun-2021	----	13 days	✓	20-Jun-2021	----	1 days	
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
HDPE dissolved (nitric acid)										
WQ3-1-EBB	E509S	07-Jun-2021	20-Jun-2021	----	13 days	✓	20-Jun-2021	----	1 days	

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Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
HDPE dissolved (nitric acid)										
WQ3-1-Flow	E509S	07-Jun-2021	20-Jun-2021	----	13 days	✓	20-Jun-2021	----	1 days	
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
HDPE dissolved (nitric acid)										
WQ3-6-Flow	E509S	07-Jun-2021	20-Jun-2021	----	13 days	✓	20-Jun-2021	----	1 days	
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
HDPE dissolved (nitric acid)										
WQ5-10-EBB	E509S	07-Jun-2021	20-Jun-2021	----	13 days	✓	20-Jun-2021	----	1 days	
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
HDPE dissolved (nitric acid)										
WQ5-1-EBB	E509S	07-Jun-2021	20-Jun-2021	----	13 days	✓	20-Jun-2021	----	1 days	
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
HDPE dissolved (nitric acid)										
WQ5-1-Flow	E509S	07-Jun-2021	20-Jun-2021	----	13 days	✓	20-Jun-2021	----	1 days	
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
HDPE dissolved (nitric acid)										
WQ5-27-Flow	E509S	07-Jun-2021	20-Jun-2021	----	13 days	✓	20-Jun-2021	----	1 days	
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
HDPE dissolved (nitric acid)										
WQ6-12-EBB	E509S	07-Jun-2021	20-Jun-2021	----	13 days	✓	20-Jun-2021	----	1 days	
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
HDPE dissolved (nitric acid)										
WQ6-12-Flow	E509S	07-Jun-2021	20-Jun-2021	----	13 days	✓	20-Jun-2021	----	1 days	
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
HDPE dissolved (nitric acid)										
WQ6-1-EBB	E509S	07-Jun-2021	20-Jun-2021	----	13 days	✓	20-Jun-2021	----	1 days	

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Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
HDPE dissolved (nitric acid)										
WQ6-1-Flow	E509S	07-Jun-2021	20-Jun-2021	----	13 days	✓	20-Jun-2021	----	1 days	
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
HDPE dissolved (nitric acid)										
Equipment Blank	E509S	07-Jun-2021	20-Jun-2021	----	14 days	✓	20-Jun-2021	----	1 days	
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE dissolved (nitric acid)										
Field Blank	E469S	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE dissolved (nitric acid)										
WQ1-10-EBB	E469S	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE dissolved (nitric acid)										
WQ1-10-Flow	E469S	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE dissolved (nitric acid)										
WQ1-1-EBB	E469S	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE dissolved (nitric acid)										
WQ1-1-EBB2	E469S	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE dissolved (nitric acid)										
WQ1-1-Flow	E469S	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE dissolved (nitric acid)										
WQ3-15-EBB	E469S	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE dissolved (nitric acid) WQ3-1-EBB	E469S	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE dissolved (nitric acid) WQ3-1-Flow	E469S	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE dissolved (nitric acid) WQ3-6-Flow	E469S	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE dissolved (nitric acid) WQ5-10-EBB	E469S	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE dissolved (nitric acid) WQ5-1-EBB	E469S	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE dissolved (nitric acid) WQ5-1-Flow	E469S	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE dissolved (nitric acid) WQ5-27-Flow	E469S	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE dissolved (nitric acid) WQ6-12-EBB	E469S	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE dissolved (nitric acid) WQ6-12-Flow	E469S	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓

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Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE dissolved (nitric acid)										
WQ6-1-EBB	E469S	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE dissolved (nitric acid)										
WQ6-1-Flow	E469S	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE dissolved (nitric acid)										
Equipment Blank	E469S	07-Jun-2021	13-Jun-2021	----	7 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE dissolved (nitric acid)										
Field Blank	E469S.NaSi	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE dissolved (nitric acid)										
WQ1-10-EBB	E469S.NaSi	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE dissolved (nitric acid)										
WQ1-10-Flow	E469S.NaSi	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE dissolved (nitric acid)										
WQ1-1-EBB	E469S.NaSi	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE dissolved (nitric acid)										
WQ1-1-EBB2	E469S.NaSi	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE dissolved (nitric acid)										
WQ1-1-Flow	E469S.NaSi	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE dissolved (nitric acid) WQ3-15-EBB	E469S.NaSi	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE dissolved (nitric acid) WQ3-1-EBB	E469S.NaSi	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE dissolved (nitric acid) WQ3-1-Flow	E469S.NaSi	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE dissolved (nitric acid) WQ3-6-Flow	E469S.NaSi	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE dissolved (nitric acid) WQ5-10-EBB	E469S.NaSi	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE dissolved (nitric acid) WQ5-1-EBB	E469S.NaSi	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE dissolved (nitric acid) WQ5-1-Flow	E469S.NaSi	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE dissolved (nitric acid) WQ5-27-Flow	E469S.NaSi	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE dissolved (nitric acid) WQ6-12-EBB	E469S.NaSi	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE dissolved (nitric acid)										
WQ6-12-Flow	E469S.NaSi	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE dissolved (nitric acid)										
WQ6-1-EBB	E469S.NaSi	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE dissolved (nitric acid)										
WQ6-1-Flow	E469S.NaSi	07-Jun-2021	13-Jun-2021	----	6 days	✓	14-Jun-2021	180 days	2 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE dissolved (nitric acid)										
Equipment Blank	E469S.NaSi	07-Jun-2021	13-Jun-2021	----	7 days	✓	14-Jun-2021	180 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ1-1-Flow	E601	07-Jun-2021	16-Jun-2021	14 days	10 days	✓	17-Jun-2021	40 days	1 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
Equipment Blank	E601	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	16-Jun-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
Field Blank	E601	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	16-Jun-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ1-10-EBB	E601	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	16-Jun-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ1-10-Flow	E601	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	16-Jun-2021	40 days	2 days	✓

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Work Order	: VA21B1579
Client	: Stantec Consulting Ltd.
Project	: ----

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ1-1-EBB2	E601	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	16-Jun-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ3-15-EBB	E601	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	16-Jun-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ3-1-EBB	E601	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	16-Jun-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ3-1-Flow	E601	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	16-Jun-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ3-6-Flow	E601	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	16-Jun-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ5-10-EBB	E601	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	16-Jun-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ5-1-EBB	E601	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	16-Jun-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ5-1-Flow	E601	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	16-Jun-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ5-27-Flow	E601	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	16-Jun-2021	40 days	2 days	✓

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Work Order	: VA21B1579
Client	: Stantec Consulting Ltd.
Project	: ----

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ6-12-EBB	E601	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	16-Jun-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ6-12-Flow	E601	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	16-Jun-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ6-1-EBB	E601	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	16-Jun-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ6-1-Flow	E601	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	16-Jun-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ1-1-EBB	E601	07-Jun-2021	16-Jun-2021	14 days	9 days	✓	17-Jun-2021	40 days	1 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate)										
WQ1-10-EBB	E581.VH+F1	07-Jun-2021	16-Jun-2021	----	10 days	✓	18-Jun-2021	14 days	2 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate)										
WQ1-10-Flow	E581.VH+F1	07-Jun-2021	16-Jun-2021	----	10 days	✓	18-Jun-2021	14 days	2 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate)										
WQ1-1-EBB	E581.VH+F1	07-Jun-2021	16-Jun-2021	----	10 days	✓	18-Jun-2021	14 days	2 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate)										
WQ1-1-EBB2	E581.VH+F1	07-Jun-2021	16-Jun-2021	----	10 days	✓	18-Jun-2021	14 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ1-1-Flow	E581.VH+F1	07-Jun-2021	16-Jun-2021	----	10 days	✓	18-Jun-2021	14 days	2 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ3-1-EBB	E581.VH+F1	07-Jun-2021	16-Jun-2021	----	10 days	✓	18-Jun-2021	14 days	2 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ3-1-Flow	E581.VH+F1	07-Jun-2021	16-Jun-2021	----	10 days	✓	18-Jun-2021	14 days	2 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) Equipment Blank	E581.VH+F1	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) Field Blank	E581.VH+F1	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ3-15-EBB	E581.VH+F1	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ3-6-Flow	E581.VH+F1	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ5-10-EBB	E581.VH+F1	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ5-1-EBB	E581.VH+F1	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ5-1-Flow	E581.VH+F1	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ5-27-Flow	E581.VH+F1	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ6-12-EBB	E581.VH+F1	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ6-12-Flow	E581.VH+F1	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ6-1-EBB	E581.VH+F1	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ6-1-Flow	E581.VH+F1	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) Equipment Blank	E358-L	07-Jun-2021	11-Jun-2021	3 days	5 days	× EHTL	11-Jun-2021	28 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) Field Blank	E358-L	07-Jun-2021	11-Jun-2021	3 days	5 days	× EHTL	11-Jun-2021	28 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) WQ1-10-EBB	E358-L	07-Jun-2021	11-Jun-2021	3 days	5 days	× EHTL	11-Jun-2021	28 days	1 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) WQ1-10-Flow	E358-L	07-Jun-2021	11-Jun-2021	3 days	5 days	× EHTL	11-Jun-2021	28 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) WQ1-1-EBB	E358-L	07-Jun-2021	11-Jun-2021	3 days	5 days	× EHTL	11-Jun-2021	28 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) WQ1-1-EBB2	E358-L	07-Jun-2021	11-Jun-2021	3 days	5 days	× EHTL	11-Jun-2021	28 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) WQ1-1-Flow	E358-L	07-Jun-2021	11-Jun-2021	3 days	5 days	× EHTL	11-Jun-2021	28 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) WQ3-15-EBB	E358-L	07-Jun-2021	11-Jun-2021	3 days	5 days	× EHTL	11-Jun-2021	28 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) WQ3-1-EBB	E358-L	07-Jun-2021	11-Jun-2021	3 days	5 days	× EHTL	11-Jun-2021	28 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) WQ3-1-Flow	E358-L	07-Jun-2021	11-Jun-2021	3 days	5 days	× EHTL	11-Jun-2021	28 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) WQ3-6-Flow	E358-L	07-Jun-2021	11-Jun-2021	3 days	5 days	× EHTL	11-Jun-2021	28 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) WQ5-10-EBB	E358-L	07-Jun-2021	11-Jun-2021	3 days	5 days	× EHTL	11-Jun-2021	28 days	1 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) WQ5-1-EBB	E358-L	07-Jun-2021	11-Jun-2021	3 days	5 days	× EHTL	11-Jun-2021	28 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) WQ5-1-Flow	E358-L	07-Jun-2021	11-Jun-2021	3 days	5 days	× EHTL	11-Jun-2021	28 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) WQ5-27-Flow	E358-L	07-Jun-2021	11-Jun-2021	3 days	5 days	× EHTL	11-Jun-2021	28 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) WQ6-12-EBB	E358-L	07-Jun-2021	11-Jun-2021	3 days	5 days	× EHTL	11-Jun-2021	28 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) WQ6-12-Flow	E358-L	07-Jun-2021	11-Jun-2021	3 days	5 days	× EHTL	11-Jun-2021	28 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) WQ6-1-EBB	E358-L	07-Jun-2021	11-Jun-2021	3 days	5 days	× EHTL	11-Jun-2021	28 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) WQ6-1-Flow	E358-L	07-Jun-2021	11-Jun-2021	3 days	5 days	× EHTL	11-Jun-2021	28 days	1 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) Equipment Blank	E355-L	07-Jun-2021	11-Jun-2021	----	5 days	✓	14-Jun-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) Field Blank	E355-L	07-Jun-2021	11-Jun-2021	----	5 days	✓	14-Jun-2021	28 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ1-10-EBB	E355-L	07-Jun-2021	11-Jun-2021	----	5 days	✓	14-Jun-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ1-10-Flow	E355-L	07-Jun-2021	11-Jun-2021	----	5 days	✓	14-Jun-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ1-1-EBB	E355-L	07-Jun-2021	11-Jun-2021	----	5 days	✓	14-Jun-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ1-1-EBB2	E355-L	07-Jun-2021	11-Jun-2021	----	5 days	✓	14-Jun-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ1-1-Flow	E355-L	07-Jun-2021	11-Jun-2021	----	5 days	✓	14-Jun-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ3-15-EBB	E355-L	07-Jun-2021	11-Jun-2021	----	5 days	✓	14-Jun-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ3-1-EBB	E355-L	07-Jun-2021	11-Jun-2021	----	5 days	✓	14-Jun-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ3-1-Flow	E355-L	07-Jun-2021	11-Jun-2021	----	5 days	✓	14-Jun-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ3-6-Flow	E355-L	07-Jun-2021	11-Jun-2021	----	5 days	✓	14-Jun-2021	28 days	3 days	✓

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Client	: Stantec Consulting Ltd.
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Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ5-10-EBB	E355-L	07-Jun-2021	11-Jun-2021	----	5 days	✓	14-Jun-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ5-1-EBB	E355-L	07-Jun-2021	11-Jun-2021	----	5 days	✓	14-Jun-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ5-1-Flow	E355-L	07-Jun-2021	11-Jun-2021	----	5 days	✓	14-Jun-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ5-27-Flow	E355-L	07-Jun-2021	11-Jun-2021	----	5 days	✓	14-Jun-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ6-12-EBB	E355-L	07-Jun-2021	11-Jun-2021	----	5 days	✓	14-Jun-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ6-12-Flow	E355-L	07-Jun-2021	11-Jun-2021	----	5 days	✓	14-Jun-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ6-1-EBB	E355-L	07-Jun-2021	11-Jun-2021	----	5 days	✓	14-Jun-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ6-1-Flow	E355-L	07-Jun-2021	11-Jun-2021	----	5 days	✓	14-Jun-2021	28 days	3 days	✓
Physical Tests : pH by Meter										
HDPE										
WQ5-10-EBB	E108	07-Jun-2021	----	----	----		14-Jun-2021	0.25 hrs	165 hrs	× EHTR-FM

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter										
HDPE WQ6-12-EBB	E108	07-Jun-2021	----	----	----		14-Jun-2021	0.25 hrs	165 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ6-1-EBB	E108	07-Jun-2021	----	----	----		14-Jun-2021	0.25 hrs	165 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE Field Blank	E108	07-Jun-2021	----	----	----		14-Jun-2021	0.25 hrs	167 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ1-10-EBB	E108	07-Jun-2021	----	----	----		14-Jun-2021	0.25 hrs	167 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ1-1-EBB	E108	07-Jun-2021	----	----	----		14-Jun-2021	0.25 hrs	167 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ1-1-EBB2	E108	07-Jun-2021	----	----	----		14-Jun-2021	0.25 hrs	167 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ3-15-EBB	E108	07-Jun-2021	----	----	----		14-Jun-2021	0.25 hrs	167 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ3-1-EBB	E108	07-Jun-2021	----	----	----		14-Jun-2021	0.25 hrs	167 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ5-1-EBB	E108	07-Jun-2021	----	----	----		14-Jun-2021	0.25 hrs	168 hrs	× EHTR-FM

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter										
HDPE WQ6-12-Flow	E108	07-Jun-2021	----	----	----		14-Jun-2021	0.25 hrs	169 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ6-1-Flow	E108	07-Jun-2021	----	----	----		14-Jun-2021	0.25 hrs	169 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ1-1-Flow	E108	07-Jun-2021	----	----	----		14-Jun-2021	0.25 hrs	170 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ3-1-Flow	E108	07-Jun-2021	----	----	----		14-Jun-2021	0.25 hrs	170 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ3-6-Flow	E108	07-Jun-2021	----	----	----		14-Jun-2021	0.25 hrs	170 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ5-1-Flow	E108	07-Jun-2021	----	----	----		14-Jun-2021	0.25 hrs	170 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ5-27-Flow	E108	07-Jun-2021	----	----	----		14-Jun-2021	0.25 hrs	170 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ1-10-Flow	E108	07-Jun-2021	----	----	----		14-Jun-2021	0.25 hrs	171 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE Equipment Blank	E108	07-Jun-2021	----	----	----		14-Jun-2021	0.25 hrs	172 hrs	× EHTR-FM

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ5-10-EBB	E162S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ6-12-EBB	E162S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ6-1-EBB	E162S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE Equipment Blank	E162S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	8 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE Field Blank	E162S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	8 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ1-10-EBB	E162S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	8 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ1-10-Flow	E162S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	8 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ1-1-EBB	E162S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	8 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ1-1-EBB2	E162S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ1-1-Flow	E162S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	8 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ3-15-EBB	E162S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	8 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ3-1-EBB	E162S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	8 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ3-1-Flow	E162S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	8 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ3-6-Flow	E162S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	8 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ5-1-EBB	E162S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	8 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ5-1-Flow	E162S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	8 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ5-27-Flow	E162S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	8 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ6-12-Flow	E162S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE										
WQ6-1-Flow	E162S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	8 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE										
Equipment Blank	E160S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE										
Field Blank	E160S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE										
WQ1-10-EBB	E160S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE										
WQ1-10-Flow	E160S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE										
WQ1-1-EBB	E160S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE										
WQ1-1-EBB2	E160S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE										
WQ1-1-Flow	E160S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE										
WQ3-15-EBB	E160S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓

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Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ3-1-EBB	E160S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ3-1-Flow	E160S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ3-6-Flow	E160S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ5-10-EBB	E160S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ5-1-EBB	E160S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ5-1-Flow	E160S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ5-27-Flow	E160S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ6-12-EBB	E160S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ6-12-Flow	E160S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ6-1-EBB	E160S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ6-1-Flow	E160S	07-Jun-2021	----	----	----		14-Jun-2021	7 days	7 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE WQ6-12-EBB	E121	07-Jun-2021	----	----	----		11-Jun-2021	3 days	4 days	× EHTL
Physical Tests : Turbidity by Nephelometry										
HDPE Field Blank	E121	07-Jun-2021	----	----	----		14-Jun-2021	3 days	7 days	× EHTL
Physical Tests : Turbidity by Nephelometry										
HDPE WQ1-10-EBB	E121	07-Jun-2021	----	----	----		14-Jun-2021	3 days	7 days	× EHTL
Physical Tests : Turbidity by Nephelometry										
HDPE WQ1-1-EBB	E121	07-Jun-2021	----	----	----		14-Jun-2021	3 days	7 days	× EHTL
Physical Tests : Turbidity by Nephelometry										
HDPE WQ1-1-EBB2	E121	07-Jun-2021	----	----	----		14-Jun-2021	3 days	7 days	× EHTL
Physical Tests : Turbidity by Nephelometry										
HDPE WQ3-15-EBB	E121	07-Jun-2021	----	----	----		14-Jun-2021	3 days	7 days	× EHTL
Physical Tests : Turbidity by Nephelometry										
HDPE WQ3-1-EBB	E121	07-Jun-2021	----	----	----		14-Jun-2021	3 days	7 days	× EHTL

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Turbidity by Nephelometry										
HDPE WQ5-10-EBB	E121	07-Jun-2021	----	----	----		14-Jun-2021	3 days	7 days	× EHTL
Physical Tests : Turbidity by Nephelometry										
HDPE WQ6-1-EBB	E121	07-Jun-2021	----	----	----		14-Jun-2021	3 days	7 days	× EHTL
Physical Tests : Turbidity by Nephelometry										
HDPE Equipment Blank	E121	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Physical Tests : Turbidity by Nephelometry										
HDPE WQ1-10-Flow	E121	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Physical Tests : Turbidity by Nephelometry										
HDPE WQ1-1-Flow	E121	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Physical Tests : Turbidity by Nephelometry										
HDPE WQ3-1-Flow	E121	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Physical Tests : Turbidity by Nephelometry										
HDPE WQ3-6-Flow	E121	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Physical Tests : Turbidity by Nephelometry										
HDPE WQ5-1-EBB	E121	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Physical Tests : Turbidity by Nephelometry										
HDPE WQ5-1-Flow	E121	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Turbidity by Nephelometry										
HDPE										
WQ5-27-Flow	E121	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Physical Tests : Turbidity by Nephelometry										
HDPE										
WQ6-12-Flow	E121	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Physical Tests : Turbidity by Nephelometry										
HDPE										
WQ6-1-Flow	E121	07-Jun-2021	----	----	----		14-Jun-2021	3 days	8 days	× EHTL
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ1-1-Flow	E641A	07-Jun-2021	16-Jun-2021	14 days	10 days	✓	16-Jun-2021	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
Equipment Blank	E641A	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	15-Jun-2021	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
Field Blank	E641A	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	15-Jun-2021	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ1-10-EBB	E641A	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	15-Jun-2021	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ1-10-Flow	E641A	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	15-Jun-2021	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ1-1-EBB2	E641A	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	15-Jun-2021	40 days	1 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ3-15-EBB	E641A	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	15-Jun-2021	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ3-1-EBB	E641A	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	15-Jun-2021	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ3-1-Flow	E641A	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	15-Jun-2021	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ3-6-Flow	E641A	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	15-Jun-2021	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ5-10-EBB	E641A	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	15-Jun-2021	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ5-1-EBB	E641A	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	15-Jun-2021	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ5-1-Flow	E641A	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	15-Jun-2021	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ5-27-Flow	E641A	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	15-Jun-2021	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ6-12-EBB	E641A	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	15-Jun-2021	40 days	1 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ6-12-Flow	E641A	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	15-Jun-2021	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ6-1-EBB	E641A	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	15-Jun-2021	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ6-1-Flow	E641A	07-Jun-2021	15-Jun-2021	14 days	8 days	✓	15-Jun-2021	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ1-1-EBB	E641A	07-Jun-2021	16-Jun-2021	14 days	9 days	✓	16-Jun-2021	40 days	1 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
HDPE total (nitric acid)										
WQ6-12-EBB	E508S	07-Jun-2021	----	----	----		17-Jun-2021	----	10 days	
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial total (hydrochloric acid)										
Field Blank	E508S	07-Jun-2021	----	----	----		17-Jun-2021	28 days	10 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial total (hydrochloric acid)										
WQ1-10-EBB	E508S	07-Jun-2021	----	----	----		17-Jun-2021	28 days	10 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial total (hydrochloric acid)										
WQ1-1-EBB	E508S	07-Jun-2021	----	----	----		17-Jun-2021	28 days	10 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial total (hydrochloric acid)										
WQ1-1-EBB2	E508S	07-Jun-2021	----	----	----		17-Jun-2021	28 days	10 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial total (hydrochloric acid)										
WQ1-1-Flow	E508S	07-Jun-2021	----	----	----		17-Jun-2021	28 days	10 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial total (hydrochloric acid)										
WQ3-15-EBB	E508S	07-Jun-2021	----	----	----		17-Jun-2021	28 days	10 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial total (hydrochloric acid)										
WQ3-1-EBB	E508S	07-Jun-2021	----	----	----		17-Jun-2021	28 days	10 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial total (hydrochloric acid)										
WQ3-1-Flow	E508S	07-Jun-2021	----	----	----		17-Jun-2021	28 days	10 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial total (hydrochloric acid)										
WQ3-6-Flow	E508S	07-Jun-2021	----	----	----		17-Jun-2021	28 days	10 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial total (hydrochloric acid)										
WQ5-10-EBB	E508S	07-Jun-2021	----	----	----		17-Jun-2021	28 days	10 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial total (hydrochloric acid)										
WQ5-1-EBB	E508S	07-Jun-2021	----	----	----		17-Jun-2021	28 days	10 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial total (hydrochloric acid)										
WQ5-1-Flow	E508S	07-Jun-2021	----	----	----		17-Jun-2021	28 days	10 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial total (hydrochloric acid)										
WQ5-27-Flow	E508S	07-Jun-2021	----	----	----		17-Jun-2021	28 days	10 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial total (hydrochloric acid)										
WQ6-12-Flow	E508S	07-Jun-2021	----	----	----		17-Jun-2021	28 days	10 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial total (hydrochloric acid)										
WQ6-1-EBB	E508S	07-Jun-2021	----	----	----		17-Jun-2021	28 days	10 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial total (hydrochloric acid)										
WQ6-1-Flow	E508S	07-Jun-2021	----	----	----		17-Jun-2021	28 days	10 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial total (hydrochloric acid)										
Equipment Blank	E508S	07-Jun-2021	----	----	----		17-Jun-2021	28 days	11 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial total (hydrochloric acid)										
WQ1-10-Flow	E508S	07-Jun-2021	----	----	----		17-Jun-2021	28 days	11 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE total (nitric acid)										
Equipment Blank	E468S	07-Jun-2021	----	----	----		14-Jun-2021	180 days	8 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE total (nitric acid)										
WQ1-10-EBB	E468S	07-Jun-2021	----	----	----		14-Jun-2021	180 days	8 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE total (nitric acid)										
WQ1-10-Flow	E468S	07-Jun-2021	----	----	----		14-Jun-2021	180 days	8 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE total (nitric acid)										
WQ1-1-EBB	E468S	07-Jun-2021	----	----	----		14-Jun-2021	180 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE total (nitric acid) WQ1-1-EBB2	E468S	07-Jun-2021	----	----	----		14-Jun-2021	180 days	8 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE total (nitric acid) WQ1-1-Flow	E468S	07-Jun-2021	----	----	----		14-Jun-2021	180 days	8 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE total (nitric acid) WQ3-15-EBB	E468S	07-Jun-2021	----	----	----		14-Jun-2021	180 days	8 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE total (nitric acid) WQ3-1-EBB	E468S	07-Jun-2021	----	----	----		14-Jun-2021	180 days	8 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE total (nitric acid) WQ3-1-Flow	E468S	07-Jun-2021	----	----	----		14-Jun-2021	180 days	8 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE total (nitric acid) WQ3-6-Flow	E468S	07-Jun-2021	----	----	----		14-Jun-2021	180 days	8 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE total (nitric acid) WQ5-10-EBB	E468S	07-Jun-2021	----	----	----		14-Jun-2021	180 days	8 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE total (nitric acid) WQ5-1-EBB	E468S	07-Jun-2021	----	----	----		14-Jun-2021	180 days	8 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE total (nitric acid) WQ5-1-Flow	E468S	07-Jun-2021	----	----	----		14-Jun-2021	180 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE total (nitric acid) WQ5-27-Flow	E468S	07-Jun-2021	----	----	----		14-Jun-2021	180 days	8 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE total (nitric acid) WQ6-12-EBB	E468S	07-Jun-2021	----	----	----		14-Jun-2021	180 days	8 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE total (nitric acid) WQ6-12-Flow	E468S	07-Jun-2021	----	----	----		14-Jun-2021	180 days	8 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE total (nitric acid) WQ6-1-EBB	E468S	07-Jun-2021	----	----	----		14-Jun-2021	180 days	8 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE total (nitric acid) WQ6-1-Flow	E468S	07-Jun-2021	----	----	----		14-Jun-2021	180 days	8 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE total (nitric acid) Field Blank	E468S	07-Jun-2021	----	----	----		14-Jun-2021	180 days	9 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE total (nitric acid) Equipment Blank	E468S.NaSi	07-Jun-2021	----	----	----		15-Jun-2021	180 days	9 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE total (nitric acid) Field Blank	E468S.NaSi	07-Jun-2021	----	----	----		15-Jun-2021	180 days	9 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE total (nitric acid) WQ1-10-EBB	E468S.NaSi	07-Jun-2021	----	----	----		16-Jun-2021	180 days	9 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE total (nitric acid)										
WQ1-10-Flow	E468S.NaSi	07-Jun-2021	----	----	----		16-Jun-2021	180 days	9 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE total (nitric acid)										
WQ1-1-EBB	E468S.NaSi	07-Jun-2021	----	----	----		16-Jun-2021	180 days	9 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE total (nitric acid)										
WQ1-1-EBB2	E468S.NaSi	07-Jun-2021	----	----	----		16-Jun-2021	180 days	9 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE total (nitric acid)										
WQ1-1-Flow	E468S.NaSi	07-Jun-2021	----	----	----		16-Jun-2021	180 days	9 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE total (nitric acid)										
WQ3-15-EBB	E468S.NaSi	07-Jun-2021	----	----	----		16-Jun-2021	180 days	9 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE total (nitric acid)										
WQ3-1-EBB	E468S.NaSi	07-Jun-2021	----	----	----		16-Jun-2021	180 days	9 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE total (nitric acid)										
WQ3-1-Flow	E468S.NaSi	07-Jun-2021	----	----	----		16-Jun-2021	180 days	9 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE total (nitric acid)										
WQ3-6-Flow	E468S.NaSi	07-Jun-2021	----	----	----		16-Jun-2021	180 days	9 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE total (nitric acid)										
WQ5-10-EBB	E468S.NaSi	07-Jun-2021	----	----	----		16-Jun-2021	180 days	9 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE total (nitric acid)										
WQ5-1-EBB	E468S.NaSi	07-Jun-2021	----	----	----		16-Jun-2021	180 days	9 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE total (nitric acid)										
WQ5-1-Flow	E468S.NaSi	07-Jun-2021	----	----	----		16-Jun-2021	180 days	9 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE total (nitric acid)										
WQ5-27-Flow	E468S.NaSi	07-Jun-2021	----	----	----		16-Jun-2021	180 days	9 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE total (nitric acid)										
WQ6-12-EBB	E468S.NaSi	07-Jun-2021	----	----	----		16-Jun-2021	180 days	9 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE total (nitric acid)										
WQ6-12-Flow	E468S.NaSi	07-Jun-2021	----	----	----		16-Jun-2021	180 days	9 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE total (nitric acid)										
WQ6-1-EBB	E468S.NaSi	07-Jun-2021	----	----	----		16-Jun-2021	180 days	9 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE total (nitric acid)										
WQ6-1-Flow	E468S.NaSi	07-Jun-2021	----	----	----		16-Jun-2021	180 days	9 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate)										
WQ1-10-EBB	E611A	07-Jun-2021	16-Jun-2021	----	10 days	✓	18-Jun-2021	14 days	2 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate)										
WQ1-10-Flow	E611A	07-Jun-2021	16-Jun-2021	----	10 days	✓	18-Jun-2021	14 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ1-1-EBB	E611A	07-Jun-2021	16-Jun-2021	----	10 days	✓	18-Jun-2021	14 days	2 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ1-1-EBB2	E611A	07-Jun-2021	16-Jun-2021	----	10 days	✓	18-Jun-2021	14 days	2 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ1-1-Flow	E611A	07-Jun-2021	16-Jun-2021	----	10 days	✓	18-Jun-2021	14 days	2 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ3-1-EBB	E611A	07-Jun-2021	16-Jun-2021	----	10 days	✓	18-Jun-2021	14 days	2 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ3-1-Flow	E611A	07-Jun-2021	16-Jun-2021	----	10 days	✓	18-Jun-2021	14 days	2 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) Equipment Blank	E611A	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) Field Blank	E611A	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ3-15-EBB	E611A	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ3-6-Flow	E611A	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ5-10-EBB	E611A	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ5-1-EBB	E611A	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ5-1-Flow	E611A	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ5-27-Flow	E611A	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ6-12-EBB	E611A	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ6-12-Flow	E611A	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ6-1-EBB	E611A	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ6-1-Flow	E611A	07-Jun-2021	17-Jun-2021	----	11 days	✓	18-Jun-2021	14 days	1 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.

Rec. HT: ALS recommended hold time (see units).

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Work Order	:	VA21B1579
Client	:	Stantec Consulting Ltd.
Project	:	----

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Ammonia by Fluorescence	E298	219186	1	19	5.2	5.0	✓
Bromide in Seawater by IC	E235S.Br	220322	1	20	5.0	5.0	✓
BTEX by Headspace GC-MS	E611A	222717	2	30	6.6	5.0	✓
Chloride in Seawater by IC	E235S.Cl	220323	1	19	5.2	5.0	✓
Dissolved Mercury in Seawater by CVAAS	E509S	225679	1	19	5.2	5.0	✓
Dissolved Metals in Seawater by CRC ICPMS (HMI)	E469S	219675	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	219183	0	19	0.0	5.0	×
Dissolved Sodium and Silicon in Seawater by CRC ICPMS	E469S.NaSi	219674	1	20	5.0	5.0	✓
Fluoride in Seawater by IC	E235S.F	220321	1	20	5.0	5.0	✓
Nitrate in Seawater by IC	E235S.NO3	220319	1	20	5.0	5.0	✓
Nitrite in Seawater by IC	E235S.NO2	220320	1	20	5.0	5.0	✓
pH by Meter	E108	220315	1	20	5.0	5.0	✓
Sulfate in Seawater by IC	E235S.SO4	220318	1	20	5.0	5.0	✓
TDS by Gravimetry (Seawater)	E162S	220721	1	19	5.2	5.0	✓
Total Mercury in Seawater by CVAAS	E508S	223447	1	19	5.2	5.0	✓
Total Metals in Seawater by CRC ICPMS (HMI)	E468S	219754	2	22	9.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	219184	1	19	5.2	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	219185	1	19	5.2	5.0	✓
Total Sodium and Silicon in Seawater by CRC ICPMS	E468S.NaSi	219755	2	20	10.0	5.0	✓
Turbidity by Nephelometry	E121	218856	3	60	5.0	5.0	✓
VH and F1 by Headspace GC-FID	E581.VH+F1	225927	2	19	10.5	5.0	✓
Laboratory Control Samples (LCS)							
Ammonia by Fluorescence	E298	219186	1	19	5.2	5.0	✓
Bromide in Seawater by IC	E235S.Br	220322	1	20	5.0	5.0	✓
BTEX by Headspace GC-MS	E611A	222717	2	30	6.6	5.0	✓
CCME PHC - F2-F4 by GC-FID	E601	219282	2	19	10.5	5.0	✓
Chloride in Seawater by IC	E235S.Cl	220323	1	19	5.2	5.0	✓
Dissolved Mercury in Seawater by CVAAS	E509S	225679	1	19	5.2	5.0	✓
Dissolved Metals in Seawater by CRC ICPMS (HMI)	E469S	219675	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	219183	1	19	5.2	5.0	✓
Dissolved Sodium and Silicon in Seawater by CRC ICPMS	E469S.NaSi	219674	1	20	5.0	5.0	✓
Fluoride in Seawater by IC	E235S.F	220321	1	20	5.0	5.0	✓
Nitrate in Seawater by IC	E235S.NO3	220319	1	20	5.0	5.0	✓
Nitrite in Seawater by IC	E235S.NO2	220320	1	20	5.0	5.0	✓
PAHs by Hexane LVI GC-MS	E641A	219281	2	36	5.5	5.0	✓
pH by Meter	E108	220315	1	20	5.0	5.0	✓
Sulfate in Seawater by IC	E235S.SO4	220318	1	20	5.0	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
TDS by Gravimetry (Seawater)	E162S	220721	1	19	5.2	5.0	✓
Total Mercury in Seawater by CVAAS	E508S	223447	1	19	5.2	5.0	✓
Total Metals in Seawater by CRC ICPMS (HMI)	E468S	219754	2	22	9.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	219184	1	19	5.2	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	219185	1	19	5.2	5.0	✓
Total Sodium and Silicon in Seawater by CRC ICPMS	E468S.NaSi	219755	2	20	10.0	5.0	✓
TSS by Gravimetry (Seawater)	E160S	220261	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	218856	3	60	5.0	5.0	✓
VH and F1 by Headspace GC-FID	E581.VH+F1	225927	2	19	10.5	5.0	✓
Method Blanks (MB)							
Ammonia by Fluorescence	E298	219186	1	19	5.2	5.0	✓
Bromide in Seawater by IC	E235S.Br	220322	1	20	5.0	5.0	✓
BTEX by Headspace GC-MS	E611A	222717	2	30	6.6	5.0	✓
CCME PHC - F2-F4 by GC-FID	E601	219282	2	19	10.5	5.0	✓
Chloride in Seawater by IC	E235S.Cl	220323	1	19	5.2	5.0	✓
Dissolved Mercury in Seawater by CVAAS	E509S	225679	1	19	5.2	5.0	✓
Dissolved Metals in Seawater by CRC ICPMS (HMI)	E469S	219675	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	219183	1	19	5.2	5.0	✓
Dissolved Sodium and Silicon in Seawater by CRC ICPMS	E469S.NaSi	219674	1	20	5.0	5.0	✓
Fluoride in Seawater by IC	E235S.F	220321	1	20	5.0	5.0	✓
Nitrate in Seawater by IC	E235S.NO3	220319	1	20	5.0	5.0	✓
Nitrite in Seawater by IC	E235S.NO2	220320	1	20	5.0	5.0	✓
PAHs by Hexane LVI GC-MS	E641A	219281	2	36	5.5	5.0	✓
Sulfate in Seawater by IC	E235S.SO4	220318	1	20	5.0	5.0	✓
TDS by Gravimetry (Seawater)	E162S	220721	1	19	5.2	5.0	✓
Total Mercury in Seawater by CVAAS	E508S	223447	1	19	5.2	5.0	✓
Total Metals in Seawater by CRC ICPMS (HMI)	E468S	219754	2	22	9.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	219184	1	19	5.2	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	219185	1	19	5.2	5.0	✓
Total Sodium and Silicon in Seawater by CRC ICPMS	E468S.NaSi	219755	2	20	10.0	5.0	✓
TSS by Gravimetry (Seawater)	E160S	220261	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	218856	3	60	5.0	5.0	✓
VH and F1 by Headspace GC-FID	E581.VH+F1	225927	2	19	10.5	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	219186	1	19	5.2	5.0	✓
Bromide in Seawater by IC	E235S.Br	220322	1	20	5.0	5.0	✓
BTEX by Headspace GC-MS	E611A	222717	2	30	6.6	5.0	✓
Chloride in Seawater by IC	E235S.Cl	220323	1	19	5.2	5.0	✓
Dissolved Mercury in Seawater by CVAAS	E509S	225679	1	19	5.2	5.0	✓
Dissolved Metals in Seawater by CRC ICPMS (HMI)	E469S	219675	1	20	5.0	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Matrix Spikes (MS) - Continued							
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	219183	1	19	5.2	5.0	✓
Dissolved Sodium and Silicon in Seawater by CRC ICPMS	E469S.NaSi	219674	1	20	5.0	5.0	✓
Fluoride in Seawater by IC	E235S.F	220321	1	20	5.0	5.0	✓
Nitrate in Seawater by IC	E235S.NO3	220319	1	20	5.0	5.0	✓
Nitrite in Seawater by IC	E235S.NO2	220320	1	20	5.0	5.0	✓
Sulfate in Seawater by IC	E235S.SO4	220318	1	20	5.0	5.0	✓
Total Mercury in Seawater by CVAAS	E508S	223447	1	19	5.2	5.0	✓
Total Metals in Seawater by CRC ICPMS (HMI)	E468S	219754	2	22	9.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	219184	1	19	5.2	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	219185	1	19	5.2	5.0	✓
Total Sodium and Silicon in Seawater by CRC ICPMS	E468S.NaSi	219755	2	20	10.0	5.0	✓
VH and F1 by Headspace GC-FID	E581.VH+F1	225927	0	19	0.0	5.0	×

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
pH by Meter	E108 Vancouver - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Vancouver - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
TSS by Gravimetry (Seawater)	E160S Vancouver - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
TDS by Gravimetry (Seawater)	E162S Vancouver - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
Bromide in Seawater by IC	E235S.Br Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Chloride in Seawater by IC	E235S.Cl Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Seawater by IC	E235S.F Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Seawater by IC	E235S.NO2 Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Seawater by IC	E235S.NO3 Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Seawater by IC	E235S.SO4 Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Ammonia by Fluorescence	E298 Vancouver - Environmental	Water	J. Environ. Monit., 2005, 7, 37-42 (mod)	Ammonia in water is analyzed by flow-injection analysis with fluorescence detection after reaction with orthophthaldialdehyde (OPA).
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L Vancouver - Environmental	Water	APHA 5310 B (mod)	Total Organic Carbon (Non-Purgeable), also known as NPOC (total), is a direct measurement of TOC after an acidified sample has been purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of total carbon (TC) is comprised of IC (which is common), this method is more accurate and more reliable than the TOC by subtraction method (i.e. TC minus TIC).
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Vancouver - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U Vancouver - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Total Metals in Seawater by CRC ICPMS (HMI)	E468S Vancouver - Environmental	Water	EPA 200.2/6020B (mod)	Seawater samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS (HMI Mode). This method is compliant with digestion requirements of the British Columbia Environmental Laboratory Manual.
Total Sodium and Silicon in Seawater by CRC ICPMS	E468S.NaSi Vancouver - Environmental	Water	EPA 200.2/6020B (mod)	Seawater samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. This method is compliant with digestion requirements of the British Columbia Environmental Laboratory Manual.
Dissolved Metals in Seawater by CRC ICPMS (HMI)	E469S Vancouver - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Seawater samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS (HMI Mode).
Dissolved Sodium and Silicon in Seawater by CRC ICPMS	E469S.NaSi Vancouver - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Seawater samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS.
Total Mercury in Seawater by CVAAS	E508S Vancouver - Environmental	Water	EPA 1631E (mod)	Seawater samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
Dissolved Mercury in Seawater by CVAAS	E509S Vancouver - Environmental	Water	APHA 3030B/EPA 1631E (mod)	Seawater samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
VH and F1 by Headspace GC-FID	E581.VH+F1 Vancouver - Environmental	Water	BC MOE Lab Manual / CCME PHC in Soil - Tier 1 (mod)	Volatile Hydrocarbons (VH and F1) is analyzed by static headspace GC-FID. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
CCME PHC - F2-F4 by GC-FID	E601 Vancouver - Environmental	Water	CCME PHC in Soil - Tier 1	CCME Fractions 2-4 (F2-F4) are analyzed by GC-FID.
BTEX by Headspace GC-MS	E611A Vancouver - Environmental	Water	EPA 8260D (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
PAHs by Hexane LVI GC-MS	E641A Vancouver - Environmental	Water	EPA 8270E (mod)	Polycyclic Aromatic Hydrocarbons (PAHs) are analyzed by large volume injection (LVI) GC-MS.
Dissolved Hardness (Calculated)	EC100 Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in $CaCO_3$ equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Hardness (Calculated) from Total Ca/Mg	EC100A Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), from total Ca/Mg" is calculated from the sum of total Calcium and Magnesium concentrations, expressed in $CaCO_3$ equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations. Hardness from total Ca/Mg is normally comparable to Dissolved Hardness in non-turbid waters.
F1-BTEX	EC580 Vancouver - Environmental	Water	CCME PHC in Soil - Tier 1	F1-BTEX is calculated as follows: F1-BTEX = F1 (C6-C10) minus benzene, toluene, ethylbenzene and xylenes (BTEX).
F2 to F3 minus PAH	EC600 Vancouver - Environmental	Water	CCME PHC in Soil - Tier 1	F2-PAH = CCME Fraction 2 (C10-C16) minus Naphthalene F3-PAH = CCME Fraction 3 (C16-C34) minus select Polycyclic Aromatic Hydrocarbons (PAH) as per CCME Soil Tier 1

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Vancouver - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Preparation for Total Organic Carbon by Combustion	EP355 Vancouver - Environmental	Water		Preparation for Total Organic Carbon by Combustion

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Dissolved Organic Carbon for Combustion	EP358 Vancouver - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Phosphorus in water	EP372 Vancouver - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Vancouver - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Dissolved Mercury Water Filtration	EP509 Vancouver - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.
VOCs Preparation for Headspace Analysis	EP581 Vancouver - Environmental	Water	EPA 5021A (mod)	Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler. An aliquot of the headspace is then injected into the GC/MS-FID system.
PHCs and PAHs Hexane Extraction	EP601 Vancouver - Environmental	Water	EPA 3511 (mod)	Petroleum Hydrocarbons (PHCs) and Polycyclic Aromatic Hydrocarbons (PAHs) are extracted using a hexane liquid-liquid extraction.

QUALITY CONTROL REPORT

Work Order	: **VA21B1579**	Page	: 1 of 28
Client	: Stantec Consulting Ltd.	Laboratory	: Vancouver - Environmental
Contact	: Jenny Minford	Account Manager	: Brent Mack
Address	: # 11 - 2042 Mills Road Sidney BC Canada V8L 5X4	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: 778-370-3279
Project	: ----	Date Samples Received	: 09-Jun-2021 17:20
PO	: ----	Date Analysis Commenced	: 11-Jun-2021
C-O-C number	: 20-917635,20-917636	Issue Date	: 28-Jun-2021 15:34
Sampler	: ----		
Site	: ----		
Quote number	: VA21-STAC100-005		
No. of samples received	: 19		
No. of samples analysed	: 19		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits
- Reference Material (RM) Report; Recovery and Acceptance Limits
- Method Blank (MB) Report; Recovery and Acceptance Limits
- Laboratory Control Sample (LCS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Annabelle Prasad	Analyst	Metals, Burnaby, British Columbia
Cindy Tang	Team Leader - Inorganics	Inorganics, Burnaby, British Columbia
Dee Lee	Analyst	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Ophelia Chiu	Department Manager - Organics	Organics, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Tracy Harley	Supervisor - Water Quality Instrumentation	Inorganics, Burnaby, British Columbia

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Work Order	: VA21B1579
Client	: Stantec Consulting Ltd.
Project	: ----

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percentage Difference
# = Indicates a QC result that did not meet the ALS DQO.

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Work Order	: VA21B1579
Client	: Stantec Consulting Ltd.
Project	: ----

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test specific).

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 218856)											
KS2101787-008	Anonymous	turbidity	----	E121	0.10	NTU	0.32	0.33	0.01	Diff <2x LOR	----
Physical Tests (QC Lot: 220315)											
VA21B1397-007	Anonymous	pH	----	E108	0.10	pH units	8.16	8.16	0.00%	4%	----
Physical Tests (QC Lot: 220543)											
FJ2100379-004	Anonymous	turbidity	----	E121	0.10	NTU	0.10	0.10	0.001	Diff <2x LOR	----
Physical Tests (QC Lot: 220688)											
VA21B1579-001	WQ1-1-EBB	turbidity	----	E121	0.10	NTU	9.79	10.0	2.42%	15%	----
Physical Tests (QC Lot: 220721)											
VA21B1579-001	WQ1-1-EBB	solids, total dissolved [TDS]	----	E162S	80	mg/L	11200	11000	2.18%	20%	----
Anions and Nutrients (QC Lot: 219185)											
VA21B1579-001	WQ1-1-EBB	phosphorus, total	7723-14-0	E372-U	0.0040	mg/L	0.0177	0.0166	0.0012	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 219186)											
VA21B1579-001	WQ1-1-EBB	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0051	0.0052	0.00008	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 220318)											
VA21B1579-001	WQ1-1-EBB	sulfate (as SO4)	14808-79-8	E235S.SO4	30	mg/L	847	891	5.10%	20%	----
Anions and Nutrients (QC Lot: 220319)											
VA21B1579-001	WQ1-1-EBB	nitrate (as N)	14797-55-8	E235S.NO3	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 220320)											
VA21B1579-001	WQ1-1-EBB	nitrite (as N)	14797-65-0	E235S.NO2	0.10	mg/L	<0.10	<0.10	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 220321)											
VA21B1579-001	WQ1-1-EBB	fluoride	16984-48-8	E235S.F	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 220322)											
VA21B1579-001	WQ1-1-EBB	bromide	24959-67-9	E235S.Br	5.0	mg/L	20.3	21.2	0.9	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 220323)											
VA21B1579-001	WQ1-1-EBB	chloride	16887-00-6	E235S.Cl	50	mg/L	5980	6310	5.26%	20%	----
Organic / Inorganic Carbon (QC Lot: 219184)											
VA21B1579-001	WQ1-1-EBB	carbon, total organic [TOC]	----	E355-L	0.50	mg/L	2.00	2.19	0.19	Diff <2x LOR	----
Total Metals (QC Lot: 219754)											
VA21B1472-001	Anonymous	aluminum, total	7429-90-5	E468S	0.0050	mg/L	0.905	0.889	1.79%	20%	----
		antimony, total	7440-36-0	E468S	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		arsenic, total	7440-38-2	E468S	0.00040	mg/L	0.00102	0.00106	0.00004	Diff <2x LOR	----

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Work Order : VA21B1579
Client : Stantec Consulting Ltd.
Project : ----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Total Metals (QC Lot: 219754) - continued											
VA21B1472-001	Anonymous	barium, total	7440-39-3	E468S	0.0010	mg/L	0.105	0.104	0.841%	20%	----
		beryllium, total	7440-41-7	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E468S	0.30	mg/L	<0.30	<0.30	0	Diff <2x LOR	----
		cadmium, total	7440-43-9	E468S	0.000010	mg/L	0.000065	0.000064	0.0000003	Diff <2x LOR	----
		calcium, total	7440-70-2	E468S	1.0	mg/L	41.8	42.5	1.65%	20%	----
		cesium, total	7440-46-2	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		chromium, total	7440-47-3	E468S	0.00050	mg/L	0.00108	0.00103	0.00005	Diff <2x LOR	----
		cobalt, total	7440-48-4	E468S	0.000050	mg/L	0.00134	0.00131	2.36%	20%	----
		copper, total	7440-50-8	E468S	0.00050	mg/L	0.00497	0.00489	0.00008	Diff <2x LOR	----
		gallium, total	7440-55-3	E468S	0.00050	mg/L	0.00053	<0.00050	0.00003	Diff <2x LOR	----
		iron, total	7439-89-6	E468S	0.010	mg/L	1.47	1.45	1.57%	20%	----
		lead, total	7439-92-1	E468S	0.000050	mg/L	0.00139	0.00141	1.09%	20%	----
		lithium, total	7439-93-2	E468S	0.020	mg/L	<0.020	<0.020	0	Diff <2x LOR	----
		magnesium, total	7439-95-4	E468S	1.0	mg/L	11.1	10.9	1.94%	20%	----
		manganese, total	7439-96-5	E468S	0.00020	mg/L	0.312	0.311	0.558%	20%	----
		molybdenum, total	7439-98-7	E468S	0.00010	mg/L	0.00163	0.00159	2.61%	20%	----
		nickel, total	7440-02-0	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		phosphorus, total	7723-14-0	E468S	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		potassium, total	7440-09-7	E468S	1.0	mg/L	5.2	5.2	0.10	Diff <2x LOR	----
		rhenium, total	7440-15-5	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		rubidium, total	7440-17-7	E468S	0.0050	mg/L	0.0056	0.0056	0.00004	Diff <2x LOR	----
		selenium, total	7782-49-2	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		silver, total	7440-22-4	E468S	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		strontium, total	7440-24-6	E468S	0.010	mg/L	0.366	0.370	1.12%	20%	----
		sulfur, total	7704-34-9	E468S	5.0	mg/L	11.1	10.9	0.3	Diff <2x LOR	----
		tellurium, total	13494-80-9	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		thallium, total	7440-28-0	E468S	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		thorium, total	7440-29-1	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		tin, total	7440-31-5	E468S	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E468S	0.0050	mg/L	0.0265	0.0263	0.0002	Diff <2x LOR	----
		tungsten, total	7440-33-7	E468S	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E468S	0.000050	mg/L	0.000386	0.000392	0.000006	Diff <2x LOR	----
		vanadium, total	7440-62-2	E468S	0.00050	mg/L	0.00357	0.00349	0.00008	Diff <2x LOR	----
		yttrium, total	7440-65-5	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----

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Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Total Metals (QC Lot: 219754) - continued											
VA21B1472-001	Anonymous	zinc, total	7440-66-6	E468S	0.0030	mg/L	0.0114	0.0121	0.0007	Diff <2x LOR	----
		zirconium, total	7440-67-7	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
Total Metals (QC Lot: 219755)											
VA21B1472-001	Anonymous	silicon, total	7440-21-3	E468S.NaSi	1.0	mg/L	6.3	7.6	1.2	Diff <2x LOR	----
		sodium, total	17341-25-2	E468S.NaSi	2.5	mg/L	121	127	5.04%	20%	----
Total Metals (QC Lot: 220702)											
VA21B1579-019	Equipment Blank	aluminum, total	7429-90-5	E468S	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
		antimony, total	7440-36-0	E468S	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		arsenic, total	7440-38-2	E468S	0.00040	mg/L	<0.00040	<0.00040	0	Diff <2x LOR	----
		barium, total	7440-39-3	E468S	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		beryllium, total	7440-41-7	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E468S	0.30	mg/L	<0.30	<0.30	0	Diff <2x LOR	----
		cadmium, total	7440-43-9	E468S	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		calcium, total	7440-70-2	E468S	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		cesium, total	7440-46-2	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		chromium, total	7440-47-3	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, total	7440-48-4	E468S	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		copper, total	7440-50-8	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		gallium, total	7440-55-3	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		iron, total	7439-89-6	E468S	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, total	7439-92-1	E468S	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, total	7439-93-2	E468S	0.020	mg/L	<0.020	<0.020	0	Diff <2x LOR	----
		magnesium, total	7439-95-4	E468S	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		manganese, total	7439-96-5	E468S	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		molybdenum, total	7439-98-7	E468S	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		nickel, total	7440-02-0	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		phosphorus, total	7723-14-0	E468S	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		potassium, total	7440-09-7	E468S	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		rhenium, total	7440-15-5	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		rubidium, total	7440-17-7	E468S	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
		selenium, total	7782-49-2	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		silver, total	7440-22-4	E468S	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		strontium, total	7440-24-6	E468S	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		sulfur, total	7704-34-9	E468S	5.0	mg/L	<5.0	<5.0	0	Diff <2x LOR	----

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Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Total Metals (QC Lot: 220702) - continued											
VA21B1579-019	Equipment Blank	tellurium, total	13494-80-9	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		thallium, total	7440-28-0	E468S	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		thorium, total	7440-29-1	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		tin, total	7440-31-5	E468S	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E468S	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
		tungsten, total	7440-33-7	E468S	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E468S	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		vanadium, total	7440-62-2	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		yttrium, total	7440-65-5	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E468S	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
		zirconium, total	7440-67-7	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
Total Metals (QC Lot: 220703)											
VA21B1579-019	Equipment Blank	silicon, total	7440-21-3	E468S.NaSi	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		sodium, total	17341-25-2	E468S.NaSi	2.5	mg/L	<2.5	<2.5	0	Diff <2x LOR	----
Total Metals (QC Lot: 223447)											
VA21B1579-001	WQ1-1-EBB	mercury, total	7439-97-6	E508S	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 219674)											
VA21B1579-001	WQ1-1-EBB	silicon, dissolved	7440-21-3	E469S.NaSi	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		sodium, dissolved	17341-25-2	E469S.NaSi	2.5	mg/L	3210	3240	0.910%	20%	----
Dissolved Metals (QC Lot: 219675)											
VA21B1579-001	WQ1-1-EBB	aluminum, dissolved	7429-90-5	E469S	0.0050	mg/L	0.0254	0.0220	0.0034	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E469S	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E469S	0.00040	mg/L	0.00062	0.00061	0.00001	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E469S	0.0010	mg/L	0.0234	0.0235	0.456%	20%	----
		beryllium, dissolved	7440-41-7	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E469S	0.30	mg/L	1.39	1.39	0.001	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E469S	0.000010	mg/L	0.000040	0.000040	0.0000001	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E469S	1.0	mg/L	127	126	0.857%	20%	----
		cesium, dissolved	7440-46-2	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		chromium, dissolved	7440-47-3	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, dissolved	7440-48-4	E469S	0.000050	mg/L	0.000086	0.000076	0.000010	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E469S	0.00020	mg/L	0.00054	0.00058	0.00003	Diff <2x LOR	----
		gallium, dissolved	7440-55-3	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E469S	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----

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Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Dissolved Metals (QC Lot: 219675) - continued											
VA21B1579-001	WQ1-1-EBB	lead, dissolved	7439-92-1	E469S	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E469S	0.020	mg/L	0.050	0.050	0.0006	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E469S	1.0	mg/L	361	364	0.583%	20%	----
		manganese, dissolved	7439-96-5	E469S	0.00010	mg/L	0.0126	0.0122	3.14%	20%	----
		molybdenum, dissolved	7439-98-7	E469S	0.00010	mg/L	0.00365	0.00369	0.917%	20%	----
		nickel, dissolved	7440-02-0	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		phosphorus, dissolved	7723-14-0	E469S	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E469S	1.0	mg/L	119	118	1.14%	20%	----
		rhenium, dissolved	7440-15-5	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		rubidium, dissolved	7440-17-7	E469S	0.0050	mg/L	0.0350	0.0338	0.0012	Diff <2x LOR	----
		selenium, dissolved	7782-49-2	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		silver, dissolved	7440-22-4	E469S	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		strontium, dissolved	7440-24-6	E469S	0.010	mg/L	2.31	2.38	2.85%	20%	----
		sulfur, dissolved	7704-34-9	E469S	5.0	mg/L	283	291	2.77%	20%	----
		tellurium, dissolved	13494-80-9	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		thallium, dissolved	7440-28-0	E469S	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		thorium, dissolved	7440-29-1	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E469S	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E469S	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
		tungsten, dissolved	7440-33-7	E469S	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E469S	0.000050	mg/L	0.000966	0.000935	3.23%	20%	----
		vanadium, dissolved	7440-62-2	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		yttrium, dissolved	7440-65-5	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E469S	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		zirconium, dissolved	7440-67-7	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 225679)											
VA21B1579-001	WQ1-1-EBB	mercury, dissolved	7439-97-6	E509S	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Volatile Organic Compounds (QC Lot: 222717)											
VA21B1579-001	WQ1-1-EBB	benzene	71-43-2	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		ethylbenzene	100-41-4	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		styrene	100-42-5	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		toluene	108-88-3	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		xylene, m+p-	179601-23-1	E611A	0.40	µg/L	<0.40	<0.40	0	Diff <2x LOR	----
		xylene, o-	95-47-6	E611A	0.30	µg/L	<0.30	<0.30	0	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Volatile Organic Compounds (QC Lot: 224056)											
VA21B1579-008	WQ3-15-EBB	benzene	71-43-2	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		ethylbenzene	100-41-4	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		styrene	100-42-5	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		toluene	108-88-3	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		xylene, m+p-	179601-23-1	E611A	0.40	µg/L	<0.40	<0.40	0	Diff <2x LOR	----
		xylene, o-	95-47-6	E611A	0.30	µg/L	<0.30	<0.30	0	Diff <2x LOR	----
Hydrocarbons (QC Lot: 225927)											
VA21B1579-001	WQ1-1-EBB	F1 (C6-C10)	----	E581.VH+F1	100	µg/L	<100	<100	0.0%	30%	----
Hydrocarbons (QC Lot: 225940)											
VA21B1579-008	WQ3-15-EBB	F1 (C6-C10)	----	E581.VH+F1	100	µg/L	<100	<100	0.0%	30%	----

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Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 218856)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 220261)						
solids, total suspended [TSS]	----	E160S	2	mg/L	<2.0	----
Physical Tests (QCLot: 220543)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 220688)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 220721)						
solids, total dissolved [TDS]	----	E162S	10	mg/L	<10	----
Anions and Nutrients (QCLot: 219185)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0040	----
Anions and Nutrients (QCLot: 219186)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 220318)						
sulfate (as SO4)	14808-79-8	E235S.SO4	30	mg/L	<30	----
Anions and Nutrients (QCLot: 220319)						
nitrate (as N)	14797-55-8	E235S.NO3	0.5	mg/L	<0.50	----
Anions and Nutrients (QCLot: 220320)						
nitrite (as N)	14797-65-0	E235S.NO2	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 220321)						
fluoride	16984-48-8	E235S.F	1	mg/L	<1.0	----
Anions and Nutrients (QCLot: 220322)						
bromide	24959-67-9	E235S.Br	5	mg/L	<5.0	----
Anions and Nutrients (QCLot: 220323)						
chloride	16887-00-6	E235S.Cl	50	mg/L	<50	----
Organic / Inorganic Carbon (QCLot: 219183)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 219184)						
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 219754)						
aluminum, total	7429-90-5	E468S	0.005	mg/L	<0.0050	----
antimony, total	7440-36-0	E468S	0.001	mg/L	<0.0010	----
arsenic, total	7440-38-2	E468S	0.0004	mg/L	<0.00040	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 219754) - continued						
barium, total	7440-39-3	E468S	0.001	mg/L	<0.0010	----
beryllium, total	7440-41-7	E468S	0.0005	mg/L	<0.00050	----
bismuth, total	7440-69-9	E468S	0.0005	mg/L	<0.00050	----
boron, total	7440-42-8	E468S	0.3	mg/L	<0.30	----
cadmium, total	7440-43-9	E468S	0.00001	mg/L	<0.000010	----
calcium, total	7440-70-2	E468S	1	mg/L	<1.0	----
cesium, total	7440-46-2	E468S	0.0005	mg/L	<0.00050	----
chromium, total	7440-47-3	E468S	0.0005	mg/L	<0.00050	----
cobalt, total	7440-48-4	E468S	0.00005	mg/L	<0.000050	----
copper, total	7440-50-8	E468S	0.0005	mg/L	<0.00050	----
gallium, total	7440-55-3	E468S	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E468S	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E468S	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E468S	0.02	mg/L	<0.020	----
magnesium, total	7439-95-4	E468S	1	mg/L	<1.0	----
manganese, total	7439-96-5	E468S	0.0002	mg/L	<0.00020	----
molybdenum, total	7439-98-7	E468S	0.0001	mg/L	<0.00010	----
nickel, total	7440-02-0	E468S	0.0005	mg/L	<0.00050	----
phosphorus, total	7723-14-0	E468S	0.05	mg/L	<0.050	----
potassium, total	7440-09-7	E468S	1	mg/L	<1.0	----
rhenium, total	7440-15-5	E468S	0.0005	mg/L	<0.00050	----
rubidium, total	7440-17-7	E468S	0.005	mg/L	<0.0050	----
selenium, total	7782-49-2	E468S	0.0005	mg/L	<0.00050	----
silver, total	7440-22-4	E468S	0.0001	mg/L	<0.00010	----
strontium, total	7440-24-6	E468S	0.01	mg/L	<0.010	----
sulfur, total	7704-34-9	E468S	5	mg/L	<5.0	----
tellurium, total	13494-80-9	E468S	0.0005	mg/L	<0.00050	----
thallium, total	7440-28-0	E468S	0.00005	mg/L	<0.000050	----
thorium, total	7440-29-1	E468S	0.0005	mg/L	<0.00050	----
tin, total	7440-31-5	E468S	0.001	mg/L	<0.0010	----
titanium, total	7440-32-6	E468S	0.005	mg/L	<0.0050	----
tungsten, total	7440-33-7	E468S	0.001	mg/L	<0.0010	----
uranium, total	7440-61-1	E468S	0.00005	mg/L	<0.000050	----
vanadium, total	7440-62-2	E468S	0.0005	mg/L	<0.00050	----
yttrium, total	7440-65-5	E468S	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E468S	0.003	mg/L	<0.0030	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 219754) - continued						
zirconium, total	7440-67-7	E468S	0.0005	mg/L	<0.00050	----
Total Metals (QCLot: 219755)						
silicon, total	7440-21-3	E468S.NaSi	1	mg/L	<1.0	----
sodium, total	17341-25-2	E468S.NaSi	2.5	mg/L	<2.5	----
Total Metals (QCLot: 220702)						
aluminum, total	7429-90-5	E468S	0.005	mg/L	<0.0050	----
antimony, total	7440-36-0	E468S	0.001	mg/L	<0.0010	----
arsenic, total	7440-38-2	E468S	0.0004	mg/L	<0.00040	----
barium, total	7440-39-3	E468S	0.001	mg/L	<0.0010	----
beryllium, total	7440-41-7	E468S	0.0005	mg/L	<0.00050	----
bismuth, total	7440-69-9	E468S	0.0005	mg/L	<0.00050	----
boron, total	7440-42-8	E468S	0.3	mg/L	<0.30	----
cadmium, total	7440-43-9	E468S	0.00001	mg/L	<0.000010	----
calcium, total	7440-70-2	E468S	1	mg/L	<1.0	----
cesium, total	7440-46-2	E468S	0.0005	mg/L	<0.00050	----
chromium, total	7440-47-3	E468S	0.0005	mg/L	<0.00050	----
cobalt, total	7440-48-4	E468S	0.00005	mg/L	<0.000050	----
copper, total	7440-50-8	E468S	0.0005	mg/L	<0.00050	----
gallium, total	7440-55-3	E468S	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E468S	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E468S	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E468S	0.02	mg/L	<0.020	----
magnesium, total	7439-95-4	E468S	1	mg/L	<1.0	----
manganese, total	7439-96-5	E468S	0.0002	mg/L	<0.00020	----
molybdenum, total	7439-98-7	E468S	0.0001	mg/L	<0.00010	----
nickel, total	7440-02-0	E468S	0.0005	mg/L	<0.00050	----
phosphorus, total	7723-14-0	E468S	0.05	mg/L	<0.050	----
potassium, total	7440-09-7	E468S	1	mg/L	<1.0	----
rhenium, total	7440-15-5	E468S	0.0005	mg/L	<0.00050	----
rubidium, total	7440-17-7	E468S	0.005	mg/L	<0.0050	----
selenium, total	7782-49-2	E468S	0.0005	mg/L	<0.00050	----
silver, total	7440-22-4	E468S	0.0001	mg/L	<0.00010	----
strontium, total	7440-24-6	E468S	0.01	mg/L	<0.010	----
sulfur, total	7704-34-9	E468S	5	mg/L	<5.0	----
tellurium, total	13494-80-9	E468S	0.0005	mg/L	<0.00050	----
thallium, total	7440-28-0	E468S	0.00005	mg/L	<0.000050	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 220702) - continued						
thorium, total	7440-29-1	E468S	0.0005	mg/L	<0.00050	----
tin, total	7440-31-5	E468S	0.001	mg/L	<0.0010	----
titanium, total	7440-32-6	E468S	0.005	mg/L	<0.0050	----
tungsten, total	7440-33-7	E468S	0.001	mg/L	<0.0010	----
uranium, total	7440-61-1	E468S	0.00005	mg/L	<0.000050	----
vanadium, total	7440-62-2	E468S	0.0005	mg/L	<0.00050	----
yttrium, total	7440-65-5	E468S	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E468S	0.003	mg/L	<0.0030	----
zirconium, total	7440-67-7	E468S	0.0005	mg/L	<0.00050	----
Total Metals (QCLot: 220703)						
silicon, total	7440-21-3	E468S.NaSi	1	mg/L	<1.0	----
sodium, total	17341-25-2	E468S.NaSi	2.5	mg/L	<2.5	----
Total Metals (QCLot: 223447)						
mercury, total	7439-97-6	E508S	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 219674)						
silicon, dissolved	7440-21-3	E469S.NaSi	1	mg/L	<1.0	----
sodium, dissolved	17341-25-2	E469S.NaSi	2.5	mg/L	<2.5	----
Dissolved Metals (QCLot: 219675)						
aluminum, dissolved	7429-90-5	E469S	0.005	mg/L	<0.0050	----
antimony, dissolved	7440-36-0	E469S	0.001	mg/L	<0.0010	----
arsenic, dissolved	7440-38-2	E469S	0.0004	mg/L	<0.00040	----
barium, dissolved	7440-39-3	E469S	0.001	mg/L	<0.0010	----
beryllium, dissolved	7440-41-7	E469S	0.0005	mg/L	<0.00050	----
bismuth, dissolved	7440-69-9	E469S	0.0005	mg/L	<0.00050	----
boron, dissolved	7440-42-8	E469S	0.3	mg/L	<0.30	----
cadmium, dissolved	7440-43-9	E469S	0.00001	mg/L	<0.000010	----
calcium, dissolved	7440-70-2	E469S	1	mg/L	<1.0	----
cesium, dissolved	7440-46-2	E469S	0.0005	mg/L	<0.00050	----
chromium, dissolved	7440-47-3	E469S	0.0005	mg/L	<0.00050	----
cobalt, dissolved	7440-48-4	E469S	0.00005	mg/L	<0.000050	----
copper, dissolved	7440-50-8	E469S	0.0002	mg/L	<0.00020	----
gallium, dissolved	7440-55-3	E469S	0.0005	mg/L	<0.00050	----
iron, dissolved	7439-89-6	E469S	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E469S	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E469S	0.02	mg/L	<0.020	----
magnesium, dissolved	7439-95-4	E469S	1	mg/L	<1.0	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 219675) - continued						
manganese, dissolved	7439-96-5	E469S	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E469S	0.0001	mg/L	<0.00010	----
nickel, dissolved	7440-02-0	E469S	0.0005	mg/L	<0.00050	----
phosphorus, dissolved	7723-14-0	E469S	0.05	mg/L	<0.050	----
potassium, dissolved	7440-09-7	E469S	1	mg/L	<1.0	----
rhenium, dissolved	7440-15-5	E469S	0.0005	mg/L	<0.00050	----
rubidium, dissolved	7440-17-7	E469S	0.005	mg/L	<0.0050	----
selenium, dissolved	7782-49-2	E469S	0.0005	mg/L	<0.00050	----
silver, dissolved	7440-22-4	E469S	0.0001	mg/L	<0.00010	----
strontium, dissolved	7440-24-6	E469S	0.01	mg/L	<0.010	----
sulfur, dissolved	7704-34-9	E469S	5	mg/L	<5.0	----
tellurium, dissolved	13494-80-9	E469S	0.0005	mg/L	<0.00050	----
thallium, dissolved	7440-28-0	E469S	0.00005	mg/L	<0.000050	----
thorium, dissolved	7440-29-1	E469S	0.0005	mg/L	<0.00050	----
tin, dissolved	7440-31-5	E469S	0.001	mg/L	<0.0010	----
titanium, dissolved	7440-32-6	E469S	0.005	mg/L	<0.0050	----
tungsten, dissolved	7440-33-7	E469S	0.001	mg/L	<0.0010	----
uranium, dissolved	7440-61-1	E469S	0.00005	mg/L	<0.000050	----
vanadium, dissolved	7440-62-2	E469S	0.0005	mg/L	<0.00050	----
yttrium, dissolved	7440-65-5	E469S	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E469S	0.001	mg/L	<0.0010	----
zirconium, dissolved	7440-67-7	E469S	0.0005	mg/L	<0.00050	----
Dissolved Metals (QCLot: 225679)						
mercury, dissolved	7439-97-6	E509S	0.000005	mg/L	<0.0000050	----
Volatile Organic Compounds (QCLot: 222717)						
benzene	71-43-2	E611A	0.5	µg/L	<0.50	----
ethylbenzene	100-41-4	E611A	0.5	µg/L	<0.50	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.5	µg/L	<0.50	----
styrene	100-42-5	E611A	0.5	µg/L	<0.50	----
toluene	108-88-3	E611A	0.5	µg/L	<0.50	----
xylene, m+p-	179601-23-1	E611A	0.4	µg/L	<0.40	----
xylene, o-	95-47-6	E611A	0.3	µg/L	<0.30	----
Volatile Organic Compounds (QCLot: 224056)						
benzene	71-43-2	E611A	0.5	µg/L	<0.50	----
ethylbenzene	100-41-4	E611A	0.5	µg/L	<0.50	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.5	µg/L	<0.50	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Volatile Organic Compounds (QCLot: 224056) - continued						
styrene	100-42-5	E611A	0.5	µg/L	<0.50	----
toluene	108-88-3	E611A	0.5	µg/L	<0.50	----
xylene, m+p-	179601-23-1	E611A	0.4	µg/L	<0.40	----
xylene, o-	95-47-6	E611A	0.3	µg/L	<0.30	----
Hydrocarbons (QCLot: 219282)						
F2 (C10-C16)	----	E601	100	µg/L	<100	----
F3 (C16-C34)	----	E601	250	µg/L	<250	----
F4 (C34-C50)	----	E601	250	µg/L	<250	----
Hydrocarbons (QCLot: 222428)						
F2 (C10-C16)	----	E601	100	µg/L	<100	----
F3 (C16-C34)	----	E601	250	µg/L	<250	----
F4 (C34-C50)	----	E601	250	µg/L	<250	----
Hydrocarbons (QCLot: 225927)						
F1 (C6-C10)	----	E581.VH+F1	100	µg/L	<100	----
Hydrocarbons (QCLot: 225940)						
F1 (C6-C10)	----	E581.VH+F1	100	µg/L	<100	----
Polycyclic Aromatic Hydrocarbons (QCLot: 219281)						
acenaphthene	83-32-9	E641A	0.01	µg/L	<0.010	----
acenaphthylene	208-96-8	E641A	0.01	µg/L	<0.010	----
acridine	260-94-6	E641A	0.01	µg/L	<0.010	----
anthracene	120-12-7	E641A	0.01	µg/L	<0.010	----
benz(a)anthracene	56-55-3	E641A	0.01	µg/L	<0.010	----
benzo(a)pyrene	50-32-8	E641A	0.005	µg/L	<0.0050	----
benzo(b+j)fluoranthene	----	E641A	0.01	µg/L	<0.010	----
benzo(g,h,i)perylene	191-24-2	E641A	0.01	µg/L	<0.010	----
benzo(k)fluoranthene	207-08-9	E641A	0.01	µg/L	<0.010	----
chrysene	218-01-9	E641A	0.01	µg/L	<0.010	----
dibenz(a,h)anthracene	53-70-3	E641A	0.005	µg/L	<0.0050	----
fluoranthene	206-44-0	E641A	0.01	µg/L	<0.010	----
fluorene	86-73-7	E641A	0.01	µg/L	<0.010	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.01	µg/L	<0.010	----
methylnaphthalene, 1-	90-12-0	E641A	0.01	µg/L	<0.010	----
methylnaphthalene, 2-	91-57-6	E641A	0.01	µg/L	<0.010	----
naphthalene	91-20-3	E641A	0.05	µg/L	<0.050	----
phenanthrene	85-01-8	E641A	0.02	µg/L	<0.020	----
pyrene	129-00-0	E641A	0.01	µg/L	<0.010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Polycyclic Aromatic Hydrocarbons (QCLot: 219281) - continued						
quinoline	6027-02-7	E641A	0.05	µg/L	<0.050	----
Polycyclic Aromatic Hydrocarbons (QCLot: 222426)						
acenaphthene	83-32-9	E641A	0.01	µg/L	<0.010	----
acenaphthylene	208-96-8	E641A	0.01	µg/L	<0.010	----
acridine	260-94-6	E641A	0.01	µg/L	<0.010	----
anthracene	120-12-7	E641A	0.01	µg/L	<0.010	----
benz(a)anthracene	56-55-3	E641A	0.01	µg/L	<0.010	----
benzo(a)pyrene	50-32-8	E641A	0.005	µg/L	<0.0050	----
benzo(b+j)fluoranthene	----	E641A	0.01	µg/L	<0.010	----
benzo(g,h,i)perylene	191-24-2	E641A	0.01	µg/L	<0.010	----
benzo(k)fluoranthene	207-08-9	E641A	0.01	µg/L	<0.010	----
chrysene	218-01-9	E641A	0.01	µg/L	<0.010	----
dibenz(a,h)anthracene	53-70-3	E641A	0.005	µg/L	<0.0050	----
fluoranthene	206-44-0	E641A	0.01	µg/L	<0.010	----
fluorene	86-73-7	E641A	0.01	µg/L	<0.010	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.01	µg/L	<0.010	----
methylnaphthalene, 1-	90-12-0	E641A	0.01	µg/L	<0.010	----
methylnaphthalene, 2-	91-57-6	E641A	0.01	µg/L	<0.010	----
naphthalene	91-20-3	E641A	0.05	µg/L	<0.050	----
phenanthrene	85-01-8	E641A	0.02	µg/L	<0.020	----
pyrene	129-00-0	E641A	0.01	µg/L	<0.010	----
quinoline	6027-02-7	E641A	0.05	µg/L	<0.050	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 218856)									
turbidity	----	E121	0.1	NTU	200 NTU	103	85.0	115	----
Physical Tests (QCLot: 220261)									
solids, total suspended [TSS]	----	E160S	2	mg/L	150 mg/L	95.8	85.0	115	----
Physical Tests (QCLot: 220315)									
pH	----	E108	----	pH units	7 pH units	100	98.0	102	----
Physical Tests (QCLot: 220543)									
turbidity	----	E121	0.1	NTU	200 NTU	100	85.0	115	----
Physical Tests (QCLot: 220688)									
turbidity	----	E121	0.1	NTU	200 NTU	101	85.0	115	----
Physical Tests (QCLot: 220721)									
solids, total dissolved [TDS]	----	E162S	10	mg/L	1000 mg/L	98.5	85.0	115	----
Anions and Nutrients (QCLot: 219185)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.05 mg/L	91.3	80.0	120	----
Anions and Nutrients (QCLot: 219186)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	102	85.0	115	----
Anions and Nutrients (QCLot: 220318)									
sulfate (as SO4)	14808-79-8	E235S.SO4	30	mg/L	100 mg/L	105	90.0	110	----
Anions and Nutrients (QCLot: 220319)									
nitrate (as N)	14797-55-8	E235S.NO3	0.5	mg/L	2.5 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 220320)									
nitrite (as N)	14797-65-0	E235S.NO2	0.1	mg/L	0.5 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 220321)									
fluoride	16984-48-8	E235S.F	1	mg/L	1 mg/L	99.8	90.0	110	----
Anions and Nutrients (QCLot: 220322)									
bromide	24959-67-9	E235S.Br	5	mg/L	0.5 mg/L	98.5	85.0	115	----
Anions and Nutrients (QCLot: 220323)									
chloride	16887-00-6	E235S.Cl	50	mg/L	100 mg/L	102	90.0	110	----
Organic / Inorganic Carbon (QCLot: 219183)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	96.7	80.0	120	----
Organic / Inorganic Carbon (QCLot: 219184)									
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	8.57 mg/L	103	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Total Metals (QCLot: 219754)									
aluminum, total	7429-90-5	E468S	0.005	mg/L	2 mg/L	99.0	80.0	120	----
antimony, total	7440-36-0	E468S	0.001	mg/L	1 mg/L	104	80.0	120	----
arsenic, total	7440-38-2	E468S	0.0004	mg/L	1 mg/L	98.2	80.0	120	----
barium, total	7440-39-3	E468S	0.001	mg/L	0.25 mg/L	99.3	80.0	120	----
beryllium, total	7440-41-7	E468S	0.0005	mg/L	0.1 mg/L	108	80.0	120	----
bismuth, total	7440-69-9	E468S	0.0005	mg/L	1 mg/L	113	80.0	120	----
boron, total	7440-42-8	E468S	0.3	mg/L	10 mg/L	104	80.0	120	----
cadmium, total	7440-43-9	E468S	0.00001	mg/L	0.1 mg/L	103	80.0	120	----
calcium, total	7440-70-2	E468S	1	mg/L	50 mg/L	105	80.0	120	----
cesium, total	7440-46-2	E468S	0.0005	mg/L	0.05 mg/L	103	80.0	120	----
chromium, total	7440-47-3	E468S	0.0005	mg/L	0.25 mg/L	104	80.0	120	----
cobalt, total	7440-48-4	E468S	0.00005	mg/L	0.25 mg/L	105	80.0	120	----
copper, total	7440-50-8	E468S	0.0005	mg/L	0.25 mg/L	108	80.0	120	----
gallium, total	7440-55-3	E468S	0.0005	mg/L	0.25 mg/L	102	80.0	120	----
iron, total	7439-89-6	E468S	0.01	mg/L	1 mg/L	104	80.0	120	----
lead, total	7439-92-1	E468S	0.00005	mg/L	0.5 mg/L	109	80.0	120	----
lithium, total	7439-93-2	E468S	0.02	mg/L	0.25 mg/L	105	80.0	120	----
magnesium, total	7439-95-4	E468S	1	mg/L	50 mg/L	88.2	80.0	120	----
manganese, total	7439-96-5	E468S	0.0002	mg/L	0.25 mg/L	100	80.0	120	----
molybdenum, total	7439-98-7	E468S	0.0001	mg/L	0.25 mg/L	102	80.0	120	----
nickel, total	7440-02-0	E468S	0.0005	mg/L	0.5 mg/L	106	80.0	120	----
phosphorus, total	7723-14-0	E468S	0.05	mg/L	10 mg/L	90.0	80.0	120	----
potassium, total	7440-09-7	E468S	1	mg/L	50 mg/L	96.6	80.0	120	----
rhenium, total	7440-15-5	E468S	0.0005	mg/L	0.1 mg/L	99.9	80.0	120	----
rubidium, total	7440-17-7	E468S	0.005	mg/L	0.1 mg/L	101	80.0	120	----
selenium, total	7782-49-2	E468S	0.0005	mg/L	1 mg/L	109	80.0	120	----
silver, total	7440-22-4	E468S	0.0001	mg/L	0.1 mg/L	104	80.0	120	----
strontium, total	7440-24-6	E468S	0.01	mg/L	0.25 mg/L	101	80.0	120	----
sulfur, total	7704-34-9	E468S	5	mg/L	50 mg/L	83.8	80.0	120	----
tellurium, total	13494-80-9	E468S	0.0005	mg/L	0.1 mg/L	114	80.0	120	----
thallium, total	7440-28-0	E468S	0.00005	mg/L	1 mg/L	111	80.0	120	----
thorium, total	7440-29-1	E468S	0.0005	mg/L	0.1 mg/L	97.9	80.0	120	----
tin, total	7440-31-5	E468S	0.001	mg/L	0.5 mg/L	99.4	80.0	120	----
titanium, total	7440-32-6	E468S	0.005	mg/L	0.25 mg/L	93.4	80.0	120	----
tungsten, total	7440-33-7	E468S	0.001	mg/L	0.1 mg/L	104	80.0	120	----
uranium, total	7440-61-1	E468S	0.00005	mg/L	0.005 mg/L	102	80.0	120	----
vanadium, total	7440-62-2	E468S	0.0005	mg/L	0.5 mg/L	99.6	80.0	120	----
yttrium, total	7440-65-5	E468S	0.0005	mg/L	0.1 mg/L	97.4	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Total Metals (QCLot: 219754) - continued									
zinc, total	7440-66-6	E468S	0.003	mg/L	0.5 mg/L	96.4	80.0	120	----
zirconium, total	7440-67-7	E468S	0.0005	mg/L	0.1 mg/L	95.6	80.0	120	----
Total Metals (QCLot: 219755)									
silicon, total	7440-21-3	E468S.NaSi	1	mg/L	10 mg/L	98.5	80.0	120	----
sodium, total	17341-25-2	E468S.NaSi	2.5	mg/L	50 mg/L	106	80.0	120	----
Total Metals (QCLot: 220702)									
aluminum, total	7429-90-5	E468S	0.005	mg/L	2 mg/L	103	80.0	120	----
antimony, total	7440-36-0	E468S	0.001	mg/L	1 mg/L	113	80.0	120	----
arsenic, total	7440-38-2	E468S	0.0004	mg/L	1 mg/L	104	80.0	120	----
barium, total	7440-39-3	E468S	0.001	mg/L	0.25 mg/L	108	80.0	120	----
beryllium, total	7440-41-7	E468S	0.0005	mg/L	0.1 mg/L	107	80.0	120	----
bismuth, total	7440-69-9	E468S	0.0005	mg/L	1 mg/L	114	80.0	120	----
boron, total	7440-42-8	E468S	0.3	mg/L	10 mg/L	103	80.0	120	----
cadmium, total	7440-43-9	E468S	0.00001	mg/L	0.1 mg/L	108	80.0	120	----
calcium, total	7440-70-2	E468S	1	mg/L	50 mg/L	106	80.0	120	----
cesium, total	7440-46-2	E468S	0.0005	mg/L	0.05 mg/L	108	80.0	120	----
chromium, total	7440-47-3	E468S	0.0005	mg/L	0.25 mg/L	109	80.0	120	----
cobalt, total	7440-48-4	E468S	0.00005	mg/L	0.25 mg/L	112	80.0	120	----
copper, total	7440-50-8	E468S	0.0005	mg/L	0.25 mg/L	112	80.0	120	----
gallium, total	7440-55-3	E468S	0.0005	mg/L	0.25 mg/L	114	80.0	120	----
iron, total	7439-89-6	E468S	0.01	mg/L	1 mg/L	108	80.0	120	----
lead, total	7439-92-1	E468S	0.00005	mg/L	0.5 mg/L	113	80.0	120	----
lithium, total	7439-93-2	E468S	0.02	mg/L	0.25 mg/L	101	80.0	120	----
magnesium, total	7439-95-4	E468S	1	mg/L	50 mg/L	103	80.0	120	----
manganese, total	7439-96-5	E468S	0.0002	mg/L	0.25 mg/L	108	80.0	120	----
molybdenum, total	7439-98-7	E468S	0.0001	mg/L	0.25 mg/L	104	80.0	120	----
nickel, total	7440-02-0	E468S	0.0005	mg/L	0.5 mg/L	112	80.0	120	----
phosphorus, total	7723-14-0	E468S	0.05	mg/L	10 mg/L	104	80.0	120	----
potassium, total	7440-09-7	E468S	1	mg/L	50 mg/L	103	80.0	120	----
rhenium, total	7440-15-5	E468S	0.0005	mg/L	0.1 mg/L	113	80.0	120	----
rubidium, total	7440-17-7	E468S	0.005	mg/L	0.1 mg/L	107	80.0	120	----
selenium, total	7782-49-2	E468S	0.0005	mg/L	1 mg/L	120	80.0	120	----
silver, total	7440-22-4	E468S	0.0001	mg/L	0.1 mg/L	107	80.0	120	----
strontium, total	7440-24-6	E468S	0.01	mg/L	0.25 mg/L	104	80.0	120	----
sulfur, total	7704-34-9	E468S	5	mg/L	50 mg/L	95.4	80.0	120	----
tellurium, total	13494-80-9	E468S	0.0005	mg/L	0.1 mg/L	117	80.0	120	----
thallium, total	7440-28-0	E468S	0.00005	mg/L	1 mg/L	109	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Total Metals (QCLot: 220702) - continued									
thorium, total	7440-29-1	E468S	0.0005	mg/L	0.1 mg/L	100	80.0	120	----
tin, total	7440-31-5	E468S	0.001	mg/L	0.5 mg/L	103	80.0	120	----
titanium, total	7440-32-6	E468S	0.005	mg/L	0.25 mg/L	103	80.0	120	----
tungsten, total	7440-33-7	E468S	0.001	mg/L	0.1 mg/L	104	80.0	120	----
uranium, total	7440-61-1	E468S	0.00005	mg/L	0.005 mg/L	104	80.0	120	----
vanadium, total	7440-62-2	E468S	0.0005	mg/L	0.5 mg/L	104	80.0	120	----
yttrium, total	7440-65-5	E468S	0.0005	mg/L	0.1 mg/L	103	80.0	120	----
zinc, total	7440-66-6	E468S	0.003	mg/L	0.5 mg/L	106	80.0	120	----
zirconium, total	7440-67-7	E468S	0.0005	mg/L	0.1 mg/L	98.3	80.0	120	----
Total Metals (QCLot: 220703)									
silicon, total	7440-21-3	E468S.NaSi	1	mg/L	10 mg/L	96.7	80.0	120	----
sodium, total	17341-25-2	E468S.NaSi	2.5	mg/L	50 mg/L	98.3	80.0	120	----
Total Metals (QCLot: 223447)									
mercury, total	7439-97-6	E508S	0.000005	mg/L	0.0001 mg/L	83.1	80.0	120	----
silicon, dissolved	7440-21-3	E469S.NaSi	1	mg/L	10 mg/L	96.9	80.0	120	----
sodium, dissolved	17341-25-2	E469S.NaSi	2.5	mg/L	50 mg/L	102	80.0	120	----
Dissolved Metals (QCLot: 219675)									
aluminum, dissolved	7429-90-5	E469S	0.005	mg/L	2 mg/L	99.0	80.0	120	----
antimony, dissolved	7440-36-0	E469S	0.001	mg/L	1 mg/L	101	80.0	120	----
arsenic, dissolved	7440-38-2	E469S	0.0004	mg/L	1 mg/L	99.6	80.0	120	----
barium, dissolved	7440-39-3	E469S	0.001	mg/L	0.25 mg/L	99.9	80.0	120	----
beryllium, dissolved	7440-41-7	E469S	0.0005	mg/L	0.1 mg/L	110	80.0	120	----
bismuth, dissolved	7440-69-9	E469S	0.0005	mg/L	1 mg/L	110	80.0	120	----
boron, dissolved	7440-42-8	E469S	0.3	mg/L	10 mg/L	105	80.0	120	----
cadmium, dissolved	7440-43-9	E469S	0.00001	mg/L	0.1 mg/L	101	80.0	120	----
calcium, dissolved	7440-70-2	E469S	1	mg/L	50 mg/L	101	80.0	120	----
cesium, dissolved	7440-46-2	E469S	0.0005	mg/L	0.05 mg/L	101	80.0	120	----
chromium, dissolved	7440-47-3	E469S	0.0005	mg/L	0.25 mg/L	100	80.0	120	----
cobalt, dissolved	7440-48-4	E469S	0.00005	mg/L	0.25 mg/L	106	80.0	120	----
copper, dissolved	7440-50-8	E469S	0.0002	mg/L	0.25 mg/L	106	80.0	120	----
gallium, dissolved	7440-55-3	E469S	0.0005	mg/L	0.25 mg/L	98.2	80.0	120	----
iron, dissolved	7439-89-6	E469S	0.01	mg/L	1 mg/L	104	80.0	120	----
lead, dissolved	7439-92-1	E469S	0.00005	mg/L	0.5 mg/L	109	80.0	120	----
lithium, dissolved	7439-93-2	E469S	0.02	mg/L	0.25 mg/L	104	80.0	120	----
magnesium, dissolved	7439-95-4	E469S	1	mg/L	50 mg/L	99.8	80.0	120	----
manganese, dissolved	7439-96-5	E469S	0.0001	mg/L	0.25 mg/L	102	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Dissolved Metals (QCLot: 219675) - continued									
molybdenum, dissolved	7439-98-7	E469S	0.0001	mg/L	0.25 mg/L	99.0	80.0	120	----
nickel, dissolved	7440-02-0	E469S	0.0005	mg/L	0.5 mg/L	106	80.0	120	----
phosphorus, dissolved	7723-14-0	E469S	0.05	mg/L	10 mg/L	97.6	80.0	120	----
potassium, dissolved	7440-09-7	E469S	1	mg/L	50 mg/L	100	80.0	120	----
rhenium, dissolved	7440-15-5	E469S	0.0005	mg/L	0.1 mg/L	102	80.0	120	----
rubidium, dissolved	7440-17-7	E469S	0.005	mg/L	0.1 mg/L	106	80.0	120	----
selenium, dissolved	7782-49-2	E469S	0.0005	mg/L	1 mg/L	109	80.0	120	----
silver, dissolved	7440-22-4	E469S	0.0001	mg/L	0.1 mg/L	100	80.0	120	----
strontium, dissolved	7440-24-6	E469S	0.01	mg/L	0.25 mg/L	105	80.0	120	----
sulfur, dissolved	7704-34-9	E469S	5	mg/L	50 mg/L	83.8	80.0	120	----
tellurium, dissolved	13494-80-9	E469S	0.0005	mg/L	0.1 mg/L	107	80.0	120	----
thallium, dissolved	7440-28-0	E469S	0.00005	mg/L	1 mg/L	105	80.0	120	----
thorium, dissolved	7440-29-1	E469S	0.0005	mg/L	0.1 mg/L	96.7	80.0	120	----
tin, dissolved	7440-31-5	E469S	0.001	mg/L	0.5 mg/L	97.0	80.0	120	----
titanium, dissolved	7440-32-6	E469S	0.005	mg/L	0.25 mg/L	97.6	80.0	120	----
tungsten, dissolved	7440-33-7	E469S	0.001	mg/L	0.1 mg/L	98.5	80.0	120	----
uranium, dissolved	7440-61-1	E469S	0.00005	mg/L	0.005 mg/L	104	80.0	120	----
vanadium, dissolved	7440-62-2	E469S	0.0005	mg/L	0.5 mg/L	101	80.0	120	----
yttrium, dissolved	7440-65-5	E469S	0.0005	mg/L	0.1 mg/L	96.0	80.0	120	----
zinc, dissolved	7440-66-6	E469S	0.001	mg/L	0.5 mg/L	102	80.0	120	----
zirconium, dissolved	7440-67-7	E469S	0.0005	mg/L	0.1 mg/L	93.7	80.0	120	----
mercury, dissolved	7439-97-6	E509S	0.000005	mg/L	0.0001 mg/L	98.3	80.0	120	----
Volatile Organic Compounds (QCLot: 222717)									
benzene	71-43-2	E611A	0.5	µg/L	100 µg/L	113	70.0	130	----
ethylbenzene	100-41-4	E611A	0.5	µg/L	100 µg/L	114	70.0	130	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.5	µg/L	100 µg/L	110	70.0	130	----
styrene	100-42-5	E611A	0.5	µg/L	100 µg/L	111	70.0	130	----
toluene	108-88-3	E611A	0.5	µg/L	100 µg/L	99.8	70.0	130	----
xylene, m+p-	179601-23-1	E611A	0.4	µg/L	200 µg/L	114	70.0	130	----
xylene, o-	95-47-6	E611A	0.3	µg/L	100 µg/L	114	70.0	130	----
Volatile Organic Compounds (QCLot: 224056)									
benzene	71-43-2	E611A	0.5	µg/L	100 µg/L	75.5	70.0	130	----
ethylbenzene	100-41-4	E611A	0.5	µg/L	100 µg/L	73.4	70.0	130	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.5	µg/L	100 µg/L	89.3	70.0	130	----
styrene	100-42-5	E611A	0.5	µg/L	100 µg/L	81.3	70.0	130	----
toluene	108-88-3	E611A	0.5	µg/L	100 µg/L	70.9	70.0	130	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Volatile Organic Compounds (QCLot: 224056) - continued									
xylene, m+p-	179601-23-1	E611A	0.4	µg/L	200 µg/L	83.1	70.0	130	----
xylene, o-	95-47-6	E611A	0.3	µg/L	100 µg/L	75.1	70.0	130	----
Hydrocarbons (QCLot: 219282)									
F2 (C10-C16)	----	E601	100	µg/L	3538 µg/L	104	70.0	130	----
F3 (C16-C34)	----	E601	250	µg/L	7053 µg/L	96.6	70.0	130	----
F4 (C34-C50)	----	E601	250	µg/L	5051 µg/L	118	70.0	130	----
Hydrocarbons (QCLot: 222428)									
F2 (C10-C16)	----	E601	100	µg/L	3538 µg/L	128	70.0	130	----
F3 (C16-C34)	----	E601	250	µg/L	7053 µg/L	118	70.0	130	----
F4 (C34-C50)	----	E601	250	µg/L	5051 µg/L	127	70.0	130	----
Hydrocarbons (QCLot: 225927)									
F1 (C6-C10)	----	E581.VH+F1	100	µg/L	6310 µg/L	83.4	70.0	130	----
Hydrocarbons (QCLot: 225940)									
F1 (C6-C10)	----	E581.VH+F1	100	µg/L	6310 µg/L	81.8	70.0	130	----
Polycyclic Aromatic Hydrocarbons (QCLot: 219281)									
acenaphthene	83-32-9	E641A	0.01	µg/L	0.5 µg/L	97.8	60.0	130	----
acenaphthylene	208-96-8	E641A	0.01	µg/L	0.5 µg/L	103	60.0	130	----
acridine	260-94-6	E641A	0.01	µg/L	0.5 µg/L	92.0	60.0	130	----
anthracene	120-12-7	E641A	0.01	µg/L	0.5 µg/L	104	60.0	130	----
benz(a)anthracene	56-55-3	E641A	0.01	µg/L	0.5 µg/L	92.8	60.0	130	----
benzo(a)pyrene	50-32-8	E641A	0.005	µg/L	0.5 µg/L	95.0	60.0	130	----
benzo(b+j)fluoranthene	----	E641A	0.01	µg/L	0.5 µg/L	96.8	60.0	130	----
benzo(g,h,i)perylene	191-24-2	E641A	0.01	µg/L	0.5 µg/L	97.9	60.0	130	----
benzo(k)fluoranthene	207-08-9	E641A	0.01	µg/L	0.5 µg/L	97.0	60.0	130	----
chrysene	218-01-9	E641A	0.01	µg/L	0.5 µg/L	114	60.0	130	----
dibenz(a,h)anthracene	53-70-3	E641A	0.005	µg/L	0.5 µg/L	103	60.0	130	----
fluoranthene	206-44-0	E641A	0.01	µg/L	0.5 µg/L	108	60.0	130	----
fluorene	86-73-7	E641A	0.01	µg/L	0.5 µg/L	105	60.0	130	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.01	µg/L	0.5 µg/L	99.5	60.0	130	----
methylnaphthalene, 1-	90-12-0	E641A	0.01	µg/L	0.5 µg/L	92.3	60.0	130	----
methylnaphthalene, 2-	91-57-6	E641A	0.01	µg/L	0.5 µg/L	84.6	60.0	130	----
naphthalene	91-20-3	E641A	0.05	µg/L	0.5 µg/L	94.5	50.0	130	----
phenanthrene	85-01-8	E641A	0.02	µg/L	0.5 µg/L	104	60.0	130	----
pyrene	129-00-0	E641A	0.01	µg/L	0.5 µg/L	113	60.0	130	----
quinoline	6027-02-7	E641A	0.05	µg/L	0.5 µg/L	111	60.0	130	----

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Work Order : VA21B1579
Client : Stantec Consulting Ltd.
Project : ----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Polycyclic Aromatic Hydrocarbons (QCLot: 222426)									
acenaphthene	83-32-9	E641A	0.01	µg/L	1 µg/L	84.1	60.0	130	----
acenaphthylene	208-96-8	E641A	0.01	µg/L	1 µg/L	88.4	60.0	130	----
acridine	260-94-6	E641A	0.01	µg/L	1 µg/L	60.9	60.0	130	----
anthracene	120-12-7	E641A	0.01	µg/L	1 µg/L	88.1	60.0	130	----
benz(a)anthracene	56-55-3	E641A	0.01	µg/L	1 µg/L	83.8	60.0	130	----
benzo(a)pyrene	50-32-8	E641A	0.005	µg/L	1 µg/L	80.6	60.0	130	----
benzo(b+j)fluoranthene	----	E641A	0.01	µg/L	1 µg/L	79.2	60.0	130	----
benzo(g,h,i)perylene	191-24-2	E641A	0.01	µg/L	1 µg/L	82.4	60.0	130	----
benzo(k)fluoranthene	207-08-9	E641A	0.01	µg/L	1 µg/L	82.6	60.0	130	----
chrysene	218-01-9	E641A	0.01	µg/L	1 µg/L	91.6	60.0	130	----
dibenz(a,h)anthracene	53-70-3	E641A	0.005	µg/L	1 µg/L	86.5	60.0	130	----
fluoranthene	206-44-0	E641A	0.01	µg/L	1 µg/L	87.9	60.0	130	----
fluorene	86-73-7	E641A	0.01	µg/L	1 µg/L	87.2	60.0	130	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.01	µg/L	1 µg/L	81.9	60.0	130	----
methylnaphthalene, 1-	90-12-0	E641A	0.01	µg/L	1 µg/L	80.6	60.0	130	----
methylnaphthalene, 2-	91-57-6	E641A	0.01	µg/L	1 µg/L	75.8	60.0	130	----
naphthalene	91-20-3	E641A	0.05	µg/L	1 µg/L	77.7	50.0	130	----
phenanthrene	85-01-8	E641A	0.02	µg/L	1 µg/L	87.0	60.0	130	----
pyrene	129-00-0	E641A	0.01	µg/L	1 µg/L	89.5	60.0	130	----
quinoline	6027-02-7	E641A	0.05	µg/L	1 µg/L	65.4	60.0	130	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 219185)										
VA21B1579-002	WQ1-1-Flow	phosphorus, total	7723-14-0	E372-U	0.0867 mg/L	0.1 mg/L	86.7	70.0	130	----
Anions and Nutrients (QCLot: 219186)										
VA21B1579-002	WQ1-1-Flow	ammonia, total (as N)	7664-41-7	E298	0.104 mg/L	0.1 mg/L	104	75.0	125	----
Anions and Nutrients (QCLot: 220318)										
VA21B1579-002	WQ1-1-Flow	sulfate (as SO4)	14808-79-8	E235S.SO4	10400 mg/L	10000 mg/L	104	75.0	125	----
Anions and Nutrients (QCLot: 220319)										
VA21B1579-002	WQ1-1-Flow	nitrate (as N)	14797-55-8	E235S.NO3	252 mg/L	250 mg/L	101	75.0	125	----
Anions and Nutrients (QCLot: 220320)										
VA21B1579-002	WQ1-1-Flow	nitrite (as N)	14797-65-0	E235S.NO2	50.5 mg/L	50 mg/L	101	75.0	125	----
Anions and Nutrients (QCLot: 220321)										
VA21B1579-002	WQ1-1-Flow	fluoride	16984-48-8	E235S.F	101 mg/L	100 mg/L	101	75.0	125	----
Anions and Nutrients (QCLot: 220322)										
VA21B1579-002	WQ1-1-Flow	bromide	24959-67-9	E235S.Br	49.9 mg/L	50 mg/L	99.9	75.0	125	----
Anions and Nutrients (QCLot: 220323)										
VA21B1579-002	WQ1-1-Flow	chloride	16887-00-6	E235S.Cl	10000 mg/L	10000 mg/L	100.0	75.0	125	----
Organic / Inorganic Carbon (QCLot: 219183)										
VA21B1579-002	WQ1-1-Flow	carbon, dissolved organic [DOC]	----	E358-L	5.25 mg/L	5 mg/L	105	70.0	130	----
Organic / Inorganic Carbon (QCLot: 219184)										
VA21B1579-002	WQ1-1-Flow	carbon, total organic [TOC]	----	E355-L	5.75 mg/L	5 mg/L	115	70.0	130	----
Total Metals (QCLot: 219754)										
VA21B1472-001	Anonymous	aluminum, total	7429-90-5	E468S	ND mg/L	0.4 mg/L	ND	70.0	130	----
		antimony, total	7440-36-0	E468S	0.0366 mg/L	0.04 mg/L	91.5	70.0	130	----
		arsenic, total	7440-38-2	E468S	0.0363 mg/L	0.04 mg/L	90.8	70.0	130	----
		barium, total	7440-39-3	E468S	ND mg/L	0.04 mg/L	ND	70.0	130	----
		beryllium, total	7440-41-7	E468S	0.0808 mg/L	0.08 mg/L	101	70.0	130	----
		bismuth, total	7440-69-9	E468S	0.0189 mg/L	0.02 mg/L	94.6	70.0	130	----
		boron, total	7440-42-8	E468S	0.23 mg/L	0.2 mg/L	115	70.0	130	----
		cadmium, total	7440-43-9	E468S	0.00752 mg/L	0.008 mg/L	93.9	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 219754) - continued										
VA21B1472-001	Anonymous	calcium, total	7440-70-2	E468S	ND mg/L	8 mg/L	ND	70.0	130	----
		cesium, total	7440-46-2	E468S	0.0186 mg/L	0.02 mg/L	93.0	70.0	130	----
		chromium, total	7440-47-3	E468S	0.0762 mg/L	0.08 mg/L	95.3	70.0	130	----
		cobalt, total	7440-48-4	E468S	0.0385 mg/L	0.04 mg/L	96.2	70.0	130	----
		copper, total	7440-50-8	E468S	0.0386 mg/L	0.04 mg/L	96.4	70.0	130	----
		gallium, total	7440-55-3	E468S	0.00477 mg/L	0.005 mg/L	95.4	70.0	130	----
		iron, total	7439-89-6	E468S	3.60 mg/L	4 mg/L	89.9	70.0	130	----
		lead, total	7439-92-1	E468S	0.0388 mg/L	0.04 mg/L	97.1	70.0	130	----
		lithium, total	7439-93-2	E468S	0.190 mg/L	0.2 mg/L	95.2	70.0	130	----
		magnesium, total	7439-95-4	E468S	ND mg/L	2 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E468S	ND mg/L	0.04 mg/L	ND	70.0	130	----
		molybdenum, total	7439-98-7	E468S	0.0368 mg/L	0.04 mg/L	92.1	70.0	130	----
		nickel, total	7440-02-0	E468S	0.0795 mg/L	0.08 mg/L	99.4	70.0	130	----
		phosphorus, total	7723-14-0	E468S	18.8 mg/L	20 mg/L	94.0	70.0	130	----
		potassium, total	7440-09-7	E468S	7.2 mg/L	8 mg/L	90.3	70.0	130	----
		rhenium, total	7440-15-5	E468S	0.00483 mg/L	0.005 mg/L	96.7	70.0	130	----
		rubidium, total	7440-17-7	E468S	0.0389 mg/L	0.04 mg/L	97.2	70.0	130	----
		selenium, total	7782-49-2	E468S	0.0804 mg/L	0.08 mg/L	100	70.0	130	----
		silver, total	7440-22-4	E468S	0.00742 mg/L	0.008 mg/L	92.7	70.0	130	----
		strontium, total	7440-24-6	E468S	ND mg/L	0.04 mg/L	ND	70.0	130	----
		sulfur, total	7704-34-9	E468S	36.7 mg/L	40 mg/L	91.7	70.0	130	----
		tellurium, total	13494-80-9	E468S	0.0806 mg/L	0.08 mg/L	101	70.0	130	----
		thallium, total	7440-28-0	E468S	0.00754 mg/L	0.008 mg/L	94.3	70.0	130	----
		thorium, total	7440-29-1	E468S	0.0389 mg/L	0.04 mg/L	97.4	70.0	130	----
		tin, total	7440-31-5	E468S	0.0362 mg/L	0.04 mg/L	90.5	70.0	130	----
		titanium, total	7440-32-6	E468S	0.0746 mg/L	0.08 mg/L	93.2	70.0	130	----
		tungsten, total	7440-33-7	E468S	0.0385 mg/L	0.04 mg/L	96.3	70.0	130	----
		uranium, total	7440-61-1	E468S	0.00740 mg/L	0.008 mg/L	92.5	70.0	130	----
		vanadium, total	7440-62-2	E468S	0.178 mg/L	0.2 mg/L	89.0	70.0	130	----
		yttrium, total	7440-65-5	E468S	0.00452 mg/L	0.005 mg/L	90.4	70.0	130	----
		zinc, total	7440-66-6	E468S	0.706 mg/L	0.8 mg/L	88.3	70.0	130	----
		zirconium, total	7440-67-7	E468S	0.0756 mg/L	0.08 mg/L	94.5	70.0	130	----
Total Metals (QCLot: 219755)										
VA21B1472-001	Anonymous	silicon, total	7440-21-3	E468S.NaSi	484 mg/L	500 mg/L	96.8	70.0	130	----
		sodium, total	17341-25-2	E468S.NaSi	ND mg/L	100 mg/L	ND	70.0	130	----
Total Metals (QCLot: 220702)										

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
					Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 220702) - continued										
VA21B1579-019	Equipment Blank	aluminum, total	7429-90-5	E468S	0.345 mg/L	0.4 mg/L	86.2	70.0	130	----
		antimony, total	7440-36-0	E468S	0.0359 mg/L	0.04 mg/L	89.7	70.0	130	----
		arsenic, total	7440-38-2	E468S	0.0349 mg/L	0.04 mg/L	87.3	70.0	130	----
		barium, total	7440-39-3	E468S	0.0367 mg/L	0.04 mg/L	91.8	70.0	130	----
		beryllium, total	7440-41-7	E468S	0.0743 mg/L	0.08 mg/L	92.9	70.0	130	----
		bismuth, total	7440-69-9	E468S	0.0187 mg/L	0.02 mg/L	93.4	70.0	130	----
		boron, total	7440-42-8	E468S	0.18 mg/L	0.2 mg/L	92.8	70.0	130	----
		cadmium, total	7440-43-9	E468S	0.00759 mg/L	0.008 mg/L	94.9	70.0	130	----
		calcium, total	7440-70-2	E468S	7.4 mg/L	8 mg/L	92.1	70.0	130	----
		cesium, total	7440-46-2	E468S	0.0179 mg/L	0.02 mg/L	89.3	70.0	130	----
		chromium, total	7440-47-3	E468S	0.0731 mg/L	0.08 mg/L	91.3	70.0	130	----
		cobalt, total	7440-48-4	E468S	0.0378 mg/L	0.04 mg/L	94.5	70.0	130	----
		copper, total	7440-50-8	E468S	0.0382 mg/L	0.04 mg/L	95.4	70.0	130	----
		gallium, total	7440-55-3	E468S	0.00496 mg/L	0.005 mg/L	99.1	70.0	130	----
		iron, total	7439-89-6	E468S	3.54 mg/L	4 mg/L	88.6	70.0	130	----
		lead, total	7439-92-1	E468S	0.0376 mg/L	0.04 mg/L	94.1	70.0	130	----
		lithium, total	7439-93-2	E468S	0.179 mg/L	0.2 mg/L	89.5	70.0	130	----
		magnesium, total	7439-95-4	E468S	1.7 mg/L	2 mg/L	86.3	70.0	130	----
		manganese, total	7439-96-5	E468S	0.0364 mg/L	0.04 mg/L	91.0	70.0	130	----
		molybdenum, total	7439-98-7	E468S	0.0348 mg/L	0.04 mg/L	87.0	70.0	130	----
		nickel, total	7440-02-0	E468S	0.0775 mg/L	0.08 mg/L	96.8	70.0	130	----
		phosphorus, total	7723-14-0	E468S	16.7 mg/L	20 mg/L	83.4	70.0	130	----
		potassium, total	7440-09-7	E468S	7.0 mg/L	8 mg/L	87.9	70.0	130	----
		rhenium, total	7440-15-5	E468S	0.00510 mg/L	0.005 mg/L	102	70.0	130	----
		rubidium, total	7440-17-7	E468S	0.0370 mg/L	0.04 mg/L	92.5	70.0	130	----
		selenium, total	7782-49-2	E468S	0.0801 mg/L	0.08 mg/L	100	70.0	130	----
		silver, total	7440-22-4	E468S	0.00748 mg/L	0.008 mg/L	93.5	70.0	130	----
		strontium, total	7440-24-6	E468S	0.036 mg/L	0.04 mg/L	91.2	70.0	130	----
		sulfur, total	7704-34-9	E468S	33.7 mg/L	40 mg/L	84.3	70.0	130	----
		tellurium, total	13494-80-9	E468S	0.0768 mg/L	0.08 mg/L	95.9	70.0	130	----
		thallium, total	7440-28-0	E468S	0.00723 mg/L	0.008 mg/L	90.4	70.0	130	----
		thorium, total	7440-29-1	E468S	0.0385 mg/L	0.04 mg/L	96.2	70.0	130	----
		tin, total	7440-31-5	E468S	0.0350 mg/L	0.04 mg/L	87.6	70.0	130	----
		titanium, total	7440-32-6	E468S	0.0703 mg/L	0.08 mg/L	87.8	70.0	130	----
		tungsten, total	7440-33-7	E468S	0.0360 mg/L	0.04 mg/L	89.9	70.0	130	----
		uranium, total	7440-61-1	E468S	0.00714 mg/L	0.008 mg/L	89.3	70.0	130	----
		vanadium, total	7440-62-2	E468S	0.182 mg/L	0.2 mg/L	91.1	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 220702) - continued										
VA21B1579-019	Equipment Blank	yttrium, total	7440-65-5	E468S	0.00470 mg/L	0.005 mg/L	94.0	70.0	130	----
		zinc, total	7440-66-6	E468S	0.730 mg/L	0.8 mg/L	91.3	70.0	130	----
		zirconium, total	7440-67-7	E468S	0.0730 mg/L	0.08 mg/L	91.3	70.0	130	----
Total Metals (QCLot: 220703)										
VA21B1579-019	Equipment Blank	silicon, total	7440-21-3	E468S.NaSi	461 mg/L	500 mg/L	92.2	70.0	130	----
		sodium, total	17341-25-2	E468S.NaSi	96.2 mg/L	100 mg/L	96.2	70.0	130	----
Total Metals (QCLot: 223447)										
VA21B1579-002	WQ1-1-Flow	mercury, total	7439-97-6	E508S	0.000108 mg/L	0.0001 mg/L	108	70.0	130	----
Dissolved Metals (QCLot: 219674)										
VA21B1579-001	WQ1-1-EBB	silicon, dissolved	7440-21-3	E469S.NaSi	463 mg/L	500 mg/L	92.7	70.0	130	----
		sodium, dissolved	17341-25-2	E469S.NaSi	ND mg/L	100 mg/L	ND	70.0	130	----
Dissolved Metals (QCLot: 219675)										
VA21B1579-001	WQ1-1-EBB	aluminum, dissolved	7429-90-5	E469S	0.364 mg/L	0.4 mg/L	91.0	70.0	130	----
		antimony, dissolved	7440-36-0	E469S	0.0361 mg/L	0.04 mg/L	90.3	70.0	130	----
		arsenic, dissolved	7440-38-2	E469S	0.0362 mg/L	0.04 mg/L	90.4	70.0	130	----
		barium, dissolved	7440-39-3	E469S	0.0362 mg/L	0.04 mg/L	90.6	70.0	130	----
		beryllium, dissolved	7440-41-7	E469S	0.0804 mg/L	0.08 mg/L	100	70.0	130	----
		bismuth, dissolved	7440-69-9	E469S	0.0164 mg/L	0.02 mg/L	82.0	70.0	130	----
		boron, dissolved	7440-42-8	E469S	ND mg/L	0.2 mg/L	ND	70.0	130	----
		cadmium, dissolved	7440-43-9	E469S	0.00705 mg/L	0.008 mg/L	88.2	70.0	130	----
		calcium, dissolved	7440-70-2	E469S	ND mg/L	8 mg/L	ND	70.0	130	----
		cesium, dissolved	7440-46-2	E469S	0.0185 mg/L	0.02 mg/L	92.4	70.0	130	----
		chromium, dissolved	7440-47-3	E469S	0.0738 mg/L	0.08 mg/L	92.2	70.0	130	----
		cobalt, dissolved	7440-48-4	E469S	0.0360 mg/L	0.04 mg/L	90.0	70.0	130	----
		copper, dissolved	7440-50-8	E469S	0.0347 mg/L	0.04 mg/L	86.8	70.0	130	----
		gallium, dissolved	7440-55-3	E469S	0.00430 mg/L	0.005 mg/L	85.9	70.0	130	----
		iron, dissolved	7439-89-6	E469S	3.60 mg/L	4 mg/L	90.1	70.0	130	----
		lead, dissolved	7439-92-1	E469S	0.0346 mg/L	0.04 mg/L	86.6	70.0	130	----
		lithium, dissolved	7439-93-2	E469S	0.175 mg/L	0.2 mg/L	87.7	70.0	130	----
		magnesium, dissolved	7439-95-4	E469S	ND mg/L	2 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E469S	0.0368 mg/L	0.04 mg/L	92.1	70.0	130	----
		molybdenum, dissolved	7439-98-7	E469S	0.0382 mg/L	0.04 mg/L	95.4	70.0	130	----
		nickel, dissolved	7440-02-0	E469S	0.0704 mg/L	0.08 mg/L	88.0	70.0	130	----
		phosphorus, dissolved	7723-14-0	E469S	19.6 mg/L	20 mg/L	97.9	70.0	130	----
		potassium, dissolved	7440-09-7	E469S	ND mg/L	8 mg/L	ND	70.0	130	----

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Work Order : VA21B1579
Client : Stantec Consulting Ltd.
Project : ----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 219675) - continued										
VA21B1579-001	WQ1-1-EBB	rhenium, dissolved	7440-15-5	E469S	0.00441 mg/L	0.005 mg/L	88.3	70.0	130	----
		rubidium, dissolved	7440-17-7	E469S	0.0365 mg/L	0.04 mg/L	91.3	70.0	130	----
		selenium, dissolved	7782-49-2	E469S	0.0780 mg/L	0.08 mg/L	97.5	70.0	130	----
		silver, dissolved	7440-22-4	E469S	0.00694 mg/L	0.008 mg/L	86.8	70.0	130	----
		strontium, dissolved	7440-24-6	E469S	ND mg/L	0.04 mg/L	ND	70.0	130	----
		sulfur, dissolved	7704-34-9	E469S	ND mg/L	40 mg/L	ND	70.0	130	----
		tellurium, dissolved	13494-80-9	E469S	0.0703 mg/L	0.08 mg/L	87.8	70.0	130	----
		thallium, dissolved	7440-28-0	E469S	0.00669 mg/L	0.008 mg/L	83.6	70.0	130	----
		thorium, dissolved	7440-29-1	E469S	0.0372 mg/L	0.04 mg/L	93.0	70.0	130	----
		tin, dissolved	7440-31-5	E469S	0.0357 mg/L	0.04 mg/L	89.3	70.0	130	----
		titanium, dissolved	7440-32-6	E469S	0.0755 mg/L	0.08 mg/L	94.4	70.0	130	----
		tungsten, dissolved	7440-33-7	E469S	0.0369 mg/L	0.04 mg/L	92.2	70.0	130	----
		uranium, dissolved	7440-61-1	E469S	0.00693 mg/L	0.008 mg/L	86.6	70.0	130	----
		vanadium, dissolved	7440-62-2	E469S	0.192 mg/L	0.2 mg/L	95.8	70.0	130	----
		yttrium, dissolved	7440-65-5	E469S	0.00468 mg/L	0.005 mg/L	93.7	70.0	130	----
		zinc, dissolved	7440-66-6	E469S	0.663 mg/L	0.8 mg/L	82.8	70.0	130	----
		zirconium, dissolved	7440-67-7	E469S	0.0781 mg/L	0.08 mg/L	97.6	70.0	130	----
Dissolved Metals (QCLot: 225679)										
VA21B1579-002	WQ1-1-Flow	mercury, dissolved	7439-97-6	E509S	0.0000933 mg/L	0.0001 mg/L	93.3	70.0	130	----
Volatile Organic Compounds (QCLot: 222717)										
VA21B1579-002	WQ1-1-Flow	benzene	71-43-2	E611A	95.6 µg/L	100 µg/L	95.6	60.0	140	----
		ethylbenzene	100-41-4	E611A	96.1 µg/L	100 µg/L	96.1	60.0	140	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	101 µg/L	100 µg/L	101	60.0	140	----
		styrene	100-42-5	E611A	103 µg/L	100 µg/L	103	60.0	140	----
		toluene	108-88-3	E611A	98.5 µg/L	100 µg/L	98.5	60.0	140	----
		xylene, m+p-	179601-23-1	E611A	194 µg/L	200 µg/L	96.9	60.0	140	----
		xylene, o-	95-47-6	E611A	99.4 µg/L	100 µg/L	99.4	60.0	140	----
Volatile Organic Compounds (QCLot: 224056)										
VA21B1579-009	WQ3-6-Flow	benzene	71-43-2	E611A	86.7 µg/L	100 µg/L	86.7	60.0	140	----
		ethylbenzene	100-41-4	E611A	87.3 µg/L	100 µg/L	87.3	60.0	140	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	91.8 µg/L	100 µg/L	91.8	60.0	140	----
		styrene	100-42-5	E611A	93.3 µg/L	100 µg/L	93.3	60.0	140	----
		toluene	108-88-3	E611A	83.6 µg/L	100 µg/L	83.6	60.0	140	----
		xylene, m+p-	179601-23-1	E611A	205 µg/L	200 µg/L	102	60.0	140	----
		xylene, o-	95-47-6	E611A	89.0 µg/L	100 µg/L	89.0	60.0	140	----

Chain of Custody (COC) / Analytical Request Form

COC Number: 20 - 917635

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Environmental Division
Vancouver
Work Order Reference
VA21B1579

Telephone : +1 604 253 4186

Report To	Contact and company name below will appear on the final report
Company:	STANTEC CONSULTING LTD.
Contact:	JENNY MINFORD
Phone:	604 363 5340
	Company address below will appear on the final report
Street:	11-2042 MILLS ROAD
City/Province:	B.C.
Postal Code:	V8L 5X4
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☑ YES ☐ NO
Company:	STANTEC CONSULTING LTD.
Contact:	LIBBY MCMILLAN

Reports / Recipients	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Merge QC/QCI Reports with COA	☑ YES ☐ NO ☐ N/A
☑ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	LIBBY.MCMILLAN@STANTEC.COM
Email 2	MAEGAN.LONG@STANTEC.COM
Email 3	JENNY.MINFORD@STANTEC.COM
Invoice Recipients	
Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	LIBBY.MCMILLAN@STANTEC
Email 2	

Turnaround Time (TAT) Requested
☑ Routine [R] if received by 3pm M-F - no surcharges apply
☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge
☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge
☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge
☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge
☐ Same day [E2] if received by 10am M-S - 200% rush surcharge may apply to rush requests on weekends, statutory holidays and
Date and Time Required for all E&P TATs:
For all tests with rush TATs requested,

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (ALS use only):		ALS Contact:	Sampler:

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Total-N, P, Kjeldahl, TKN, Ion Balance	Dissolved-N, P, DOC, DKN	Total Mercury	Dissolved Mercury	Extractable Hydrocarbons, Fuels, Oil and Grease	Volatile Hydrocarbons, Fuels, Oil and Grease	General	Total Metals	Dissolved Metals	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	WQ1-1-EBB	2021-06-07	14:30	SEAWATER	11	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	WQ1-1-FLOW	"	10:59am	SEAWATER	11	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	WQ1-1-EBB	"	14:30	SEAWATER	11	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	WQ1-10-FLOW	"	10:30am	SEAWATER	11	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	WQ1-10-EBB	"	14:44	SEAWATER	11	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	WQ3-1-EBB	"	14:08	SEAWATER	11	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	WQ3-1-FLOW	"	11:08	SEAWATER	11	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	WQ3-15-EBB	"	14:17	SEAWATER	11	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	WQ3-6-FLOW	"	11:08	SEAWATER	11	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	WQ5-1-EBB	"	13:52	SEAWATER	11	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	WQ5-1-FLOW	"	11:25	SEAWATER	11	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	WQ5-77-FLOW	"	11:43	SEAWATER	11	✓	✓	✓	✓	✓	✓	✓	✓	✓			

Terrace Shipping ☐ Ground ☐ Air
3 Coolers # Carbouys

Drinking Water (DW) Samples[1] (client use)	Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)
Are samples taken from a Regulated DW System? ☐ YES ☑ NO	SAMPLES ARE "SEAWATER"
Are samples for human consumption/ use? ☐ YES ☑ NO	ANALYSIS AS PER REQUEST FLOW LIBBY MCMILLAN

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☐ NONE ☐ ICE ☑ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
5.6	5.8	3.2	9.2	10.2			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (ALS use only)			FINAL SHIPMENT RECEPTION (ALS use only)		
Released by:	Date:	Time:	Received by: Chris	Date: 8 Jun 21	Time: 1415	Received by: JA	Date: 9/06/2021	Time: 530

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

AUG 2023 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

Chain of Custody (COC) / Analytical Request Form

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

COC Number: 20 - 917636

Page 2 of 2

Report To	Contact and company name below will appear on the final report
Company:	STANTEC CONSULTING LTD.
Contact:	JENNY MINFORD
Phone:	604 363 5340
	Company address below will appear on the final report
Street:	11 - 2042 MILLS ROAD
City/Province:	B.C.
Postal Code:	V8L 5X4
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☑ YES ☐ NO
Company:	STANTEC CONSULTING LTD.
Contact:	LIBBY MCMILLAN

Reports / Recipients

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Merge QC/QCI Reports with COA ☑ YES ☐ NO ☐ N/A

☑ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: LIBBY.MCMILLAN@STANTEC.COM

Email 2: MAEGAN.LONG@STANTEC.COM

Email 3: JENNY.MINFORD@STANTEC.COM

Invoice Recipients

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: LIBBY.MCMILLAN@STANTEC.COM

Email 2:

Turnaround Time (TAT) Requested

☑ Routine [R] if received by 3pm M-F - no surcharges apply

☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum

☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum

☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum

☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum

☐ Same day [E2] if received by 10am M-S - 200% rush surcharge. Additional fees may apply to rush requests on weekends, statutory holidays and non-routine tests

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm am/pm

For all tests with rush TATs requested, please contact your AM to confirm availability.

AFFIX ALS BARCODE LABEL HERE (ALS use only)

Project Information

ALS Account # / Quote #:	
Job #:	
PO / AFE:	
LSD:	
ALS Lab Work Order # (ALS use only):	

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	
ALS Contact:	Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	TOTAL N, NH3, TOC, TSS, TURBIDITY, TDS, DISSOLVED P, DOC, DKN	TOTAL UNFILTERED P	DISSOLVED MERCURY	EPH, LEPH, HEPH, DIESEL, MOTOR OIL, BTEX, VPH, THM, VFA	GENERAL	TOTAL METALS	DISSOLVED METALS	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	WQ5 - 10 - EBB	" "	16:00	Seawater	11	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	WQ6 - 1 - EBB	" "	16:15	Seawater	11	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	WQ6 - 1 - FLOW	" "	12:00	Seawater	11	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	WQ6 - 12 - FLOW	" "	12:18	Seawater	11	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	WQ6 - 12 - EBB	" "	16:26	Seawater	11	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	FIELD BLANK	" "	14:17	Seawater	11	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	EQUIPMENT BLANK	" "	09:30	Distilled	11	✓	✓	✓	✓	✓	✓	✓	✓	✓			

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☑ NO

Are samples for human consumption/ use? ☐ YES ☑ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

SAMPLES ARE SEAWATER

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☐ NONE ☐ ICE ☑ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
9.3				10°C			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (ALS use only)			FINAL SHIPMENT RECEPTION (ALS use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by: JA	Date: 9/06/2024	Time: 5:30PM

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

AUG 2020 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form.**

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA21C5432**	Page	: 1 of 26
Client	: **Stantec Consulting Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Libby McMillan	Account Manager	: Brent Mack
Address	: # 11 - 2042 Mills Road Sidney BC Canada V8L 5X4	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 250 655 5371	Telephone	: 778-370-3279
Project	: ----	Date Samples Received	: 12-Nov-2021 21:20
PO	: ----	Date Analysis Commenced	: 13-Nov-2021
C-O-C number	: ----	Issue Date	: 25-Nov-2021 10:20
Sampler	: ----		
Site	: ----		
Quote number	: VA21-STAC100-005		
No. of samples received	: 19		
No. of samples analysed	: 19		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Angela Ren	Team Leader - Metals	Metals, Burnaby, British Columbia
Caleb Deroche	Lab Analyst	Metals, Burnaby, British Columbia
Dan Gebert	Laboratory Analyst	Metals, Burnaby, British Columbia
Dee Lee	Analyst	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Monica Ko	Lab Assistant	Metals, Burnaby, British Columbia
Ophelia Chiu	Department Manager - Organics	Organics, Burnaby, British Columbia
Paul Cushing	Team Leader - Organics	Organics, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
µg/L	micrograms per litre
mg/L	milligrams per litre
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLIS	*Detection Limit Adjusted due to insufficient sample.*
HTD	*Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.*
RRV	*Reported result verified by repeat analysis.*

Page : 3 of 26
Work Order : VA21C5432
Client : Stantec Consulting Ltd.
Project : ----

Analytical Results

Sub-Matrix: **Seawater**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ01-Ebb-1m	WQ01-Ebb-20m	WQ03-Ebb-1m	WQ03-Ebb-20m	WQ05-Ebb-1m
					Client sampling date / time	11-Nov-2021 09:07	11-Nov-2021 09:29	11-Nov-2021 09:54	11-Nov-2021 10:09	11-Nov-2021 10:26
						VA21C5432-001	VA21C5432-002	VA21C5432-003	VA21C5432-004	VA21C5432-005
						Result	Result	Result	Result	Result
Physical Tests										
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L		132	123	124	88.5	89.8
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		5550	5290	5610	5580	5480
pH	----	E108	0.10	pH units		7.72	7.76	7.77	7.77	7.76
solids, total dissolved [TDS]	----	E162S	10	mg/L		28500	24800	28700	29200	28000
solids, total suspended [TSS]	----	E160S	2.0	mg/L		8.5	<2.0	2.5	<2.0	7.2
turbidity	----	E121	0.10	NTU		0.13	0.11	0.11	0.11	0.12
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.60	mg/L		5430	5590	5540	5580	5460
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
bromide	24959-67-9	E235S.Br	5.0	mg/L		48.1	61.8	53.5	44.0	44.4
chloride	16887-00-6	E235S.Cl	50	mg/L		14500	17600	15600	12800	12900
fluoride	16984-48-8	E235S.F	1.0	mg/L		<1.0	1.1	<1.0	<1.0	<1.0
nitrate (as N)	14797-55-8	E235S.NO3	0.50	mg/L		<0.50	<0.50 HTD	<0.50	<0.50	<0.50
nitrite (as N)	14797-65-0	E235S.NO2	0.10	mg/L		<0.10	<0.10 HTD	<0.10	<0.10	<0.10
phosphorus, total	7723-14-0	E372S	0.0020	mg/L		0.0599	0.0600	0.0569	0.0577	0.0560
sulfate (as SO4)	14808-79-8	E235S.SO4	30	mg/L		1960	2420	2120	1700	1720
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		1.11	0.88	1.07	0.81	1.07
carbon, total organic [TOC]	----	E355-L	0.50	mg/L		0.81	0.97	2.02	0.88	1.04
Total Metals										
aluminum, total	7429-90-5	E468S	0.0050	mg/L		0.0132	0.0154	0.0144	0.0148	0.0152
antimony, total	7440-36-0	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
arsenic, total	7440-38-2	E468S	0.00040	mg/L		0.00154	0.00159	0.00166	0.00160	0.00160
barium, total	7440-39-3	E468S	0.0010	mg/L		0.0101	0.0105	0.0102	0.0104	0.0103
beryllium, total	7440-41-7	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
bismuth, total	7440-69-9	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
boron, total	7440-42-8	E468S	0.30	mg/L		3.94	4.04	4.09	4.00	3.98
cadmium, total	7440-43-9	E468S	0.000010	mg/L		0.000061	0.000067	0.000056	0.000064	0.000058
calcium, total	7440-70-2	E468S	1.0	mg/L		362	375	373	370	372
cesium, total	7440-46-2	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050

Page : 4 of 26
Work Order : VA21C5432
Client : Stantec Consulting Ltd.
Project : ----

Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ01-Ebb-1m	WQ01-Ebb-20m	WQ03-Ebb-1m	WQ03-Ebb-20m	WQ05-Ebb-1m
					Client sampling date / time	11-Nov-2021 09:07	11-Nov-2021 09:29	11-Nov-2021 09:54	11-Nov-2021 10:09	11-Nov-2021 10:26
						VA21C5432-001	VA21C5432-002	VA21C5432-003	VA21C5432-004	VA21C5432-005
						Result	Result	Result	Result	Result
Total Metals										
chromium, total	7440-47-3	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
cobalt, total	7440-48-4	E468S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
copper, total	7440-50-8	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
gallium, total	7440-55-3	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
iron, total	7439-89-6	E468S	0.010	mg/L		0.014	0.017	0.015	0.017	0.019
lead, total	7439-92-1	E468S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
lithium, total	7439-93-2	E468S	0.020	mg/L		0.147	0.147	0.151	0.152	0.148
magnesium, total	7439-95-4	E468S	1.0	mg/L		1100	1130	1120	1130	1100
manganese, total	7439-96-5	E468S	0.00020	mg/L		0.00395	0.00440	0.00392	0.00430	0.00414
mercury, total	7439-97-6	E508S	0.0000050	mg/L		<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
molybdenum, total	7439-98-7	E468S	0.00010	mg/L		0.00968	0.00953	0.00936	0.00932	0.00926
nickel, total	7440-02-0	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
phosphorus, total	7723-14-0	E468S	0.050	mg/L		0.087	0.069	0.075	0.075	0.083
potassium, total	7440-09-7	E468S	1.0	mg/L		374	386	378	390	377
rhenium, total	7440-15-5	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
rubidium, total	7440-17-7	E468S	0.0050	mg/L		0.101	0.104	0.101	0.104	0.101
selenium, total	7782-49-2	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
silicon, total	7440-21-3	E468S.NaSi	1.0	mg/L		1.4	1.3	1.3	1.2	1.4
silver, total	7440-22-4	E468S	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
sodium, total	17341-25-2	E468S.NaSi	2.5	mg/L		9220	9030	9170	9450	8930
strontium, total	7440-24-6	E468S	0.010	mg/L		6.64	6.66	6.67	6.66	6.70
sulfur, total	7704-34-9	E468S	5.0	mg/L		896	958	928	919	926
tellurium, total	13494-80-9	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
thallium, total	7440-28-0	E468S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
thorium, total	7440-29-1	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
tin, total	7440-31-5	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
titanium, total	7440-32-6	E468S	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
tungsten, total	7440-33-7	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
uranium, total	7440-61-1	E468S	0.000050	mg/L		0.00257	0.00262	0.00251	0.00258	0.00255
vanadium, total	7440-62-2	E468S	0.00050	mg/L		0.00164	0.00169	0.00166	0.00165	0.00164
yttrium, total	7440-65-5	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050

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Work Order	:	VA21C5432
Client	:	Stantec Consulting Ltd.
Project	:	----

Analytical Results

Sub-Matrix: **Seawater**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ01-Ebb-1m	WQ01-Ebb-20m	WQ03-Ebb-1m	WQ03-Ebb-20m	WQ05-Ebb-1m
					Client sampling date / time	11-Nov-2021 09:07	11-Nov-2021 09:29	11-Nov-2021 09:54	11-Nov-2021 10:09	11-Nov-2021 10:26
						VA21C5432-001	VA21C5432-002	VA21C5432-003	VA21C5432-004	VA21C5432-005
						Result	Result	Result	Result	Result
Total Metals										
zinc, total	7440-66-6	E468S	0.0030	mg/L		<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
zirconium, total	7440-67-7	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Dissolved Metals										
aluminum, dissolved	7429-90-5	E469S	0.0050	mg/L		0.0059	0.0059	0.0062	0.0062	0.0062
antimony, dissolved	7440-36-0	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
arsenic, dissolved	7440-38-2	E469S	0.00040	mg/L		0.00157	0.00161	0.00156	0.00154	0.00156
barium, dissolved	7440-39-3	E469S	0.0010	mg/L		0.0101	0.0103	0.0105	0.0103	0.0100
beryllium, dissolved	7440-41-7	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
bismuth, dissolved	7440-69-9	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
boron, dissolved	7440-42-8	E469S	0.30	mg/L		3.98	3.67	3.84	3.82	3.74
cadmium, dissolved	7440-43-9	E469S	0.000010	mg/L		0.000061	0.000062	0.000076	0.000061	0.000057
calcium, dissolved	7440-70-2	E469S	1.0	mg/L		358	370	366	371	363
cesium, dissolved	7440-46-2	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
chromium, dissolved	7440-47-3	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
cobalt, dissolved	7440-48-4	E469S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
copper, dissolved	7440-50-8	E469S	0.00020	mg/L		<0.00020	0.00024	<0.00020	0.00030	0.00020
gallium, dissolved	7440-55-3	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
iron, dissolved	7439-89-6	E469S	0.010	mg/L		<0.010	<0.010	<0.010	<0.010	<0.010
lead, dissolved	7439-92-1	E469S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
lithium, dissolved	7439-93-2	E469S	0.020	mg/L		0.152	0.138	0.146	0.142	0.140
magnesium, dissolved	7439-95-4	E469S	1.0	mg/L		1130	1060	1140	1130	1110
manganese, dissolved	7439-96-5	E469S	0.00010	mg/L		0.00240	0.00255	0.00232	0.00258	0.00256
mercury, dissolved	7439-97-6	E509S	0.0000050	mg/L		<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
molybdenum, dissolved	7439-98-7	E469S	0.00010	mg/L		0.00927	0.00928	0.00934	0.00937	0.00919
nickel, dissolved	7440-02-0	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
phosphorus, dissolved	7723-14-0	E469S	0.050	mg/L		0.071	0.064	0.073	0.065	0.067
potassium, dissolved	7440-09-7	E469S	1.0	mg/L		377	371	388	390	386
rhenium, dissolved	7440-15-5	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
rubidium, dissolved	7440-17-7	E469S	0.0050	mg/L		0.102	0.102	0.105	0.104	0.102
selenium, dissolved	7782-49-2	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
silicon, dissolved	7440-21-3	E469S.NaSi	1.0	mg/L		1.1	1.1	<1.0	1.2	1.1

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Work Order : VA21C5432
Client : Stantec Consulting Ltd.
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Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ01-Ebb-1m	WQ01-Ebb-20m	WQ03-Ebb-1m	WQ03-Ebb-20m	WQ05-Ebb-1m
					Client sampling date / time	11-Nov-2021 09:07	11-Nov-2021 09:29	11-Nov-2021 09:54	11-Nov-2021 10:09	11-Nov-2021 10:26
						VA21C5432-001	VA21C5432-002	VA21C5432-003	VA21C5432-004	VA21C5432-005
						Result	Result	Result	Result	Result
Dissolved Metals										
silver, dissolved	7440-22-4	E469S	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
sodium, dissolved	17341-25-2	E469S.NaSi	2.5	mg/L		9260	9540	9430	9500	9300
strontium, dissolved	7440-24-6	E469S	0.010	mg/L		6.55	6.65	6.67	6.69	6.49
sulfur, dissolved	7704-34-9	E469S	5.0	mg/L		894	965	959	942	934
tellurium, dissolved	13494-80-9	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
thallium, dissolved	7440-28-0	E469S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
thorium, dissolved	7440-29-1	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
tin, dissolved	7440-31-5	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
titanium, dissolved	7440-32-6	E469S	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
tungsten, dissolved	7440-33-7	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
uranium, dissolved	7440-61-1	E469S	0.000050	mg/L		0.00261	0.00254	0.00256	0.00255	0.00251
vanadium, dissolved	7440-62-2	E469S	0.00050	mg/L		0.00154	0.00154	0.00159	0.00156	0.00155
yttrium, dissolved	7440-65-5	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
zinc, dissolved	7440-66-6	E469S	0.0010	mg/L		0.0015	<0.0010	<0.0010	<0.0010	<0.0010
zirconium, dissolved	7440-67-7	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
dissolved mercury filtration location	----	EP509	-	-		Laboratory	Laboratory	Laboratory	Laboratory	Laboratory
dissolved metals filtration location	----	EP421	-	-		Laboratory	Laboratory	Laboratory	Laboratory	Laboratory
Volatile Organic Compounds [Fuels]										
benzene	71-43-2	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
ethylbenzene	100-41-4	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
styrene	100-42-5	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
toluene	108-88-3	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
xylene, m+p-	179601-23-1	E611A	0.40	µg/L		<0.40	<0.40	<0.40	<0.40	<0.40
xylene, o-	95-47-6	E611A	0.30	µg/L		<0.30	<0.30	<0.30	<0.30	<0.30
xylenes, total	1330-20-7	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
Volatile Organic Compounds Surrogates										
bromofluorobenzene, 4-	460-00-4	E611A	1.0	%		109	102	103	106	107
difluorobenzene, 1,4-	540-36-3	E611A	1.0	%		101	99.7	99.6	101	101
Hydrocarbons										
F1 (C6-C10)	----	E581.VH+F1	100	µg/L		<100	<100	<100	<100	<100

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Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ01-Ebb-1m	WQ01-Ebb-20m	WQ03-Ebb-1m	WQ03-Ebb-20m	WQ05-Ebb-1m
					Client sampling date / time	11-Nov-2021 09:07	11-Nov-2021 09:29	11-Nov-2021 09:54	11-Nov-2021 10:09	11-Nov-2021 10:26
						VA21C5432-001	VA21C5432-002	VA21C5432-003	VA21C5432-004	VA21C5432-005
						Result	Result	Result	Result	Result
Hydrocarbons										
F1-BTEX	----	EC580	100	µg/L		<100	<100	<100	<100	<100
F2 (C10-C16)	----	E601	100	µg/L		<100	<100	<100	<100	<100
F2-naphthalene	----	EC600	100	µg/L		<100	<100	<100	<100	<100
F3 (C16-C34)	----	E601	250	µg/L		<250	<250	<250	<250	<250
F3-PAH	----	EC600	250	µg/L		<250	<250	<250	<250	<250
F4 (C34-C50)	----	E601	250	µg/L		<250	<250	<250	<250	<250
Hydrocarbons Surrogates										
bromobenzotrifluoride, 2- (F2-F4 surr)	392-83-6	E601	1.0	%		87.5	91.4	89.2	89.5	88.4
dichlorotoluene, 3,4-	97-75-0	E581.VH+F1	1.0	%		105	89.8	95.4	99.4	102
Polycyclic Aromatic Hydrocarbons										
acenaphthene	83-32-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
acenaphthylene	208-96-8	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
acridine	260-94-6	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
anthracene	120-12-7	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benz(a)anthracene	56-55-3	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(a)pyrene	50-32-8	E641A	0.0050	µg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
benzo(b+j)fluoranthene	----	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(b+j+k)fluoranthene	----	E641A	0.015	µg/L		<0.015	<0.015	<0.015	<0.015	<0.015
benzo(g,h,i)perylene	191-24-2	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(k)fluoranthene	207-08-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
chrysene	218-01-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
dibenz(a,h)anthracene	53-70-3	E641A	0.0050	µg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
fluoranthene	206-44-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
fluorene	86-73-7	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 1-	90-12-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 1+2-	----	E641A	0.015	µg/L		<0.015	<0.015	<0.015	<0.015	<0.015
methylnaphthalene, 2-	91-57-6	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
naphthalene	91-20-3	E641A	0.050	µg/L		<0.050	<0.050	<0.050	<0.050	<0.050
phenanthrene	85-01-8	E641A	0.020	µg/L		<0.020	<0.020	<0.020	<0.020	<0.020
pyrene	129-00-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010

Analytical Results

Sub-Matrix: **Seawater**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ01-Ebb-1m	WQ01-Ebb-20m	WQ03-Ebb-1m	WQ03-Ebb-20m	WQ05-Ebb-1m
					Client sampling date / time	11-Nov-2021 09:07	11-Nov-2021 09:29	11-Nov-2021 09:54	11-Nov-2021 10:09	11-Nov-2021 10:26
						VA21C5432-001	VA21C5432-002	VA21C5432-003	VA21C5432-004	VA21C5432-005
						Result	Result	Result	Result	Result
Polycyclic Aromatic Hydrocarbons										
quinoline	91-22-5	E641A	0.050	µg/L		<0.050	<0.050	<0.050	<0.050	<0.050
B(a)P total potency equivalents [B(a)P TPE]	----	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
Polycyclic Aromatic Hydrocarbons Surrogates										
chrysene-d12	1719-03-5	E641A	0.1	%		77.2	78.7	78.8	77.8	73.4
naphthalene-d8	1146-65-2	E641A	0.1	%		92.4	93.4	95.4	92.9	86.2
phenanthrene-d10	1517-22-2	E641A	0.1	%		101	103	105	102	95.0

Please refer to the General Comments section for an explanation of any qualifiers detected.

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Work Order : VA21C5432
Client : Stantec Consulting Ltd.
Project : ----

Analytical Results

Sub-Matrix: **Seawater**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ05-Ebb-20m	WQ06-Ebb-1m	WQ06-Ebb-20m	Field Blank	Equipment Blank
					Client sampling date / time	11-Nov-2021 10:35	11-Nov-2021 10:59	11-Nov-2021 11:20	11-Nov-2021 14:45	11-Nov-2021 15:47
						VA21C5432-006	VA21C5432-007	VA21C5432-008	VA21C5432-009	VA21C5432-010
						Result	Result	Result	Result	Result
Physical Tests										
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L		88.1	88.9	104 DLIS	<1.0	<2.5 DLIS
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		5470	5480	5490	<1.00	<1.00
pH	----	E108	0.10	pH units		7.78	7.78	7.75	6.10	5.72
solids, total dissolved [TDS]	----	E162S	10	mg/L		26500	29800	26000	<10	<10
solids, total suspended [TSS]	----	E160S	2.0	mg/L		3.7	2.5	5.1	<2.0	<2.0
turbidity	----	E121	0.10	NTU		0.12	0.13	0.11	<0.10	<0.10
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.60	mg/L		5580	5740	5730	<1.00	<1.00
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
bromide	24959-67-9	E235S.Br	5.0	mg/L		40.3	49.2	51.4	<5.0	<5.0
chloride	16887-00-6	E235S.Cl	50	mg/L		11500	13900	14900	<50	<50
fluoride	16984-48-8	E235S.F	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	<1.0
nitrate (as N)	14797-55-8	E235S.NO3	0.50	mg/L		<0.50	<0.50	<0.50	<0.50 HTD	<0.50 HTD
nitrite (as N)	14797-65-0	E235S.NO2	0.10	mg/L		<0.10	<0.10	<0.10	<0.10 HTD	<0.10 HTD
phosphorus, total	7723-14-0	E372S	0.0020	mg/L		0.0594	0.0726	0.0624	<0.0040	0.0064 RRV
sulfate (as SO4)	14808-79-8	E235S.SO4	30	mg/L		1510	1870	2010	<30	<30
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		1.10	0.89	0.87	<0.50	<0.50
carbon, total organic [TOC]	----	E355-L	0.50	mg/L		1.11	1.60	1.09	<0.50	<0.50
Total Metals										
aluminum, total	7429-90-5	E468S	0.0050	mg/L		0.0146	0.0146	0.0138	<0.0050	<0.0050
antimony, total	7440-36-0	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
arsenic, total	7440-38-2	E468S	0.00040	mg/L		0.00159	0.00167	0.00171	<0.00040	<0.00040
barium, total	7440-39-3	E468S	0.0010	mg/L		0.0105	0.0105	0.0100	<0.0010	<0.0010
beryllium, total	7440-41-7	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
bismuth, total	7440-69-9	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
boron, total	7440-42-8	E468S	0.30	mg/L		3.90	4.29	3.99	<0.30	<0.30
cadmium, total	7440-43-9	E468S	0.000010	mg/L		0.000061	0.000060	0.000060	<0.000010	<0.000010
calcium, total	7440-70-2	E468S	1.0	mg/L		370	403	383	<1.0	<1.0
cesium, total	7440-46-2	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
chromium, total	7440-47-3	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050

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Work Order : VA21C5432
Client : Stantec Consulting Ltd.
Project : ----

Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)					Client sample ID	WQ05-Ebb-20m	WQ06-Ebb-1m	WQ06-Ebb-20m	Field Blank	Equipment Blank
					Client sampling date / time	11-Nov-2021 10:35	11-Nov-2021 10:59	11-Nov-2021 11:20	11-Nov-2021 14:45	11-Nov-2021 15:47
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*		VA21C5432-006	VA21C5432-007	VA21C5432-008	VA21C5432-009	VA21C5432-010
						Result	Result	Result	Result	Result
Total Metals										
cobalt, total	7440-48-4	E468S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
copper, total	7440-50-8	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
gallium, total	7440-55-3	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
iron, total	7439-89-6	E468S	0.010	mg/L		0.016	0.017	0.015	<0.010	<0.010
lead, total	7439-92-1	E468S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
lithium, total	7439-93-2	E468S	0.020	mg/L		0.148	0.159	0.151	<0.020	<0.020
magnesium, total	7439-95-4	E468S	1.0	mg/L		1130	1150	1160	<1.0	<1.0
manganese, total	7439-96-5	E468S	0.00020	mg/L		0.00416	0.00413	0.00452	<0.00020	<0.00020
mercury, total	7439-97-6	E508S	0.0000050	mg/L		<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
molybdenum, total	7439-98-7	E468S	0.00010	mg/L		0.00945	0.0100	0.00966	<0.00010	<0.00010
nickel, total	7440-02-0	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
phosphorus, total	7723-14-0	E468S	0.050	mg/L		0.084	0.114	0.082	<0.050	<0.050
potassium, total	7440-09-7	E468S	1.0	mg/L		386	391	406	<1.0	<1.0
rhenium, total	7440-15-5	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
rubidium, total	7440-17-7	E468S	0.0050	mg/L		0.103	0.105	0.106	<0.0050	<0.0050
selenium, total	7782-49-2	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
silicon, total	7440-21-3	E468S.NaSi	1.0	mg/L		1.2	1.4	1.3	<1.0	<1.0
silver, total	7440-22-4	E468S	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
sodium, total	17341-25-2	E468S.NaSi	2.5	mg/L		9200	9390	9320	<2.5	<2.5
strontium, total	7440-24-6	E468S	0.010	mg/L		6.84	7.13	6.87	<0.010	<0.010
sulfur, total	7704-34-9	E468S	5.0	mg/L		929	937	916	<5.0	<5.0
tellurium, total	13494-80-9	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
thallium, total	7440-28-0	E468S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
thorium, total	7440-29-1	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
tin, total	7440-31-5	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
titanium, total	7440-32-6	E468S	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
tungsten, total	7440-33-7	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
uranium, total	7440-61-1	E468S	0.000050	mg/L		0.00256	0.00272	0.00261	<0.000050	<0.000050
vanadium, total	7440-62-2	E468S	0.00050	mg/L		0.00167	0.00167	0.00173	<0.00050	<0.00050
yttrium, total	7440-65-5	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
zinc, total	7440-66-6	E468S	0.0030	mg/L		<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

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Work Order : VA21C5432
Client : Stantec Consulting Ltd.
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Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ05-Ebb-20m	WQ06-Ebb-1m	WQ06-Ebb-20m	Field Blank	Equipment Blank
					Client sampling date / time	11-Nov-2021 10:35	11-Nov-2021 10:59	11-Nov-2021 11:20	11-Nov-2021 14:45	11-Nov-2021 15:47
						VA21C5432-006	VA21C5432-007	VA21C5432-008	VA21C5432-009	VA21C5432-010
						Result	Result	Result	Result	Result
Total Metals										
zirconium, total	7440-67-7	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Dissolved Metals										
aluminum, dissolved	7429-90-5	E469S	0.0050	mg/L		0.0065	0.0061	0.0059	<0.0050	<0.0050
antimony, dissolved	7440-36-0	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
arsenic, dissolved	7440-38-2	E469S	0.00040	mg/L		0.00156	0.00162	0.00162	<0.00040	<0.00040
barium, dissolved	7440-39-3	E469S	0.0010	mg/L		0.0102	0.0105	0.0099	<0.0010	<0.0010
beryllium, dissolved	7440-41-7	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
bismuth, dissolved	7440-69-9	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
boron, dissolved	7440-42-8	E469S	0.30	mg/L		3.77	3.72	3.80	<0.30	<0.30
cadmium, dissolved	7440-43-9	E469S	0.000010	mg/L		0.000065	0.000074	0.000062	<0.000010	<0.000010
calcium, dissolved	7440-70-2	E469S	1.0	mg/L		362	364	368	<1.0	<1.0
cesium, dissolved	7440-46-2	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
chromium, dissolved	7440-47-3	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
cobalt, dissolved	7440-48-4	E469S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
copper, dissolved	7440-50-8	E469S	0.00020	mg/L		0.00021	0.00025	0.00039	<0.00020	<0.00020
gallium, dissolved	7440-55-3	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
iron, dissolved	7439-89-6	E469S	0.010	mg/L		<0.010	<0.010	<0.010	<0.010	<0.010
lead, dissolved	7439-92-1	E469S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
lithium, dissolved	7439-93-2	E469S	0.020	mg/L		0.143	0.145	0.141	<0.020	<0.020
magnesium, dissolved	7439-95-4	E469S	1.0	mg/L		1110	1110	1110	<1.0	<1.0
manganese, dissolved	7439-96-5	E469S	0.00010	mg/L		0.00244	0.00256	0.00232	<0.00010	<0.00010
mercury, dissolved	7439-97-6	E509S	0.0000050	mg/L		<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
molybdenum, dissolved	7439-98-7	E469S	0.00010	mg/L		0.00928	0.00934	0.00945	<0.00010	<0.00010
nickel, dissolved	7440-02-0	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
phosphorus, dissolved	7723-14-0	E469S	0.050	mg/L		0.074	0.076	0.069	<0.050	<0.050
potassium, dissolved	7440-09-7	E469S	1.0	mg/L		379	380	387	<1.0	<1.0
rhenium, dissolved	7440-15-5	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
rubidium, dissolved	7440-17-7	E469S	0.0050	mg/L		0.104	0.104	0.105	<0.0050	<0.0050
selenium, dissolved	7782-49-2	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
silicon, dissolved	7440-21-3	E469S.NaSi	1.0	mg/L		1.0	<1.0	1.2	<1.0	<1.0
silver, dissolved	7440-22-4	E469S	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

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Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ05-Ebb-20m	WQ06-Ebb-1m	WQ06-Ebb-20m	Field Blank	Equipment Blank
					Client sampling date / time	11-Nov-2021 10:35	11-Nov-2021 10:59	11-Nov-2021 11:20	11-Nov-2021 14:45	11-Nov-2021 15:47
						VA21C5432-006	VA21C5432-007	VA21C5432-008	VA21C5432-009	VA21C5432-010
						Result	Result	Result	Result	Result
Dissolved Metals										
sodium, dissolved	17341-25-2	E469S.NaSi	2.5	mg/L		9590	9210	9570	<2.5	<2.5
strontium, dissolved	7440-24-6	E469S	0.010	mg/L		6.64	6.55	6.70	<0.010	<0.010
sulfur, dissolved	7704-34-9	E469S	5.0	mg/L		960	949	947	<5.0	<5.0
tellurium, dissolved	13494-80-9	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
thallium, dissolved	7440-28-0	E469S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
thorium, dissolved	7440-29-1	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
tin, dissolved	7440-31-5	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
titanium, dissolved	7440-32-6	E469S	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
tungsten, dissolved	7440-33-7	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
uranium, dissolved	7440-61-1	E469S	0.000050	mg/L		0.00261	0.00259	0.00255	<0.000050	<0.000050
vanadium, dissolved	7440-62-2	E469S	0.00050	mg/L		0.00154	0.00155	0.00159	<0.00050	<0.00050
yttrium, dissolved	7440-65-5	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
zinc, dissolved	7440-66-6	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
zirconium, dissolved	7440-67-7	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
dissolved mercury filtration location	----	EP509	-	-		Laboratory	Laboratory	Laboratory	Laboratory	Laboratory
dissolved metals filtration location	----	EP421	-	-		Laboratory	Laboratory	Laboratory	Laboratory	Laboratory
Volatile Organic Compounds [Fuels]										
benzene	71-43-2	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
ethylbenzene	100-41-4	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
styrene	100-42-5	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
toluene	108-88-3	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
xylene, m+p-	179601-23-1	E611A	0.40	µg/L		<0.40	<0.40	<0.40	<0.40	<0.40
xylene, o-	95-47-6	E611A	0.30	µg/L		<0.30	<0.30	<0.30	<0.30	<0.30
xylenes, total	1330-20-7	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
Volatile Organic Compounds Surrogates										
bromofluorobenzene, 4-	460-00-4	E611A	1.0	%		104	102	110	105	109
difluorobenzene, 1,4-	540-36-3	E611A	1.0	%		100	99.6	101	101	101
Hydrocarbons										
F1 (C6-C10)	----	E581.VH+F1	100	µg/L		<100	<100	<100	<100	<100
F1-BTEX	----	EC580	100	µg/L		<100	<100	<100	<100	<100

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Client : Stantec Consulting Ltd.
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Analytical Results

Sub-Matrix: **Seawater**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ05-Ebb-20m	WQ06-Ebb-1m	WQ06-Ebb-20m	Field Blank	Equipment Blank
					Client sampling date / time	11-Nov-2021 10:35	11-Nov-2021 10:59	11-Nov-2021 11:20	11-Nov-2021 14:45	11-Nov-2021 15:47
						VA21C5432-006	VA21C5432-007	VA21C5432-008	VA21C5432-009	VA21C5432-010
						Result	Result	Result	Result	Result
Hydrocarbons										
F2 (C10-C16)	----	E601	100	µg/L		<100	<100	<100	<100	<100
F2-naphthalene	----	EC600	100	µg/L		<100	<100	<100	<100	<100
F3 (C16-C34)	----	E601	250	µg/L		<250	<250	<250	<250	<250
F3-PAH	----	EC600	250	µg/L		<250	<250	<250	<250	<250
F4 (C34-C50)	----	E601	250	µg/L		<250	<250	<250	<250	<250
Hydrocarbons Surrogates										
bromobenzotrifluoride, 2- (F2-F4 surr)	392-83-6	E601	1.0	%		94.8	94.6	77.4	75.0	90.0
dichlorotoluene, 3,4-	97-75-0	E581.VH+F1	1.0	%		88.6	89.0	99.6	93.6	102
Polycyclic Aromatic Hydrocarbons										
acenaphthene	83-32-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
acenaphthylene	208-96-8	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
acridine	260-94-6	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
anthracene	120-12-7	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benz(a)anthracene	56-55-3	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(a)pyrene	50-32-8	E641A	0.0050	µg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
benzo(b+j)fluoranthene	----	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(b+j+k)fluoranthene	----	E641A	0.015	µg/L		<0.015	<0.015	<0.015	<0.015	<0.015
benzo(g,h,i)perylene	191-24-2	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(k)fluoranthene	207-08-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
chrysene	218-01-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
dibenz(a,h)anthracene	53-70-3	E641A	0.0050	µg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
fluoranthene	206-44-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
fluorene	86-73-7	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 1-	90-12-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 1+2-	----	E641A	0.015	µg/L		<0.015	<0.015	<0.015	<0.015	<0.015
methylnaphthalene, 2-	91-57-6	E641A	0.010	µg/L		<0.010	0.011	<0.010	<0.010	<0.010
naphthalene	91-20-3	E641A	0.050	µg/L		<0.050	<0.050	<0.050	<0.050	<0.050
phenanthrene	85-01-8	E641A	0.020	µg/L		<0.020	<0.020	<0.020	<0.020	<0.020
pyrene	129-00-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
quinoline	91-22-5	E641A	0.050	µg/L		<0.050	<0.050	<0.050	<0.050	<0.050

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Work Order : VA21C5432
Client : Stantec Consulting Ltd.
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Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ05-Ebb-20m	WQ06-Ebb-1m	WQ06-Ebb-20m	Field Blank	Equipment Blank
					Client sampling date / time	11-Nov-2021 10:35	11-Nov-2021 10:59	11-Nov-2021 11:20	11-Nov-2021 14:45	11-Nov-2021 15:47
						VA21C5432-006	VA21C5432-007	VA21C5432-008	VA21C5432-009	VA21C5432-010
						Result	Result	Result	Result	Result
Polycyclic Aromatic Hydrocarbons										
B(a)P total potency equivalents [B(a)P TPE]	----	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
Polycyclic Aromatic Hydrocarbons Surrogates										
chrysene-d12	1719-03-5	E641A	0.1	%		79.1	71.2	72.8	71.7	73.1
naphthalene-d8	1146-65-2	E641A	0.1	%		94.3	88.5	91.0	88.0	92.2
phenanthrene-d10	1517-22-2	E641A	0.1	%		105	95.7	99.2	96.5	99.0

Please refer to the General Comments section for an explanation of any qualifiers detected.

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Work Order : VA21C5432
Client : Stantec Consulting Ltd.
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Analytical Results

Sub-Matrix: **Seawater**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ06-Flood-1 m	WQ06-Flood-20 m	WQ05-Flood-1 m	WQ05-Flood-20 m	WQ03-Flood-1 m
					Client sampling date / time	11-Nov-2021 13:34	11-Nov-2021 13:47	11-Nov-2021 14:12	11-Nov-2021 14:25	11-Nov-2021 14:54
						VA21C5432-011	VA21C5432-012	VA21C5432-013	VA21C5432-014	VA21C5432-015
						Result	Result	Result	Result	Result
Physical Tests										
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L		88.5	86.4	88.4	91.4	96.7
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		5670	5450	5330	5420	5440
pH	----	E108	0.10	pH units		7.77	7.77	7.78	7.78	7.78
solids, total dissolved [TDS]	----	E162S	10	mg/L		26400	28700	31300	22200	30300
solids, total suspended [TSS]	----	E160S	2.0	mg/L		3.9	9.9	2.0	8.7	<2.0
turbidity	----	E121	0.10	NTU		0.20	0.12	0.19	<0.10	0.20
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.60	mg/L		5650	5620	5620	5820	5700
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
bromide	24959-67-9	E235S.Br	5.0	mg/L		49.5	50.6	44.7	48.8	51.3
chloride	16887-00-6	E235S.Cl	50	mg/L		14500	14600	13000	14200	14900
fluoride	16984-48-8	E235S.F	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	<1.0
nitrate (as N)	14797-55-8	E235S.NO3	0.50	mg/L		<0.50	<0.50	<0.50	<0.50	<0.50
nitrite (as N)	14797-65-0	E235S.NO2	0.10	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10
phosphorus, total	7723-14-0	E372S	0.0020	mg/L		0.0719	0.0657	0.0803	0.0619	0.0811
sulfate (as SO4)	14808-79-8	E235S.SO4	30	mg/L		1960	1940	1740	1920	2020
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		0.86	0.86	1.14	1.09	0.72
carbon, total organic [TOC]	----	E355-L	0.50	mg/L		0.84	0.73	0.83	0.90	0.77
Total Metals										
aluminum, total	7429-90-5	E468S	0.0050	mg/L		0.0148	0.0142	0.0180	0.0153	0.0142
antimony, total	7440-36-0	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
arsenic, total	7440-38-2	E468S	0.00040	mg/L		0.00163	0.00161	0.00159	0.00168	0.00167
barium, total	7440-39-3	E468S	0.0010	mg/L		0.0103	0.0099	0.0102	0.0107	0.0103
beryllium, total	7440-41-7	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
bismuth, total	7440-69-9	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
boron, total	7440-42-8	E468S	0.30	mg/L		4.32	4.17	4.12	4.04	3.99
cadmium, total	7440-43-9	E468S	0.000010	mg/L		0.000057	0.000058	0.000059	0.000070	0.000063
calcium, total	7440-70-2	E468S	1.0	mg/L		366	371	372	370	370
cesium, total	7440-46-2	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
chromium, total	7440-47-3	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050

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Analytical Results

Sub-Matrix: **Seawater**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ06-Flood-1 m	WQ06-Flood-20 m	WQ05-Flood-1 m	WQ05-Flood-20 m	WQ03-Flood-1 m
					Client sampling date / time	11-Nov-2021 13:34	11-Nov-2021 13:47	11-Nov-2021 14:12	11-Nov-2021 14:25	11-Nov-2021 14:54
						VA21C5432-011	VA21C5432-012	VA21C5432-013	VA21C5432-014	VA21C5432-015
						Result	Result	Result	Result	Result
Total Metals										
cobalt, total	7440-48-4	E468S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
copper, total	7440-50-8	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	0.00118
gallium, total	7440-55-3	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
iron, total	7439-89-6	E468S	0.010	mg/L		0.015	0.014	0.020	0.015	0.015
lead, total	7439-92-1	E468S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
lithium, total	7439-93-2	E468S	0.020	mg/L		0.168	0.162	0.161	0.152	0.146
magnesium, total	7439-95-4	E468S	1.0	mg/L		1150	1140	1140	1190	1160
manganese, total	7439-96-5	E468S	0.00020	mg/L		0.00375	0.00397	0.00415	0.00408	0.00425
mercury, total	7439-97-6	E508S	0.0000050	mg/L		<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
molybdenum, total	7439-98-7	E468S	0.00010	mg/L		0.00931	0.00943	0.00959	0.00973	0.00959
nickel, total	7440-02-0	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
phosphorus, total	7723-14-0	E468S	0.050	mg/L		0.090	0.082	0.096	0.082	0.095
potassium, total	7440-09-7	E468S	1.0	mg/L		373	378	379	400	386
rhenium, total	7440-15-5	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
rubidium, total	7440-17-7	E468S	0.0050	mg/L		0.102	0.103	0.104	0.108	0.104
selenium, total	7782-49-2	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
silicon, total	7440-21-3	E468S.NaSi	1.0	mg/L		<1.0	1.1	1.1	1.1	1.1
silver, total	7440-22-4	E468S	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
sodium, total	17341-25-2	E468S.NaSi	2.5	mg/L		10200	9580	9250	9640	9860
strontium, total	7440-24-6	E468S	0.010	mg/L		6.39	6.59	6.67	6.73	6.85
sulfur, total	7704-34-9	E468S	5.0	mg/L		874	878	847	861	856
tellurium, total	13494-80-9	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
thallium, total	7440-28-0	E468S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
thorium, total	7440-29-1	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
tin, total	7440-31-5	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
titanium, total	7440-32-6	E468S	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
tungsten, total	7440-33-7	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
uranium, total	7440-61-1	E468S	0.000050	mg/L		0.00273	0.00266	0.00263	0.00270	0.00262
vanadium, total	7440-62-2	E468S	0.00050	mg/L		0.00167	0.00164	0.00165	0.00175	0.00169
yttrium, total	7440-65-5	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
zinc, total	7440-66-6	E468S	0.0030	mg/L		<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

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Analytical Results

Sub-Matrix: **Seawater**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ06-Flood-1 m	WQ06-Flood-20 m	WQ05-Flood-1 m	WQ05-Flood-20 m	WQ03-Flood-1 m
					Client sampling date / time	11-Nov-2021 13:34	11-Nov-2021 13:47	11-Nov-2021 14:12	11-Nov-2021 14:25	11-Nov-2021 14:54
						VA21C5432-011	VA21C5432-012	VA21C5432-013	VA21C5432-014	VA21C5432-015
						Result	Result	Result	Result	Result
Total Metals										
zirconium, total	7440-67-7	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Dissolved Metals										
aluminum, dissolved	7429-90-5	E469S	0.0050	mg/L		0.0061	0.0059	0.0073	0.0064	0.0057
antimony, dissolved	7440-36-0	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
arsenic, dissolved	7440-38-2	E469S	0.00040	mg/L		0.00159	0.00166	0.00150	0.00163	0.00158
barium, dissolved	7440-39-3	E469S	0.0010	mg/L		0.0107	0.0101	0.0102	0.0105	0.0105
beryllium, dissolved	7440-41-7	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
bismuth, dissolved	7440-69-9	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
boron, dissolved	7440-42-8	E469S	0.30	mg/L		3.71	3.60	3.67	3.71	3.60
cadmium, dissolved	7440-43-9	E469S	0.000010	mg/L		0.000067	0.000066	0.000066	0.000068	0.000064
calcium, dissolved	7440-70-2	E469S	1.0	mg/L		375	367	369	374	363
cesium, dissolved	7440-46-2	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
chromium, dissolved	7440-47-3	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
cobalt, dissolved	7440-48-4	E469S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
copper, dissolved	7440-50-8	E469S	0.00020	mg/L		0.00023	<0.00020	<0.00020	0.00023	0.00044
gallium, dissolved	7440-55-3	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
iron, dissolved	7439-89-6	E469S	0.010	mg/L		<0.010	<0.010	<0.010	<0.010	<0.010
lead, dissolved	7439-92-1	E469S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
lithium, dissolved	7439-93-2	E469S	0.020	mg/L		0.146	0.143	0.139	0.145	0.139
magnesium, dissolved	7439-95-4	E469S	1.0	mg/L		1150	1100	1070	1090	1100
manganese, dissolved	7439-96-5	E469S	0.00010	mg/L		0.00241	0.00225	0.00251	0.00234	0.00256
mercury, dissolved	7439-97-6	E509S	0.0000050	mg/L		<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
molybdenum, dissolved	7439-98-7	E469S	0.00010	mg/L		0.00933	0.00924	0.00904	0.00913	0.00955
nickel, dissolved	7440-02-0	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
phosphorus, dissolved	7723-14-0	E469S	0.050	mg/L		0.090	0.084	0.072	0.069	0.079
potassium, dissolved	7440-09-7	E469S	1.0	mg/L		397	385	372	380	393
rhenium, dissolved	7440-15-5	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
rubidium, dissolved	7440-17-7	E469S	0.0050	mg/L		0.107	0.104	0.101	0.104	0.108
selenium, dissolved	7782-49-2	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
silicon, dissolved	7440-21-3	E469S.NaSi	1.0	mg/L		1.1	1.0	1.2	1.1	<1.0
silver, dissolved	7440-22-4	E469S	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

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Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ06-Flood-1 m	WQ06-Flood-20 m	WQ05-Flood-1 m	WQ05-Flood-20 m	WQ03-Flood-1 m
					Client sampling date / time	11-Nov-2021 13:34	11-Nov-2021 13:47	11-Nov-2021 14:12	11-Nov-2021 14:25	11-Nov-2021 14:54
						VA21C5432-011	VA21C5432-012	VA21C5432-013	VA21C5432-014	VA21C5432-015
						Result	Result	Result	Result	Result
Dissolved Metals										
sodium, dissolved	17341-25-2	E469S.NaSi	2.5	mg/L		9550	9260	9040	9340	9250
strontium, dissolved	7440-24-6	E469S	0.010	mg/L		6.60	6.65	6.52	6.48	6.60
sulfur, dissolved	7704-34-9	E469S	5.0	mg/L		960	929	940	930	946
tellurium, dissolved	13494-80-9	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
thallium, dissolved	7440-28-0	E469S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
thorium, dissolved	7440-29-1	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
tin, dissolved	7440-31-5	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
titanium, dissolved	7440-32-6	E469S	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
tungsten, dissolved	7440-33-7	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
uranium, dissolved	7440-61-1	E469S	0.000050	mg/L		0.00260	0.00256	0.00256	0.00265	0.00258
vanadium, dissolved	7440-62-2	E469S	0.00050	mg/L		0.00159	0.00155	0.00148	0.00161	0.00156
yttrium, dissolved	7440-65-5	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
zinc, dissolved	7440-66-6	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
zirconium, dissolved	7440-67-7	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
dissolved mercury filtration location	----	EP509	-	-		Laboratory	Laboratory	Laboratory	Laboratory	Laboratory
dissolved metals filtration location	----	EP421	-	-		Laboratory	Laboratory	Laboratory	Laboratory	Laboratory
Volatile Organic Compounds [Fuels]										
benzene	71-43-2	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
ethylbenzene	100-41-4	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
styrene	100-42-5	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
toluene	108-88-3	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
xylene, m+p-	179601-23-1	E611A	0.40	µg/L		<0.40	<0.40	<0.40	<0.40	<0.40
xylene, o-	95-47-6	E611A	0.30	µg/L		<0.30	<0.30	<0.30	<0.30	<0.30
xylenes, total	1330-20-7	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
Volatile Organic Compounds Surrogates										
bromofluorobenzene, 4-	460-00-4	E611A	1.0	%		109	106	107	112	110
difluorobenzene, 1,4-	540-36-3	E611A	1.0	%		99.8	101	101	101	101
Hydrocarbons										
F1 (C6-C10)	----	E581.VH+F1	100	µg/L		<100	<100	<100	<100	<100
F1-BTEX	----	EC580	100	µg/L		<100	<100	<100	<100	<100

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Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ06-Flood-1 m	WQ06-Flood-20 m	WQ05-Flood-1 m	WQ05-Flood-20 m	WQ03-Flood-1 m
					Client sampling date / time	11-Nov-2021 13:34	11-Nov-2021 13:47	11-Nov-2021 14:12	11-Nov-2021 14:25	11-Nov-2021 14:54
						VA21C5432-011	VA21C5432-012	VA21C5432-013	VA21C5432-014	VA21C5432-015
						Result	Result	Result	Result	Result
Hydrocarbons										
F2 (C10-C16)	----	E601	100	µg/L		<100	<100	<100	<100	<100
F2-naphthalene	----	EC600	100	µg/L		<100	<100	<100	<100	<100
F3 (C16-C34)	----	E601	250	µg/L		<250	<250	<250	<250	<250
F3-PAH	----	EC600	250	µg/L		<250	<250	<250	<250	<250
F4 (C34-C50)	----	E601	250	µg/L		<250	<250	<250	<250	<250
Hydrocarbons Surrogates										
bromobenzotrifluoride, 2- (F2-F4 surr)	392-83-6	E601	1.0	%		89.0	90.6	85.7	87.4	87.9
dichlorotoluene, 3,4-	97-75-0	E581.VH+F1	1.0	%		92.8	99.1	95.2	95.2	73.6
Polycyclic Aromatic Hydrocarbons										
acenaphthene	83-32-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
acenaphthylene	208-96-8	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
acridine	260-94-6	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
anthracene	120-12-7	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benz(a)anthracene	56-55-3	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(a)pyrene	50-32-8	E641A	0.0050	µg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
benzo(b+j)fluoranthene	----	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(b+j+k)fluoranthene	----	E641A	0.015	µg/L		<0.015	<0.015	<0.015	<0.015	<0.015
benzo(g,h,i)perylene	191-24-2	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(k)fluoranthene	207-08-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
chrysene	218-01-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
dibenz(a,h)anthracene	53-70-3	E641A	0.0050	µg/L		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
fluoranthene	206-44-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
fluorene	86-73-7	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 1-	90-12-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 1+2-	----	E641A	0.015	µg/L		<0.015	<0.015	<0.015	<0.015	<0.015
methylnaphthalene, 2-	91-57-6	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
naphthalene	91-20-3	E641A	0.050	µg/L		<0.050	<0.050	<0.050	<0.050	<0.050
phenanthrene	85-01-8	E641A	0.020	µg/L		<0.020	<0.020	<0.020	<0.020	<0.020
pyrene	129-00-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
quinoline	91-22-5	E641A	0.050	µg/L		<0.050	<0.050	<0.050	<0.050	<0.050

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Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)					Client sample ID	WQ06-Flood-1 m	WQ06-Flood-20 m	WQ05-Flood-1 m	WQ05-Flood-20 m	WQ03-Flood-1 m
					Client sampling date / time	11-Nov-2021 13:34	11-Nov-2021 13:47	11-Nov-2021 14:12	11-Nov-2021 14:25	11-Nov-2021 14:54
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*		**VA21C5432-011**	**VA21C5432-012**	**VA21C5432-013**	**VA21C5432-014**	**VA21C5432-015**
						Result	Result	Result	Result	Result
Polycyclic Aromatic Hydrocarbons										
B(a)P total potency equivalents [B(a)P TPE]	----	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	<0.010
Polycyclic Aromatic Hydrocarbons Surrogates										
chrysene-d12	1719-03-5	E641A	0.1	%		68.6	75.8	84.1	82.3	83.3
naphthalene-d8	1146-65-2	E641A	0.1	%		88.5	94.5	89.0	93.1	92.2
phenanthrene-d10	1517-22-2	E641A	0.1	%		95.6	102	103	107	105

Please refer to the General Comments section for an explanation of any qualifiers detected.

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Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ03-Flood-20 m	WQ01-Flood-1 m	WQ01-Flood-20 m	WQ06-Flood-20 m-DUP	----
					Client sampling date / time	11-Nov-2021 15:05	11-Nov-2021 15:18	11-Nov-2021 15:33	11-Nov-2021 15:33	----
						VA21C5432-016	VA21C5432-017	VA21C5432-018	VA21C5432-019	--------
						Result	Result	Result	Result	----
Physical Tests										
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L		98.9	88.9	89.8	95.8	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		5460	5310	5470	5290	----
pH	----	E108	0.10	pH units		7.77	7.78	7.78	7.79	----
solids, total dissolved [TDS]	----	E162S	10	mg/L		31400	25800	33900	22600	----
solids, total suspended [TSS]	----	E160S	2.0	mg/L		8.0	8.5	5.6	4.1	----
turbidity	----	E121	0.10	NTU		0.19	0.21	0.15	0.12	----
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.60	mg/L		5870	5670	5720	5700	----
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	----
bromide	24959-67-9	E235S.Br	5.0	mg/L		45.0	43.2	48.0	52.2	----
chloride	16887-00-6	E235S.Cl	50	mg/L		12900	12700	14100	15200	----
fluoride	16984-48-8	E235S.F	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	----
nitrate (as N)	14797-55-8	E235S.NO3	0.50	mg/L		<0.50	<0.50	<0.50	<0.50	----
nitrite (as N)	14797-65-0	E235S.NO2	0.10	mg/L		<0.10	<0.10	<0.10	<0.10	----
phosphorus, total	7723-14-0	E372S	0.0020	mg/L		0.0787	0.0863	0.0696	0.0654	----
sulfate (as SO4)	14808-79-8	E235S.SO4	30	mg/L		1720	1700	1900	2060	----
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		0.85	0.81	1.00	0.83	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L		0.79	1.05	1.64	0.99	----
Total Metals										
aluminum, total	7429-90-5	E468S	0.0050	mg/L		0.0150	0.0158	0.0152	0.0170	----
antimony, total	7440-36-0	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	----
arsenic, total	7440-38-2	E468S	0.00040	mg/L		0.00173	0.00168	0.00165	0.00166	----
barium, total	7440-39-3	E468S	0.0010	mg/L		0.0097	0.0104	0.0096	0.0101	----
beryllium, total	7440-41-7	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
bismuth, total	7440-69-9	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
boron, total	7440-42-8	E468S	0.30	mg/L		4.04	4.00	4.21	3.87	----
cadmium, total	7440-43-9	E468S	0.000010	mg/L		0.000064	0.000064	0.000066	0.000058	----
calcium, total	7440-70-2	E468S	1.0	mg/L		371	375	393	371	----
cesium, total	7440-46-2	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
chromium, total	7440-47-3	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----

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Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)					Client sample ID	WQ03-Flood-20 m	WQ01-Flood-1 m	WQ01-Flood-20 m	WQ06-Flood-20 m-DUP	----
					Client sampling date / time	11-Nov-2021 15:05	11-Nov-2021 15:18	11-Nov-2021 15:33	11-Nov-2021 15:33	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*		VA21C5432-016	VA21C5432-017	VA21C5432-018	VA21C5432-019	--------
						Result	Result	Result	Result	----
Total Metals										
cobalt, total	7440-48-4	E468S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	----
copper, total	7440-50-8	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	0.00165	----
gallium, total	7440-55-3	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
iron, total	7439-89-6	E468S	0.010	mg/L		0.017	0.016	0.018	0.027	----
lead, total	7439-92-1	E468S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	----
lithium, total	7439-93-2	E468S	0.020	mg/L		0.157	0.149	0.154	0.145	----
magnesium, total	7439-95-4	E468S	1.0	mg/L		1200	1150	1150	1160	----
manganese, total	7439-96-5	E468S	0.00020	mg/L		0.00398	0.00427	0.00419	0.00418	----
mercury, total	7439-97-6	E508S	0.0000050	mg/L		<0.0000050	<0.0000050	<0.0000050	<0.0000050	----
molybdenum, total	7439-98-7	E468S	0.00010	mg/L		0.00981	0.00939	0.0100	0.00933	----
nickel, total	7440-02-0	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	0.00343	----
phosphorus, total	7723-14-0	E468S	0.050	mg/L		0.112	0.100	0.094	0.095	----
potassium, total	7440-09-7	E468S	1.0	mg/L		396	382	388	384	----
rhenium, total	7440-15-5	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
rubidium, total	7440-17-7	E468S	0.0050	mg/L		0.110	0.104	0.105	0.104	----
selenium, total	7782-49-2	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
silicon, total	7440-21-3	E468S.NaSi	1.0	mg/L		1.1	1.0	1.2	1.1	----
silver, total	7440-22-4	E468S	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	----
sodium, total	17341-25-2	E468S.NaSi	2.5	mg/L		10400	9900	10100	9540	----
strontium, total	7440-24-6	E468S	0.010	mg/L		7.01	6.75	7.10	6.51	----
sulfur, total	7704-34-9	E468S	5.0	mg/L		862	840	878	855	----
tellurium, total	13494-80-9	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
thallium, total	7440-28-0	E468S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	----
thorium, total	7440-29-1	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
tin, total	7440-31-5	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	----
titanium, total	7440-32-6	E468S	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	----
tungsten, total	7440-33-7	E468S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	----
uranium, total	7440-61-1	E468S	0.000050	mg/L		0.00272	0.00266	0.00280	0.00260	----
vanadium, total	7440-62-2	E468S	0.00050	mg/L		0.00177	0.00164	0.00171	0.00166	----
yttrium, total	7440-65-5	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
zinc, total	7440-66-6	E468S	0.0030	mg/L		<0.0030	<0.0030	<0.0030	<0.0030	----

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Analytical Results

Sub-Matrix: Seawater (Matrix: Water)					Client sample ID	WQ03-Flood-20 m	WQ01-Flood-1 m	WQ01-Flood-20 m	WQ06-Flood-20 m-DUP	----
					Client sampling date / time	11-Nov-2021 15:05	11-Nov-2021 15:18	11-Nov-2021 15:33	11-Nov-2021 15:33	----
Analyte	CAS Number	Method	LOR	Unit		VA21C5432-016	VA21C5432-017	VA21C5432-018	VA21C5432-019	--------
						Result	Result	Result	Result	----
Total Metals										
zirconium, total	7440-67-7	E468S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
Dissolved Metals										
aluminum, dissolved	7429-90-5	E469S	0.0050	mg/L		<0.0050	0.0059	<0.0050	0.0050	----
antimony, dissolved	7440-36-0	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	----
arsenic, dissolved	7440-38-2	E469S	0.00040	mg/L		0.00161	0.00160	0.00164	0.00155	----
barium, dissolved	7440-39-3	E469S	0.0010	mg/L		0.0095	0.0100	0.0097	0.0098	----
beryllium, dissolved	7440-41-7	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
bismuth, dissolved	7440-69-9	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
boron, dissolved	7440-42-8	E469S	0.30	mg/L		3.65	3.72	3.73	3.63	----
cadmium, dissolved	7440-43-9	E469S	0.000010	mg/L		0.000059	0.000060	0.000077	0.000066	----
calcium, dissolved	7440-70-2	E469S	1.0	mg/L		374	377	375	372	----
cesium, dissolved	7440-46-2	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
chromium, dissolved	7440-47-3	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
cobalt, dissolved	7440-48-4	E469S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	----
copper, dissolved	7440-50-8	E469S	0.00020	mg/L		<0.00020	0.00020	<0.00020	<0.00020	----
gallium, dissolved	7440-55-3	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
iron, dissolved	7439-89-6	E469S	0.010	mg/L		<0.010	<0.010	<0.010	<0.010	----
lead, dissolved	7439-92-1	E469S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	----
lithium, dissolved	7439-93-2	E469S	0.020	mg/L		0.144	0.144	0.147	0.142	----
magnesium, dissolved	7439-95-4	E469S	1.0	mg/L		1100	1060	1100	1060	----
manganese, dissolved	7439-96-5	E469S	0.00010	mg/L		0.00182	0.00258	0.00228	0.00226	----
mercury, dissolved	7439-97-6	E509S	0.0000050	mg/L		<0.0000050	<0.0000050	<0.0000050	<0.0000050	----
molybdenum, dissolved	7439-98-7	E469S	0.00010	mg/L		0.00954	0.00910	0.00960	0.00945	----
nickel, dissolved	7440-02-0	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
phosphorus, dissolved	7723-14-0	E469S	0.050	mg/L		0.096	0.105	0.096	0.077	----
potassium, dissolved	7440-09-7	E469S	1.0	mg/L		382	370	390	374	----
rhenium, dissolved	7440-15-5	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
rubidium, dissolved	7440-17-7	E469S	0.0050	mg/L		0.105	0.102	0.106	0.104	----
selenium, dissolved	7782-49-2	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
silicon, dissolved	7440-21-3	E469S.NaSi	1.0	mg/L		<1.0	1.2	1.1	1.1	----
silver, dissolved	7440-22-4	E469S	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	----

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Analytical Results

Sub-Matrix: **Seawater** (Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ03-Flood-20 m	WQ01-Flood-1 m	WQ01-Flood-20 m	WQ06-Flood-20 m-DUP	----
					Client sampling date / time	11-Nov-2021 15:05	11-Nov-2021 15:18	11-Nov-2021 15:33	11-Nov-2021 15:33	----
						VA21C5432-016	VA21C5432-017	VA21C5432-018	VA21C5432-019	--------
						Result	Result	Result	Result	----
Dissolved Metals										
sodium, dissolved	17341-25-2	E469S.NaSi	2.5	mg/L		9800	9530	9910	9380	----
strontium, dissolved	7440-24-6	E469S	0.010	mg/L		6.82	6.50	6.77	6.66	----
sulfur, dissolved	7704-34-9	E469S	5.0	mg/L		938	920	1010	902	----
tellurium, dissolved	13494-80-9	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
thallium, dissolved	7440-28-0	E469S	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	----
thorium, dissolved	7440-29-1	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
tin, dissolved	7440-31-5	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	----
titanium, dissolved	7440-32-6	E469S	0.0050	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	----
tungsten, dissolved	7440-33-7	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	----
uranium, dissolved	7440-61-1	E469S	0.000050	mg/L		0.00263	0.00262	0.00272	0.00261	----
vanadium, dissolved	7440-62-2	E469S	0.00050	mg/L		0.00161	0.00154	0.00163	0.00158	----
yttrium, dissolved	7440-65-5	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
zinc, dissolved	7440-66-6	E469S	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	----
zirconium, dissolved	7440-67-7	E469S	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	----
dissolved mercury filtration location	----	EP509	-	-		Laboratory	Laboratory	Laboratory	Laboratory	----
dissolved metals filtration location	----	EP421	-	-		Laboratory	Laboratory	Laboratory	Laboratory	----
Volatile Organic Compounds [Fuels]										
benzene	71-43-2	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	----
ethylbenzene	100-41-4	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	----
styrene	100-42-5	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	----
toluene	108-88-3	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	----
xylene, m+p-	179601-23-1	E611A	0.40	µg/L		<0.40	<0.40	<0.40	<0.40	----
xylene, o-	95-47-6	E611A	0.30	µg/L		<0.30	<0.30	<0.30	<0.30	----
xylenes, total	1330-20-7	E611A	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	----
Volatile Organic Compounds Surrogates										
bromofluorobenzene, 4-	460-00-4	E611A	1.0	%		104	110	107	108	----
difluorobenzene, 1,4-	540-36-3	E611A	1.0	%		98.2	99.6	100	99.1	----
Hydrocarbons										
F1 (C6-C10)	----	E581.VH+F1	100	µg/L		<100	<100	<100	<100	----
F1-BTEX	----	EC580	100	µg/L		<100	<100	<100	<100	----

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Analytical Results

Sub-Matrix: **Seawater**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ03-Flood-20 m	WQ01-Flood-1 m	WQ01-Flood-20 m	WQ06-Flood-20 m-DUP	----
					Client sampling date / time	11-Nov-2021 15:05	11-Nov-2021 15:18	11-Nov-2021 15:33	11-Nov-2021 15:33	----
						VA21C5432-016	VA21C5432-017	VA21C5432-018	VA21C5432-019	--------
						Result	Result	Result	Result	----
Hydrocarbons										
F2 (C10-C16)	----	E601	100	µg/L		<100	<100	<100	<100	----
F2-naphthalene	----	EC600	100	µg/L		<100	<100	<100	<100	----
F3 (C16-C34)	----	E601	250	µg/L		<250	<250	<250	<250	----
F3-PAH	----	EC600	250	µg/L		<250	<250	<250	<250	----
F4 (C34-C50)	----	E601	250	µg/L		<250	<250	<250	<250	----
Hydrocarbons Surrogates										
bromobenzotrifluoride, 2- (F2-F4 surr)	392-83-6	E601	1.0	%		86.0	87.9	86.7	88.3	----
dichlorotoluene, 3,4-	97-75-0	E581.VH+F1	1.0	%		100	107	93.0	95.5	----
Polycyclic Aromatic Hydrocarbons										
acenaphthene	83-32-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	----
acenaphthylene	208-96-8	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	----
acridine	260-94-6	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	----
anthracene	120-12-7	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	----
benz(a)anthracene	56-55-3	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	----
benzo(a)pyrene	50-32-8	E641A	0.0050	µg/L		<0.0050	<0.0050	<0.0050	<0.0050	----
benzo(b+j)fluoranthene	----	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	----
benzo(b+j+k)fluoranthene	----	E641A	0.015	µg/L		<0.015	<0.015	<0.015	<0.015	----
benzo(g,h,i)perylene	191-24-2	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	----
benzo(k)fluoranthene	207-08-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	----
chrysene	218-01-9	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	----
dibenz(a,h)anthracene	53-70-3	E641A	0.0050	µg/L		<0.0050	<0.0050	<0.0050	<0.0050	----
fluoranthene	206-44-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	----
fluorene	86-73-7	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	----
methylnaphthalene, 1-	90-12-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	----
methylnaphthalene, 1+2-	----	E641A	0.015	µg/L		<0.015	<0.015	<0.015	<0.015	----
methylnaphthalene, 2-	91-57-6	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	----
naphthalene	91-20-3	E641A	0.050	µg/L		<0.050	<0.050	<0.050	<0.050	----
phenanthrene	85-01-8	E641A	0.020	µg/L		<0.020	<0.020	<0.020	<0.020	----
pyrene	129-00-0	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	----
quinoline	91-22-5	E641A	0.050	µg/L		<0.050	<0.050	<0.050	<0.050	----

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Work Order	:	VA21C5432
Client	:	Stantec Consulting Ltd.
Project	:	----

Analytical Results

Sub-Matrix: **Seawater**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	WQ03-Flood-20 m	WQ01-Flood-1 m	WQ01-Flood-20 m	WQ06-Flood-20 m-DUP	----
					Client sampling date / time	11-Nov-2021 15:05	11-Nov-2021 15:18	11-Nov-2021 15:33	11-Nov-2021 15:33	----
						VA21C5432-016	VA21C5432-017	VA21C5432-018	VA21C5432-019	--------
						Result	Result	Result	Result	----
Polycyclic Aromatic Hydrocarbons										
B(a)P total potency equivalents [B(a)P TPE]	----	E641A	0.010	µg/L		<0.010	<0.010	<0.010	<0.010	----
Polycyclic Aromatic Hydrocarbons Surrogates										
chrysene-d12	1719-03-5	E641A	0.1	%		76.3	83.5	80.0	73.0	----
naphthalene-d8	1146-65-2	E641A	0.1	%		87.4	97.6	90.6	92.1	----
phenanthrene-d10	1517-22-2	E641A	0.1	%		100	108	102	102	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA21C5432**	Page	: 1 of 63
Client	: **Stantec Consulting Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Libby McMillan	Account Manager	: Brent Mack
Address	: # 11 - 2042 Mills Road Sidney BC Canada V8L 5X4	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 250 655 5371	Telephone	: 778-370-3279
Project	: ----	Date Samples Received	: 12-Nov-2021 21:20
PO	: ----	Issue Date	: 25-Nov-2021 10:21
C-O-C number	: ----		
Sampler	: ----		
Site	: ----		
Quote number	: VA21-STAC100-005		
No. of samples received	: 19		
No. of samples analysed	: 19		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Matrix Spike outliers occur.
- Laboratory Control Sample (LCS) outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers occur - please see following pages for full details.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Water**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Laboratory Control Sample (LCS) Recoveries								
Total Metals	QC-MRG2-345366002	----	tellurium, total	13494-80-9	E468S	122 % MES	80.0-120%	Recovery greater than upper control limit

Result Qualifiers

Qualifier	*Description*
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

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Work Order	: VA21C5432
Client	: Stantec Consulting Ltd.
Project	: ----

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
Equipment Blank	E298	11-Nov-2021	14-Nov-2021	----	----		20-Nov-2021	28 days	9 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
Field Blank	E298	11-Nov-2021	14-Nov-2021	----	----		20-Nov-2021	28 days	9 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ01-Ebb-1m	E298	11-Nov-2021	14-Nov-2021	----	----		20-Nov-2021	28 days	9 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ01-Ebb-20m	E298	11-Nov-2021	14-Nov-2021	----	----		20-Nov-2021	28 days	9 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ01-Flood-1m	E298	11-Nov-2021	14-Nov-2021	----	----		20-Nov-2021	28 days	9 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ01-Flood-20m	E298	11-Nov-2021	14-Nov-2021	----	----		20-Nov-2021	28 days	9 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ03-Ebb-1m	E298	11-Nov-2021	14-Nov-2021	----	----		20-Nov-2021	28 days	9 days	✓

Page	: 4 of 63
Work Order	: VA21C5432
Client	: Stantec Consulting Ltd.
Project	: ----

Matrix: **Water**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
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Amber glass total (sulfuric acid)										
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Amber glass total (sulfuric acid)										
WQ03-Flood-20m	E298	11-Nov-2021	14-Nov-2021	----	----		20-Nov-2021	28 days	9 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ05-Ebb-1m	E298	11-Nov-2021	14-Nov-2021	----	----		20-Nov-2021	28 days	9 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ05-Ebb-20m	E298	11-Nov-2021	14-Nov-2021	----	----		20-Nov-2021	28 days	9 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
WQ05-Flood-1m	E298	11-Nov-2021	14-Nov-2021	----	----		20-Nov-2021	28 days	9 days	✓
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Amber glass total (sulfuric acid) WQ06-Flood-20m-DUP	E298	11-Nov-2021	14-Nov-2021	----	----		20-Nov-2021	28 days	9 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE Equipment Blank	E235S.Br	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE Field Blank	E235S.Br	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE WQ01-Ebb-1m	E235S.Br	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
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Anions and Nutrients : Bromide in Seawater by IC										
HDPE WQ01-Flood-1m	E235S.Br	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE WQ01-Flood-20m	E235S.Br	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Bromide in Seawater by IC										
HDPE WQ03-Ebb-1m	E235S.Br	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Bromide in Seawater by IC										
HDPE WQ03-Ebb-20m	E235S.Br	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
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HDPE WQ06-Ebb-1m	E235S.Br	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓

Matrix: **Water**

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HDPE										
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HDPE										
WQ06-Flood-20m-DUP	E235S.Br	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Chloride in Seawater by IC										
HDPE										
Equipment Blank	E235S.Cl	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Chloride in Seawater by IC										
HDPE										
Field Blank	E235S.Cl	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Chloride in Seawater by IC										
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WQ01-Ebb-1m	E235S.Cl	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
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Matrix: **Water**

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			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Chloride in Seawater by IC										
HDPE WQ06-Ebb-1m	E235S.Cl	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
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HDPE WQ06-Flood-1m	E235S.Cl	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
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Anions and Nutrients : Chloride in Seawater by IC										
HDPE WQ06-Flood-20m-DUP	E235S.Cl	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE Equipment Blank	E235S.F	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE Field Blank	E235S.F	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
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Anions and Nutrients : Fluoride in Seawater by IC										
HDPE WQ01-Ebb-20m	E235S.F	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓

Matrix: **Water**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Fluoride in Seawater by IC										
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HDPE WQ06-Flood-1m	E235S.F	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE WQ06-Flood-20m	E235S.F	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Fluoride in Seawater by IC										
HDPE WQ06-Flood-20m-DUP	E235S.F	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE Equipment Blank	E235S.NO3	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE Field Blank	E235S.NO3	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ01-Ebb-1m	E235S.NO3	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ01-Ebb-20m	E235S.NO3	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ01-Flood-1m	E235S.NO3	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ01-Flood-20m	E235S.NO3	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ03-Ebb-1m	E235S.NO3	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ03-Ebb-20m	E235S.NO3	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ03-Flood-1m	E235S.NO3	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ03-Flood-20m	E235S.NO3	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ05-Ebb-1m	E235S.NO3	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE WQ05-Ebb-20m	E235S.NO3	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE										
WQ05-Flood-1m	E235S.NO3	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE										
WQ05-Flood-20m	E235S.NO3	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE										
WQ06-Ebb-1m	E235S.NO3	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE										
WQ06-Ebb-20m	E235S.NO3	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE										
WQ06-Flood-1m	E235S.NO3	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE										
WQ06-Flood-20m	E235S.NO3	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrate in Seawater by IC										
HDPE										
WQ06-Flood-20m-DUP	E235S.NO3	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE										
Equipment Blank	E235S.NO2	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE										
Field Blank	E235S.NO2	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE WQ01-Ebb-1m	E235S.NO2	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE WQ01-Ebb-20m	E235S.NO2	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE WQ01-Flood-1m	E235S.NO2	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE WQ01-Flood-20m	E235S.NO2	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE WQ03-Ebb-1m	E235S.NO2	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE WQ03-Ebb-20m	E235S.NO2	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE WQ03-Flood-1m	E235S.NO2	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE WQ03-Flood-20m	E235S.NO2	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE WQ05-Ebb-1m	E235S.NO2	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE										
WQ05-Ebb-20m	E235S.NO2	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE										
WQ05-Flood-1m	E235S.NO2	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE										
WQ05-Flood-20m	E235S.NO2	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE										
WQ06-Ebb-1m	E235S.NO2	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE										
WQ06-Ebb-20m	E235S.NO2	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE										
WQ06-Flood-1m	E235S.NO2	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE										
WQ06-Flood-20m	E235S.NO2	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Nitrite in Seawater by IC										
HDPE										
WQ06-Flood-20m-DUP	E235S.NO2	11-Nov-2021	----	----	----		13-Nov-2021	3 days	2 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
Equipment Blank	E235S.SO4	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
Field Blank	E235S.SO4	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ01-Ebb-1m	E235S.SO4	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ01-Ebb-20m	E235S.SO4	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ01-Flood-1m	E235S.SO4	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ01-Flood-20m	E235S.SO4	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ03-Ebb-1m	E235S.SO4	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ03-Ebb-20m	E235S.SO4	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ03-Flood-1m	E235S.SO4	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ03-Flood-20m	E235S.SO4	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ05-Ebb-1m	E235S.SO4	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ05-Ebb-20m	E235S.SO4	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ05-Flood-1m	E235S.SO4	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ05-Flood-20m	E235S.SO4	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ06-Ebb-1m	E235S.SO4	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ06-Ebb-20m	E235S.SO4	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ06-Flood-1m	E235S.SO4	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ06-Flood-20m	E235S.SO4	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓
Anions and Nutrients : Sulfate in Seawater by IC										
HDPE										
WQ06-Flood-20m-DUP	E235S.SO4	11-Nov-2021	----	----	----		13-Nov-2021	28 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Phosphorus in Seawater by Colourimetry										
Amber glass total (sulfuric acid)										
Equipment Blank	E372S	11-Nov-2021	14-Nov-2021	----	----		15-Nov-2021	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus in Seawater by Colourimetry										
Amber glass total (sulfuric acid)										
Field Blank	E372S	11-Nov-2021	14-Nov-2021	----	----		15-Nov-2021	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus in Seawater by Colourimetry										
Amber glass total (sulfuric acid)										
WQ01-Ebb-1m	E372S	11-Nov-2021	14-Nov-2021	----	----		15-Nov-2021	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus in Seawater by Colourimetry										
Amber glass total (sulfuric acid)										
WQ01-Ebb-20m	E372S	11-Nov-2021	14-Nov-2021	----	----		15-Nov-2021	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus in Seawater by Colourimetry										
Amber glass total (sulfuric acid)										
WQ01-Flood-1m	E372S	11-Nov-2021	14-Nov-2021	----	----		15-Nov-2021	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus in Seawater by Colourimetry										
Amber glass total (sulfuric acid)										
WQ01-Flood-20m	E372S	11-Nov-2021	14-Nov-2021	----	----		15-Nov-2021	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus in Seawater by Colourimetry										
Amber glass total (sulfuric acid)										
WQ03-Ebb-1m	E372S	11-Nov-2021	14-Nov-2021	----	----		15-Nov-2021	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus in Seawater by Colourimetry										
Amber glass total (sulfuric acid)										
WQ03-Ebb-20m	E372S	11-Nov-2021	14-Nov-2021	----	----		15-Nov-2021	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus in Seawater by Colourimetry										
Amber glass total (sulfuric acid)										
WQ03-Flood-1m	E372S	11-Nov-2021	14-Nov-2021	----	----		15-Nov-2021	28 days	4 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Phosphorus in Seawater by Colourimetry										
Amber glass total (sulfuric acid)										
WQ03-Flood-20m	E372S	11-Nov-2021	14-Nov-2021	----	----		15-Nov-2021	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus in Seawater by Colourimetry										
Amber glass total (sulfuric acid)										
WQ05-Ebb-1m	E372S	11-Nov-2021	14-Nov-2021	----	----		15-Nov-2021	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus in Seawater by Colourimetry										
Amber glass total (sulfuric acid)										
WQ05-Ebb-20m	E372S	11-Nov-2021	14-Nov-2021	----	----		15-Nov-2021	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus in Seawater by Colourimetry										
Amber glass total (sulfuric acid)										
WQ05-Flood-1m	E372S	11-Nov-2021	14-Nov-2021	----	----		15-Nov-2021	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus in Seawater by Colourimetry										
Amber glass total (sulfuric acid)										
WQ05-Flood-20m	E372S	11-Nov-2021	14-Nov-2021	----	----		15-Nov-2021	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus in Seawater by Colourimetry										
Amber glass total (sulfuric acid)										
WQ06-Ebb-1m	E372S	11-Nov-2021	14-Nov-2021	----	----		15-Nov-2021	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus in Seawater by Colourimetry										
Amber glass total (sulfuric acid)										
WQ06-Ebb-20m	E372S	11-Nov-2021	14-Nov-2021	----	----		15-Nov-2021	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus in Seawater by Colourimetry										
Amber glass total (sulfuric acid)										
WQ06-Flood-1m	E372S	11-Nov-2021	14-Nov-2021	----	----		15-Nov-2021	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus in Seawater by Colourimetry										
Amber glass total (sulfuric acid)										
WQ06-Flood-20m	E372S	11-Nov-2021	14-Nov-2021	----	----		15-Nov-2021	28 days	4 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Phosphorus in Seawater by Colourimetry										
Amber glass total (sulfuric acid)										
WQ06-Flood-20m-DUP	E372S	11-Nov-2021	14-Nov-2021	----	----		15-Nov-2021	28 days	4 days	✓
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
Glass vial - dissolved (lab preserved)										
Equipment Blank	E509S	11-Nov-2021	23-Nov-2021	----	----		23-Nov-2021	28 days	12 days	✓
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
Glass vial - dissolved (lab preserved)										
Field Blank	E509S	11-Nov-2021	23-Nov-2021	----	----		23-Nov-2021	28 days	12 days	✓
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
Glass vial - dissolved (lab preserved)										
WQ01-Ebb-1m	E509S	11-Nov-2021	23-Nov-2021	----	----		23-Nov-2021	28 days	12 days	✓
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
Glass vial - dissolved (lab preserved)										
WQ01-Ebb-20m	E509S	11-Nov-2021	23-Nov-2021	----	----		23-Nov-2021	28 days	12 days	✓
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
Glass vial - dissolved (lab preserved)										
WQ01-Flood-1m	E509S	11-Nov-2021	23-Nov-2021	----	----		23-Nov-2021	28 days	12 days	✓
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
Glass vial - dissolved (lab preserved)										
WQ01-Flood-20m	E509S	11-Nov-2021	23-Nov-2021	----	----		23-Nov-2021	28 days	12 days	✓
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
Glass vial - dissolved (lab preserved)										
WQ03-Ebb-1m	E509S	11-Nov-2021	23-Nov-2021	----	----		23-Nov-2021	28 days	12 days	✓
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
Glass vial - dissolved (lab preserved)										
WQ03-Ebb-20m	E509S	11-Nov-2021	23-Nov-2021	----	----		23-Nov-2021	28 days	12 days	✓

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Work Order	: VA21C5432
Client	: Stantec Consulting Ltd.
Project	: ----

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
Glass vial - dissolved (lab preserved)										
WQ03-Flood-1m	E509S	11-Nov-2021	23-Nov-2021	----	----		23-Nov-2021	28 days	12 days	✓
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
Glass vial - dissolved (lab preserved)										
WQ03-Flood-20m	E509S	11-Nov-2021	23-Nov-2021	----	----		23-Nov-2021	28 days	12 days	✓
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
Glass vial - dissolved (lab preserved)										
WQ05-Ebb-1m	E509S	11-Nov-2021	23-Nov-2021	----	----		23-Nov-2021	28 days	12 days	✓
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
Glass vial - dissolved (lab preserved)										
WQ05-Ebb-20m	E509S	11-Nov-2021	23-Nov-2021	----	----		23-Nov-2021	28 days	12 days	✓
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
Glass vial - dissolved (lab preserved)										
WQ05-Flood-1m	E509S	11-Nov-2021	23-Nov-2021	----	----		23-Nov-2021	28 days	12 days	✓
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
Glass vial - dissolved (lab preserved)										
WQ05-Flood-20m	E509S	11-Nov-2021	23-Nov-2021	----	----		23-Nov-2021	28 days	12 days	✓
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
Glass vial - dissolved (lab preserved)										
WQ06-Ebb-1m	E509S	11-Nov-2021	23-Nov-2021	----	----		23-Nov-2021	28 days	12 days	✓
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
Glass vial - dissolved (lab preserved)										
WQ06-Ebb-20m	E509S	11-Nov-2021	23-Nov-2021	----	----		23-Nov-2021	28 days	12 days	✓
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
Glass vial - dissolved (lab preserved)										
WQ06-Flood-1m	E509S	11-Nov-2021	23-Nov-2021	----	----		23-Nov-2021	28 days	12 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
Glass vial - dissolved (lab preserved) WQ06-Flood-20m	E509S	11-Nov-2021	23-Nov-2021	----	----		23-Nov-2021	28 days	12 days	✓
Dissolved Metals : Dissolved Mercury in Seawater by CVAAS										
Glass vial - dissolved (lab preserved) WQ06-Flood-20m-DUP	E509S	11-Nov-2021	23-Nov-2021	----	----		23-Nov-2021	28 days	12 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE - dissolved (lab preserved) Equipment Blank	E469S	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE - dissolved (lab preserved) Field Blank	E469S	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE - dissolved (lab preserved) WQ01-Ebb-1m	E469S	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE - dissolved (lab preserved) WQ01-Ebb-20m	E469S	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE - dissolved (lab preserved) WQ01-Flood-1m	E469S	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE - dissolved (lab preserved) WQ01-Flood-20m	E469S	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE - dissolved (lab preserved) WQ03-Ebb-1m	E469S	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE - dissolved (lab preserved)										
WQ03-Ebb-20m	E469S	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE - dissolved (lab preserved)										
WQ03-Flood-1m	E469S	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE - dissolved (lab preserved)										
WQ03-Flood-20m	E469S	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE - dissolved (lab preserved)										
WQ05-Ebb-1m	E469S	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE - dissolved (lab preserved)										
WQ05-Ebb-20m	E469S	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE - dissolved (lab preserved)										
WQ05-Flood-1m	E469S	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE - dissolved (lab preserved)										
WQ05-Flood-20m	E469S	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE - dissolved (lab preserved)										
WQ06-Ebb-1m	E469S	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE - dissolved (lab preserved)										
WQ06-Ebb-20m	E469S	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE - dissolved (lab preserved)										
WQ06-Flood-1m	E469S	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE - dissolved (lab preserved)										
WQ06-Flood-20m	E469S	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Metals in Seawater by CRC ICPMS (HMI)										
HDPE - dissolved (lab preserved)										
WQ06-Flood-20m-DUP	E469S	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - dissolved (lab preserved)										
Equipment Blank	E469S.NaSi	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - dissolved (lab preserved)										
Field Blank	E469S.NaSi	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - dissolved (lab preserved)										
WQ01-Ebb-1m	E469S.NaSi	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - dissolved (lab preserved)										
WQ01-Ebb-20m	E469S.NaSi	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - dissolved (lab preserved)										
WQ01-Flood-1m	E469S.NaSi	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - dissolved (lab preserved)										
WQ01-Flood-20m	E469S.NaSi	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - dissolved (lab preserved) WQ03-Ebb-1m	E469S.NaSi	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - dissolved (lab preserved) WQ03-Ebb-20m	E469S.NaSi	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - dissolved (lab preserved) WQ03-Flood-1m	E469S.NaSi	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - dissolved (lab preserved) WQ03-Flood-20m	E469S.NaSi	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - dissolved (lab preserved) WQ05-Ebb-1m	E469S.NaSi	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - dissolved (lab preserved) WQ05-Ebb-20m	E469S.NaSi	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - dissolved (lab preserved) WQ05-Flood-1m	E469S.NaSi	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - dissolved (lab preserved) WQ05-Flood-20m	E469S.NaSi	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - dissolved (lab preserved) WQ06-Ebb-1m	E469S.NaSi	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - dissolved (lab preserved) WQ06-Ebb-20m	E469S.NaSi	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - dissolved (lab preserved) WQ06-Flood-1m	E469S.NaSi	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - dissolved (lab preserved) WQ06-Flood-20m	E469S.NaSi	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Dissolved Metals : Dissolved Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - dissolved (lab preserved) WQ06-Flood-20m-DUP	E469S.NaSi	11-Nov-2021	20-Nov-2021	----	----		23-Nov-2021	180 days	12 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) WQ01-Flood-1m	E601	11-Nov-2021	22-Nov-2021	14 days	11 days	✓	23-Nov-2021	40 days	1 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) WQ01-Flood-20m	E601	11-Nov-2021	22-Nov-2021	14 days	11 days	✓	23-Nov-2021	40 days	1 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) WQ03-Flood-1m	E601	11-Nov-2021	22-Nov-2021	14 days	11 days	✓	23-Nov-2021	40 days	1 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) WQ03-Flood-20m	E601	11-Nov-2021	22-Nov-2021	14 days	11 days	✓	23-Nov-2021	40 days	1 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) WQ05-Flood-1m	E601	11-Nov-2021	22-Nov-2021	14 days	11 days	✓	23-Nov-2021	40 days	1 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) WQ05-Flood-20m	E601	11-Nov-2021	22-Nov-2021	14 days	11 days	✓	23-Nov-2021	40 days	1 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) WQ06-Flood-20m-DUP	E601	11-Nov-2021	22-Nov-2021	14 days	11 days	✓	23-Nov-2021	40 days	1 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) Equipment Blank	E601	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) Field Blank	E601	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) WQ01-Ebb-1m	E601	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) WQ01-Ebb-20m	E601	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) WQ03-Ebb-1m	E601	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) WQ03-Ebb-20m	E601	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) WQ05-Ebb-1m	E601	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ05-Ebb-20m	E601	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ06-Ebb-1m	E601	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ06-Ebb-20m	E601	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ06-Flood-1m	E601	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Hydrocarbons : CCME PHC - F2-F4 by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ06-Flood-20m	E601	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate)										
Equipment Blank	E581.VH+F1	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	8 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate)										
Field Blank	E581.VH+F1	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	8 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate)										
WQ01-Flood-1m	E581.VH+F1	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	8 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate)										
WQ01-Flood-20m	E581.VH+F1	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	8 days	✓

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Work Order	: VA21C5432
Client	: Stantec Consulting Ltd.
Project	: ----

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ03-Flood-1m	E581.VH+F1	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	8 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ03-Flood-20m	E581.VH+F1	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	8 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ05-Flood-20m	E581.VH+F1	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	8 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ06-Flood-20m-DUP	E581.VH+F1	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	8 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ01-Ebb-1m	E581.VH+F1	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ01-Ebb-20m	E581.VH+F1	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ03-Ebb-1m	E581.VH+F1	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ03-Ebb-20m	E581.VH+F1	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ05-Ebb-1m	E581.VH+F1	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ05-Ebb-20m	E581.VH+F1	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ05-Flood-1m	E581.VH+F1	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ06-Ebb-1m	E581.VH+F1	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ06-Ebb-20m	E581.VH+F1	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ06-Flood-1m	E581.VH+F1	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) WQ06-Flood-20m	E581.VH+F1	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) Equipment Blank	E358-L	11-Nov-2021	14-Nov-2021	3 days	3 days	✓	14-Nov-2021	28 days	0 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) Field Blank	E358-L	11-Nov-2021	14-Nov-2021	3 days	3 days	✓	14-Nov-2021	28 days	0 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved) WQ01-Ebb-1m	E358-L	11-Nov-2021	14-Nov-2021	3 days	3 days	✓	14-Nov-2021	28 days	0 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved)										
WQ01-Ebb-20m	E358-L	11-Nov-2021	14-Nov-2021	3 days	3 days	✓	14-Nov-2021	28 days	0 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved)										
WQ01-Flood-1m	E358-L	11-Nov-2021	14-Nov-2021	3 days	3 days	✓	14-Nov-2021	28 days	0 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved)										
WQ01-Flood-20m	E358-L	11-Nov-2021	14-Nov-2021	3 days	3 days	✓	14-Nov-2021	28 days	0 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved)										
WQ03-Ebb-1m	E358-L	11-Nov-2021	14-Nov-2021	3 days	3 days	✓	14-Nov-2021	28 days	0 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved)										
WQ03-Ebb-20m	E358-L	11-Nov-2021	14-Nov-2021	3 days	3 days	✓	14-Nov-2021	28 days	0 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved)										
WQ03-Flood-1m	E358-L	11-Nov-2021	14-Nov-2021	3 days	3 days	✓	14-Nov-2021	28 days	0 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved)										
WQ03-Flood-20m	E358-L	11-Nov-2021	14-Nov-2021	3 days	3 days	✓	14-Nov-2021	28 days	0 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved)										
WQ05-Ebb-1m	E358-L	11-Nov-2021	14-Nov-2021	3 days	3 days	✓	14-Nov-2021	28 days	0 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved)										
WQ05-Ebb-20m	E358-L	11-Nov-2021	14-Nov-2021	3 days	3 days	✓	14-Nov-2021	28 days	0 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved)										
WQ05-Flood-1m	E358-L	11-Nov-2021	14-Nov-2021	3 days	3 days	✓	14-Nov-2021	28 days	0 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved)										
WQ05-Flood-20m	E358-L	11-Nov-2021	14-Nov-2021	3 days	3 days	✓	14-Nov-2021	28 days	0 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved)										
WQ06-Ebb-1m	E358-L	11-Nov-2021	14-Nov-2021	3 days	3 days	✓	14-Nov-2021	28 days	0 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved)										
WQ06-Ebb-20m	E358-L	11-Nov-2021	14-Nov-2021	3 days	3 days	✓	14-Nov-2021	28 days	0 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved)										
WQ06-Flood-1m	E358-L	11-Nov-2021	14-Nov-2021	3 days	3 days	✓	14-Nov-2021	28 days	0 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved)										
WQ06-Flood-20m	E358-L	11-Nov-2021	14-Nov-2021	3 days	3 days	✓	14-Nov-2021	28 days	0 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (lab preserved)										
WQ06-Flood-20m-DUP	E358-L	11-Nov-2021	14-Nov-2021	3 days	3 days	✓	14-Nov-2021	28 days	0 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
Equipment Blank	E355-L	11-Nov-2021	14-Nov-2021	----	----		14-Nov-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
Field Blank	E355-L	11-Nov-2021	14-Nov-2021	----	----		14-Nov-2021	28 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) WQ01-Ebb-1m	E355-L	11-Nov-2021	14-Nov-2021	----	----		14-Nov-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) WQ01-Ebb-20m	E355-L	11-Nov-2021	14-Nov-2021	----	----		14-Nov-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) WQ01-Flood-1m	E355-L	11-Nov-2021	14-Nov-2021	----	----		14-Nov-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) WQ01-Flood-20m	E355-L	11-Nov-2021	14-Nov-2021	----	----		14-Nov-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) WQ03-Ebb-1m	E355-L	11-Nov-2021	14-Nov-2021	----	----		14-Nov-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) WQ03-Ebb-20m	E355-L	11-Nov-2021	14-Nov-2021	----	----		14-Nov-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) WQ03-Flood-1m	E355-L	11-Nov-2021	14-Nov-2021	----	----		14-Nov-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) WQ03-Flood-20m	E355-L	11-Nov-2021	14-Nov-2021	----	----		14-Nov-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) WQ05-Ebb-1m	E355-L	11-Nov-2021	14-Nov-2021	----	----		14-Nov-2021	28 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ05-Ebb-20m	E355-L	11-Nov-2021	14-Nov-2021	----	----		14-Nov-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ05-Flood-1m	E355-L	11-Nov-2021	14-Nov-2021	----	----		14-Nov-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ05-Flood-20m	E355-L	11-Nov-2021	14-Nov-2021	----	----		14-Nov-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ06-Ebb-1m	E355-L	11-Nov-2021	14-Nov-2021	----	----		14-Nov-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ06-Ebb-20m	E355-L	11-Nov-2021	14-Nov-2021	----	----		14-Nov-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ06-Flood-1m	E355-L	11-Nov-2021	14-Nov-2021	----	----		14-Nov-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ06-Flood-20m	E355-L	11-Nov-2021	14-Nov-2021	----	----		14-Nov-2021	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
WQ06-Flood-20m-DUP	E355-L	11-Nov-2021	14-Nov-2021	----	----		14-Nov-2021	28 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
Equipment Blank	E290	11-Nov-2021	----	----	----		19-Nov-2021	14 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Alkalinity Species by Titration										
HDPE										
Field Blank	E290	11-Nov-2021	----	----	----		19-Nov-2021	14 days	8 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
WQ01-Ebb-1m	E290	11-Nov-2021	----	----	----		19-Nov-2021	14 days	8 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
WQ01-Ebb-20m	E290	11-Nov-2021	----	----	----		19-Nov-2021	14 days	8 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
WQ01-Flood-1m	E290	11-Nov-2021	----	----	----		19-Nov-2021	14 days	8 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
WQ01-Flood-20m	E290	11-Nov-2021	----	----	----		19-Nov-2021	14 days	8 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
WQ03-Ebb-1m	E290	11-Nov-2021	----	----	----		19-Nov-2021	14 days	8 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
WQ03-Ebb-20m	E290	11-Nov-2021	----	----	----		19-Nov-2021	14 days	8 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
WQ03-Flood-1m	E290	11-Nov-2021	----	----	----		19-Nov-2021	14 days	8 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
WQ03-Flood-20m	E290	11-Nov-2021	----	----	----		19-Nov-2021	14 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Alkalinity Species by Titration										
HDPE WQ05-Ebb-1m	E290	11-Nov-2021	----	----	----		19-Nov-2021	14 days	8 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE WQ05-Ebb-20m	E290	11-Nov-2021	----	----	----		19-Nov-2021	14 days	8 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE WQ05-Flood-1m	E290	11-Nov-2021	----	----	----		19-Nov-2021	14 days	8 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE WQ05-Flood-20m	E290	11-Nov-2021	----	----	----		19-Nov-2021	14 days	8 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE WQ06-Ebb-1m	E290	11-Nov-2021	----	----	----		19-Nov-2021	14 days	8 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE WQ06-Ebb-20m	E290	11-Nov-2021	----	----	----		19-Nov-2021	14 days	8 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE WQ06-Flood-1m	E290	11-Nov-2021	----	----	----		19-Nov-2021	14 days	8 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE WQ06-Flood-20m	E290	11-Nov-2021	----	----	----		19-Nov-2021	14 days	8 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE WQ06-Flood-20m-DUP	E290	11-Nov-2021	----	----	----		19-Nov-2021	14 days	8 days	✓

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Work Order : VA21C5432
Client : Stantec Consulting Ltd.
Project : ----

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter										
HDPE Equipment Blank	E108	11-Nov-2021	----	----	----		15-Nov-2021	0.25 hrs	91 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE Field Blank	E108	11-Nov-2021	----	----	----		15-Nov-2021	0.25 hrs	92 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ01-Flood-1m	E108	11-Nov-2021	----	----	----		15-Nov-2021	0.25 hrs	92 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ01-Flood-20m	E108	11-Nov-2021	----	----	----		15-Nov-2021	0.25 hrs	92 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ03-Flood-1m	E108	11-Nov-2021	----	----	----		15-Nov-2021	0.25 hrs	92 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ03-Flood-20m	E108	11-Nov-2021	----	----	----		15-Nov-2021	0.25 hrs	92 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ06-Flood-20m-DUP	E108	11-Nov-2021	----	----	----		15-Nov-2021	0.25 hrs	92 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ05-Flood-1m	E108	11-Nov-2021	----	----	----		15-Nov-2021	0.25 hrs	93 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ05-Flood-20m	E108	11-Nov-2021	----	----	----		15-Nov-2021	0.25 hrs	93 hrs	× EHTR-FM

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter										
HDPE WQ06-Flood-20m	E108	11-Nov-2021	----	----	----		15-Nov-2021	0.25 hrs	93 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ06-Flood-1m	E108	11-Nov-2021	----	----	----		15-Nov-2021	0.25 hrs	94 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ06-Ebb-1m	E108	11-Nov-2021	----	----	----		15-Nov-2021	0.25 hrs	96 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ06-Ebb-20m	E108	11-Nov-2021	----	----	----		15-Nov-2021	0.25 hrs	96 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ03-Ebb-1m	E108	11-Nov-2021	----	----	----		15-Nov-2021	0.25 hrs	97 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ03-Ebb-20m	E108	11-Nov-2021	----	----	----		15-Nov-2021	0.25 hrs	97 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ05-Ebb-1m	E108	11-Nov-2021	----	----	----		15-Nov-2021	0.25 hrs	97 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ05-Ebb-20m	E108	11-Nov-2021	----	----	----		15-Nov-2021	0.25 hrs	97 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE WQ01-Ebb-1m	E108	11-Nov-2021	----	----	----		15-Nov-2021	0.25 hrs	98 hrs	× EHTR-FM

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter										
HDPE WQ01-Ebb-20m	E108	11-Nov-2021	----	----	----		15-Nov-2021	0.25 hrs	98 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE Equipment Blank	E162S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE Field Blank	E162S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ01-Flood-1m	E162S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ01-Flood-20m	E162S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ03-Flood-1m	E162S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ03-Flood-20m	E162S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ05-Flood-1m	E162S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ05-Flood-20m	E162S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ06-Flood-1m	E162S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ06-Flood-20m	E162S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ06-Flood-20m-DUP	E162S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ01-Ebb-1m	E162S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	7 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ01-Ebb-20m	E162S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	7 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ03-Ebb-1m	E162S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	7 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ03-Ebb-20m	E162S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	7 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ05-Ebb-1m	E162S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	7 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ05-Ebb-20m	E162S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	7 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ06-Ebb-1m	E162S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	7 days	✓
Physical Tests : TDS by Gravimetry (Seawater)										
HDPE WQ06-Ebb-20m	E162S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE Equipment Blank	E160S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE Field Blank	E160S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ01-Flood-1m	E160S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ01-Flood-20m	E160S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ03-Flood-1m	E160S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ03-Flood-20m	E160S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ05-Flood-1m	E160S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ05-Flood-20m	E160S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ06-Flood-1m	E160S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ06-Flood-20m	E160S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ06-Flood-20m-DUP	E160S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ01-Ebb-1m	E160S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ01-Ebb-20m	E160S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ03-Ebb-1m	E160S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ03-Ebb-20m	E160S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ05-Ebb-1m	E160S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	7 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ05-Ebb-20m	E160S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ06-Ebb-1m	E160S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Seawater)										
HDPE WQ06-Ebb-20m	E160S	11-Nov-2021	----	----	----		17-Nov-2021	7 days	7 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE Equipment Blank	E121	11-Nov-2021	----	----	----		14-Nov-2021	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE Field Blank	E121	11-Nov-2021	----	----	----		14-Nov-2021	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE WQ01-Ebb-1m	E121	11-Nov-2021	----	----	----		14-Nov-2021	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE WQ01-Ebb-20m	E121	11-Nov-2021	----	----	----		14-Nov-2021	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE WQ01-Flood-1m	E121	11-Nov-2021	----	----	----		14-Nov-2021	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE WQ01-Flood-20m	E121	11-Nov-2021	----	----	----		14-Nov-2021	3 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Turbidity by Nephelometry										
HDPE WQ03-Ebb-1m	E121	11-Nov-2021	----	----	----		14-Nov-2021	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE WQ03-Ebb-20m	E121	11-Nov-2021	----	----	----		14-Nov-2021	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE WQ03-Flood-1m	E121	11-Nov-2021	----	----	----		14-Nov-2021	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE WQ03-Flood-20m	E121	11-Nov-2021	----	----	----		14-Nov-2021	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE WQ05-Ebb-1m	E121	11-Nov-2021	----	----	----		14-Nov-2021	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE WQ05-Ebb-20m	E121	11-Nov-2021	----	----	----		14-Nov-2021	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE WQ05-Flood-1m	E121	11-Nov-2021	----	----	----		14-Nov-2021	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE WQ05-Flood-20m	E121	11-Nov-2021	----	----	----		14-Nov-2021	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE WQ06-Ebb-1m	E121	11-Nov-2021	----	----	----		14-Nov-2021	3 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Turbidity by Nephelometry										
HDPE										
WQ06-Ebb-20m	E121	11-Nov-2021	----	----	----		14-Nov-2021	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE										
WQ06-Flood-1m	E121	11-Nov-2021	----	----	----		14-Nov-2021	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE										
WQ06-Flood-20m	E121	11-Nov-2021	----	----	----		14-Nov-2021	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE										
WQ06-Flood-20m-DUP	E121	11-Nov-2021	----	----	----		14-Nov-2021	3 days	3 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ01-Flood-1m	E641A	11-Nov-2021	22-Nov-2021	14 days	11 days	✓	22-Nov-2021	40 days	0 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ01-Flood-20m	E641A	11-Nov-2021	22-Nov-2021	14 days	11 days	✓	22-Nov-2021	40 days	0 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ03-Flood-1m	E641A	11-Nov-2021	22-Nov-2021	14 days	11 days	✓	22-Nov-2021	40 days	0 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ03-Flood-20m	E641A	11-Nov-2021	22-Nov-2021	14 days	11 days	✓	22-Nov-2021	40 days	0 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ05-Flood-1m	E641A	11-Nov-2021	22-Nov-2021	14 days	11 days	✓	22-Nov-2021	40 days	0 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate) WQ05-Flood-20m	E641A	11-Nov-2021	22-Nov-2021	14 days	11 days	✓	22-Nov-2021	40 days	0 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate) WQ06-Flood-20m-DUP	E641A	11-Nov-2021	22-Nov-2021	14 days	11 days	✓	22-Nov-2021	40 days	0 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate) Equipment Blank	E641A	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate) Field Blank	E641A	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate) WQ01-Ebb-1m	E641A	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate) WQ01-Ebb-20m	E641A	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate) WQ03-Ebb-1m	E641A	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate) WQ03-Ebb-20m	E641A	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate) WQ05-Ebb-1m	E641A	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ05-Ebb-20m	E641A	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ06-Ebb-1m	E641A	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ06-Ebb-20m	E641A	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ06-Flood-1m	E641A	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
WQ06-Flood-20m	E641A	11-Nov-2021	20-Nov-2021	14 days	9 days	✓	22-Nov-2021	40 days	2 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial - total (lab preserved)										
WQ01-Ebb-20m	E508S	11-Nov-2021	----	----	----		18-Nov-2021	28 days	7 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial - total (lab preserved)										
WQ03-Ebb-1m	E508S	11-Nov-2021	----	----	----		18-Nov-2021	28 days	7 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial - total (lab preserved)										
WQ03-Ebb-20m	E508S	11-Nov-2021	----	----	----		18-Nov-2021	28 days	7 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial - total (lab preserved)										
WQ05-Ebb-1m	E508S	11-Nov-2021	----	----	----		18-Nov-2021	28 days	7 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial - total (lab preserved)										
WQ05-Ebb-20m	E508S	11-Nov-2021	----	----	----		18-Nov-2021	28 days	7 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial - total (lab preserved)										
WQ06-Ebb-1m	E508S	11-Nov-2021	----	----	----		18-Nov-2021	28 days	7 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial - total (lab preserved)										
Equipment Blank	E508S	11-Nov-2021	----	----	----		19-Nov-2021	28 days	8 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial - total (lab preserved)										
Field Blank	E508S	11-Nov-2021	----	----	----		19-Nov-2021	28 days	8 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial - total (lab preserved)										
WQ01-Flood-1m	E508S	11-Nov-2021	----	----	----		19-Nov-2021	28 days	8 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial - total (lab preserved)										
WQ01-Flood-20m	E508S	11-Nov-2021	----	----	----		19-Nov-2021	28 days	8 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial - total (lab preserved)										
WQ03-Flood-1m	E508S	11-Nov-2021	----	----	----		19-Nov-2021	28 days	8 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial - total (lab preserved)										
WQ03-Flood-20m	E508S	11-Nov-2021	----	----	----		19-Nov-2021	28 days	8 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial - total (lab preserved)										
WQ05-Flood-1m	E508S	11-Nov-2021	----	----	----		19-Nov-2021	28 days	8 days	✓

Matrix: **Water**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial - total (lab preserved)										
WQ05-Flood-20m	E508S	11-Nov-2021	----	----	----		19-Nov-2021	28 days	8 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial - total (lab preserved)										
WQ06-Ebb-20m	E508S	11-Nov-2021	----	----	----		19-Nov-2021	28 days	8 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial - total (lab preserved)										
WQ06-Flood-1m	E508S	11-Nov-2021	----	----	----		19-Nov-2021	28 days	8 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial - total (lab preserved)										
WQ06-Flood-20m	E508S	11-Nov-2021	----	----	----		19-Nov-2021	28 days	8 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial - total (lab preserved)										
WQ06-Flood-20m-DUP	E508S	11-Nov-2021	----	----	----		19-Nov-2021	28 days	8 days	✓
Total Metals : Total Mercury in Seawater by CVAAS										
Glass vial - total (lab preserved)										
WQ01-Ebb-1m	E508S	11-Nov-2021	----	----	----		20-Nov-2021	28 days	9 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE - total (lab preserved)										
Equipment Blank	E468S	11-Nov-2021	----	----	----		22-Nov-2021	180 days	11 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE - total (lab preserved)										
Field Blank	E468S	11-Nov-2021	----	----	----		22-Nov-2021	180 days	11 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE - total (lab preserved)										
WQ01-Flood-1m	E468S	11-Nov-2021	----	----	----		22-Nov-2021	180 days	11 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE - total (lab preserved) WQ01-Flood-20m	E468S	11-Nov-2021	----	----	----		22-Nov-2021	180 days	11 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE - total (lab preserved) WQ03-Ebb-20m	E468S	11-Nov-2021	----	----	----		22-Nov-2021	180 days	11 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE - total (lab preserved) WQ03-Flood-1m	E468S	11-Nov-2021	----	----	----		22-Nov-2021	180 days	11 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE - total (lab preserved) WQ03-Flood-20m	E468S	11-Nov-2021	----	----	----		22-Nov-2021	180 days	11 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE - total (lab preserved) WQ05-Ebb-1m	E468S	11-Nov-2021	----	----	----		22-Nov-2021	180 days	11 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE - total (lab preserved) WQ05-Ebb-20m	E468S	11-Nov-2021	----	----	----		22-Nov-2021	180 days	11 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE - total (lab preserved) WQ05-Flood-1m	E468S	11-Nov-2021	----	----	----		22-Nov-2021	180 days	11 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE - total (lab preserved) WQ05-Flood-20m	E468S	11-Nov-2021	----	----	----		22-Nov-2021	180 days	11 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE - total (lab preserved) WQ06-Ebb-1m	E468S	11-Nov-2021	----	----	----		22-Nov-2021	180 days	11 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE - total (lab preserved) WQ06-Ebb-20m	E468S	11-Nov-2021	----	----	----		22-Nov-2021	180 days	11 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE - total (lab preserved) WQ06-Flood-1m	E468S	11-Nov-2021	----	----	----		22-Nov-2021	180 days	11 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE - total (lab preserved) WQ06-Flood-20m	E468S	11-Nov-2021	----	----	----		22-Nov-2021	180 days	11 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE - total (lab preserved) WQ06-Flood-20m-DUP	E468S	11-Nov-2021	----	----	----		22-Nov-2021	180 days	11 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE - total (lab preserved) WQ01-Ebb-1m	E468S	11-Nov-2021	----	----	----		22-Nov-2021	180 days	12 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE - total (lab preserved) WQ01-Ebb-20m	E468S	11-Nov-2021	----	----	----		22-Nov-2021	180 days	12 days	✓
Total Metals : Total Metals in Seawater by CRC ICPMS (HMI)										
HDPE - total (lab preserved) WQ03-Ebb-1m	E468S	11-Nov-2021	----	----	----		22-Nov-2021	180 days	12 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - total (lab preserved) Equipment Blank	E468S.NaSi	11-Nov-2021	----	----	----		23-Nov-2021	180 days	12 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - total (lab preserved) Field Blank	E468S.NaSi	11-Nov-2021	----	----	----		23-Nov-2021	180 days	12 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - total (lab preserved)										
WQ01-Ebb-1m	E468S.NaSi	11-Nov-2021	----	----	----		23-Nov-2021	180 days	12 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - total (lab preserved)										
WQ01-Ebb-20m	E468S.NaSi	11-Nov-2021	----	----	----		23-Nov-2021	180 days	12 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - total (lab preserved)										
WQ01-Flood-1m	E468S.NaSi	11-Nov-2021	----	----	----		23-Nov-2021	180 days	12 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - total (lab preserved)										
WQ01-Flood-20m	E468S.NaSi	11-Nov-2021	----	----	----		23-Nov-2021	180 days	12 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - total (lab preserved)										
WQ03-Ebb-1m	E468S.NaSi	11-Nov-2021	----	----	----		23-Nov-2021	180 days	12 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - total (lab preserved)										
WQ03-Ebb-20m	E468S.NaSi	11-Nov-2021	----	----	----		23-Nov-2021	180 days	12 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - total (lab preserved)										
WQ03-Flood-1m	E468S.NaSi	11-Nov-2021	----	----	----		23-Nov-2021	180 days	12 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - total (lab preserved)										
WQ03-Flood-20m	E468S.NaSi	11-Nov-2021	----	----	----		23-Nov-2021	180 days	12 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - total (lab preserved)										
WQ05-Ebb-1m	E468S.NaSi	11-Nov-2021	----	----	----		23-Nov-2021	180 days	12 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - total (lab preserved) WQ05-Ebb-20m	E468S.NaSi	11-Nov-2021	----	----	----		23-Nov-2021	180 days	12 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - total (lab preserved) WQ05-Flood-1m	E468S.NaSi	11-Nov-2021	----	----	----		23-Nov-2021	180 days	12 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - total (lab preserved) WQ05-Flood-20m	E468S.NaSi	11-Nov-2021	----	----	----		23-Nov-2021	180 days	12 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - total (lab preserved) WQ06-Ebb-1m	E468S.NaSi	11-Nov-2021	----	----	----		23-Nov-2021	180 days	12 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - total (lab preserved) WQ06-Ebb-20m	E468S.NaSi	11-Nov-2021	----	----	----		23-Nov-2021	180 days	12 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - total (lab preserved) WQ06-Flood-1m	E468S.NaSi	11-Nov-2021	----	----	----		23-Nov-2021	180 days	12 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - total (lab preserved) WQ06-Flood-20m	E468S.NaSi	11-Nov-2021	----	----	----		23-Nov-2021	180 days	12 days	✓
Total Metals : Total Sodium and Silicon in Seawater by CRC ICPMS										
HDPE - total (lab preserved) WQ06-Flood-20m-DUP	E468S.NaSi	11-Nov-2021	----	----	----		23-Nov-2021	180 days	12 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) Equipment Blank	E611A	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	8 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate)										
Field Blank	E611A	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	8 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate)										
WQ01-Flood-1m	E611A	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	8 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate)										
WQ01-Flood-20m	E611A	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	8 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate)										
WQ03-Flood-1m	E611A	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	8 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate)										
WQ03-Flood-20m	E611A	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	8 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate)										
WQ05-Flood-20m	E611A	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	8 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate)										
WQ06-Flood-20m-DUP	E611A	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	8 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate)										
WQ01-Ebb-1m	E611A	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate)										
WQ01-Ebb-20m	E611A	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ03-Ebb-1m	E611A	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ03-Ebb-20m	E611A	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ05-Ebb-1m	E611A	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ05-Ebb-20m	E611A	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ05-Flood-1m	E611A	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ06-Ebb-1m	E611A	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ06-Ebb-20m	E611A	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ06-Flood-1m	E611A	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass vial (sodium bisulfate) WQ06-Flood-20m	E611A	11-Nov-2021	20-Nov-2021	----	----		20-Nov-2021	14 days	9 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

Rec. HT: ALS recommended hold time (see units).

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Work Order	: VA21C5432
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Project	: ----

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration	E290	348480	0	19	0.0	5.0	×
Ammonia by Fluorescence	E298	344547	1	19	5.2	5.0	✓
Bromide in Seawater by IC	E235S.Br	344398	1	19	5.2	5.0	✓
BTEX by Headspace GC-MS	E611A	349048	1	20	5.0	5.0	✓
Chloride in Seawater by IC	E235S.Cl	344399	1	19	5.2	5.0	✓
Dissolved Mercury in Seawater by CVAAS	E509S	351045	1	19	5.2	5.0	✓
Dissolved Metals in Seawater by CRC ICPMS (HMI)	E469S	347690	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	344545	1	19	5.2	5.0	✓
Dissolved Sodium and Silicon in Seawater by CRC ICPMS	E469S.NaSi	347689	1	19	5.2	5.0	✓
Fluoride in Seawater by IC	E235S.F	344400	1	19	5.2	5.0	✓
Nitrate in Seawater by IC	E235S.NO3	344401	1	19	5.2	5.0	✓
Nitrite in Seawater by IC	E235S.NO2	344402	1	19	5.2	5.0	✓
pH by Meter	E108	344930	1	19	5.2	5.0	✓
Sulfate in Seawater by IC	E235S.SO4	344403	1	19	5.2	5.0	✓
TDS by Gravimetry (Seawater)	E162S	347256	1	19	5.2	5.0	✓
Total Mercury in Seawater by CVAAS	E508S	347848	3	38	7.8	5.0	✓
Total Metals in Seawater by CRC ICPMS (HMI)	E468S	345365	2	39	5.1	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	344546	1	19	5.2	5.0	✓
Total Phosphorus in Seawater by Colourimetry	E372S	344548	1	19	5.2	5.0	✓
Total Sodium and Silicon in Seawater by CRC ICPMS	E468S.NaSi	345364	2	31	6.4	5.0	✓
Turbidity by Nephelometry	E121	344516	2	33	6.0	5.0	✓
VH and F1 by Headspace GC-FID	E581.VH+F1	349047	1	20	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration	E290	348480	1	19	5.2	5.0	✓
Ammonia by Fluorescence	E298	344547	1	19	5.2	5.0	✓
Bromide in Seawater by IC	E235S.Br	344398	1	19	5.2	5.0	✓
BTEX by Headspace GC-MS	E611A	349048	1	20	5.0	5.0	✓
CCME PHC - F2-F4 by GC-FID	E601	349111	2	19	10.5	5.0	✓
Chloride in Seawater by IC	E235S.Cl	344399	1	19	5.2	5.0	✓
Dissolved Mercury in Seawater by CVAAS	E509S	351045	1	19	5.2	5.0	✓
Dissolved Metals in Seawater by CRC ICPMS (HMI)	E469S	347690	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	344545	1	19	5.2	5.0	✓
Dissolved Sodium and Silicon in Seawater by CRC ICPMS	E469S.NaSi	347689	1	19	5.2	5.0	✓
Fluoride in Seawater by IC	E235S.F	344400	1	19	5.2	5.0	✓
Nitrate in Seawater by IC	E235S.NO3	344401	1	19	5.2	5.0	✓
Nitrite in Seawater by IC	E235S.NO2	344402	1	19	5.2	5.0	✓
PAHs by Hexane LVI GC-MS	E641A	349110	2	34	5.8	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
pH by Meter	E108	344930	1	19	5.2	5.0	✓
Sulfate in Seawater by IC	E235S.SO4	344403	1	19	5.2	5.0	✓
TDS by Gravimetry (Seawater)	E162S	347256	1	19	5.2	5.0	✓
Total Mercury in Seawater by CVAAS	E508S	347848	3	38	7.8	5.0	✓
Total Metals in Seawater by CRC ICPMS (HMI)	E468S	345365	2	39	5.1	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	344546	1	19	5.2	5.0	✓
Total Phosphorus in Seawater by Colourimetry	E372S	344548	1	19	5.2	5.0	✓
Total Sodium and Silicon in Seawater by CRC ICPMS	E468S.NaSi	345364	2	31	6.4	5.0	✓
TSS by Gravimetry (Seawater)	E160S	347255	1	19	5.2	5.0	✓
Turbidity by Nephelometry	E121	344516	2	33	6.0	5.0	✓
VH and F1 by Headspace GC-FID	E581.VH+F1	349047	1	20	5.0	5.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration	E290	348480	1	19	5.2	5.0	✓
Ammonia by Fluorescence	E298	344547	1	19	5.2	5.0	✓
Bromide in Seawater by IC	E235S.Br	344398	1	19	5.2	5.0	✓
BTEX by Headspace GC-MS	E611A	349048	1	20	5.0	5.0	✓
CCME PHC - F2-F4 by GC-FID	E601	349111	2	19	10.5	5.0	✓
Chloride in Seawater by IC	E235S.Cl	344399	1	19	5.2	5.0	✓
Dissolved Mercury in Seawater by CVAAS	E509S	351045	1	19	5.2	5.0	✓
Dissolved Metals in Seawater by CRC ICPMS (HMI)	E469S	347690	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	344545	1	19	5.2	5.0	✓
Dissolved Sodium and Silicon in Seawater by CRC ICPMS	E469S.NaSi	347689	1	19	5.2	5.0	✓
Fluoride in Seawater by IC	E235S.F	344400	1	19	5.2	5.0	✓
Nitrate in Seawater by IC	E235S.NO3	344401	1	19	5.2	5.0	✓
Nitrite in Seawater by IC	E235S.NO2	344402	1	19	5.2	5.0	✓
PAHs by Hexane LVI GC-MS	E641A	349110	2	34	5.8	5.0	✓
Sulfate in Seawater by IC	E235S.SO4	344403	1	19	5.2	5.0	✓
TDS by Gravimetry (Seawater)	E162S	347256	1	19	5.2	5.0	✓
Total Mercury in Seawater by CVAAS	E508S	347848	3	38	7.8	5.0	✓
Total Metals in Seawater by CRC ICPMS (HMI)	E468S	345365	2	39	5.1	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	344546	1	19	5.2	5.0	✓
Total Phosphorus in Seawater by Colourimetry	E372S	344548	1	19	5.2	5.0	✓
Total Sodium and Silicon in Seawater by CRC ICPMS	E468S.NaSi	345364	2	31	6.4	5.0	✓
TSS by Gravimetry (Seawater)	E160S	347255	1	19	5.2	5.0	✓
Turbidity by Nephelometry	E121	344516	2	33	6.0	5.0	✓
VH and F1 by Headspace GC-FID	E581.VH+F1	349047	1	20	5.0	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	344547	1	19	5.2	5.0	✓
Bromide in Seawater by IC	E235S.Br	344398	1	19	5.2	5.0	✓
BTEX by Headspace GC-MS	E611A	349048	1	20	5.0	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Matrix Spikes (MS) - Continued							
Chloride in Seawater by IC	E235S.Cl	344399	1	19	5.2	5.0	✓
Dissolved Mercury in Seawater by CVAAS	E509S	351045	1	19	5.2	5.0	✓
Dissolved Metals in Seawater by CRC ICPMS (HMI)	E469S	347690	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	344545	1	19	5.2	5.0	✓
Dissolved Sodium and Silicon in Seawater by CRC ICPMS	E469S.NaSi	347689	1	19	5.2	5.0	✓
Fluoride in Seawater by IC	E235S.F	344400	1	19	5.2	5.0	✓
Nitrate in Seawater by IC	E235S.NO3	344401	1	19	5.2	5.0	✓
Nitrite in Seawater by IC	E235S.NO2	344402	1	19	5.2	5.0	✓
Sulfate in Seawater by IC	E235S.SO4	344403	1	19	5.2	5.0	✓
Total Mercury in Seawater by CVAAS	E508S	347848	3	38	7.8	5.0	✓
Total Metals in Seawater by CRC ICPMS (HMI)	E468S	345365	3	39	7.6	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	344546	1	19	5.2	5.0	✓
Total Phosphorus in Seawater by Colourimetry	E372S	344548	1	19	5.2	5.0	✓
Total Sodium and Silicon in Seawater by CRC ICPMS	E468S.NaSi	345364	2	31	6.4	5.0	✓
VH and F1 by Headspace GC-FID	E581.VH+F1	349047	1	20	5.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
pH by Meter	E108 Vancouver - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Vancouver - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
TSS by Gravimetry (Seawater)	E160S Vancouver - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
TDS by Gravimetry (Seawater)	E162S Vancouver - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
Bromide in Seawater by IC	E235S.Br Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Chloride in Seawater by IC	E235S.Cl Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Seawater by IC	E235S.F Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Seawater by IC	E235S.NO2 Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Seawater by IC	E235S.NO3 Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Seawater by IC	E235S.SO4 Vancouver - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Vancouver - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Vancouver - Environmental	Water	J. Environ. Monit., 2005, 7, 37-42 (mod)	Ammonia in water is analyzed by flow-injection analysis with fluorescence detection after reaction with orthophthaldialdehyde (OPA).
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L Vancouver - Environmental	Water	APHA 5310 B (mod)	Total Organic Carbon (Non-Purgeable), also known as NPOC (total), is a direct measurement of TOC after an acidified sample has been purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of total carbon (TC) is comprised of IC (which is common), this method is more accurate and more reliable than the TOC by subtraction method (i.e. TC minus TIC).
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Vancouver - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Phosphorus in Seawater by Colourimetry	E372S Vancouver - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Total Metals in Seawater by CRC ICPMS (HMI)	E468S Vancouver - Environmental	Water	EPA 200.2/6020B (mod)	Seawater samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS (HMI Mode). This method is compliant with digestion requirements of the British Columbia Environmental Laboratory Manual.
Total Sodium and Silicon in Seawater by CRC ICPMS	E468S.NaSi Vancouver - Environmental	Water	EPA 200.2/6020B (mod)	Seawater samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. This method is compliant with digestion requirements of the British Columbia Environmental Laboratory Manual.
Dissolved Metals in Seawater by CRC ICPMS (HMI)	E469S Vancouver - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Seawater samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS (HMI Mode).
Dissolved Sodium and Silicon in Seawater by CRC ICPMS	E469S.NaSi Vancouver - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Seawater samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS.
Total Mercury in Seawater by CVAAS	E508S Vancouver - Environmental	Water	EPA 1631E (mod)	Seawater samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Mercury in Seawater by CVAAS	E509S Vancouver - Environmental	Water	APHA 3030B/EPA 1631E (mod)	Seawater samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
VH and F1 by Headspace GC-FID	E581.VH+F1 Vancouver - Environmental	Water	BC MOE Lab Manual / CCME PHC in Soil - Tier 1 (mod)	Volatile Hydrocarbons (VH and F1) is analyzed by static headspace GC-FID. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
CCME PHC - F2-F4 by GC-FID	E601 Vancouver - Environmental	Water	CCME PHC in Soil - Tier 1	CCME Fractions 2-4 (F2-F4) are analyzed by GC-FID.
BTEX by Headspace GC-MS	E611A Vancouver - Environmental	Water	EPA 8260D (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
PAHs by Hexane LVI GC-MS	E641A Vancouver - Environmental	Water	EPA 8270E (mod)	Polycyclic Aromatic Hydrocarbons (PAHs) are analyzed by large volume injection (LVI) GC-MS.
Dissolved Hardness (Calculated)	EC100 Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in $CaCO_3$ equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Hardness (Calculated) from Total Ca/Mg	EC100A Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), from total Ca/Mg" is calculated from the sum of total Calcium and Magnesium concentrations, expressed in $CaCO_3$ equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations. Hardness from total Ca/Mg is normally comparable to Dissolved Hardness in non-turbid waters.
F1-BTEX	EC580 Vancouver - Environmental	Water	CCME PHC in Soil - Tier 1	F1-BTEX is calculated as follows: F1-BTEX = F1 (C6-C10) minus benzene, toluene, ethylbenzene and xylenes (BTEX).
F2 to F3 minus PAH	EC600 Vancouver - Environmental	Water	CCME PHC in Soil - Tier 1	F2-PAH = CCME Fraction 2 (C10-C16) minus Naphthalene F3-PAH = CCME Fraction 3 (C16-C34) minus select Polycyclic Aromatic Hydrocarbons (PAH) as per CCME Soil Tier 1

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Vancouver - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Total Organic Carbon by Combustion	EP355 Vancouver - Environmental	Water		Preparation for Total Organic Carbon by Combustion
Preparation for Dissolved Organic Carbon for Combustion	EP358 Vancouver - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Phosphorus in water	EP372 Vancouver - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Vancouver - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Dissolved Mercury Water Filtration	EP509 Vancouver - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.
VOCs Preparation for Headspace Analysis	EP581 Vancouver - Environmental	Water	EPA 5021A (mod)	Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler. An aliquot of the headspace is then injected into the GC/MS-FID system.
PHCs and PAHs Hexane Extraction	EP601 Vancouver - Environmental	Water	EPA 3511 (mod)	Petroleum Hydrocarbons (PHCs) and Polycyclic Aromatic Hydrocarbons (PAHs) are extracted using a hexane liquid-liquid extraction.

QUALITY CONTROL REPORT

Work Order	: **VA21C5432**	Page	: 1 of 28
Client	: Stantec Consulting Ltd.	Laboratory	: Vancouver - Environmental
Contact	: Libby McMillan	Account Manager	: Brent Mack
Address	: # 11 - 2042 Mills Road Sidney BC Canada V8L 5X4	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: 250 655 5371	Telephone	: 778-370-3279
Project	: ----	Date Samples Received	: 12-Nov-2021 21:20
PO	: ----	Date Analysis Commenced	: 13-Nov-2021
C-O-C number	: ----	Issue Date	: 25-Nov-2021 10:21
Sampler	: ----		
Site	: ----		
Quote number	: VA21-STAC100-005		
No. of samples received	: 19		
No. of samples analysed	: 19		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits
- Reference Material (RM) Report; Recovery and Acceptance Limits
- Method Blank (MB) Report; Recovery and Acceptance Limits
- Laboratory Control Sample (LCS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Angela Ren	Team Leader - Metals	Metals, Burnaby, British Columbia
Caleb Deroche	Lab Analyst	Metals, Burnaby, British Columbia
Dan Gebert	Laboratory Analyst	Metals, Burnaby, British Columbia
Dee Lee	Analyst	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Monica Ko	Lab Assistant	Metals, Burnaby, British Columbia
Ophelia Chiu	Department Manager - Organics	Organics, Burnaby, British Columbia
Paul Cushing	Team Leader - Organics	Organics, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia

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Work Order	: VA21C5432
Client	: Stantec Consulting Ltd.
Project	: ----

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percentage Difference
# = Indicates a QC result that did not meet the ALS DQO.

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Work Order	: VA21C5432
Client	: Stantec Consulting Ltd.
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Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test specific).

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 344516)											
FJ2101292-001	Anonymous	turbidity	----	E121	0.10	NTU	12.9	12.9	0.155%	15%	----
Physical Tests (QC Lot: 344517)											
VA21C5432-008	WQ06-Ebb-20m	turbidity	----	E121	0.10	NTU	0.11	0.12	0.009	Diff <2x LOR	----
Physical Tests (QC Lot: 344930)											
VA21C5432-001	WQ01-Ebb-1m	pH	----	E108	0.10	pH units	7.72	7.76	0.517%	4%	----
Physical Tests (QC Lot: 347256)											
VA21C5432-001	WQ01-Ebb-1m	solids, total dissolved [TDS]	----	E162S	80	mg/L	28500	27800	2.27%	20%	----
Anions and Nutrients (QC Lot: 344398)											
VA21C5432-001	WQ01-Ebb-1m	bromide	24959-67-9	E235S.Br	5.0	mg/L	48.1	46.8	1.3	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 344399)											
VA21C5432-001	WQ01-Ebb-1m	chloride	16887-00-6	E235S.Cl	50	mg/L	14500	13800	5.00%	20%	----
Anions and Nutrients (QC Lot: 344400)											
VA21C5432-001	WQ01-Ebb-1m	fluoride	16984-48-8	E235S.F	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 344401)											
VA21C5432-001	WQ01-Ebb-1m	nitrate (as N)	14797-55-8	E235S.NO3	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 344402)											
VA21C5432-001	WQ01-Ebb-1m	nitrite (as N)	14797-65-0	E235S.NO2	0.10	mg/L	<0.10	<0.10	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 344403)											
VA21C5432-001	WQ01-Ebb-1m	sulfate (as SO4)	14808-79-8	E235S.SO4	30	mg/L	1960	1870	4.63%	20%	----
Anions and Nutrients (QC Lot: 344547)											
VA21C5432-001	WQ01-Ebb-1m	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 344548)											
VA21C5432-001	WQ01-Ebb-1m	phosphorus, total	7723-14-0	E372S	0.0040	mg/L	0.0599	0.0596	0.532%	20%	----
Organic / Inorganic Carbon (QC Lot: 344545)											
VA21C5432-001	WQ01-Ebb-1m	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	1.11	0.84	0.27	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 344546)											
VA21C5432-001	WQ01-Ebb-1m	carbon, total organic [TOC]	----	E355-L	0.50	mg/L	0.81	0.92	0.11	Diff <2x LOR	----
Total Metals (QC Lot: 345364)											
VA21C5426-001	Anonymous	silicon, total	7440-21-3	E468S.NaSi	1.0	mg/L	1.3	1.3	0.05	Diff <2x LOR	----
		sodium, total	17341-25-2	E468S.NaSi	2.5	mg/L	7420	7350	0.957%	20%	----
Total Metals (QC Lot: 345365)											

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Work Order : VA21C5432
Client : Stantec Consulting Ltd.
Project : ----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Total Metals (QC Lot: 345365) - continued											
VA21C5426-001	Anonymous	aluminum, total	7429-90-5	E468S	0.0050	mg/L	0.0269	0.0276	0.0007	Diff <2x LOR	----
		antimony, total	7440-36-0	E468S	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		arsenic, total	7440-38-2	E468S	0.00040	mg/L	0.00129	0.00127	0.00002	Diff <2x LOR	----
		barium, total	7440-39-3	E468S	0.0010	mg/L	0.0085	0.0085	0.00006	Diff <2x LOR	----
		beryllium, total	7440-41-7	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E468S	0.30	mg/L	3.40	3.40	0.0723%	20%	----
		cadmium, total	7440-43-9	E468S	0.000010	mg/L	0.000052	0.000048	0.000004	Diff <2x LOR	----
		calcium, total	7440-70-2	E468S	1.0	mg/L	294	304	3.51%	20%	----
		cesium, total	7440-46-2	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		chromium, total	7440-47-3	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, total	7440-48-4	E468S	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		gallium, total	7440-55-3	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		iron, total	7439-89-6	E468S	0.010	mg/L	0.026	0.027	0.001	Diff <2x LOR	----
		lead, total	7439-92-1	E468S	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, total	7439-93-2	E468S	0.020	mg/L	0.128	0.131	0.003	Diff <2x LOR	----
		magnesium, total	7439-95-4	E468S	1.0	mg/L	925	933	0.787%	20%	----
		manganese, total	7439-96-5	E468S	0.00020	mg/L	0.00487	0.00495	1.67%	20%	----
		molybdenum, total	7439-98-7	E468S	0.00010	mg/L	0.00792	0.00776	2.06%	20%	----
		nickel, total	7440-02-0	E468S	0.00050	mg/L	<0.00050	0.00097	0.00047	Diff <2x LOR	----
		phosphorus, total	7723-14-0	E468S	0.050	mg/L	0.076	0.070	0.007	Diff <2x LOR	----
		potassium, total	7440-09-7	E468S	1.0	mg/L	307	317	3.16%	20%	----
		rhenium, total	7440-15-5	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		rubidium, total	7440-17-7	E468S	0.0050	mg/L	0.0842	0.0871	3.35%	20%	----
		selenium, total	7782-49-2	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		silver, total	7440-22-4	E468S	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		strontium, total	7440-24-6	E468S	0.010	mg/L	5.52	5.61	1.56%	20%	----
		sulfur, total	7704-34-9	E468S	5.0	mg/L	751	768	2.21%	20%	----
		tellurium, total	13494-80-9	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		thallium, total	7440-28-0	E468S	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		thorium, total	7440-29-1	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		tin, total	7440-31-5	E468S	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E468S	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
		tungsten, total	7440-33-7	E468S	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E468S	0.000050	mg/L	0.00218	0.00218	0.118%	20%	----

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Work Order : VA21C5432
Client : Stantec Consulting Ltd.
Project : ----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Total Metals (QC Lot: 345365) - continued											
VA21C5426-001	Anonymous	vanadium, total	7440-62-2	E468S	0.00050	mg/L	0.00150	0.00146	0.00004	Diff <2x LOR	----
		yttrium, total	7440-65-5	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E468S	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
		zirconium, total	7440-67-7	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
Total Metals (QC Lot: 345366)											
VA21C5432-009	Field Blank	aluminum, total	7429-90-5	E468S	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
		antimony, total	7440-36-0	E468S	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		arsenic, total	7440-38-2	E468S	0.00040	mg/L	<0.00040	<0.00040	0	Diff <2x LOR	----
		barium, total	7440-39-3	E468S	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		beryllium, total	7440-41-7	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E468S	0.30	mg/L	<0.30	<0.30	0	Diff <2x LOR	----
		cadmium, total	7440-43-9	E468S	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		calcium, total	7440-70-2	E468S	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		cesium, total	7440-46-2	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		chromium, total	7440-47-3	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, total	7440-48-4	E468S	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		copper, total	7440-50-8	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		gallium, total	7440-55-3	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		iron, total	7439-89-6	E468S	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, total	7439-92-1	E468S	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, total	7439-93-2	E468S	0.020	mg/L	<0.020	<0.020	0	Diff <2x LOR	----
		magnesium, total	7439-95-4	E468S	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		manganese, total	7439-96-5	E468S	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		molybdenum, total	7439-98-7	E468S	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		nickel, total	7440-02-0	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		phosphorus, total	7723-14-0	E468S	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		potassium, total	7440-09-7	E468S	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		rhenium, total	7440-15-5	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		rubidium, total	7440-17-7	E468S	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
		selenium, total	7782-49-2	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		silver, total	7440-22-4	E468S	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		strontium, total	7440-24-6	E468S	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		sulfur, total	7704-34-9	E468S	5.0	mg/L	<5.0	<5.0	0	Diff <2x LOR	----
		tellurium, total	13494-80-9	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----

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Work Order : VA21C5432
Client : Stantec Consulting Ltd.
Project : ----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Total Metals (QC Lot: 345366) - continued											
VA21C5432-009	Field Blank	thallium, total	7440-28-0	E468S	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		thorium, total	7440-29-1	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		tin, total	7440-31-5	E468S	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E468S	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
		tungsten, total	7440-33-7	E468S	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E468S	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		vanadium, total	7440-62-2	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		yttrium, total	7440-65-5	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E468S	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
		zirconium, total	7440-67-7	E468S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
Total Metals (QC Lot: 345367)											
VA21C5432-009	Field Blank	silicon, total	7440-21-3	E468S.NaSi	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		sodium, total	17341-25-2	E468S.NaSi	2.5	mg/L	<2.5	<2.5	0	Diff <2x LOR	----
Total Metals (QC Lot: 347848)											
VA21C5432-002	WQ01-Ebb-20m	mercury, total	7439-97-6	E508S	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Total Metals (QC Lot: 348865)											
VA21C5432-008	WQ06-Ebb-20m	mercury, total	7439-97-6	E508S	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Total Metals (QC Lot: 349303)											
VA21C5432-001	WQ01-Ebb-1m	mercury, total	7439-97-6	E508S	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 347689)											
VA21C5432-001	WQ01-Ebb-1m	silicon, dissolved	7440-21-3	E469S.NaSi	1.0	mg/L	1.1	<1.0	0.07	Diff <2x LOR	----
		sodium, dissolved	17341-25-2	E469S.NaSi	2.5	mg/L	9260	9380	1.27%	20%	----
Dissolved Metals (QC Lot: 347690)											
VA21C5432-001	WQ01-Ebb-1m	aluminum, dissolved	7429-90-5	E469S	0.0050	mg/L	0.0059	0.0063	0.0004	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E469S	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E469S	0.00040	mg/L	0.00157	0.00156	0.000001	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E469S	0.0010	mg/L	0.0101	0.0101	0.559%	20%	----
		beryllium, dissolved	7440-41-7	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E469S	0.30	mg/L	3.98	3.96	0.520%	20%	----
		cadmium, dissolved	7440-43-9	E469S	0.000010	mg/L	0.000061	0.000059	0.000002	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E469S	1.0	mg/L	358	366	2.14%	20%	----
		cesium, dissolved	7440-46-2	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		chromium, dissolved	7440-47-3	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		cobalt, dissolved	7440-48-4	E469S	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----

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Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Dissolved Metals (QC Lot: 347690) - continued											
VA21C5432-001	WQ01-Ebb-1m	copper, dissolved	7440-50-8	E469S	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		gallium, dissolved	7440-55-3	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E469S	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E469S	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E469S	0.020	mg/L	0.152	0.151	0.0002	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E469S	1.0	mg/L	1130	1140	0.608%	20%	----
		manganese, dissolved	7439-96-5	E469S	0.00010	mg/L	0.00240	0.00243	1.25%	20%	----
		molybdenum, dissolved	7439-98-7	E469S	0.00010	mg/L	0.00927	0.00932	0.533%	20%	----
		nickel, dissolved	7440-02-0	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		phosphorus, dissolved	7723-14-0	E469S	0.050	mg/L	0.071	0.069	0.002	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E469S	1.0	mg/L	377	389	3.29%	20%	----
		rhenium, dissolved	7440-15-5	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		rubidium, dissolved	7440-17-7	E469S	0.0050	mg/L	0.102	0.104	1.70%	20%	----
		selenium, dissolved	7782-49-2	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		silver, dissolved	7440-22-4	E469S	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		strontium, dissolved	7440-24-6	E469S	0.010	mg/L	6.55	6.70	2.29%	20%	----
		sulfur, dissolved	7704-34-9	E469S	5.0	mg/L	894	972	8.43%	20%	----
		tellurium, dissolved	13494-80-9	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		thallium, dissolved	7440-28-0	E469S	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		thorium, dissolved	7440-29-1	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E469S	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E469S	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
		tungsten, dissolved	7440-33-7	E469S	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E469S	0.000050	mg/L	0.00261	0.00257	1.57%	20%	----
		vanadium, dissolved	7440-62-2	E469S	0.00050	mg/L	0.00154	0.00161	0.00007	Diff <2x LOR	----
		yttrium, dissolved	7440-65-5	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E469S	0.0010	mg/L	0.0015	0.0013	0.0002	Diff <2x LOR	----
		zirconium, dissolved	7440-67-7	E469S	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 351045)											
VA21C5432-001	WQ01-Ebb-1m	mercury, dissolved	7439-97-6	E509S	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Volatile Organic Compounds (QC Lot: 349048)											
VA21C5415-013	Anonymous	benzene	71-43-2	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		ethylbenzene	100-41-4	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		styrene	100-42-5	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Volatile Organic Compounds (QC Lot: 349048) - continued											
VA21C5415-013	Anonymous	toluene	108-88-3	E611A	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		xylene, m+p-	179601-23-1	E611A	0.40	µg/L	<0.40	<0.40	0	Diff <2x LOR	----
		xylene, o-	95-47-6	E611A	0.30	µg/L	<0.30	<0.30	0	Diff <2x LOR	----
Hydrocarbons (QC Lot: 349047)											
VA21C5415-013	Anonymous	F1 (C6-C10)	----	E581.VH+F1	100	µg/L	<100	<100	0.0%	30%	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 344516)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 344517)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 347255)						
solids, total suspended [TSS]	----	E160S	2	mg/L	<2.0	----
Physical Tests (QCLot: 347256)						
solids, total dissolved [TDS]	----	E162S	10	mg/L	<10	----
Physical Tests (QCLot: 348480)						
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Anions and Nutrients (QCLot: 344398)						
bromide	24959-67-9	E235S.Br	5	mg/L	<5.0	----
Anions and Nutrients (QCLot: 344399)						
chloride	16887-00-6	E235S.Cl	50	mg/L	<50	----
Anions and Nutrients (QCLot: 344400)						
fluoride	16984-48-8	E235S.F	1	mg/L	<1.0	----
Anions and Nutrients (QCLot: 344401)						
nitrate (as N)	14797-55-8	E235S.NO3	0.5	mg/L	<0.50	----
Anions and Nutrients (QCLot: 344402)						
nitrite (as N)	14797-65-0	E235S.NO2	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 344403)						
sulfate (as SO4)	14808-79-8	E235S.SO4	30	mg/L	<30	----
Anions and Nutrients (QCLot: 344547)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 344548)						
phosphorus, total	7723-14-0	E372S	0.002	mg/L	<0.0040	----
Organic / Inorganic Carbon (QCLot: 344545)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 344546)						
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 345364)						
silicon, total	7440-21-3	E468S.NaSi	1	mg/L	<1.0	----
sodium, total	17341-25-2	E468S.NaSi	2.5	mg/L	<2.5	----
Total Metals (QCLot: 345365)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 345365) - continued						
aluminum, total	7429-90-5	E468S	0.005	mg/L	<0.0050	----
antimony, total	7440-36-0	E468S	0.001	mg/L	<0.0010	----
arsenic, total	7440-38-2	E468S	0.0004	mg/L	<0.00040	----
barium, total	7440-39-3	E468S	0.001	mg/L	<0.0010	----
beryllium, total	7440-41-7	E468S	0.0005	mg/L	<0.00050	----
bismuth, total	7440-69-9	E468S	0.0005	mg/L	<0.00050	----
boron, total	7440-42-8	E468S	0.3	mg/L	<0.30	----
cadmium, total	7440-43-9	E468S	0.00001	mg/L	<0.000010	----
calcium, total	7440-70-2	E468S	1	mg/L	<1.0	----
cesium, total	7440-46-2	E468S	0.0005	mg/L	<0.00050	----
chromium, total	7440-47-3	E468S	0.0005	mg/L	<0.00050	----
cobalt, total	7440-48-4	E468S	0.00005	mg/L	<0.000050	----
copper, total	7440-50-8	E468S	0.0005	mg/L	<0.00050	----
gallium, total	7440-55-3	E468S	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E468S	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E468S	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E468S	0.02	mg/L	<0.020	----
magnesium, total	7439-95-4	E468S	1	mg/L	<1.0	----
manganese, total	7439-96-5	E468S	0.0002	mg/L	<0.00020	----
molybdenum, total	7439-98-7	E468S	0.0001	mg/L	<0.00010	----
nickel, total	7440-02-0	E468S	0.0005	mg/L	<0.00050	----
phosphorus, total	7723-14-0	E468S	0.05	mg/L	<0.050	----
potassium, total	7440-09-7	E468S	1	mg/L	<1.0	----
rhenium, total	7440-15-5	E468S	0.0005	mg/L	<0.00050	----
rubidium, total	7440-17-7	E468S	0.005	mg/L	<0.0050	----
selenium, total	7782-49-2	E468S	0.0005	mg/L	<0.00050	----
silver, total	7440-22-4	E468S	0.0001	mg/L	<0.00010	----
strontium, total	7440-24-6	E468S	0.01	mg/L	<0.010	----
sulfur, total	7704-34-9	E468S	5	mg/L	<5.0	----
tellurium, total	13494-80-9	E468S	0.0005	mg/L	<0.00050	----
thallium, total	7440-28-0	E468S	0.00005	mg/L	<0.000050	----
thorium, total	7440-29-1	E468S	0.0005	mg/L	<0.00050	----
tin, total	7440-31-5	E468S	0.001	mg/L	<0.0010	----
titanium, total	7440-32-6	E468S	0.005	mg/L	<0.0050	----
tungsten, total	7440-33-7	E468S	0.001	mg/L	<0.0010	----
uranium, total	7440-61-1	E468S	0.00005	mg/L	<0.000050	----

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Client : Stantec Consulting Ltd.
Project : ----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 345365) - continued						
vanadium, total	7440-62-2	E468S	0.0005	mg/L	<0.00050	----
yttrium, total	7440-65-5	E468S	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E468S	0.003	mg/L	<0.0030	----
zirconium, total	7440-67-7	E468S	0.0005	mg/L	<0.00050	----
Total Metals (QCLot: 345366)						
aluminum, total	7429-90-5	E468S	0.005	mg/L	<0.0050	----
antimony, total	7440-36-0	E468S	0.001	mg/L	<0.0010	----
arsenic, total	7440-38-2	E468S	0.0004	mg/L	<0.00040	----
barium, total	7440-39-3	E468S	0.001	mg/L	<0.0010	----
beryllium, total	7440-41-7	E468S	0.0005	mg/L	<0.00050	----
bismuth, total	7440-69-9	E468S	0.0005	mg/L	<0.00050	----
boron, total	7440-42-8	E468S	0.3	mg/L	<0.30	----
cadmium, total	7440-43-9	E468S	0.00001	mg/L	<0.000010	----
calcium, total	7440-70-2	E468S	1	mg/L	<1.0	----
cesium, total	7440-46-2	E468S	0.0005	mg/L	<0.00050	----
chromium, total	7440-47-3	E468S	0.0005	mg/L	<0.00050	----
cobalt, total	7440-48-4	E468S	0.00005	mg/L	<0.000050	----
copper, total	7440-50-8	E468S	0.0005	mg/L	<0.00050	----
gallium, total	7440-55-3	E468S	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E468S	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E468S	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E468S	0.02	mg/L	<0.020	----
magnesium, total	7439-95-4	E468S	1	mg/L	<1.0	----
manganese, total	7439-96-5	E468S	0.0002	mg/L	<0.00020	----
molybdenum, total	7439-98-7	E468S	0.0001	mg/L	<0.00010	----
nickel, total	7440-02-0	E468S	0.0005	mg/L	<0.00050	----
phosphorus, total	7723-14-0	E468S	0.05	mg/L	<0.050	----
potassium, total	7440-09-7	E468S	1	mg/L	<1.0	----
rhenium, total	7440-15-5	E468S	0.0005	mg/L	<0.00050	----
rubidium, total	7440-17-7	E468S	0.005	mg/L	<0.0050	----
selenium, total	7782-49-2	E468S	0.0005	mg/L	<0.00050	----
silver, total	7440-22-4	E468S	0.0001	mg/L	<0.00010	----
strontium, total	7440-24-6	E468S	0.01	mg/L	<0.010	----
sulfur, total	7704-34-9	E468S	5	mg/L	<5.0	----
tellurium, total	13494-80-9	E468S	0.0005	mg/L	<0.00050	----
thallium, total	7440-28-0	E468S	0.00005	mg/L	<0.000050	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 345366) - continued						
thorium, total	7440-29-1	E468S	0.0005	mg/L	<0.00050	----
tin, total	7440-31-5	E468S	0.001	mg/L	<0.0010	----
titanium, total	7440-32-6	E468S	0.005	mg/L	<0.0050	----
tungsten, total	7440-33-7	E468S	0.001	mg/L	<0.0010	----
uranium, total	7440-61-1	E468S	0.00005	mg/L	<0.000050	----
vanadium, total	7440-62-2	E468S	0.0005	mg/L	<0.00050	----
yttrium, total	7440-65-5	E468S	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E468S	0.003	mg/L	<0.0030	----
zirconium, total	7440-67-7	E468S	0.0005	mg/L	<0.00050	----
Total Metals (QCLot: 345367)						
silicon, total	7440-21-3	E468S.NaSi	1	mg/L	<1.0	----
sodium, total	17341-25-2	E468S.NaSi	2.5	mg/L	<2.5	----
Total Metals (QCLot: 347848)						
mercury, total	7439-97-6	E508S	0.000005	mg/L	<0.0000050	----
Total Metals (QCLot: 348865)						
mercury, total	7439-97-6	E508S	0.000005	mg/L	<0.0000050	----
Total Metals (QCLot: 349303)						
mercury, total	7439-97-6	E508S	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 347689)						
silicon, dissolved	7440-21-3	E469S.NaSi	1	mg/L	<1.0	----
sodium, dissolved	17341-25-2	E469S.NaSi	2.5	mg/L	<2.5	----
Dissolved Metals (QCLot: 347690)						
aluminum, dissolved	7429-90-5	E469S	0.005	mg/L	<0.0050	----
antimony, dissolved	7440-36-0	E469S	0.001	mg/L	<0.0010	----
arsenic, dissolved	7440-38-2	E469S	0.0004	mg/L	<0.00040	----
barium, dissolved	7440-39-3	E469S	0.001	mg/L	<0.0010	----
beryllium, dissolved	7440-41-7	E469S	0.0005	mg/L	<0.00050	----
bismuth, dissolved	7440-69-9	E469S	0.0005	mg/L	<0.00050	----
boron, dissolved	7440-42-8	E469S	0.3	mg/L	<0.30	----
cadmium, dissolved	7440-43-9	E469S	0.00001	mg/L	<0.000010	----
calcium, dissolved	7440-70-2	E469S	1	mg/L	<1.0	----
cesium, dissolved	7440-46-2	E469S	0.0005	mg/L	<0.00050	----
chromium, dissolved	7440-47-3	E469S	0.0005	mg/L	<0.00050	----
cobalt, dissolved	7440-48-4	E469S	0.00005	mg/L	<0.000050	----
copper, dissolved	7440-50-8	E469S	0.0002	mg/L	<0.00020	----
gallium, dissolved	7440-55-3	E469S	0.0005	mg/L	<0.00050	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 347690) - continued						
iron, dissolved	7439-89-6	E469S	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E469S	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E469S	0.02	mg/L	<0.020	----
magnesium, dissolved	7439-95-4	E469S	1	mg/L	<1.0	----
manganese, dissolved	7439-96-5	E469S	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E469S	0.0001	mg/L	<0.00010	----
nickel, dissolved	7440-02-0	E469S	0.0005	mg/L	<0.00050	----
phosphorus, dissolved	7723-14-0	E469S	0.05	mg/L	<0.050	----
potassium, dissolved	7440-09-7	E469S	1	mg/L	<1.0	----
rhenium, dissolved	7440-15-5	E469S	0.0005	mg/L	<0.00050	----
rubidium, dissolved	7440-17-7	E469S	0.005	mg/L	<0.0050	----
selenium, dissolved	7782-49-2	E469S	0.0005	mg/L	<0.00050	----
silver, dissolved	7440-22-4	E469S	0.0001	mg/L	<0.00010	----
strontium, dissolved	7440-24-6	E469S	0.01	mg/L	<0.010	----
sulfur, dissolved	7704-34-9	E469S	5	mg/L	<5.0	----
tellurium, dissolved	13494-80-9	E469S	0.0005	mg/L	<0.00050	----
thallium, dissolved	7440-28-0	E469S	0.00005	mg/L	<0.000050	----
thorium, dissolved	7440-29-1	E469S	0.0005	mg/L	<0.00050	----
tin, dissolved	7440-31-5	E469S	0.001	mg/L	<0.0010	----
titanium, dissolved	7440-32-6	E469S	0.005	mg/L	<0.0050	----
tungsten, dissolved	7440-33-7	E469S	0.001	mg/L	<0.0010	----
uranium, dissolved	7440-61-1	E469S	0.00005	mg/L	<0.000050	----
vanadium, dissolved	7440-62-2	E469S	0.0005	mg/L	<0.00050	----
yttrium, dissolved	7440-65-5	E469S	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E469S	0.001	mg/L	<0.0010	----
zirconium, dissolved	7440-67-7	E469S	0.0005	mg/L	<0.00050	----
Dissolved Metals (QCLot: 351045)						
mercury, dissolved	7439-97-6	E509S	0.000005	mg/L	<0.0000050	----
Volatile Organic Compounds (QCLot: 349048)						
benzene	71-43-2	E611A	0.5	µg/L	<0.50	----
ethylbenzene	100-41-4	E611A	0.5	µg/L	<0.50	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.5	µg/L	<0.50	----
styrene	100-42-5	E611A	0.5	µg/L	<0.50	----
toluene	108-88-3	E611A	0.5	µg/L	<0.50	----
xylene, m+p-	179601-23-1	E611A	0.4	µg/L	<0.40	----
xylene, o-	95-47-6	E611A	0.3	µg/L	<0.30	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Hydrocarbons (QCLot: 349047)						
F1 (C6-C10)	----	E581.VH+F1	100	µg/L	<100	----
Hydrocarbons (QCLot: 349111)						
F2 (C10-C16)	----	E601	100	µg/L	<100	----
F3 (C16-C34)	----	E601	250	µg/L	<250	----
F4 (C34-C50)	----	E601	250	µg/L	<250	----
Hydrocarbons (QCLot: 349528)						
F2 (C10-C16)	----	E601	100	µg/L	<100	----
F3 (C16-C34)	----	E601	250	µg/L	<250	----
F4 (C34-C50)	----	E601	250	µg/L	<250	----
Polycyclic Aromatic Hydrocarbons (QCLot: 349110)						
acenaphthene	83-32-9	E641A	0.01	µg/L	<0.010	----
acenaphthylene	208-96-8	E641A	0.01	µg/L	<0.010	----
acridine	260-94-6	E641A	0.01	µg/L	<0.010	----
anthracene	120-12-7	E641A	0.01	µg/L	<0.010	----
benz(a)anthracene	56-55-3	E641A	0.01	µg/L	<0.010	----
benzo(a)pyrene	50-32-8	E641A	0.005	µg/L	<0.0050	----
benzo(b+j)fluoranthene	----	E641A	0.01	µg/L	<0.010	----
benzo(g,h,i)perylene	191-24-2	E641A	0.01	µg/L	<0.010	----
benzo(k)fluoranthene	207-08-9	E641A	0.01	µg/L	<0.010	----
chrysene	218-01-9	E641A	0.01	µg/L	<0.010	----
dibenz(a,h)anthracene	53-70-3	E641A	0.005	µg/L	<0.0050	----
fluoranthene	206-44-0	E641A	0.01	µg/L	<0.010	----
fluorene	86-73-7	E641A	0.01	µg/L	<0.010	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.01	µg/L	<0.010	----
methylnaphthalene, 1-	90-12-0	E641A	0.01	µg/L	<0.010	----
methylnaphthalene, 2-	91-57-6	E641A	0.01	µg/L	<0.010	----
naphthalene	91-20-3	E641A	0.05	µg/L	<0.050	----
phenanthrene	85-01-8	E641A	0.02	µg/L	<0.020	----
pyrene	129-00-0	E641A	0.01	µg/L	<0.010	----
quinoline	91-22-5	E641A	0.05	µg/L	<0.050	----
Polycyclic Aromatic Hydrocarbons (QCLot: 349529)						
acenaphthene	83-32-9	E641A	0.01	µg/L	<0.010	----
acenaphthylene	208-96-8	E641A	0.01	µg/L	<0.010	----
acridine	260-94-6	E641A	0.01	µg/L	<0.010	----
anthracene	120-12-7	E641A	0.01	µg/L	<0.010	----
benz(a)anthracene	56-55-3	E641A	0.01	µg/L	<0.010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Polycyclic Aromatic Hydrocarbons (QCLot: 349529) - continued						
benzo(a)pyrene	50-32-8	E641A	0.005	µg/L	<0.0050	----
benzo(b+j)fluoranthene	----	E641A	0.01	µg/L	<0.010	----
benzo(g,h,i)perylene	191-24-2	E641A	0.01	µg/L	<0.010	----
benzo(k)fluoranthene	207-08-9	E641A	0.01	µg/L	<0.010	----
chrysene	218-01-9	E641A	0.01	µg/L	<0.010	----
dibenz(a,h)anthracene	53-70-3	E641A	0.005	µg/L	<0.0050	----
fluoranthene	206-44-0	E641A	0.01	µg/L	<0.010	----
fluorene	86-73-7	E641A	0.01	µg/L	<0.010	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.01	µg/L	<0.010	----
methylnaphthalene, 1-	90-12-0	E641A	0.01	µg/L	<0.010	----
methylnaphthalene, 2-	91-57-6	E641A	0.01	µg/L	<0.010	----
naphthalene	91-20-3	E641A	0.05	µg/L	<0.050	----
phenanthrene	85-01-8	E641A	0.02	µg/L	<0.020	----
pyrene	129-00-0	E641A	0.01	µg/L	<0.010	----
quinoline	91-22-5	E641A	0.05	µg/L	<0.050	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 344516)									
turbidity	----	E121	0.1	NTU	200 NTU	102	85.0	115	----
Physical Tests (QCLot: 344517)									
turbidity	----	E121	0.1	NTU	200 NTU	102	85.0	115	----
Physical Tests (QCLot: 344930)									
pH	----	E108	----	pH units	7 pH units	100	98.0	102	----
Physical Tests (QCLot: 347255)									
solids, total suspended [TSS]	----	E160S	2	mg/L	150 mg/L	92.7	85.0	115	----
Physical Tests (QCLot: 347256)									
solids, total dissolved [TDS]	----	E162S	10	mg/L	1000 mg/L	97.8	85.0	115	----
Physical Tests (QCLot: 348480)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	102	85.0	115	----
Anions and Nutrients (QCLot: 344398)									
bromide	24959-67-9	E235S.Br	5	mg/L	0.5 mg/L	98.0	85.0	115	----
Anions and Nutrients (QCLot: 344399)									
chloride	16887-00-6	E235S.Cl	50	mg/L	100 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 344400)									
fluoride	16984-48-8	E235S.F	1	mg/L	1 mg/L	100	90.0	110	----
Anions and Nutrients (QCLot: 344401)									
nitrate (as N)	14797-55-8	E235S.NO3	0.5	mg/L	2.5 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 344402)									
nitrite (as N)	14797-65-0	E235S.NO2	0.1	mg/L	0.5 mg/L	99.8	90.0	110	----
Anions and Nutrients (QCLot: 344403)									
sulfate (as SO4)	14808-79-8	E235S.SO4	30	mg/L	100 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 344547)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	98.9	85.0	115	----
Anions and Nutrients (QCLot: 344548)									
phosphorus, total	7723-14-0	E372S	0.002	mg/L	0.05 mg/L	93.8	80.0	120	----
Organic / Inorganic Carbon (QCLot: 344545)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	108	80.0	120	----
Organic / Inorganic Carbon (QCLot: 344546)									
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	8.57 mg/L	91.3	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 345364)									
silicon, total	7440-21-3	E468S.NaSi	1	mg/L	10 mg/L	105	80.0	120	----
sodium, total	17341-25-2	E468S.NaSi	2.5	mg/L	50 mg/L	104	80.0	120	----
Total Metals (QCLot: 345365)									
aluminum, total	7429-90-5	E468S	0.005	mg/L	2 mg/L	97.9	80.0	120	----
antimony, total	7440-36-0	E468S	0.001	mg/L	1 mg/L	111	80.0	120	----
arsenic, total	7440-38-2	E468S	0.0004	mg/L	1 mg/L	105	80.0	120	----
barium, total	7440-39-3	E468S	0.001	mg/L	0.25 mg/L	103	80.0	120	----
beryllium, total	7440-41-7	E468S	0.0005	mg/L	0.1 mg/L	97.1	80.0	120	----
bismuth, total	7440-69-9	E468S	0.0005	mg/L	1 mg/L	109	80.0	120	----
boron, total	7440-42-8	E468S	0.3	mg/L	10 mg/L	95.9	80.0	120	----
cadmium, total	7440-43-9	E468S	0.00001	mg/L	0.1 mg/L	99.4	80.0	120	----
calcium, total	7440-70-2	E468S	1	mg/L	50 mg/L	97.7	80.0	120	----
cesium, total	7440-46-2	E468S	0.0005	mg/L	0.05 mg/L	95.7	80.0	120	----
chromium, total	7440-47-3	E468S	0.0005	mg/L	0.25 mg/L	101	80.0	120	----
cobalt, total	7440-48-4	E468S	0.00005	mg/L	0.25 mg/L	102	80.0	120	----
copper, total	7440-50-8	E468S	0.0005	mg/L	0.25 mg/L	104	80.0	120	----
gallium, total	7440-55-3	E468S	0.0005	mg/L	0.25 mg/L	97.1	80.0	120	----
iron, total	7439-89-6	E468S	0.01	mg/L	1 mg/L	106	80.0	120	----
lead, total	7439-92-1	E468S	0.00005	mg/L	0.5 mg/L	106	80.0	120	----
lithium, total	7439-93-2	E468S	0.02	mg/L	0.25 mg/L	98.5	80.0	120	----
magnesium, total	7439-95-4	E468S	1	mg/L	50 mg/L	97.7	80.0	120	----
manganese, total	7439-96-5	E468S	0.0002	mg/L	0.25 mg/L	100	80.0	120	----
molybdenum, total	7439-98-7	E468S	0.0001	mg/L	0.25 mg/L	95.6	80.0	120	----
nickel, total	7440-02-0	E468S	0.0005	mg/L	0.5 mg/L	103	80.0	120	----
phosphorus, total	7723-14-0	E468S	0.05	mg/L	10 mg/L	99.7	80.0	120	----
potassium, total	7440-09-7	E468S	1	mg/L	50 mg/L	100	80.0	120	----
rhenium, total	7440-15-5	E468S	0.0005	mg/L	0.1 mg/L	102	80.0	120	----
rubidium, total	7440-17-7	E468S	0.005	mg/L	0.1 mg/L	100	80.0	120	----
selenium, total	7782-49-2	E468S	0.0005	mg/L	1 mg/L	108	80.0	120	----
silver, total	7440-22-4	E468S	0.0001	mg/L	0.1 mg/L	102	80.0	120	----
strontium, total	7440-24-6	E468S	0.01	mg/L	0.25 mg/L	94.1	80.0	120	----
sulfur, total	7704-34-9	E468S	5	mg/L	50 mg/L	96.0	80.0	120	----
tellurium, total	13494-80-9	E468S	0.0005	mg/L	0.1 mg/L	107	80.0	120	----
thallium, total	7440-28-0	E468S	0.00005	mg/L	1 mg/L	107	80.0	120	----
thorium, total	7440-29-1	E468S	0.0005	mg/L	0.1 mg/L	93.8	80.0	120	----
tin, total	7440-31-5	E468S	0.001	mg/L	0.5 mg/L	95.3	80.0	120	----
titanium, total	7440-32-6	E468S	0.005	mg/L	0.25 mg/L	96.9	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Total Metals (QCLot: 345365) - continued									
tungsten, total	7440-33-7	E468S	0.001	mg/L	0.1 mg/L	99.7	80.0	120	----
uranium, total	7440-61-1	E468S	0.00005	mg/L	0.005 mg/L	96.7	80.0	120	----
vanadium, total	7440-62-2	E468S	0.0005	mg/L	0.5 mg/L	98.2	80.0	120	----
yttrium, total	7440-65-5	E468S	0.0005	mg/L	0.1 mg/L	92.3	80.0	120	----
zinc, total	7440-66-6	E468S	0.003	mg/L	0.5 mg/L	102	80.0	120	----
zirconium, total	7440-67-7	E468S	0.0005	mg/L	0.1 mg/L	90.3	80.0	120	----
Total Metals (QCLot: 345366)									
aluminum, total	7429-90-5	E468S	0.005	mg/L	2 mg/L	101	80.0	120	----
antimony, total	7440-36-0	E468S	0.001	mg/L	1 mg/L	113	80.0	120	----
arsenic, total	7440-38-2	E468S	0.0004	mg/L	1 mg/L	109	80.0	120	----
barium, total	7440-39-3	E468S	0.001	mg/L	0.25 mg/L	109	80.0	120	----
beryllium, total	7440-41-7	E468S	0.0005	mg/L	0.1 mg/L	104	80.0	120	----
bismuth, total	7440-69-9	E468S	0.0005	mg/L	1 mg/L	110	80.0	120	----
boron, total	7440-42-8	E468S	0.3	mg/L	10 mg/L	87.7	80.0	120	----
cadmium, total	7440-43-9	E468S	0.00001	mg/L	0.1 mg/L	104	80.0	120	----
calcium, total	7440-70-2	E468S	1	mg/L	50 mg/L	102	80.0	120	----
cesium, total	7440-46-2	E468S	0.0005	mg/L	0.05 mg/L	99.9	80.0	120	----
chromium, total	7440-47-3	E468S	0.0005	mg/L	0.25 mg/L	106	80.0	120	----
cobalt, total	7440-48-4	E468S	0.00005	mg/L	0.25 mg/L	105	80.0	120	----
copper, total	7440-50-8	E468S	0.0005	mg/L	0.25 mg/L	107	80.0	120	----
gallium, total	7440-55-3	E468S	0.0005	mg/L	0.25 mg/L	105	80.0	120	----
iron, total	7439-89-6	E468S	0.01	mg/L	1 mg/L	108	80.0	120	----
lead, total	7439-92-1	E468S	0.00005	mg/L	0.5 mg/L	109	80.0	120	----
lithium, total	7439-93-2	E468S	0.02	mg/L	0.25 mg/L	105	80.0	120	----
magnesium, total	7439-95-4	E468S	1	mg/L	50 mg/L	104	80.0	120	----
manganese, total	7439-96-5	E468S	0.0002	mg/L	0.25 mg/L	106	80.0	120	----
molybdenum, total	7439-98-7	E468S	0.0001	mg/L	0.25 mg/L	101	80.0	120	----
nickel, total	7440-02-0	E468S	0.0005	mg/L	0.5 mg/L	108	80.0	120	----
phosphorus, total	7723-14-0	E468S	0.05	mg/L	10 mg/L	107	80.0	120	----
potassium, total	7440-09-7	E468S	1	mg/L	50 mg/L	104	80.0	120	----
rhenium, total	7440-15-5	E468S	0.0005	mg/L	0.1 mg/L	109	80.0	120	----
rubidium, total	7440-17-7	E468S	0.005	mg/L	0.1 mg/L	106	80.0	120	----
selenium, total	7782-49-2	E468S	0.0005	mg/L	1 mg/L	116	80.0	120	----
silver, total	7440-22-4	E468S	0.0001	mg/L	0.1 mg/L	107	80.0	120	----
strontium, total	7440-24-6	E468S	0.01	mg/L	0.25 mg/L	100.0	80.0	120	----
sulfur, total	7704-34-9	E468S	5	mg/L	50 mg/L	91.5	80.0	120	----
tellurium, total	13494-80-9	E468S	0.0005	mg/L	0.1 mg/L	# 122	80.0	120	MES

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Total Metals (QCLot: 345366) - continued									
thallium, total	7440-28-0	E468S	0.00005	mg/L	1 mg/L	110	80.0	120	----
thorium, total	7440-29-1	E468S	0.0005	mg/L	0.1 mg/L	96.1	80.0	120	----
tin, total	7440-31-5	E468S	0.001	mg/L	0.5 mg/L	101	80.0	120	----
titanium, total	7440-32-6	E468S	0.005	mg/L	0.25 mg/L	101	80.0	120	----
tungsten, total	7440-33-7	E468S	0.001	mg/L	0.1 mg/L	104	80.0	120	----
uranium, total	7440-61-1	E468S	0.00005	mg/L	0.005 mg/L	102	80.0	120	----
vanadium, total	7440-62-2	E468S	0.0005	mg/L	0.5 mg/L	102	80.0	120	----
yttrium, total	7440-65-5	E468S	0.0005	mg/L	0.1 mg/L	95.5	80.0	120	----
zinc, total	7440-66-6	E468S	0.003	mg/L	0.5 mg/L	110	80.0	120	----
zirconium, total	7440-67-7	E468S	0.0005	mg/L	0.1 mg/L	96.5	80.0	120	----
Total Metals (QCLot: 345367)									
silicon, total	7440-21-3	E468S.NaSi	1	mg/L	10 mg/L	94.3	80.0	120	----
sodium, total	17341-25-2	E468S.NaSi	2.5	mg/L	50 mg/L	103	80.0	120	----
Total Metals (QCLot: 347848)									
mercury, total	7439-97-6	E508S	0.000005	mg/L	0.0001 mg/L	97.1	80.0	120	----
Total Metals (QCLot: 348865)									
mercury, total	7439-97-6	E508S	0.000005	mg/L	0.0001 mg/L	97.1	80.0	120	----
Total Metals (QCLot: 349303)									
mercury, total	7439-97-6	E508S	0.000005	mg/L	0.0001 mg/L	102	80.0	120	----
silicon, dissolved	7440-21-3	E469S.NaSi	1	mg/L	10 mg/L	105	80.0	120	----
sodium, dissolved	17341-25-2	E469S.NaSi	2.5	mg/L	50 mg/L	109	80.0	120	----
Dissolved Metals (QCLot: 347690)									
aluminum, dissolved	7429-90-5	E469S	0.005	mg/L	2 mg/L	103	80.0	120	----
antimony, dissolved	7440-36-0	E469S	0.001	mg/L	1 mg/L	111	80.0	120	----
arsenic, dissolved	7440-38-2	E469S	0.0004	mg/L	1 mg/L	105	80.0	120	----
barium, dissolved	7440-39-3	E469S	0.001	mg/L	0.25 mg/L	105	80.0	120	----
beryllium, dissolved	7440-41-7	E469S	0.0005	mg/L	0.1 mg/L	101	80.0	120	----
bismuth, dissolved	7440-69-9	E469S	0.0005	mg/L	1 mg/L	112	80.0	120	----
boron, dissolved	7440-42-8	E469S	0.3	mg/L	10 mg/L	103	80.0	120	----
cadmium, dissolved	7440-43-9	E469S	0.00001	mg/L	0.1 mg/L	103	80.0	120	----
calcium, dissolved	7440-70-2	E469S	1	mg/L	50 mg/L	103	80.0	120	----
cesium, dissolved	7440-46-2	E469S	0.0005	mg/L	0.05 mg/L	98.4	80.0	120	----
chromium, dissolved	7440-47-3	E469S	0.0005	mg/L	0.25 mg/L	102	80.0	120	----
cobalt, dissolved	7440-48-4	E469S	0.00005	mg/L	0.25 mg/L	103	80.0	120	----
copper, dissolved	7440-50-8	E469S	0.0002	mg/L	0.25 mg/L	102	80.0	120	----
gallium, dissolved	7440-55-3	E469S	0.0005	mg/L	0.25 mg/L	103	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Dissolved Metals (QCLot: 347690) - continued									
iron, dissolved	7439-89-6	E469S	0.01	mg/L	1 mg/L	107	80.0	120	----
lead, dissolved	7439-92-1	E469S	0.00005	mg/L	0.5 mg/L	110	80.0	120	----
lithium, dissolved	7439-93-2	E469S	0.02	mg/L	0.25 mg/L	102	80.0	120	----
magnesium, dissolved	7439-95-4	E469S	1	mg/L	50 mg/L	99.0	80.0	120	----
manganese, dissolved	7439-96-5	E469S	0.0001	mg/L	0.25 mg/L	103	80.0	120	----
molybdenum, dissolved	7439-98-7	E469S	0.0001	mg/L	0.25 mg/L	98.2	80.0	120	----
nickel, dissolved	7440-02-0	E469S	0.0005	mg/L	0.5 mg/L	105	80.0	120	----
phosphorus, dissolved	7723-14-0	E469S	0.05	mg/L	10 mg/L	97.9	80.0	120	----
potassium, dissolved	7440-09-7	E469S	1	mg/L	50 mg/L	102	80.0	120	----
rhenium, dissolved	7440-15-5	E469S	0.0005	mg/L	0.1 mg/L	104	80.0	120	----
rubidium, dissolved	7440-17-7	E469S	0.005	mg/L	0.1 mg/L	106	80.0	120	----
selenium, dissolved	7782-49-2	E469S	0.0005	mg/L	1 mg/L	112	80.0	120	----
silver, dissolved	7440-22-4	E469S	0.0001	mg/L	0.1 mg/L	104	80.0	120	----
strontium, dissolved	7440-24-6	E469S	0.01	mg/L	0.25 mg/L	102	80.0	120	----
sulfur, dissolved	7704-34-9	E469S	5	mg/L	50 mg/L	104	80.0	120	----
tellurium, dissolved	13494-80-9	E469S	0.0005	mg/L	0.1 mg/L	112	80.0	120	----
thallium, dissolved	7440-28-0	E469S	0.00005	mg/L	1 mg/L	110	80.0	120	----
thorium, dissolved	7440-29-1	E469S	0.0005	mg/L	0.1 mg/L	97.4	80.0	120	----
tin, dissolved	7440-31-5	E469S	0.001	mg/L	0.5 mg/L	101	80.0	120	----
titanium, dissolved	7440-32-6	E469S	0.005	mg/L	0.25 mg/L	102	80.0	120	----
tungsten, dissolved	7440-33-7	E469S	0.001	mg/L	0.1 mg/L	102	80.0	120	----
uranium, dissolved	7440-61-1	E469S	0.00005	mg/L	0.005 mg/L	100	80.0	120	----
vanadium, dissolved	7440-62-2	E469S	0.0005	mg/L	0.5 mg/L	99.2	80.0	120	----
yttrium, dissolved	7440-65-5	E469S	0.0005	mg/L	0.1 mg/L	96.6	80.0	120	----
zinc, dissolved	7440-66-6	E469S	0.001	mg/L	0.5 mg/L	105	80.0	120	----
zirconium, dissolved	7440-67-7	E469S	0.0005	mg/L	0.1 mg/L	93.8	80.0	120	----
mercury, dissolved	7439-97-6	E509S	0.000005	mg/L	0.0001 mg/L	104	80.0	120	----
Volatile Organic Compounds (QCLot: 349048)									
benzene	71-43-2	E611A	0.5	µg/L	100 µg/L	105	70.0	130	----
ethylbenzene	100-41-4	E611A	0.5	µg/L	100 µg/L	108	70.0	130	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.5	µg/L	100 µg/L	103	70.0	130	----
styrene	100-42-5	E611A	0.5	µg/L	100 µg/L	104	70.0	130	----
toluene	108-88-3	E611A	0.5	µg/L	100 µg/L	111	70.0	130	----
xylene, m+p-	179601-23-1	E611A	0.4	µg/L	200 µg/L	109	70.0	130	----
xylene, o-	95-47-6	E611A	0.3	µg/L	100 µg/L	106	70.0	130	----
Hydrocarbons (QCLot: 349047)									

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Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Hydrocarbons (QCLot: 349047) - continued									
F1 (C6-C10)	----	E581.VH+F1	100	µg/L	6310 µg/L	86.0	70.0	130	----
Hydrocarbons (QCLot: 349111)									
F2 (C10-C16)	----	E601	100	µg/L	3538 µg/L	108	70.0	130	----
F3 (C16-C34)	----	E601	250	µg/L	7053 µg/L	101	70.0	130	----
F4 (C34-C50)	----	E601	250	µg/L	5051 µg/L	106	70.0	130	----
Hydrocarbons (QCLot: 349528)									
F2 (C10-C16)	----	E601	100	µg/L	3538 µg/L	107	70.0	130	----
F3 (C16-C34)	----	E601	250	µg/L	7053 µg/L	102	70.0	130	----
F4 (C34-C50)	----	E601	250	µg/L	5051 µg/L	111	70.0	130	----
Polycyclic Aromatic Hydrocarbons (QCLot: 349110)									
acenaphthene	83-32-9	E641A	0.01	µg/L	0.5 µg/L	92.9	60.0	130	----
acenaphthylene	208-96-8	E641A	0.01	µg/L	0.5 µg/L	95.8	60.0	130	----
acridine	260-94-6	E641A	0.01	µg/L	0.5 µg/L	104	60.0	130	----
anthracene	120-12-7	E641A	0.01	µg/L	0.5 µg/L	105	60.0	130	----
benz(a)anthracene	56-55-3	E641A	0.01	µg/L	0.5 µg/L	80.8	60.0	130	----
benzo(a)pyrene	50-32-8	E641A	0.005	µg/L	0.5 µg/L	93.8	60.0	130	----
benzo(b+j)fluoranthene	----	E641A	0.01	µg/L	0.5 µg/L	80.4	60.0	130	----
benzo(g,h,i)perylene	191-24-2	E641A	0.01	µg/L	0.5 µg/L	92.6	60.0	130	----
benzo(k)fluoranthene	207-08-9	E641A	0.01	µg/L	0.5 µg/L	90.9	60.0	130	----
chrysene	218-01-9	E641A	0.01	µg/L	0.5 µg/L	85.4	60.0	130	----
dibenz(a,h)anthracene	53-70-3	E641A	0.005	µg/L	0.5 µg/L	96.3	60.0	130	----
fluoranthene	206-44-0	E641A	0.01	µg/L	0.5 µg/L	101	60.0	130	----
fluorene	86-73-7	E641A	0.01	µg/L	0.5 µg/L	96.7	60.0	130	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.01	µg/L	0.5 µg/L	111	60.0	130	----
methylnaphthalene, 1-	90-12-0	E641A	0.01	µg/L	0.5 µg/L	94.2	60.0	130	----
methylnaphthalene, 2-	91-57-6	E641A	0.01	µg/L	0.5 µg/L	89.2	60.0	130	----
naphthalene	91-20-3	E641A	0.05	µg/L	0.5 µg/L	91.6	50.0	130	----
phenanthrene	85-01-8	E641A	0.02	µg/L	0.5 µg/L	99.8	60.0	130	----
pyrene	129-00-0	E641A	0.01	µg/L	0.5 µg/L	101	60.0	130	----
quinoline	91-22-5	E641A	0.05	µg/L	0.5 µg/L	102	60.0	130	----
Polycyclic Aromatic Hydrocarbons (QCLot: 349529)									
acenaphthene	83-32-9	E641A	0.01	µg/L	0.5 µg/L	107	60.0	130	----
acenaphthylene	208-96-8	E641A	0.01	µg/L	0.5 µg/L	110	60.0	130	----
acridine	260-94-6	E641A	0.01	µg/L	0.5 µg/L	116	60.0	130	----
anthracene	120-12-7	E641A	0.01	µg/L	0.5 µg/L	117	60.0	130	----
benz(a)anthracene	56-55-3	E641A	0.01	µg/L	0.5 µg/L	94.3	60.0	130	----

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Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Polycyclic Aromatic Hydrocarbons (QCLot: 349529) - continued									
benzo(a)pyrene	50-32-8	E641A	0.005	µg/L	0.5 µg/L	107	60.0	130	----
benzo(b+j)fluoranthene	----	E641A	0.01	µg/L	0.5 µg/L	86.4	60.0	130	----
benzo(g,h,i)perylene	191-24-2	E641A	0.01	µg/L	0.5 µg/L	114	60.0	130	----
benzo(k)fluoranthene	207-08-9	E641A	0.01	µg/L	0.5 µg/L	94.8	60.0	130	----
chrysene	218-01-9	E641A	0.01	µg/L	0.5 µg/L	98.1	60.0	130	----
dibenz(a,h)anthracene	53-70-3	E641A	0.005	µg/L	0.5 µg/L	104	60.0	130	----
fluoranthene	206-44-0	E641A	0.01	µg/L	0.5 µg/L	116	60.0	130	----
fluorene	86-73-7	E641A	0.01	µg/L	0.5 µg/L	111	60.0	130	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.01	µg/L	0.5 µg/L	129	60.0	130	----
methylnaphthalene, 1-	90-12-0	E641A	0.01	µg/L	0.5 µg/L	106	60.0	130	----
methylnaphthalene, 2-	91-57-6	E641A	0.01	µg/L	0.5 µg/L	101	60.0	130	----
naphthalene	91-20-3	E641A	0.05	µg/L	0.5 µg/L	103	50.0	130	----
phenanthrene	85-01-8	E641A	0.02	µg/L	0.5 µg/L	113	60.0	130	----
pyrene	129-00-0	E641A	0.01	µg/L	0.5 µg/L	113	60.0	130	----
quinoline	91-22-5	E641A	0.05	µg/L	0.5 µg/L	113	60.0	130	----

Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

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Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 344398)										
VA21C5432-002	WQ01-Ebb-20m	bromide	24959-67-9	E235S.Br	ND mg/L	50 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 344399)										
VA21C5432-002	WQ01-Ebb-20m	chloride	16887-00-6	E235S.Cl	ND mg/L	10000 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 344400)										
VA21C5432-002	WQ01-Ebb-20m	fluoride	16984-48-8	E235S.F	104 mg/L	100 mg/L	104	75.0	125	----
Anions and Nutrients (QCLot: 344401)										
VA21C5432-002	WQ01-Ebb-20m	nitrate (as N)	14797-55-8	E235S.NO3	249 mg/L	250 mg/L	99.6	75.0	125	----
Anions and Nutrients (QCLot: 344402)										
VA21C5432-002	WQ01-Ebb-20m	nitrite (as N)	14797-65-0	E235S.NO2	48.7 mg/L	50 mg/L	97.4	75.0	125	----
Anions and Nutrients (QCLot: 344403)										
VA21C5432-002	WQ01-Ebb-20m	sulfate (as SO4)	14808-79-8	E235S.SO4	9990 mg/L	10000 mg/L	99.9	75.0	125	----
Anions and Nutrients (QCLot: 344547)										
VA21C5432-002	WQ01-Ebb-20m	ammonia, total (as N)	7664-41-7	E298	0.121 mg/L	0.1 mg/L	121	75.0	125	----
Anions and Nutrients (QCLot: 344548)										
VA21C5432-002	WQ01-Ebb-20m	phosphorus, total	7723-14-0	E372S	ND mg/L	0.05 mg/L	ND	70.0	130	----
Organic / Inorganic Carbon (QCLot: 344545)										
VA21C5432-002	WQ01-Ebb-20m	carbon, dissolved organic [DOC]	----	E358-L	5.00 mg/L	5 mg/L	100	70.0	130	----
Organic / Inorganic Carbon (QCLot: 344546)										
VA21C5432-002	WQ01-Ebb-20m	carbon, total organic [TOC]	----	E355-L	5.04 mg/L	5 mg/L	101	70.0	130	----
Total Metals (QCLot: 345364)										
VA21C5426-002	Anonymous	silicon, total	7440-21-3	E468S.NaSi	470 mg/L	500 mg/L	93.9	70.0	130	----
		sodium, total	17341-25-2	E468S.NaSi	ND mg/L	100 mg/L	ND	70.0	130	----
Total Metals (QCLot: 345365)										
VA21C5426-002	Anonymous	aluminum, total	7429-90-5	E468S	0.421 mg/L	0.4 mg/L	105	70.0	130	----
		antimony, total	7440-36-0	E468S	0.0438 mg/L	0.04 mg/L	109	70.0	130	----
		arsenic, total	7440-38-2	E468S	0.0377 mg/L	0.04 mg/L	94.4	70.0	130	----
		barium, total	7440-39-3	E468S	0.0368 mg/L	0.04 mg/L	92.1	70.0	130	----
		beryllium, total	7440-41-7	E468S	0.0862 mg/L	0.08 mg/L	108	70.0	130	----

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Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 345365) - continued										
VA21C5426-002	Anonymous	bismuth, total	7440-69-9	E468S	0.0177 mg/L	0.02 mg/L	88.6	70.0	130	----
		boron, total	7440-42-8	E468S	ND mg/L	0.2 mg/L	ND	70.0	130	----
		cadmium, total	7440-43-9	E468S	0.00651 mg/L	0.008 mg/L	81.4	70.0	130	----
		calcium, total	7440-70-2	E468S	ND mg/L	8 mg/L	ND	70.0	130	----
		cesium, total	7440-46-2	E468S	0.0205 mg/L	0.02 mg/L	102	70.0	130	----
		chromium, total	7440-47-3	E468S	0.0826 mg/L	0.08 mg/L	103	70.0	130	----
		cobalt, total	7440-48-4	E468S	0.0373 mg/L	0.04 mg/L	93.2	70.0	130	----
		copper, total	7440-50-8	E468S	0.0356 mg/L	0.04 mg/L	88.9	70.0	130	----
		gallium, total	7440-55-3	E468S	0.00495 mg/L	0.005 mg/L	98.9	70.0	130	----
		iron, total	7439-89-6	E468S	4.02 mg/L	4 mg/L	101	70.0	130	----
		lead, total	7439-92-1	E468S	0.0370 mg/L	0.04 mg/L	92.4	70.0	130	----
		lithium, total	7439-93-2	E468S	0.222 mg/L	0.2 mg/L	111	70.0	130	----
		magnesium, total	7439-95-4	E468S	ND mg/L	2 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E468S	0.0402 mg/L	0.04 mg/L	100	70.0	130	----
		molybdenum, total	7439-98-7	E468S	0.0440 mg/L	0.04 mg/L	110	70.0	130	----
		nickel, total	7440-02-0	E468S	0.0735 mg/L	0.08 mg/L	91.9	70.0	130	----
		phosphorus, total	7723-14-0	E468S	21.5 mg/L	20 mg/L	108	70.0	130	----
		potassium, total	7440-09-7	E468S	ND mg/L	8 mg/L	ND	70.0	130	----
		rhenium, total	7440-15-5	E468S	0.00457 mg/L	0.005 mg/L	91.4	70.0	130	----
		rubidium, total	7440-17-7	E468S	ND mg/L	0.04 mg/L	ND	70.0	130	----
		selenium, total	7782-49-2	E468S	0.0732 mg/L	0.08 mg/L	91.5	70.0	130	----
		silver, total	7440-22-4	E468S	0.00750 mg/L	0.008 mg/L	93.8	70.0	130	----
		strontium, total	7440-24-6	E468S	ND mg/L	0.04 mg/L	ND	70.0	130	----
		sulfur, total	7704-34-9	E468S	ND mg/L	40 mg/L	ND	70.0	130	----
		tellurium, total	13494-80-9	E468S	0.0710 mg/L	0.08 mg/L	88.8	70.0	130	----
		thallium, total	7440-28-0	E468S	0.00744 mg/L	0.008 mg/L	92.9	70.0	130	----
		thorium, total	7440-29-1	E468S	0.0420 mg/L	0.04 mg/L	105	70.0	130	----
		tin, total	7440-31-5	E468S	0.0366 mg/L	0.04 mg/L	91.6	70.0	130	----
		titanium, total	7440-32-6	E468S	0.0873 mg/L	0.08 mg/L	109	70.0	130	----
		tungsten, total	7440-33-7	E468S	0.0411 mg/L	0.04 mg/L	103	70.0	130	----
		uranium, total	7440-61-1	E468S	0.00794 mg/L	0.008 mg/L	99.2	70.0	130	----
		vanadium, total	7440-62-2	E468S	0.213 mg/L	0.2 mg/L	106	70.0	130	----
		yttrium, total	7440-65-5	E468S	0.00520 mg/L	0.005 mg/L	104	70.0	130	----
		zinc, total	7440-66-6	E468S	0.673 mg/L	0.8 mg/L	84.2	70.0	130	----
		zirconium, total	7440-67-7	E468S	0.0890 mg/L	0.08 mg/L	111	70.0	130	----
Total Metals (QCLot: 345366)										

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
					Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 345366) - continued										
VA21C5432-010	Equipment Blank	phosphorus, total	7723-14-0	E468S	16.7 mg/L	20 mg/L	83.5	70.0	130	----
VA21C5432-010	Equipment Blank	aluminum, total	7429-90-5	E468S	0.369 mg/L	0.4 mg/L	92.2	70.0	130	----
		antimony, total	7440-36-0	E468S	0.0412 mg/L	0.04 mg/L	103	70.0	130	----
		arsenic, total	7440-38-2	E468S	0.0394 mg/L	0.04 mg/L	98.5	70.0	130	----
		barium, total	7440-39-3	E468S	0.0368 mg/L	0.04 mg/L	92.0	70.0	130	----
		beryllium, total	7440-41-7	E468S	0.0771 mg/L	0.08 mg/L	96.4	70.0	130	----
		bismuth, total	7440-69-9	E468S	0.0215 mg/L	0.02 mg/L	107	70.0	130	----
		boron, total	7440-42-8	E468S	0.21 mg/L	0.2 mg/L	104	70.0	130	----
		cadmium, total	7440-43-9	E468S	0.00835 mg/L	0.008 mg/L	104	70.0	130	----
		calcium, total	7440-70-2	E468S	7.5 mg/L	8 mg/L	93.4	70.0	130	----
		cesium, total	7440-46-2	E468S	0.0189 mg/L	0.02 mg/L	94.6	70.0	130	----
		chromium, total	7440-47-3	E468S	0.0772 mg/L	0.08 mg/L	96.5	70.0	130	----
		cobalt, total	7440-48-4	E468S	0.0392 mg/L	0.04 mg/L	98.0	70.0	130	----
		copper, total	7440-50-8	E468S	0.0405 mg/L	0.04 mg/L	101	70.0	130	----
		gallium, total	7440-55-3	E468S	0.00534 mg/L	0.005 mg/L	107	70.0	130	----
		iron, total	7439-89-6	E468S	3.79 mg/L	4 mg/L	94.7	70.0	130	----
		lead, total	7439-92-1	E468S	0.0424 mg/L	0.04 mg/L	106	70.0	130	----
		lithium, total	7439-93-2	E468S	0.192 mg/L	0.2 mg/L	96.0	70.0	130	----
		magnesium, total	7439-95-4	E468S	1.8 mg/L	2 mg/L	89.5	70.0	130	----
		manganese, total	7439-96-5	E468S	0.0392 mg/L	0.04 mg/L	98.0	70.0	130	----
		molybdenum, total	7439-98-7	E468S	0.0363 mg/L	0.04 mg/L	90.8	70.0	130	----
		nickel, total	7440-02-0	E468S	0.0804 mg/L	0.08 mg/L	100	70.0	130	----
		potassium, total	7440-09-7	E468S	7.3 mg/L	8 mg/L	91.3	70.0	130	----
		rhenium, total	7440-15-5	E468S	0.00520 mg/L	0.005 mg/L	104	70.0	130	----
		rubidium, total	7440-17-7	E468S	0.0389 mg/L	0.04 mg/L	97.2	70.0	130	----
		selenium, total	7782-49-2	E468S	0.0826 mg/L	0.08 mg/L	103	70.0	130	----
		silver, total	7440-22-4	E468S	0.00787 mg/L	0.008 mg/L	98.4	70.0	130	----
		strontium, total	7440-24-6	E468S	0.038 mg/L	0.04 mg/L	94.8	70.0	130	----
		sulfur, total	7704-34-9	E468S	33.6 mg/L	40 mg/L	83.9	70.0	130	----
		tellurium, total	13494-80-9	E468S	0.0864 mg/L	0.08 mg/L	108	70.0	130	----
		thallium, total	7440-28-0	E468S	0.00821 mg/L	0.008 mg/L	102	70.0	130	----
		thorium, total	7440-29-1	E468S	0.0426 mg/L	0.04 mg/L	106	70.0	130	----
		tin, total	7440-31-5	E468S	0.0391 mg/L	0.04 mg/L	97.6	70.0	130	----
		titanium, total	7440-32-6	E468S	0.0729 mg/L	0.08 mg/L	91.1	70.0	130	----
		tungsten, total	7440-33-7	E468S	0.0396 mg/L	0.04 mg/L	99.1	70.0	130	----
		uranium, total	7440-61-1	E468S	0.00811 mg/L	0.008 mg/L	101	70.0	130	----
		vanadium, total	7440-62-2	E468S	0.184 mg/L	0.2 mg/L	91.8	70.0	130	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
					Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 345366) - continued										
VA21C5432-010	Equipment Blank	yttrium, total	7440-65-5	E468S	0.00473 mg/L	0.005 mg/L	94.6	70.0	130	----
		zinc, total	7440-66-6	E468S	0.856 mg/L	0.8 mg/L	107	70.0	130	----
		zirconium, total	7440-67-7	E468S	0.0728 mg/L	0.08 mg/L	91.0	70.0	130	----
Total Metals (QCLot: 345367)										
VA21C5432-010	Equipment Blank	silicon, total	7440-21-3	E468S.NaSi	487 mg/L	500 mg/L	97.5	70.0	130	----
		sodium, total	17341-25-2	E468S.NaSi	101 mg/L	100 mg/L	101	70.0	130	----
Total Metals (QCLot: 347848)										
VA21C5432-003	WQ03-Ebb-1m	mercury, total	7439-97-6	E508S	0.0000933 mg/L	0.0001 mg/L	93.3	70.0	130	----
Total Metals (QCLot: 348865)										
VA21C5432-009	Field Blank	mercury, total	7439-97-6	E508S	0.0000967 mg/L	0.0001 mg/L	96.7	70.0	130	----
Total Metals (QCLot: 349303)										
VA21C5591-020	Anonymous	mercury, total	7439-97-6	E508S	0.000102 mg/L	0.0001 mg/L	102	70.0	130	----
Dissolved Metals (QCLot: 347689)										
VA21C5432-002	WQ01-Ebb-20m	silicon, dissolved	7440-21-3	E469S.NaSi	477 mg/L	500 mg/L	95.4	70.0	130	----
		sodium, dissolved	17341-25-2	E469S.NaSi	ND mg/L	100 mg/L	ND	70.0	130	----
Dissolved Metals (QCLot: 347690)										
VA21C5432-002	WQ01-Ebb-20m	aluminum, dissolved	7429-90-5	E469S	0.432 mg/L	0.4 mg/L	108	70.0	130	----
		antimony, dissolved	7440-36-0	E469S	0.0398 mg/L	0.04 mg/L	99.4	70.0	130	----
		arsenic, dissolved	7440-38-2	E469S	0.0376 mg/L	0.04 mg/L	94.0	70.0	130	----
		barium, dissolved	7440-39-3	E469S	0.0380 mg/L	0.04 mg/L	94.9	70.0	130	----
		beryllium, dissolved	7440-41-7	E469S	0.0784 mg/L	0.08 mg/L	98.0	70.0	130	----
		bismuth, dissolved	7440-69-9	E469S	0.0164 mg/L	0.02 mg/L	82.2	70.0	130	----
		boron, dissolved	7440-42-8	E469S	ND mg/L	0.2 mg/L	ND	70.0	130	----
		cadmium, dissolved	7440-43-9	E469S	0.00681 mg/L	0.008 mg/L	85.1	70.0	130	----
		calcium, dissolved	7440-70-2	E469S	ND mg/L	8 mg/L	ND	70.0	130	----
		cesium, dissolved	7440-46-2	E469S	0.0189 mg/L	0.02 mg/L	94.5	70.0	130	----
		chromium, dissolved	7440-47-3	E469S	0.0822 mg/L	0.08 mg/L	103	70.0	130	----
		cobalt, dissolved	7440-48-4	E469S	0.0372 mg/L	0.04 mg/L	93.0	70.0	130	----
		copper, dissolved	7440-50-8	E469S	0.0346 mg/L	0.04 mg/L	86.5	70.0	130	----
		gallium, dissolved	7440-55-3	E469S	0.00510 mg/L	0.005 mg/L	102	70.0	130	----
		iron, dissolved	7439-89-6	E469S	4.02 mg/L	4 mg/L	100	70.0	130	----
		lead, dissolved	7439-92-1	E469S	0.0345 mg/L	0.04 mg/L	86.2	70.0	130	----
		lithium, dissolved	7439-93-2	E469S	0.178 mg/L	0.2 mg/L	89.2	70.0	130	----
		magnesium, dissolved	7439-95-4	E469S	ND mg/L	2 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E469S	0.0407 mg/L	0.04 mg/L	102	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 347690) - continued										
VA21C5432-002	WQ01-Ebb-20m	molybdenum, dissolved	7439-98-7	E469S	0.0391 mg/L	0.04 mg/L	97.7	70.0	130	----
		nickel, dissolved	7440-02-0	E469S	0.0721 mg/L	0.08 mg/L	90.2	70.0	130	----
		phosphorus, dissolved	7723-14-0	E469S	21.8 mg/L	20 mg/L	109	70.0	130	----
		potassium, dissolved	7440-09-7	E469S	ND mg/L	8 mg/L	ND	70.0	130	----
		rhenium, dissolved	7440-15-5	E469S	0.00468 mg/L	0.005 mg/L	93.6	70.0	130	----
		rubidium, dissolved	7440-17-7	E469S	ND mg/L	0.04 mg/L	ND	70.0	130	----
		selenium, dissolved	7782-49-2	E469S	0.0705 mg/L	0.08 mg/L	88.2	70.0	130	----
		silver, dissolved	7440-22-4	E469S	0.00680 mg/L	0.008 mg/L	85.0	70.0	130	----
		strontium, dissolved	7440-24-6	E469S	ND mg/L	0.04 mg/L	ND	70.0	130	----
		sulfur, dissolved	7704-34-9	E469S	ND mg/L	40 mg/L	ND	70.0	130	----
		tellurium, dissolved	13494-80-9	E469S	0.0647 mg/L	0.08 mg/L	80.8	70.0	130	----
		thallium, dissolved	7440-28-0	E469S	0.00682 mg/L	0.008 mg/L	85.2	70.0	130	----
		thorium, dissolved	7440-29-1	E469S	0.0389 mg/L	0.04 mg/L	97.2	70.0	130	----
		tin, dissolved	7440-31-5	E469S	0.0364 mg/L	0.04 mg/L	91.0	70.0	130	----
		titanium, dissolved	7440-32-6	E469S	0.0913 mg/L	0.08 mg/L	114	70.0	130	----
		tungsten, dissolved	7440-33-7	E469S	0.0379 mg/L	0.04 mg/L	94.8	70.0	130	----
		uranium, dissolved	7440-61-1	E469S	0.00705 mg/L	0.008 mg/L	88.1	70.0	130	----
		vanadium, dissolved	7440-62-2	E469S	0.213 mg/L	0.2 mg/L	106	70.0	130	----
		yttrium, dissolved	7440-65-5	E469S	0.00542 mg/L	0.005 mg/L	108	70.0	130	----
		zinc, dissolved	7440-66-6	E469S	0.671 mg/L	0.8 mg/L	83.8	70.0	130	----
		zirconium, dissolved	7440-67-7	E469S	0.0819 mg/L	0.08 mg/L	102	70.0	130	----
Dissolved Metals (QCLot: 351045)										
VA21C5432-002	WQ01-Ebb-20m	mercury, dissolved	7439-97-6	E509S	0.0000916 mg/L	0.0001 mg/L	91.6	70.0	130	----
Volatile Organic Compounds (QCLot: 349048)										
VA21C5415-013	Anonymous	benzene	71-43-2	E611A	103 µg/L	100 µg/L	103	70.0	130	----
		ethylbenzene	100-41-4	E611A	104 µg/L	100 µg/L	104	70.0	130	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	101 µg/L	100 µg/L	101	70.0	130	----
		styrene	100-42-5	E611A	102 µg/L	100 µg/L	102	70.0	130	----
		toluene	108-88-3	E611A	108 µg/L	100 µg/L	108	70.0	130	----
		xylene, m+p-	179601-23-1	E611A	211 µg/L	200 µg/L	105	70.0	130	----
		xylene, o-	95-47-6	E611A	104 µg/L	100 µg/L	104	70.0	130	----
Hydrocarbons (QCLot: 349047)										
VA21C5432-001	WQ01-Ebb-1m	F1 (C6-C10)	----	E581.VH+F1	5100 µg/L	6310 µg/L	80.9	60.0	140	----

Chain of Custody (COC) / Analytical Request Form

COC Number: 21 -

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Canada Toll Free: 1 800 668 9878

Environmental Division
Vancouver
Work Order Reference
VA21C5432

Telephone : +1 604 253 4188

Report To	Contact and company name below will appear on the final report
Company:	Stantec Consulting Ltd
Contact:	Libby McMillan
Phone:	250-208-6543
	Company address below will appear on the final report
Street:	11-2042 Mills Rd.
City/Province:	Sidney, BC
Postal Code:	V8L 5X4
Invoice To	Same as Report To ☐ YES ☒ NO
	Copy of Invoice with Report ☒ YES ☐ NO
Company:	Stantec Consulting Ltd.
Contact:	Peter Pastuszak

Reports / Recipients	
Select Report Format:	☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)
Merge QC/QCI Reports with COA	☒ YES ☐ NO ☐ N/A
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	libby.mcmillan@stantec.com
Email 2	maegan.long@stantec.com
Email 3	jasspreet.sahib@stantec.com

Invoice Recipients	
Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	peter.pastuszak@stantec.com
Email 2	libby.mcmillan@stantec.com

Turnaround Time (TAT) Requested
☒ Routine [R] if received by 3pm M-F - no surcharges apply
☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum
☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum
☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum
☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum
☐ Same day [E2] if received by 10am M-S - 200% rush surcharge.
Additional fees may apply to rush requests on weekends, s
Date and Time Required for all E&P TATs:
For all tests with rush TATs requested, please conti

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	VA21-STAC100-005	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (ALS use only):		ALS Contact:	Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

NUMBER OF CONTAINERS

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	General (TSS/TDS/Routine CBC)	Total Metals	Dissolved Metals	Total Mercury	Dissolved Mercury	NUT (DOC/DKN/TDN/TDP/DNH3 CBC)	NUT (TOC/COD/TKN/TNP/NH3/PHENOLS)	BTEX/VOC/F1-F4, PAH	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	WQ01-Ebb-1m	11-11-2021	09:07	Seawater	11	✓	✓	✓	✓	✓	✓	✓	✓		
	WQ01-Ebb-20m		09:29		11										
	WQ03-Ebb-1m		09:54		11										
	WQ03-Ebb-20m		10:09		11										
	WQ05-Ebb-1m		10:26		11										
	WQ05-Ebb-20m		10:35		11										
	WQ06-Ebb-1m		10:59		11										
	WQ06-Ebb-20m		11:20		11										
	Field Blank		14:45		11										
	Equipment Blank		15:47		11										
	WQ06-Flood-1m		13:34		11										
	WQ06-Flood-20m		13:47		11										

Terrace Shipping
4 Coolers ☐ Ground ☒ Air ☐ SFX
___ Carbouys

Drinking Water (DW) Samples[1] (client use)	Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	-samples have not been filtered in the field
Are samples for human consumption/ use? ☐ YES ☐ NO	-samples are seawater -metals and mercury not preserved

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☐ NONE ☐ ICE ☒ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☒ N/A Sample Custody Seals Intact: ☐ YES ☒ N/A

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
5.4	4.3	4.6	4.8			5	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (ALS use only)			FINAL SHIPMENT RECEPTION (ALS use only)		
Released by:	Date:	Time:	Received by: Chris	Date: 12 Nov 21	Time: 0920	Received by: PD	Date: NOV 12 2021	Time: 21:20

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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AUG 2020 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

Appendix G.3 Laboratory Results

Chain of Custody (COC) / Analytical Request Form

COC Number: 21 -

Page 2 of 2

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Canada Toll Free: 1 800 668 9878

Report To	Contact and company name below will appear on the final report
Company:	Stantec
Contact:	Libby McMillan
Phone:	250-208 6543
	Company address below will appear on the final report
Street:	11-2042 Mills Rd
City/Province:	Sidney, BC
Postal Code:	V8L 5X4
Invoice To	Same as Report To ☐ YES ☒ NO
	Copy of Invoice with Report ☒ YES ☐ NO
Company:	Stantec Consulting Ltd.
Contact:	Dobra Bystrizak

Project Information

ALS Account # / Quote #:	
Job #:	VA21-STAC100-005
PO / AFE:	
LSD:	
ALS Lab Work Order # (ALS use only):	

Reports / Recipients

Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)

Merge QC/QCI Reports with COA ☒ YES ☐ NO ☐ N/A

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: libby.mcmillan@stantec.com

Email 2: maegan.lona@stantec.com

Email 3: jacqueline.smith@stantec.com

Invoice Recipients

Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: Peter.Bystrizak@stantec.com

Email 2: Libby.McMillan@Stantec.com

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	
ALS Contact:	Sampler:

Turnaround Time (TAT) Requested

☒ Routine [R] if received by 3pm M-F - no surcharges apply

☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum

☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum

☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum

☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum

☐ Same day [E2] if received by 10am M-S - 200% rush surcharge.

Additional fees may apply to rush requests on weekends, statutory holidays and for non-routine tests.

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm am/pm

For all tests with rush TATs requested, please contact your AM to confirm availability.

AFFIX ALS BARCODE LABEL HERE (ALS use only)

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	General/TSS/TDS/Routine (BC)	Total Metals	Dissolved Metals	Total Mercury	Dissolved Mercury	NUT/DOC/DKN/TDN TDP/DW H3 (BC)	NUT/TOC/CoDATEN TN/TP/NH3/NH3ENG	BTEX, VOC, F1-F4, PAH	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	WQ05-Flood-1m	11-11-2021	14:12	Seawater	11	✓	✓	✓	✓	✓	✓	✓	✓			
	WQ05-Flood-20m		14:25		11											
	WQ03-Flood-1m		14:54		11											
	WQ03-Flood-20m		15:05		11											
	WQ01-Flood-1m		15:18		11											
	WQ01-Flood-20m	↓	15:33	↓	11	↓	↓	↓	↓	↓	↓	↓	↓			

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human consumption/ use? ☐ YES ☐ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

- Samples have Not been filtered in the field
- Samples are seawater

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☐ NONE ☐ ICE ☒ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☒ N/A Sample Custody Seals Intact: ☐ YES ☒ N/A

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
						5	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (ALS use only)			FINAL SHIPMENT RECEPTION (ALS use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by: PD	Date: NOV 12 2021	Time: 21:20

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form.**

Appendix H SEDIMENT QUALITY ANALYTICAL RESULTS

					Sediment Sample														
Parameter	**LDU**	**Units**	**WSQG - Lower**	**WSQG - Upper**	**PEI-SED-01**	**PEI-SED-02**	**PEI-SED-03**	**PEI-SED-04**	**PEI-SED-05**	**PEI-SED-06**	**PEI-SED-07**	**PEI-SED-08**	**PEI-SED-09**	**PEI-SED-10**	**PEI-SED-11**	**PEI-SED-12**	**PEI-SED-13**	**PEI-SED-14**	**PEI-SED-15**
Date Sampled	-	-	-	-	20-May-22	19-May-22	20-May-22	20-May-22	20-May-22	20-May-22	20-May-22	20-May-22	20-May-22	19-May-22	19-May-22	19-May-22	19-May-22	19-May-22	19-May-22
Physical Tests																			
moisture	0.25	%	-	-	35.8	33.5	37.1	31.9	27.5	41.2	33.4	28.7	41.5	27.2	29.9	37.5	33.6	35.6	37
pH (1:2 soil:water)	0.1	pH units	-	-	8.22	8.18	8.16	8.28	8.3	8.16	8.35	8.35	8.21	8.35	8.19	8.17	8.11	8.17	8.11
Particle Size																			
clay (<0.004mm)	1	%	-	-	8.8	12.2	14.5	9	9.5	23	16.9	13.2	27.9	13.6	16.4	21.2	17.7	23.8	21.8
silt (0.0312mm - 0.004mm)	1	%	-	-	11	10.7	13.7	9.8	8.4	19.1	12.1	10.8	21.7	10.4	13.9	16.6	14.3	16.9	17.9
silt (0.063mm - 0.0312mm)	1	%	-	-	5.4	3	4.4	3.4	2.9	3.7	2.7	2.9	6.6	2.3	4.3	4.6	4.7	4.8	5
sand (0.125mm - 0.063mm)	1	%	-	-	3.2	5.8	5.6	5.4	5.2	2.7	2.3	2.7	3.7	1.4	4.1	5.5	5.7	5.1	5.6
sand (0.25mm - 0.125mm)	1	%	-	-	16.7	31.9	37.3	40.6	43.6	11.7	17.6	20.3	9.8	7.9	16.4	24.5	22.9	22.5	19.1
sand (0.5mm - 0.25mm)	1	%	-	-	12.1	16.8	10.1	15.8	19.2	14.2	27.6	24.9	10.1	19.6	19.1	10.5	13.1	11.1	12.4
sand (1.0mm - 0.50mm)	1	%	-	-	9.8	7.8	3.2	4.2	4.7	8.8	10.9	12.9	9	20	10	6.1	7.5	7.9	6.6
sand (2.0mm - 1.0mm)	1	%	-	-	16.3	5.9	3.1	3.7	3	9	6	10	3.9	15.2	7.9	7.5	4.1	4.1	2.6
gravel (>2mm)	1	%	-	-	16.7	5.9	8.1	8.1	3.5	7.8	3.9	2.3	7.3	9.6	7.9	3.5	10	3.8	9
Organic / Inorganic Carbon																			
carbon, total organic [TOC]	0.05	%	-	-	<0.674	0.78	1.09	0.92	0.71	1.03	<0.493	0.49	0.81	0.46	0.677	0.83	0.718	0.97	0.96
Metals																			
aluminum	50	mg/kg	-	-	9210	11600	14800	11500	14100	14800	11700	10300	16500	13300	19800	17400	18800	18600	21200
antimony	0.1	mg/kg	-	-	0.52	0.57	0.77	0.58	0.71	0.84	0.59	0.59	1.02	0.6	0.93	0.79	0.9	0.86	1.03
arsenic	0.1	mg/kg	7.24	42	5.53	5.87	6.85	5.77	5.62	6.85	4.03	6.47	6.62	5.94	**9.76**	6.95	**10.5**	**8.23**	**9.18**
barium	0.5	mg/kg	-	-	47.5	47.8	54.4	43.2	51.2	82.3	60.4	39	69.5	52.1	78	71.8	68	72.2	82.9
beryllium	0.1	mg/kg	-	-	0.26	0.29	0.38	0.31	0.39	0.41	0.33	0.24	0.45	0.32	0.5	0.4	0.49	0.45	0.56
bismuth	0.2	mg/kg	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
boron	5	mg/kg	-	-	20	21.2	27	21.6	29.9	29.4	22.1	18.2	27.4	17.8	32.4	24.7	34.7	27.1	34.5
cadmium	0.02	mg/kg	0.7	4.2	0.138	0.17	0.176	0.14	0.117	0.237	0.201	0.137	0.216	0.137	0.151	0.222	0.244	0.164	0.161
calcium	50	mg/kg	-	-	195000	126000	74200	82600	40300	149000	133000	126000	82700	73600	37500	131000	25800	112000	48600
chromium	0.5	mg/kg	52.3	160	22.1	25	34.9	25.8	31.5	37.7	28.6	25.1	42.7	28.8	46.3	37.7	44.6	43.8	50.8
cobalt	0.1	mg/kg	-	-	8.48	9.66	11.9	10.1	13	11.7	9.92	10.5	13.3	11.3	17.8	12.9	18.5	15.1	18.4
copper	0.5	mg/kg	18.7	108	14.5	15.4	**20.4**	14.4	16.4	**27.6**	18.5	14.9	**31**	**20.6**	**27.2**	**24.4**	**27.4**	**28.7**	**31.8**
iron	50	mg/kg	-	-	17100	19000	24300	20500	26500	24900	20000	19600	29600	21600	36800	25700	36700	30800	38400
lead	0.5	mg/kg	30.2	112	5.83	6.41	7.62	6.23	6.58	9.75	7.54	6.76	10.2	6.64	8.84	9.16	8.26	9.08	9.81
lithium	2	mg/kg	-	-	16.5	17	21.1	16.9	17.4	21.2	17.4	16.8	24.2	17.1	25.3	24	26.5	26.2	28.1
magnesium	20	mg/kg	-	-	8360	8290	9740	8310	9550	10800	8760	8850	11800	8830	13600	11300	13700	12400	15000
manganese	1	mg/kg	-	-	351	353	354	326	378	559	379	418	568	410	555	486	562	491	628
mercury	0.05	mg/kg	0.13	0.7	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500	0.0614	<0.0500	<0.0500	0.0693	<0.0500	0.0578	0.0587	0.0629	0.0628	0.0707
molybdenum	0.1	mg/kg	-	-	0.48	0.58	0.75	0.53	0.54	0.71	0.43	0.44	0.7	0.43	0.66	0.65	0.67	0.66	0.8
nickel	0.5	mg/kg	30	50	23.7	25.8	**35.1**	26.4	**33.6**	**42**	**32.1**	29.2	**50.1**	**33.4**	**53.6**	**40.6**	**54.6**	**49.3**	**60.6**
phosphorus	50	mg/kg	-	-	756	745	706	711	731	771	661	657	798	696	955	869	977	986	1060
potassium	100	mg/kg	-	-	1370	1660	2110	1700	2530	2510	1990	1560	2510	1920	3220	2250	3190	2510	3300
selenium	0.2	mg/kg	-	-	0.39	0.44	0.52	0.31	0.29	0.59	0.4	0.33	0.59	0.36	0.44	0.51	0.44	0.54	0.51
silver	0.1	mg/kg	1	2.2	<0.10	<0.10	0.12	<0.10	<0.10	0.16	0.14	<0.10	0.17	<0.10	0.13	0.13	0.12	0.15	0.14
sodium	50	mg/kg	-	-	8860	8080	7080	5270	6060	10100	6860	5880	8240	5890	7400	9320	7660	9500	9290
strontium	0.5	mg/kg	-	-	1260	666	316	397	161	1030	851	853	542	360	158	750	104	522	200
sulfur	1000	mg/kg	-	-	1600	1600	1500	1000	<1000	1600	1100	1200	1100	<1000	<1000	1300	<1000	1400	<1000
thallium	0.05	mg/kg	-	-	0.077	0.141	0.119	0.116	0.085	0.108	0.115	0.098	0.098	0.124	0.108	0.123	0.095	0.118	0.107
tin	2	mg/kg	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
titanium	1	mg/kg	-	-	527	612	762	692	884	453	466	471	435	516	928	854	888	874	1020
tungsten	0.5	mg/kg	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
uranium	0.05	mg/kg	-	-	0.542	0.774	0.997	0.711	0.664	0.905	0.729	0.673	0.812	0.68	0.721	0.771	0.789	0.877	0.72
vanadium	0.2	mg/kg	-	-	34.4	41.5	49.4	41.3	49.4	53.9	42.4	38	58	46.1	70.9	57.3	68.4	63.8	75.6
zinc	2	mg/kg	124	271	51.2	64.9	74.5	60.2	71.4	80.2	61.1	56.9	89.7	66	107	93.3	110	102	120
zirconium	1	mg/kg	-	-	1.5	1.6	2.6	1.7	2.7	<1.0	<2.0	1.2	1.4	<2.0	2.6	2	2.6	2.7	3
Volatile Organic Compounds Surrogates																			
bromofluorobenzene, 4-	0.1	%	-	-	84.3	76.3	90	89.3	94.4	84.5	82.8	100	80.1	88.1	93	89.3	93.3	89.8	88.3
difluorobenzene, 1,4-	0.1	%	-	-	89.9	82.8	101	97.3	104	92.1	91.2	106	86.8	96.5	99.4	95	99.8	98.6	92.3

Volatile Organic Compounds [Fuels]																			
benzene	0.005	mg/kg	-	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
ethylbenzene	0.015	mg/kg	-	-	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
methyl-tert-butyl ether [MTBE]	0.04	mg/kg	-	-	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
styrene	0.05	mg/kg	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
toluene	0.05	mg/kg	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
xylene, m+p-	0.03	mg/kg	-	-	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
xylene, o-	0.03	mg/kg	-	-	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
xylenes, total	0.05	mg/kg	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Polycyclic Aromatic Hydrocarbons																			
acenaphthene	0.005	mg/kg	-	-	<0.0050	<0.0050	0.0056	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
acenaphthylene	0.005	mg/kg	-	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
acridine	0.01	mg/kg	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
anthracene	0.004	mg/kg	-	-	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
benz(a)anthracene	0.01	mg/kg	0.0748	0.693	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
benzo(a)pyrene	0.01	mg/kg	0.0888	0.763	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
benzo(b+j)fluoranthene	0.01	mg/kg	2.3	4.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010
benzo(b+j+k)fluoranthene	0.015	mg/kg	2.3	4.5	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
benzo(g,h,i)perylene	0.01	mg/kg	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
benzo(k)fluoranthene	0.01	mg/kg	2.3	4.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
chrysene	0.01	mg/kg	0.108	0.846	<0.010	<0.010	<0.010	<0.010	<0.010	<0.012	<0.010	<0.010	<0.020	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
dibenzo(a,h)anthracene	0.005	mg/kg	0.00622	0.135	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
fluoranthene	0.01	mg/kg	0.113	1.494	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
fluorene	0.01	mg/kg	0.0212	0.144	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
indeno(1,2,3-c,d)pyrene	0.01	mg/kg	0.34	0.88	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 1+2-	0.015	mg/kg	-	-	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
methylnaphthalene, 1-	0.01	mg/kg	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 2-	0.01	mg/kg	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	0.01	<0.010	<0.010	0.015	<0.010	<0.010	<0.010	<0.010	<0.010	0.011
naphthalene	0.01	mg/kg	0.0346	0.391	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
phenanthrene	0.01	mg/kg	0.0867	0.544	0.016	0.013	0.02	0.015	0.014	0.026	0.022	0.015	0.04	0.015	0.01	0.011	0.013	0.017	0.029
pyrene	0.01	mg/kg	0.153	1.398	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
quinoline	0.01	mg/kg	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
B(a)P total potency equivalents [B(a)P TPE]	0.02	mg/kg	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
IACR (CCME)	0.15	-	-	-	<0.150	<0.150	<0.150	<0.150	<0.150	<0.150	<0.150	<0.150	<0.150	<0.150	<0.150	<0.150	<0.150	<0.150	<0.150
Polycyclic Aromatic Hydrocarbons Surrogates																			
acridine-d9	0.1	%	-	-	109	119	120	112	130	99	116	103	103	109	95.1	104	102	88.5	103
chrysene-d12	0.1	%	-	-	104	110	106	103	119	88.5	108	99.1	95.2	104	103	112	108	92.3	90.3
naphthalene-d8	0.1	%	-	-	116	119	126	115	128	107	125	112	117	118	106	116	111	96.3	121
phenanthrene-d10	0.1	%	-	-	114	120	124	114	129	107	126	109	115	115	107	114	111	97.2	117

WSQG = Working Sediment Quality Guidelines
LDU = Lowest Detection Limit
WSQG expressed in ug/g which = mg/kg

https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/bc_env_working_water_quality_guidelines.pdf

Bold = Above lower WSQG limit but below upper limit
Bold Underlined = Above upper WSQG limit

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22B1606**	Page	: 1 of 18
Client	: **Stantec Consulting Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Emily Hulley	Account Manager	: Brent Mack
Address	: 500 - 4730 Kingsway Burnaby BC Canada V5H 0C6	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: 778-370-3279
Project	: KSI LISIMS Sediment 123221820.500	Date Samples Received	: 26-May-2022 10:20
PO	: ----	Date Analysis Commenced	: 29-May-2022
C-O-C number	: ----	Issue Date	: 10-Jun-2022 09:47
Sampler	: ----		
Site	: ----		
Quote number	: Standing Offer (BC, YK) 2020-2023		
No. of samples received	: 17		
No. of samples analysed	: 17		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Caleb Deroche	Lab Analyst	Metals, Burnaby, British Columbia
Colby Bingham	Quality Systems Coordinator	Inorganics, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Inorganics, Saskatoon, Saskatchewan
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
mg/kg	milligrams per kilogram
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLCI	*Detection Limit Raised: Chromatographic interference due to co-elution.*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*

Page	: 3 of 18
Work Order	: VA22B1606
Client	: Stantec Consulting Ltd.
Project	: KSI LISIMS Sediment 123221820.500

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	PEI-SED-01	PEI-SED-02	PEI-SED-03	PEI-SED-04	PEI-SED-05
					Client sampling date / time	20-May-2022 16:00	19-May-2022 10:34	20-May-2022 10:15	20-May-2022 11:15	20-May-2022 12:25
						VA22B1606-001	VA22B1606-002	VA22B1606-003	VA22B1606-004	VA22B1606-005
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.25	%		35.8	33.5	37.1	31.9	27.5
pH (1:2 soil:water)	----	E108	0.10	pH units		8.22	8.18	8.16	8.28	8.30
Particle Size										
grain size curve	----	E185A	-	-		See Attached	See Attached	See Attached	See Attached	See Attached
clay (<0.004mm)	----	EC184A	1.0	%		8.8	12.2	14.5	9.0	9.5
silt (0.063mm - 0.0312mm)	----	EC184A	1.0	%		5.4	3.0	4.4	3.4	2.9
silt (0.0312mm - 0.004mm)	----	EC184A	1.0	%		11.0	10.7	13.7	9.8	8.4
sand (0.125mm - 0.063mm)	----	EC184A	1.0	%		3.2	5.8	5.6	5.4	5.2
sand (0.25mm - 0.125mm)	----	EC184A	1.0	%		16.7	31.9	37.3	40.6	43.6
sand (0.5mm - 0.25mm)	----	EC184A	1.0	%		12.1	16.8	10.1	15.8	19.2
sand (1.0mm - 0.50mm)	----	EC184A	1.0	%		9.8	7.8	3.2	4.2	4.7
sand (2.0mm - 1.0mm)	----	EC184A	1.0	%		16.3	5.9	3.1	3.7	3.0
gravel (>2mm)	----	EC184A	1.0	%		16.7	5.9	8.1	8.1	3.5
Organic / Inorganic Carbon										
carbon, total organic [TOC]	----	EC356	0.050	%		<0.674	0.780	1.09	0.920	0.710
Metals										
aluminum	7429-90-5	E440	50	mg/kg		9210	11600	14800	11500	14100
antimony	7440-36-0	E440	0.10	mg/kg		0.52	0.57	0.77	0.58	0.71
arsenic	7440-38-2	E440	0.10	mg/kg		5.53	5.87	6.85	5.77	5.62
barium	7440-39-3	E440	0.50	mg/kg		47.5	47.8	54.4	43.2	51.2
beryllium	7440-41-7	E440	0.10	mg/kg		0.26	0.29	0.38	0.31	0.39
bismuth	7440-69-9	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
boron	7440-42-8	E440	5.0	mg/kg		20.0	21.2	27.0	21.6	29.9
cadmium	7440-43-9	E440	0.020	mg/kg		0.138	0.170	0.176	0.140	0.117
calcium	7440-70-2	E440	50	mg/kg		195000	126000	74200	82600	40300
chromium	7440-47-3	E440	0.50	mg/kg		22.1	25.0	34.9	25.8	31.5
cobalt	7440-48-4	E440	0.10	mg/kg		8.48	9.66	11.9	10.1	13.0
copper	7440-50-8	E440	0.50	mg/kg		14.5	15.4	20.4	14.4	16.4
iron	7439-89-6	E440	50	mg/kg		17100	19000	24300	20500	26500

Page	: 4 of 18
Work Order	: VA22B1606
Client	: Stantec Consulting Ltd.
Project	: KSI LISIMS Sediment 123221820.500

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	PEI-SED-01	PEI-SED-02	PEI-SED-03	PEI-SED-04	PEI-SED-05
					Client sampling date / time	20-May-2022 16:00	19-May-2022 10:34	20-May-2022 10:15	20-May-2022 11:15	20-May-2022 12:25
						VA22B1606-001	VA22B1606-002	VA22B1606-003	VA22B1606-004	VA22B1606-005
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.50	mg/kg		5.83	6.41	7.62	6.23	6.58
lithium	7439-93-2	E440	2.0	mg/kg		16.5	17.0	21.1	16.9	17.4
magnesium	7439-95-4	E440	20	mg/kg		8360	8290	9740	8310	9550
manganese	7439-96-5	E440	1.0	mg/kg		351	353	354	326	378
mercury	7439-97-6	E510	0.0500	mg/kg		<0.0500	<0.0500	<0.0500	<0.0500	<0.0500
molybdenum	7439-98-7	E440	0.10	mg/kg		0.48	0.58	0.75	0.53	0.54
nickel	7440-02-0	E440	0.50	mg/kg		23.7	25.8	35.1	26.4	33.6
phosphorus	7723-14-0	E440	50	mg/kg		756	745	706	711	731
potassium	7440-09-7	E440	100	mg/kg		1370	1660	2110	1700	2530
selenium	7782-49-2	E440	0.20	mg/kg		0.39	0.44	0.52	0.31	0.29
silver	7440-22-4	E440	0.10	mg/kg		<0.10	<0.10	0.12	<0.10	<0.10
sodium	7440-23-5	E440	50	mg/kg		8860	8080	7080	5270	6060
strontium	7440-24-6	E440	0.50	mg/kg		1260	666	316	397	161
sulfur	7704-34-9	E440	1000	mg/kg		1600	1600	1500	1000	<1000
thallium	7440-28-0	E440	0.050	mg/kg		0.077	0.141	0.119	0.116	0.085
tin	7440-31-5	E440	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0
titanium	7440-32-6	E440	1.0	mg/kg		527	612	762	692	884
tungsten	7440-33-7	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
uranium	7440-61-1	E440	0.050	mg/kg		0.542	0.774	0.997	0.711	0.664
vanadium	7440-62-2	E440	0.20	mg/kg		34.4	41.5	49.4	41.3	49.4
zinc	7440-66-6	E440	2.0	mg/kg		51.2	64.9	74.5	60.2	71.4
zirconium	7440-67-7	E440	1.0	mg/kg		1.5	1.6	2.6	1.7	2.7
Volatile Organic Compounds [Fuels]										
benzene	71-43-2	E611A	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
ethylbenzene	100-41-4	E611A	0.015	mg/kg		<0.015	<0.015	<0.015	<0.015	<0.015
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.040	mg/kg		<0.040	<0.040	<0.040	<0.040	<0.040
styrene	100-42-5	E611A	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
toluene	108-88-3	E611A	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
xylene, m+p-	179601-23-1	E611A	0.030	mg/kg		<0.030	<0.030	<0.030	<0.030	<0.030
xylene, o-	95-47-6	E611A	0.030	mg/kg		<0.030	<0.030	<0.030	<0.030	<0.030
xylenes, total	1330-20-7	E611A	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	PEI-SED-01	PEI-SED-02	PEI-SED-03	PEI-SED-04	PEI-SED-05
					Client sampling date / time	20-May-2022 16:00	19-May-2022 10:34	20-May-2022 10:15	20-May-2022 11:15	20-May-2022 12:25
						VA22B1606-001	VA22B1606-002	VA22B1606-003	VA22B1606-004	VA22B1606-005
						Result	Result	Result	Result	Result
Volatile Organic Compounds Surrogates										
bromofluorobenzene, 4-	460-00-4	E611A	0.10	%		84.3	76.3	90.0	89.3	94.4
difluorobenzene, 1,4-	540-36-3	E611A	0.10	%		89.9	82.8	101	97.3	104
Polycyclic Aromatic Hydrocarbons										
acenaphthene	83-32-9	E641A-L	0.0050	mg/kg		<0.0050	<0.0050	0.0056	<0.0050	<0.0050
acenaphthylene	208-96-8	E641A-L	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
acridine	260-94-6	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
anthracene	120-12-7	E641A-L	0.0040	mg/kg		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
benz(a)anthracene	56-55-3	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(a)pyrene	50-32-8	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(b+j)fluoranthene	n/a	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(b+j+k)fluoranthene	n/a	E641A-L	0.015	mg/kg		<0.015	<0.015	<0.015	<0.015	<0.015
benzo(g,h,i)perylene	191-24-2	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(k)fluoranthene	207-08-9	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
chrysene	218-01-9	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
dibenz(a,h)anthracene	53-70-3	E641A-L	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
fluoranthene	206-44-0	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
fluorene	86-73-7	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 1-	90-12-0	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 1+2-	----	E641A-L	0.015	mg/kg		<0.015	<0.015	<0.015	<0.015	<0.015
methylnaphthalene, 2-	91-57-6	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
naphthalene	91-20-3	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
phenanthrene	85-01-8	E641A-L	0.010	mg/kg		0.016	0.013	0.020	0.015	0.014
pyrene	129-00-0	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
quinoline	91-22-5	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
B(a)P total potency equivalents [B(a)P TPE]	----	E641A-L	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
IACR (CCME)	----	E641A-L	0.150	-		<0.150	<0.150	<0.150	<0.150	<0.150
Polycyclic Aromatic Hydrocarbons Surrogates										
acridine-d9	34749-75-2	E641A-L	0.1	%		109	119	120	112	130
chrysene-d12	1719-03-5	E641A-L	0.1	%		104	110	106	103	119
naphthalene-d8	1146-65-2	E641A-L	0.1	%		116	119	126	115	128

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Work Order	:	VA22B1606
Client	:	Stantec Consulting Ltd.
Project	:	KSI LISIMS Sediment 123221820.500

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	PEI-SED-01	PEI-SED-02	PEI-SED-03	PEI-SED-04	PEI-SED-05
					Client sampling date / time	20-May-2022 16:00	19-May-2022 10:34	20-May-2022 10:15	20-May-2022 11:15	20-May-2022 12:25
						VA22B1606-001	VA22B1606-002	VA22B1606-003	VA22B1606-004	VA22B1606-005
						Result	Result	Result	Result	Result
Polycyclic Aromatic Hydrocarbons Surrogates										
phenanthrene-d10	1517-22-2	E641A-L	0.1	%		114	120	124	114	129

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	PEI-SED-06	PEI-SED-07	PEI-SED-08	PEI-SED-09	PEI-SED-10
					Client sampling date / time	20-May-2022 13:25	20-May-2022 09:00	20-May-2022 15:00	20-May-2022 08:00	19-May-2022 16:50
						VA22B1606-006	VA22B1606-007	VA22B1606-008	VA22B1606-009	VA22B1606-010
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.25	%		41.2	33.4	28.7	41.5	27.2
pH (1:2 soil:water)	----	E108	0.10	pH units		8.16	8.35	8.35	8.21	8.35
Particle Size										
grain size curve	----	E185A	-	-		See Attached	See Attached	See Attached	See Attached	See Attached
clay (<0.004mm)	----	EC184A	1.0	%		23.0	16.9	13.2	27.9	13.6
silt (0.063mm - 0.0312mm)	----	EC184A	1.0	%		3.7	2.7	2.9	6.6	2.3
silt (0.0312mm - 0.004mm)	----	EC184A	1.0	%		19.1	12.1	10.8	21.7	10.4
sand (0.125mm - 0.063mm)	----	EC184A	1.0	%		2.7	2.3	2.7	3.7	1.4
sand (0.25mm - 0.125mm)	----	EC184A	1.0	%		11.7	17.6	20.3	9.8	7.9
sand (0.5mm - 0.25mm)	----	EC184A	1.0	%		14.2	27.6	24.9	10.1	19.6
sand (1.0mm - 0.50mm)	----	EC184A	1.0	%		8.8	10.9	12.9	9.0	20.0
sand (2.0mm - 1.0mm)	----	EC184A	1.0	%		9.0	6.0	10.0	3.9	15.2
gravel (>2mm)	----	EC184A	1.0	%		7.8	3.9	2.3	7.3	9.6
Organic / Inorganic Carbon										
carbon, total organic [TOC]	----	EC356	0.050	%		1.03	<0.493	0.490	0.810	0.460
Metals										
aluminum	7429-90-5	E440	50	mg/kg		14800	11700	10300	16500	13300
antimony	7440-36-0	E440	0.10	mg/kg		0.84	0.59	0.59	1.02	0.60
arsenic	7440-38-2	E440	0.10	mg/kg		6.85	4.03	6.47	6.62	5.94
barium	7440-39-3	E440	0.50	mg/kg		82.3	60.4	39.0	69.5	52.1
beryllium	7440-41-7	E440	0.10	mg/kg		0.41	0.33	0.24	0.45	0.32
bismuth	7440-69-9	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
boron	7440-42-8	E440	5.0	mg/kg		29.4	22.1	18.2	27.4	17.8
cadmium	7440-43-9	E440	0.020	mg/kg		0.237	0.201	0.137	0.216	0.137
calcium	7440-70-2	E440	50	mg/kg		149000	133000	126000	82700	73600
chromium	7440-47-3	E440	0.50	mg/kg		37.7	28.6	25.1	42.7	28.8
cobalt	7440-48-4	E440	0.10	mg/kg		11.7	9.92	10.5	13.3	11.3
copper	7440-50-8	E440	0.50	mg/kg		27.6	18.5	14.9	31.0	20.6
iron	7439-89-6	E440	50	mg/kg		24900	20000	19600	29600	21600
lead	7439-92-1	E440	0.50	mg/kg		9.75	7.54	6.76	10.2	6.64

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	PEI-SED-06	PEI-SED-07	PEI-SED-08	PEI-SED-09	PEI-SED-10
					Client sampling date / time	20-May-2022 13:25	20-May-2022 09:00	20-May-2022 15:00	20-May-2022 08:00	19-May-2022 16:50
						VA22B1606-006	VA22B1606-007	VA22B1606-008	VA22B1606-009	VA22B1606-010
						Result	Result	Result	Result	Result
Metals										
lithium	7439-93-2	E440	2.0	mg/kg		21.2	17.4	16.8	24.2	17.1
magnesium	7439-95-4	E440	20	mg/kg		10800	8760	8850	11800	8830
manganese	7439-96-5	E440	1.0	mg/kg		559	379	418	568	410
mercury	7439-97-6	E510	0.0500	mg/kg		0.0614	<0.0500	<0.0500	0.0693	<0.0500
molybdenum	7439-98-7	E440	0.10	mg/kg		0.71	0.43	0.44	0.70	0.43
nickel	7440-02-0	E440	0.50	mg/kg		42.0	32.1	29.2	50.1	33.4
phosphorus	7723-14-0	E440	50	mg/kg		771	661	657	798	696
potassium	7440-09-7	E440	100	mg/kg		2510	1990	1560	2510	1920
selenium	7782-49-2	E440	0.20	mg/kg		0.59	0.40	0.33	0.59	0.36
silver	7440-22-4	E440	0.10	mg/kg		0.16	0.14	<0.10	0.17	<0.10
sodium	7440-23-5	E440	50	mg/kg		10100	6860	5880	8240	5890
strontium	7440-24-6	E440	0.50	mg/kg		1030	851	853	542	360
sulfur	7704-34-9	E440	1000	mg/kg		1600	1100	1200	1100	<1000
thallium	7440-28-0	E440	0.050	mg/kg		0.108	0.115	0.098	0.098	0.124
tin	7440-31-5	E440	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0
titanium	7440-32-6	E440	1.0	mg/kg		453	466	471	435	516
tungsten	7440-33-7	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
uranium	7440-61-1	E440	0.050	mg/kg		0.905	0.729	0.673	0.812	0.680
vanadium	7440-62-2	E440	0.20	mg/kg		53.9	42.4	38.0	58.0	46.1
zinc	7440-66-6	E440	2.0	mg/kg		80.2	61.1	56.9	89.7	66.0
zirconium	7440-67-7	E440	1.0	mg/kg		<1.0	<2.0 DLM	1.2	1.4	<2.0 DLM
Volatile Organic Compounds [Fuels]										
benzene	71-43-2	E611A	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
ethylbenzene	100-41-4	E611A	0.015	mg/kg		<0.015	<0.015	<0.015	<0.015	<0.015
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.040	mg/kg		<0.040	<0.040	<0.040	<0.040	<0.040
styrene	100-42-5	E611A	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
toluene	108-88-3	E611A	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
xylene, m+p-	179601-23-1	E611A	0.030	mg/kg		<0.030	<0.030	<0.030	<0.030	<0.030
xylene, o-	95-47-6	E611A	0.030	mg/kg		<0.030	<0.030	<0.030	<0.030	<0.030
xylenes, total	1330-20-7	E611A	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
Volatile Organic Compounds Surrogates										

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	PEI-SED-06	PEI-SED-07	PEI-SED-08	PEI-SED-09	PEI-SED-10
					Client sampling date / time	20-May-2022 13:25	20-May-2022 09:00	20-May-2022 15:00	20-May-2022 08:00	19-May-2022 16:50
						VA22B1606-006	VA22B1606-007	VA22B1606-008	VA22B1606-009	VA22B1606-010
						Result	Result	Result	Result	Result
Volatile Organic Compounds Surrogates										
bromofluorobenzene, 4-	460-00-4	E611A	0.10	%		84.5	82.8	100.0	80.1	88.1
difluorobenzene, 1,4-	540-36-3	E611A	0.10	%		92.1	91.2	106	86.8	96.5
Polycyclic Aromatic Hydrocarbons										
acenaphthene	83-32-9	E641A-L	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
acenaphthylene	208-96-8	E641A-L	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
acridine	260-94-6	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
anthracene	120-12-7	E641A-L	0.0040	mg/kg		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
benz(a)anthracene	56-55-3	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(a)pyrene	50-32-8	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(b+j)fluoranthene	n/a	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	0.011	<0.010
benzo(b+j+k)fluoranthene	n/a	E641A-L	0.015	mg/kg		<0.015	<0.015	<0.015	<0.015	<0.015
benzo(g,h,i)perylene	191-24-2	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(k)fluoranthene	207-08-9	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
chrysene	218-01-9	E641A-L	0.010	mg/kg		<0.012 DLCI	<0.010	<0.010	<0.020 DLCI	<0.010
dibenz(a,h)anthracene	53-70-3	E641A-L	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
fluoranthene	206-44-0	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
fluorene	86-73-7	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 1-	90-12-0	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 1+2-	----	E641A-L	0.015	mg/kg		<0.015	<0.015	<0.015	0.015	<0.015
methylnaphthalene, 2-	91-57-6	E641A-L	0.010	mg/kg		0.010	<0.010	<0.010	0.015	<0.010
naphthalene	91-20-3	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	0.012	<0.010
phenanthrene	85-01-8	E641A-L	0.010	mg/kg		0.026	0.022	0.015	0.040	0.015
pyrene	129-00-0	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	0.012	<0.010
quinoline	91-22-5	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
B(a)P total potency equivalents [B(a)P TPE]	----	E641A-L	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
IACR (CCME)	----	E641A-L	0.150	-		<0.150	<0.150	<0.150	<0.150	<0.150
Polycyclic Aromatic Hydrocarbons Surrogates										
acridine-d9	34749-75-2	E641A-L	0.1	%		99.0	116	103	103	109
chrysene-d12	1719-03-5	E641A-L	0.1	%		88.5	108	99.1	95.2	104
naphthalene-d8	1146-65-2	E641A-L	0.1	%		107	125	112	117	118

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Work Order	:	VA22B1606
Client	:	Stantec Consulting Ltd.
Project	:	KSI LISIMS Sediment 123221820.500

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	PEI-SED-06	PEI-SED-07	PEI-SED-08	PEI-SED-09	PEI-SED-10
					Client sampling date / time	20-May-2022 13:25	20-May-2022 09:00	20-May-2022 15:00	20-May-2022 08:00	19-May-2022 16:50
						VA22B1606-006	VA22B1606-007	VA22B1606-008	VA22B1606-009	VA22B1606-010
						Result	Result	Result	Result	Result
Polycyclic Aromatic Hydrocarbons Surrogates										
phenanthrene-d10	1517-22-2	E641A-L	0.1	%		107	126	109	115	115

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	PEI-SED-11	PEI-SED-12	PEI-SED-13	PEI-SED-14	PEI-SED-15
					Client sampling date / time	19-May-2022 16:15	19-May-2022 15:20	19-May-2022 13:30	19-May-2022 12:00	19-May-2022 09:00
						VA22B1606-011	VA22B1606-012	VA22B1606-013	VA22B1606-014	VA22B1606-015
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.25	%		29.9	37.5	33.6	35.6	37.0
pH (1:2 soil:water)	----	E108	0.10	pH units		8.19	8.17	8.11	8.17	8.11
Particle Size										
grain size curve	----	E185A	-	-		See Attached	See Attached	See Attached	See Attached	See Attached
clay (<0.004mm)	----	EC184A	1.0	%		16.4	21.2	17.7	23.8	21.8
silt (0.063mm - 0.0312mm)	----	EC184A	1.0	%		4.3	4.6	4.7	4.8	5.0
silt (0.0312mm - 0.004mm)	----	EC184A	1.0	%		13.9	16.6	14.3	16.9	17.9
sand (0.125mm - 0.063mm)	----	EC184A	1.0	%		4.1	5.5	5.7	5.1	5.6
sand (0.25mm - 0.125mm)	----	EC184A	1.0	%		16.4	24.5	22.9	22.5	19.1
sand (0.5mm - 0.25mm)	----	EC184A	1.0	%		19.1	10.5	13.1	11.1	12.4
sand (1.0mm - 0.50mm)	----	EC184A	1.0	%		10.0	6.1	7.5	7.9	6.6
sand (2.0mm - 1.0mm)	----	EC184A	1.0	%		7.9	7.5	4.1	4.1	2.6
gravel (>2mm)	----	EC184A	1.0	%		7.9	3.5	10.0	3.8	9.0
Organic / Inorganic Carbon										
carbon, total organic [TOC]	----	EC356	0.050	%		0.677	0.830	0.718	0.970	0.960
Metals										
aluminum	7429-90-5	E440	50	mg/kg		19800	17400	18800	18600	21200
antimony	7440-36-0	E440	0.10	mg/kg		0.93	0.79	0.90	0.86	1.03
arsenic	7440-38-2	E440	0.10	mg/kg		9.76	6.95	10.5	8.23	9.18
barium	7440-39-3	E440	0.50	mg/kg		78.0	71.8	68.0	72.2	82.9
beryllium	7440-41-7	E440	0.10	mg/kg		0.50	0.40	0.49	0.45	0.56
bismuth	7440-69-9	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
boron	7440-42-8	E440	5.0	mg/kg		32.4	24.7	34.7	27.1	34.5
cadmium	7440-43-9	E440	0.020	mg/kg		0.151	0.222	0.244	0.164	0.161
calcium	7440-70-2	E440	50	mg/kg		37500	131000	25800	112000	48600
chromium	7440-47-3	E440	0.50	mg/kg		46.3	37.7	44.6	43.8	50.8
cobalt	7440-48-4	E440	0.10	mg/kg		17.8	12.9	18.5	15.1	18.4
copper	7440-50-8	E440	0.50	mg/kg		27.2	24.4	27.4	28.7	31.8
iron	7439-89-6	E440	50	mg/kg		36800	25700	36700	30800	38400
lead	7439-92-1	E440	0.50	mg/kg		8.84	9.16	8.26	9.08	9.81

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	PEI-SED-11	PEI-SED-12	PEI-SED-13	PEI-SED-14	PEI-SED-15
					Client sampling date / time	19-May-2022 16:15	19-May-2022 15:20	19-May-2022 13:30	19-May-2022 12:00	19-May-2022 09:00
						VA22B1606-011	VA22B1606-012	VA22B1606-013	VA22B1606-014	VA22B1606-015
						Result	Result	Result	Result	Result
Metals										
lithium	7439-93-2	E440	2.0	mg/kg		25.3	24.0	26.5	26.2	28.1
magnesium	7439-95-4	E440	20	mg/kg		13600	11300	13700	12400	15000
manganese	7439-96-5	E440	1.0	mg/kg		555	486	562	491	628
mercury	7439-97-6	E510	0.0500	mg/kg		0.0578	0.0587	0.0629	0.0628	0.0707
molybdenum	7439-98-7	E440	0.10	mg/kg		0.66	0.65	0.67	0.66	0.80
nickel	7440-02-0	E440	0.50	mg/kg		53.6	40.6	54.6	49.3	60.6
phosphorus	7723-14-0	E440	50	mg/kg		955	869	977	986	1060
potassium	7440-09-7	E440	100	mg/kg		3220	2250	3190	2510	3300
selenium	7782-49-2	E440	0.20	mg/kg		0.44	0.51	0.44	0.54	0.51
silver	7440-22-4	E440	0.10	mg/kg		0.13	0.13	0.12	0.15	0.14
sodium	7440-23-5	E440	50	mg/kg		7400	9320	7660	9500	9290
strontium	7440-24-6	E440	0.50	mg/kg		158	750	104	522	200
sulfur	7704-34-9	E440	1000	mg/kg		<1000	1300	<1000	1400	<1000
thallium	7440-28-0	E440	0.050	mg/kg		0.108	0.123	0.095	0.118	0.107
tin	7440-31-5	E440	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0
titanium	7440-32-6	E440	1.0	mg/kg		928	854	888	874	1020
tungsten	7440-33-7	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
uranium	7440-61-1	E440	0.050	mg/kg		0.721	0.771	0.789	0.877	0.720
vanadium	7440-62-2	E440	0.20	mg/kg		70.9	57.3	68.4	63.8	75.6
zinc	7440-66-6	E440	2.0	mg/kg		107	93.3	110	102	120
zirconium	7440-67-7	E440	1.0	mg/kg		2.6	2.0	2.6	2.7	3.0
Volatile Organic Compounds [Fuels]										
benzene	71-43-2	E611A	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
ethylbenzene	100-41-4	E611A	0.015	mg/kg		<0.015	<0.015	<0.015	<0.015	<0.015
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.040	mg/kg		<0.040	<0.040	<0.040	<0.040	<0.040
styrene	100-42-5	E611A	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
toluene	108-88-3	E611A	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
xylene, m+p-	179601-23-1	E611A	0.030	mg/kg		<0.030	<0.030	<0.030	<0.030	<0.030
xylene, o-	95-47-6	E611A	0.030	mg/kg		<0.030	<0.030	<0.030	<0.030	<0.030
xylenes, total	1330-20-7	E611A	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
Volatile Organic Compounds Surrogates										

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	PEI-SED-11	PEI-SED-12	PEI-SED-13	PEI-SED-14	PEI-SED-15
					Client sampling date / time	19-May-2022 16:15	19-May-2022 15:20	19-May-2022 13:30	19-May-2022 12:00	19-May-2022 09:00
						VA22B1606-011	VA22B1606-012	VA22B1606-013	VA22B1606-014	VA22B1606-015
						Result	Result	Result	Result	Result
Volatile Organic Compounds Surrogates										
bromofluorobenzene, 4-	460-00-4	E611A	0.10	%		93.0	89.3	93.3	89.8	88.3
difluorobenzene, 1,4-	540-36-3	E611A	0.10	%		99.4	95.0	99.8	98.6	92.3
Polycyclic Aromatic Hydrocarbons										
acenaphthene	83-32-9	E641A-L	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
acenaphthylene	208-96-8	E641A-L	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
acridine	260-94-6	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
anthracene	120-12-7	E641A-L	0.0040	mg/kg		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
benz(a)anthracene	56-55-3	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(a)pyrene	50-32-8	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(b+j)fluoranthene	n/a	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(b+j+k)fluoranthene	n/a	E641A-L	0.015	mg/kg		<0.015	<0.015	<0.015	<0.015	<0.015
benzo(g,h,i)perylene	191-24-2	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
benzo(k)fluoranthene	207-08-9	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
chrysene	218-01-9	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
dibenz(a,h)anthracene	53-70-3	E641A-L	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
fluoranthene	206-44-0	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
fluorene	86-73-7	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 1-	90-12-0	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 1+2-	----	E641A-L	0.015	mg/kg		<0.015	<0.015	<0.015	<0.015	<0.015
methylnaphthalene, 2-	91-57-6	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	0.011
naphthalene	91-20-3	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
phenanthrene	85-01-8	E641A-L	0.010	mg/kg		0.010	0.011	0.013	0.017	0.029
pyrene	129-00-0	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
quinoline	91-22-5	E641A-L	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
B(a)P total potency equivalents [B(a)P TPE]	----	E641A-L	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
IACR (CCME)	----	E641A-L	0.150	-		<0.150	<0.150	<0.150	<0.150	<0.150
Polycyclic Aromatic Hydrocarbons Surrogates										
acridine-d9	34749-75-2	E641A-L	0.1	%		95.1	104	102	88.5	103
chrysene-d12	1719-03-5	E641A-L	0.1	%		103	112	108	92.3	90.3
naphthalene-d8	1146-65-2	E641A-L	0.1	%		106	116	111	96.3	121

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Work Order	:	VA22B1606
Client	:	Stantec Consulting Ltd.
Project	:	KSI LISIMS Sediment 123221820.500

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	PEI-SED-11	PEI-SED-12	PEI-SED-13	PEI-SED-14	PEI-SED-15
					Client sampling date / time	19-May-2022 16:15	19-May-2022 15:20	19-May-2022 13:30	19-May-2022 12:00	19-May-2022 09:00
						VA22B1606-011	VA22B1606-012	VA22B1606-013	VA22B1606-014	VA22B1606-015
						Result	Result	Result	Result	Result
Polycyclic Aromatic Hydrocarbons Surrogates										
phenanthrene-d10	1517-22-2	E641A-L	0.1	%		107	114	111	97.2	117

Please refer to the General Comments section for an explanation of any qualifiers detected.

Page	:	15 of 18
Work Order	:	VA22B1606
Client	:	Stantec Consulting Ltd.
Project	:	KSI LISIMS Sediment 123221820.500

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	DUP-SED-X	DUP-SED-Y	----	----	----
					Client sampling date / time	19-May-2022 10:35	19-May-2022 15:20	----	----	----
						VA22B1606-016	VA22B1606-017	--------	--------	--------
						Result	Result	----	----	----
Physical Tests										
moisture	----	E144	0.25	%		32.6	37.5	----	----	----
pH (1:2 soil:water)	----	E108	0.10	pH units		8.24	8.22	----	----	----
Particle Size										
grain size curve	----	E185A	-	-		See Attached	See Attached	----	----	----
clay (<0.004mm)	----	EC184A	1.0	%		14.0	22.7	----	----	----
silt (0.063mm - 0.0312mm)	----	EC184A	1.0	%		3.0	4.7	----	----	----
silt (0.0312mm - 0.004mm)	----	EC184A	1.0	%		11.8	16.5	----	----	----
sand (0.125mm - 0.063mm)	----	EC184A	1.0	%		5.6	5.9	----	----	----
sand (0.25mm - 0.125mm)	----	EC184A	1.0	%		31.6	25.7	----	----	----
sand (0.5mm - 0.25mm)	----	EC184A	1.0	%		13.8	10.8	----	----	----
sand (1.0mm - 0.50mm)	----	EC184A	1.0	%		7.0	4.8	----	----	----
sand (2.0mm - 1.0mm)	----	EC184A	1.0	%		6.9	6.1	----	----	----
gravel (>2mm)	----	EC184A	1.0	%		6.3	2.8	----	----	----
Organic / Inorganic Carbon										
carbon, total organic [TOC]	----	EC356	0.050	%		0.790	0.760	----	----	----
Metals										
aluminum	7429-90-5	E440	50	mg/kg		9940	17100	----	----	----
antimony	7440-36-0	E440	0.10	mg/kg		0.48	0.88	----	----	----
arsenic	7440-38-2	E440	0.10	mg/kg		5.81	7.13	----	----	----
barium	7440-39-3	E440	0.50	mg/kg		42.5	71.6	----	----	----
beryllium	7440-41-7	E440	0.10	mg/kg		0.29	0.38	----	----	----
bismuth	7440-69-9	E440	0.20	mg/kg		<0.20	<0.20	----	----	----
boron	7440-42-8	E440	5.0	mg/kg		20.6	26.9	----	----	----
cadmium	7440-43-9	E440	0.020	mg/kg		0.158	0.204	----	----	----
calcium	7440-70-2	E440	50	mg/kg		147000	155000	----	----	----
chromium	7440-47-3	E440	0.50	mg/kg		22.0	39.3	----	----	----
cobalt	7440-48-4	E440	0.10	mg/kg		8.99	13.0	----	----	----
copper	7440-50-8	E440	0.50	mg/kg		14.6	26.1	----	----	----
iron	7439-89-6	E440	50	mg/kg		17500	27000	----	----	----
lead	7439-92-1	E440	0.50	mg/kg		6.14	9.79	----	----	----

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	DUP-SED-X	DUP-SED-Y	----	----	----
					Client sampling date / time	19-May-2022 10:35	19-May-2022 15:20	----	----	----
						VA22B1606-016	VA22B1606-017	--------	--------	--------
						Result	Result	----	----	----
Metals										
lithium	7439-93-2	E440	2.0	mg/kg		15.9	24.8	----	----	----
magnesium	7439-95-4	E440	20	mg/kg		7840	12000	----	----	----
manganese	7439-96-5	E440	1.0	mg/kg		337	498	----	----	----
mercury	7439-97-6	E510	0.0500	mg/kg		<0.0500	0.0592	----	----	----
molybdenum	7439-98-7	E440	0.10	mg/kg		0.68	0.67	----	----	----
nickel	7440-02-0	E440	0.50	mg/kg		23.7	42.4	----	----	----
phosphorus	7723-14-0	E440	50	mg/kg		737	923	----	----	----
potassium	7440-09-7	E440	100	mg/kg		1420	2280	----	----	----
selenium	7782-49-2	E440	0.20	mg/kg		0.38	0.61	----	----	----
silver	7440-22-4	E440	0.10	mg/kg		<0.10	0.14	----	----	----
sodium	7440-23-5	E440	50	mg/kg		6980	10200	----	----	----
strontium	7440-24-6	E440	0.50	mg/kg		713	905	----	----	----
sulfur	7704-34-9	E440	1000	mg/kg		1400	1600	----	----	----
thallium	7440-28-0	E440	0.050	mg/kg		0.125	0.114	----	----	----
tin	7440-31-5	E440	2.0	mg/kg		<2.0	<2.0	----	----	----
titanium	7440-32-6	E440	1.0	mg/kg		449	759	----	----	----
tungsten	7440-33-7	E440	0.50	mg/kg		<0.50	<0.50	----	----	----
uranium	7440-61-1	E440	0.050	mg/kg		0.656	0.888	----	----	----
vanadium	7440-62-2	E440	0.20	mg/kg		36.8	57.9	----	----	----
zinc	7440-66-6	E440	2.0	mg/kg		59.2	92.0	----	----	----
zirconium	7440-67-7	E440	1.0	mg/kg		1.2	2.0	----	----	----
Volatile Organic Compounds [Fuels]										
benzene	71-43-2	E611A	0.0050	mg/kg		<0.0050	<0.0050	----	----	----
ethylbenzene	100-41-4	E611A	0.015	mg/kg		<0.015	<0.015	----	----	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.040	mg/kg		<0.040	<0.040	----	----	----
styrene	100-42-5	E611A	0.050	mg/kg		<0.050	<0.050	----	----	----
toluene	108-88-3	E611A	0.050	mg/kg		<0.050	<0.050	----	----	----
xylene, m+p-	179601-23-1	E611A	0.030	mg/kg		<0.030	<0.030	----	----	----
xylene, o-	95-47-6	E611A	0.030	mg/kg		<0.030	<0.030	----	----	----
xylenes, total	1330-20-7	E611A	0.050	mg/kg		<0.050	<0.050	----	----	----
Volatile Organic Compounds Surrogates										

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Work Order	:	VA22B1606
Client	:	Stantec Consulting Ltd.
Project	:	KSI LISIMS Sediment 123221820.500

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	DUP-SED-X	DUP-SED-Y	----	----	----
					Client sampling date / time	19-May-2022 10:35	19-May-2022 15:20	----	----	----
						VA22B1606-016	VA22B1606-017	--------	--------	--------
						Result	Result	----	----	----
Volatile Organic Compounds Surrogates										
bromofluorobenzene, 4-	460-00-4	E611A	0.10	%		78.0	91.7	----	----	----
difluorobenzene, 1,4-	540-36-3	E611A	0.10	%		84.4	99.4	----	----	----
Polycyclic Aromatic Hydrocarbons										
acenaphthene	83-32-9	E641A-L	0.0050	mg/kg		<0.0050	<0.0050	----	----	----
acenaphthylene	208-96-8	E641A-L	0.0050	mg/kg		<0.0050	<0.0050	----	----	----
acridine	260-94-6	E641A-L	0.010	mg/kg		<0.010	<0.010	----	----	----
anthracene	120-12-7	E641A-L	0.0040	mg/kg		<0.0040	<0.0040	----	----	----
benz(a)anthracene	56-55-3	E641A-L	0.010	mg/kg		<0.010	<0.010	----	----	----
benzo(a)pyrene	50-32-8	E641A-L	0.010	mg/kg		<0.010	<0.010	----	----	----
benzo(b+j)fluoranthene	n/a	E641A-L	0.010	mg/kg		<0.010	<0.010	----	----	----
benzo(b+j+k)fluoranthene	n/a	E641A-L	0.015	mg/kg		<0.015	<0.015	----	----	----
benzo(g,h,i)perylene	191-24-2	E641A-L	0.010	mg/kg		<0.010	<0.010	----	----	----
benzo(k)fluoranthene	207-08-9	E641A-L	0.010	mg/kg		<0.010	<0.010	----	----	----
chrysene	218-01-9	E641A-L	0.010	mg/kg		<0.010	<0.010	----	----	----
dibenz(a,h)anthracene	53-70-3	E641A-L	0.0050	mg/kg		<0.0050	<0.0050	----	----	----
fluoranthene	206-44-0	E641A-L	0.010	mg/kg		<0.010	<0.010	----	----	----
fluorene	86-73-7	E641A-L	0.010	mg/kg		<0.010	<0.010	----	----	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.010	mg/kg		<0.010	<0.010	----	----	----
methylnaphthalene, 1-	90-12-0	E641A-L	0.010	mg/kg		<0.010	<0.010	----	----	----
methylnaphthalene, 1+2-	----	E641A-L	0.015	mg/kg		<0.015	<0.015	----	----	----
methylnaphthalene, 2-	91-57-6	E641A-L	0.010	mg/kg		<0.010	<0.010	----	----	----
naphthalene	91-20-3	E641A-L	0.010	mg/kg		<0.010	<0.010	----	----	----
phenanthrene	85-01-8	E641A-L	0.010	mg/kg		0.012	0.026	----	----	----
pyrene	129-00-0	E641A-L	0.010	mg/kg		<0.010	<0.010	----	----	----
quinoline	91-22-5	E641A-L	0.010	mg/kg		<0.010	<0.010	----	----	----
B(a)P total potency equivalents [B(a)P TPE]	----	E641A-L	0.020	mg/kg		<0.020	<0.020	----	----	----
IACR (CCME)	----	E641A-L	0.150	-		<0.150	<0.150	----	----	----
Polycyclic Aromatic Hydrocarbons Surrogates										
acridine-d9	34749-75-2	E641A-L	0.1	%		95.9	107	----	----	----
chrysene-d12	1719-03-5	E641A-L	0.1	%		92.4	94.4	----	----	----
naphthalene-d8	1146-65-2	E641A-L	0.1	%		103	118	----	----	----

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Work Order	:	VA22B1606
Client	:	Stantec Consulting Ltd.
Project	:	KSI LISIMS Sediment 123221820.500

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	DUP-SED-X	DUP-SED-Y	----	----	----
					Client sampling date / time	19-May-2022 10:35	19-May-2022 15:20	----	----	----
						VA22B1606-016	VA22B1606-017	--------	--------	--------
						Result	Result	----	----	----
Polycyclic Aromatic Hydrocarbons Surrogates										
phenanthrene-d10	1517-22-2	E641A-L	0.1	%		101	114	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Environmental

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22B1606**	Page	: 1 of 20
Client	: **Stantec Consulting Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Emily Hulley	Account Manager	: Brent Mack
Address	: 500 - 4730 Kingsway Burnaby BC Canada V5H 0C6	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: 778-370-3279
Project	: KSI LISIMS Sediment 123221820.500	Date Samples Received	: 26-May-2022 10:20
PO	: ----	Issue Date	: 10-Jun-2022 09:47
C-O-C number	: ----		
Sampler	: ----		
Site	: ----		
Quote number	: Standing Offer (BC, YK) 2020-2023		
No. of samples received	: 17		
No. of samples analysed	: 17		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- Duplicate outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Soil/Solid**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs								
Metals	Anonymous	Anonymous	antimony	7440-36-0	E440	43.1 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Metals	Anonymous	Anonymous	uranium	7440-61-1	E440	33.9 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.

Result Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
PEI-SED-01	E510	20-May-2022	30-May-2022	----	----		31-May-2022	28 days	11 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
PEI-SED-03	E510	20-May-2022	30-May-2022	----	----		31-May-2022	28 days	11 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
PEI-SED-04	E510	20-May-2022	30-May-2022	----	----		31-May-2022	28 days	11 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
PEI-SED-05	E510	20-May-2022	30-May-2022	----	----		31-May-2022	28 days	11 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
PEI-SED-06	E510	20-May-2022	30-May-2022	----	----		31-May-2022	28 days	11 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
PEI-SED-08	E510	20-May-2022	30-May-2022	----	----		31-May-2022	28 days	11 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
PEI-SED-07	E510	20-May-2022	30-May-2022	----	----		31-May-2022	28 days	12 days	✓

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Work Order	:	VA22B1606
Client	:	Stantec Consulting Ltd.
Project	:	KSI LISIMS Sediment 123221820.500

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
PEI-SED-09	E510	20-May-2022	30-May-2022	----	----		31-May-2022	28 days	12 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
DUP-SED-X	E510	19-May-2022	31-May-2022	----	----		01-Jun-2022	28 days	13 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
DUP-SED-Y	E510	19-May-2022	31-May-2022	----	----		01-Jun-2022	28 days	13 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
PEI-SED-02	E510	19-May-2022	31-May-2022	----	----		01-Jun-2022	28 days	13 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
PEI-SED-10	E510	19-May-2022	31-May-2022	----	----		01-Jun-2022	28 days	13 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
PEI-SED-11	E510	19-May-2022	31-May-2022	----	----		01-Jun-2022	28 days	13 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
PEI-SED-12	E510	19-May-2022	31-May-2022	----	----		01-Jun-2022	28 days	13 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
PEI-SED-13	E510	19-May-2022	31-May-2022	----	----		01-Jun-2022	28 days	13 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
PEI-SED-14	E510	19-May-2022	31-May-2022	----	----		01-Jun-2022	28 days	13 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
PEI-SED-15	E510	19-May-2022	31-May-2022	----	----		01-Jun-2022	28 days	13 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
PEI-SED-01	E440	20-May-2022	30-May-2022	----	----		31-May-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
PEI-SED-03	E440	20-May-2022	30-May-2022	----	----		31-May-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
PEI-SED-04	E440	20-May-2022	30-May-2022	----	----		31-May-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
PEI-SED-05	E440	20-May-2022	30-May-2022	----	----		31-May-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
PEI-SED-06	E440	20-May-2022	30-May-2022	----	----		31-May-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
PEI-SED-08	E440	20-May-2022	30-May-2022	----	----		31-May-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
PEI-SED-07	E440	20-May-2022	30-May-2022	----	----		31-May-2022	180 days	12 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
PEI-SED-09	E440	20-May-2022	30-May-2022	----	----		31-May-2022	180 days	12 days	✓

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Work Order	:	VA22B1606
Client	:	Stantec Consulting Ltd.
Project	:	KSI LISIMS Sediment 123221820.500

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
DUP-SED-X	E440	19-May-2022	31-May-2022	----	----		01-Jun-2022	180 days	13 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
DUP-SED-Y	E440	19-May-2022	31-May-2022	----	----		01-Jun-2022	180 days	13 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
PEI-SED-02	E440	19-May-2022	31-May-2022	----	----		01-Jun-2022	180 days	13 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
PEI-SED-10	E440	19-May-2022	31-May-2022	----	----		01-Jun-2022	180 days	13 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
PEI-SED-11	E440	19-May-2022	31-May-2022	----	----		01-Jun-2022	180 days	13 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
PEI-SED-12	E440	19-May-2022	31-May-2022	----	----		01-Jun-2022	180 days	13 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
PEI-SED-13	E440	19-May-2022	31-May-2022	----	----		01-Jun-2022	180 days	13 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
PEI-SED-14	E440	19-May-2022	31-May-2022	----	----		01-Jun-2022	180 days	13 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
PEI-SED-15	E440	19-May-2022	31-May-2022	----	----		01-Jun-2022	180 days	13 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag DUP-SED-X	E185A	19-May-2022	----	----	----		03-Jun-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag DUP-SED-Y	E185A	19-May-2022	----	----	----		03-Jun-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag PEI-SED-01	E185A	20-May-2022	----	----	----		03-Jun-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag PEI-SED-02	E185A	19-May-2022	----	----	----		03-Jun-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag PEI-SED-03	E185A	20-May-2022	----	----	----		03-Jun-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag PEI-SED-04	E185A	20-May-2022	----	----	----		03-Jun-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag PEI-SED-05	E185A	20-May-2022	----	----	----		03-Jun-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag PEI-SED-06	E185A	20-May-2022	----	----	----		03-Jun-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag PEI-SED-07	E185A	20-May-2022	----	----	----		03-Jun-2022	365 days	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag PEI-SED-08	E185A	20-May-2022	----	----	----		03-Jun-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag PEI-SED-09	E185A	20-May-2022	----	----	----		03-Jun-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag PEI-SED-10	E185A	19-May-2022	----	----	----		03-Jun-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag PEI-SED-11	E185A	19-May-2022	----	----	----		03-Jun-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag PEI-SED-12	E185A	19-May-2022	----	----	----		03-Jun-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag PEI-SED-13	E185A	19-May-2022	----	----	----		03-Jun-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag PEI-SED-14	E185A	19-May-2022	----	----	----		03-Jun-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag PEI-SED-15	E185A	19-May-2022	----	----	----		03-Jun-2022	365 days	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap DUP-SED-X	E144	19-May-2022	----	----	----		29-May-2022	----	----	

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Work Order	: VA22B1606
Client	: Stantec Consulting Ltd.
Project	: KSI LISIMS Sediment 123221820.500

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap DUP-SED-Y	E144	19-May-2022	----	----	----		29-May-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap PEI-SED-01	E144	20-May-2022	----	----	----		29-May-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap PEI-SED-02	E144	19-May-2022	----	----	----		29-May-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap PEI-SED-03	E144	20-May-2022	----	----	----		29-May-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap PEI-SED-04	E144	20-May-2022	----	----	----		29-May-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap PEI-SED-05	E144	20-May-2022	----	----	----		29-May-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap PEI-SED-06	E144	20-May-2022	----	----	----		29-May-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap PEI-SED-07	E144	20-May-2022	----	----	----		29-May-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap PEI-SED-08	E144	20-May-2022	----	----	----		29-May-2022	----	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap PEI-SED-09	E144	20-May-2022	----	----	----		29-May-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap PEI-SED-10	E144	19-May-2022	----	----	----		29-May-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap PEI-SED-11	E144	19-May-2022	----	----	----		29-May-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap PEI-SED-12	E144	19-May-2022	----	----	----		29-May-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap PEI-SED-13	E144	19-May-2022	----	----	----		29-May-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap PEI-SED-14	E144	19-May-2022	----	----	----		29-May-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap PEI-SED-15	E144	19-May-2022	----	----	----		29-May-2022	----	----	
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap PEI-SED-01	E108	20-May-2022	30-May-2022	----	----		30-May-2022	30 days	10 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap PEI-SED-03	E108	20-May-2022	30-May-2022	----	----		30-May-2022	30 days	10 days	✓

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Work Order	:	VA22B1606
Client	:	Stantec Consulting Ltd.
Project	:	KSI LISIMS Sediment 123221820.500

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
PEI-SED-04	E108	20-May-2022	30-May-2022	----	----		30-May-2022	30 days	10 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
PEI-SED-05	E108	20-May-2022	30-May-2022	----	----		30-May-2022	30 days	10 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
PEI-SED-06	E108	20-May-2022	30-May-2022	----	----		30-May-2022	30 days	10 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
PEI-SED-08	E108	20-May-2022	30-May-2022	----	----		30-May-2022	30 days	10 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
PEI-SED-07	E108	20-May-2022	30-May-2022	----	----		30-May-2022	30 days	11 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
PEI-SED-09	E108	20-May-2022	30-May-2022	----	----		30-May-2022	30 days	11 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
DUP-SED-X	E108	19-May-2022	31-May-2022	----	----		31-May-2022	30 days	12 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
DUP-SED-Y	E108	19-May-2022	31-May-2022	----	----		31-May-2022	30 days	12 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
PEI-SED-02	E108	19-May-2022	31-May-2022	----	----		31-May-2022	30 days	12 days	✓

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Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
PEI-SED-10	E108	19-May-2022	31-May-2022	----	----		31-May-2022	30 days	12 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
PEI-SED-11	E108	19-May-2022	31-May-2022	----	----		31-May-2022	30 days	12 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
PEI-SED-12	E108	19-May-2022	31-May-2022	----	----		31-May-2022	30 days	12 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
PEI-SED-13	E108	19-May-2022	31-May-2022	----	----		31-May-2022	30 days	12 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
PEI-SED-14	E108	19-May-2022	31-May-2022	----	----		31-May-2022	30 days	12 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
PEI-SED-15	E108	19-May-2022	31-May-2022	----	----		31-May-2022	30 days	12 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap										
DUP-SED-X	E641A-L	19-May-2022	29-May-2022	14 days	10 days	✓	01-Jun-2022	40 days	3 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap										
DUP-SED-Y	E641A-L	19-May-2022	29-May-2022	14 days	10 days	✓	01-Jun-2022	40 days	3 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap										
PEI-SED-02	E641A-L	19-May-2022	29-May-2022	14 days	10 days	✓	01-Jun-2022	40 days	3 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap PEI-SED-10	E641A-L	19-May-2022	29-May-2022	14 days	10 days	✓	01-Jun-2022	40 days	3 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap PEI-SED-11	E641A-L	19-May-2022	29-May-2022	14 days	10 days	✓	01-Jun-2022	40 days	3 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap PEI-SED-12	E641A-L	19-May-2022	29-May-2022	14 days	10 days	✓	01-Jun-2022	40 days	3 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap PEI-SED-13	E641A-L	19-May-2022	29-May-2022	14 days	10 days	✓	01-Jun-2022	40 days	3 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap PEI-SED-14	E641A-L	19-May-2022	29-May-2022	14 days	10 days	✓	01-Jun-2022	40 days	3 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap PEI-SED-15	E641A-L	19-May-2022	29-May-2022	14 days	10 days	✓	01-Jun-2022	40 days	3 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap PEI-SED-01	E641A-L	20-May-2022	29-May-2022	14 days	9 days	✓	01-Jun-2022	40 days	3 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap PEI-SED-03	E641A-L	20-May-2022	29-May-2022	14 days	9 days	✓	01-Jun-2022	40 days	3 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap PEI-SED-04	E641A-L	20-May-2022	29-May-2022	14 days	9 days	✓	01-Jun-2022	40 days	3 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap PEI-SED-05	E641A-L	20-May-2022	29-May-2022	14 days	9 days	✓	01-Jun-2022	40 days	3 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap PEI-SED-06	E641A-L	20-May-2022	29-May-2022	14 days	9 days	✓	01-Jun-2022	40 days	3 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap PEI-SED-07	E641A-L	20-May-2022	29-May-2022	14 days	9 days	✓	01-Jun-2022	40 days	3 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap PEI-SED-08	E641A-L	20-May-2022	29-May-2022	14 days	9 days	✓	01-Jun-2022	40 days	3 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap PEI-SED-09	E641A-L	20-May-2022	29-May-2022	14 days	9 days	✓	01-Jun-2022	40 days	3 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass soil methanol vial PEI-SED-01	E611A	20-May-2022	05-Jun-2022	----	----		05-Jun-2022	40 days	16 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass soil methanol vial PEI-SED-03	E611A	20-May-2022	05-Jun-2022	----	----		05-Jun-2022	40 days	16 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass soil methanol vial PEI-SED-04	E611A	20-May-2022	05-Jun-2022	----	----		05-Jun-2022	40 days	16 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass soil methanol vial PEI-SED-05	E611A	20-May-2022	05-Jun-2022	----	----		05-Jun-2022	40 days	16 days	✓

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Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass soil methanol vial PEI-SED-06	E611A	20-May-2022	05-Jun-2022	----	----		05-Jun-2022	40 days	16 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass soil methanol vial PEI-SED-07	E611A	20-May-2022	05-Jun-2022	----	----		05-Jun-2022	40 days	16 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass soil methanol vial PEI-SED-02	E611A	19-May-2022	05-Jun-2022	----	----		05-Jun-2022	40 days	17 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass soil methanol vial PEI-SED-08	E611A	20-May-2022	05-Jun-2022	----	----		07-Jun-2022	40 days	17 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass soil methanol vial PEI-SED-09	E611A	20-May-2022	05-Jun-2022	----	----		07-Jun-2022	40 days	17 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass soil methanol vial DUP-SED-X	E611A	19-May-2022	05-Jun-2022	----	----		07-Jun-2022	40 days	18 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass soil methanol vial DUP-SED-Y	E611A	19-May-2022	05-Jun-2022	----	----		07-Jun-2022	40 days	18 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass soil methanol vial PEI-SED-10	E611A	19-May-2022	05-Jun-2022	----	----		07-Jun-2022	40 days	18 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass soil methanol vial PEI-SED-11	E611A	19-May-2022	05-Jun-2022	----	----		07-Jun-2022	40 days	18 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass soil methanol vial PEI-SED-12	E611A	19-May-2022	05-Jun-2022	----	----		07-Jun-2022	40 days	18 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass soil methanol vial PEI-SED-13	E611A	19-May-2022	05-Jun-2022	----	----		07-Jun-2022	40 days	18 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass soil methanol vial PEI-SED-14	E611A	19-May-2022	05-Jun-2022	----	----		07-Jun-2022	40 days	18 days	✓
Volatile Organic Compounds [Fuels] : BTEX by Headspace GC-MS										
Glass soil methanol vial PEI-SED-15	E611A	19-May-2022	05-Jun-2022	----	----		07-Jun-2022	40 days	18 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
BTEX by Headspace GC-MS	E611A	512025	2	40	5.0	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	503732	2	32	6.2	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	503731	2	32	6.2	5.0	✓
Moisture Content by Gravimetry	E144	503738	2	33	6.0	5.0	✓
PAHs by Hex:Ace GC-MS (Low Level CCME)	E641A-L	503736	2	29	6.9	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	503538	2	28	7.1	5.0	✓
Laboratory Control Samples (LCS)							
BTEX by Headspace GC-MS	E611A	512025	2	40	5.0	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	503732	4	32	12.5	10.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	503731	4	32	12.5	10.0	✓
Moisture Content by Gravimetry	E144	503738	2	33	6.0	5.0	✓
PAHs by Hex:Ace GC-MS (Low Level CCME)	E641A-L	503736	2	29	6.9	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	503734	2	28	7.1	5.0	✓
Method Blanks (MB)							
BTEX by Headspace GC-MS	E611A	512025	2	40	5.0	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	503732	2	32	6.2	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	503731	2	32	6.2	5.0	✓
Moisture Content by Gravimetry	E144	503738	2	33	6.0	5.0	✓
PAHs by Hex:Ace GC-MS (Low Level CCME)	E641A-L	503736	2	29	6.9	5.0	✓
Matrix Spikes (MS)							
BTEX by Headspace GC-MS	E611A	512025	2	40	5.0	5.0	✓
PAHs by Hex:Ace GC-MS (Low Level CCME)	E641A-L	503736	2	29	6.9	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
pH by Meter (1:2 Soil:Water Extraction)	E108 Vancouver - Environmental	Soil/Solid	BC Lab Manual	pH is determined by potentiometric measurement with a pH electrode at ambient laboratory temperature (normally 20 ± 5°C), and is carried out in accordance with procedures described in the BC Lab Manual (prescriptive method). The procedure involves mixing the dried (at <60 °C) and sieved (10mesh/2mm) sample with ultra pure water at a 1:2 ratio of sediment to water. The pH is then measured by a standard pH probe.
Moisture Content by Gravimetry	E144 Vancouver - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Grain Size Report (Attachment) Pipet/Sieve Method	E185A Saskatoon - Environmental	Soil/Solid	SSIR-51 Method 3.2.1	A grain size curve is a graphical representation of the particle sizing of a sample representing the percent passing against the effective particle size.
Metals in Soil/Solid by CRC ICPMS	E440 Vancouver - Environmental	Soil/Solid	EPA 6020B (mod)	This method is intended to liberate metals that may be environmentally available. Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Silicate minerals are not solubilized. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. This method does not adequately recover elemental sulfur, and is unsuitable for assessment of elemental sulfur standards or guidelines. Analysis is by Collision/Reaction Cell ICPMS.
Mercury in Soil/Solid by CVAAS	E510 Vancouver - Environmental	Soil/Solid	EPA 200.2/1631 Appendix (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl, followed by CVAAS analysis.
BTEX by Headspace GC-MS	E611A Vancouver - Environmental	Soil/Solid	EPA 8260D (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
PAHs by Hex:Ace GC-MS (Low Level CCME)	E641A-L Vancouver - Environmental	Soil/Solid	EPA 8270E (mod)	Polycyclic Aromatic Hydrocarbons (PAHs) are extracted with hexane/acetone and analyzed by GC-MS. If reported, IACR (index of additive cancer risk, unitless) and B(a)P toxic potency equivalent (in soil concentration units) are calculated as per CCME PAH Soil Quality Guidelines fact sheet (2010) or ABT1.
Particle Size Analysis (Pipette) - Wentworth Classification	EC184A Saskatoon - Environmental	Soil/Solid	Modified Wentworth	The particle size determination is performed by various methods to generate a Grain Size curve. The data from the curve is then used to produce particle size ranges based on the Modified Wentworth Classification system.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Total Organic Carbon (Calculated) in soil	EC356 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 21.2	Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon (TIC).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 Vancouver - Environmental	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Digestion for Metals and Mercury	EP440 Vancouver - Environmental	Soil/Solid	EPA 200.2 (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. This method is intended to liberate metals that may be environmentally available.
VOCs Methanol Extraction for Headspace Analysis	EP581 Vancouver - Environmental	Soil/Solid	EPA 5035A (mod)	VOCs in samples are extracted with methanol. Extracts are then prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry 's law.
PHCs and PAHs Hexane-Acetone Tumbler Extraction	EP601 Vancouver - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1 (mod)	Samples are subsampled and Petroleum Hydrocarbons (PHC) and PAHs are extracted with 1:1 hexane:acetone using a rotary extractor.
Dry and Grind	EPP442 Saskatoon - Environmental	Soil/Solid	Soil Sampling and Methods of Analysis, Carter 2008	After removal of any coarse fragments and reservation of wet subsamples a portion of homogenized sample is set in a tray and dried at less than 60°C until dry. The sample is then particle size reduced with an automated crusher or mortar and pestle, typically to <2 mm. Further size reduction may be needed for particular tests.

QUALITY CONTROL REPORT

Work Order	: **VA22B1606**	Page	: 1 of 20
Client	: Stantec Consulting Ltd.	Laboratory	: Vancouver - Environmental
Contact	: Emily Hulley	Account Manager	: Brent Mack
Address	: 500 - 4730 Kingsway Burnaby BC Canada V5H 0C6	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: 778-370-3279
Project	: KSI LISIMS Sediment 123221820.500	Date Samples Received	: 26-May-2022 10:20
PO	: ----	Date Analysis Commenced	: 29-May-2022
C-O-C number	: ----	Issue Date	: 10-Jun-2022 09:47
Sampler	: ----		
Site	: ----		
Quote number	: Standing Offer (BC, YK) 2020-2023		
No. of samples received	: 17		
No. of samples analysed	: 17		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Caleb Deroche	Lab Analyst	Vancouver Metals, Burnaby, British Columbia
Colby Bingham	Quality Systems Coordinator	Saskatoon Inorganics, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Saskatoon Inorganics, Saskatoon, Saskatchewan
Janice Leung	Supervisor - Organics Instrumentation	Vancouver Organics, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Page	: 3 of 20
Work Order	: VA22B1606
Client	: Stantec Consulting Ltd.
Project	: KSI LISIMS Sediment 123221820.500

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 503538)											
FJ2201278-001	Anonymous	pH (1:2 soil:water)	----	E108	0.10	pH units	8.22	8.19	0.4%	5%	----
Physical Tests (QC Lot: 503543)											
VA22B1579-001	Anonymous	moisture	----	E144	0.25	%	9.34	9.28	0.658%	20%	----
Physical Tests (QC Lot: 503734)											
VA22B1605-001	Anonymous	pH (1:2 soil:water)	----	E108	0.10	pH units	7.90	7.97	0.9%	5%	----
Physical Tests (QC Lot: 503738)											
VA22B1605-001	Anonymous	moisture	----	E144	0.25	%	10.7	9.05	17.1%	20%	----
Metals (QC Lot: 503539)											
VA22B0768-002	Anonymous	mercury	7439-97-6	E510	0.0500	mg/kg	<0.0500	<0.0500	0	Diff <2x LOR	----
Metals (QC Lot: 503540)											
VA22B0768-002	Anonymous	aluminum	7429-90-5	E440	50	mg/kg	7240	7720	6.51%	40%	----
		antimony	7440-36-0	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.10	mg/kg	1.10	1.20	8.93%	30%	----
		barium	7440-39-3	E440	0.50	mg/kg	21.4	24.0	11.2%	40%	----
		beryllium	7440-41-7	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		boron	7440-42-8	E440	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.020	mg/kg	0.030	0.036	0.006	Diff <2x LOR	----
		calcium	7440-70-2	E440	50	mg/kg	3650	4120	12.0%	30%	----
		chromium	7440-47-3	E440	0.50	mg/kg	8.19	9.72	17.0%	30%	----
		cobalt	7440-48-4	E440	0.10	mg/kg	3.34	3.61	7.55%	30%	----
		copper	7440-50-8	E440	0.50	mg/kg	8.98	10.3	14.0%	30%	----
		iron	7439-89-6	E440	50	mg/kg	12700	15000	17.1%	30%	----
		lead	7439-92-1	E440	0.50	mg/kg	1.01	0.98	0.03	Diff <2x LOR	----
		lithium	7439-93-2	E440	2.0	mg/kg	3.8	3.8	0.03	Diff <2x LOR	----
		magnesium	7439-95-4	E440	20	mg/kg	2730	2690	1.62%	30%	----
		manganese	7439-96-5	E440	1.0	mg/kg	152	156	3.03%	30%	----
		molybdenum	7439-98-7	E440	0.10	mg/kg	0.29	0.36	0.07	Diff <2x LOR	----
		nickel	7440-02-0	E440	0.50	mg/kg	4.78	5.34	10.9%	30%	----
		phosphorus	7723-14-0	E440	50	mg/kg	261	266	5	Diff <2x LOR	----
		potassium	7440-09-7	E440	100	mg/kg	610	630	3.19%	40%	----

Page : 4 of 20
Work Order : VA22B1606
Client : Stantec Consulting Ltd.
Project : KSI LISIMS Sediment 123221820.500

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 503540) - continued											
VA22B0768-002	Anonymous	selenium	7782-49-2	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		silver	7440-22-4	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		sodium	7440-23-5	E440	50	mg/kg	444	488	9.42%	40%	----
		strontium	7440-24-6	E440	0.50	mg/kg	27.4	29.9	8.45%	40%	----
		sulfur	7704-34-9	E440	1000	mg/kg	<1000	<1000	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium	7440-32-6	E440	1.0	mg/kg	506	561	10.4%	40%	----
		tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.050	mg/kg	0.200	0.219	0.019	Diff <2x LOR	----
		vanadium	7440-62-2	E440	0.20	mg/kg	42.1	52.6	22.3%	30%	----
		zinc	7440-66-6	E440	2.0	mg/kg	17.2	18.7	8.49%	30%	----
		zirconium	7440-67-7	E440	1.0	mg/kg	1.1	1.1	0.04	Diff <2x LOR	----
Metals (QC Lot: 503731)											
VA22B1605-001	Anonymous	aluminum	7429-90-5	E440	50	mg/kg	10600	10000	5.66%	40%	----
		antimony	7440-36-0	E440	0.10	mg/kg	76.8	49.5	43.1%	30%	DUP-H
		arsenic	7440-38-2	E440	0.10	mg/kg	129	105	20.2%	30%	----
		barium	7440-39-3	E440	0.50	mg/kg	86.0	85.2	0.826%	40%	----
		beryllium	7440-41-7	E440	0.10	mg/kg	0.14	0.13	0.009	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.20	mg/kg	0.23	0.26	0.03	Diff <2x LOR	----
		boron	7440-42-8	E440	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.020	mg/kg	0.327	0.291	11.6%	30%	----
		calcium	7440-70-2	E440	50	mg/kg	20000	19900	0.507%	30%	----
		chromium	7440-47-3	E440	0.50	mg/kg	18.8	18.8	0.132%	30%	----
		cobalt	7440-48-4	E440	0.10	mg/kg	14.3	11.7	19.6%	30%	----
		copper	7440-50-8	E440	0.50	mg/kg	125	120	4.38%	30%	----
		iron	7439-89-6	E440	50	mg/kg	21400	21800	1.70%	30%	----
		lead	7439-92-1	E440	0.50	mg/kg	99.1	68.5	36.6%	40%	----
		lithium	7439-93-2	E440	2.0	mg/kg	4.8	4.7	0.1	Diff <2x LOR	----
		magnesium	7439-95-4	E440	20	mg/kg	4560	4420	3.17%	30%	----
		manganese	7439-96-5	E440	1.0	mg/kg	240	225	6.44%	30%	----
		molybdenum	7439-98-7	E440	0.10	mg/kg	12.4	12.6	1.83%	40%	----
		nickel	7440-02-0	E440	0.50	mg/kg	17.5	18.5	5.42%	30%	----
		phosphorus	7723-14-0	E440	50	mg/kg	354	349	1.43%	30%	----
		potassium	7440-09-7	E440	100	mg/kg	910	920	1.50%	40%	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 503731) - continued											
VA22B1605-001	Anonymous	selenium	7782-49-2	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		silver	7440-22-4	E440	0.10	mg/kg	0.16	0.16	0.007	Diff <2x LOR	----
		sodium	7440-23-5	E440	50	mg/kg	516	459	11.8%	40%	----
		strontium	7440-24-6	E440	0.50	mg/kg	64.8	64.6	0.339%	40%	----
		sulfur	7704-34-9	E440	1000	mg/kg	<1000	<1000	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.050	mg/kg	0.081	0.080	0.002	Diff <2x LOR	----
		tin	7440-31-5	E440	2.0	mg/kg	9.6	7.8	1.8	Diff <2x LOR	----
		titanium	7440-32-6	E440	1.0	mg/kg	680	673	1.05%	40%	----
		tungsten	7440-33-7	E440	0.50	mg/kg	0.67	1.42	0.75	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.050	mg/kg	0.520	0.732	33.9%	30%	DUP-H
		vanadium	7440-62-2	E440	0.20	mg/kg	48.9	47.7	2.53%	30%	----
		zinc	7440-66-6	E440	2.0	mg/kg	272	349	24.8%	30%	----
		zirconium	7440-67-7	E440	1.0	mg/kg	2.8	3.3	0.4	Diff <2x LOR	----
Metals (QC Lot: 503732)											
VA22B1605-001	Anonymous	mercury	7439-97-6	E510	0.0500	mg/kg	<0.0500	<0.0500	0	Diff <2x LOR	----
Volatile Organic Compounds (QC Lot: 511571)											
FJ2201412-001	Anonymous	benzene	71-43-2	E611A	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
		ethylbenzene	100-41-4	E611A	0.015	mg/kg	<0.015	<0.015	0	Diff <2x LOR	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.200	mg/kg	<0.200	<0.200	0	Diff <2x LOR	----
		styrene	100-42-5	E611A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		toluene	108-88-3	E611A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		xylene, m+p-	179601-23-1	E611A	0.030	mg/kg	<0.030	<0.030	0	Diff <2x LOR	----
		xylene, o-	95-47-6	E611A	0.030	mg/kg	<0.030	<0.030	0	Diff <2x LOR	----
Volatile Organic Compounds (QC Lot: 512025)											
KS2201752-001	Anonymous	benzene	71-43-2	E611A	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
		ethylbenzene	100-41-4	E611A	0.015	mg/kg	<0.015	<0.015	0	Diff <2x LOR	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.200	mg/kg	<0.200	<0.200	0	Diff <2x LOR	----
		styrene	100-42-5	E611A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		toluene	108-88-3	E611A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		xylene, m+p-	179601-23-1	E611A	0.030	mg/kg	<0.030	<0.030	0	Diff <2x LOR	----
		xylene, o-	95-47-6	E611A	0.030	mg/kg	<0.030	<0.030	0	Diff <2x LOR	----
Polycyclic Aromatic Hydrocarbons (QC Lot: 503542)											
VA22B1606-002	PEI-SED-02	acenaphthene	83-32-9	E641A-L	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
		acenaphthylene	208-96-8	E641A-L	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
		acridine	260-94-6	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Polycyclic Aromatic Hydrocarbons (QC Lot: 503542) - continued											
VA22B1606-002	PEI-SED-02	anthracene	120-12-7	E641A-L	0.0040	mg/kg	<0.0040	<0.0040	0	Diff <2x LOR	----
		benz(a)anthracene	56-55-3	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		benzo(a)pyrene	50-32-8	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		benzo(b+j)fluoranthene	n/a	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		benzo(g,h,i)perylene	191-24-2	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		benzo(k)fluoranthene	207-08-9	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		chrysene	218-01-9	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		dibenz(a,h)anthracene	53-70-3	E641A-L	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
		fluoranthene	206-44-0	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		fluorene	86-73-7	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		methylnaphthalene, 1-	90-12-0	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		methylnaphthalene, 2-	91-57-6	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		naphthalene	91-20-3	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		phenanthrene	85-01-8	E641A-L	0.010	mg/kg	0.013	0.013	0.0002	Diff <2x LOR	----
		pyrene	129-00-0	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		quinoline	91-22-5	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
Polycyclic Aromatic Hydrocarbons (QC Lot: 503736)											
VA22B1605-001	Anonymous	acenaphthene	83-32-9	E641A-L	0.0285	mg/kg	<0.0280	<0.0285	0	Diff <2x LOR	----
		acenaphthylene	208-96-8	E641A-L	0.0285	mg/kg	<0.0280	<0.0285	0	Diff <2x LOR	----
		acridine	260-94-6	E641A-L	0.028	mg/kg	<0.028	<0.028	0.028	Diff <2x LOR	----
		anthracene	120-12-7	E641A-L	0.0285	mg/kg	0.0317	<0.0285	0.0317	Diff <2x LOR	----
		benz(a)anthracene	56-55-3	E641A-L	0.028	mg/kg	0.056	0.033	0.023	Diff <2x LOR	----
		benzo(a)pyrene	50-32-8	E641A-L	0.028	mg/kg	0.057	0.047	0.010	Diff <2x LOR	----
		benzo(b+j)fluoranthene	n/a	E641A-L	0.028	mg/kg	0.084	0.073	0.011	Diff <2x LOR	----
		benzo(g,h,i)perylene	191-24-2	E641A-L	0.028	mg/kg	0.117	0.148	23.5%	50%	----
		benzo(k)fluoranthene	207-08-9	E641A-L	0.028	mg/kg	0.028	<0.028	0.00008	Diff <2x LOR	----
		chrysene	218-01-9	E641A-L	0.120	mg/kg	<0.100	<0.120	0.020	Diff <2x LOR	----
		dibenz(a,h)anthracene	53-70-3	E641A-L	0.0285	mg/kg	0.0434	0.0492	0.0057	Diff <2x LOR	----
		fluoranthene	206-44-0	E641A-L	0.028	mg/kg	0.114	0.061	0.054	Diff <2x LOR	----
		fluorene	86-73-7	E641A-L	0.028	mg/kg	<0.028	<0.028	0.028	Diff <2x LOR	----
		indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.028	mg/kg	0.071	0.064	0.007	Diff <2x LOR	----
		methylnaphthalene, 1-	90-12-0	E641A-L	0.028	mg/kg	<0.028	<0.028	0.028	Diff <2x LOR	----
		methylnaphthalene, 2-	91-57-6	E641A-L	0.028	mg/kg	<0.028	<0.028	0.028	Diff <2x LOR	----
		naphthalene	91-20-3	E641A-L	0.028	mg/kg	<0.028	<0.028	0.028	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Polycyclic Aromatic Hydrocarbons (QC Lot: 503736) - continued											
VA22B1605-001	Anonymous	phenanthrene	85-01-8	E641A-L	0.028	mg/kg	0.062	0.034	0.028	Diff <2x LOR	----
		pyrene	129-00-0	E641A-L	0.028	mg/kg	0.098	0.061	0.037	Diff <2x LOR	----
		quinoline	91-22-5	E641A-L	0.028	mg/kg	<0.028	<0.028	0.028	Diff <2x LOR	----

Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 503543)						
moisture	----	E144	0.25	%	<0.25	----
Physical Tests (QCLot: 503738)						
moisture	----	E144	0.25	%	<0.25	----
Metals (QCLot: 503539)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 503540)						
aluminum	7429-90-5	E440	50	mg/kg	<50	----
antimony	7440-36-0	E440	0.1	mg/kg	<0.10	----
arsenic	7440-38-2	E440	0.1	mg/kg	<0.10	----
barium	7440-39-3	E440	0.5	mg/kg	<0.50	----
beryllium	7440-41-7	E440	0.1	mg/kg	<0.10	----
bismuth	7440-69-9	E440	0.2	mg/kg	<0.20	----
boron	7440-42-8	E440	5	mg/kg	<5.0	----
cadmium	7440-43-9	E440	0.02	mg/kg	<0.020	----
calcium	7440-70-2	E440	50	mg/kg	<50	----
chromium	7440-47-3	E440	0.5	mg/kg	<0.50	----
cobalt	7440-48-4	E440	0.1	mg/kg	<0.10	----
copper	7440-50-8	E440	0.5	mg/kg	<0.50	----
iron	7439-89-6	E440	50	mg/kg	<50	----
lead	7439-92-1	E440	0.5	mg/kg	<0.50	----
lithium	7439-93-2	E440	2	mg/kg	<2.0	----
magnesium	7439-95-4	E440	20	mg/kg	<20	----
manganese	7439-96-5	E440	1	mg/kg	<1.0	----
molybdenum	7439-98-7	E440	0.1	mg/kg	<0.10	----
nickel	7440-02-0	E440	0.5	mg/kg	<0.50	----
phosphorus	7723-14-0	E440	50	mg/kg	<50	----
potassium	7440-09-7	E440	100	mg/kg	<100	----
selenium	7782-49-2	E440	0.2	mg/kg	<0.20	----
silver	7440-22-4	E440	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E440	50	mg/kg	<50	----
strontium	7440-24-6	E440	0.5	mg/kg	<0.50	----
sulfur	7704-34-9	E440	1000	mg/kg	<1000	----
thallium	7440-28-0	E440	0.05	mg/kg	<0.050	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 503540) - continued						
tin	7440-31-5	E440	2	mg/kg	<2.0	----
titanium	7440-32-6	E440	1	mg/kg	<1.0	----
tungsten	7440-33-7	E440	0.5	mg/kg	<0.50	----
uranium	7440-61-1	E440	0.05	mg/kg	<0.050	----
vanadium	7440-62-2	E440	0.2	mg/kg	<0.20	----
zinc	7440-66-6	E440	2	mg/kg	<2.0	----
zirconium	7440-67-7	E440	1	mg/kg	<1.0	----
Metals (QCLot: 503731)						
aluminum	7429-90-5	E440	50	mg/kg	<50	----
antimony	7440-36-0	E440	0.1	mg/kg	<0.10	----
arsenic	7440-38-2	E440	0.1	mg/kg	<0.10	----
barium	7440-39-3	E440	0.5	mg/kg	<0.50	----
beryllium	7440-41-7	E440	0.1	mg/kg	<0.10	----
bismuth	7440-69-9	E440	0.2	mg/kg	<0.20	----
boron	7440-42-8	E440	5	mg/kg	<5.0	----
cadmium	7440-43-9	E440	0.02	mg/kg	<0.020	----
calcium	7440-70-2	E440	50	mg/kg	<50	----
chromium	7440-47-3	E440	0.5	mg/kg	<0.50	----
cobalt	7440-48-4	E440	0.1	mg/kg	<0.10	----
copper	7440-50-8	E440	0.5	mg/kg	<0.50	----
iron	7439-89-6	E440	50	mg/kg	<50	----
lead	7439-92-1	E440	0.5	mg/kg	<0.50	----
lithium	7439-93-2	E440	2	mg/kg	<2.0	----
magnesium	7439-95-4	E440	20	mg/kg	<20	----
manganese	7439-96-5	E440	1	mg/kg	<1.0	----
molybdenum	7439-98-7	E440	0.1	mg/kg	<0.10	----
nickel	7440-02-0	E440	0.5	mg/kg	<0.50	----
phosphorus	7723-14-0	E440	50	mg/kg	<50	----
potassium	7440-09-7	E440	100	mg/kg	<100	----
selenium	7782-49-2	E440	0.2	mg/kg	<0.20	----
silver	7440-22-4	E440	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E440	50	mg/kg	<50	----
strontium	7440-24-6	E440	0.5	mg/kg	<0.50	----
sulfur	7704-34-9	E440	1000	mg/kg	<1000	----
thallium	7440-28-0	E440	0.05	mg/kg	<0.050	----
tin	7440-31-5	E440	2	mg/kg	<2.0	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 503731) - continued						
titanium	7440-32-6	E440	1	mg/kg	<1.0	----
tungsten	7440-33-7	E440	0.5	mg/kg	<0.50	----
uranium	7440-61-1	E440	0.05	mg/kg	<0.050	----
vanadium	7440-62-2	E440	0.2	mg/kg	<0.20	----
zinc	7440-66-6	E440	2	mg/kg	<2.0	----
zirconium	7440-67-7	E440	1	mg/kg	<1.0	----
Metals (QCLot: 503732)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Volatile Organic Compounds (QCLot: 511571)						
benzene	71-43-2	E611A	0.005	mg/kg	<0.0050	----
ethylbenzene	100-41-4	E611A	0.015	mg/kg	<0.015	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.04	mg/kg	<0.040	----
styrene	100-42-5	E611A	0.05	mg/kg	<0.050	----
toluene	108-88-3	E611A	0.05	mg/kg	<0.050	----
xylene, m+p-	179601-23-1	E611A	0.03	mg/kg	<0.030	----
xylene, o-	95-47-6	E611A	0.03	mg/kg	<0.030	----
Volatile Organic Compounds (QCLot: 512025)						
benzene	71-43-2	E611A	0.005	mg/kg	<0.0050	----
ethylbenzene	100-41-4	E611A	0.015	mg/kg	<0.015	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.04	mg/kg	<0.040	----
styrene	100-42-5	E611A	0.05	mg/kg	<0.050	----
toluene	108-88-3	E611A	0.05	mg/kg	<0.050	----
xylene, m+p-	179601-23-1	E611A	0.03	mg/kg	<0.030	----
xylene, o-	95-47-6	E611A	0.03	mg/kg	<0.030	----
Polycyclic Aromatic Hydrocarbons (QCLot: 503542)						
acenaphthene	83-32-9	E641A-L	0.005	mg/kg	<0.0050	----
acenaphthylene	208-96-8	E641A-L	0.005	mg/kg	<0.0050	----
acridine	260-94-6	E641A-L	0.01	mg/kg	<0.010	----
anthracene	120-12-7	E641A-L	0.004	mg/kg	<0.0040	----
benz(a)anthracene	56-55-3	E641A-L	0.01	mg/kg	<0.010	----
benzo(a)pyrene	50-32-8	E641A-L	0.01	mg/kg	<0.010	----
benzo(b+j)fluoranthene	n/a	E641A-L	0.01	mg/kg	<0.010	----
benzo(g,h,i)perylene	191-24-2	E641A-L	0.01	mg/kg	<0.010	----
benzo(k)fluoranthene	207-08-9	E641A-L	0.01	mg/kg	<0.010	----
chrysene	218-01-9	E641A-L	0.01	mg/kg	<0.010	----
dibenz(a,h)anthracene	53-70-3	E641A-L	0.005	mg/kg	<0.0050	----

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Client	: Stantec Consulting Ltd.
Project	: KSI LISIMS Sediment 123221820.500

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Polycyclic Aromatic Hydrocarbons (QCLot: 503542) - continued						
fluoranthene	206-44-0	E641A-L	0.01	mg/kg	<0.010	----
fluorene	86-73-7	E641A-L	0.01	mg/kg	<0.010	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.01	mg/kg	<0.010	----
methylnaphthalene, 1-	90-12-0	E641A-L	0.01	mg/kg	<0.010	----
methylnaphthalene, 2-	91-57-6	E641A-L	0.01	mg/kg	<0.010	----
naphthalene	91-20-3	E641A-L	0.01	mg/kg	<0.010	----
phenanthrene	85-01-8	E641A-L	0.01	mg/kg	<0.010	----
pyrene	129-00-0	E641A-L	0.01	mg/kg	<0.010	----
quinoline	91-22-5	E641A-L	0.01	mg/kg	<0.010	----
Polycyclic Aromatic Hydrocarbons (QCLot: 503736)						
acenaphthene	83-32-9	E641A-L	0.005	mg/kg	<0.0050	----
acenaphthylene	208-96-8	E641A-L	0.005	mg/kg	<0.0050	----
acridine	260-94-6	E641A-L	0.01	mg/kg	<0.010	----
anthracene	120-12-7	E641A-L	0.004	mg/kg	<0.0040	----
benz(a)anthracene	56-55-3	E641A-L	0.01	mg/kg	<0.010	----
benzo(a)pyrene	50-32-8	E641A-L	0.01	mg/kg	<0.010	----
benzo(b+j)fluoranthene	n/a	E641A-L	0.01	mg/kg	<0.010	----
benzo(g,h,i)perylene	191-24-2	E641A-L	0.01	mg/kg	<0.010	----
benzo(k)fluoranthene	207-08-9	E641A-L	0.01	mg/kg	<0.010	----
chrysene	218-01-9	E641A-L	0.01	mg/kg	<0.010	----
dibenz(a,h)anthracene	53-70-3	E641A-L	0.005	mg/kg	<0.0050	----
fluoranthene	206-44-0	E641A-L	0.01	mg/kg	<0.010	----
fluorene	86-73-7	E641A-L	0.01	mg/kg	<0.010	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.01	mg/kg	<0.010	----
methylnaphthalene, 1-	90-12-0	E641A-L	0.01	mg/kg	<0.010	----
methylnaphthalene, 2-	91-57-6	E641A-L	0.01	mg/kg	<0.010	----
naphthalene	91-20-3	E641A-L	0.01	mg/kg	<0.010	----
phenanthrene	85-01-8	E641A-L	0.01	mg/kg	<0.010	----
pyrene	129-00-0	E641A-L	0.01	mg/kg	<0.010	----
quinoline	91-22-5	E641A-L	0.01	mg/kg	<0.010	----

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Work Order	: VA22B1606
Client	: Stantec Consulting Ltd.
Project	: KSI LISIMS Sediment 123221820.500

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 503538)									
pH (1:2 soil:water)	----	E108	----	pH units	6 pH units	100	95.0	105	----
Physical Tests (QCLot: 503543)									
moisture	----	E144	0.25	%	50 %	94.8	90.0	110	----
Physical Tests (QCLot: 503734)									
pH (1:2 soil:water)	----	E108	----	pH units	6 pH units	99.5	95.0	105	----
Physical Tests (QCLot: 503738)									
moisture	----	E144	0.25	%	50 %	97.2	90.0	110	----
Metals (QCLot: 503539)									
mercury	7439-97-6	E510	0.005	mg/kg	0.1 mg/kg	113	80.0	120	----
Metals (QCLot: 503540)									
aluminum	7429-90-5	E440	50	mg/kg	200 mg/kg	106	80.0	120	----
antimony	7440-36-0	E440	0.1	mg/kg	100 mg/kg	113	80.0	120	----
arsenic	7440-38-2	E440	0.1	mg/kg	100 mg/kg	107	80.0	120	----
barium	7440-39-3	E440	0.5	mg/kg	25 mg/kg	106	80.0	120	----
beryllium	7440-41-7	E440	0.1	mg/kg	10 mg/kg	99.7	80.0	120	----
bismuth	7440-69-9	E440	0.2	mg/kg	100 mg/kg	104	80.0	120	----
boron	7440-42-8	E440	5	mg/kg	100 mg/kg	98.4	80.0	120	----
cadmium	7440-43-9	E440	0.02	mg/kg	10 mg/kg	102	80.0	120	----
calcium	7440-70-2	E440	50	mg/kg	5000 mg/kg	101	80.0	120	----
chromium	7440-47-3	E440	0.5	mg/kg	25 mg/kg	103	80.0	120	----
cobalt	7440-48-4	E440	0.1	mg/kg	25 mg/kg	102	80.0	120	----
copper	7440-50-8	E440	0.5	mg/kg	25 mg/kg	101	80.0	120	----
iron	7439-89-6	E440	50	mg/kg	100 mg/kg	101	80.0	120	----
lead	7439-92-1	E440	0.5	mg/kg	50 mg/kg	102	80.0	120	----
lithium	7439-93-2	E440	2	mg/kg	25 mg/kg	98.6	80.0	120	----
magnesium	7439-95-4	E440	20	mg/kg	5000 mg/kg	110	80.0	120	----
manganese	7439-96-5	E440	1	mg/kg	25 mg/kg	101	80.0	120	----
molybdenum	7439-98-7	E440	0.1	mg/kg	25 mg/kg	105	80.0	120	----
nickel	7440-02-0	E440	0.5	mg/kg	50 mg/kg	103	80.0	120	----
phosphorus	7723-14-0	E440	50	mg/kg	1000 mg/kg	110	80.0	120	----
potassium	7440-09-7	E440	100	mg/kg	5000 mg/kg	111	80.0	120	----
selenium	7782-49-2	E440	0.2	mg/kg	100 mg/kg	108	80.0	120	----
silver	7440-22-4	E440	0.1	mg/kg	10 mg/kg	88.7	80.0	120	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 503540) - continued									
sodium	7440-23-5	E440	50	mg/kg	5000 mg/kg	111	80.0	120	----
strontium	7440-24-6	E440	0.5	mg/kg	25 mg/kg	99.5	80.0	120	----
sulfur	7704-34-9	E440	1000	mg/kg	5000 mg/kg	110	80.0	120	----
thallium	7440-28-0	E440	0.05	mg/kg	100 mg/kg	105	80.0	120	----
tin	7440-31-5	E440	2	mg/kg	50 mg/kg	102	80.0	120	----
titanium	7440-32-6	E440	1	mg/kg	25 mg/kg	103	80.0	120	----
tungsten	7440-33-7	E440	0.5	mg/kg	10 mg/kg	102	80.0	120	----
uranium	7440-61-1	E440	0.05	mg/kg	0.5 mg/kg	100	80.0	120	----
vanadium	7440-62-2	E440	0.2	mg/kg	50 mg/kg	108	80.0	120	----
zinc	7440-66-6	E440	2	mg/kg	50 mg/kg	107	80.0	120	----
zirconium	7440-67-7	E440	1	mg/kg	10 mg/kg	105	80.0	120	----
Metals (QCLot: 503731)									
aluminum	7429-90-5	E440	50	mg/kg	200 mg/kg	101	80.0	120	----
antimony	7440-36-0	E440	0.1	mg/kg	100 mg/kg	118	80.0	120	----
arsenic	7440-38-2	E440	0.1	mg/kg	100 mg/kg	97.3	80.0	120	----
barium	7440-39-3	E440	0.5	mg/kg	25 mg/kg	97.0	80.0	120	----
beryllium	7440-41-7	E440	0.1	mg/kg	10 mg/kg	95.3	80.0	120	----
bismuth	7440-69-9	E440	0.2	mg/kg	100 mg/kg	100	80.0	120	----
boron	7440-42-8	E440	5	mg/kg	100 mg/kg	97.0	80.0	120	----
cadmium	7440-43-9	E440	0.02	mg/kg	10 mg/kg	97.8	80.0	120	----
calcium	7440-70-2	E440	50	mg/kg	5000 mg/kg	96.3	80.0	120	----
chromium	7440-47-3	E440	0.5	mg/kg	25 mg/kg	98.3	80.0	120	----
cobalt	7440-48-4	E440	0.1	mg/kg	25 mg/kg	95.4	80.0	120	----
copper	7440-50-8	E440	0.5	mg/kg	25 mg/kg	95.2	80.0	120	----
iron	7439-89-6	E440	50	mg/kg	100 mg/kg	94.3	80.0	120	----
lead	7439-92-1	E440	0.5	mg/kg	50 mg/kg	99.3	80.0	120	----
lithium	7439-93-2	E440	2	mg/kg	25 mg/kg	95.1	80.0	120	----
magnesium	7439-95-4	E440	20	mg/kg	5000 mg/kg	102	80.0	120	----
manganese	7439-96-5	E440	1	mg/kg	25 mg/kg	98.0	80.0	120	----
molybdenum	7439-98-7	E440	0.1	mg/kg	25 mg/kg	104	80.0	120	----
nickel	7440-02-0	E440	0.5	mg/kg	50 mg/kg	95.9	80.0	120	----
phosphorus	7723-14-0	E440	50	mg/kg	1000 mg/kg	101	80.0	120	----
potassium	7440-09-7	E440	100	mg/kg	5000 mg/kg	102	80.0	120	----
selenium	7782-49-2	E440	0.2	mg/kg	100 mg/kg	97.3	80.0	120	----
silver	7440-22-4	E440	0.1	mg/kg	10 mg/kg	93.8	80.0	120	----
sodium	7440-23-5	E440	50	mg/kg	5000 mg/kg	100	80.0	120	----
strontium	7440-24-6	E440	0.5	mg/kg	25 mg/kg	114	80.0	120	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 503731) - continued									
sulfur	7704-34-9	E440	1000	mg/kg	5000 mg/kg	96.0	80.0	120	----
thallium	7440-28-0	E440	0.05	mg/kg	100 mg/kg	96.4	80.0	120	----
tin	7440-31-5	E440	2	mg/kg	50 mg/kg	101	80.0	120	----
titanium	7440-32-6	E440	1	mg/kg	25 mg/kg	94.6	80.0	120	----
tungsten	7440-33-7	E440	0.5	mg/kg	10 mg/kg	92.3	80.0	120	----
uranium	7440-61-1	E440	0.05	mg/kg	0.5 mg/kg	97.2	80.0	120	----
vanadium	7440-62-2	E440	0.2	mg/kg	50 mg/kg	99.3	80.0	120	----
zinc	7440-66-6	E440	2	mg/kg	50 mg/kg	93.1	80.0	120	----
zirconium	7440-67-7	E440	1	mg/kg	10 mg/kg	97.6	80.0	120	----
Metals (QCLot: 503732)									
mercury	7439-97-6	E510	0.005	mg/kg	0.1 mg/kg	106	80.0	120	----
Volatile Organic Compounds (QCLot: 511571)									
benzene	71-43-2	E611A	0.005	mg/kg	2.5 mg/kg	95.9	70.0	130	----
ethylbenzene	100-41-4	E611A	0.015	mg/kg	2.5 mg/kg	104	70.0	130	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.04	mg/kg	2.5 mg/kg	101	70.0	130	----
styrene	100-42-5	E611A	0.05	mg/kg	2.5 mg/kg	98.5	70.0	130	----
toluene	108-88-3	E611A	0.05	mg/kg	2.5 mg/kg	106	70.0	130	----
xylene, m+p-	179601-23-1	E611A	0.03	mg/kg	5 mg/kg	109	70.0	130	----
xylene, o-	95-47-6	E611A	0.03	mg/kg	2.5 mg/kg	107	70.0	130	----
Volatile Organic Compounds (QCLot: 512025)									
benzene	71-43-2	E611A	0.005	mg/kg	2.5 mg/kg	101	70.0	130	----
ethylbenzene	100-41-4	E611A	0.015	mg/kg	2.5 mg/kg	102	70.0	130	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.04	mg/kg	2.5 mg/kg	106	70.0	130	----
styrene	100-42-5	E611A	0.05	mg/kg	2.5 mg/kg	104	70.0	130	----
toluene	108-88-3	E611A	0.05	mg/kg	2.5 mg/kg	104	70.0	130	----
xylene, m+p-	179601-23-1	E611A	0.03	mg/kg	5 mg/kg	109	70.0	130	----
xylene, o-	95-47-6	E611A	0.03	mg/kg	2.5 mg/kg	108	70.0	130	----
Polycyclic Aromatic Hydrocarbons (QCLot: 503542)									
acenaphthene	83-32-9	E641A-L	0.005	mg/kg	0.5 mg/kg	102	60.0	130	----
acenaphthylene	208-96-8	E641A-L	0.005	mg/kg	0.5 mg/kg	99.5	60.0	130	----
acridine	260-94-6	E641A-L	0.01	mg/kg	0.5 mg/kg	91.3	60.0	130	----
anthracene	120-12-7	E641A-L	0.004	mg/kg	0.5 mg/kg	108	60.0	130	----
benz(a)anthracene	56-55-3	E641A-L	0.01	mg/kg	0.5 mg/kg	97.8	60.0	130	----
benzo(a)pyrene	50-32-8	E641A-L	0.01	mg/kg	0.5 mg/kg	82.8	60.0	130	----
benzo(b+j)fluoranthene	n/a	E641A-L	0.01	mg/kg	0.5 mg/kg	87.3	60.0	130	----

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Work Order	: VA22B1606
Client	: Stantec Consulting Ltd.
Project	: KSI LISIMS Sediment 123221820.500

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Polycyclic Aromatic Hydrocarbons (QCLot: 503542) - continued									
benzo(g,h,i)perylene	191-24-2	E641A-L	0.01	mg/kg	0.5 mg/kg	89.5	60.0	130	----
benzo(k)fluoranthene	207-08-9	E641A-L	0.01	mg/kg	0.5 mg/kg	83.7	60.0	130	----
chrysene	218-01-9	E641A-L	0.01	mg/kg	0.5 mg/kg	97.8	60.0	130	----
dibenz(a,h)anthracene	53-70-3	E641A-L	0.005	mg/kg	0.5 mg/kg	90.1	60.0	130	----
fluoranthene	206-44-0	E641A-L	0.01	mg/kg	0.5 mg/kg	96.0	60.0	130	----
fluorene	86-73-7	E641A-L	0.01	mg/kg	0.5 mg/kg	102	60.0	130	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.01	mg/kg	0.5 mg/kg	89.1	60.0	130	----
methylnaphthalene, 1-	90-12-0	E641A-L	0.01	mg/kg	0.5 mg/kg	103	60.0	130	----
methylnaphthalene, 2-	91-57-6	E641A-L	0.01	mg/kg	0.5 mg/kg	104	60.0	130	----
naphthalene	91-20-3	E641A-L	0.01	mg/kg	0.5 mg/kg	105	50.0	130	----
phenanthrene	85-01-8	E641A-L	0.01	mg/kg	0.5 mg/kg	104	60.0	130	----
pyrene	129-00-0	E641A-L	0.01	mg/kg	0.5 mg/kg	98.6	60.0	130	----
quinoline	91-22-5	E641A-L	0.01	mg/kg	0.5 mg/kg	94.7	60.0	130	----
Polycyclic Aromatic Hydrocarbons (QCLot: 503736)									
acenaphthene	83-32-9	E641A-L	0.005	mg/kg	0.5 mg/kg	97.6	60.0	130	----
acenaphthylene	208-96-8	E641A-L	0.005	mg/kg	0.5 mg/kg	94.0	60.0	130	----
acridine	260-94-6	E641A-L	0.01	mg/kg	0.5 mg/kg	88.3	60.0	130	----
anthracene	120-12-7	E641A-L	0.004	mg/kg	0.5 mg/kg	105	60.0	130	----
benz(a)anthracene	56-55-3	E641A-L	0.01	mg/kg	0.5 mg/kg	98.5	60.0	130	----
benzo(a)pyrene	50-32-8	E641A-L	0.01	mg/kg	0.5 mg/kg	84.4	60.0	130	----
benzo(b+j)fluoranthene	n/a	E641A-L	0.01	mg/kg	0.5 mg/kg	88.2	60.0	130	----
benzo(g,h,i)perylene	191-24-2	E641A-L	0.01	mg/kg	0.5 mg/kg	86.2	60.0	130	----
benzo(k)fluoranthene	207-08-9	E641A-L	0.01	mg/kg	0.5 mg/kg	86.5	60.0	130	----
chrysene	218-01-9	E641A-L	0.01	mg/kg	0.5 mg/kg	98.0	60.0	130	----
dibenz(a,h)anthracene	53-70-3	E641A-L	0.005	mg/kg	0.5 mg/kg	89.8	60.0	130	----
fluoranthene	206-44-0	E641A-L	0.01	mg/kg	0.5 mg/kg	97.8	60.0	130	----
fluorene	86-73-7	E641A-L	0.01	mg/kg	0.5 mg/kg	98.9	60.0	130	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.01	mg/kg	0.5 mg/kg	88.6	60.0	130	----
methylnaphthalene, 1-	90-12-0	E641A-L	0.01	mg/kg	0.5 mg/kg	91.0	60.0	130	----
methylnaphthalene, 2-	91-57-6	E641A-L	0.01	mg/kg	0.5 mg/kg	92.3	60.0	130	----
naphthalene	91-20-3	E641A-L	0.01	mg/kg	0.5 mg/kg	85.9	50.0	130	----
phenanthrene	85-01-8	E641A-L	0.01	mg/kg	0.5 mg/kg	103	60.0	130	----
pyrene	129-00-0	E641A-L	0.01	mg/kg	0.5 mg/kg	98.9	60.0	130	----
quinoline	91-22-5	E641A-L	0.01	mg/kg	0.5 mg/kg	89.0	60.0	130	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Soil/Solid**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 511571)										
FJ2201412-001	Anonymous	benzene	71-43-2	E611A	2.32 mg/kg	3.125 mg/kg	93.0	60.0	140	----
		ethylbenzene	100-41-4	E611A	2.45 mg/kg	3.125 mg/kg	98.3	60.0	140	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	2.42 mg/kg	3.125 mg/kg	97.1	60.0	140	----
		styrene	100-42-5	E611A	2.35 mg/kg	3.125 mg/kg	94.1	60.0	140	----
		toluene	108-88-3	E611A	2.48 mg/kg	3.125 mg/kg	99.3	60.0	140	----
		xylene, m+p-	179601-23-1	E611A	5.01 mg/kg	6.25 mg/kg	100	60.0	140	----
		xylene, o-	95-47-6	E611A	2.49 mg/kg	3.125 mg/kg	99.7	60.0	140	----
Volatile Organic Compounds (QCLot: 512025)										
KS2201752-001	Anonymous	benzene	71-43-2	E611A	2.46 mg/kg	3.125 mg/kg	97.6	60.0	140	----
		ethylbenzene	100-41-4	E611A	2.55 mg/kg	3.125 mg/kg	101	60.0	140	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	2.54 mg/kg	3.125 mg/kg	101	60.0	140	----
		styrene	100-42-5	E611A	2.44 mg/kg	3.125 mg/kg	97.1	60.0	140	----
		toluene	108-88-3	E611A	2.60 mg/kg	3.125 mg/kg	103	60.0	140	----
		xylene, m+p-	179601-23-1	E611A	5.40 mg/kg	6.25 mg/kg	107	60.0	140	----
		xylene, o-	95-47-6	E611A	2.59 mg/kg	3.125 mg/kg	103	60.0	140	----
Polycyclic Aromatic Hydrocarbons (QCLot: 503542)										
VA22B1606-010	PEI-SED-10	acenaphthene	83-32-9	E641A-L	0.364 mg/kg	0.5 mg/kg	97.0	50.0	140	----
		acenaphthylene	208-96-8	E641A-L	0.360 mg/kg	0.5 mg/kg	95.9	50.0	140	----
		acridine	260-94-6	E641A-L	0.325 mg/kg	0.5 mg/kg	86.5	50.0	140	----
		anthracene	120-12-7	E641A-L	0.383 mg/kg	0.5 mg/kg	102	50.0	140	----
		benz(a)anthracene	56-55-3	E641A-L	0.333 mg/kg	0.5 mg/kg	88.8	50.0	140	----
		benzo(a)pyrene	50-32-8	E641A-L	0.256 mg/kg	0.5 mg/kg	68.2	50.0	140	----
		benzo(b+j)fluoranthene	n/a	E641A-L	0.287 mg/kg	0.5 mg/kg	76.5	50.0	140	----
		benzo(g,h,i)perylene	191-24-2	E641A-L	0.245 mg/kg	0.5 mg/kg	65.2	50.0	140	----
		benzo(k)fluoranthene	207-08-9	E641A-L	0.274 mg/kg	0.5 mg/kg	73.1	50.0	140	----
		chrysene	218-01-9	E641A-L	0.335 mg/kg	0.5 mg/kg	89.1	50.0	140	----
		dibenz(a,h)anthracene	53-70-3	E641A-L	0.267 mg/kg	0.5 mg/kg	71.0	50.0	140	----
		fluoranthene	206-44-0	E641A-L	0.346 mg/kg	0.5 mg/kg	92.1	50.0	140	----
		fluorene	86-73-7	E641A-L	0.365 mg/kg	0.5 mg/kg	97.2	50.0	140	----
		indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.236 mg/kg	0.5 mg/kg	62.7	50.0	140	----
		methylnaphthalene, 1-	90-12-0	E641A-L	0.363 mg/kg	0.5 mg/kg	96.7	50.0	140	----
		methylnaphthalene, 2-	91-57-6	E641A-L	0.370 mg/kg	0.5 mg/kg	98.5	50.0	140	----

Sub-Matrix: **Soil/Solid**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Polycyclic Aromatic Hydrocarbons (QCLot: 503542) - continued										
VA22B1606-010	PEI-SED-10	naphthalene	91-20-3	E641A-L	0.373 mg/kg	0.5 mg/kg	99.2	50.0	140	----
		phenanthrene	85-01-8	E641A-L	0.376 mg/kg	0.5 mg/kg	100	50.0	140	----
		pyrene	129-00-0	E641A-L	0.353 mg/kg	0.5 mg/kg	94.0	50.0	140	----
		quinoline	91-22-5	E641A-L	0.339 mg/kg	0.5 mg/kg	90.2	50.0	140	----
Polycyclic Aromatic Hydrocarbons (QCLot: 503736)										
VA22B1605-002	Anonymous	acenaphthene	83-32-9	E641A-L	0.373 mg/kg	0.5 mg/kg	96.3	50.0	140	----
		acenaphthylene	208-96-8	E641A-L	0.361 mg/kg	0.5 mg/kg	93.4	50.0	140	----
		acridine	260-94-6	E641A-L	0.266 mg/kg	0.5 mg/kg	68.7	50.0	140	----
		anthracene	120-12-7	E641A-L	0.372 mg/kg	0.5 mg/kg	96.2	50.0	140	----
		benz(a)anthracene	56-55-3	E641A-L	0.341 mg/kg	0.5 mg/kg	88.1	50.0	140	----
		benzo(a)pyrene	50-32-8	E641A-L	0.300 mg/kg	0.5 mg/kg	77.4	50.0	140	----
		benzo(b+j)fluoranthene	n/a	E641A-L	0.326 mg/kg	0.5 mg/kg	84.2	50.0	140	----
		benzo(g,h,i)perylene	191-24-2	E641A-L	0.393 mg/kg	0.5 mg/kg	102	50.0	140	----
		benzo(k)fluoranthene	207-08-9	E641A-L	0.286 mg/kg	0.5 mg/kg	74.1	50.0	140	----
		chrysene	218-01-9	E641A-L	0.382 mg/kg	0.5 mg/kg	98.7	50.0	140	----
		dibenz(a,h)anthracene	53-70-3	E641A-L	0.324 mg/kg	0.5 mg/kg	83.8	50.0	140	----
		fluoranthene	206-44-0	E641A-L	0.350 mg/kg	0.5 mg/kg	90.4	50.0	140	----
		fluorene	86-73-7	E641A-L	0.377 mg/kg	0.5 mg/kg	97.5	50.0	140	----
		indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.338 mg/kg	0.5 mg/kg	87.4	50.0	140	----
		methylnaphthalene, 1-	90-12-0	E641A-L	0.356 mg/kg	0.5 mg/kg	92.1	50.0	140	----
		methylnaphthalene, 2-	91-57-6	E641A-L	0.351 mg/kg	0.5 mg/kg	90.6	50.0	140	----
		naphthalene	91-20-3	E641A-L	0.352 mg/kg	0.5 mg/kg	91.1	50.0	140	----
		phenanthrene	85-01-8	E641A-L	0.379 mg/kg	0.5 mg/kg	97.9	50.0	140	----
		pyrene	129-00-0	E641A-L	0.352 mg/kg	0.5 mg/kg	90.9	50.0	140	----
		quinoline	91-22-5	E641A-L	0.275 mg/kg	0.5 mg/kg	71.0	50.0	140	----

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Work Order	: VA22B1606
Client	: Stantec Consulting Ltd.
Project	: KSI LISIMS Sediment 123221820.500

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 503539)									
	SCP SS-2	mercury	7439-97-6	E510	0.059 mg/kg	108	70.0	130	----
Metals (QCLot: 503540)									
	SCP SS-2	aluminum	7429-90-5	E440	9817 mg/kg	121	70.0	130	----
	SCP SS-2	antimony	7440-36-0	E440	3.99 mg/kg	108	70.0	130	----
	SCP SS-2	arsenic	7440-38-2	E440	3.73 mg/kg	106	70.0	130	----
	SCP SS-2	barium	7440-39-3	E440	105 mg/kg	103	70.0	130	----
	SCP SS-2	beryllium	7440-41-7	E440	0.349 mg/kg	112	70.0	130	----
	SCP SS-2	boron	7440-42-8	E440	8.5 mg/kg	125	40.0	160	----
	SCP SS-2	cadmium	7440-43-9	E440	0.91 mg/kg	101	70.0	130	----
	SCP SS-2	calcium	7440-70-2	E440	31082 mg/kg	107	70.0	130	----
	SCP SS-2	chromium	7440-47-3	E440	101 mg/kg	115	70.0	130	----
	SCP SS-2	cobalt	7440-48-4	E440	6.9 mg/kg	108	70.0	130	----
	SCP SS-2	copper	7440-50-8	E440	123 mg/kg	104	70.0	130	----
	SCP SS-2	iron	7439-89-6	E440	23558 mg/kg	108	70.0	130	----
	SCP SS-2	lead	7439-92-1	E440	267 mg/kg	104	70.0	130	----
	SCP SS-2	lithium	7439-93-2	E440	9.5 mg/kg	108	70.0	130	----
	SCP SS-2	magnesium	7439-95-4	E440	5509 mg/kg	112	70.0	130	----
	SCP SS-2	manganese	7439-96-5	E440	269 mg/kg	111	70.0	130	----
	SCP SS-2	molybdenum	7439-98-7	E440	1.03 mg/kg	101	70.0	130	----
	SCP SS-2	nickel	7440-02-0	E440	26.7 mg/kg	108	70.0	130	----
	SCP SS-2	phosphorus	7723-14-0	E440	752 mg/kg	112	70.0	130	----
	SCP SS-2	potassium	7440-09-7	E440	1587 mg/kg	118	70.0	130	----
	SCP SS-2	sodium	7440-23-5	E440	797 mg/kg	112	70.0	130	----
	SCP SS-2	strontium	7440-24-6	E440	86.1 mg/kg	104	70.0	130	----
	SCP SS-2	thallium	7440-28-0	E440	0.0786 mg/kg	104	40.0	160	----
	SCP SS-2	tin	7440-31-5	E440	10.6 mg/kg	100	70.0	130	----
	SCP SS-2	titanium	7440-32-6	E440	839 mg/kg	124	70.0	130	----
	SCP SS-2	uranium	7440-61-1	E440	0.52 mg/kg	104	70.0	130	----
	SCP SS-2	vanadium	7440-62-2	E440	32.7 mg/kg	114	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 503540) - continued									
	SCP SS-2	zinc	7440-66-6	E440	297 mg/kg	108	70.0	130	----
	SCP SS-2	zirconium	7440-67-7	E440	5.73 mg/kg	92.6	70.0	130	----
Metals (QCLot: 503731)									
	SCP SS-2	aluminum	7429-90-5	E440	9817 mg/kg	104	70.0	130	----
	SCP SS-2	antimony	7440-36-0	E440	3.99 mg/kg	115	70.0	130	----
	SCP SS-2	arsenic	7440-38-2	E440	3.73 mg/kg	106	70.0	130	----
	SCP SS-2	barium	7440-39-3	E440	105 mg/kg	101	70.0	130	----
	SCP SS-2	beryllium	7440-41-7	E440	0.349 mg/kg	105	70.0	130	----
	SCP SS-2	boron	7440-42-8	E440	8.5 mg/kg	119	40.0	160	----
	SCP SS-2	cadmium	7440-43-9	E440	0.91 mg/kg	111	70.0	130	----
	SCP SS-2	calcium	7440-70-2	E440	31082 mg/kg	104	70.0	130	----
	SCP SS-2	chromium	7440-47-3	E440	101 mg/kg	104	70.0	130	----
	SCP SS-2	cobalt	7440-48-4	E440	6.9 mg/kg	103	70.0	130	----
	SCP SS-2	copper	7440-50-8	E440	123 mg/kg	103	70.0	130	----
	SCP SS-2	iron	7439-89-6	E440	23558 mg/kg	103	70.0	130	----
	SCP SS-2	lead	7439-92-1	E440	267 mg/kg	108	70.0	130	----
	SCP SS-2	lithium	7439-93-2	E440	9.5 mg/kg	103	70.0	130	----
	SCP SS-2	magnesium	7439-95-4	E440	5509 mg/kg	107	70.0	130	----
	SCP SS-2	manganese	7439-96-5	E440	269 mg/kg	105	70.0	130	----
	SCP SS-2	molybdenum	7439-98-7	E440	1.03 mg/kg	117	70.0	130	----
	SCP SS-2	nickel	7440-02-0	E440	26.7 mg/kg	102	70.0	130	----
	SCP SS-2	phosphorus	7723-14-0	E440	752 mg/kg	105	70.0	130	----
	SCP SS-2	potassium	7440-09-7	E440	1587 mg/kg	108	70.0	130	----
	SCP SS-2	sodium	7440-23-5	E440	797 mg/kg	102	70.0	130	----
	SCP SS-2	strontium	7440-24-6	E440	86.1 mg/kg	112	70.0	130	----
	SCP SS-2	thallium	7440-28-0	E440	0.0786 mg/kg	102	40.0	160	----
	SCP SS-2	tin	7440-31-5	E440	10.6 mg/kg	106	70.0	130	----
	SCP SS-2	titanium	7440-32-6	E440	839 mg/kg	108	70.0	130	----
	SCP SS-2	uranium	7440-61-1	E440	0.52 mg/kg	104	70.0	130	----
	SCP SS-2	vanadium	7440-62-2	E440	32.7 mg/kg	104	70.0	130	----
	SCP SS-2	zinc	7440-66-6	E440	297 mg/kg	97.5	70.0	130	----
	SCP SS-2	zirconium	7440-67-7	E440	5.73 mg/kg	91.9	70.0	130	----
Metals (QCLot: 503732)									

Sub-Matrix:

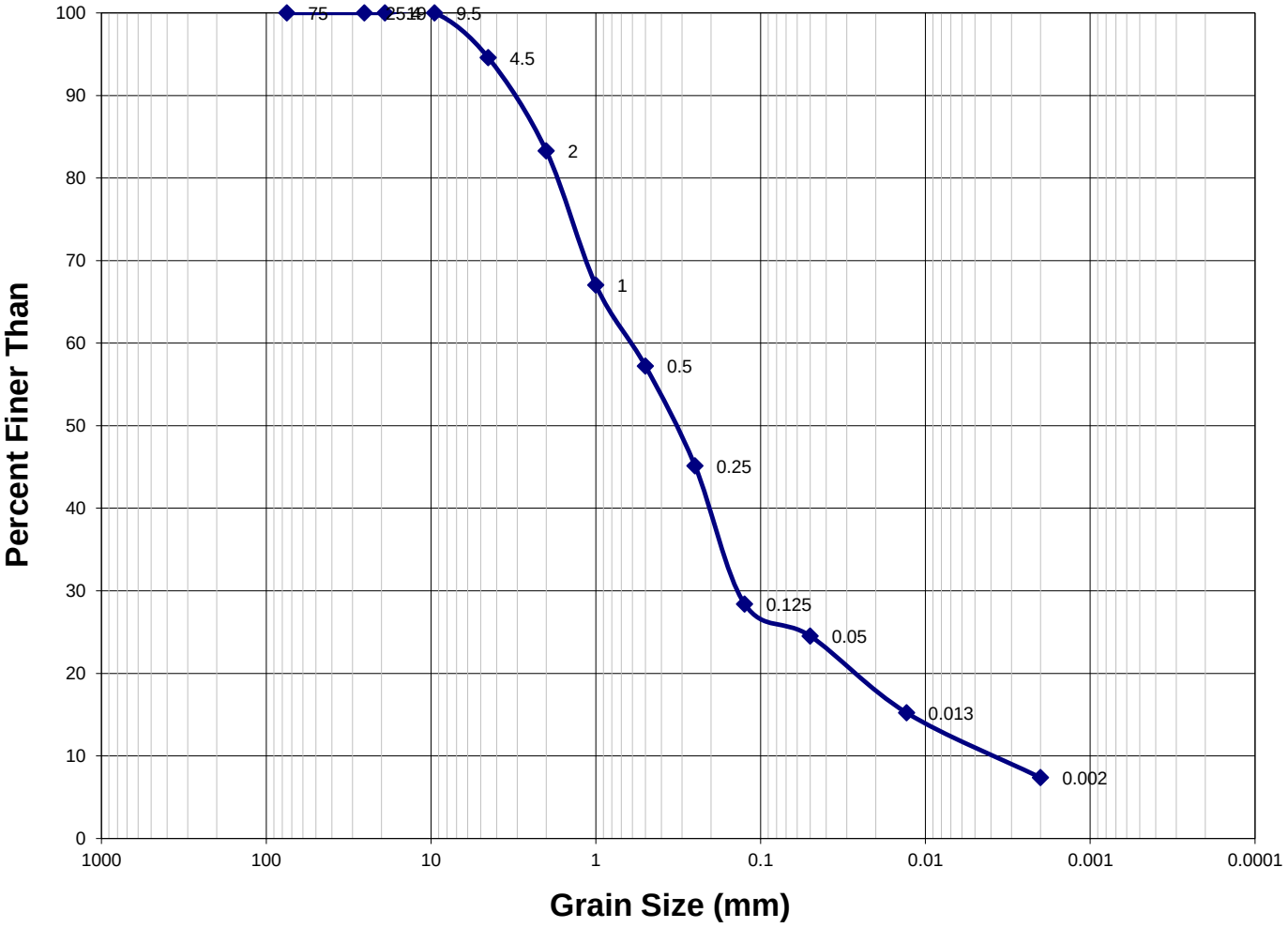
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 503732) - continued									
	SCP SS-2	mercury	7439-97-6	E510	0.059 mg/kg	105	70.0	130	----

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: STAC100
Project:
Sample ID: PEI-SED-01
Lab ID: VA22B1606001

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	5
Coarse Sand	2.0mm - 4.75mm	12
Medium Sand	0.425mm - 2.0mm	26
Fine Sand	0.075mm - 0.425mm	31
Fines	< 0.075mm	26

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	17
Sand	0.05mm - 2mm	59
Silt	0.002mm - 0.05mm	17
Clay	< 0.002mm	7

Texture Sample contains material greater than 4.75mm. T

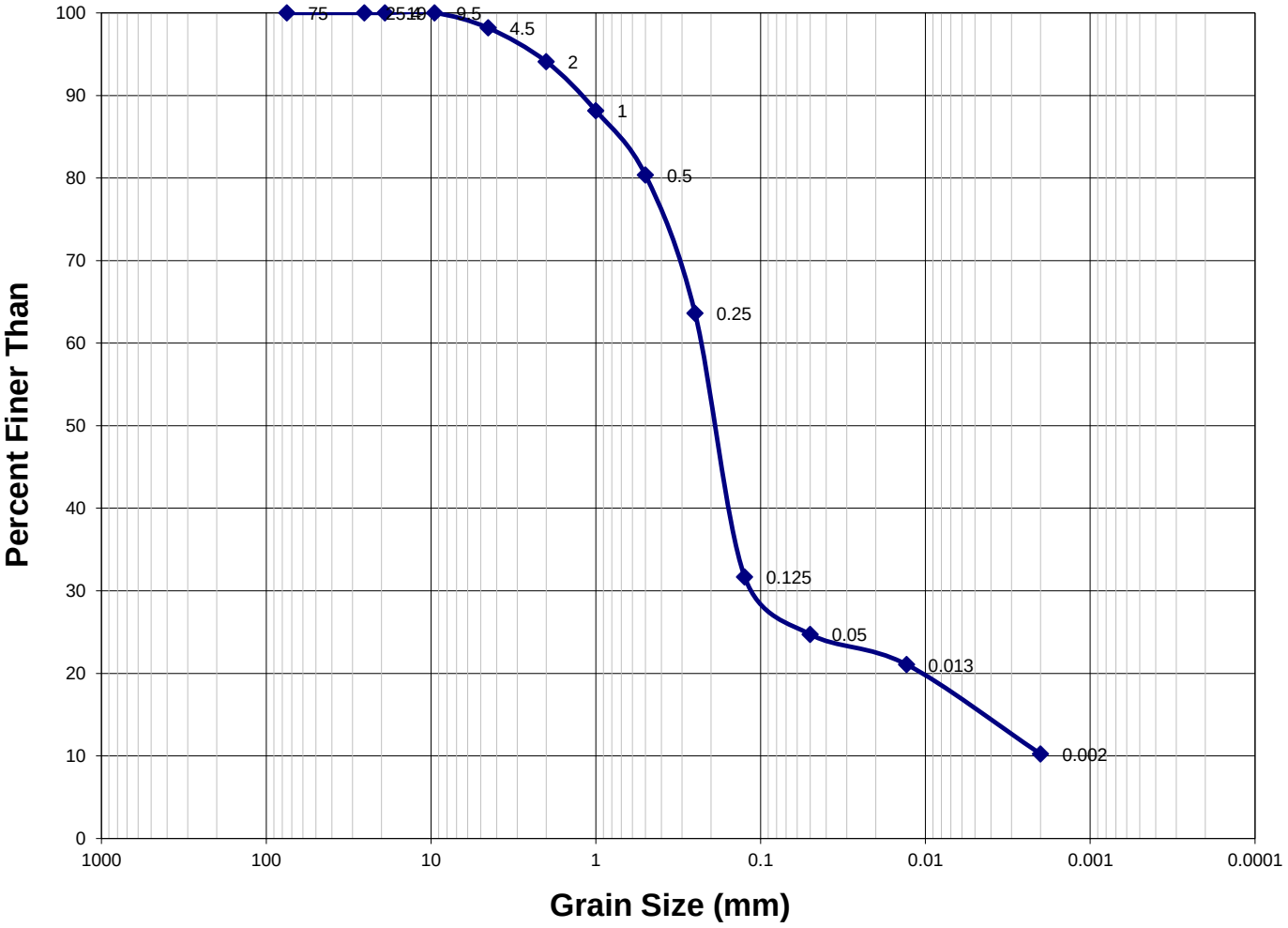
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: STAC100
Project:
Sample ID: PEI-SED-02
Lab ID: VA22B1606002

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	2
Coarse Sand	2.0mm - 4.75mm	4
Medium Sand	0.425mm - 2.0mm	14
Fine Sand	0.075mm - 0.425mm	53
Fines	< 0.075mm	27

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	6
Sand	0.05mm - 2mm	69
Silt	0.002mm - 0.05mm	14
Clay	< 0.002mm	10

Texture Sample contains material greater than 4.75mm. T

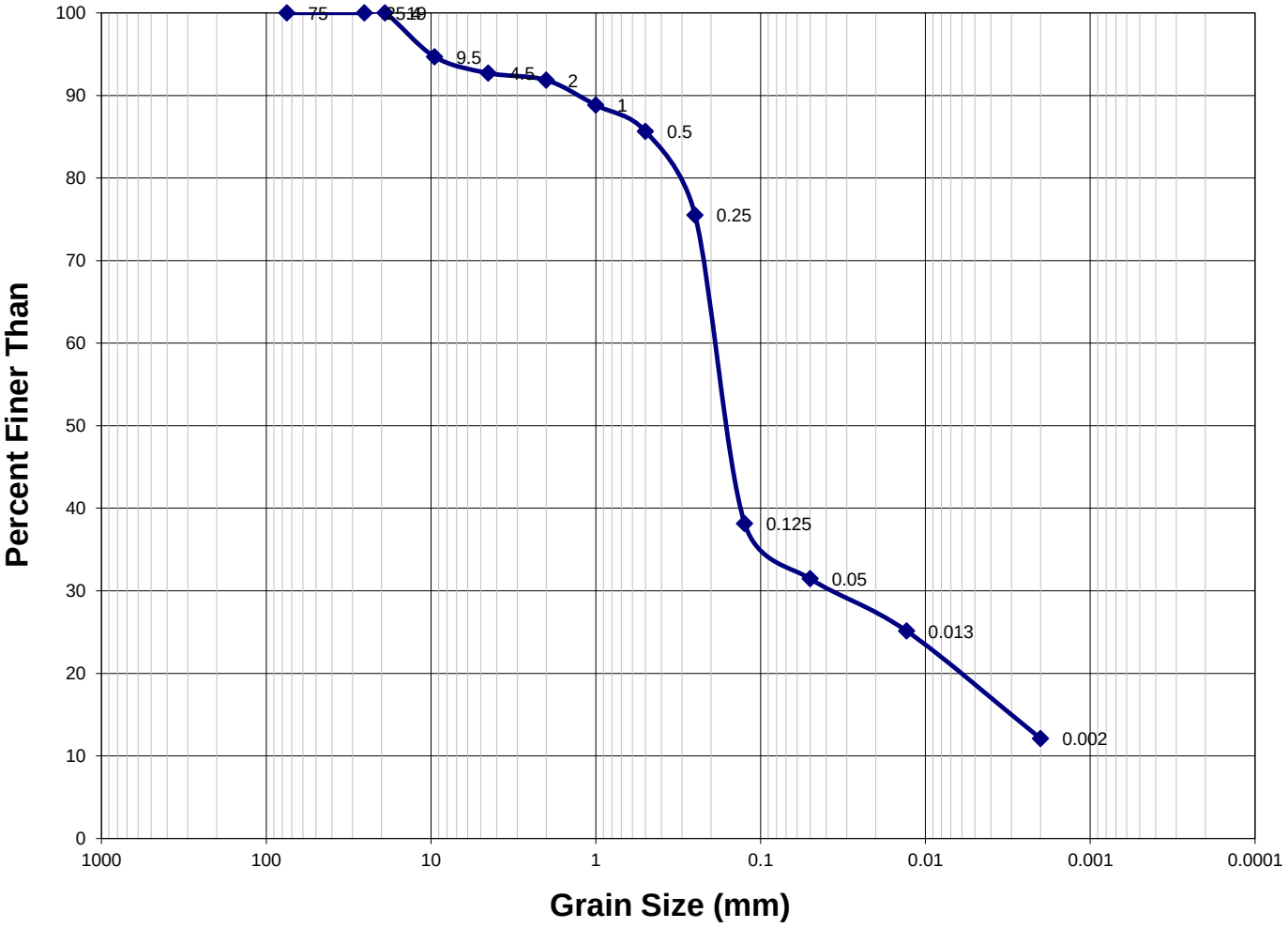
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: STAC100
Project:
Sample ID: PEI-SED-03
Lab ID: VA22B1606003

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	7
Coarse Sand	2.0mm - 4.75mm	1
Medium Sand	0.425mm - 2.0mm	6
Fine Sand	0.075mm - 0.425mm	52
Fines	< 0.075mm	34

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	8
Sand	0.05mm - 2mm	60
Silt	0.002mm - 0.05mm	19
Clay	< 0.002mm	12

Texture Sample contains material greater than 4.75mm. T

Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
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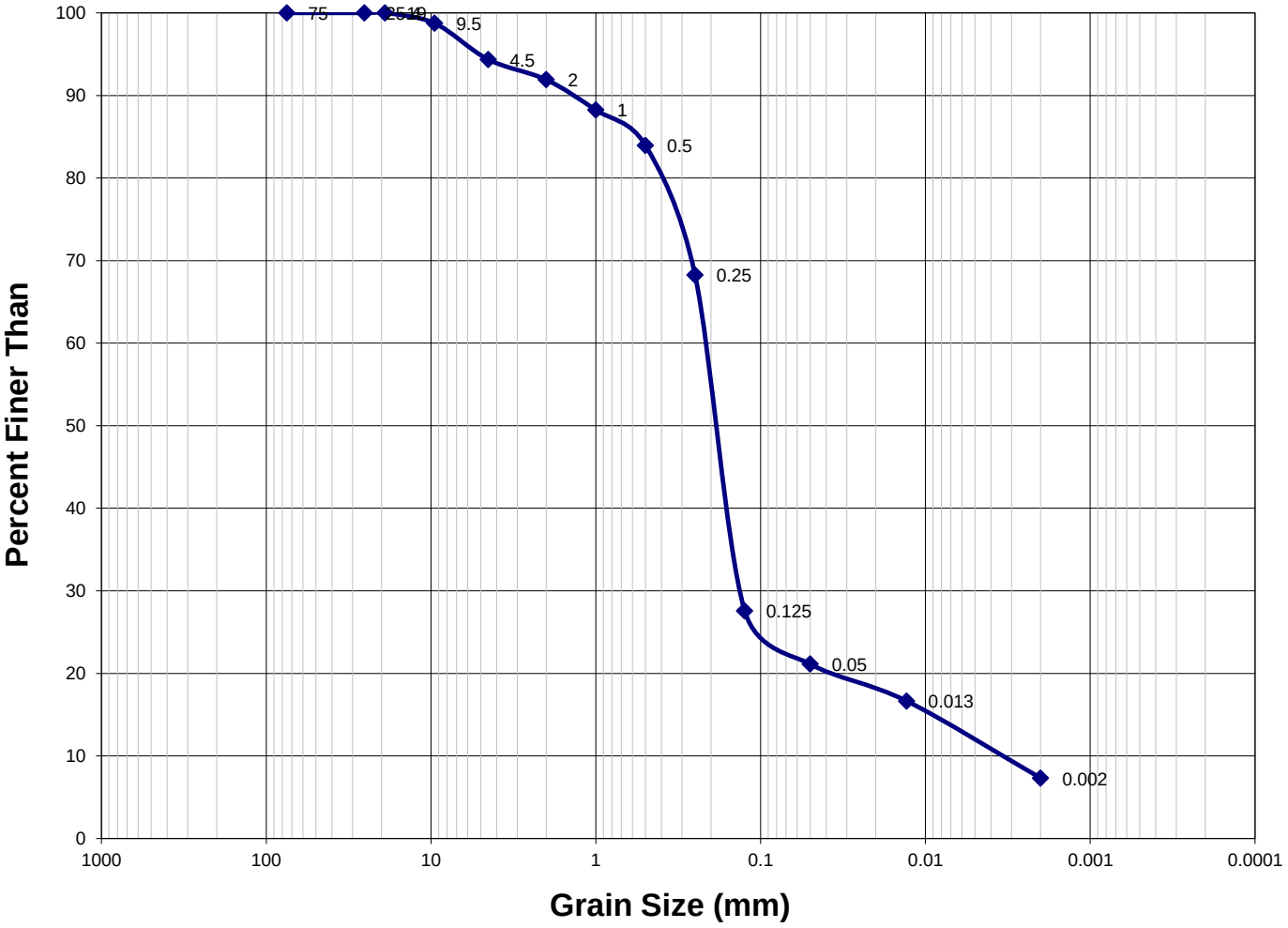
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: STAC100
Project:
Sample ID: PEI-SED-04
Lab ID: VA22B1606004

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	5
Coarse Sand	2.0mm - 4.75mm	3
Medium Sand	0.425mm - 2.0mm	8
Fine Sand	0.075mm - 0.425mm	61
Fines	< 0.075mm	23

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	8
Sand	0.05mm - 2mm	71
Silt	0.002mm - 0.05mm	14
Clay	< 0.002mm	7

Texture Sample contains material greater than 4.75mm. T

Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

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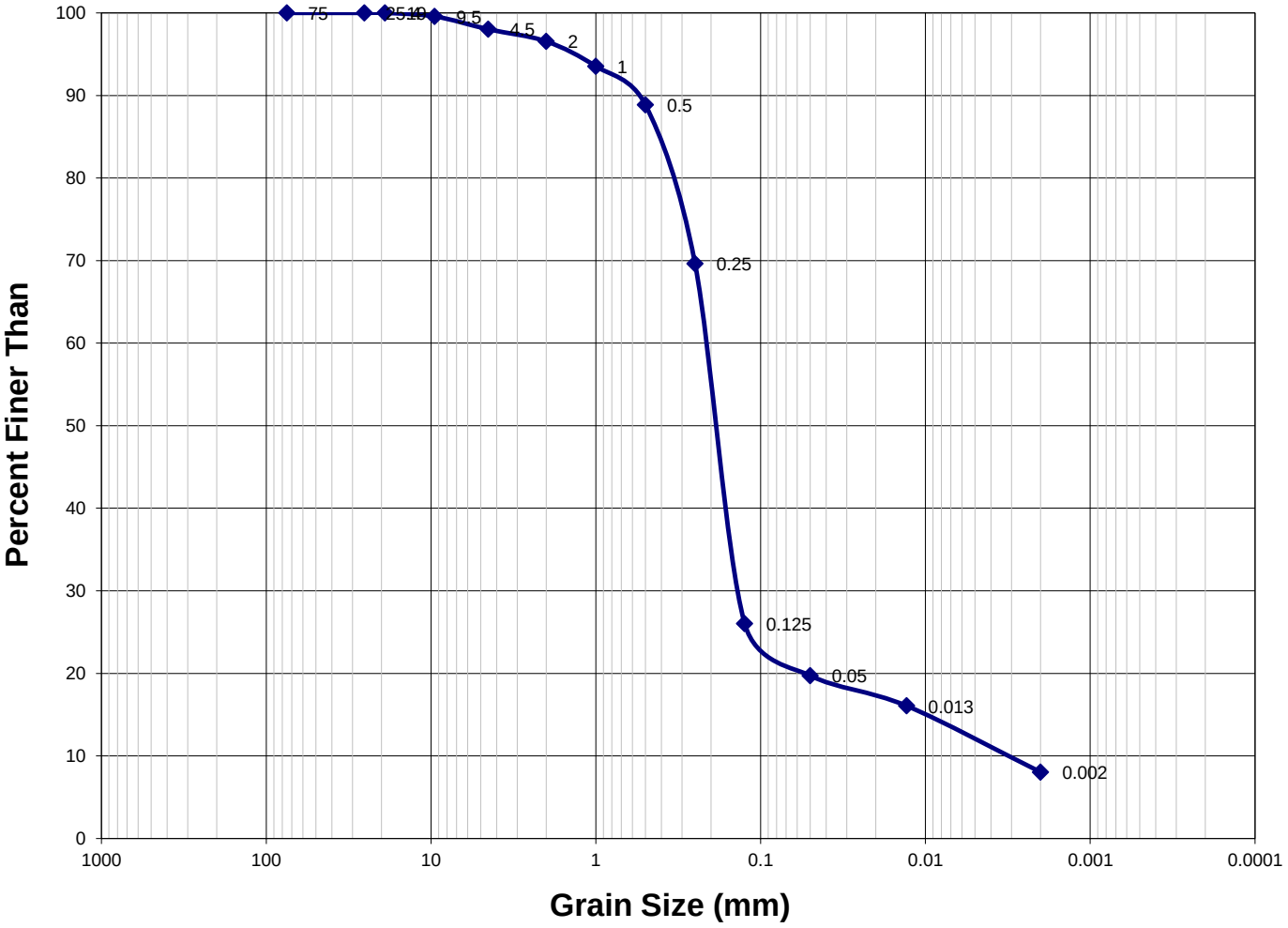
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: STAC100
Project:
Sample ID: PEI-SED-05
Lab ID: VA22B1606005

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	2
Coarse Sand	2.0mm - 4.75mm	2
Medium Sand	0.425mm - 2.0mm	8
Fine Sand	0.075mm - 0.425mm	67
Fines	< 0.075mm	22

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	3
Sand	0.05mm - 2mm	77
Silt	0.002mm - 0.05mm	12
Clay	< 0.002mm	8

Texture Sample contains material greater than 4.75mm. T

Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

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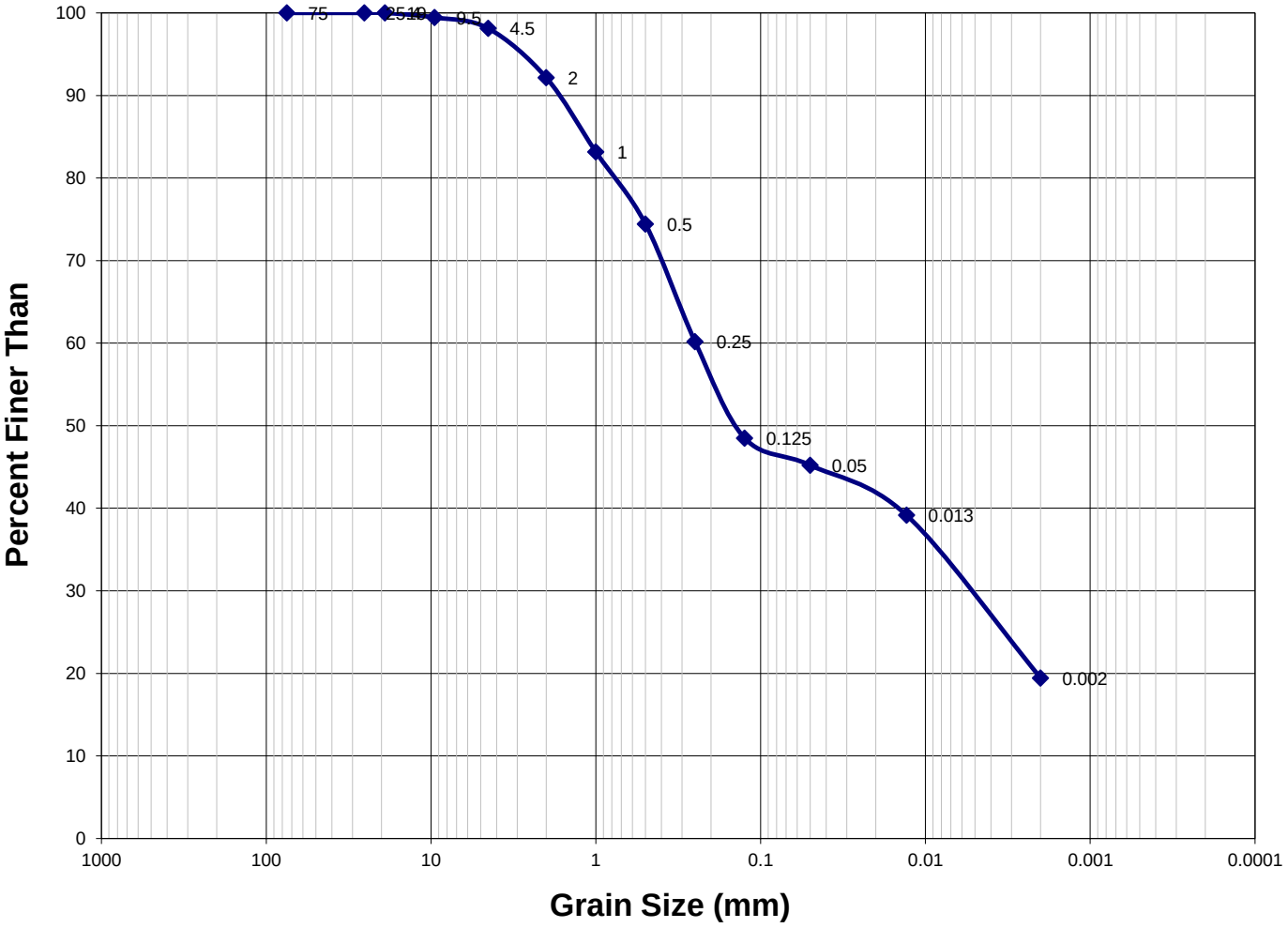
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: STAC100
Project:
Sample ID: PEI-SED-06
Lab ID: VA22B1606006

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	2
Coarse Sand	2.0mm - 4.75mm	6
Medium Sand	0.425mm - 2.0mm	18
Fine Sand	0.075mm - 0.425mm	28
Fines	< 0.075mm	46

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	8
Sand	0.05mm - 2mm	47
Silt	0.002mm - 0.05mm	26
Clay	< 0.002mm	19

Texture Sample contains material greater than 4.75mm. T

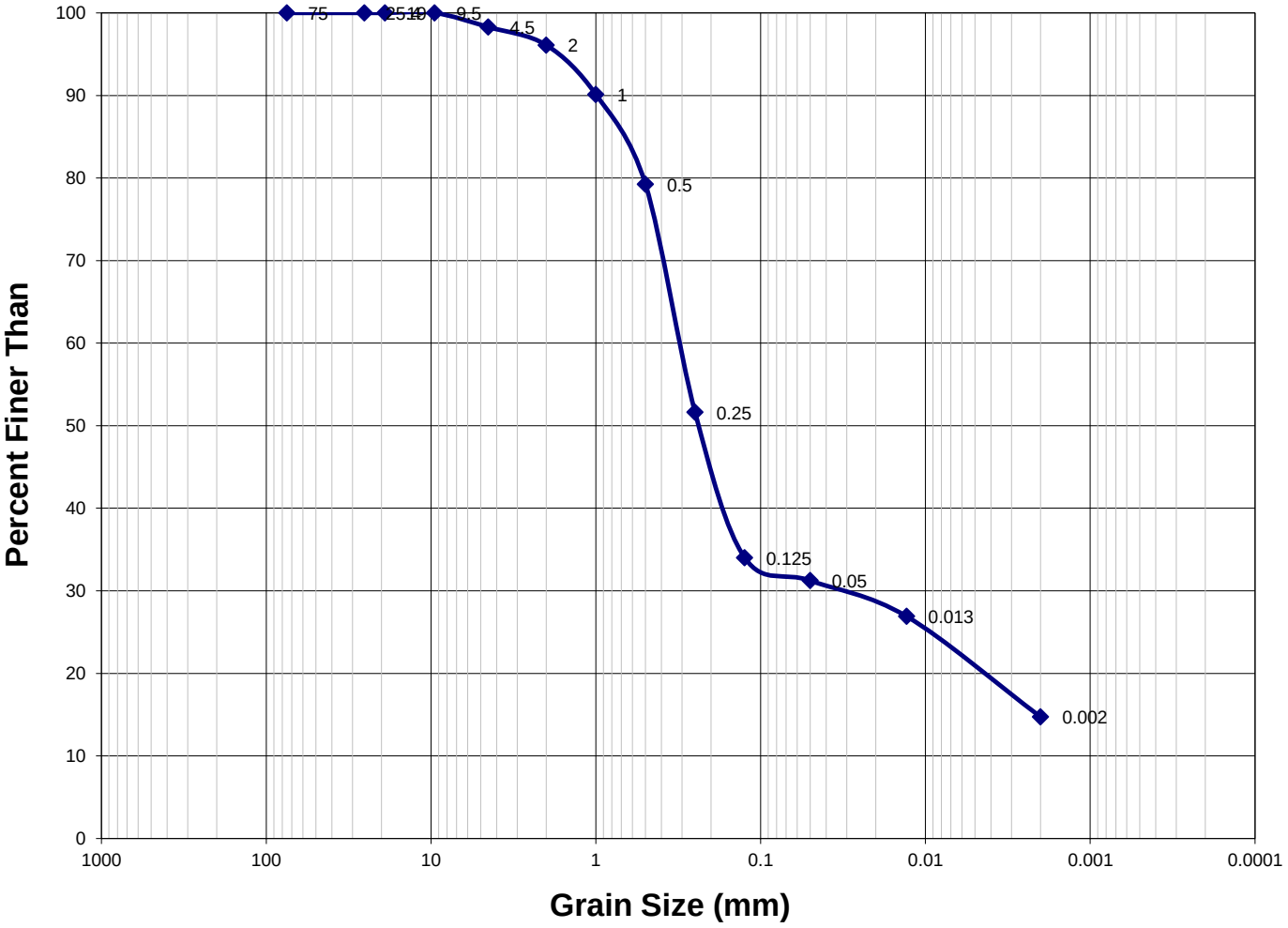
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: STAC100
Project:
Sample ID: PEI-SED-07
Lab ID: VA22B1606007

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	2
Coarse Sand	2.0mm - 4.75mm	2
Medium Sand	0.425mm - 2.0mm	17
Fine Sand	0.075mm - 0.425mm	47
Fines	< 0.075mm	32

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	4
Sand	0.05mm - 2mm	65
Silt	0.002mm - 0.05mm	17
Clay	< 0.002mm	15

Texture Sample contains material greater than 4.75mm. T

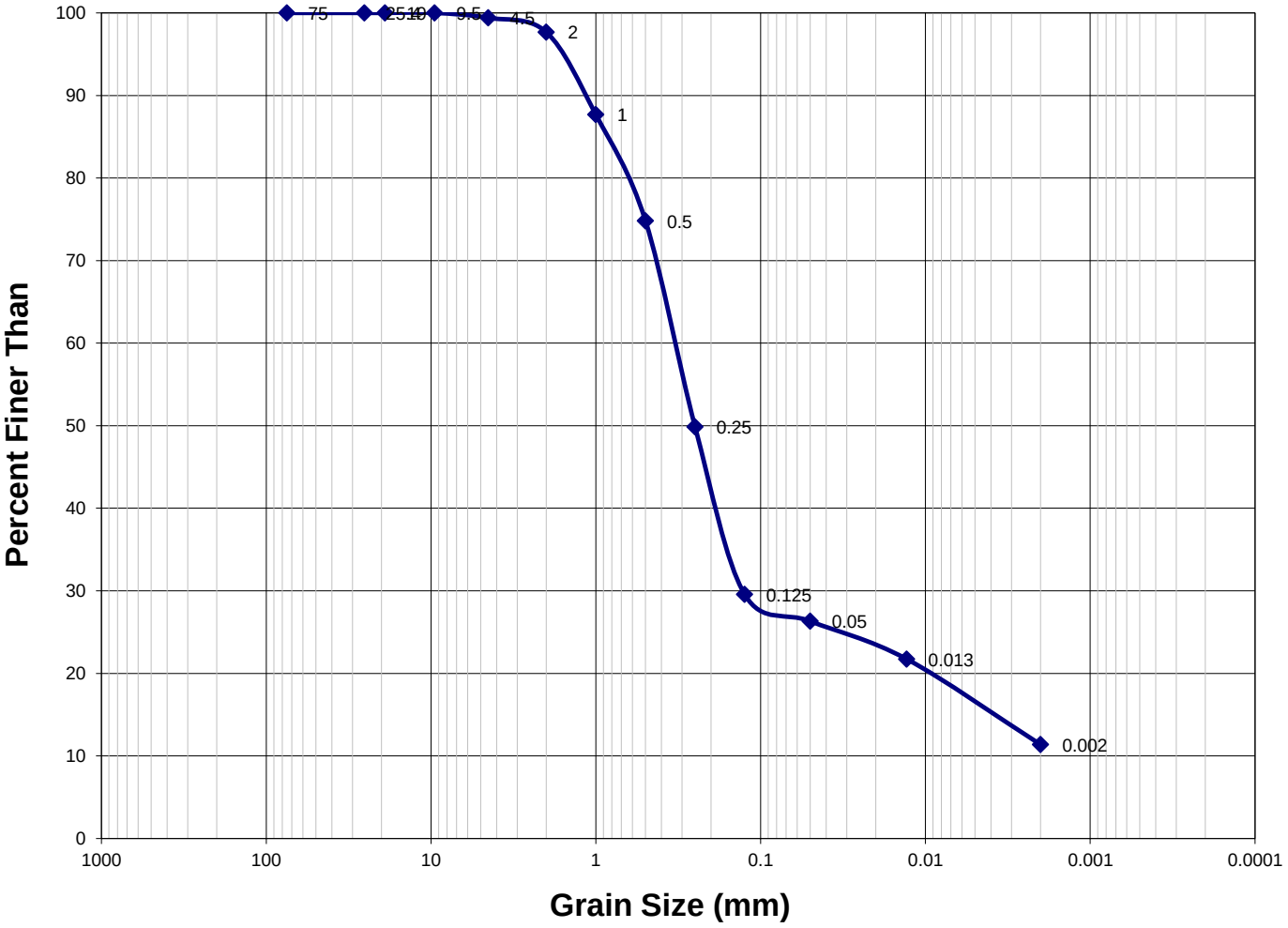
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: STAC100
Project:
Sample ID: PEI-SED-08
Lab ID: VA22B1606008

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	1
Coarse Sand	2.0mm - 4.75mm	2
Medium Sand	0.425mm - 2.0mm	23
Fine Sand	0.075mm - 0.425mm	47
Fines	< 0.075mm	27

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	2
Sand	0.05mm - 2mm	71
Silt	0.002mm - 0.05mm	15
Clay	< 0.002mm	11

Texture Sample contains material greater than 4.75mm. T

Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

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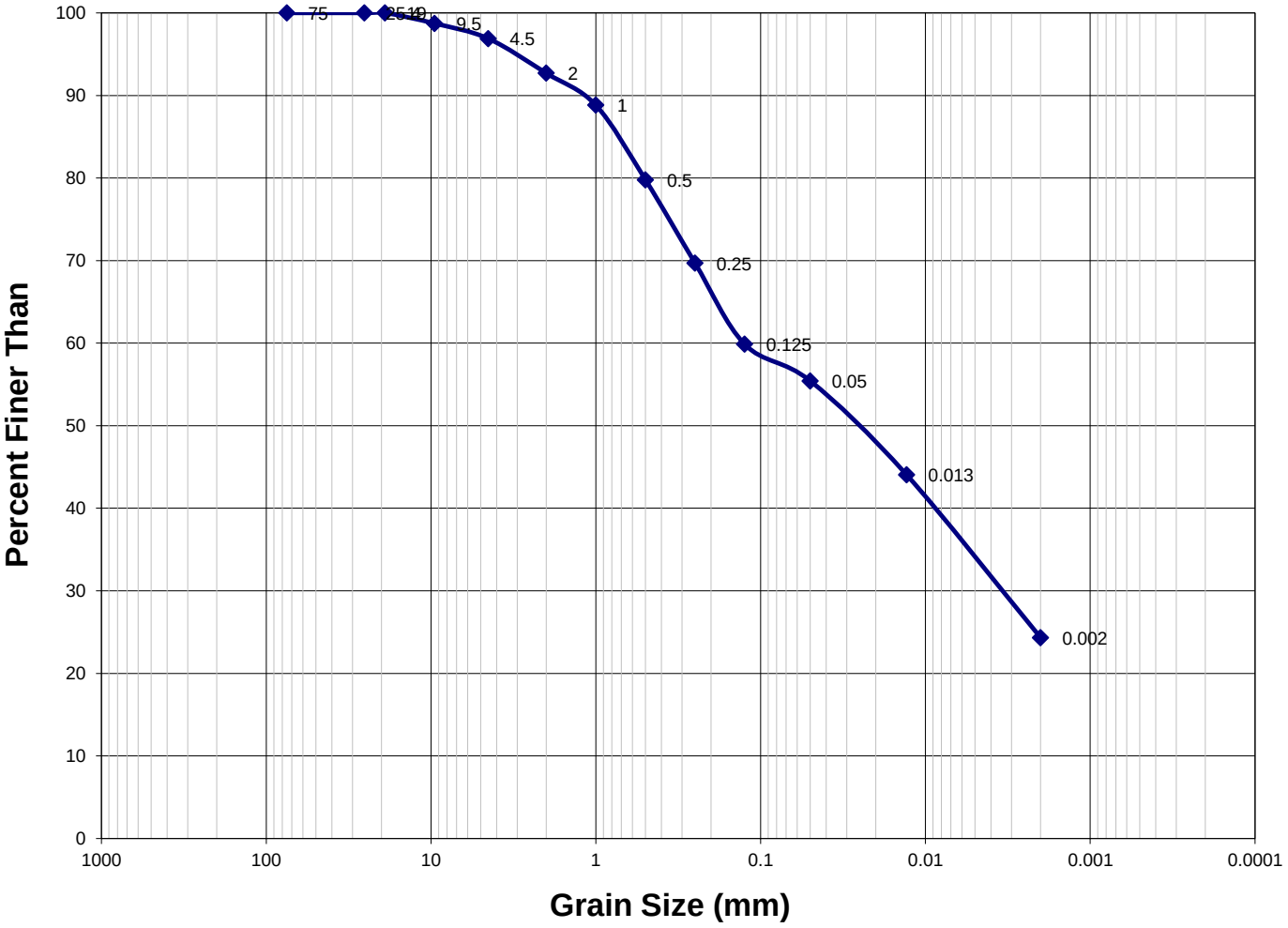
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: STAC100
Project:
Sample ID: PEI-SED-09
Lab ID: VA22B1606009

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	3
Coarse Sand	2.0mm - 4.75mm	4
Medium Sand	0.425mm - 2.0mm	13
Fine Sand	0.075mm - 0.425mm	23
Fines	< 0.075mm	57

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	7
Sand	0.05mm - 2mm	37
Silt	0.002mm - 0.05mm	31
Clay	< 0.002mm	24

Texture Sample contains material greater than 4.75mm. T

Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

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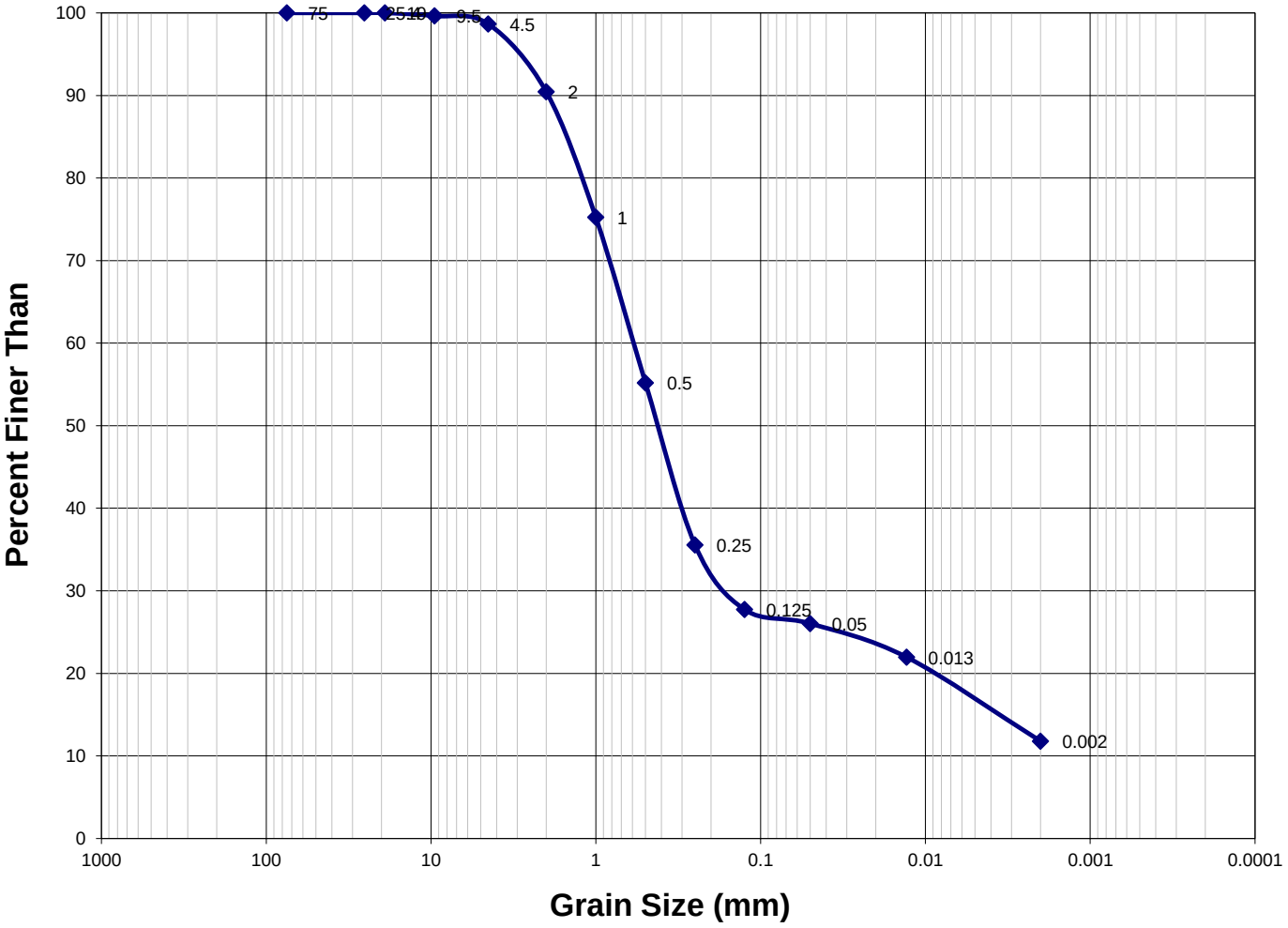
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: STAC100
Project:
Sample ID: PEI-SED-10
Lab ID: VA22B1606010

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	1
Coarse Sand	2.0mm - 4.75mm	8
Medium Sand	0.425mm - 2.0mm	35
Fine Sand	0.075mm - 0.425mm	29
Fines	< 0.075mm	27

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	10
Sand	0.05mm - 2mm	64
Silt	0.002mm - 0.05mm	14
Clay	< 0.002mm	12

Texture Sample contains material greater than 4.75mm. T

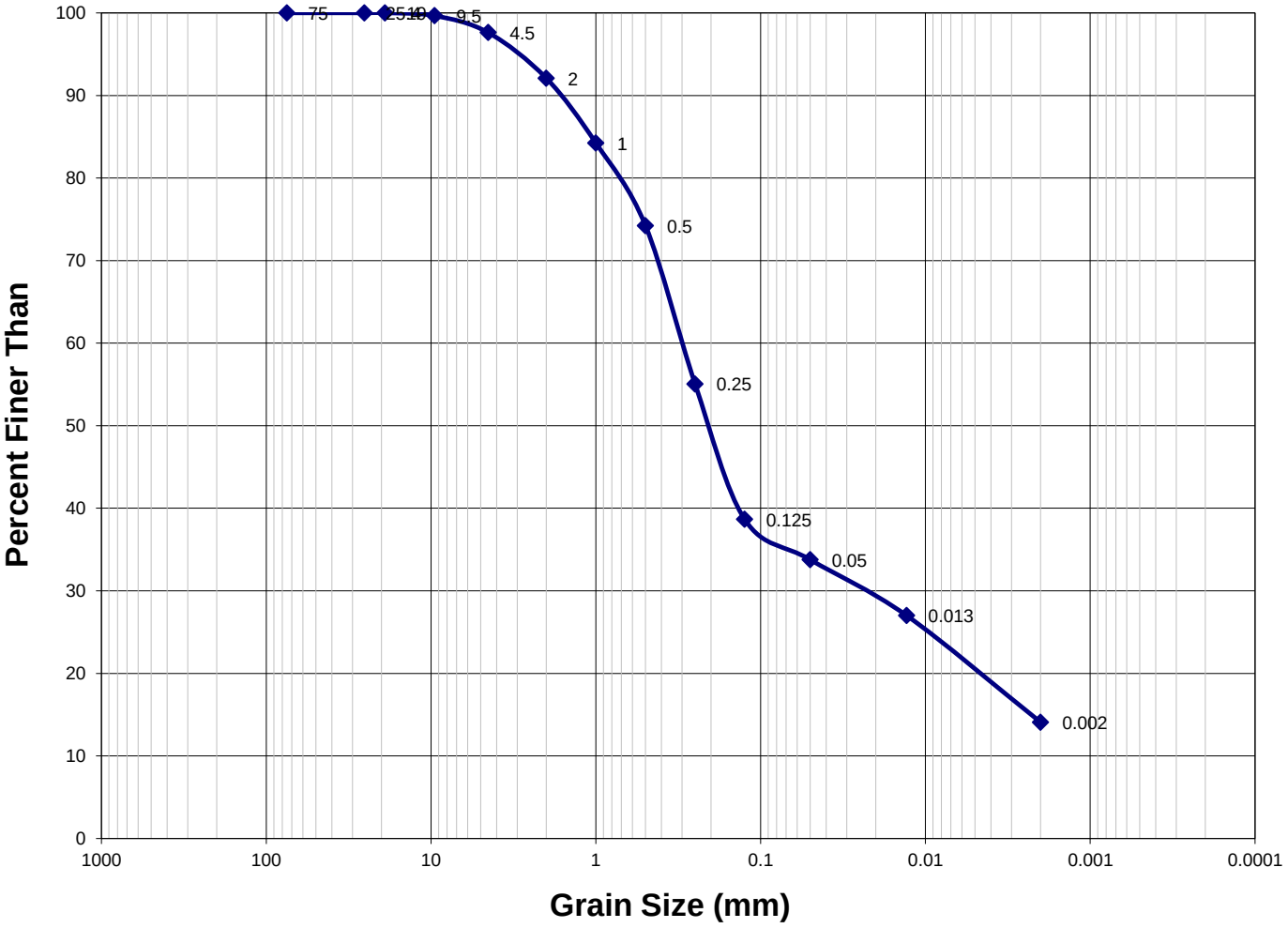
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: STAC100
Project:
Sample ID: PEI-SED-11
Lab ID: VA22B1606011

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	2
Coarse Sand	2.0mm - 4.75mm	6
Medium Sand	0.425mm - 2.0mm	18
Fine Sand	0.075mm - 0.425mm	39
Fines	< 0.075mm	35

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	8
Sand	0.05mm - 2mm	58
Silt	0.002mm - 0.05mm	20
Clay	< 0.002mm	14

Texture Sample contains material greater than 4.75mm. T

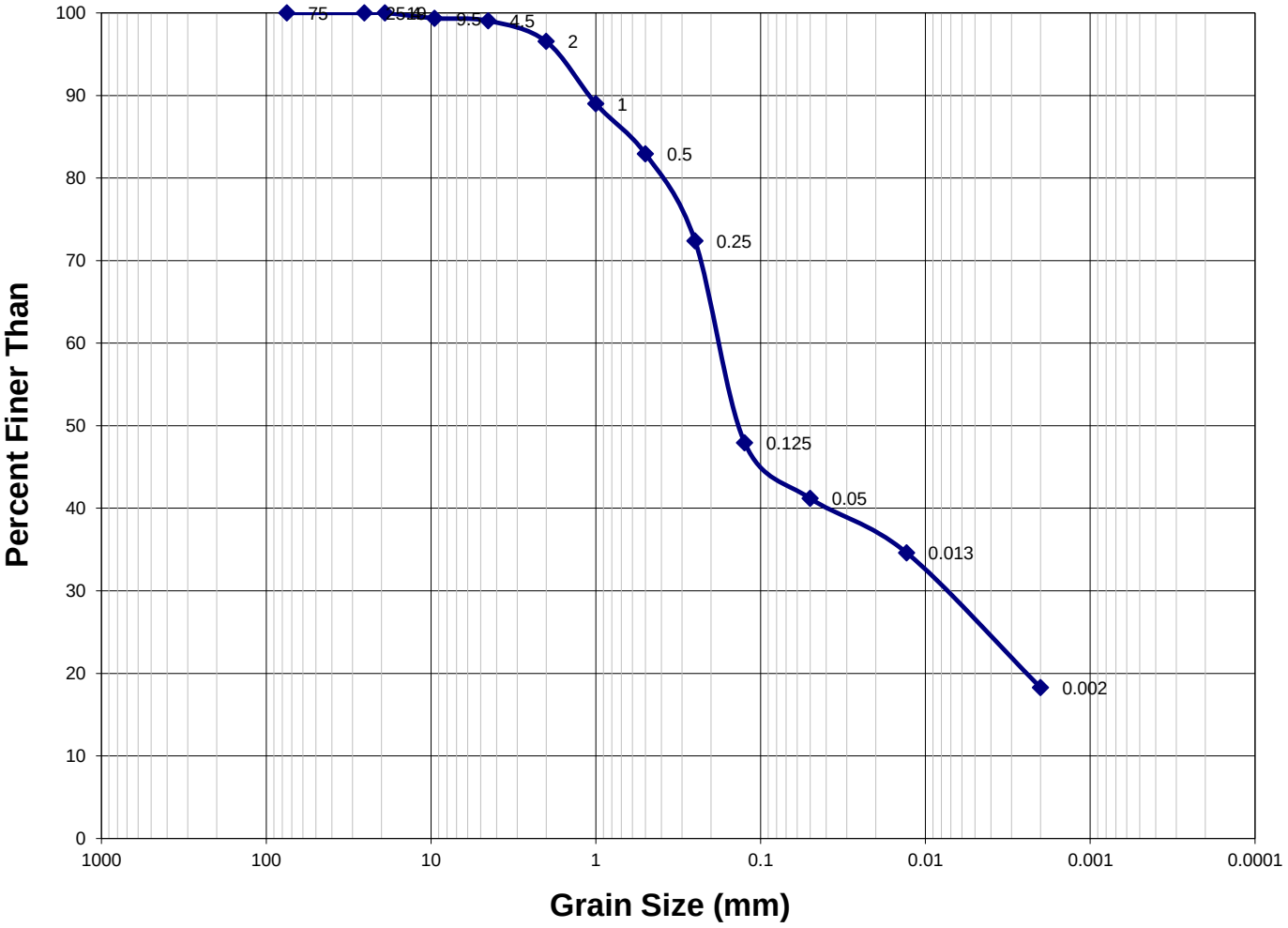
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: STAC100
Project:
Sample ID: PEI-SED-12
Lab ID: VA22B1606012

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	1
Coarse Sand	2.0mm - 4.75mm	3
Medium Sand	0.425mm - 2.0mm	14
Fine Sand	0.075mm - 0.425mm	39
Fines	< 0.075mm	43

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	3
Sand	0.05mm - 2mm	55
Silt	0.002mm - 0.05mm	23
Clay	< 0.002mm	18

Texture Sample contains material greater than 4.75mm. T

Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

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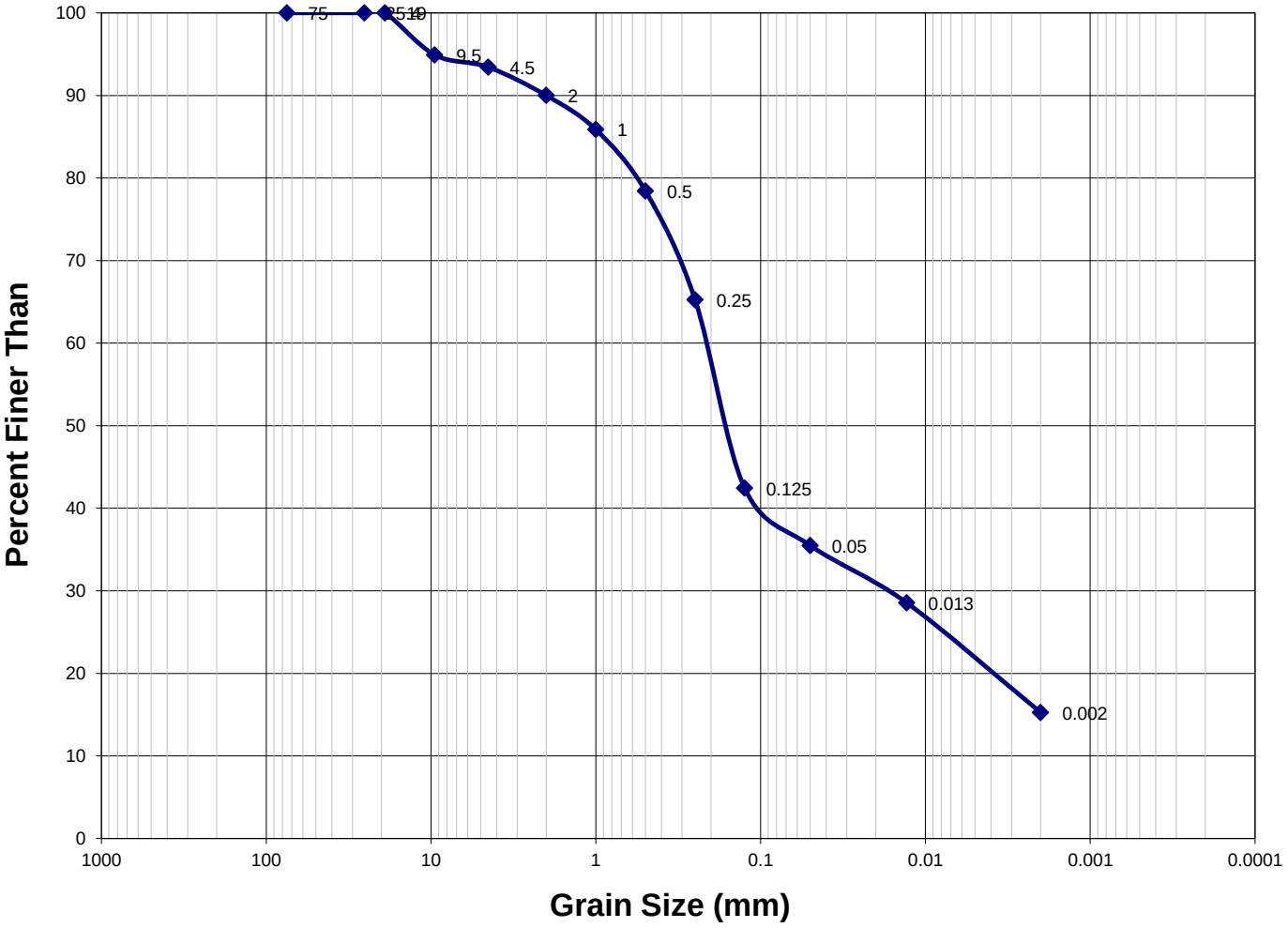
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: STAC100
Project:
Sample ID: PEI-SED-13
Lab ID: VA22B1606013

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	6
Coarse Sand	2.0mm - 4.75mm	4
Medium Sand	0.425mm - 2.0mm	12
Fine Sand	0.075mm - 0.425mm	41
Fines	< 0.075mm	38

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	10
Sand	0.05mm - 2mm	55
Silt	0.002mm - 0.05mm	20
Clay	< 0.002mm	15

Texture Sample contains material greater than 4.75mm. T

Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

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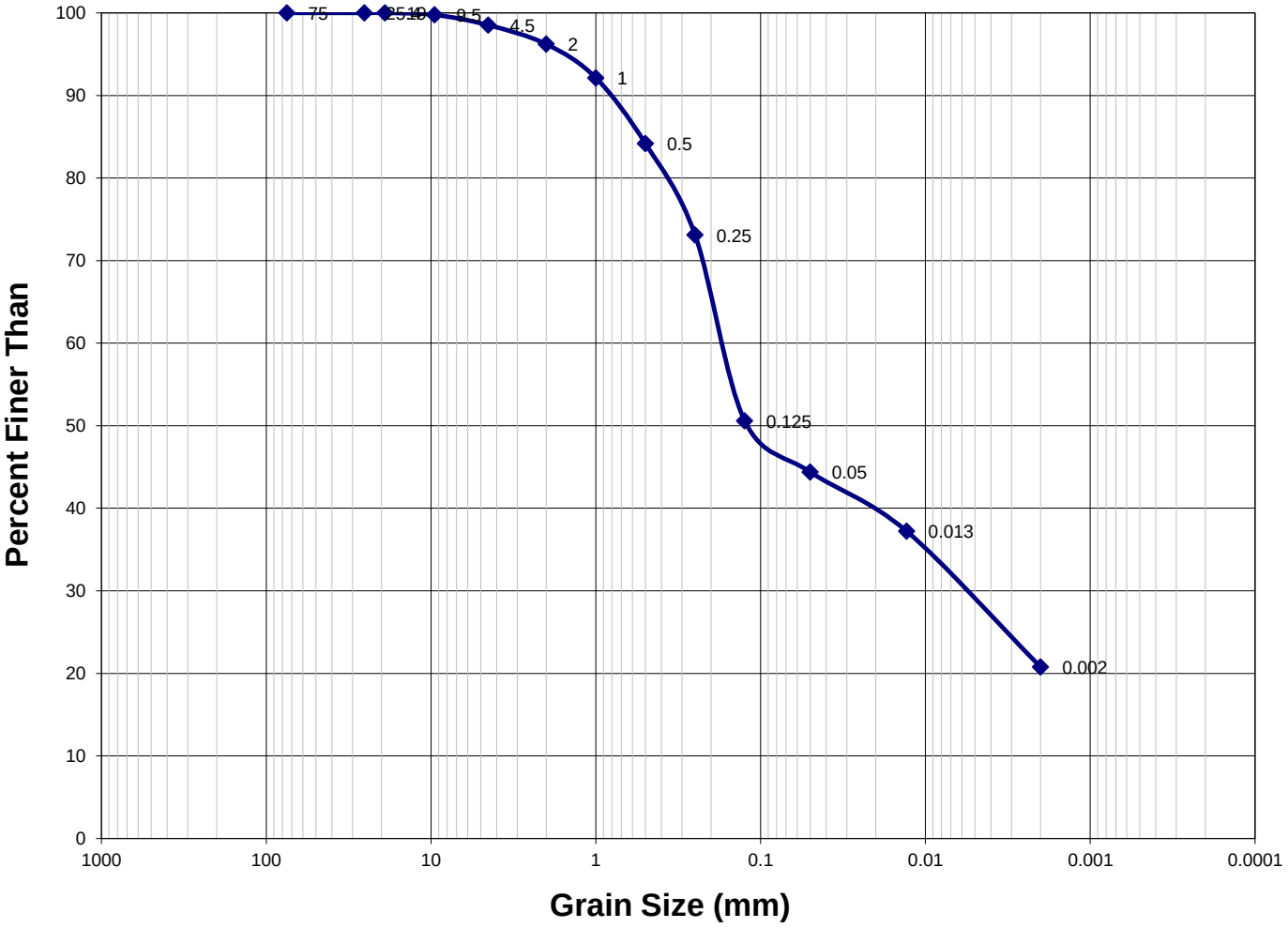
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: STAC100
Project:
Sample ID: PEI-SED-14
Lab ID: VA22B1606014

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	1
Coarse Sand	2.0mm - 4.75mm	2
Medium Sand	0.425mm - 2.0mm	12
Fine Sand	0.075mm - 0.425mm	38
Fines	< 0.075mm	46

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	4
Sand	0.05mm - 2mm	52
Silt	0.002mm - 0.05mm	24
Clay	< 0.002mm	21

Texture Sample contains material greater than 4.75mm. T

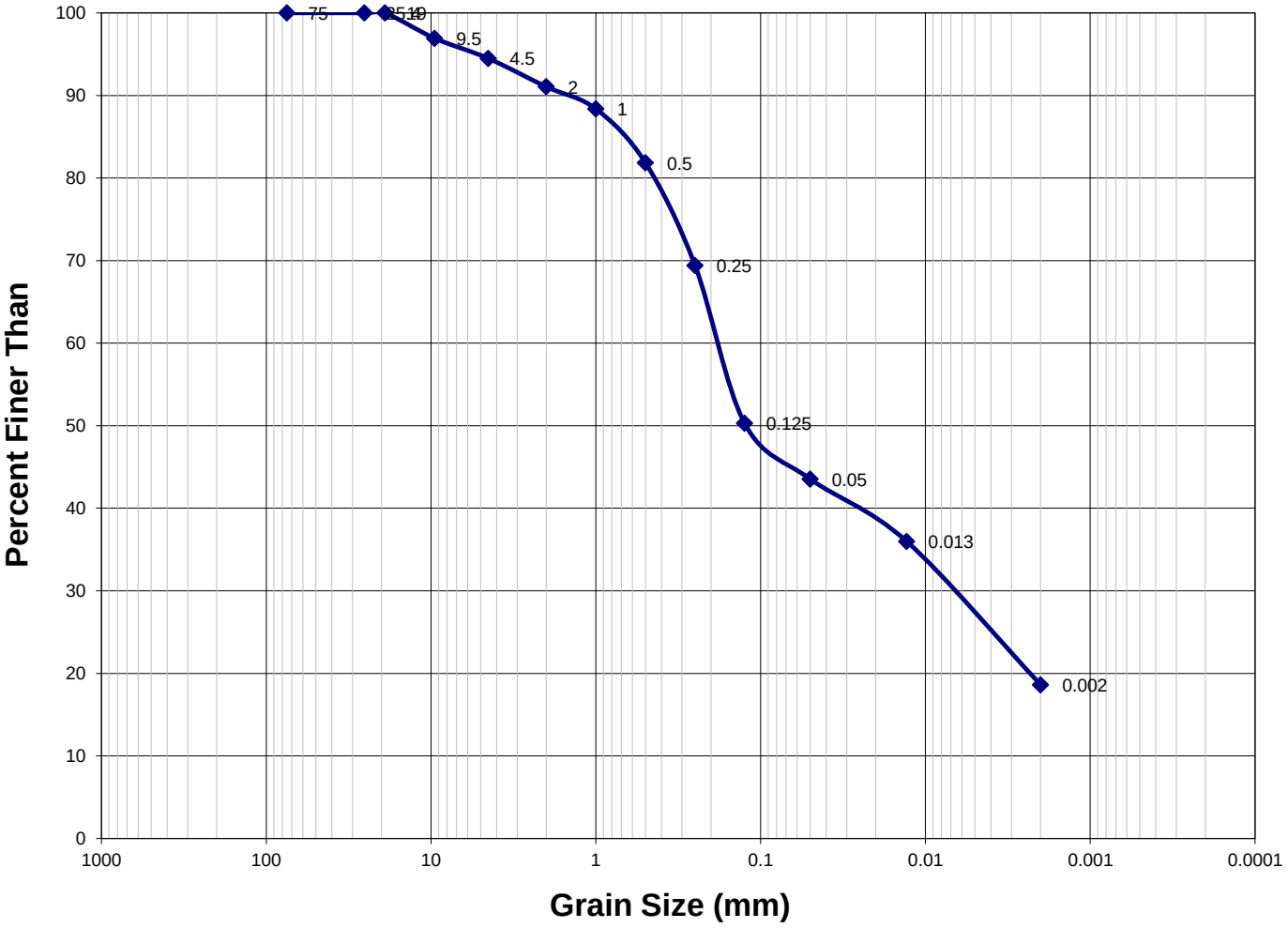
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: STAC100
Project:
Sample ID: PEI-SED-15
Lab ID: VA22B1606015

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	5
Coarse Sand	2.0mm - 4.75mm	4
Medium Sand	0.425mm - 2.0mm	9
Fine Sand	0.075mm - 0.425mm	36
Fines	< 0.075mm	46

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	9
Sand	0.05mm - 2mm	48
Silt	0.002mm - 0.05mm	25
Clay	< 0.002mm	19

Texture Sample contains material greater than 4.75mm. T

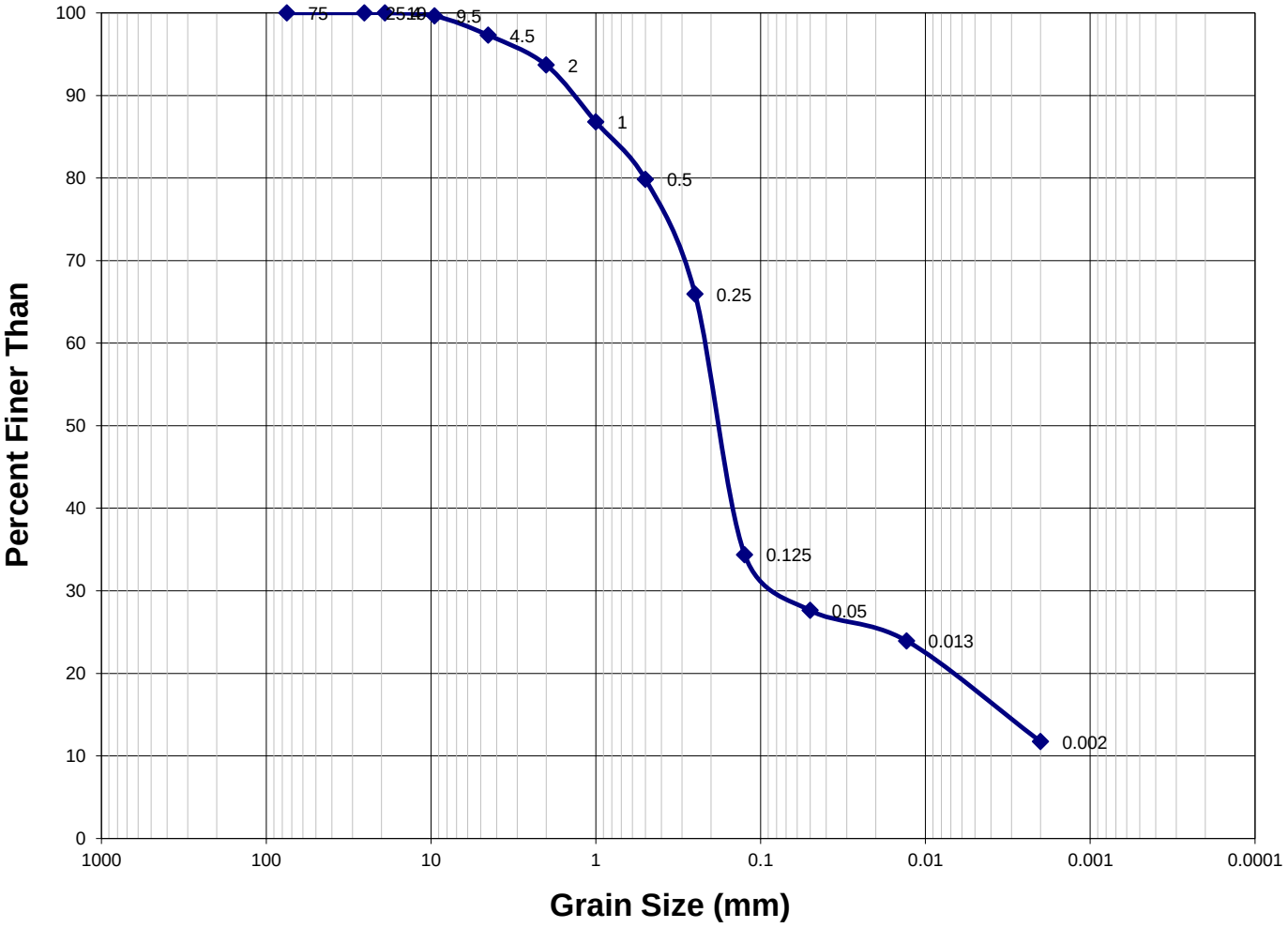
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: STAC100
Project:
Sample ID: DUP-SED-X
Lab ID: VA22B1606016

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	3
Coarse Sand	2.0mm - 4.75mm	4
Medium Sand	0.425mm - 2.0mm	14
Fine Sand	0.075mm - 0.425mm	50
Fines	< 0.075mm	30

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	6
Sand	0.05mm - 2mm	66
Silt	0.002mm - 0.05mm	16
Clay	< 0.002mm	12

Texture Sample contains material greater than 4.75mm. T

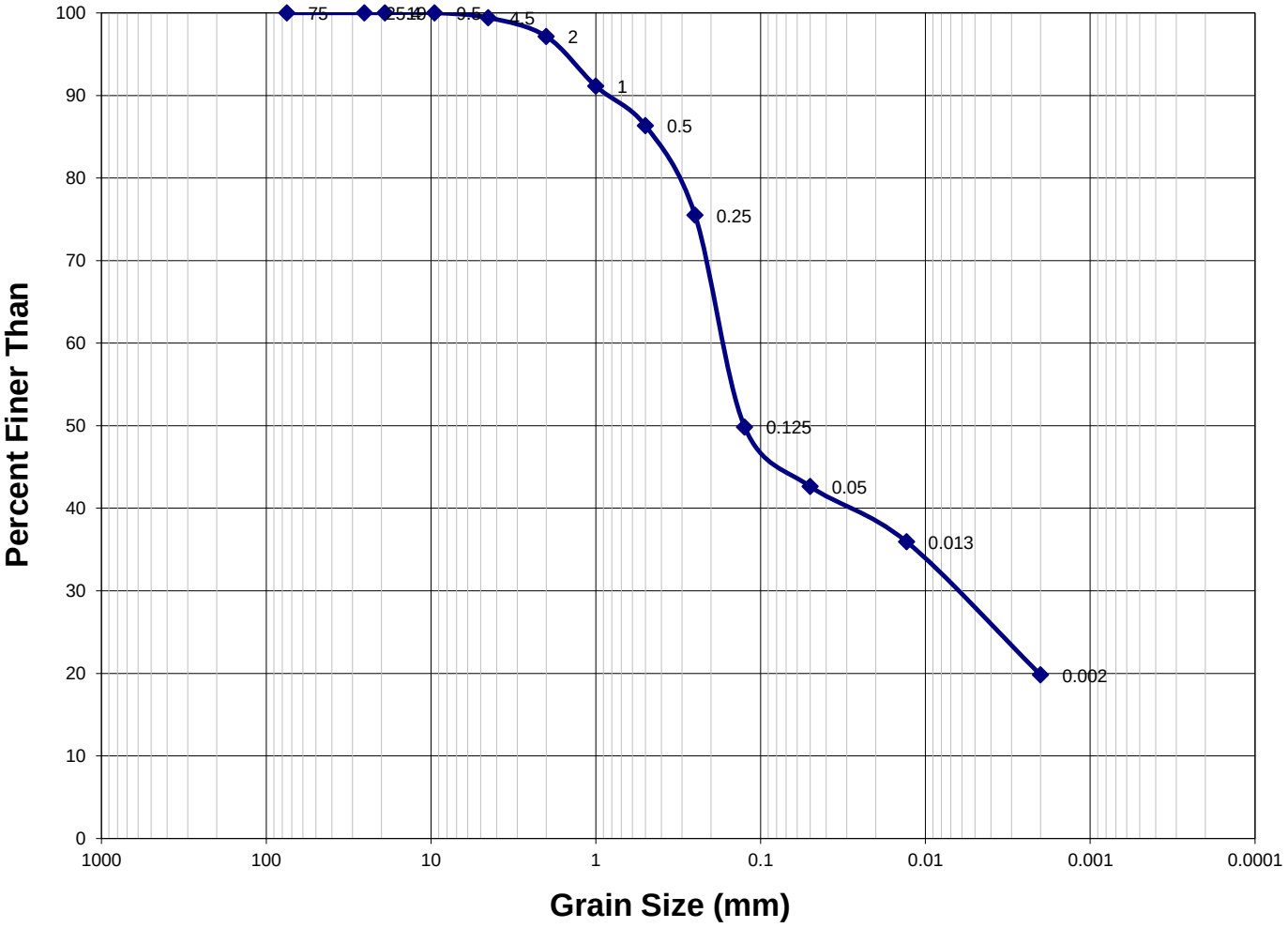
Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

819-58th Street, Saskatoon, SK S7K 6X5

Client Name: STAC100
Project:
Sample ID: DUP-SED-Y
Lab ID: VA22B1606017

Particle Size Distribution Curve



Summary of Results

Unified Soil Classification System (USCS)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	4.75mm - 3"	1
Coarse Sand	2.0mm - 4.75mm	2
Medium Sand	0.425mm - 2.0mm	11
Fine Sand	0.075mm - 0.425mm	41
Fines	< 0.075mm	45

Canadian Soil Survey Committee (CSSC)

Size Class	Size Range	Wt. (%)
Cobbles	> 3"	0
Gravel	2mm - 3"	3
Sand	0.05mm - 2mm	55
Silt	0.002mm - 0.05mm	23
Clay	< 0.002mm	20

Texture Sample contains material greater than 4.75mm. T

Method Reference: Can. Soc. Soil Sci. (1993) Method 47.2

H.2 Laboratory Certificate of Analysis

Chain of Custody (COC) / Analytical Request Form

COC Number: 22 -

Page 1 of 2

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Report To	Contact and company name below will appear on the final report	Reports / Recipients	Turnaround Time (TAT) Requested
Company:	Stantec Consulting	Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	☑ Routine [R] if received by 3pm M-F - no surcharges apply
Contact:	Emily Hulley	Merge QC/QCI Reports with COA ☑ YES ☐ NO ☐ N/A	☐ 4 day [P4] if received by 3pm M-F - 20% rush s
Phone:	226-962-0512	☐ Compare Results to Criteria on Report - provide details below if box checked	☐ 3 day [P3] if received by 3pm M-F - 25% rush s
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	☐ 2 day [P2] if received by 3pm M-F - 50% rush s
Street:	4515 Central Blvd #500	Email 1 or Fax Emily.Hulley@stantec.com	☐ 1 day [E] if received by 3pm M-F - 100% rush s
City/Province:	Burnaby, BC	Email 2 Emily.Hulley@stantec.com	Additional fees may apply to rush requ
Postal Code:	V5H 0C6	Email 3 Peter.Pastuszak@stantec.com	Date and Time Required for all E&P TATs:
Invoice To	Same as Report To ☑ YES ☐ NO	Invoice Recipients	For all tests with rush TATs re
	Copy of Invoice with Report ☑ YES ☐ NO	Select Invoice Distribution: ☑ EMAIL ☑ MAIL ☐ FAX	
Company:	Stantec Consulting	Email 1 or Fax Peter.Pastuszak@stantec.com	
Contact:	Peter Pastuszak	Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	Ksi Lisims Sediment 123221820.500	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (ALS use only):		ALS Contact: Brent Mack	Sampler:

Environmental Division Vancouver
Work Order Reference
VA22B1606

Telephone : +1 604 253 4188

Terrace Shipping # 3 Coolers # ___ Carbouys Ground ☒ Air ☐ SFX ☐

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Particle Size (detailed)	Total Metals	Polycyclic Aromatic Hydrocarbons (PA	Total Organic Carbon (TOC)	BTEX						SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	PEI-SED-01	20-May-22	16:00	Sediment	5	R	R	R	R	R								
	PEI-SED-02	19-May-22	10:35	Sediment	5	R	R	R	R	R								
	PEI-SED-03	20-May-22	10:15	Sediment	5	R	R	R	R	R								
	PEI-SED-04	20-May-22	11:15	Sediment	5	R	R	R	R	R								
	PEI-SED-05	20-May-22	12:25	Sediment	5	R	R	R	R	R								
	PEI-SED-06	20-May-22	13:25	Sediment	5	R	R	R	R	R								
	PEI-SED-07	20-May-22	9:00	Sediment	5	R	R	R	R	R								
	PEI-SED-08	20-May-22	15:00	Sediment	5	R	R	R	R	R								
	PEI-SED-09	20-May-22	8:00	Sediment	5	R	R	R	R	R								
	PEI-SED-10	19-May-22	16:50	Sediment	5	R	R	R	R	R								
	PEI-SED-11	19-May-22	16:15	Sediment	5	R	R	R	R	R								
	PEI-SED-12	19-May-22	15:20	Sediment	5	R	R	R	R	R								

Drinking Water (DW) Samples[1] (client use)	Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)
Are samples taken from a Regulated DW System? ☐ YES ☑ NO	
Are samples for human consumption/use? ☐ YES ☑ NO	

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☐ NONE ☐ ICE ☒ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
8.5	8.0	7.0		8	5.6	4.1	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (ALS use only)			FINAL SHIPMENT RECEPTION (ALS use only)		
Released by: E Hulley	Date: May 21/22	Time: 830	Received by: Chris	Date: 23 May 22	Time: 1100	Received by: JR	Date: MAY 26 2022	Time: 1020am

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Chain of Custody (COC) / Analytical Request Form

COC Number: 22 -

Page 2 of 2

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Report To	Contact and company name below will appear on the final report
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Contact:	Emily Hulley
Phone:	226-962-0512
	Company address below will appear on the final report
Street:	4515 Central Blvd #500
City/Province:	Burnaby, BC
Postal Code:	V5H 0C6
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☑ YES ☐ NO
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Contact:	Peter Pastuszak

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Project Information	
ALS Account # / Quote #:	
Job #:	Ksi Lisims Sediment 123221820.500
PO / AFE:	
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Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
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ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Particle Size (detailed)	Total Metals	Polycyclic Aromatic Hydrocarbons (PA	Total Organic Carbon (TOC)	BTEX	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	PEI-SED-13	19-May-22	13:30	Sediment	5	R	R	R	R	R			
	PEI-SED-14	19-May-22	12:00	Sediment	5	R	R	R	R	R			
	PEI-SED-15	19-May-22	9:00	Sediment	5	R	R	R	R	R			
	DUP-SED-X	19-May-22	10:35	Sediment	5	R	R	R	R	R			
	DUP-SED-Y	19-May-22	15:20	Sediment	5	R	R	R	R	R			

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☑ NO

Are samples for human consumption/ use? ☐ YES ☑ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☐ NONE ☐ ICE ☐ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				8	5.6	4.1	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (ALS use only)			FINAL SHIPMENT RECEPTION (ALS use only)		
Released by: EHulley	Date: May 21/22	Time: 830	Received by:	Date:	Time:	Received by: JC	Date: MAY 26 2022	Time: 1020am

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

H.2 Laboratory Certificate of Analysis

Appendix I JASCO HYDROPHONE REPORT

Ksi Lisims Underwater Noise Monitoring

One Year of Underwater Acoustic Monitoring for Detections of Marine Mammal Calls and Underwater Noise 2021–2022

JASCO Applied Sciences (Canada) Ltd

4 November 2022

Submitted to:

Andrea Ahrens
Stantec Consulting Ltd.

Authors:

Emily E. Maxner
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Colleen C. Wilson

P001613-001
Document 02892
Version 1.0

JASCO APPLIED SCIENCES

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The results presented herein are relevant within the specific context described in this report. They could be misinterpreted if not considered in the light of all the information contained in this report. Accordingly, if information from this report is used in documents released to the public or to regulatory bodies, such documents must clearly cite the original report, which shall be made readily available to the recipients in integral and unedited form.

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1. Introduction

The Nisga'a Nation and its partners Rockies LNG Limited Partnership (Calgary, Alberta) and Western LNG (Houston, Texas) (collectively, the Project Partners) propose to develop a large-scale energy project on Nisga'a-owned lands on British Columbia's northwest coast. The Ksi Lisims Project is a liquified natural gas (LNG) export facility located at Wil Milit Bay on the far northern end of Pearse Island and in Portland Canal (the Project Site). The project site is remote and ~15 km west of the Nisga'a community of Ginglox on the mainland at the mouth of the Nass River. The Project proposed is a "floating" LNG (FLNG) export facility with supporting upland infrastructure and a marine terminal for LNG carriers. Construction and operation of the Project will require activities producing underwater noise that has the potential to result in impacts to marine mammals and marine fish. To provide background information on the existing underwater soundscape, and to document the acoustic presence of marine mammals in the Project area, environmental consultant Stantec Consulting Ltd. contracted JASCO Applied Sciences (JASCO) to conduct one year of underwater noise and marine mammal acoustic monitoring using underwater acoustic recorders.

This report presents the results of the analysis of acoustic data collected at two locations, near the Project Site at the northern end of Pearse Island and near the mouth of Portland Inlet (AMAR-N and AMAR-S, respectively; see Figure 1). The acoustic data were acquired over two consecutive monitoring periods spanning June 2021 to August 2022. The data were analyzed to characterize the underwater soundscape and the acoustic occurrence of marine mammal species in the area. This report provides some background of the sources of underwater noise relevant to the project site (Section 2), documents the recording and analysis methods used (Section 3), and provides the results (Section 4) with a discussion and summary (Section 5).

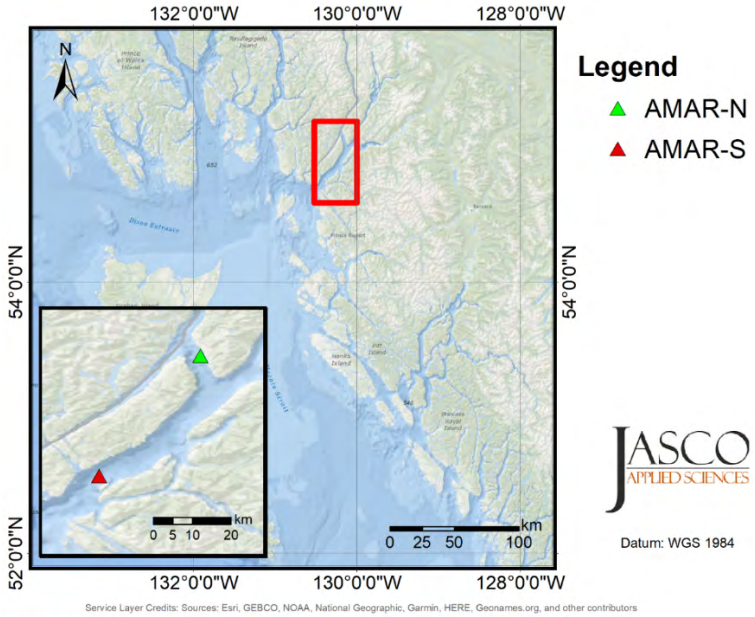


Figure 1. Map of Portland Inlet, BC. Red box indicates the zoom-in area, and the red and green triangles indicate the two monitoring locations.

2. Background

2.1. Soundscape and Ambient Sound

The acoustic environment of a location is known as its soundscape. A soundscape is comprised of the cumulative contributions from abiotic (geophonic), biotic (biophonic), and human (anthrophonic) sound sources (Krause 2008). Ambient sound is defined as any sound that is present in the absence of human activity. It is also temporally and spatially specific (ISO 2017a). The typical frequencies and spectral levels of many of these activities are shown on Wenz (1962) curves (Figure 2).

In the marine environment, the geophonic elements of a soundscape can act as proxies for oceanographic conditions. Knudsen et al. (1948) and Wenz (1962) demonstrated that increased sea state and wind speed commonly correlate with higher sound intensities across acoustic frequencies from 500 Hz to 30 kHz due to breaking whitecaps, surface flow noise, wave generation, cavitation, and pressure change (Urick 1983). Rainfall can elevate sound levels in the 1–15 kHz frequency range via sound from surface impacts and bubble entrainment (Heindsmann et al. 1955, Bom 1969, Scrimger et al. 1987). Besides wind, waves, sea ice, currents, seismic activity such as earth movement and subsea landslides can be loud, though short-duration, geophonic contributors. While geophonic and biophonic contributors comprise the natural soundscape, the total soundscape also includes anthrophonic sounds (see Section 2.2). Biophonic signals include those generated by aquatic mammals, crustaceans, and fish for communicating, navigating, and foraging (see Section 2.3).

Measuring ambient sound is complicated by non-acoustic processes that often appear in acoustic recordings. One such issue is flow noise, caused by pressure eddies and vortices produced by water movement along the surfaces of hydrophone pressure transducers. This is similar to buffeting sounds on microphones during windy conditions. Flow noise is not part of a marine soundscape (Strasberg 1979, Urick 1983), but its intensity may indicate current strength (Willis and Dietz 1961). Current or wave action can also induce mooring noise when mobile components of moorings create sound as they move or strum.

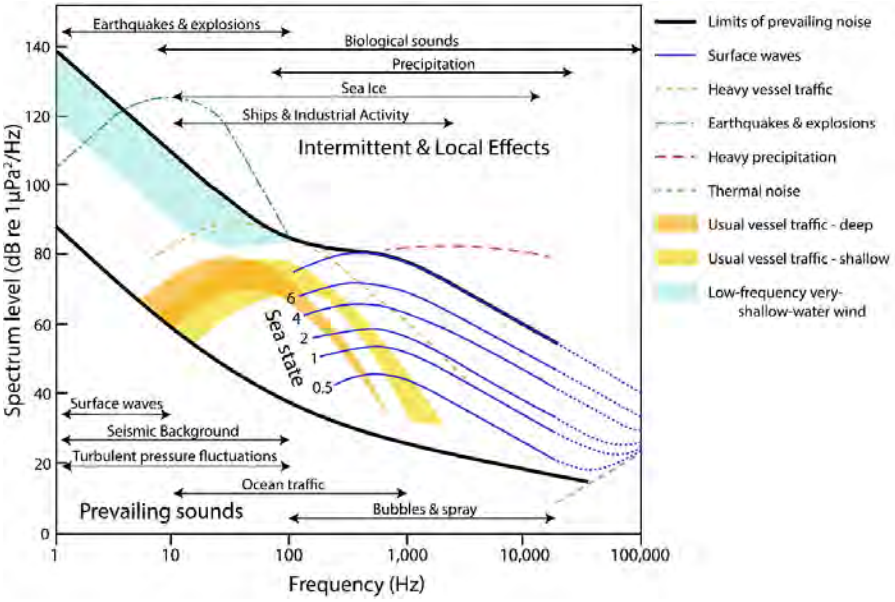


Figure 2. Wenz curves (Wenz 1962). Spectrum levels exhibit a local minimum at ~100–200 Hz and rise for f < 100 Hz.

2.2. Anthropogenic Contributors to the Soundscape

The contribution of anthropogenic sources to the ocean soundscape is dependent on the amount and type of human activity, and may have temporal patterns that vary by year, season, weekday, or even hour. The main anthropogenic noise source near the acoustic recording locations is vessel activity, consisting mainly of local vessels involved in fishing and recreation, and occasional commercial traffic (mainly bulk carriers) transiting to the Port in Stewart, BC at the head of Portland Canal. Anthropogenic noise from vessels can be a by-product of vessel operations, such as engine sound radiating through vessel hulls and cavitating propulsion systems, or it can be a product of active acoustic systems, for example, from vessel depth sounders. Figure 3 highlights the area of focus of this project in Portland Inlet and is overlaid with a vessel density surface for vessels equipped with AIS (automated identification system). Marine construction projects also introduce anthropogenic noise to an environment. These often involve nearshore blasting and pile driving that can produce high levels of impulsive-type noise, and dredging activity that can produce high levels of continuous sounds. Pile driving activities are expected to be the main anthropogenic noise contributor during construction of the Ksi Lisims Project, and noise from tugs and LNG carriers as well as from the FLNG facility operations are anticipated to be the main noise sources during the Ksi Lisims Project operations.

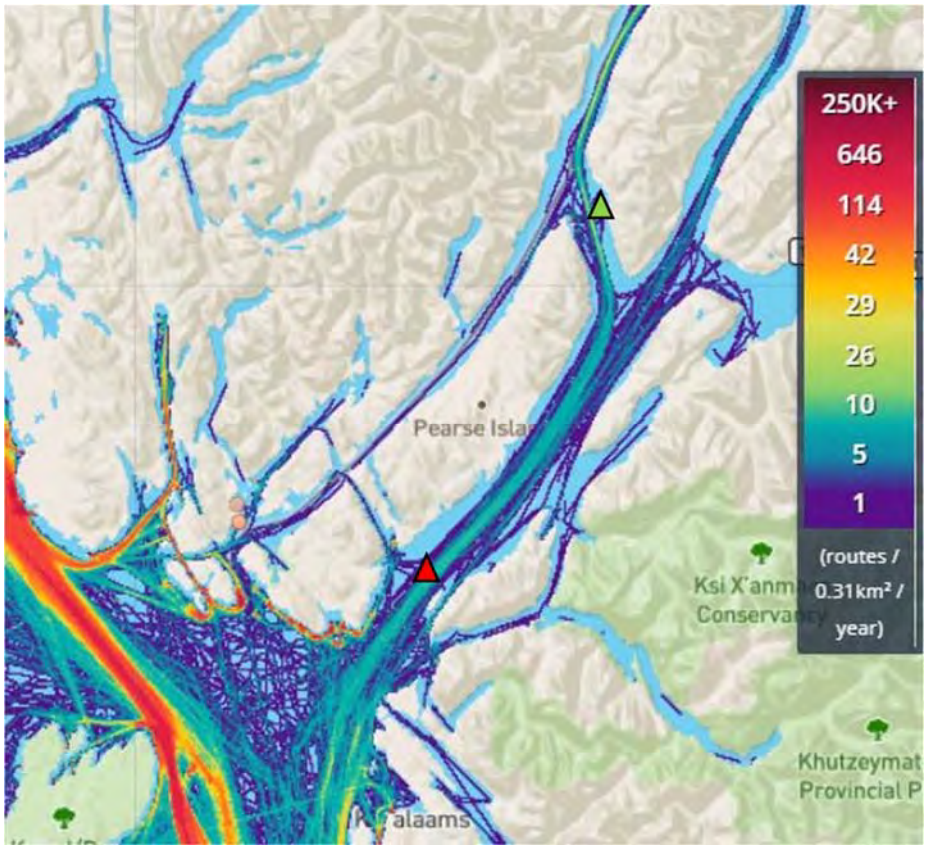


Figure 3. Vessel traffic for 2021 in the study area (source: marinetraffic.com; accessed 25 Oct 2022). Red (AMAR-S) and green (AMAR-N) triangles indicate the monitoring locations of the acoustic recorders.

2.3. Biological Marine Sounds and Species in Portland Inlet

Biological sources of sound are diverse, and many marine taxa produce sounds. Animals that are known to produce acoustic signals include crustaceans, fish, and marine mammals. Biophonic signals include those generated for communicating, navigating, breeding, and foraging by sound-producing species. Marine mammals have received the most attention in terms of the description of their vocal repertoire and acoustic behaviour.

Given that most marine mammals produce species-specific sounds underwater, passive acoustics are generally a highly effective way to monitor for the presence of multiple species of marine mammals in remote environments over long durations. Acoustic monitoring is less dependant on weather conditions than visual monitoring and is unaffected by restricted visibility conditions. It is also entirely nonintrusive. However, acoustic monitoring requires animals to make sounds that are sufficiently loud so that they can be detected. Because not all species vocalize regularly, and vocalization activity is often seasonal, passive acoustic monitoring effectiveness varies by species and seasonally.

For an acoustic recording device to detect a marine mammal vocalization, the vocalization's received amplitude at a monitoring location must be above background noise levels in at least one of the vocalization's frequency bands (although some more complex acoustic systems can detect sounds below background noise level). The distance over which vocalizations can be detected consequently depends on the background sound levels, source levels of the vocalization (which often vary by season, sex, etc.), the animal's calling depth, and acoustic propagation properties of the environment. Higher frequencies do not propagate efficiently underwater compared to the lower frequencies, due to increased absorption and scattering of the higher-frequency sound energy. As a result, the detection range for higher frequency vocalizations may be shorter than that for lower frequency vocalizations. Background or ambient sound levels vary due to fluctuations in natural sounds (e.g., wind, precipitation, waves, seismic activity, and biologic activity) and anthropogenic sounds (mainly vessels but also marine construction and oil and gas exploration). Acoustic propagation also varies seasonally due to changing temperature and salinity properties of the water column.

Table 1 presents the eleven marine mammal species, population, or ecotypes that frequent the waters of Portland Inlet. Seven of these are considered at risk. At-risk species and their habitats are protected by existing national park and marine conservation area regulations and management regimes, as well as by the Species At Risk Act (SARA; Parks Canada 2016).

Table 1. Marine mammals that frequent Portland Inlet including their status according to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and Species at risk (SARA).

Species		Scientific name	SARA status	COSEWIC status
Baleen whales				
Grey whales	Northern Pacific Migratory population	*Eschrichtius robustus*	Not listed*	Not at risk
	Pacific Coast Feeding Group population		Decision pending*	Endangered
	Western Pacific population		Decision pending*	Endangered
Humpback whales	North Pacific population	*Megaptera novaeangliae*	Special concern	Special concern
Minke whales		*Balaenoptera acutorostrata*	Not listed	Not at risk
Toothed whales				
Dall's porpoises		*Phocoenoides dalli*	Not listed	Not at risk
Harbour porpoises	Pacific population	*Phocoena phocoena*	Special concern	Special concern

Northern resident killer whales	*Orcinus orca*	Threatened	Threatened
Bigg's killer whales		Threatened	Threatened
Pacific white-sided dolphins	*Lagenorhynchus obliquidens*	Not listed	Not at risk
Pinnipeds			
Steller sea lions	*Eumetopias jubatus*	Special concern	Special concern
California sea lions	*Zalophus californianus*	Not listed	Not at risk
Harbour seals	*Phoca vitulina richardsi*	Not listed	Not at risk

* Previously included in eastern North Pacific Population which was listed as Special Concern.

The acoustic signal characteristics of marine mammal species that may be present in Portland Inlet are relatively well known and described in the scientific literature (see Table 2). While the vocalizations of delphinid species (i.e., dolphins or killer whales) in the area have all been described, the overlap in the spectral characteristics of different delphinid species complicates their identification by both human analysts and automated detectors (Ding et al. 1995, Oswald et al. 2007, Gannier et al. 2010). During the acoustic data processing performed here, vocalizations were generally split into two broad categories: tonal signals (including baleen whale moans and delphinid whistles) and echolocation clicks (produced by all toothed whales mainly while foraging and navigating).

Table 2. List of vocalizations that have been described for baleen whales and toothed whales that frequent Portland Inlet.

Species	Vocalizations described	Reference(s)
Grey whales	Classes 1–6 (pulses, sweeps, moans, etc.)	Fish et al. (1974), Crane and Lashkari (1996), Guazzo et al. (2017), Burnham et al. (2018)
Humpback whales	Song and non-song moans, grunts, whups, etc.	Payne and McVay (1971), Thompson et al. (1986), Au et al. (2006), Parsons et al. (2008), Dunlop et al. (2013), Rekdahl et al. (2015)
Harbour porpoises and Dall's porpoises	Clicks	Villadsgaard et al. (2007), Kyhn et al. (2013)
Northern Resident and Bigg's killer whales	Whistles and clicks	Ford (1989), Thomsen et al. (2001), Au et al. (2004), Miller (2006), Eskesen et al. (2011)
Pacific white-sided dolphins	Whistles and clicks	Soldevilla et al. (2008), Henderson et al. (2011)

Section 3.1 describes the data sets and the data analysis methods, including a description of the automatic and manual marine mammal vocalization detection methods. Section 4.3 presents marine mammal vocalization detections over time for each data set. Section 5.2 provides a discussion of the results and the conclusions of the analyses.

3. Methods

This section describes the data sets analyzed, as well as the methods used for detecting marine mammals and vessels, calculating ambient sound, and analyzing detection ranges.

3.1. Acoustic Data Acquisition

Underwater sound was recorded with precisely calibrated Autonomous Multichannel Acoustic Recorders – Generation 4-5.1 (AMAR G4-5.1; JASCO Applied Sciences; Figures 4 and 5). The recorders were deployed at two locations in Portland Inlet (Figure 1; Table 3). Digital acoustic data with 24 bit samples were recorded continuously with an alternating sample rate between 64 and 512 kHz as described in Table 3. AMAR-S and AMAR-N recorded for 369 and 374 days, respectively.

Figure 4. Preparing JASCO's Autonomous Multichannel Acoustic Recorder (AMAR) for deployment in Portland Inlet. Photo taken by Melanie Austin on 22 Jun 2021.

Figure 5. Retrieving JASCO's Autonomous Multichannel Acoustic Recorder (AMAR) in Portland Inlet. Photo taken by Kim Aubut Demers on 16 Aug 2022.

Table 3. Location, depth, recorder type, sample rates, and operation periods of the data sets analyzed.

Location	Deployment	Depth (m)	Latitude	Longitude	Recorder	Start	End	Duration (days)	Duty cycle
AMAR-N	1	112	55.035	-130.144	AMAR G4-5.1	22 Jun 2021	9 Dec 2021	170	9 mins @ 64 kHz 1 min @ 512 kHz
AMAR-S		552	54.754	-130.380	AMAR G4-5.1	13 Aug 2021	8 Dec 2021	118	9 mins @ 64 kHz 1 min @ 512 kHz
AMAR-N	2	118	55.034	-130.145	AMAR G4-5.1	9 Dec 2021	30 Jun 2022	204	9 mins @ 64 kHz 1 min @ 512 kHz
AMAR-S		508	54.754	-130.381	AMAR G4-5.1	8 Dec 2021	15 Aug 2022	251	9 mins @ 64 kHz 1 min @ 512 kHz

3.2. Ambient Data Analysis

3.2.1. Soundscape and Time Series Analysis

The recorded data were analyzed to quantitatively describe the area's underwater soundscape. The raw pressure waveform data were scaled according to the mean calibrated voltage sensitivity of the recorders and adjusted for the amplitude and frequency response of the hydrophone sensor. The AMAR calibration was verified before and after deployments with a pistonphone type 42AC precision sound source (G.R.A.S. Sound & Vibration A/S) at 250 Hz and an end-to-end laboratory calibration (from about 4 Hz to 1000 kHz on channel 1) was also performed.

The first stage of the sound level analysis involved computing the peak (PK) and rms (root mean squared) sound pressure level (SPL) for each minute of data. This reduced the data to a manageable size without compromising the value for characterizing the soundscape (ISO 2017b, Ainslie et al. 2018, Martin et al. 2019). SPL analysis was performed by averaging 120 fast-Fourier transforms (FFTs) that each include 1 s of data with a 50 % overlap and that use the Hann window to reduce spectral leakage. The 1 min average data were stored as power spectral densities (1 Hz resolution up to 455 Hz and millidecade frequency bands above 455 Hz) and summed over frequency to calculate decidecade band SPL. Martin et al. (2021) describes the millidecade band analysis approach. Millidecades are logarithmically spaced frequency bands but have a bandwidth equal to 1/1000th of a decade. Using millidecades instead of 1 Hz frequency bands reduced the size of the spectral data by a large factor without compromising the use of the data.

Decidecade frequency band levels are very similar to 1/3-octave-band levels. Table A-1 lists the decidecade band frequencies. Figure A-2 lists the decade-band frequencies. The decidecade analysis sums as many frequencies as contained in the recorded bandwidth in the power spectral density data to a manageable set of up to 45 bands that approximate the critical bandwidths of marine mammal hearing. Decade bands further summarize the sound levels into four frequency bands for manageability. Detailed descriptions of acoustic metrics and decidecade analysis can be found in Appendices A.1 and A.2.

Section 4.1 displays graphical outputs of ambient sound level results, as follows:

- **Band-level plots**: These strip charts show the averaged received sound pressure levels as a function of time within a given frequency band. We show the total sound levels (across the entire recorded bandwidth from 10–32,000 Hz for the low sample rate and 10–256,000 Hz for the high sample rate) and the levels in the decade bands of 10–100 (Decade A); 100–1000 (Decade B); 1000–10,000 (Decade C); and 10,000–100,000 Hz (Decade D), depending on the recording bandwidth. The 10–100 Hz band is generally associated with fin and blue whales, large shipping vessels, flow and mooring noise, and seismic survey impulses (when present). Sounds within the 100–1000 Hz band are generally associated with the physical environment such as wind and wave conditions but can also include both biological and anthropogenic sources such as minke and humpback whales, fish, smaller vessels, seismic surveys, and pile driving. Sounds above 1000 Hz include high-frequency components of humpback whale sounds, odontocete whistles and echolocation signals, wind- and wave-generated sounds, and sounds from human sources at close range including pile driving, vessels, seismic surveys, and sonars.
- **Long-term Spectral Averages (LTSAs)**: These color plots show power spectral density levels as a function of time (*x*-axis) and frequency (*y*-axis). The frequency axis uses a logarithmic scale, which provides equal vertical space for each decade increase in frequency and allows the reader to equally see the contributions of low and high-frequency sound sources. The LTSAs are excellent summaries of the temporal and frequency variability in the data.
- **Decidecade box-and-whisker plots**: In these figures, the 'boxes' represent the middle 50 % of the range of sound pressure levels measured, so that the bottom of the box is the sound level 25th percentile (L_{25}) of the recorded levels, the bar in the middle of the box is the median (L_{50}), and the top of the box is the level that exceeded 75 % of the data (L_{75}). The whiskers indicate the maximum and minimum range of the data.
- **Spectral density level percentiles**: The decidecade box-and-whisker plots are representations of the histogram of each band's sound pressure levels. The power spectral density data has too many frequency bins for a similar presentation. Instead, colored lines are drawn to represent the L_{eq}, L_5, L_{25}, L_{50}, L_{75}, and L_{95} percentiles of the histograms. Shading is provided underneath these lines to provide an indication of the relative probability distribution. It is common to compare the power spectral densities to the results from Wenz (1962), which documented the variability of ambient spectral levels off the US Pacific coast as a function of frequency of measurements for a range of weather, vessel traffic, and geologic conditions. The Wenz levels are appropriate for approximate comparisons only since the data were collected in deep water before the known increase in low-frequency sound levels attributed to the increase in maritime shipping (Andrew et al. 2011).
- **Weekly rhythm plots**: The decade band sound pressure level measurements are examined in 30 min steps over a week. Each 30 min step is comprised of thirty 1 min bins. The thirty 1 min bins in each step are combined over the weeks making up the recording period. Median values are calculated from the samples. Plotting the weekly cadences can reveal patterns associated with human activity that vary on a weekly schedule, such as work week versus weekend differences.
- **Tidal rhythm plots**: Similarly to the weekly rhythm plots, the decade band SPL are examined in 10 min steps over each tidal cycle. Median values are calculated from the sample of tidal cycles across the recording period and plotted in reference to time at low tide for a full tidal cycle (from low to high to low tide). Plotting the tidal cadences can reveal the influence of tidal currents on sound level measurements.

3.2.2. Vessel Noise Detection

The boat and vessel detectors compare sound levels in an established frequency range to criteria values. If the criterion is met, a 'shippingFlag' value of either 1 (boat/vessel is present) or 4 (boat/vessel is nearby) is set. The highest sound level within the minutes flagged as having a boat present is assigned as the closest point of approach (CPA). The criteria values are outlined in Table 4; criteria names are shown in italics in the description below. Previously, this detector was used to detect larger vessels, so the following criteria were adjusted to detect boats, which are quieter and emit more sound at higher frequencies:

- The background SPL within the frequency range is calculated as a long-term average over the *Background window duration*.
- Each minute's SPL (within the frequency range) must be greater than the background value by the *Shipping to background threshold*.
- Each minute's SPL (within the frequency range) must exceed the total broadband SPL by the *Shipping to RMS Threshold.*
- Each minute's SPL must be greater than the *Minimum broadband SPL.*
- The average number of tonals detected over a *Minimum shipping duration* minute window must be greater than *Minimum number of shipping tonals.*
- The duration of the shipping detection must be greater than *Minimum shipping duration* and less than *Maximum shipping duration.*

If all criteria are met, the 'shippingFlag' is set to 1, indicating that a boat or vessel is present in that minute of data. We then assume that the anthropogenic shoulder before and after the shipping detection flag '1' values have energy from the vessel that did not meet the criteria and should not be considered as 'ambient'. This window is given a value of 4 for the shipping detection flag. This system of 1 and 4 attempts to distinguish between vessels/boats that are nearer and farther from the AMAR, i.e., for large vessels the sequence is typically a series of flags of 4 (approach), then 1 (over/nearest), and then 4 (departure).

Vessel detections were defined by the following three criteria:

- SPL in the shipping band was at least 3 dB above the median.
- At least five shipping tonals (0.125 Hz bandwidth) were present.
- SPL in the shipping band was within 8 dB of the broadband SPL (see Figure 6).

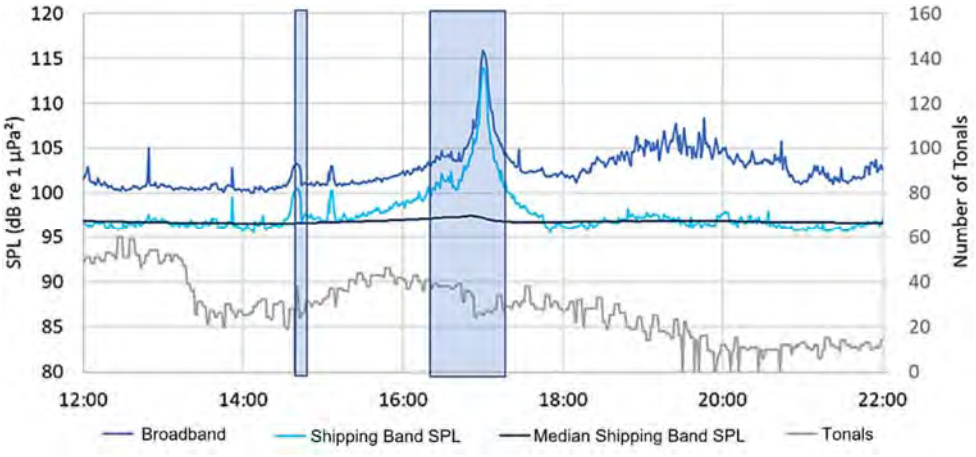


Figure 6. Example of broadband and 40–315 Hz band sound pressure level (SPL), and the number of tonals detected per minute as a vessel approached a recorder, stopped, and then departed. The shaded area is the period of shipping detection. Fewer tonals are detected at the ship's closest point of approach (CPA) at 17:00 because of masking by broadband cavitation noise and due to Doppler shift that changes the tone frequencies and makes them more difficult to identify.

Table 4. Parameters of the boat and vessel detector.

Parameter	Unit	Vessel detector	Boat detector
Minimum decidecade band to include in detector	Hz	40	315
Minimum decidecade band to include in detector	Hz	315	2000
Minimum broadband SPL	dB	105	95
Minimum number of shipping tonals		3	0.49
Background window duration	min	720	720
Minimum shipping duration	min	5	3
Maximum shipping duration	min	360	60
Typical shipping passing duration	min	30	10
Shipping to background threshold	dB	3	3
Shipping to RMS threshold	dB	12	15
Anthropogenic shoulder	min	15	15

3.3. Marine Mammal Detection Overview

We used a combination of automated detector-classifiers (referred to as automated detectors) and manual review by experienced analysts to determine the presence of sounds produced by marine mammals in the acoustic data. First, a suite of automated detectors was applied to the full data set (see Appendices B.1 to B.4). Second, a subset (1 %) of acoustic data was selected for manual analysis of marine mammal acoustic occurrence. The subset, representing 1,915 sound files (~160 h worth of 9 min 64 kHz sound files and ~14 h worth of 1 min 512 kHz sound files), was selected based on automated detector results via our Automatic Data Selection for Validation (ADSV) algorithm (Kowarski et al. 2021) (see Appendix B.3). Third, manual analysis results were compared to automated detector results to determine automated detector performance (see Appendix B.4). Finally, hourly marine mammal occurrence plots were created that incorporated both manual and automated detections (see Section 4.3) and automated detector performance metrics were provided (see Appendix C) to present a reliable representation of marine mammal presence in the acoustic data. These marine mammal analysis steps are summarized here and described in detail in Appendix A. Where automated detector results were unreliable or did not add additional information to species occurrence, only the validated results from manual analysis are presented.

3.3.1. Automated Click Detection

Odontocete clicks are high-frequency impulses ranging from 5 to over 150 kHz (Au et al. 1999, Møhl et al. 2000). We applied an automated click detector to the acoustic data sampled at 512 kHz to identify clicks from sperm whales, delphinids, beaked whales, porpoises, and Kogia. This automated detector is based on zero-crossings in the acoustic time series. Zero-crossings are the rapid oscillations of a click's pressure waveform above and below the signal's normal level (e.g., see Figure B-1). Zero-crossing-based features of automatically detected events are then compared to templates of known clicks for classification (see Appendix B.1 for details).

3.3.2. Automated Tonal Signal Detection

Tonal signals are narrowband, often frequency-modulated, signals produced by many species across a range of taxa (e.g., baleen whale moans, delphinids whistles, and pinniped moans). They range predominantly between 15 Hz and 20 kHz (Steiner 1981, Berchok et al. 2006, Risch et al. 2007). An automated Java-based contour detector was used to identify and target the tonal signals of all marine mammals in the data (see Appendix A for details). The tonal detector was applied to the acoustic data sampled at 64 kHz.

3.3.3. Evaluating Automated Detector Performance

JASCO's suite of automated detectors are developed, trained, and tested to be as reliable and broadly applicable as possible. However, the performance of marine mammal automated detectors varies across acoustic environments (e.g., Hodge et al. 2015, Širović et al. 2015, Erbs et al. 2017, Delarue et al. 2018). Therefore, automated detector results must always be supplemented by some level of manual review to evaluate automated detector performance. Here, we manually analyzed a subset of acoustic files for the presence/absence of marine mammal acoustic signals via spectrogram review in JASCO's PAMlab software. A subset of acoustic data (1 % of 512 kHz data and 0.8 % of 64 kHz data) from each station and sampling rate was selected via ADSV for manual review (see Appendix B.4).

To determine the performance of the automated detectors at each station per acoustic file (1 min files sampled at 512 kHz and 9 min files sampled at 64 kHz) the automated and manual results (excluding files where an analyst indicated uncertainty in species occurrence) were fed into an algorithm that calculates precision (*P*), recall (*R*), and Matthew's Correlation Coefficient (*MCC*) (see Appendix B.4 for formulas). *P* represents the proportion of files with detections that are true positives. A *P* value of 0.90 means that 90 % of the files with automated detections truly contain the targeted signal, but it does not indicate whether all files containing acoustic signals from the species were identified. *R* represents the proportion of files containing the signal of interest that were identified by the automated detector. An *R* value of 0.90 means that 90 % of files known to contain a target signal had automated detections, but it says nothing about how many files with automated detections were incorrect. An MCC is a combined measure of *P* and *R*, where an MCC of 1.00 indicates perfect performance: all events were correctly automatically detected. The algorithm determines a per file automated detector threshold (the number of automated detections per file at and above which automated detections were considered valid) that maximizes the MCC.

For many species, more than one automated detector targeted their vocalizations. In these instances, the performance of all automated detectors was evaluated, and the highest performing detector used to represent species/vocalization-type occurrence in Section 4.3. Only automated detections associated with a *P* greater than or equal to 0.75 were considered. When $P < 0.75$, only the validated results were used to describe the acoustic occurrence of a species.

The occurrence of each species (both validated and automated, or validated only where appropriate) was plotted using JASCO's Ark software as time series showing presence/absence by hour over each day of the recording period. Automated detector performance metrics associated with results in Section 4.3 are provided in Appendix C and should be considered when interpreting results.

4. Results

4.1. Ambient Sound

The band-level plots, spectrograms (long-term spectral averages), decidecade box-and-whisker plots, and spectral density level percentiles for both stations (see Figures 7–10) provide an overview of the sound variability in time and frequency. These plots present an overview of presence and level of contribution from different sources. Short-term events appear as vertical stripes on the spectrograms and spikes on the band level plots. Long-term events affect (increasing or decreasing accordingly) the band level over the event period and appear in the spectrograms as horizontal bands of colour. Table 5 shows the overall percentile values for the broadband sound levels by station and deployment. Figures 11–14 show the decade band sound levels by time since low tide and day of week.

For both stations, the strongest contributions to the soundscape occur at low frequency, below ~100 Hz, was a combination of flow noise and vessel traffic. Tide-induced flow noise influences the lowest frequency band, as well as the broadband (Figures 11–14). The left sides of these figures show that sound levels in the lowest frequency band increase on the flooding tide following the low, then decrease in the approach to high tide, and then repeat for the ebb. The higher frequency bands do not show a relationship with the tidal processes. For these monitoring periods, the flow noise is driven by tidal flow over the hydrophones. AMAR-N had higher flow noise than AMAR-S at peak flow. AMAR-S had substantially lower sound levels on flood than on ebb tide, whereas the influence of tidal flow was more consistent during flood and ebb at AMAR-N. Interestingly, the sound level patterns related to tidal flow changed over the two monitoring periods, possibly indicating a sensitivity to subtle changes in instrument position on the seafloor. There is also evidence of mooring noise driven by tidal flow, which may have differed between the two monitoring periods.

Vessel traffic is a soundscape contributor, specifically larger vessels that increase sound levels in the 40–315 Hz range. Figure 3 shows the marine traffic through the area in 2021 and demonstrates that both stations are located near a minor shipping lane. A diurnal pattern of sound levels across all bands was observed at AMAR-N, which suggests vessel activities that occurred mainly during daytime. The right side of Figures 11 and 12 show this trend for bands above 100 Hz. The lowest band does not reflect the daily/weekly pattern as sound levels are driven by flow noise related to the tidal period, not time of day. AMAR-S does not demonstrate the same pattern as AMAR-N, indicating different vessel activities influence each station's soundscape. Vessel activities from baseline surveys conducted near to AMAR-N may contribute substantially to this noted pattern at that location.

Rainfall noise is apparent at both stations but is more apparent at AMAR-N due to the shallower deployment depth. Drizzle noise occurs above 10 kHz and is characterized by intermittent sound level increases from ~10–100 kHz in the spectrogram (Figure 7) and an increase in mean and 95th percentiles (Figure 9). Since drizzle produces low levels of total daily precipitation, elevated sound levels in the 10–100 kHz band are not necessarily correlated with the precipitation shown in Figure 15. Heavier precipitation is associated with more broadband sound level increases (see Figure 2), such as events in late September or early January. In general, wind (Figure 16) and precipitation levels appear higher through October to April than in summer, which can both drive sound levels in the 10–10000 Hz ranges. This was more strongly reflected at AMAR-S than AMAR-N, as demonstrated in the spectrograms (Figures 7–8) and percentile figures (Figures 9–10), which may indicate that AMAR-N was in a more locally sheltered monitoring area.

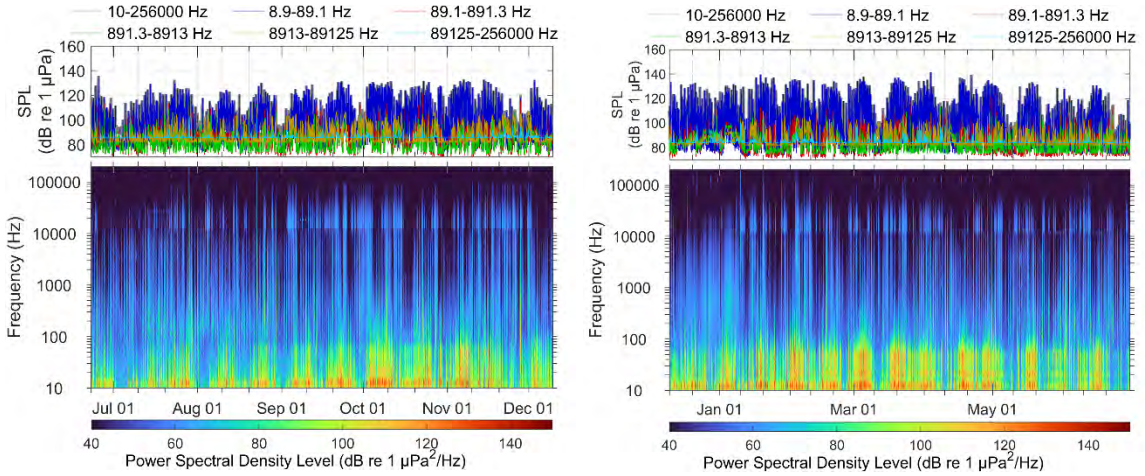


Figure 7. AMAR-N (left) Deployment 1 and (right) Deployment 2: In-band sound pressure level (SPL) and spectrogram for data recorded from 22 Jun to 9 Dec 2021 and 9 Dec 2021 to 30 Jun 2022, respectively.

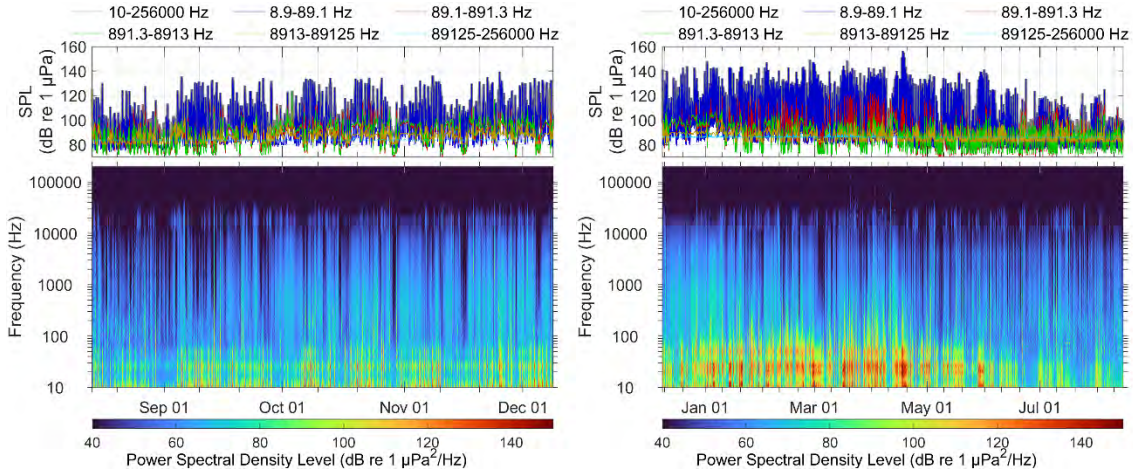


Figure 8. AMAR-S (left) Deployment 1 and (right) Deployment 2: In-band sound pressure level (SPL) and spectrogram for data recorded from 13 Aug to 8 Dec 2021 and 8 Dec 2021 to 15 Aug 2022, respectively.

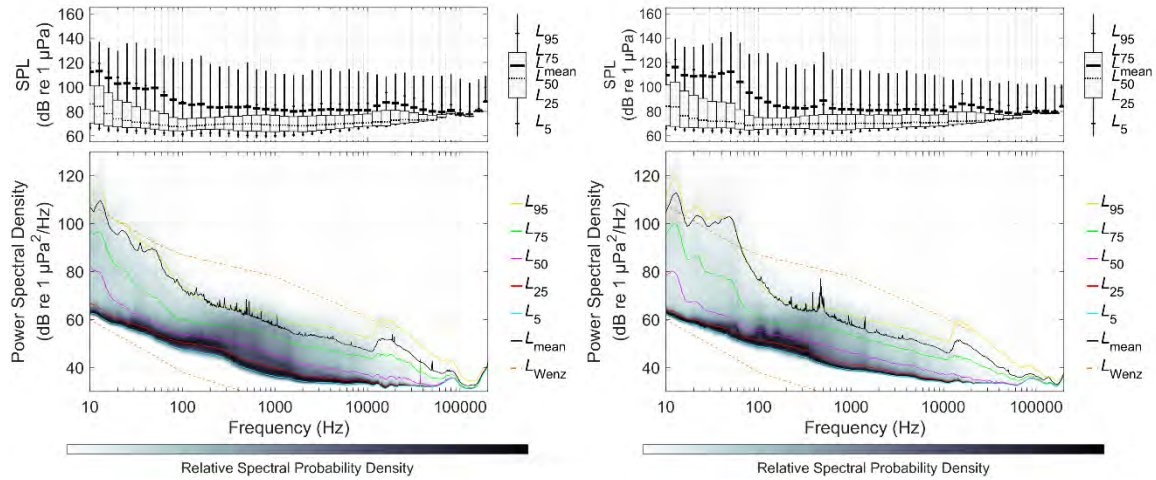


Figure 9. AMAR-N (left) Deployment 1 and (right) Deployment 2: Percentiles and mean of decidecade band sound pressure level (SPL) and percentiles and probability density (grayscale) of 1 min power spectral density levels compared to the limits of prevailing noise (Wenz 1962) for data recorded. L_{Mean} is the arithmetic mean (ISO 2017a).

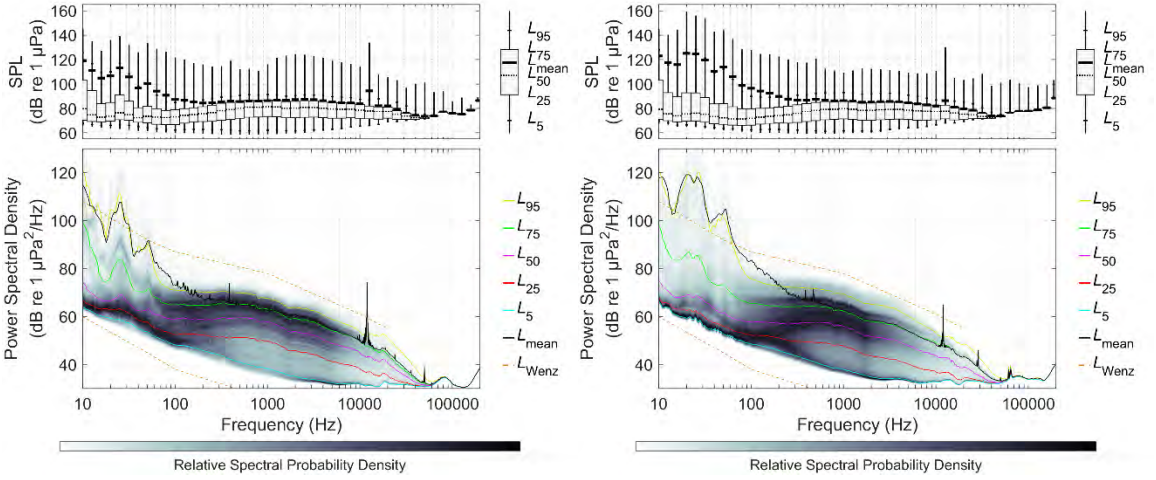


Figure 10. AMAR-S (left) Deployment 1 and (right) Deployment 2: Percentiles and mean of decidecade band sound pressure level (SPL) and percentiles and probability density (grayscale) of 1 min power spectral density levels compared to the limits of prevailing noise (Wenz 1962) for data recorded. L_{Mean} is the arithmetic mean (ISO 2017a).

Table 5. Broadband percentile levels for each deployment.

Percentile Level	AMAR-N Deployment 1	AMAR-N Deployment 2	AMAR-S Deployment 1	AMAR-S Deployment 2
Min	78.9	80.3	78.9	79.8
L_5	81.5	81.8	82.2	82.1
L_{25}	88.3	87.3	92.5	90.5
L_{50}	96.9	96.8	99.4	97.8
L_{75}	106.2	108.2	105.9	107.5
L_{95}	122.7	126.8	128.7	134.9
Max	142.9	147.1	145.2	159.9
Mean	116.8	120.6	120.8	130.1

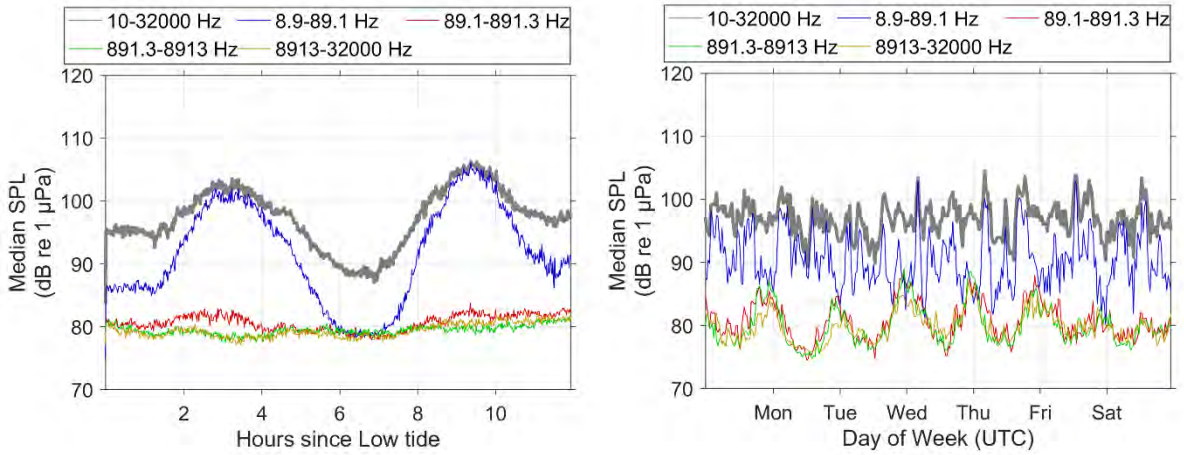


Figure 11. AMAR-N Deployment 1: Median sound pressure level (SPL) hours since low tide (left) and per week (right) for data recorded from 22 Jun to 9 Dec 2021. Note UTC is PDT+7 h and PST+8 h.

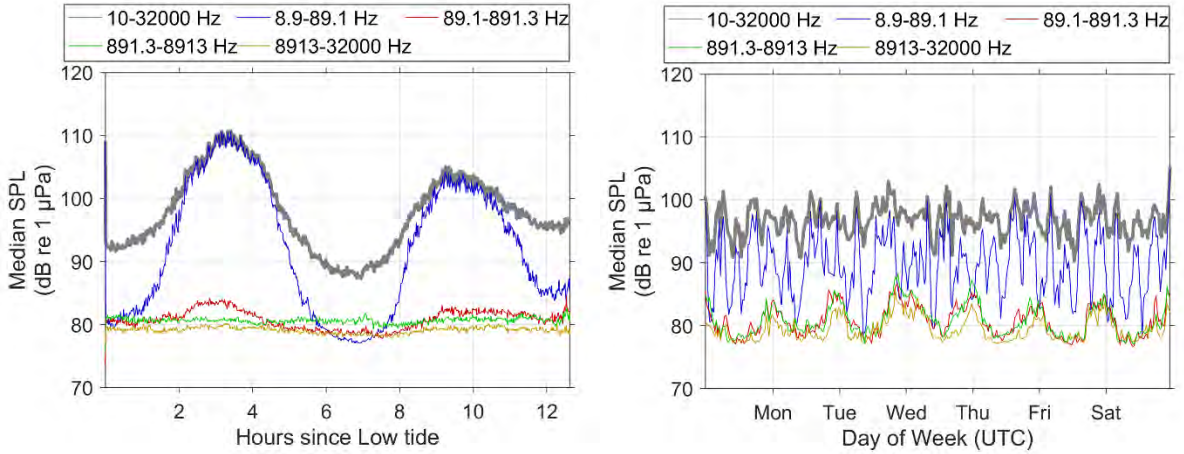


Figure 12. AMAR-N Deployment 2: Median sound pressure level (SPL) hours since low tide (left) and per week (right) for data recorded from 9 Dec 2021 to 30 Jun 2022.

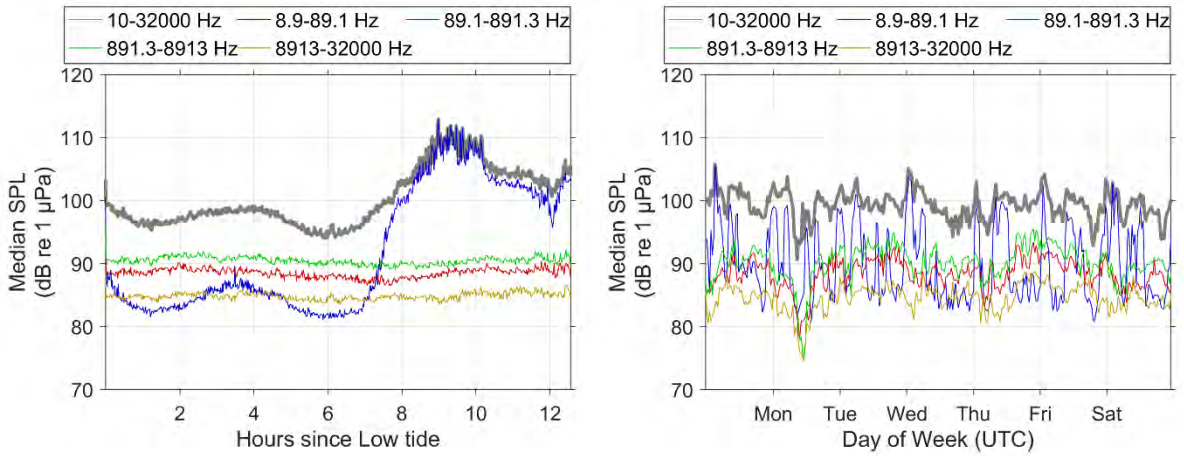


Figure 13. AMAR-S Deployment 1: Median sound pressure level (SPL) hours since low tide (left) and per week (right) for data recorded from 13 Aug to 8 Dec 2021.

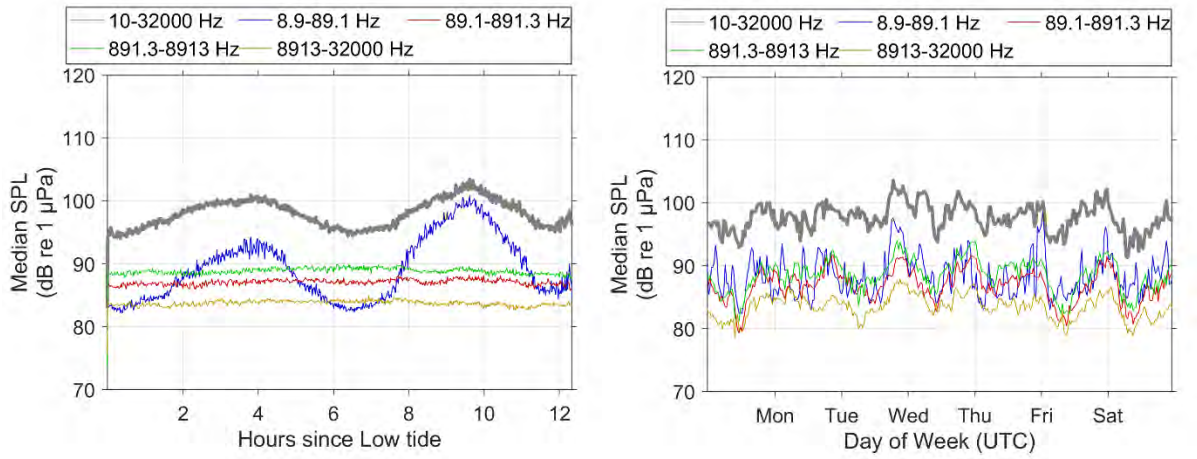


Figure 14. AMAR-S Deployment 2: Median sound pressure level (SPL) hours since low tide (left) and per week (right) for data recorded from 8 Dec 2021 to 15 Aug 2022.

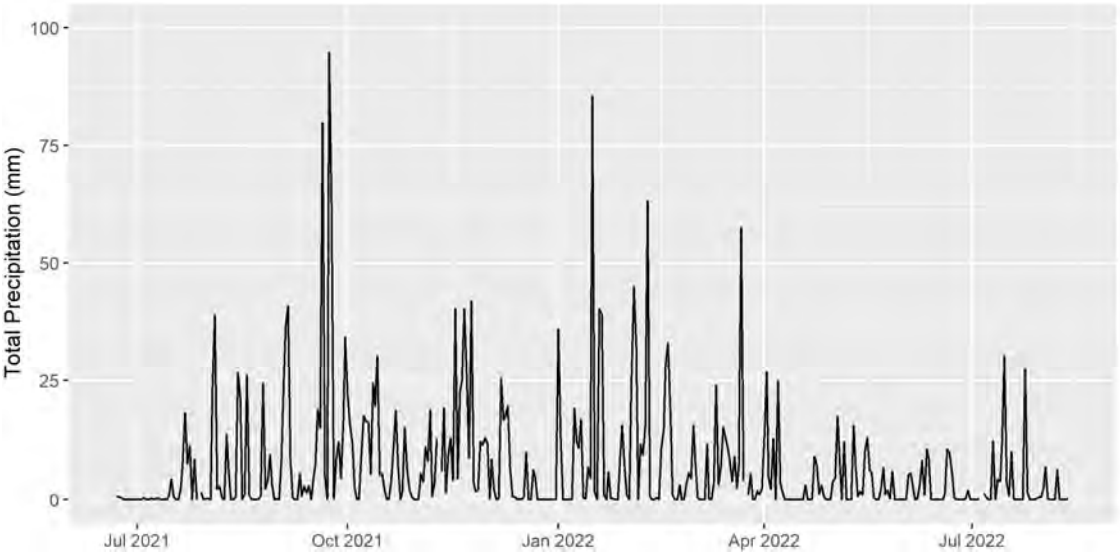


Figure 15. Daily total precipitation during the monitoring period from Prince Rupert (climate.weather.gc.ca).

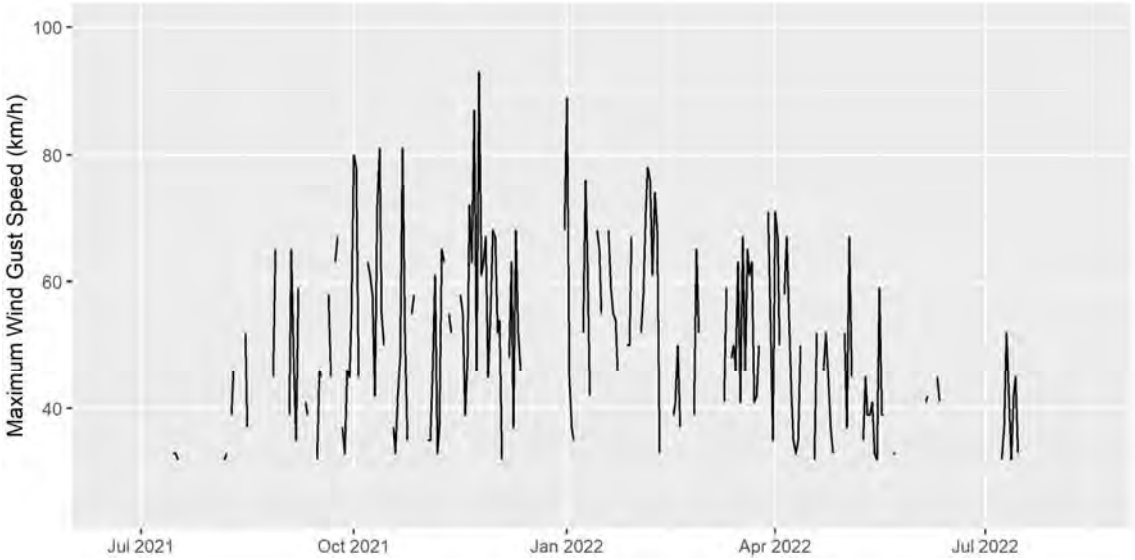


Figure 16. Maximum wind gust speeds during the monitoring period from Prince Rupert (climate.weather.gc.ca).

4.2. Vessel Noise Detection

Vessels were detected using the automated detection algorithms described in Section 3.2.2. Figure 17 shows vessel detections at both monitoring sites in Portland Inlet. Vessel detections were continuous throughout both monitoring periods, with a clear trend showing a decrease during nighttime hours. Vessel presence increased in summer months and decreased from approximately October to May. Vessel detections were similar at both stations for the overlapping time periods (slightly more detections in summer at AMAR-S than AMAR-N).

The shipping detector determines when each vessel or boat reaches its closest point of approach (CPA) to the AMAR. So we plotted the number of CPAs per day (Figure 18 and 19) as a proxy for the number of vessel passes per day. At both stations there is more vessel and boat activity in the summer compared to winter. Days with the highest numbers of vessel passes at AMAR-N may reflect times that marine mammal and fish baseline surveys for the Project were being conducted in the area. Other boat and vessel activity at that location are likely attributed to local fishing and recreational activities. Vessel and boat activity at AMAR-S is likely associated mainly with fishing, recreational, and tourism activities. Each station also experiences occasional commercial traffic transiting to and from Stewart, BC.

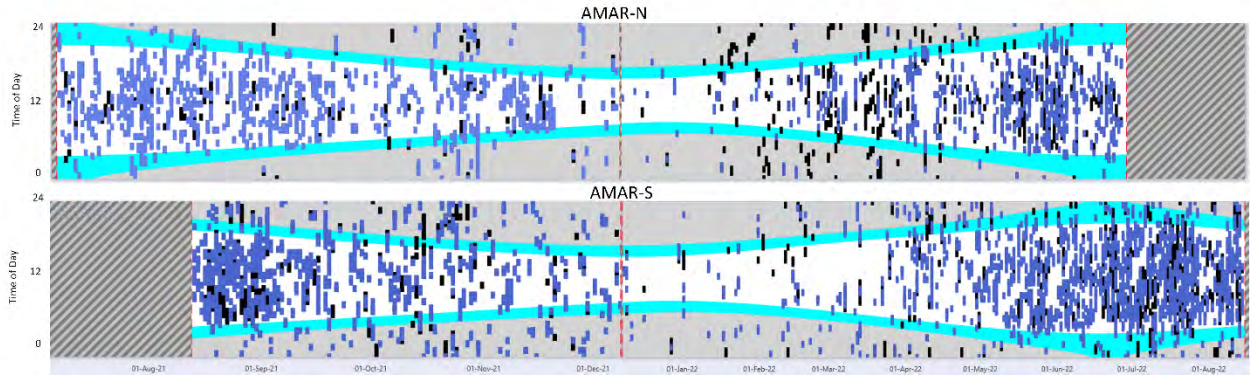


Figure 17 (Top) AMAR-N and (bottom) AMAR-S: Half hourly occurrence of vessels at the monitoring locations in Portland Inlet from Jun 2021 until Aug 2022. Blacked out hours indicate automated detections of vessels, blue indicate boats. Red dashed lines indicate recorder deployment and retrieval dates. Shaded areas indicate hours of darkness from sunset to sunrise (data from Ocean Time Series Group 2009).

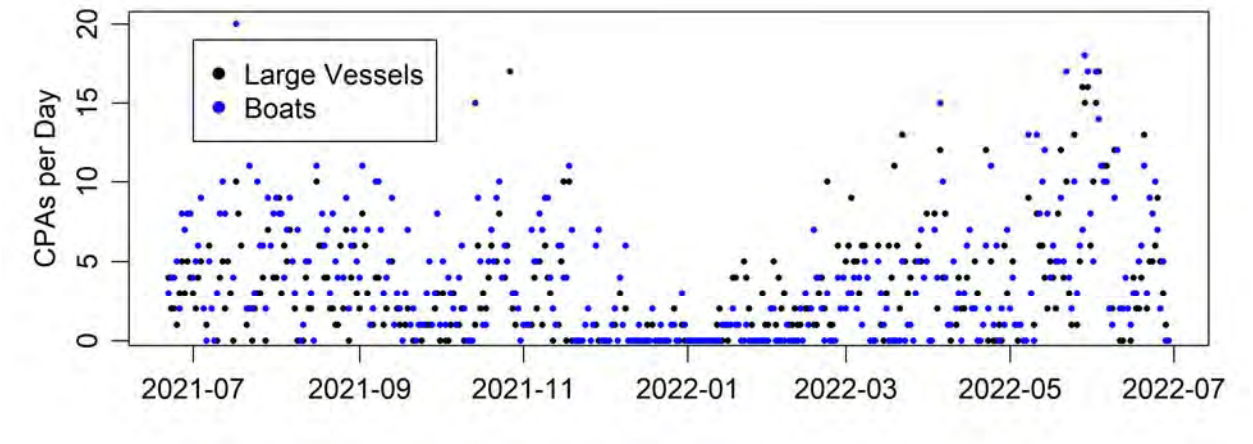


Figure 18 AMAR N number of closest points of approach (CPA) as a proxy of number of passes by vessels and boats.

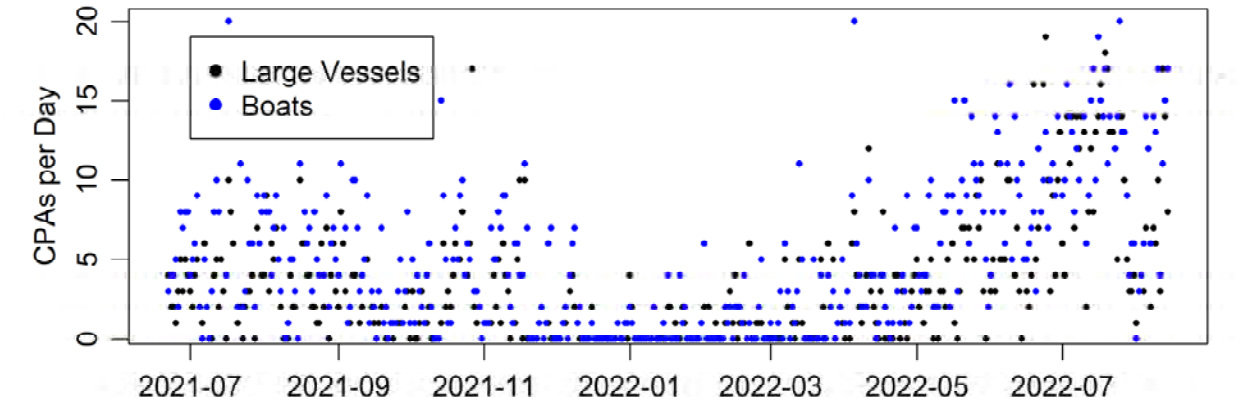


Figure 19 AMAR S number of closest points of approach (CPA) as a proxy of number of passes by vessels and boats.

4.3. Marine Mammals

The acoustic presence of marine mammals was identified automatically by JASCO's detectors and validated via the manual review of 1 % ADSV of the Portland Inlet data (see Appendix B.4), which represents 1,915 sound files, or ~160 h worth of 9 min 64 kHz sound files and ~14 h worth of 1 min 512 kHz sound files.

Detectors and analysts found acoustic signals of killer whales, harbour porpoises, harbour seals, and humpback whales. No sea lions, grey whales, or Pacific white-sided dolphins were detected. Detailed automated detector results can be found in Appendix C.

Some automated detectors performed, well with precisions ranging from 0.75 to 1.00 and recalls from 0.04 to 0.86 for the Portland Inlet data (see details on automated detector performance in Appendix C). Automated detector performance should always be considered when interpreting the occurrence plots in the following marine mammal sections. Automated detections were only used to assess acoustic occurrence when $P \geq 0.75$. For humpback whales, the automated detectors were found to be unreliable, so only the manually annotated results are presented in the following sections. Sections 4.3.1 to 4.3.4 focus on the occurrence of detected marine mammal species at AMAR-N and AMAR-S Portland Inlet stations.

4.3.1. Killer Whales

Killer whale tonal vocalizations (Figure 20) (Ford 1991) and clicks (~~see~~ Figure 21) were detected at both stations. In general, manual and automated detections of both signal types provide very similar representations of the acoustic occurrence of this species. Detections occurred in pulses throughout both recording periods, with no clear temporal trends or seasonal patterns. Killer whale detections were systematically higher at AMAR-S. A few clusters of detections suggest that the same pods of killer whales may have been sequentially detected at both stations (see for instance in January and early April) (Figures 22 and 23).

The performance of the whistle detector was good at AMAR-S but likely underrepresented the occurrence of killer whales at AMAR-N (R = 0.12-0.67; Appendix C; Figure 22). There were too few confirmed click detections to accurately assess the automated detector performance at AMAR-N and therefore only manual detections are presented. At AMAR-S, the automated click detector accurately represents clicks over 75% of the time for both deployments (Figure 23; Appendix C).

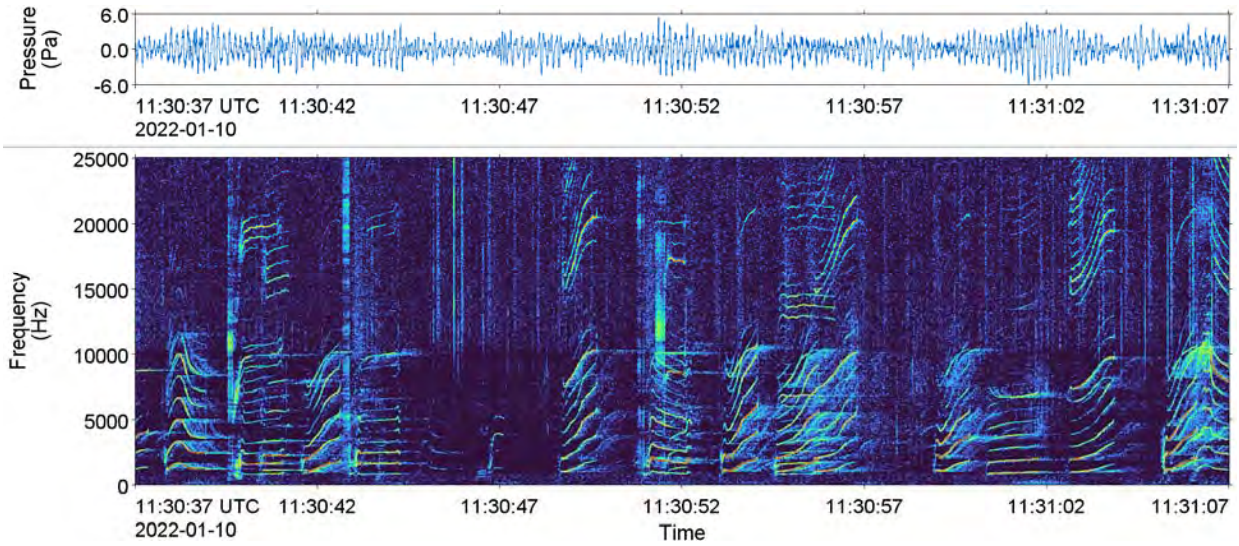


Figure 20. Killer whale: (Top) 30 s waveform and (bottom) spectrogram of whistles recorded on AMAR-N on 10 Jan 2022 (4 Hz frequency resolution, 0.05 s time window, 0.01 s time step, Hamming window, normalized across time).

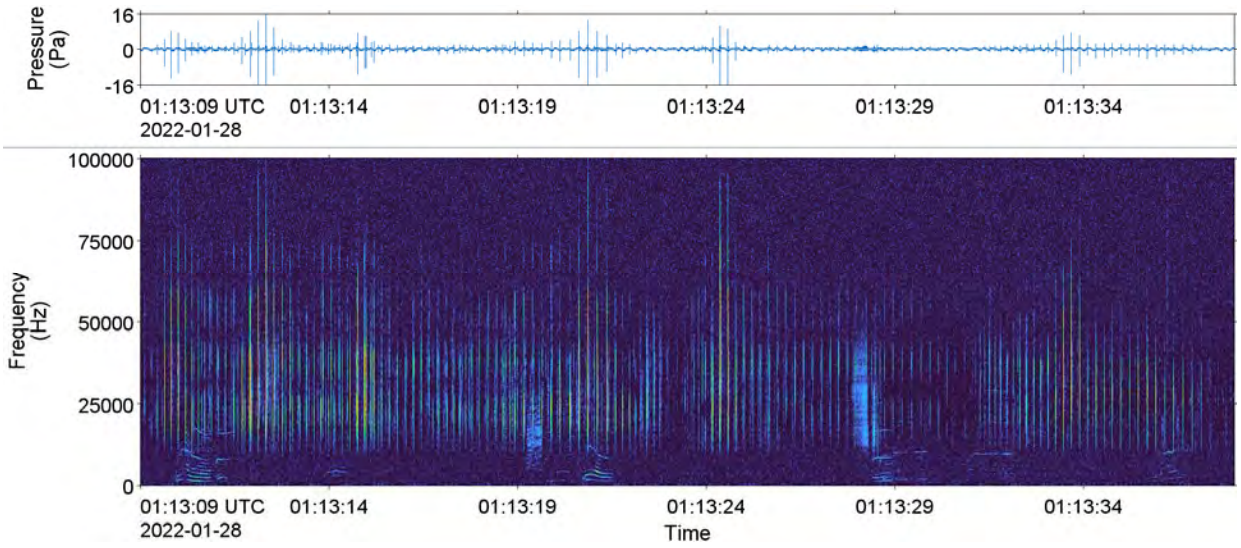


Figure 21. Killer whale: (Top) 30 s waveform and (bottom) spectrogram of clicks recorded on AMAR-S on 28 Jan 2022 (64 Hz frequency resolution, 0.01 s time window, 0.005 s time step, Hamming window, normalized across time).

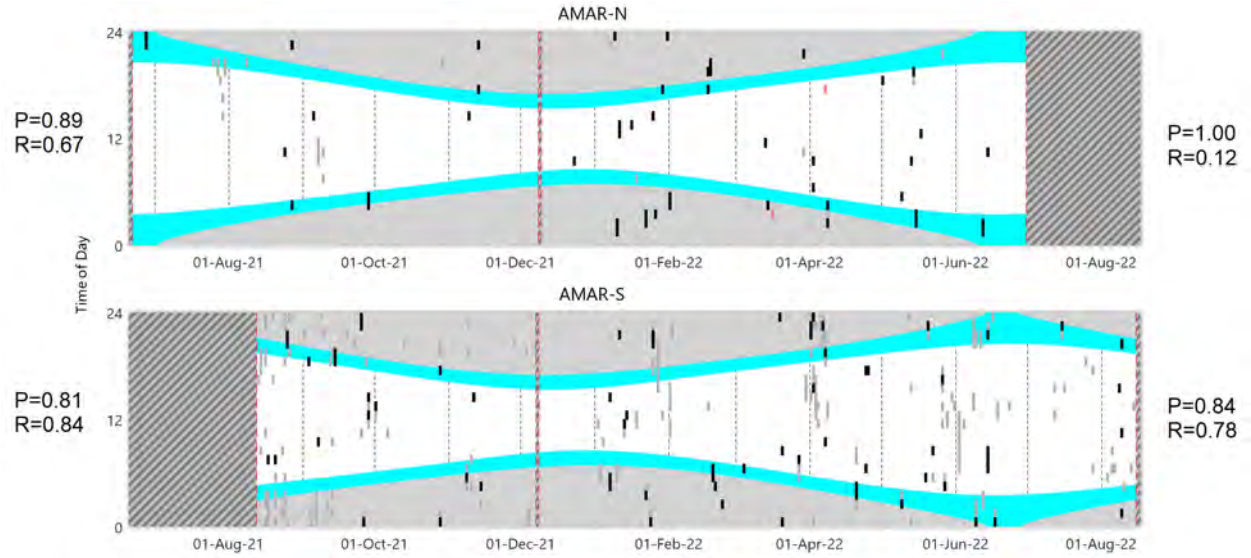


Figure 22. Killer whales: Daily and hourly occurrence of whistles during the recording period (June 2021 to August 2022) at (top) AMAR-N and (bottom) AMAR-S. Greyed out hours indicate automated detections. Blacked out hours indicate confirmed occurrence. Red hours indicate possible detections. Red dashed lines indicate recorder deployment and retrieval dates. Shaded areas indicate hours of darkness from sunset to sunrise (data from Ocean Time Series Group 2009). Automated detector results for Deployment 1 are on the left and Deployment 2 on the right for both stations.

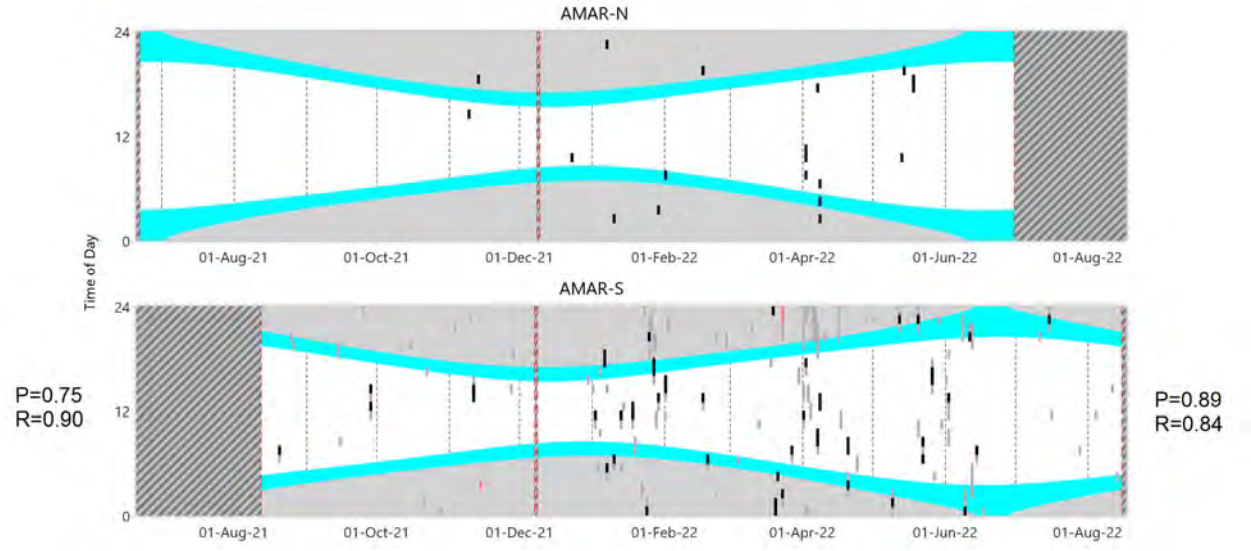


Figure 23. Killer whales: Daily and hourly occurrence of clicks during the recording period (June 2021 to August 2022) at (top) AMAR-N and (bottom) AMAR-S. Greyed out hours indicate automated detections. Blacked out hours indicate confirmed occurrence. Red hours indicate possible detections. Red dashed lines indicate recorder deployment and retrieval dates. Shaded areas indicate hours of darkness from sunset to sunrise (data from Ocean Time Series Group 2009). Automated detector results for Deployment 1 are on the left and Deployment 2 on the right for AMAR-S.

4.3.2. Harbour/Dall's Porpoises

Narrowband high-frequency clicks produced by either harbour or Dall's porpoises (Figures 24 and 25) were identified in the Portland Inlet data at both stations. These signals were detected sporadically at AMAR-N during the first recording period. Detections were more common during, and stable throughout, the second recording period. The recall value (R=0.65) indicates that automated detections underestimate the acoustic occurrence of porpoise clicks at AMAR-N. Click detections at AMAR-S were higher than at AMAR-N and characterize the acoustic occurrence of this species accurately (P=0.89; R=0.86). A clear seasonal signal was observed at that site. Detections increased in late October, remained at sustained levels until the end of March when they stopped abruptly, with only sporadic detections thereafter (Figure 26). At both stations, detections were biased towards nighttime hours.

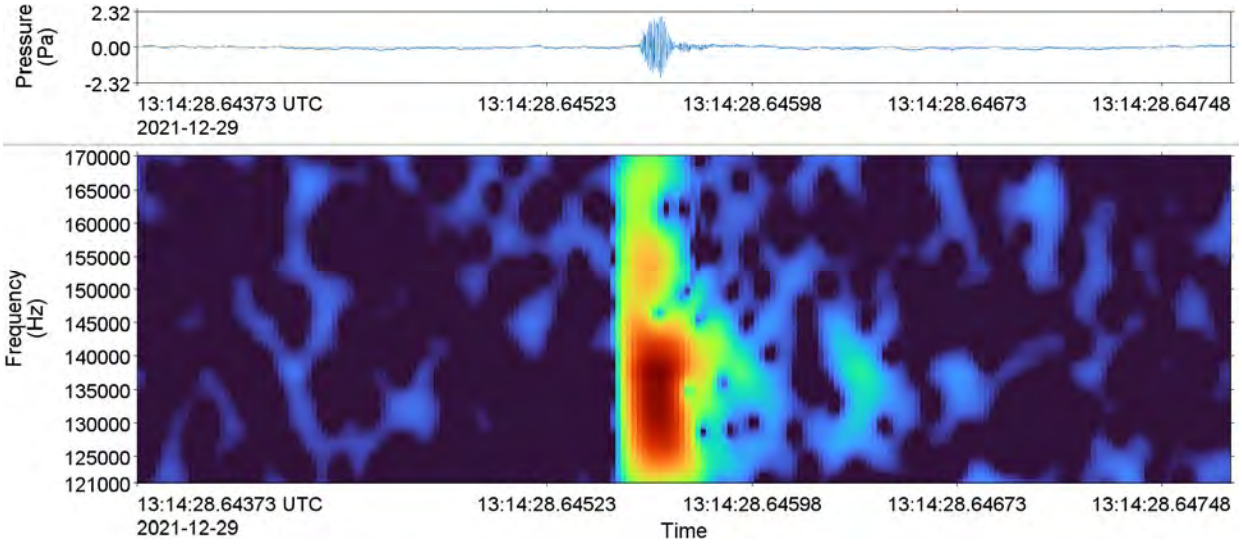


Figure 24. Porpoises: (Top) waveform and (bottom) spectrogram of a harbour or Dall's porpoise click recorded in Portland Inlet on 29 Dec 2021(512 Hz frequency resolution, 0.26 ms time window, 0.02 ms time step, Hamming window, normalized across time).

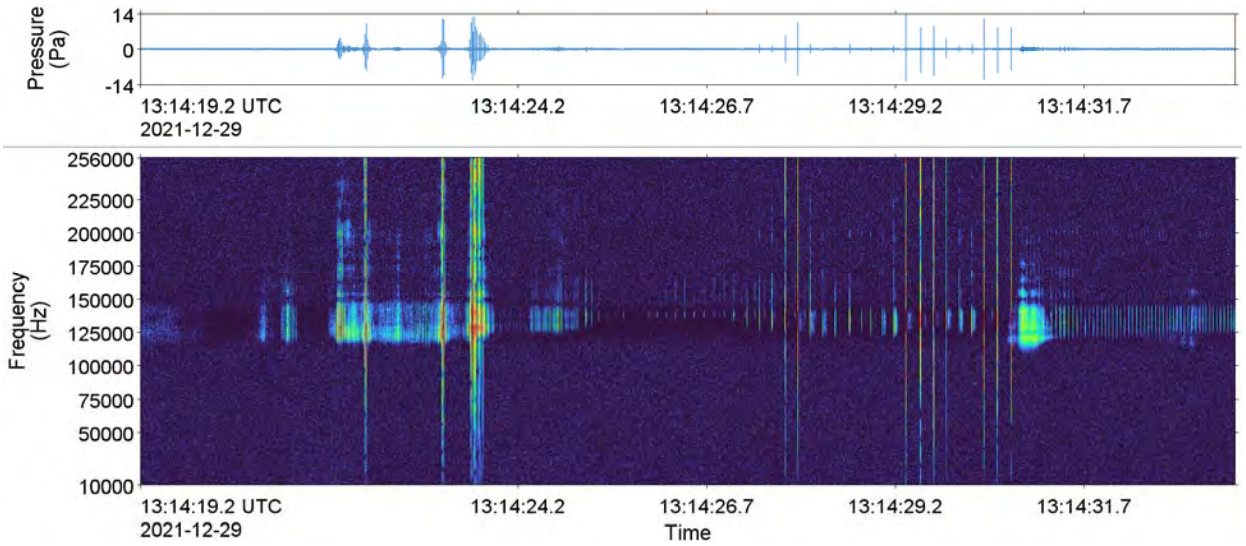


Figure 25. Porpoises: (Top) waveform and (bottom) spectrogram of harbour or Dall's porpoise' clicks recorded in Portland Inlet on 29 Dec 2021 (64 Hz frequency resolution, 0.01 s time window, 0.005 s time step, Hamming window, normalized across time).

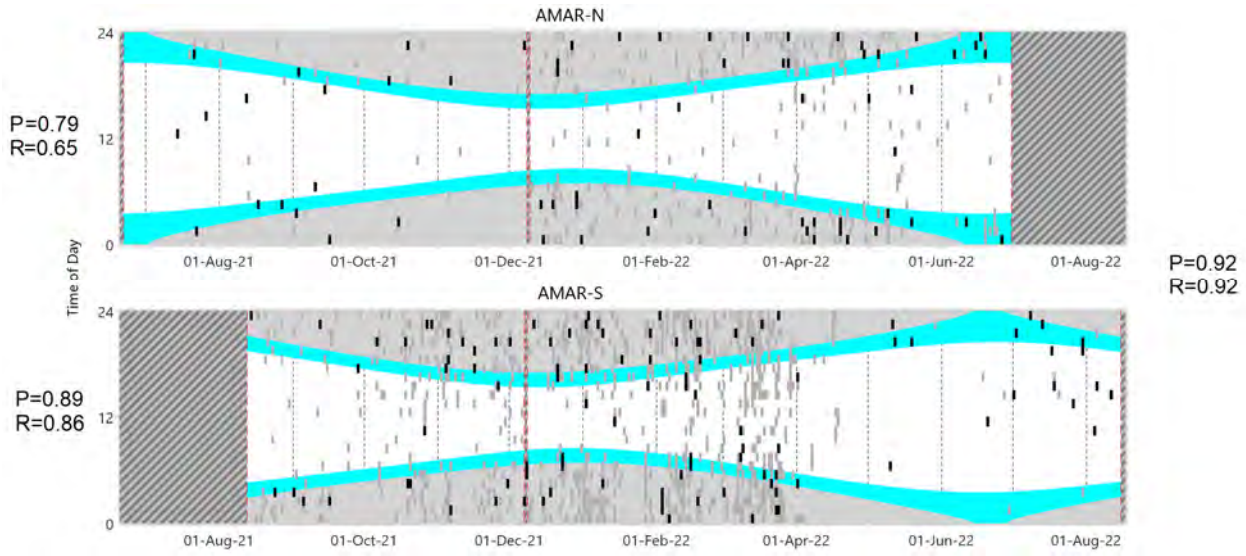


Figure 26. Harbour or Dall's porpoises: Daily and hourly occurrence of clicks during the first recording period (June 2021 August 2022) at (top) AMAR-N and (bottom) AMAR-S. Greyed out hours indicate automated detections. Blacked out hours indicate confirmed occurrence. Red dashed lines indicate recorder deployment and retrieval dates. Shaded areas indicate hours of darkness from sunset to sunrise (data from Ocean Time Series Group 2009). Automated detector results for Deployment 1 are on the left for both stations and combined for Deployment 2 on the right.

4.3.3. Harbour Seals

Harbour seal vocalizations (roar, below 2 kHz; Figure 27) were primarily detected in July and August at both stations, with sporadic confirmed and presumed detections also occurring in May and June (Figure 28). Harbour seals roars displayed a diel pattern with vocalizations occurring primarily during nighttime at AMAR-S (Figure 28). Harbour seal roars were identified with a relatively good precision by the automated detector (P=0.75-1.0) but their occurrence was underestimated at both stations during the first (R=0.64), and particularly the second (AMAR-S, R=0.04), deployment (Appendix C).

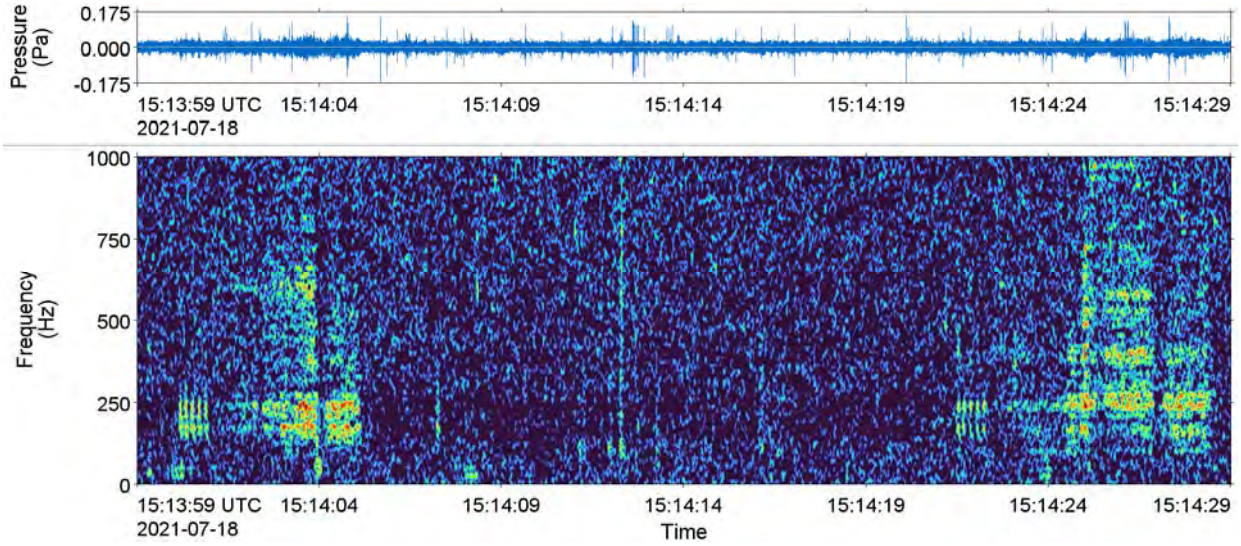


Figure 27. Harbour seals: (Top) waveform and (bottom) spectrogram of roars recorded on AMAR-N on 18 Jul 2021 (2 Hz frequency resolution, 0.125 s time window, 0.03125 s time step, Hamming window, normalized across time).

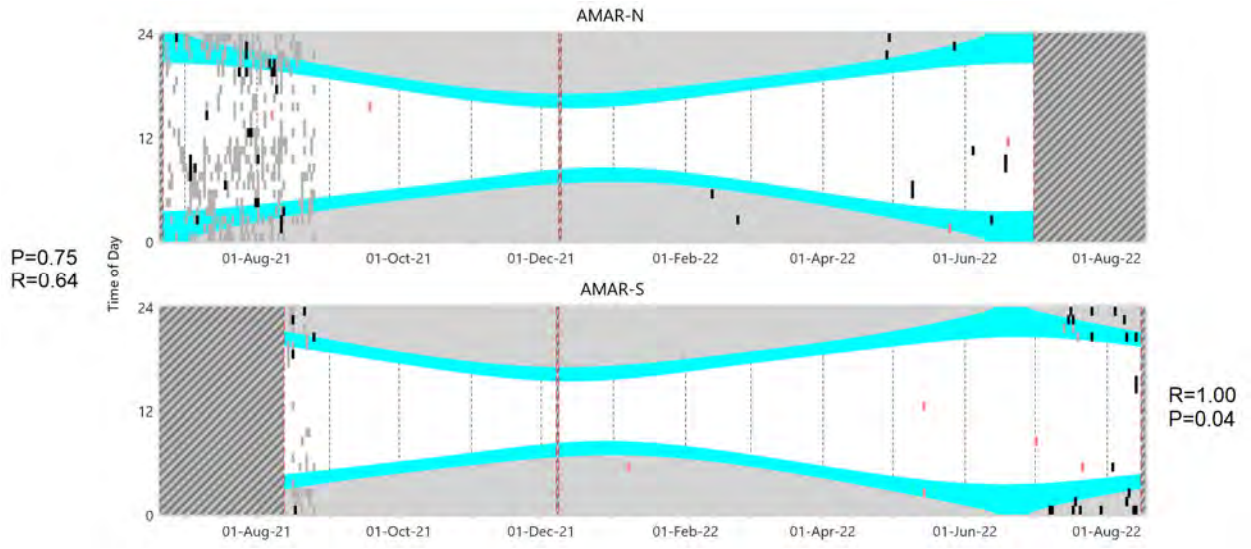


Figure 28. Harbour seals: Daily and hourly occurrence of vocalizations during the first recording period (June 2021 to August 2022) at (top) AMAR-N and (bottom) AMAR-S. Greyed out hours indicate automated detections. Blacked out hours indicate confirmed occurrence. Red hours indicate possible detections. Red dashed lines indicate recorder deployment and retrieval dates. Shaded areas indicate hours of darkness from sunset to sunrise (data from Ocean Time Series Group 2009). Automated detector results are combined for both stations for Deployment 1 on the left and Deployment 2 on the right for AMAR-S.

4.3.4. Humpback Whales

Humpback whale vocalizations recorded during this study consisted of hierarchical songs (Payne and McVay 1971) (Figure 29), as well as non-song vocalizations including grunts (Figure 30) (Rekdahl et al. 2015). Humpback whale vocalizations were detected sporadically throughout the recording period at AMAR-S only, mainly during nighttime (Figure 31). Sporadic unconfirmed manual detections were recorded at AMAR-N. A slight increase in vocal activity was apparent from September until March when songs were most prevalent. There were too few confirmed detections to accurately assess the automated detector performance.

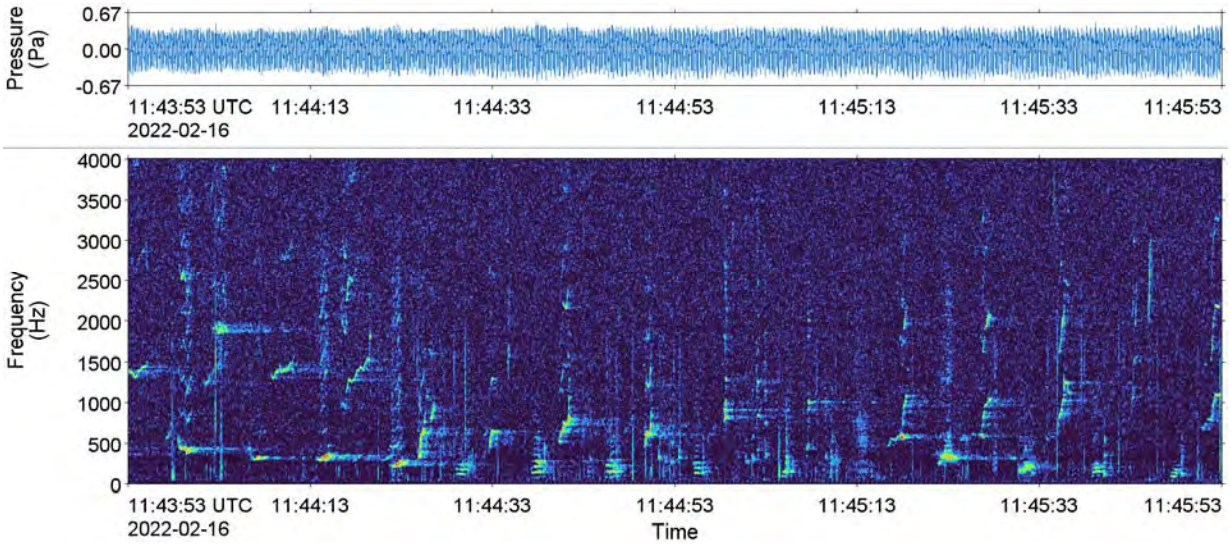


Figure 29. Humpback whales: 120 s (top) waveform and (bottom) spectrogram of vocalizations (songs) recorded on AMAR-S on 16 Feb 2022. (2 Hz frequency resolution, 0.125 s time window, 0.03125 s time step, Hamming window, normalized across time).

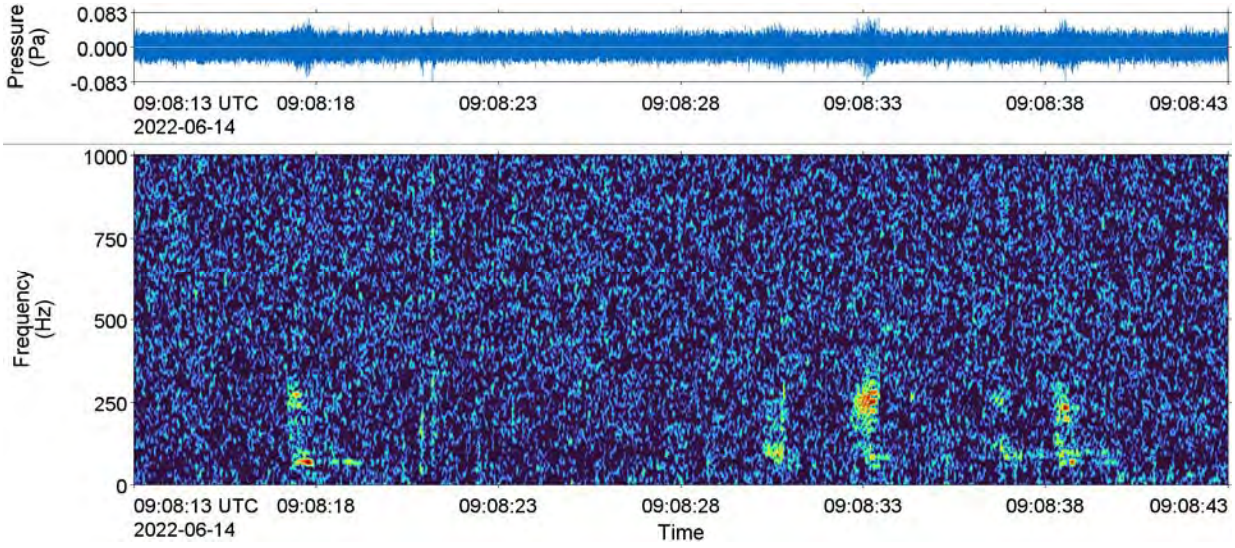


Figure 30. Humpback whales: (top) waveform and (bottom) spectrogram of grunts recorded on AMAR-S on 14 Jun 2022. (2 Hz frequency resolution, 0.125 s time window, 0.03125 s time step, Hamming window, normalized across time).

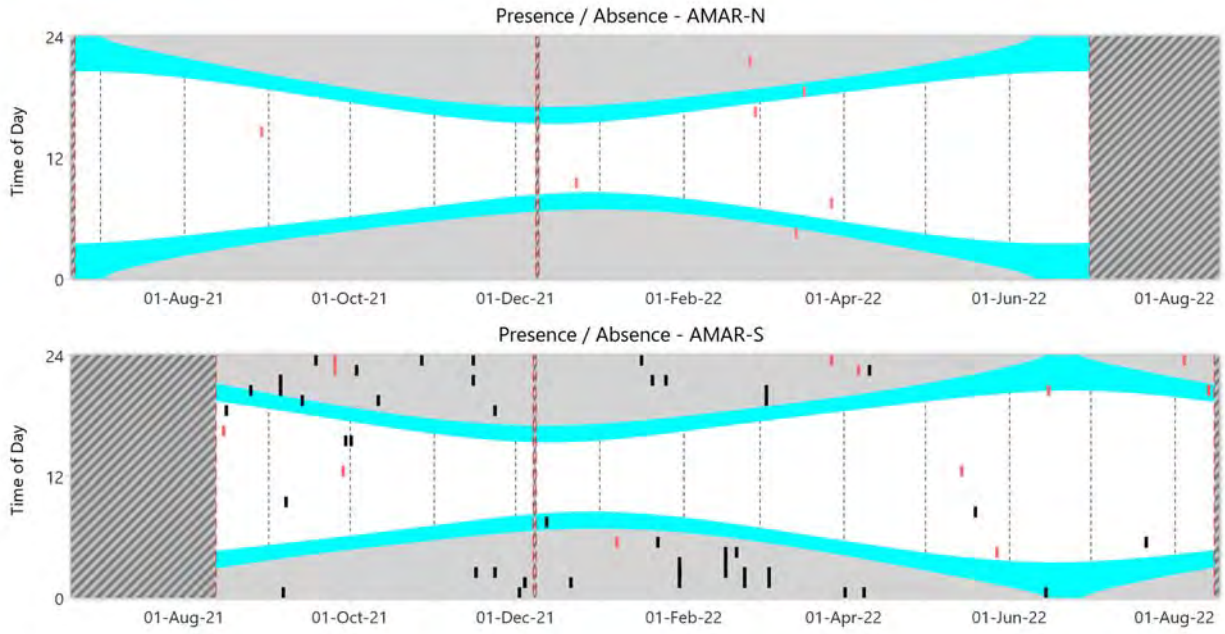


Figure 31. Humpback whales: Daily and hourly occurrence of tonal vocalizations during the first recording period (June 2021 to August 2022) at (top) AMAR-N and (bottom) AMAR-S. Blacked out hours indicate confirmed occurrence. Red hours indicate possible detections. Red dashed lines indicate recorder deployment and retrieval dates. Shaded areas indicate hours of darkness from sunset to sunrise (data from Ocean Time Series Group 2009).

5. Discussion and Conclusion

5.1. Ambient Sound and Vessel Traffic

The main contributors to the soundscape were vessels, rain, and flow noise. In general, both stations demonstrated variable sound levels, likely attested to changes in local vessel traffic and weather conditions. Figure 32 shows a vessel passing nearby to AMAR-S and Figure 33 shows an example of drizzle noise detected at the shallower station, AMAR-N.

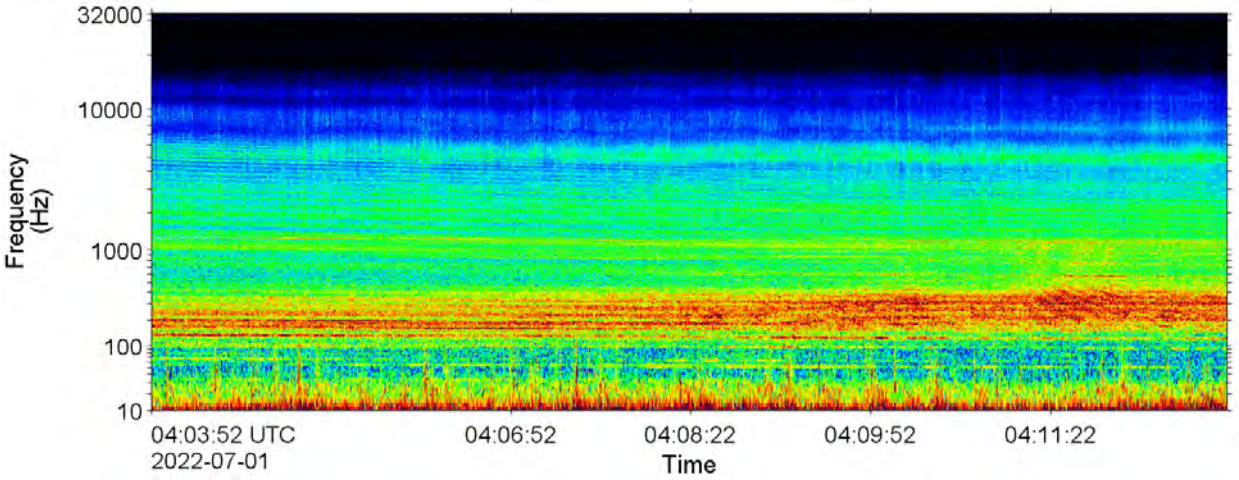


Figure 32. AMAR-S: Spectrum of sound levels during a period with a vessel present on 1 Jul 2022.

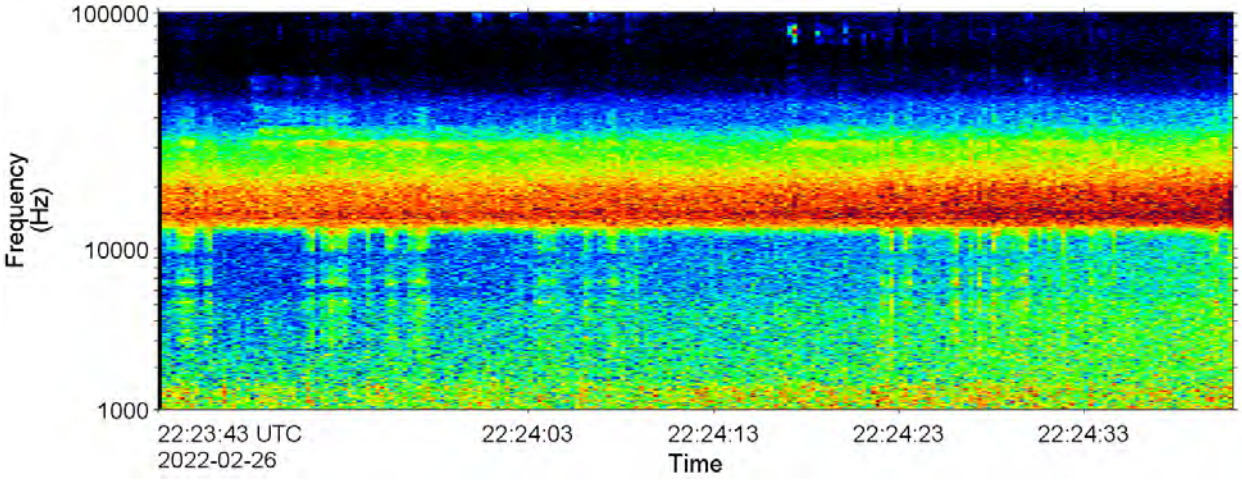


Figure 33. AMAR-N: Spectrum of sound levels influenced by drizzle noise on 26 Feb 2022.

5.2. Marine Mammals

The marine mammal acoustic detection results presented in this report provide an index of acoustic occurrence for each species. Although they might be used to describe the relative abundance of a species across the study area, many factors influence the detectability of the targeted signals. Several marine mammal species, for example, produce sounds on a seasonal basis, e.g., courting calls during breeding months, leading to an increase in acoustic detections for those times. Temporal changes in ambient sound levels may lead to variable probability of detections throughout the year. While an acoustic detection does indicate presence, an absence of detections does not necessarily indicate an absence of animals; absences can be due to a lack of calling by individuals near the acoustic recorders, masking of signals by environmental or anthropogenic noise sources, or a combination of these factors.

5.2.1. Killer Whales

Based on differences in genetics, acoustics, social behaviour, morphology, diet, and range, killer whales residing off the BC coast are divided into four distinct populations: Southern Resident (SRKW), Northern Resident (NRKW), Bigg's or Transient (Bigg's), and Offshore (OKW) (Ford et al. 1998, Ford et al. 2000, Barrett-Lennard and Ellis 2001). Bigg's travel in small, acoustically quiet groups and feed on marine mammals (Ford and Ellis 1999). SRKW and NRKW usually travel in acoustically active groups of 10 to 25 or more whales and feed exclusively on fish and cephalopods, while Bigg's killer whales feed primarily on marine mammals (Ford et al. 2000). OKW are the least understood of the three ecotypes but are believed to primarily consume fish, with shark species comprising a significant part of their diet (DFO 2018).

Based on the known range of the different resident killer whale ecotypes off British Columbia and southeast Alaska (Krahn et al. 2002), the most likely candidates for the detections presented here are northern resident killer whales. Because the study area lies just south of the southern edge of the range of southern Alaska residents, it is possible that some of the detected calls may have been produced individuals belonging to this group of killer whales. In addition, one cannot rule out that some of the calls may have been produced by Bigg's killer whales. This ecotype is notoriously less vocally active than resident killer whales (Deecke et al. 2005), which would affect their detectability in relation to NRKW Harbour seal acoustic detections confirm the presence of their preferred prey in the study area. Detailed analysis of the detected killer whale calls would allow determination of the ecotypes encountered but was outside the scope of this project.

The presence of resident killer whales in nearshore waters of the Pacific Northwest is largely driven by the presence of their main prey, chinook salmon, primarily from May to September. When chinook salmon become less abundant, resident killer whales target chum salmon in October and November (Ford and Ellis 2006). The diet of resident killer whales throughout the rest of the year is unknown.

5.2.2. Harbour/Dall's Porpoises

Narrowband high-frequency (NBHF) clicks from harbour or Dall's porpoises were recorded nearly year-round at both stations in the acoustic data analyzed in this study. Distinguishing both species remain difficult without advanced spectral analyses and degraded off-axis clicks as those often recorded via passive acoustic monitoring are not prone to these types of analyses. Harbour porpoises generally occupy an ecological niche consisting of coastal shelf waters less than 150 m deep, with temperatures ranging from 6 to 17°C. In BC, they also occupy deeper waters exceeding 200 m and occur year-round

(COSEWIC 2003). Dall's porpoises can be found inshore and in deep oceanic waters (Carretta et al. 2020). They are common in waters off southeast Alaska and BC. Habitat preference is therefore not a reliable factor to try assigning the detected clicks to one species or the other.

Pacific herring is an important prey item for both species (representing up to 60% of harbour porpoises' caloric input in the Salish Sea). Seasonal changes in harbour porpoise distribution in BC are likely tied to the movements and availability of prey (COSEWIC 2003) and Dall's porpoise presumably respond to the same type of foraging requirements. It remains unclear whether the abrupt cessation of detections in early April at AMAR-S can be assigned to the occurrence of a specific prey item. The high-frequency of NBHF clicks and lack of overlap with the frequencies of most natural or anthropogenic sources of underwater noise make them relatively immune to masking. Therefore, this drop in detection is believed to be real and not an artefact of data collection or masking.

Harbour porpoises are known to be highly sensitive to acoustic disturbance (Tougaard et al. 2015). Harbour porpoises demonstrate a change in behaviour in response to increased underwater sound levels. Anthropogenic noise may interfere with foraging, navigating, or social communication. Exposure to sonar has been shown (in captivity) to increase respiration rate and induce agitated and avoidance behaviours in harbour porpoises (Kastelein et al. 2015a, Kastelein et al. 2015b, Kastelein et al. 2015c).

5.2.3. Harbour Seals

Harbor seals are by far the most abundant marine mammals in BC. It is the only common earless seal in BC and is present in most nearshore habitats. Harbor seals generally occur in coastal waters within 20 km of land but have occasionally been seen as far as 100 km offshore. Mainly solitary in water, they can form small groups when ashore or out of water on exposed rocks. Although these animals move around to feed, breed, and moult, they are not considered migratory. They exhibit a high degree of site fidelity, often returning to the same haul out every year (BC Marine Conservation Analyses 2010).

Harbour seal vocalizations ("roars") were identified primarily in summer, which coincides with their mating season in the study area (Cottrell et al. 2002, Nikolich et al. 2018). The roar has been associated with breeding harbour seals throughout their global range (Van Parijs et al. 2003). Because this vocalization is stereotyped within an individual and varies between individuals, it is considered to be the primary means by which males display dominance to other males and likely to females (Van Parijs et al. 1997, Hayes et al. 2004a, Hayes et al. 2004b). Harbour seal calls are low-intensity sounds that can be easily masked during periods of elevated background noise under 500 Hz. However, the lack of detection outside of the breeding season in this study should not be interpreted as an absence of harbour seals and is presumably mainly driven by low calling rates. Most harbour seal vocalizations were detected during nighttime hours (Figure 28), which is typical for the species (Nikolich et al. 2018).

5.2.4. Humpback Whales

BC waters are used by foraging and migrating humpback whales. They are seen year-round in BC waters but are most abundant from April to November. They are the most frequently sighted baleen whale during ship surveys and have recently been regularly sighted in the Salish Sea during summer and early fall (Ford et al. 2014). 1092 humpback whales are estimated to frequent the Queen Charlotte Sound and Hecate Strait north up to Dixon Entrance (Best et al. 2015). In general, photo-identification data suggest the existence of two populations in northern and southern BC with different migratory destinations and low rate of exchange (COSEWIC 2011). Humpback whales in BC waters are part of a recovering North Pacific population. The most recent (2004–2006) abundance estimate for the North Pacific population is 21,808 (CV = 0.04). It is believed to be an underestimate of the population, which may be growing (Barlow et al. 2011).

Humpback whale acoustic occurrence at the mouth of the inlet peaked during winter when males were singing, a finding that coincides with the observations of the previous northern BC data sets (Frouin-Mouy et al. 2020, Mouy et al. 2020, Frouin-Mouy et al. 2021). There were no confirmed humpback whale vocalizations north of Pearse Island. Singing outside of known low-latitude breeding grounds has similarly been reported elsewhere in the North Pacific and in other high-latitude feeding areas or migratory routes around the globe (Baker et al. 1985, McSweeney et al. 1989, Norris et al. 1999, Stanistreet et al. 2013, Kowarski et al. 2019, Magnúsdóttir and Lim 2019, Ryan et al. 2019). Song production outside of breeding grounds may be important for song learning of this culturally transmitted behaviour (Payne et al. 1983, Garland et al. 2013, Kowarski et al. 2019, Magnúsdóttir and Lim 2019) and the timing of onset may be driven by physiological changes caused by seasonal fluctuations in hormone levels (Cates et al. 2019, Kowarski et al. 2019). It is yet unclear whether successful mating occurs outside of the breeding grounds. The apparent diel trend in humpback whale vocal behaviour observed here and in previous BC acoustic data sets has similarly been reported elsewhere including off eastern Canada (Kowarski et al. 2018, Kowarski et al. 2019), Mexico (Cholewiak 2008), Brazil (Sousa-Lima and Clark 2008), and Angola (Cerchio et al. 2014).

Glossary

Unless otherwise stated in an entry, these definitions are consistent with ISO 80000-3 (2017a).

ambient sound

Sound that would be present in the absence of a specified activity, usually a composite of sound from many sources near and far, e.g., shipping vessels, seismic activity, precipitation, sea ice movement, wave action, and biological activity.

annotation

A labelled selection of a period of time and frequency within a spectrogram as created by a human analyst during **manual analysis**.

automated detection

The output of an **automated detector**.

automated detector

An algorithm that includes both the **automated detection** of a sound of interest based on how it stands out from the background and its automated classification based on similarities to templates in a library of reference signals.

background noise

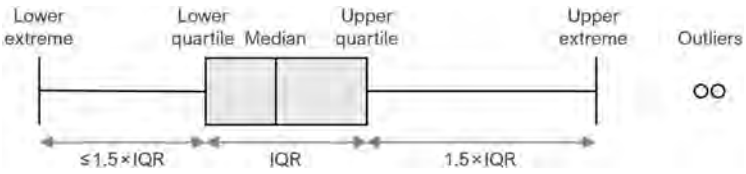
Combination of ambient sound, acoustic self-noise, and sonar reverberation. Ambient sound detected, measured, or recorded with a signal is part of the background noise.

bandwidth

The range of frequencies over which a sound occurs. Broadband refers to a source that produces sound over a broad range of frequencies (e.g., seismic airguns, vessels) whereas narrowband sources produce sounds over a narrow frequency range (e.g., sonar) (ANSI R2010).

box-and-whisker plot

A plot that illustrates the centre, spread, and overall range of data from a visual 5-number summary. The box is the interquartile range (IQR), which shows the middle 50 % of the data—from the lower quartile (25th percentile) to the upper quartile (75th percentiles). The line inside the box is the median (50th percentile). The whiskers show the lower and upper extremes excluding outliers, which are data points that fall more than 1.5 × IQR beyond the upper and lower quartiles.



cetacean

Any animal in the order Cetacea. These are aquatic species and include whales, dolphins, and porpoises.

decade

Logarithmic frequency interval whose upper bound is ten times larger than its lower bound (ISO 80000-3:2006).

decidecade

One tenth of a decade. *Note*: An alternative name for decidecade (symbol ddec) is “one-tenth decade”. A decidecade is approximately equal to one third of an octave (1 ddec ≈ 0.3322 oct) and for this reason is sometimes referred to as a “one-third octave”.

decidecade band

Frequency band whose bandwidth is one decidecade. *Note*: The bandwidth of a decidecade band increases with increasing centre frequency.

decibel (dB)

Unit of level used to express the ratio of one value of a power quantity to another on a logarithmic scale. Unit: dB.

delphinid

Family of oceanic dolphins, or Delphinidae, composed of approximately thirty extant species, including dolphins, porpoises and killer whales.

duty cycle

The time when sound is periodically recorded by an acoustic recording system.

Fourier transform (or Fourier synthesis)

A mathematical technique which, although it has varied applications, is referenced in the context of this report as a method used in the process of deriving a spectrum estimate from time-series data (or the reverse process, termed the inverse Fourier transform). A computationally efficient numerical algorithm for computing the Fourier transform is known as fast Fourier transform (FFT).

frequency

The rate of oscillation of a periodic function measured in cycles-per-unit-time. The reciprocal of the period. Unit: hertz (Hz). Symbol: f. 1 Hz is equal to 1 cycle per second.

hertz (Hz)

A unit of frequency defined as one cycle per second.

hydrophone

An underwater sound pressure transducer. A passive electronic device for recording or listening to underwater sound.

manual analysis

Human examination of acoustic data via visual review of spectrograms and/or aural inspection of data.

manual detection

The output of **manual analysis** as recorded in an **annotation**.

masking

Obscuring of sounds of interest by sounds at similar frequencies.

power spectral density

Generic term, formally defined as power in a unit frequency band. Unit: watt per hertz (W/Hz). The term is sometimes loosely used to refer to the spectral density of other parameters such as squared sound pressure. ratio of **energy spectral density**, E_f, to time duration, Δt, in a specified temporal observation window. In equation form, the power spectral density P_f is given by:

$$P_f = \frac{E_f}{\Delta t}.$$

Power spectral density can be expressed in terms of various field variables (e.g., sound pressure, sound particle displacement).

median

The 50th percentile of a statistical distribution.

mysticete

A suborder of cetaceans that use baleen plates to filter food from water. Members of this group include rorquals (Balaenopteridae), right whales (Balaenidae), and grey whales (*Eschrichtius robustus*).

octave

The interval between a sound and another sound with double or half the frequency. For example, one octave above 200 Hz is 400 Hz, and one octave below 200 Hz is 100 Hz.

odontocete

The presence of teeth, rather than baleen, characterizes these whales. Members of the Odontoceti are a suborder of cetaceans, a group comprised of whales, dolphins, and porpoises. The skulls of toothed whales are mostly asymmetric, an adaptation for their echolocation. This group includes sperm whales, killer whales, belugas, narwhals, dolphins, and porpoises.

power spectral density

Generic term, formally defined as power in a unit frequency band. Unit: watt per hertz (W/Hz). The term is sometimes loosely used to refer to the spectral density of other parameters such as squared sound pressure. ratio of the energy spectral density, E_f, to time duration, Δt, in a specified temporal observation window. In equation form, the power spectral density P_f is given by:

$$P_f = \frac{E_f}{\Delta t}.$$

Power spectral density can be expressed in terms of various field variables (e.g., sound pressure, sound particle displacement).

power spectral density level

The level ($L_{P,f}$) of the **power spectral density** (P_f). Unit: decibel (dB).

$$L_{P,f} := 10 \log_{10}\left(P_f / P_{f,0}\right) \text{ dB} .$$

The frequency band and integration time should be specified.

As with **power spectral density**, power spectral density level can be expressed in terms of various field variables (e.g., sound pressure, sound particle displacement). The reference value ($P_{f,0}$) for power spectral density level depends on the nature of field variable.

pressure, acoustic

The deviation from the ambient pressure caused by a sound wave. Also called sound pressure. Unit: pascal (Pa).

pressure, hydrostatic

The pressure at any given depth in a static liquid that is the result of the weight of the liquid acting on a unit area at that depth, plus any pressure acting on the surface of the liquid. Unit: pascal (Pa).

rms

abbreviation for root-mean-square.

sound

A time-varying disturbance in the pressure, stress, or material displacement of a medium propagated by local compression and expansion of the medium.

sound pressure

The contribution to total pressure caused by the action of sound.

sound pressure level (rms sound pressure level)

The level ($L_{p,\text{rms}}$) of the time-mean-square sound pressure (p^2_{rms}). Unit: decibel (dB). Reference value (p_0^2) for sound in water: 1 μPa^2.

$$L_{p,\text{rms}} := 10 \log_{10}(p^2_{\text{rms}} / p_0^2) \text{ dB } = 20 \log_{10}(p_{\text{rms}} / p_0) \text{ dB}$$

The frequency band and averaging time should be specified. Abbreviation: SPL or Lrms.

soundscape

The characterization of the ambient sound in terms of its spatial, temporal, and frequency attributes, and the types of sources contributing to the sound field.

spectrogram

A visual representation of acoustic amplitude compared with time and frequency.

spectrum

An acoustic signal represented in terms of its power, energy, mean-square sound pressure, or sound exposure distribution with frequency.

validated detection

The output of an **automated detector** that has been subsequently validated by a human analyst.

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Appendix A. Acoustic Data Analysis Methods

A.1. Total Ambient Sound Levels

Underwater sound pressure amplitude is measured in decibels (dB) relative to a fixed reference pressure of p_0 = 1 µPa. Because the perceived loudness of sound, especially impulsive noise such as from seismic airguns, pile driving, and sonar, is not generally proportional to the instantaneous acoustic pressure, several sound level metrics are commonly used to evaluate noise and its effects on marine life. We provide specific definitions of relevant metrics used in this report. Where possible we follow the ANSI and ISO standard definitions and symbols for sound metrics, but these standards are not always consistent.

The zero-to-peak pressure level, or peak pressure level (PK or $L_{p,pk}$; dB re 1 µPa), is the decibel level of the maximum instantaneous sound pressure level in a stated frequency band attained by an acoustic pressure signal, $p(t)$:

$$\mathrm{PK} = L_{p,\mathrm{pk}} = 10 \log_{10} \frac{\max|p^2(t)|}{p_0^2} \tag{A-1}$$

PK is often included as criterion for assessing whether a sound is potentially injurious; however, because it does not account for the duration of a noise event, it is generally a poor indicator of perceived loudness.

The sound pressure level (SPL or L_p; dB re 1 µPa) is the decibel level of the root-mean-square (rms) pressure in a stated frequency band over a specified time window (T; s) containing the acoustic event of interest. It is important to note that SPL always refers to an rms pressure level and therefore not instantaneous pressure:

$$\mathrm{SPL} = L_p = 10 \log_{10} \left[\frac{1}{T} \int_T p^2(t)\, dt \Big/ p_0^2 \right] \tag{A-2}$$

The SPL represents a nominal effective continuous sound over the duration of an acoustic event, such as the emission of one acoustic pulse, a marine mammal vocalization, the passage of a vessel, or over a fixed duration. Because the window length, T, is the divisor, events with similar sound exposure level (SEL), but more spread out in time have a lower SPL.

The sound exposure level (SEL or L_E, dB re 1 µPa^2 s) is a measure related to the acoustic energy contained in one or more acoustic events (N). The SEL for a single event is computed from the time-integral of the squared pressure over the full event duration (T):

$$\mathrm{SEL} = L_E = 10 \log_{10} \left[\int_T p^2(t)\, dt \Big/ T_0 p_0^2 \right] \tag{A-3}$$

where T_0 is a reference time interval of 1 s. The SEL continues to increase with time when non-zero pressure signals are present. It therefore can be construed as a dose-type measurement, so the integration time used must be carefully considered in terms of relevance for impact to the exposed recipients.

SEL can be calculated over periods with multiple events or over a fixed duration. For a fixed duration, the square pressure is integrated over the duration of interest. For multiple events, the SEL can be computed by summing (in linear units) the SEL of the N individual events:

$$L_{E,N} = 10\log_{10}\sum_{i=1}^{N} 10^{\frac{L_{E,i}}{10}} \tag{A-4}$$

To compute the SPL(T_{90}) and SEL of acoustic events in the presence of high levels of background noise, equations A-1 and A-2 are modified to subtract the background noise contribution:

$$\mathrm{SPL}(T_{90}) = L_{p90} = 10\log_{10}\left[\frac{1}{T_{90}}\int_{T_{90}}\left(p^2(t) - \overline{n^2}\right)dt \Big/ p_0^2\right] \tag{A-5}$$

$$L_E = 10\log_{10}\left[\int_{T}\left(p^2(t) - \overline{n^2}\right)dt \Big/ T_0 p_0^2\right] \tag{A-6}$$

where $\overline{\mathrm{n}^2}$ is the mean square pressure of the background noise, generally computed by averaging the squared pressure of a temporally proximal segment of the acoustic recording during which acoustic events are absent (e.g., between pulses).

Because the SPL(T_{90}) and SEL are both computed from the integral of square pressure, these metrics are related numerically by the following expression, which depends only on the duration of the time window T:

$$L_p = L_E - 10\log_{10}(T) \tag{A-7}$$

$$L_{p90} = L_E - 10\log_{10}(T_{90}) - 0.458 \tag{A-8}$$

where the 0.458 dB factor accounts for the 10 % of SEL missing from the SPL(T_{90}) integration time window.

Energy equivalent SPL (dB re 1 µPa) denotes the SPL of a stationary (constant amplitude) sound that generates the same SEL as the signal being examined, $\mathrm{p(t)}$, over the same period of time, T:

$$L_{\mathrm{eq}} = 10\log_{10}\left[\frac{1}{T}\int_{T} p^2(t)\,dt \Big/ p_0^2\right] \tag{A–9}$$

The equations for SPL and the energy-equivalent SPL are numerically identical; conceptually, the difference between the two metrics is that the former is typically computed over short periods (typically of 1 s or less) and tracks the fluctuations of a non-steady acoustic signal, whereas the latter reflects the average SPL of an acoustic signal over times typically of one minute to several hours.

A.2. Decidecade Band Analysis

The distribution of a sound's power with frequency is described by the sound's spectrum. The sound spectrum can be split into a series of adjacent frequency bands. Splitting a spectrum into 1 Hz wide bands, called passbands, yields the power spectral density of the sound. These values directly compare to the Wenz curves, which represent typical deep ocean sound levels (Figure 2) (Wenz 1962). This splitting of the spectrum into passbands of a constant width of 1 Hz, however, does not represent how animals perceive sound.

Because animals perceive exponential increases in frequency rather than linear increases, analyzing a sound spectrum with passbands that increase exponentially in size better approximates real-world scenarios. In underwater acoustics, a spectrum is commonly split into decidecade bands, which are one tenth of a decade wide. A decidecade is sometimes referred to as a "1/3-octave" because one tenth of a decade is approximately equal to one third of an octave. Each decade represents a factor 10 in sound frequency. Each octave represents a factor 2 in sound frequency. The centre frequency of the *i*th band, $\mathrm{f_c(i)}$, is defined as:

$$f_c(i) = 10^{\frac{i}{10}} \text{ kHz} \tag{A-1}$$

and the low ($\mathrm{f_{lo}}$) and high ($\mathrm{f_{hi}}$) frequency limits of the *i*th decade band are defined as:

$$f_{\mathrm{lo},i} = 10^{\frac{-1}{20}} f_c(i) \text{ and } f_{\mathrm{hi},i} = 10^{\frac{1}{20}} f_c(i) \tag{A-2}$$

The decidecade bands become wider with increasing frequency, and on a logarithmic scale the bands appear equally spaced (Figure A-1).

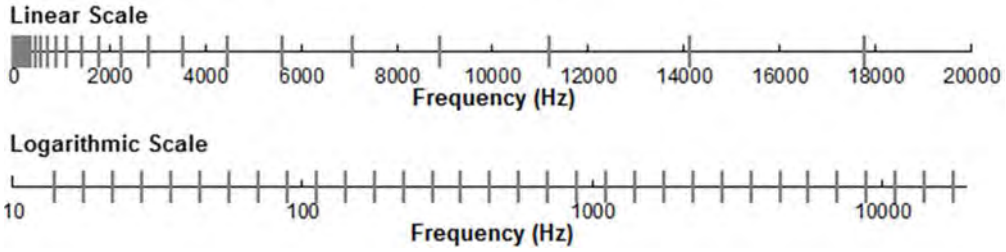

Figure A-1. Decidecade frequency bands (vertical lines) shown on a linear frequency scale and a logarithmic scale.

The sound pressure level in the *i*th band ($L_{p,i}$) is computed from the spectrum $S(f)$ between $f_{\mathrm{lo},i}$ and $f_{\mathrm{hi},i}$:

$$L_{p,i} = 10 \log_{10} \int_{f_{\mathrm{lo},i}}^{f_{\mathrm{hi},i}} S(f)\, \mathrm{d}f \text{ dB} \tag{A-3}$$

Summing the sound pressure level of all the bands yields the broadband sound pressure level:

$$\text{Broadband SPL} = 10 \log_{10} \sum_i 10^{\frac{L_{p,i}}{10}} \text{ dB} \tag{A-4}$$

Figure A-2 shows an example of how the decidecade band sound pressure levels compare to the sound pressure spectral density levels of an ambient sound signal. Because the decidecade bands are wider than 1 Hz, the decidecade band SPL is higher than the spectral levels at higher frequencies. Decidecade

band analysis is applied to continuous and impulsive noise sources. For impulsive sources, the decidecade band SEL is typically reported.

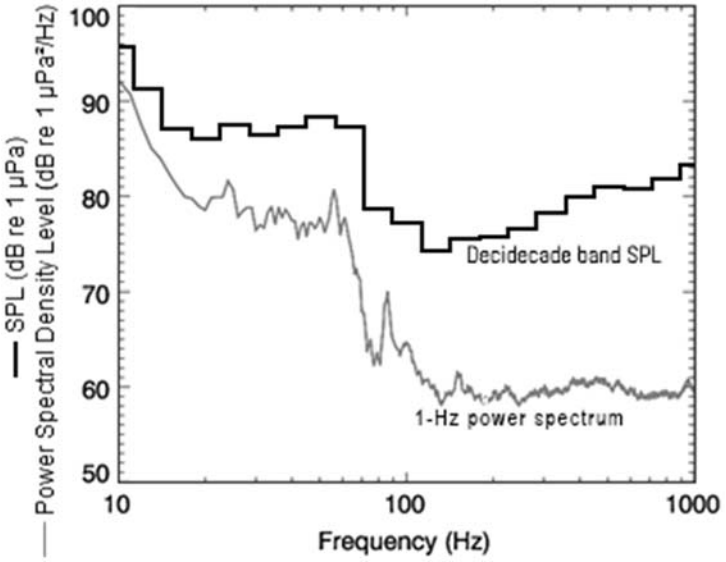

Figure A-2. Sound pressure spectral density levels and the corresponding decidecade band sound pressure levels of example ambient sound shown on a logarithmic frequency scale. Because the decidecade bands are wider with increasing frequency, the 1/3-octave-band SPL is higher than the power spectrum.

Table A-1. Decidecade-band frequencies (Hz).

Band	Lower frequency	Nominal centre frequency	Upper frequency
10	8.9	10.0	11.2
11	11.2	12.6	14.1
12	14.1	15.8	17.8
13	17.8	20.0	22.4
14	22.4	25.1	28.2
15	28.2	31.6	35.5
16	35.5	39.8	44.7
17	44.7	50.1	56.2
18	56.2	63.1	70.8
19	70.8	79.4	89.1
20	89.1	100.0	112.2
21	112	126	141
22	141	158	178
23	178	200	224
24	224	251	282
25	282	316	355
26	355	398	447
27	447	501	562
28	562	631	708
32	1413	1585	1778

Band	Lower frequency	Nominal centre frequency	Upper frequency
33	1778	1995	2239
34	2239	2512	2818
35	2818	3162	3548
36	3548	3981	4467
37	4467	5012	5623
38	5623	6310	7079
39	7079	7943	8913
40	8913	10000	11220
41	11220	12589	14125
42	14260	16000	17952
43	17825	20000	22440
44	22281	25000	28050
45	28074	31500	35344
46	35650	40000	44881
47	44563	50000	56101
48	56149	63000	70687
49	71300	80000	89761
50	89125	100000	112202
51	111406	125000	NA- above Nyquist

Table A-2. Decade-band frequencies (Hz).

Decade band	Lower frequency	Nominal centre frequency	Upper frequency
A	8.9	50	89.1
B	89.1	500	891
C	891	5,000	8913
D	8913	50,000	89125

Appendix B. Marine Mammal Detection Methodology

B.1. Automated Click Detector for Odontocetes

We applied an automated click detector/classifier to the data sampled at 512 kHz to detect clicks from odontocetes (Figure B-1). This detector/classifier is based on the zero-crossings in the acoustic time series. Zero-crossings are the rapid oscillations of a click's pressure waveform above and below the signal's normal level (e.g., Figure B-1). Clicks are detected by the following steps (Figure B-1):

1. The raw data is high-pass filtered to remove all energy below 5 kHz. This removes most energy from other sources such as shrimp, vessels, wind, and cetacean tonal calls, yet allows the energy from all marine mammal click types to pass.
2. The filtered samples are summed to create a 0.334 ms rms time series. Most marine mammal clicks have a 0.1–1 ms duration.
3. Possible click events are identified with a split-window normaliser that divides the 'test' bin of the time series by the mean of the 6 'window' bins on either side of the test bin, leaving a 1-bin wide 'notch'.
4. A Teager-Kaiser energy detector identifies possible click events.
5. The high-pass filtered data is searched to find the maximum peak signal within 1 ms of the detected peak.
6. The high-pass filtered data is searched backwards and forwards to find the time span where the local data maxima are within 9 dB of the maximum peak. The algorithm allows for two zero-crossings to occur where the local peak is not within 9 dB of the maximum before stopping the search. This defines the time window of the detected click.
7. The classification parameters are extracted. The number of zero crossings within the click, the median time separation between zero crossings, and the slope of the change in time separation between zero crossings are computed. The slope parameter helps to identify beaked whale clicks, as beaked whales can be identified by the increase in frequency (upsweep) of their clicks.
8. The Mahalanobis distance between the extracted classification parameters and the templates of known click types is computed. The covariance matrices for the known click types, computed from thousands of manually identified clicks for each species, are stored in an external file. Each click is classified as a type with the minimum Mahalanobis distance unless none of them are less than the specified distance threshold.

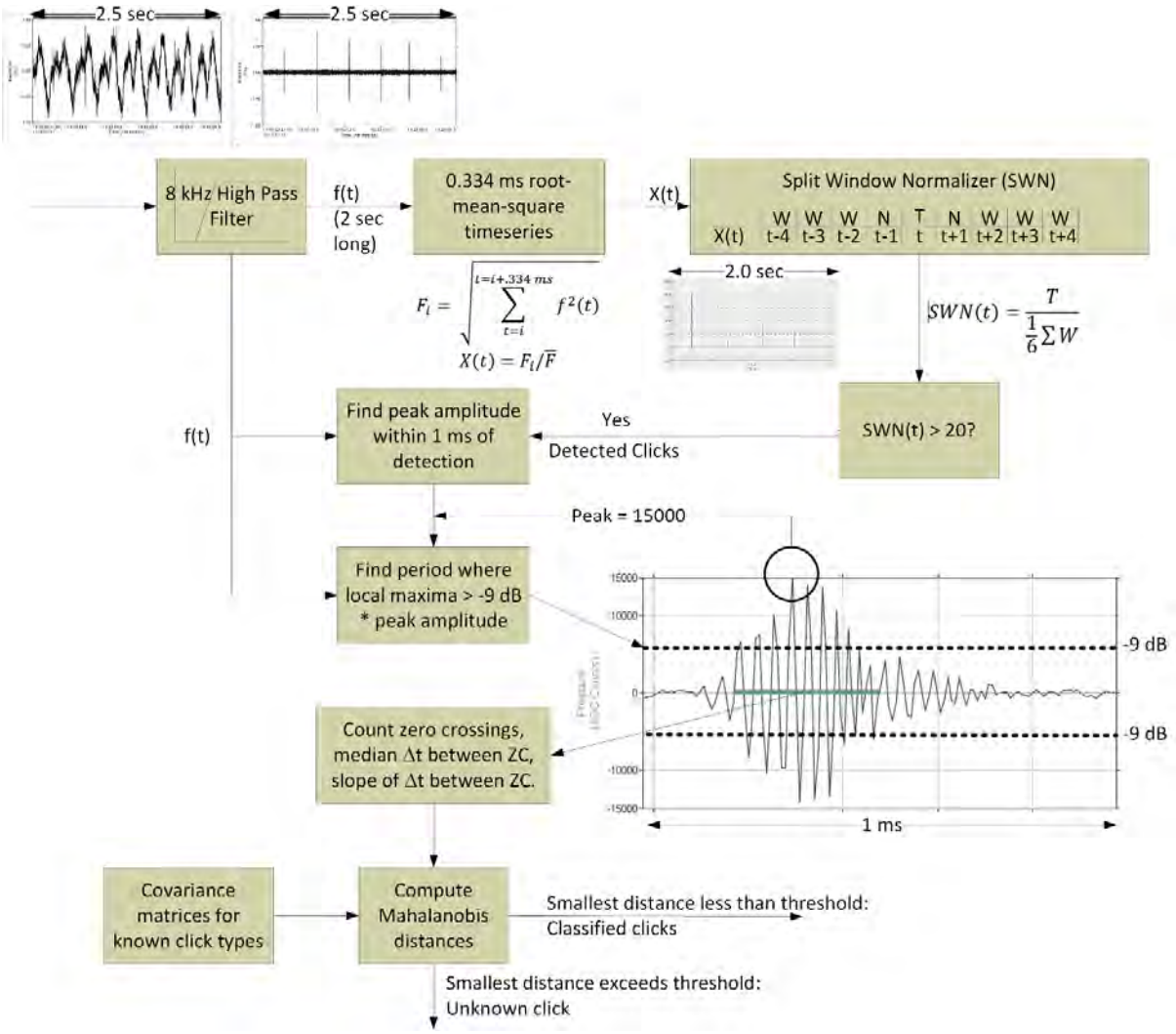

Figure B-1. The automated click detector/classifier block diagram.

Odontocete clicks occur in groups called click trains. Each species has a characteristic inter-click-interval (ICI) and number of clicks per train. The automated click detector includes a second stage that associates individual clicks into trains (Figure B-2). The steps of the click train associator algorithm are:

1. Queue clicks for N seconds, where N is twice the maximum number of clicks per train times the maximum ICI.
2. Search for all clicks within the window that have Mahalanobis distances less than 11 for the species of interest (this gets 99 % of all clicks for the species as defined by the template).
3. Create a candidate click train if:
   a. The number of clicks is greater or equal to the minimum number of clicks in a train;
   b. The maximum time between any two clicks is less than twice the maximum ICI, and
   c. The smallest Mahalanobis distance for all clicks in the candidate train is less than 4.1.
4. Create a new ‘time-series’ that has a value of 1 at the time of arrival of each click and zeroes everywhere else.

5. Apply a Hann window to the timeseries then compute the cepstrum.
6. A click train is classified if a peak in the cepstrum with amplitude > 5 times the standard deviation of the cepstrum occurs at a quefrency between the minimum maximum ICI.
7. Queue clicks for N seconds
8. Search for all clicks within the window that have Mahalanobis distances less than 10 (equal to the extent of the variance in the training data set).
9. If the number of clicks is greater than or equal to 3 and dT is less than 2 * max ICI, make a new time-series at the 0.333 ms rate; where the value is 1 when the clicks occurred and 0 for all other time bins. Perform the following processing on this time series:
    a. Compute cepstrum
    b. ICI is the peak of the cepstrum with amplitude > 5 * stdev and searching for quefrency between minICI and maxICI.
    c. For each click related to the previous Ncepstrum, create a new time series and compute ICI; if we get a good match, extend the click train; find a mean ICI and variance.
10. If the click features, total clicks and mean ICI match the species, output a species_click_train detection.

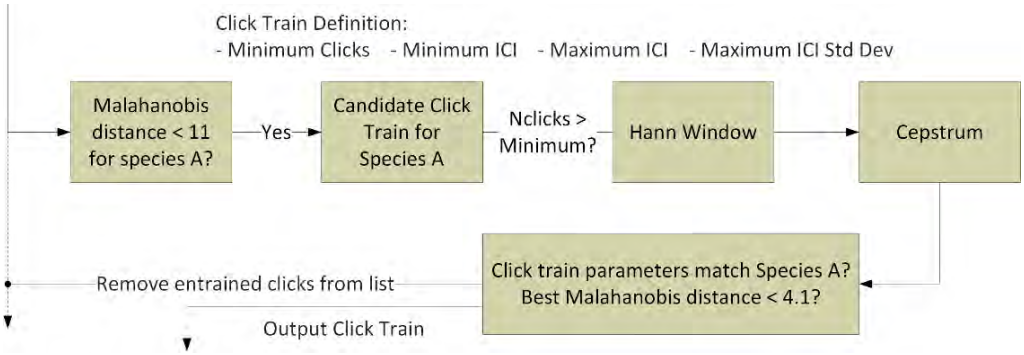

Figure B-2. The click train automated detector/classifier block diagram.

Table B-1. List of automated detectors used to identify clicks produced by odontocetes. NBHF: Narrow-band high-frequency.

Detector	Species targeted	Result nomenclature (clicks)	Result nomenclature (click trains)	Comments
DefaultClicks_LF.xml	Sperm whale	SpermWhale:Click	SpermWhale (Click Train)	HighPass Filter @ 5 kHz
	Killer whale	KillerWhale:Click	KillerWhale (Click Train)	
DefaultClicks_MF.xml	True's & Gervais beaked whale	TBW_GBW:Click	TBW_GBW (Click Train)	HighPass Filter @ 25 kHz
	Cuvier's beaked whale	Cuviers:Click	Cuviers (Click Train)	
	Unidentified beaked whale	BW-STP:Click	BW-STP (Click Train)	
	Northern bottlenose whale	NBW:Click	NBW (Click Train)	
	Delphinids	Dolphin:Click	Dolphin (Click Train)	
	Atlantic white-sided dolphin	AWSD_La:Click	AWSD_La (Click Train)	
	Stenella species	StenellaSP:Click	StenellaSP (Click Train)	
	Unidentified dolphin, type A	UDA:Click	UDA (Click Train)	
	Unidentified dolphin, type B	UDB:Click	UDB (Click Train)	
	Risso's dolphin	Rissos_Gg_Short:Click	Rissos_Gg_Short (Click Train)	
		Rissos_Gg_long:Click	Rissos_Gg_long (Click Train)	
	Pilot whale	PilotWhale:Click	PilotWhale (Click Train)	
	Unknown beaked whale	Unknown beaked whale_51kHz Click	Unknown beaked whale_51kHz (Click Train)	
	True's beaked whale	Trues:Click	Trues (Click Train)	
	Blainville's beaked whale	Blainsvilles:Click	Blainsvilles (Click Train)	
DefaultClicks_HF.xml	Sowerby's beaked whale	Sowerbys:Click	Sowerbys (Click Train)	HighPass Filter @ 50 kHz
	Harbour Porpoise/NBHF	Porpoise:Click	Porpoise (Click Train)	
		Porpoise250ksps:Click	Porpoise250ksps (Click Train)	
	Kogiids/NBHF	KSima:Click	KSima (Click Train)	

B.2. Automated Java-based Tonal Detector

Marine mammal tonal acoustic signals are automatically detected by the following steps:

1. Spectrograms of the appropriate resolution for each mammal vocalization type that were normalised by the median value in each frequency bin for each detection window Table B-2 were created.
2. Adjacent bins were joined, and contours were created via a contour-following algorithm (Figure B-3).
3. A sorting algorithm determined if the contours match the definition of a marine mammal vocalization (Table B-3).

Detectors were applied to the 64 kHz data, with the exception of Whistle High, which was also applied to the 512 kHz data.

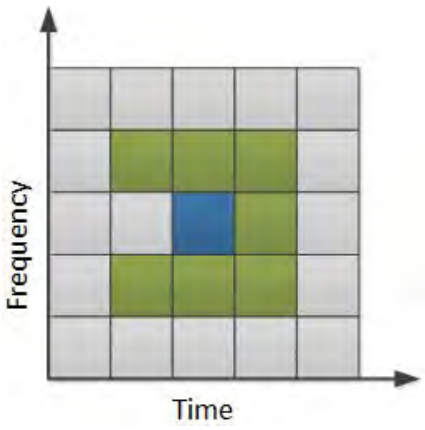

Figure B-3. Illustration of the search area used to connect spectrogram bins. The blue square represents a bin of the binary spectrogram equalling 1 and the green squares represent the potential bins it could be connected to. The algorithm advances from left to right so grey cells left of the test cell need not be checked.

Table B-2. Fast Fourier Transform (FFT) and detection window settings for all automated contour-based detectors used to detect tonal vocalizations of marine mammal species expected in the data. Values are based on JASCO's experience and empirical evaluation on a variety of data sets.

Automated detector	Species targeted	Signal targeted	FFT			Detection window (s)	Detection threshold
			Resolution (Hz)	Frame length (s)	Timestep (s)		
GenericMoans: VLFMoan	Various	VLFMoan	2	0.2	0.05	15	4
GenericMoans: LFMoan	Various	LFMoan	2	0.25	0.05	10	3
GenericMoans: ShortLow	Various	ShLow	7	0.17	0.025	10	3
GenericMoans: MFMoanLow	Various	MFMoanLow	4	0.2	0.05	5	3
GenericMoans: MFMoanHigh	Various	MFMoanHigh	8	0.125	0.05	5	3
GenericWhistles: WhistleLow	Various	WhistleLow	8	0.125	0.05	5	1.5
GenericWhistles: WhistleHigh	Various	WhistleHigh	64	0.015	0.005	5	1.5
HarbourSeal_1	Harbour seal	HbrS_1	8	0.128	0.032	30	3
HarbourSeal_2	Harbour seal	HbrS_2	20	0.06	0.03	35	2.2
NPac_FinWhale_17HSNR	Fin whales	A note	1	0.05	0.2	5	5
NPac_FinWhale_17LSNR	Fin whales	A note	1	0.05	0.2	5	1.7
NPac_FinWhale_21HSNR	Fin whales	B note	1	0.05	0.2	5	5
NPac_FinWhale_21LSNR	Fin whales	B note	1	0.05	0.2	5	1.7
NPac_MW_Boing	Minke whales	Boing	2	0.4	0.1	5	5
GrayWhale	Grey whales	Moan	8	0.1	0.025	40	3.5

Table B-3. A sample of vocalization sorter definitions for the tonal vocalizations of cetacean species expected in the area.

Automated detector	Species targeted	Signal targeted	Frequency (Hz)	Duration (s)	Bandwidth (B; Hz)	Other detection parameters
GenericMoans	Various	VLFMoan	10–100	0.3–10	>10	Minimum frequency not to exceed: 40 Hz
	Various	LFMoan	40–250	0.5–10	>15	Max median instantaneous bandwidth: 50
	Various	ShLow	30–400	0.08–0.6	>25	Time component bandwidth: 5–200 Time component duration: 0.1–0.5 Max time component frequency shift: 200
	Various	MFMoanLow	100–700	0.5–5.0	>50	Minimum frequency not to exceed: 450 Hz Max median instantaneous bandwidth: 200
	Various	MFMoanHigh	500–2500	0.5–5.0	>150	Minimum frequency not to exceed: 1500 Hz Max median instantaneous bandwidth: 300
GenericWhistles	Various	WhistleLow	1000–10000	0.8–3.0	>300	Minimum frequency not to exceed: 5000 Hz Max median instantaneous bandwidth: 1000 Multi component: 1 Minimum component bandwidth: 50 Minimum component duration: 0.4 Suppress detections for high SPL between 50–1000 Hz Suppress detections for SPL >125 dB
	Various	WhistleHigh	4000–20000	0.3–3.0	>700	Max median instantaneous bandwidth: 2000 Suppress detections for high SPL between 5–1000 Hz Suppress detections for SPL > 125
HarbourSeal_1	Harbour seal	HbrS_1	75–1200	0.75–2.0	>250	Minimum frequency not to exceed: 150 Hz Max median instantaneous bandwidth: 1000 Multi component: 1 Minimum component bandwidth: 100 Minimum component duration: 0.5
HarbourSeal_2	Harbour seal	HbrS_2	75–1200	0.5–2	>100	Minimum frequency not to exceed: 150 Hz Max median instantaneous bandwidth: 1000 Multi component: 1 Minimum component bandwidth: 100 Minimum component duration: 0.5
NPac_FinWhale_17HSNR	Fin whale	A note	3–50	0.4–3.0	>6	Peak frequency 16 to 19 Hz
NPac_FinWhale_17LSNR	Fin whale	A note	3–50	0.4–3.0	>6	Peak frequency 16 to 19 Hz
NPac_FinWhale_21HSNR	Fin whale	B note	3–50	0.4–3.0	>6	Peak frequency 20 to 23.5 Hz
NPac_FinWhale_21LSNR	Fin whale	B note	3–50	0.4–3.0	>6	Peak frequency 20 to 23.5 Hz
NPac_MW_Boing	Minke whale	Boing	1100–1700	0.5–4.0	>20	N/A
GrayWhale	Grey whale	Moan	10–150	0.5–2.0	>30	N/A

B.3. Automatic Data Selection for Validation (ADSV)

To standardize the file selection process for the selection of data for manual analysis, we applied our Automated Data Selection for Validation (ADSV) algorithm. Details of the ADSV algorithm are described in Kowarski et al. (2021) and a schematic of the process is provided in Figure B-4. ADSV computes the distribution of three descriptors that describe the automated detections in the full data set: the Diversity (number of automated detectors triggered per file), the Counts (number of automated detections per file for each automated detector), and the Temporal Distribution (spread of detections for each automated detector across the recording period). The algorithm removes files from the temporary data set that have the least impact on the distribution of the three descriptors in the full data set. Files are removed until a pre-determined data set size (*N*) is reached, at which point the temporary data set becomes the subset to be manually reviewed. A confidence threshold of 75 was used during ADSV.

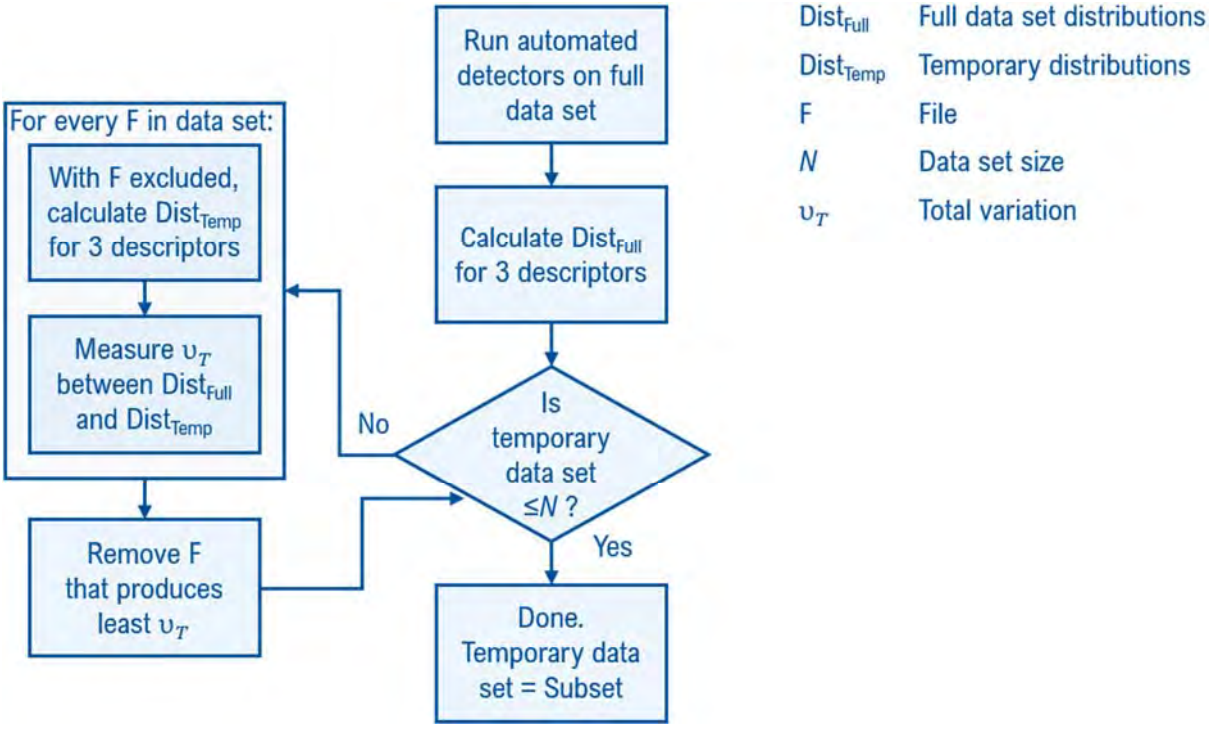

Figure B-4. Automated Data Selection for Validation (ADSV) process based on Figure 1 from Kowarski et al. (2021).

For the present work, an *N* of 1 % was selected and applied to the 250 and 32 kHz data separately. Even with only a subset of data manually reviewed, the results presented here can be considered reliable, but some caveats should be considered. It is important to note that with only a subset of data manually reviewed, very rare species may have been missed or their occurrence underestimated. If the 1 % subset of data manually analyzed was not sufficiently large to capture the full range of acoustic environments in the full data set, the resulting automated detector performance metrics may be inaccurate and therefore should be taken as an estimate.

B.4. Automated Detector Performance Calculation and Optimization

All files selected for manual validation were reviewed by an experienced analyst using JASCO's PAMlab software to determine the presence or absence of every species, regardless of whether a species was automatically detected in the file. Although the automated detectors classify specific signals, we validated the presence/absence of species at the file level, not the detection level. Acoustic signals were only assigned to a species if the analyst was confident in their assessment. When unsure, analysts would consult one another, peer reviewed literature, and other experts in the field. If certainty could not be reached, the file of concern would be classified as possibly containing the species in question or containing an unknown acoustic signal. Next, the validated results were compared to the automated detector results in three phases to refine the results and ensure they accurately represent the occurrence of each species in the study area.

In phase 1, the human validated versus automated detector results were plotted as time series and critically reviewed to determine when and where automated detections should be excluded. Questionable detections that overlap with the detection period of other species were scrutinized. By restricting detections spatially and/or temporally where appropriate, we can maximize the reliability of the results.

In phase 2, the performance of the automated detectors was calculated and optimized for each species using a threshold, defined as the number of automated detections per file at and above which detections of species were considered valid.

To determine the performance of each automated detector and any necessary thresholds, the automated and validated results (excluding files where an analyst indicated uncertainty in species occurrence) were fed to a maximum likelihood estimation algorithm that maximizes the probability of detection and minimizes the number of false alarms using the Matthews Correlation Coefficient (MCC):

$$MCC = \frac{TPxTN - FPxFN}{\sqrt{(\mathrm{TP}+\mathrm{FP})(\mathrm{TP}+\mathrm{FN})(\mathrm{TN}+\mathrm{FP})(\mathrm{TN}+\mathrm{FN})}}$$

$$P = \frac{TP}{TP+FP}; R = \frac{TP}{TP+FN}$$

where *TP* (true positive) is the number of correctly detected files, *FP* (false positive) is the number of files that are false detections, and *FN* (false negatives) is the number of files with missed detections.

In phase 3, detections were further restricted to include only those where *P* was greater than or equal to 0.75. When *P* was less than 0.75, only validated results were used to describe the acoustic occurrence of a species. The occurrence of each species was plotted using JASCO's Ark software as time series showing presence/absence by hour over each day.

Appendix C. Automated Detector Performance

Tables C-1 and C-2 provide the automated detector performance of the automated detector that performed best for each species during the first and second monitoring periods, respectively. The final precision (*P*) and recall (*R*) values in these tables should be considered when interpreting the presence/absence figures included in Section 4.3.

Table C-1. Automated detector performance for the first recording period (June to December 2021) including the threshold implemented (minimum number of automated detections per file for species to be considered present) and the original and final detector precision (*P*), recall, and MCC score. The final automated detector performance values (Final) represent the performance after any timeframe and/or threshold restrictions have been applied. The unit of time over which the automated detector performance (T min) was calculated is provided where 9 min refers to the data sampled at 64 kHz and 1 min refers to the data sampled at 512 kHz.

Species-signal	Station	Automated detector	T (min)	Original		Exclusion periods	Per-file threshold	Final		
				P	*R*			*P*	*R*	*MCC*
Killer whale tonals	AMAR-N	MFMoanHigh	9	0.26	1.00	None	10	0.89	0.67	0.76
	AMAR-S			0.81	0.84		1	0.81	0.84	0.78
Killer whale clicks	AMAR-S	KillerWhale:ClickTrain	1	0.75	0.9	None	1	0.75	0.9	0.81
Harbour porpoise clicks	AMAR-N	Porpoise:Click	1	0.33	1.00	None	149	0.79	0.65	0.68
	AMAR-S	Porpoise250ksps	1	0.89	0.86	None	1	0.89	0.86	0.84
Harbour seals	Combined	HarbourSeal_1	9	0.75	0.64	After 26 Aug 2021	1	0.75	0.64	0.67

Table C-2. Automated detector performance for the second recording period (December 2021 to August 2022) including the threshold implemented (minimum number of automated detections per file for species to be considered present) and the original and final detector precision (*P*), recall, and MCC score. The final automated detector performance values (Final) represent the performance after any timeframe and/or threshold restrictions have been applied. The unit of time over which the automated detector performance (T min) was calculated is provided where 9 min refers to the data sampled at 64 kHz and 1 min refers to the data sampled at 512 kHz.

Species-Signal	Station	Automated detector	T (min)	Original		Exclusion periods	Per-file threshold	Final		
				P	*R*			*P*	*R*	*MCC*
Killer whale tonal	AMAR-N	WhistleHigh	9	0.45	0.39	None	42	1.00	0.12	0.32
	AMAR-S			0.75	0.84		4	0.84	0.78	0.76
Killer whale click	AMAR-S	KillerWhale Click	1	0.69	1.00	None	22	0.89	0.84	0.82
Harbour porpoise click	Combined	Porpoise:Click	1	0.75	0.89	None	10	0.92	0.82	0.83
Harbour seal	AMAR-S	HarbourSeal_2	9	0.10	0.42	None	19	1.00	0.04	0.20

Appendix J JASCO UNDERWATER NOISE MODELLING

Ksi Lisims LNG Terminal Underwater Acoustic Modelling

Construction and Operations

JASCO Applied Sciences (Canada) Ltd

11 September 2023

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The results presented herein are relevant within the specific context described in this report. They could be misinterpreted if not considered in the light of all the information contained in this report. Accordingly, if information from this report is used in documents released to the public or to regulatory bodies, such documents must clearly cite the original report, which shall be made readily available to the recipients in integral and unedited form.

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Executive Summary

JASCO Applied Sciences Ltd., under contract to Stantec Consulting Ltd and on behalf of Ksi Lisims LNG, performed an underwater acoustic modelling study for the construction and operation of a proposed floating liquified natural gas (FLNG) facility in Wil Milit Bay at the northern end of Pearse Island in Portland Canal. Sound propagation models were applied to assess underwater noise exposure of marine mammals and fish during marine terminal construction activities consisting of impact pile driving with a confined bubble curtain and down the hole drilling for pile installation, as well as noise exposure from marine traffic activities of LNG carriers berthing and transiting with tug assistance and from the operational FLNG facilities. These models include JASCO's Full Waveform Range-dependent Acoustic Model (FWRAM) and Marine Operations Noise Model (MONM). Both models accept as input the activity-specific spectral source levels, bathymetry, water sound speed profiles, and seabed geoacoustic parameters. JASCO's physical model of pile vibration and near-field sound radiation was used to predict the acoustic emission characteristics of the impact pile driving. The source levels for down the hole drilling and vessel activities were derived from published measurements and empirical models. Frequency weighting was applied to the modelled sound fields to estimate received levels relative to hearing capabilities of five marine mammal hearing groups.

The goal of this study was to predict the extent of ensonification from modelling scenarios as described below and to define zones of potential effects on marine fauna based on currently adopted sound level thresholds for auditory injury and behavioural disturbance. Following is a summary of the threshold criteria and results:

- Marine mammal injury (permanent threshold shift (PTS)): Thresholds were based on NMFS (2018).
  - Impact pile driving and down the hole drilling, with confined bubble curtains, at the materials offloading facility (MOF): The $R_{95\%}$ distances to marine mammal peak pressure level injury thresholds were less than 63m; this is based on the threshold for high-frequency cetaceans; this distance was less than 10 m for all other marine mammal hearing groups. The maximum $R_{95\%}$ distance to 24 h frequency-weighted species-specific injury thresholds was between 0.03 km and 1.94 km for the otariid and low-frequency cetacean hearing groups, respectively, considering the thresholds for impulsive noise. It was between <10 m and 182 m considering the thresholds for otariid and low-frequency cetacean hearing groups, respectively, for non-impulsive noise.
  - Down the hole drilling at the mooring anchor location: The distances to marine mammal injury criteria were between 7 m (otraiids) and 43 m (low-frequency cetaceans) from the pile location based on the respective SEL_{24h} thresholds.
  - FLNG operations: The distances to marine mammal injury criteria were between <5 m (otariids) and 15 m (high-frequency cetaceans) from the FLNG locations based on the respective SEL_{24h} thresholds.
  - LNG carrier berthing/unberthing assisted by three tugs: The distances to marine mammal injury criteria were between <5 m (phocids) and22 m (high-frequency cetaceans) from the vessel locations based on the respective SEL_{24h} thresholds.
  - LNG carrier transiting with an escort tug in Portland Inlet: Marine mammal injury criteria were not reached.
  - LNG carrier transiting in Dixon Entrance: Marine mammal injury criteria were not reached.
- Marine mammal disturbance: Thresholds were based on the NMFS (2013) SPL criteria

- Impulsive thresholds for pile installation at the MOF, with confined bubble curtains: The maximum range for marine mammal disturbance, based on the 160 dB re 1 µPa SPL threshold, was 3.45 km
- Continuous thresholds for pile installation at the MOF with confined bubble curtains: The maximum range for marine mammal disturbance, based on the 120 dB re 1 µPa SPL threshold, was 5.58 km.
- Down the hole drilling at the mooring anchor location: The maximum range for marine mammal disturbance, based on the 120 dB re 1 µPa SPL threshold, was 4.96 km.
- FLNG operations: The maximum range for marine mammal disturbance, based on the 120 dB re 1 µPa SPL threshold, was 3.51 km
- LNG carrier berthing/unberthing assisted by three tugs: The maximum range for marine mammal disturbance, based on the 120 dB re 1 µPa SPL threshold, was 11.5 km.
- LNG carrier transiting with an escort tug in Portland Inlet: The maximum range for marine mammal disturbance, based on the 120 dB re 1 µPa SPL threshold, was 28.22 km.
- LNG carrier transiting in Dixon Entrance: The maximum range for marine mammal disturbance, based on the 120 dB re 1 µPa SPL threshold, was 20.79 km.

- Fish injury due to impact pile driving: The thresholds were based on Popper et al. (2014b) as well as the 30 kPa threshold from the *Best Management Practices for Pile Driving and Related Operations in British Columbia* (BC MPDCA and DFO 2003).
  - thresholds for mortality and potential mortal injury extended to distances between $R_{95\%}$ = 11 m (PK) to 86 m (SEL_{24h}) and thresholds for recoverable injury ranged between $R_{95\%}$ = 11 m (PK) to 165 m (SEL_{24h})), depending on type of fish. Fish of all types could experience TTS at $R_{95\%}$ distance of 2 km. The 210 dB re 1 µPa PK threshold reached $R_{95\%}$ = 16 m.

1. Introduction

The Nisga'a Nation and its partners Rockies LNG Limited Partnership (Calgary, AB) and Western LNG (Houston, TX) (collectively, the 'Project Partners') propose to develop a large-scale energy project on Nisga'a-owned lands on British Columbia's northwest coast. The Project is the construction and operation of a liquified natural gas (LNG) export facility located at Wil Milit Bay on the far northern end of Pearse Island and in Portland Canal (the Project site). The Project site is remote and ~15 km west of the Nisga'a community of Ginglox on the mainland at the mouth of the Nass River. The Project proposed is a 'floating' LNG (FLNG) export facility with supporting upland infrastructure and a marine terminal for LNG carriers. Construction and operation of the Project will require activities that produce underwater noise with the potential to result in impacts to marine mammals and marine fish. Environmental consultant Stantec Consulting Ltd. contracted JASCO Applied Sciences (JASCO) to conduct this underwater noise modelling study to predict the underwater sound levels that could be produced during construction and operations of the facility and to predict the spatial extent where the resulting noise has the potential to disturb or injure marine mammals and fish.

1.1. Modelling Scenarios

Construction and operation of the proposed FLNG facility will generate underwater noise from various sources. The scope of this modelling study is limited to analyzing underwater sound generated from pile installation activities using both impact and drilling techniques, as well underwater radiated noise from the FLNG facility, LNG carrier vessels, and tugs. The following scenarios were modelled:

1. Pile installation
    a. *Material Offloading Facility (MOF) - Impact piling and drilling*: This scenario provides a conservative assessment of noise produced during pile installation at either the MOF or the FLNG terminals because the pile locations were selected as the deepest of all planned pile locations, with minimal obstruction by the shoreline. The scenario includes simultaneous pile driving operations at two close-by locations at the MOF. The piles will be installed by vibratory and impact pile driving to the bedrock and then drilling into the bedrock. Vibratory pile driving was not included in the model because it is the quietest of the three pile installation methods, so days involving vibratory pile driving will produce less underwater noise than the scenario modelled. The modelling assumes that the sediment thickness at the location is 5 m and that 375 impact hammer strikes will be required to drive a single pile. As a worst-case assessment, the scenario considered maximum technically possible achievements within a 12 h shift (one 12 h shift per 24 h period): installation of three piles at both locations (six piles total) involving 1,125 total hammer strikes per location (2,250 strikes total) as well as 5 h of active down the hole drilling per location (10 h total).
    b. *Mooring anchors - Down the hole drilling :* This scenario provides a conservative assessment of noise produced during pile installation at one of the of the mooring anchor locations. The mooring anchor location with the deepest water depth was modelled because it is expected to represent the worst-case scenario. For this scenario, the model assumes that active down the hole drilling will occur for 12 h to install a single pile.
2. *FLNG operations*: This scenario considers the simultaneous operation of two FLNG facilities for 24 h. No additional berthing or tug movement in the vicinity was modelled.
3. *LNG carrier* (LNGC) *berthing/unberthing with tugs*: This scenario represents the berthing and unberthing operation of a single LNGC to an FLNG with the assistance of three tugs. During these operations, both FLNG facilities were modelled to be in operation. For this scenario, the model

assumes that berthing operations take 1.5 h, unberthing takes 1 h, and the FLNG operates continuously for 24 h.

4. *LNGC and tug transiting in Portland Inlet*: In this scenario, an LNGC with a single escort tug was modelled transiting through Portland Inlet. The vessel speed used for estimating source levels for both vessels is 14 kn. A vessel separation of 1 km was modelled.
5. *LNGC transiting in Dixon Entrance*: In this scenario, a single LNGC with no tug assistance was modelled transiting along the ocean-bound shipping lane through Dixon Entrance. The vessel speed used for estimating source levels conformed to the proposed upper end of the LNGC carrier speed of 16 kn.

An overview map of the locations where scenarios were modelled is presented in Figure 1, and locations of each respective sound source are outlined in Table 1. Figure 2 is a map showing the individual source locations for the scenarios near the Pearse Island terminal (Scenarios 1, 2, and 3).

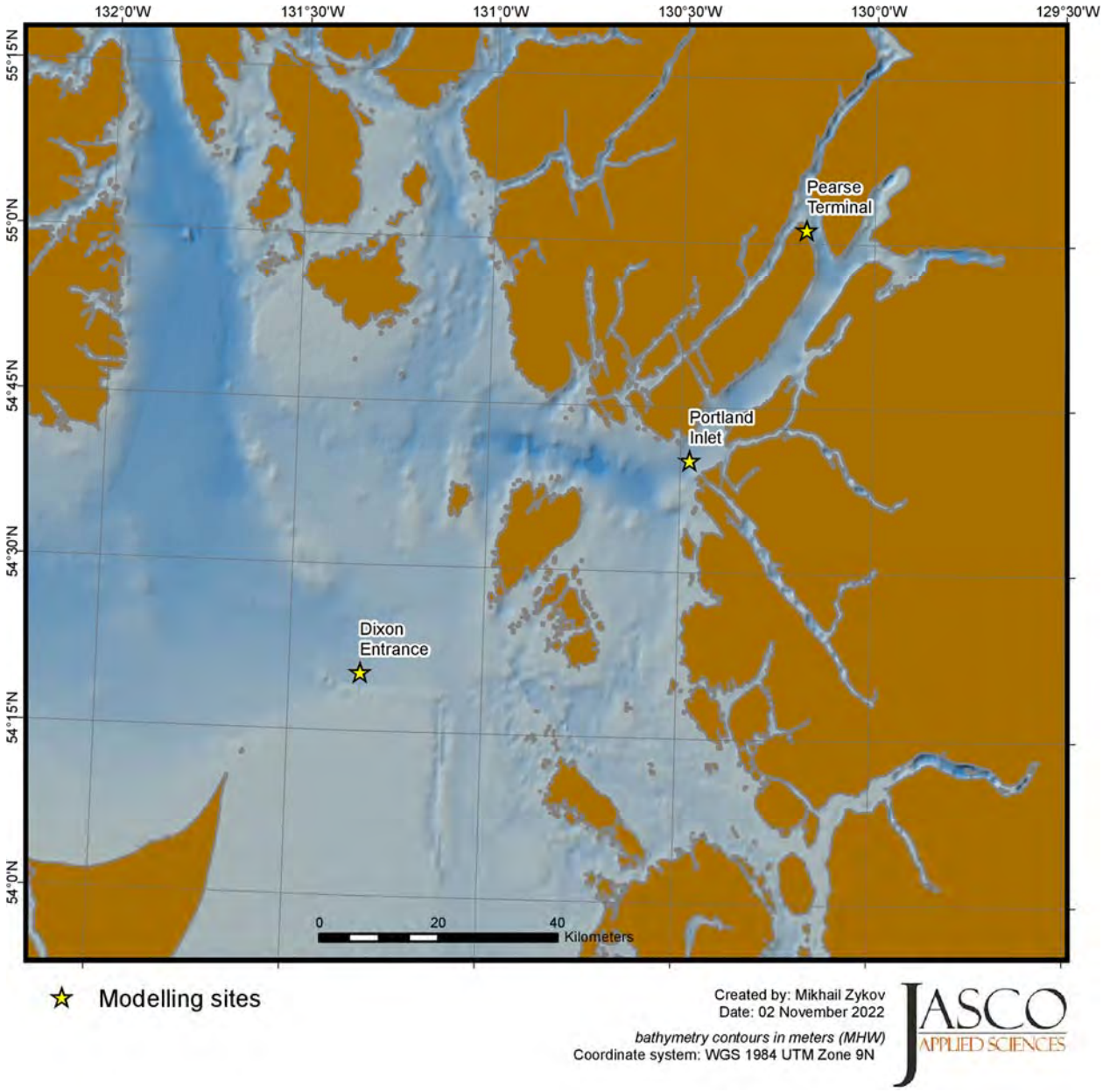

Figure 1. Overview map of modelling sites. Scenarios 1 (pile installation), 2 (FLNG operations), and 3 (LNGC berthing) were modelled at the Pearse Terminal site. Scenario 4 (LNGC transiting with tug escort) was modelled at the Portland Inlet site. Scenario 5 (LNGC transiting, no tug) was modelled at the Dixon Entrance site.

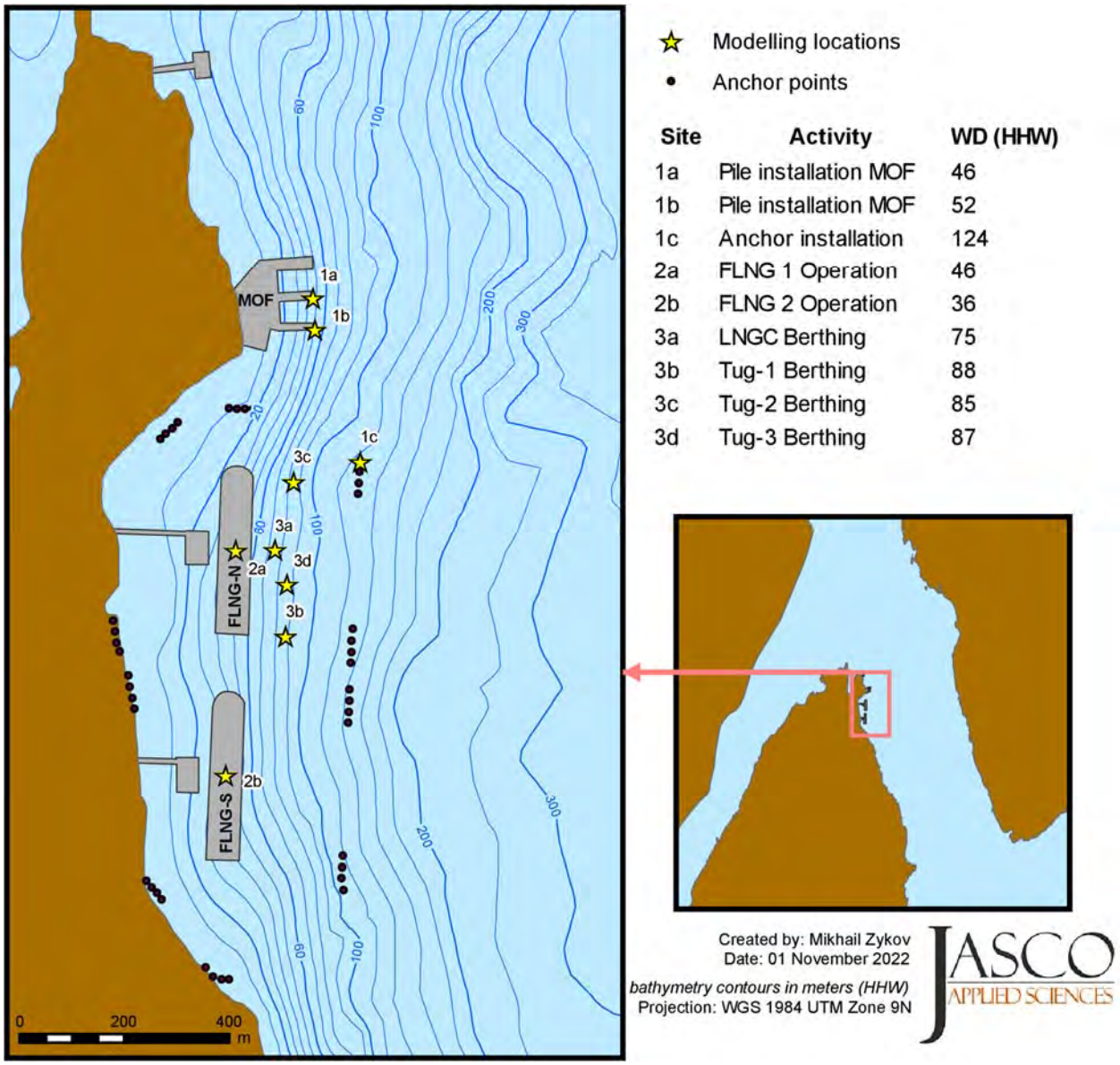

Figure 2. Modelled source locations at Pearse Island Floating Liquified Natural Gas (FLNG) facility. Bathymetry and coastline are shown for Higher High Water (HHW).

Table 1. Locations and description of modelled scenarios.

Scenario	Description	Site	Location	Activity	Latitude	Longitude	Easting	Northing
1	Pile installation	MOF	1a	Impact pile driving + Down the hole drilling	55° 01.586’ N	130° 10.633’ W	424746	6098367
			1b		55° 01.554’ N	130° 10.628’ W	424751	6098307
		Mooring anchor location	1c	Down the hole drilling	55° 01' 25.1" N	130° 10' 32.6" W	424837	6098055
2	FLNG operations	FLNG Terminals	2a	FLNG operating	55° 01' 19.5" N	130° 10' 45.8" W	424599	6097885
			2b		55° 01' 05.5" N	130° 10' 46.4" W	424580	6097454
3	FLNG operation + LNGC carrier berthing/ unberthing	FLNG Terminals	3a	LNGC during berthing/unberthing	55° 01’ 19.6” N	130° 10’ 41.6” W	424674	6097886
			3b	Tug during berthing/unberthing	55° 01' 14.2" N	130° 10' 40.3" W	424694	6097720
			3c		55° 01' 23.8" N	130° 10' 39.7" W	424710	6098017
			3d		55° 01' 17.4" N	130° 10' 40.2" W	424697	6097820
			2a	FLNG operating	55° 01' 19.5" N	130° 10' 45.8" W	424599	6097885
			2b		55° 01' 05.5" N	130° 10' 46.5" W	424580	6097454
4	LNGC transit with tug escort	Portland Inlet	4a	LNGC transiting at 14 kn	54° 40' 15.1" N	130° 28' 29.6" W	404886	6059165
			4b	Tug transiting at 14 kn	54° 40' 13.3" N	130° 29' 25.3" W	403887	6059130
5	LNGC transit	Dixon Entrance	5	LNGC transiting at 16 kn	54° 20' 16.2" N	131° 18' 57.5" W	349435	6023583

2. Acoustic Impact Criteria

Underwater noise can affect marine fauna in several ways, and the criteria that impact assessments are based on can be complex. At least three primary severity levels for how noise affects marine fauna should be considered in an environmental assessment: acute auditory injury, disturbance, and chronic and cumulative effects. Regulatory conditions for marine industrial projects typically require and focus on evaluations that deal with the first two types, but agencies are increasingly requesting that chronic and cumulative effects also be appraised. Environmental assessments in Canada are governed by the Canadian Environmental Assessment Act (CEAA 2012) and require evaluating cumulative effects. Bioacousticians have differing views about the best method for estimating auditory injury and disturbance effects on animals, and because evaluating chronic effects is even more complex and harder to quantify, there is little consensus at the moment on how to perform those assessments.

The assessment criteria we chose to apply in this study arose from several options. The question of which acoustic exposure levels might injure or disturb marine mammals is still an active topic of research. Since 2007, several expert groups have investigated an SEL-based assessment approach for auditory injury, with a handful of key papers published on the topic. Likewise, the number of studies investigating the level of disturbance to marine animals by underwater noise has increased substantially. Those publications are reviewed, and the relative criteria discussed, in Appendix B.2 for marine mammals and Appendix B.2.1 for fish and turtles. In the present section we propose specific methods and thresholds to apply in the current study based on the best available knowledge at this time.

Results of this modelling study are presented for the following noise criteria, which were chosen to include standard thresholds and thresholds suggested by the best available science, as reviewed and discussed in Appendix B:

- Frequency-weighted sound exposure level (SEL; $L_{E,24h}$) and peak sound pressure level (PK; L_{pk}) thresholds for marine mammal auditory injury based on the US National Marine Fisheries Service (NMFS) for all sound sources, NMFS (2018);
- Behavioural thresholds based on the current interim NMFS criteria (NMFS 2013) for marine mammals of 120 and 160 dB re 1 µPa sound pressure level (SPL; L_p) for non-impulsive and impulsive sound sources, respectively;
- SEL and PK thresholds for fish mortality and impairment based on sound exposure guidelines for fish recommended by Popper et al. (2014b) for impact pile driving only; and
- PK threshold of 30 kPa (equivalent to PK of 210 dB re 1 µPa) for fish based on the *Best Management Practices for Pile Driving and Related Operations in British Columbia* (BC MPDCA and DFO 2003) for impact pile driving only.

2.1. Marine Mammals

2.1.1. Auditory Injury

This study applies the specific methods and thresholds for auditory injury (specifically, permanent threshold shift (PTS)), summarized by NMFS (2018). Table 2 lists the applied marine mammal auditory injury thresholds.

Table 2. Thresholds for permanent threshold shift (PTS) for marine mammals underwater (NMFS 2018) for impulsive and non-impulsive sounds.

Functional hearing group	Impulsive		Non-impulsive
	Weighted SEL_{24h} (dB re 1 $\mu Pa^2 \cdot s$)	PK (dB re 1 µPa)	Weighted SEL_{24h} (dB re 1 $\mu Pa^2 \cdot s$)
Low-frequency (LF) cetaceans	183	219	199
Mid-frequency (MF) cetaceans	185	230	198
High-frequency (HF) cetaceans	155	202	173
Phocid pinnipeds in water	185	218	201
Otariid pinnipeds in water	203	232	219

2.1.2. Disturbance

Unlike auditory injury thresholds, no recent guidance has been published on disturbance thresholds for marine mammals. In this assessment, we applied the NMFS SPL criteria to be consistent with earlier studies. These thresholds are from NMFS (2013) and Table 3 lists the specific underwater sound criteria for marine mammal disturbance applied in this study.

Table 3. Thresholds for marine mammal disturbance for impulsive and non-impulsive sounds.

Hearing group	Impulsive	Non-impulsive
	SPL (dB re 1 µPa)	SPL (dB re 1 µPa)
All marine mammals	160	120

2.2. Fish

In this study, we applied the fish injury thresholds for impact pile driving recommended by Popper et al. (2014) (see Table 4) as well as the 30 kPa criterion based on the *Best Management Practices for Pile Driving and Related Operations in British Columbia* (BC MPDCA and DFO 2003). There is scarce knowledge on the behavioural impact of impulsive sounds on fish, and very limited experimental data exist to account for the variability among fish species. Furthermore, few studies have been conducted in the wild, and wild fish show very different behavioural responses to stimuli than animals in tank experiments (Popper et al. 2014b).

Table 4. Mortality and impairment criteria for sound from impulsive sources (Popper et al. 2014b).

Fish group		Mortality and potential mortal injury		Impairment		
				Recoverable Injury		Temporary threshold shift
		SEL (24 h) (dB re 1 µPa²·s)	PK (dB re 1 µPa)	SEL (24 h) (dB re 1 µPa²·s)	PK (dB re 1 µPa)	SEL (24 h) (dB re 1 µPa²·s)
I	No swim bladder (particle motion detection)	>219	>213	>216	>213	≫186
II	Swim bladder not involved in hearing (particle motion detection)	210	>207	203	>207	≫186
III	Swim bladder involved in hearing (primary pressure detection)	207	>207	203	>207	186

3. Modelling Methodology

Four types of noise sources were modelled for this study: vessels (LNGC and tugs), FLNG operations, down the hole drilling, and impact pile driving. The vessels, FLNG facilities, and down the hole drilling are considered continuous noise sources, while impact pile driving is an impulsive noise source.

JASCO's Marine Operations Noise Model (MONM; Appendix C.2.3), which is based on decidecade band analysis, was employed for calculating the acoustic fields from continuous noise sources (vessels, FLNG facilities, and drilling). For modelling the acoustic fields from impact pile driving operations, the full waveform modelling approach (FWRAM; Appendix C.2.4) was used to produce synthetic pressure waveforms that allow direct calculations of peak and SPL metrics for impulsive sounds.

3.1. Acoustic Sources

At the time of writing of this report, the specific equipment associated with pile driving and drilling activities were not yet identified. The parameters required to model the activities considered in this report were therefore based on reasonably precautionary assumptions. Additionally, details about the FLNG facilities, LNGCs, and tugs were based on best available information from the project description The actual source levels that will be generated may vary for a given activity, depending on the specific equipment used and its operation. In this section, we describe our methodology for determining source levels for the considered noise sources.

3.1.1. Impact Pile Driving

JASCO's physical model of pile vibration and near-field sound radiation (MacGillivray 2014) was used with the GRLWEAP 2010 wave equation model (GRLWEAP, Pile Dynamics 2010) to predict source levels associated with impact pile driving scenarios. The sound radiating from the pile itself was simulated using a vertical array of discrete point sources. The models account for several parameters that describe the operation, including pile type, material, pile dimensions (size and length), the pile driving equipment, and approximate pile penetration depth. Appendix C.1.1 details the acoustic source models applied in this study.

Impact pile driving was modelled for steel cylindrical pipes of diameter 1.524 m (nominal 60 in) and a wall thickness of 0.019 m (nominal 3/4 in). The source level was modelled for the instant when the pile is at its deepest penetration through sediments (5 m thickness) with a 1 m section of the pile above the water level (HHW conditions). With water depths of 46 and 52 m at Locations 1a and 1b, the pile lengths were 52 m for Location 1a and 58 m for Location 1b. The pile hammer Delmag D100-13, commonly used to drive piles more than 48 inches in diameter (ICF Jones & Stokes and Illingworth & Rodkin 2009), was selected in this study to model the force on top of the pile (i.e., the forcing function; see details in Appendix C.1.1) resulting from a single hammer strike.

The signatures were modelled in the frequency range from 9 to 708 Hz and extrapolated to higher frequencies using a roll-off factor of 2 dB per decidecade band. The modelled decidecade band levels were adjusted to account for noise attenuation from the application of a confined bubble curtain for noise mitigation (see Section 3.2).The modelled decidecade band energy source levels for a single pile strike at Location 1a, non-mitigated and mitigated, are shown on Figure 3.

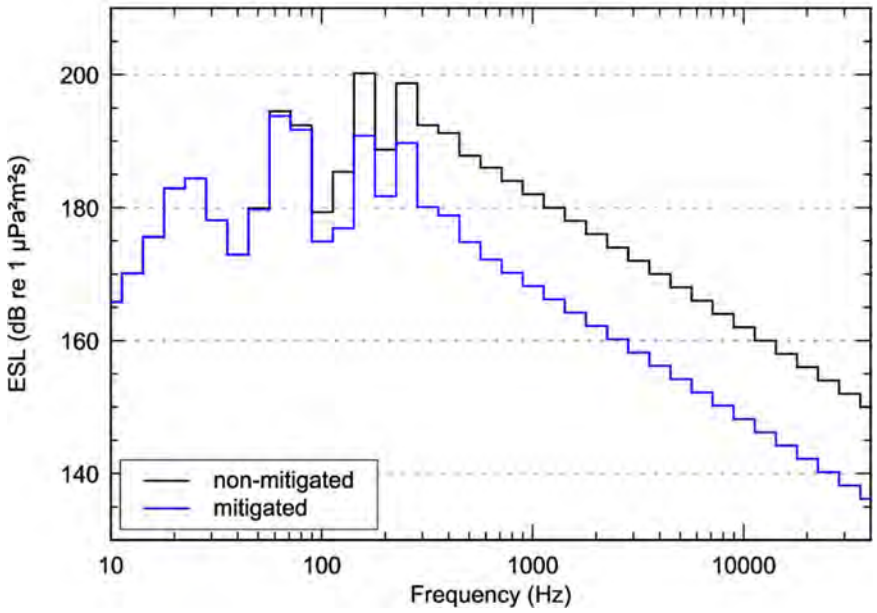

Figure 3. Modelled decidecade band energy source level spectrum (non-mitigated and mitigated) for a pile strike at Location 1a. Calculated as a sum of individual monopole signatures (water column pile portion only) in the far field without consideration of the environment effect.

The model computes the sound field for a single impact hammer pulse. The 24 h SEL was calculated using the modelled per-pulse field with adjustment for the number of impact hammer pulses in 24 h, using the following formula:

$$L_{E,N} = L_E + 10 \log_{10} N \quad (1)$$

where L_E is the per-pulse SEL and N is the total number of pulses. The adjustment for impact pile driving was 30.5 dB (N = 3·375 = 1125 impact hammer pulses) applied to the field modelled at each location.

3.1.2. Down the Hole Drilling

Down the hole drilling will be required for advancing piles into the bedrock for this project. This is performed by a drill bit in a vertical pile that has been partially installed through means of vibratory and impact hammers. Source levels for this activity were derived from available empirical measurements from a similar project in Alaska. In May 2016, a Numa Patriot 180 hydro-hammer was used to drive 24 in diameter piles into bedrock at a ferry terminal at Kodiak, AK (Denes et al. 2016). Acoustic signatures for this drilling activity were recorded at ranges of 10–30 m from the pile. The measured source levels from these measurements, in decidecade bands, were adjusted by $20\log_{10}$(range) (i.e., back propagated assuming spherical spreading) and averaged to provide the representative SEL source levels (Figure 4). These source levels were only measured up to 25 kHz and extrapolated up to 64 kHz. The broadband source level from this measurement is 192 dB re 1 µPa, which is a conservative estimate relative to other reported measurements of similar activities (Denes et al. 2019, Reyff and Heyvaert 2019, Guan et al. 2022) but is the best reference of frequency-dependent source levels available at this time.

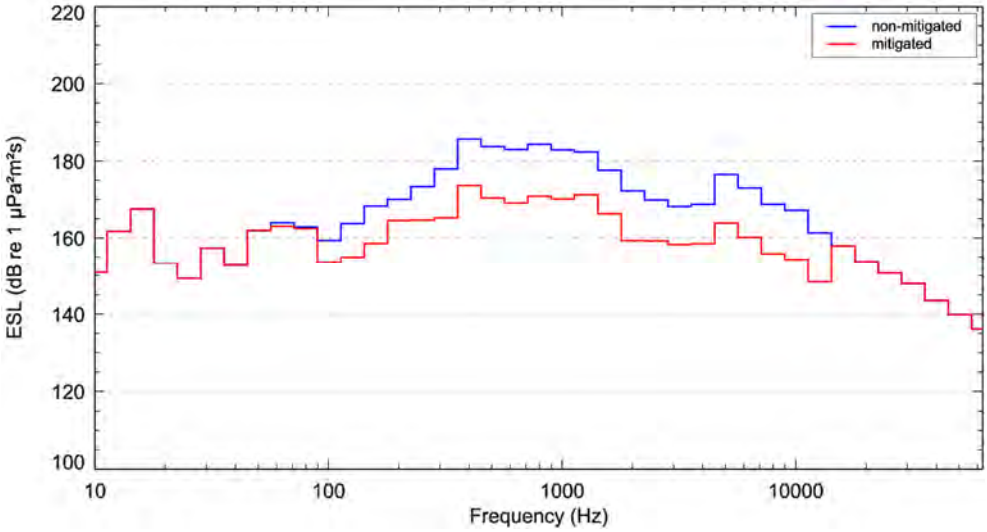

Figure 4. Source levels for drilling into bedrock for Scenario 1 represented in decidecade bands for mitigated and unmitigated scenarios.

The model computes the sound field equivalent to 1 s of activity. The 24 h SEL was calculated using the modelled per-second field with adjustment for the total duration of activity within 24 h, using Equation 1 from Section 3.1.1 where, in this case, N represents the total number of seconds of operation. For pile installation at the MOF, the adjustment for the component of the field associated with down the hole drilling was 42.6 dB (N = 5 h·60 min/h 60 s/min = 18,000 s) applied to the field modelled at each location. For pile installation at the mooring anchor location, the adjustment was 45.6 dB (N = 10 h·60 mini/h 60 s/min = 36,000 s).

3.1.3. Vessels and Floating Liquified Natural Gas (FLNG) Facility

The two main sources of a vessel's underwater noise are propeller cavitation and hull vibrations from internal machinery (Ross 1976). Different types of vessels have different spectral characteristics because of their design and operating conditions.

Source levels for the transiting vessel scenarios were modelled using the JOMOPANS-ECHO reference spectrum model developed as part of the Joint Monitoring Programme for Ambient Noise in the North Sea (JOMOPANS) project and validated using statistics of monopole source level (MSL) measurements from the Enhancing Cetacean Habitat and Observation (ECHO) Program led by the Vancouver Fraser Port Authority. The model depends on vessel speed, length, and class, where longer or faster vessels have higher source levels (all other factors being equal). The model employs a monopole source representation with a consistently specified reference source depth which is different for each vessel (Table 5). A complete technical description of the model can be found in MacGillivray and de Jong (2021).

Source levels for the LNG carrier and the tugs during berthing were derived from measurements. Since source level measurements of the proposed vessels during berthing were unavailable, we used published measurements of vessels of similar type and size and adjusted them to the proposed vessel specifications (details in Appendix C.1.2.1). The LNG carriers proposed for this modelling study were based on a carrier of 315 m length, 217 000 m^3 capacity. Measured source levels for such LNG carriers were not available at the time of this modelling study. Consequently, the source levels for an LNG carrier during transit were based on published measurements of three crude oil tankers operating under normal conditions (McKenna et al. 2012), which are expected to be a conservative surrogate for LNG carriers in terms of noise output. These oil tankers transited at 13.5 kn on average; the mean spectral source levels based on measurements are presented in the cited reference in decidecade bands ranging from 20 to 800 Hz. We extrapolated decidecade band source levels to lower (10–20 Hz) and higher frequencies (800 Hz–16 kHz) based on measurements of the modern cargo ship M/V *Overseas Harriette* that transited at 8-16 kn (Arveson and Vendittis 2000). The source levels for the tugs during berthing/unberthing were derived from acoustic measurements of a surrogate tug (Britoil 51; Hannay et al. 2004). The specifications of this surrogate tug are similar to the possible specifications for the proposed tug type (Table 5). Source levels derived from measurements during pulling and pushing activities were used to model berthing/unberthing.

While berthing, the LNG carrier's modelled speed decreases from 14 to 6 kn, which substantially reduces its overall noise emissions. Tugs also reduce their average speed to 6 kn, but while berthing they engage in pushing and pulling the LNG carrier into its berth; this activity may require a varying amount of power (and thus result in different sound emission) depending on the wind and currents but is intrinsically noisier. Based on the modelling assumptions, the expected source levels for individual tugs engaged in pushing/pulling operations will not be substantially different than when transiting at higher speeds.

The proposed FLNG facility is an anchored facility assumed to not be undergoing any dynamic positioning (DP) maneuvers. The acoustic impact is therefore expected to be due to mechanical vibrations from onboard equipment. With no directly measured source levels of these facilities at the time of modelling source levels for a comparable Floating Production Storage and Offloading (FPSO) facility were adjusted to match the source depth of the proposed FLNG (McPherson et al. 2019). Two FPSO facilities (*Ngujima Yin* and *Nganhurra*) were measured while moored and not offloading in calm weather. These source levels were averaged, and a source depth scaling was done to match the FLNG source depth of mid-hull (7.5 m) using equations proposed in MacGillivray and de Jong (2021).

Table 5. Information of vessels used for source level estimations of each relative vessel class and scenario. Length over all (LOA), draft, and speed can vary depending on type of vessel used in each operation.

Vessel	Activity	LOA (m)	Draft (m)	Speed (kn)
Tug	Transiting	40.2	7.0	14
Tug	Berthing/Unberthing	38.0	5.5	N/A
LNGC	Transiting	315	12.5	14,16
LNGC	Berthing/Unberthing	315	12.5	6
FLNG	Operation	353	15	N/A

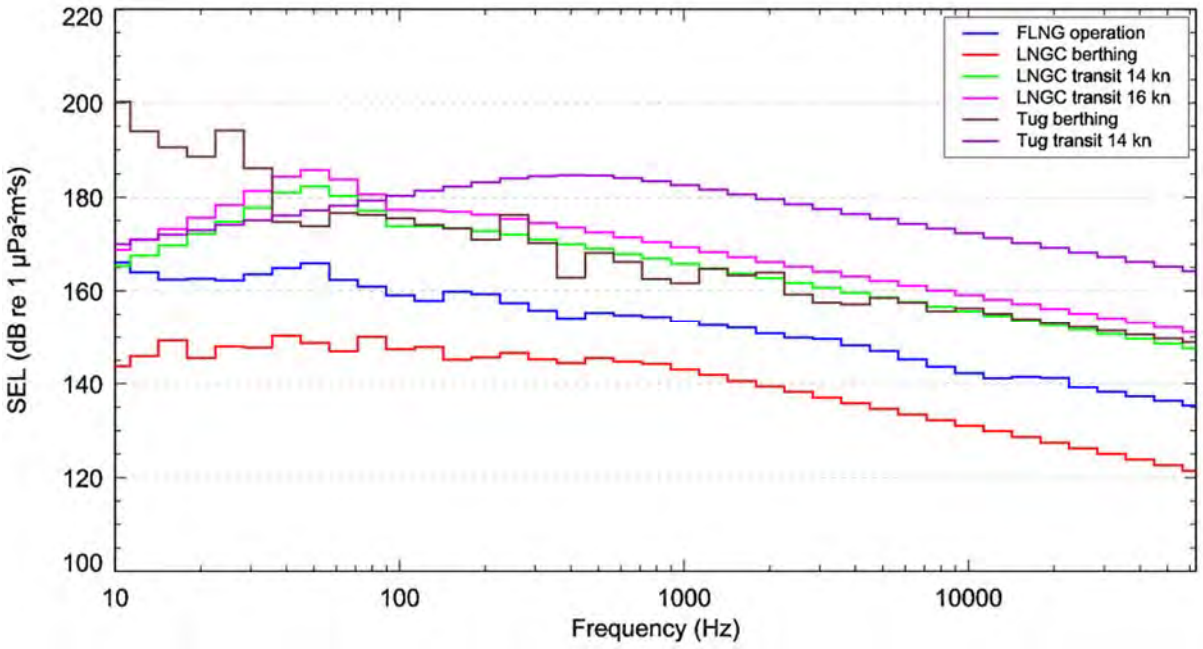

Figure 5. Source levels for each vessel scenario (Scenarios 2–5) represented in decidecade bands.

3.2. Mitigation Systems

3.2.1. Confined Bubble Curtains

Bubble curtain systems can reduce the sound energy propagating from pile driving operations. Noise mitigation is achieved by two mechanisms (Lucke et al. 2011). First, each bubble scatters sound because of the high acoustic impedance mismatch between the water and the injected air that forms the bubble. Second, at certain wavelengths acoustic waves cause bubbles to resonate, resulting in a net acoustic energy loss. The broadband attenuation level achieved depends on environmental factors, the characteristics of the pile, and the penetration depth of the pile into the seabed substrate. The density of the bubbles rising through the water column from an unconfined bubble curtain is difficult to control, especially when currents are strong or in deep water. A higher attenuation level may be achieved using a confined bubble curtain, which traps the bubbles within a membrane and allows for better controls of the bubble density in the water. It is important that bubble curtains be appropriately designed for their specific environmental parameters to maximize their potential effectiveness; acoustic measurements of pile driving activities with confined bubble curtains have shown a range in achieved broadband sound level reductions, from 5 to 36 dB (Caltrans 2001, MacGillivray and Racca 2005, ICF Jones & Stokes and Illingworth & Rodkin 2009, MacGillivray et al. 2011, Martin et al. 2012).

Bubble curtains are less effective when a significant portion of sound travels unimpeded through the seabed substrate and enters the water column via the seafloor interface at a distance greater than the bubble curtain can contain (WSDOT 2010). Two factors can influence this indirect propagation: first, the length of pile already buried into the sediment, which radiates acoustic waves into the seabed; second, the ability of these ground-borne acoustic waves to couple into the water, which can result from upward-refracting sound speed profiles in the sediment as well as a reflective layering structure deflecting ground-borne waves up to the water-sediment interface. For the MOF location the portion of the pile buried in the sediment and therefore not subject to mitigation from the bubble curtain is 5 m, i.e., about 10 % of the total pile length.

To model the attenuation from a confined bubble curtain, the spectral content of the point sources representing the pile (see Appendix C.1.1) was filtered using a frequency-dependent attenuation coefficient. The frequency dependent attenuation factor (Figure 6) was obtained by compiling measurements from multiple confined bubble curtain performance studies to determine an average attenuation across 1/3-octave-bands (measurements available at 63–6300 Hz; Caltrans 2001, MacGillivray and Racca 2005, ICF Jones & Stokes and Illingworth & Rodkin 2009, Martin et al. 2012). The attenuation coefficient was assumed to be 0 dB (no mitigation effect) below 63 Hz, which is consistent with measurements just above that frequency and justified by the attenuation mechanism of typical bubble curtains at low frequencies (MacGillivray et al. 2011). Based on assessment guidelines (ICF Jones & Stokes and Illingworth & Rodkin 2009 §2-25, WSDOT 2010 §7.41), it was determined that for a typical confined bubble curtain system, a broadband sound level reduction by 10 dB is a realistic target assumption. This is especially true when little is known about the environment or for projects where multiple piles will be driven over a large area within which environmental conditions are likely to vary. All sound metrics for both impact pile driving and down the hole drilling operations were calculated considering the mitigation effect of the confined bubble curtain.

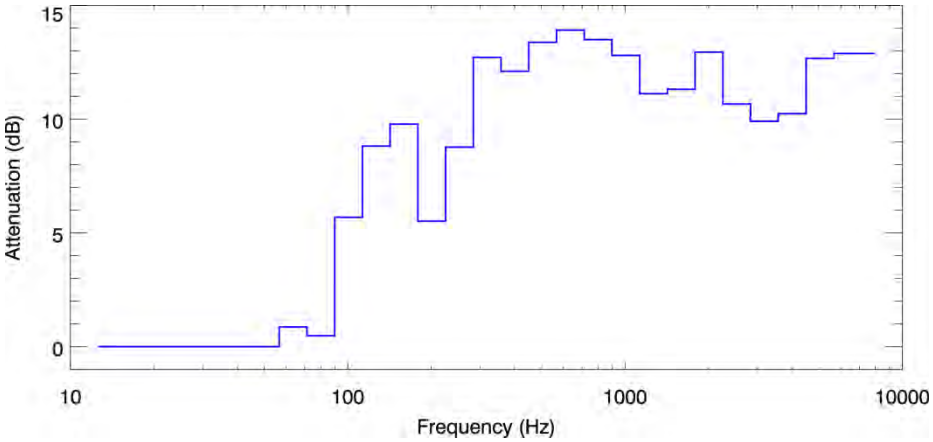

Figure 6. Averaged attenuation factor function versus frequency representing the mitigation effect from a confined bubble curtain.

3.3. Sound Propagation

3.3.1. Impact Pile Driving

The sound field from impact pile driving operation was modelled using the full waveform approach (FWRAM; see Appendix C.2.4). The modelled waveforms allowed direct calculation of the required acoustic sound metrics such as PK and SPL, as well as SEL. An array of distributed sources representing a vibrating pile emitting an acoustic wave was used. Each individual source from the array was defined as a monopole with signature calculated through an impact pile driving signature model (see Section 3.1.1) and considered mitigation effects from a confined bubble curtain (see Section 3.2).

The sound from impact pile driving was modelled in the frequency range from 9 to 708 Hz: from the start of band -20 ($f_c(-20)$ = 10 Hz) to band -2 ($f_c(-2)$ = 631 Hz). The *N*x2D approach (see Appendix C.2.2) was employed to model the three dimensional field around the pile. The modelling was performed along 42 radials that extended from the pile installation site to the shoreline (maximum range about 14.5 km). Sufficiently dense vertical sampling was used. The receiver depths were as follows:

- Every 2 m from 2 to 20 m
- Every 5 m from 25 to 50 m
- Every 10 m from 60 to 100 m
- Every 20 m from 120 to maximum depth

The PK and SPL metrics were calculated directly from the modelled waveforms. The SEL (un-weighted and frequency-weighted) was estimated by calculating band levels for 10 to 631 Hz bands from the waveform and extrapolating up to 63 kHz by using 2 dB roll-off factor per decidecade band.

3.3.2. Continuous Noise Sources

For the continuous noise sources (FLNG operations, vessels, and drilling) underwater sound propagation at frequencies of 10 Hz to 63 kHz was predicted with JASCO's Marine Operations Noise Model (MONM; Appendix C.2.2).

For each scenario, radials with a maximum length of 50 km were selected and the length of each radial was adjusted such that it ended when it reached land. A resolution for each source around the terminal was modelled to 5 m steps. For the two transiting scenarios (4 and 5), a resolution of 20 m was modelled. The modelling was performed along 109 radials for location 2a, 110 for location 2b and 3d, 111 radials for location 3a and 3b, 112 radials for location 3c, 181 radials for location 4a, 183 radials for location 4b, 120 radials for Scenario 5, which extended from the source location to the shoreline. The receiver depths were as follows:

- Every 1 m from 2 to 10 m,
- Every 2 m from 12 to 20 m,
- Every 5 m from 25 to 50 m,
- Every 10 m from 60 to 100 m, and
- Every 50 m from 150 to maximum depth.

4. Results

This section presents the modelled acoustic fields as tables of distances to the thresholds for acoustic effects and maps with contours of the corresponding thresholds. Shaded isopleth maps of the modelled sound fields can be found in Appendix D.

4.1. Pile Installation at the MOF

The PK and SPL thresholds for impulsive sound were calculated based on the per-pulse modelled field from a single pile. The SPL threshold for non-impulsive sound was calculated based on the per-second modelled field for the down the hole drilling operation. The SEL thresholds were calculated based on the total 24 h SEL field comprised of the impact pile driving installation field and down the hole drilling field at two locations. Since the pile installation activities include both impulsive and non-impulsive sound sources, we provide distances to the thresholds for both types of noise calculated from the total combined noise field.

Table 6 presents maximum (R_{max}, m) and 95 % ($R_{95\%}$, m) distances from the work site to impulsive sound thresholds for permanent threshold shift (PTS) onset (NMFS 2018) defined based on frequency-weighted SEL and PK metrics, and disturbance criteria based on SPL, for 24 h pile installation activities at the MOF with bubble curtain mitigation. Contours for the SEL and SPL thresholds are shown in Figure 7, and contours for the PK thresholds are in Figure 8.

Table 7 presents maximum (R_{max}, m) and 95 % ($R_{95\%}$, m) distances from the work site to non-impulsive sound thresholds for permanent threshold shift (PTS) onset (NMFS 2018) defined based on frequency-weighted SEL metric and disturbance criteria based on SPL for 24 h pile installation operation at the MOF with bubble curtain mitigation. Corresponding contours are in shown in Figure 7.

Table 8 presents maximum (R_{max}, m) and 95 % ($R_{95\%}$, m) distances from the work site to criteria thresholds for fish (Popper et al. 2014b) defined based on un-weighted SEL and PK metrics, for 24 h pile installation operation at the MOF with bubble curtain mitigation. The contours for temporary threshold shift are shown in Figure 7, and contours for mortality, potential mortal injury, and recoverable injury are in Figure 9.

Table 6. Distances (m) to marine mammal injury and disturbance thresholds defined for impulsive sound for pile installation operation at the materials offloading facility (MOF) with bubble curtain mitigation.

Marine mammal group	Threshold	MOF	
		R_{max}	$R_{95\%}$
Injury (PTS onset)			
Low-frequency cetaceans	219 dB re 1 µPa (PK)	<10	<10
Mid-frequency cetaceans	230 dB re 1 µPa (PK)	N/R	N/R
High-frequency cetaceans	202 dB re 1 µPa (PK)	84	63
Phocid pinnipeds (in water)	218 dB re 1 µPa (PK)	<10	<10
Otariid pinnipeds (in water)	232 dB re 1 µPa (PK)	N/R	N/R
Low-frequency cetaceans	183 re 1 µPa²·s ($SEL_{LF,24h}$)	4140	1940
Mid-frequency cetaceans	185 re 1 µPa²·s ($SEL_{MF,24h}$)	40	40
High-frequency cetaceans	155 re 1 µPa²·s ($SEL_{HF,24h}$)	868	683
Phocid pinnipeds (in water)	185 re 1 µPa²·s ($SEL_{PW,24h}$)	308	225
Otariid pinnipeds (in water)	203 re 1 µPa²·s ($SEL_{OW,24h}$)	31	31
Disturbance			
All marine mammals	160 dB re 1 µPa (rms SPL)*	5330	3450

* Calculated based on modelled per-pulse field for impact pile driving operation.
N/R = not registered; the maximum registered sound level was below the threshold.

Table 7 Distances (m) to marine mammal injury and disturbance thresholds defined for non-impulsive sound for pile installation operation at the materials offloading facility (MOF) with bubble curtain mitigation.

Marine mammal group	Threshold	MOF	
		R_{max}	$R_{95\%}$
Injury (PTS onset)			
Low-frequency cetaceans	199 re 1 µPa²·s ($SEL_{LF,24h}$)	230	182
Mid-frequency cetaceans	198 re 1 µPa²·s ($SEL_{MF,24h}$)	30	30
High-frequency cetaceans	173 re 1 µPa²·s ($SEL_{HF,24h}$)	82	67
Phocid pinnipeds (in water)	201 re 1 µPa²·s ($SEL_{PW,24h}$)	40	40
Otariid pinnipeds (in water)	219 re 1 µPa²·s ($SEL_{OW,24h}$)	<10	<10
Disturbance			
All marine mammals	120 dB re 1 µPa (rms SPL)*	7470	5580

* Calculated based on modelled per-second field for down the hole drilling operation

Table 8. Distances (m) to Fish injury thresholds for pile installation with a bubble curtain at the materials offloading facility (MOF). Fish I–No swim bladder; Fish II–Swim bladder not involved with hearing; Fish III–Swim bladder involved with hearing.

Fish group	Threshold	MOF	
		R_{max}	$R_{95\%}$
Mortality and potential mortal injury			
I	213 dB re 1 µPa (PK)	11	11
II, III	207 dB re 1 µPa (PK)	49	32
I	219 dB re 1 µPa²·s (SEL_{24h})	31	31
II	210 dB re 1 µPa²·s (SEL_{24h})	65	61
III	207 dB re 1 µPa²·s (SEL_{24h})	96	86
Recoverable injury			
I	213 dB re 1 µPa (PK)	11	11
II, III	207 dB re 1 µPa (PK)	49	32
I	216 dB re 1 µPa²·s (SEL_{24h})	41	41
II, III	203 dB re 1 µPa²·s (SEL_{24h})	196	165
Temporary Threshold Shift			
I, II, III	186 dB re 1 µPa²·s (SEL_{24h})	4140	2050
Best Management Practices for Pile Driving and Related Operations in British Columbia			
All	210 dB re 1 µPa (PK)	16	16

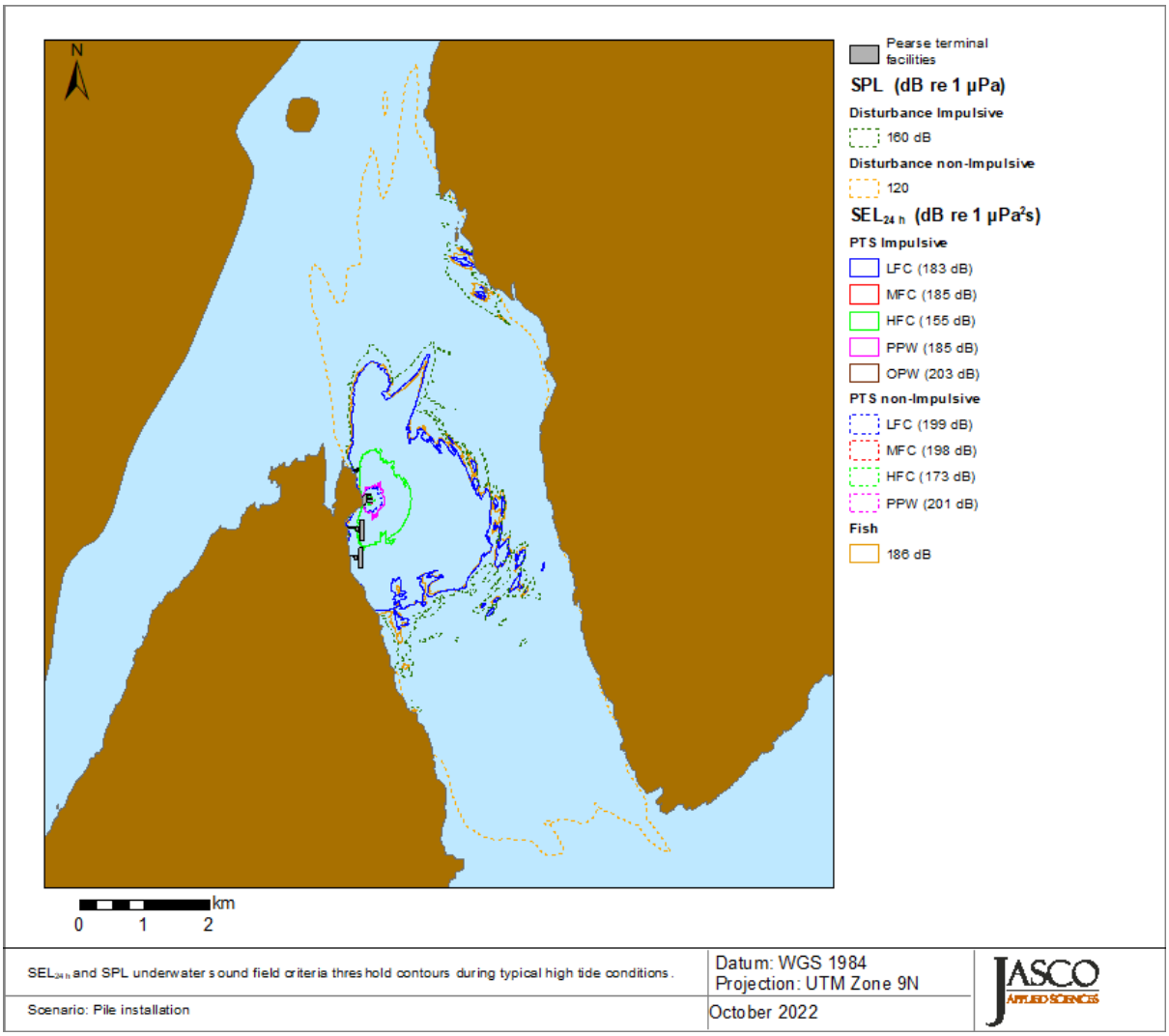

Figure 7. Pile installation at the MOF: Contours based on criteria for frequency-weighted (marine mammals: low-frequency cetaceans (LFC), mid-frequency cetaceans (MFC), high-frequency cetaceans (HFC) phocid pinnipeds in water (PPW) and otariid pinnipeds in water (OPW)) and un-weighted (fish) sound exposure level (SEL_{24h}) (impulsive and non-impulsive sound) and disturbance criteria based on sound pressure level (SPL) for impulsive sound.

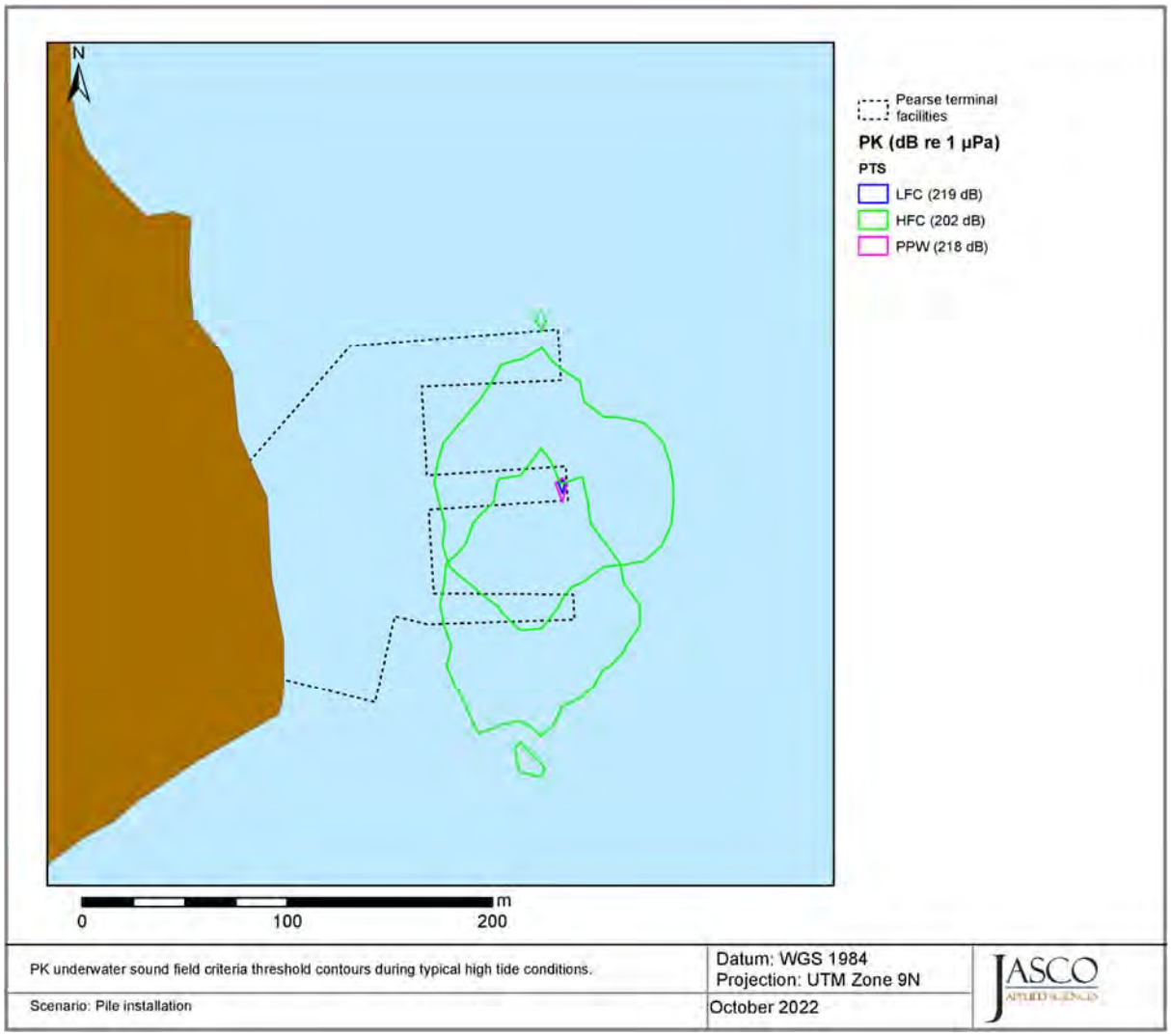

Figure 8. Pile installation at the MOF: Threshold contours based on criteria for peak sound level (PK) field for low-frequency cetaceans (LFC), high-frequency cetaceans (HFC), and phocid pinnipeds in water (PPW). Thresholds for other marine mammal hearings groups were not reached.

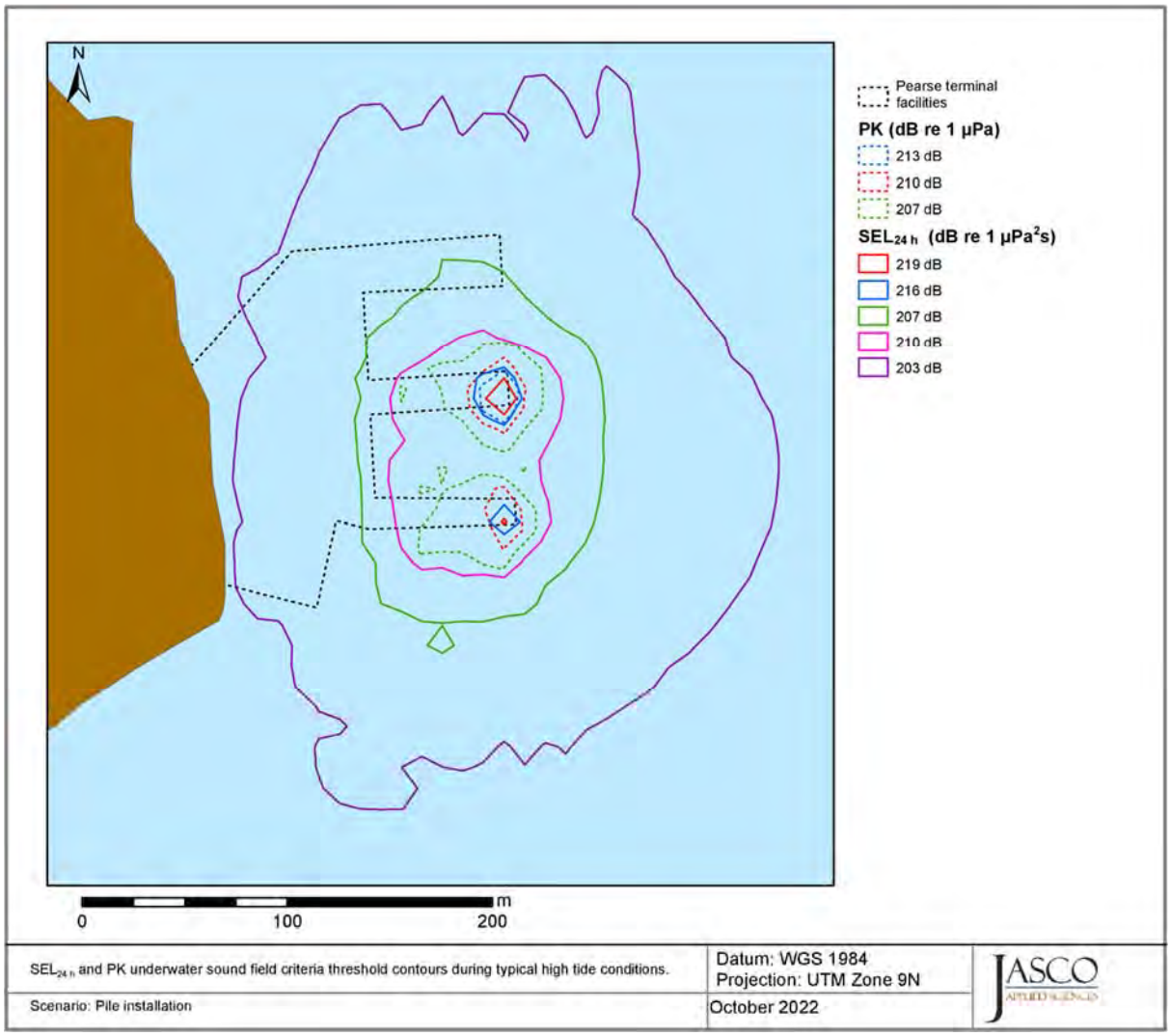

Figure 9. Pile installation at the MOF: Threshold contours based on criteria for peak sound level (PK) and un-weighted sound exposure level (SEL_{24h}) fields for fish.

4.2. Pile Installation for Mooring Anchors

Table 9 presents maximum (R_{max}, m) and 95 % ($R_{95\%}$, m) distances from the work site to non-impulsive sound thresholds for permanent threshold shift (PTS) onset (NMFS 2018) defined based on frequency-weighted SEL metric and disturbance criteria based on SPL for 12 h pile installation operation at the mooring anchor location with bubble curtain mitigation. Corresponding contours are in shown in Figure 10.

Table 9 Distances (m) to marine mammal injury and disturbance thresholds for down the hole drilling at the mooring anchor location.

Marine mammal group	Threshold	MOF	
		R_{max}	$R_{95\%}$
Injury (PTS onset)			
Low-frequency cetaceans	199 re 1 µPa²·s ($SEL_{LF,24h}$)	21	21
Mid-frequency cetaceans	198 re 1 µPa²·s ($SEL_{MF,24h}$)	29	29
High-frequency cetaceans	173 re 1 µPa²·s ($SEL_{HF,24h}$)	43	43
Phocid pinnipeds (in water)	201 re 1 µPa²·s ($SEL_{PW,24h}$)	7	7
Otariid pinnipeds (in water)	219 re 1 µPa²·s ($SEL_{OW,24h}$)	7	7
Disturbance			
All marine mammals	120 dB re 1 µPa (rms SPL)	6410	4963

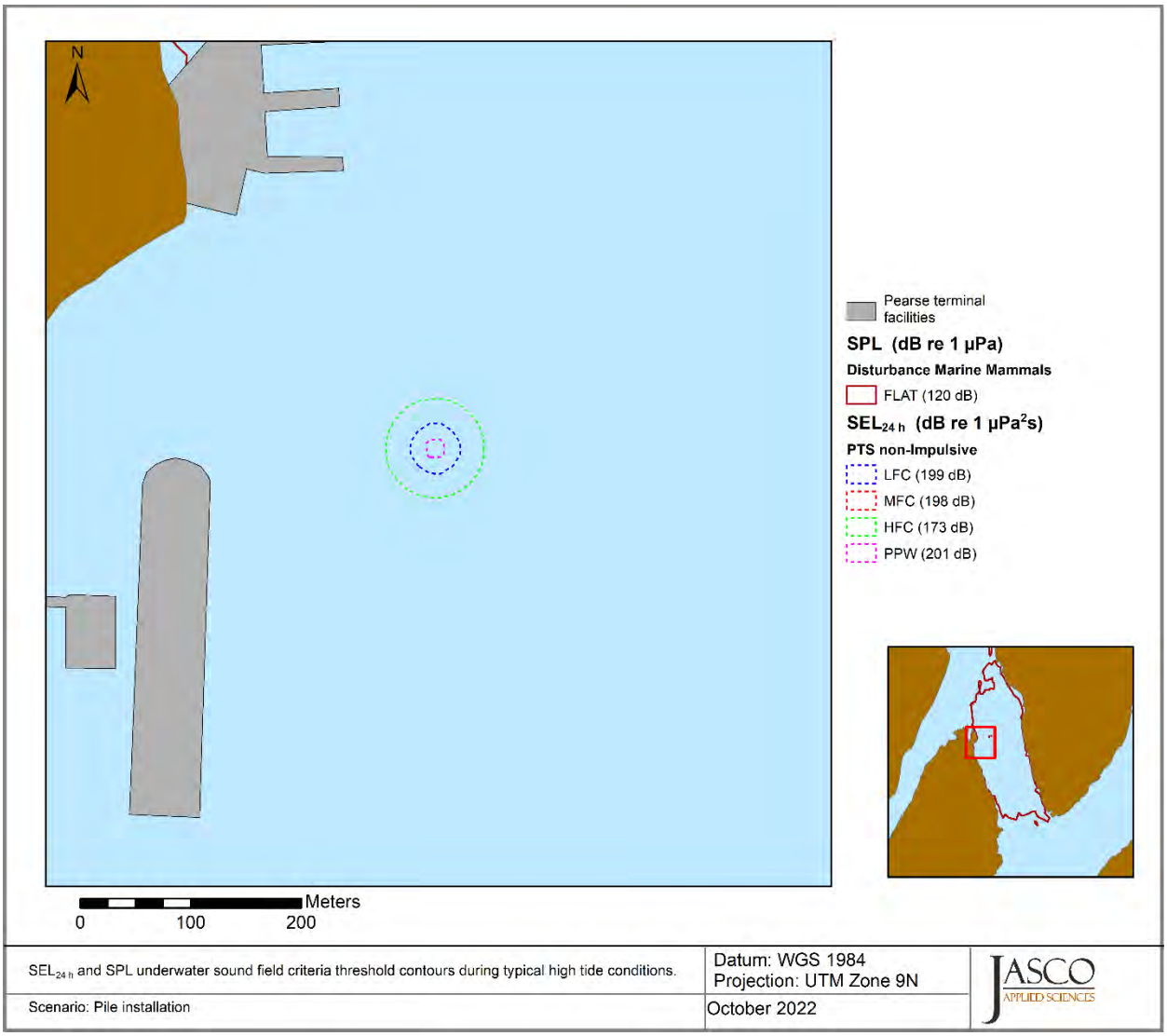

Figure 10. Pile installation at the mooring anchor location: Threshold contours based on criteria for 24 h sound exposure level (SEL_{24h}) and sound pressure level (SPL) for low-frequency cetaceans (LFC), mid-frequency cetaceans (MFC), high-frequency cetaceans (HFC), and phocid pinnipeds in water (PPW). Thresholds for otariid pinnipeds in water were never reached.

4.3. FLNG Operations

Table 10 presents maximum (R_{max}, m) and 95 % ($R_{95\%}$, m) distances from the work site to non-impulsive sound thresholds for permanent threshold shift (PTS) onset (NMFS 2018) defined based on frequency-weighted SEL metric and disturbance criteria based on SPL for 24 h operation of two FLNGs. Corresponding contours are in shown in Figure 11.

Table 10. Distances (m) to marine mammal injury and disturbance thresholds for an operational Floating Liquified Natural Gas (FLNG) operations (Scenario 2) at Pearse Island.

Marine mammal group	Threshold	MOF	
		R_{max}	$R_{95\%}$
Injury (PTS onset)			
Low-frequency cetaceans	199 re 1 µPa²·s ($SEL_{LF,24h}$)	9	9
Mid-frequency cetaceans	198 re 1 µPa²·s ($SEL_{MF,24h}$)	<5	<5
High-frequency cetaceans	173 re 1 µPa²·s ($SEL_{HF,24h}$)	16	15
Phocid pinnipeds (in water)	201 re 1 µPa²·s ($SEL_{PW,24h}$)	<5	<5
Otariid pinnipeds (in water)	219 re 1 µPa²·s ($SEL_{OW,24h}$)	N/R	N/R
Disturbance			
All marine mammals	120 dB re 1 µPa (rms SPL)	5483	3509

N/R = not registered; the maximum registered sound level was below the threshold.

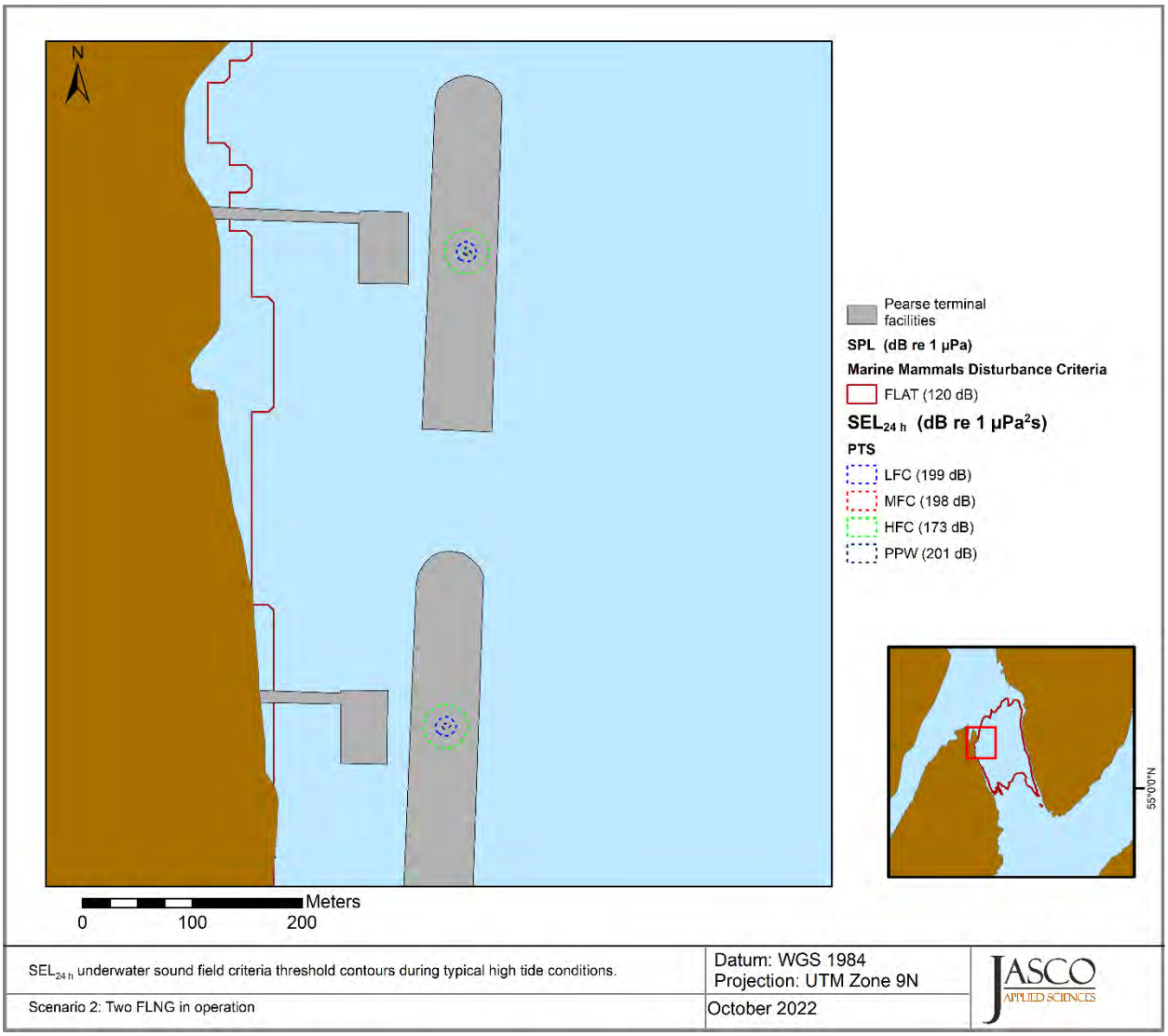

Figure 11. FLNG operations: Threshold contours based on criteria for 24 h sound exposure level (SEL_{24h}) and sound pressure level (SPL) for low-frequency cetaceans (LFC), mid-frequency cetaceans (MFC), high-frequency cetaceans (HFC), and phocid pinnipeds in water (PPW). Thresholds for otariid pinnipeds in water were not reached.

4.4. Liquified Natural Gas Carrier (LNGC) Berthing

Table 11 presents maximum (R_{max}, m) and 95 % ($R_{95\%}$, m) distances from the work site to non-impulsive sound thresholds for permanent threshold shift (PTS) onset (NMFS 2018) defined based on frequency-weighted SEL metric and disturbance criteria based on SPL for 24 h operation of two FLNGs as well as a berthing and unberthing operation of and LNGC using three tugs. Corresponding contours are in shown in Figure 12. The SEL thresholds were calculated based on the total 24 h SEL field comprised of 1.5 h of berthing at one facility, 1 h of unberthing at the same facility, and 24 h of FLNG operations at both facilities.

Table 11. Distances (m) to marine mammal injury and disturbance thresholds for three tugs berthing an LNGC at Berth 1 with Floating Liquified Natural Gas (FLNG) operations ongoing at Berths 1 and 2 at Pearse Island.

Marine mammal group	Threshold	MOF	
		R_{max}	$R_{95\%}$
Injury (PTS onset)			
Low-frequency cetaceans	199 re 1 µPa²·s ($SEL_{LF,24h}$)	17	16
Mid-frequency cetaceans	198 re 1 µPa²·s ($SEL_{MF,24h}$)	<5	<5
High-frequency cetaceans	173 re 1 µPa²·s ($SEL_{HF,24h}$)	23	22
Phocid pinnipeds (in water)	201 re 1 µPa²·s ($SEL_{PW,24h}$)	<5	<5
Otariid pinnipeds (in water)	219 re 1 µPa²·s ($SEL_{OW,24h}$)	N/R	N/R
Disturbance			
All marine mammals	120 dB re 1 µPa (rms SPL)	13630	11540

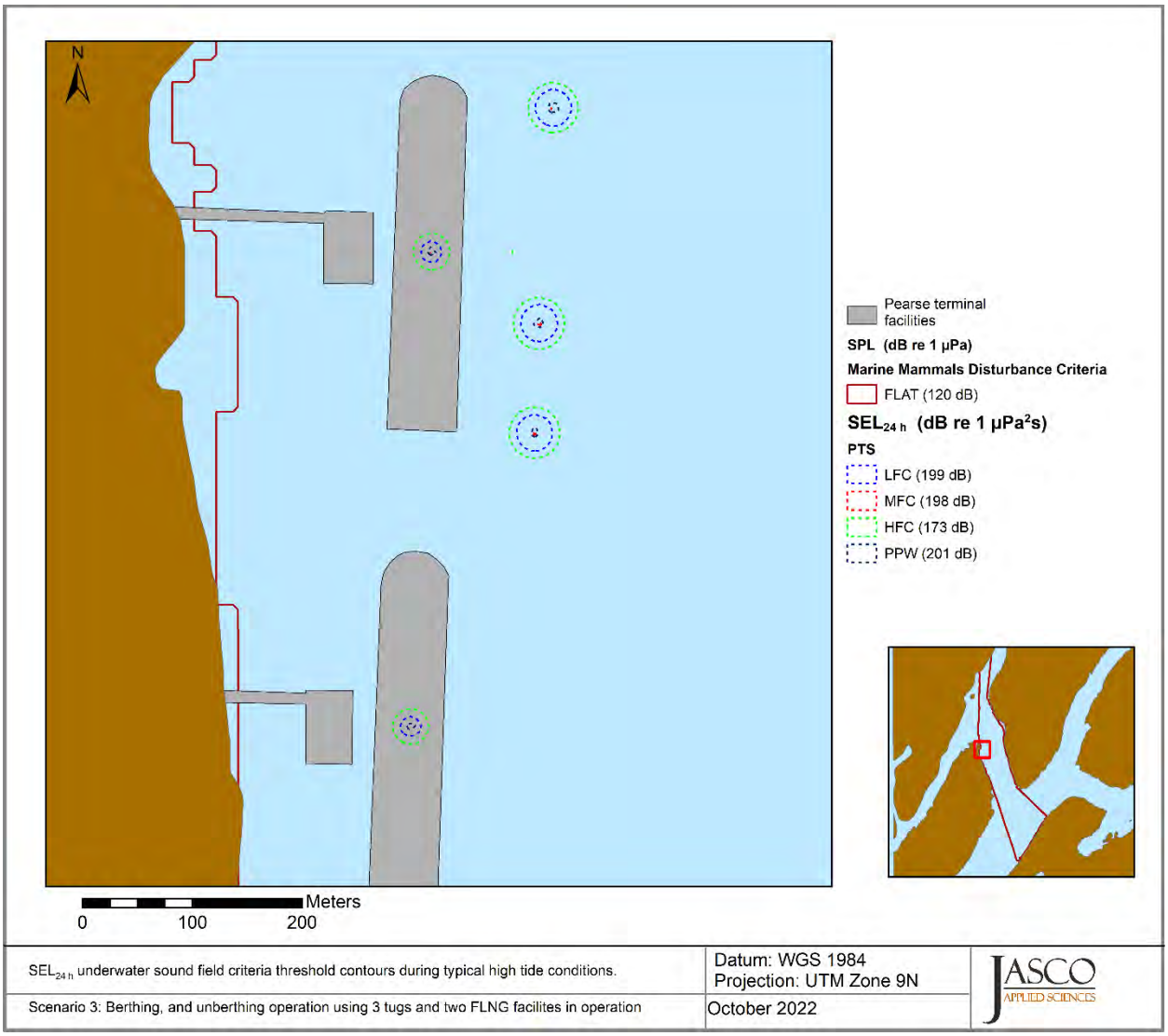

Figure 12. LNGC berthing: Threshold contours based on criteria for 24 h sound exposure level (SEL_{24h}) and sound pressure level (SPL) for low-frequency cetaceans (LFC), mid-frequency cetaceans (MFC), high-frequency cetaceans (HFC), and phocid pinnipeds in water (PPW). Thresholds for otariid pinnipeds in water were never reached.

4.5. Transiting Vessels

Table 12 presents maximum (R_{max}, m) and 95 % ($R_{95\%}$, m) distances from the vessels transit to non-impulsive sound thresholds for disturbance criteria (NMFS 2018) based on SPL for the transiting of an LNGC with and without tug escort in Dixon Entrance and Portland Inlet respectively. Corresponding contours are in shown in Figures 13 and 14.

Table 12. Distances to marine mammal injury and disturbance thresholds for vessels transiting in Dixon Entrance and Portland Inlet.

Marine mammal group	Threshold	Dixon Entrance		Portland Inlet (inc. escort tug) [1]	
		R_{max} (km)	$R_{95\%}$ (km)	R_{max} (km)	$R_{95\%}$(km)
Sensory disturbance					
All marine mammals	120 dB re 1 µPa (rms SPL)	24.50	20.79	37.85	28.22

[1] Radius computed from centre of vessel spread

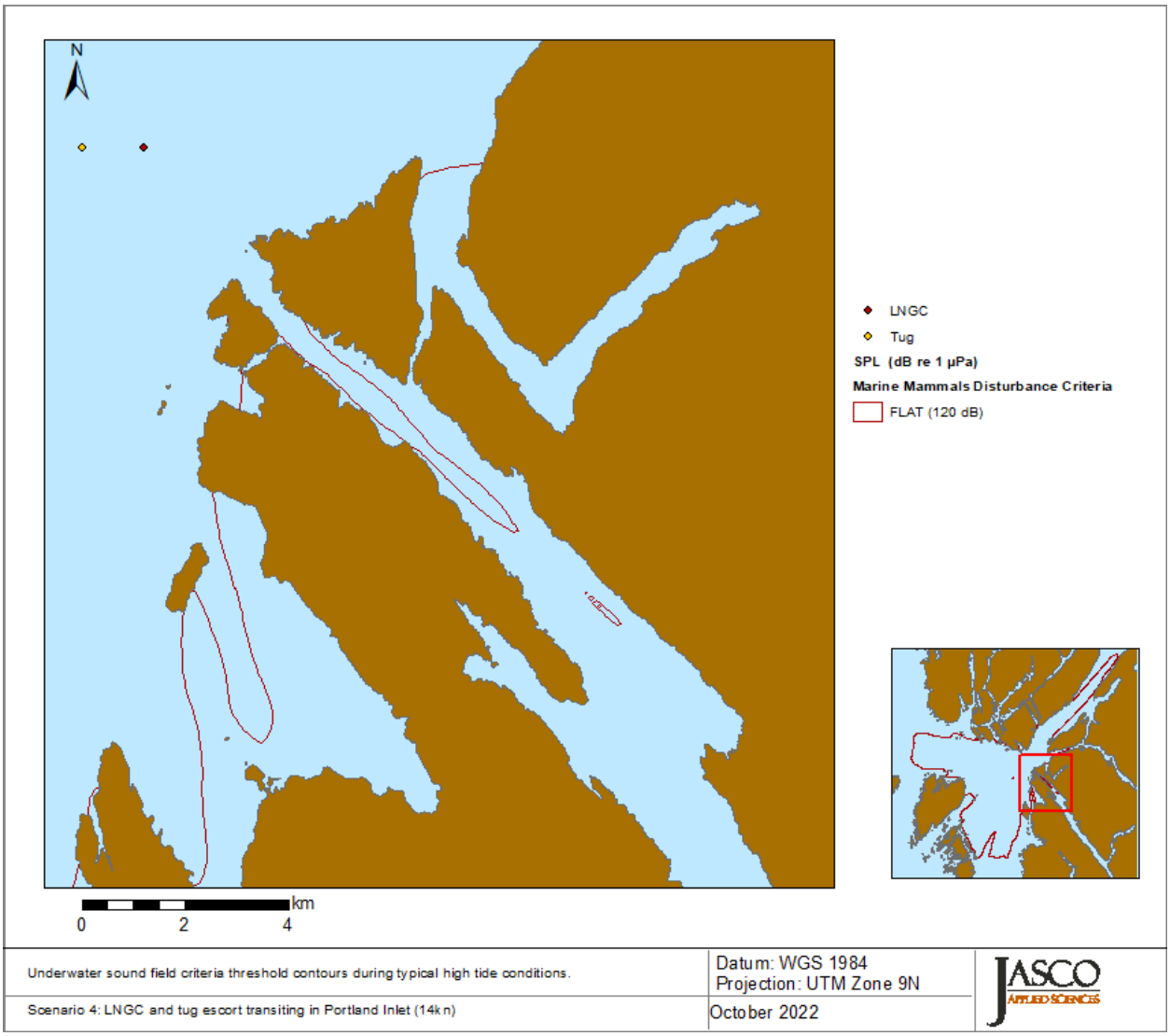

Figure 13. Liquified Natural Gas Carrier (LNGC) transiting, with tug escort, in Portland Inlet: Threshold contours based on sound pressure level (SPL) criterion for marine mammals disturbance.

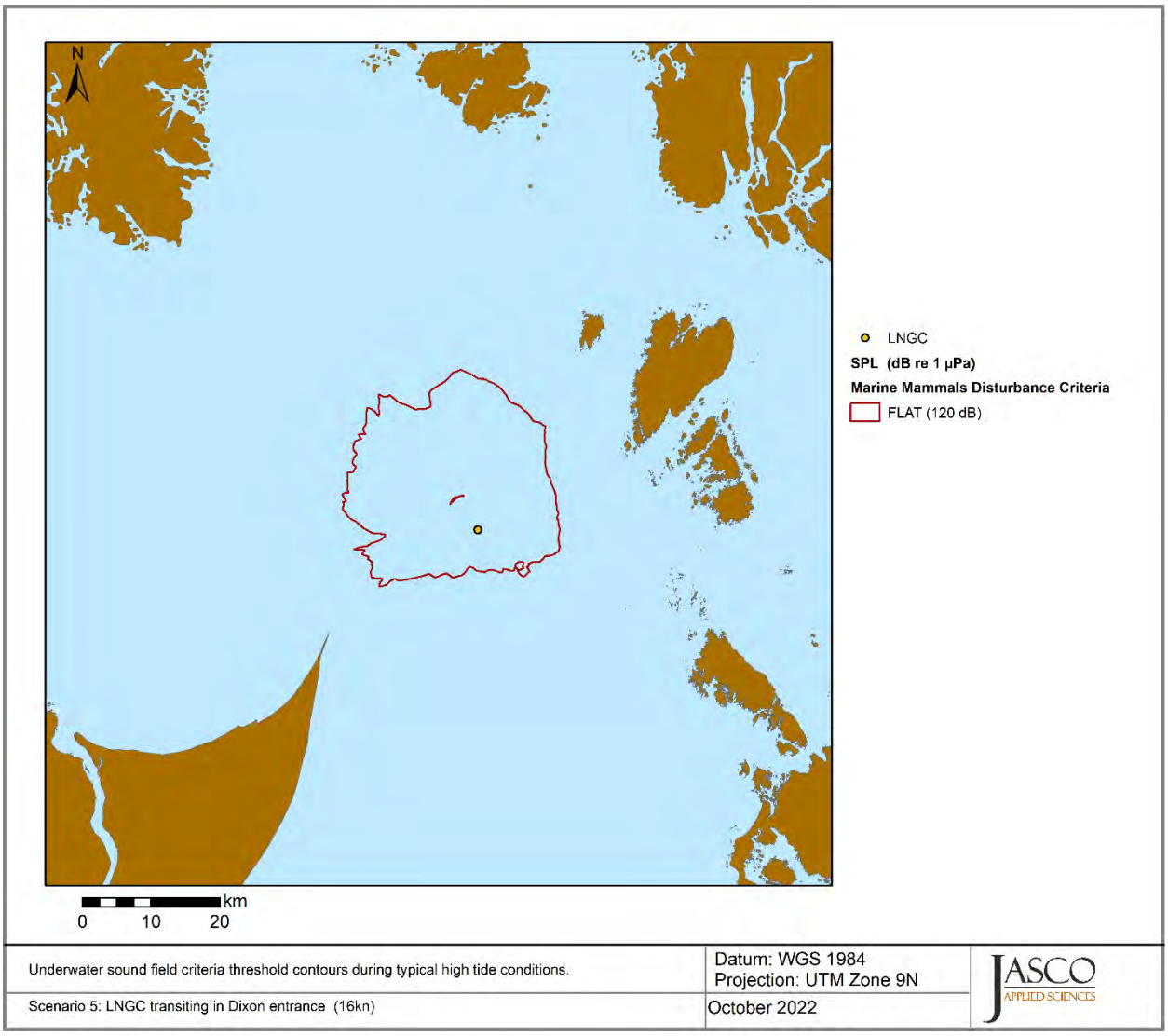

Figure 14. Liquified Natural Gas Carrier (LNGC) transiting in Dixon Entrance: Threshold contours based on sound pressure level (SPL) criterion marine mammals disturbance.

To determine the accumulation of noise from a transiting vessel a 5 km section of track was modelled and a comparison of the frequency-weighted SEL_{24h} at a receiver distance of 10 m from the vessel was created (Figures 15 and 16). Where the vessels headed toward the simulated receiver (indicated by negative distances), a monotonic increase in sound exposure occurred. At the closest point of approach (0 m), sound exposure increased as a sharp step. Once the vessels passed the closest point of approach to the receiver point (indicated by positive distances), sound exposure quickly plateaued to its final value. Therefore, the maximum sound exposure occurred at the closest point of approach, and further noise contributions to the total sound exposure when the vessel was at longer distances were negligible. None of the injury thresholds (shown as horizontal dashed lines) were reached for either scenario. Marine mammals would therefore never experience PTS from the vessel noise, even if the vessels passed them at a closest point of approach of 10 m.

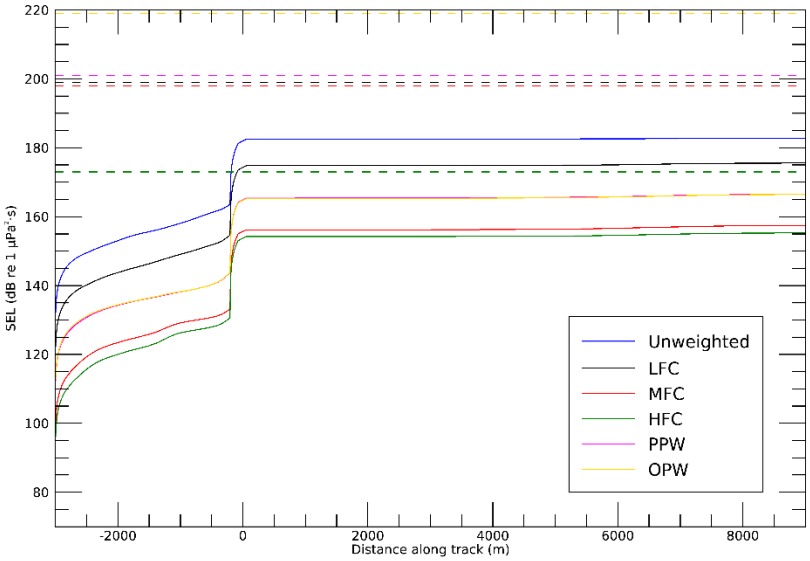

Figure 15. Scenario 4: Weighted 24 h sound exposure level (SEL_{24h}) at a modelled receiver located 10 m off the vessel's track, corresponding to a single pass a Liquified Natural Gas Carrier (LNGC) and escort tug traveling at 14 kn in Portland Inlet. Negative and positive distances along the track indicate the vessel position before and after passing the closest point of approach (CPA), respectively. Weighting functions correspond to the Southall (2019) threshold criteria; the corresponding thresholds are indicated by horizontal colour-coded dashed lines.

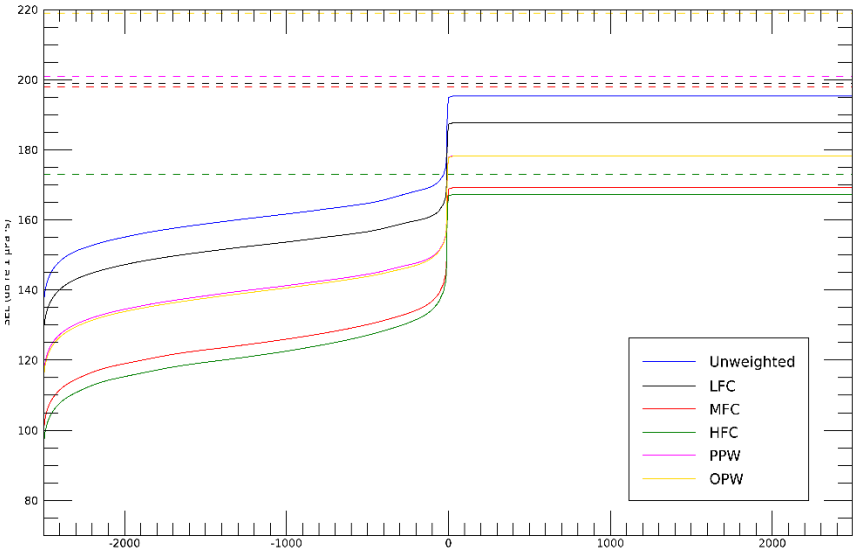

Figure 16. Scenario 5: Weighted 24 h sound exposure level (SEL_{24h}) at a modelled receiver located 10 m off the vessel's track, corresponding to a single pass of a Liquified Natural Gas Carrier (LNGC) traveling at 16 kn in Dixon Entrance. Negative and positive distances along the track indicate the vessel position before and after passing the closest point of approach (CPA), respectively. Weighting functions correspond to the Southall (2019) threshold criteria; the corresponding thresholds are indicated by horizontal colour-coded dashed lines.

5. Discussion and Summary

The purpose of this study was to assess the extent over which marine mammal species could be affected by additional noise generated by the operation and construction of the FLNG facilities at Pearse Island. This includes additional vessel traffic of both LNGC and tugs within the region, berthing and unberthing operations at the FLNG facility, FLNG facility operations, and marine construction operations. For all scenarios, acoustic models were used to predict noise levels generated from the relative scenarios and results were compared to various metrics for acoustic impacts.

Modeling results were processed to obtain isopleths for each scenario representing injury and disturbance thresholds as outlined by NMFS (2018). Results were also processed to obtain distances to various marine mammal impact thresholds. These distances are presented in tables of maximum (R_{max}) ranges, the maximum distances at which thresholds are exceeded, and 95 % ranges ($R_{95\%}$), the maximum range at which the given sound level was encountered after excluding 5 % of the farthest such points to provide an estimate less affected by sound field outliers.

Considering impulsive thresholds for pile installation at the MOF, PK level criteria for marine mammal injury were not reached beyond $R_{95\%}$ = 63 m from the pile for any scenario. This is based on the threshold for high-frequency cetaceans; this distance was less than 10 m for all other marine mammal hearing groups. The maximum range for marine mammal disturbance, based on the 160 dB re 1 µPa SPL threshold, was $R_{95\%}$=3.45 km. The $R_{95\%}$ distance to 24 h frequency weighted SEL injury thresholds was between $R_{95\%}$ = 0.03 km for otariids and $R_{95\%}$ = 1.94 km for the low-frequency cetacean hearing group. For fish, thresholds for mortality and potential mortal injury extended to distances between $R_{95\%}$ = 11 m (PK) to 86 m (SEL_{24h}) and thresholds for recoverable injury ranged between $R_{95\%}$ = 11 m (PK) to 165 m (SEL_{24h})), depending on type of fish. Fish of all types could experience TTS at $R_{95\%}$ distance of 2 km. The 210 dB re 1 µPa PK threshold reached $R_{95\%}$ = 16 m.

Considering non-impulsive thresholds for pile installation at the MOF resulted in the maximum range for marine mammal disturbance, based on the 120 dB re 1 µPa SPL threshold, of $R_{95\%}$ = 5.58 km. The $R_{95\%}$ distance to 24 h frequency weighted SEL injury thresholds was between $R_{95\%}$ = <10 m for otariids and $R_{95\%}$ = 182 m for the low-frequency cetacean hearing group.

Continuous thresholds for pile installation of the mooring anchors resulted in the maximum range for marine mammal disturbance, based on the 120 dB re 1 µPa SPL threshold, of $R_{95\%}$ = 4.96 km. The $R_{95\%}$ distance to 24 h frequency weighted SEL injury thresholds was between $R_{95\%}$ = 7 m for otariids and $R_{95\%}$ = 43 m for the low-frequency cetacean hearing group.

Continuous thresholds for a 24 h operation of two FLNG facilities resulted in the maximum range for marine mammal disturbance, based on the 120 dB re 1 µPa SPL threshold, of $R_{95\%}$ = 3.51 km. The $R_{95\%}$ distance to 24 h frequency weighted SEL injury thresholds was between $R_{95\%}$ = <5 m for otariids and $R_{95\%}$ = 15 m for the high-frequency cetacean hearing group.

Continuous thresholds for a 1.5 h berthing and 1 hour un-berthing operation using three tugs during the 24 h operation of two FLNG stations resulted in the maximum range for marine mammal disturbance, based on the 120 dB re 1 µPa SPL threshold, of $R_{95\%}$ = 11.5 km. The $R_{95\%}$ distance to 24 h frequency weighted SEL injury thresholds was between $R_{95\%}$ = <5 m for phocids and $R_{95\%}$ = 22 m for the high-frequency cetacean hearing group.

For LNG carrier transiting in Dixon Entrance at 16 kn the maximum distance to the 120 dB re 1 µPa (SPL) NMFS threshold for behavioural disturbance due to non-impulsive noise was $R_{95\%}$ = 20.79 km.

For LNG carrier transiting with an escort tug at 14 kn in Portland Inlet the maximum distance to the 120 dB re 1 µPa (SPL (rms)) NMFS threshold for behavioural disturbance due to non-impulsive noise was $R_{95\%}$ = 28.22 km.

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Glossary

absorption

The conversion of acoustic energy into heat, which is captured by insulation.

attenuation

The gradual loss of acoustic energy from absorption and scattering as sound propagates through a medium.

audiogram

A graph of hearing threshold level (sound pressure levels) as a function of frequency, which describes the hearing sensitivity of an animal over its hearing range.

audiogram weighting

The process of applying an animal's audiogram to sound pressure levels to determine the sound level relative to the animal's hearing threshold (HT). Unit: dB re HT.

auditory weighting function (frequency-weighting function)

Auditory weighting functions account for marine mammal hearing sensitivity. They are applied to sound measurements to emphasize frequencies that an animal hears well and de-emphasize frequencies they hear less well or not at all (Southall et al. 2007, Finneran and Jenkins 2012, NOAA 2013).

bandwidth

The range of frequencies over which a sound occurs. Broadband refers to a source that produces sound over a broad range of frequencies (e.g., seismic airguns, vessels) whereas narrowband sources produce sounds over a narrow frequency range (e.g., sonar) (ANSI/ASA S1.13-2005 R2010).

bar

Unit of pressure equal to 100 kPa, which is approximately equal to the atmospheric pressure on Earth at sea level. 1 bar is equal to 106 Pa or 1011 µPa.

broadband sound level

The total sound pressure level measured over a specified frequency range. If the frequency range is unspecified, it refers to the entire measured frequency range.

cavitation

A rapid formation and collapse of vapor cavities (i.e., bubbles or voids) in water, most often caused by a rapid change in pressure. Fast-spinning vessel propellers typically cause cavitation, which creates a lot of noise.

cetacean

Any animal in the order Cetacea. These are aquatic, mostly marine mammals and include whales, dolphins, and porpoises.

compressional wave

A mechanical vibration wave in which the direction of particle motion is parallel to the direction of propagation. Also called primary wave or P-wave.

continuous sound

A sound whose sound pressure level remains above ambient sound during the observation period (ANSI/ASA S1.13-2005 R2010). A sound that gradually varies in intensity with time, for example, sound from a marine vessel.

decibel (dB)

One-tenth of a bel. Unit of level when the base of the logarithm is the tenth root of ten, and the quantities concerned are proportional to power (ANSI S1.1-1994 R2004).

ensonified

Exposed to sound.

frequency

The rate of oscillation of a periodic function measured in cycles-per-unit-time. The reciprocal of the period. Unit: hertz (Hz). Symbol: *f*. 1 Hz is equal to 1 cycle per second.

hearing group

Groups of marine mammal species with similar hearing ranges. Commonly defined functional hearing groups include low-, mid-, and high-frequency cetaceans, pinnipeds in water, and pinnipeds in air.

geoacoustic

Relating to the acoustic properties of the seabed.

hearing threshold

The sound pressure level that is barely audible for a given individual in the absence of significant background noise during a specific percentage of experimental trials.

hertz (Hz)

A unit of frequency defined as one cycle per second.

high-frequency cetacean (HFC)

The functional cetacean hearing group that represents those odontocetes (toothed whales) specialized for hearing high frequencies.

low-frequency cetacean (LFC)

The functional cetacean hearing group that represents mysticetes (baleen whales) specialized for hearing low frequencies.

masking

Obscuring of sounds of interest by sounds at similar frequencies.

mid-frequency cetacean (MFC)

The functional cetacean hearing group that represents those odontocetes (toothed whales) specialized for mid-frequency hearing.

mysticete

Mysticeti, a suborder of cetaceans, use their baleen plates, rather than teeth, to filter food from water. They are not known to echolocate but use sound for communication. Members of this group include rorquals (Balaenopteridae), right whales (Balaenidae), and gray whales (*Eschrichtius robustus*).

non-impulsive sound

Sound that is broadband, narrowband or tonal, brief or prolonged, continuous or intermittent, and typically does not have a high peak pressure with rapid rise time (typically only small fluctuations in decibel level) that impulsive signals have (ANSI/ASA S3.20-1995 R2008). For example, marine vessels, aircraft, machinery, construction, and vibratory pile driving (NIOSH 1998, NOAA 2015).

octave

The interval between a sound and another sound with double or half the frequency. For example, one octave above 200 Hz is 400 Hz, and one octave below 200 Hz is 100 Hz.

odontocete

The presence of teeth, rather than baleen, characterizes these whales. Members of the Odontoceti are a suborder of cetaceans, a group comprised of whales, dolphins, and porpoises. The toothed whales' skulls are mostly asymmetric, an adaptation for their echolocation. This group includes sperm whales, killer whales, belugas, narwhals, dolphins, and porpoises.

otariid

A common term used to describe members of the Otariidae, eared seals, commonly called sea lions and fur seals. Otariids are adapted to a semi-aquatic life; they use their large fore flippers for propulsion. Their ears distinguish them from phocids. Otariids are one of the three main groups in the superfamily Pinnipedia; the other two groups are phocids and walrus.

otariid pinnipeds in water (OPW)

The functional pinniped hearing group that represents eared seals.

parabolic equation method

A computationally efficient solution to the acoustic wave equation that is used to model transmission loss. The parabolic equation approximation omits effects of back-scattered sound, simplifying the computation of transmission loss. The effect of back-scattered sound is negligible for most ocean-acoustic propagation problems.

permanent threshold shift (PTS)

A permanent loss of hearing sensitivity caused by excessive noise exposure. PTS is considered auditory injury.

phocid

A common term used to describe all members of the family Phocidae. These true/earless seals are more adapted to in-water life than are otariids, which have more terrestrial adaptations. Phocids use their hind

flippers to propel themselves. Phocids are one of the three main groups in the superfamily Pinnipedia; the other two groups are otariids and walrus.

pinniped

A common term used to describe all three groups that form the superfamily Pinnipedia: phocids (true seals or earless seals), otariids (eared seals or fur seals and sea lions), and walrus.

phocid pinnipeds in water (PPW)

The functional pinniped hearing group that represents true/earless seals.

pressure, acoustic

The deviation from the ambient hydrostatic pressure caused by a sound wave. Also called overpressure. Unit: pascal (Pa). Symbol: *p*.

pressure, hydrostatic

The pressure at any given depth in a static liquid that is the result of the weight of the liquid acting on a unit area at that depth, plus any pressure acting on the surface of the liquid. Unit: pascal (Pa).

received level

The sound level measured at a receiver.

rms

root-mean-square.

sound

A time-varying pressure disturbance generated by mechanical vibration waves travelling through a fluid medium such as air or water.

sound exposure

Time integral of squared, instantaneous frequency-weighted sound pressure over a stated time interval or event. Unit: pascal-squared second ($Pa^2 \cdot s$) (ANSI S1.1-1994 R2004).

sound exposure level (SEL)

A cumulative measure related to the sound energy in one or more pulses. Unit: dB re 1 $\mu Pa^2 \cdot s$. SEL is expressed over the summation period (e.g., per-pulse SEL [for airguns], single-strike SEL [for pile drivers], 24-hour SEL).

sound field

Region containing sound waves (ANSI S1.1-1994 R2004).

sound intensity

Sound energy flowing through a unit area perpendicular to the direction of propagation per unit time.

sound pressure level (SPL)

The decibel ratio of the time-mean-square sound pressure, in a stated frequency band, to the square of the reference sound pressure (ANSI S1.1-1994 R2004).

For sound in water, the reference sound pressure is one micropascal (p_0 = 1 µPa) and the unit for SPL is dB re 1 µPa:

$$\mathrm{SPL} = 10\log_{10}\left(p^2 / p_0^2\right) = 20\log_{10}\left(p / p_0\right)$$

Unless otherwise stated, SPL refers to the root-mean-square sound pressure level. See also 90 % sound pressure level and fast-average sound pressure level. Non-rectangular time window functions may be applied during calculation of the rms value, in which case the SPL unit should identify the window type.

sound speed profile

The speed of sound in the water column as a function of depth below the water surface.

source level (SL)

The sound level measured in the far field and scaled back to a standard reference distance of 1 metre from the acoustic centre of the source. Unit: dB re 1 µPa at 1 m (sound pressure level) or dB re 1 µPa^2·s (sound exposure level).

spectrum

An acoustic signal represented in terms of its power (or energy) distribution compared with frequency.

transmission loss (TL)

The decibel reduction in sound level between two stated points that results from sound spreading away from an acoustic source subject to the influence of the surrounding environment. Also called propagation loss.

wavelength

Distance over which a wave completes one oscillation cycle. Unit: meter (m). Symbol: λ.

Appendix A. Acoustic Metrics

A.1. Pressure Related Acoustic Metrics

Underwater sound pressure amplitude is measured in decibels (dB) relative to a fixed reference pressure of p_0 = 1 µPa. Because the perceived loudness of sound, especially pulsed sound such as from seismic airguns, pile driving, and sonar, is not generally proportional to the instantaneous acoustic pressure, several sound level metrics are commonly used to evaluate sound and its effects on marine life. Here we provide specific definitions of relevant metrics used in the accompanying report. Where possible, we follow the American National Standard Institute and International Organization for Standardization definitions and symbols for sound metrics (e.g., ISO 2017, ANSI S1.1-2013), but these standards are not always consistent.

The zero-to-peak sound pressure, or peak sound pressure (PK or $L_{p,pk}$; dB re 1 µPa), is the decibel level of the maximum instantaneous acoustic pressure in a stated frequency band attained by an acoustic pressure signal, $p(t)$:

$$L_{p,\mathrm{pk}} = 10\log_{10}\left(\frac{\max|p^2(t)|}{p_0^2}\right) = 20\log_{10}\left(\frac{\max|p(t)|}{p_0}\right) \quad \text{(A-1)}$$

PK is often included as a criterion for assessing whether a sound is potentially injurious; however, because it does not account for the duration of an acoustic event, it is generally a poor indicator of perceived loudness.

The peak-to-peak sound pressure (PK-PK or $L_{p,pk\text{-}pk}$; dB re 1 µPa) is the difference between the maximum and minimum instantaneous sound pressure, possibly filtered in a stated frequency band, attained by an impulsive sound, $p(t)$:

$$L_{p,\mathrm{pk\text{-}pk}} = 10\log_{10}\left(\frac{[\max(p(t)) - \min(p(t))]^2}{p_0^2}\right) \quad \text{(A-2)}$$

The sound pressure level (SPL or L_p; dB re 1 µPa) is the root-mean-square (rms) pressure level in a stated frequency band over a specified time window (T; s). It is important to note that SPL always refers to an rms pressure level and therefore not instantaneous pressure:

$$L_p = 10\log_{10}\left(\frac{1}{T}\int_T g(t)\,p^2(t)\,dt \Big/ p_0^2\right) \quad \text{(A-3)}$$

where $g(t)$ is an optional time weighting function. In many cases, the start time of the integration is marched forward in small time steps to produce a time-varying SPL function. For short acoustic events, such as sonar pulses and marine mammal vocalizations, it is important to choose an appropriate time window that matches the duration of the signal. For in-air studies, when evaluating the perceived loudness of sounds with rapid amplitude variations in time, the time weighting function $g(t)$ is often set to a decaying exponential function that emphasizes more recent pressure signals. This function mimics the leaky integration nature of mammalian hearing. For example, human-based fast time-weighted SPL ($L_{p,fast}$) applies an exponential function with time constant 125 ms. A related simpler approach used in underwater acoustics sets $g(t)$ to a boxcar (unity amplitude) function of width 125 ms; the results can be referred to as $L_{p,boxcar\ 125ms}$. Another approach, historically used to evaluate SPL of impulsive signals underwater,

defines $g(t)$ as a boxcar function with edges set to the times corresponding to 5 % and 95 % of the cumulative square pressure function encompassing the duration of an impulsive acoustic event. This calculation is applied individually to each impulse signal, and the results have been referred to as 90 % SPL ($L_{p,90\%}$). In this report, SPL refers to $L_{p,boxcar\ 125ms}$.

The sound exposure level (SEL or L_E; dB re 1 µPa²·s) is the time-integral of the squared acoustic pressure over a duration (T):

$$L_E = 10 \log_{10} \left(\int_T p^2(t)\, dt \Big/ T_0 p_0^2 \right) \tag{A-4}$$

where T_0 is a reference time interval of 1 s. SEL continues to increase with time when non-zero pressure signals are present. It is a dose-type measurement, so the integration time applied must be carefully considered for its relevance to impact to the exposed recipients.

SEL can be calculated over a fixed duration, such as the time of a single event or a period with multiple acoustic events. When applied to pulsed sounds, SEL can be calculated by summing the SEL of the N individual pulses. For a fixed duration, the square pressure is integrated over the duration of interest. For multiple events, the SEL can be computed by summing (in linear units) the SEL of the N individual events:

$$L_{E,N} = 10 \log_{10} \sum_{i=1}^{N} 10^{\frac{L_{E,i}}{10}} \tag{A-5}$$

Because the SPL and SEL are both computed from the integral of square pressure, these metrics are related numerically by the following expression, which depends only on the duration of the time window T:

$$L_p = L_E - 10 \log_{10}(T) \tag{A-6}$$

When applied, the frequency weighting of an acoustic event should be specified, as in the case of weighted SEL (e.g., $L_{E,LF,24h}$).

A.2. Decidecade Band Analysis

The distribution of a sound's power with frequency is described by the sound's spectrum. The sound spectrum can be split into a series of adjacent frequency bands. Splitting a spectrum into 1 Hz wide bands, called passbands, yields the power spectral density of the sound. This splitting of the spectrum into passbands of a constant width of 1 Hz, however, does not represent how animals perceive sound.

Because animals perceive exponential increases in frequency rather than linear increases, analysing a sound spectrum with passbands that increase exponentially in size better approximates real-world scenarios. In underwater acoustics, a spectrum is commonly split into decidecade bands, which are one tenth of a decade wide. They are approximately one third of an octave (base 2) wide and are therefore often referred to as 1/3-octave-bands. Each octave represents a doubling in sound frequency. The centre frequency of the ith band, $f_c(i)$, is defined as:

$$f_c(i) = 10^{\frac{i}{10}} \text{ kHz} \tag{A-7}$$

and the low (f_{lo}) and high (f_{hi}) frequency limits of the ith decade band are defined as:

$$f_{lo,i} = 10^{\frac{-1}{20}} f_c(i) \quad \text{and} \quad f_{hi,i} = 10^{\frac{1}{20}} f_c(i) \tag{A-8}$$

The decidecade bands become wider with increasing frequency, and on a logarithmic scale the bands appear equally spaced (Figure A-1).

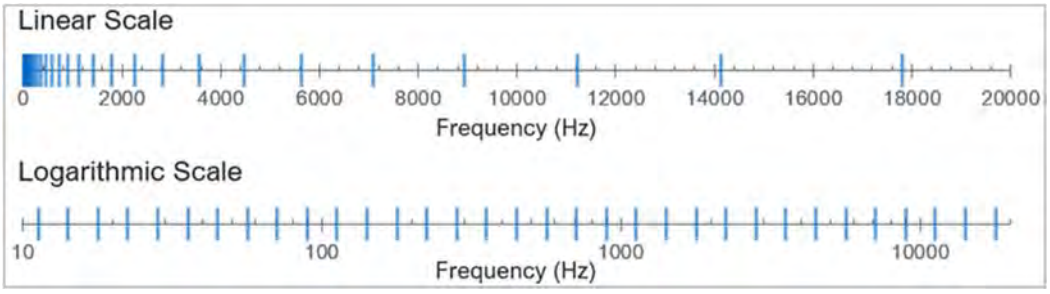


Figure A-1. Decidecade frequency bands (vertical lines) shown on a linear frequency scale and a logarithmic scale.

The sound pressure level in the ith band $(L_{p,i})$ is computed from the spectrum $S(f)$ between $f_{lo,i}$ and $f_{hi,i}$:

$$L_{p,i} = 10 \log_{10} \int_{f_{lo,i}}^{f_{hi,i}} S(f)\, df \tag{A-9}$$

Summing the sound pressure level of all the bands yields the broadband sound pressure level:

$$\text{Broadband SPL} = 10 \log_{10} \sum_i 10^{\frac{L_{p,i}}{10}} \tag{A-10}$$

Figure A-2 shows an example of how the decidecade band sound pressure levels compare to the sound pressure spectral density levels of an ambient noise signal. Because the decidecade bands are wider with increasing frequency, the decidecade band SPL is higher than the spectral levels at higher frequencies. Acoustic modelling of decidecade bands requires less computation time than 1 Hz bands and still resolves the frequency-dependence of the sound source and the propagation environment.

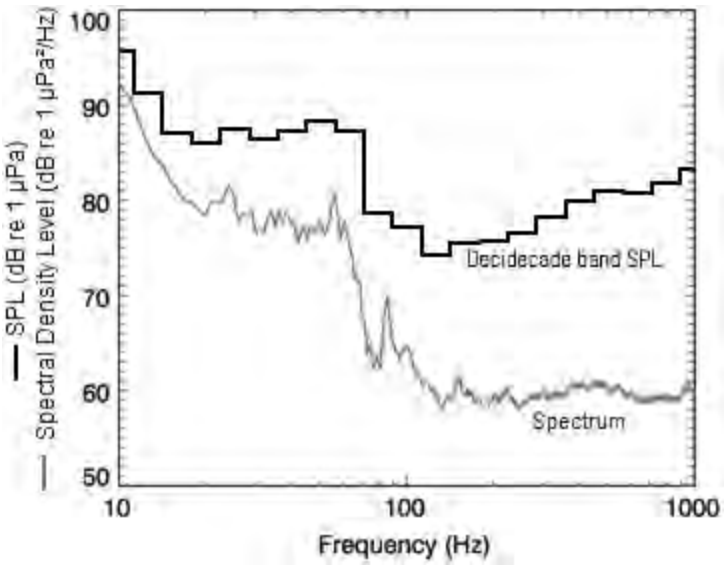


Figure A-2. Sound pressure spectral density levels and the corresponding decidecade band sound pressure levels of example ambient noise shown on a logarithmic frequency scale.

Appendix B. Marine Fauna Effect Criteria

B.1. Marine Mammal Auditory Frequency Weighting

The potential for noise to affect animals of a certain species depends on how well the animals can hear it. Noises are less likely to disturb or injure an animal if they are at frequencies that the animal cannot hear well. An exception occurs when the sound pressure is so high that it can physically injure an animal by non-auditory means (i.e., barotrauma). For sound levels below such extremes, the importance of sound components at particular frequencies can be scaled by frequency weighting relevant to an animal's sensitivity to those frequencies (Nedwell and Turnpenny 1998, Nedwell et al. 2007).

In 2015, a US Navy technical report by Finneran (2015) recommended new auditory weighting functions. The auditory weighting functions for marine mammals are applied in a similar way as A-weighting for noise level assessments for humans. The new frequency-weighting functions are expressed as:

$$G(f) = K + 10\,log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}. \quad \text{(B-1)}$$

Finneran (2015) proposed five functional hearing groups for marine mammals in water: low-, mid- and high-frequency cetaceans (LF, MF, and HF cetaceans, respectively), phocid pinnipeds, and otariid pinnipeds. The parameters for these frequency-weighting functions were further modified the following year (Finneran 2016) and were adopted in NOAA's technical guidance that assesses acoustic impacts on marine mammals (NMFS 2018), and in the latest guidance by Southall (2019). The updates did not affect the content related to either the definitions of frequency-weighting functions or the threshold values. Table B-1 lists the frequency-weighting parameters for each hearing group. Figure B-1 shows the resulting frequency-weighting curves.

Table B-1. Parameters for the auditory weighting functions recommended by Southall (2019).

Functional hearing group	a	b	f_1 (Hz)	f_2 (Hz)	K (dB)
Low-frequency cetaceans	1.0	2	200	19,000	0.13
High-frequency cetaceans	1.6	2	8,800	110,000	1.20
Very-high-frequency cetaceans	1.8	2	12,000	140,000	1.36
Phocid pinnipeds in water	1.0	2	1,900	30,000	0.75
Otariid pinnipeds in water	2.0	2	940	25,000	0.64

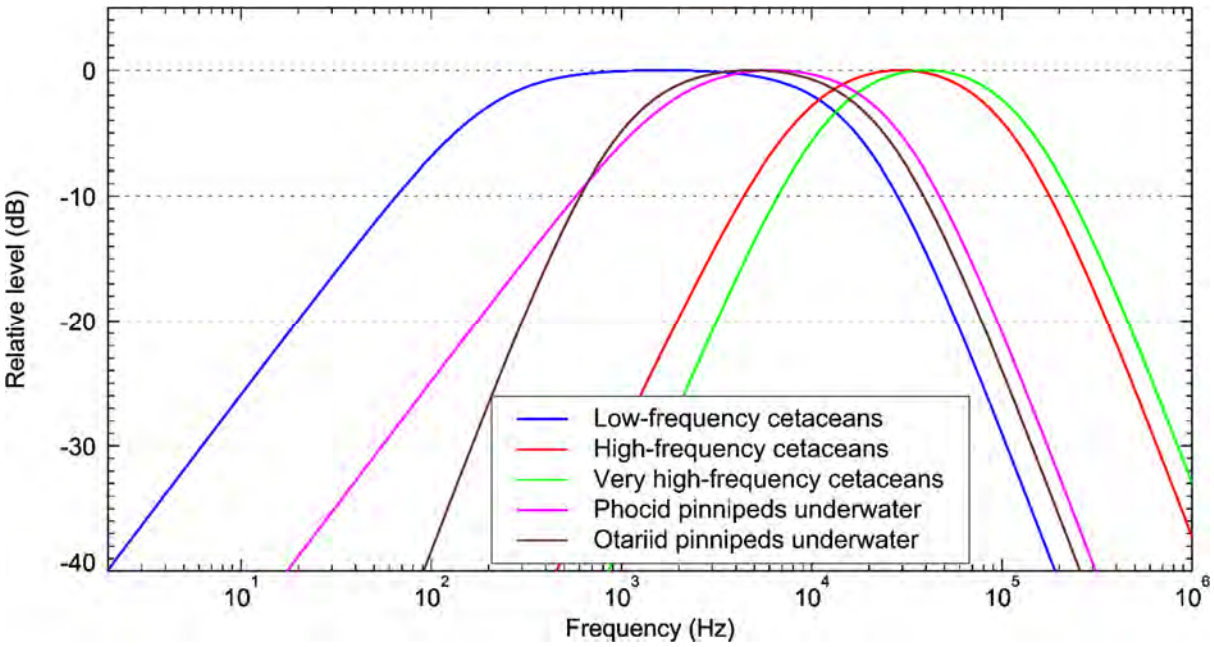


Figure B-1. Auditory weighting functions for the functional marine mammal hearing groups as recommended by Southall (2019).

B.2. Marine Mammal Impact criteria

It has been long recognized that marine mammals can be adversely affected by underwater anthropogenic noise. For example, Payne and Webb (1971) suggest that communication distances of fin whales are reduced by shipping sounds. Subsequently, similar concerns arose regarding effects of other underwater noise sources and the possibility that impulsive sources—primarily airguns used in seismic surveys—could cause auditory injury. This led to a series of workshops held in the late 1990s, conducted to address acoustic mitigation requirements for seismic surveys and other underwater noise sources (NMFS 1998, ONR 1998, Nedwell and Turnpenny 1998, HESS 1999, Ellison and Stein 1999). In the years since these early workshops, a variety of thresholds have been proposed for both auditory injury (Appendix B.2.1.1) and disturbance (Appendix B.2.1.2). The following sections summarize the development of the current thresholds relevant to this study; this remains an active research topic, however.

B.2.1.1. Auditory Injury Criteria

The NMFS SPL criteria for auditory injury to marine mammals from acoustic exposure were set according to recommendations for cautionary estimates of sound levels leading to onset of permanent hearing threshold shift (PTS). These criteria prescribed auditory injury thresholds of 190 dB re 1 µPa SPL for pinnipeds and 180 dB re 1 µPa SPL for cetaceans, for all types of sound sources except tactical sonar and explosives (NMFS 2018). These auditory injury thresholds are applied to individual noise pulses or instantaneous sound levels and do not consider the overall duration of the noise or its acoustic frequency distribution.

Criteria that do not account for exposure duration or noise spectra are generally insufficient on their own for assessing hearing injury. Human workplace noise assessment metrics consider the SPL as well as the duration of exposure and sound spectral characteristics. For example, the International Institute of Noise Control Engineering (I-INCE) and the Occupational Safety and Health Administration (OSHA) suggests thresholds in C-weighted peak pressure level and A-weighted time-average sound level (dB(A)[1] L_{eq}). They also suggest exchange rates that increase the allowable thresholds for each halving or doubling of exposure time. This approach assumes that hearing damage depends on the relative loudness perceived by the human ear, and that the ear might partially recover from past exposures, particularly if there are periods of quiet during the overall exposure.

In recognition of shortcomings of the SPL-only based auditory injury criteria, in 2005 NMFS sponsored the Noise Criteria Group to review literature on marine mammal hearing to propose new noise exposure criteria. Some members of this expert group published a landmark paper (Southall et al. 2007) that suggested assessment methods similar to those applied for humans. The resulting recommendations introduced dual auditory injury criteria for impulsive sounds that included peak pressure level thresholds and SEL_{24h} thresholds, where the subscripted 24h refers to the accumulation period for calculating SEL. The peak pressure level criterion is not frequency weighted, whereas SEL_{24h} is frequency weighted according to one of four marine mammal species hearing groups: low-, mid- and high-frequency cetaceans (LF, MF, and HF cetaceans, respectively) and pinnipeds in water (PW)[2]. These weighting functions are referred to as M-weighting filters (analogous to the A-weighting filter for humans; see Appendix B.1). The SEL_{24h} thresholds were obtained by extrapolating measurements of onset levels of Temporary Threshold Shift (TTS) in belugas by the amount of TTS required to produce Permanent Threshold Shift (PTS) in chinchillas. The Southall et al. (2007) recommendations do not specify an exchange rate, which suggests that the thresholds are the same regardless of the duration of exposure (i.e., it implies a 3 dB exchange rate).

Wood et al. (2012) refined Southall et al.'s (2007) thresholds, suggesting lower values for LF cetaceans and HF cetaceans while retaining the filter shapes (see Appendix B.1). Their revised thresholds were based on TTS-onset levels in harbour porpoises from Lucke et al. (2009), which led to a revised impulsive sound PTS threshold for HF cetaceans of 179 dB re 1 μPa^2 s. Because no data were available for baleen whales, Wood et al. (2012) based their recommendations for LF cetaceans on results from MF cetacean studies. In particular they referenced Finneran and Schlundt's (2010) research, which found MF cetaceans are more sensitive to non-impulsive sound exposure than Southall et al. (2007) assumed. Wood et al. (2012) thus recommended a more conservative TTS-onset level for LF cetaceans of 192 dB re 1 μPa^2 s.

Also in 2012, the US Navy recommended a different set of criteria for assessing Navy operations (Finneran and Jenkins 2012). Their analysis incorporated new dolphin equal-loudness contours[3] to update weighting functions and auditory injury thresholds for LF, MF, and HF cetaceans. They recommended separating the pinniped group into otariids (eared seals) and phocids (earless seals) and assigning adjusted frequency thresholds to the former based on several sensitivity studies (Schusterman et al. 1972, Moore and Schusterman 1987, Babushina et al. 1991, Kastak and Schusterman 1998, Kastelein et al. 2005, Mulsow and Reichmuth 2007, Mulsow et al. 2011a, Mulsow et al. 2011b).

As of 2017, a definitive approach is still not apparent. There is consensus in the research community that an SEL-based method is preferable, either separately or in addition to an SPL-based approach, to assess

[1] The "A" refers to a specific frequency-dependent filter shaped according to a human equal loudness contour.
[2] Pinnipeds in air were also included but are not applicable here.
[3] An equal-loudness contour is the measured sound pressure level (dB re 1 µPa for underwater sounds) over frequency, for which a listener perceives a constant loudness when exposed to pure tones.

the potential for injuries. In August 2016, after substantial public and expert input into three draft versions and based largely on the above-mentioned literature (NOAA 2013, 2015, 2016), NMFS finalized technical guidance for assessing the effect of anthropogenic sound on marine mammal hearing (NMFS 2016, NMFS 2018). The guidance describes auditory injury criteria with new thresholds and frequency weighting functions for the five hearing groups described by Finneran and Jenkins (2012). The latest revision to this work was published in 2018 (NMFS 2018). Southall et al. (2019) revisited the interim criteria published in 2007. All noise exposure criteria in NMFS (2018) and Southall et al. (2019) are identical (for impulsive and non-impulsive sounds); however, the mid- and high-frequency cetaceans groups from NMFS (2018) were renamed high- and very high-frequency cetaceans, respectively, in Southall et al. (2019). This report uses the hearing group names from NMFS (2018) for consistency with other projects. Table B-2 provides the recommended thresholds.

Table B-2. Sound pressure level (SPL; dB re 1 µPa), peak sound pressure level (PK; dB re 1 µPa), and sound exposure level (SEL; dB re 1 µPa^2 s) thresholds for behavioural disturbance, auditory injury (PTS onset), and TTS onset for marine mammals for impulsive sounds, as proposed by NMFS.

Hearing group	Behaviour [1]	Auditory injury [2] (PTS)		TTS [2]	
	SPL	Weighted SEL_{24h}	PK	Weighted SEL_{24h}	PK
Low-frequency cetaceans	160	183	219	168	213
Mid-frequency cetaceans		185	230	170	224
High-frequency cetaceans		155	202	140	196
Sirenians		190	226	175	220
Otariid pinnipeds in water		203	232	188	226
Phocid pinnipeds in water		185	218	170	212

[1] NMFS (2013)
[2] NMFS (2018)

B.2.1.2. Disturbance Criteria

For non-impulsive sound, the US National Marine Fisheries Service (NMFS) currently uses a step function (all-or-none) threshold of 120 dB re 1 µPa[4] SPL (i.e., a sound pressure-based metric) to assess and regulate noise-induced behavioural impacts of non-impulsive underwater sounds on marine mammals (NOAA 2019). This approach was developed decades ago based on limited data from studies in relatively artificial field contexts; exposures were experimentally generated using low-power simulations of real operations. The 120 dB re 1 µPa SPL threshold for non-impulsive sounds was derived from studies by Malme et al. (1983, 1984, 1986) examining behavioural responses of migrating grey whales (*Eschrichtius robustus*) to drilling and dredging noise (NOAA 2018). Malme et al. (1984) determined that measurable reactions usually consisted of rather subtle short-term changes in speed and/or heading of the whale(s) under observation. Malme et al. (1986) found that playback of drillship noise did not produce clear evidence of disturbance or avoidance for levels below 110 dB re 1 µPa (SPL); avoidance possibly occurred for exposure levels approaching 119 dB re 1 µPa (SPL). A later study by Richardson et al. (1990) on migrating bowhead whales (*Balaena mysticetus*) generally supports their findings. While these studies were useful early measures in providing insight in response types and the importance of behavioural state and spatial relationships, extensive subsequent research, including with more advanced sensing technologies and more realistic exposure scenarios, has been conducted or is ongoing. New

[4] Unweighted; different auditory frequency weighting functions are applied to auditory impact thresholds to represent the differences in hearing sensitivities between different functional hearing groups (see NMFS 2018).

research strongly suggest an alternate and more sophisticated approach than the 120 dB SPL step function.

For impulsive noise, NMFS currently uses step function thresholds of 160 dB re 1 µPa SPL (unweighted) to assess and regulate noise-induced behavioural impacts for marine mammals (NMFS 2018, NOAA 2019). The threshold for impulsive sound is derived from the High-Energy Seismic Survey (HESS) panel (HESS 1999) report that, in turn, is based on the responses of migrating mysticete whales to airgun sounds (Malme et al. 1984). The HESS team recognized that behavioural responses to sound may occur at lower levels, but significant responses were only likely to occur above an SPL of 140 dB re 1 µPa. Southall et al. (2007) found varying responses for most marine mammals between an SPL of 140 and 180 dB re 1 µPa, consistent with the HESS (1999) report, but lack of convergence in the data prevented them from suggesting explicit step functions.

Because of the complexity and variability of marine mammal behavioural responses to acoustic exposure, NMFS has not yet released technical guidance on behaviour thresholds for use in calculating animal exposures (NMFS 2018).

Ellison et al. (2012) suggest that disturbance assessments should also consider the context under which animals experience sounds. They suggest that an animal's response to sounds will also depend on the animals' behavioural state, their perception of whether the source of the sound might be dangerous, and their proximity to the source. Contextual parameters are relevant to assess the importance of the effect of a sound on an animal's well-being but do not influence effects such as masking, which occurs when a louder sound or background noise obscures a quieter sound in the same frequency band. Masking can limit the effectiveness of predator and prey detection, finding mates, and socializing.

B.2.1. Fish

Fish have all of the basic acoustic processing capabilities of other vertebrates (see review by Popper et al. 2003, Ladich and Popper 2004). Fish can discriminate between sounds of different magnitudes or frequencies, detect specific sounds when other signals are present, and determine the direction of a sound source. Their auditory systems differ, however, from those of marine mammals.

The pressure component of sound is represented by sound waves, which are characterized by the medium compressing and expanding as sound energy moves through it. At the same time, the particles that form the medium move back and forth (particle motion). All fish directly sense the particle motion component of sound (Fay 1984), although relatively few fish sense both the particle and pressure components (Popper et al. 2003). The ears of all fish consist of otolith- (or otoconia-) containing end organs that function as inertial accelerometers. Fish that sense pressure have additional morphological adaptations that allow them to detect acoustic pressure (e.g., Popper et al. 2003). In these fish, gas-filled bladders such as the swim bladder, which is near the ear, or mechanical connections such as Weberian ossicles, which are between the gas-filled bladder and the ear, convey sound pressure from the water to the ear when pressure deforms the bladder.

Most fish detect only particle motion, not pressure, and their hearing frequency range is typically limited to frequencies below 1 kHz. Pressure-sensing fish tend to have extended hearing bandwidth and lower detection thresholds. They are often capable of detecting signals up to 3–4 kHz, with thresholds that may be 20 dB or more lower than for fish that are not sensitive to pressure (Hastings and Popper 2005). Several fish taxonomic groups contain fish that can sense pressure, but this feature is not used to allocate fish into groups. Hearing abilities have been determined for relatively few (~100) of the more than 27,000 extant fish species (see Fay 1988, Popper et al. 2003). Hearing capabilities between different species, especially those that are taxonomically or geographically distant, must be extrapolated with caution.

Appendix C. Sound Exposure Field Modelling

C.1. Noise Source Level Models

C.1.1. Pile Driving Source Model

A physical model of pile vibration and near-field sound radiation is used to calculate source levels of piles. The physical model employed in this study computes the underwater vibration and sound radiation of a pile by solving the theoretical equations of motion for axial and radial vibrations of a cylindrical shell. These equations of motion are solved subject to boundary conditions, which describe the forcing function of the hammer at the top of the pile and the soil resistance at the base of the pile (Figure C-1). Damping of the pile vibration due to radiation loading is computed for Mach waves emanating from the pile wall. The equations of motion are discretised using the finite difference (FD) method and are solved on a discrete time and depth mesh.

To model the sound emissions from the piles, the force of the pile driving hammers also had to be modelled. The force at the top of each pile was computed using the GRLWEAP 2010 wave equation model (GRLWEAP, Pile Dynamics 2010), which includes a large database of simulated hammers—both impact and vibratory—based on the manufacturer's specifications. The forcing functions from GRLWEAP were used as inputs to the FD model to compute the resulting pile vibrations.

The sound radiating from the pile itself is simulated using a vertical array of discrete point sources. The point sources are centred on the pile axis. Their amplitudes are derived using an inverse technique, such that their collective particle velocity, calculated using a near-field wave-number integration model, matches the particle velocity in the water at the pile wall. MacGillivray (2014) describes the theory behind the physical model in more detail.

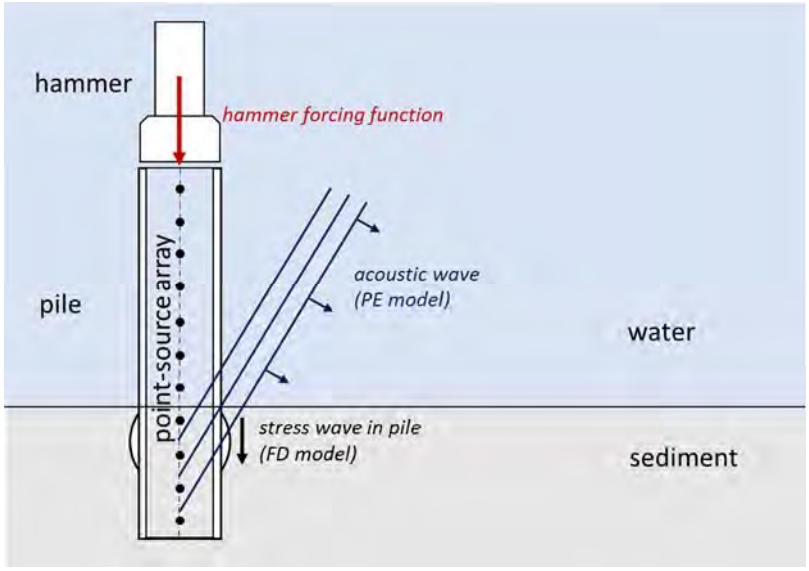


Figure C-1. Physical model geometry for impact driving of a cylindrical pile (vertical cross-section). The hammer forcing function is used with the finite difference (FD) model to compute the stress wave vibration in the pile. A vertical array of point sources is used with the parabolic equation (PE) model to compute the acoustic waves that the pile wall radiates.

C.1.2. Vessels

C.1.2.1. Vessels during Berthing and Unberthing

Source levels for large carriers in transit can be estimated by reviewing literature about underwater sound measurements of bulk carriers and similar merchant vessels. A generalized source spectrum for large merchant ships, expressed as a function of ship size, speed, and propeller characteristics, was proposed by Ross (1976) and developed further by Scrimger and Heitmeyer (1991) and Hamson (1997):

$$\mathrm{SL}(f) = \mathrm{SV}(f) + 60\log_{10}(V/12) + 20\log_{10}(l/300) \quad (2)$$

where V is the vessel speed (knots), l is the length overall (feet), and $\mathrm{SV}(f)$ is the reference level for a merchant vessel noise spectrum. Erbe et al. (2012) found that the correction for vessel length, however, might only be appropriate up to 150 m. The broadband level, L, of the reference spectrum, $\mathrm{SV}(f)$, defined by Ross (1976) was further adjusted based on 50 recorded spectra of more modern merchant ships (Hamson 1997), using the ships' propeller characteristics:

$$L = 175 + 60\log_{10}(u/25) + 10\log_{10}(B/4) \quad (3)$$

where L is the broadband level of the reference spectrum for a propeller tip speed, u (m/s), and number of propeller blades, B.

The generalized source spectra were compared with those of similar vessels operating at typical transit speeds. Because source levels depend in part on ship size and transit speed, 1/3-octave-band source levels for each of the merchant vessels were adjusted to the length and transit speed of the modelled carrier using a modified form of the power-law equation of Ross (1976):

$$S(f, V, L) = S_0(f) + c_V 10\log_{10}\left(\frac{V}{V_0}\right) \quad (4)$$

Since the dominant source of underwater noise from transiting vessels is generally propeller cavitation, the source depth was estimated based on the draft and propeller diameter. The source of radiated noise was assumed to be at a point partway between the shaft and the top of the propeller disk; we used the following equation (Gray and Greeley 1980) to estimate the source depth, Z_s:

$$Z_s = D - 0.85d \quad (5)$$

where D is the vessel draft and d is the propeller diameter.

C.2. Sound Propagation Modelling

C.2.1. Environmental Parameters

C.2.1.1. Bathymetry

Three separate bathymetry grids were compiled for Pearse Terminal, Portland Inlet, and Dixon Entrance.

The Pearse Terminal bathymetry grid was compiled using Canadian Hydrographic Service Non-Navigational (NONNA) Bathymetric Data with nominal spatial resolution of 10 m complimented by data from high-resolution bathymetry survey for the areas offshore terminal facilities. The data were referenced to Higher High Water datum. The difference between Higher High Water and Lower Low Water is about 7 m at the Terminal. The grid was created with 20 m cell size.

The Portland Inlet bathymetry grid was compiled using Canadian Hydrographic Service Non-Navigational (NONNA) Bathymetric Data with nominal spatial resolution of 100 m. The grid was created with 50 m cell size.

The Dixon Entrance bathymetry grid was compiled using GEBCO 2019 data with nominal resolution of 15 arc seconds (~400–450 m). The grid was created with 200 m cell size.

All bathymetry grids were in projected coordinates using a Universal Transverse Mercator (UTM) Zone 9 projection.

C.2.1.2. Sound Speed Profile

The sound speed profiles for the modelled sites were derived from temperature and salinity profiles from the US Naval Oceanographic Office's *Generalized Digital Environmental Model V 3.0* (GDEM; Teague et al. 1990, Carnes 2009). GDEM provides an ocean climatology of temperature and salinity for the world's oceans on a latitude-longitude grid with 0.25° resolution, with a temporal resolution of one month, based on global historical observations from the US Navy's Master Oceanographic Observational Data Set (MOODS). The climatology profiles include 78 fixed depth points to a maximum depth of 6800 m (where the ocean is that deep). The GDEM temperature-salinity profiles were converted to sound speed profiles according to Coppens (1981).

Mean monthly sound speed profiles were derived from the GDEM profiles for March in both Dixon Entrance (54° 25' 8.148" N, 132° 2' 38.202" W) and Portland Inlet (54° 53' 50.4852"N, 130° 9' 15.894"W).

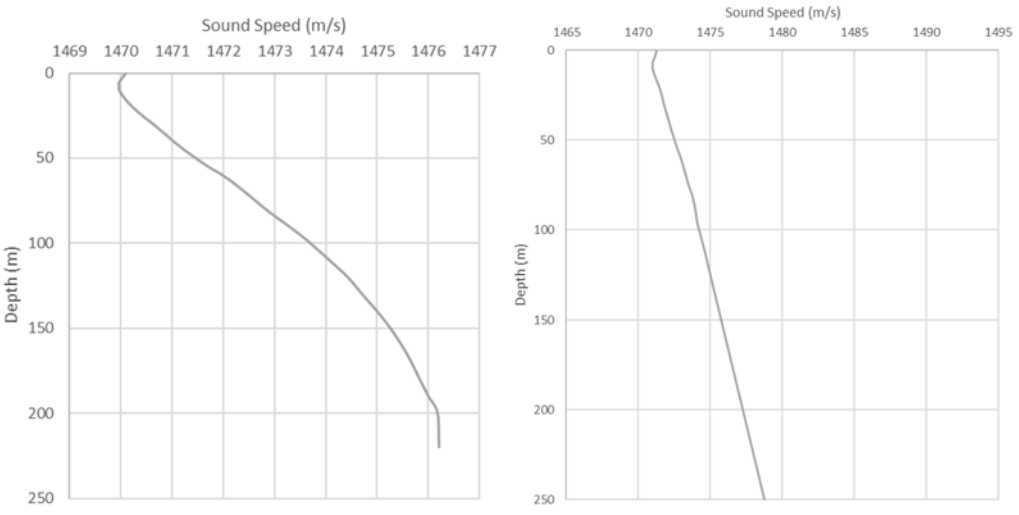


Figure C-2. Mean monthly sound speed profiles for March (derived from data obtained from *GDEM V 3.0* (Teague et al. 1990, Carnes 2009).

C.2.1.3. Geoacoustics

In a shallow environment, interactions between the acoustic field and the seabed are important and accurate geoacoustic profiles are needed for proper acoustic modelling. The interactions between the acoustic field and seabed become negligible in much deeper water. The generic geoacoustic profiles are therefore considered valid for the entire modelled areas around the study sites. The layers as deep as several hundreds of meters can affect the propagation of the low-frequency waves. With the increase in frequency of the waves, the importance of deeper layers decreases and for frequencies above 1 kHz, only the properties of the surficial layer are relevant.

The geoacoustic properties of the bottom for the Project area were selected (Table C-1) based on data from the Geophysical Survey Report for the Ksi Lisims LNG Project (Sherman and Candy 2022). The bottom is approximated by varying thickness of silt on top of bedrock depending on the relative location. Much thinner layers of sediment were estimated at the piling locations and thus were adjusted to be more reflective of the measured sediment depths for those locations. For the vessel berthing scenarios the thin layer of 10 m of sediment was selected to be reflective of the region.

Table C-1. Geoacoustic models, which represents a silty bottom of varying depths on top of bedrock. Within each depth range, each parameter varies linearly within the stated range. The compressional wave is the primary wave. The shear wave is the secondary wave.

Depth below seafloor (m)	Material	Density (g/cm^3)	Compressional wave		Shear wave	
			Speed (m/s)	Attenuation (dB/λ)	Speed (m/s)	Attenuation (dB/λ)
Dixon Entrance (Site 5)						
0–10	Silt	2.07	1667–1768	0.33–0.70	300	1.6
10–20			1768–1821	0.70–0.87		
20–50			1821–1917	0.87–1.14		
50–100			1917–2018	1.14–1.39		
100–150			2018–2092	1.39–1.54		
150–200			2092–2152	1.54–1.66		
>200	Bedrock	2.4	3500	0.4		
Portland Inlet (Site 4)						
0–10	Silt	2.07	1667–1768	0.33–0.70	300	1.6
10–20			1768–1821	0.70–0.87		
20–50			1821–1917	0.87–1.14		
50–60			1917–1941	1.14–1.21		
>60	Bedrock	2.4	3500	0.4		
Pearse Terminal (Site 1)						
1–5	Silt	2.07	1667–1768	0.33–0.70	300	1.6
>5	Bedrock	2.4	3500	0.4		
Pearse Terminal (Sites 2 and 3)						
1–10	Silt	2.07	1667–1768	0.33–0.70	300	1.6
>10	Bedrock	2.4	3500	0.4		

C.2.2. *N*×2-D Volume Approximation and Maximum-over-depth Sampling

The sound propagation models employed for this Project are two-dimensional (2-D) acoustic propagation models. The calculations of the acoustic fields in three dimensions are achieved by propagating the acoustic field within 2-D vertical planes aligned along radials covering a 360° swath from the source, an approach commonly referred to as *N*×2-D. These vertical radial planes are separated by an angular step size of $\Delta\theta$, yielding $N = 360°/\Delta\theta$ number of planes (Figure C-3).

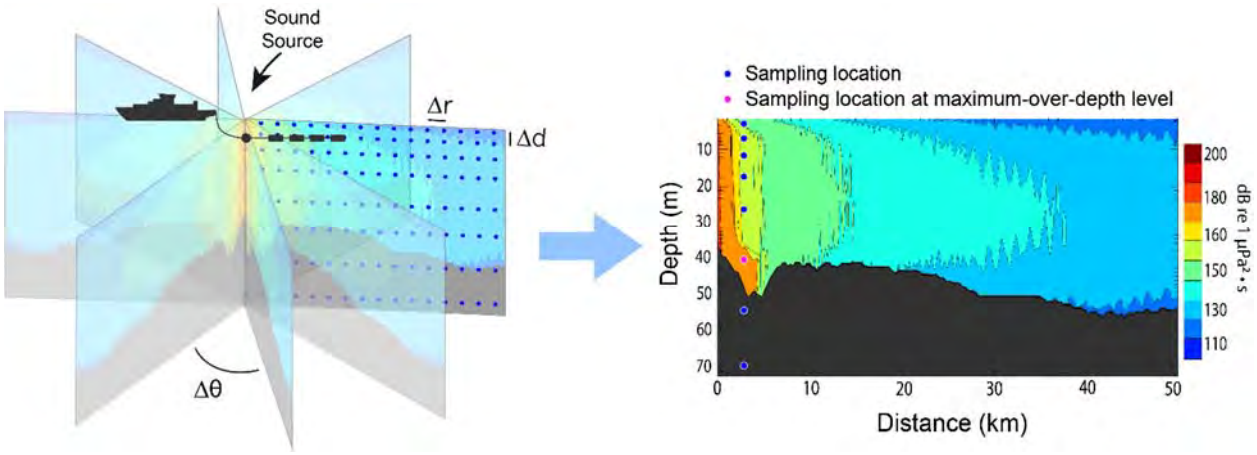


Figure C-3. The N×2-D and maximum-over-depth modelling approach.

The propagated sound field within each vertical radial plane is sampled at various ranges from the source, generally with a fixed radial step size (Δr in Figure C-3). At each sampling range along the surface, the sound field is sampled at various depths (Δd in Figure C-3), with the step size between samples increasing with depth below the surface. The step sizes are chosen to provide increased coverage near the depth of the source and at depths of interest in terms of the sound speed profile. For areas with deep water, sampling is not performed at depths beyond those reachable by marine mammals. The received acoustic levels at a surface sampling location is taken as the maximum value that occurs over all samples within the water column, i.e., the maximum-over-depth received level. These maximum-over-depth acoustic levels are further used to calculate the ranges to specific thresholds and create acoustic field maps.

C.2.3. MONM-RAM/BELLHOP Propagation Loss Model

The propagation of sound through the environment can be modelled by predicting the acoustic propagation loss—a measure, in decibels, of the decrease in sound level between a source and a receiver some distance away. Geometric spreading of acoustic waves is the predominant way by which propagation loss occurs. Propagation loss also happens when the sound is absorbed and scattered by the seawater, and absorbed scattered, and reflected at the water surface and within the seabed. Propagation loss depends on the acoustic properties of the ocean and seabed; its value changes with frequency.

If the acoustic energy source level ($L_{S,E}$), expressed in dB re 1 µPa²m²s, and energy propagation loss ($N_{\mathrm{PL},E}$), in units of dB, at a given frequency are known, then the received level ($L_{E,p}$) at a specific location can be calculated in dB re 1 µPa²s by:

$$L_{E,p}(r) = L_{\mathrm{S},E} - N_{\mathrm{PL},E}(r)\,, \tag{6}$$

where r is the range of the receiver from the source.

In the present study, the energy source levels were modelled with AASM, while MONM was used to predicted propagation loss at decidecade band centre frequencies from 10 to 25,000 Hz. MONM employs two underlaying subroutines: MONM-RAM is used for propagating acoustic waves at low frequencies (e.g., up to 1600 Hz) and MONM-BELLHOP is used for high frequencies (e.g., above 1600 Hz).

MONM-RAM computes acoustic propagation via a wide-angle parabolic equation solution to the acoustic wave equation (Collins 1993) based on a version of the US Naval Research Laboratory's Range-dependent Acoustic Model (RAM), which has been modified to account for an elastic seabed (Zhang and Tindle 1995). The parabolic equation method has been extensively benchmarked and is widely employed in the underwater acoustics community (Collins et al. 1996). MONM-RAM accounts for the additional reflection loss at the seabed due to partial conversion of incident compressional waves to shear waves at the seabed and sub-bottom interfaces, and it includes wave attenuations in all layers. MONM-RAM incorporates the following site-specific environmental properties: a modelled area bathymetric grid, underwater sound speed as a function of depth, and a geoacoustic profile based on the overall stratified composition of the seafloor.

MONM-BELLHOP employs Gaussian beam acoustic ray-trace model (Porter and Liu 1994). This version of MONM accounts for sound attenuation due to energy absorption through ion relaxation and viscosity of water in addition to acoustic attenuation due to reflection at the medium boundaries and internal layers (Fisher and Simmons 1977). The former type of sound attenuation is significant for frequencies higher than 5 kHz and cannot be neglected without noticeably affecting the model results. MONM-BELLHOP incorporates the following site-specific environmental properties: a modelled area bathymetric grid, water column sound speed as a function of depth, as well as temperature and salinity for calculating the sound attenuation due to energy absorption, geoacoustic properties of the surficial sediments, and surface roughness (due to wind).

The accuracy of MONM's predictions have been validated against experimental data from several sound source verification programs conducted by JASCO (Hannay and Racca 2005, Aerts et al. 2008, Funk et al. 2008, Ireland et al. 2009, O'Neill et al. 2010, Warner et al. 2010).

C.2.4. Full Waveform Modelling

For impulsive sounds, time-domain representations of the pressure waves generated in the water are required for calculating SPL and peak pressure level. The synthetic pressure waveforms (seismograms) can be computed using FWRAM, which is a time-domain acoustic model based on the wide-angle parabolic equation (PE) algorithm (Collins 1993). The code is based on a version of the US Naval Research Laboratory's Range-dependent Acoustic Model (RAM), which has been modified to account for an elastic seabed (Zhang and Tindle 1995). The parabolic equation method has been extensively benchmarked and is widely employed in the underwater acoustics community (Collins et al. 1996). The modified RAM accounts for the additional reflection loss at the seabed due to partial conversion of incident compressional waves to shear waves at the seabed and sub-bottom interfaces, and it includes compressional wave attenuation in all layers. The propagation code incorporates the following site-specific environmental properties: a bathymetric grid of the modelled area, underwater sound speed as a function of depth, and a geoacoustic profile based on the overall stratified composition of the seafloor. FWRAM accounts for the azimuthal (horizontal) variability of the sound level of the emitted pulse of the source.

FWRAM computes synthetic pressure waveforms versus range and depth (Figure C-4) via Fourier synthesis of the modelled acoustic transfer function in closely spaced frequency bands. FWRAM employs the array starter method to accurately model sound propagation from a spatially distributed source (MacGillivray and Chapman 2012).

The FWRAM modelling method is computationaly extensive, and it is performed within a narrow frequency band (usually 10–512/1024 Hz). because most acoustic energy emmited by a seismic source is below 500 Hz and SPL and peak SPL metrics are calculated on an unweighted field, the limited modelled frequency band does not affect the accuracy of the modelling.

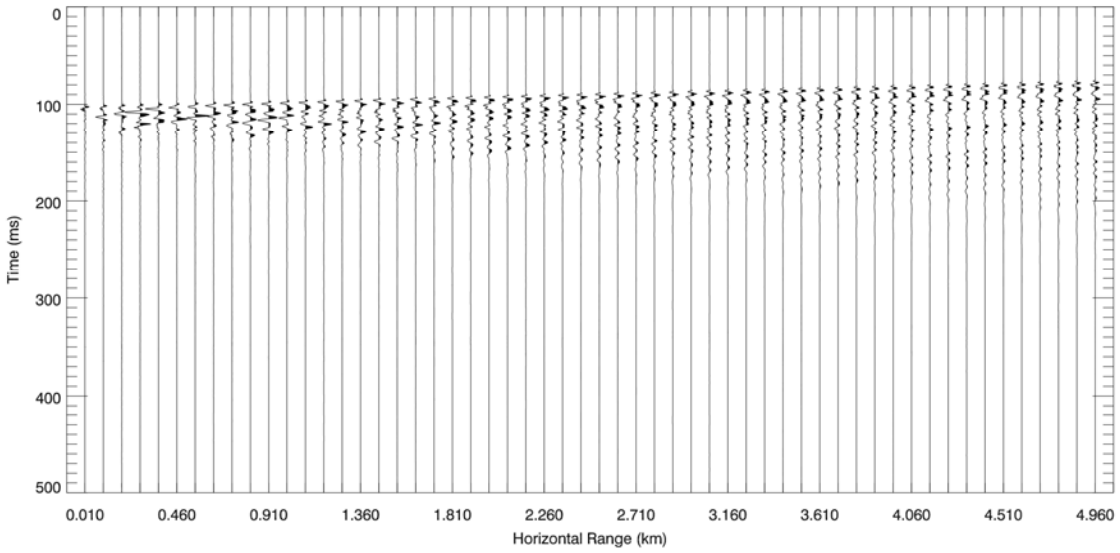


Figure C-4. Example of synthetic pressure waveforms computed by FWRAM.

C.3. Acoustic Exposure Calculations

C.3.1. Range Averaging

The propagation loss values calculated for each individual band are subject to range averaging that replaces frequency averaging (Harrison and Harrison 1995, Siderius and Porter 2006). The range averaging technique allows to compensate the deficiencies of band modelling approach and achieve better match of the propagation loss function calculated for single frequency with the band average propagation loss calculated using 1-Hz step frequency propagation loss functions.

C.3.2. Summing over Decidecade Bands

In case the source emits acoustic energy that spans across multiple frequency bands, like vessels, the composite broadband received SEL can be computed by summing the received decidecade band levels (provided in dB units):

$$L_E = 10 \cdot \log_{10}\left(\sum_{i=1}^{N} 10^{L_E,i/(10\text{dB})}\right) \text{dB}\,. \quad \text{(C-1)}$$

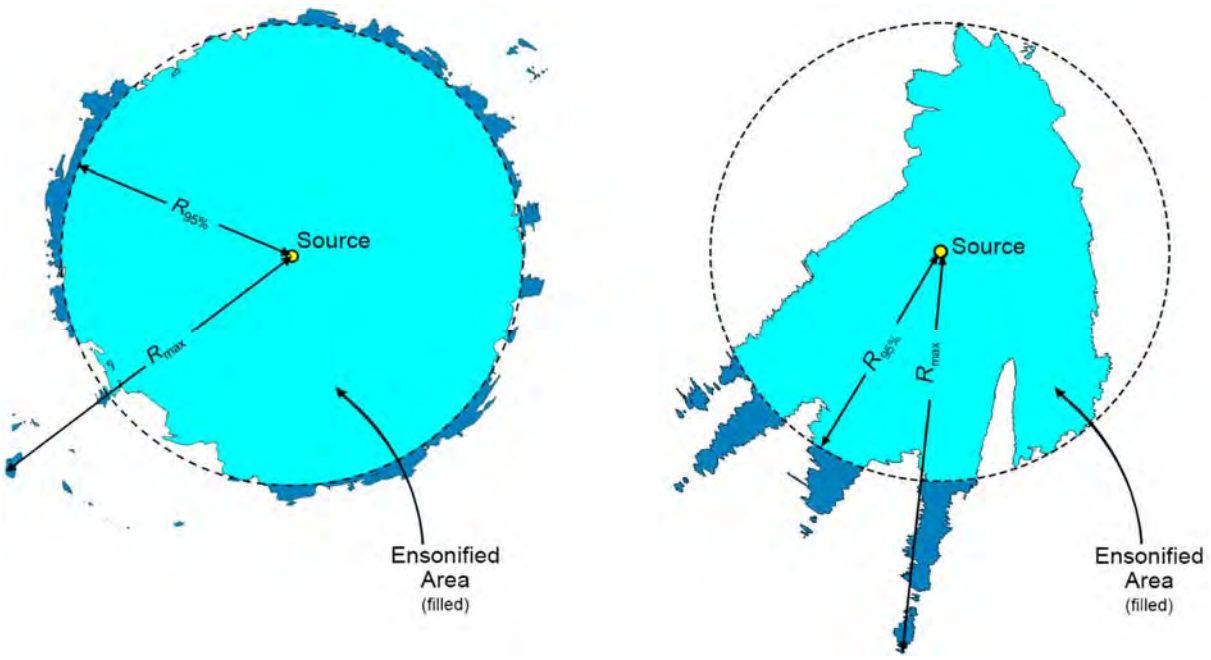
If frequency weighed SEL is required ($L_{E,\text{MW}}$) for the impact assessment with criteria thresholds, it can be obtained by adding the relative levels (MW) to the equation:

$$L_{E,\text{MW}} = 10 \cdot \log_{10}\left(\sum_{i=1}^{N} 10^{(L_E,i+\text{MW}_i)/(10\text{dB})}\right)\text{dB}\,. \quad \text{(C-2)}$$

C.3.3. Estimating Range to Thresholds Levels

Sound level contours were calculated based on the underwater sound fields predicted by the propagation models, sampled by taking the maximum value over all modelled depths above the sea floor for each location in the modelled region. The predicted distances to specific levels were computed from these contours. Two distances relative to the source are reported for each sound level: 1) R_{max}, the maximum range to the given sound level over all azimuths, and 2) $R_{95\%}$, the range to the given sound level after the 5% farthest points were excluded (see examples in Figure C-5).

The $R_{95\%}$ is used because sound field footprints are often irregular in shape. In some cases, a sound level contour might have small protrusions or anomalous isolated fringes. This is demonstrated in the image in Figure C-5(a). In cases such as this, where relatively few points are excluded in any given direction, R_{max} can misrepresent the area of the region exposed to such effects, and $R_{95\%}$ is considered more representative. In strongly asymmetric cases such as shown in Figure C-5(b), on the other hand, $R_{95\%}$ neglects to account for significant protrusions in the footprint. In such cases R_{max} might better represent the region of effect in specific directions. Cases such as this are usually associated with bathymetric features affecting propagation. The difference between R_{max} and $R_{95\%}$ depends on the source directivity and the non-uniformity of the acoustic environment.



(a) (b)

Figure C-5. Sample areas ensonified to an arbitrary sound level with R_{max} and $R_{95\%}$ ranges shown for two scenarios. (a) Largely symmetric sound level contour with small protrusions. (b) Strongly asymmetric sound level contour with long protrusions. Light blue indicates the ensonified areas bounded by $R_{95\%}$; darker blue indicates the areas outside this boundary which determine R_{max}.

Appendix D. Modelled Sound Fields

D.1. Scenario 1: Pile Installation

D.1.1. Pile Installation at the MOF by Impact Pile Driving and Drilling

D.1.1.1. FLAT

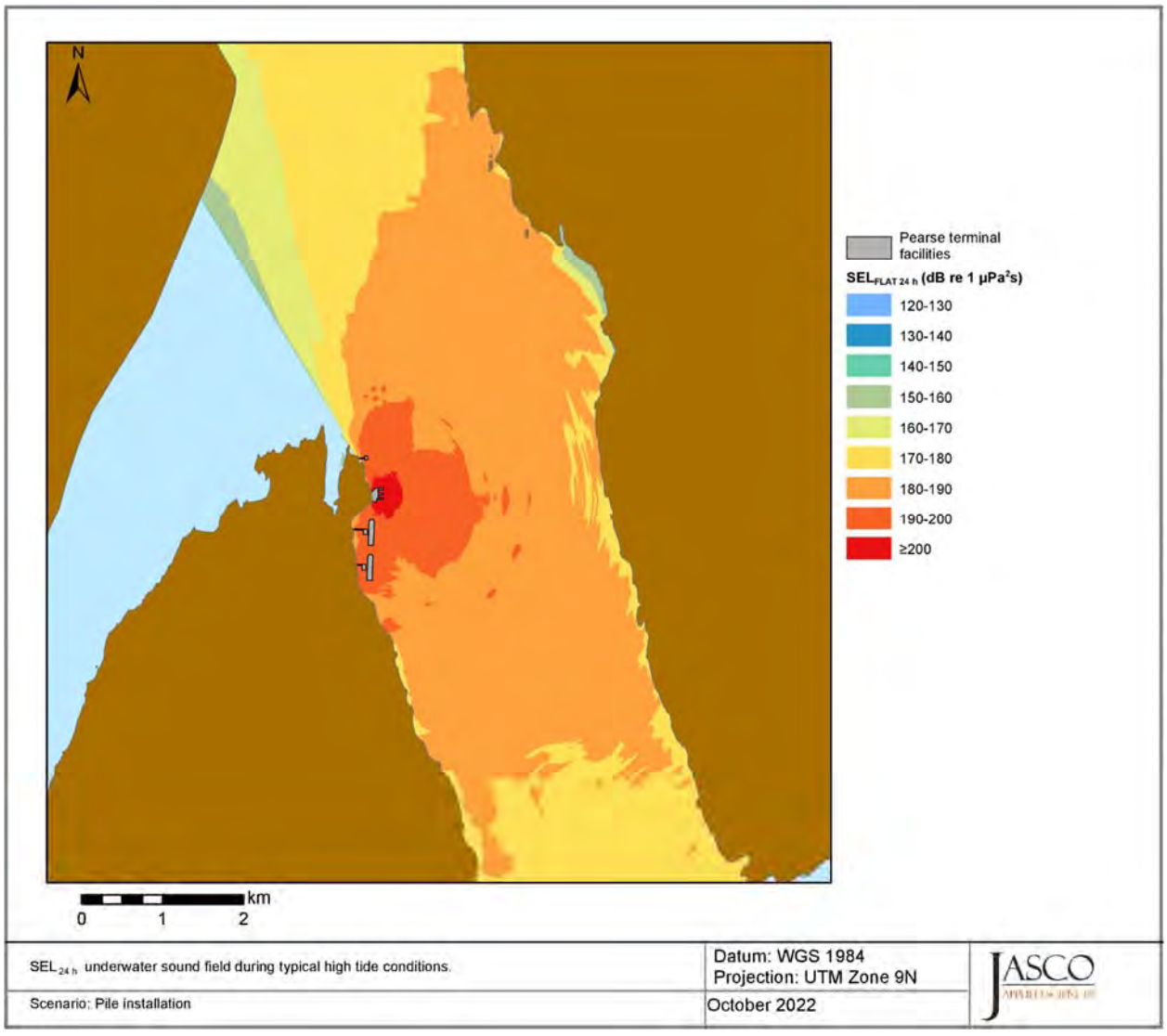


Figure D-1. FLAT, Pile installation at the MOF: Modelled 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.1.1.2. Low-frequency Cetacean (LFC) SEL_{24h}

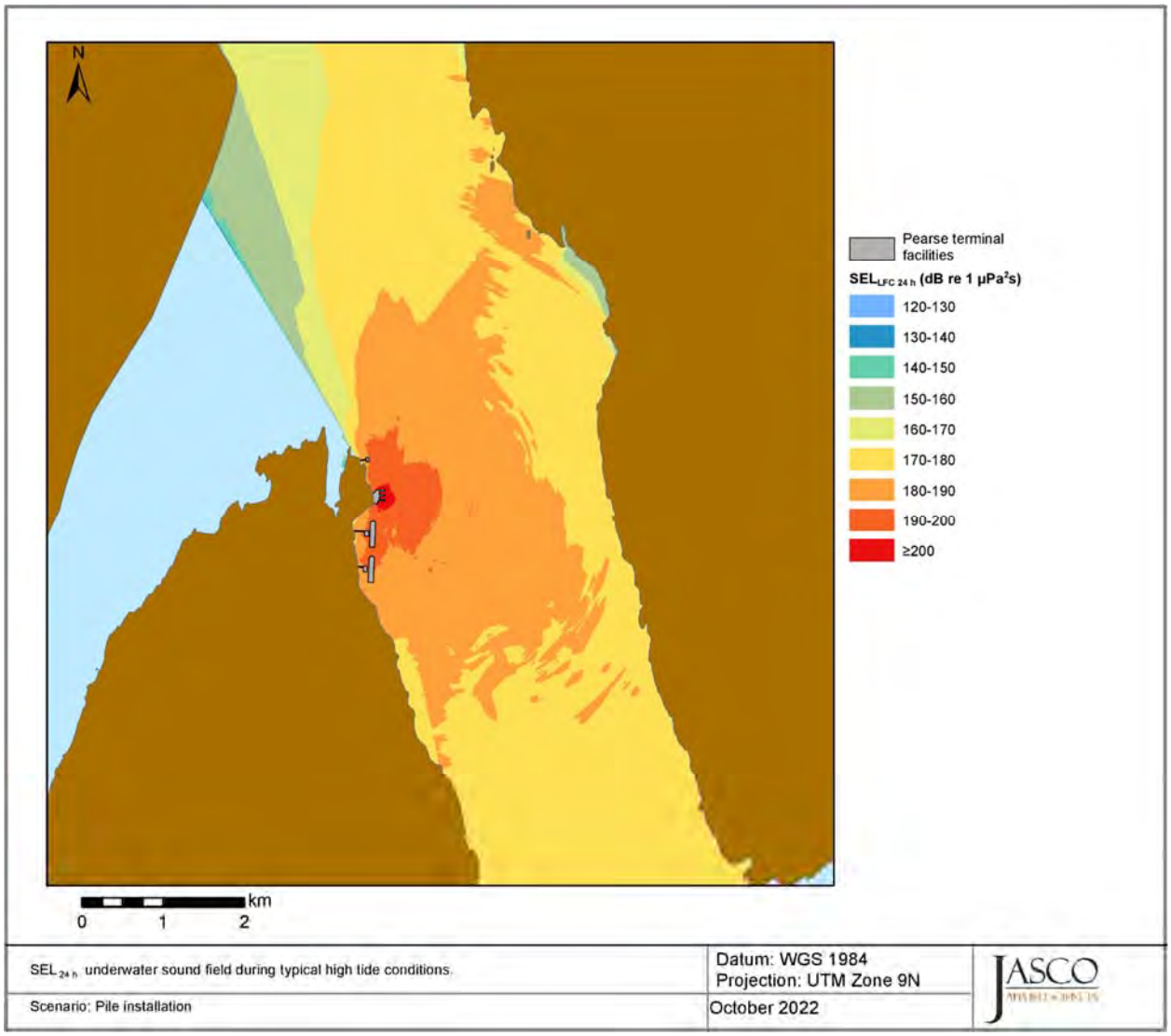


Figure D-2. LFC, Pile installation at the MOF: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.1.1.3. Mid-frequency Cetacean (MFC) SEL_{24h}

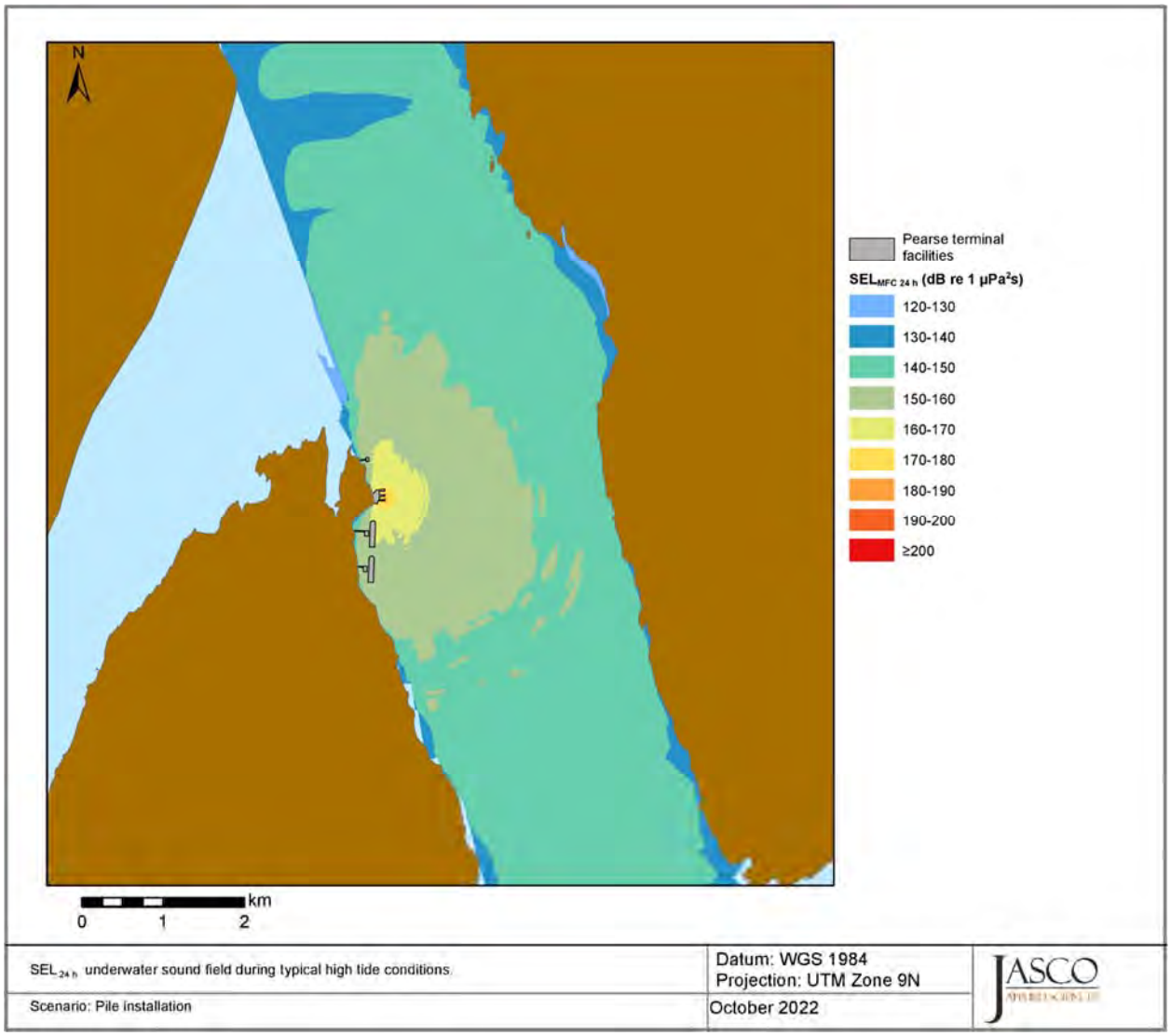


Figure D-3. MFC, Pile installation at the MOF: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.1.1.4. High-frequency Cetacean (HFC) SEL_{24h}

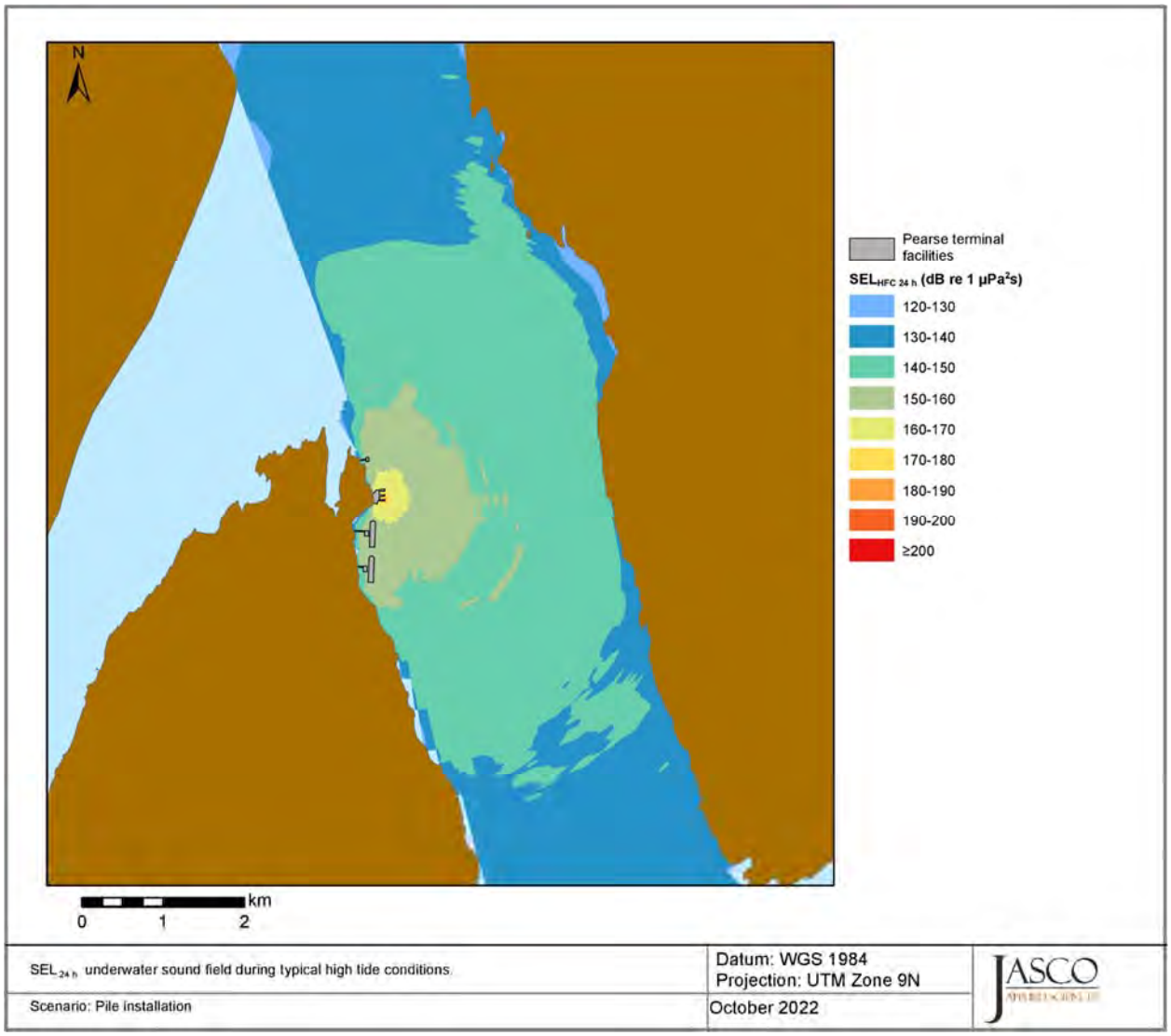


Figure D-4. HFC, Pile installation at the MOF: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.1.1.5. Phocid Pinnipeds in Water (PPW) SEL_{24h}

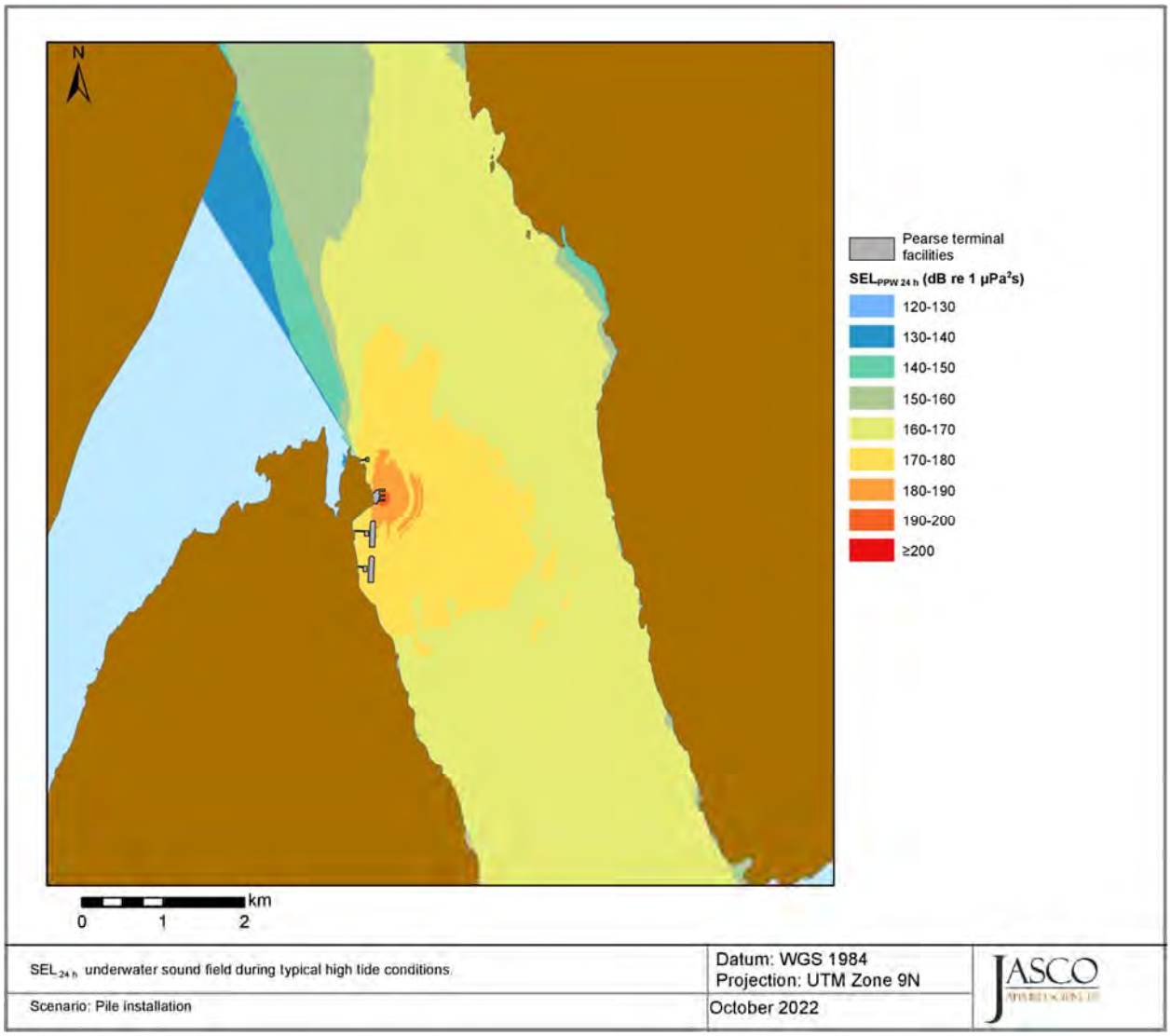


Figure D-5. PPW, Pile installation at the MOF: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.1.1.6. Otariid Pinnipeds in Water (OPW) SEL_{24h}

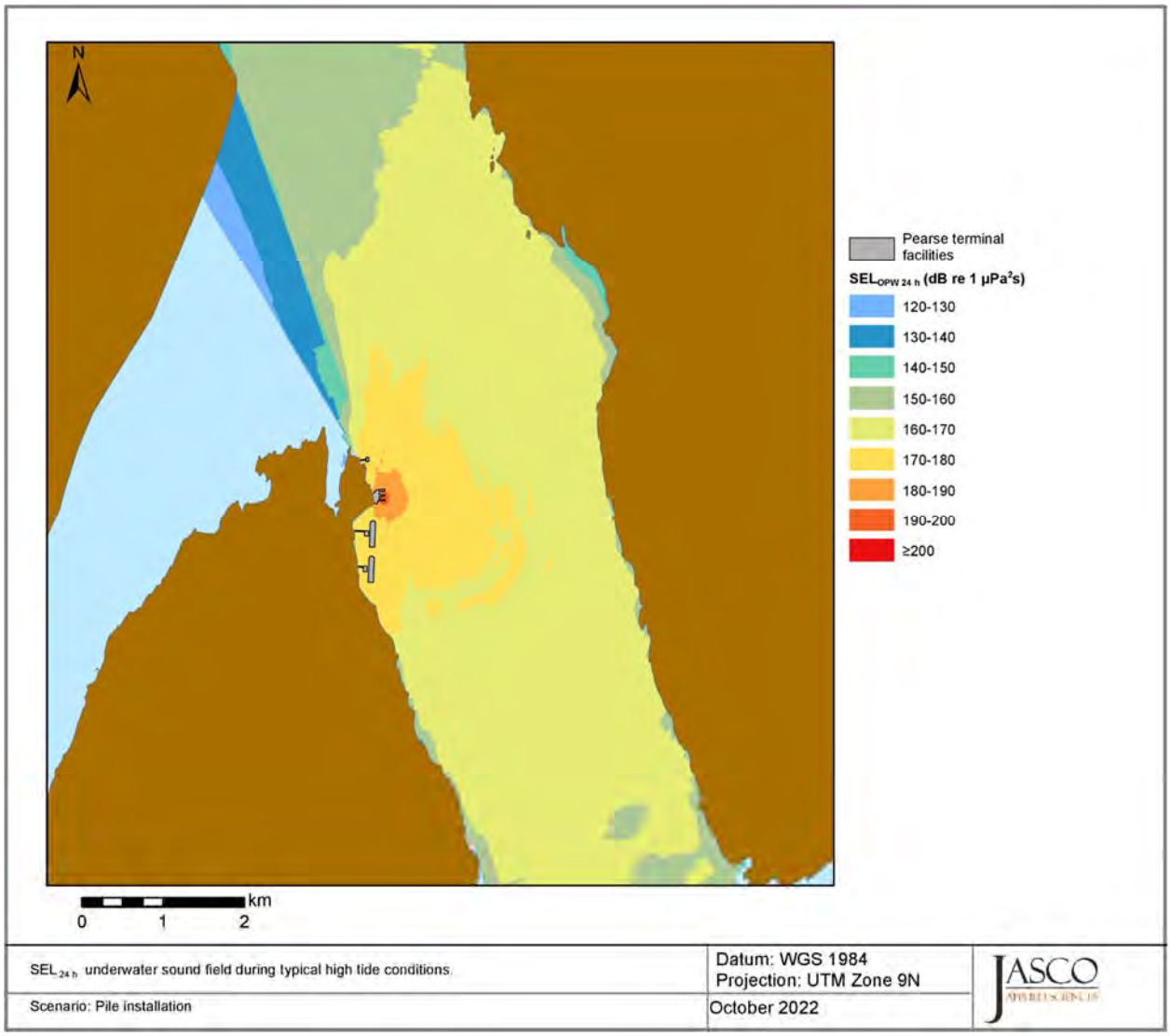


Figure D-6. OPW, Pile installation at the MOF: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.1.1.7. PK

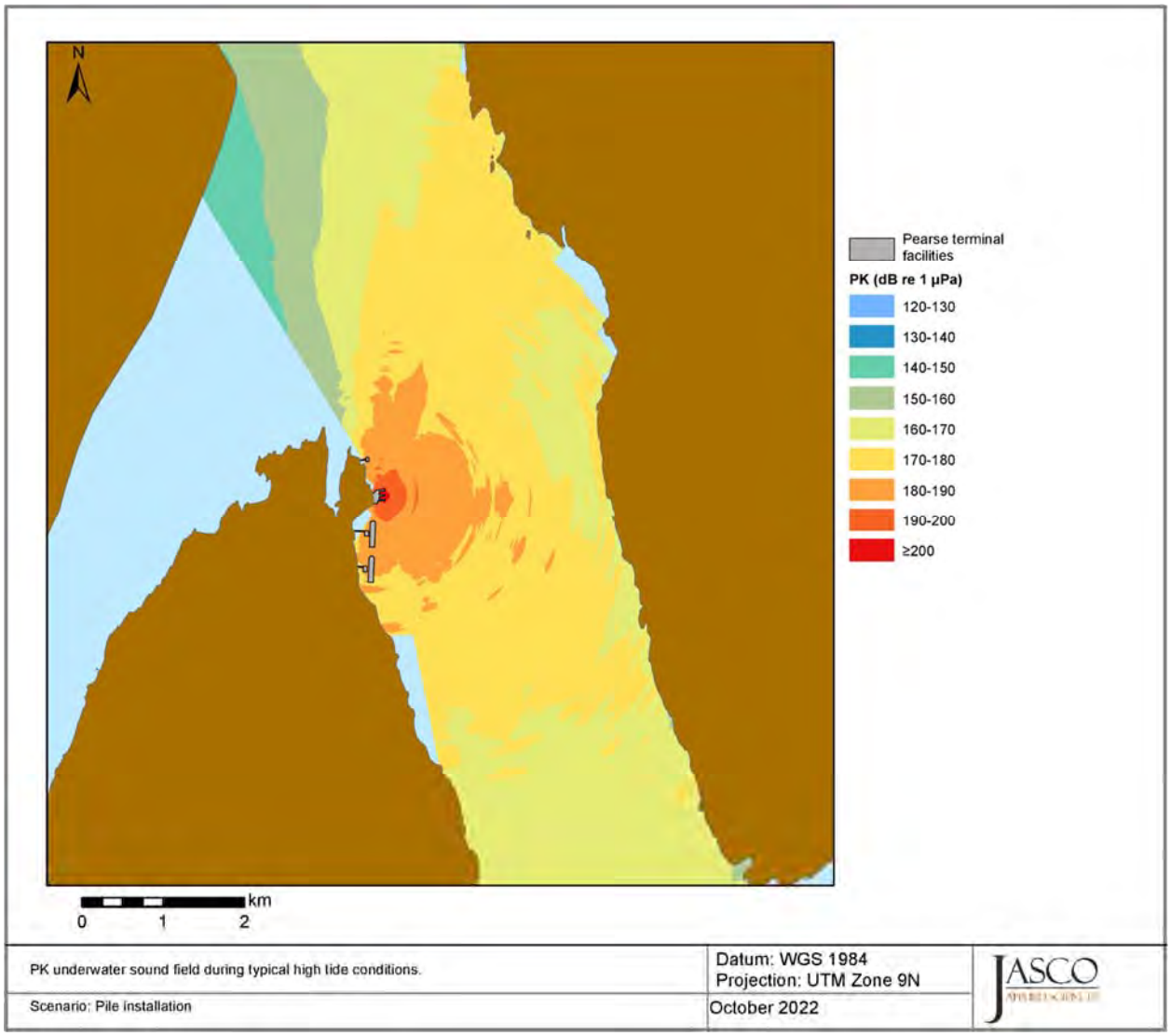


Figure D-7. PK Pile installation at the MOF: Modelled peak sound level (PK) field from single strike during pile installation operation, regular spaced threshold levels (120–200 dB).

D.1.1.8. SPL

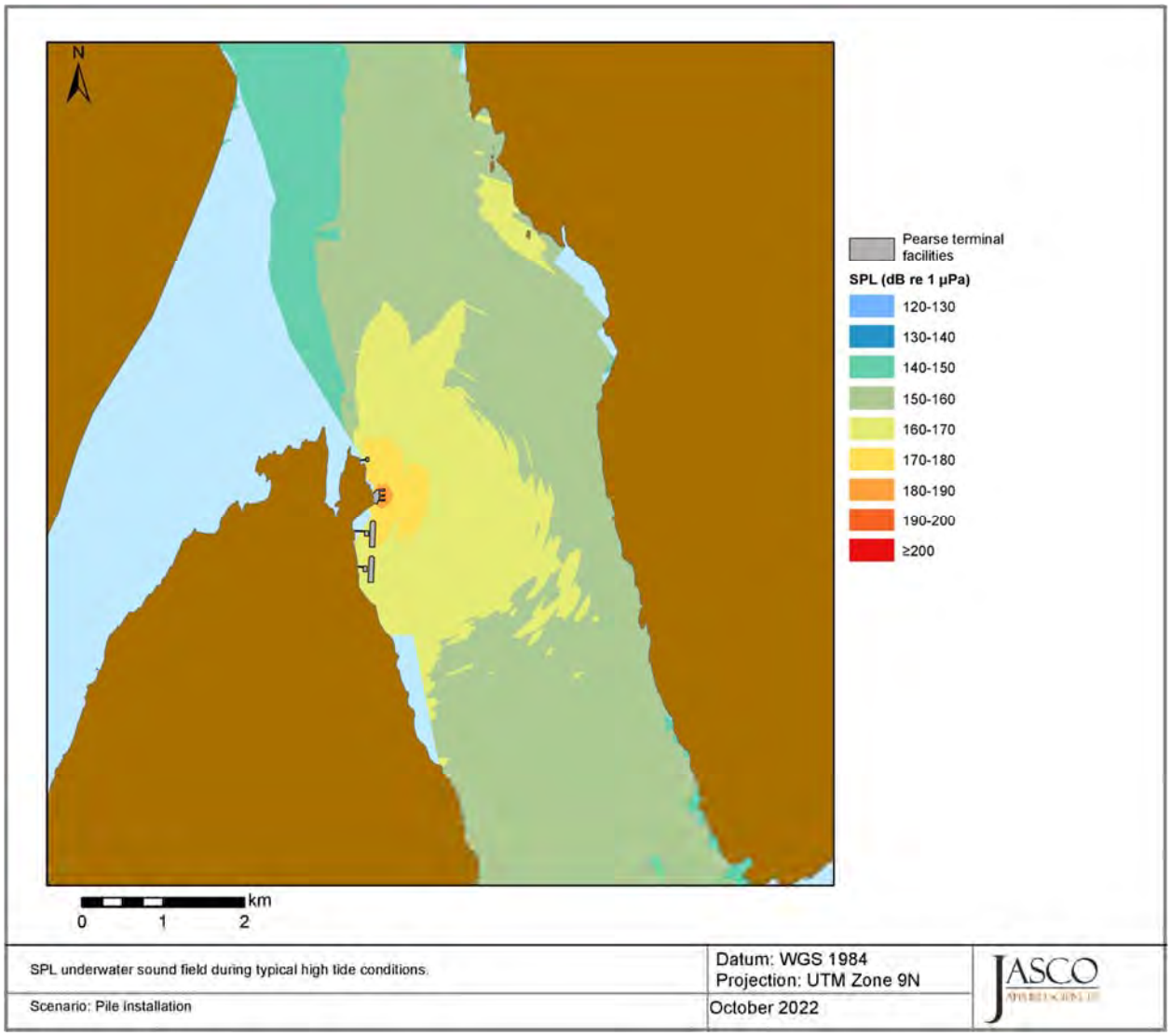


Figure D-8. SPL, Pile installation at the MOF: Modelled sound pressure level (SPL) field from a single strike during pile installation operation, regular spaced threshold levels (120–200 dB).

D.1.2. Pile Installation at the Mooring Anchor by Drilling

D.1.2.1. FLAT SEL_{24h}

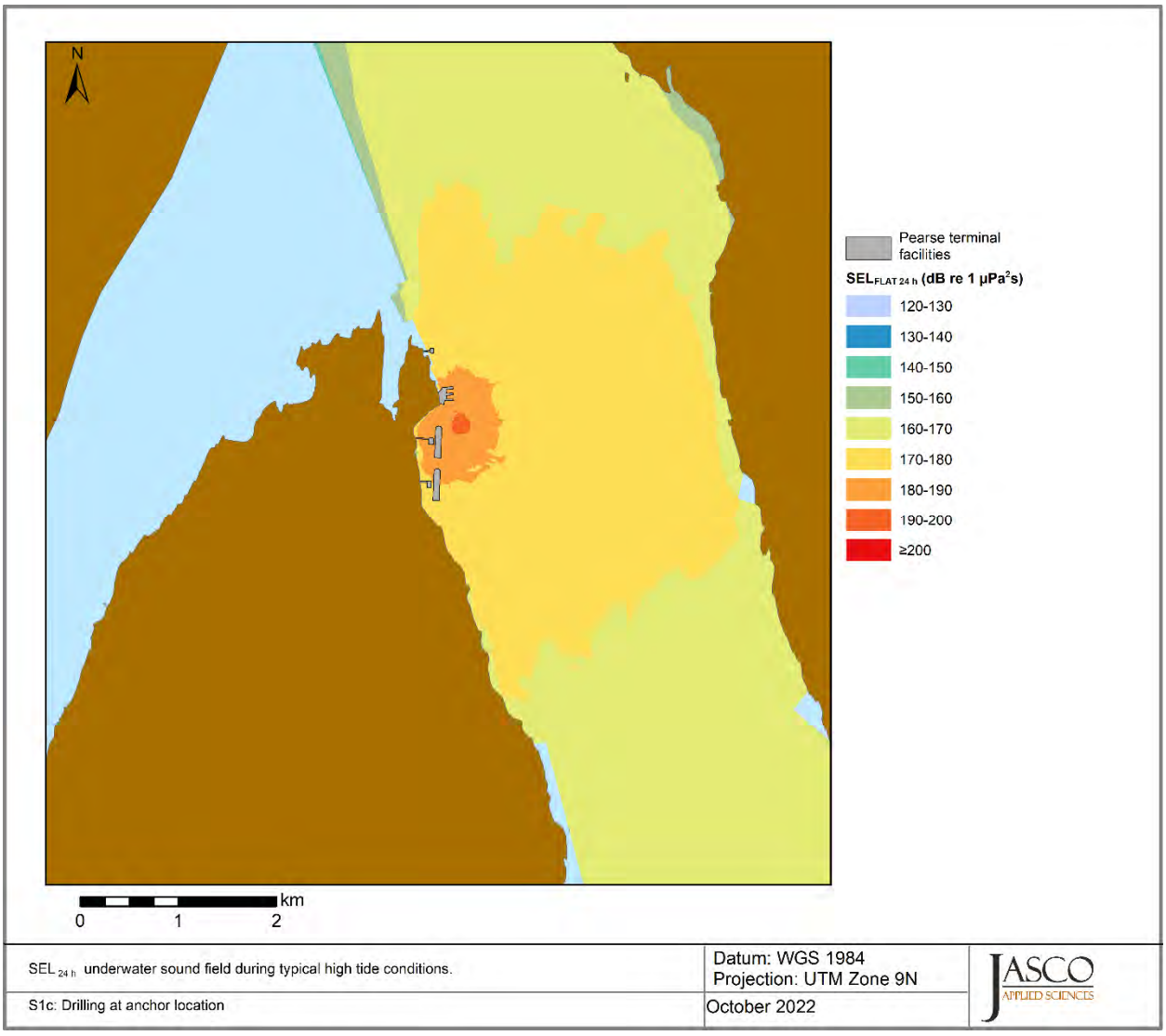


Figure D-9. FLAT, Pile installation at the mooring anchor: Modelled 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.1.2.2. Low-frequency Cetacean (LFC) SEL_{24h}

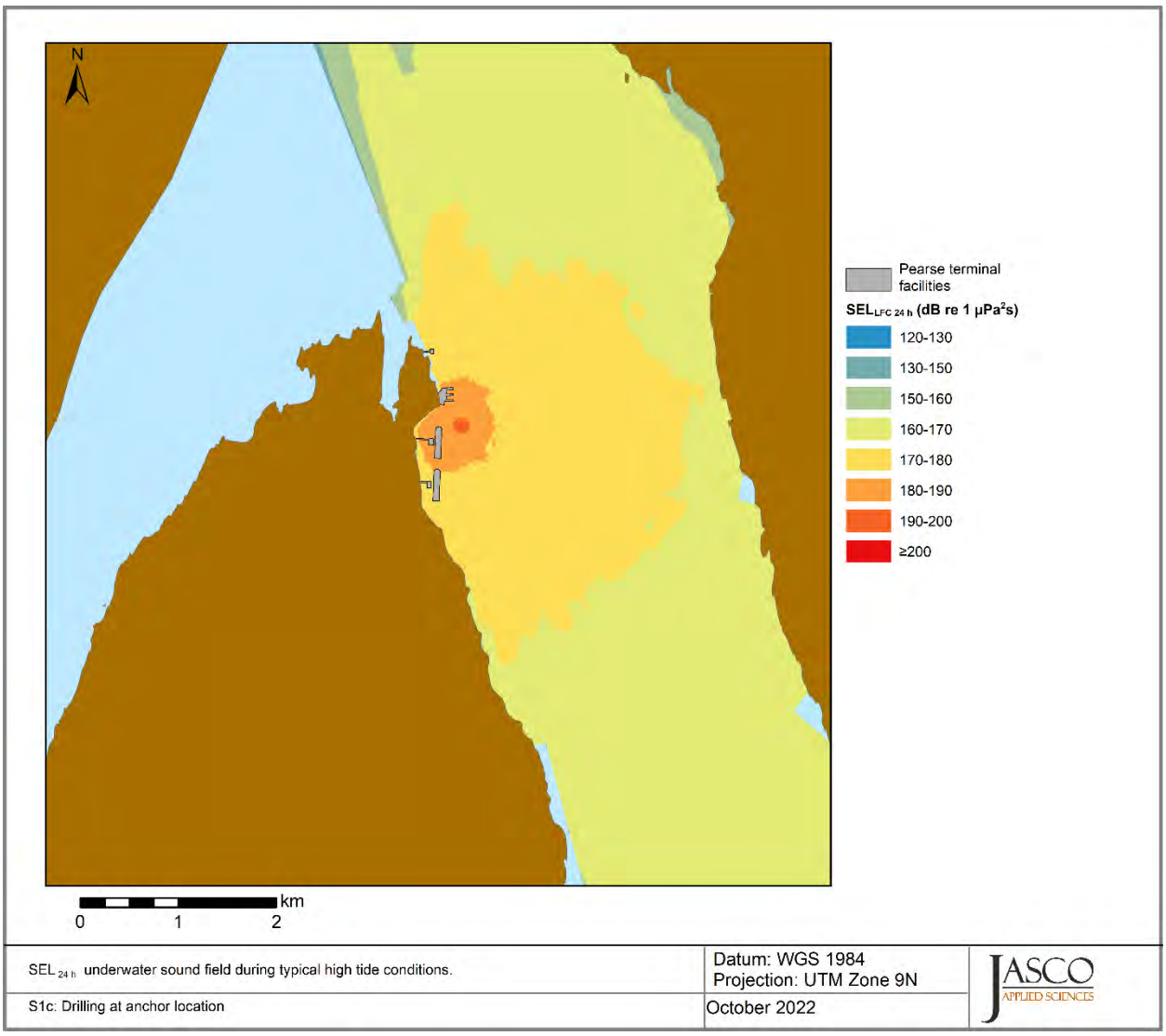


Figure D-10. LFC, Pile installation at the mooring anchor: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.1.2.3. Mid-frequency Cetacean (MFC) SEL_{24h}

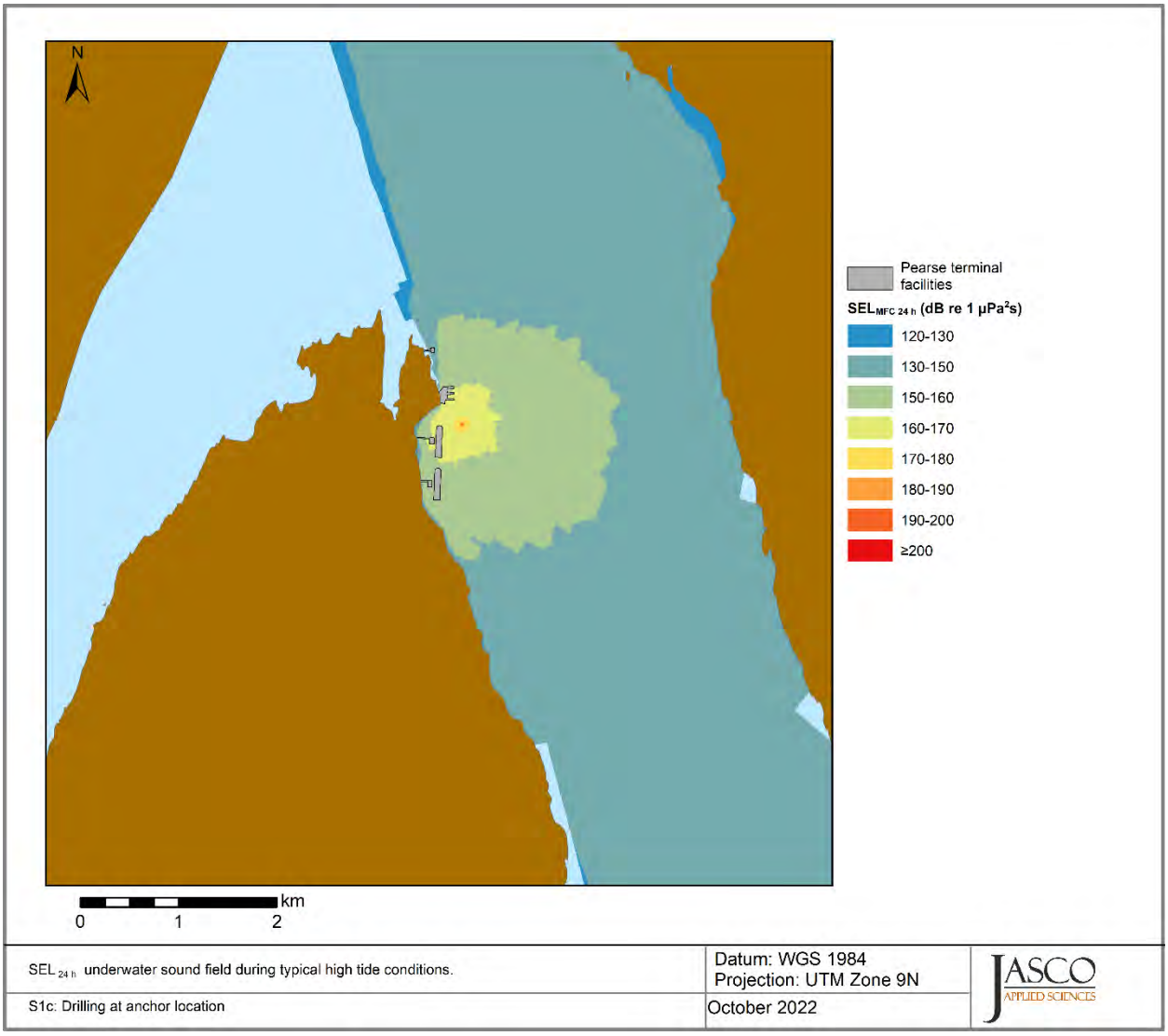


Figure D-11. MFC, Pile installation at the mooring anchor: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.1.2.4. High-frequency Cetacean (HFC) SEL_{24h}

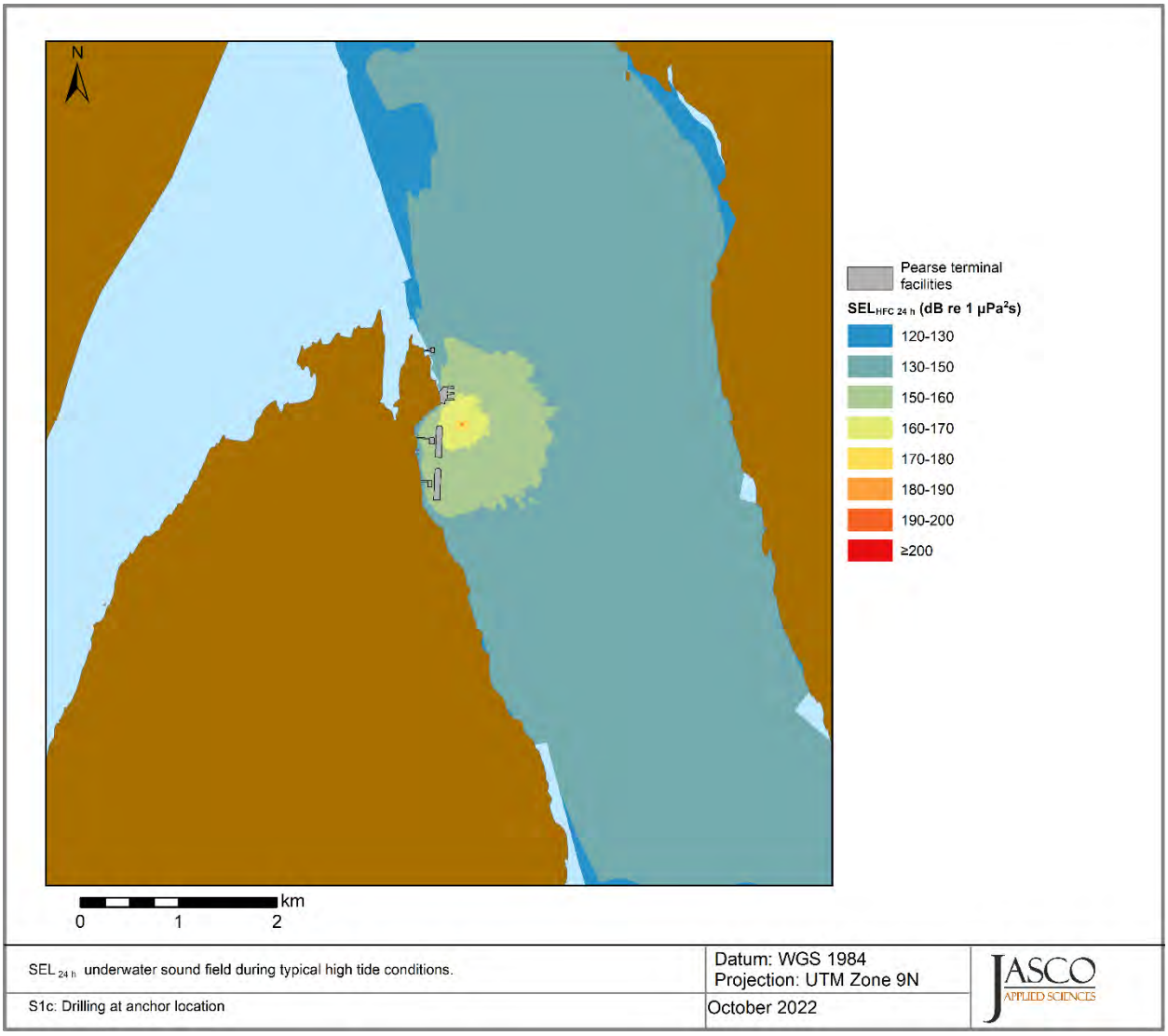


Figure D-12. HFC, Pile installation at the mooring anchor: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.1.2.5. Phocid Pinniped in Water (PPW) SEL_{24h}

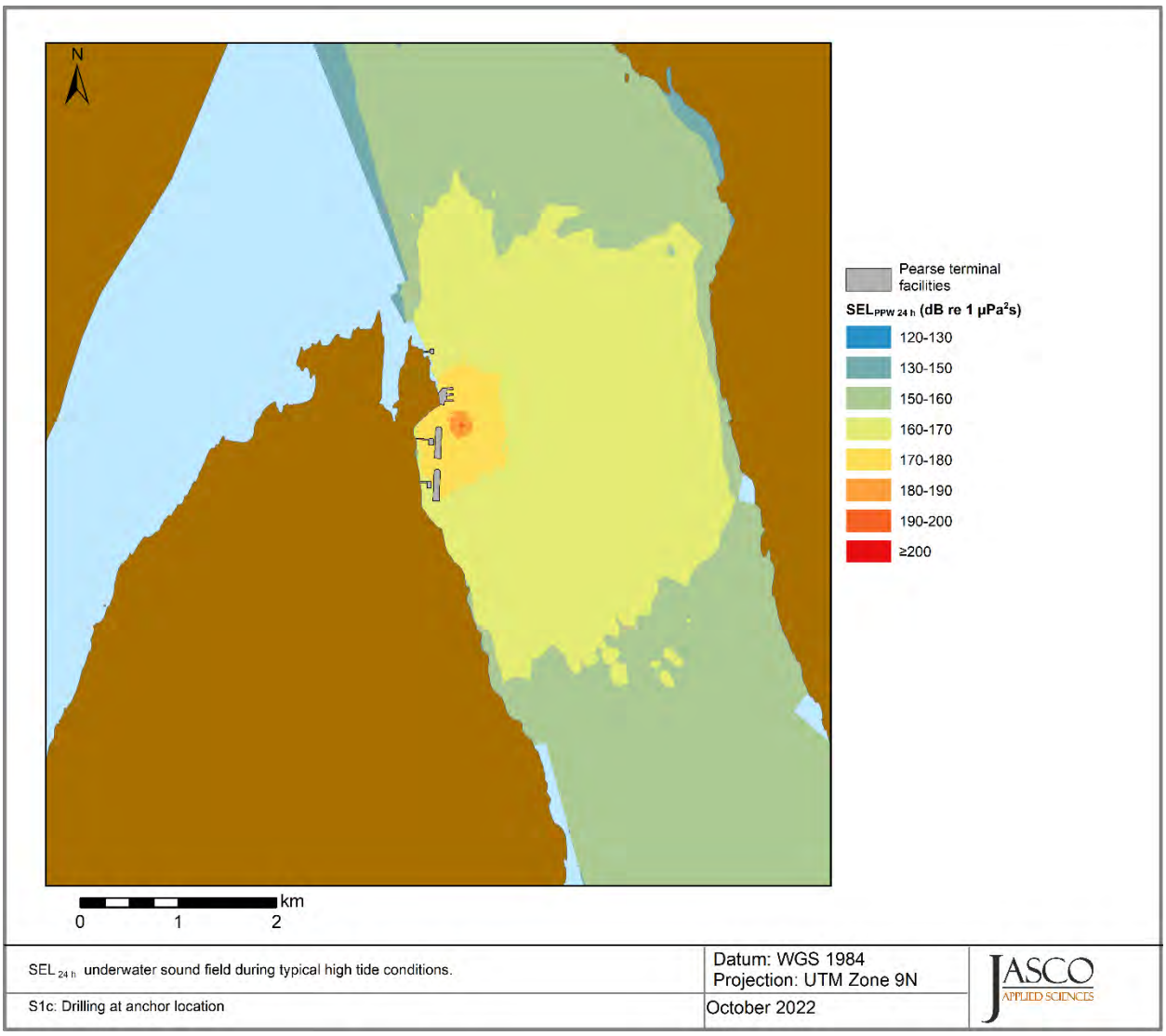


Figure D-13. PPW, Pile installation at the mooring anchor: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.1.2.6. Otariid Pinniped in Water (OPW) SEL_{24h}

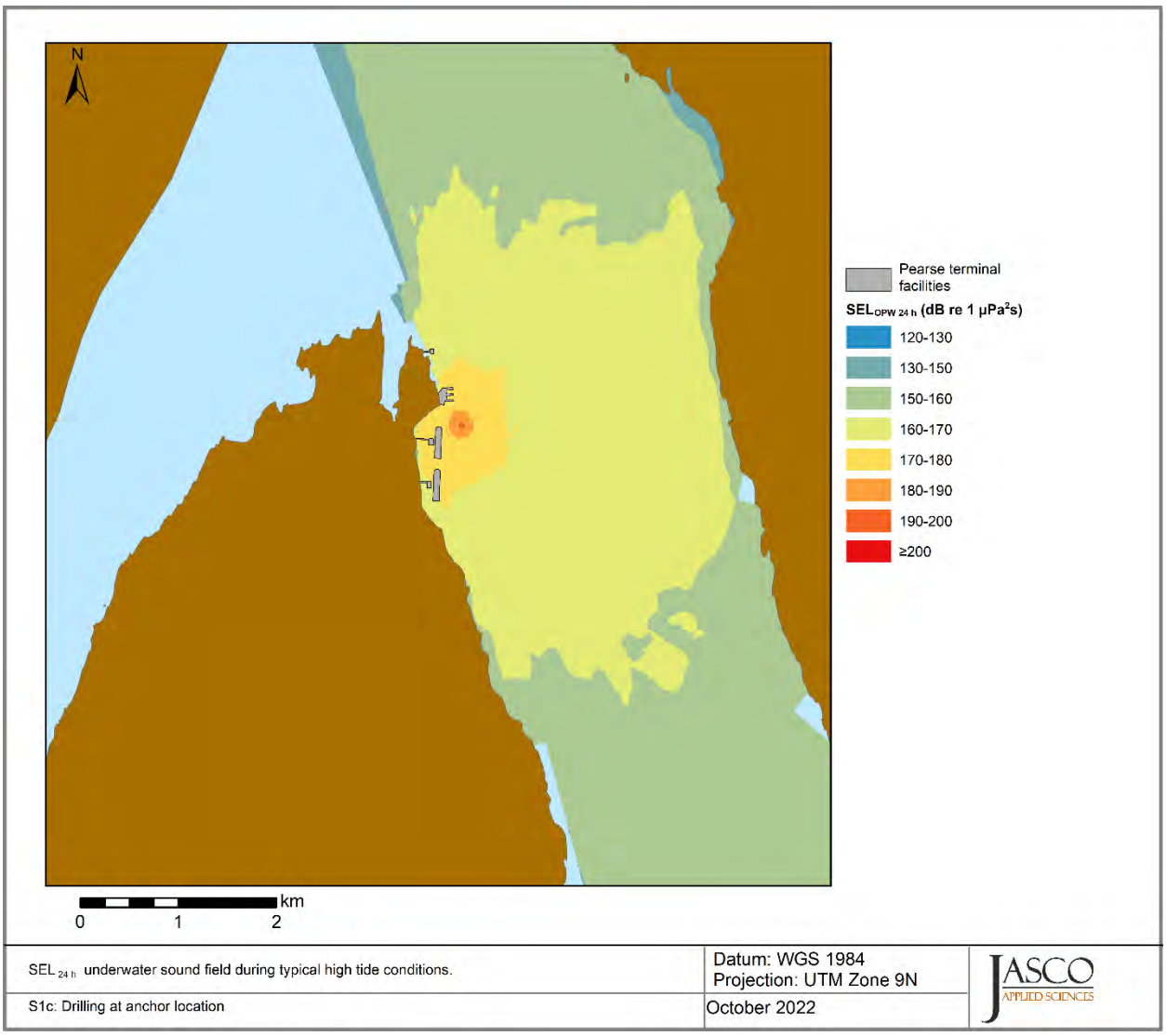


Figure D-14. OPW, Pile installation at the mooring anchor: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.2. Scenario 2: FLNG Operations

D.2.1. FLAT SEL_{24h}

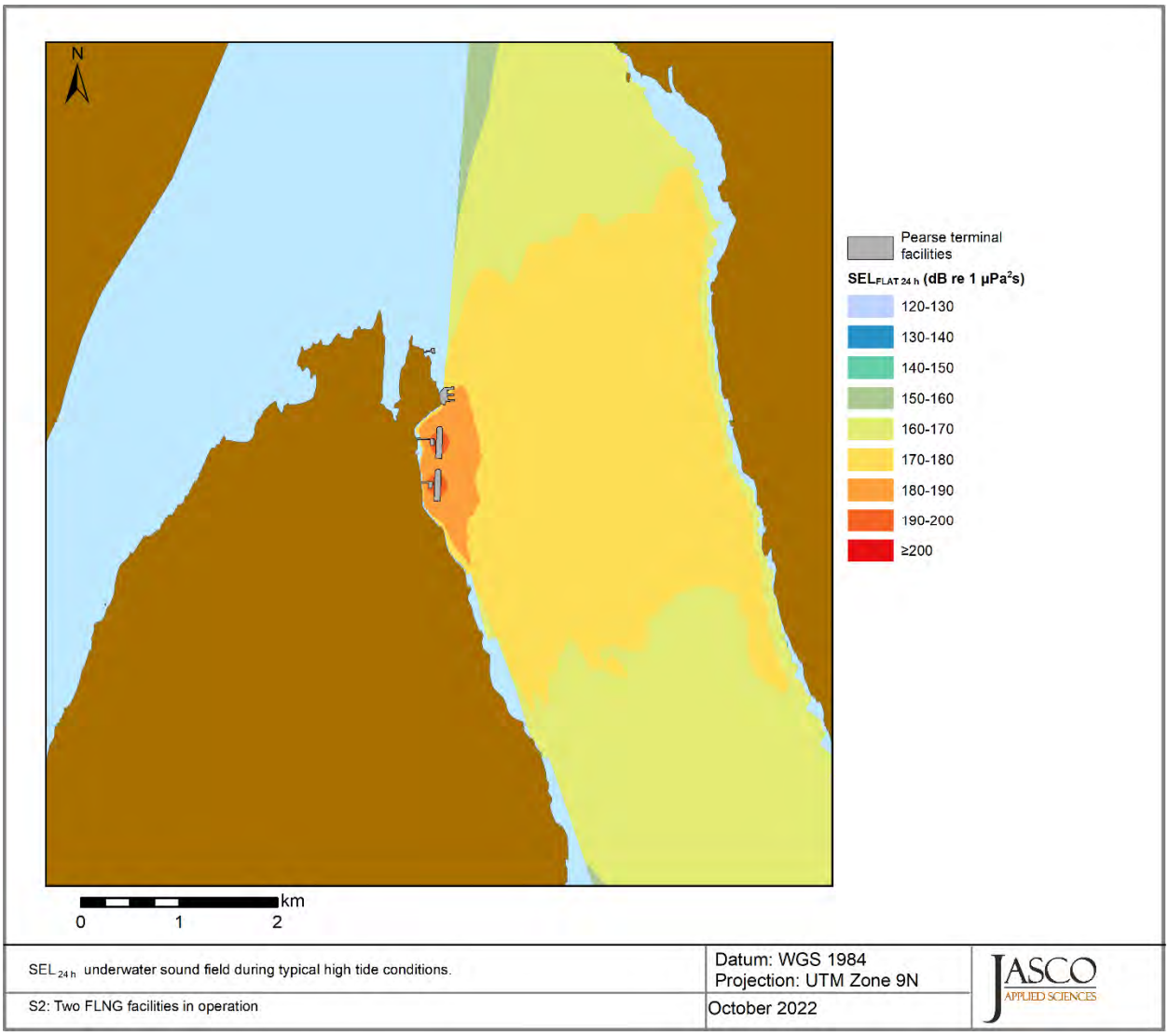


Figure D-15. FLAT, FLNG operation: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.2.2. Low-frequency Cetacean (LFC) SEL_{24h}

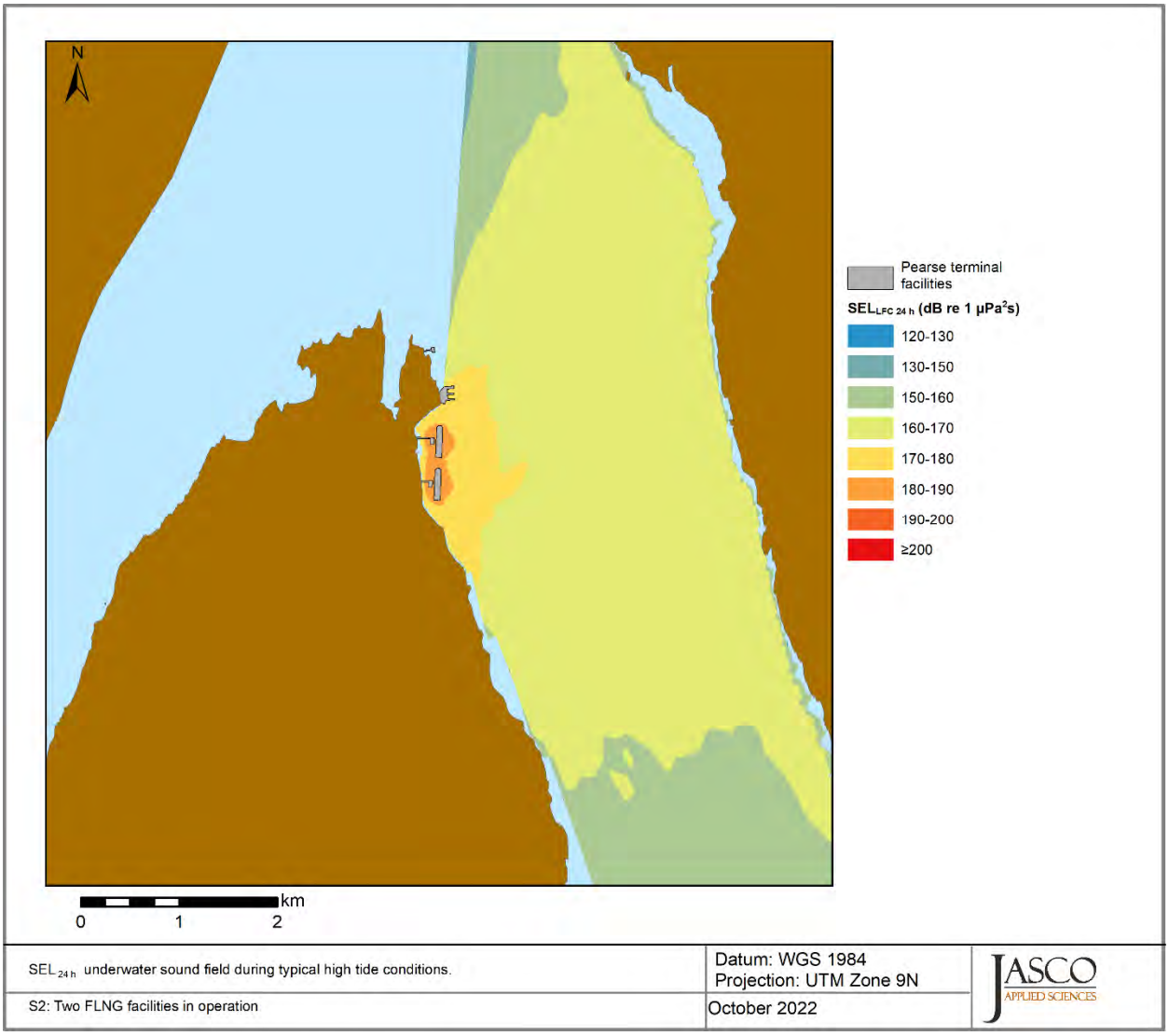


Figure D-16. LFC, FLNG operation: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.2.3. Mid-frequency Cetacean (MFC) SEL_{24h}

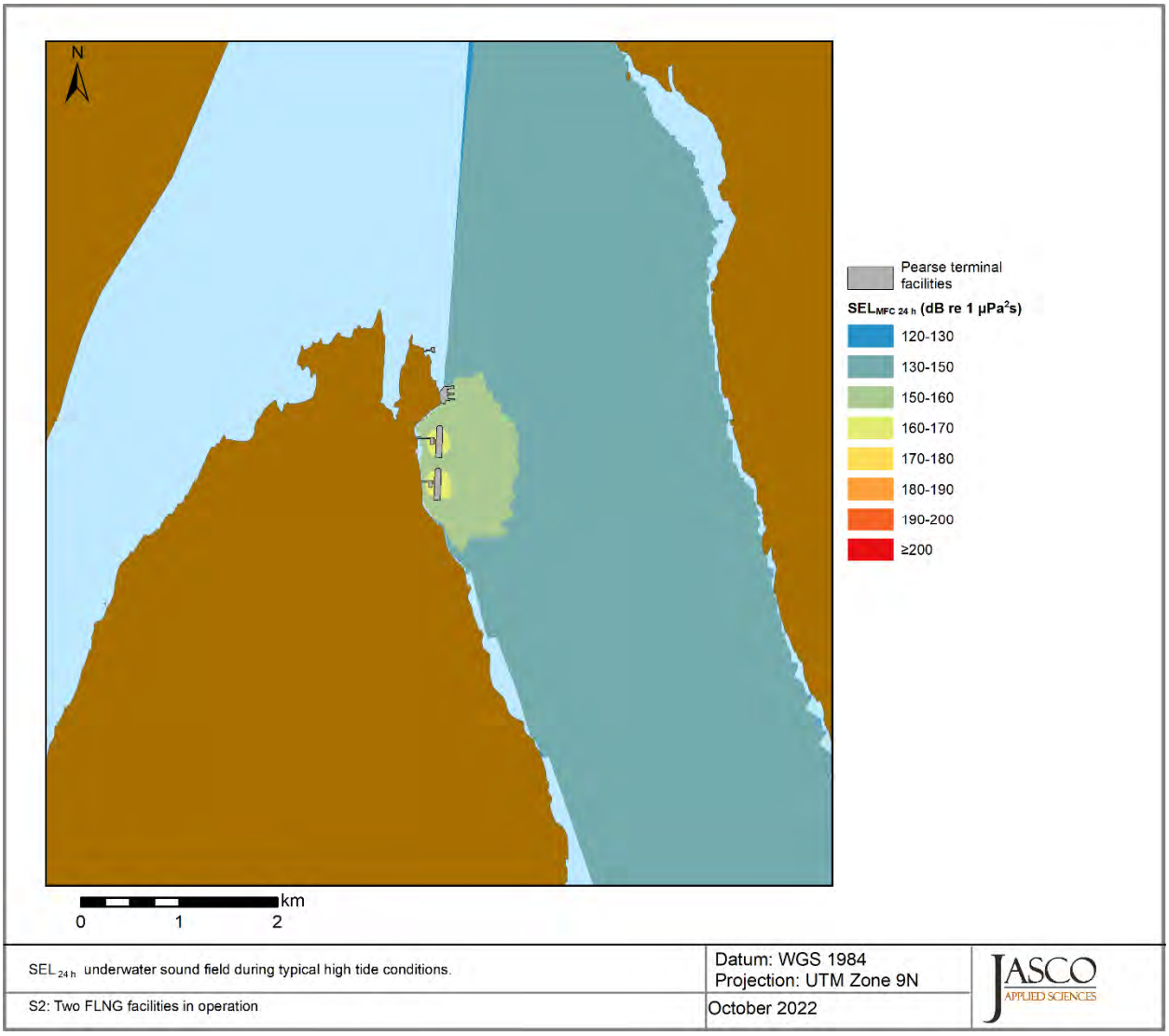


Figure D-17. MFC, FLNG operation: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.2.4. High-frequency Cetacean (HFC) SEL_{24h}

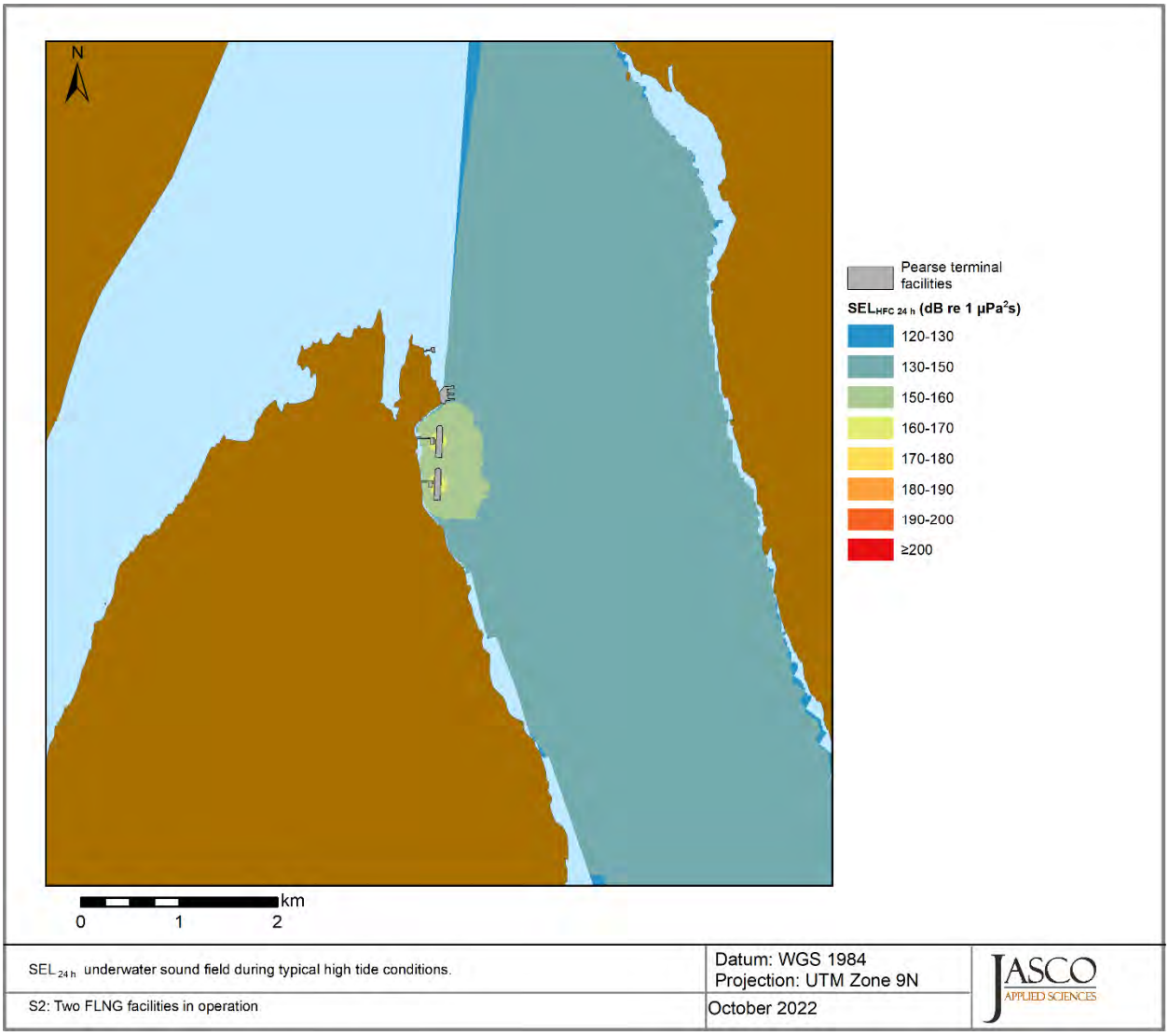


Figure D-18. HFC, FLNG operation: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.2.5. Phocid Pinniped in Water (PPW) SEL_{24h}

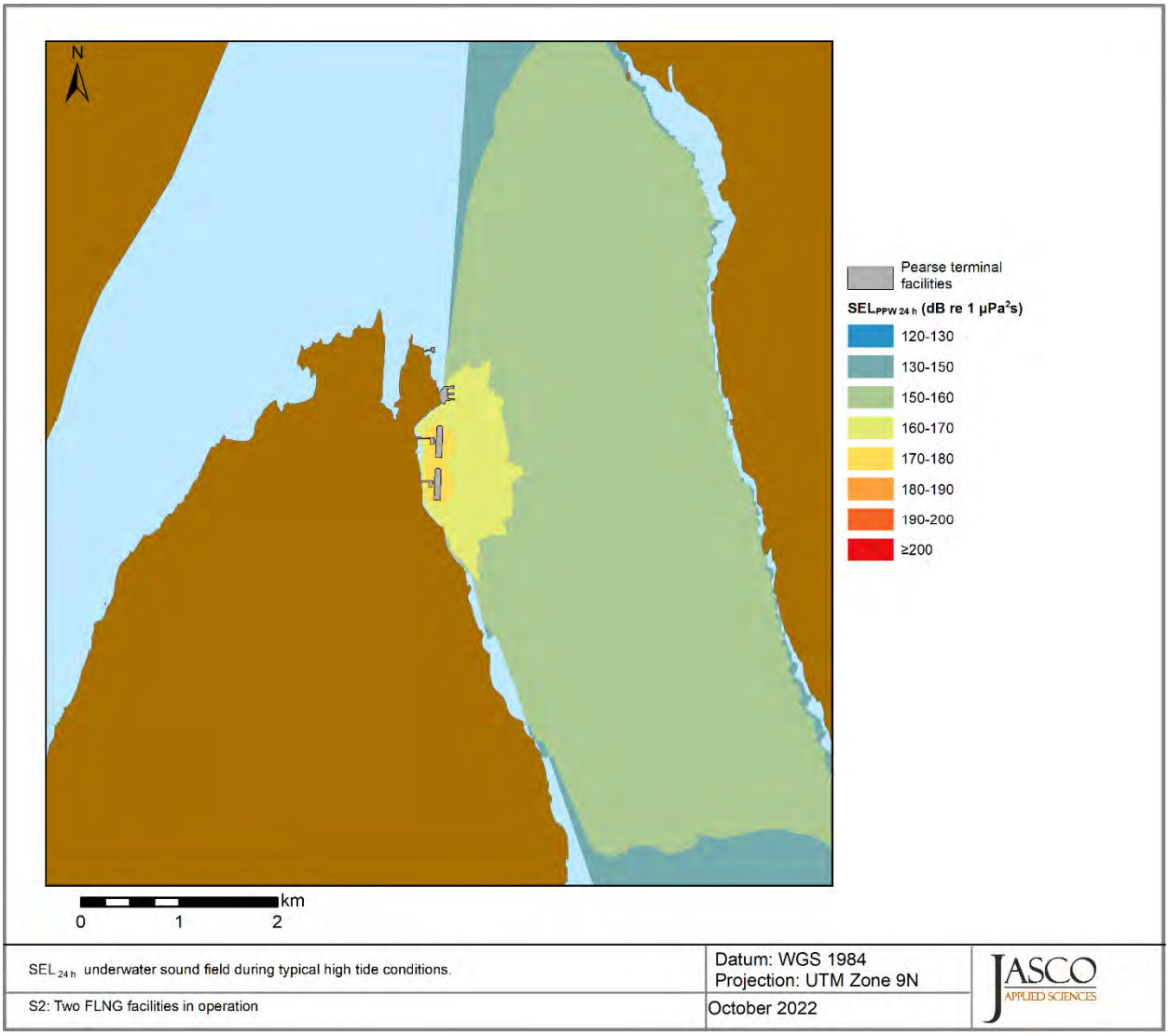


Figure D-19. PPW, FLNG operation: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.2.6. Otariid Pinniped in Water (OPW) SEL_{24h}

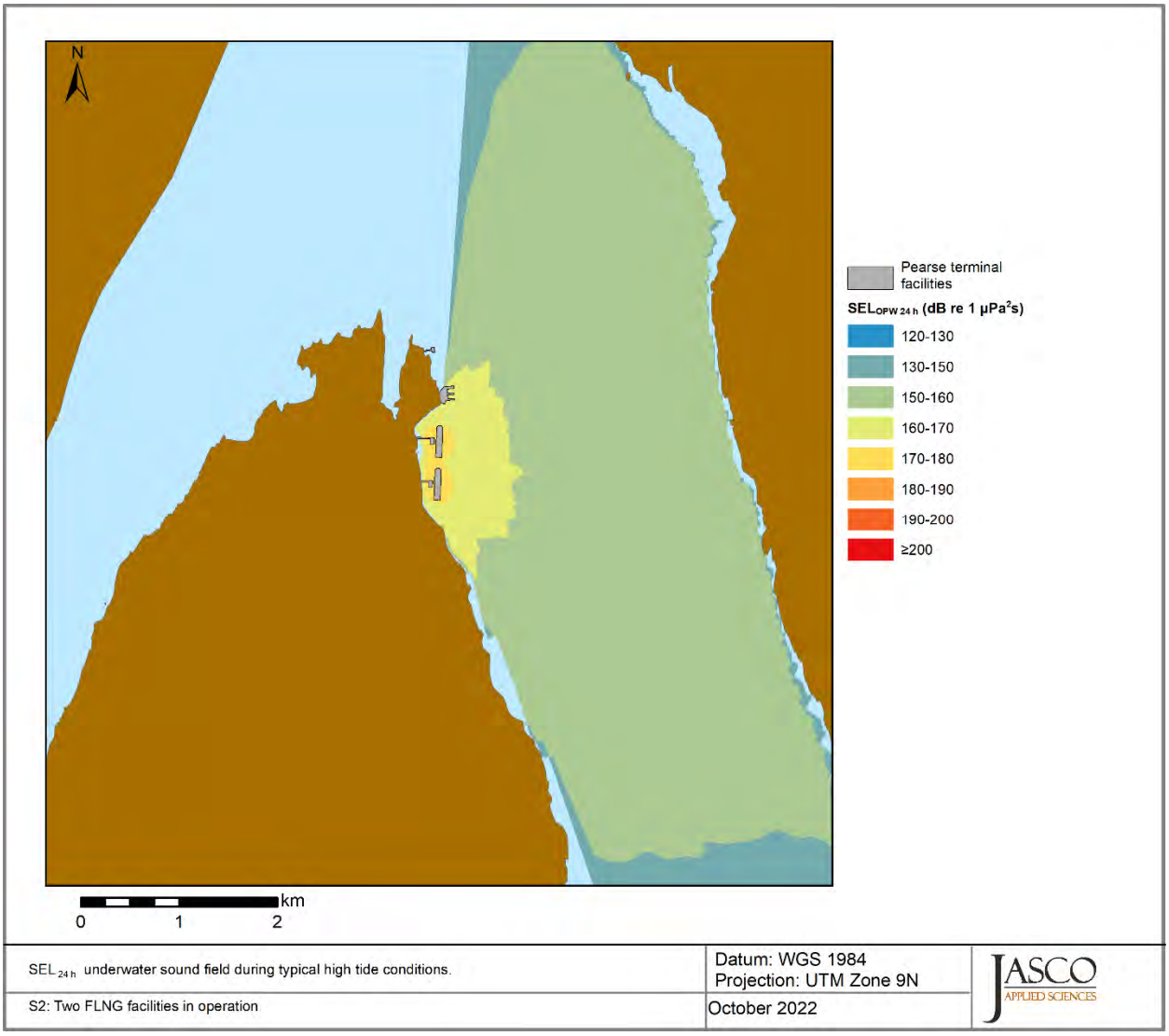


Figure D-20. OPW, FLNG operation: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.3. Scenario 3: Berthing and Unberthing

D.3.1. FLAT SEL_{24h}

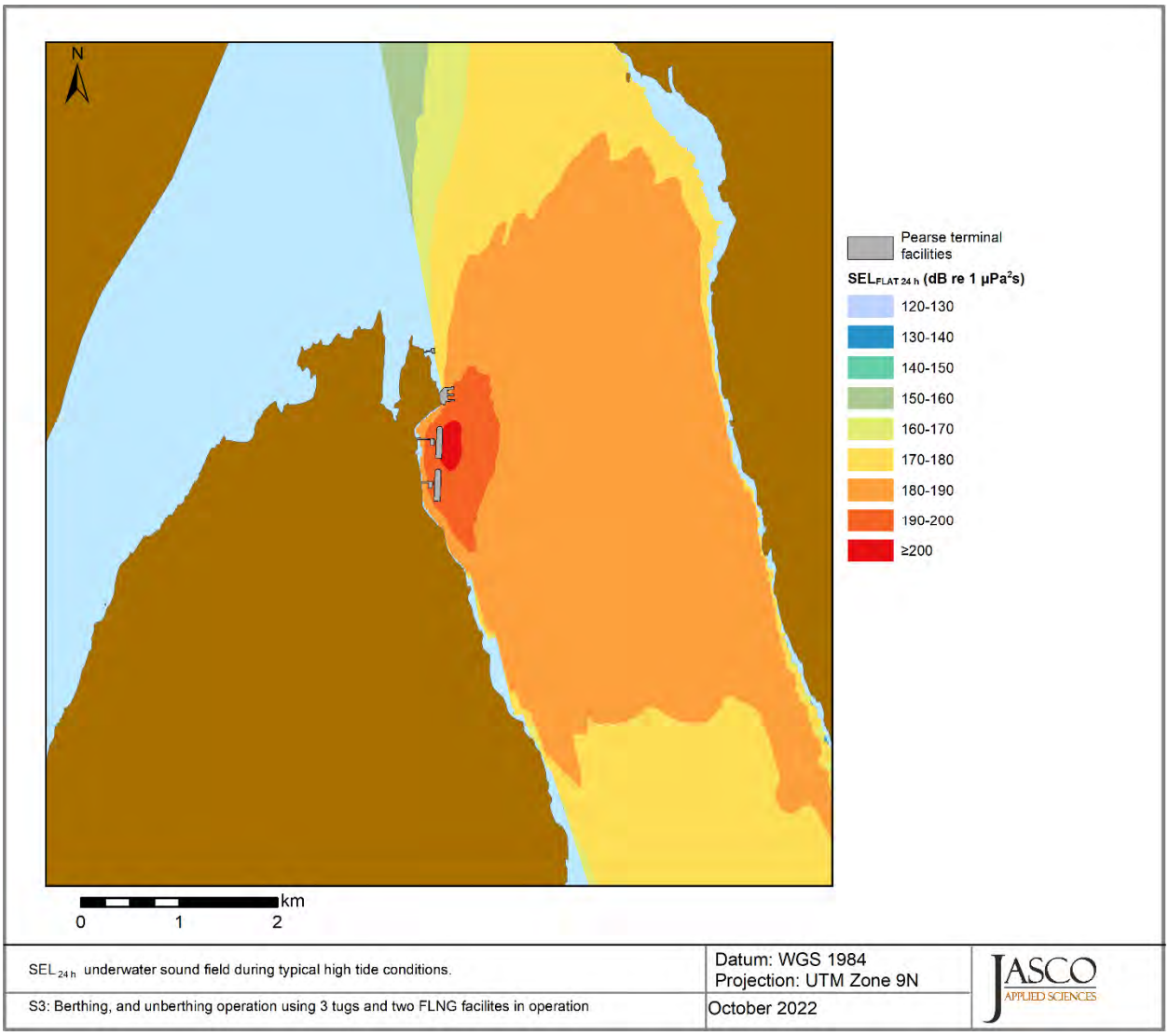


Figure D-21. FLAT, Berthing and Unberthing: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.3.2. Low-frequency Cetacean (LFC) SEL_{24h}

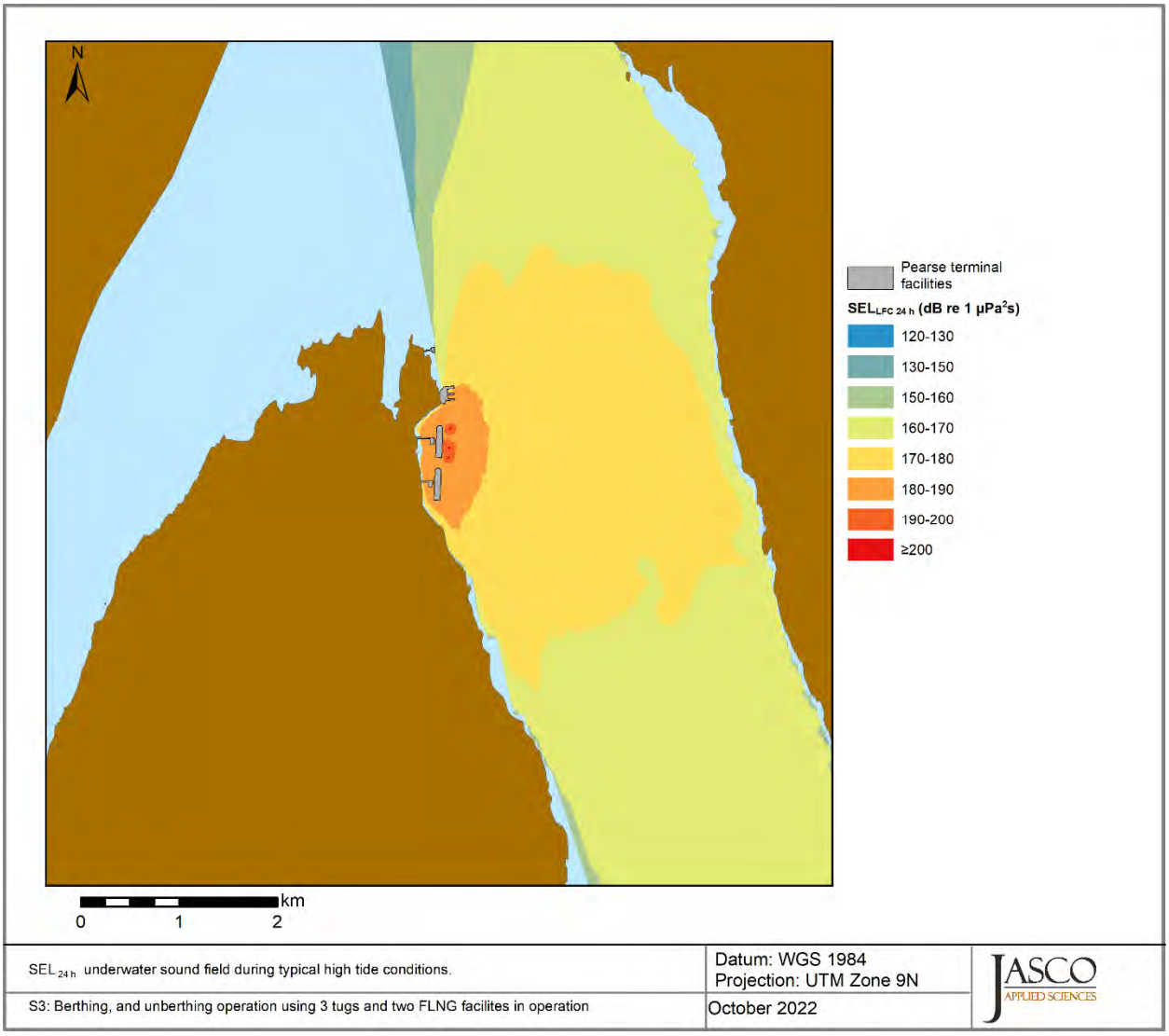


Figure D-22. LFC, Berthing and Unberthing: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.3.3. Mid-frequency Cetacean (MFC) SEL_{24h}

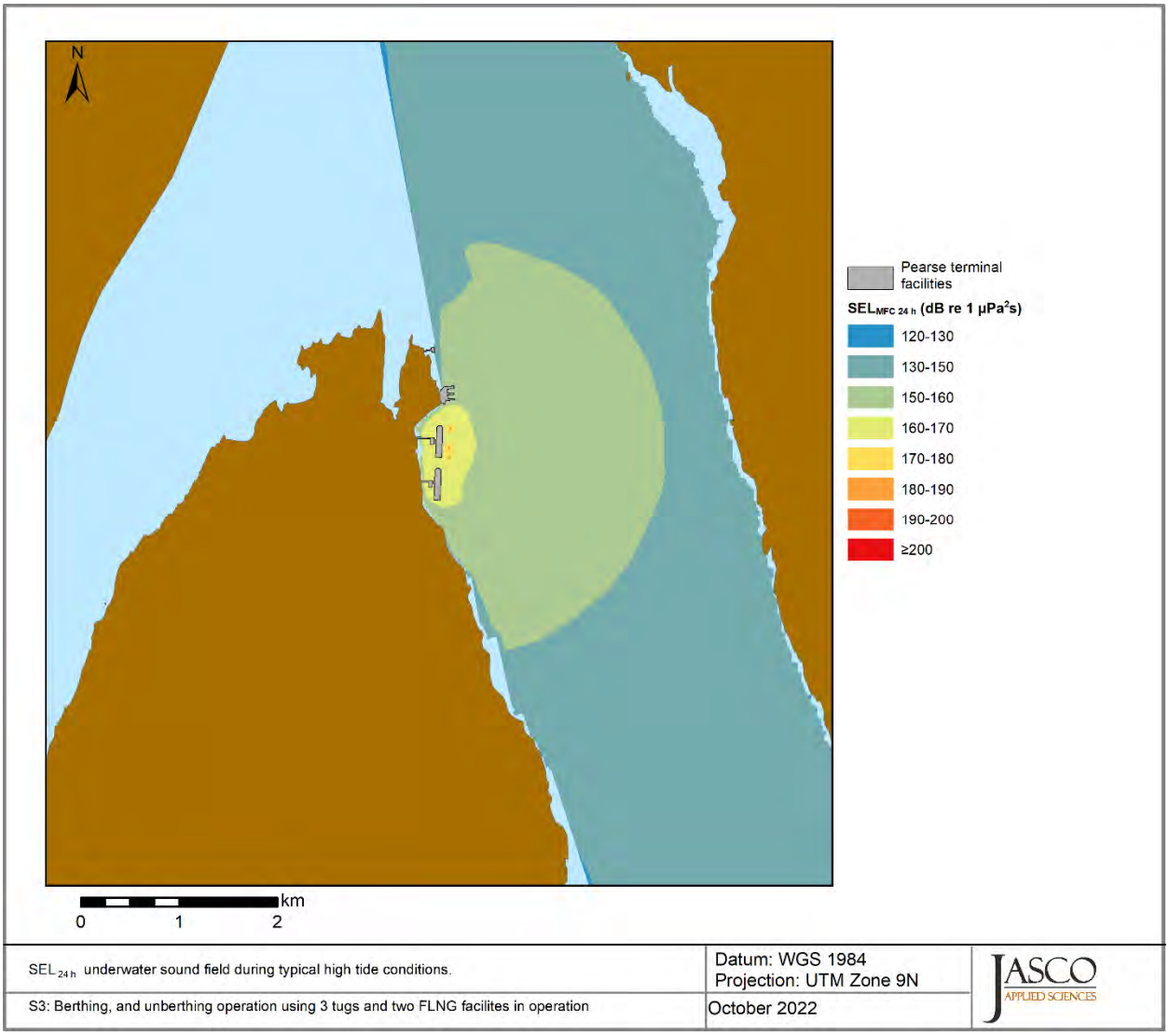


Figure D-23. MFC, Berthing and Unberthing: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.3.4. High-frequency Cetacean (HFC) SEL_{24h}

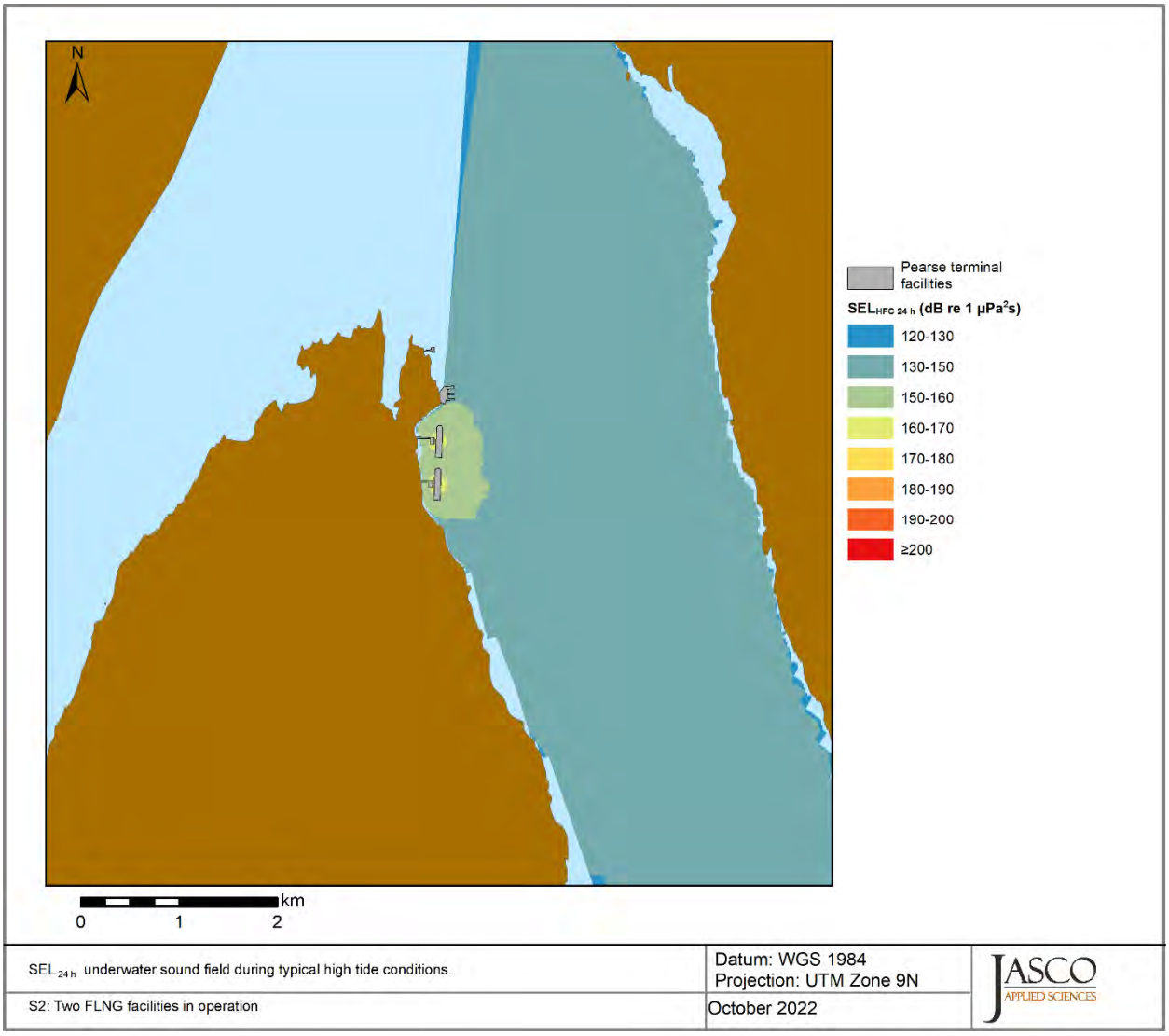


Figure D-24. HFC, Berthing and Unberthing: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.3.5. Phocid Pinniped in Water (PPW) SEL_{24h}

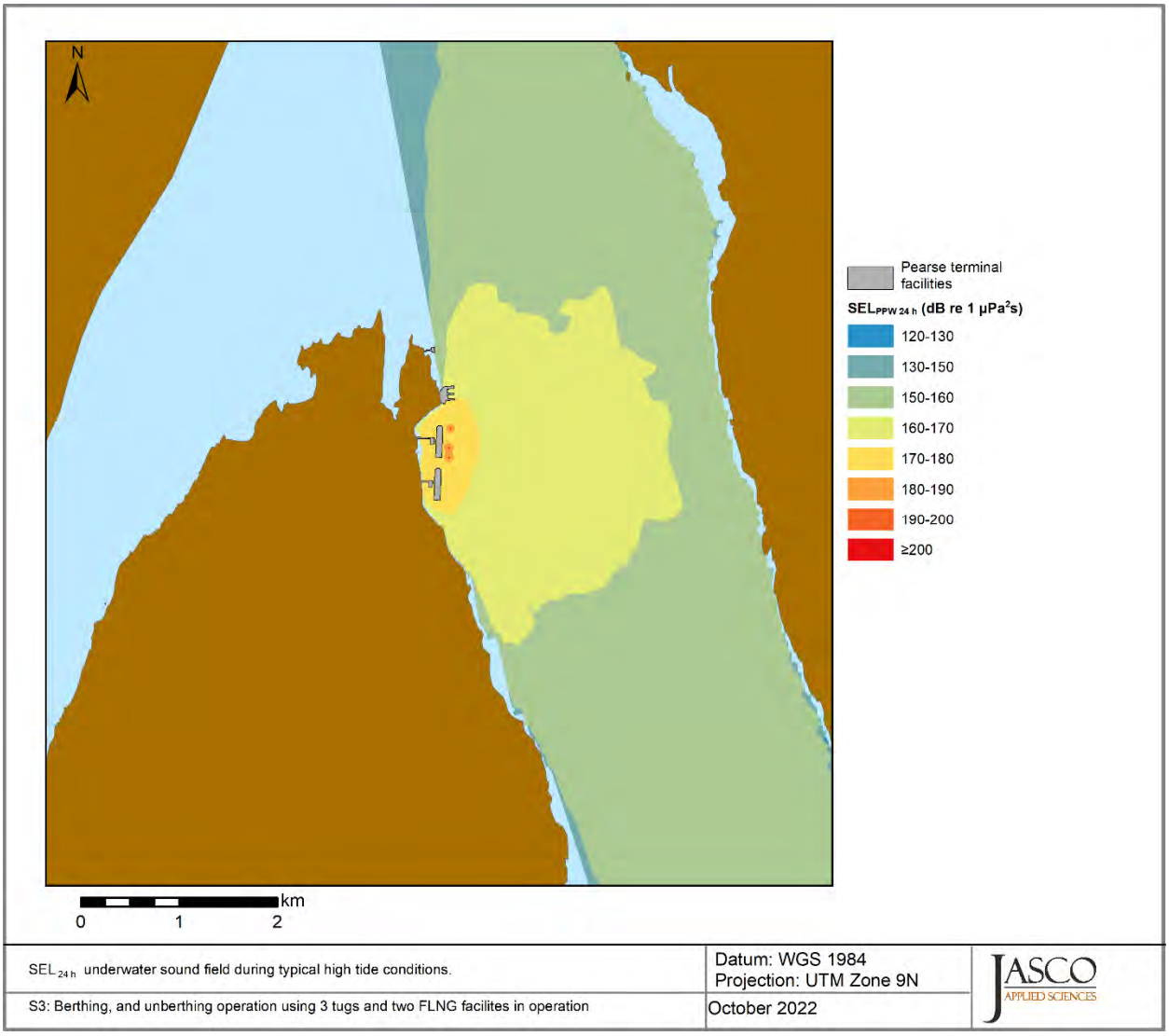


Figure D-25. PPW, Berthing and Unberthing: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.3.6. Otariid Pinniped in Water (OPW) SEL_{24h}

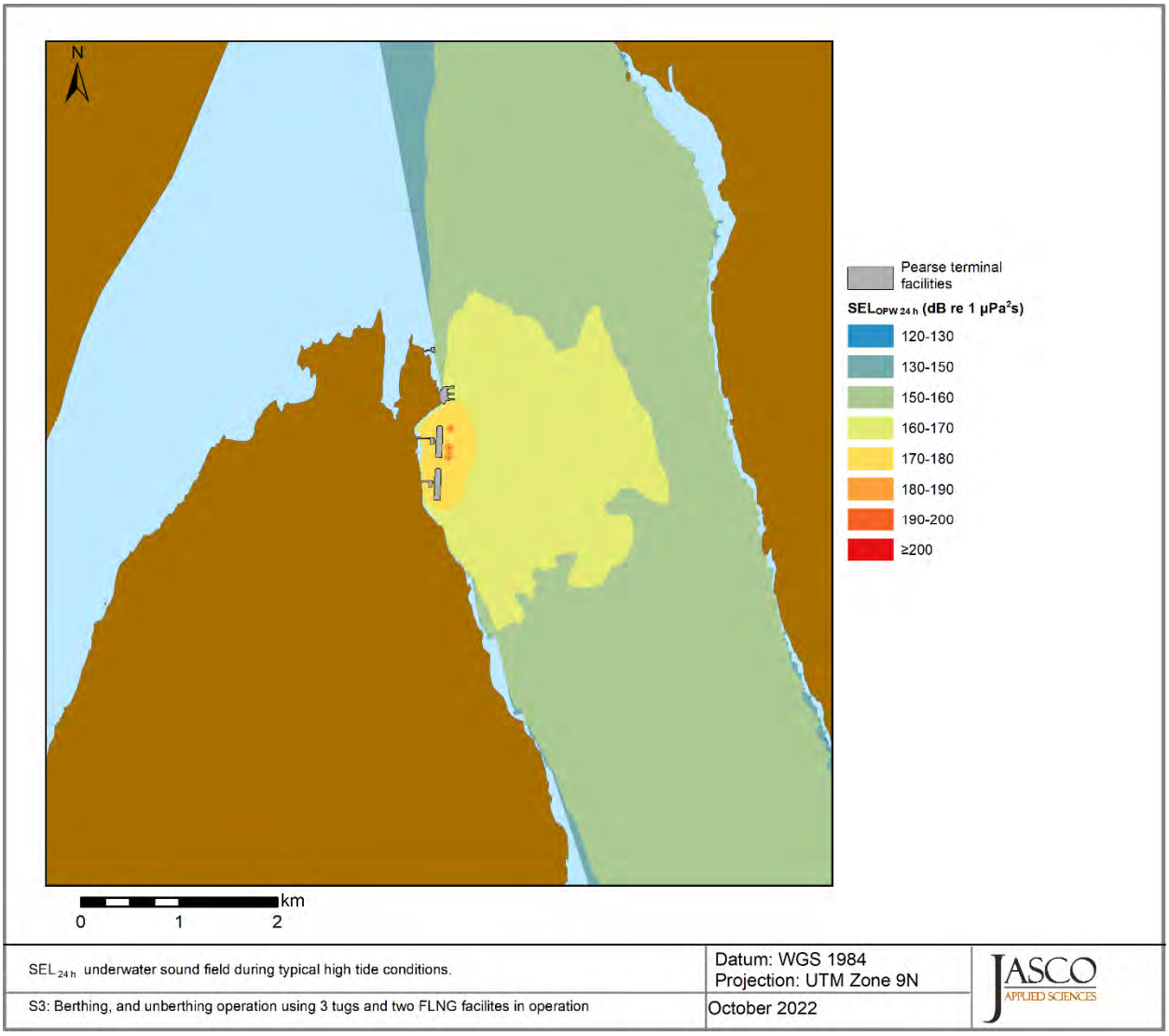


Figure D-26. OPW, Berthing and Unberthing: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.4. Scenario 4: LNGC and Tug Transiting

D.4.1. FLAT SEL_{24h}

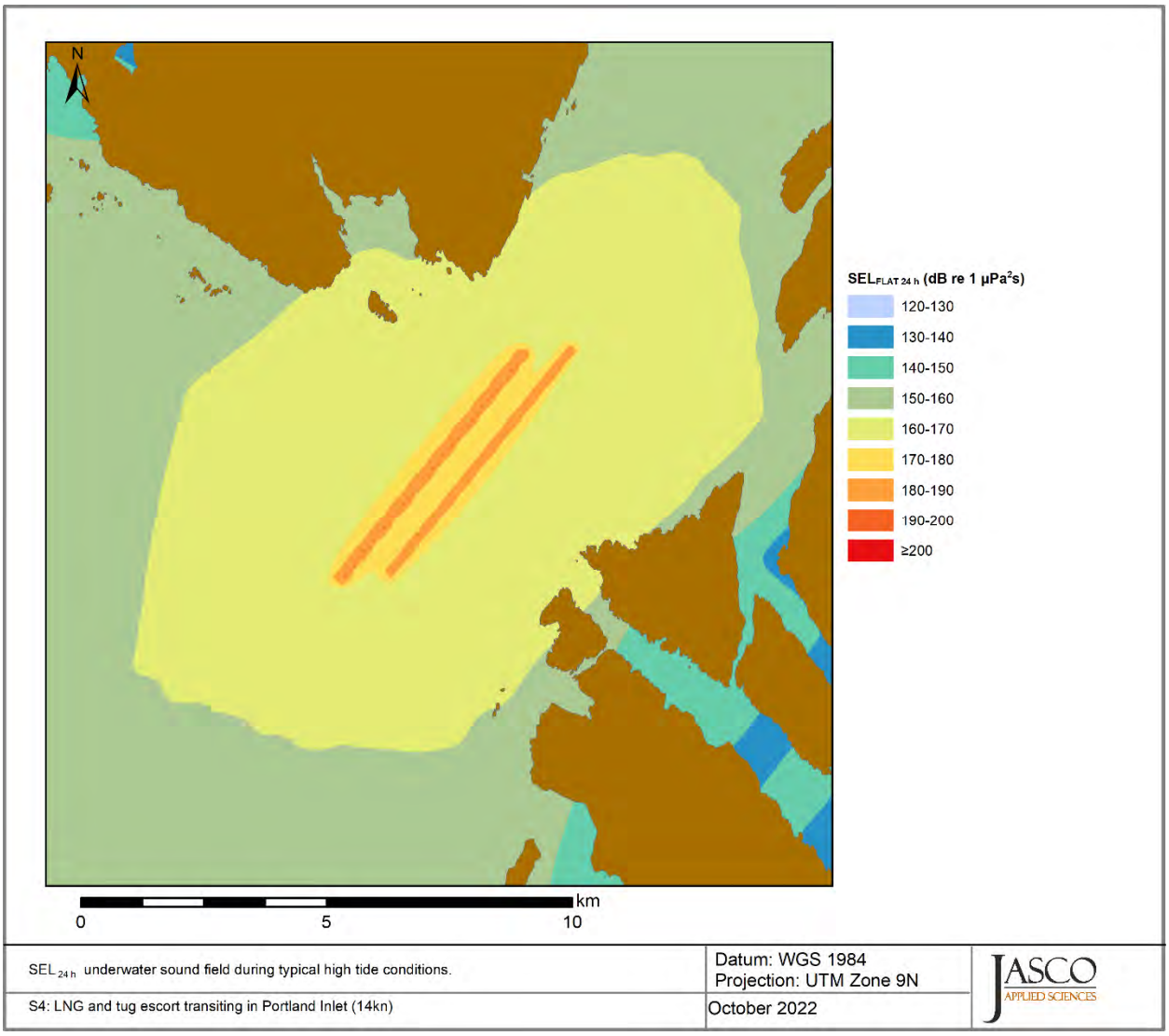


Figure D-27. FLAT, LNGC and Tug Transiting: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.4.2. Low-frequency Cetacean (LFC) SEL_{24h}

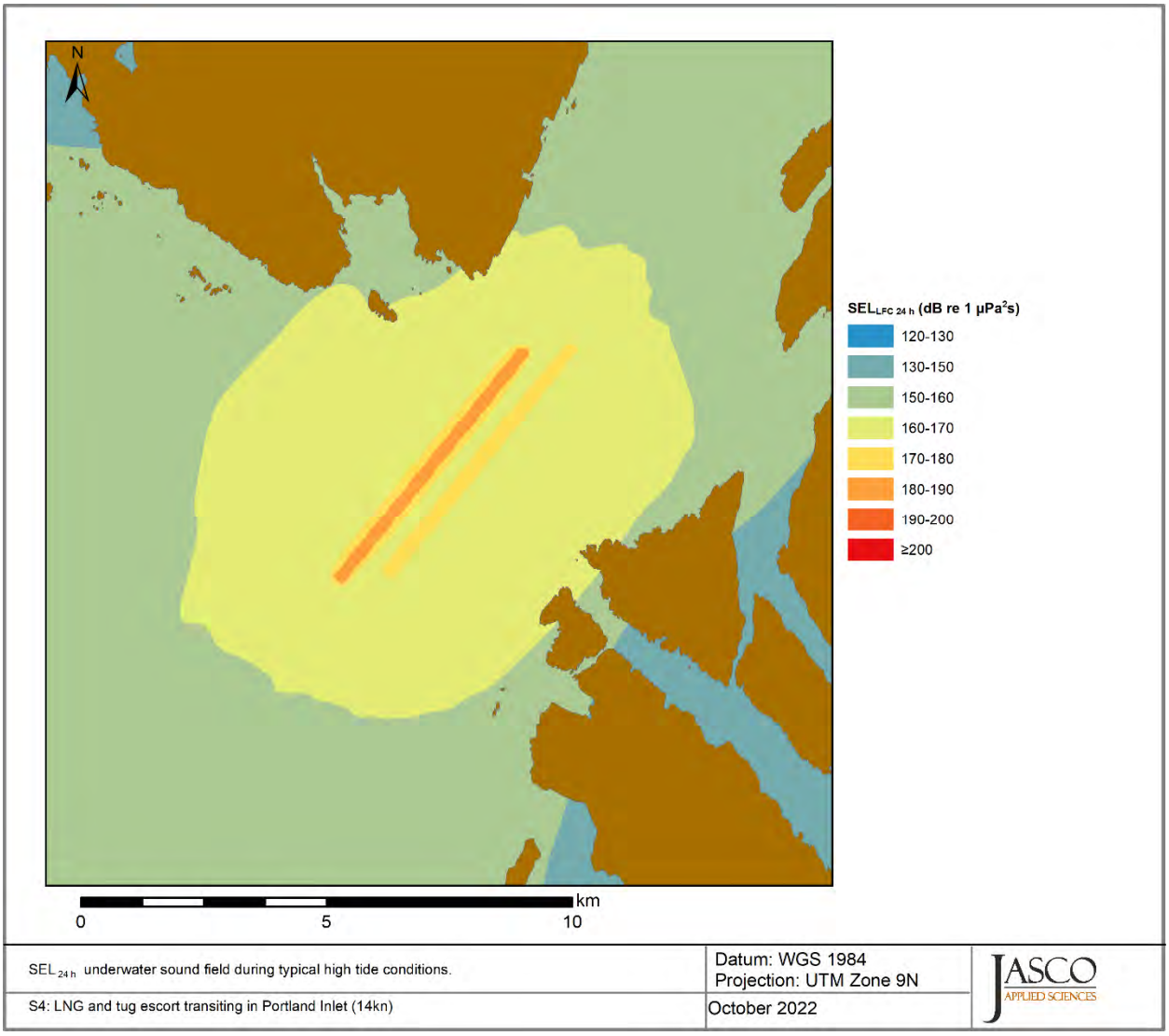


Figure D-28. LFC, LNGC and Tug Transiting: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.4.3. Mid-frequency Cetacean (MFC) SEL_{24h}

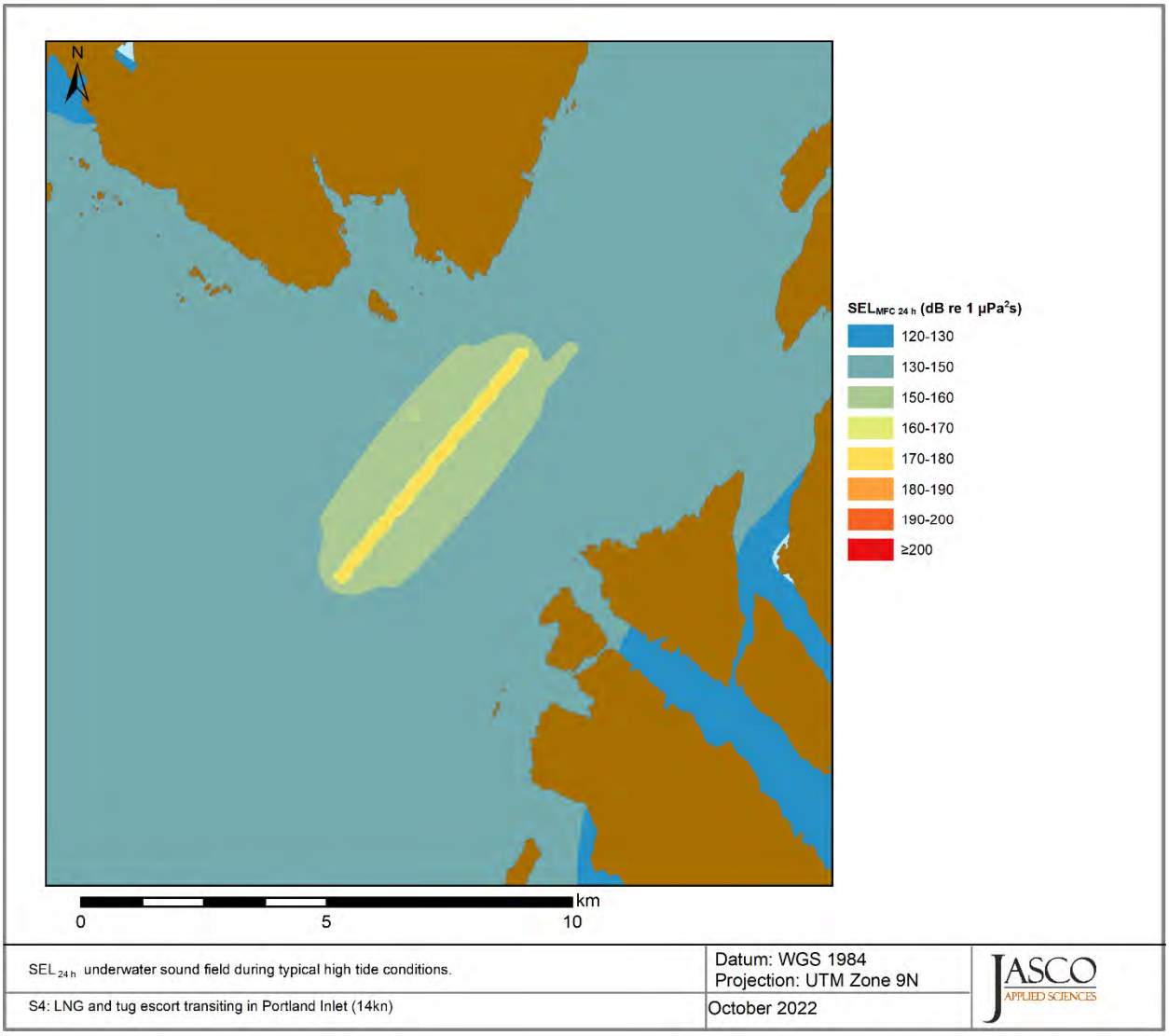


Figure D-29. MFC, LNGC and Tug Transiting: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.4.4. High-frequency Cetacean (HFC) SEL_{24h}

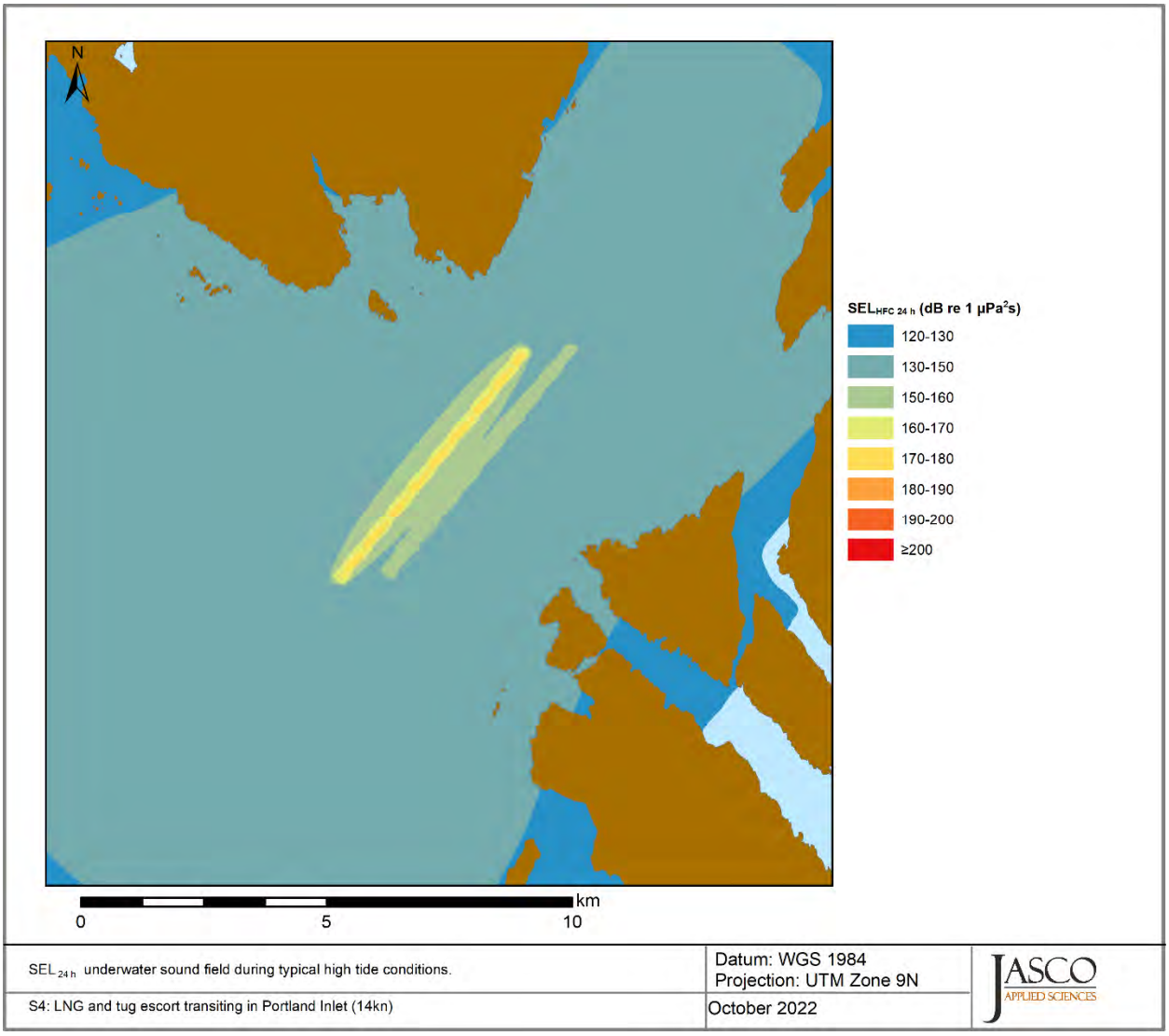


Figure D-30. HFC, LNGC and Tug Transiting: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.4.5. Phocid Pinniped in Water (PPW) SEL_{24h}

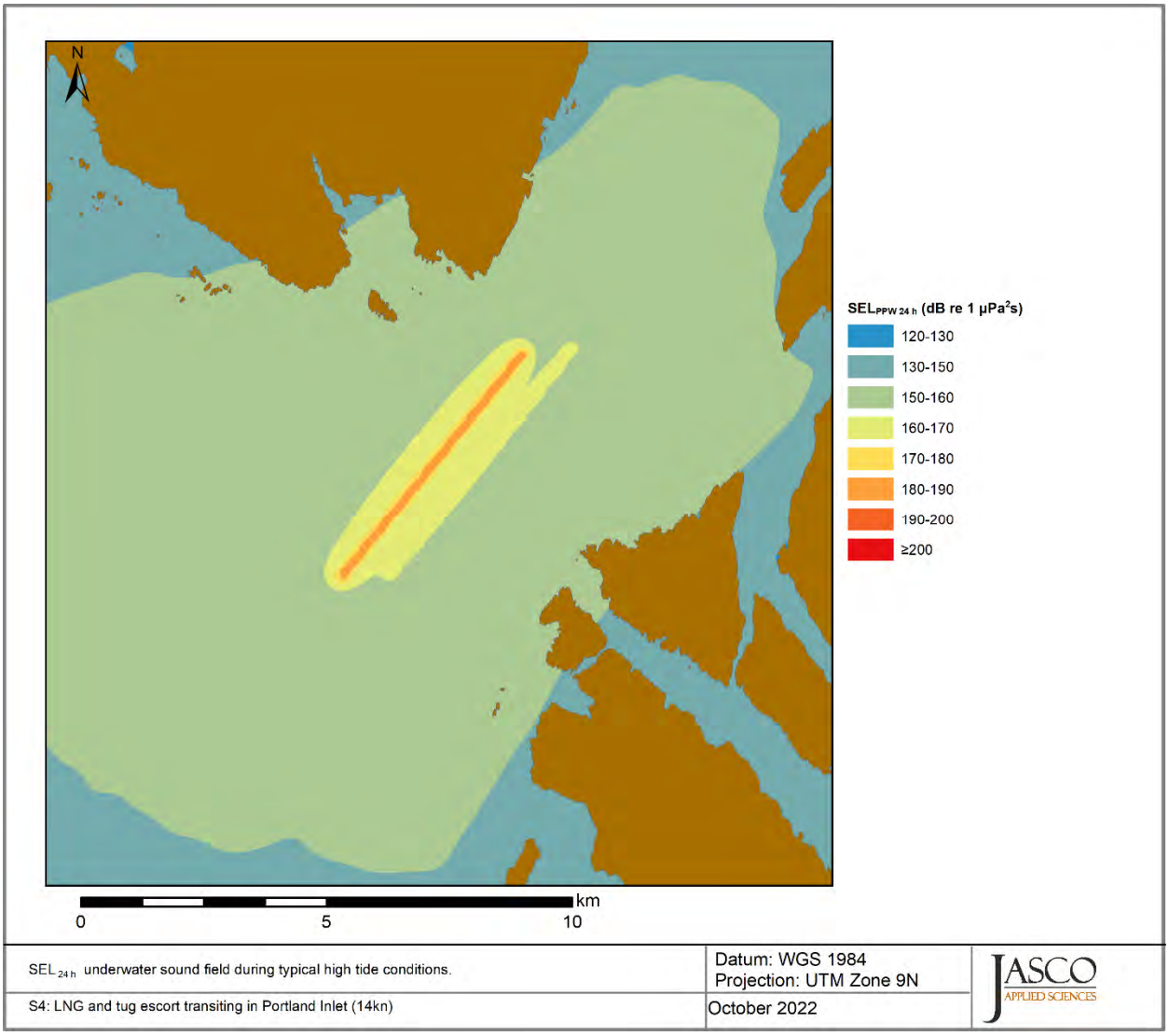


Figure D-31. PPW, LNGC and Tug Transiting: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.4.6. Otariid Pinniped in Water (OPW) SEL_{24h}

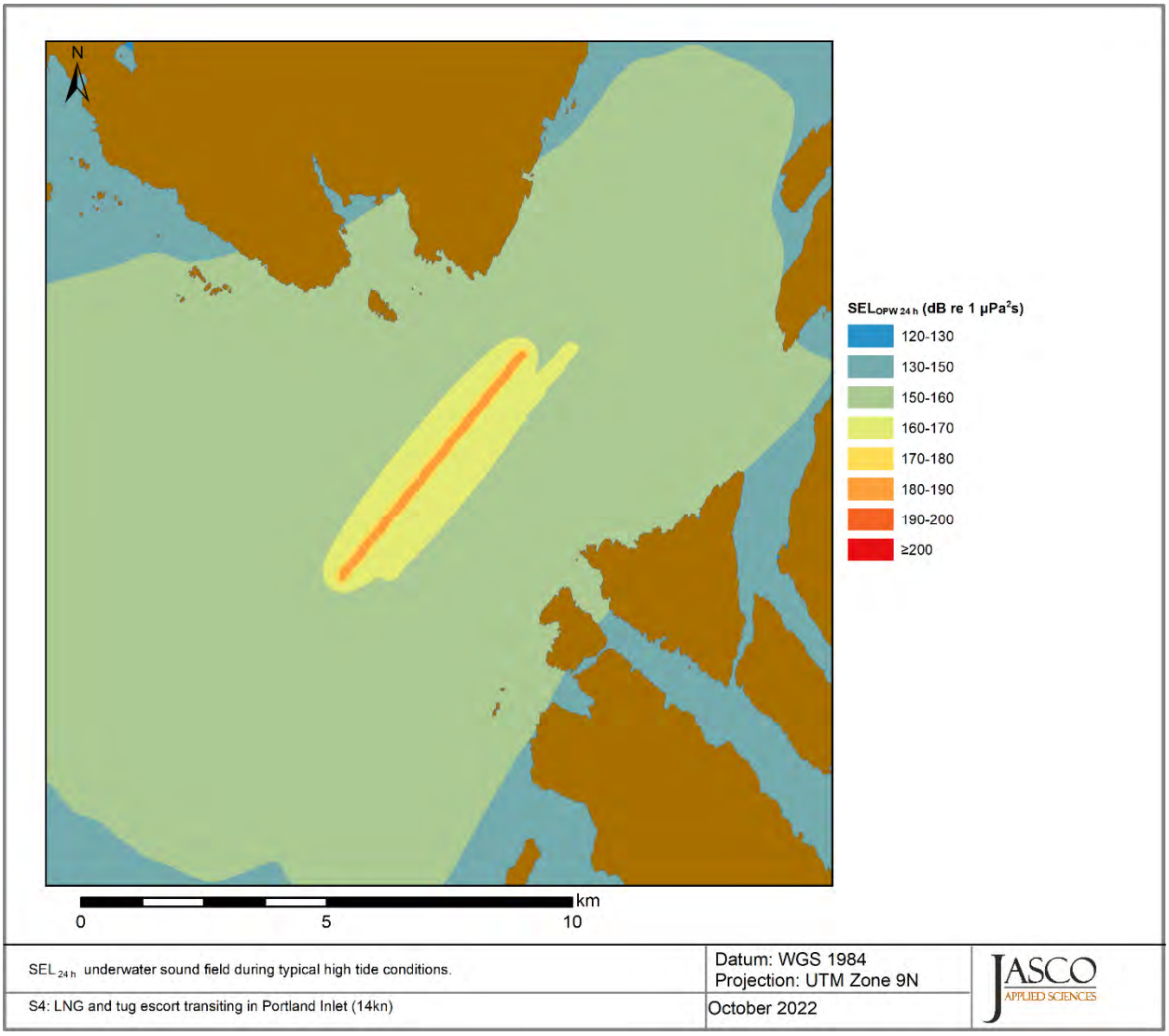


Figure D-32. OPW, LNGC and Tug Transiting: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.5. Scenario 5: LNGC Transiting

D.5.1. FLAT SEL_{24h}

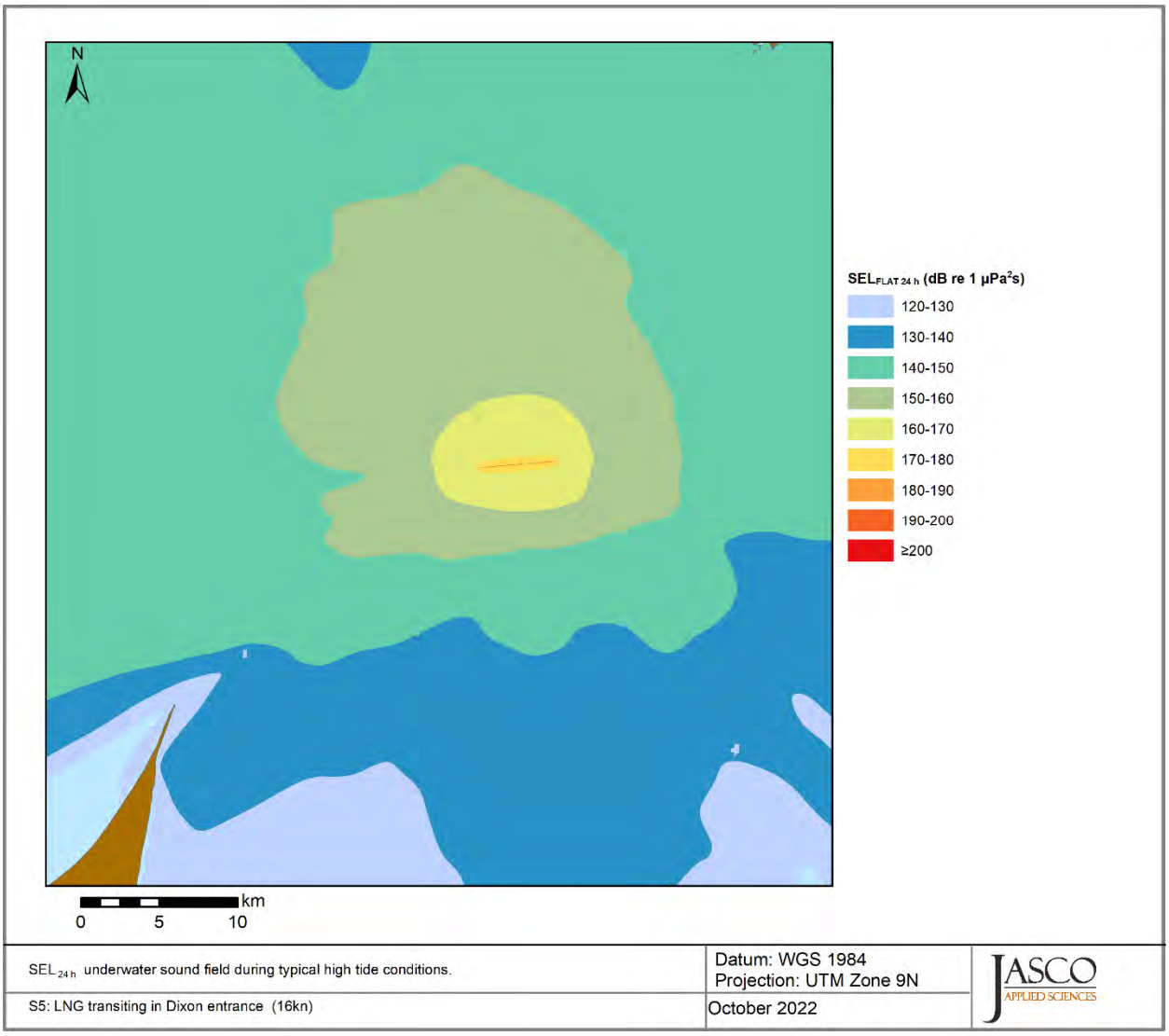


Figure D-33. FLAT, LNGC Transiting: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.5.2. Low-frequency Cetacean (LFC) SEL_{24h}

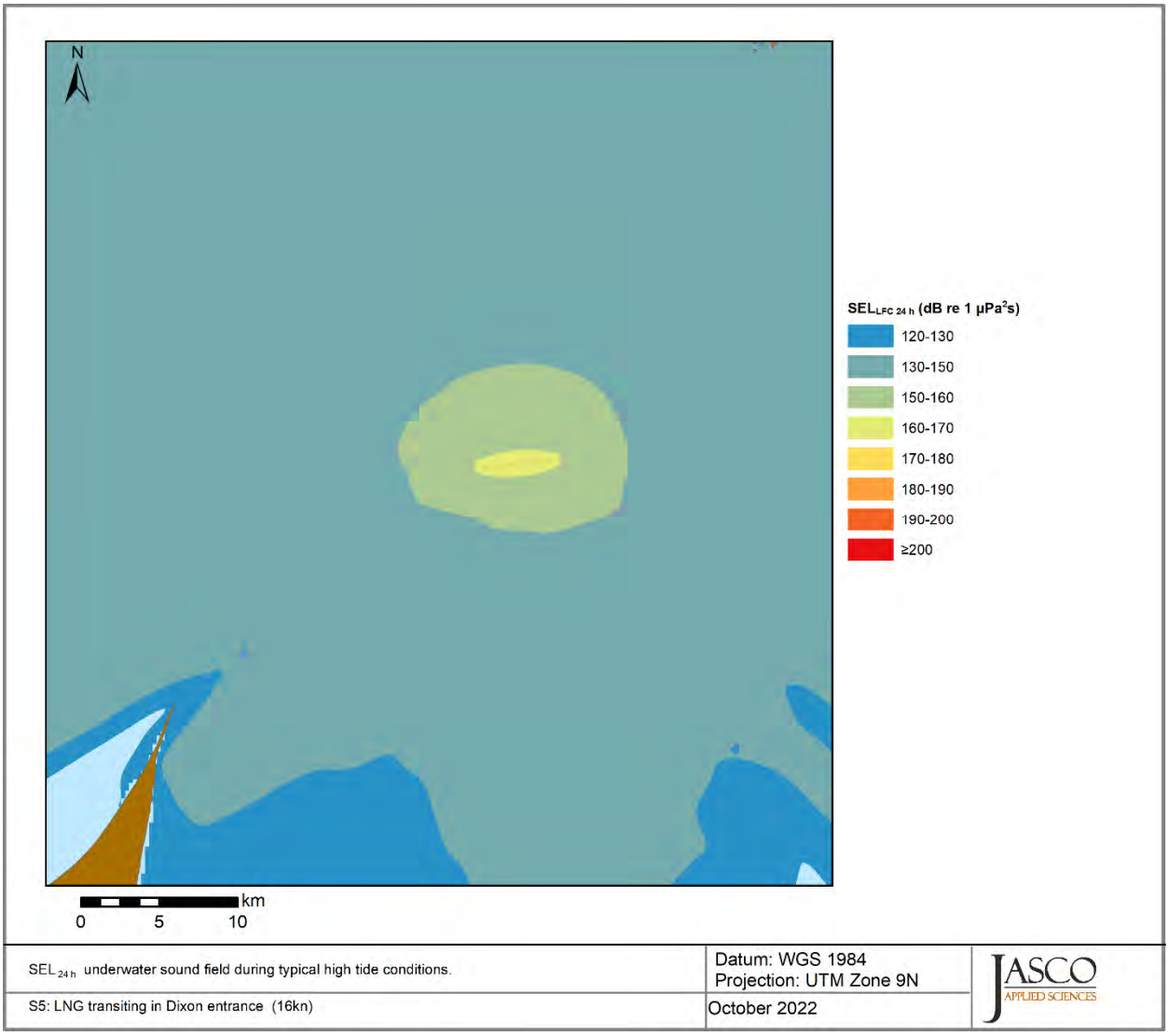


Figure D-34. LFC, LNGC Transiting: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.5.3. Mid-frequency Cetacean (MFC) SEL_{24h}

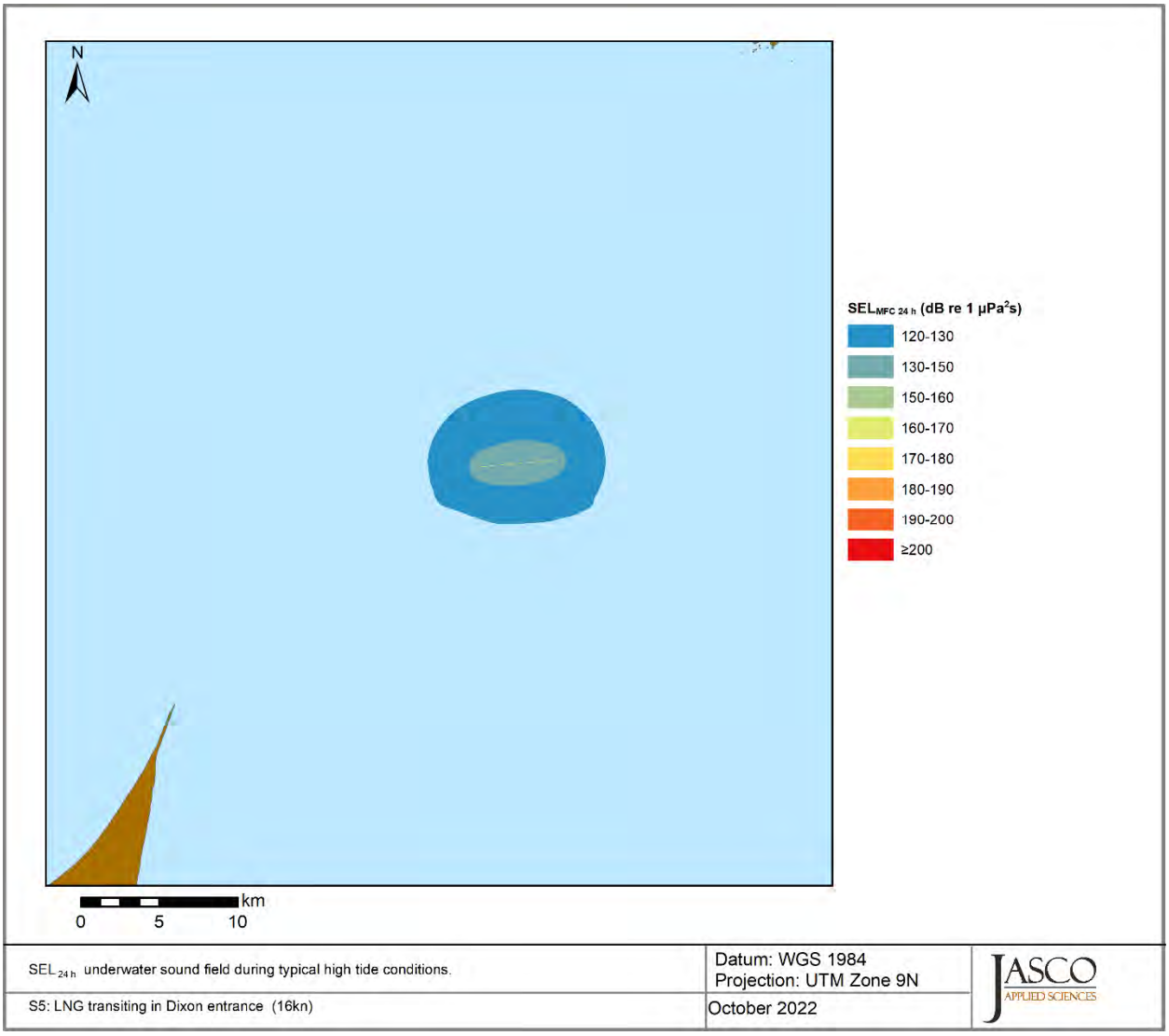


Figure D-35. MFC, LNGC Transiting: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.5.4. High-frequency Cetacean (HFC) SEL_{24h}

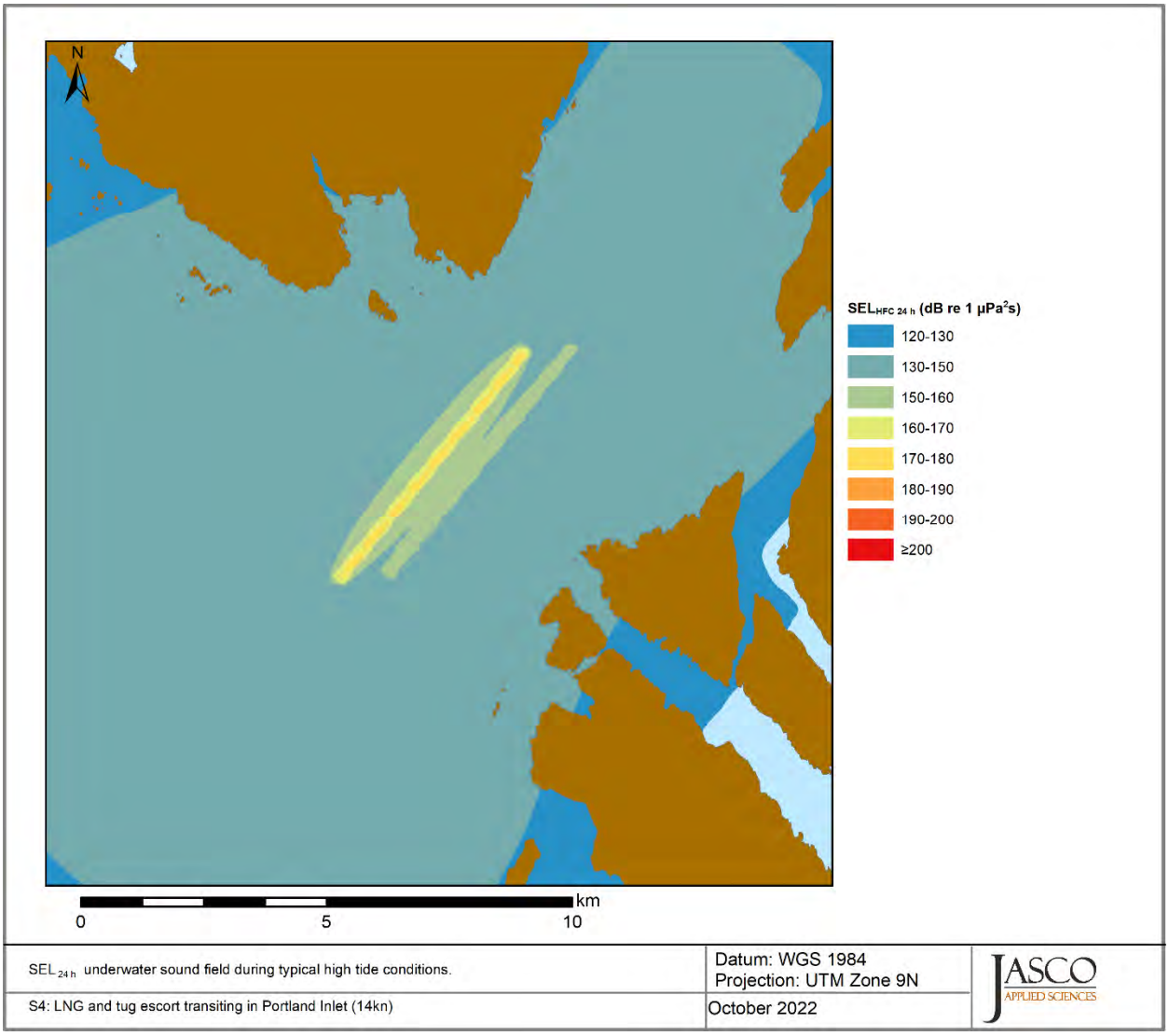


Figure D-36. HFC, LNGC Transiting: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.5.5. Phocid Pinniped in Water (PPW) SEL_{24h}

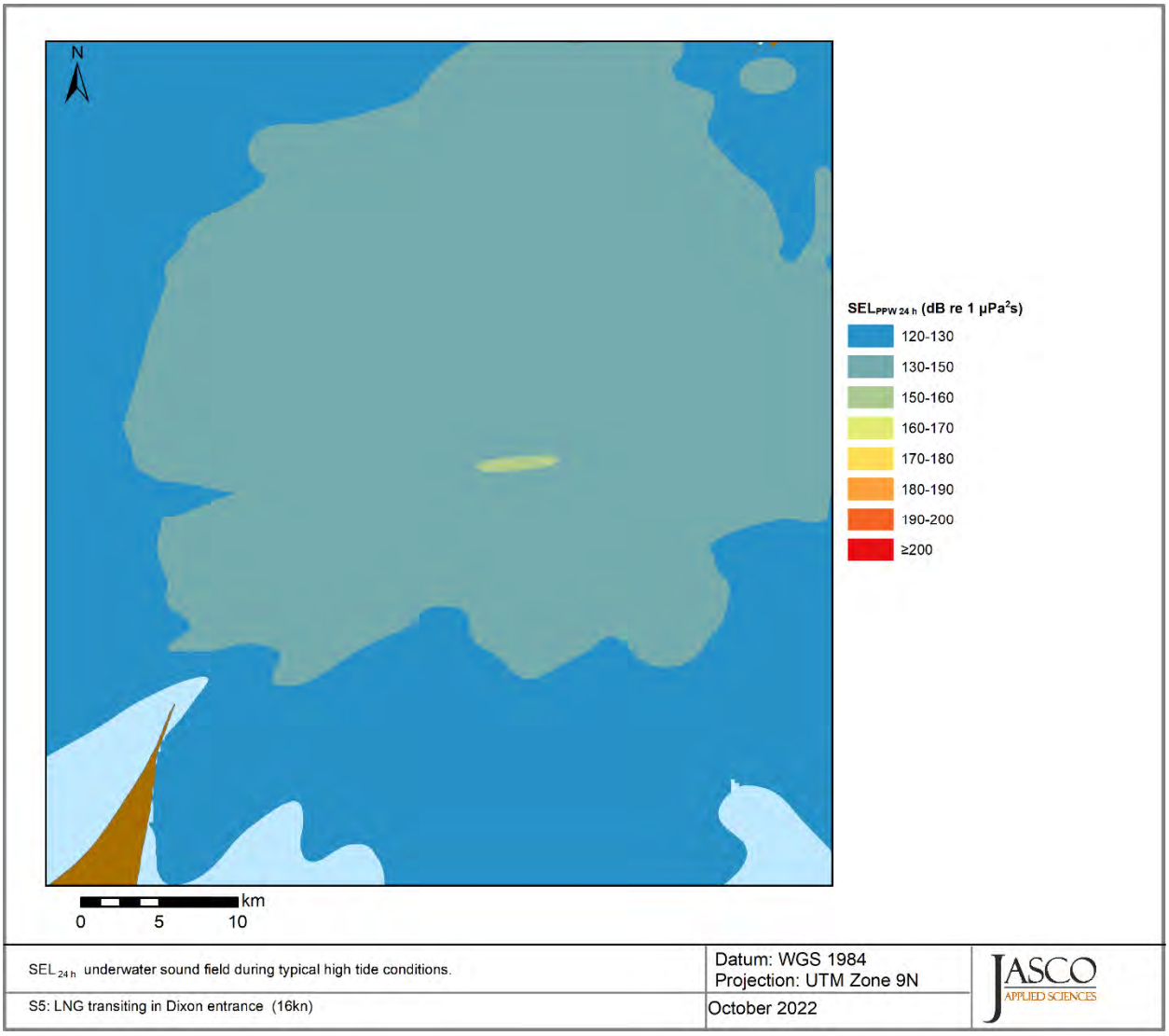


Figure D-37. PPW, LNGC Transiting: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).

D.5.6. Otariid Pinniped in Water (OPW) SEL_{24h}

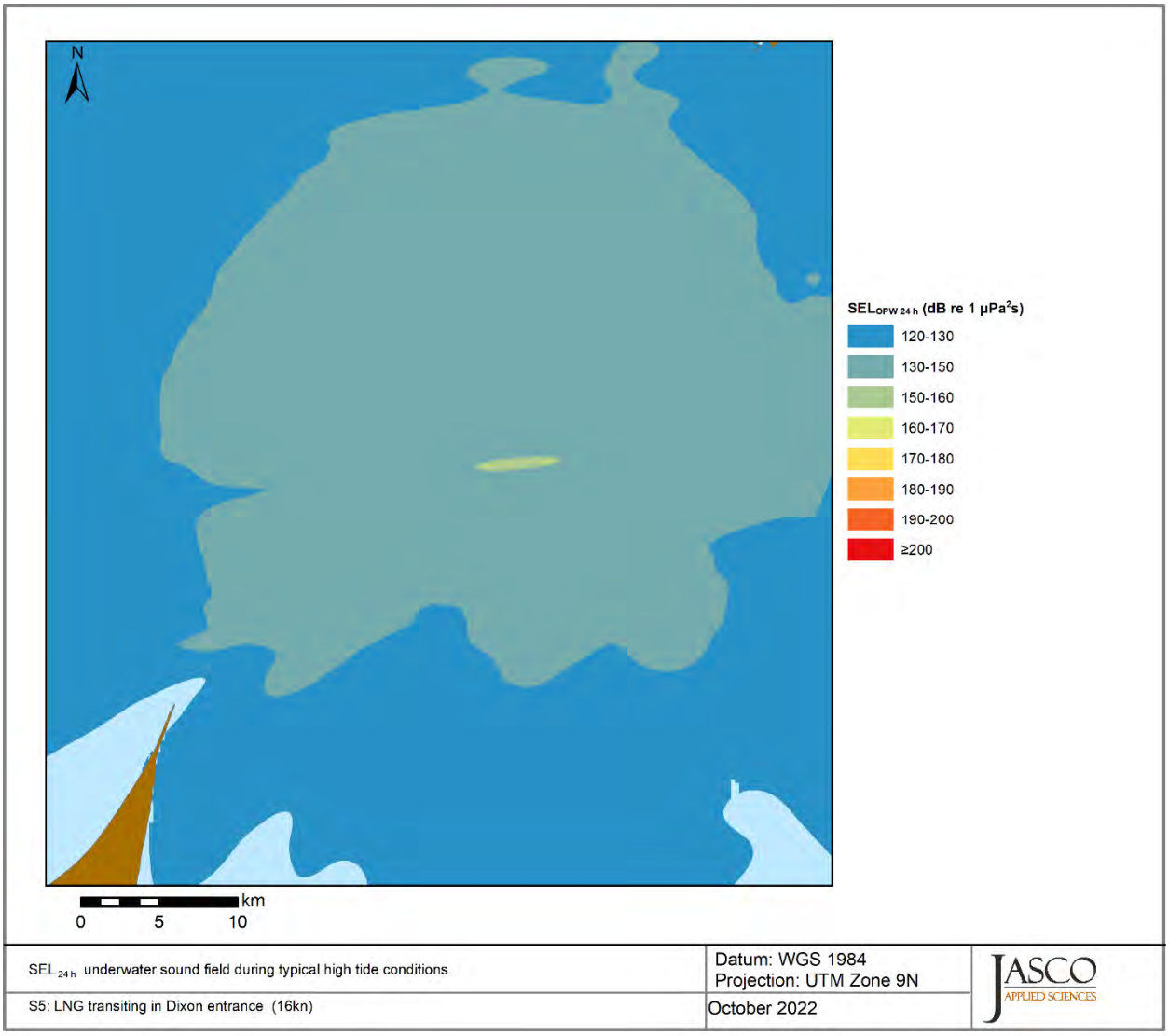


Figure D-38. OPW, LNGC Transiting: Modelled frequency-weighted 24 h sound exposure level (SEL_{24h}) field from pile installation operation, regular spaced threshold levels (120–200 dB).