



January 19, 2018

## CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

### BURRARD INLET PIPELINE REMOVAL PROJECT 2225 IOCO ROAD, PORT MOODY, BC

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## 1.0 OVERVIEW

This Construction Environmental Management Plan (CEMP) for the Burrard Inlet Pipeline Removal (BIPR) Project, has been prepared for Imperial Oil Limited (Imperial) by Golder Associates Ltd. (Golder), to support Imperial's regulatory agency applications and First Nations and stakeholder engagement. This document, prepared as part of the preconstruction planning activities, is intended to provide public notification level summary of activities and execution details, for regulatory agency and general public distribution. This CEMP has been developed in accordance with Port of Vancouver (PV) Project and Environmental Review Guidelines for CEMPs (issued July 2015). The regulatory agencies receiving this CEMP are:

- Port of Vancouver (PV) for a Category C Project and Environmental Review (File Ref. PER 17-091; formerly PP 2014-002);
- Environment and Climate Change Canada (ECCC), Disposal at Sea (DAS) Program (DAS Permit File Ref. 4543-2-03672);
- Transport Canada (TC), Navigation Protection Program (Notice of Project Application File Ref. #1955-500034 [8200-5694]); and
- British Columbia Oil & Gas Commission (BC OGC).

The CEMP is intended to provide Environmental Specifications for the Burrard Inlet Pipeline Removal (BIPR) Project in Burrard Inlet (the Project). The CEMP identifies potential environmental effects and mitigation measures for proposed Project activities.

The main environmental issues regarding this Project are the potential impacts to local habitats and aquatic life (marine birds, fish) as a result of dredging, barge access/anchoring requirements, and Project activities. These activities may result in potential effects to the surrounding marine environment from increased levels of noise or vibrations or accidental spills of deleterious substances, such as dredging fluids, diesel fuel, or petroleum-based lubricants. Mitigations are proposed for each of the issues following commonly-accepted best practices.

This CEMP is intended to be read in conjunction with applicable environmental approvals, authorizations, and permits, as well as contract requirements for the Project.

## 2.0 PROJECT INFORMATION

### 2.1 Project Location

The project comprises the removal of two sections of decommissioned Imperial product pipelines buried beneath sediment in Burrard Inlet, near Port Moody, BC, in the immediate vicinity northeast of Reed Point Marina. The geographical coordinates at the projects approximate centre are 5460130 m N, 508930 m E (UTM coordinates Zone 10 NAD83) and almost extends to the Burrard Inlet foreshore along the south side of the project. Figure 1 below illustrates the Project location.

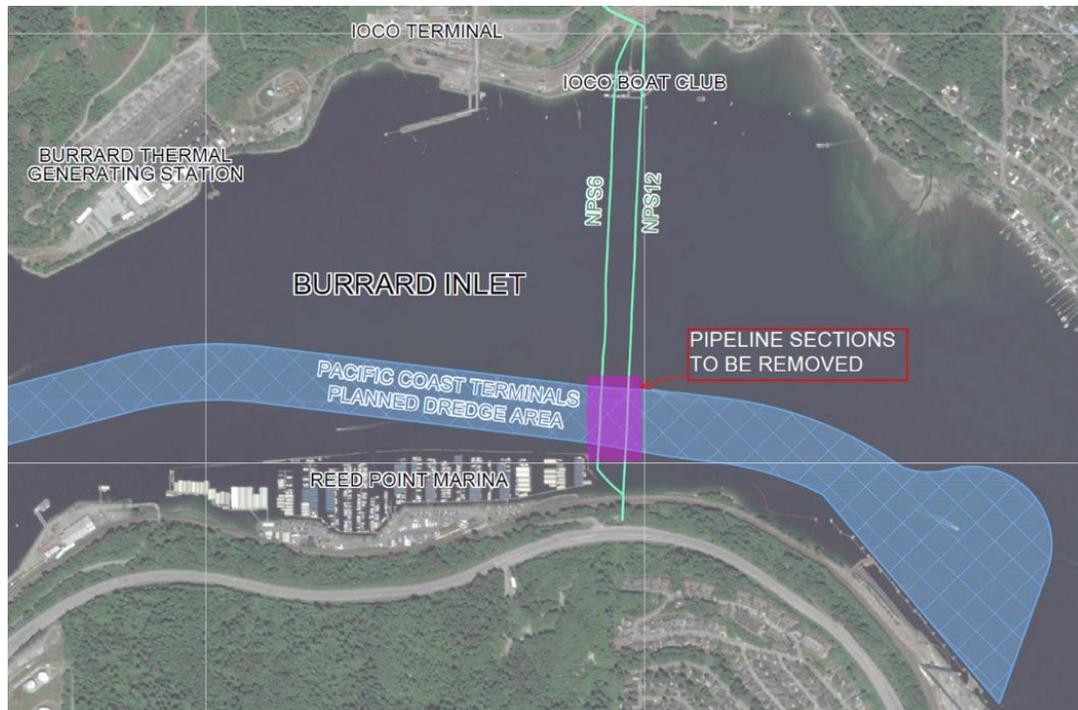


FIGURE 1: Imperial's Burrard Inlet Pipeline Removal (BIPR) Project – Site Plan

## 2.2 Site Description

The Project Site is in the subtidal marine environment in the Port Moody Arm of Burrard Inlet. Burrard Inlet, a tidal body of water, has been described as a narrow deep water fjord in which tides transport silt into the Port Moody Arm to be deposited on the mudflats located at the east end of the Arm. Previous underwater observations by Golder show that the Project Site is dominated by soft bottom sediments which is consistent with what has been previously reported for the area.

The project is located within a Port of Vancouver (PV) lease for right of way, (VFPA Lease Plan 2002-117). The sections of pipeline for removal are located in and beyond an active navigation channel. Following pipeline removal, PCT has proposed undertaking a capital dredging project, to extend and deepen the existing navigation channel.

## 2.3 Project Description

Imperial and Golder will be completing marine construction work to remove sections of two defunct Imperial pipelines buried beneath sediment in Burrard Inlet, northeast of Reed Point Marina, near Port Moody, BC. The two pipelines are buried under the seabed of Burrard Inlet from the IOCO Yacht Club to the north, and to the foreshore immediately east of Reed Point Marina to the south. They run parallel across the inlet, laterally offset approximately 60 m from each other, and are designated NPS6 to the west and NPS12 to the east. The pipeline removal is required to facilitate a capital dredging project by a third party (Pacific Coast Terminals (PCT)) to extend and deepen the navigational channel. PCT's capital dredging project is being done independent of this application.

The sections of pipeline for removal extend past the limits of the proposed future extended navigational channel into a safety zone mandated by the Port (approximately 5 m length to the south and 50 m north of the navigation channel). The total length of pipeline to be removed is approximately 220 m of each pipeline. The pipes will be removed to achieve a final navigation channel depth of El.-13.5 mCD ( $\pm 0.5$  m) (Chart Datum elevation), prior to PCT's capital dredging project. In the sections for removal, the pipelines are estimated to be overlain by between 2.6 and 3.3 m of typically fine-grained and loosely consolidated marine sediment. The limits of the sections to be removed are identified in Table 1.

**Table 1 – Pipe Removal Details**

Pipeline	Pipeline Removal Chainage <sup>(a)</sup>		Pipeline Removal UTM Coordinates <sup>(a)</sup>		Total Length (m)
	South	North	South	North	
NPS6	0+183	0+400	N: 5460025 E: 508895	N: 5460240 E: 508905	215
NPS12	0+157	0+365	N: 5460025 E: 508957	N: 5460233 E: 508967	208

The pipe removal work will be scheduled during the least risk timing window for the protection of fish and fish habitat, which occurs from August 16 to February 28. The work will be completed from a single marine construction barge set-up, comprised of a derrick and crane, with support scows towed in and out as required adjacent to the derrick, and ancillary support and personnel vessels. Divers will be used for some underwater operations. The project will be completed in two phases, with the following phased approach:

**PHASE A: PAH Impacted Sediment Removal:**

- Clam shell dredging to remove approximately 1000 cubic metres (m<sup>3</sup>) of PAH impacted sediment, in a zone extending approximately 2000 square metres (m<sup>2</sup>) plan area, dredged to an extent of up to 0.5 metres (m) depth below existing seabed.
- Disposal of dredged impacted sediment at upland regulated landfill facility.
- Confirmatory sediment sampling and lab testing program following impacted sediment removal, to proceed with Phase B works under ECCC DAS Permit

**PHASE B: Dredging and Pipeline Removal:**

- Dredging sediment at the north and south end of each pipe at the limits for removal to expose pipeline and perform cuts and to isolate pipeline sections for removal.
- Complete main “isolation cuts” at each end of the pipe, and cap and bury remaining pipe stubs for abandonment, in accordance with BC OGC requirements, generally Canadian Standard CSA Z662 *Abandonment of Piping*.
- Dredge removal of marine sediment overburden along the pipe alignment to expose pipe trench. Dredged sediment will be side cast from clam shell bucket and distributed across the seafloor away from the trench work zone, in a manner which will not impact navigational draft

conditions of the channel and reduce side cast distribution area for coverage of the existing seabed.

- Underwater cutting of the exposed pipe on the seabed by divers into manageable, approximately 20 m, sections for removal to surface.
- Lifting cut sections of pipe to surface and loading onto material scows for appropriate upland transport and disposal.

## 2.4 Project Schedule

The two phases of the project are anticipated to be undertaken over the following time windows (Table 2). Work will only occur during daytime hours (anticipated from 07:00 to 19:00). Upon completion of the daily work, the marine equipment will be removed from the immediate project area and tied up for the night in the vicinity but away from the active navigation channel.

**Table 2 – Proposed Project Schedule**

Project Phase	Estimated Duration	Proposed Dates
PHASE A: Impacted Sediment Removal	5-10 Days	31 January – 15 February 2018
PHASE B: Dredging and Pipeline Removal	4-6 Weeks	16 August 2018 – 28 February 2019 (Timing is subject to receipt of Environment Canada Disposal at Sea Permit following completion of Phase A as scheduled)

## 2.5 Proposed Marine Construction Equipment

A detailed methodology is provided in the Marine Construction and Staging Plan, but in brief, the proposed methodology for pipe removal adopts an expose, cut and lift procedure. Barge-mounted cranes are required to complete a number of key activities, including supporting the isolation cuts component, removing sediments and also lifting cut pieces of pipe to the surface for disposal.

The Contractors' Equipment currently proposed for the Project are as follows:

- Marine Working Platform to support personnel and diving operation:
  - 200 ton capacity clamshell derrick or similar; and
  - Assist tug boat and work skiffs / boats.
- Sediment Removal for upland disposal:
  - 200 ton capacity clamshell derrick or similar;
  - 1,600 ton spoil scow or similar (sealed for upland disposal);
  - Turbidity curtain / containment system; and
  - Assist tug boat and work skiffs / boats.

- Sediment Removal for disposal at sea (side cast):
  - 200 ton capacity clamshell derrick or similar; and
  - Assist tug boat and work skiffs / boats.
- Underwater Pipe Flooding and Cutting Operations:
  - Hand-held underwater high pressure (HP) jetting system (diver operated) to clear sediment, if required;
  - Underwater Stanley Hydraulic Core Drill CD12;
  - BROCO Underwater Ultrathermic Cutting Rods;
  - 200 ton capacity clamshell derrick or similar;
  - 1,600 ton materials scow or similar; and
  - Assist tug boat and work skiffs / boats.

The pipeline removal work uses methods that can only be carried out with the use of specialized barge-mounted equipment. The barge will travel short distances within the navigation channel while dredging and lifting pipe sections. The barge will operate within the vicinity of the pipeline right of way, over the extents for the pipeline removal.

Prior to commencement of work, the Prime Contractor will inform the Harbour Master and provide a Notice for Mariners to be posted by the Canadian Coast Guard and the Canadian Hydrographic Services. It is considered that due to the width of Burrard Inlet there will be minimal effect on navigation. It may be required that other boating traffic near the work area reduce speed. A spotter will be present on the barge during all works that involve divers or equipment to be in the water. Marine equipment will operate with appropriate marks and lights in accordance with marine traffic and navigation protocols.

## 3.0 PROJECT CONTACTS

### 3.1 Key Project Personnel

Key project personnel are listed in Table 3.

**Table 3 – Key Project Personnel Contact List**

Name	Company	Role	Contact Cellphone & Email
Alistair Kirk	Imperial	Project Owner – Project Lead / Project Manager	(403) 710-6732 alistair.s.kirk@esso.ca
Blair McDonald	Golder	Owner's Agent – Permitting / Regulatory Consultant	(604) 626 5042 blair_mcdonald@golder.com
John Smith	Golder	Prime Contractor Marine Construction Lead	(778) 228-9265 john_smith@golder.com
Carol Yan	Golder	Project Manager	(604) 219-2660 carol_yan@golder.com

Name	Company	Role	Contact Cellphone & Email
Richard Walls	Golder	Construction Site Supervisor	(604) 345-1390 richard_walls@golder.com
Raveen Kang	Fraser River Pile & Dredge (FRPD)	Marine Construction Sub-contractor (Project Manager)	(604) 619-8221 rkang@frpd.com
Ted Hill	Hydra Marine Services Inc.	Diving Sub-contractor Supervisor	(604) 785-1760 tedhill@shaw.ca
Michelle Spani	Golder	Environmental Lead – Qualified Environmental Professional	(250) 704-9841 michelle_spani@golder.com
Trish Tomliens	Golder	Environmental Monitor(s)	(250) 818-0403 patricia_tomliens@golder.com
Darryl Person	BC Oil & Gas Commission	BC OGC Contact	(250) 638-6406 Darryl.Person@BCOGC.ca
Marianne Gilbert	Port of Vancouver	Project Review contact	(604) 679-2442 Marianne.Gilbert@portvancouver.com
Rebecca Seifert	Environment and Climate Change Canada	Environment and Climate Change Canada Disposal at Sea Permit contact	(604) 666-5566 Rebecca.Seifert@canada.ca
John Mackie	Transport Canada	Transport Canada Navigation Protection Program Contact	John.Mackie@tc.gc.ca

## 3.2 Applicant/Contractor Responsibilities

This section describes the roles and responsibilities of Imperial, the EM, and the Contractor for implementing, inspecting, and reporting on the effectiveness of the environmental mitigation measures.

### 3.2.1 Project Applicant / Owner – Imperial

The Project Applicant / Owner will be responsible for the actions of its agents, employees, and subcontractors, and thus will undertake all reasonable actions to have environmental protection measures in place and working effectively throughout the Project Area. The Project Owner will:

- Obtain the necessary regulatory authorizations, approvals and permits, required to undertake the project.
- Consult with potentially impacted First Nations parties, and identified project stakeholders.
- Retain an appropriately qualified and experienced Prime Contractor to complete the Project.
- Retain an appropriate Qualified Environmental Professional (QEP) to be the Project environmental monitor and confirm that environmental management measures and controls are implemented in accordance with regulatory approvals, authorizations, permits, and environmental components of the contract.

- Comply with regulatory and permitting close-out requirements following work completion.

### 3.2.2 Prime Contractor – Golder

The Prime Contractor will be responsible for the actions of its agents, employees, and subcontractors, and thus will undertake all reasonable actions to have environmental protection measures in place and working effectively throughout the Project Area. The Prime Contractor will:

- Adhere to requirements set out in regulatory authorizations, approvals and permits, and contract requirements, as summarized in this Plan.
- Maintain effective communication with regulatory agencies, the Port and relevant stakeholders (such as First Nations) with respect to specific timing of activities. This will specifically include informing First Nations about the timing of in-water activities and barge transits.
- Develop and implement a Construction Environmental Monitoring Program, in accordance with the requirements of this Plan, based on the roles and responsibilities of the Prime Contractor and their designated Qualified Environmental Professional (QEP) and Environmental Monitoring personnel.
- Undertake effective communication with work crews and subcontractors such that environmental responsibilities and requirements are understood prior to the commencement of work, and are implemented during the work. This will include disseminating information from orientation and other meetings to personnel not in attendance at those meetings.
- Use equipment and implement work procedures and controls to prevent and/or reduce work-related disturbance to environmental, social, heritage, archaeological, and cultural resources.
- Take preventative and corrective measures in response to non-conformance with regulatory permits and approvals that the contract requires including this Plan.
- Respond appropriately to emergencies and incidents as they arise or are identified.

### 3.2.3 Qualified Environmental Professional and Environmental Monitors – Golder

Implementation of the Construction Environmental Monitoring Program, comprising on-site environmental monitoring and regular environmental compliance reporting, will be undertaken by Qualified Environmental Professional (QEP) and qualified Environmental Monitors (EM) for the duration of the Project. The QEP and EM(s) have authority to temporarily halt work activities to meet their regulatory obligations until appropriate mitigation has been implemented. A written confirmation of this authority will be provided to all members of the Golder project team and maintained on site as part of the project communication plan (i.e., it is part of the project health, safety, security and environment plan).

Preparation and oversight of the Monitoring Program will be the responsibility of the QEP. Full-time field activities monitoring will be undertaken by the EMs, with oversight by the QEP.

- The QEP participated in the development of the Construction Environmental Monitoring Plan and will be responsible for implementing the Construction Environmental Monitoring Plan, in coordination with the Prime Contractor.
- The QEP will independently report on the Contractors' performance and compliance with environmental control strategies and mitigation measures specified in this CEMP along with the terms and conditions to be specified by all applicable legislation, guidelines and best management practices. Specifically, the QEP will report to, and advise the appropriate regulatory agencies, Project Owner, and Prime Contractor on all non-conformances, difficulties encountered, how they were managed, and effectiveness of mitigation measures being implemented.
- The QEP will provide regular environmental reporting in accordance with the reporting requirements of the Monitoring Plan.
- The EM will report to the QEP on all non-conformances in the form of Incident Reports, and describe how they were managed/resolved, and effectiveness of mitigation measures being implemented.
- The EM will prepare daily summary reports, provided to the QEP, which will document the construction activities, effectiveness of mitigation measures, incidents, non-compliant events, corrective action recommendations taken and photograph documentation. The daily summary report template is provided in Appendix A.
- The EM will help identify and resolve potential problems through effective communication with the Contractor(s), Owner, and, where appropriate, regulatory agencies and key stakeholders.

The EM will also complete and report on the follow tasks:

- Attend pre-mobilization kick-off meeting and regular daily kick-off meetings to review the CEMP, and to convey the environmental sensitivities and environmental requirements of the work to the Prime Contractor and contractors' personnel.
- Provide recommendations to the Prime Contractor's site supervisor and related contractors for installing, maintaining, and/or improving mitigation measures, as necessary.
- Monitor for any signs of distress or injury to fish<sup>1</sup>, or damage to fish habitat, for aggregations of fish and for spawning behaviour. The EM will advise and recommend measures as necessary to mitigate potential disturbance to fish, as required, during dredging and mobilization between the work locations.
- Evaluate potential for the presence of marine mammals in the vicinity of the dredging barge operations as required, to comply with Section 7 of the Marine Mammal Regulations, which prohibits the disturbance of marine mammals. The EM will advise and recommend measures

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<sup>1</sup> Fish, as defined by DFO under the *Fisheries Act*, includes fish, shellfish, crustaceans, marine mammals and any other marine animals, or the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans, or other marine animals.

as necessary to mitigate potential disturbance to marine mammals, as required, during dredging and mobilization between the work locations.

- Anticipate potential environmental difficulties and provide advice to minimize potential for environmental incidents.
- Verify that emergency spill response materials are available at the site and appropriately stocked.
- Inspect dredging equipment for potential leaks.
- Conduct water quality monitoring for turbidity plumes (visual, and with a turbidity meter) and hydrocarbon sheens from oil and grease (visual), if deemed necessary.

## 4.0 MONITORING PROGRAM

Imperial and Golder are committed to achieving a high standard of environmental management. Environmental monitoring will be carried out during in-water works to promote compliance with regulatory requirements and monitor the effectiveness of control and mitigation measures. To achieve compliance with the Plan, and terms and conditions of regulatory approvals, work instructions for the environmental monitoring were developed by the QEP and are included in this Construction Environmental Monitoring Plan. Specific actions and documentation required by the EM and project staff to deliver the CEMP, at a minimum, will include the following:

- Proof of qualification for all Environmental Monitors to oversee all of the work for the Contract duration, based on criteria such as professional experience, training, eligibility for registration with a professional association such as the College of Applied Biology, and references.
- The EM will be a trained marine mammal observer with relevant marine mammal monitoring experience.
- The Environmental Monitor(s) will be available on-site on a continuous basis, and full time during in-water work.
- Proof of authority for the EM to suspend work if conditions, requirements, or terms and conditions of regulatory approvals, the CEMP and/or applicable legislation are not being met.
- The type and frequency of observations and data collection, methodologies to be employed, and protocols to be followed.

This CEMP considers and proactively addresses incidents that must be reported to the relevant agency or authority including, but not limited to, a discharge of deleterious substances to a waterbody, such as spills of oil, fuel or chemicals, or release of sediment laden water entering a waterbody. Monitoring will be focused on determining whether terms and conditions of permits, authorizations, approvals, and contracts are being met and will include:

- Regular inspection of sediment and erosion control measures;
- Regular inspection of construction equipment on site for leaks or spills;
- Regular water quality monitoring (turbidity);

- Monitoring of fuel deliveries and transfers;
- Regular inspection of bulk fuel and petroleum hydrocarbon storage facilities;
- Regular inspection of the adequacy of the emergency response and spill containment and recovery equipment, and spill response training programs;
- Inspection of construction waste management programs; and
- Inspection and reporting on mitigation measures for wildlife including recording observations of wildlife and specific wildlife habitats.

The daily EM report template was developed for the Project (Appendix A) and includes the following:

- Inspection checklists for each monitoring site visit undertaken during the reporting period. The monitoring checklists will indicate what was inspected, if any issues were encountered, and the status of mitigation measures.
- Example of the required information to be collected by the EM regarding:
  - A description of construction activities;
  - A description of environmental issues and corresponding mitigation measures implemented;
  - Communications with Project personnel and regulatory agencies;
  - Results of water quality monitoring, and
  - Photos documenting construction activities, environmental issues, and corresponding mitigation measures.

## 5.0 RELEVANT ENVIRONMENTAL LEGISLATION

This section provides a summary of the federal, provincial and municipal environmental legislation that applies to the Project (Table 4).

**Table 4: Legislation, Strategies, and Policies Applicable to the Project**

Legislation / Strategy / Policy	Agency	Description	Project Requirements and Timeframes
<b>Federal</b>			
<i>Fisheries Act</i> (1985), 2015 amendment	Fisheries and Oceans Canada (DFO)	The <i>Fisheries Act</i> (1985) manages Canadian fisheries resources by regulating fishing as well as protecting fish and fish habitat. The recent amendments to the Act prohibit serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or fish that support such a fishery. It is also an offence to introduce a deleterious substance in water frequented by fish.	The DFO self-assessment for the Project determined that the Project is not likely to cause serious harm to fish or fish habitat, therefore a review of the Project by DFO is not required. Due diligence mitigation measures are prescribed in this CEMP
<i>Species at Risk Act</i> (2002), 2013 amendment	Environment and Climate Change Canada (ECCC)	The <i>Species at Risk Act</i> (2002) protects Canadian indigenous species, subspecies, and distinct populations from becoming extirpated or extinct, provides for the recovery of endangered or threatened species, and encourages the management of other species to prevent them from becoming at-risk. To kill, harm, harass, capture or take wildlife listed as Extirpated, Endangered or Threatened under this Act is prohibited. The Act prohibits damage to residences or critical habitat of listed species and applies only on federal land with the exception of aquatic species and migratory birds listed in the federal <i>Migratory Birds Convention Act, 1994</i> . In some circumstances, the federal prohibitions can be applied to other species on private or provincial Crown land if it is deemed that provincial or voluntary measures do not adequately protect a species and its residence (Government of Canada 2002).	No permit or approval required.
Canadian Environmental Protection Act (1999), 2014 amendment	ECCC	The aim of the <i>Canadian Environmental Protection Act</i> (1999) is to prevent pollution and protect the environment and human health. It prohibits the disposal of wastes and other matter at sea within Canadian jurisdiction unless the disposal is done under condition of a permit issued by the Minister of Environment (Government of Canada 1999).	Permit pending for submitted DAS Permit Application of clean sediments that will be sidecast by clamshell dredge. No Permit is required for the removal of the contaminated sediments identified.
<i>Navigation Protection Act</i>	Transport Canada (TC)	Required for any works within scheduled navigable waters of Canada. The Transport Canada Notice of Works application was first submitted by Golder in October 2015 (File #1955-500034 [8200-5694]) and requisite stakeholder engagement and consultation is ongoing in coordination with the Port and Environment Canada consultation processes.	TC Notice of Works Application submitted and in progress.

Legislation / Strategy / Policy	Agency	Description	Project Requirements and Timeframes
<b>Provincial</b>			
<i>Oil and Gas Activities Act (OGAA)</i>	BC Oil & Gas Commission (BC OGC)	The OGAA <i>Pipeline Operations Manual</i> (January 2015) indicates that a <i>Notice of Intent (NOI)</i> is required to be submitted. This amendment applies to pipelines which are being abandoned in the ground or which are being removed. Pipelines may be abandoned in place if they are properly deactivated in accordance with CSA-Z662. A Notice of Deactivation must be submitted prior to submitting an amendment to abandon.	Notice of Intent (NOI) to BC OGC in progress by Imperial.
<i>Wildlife Act (1996)</i>	MFLNRO	The BC <i>Wildlife Act (1996)</i> protects wildlife and wildlife habitat in British Columbia by identifying wildlife areas, defining human interactions with wildlife and regulating hunting, trapping and angling. Section 34 of the <i>Act</i> prohibits possessing, taking or destroying: (i) a bird or its egg, (ii) the nest of an eagle, peregrine falcon, gyrfalcon, osprey, heron or burrowing owl, or (iii) the nest of a bird not mentioned in (ii), when the nest is occupied by a bird or its egg unless authorized under permit. (Government of BC 1996).	No permit or approval required.
<i>BC Environmental Management Act (2003)</i>	BC Ministry of Environment (BC MoE)	The BC <i>Environmental Management Act (2003)</i> establishes, among others, the Contaminated Sites Regulation (BC CSR), Hazardous Waste Regulation, and Spill Reporting Regulation and provides a permitting system to enable the authorized discharge of effluent to water, disposal of solid waste to land, and discharge of emissions to the atmosphere. This <i>Act</i> provides guidelines for the regulation of activities which introduce waste into the environment, and store, treat or recycle hazardous waste. The Spill Reporting Regulation (2004) defines a “spill” as an unauthorized release or discharge of a listed substance into the environment in an amount exceeding the listed quantity (Government of BC 2003).	Impacted sediment removed for Upland disposal will be considered “soils” under the BC CSR when they are handled and disposed on land under provincial jurisdiction. A waste manifest will be prepared in compliance with provincial regulation.  For sidecast sediment refer EC DAS Permit Application.

Legislation / Strategy / Policy	Agency	Description	Project Requirements and Timeframes
<b>Municipal</b>			
City of Port Moody Sound Level Bylaw, 1980, No. 1399	City of Port Moody	Continual noise must be limited to 65 dBA or non-continual noise must be limited to 80 dBA, and only occur between the City's defined Daytime hours of 7 AM and 10 PM on a weekday or Saturday and between 9 AM and 10 PM on a Sunday or holiday.	The project falls within the Municipality of the City of Port Moody. No specific legislation is applicable; however, bylaws including noise restrictions may apply to the project. Work hours will not extend beyond the City's defined Daytime hours, and are not anticipated to exceed allowable noise limits, so noise permits will not be required.  Noise monitoring may be conducted as required.

Additional legislation referenced within and used to develop this CEMP include:

- *BC Fire Services Act* (RSBC 1996, c. 144);
- *BC Transportation of Dangerous Goods Act* (RSBC 1996, c. 458);
- *BC Health Act* (RSBC 1996, c. 179);
- *BC Workers Compensation Act* (RSBC 1996; c. 492);
- BC Occupational Health and Safety (OHS) Regulation;
- BC Fire Code;
- Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines (2016);
- A Field Guide to Fuel Handling, Transportation and Storage (Ministry of Water, Land and Air Protection [MWLAP] and MoFR 2002);
- Workplace Hazardous Materials Information System (WHMIS); and
- BC Approved Water Quality Guidelines (MoE 2016).

## 6.0 SITE SENSITIVE HABITAT FEATURES AND SPECIES

A detailed review of the habitat and species was prepared as part of the technical submission to PV (Golder 2017), but in brief:

- Habitat consists of soft-bottom sediment with minimal habitat complexity (Golder 2017). Underwater observations completed by Golder (2017) found anthropogenic debris along survey transects, including wood debris, discarded rope, small fragments of metal pipes and tubes, and a crab trap. The majority of debris was located in areas proximate to the Reed Point Marina and was consistent with observations made at other small craft harbours.
- In terms of sessile species and vegetation, no established vegetation was present. Detrital macroalgae (i.e., algae that has drifted into the site from other locations) was observed along the ROWs. Faunal observations during the dive survey included Dungeness crabs (*Metacarcinus magister*), plumose anemones (*Metridium senile*), jellyfish (*Polyorchis penicillatus*), giant pink stars (*Pisaster brevispinus*), mottled stars (*Evasterias troscheli*), ochre stars (*Pisaster ochraceus*) and sunflower stars (*Pycnopodia helianthoides*). Signs of infauna such as clams (siphon holes) or worms (worm burrows) were also observed.
- Port Moody Arm provides habitat for fish species including salmon and flatfishes. There are two local hatcheries on Noons and Mossom Creeks that release salmon fry and smolts into local streams and into the Arm annually (City of Port Moody 2011). Cutthroat trout (*Oncorhynchus clarkii*) and four Pacific salmon species including chinook (*O. tshawytscha*), chum (*O. keta*), coho (*O. kisutch*), and pink (*O. gorbuscha*) are known to use Port Moody Arm at various stages of their lives (City of Port Moody 2011); however, these species are not federally or provincially listed as species of concern.

- A marine research facility which houses and completes studies on Steller (Northern) Sea Lions is located within the Reed Point Marina water lot. This facility is located approximately 500 m away from the Project area.
- Northern abalone and Olympia oyster occur in the general project vicinity but not at the Project site due to soft sediments that compose marine substrate.

Golder (2017) reviewed the applicable aquatic Species at Risk maps for the Project Site (<http://www.dfo-mpo.gc.ca/species-especies/fpp-ppp/bcsw-socb-4-eng.htm>). The area is not listed as Critical Habitat for any aquatic SARA-listed species. However, the area is potentially used by SARA-listed species and, therefore, appropriate mitigation measures may need to be implemented. If a provincially or federally listed species noted below is identified at the site at any time during the project, the EM will be notified immediately and actions will be undertaken to manage potential adverse effects. Further information about SARA-listed species with the potential to use Burrard Inlet or the surrounding waters is provided in

Table 5.

**Table 5 - Listed Species with Potential to use Burrard Inlet**

Common Name	Scientific Name	Taxon	BC Lista	SARA Schedule <sup>b</sup>	Evaluation
Bluntnose Sixgill Shark	<i>Hexanchus griseus</i>	Fishes	No status	1-SC (2007)	Primarily a deep-water species – unlikely to be present near Project Site
Green Sturgeon	<i>Acipenser medirostris</i>	Fishes	Red	1-SC (2006)	Adult green sturgeon may use brackish environments near large rivers – unlikely to be present near Project Site
Grey Whale	<i>Eschrichtius robustus</i>	Mammals	Blue	1-SC (2005)	Unlikely to be near Project Site
Harbour Porpoise	<i>Phocoena</i>	Mammals	Blue	1-SC (2005)	Could potentially be near Project Site during works – provision to monitor for and mitigate upon encountering
Humpback Whale	<i>Megaptera novaeangliae</i>	Mammals	Blue	1-T (2005)	Unlikely to be near Project Site
Killer Whale	<i>Orcinus orca</i>	Mammals	Red	1-E (2008)	Unlikely to be near Project Site
Leatherback Sea Turtle	<i>Dermochelys coriacea</i>	Reptiles	Red	1-E (2003)	Primarily a deep-water species – unlikely to be present near Project Site
Nooksack Dace	<i>Rhinichthys cataractae</i> spp.	Fishes	Red	1-E (2003)	Freshwater species – will not be near Project Site

Common Name	Scientific Name	Taxon	BC Lista	SARA Schedule <sup>b</sup>	Evaluation
Northern Abalone	<i>Haliotis kamtschatkana</i>	Molluscs	Red	1-E	Prefers rocky substrates and exposed waters – unlikely to be near Project Site
Rougheye Rockfish	<i>Sebastes sp.</i> Type I	Fishes	No status	1-SC (2009)	Prefers rocky substrates – unlikely to be near Project Site
Steller Sea Lion	<i>Eumetopias jubatus</i>	Mammals	Blue	1-SC (2005)	Could potentially be near Project Site during works – provision to monitor for and mitigate upon encountering
Yelloweye Rockfish	<i>Sebastes ruberrimus</i>	Fishes	No status	NA	Prefers rocky substrates – unlikely to be near Project Site

## 7.0 PROJECT MITIGATION MEASURES AND ENVIRONMENTAL SPECIFICATIONS

This section specifies the mitigation measures and other environmental requirements to be implemented during the Burrard Inlet Pipe Removal Project. It may be necessary to adjust mitigation measures to reflect site-specific conditions under supervision of the QEP and/or to incorporate input from regulatory agencies. The following mitigation measures will be implemented during the work activities.

### 7.1 General Practices

The following is a list of general practices to be implemented during construction:

- All project staff will review this CEMP and the applicable work instruction prior to each project phase or new activity. The EM will lead a daily environmental briefing to review the key elements of the CEMP and work instructions with workers.
- All field execution staff will know how to properly install protection measures and understand the BMPs used on the project. The field execution team will be prepared to change existing measures should they fail or additional measures be required.
- There will be a written communication plan that requires field execution staff to promptly inform the EM of any planned changes in execution method that deviate from the work instruction. The EM will consult with the QEP to confirm that any proposed changes are acceptable in terms of environmental management. The change in the work instruction will then be documented.
- Where possible, work will be conducted during dry weather and minimized during periods of heavy precipitation. Work will be discontinued if wind velocities exceed 80 km/hr or current velocities exceed 8 knots.

## 7.2 Site Access, Mobilization and Laydown Areas

**Marine Equipment Mobilization:** Marine equipment will be towed and mobilized from Contractors' Yard to site.

**Equipment Laydown Area:** On-shore equipment laydown area is not anticipated to be required as equipment and materials will be loaded onto scows for transportation and handling at Contractors' Yard. Marine construction spread will be re-located and anchored out of the navigation channel when not actively working, and on a nightly basis.

**Personnel Mobilization and Parking:** During construction, there will be on-shore trailer and personnel parking provided for the Contractors near the work site. The location of Contractor's on-shore field office and personnel mobilization is Reed Point Marina.

## 7.3 Machinery and Equipment

Materials and equipment will be transported to the site via land (truck) and water (barge). Equipment to be utilized includes: derrick (barge), clamshell dredge, barge-mounted crane, spud barges, sealed scows, flat deck material scows, support tugs, work boats, and support trucks. The following are a list of measures to be employed during construction to reduce the potential for impacts resulting from the use and storage of equipment:

- Vehicles and machinery will arrive at the site in a clean and washed condition and will be maintained such that they are free of fluid leaks, excess oil/grease, and invasive or weedy species. A pre-mobilization inspection will be completed.
- Vehicles, vessels and equipment will be operated and maintained according to manufacturer's guidelines and inspected by the Contractor prior to start up at the beginning of each day, and by the EM periodically when on-site.
- Vehicles or equipment producing excessive exhaust or noise will be repaired or replaced immediately.
- Fit equipment with standard mufflers or silencers and keep these mufflers/silencers in good working order.
- Turn off engines when not in use or reduce to limited idle.
- Refuelling location(s) and each vehicle or piece of machinery will maintain a readily available supply of spill prevention and emergency response equipment (i.e., absorbent pads and /or booms, etc.) at all times in effective working condition.
- All Contractor's personnel will be sufficiently trained in the use of spill containment equipment/items and to deal with environmental emergency situations.
- Any spill of a substance to marine receiving environment that is deleterious to aquatic life must immediately be reported.
- Lighting, if required, will be placed as close to the work area as possible and used only to illuminate the dock structure from a location above the work area.

## 7.4 Air Quality

The following air quality mitigation measures are proposed:

**Table 6 - Air Quality Protection Measures**

Protection Measures	Responsibility	Timing
<i>Implementation</i>		
Vessels and equipment will be well maintained and in good working order.	Contractor	On-going during work
Efforts will be made to minimize exhaust emissions. The contractor will be encouraged to use clean alternative fuels for vessels and equipment. Idling of vessels and equipment will be minimized.	Contractor	On-going during work
To reduce potential dust emissions during hot, dry weather, sediment on barges, in trucks, or stockpiled on land, if exposed to open environment, will be covered or wetted as required, if it is being left overnight or if there are strong winds.	Contractor	On-going during work

## 7.5 Noise and Vibration

With respect to the nearby residential zone, the dredging and construction operations will abide by the City of Port Moody's noise bylaw. Proposed mitigation measures to be implemented for compliance with applicable noise bylaws are outlined in Table 7.

**Table 7 - Noise Mitigation Measures**

Protection Measures	Responsibility	Timing
<i>Implementation</i>		
Maintain equipment in good working order and switch it off when not in use.	Contractor	On-going during work
Implement best practices for construction such as installation mufflers on machinery for noise control.		
Undertake noisier work during daytime, weekday hours and modify activities based on noise monitoring and resident feedback.		
Spotlights will be directed away from residential areas or lights will be fitted with shrouds to direct light to the immediate work area.		
<i>Monitoring</i>		
A monitoring program will be implemented on an as needed basis if complaints are received, to verify that specified bylaw noise levels are met.	EM	As necessary
Complaints will be received and reviewed to evaluate the need to implement additional noise monitoring or modifications to activities.	Imperial	As necessary

## 7.6 Marine Works

### 7.6.1 Marine Life and Fisheries Habitat Protection

The following general mitigation measures are proposed to reduce the potential for adverse effects on marine life or habitat:

- Conduct marine work during the identified time window of least risk to fisheries in Burrard Inlet (August 16 - February 28).
- Machinery will be washed, refueled and serviced in such a way to prevent deleterious substances from entering marine receiving environment and storm water system.
- Machinery will be operated from a floating barge in a manner that minimizes disturbance to and seabed. No equipment will be operated from the intertidal areas. The barge platform will not make contact with the seabed but will use spud piles to stabilize the barge during the dredging process and for pipe removal.
- Shallow water vessel manoeuvring that has the potential to disrupt the seafloor will be avoided and limited.

### 7.6.2 Underwater Noise Management

Whales and other marine animals are known to be sensitive to noise levels. A total of 16 marine mammal species have been documented in Georgia Strait. Within the vicinity of the Project, Harbour seals (*Phoca vitulina*) likely forage in the marine subtidal habitat adjacent to the Pacific Coast Terminal. Other marine mammals (such as sea lion, dolphin, porpoise, and whales) occur within the main body of the Strait, and rarely frequent the upper area of Burrard Inlet. Observing for marine mammals in the vicinity of the dredging barge operations and conducting underwater noise monitoring to comply with Section 7 of the *Marine Mammal Regulations* and the *Fisheries Act* which prohibits the disturbance of marine mammals and serious harm to fish.

The following mitigation measures will be implemented throughout the Project to minimize effects of noise produced by the dredging program on aquatic life.

#### **General Operations:**

- The creation of underwater noise and vibration will be limited to noise output produced by the normal operation of the dredge equipment, barge and the tug/support vessel (as applicable). All equipment will be maintained in good working order to limit generated underwater noise to the lowest levels practical.
- Concurrent multiple underwater noise generating activities will be minimized where practicable. Where multiple underwater noise generating activities are planned they will be sequenced where possible to minimize their duration.
- At the start of the dredge program, and after major changes in in-water project activities or equipment, the EM will verify underwater sound levels in the field using a hydrophone and real-time sound monitor to confirm that sound levels are below the established injury thresholds for fish and marine mammals (Table 8).

- If sound levels are shown to exceed the injury thresholds to marine mammals within close proximity to the work area, a safety zone<sup>2</sup> distance will be determined accordingly by step-out acoustic sampling during active dredging. If necessary, the EM will suspend dredging operations if a marine mammal enters the designated safety zone during active construction or dredging operations. Activities will not resume until it is visually confirmed that the marine mammal is outside the safety zone, or if a minimum of 10 minutes has elapsed since the animal was last sighted within the safety zone. At any moment during the surveys, the EM should be able to contact the person in charge of the dredging in the event a shut-down is necessary.
- The EM will also be a trained Marine Mammal Observer (MMO) with relevant marine mammal monitoring experience. MMOs are responsible for accurately identifying marine mammals from a distance during site activities, and for implementing project-based mitigation to satisfy environmental permitting requirements. The role of an MMO is to be present on site during activities and to effectively report and communicate to operations crews when marine mammals enter a set safety zone prior to and during operations. MMOs advise onboard personnel of necessary delays or shut-downs during site activities and record marine mammal behaviours during each sighting. Underwater noise monitoring and management measures described in this section constitute industry best practice.
- If and when a marine mammal is sighted, detailed sighting information will be documented, including time and spatial (location) information, sea conditions, as well as species information, reliability of species identification, numbers of animals, location of sightings, and behaviour and movement of the animal(s). Photographs will be used, as necessary and where possible, to document sightings. The EM/ MMO and other on-board personnel will record any signs of whale, porpoise or dolphin distress or behavioural avoidance.
- If a marine mammal is observed in the work area, vessels must reduce speed to less than 7 knots when within 400 metres/yards of the nearest whale, avoid abrupt course changes; and will not approach closer than 100 metres/yards.
- Visual monitoring for evidence of physiological disturbance of fish (mortalities, pressure-related injuries such as barotrauma) will be implemented during Project activities. If visual or acoustic monitoring reveals unacceptable conditions (fish kill, marine mammal distress or sound levels above thresholds), then the work will stop immediately and the methods will be corrected accordingly.
- Prior to the start of the program, the EM will host a 'pre-start' contractor's orientation meeting to orient all on-board crew to the role of the EM, applicable regulatory guidelines, and mitigation requirements for underwater noise management.

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<sup>2</sup> Safety zones are used to mitigate the potential effect of injury (permanent or temporary auditory trauma) to marine mammals as a result of elevated underwater noise levels. The radius of the safety zone is conservatively set to include the ensonification zone that would exceed established underwater noise injury thresholds for marine mammals. As there are no underwater noise injury thresholds established under Canadian legislation, the NMFS thresholds have been applied for the proposed works. If underwater noise levels are below the established noise thresholds, a safety zone of 200 m will be established and monitored for the duration of the project.

### Clamshell Dredging:

- If a cetacean (porpoise or whale) enters the designated safety zone prior to, or during, active dredging, the EM will suspend the start of dredging until the cetacean has cleared the safety zone, or until 10 minutes have elapsed since the last sighting of the cetacean in the safety zone.
- Dredging is permitted when pinnipeds (sea lions and seals) are within the safety zone provided that underwater noise does not exceed the management threshold for pinnipeds and the animal shows no signs of distress. Construction operations may be shut down if the animal exhibits signs of distress.
- If underwater noise as a result of the Project exceeds injury thresholds for marine mammals and fish (Table 8), additional mitigation measures may be implemented to reduce the noise to below threshold values (e.g. bubble curtain).
- The EM will maintain regular communication with the Contractor during construction operations.

**Table 8 - Management Thresholds for Marine Mammals and Fish**

Species Group	Management Threshold	Reference
Cetaceans (baleen and toothed whales)	180 dB re 1 µPa (SPL <sub>peak</sub> )	National Marine Fisheries Service Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: (2016)
Pinnipeds (seals and sea lions)	190 dB re 1µPa (SPL <sub>rms</sub> )	
Fish	30 kPa (equivalent to ~210 dB re 1 µPa SPL <sub>peak</sub> )	DFO guidelines for pile-driving (e.g., pulsive) activity.

**Notes:** SPL = Sound Pressure Level; kPa = kilopascals; rms = root mean square; dB = decibels; re 1 µPa = reference pressure is one micropascal.

Injury thresholds in NMFS (2016) were updated to 202 db and 218 db for high-frequency cetaceans and pinnipeds exposed to impulsive sources. Golder is conservatively retaining the generic NOAA thresholds of 180 and 190 db as a management threshold.

## 7.7 Water Quality Management

The EM will monitor the following water quality parameters in the marine environment in accordance with the minimum requirements specified in Table 9:

- Turbidity plumes (visual and *in-situ* measurements with a turbidity meter); and
- Hydrocarbon sheens (visual).
- Suspended sediment (sediment traps)

**Table 9 - Water Quality Guidelines for the Protection of Marine Aquatic Life**

Parameter	Maximum Allowable Limits <sup>1</sup>
Turbidity	Change in background of 8 nephelometric turbidity units (NTU) at any one time for a duration of 24 hours in all waters during clear flows or in clear waters Change in background of 2 NTU at any one time for a duration of 30 days in all waters during clear flows or in clear waters

	<p>Change from background of 5 NTU at any time when background is between 8 and 50 NTU</p> <p>Change from background of 10% when background is &gt;50 NTU at any time during high flows or in turbid waters</p>
Oil and Petrochemicals	<p>Not be present in concentrations that:</p> <ul style="list-style-type: none"> <li>can be detected as a visible film, sheen or discoloration on the surface;</li> <li>can be detected by odour; or</li> <li>can form deposits on shorelines and bottom deposits that are detectable by sight and odour.</li> </ul>

Notes:

1. Adapted from: BC Approved Water Quality Guidelines (MoE 2016) and Canadian Water Quality Guidelines (CCME 2016).
2. Background is defined as the NTU value measured in the receiving environment, up current from the activity.

### 7.7.1 Turbidity

Visual monitoring for evidence of turbidity will be conducted during all in-water works. *In-situ* water quality monitoring will be undertaken manually from a boat using a hand-held turbidity meter. Field meters used to measure turbidity (measured in nephelometric turbidity units (NTU)) will be calibrated daily, following the manufacturer’s instructions, and re-checked during the day using known calibration standards. Field meter calibrations will be recorded in the calibration log.

It is expected that *in-situ* sampling will be conducted three times per day when dredging and side casting activities are underway. The frequency of inspections may be increased if plumes or elevated turbidity readings are observed. Visual and *in-situ* turbidity measurements will be taken adjacent to the work area to provide background levels for comparison. Detailed monitoring for *in-situ* water quality monitoring during dredging and side casting are outlined below.

#### ***In-Situ Water Quality Monitoring - Clam Shell Dredging***

*In-situ* water quality monitoring will be undertaken by the EM during dredging at monitoring locations positioned both up-current and down-current of the works. Monitoring locations will be adjusted depending on the location of the work site and the direction of prevailing current at the time of sampling. The sampling locations will be documented using hand-held GPS. Water samples for *in-situ* monitoring will be collected at three discrete depths to evaluate the re-suspension of sediments into the water column during dredging. Measurements will be collected using a water sampler or by lowering the field meter probe to the desired depth, as follows:

- At the surface of the water column: 1 m below the surface.
- At the bottom of the water column: 2 m above the sea bed (the grab sampler will be fitted with a weighted lead to help prevent the sampler itself from hitting the seabed and causing re-suspension of solids that may become entrained in the sample).
- Mid-water column: half-way between the surface and bottom of the water column when it is not stratified, or just below the density barrier (i.e., thermocline or halocline) when/if stratification is occurring.

The conceptual layout of sampling locations for dredging are indicated in Figure 2 and described below.

- Compliance Samples—25 m from the edge of the silt curtain— the edge of the silt curtain represents the point at which the Contractor is no longer in control of induced turbidity. Due to safety concerns associated with sampling in close proximity to the work area, the dredging compliance point is assessed at a distance of 25 m down-current of the silt curtain.
- Assessment Samples—100 m down-current from the edge of the silt curtain — measurements will be collected from the receiving environment at the edge of the work zone at three locations along a 100 m radius with discrete measurements at three depths (Figure 2), as noted above.
- Background samples—outside of the project area influence— measurements will be collected at three background locations located up current from the silt curtain (Figure 2). When there is potential for non-Project related activities (e.g., vessel traffic, storm water discharge during inclement weather, etc.) to influence background turbidity, a higher number of background stations will be sampled. Field measurements will be collected at three depths, in the same manner as the compliance and assessment samples.

### ***In-Situ Water Quality Monitoring – Side Casting***

*In-situ* monitoring of turbidity will be undertaken by the EM during side casting at monitoring locations positioned both up-current and down-current of the works. Monitoring locations will be adjusted depending on the location of the work site and the direction of prevailing current at the time of sampling. The sampling locations will be documented using hand-held GPS. Disturbance of seafloor sediments is anticipated during side casting and water samples for *in-situ* monitoring will be collected at two discrete depths during side casting activities to evaluate the re-suspension of sediments into the water column. Measurements will be collected using a water sampler or by lowering the field meter probe to the desired depth, as follows:

- At the surface of the water column: 1 m below the surface.
- Mid-water column: half-way between the surface and bottom of the water column when it is not stratified, or just below the density barrier (i.e., thermocline or halocline) when/if stratification is occurring.

The conceptual layout of sampling locations for dredging are indicated in Figure 2 and described below.

- Compliance Samples—25 m from the work area—due to safety concerns associated with sampling in close proximity to the work area, the compliance point is assessed at a distance of 25 m down-current of the work area.
- Assessment Samples—100 m down-current from the work area — measurements will be collected from the receiving environment at the edge of the work zone at three locations along a 100 m radius with discrete measurements at three depths (Figure 3), as noted above.
- Background samples—outside of the project area influence— measurements will be collected at three background locations located up current from the silt curtain (Figure 3). When there is potential for non-Project related activities (e.g., vessel traffic, storm water discharge during inclement weather, etc.) to influence background turbidity, a higher number of background stations will be sampled. Field measurements will be collected at two depths, in the same manner as the compliance and assessment samples.

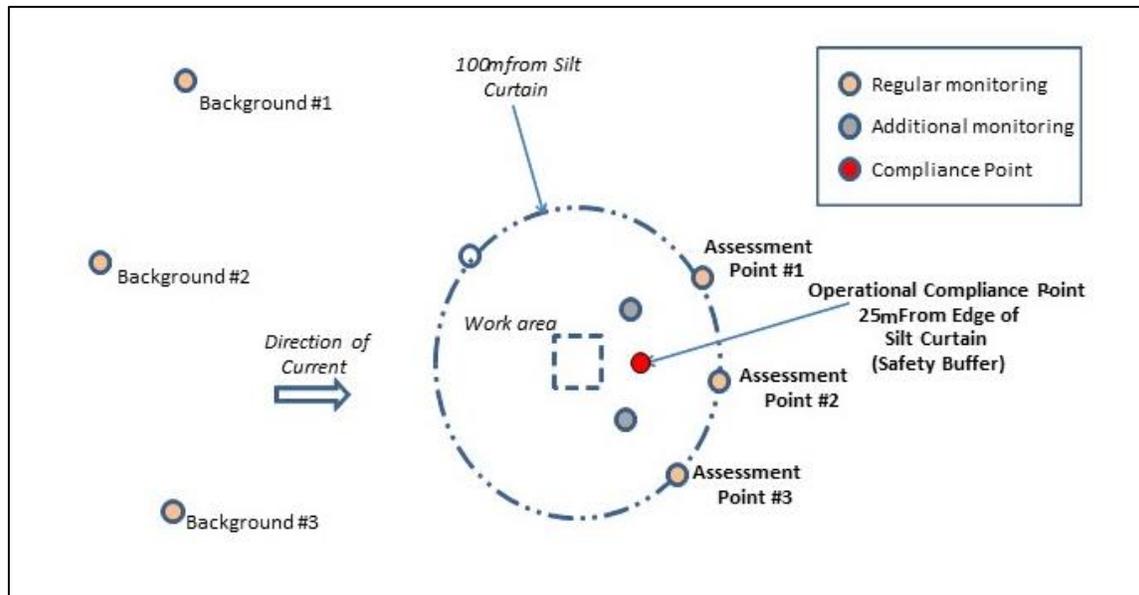


Figure 2: Conceptual layout of monitoring locations

### 7.7.2 Hydrocarbons

The EM will visually monitor for the presence of hydrocarbon sheen in the vicinity of the work area during all in-water works. The presence of sheen will be documented in the daily EM report. (Appendix A) Any spills or leaks observed will be addressed as outlined in the spill response plan developed for the Project (see section 7.10.3).

### 7.7.3 Suspended Sediment

The suspension of sediment and the potential transport of sediment during dredging and side casting will be evaluated using the *in-situ* turbidity measurements described above. Sediment transport and deposition in the vicinity of work area will also be evaluated using sediment traps. One sediment trap will be set outside of the work area during dredging and side casting works to evaluate sediment deposition in the vicinity to the Project area. The sediment trap will be placed near the seabed and will be checked weekly by the EM. The sediment trap will be set at the start of the dredging and side casting works and will be collected when each of these activities are complete. After the trap is collected, the contents of the sediment trap will be photographed. For each sediment trap deployment, the following information will be documented by the EM:

- Sediment trap location (GPS position);
- Time and date of deployment;
- Time and date of retrieval;
- A visual description of sediment accumulated in trap; and
- An estimated depth of sediment accumulated in trap (if applicable).

## 7.8 Dredged Sediment Management

### 7.8.1 Upland Disposal of Dredged Material

A volume of approximately 1,000 m<sup>3</sup> of dredgate material has been characterized and identified as PAH impacted sediment during project planning, and will require upland disposal. This sediment will be clamshell dredged, then will be brought to the surface and loaded onto a sealed scow, for transportation to a regulated landfill facility for upland disposal. This sediment removal and disposal does not require Environment Canada approval. The upland disposal material handling, transportation, processing, and disposal, will be implemented under to the proposed protection measures in Table 10.

**Table 10 – Proposed Protection Measures for Upland Disposal of Dredged material**

Protection Measures	Responsibility	Timing
<i>Implementation</i>		
Clamshell Dredging		
Use of turbidity curtain around dredge bucket upon material removal through water column, to break surface, to manage and contain potential turbidity upon bucket and water movement.	Contractor	On-going during Project
Appropriate control of clamshell operations and dredge cycle times to reduce turbidity potential.	Contractor	On-going during operation
In-water Transport of Dredged Material		
Use of sealed scow such that dredged material and water are contained during transportation.	Contractor	On-going during Project
The Contractor will provide certification of seaworthiness from an independent marine surveyor for each haul barge that will be used for the Project. In the event that a barge is damaged during Project activities and requires repair, a new certification of seaworthiness will be required.	Contractor	Before Contractor mobilizes equipment to project for use
Material transportation by barge will require the Contractor to obtain an authorization from the Port of Vancouver pursuant to the <i>Canada Marine Act</i> .	Contractor	Before dredged material is transported
<i>Off-Site Upland Offloading and Processing Facility</i>		
Dredged material will be transported by barge to an appropriate upland material handling and offloading facility. The offloading and processing facility that needs to provide adequate containment of dredge material and debris prior to final shipping of this material.	Contractor	On-going during Project
The Contractor will offload in-water transportation barges at the upland offloading and processing facility in a manner that prevents discharge or spillage of waste or effluent to the water. A spill apron (or equivalent spill prevention measure) will be used during all offloading activities.		
Any spillage on the spill apron will be removed as soon as practicable and properly disposed. Any such spillage outside of the upland offloading and processing facility will be promptly cleaned up.		
Spillage of sediment or debris during offloading will be promptly cleaned up. If uncontrolled spillage occurs, all offloading operations will cease until the spillage is contained and cleaned up.		

Protection Measures	Responsibility	Timing
<p>All effluent drainage water, stormwater, or other form of discharges from stockpiled sediment and debris are collected for treatment and proper disposal by the Contractor.</p> <p>No direct discharge of untreated effluent from the upland offloading and processing facility to the receiving waters is allowed.</p> <p>All effluent from the upland offloading and processing facility will be collected, treated, and discharged to federal, provincial, and local laws and regulations, and conditions of the permits.</p>		
Upland stockpiles will be managed to prevent uncontrolled runoff of water that has been in contact with the dredged material and to protect them from the weather.		
The contractor will be required to maintain a clean upland offloading and processing facility and provide a wheel/truck wash to prevent vehicles from tracking contaminated soil or sediment off site.		
Equipment will be fuelled in a designated area that separates fuelling operations and protects the environment from accidental spills during fuelling.		
The Contractor will be responsible for site security at the upland offloading and processing facility.		
<i>Upland Transport and Disposal of Dredged Material</i>		
If temporary storage of material is proposed prior to final transportation and disposal, the Contractor will use appropriately permitted sites.	Contractor	On-going during Project
The Contractor will dispose of the dredged material at a permitted disposal facility and will provide certification from the landfill operator that they can accept the dredged sediment with its contaminant and salinity concentrations.		
Material transported from the site will be safe for transport, and adequately secured.		
If required, based on the quality of the material for off-site disposal, materials will be transported by a licensed hauler in accordance with the <i>Transportation of Dangerous Goods Act</i> .		
The Contractor will provide waste manifests for shipment/disposal of dredged materials.		
<i>Monitoring</i>		
Inspection of upland offloading and processing facility prior to or during material transportation from the site may be conducted. Environmental records pertaining to the management of the sites will be made available by the Contractor, if requested.	EM / Imperial	On-going during Project

### 7.8.2 Side casting of Dredged Material

The remainder of “clean” dredgeate material will be side cast as authorized by the ECCC Disposal at Sea (DAS) Permit (pending). The following preventative mitigation measures are proposed for this operation (Table 11):

**Table 11 – Proposed Protection Measures for Side casting of Dredged material**

Protection Measures	Responsibility	Timing
<i>Implementation</i>		
Clamshell Dredging and Side casting		
Appropriate control of clamshell operations and dredge cycle times to reduce turbidity potential. Clamshell bucket will not break water surface when loaded with dredge sediment for release, and where possible, reduce the lift height of the bucket prior to side casting release of sediment over existing seabed.	Contractor	On-going during operation

## 7.9 Archaeological Resources

Proposed works are located within the marine environment, therefore, archaeological resources are not expected to be encountered. In the unlikely event that archaeological resources are encountered, the following are a list of measures to be followed:

- Immediately stop any activities that might further disturb the archaeological resource or the site in which they are contained;
- Do not move or otherwise disturb the artifacts or other remains present at the site;
- Stake or flag off the site to prevent additional disturbances; and
- Immediately notify an Archeologist to determine next steps.

## 7.10 Project Emergency Response

### 7.10.1 Emergency Communication

The above project contact list provides details and contact information for individuals within the project team to be contacted in the event of an emergency. This list should be expanded and completed to include Contractor personnel and other individuals as needed or when changes in personnel are made.

The contact list contains summary of potential emergency contacts requiring notification in event of emergency (Table 12).

**Table 12 - Emergency Communication Contact List**

Contact	Name	Office #	Other #
Emergency Management BC (EMBC)	N/A	N/A	1-800-663-3456
Western Canada Marine Response Corporation	24-hour spill emergency line	604-294-9116	1-855-294-9116
Environment Canada Spill Reporting Line	N/A	N/A	604-666-6100
Emergency Response Services (e.g., RCMP, Fire)	N/A	N/A	911
Worksafe BC	N/A	N/A	1-888-621-7233 1-866-922-4357 (after hours)

Contact	Name	Office #	Other #
Gas leaks (FortisBC):	N/A	N/A	1-800-663-9911
Poison Control Centre	N/A	N/A	1-800-567-8911
BC One Call	N/A	N/A	1-800-474-6886
First Nations	TWN - TBD MIB - TBD		

## 7.10.2 Environmental Emergency Plan

An environmental emergency plan will be developed by the Contractor and implemented in the event of an environmental incident. An environmental incident is an event that has caused or has the potential to cause one or more of the following:

- Damage to aquatic or terrestrial habitat.
- Adverse/harmful effects to fish, wildlife or other environmental resources.
- Adverse publicity associated with impacts on the environment.
- Violation of statutes, regulatory authorizations or environmental damage.

Examples of environmental incidents include, but are not limited to:

- Spills of oil, fuel, or other potentially hazardous chemicals.
- Discharges of deleterious substances into fish-bearing waterbodies.
- Landslides, erosion, or floods with the potential to adversely affect environmental quality.
- Serious harm to fish without prior authorization.

All environmental incidents are to be reported to Imperial immediately. An Environmental Incident Report (EIR) is to be prepared and submitted by the Contractor(s) to provide a timely and accurate internal written notification of environmental incidents to Imperial. The deadline for submission of the EIR is within 24 hours following an incident. The EIR will include the following information:

- Who reported, and responded, to the incident.
- A description of the incident (e.g. date, time, cause, personnel present, type of material spilled, environment affected).
- Actions taken to mitigate the incident.
- Preventative measures implemented following the incident.
- Photo documentation.

The written EIR is not intended to take the place of verbal notification of an incident requiring immediate action by the Contractor or further notification of regulatory agencies (e.g. a spill that affects neighbouring properties or requires assistance in the supply or deployment of containment equipment). In addition to a written EIR report, Imperial will be notified immediately after any incident occurs along with post-incident internal reporting summarizing the incident and the

response to it. It may be necessary in some situations to report an emergency to Emergency Management BC (EMBC) and notify regulatory agencies (DFO, Environment and Climate Change Canada (ECCC), Ministry of Environment (MOE)), local municipal environmental representatives (City of Port Moody), and owners of neighbouring properties (e.g. Reed Point Marina) of the environmental incidents.

In the event that the incident is considered an emergency, and Imperial representatives are not available, or where a delay in notification could result in environmental damage or risk to human health, Golder's Environmental Coordinator will provide these notifications. Notification of corrective measures and closure of the incident may also be reported, as per direction from Imperial.

### 7.10.3 Spill Response Plan

The release of deleterious substances (such as hydrocarbons) can impact aquatic species found in the Project area. The following spill mitigation measures are proposed:

- A support boat that can be used for barge manoeuvring, spill response procedures or other emergency situations will be available in a state of readiness throughout the dredging operations.
- Prior to the commencement of the field portion of the Project, an Emergency Spill Procedure will be developed; this will include names and telephone numbers of persons and organizations that may be contacted in the event of a potential environmental incident. The Procedure will be posted at a predetermined, accessible, and visible location with emergency response equipment and a list of emergency contacts. The Plan will meet Canadian Coast Guard requirements.
- All field personnel will be made aware of the location of Emergency Spill Response equipment and the procedures necessary to contain spills of any fluid.
- The dredging and pipe removal contractor will be prepared to deploy a spill boom around the barge during the initial set-up for the dredging and pipe removal program as a precautionary measure to contain potential spills or leaks of hydraulic fluids or fuels during the dredging and pipe removal operations.
- Prior to use, the dredging and pipe removal contractors' equipment will be in good repair, and be cleaned of external oils and grease prior to mobilizing to site.
- During dredging and pipe removal, the surrounding water will be periodically checked for signs of spills or leaks. If spills or leaks to the surrounding waters were detected, the Emergency Spill Procedure will be followed.
- In the event of any spill in a marine environment, the Contractor will immediately suspend dredging and related activities, and implement the Emergency Spill Response Procedure.
- A reportable spill is defined as per below (External Reporting Requirements) extracted from *Schedule to the Spill Reporting Regulation (2004)* (Table 13). A reportable spill will be reported verbally at the earliest practical opportunity to the Emergency Management BC/Provincial

Emergency Program (EMBC/PEP), DFO (DFO), and Environment Canada. Lesser volumes than reportable may also be considered deleterious per the *Fisheries Act*, and may also need to be reported as per the “Duty to Notify” in Section 38(4) of the *Fisheries Act*. If in doubt, the Environmental Monitor/Project Manager should be consulted, and/or a report should be made.

- Within 24 hours of the reportable spill, a written incident report will be prepared and submitted to Imperial and government authorities having jurisdiction. Information within the report will include the reporting organization, date, time, location, hazardous materials involved, source, persons or organizations notified, how the spill occurred, remedial action taken or planned, and actions necessary to prevent recurrence.
- Emergency response equipment necessary to contain hazardous material spills will be at the site at all times, and be available for immediate use. The recommended minimum spill kit contents include, but should not be limited to, those listed in Table 14.

**Table 13 – Spill Response External Reporting Requirements**

Substance	Quantity	External Reporting Requirements	Internal Reporting Requirements
Any Spill	Any amount in aquatic habitat	EMBC DFO and MFLNRO	Environmental Incident Report (EIR)
Oil and Waste Oil	≥100 litres on land	EMBC, MFLNRO	EIR
Oil with >50 ppm PCB	≥1 kilogram on land	EMBC	EIR
Flammable or Non-Flammable Gas	≥ 10 kilograms on land	EMBC	EIR
Toxic or Corrosive Waste	≥ 5 litres or kilograms on land	EMBC	EIR
Hazardous Waste	≥5 litres or kilograms on land	EMBC	EIR
Pesticides and Herbicides	≥ 5 kg or litre on land	EMBC	EIR
Explosives	Any quantity that could pose a danger to the public or 50 kg	EMBC	EIR

**Table 14 - Recommended Minimum Spill Kit Contents**

Item	Quantity
Oil boom	50 m or TBD – Based on Barge / Platform Size
Oil dispersant	TBD – Based on Barge / Platform Size
210-L polyethylene overpack drum	1
Oil sorbent socks (3" x 4")	5
Oil sorbent pillows (12" x 13")	5
Oil sorbent sheets (16.5" x 20" x 3/8")	50
Oil sorbent roll (16.5" x 115" x 3/8")	1

Item	Quantity
Drain cover (36"x36"x1/16")	1
Caution tape (3"x500')	1
1-lb. plugging compound	1
Nitrile gloves	2
Safety glasses	2
Tyvek coveralls	2
Instruction booklet	1
Printed disposal bags	10

## 7.11 Fuel Management Plan

The following mitigation measures will be implemented during on-site refuelling and fuel transfers, if required:

- Fuel transfers will be monitored so that there are personnel stationed both at the fuel source and at the equipment receiving the fuel.
- Valves will be in the closed position and locked and secured when not in use.
- Accidental release or overfilling of equipment will be controlled by careful observation and communication.
- A drip tray or pan will be used to collect excess fuel, oil, or other hazardous materials to avoid release to marine receiving environment.
- Nozzles will be equipped with automatic shut offs or a drip-free dispensing nozzle will be used.
- No ignition sources will be permitted within the fuelling area.
- Refuelling location(s) and each vehicle or piece of machinery will maintain a readily available supply of spill prevention and emergency response equipment (i.e., absorbent pads and/or booms, etc.) at all times and in effective working condition.
- Fuel tanks stored at the site (if any) will be situated within appropriate secondary containment (an impermeable containment facility capable of holding 110% of the storage tank contents). This may be achieved through the use of double-walled storage tanks or sit-in containers constructed out of impermeable material, such as aluminum or plastic. Dispensing hoses will be located within the secondary containment when not in use.
- All Contractor's personnel will be sufficiently trained in the use of spill containment equipment/items and to deal with environmental emergency situations (see Section 7.10.3).

## 7.12 Waste Management

### 7.12.1 Non-hazardous Waste Management

**Table 15 –Non-hazardous Waste Management Proposed Protection Measures**

Protection Measures	Responsibility	Timing
<p>Specific measures to be undertaken and equipment to be used to manage non-hazardous waste will be described. The measures will address, at a minimum:</p> <ul style="list-style-type: none"> <li>A list of approved locations that will accept recyclable and non-recyclable solid non-hazardous construction wastes to be generated during the Work.</li> <li>The types and quantities of materials to be recycled, as well as those requiring disposal, names of construction waste material haulers, and approved disposal facilities that meet the requirements of the BC <i>Environmental Management Act</i>.</li> </ul>	Contractor	Prior to work commencing
<i>Implementation</i>		
<p>Refuse and debris related to the Work will be collected and disposed of at approved disposal facilities in compliance with laws and requirements of all authorities having jurisdiction.</p>	Contractor	On-going during Projects
<p>Surficial debris, such as metal, cable and tires, encountered during excavation will be removed and recycled or disposed of at an appropriate disposal site.</p>		
<p>The Contractor will not dump, burn, bury, or allow others under its control to dump, burn, or bury construction wastes and refuse associated with the Work. Should refuse or construction wastes related to the work be dumped, the Contractor will immediately act to clean up and remove the waste material to an approved location.</p>		
<p>The Contractor will establish good site housekeeping practices including regular clean up and disposal programs so as to prevent the unnecessary accumulation of excessive construction waste and refuse.</p>		
<i>Monitoring</i>		
<p>The work area will be inspected by the EM for effectiveness of control measures put into place by the Contractor(s).</p>	EM	As necessary

### 7.12.2 Hazardous Materials Handling and Storage

The project has the potential to encounter hazardous materials during construction, in the pipe sections to be removed for disposal. The anticipated hazardous materials comprise asbestos in tar coating and creosote (or other metal based preservative) in treated timber lagging, or naturally occurring radioactive material (NORM) may be present given the former use of the pipelines for product transport. The presence of hazardous materials has not yet been determined, and is unlikely to be confirmed until pipe sections can be retrieved from the seabed. As such, a conservative approach to construction activities will be taken to protect workers and the environment from possible hazards. Until confirmed otherwise, it will be assumed that hazardous materials are present and appropriate controls will be implemented based on best practice, industry guidance and regulatory requirements.

To enable asbestos testing to be conducted, sections of both NPS6 and NPS12 pipelines (approximately 0.5 m) will be removed during completion of the initial isolation cuts. The pipes may be coated with a coal tar that will be removed prior to cutting. The coating will be recovered by divers and brought to surface during initial exposure and extraction of the pipe. The coating, if

found, will be handled and packaged assuming it contains hazardous materials, and either screened on site or sent to a third party accredited laboratory for confirmatory testing, as appropriate. The results of the analysis will determine the ultimate handling and disposal of removed pipe sections.

Proposed protection measures for hazardous materials management are summarized in Table 16, to be implemented as required upon encountering hazardous materials on-site.

**Table 16 – Hazardous Materials Management Proposed Protection Measures**

Protection Measures	Responsibility	Timing
<p>Specific measures that will be undertaken and equipment that will be used to manage hazardous materials will be described, including:</p> <ul style="list-style-type: none"> <li>▪ The proposed location and types of facilities where hazardous materials will be stored and handled, and where construction equipment will be refuelled.</li> <li>▪ Details of containment facilities for fuels, oils, antifreeze, and other liquid forms of hazardous materials such that spills can be contained and collected before contaminants enter soils or reach any watercourse or storm water system.</li> </ul> <p>This information may be included in the Health and Safety Plan prepared by the Contractor for the Project.</p>	Contractor	Prior to work commencing
<i>Implementation</i>		
Hazardous materials will be disposed of in accordance with law and the requirements of all authorities having jurisdiction.	Contractor	On-going during Projects
Should the on-site storage of hazardous materials such as gasoline or oils be required, secondary containment capable of holding at least 110% of all hazardous materials stored within will be in place.		
Above ground storage tank areas will be bermed, lined, and have in place appropriate drainage systems for removing accumulated rainwater.		
Current Safety Data Sheets (SDS) and an inventory will be maintained for all controlled substances used, stored, and handled onsite associated with Project activities.		
An area will be designated, as required, for the transfer or temporary storage of hazardous materials and wastes. The area will be clearly labelled and controlled in accordance with WHMIS and other statutes.		
<p>Where construction activities involve the handling, storage, and removal of hazardous waste, the Contractor(s) will maintain the following records:</p> <ul style="list-style-type: none"> <li>▪ Inventories of types and quantities of hazardous waste generated, stored, or removed.</li> <li>▪ Manifests identifying hazardous waste haulers and disposal destinations.</li> <li>▪ Disposal certification documents.</li> </ul>		
Personnel will be trained in the handling and transportation of dangerous goods and controlled substances.		
<i>Monitoring</i>		
The work area will be inspected for effectiveness of control measures implemented by the Contractor(s).	EM	As necessary

## 8.0 STATEMENT OF LIMITATIONS

This Construction Environmental Management Plan (CEMP) was prepared by Golder Associates Ltd. (Golder) for Imperial Oil Ltd. (Imperial), for the exclusive use of Imperial and its Contractors while undertaking the Burrard Inlet Pipeline Removal (BIPR) Project in Burrard Inlet, as described above, and any use, reliance, or decisions made by third parties on the basis of this CEMP are the responsibility of such third parties.

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If encountered site conditions or applicable standards change or if any additional information becomes available at a future date, modifications to the findings, conclusions and recommendations in this report may be necessary.

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# Daily Environmental Monitoring Field Notes

ENVIRONMENTAL MONITORING SUMMARY		
<b>Project Information</b>		
Project Name: Burrard Inlet Pipeline Removal Project	Location: Port Moody, BC	
Client: Imperial Oil Limited	Client Site Supervisor: Alistair Kirk	
<b>Contractor Information</b>		
Prime Contractor: FRPD	Contractor Site Supervisor: Jerry Kyaas	
<b>Environmental Monitor Information</b>		
Environmental Monitors: test		
Date:	Time Arrive On Site:	Time Leave Site:

WEATHER/OCEAN CONDITIONS (RANGE THROUGHOUT DAY)												
<b>Morning Observations</b>												
Air Temperature (°C):						Wind Strength:			Wind Dir.:			
Precipitation:						Waves:						
Low Tide (height and time): m -						High Tide (height and time): m -						
<b>Afternoon Observations</b>												
Air Temperature (°C):						Wind Strength:			Wind Dir.:			
Precipitation:						Waves:						
Low Tide (height and time): m -						High Tide (height and time): m -						
<b>Beaufort Wind Scale</b>												
0	1	2	3	4	5	6	7	8	9	10	11	12
Calm	Light Air	Light Breeze	Gentle Breeze	Moderate Breeze	Fresh Breeze	Strong Breeze	Near Gale	Gale	Strong Gale	Storm	Violent Storm	Hurricane Force
< 1 knot	1-3 knots	4-6 knots	7-10 knots	11-16 knots	17-21 knots	22-27 knots	28-33 knots	34-40 knots	41-47 knots	48-55 knots	56-63 knots	≥63 knots
<b>Douglas Sea Scale for Waves</b>												
Degree	0	1	2	3	4	5	6	7	8	9		
Ht (m)	no wave	0-0.1	0.1-0.5	0.5-1.25	1.25-2.5	2.5-4.0	4.0-6.0	6.0-9.0	9.0-14.0	14.0+		
Desc.	Glassy	Rippled	Smooth	Slight	Moderate	Rough	Very rough	High	Very high	Phenomenal		

## CONSTRUCTION ACTIVITIES

Daily Environmental Monitoring Field Notes

SITE INSPECTION CHECKLIST				
Component	Description	Checked		Comments
		Y	N	
Contamination Prevention	Check that hazardous, deleterious or regulated substances used onsite comply with the CEMP.	<input type="checkbox"/>	<input type="checkbox"/>	
	Check that equipment and machinery are free of visible leaks prior to machinery being located onto the barge	<input type="checkbox"/>	<input type="checkbox"/>	
	If refueling occurs on the barge or over water, check that refueling measures are being used to prevent deleterious substances from entering the water, as specified in the CEMP	<input type="checkbox"/>	<input type="checkbox"/>	
	Check that secondary containment and other protection measures are used where needed.	<input type="checkbox"/>	<input type="checkbox"/>	
Spills	Check that activities conform to the Environmental Emergency and Spill Response Plan, as part of the CEMP.	<input type="checkbox"/>	<input type="checkbox"/>	
	Check that spill containment kits are accessible at the Project site and on marine derricks.	<input type="checkbox"/>	<input type="checkbox"/>	
Materials and Waste Management	Check that activities conform to the protection measures for waste water, dredged sediment, and hazardous and non-hazardous waste, as part of the CEMP.	<input type="checkbox"/>	<input type="checkbox"/>	
	Check that Materials are properly stockpiled on the barges.	<input type="checkbox"/>	<input type="checkbox"/>	
	Dangerous goods are stored in secure sheds or stowage and handled in such a manner as to prevent their inadvertent release to the environment.	<input type="checkbox"/>	<input type="checkbox"/>	
Erosion and Sediment Control	Check that activities conform to the CEMP, including site isolation measures (e.g. silt curtain).	<input type="checkbox"/>	<input type="checkbox"/>	
	Visually inspect sediment and erosion control measures to confirm that they are functioning as intended.	<input type="checkbox"/>	<input type="checkbox"/>	
	Equipment are cleaned and decontaminated before entering and leaving site.	<input type="checkbox"/>	<input type="checkbox"/>	
Moon well/silt curtain	Check daily for trapped or stranded fish, marine mammals, and other aquatic life within the moon well/silt curtain.	<input type="checkbox"/>	<input type="checkbox"/>	
	Visibly inspect silt curtain from above water for damage, shift in location, and anchorage to shore.	<input type="checkbox"/>	<input type="checkbox"/>	
Fish and Wildlife Values	Habitat alteration is being minimized where possible.	<input type="checkbox"/>	<input type="checkbox"/>	
	No mortalities or visual signs of behavioral disturbances to fish or marine mammals.	<input type="checkbox"/>	<input type="checkbox"/>	
	Visually observe for fish and marine mammals inside of the moon well/silt curtain and within the vicinity of the work zone.	<input type="checkbox"/>	<input type="checkbox"/>	
	Visually observe for species at risk.	<input type="checkbox"/>	<input type="checkbox"/>	
	Check that barges do not ground in or adjacent to the Project area. Barges should be tied to the existing wharf or held in place with spuds.	<input type="checkbox"/>	<input type="checkbox"/>	
	Check that shallow water maneuvering is avoided and limited.	<input type="checkbox"/>	<input type="checkbox"/>	
Noise	Check that activities conform to working hours related to City of Port Moody Noise Bylaw and that best practices are implemented for noise control.	<input type="checkbox"/>	<input type="checkbox"/>	
Air Quality	Check that efforts are made to minimize exhaust emissions and potential dust emissions during hot, dry weather.	<input type="checkbox"/>	<input type="checkbox"/>	
Historical, Archaeological, and Cultural Resources	Check that procedures for identifying and protecting historical, archaeological, and cultural chance finds are in place.	<input type="checkbox"/>	<input type="checkbox"/>	

## Daily Environmental Monitoring Field Notes

### WATER QUALITY MONITORING

#### Visual Observations

Item to Check	Yes	No	Comments
Is there any sign of turbidity?	<input type="checkbox"/>	<input type="checkbox"/>	
Is there any sign of contamination or spills?	<input type="checkbox"/>	<input type="checkbox"/>	

#### In-Situ Monitoring

**Make/Model of Water Quality Meter:**

#### Water Quality Monitoring

Time	Site ID	Tide	Latitude	Longitude	Depth (m)	Turbidity (NTU)	pH	DO (mg/l)	Temp.
<b>Comments</b>									

Time	Site ID	Tide	Latitude	Longitude	Depth (m)	Sample #
<b>Comments</b>						

### UNDERWATER NOISE MONITORING

#### In-Situ Monitoring

Time	Sampling Location	Hydrophone Depth (m)	Noise Level dB SPL <sub>peak</sub>	Horizontal Distance to Sound Source	Water Depth	Comments

#### Notes

\*dB to kPa (underwater): 160dB = 100 Pa; 180 dB= 1000 Pa (1 kPa); 200 dB = 10,000 Pa (10 kPa); 210 db = 30 kPa; 220 dB = 100 kPa

## Daily Environmental Monitoring Field Notes

### MARINE MAMMAL MONITORING

Visual Observations			
Time	Location	Species ID (if possible)	Observation
Notes			

### FISH MONITORING

Visual Observations		
Time	Location	Observation (Life Stage, Behaviour, Presence of Eggs)
Notes		

### BIRD MONITORING

Visual Observations		
Time	Location	Observation (Adult/Eggs/Nestlings/Fledglings, Behaviour)
Notes		

**SUMMARY OF ISSUES AND RECOMMENDATIONS**

Health and Safety / Environmental Issue	Recommendation/Action	Comments
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## Daily Environmental Monitoring Field Notes

### ON-SITE COMMUNICATIONS

Time	Communications

**PHOTOS**

