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Subject Fish and Fish Habitat Technical Memorandum

Project Name Eagle Mountain – Woodfibre Gas Pipeline Project (EGP Project)

Attention Marie Cardona FortisBC Energy Inc. (FortisBC)
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From Bree Milne, Jacobs Consultancy Canada Inc. (Jacobs)

Date August 4, 2022

Copies to Ignacio Calvo Gonzalez (FortisBC)

1. Introduction

1.1 Project Overview

The EGP Project involves the construction of approximately 47 kilometre (km) of 24-inch outside diameter pipeline, including a 9-km tunnel (EGP Tunnel) from the BC Rail Properties Ltd. (BC Rail Site) to the proposed Woodfibre Liquefied Natural Gas Ltd. (WLNG) production facility (WLNG Site) in Squamish, BC. The EGP Project will expand FortisBC's existing natural gas transmission system to supply natural gas to the proposed WLNG Site, located southwest of Squamish, BC.

Construction is expected to begin in early-2023 and will occur over approximately 3 years, spanning all four seasons and likely a wide range of precipitation events. FortisBC is proposing to discharge tunnel wastewater from the Woodfibre Portal site into a small freshwater stream that enters Howe Sound approximately 150 m downstream of the proposed discharge site. Figure 1 shows the Woodfibre Portal footprint, location of the proposed wastewater discharge, and aquatic features including the unnamed tributary to Howe Sound that would receive the wastewater discharge.

1.2 Objectives

This Fish Habitat Assessment (FHA) memorandum supports the submission of a Waste Discharge Authorization (WDA) application for the Woodfibre Portal site. This FHA memorandum summarizes findings of desktop review and field assessment of the aquatic environment at the discharge location and in receiving waters. It also outlines Project regulatory requirements and provides recommendations to protect fish and fish habitat.

The objectives of this FHA technical memorandum are outlined as follows:

- Complete a desktop study to identify streams that may be impacted by discharge activities
- Present results of desktop and field assessment on baseline fish and fish habitat conditions, including from Jacobs' field studies and publicly available databases

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- Identify potential interactions with fish and fish habitat and identify listed or regionally important fish species that may be impacted by the discharge activities
- Provide Qualified Professional (QP) recommendations to reduce potential environmental impacts from the Project to protect fish and fish habitat
- Provide information to support WDA permitting under the *Environmental Management Act (EMA)*

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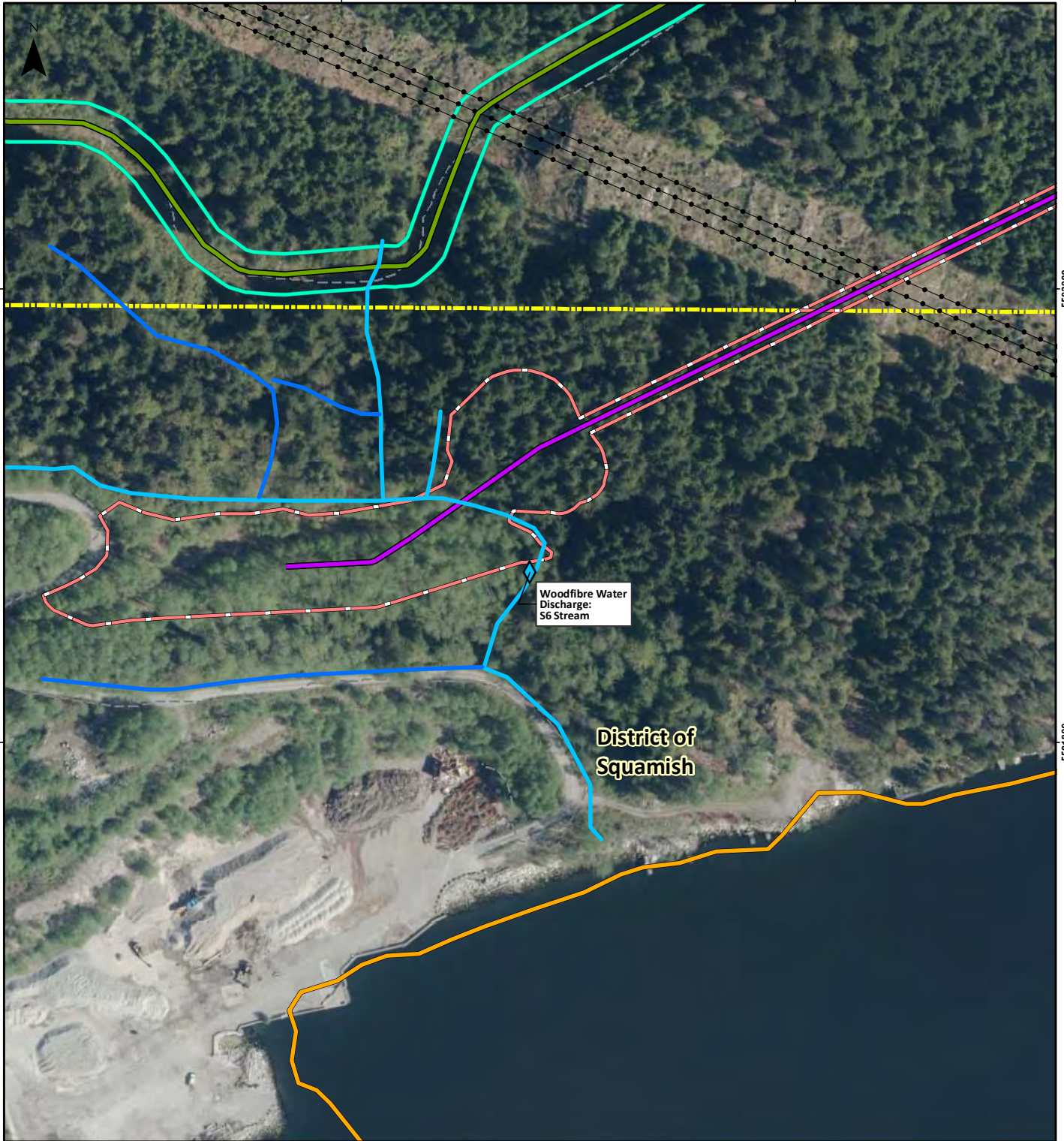
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Woodfibre Water Discharge: S6 Stream

District of Squamish

0 90 Meters

ALL LOCATIONS APPROXIMATE

JACOBS

- Water Discharge
- Existing NPS 10 FortisBC Pipeline
- Proposed FortisBC Pipeline (Tunnel)
- Stream – Classified
- Stream – NCD
- Certified Application Corridor
- Existing FortisBC pipeline ROW
- Tunnel ROW and Workspace
- Municipality
- Secondary Road
- Electrical Transmission Line



FIGURE 1
WATER DISCHARGE - WOODFIBRE SITE
EAGLE MOUNTAIN-WOODFIBRE GAS PIPELINE PROJECT

MAP NUMBER EGP_FIG2_WATERDISCHARGE_WOODFIBRESITE		PAGE SHEET 1 OF 1	
DATE October 2020	REFERENCE CE777000	REVISION 0	
SCALE 1:2,500	PAGE SIZE 8.5x11	DISCIPLINE PER	
DRAWN SL	CHECKED DJN	DESIGN DJN	

Projection: NAD 1983 UTM Zone 10N.
 Water Discharge Site: McMillen Jacobs Associates, 10-03-2019; V2 Compressor station: Fortis BC Aug 16, 2019; Tunnel routing and Workspace: Based on Solaris 2019-0604; Streams: Jacobs 9-24-2019; Existing Pipeline: FortisBC 2012; Road: BC FLNRO Digital Road Atlas, 2010; Hydrography: BC MFLNRO 2008; Municipal Boundaries: BC Ministry of Municipal Affairs and Housing, 2018; Provincial Park: BC FLNRO, 2005; Existing Electrical Transmission Lines: Integrated Cadastral Information Society 02-24-2014; Imagery: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that

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2. Methods

2.1 Desktop Assessment Methods

A desktop assessment was conducted to identify locations with documented fish presence, potentially important habitat, and fish species of conservation concern. Sources reviewed during desktop review included, but were not limited to:

- Reduced Risk Instream Work Windows for BC provincial work windows for the South Coast (instream work window) and Least Risk Timing Windows for DFO (Province of BC 2006 & DFO 2014)
- BC Habitat Wizard database to identify historical fish capture information, as well as presence of species at risk species (Province of BC 2021b)
- EcoCat Ecological Reports Catalogue to review any reports relating to previous fish captures for additional information (Province of BC 2021c)
- DFO's Aquatic Species at Risk Map to identify Critical Habitat and documented species at risk species presence (DFO 2021b)
- BC Conservation Data Centre (BC CDC) Species and Ecosystem Explorer (Province of BC 2021d) and BC CDC iMap (Province of BC 2021e) to identify status for potential species at risk
- Reviewed Technical Data Report from Jacobs in 2016 concerning a marine study 3km North of the Project along the coastline of Howe Sound (Jacobs 2016)

2.2 Field Survey Methods

Aquatic field assessments were conducted at the Woodfibre Portal area on April 17 and October 4, 2019, by a QP with aquatic specialty (including fish and fish habitat). Watercourses near the portal were assessed for fish presence potential based on guidance in the Fish-stream Identification Guidebook (BC Ministry of Forests 1998), including consideration of stream gradient, barriers to access, and perennial habitat potential above barriers. The nearest expected fish habitat from the portal was documented.

Stream morphology and channel characteristics were measured in watercourses at the Woodfibre Portal site. Bankfull width, wetted width, and bank heights were recorded to the nearest 0.1 m and water depths were recorded to the nearest 0.01 m. Slope was measured along the streams using a clinometer. Stream riparian classifications were assigned to watercourse reaches based on fish presence/absence and channel width based on the *Environmental Management Protection Regulation (EPMR)*, which determines Riparian Management Areas (RMAs).

Assessment of riparian vegetation along the watercourses included determining approximate functional width and condition, dominant vegetation type (such as, coniferous forest, shrub), maturity of the riparian community and potential value of the vegetation to fish and fish habitat. Discharge in watercourses was measured with a Hach FH950 velocity meter. Water quality parameters, including dissolved oxygen (DO), conductivity, pH, and water temperature were measured at sites where water was present using a YSI Pro Plus water quality meter. Turbidity was visually assessed. Potential erosional issues were identified and documented.

3. Results

3.1 Desktop Assessment Results

3.1.1 Aquatic Environment

The Woodfibre Portal site falls within the Pacific Ranges Ecoregion and the Coastal Cedar Hemlock biogeoclimatic (BGC) zone of BC. The site is located approximately 150 m from Howe Sound between 50 to 70 m above sea level. Two named fish-bearing watercourses are located south of the Woodfibre Portal, including Mill Creek and Woodfibre Creek. Coho salmon, Dolly Varden, and steelhead have previously been documented in Mill Creek and rainbow trout and cutthroat trout have previously been documented in Woodfibre Creek (Province of BC 2021a).

The proposed discharge site is located on an unnamed tributary to Howe Sound at approximately 10U 482083E 5501870N. The small watercourse flows down a steep south-facing slope and directly into Howe Sound. No fish have been previously documented in the watercourse (Province of BC 2021a).

3.1.2 Fish and Invertebrate Species Considered to be of Regional Importance

There were 14 fish species of regional importance identified in the desktop study (Province of BC 2021b), including provincially Blue-listed species, COSEWIC-listed species, and species listed as Special Concern on Schedule 1 of SARA (Government of Canada 2021a; Province of BC 2021d). The species that appear on the Red list for BC are either Extirpated, Endangered, or Threatened, or are being legally considered for such status, while the species that are Blue-listed are species that are considered to be vulnerable (Province of BC 2021d). The species with the highest regional importance are discussed in more detail as follows.

Pacific Herring

Pacific herring are a small forage fish which support a commercial fishery, a host of marine mammals and other fish species. They are known to spawn on the shorelines of Howe Sound (DFO 2014b). They have a lifespan of 14-16 years and breed once a year in the springtime along shorelines in intertidal zones, depositing their eggs on kelp, eelgrass, or other seaweeds or available structures. Results from field studies conducted by a citizen of Squamish between 2010 and 2019, and reviewed by DFO, revealed Pacific herring spawning along the north shore of Howe Sound, including at the shoreline where the unnamed tributary discharges into Howe Sound in April 2014 (Dearden 2020). The shoreline is modified and includes rip rap from historical disturbance but may be suitable for herring spawning (Photo 10). Although there is only a single observation of herring spawning at this location, due to the annual variability in herring spawning locations, it is assumed that herring could spawn again in the marine waters where the unnamed tributary flows into Howe Sound. Therefore, mitigation measures should aim to avoid impacting herring spawning activities and habitat.

Northern Abalone

Northern abalone is a marine mollusk that is federally listed as Endangered under COSEWIC and the Schedule 1 Species at Risk Act (Government of Canada 2021b, Province of BC 2021c). The Woodfibre discharge site was identified on the Aquatic Species at Risk Map (DFO 2021b) as potential habitat for the northern abalone. Habitat for the northern abalone includes shallow intertidal and subtidal waters along rocky coastline including bedrock or boulders (COSEWIC 2009). The northern abalone requires full salinity (>30 ppt) and is not likely to occur near river run off and are therefore likely to be sensitive to the influx of freshwater (COSEWIC 2009). Northern abalone require good water exchange and are found in the low

intertidal zone to shallow subtidal depths (up to 10 m) and in conjunction with encrusting coralline algae (*Lithothamnium*), sea urchins (*Strongylocentrotus sp.*), sea stars (*Pisaster sp.*), and kelp (*Nereocystis*, *Macrocystis*, *Pterygophora*) (COSEWIC 2009). Northern abalone typically move to shallower waters to mate and have a life span of up to 10 years. Freshwater inputs from the Squamish River and, more locally, from Mill and Woodfibre Creeks and small streams (including unnamed tributary to Howe Sound), may limit suitability of the shoreline to Northern abalone by lowering salinity. However, salinity levels are unconfirmed and Northern abalone should be assumed potentially present for the purposes of developing mitigation measures.

Eulachon

Eulachon are a small (<20cm) anadromous forage fish which spawn in the lower reaches of rivers, including the Squamish River (DFO 2014b). They serve as an important food source to larger fish such as sturgeon and used to support a commercial fishery before it was closed in 1990 (DFO 2014). During juvenile and adult phases they live near the sea floor at depths of 70m to 200m in open water, however the small larvae (4-8cm) are usually flushed out to sea once hatched and often remain in shallow low-salinity waters and estuaries (COSEWIC 2011). Both the Central Pacific Coast and Fraser River populations of eulachon have a COSEWIC status of Endangered and are under consideration to be listed on Schedule 1 on the Species at Risk Act (Government of Canada 2021b, Province of BC 2021c). While eulachon are listed under COSEWIC as endangered, the influx of freshwater treated under the BC Water Quality Guidelines is not expected to affect eulachon at any life stage as they are anadromous (COSEWIC 2014).

Other Fish and Invertebrates

Several other types of fish (e.g., anadromous salmon, rockfish) may occur in vicinity of the proposed discharge location. Pacific sand lance (*Ammodytes hexapterus*) and surf smelt (*Hypomesus pretiosus*) are known to spawn on the shores of Howe Sound and typically spawn in finer substrates (e.g., sand and gravels) in upper intertidal zones, which was not observed at the outlet of the watercourse along the shoreline (DFO 2014b) (Photo 10). Bathymetric data and field observations three kilometres North of the discharge were conducted in a previous marine Technical Data Report by Archipelago and showed a steeply dropping bottom, limiting the suitability of habitat eelgrass and limited area for kelps which generally grow at depths less than 25m (Jacobs 2016). No field work was conducted on the shoreline at the Woodfibre site. Although rearing habitat for juvenile salmonids is limited, chum, pink and chinook salmon from the Squamish River likely move through nearshore areas of the site in spring and early summer. There are rockfish conservation areas in Howe Sound, but none are located near the marine shoreline of the Woodfibre facility.

Benthic marine species that occur in Howe Sound include attached invertebrates (e.g., barnacles, corals, sponges, mussels) and mobile invertebrates (e.g., crab, starfish, urchins) (Lamb et al. 2011). Sensitive species that may occur in Howe Sound also include the glass (*Hexactinellid*) sponges.

Table 1 provides a comprehensive list of documented fish species within Howe Sound including the species, population specific spawning seasons, and the provincial and federal species status.

Table 1. Fish Species Previously Documented within the Howe Sound

Common Name ^a Scientific Name ^b	Population ^{a,c,d}	Spawning Season ^{b,c}	BC General Status ^c	COSEWIC Status ^d	SARA Listed ^d
Bocaccio Rockfish <i>Sebastes paucispinis</i>	General	N/A	No Status SNR (2002)	Endangered	-

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Common Name ^a Scientific Name ^b	Population ^{a,c,d}	Spawning Season ^{b,c}	BC General Status ^c	COSEWIC Status ^d	SARA Listed ^d
Chinook Salmon <i>Oncorhynchus tshawytscha</i>	South Coast, Georgia Strait	Fall	No Status SNR (2019)	Data Deficient	-
Chum Salmon <i>Oncorhynchus keta</i>	General	Summer/Fall	No Status SNR (2019)	-	-
Coho Salmon <i>Oncorhynchus kisutch</i>	General	Late Fall	No Status SNR (2019)	-	-
Eulachon <i>Thaleichthys pacificus</i>	Central Pacific Coast	Spring	No Status SNR	Endangered	-
Green Sturgeon <i>Acipenser medirostris</i>	General	Winter	Blue S2S3N (2019)	Special Concern	Special Concern
Longspine Thornyhead <i>Sebastolobus</i>	General	N/A	No Status SNR	Special Concern	Special Concern (2009)
Pacific Herring <i>Clupea pallasii</i>	General	Spring	No Status SNR	-	-
Pink Salmon <i>Oncorhynchus keta</i>	General	Summer/Fall	No Status SNR (2019)	-	-
Rougheye Rockfish Type I <i>Sebastes sp. Type I</i>	General	N/A	No Status SNR	Special Concern	Special Concern (2009)
Rougheye Rockfish Type II <i>Sebastes sp. Type II</i>	General	N/A	No Status SNR	Special Concern	Special Concern (2009)
Yelloweye Rockfish <i>Sebastes ruberrimus</i>	Inside waters	N/A	No Status SNR	Threatened	Special Concern
Sockeye Salmon <i>Oncorhynchus nerka</i>	General	Summer/Fall	Yellow SNR (2019)	-	-
Pacific Sand Lance <i>Ammodyte hexapterus</i>	General	Fall/Winter	No Status SNR	-	-
Surf Smelt <i>Hypomesus pretiosus</i>	General	Summer	No Status SNR	-	-

Notes:

^a Aquatic Species at Risk Map and Fisheries and Oceans Canada (Government of Canada 2021b and DFO 2022)

^b McPhail and Carveth 1993; McPhail 2007

^c BC Ecosystem Explorer (Province of BC 2021c)

^d Species at Risk Public Registry (Government of Canada 2021a)

All fish species listed in this table require a BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (BC MFLNRORD) Scientific Fish Permit (BC MFLNRO 2006)

-- Not listed or not required

3.2 Field Survey Results

The following subsection describes the combined results of the field assessments conducted for the unnamed tributary to Howe Sound. Table 2 provides the discharge location and stream classification information. Photographs of the existing discharge infrastructure and the watercourse are provided in Attachment 1.

Table 2. Summary of the Aquatic Interactions on the Project

Stream ID ^a	Stream Name ^a	UTM Coordinates (10U) ^a	Riparian Stream Classification ^b	Riparian Management Area ^b	Primary Interaction
WC-1	Unnamed tributary to Howe Sound	4881966E 5501901N	S6	RRRZ= 0 RRMZ= 20 m RMA = 20 m	Wastewater discharge

Notes:

^a Field Data collected by Jacobs QP , recorded April 17, 2019

^b Riparian Management Area Guidebook (Province of BC 2004)

RMA = Riparian Management Area

RMZ = Riparian Management Zone

RRZ = Riparian Reserve Zone

UTM = Universal Transverse Mercator

WC = watercourse (stream) crossing

3.2.1 Unnamed Tributary to Howe Sound

Stream Morphology and Water Quality

The unnamed tributary is heavily disturbed by historical activity, including channelized reaches along road or trail ditches. The watercourse is mostly along steep gradients (20 to 40%), but flows along a lower gradient (1 to 9%) bench for approximately 250 m (Photos 1 and 2), including along the portal site, before reaching the discharge site. At the east end of the portal site, upstream of the discharge site, the watercourse becomes confined by a steep north slope and road/trail fill placement to the south. There is notable bank and slope erosion at this location (Photos 3 and 4). The stream then bends sharply south where it becomes steeper again (upwards of 40%) through the proposed discharge location. A small waterfall (Photo 6) is located downstream of the discharge site, after which the stream flows along additional road ditches and culverts (Photo 7) before reaching Howe Sound (Photo 10). The total length of the stream from the discharge location to the outflow into Howe Sound is approximately 150m.

The channel width varied between 1 and 3 m wide along the assessed reach. Depths were shallow and generally less than 0.2 m. The substrate was variable, consisting mostly of fines with lesser amounts of gravels along the lower gradient bench. Coarser cobble and boulder substrates were present along steeper gradient sections of the stream. Bank structure was also variable with areas of valley or road fill confinement, presenting steep and sometimes unstable banks (upstream of the discharge location, Photos 3 and 4).

Water quality data are provided in Table 3 (including temperature, pH, dissolved oxygen, and conductivity). The data were collected during an instream survey on April 17, 2019. Other stream morphology measurements recorded were estimated from desktop resources or observed during land-based site assessments.

Table 3. Stream Morphology and Water Quality Measurements

Stream ID ^a	Temp. (°C) ^a	pH ^a	Dissolved Oxygen (mg/L) ^a	Discharge Rate (m ³ /s) ^a	Channel Width, Depths ^a (m)	Dominant Substrate	Bank Conditions
Unnamed tributary to Howe Sound	7.48	6.11	12.03	0.027	1 to 3 m; 0.07 to 0.14 m	Fines along low gradient bench, cobble/boulder in steeper sections	Steep, sections of undercutting and instability

Notes:

^a Recorded April 17, 2019

LB = Left Bank

LBH = Left Bank height

mg/L = milligram(s) per litre

RBH = Right Bank Height

Fish Habitat Characteristics

There were several barriers to fish passage along the stream including gradients exceeding 30% and a 3 to 4 m waterfall (Photo 6). Drops of 0.6 to 1.2m without pools and a hanging culvert impaired fish access from the intertidal zone (Photo 10). A lack of perennial habitat potential was noted above the barriers along the lower gradient bench with no deep pools and shallow seasonal conditions. Due to barriers to fish passage and seasonal lack of flow and depth for perennial suitability, the watercourse is classified as non-fish bearing. The intertidal zone of Howe Sound is expected to be the closest fish habitat to the discharge site, providing habitat for a variety of marine fish and invertebrate species.

3.2.2 Reduced Risk Timing Window

Howe Sound has documented presence fish species such as chum salmon (*Oncorhynchus keta*), coho salmon (*Oncorhynchus kisutch*), and Chinook Salmon (*Oncorhynchus tshawytscha*) which have federally recognized timing window of least risk. The LRTW for Howe Sound is August 16 to January 31 (DFO 2014a). The Provincial reduced risk window is not applicable to the Project as it is based on freshwater fish and the Tributary to Howe Sound is non-fish bearing. Since the Project is able to meet the BC Water Quality Guidelines when discharging into Howe Sound, there are no additional concerns with Project work outside the reduced risk window since anticipated effects from the discharging activities on fish and fish habitat are not anticipated to affect spawning fish.

4. Assessment of Discharge Activities

The discharge of the unnamed tributary Howe Sound was measured at 0.027m³/s by an aquatics specialist QP on April 1, 2019. This was during spring freshet and was likely representative of the approximate high flow rates in this stream. The stream is presumed to be seasonally dry during the summer though this was not confirmed with a field visit to the site.

The Project will discharge treated wastewater from the tunneling process into the Unnamed Tributary to Howe Sound. It is expected to produce an average wastewater discharge of 0.0018 m³/s, 24hr/day, 7 days a week, during normal operations. The rate of discharge may vary depending on the groundwater conditions at the time of construction. The maximum expected wastewater discharge from the Project is almost three times the maximum recorded background discharge. Based on the discrete measurements collected on April 17, 2019, the estimate of background discharge rate was approximately 0m³/s to 0.3m³/s. The discharge rates from the Project may vary depending on the groundwater conditions.

The field survey identified that the stream banks were partially eroded, indicating that the current discharge is likely exceeding the stream capacity. Mitigation is in development to ensure there will be no risk to fish or fish habitat. To avoid harm to fish or fish habitat the discharge into Howe Sound should also meet the BC Water Quality Guidelines, and implementation plans should be reviewed by a hydrologist to determine how to meet the guidelines (Province of BC 2021d).

The current stream channel morphology has not been adequate for the natural flow regime as there was evidence of erosion and unstable banks, resulting in a higher risk for sediment mobilization during instream work. The stream would likely require bed and bank stabilization, armouring such as rip rap, and sediment fencing to handle an increase in discharge, and to manage the risk of exceeding the BC Water Quality Guidelines for discharge into Howe Sound. Another option to reduce the risk of sedimentation associated with the unnamed tributary to Howe Sound would be to lengthen the discharge pipe, and discharge directly into Howe Sound or at a lower point on the tributary.

The influx of 0.017m³/s freshwater into Howe Sound is not anticipated to have any adverse effects on fish or fish habitat in relation to suitable salinity levels, as the dilution of salinity would likely be negligible given the potential for currents and tidal mixing.

5. Recommendations and Mitigation Measures

The proposed discharge activities are anticipated to require mitigation to manage the impacts to hydrology and water quality of downstream fish habitat in Howe Sound. The activities will be managed in accordance with the Construction Environmental Management Plan.

Recommendations are based on aquatic survey results and consideration of measures from DFO's Measures to Protect Fish and Fish Habitat (DFO 2019a), BC OGC's Environmental Protection and Management Guideline (BC OGC 2021d), and BC's Standards and Best Practices for Instream Works (Province of BC 2022). Additional mitigation measures or conditions may be included in permits issued to the Project. Table 4 lists the standard mitigation measures used to protect fish and fish habitat.

Table 4. Mitigation Measures to Protect Fish and Fish Habitat

Mitigation Type	Mitigation Description
<i>General Mitigation Measures</i>	
Regulatory	<ul style="list-style-type: none"> ▪ Confirm that necessary approvals, licences, and permits are secured before commencing applicable construction activities, and verify that notifications related to the approvals, licences, and permits are provided, as necessary. ▪ Review all mitigation and regulatory requirements before construction to confirm mitigation requirements are understood and implemented as described. ▪ A suitable Qualified Environmental Professional (QEP) will be retained to oversee Project activities within riparian areas, and to provide guidance on limiting Project footprint where disturbances are unavoidable.
Timing	<ul style="list-style-type: none"> ▪ Work must occur during the reduced risk timing window for the identified species or appropriate steps taken to implement mitigation measures or compensatory mitigation measures to prevent or address impacts of the Changes In and About a Stream activity if occurring outside the reduced risk timing window. Work must be planned for favourable weather and low flow water conditions within the approved work timing window. Species that may be impacted by the Changes In and About a Stream activity must be identified, and plans must be in place to minimize and mitigate any impacts in the event of an incident (Province of BC 2022).

Table 4. Mitigation Measures to Protect Fish and Fish Habitat

Mitigation Type	Mitigation Description
Timing Cont'd	<ul style="list-style-type: none"> ▪ Make all reasonable efforts to minimize the duration of construction. Construction crews should have all necessary materials and equipment prepared onsite before beginning. The excavation and removal of the existing pipeline should occur in a single phase without unnecessary interruptions. ▪ If activities or works occur during periods of heavy or persistent precipitation, these must be halted if sedimentation from them poses a significant risk of harm to the stream, stream channel, or the aquatic environment (Province of BC 2022).
Worksite Planning	<ul style="list-style-type: none"> ▪ Design and plan activities and works in the stream so loss or disturbance to aquatic habitat is limited. ▪ Design and construct temporary workspaces, stand down locations, and storage locations so they are set back from the stream as feasible, and limit loss or disturbance to riparian vegetation. ▪ If storage of equipment or materials is necessary within immediate proximity of the stream, install and maintain sediment and erosion control measures around the storage site. ▪ Areas of work and access routes must be clearly marked onsite prior to starting work (e.g., for work, staging, storage, access) and the route taken must minimize disturbance to riparian vegetation (Province of BC 2022). ▪ Environmentally sensitive areas (e.g., riparian areas or wetlands) will be flagged and fenced as appropriate prior to commencement of construction.
Containment and Spill Measures	<ul style="list-style-type: none"> ▪ Develop a Fuels and Hazardous Materials Spill Contingency Plan, inclusive of terrestrial and aquatic spills, to be implemented immediately in case of a spill of a deleterious substance; and keep an emergency spill kit onsite. ▪ Confirm building materials, construction equipment, and tools to be used in a stream have been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish (see Fish Protection). ▪ Prevent construction materials (not intended for use) and debris from entering the stream. ▪ Paints and solvents must be stored, mixed, and transferred in spill containment trays on land at least 30 m from any stream or surface water drainage (Province of BC 2022). ▪ All waste materials must be stored outside of the riparian area until appropriate disposal. All excess drilling mud, cuttings, and other waste materials must be stored a minimum of 30 m away from the stream on flat ground to prevent sediment and other deleterious substances from entering the stream (Province of BC 2022). ▪ Equipment and machinery must be clean and in good operating condition (e.g., power washed and free of leaks or excess oil and grease). No equipment refueling or servicing is conducted within 30 m of any stream or surface water drainage (Province of BC 2022). ▪ Hydraulic machinery that is in and about a stream must use environmentally sensitive hydraulic fluids which are non-toxic to aquatic life and are biodegradable (Province of BC 2022). ▪ To prevent the release of substances toxic to fish, there must be no use of treated wood products within the stream or stream channel or ditch lines (Province of BC 2022). ▪ Fill, road crush, riprap, or other materials used in or about the stream must be inert, clean, and free of contaminants. Processed rock must not be acid generating or metal leaching (Province of BC 2022). ▪ A spill response plan and spill kit suitable for all substances onsite must be readily accessible onsite in the event of a release of a deleterious substance to the environment (Province of BC 2022).

Table 4. Mitigation Measures to Protect Fish and Fish Habitat

Mitigation Type	Mitigation Description
Containment and Spill Measures (cont'd)	<ul style="list-style-type: none"> ▪ FortisBC's Regulatory Advisor will report any contravention of the <i>Water Act</i> or <i>Fisheries Act</i> as soon as practical and will complete any required reporting. ▪ Cease all work immediately if deleterious substances are entering the stream. The containment and cleanup of this material is to occur immediately (if feasible, without causing further environmental damage) to prevent it from moving downstream.
Erosion and Sediment Control	<ul style="list-style-type: none"> ▪ Sediment, runoff, and erosion control measures must be developed and implemented before Changes In and About a Stream activity and works begin, including details on the steps that will be taken to reduce sedimentation when significant precipitation or overland flow events occur. Efficacy of these measures is monitored during construction and adjustments are made, if needed (Province of BC 2022). ▪ The plan will include the following, where applicable: <ul style="list-style-type: none"> – Installation of effective erosion and sediment control measures before starting work to prevent sediment from entering the stream – Measures for containing and stabilizing waste material above the high watermark of the stream to prevent mobilization – Regular inspection and maintenance of erosion and sediment control measures and structures during construction – Repairs to erosion and sediment control measures and structures if damage occurs – Removal of nonbiodegradable erosion and sediment control materials once the site is stabilized. ▪ Leave an organic mat where possible as a buffer zone to limit the potential for sediment to enter the S2 fish stream. Do not grade the entire width of the construction work area in proximity to a stream or wetland unless absolutely necessary (Province of BC 2022). ▪ The topsoil must be protected from compaction and admixing. Replace topsoil over root networks at a stable angle of repose without compaction at the completion of the work (Province of BC 2022). ▪ Fill, excavated material, debris, or other erodible materials must be contained and placed at least 30 m outside of the bank of the stream and to an area where the material will not result in sediment run-off into the stream or another stream (Province of BC 2022). ▪ Where excavated or disturbed material remains within the work area, these must be graded to a stable angle of repose and sediment mobilization mitigation measures must be employed (Province of BC 2022). ▪ All equipment, supplies, and non-biodegradable materials must be removed from the site and disposed of at an approved facility, including non-permanent sediment control works once they are no longer required, or any suspended sediment has settled (e.g., non-biodegradable silt fences) (Province of BC 2022).
Bank Protection	<ul style="list-style-type: none"> ▪ Removal of roots or trees that are embedded in the stream bank must be avoided, and root protection zones must be described in advance for trees that can be retained. These trees must be delineated and protected at the onset of works. Trees and shrubs with roots embedded in the stream or stream channel are only removed if there are concerns about human safety or the activities or works cannot be completed without their removal (Province of BC 2022). ▪ Make efforts to avoid the unnecessary disturbance of the stream bank. If unplanned degradation of either bank occurs during construction, a site-specific bank reclamation plan will be developed and implemented. Immediately stabilize banks disturbed by any activity associated with the Project to prevent erosion and sedimentation.

Table 4. Mitigation Measures to Protect Fish and Fish Habitat

Mitigation Type	Mitigation Description
Bank Protection (cont'd)	<ul style="list-style-type: none"> <li data-bbox="430 331 1409 451">▪ Where windthrow risk is moderate or high in the RRZ, a sufficient number of trees should be retained within the RMZ to protect the windfirmness of the RRZ. Manage windthrow hazard consistent with the section "Options to reduce windthrow risk to reserve zone" (Province of BC 2019). <li data-bbox="430 466 1409 737">▪ Trees are felled away from the stream or stream channel unless there are public or worker safety concerns. Trees that are felled into the stream or stream channel are removed during the instream work timing window in a manner that does not damage the bed or banks of the stream (stream channel) and are placed at a site where they will not enter the stream channel during high flows. Removal of riparian trees and shrubs using hand tools/saws is preferable overuse of heavy equipment to minimize ground disturbance. Where equipment must be used, a machine-free zone adjacent to the stream or stream channel to protect the bank from ground compaction is followed, where practicable (Province of BC 2022). <li data-bbox="430 751 1409 930">▪ Large woody debris and the stumps of large diameter trees must be left in place where it is safe to do so. If it must be moved, large woody debris that provides habitat for plants or wildlife (as identified during pre-construction supporting studies) should be salvaged and replaced after construction if practical. Large woody debris may be incorporated into riparian reclamation plans to provide wildlife habitat. Ensure the stem and limbs do not obstruct stream flow or fish passage (Province of BC 2022). <li data-bbox="430 945 1409 1031">▪ Tree protection measures are used, including horizontal root protections and vertical trunk and crown protections, where potential adverse impacts to tree parts are identified (Province of BC 2022). <li data-bbox="430 1045 1409 1165">▪ The planting of live stakes must be timed for the dormant season in the spring (prior to leaf out) or in the fall (once the leaves have dropped). Salvage seed or live stakes from the natural vegetation prior to disturbance for site restoration following the work (Province of BC 2022). <li data-bbox="430 1180 1409 1358">▪ Disturbed areas (including riparian areas) must be restored to an augmented or ecologically similar state with suitable species to restore the vegetative cover and prevent surface erosion and subsequent siltation of the stream. This may include hydroseeding the banks and areas adjacent to the stream with a heavy mulch, tackifier and local, ecologically suitable seed mix (i.e., does not include undesirable or Invasive species) (Province of BC 2022). <li data-bbox="430 1373 1409 1488">▪ Revegetation must include a diverse mix of native ecologically suitable trees, shrubs, and herbaceous plants appropriate to the site conditions. In addition to tree replacement quantities, shrub and herbaceous species must be replaced on the landscape to their natural assemblage (Province of BC 2022). <li data-bbox="430 1503 1409 1623">▪ Soil amendments or mulch must be used, where appropriate, to promote growth of newly planted vegetation, particularly in well drained soils. Regular watering is conducted, where appropriate, until plants and stakes become established (Province of BC 2022). Remove all construction materials from the site upon Project completion. <li data-bbox="430 1638 1409 1694">▪ Restore the channel bed and banks to their natural state as much as practicable. Replace or restore any habitat features that were disturbed (Province of BC 2022). <li data-bbox="430 1709 1409 1793">▪ A plan must be in place to monitor the effectiveness of the restoration and site stability over time (e.g., over one or more growing seasons or one or more freshets) (Province of BC 2022).

Table 4. Mitigation Measures to Protect Fish and Fish Habitat

Mitigation Type	Mitigation Description
Fish Protection	<ul style="list-style-type: none"> ▪ Only material that is necessary to mitigate flooding or to facilitate the proper functioning of the stream must be removed. Material that is not causing an adverse impact to the functioning of the stream and whose removal may adversely impact instream habitat (e.g., debris that is more than one-third buried) must be left in place (Province of BC 2022). ▪ Steps must be taken to prevent the introduction of silt, debris, refuse, sediment, or sediment-laden water, raw concrete or concrete leachate, or any other deleterious substances into streams, ditches, and storm sewer systems so that the quality of water is not adversely affected (Province of BC 2022). ▪ Perform water quality monitoring during instream construction activity to confirm that adverse effects related to turbidity and total suspended solids are avoided. ▪ Perform a fish salvage within the isolated section of the stream, and within any flooded areas in within the PCF prior to commencing work to confirm that no fish are present. ▪ Clean, drain, and dry equipment that contacted water before arriving onsite and after construction is completed. <ul style="list-style-type: none"> – Verify that workers who will be instream (including fisheries workers) take appropriate measures for disinfecting equipment to avoid transporting aquatic invasive species. ▪ The DFO Interim COP: End-of-Pipe Fish Protection Screens for Small Water Intakes in Freshwater (DFO 2021a) will be followed, and a notification submitted during water withdrawal activities.
Instream Construction Activities	<ul style="list-style-type: none"> ▪ Confirm that pre- and post-construction photographic records are developed and kept on file. The photographic records must use the same photograph points. ▪ Confirm that disturbance of the access or the stream’s approach is reduced, immediately stabilized, and restored, where feasible, to approximate pre-construction conditions. See Riparian Vegetation and Bank Protection. ▪ Equipment must operate from outside the stream channel, wherever possible. Mechanized equipment and machinery must not be operated within the water without appropriate mitigation measures (Province of BC 2022). ▪ If an isolated trenched crossing method is employed, water flow must be maintained around the isolated section of the stream. ▪ Fording will occur in dry or frozen conditions, or both, to avoid rutting and compaction of the riparian area of wetlands. If wet conditions are encountered, matting or ramping should be used as appropriate (DFO 2021a). ▪ If fish migration is impeded by instream works, aquatics staff who are listed and qualified under the Scientific Fish Collection Permit and DFO licence, should assist migration by capturing and relocating fish around the instream isolation.
Environmental Monitoring of Activities or Works	<ul style="list-style-type: none"> ▪ A pre-construction meeting must be held between the approval holder or proponent, site manager, environmental monitor, and any Contractors managing activities and works to verify a common understanding of the legal requirements and relevant BMPs for the Project (Province of BC 2022). ▪ A copy of authorizing instruments authorizing the Changes In and About a Stream (e.g., change approval or licence) and relevant BMPs related to the work must be available at the worksite at all times (Province of BC 2022). ▪ An environmental monitor must be retained with respect to Changes In and About a Stream who is appropriately qualified to monitor the activities and works to assure compliance with <i>Water Sustainability Act (WSA)</i> and <i>Water Sustainability Regulation</i>

Table 4. Mitigation Measures to Protect Fish and Fish Habitat

Mitigation Type	Mitigation Description
Environmental Monitoring of Activities or Works (cont'd)	<ul style="list-style-type: none"> ▪ legislation and the terms and conditions of the authorizing instrument (Province of BC 2022). ▪ During construction, the Environmental Inspector (EI) will confirm that mitigation measures are implemented to provide effective protection of the environment in the Project area. ▪ Within 60 days of the Project's completion, the environmental monitor must: complete and submit at least one copy of an environmental monitoring report to the person authorized to make the Changes In and About a Stream (e.g., the approval holder, proponent, or key contractor); and make the report available at the request or direction of a WSA official or as required by the authorizing instrument (Province of BC 2022). ▪ A post-construction monitoring program will be implemented to confirm that mitigation measures implemented during final clean-up and reclamation are successful and continue to be effective (Province of BC 2022). Additional mitigation measures will be implemented if necessary.

6. Summary and Closing

After reviewing the available data and the proposed Project activities, the Professional Biologist (QP) has determined that the *DFO Measures to Protect Fish and Fish Habitat* cannot be fully implemented during the Project since instream works are required during discharging activity.

It is anticipated, that with the successful implementation of the recommended Best Management Practices and additional mitigation the Project activities (bank erosion stabilization and discharge) should not result in harmful alteration, disruption or destruction (HADD) of fish or fish habitat in the unnamed tributary to Howe Sound (WC-1) since the stream was determined to be non-fish bearing and lacking habitat for fish.

There may be a risk of HADD of fish and fish habitat in the estuarine foreshore of Howe Sound if bank stabilization and erosion control measures planned in WC-1 are inadequate in keeping turbidity below the thresholds tolerated by aquatic life as outlined in the BC Water Quality Guidelines.

If you have any questions or concerns regarding this information, do not hesitate to contact Carissa Stenzel at 587.591.8375 or via email at carissa.stenzel@jacobs.com.

Sincerely
Jacobs Consultancy Canada Inc.

Written by:



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Attachment 1
Photographs



Photo 1. View upstream of Unnamed Tributary to Howe Sound along low gradient bench adjacent to the portal site (April 17, 2019).



Photo 2. View downstream of Unnamed Tributary to Howe Sound along low gradient bench adjacent to the portal site (April 17, 2019).



Photo 3. View downstream of bank/fill erosion, approximately 40 m upstream of the proposed discharge. (October 4, 2019).



Photo 4 View downstream at bend approximately 30 m upstream of the proposed discharge location, showing instability and erosion on north slope. (October 4, 2019).



Photo 5. View downstream approximately 20 m upstream of the proposed discharge location, showing bank instability and metal debris/boulders in the watercourse. (April 17, 2019).



Photo 6. View upstream of waterfall (3 to 4 m barrier to fish passage) approximately 100 m upstream of Howe Sound (April 17, 2019).



Photo 7. View upstream of ditch from downstream of the discharge location, in the lower ditch reach before Howe Sound. (April 17, 2019).



Photo 8. View upstream 15 m upstream Howe Sound interface showing 33% slope (fish access barriers). (April 17, 2019).



Photo 9. View downstream towards the intertidal zone and Howe Sound. (April 17, 2019).