

Metrotower II – Suite 2100
4720 Kingsway
Burnaby, BC V5H 4N2
Canada
T +1.604.684.3282
F +1.604.684.3292
www.jacobs.com

Subject Waste Discharge Authorization Sampling and Analysis for the WLNG Site

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

Attention Ignacio Calvo Gonzalez, FortisBC Energy Inc. (FortisBC)

From Jacobs Consultancy Canada Inc. (Jacobs)

Date September 6, 2022

Copies to Ilona Berbekar, FortisBC/Jacobs

1. Introduction

The EGP Project involves the construction of approximately 47 kilometres (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.

1.1 Water Sources

Water will be generated at the WLNG Site during construction activities of the EGP Tunnel, including water from precipitation and runoff, groundwater inflow into the unlined tunnel and Tunnel Boring Machine (TBM) industrial water including water for drilling and probing and cleaning of equipment. The proposed discharge location is into a small stream called the Stream "X" which is the small creek directly adjacent to the Woodfibre Tunnel Portal (Figure 1). Other names for this stream have been "East drainage" "East Creek" or "Stream 2" within various reference documents. Throughout this memo the watercourse will be referenced as Stream X. It is noted that in addition to the proposed treated water discharge from the Woodfibre Tunnel Portal going into Stream X and discharging to reach A, there are several new stormwater discharges to Stream X which are upstream of the Woodfibre Tunnel Portal discharge. These are currently proposed as part of the planned works within the WLNG Site (Jacobs 2020) and are not the subject of this memorandum. They include:

- Runoff from the V2 Compressor Station during construction and operations (to Reach D)
- Runoff from the planned WLNG landfill closure (to Reach B)
- Runoff from the Custody Transfer Station (CTS) during construction and operations (to Reach B)

The water originating from the Woodfibre Tunnel Portal discharge location will have a water treatment plant that will collect water and treat it to meet the BC Approved Water Quality Guidelines (BC ENV 2021) as detailed in Appendix A, and BC Oil and Gas Commission (OGC) criteria before discharge into Stream X.

1.2 Existing Groundwater Quality

The existing surface and groundwater quality that will eventually discharge into Stream X has been documented from the following sources:

1. The Risk-based Certificate of Compliance (CofC) issued in 2014 for the uplands portion of the WLNG Site which lists which parameters in groundwater were remediated.
2. An upgradient monitoring well groundwater monitoring result and surface water results for Stream X from the report that supported the CofC: "Report of Findings for Preliminary Site Investigation, Stage 1, Preliminary Site Investigation, Stage 2, Detailed Site Investigation and Supplementary Site Investigation Former Squamish Pulp Mill Site, Woodfibre, BC - Project No. 11644-03" Prepared by Keystone Environmental Ltd. (Keystone) in 2014.
3. The investigation into potential surface and groundwater that may be intercepted by the proposed tunnel and subsequently discharged into Stream X. The work was conducted in 2021 by TetraTech and reported in their technical memo entitled: Eagle Mountain – Woodfibre Gas Pipeline Project – Surface Water Quality Sampling along the Bedrock Tunnel Alignment – Revision 1.
4. The Draft #1 (February 12, 2020) Landfill Pre-Closure Flow Assessment – Interim Report, Woodfibre, BC - Project no. 112550-51E, prepared by Keystone, which describes the water quality of groundwater and surface water that may be directed into Stream X but would have to be approved under the existing discharge permit for the landfill.

The water quality results of Stream X, and other potential discharge waters that were gleaned from these reports, were tabulated and compared to the current 2020 BC WQG which include both the approved and working guidelines. These values are presented in appended Table 1. The following is a summary of the present water quality of Stream X or of seeps that may eventually become groundwater encountered during tunnel construction that could be discharged.

1.2.1 Risk Based Certificate of Compliance 2014 – Groundwater Quality.

The WLNG Site was issued a Risk Based CofC in 2014 (BC MOE 2014). The CofC indicated that pre-existing groundwater impacts have been discharging to the Mill Creek and other drainages and subsequently to Howe Sound, but these have been either remediated and/or assessed to have an acceptable risk. The identified contaminants listed on the CofC, that were remediated in groundwater, were: arsenic, chromium, lead, extractable petroleum hydrocarbons (EPWw) 10-19, benzo[a]pyrene and ethylbenzene. The contaminants in groundwater that were assessed not to pose a risk were: antimony, arsenic, lead, magnesium, sodium, uranium, and benzo[a]pyrene. The groundwater quality for both remediated and risk evaluated contaminants of concern were compared to the Drinking Water Standards which were identified as the most stringent applicable groundwater standards for the WLNG Site.

1.2.2 Keystone 2014 Report of Findings Supporting the 2014 CofC – Surface Water Investigation.

The investigation report that supports the CofC (Keystone 2014) had sampled surface water in Stream X and the results were compared to the BC Surface Water Quality Guidelines in effect at that time. Four sampling locations (SW07-5, SW07-12, SW13-05 and SW13-202) are situated at or just above the proposed location of the Woodfibre Tunnel Portal Discharge. Two sampling locations are situated downgradient along the upper portion of Reach A of Stream X (SW07-13 and SW07-157). There are two upstream sample locations on Stream X (SW07-3 and SW07-4). See Figure 2 for the sampling locations.

The following parameters were assessed at one or more of the six locations:

- Extractable Hydrocarbons (EHw)
- Light and Heavy Extractable Petroleum Hydrocarbons in water (LEPHw/HEPHw)
- Polycyclic Aromatic Hydrocarbons (PAH):
- Dissolved metals
- Total metals
- Benzene, ethylbenzene, toluene, xylenes, and styrene (BETXS), Volatile Hydrocarbons (VH), Volatile Petroleum Hydrocarbons (VPH) and Methyl tert-butyl ether (MTBE)
- Volatile Organic Compounds
- Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Dissolved Chloride, Dissolved Fluoride, Dissolved Sulphate, Nitrate and Nitrite, Total Organic Carbon (TOC) and Biochemical Oxygen Demand (BOD)
- Fatty and Resin Acids
- Total Phenolics

Exceedances of the BC WQG were identified at the locations around the proposed Woodfibre Tunnel Portal discharge location for total barium (4.9 ug/L), total iron (1140 ug/L), total zinc (11 ug/L) and dissolved calcium (ranging from 8740 ug/L to 189,000 ug/L). None of the other parameters tested exceeded the BC WQG.

One groundwater monitoring well was installed just above Stream X (MW06-4) along Reach C and the groundwater sample from that well had dissolved calcium and dissolved aluminium at concentrations of 30200 ug/L and 450 ug/L respectively which were above the BC WQG at that time. None of the wells installed downgradient of Stream X and upgradient of the former main industrial site were found with contamination above the DW standard or the BC WQG.

1.2.3 Keystone 2020 Landfill Pre-Closure Flow Assessment – Interim Report

Currently there is a water discharge permit for the existing landfill on the Site. The drainage from the landfill is intercepted and directly to a specific discharge location that goes to Mill Creek and should not mix or add water to the construction efforts of the EGP project. There is upgradient, overflow water that is not in contact with the landfill which is proposed to be discharged into Stream "X", just above Reach C, (Keystone 2020), This water should not be impacted with any contaminants from the landfill and is surface water overland flow. This report measured concentration in Stream X at one location at the upper end of Reach C at sample location S4. The surface water sample was assessed for the following parameters:

- pH
- BOD
- TSS
- Ammonia
- Nitrate
- Nitrite
- Calcium
- Magnesium
- Sodium
- Potassium
- Bicarbonate
- Sulfate
- Chloride
- Total Metals
- Rainbow Trout Toxicity 96 hr LC50

The sample results were in compliance for the parameters listed in the BC WQG. The report also indicated that historical sampling of water at S4 had been conducted. The historical results were summarized within the text as ranges but the specific data was not included in the appended tables. The historical ranges for pH, BOD, conductivity and Rainbow Trout Toxicity 96Hr LC50 were within acceptable ranges or under the BC WQG.

1.2.4 TetraTech 2021 Surface Water Quality Sampling

An evaluation of the quality of the groundwater that may be encountered during the tunnel boring was assessed in 2021 by TetraTech and reported in their technical memo entitled: Eagle Mountain – Woodfibre Gas Pipeline Project – Surface Water Quality Sampling along the Bedrock Tunnel Alignment – Revision 1.

The methodology was based on the assumption that water from water catchment areas that originate from groundwater seeps eventually form drainages or creeks that will intersect with the tunnel alignment and could infiltrate into the tunnel during excavation. Twenty-four water catchment areas were mapped (WC-A through WC-X) – See Figure 3. Six of the catchment areas plus the Woodfibre Tunnel Portal proposed discharge (Stream X) were sampled during the driest time of year (late summer) to maximize the likelihood that any water flowing through the drainages was sourced from groundwater springs/seeps and not from rainfall or surface run-off. Their results were compared to the 2019 BC Approved WQG.

Their primary findings were:

- The Woodfibre Portal Discharge Site (Stream X) had exceedances for pH (6.8) and dissolved copper (0.41 ug/L) and was under the minimum level for alkalinity of 10,000 ug/L (6600 ug/L).
- WC-A (unmapped) had exceedances for total beryllium (0.171 ug/L), total iron (2080 ug/L) and total uranium (9.11 ug/L).
- WC-K had an exceedance for dissolved copper (0.85 ug/L).
- No exceedances were detected at WC-N, WC-R, WC-U and WC-V.

1.3 Anticipated Groundwater Quality

The activity of the tunnel boring operations will likely produce industrial water including water for drilling and probing, cleaning of equipment, etc. The typical parameters that would be used to characterize these waters would include total and dissolved metals, BETXS, PAHs, TDS, TSS, BOD.

1.4 Target Parameters for Discharge Water Monitoring

The parameters identified as the target WLNG Site specific parameters of concern are shown in Table 1-1.

Table 1-1. Target Parameters for Discharge Water based on Previous Groundwater Sampling Events
TARGET PARAMETERS OF CONCERN FOR DISCHARGE WATER
Monitoring Parameters
pH, hardness, TDS, BOD
Inorganic Parameters
Anions: chloride, fluoride, sulphate (SO ₄ -2), sulphide
Dissolved metals: aluminium, cadmium and iron
Total metals: antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, mercury, molybdenum, nickel, selenium, thallium, tin, zinc
Organic Parameters
Benzene, ethylbenzene, toluene, xylene, styrene
Ethylene glycol, 1-2 propylene glycol
acenaphthene, acridine, anthracene, benzo(a)anthracene, benzo(a)pyrene, chrysene, fluoranthene, fluorene, naphthalene, phenanthrene, pyrene

1.5 Sampling

Water quality sampling (for lab analysis and field monitoring) will be conducted prior to discharge at the WLNG Site to verify effective treatment of the water and compliance with the Waste Discharge Authorization from the BC OGC. Water quality monitoring (field monitoring and visual observations) will be conducted prior to discharge, throughout discharge and post discharge. All water quality sampling will be conducted according to the B.C. Field Sampling Manual – Part E (BC MOE 2013)

1.6 Sampling Plan

- Initial discharge water will be sampled for all parameters in Table 2-1 prior to release to verify compliance with the Waste Discharge Authorization from the BC OGC.
- During water discharge, treated water will be sampled on a frequency, as outlined in Table 2-1, as well as on an as-needed basis. Refer to Appendix A for water quality parameter guidelines.
- Treated water cannot be released to the environment unless it meets discharge parameter guidelines (see Appendix A). Contractor will continue to treat the water until it meets discharge parameters.
- Lab samples will be taken with sample containers provided by the lab. Samples will be kept at the correct temperature and brought to the lab within the specified holding time, as per the instructions.
- Sampling protocols will follow the B.C. Field Sampling Manual - Part E Water and Wastewater Sampling (BC MOE 2013).

- The standardized field protocol in the B.C. Field Sampling Manual (BC MOE 2013) requires a minimum of 10 percent of the samples to be replicate samples and an additional 10 percent to be blank samples, both of which are, to be submitted to the lab as part of the quality control program.
- Field equipment will be calibrated as per factory instructions.
- Water samples will be collected at the outlet of the treatment facility on the WLNG Site.

1.7 Methodology

The sampling parameters chosen reflect the target parameters listed in Section 1.4, identified from the background information (Certificate of Compliance and recent groundwater monitoring and analytical test results), known geological influences in the area (sulfate bearing rock) and additional parameters based on proposed usage of the Site as staging and construction area for the pipeline.

1.8 Sampling Frequency and Parameters

Frequent testing and monitoring will be conducted to verify that the water treatment system is working properly. Initial monitoring will be done on a more frequent basis (“stabilization of parameters” frequency) until three consecutive rounds of sampling results are obtained that are below the BC WQG which indicates that the system is working as per design specifications. Once the system has been confirmed, routine sampling frequency will be followed (see Table 2-1).

If during the routine sampling work, there is an exceedance, the sampling frequency for that parameter will revert to the stabilization frequency as described in Table 2-1.

See Table 2-1 for a description of the sampling frequency and parameters to be tested for the treated water.

Table 2-1. Water Sampling Parameters and Frequency ^a

Parameter	Sampling Frequency	
	Stabilization of Parameters ¹	Routine Sampling
Anions and Nutrients		
Chloride (chloride ion)	Every 2 weeks	monthly
Total residual chlorine (TRC) or Cl-produced oxidants (CPO)	Twice per week	weekly
Fluoride	Every 2 weeks	monthly
Sulphate (SO ₄ -2)	Every 2 weeks	Monthly
Sulphide	Every 2 weeks	Monthly
Glycols		
Ethylene glycol	Twice per week	Weekly
Propylene glycol, 1,2-	Twice per week	Weekly
Organics - Polycyclic Aromatic Hydrocarbons		
acenaphthene	Twice per week	Weekly

Waste Discharge Authorization Sampling and Analysis for the WLNG Site

Table 2-1. Water Sampling Parameters and Frequency ^a

Parameter	Sampling Frequency	
	Stabilization of Parameters ¹	Routine Sampling
acridine	Twice per week	Weekly
anthracene	Twice per week	Weekly
benzo(a)anthracene	Twice per week	Weekly
benzo(a)pyrene	Twice per week	Weekly
chrysene	Twice per week	Weekly
fluoranthene	Twice per week	Weekly
fluorene	Twice per week	Weekly
naphthalene	Twice per week	Weekly
phenanthrene	Twice per week	Weekly
pyrene	Twice per week	Weekly
Organics - Volatile Organic Compounds		
Benzene	Twice per week	Weekly
Ethylbenzene (C ₈ H ₁₀)	Twice per week	Weekly
Monochlorobenzene	Twice per week	Weekly
Styrene	Twice per week	Weekly
Toluene	Twice per week	Weekly
Xylene (C ₆ H ₄ (CH ₃) ₂)	Twice per week	Weekly
Physical Parameters		
pH ^b BOD, TSS, Bicarbonate Hardness	Daily	Daily
Dissolved oxygen ^b	Daily	Daily
Salinity ^b	Daily	Daily
Temperature ^b	Daily	Daily
Dissolved Metals		
Aluminum (pH dependent)	Weekly	Monthly
Cadmium	Twice per week	Weekly
Iron	Twice per week	Weekly
Total Metals		
Antimony	Weekly	Monthly
Arsenic	Weekly	Monthly
Barium	Weekly	Monthly

Table 2-1. Water Sampling Parameters and Frequency ^a

Parameter	Sampling Frequency	
	Stabilization of Parameters ¹	Routine Sampling
Beryllium	Weekly	Monthly
Cadmium	Weekly	Monthly
Calcium	Weekly	Monthly
Chromium- III	Weekly	Monthly
Chromium- IV	Weekly	Monthly
Cobalt	Weekly	Monthly
Copper	Weekly	Monthly
Iron	Weekly	Monthly
Lead total	Weekly	Monthly
Magnesium	Weekly	Monthly
Mercury	Weekly	Monthly
Molybdenum	Weekly	Monthly
Nickel (hardness dependent)	Weekly	Monthly
Selenium	Weekly	Monthly
Thallium	Weekly	Monthly
Tin	Weekly	Monthly
Zinc (hardness dependent)	Weekly	Monthly

¹ Frequency to be used during initial system set up until stabilization is achieved (three consecutive rounds of sampling that meet the BC WQG) ***OR*** to be applied on a parameter by parameter basis during routine sampling when any parameter is found to exceed the BC WQG.

^a Refer to the Appendix A, Water Quality Objectives - Fresh and Marine Aquatic Life for parameter concentration guidelines.

^b Field Parameters.

1.8.1 Materials and Equipment

Materials and equipment for lab samples will be obtained from a lab (including bottles, additives, and filters). Physical field water quality parameters will be measured by a calibrated field meter.

1.9 Recordkeeping

FortisBC (or its Contractor) will document and retain all records from sampling and monitoring of water discharge, including:

- Sampling logs
- Photos
- Field and lab sample results

- Field notes
- Field Meter calibration log
- Reports
- Quantity and rate of water discharge

2. Closing

If you have any questions or concerns regarding this information, do not hesitate to contact Lori Larsen at 778.984.6404 or via email at lori.larsen@jacobs.com.

Sincerely
Jacobs Consultancy Canada Inc.

Written by:

A handwritten signature in blue ink, appearing to read "Lori Larsen". The signature is fluid and cursive, with the first name "Lori" being more prominent and the last name "Larsen" following in a similar style.

Lori Larsen, P.Ag., CSAP
Senior Technical Consultant

3. References

British Columbia Ministry of Environment and Climate Change Strategy (BC ENV). 2021a British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife and Agriculture. Accessed January 2022.

https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf.

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[water/water/waterquality/water-quality-guidelines/bc_env_working_water_quality_guidelines.pdf](https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/bc_env_working_water_quality_guidelines.pdf).

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<https://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/monitoring/laboratory-standards-quality-assurance/bc-field-sampling-manual>.

Jacobs Consultancy Canada Inc. (Jacobs). 2021a. Eagle Mountain-Woodfibre Gas Pipeline Project – Soil and Groundwater Investigation on the BC Rail Property in Squamish, BC. February 10.

Jacobs Consultancy Canada Inc. (Jacobs). 2021b. Eagle Mountain-Woodfibre Gas Pipeline Project – Comparing Annual Groundwater Monitoring Results to Regulatory Conditions in 2021. December 17.

Keystone Environmental. 2020. LANDFILL Pre-Closure Flow Assessment – Interim Report. February 12.

McMillen Jacobs Associates (MJA). 2020. Technical Memorandum Temporary Water Discharge. October 23.

FIGURES

FIGURE 1
STREAM X EGP TUNNEL
PORTAL DISCHARGE AND OTHER
UPSTREAM PROPOSED DISCHARGES

EAGLE MOUNTAIN - WOODFIBRE
GAS PIPELINE PROJECT

Project (EA Amendment)

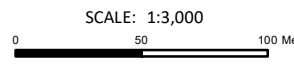
- Proposed Fortis NPS 24 Pipeline Route
- Proposed Lateral Pipeline
- Proposed Relocation Pipeline
- Proposed 25 kV Electrical Transmission Line
- Proposed Custody Transfer Station
- Proposed V2 Compressor Station

Other

- Proposed Culvert
- Existing FortisBC Pipeline
- Surveyed Stream
- - - Resource Road
- Municipal Boundary
- Landfill Extent
- Portal
- Laydown Area
- Approximate extent of Stream X Hydraulic Capacity Assessment

Stream X Reach

- Stream X Reach



JACOBS

JACOBS Project Number CE777000

UTM Zone 10 North, NAD 1983.
 Tunnel Route: UPI 10-30-2019; Certified Pipeline Corridor: CH2M 09-11-2015; Existing Pipeline: FortisBC 2012; Proposed Lateral/Relocation Pipeline: Solaris 02-19-2020; Existing Pipeline: FortisBC 2012; 25 kV Electrical Transmission Line: Primary Engineering and Construction 04-24-2020; Certified Squamish Compressor Station: Solaris 06-09-2020; Certified Squamish Facility Siting Area: Jacobs 05-28-2020; CTS: FortisBC 2-25-2020; Landfill: Keystone Environmental 2014; Roads: BC FLNRO Digital Road Atlas, 2010; Streams: Jacobs 2019, Hemmera 2020; Hydrography: BC
 MFLNRO 2008, Jacobs 2019; Municipal Boundaries: BC Ministry of Municipal Affairs and Housing 2018; Proposed Culvert, Portal, Laydown area: Jacobs digitized (9-15-2020) based on drawing from McMillen Jacobs Associates 2019; Base Imagery: Source: Esri, Maxar, 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 errors in the data may be present.

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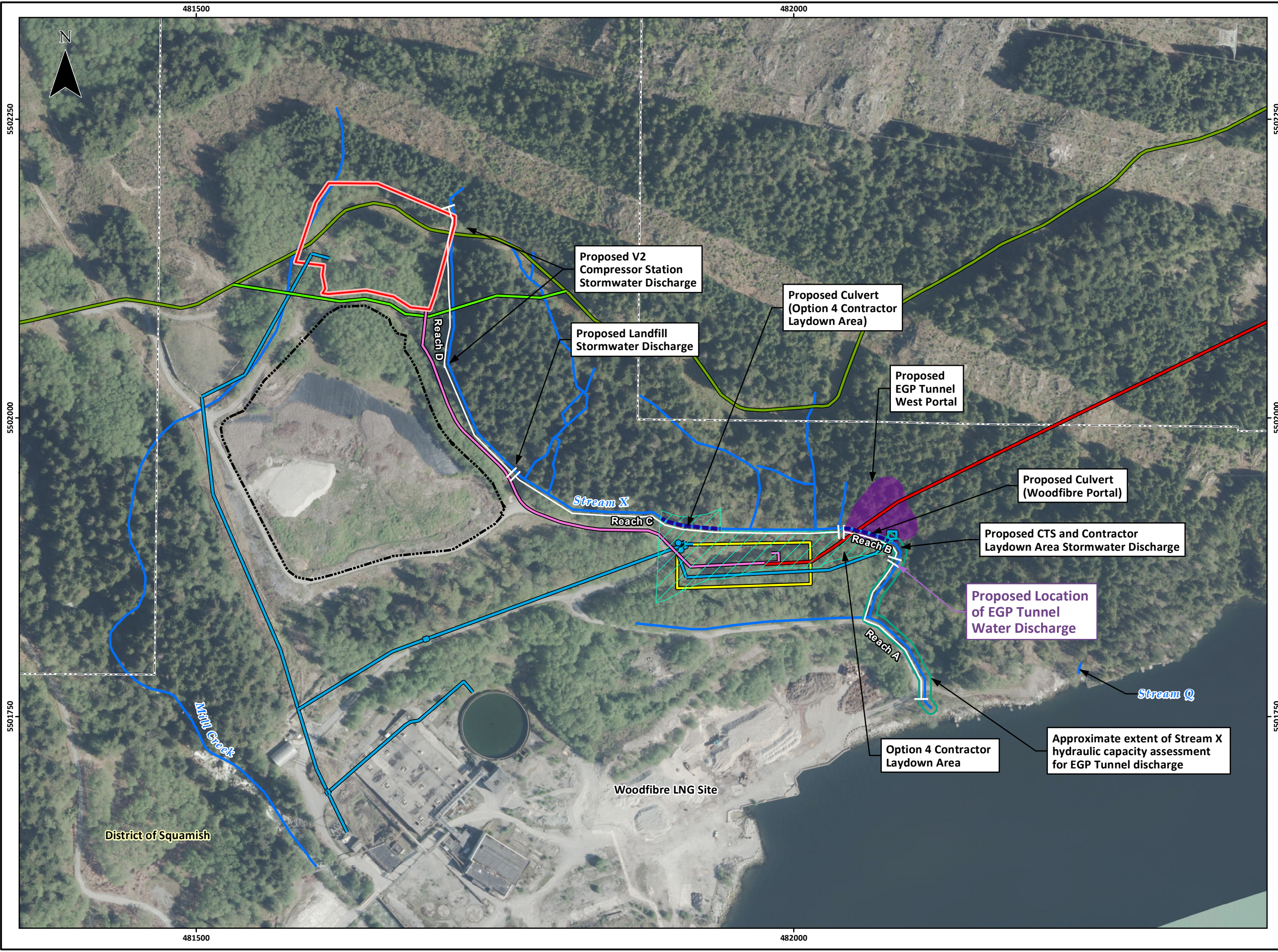



















FIGURE 2
SURFACE WATER AND GROUNDWATER
MONITORING LOCATIONS
2014 AND 2020 KEYSTONE
EAGLE MOUNTAIN - WOODFIBRE
GAS PIPELINE PROJECT


Project (EA Amendment)

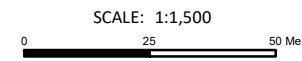
-  Monitoring Well
-  Surface Water Sample Location
-  Proposed Fortis NPS 24 Pipeline Route
-  Proposed Lateral Pipeline
-  Proposed Relocation Pipeline
-  Proposed 25 kV Electrical Transmission Line
-  Proposed Custody Transfer Station
-  Proposed V2 Compressor Station

Other

-  Proposed Culvert
-  Existing FortisBC Pipeline
-  Surveyed Stream
-  Resource Road
-  Municipal Boundary
-  Landfill Extent
-  Portal
-  Laydown Area
-  Approximate extent of Stream X Hydraulic Capacity Assessment

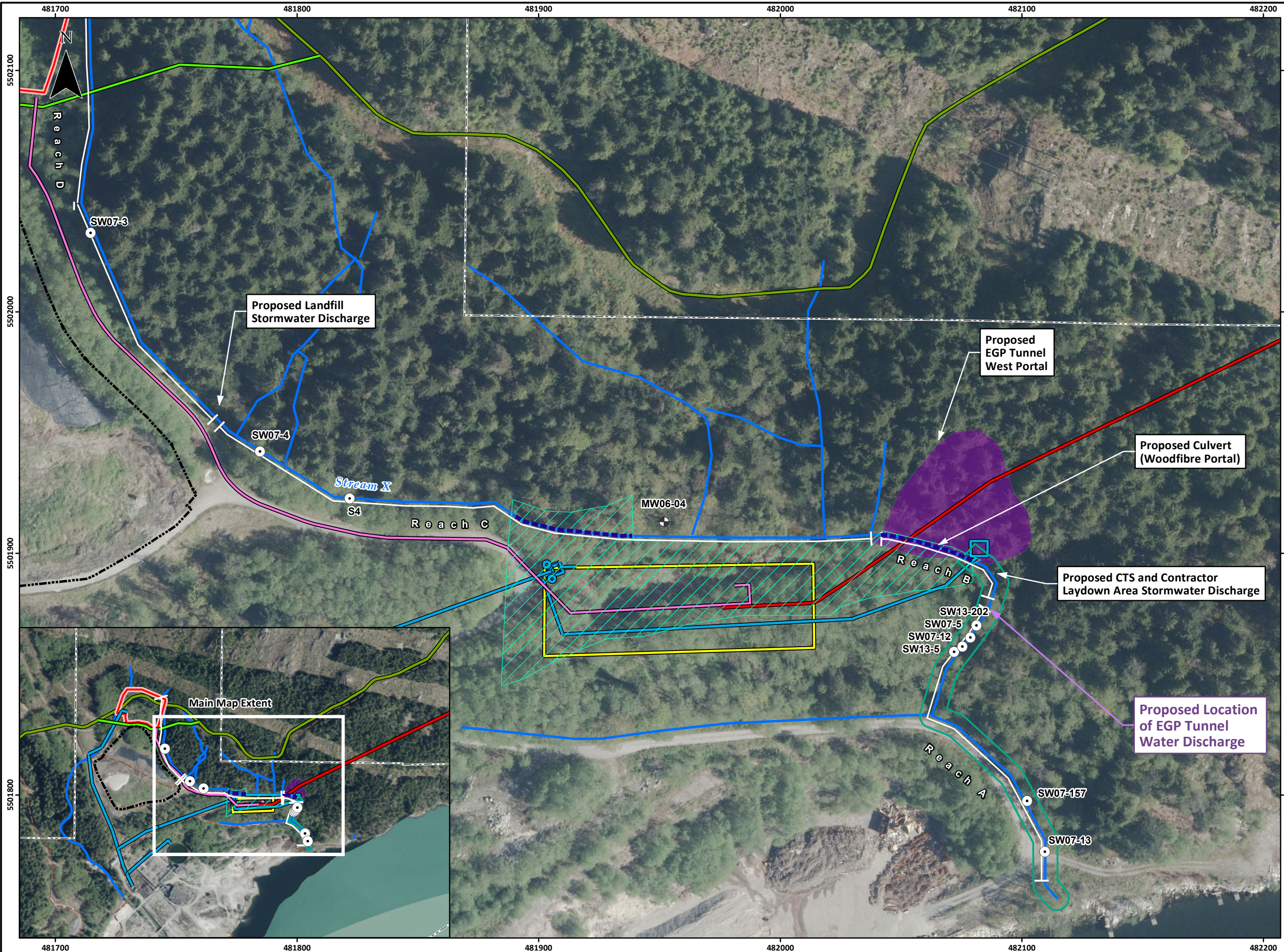
Stream X Reach

-  Stream X Reach



UTM Zone 10 North, NAD 1983.
 Surface Water Sample Locations, Keystone 2014, 2020; Tunnel Route: UPI
 10-30-2019; Certified Pipeline Corridor: CH2M 09-11-2015; Existing
 Pipeline: FortisBC 2012; Proposed Lateral/Relocation Pipeline: Solaris 02-
 19-2020; Existing Pipeline: FortisBC 2012; 25 kV Electrical Transmission
 Line: Primary Engineering and Construction 04-24-2020; Certified Squamish
 Compressor Station: Solaris 06-09-2020; Certified Squamish Facility Siting
 Area: Jacobs 05-28-2020; CTS: FortisBC 2-25-2020; Landfill: Keystone
 Environmental 2014; Roads: BC FLNRO Digital Road Atlas, 2010; Streams:
 Jacobs 2019; Hemmera 2020; Hydrography: BC
 MFLNRO 2008; Jacobs 2019; Municipal Boundaries: BC Ministry of
 Municipal Affairs and Housing 2018; Proposed Culvert, Portal, Laydown
 area: Jacobs digitized (9-15-2020) based on drawing from McMillen Jacobs
 Associates 2019; Base Imagery: Source: Esri, Maxar, GeoEye, Earthstar
 Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the
 GIS User Community.

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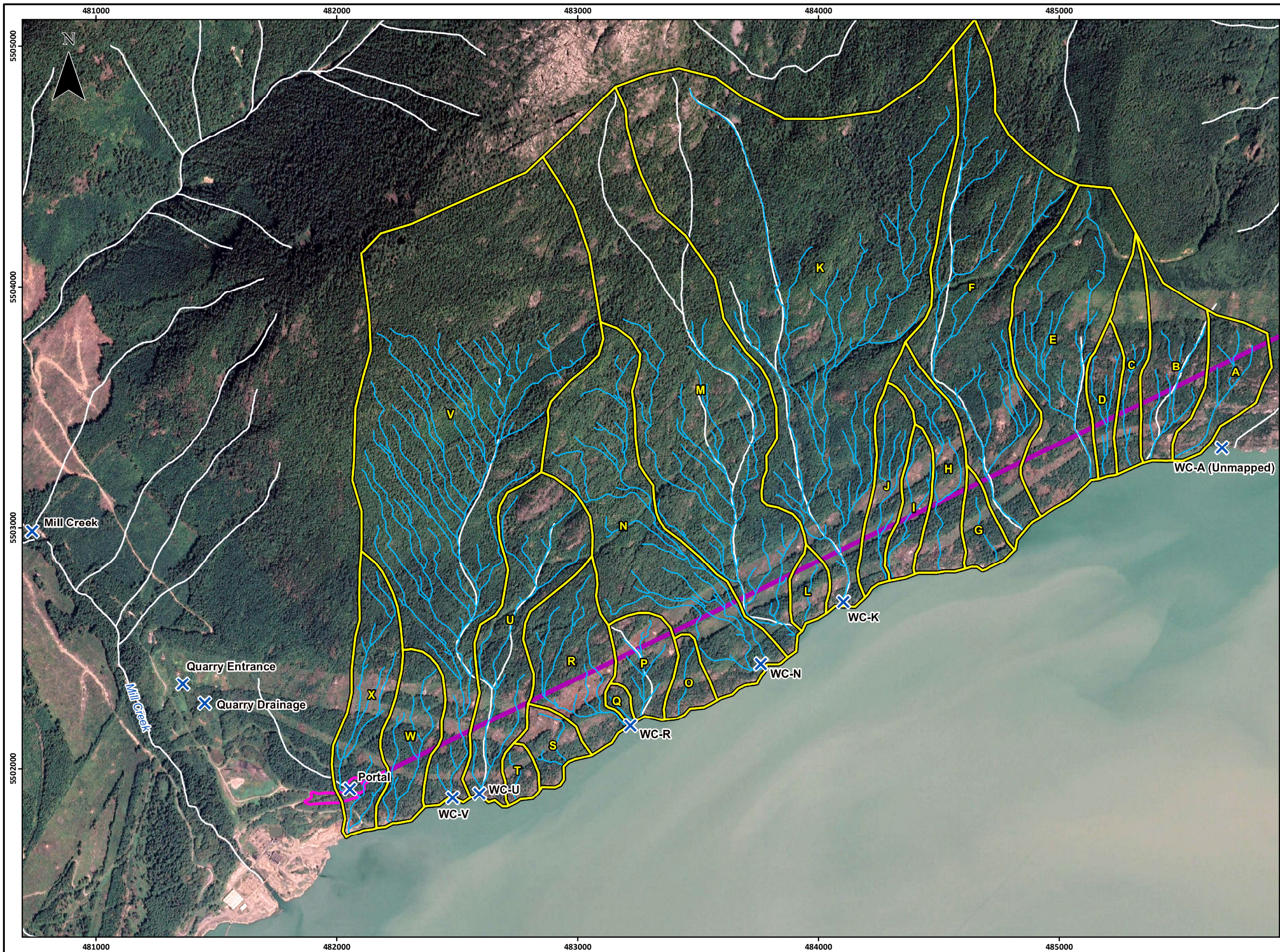








FIGURE 3
WATER QUALITY SAMPLE
LOCATIONS – TETRATECH 2021
EAGLE MOUNTAIN - WOODFIBRE
GAS PIPELINE PROJECT

-  Water Quality Sample
-  Study Catchment (Jacobs 2020)
-  Woodfibre Portal Area
-  Tunnel Alignment (MJA 2019)
-  Study Stream (Jacobs 2020)
-  Provincial Watercourse

Note: Figure 3 is a reproduction of Figure 1 from the 2021 Technical Memo: Eagle Mountain – Woodfibre Gas Pipeline Project – Surface Water Quality Sampling along the Bedrock Tunnel Alignment – Revision 1, produced by TetraTech

SCALE: 1:15,000
 0 300 600 Meters

JACOBS

JACOBS Project Number CE832900

UTM Zone 10 North, NAD 1983

Source: 2021 Technical Memo: Eagle Mountain – Woodfibre Gas Pipeline Project – Surface Water Quality Sampling along the Bedrock Tunnel Alignment – Revision 1, TetraTech 2021

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TABLES

Table 1. Water Quality Objectives - Fresh and Marine Aquatic Life

Approved and Working Water Quality Guidelines (WQG) ^{1, 2, 3}					Sample ID	MW06-4	Portal	S4	S4	SW07-3	SW07-4	SW07-5	SW07-157	SW07-12	SW07-13	SW13-5	SW13-A	SW13-202	WC-A Unmapped	WC-K	WC-N	WC-R	WC-U	WC-V	
PARAMETERS	SHORT TERM ACUTE ⁴				Duplicate ID	-	-	-	-	-	-	-	-	-	-	-	SW13-202	SW13-A	-	-	-	-	-	-	
	Surface Water Freshwater Aquatic Life		Units	Surface Water Freshwater Aquatic Life		Units	Lab Sample ID	602160228	VA21B7621-005	XA8815	602080411	704070075	704070076	704070076	705250404	704240408	704240409	G04319	FW9574	FW9573	VA21B7621-011	VA21B7621-010	VA21B7621-009	VA21B7621-008	VA21B7621-007
	120 mg/L CaCO ₃ ¹¹	-	µg/L	110																					
	≥ 180 mg/L CaCO ₃ ¹³	-	µg/L	150																					
Selenium		-	µg/L	2																					
Silver	0.1 @ hardness ≤ 100 3 @ hardness > 100		µg/L	0.05 @ hardness ≤ 100 0.1 @ hardness > 100																					
Thallium		-	µg/L	0.8																					
Tin, tributyltin		-	µg/L	0.008																					
Uranium		-	µg/L	8.5																					
Zinc	Water hardness ≤ 90 mg/L	33	µg/L	7.5																					
	Water hardness > 90 mg/L	Calculated WQG = 33 + 0.75(hardness - 90) Where hardness is between 90-500 mg/L CaCO ₃	mg/L	Calculated WQG = 7.5 + 0.75 (hardness - 90) Where hardness is between 90-330 mg/L CaCO ₃																					

Footnotes:

- Values from the British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary - Water Quality Guideline Series, WQG-20 (BC Ministry of Environment and Climate Change Strategy 2021).
- Values from the British Columbia Working Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture (BC Ministry of Environment and Climate Change Strategy, February 2021) https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/bc_env_working_water_quality_guidelines.pdf
- Values adopted from the Canadian Council of Ministers of the Environment - Water Quality Guidelines for the Protection of Aquatic Life. Set to protect against severe effects such as lethality (for example, LC₅₀) or other equivalent measures (for example, EC₅₀) to the most sensitive species and life stage over a defined short-term exposure period (for example, 96 hours). A short-term maximum (i.e. acute) WQG is a level that should never be exceeded in order to meet the intended protection of the most sensitive species and life stage against severe effects such as lethality over a defined short term exposure period (e.g. 96 hrs). Short-term maximum WQGs are intended to assess risks associated with infrequent exposure events such as spills.
- Intended to protect the most sensitive species and life stage against sublethal and lethal effects for indefinite exposures. An averaging period approach is used for these WQGs. This approach allows concentrations of a substance to fluctuate above and below the guideline provided that the short-term acute is never exceeded and the long-term chronic is met over the specified averaging period (for example, five samples in 30 days).
 - Water body is highly sensitive to acid inputs (< 4 mg/L dissolved calcium).
 - Water body is moderately sensitive to acid inputs (4-8 mg/L dissolved calcium).
 - Water body has low sensitivity to acid inputs (> 8 mg/L dissolved calcium).
- For the maximum controlled intermittent exposure of aquatic life, the total duration of exposure in any consecutive 24-hour period should not exceed 2 hours, and is the threshold of short-term toxicity.
 - The duration in controlled intermittent exposures, the exposure period (min), is the threshold of short-term toxicity.
 - The continuous exposure average should be based on at least five samples equally spaced in time, and the averaging period should be not be less than 4 days or more than 30 days for fresh water, and not less than 2 hours or more than 30 days for marine or estuarine water. This is the threshold of long-term toxicity.
- Total sulphide = dissolved H₂S + HS + acid-soluble metal sulphides present in suspended matter. Dissolved sulphide is that remaining after suspended solids have been removed after flocculation or settling. In aquatic environments, H₂S and HS are in equilibrium as H₂S + H⁺ + HS⁻. The unionized H₂S can be calculated from dissolved sulphide, the sample pH and the ionization constant (which is dependent on the sample water temperature) of H₂S.
- Criterion for surface water samples analyzed for all organic substances presented are based on total substance concentrations. Any water sample to be analyzed for organic substances should not be filtered.
- Criterion for surface water samples analyzed for inorganic parameters, metals, heavy metals, metalloids, and inorganic ions that are presented are based on total substance concentrations, unless otherwise stated. In addition, it is recommended that surface water samples being analyzed for heavy metals, metalloids, and inorganic ions should also be analyzed for dissolved substance concentrations.
- Copper WQGs are dependent on the specific chemistry of the water body and can only be calculated using the BC BLM software. The BC BLM User's Manual 1 provides clear instruction of how the software should be used to calculate chronic and acute WQGs (BC ENV 2019b). Calculating a WQG using the full BC BLM requires 11 water chemistry parameters. To overcome the fact that these parameters are not always routinely measured, a simplified version of the BC BLM was included in the software and requires only four water chemistry parameters, which cannot be estimated: temperature, DOC, pH, and hardness. The remaining seven parameters are estimated based on the criteria described in Cu WQGs Technical Report (BC ENV 2019b).
- Lead: No more than 20% (for example, one in five) of values in a 30-day period should exceed 1.5 times the long-term chronic WQG.
- Nickel: For hardness values > 60 mg/L to ≤ 180 mg/L, the WWQG is calculated using an equation: $WQG (\mu g/L) = 0.740^{(hardness-1.06)}$ where CaCO₃ is in mg/L - An online chronic guideline calculator can be found here: https://ccme.ca/en/chemical/139#_aq_fresh_concentration Accessed January 5, 2022.

Notes:

°C = degree(s) Celsius	µg/L = microgram(s) per litre	H ₂ S = hydrogen sulfide	mg/L = milligram(s) per litre
> = greater than	BC = British Columbia	Hg = mercury	O ₂ = oxygen
< = less than	CaCO ₃ = calcium carbonate	HS = hydrogensulfide	TOC = total organic carbon
≤ = less than or equal to	DOC = Dissolved Organic Carbon	MeHg = methylmercury	WQG = Water Quality Guidelines

Blue text indicates RDL > the WQG
 Red, Bold and Underlined indicates the sample one or more BC WQG
 Yellow shading = Not all required parameters were obtained to determine if sample exceeds applicable BC WQGs

References:

British Columbia Ministry of Environment and Climate Change Strategy, 2019a. *Copper Water Quality Guideline for the Protection of Freshwater Aquatic Life*. BC BLM User's Manual. Water Quality Guideline Series, WQG-03-2. Accessed January 4, 2022. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/copper/bc_blm_users_manual.pdf

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Appendix A
Water Quality Objectives - Fresh and Marine Aquatic
Life

Table A-1. Water Quality Objectives - Fresh and Marine Aquatic Life

Approved and Working Water Quality Guidelines (WQG) ^{1, 2, 3}																			
PARAMETERS		SHORT TERM ACUTE ⁴					LONG TERM CHRONIC ⁵												
		Surface Water Freshwater Aquatic Life			Marine	Units	Surface Water Freshwater Aquatic Life			Marine	Units								
Anions and Nutrients																			
Alkalinity (total CaCO ₃)		-			-	mg/L	Default is 10	highly sensitive to acid inputs < 10 ^{6A} moderately sensitive to acid inputs 10 to 20 ^{6B} low sensitivity to acid inputs > 20 ^{6C}			-	mg/L							
Chlorate		-			-	mg/L	≤ 30			≤ 5	mg/L								
Chloride (chloride ion)		600			Human activities should not cause the chloride of marine and estuarine waters to fluctuate by more than 10% of the natural chloride expected at that time and depth.	mg/L	150			Human activities should not cause the chloride of marine and estuarine waters to fluctuate by more than 10% of the natural chloride expected at that time and depth.	mg/L								
Total residual chlorine (TRC) or Cl-produced oxidants (CPO)	Short-term Controlled Intermittent Exposure ^{7A}	≤100			≤ 40	µg/L	≤100			≤ 40	µg/L								
	Controlled Intermittent Exposure Calculation ^{7B}	1,074 (duration in minutes) ^{-0.74}			20.36 (duration in minutes) ^{-0.4}	µg/L	1,074 (duration in minutes) ^{-0.74}			20.36 (duration in minutes) ^{-0.4}	µg/L								
	Continuous Exposure ^{7C}	2			3	µg/L	2			3	µg/L								
Cyanide - weak acid dissociable - unfiltered		10			1	µg/L	≤ 5 (30 day average)			1	µg/L								
Fluoride		Hardness dependent H = 10 standard is 0.4 H > 10 to 385 mg/L calculate criteria WQG = LC ₅₀ = [-51.73 + 92.57 log ₁₀ (hardness)] × 0.01			1.5	mg/L	-			-	mg/L								
Nitrate		32.8 reported as N.			-	mg/L	3 reported as N			3.7 reported as N	mg/L								
Nitrite		Chloride mg/L	< 2	2 to 4	4 to 6	6 to 8	8 to 10	> 10	-	mg/L	Chloride mg/L	< 2	2 to 4	4 to 6	6 to 8	8 to 10	> 10	-	mg/L
		WQG =	0.06	0.12	0.18	0.24	0.3	0.6	-	mg/L	WQG =	0.02	0.04	0.06	0.08	0.1	0.2	-	mg/L
Sulphate (SO ₄ -2)		-			-	mg/L	Water hardness (mg/L CaCO ₃) Very soft (0-30) Soft to moderately soft (31-75) Moderately soft/hard to hard (76-180) Very hard (181-250) > 250			128 218 309 429	-	mg/L							
Sulphide ⁸		-			-	µg/L	2			-	µg/L								
Glycols ⁹																			
Ethylene glycol		-			-	mg/L	192			-	mg/L								
Propylene glycol, 1,2-		-			-	mg/L	500			-	mg/L								

Table A-1. Water Quality Objectives - Fresh and Marine Aquatic Life

Approved and Working Water Quality Guidelines (WQG) ^{1, 2, 3}							
PARAMETERS	SHORT TERM ACUTE ⁴			LONG TERM CHRONIC ⁵			
	Surface Water Freshwater Aquatic Life	Marine	Units	Surface Water Freshwater Aquatic Life	Marine	Units	
Organics - Polycyclic Aromatic Hydrocarbons ⁹							
Acenaphthene	-	6	ug/L	6	-	ug/L	
Acridine	0.05	-	µg/L	3	-	µg/L	
Anthracene	0.1	4	µg/L	-	-	µg/L	
Benz[a]anthracene	0.1	-	µg/L	0.1	-	µg/L	
Benzo[a]pyrene	-	-	µg/g	0.01	0.01	µg/g	
Chrysene	-	0.1	µg/L	-	0.1	µg/L	
Fluoranthene	0.2	-	µg/L	4.0	-	µg/L	
Fluorene	-	-	µg/L	12	12	µg/L	
Methylated naphthalene	-	-	µg/L	-	1	µg/L	
Naphthalene	1	-	µg/L	1	1	µg/L	
Phenanthrene	0.3	-	µg/L	-	-	µg/L	
Pyrene	0.02	-	µg/L	-	-	µg/L	
Quinoline	-	-	µg/L	3.4	-	µg/L	
Organics - Volatile Organic Compounds ⁹							
Benzene	40	110	µg/L	40	110	µg/L	
Ethylbenzene (C ₈ H ₁₀)	-	-	mg/L	0.2	0.25	mg/L	
Monochlorobenzene	-	-	µg/L	1.3	25	µg/L	
Styrene	-	-	µg/L	72	-	µg/L	
Toluene	-	-	µg/L	0.5	-	µg/L	
Xylene (C ₆ H ₄ (CH ₃) ₂)	-	-	mg/L	0.3	-	mg/L	
Organics - Others ⁹							
Phenols	4-hydroxyphenol (hydroquinone, quinol)	4.5	-	µg/L	-	-	µg/L
	3-hydroxyphenol (resorcinol)	12.5	-	µg/L	-	-	µg/L
	All other phenols	50	-	µg/L	-	-	µg/L
Nitrogen as ammonia	See Table 26C ¹		See Table 26E ¹	-	See Table 26D ¹	See Table 26F ¹	-
Organic carbon	-	-	-	Dissolved:	Long-term median within 20% of background median	-	-
	-	-	-	Total:	Long-term median within 20% of background median	-	-

Table A-1. Water Quality Objectives - Fresh and Marine Aquatic Life

Approved and Working Water Quality Guidelines (WQG) ^{1, 2, 3}							
PARAMETERS	SHORT TERM ACUTE ⁴			LONG TERM CHRONIC ⁵			
	Surface Water Freshwater Aquatic Life	Marine	Units	Surface Water Freshwater Aquatic Life	Marine	Units	
Physical Parameters							
Dissolved oxygen (DO)	≥ 5		-	mg/L O ₂	≥ 8	-	mg/L O ₂
pH	See Table 30 ¹		7.0 to 8.7	unitless	See Table 30 ¹	7.0 to 8.7	unitless
Salinity	-		-	-	-	+/- 10% change	-
Temperature	Streams with bull trout and/or dolly varden	Short-term daily temperature is 15. Short-term incubation temperature is 10. Minimum incubation temperature is 2. Short-term spawning temperature is 10.		+/- 1 degree over natural ambient temperature.	°C	-	-
	Streams with known fish distribution	± 1 change beyond optimum temperature range as shown in Table 42B ¹ for each life-history phase of the most sensitive salmonid species present. Hourly rate of change not to exceed 1.				-	-
	Streams with unknown fish distribution	Mean minimum weekly temperature = 18. (Short-term daily temperature = 19). Hourly rate of change not to exceed 1. Short-term incubation temperature = 12 (in spring and fall).				-	-
	Lakes and impoundments	± 1 change from ambient background.				-	-
Total dissolved solids	During clear flows or in clear waters	-		mg/L	Change from background of 5 mg/L at any one time.		mg/L
	During high flows or in turbid waters	Change from background of 10 mg/L at any time when background is 25 - 100 mg/L. Change from background of 10% when background is > 100 mg/L.		mg/L	Change from background of 20 mg/L when background is < 100 mg/L.		mg/L
Dissolved Metals ¹⁰							
Aluminum	Calculated value (use pH of sample [e=2.71828]) = e[1.209-2.426(pH)+0.286(pH) ²]		-	mg/L	Calculated value (use median of sample pH over averaged period [e=2.71828]) = e[1.6-3.327(median pH)+0.402(median pH) ²]	-	mg/L
Aluminum <u>dissolved</u> and pH < 6.5			-			-	
Aluminum <u>dissolved</u> and pH ≥ 6.5	0.1		-	mg/L	0.05	-	mg/L
Cadmium	Calculated value (use water hardness [mg/L CaCO ₃ between 7-455 mg/L]) = e[1.03 x ln (hardness)-5.274]		-	µg/L	Calculated value (use water hardness [mg/L CaCO ₃ between 3.4-285 mg/L]) = e[0.736 x ln (hardness)-4.943]	-	µg/L
Iron	0.35		-	mg/L	-	-	mg/L

Table A-1. Water Quality Objectives - Fresh and Marine Aquatic Life

Approved and Working Water Quality Guidelines (WQG) ^{1, 2, 3}						
PARAMETERS	SHORT TERM ACUTE ⁴			LONG TERM CHRONIC ⁵		
	Surface Water Freshwater Aquatic Life	Marine	Units	Surface Water Freshwater Aquatic Life	Marine	Units
Total Metals ¹⁰						
Antimony (III)	-	-	µg/L	9	270	µg/L
Arsenic	5	12.5	µg/L	5	12.5	µg/L
Barium	1	-	mg/L	-	-	mg/L
Beryllium	-	-	µg/L	0.13	100	µg/L
Boron	-	-	mg/L	1.2	1.2	mg/L
Cadmium	-	-	-	-	-	-
Calcium	See alkalinity	See alkalinity	-	See alkalinity	See alkalinity	-
Chromium (total)	-	-	-	-	-	-
Chromium - III	-	-	µg/L	8.9	56	µg/L
Chromium - VI	-	-	µg/L	1	1.5	µg/L
Cobalt	110	-	µg/L	4	-	µg/L
Copper - total	Calculated using BC BLM ¹¹	3	µg/L	Calculated using BC BLM ¹¹	≤ 2	µg/L
Iron	1	-	mg/L	-	-	mg/L
Lead - total	Hardness ≤ 8 mg/L CaCO ₃	3	µg/L	-	≤ 2	µg/L
	Hardness > 8 mg/L CaCO ₃	Calculated value - hardness dependent > 8 - 360 mg/L CaCO ₃ WQG = e ^[1.273 ln (hardness) - 1.460]		140		
Lead - Tetra-ethyl lead	-	-	µg/L	0.0007	-	µg/L
Lead - Tetra-methyl lead	-	-	µg/L	0.0006	-	µg/L
Manganese - Total	Calculated value - hardnesses between 25-259 mg/L CaCO ₃ WQG ≤ 0.01102 hardness + 0.54	-	mg/L	Calculated value - hardnesses between 37-450 mg/L CaCO ₃ WQG ≤ 0.0044 hardness + 0.605	100 µg/L	mg/L
Mercury - Total	-	-	µg/L	WQG = 0.0001 / (MeHg/total Hg), where MeHg is mass (or concentration) of methyl mercury and total Hg is total mass (or concentration) of mercury in a given water volume When MeHg is ≤ 0.5% of total Hg, WQG = 0.02	-	µg/L
Molybdenum - Total	46	-	mg/L	7.6	-	mg/L
Nickel ^{3 & 13}	0 to ≤ 60 mg/L CaCO ₃	-	µg/L	25	-	µg/L
	60 - 120 mg/L CaCO ₃ ^{3 & 13}	-	µg/L	WQG (µg/L) = e ^{0.76[ln (hardness)]+1.06} where CaCO ₃ is in mg/L ^{3 & 13}	-	µg/L
	120 mg/L CaCO ₃ ¹³	-	µg/L	110	-	µg/L
	≥ 180 mg/L CaCO ₃ ¹³	-	µg/L	150	-	µg/L
Selenium	-	-	µg/L	2	2	µg/L
Silver	0.1 @ hardness ≤ 100 3 @ hardness > 100	3	µg/L	0.05 @ hardness ≤ 100 0.1 @ hardness > 100	1.5	µg/L
Thallium	-	-	µg/L	0.8	-	µg/L
Tin, tributyltin	-	0.0001	µg/L	0.008	0.001	µg/L
Uranium	-	-	µg/L	8.5	-	µg/L
Zinc	Water hardness ≤ 90 mg/L	33	µg/L	7.5	10	µg/L
	Water hardness > 90 mg/L	Calculated WQG = 33 + 0.75(hardness - 90) Where hardness is between 90-500 mg/L CaCO ₃	-	mg/L	Calculated WQG = 7.5 + 0.75 (hardness - 90) Where hardness is between 90-330 mg/L CaCO ₃	mg/L

Table A-1. Water Quality Objectives - Fresh and Marine Aquatic Life

Approved and Working Water Quality Guidelines (WQG) ^{1, 2, 3}									
PARAMETERS	SHORT TERM ACUTE ⁴			LONG TERM CHRONIC ⁵					
	Surface Water	Freshwater	Aquatic Life	Marine	Units	Surface Water	Freshwater	Aquatic Life	Marine

Footnotes:

- 1 Values from the *British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary - Water Quality Guideline Series, WQG-20* (BC Ministry of Environment and Climate Change Strategy 2021). https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf
- 2 Values from the *British Columbia Working Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture* (BC Ministry of Environment and Climate Change Strategy, February 2021) https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/bc_env_working_water_quality_guidelines.pdf
- 3 Values adopted from the Canadian Council of Ministers of the Environment - Water Quality Guidelines for the protection of Aquatic Life
Set to protect against severe effects such as lethality (for example, LC₅₀) or other equivalent measures (for example, EC₅₀) to the most sensitive species and life stage over a defined short-term exposure period (for example, 96 hours).
- 4 A short-term maximum (i.e. acute) WQG is a level that should never be exceeded in order to meet the intended protection of the most sensitive species and life stage against severe effects such as lethality over a defined short term exposure period (e.g. 96 hrs). Short-term maximum WQGs are intended to assess risks associated with infrequent exposure events such as spills.
- 5 Intended to protect the most sensitive species and life stage against sublethal and lethal effects for indefinite exposures. An averaging period approach is used for these WQGs. This approach allows concentrations of a substance to fluctuate above and below the guideline provided that the short-term acute is never exceeded and the long-term chronic is met over the specified averaging period (for example, five samples in 30 days).
 - A Water body is highly sensitive to acid inputs (< 4 mg/L dissolved calcium).
 - B Water body is moderately sensitive to acid inputs (4-8 mg/L dissolved calcium).
 - C Water body has low sensitivity to acid inputs (> 8 mg/L dissolved calcium).
- 6
 - A For the maximum controlled intermittent exposure of aquatic life, the total duration of exposure in any consecutive 24-hour period should not exceed 2 hours, and is the threshold of short-term toxicity.
 - B The duration in controlled intermittent exposures, the exposure period (min), is the threshold of short-term toxicity.
- 7 C The continuous exposure average should be based on at least five samples equally spaced in time, and the averaging period should be not be less than 4 days or more than 30 days for fresh water, and not less than 2 hours or more than 30 days for marine or estuarine water. This is the threshold of long-term toxicity.
- 8 Total sulphide = dissolved H₂S + HS + acid-soluble metal sulphides present in suspended matter. Dissolved sulphide is that remaining after suspended solids have been removed after flocculation or settling. In aquatic environments, H₂S and HS are in equilibrium as H₂S = H⁺ + HS⁻. The unionized H₂S can be calculated from dissolved sulphide, the sample pH and the ionization constant (which is dependent on the sample water temperature) of H₂S.
- 9 Criterion for surface water samples analyzed for all organic substances presented are based on total substance concentrations. Any water sample to be analyzed for organic substances should not be filtered.
- 10 Criterion for surface water samples analyzed for inorganic parameters, metals, heavy metals, metalloids, and inorganic ions that are presented are based on total substance concentrations, unless otherwise stated. In addition, it is recommended that surface water samples being analyzed for heavy metals, metalloids, and inorganic ions should also be analyzed for dissolved substance concentrations.
- 11 Copper WQGs are dependent on the specific chemistry of the water body and can only be calculated using the BC BLM software. The BC BLM User's Manual 1 provides clear instruction of how the software should be used to calculate chronic and acute WQGs (BC ENV 2019b). Calculating a WQG using the full BC BLM requires 11 water chemistry parameters. To overcome the fact that these parameters are not always routinely measured, a simplified version of the BC BLM was included in the software and requires only four water chemistry parameters, which cannot be estimated: **temperature, DOC, pH, and hardness**. The remaining seven parameters are estimated based on the criteria described in Cu WQGs Technical Report (BC ENV 2019b).
- 12 Lead: No more than 20% (for example, one in five) of values in a 30-day period should exceed 1.5 times the long-term chronic WQG.
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Notes:

°C = degree(s) Celsius
 > = greater than
 < = less than
 ≤ = less than or equal to

µg/L = microgram(s) per litre
 BC = British Columbia
 CaCO₃ = calcium carbonate
 DOC = Dissolved Organic Carbon

H₂S = hydrogen sulfide
 Hg = mercury
 HS = hydrogensulfide
 MeHg = methylmercury

mg/L = milligram(s) per litre
 O₂ = oxygen
 TOC = total organic carbon
 WQG = Water Quality Guidelines

Table A-1. Water Quality Objectives - Fresh and Marine Aquatic Life

Approved and Working Water Quality Guidelines (WQG) ^{1, 2, 3}						
PARAMETERS	SHORT TERM ACUTE ⁴			LONG TERM CHRONIC ⁵		
	Surface Water Freshwater Aquatic Life	Marine	Units	Surface Water Freshwater Aquatic Life	Marine	Units

References:

British Columbia Ministry of Environment and Climate Change Strategy, 2019a. **Copper Water Quality Guideline for the Protection of Freshwater Aquatic Life. BC BLM User’s Manual. Water Quality Guideline Series, WQG-03-2.** Accessed January 4, 2022.

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