



**Westcoast Connector
Gas Transmission**

Westcoast Connector Gas Transmission Project

Freshwater Water Quality Monitoring Plan
Condition 10

Detailed Outline – Revision 1

January 2022

Prepared for:

Westcoast Connector Gas Transmission Ltd.

Prepared by:
Jacobs Consultancy Canada Inc.

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Westcoast Connector Gas Transmission Project

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Land Acknowledgement

We acknowledge that the Westcoast Connector Gas Transmission project (WCGT Project) area is in the Traditional and Ancestral Territory of many Indigenous Peoples, presently subject to the Nisga'a Treaty, Treaty 8, and vast areas of unceded Indigenous Traditional lands. These Indigenous groups include the Nisga'a Nation, Prophet River First Nation, Blueberry River First Nations, Doig River First Nation, Gitanyow Hereditary Chiefs, Gitxsan Hereditary Wilp, Halfway River First Nation, Kitselas First Nation, Kitsumkalum First Nation, Lake Babine Nation, Lax Kw'alaams First Nation, Wilp Luuxhon, Metlakatla First Nation, Saulteau First Nation, Takla Lake First Nation, Tsay Keh Dene First Nation, West Moberly First Nations, Nak'azdli First Nation, McLeod Lake Band, Gitxaala Nation, and the Métis Nation British Columbia.

We acknowledge the many Indigenous Peoples who live on care for these lands and have for generations. We are grateful for the traditional Knowledge Keepers and Elders who are still with us today and those who have gone before us. We make this acknowledgement as an act of reconciliation and gratitude to those whose territory we reside on or are visiting.

Executive Summary

The British Columbia Environmental Assessment Office (BC EAO) issued an Environmental Assessment Certificate (Certificate) to Westcoast Connector Gas Transmission Ltd. (WCGT Ltd.) for the WCGT Project on November 25, 2014, and later granted a 5-year extension to the Certificate on April 25, 2019. The Certificate expires on November 25, 2024.

WCGT Ltd. is actively developing the WCGT Project to build one express, single-purpose natural gas pipeline from a compressor station near Willow Flats in northeast British Columbia (BC) to a delivery point at Wil Metl on the north coast to supply natural gas to potential liquified natural gas terminal sites (Project).

This Freshwater Water Quality Monitoring Plan (FWQMP or Plan) outlines the procedures that will be used to monitor freshwater water quality during construction of the Project. This Plan was prepared to address the requirements of Certificate Condition 10 for the Project. Further iterations will be developed in collaboration with Indigenous groups, relevant regulatory authorities (RRAs), and stakeholders.

The scope of the FWQMP includes:

- Purpose and objectives, construction activities, linkages to other plans, roles and responsibilities, implementation schedule, and future updates (Section 2);
- Engagement methods that identify the parties to be engaged, a plan for engaging the Indigenous Groups, RRAs, and stakeholders, and a description of how engagement outcomes help shape the Plan (Section 3);
- Regulatory requirements related to construction activities that may impact fish and freshwater water quality (Section 4);
- A description of the freshwater water quality monitoring (WQM) program including activities, locations, schedule and parameters, responses to exceedances, benthic sediment sampling, safety considerations, and reporting requirements (Section 5);
- A description of the adaptive management program in relation to WQM, including how the results will inform adaptive management (Section 6);
- A plan for reporting on the implementation of the Plan including the schedule, content, and recipients of reports (Section 7); and
- Professional Authentication of the Plan (Section 8).

In general, WQM will be conducted where there are instream works, or works within the Riparian Reserve Zone (RRZ) of an S1, S2, S3, or within 20 metres of an S4 stream, unless otherwise authorized by BC Oil and Gas Commission or Fisheries and Oceans Canada. Parameters will include turbidity, total suspended solids, and pH in accordance with the BC Ambient Water Quality Guidelines for Turbidity, Suspended, and Benthic Sediments.

Additionally, a Benthic Sediment Sampling Program may be implemented where instream works associated with pipeline installation are planned and potential spawning habitat for redd-building salmonids was rated as "Important" or better within, or downstream of, the Project footprint during field studies.

Table of Concordance

Table 0-1 describes how this Plan addresses the applicable Certificate Conditions.

Table 0-1. Concordance with Certificate Condition 10: Fish and Water Quality

Certificate Condition	Section
<i>Condition 10 - Fish and Water Quality</i>	
The Holder must develop, in consultation with OGC, and implement a Freshwater Water Quality Monitoring Plan to address onsite water quality monitoring during Construction where works are planned for either in-stream or within the RRZ of streams with a Riparian Class of S1, S2, or S3, under the <i>Environmental Protection and Management Regulation</i> (EMPR) under the OGAA, or in-stream or within 20 m of a stream with a Riparian Class of S4 under the EMPR, unless otherwise authorized by OGC or DFO.	Section 6
The Freshwater Water Quality Monitoring Plan must be consistent with the following as they apply to aquatic life: <ul style="list-style-type: none"> ▪ The BC Ambient Water Quality Guidelines (Criteria) for Turbidity, Suspended and Benthic Sediments. ▪ The BC Ambient Water Quality Criteria for pH; or, if applicable. ▪ The BC Water Quality Objectives established by MOE as of the date of this EAC with respect to turbidity, total suspended solids, benthic sediments, and pH, (collectively the Water Guidelines). 	Subsection 6.3.1, 6.3.4
A Qualified Professional must develop and supervise the implementation of the Freshwater Water Quality Monitoring Plan.	Subsection 2.5, Section 9
The Plan must include monitoring at locations upstream and downstream of the location of any disturbance.	Subsection 6.2.2
The Plan must include measures to identify and report to OGC any exceedances, and measures to remedy the exceedances, of the Water Guidelines.	Section 8
For exceedances of the Water Guidelines that are caused, or contributed to, by Construction activities, the Holder must consult with OGC regarding and undertake measures to remedy the factors producing the exceedance.	Section 8, Subsection 7.2
In order to allow for 60 days review and comment, the Holder must provide the Plan to EAO no less than 90 days prior to the Holder's planned date to commence Construction. Once the Plan is complete, the Plan must be submitted to OGC	Section 3

Notes:

BC EAO = British Columbia Environmental Assessment Office

BC OGC = British Columbia Oil and Gas Commission

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Acronyms and Abbreviations

ARD	acid rock drainage
BC	British Columbia
BC EAO	British Columbia Environmental Assessment Office
BC OGC	British Columbia Oil and Gas Commission
BMP	best management practice
BSS	benthic sediment sampling
CCME	Canadian Council of Ministers of the Environment
Certificate	Environmental Assessment Certificate
DFO	Fisheries and Oceans Canada
EI	Environmental Inspector
FWQMP or Plan	Freshwater Water Quality Monitoring Plan
HDD	horizontal directional drill
LNG	liquefied natural gas
LRMP	Land and Resource Management Plans
LRW	Least Risk Window
m	metre(s)
mg/L	milligram(s) per litre
ML	metal leaching
MLARDMP	Metal Leaching/Acid Rock Drainage Management Plan
mm	millimetre(s)
NTU	Nephelometric Turbidity Unit
NWRP	Nisga'a Watercourse Restoration Plan
Project	one express, single-purpose natural gas pipeline from a compressor station near Willow Flats in northeast British Columbia to a delivery point at Wil Milt on the north coast to supply natural gas to potential liquefied natural gas terminal sites
QP	Qualified Professional
RP	Restoration Plan
RMA	Riparian Management Area
RMZ	Riparian Management Zone
RRA	Relevant Regulatory Authority
RRZ	Riparian Reserve Zone
SRMP	Sustainable Resource Management Plan
TBD	to be determined

TCEMP	Terrestrial Construction Environmental Management Plan
TSS	total suspended solid
WCGT Ltd.	Westcoast Connector Gas Transmission Ltd.
WCGT Project	Westcoast Connector Gas Transmission Project
WMP	Wetlands Management Plan
WQM	water quality monitoring
ZOI	zone-of-influence

1. Introduction

2 The British Columbia Environmental Assessment Office (BC EAO) issued an Environmental Assessment
3 Certificate (Certificate) to Westcoast Connector Gas Transmission Ltd. (WCGT Ltd.) for the Westcoast
4 Connector Gas Transmission Project (WCGT Project) on November 25, 2014, and later granted a 5-year
5 extension to the Certificate on April 25, 2019. The Certificate expires on November 25, 2024. The
6 Certificate granted for the WCGT Project is subject to 43 Conditions. The purpose of the Freshwater Quality
7 Monitoring Plan (FWQMP or Plan) is to address the requirements of Certificate Condition 10.

8 WCGT Ltd. is engaging with Indigenous groups and Relevant Regulatory Authorities (RRAs) in the
9 development of this detailed outline to support the full build-out of the FWQMP. Through engagement,
10 WCGT Ltd. is seeking collaboration in the development of the FWQMP and any information that can be
11 shared to strengthen the FWQMP and the commitment to fulfilling Condition 10.

12 WCGT Ltd. acknowledges the inherent connection Indigenous Peoples have with freshwater resources and
13 that while the FWQMP will satisfy the regulatory requirement, the FWQMP is intended to minimize impacts
14 to the freshwater aquatic environment and water quality by incorporating Indigenous Knowledge and
15 ensuring concerns are addressed during development.

16 The FWQMP provides a framework for freshwater water quality monitoring (WQM) during construction of
17 the Project. The FWQMP is intended as a tool to monitor the effectiveness of mitigation measures during
18 construction of Project components located in or near water. The decision-making process as well as
19 general protocols and procedures for freshwater WQM are outlined.

20 The FWQMP should be read in conjunction with the Terrestrial Construction Environmental Management
21 Plan (TCEMP), Environmental Alignment Sheets, Project commitments, and applicable regulatory
22 approvals and permits.

23 1.1 Project Description

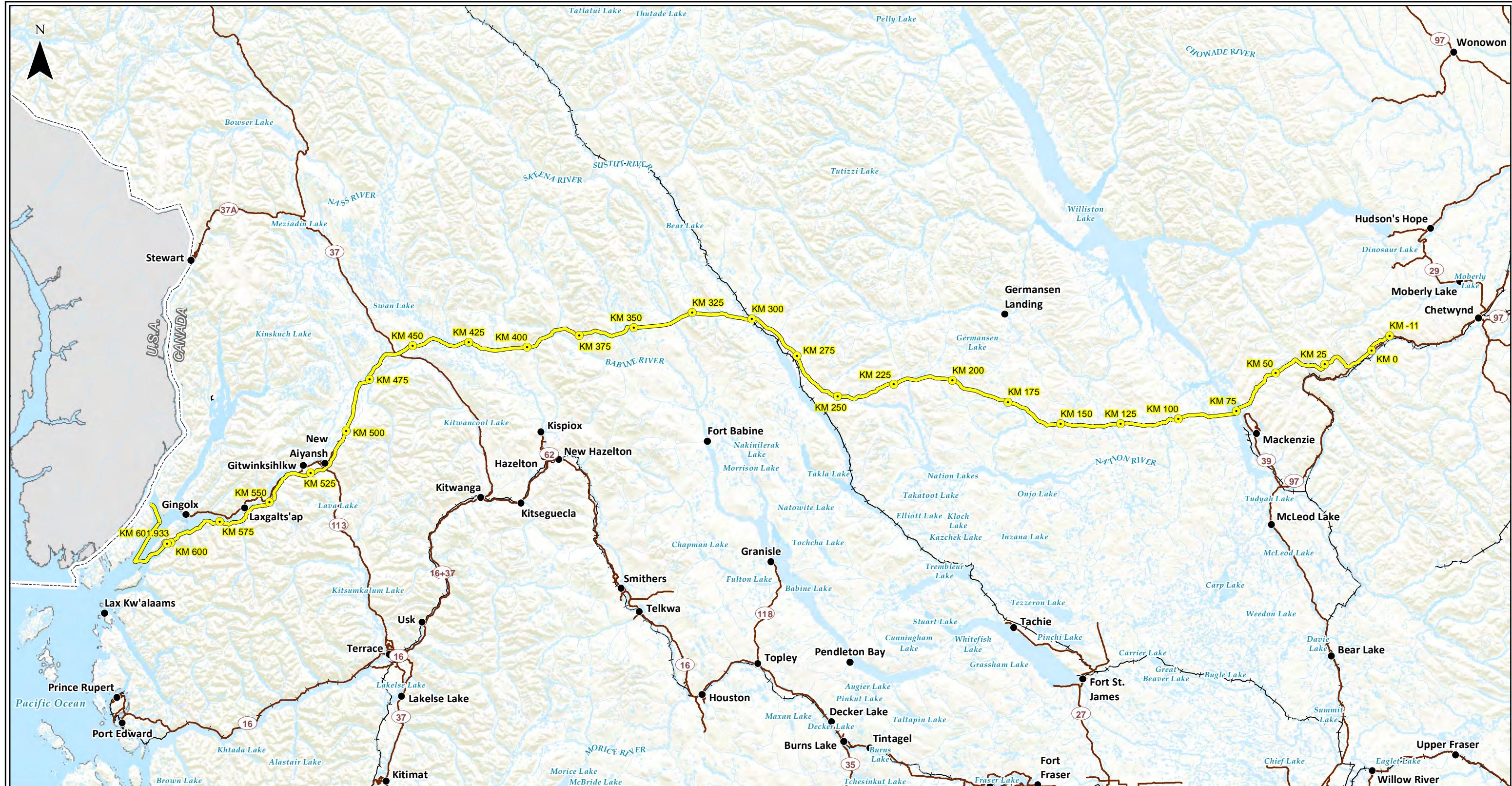
24 The WCGT Project approved in the Certificate includes the potential to build two 48-inch diameter natural
25 gas pipelines within the same right-of-way along with accompanying compressor stations that could
26 potentially service multiple liquefied natural gas (LNG) terminal sites starting at Cypress in northeast
27 British Columbia (BC) and ending at Ridley Island on the north coast. The Certificate provided the
28 flexibility to choose one of two routes to the Prince Rupert area—either through the Nass Valley (Nasoga
29 Route) or north towards Kitsault (Kitsault Route).

30 WCGT Ltd. is actively developing the WCGT Project to build one express, single-purpose natural gas
31 pipeline from a compressor station near Willow Flats in northeast BC to a delivery point at Wil Metl on the
32 north coast to supply natural gas to potential LNG terminal sites (the Project) (Figure 1).

33 The new compressor station at Willow Flats will have the potential to connect to Enbridge Inc.'s Westcoast
34 Energy Inc. pipeline system near Compressor Station 2 or TC Energy's NGTL system, eliminating the need
35 for the pipeline corridor from Cypress to Willow Flats and the compressor station at Cypress. WCGT Ltd.
36 will apply to the BC EAO to amend its Certificate to:

- 37 1) remove approximately 100 kilometres of the Certified Pipeline Corridor from Cypress to Willow Flats;
38 and
- 39 2) change the location of the compressor station from Cypress to Willow Flats.

- 1 If WCGT Ltd. proceeds with construction of a second pipeline, it would also start near Willow Flats and
- 2 would not use the corridor from Cypress to Willow Flats.
- 3 The new delivery point for the pipeline will be near Wil Milit. WCGT Ltd. will apply to the BC EAO to amend
- 4 its Certificate to make routing changes along its approved Nasoga Route to end the first pipeline at Wil
- 5 Milit. WCGT Ltd. will retain the option to expand the WCGT Project to the currently approved delivery point
- 6 at Ridley Island at a later date.
- 7 WCGT Ltd. is developing condition plans for the Project with Indigenous groups and stakeholders for
- 8 submission to the BC EAO in accordance with its Certificate. The condition plans will address potential
- 9 impacts from the Project, which includes the first pipeline from Willow Flats to Wil Milit, one compressor
- 10 station at Willow Flats, and the necessary meter stations.
- 11 WCGT Ltd. does not have plans to build the second pipeline at this time; however, should it decide to
- 12 construct a second pipeline, increase capacity by adding compressor stations, or extend the first pipeline
- 13 to Ridley Island, WCGT Ltd. will submit revised or new condition plans to the BC EAO in accordance with
- 14 Condition 1 of its Certificate.
- 15



- Town/Village/Service Area
- Kilometre Marker
- Highway
- International Border
- WCGT Pipeline Route
- Watercourse
- Railway
- Water Body

ENBRIDGE

Westcoast Connector
Gas Transmission

SCALE: 1:1,500,000

0 14,000 28,000 42,000 56,000 m

(All Locations Approximate)

FIGURE 1

REGIONAL OVERVIEW

**WESTCOAST CONNECTOR GAS TRANSMISSION LTD.
WESTCOAST CONNECTOR GAS TRANSMISSION PROJECT**

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NAD 1983 BC Environment Albers
Hillshade Background: TERA Environmental 2008;
Highways/Roads: NRCan 2015; Railways: NRCan 2012; Hydrology: BC FLNRO 2008; Reserves: Government of Canada 2018; Legal Grid: TERA Environmental Consultants 2010; Watercourse Crossings: Jacobs 2021; Project Components: Enbridge 2021.

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.

January 2022

CE820100

2. Freshwater Water Quality Monitoring Plan Overview

The FWQMP is being developed to meet the requirements of Certificate Condition 10. Further iterations will be developed in collaboration with the Indigenous Groups, RRAs, and stakeholders.

The scope of the FWQMP includes:

- Purpose and objectives, construction activities, linkages to other plans, roles and responsibilities, implementation schedule, and future updates (Section 2);
- Engagement methods that identify parties to be engaged, a plan for engaging Indigenous groups, RRAs, and stakeholders, and a description of how engagement outcomes help shape the Plan (Section 3);
- Regulatory requirements related to construction activities of the Project that may impact fish and freshwater water quality (Section 4);
- A description of the freshwater WQM program including activities, locations, schedule and parameters, responses to exceedances, benthic sediment sampling (BSS), safety considerations, and reporting requirements (Section 5);
- A description of the adaptive management program in relation to WQM, including how the results will inform adaptive management (Section 6);
- A plan for reporting on the implementation of the FWQMP including the schedule, content, and recipients of reports (Section 7); and
- Professional Authentication of the FWQMP (Section 8).

2.1 Purpose and Objectives

The purpose of the FWQMP is to satisfy the applicable conditions outlined in Schedule B Table of Conditions for a Certificate for the WCGT Project specifically Condition 10. The rationale for including WQM as a monitoring component during construction activities in and around freshwater varies with the type of construction activity. The overall objectives of the FWQMP include the following:

- enhance the potential for early warning of a potentially harmful change in water quality resulting from construction activity;
- assist in adjusting construction activities in response to WQM results to reduce the potential impact of changes to water quality on fish and fish habitat;
- help document the extent of the effects should an exceedance to established instream Water Quality Guidelines occur; and
- identify the need for additional mitigation from any changes in water quality caused by construction activities.

2.2 Construction Activities

Activities that are anticipated in and around water during construction of the Project that may necessitate WQM include:

- trenchless crossings;
 - microtunnel crossing;
 - punch and bore crossing;

- 1 – horizontal directional drill (HDD) crossing;
- 2 – Direct Pipe® installation;
- 3 – aerial crossing;
- 4 ▪ trenched crossings;
 - 5 – isolated crossing;
 - 6 – open cut crossing;
- 7 ▪ beaver dam removal;
- 8 ▪ vehicle and equipment crossings; and
- 9 ▪ clearing and construction within the Riparian Reserve Zone (RRZ)

10 Stream crossing methods are selected based on several factors, including fish habitat potential, least risk
11 windows (LRW), flow, geotechnical information, time of year, and constructability. Descriptions of
12 construction activities and crossing methods that may necessitate WQM are included in the following
13 sections. WQM may also be required during release of hydrostatic test water; however, the details of such
14 are not included in the FWQMP and can be found in the TCEMP.

15 2.2.1 Trenchless Crossings

16 2.2.1.1 Microtunnel Crossings

17 Microtunneling is a remotely controlled trenchless pipeline installation technique that can be
18 implemented in various soil conditions. In a one-step process, a microtunneling boring machine excavates
19 the ground while being pushed through by hydraulic jacks adding a casing pipe. Once the casing pipe is
20 installed, a steel pipe is then installed inside. Microtunneling poses a low risk of instream fluid release.

21 2.2.1.2 Punch and Bore Crossings

22 Punch and bore are trenchless techniques that use bell holes for horizontal punching and boring between
23 two bell holes. Once a passageway is created between the two bell holes, the pipe is pushed or pulled
24 through. Pressurized fluids are not used and there is no risk of an instream drilling fluid release.

25 2.2.1.3 Horizontal Directional Drill Crossings

26 During an HDD, drill entry and exit locations are setup on opposite sides of a stream. A drill rig at the entry
27 site first drills a pilot hole with a drill bit using pressurized drilling fluid. Once the drill bit breaks through
28 the exit location, if appropriate, it is replaced with a back reamer and is pulled back, increasing the
29 diameter of the drill hole. Once the drill hole has reached the desired size, the pipe is attached to the
30 reamer and pulled through until it exits at the drill entry. During HDD, there is a risk of drilling fluid to the
31 environment.

32 2.2.1.4 Direct Pipe® Installation

33 Direct Pipe® installation is a trenchless pipe installation method that is a combination of microtunneling
34 and HDD methods. Direct Pipe® installation involves the simultaneous excavation of the borehole and
35 installation of the pipeline, requiring only one pass for pipeline installation. There is a low risk of release of
36 drilling fluid to the environment during Direct Pipe® installation.

37 2.2.1.5 Aerial Crossings

38 Aerial crossings involve attaching the pipeline to an existing bridge or constructing a bridge to support the
39 pipeline.

1 2.2.2 Trenched Crossings

2 2.2.2.1 Isolated Crossings

3 Watercourse crossing locations may be isolated using several methods including: flume; dam and pump;
4 coffer dam and channel diversion. During installation of pipelines using isolations, the crossing is isolated
5 from flow and the water is moved around the instream work area, maintaining downstream flow. Once the
6 trench is excavated, the pipe is installed across the stream. The trench is then backfilled, the surface
7 streambed and banks restored, and the isolation structures removed.

8 The short-term mobilization of sediment during certain steps of isolated crossings (e.g., isolation structure
9 installation and removal) is largely unavoidable. However, these events typically result in minimal
10 disturbances to fish and aquatic habitat when appropriate mitigation measures are implemented.

11 2.2.2.2 Open Cut Crossings

12 Open cut crossings generally occur only when a crossing has limited fish habitat potential, is dry or frozen
13 to the bottom at the time of construction, or where other methods are not feasible. During an open cut,
14 the streambed is excavated without flow isolation, and the pipe is installed into the trench across the
15 stream. After pipe installation, the trench is backfilled, and streambed and banks are restored.

16 2.2.3 Vehicle Crossings

17 Construction of vehicle and equipment crossings may be needed for access during construction and
18 operation of the Project. Depending on stream size and conditions, the following equipment and vehicle
19 crossing types may be used: clear-span bridges, multi-span bridges, ice bridges, snowfills, culverts,
20 log/pipe fills, swamp mats and/or stream fords. Clear-span bridge, ice bridge, and snowfill installation and
21 removal generally avoid instream work and result in limited to no sediment release.

22 2.2.4 Beaver Dam Removal

23 If beaver dam removals are required, the potential for negative effects to fish and fish habitat (e.g.,
24 sediment transport and anoxic water released downstream) will need to be mitigated. It is recommended
25 that water quality sampling occur prior to beaver dam removals to compare water quality parameters (e.g.,
26 turbidity) between the release water upstream of the beaver dam and the receiving water downstream of
27 the beaver dam.

28 2.2.5 Clearing and Construction Within the Riparian Reserve Zone

29 Clearing and construction within the RRZ has the potential to result in exposed soils and potential release
30 of sediment from erosion and sedimentation events resulting from precipitation if appropriate erosion and
31 sediment control measures are not effectively implemented.

32 2.3 Water Quality Monitoring Sites

33 Once pipeline and vehicle/equipment crossings methods, timing, and locations are determined, a list of
34 streams and wetlands requiring WQM will be developed. In general, WQM will be conducted where there
35 will be instream works or works within the RRZ of an S1, S2, S3, or within 20 metres (m) of an S4 stream,
36 unless otherwise authorized by BC Oil and Gas Commission (BC OGC) or Fisheries and Oceans Canada
37 (DFO). Definitions for stream class and associated Riparian Management Area (RMA), RRZ, and Riparian
38 Management Zone are included in Table 2-1. In general, WQM will not be conducted at waterbodies that
39 are dry or frozen to bottom at the time of construction.

Table 2-1. Stream Classification Definitions as outlined in the British Columbia *Environmental Protection Management Regulation*

Riparian Class	Stream Width	Fish Status	RMA	RRZ	RMZ
S1-A	Greater than 100 m	Fish Stream	100	50	50
S1-B	Greater than 20 m but less than 100 m	Fish Stream	70	50	20
S2	Greater than or equal to 5 m but less than 20 m	Fish Stream	50	30	20
S3	Greater than or equal to 1.5 m	Fish Stream	40	20	20
S4	Less than 1.5 m	Fish Stream	30	0	30
S5	Greater than 3 m	Not a Fish Stream	30	0	30
S6	Less than or equal to 3 m	Not a Fish Stream	20	0	20

1 2.4 Linkages to Other Condition Plans

- 2 Information on other condition plans prepared for the Project will be considered in the FWQMP. The links
3 between the FWQMP and other condition plans will be provided in Table 2-2.

Table 2-2. Linkages to Other Condition Plans

Plan	Description of the Plan	Linkages to this Plan
Condition 11 - Metal Leaching/Acid Rock (ML/ARD) Drainage Management Plan (MLARDMP)	The MLARDMP identifies potential ARD sites, recommends mitigation measures to be implemented during construction, and outlines monitoring and reporting recommendations.	To be determined (TBD)
Condition 12 - Wetlands Management Plan (WMP)	The WMP includes results of pre-construction surveys, recommends mitigation measures to be implemented during construction, and outlines the post-construction monitoring program for wetlands. The WMP also includes consideration for the objectives of the Sensitive Area Plan for Mugaha Marsh as per Condition 26.	TBD
Condition 25 - Restoration Plan (RP)	The RP provides recommendations for soil handling, construction clean-up, erosion control measures, revegetation plans, and life of Project vegetation management.	Restoration of riparian areas and bank restoration will be required. The FWQMP outlines WQM during these activities.

Table 2-2. Linkages to Other Condition Plans

Plan	Description of the Plan	Linkages to this Plan
Condition 35 - TCEMP	<p>The TCEMP describes WCGT Ltd.'s environmental procedures and mitigation measures to field and construction personnel. These environmental procedures and mitigation measures will be implemented during construction of the Project to mitigate, avoid, or reduce potential adverse environmental effects.</p> <p>The TCEMP serves as reference information for construction and inspection personnel to support decision-making and to provide direction to more detailed information (i.e., resource-specific mitigation, management, and contingency plans).</p>	<p>The TCEMP provides the mitigation measures that will be implemented during the Project, including at watercourse crossings (subsection 4.8). The success of these mitigation measures will be measured through the FWQMP. Contingency plans are outlined in Section 5 of the TCEMP, including the Spill Contingency Plan and Drilling Mud Release Contingency Plan, that will be followed in the event WQM results in the detection of potential construction-related releases.</p>
Condition 43 – Nisga'a Watercourse Restoration Plan (NWRP)	<p>The NWRP outlines the objectives for achieving no net loss of environmental function for areas where the pipeline route intersects existing aquatic or riparian habitat restoration or compensation sites within Nisga'a Lands.</p>	TBD

1 2.5 Implementation Schedule

2 The FWQMP will be submitted to the BC EAO at least 90 days before the start of construction. Planning will
3 continue while clearing and construction activities begin, as per the latest Project schedule. The FWQMP
4 will be implemented throughout construction under the supervision of a Qualified Professional (QP), and
5 as described in the TCEMP.

6 2.6 Future Updates to the Freshwater Water Quality Management Plan

7 Revisions to the FWQMP could occur as a result of:

- 8 □ Engagement programs with Indigenous groups;
- 9 □ Additional information becoming available;
- 10 □ Changes to Project planning (e.g., engineering changes);
- 11 □ Commitments made during the regulatory review process;
- 12 □ Regulatory permits and authorization Conditions; and
- 13 □ Updates to Water Quality Guidelines.

14 WCGT Ltd. will not notify Indigenous Groups, RRAs, and stakeholders when minor revisions are made to
15 the FWQMP (i.e., small changes that would not affect the scope and objectives of the FWQMP). Indigenous
16 groups, RRAs, and stakeholders will be provided an opportunity to review and provide comment on
17 material revisions to the Plan (i.e., changes to the scope or mitigation and monitoring requirements). A
18 Document History table listing version, date, and distribution will be provided in this document.

1 3. Engagement

2 This FWQMP is being developed through engagement with Indigenous groups and the BC OGC. Once
3 complete, the FWQMP will be provided to the BC EAO and BC OGC for final review at least 90 days prior to
4 the planned start of construction.

5 Throughout the development of the detailed outline, WCGT Ltd. is engaging to ensure the FWQMP is
6 reflective of Indigenous interests and concerns, meets the intent of the Certificate Condition, and aligns
7 with regulatory requirements as informed by RRA reviewers.

8 WCGT Ltd. is engaging on the content and approach provided in this detailed outline. Through this review,
9 WCGT Ltd. wants to ensure a collaborative approach at this early stage and that the outline captures, at a
10 high level, the intent and expectation of the Certificate Condition, as well as interests and concerns raised
11 by Indigenous groups and RRAs.

12 The information that WCGT Ltd receives will inform the drafting of the full FWQMP. WCGT Ltd. will
13 document and track all comments and recommendations received and provide a description on how this
14 information has been considered and incorporated into the FWQMP.

1 4. Regulatory Framework

2 The legislation, regulatory guidelines, best management practices (BMPs), and policy documents that
3 guided the development of the FWQMP are summarized in this section.

4 4.1 Indigenous Land Use Planning Documents

5 Indigenous Land Use planning documents provide strategic direction for resource management activities.
6 The Project crosses 14 Indigenous Land Use and marine use plan boundaries. These plans provide
7 direction for areas with general and specific resource values that are managed to sustain environmental,
8 social, economic, or cultural values.

9 There are no known Indigenous Land Use planning documents applicable to the Plan.

10 4.2 Regional and Municipal Land Management Plans

11 Land and Resource Management Plans (LRMPs) and Sustainable Resource Management Plans (SRMPs)
12 provide strategic direction for resource management activities. These plans provide direction for areas
13 with general and specific resource values that are managed to sustain environmental, social, or economic
14 values.

15 Resource management planning documents applicable to the FWQMP include:

- 16 ▪ Dawson Creek LRMP
- 17 ▪ Fort St. John LRMP
- 18 ▪ Fort St. James LRMP
- 19 ▪ Mackenzie LRMP
- 20 ▪ Prince George LRMP
- 21 ▪ Vanderhoof LRMP
- 22 ▪ Bulkley LRMP
- 23 ▪ Bulkley SRMP
- 24 ▪ Bulkley Landscape Unit Plans
- 25 ▪ Central Coast LRMP
- 26 ▪ Cranberry SRMP
- 27 ▪ Kalum LRMP
- 28 ▪ Kispiox LRMP
- 29 ▪ Lakes District LRMP
- 30 ▪ North Lakes SRMP
- 31 ▪ Morice Lake SRMP

32 4.3 Federal

33 Federal legislation, regulatory guidelines, BMPs, and policy documents that are applicable to the FWQMP
34 include:

- 35 ▪ *Fisheries Act*
- 36 ▪ *Species at Risk Act*

1 4.4 Provincial

2 Provincial legislation, regulatory guidelines, BMPs, and policy documents that are applicable to the
3 FWQMP include:

- 4 ▪ *Water Sustainability Act*
- 5 ▪ *Oil and Gas Activities Act and Environmental Protection and Management Regulation*
 - 6 – BC OGC- Oil and Gas Activity Application Manual
- 7 ▪ British Columbia's Policy for Mitigating Impacts on Environmental Values
- 8 ▪ *Forest and Range Practices Act*
 - 9 – Fish-Stream Crossing Guidebook
 - 10 – Riparian Management Area Guidebook
 - 11 – Fish-Stream Identification Guidebook

12 4.5 Timing Windows

13 Regional LRWs represent time periods when there is a lower risk to freshwater fish and fish habitat from
14 instream activities. LRWs are not to be considered as time periods during which there is no risk. LRWs for
15 instream activities were determined for each stream crossed based on fish presence and the regional
16 terms and conditions in each of the three regions traversed by the Project: Northeast, Omineca, and
17 Skeena.

1 5. Monitoring Program

2 To meet Condition 10 of the Certificate, WCGT Ltd. has designed and will implement a monitoring
3 program to assess the effectiveness of mitigation implemented on the Project. The WQM plans and
4 strategies to be implemented are included in the FWQMP. Appropriate corrective measures will be
5 implemented, where warranted (Section 6).

6 5.1 Water Quality Monitoring Activities

7 WQM will be implemented based on construction activities and overall risk to the aquatic environment.
8 Construction activities that may necessitate freshwater WQM are outlined in subsection 2.2. The overall
9 implementation and coordination of WQM will be the responsibility of WCGT Ltd. The WQM crew will be
10 notified of the expected start and duration dates of each construction activity where WQM will be
11 conducted.

12 5.2 Water Quality Monitoring Locations and Schedule

13 5.2.1 Zone-of-Influence

14 WQM typically occurs within an activity's estimated zone-of-influence (ZOI). The ZOI is the stream reach
15 with the highest potential to be impacted by construction activities. The ZOI is typically the reach where
16 90 percent of the sediment load caused by construction activities is expected to fall out of suspension and
17 be deposited. The length of the ZOI is based on several factors (e.g., stream gradient, channel width,
18 channel depth, channel morphology, and discharge). Water velocity and depth are major factors in
19 estimating the ZOI and should be measured immediately prior to construction to provide information
20 about the extent of WQM. Other factors to consider when determining the ZOI include the location of
21 groundwater inputs, beaver dams, and/or tributaries.

22 Conducting WQM within the ZOI assists in documenting the magnitude and duration of any construction-
23 related changes in water quality and the associated potential impact on the aquatic environment. During
24 trenched crossing construction the source of sediment is typically the excavation area, and sampling
25 transects are primarily located within the ZOI downstream of the activity. If WQM results indicate that the
26 ZOI is too small, it will be extended as needed. For trenchless crossings, the potential instream source of
27 drilling fluid is not always obvious, especially under ice cover. To detect and document the distribution of
28 instream drilling fluid releases, WQM is typically conducted at set downstream intervals within the ZOI.

29 5.2.2 Data Collection Locations

30 Where the FWQMP is implemented, a control station will be established upstream of the construction
31 activity. The control is used to determine whether any changes in the measured parameters can be
32 attributed to construction activities or if changes are the result of prevailing environmental conditions. The
33 control locations will be safely accessible without disturbing the stream and far enough upstream or away
34 from the works that no construction-related effects would be expected.

35 The following are considerations for WQM transect placement:

- 36 ▪ Establish at least one transect upstream (control) and at least one downstream within the ZOI.
37 Multiple transects downstream should be established at the discretion of the QP.
- 38 ▪ Install two automated data recorders (sondes) at the start of WQM activities, if feasible.

- 1 ▪ Select transect locations and sample stations (e.g., left, centre, and right) based on wetted width and
2 site conditions at the time of WQM. Wider streams (e.g., >5 m wetted width) may require multiple
3 sample stations at transects.

4 Transect location criteria will be documented and consider:

- 5 ▪ Potential sediment sources within the sampling reach (e.g., roads, beaver activity, or tributaries) that
6 could affect water quality parameters.
7 ▪ Safety concerns effecting access and egress such as steep/unstable banks, swift water, poor ice
8 quality, etc.
9 ▪ Additional sampling locations may be established to address site-specific requirements.

10 5.2.3 Data Collection Period

11 Collection of pre-construction water quality data should occur before any substantial site preparation work
12 occurs near the crossing, including vegetation clearing in preparation for crossing construction. WQM will
13 begin a minimum of 24 hours prior to the start of instream works, when possible, and will be considered
14 complete when all instream works are finished, and WQM parameters are within the WQM guidelines.

15 Two sondes should be setup to sample at 10-minute intervals at the start of WQM, where feasible. All
16 sondes at a site should collect data at the same time. Sondes will record both turbidity and pH when
17 feasible. If there is only one multi-parameter sonde at a site, it should be setup at the downstream
18 location.

19 WQM data will also be collected manually (i.e., with handheld water quality meters) throughout the
20 construction period, at least three times daily while instream work is occurring (e.g., before the start of
21 activities each morning, midday and immediately following construction activities for the day). Sampling
22 frequency may increase during activities with higher risk of causing sedimentation or altering water quality
23 (e.g., during instream work, during water diversions and when bore paths are under streams), or
24 immediately following any incident which may affect water quality.

25 5.3 Water Quality Monitoring Parameters and Guidelines

26 The Canadian Council of Ministers of the Environment (CCME), and BC Ministry of Environment and
27 Climate Change Strategy have developed Water Quality Guidelines for freshwater. The CCME Guidelines
28 for the Protection of Aquatic Life and BC Approved Water Quality Guidelines: Aquatic Life, Wildlife &
29 Agriculture provide guidelines for total suspended solids (TSS) and turbidity to guide protection of aquatic
30 resources during instream activities in BC. The parameters monitored and guidelines to be used for the
31 Project are discussed in the following sections.

32 5.3.1 Turbidity and Total Suspended Solids

33 Consistent with Certificate Condition 10, guidelines for turbidity and TSS were derived from the BC
34 Ambient Water Quality Guidelines (Criteria) for Turbidity, Suspended and Benthic Sediments (Singleton
35 2001) and are shown in Table 5-1.

Table 5-1. Guidelines for Turbidity and Total Suspended Solids

Parameter	Guideline	
	Clear Flow*	High Flow or Turbid Water
TSS	Change from background of 25 mg/L at any one time for a duration of 24 hours	Change from background of 10 mg/L at any time when background is 25 to 100 mg/L
	Change from background of 5 mg/L at any one time for a duration of 30 days	Change from background of 10% when background is >100 mg/L
Turbidity	Change from background of 8 NTU at any one time for a duration of 24 hours	Change from background of 5 NTU at any time when background is 8 to 50 NTU
	Change from background of 2 NTU at any one time for a duration of 30 days	Change from background of 10% when background is >50 NTU

Notes:

mg/L = milligrams(s) per litre

NTU = nephelometric turbidity unit

- 1 5.3.1.1 Turbidity and Total Suspended Solids Relationship
- 2 Turbidity measurements (in NTU) measure how particles in the water column reflect. Turbidity readings taken in the field provide an immediate indication of a sediment event and its magnitude, as well as the duration.
- 5 The amount of light reflected for a given amount of particulates is dependent upon properties of the particles (e.g., shape, colour and reflectivity). Different types of particles that can reflect light include suspended solids, tannins, and phytoplankton, therefore, a correlation between turbidity and TSS is often unique for each location and situation. The establishment of a turbidity/TSS relationship allows turbidity results to be measured as a proxy measurement for TSS.
- 10 In the event of a sediment release to the aquatic environment, water samples may be collected to determine the TSS/turbidity relationship using a linear regression, to evaluate the potential effects of TSS on aquatic resources. A suitable number of samples representing the range of expected TSS concentrations is submitted to a Canadian Association of Environmental Analytical Laboratories accredited laboratory for analysis of TSS concentration. Once the TSS/turbidity relationship is established, the TSS levels can be retroactively applied to turbidity data collected onsite.
- 16 5.3.2 pH
- 17 Consistent with Certificate Condition 10, pH will be measured during WQM. Guidelines for pH were derived from the BC Ambient Water Quality Guidelines (Criteria) reports, however the CCME guidelines were selected as the guidelines for the Project (Table 5-2).

Table 5-2. Guidelines for pH

Parameter	Guideline
pH	6.5 to 9.0

1 5.4 Response to Exceedances

2 If water quality parameters reach or exceed guideline values, the Environmental Inspector (EI) and QP will
3 be notified. The EI or QP will alert the Construction Manager and work with the construction management
4 team to develop corrective actions. If the EI or QP is not immediately available, the Construction Manager
5 will be notified. Corrective actions will be site-specific, but could include the following.

- 6 ▪ Installation of additional erosion and sediment control measures to limit turbid water from entering
7 streams.
- 8 ▪ Temporarily stopping activities that are contributing to the water quality exceedance until parameters
9 return to near-background levels.
- 10 ▪ Consideration of rescheduling works until conditions are more favourable (e.g., avoiding work during
11 heavy precipitation or working in the early morning when the ground is frozen during freeze-thaw
12 activity).

13 Corrective actions will be documented within 24 hours of implementation. An adaptive management
14 approach will be used to implement corrective actions and monitor their effectiveness. If unsuccessful,
15 alternate corrective actions will be implemented promptly (this may include ceasing on site construction
16 activities).

17 Where an exceedance persists for more than 24 hours and corrective actions are unsuccessful in
18 addressing the exceedance, crossing construction activities may be suspended at the crossing location
19 until effective solutions have been developed and implemented. In such situations, the Construction
20 Manager has the decision-making authority after considering input and recommendations from the EI or
21 the QP.

22 5.5 Benthic Sediment Sampling

23 A BSS Program may be implemented where instream works associated with pipeline installation are
24 planned and potential spawning habitat for redd-building salmonids was rated as "Important" or better
25 within, or downstream of, the Project footprint during field studies. BSS may be conducted along with
26 WQM as outlined in Condition 10 of the Certificate and will be consistent with the BC Ambient Water
27 Quality Guidelines (Criteria) for Turbidity, Suspended and Benthic Sediments.

28 Sediment releases may result in extensive sediment deposition on spawning habitat, which may reduce
29 recruitment for one or more year classes. The methods provided in this section focus on monitoring
30 potential sediment deposition on the spawning habitat of redd-building salmonid species in flowing water
31 environments.

32 5.5.1 Data Collection and Timing

33 BSS will generally occur twice, pre-construction and post-construction. The results of the pre-construction
34 BSS will determine whether post-construction BSS is needed. If the guidelines for streambed substrate
35 composition (see Table 5-3) are met, post-construction BSS will occur. Prior to BSS, spawning surveys are
36 recommended to confirm the location of any redds and potential salmonid spawning habitat areas.

37 If the substrate at a given transect meets the guidelines for streambed substrate composition (BC MELP
38 1997b) (see Table 5-3), post-construction sampling will be implemented. BSS should only occur during
39 the LRW or an alternate time recommended by a QP when redds, spawning fish, or eggs are unlikely to be
40 present.

- 1 Sampling during spawning and incubation periods may cause adverse effects to fish or fish habitat. If BSS
 2 cannot be completed within the LRW, or there is no LRW, an alternate time for BSS may be recommended
 3 by a QP. If a low risk period cannot be identified, BSS will not be conducted. In this case, the turbidity and
 4 TSS data collected during the WQM program would serve as a proxy for BSS. TSS data could be used to
 5 evaluate the potential for negative effects to fish and fish habitat if BSS is not feasible.

Table 5-3. Streambed Substrate Compositions Guidelines

Fine substrate not to exceed (at salmonid spawning sites):	
<2 mm	10%
<3 mm	19%
<6.35 mm	25%
Geometric mean diameter: not <12 mm	
Fredle number not <5 mm	

Source: BC MELP

mm = millimetre(s)

6 5.5.2 Recommended Methods

- 7 The BSS methods summarized in Table 5-4 are anticipated to yield high quality and quantity samples and
 8 limit the disturbance to spawning habitat. In the event of high-water levels, inclement weather, frozen
 9 conditions, or other factors affecting sampling efficiency, the contingency method could be used. BSS
 10 methods should be evaluated based on site-specific conditions expected at the time of sampling and may
 11 include other methods.

Table 5-4. Potential Benthic Sediment Sampling Methods

Sampling Methods - Open water and frozen conditions		
Primary	Secondary	Contingency
Pipe and McNeil	Mesh bag scoop	Scoops and spoons

12 Pipe and McNeil Technique

- 13 The Pipe and McNeil method uses a cylinder that defines the portion of the streambed to be sampled
 14 and an attached basin that is used to store the collected substrate and trap the suspended fines. It is
 15 designed for streams with relatively shallow water and low flow velocities (i.e., wadable streams), and
 16 a variety of substrate types. Limitations of this method include a lack of penetration in cobble and
 17 boulder substrate.

18 Mesh Bag Scoop Technique

- 19 This method uses a mesh bag to collect substrate from the streambed. It works well in wadable streams
 20 with predominantly fine to moderate-sized gravel substrate. It is difficult to deploy in higher flows and
 21 depths. The mesh must be sized appropriately for smaller substrate and deposited sediment, to ensure
 22 that all material collected is retained. A consistent area is sampled for a defined period of time and the
 23 captured substrate is cleaned, removed from the bag, and measured (i.e., weighed and measured for
 24 substrate particle size and distribution) in the field or laboratory.

1 Scoops and Spoons Technique

2 The scoops and spoons (sometimes called spatula) method uses simple, inexpensive, and lightweight
3 tools to collect substrate samples directly from the streambed. Usually, stainless steel spoons, scoops, or
4 spatula are used. They are widely available, non-mechanical, portable, and able to sample smaller
5 substrate types. They are recommended for shallow water; however, attaching the scoop to a telescoping
6 pole allows for sample collection in deeper water. Care must be taken when the scoop is raised through
7 the water column or passed through a river current during retrieval to reduce the loss of fine material.
8 Other limitations of the scoops and spoons method include limited sample volume, and sampling
9 challenges where water depth is greater than 1 m.

10 5.6 Safety Considerations

11 Stream crossing construction will occur in both open water and frozen conditions and consideration must
12 be given to a variety of safety concerns, including the season, time of day, weather, and flow conditions. A
13 safety assessment will occur prior to the start of the WQM and BSS programs, with ongoing safety
14 assessments throughout the programs. Where sampling of swift, turbulent, or deep waters is necessary,
15 sampling should be conducted by a two-person team, at a minimum.

16 Flow conditions vary throughout the year, and the potential risks associated with working in and around
17 water must be considered during planning and implementation of the WQM program. High flow
18 conditions may lead to adjustments or halting of construction activities, BSS and WQM until flow
19 conditions return to lower, less hazardous levels. Winter conditions bring additional hazards, including
20 avalanches, working on ice, in deep snow, and cold weather. Working at night poses additional risks of
21 working in potentially hazardous conditions (e.g., open water or ice) in low visibility.

22 The WQM and BSS programs will be developed in accordance with Standard Operating Procedures, the
23 Project Health, Safety, and Environment Plan, Hazard Impact Identification and Risk Assessment, and
24 WCGT Ltd. safety standards.

1 6. Adaptive Management

2 This section outlines how mitigation measures will be re-evaluated should monitoring programs indicate
3 that the measures implemented were not adequate or effective at avoiding or reducing potential residual
4 effects on the freshwater aquatic environment.

5 6.1 Potential Corrective Measures

6 WQM will provide an early indication of unsuccessful mitigation measures during work in and around
7 water. Corrective measures will be implemented as soon as practical. Corrective measures may involve
8 implementing modified, alternate, or additional mitigation or remedial measures that may include, but are
9 not limited to:

- 10 ▪ Sealing (e.g., using additives) or isolating (e.g., coffer dam) locations of fluid discharge in the event of
11 a drilling fluid release to the aquatic environment.
- 12 ▪ Isolating terrestrial drilling fluid releases near waterbodies using purpose-built dams and/or constant
13 removal with a hydrovac truck.
- 14 ▪ Modification of instream work to minimize release of sediment by introducing routine breaks during
15 installation of isolation infrastructure.

16 6.2 Construction Environmental Management Plan Contingency Plans

17 Contingency plans have been developed for activities that introduce known risks to fish and fish habitat, as
18 follows (refer to Section 5 of the TCEMP for individual plans):

- 19 ▪ Spill Contingency Plan
- 20 ▪ Soil Erosion Contingency Plan
- 21 ▪ Flood and Excessive Flow Contingency Plan
- 22 ▪ Drilling Mud Release Contingency Plan
- 23 ▪ Siltation of Watercourse Contingency Plan
- 24 ▪ Wet/Thawed Soils Contingency Plan

1 7. Reporting Requirements

- 2 Daily summaries, an annual report, and ad-hoc summaries of WQM and BSS activities will be provided to
3 WCGT Ltd. Reports will note any exceedances (including the time, duration, and severity of the
4 exceedance), actions taken to bring water quality back to within the guideline levels, and comments about
5 the effectiveness of the actions taken. If applicable, reports should include recommendations to prevent a
6 similar exceedance from occurring at other crossing locations, and any improvements that could make the
7 response more effective. It is preferable to display WQM results graphically in summary reports.
- 8 Where the WQM program indicates that there were exceedances and negative effects on fish and fish
9 habitat may have occurred (e.g., prolonged elevated levels of TSS, fine sediment deposition on potential
10 spawning habitat, changes to pH level outside of guideline levels), incident reports will be prepared, and
11 the proposed remedial action will be discussed with the BC OGC.

8. Professional Authentication

This FWQMP is being developed and signed by the QPs. These individuals will be directly responsible for providing professional services and submitting accurate work as directed by WCGT Ltd. in support of the submission as required by the BC EAO.

(Name, designation(s) to come)