BC EAO EAC Application – Tenas Project

Section 13.0 Management Plans
Chapter 11 Minesite Water Management Plan
Appendix 13.11-E Minesite Water Monitoring Program

May 2022

VERSION 1.0

Submitted to:	BC Environmental Assessment Office
Pursuant to:	*Environmental Assessment Act*, S.B.C. 2002, c.43
Submitted by:	Telkwa Coal Limited Suite 1410 – 409 Granville Street Vancouver, BC V6C 1T2

Tenas Project

Section 13 Management Plans
Chapter 11 Minesite Water Management Plan
Appendix 13.11-E Water Monitoring Program

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ABBREVIATIONS AND ACRONYMS

Abbreviation or Acronym	Long Form of Abbreviation or Acronym
BC	British Columbia
BC MECCS	British Columbia Ministry of Environment and Climate Change Strategy
BC MEMLI	British Columbia Ministry of Energy, Mines and Low Carbon Innovation
BC MOE	British Columbia Ministry of Environment
BC MWLAP	British Columbia Ministry of Water, Land and Air Protection
CPP	Coal Processing Plant
DMP	Discharge Management Plan (S13.0-C5)
DSI	Dam Safety Inspection (report)
DSR	Dam Safety Review
EoR	Engineer of Record
HPE	high density polyethylene
JAIR	Joint Application Information Requirements for Mines Act and Environmental Management Act Permits (British Columbia Ministry of Energy, Mines and Petroleum Resources [BC MEMPR] and British Columbia Ministry of Environment and Climate Change Strategy [BC MECCS] 2019)
MA/EMA	*Mines Act*, RSBC 1996, c 293, and *Environmental Management Act*, SBC 2003, c 53
MWMP	Minesite Water Management Plan (S13.0-C11)
Program	Minesite Water Monitoring Program
OD	outer diameter
OMS manual	Operation, Maintenance and Surveillance (Manual)
PAG	potentially acid generating
POPC/COPC	Parameters of Potential Concern/Contaminants of Potential Concern
Project	Tenas Project
QA	Quality Assurance
RPD	Relative Percent Difference
SPPs	Standard Policies and Procedures
TCL	Telkwa Coal Limited
TSS	total suspended solids

UNITS OF MEASURE

Abbreviation or Acronym	Long Form of Abbreviation or Acronym
°C	degrees Celsius
%	percent
cm	centimetre
km	kilometre
km/hr	kilometres per hour
m	metre

EXECUTIVE SUMMARY

Streamflow and water quality monitoring will continue at the stations shown in **Figure 2.3-1**, developed as part of the environmental baseline program to evaluate changes relative to pre-mining conditions and relative to modelled conditions. Water quality samples will be collected monthly using a grab sample as per this Appendix. Water level data will continue to be collected using in-situ pressure transducers and rating curves will be reviewed annually and updated to convert levels to streamflow.

The objective of this Minesite Water Monitoring Program (Program) and the **Minesite Water Management Plan (S13.0-C11) (MWMP)** is to minimize effects on surface water and groundwater quality in reference to British Columbia (BC) water quality guidelines and/or site performance objectives downstream that could impact its use; and to support the proposed effluent quality objectives and trigger levels/conditions describing when action is to be taken and propose potential mitigation measures to remedy unexpected or deteriorating effluent quality.

Management of surface and groundwater at the Project is important. Through implementation of the **MWMP**, this Program**,** and relevant Standard Policies and Procedures (SPPs) developed during the Construction Phase, Telkwa Coal Limited (TCL) will ensure the protection of water resources through the minimizing of potential Project effects and mitigations of any identified effects.

1. INTRODUCTION

This document provides details on a comprehensive water monitoring program for surface water and groundwater quantity and quality within the Tenas Project (Project) area, as per Section 7.1 to 7.5 of the Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits (British Columbia Ministry of Energy, Mines and Petroleum Resources [BC MEMPR] and British Columbia Ministry of Environment and Climate Change Strategy [BC MECCS] 2019) (JAIR).

This Minesite Water Monitoring Program (Program) has been designed to support the ongoing evaluation and refinement of modelling prepared for the Environmental Assessment Certificate (EAC) Application of the Project and should be read in conjunction with the **Discharge Management Plan (S13.0-C5) (DMP)** and the **Minesite Water Management Plan (S13.0-C11) (MWMP)**.

2. MONITORING PROGRAM

2.1 Overview

The monitoring program describes the water quality and hydrological monitoring for effluent, seepage, receiving surface water, and groundwater.

Data will be presented and analyzed for all mine life phases, which are Construction, Operation, Closure and Decommissioning, and Post-closure.

2.2 Objectives

The objectives to the water monitoring program are as follows:

- Track changes in water quality and compare water quality results to relevant regulatory criteria;
- Track changes in effluent, seepage and receiving stream water quantity and flow;
- Seasonality of groundwater levels, as well as directional changes in the flow, and
- Track storage pond water levels and operations.

2.3 Program Description

2.3.1 In-Stream Water Quality and Quantity Monitoring

Streamflow and water quality monitoring will continue at the stations shown in **Figure 2.3-1**, developed as part of the environmental baseline program to evaluate changes relative to pre-mining conditions and relative to modelled conditions. Water quality samples will be collected monthly using a grab sample. Water level data will continue to be collected using in-situ pressure transducers and rating curves will be reviewed annually and updated to convert levels to streamflow.

Table 2.3-1 summarizes water quality station descriptions, including coordinates, collection method, frequency, parameters measured and the monitoring period for surface water and on-site monitoring locations, respectively. Hydrometric stations and their location coordinates are listed in **Table 2-3-2**.

2.3.2 Groundwater Monitoring

Groundwater monitoring will be conducted at existing and proposed monitoring wells. A summary of the groundwater monitoring stations are presented in **Table 2.3-3**; and locations are mapped in **Figure 2.3-2**. The monitored parameters will include the groundwater levels (automated and manual), and the groundwater quality. The program and sampling methods will be based on protocols described in the Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators. Version 2. (British Columbia Ministry of Environment [BC MOE] 2016c), and the methodology specified in the BC Field Sampling Manual (GovBC 2013). Automated levels will be measured hourly using level loggers. Manual levels will be measured with depth meter during each sampling event and/or prior to manipulating the well instruments. The groundwater quality parameters will be consistent with those collected for the baseline study presented in **Appendix 4.4-A Groundwater Technical Report for the Tenas Coal Project, Telkwa (SRK)** of the **EAC Application**: pH, turbidity, hardness and alkalinity, anions and nutrients, total and dissolved metals.

2.3.3 Pond Monitoring

Water quality sampling, water level, and flow measuring facilities will be installed in each management, control, sedimentation, storage ponds to enable monitoring of the pond water levels, inflows and discharges. If settling aids such as flocculants are required, real time information on influent total suspended solids (TSS) concentrations will be used to ensure effectiveness of settling aids. This will be achieved by directly measuring turbidity and converting to TSS based on a prior evaluation of TSS-turbidity relationships through a range of seasonal and flow conditions. Water level data will also be used to ensure minimum freeboard levels are maintained.

Water levels in the management ponds (North, West, and East) will be measured daily to ensure minimum water cover is maintained over potentially-acid-generating (PAG) material. Water quality samples will be collected monthly and compared against predicted values in the **Appendix 1.0-E SRK Water and Load Balance Modeling Report**.

Figures 2.3-1, 2.3-2, and **2.3-3** show site monitoring stations for surface water quality and quantity monitoring, hydrometric stations, and groundwater monitoring piezometers and/or wells, respectively.

Figure 2.3-4 provides the monitoring stations and frequency for each water storage facility including the three (3) management, the Potable Water Storage Pond, the Explosive Magazine Sedimentation Pond, Explosive Facility Sedimentation Pond, Coal Processing Plant (CPP) Sedimentation Pond, Rail Infrastructure Sedimentation Pond, Gravel Quarry Sedimentation Ponds 1 and 2, Rock Quarry Sedimentation Pond, Tenas Access Corridor Sedimentation Ponds (East and West), and Tenas Control Pond.

Table 2.3-5 summarizes the parameters proposed for in site water samples based on the BC MOE Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators, Table 2 (BC MOE, 2016c). British Columbia Ministry of Environment and Climate Change Strategy (BC MECCS) effluent permits will provide the final list of parameters and rates to be measured at each location.

Table 2.3-1: Surface Water Monitoring Station Summary

Station ID	Station Name	GPS Coordinates		Site Description	Sampling Frequency	Sample Collection Method	Historic Sampling Record
		Easting	Northing				
WQS01	Tenas Creek	615171	6050438	Upstream reference for proposed Project infrastructure	Monthly	grab	May 2017 to March 2019
WQS02		616914	6053490	Near-field downstream of deposits and proposed associated Project infrastructure	Monthly	grab	May 2017 to March 2019
WQS04		620676	6057950	Mid-field downstream of deposits and proposed associated Project infrastructure	Monthly	grab	October 2017 to March 2019
WQS03	Four Creek	619235	6049989	Upstream reference for proposed Project infrastructure	Monthly	grab	May 2017 to March 2019
WQS20		619344	6052005	Adjacent to proposed Project infrastructure	Monthly	grab	March 2020
WQS21		619269	6051446	Adjacent to proposed Project infrastructure	Monthly	grab	March 2020
WQS03-DS		620034	6054076	Downstream of proposed Project infrastructure, potentially influenced by historical workings.	Monthly	grab	May 2018 to March 2019 and 1997 to 1998
WQS13	Goathorn Creek	621664	6051778	Upstream reference site on Goathorn Creek. Upstream of historical workings	Monthly	grab	September 2018 to March 2019
WQS06-US		620587	6053711	Upstream of WQS06 and of confluence with Four Creek. Potentially influenced by historical workings	Monthly	grab	May 2018 to March 2019
WQS06		621100	6057441	Downstream of project area, above confluence with Tenas Creek	Monthly	grab	May 2017 to March 2019

Station ID	Station Name	GPS Coordinates		Site Description	Sampling Frequency	Sample Collection Method	Historic Sampling Record
		Easting	Northing				
WQS05		620615	6058133	Mid-field downstream of confluence with Tenas Creek	Monthly	grab	May 2017 to March 2019
WQS16	Helps Creek	625906	6055851	Upstream of proposed Tenas bypass road	Monthly	grab	September 2018 to March 2019
WQS17		625801	6055979	Upstream of proposed Tenas bypass road	Monthly	grab	September 2018 to March 2019
WQS08	Telkwa River	617964	6057860	Upstream reference; above confluence with Goathorn Creek	Monthly	grab	May 2017 to March 2019
WQS09		621394	6058998	Mid-field downstream of confluence with Goathorn Creek	Monthly	grab	May 2017 to March 2019
WQS10		624269	6061725	Far-field downstream before confluence with the Bulkley River	Monthly	grab	May 2017 to March 2019
400187		625481	6062592	At mouth of river at village	Monthly	grab	1974, 1975, 1983 to 1988, and 2006 to 2009
WQS11-US	Bulkley River	630472	6056723	Upstream reference for proposed rail infrastructure	Monthly	grab	November and December 2017 and May 2018 to March 2019
WQS11		629601	6059221	Near-field downstream of proposed rail infrastructure	Monthly	grab	May to December 2017 and June 2018 to March 2019
E246125		625477	6062748	Immediately downstream of Telkwa River confluence, likely not fully mixed; water intake for Telkwa	Monthly	grab	2001 and 2002
WQS12		625021	6063831	Mid-field downstream of proposed rail loadout and confluence with the Telkwa River	Monthly	grab	May to December 2017 and March 2018 to March 2019

Station ID	Station Name	GPS Coordinates		Site Description	Sampling Frequency	Sample Collection Method	Historic Sampling Record
		Easting	Northing				
400434		618410	6074024	Far-field downstream of Project; downstream of Smithers and upstream of sewage discharge	Monthly	grab	1974, 1975, 1983, 1984, 1987 to 1992, and 2012
400435		617870	6074979	Far-field downstream of Project; downstream of Smithers and downstream of sewage discharge	Monthly	grab	1974, 1975, 1983, 1984, 1987 to 1992, 2007, and 2012

Notes:

1. Parameter list is summarized in Table 2.4-1

2. WQS04 was moved approximately 1 km downstream to WQS04B for improved site access and safety.

3. WQS11-US was added in November 2017 to provide an upstream sampling site for the updated footprint of the rail loadout. WQS03-DS was added in May 2018 to provide an upstream reference for proposed Project infrastructure on Four Creek. WQS06-US was added in September 2018 to provide an upstream site to WQS06.

4. WQS13 was added in September 2018 to provide an upstream reference site on Goathorn Creek.

5. WQS16 and 17 were added in September 2018 to monitor Helps Creek upstream and downstream of the proposed Tenas bypass road. Samples were not collected in January to April 2018 from the Bulkley River due to safety concerns.

6. WQS20 and WQS21 were added in March 2020 to provide reference points along Four Creek adjacent to proposed infrastructure.

Table 2.3-2: Groundwater Monitoring Station Summary

Station name	Description	Phase	GPS Coordinates		Well type	Geology associated with well screen(s)	Inside Project Component	Measurement Frequency	Measurement Collection Method	Historic Sampling Record
			Easting	Northing						
T18-04S, and -04D	Existing monitoring well east of the pit and saturated waste rock at Post-closure Phase	B, C, O, D, P	6051115	615955	Nested well	Overburden and Bedrock	No	Automated Levels: hourly Manual levels: Quarterly Sampling: Quarterly	level loggers, depth meter, purging and pumping	2018 to 2019
T18-06D	Existing monitoring well east of East Management Pond (EMP)	B, C, O, D, P	6052647	616245	Single well	Overburden	No	Automated Levels: hourly Manual levels: Quarterly Sampling: Quarterly	level loggers, depth meter, purging and pumping	2018 to 2019
T18-08S, and T18-08D	Existing monitoring well east of North Management Pond (NMP) and immediately upgradient of the Tenas Control Pond	B, C, O, D, P	6053379	618515	Nested well	Overburden and Bedrock	Yes	Automated Levels: hourly Manual levels: Quarterly Sampling: Quarterly	level loggers, depth meter, purging and pumping	2018 to 2019
T19-18S	Existing monitoring well immediately southeast of West Management Pond (WMP)	B, C, O, D, P	6052454	619237	Single well	Overburden	No	Automated Levels: hourly Manual levels: Quarterly Sampling: Quarterly	level loggers, depth meter, purging and pumping	2018 to 2019

Station name	Description	Phase	GPS Coordinates		Well type	Geology associated with well screen(s)	Inside Project Component	Measurement Frequency	Measurement Collection Method	Historic Sampling Record
			Easting	Northing						
T19-26S	Existing monitoring well northwest of NMP and immediately upgradient of the Control Pond	B, C, O, D, P	6053665	617469	Single well	Bedrock	No	Automated Levels: hourly Manual levels: Quarterly Sampling: Quarterly	level loggers, depth meter, purging and pumping	2018 to 2019
T95R-40	Existing bedrock monitoring well southeast of saturated waste rock, and south of pit lake at Post-closure Phase	B, C, O, D, P	6051461	618188	Single well	Bedrock	No	Automated Levels: hourly Manual levels: Quarterly Sampling: Quarterly	level loggers, depth meter, purging and pumping	2018 to 2019
T95R-64	Existing bedrock monitoring well immediately southwest of pit lake at Post-closure Phase	B, C, O, D, P	6050597	618278	Single well	Bedrock	No	Automated Levels: hourly Manual levels: Quarterly Sampling: Quarterly	level loggers, depth meter, purging and pumping	2018 to 2019
T96R-34-87	Existing bedrock monitoring well immediately south of saturated waste rock at Post-closure Phase	B, C, O, D, P	6051180	617691	Single well	Bedrock	No	Automated Levels: hourly Manual levels: Quarterly Sampling: Quarterly	level loggers, depth meter, purging and pumping	2018 to 2019

Station name	Description	Phase	GPS Coordinates		Well type	Geology associated with well screen(s)	Inside Project Component	Measurement Frequency	Measurement Collection Method	Historic Sampling Record
			Easting	Northing						
TOB96-01-05	Existing overburden monitoring well southeast of pit lake at Post-closure Phase	B, C, O, D, P	6050602	619014	Single well	Overburden	No	Automated Levels: hourly Manual levels: Quarterly Sampling: Quarterly	level loggers, depth meter, purging and pumping	2018 to 2019
TOB96-02-06	Existing overburden monitoring well south of saturated waste rock and pit lake at Post-closure and north of WMP	B, C, O, D, P	6051947	618466	Single well	Overburden	No	Automated Levels: hourly Manual levels: Quarterly Sampling: Quarterly	level loggers, depth meter, purging and pumping	2018 to 2019
MW1	Proposed monitoring well southwest of the WMP	C, O, D, P	617003	6053101	Nested well	Overburden and Bedrock	No	Automated Levels: hourly Manual levels: Quarterly Sampling: Quarterly	level loggers, depth meter, purging and pumping	2018 to 2019
MW2	Proposed bedrock monitoring well west of the NMP, paired with T19-26S	C, O, D, P	617412	6053582	Single Well	Bedrock	No	Automated Levels: hourly Manual levels: Quarterly Sampling: Quarterly	level loggers, depth meter, purging and pumping	2018 to 2019
MW3	Proposed monitoring well west of the Tenas Control Pond	C, O, D, P	617575	6054132	Nested well	Overburden and Bedrock	No	Automated Levels: hourly Manual levels: Quarterly Sampling: Quarterly	level loggers, depth meter, purging and pumping	2018 to 2019

Station name	Description	Phase	GPS Coordinates		Well type	Geology associated with well screen(s)	Inside Project Component	Measurement Frequency	Measurement Collection Method	Historic Sampling Record
			Easting	Northing						
MW4	Proposed monitoring well north of the Tenas Control Pond	C, O, D, P	618343	6054121	Nested well	Overburden and Bedrock	No	Automated Levels: hourly Manual levels: Quarterly Sampling: Quarterly	level loggers, depth meter, purging and pumping	2018 to 2019
MW5	Proposed monitoring well northeast of the Tenas Control Pond	C, O, D, P	618767	6053875	Nested well	Overburden and Bedrock	No	Automated Levels: hourly Manual levels: Quarterly Sampling: Quarterly	level loggers, depth meter, purging and pumping	2018 to 2019
MW6	Proposed monitoring well northeast of the EMP	C, O, D, P	618942	6053106	Nested well	Overburden and Bedrock	No	Automated Levels: hourly Manual levels: Quarterly Sampling: Quarterly	level loggers, depth meter, purging and pumping	2018 to 2019
MW7	Proposed bedrock monitoring well immediately east of the NMP, paired with T19-18S	C, O, D, P	619357	6052651	Single well	Bedrock	No	Automated Levels: hourly Manual levels: Quarterly Sampling: Quarterly	level loggers, depth meter, purging and pumping	2018 to 2019
MW8	Proposed monitoring well east of the EMP	C, O, D, P	619240	6052049	Nested well	Overburden and Bedrock	No	Automated Levels: hourly Manual levels: Quarterly Sampling: Quarterly	level loggers, depth meter, purging and pumping	2018 to 2019

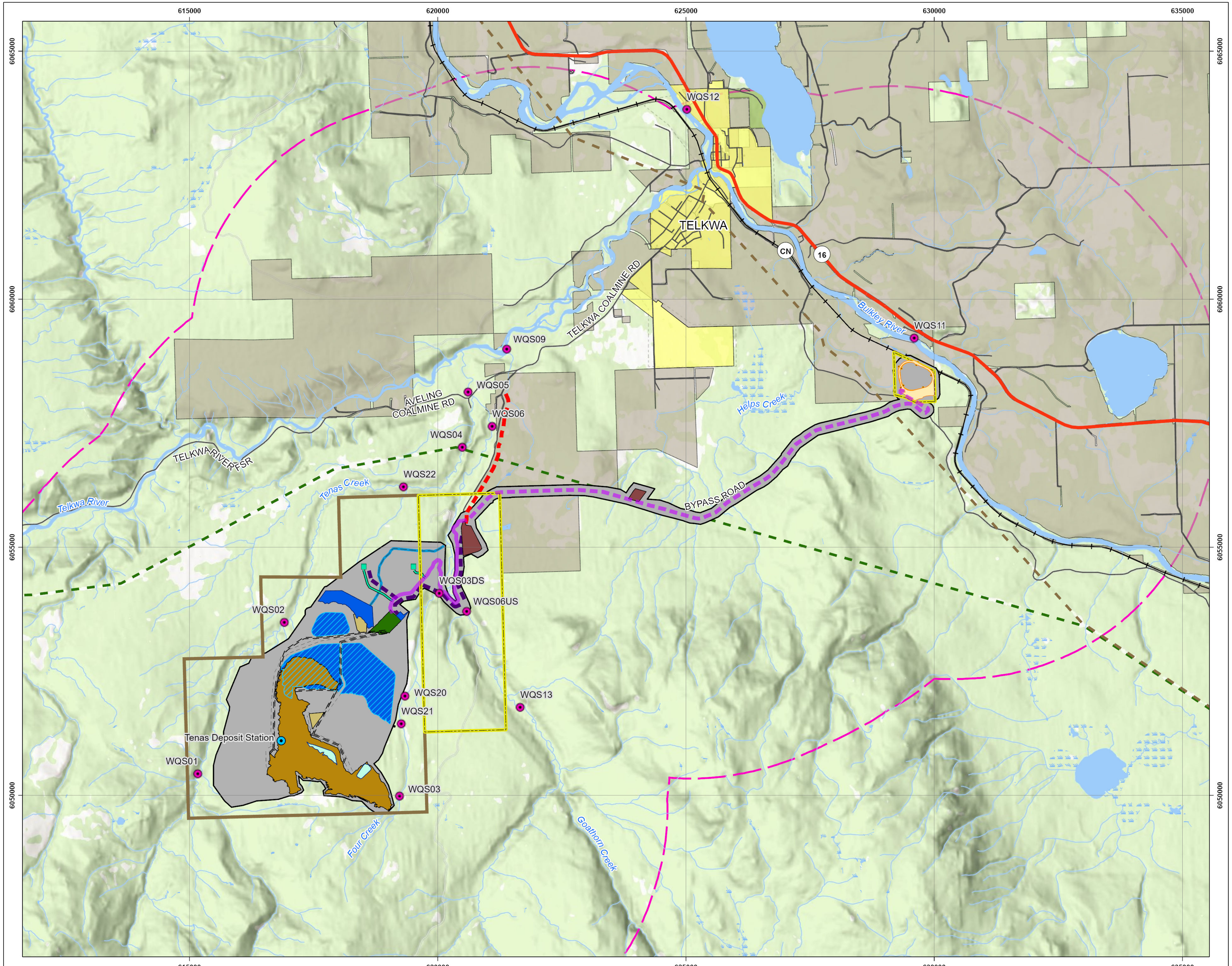
Table 2.3-3: Hydrometric Stations

Water Body	Station	UTM Location[1]		Period of Operation[2]
		Easting (m)	Northing (m)	
Tenas Creek	Tenas-Hydro B[3]	616806	6053377	2019
Goathorn Creek	Goathorn-Hydro	621100	6057441	2017 - 2019
Telkwa River	Telkwa-Hydro	617964	6057860	2017 - 2019
Four Creek	Four-Creek Hydro	619235	6049989	2020

Notes: *m=metre; UTM=Universal Transverse Mercator*
1. UTM Zone 9U; NAD83
2. Project stations were only operational during the open water season (May through October) each year.
3. Tenas Hydro was relocated to Tenas Hydro B in 2018Table 2-4: On-Site Water Monitoring Locations

Table 2.3-4: Onsite Water Monitoring Locations

Monitoring Location	Water Level Monitoring Frequency	Water Quality Monitoring Frequency
Tenas Control Pond	Daily	Monthly if discharging
Coal Processing Plant Sedimentation Pond	Daily	Monthly if discharging
Potable Water Storage Pond	Daily	Monthly if discharging
Rail Infrastructure Sedimentation Pond	Daily	Monthly if discharging
Management Ponds (North, East, and West)	Daily	Monthly if discharging
Explosive Facility Sedimentation Pond	Daily	Monthly if discharging
Explosive Magazine Sedimentation Pond	Daily	Monthly if discharging
Rock Quarry Sedimentation Pond	Daily	Monthly if discharging
Gravel Quarry Sedimentation Ponds 1 and 2	Daily	Monthly if discharging
East Tenas Access Corridor Sedimentation Pond	Daily	Monthly if discharging
West Tenas Access Corridor Sedimentation Pond	Daily	Monthly if discharging



Tenas Project

Surface Water Monitoring Stations

Legend

- Meterological Station
- Surface Water Monitoring Station
- Rail Line
- Highway
- Road
- Watercourse
- Wetland
- Waterbody
- Park or Protected Area
- Municipal Area
- General Private Property
- 138 kV Transmission Line
- 500 kV Transmission Line

Project Features

- Explosive Facility Road
- Backfill Area
- Management and Control Ponds
- Explosive Infrastructure
- Management Pond
- Mine Infrastructure Complex
- Open Pit
- End Pit Lake
- Quarry
- Rail Infrastructure
- Topsoil Stockpile
- Tenas Coal Licenses
- Tenas Coal Licenses
- Project Area
- Wildlife LSA

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Project Features: Allegiance Coal, 2020
- Basedata: Government of British Columbia
- Basemap: World Topo Base

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Kilometers

NAD 1983 UTM Zone 9N

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Tenas Project

Hydrometric Monitoring Stations

615000 620000 625000 630000

6060000 6055000 6050000

TELKWA
TELKWA
16
CN
TELKWA COALMINE RD
AVELING COALMINE RD
Telkwa-Hydro
Goathorn-Hydro
Helps Creek
Bulkley River
Telkwa River
TELKWA RIVER FSR
Tenas Creek
BYPASS ROAD
Tenas-Hydro
Four Creek-Hydro
Goathorn Creek
Four Creek

Legend

- Hydrometric Stations
- Rail Line
- Highway
- Road
- Watercourse
- Wetland
- Waterbody
- Park or Protected Area
- Municipal Area
- General Private Property
- 138 kV Transmission Line
- 500 kV Transmission Line

Project Features

- Explosive Facility Road
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- Management and Control Ponds
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Kilometers

NAD 1983 UTM Zone 9N

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1CT027.003	Production Date: Apr 26, 2022	Figure 2.3-2

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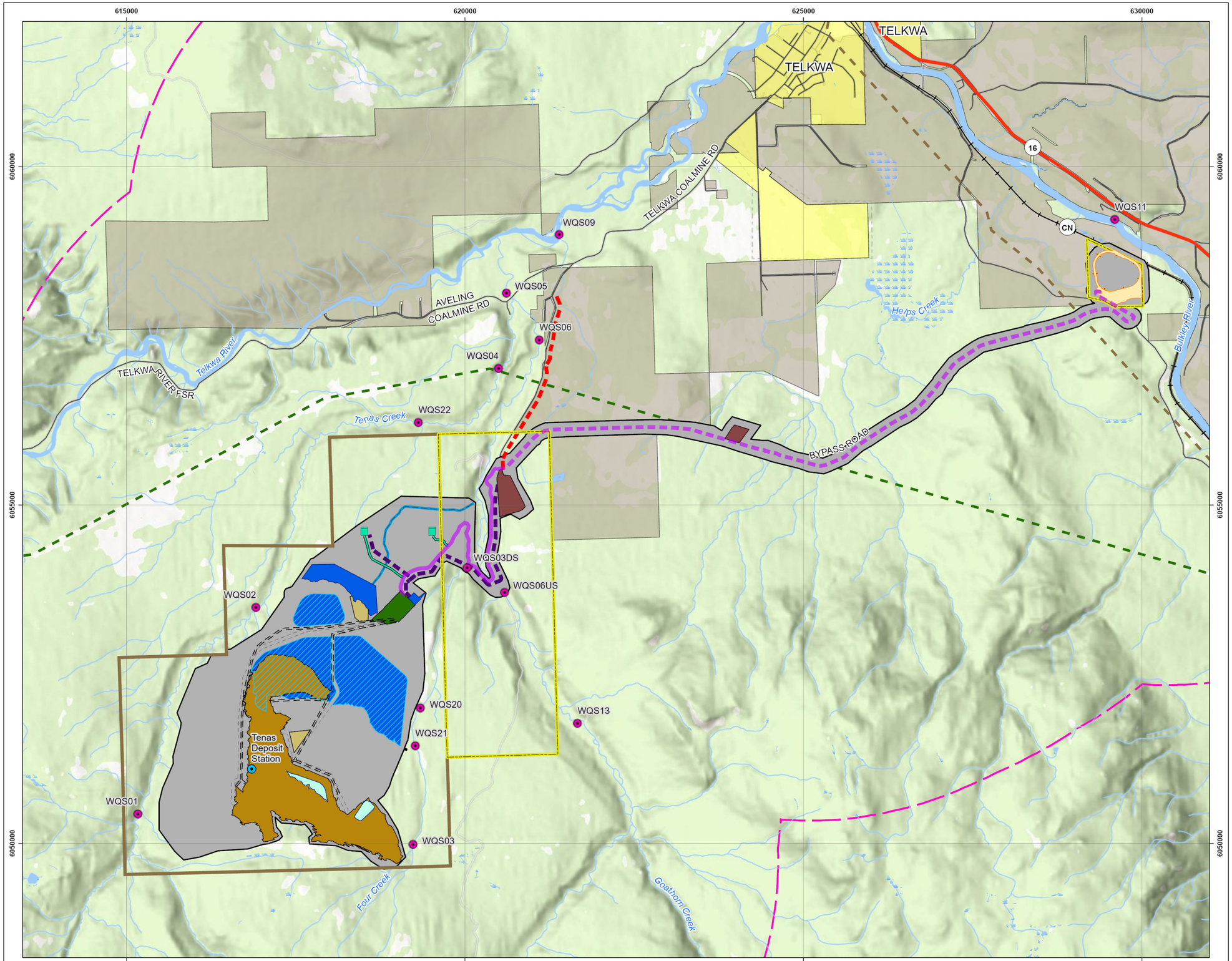
Tenas Project

Groundwater Monitoring Stations



Legend

- Groundwater Monitoring Well
- Rail Line
- Highway
- Road
- Watercourse
- Wetland
- Waterbody
- Park or Protected Area
- Municipal Area
- General Private Property
- 138 kV Transmission Line
- 500 kV Transmission Line

Project Features

- Explosive Facility Road
- Backfill Area
- Management and Control Ponds
- Explosive Infrastructure
- Management Pond
- Mine Infrastructure Complex
- Open Pit
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Kilometers

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Tenas Project

Onsite Water Monitoring Stations for Tenas Control Ponds

610000 615000 620000 625000 630000 635000

6065000 6060000 6055000 6050000 6045000

BURNT CABIN BOG ECOLOGICAL RESERVE

Tyhee Lake

CN

16

TELKWA

TELKWA COALMINE RD

AVELING COALMINE RD

LAWSON RD

Bulkley River

Telkwa River

Tenas Creek

Helps Creek

BYPASS ROAD

RAIL INFRASTRUCTURE SEDIMENTATION POND

RAIL INFRASTRUCTURE AREA

ROCK QUARRY AND SEDIMENTATION POND

GRAVEL QUARRY AND SEDIMENTATION PONDS

EXPLOSIVE MAGAZINE SEDIMENTATION POND

EXPLOSIVE FACILITY SEDIMENTATION POND

TENAS CONTROL POND

NORTH MANAGEMENT POND

WEST MANAGEMENT POND

TELKWA RIVER FSR

TENAS ACCESS CORRIDOR SEDIMENTATION POND (EAST)

TENAS ACCESS CORRIDOR SEDIMENTATION POND (WEST)

CPP SEDIMENTATION POND

SOIL TREATMENT FACILITY POND

WASTEWATER STORAGE POND

EAST MANAGEMENT POND

POTABLE WATER STORAGE POND

Four Creek

Goathorn Creek

Legend

- Rail Line
- Highway
- Road
- Watercourse
- Wetland
- Waterbody
- Park or Protected Area
- Municipal Area
- General Private Property
- 138 kV Transmission Line
- 500 kV Transmission Line

Project Features

- 25 kV Power Line
- Haul Road
- Rail Loop
- Discharge Path
- Tenas Access Corridor
- Backfill Area
- Control and Plant Sedimentation Pond
- Explosive Infrastructure
- Management Pond
- Mine Infrastructure Complex (Coal, Processing Plant, Mine Administration and Dry Building, Maintenance Facility, Run-of-Mine and Processed Coal Stockpiles)
- Open Pit
- Pit Lake
- Quarry
- Rail Infrastructure
- Topsoil Stockpile
- Tenas Coal Licenses
- Telkwa Coal Limited Private Property
- Project Area

Notes

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2. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
3. Project line features are for display only.

Sources

- Project Features: Allegiance Coal, April 21, 2021.
- Basedata: Government of British Columbia
- Basemap: World Topo Base

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Kilometres

NAD 1983 UTM Zone 9N

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2.4 Sampling Methodology

2.4.1 Study Area

The study area for surface water quality includes sites along the Telkwa and Bulkley rivers, as well as the baseline sampling sites upstream and downstream of proposed Project infrastructure and activities which focused on the three primary creeks that flow from the Tenas Project area - Tenas Creek, Goathorn Creek, and Four Creek. These creeks flow northward and into The Telkwa River. Four Creek lies east of the proposed Tenas Project and enters Goathorn Creek before Tenas Creek. Tenas Creek is west of the proposed Tenas Project, and its confluence with Goathorn Creek is approximately 1.25 kilometres (km) upstream of where Goathorn Creek merges with the Telkwa River. The Telkwa River flows northeast for approximately 6 km before it empties into the Bulkley River. The Bulkley River is a tributary of the Skeena River, which empties into the Pacific Ocean.

The study area also includes Helps Creek, which flows into the Bulkley River, southeast of the confluence of the Tenas and Bulkley rivers. The proposed Tenas Bypass Road originates from the Tenas Project area, and crosses Helps Creek before it reaches the proposed Rail Infrastructure (ERM 2019).

Streamflow and water quality monitoring will continue at the stations shown in **Figure 2.3-1**, developed as part of the environmental baseline program to evaluate changes relative to pre-mining conditions and modelled conditions developed in the **Water and Load Balance Modeling Report** (**Appendix 1.0-E** of the **EAC Application**). The program will follow the sections below.

2.4.2 Sampling Equipment Requirements

The following equipment will be required for sampling:

- sampling bottles (pre-labelled). Clean (acid washed) bottles can be provided by laboratory;
- appropriate preservatives for samples collected (e.g., nitric acid for dissolved metals samples); Preservatives can be provided by laboratory;
- filtration apparatus for dissolved metals samples;
- calibrated field parameter meters for temperature, conductivity, pH and ORP;
- flow measurement equipment (to be determined); and
- cooler(s), ice packs, chain of custody forms and shipping labels.

Analyzed water quality parameters are listed below and will be continued at stations by TCL. Method detection limits are listed in **Table 2.4-1**.

- general parameters (pH, specific conductivity, total dissolved solids, TSS, turbidity, color, total hardness);
- major anions and nutrients (nitrate, nitrite, total nitrogen, ammonia, sulphate, total and dissolved phosphorus);
- alkalinity and acidity;
- total and dissolved organic carbon;
- total metals (including total mercury);

- dissolved metals (including dissolved mercury); and
- polycyclic aromatic hydrocarbons (PAHs) (March/April 2018 event and all following events).

The listed analytes were chosen based on the requirements set out in the BC MOE document Technical Guidance 6: Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators (BC MOE 2016c). The parameters to be analyzed for dissolved constituents were filtered in the field and all the required preservatives were added in the field after the sample was collected. Samples were stored in coolers with ice and/or ice packs to minimize the potential for chemical alteration. Coolers were transported to ALS Environmental Laboratory (ALS) in Burnaby, BC by Air Canada Cargo from Smithers, BC, with the accompanying chain-of-custody forms. The analytical results for the groundwater samples were compared to the BC MOE approved and working water quality guidelines - freshwater aquatic life (BC WQG - FAL).

Table 2.4-1: Water Quality Monitoring Parameter List

Parameter		Acronym	Units	MDL(1)
Field Physical	pH	-	-	0.1
	Temperature	-	°C	0.1
	Oxidation-Reduction Potential	ORP	mV	1
	Conductivity	-	µS/cm	1
	Dissolved Oxygen	DO	mg-O_2/L	1
Laboratory Physical	pH	-	-	0.1
	Temperature	-	°C	-
	Oxidation-Reduction Potential	ORP	mV	-
	Conductivity	-	µS/cm	1
	Turbidity	-	NTU	2
	Dissolved Oxygen	DO	mg-O2/L	1
	Colour	-	TCU	1
	Total Suspended Solids	TSS	mg/L	2
	Total Dissolved Solids	TDS	mg/L	10
	Acidity, CaCO3	-	mg-$CaCO_3$/L	5
	Alkalinity, total	-	mg-$CaCO_3$/L	5
	Hardness, total	-	mg-$CaCO_3$/L	5
Major Ions	Bicarbonate	HCO_3	mg/L	-
	Bromide	Br	mg/L	0.05
	Calcium	Ca	mg/L	-
	Carbonate	CO_3	mg/L	-
	Chloride	Cl-	mg/L	0.1
	Fluoride	F-	mg/L	0.03
	Magnesium	Mg	mg/L	-

Parameter		Acronym	Units	MDL(1)
	Potassium	K	mg/L	-
	Sodium	Na	mg/L	-
	Sulphate	SO_4^2	mg/L	0.3
Nutrients	Total Nitrogen	N	mg-N/L	0.03
	Total Kjeldahl Nitrogen	TKN	mg-N/L	0.2
	Ammonia, total	NH_3/NH_4^+	mg-N/L	0.02
	Ammonia, un-iodized	NH_3	mg-N/L	-
	Nitrate	NO_3^-	mg-N/L	0.03
	Nitrite	NO_2^-	mg-N/L	0.02
	Phosphorus	PO_4^{3-}	mg-P/L	0.6
	Orthophosphate, Dissolved	P	mg/L	0.001
	Organic Carbon, Dissolved	-	mg/L	0.5
	Organic Carbon, Total	-	mg/L	0.5
Metals	Total Metals (2)	-	mg/L	Note 3
	Dissolved Metals (2)	-	mg/L	Note 3
Volatile Organic Compounds (VOCs)	Benzene	-	mg/L	0.0005
	Toluene	-	mg/L	0.00045
	Ethylbenzene	-	mg/L	0.0005
	Xylene	-	mg/L	0.00075
Aggregate Organics	Phenols	4AAP	mg/L	0.001
Polycyclic aromatic hydrocarbons (PAH)	Note 4	-	mg/L	Note 5

Notes:

1. *Maximum Method Detection Limit (MDL).*
2. *List of total and dissolved: aluminum (Al), antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), bismuth (B), boron (B), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), iron (Fe), lead (Pb), lithium (Li), magnesium(Mg), manganese (Mn), mercury (Hg), molybdenum (Mo), nickel (Ni), phosphorus (P), potassium (K), selenium (Se), silicon (Si), silver (Ag), sodium (Na), strontium (Sr), thallium (Tl), tin (Sn), titanium (Ti), uranium (U), vanadium (V), and zinc (Zn).*
3. *Total and dissolved metals should be analyzed using ICP-MS (Inductively coupled plasma mass spectrometry) and mercury by CVAAS (Cold Vapor Atomic Absorption).*
4. *See laboratory details (ALS, 2015)*
5. *MDL varies per compound*

2.4.3 Surface Water Sampling

Surface water samples should be collected mid-stream, provided safe access, to reduce the possibility of contamination from shore effects. The BC Field Sampling Manual (GovBC 2013) protocol for sampling and handling will be followed.

The following protocol for wading into the flow should be used when measuring surface water (GovBC 2013):

1. Obtain labeled bottles and wade into the river downstream from the point at which you will collect the samples, then wade upstream to the sample site. This ensures that you will not disturb sediments upstream of the sample point. Attach safety line if conditions have any significant risk;
2. Stand perpendicular to the flow and face upstream;
3. Remove the lid and hold it aside without touching the inner surface. If rinsing is required for the type of bottle, fill and rinse three times (see section 4);
4. With your other hand, grasp the bottle well below the neck. Plunge it beneath the surface in front of you with the opening facing directly down, then immediately orient the bottle into the current. Avoid collecting surface scum and film;
5. Once the bottle is full, remove it from the water by forcing it forward (into the current) and upwards, and replace the cap immediately;
6. Samples collected for dissolved metals will be field filtered;
7. Samples that require preservation will be preserved in the field, except for dissolved ultra-trace mercury that will be lab filtered as required by the laboratory; and
8. Samples will be shipped in ice-chilled coolers under chain-of-custody documentation and procedures.

Field parameters (temperature, pH, conductivity) are measured in situ using a YSI ProPlus multiparameter probe or an Oakton PCS Tester multi-parameter probe. Collection of additional field parameters (ORP, turbidity, dissolved oxygen) began in October 2018 using a YSI ProDSS fitted with turbidity, dissolved oxygen and ORP sensors. The probes are placed in the water and allowed to stabilize for several minutes before data were recorded (ERM 2019).

2.4.4 Groundwater Sampling

Groundwater sampling procedures are followed in general accordance, per the protocols in the BC Field Sampling Manual (GovBC 2013). Groundwater is purged from each well prior to sampling so that a representative sample could be obtained. Field parameters (pH, specific conductivity, temperature, dissolved oxygen, and oxidation-reduction potential) are measured insitu during the purging process using a YSI 556 multi-parameter reader and/or Oakton multi-parameter probes. Turbidity is measured qualitatively in the field, and periodic turbidity measurements were taken with a LaMotte 2020 turbidity reader. Purging is considered complete when the field parameters stabilized, indicating natural groundwater. All the field parameter instruments are checked each day with buffer solutions, and recalibrated if the readings were off by more than 5 percent (%).

Purging and sampling methods differed based on the depth and location of the well:

- Bedrock wells – Waterra foot valve with 5/8-inch outer diameter (OD) high density polyethylene (HDPE) tubing (inertial pump system) combined with a Hydrolift pump, Grundfos submersible pump with 5/8-inch OD HDPE tubing or a Waterra Mini-Monsoon submersible pump with ½-inch OD low density polyethylene (LDPE) tubing;
- Overburden wells – 1.6-inch diameter, standard-weighted bailer or a Geotech peristaltic low flow pump; and

- Groundwater seeps from open pit walls – no purging required.

After purging is considered complete, groundwater samples are collected by pumping directly into the appropriate bottles supplied by ALS or another approved laboratory. Groundwater samples are collected for analysis.

2.4.5 Hydrometric Sampling

The hydrometric monitoring stations consist of a PS98i® 0-5 PSI vented pressure transducer paired with a GDL® data logger (Instrumentation Northwest Inc.). The pressure transducers and cabling are inserted into a flexible aluminum conduit with one end of the conduit secured in a 1.5 metre (m) long aluminum tube or secured to a 1.5 m angle iron. The aluminum tube is open at both ends and a series of small diameter holes are drilled along its length to allow water to pass in and out of the pipe freely. The aluminum tube/angle iron was then placed into the water and secured to the bank. The data loggers are housed in steel, waterproof enclosures attached to trees on the adjacent channel bank above the expected high-water level. At each station, pressure transducers are installed as deep in the channel as possible to allow for continuous monitoring of water levels at all ranges of flows. Pressure transducers continuously record water level at a 10-minute interval (ERM 2019).

Flow calibration measurements by floating object should be done according to following method (GovBC 2013):

1. Measure stream width (i.e., width of the water exclusive of dry stream bed) and average depth.
2. Measure a defined length of stream reach (approximately 3 m recommended).
3. Toss a floating object (e.g., cork, twig, etc.) into the flow upstream of the three-meter measure area.
4. Time the float as it travels the three-meter segment.
5. Repeat measured until you get three (3) measurements very nearly the same.
6. Calculate flow as follows:

$$q=wdla/t$$

where q = flow, w = stream width, d = stream depth, l = stream reach length, and a = roughness coefficient (0.8 if rough, 0.9 if smooth)

In addition to in-stream flow monitoring, the hydrometric data would be used to update the baseline reporting and models to compare to predictions presented in the **Water and Load Balance Modeling Report** (**Appendix 1.0-E** of the **EAC Application**). The following additional data collection will be completed:

- Two (2) flow measurements and two (2) cross-sectional surveys per year to update the rating curves for each monitoring station (one during high-flow, one during low-flow);
- Appropriate maintenance performed on each station, as needed;
- Photographs collected;
- Details of instrumentation for existing stations – sensors, accuracy, calibration, etc.;
- Present flow measurements with respect to existing rating curves and discuss residuals as a percentage of deviations from the curve for each measurement and respective hydrometric station;

- Survey staff gauge zero with respect to pressure transducer invert and comment on any deviations, and
- Comment on level of correlation of staff gauge measurements to in-stream flow measurements and pressure transducer readings.

2.5 Management and Tenas Control Ponds Dam Safety

The following section provides a summary of the expected monitoring and inspections to complete once the management pond embankments are completed.

2.5.1 Inspection and Site Observation

Inspections and site observations are used to identify and track visible changes in the condition of the ponds. Their objective is to identify any conditions that might indicate changes in the facility performance and therefore require maintenance, investigation, documentation and reporting, or emergency responses.

Inspections are to be conducted by personnel with appropriate training and are to target specific activities that are required on a routine basis and/or after unusual or extreme events (e.g., heavy rainfall, windstorms, rapid snow melt, seismic events, exceedance of minimum freeboard).

Site observation is conducted by all personnel working on or adjacent to a pond as part of their daily activities, including those who do not have specialized training and competencies related to dam management (e.g., equipment operators, security personnel). All personnel working on or adjacent to the Tenas Control Pond and management ponds need to be provided with training to understand the changes that, if observed, need to be documented and reported.

If an issue is observed the following actions should be taken:

- Document all issues in accordance with **2.4.8.6**;
- Provide maintenance as appropriate in accordance with **Table 2-6**;
- Engage the Engineer of Record (EoR) for any unfamiliar or significant issues under the discretion of the Mine Superintendent or Mine Manager;
- Increase inspection frequency according to the magnitude of the issue under the discretion of the Mine Superintendent, Mine Manager, or geotechnical engineer, and
- Record safety hazards (e.g. cracks in roads and embankments, damage to safety infrastructure (sampling/flow stations), spills of any nature, etc.), mark and/or block access and implement the appropriate HSE procedures.

2.5.2 Routine Inspection

The inspection items and their frequencies are presented in **Table 2.5-1**. The frequency of inspections should be increased for items where issues are detected. The frequency would depend on the magnitude of the issue under the discretion of the Mine Superintendent, Mine Manager, or geotechnical engineer.

Table 2.5-1: Inspection Activities and Frequencies

Management Pond Component	Inspection Item / Potential Issues	Frequency
Embankment Crests and Outer Slopes	General management pond inspection from vehicle	daily
	Available operational and pond freeboard along the perimeter of the management pond	daily
	Appearance of new movement, cracks, erosion, seepage, bulging, deformations.	weekly
	Status of existing cracks, erosion, seepage, or deformations.	daily
Spillway	Debris and significant vegetation in spillway inlet and channel	weekly
	Erosion protection condition	monthly
	Inlet and channel cracks, bulging, deformations	monthly
Instrumentation	Condition of monitoring instrumentation and associated components, including labels, damage, functionality	monthly

2.5.3 Event Driven Inspections

Event driven inspections are conducted during and after, if safe and practical to do so, unusual or extreme events that may impact the facilities. Inspections should also be conducted in response to significant changes to normal operations, nearby construction activity, or other unusual events.

If a major event occurs, all activities listed in **Table 2.4-2** should be conducted. The EoR or a qualified geotechnical engineer should be engaged to inspect the facilities immediately.

2.5.4 Instrument Monitoring

Instrument monitoring provides information on parameters or characteristics that cannot be detected through site observation or inspections, cannot be observed with sufficient precision and accuracy, or needs to be monitored at high frequency or continuously.

A location for piezometers was selected based on the critical section of each management pond. Proposed piezometers will be located at the dam embankment and the buttress, as presented in **Figures 2.5-1** and **2.5-2**.

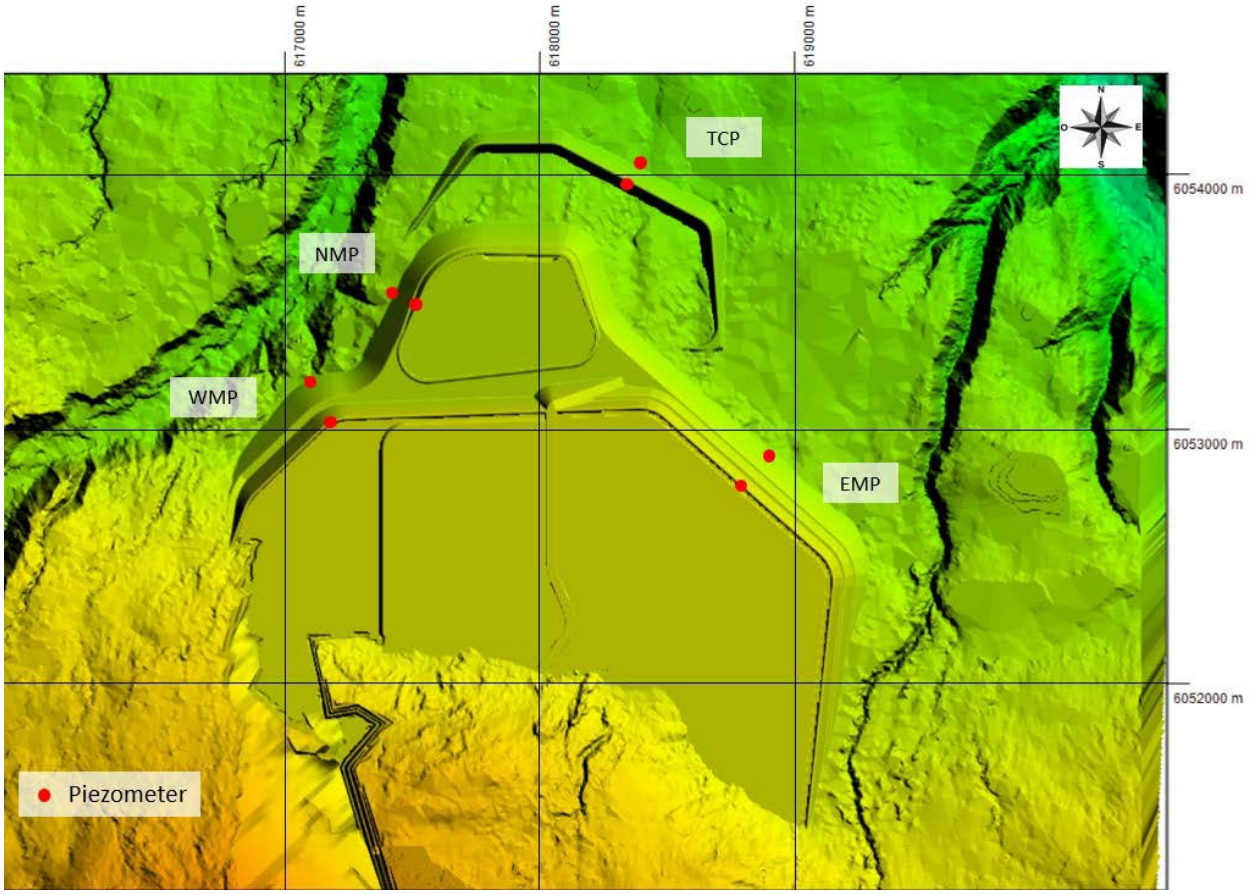

Figure 2.5-1: Piezometer proposed locations

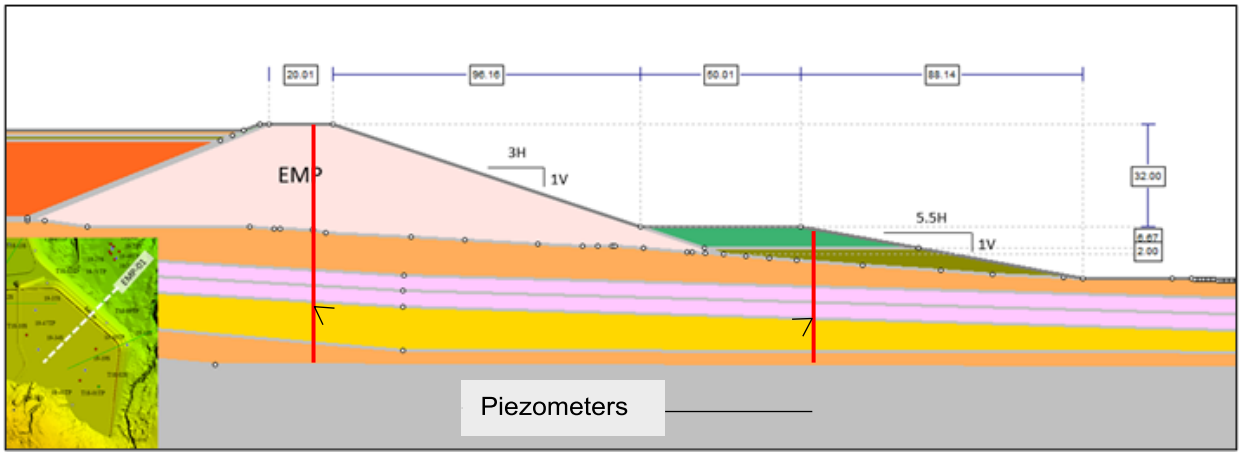

Figure 2.5-2: Piezometer proposed locations, section view (illustrative)

2.5.5 Monitoring Parameters and Schedule

The monitoring parameters applicable to the MP, their method of data acquisition, and frequency of data acquisition are presented in **Table 2.5-2**. Monitoring data is to be documented and reported as discussed in **3. Annual Reporting Requirements**.

Table 2.5-2: Monitoring Parameters, Methods and Frequency of Data Acquisition

Parameter	Method	Frequency
Climate		
Wind speed and direction	Measured on site weather station	hourly
Precipitation	Measured using rain gauge on site weather station	daily
Evaporation	Measured using evaporation pan on site weather station	daily
Elevations and freeboards		
Pond level	Measured using a vertical well-secured staff gauge or digital system in the ponds	daily
Pond freeboard	Calculated from pond elevations and dam crest and spillway elevation	daily
Embankment		
Pore pressures (piezometers)	Measured using piezometers located in the embankment and buttress	weekly
Crest settlement	Measured using manual survey equipment with survey beacons located at regular intervals on the crest and face of the downstream embankments.	weekly
Seepage	Measured using piezometers and wells located within the center of the ponds and via a downstream array to detect groundwater flows and quality	monthly
Survey		
Survey	Surveyed using manual survey equipment or LiDAR drone, includes impoundment surface, embankments, and auxiliary features such as the buttresses.	Annual during Operation, Decommissioning and Reclamation phases, moving to every five (5) years in Post closure. Weekly during Construction Phase of structures

2.5.6 Compliance Inspection Audits

The purpose of the compliance audit is to ensure ongoing compliance with the design intent. These audits are to focus on the identification of deficiencies by visual examination of the management pond embankments and all appurtenant structures, the effectiveness of the Operation, Maintenance and Surveillance (Manual) (OMS manual), as well as a review of all surveillance and monitoring data.

Compliance inspections shall be conducted by the EoR annually in the form of a Dam Safety Inspection (DSI) report and in line with the TCL *Mines Act* Permit, at minimum.

2.5.7 Dam Safety Review

A dam safety review (DSR) is a third-party systematic review and evaluation of all aspects of design, construction, operation, maintenance, and surveillance, and governance affecting the dams, to evaluate the design criteria with current standards, operational compliance with design intent, stability, and functionality of the dams, and to identify appropriate remedial measures.

A DSR is to be conducted by a suitably qualified geotechnical consultant (different from the EoR) and is to comply with the Canadian Dam Association guidelines (CDA 2016) and pertinent regulatory requirements.

2.5.8 Documentation and Reporting

All surveillance, monitoring and maintenance activities will be documented as they assist in the identification of trends as well as changing conditions at the facility. Site staff will develop an OMS manual which will have checklists or templates to record pertinent information in a consistent manner. Routine maintenance records should include:

- relevant inspection reports;
- monitoring data record sheets (piezometers, freeboards, etc.);
- maintenance activity records, memos, reports;
- quality control records;
- photographs of all issues identified through inspection and site observations;
- equipment logs, inventories of spares, materials, tool, and equipment, and
- maintenance schedules.

These records will document the frequency of problems that may be important when assessing the site conditions and reliability of various components and will be used in annual DSI reports by the EoR.

2.6 Analytical Testing

Analytical testing of parameters summarized in **Table 2.4-1** is carried out by ALS in accordance with. recommended procedures for each parameter and as referenced in the ALS Environmental Western Canada Sampling/Handling Guide (ALS 2015).

Preservatives are added at the time of collection, except for dissolved metals samples which are filtered under trace-metal clean conditions at the laboratory, to avoid contamination associated with field filtration.

Sample bottles are pre-charged with preservatives. All bottles are filled from the General Parameters bottle to ensure consistency in sample handling. In addition, samples requiring filtration (dissolved parameters) are filtered in the field instead of in the laboratory. Laboratory filtered samples can be biased (usually biased low); filtering in the field helps to avoid biases and ensures the sample is representative of actual field concentrations.

After collection and preservation, samples are kept cool (4 degrees Celsius [°C]) until analysis by ALS. Holding times for each parameter are summarized by the ALS Environmental Western Canada Sampling/Handling Guide (ALS 2015).

ALS performs internal quality control by:

- Method blanks: Method blanks are used to verify for contamination;
- Total vs Dissolved Metals: Total metals should be higher than dissolved metals. For very low concentrations of metals (concentrations near detection limits), some variability of analytical results is generally acceptable (30% Relative Percent Difference [RPD]). If the threshold of acceptability is not met, ALS confirms the results by re-analysis prior to issuing the data. ALS conducts these checks for all samples prior to issuing data;
- Laboratory Control Samples: Control samples provide a reference to compare samples against; and
- Laboratory Duplicate: Duplicates are used to verify reproducibility. RPD values under 20% are considered low. The formula used to calculate RPD is as follows:

$$RDP=abs(((S\_1-S\_2)/(S\_1+S\_2\ ))/2)*100\%$$

Where S1 and S2 are duplicate samples.

2.6.1 Data Quality Assurance (QA) and Quality Control (QC)

Appropriate data quality assurance and quality control measures will be required during sampling and will follow the processes conducted during TCL environmental baseline studies.

Water quality monitoring is carried out according to provincial guidelines (GovBC 2013).

- Duplicate Samples (two [2] per sampling round): Duplicate samples are independent samples collected as close as possible to the same point in space and time and are intended to be identical. These samples are essential in documenting the precision of the entire sampling and analytical (laboratory) process;
- Field Blank Sample (one [1] per sampling round): Field blanks mimic the extra sampling and preservative process but does not encounter ambient water. Field blanks are exposed to the sampling environment at the sample site. Consequently, they provide information on contamination resulting from the handling technique and through exposure to the atmosphere. They are processed in the same manner as the associate samples (i.e., they are exposed to all the same potential sources of contamination as the sample). This includes handling and, in some cases, filtration and/or preservation;
- Trip blank Sample (one [1] per sampling round): Trip blanks are meant to detect any widespread contamination resulting from the container (including caps) and preservative during transport and storage. The recommended practice for organic parameters is to use carbon free de-ionized water for trip blanks;
- Total versus Dissolved Metals: Total and dissolved concentrations are compared for each species to ensure that the total concentration is greater than the dissolved; and
- Ion Balance Percent Difference: A relative difference between anions and cations, calculated as follows:

$$\%\ Difference = \frac{\sum cations - \sum anions}{\sum cations + \sum anions} * 100\%$$

2.7 Performance Objectives

Table **2.7-1** below highlights the performance objectives and targets required to ensure the proper implementation of this Appendix of the Program:

Table 2.7-1: Performance Objectives

Objective	Target
Total suspended solids (TSS) levels in discharge from sedimentation and Tenas Control Ponds meet regulatory requirements	Meet regulatory requirements for discharges from all structures and if needed, assess flocculant and/or coagulant effectiveness and quantities used.
effects on Fish from flocculant and/or coagulant use are monitored	Target zero, no measurable effects on fish and/or fish habitat due to the use of flocculants and/or coagulants
Sedimentation, management, Tenas Control Ponds, Potable Water Storage Pond flows are tracked	Track flows through all structures and water levels
Sedimentation, management, Tenas Control Ponds, Potable Water Storage Pond are monitored for quantity and quality	Complete water quality and quantity monitoring for all structures
Sedimentation, management, Tenas Control Ponds, Potable Water Storage Pond are monitored for seepage	Complete seepage monitoring and compare to target levels and make any changes in future management pond liner construction requirements
Monitoring is completed as required by Minesite Water Monitoring Program (Program)	Monitoring detailed in this Minesite Water Monitoring Program (Program), was completed as required and reporting provided to Regulators as per Mines Act, RSBC 1996, c 293, and Environmental Management Act, SBC 2003, c 53 (*MA/EMA)* permits.
Monitoring Parameters of Potential Concern/Contaminants of Potential Concern (POPC/COPC) meets benchmarks	Monitoring of POPC/COPC concentrations downstream of the Tenas Project (Project) discharge in Goathorn, Tenas and Four creeks and in the Telkwa and Bulkley rivers, meets benchmarks.

3. ANNUAL REPORTING REQUIREMENTS

TCL will prepare an annual report to the BC MECCS summarizing the results of all monitoring required under the *EMA* permits.

Key information requirements in the Annual Report (BC MOE 2016a) :

- Compliance: effluent and process monitoring results will be compared to the applicable permit requirements and limits. All non-compliance events should be highlighted;
- Spills and other incidents: include dates, times, descriptions, and a chronology of measures taken for all incidents over the year that resulted in the release of unauthorized effluent emissions;
- Management Plan summaries: summary of activities that occurred during the year related to applicable management plans in place on site;
- Environmental effects: monitoring results need to be summarized and impacts assessed; and
- Recommendations: on how existing impacts will be resolved or minimized, how non-compliance or impacts will be avoided in the future, whether the monitoring programs is still sufficient and effective, and how to enhance the monitoring program, if required.

The annual report outline will be comprised of the following sections:

- Executive summary;
- Description of Minesite operation and discharges;
- Chemical reagents and waste storage;
- Incidents;
- Monitoring: summarize, interpret and discuss the results of all environmental monitoring as required in the associated discharge permit. This includes:
  - Monitoring program description;
  - Sampling methodology and equipment used, noting any variations in data collection;
  - Description of Quality Assurance (QA) measures and procedures used;
  - Hydrological and flow monitoring results ;
  - Water quality monitoring results;
  - Data interpretation;
- Summary and Conclusion
- Appendices

3.1 Monitoring Summaries

3.1.1 Flow Monitoring Results

Flow monitoring results will be presented in the annual report. This will include the following:

- Monthly and annual project discharge volumes from the Tenas Control Pond, management ponds, sedimentation ponds (Coal Processing Plant, Rail Infrastructure, Explosives Magazine and Explosives Facility sedimentation ponds), and the Potable Water Storage Pond;
- Any exceedance of regulatory permitted discharge flow limits identified, including summary of cause for exceedance, the potential environmental risks, and any corrective and/or preventative measures taken to ensure the cause of the non-compliance is not ongoing;
- Receiving environment: annual hydrograph plots prepared for Tenas Creek, Four Creek, Goathorn Creek and Telkwa River, including the average annual hydrograph pre-mining;
- An appendix including plots of spot-flow measurements and converted water level readings based on the rating curve for each hydrometric station;
- Explanations for data gaps; and
- Quality assurance checks of raw data.

3.1.2 Water Quality Monitoring Results

Water quality monitoring results for effluent, seepage, surface water and groundwater will be presented in the annual report, including toxicity testing results. In particular, water quality monitoring will focus on identified parameters of potential concern (POPCs) from the Initial Dilution Zone mixing model (SRK 2021k), which include dissolved and total aluminum, total antimony, total arsenic, dissolved cadmium, total chromium, total copper, total iron, total manganese, nitrate, nitrite, total selenium, total strontium, sulphate, total thallium, total uranium and total zinc.

All annual results will be provided in an appendix, along with a compilation of historical data for trend analysis and modelled data to identify any deviations from expected conditions.

Summary statistics will be provided in a table or graph, highlighting non-compliance and/or exceedances of safe levels for parameters that:

- Show a trend over time and space;
- Exceed permit limits, and
- Approach or exceed water quality guidelines in the receiving water.

Summary statistics will include minimum, maximum, mean, median, standard deviation, standard error, method detection limit and sample size and percent non-detects. Statistics will be calculated using 0.5 of the method detection limit, as per (BC MOE 2016b).

Parameter concentrations will be plotted such that current calendar year is clearly compared against the last five years of measurements. Trend lines and associated regression values will be added to show trends, where applicable. Plots will also include applicable permit limits.

Monitoring will take place through all Project phases, including construction through post-closure.

3.1.3 Data Interpretation

The annual report will include discussion of any permit limit exceedances, information on why exceedances occurred, what environmental risk the non-compliance posted, and what was one (or planned) to deal with non-compliance.

The text will identify effects of the mine activities and discharges on the receiving water based on temporal and spatial trends as well as a comparison to baseline conditions and changes in discharges volumes or concentrations.

Parameter concentrations in receiving water that are above 80% of the guideline or exceed safe management levels or any permitted levels will be identified.

A comparison of receiving water parameter concentrations to impact predictions from the Environmental Assessment water quality modeling will be included to verify predictions and identify potential unforeseen issues.

4. EVALUATION AND ADAPTIVE MANAGEMENT

4.1 Evaluation

A review of the MWMP be completed by the Environmental Coordinator on an annual basis to compare data, trends, and implementation of the management plans and their objectives. This process will include a review of the management plan deliverables and input received from Indigenous groups through the **SEMP.**

4.2 Adaptive Management

A philosophy of adaptive management will be adopted to verify that management plans and mitigation measures are consistently meeting or exceeding performance targets. This will be achieved through periodic reviews of the MWMP and the results of monitoring programs.

The MWMP is a living document that should be reviewed and improved as site conditions change and following the evaluation of monitoring and sampling data collected through the life of the Project.

4.3 Continual Improvement

TCL will work towards continual improvement at the Project. The Mine Manager or their delegate will investigate improvements in any trend and assess whether the practices responsible for the improvements can be applied to other areas of the Project. Deteriorating trends will be studied to determine the root cause.

When the cause is identified, the Mine Manager or their delegate will implement a suitable corrective action. Examples of corrective actions could include:

- finding alternate flocculant and addition rates to improve TSS;
- additional training of employees and contractors on procedures;
- enhancement of maintenance or monitoring measures;
- construction of additional water management infrastructure; and/or
- additional supervisory oversight.

TCL will amend the Water Monitoring Plan as required based on annual evaluations and feedback from stakeholders and the Indigenous groups. Any proposed changes will be sent out for review by regulators, stakeholders, Indigenous groups, and community before being finalized and implemented into the MWMP.

5. CHANGE MANAGEMENT

Changing any part of the MWMP requires the use of a formalized process. If significant changes are being planned to objectives, management plan structure, operational milestones, communication and/or information management, it is required that the Management of Change (MOC) procedure in the **EMS** be followed. Minor edits and/or updates to this MWMP will be controlled through version control and content approval functions.

6. CONCLUSION

Management of surface and groundwater at the Project is important. Through implementation of the MWMP**,** and relevant SPPs developed during the Construction Phase, TCL will ensure the protection of water resources through the minimizing of potential Project effects and mitigations of any identified effects.

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