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Technical Report Overview

Report: Regional Groundwater Monitoring Program 2017 Report

Overview: This report presents the 2017 results of the regional groundwater monitoring program required under Permit 107517. This report summarizes the results of groundwater quality in 2017 and compares groundwater chemistry to nearby surface water chemistry to understand groundwater transport pathways.

This report was prepared for Teck by SNC-Lavalin Inc.

For More Information

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2017 Annual Report

Regional Groundwater Monitoring Program

May 16, 2018

Internal Ref: 635544

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Executive Summary

This 2017 Annual Report meets reporting requirements for regional groundwater monitoring in the Elk Valley as outlined in Section 10.4 of Permit 107517 (updated October 13, 2017). The Elk Valley Regional Groundwater Monitoring Program (RGMP) started in 2015 and consists of data from selected locations in the following groundwater monitoring programs:

- Fording River Operations (FRO);
- Greenhills Operations (GHO);
- Line Creek Operations (LCO);
- Elkview Operations (EVO);
- Coal Mountain Operations (CMO); and
- The Regional Drinking Water Sampling Program (RDW).

The RGMP focuses on twelve areas ("Study Areas") identified in the Regional Groundwater Synthesis Report for the Elk Valley (the "Synthesis Report", 2015b) including the 2017 RGMP (SNC-Lavalin, 2017a). This 2017 Annual Report for the RGMP has been prepared following the approved 2015 RGMP (SNC-Lavalin, 2015a) and incorporates feedback received from the Environmental Monitoring Committee (EMC) and Groundwater Working Group (GWG) on numerous reports.

Quarterly samples were collected from all wells included in the RGMP with the exception of the Q1 sample from FR_HMW5 (Background Study Area) due to a frozen well. Samples from site-specific programs were submitted for all parameters on the analyte list except: 1) Total Kjeldahl Nitrogen and Total Organic Carbon at LC_PIZDC1307 and LC_PIZDC1308 in Q2 (located in Study Area 2); 2) hardness from the field duplicate of GH_GA-MW-4 (located in Study Area 4); and 3) field-measured pH from RG_DW-series wells in Q1 (due to pH probe malfunction). Quarterly water levels were measured at all required RGMP dedicated monitoring wells except for FR_HMW5 in Q1 (due to a frozen well), GH_GA-MW-2 in Q4 (due to water level tape malfunction), and EV_ECgw in Q1 (due to a frozen well). These modifications to the RGMP do not impact the overall quality or interpretation of the data.

Groundwater quality at all groundwater monitoring locations were compared to applicable primary and secondary screening criteria and discussion of trends as well as interpretation of water levels and selected parameters were completed by Study Area. To assess groundwater and surface water interaction and increase our understanding of groundwater transport pathways, groundwater chemistry was compared to chemistry at nearby surface water stations in some Study Areas where relevant.

In general, groundwater results in 2017 were relatively similar to those from 2015 and 2016. Concentrations of Constituents of Interest (CI; nitrate-N, sulphate, dissolved cadmium, and dissolved selenium) above primary and secondary screening criteria were generally consistent with previous observations and are summarized by Study Area within the report. The following exceptions were noted.

- Study Area 4: The dissolved selenium concentration in Q4 (18.9 µg/L) in GH_GA-MW-2 and GH_MW_ERSC-1 in Q4 (68.7 µg/L) were historical highs. At GH_MW_ERSC-1 concentrations were similar in magnitude to the highest concentrations measured in 2014 (52.6 µg/L) and 2015 (28.2 µg/L). Concentrations were higher than upgradient wells, suggesting either a surface water influence or another source. The GHO SSGMP did not identify a source and it is possible that infiltration from the proximate Elk River side channel may be influencing the groundwater quality.

- Study Area 11: Dissolved selenium concentrations at RG_DW-07-01 (6.85 to 15.4 µg/L) have fluctuated, but increased slightly compared to previous years (3.81 to 10.2 µg/L in 2014 to 2016) and were above the CSR DW standard in 2017 Q2 (15.4 µg/L) and Q3 (11.6 µg/L). Teck is currently supplying alternate drinking water to the owners of this domestic well. Elevated concentrations of selenium in groundwater appear to be related to infiltration of selenium from surface water in Corbin Creek (10.6 to 27 µg/L) and/or Michel Creek (5.2 to 12.2 µg/L); concentrations at both surface water locations increased in 2017.

The 2017 RGMP included a review of non-order constituents in groundwater other than the CI with concentrations greater than primary screening criteria, including chloride, fluoride, dissolved barium, boron, manganese, molybdenum, and sodium, which may originate from natural sources (e.g., interaction with bedrock or unconsolidated materials); results from non-order constituents in 2017 were consistent with the review conducted to support the 2017 RGMP and these constituents are inferred to originate from natural sources. In Study Area 9, non-order constituent dissolved copper concentrations were interpreted as locally sourced and likely mine-influenced.

Dissolved lithium was not identified in the 2017 RGMP as the new standard was not yet in effect; however, concentrations greater than primary screening criteria were prevalent in RGMP wells. Because dissolved lithium exceeded the new standard in the majority of sampling events, a similar non-order constituent review was conducted. Wells installed in bedrock at CMO had concentrations > 3,000 µg/L. It is interpreted that marine sedimentary rocks, such as those in the Elk Valley, typically have high lithium concentrations and are contributing to elevated lithium concentrations measured above primary screening criteria in wells in the RGMP.

General recommendations for the RGMP are as follows:

- Increase water level data quality by:
  - collecting concurrent (before and after) manual water level measurements each time a water level logger is deployed or removed from a well and prior to each sampling event;
  - re-deploying level logger at exact same depth in monitoring well after it was removed for downloading; and
  - using a barometer and manual water level measurements to compensate and correct the data.
- Review the QA/QC programs, specifically related to field and trip blanks, to evaluate the source of constituents above the detection limit; and
- Review sampling protocols to confirm which parameters should be analyzed for Study Area 6;
- For samples from RDW wells (RG_DW-series), continue to analyse for all the parameters listed in the RGMP in 2018.

Data gaps in the RGMP and the requirement for additional studies was outlined in the 2017 RGMP (SNC-Lavalin, 2017a). The 2017 monitoring data supported the conclusions from the 2017 RGMP, with the following additional recommendations:

- Study Area 3: The supply wells have been instrumented with continuous level monitors. We recommend reviewing these data to further understand the groundwater-surface water interactions in this portion of the Fording River valley-bottom.
- Study Area 4: A localized gap in the groundwater understanding was identified as result the historical highs at two monitoring wells. Groundwater and surface water interactions in the Elk River side channel will be assessed as part of the GHO local aquatic effects monitoring program currently being undertaken.

Table of Contents

Table of Contents (Cont'd)

Table of Contents (Cont'd)

Table of Contents (Cont'd)

In-Text Figures

In-Text Tables

Table of Contents (Cont'd)

In-Text Tables (Cont'd)

Table of Contents (Cont'd)

In-Text Tables (Cont'd)

Tables

Drawings

Table of Contents (Cont'd)

Drawings (Cont'd)

Appendices

Table of Contents (Cont'd)

Appendices (Cont'd)

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Acronyms

AMP	Adaptive Management Plan
AW	Aquatic Life Water Use
BCWQG	British Columbia Approved Water Quality Guidelines, includes Working Water Quality Guidelines for BC (BCWQG). British Columbia Ministry of Environment & Climate Change Strategy (ENV), updated March, 2018
BQ	Big Question (part of the AMP)
CCME	Canadian Council of Ministers of the Environment
CCR	Coarse Coal Rejects Dump
CI	Constituents of interest
CMO	Coal Mountain Operations
CP	Compliance Point
CSM	Conceptual Site Model
CSR	Contaminated Sites Regulation (CSR), B.C. Reg. 375/96, includes amendments up to B.C. Reg. 196/2017, November 1, 2017
DCWMS	Dry Creek Water Management System
DO	Dissolved Oxygen
DW	Drinking Water Use
EMC	Environmental Monitoring Committee
ENV	Ministry of Environment & Climate Change Strategy
EVO	Elkview Operations
EVWQP	Elk Valley Water Quality Plan
FRO	Fording River Operations
GHO	Greenhills Operations
GWG	Groundwater Working Group
GCDWQ	Guidelines for Canadian Drinking Water Quality
IW	Irrigation Water Use
KNC	Ktuxana Nation Council
KU	Key Uncertainty (part of the AMP)
LAEMP	Local Aquifer Effects Monitoring Program
LCO	Line Creek Operations
LW	Livestock Water Use
MU	Management Unit
MDL	Method Detection Limit
MEM	Ministry of Energy and Mines
MoE	Ministry of Environment, now known as Ministry of Environment & Climate Change Strategy (ENV)
RDW	Regional Drinking Water Sampling Program

Acronyms (Cont'd)

RGMP	Regional Groundwater Monitoring Program
SPO	Site Performance Objective
STP	South Tailings Pond
SWMP	Surface Water Monitoring Program
SSGMP	Site-Specific Groundwater Monitoring Program
UCC	Upper Cap Concentration

1 Introduction

This report was generated to meet annual reporting requirements for Teck Coal Limited (Teck) for regional groundwater monitoring in the Elk Valley outlined in Permit 107517[1] issued by the Ministry of Environment & Climate Change Strategy[2] (ENV). SNC-Lavalin Inc. (SNC-Lavalin) and Teck developed a Regional Groundwater Monitoring Program (RGMP) to monitor groundwater in the valley bottoms of defined areas within Management Units (MU[s]) 1, 2, 3 and 4 as described in the Elk Valley Water Quality Plan (EVWQP; Teck, 2014) and shown on Drawing 635544-301. This report fulfills reporting requirements listed in Section 10.4 of Permit 107517, specifically:

Regional groundwater monitoring results and interpretation must be compiled into a written report and submitted on an annual basis for each calendar year to the Director by May 16 of the following year. The Annual Report must include summaries of the site-specific groundwater reports.

The report(s) must include, but is not limited to:

- i. *A map of monitoring locations with EMS and Permittee descriptors;*
- ii. *Cross sections showing well installation details, stratigraphy, groundwater elevations, and flow. Cross sections should be in the direction of groundwater flow and perpendicular to groundwater flow;*
- iii. *Drawings showing locations and water quality data of groundwater sampling points;*
- iv. *A summary of background information on that year's program, including discussion of program modifications relative to previous years;*
- v. *A summary of measured parameters, including appropriate graphs and comparison of results to, Approved and Working Water Quality Guidelines, or other criteria and benchmarks as specified by the Director;*
- vi. *If applicable, a summary of exceedances of screening benchmarks;*
- vii. *Evaluation and discussion of spatial patterns and temporal trends;*
- viii. *A summary of all QA/QC issues during the year; and*
- ix. *Recommendations for further study or measures to be taken.*

1.1 Regulatory History and Permit Requirements

A RGMP is required in Permit 107517. In July 2015, a RGMP was submitted ("2015 RGMP"; SNC-Lavalin, 2015a) focusing on mine-related constituents including selenium, cadmium, sulphate, and nitrate, or "constituents of interest" (hereafter referred to as CI). Since submission of the 2015 RGMP, the following related submissions and activities have taken place, listed in Table A below.

[1] Permit 107517, amended October 13, 2017.
[2] Formerly known as Ministry of Environment (MoE).

Table A: Submissions and Activities since Submission of the 2015 RGMP

Timeline	Activity
July 30, 2016	› Submission of the Water Quality Adaptive Management Plan (AMP) which considers results from the 2015 RGMP (i.e., Big Question (BQ) 6 and Key Uncertainty (KU) 6.1; Teck, 2016).
March 31, 2016	› Submission of 2015 regional and site-specific Groundwater Annual Reports.
October 26/27, 2016	› Workshop with Teck, Ktunaxa Nation Council (KNC) and MoE (now ENV) representatives. This group has been termed 'the Groundwater Working Group (GWG)' and in the workshop the group discussed key concepts related to groundwater in the Elk Valley, and feedback on the 2015 RGMP and other related submittals.
March 1 and June 5, 2017	› Amendment of Permit 107517 by the MoE with additional requirements for regional and site-specific groundwater monitoring programs and reporting.
March 31, 2017	› Submission of 2016 site-specific Groundwater Annual Reports.
April 18, 2017	› 2015 RGMP was approved by the MoE with conditions.
May 16, 2017	› Submission of the 2016 RGMP Annual Report.
June 28, 2017	› GWG meeting to review and gain alignment on the major components of the RGMP update, discuss feedback received on the 2016 Annual RGMP report that could influence the RGMP update and discuss other GW supporting studies and how they could be prioritized within the RGMP update.
September 30, 2017	› Submission of the 2017 RGMP.
March 31, 2017	› Submission of 2017 site-specific Groundwater Annual Reports.

The 2015 RGMP was approved on April 18, 2017 with a number of conditions with one of the conditions requiring an update to the RGMP, which was submitted on September 29, 2017 by Teck ("2017 RGMP"; SNC-Lavalin, 2017a) to meet conditions listed by ENV in the approval letter. The 2017 RGMP included:

- An updated Conceptual Site Model (CSM) with well-presented data to support the model;
- Maps and visual data presentation;
- Definitions and conceptual boundaries of site-specific and regional groundwater programs and the linkages between them;
- Screening criteria with rationale;
- Integration of information from the site-specific groundwater monitoring programs (SSGMP), used to identify potential areas of additional study;
- A list of areas requiring additional study, a system for prioritizing the implementation of groundwater studies for the specific areas identified, and a tentative schedule of the additional studies; and
- A framework for developing and prioritizing groundwater triggers that integrate with the AMP for Teck's coal operations in the Elk Valley.

1.2 Purpose and Objectives of the RGMP

Teck has developed three purpose statements and supporting objectives for the RGMP. These were developed in consultation with the GWG during the October 2016 and June 2017 meetings and were presented in the 2017 RGMP (SNC-Lavalin, 2017a). Purpose statements and supporting objectives are described in the following sections.

1.2.1 Purpose Statements

Using the framework of the EVWQP, the RGMP has been updated to:

1: Monitor and evaluate potential quality effects to groundwater resources from mining activities to protect current groundwater users (initial focus) in the Elk Valley. Monitoring and evaluations will continue to inform management decisions that work towards protection of future groundwater users in the Elk Valley.

2: To monitor and evaluate groundwater as a potential pathway for transport of mine-related constituents of interest to surface water to support management decisions under the Water Quality AMP.

3: Evaluate and refine the conceptual site model for source, transport and fate of mine-related constituents of interest in groundwater in the Elk Valley.

1.2.2 Objectives

Teck has developed objectives that relate to each of these purposes, described in Table B below:

Table B: RGMP Purpose and Objectives

Purpose	Objectives
Purpose 1: Using the framework of the EVWQP, the RGMP will be updated to monitor and evaluate potential quality effects to groundwater resources from mining activities to protect current groundwater users in the Elk Valley. Monitoring and evaluations will continue to inform management decisions that work towards protection of future groundwater users in the Elk Valley.	› To identify the current receptors (i.e., drinking water, aquatic life, livestock watering and irrigation watering) and evaluate the potential for a complete transport pathway between source and receptors.
	› To collect groundwater quality information from a monitoring network with appropriate locations to assess the presence of complete transport pathways (i.e., between source and receptors) for constituents of interest.
	› Evaluate groundwater quality information against established screening criteria to assess potential effects to identified users and evaluate temporal / spatial trends.
Purpose 2: Using the framework of the EVWQP, the RGMP will be updated to monitor and evaluate groundwater as a potential pathway for transport of mine-related constituents of interest to surface water to support management decisions under the AMP.	› To collect necessary groundwater information to support the refinement of surface water quality predictions.
	› To evaluate the need to manage groundwater to meet surface water quality compliance.
Purpose 3: Using the framework of the EVWQP, the RGMP will be updated to evaluate and refine the conceptual model for source, transport and fate of mine-related constituents of interest in groundwater in the Elk Valley.	› To review and synthesize regional and site-specific groundwater monitoring data on a three year timeframe to update and refine the Regional Conceptual Site Model.

1.3 Linkages Between the Site-Specific and Regional Programs

In addition to requirements for a RGMP, Permit 107517 requires a SSMGP at each of Teck's five active coal mines in the Elk Valley. The 2017 RGMP defined conceptual boundaries of site-specific and regional groundwater monitoring programs and the linkages between them. The following definitions of site specific and regional programs were proposed and accepted at the June 2017 GWG meeting and were reported in the 2017 RGMP submitted in September 2017:

- SSGMPs will focus on potential sources of mine-related constituents in groundwater and transport pathways to groundwater in the valley-bottom of the main stem rivers (i.e., Elk and Fording Rivers, Michel Creek). It is anticipated that the majority of the site-specific groundwater monitoring will be located within mine operations permitted boundaries; and
- The RGMP will focus on groundwater fate and transport in the valley-bottom of the main stems, and how they relate to applicable receptors. It is anticipated that the majority of the regional groundwater monitoring will be located outside mine operations permitted boundaries.

1.4 Report Structure and Content

The 2017 Annual Report for the RGMP has been prepared following the approved 2015 RGMP (SNC-Lavalin, 2015a) and the annual groundwater reporting requirements listed in Section 10.4 of Permit 107517. The structure and content of this report has incorporated past feedback from Environmental Monitoring Committee (EMC) and GWG on the Synthesis Report (SNC-Lavalin, 2015b), 2015 Annual Report (SNC-Lavalin, 2016) and the 2016 Annual Report (SNC-Lavalin, 2017c), as well as the 2017 RGMP (SNC-Lavalin, 2017a), where appropriate.

The 2017 Annual Report for the RGMP is structured as follows:

Table C: Summary of the Report Structure

Section	Description of Hydrogeological Information and Relevant Permit Requirement
Sections 1 and 2	› includes background information on the RGMP and a brief presentation of the Regional CSM; and › Section 2.2 provides a summary of site-specific groundwater reports.
Section 3	› provides a description of the RGMP including monitoring locations, sampling methodologies and Quality Assurance/Quality Control (QA/QC). This Section meets the Permit 107517 Section 10.4 requirements: - *i. a map of monitoring locations with EMS and Permittee descriptors;* - *iv. a summary of background information on that year's program, including discussion of program modifications relative to previous years; and* - *viii. a summary of all QA/QC issues for the year.*
Section 4	› provides a description and explanation of primary and secondary screening criteria for comparison of groundwater quality data as defined in the approved RGMP.

Table C (Cont'd): Summary of the Report Structure

Section	Description of Hydrogeological Information and Relevant Permit Requirement
Section 5	› includes presentation of 2017 results and discussion, including comparison to screening criteria outlined in Section 4, by Study Area. Trends for water levels and groundwater quality and a comparison against available surface water data, where sufficient data are available, are presented and used for data interpretation by Study Area. This Section meets the Permit 107517 Section 10.4 requirements: - *ii. cross sections showing well installation details, stratigraphy, groundwater elevations, and flow. Cross sections should be in the direction of groundwater flow and perpendicular to groundwater flow;* - *iii. drawings showing locations and water quality data of groundwater sampling points;* - *v. a summary of measured parameters, including appropriate graphs and comparison of result to, Approved and Working Water Quality Guidelines, or other criteria and benchmarks as specified by the Director;* - *vi. if applicable, a summary of exceedances of screening benchmarks; and* - *vii. evaluation and discussion of spatial patterns and temporal trends.*
Section 6	› provides the conclusions as well as any recommendations for monitoring, intended to meet Permit 107517 Section 10.4 requirement: - *ix: recommendations for further study or measures to be taken.*
Section 7	› lists references.

1.5 Data Sources and Limitations

SNC-Lavalin received field and chemistry data from both the SSGMP and Regional Drinking Water Sampling Program (RDW) (including both manual and level logger groundwater levels, top of casing information, field measurements and laboratory analytical results, where applicable). Teck also received some data from the District of Sparwood that has been transferred to SNC-Lavalin through Teck. SNC-Lavalin has relied on data and information provided by Teck and, as such, has assumed that the information provided is both complete and accurate. To confirm that field activities are conducted in a manner that meets the overall data quality objective of the QA/QC program, Teck's sampling activities are conducted in accordance with the 2013 Edition of the British Columbia Field Sampling Manual (Clark, 2002). Environmental personal are trained using on-site Standard Practice and Procedure (SP&P) as detailed in the "Teck Field Sampling Manual". Interpretations and conclusions within this report are made with the assumption that data collection was performed following these standards using the proper duty of care.

1.6 Linkage to Adaptive Management

As required in Permit 107517 Section 11, Teck has developed an AMP to support implementation of the EVWQP, to achieve water quality targets including calcite targets, ensure that human health and the environment are protected, and where necessary, restored, and to facilitate continuous improvement of water quality in the Elk Valley.

Following an adaptive management framework, the AMP identifies six Big Questions (now referred to as Management Questions) that will be re-evaluated at regular intervals as part of AMP updates throughout the duration of EVWQP implementation. For each Management Question (MQ), the AMP describes how the MQ will be periodically re-evaluated, and how the key uncertainties under the MQ will be reduced.

The AMP was submitted to the Environmental Monitoring Committee and ENV Director July 31, 2016 as required (hereafter referred to as the “July 2016 AMP”). Study designs for many programs (including the RGMP) were established before the July 2016 AMP was submitted. Teck has been working to embed elements of the AMP within each program through reviews of monitoring programs at the study design and annual report stages.

Through stakeholder review of the July 2016 AMP, it was determined that an update to the AMP was required to advance several elements that were in development at the time of the July 2016 AMP submission. Teck is currently working in collaboration with the KNC and EMC to update AMP content and will submit an updated AMP for acceptance by the ENV Director by December 21, 2018.

Related to the RGMP, the AMP will be updated to reflect advances made in the RGMP by incorporating groundwater into Management Questions 1, 3, 4 and 5 and strengthening it under Management Question 6. Specific groundwater-related key uncertainties, hypothesis, and documentation of potential continuous improvement goals will be incorporated into the 2018 AMP as developed in consultation with the GWG and/or the EMC. A meeting with the GWG in May 2018 will advance inclusion of groundwater-related uncertainties and the RGMP/SSGMP into the 2018 AMP.

2 RGMP Background and Regional Conceptual Site Model

2.1 RGMP Background

The basis for the 2015 RGMP was a regional hydrogeological conceptual site model (‘Regional CSM’) developed to describe regional groundwater flow patterns and quality, focusing on mine-related CI (i.e., order constituents). A hydrogeological conceptual model is typically a representation of groundwater recharge, flow, and discharge for a given area, and, where water quality may be affected. Additional components include presentation of constituent sources, transport pathways and receptors for groundwater. In general, hydrogeological conceptual models are ‘living’ or ‘dynamic’ and continue to be modified as various aspects of the physical and chemical hydrogeology continue to be monitored, investigated and understood.

The Regional CSM was initially developed in 2015 and described in a Regional Groundwater Synthesis Report for the Elk Valley (the “Synthesis Report”, SNC-Lavalin, 2015b). The Synthesis Report compiled and interpreted all relevant groundwater information available in the Elk Valley and provided technical rationale for the 2015 RGMP, which consisted of collecting monitoring data from selected locations in the following groundwater monitoring programs:

- Fording River Operations (FRO);
- Greenhills Operations (GHO);
- Line Creek Operations (LCO);
- Elkview Operations (EVO);
- Coal Mountain Operations (CMO); and
- Regional Drinking Water Sampling Program (RDW).

The Regional CSM indicated the main potential pathway for regional groundwater transport of mine-influenced water was through the valley bottom sediments in the main stems (i.e., Elk and Fording Rivers, and Michel Creek) and not through bedrock due to low permeability bedrock and the steep topographic gradient in mountainous terrain. In addition, the Regional CSM identified that the principal groundwater systems of interest for transport of CI to receptors in the Elk Valley were at the local scale. As such, 12 areas (originally called “Key Areas” and now referred to as “Study Areas”) at the local scale (i.e., on the order of tens of metres to a few kilometres) were defined as being areas where groundwater monitoring may be required to understand potential groundwater transport of mining-related CI in the valley bottoms of the main stems.

These Study Areas were described in detail in the Synthesis Report and summarized in Table D below.

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Table D: Study Areas for Groundwater Monitoring as Defined in SNC-Lavalin (2017a)

Study Area	Description	MU	Program(s)
1	**Fording River Valley Bottom Downgradient of FRO, Cataract and Porter Creeks:** This area is the focal point for the majority of upland and tributary flow to the Fording River valley bottom near the FRO and GHO property boundaries, and the primary off-site migration pathway from FRO.	1	FRO
2	**Fording River Valley Bottom Downgradient of LCO Dry Creek**: This area receives drainage from the planned LCO Phase II development as well as upgradient Fording River valley-bottom groundwater from FRO and GHO.	1	LCO
3	**Fording River Valley Bottom Downgradient of GHO Rail Loop and Greenhills Creek**: This area receives upland groundwater from GHO.	1	GHO
4	**Elk River Valley Bottom Downgradient of Leask, Wolfram and Thompson Creeks:** This area receives groundwater recharge from upgradient mining activities along the western slope of GHO, and is a potential off-site migration pathway.	2	GHO / RDW
5	**Fording River Valley Bottom Downgradient of Line Creek:** The valley bottom in this area receives inputs from Line Creek, the Fording River and the LCO Process Plant.	2 and 4	LCO
6	**Elk River Valley Bottom Downgradient of Confluence with Fording River:** This area receives input from the Fording River valley-bottom, the Elk River valley-bottom and the Line Creek Process Plant site.	4	LCO
7	**Elk River Valley Bottom Downgradient of Grave Creek:** This area receives input from drainages flowing from the northwest slope of EVO, as well as upgradient input from the Elk River and Study Area 6.	4	EVO / RG
8	**Elk River Valley Bottom Downgradient of Balmer, Lindsay and Otto/Cossarini Creeks:** Upland groundwater flows into the Elk River valley bottom from potential sources along the western slope of EVO.	4	EVO
9	**Michel Creek Valley Bottom Downgradient of EVO:** Upland groundwater flows into the Michel Creek valley bottom from potential sources along the western slope of EVO.	4	EVO / EVO / RDW
10	**Michel Creek Valley Bottom Downgradient of Erickson Creek**: Mining activities on the southwest slope of EVO around Erickson Creek, are a potential source of mining-related constituents to valley-bottom groundwater into the Michel Creek valley bottom.	4	EVO
11	**Michel Creek Valley Bottom Downgradient of CMO:** The Michel Creek valley bottom receives input from CMO immediately downgradient of the confluence of Michel and Corbin Creeks. Valley-bottom deposits in this area are the primary off-site migration pathway.	4	CMO / RDW
12	**Elk River Valley Bottom at MU4 Boundary:** This area is at the boundary of MU4. Coarse sediments in this area have been identified as a potential migration pathway, and previous studies have inferred that surface water recharge from the Elk River occurs in this area.	4	EVO / RDW

2.2 Summary of SSGMP 2017 Annual Reports

A summary of site-specific groundwater reports was developed to fulfill requirements listed in Section 10.4 of Permit 107517 which states: "*The Annual Report must include summaries of the site specific groundwater reports."* The 2017 Annual Reports for each site-specific program were prepared for Teck by the following:

- FRO: SNC-Lavalin (2018a);
- GHO: SNC-Lavalin (2018b);
- LCO: Golder (2018);
- EVO: SNC-Lavalin (2018c); and
- CMO: Teck (2018).

SNC-Lavalin reviewed site-specific 2017 annual monitoring reports for each operation as part of the 2017 RGMP annual report. A summary of the conclusions and recommendations from each operation is provided in Appendix I along with a site location plan showing wells locations, a table providing monitoring rationale for wells, and plan view maps indicating 2017 results for CI.

2.3 Regional CSM

The Regional CSM updated in the RGMP Update (SNC-Lavalin, 2017a) builds on concepts originally presented in SNC-Lavalin (2015a) using information from additional studies and monitoring data from site-specific and regional groundwater monitoring programs.

Drawings showing bedrock and surficial geology and potential down-valley groundwater flow in the valley bottoms are shown in Drawings 635544-302 to 635544-307. The main concepts from the Regional CSM relevant to the RGMP are:

- Regional groundwater flow velocities through bedrock are relatively low (i.e., on the order of 1 m/year). The differences in permeability between bedrock and surficial materials and steep topographic gradients indicates the surficial materials are the most important for understanding pathways of mine-influenced groundwater;
- Two hydrogeologic settings were identified in surficial materials: the upland setting (i.e., valley flanks) and valley-bottom setting:
  - The groundwater flow regime in the upland setting is generally governed by the surface of low permeability units and all groundwater eventually flows to valley-bottom surficial deposits, either as surface water or groundwater; and
  - The valley bottoms are where the main aquifers exist in fluvial and glaciofluvial deposits. Locally, groundwater flow patterns converge into the valley bottom from bedrock and upland units and discharge to surface water is expected. However, local-scale down-valley flow in the main stem valley bottoms is known to occur, resulting in groundwater recharge from a losing stream.
- The only potential 'regional' flow system is through the sediments in the valley bottoms of the main stem rivers; however, down-valley flow has been shown to be local in scale, and not regional. The valley-bottom setting was delineated for main stem rivers and shown in Drawings 635544-306 and 635544-307, showing hydraulic heads for RGMP wells;

› Mining influences on groundwater in surficial sediments in the main stem valley bottoms can occur through two different pathways:
  - "the groundwater pathway", where localized areas of mine-influenced groundwater can develop due to transport of CI from upland mining areas to the valley-bottom. Concentrations of CI in groundwater in the valley bottom are expected to be higher than adjacent surface water. Since down-valley flow is limited on a regional scale, the areas where groundwater can be affected is localized areas to the vicinity of Operations; and
  - "the surface water pathway", where mine-influenced surface water recharges groundwater. Concentrations of CI in groundwater in the valley bottom are expected to be equal to or less than adjacent surface water due to mixing with fresh water sources. The surface water pathway may affect groundwater distal to Operations and is considered to be the only pathway where mining-related activities can affect groundwater on a regional scale.

These concepts are discussed further with illustrations in Appendix I, which has been extracted from the RGMP Update (SNC-Lavalin, 2017a). Figure A is a graphical representation of the concepts presented in the Regional CSM and potential pathways for mining-influenced groundwater in the valley-bottoms of main stem rivers in the Elk Valley.

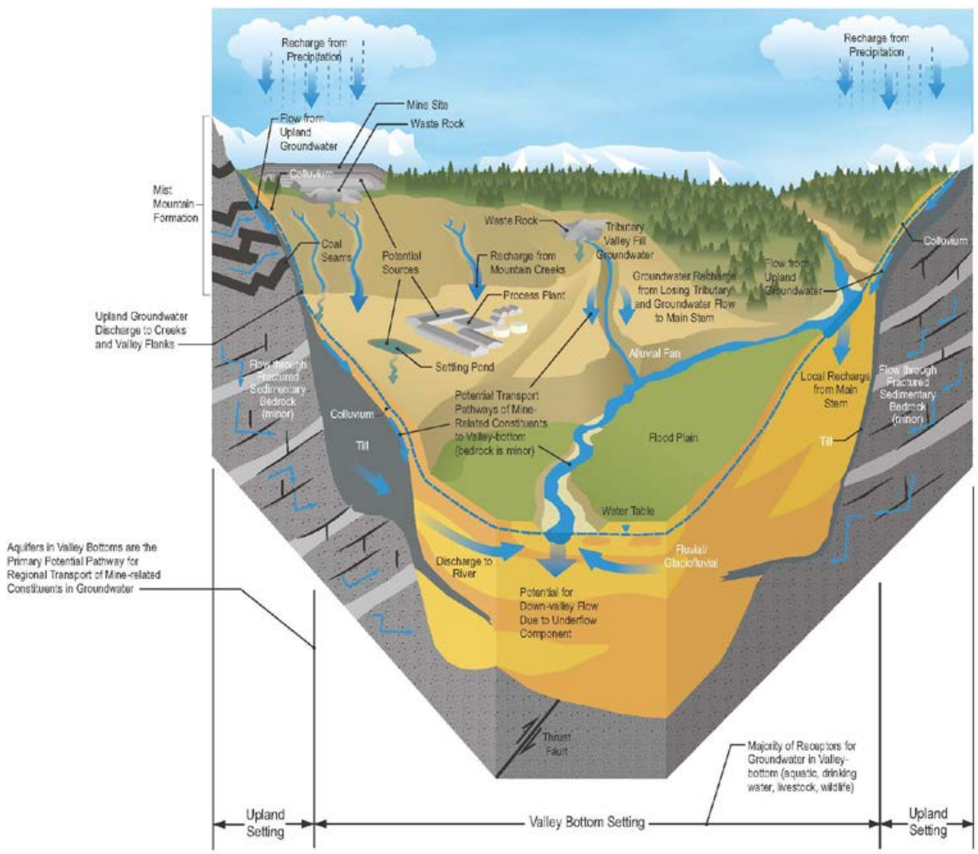

Figure A: Potential Pathways for Mining-Influenced Groundwater in the Elk Valley

3 Regional Groundwater Monitoring Program Description

The approved RGMP outlines monitoring locations; sampling methodology; sampling frequency; analytical parameters; and a QA/QC program which combined define a comprehensive groundwater monitoring program for MUs 1, 2, 3 and 4 as required by Permit 107517. The intent of the RGMP is to dovetail with the SSGMPs to monitor for potential regional effects of mining activities on groundwater. Details of the 2017 monitoring program are provided in the following subsections.

3.1 Monitoring Locations and Rationale

A total of 37 existing monitoring, supply and/or domestic wells were included in the RGMP. These wells provide information on the regional groundwater understanding and have been selected for inclusion into the RGMP as they are existing locations that best characterize groundwater conditions and potential groundwater transport of CI to the valley bottom in Study Areas as defined by the Regional CSM. Monitoring locations were selected in the RGMP based on the following:

- Wells completed in valley-bottom sediments upgradient of, within, or downgradient of a Study Area;
- Wells in upland or tributary areas upgradient of Study Areas where potential for a groundwater transport pathway was identified by SSGMPs; and
- A background or reference well to provide a suggestion of naturally occurring conditions in the main river valley-bottoms.

The wells selected for the RGMP are an integration of SSGMPs, the RDW and other ongoing sampling programs such as operational water supply sampling programs. Wells consist of dedicated monitoring wells, supply wells and domestic wells; general rationale for selection and limitations are described below:

- Dedicated groundwater monitoring wells are preferred for inclusion in the monitoring network because they provide a discrete, representative sample of groundwater and water level from the targeted formation. Where available, nested wells screened at two or more different depths were chosen to monitor the variation of water constituents with depth. Multi-level wells may also be used to assess the vertical hydraulic gradient and inform groundwater and surface water interactions;
- Supply wells can provide representative average groundwater quality over a much larger region compared to dedicated monitoring wells and can identify potential influences due to pumping. Supply wells are sampled from an access point, such as a tap, due to the limited access to the well head. Water supply wells are not ideal for discrete sampling of groundwater due to longer well screens and mixing effects within the well's capture zone induced by pumping. Also, in most cases static water levels are not available which limits their application for monitoring groundwater levels. However, water supply wells were included in the RGMP in areas where dedicated monitoring wells do not exist;
- Domestic wells selected in the RGMP are distal to operations and provide a representative indication of groundwater quality in areas that would be subject to recharge from surface water such as the Elk and Fording Rivers. Similar to supply wells, the use of domestic wells for monitoring is limited by the effects of long well screens and limited access to wellhead to measure static water level or conduct hydraulic testing. Also, continued monitoring of these wells is at the discretion of the private

well owners; therefore, changes may occur to sampling plan based on desired participation of landowners. However, the current RDW Sampling Program allows quarterly access to domestic wells that are useful for monitoring groundwater quality in Study Areas where dedicated monitoring wells or supply wells are not available.

Table E provides a list of locations associated with each Study Area, as well as information such as well type (monitoring, supply or domestic), associated operation and location UTMs. Table E also includes a description of each well location and a rationale indicating why these wells were included in the monitoring program. Drawings 635544-308 to -311 indicate the location of monitoring locations included in the RGMP in each Study Area in relation permitted mine boundaries.

Additional details on rationale for well selection and information associated with well type (i.e., monitoring supply, or domestic well) are provided in the 2015 RGMP (SNC-Lavalin, 2015a). Borehole logs for the wells sampled as part of the RGMP are included in Appendix II.

Table E: Groundwater Monitoring Locations by Study Area, Well Type, Associated Operation and Description

Study Area	Well ID	Well Type	Management Unit (MU)	Operation	Easting (m)	Northing (m)	Setting	Location Description and Rationale
Background	FR_HMW5	Monitoring	1	FRO	655476	5567514	Tributary valley-bottom	Background well upgradient of FRO in Henretta Creek Drainage. Selected to provide background regional groundwater conditions.
1	FR_09-01-A	Monitoring	1	FRO	652601	5558300	Fording River valley-bottom	Downgradient of South Kilmarnock Phase 1 and 2 Settling Ponds, Swift Creek and Kilmarnock Creek, upgradient of Cataract Creek and Study Area 1. Completed in coarse sediments within the Fording River Valley. Selected to monitor groundwater near the Site boundary of FRO.
	FR_09-01-B	Monitoring	1	FRO	652601	5558300		
	FR_GHHW[1]	Supply	1	FRO	653150	5557337		Wells screened within coarse Fording River valley-bottom sediments at the southern border of FRO, downgradient of Swift, Porter and Cataract Creeks. Selected to monitor groundwater transport outside of mine-permitted areas in Study Area 1.
2	LC_PIZDC1308	Monitoring	1	LCO	658111	5541267	Tributary valley-bottom	Multi-level overburden sentry well upgradient of Study Area 2 in the LCO Dry Creek valley bottom. Selected to monitor potential influence of planned upland and tributary valley-bottom development at LCO Phase II.
	LC_PIZDC1307	Monitoring	1	LCO	658111	5541267		
3	GH_POTW09	Supply	1	GHO	654208	5545404	Fording River valley-bottom	Located in the Fording River Valley Aquifer. Selected to monitor groundwater conditions in Study Area 3.
	GH_POTW10	Supply	1	GHO	653291	5545484		
	GH_POTW15	Supply	1	GHO	653169	5545667		
	GH_POTW17	Supply	1	GHO	653698	5545811		
4	GH_MW-ERSC-1	Monitoring	3	GHO	649081	5548704	Elk River valley-bottom	Located near the southern boundary of Study Area 4. Selected as a potential sentry well to monitor groundwater quality in Elk River valley-bottom sediments.
	GH_GA-MW-1	Monitoring	3	GHO	648019	5554750		Upgradient area of Study Area 4. Selected to monitor groundwater conditions in Elk River valley-bottom groundwater conditions near GHO in the upgradient area of Study Area 4.
	GH_GA-MW-2	Monitoring	3	GHO	648291	5552115		Located downgradient of Wolfram Creek Settling Ponds. Selected to monitor upland and tributary valley bottom influences from the west side of GHO and evolution of groundwater quality in within the Elk River valley bottom in Study Area 4.
	GH_GA-MW-3	Monitoring	3	GHO	648578	5550296		Located downgradient of Thompson Creek Settling Ponds. Selected to monitor upland and tributary valley bottom influences from the west side of GHO and evolution of groundwater quality in within the Elk River valley bottom in Study Area 4.
	GH_GA-MW-4	Monitoring	3	GHO	648217	5552963		Located downgradient of Leask Creek Settling Ponds. Selected to monitor upland and tributary valley bottom influences from the west side of GHO and evolution of groundwater quality in within the Elk River valley bottom in Study Area 4.
	RG_DW-01-03	Supply	3	RG	649089	5543336		Located 5 km downgradient of Study Area 4. Selected as a potential sentry well to monitor groundwater within coarse Elk River valley bottom sediments downgradient of Study Area 4.
	RG_DW-01-07	Domestic	3	RDW	649737	5534118		Located 15 km downgradient of Study Area 4. A sentry well to monitor groundwater within the Elk River valley bottom downgradient of Study Area 4.
5/6	LC_PIZP1101	Monitoring	4	LCO	653960	5528263	Elk River valley-bottom	Southwest of the effluent ponds at the LCO Process Plant Site, upgradient of Study Area 6. Selected to monitor potential influence from the LCO Process Plant Site on the Elk River valley bottom in Study Area 6.
7	EV_GV3gw	Monitoring	4	EVO	656580	5522255	Tributary valley-bottom	Nearest upgradient well of Study Area 7, within the Grave Creek valley bottom. Selected to monitor upland and tributary valley-bottom input from drainages to the northeast of EVO.
	RG_DW-02-20	Domestic	4	RDW	652327	5522263	Elk River valley-bottom	Located 4 km downgradient of Study Area 6. Selected to monitor groundwater in the Elk River valley bottom in Study Area 7.
8	EV_LSgw	Monitoring	4	EVO	653274	5514731	Elk River valley-bottom	Located near the discharge of Lindsay Creek to the Elk River. Selected to monitor potential inputs to Study Area 8 from upland, tributary valley bottom, and Elk River valley bottom features along the western slope of EVO.
	EV_OCgw	Monitoring	4	EVO	652480	5512671		Located immediately downgradient of Lagoon D and adjacent to Otto Creek. Selected to monitor potential inputs to Study Area 8 from upland, tributary valley bottom, and Elk River valley bottom features along the western slope of EVO.

Table E (Cont'd): Groundwater Monitoring Locations by Study Area, Well Type, Associated Operation and Description

Study Area	Well ID	Well Type	Management Unit (MU)	Operation	Easting (m)	Northing (m)	Setting	Location Description and Rationale
9	EV_BCgw	Monitoring	4	EVO	655381	5509659	Michel Creek valley-bottom	Downgradient of the confluence of Bodie Creek and Michel Creek. Selected to monitor spatial distribution of water quality within Michel Creek valley-bottom sediments in relation to potential inputs in Study Area 9.
	EV_MCgwS	Monitoring	4	EVO	653476	5511624	Michel Creek valley-bottom	Located 1.8 km upgradient of the confluence of Michel Creek and the Elk River. Selected to monitor spatial distribution of water quality within Michel Creek valley-bottom sediments in relation to potential inputs in Study Area 9.
	EV_MCgwD	Monitoring	4	EVO	653476	5511624		
	EV_BRgw	Supply	4	EVO	654961	5510221		Michel Creek valley bottom upgradient and downgradient of Gate Creek and Bodie Creek confluence with Michel Creek. Selected to monitor spatial variation in groundwater quality within Michel Creek valley bottom in relation to Study Area 9.
	EV_RCgw	Supply	4	EVO	655902	5509299		
	EV_WH50gw	Supply	4	EVO	655705	5509196		
	RG_DW-03-01	Domestic	4	RDW	653073	5511979		Located 1.2 km upgradient of the confluence of Michel Creek and the Elk River. Selected as a potential sentry well to monitor groundwater within coarse Elk River valley bottom sediments downgradient from Study Area 9.
10	EV_ECgw	Monitoring	4	EVO	660795	5506384	Tributary valley-bottom	Nearest upgradient well of Study Area 10, within Erickson Creek valley bottom. Selected as a sentry well to monitor potential influence of upland and tributary valley-bottom groundwater from the southwest portion of EVO to Study Area 10.
11	CM_MW1-OB	Monitoring	4	CMO	667957	5487526	Michel Creek valley-bottom	Multi-level sentry well immediately downgradient of CMO and the confluence of Michel Creek and Corbin Creek. Selected to monitor groundwater in the Michel Creek valley-bottom in Study Area 11.
	CM_MW1-SH	Monitoring	4	CMO	667957	5487526		
	CM_MW1-DP	Monitoring	4	CMO	667957	5487526		
	RG_DW-07-01	Domestic	4	RDW	668408	5487454		Immediately downgradient of CMO at the confluence of Michel Creek and Corbin Creek. Selected as a sentry well to monitor groundwater conditions in the Michel Creek Valley bottom downgradient of CMO in Study Area 11.
12	EV_ER1gwS	Monitoring	4	EVO	651374	5510955	Elk River valley-bottom	Adjacent to the Elk River, 1 km downgradient of the confluence with Michel Creek. Multi-level sentry well to monitor groundwater in Elk River valley-bottom sediments in Study Area 12.
	EV_ER1gwD	Monitoring	4	EVO	651379	5510952		
	RG_DW-03-04	Supply	4	RG	651839	5510619		Located near the border of MU4 and MU5 in the Elk River valley bottom. Selected as a sentry well to monitor deep overburden groundwater in the Elk River valley bottom at the southern extent of the Study Area in Study Area 12.

[1] Greenhouse water supply includes four wells (FR_GH_WELL1, FR_GH_WELL2, FR_GH_WELL3 and FR_GH_WELL4) which are collectively referred to as FR_GHHW. Easting and Northing are listed for FR_GH_WELL4.

3.2 Sampling Methodology

Sampling for the RGMP was completed by Teck or others and carried out in accordance with the 2013 edition of the British Columbia Field Sampling Manual (Clark, 2002), as required in Permit 107517, and Teck's Standard Practices and Procedures (SP&Ps) for well purging and groundwater sampling (TC_GW-01 and TC_GW-02) using well-specific methods based on well construction, type, and recharge. Specific sampling methodology varied by program and well type. SNC-Lavalin reviewed site-specific 2017 annual monitoring reports for each operation (Golder, 2018; SNC-Lavalin, 2018a,b,c; Teck, 2018) and groundwater samples were collected in accordance with the 2013 edition of the British Columbia Field Sampling Manual (Clark, 2002). A summary of sampling methodology for each monitoring program is provided in Sections 3.2.1 to 3.2.5 below. Teck provided details relating to the sampling methodology for the 2017 RDW program, which is summarized below in Section 3.2.6.

3.2.1 Fording River Operations (FRO)

Groundwater elevation was measured manually with a water level tape. In addition to manual monitoring, continuous level logger data were collected in well FR_HMW5. Samples collected from FR_09-01-A, FR_09-01-B, and FR_HMW5 were collected using dedicated tubing and a pump. Samples collected from supply well FR_GHHW (includes FR_GH_WELL1, FR_GH_WELL2, FR_GH_WELL3 and FR_GH_WELL4) were collected from a distribution point (i.e., faucet) within the water system for each quarter. Based on recommendations from the Hydrogeological Assessment (SNC-Lavalin, 2017b) that a single well be used for sampling, FR_GH_WELL4 was sampled beginning in Q4 (SNC-Lavalin, 2018a).

3.2.2 Greenhills Operations (GHO)

Water levels were manually measured from the top of the well casing using a water level tape. Level loggers were also used to measure groundwater elevation at select wells, GH_GA-MW-1, GH_GA-MW-2 and GH_GA-MW-3. Level loggers were set to record hourly pressure and temperature measurements; pressure measurements were corrected using barometric pressure (with a barologger). Prior to sampling, wells were purged using a Geosub submersible pump with dedicated polyethylene tubing. The wells were purged at a rate of less than 1 L/min depending on purging duration and stability of parameters. Field parameters (pH, temperature, electrical conductivity) were measured using a calibrated YSI Pro-DSS (SNC-Lavalin, 2018b). Wells were sampled after field parameters stabilized.

3.2.3 Line Creek Operation (LCO)

Manual depth to groundwater was measured with a water level tape. In addition, level loggers were used to measure groundwater elevation in wells LC_PIZDC1307, LC_PIZDC1308, and LC_PIZP1101. Prior to sampling, wells were purged using a low-flow pump until field parameters (pH, temperature, turbidity, dissolved oxygen and electrical conductivity) stabilized. Field parameters were monitored with a calibrated YSI Pro-Plus multi-parameter instrument (Golder, 2018).

3.2.4 Elkview Operations (EVO)

Water elevations were measured manually with a water level tape at each location. Additionally, groundwater elevations in wells were measured continuously with level loggers with the exception of EV_ER1gwD. Data loggers were set to record pressure and temperature measurements every two hours; pressure measurements were corrected using barometric pressure data collected from a barometric logger. Wells were purged and sampled following low-flow sampling techniques. The specific pump type selected for each monitoring well location was determined based on well construction, type, and recharge characteristics (Golder, 2015). Wells were purged until field parameters stabilized (conductivity, dissolved oxygen, pH, oxidation-reduction potential, and temperature) following Teck's purging procedures. Field parameters were recorded once stable and wells were sampled.

3.2.5 Coal Mountain Operations (CMO)

Water level measurements were collected manually using a Heron-Dipper T graduated water level tape. Continuous water level loggers (Solinst levelogger) were used in wells CM_MW5-DP and CM_MW5-SH. A barologger, attached to the outside of each well, was used for barometric pressure compensation. Wells were purged and sampled with a Geotech portable bladder pump and disposable bladders, with the exception of CM_MW8. Field parameters (pH, EC, temperature, oxidation-reduction potential [ORP], and dissolved oxygen) were monitored with a YSI 556 multi-parameter meter and Hach 2100Q turbidity meter. Water was purged at a low rate until field parameters stabilized (Teck, 2018). Well CM_MW8 could not be purged due to a lack of equipment to accommodate its width (2 in) and depth (80 m). Consequently, CM_MW8 was sampled with the HydraSleeve system.

3.2.6 Regional Drinking Water Sampling Program (RDW)

In 2017, Teck sampled the RG_DW-series wells from the RDW. Teck indicated sampling methodology was as follows:

- Where possible, the sample port used in the initial drinking water evaluation or previous sampling event was used to collect the sample;
- Prior to collection of samples, the tap or valve at the sample location was opened for a minimum of five minutes to purge water through the distribution system. The objective of purging was to obtain samples representative of the water source and not a sample influenced by the distribution system; and
- Water quality parameters (pH/electrical conductivity/temperature) were monitored until stable readings were obtained. Once the stabilized water quality parameters were recorded, the flow was reduced to minimize splashing and samples were collected in laboratory supplied bottles.

3.3 Sample Handling, Shipment and Analysis

Sample bottles and preservatives were provided by a third-party analytical laboratory, ALS Environmental Laboratories (ALS). Sample bottles were certified clean and nitrile gloves were worn by samplers. Samples collected for dissolved parameters were filtered using an in-line filter, with the exception of samples collected for the RDW and select samples at EVO that were filtered with a syringe filter. Samples that required preservation were preserved in the field with the exception of samples analysed for dissolved ultra-trace mercury collected at FRO that were filtered at the laboratory as instructed by the laboratory. Samples were shipped in ice-chilled coolers following chain-of-custody procedures.

Lab analyses for all groundwater samples were completed by ALS in Burnaby, British Columbia and Calgary, Alberta. ALS is certified by the Canadian Association for Laboratory Accreditation and follows the procedures described in British Columbia Laboratory Methods Manual for the Analyses of Water, Wastewater, Sediment, Biological Materials and Discrete Ambient Air Samples (Horvath, 2005).

3.4 Monitoring Specifications in the RGMP

The RGMP (SNC-Lavalin, 2015a) provided details and rationale on sampling frequency and the analyte list as summarized below.

3.4.1 Sampling Frequency

The RGMP specified quarterly sampling, as follows:

- Winter (First Quarter – Q1): January, February, March;
- Spring (Second Quarter – Q2): April, May, June;
- Summer (Third Quarter – Q3): July, August, September; and
- Fall (Fourth Quarter – Q4): October, November, December.

A summary of wells not sampled each quarter of 2017 is provided in Section 3.5.

3.4.2 Analyte List

The 2015 RGMP indicated groundwater will be analyzed for select constituents based on the core list of general water quality analytes provided in Table 2 of the BC MoE's (2016a) Water and Air Baseline Monitoring Document for Mine Proponents and Operators and Permit 107517 Table 26. The minimum detection limits for each parameter will be suitable for comparison to the applicable standards and/or guidelines. Analyses for dissolved rather than total metals was specified in the RGMP to prevent misrepresentation of the mobile concentrations of constituents due to increased turbidity, which may occur as the result of sampling techniques, well construction, and/or geological formation (i.e., clay or silt bearing formations).

3.5 Modifications to Regional Groundwater Monitoring Program

A summary and discussion of modifications to the program outlined in the RGMP (SNC-Lavalin, 2015a) is provided below.

3.5.1 Site-specific Programs

Groundwater levels were monitored at each location included in the RGMP for each quarter except where data could not be collected from supply or domestic wells and exceptions noted below in Table F. Quarterly samples were collected from each well included in the RGMP with the exception of the locations noted in Table F below.

Table F: Summary of Program Modifications

Study Area	Well ID	Q	Data Not Collected	Reason
Back-ground	FR_HMW5	1	Well not sampled	Frozen well
Back-ground	FR_HMW5	4	One and a half months of water level and temperature data could not be retrieved	Frozen well
Back-ground	FR_HMW5	Initiation[1] Q varied depending on well	Began field-filtering samples for dissolved mercury and dissolved metals	To comply with BC Field Sampling Manual recommendation for collecting dissolved metals
1	FR_GHHW	4	Sample collected from single well rather than composite sample	Composite sampling location removed and replaced with well FR_GH_WELL4 as per recommendations in SNC-Lavalin (2017b) in response to ENV approval condition
1	FR_09-01-A/B; FR_GHHW	Initiation[1] Q varied depending on well	Began field-filtering samples for dissolved mercury and dissolved metals.	To comply with BC Field Sampling Manual recommendation for collecting dissolved metals
2	LC_PIZDC1307; LC_PIZD1308	3 and 4	Total Kjeldahl Nitrogen (TKN) and Total Organic Carbon (TOC)	Sample was not collected due to oversight
4	GH_GA-MW-4 (field duplicate)	2	Hardness	Not reported by laboratory
4	GH_GA-MW-2	4	Manual water level measurement	Water level tape malfunction (battery failure)
10	EV_ECgw	1	Manual water level measurement and groundwater sample	Frozen well

Note 1) Once field-filtering was initiated at a well, the practice continued for remaining quarters.

3.5.2 Regional Drinking Water Sampling Program (RDW)

RG_DW-series wells were sampled in each of the four quarters in 2017. The RG_DW-series wells were sampled for a limited number of parameters in Q1, as outlined in the RDW and RGMP, including:

- Field parameters including temperature, pH, electrical conductivity;
- Alkalinity, sulphate, nitrate-N, nitrite-N, chloride, hardness; and

- Total metals including selenium, cadmium, calcium, magnesium, potassium and sodium, as well as dissolved selenium.

The RDW and the RGMP also specify collection of field pH which was not measured in Q1 of 2017 due to a pH probe fault, but was collected in subsequent quarters. It is noted that the Q1 sample from RG_DW-series wells was submitted for analysis of alkalinity (bicarbonate) instead of total alkalinity listed in the analyte list. Alkalinity (bicarbonate) results from Q1 are included in the appended tables.

3.6 QA/QC Program

The RGMP included a QA/QC program for the analysis of groundwater samples to be implemented in accordance with Permit 107517, the British Columbia Field Sampling Manual, and Teck's internal guidance documents. A QA/QC program specific to the RGMP is not yet in place; however, each site conducted a QA/QC program, which is described in site-specific reports and summarized in Section 3.6.1. QA/QC results of RDW Sampling Program are summarized in Section 3.6.2.

3.6.1 Site-specific Programs

Results of each site-specific QA/QC program were summarized in each annual report (Golder, 2018; SNC-Lavalin, 2018a, b, c; Teck, 2018). Each operation identified any shipping and handling issues (if applicable), summarized results of relative percent differences (RPDs) from duplicate samples, and summarized parameters above the detection limit for trip blanks or field blanks. Results from the QA/QC program for wells included in the RGMP from each of the site-specific groundwater monitoring programs is summarized in the following sections.

3.6.1.1 Shipping and Handling Issues

A summary of shipping and handling issues from the EVO SSGMP is provided in Table G below. There were no shipping and handling issues identified for other operations.

Table G: Summary of Shipping and Handling Issues at EVO

Study Area	Well ID	Q	Issue
7	EV_GV3gw and associated field duplicates and field blanks	2	Hold times for true colour, turbidity and orthophosphate were exceeded by one day prior to analysis (laboratory error; samples were received on time). Note the duplicate sample for EV_GV3gw did not exceed the hold time for orthophosphate.
7	EV_GV3gw	3	Hold times for true colour, turbidity and orthophosphate were exceeded by one day prior to analysis (laboratory error; samples were received on time). EV_GV3gw was re-sampled on August 29, 2017 and the hold time for orthophosphate was exceeded by one day prior to analysis (received at the lab on time).
8	EV_LSgw	1	Hold times for true colour and were exceeded by one day prior to analysis (laboratory error; samples were received on time). Samples were received less than 24 hours prior to expiry.

Table G (Cont'd): Summary of Shipping and Handling Issues at EVO

Study Area	Well ID	Q	Issue
8	EV_OCgw and associated field duplicate and field blank	2	Hold times for true colour, turbidity, orthophosphate, nitrate-nitrogen and nitrite-nitrogen were exceeded by two days due to shipping delays. EV_OCgw and associated field duplicates and field blanks were re-sampled on June 29, 2017. EV_OCgw and associated field duplicate and field blank were re-sampled on June 29, 2017 with no hold time exceedances.
8	EV_LSgw	2	Hold times for true colour, turbidity, orthophosphate, nitrate-nitrogen and nitrate-nitrogen were exceeded by one day prior to analysis (laboratory error; samples were received on time).
8	EV_OCgw and associated field duplicate and field blanks	3	Hold times for true colour, turbidity and orthophosphate were exceeded by one day prior to analysis (i.e., laboratory error; samples were received on time). EV_OCgw (and associated field duplicates and field blanks) was re-sampled on August 29, 2017 and the hold time for orthophosphate was exceeded by one day prior to analysis (received at the lab on time). EV_OCgw was re-sampled again on September 21, 2017 and there were no associated hold time exceedances.
9	EV_MCgwD, EV_MCgwS	1	Hold times for nitrate-nitrogen and nitrite-nitrogen were exceeded by two days due to shipping delay. Wells were re-sampled on March 30, 2017 and the hold times for nitrogen parameters were again exceeded by one day prior to analysis (laboratory error; samples were received on time).
9	EV_BCgw	1	Hold times for true colour, turbidity, orthophosphate, nitrate-nitrogen and nitrite-nitrogen were exceeded by one to three days (depending on parameter) due to shipping delays. EV_BCgw was re-sampled on March 30, 2017; the hold time for nitrogen parameters was exceeded once again in the March 30, 2017 re-sample due to laboratory error (the same was received on time).
9	EV_BCgw	2	Hold times for true colour, turbidity, orthophosphate, nitrate-nitrogen and nitrate-nitrogen were exceeded by one day prior to analysis (laboratory error; samples were received on time).
9	EV_MCgwS	4	Hold time for alkalinity was exceeded by one day prior to analysis (laboratory error; samples were received on time).
10	EV_ECgw	4	Hold time for nitrate-nitrogen and nitrite-nitrogen were exceeded by two days prior to analysis (laboratory error; samples were received on time). EV_ECgw was re-sampled on November 22, 2017 and there were no associated hold time exceedances.
12	EV_ER1gwS, EV_ER1gwD	1	Hold time for true colour was exceeded by four days prior to analysis (laboratory error; samples were received on time).
12	EV_ER1gwS, EV_ER1gwD	4	Hold time for nitrate-nitrogen and nitrite-nitrogen were exceeded by three days prior to analysis (laboratory error; samples were received on time).

The hold time exceedances of true colour, turbidity and orthophosphate and alkalinity are not expected to influence the interpretation of results. Review of data indicated there are three well locations in Q1 (EV_MCgwS, EV_MCgwD, EV_BCgw) and two well locations in Q4 (EV_ER1gwS, EV_ER1gwD), as well as one well location in Q2 (EV_LSgw) where re-sampling for nitrate parameters was not possible. EVO nitrate results are discussed in detail in the EVO SSGMP (SNC-Lavalin, 2018c) and were not found to be an issue for data interpretation.

3.6.1.2 Duplicate Samples

Duplicate samples were collected at a frequency of between 1 per 6 and 1 per 15 samples, during site-specific sampling events to assess the precision of the field sampling methodology and consistency of laboratory analysis. Duplicate samples were evaluated by calculation of the RPD of the concentration between the sample and duplicate.

RPD = (original value - duplicate value)/[(original value +duplicate value)/2] *100

RPDs were calculated for parameters where at least one of the samples was greater than five times the laboratory DL; a RPD of less than 20% for metals and inorganics is considered as an acceptable level of precision per the BC Environmental Laboratory Manual (BC MoE, 2016b). Consistent with reporting in site-specific reports, where the result was close to the detection limit, the acceptable RPD was modified as follows:

- RPD of < 20% = Pass
- RPD of > 20% with results < 5 times the detection limit = Pass-1
- RPD of > 20% and <50% with results > 5 times the detection limit = Pass-2
- RPD of >50% with results > 5 times the detection limit = Fail

Table H below summarizes the number of sample duplicates for wells included in the RGMP and any RPDs above acceptable levels (RPD > 50% with results > 5 times the detection limit).

Table H: Summary of Duplicate Sample Results above Acceptable Levels

Operation	Number of Duplicates Included in the RGMP	Summary of RPDs above Acceptable Levels
FRO	2	Dissolved selenium had an RPD of 56% in monitoring well FR_HMW5 sampled on September 18, 2017.
GHO	9	RPD values above acceptable level for dissolved manganese (70%), nitrate (as N) (59%), and turbidity (103%) in GH_GA-MW-2.
LCO	2	All RPDs were considered acceptable.
EVO	9	Total Suspended Solids (TSS) and turbidity RPDs were 75% and 55%, respectively, between EV_OCgw and duplicate sample collected March 29, 2017. Carbonate component of alkalinity RPD was 74% between EV_OCgw and duplicate collected October 18, 2017.
CMO	0	Duplicate samples were collected for each sampling survey as part of the 2017 site-specific groundwater monitoring program at CMO; however, duplicate samples were not collected from wells included in the RGMP. Readers are referred to Teck (2018) for details.

A review of duplicate sample results at GHO indicated that dissolved manganese and nitrate (as N) and turbidity at GH_GA-MW-2 exhibited RPDs above acceptable levels. Nitrate and manganese concentrations were below the primary screening criteria and do not affect the reliability of the results. The TSS and turbidity RPDs above acceptable levels are not expected to influence the interpretation of results as these are physical parameters, which can differ significantly between the sample and the duplicate.

A review of duplicates at FRO indicated that of the 152 organic, inorganic, and physical parameters analyzed, RPDs were less than 50%. Of the 248 dissolved metals parameters analysed, one RPD result (dissolved selenium in FR_HMW5) was above the maximum RPD of 50%. These results indicate a good sampling program with low variability in constituent concentrations from sampling and handling. The variability in dissolved selenium concentrations will be considered during data interpretation in Section 5.1.3.

A review of duplicate sample results at EVO indicated TSS and turbidity RPDs above the acceptable levels at EV_OCgw. The TSS and turbidity RPDs above acceptable levels are not expected to influence the interpretation of results as these are physical parameters, which can differ significantly between the sample and the duplicate. The carbonate component of alkalinity RPD above acceptable levels at EV_OCgw is not considered to influence the interpretation for this sample because the bicarbonate component, which is the dominant component of alkalinity in this water sample, had a RPD of 5%.

3.6.1.3 Field Blanks

In 2017, field blank samples were collected as part of each site-specific groundwater sampling program. Field blank samples are collected at the sampling site during normal sample collection using de-ionized water, which was filtered and preserved using the same method as groundwater samples. Field blanks provide information on contamination resulting from the handling technique and atmospheric contamination. A summary of field blank sample results is provided in Table I; field blank data is provided in Appendix I.

Table I: Summary of Field Blank Sample Results

Operation	Number of Field Blanks and Summary of Results
FRO	Four field blanks were collected (one in each quarter); however, field blank collection locations were not indicated. Readers are referred to SNC-Lavalin (2018a) for details related to detected parameters in field blanks.
GHO	A total of eight field blanks were collected in Q1 through Q4. The results were as follows: › GH_POT09 (Q2) - Turbidity value of 0.92 NTU above DL of < 0.10 NTU - Total ammonia (as N) value of 9.2 µg/L above DL of < 5.0 µg/L - TOC value of 0.52 mg/L above DL of < 0.5 mg/L › GH_GA-MW-1 (Q2) - Nitrate (as N) value of 0.013 mg/L above DL of < 0.005 mg/L - Dissolved magnesium value of 0.0057 mg/L above the DL of < 0.005 mg/L - Dissolved strontium value of 0.34 µg/L above the DL of <0.2 µg/L › GH_GA-MW-3 (Q3&4) - Total ammonia (as N) value of 11.6 µg/L above the DL of < 5.0 µg/L - Total ammonia (as N) value of 7.7 µg/L above the DL of < 5.0 µg/L
LCO	Two field blanks were collected in the 2017 site-specific program; however, field blanks were not collected at locations included in the RGMP. One field blank collected in Q2 had concentrations greater than the detection limits. Readers are referred to Golder (2018) for details related to detected parameters in field blanks.

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Table I (Cont'd): Summary of Field Blank Sample Results

Operation	Number of Field Blanks and Summary of Results
EVO	Seventeen field blanks were collected throughout 2017. The results were as follows: › EV_GV3gw (Q1-Q3) - Total organic carbon (TOC) value of 1.21 mg/L above the DL of < 0.5 mg/L - Dissolved mercury value of 0.007 µg/L slightly above the DL of < 0.005 µg/L - Alkalinity value of 1 mg/L, equal to the DL of < 1.0 mg/L › EV_OCgw (Q1-Q4) - Total phosphorus value of 0.003 mg/L above the DL of < 0.001 mg/L - Dissolved barium value of 0.084 µg/L above the DL of < 0.05 µg/L - Alkalinity value of 1.1 mg/L, slightly above the DL of < 1.0 mg/L - Conductivity value of 2.9 µS/cm above the DL of < 2.0 mg/L - Turbidity value of 0.1 NTU above the DL of < 0.10 NTU - Total ammonia (as N) value of 13.3 µg/L above the DL of < 5.0 µg/L › EV_MCgwD (Q1-Q4) - Turbidity value of 0.14 NTU above the DL of < 0.10 NTU - Turbidity value of 0.19 NTU above the DL of < 0.10 NTU - Total dissolved solids value of 21 mg/L above the DL of < 3.0 mg/L - Total ammonia (as N) value of 8.7 µg/L above the DL of < 5.0 µg/L - Total ammonia (as N) value of 10.4 µg/L above the DL of < 5.0 µg/L - Kjeldahl Nitrogen-N value of 0.056 mg/L above the DL of < 0.050 mg/L - Nitrate (as N) value of 0.0193 mg/L above the DL of < 0.005 mg/L
T	› EV_ECgw (Q1-Q4) - Turbidity value of 0.24 NTU above the DL of < 0.10 NTU - Turbidity value of 0.20 NTU above the DL of < 0.10 NTU - Total ammonia (as N) value of 5.7 µg/L above the DL of < 5.0 µg/L - Total ammonia (as N) value of 9.1 µg/L above the DL of < 5.0 µg/L - Nitrate (as N) value of 0.0306 mg/L above the DL of < 0.005 mg/L - Nitrite (as N) value of 0.0028 mg/L above the DL of < 0.001 mg/L - Nitrite (as N) value of 0.0011 mg/L above the DL of < 0.001 mg/L - TOC value of 0.71 mg/L above the DL of < 0.50 mg/L
CMO	Three field blanks were collected in 2017. A field blank collected in Q4 had parameters above detection limits; however, the sample was collected from a location that is not included in the RGMP. Readers are referred to Teck (2018) for additional details.

At GHO, the concentrations of dissolved magnesium and strontium values above the DLs were only slightly greater than the DL. Concentrations of total ammonia-nitrogen were measured to be 1.5 to 2.3 times the detection limit and concentrations of nitrate-nitrogen were 2.6 times the detection limit. It is noted that total ammonia-nitrogen and nitrate-nitrogen concentrations measured in field blanks are two to three orders-of-magnitude lower than the lowest applicable groundwater standard. TOC concentrations were only slightly greater than the DL and turbidity values were 9.2 times the DL. There are no applicable standards or guidelines for TOC or turbidity.

At EVO, for most parameters measured above the DL, the concentrations were only slightly greater than the DL; exceptions to this include TOC, total ammonia-nitrogen, nitrate-nitrogen and nitrite-nitrogen which were measured to be 1.9 to 2.9 times the DL. It is noted that there are no applicable standards for TOC, and nitrogen parameter concentrations measured in field blanks are two to four orders of magnitude lower than the lowest applicable groundwater standard. Additionally, total dissolved solids (7 times the DL) and turbidity (2 to 2.4 times the DL) were also above the DLs; total dissolved solids and turbidity do not have applicable standards or guidelines.

These detections suggest either the ultra-pure deionized water (DI) provided by the laboratory contains some detectable parameters or there is some low-level introduction of these parameters in the field. Teck and SNC-Lavalin contacted the laboratory to inquire about the ultra-pure DI and the laboratory indicated that they are currently doing low-level detection testing to evaluate whether there are parameters above detection limits in the DI. One report (Q1) provided by the laboratory and reviewed by SNC-Lavalin did not have parameters above the detection limit in DI matching those above detection limit in field blanks. The above mentioned detectable concentrations of parameters are not considered to be a concern for data reliability.

3.6.1.4 Trip Blanks

Trip blanks were collected as part of some of the 2017 site-specific annual monitoring programs. Standard practice for collection of trip blanks consists of ordering bottles with de-ionized water from the lab which are unopened throughout the sampling trip. Trip blanks are meant to detect widespread contamination from the container and preservative during transport and storage. A summary of trip blank sample results is provided in Table J; field blank data is provided in Appendix I.

Table J: Summary of Trip Blank Sample Results

Operation	Number of Trip Blanks and Summary of Results
FRO	Four trip blank samples were conducted in 2017 with concentrations above the DL detected in each quarter. › Q1 – Phosphorus with a concentration of 0.0052 mg/L above the DL of < 0.0010 mg/L › Q2 – Nitrate-nitrogen with a concentration of 0.0079 mg/L above the DL of < 0.005 mg/L › Q3 – Ammonia nitrogen with a concentration of 0.0056 mg/L above a DL of < 0.005 mg/L › Q4 – Turbidity with a value of 0.19 NTU above the DL of < 0.10 NTU For parameters above the detection limits for trip blanks, concentrations were marginally above the detection limits with the exception of phosphorus that was five times the detection limit. For parameters within applicable screening criteria, the concentrations measured were four orders of magnitude below primary screening criteria. As indicated in the previous section, the laboratory is currently evaluating their ultra-pure DI. The parameters above the detection limits are not considered to affect the reliability of the data.
GHO	Not required in GHO SSGMP

Table J (Cont'd): Summary of Trip Blank Sample Results

Operation	Number of Trip Blanks and Summary of Results
LCO	Three trip blanks collected in 2017 which had concentrations about the DL in the following quarters: › Q1 - Nitrate-nitrogen value of 2.8 mg/L above the DL of < 0.005 mg/L - Sulphate value of 15.6 mg/L above the DL of < 0.30 mg/L - Total barium value of 0.058 µg/L above the DL of < 0.05 µg/L - Total calcium value of 0.064 mg/L above the DL of < 0.05 mg/L - Dissolved chloride value of 0.66 mg/L above the DL of 0.5 mg/L - Total copper value of 1.69 µg/L above the DL of < 0.5 µg/L - Total lead value of 0.076 µg/L above the DL of < 0.05 µg/L - Total magnesium value of 0.0069 mg/L above the DL of < 0.005 mg/L - Total manganese value of 0.12 µg/L above the DL of < 0.1 µg/L - Total silver value of 0.015 µg/L above the DL of < 0.01 µg/L - Total tin value of 0.12 µg/L above the DL of < 0.1 µg/L › Q2 - Ammonia-nitrogen value of 0.0201 mg/L above the DL of < 0.005 mg/L - Phosphorus value of 0.0242 mgL above the DL of < 0.004 mg/L - Lab Turbidity value of 0.18 NTU above the DL of < 0.1 NTU › Q3 - Ammonia-nitrogen value of 0.0108 mg/L above the DL of < 0.005 mg/L For parameters above the detection limits for trip blanks, concentrations were marginally above the detection limits with the exception of nitrate-nitrogen in Q1, Q2, and Q3; sulphate and total copper in Q1; and phosphorous in Q2. Phosphorous was double the DL; however, there is no applicable standard for phosphorous. Sulphate was 50 times the DL, but approximately an order of magnitude lower than the lowest applicable screening criteria. Total copper was approximately three times the DL, but below primary screening criteria for dissolved copper. The parameters above the detection limits are not considered to affect the reliability of the data.

Table J (Cont'd): Summary of Trip Blank Sample Results

Operation	Number of Trip Blanks and Summary of Results
EVO	Eight trip blank samples were conducted in 2017, seven of which had concentrations above the DL detected in the following quarters. › Q1 - Nitrite-nitrogen value of 0.0028 mg/L above the DL of < 0.001 mg/L - TDS value of 21 mg/L above the DL of < 10 mg/L - Kjeldahl nitrogen value of 0.056 µg/L above the DL of < 0.05 µg/L › Q2 - TOC value of 0.71 mg/L above the DL of < 0.5 mg/L › Q3 - Lab turbidity value of 0.24 NTU above the DL of < 0.10 NTU - Nitrate-nitrogen value of 0.0306 mg/L above the DL of < 0.005 mg/L - Nitrite-nitrogen value of 0.0011 mg/L above the DL of < 0.001 mg/L › Q4 - Lab turbidity value of 0.20 NTU above the DL of < 0.10 NTU - Turbidity value of 0.19 NTU above the DL of < 0.10 NTU For most parameters measured above the DL, concentrations were only slightly greater than the DL; exceptions to this include TDS, nitrate-nitrogen and nitrite-nitrogen, which were measured to be 2.1 to 6.1 times the DL. It is noted that there are no applicable standards for TOC, and nitrogen parameter concentrations measured in trip blanks are two to three orders of magnitude lower than the lowest applicable groundwater standard. As indicated in the previous section, the laboratory is currently evaluating their ultra-pure DI. The above-mentioned detectable concentrations of parameters are not considered to be a concern for data reliability.
CMO	Not required in CMO SSGMP

3.6.2 Regional Drinking Water Sampling Program (RDW)

A summary of QA/QC results for the RG_DW-series wells is provided below.

- **Shipping and Handling Issues:** Certificates of Analysis (COA) for RG_DW-series wells were reviewed by SNC-Lavalin. QA/QC issues were not identified by the laboratory with the exception of hold time exceedances identified for the following wells:
  - Low-level TDS (exceeded by one day) and turbidity at RG_DW-01-07 in Q3 (exceeded by one day);
  - Low-level TDS (exceeded by one day) at RG_DW-02-20 in Q4; and
  - Nitrate and nitrite (exceeded by one day) at RG_DW-07-01 in Q3. Nitrate and nitrite concentrations from 2017 at RG_DW-07-01 were similar to 2016 results; as such, the exceedances of hold times are not considered to be an issue for data quality.
- **Duplicate Samples:** Four field duplicates were collected in 2017 from RG_DW-series wells included in the RGMP. The Q1 duplicate was collected in RG_DW-03-01, Q2 and Q4 duplicates in RG_DW-02-20, and the Q3 duplicate in RG_DW-01-07. RPD values greater than (50%) in well RG_DW-02-20 were turbidity in Q4 (53%) and dissolved chromium (60%), copper (52%), lead (63%),

and zinc (58%) in Q2. There are no screening criteria for turbidity and dissolved metals concentrations were below primary screening criteria; therefore, the RPDs above 50% are not expected to affect the reliability of the data.

› **Blanks:** Four trip blanks and four field blanks were collected and parameters greater than the detection limit are summarised in Table K; blank data for RG_DW-series wells are provided in appended Tables 3 and 4.

Table K: Summary of Field and Trip Blank Sample Results at RG_DW-series Wells

Operation	Field and Trip Blanks Sample Results
RG_DW-series wells	Four trip and four field blank samples were conducted in 2017 with concentrations above the DL detected in each quarter. › Q1 – Total cadmium and selenium submitted for analysis only; both were below the DL. › Q2 – total ammonia (as N) in trip blank with a value of 0.0237 mg/L above a DL of <0.0050. › Q3 – alkalinity (total and bicarbonate) in field blank with value of 1.9 mg/L above a DL of <1.0 mg/L. For parameters above the detection limits for trip and field blanks the concentrations were marginally above the detection limits, with the exception of total ammonia that was four times the detection limit. For parameters within applicable screening criteria, the concentrations measured were one or more orders of magnitude below primary screening criteria. As indicated in the previous section, the laboratory is currently evaluating their ultra-pure DI. The parameters above the detection limits are not considered to affect the reliability of the data.

3.6.3 Summary of QA/QC Results

Data from site-specific groundwater monitoring programs were considered acceptable. A summary of the QA/QC results is as follows.

› Hold time exceedances are not expected to influence interpretation of results, with the exception of the select locations where re-sampling was not possible for nitrate-nitrogen and nitrite-nitrogen. At these locations hold time exceedances will be considered during data interpretation;

› RPDs above acceptable levels are not expected to influence the interpretation of results; and

› Detectable concentrations were measured in field and trip blank samples and will be considered as part of the data interpretation but were not considered to affect the reliability of results.

SNC-Lavalin recommends continuing to investigate the results through low-level analyses of the ultra-pure deionized water provided by the laboratory to see if there is a possibility that the parameters detected in the field and trip blanks were from the DI water provided by the laboratory. Additionally, SNC-Lavalin recommends adding trip blanks to GHO and CMO sampling programs and continuing to use trip and field blanks at FRO, LCO and EVO so that results can be monitored for the possibility of introduction of parameters in the field.

4 Assessment Criteria

Groundwater quality data were screened against a number of different criteria based on applicable receptors. A technically-based screening process was developed for the 2015 RGMP and was updated in the 2017 RGMP. The screening process is summarized below.

Primary and secondary screening criteria may be adjusted based on the needs and requirements for other programs under the AMP. For example, Teck's chronic toxicity program has identified that the nickel British Columbia Approved Water Quality Guidelines (BCWQG) may not be protective of all aquatic life. Teck is currently in the process of investigating the results from this program and will determine if adjustments to screening criteria are needed.

4.1 Primary Screening Criteria

The primary screening approach was consistent with regulatory guidance, including: Technical Guidance 6 (TG 6): *Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators* (BC MoE, 2016a) for EMA Applications; and Technical Guidance 15 (TG 15) *Concentration Limits for the Protection of Aquatic Receiving Environments* (BC ENV, 2017b). The primary screening process considered the following receptors:

- **Human Health** – groundwater used for drinking water for current and future use as a default use, consistent with TG 6. Primary screening of groundwater data for protection of drinking water (DW) was conducted against the applicable *Contaminated Sites Regulation*[3] (CSR) DW.
- **Freshwater Aquatic Life** – groundwater discharging to aquatic environments as a default use, consistent with TG 6. Primary screening of groundwater data for protection of aquatic life was conducted against CSR AW standards. Consistent with TG 15, and as a conservative approach, the application of BC Water Quality Guidelines (BCWQG; BC ENV, 2018) to wells within 10 m of the high water mark was applied.
- **Irrigation and Livestock Watering** – groundwater for livestock or irrigation watering use. This use was not described in TG 6; however, these uses have been applied to be conservative as livestock and irrigation water supplies are sourced from groundwater wells in some locations. Since the EMC have indicated that livestock watering use was used as a surrogate for wildlife watering, livestock watering should be applied as a default use. Primary screening of groundwater data protection of irrigation and livestock watering was conducted against CSR Irrigation (IW) and Livestock (LW) standards.

This screening process allowed for water to be compared to uniform criteria for groundwater protection across the Elk Valley (i.e., CSR standards and Approved and Working BCWQG), as applicable. The default uses, which consist of human health, freshwater aquatic life, and livestock as a surrogate for wildlife were applied across the entire valley.

As of November 1, 2017, the Stage 10 and Stage 11 Amendments to the CSR came into effect. The new standards were used to assess 2017 groundwater data. Table L below summarizes changes to CI and non-order constituents, measured in 2017 or previously measured (i.e., 2015 or 2016) to be above standards:

[3] *Contaminated Sites Regulation* (CSR), B.C. Reg. 375/96, includes amendments up to B.C. Reg. 196/2017, November 1, 2017.

Table L: November 1, 2017 Primary Screening Criteria Changes to the CSR

Constituent	Unit	From	To	Pathway
Sulphate	mg/L	1,000	1,280 to 4,290[1]	Aquatic life
Nitrate-Nitrogen	mg/L	3,200	1,000	Drinking Water
Dissolved Cadmium	µg/L	0.1 to 0.6[1]	0.5 to 4[1]	Aquatic life
Dissolved Selenium	µg/L	10	20	Aquatic life
Dissolved Selenium	µg/L	50	30	Livestock
Dissolved Boron	µg/L	50,000	12,000	Aquatic life
Dissolved Lithium	µg/L	730	8	Drinking Water
Dissolved Manganese	µg/L	550	1,500	Drinking Water
Dissolved Strontium	µg/L	22,000	2,500	Drinking Water

[1] Hardness dependent range

The two orders of magnitude decrease in the DW standard for dissolved lithium has resulted in numerous values screening above the standard (refer to Section 5) for groundwater sampled from wells in the RGMP. However, it is noted that there is no drinking water guideline for lithium in Health Canada's Guidelines for Canadian Drinking Water Quality (GCDWQ; Health Canada, 2017) which is considered to be more applicable for consumption of drinking water at the tap.

In addition to the above listed constituents, dissolved copper, magnesium and zinc were previously measured in concentrations above standards in wells located in Study Area 9 (SNC-Lavalin, 2017a). The CSR standards for these constituents are listed in Table M.

Table M: November 1, 2017 Primary Screening Criteria Changes to the CSR for Study Area 9

Constituent	Unit	From	To	Pathway
Dissolved Copper	µg/L	1,000	1,500	Drinking Water
Dissolved Magnesium	µg/L	100	No standard	Drinking Water
Dissolved Zinc	µg/L	5,000	3,000	Drinking Water

Table 1, attached, summarizes the primary screening criteria for the RGMP wells. SNC-Lavalin reviewed the wells located within 10 metres of a high water mark, consistent with TG 15 described above, and found that EV_OCgw is within 10 metres of a high water mark. Results from EV_OCgw were therefore compared to BCWQG for AW. Previously, GH_POTW17, EV_BCgw and EV_MCgwS/D were also compared to BCWQG for AW instead of CSR; however, review of these well locations with the updated surface water feature layer provided by Teck in 2017 indicated these wells are greater than 10 metres from the high water mark and results were compared to CSR AW standards.

4.2 Secondary Screening

The primary screening step will provide the main indicator for groundwater quality; however, in some MUs, existing concentrations of CI in surface water can be higher than BCWQG and CSR standards. The Regional CSM provided in the 2017 RGMP indicates that elevated concentrations of CI in groundwater could result from recharge of groundwater from surface water (i.e., the surface water pathway). As such, a secondary screening step is specified to provide a comparison to area-based surface water quality requirements laid out in Permit 107517. The intention of the secondary screening criteria is to provide context in relation to Teck's operational surface water quality requirements, as well as to provide a technically-based framework for regional evaluation of groundwater as it related to the protection of aquatic life in the Elk Valley (i.e., the area-based Site Performance Objective [SPO] and Compliance Point [CP] concentrations specified in Permit 107517).

Selenium is the only constituent where CP and SPO concentration values are greater than primary screening criteria (i.e., BCWQG or CSR standards), and as such is the only constituent where secondary screening will be of value. SNC-Lavalin notes that due to the November 2017 update to the CSR, the CSR AW standard for selenium (20 µg/L) is now greater than select SPO and CP (provided in Table L below). Geographically relevant CP and SPO concentration values are specified for the secondary screening process for selenium. CP and SPO criteria in the main stem rivers differ along the flow path, and as such screening of groundwater data against these criteria were applied accordingly (i.e., criteria were applied to groundwater wells inferred to be up-gradient of any give surface water Compliance Point or Order Station).

As a secondary screening step for drinking water use, groundwater concentrations for selenium were screened against the GCDWQ (Health Canada, 2017) to provide context in relation to recent toxicological studies. The GCDWQ for selenium was updated in October 2014 from 10 to 50 µg/L and is similar to the value developed in the Human Health Risk Assessment (HHRA; Ramboll Environ., 2016). Secondary screening for selenium was completed only where sample concentrations exceeded primary screening criteria.

The CP and SPO selenium criteria applied are shown below in Table N.

Table N: Secondary Groundwater Screening Criteria for Aquatic Life

CI (Monthly Average Limits)	Compliance Points					Site Performance Objectives			
	Elk River	Fording River		Michel Creek		Elk River			Fording River
	GH_ERC E300090	GH_FR1 E200378	FR_FRCP1 E300071	CM_MC2 E258937	EV_MC2 E300091	GH_ER1 E206661	EV_ER4 0200027	EV_ER1 0200393	GH_FR1 0200378
Selenium [1] (µg/L)	15	80	130	19	28	19	23	19	63[2]

Notes: 1) Criteria to be applied to dissolved metals only as per the approved RGMP. 2) SPO is effective December 31, 2019

Not shown in the table is the updated GCDWQ for selenium of 50 µg/L. This will be applied to all samples above the DW primary screening as a secondary screening criteria for drinking water.

5 Results and Discussion

Results are presented by Study Area, as defined in Section 1.3. Drawings with well locations and tables summarizing results above screening criteria are referenced throughout the text below. Graphs showing temporal trends, including select surface water data, are also referenced and provided in Appendix III. Surficial and bedrock geology is presented on Drawings 635544-302 to -305. To fulfill permit requirement (ii) listed in Section 1, cross sections showing well installation, stratigraphy, and groundwater elevations are presented on Drawings 635544-312 to -326. These drawings focus on Study Areas where the distribution of monitoring wells allows for representative cross sections perpendicular and parallel to groundwater flow in the valley bottom. For some cross sections, strict adherence to generations of sections perpendicular and parallel to groundwater flow was not possible given monitoring well distribution and complexities of local-scale groundwater flow regime. The cross section location lines are shown on Drawings 635544-302 to -305.

Drawings 635544-306 and -307 show the spatial distribution of groundwater elevations and conceptual groundwater flow path through valley-bottom aquifers. Groundwater elevations taken prior to sampling for the fourth quarter were selected and included on Drawings 635544-306 and -307 to provide regional context. Drawings 635544-327 to -330 show the spatial distribution of groundwater quality results for nitrate-nitrogen, sulphate, dissolved cadmium and selenium in the Study Areas.

For additional reference and to assist with visualization, the 3D block diagrams developed for the 2017 RGMP have been included in Appendix IV for reference. It is noted that concentrations have not been updated since the 2017 RGMP.

5.1 Background (Reference) Conditions

A background well, FR_HMW5, is monitored to understand reference conditions is well installed in the valley-bottom of Henretta Creek, located upgradient of the mining footprint at FRO Monitoring well FR_HMW5 is completed in alluvial gravel in the Henretta Creek valley-bottom, a tributary of the upper watershed of the Fording River.

5.1.1 Groundwater Levels

In 2017, both manual (Table 2) and data logger water level measurements from FR_HMW5 were used to assess seasonal groundwater levels. Groundwater elevations from January 2015 to November 2017 were plotted on a time-series graph and included in Appendix III (Graph B-1). Continuous groundwater level data were available from January 2015 to November 2017 with the exception of three weeks in February and March of 2016. There is generally good agreement between the manual and data logger groundwater elevations. Continuous measurements generally display higher groundwater elevations in FR_HMW5 during freshet. The 2017 data display rising groundwater elevation in the beginning of May, peak elevations at the end of May, and a steady decline at the end of June. This pattern is similar to 2015 and 2016 data.

The maximum fluctuation of groundwater elevation in 2017 was approximately 0.39 m. Between January 2015 and November 2017, the groundwater elevation ranged from 1,784.34 metres above sea level (masl) to 1,784.73 masl.

5.1.2 Groundwater Quality

Field parameters for FR_HMW5 measured in 2017 were similar to those measured in 2016 (Appendix III, Graphs B-2 and B-3). A summary of CI and non-order constituents above primary screening criteria for FR_HMW5 is presented in tables below. The analytical results compared to screening criteria are presented in Tables 3 and 4 (primary screening) and Table 5 (secondary screening). Monitoring well FR_HMW5 did not have CI above secondary screening criteria.

Table O: Summary of Constituents above Primary Screening Criteria in Background Well

Parameter[1,2,3]	FR_HMW5			
	Q1	Q2	Q3	Q4
Selenium	na[4]	DW	-	-
Lithium	na[4]	DW	DW	DW

Notes: 1.) Dissolved parameter unless otherwise indicated; 2) Primary screening criteria applied are CSR standards for Aquatic Life (AW), Drinking Water (DW), Livestock (LW) and Irrigation (IW); 3) '–' denotes result below primary screening criteria for given constituents. 4) na indicates the well was not sampled for specific parameter; well could not be sampled because it was frozen.

Lithium concentrations measured at reference well FR_HMW5 (218 to 265 µg/L) were the highest concentrations measured in 2017 at FRO and one to two orders of magnitude greater than other locations in the Henretta Creek and Fording River valleys. These results indicate that lithium concentrations are naturally high across the Elk Valley. Dissolved lithium concentrations were similar to previous years; however, lithium concentrations have not been previously identified as the DW standard changed from 730 µg/L to 8 µg/L on November 1, 2017. Selenium concentrations at this well are discussed further below.

5.1.3 Discussion

Groundwater quality results for reference well FR_HMW5 were below the primary screening criteria for each sample with the exception of dissolved selenium (14.8 µg/L) in Q2 (Appendix III, Graph B-2). The Q2 result is five times the 2016 Q3 sample concentration (3.04 µg/L); the previous maximum concentration); prior to the 2016 Q3 sample, concentrations were < 0.050 µg/L or 0.054 µg/L on one occasion. Dissolved selenium concentrations for Q2 are considered to be anomalous. Approximately 20 L of hot water from FR_POTWELLS (with selenium concentrations of 22.2 µg/L) was added to FR_HMW5 in Q1 in an attempt to defrost the well. If the well was not purged three well volumes prior to sampling, and instead the sampler waited for parameters to stabilize, then this may account for elevated selenium concentrations in FR_HMW5 (SNC-Lavalin, 2018a). Dissolved selenium concentrations at reference well FR_HMW5 were typically below the laboratory method detection limit (MDL) of < 0.05 µg/L. Notably, dissolved selenium concentrations at adjacent Henretta Creek surface water station FR_HC3, where a hydraulic connection to FR_HMW5 has previously been inferred, were low when groundwater samples were collected as shown on Graph B-2 in Appendix III.

Nitrate-nitrogen and dissolved cadmium at FR_HMW5 were below the MDL in each quarter and sulphate concentrations (Graph B-3) were one to two orders of magnitude less than other sulphate concentrations measured at FRO in 2017.

5.1.3.1 Dissolved Lithium in Groundwater

Dissolved lithium concentrations in reference well FR_HMW5 ranged from 218 to 265 µg/L in 2017 and were generally an order of magnitude higher than wells situated downgradient at FRO, including some RGMP wells. Dissolved lithium concentrations were above the updated CSR DW standard (8 µg/L) in 34 of the 37 wells (92%) included in the RGMP in at least one quarter, including RG_DW-03-04 (Sparwood Municipal Supply Well 3) in Q4 of 2017.

Study Area 4 wells GH_GA-MW-1 and GH_GA-MW-3 had slightly lower lithium concentrations than the reference well, ranging from 139 to 156 µg/L and 89.7 to 107 µg/L, respectively. These wells were installed directly above bedrock. Study Area 11 well CM_MW1-DP had lithium concentrations ranging from 258 to 710 µg/L, the highest lithium concentrations measured in RGMP wells. Monitoring well CM_MW1-DP was installed at a depth of 37 m in 'black siltstone'. An upward vertical gradient was measured between groundwater in CM_MW1-DP and shallower well CM_MW1-SH (see data in Study Area 11; Section 5.11), indicating that lithium concentrations in the deeper well were not influenced from downward movement of shallower groundwater.

Based on the 2017 RGMP data, bedrock appears to be a naturally occurring source of dissolved lithium. Typically, fine-grained (silt and clay) sedimentary rocks deposited in a marine environment, similar to those logged in CM_MW1-DP and mapped in the area, have relatively high lithium content (Salminen et al., 2005). Lithium occurs mainly in silicate minerals such as feldspars and clays that are prevalent in fine-grained siliciclastic rocks found in the Elk Valley. Coal can also have naturally high lithium concentrations (Qin et al., 2015).

To further substantiate this interpretation, a broader review of dissolved lithium in groundwater was undertaken which included wells completed in bedrock. The approach taken was similar to that of non-order constituents in groundwater in the 2017 RGMP. The review indicated that:

- 77 of the 83 wells (93%) in the Elk Valley had dissolved lithium above the CSR DW standard for at least one quarter between 2015 and 2017;
- The highest dissolved lithium concentrations were measured at CM_MW4-DP (3,430 µg/L), which was installed in bedrock;
- Reference wells (FR_HMW5 and 2017 RGMP recommended well CM_MW3-SH/DP) had dissolved lithium concentrations ranging from 6 to 2,510 µg/L. The second highest lithium concentration measured in the Elk Valley was at background well CM_MW3-DP;
- The range of dissolved lithium concentrations in groundwater in wells installed in bedrock was 7 to 3,430 µg/L; and
- Groundwater from wells with dissolved selenium concentrations <10 µg/L (i.e., relatively less influence from mining activities) had dissolved lithium concentrations ranging from 1 to 3,430 µg/L whereas wells with dissolved selenium concentrations >10 µg/L had dissolved lithium concentrations ranging from 3 to 232 µg/L.

Based on these observations, dissolved lithium in groundwater appears to be naturally occurring and related to bedrock. Further, the second highest lithium concentrations were measured in a background monitoring well (i.e., CM_MW3-DP).

5.2 Study Area 1: Fording River Valley-bottom Downgradient of Fording River Operations, Cataract and Porter Creeks

This area was identified because it is the focal point for the majority of upland and tributary valley groundwater flow to the Fording River valley-bottom near the FRO and GHO property boundaries and the primary off-site migration pathway from FRO (Drawing 635544-308). Study Area 1 is downgradient of the South Tailings Pond (STP), South Kilmarnock Settling Ponds, Kilmarnock Creek, Swift Creek, Cataract Creek and Porter Creek watersheds. Wells installed in overburden (upland and valley-bottom sediments) and relevant surface water locations for Study Area 1 are shown on Drawing 635544-308.

Glaciofluvial and fluvial deposits consisting of medium to coarse-grained unconsolidated sediments are in the Fording River floodplain south of the STP and in the vicinity of the Kilmarnock Settling Ponds and considered the key aquifer for Study Area 1 (Appendix IV). The aquifer is unconfined with a saturated thickness ranging from ~ 5 m, immediately south of the STP, to > 30 m further downgradient.

Two monitoring well locations are included for Study Area 1: FR_09-01-A/B (nested) and the greenhouse water supply wells that consist of four wells (FR_GH_WELL1, FR_GH_WELL2, FR_GH_WELL3 and FR_GH_WELL4), collectively referred to as FR_GHHW. FR_09-01-A/B and FR_GHHW were selected to monitor valley-bottom groundwater near the southern site boundary of FRO.

5.2.1 Potential Sources and Transport Pathways

The 2017 RGMP identified potential sources of CI and potential transport pathways to valley-bottom groundwater in Study Area 1, summarized in the following table. Potential sources are also shown in plan on Drawing 635544-308.

Table P: Potential Sources and Transport Pathways to Study Area 1 (After SNC-Lavalin, 2017a)

Potential Sources	Potential Transport Pathways	Current Monitoring Location[1]
FRO mining activities upgradient from Study Area 1 and STP	Groundwater flow though Fording River valley bottom.	FR_09-04-A/B (FRO SSGMP)
	Upland groundwater and tributaries discharging into Fording River.	FR_FR2 (SWMP)
Fording River	Recharge to groundwater from infiltration of the Fording River along some stretches.	FR_09-01-A/B (FRO SSGMP and RGMP) and FR_09-02-A/B (FRO SSGMP) FR_FR2, FR_FR4 and FR_FRCP1 (SWMP)
South Tailings Pond (STP)	Recharge to groundwater from infiltration from STP.	FR_09-04-A/B (FRO SSGMP)
Waste Spoils in the Kilmarnock Creek drainage	Recharge to groundwater from infiltration of Kilmarnock Creek channel and Kilmarnock Settling Ponds. Previous hydrogeological assessment results suggested the presence of a groundwater preferential flow path on the east side of the Fording River valley from Kilmarnock Creek drainage to the Greenhouse Wells water system (SNC-Lavalin, 2017b).	FR_GHHW (FRO SSGMP and RGMP) FR_KC1 (SWMP)

Table P (Cont'd): Potential Sources and Transport Pathways to Study Area 1

Potential Sources	Potential Transport Pathways	Current Monitoring Location[1]
Waste Spoils (North and Connector Spoils) in the Cataract Creek and Swift Creek drainages	Previous hydrogeological assessment results indicated that impacts from Swift Creek and Cataract Creek drainages are inferred to be primarily from surface water from Swift Creek and Cataract Creek discharging into the Fording River (SNC-Lavalin, 2017b). Water quality results indicate that mine-affected surface water impacts on groundwater quality is limited to groundwater in the vicinity of the settling ponds and the creeks and are likely due to local exchange between groundwater and surface water.	GH_SC1, GH_SC2, GH_CC1, FR_FR4 and FR_FRCP1(SWMP)
Historical Waste Spoils in the Porter Creek drainage	Impacts from Porter Creek drainage is inferred to be primarily from Porter Creek surface water recharging groundwater and discharging into the Fording River.	GH_MW-PC[2] (GHO_SSGMP) GH_PC1 (SWMP)

1. SSGMP: Site-Specific Groundwater Monitoring Program; RGMP: Regional Groundwater Monitoring Program and SWMP: Surface Water Monitoring Program.
2. This monitoring well was drilled in 2016 and is now part of the GHO SSGMP.

A hydrogeological assessment was conducted at FRO to further assess groundwater influence from Kilmarnock Creek, Swift Creek, and Cataract Creek, and the adequacy of existing monitoring wells. The assessment indicated loading of mine-influenced constituents to groundwater in Fording River valley-bottom is inferred to be primarily from infiltration of Fording River and Kilmarnock surface water. The development of a water treatment facility (referred to as Active Water Treatment Facility South) south of the STP is proposed to mitigate impacts on surface water quality at FRO. As a result, improvement to groundwater quality is expected once the Active Water Treatment Facility South is in operation.

The assessment also suggested the presence of groundwater preferential flow path on the east side of the Fording River valley from Kilmarnock Creek drainage to the Greenhouse Wells water system based on comparison of surface water and groundwater quality. Groundwater with concentrations of Cl above secondary screening criteria was identified to flow down-valley parallel to the Fording River. As part of the SSGMP, additional monitoring locations were recommended within the Fording River valley-bottom to monitor the impacts of Kilmarnock Creek drainage on groundwater quality, confirm the groundwater preferential flow path from Kilmarnock Creek, confirm the vertical extent of the aquifer and increase the lateral coverage in the southern area of FRO.

In 2016, a new monitoring well, GH_MW-PC, was drilled and added to GHO SSGMP to monitor groundwater impacts associated with historical waste spoils in the Porter Creek drainage.

5.2.2 Groundwater Levels

Manual water level measurements were provided for FR_09-01-A/B for each of the four quarters in 2017 (Table 2). Groundwater elevations from May 2015 to November 2017 were plotted on a time-series graph and included in Appendix III (Graph 1-1). Groundwater elevations at both wells followed a seasonal trend with higher groundwater elevations recorded in June. Water levels at FR_09-01-A/B varied by up to approximately 6.5 m between June and November 2017. Between May 2015 and November 2017 groundwater elevations ranged from 1577.31 masl to 1,583.77 masl (FR_09-01-A) and 1,576.72 masl to

1,583.26 masl (FR_09-01-B). Based on groundwater elevations recorded at FR_09-01-A/B, the vertical groundwater flow is inferred to be downward from the shallow sandy gravel unit towards the deeper gravel unit (Table 2). The calculated vertical hydraulic gradient at FR_09-01-A/B varied from -0.04 to -0.05 in 2017 (Appendix V). Groundwater elevations for the fourth quarter of 2017 are shown on Drawing 635544-306 to provide regional context.

Consistent with the RGMP, groundwater levels were not recorded at FR_GHHW.

5.2.3 Groundwater Quality

A summary of results above primary and secondary screening criteria for Study Area 1 are presented in tables below and select CI are presented in Appendix III, Graphs 1-2 and 1-3. The analytical results compared to screening criteria are presented in Tables 3 and 4 (primary screening) and Table 5 (secondary screening).

Table Q: Summary of Constituents above Primary Screening Criteria for Study Area 1

Parameter 1,2,3	FR_09-01-A				FR_09-01-B				FR_GHHW4			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Nitrate	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW
Nitrite	-	-	-	-	-	-	-	-	-	-	AW	-
Lithium	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW
Selenium	AW DW LW IW	AW DW LW IW	AW DW LW IW	AW DW LW IW	AW DW LW IW	AW DW LW IW	AW DW LW IW	AW DW LW IW	AW DW LW IW	AW DW LW IW	AW DW LW IW	AW DW LW IW

Notes: 1) Dissolved parameter unless otherwise indicated; 2) Primary screening criteria applied are CSR standards for Aquatic Life (AW), Drinking Water (DW), Livestock (LW) and Irrigation (IW); 3) '–' denotes result below primary screening criteria for given constituents; 4) FR_GHHW consists of four wells including FR_GH_WELL1, FR_GH_WELL2, FR_GH_WELL3, and FR_GH_WELL4. As a recommendation of the hydrogeological assessment (SNC-Lavalin, 2017b), monitoring of a dedicated well (FR_GH_WELL4) began in Q4 2017.

Wells in the Fording River valley contained dissolved lithium concentrations greater than the CSR DW standard. Lithium concentrations were similar to previous years; however, new standards for dissolved lithium implemented in 2017 resulted in lithium screening above primary criteria. The source of dissolved lithium is inferred to originate from natural sources (interaction with bedrock and/or unconsolidated materials) as it is present in concentrations above CSR DW throughout the Elk Valley, including in background location FR_HMW5. A review of dissolved lithium in groundwater was performed in Section 5.1.3 above.

The only other constituent, other than CI, that was greater than the primary screening criteria was nitrite. Nitrite concentrations of 398 µg/L were measured in FR_GHHW in 2017 Q3. The Q3 result is considered anomalous as it is approximately 800 times more than the previous sample concentration (<0.5 µg/L; 2017 Q2) and more than 5 times the highest concentration measured at this location since 2012 (69.2 µg/L in 2015 Q4).

Secondary screening was completed where sample concentrations exceeded primary screening criteria for selenium. Table R shows the summary of results above secondary screening criteria. Most samples were above secondary SPO and DW criteria and one sample was also above CP criteria.

Table R: Summary of Results above Secondary Screening Criteria in Study Area 1

Parameter [1,2]	FR_09-01-A				FR_09-01-B				FR_GHHW[a]			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Selenium	SPO, DW	SPO, DW	SPO, DW	SPO, CP, DW	SPO, DW	SPO, DW	-	SPO, DW	SPO, DW	SPO, DW	SPO, DW	SPO, DW

Notes: 1) '–' denotes result below secondary screening criteria; and 2) Secondary screening criteria are Site Performance Objective (SPO), Compliance Point (CP) and GCDWQ for drinking water (DW). [a] FR_GHHW consists of four wells including FR_GH_WELL1, FR_GH_WELL2, FR_GH_WELL3, and FR_GH_WELL4. As a recommendation of the hydrogeological assessment, monitoring of a dedicated well (FR_GH_WELL4) began in Q4 2017.

5.2.4 Discussion

Discussion of trends in groundwater quality in Study Area 1 focuses on dissolved selenium and nitrate-nitrogen, which are the CI above screening criteria. Drawing 635544-327 shows the spatial distribution of the concentrations of dissolved cadmium, dissolved selenium, sulphate, and nitrate-nitrogen for wells in Study Area 1. Time-series plots of dissolved selenium and nitrate-nitrogen from the selected wells located in Study Area 1 are shown in Appendix III (Graphs 1-2 and 1-3). For comparison purposes, surface water concentrations measured in Fording River at surface water station FR_FR2, FR_FR4, and in Kilmarnock Creek at surface water station FR_KC1 were added to Graphs 1-2 and 1-3.

At monitoring wells FR_09-01-A/B, downgradient of Kilmarnock Creek, dissolved selenium and nitrate-nitrogen were greater than the primary screening criteria in each quarter (Drawing 635544-327). Dissolved selenium concentrations in wells FR_09-01-A/B were also greater than the SPO and GCDWQ DW secondary screening criteria in most quarters and the CP secondary screening criteria in Q4 in 2017. Dissolved selenium concentrations in 2017 at FR_09-01-A/B (44.2 to 166 µg/L) were generally within historical ranges except for a historical high in Q4 (Appendix III, Graph 1-2). Nitrate-nitrogen concentrations in FR_09-01-A/B (12.7 to 54.3 mg/L) were slightly higher than concentrations measured in the last three years, but similar to concentrations measured in 2012 and 2013 (Appendix III Graph 1-3).

Dissolved selenium concentrations were higher in shallow well FR_09-01-A (68.1 µg/L to 166 µg/L) than in deeper well FR_09-01-B (44.2 µg/L to 126 µg/L). Nitrate-nitrogen concentrations display a similar trend with slightly higher concentrations in the shallower well, with the exception of Q2.

Two previously identified transport pathways for elevated dissolved selenium and nitrate-nitrogen concentrations in monitoring wells FR_09-01-A/B were recharge of groundwater from the Fording River and Kilmarnock Creek. Dissolved selenium and nitrate-nitrogen concentrations for both the Fording River (upstream surface water location FR_FR2) and Kilmarnock Creek (surface water location FR_KC1) are plotted on Graphs 1-2 and 1-3. Surface water at both of these sampling locations exhibits the lowest dissolved selenium and nitrate-nitrogen concentrations in June to August and the highest selenium concentrations in January through April (Appendix III, Graphs 1-2 and 1-3). This reflects the effects of dilution from runoff from the spring freshet and groundwater trends for these CI appear to be similar.

Farthest downgradient in monitoring well FR_GHHW, dissolved selenium and nitrate-nitrogen concentrations were similar to concentrations measured in upgradient well FR_09-01-A and generally higher than those measured in upgradient well FR_09-01-B. Dissolved selenium and nitrate-nitrogen in well FR_GHHW were above the primary screening criteria in each quarter and dissolved selenium was greater than SPO and GCDWQ DW secondary screening criteria in each quarter (Drawing 635544-327).

Dissolved selenium and nitrate-nitrogen concentrations in well FR_GHHW (Appendix III, Graphs 1-2 and 1-3) were less than concentrations measured in surface water at upstream location FR_KC1 (with the exception of one sample from June 2016) in Kilmarnock Creek.

Concentrations in Fording River surface water and the valley-bottom aquifer are increasing downgradient of the STP. Tributary valley-bottom groundwater flow from the Kilmarnock Creek drainage is a major source of mining-related constituents to Fording River valley-bottom groundwater in the area downgradient of the STP and is resulting in the higher concentrations observed at the FR_GHHW. Groundwater results from the Kilmarnock Creek alluvial fan in previous studies suggest that groundwater with elevated concentrations of CI flowing to the Fording River valley-bottom is probable (SNC-Lavalin, 2017b). In 2016 and 2017, CI concentrations were higher in FR_09-01-A/B and FR_GHHW than concentrations measured in the Fording River surface water monitoring station FR_FR4 (Graphs 1-2 and 1-3) and other wells located closer to Fording River (e.g. FR_09-02-A/B) monitored as part of the FRO SSGMP (SNC-Lavalin, 2018a). Increasing downgradient CI concentrations in Study Area 1 suggests the presence of a preferential groundwater flow path on the east side of the Fording River valley from Kilmarnock Creek drainage to FR_GHHW.

5.3 Study Area 2: Fording River Valley-bottom Downgradient of LCO Dry Creek

Study Area 2 was selected because the LCO SSGMP identified that it receives drainage from the permitted LCO Phase II mining in the southern portion of the LCO Dry Creek watershed. The LCO Phase II mining includes an estimated 500 ha footprint of waste rock storage (Golder, 2016). The Dry Creek Water Management System (DCWMS) was constructed to divert, convey, and treat mine-influenced surface runoff, which is interacting with waste rock associated with LCO Phase II mining, from the Dry Creek watershed. The DCWMS was fully commissioned in July 2015 and intercepts mine-influenced water and distributes it to two sediment ponds for treatment of TSS. Clarified water is returned to Dry Creek immediately downstream of sediment ponds (Golder, 2016).

The valley-bottom in the LCO Dry Creek watershed consists of a relatively thick till unit with little to no fluvial or glaciofluvial deposits (Appendix IV). The till has a relatively low hydraulic conductivity, on the order of 10^{-7} m/s to 10^{-9} m/s. Dry Creek is intermittent along some reaches and losses to groundwater are expected. A small lens of gravel of limited extent was identified in the till; however, no continuous aquifers were identified in the drainage. Monitoring wells LC_PIZDC1308 and LC_PIZDC1307 are shallow and deep wells installed in a colluvium/till and basal till, respectively, downstream of the DCWMS. These wells are downgradient of any potential mine influence and are expected to identify any mine-related impacts to groundwater; however, as noted in the 2017 RGMP (SNC-Lavalin, 2017a) the primary pathway to groundwater in the Fording River valley-bottom is through surface water in Dry Creek, which is monitored by station LC_DC3. There are also relevant surface water monitoring locations on the Fording River for Study Area 2 (shown on Drawing 635544-308).

5.3.1 Potential Sources and Transport Pathways

The 2017 RGMP identified potential sources of CI and potential transport pathways to valley-bottom groundwater in Study Area 2, summarized in the following table. Potential sources are also shown in plan on Drawing 635544-308.

Table S: Potential Sources and Transport Pathways for Study Area 2 (After SNC-Lavalin, 2017a)

Potential Sources	Potential Transport Pathways	Current Monitoring Location[1]
LCO Phase II waste rock storage	Surface water flow down Dry Creek valley-bottom and infiltration to groundwater in the vicinity of the Dry Creek Fan/Study Area 2.	LC_DC1, LC_DC3 (SWMP) (surface water) LC_PIZDC1307/1308 (RGMP)
Fording River	Recharge to groundwater from infiltration of the Fording River along some stretches.	LC_LC5 (SWMP)

1. SSGMP: Site-Specific Groundwater Monitoring Program; RGMP: Regional Groundwater Monitoring Program and SWMP: Surface Water Monitoring Program.

5.3.2 Groundwater Levels

Manual and continuous groundwater elevation data available for nested wells LC_PIZDC1308 (shallow) and LC_PIZDC1307 (deep) were reviewed and assessed for seasonal variability, vertical flow and long-term trends (manual values are presented in Table 2 and both manual and continuous data are presented in Appendix III, Graph 2-1). The data indicate a seasonal trend is apparent, with annual fluctuations in 2017 of 1.9 m and 5.1 m in LC_PIZDC1308 and LC_PIZDC1307, respectively (based on continuous level data). In 2017 the highest groundwater levels were measured in May and the lowest elevations were measured in March. The inferred vertical groundwater flow at the nested well LC_PIZDC1308/1307 was consistently downwards in 2017 (based on continuous groundwater level data) except for a short period at the end of May where vertical groundwater flow was reversed. The vertical hydraulic gradient calculated using the manual groundwater elevation data ranged in magnitude from -0.11 m/m to -0.01 m/m (Appendix V). The Q4 groundwater elevation measured at LC_PIZDC1308 and LC_PIZDC1307 is shown on Drawing 635544-306 to provide regional context.

5.3.3 Groundwater Quality

The analytical results compared to screening criteria are presented in Tables 3 and 4 (primary screening) and dissolved selenium is presented in Appendix III, Graph 2-2. A summary of results above primary screening criteria for Study Area 2 is presented in Table T below.

Table T: Summary of Non-order Constituents above Primary Screening Criteria Upgradient of Study Area 2

Parameter[1,2,3]	LC_PIZDC1307				LC_PIZDC1308			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Barium	DW	DW	DW	DW	-	-	-	-
Lithium	DW	DW	DW	DW	DW	-	DW	DW
Molybdenum	IW	IW/LW	IW	IW	-	-	-	-

Notes: 1) Dissolved parameter unless otherwise indicated; 2) Primary screening criteria applied are CSR standards for Aquatic Life (AW), Drinking Water (DW), Livestock (LW) and Irrigation (IW); 3) ‘ –‘ denotes result below primary screening criteria for given constituents.

Groundwater quality in LC_PIZDC1308 and LC_PIZDC1307 was below the primary screening criteria concentrations for CI; therefore, secondary screening was not completed.

Groundwater concentrations were above primary screening criteria for dissolved barium (DW) and dissolved molybdenum (IW or IW/LW) for each the sampling events in LC_PIZDC1307. Dissolved barium concentrations ranged from 1,380 to 1,460 µg/L and were above the CSR DW standard of 1,000 µg/L. The concentrations of dissolved molybdenum ranged from 33.0 to 61.6 µg/L, which were above the CSR IW of 10 - 30 µg/L and the CSR LW of 50 µg/L.

Dissolved lithium concentrations in both wells were greater than the CSR DW standard of 8 µg/L in each quarter with the exception of Q2 in LC_PIZDC1308. Dissolved lithium concentrations were similar to previous years and ranged from 19.0 µg/L to 79.5 µg/L; however, the standard for dissolved lithium changed from 730 µg/L to 8 µg/L on November 1, 2017, resulting in lithium screening above primary criteria.

The 2017 RGMP (SNC-Lavalin, 2017a) included a review of non-order constituents in groundwater (including dissolved barium, boron, manganese and molybdenum) with concentrations greater than the primary screening criteria. The majority of these non-order constituents originate from natural sources (e.g., interaction with bedrock or unconsolidated materials). These constituents have a wide spatial distribution across the region and are typically not present with the assemblage of CI in groundwater or surface water that indicate mine-influence (i.e., concentrations of CI above applicable criteria). A similar analysis of dissolved lithium was also performed in Section 5.1.3 above. Based on this information and the receptor information provided in the 2017 RGMP, the following interpretations were made:

› The source of barium and molybdenum is naturally occurring (interaction with bedrock or unconsolidated materials). These constituents above primary criteria are only noted in the deep well LC_PIZDC1307 installed in basal till which support the conclusion of the review.

› Similar to dissolved barium and molybdenum, the source of dissolved lithium is inferred to originate from natural sources (interaction with bedrock and/or unconsolidated materials). This is supported by concentrations above CSR DW throughout the Elk Valley, including in reference location FR_HMW5. The highest concentrations of dissolved lithium in Study Area 2 were in the deep well LC_PIZDC1307 installed in basal till which supports this interpretation.

Drinking or irrigation wells are not located in Study Area 2; therefore, there is no exposure pathway for these constituents.

5.3.4 Discussion

Study Area 2 was identified as an area where transport of CI to the Fording River valley-bottom may be occurring due to the LCO Phase II development in the LCO Dry Creek watershed. There are no groundwater wells in the Fording River valley-bottom aquifer in this area; however, a groundwater pathway to the valley-bottom has not been identified due to the lack of a continuous aquifer. Consequently, this data gap is considered to be addressed through monitoring of surface water in the LCO Dry Creek drainage and groundwater at LC_PIZDC1308 and LC_PIZDC1307 in the drainage. Drawing 635544-327 shows analytical results for dissolved cadmium, dissolved selenium, sulphate, and nitrate-nitrogen compared to primary and secondary screening criteria for samples collected in Study Area 2. Time series plots displaying dissolved selenium concentrations are in Appendix III (Graph 2-2). Results from 2017 are consistent with historical results showing groundwater quality in LC_PIZDC1308 and LC_PIZDC1307 below primary screening criteria for CIs. Concentrations in the shallow well LC_PIZDC1308 display a seasonal trend with higher concentrations measured in June (Tables 3 and 4).

To assess groundwater and surface water interactions, selenium concentrations measured in groundwater at LC_PIZDC1308 and LC_PIZDC1307 were compared to concentrations in surface water in LCO Dry Creek (LC_DC1 and LC_DC3; Appendix III, Graph 2-2). Selenium concentrations in groundwater at LC_PIZP1307 (deep well) and LC_PIZP1308 (shallow) were below the detection limits or slightly above the detection limit for each sample collected in 2017. Selenium concentrations in groundwater have been relatively low and stable since December 2014 and are lower than concentrations measured in LCO Dry Creek. Selenium concentrations in Dry Creek surface water were higher than groundwater and took a step-wise increase in 2017 (Graph 2-2), whereas no concurrent increase was noted for groundwater. Fording River concentrations at station LC_LC5 (formerly LC_FRDSDC), located in Study Area 2, were higher than surface water concentrations in Dry Creek. The current contribution of CI to groundwater from infiltration of Dry Creek over the alluvial fan is interpreted to be minimal, compared to the existing load of CI in the Fording River, which has the potential to infiltrate to groundwater in the Study Area.

5.4 Study Area 3: Fording River Valley-bottom Downgradient of GHO Rail Loop and Greenhills Creek

Study Area 3 was selected because the GHO SSGMP identified potential sources (upland groundwater from GHO) as well as surface water and groundwater transport pathways that provided loading to the Fording River valley-bottom. Study Area 3 is situated downgradient from GHO, and Greenhills Creek is the main tributary that flows into the Fording River valley-bottom. Fording River valley-bottom sediments in Study Area 3 are approximately 70 m thick and consist mainly of coarse-grained glaciofluvial deposits (sand and gravel) confined by a clay/silty clay unit as shown on cross sections D-D’ and E-E’ (Drawings 635544-315 and -316) and the block diagram shown in Appendix IV.

In Study Area 3, four supply wells (GH_POTW09, GH_POTW10, GH_POTW15 and GH_POTW17) located in the area near the rail loop were included in the RGMP. Since the 2015 RGMP, one monitoring well, GH_MW-RLP-1D, was installed as part of the GHO SSGMP (Hemmera, 2017a). The well was installed in till to a depth of 82 mbgs in the vicinity of the rail loop. Additional information has been reviewed and monitoring well GH_MW-RLP-1D in Study Area 3 was included in the 2017 RGMP (SNC-Lavalin, 2017a). This well was not part of the 2015 RGMP but has been added here for discussion purposes. Selected groundwater monitoring locations and relevant surface water locations for Study Area 3 are shown on Drawing 635544-308.

5.4.1 Potential Sources and Transport Pathways

The 2017 RGMP identified potential sources of CI and potential transport pathways to valley-bottom groundwater in Study Area 3, summarized in the following table. Potential sources are also shown in plan on Drawing 635544-308.

Table U: Potential Sources and Transport Pathways to Groundwater in Study Area 3 (After SNC-Lavalin, 2017a)

Potential Sources	Potential Transport Pathways	Current Monitoring Location[1]
Tailings Pond, Site A-E Rejects, Coal Wash Plant, Overland Conveyor.	Upland groundwater transport to valley-bottom.	GH_MW-TD, GH_MW-GHC-1S/D (SSGMP), GH_POTW17 (RGMP)
	Surface water flow from Greenhills Pond and infiltration to valley-bottom.	GH_GH1 (SWMP)
Clean Coal, Dryer Building/Ponds, Rail Loop/Loadout.	Upland groundwater transport to valley-bottom.	GH_MW-RLP-1D (SSGMP), GH_POTW09 (RGMP)
	Surface water infiltration.	GH_RLP (SWMP)
Upgradient Fording River valley bottom groundwater.	Potential down-valley groundwater flow from upgradient Study Area 2.	GH_POTW09, GH_POTW10, GH_POTW15 (RGMP)
Fording River.	Surface Water infiltration.	GH_POTW09, GH_POTW10, GH_POTW15 (RGMP), GH_FR1 (SWMP)

1. SSGMP: Site-Specific Groundwater Monitoring Program; RGMP: Regional Groundwater Monitoring Program and SWMP: Surface Water Monitoring Program.

5.4.2 Groundwater Levels

Groundwater levels for 2017 supply wells were not available, but continuous recording of water levels is currently being performed. Seasonal variability and long-term trends in groundwater elevations in GH_MW-RLP-1D were assessed using manual water level measurements as well as continuous groundwater level data (Graph 3-1). Groundwater elevations at GH_MW-RLP-1D ranged from 1488.23 masl to 1489.74 masl in 2017. Overall, groundwater elevations fluctuated by 1.5 m in 2017, with the highest water level measured in June 2017. This well was installed in 2016 and limited historical data exists; therefore, no further trends are discernible at this time.

5.4.3 Groundwater Quality

The analytical results compared to screening criteria are presented in Tables 3 and 4 (primary screening) and Table 5 (secondary screening) and select CI are presented in Appendix III, Graphs 3-2 and 3-3. CI were below primary screening criteria. Non-order constituents above primary screening criteria are shown in Table V and Table W below.

Table V: Summary of Non-order Constituents above Primary Screening Criteria for Study Area 3 (1/2)

Parameter[1,3]	GH_POTW09				GH_POTW10				GH_POTW15				GH_POTW17[2]			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Lithium	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW
Manganese	IW	-	-	-	-	IW	-	-	-	-	-	IW	-	-	-	-

Notes: 1) Dissolved parameter unless otherwise indicated; 2) Primary screening criteria applied are CSR standards for Aquatic Life (AW), Drinking Water (DW), Livestock (LW) and Irrigation (IW); 3) ' –' denotes result below primary screening criteria for given constituents.

Table W: Summary of Non-order Constituents above Primary Screening Criteria for Study Area 3 (2/2)

Parameter[1,3]	GH_MW-RLP-1D			
	Q1	Q2	Q3	Q4
Fluoride	IW, DW, LW	IW, DW, LW	IW, DW, LW	IW, DW, LW

Notes: 1) Dissolved parameter unless otherwise indicated; 2) Primary screening criteria applied are CSR standards for Aquatic Life (AW), Drinking Water (DW), Livestock (LW) and Irrigation (IW); 3) ‘ –‘ denotes result below primary screening criteria for given constituents.

Groundwater quality in GH_POTW09, GH_POTW10, and GH_POTW15 was above primary screening criteria for manganese (IW) for one quarter each in 2017 with concentrations between 202 to 211 µg/L. Manganese concentrations are inferred to be naturally elevated due to limited interaction with atmosphere based on the review performed in the 2017 RGMP (SNC-Lavalin, 2017a). Lithium concentrations were greater than the CSR DW standard at GH_POTW09, GH_POTW10, GH_POTW15, and GW_POTW17. Lithium concentrations were similar to previous years and ranged from 11.5 µg/L to 17.6 µg/L; however, new standards for dissolved lithium implemented in 2017 resulted in lithium screening above primary screening criteria. The source of dissolved lithium is inferred to originate from natural sources (interaction with bedrock and/or unconsolidated materials) as it is present in concentrations above CSR DW throughout the Elk Valley, including in background location FR_HMW5. A review of dissolved lithium in groundwater was performed in Section 5.1.3 above.

Monitoring well GH_MW-RLP-1D was installed at a total depth of 82.5 m and is interpreted to be relatively hydraulically isolated from groundwater or surface water systems that would be mine-influenced. Fluoride concentrations at this location are interpreted to be naturally occurring and derived from water interaction with unconsolidated materials (SNC-Lavalin, 2017; 2018).

Drinking or irrigation wells are not located in Study Area 3; therefore, there is no exposure pathway for these constituents.

5.4.4 Discussion

The concentrations of Cl in GH_POTW09, GH_POTW10, GH_POTW15, GH_POT17, and GH_MW-RLP-1D were below primary screening criteria in 2017. Time series plots of dissolved selenium and sulphate concentrations are shown in Appendix III (Graphs 3-2 and 3-3). To assess groundwater and surface water interactions, selenium and sulphate concentrations in surface water in the Fording River (GH_FR1) and Greenhills Creek (GH_GH1) were plotted. Drawing 635544-327 shows the spatial distribution of dissolved cadmium, dissolved selenium, sulphate, and nitrate-nitrogen for samples collected in Study Area 3.

Surface water dissolved selenium concentrations in the Fording River at GH_FR1 and Greenhills Creek GH_GH1 were consistently higher than groundwater concentrations at RGMP wells in Study Area 3 (Appendix III, Graph 3-2). In 2017, dissolved selenium concentrations at GH_FR1 ranged from 20.7 to 75.6 µg/L and from 22.1 to 199 µg/L in GH_GH1. Surface water dissolved selenium concentrations at GH_FR1 and GH-GH1 follow a seasonal trend with higher concentrations measured in the late summer, fall, and winter months and lower concentrations measured during spring freshet as a result of dilution.

Silt and clay units at surface in the Fording River valley-bottom appear to provide a barrier to downward transport of CI to the aquifer with water supply wells. Comparison of groundwater quality in this aquifer to surface water in the Fording River (GH_FR1) indicates that concentrations of dissolved selenium were approximately one order of magnitude lower; however, sulphate concentrations were relatively similar or higher (GH_POTW17) compared to surface water in the Fording River (Appendix III, Graph 3-3). The sulphate may be naturally sourced or a result of infiltration from Greenhills Creek over the alluvial fan; if the latter is occurring, then associated dissolved selenium contributions from Greenhills Creek may have preferentially attenuated in the aquifer.

Concentrations of selenium at GH_MW-RLP-1D ranged from 0.08 to 6.53 µg/L in 2017. Fluctuation in dissolved selenium concentrations appear to be similar to fluctuations measured in nearby surface water samples (GH_FR1 and GH_GH1) with the lowest concentration measured during freshet (Appendix III, Graph 3-2). No significant variation or trend in dissolved sulphate concentrations has been observed at GH_MW-RLP-1D.

The relatively low dissolved selenium and sulphate concentrations measured at GH_MW-RLP-1D compared to concentrations at GH_FR1 suggest little influence from Fording River surface water (Appendix III, Graphs 3-2 and 3-3). This is consistent with the interpretation that a relatively continuous aquitard exists in the Fording River valley.

5.5 Study Area 4: Elk River Valley-bottom Downgradient of Leask, Wolfram, and Thompson Creeks

Study Area 4 is situated downgradient from the west side of GHO and was selected because the GHO SSGMP identified potential sources of CI from the Mickelson, Leask, Wolfram, and Thompson Creek drainages. The SSGMP also identified surface water and upland groundwater infiltration as transport pathways from these potential sources to the Elk River valley-bottom. Surface water from each of these creeks is diverted to settling ponds near the valley-bottom and groundwater in upland areas is inferred to flow toward the Elk River valley-bottom. The boundaries of Study Area 4 were modified as part of the 2017 RGMP (SNC-Lavalin, 2017a) to reflect information from the GHO SSGMP that indicated groundwater from the tailings pond may flow towards the Elk River.

Valley-bottom deposits are predominantly fluvial and glaciofluvial in this area (Appendix IV) with a number of former Elk River channels identified; however, the stratigraphy in boreholes at monitoring well locations GH_GA-MW-1 and GH_GA-MW-2 were lower permeability till and lacustrine/glaciolacustrine (i.e., soft, silty clay) sediment. To the south at wells GH_GA-MW-3 and GH_GA-MW-4, coarse-grained sediment, including sub-angular gravel, infers glaciofluvial deposits overlying local bedrock. Monitoring well GH_MW-ERSC-1, situated approximately 1 km south of the Lower Thompson Creek Settling Pond, is installed in fluvial sand and gravel. The linear distribution of the monitoring wells in the valley-bottom does not allow for triangulation for determining groundwater flow direction; however, groundwater is expected to discharge to the Elk River, with a flow component parallel or sub-parallel to the river. Cross section F-F' depicts this stratigraphy, approximately parallel to the Elk River (Drawing 635544-317).

The RGMP for Study Area 4 includes five monitoring wells (GH_GA-MW-1, GH_GA-MW-2, GH_GA-MW-3, GH_GA-MW-4, and GH_MW-ERSC-1), one water supply well (RG_DW-01-03), and one domestic well (RG_DW-01-07). RGMP wells and relevant surface water locations for Study Area 4 are shown on Drawing 635544-308.

5.5.1 Potential Sources and Transport Pathways

The 2017 RGMP identified potential sources of CI and potential transport pathways to valley-bottom groundwater in Study Area 4, summarized in the following table. Potential sources are also shown in plan on Drawing 635544-308.

Table X: Potential Sources and Transport Pathways to Groundwater in Study Area 4 (After SNC-Lavalin, 2017a)

Potential Sources	Potential Transport Pathways	Current Monitoring Location[1]
Waste Spoils in Leask, Wolfram, Thomson Creek drainages, and ponds at the base of each of these drainages.	Upland groundwater transport to valley-bottom.	GH_GA-MW-1, GH_GA-MW-2, GH_GA-MW-3, GH_GA-MW-4 (SSGMP and RGMP), GH_MW-UTC-1S/D (SSGMP)
	Surface water flow from ponds and infiltration to valley-bottom.	GH_MC1, GH_LC1, GH_TC2 (SWMP)
Tailings Pond.	Upland groundwater transport to valley bottom	GH_MW-TD (SSGMP)
Elk River.	Surface water infiltration.	GH_MW-ERSC-1 (RGMP)

1. SSGMP: Site-Specific Groundwater Monitoring Program; RGMP: Regional Groundwater Monitoring Program and SWMP: Surface Water Monitoring Program.

Surface water from the Leask, Wolfram, and Thomson Creek drainages flows from rock drains on the Elk River valley flanks to the valley bottom and has the potential to infiltrate through settling ponds.

5.5.2 Groundwater Levels

Continuous groundwater level data available from level loggers installed in GH_GA-MW-1, GH_GA-MW-2 and GH_GA-MW-3 were recorded along with manual water level measurements during the monitoring period (Table 2). Groundwater elevations from January 2015 to December 2017 were plotted on a time-series graph and included in Appendix III (Graph 4-1). Groundwater elevations at GH_GA-MW-2, GH_GA-MW-3, GH_GA-MW-4 (manual only, Table 2), and GH_MW-ERSC-1 exhibited a seasonal trend with generally higher groundwater elevations during the spring freshet from mid-March to June whereas groundwater elevations at GH_GA-MW-1 were relatively consistent throughout the year and did not appear to vary seasonally.

The fluctuation in groundwater levels in GH_GA-MW-2 and GH_GA-MW-3 was relatively high, ranging from 3.3 to 7.3 m, respectively. Groundwater elevations in GH_GA-MW-1 showed a time lag of approximately 30 days for groundwater levels to return to static levels after a sampling event. This is consistent with the low hydraulic conductivity value (1 x 10^{-12} m/s) reported in previous studies.

Groundwater elevations prior to sampling for the fourth quarter were selected and shown on Drawing 635544-306 to provide regional context.

5.5.3 Groundwater Quality

Analytical results compared to screening criteria are presented in Tables 3 and 4 (primary screening) and Table 5 (secondary screening) and dissolved selenium is presented in Appendix III, Graph 4-2. A summary of results above primary and secondary screening criteria for Study Area 4 is presented in Table Y and Table Z below.

Table Y: Summary of CI above Primary Groundwater Screening Criteria for Study Area 4 (1/2)

Parameter[1,2,3]	GH_GA-MW-1	GH_GA-MW-4	GH_GA-MW-2				GH_GA-MW-3			
	Q1 to Q4	Q1 to Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Selenium	-	-	-	-	-	DW	-	-	-	DW

Notes: 1) Dissolved parameter unless otherwise noted; 2) Primary screening criteria applied are CSR standards for Aquatic Life (AW), Drinking Water (DW), Livestock (LW) and Irrigation (IW); 3) '–' denotes result below primary screening criteria for given constituents.

Table Z: Summary of CI above Primary Groundwater Screening Criteria for Study Area 4 (2/2)

Parameter[1,2,3]	GH_MW-ERSC-1		RG_DW-01-03				RG_DW-01-07			
	Q1-Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Selenium	-	AW, DW, IW, LW	-	-	-	-	-	-	-	-

Notes: 1) Dissolved parameter unless otherwise noted; 2) Primary screening criteria applied are CSR standards for Aquatic Life (AW), Drinking Water (DW), Livestock (LW) and Irrigation (IW); 3) '–' denotes result below primary screening criteria for given constituents.

Of the CI, selenium concentrations were measured above primary screening criteria in Study Area 4 in groundwater at locations GH_GA-MW-2, GH_GA-MW-3, and GH_MW-ERSC-1 in Q4 in 2017 (Appendix III, Graph 4-2). Selenium concentrations ranged from 18.9 to 68.7 µg/L. Results for selenium concentrations for GH_GA-MW-2 and GH_GA-MW-3 were consistent with historical results; however, concentrations at GH_GA-MW-2 and GH_GA-MW-3 were no longer above the CSR AW standard (now only above CSR DW) due to the updated standard on November 1, 2017 (CSR AW now 20 µg/L). Selenium concentrations in Q4 (68.7 µg/L) at GH_MW-ERSC-1 are one to two orders of magnitude higher than other concentrations measured in 2016 and 2017; however, they are within range of concentrations measured in 2014 and 2015.

A summary of non-order constituents with concentrations above primary screening criteria for at least one sampling event in 2017 is listed in Table AA.

Table AA: Summary of Non-order Constituents above Primary Groundwater Screening Criteria for Study Area 4

Parameter[1,2,3]	GH_GA-MW-1	GH_GA-MW-4	GH_GA-MW-2	GH_GA-MW-3	GH_MW-ERSC-1	RG_DW-01-03	RG_DW-01-07
Boron	IW (Q1-Q4)	-	-	-	-	-	-
Lithium	DW(Q1-Q4)	DW (Q1-Q4)	DW (Q1-Q4)	DW (Q1-Q4)	DW (Q1, Q3, Q4)	-	-

Table AA (Cont'd): Summary of Non-order Constituents above Primary Groundwater Screening Criteria for Study Area 4

Parameter[1,2,3]	GH_GA-MW-1	GH_GA-MW-4	GH_GA-MW-2	GH_GA-MW-3	GH_MW-ERSC-1	RG_DW-01-03	RG_DW-01-07
Manganese	IW (Q3, Q4)	-	-	-	-	-	-
Molybdenum	IW, LW (Q3,Q4)	-	IW (Q1-Q4)	-	-	-	-
Strontium	DW (Q1-Q4)	-	-	-	-	-	-

Notes: 1) Dissolved parameter unless otherwise indicated; 2) Primary screening criteria applied are CSR standards for Aquatic Life (AW), Drinking Water (DW), Livestock (LW) and Irrigation (IW); and 3) '–' denotes result below primary screening criteria for given constituents.

Groundwater analytical results from 2017 and concentrations above primary screening criteria were similar to previous years with the following exceptions:

- Dissolved lithium concentrations exceeded the CSR DW standards at each location, with the exception of RG_DW-01-03 and RG_DW-01-07, due to the updated standard that was reduced from 730 µg/L to 8 µg/L on November 1, 2017; however, concentrations remained consistent with historical results. The source of dissolved lithium is inferred to originate from natural sources (interaction with bedrock and/or unconsolidated materials) as it is present in concentrations above CSR DW throughout the Elk Valley, including in background location FR_HMW5. A review of dissolved lithium in groundwater was performed in Section 5.1.3 above;
- Dissolved strontium exceeded the CSR DW standard at GH_GA-MW-1 for each sampling event in 2017 due to the updated standard that was reduced from 22,000 µg/L to 2,500 µg/L on November 1, 2017; however, concentrations remained consistent with historical results; and
- Molybdenum concentrations increased to a historical high at GH_GA-MW-1 in September 2017 (85.7 µg/L) and subsequently decreased to 21.4 µg/L and were a similar magnitude as historical results starting in February 2015. Molybdenum concentrations in GH_GA-MW-2 ranged from 20.0 to 35.4 µg/L with the highest concentration recorded in September 2017. Q3 concentrations were higher than concentrations measured in 2015 and 2016.

The 2017 RGMP (SNC-Lavalin, 2017a) included a review of non-order constituents in groundwater with concentrations greater than primary screening criteria, which included dissolved manganese, boron, and molybdenum. Based on this information and the receptor information provided in the 2017 RGMP, the following interpretations were made:

- Manganese concentrations at GH_GA-MW-1 are inferred to be naturally elevated due to limited interaction with atmosphere. GH_GA-MW-1 is screened in clayey sand directly overlying bedrock with a reported low measured hydraulic conductivity of 1×10^{-12} m/s (Hemmera, 2017b);
- Dissolved boron at GH_GA-MW-1 is inferred to be naturally occurring and derived from interaction with bedrock. Dissolved boron concentrations were above CSR IW standard of 500 µg/L to 6,000 µg/L based on crop sensitivity. Boron concentrations since 2015 at GH_GA-MW-1 ranged from 717 to 909 µg/L and would generally only affect the very sensitive to sensitive crops. Irrigation wells are not located in this area; therefore, dissolved boron is not currently considered a concern; and

- The source of molybdenum at GH_GA-MW-1 and GH_GA-MW-2 is inferred to be naturally occurring and originating primary from bedrock. GH_GA-MW-1 is installed in fine-grained materials above bedrock and GH_GA-MW-2 is installed in a permeable sand unit above the bedrock contact.

Dissolved selenium concentrations in GH_GA-MW-2, GH_GA-MW-3, and GH_MW-ERSC-1 were compared with secondary screening criteria. Table BB shows the summary of results above secondary screening criteria in groundwater. Selenium concentrations were above secondary screening criteria at these three locations in Q4 (Appendix III, Graph 4-2).

Table BB: Summary of CI above Secondary Screening Criteria for Study Area 4

Parameter[1,2,3]	GH_GA-MW-2				GH_GA-MW-3				GH_MW-ERSC-1			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Selenium	-	-	-	CP	-	-	-	CP, SPO	-	-	-	DW, SPO, CP

Notes: 1) Secondary screening criteria are Site Performance Objective (SPO), Compliance Point (CP) and GCDWQ for drinking water (DW); and 2) '–' denotes result below secondary screening criteria.

5.5.4 Discussion

Discussion of trends in groundwater quality in Study Area 4 focuses on dissolved selenium concentrations, the CI above the primary and secondary screening criteria in select monitoring wells. Sulphate previously exceeded the CSR DW standard of 500 mg/L at GH_GA-MW-1 and GH_GA-MW-4; however, the maximum sulphate concentrations at these wells in 2017 were 344 mg/L (September) at GH_GA-MW-1 and 215 mg/L (January) at GH_GA-MW-4. Drawing 635544-327 shows the spatial distribution of dissolved selenium, dissolved cadmium, sulphate, and nitrate-nitrogen for samples collected in Study Area 4. A time series plot of dissolved selenium from wells located in Study Area 4 and included in the 2017 RGMP is shown in Appendix III (Graph 4-2). To compare groundwater concentration trends to surface water in Study Area 4, dissolved selenium concentrations measured in nearby surface water in the Elk River (GH_ERC and GH_ER2), Thompson Creek (GH_TC2), Wolfram Creek (GH_WC1) and Leask Creek (GH_LC1) were plotted on the graphs.

Dissolved selenium concentrations have historically been greatest at downstream locations from tributary drainages: GH_GA_MW-4 (Leask Creek catchment), GH_GA-MW-2 (Wolfram Creek catchment) and GH_GA-MW3 (Thompson Creek catchment; Appendix III, Graph 4-2). Historically dissolved selenium concentrations were highest at GH_GA-MW-3; however, in 2017, dissolved selenium concentrations in GH_GA-MW-2 were higher. Dissolved selenium at GH_GA-MW-3 has varied considerably since 2014 with no distinct seasonal or long-term trends. Dissolved selenium concentrations at GH_GA-MW-2 decreased from 17.9 µg/L November 2016 to 7.87 µg/L in January 2017, consistent with values measured in 2014 and 2015. In November 2017, concentrations subsequently increased to 18.9 µg/L, which was consistent with 2016 ranges. No significant variation in selenium concentrations were noted at GH_GA-MW-1 and GH_GA-MW-4. Dissolved selenium concentrations measured farthest downgradient in GH_MW-ERSC-1 were the highest concentrations (68.7 µg/L) measured in Study Area 4 RGMP wells. Results for 2017 from GH_MW-ERSC-1 are consistent with concentrations measured in 2014 and 2015 and suggest large variability in selenium concentrations.

Surface water selenium concentrations in tributary surface water stations (GH_LC1, GH_WC1 and GH_TC2) have consistently been higher than concentrations in groundwater samples and at least an order of magnitude higher than surface water from Elk River (GH_ER2 and GH_ERC). This suggests that surface water from the tributaries is the primary pathway for transport of CI to the Elk River valley-bottom. Seasonal fluctuations in groundwater elevations have historically been greatest at GH_GA-MW-3, located approximately 380 m from GH_TC2, suggesting the well is influenced by freshet. Concentrations of dissolved selenium in groundwater also appear to be greatest during times of low flow, suggesting that local-scale interaction with surface water may have occurred at this location. A more muted seasonal trend in groundwater elevations has been observed at GH_GA-MW-2; however, slight seasonal fluctuations of selenium were measured, suggesting some localized surface water influence in this area.

The relatively high concentrations of CI (i.e., either approaching or above primary criteria) at GH_MW-ERSC-1 in comparison to surface water concentrations at Elk River surface water station GH_ERC (located adjacent to GH_MW-ERSC-1) suggest a groundwater pathway may exist at this location. This well is completed in a sand unit above bedrock (logged as a till) with a hydraulic conductivity of 3×10^{-6} m/s. Concentrations in Q4 in GH_MW-ERSC-1 were much higher than upgradient wells GH_GA-MW-2 and GH_GA-MW-3, suggesting either a surface water influence or another source between these wells. The SSGMP did not identify any sources in the vicinity and there are no adjacent tributary drainages; however, well GH_MW-ERSC-1 is situated approximately 45 m from the Elk River side channel which does contain surface flows from tributaries in Thompson Creek and Wolfram Creek. Consequently, it is possible that the intermittent elevated concentrations may be due to infiltration from surface water in the side channel.

Downgradient groundwater quality in the Elk River valley-bottom improves, and delineation (i.e., extent of groundwater impacts) is achieved on a regional scale. Selenium concentrations in the valley-bottom groundwater were below screening criteria at the water supply well RG_DW-01-03, with concentrations decreasing further downgradient of Elkford at domestic well location RG_DW-01-07, suggesting dilution is occurring along the valley-bottom groundwater down-valley flow path due to mixing with surface water and additional fresh water inputs.

5.6 Study Areas 5 and 6: Fording River Valley-bottom Downgradient of LCO

Study Area 5 was selected because the LCO SSGMP identified possible inputs of CI from Line Creek and the Process Plant to Fording River valley-bottom. After exiting LCO Phase I area, Line Creek flows through incised bedrock towards the Fording River, losing approximately 60 m in elevation (from about 1,300 masl) over an alluvial fan. Study Area 6 was selected as it spans the Elk River valley-bottom and is downgradient of the LCO Process Plant (AMEC, 2010). Additionally, Study Areas 5 and 6 were selected as the RDW Sampling Program identified elevated selenium in groundwater downgradient of the confluence of the Fording and Elk rivers.

Bedrock at the confluence of the Fording and Elk rivers may locally affect river grade and restrict groundwater recharge to the valley-bottom (SNC-Lavalin, 2015a). In this area, surficial geology indicates that the depositional environment in the valley-bottom was glaciofluvial and fluvial (Appendix IV). Bedrock elevations and detailed surficial stratigraphy, well installation details, and groundwater elevations in Study Areas 5 and 6 are presented on cross section G-G' and H-H' (Drawings 635544-318 and -319). Cross section G-G' is perpendicular to groundwater flow and extends from Fording River to the north to the East Refuse Expansion to the south. Cross section H-H' is parallel to groundwater flow and extends from Line Creek in the northeast to the Elk River in the southwest. For the RGMP, there are no monitoring wells within Study Area 5 and one monitoring well, LC_PIZP1101, is located in Study Area 6 (Drawing 635544-309). Monitoring well LC_PIZP1101 is screened in a deeper sand aquifer at approximately 41 mbgs.

5.6.1 Potential Sources and Transport Pathways

The 2017 RGMP identified potential sources of CI and potential transport pathways to valley-bottom groundwater in Study Areas 5 and 6, summarized in the following table. Potential sources are also shown in plan on Drawing 635544-309.

Table CC: Potential Sources and Transport Pathways to Groundwater in Study Areas 5/6 (After SNC-Lavalin, 2017a)

Potential Sources	Potential Transport Pathways	Current Monitoring Location[1]
ERX Coarse Coal Rejects (CCR) Dump South Rejects near the Process Plant.	Upland groundwater flow towards Elk River valley bottom in Study Area 6.	No monitoring well
Line Creek.	Surface water infiltration to ground.	LC_PIZP1101 (RGMP and LCO SSGMP) LC_PIZP1103, LC_PIZP1104 and LC_PIZP1105 (LCO SSGMP) LC-LC4 (SWMP)
	Discharge to Fording River.	LC_LC4 and LC_LC5 (SWMP)
Fording River.	Surface water infiltration.	LC_LC5 (SWMP)
Elk River.	Surface water infiltration.	EV_ER4 (SWMP)

1. LCO SSGMP: Line Creek Operations Site-Specific Groundwater Monitoring Program; RGMP: Regional Groundwater Monitoring Program and SWMP: Surface Water Monitoring Program

Loading of mine-influenced constituents to groundwater valley-bottom in Study Areas 5 and 6 is inferred to be primarily from Line Creek surface water upstream from the Process Plant. Line Creek flows through bedrock canyon upstream from the Process Plant and then is inferred to flow over an alluvial fan and loses water to ground. Borehole logs suggest the presence of a southwest-northeast oriented linear channel of sand and gravel from Line Creek to Elk River that may act as a preferential groundwater flow path to the valley bottom. The sand and gravel channel acting as a potential groundwater flowpath is shown on sections G-G' and H-H' (Drawings 635544-318 and -319). The ultimate receptors for CI are the Elk River surface water and valley bottom groundwater.

In addition, the ERX CCR Dump and South Rejects near the Process Plant were identified as potential sources, with groundwater transport assumed to occur to the valley-bottom.

5.6.2 Groundwater Levels

In 2016, a level logger was installed in LC_PIZP1101 to monitor groundwater levels in Study Areas 5 and 6. Continuous groundwater level data along with manual water level measurements (Table 2) were plotted on Graph 6-1 (Appendix III) and reviewed and assessed for seasonal variability and long-term trends. The data indicate a seasonal trend is apparent, with annual fluctuations in 2017 of 1.0 m (based on continuous level data). In 2017, the highest groundwater levels were measured in June and the lowest elevations were measured in March. The discrepancies observed in 2016 between manual readings and level logger data (shown on Appendix III, Graph 6-1) appear to have been resolved in 2017. The groundwater elevation measured at LC_PIZP1101 prior to sampling for the fourth quarter is shown on Drawing 635544-306 to provide regional context.

5.6.3 Groundwater Quality

The analytical results compared to screening criteria are presented in Tables 3 and 4 (primary screening) and dissolved selenium is presented in Appendix III, Graph 6-2. A summary of results above primary screening criteria for Study Area 6 is presented in Table DD below.

Table DD: Summary of Non-order Constituents above Primary Screening Criteria for Study Area 6

Parameter[1,2,3]	LC_PIZP1101			
	Q1	Q2	Q3	Q4
Fluoride	IW, LW, DW	IW, LW, DW	IW, LW, DW	IW, LW, DW
Lithium	DW	DW	DW	DW
Manganese	IW	IW	IW	IW
Molybdenum	IW	IW	IW	IW

Notes: 1) Dissolved parameter unless otherwise indicated; and 2) Primary screening criteria applied are CSR standards for Aquatic Life (AW), Drinking Water (DW), Livestock (LW) and Irrigation (IW); and 3) '–' denotes result below primary screening criteria.

CI concentrations in groundwater in LC_PIZP1101 were below the primary screening criteria; therefore, secondary screening was not performed.

The 2017 results were similar to previous years with groundwater concentrations above primary screening criteria for dissolved molybdenum (IW) and fluoride (DW, IW and LW) for each quarter. In 2017, concentrations of manganese in LC_PIZP1101 were marginally above the CSR IW standard in each quarter.

The 2017 RGMP (SNC-Lavalin, 2017a) included a review of non-order constituents in groundwater with concentrations greater than primary screening criteria, which included fluoride, dissolved manganese and molybdenum. A similar review of dissolved lithium in groundwater was performed in Section 5.1.3 above. Based on this information and the receptor information provided in the 2017 RGMP, the following interpretations were made:

- Monitoring well LC_PIZP1101 is installed in a deep sand aquifer with limited interaction with atmosphere and connection to surface water. Dissolved molybdenum and manganese are inferred to originate from natural sources and low DO concentrations (less than 1 mg/L, except in Q4 when concentrations were 1.93 mg/L) reflecting reducing conditions may account for higher manganese concentrations in this deep well (41 mbgs) that would have limited exchange with atmospheric oxygen;
- Dissolved lithium concentrations exceeded the CSR DW standards due to the updated standard that was reduced from 730 µg/L to 8 µg/L on November 1, 2017; however, concentrations remained consistent with historical results. The source of dissolved lithium is inferred to originate from natural

sources (interaction with bedrock and/or unconsolidated materials) as it is present in concentrations above CSR DW throughout the Elk Valley, including in background location FR_HMW5; and

› LC_PIZP1101 is installed 41.2 mbgs in sand and has little connection with surface water. Fluoride concentrations at this location are interpreted to be naturally occurring and derived from water interaction with unconsolidated materials.

5.6.4 Discussion

Groundwater from the LCO Process Plant Site flows towards Study Area 6; however, relatively low concentrations of Cl were measured in groundwater collected from LC_PIZP1101 in 2017 (Drawing 63544-328). This is consistent with historical sampling results from several wells situated in the Process Plant Site.

To assess groundwater and surface water interactions, selenium concentrations measured in groundwater at LC_PIZP1101 were compared to concentrations in surface water in Line Creek (LC_LC4) and in the Elk River downstream of Study Area 6 (EV_ER4), respectively (Appendix III; Graph 6-2). Concentrations in groundwater at LC_PIZP1101 have been relatively low and stable since May 2013 and are substantially lower than concentrations measured in Line Creek and in the Elk River. Consequently, the most significant pathway for mine-affected water in Study Areas 5 and 6 is through surface water from Line Creek.

The 2017 RGMP indicated LC_PIZP1101 is not the most appropriate well to monitor the potential groundwater pathway in this area and that other wells at LCO (LC_PIZP1001, LC_PIZP1002, LC_PIZP1003, and LC_PIZP1004) intercept the unconfined sand and gravel aquifer as shown on cross sections G-G' and H-H' (Drawings 635544-318 and -319) and would be more appropriate. The results from 2107 monitoring confirm this interpretation.

5.7 Study Area 7: Elk River Valley-bottom Downgradient of Grave Creek

This area was selected because the EVO SSGMP identified potential sources of CI in the Harmer Creek drainage. Tributary surface water (i.e., Harmer Creek that flows to Grave Creek) and valley-bottom groundwater ultimately flows into the Elk River valley-bottom. Additionally, samples from the RDW Sampling Program (i.e., RG_DW-02-20) historically exceeded the primary screening criteria (AW and DW) for selenium; however, it is noted that historical dissolved selenium concentrations at RG_DW-02-20 no longer exceed the CSR AW standards due to the adjusted CSR standard which increased from 10 µg/L to 20 µg/L.

The surficial geology in the Grave Creek is mapped as colluvium; however, borehole logging at monitoring well EV_GV3gw indicates a relatively large thickness (i.e., up to 25 m) of loose sand and sub-angular gravel and silty gravel deposits. This well is situated near the confluence of Grave and Harmer Creeks, and thicker sediments in this area may be reflective of the Grave Creek alluvial fan. The groundwater level at EV_GV3gw is relatively deep, approximately 10 mbgs, with a saturated thickness of approximately 15 m. Based on a comparison of groundwater elevation with the elevation of Grave Creek, the creek appears to have a losing reach in this area, and accordingly the creek is interpreted to be losing along the approximate 120 m drop in elevation to the Elk River (Appendix IV). As such, groundwater from the Grave Creek valley-bottom is interpreted to flow into the Elk River valley-bottom.

The monitoring wells included in Study Area 7 are monitoring well EV_GV3gw, which monitors upland and tributary valley-bottom input from drainage to the northeast of EVO, and the domestic well RG_DW-02-20 that monitors groundwater in the Elk River valley-bottom. Monitoring wells and relevant surface water locations for Study Area 7 are shown on Drawing 635544-309. Drawing 635544-320, cross section I-I', shows the inferred geology parallel to groundwater flow in the valley bottom in Study Area 7.

5.7.1 Potential Sources and Transport Pathways

The 2017 RGMP identified potential sources of CI and potential transport pathways to valley-bottom groundwater in Study Area 7, summarized in the following table. Potential sources are also shown in plan on Drawing 635544-309.

Table EE: Potential Sources and Transport Pathways to Groundwater in Study Area 7 (After SNC-Lavalin, 2017a)

Potential Sources	Potential Transport Pathways	Current Monitoring Location[1]
EVO Dry Creek Spoils and other waste spoils located in Harmer Creek drainage.	Upland groundwater flow and surface water infiltration associated with Harmer Creek drainage.	EV_GV3gw (RGMP and EVO SSGMP) EV_HC1 (SWMP)
Upstream Elk River valley bottom groundwater.	Potential down-valley groundwater flow from upgradient Study Area 6.	RG_DW-02-20 (RGMP)
Elk River.	Surface water infiltration.	RG_DW-02-20 (RGMP) EV_ER4 (SWMP)

1. EVO SSGMP: Elkview Operations Site-Specific Groundwater Monitoring Program; RGMP: Regional Groundwater Monitoring Program and SWMP: Surface Water Monitoring Program.

5.7.2 Groundwater Levels

Continuous groundwater level data in Study Area 7, available from a level logger installed in monitoring well EV_GV3gw along with manual water level measurements (Table 2), were reviewed and assessed for seasonal variability and long-term trends. Groundwater elevations from January 2015 to December 2017 were plotted on a time-series graph and included in Appendix III (Graph 7-1). Groundwater elevations in EV_GV3gw ranged from 1,296.9 masl to 1,297.7 masl throughout the monitoring period and followed a seasonal trend with higher groundwater elevations recorded in the spring months. The groundwater elevation prior to sampling for the fourth quarter was selected and shown on Drawing 635544-307 to provide regional context.

5.7.3 Groundwater Quality

The analytical results compared to screening criteria are presented in Tables 3 and 4 (primary screening) and dissolved selenium is presented in Appendix III, Graph 7-2. A summary of results above primary screening criteria for Study Area 7 are presented in Table FF below.

Table FF: Summary of Constituents above Primary Screening Criteria for Study Area 7

Parameter[1,2,3]	EV_GV3gw				RG_DW-02-20			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Selenium	-	-	-	-	DW	DW	-	-

Notes: 1) Dissolved parameter unless otherwise indicated; 2) Primary screening criteria applied are CSR standards for Aquatic Life (AW), Drinking Water (DW), Livestock (LW) and Irrigation (IW); 3) ' –' denotes result below primary screening criteria.

Groundwater quality in the domestic well RG_DW-02-20 was above primary screening criteria for selenium (CSR DW) for Q1 and Q2 (Appendix III, Graph 7-2), but below the primary screening criteria for all non-order constituents. Groundwater concentrations in EV_GV3gw were below the primary screening criteria for all constituents including the four CIs. Secondary screening was performed for dissolved selenium concentrations in well RG_DW-02-20 and all results were below the secondary screening criteria.

Dissolved lithium was the only constituent measured above CSR standards in samples collected in 2017 from EV_GV3gw; concentrations ranged from 12.2 µg/L to 17.1 µg/L, above the DW standard of 8 µg/L. Lithium concentrations at EV_GV3gw were similar to concentrations measured in 2015 and 2016 but this constituent was not previously identified to be above DW standards as the DW standard for lithium prior to the November 1, 2017 update to the CSR was 730 µg/L. The source of dissolved lithium is inferred to originate from natural sources (interaction with bedrock and/or unconsolidated materials) as it is present in concentrations above CSR DW throughout the Elk Valley, including in background location FR_HMW5. A review of dissolved lithium in groundwater was performed in Section 5.1.3 above.

5.7.4 Discussion

Discussion of trends in groundwater quality in Study Area 7 focuses on dissolved selenium which exceeded the primary screening criteria in domestic well RG_DW-02-20. Drawing 635544-328 shows the spatial distribution of CI for samples collected in Study Area 7. A time series plot of dissolved selenium for EV_GV3gw and RG_DW-02-20 is shown in Appendix III (Graph 7-2).

To assess groundwater and surface water interactions, selenium concentrations measured in groundwater at EV_GV3gw and RG_DW-02-20 were compared to concentrations in surface water in Harmer Creek (EV_HC1) and in the Elk River upstream from the confluence with Grave Creek (EV_ER4), respectively (Appendix III, Graph 7-2). Concentrations in groundwater at EV_GV3gw have been stable since November 2013 and are substantially lower than concentrations measured in Harmer Creek at EV_HC1 and also lower than concentrations in Elk River upstream from the confluence with Grave Creek. Concentrations measured at RG_DW-02-20 appear to follow a seasonal trend with the highest concentrations measured during the spring months and were generally within the range of concentrations measured upstream in the Elk River at EV_ER4, but considerably lower than surface water concentrations in Harmer Creek. Surface water concentrations fluctuate and are typically lower during freshet which is consistent with the effect of dilution on constituents in a freshet dominated regime. We note that although selenium concentrations at RG_DW-02-20 are similar in magnitude to the Elk River, they do not follow the same seasonal trend as observed in surface water suggesting some lag in groundwater-surface water interaction.

Loading of mine-influenced constituents to groundwater valley-bottom in Study Area 7 is inferred to be primarily from infiltration of Elk River surface water as CI concentrations measured at RG_DW-02-20 reflect Elk River surface water quality. Significant groundwater transport of CI from the Harmer Creek drainage to the Elk River valley bottom is inferred to be minimal based on relatively low groundwater concentrations measured in Harmer Creek drainage at EV_GV3gw compared to surface water at EV_HC1. As such, transport of CI from the Harmer Creek drainage to groundwater in the Elk River valley bottom is primarily through surface water.

5.8 Study Area 8: Elk River Valley-bottom Downgradient of Balmer, Lindsay and Otto/Cossarini Creeks

This area was selected because the EVO SSGMP identified potential sources of CI on the western slope of EVO and potential transport in the Lindsay, Otto/Cossarini drainages as well as the Goddard Marsh area (Drawing 635544-310); tributary surface water and upland groundwater flow into the Elk River valley-bottom in these areas. Groundwater in Study Area 8 will eventually discharge to the Elk River or flow to the valley bottom of the Elk River in Study Area 12.

The valley-bottom consists mainly of fluvial, glaciofluvial and alluvial fan deposits in this area as the area is near the confluence with Cummings Creek. Underlying the coarse units are finer-grained deposits of lower permeability silt and clay suggesting relatively thick lacustrine/glaciolacustrine deposits exist in the subsurface (see Appendix IV). Groundwater flow in upland areas is inferred to be toward the Elk River valley-bottom. Groundwater flow direction in the valley-bottom is assumed to be parallel or sub-parallel to the Elk River. Inferred geological cross sections J-J' and K-K' (Drawings 635544-321 and 322, respectively) depict stratigraphy parallel and perpendicular to the inferred groundwater flow direction.

The monitoring wells in Study Area 8 included the monitoring wells EV_LSgw and EV_OCgw to monitor potential inputs from upland, tributary valley bottom, and Elk River valley bottom features along the western slope of EVO. Monitoring wells and relevant surface water locations for Study Area 8 are shown on Drawing 635544-310.

5.8.1 Potential Sources and Transport Pathways

The 2017 RGMP identified potential sources of CI and potential transport pathways to valley-bottom groundwater in Study Area 8, summarized in the following table. Potential sources are also shown in plan on Drawing 635544-310.

Table GG: Potential Sources and Transport Pathways to Groundwater in Study Area 8 (After SNC-Lavalin, 2017a)

Potential Sources	Potential Transport Pathways	Current Monitoring Location[1]
Waste Spoils and Stock piles located in Lindsay, Otto/Cossarini and Goddard Creek drainages.	Upland groundwater and surface water infiltration associated with Balmer, Lindsay, Fenelon, Goddard and Otto/Cossarini Creeks drainages.	EV_LSgw, EV_OCgw (RGMP and EVO SSGMP) EV_GCgw, EV_BALgw (EVO SSGMP) EV_BLM2, EV_FC1, EV_GC2, EV_GH1, EV_OC1, EV_ER2 (SWMP)
Upstream Elk River valley bottom groundwater.	Potential down-valley groundwater flow from upgradient Study Area 7.	RG_DW-02-20 (RGMP)

Table GG (Cont'd): Potential Sources and Transport Pathways to Groundwater in Study Area 8 (After SNC-Lavalin, 2017a)

Potential Sources	Potential Transport Pathways	Current Monitoring Location[1]
Lagoon C and Lagoon D.	Recharge to groundwater from infiltration from tailings ponds and other discharge.	EV_GCgw (EVO SSGMP) EV_OCgw (RGMP and EVO SSGMP) EV_OC1 and ER_2 (SWMP)
Elk River.	Surface water infiltration.	EV_ER2 (SWMP)

1. EVO SSGMP: Elkview Operations Site-Specific Groundwater Monitoring Program; RGMP: Regional Groundwater Monitoring Program and SWMP: Surface Water Monitoring Program

5.8.2 Groundwater Levels

Continuous groundwater level data, available from water level loggers installed in monitoring wells EV_LSgw and EV_OCgw along with manual water level measurements prior to sampling events (Table 2), were reviewed and assessed for seasonal variability and long-term trends. Groundwater elevations from January 2015 to October 2017 at those wells were plotted on a time-series graph and included in Appendix III (Graph 8-1). Groundwater elevations in both wells show a seasonal trend with slightly higher groundwater elevations between March and June. The maximum annual water level fluctuation recorded at EV_LSgw and EV_OCgw between January 2015 and October 2017 was approximately 1.1 m and 0.83 m, respectively. It is noted that the manual water level measurement collected at EV_LSgw in March of 2017 appears to have been collected during sampling as the measurement was approximately 1 more than 0.5 m lower than continuous water level measurements recorded before and after sampling (Graph 8-1). Groundwater elevations prior to sampling for the fourth quarter were selected and shown on Drawing 635544-307 to provide regional context.

5.8.3 Groundwater Quality

The analytical results compared to screening criteria are presented in Tables 3 and 4 (primary screening) and in Appendix III, Graph 8-2 (dissolved selenium only). A summary of results above primary screening criteria for Study Area 8 is presented in Table HH below.

Table HH: Summary of Constituents above Primary Screening Criteria for Study Area 8

Parameter[1,2,3]	EV_LSgw				EV_OCgw**			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Fluoride	-	-	-	-	IW, LW	IW, LW	IW, LW	IW, LW
Lithium	DW	DW	DW	DW	DW	DW	DW	DW
Manganese	IW	IW	IW	IW	-	-	-	-
Molybdenum	-	-	-	-	IW	IW	IW	IW

Notes: 1.) Dissolved parameter unless otherwise indicated; 2.) Primary screening criteria applied are CSR standards for Aquatic Life (AW); Drinking Water (DW), Livestock (LW) and Irrigation (IW) except for wells with a ** which indicates the well is located within 10 m of surface water and results are compared to BCWQG for AW; and 3.) '–' denotes result below primary screening criteria for given constituents.

Results from 2017 were similar to previous years with the exception of lithium concentrations above the CSR DW standard due to the updated standard on November 1, 2017. Groundwater quality in EV_LSgw and EV_OCgw was below the primary screening criteria concentrations for all the CI, but exceeded the primary screening criteria for other constituents.

The 2017 RGMP (SNC-Lavalin, 2017a) included a review of non-order constituents in groundwater with concentrations greater than primary screening criteria, which included fluoride, dissolved manganese and molybdenum. A similar review of dissolved lithium in groundwater was performed in Section 5.1.3 above. Based on this information and the receptor information provided in the 2017 RGMP, the following interpretations were made:

› Monitoring well EV_OCgw is installed directly overlying the bedrock surface suggesting the source of fluoride and molybdenum likely originates from water interaction with bedrock;
› The source of dissolved manganese at EV_LSgw is inferred to originate from natural processes and is likely due to limited interactions with the atmosphere as dissolved oxygen concentrations ranged from 0.4 to 0.7 mg/L is inferred to originate from natural processes and likely originates from aquifers with limited interaction with the atmosphere (low dissolved oxygen [DO], equivalent to approximately less than 1 mg/L); and
› The source of dissolved lithium is inferred to originate from natural sources (interaction with bedrock and/or unconsolidated materials) as it is present in concentrations above CSR DW throughout the Elk Valley, including in background location FR_HMW5.

5.8.4 Discussion

All CI in groundwater were below primary screening criteria in Study Area 8. Dissolved selenium concentrations in groundwater at EV_LSgw and EV_OCgw have been relatively stable since March of 2014 (Appendix III, Graph 8-2).

To assess groundwater and surface water interactions, selenium concentrations measured in groundwater in Study Area 8 were compared to concentrations in surface water in adjacent creeks. Adjacent surface water chemistry data indicated selenium concentrations above BCWQG for AW; therefore, discussion of chemistry trends in Study Area 8 is focused on selenium.

Consistent with findings from the 2017 RGMP (SNC-Lavalin, 2017a), selenium concentrations in surface water are approximately two orders of magnitude higher (15.2 to 119 µg/L in EV_GC2) compared to groundwater concentrations (<0.050 to 0.76 µg/L in EV_LSgw and EV_OCgw) in Study Area 8 (Appendix III, Graph 8-2). The highest selenium concentrations in surface water were measured at EV_GC2 (Goddard Creek Sedimentation Pond Decant). Loading of mine-influenced constituents to groundwater valley-bottom in Study Area 8 is therefore inferred to be primarily from infiltration of surface water associated with drainages and mining features along the western slope of EVO and surface water recharge from nearby Elk River.

Groundwater in Study Area 8 does not contain elevated concentrations of CI at the monitoring wells EV_LSgw and EV_OCgw which monitor inputs from upland, tributary valley bottom, and Elk River valley bottom features along the western slope of EVO. In addition, groundwater quality reported by UMA (2008) and Waterline (2014) for District of Sparwood Wells 1 and 2 (RG_DW-02-02 and -03) and the test well TW14-04 located on the west side of the Elk River in Study Area 8 are below primary screening criteria. As such, there does not appear to be confirmed groundwater transport pathway between the sources identified on the western slope of EVO and Elk River valley-bottom based on the current RGMP monitoring well locations.

5.9 Study Area 9: Michel Creek Valley-bottom Downgradient of EVO

This area was selected as the EVO site-specific groundwater monitoring program identified potential sources of CI that may contribute to mine-influenced groundwater in the Michel Creek valley-bottom. Study Area 9 is situated adjacent to EVO and receives tributary surface water and upland groundwater flow from potential sources along the southwestern slope of EVO. The boundaries of Study Area 9 were modified as part of the 2017 RGMP (SNC-Lavalin, 2017a) to reflect information from the EVO monitoring program and now extend from South Gate Creek to the confluence of Michel Creek with the Elk River (Drawing 635544-310).

The Michel Creek valley-bottom consists mainly of fluvial and glaciofluvial deposits, with a glaciolacustrine clay/silt unit to the northwest that increases in thickness along the valley axis (see Appendix IV). The sand and gravel aquifer is unconfined with a saturated thickness over 22 m at EV_BCgw (shown on Drawing 635544-310). Upland groundwater flow in the tributary drainages either discharges to the creeks or flows as a thin saturated zone to the Michel Creek valley-bottom. Flow direction in the valley-bottom is assumed to be parallel or sub-parallel to Michel Creek. Cross sections L-L’ and M-M’ (Drawings 635544-323 and -324) are located parallel and perpendicular, respectively, to the inferred groundwater flow direction.

To monitor Michel Creek valley-bottom groundwater in Study Area 9, the following wells were included: three water supply wells (EV_RCgw, EV_WH50gw and EV_BRgw); two monitoring wells (EV_BCgw and EV_MCgwS/D [nested]); and one domestic well (RG_DW-03-01) to monitor valley-bottom groundwater in Michel Creek.

5.9.1 Potential Sources and Transport Pathways

The 2017 RGMP identified potential sources of CI and potential transport pathways to valley-bottom groundwater in Study Area 9, summarized in the following table. Potential sources are also shown in plan on Drawing 635544-310.

Table II: Potential Sources and Transport Pathways to Groundwater in Study Area 9 (After SNC-Lavalin, 2017a)

Potential Sources	Potential Transport Pathways	Current Monitoring Location[1]
Upstream Michel Creek valley bottom groundwater.	Down-valley Michel Creek groundwater flow from areas upgradient of Study Area 9.	No current monitoring well.
EVO mining activities upstream from Bodie Creek and Gate Creek drainages.	Upland groundwater and infiltration of surface water associated with Bodie Creek and Gate Creek drainages.	EV_BC1, EV_GT1 (SWMP) EV_RCgw, EV_WH50gw, EV_BCgw and EV_BRgw (RGMP and EVO SSGMP)
Michel Creek.	Recharge to groundwater from infiltration of Michel Creek along some stretches.	EV_MCgwS/D (RGMP) RG_DW-03-01 (RGMP) EV_MC2 and EV_MC1 (SWMP)

Table II (Cont'd): Potential Sources and Transport Pathways to Groundwater in Study Area 9 (After SNC-Lavalin, 2017a)

Potential Sources	Potential Transport Pathways	Current Monitoring Location[1]
Historical and current EVO mining activities on Baldy Ridge.	Upland groundwater and surface water infiltration associated with drainages of Aqueduct and Qualtieri creeks.	EV_AQ1, EV_SPR2 (SWMP) No shallow monitoring well at the base of Baldy Ridge EV_MCgwS/D and RG_DW-03-01 (RGMP) located further downgradient

1. EVO SSGMP: Elkview Operations Site-Specific Groundwater Monitoring Program; RGMP: Regional Groundwater Monitoring Program and SWMP: Surface Water Monitoring Program.

5.9.2 Groundwater Levels

Continuous groundwater level data, available from level loggers installed in monitoring wells EV_BCgw, EV_MCgwS and EV_MCgwD, were recorded along with manual water level measurements during the monitoring period (Table 2). Groundwater elevations from January 2015 to October 2017 at those wells was plotted on a time-series graph and included in Appendix III (Graph 9-1). Groundwater elevations in all three wells followed the same pattern and showed a seasonal trend with generally higher groundwater elevations during the spring from mid-March or early April to beginning of June. The lowest elevations during the monitoring period were recorded from August to September in each year. The groundwater levels measured in spring of 2017 were 0.2 m, 0.5 m and 0.3 m higher compared to levels in spring of 2015 and 2016 at EV_MCgwS, EV_MCgwD and EV_BCgw, respectively. It is noted that the manual water level measurements collected in September and October at EV_MCgwD and EV_MCgwS appear to have been collected during sampling as they were lower than continuous water level measurements recorded before and after sampling (Appendix III, Graph 9-1).

Surface water level data from EV_MC2 (located between EV_MCgwS/D and EV_BCgw) follow the same pattern and seasonal trend as groundwater at all three monitoring locations suggesting a hydraulic connection between surface water and groundwater at these locations. The vertical groundwater gradient at the nested well EV_MCgwS/D is downwards with a vertical ranging from -0.05 m/m to -0.04 m/m calculated from data. These gradient calculations excluded the September and October monitoring events, which are considered suspect as described above. The range in 2017 values listed above is within range of previously calculated values from 2015 and 2016, which ranged from -0.08 m/m to -0.04 m/m.

Groundwater elevations prior to sampling for the fourth quarter of 2017 were selected and shown on Drawing 635544-307 to provide regional context. The only exceptions to this were for EV_MCgwS/D where groundwater elevations from continuous water level measurements (from October 18, 2017, the date of sampling) were selected to shown on drawing 635544-307 due to suspect measurements.

5.9.3 Groundwater Quality

The analytical results compared to screening criteria are presented in Tables 3 and 4 (primary screening), Table 5 (secondary screening), and Appendix III, Graphs 9-2(1), 9-2(2), 9-3, and 9-4. A summary of results above primary screening criteria for Study Area 9 is presented in Table JJ (monitoring wells) and Table KK (supply and domestic wells) below. In some cases, more than one sample was collected in a quarter due to hold time issues; for Tables GG and HH the higher concentration was used to summarize results of primary and secondary screening.

Table JJ: Summary of Constituents above Primary Screening Criteria for Study Area 9 (1/2)

Parameter[1,2,3]	EV_BCgw				EV_MCgwS	EV_MCgwD			
	Q1	Q2	Q3	Q4	Q1 to Q4	Q1	Q2	Q3	Q4
Nitrate-Nitrogen	-	DW	DW	-	-	-	-	-	-
Lithium	DW	DW	DW	DW	DW	DW	DW	DW	DW
Manganese	-	-	-	-	-	IW	IW	IW	IW
Molybdenum	-	-	-	-	-	IW	IW	IW	IW
Selenium	AW IW LW DW	AW IW LW DW	AW IW LW DW	AW IW LW DW	-	-	-	-	-

Notes: 1.) Dissolved parameter unless otherwise indicated; Primary screening criteria applied are CSR standards for Aquatic Life (AW), Drinking Water (DW), Livestock (LW) and Irrigation (IW); and 3.) '–' denotes result below primary screening criteria for given constituents.

Table KK: Summary of Constituents above Primary Screening Criteria for Study Area 9 (2/2)

Parameter[1,2,3,4]	EV_BRgw				EV_WH50gw				EV_RCgw				RG_DW-03-01	
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2 to Q4
Nitrate-Nitrogen	-	DW	DW	-	-	-	-	-	DW	DW	DW	DW	-	-
Sulphate	-	-	-	-	-	-	-	-	LW DW	LW DW	LW DW	LW DW	-	
Copper	-	-	-	-	-	-	-	-	-	AW	AW	AW	-	-
Lithium	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	na	DW
Selenium	DW	AW IW LW DW	AW IW LW DW	AW IW LW DW	DW	-	DW	DW	AW IW LW DW	AW IW LW DW	AW IW LW DW	AW IW LW DW	-	-

Notes: 1.) Dissolved parameter unless otherwise indicated; 2.) Primary screening criteria applied are CSR standards for AW, DW, LW and IW; 3.) '–' denotes result below primary screening criteria for given constituents; and 4.) na indicates the well was not sampled for specific parameter.

Results from 2017 were similar to previous years with the following exceptions:

- Dissolved iron at EV_MCgwD decreased by at least one order of magnitude starting in Q2 of 2017;
- Dissolved iron at EV_MCgwS in August 2017 was below the DL (< 10 µg/L) whereas iron concentrations from other time periods ranged from 2,050 µg/L to 2,920 µg/L; and
- Dissolved lithium concentrations were above the CSR DW standard at all locations due to the updated standard to a lower concentration on November 1, 2017.

Similar to results from 2015 and 2016, groundwater quality at EV_BCgw, EV_BRgw and EV_RCgw were above primary screening criteria concentrations for selenium (AW, DW, IW and/or LW) for most sampling events in 2017 (Appendix III, Graph 9-2(1) and 9-2(2)). Selenium concentrations at EV_WH50gw were also above DW standards during Q1, Q2 and Q4 of 2017. The highest concentrations were measured at EV_RCgw and were an order of magnitude higher than concentrations at EV_BCgw, EV_BRgw and EV_WH50gw.

Groundwater quality in EV_BCgw, EV_BRgw and EV_RCgw was also above primary screening criteria concentrations for nitrate-nitrogen (DW and/or AW) for most monitoring samples in 2017, consistent with results from 2015 and 2016 (Appendix III, Graph 9-3). In addition to selenium and nitrate-nitrogen, groundwater quality in EV_RCgw was also above primary screening criteria concentrations for sulphate (DW and LW; Appendix III, Graph 9-4).

The 2017 RGMP (SNC-Lavalin, 2017a) included a review of non-order constituents in groundwater with concentrations greater than primary screening criteria, which included dissolved manganese, molybdenum and copper. A similar review of dissolved lithium in groundwater was performed in Section 5.1.3 above. Based on this information and the receptor information provided in the 2017 RGMP, the following interpretations were made:

- Dissolved iron and manganese at EV_MCgwS/D is inferred to originate from natural processes associated with reducing conditions. Review of DO concentrations indicates relatively low concentrations (< 2 mg/L) at EV_MCgwS during all sampling events (except the March 30, 2017 event. Groundwater levels in EV_MCgwS/D increased approximately 0.9 m prior to the March sampling event (Graph 9-1) which may have resulted in slightly higher DO concentrations. At EV_MCgwD, DO concentrations starting in Q2 were higher than previously recorded (up to 11.63 mg/L) coincident with the order of magnitude decrease in iron concentrations indicating a strong inverse relationship between DO and iron concentrations. Dissolved manganese concentrations also began to decrease after Q2 at EV_MCgwD; however, the decrease was more subtle (i.e., less than half compared to an order of magnitude);
- Dissolved molybdenum at EV_MCgwD is inferred to be naturally occurring, primarily water interacting with unconsolidated materials;
- Dissolved lithium at EV_MCgwS/D, EV_BCgw, EVBRgw, EV_RCgw, EV_WH50gw and RG_DW-03-01 is inferred to originate from natural sources (interaction with bedrock and/or unconsolidated materials) as it is present in concentrations above CSR DW throughout the Elk Valley, including in background location FR_HMW5. Location RG_DW-03-01 is a well that is no longer used for drinking water; and
- The source of dissolved copper at EV_RCgw is not known and is potentially mining-influenced as concentrations of Cl were also consistently measured above standards at this location. Dissolved copper was measured above AW standards in Q4 of 2016 (123 µg/L); in 2017 dissolved copper was measured above AW standards in all quarters except Q1 and concentrations reached as high as 156 µg/L, which is the highest recorded copper concentration from EV_RCgw. Because dissolved copper above CSR standards was only measured at EV_RCgw, the extent appears to be localized.

Secondary screening for selenium was completed where sample concentrations were above primary screening criteria. Table LL shows the summary of results above secondary screening criteria for Study Area 9. In some cases, more than one sample was collected in a quarter due to hold time issues; for Table LL the higher concentration was used to summarize results of primary and secondary screening.

Table LL: Summary of Results above Secondary Screening Criteria for Study Area 9

Para-meter [1,2]	EV_BCgw				EV_BRgw				EV_WH50gw		EV_RCgw			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1 to Q3	Q4	Q1	Q2	Q3	Q4
Selenium	SPO CP	SPO CP DW	SPO CP DW	SPO CP	-	SPO CP DW	SPO CP DW	SPO CP	-	-	SPO CP DW	SPO CP DW	SPO CP DW	SPO CP DW

Notes: 1) Secondary screening criteria are Site Performance Objective (SPO), Compliance Point (CP) and GCDWQ for drinking water (DW); and 2.) '–' denotes result below secondary screening criteria.

EV_BCgw, EV_BRgw, and EV_RCgw concentrations were above SPO and CP secondary screening criteria for selenium for all the sampling events in 2017, with the exception of EV_BRgw in Q1. The GCDWQ of 50 mg/L was exceeded for all four sampling events at EV_RCgw and only marginally during Q1 at EV_BCgw and EV_BRgw.

5.9.4 Discussion

Discussion of trends in groundwater quality in Study Area 9 focuses on dissolved selenium, nitrate-nitrogen and sulphate concentrations that approach or were above the primary and secondary screening criteria in select wells. Drawing 635544-329 shows the spatial distribution of dissolved cadmium, dissolved selenium, sulphate and nitrate-nitrogen for samples collected in Study Area 9. Time series plots of dissolved selenium, nitrate-nitrogen and sulphate from the select wells from Study Area 9 are shown in Appendix III (Graphs 9-2(1), 9-2(2), 9-3, 9-4). To compare groundwater concentration trends to surface water in Study Area 9, dissolved selenium, nitrate-nitrogen and sulphate concentrations measured in nearby surface water at Bodie Creek (EV_BC1), Gate Creek (EV_GT1) and further downstream at Michel Creek (EV_MC2) were plotted on these graphs.

Concentrations of selenium, nitrate-nitrogen and sulphate in groundwater have varied temporally but a clear seasonal trend in the concentrations cannot be identified based on data from 2013 to 2017 (Appendix III, Graphs 9-2(1), 9-2(2), 9-3, and 9-4). The highest concentrations in dissolved selenium, nitrate-nitrogen and sulphate have been measured in water supply well EV_RCgw with levels consistently higher than concentrations measured in surface water stations EV_BC1 and EV_GT1 since 2015. This is also the location where localized elevated dissolved copper concentrations were measured. The source and extent of high concentrations of these constituents measured at EV_RCgw are not well understood. The elevated concentrations of CI and extents of these constituents have been identified as data gaps in the 2017 RGMP and Teck is planning additional studies in Study Area 9 to better understand the sources and groundwater pathways of these constituents.

Consistent with observations made in the 2016 Annual Report (SNC-Lavalin, 2017c) and the 2017 RGMP (SNC-Lavalin, 2017a), attenuation of dissolved selenium, nitrate-nitrogen and sulphate appears to be occurring in the Michel Creek valley-bottom suggesting attenuation along the flowpath. Selenium concentrations above primary and secondary screening criteria and nitrate-nitrogen concentrations above primary screening criteria were still measured in assumed downgradient wells EV_BCgw and EV_BRgw but concentrations were lower than measured at EV_RCgw as shown on Drawing 635544-329. Further downgradient in Study Area 9, concentrations at EV_MCgwS/D and RG_DW_03-01 respectively are below all screening criteria (except lithium) suggesting further attenuation along the flow path. EV_MCgwS/D is installed in a clayey unit and RG_DW-03-01 is a domestic well located more than 2 km downgradient from EV_BRgw. SNC-Lavalin (2016a) noted that wells EV_MCgwS/D might not be ideal downgradient sentry wells due to their installation; however, groundwater level data suggests there may be a connection to surface water. Also, monitoring locations do not extend to the deep sand and gravel unit as shown on cross section L-L' (Drawing 635544-323). Uncertainty continues to exist in the groundwater quality delineation (i.e., extent of groundwater impacts) in Study Area 9.

5.10 Study Area 10: Michel Creek Valley-bottom Downgradient of Erickson Creek

This area was selected as the EVO SSGMP identified waste rock spoils and other potential sources of CI in the Erickson Creek drainage which flows into the Michel Creek valley-bottom and may contribute to mine-influence groundwater in the valley-bottom. The Erickson Creek valley-bottom consists mainly of colluvium as shown on Drawing 635544-303. The lithology observed at EV_ECgw is consistent with surficial geology mapping and shows till underlying the colluvium (Appendix IV). Bedrock was not encountered at this location. There is no groundwater well in the Michel Creek valley-bottom aquifer in Study Area 10; however, groundwater monitoring of EV_ECgw located upgradient in the tributary has been ongoing to assess potential groundwater transport through the Erickson Creek valley bottom to groundwater in Study Area 10. The boundaries of Study Area 10 were modified as part of the 2017 RGMP (SNC-Lavalin, 2017a) to reflect surface water monitoring data and now extend further northwest past the confluence of Milligan Creek with Michel Creek (Drawing 635544-310).

The monitoring well and relevant surface water locations for Study Area 10 are shown on Drawing 635544-310.

5.10.1 Potential Sources and Transport Pathways

The 2017 RGMP identified potential sources of CI and potential transport pathways to valley-bottom groundwater in Study Area 10, summarized in the following table. Potential sources are also shown in plan on Drawing 635544-310.

Table MM: Potential Sources and Transport Pathways to Groundwater in Study Area 10 (After SNC-Lavalin, 2017a)

Potential Sources	Potential Transport Pathways	Current Monitoring Location[1]
Erickson Waste Rock Spoils and other potential sources in Erickson Creek drainage.	Upland groundwater and tributaries discharging into Erickson Creek.	EV_EC1 (SWMP)
	Groundwater flow through Erickson Creek valley bottom.	EV_ECgw (RGMP and EVO SSGMP)
Waste Spoils and South Pit.	Upland groundwater and tributaries (South Pit Creek and Milligan Creek) discharging into Michel Creek.	EV_SP1 and EV_MG1 (SWMP) No monitoring well within Study Area 10.
Erickson Creek, Milligan Creek and South Pit Creek Decant Pond.	Surface water infiltrating to ground.	No monitoring well within Study Area 10.

1. RGMP: Regional Groundwater Monitoring Program and SWMP: Surface Water Monitoring Program

5.10.2 Groundwater Levels

Continuous groundwater level data, available from a level logger installed at monitoring well EV_ECgw, were recorded along with manual water level measurements during the monitoring period (Table 2). Groundwater elevations from January 2015 to October 2017 were plotted on a time-series graph (Appendix III, Graph 10-1). Groundwater elevation in EV_ECgw ranged from approximately 1,325.3 masl to 1,327.6 masl, throughout the monitoring period and followed a seasonal trend with fluctuations up to 2.3 m. In 2017, groundwater levels were at their highest in late April-early May and at their lowest in October, similar to previous results. The groundwater levels measured in 2017 were 0.1 m higher than previously recorded (in April) and 0.8 m lower than previously recorded (in October). It is noted that the manual water level measurements collected at EV_ECgw in 2017 appear to have been collected during sampling as they are lower than continuous water level measurements recorded before and after sampling (Graph 10-1).

A water level elevation obtained from level logger data from EV_ECgw for the fourth quarter of 2017 and inferred groundwater flow direction are shown on Drawing 635544-307 to provide regional context.

5.10.3 Groundwater Quality

Field measured parameters for EV_ECgw are presented in Table 3. Field parameters measured in 2017 were similar to values measured in 2015 and 2016.

Analytical results compared to primary screening criteria are presented in Table 4 and Appendix III, Graph 10-2 (dissolved selenium only). There were no CI concentrations above primary screening standards as shown on Drawing 635544-329. A summary of results above primary screening criteria for other constituents is presented in Table NN below.

Table NN: Summary of Non-order Constituents above Primary Screening Criteria for Study Area 10

Parameter[1,2,3,4]	EV_ECgw[4]			
	Q1	Q2	Q3	Q4
Lithium	ns	DW	DW	DW
Molybdenum	ns	IW	IW	IW

Notes: 1.) Dissolved parameter unless otherwise indicated; 2.) Primary screening criteria applied are CSR standards for Aquatic Life (AW); Drinking Water (DW), Livestock (LW) and Irrigation (IW); 3.) ' –' denotes result below primary screening criteria for given constituents; and 4.) 'ns' indicates well was not sampled.

Results from 2017 were similar to previous years with the exception of lithium concentrations above the CSR DW standard due to the standard updated to a lower concentration in November 1, 2017. The 2017 RGMP (SNC-Lavalin, 2017a) included a review of non-order constituents in groundwater with concentrations greater than primary screening criteria, which included dissolved molybdenum. A similar review of dissolved lithium in groundwater was performed in Section 5.1.3 above. Based on this information and the receptor information provided in the 2017 RGMP, the following interpretations were made:

- Dissolved molybdenum at EV_ECgw is inferred to be naturally occurring based on the low estimated hydraulic conductivity value (1 x 10^{-8} m/s) of the screened interval suggesting relatively slow groundwater velocities and no direct connection to surface water; and
- Dissolved lithium at EV_ECgw is inferred to originate from natural sources (interaction with bedrock and/or unconsolidated materials) as it is present in concentrations above CSR DW throughout the Elk Valley, including in background location FR_HMW5.

5.10.4 Discussion

Groundwater quality in EV_ECgw was below all primary screening criteria for the CI in 2017; therefore, groundwater transport of CI in the Erickson drainage appears to be minimal. To assess groundwater and surface water interaction in the Erickson drainage and potential impacts to the Michel Creek valley-bottom sediments, selenium concentrations measured in shallow groundwater at EV_ECgw were compared to concentrations in surface water at the mouth of Erickson Creek (EV_EC1) and Michel Creek (EV_MC3) upstream from Erickson Creek discharge. A time series plot of dissolved selenium from the selected well and surface water stations located in Study Area 10 is shown in Appendix III (Graph 10-2(1)). Dissolved selenium concentrations in groundwater at EV_ECgw have been stable since March 2014, ranging in concentration from < 0.05 µg/L to 0.8 µg/L, with no distinct seasonal trend observed. As shown in Appendix, Graph 10-2(2), 2017 selenium concentrations at EV_ECgw were within range of previous results. Drawing 653344-329 provides a summary of CI concentrations measured in 2017 at EV_ECgw.

Concentrations in groundwater at EV_ECgw are more than two orders of magnitude lower than concentrations measured in Erickson Creek at EV_EC1 and also lower than concentrations in Michel Creek upstream from the confluence with Erickson Creek. Surface water concentrations in Erickson Creek (EV_EC1) follow a seasonal trend with lower concentrations measured during freshet as a result of dilution.

CI concentrations at EV_ECgw are low in comparison to Erickson surface water; therefore, Erickson Creek is inferred to the only pathway for CI in the Erickson Creek drainage to the valley-bottom of Michel Creek. Elevated dissolved selenium concentrations at the South Pit Creek Sediment Pond Decant (EV_SP1), located in the valley-bottom within Study Area 10 and the Milligan Creek Sediment Pond Decant (EV_MG1), located in the valley-bottom downgradient of Study Area 10 were also high (Graph 10-2) and identified as a potential source of dissolved selenium in valley-bottom groundwater.

In the absence of monitoring well in the Michel valley-bottom aquifer in Study Area 10, groundwater quality is unknown, however, impacts on groundwater, if any, are likely to be the result of infiltration of impacted surface water rather than tributary groundwater transport.

5.11 Study Area 11: Michel Creek Valley-bottom Downgradient of CMO

This area was selected as it was identified to be the focal point of groundwater flow at CMO immediately downgradient of the confluence of Michel and Corbin Creeks in the CMO SSGMP. Potential sources of CI exist upgradient of this area, and may contribute to the mine influences observed in groundwater in the Michel Creek valley-bottom. Study Area 11 consists of Michel Creek valley-bottom deposits located downgradient of CMO (Drawing 635544-311).

Mining activities at CMO occur along a north-south trending ridge bordered by steep mountain ranges to the east and west. Michel Creek runs south to north along the west side of the site. Corbin Creek runs south to north along the east side of the mine site, and turns to the west at the north end of the site before it flows into Michel Creek in the northwest corner of the site. CMO is therefore isolated from other mountain ranges. The valley bottoms in Study Area 11 are infilled with till and glacial outwash deposits, as well as modern fluvial sands and gravels associated with Michel and Corbin Creeks (Appendix IV). Valley-bottom deposits in this area were identified as the primary migration pathway outside of mine-permitted areas from CMO (Appendix IV). The monitoring locations in Study Area 11 included a domestic well near Corbin Creek (RG_DW-07-01) located just west of the Main Settling Ponds and the nested monitoring well (CM_MW1-OB/SH/DP) installed downgradient of CMO at the confluence of Michel and Corbin creeks. Monitoring wells and relevant surface water locations for Study Area 11 are shown on Drawing 635544-311.

5.11.1 Potential Sources and Transport Pathways

The 2017 RGMP identified potential sources of CI and potential transport pathways to valley-bottom groundwater in Study Area 11, summarized in the following table. Potential sources are also shown in plan on Drawing 635544-311.

Table OO: Potential Sources and Transport Pathways to Groundwater Study Area 11 (After SNC-Lavalin, 2017a)

Potential Sources	Potential Transport Pathways	Current Monitoring Location[1]
CMO mining activities upgradient from Study Area 11.	Upland groundwater and tributaries discharging into Michel Creek, West Ditch, Corbin Creek and North Ditch.	CM_MC1 CM_CC1 CM_MC2
	Groundwater flow through Corbin Creek valley bottom.	CM_MW4_SH/DP CM_MW5_SH/DP (CMO SSGMP) CM_MW6_SH/DP (CMO SSGMP)
	Groundwater flow through Michel Creek valley bottom.	CM_MW1_OB/SH/DP (RGMP and CMO SSGMP) CM_MW2_SH RG_DW-07-01 (RGMP)
Sowchuck Sump.	Surface water infiltrating to ground.	CM_SOW (Sowchuck Sump; SWMP)

Table OO (Cont'd): Potential Sources and Transport Pathways to Groundwater Study Area 11 (After SNC-Lavalin, 2017a)

Potential Sources	Potential Transport Pathways	Current Monitoring Location[1]
Main Settling Ponds.	Surface water infiltrating to ground.	CM_MW4-SH/DP (CMO SSGMP)[2] RG_DW-07-01 (RGMP) CM_SPD (Main Pond Decant; SWMP)
CMO Loadout and Infiltration Ponds.	Recharge to groundwater system.	CM_LOIP (surface water) No monitoring well.

1. CMO SSGMP: Coal Mountain Operations Site-Specific Groundwater Monitoring Program; RGMP: Regional Groundwater Monitoring Program and SWMP: Surface Water Monitoring Program.
2. Both monitoring wells installed in bedrock. No monitoring well installed in shallow gravel deposits at this location.

5.11.2 Groundwater Levels

Manual groundwater levels measured quarterly at the nested well CM_MW1 were reviewed and assessed for seasonal variability and vertical groundwater flow. Table 2 shows manual water level measurements recorded at CM_MW1 in 2017; manual water level measurements are presented in Appendix III (Graph 11-1).

The data show no significant variation in groundwater levels in all three wells; groundwater elevation in CM_MW1-OB ranged from 1,497.72 masl to 1,498.26 masl throughout the monitoring period with similar fluctuation at the other two monitoring wells. The vertical groundwater flow is inferred to be downwards from the shallow gravel aquifer to the bedrock aquifer. The calculated vertical hydraulic gradients between CM_MW1-OB and CM_MW1-SH varied from -0.04 m/m to -0.06 m/m in 2017 (Appendix V). The vertical gradient between CM_MW1-SH and CM_MW1-DP indicated an upward groundwater flow from the deeper bedrock unit to the shallower unit in Q4. Vertical gradients were not calculated in Q1, Q2 and Q3 as the depth to water measurements were not collected on the same date.

Groundwater elevations for the fourth quarter are shown on Drawing 635544-307 to provide regional context.

5.11.3 Groundwater Quality

Groundwater quality results for CM_MW1 and RG_DW-07-01 were compared to screening criteria in Tables 3 and 4 (primary screening) and in Appendix III, Graphs 11-2 and 11-3. A summary of results above primary screening criteria for Study Area 11 is presented in Table PP below.

Table PP: Summary of Constituents above Primary Screening Criteria for Study Area 11

Parameter 1,2,3,4	CM_MW-1-OB				CM_MW-1-SH				CM_MW-1-DP				RG_DW-07-01			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Selenium	-	-	-	-	-	-	-	-	-	-	-	-	-	DW	DW	-
Sulphate	-	-	-	-	-	-	-	-	-	-	-	-	DW	-	DW	DW
Chloride	-	-	-	-	IW DW	IW	IW	IW	IW	IW	IW	IW	-	-	-	-

Table PP (Cont'd): Summary of Constituents above Primary Screening Criteria for Study Area 11

Parameter [1,2,3,4]	CM_MW-1-OB				CM_MW-1-SH				CM_MW-1-DP				RG_DW-07-01			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Sodium	-	-	-	-	DW	-	-	-	DW	-	-	DW	na	-	-	-
Barium	-	-	-	-	-	-	-	-	DW	DW	DW	DW AW	na	-	-	-
Lithium	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	na	DW	DW	DW
Manganese	-	-	-	-	-	-	-	-	IW	-	-	-	na	-	-	-
Molybdenum	-	-	-	-	IW LW	IW LW	IW LW	IW	-	IW	-	-	na	-	-	-

Notes: 1.) Dissolved parameter unless otherwise indicated; 2.) Primary screening criteria applied are CSR standards for Aquatic Life (AW), Drinking Water (DW), Livestock (LW) and Irrigation (IW); 3.) '–' denotes result below primary screening criteria for given constituents; and 4.) na indicates the well was not sampled for specific parameter.

Selenium and sulphate concentrations were above primary screening criteria in domestic well RG_DW-07-01 in some samples from 2017; selenium concentrations were above CSR DW standard in 2017 Q2 and Q3 and sulphate concentrations also exceeded CSR DW standard in 2017 Q1, Q3 and Q4 (Appendix III, Graphs 11-2 and 11-3).

The 2017 RGMP (SNC-Lavalin, 2017a) included a review of non-order constituents in groundwater with concentrations greater than primary screening criteria, which included chloride, dissolved barium, manganese and molybdenum. A similar review of dissolved lithium in groundwater was performed in Section 5.1.3 above. Based on this information and the receptor information provided in the 2017 RGMP, the following interpretations were made:

- CM_MW1-SH and CM_MW1-DP are installed bedrock and the source of chloride, dissolved sodium, barium, manganese, molybdenum is inferred to be naturally occurring and originate from either water interacting with bedrock, or from limited interactions with the atmosphere; and
- dissolved lithium at CM_MW-1-OB/SH/DP and RG_DW-07-01 are inferred to originate from natural sources (interaction with bedrock and/or unconsolidated materials) as it is present in concentrations above CSR DW throughout the Elk Valley, including in background location FR_HMW5.

5.11.4 Discussion

Discussion of trends in groundwater quality in Study Area 11 focuses on dissolved selenium and sulphate concentrations, which were above the primary screening criteria at RG_DW-07-01. Time series plots of dissolved selenium and sulphate from the RGMP monitoring locations in Study Area 11 are shown in Appendix III (Graphs 11-2 and 11-3, respectively). For comparison purposes, dissolved selenium and sulphate concentrations measured in Corbin Creek at surface water location CM_CC1 and in Michel Creek downstream from the confluence with Corbin Creek at surface water location CM_MC2 were added to Graphs 11-2 and 11-3.

As shown on Graph 11-2, selenium concentrations at RG_DW-07-01 have increased compared to previous years and were above CSR DW standard in 2017 Q2 and Q3 (the concentration in Q2 of 15.2 µg/L was a historical high for RG_DW-07-01). An increase in selenium concentrations was also noted at surface water locations CM_MC2 and CM_CC1 in 2017. Selenium concentrations measured at

RG_DW-07-01 have typically been within the range of concentrations measured in Michel Creek at CM_MC2 and below the primary screening criteria, but 2017 concentrations were above surface water concentrations at CM_MC2 and primary screening criteria in Q2 and Q3. Selenium concentrations at this location were also higher than Michel Creek in Q2 2016 and Q3 2014 (Graph 11-2). These results suggest that this monitoring locations is at least seasonally influenced by Corbin Creek, which contains higher selenium concentrations.

Consistent with results from previous years, sulphate concentrations at RG_DW-07-01 also exceeded CSR DW standard in 2017 (Graph 11-3); the highest concentration was measured in 2017 Q4. A seasonal trend in concentrations of sulphate appears to be present at RG_DW-07-01 based on 2014-2017 data. In general, concentrations of these constituents at this location are lowest in spring, which is consistent with the effect of dilution on constituents in shallow groundwater in a freshet dominated regime. Fluctuations of sulphate concentrations in surface water are more prominent compared to groundwater but follows generally the same seasonal pattern. Sulphate concentrations measured at RG_DW-07-01 were higher than those measured in Michel Creek but within the range and generally lower than concentrations measured in Corbin Creek at CM_CC1. These results suggest support the interpretation that groundwater sampled from RG_DW-07-01 is influenced by surface water recharge from Corbin Creek.

Selenium and sulphate concentrations at the nested well CM_MW1 were below the primary screening criteria. The data for the nested well show higher concentrations of dissolved selenium and sulphate in the shallow overburden well (CM_MW1-OB) compared to the two bedrock monitoring wells (CM_MW1-SH and CM_MW1-DP). This observation is consistent with the CSM identifying the surficial deposits as the main groundwater transport pathway for CI in the Study Area. Concentrations in the shallow overburden well (CM_MW1-OB) fluctuate with no obvious trend.

Drawing 635544-330 shows the spatial distribution of CI for samples collected in Study Area 11. Attenuation of sulphate and dissolved selenium appears to be occurring in the Michel Creek valley-bottom further downgradient of the confluence of Corbin Creek and Michel Creek as no constituent concentrations above screening criteria were noted in CM_MW1-OB, the location installed in valley-bottom deposits furthest downgradient from CMO.

5.12 Study Area 12: Elk River Valley-bottom at Study Area Boundary

This area was selected as it is at the boundary of MU4. Study Area 12 is located downgradient from the confluence of Michel Creek and Elk River. The monitoring points in Study Area 12 are EV_ER1gwS/D and RG_DW-03-04 (also identified as the Sparwood Municipal Well 3). Monitoring wells and relevant surface water locations for Study Area 12 are shown on Drawing 635544-310.

Coarse-grained fluvial and glaciofluvial deposits in Study Area 12 are the primary groundwater-bearing units for domestic and municipal groundwater supplies (Appendix IV). District of Sparwood Wells 1 and 2 and several domestic wells located north of Study Area 12 extract groundwater from a shallow unconfined sand and gravel unit. A deeper semi-confined to confined sand and gravel aquifer is also present in Study Area 12 (e.g., RG_DW-03-4). The confining layer identified as clay at RG_DW-03-04 is not continuous and the deep unit is inferred to interact with the shallow unit and surface water (Michel Creek and/or Elk River). The extent of the deep unit and the confining layer are not well constrained. Groundwater flow direction is expected to be generally parallel or sub parallel to the Elk River; however, at the confluence of Michel Creek and Elk River, groundwater flow is likely governed by the presence of preferential pathways formed by channels of coarser grained sediments. Cross sections O-O’ and N-N’ (Drawings 635544-325 and -326) are located approximately parallel and perpendicular to the inferred groundwater flow direction.

5.12.1 Potential Sources and Transport Pathways

The 2017 RGMP identified potential sources of Cl and potential transport pathways to valley-bottom groundwater in Study Area 12, summarized in the following table. Potential sources are also shown in plan on Drawing 635544-310.

Table QQ: Potential Sources and Transport Pathways to Groundwater in Study Area 12 (After SNC-Lavalin, 2017a)

Potential Sources	Potential Transport Pathways	Current Monitoring Location[1]
Upstream Michel Creek valley bottom groundwater.	Down-valley Michel Creek groundwater flow from Study Area 9.	EV_ER1gwS/D (RGMP and EVO SSGMP) RG_DW-03-04 (RGMP)
Upstream Elk River valley bottom groundwater.	Down-valley Elk River groundwater flow from Study Area 8.	EV_ER1gwS/D (RGMP and EVO SSGMP) RG_DW-03-04 (RGMP)
Michel Creek and Elk River.	Recharge to groundwater from infiltration of Michel Creek and Elk River along some stretches.	EV_MC2 and EV_MC1 (SWMP) EV_ER1 and EV_ER2 (SWMP)

1. EVO SSGMP: Elkview Operations Site-Specific Groundwater Monitoring Program; RGMP: Regional Groundwater Monitoring Program and SWMP: Surface Water Monitoring Program.

5.12.2 Groundwater Levels

Seasonal variability and long-term trends in groundwater elevations in Study Area 12 were assessed using manual water level measurements at EV_ER1gwS and EV_ER1gwD (Table 2) and continuous groundwater level data for EV_ER1gwS. Groundwater elevations from January 2015 to October 2017 were plotted on a time-series graph (Appendix III, Graph 12-1) along with daily water level data recorded for Elk River (hydrometric station 08NK016). Consistent with observations made by SNC-Lavalin (2017c), fluctuations in EV_ER1gwS generally follow the surface water fluctuation observed at the Elk River hydrometric station suggesting a strong hydraulic connection between groundwater and surface water at this location. Note that the amplitude of the fluctuation in groundwater and surface water are not directly comparable as the hydrometric station is located approximately 15 m north of Sparwood. In addition, we note that the elevation of water level measurement at the hydrometric station is unknown; therefore, the water level data shown on Graph 12-1 are relative and based on the local datum.

Groundwater elevation in EV_ER1gwS ranged from 1,110.2 masl to 1,112.5 masl throughout the monitoring period (2015 to 2017) and followed a typical seasonal trend associated with a freshet regime. In 2017, the maximum groundwater level was approximately 0.4 m higher than previously recorded in 2015 and 2016. The vertical groundwater gradient at the nested well EV_ER1gwS/D is upwards ranging from 0.02 m/m to 0.03 m/m in 2017 (Appendix V). The range in 2017 vertical gradient values listed above is within the range of previously calculated values from 2015 and 2016. Groundwater elevation measured during the fourth quarter at EV_ER1gwS/D in Study Area 12 is shown on Drawing 635544-307 to provide regional context with other Study Areas.

The District of Sparwood municipal supply well (RG_DW-03-04) is located approximately 0.5 km southeast (i.e., further from the Elk River) of EV_ER1gwS/D. The reported average daily pumping rate of RG_DW-03-04 between January and mid-November 2017 was 2,850 m^3/day, approximately 600 m^3/day greater than the average pumping rate in 2016 (between May and December) which was approximately 2,250 m^3/day (SNC-Lavalin, 2017c). No pumping occurred from mid-November through December of 2017. Based on pumping data reviewed, the average daily pumping rate in 2017 was relatively consistent, ranging from an average pumping rate of 2,463 m^3/day in February to 2,962 m^3/day in July. As shown on Graph 12-1, groundwater levels at EV_ER1gwS do not appear to be affected by groundwater extraction at RG_DW-03-04. There are no continuous water level data for EV_ER1gwD and as such it is unknown if the deep aquifer is affected by groundwater extraction. The nested monitoring well EV_ER1gwS/D is located more than 600 m away and generally upgradient from the municipal well RG_DW-03-04. Interference at this distance is expected to be minimal. In addition, it is possible that EV_ER1gwS/D is outside the capture zone of RG_DW-03-04 as indicated in the assessment completed by UMA (2008).

5.12.3 Groundwater Quality

The analytical results compared to screening criteria are presented in Tables 3 and 4 (primary screening), Table 5 (secondary screening), and Appendix III, Graphs 12-1 (dissolved selenium only). A summary of results above primary screening criteria for Study Area 12 is presented in Table RR.

Table RR: Summary of Constituents above Primary Screening Criteria for Study Area 12

Parameter[1,2,3,4]	EV_ER1gwS				EV_ER1gwD				RG_DW-03-04			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Selenium	DW	-	-	-	-	-	-	DW	-	-	-	DW
Lithium	-	-	DW	-	-	-	DW	-	na	-	-	DW

Notes: 1.) Dissolved parameter unless otherwise indicated; 2.) Primary screening criteria applied are CSR standards for Aquatic Life (AW), Drinking Water (DW), Livestock (LW) and Irrigation (IW); 3.) '–' denotes result below primary screening criteria for given constituent; and 4.) na indicates the well was not sampled for specific parameter.

Results from 2017 were similar to previous years with the exception of lithium concentrations above the CSR DW standard due to the updated standard on November 1, 2017. Dissolved lithium concentrations were above CSR DW standards during select quarters at EV_ERgwS/D (Q3) and RG_DW-03-04 (Q4). The source of dissolved lithium is inferred to originate from natural sources (interaction with bedrock and/or unconsolidated materials), as described in Section 5.1.3 above, as it is present in concentrations above CSR DW throughout the Elk Valley, including in background location FR_HMW5.

Selenium was the only CI with concentrations above primary screening criteria in Study Area 12 (Appendix III, Graph 2-2). Dissolved selenium concentrations were marginally above the primary screening criteria (DW) in Q1 at EV_ER1gwS and in Q4 at EV_ER1gwD and RG_DW-03-04. Groundwater concentrations for other CI in Study Area 12 were below applicable primary screening criteria. Secondary screening was performed for selenium where concentrations were above primary criteria and all concentrations were below secondary screening criteria.

5.12.4 Discussion

Discussion of chemistry trends in Study Area 12 focused on selenium as this constituent was marginally above primary screening criteria on one occasion in 2017 at each of the monitoring locations EV_ER1gwS (Q1), EV_ER1gwD (Q4) and RG_DW-03-04 (Q4). A time-series plot of dissolved selenium concentrations for groundwater (EV_ER1gwS, EV_ER1gwD and RG_DW-03-04) and surface water stations in the Elk River (EV_ER1) and Michel Creek (EV_MC2) are shown on Graph 12-2 in Appendix III. Graph 12-2 also includes the Elk River hydrometric station 08NK016 to assess the effect of freshet on selenium concentrations.

Consistent with observations in previous annual reports, a clear seasonal trend in selenium concentrations is observed in the surface water (Elk River and Michel Creek) and groundwater (EV_ER1gwS/D and RG_DW-03-04). Selenium concentrations are lowest in spring and summer and increase through the fall and winter, consistent with the effect of dilution on constituents in shallow groundwater in a freshet dominated regime. Selenium concentrations in groundwater at EV_ER1gwS/D in 2017 were lower than concentrations in Michel Creek and Elk River surface water (EV_MC2 and EV_ER1, respectively) as shown on Graph 12-2. At RG_DW-03-04, 2017 selenium concentrations were also lower than surface water concentrations except for the sample collected in May 2017 (Q2).

Since 2015, selenium concentrations in Michel Creek have been higher compared to Elk River and groundwater concentrations in EV_ER1gwS/D (SNC-Lavalin, 2016). The increases in Michel Creek do not appear to be affecting selenium concentrations in EV_ER1gwS/D (Appendix III, Graph 12-2). Based on comparison of selenium concentration between groundwater at EV_ER1gwS/D and surface water in the Elk River, surface water infiltration (recharge) from the Elk River appears to be the main source of selenium in EV_ER1gwS/D.

In 2016 and 2017, groundwater quality in the deeper aquifer at municipal well RG_DW-03-04 (completed at approximately 35 mbgs) appeared to generally reflect the Elk River surface water quality. However, we note that selenium concentrations measured at RG_DW-03-04 were above the concentrations measured in Elk River surface water during the fall of 2015 and 2016 also suggesting an influence of Michel Creek surface water.

RG_DW-03-04 extracts groundwater from a semi-confined to confined sand and gravel aquifer. The confining layer identified as clay at RG_DW-03-04 is not continuous and the deep unit is inferred to interact with the shallow sand and gravel aquifer and surface water. The extent of the deep unit and the confining layer are not well constrained and neither is the groundwater flow direction at the confluence of Michel Creek and Elk River. Groundwater flow in the area south of Michel Creek and east of Elk River is likely governed by the presence of preferential pathways formed by channels of coarser grained sediments. Detailed lithology and groundwater elevation are not available in this area but the confining silt and clay layer is inferred to pinch out towards the Elk River as shown on cross section N-N' (Drawing 635544-325). The RG_DW-03-04 capture zone is inferred to extend in a generally north to northeast direction and draw water from Elk River and/or Michel Creek. The extraction of groundwater from the deep aquifer at RG_DW-03-04 likely induces a downward vertical hydraulic gradient within the capture zone resulting in surface water from Elk River and/or Michel Creek recharging the deeper aquifer.

Drawing 635544-329 shows the spatial distribution of dissolved cadmium, dissolved selenium, sulphate and nitrate-nitrogen for samples collected in 2017 in Study Area 12 and provide regional context Study Areas 8 and 9. Selenium concentrations above primary screening criteria but below secondary screening criteria were measured at the farthest downgradient monitoring location in MU 4 and the Study Area boundary (i.e., EV_ER1gwS/D). The extent of groundwater quality above primary screening criteria in the Elk River valley-bottom aquifer us unknown; however, because groundwater quality in Study Area 12 appears to reflect the Elk River surface water quality, surface water infiltration (recharge) rather than a valley-bottom groundwater pathway appears to be the cause of concentrations above screening criteria measured at this location. Accordingly, achieving delineation will not be valuable or even possible as groundwater further down the Elk Valley should continue to reflect surface water quality, which is anticipated to improve over time through implementation of the EVWQP. Furthermore, as discussed in the CSM (Section 2) and in Section 5.13 below, the degree of the influence of surface water infiltration on groundwater is on the local scale and highly variable due to heterogeneity in the valley-bottom aquifer system.

5.13 Groundwater Surface Water Interactions in Other Management Units

As required in Permit 107517, an assessment of potential surface water to groundwater interaction effects in all management units must be performed. Groundwater-surface water interactions in Study Areas in MUs 1-4 are presented above. Infiltration of the Elk River is interpreted to occur on the local scale downstream of MU 4 based on results from the Drinking Water Sampling Evaluation Program (SNC-Lavalin, 2014). The degree of the influence of surface water infiltration on groundwater in other MUs is variable, dependent on relative levels in the river and groundwater system, river morphology, river gradient, hydraulic properties of the streambed and valley-bottom surficial deposits, distance from river and the degree of pumping from wells. Teck is currently monitoring a number of domestic water supplies in MU 5 and is undertaking further assessment of water supplies in 2018. The results from this assessment will be considered under the AMP and in future annual reports as appropriate.

6 Conclusions and Recommendations

In general, groundwater conditions and interpretations in 2017 were consistent with those outlined in past reports, and most recently the 2017 RGMP (SNC-Lavalin, 2017a). Concentrations of CI above primary and secondary screening criteria were generally consistent with previous measurements and are summarized by Study Area below. A change in CSR standards on November 1, 2017 resulted in changes in primary screening for constituents in the RGMP data set (Table SS).

Table SS: November 1, 2017 Primary Screening Criteria Changes to the CSR

Constituent	Unit	From	To	Pathway
Sulphate	mg/L	1,000	1,280 to 4,290[1]	Aquatic life
Nitrate-Nitrogen	mg/L	3,200	1,000	Drinking Water
Dissolved Cadmium	µg/L	0.1 to 0.6[1]	0.5 to 4[1]	Aquatic life
Dissolved Selenium	µg/L	10	20	Aquatic life
Dissolved Selenium	µg/L	50	30	Livestock
Dissolved Boron	µg/L	50,000	12,000	Aquatic life
Dissolved Lithium	µg/L	730	8	Drinking Water
Dissolved Manganese	µg/L	550	1,500	Drinking Water
Dissolved Strontium	µg/L	22,000	2,500	Drinking Water

[1] Hardness dependent range

The two orders of magnitude decrease in the DW standard for dissolved lithium has resulted in numerous values screening above the standard (refer to Section 5) for groundwater sampled from wells in the RGMP. However, it is noted that there is no drinking water guideline for lithium in Health Canada's Guidelines for Canadian Drinking Water Quality (GCDWQ; Health Canada, 2017) which is considered to be more applicable for consumption of drinking water at the tap.

In addition to the above listed constituents, dissolved copper, magnesium, and zinc were previously measured in concentrations above standards in wells located in Study Area 9 (SNC-Lavalin, 2017a). The CSR standards for these constituents are listed in Table TT.

Table TT: November 1, 2017 Primary Screening Criteria Changes to the CSR for Study Area 9

Constituent	Unit	From	To	Pathway
Dissolved Copper	µg/L	1,000	1,500	Drinking Water
Dissolved Magnesium	µg/L	100	No standard	Drinking Water
Dissolved Zinc	µg/L	5,000	3,000	Drinking Water

In general, the changes in standards resulted in fewer results screening above primary screening criteria due to increasing standards; however, the applicable standards for dissolved lithium and strontium did result in an increase in the number of samples above primary screening criteria for those particular parameters. The 2017 RGMP (SNC-Lavalin, 2017) included a review of non-order constituents in groundwater with concentrations greater than primary screening criteria, including chloride, fluoride, dissolved barium, boron, manganese, molybdenum and sodium, which were interpreted to originate from natural sources (e.g., interaction with bedrock or unconsolidated materials). A similar review was undertaken for dissolved lithium since it was not part of the 2017 RGMP review. Dissolved lithium is also interpreted to be naturally occurring, based on data from the reference well, and other wells in the RGMP and bedrock wells at CMO.

General recommendations for the RGMP are as follows:

› Increase water level data quality by:
  - collecting concurrent (before and after) manual water level measurements each time a water level logger is deployed or removed from a well and prior to each sampling event;
  - re-deploying level logger at exact same depth in monitoring well after it was removed for downloading; and
  - using a barometer and manual water level measurements to compensate and correct the data.
› Review the QA/QC programs, specifically related to field and trip blanks, and the source of constituents above the detection limit in samples;
› Review sampling protocols to confirm which parameters should be analyzed for Study Area 6; and
› For samples from RDW wells (RG_DW-series), continue to analyse for all the parameters listed in the 2017 RGMP in 2018.

The following summarizes conclusions from the 2017 results. The 2017 RGMP considered data gaps and additional studies recommended to fill the data gaps; the text below references these gaps where applicable and provides further recommendations as necessary.

6.1 Background (Reference) Conditions

Each CI concentration, with the exception of the anomalous dissolved selenium in Q2 and sulphate, was below or near the MDL. The Q2 selenium result is considered anomalous and a result of inadequate purging of the well after introduction of water to the well. We recommend eliminating the practice of introducing water into this well and also following the standard purging procedure to remove adequate purge volumes from dedicated monitoring wells.

Because this well is upgradient of any mining activities, concentrations of each parameter were below primary screening criteria (except dissolved selenium in Q2 and dissolved lithium in each quarter sampled), monitoring well FR_HMW5 was considered an appropriate reference monitoring well for the RGMP.

Elevated dissolved lithium concentrations (i.e., two orders of magnitude higher than the standard) at the reference location indicated that it is likely a naturally occurring constituent. Dissolved lithium above primary screening criteria in groundwater at 92% of wells across the RGMP prompted a review of this non-order constituent, similar to what was completed in the 2017 RGMP. Results from the review indicated that it is naturally occurring and sourced from bedrock.

6.2 Study Area 1

A down-valley groundwater transport pathway was identified in the Fording River valley-bottom to the east of the Fording River. Dissolved selenium concentrations in Q4 in FR-09-01-A/B were a historical high. The farthest downgradient monitoring points (FR_GHHW) reported selenium and nitrate-nitrogen above primary screening criteria but within historical ranges. Selenium concentrations at FR_GHHW were also above secondary screening criteria for some sampling events. Discharge and mixing with Fording River surface water likely occurs between these points and the nearest downgradient monitoring points at GHO; however, these monitoring points are over 15 km downstream and the localized extents of CI in groundwater are not well constrained. The spatial extent of the coarse-grained aquifer intercepted at the Greenhouse Wells, as well as the spatial extent of the down-valley groundwater transport of CI, were identified as data gaps in the 2017 RGMP (SNC-Lavalin, 2017a).

6.3 Study Area 2

Groundwater quality in LC_PIZDC1308 and LC_PIZDC1307 has historically been consistently below all primary screening criteria for the CI. No groundwater monitoring wells exist in the valley-bottom; however, potential pathways for CI to groundwater in the valley-bottom within Study Area 2 are being monitored by monitoring wells located upgradient in the Dry Creek drainage and in surface water at monitoring stations in Dry Creek and the Fording River. There are no continuous aquifers in the Dry creek drainage; therefore, the only transport pathway identified to groundwater in Study Area 2 is the surface water pathway as groundwater transport through the till is negligible. Although there are no data for the valley-bottom, the information is not considered necessary for monitoring mine-influences to groundwater.

6.4 Study Area 3

Based on monitoring results for dissolved selenium and sulphate in Study Area 3 wells, it is uncertain whether a groundwater transport pathway exists from the Greenhills Creek alluvial fan into the Fording River valley-bottom. Comparison of groundwater quality in the Fording River valley-bottom to surface water in the Fording River indicates that groundwater concentrations of dissolved selenium were approximately one order of magnitude lower; however, sulphate concentrations in groundwater were relatively similar or higher compared to surface water in the Fording River. The sulphate may be naturally sourced or a result of infiltration from Greenhills Creek over the alluvial fan; if the latter is occurring, then associated dissolved selenium contributions from Greenhills Creek may have preferentially attenuated in the aquifer.

The 2017 RGMP (SNC-Lavalin, 2017a) did not identify the above described uncertainty as data gaps because complete pathways to receptors were not identified, as there are no current uses of groundwater for drinking. The supply wells have been instrumented with continuous level monitors and continued monitoring of groundwater in Study Area 3 is warranted to further understand the groundwater-surface water interactions in this portion of the Fording River valley-bottom.

6.5 Study Area 4

Groundwater selenium concentrations in Study Area 4 have shown considerable variability (i.e., orders-of-magnitude) and the local-scale interaction with surface water and groundwater discharge is not well understood. It is suspected that variable groundwater CI concentrations are due to variability in CI concentrations in surface water. Mining influence on groundwater is interpreted to be on the local scale proximal to the infiltration ponds at the base of the valley flanks adjacent to GHO. Groundwater concentrations of CI were below all screening criteria at the supply well RG_DW-01-03, with concentrations decreasing further downgradient of Elkford at domestic well location RG_DW-01-07, indicating a regional down-valley pathway does not exist.

The Q4 results for three of the monitoring wells adjacent to GHO were relatively higher than historical ranges; at GH_GA-MW-2 and GH_MW-ERSC-1 they were historical highs. At location GH_MW-ERSC-1 only two results from 2014 and 2015 were of the same order of magnitude. Concentrations were much higher than upgradient wells, suggesting either a surface water influence or another source between these wells. The GHO SSGMP did not identify any source in the vicinity and there are no immediate upgradient tributary drainages; however, the well is situated in 45 m from the Elk River side channel and infiltration may be influencing the groundwater quality in this well. The Elk River side channel was flowing in 2017 and is currently being studied under a local aquatic effects monitoring program (LAEMP).

The 2017 RGMP indicated that on a regional scale a data gap does not exist (SNC-Lavalin, 2017a). The 2017 monitoring results, particularly Q4, do; however, suggest that a localized gap exists. The LAEMP will be evaluating groundwater-surface water interactions which we expect will inform the GHO SSGMO and RGMP through the AMP.

6.6 Study Areas 5 and 6

Previous studies and monitoring results to date indicated that groundwater at the LCO Process Plant does not appear to be affected by activities at the Process Plant or infiltration of Line Creek surface water. The 2017 RGMP indicated that LC_PIZP1101 does not appear to be the most appropriate location to confirm the presence of a groundwater flow path from Line Creek under the Process Plant to the Elk River valley bottom and recommended adding existing wells that intercept the unconfined sand and gravel aquifer (SNC-Lavalin, 2017a). There are no data for the Elk River valley-bottom aquifer downgradient of identified sources near the Process Plant and the 2017 RGMP identified that as a data gap. However, it is worth noting that groundwater farther down the Elk River valley monitored in Study Area 7, which indicates a down-valley groundwater transport pathway does not exist at the regional scale.

6.7 Study Area 7

Significant groundwater transport of CI from the Harmer Creek drainage to the Elk River valley bottom is inferred to be minimal based on relatively low groundwater concentrations measured in Harmer Creek drainage at EV_GV3gw compared to surface water. Groundwater quality in the Elk River valley-bottom is influenced by Elk River surface water quality and dissolved selenium concentrations were measured above CSR DW in RG_DW-02-20 in Q1 and Q2. Teck is currently supplying alternate drinking water to the owners of this well. Because the main pathway for CI above criteria in groundwater in the Elk River valley bottom is surface water infiltration (i.e., surface water pathway) and groundwater quality is being monitored by RG_DW-02-20, no data gap was identified for Study Area 7 in the 2017 RGMP

(SNC-Lavalin, 2017a). Although there are no data for the deeper aquifer in this area, the information is not considered necessary for monitoring mine-influences to groundwater.

6.8 Study Area 8

Groundwater in Study Area 8 does not contain elevated concentrations of CI at the monitoring wells EV_LSgw and EV_OCgw which monitor potential inputs from upland, tributary valley bottom, and Elk River valley bottom features along the western slope of EVO. As such, there does not appear to be a confirmed groundwater transport pathway between the sources identified on the western slope of EVO and Elk River valley-bottom based on the current RGMP monitoring well locations. Loading of mine-influenced constituents to groundwater valley-bottom in Study Area 8 is therefore inferred to be primarily from infiltration of surface water associated with drainages and mining features along the western slope of EVO and surface water recharge from nearby Elk River. The highest concentrations of CI in Study Area 8 were measured at surface water station Goddard Creek Sedimentation Pond Decant (EV_GC2). The 2017 RGMP identified a data gap in the absence of monitoring wells screened in the shallow and deep aquifer at this location (SNC-Lavalin, 2017a).

6.9 Study Area 9

A down-valley groundwater pathway was identified where concentrations of CI in groundwater in the Michel Creek valley-bottom were above the surface water concentrations and secondary screening criteria. Downgradient monitoring wells EV_MCgwS/D and domestic well RG_DW-03-01 are installed in lower permeability units which may limit their utility as downgradient sentry wells; however, groundwater level data suggests there may be a connection of groundwater in EV_MCgwS/D to surface water. The borehole log at EV_BCgw mostly indicates continuous gravel from ground surface to 23 m bgs. It is unknown whether this gravel unit is continuous further downgradient within the District of Sparwood and whether a down-valley pathway in the deep aquifer for groundwater transport of elevated CI exists.

The spatial extent of the aquifer where CI concentrations in groundwater are above secondary screening criteria is also not well defined. Borehole logs for some the wells in the Michel Creek valley-bottom where elevated concentrations on CI were measured are not available (e.g., EV_RCgw, EV_WH50gw and EV_BRgw). The 2017 RGMP (SNC-Lavalin, 2017a) identified data gaps that appear to still exist; however, the Sparwood Area Groundwater Supporting Study currently underway will provide additional data and further refine data gaps.

6.10 Study Area 10

Groundwater quality in EV_ECgw was below all primary screening criteria for the CI in 2017; therefore, groundwater transport of CI in the Erickson drainage appears to be negligible. Data do not exist for the Michel Creek valley-bottom aquifer downgradient of Erickson Creek and the South Pit Decant Pond and as such local groundwater conditions are unknown. The nearest monitoring points are approximately 6 km down the valley (Study Area 9) and because they are elevated in CI from assumed local sources they do not provide any indication of groundwater quality down-valley from Study Area 10. The 2017 RGMP identified a data gap in the Michel Creek valley-bottom aquifer immediately downgradient of Erickson Creek and the South Pit Creek Decant Pond (SNC-Lavalin, 2017a).

6.11 Study Area 11

Selenium concentrations at RG_DW-07-01 historically fluctuate around the CSR DW standard but have increased slightly compared to previous years and were above CSR DW standard in 2017 Q2 and Q3. Teck is currently supplying alternate drinking water to the owners of this domestic well seasonally. An increasing trend of selenium concentrations was also noted at surface water locations CM_MC2 and CM_CC1 in 2017. Groundwater dissolved concentrations of CI from RG_DW-07-01 in Q2 and Q3 appears to be influenced seasonally by infiltration of Corbin Creek.

The furthest downgradient groundwater monitoring location in the Michel Creek valley-bottom in Study Area 11 (CM_MW1-OB/SH/DP) reported concentrations of CI below primary screening criteria with no increase. The data for the nested well show higher concentrations of dissolved selenium and sulphate in the shallow overburden well compared to the two bedrock monitoring wells, consistent with the CSM identifying the surficial deposits as the main groundwater transport pathway for CI in the Study Area. The 2017 RGMP identified a data gap near the CMO Loadout area and Loadout Infiltration Ponds (SNC-Lavalin, 2017a).

6.12 Study Area 12

Groundwater quality in Study Area 12 appears to reflect Elk River and/or Michel Creek surface water quality and groundwater concentrations are generally lower than surface water concentrations. Surface water infiltration (recharge) rather than a valley-bottom groundwater pathway appears to be the cause of concentrations above screening criteria measured at this location; however, there is potential for a down-valley groundwater flow pathway from Study Area 9 also affecting groundwater quality in Study Area 12. No data exist for the Elk River and Michel valley-bottom upgradient aquifers of RG_DW-03-04. There are no continuous water level data for EV_ER1gwD and; therefore, it is unknown if the deep aquifer is affected by groundwater extraction. Although a surface water connection is apparent, the absence of groundwater elevation and groundwater quality data does not allow for a detailed understanding of the groundwater flow path and surface water influence was considered a gap in the 2017 RGMP (SNC-Lavalin, 2017a).

Selenium concentrations above primary screening criteria, but below secondary screening criteria were measured at the farthest downgradient monitoring locations in MU 4 (i.e., EV_ER1gwS/D and RG_DW-03-04). Groundwater with concentrations above CI is expected outside of MU4 due to the potential infiltration of the Elk River downstream (i.e., the surface water pathway). However, the degree of the influence of surface water infiltration on groundwater is on the local scale and highly variable due to heterogeneity in the valley-bottom aquifer system. Teck is currently monitoring a number of domestic water supplies down-valley from MU 4 and is undertaking further assessment of water supplies in 2018. The results from this assessment will be considered under the AMP and in future annual reports as appropriate.

It is noted that groundwater quality is expected to improve with surface water quality as the EVWQP is implemented. Groundwater quality does improve in the down-valley direction from MU4; as part of the Elk Valley Drinking Water Evaluation and Sampling Program (SNC-Lavalin, 2014), five domestic wells located about 2 km downstream from Study Area 12 in the Elk valley were sampled and selenium concentrations in groundwater were below primary screening criteria.

Dissolved lithium was identified above CSR DW in RG_DW-03-04. Water from this well is used by the District of Sparwood when results are below the GCDWQ (Health Canada, 2017) and there is no GCDWQ for lithium. The source of dissolved lithium is inferred to originate from natural sources (interaction with bedrock and/or unconsolidated materials), as it is present in concentrations above CSR DW throughout the Elk Valley, including in background location FR_HMW5 and bedrock wells at relatively high concentrations.

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The findings, conclusions and recommendations in this report (i) have been developed in a manner consistent with the level of skill normally exercised by professionals currently practicing under similar conditions in the area, and (ii) reflect SNC-Lavalin's best judgment based on information available at the time of preparation of this report. No other warranties, either expressed or implied, are made as to the professional services provided under the terms of our original contract and included in this report. The findings and conclusions contained in this report are valid only as of the date of this report and may be based, in part, upon information provided by others. If any of the information is inaccurate, new information is discovered, site conditions change or standards are amended, modifications to this report may be necessary. The results of this assessment should in no way be construed as a warranty that the subject site is free from any and all environmental impact.

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Tables

TABLE 1: Summary of Applicable Primary and Secondary Screening Criteria

Study Area	Well ID	Operation	MU	Primary Screening				Secondary Screening (Selenium Only)		
				AW Criteria Applied**	DW Criteria Applied	IW Criteria Applied	LW Criteria Applied	Site Performance Objective	Compliance Point	DW Guidelines Applied
Background	FR_HMW5	FRO	1	BC CSR	BC CSR	BC CSR	BC CSR	GH_FR1 (0200378)	FR_FRCP1 (E300071)	CDWQG
1	FR_09-01-A	FRO	1	BC CSR	BC CSR	BC CSR	BC CSR	GH_FR1 (0200378)	FR_FRCP1 (E300071)	CDWQG
	FR_09-01-B	FRO	1	BC CSR	BC CSR	BC CSR	BC CSR	GH_FR1 (0200378)	FR_FRCP1 (E300071)	CDWQG
	FR_GHHW	FRO	1	BC CSR	BC CSR	BC CSR	BC CSR	GH_FR1 (0200378)	FR_FRCP1 (E300071)	CDWQG
2	LC_PIZDC1308	LCO	1	BC CSR	BC CSR	BC CSR	BC CSR	GH_FR1 (0200378)	GH_FR1 (200378)	CDWQG
	LC_PIZDC1307	LCO	1	BC CSR	BC CSR	BC CSR	BC CSR	GH_FR1 (0200378)	GH_FR1 (200378)	CDWQG
3	GH_POTW09	GHO	1	BC CSR	BC CSR	BC CSR	BC CSR	GH_FR1 (0200378)	GH_FR1 (200378)	CDWQG
	GH_POTW10	GHO	1	BC CSR	BC CSR	BC CSR	BC CSR	GH_FR1 (0200378)	GH_FR1 (200378)	CDWQG
	GH_POTW15	GHO	1	BC CSR	BC CSR	BC CSR	BC CSR	GH_FR1 (0200378)	GH_FR1 (200378)	CDWQG
	GH_POTW17	GHO	1	BC CSR	BC CSR	BC CSR	BC CSR	GH_FR1 (0200378)	GH_FR1 (200378)	CDWQG
	GH_MW-RLP-1D	GHO	1	BC CSR	BC CSR	BC CSR	BC CSR	GH_FR1 (0200378)	GH_FR1 (200378)	CDWQG
4	GH_MW-ERSC-1	GHO	3	BC CSR	BC CSR	BC CSR	BC CSR	GH_ER1 (E206661)	GH_ERC (E300090)	CDWQG
	GH_GA-MW-1	GHO	3	BC CSR	BC CSR	BC CSR	BC CSR	GH_ER1 (E206661)	GH_ERC (E300090)	CDWQG
	GH_GA-MW-2	GHO	3	BC CSR	BC CSR	BC CSR	BC CSR	GH_ER1 (E206661)	GH_ERC (E300090)	CDWQG
	GH_GA-MW-3	GHO	3	BC CSR	BC CSR	BC CSR	BC CSR	GH_ER1 (E206661)	GH_ERC (E300090)	CDWQG
	GH_GA-MW-4	GHO	3	BC CSR	BC CSR	BC CSR	BC CSR	GH_ER1 (E206661)	GH_ERC (E300090)	CDWQG
	RG_DW-01-03	RG	3	BC CSR	BC CSR	BC CSR	BC CSR	GH_ER1 (E206661)	-	CDWQG
	RG_DW-01-07	RDW	3	BC CSR	BC CSR	BC CSR	BC CSR	GH_ER1 (E206661)	-	CDWQG
6	LC_PIZP1101	LCO	4	BC CSR	BC CSR	BC CSR	BC CSR	EV_ER4 (0200027)	-	CDWQG
7	EV_GV3gw	EVO	4	BC CSR	BC CSR	BC CSR	BC CSR	EV_ER1 (0200393)	-	CDWQG
	RG_DW-02-20	RDW	4	BC CSR	BC CSR	BC CSR	BC CSR	EV_ER1 (0200393)	-	CDWQG
8	EV_LSgw	EVO	4	BC CSR	BC CSR	BC CSR	BC CSR	EV_ER1 (0200393)	-	CDWQG
	EV_OCgw	EVO	4	BC WQG	BC CSR	BC CSR	BC CSR	EV_ER1 (0200393)	-	CDWQG
9	EV_BCgw	EVO	4	BC CSR	BC CSR	BC CSR	BC CSR	EV_ER1 (0200393)	EV_MC2 (E300091)	CDWQG
	EV_MCgwS	EVO	4	BC CSR	BC CSR	BC CSR	BC CSR	EV_ER1 (0200393)	EV_MC2 (E300091)	CDWQG
	EV_MCgwD	EVO	4	BC CSR	BC CSR	BC CSR	BC CSR	EV_ER1 (0200393)	EV_MC2 (E300091)	CDWQG
	EV_BRgw	EVO	4	BC CSR	BC CSR	BC CSR	BC CSR	EV_ER1 (0200393)	EV_MC2 (E300091)	CDWQG
	EV_RCgw	EVO	4	BC CSR	BC CSR	BC CSR	BC CSR	EV_ER1 (0200393)	EV_MC2 (E300091)	CDWQG
	EV_WH50gw	EVO	4	BC CSR	BC CSR	BC CSR	BC CSR	EV_ER1 (0200393)	EV_MC2 (E300091)	CDWQG
	RG_DW-03-01	RDW	4	BC CSR	BC CSR	BC CSR	BC CSR	EV_ER1 (0200393)	-	CDWQG
10	EV_ECgw	EVO	4	BC CSR	BC CSR	BC CSR	BC CSR	EV_ER1 (0200393)	EV_MC2 (E300091)	CDWQG
11	CM_MW1-OB	CMO	4	BC CSR	BC CSR	BC CSR	BC CSR	EV_ER1 (0200393)	CM_MC2 (E258937)	CDWQG
	CM_MW1-SH	CMO	4	BC CSR	BC CSR	BC CSR	BC CSR	EV_ER1 (0200393)	CM_MC2 (E258937)	CDWQG
	CM_MW1-DP	CMO	4	BC CSR	BC CSR	BC CSR	BC CSR	EV_ER1 (0200393)	CM_MC2 (E258937)	CDWQG
	RG_DW-07-01	RDW	4	BC CSR	BC CSR	BC CSR	BC CSR	EV_ER1 (0200393)	CM_MC2 (E258937)	CDWQG
12	EV_ER1gwS	EVO	4	BC CSR	BC CSR	BC CSR	BC CSR	EV_ER1 (0200393)	-	CDWQG
	EV_ER1gwD	EVO	4	BC CSR	BC CSR	BC CSR	BC CSR	EV_ER1 (0200393)	-	CDWQG
	RG_DW-03-04	RG	4	BC CSR	BC CSR	BC CSR	BC CSR	EV_ER1 (0200393)	-	CDWQG

** BCWQG applied for wells located within 10 m from a receiving surface water body

TABLE 2: Well Installation Details, Monitoring Values and Hydrogeological Information

Study Area	Well ID	Type	Operation	MU	LIDAR Ground Elevation (masl)	Ground Elevation (masl)	TOC Elevation (masl)	Drilled Depth (mbgs)	Screened Depth (mbgs)	Screened Formation	Date of Static Water Level Measurement	Depth to Water (mbtoc)	Potentiometric Elevation (masl)	Depth to Bedrock (mbgs)	Hydrostratigraphic Unit	Hydraulic Conductivity[2] (m/s)
Background	FR_HMW5	Monitoring	FRO	1	1793.23	1785.2	1786.03	12.6	7.3 - 10.4	Gravel	-	Frozen	-	10.7	-	3.00E-03
											2017/06/21	1.491	1784.54			
											2017/09/18	1.642	1784.39			
											2017/11/14	1.672	1784.36			
1	FR_09-01-A	Monitoring	FRO	1	1584.64	1584.10	1584.95	8.4	3.83 - 6.88	Sandy Gravel	2017/03/08	7.357	1577.59	-	Fording River valley bottom sediments	1.00E-03
											2017/06/01	1.156	1583.79			
											2017/09/12	6.405	1578.55			
											2017/11/22	7.642	1577.31			
	FR_09-01-B	Monitoring	FRO	1	1584.64	1584.10	1584.86	29.0	17.15 - 18.67	Gravel	2017/03/08	7.864	1577.00	-	Fording River valley bottom sediments	1.50E-04
											2017/06/01	1.594	1583.27			
											2017/09/12	6.946	1577.91			
											2017/11/22	8.133	1576.73			
	FR_GHHW[1]	Supply	FRO	1	1576.45	1575.80	-	Well 1: 21.6	Well 1: 20.4 - 21.6	Well 1: Gravel	-	-	-	-	Valley-bottom fluvial aquifer	-
								Well 2: 16.8	Well 2: 10.7 - 16.8	Well 2: Gravel						
								Well 3: 11.6	Well 3: 10.4 - 11.6	Well 3: Gravel						
								Well 4: 29.0	Well 4: 25.9 - 29.0	Well 4: Sand and Gravel						
2	LC_PIZDC1308	Monitoring	LCO	1	1721.68	1690.42	1691.37	19.81	6.10 - 9.14	Till and Colluvium	2017/03/16	3.23	1688.14	-	Colluvium and till	-
											2017/06/12	1.68	1689.69			
											2017/09/19	3.09	1688.28			
											2017/11/01	3.31	1688.06			
	LC_PIZDC1307	Monitoring	LCO	1	1721.68	1690.50	1691.21	35.05	32.77 - 34.75	Till	2017/03/16	6.06	1685.15	-	Highly consolidated basal till	-
											2017/06/12	1.68	1689.53			
											2017/09/19	5.17	1686.04			
											2017/11/01	5.22	1685.99			
3	GH_POTW09	Supply	GHO	1	1495.28	-	-	37	26.8 - 36.3	Silty Gravel	-	-	-	36.08	Fluvial sediments overlying bedrock	-
	GH_POTW10	Supply	GHO	1	1488.94	-	-	53.6	-	Gravel	-	-	-	-	Fluvial/glaciofluvial sediments	-
	GH_POTW15	Supply	GHO	1	1489.67	-	-	43.9	-	Gravel and Cobbles	-	-	-	-	Fluvial/glaciofluvial sediments	-
	GH_POTW17	Supply	GHO	1	1505.18	1504.00	-	47.2	39.3 - 42.4	Sand and Gravel	-	-	-	-	Fluvial sediments underlying lacustrine sediments	-
	GH_MW-RLP-1D	Monitoring	GHO	1	1494.78	1495.00	-	83.5	79.5 - 82.5	Sand and Gravel	2017/02/02	7.99	1488.23	-	Fluvial/glaciofluvial sediments	-
											2017/06/22	6.48	1489.74			
											2017/09/26	6.50	1489.72			
											2017/11/13	6.56	1489.66			
4	GH_MW-ERSC-1	Monitoring	GHO	3	1286.45	1283.36	1284.11	7.924	4.12 - 7.17	Till/Bedrock	2017/01/31	6.01	1278.10	6.1	Till/ Bedrock interface	3.00E-06
											2017/06/20	4.30	1279.81			
											2017/09/20	6.30	1277.81			
											2017/11/30	5.20	1278.91			
	GH_GA-MW-1	Monitoring	GHO	3	1378.81	1379.21	1380.26	22.6	15.5 - 18.5	Clayey Sand	2017/01/30	17.01	1363.25	22.6	Interlayered alluvial and lacustrine sediments	1.00E-12
											2017/06/20	16.71	1363.55			
											2017/09/19	16.94	1363.32			
											2017/10/19	16.99	1363.27			
	GH_GA-MW-2	Monitoring	GHO	3	1305.23	1306.66	1307.68	29.6	23 - 28	Sand/Silt	2017/01/30	5.49	1302.19	28.5	Fluvial sediments about the bedrock contact	1.00E-03
											2017/06/20	4.03	1303.65			
											2017/09/20	5.78	1301.90			
											2017/11/27	6.00*	1301.68			
	GH_GA-MW-3	Monitoring	GHO	3	1299.62	1299.78	1300.75	14.4	8 - 14	Sand and Gravel	2017/01/30	6.49	1294.26	14.4	Fluvial sediments above the bedrock contact	2.00E-06
											2017/06/19	6.20	1294.55			
											2017/09/20	8.99	1291.76			
											2017/11/30	7.89	1292.86			
	GH_GA-MW-4	Monitoring	GHO	3	1311.57	1312.15	1313.05	17.2	13.7 - 16.7	Sand and Gravel	2017/01/30	6.65	1306.40	-	Alluvial sediments	1.00E-04
											2017/06/30	4.93	1308.12			
											2017/09/19	6.50	1306.55			
											2017/11/27	6.57	1306.48			
	RG_DW-01-03	Supply	RDW	3	1262.49	-	-	27.96	-	Sand and Gravel	-	-	-	-	Interlayered Silt Sand and Gravel Fluvial Sediments	-
	RG_DW-01-07	Domestic	RDW	3	1244.76	-	-	9.8	-	Sandy Gravel	-	-	-	-	-	-
6	LC_PIZP1101	Monitoring	LCO	4	1266.65	1266.00	1267.06	41.2	37.5 - 40.5	Sand and Gravel	2017/03/15	31.26	1235.8	-	Fluvial sediments	7.40E-04
											2017/06/13	30.445	1236.62			
											2017/09/21	30.86	1236.2			
											2017/11/03	31.21	1235.85			
7	EV_GV3gw	Monitoring	EVO	4	1307.01	1307.05	1307.96	25	22.85 - 24.38	Silty Gravel	2017/03/29	10.58	1297.38	-	Alluvial sediments in the Grave Creek valley-bottom	-
											2017/06/27	10.69	1297.27			
											2017/08/15	10.82	1297.14			
											2017/08/29	10.86	1297.10			
											2017/10/17	10.91	1297.05			

[1] Greenhouse water supply includes four wells (FR_GW_WELL1, FR_GW_WELL2, FR_GW_WELL3 and FR_GW_WELL4) which are collectively referred to as FR_GHHW. Ground elevation of FR_GW_WELL4 is included in Table 2.
[2] Average hydraulic conductivity.
* The depth to water measured at GH_GA-MW-2 was reported to be approximate due to issues with the water level probe.
** Reported depth to water was 0.49 m which was considered suspect based on other measurements collected on this day. Value was changed to 2.49 and discrepancy was considered to be a field transcription error.
*** Based on continuous water elevation data, depth to water measurements appear to have been collected while sampling.
TOC: Top of casing
- indicates that data for the given field is unavailable

TABLE 2 (Cont'd): Well Installation Details, Monitoring Values and Hydrogeological Information

Study Area	Well ID	Type	Operation	MU	LIDAR Ground Elevation (masl)	Ground Elevation (masl)	TOC Elevation (masl)	Drilled Depth (mbgs)	Screened Depth (mbgs)	Screened Formation	Date of Static Water Level Measurement	Depth to Water (mbtoc)	Potentiometric Elevation (masl)	Depth to Bedrock (mbgs)	Hydrostratigraphic Unit	Hydraulic Conductivity[2] (m/s)
7 (Cont'd)	RG_DW-02-20	Domestic	RDW	4	1169.15	-	-	18.3	-	-	-	-	-	-	-	-
8	EV_LSgw	Monitoring	EVO	4	1133.05	1133.00	1133.93	10.67	5.18 - 6.71	Sand and Gravel	2017/03/07	5.43	1128.50	-	Fluvial valley-bottom sediments	1.00E-03
											2017/06/27	3.77	1130.16			
											2017/08/22	4.09	1129.84			
											2017/10/17	4.23	1129.70			
	EV_OCgw	Monitoring	EVO	4	1125.48	1126.00	1126.89	15.54	11.58 - 14.63	Sand	2017/03/29	3.20	1123.69	14.48	Fluvial valley-bottom sediments	7.00E-07
											2017/06/19	3.44	1123.45			
											2017/06/29	3.55	1123.34			
											2017/08/15	3.64	1123.25			
											2017/08/29	4.32	1122.57			
											2017/09/21	5.29	1121.60			
											2017/10/18	3.61	1123.28			
9	EV_BCgw	Monitoring	EVO	4	1153.15	1153.00	1153.86	23.16	17.77 - 20.82	Gravel	2017/03/14	3.11	1150.75	-	Fluvial valley-bottom sediments	1.00E-04
											2017/03/30	2.62	1151.24			
											2017/05/16	2.15	1151.71			
											2017/06/27	2.49**	1151.37			
											2017/08/23	3.01	1150.85			
											2017/10/18	3.14	1150.72			
	EV_MCgwS	Monitoring	EVO	4	1131.04	1131.00	1131.96	10.67	5.79 - 7.32	Clayey Silt	2017/03/16	1.67	1130.29	-	Shallowest valley-bottom aquifer	7.00E-08
											2017/06/28	2.24	1129.72			
											2017/08/16	2.90	1129.06			
											2017/09/21	4.80	1127.16***			
											2017/10/18	6.38	1125.58***			
	EV_MCgwD	Monitoring	EVO	4	1131.04	1131.00	1131.84	47.55	24.50 - 27.55	Sand and Clay	2017/03/16	2.61	1129.23	-	Deepest valley-bottom aquifer	3.00E-06
											2017/06/28	3.07	1128.77			
											2017/08/16	3.65	1128.19			
											2017/09/19	4.03	1127.81***			
											2017/10/18	4.21	1127.63***			
	EV_BRgw	Supply	EVO	4	1149.34	-	-	-	-	-	-	-	-	-	Fluvial sediments in the Michel Creek valley bottom	-
	EV_RCgw	Supply	EVO	4	1162.02	-	-	-	-	Sand and Gravel	-	-	-	-	Fluvial sediments in the Michel Creek valley bottom	-
	EV_WH50gw	Supply	EVO	4	1159.14	-	-	-	-	-	-	-	-	-	Fluvial sediments in the Michel Creek valley bottom	-
	RG_DW-03-01	Domestic	RDW	4	1127.54	-	-	15.24	14.0 - 15.2	Gravel	-	-	-	-	-	-
10	EV_ECgw	Monitoring	EVO	4	1327.17	1327.00	1327.74	10.97	2.59 - 4.12	Sand/Clay and Sand	2017/03/13	Frozen	-	-	Colluvium overlying till	1.00E-08
											2017/06/20	1.86	1325.88			
											2017/08/23	2.35	1325.39			
											2017/10/25	2.59	1325.15			
											2017/11/21	1.78	1325.96			
											2017/11/22	2.05	1325.69			
11	CM_MW1-OB	Monitoring	CMO	4	1494.47	1500.44	1501.29	37.19	2.87 - 4.39	Gravel and Silt	2017/03/27	3.03	1498.26	-	Fluvial sediments in the Michel Creek valley bottom	1.20E-04
											2017/06/19	3.38	1497.91			
											2017/08/28	3.57	1497.72			
											2017/12/07	3.33	1497.96			
	CM_MW1-SH	Monitoring	CMO	4	1494.47	1500.44	1501.29	37.19	20.44 - 23.49	Siltstone	2017/03/21	4.07	1497.23	-	Siltstone	2.00E-07
											2017/06/19	4.18	1497.12			
											2017/08/28	4.5	1496.79			
											2017/12/07	4.25	1497.04			
	CM_MW1-DP	Monitoring	CMO	4	1494.47	1500.44	1501.29	37.19	34.22 - 37.19	Siltstone	2017/03/28	3.47	1497.82	18	Siltstone	6.00E-06
											2017/06/27	3.16	1498.13			
											2017/09/06	4.25	1497.04			
											2017/12/07	3.99	1497.30			
	RG_DW-07-01	Domestic	RDW	4	1506.50	-	-	13.7	-	-	-	-	-	-	-	-
12	EV_ER1gwS	Monitoring	EVO	4	1114.41	1115.25	1115.96	17.61	14.56 - 17.61	Sand and Gravel	2017/02/15	5.75	1110.21	-	Shallowest fluvial aquifer	-
											2017/06/28	4.30	1111.66			
											2017/08/22	5.03	1110.93			
											2017/10/24	5.19	1110.77			
	EV_ER1gwD	Monitoring	EVO	4	1114.35	1115.2	1115.91	30.78	25.82 - 28.87	Sand/Silty Sand	2017/02/15	5.40	1110.51	27.89	Deepest fluvial aquifer	9.00E-04
											2017/06/28	3.97	1111.94			
											2017/08/22	4.69	1111.22			
											2017/10/24	4.85	1111.06			
	RG_DW-03-04	Supply	RDW	4	1113.23	-	-	32.4	24.2 - 32.4	Sandy Gravel	-	-	-	-	Fluvial sediments in the Elk River valley bottom	-

[1] Greenhouse water supply includes four wells (FR_GW_WELL1, FR_GW_WELL2, FR_GW_WELL3 and FR_GW_WELL4) which are collectively referred to as FR_GHHW. Ground elevation of FR_GW_WELL4 is included in Table 2.
[2] Average hydraulic conductivity.
* The depth to water measured at GH_GA-MW-2 was reported to be approximate due to issues with the water level probe.
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*** Based on continuous water elevation data, depth to water measurements appear to have been collected while sampling.
TOC: Top of casing
- indicates that data for the given field is unavailable

TABLE 3: Summary of Analytical Results compared to Primary Screening Criteria for Dissolved Inorganics in Groundwater

			Field Parameters					Physical Parameters								Dissolved Inorganics											
Sample Location	Sample ID	Sample Date (yyyy mm dd)	Temperature °C	pH (field) pH	Dissolved Oxygen mg/L	Conductivity µS/cm	Specific Conductance µS/cm	pH pH	Hardness mg/L	Conductivity µS/cm	Total Suspended Solids mg/L	Total Dissolved Solids mg/L	Turbidity, Lab NTU	Total Alkalinity (as CaCO3) mg/L	Alkalinity, Bicarbonate (as CaCO3) mg/L	Ammonia, total (as N) µg/L	Bromide mg/L	Chloride mg/L	Fluoride µg/L	Nitrate (as N) mg/L	Nitrite (as N) mg/L	Kjeldahl Nitrogen-N mg/L	Ortho-Phosphate mg/L	Total Phosphorous as P mg/L	Sulphate mg/L	Total Organic Carbon mg/L	Dissolved Organic Carbon mg/L
BC Standard																											
BCWQG Aquatic Life Short-term Maximum (AW)[a]			n/a	6.5-9.0	n/a	n/a	n/a	6.5-9.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5,680-24,500[d]	n/a	n/a	1,454-1,871[e]	32.8 (max)	0.06-0.6[f]	n/a	n/a	n/a	n/a	n/a	n/a
BCWQG Aquatic Life Long-term Average (AW)[b]			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	365-1,780[d]	n/a	n/a	n/a	3	0.02-0.2[f]	n/a	n/a	n/a	128-429[e]	n/a	n/a
CSR Aquatic Life (AW)[c]			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1,310-18,500[d]	n/a	1,500	2,000-3,000[e]	400	0.2-2[f]	n/a	n/a	n/a	1,280-4,290[e]	n/a	n/a
CSR Irrigation Watering (IW)			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100	1,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CSR Livestock Watering (LW)			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	600	1,000	100	10	n/a	n/a	n/a	1,000	n/a	n/a
CSR Drinking Water (DW)			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	250	1,500	10	1	n/a	n/a	n/a	500	n/a	n/a
Background																											
FR_HMW5	FR_HMW5_QSW_03042017_N	2017 06 21	3.4	8.01	0.62	362.9	-	8.22	158	365	< 1.0	231	0.18	158	-	65	< 0.050	1.34	655	< 0.005	< 0.001	0.061	0.0246	0.0258	43.2	0.58	1.28
	FR_HMW5_QTR_2017-09-11_N	2017 09 18	3.6	8.05	0.34	348.6	-	8.40	162	373	< 1.0	247	0.12	161	-	61.4	< 0.050	1.02	599	< 0.005	< 0.001	< 0.050	0.0227	0.0229	44.3	< 0.50	< 0.50
	WG_2017-09-11_003	Duplicate	-	-	-	-	-	8.33	166	370	< 1.0	232	0.29	163	-	61.1	< 0.050	1.07	593	< 0.005	< 0.001	< 0.050	0.0214	0.0229	44.5	< 0.50	< 0.50
	QA/QC RPD%		*	*	*	*	-	1	2	1	*	6	*	1	-	< 1	*	5	1	*	*	*	6	0	< 1	*	*
	FR_HMW5_QTR_2017-10-02_N	2017 11 14	3.6	8.22	0.34	345.4	-	8.44	187	383	< 1.0	196	0.36	162	-	62.1	< 0.050	0.96	511	< 0.005	< 0.001	0.087	0.0214	0.0201	45.4	< 0.50	< 0.50
	WG_2017-10-02_005	Duplicate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	QA/QC RPD%		*	*	*	*	-	*	*	*	*	*	*	*	-	*	*	*	*	*	*	*	*	*	*	*	*
Study Area 1																											
FR_09-01-A	FR_09-01-A_QSW_02012017_N	2017 03 08	2.8	7.73	8.43	1,447	-	7.51	986	1,540	< 1.0	1,240	0.15	305	-	< 5.0	< 0.25	3.2	120	**47.2**	< 0.005	0.165	0.0034	0.0083	481	< 0.50	< 0.50
	FR_09-01-A_QSW_03042017_N	2017 06 01	5.5	7.65	10.76	990	-	8.04	557	1,030	< 1.0	789	0.86	231	-	< 5.0	< 0.25	< 2.5	200	**35.1**	< 0.005	0.486	0.0021	0.0029	208	0.76	0.53
	FR_09-01-A_QTR_2017-09-11_N	2017 09 12	8.6	7.34	5.41	1,185	-	8.08	738	1,170	< 1.0	927	0.13	298	-	< 5.0	< 0.25	3.0	< 100	**21.2**	< 0.005	< 0.050	0.0016	0.0233	347	0.63	0.74
	FR_09-01-A_QTR_2017-10-02_N	2017 11 22	6.9	7.30	7.71	1,542	-	7.79	1,050	1,590	< 1.0	1,350	0.29	328	-	< 5.0	< 0.25	< 2.5	< 100	**54.3**	0.0127	0.449	0.0030	0.0039	486	0.58	< 0.50
FR_09-01-B	FR_09-01-B_QSW_02012017_N	2017 03 08	4.7	7.45	5.76	1,231	-	7.45	882	1,320	36.4	1,040	11.2	307	-	< 5.0	< 0.25	4.1	120	**25.9**	< 0.005	0.613	0.0027	0.0154	409	< 0.50	< 0.50
	FR_09-01-B_QSW_03042017_N	2017 06 01	6.1	7.32	10.34	1,102	-	8.18	636	1,160	< 1.0	907	0.27	236	-	5.0	< 0.25	< 2.5	170	**43.9**	< 0.005	0.457	0.0014	0.0044	267	0.54	< 0.50
	FR_09-01-B_QTR_2017-09-11_N	2017 09 12	7.9	7.23	4.28	1,012	-	8.19	613	987	< 1.0	738	0.35	258	-	< 5.0	< 0.25	3.0	140	**12.7**	< 0.005	< 0.050	0.0010	0.0028	296	0.78	0.88
	FR_09-01-B_QTR_2017-10-02_N	2017 11 22	7.6	7.29	8.29	1,298	-	7.85	890	1,330	2.3	1,050	1.26	336	-	< 5.0	< 0.25	3.1	140	**29.6**	< 0.005	0.294	0.0032	0.0055	407	0.70	< 0.50
FR_GHHW	FR_GHHW_QSW_02012017_N	2017 02 27	7.9	7.57	5.84	1,082	-	7.58	689	1,230	< 1.0	957	0.30	263	-	< 5.0	< 0.050	1.52	96	**46.6**	0.0019	< 0.050	0.0101	0.0155	287	0.87	0.78
	FR_GHHW_QSW_03042017_N	2017 06 01	12.2	7.34	6.40	1,024	-	8.09	597	1,090	< 1.0	844	0.88	271	-	7.5	< 0.25	2.9	< 100	**33.4**	< 0.005	< 0.050	< 0.0010	< 0.0020	248	0.76	0.60
	FR_GHHW_QTR_2017-09-11_N	2017 09 13	17.7	7.33	3.32	898	-	8.26	527	942	< 1.0	637	1.32	242	-	9.2	< 0.050	1.67	94	**27.3**	***0.398***	0.499	< 0.0010	0.0014	195	2.08	1.57
FR_GH_WELL4	FR_GH_WELL4_QTR_2017-10-02_N	2017 11 15	8.7	7.48	5.39	976	-	8.35	590	1,050	< 1.0	772	0.38	248	-	< 5.0	< 0.25	< 2.5	< 100	**34.9**	0.0191	0.240	< 0.0010	< 0.0020	243	0.93	0.77
Study Area 2																											
LC_PIZDC1307	LC_PIZDC1307_WG_2017-03-13_NP	2017 03 16	2.4	8.22	1.16	-	307	8.22	171	368	1.6	206	7.47	222	-	93.5	< 0.050	< 0.50	527	< 0.005	< 0.001	0.187	0.0182	0.0150	< 0.30	1.70	1.67
	LC_PIZDC1307_WG_2017-06-12_NP	2017 06 12	10.1	8.19	0.37	-	356.6	8.28	164	378	4.1	192	11.6	242	-	125	< 0.050	< 0.50	513	< 0.005	< 0.001	0.207	< 0.0010	0.0225	< 0.30	2.14	1.81
	LC_PIZDC1307_WG_2017-09-11_NP	2017 09 19	4.9	8.19	0.52	-	329.6	8.36	177	369	2.2	207	7.80	220	-	113	< 0.050	< 0.50	519	< 0.005	< 0.001	-	< 0.0010	0.0080	< 0.30	-	1.52
	LC_PIZDC1307_WG_2017-12-11_NP	2017 11 01	3.2	8.16	0.68	-	289.6	8.30	182	380	2.0	235	9.71	220	-	105	< 0.050	< 0.50	442	0.0058	< 0.001	-	< 0.0010	0.0100	< 0.30	-	1.71
LC_PIZDC1308	LC_PIZDC1308_WG_2017-03-13_NP	2017 03 13	3	7.69	0.2	-	380.1	8.01	233	449	1.8	261	9.14	268	-	62.9	< 0.050	< 0.50	272	0.0055	< 0.001	0.111	< 0.0010	0.0097	2.50	1.95	1.93
	LC_PIZDC1308_WG_2017-06-12_NP	2017 06 12	7.2	7.21	0.71	-	513	7.84	315	569	1.7	301	1.79	355	-	< 5.0	< 0.050	1.13	132	0.159	< 0.001	0.096	< 0.0010	0.0023	4.74	2.78	2.57
	LC_PIZDC1308_WG_2017-09-11_NP	2017 09 19	5.0	7.40	0.19	-	425.9	8.31	211	441	< 1.0	251	4.47	260	-	44.8	< 0.050	< 0.50	271	< 0.005	< 0.001	-	< 0.0010	0.0019	1.92	-	1.77
	FD_WG_20170911_020	Duplicate	-	-	-	-	-	8.22	233	444	< 1.0	258	4.60	265	-	47.7	< 0.050	< 0.50	272	0.005	< 0.001	-	< 0.0010	0.0279	2.06	-	2.04
	QA/QC RPD%		*	*	*	-	*	1	10	1	*	3	3	2	-	6	*	*	< 1	*	*	-	*	*	7	-	*
	LC_PIZDC1308_WG_2017-12-11_NP	2017 11 01	4	7.48	0.09	-	346.3	8.05	240	451	2.8	278	10.5	264	-	51.7	< 0.050	< 0.50	230	0.0627	< 0.001	-	< 0.0010	0.0035	1.84	-	1.88
	FD_WG_20171211_023	Duplicate	-	-	-	-	-	8.17	238	460	2.0	304	10.6	258	-	50.5	< 0.050	< 0.50	224	0.0075	< 0.001	-	0.0042	0.0031	2.02	-	1.99
	QA/QC RPD%		*	*	*	-	*	1	1	2	*	9	1	2	-	2	*	*	3	*	*	-	*	*	9	-	*
Study Area 3															-												
GH_POTW09	GH_POTW09_WG_2017-02-07_NP	2017 02 07	6.2	7.38	2.48	618.5	-	7.72	398	726	7.5	474	20.4	248	-	30.3	< 0.050	6.38	798	0.0111	0.0018	< 0.050	< 0.0010	0.0031	156	0.79	0.80
	GH_POTW09_WG_2017-06-19_NP	2017 06 22	9.2	7.61	9.52	660	-	8.33	372	723	< 1.0	516	0.91	220	-	32.8	< 0.050	7.39	665	0.0320	< 0.001	0.091	< 0.0010	< 0.0020	158	0.69	1.05
	GH_POTW09_WG_2017-06-19_FD	Duplicate	-	-	-	-	-	8.32	372	717	< 1.0	529	0.92	210	-	53.5	< 0.050	7.26	665	0.0323	0.0026	< 0.050	< 0.0010	0.0056	158	0.84	0.61
	QA/QC RPD%		*	*	*	*	-	< 1	0	1	*	2	1	5	-	48	*	2	0	1	*	*	*	*	0	*	*
	GH_POTW09_WG_2017-07-05_NP	2017 07 05	-	-	-	-	-	8.19	398	774	< 1.0	517	1.69	256	-	29.5	< 0.050	7.03	776	0.0375	< 0.001	< 0.050	< 0.0010	< 0.0020	159	< 0.50	0.71
	GH_POTW09_WG_2017-07-01_NP	2017 09 25	6.9	7.41	3.34	637	-	8.30	392	687	< 1.0	501	0.88	238	-	36.0	0.063	6.06	860	0.0154	< 0.001	< 0.050	< 0.0010	0.0022	160	0.62	0.57
	GH_POTW09_WG_2017-10-01_NP	2017 11 16	7.6	7.44	4.86	676	-	8.38	416	741	< 1.0	487	0.85	252	-	31.2	< 0.050	6.04	609	0.0184	< 0.001	0.168	< 0.0010	0.0029	162	0.53	0.56

Data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.
** Comparison to BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline.

[a] Guideline to protect freshwater aquatic life, short-term maximum (i.e. "acute"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[b] Guideline to protect freshwater aquatic life, long-term average (i.e. "chronic"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[c] Standard to protect freshwater aquatic life.
[d] Guideline/standard varies with pH.
[e] Guideline/standard varies with Hardness.
[f] Guideline/standard varies with Chloride.
[g] Samples inferred to be mislabelled in field.

BOLD**	Concentration greater than BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline
BOLD	Concentration greater than CSR Aquatic Life (AW) standard
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard

TABLE 3 (Cont'd): Summary of Analytical Results compared to Primary Screening Criteria for Dissolved Inorganics in Groundwater

			Field Parameters					Physical Parameters								Dissolved Inorganics											
Sample Location	Sample ID	Sample Date (yyyy mm dd)	Temperature °C	pH (field) pH	Dissolved Oxygen mg/L	Conductivity µS/cm	Specific Conductance µS/cm	pH pH	Hardness mg/L	Conductivity µS/cm	Total Suspended Solids mg/L	Total Dissolved Solids mg/L	Turbidity, Lab NTU	Total Alkalinity (as CaCO3) mg/L	Alkalinity, Bicarbonate (as CaCO3) mg/L	Ammonia, total (as N) µg/L	Bromide mg/L	Chloride mg/L	Fluoride µg/L	Nitrate (as N) mg/L	Nitrite (as N) mg/L	Kjeldahl Nitrogen-N mg/L	Ortho-Phosphate mg/L	Total Phosphorous as P mg/L	Sulphate mg/L	Total Organic Carbon mg/L	Dissolved Organic Carbon mg/L
BC Standard																											
BCWQG Aquatic Life Short-term Maximum (AW)[a]			n/a	6.5-9.0	n/a	n/a	n/a	6.5-9.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5,680-24,500[d]	n/a	n/a	1,454-1,871[e]	32.8 (max)	0.06-0.6[f]	n/a	n/a	n/a	n/a	n/a	n/a
BCWQG Aquatic Life Long-term Average (AW)[b]			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	365-1,780[d]	n/a	n/a	n/a	3	0.02-0.2[f]	n/a	n/a	n/a	128-429[e]	n/a	n/a
CSR Aquatic Life (AW)[c]			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1,310-18,500[d]	n/a	1,500	2,000-3,000[e]	400	0.2-2[f]	n/a	n/a	n/a	1,280-4,290[e]	n/a	n/a
CSR Irrigation Watering (IW)			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100	1,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CSR Livestock Watering (LW)			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	600	1,000	100	10	n/a	n/a	n/a	1,000	n/a	n/a
CSR Drinking Water (DW)			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	250	1,500	10	1	n/a	n/a	n/a	500	n/a	n/a
Study Area 3 (Cont'd)																											
GH_POTW10	GH_POTW10_WG_2017-02-07_NP	2017 02 07	6.4	7.65	3.93	603.7	-	7.76	365	712	1.3	465	11.4	201	-	63.8	< 0.050	4.45	837	0.675	0.0177	< 0.050	< 0.0010	0.0030	182	0.85	0.82
	GH_POTW10_WG_2017-02-07_FD	Duplicate	-	-	-	-	-	7.73	353	705	1.7	476	11.6	198	-	77.2	< 0.050	4.42	861	0.677	0.0175	0.065	< 0.0010	0.0031	182	0.82	0.87
	QA/QC RPD%		*	*	*	*	-	< 1	3	1	*	2	2	2	-	19	*	1	3	< 1	1	*	*	*	0	*	*
	GH_POTW10_WG_2017-06-19_NP	2017 06 19	9.9	7.46	7.74	851	-	8.27	513	1,000	2.1	723	12.5	244	-	55.5	< 0.25	38.6	120	< 0.025	< 0.005	0.135	< 0.0010	< 0.0020	278	1.34	1.39
	GH_POTW10_WG_2017-07-01_NP	2017 09 25	7.8	7.63	5.05	609	-	8.33	381	678	< 1.0	492	11.2	199	-	83.9	< 0.050	4.59	839	0.453	0.0145	0.245	< 0.0010	0.0048	191	< 0.50	< 0.50
	GH_POTW10_WG_2017-10-01_NP	2017 11 16	7.1	7.62	4.55	665	-	8.39	399	728	1.4	492	12.1	208	-	71.9	< 0.050	4.73	652	0.448	0.0157	0.250	< 0.0010	0.0022	195	< 0.50	< 0.50
GH_POTW15	GH_POTW15_WG_2017-02-07_NP	2017 02 07	6.9	7.49	2.69	760	-	7.64	464	887	1.3	621	10.2	222	-	34.6	0.096	28.2	176	0.0103	0.0051	< 0.050	< 0.0010	0.0022	234	1.21	1.21
	GH_POTW15_WG_2017-06-19_NP	2017 06 19	8.7	7.67	8.3	629	-	8.34	382	730	< 1.0	503	10.4	212	-	62.8	< 0.050	4.59	818	0.390	0.0166	0.810	< 0.0010	< 0.0020	190	0.85	1.31
	GH_POTW15_WG_2017-07-01_NP	2017 09 25	8.4	7.39	1.17	771	-	8.24	475	855	1.2	651	12.2	208	-	46.0	0.159	29.3	170	< 0.005	< 0.001	< 0.050	< 0.0010	0.0039	250	1.08	1.19
	GH_POTW15_WG_2017-10-01_NP	2017 11 16	8.0	7.49	6.56	863	-	8.26	516	936	6.4	632	12.6	226	-	43.3	0.138	33.3	126	< 0.005	< 0.001	0.100	< 0.0010	0.0051	254	1.24	1.32
GH_POTW17	GH_POTW17_WG_2017-01-03_NP	2017 01 03	-	-	-	-	-	7.55	739	1,140	23.9	951	31.3	276	-	14.4	< 0.25	19.5	140	0.281	0.0124	0.080	< 0.0010	0.0112	464	1.83	1.17
	GH_POTW17_WG_2017-02-07_NP	2017 02 07	5.9	7.67	7.81	1,086	-	7.90	719	1,260	209	989	116	274	-	13.0	< 0.050	20.4	139	0.302	0.0036	0.317	< 0.0010	0.215	450	3.34	2.48
	GH_POTW17_WG_2017-06-19_NP	2017 06 19	9.2	7.69	10.36	1,118	-	8.29	737	1,290	< 1.0	1,050	1.24	283	-	11.6	< 0.25	17.3	130	0.505	0.0094	< 0.050	< 0.0010	< 0.0020	475	1.14	1.15
	GH_POTW17_WG_2017-07-05_NP	2017 07 05	-	-	-	-	-	8.20	729	1,290	3.1	1,050	6.11	267	-	11.0	< 0.25	17.6	140	0.414	0.0106	0.068	< 0.0010	< 0.0020	448	1.10	1.15
	GH_POTW17_WG_2017-07-01_NP	2017 09 25	8.5	7.4	4.09	1,033	-	8.06	709	1,110	3.3	961	4.71	245	-	19.4	< 0.25	17.4	100	0.311	< 0.005	< 0.050	< 0.0010	0.0025	450	1.06	0.92
	GH_POTW17_WG_2017-10-01_NP	2017 11 21	6.9	7.45	3.68	1,145	-	8.20	780	1,220	1.1	959	1.56	284	-	12.0	< 0.25	17.5	130	0.415	0.0052	0.089	< 0.0010	0.0029	450	0.89	0.88
GH_MW-RLP-1D	GH_MW-RL-1D_WG_2017-02-02_NP	2017 02 02	1.5	7.7	0.5	-	-	7.73	255	466	1.5	263	5.01	222	-	< 5.0	< 0.050	< 0.50	1,800	0.0063	< 0.001	< 0.050	0.0012	0.0079	39.0	1.68	1.91
	GH_MW-RL-1D_WG_2017-02-02_FD	Duplicate	-	-	-	-	-	7.75	274	474	1.5	258	4.72	225	-	< 5.0	< 0.050	< 0.50	1,790	< 0.005	< 0.001	< 0.050	< 0.0010	0.0067	38.8	1.63	1.71
	QA/QC RPD%		*	*	*	-	-	< 1	7	2	*	2	6	1	-	*	*	*	1	*	*	*	*	*	1	*	*
	GH_MW-RL-1D_WG_2017-06-19_NP	2017 06 22	8.5	8.1	0.42	-	-	8.32	235	431	4.8	259	30.8	187	-	27.7	< 0.050	< 0.50	1,900	< 0.005	< 0.001	< 0.050	< 0.0010	< 0.0020	29.9	1.50	1.66
	GH_MW-RLP_WG_2017-07-01_NP	2017 09 26	11.2	7.98	4.28	394.4	-	8.20	244	412	42.8	274	87.8	228	-	< 5.0	< 0.050	< 0.50	1,890	0.0131	< 0.001	< 0.050	< 0.0010	0.0448	18.9	4.4	3.8
	GH_MW-RLP_WG_2017-10-01_NP	2017 12 13	2.7	8.05	4.48	395.6	-	8.29	220	449	16.8	242	76.2	232	-	5.3	< 0.050	< 0.50	1,680	< 0.005	< 0.001	0.17	< 0.0010	0.0212	8.09	1.52	1.61
Study Area 4																											
GH_MW-ERSC-1	GH_MW-ERSC-1_WG_2017-01-31_NP	2017 01 31	3.8	7.29	6.42	461.8	-	7.57	311	562	2.3	331	3.13	304	-	62.2	< 0.050	3.62	358	0.0184	< 0.001	0.109	< 0.0010	0.0176	15.8	1.79	1.82
	GH_MW-ERSC-1_WG_2017-01-31_FD	Duplicate	-	-	-	-	-	7.55	301	562	1.5	319	2.90	307	-	56.1	< 0.050	3.07	327	0.0202	< 0.001	0.101	< 0.0010	0.0143	16.1	1.57	1.90
	QA/QC RPD%		*	*	*	*	-	< 1	3	0	*	4	8	1	-	10	*	16	9	*	*	*	*	21	2	*	*
	GH_MW-ERSC-1_WG_2017-06-19_NP	2017 06 20	9.8	7.52	5.96	300.1	-	8.12	-	328	1.0	195	1.33	158	-	< 5.0	< 0.050	< 0.50	116	0.543	< 0.001	< 0.050	0.0012	0.0086	29.7	1.50	1.56
	GH_ERSC-1_WG_2017-07-01_NP	2017 09 20	8.6	7.3	7.25	506	-	8.12	334	520	18.0	364	10.5	236	-	12.1	< 0.050	1.66	144	0.608	< 0.001	0.085	0.0047	0.0489	59.6	2.05	1.37
	GH_MW-ERSC-1_WG_2017-10-01_NP	2017 12 18	5.55	7.41	9.32	1,088	-	8.10	641	1,090	29.2	841	5.06	181	-	< 5.0	< 0.25	8.93	120	9.04	< 0.005	0.273	< 0.0010	0.0492	442	1.97	1.20
GH_GA-MW-1	GH_GA-MW-1_WG_2017-01-30_NP	2017 01 30	1.3	7.46	4.27	-	-	8.03	228	997	7.6	641	4.78	337	-	94.6	< 0.25	10.1	640	1.27	< 0.005	0.311	0.0321	0.0508	204	3.04	2.76
	GH_GA-MW-1_WG_2017-06-19_NP	2017 06 20	11.9	8.96	4.5	-	-	8.18	233	948	4.2	639	2.76	351	-	9.3	0.208	8.07	590	1.14	0.0120	0.082	0.0407	0.0433	192	1.91	2.04
	GH_GA_MW-1_WG_2017-07-01_NP	2017 09 19	9.0	7.28	1.5	1,254	-	8.52	363	1,300	9.6	822	5.77	358	-	222	0.42	21.7	390	0.177	0.0081	0.308	0.0131	0.0497	344	4.40	8.83
	GH_GA-MW-1_WG_2017-10-01_NP	2017 10 19	6.3	7.49	3.02	1,110	-	8.55	296	1,190	1.7	825	1.53	393	-	229	0.46	23.8	380	0.523	0.0054	0.404	0.0265	0.0419	295	4.82	5.17
GH_GA-MW-2	GH_GA-MW-2_WG_2017-01-30_NP	2017 01 30	4.4	7.58	0.55	-	-	8.08	362	707	4.5	488	1.91	215	-	< 5.0	< 0.25	8.01	120	0.837	0.0691	0.053	0.0015	0.0065	176	0.79	0.75
	GH_GA-MW-2_WG_2017-06-19_NP	2017 06 20	9.2	11	0.67	-	-	8.06	366	673	1.4	489	0.35	214	-	< 5.0	< 0.050	7.12	104	1.50	< 0.001	0.123	< 0.0010	< 0.0040	171	0.90	0.86
	GH_GA-MW-2_WG_2017-07-01_NP	2017 09 20	7.5	7.54	4.01	648	-	7.98	423	675	10.3	538	5.74	177	-	12.6	0.067	7.23	102	0.85	0.0944	< 0.050	< 0.0010	0.0092	189	0.77	0.61
	GH_GA-MW-2_WG_2017-07-01_FD	Duplicate	-	-	-	-	-	8.02	385	685	4.0	532	1.85	170	-	13.6	0.068	7.27	97	1.56	0.100	< 0.050	0.0010	0.0067	192	0.71	0.67
	QA/QC RPD%		*	*	*	*	-	< 1	9	1	*	1	103	4	-	*	*	1	*	59	6	*	*	31	2	*	*
	GH_GA-MW-2_WG_2017-10-01_NP	2017 11 27	6.0	7.47	0.49	740	-	8.20	448	792	1.6	619	0.72	221	-	< 5.0	< 0.050	7.44	98	5.52	0.0384	0.564	0.0030	0.0047	214	0.81	0.86
GH_GA-MW-3	GH_GA-MW-3_WG_2017-01-30_NP	2017 01 30	4.4	7.7	0.53	-	-	7.75	218	604	16.7	356	36.9	259	-	372	< 0.050	6.87	700	< 0.005	< 0.001	0.427	< 0.0010	0.0190	33.3	0.89	0.72
	GH_GA-MW-3_WG_2017-06-19_NP	2017 06 19	7.4	7.65	1.06	-	-	8.15	281	680	4.9	407	16.5	258	-	334	< 0.050	6.93	593	< 0.005	0.0018	0.462	< 0.0010	0.0260	84.0	0.93	1.03
	GH_GA-MW-3_WG_2017-07-01_NP	2017 09 20	6.1	7.6	0.48	522	-	8.37	256	584	7.3	331	84.4	258	-	363	< 0.050	5.73	647	< 0.005	< 0.001	0.330	0.0072	0.0250	38.7	< 0.50	< 0.50
	GH_GA-MW-3_WG_2017-10-01_NP	2017 11 30	4.8	7.66	0.16	-	-	8.20	274	597	4.7	324	75.1	292	-	362	< 0.050	5.84	652	0.161	0.002	0.41	0.0092	0.0151	41.1	0.56	0.56
GH_GA-MW-4	GH_GA-MW-4_WG_2017-01-30_NP	2017 01 30	4.6	7.52	5.12	-	-	8.13	377	744	< 1.0	506	0.12	203	-	49.8	< 0.25	4.66	150	1.92	< 0.005	0.104	0.0016	0.0022	211	0.81	0.70
	GH_GA-MW-4_WG_2017-01-30_FD	Duplicate	-	-	-	-	-	8.04	367	750	1.3	505	0.14	206	-	< 5.0	< 0.25	4.74	150	1.96	< 0.005	0.074	0.0015	< 0.0020	215	0.82	0.69
	QA/QC RPD%		*	*	*	-	-	1	3	1	*	< 1	*	1	-	*	*	2	0	2	*	*	*	*	2	*	*

Data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.
** Comparison to BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline.

[a] Guideline to protect freshwater aquatic life, short-term maximum (i.e. "acute"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[b] Guideline to protect freshwater aquatic life, long-term average (i.e. "chronic"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[c] Standard to protect freshwater aquatic life.
[d] Guideline/standard varies with pH.
[e] Guideline/standard varies with Hardness.
[f] Guideline/standard varies with Chloride.
[g] Samples inferred to be mislabelled in field.

BOLD**	Concentration greater than BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline
BOLD	Concentration greater than CSR Aquatic Life (AW) standard
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard

TABLE 3 (Cont'd): Summary of Analytical Results compared to Primary Screening Criteria for Dissolved Inorganics in Groundwater

			Field Parameters					Physical Parameters								Dissolved Inorganics											
Sample Location	Sample ID	Sample Date (yyyy mm dd)	Temperature °C	pH (field) pH	Dissolved Oxygen mg/L	Conductivity µS/cm	Specific Conductance µS/cm	pH pH	Hardness mg/L	Conductivity µS/cm	Total Suspended Solids mg/L	Total Dissolved Solids mg/L	Turbidity, Lab NTU	Total Alkalinity (as CaCO3) mg/L	Alkalinity, Bicarbonate (as CaCO3) mg/L	Ammonia, total (as N) µg/L	Bromide mg/L	Chloride mg/L	Fluoride µg/L	Nitrate (as N) mg/L	Nitrite (as N) mg/L	Kjeldahl Nitrogen-N mg/L	Ortho-Phosphate mg/L	Total Phosphorous as P mg/L	Sulphate mg/L	Total Organic Carbon mg/L	Dissolved Organic Carbon mg/L
BC Standard																											
BCWQG Aquatic Life Short-term Maximum (AW)[a]			n/a	6.5-9.0	n/a	n/a	n/a	6.5-9.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5,680-24,500[d]	n/a	n/a	1,454-1,871[e]	32.8 (max)	0.06-0.6[f]	n/a	n/a	n/a	n/a	n/a	n/a
BCWQG Aquatic Life Long-term Average (AW)[b]			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	365-1,780[d]	n/a	n/a	n/a	3	0.02-0.2[f]	n/a	n/a	n/a	128-429[e]	n/a	n/a
CSR Aquatic Life (AW)[c]			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1,310-18,500[d]	n/a	1,500	2,000-3,000[e]	400	0.2-2[f]	n/a	n/a	n/a	1,280-4,290[e]	n/a	n/a
CSR Irrigation Watering (IW)			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100	1,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CSR Livestock Watering (LW)			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	600	1,000	100	10	n/a	n/a	n/a	1,000	n/a	n/a
CSR Drinking Water (DW)			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	250	1,500	10	1	n/a	n/a	n/a	500	n/a	n/a
Study Area 4 (Cont'd)																											
GH_GA-MW-4 (Cont'd)	GH_GA-MW-4_WG_2017-06-19_NP	2017 06 20	9.9	10.43	5.39	-	-	8.12	277	502	< 1.0	309	0.29	213	-	< 5.0	< 0.050	1.11	190	3.18	< 0.001	0.275	0.0025	< 0.0040	63.0	2.39	2.45
	GH_GA-MW-4_WG_2017-06-19_FD	Duplicate	-	-	-	-	-	8.13	-	494	< 1.0	308	0.44	211	-	< 5.0	< 0.050	1.10	172	3.17	< 0.001	0.270	0.0020	< 0.0040	63.0	2.32	2.41
	QA/QC RPD%		*	*	*	-	-	< 1	*	2	*	< 1	*	1	-	*	*	1	10	< 1	*	2	*	*	0	*	*
	GH_GA_MW-4_WG_2017-07-01_NP	2017 09 19	9.4	7.55	4.87	421.4	-	8.44	246	463	< 1.0	297	0.32	180	-	24.3	< 0.050	2.46	139	0.638	< 0.001	0.494	< 0.0010	0.0014	68.0	0.72	0.74
	GH_GA_MW-4_WG_2017-07-01_FD	Duplicate	-	-	-	-	-	8.41	248	466	< 1.0	305	0.15	180	-	< 5.0	< 0.050	2.31	142	0.623	< 0.001	0.080	< 0.0010	0.0016	67.7	0.76	0.74
	QA/QC RPD%		*	*	*	*	-	< 1	1	1	*	3	*	0	-	*	*	6	2	2	*	*	*	*	< 1	*	*
	GH_GA-MW-4_WG_2017-10-01_NP	2017 11 27	4.9	7.62	4.86	433.3	-	8.14	250	468	< 1.0	303	0.51	189	-	< 5.0	< 0.050	3.27	183	1.73	< 0.001	0.087	0.0023	0.0013	66.4	0.88	0.85
	WG_2017-10-01_009	Duplicate	-	-	-	-	-	8.34	251	465	< 1.0	306	0.17	194	-	5.4	< 0.050	3.29	174	1.74	< 0.001	0.131	0.0024	0.0015	66.7	2.56	1.23
	QA/QC RPD%		*	*	*	*	-	2	< 1	1	*	1	*	3	-	*	*	1	5	1	*	*	*	*	< 1	*	*
RG_DW-01-03	RG_DW_01-03_WP_2017-03-06_NP	2017 03 06	6.62	-	9.1	-	377	-	204	-	-	-	-	-	159	-	-	1.12	-	0.512	< 0.001	-	-	-	42.1	-	-
	RG_DW-01-03_WP_2017-05-31_NP	2017 05 31	6.7	7.86	10.4	-	380.7	8.36	200	381	< 1.0	281	< 0.10	157	-	< 5.0	< 0.050	1.21	153	0.596	< 0.001	< 0.050	< 0.0010	< 0.0020	46.0	9.37	9.64
	RG_DW-01-03_WP_2017-08-22_NP	2017 08 22	6.6	7.69	10.96	-	382.6	8.24	202	385	< 1.0	254	< 0.10	157	-	< 5.0	< 0.050	1.71	146	0.655	< 0.001	< 0.050	0.0014	< 0.0020	44.8	< 0.50	0.62
	RG_DW-01-03_WP_Q4-2017_NP	2017 11 21	6.0	7.77	10.58	-	358.3	8.26	202	341	< 1.0	226	< 0.10	156	-	< 5.0	< 0.050	1.02	150	0.470	< 0.001	0.067	< 0.0010	< 0.0020	35.7	< 0.50	0.59
RG_DW-01-07	RG_DW-01-07_WP_2017-03-01_NP	2017 03 01	6.7	-	11	-	1,231	-	460	-	-	-	-	-	326	-	-	47.7	-	0.634	< 0.005	-	-	-	64.5	-	-
	RG_DW-01-07_WP_2017-05-29_NP	2017 05 29	6.5	7.04	8.1	-	949	7.75	527	898	< 1.0	554	0.23	442	-	< 5.0	< 0.25	24.1	< 100	1.06	< 0.005	0.074	0.0014	< 0.0020	64.0	1.02	1.12
	RG_DW-01-07_WP_2017-08-21_NP	2017 08 21	6.5	6.98	8.23	-	860	7.69	459	839	< 1.0	544	0.33	393	-	< 5.0	< 0.25	9.45	< 100	0.997	< 0.005	0.096	0.0012	< 0.0020	65.1	0.77	0.84
	RG_DW-DUP_WQ_2017-08-21_NP	Duplicate	-	-	-	-	-	7.66	437	849	1.5	536	0.38	410	-	< 5.0	< 0.25	9.37	< 100	0.997	< 0.005	0.117	0.0015	< 0.0020	65.0	0.68	0.87
	QA/QC RPD%		*	*	*	-	*	< 1	5	1	*	1	14	4	-	*	*	1	*	0	*	20	22	*	< 1	12	4
	RG_DW-01-07_WP_Q4-2017_NP	2017 11 15	7.1	7.00	6.85	-	816	7.95	501	709	1.2	489	0.18	383	-	< 5.0	< 0.25	7.97	< 100	0.863	< 0.005	0.072	0.0011	< 0.0020	66.6	0.81	0.87
Study Area 6																											
LC_PIZP1101	LC_PIZP1101_WG_2017-03-13_N	2017 03 15	4.9	8.26	0.25	-	1,448	8.07	126	296	30.0	171	38.9	166	-	21.1	< 0.050	0.51	1,790	0.0074	< 0.001	0.053	0.0276	0.0369	3.44	1.03	0.66
	LC_PIZP1101_WG_2017-06-12_N	2017 06 13	13	8.02	0.58	-	285.1	8.18	118	306	33.7	157	42.3	182	-	15.0	< 0.050	0.58	1,760	< 0.005	< 0.001	< 0.050	0.0040	0.0539	2.97	0.87	0.58
	LC_PIZP1101_WG_2017-09-11_N	2017 09 21	8.2	8.02	0.62	-	259.4	8.57	123	301	16.8	179	54.3	183	-	19.4	< 0.050	0.73	1,840	< 0.005	< 0.001	< 0.050	0.0073	0.0686	2.70	1.27	0.88
	LC_PIZP1101_WG_2017-12-11_N	2017 11 03	6.7	8	1.93	-	231.1	8.26	124	298	429	419	918	235	-	140	< 0.050	0.55	1,870	< 0.005	< 0.001	1.59	0.0092	1.19	2.84	13.2	< 0.50
Study Area 7																											
EV_GV3gw	EV_GV3GW_WG_2017-03-29_NP	2017 03 29	4.59	7.5	3.57	624	-	8.04	336	600	1.9	421	2.51	195	-	< 5.0	< 0.050	1.53	517	0.137	< 0.001	< 0.050	< 0.0010	0.0044	148	< 0.50	< 0.50
	EV_GV3GW_WG_2017-06-28_NP	2017 06 27	10.7	7.37	2.83	-	662	8.06	343	647	1.6	483	0.14	204	-	< 5.0	< 0.050	1.68	509	0.147	< 0.001	< 0.050	0.0012	0.0083	142	0.53	< 0.50
	EV_EC5GW_WG_2017-06-28_NP	Duplicate	-	-	-	-	-	8.08	338	642	1.0	485	< 0.10	205	-	< 5.0	< 0.050	1.65	503	0.143	< 0.001	< 0.050	0.0013	< 0.0020	142	1.08	0.65
	QA/QC RPD%		*	*	*	-	*	< 1	1	1	*	< 1	*	< 1	-	*	*	2	1	3	*	*	*	*	0	*	*
	EV_GV3GW_WG_2017-08-15_NP	2017 08 15	8.57	7.48	3.62	-	637	7.92	336	646	< 1.0	404	< 0.10	196	-	< 5.0	< 0.050	1.60	486	0.136	< 0.001	< 0.050	0.0020	< 0.0020	141	< 0.50	< 0.50
	EV_EC5GW_WG_2017-08-15_NP	Duplicate	-	-	-	-	-	7.90	332	641	1.3	429	< 0.10	197	-	< 5.0	< 0.050	1.62	486	0.137	0.0011	< 0.050	0.0017	< 0.0020	141	< 0.50	< 0.50
	QA/QC RPD%		*	*	*	-	*	< 1	1	1	*	6	*	1	-	*	*	1	0	1	*	*	*	*	0	*	*
	EV_GV3GW_WG_2017-08-29_NP	2017 08 29	13	7.4	3.2	-	626	8.10	285	618	< 1.0	393	0.16	212	-	< 5.0	< 0.050	1.35	445	0.140	< 0.001	< 0.050	< 0.0010	< 0.0020	142	0.59	0.64
	EV_GV3GW_WG_2017-10-17_NP	2017 10 17	6.86	7.45	3.82	-	634	8.23	318	552	< 1.0	435	0.35	182	-	6.5	0.053	1.28	410	0.132	< 0.001	0.210	0.0016	0.0028	140	< 0.50	0.50
	EV_EC5GW_WG_2017-10-17_NP	Duplicate	-	-	-	-	-	8.35	322	556	< 1.0	424	0.29	193	-	6.9	< 0.050	1.29	428	0.134	< 0.001	< 0.050	0.0016	< 0.0020	140	< 0.50	< 0.50
	QA/QC RPD%		*	*	*	-	*	1	1	1	*	3	*	6	-	*	*	1	4	2	*	*	*	*	0	*	*
RG_DW-02-20	RG_DW-02-20_WP_2017-03-01_NP	2017 03 01	6.17	-	9.4	-	694	-	251	-	-	-	-	-	161	-	-	2.45	-	2.75	< 0.001	-	-	-	74.6	-	-
	RG_DW-02-20_WP_2017-05-29_NP	2017 05 29	6.9	7.63	8.92	-	477.3	7.95	253	459	< 1.0	292	0.59	160	-	< 5.0	< 0.050	3.07	196	2.97	< 0.001	0.062	< 0.0010	< 0.0020	74.8	0.51	0.77
	RG_DW-DUP_WQ_2017-05-29_NP	Duplicate	-	-	-	-	-	8.09	251	465	< 1.0	272	0.55	159	-	< 5.0	< 0.050	3.07	196	2.97	< 0.001	0.064	< 0.0010	< 0.0020	74.9	0.50	0.71
	QA/QC RPD%		*	*	*	-	*	1	1	1	*	7	7	1	-	*	*	0	0	0	*	3	*	*	< 1	2	8
	RG_DW-02-20_WP_2017-08-21_NP	2017 08 21	9.5	7.45	8.2	-	431.7	8.10	221	436	< 1.0	255	0.33	163	-	< 5.0	< 0.050	1.79	203	1.81	< 0.001	0.114	< 0.0010	< 0.0020	52.8	< 0.50	0.74
	RG_DW-02-20_WP_Q4-2017_NP	2017 11 15	7.4	7.46	8.80	-	438.3	8.37	255	443	< 1.0	275	1.17	168	-	< 5.0	< 0.050	2.06	206	2.05	< 0.001	0.091	< 0.0010	< 0.0020	56.5	< 0.50	< 0.50
	WP_Q4-2017_001	Duplicate	-	-	-	-	-	8.39	253	432	< 1.0	260	2.01	166	-	< 5.0	< 0.050	2.05	206	2.04	< 0.001	0.112	< 0.0010	< 0.0020	56.4	< 0.50	0.58
	QA/QC RPD%		*	*	*	-	*	< 1	1	3	*	6	53	1	-	*	*	< 1	0	< 1	*	21	*	*	< 1	*	*

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n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.
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[a] Guideline to protect freshwater aquatic life, short-term maximum (i.e. "acute"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
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[d] Guideline/standard varies with pH.
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[f] Guideline/standard varies with Chloride.
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BOLD**	Concentration greater than BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline
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SHADED	Concentration greater than CSR Drinking Water (DW) standard

TABLE 3 (Cont'd): Summary of Analytical Results compared to Primary Screening Criteria for Dissolved Inorganics in Groundwater

Sample Location	Sample ID	Sample Date (yyyy mm dd)	Field Parameters: Temperature °C	pH (field) pH	Dissolved Oxygen mg/L	Conductivity µS/cm	Specific Conductance µS/cm	Physical Parameters: pH pH	Hardness mg/L	Conductivity µS/cm	Total Suspended Solids mg/L	Total Dissolved Solids mg/L	Turbidity, Lab NTU	Total Alkalinity (as CaCO3) mg/L	Alkalinity, Bicarbonate (as CaCO3) mg/L	Dissolved Inorganics: Ammonia, total (as N) µg/L	Bromide mg/L	Chloride mg/L	Fluoride µg/L	Nitrate (as N) mg/L	Nitrite (as N) mg/L	Kjeldahl Nitrogen-N mg/L	Ortho-Phosphate mg/L	Total Phosphorous as P mg/L	Sulphate mg/L	Total Organic Carbon mg/L	Dissolved Organic Carbon mg/L
BC Standard																											
BCWQG Aquatic Life Short-term Maximum (AW)[a]			n/a	6.5-9.0	n/a	n/a	n/a	6.5-9.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5,680-24,500[d]	n/a	n/a	1,454-1,871[e]	32.8 (max)	0.06-0.6[f]	n/a	n/a	n/a	n/a	n/a	n/a
BCWQG Aquatic Life Long-term Average (AW)[b]			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	365-1,780[d]	n/a	n/a	n/a	3	0.02-0.2[f]	n/a	n/a	n/a	128-429[e]	n/a	n/a
CSR Aquatic Life (AW)[c]			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1,310-18,500[d]	n/a	1,500	2,000-3,000[e]	400	0.2-2[f]	n/a	n/a	n/a	1,280-4,290[e]	n/a	n/a
CSR Irrigation Watering (IW)			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100	1,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CSR Livestock Watering (LW)			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	600	1,000	100	10	n/a	n/a	n/a	1,000	n/a	n/a
CSR Drinking Water (DW)			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	250	1,500	10	1	n/a	n/a	n/a	500	n/a	n/a
Study Area 8																											
EV_LSgw	EV_LSGW_WG_2017-03-07_NP	2017 03 07	9.6	5.19	0.43	988	-	7.73	549	981	8.6	566	14.4	483	-	103	< 0.25	12.4	270	< 0.025	< 0.005	0.208	0.0013	0.174	80.1	2.44	1.94
	EV_LSGW_WG_2017-06-28_NP	2017 06 27	12.99	6.97	0.7	-	1,172	7.94	651	1,120	30.6	703	39.1	564	-	171	< 0.25	10.7	280	< 0.025	< 0.005	0.269	0.0018	0.0527	81.1	2.89	3.20
	EV_LSGW_WG_2017-08-22_NP	2017 08 22	15.42	7.1	0.44	-	1,150	7.74	632	1,080	7.6	642	46.9	608	-	203	< 0.25	10.2	190	0.027	< 0.005	0.198	0.0012	0.0601	79.5	2.64	2.45
	EV_LSGW_WG_2017-10-17_NP	2017 10 17	13.92	7.13	0.49	-	1,094	8.15	594	816	18.7	653	43.0	450	-	208	< 0.25	9.5	210	0.196	< 0.005	0.73	< 0.0010	0.111	90.5	3.91	2.88
EV_OCgw**	EV_OCGW_WG_2017-03-29_NP	2017 03 29	5.07	7.78	0.39	454	-	8.20	151	440	16.5	260	12.5	180	-	69.9	< 0.050	1.87	1,330	< 0.005	< 0.001	0.163	0.0025	0.0175	58.2	1.20	1.18
	EV_EC6GW_WG_2017-03-29_NP	Duplicate	-	-	-	-	-	8.22	150	428	7.5	277	7.12	182	-	68.2	< 0.050	1.94	1,320	< 0.005	< 0.001	0.159	0.0029	0.0208	57.5	1.12	1.01
	QA/QC RPD%		*	*	*	*	-	< 1	1	3	75	6	55	1	-	2	*	4	1	*	*	*	*	17	1	*	*
	EV_OCGW_WG_2017-06-21_NP	2017 06 19	10.45	7.63	1.41	-	472	8.32	147	437	4.3	275	2.55	181	-	71.8	< 0.050	2.13	1,190	< 0.005	< 0.001	0.100	0.0048	0.0156	56.3	1.02	0.78
	EV_MC5GW_WG_2017-06-21_NP	Duplicate	-	-	-	-	-	8.32	145	436	8.1	285	2.53	179	-	75.5	< 0.050	2.06	1,210	< 0.005	< 0.001	0.198	0.0039	0.0224	57.4	0.87	1.13
	QA/QC RPD%		*	*	*	-	*	0	1	< 1	*	4	1	1	-	5	*	3	2	*	*	*	*	36	2	*	*
	EV_OCGW_WG_2017-06-29_NP	2017 06 29	9.03	7.79	0.26	-	451	8.29	145	457	3.8	269	3.12	182	-	73.6	< 0.050	1.95	1,190	< 0.005	< 0.001	0.115	0.0066	0.0249	55.8	0.94	1.02
	EV_MC6GW_WG_2017-06-29_NP	Duplicate	-	-	-	-	-	8.27	144	458	4.0	258	3.82	184	-	73.7	< 0.050	1.91	1,210	< 0.005	< 0.001	0.110	0.0052	0.0230	56.7	0.99	0.54
	QA/QC RPD%		*	*	*	-	*	< 1	1	< 1	*	4	20	1	-	< 1	*	2	2	*	*	*	24	8	2	*	*
	EV_OCGW_WG_2017-08-15_NP	2017 08 15	10.92	7.84	0.31	-	455	8.20	144	468	2.5	271	1.58	180	-	72.2	< 0.050	2.07	1,190	< 0.005	0.0014	0.101	0.0077	0.0122	56.1	< 0.50	< 0.50
	EV_MC5GW_WG_2017-08-15_NP	Duplicate	-	-	-	-	-	8.23	143	461	2.1	275	1.31	177	-	73.0	< 0.050	2.08	1,190	< 0.005	< 0.001	0.115	0.0078	0.0113	55.9	< 0.50	< 0.50
	QA/QC RPD%		*	*	*	-	*	<	1	2	*	1	19	2	-	1	*	< 1	0	*	*	*	1	8	< 1	*	*
	EV_OCGW_WG_2017-08-29_NP	2017 08 29	8.83	7.66	0.42	-	4.39	8.26	135	440	1.7	250	1.98	187	-	66.5	< 0.050	1.86	1,170	< 0.005	0.0012	0.107	0.0047	0.0066	52.5	0.79	0.82
	EV_MC5GW_WG_2017-08-29_NP	Duplicate	-	-	-	-	-	8.28	142	444	1.5	256	2.03	193	-	73.5	< 0.050	1.90	1,180	< 0.005	0.0011	0.089	0.0051	0.0098	52.2	0.67	0.68
	QA/QC RPD%		*	*	*	-	*	< 1	5	1	*	2	2	3	-	10	*	2	1	*	*	*	*	39	1	*	*
	EV_OCGW_WG_2017-09-21_NP	2017 09 21	7.86	7.69	0.47	-	448	8.53	141	422	1.2	245	2.62	191	-	80.9	< 0.050	2.00	1,170	0.0084	< 0.001	< 0.050	0.0027	0.0129	52.3	< 0.50	< 0.50
	EV_OCGW_WG_2017-10-18_NP	2017 10 18	9.09	7.87	0.41	-	458	8.34	147	418	1.7	280	2.65	177	-	85.1	< 0.050	1.82	1,230	< 0.005	< 0.001	0.109	0.0060	0.0163	53.7	< 0.50	< 0.50
	EV_MC5GW_WG_2017-10-18_NP	Duplicate	-	-	-	-	-	8.42	143	438	1.7	290	2.82	192	-	84.4	< 0.050	1.85	1,230	< 0.005	< 0.001	0.141	0.0054	0.0156	53.1	< 0.50	< 0.50
	QA/QC RPD%		*	*	*	-	*	1	3	5	*	4	6	8	-	1	*	2	0	*	*	*	11	4	1	*	*
Study Area 9																											
EV_BCgw	EV_BCGW_WG_2017-03-14_NP	2017 03 14	5.36	7.44	5.02	757	-	8.00	417	768	4.1	528	1.40	184	-	< 5.0	< 0.25	6.04	150	5.00	< 0.005	0.082	0.0035	0.0073	206	0.68	0.68
	EV_BCGW_WG_2017-03-30_NP	2017 03 30	7.5	7.35	3.97	987	-	7.82	522	944	13.4	709	2.08	194	-	< 5.0	< 0.050	10.5	124	9.04	0.0031	0.47	0.0035	0.0069	314	0.80	0.77
	EV_BCGW_WG_2017-05-16_NP	2017 05 16	6.34	7.2	2.94	1,152	-	7.96	619	1,210	6.6	930	2.06	215	-	< 5.0	< 0.25	19.3	160	14.0	< 0.005	0.115	0.0035	0.019	462	0.82	0.72
	EV_BCGW_WG_2017-06-28_NP	2017 06 27	8.02	6.96	1.95	-	702	7.98	336	692	1.4	530	0.32	189	-	61.5	< 0.050	5.09	170	3.09	0.0393	0.178	0.0020	0.0084	163	1.07	1.17
	EV_BCGW_WG_2017-08-23_NP	2017 08 23	7.84	7.18	2.09	-	1,175	7.97	660	1,080	2.4	755	1.31	215	-	< 5.0	< 0.25	13.5	< 100	10.6	< 0.005	1.01	0.0027	0.0046	391	25.4	0.75
	EV_BCGW_WG_2017-10-18_NP	2017 10 18	6.81	7.35	2.16	-	924	8.02	475	784	4.3	696	2.28	160	-	6.9	< 0.050	8.33	118	6.27	< 0.001	< 0.050	0.0035	0.0081	261	< 0.50	< 0.50
EV_MCgwS	EV_MCGWS_WG_2017-03-08_NP	2017 03 08	4.05	11.55	1.9	853	-	7.92	371	838	24.5	523	45.3	297	-	120	< 0.25	45.4	310	< 0.025	< 0.005	0.174	< 0.0010	0.0174	105	1.57	1.56
	EV_MCGWS_WG_2017-03-30_NP	2017 03 30	6.29	7.55	4.61	682	-	7.82	386	822	14.4	519	23.8	290	-	102	0.233	49.7	287	0.0069	0.0079	0.22	< 0.0010	0.0084	124	2.13	2.11
	EV_MCGWS_WG_2017-05-16_NP	2017 05 16	5.85	7.28	0.8	803	-	7.86	380	843	15.0	526	40.5	290	-	109	0.26	56.0	340	< 0.025	< 0.005	0.162	< 0.0010	0.0146	104	1.49	1.62
	EV_MCGWS_WG_2017-06-28_NP	2017 06 28	7.11	7.14	1.67	-	871	7.87	369	724	89.0	538	43.3	291	-	130	< 0.25	48.0	290	< 0.025	< 0.005	0.201	< 0.0010	0.0855	94.2	1.19	1.53
	EV_MCGWS_WG_2017-08-16_NP	2017 08 16	9.1	7.19	1.17	-	822	8.06	412	772	9.3	525	44.8	278	-	122	0.218	42.0	205	< 0.005	< 0.001	0.147	< 0.0010	0.0157	88.1	1.27	1.37
	EV_MCGWS_WG_2017-09-21_NP	2017 09 21	8.68	6.91	0.54	-	820	8.06	387	649	14.8	486	28.3	216	-	113	0.215	43.3	233	< 0.005	< 0.001	0.104	< 0.0010	0.0039	94.4	1.03	1.06
	EV_MCGWS_WG_2017-10-18_NP	2017 10 18	7.93	7.24	1.9	-	809	8.02	424	748	179	516	48.0	262	-	131	0.204	40.7	200	< 0.005	< 0.001	0.160	< 0.0010	0.175	82.3	1.06	1.00

Data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.
** Comparison to BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline.

[a] Guideline to protect freshwater aquatic life, short-term maximum (i.e. "acute"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[b] Guideline to protect freshwater aquatic life, long-term average (i.e. "chronic"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[c] Standard to protect freshwater aquatic life.
[d] Guideline/standard varies with pH.
[e] Guideline/standard varies with Hardness.
[f] Guideline/standard varies with Chloride.
[g] Samples inferred to be mislabelled in field.

BOLD**	Concentration greater than BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline
BOLD	Concentration greater than CSR Aquatic Life (AW) standard
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard

TABLE 3 (Cont'd): Summary of Analytical Results compared to Primary Screening Criteria for Dissolved Inorganics in Groundwater

			Field Parameters					Physical Parameters								Dissolved Inorganics											
Sample Location	Sample ID	Sample Date (yyyy mm dd)	Temperature °C	pH (field) pH	Dissolved Oxygen mg/L	Conductivity µS/cm	Specific Conductance µS/cm	pH pH	Hardness mg/L	Conductivity µS/cm	Total Suspended Solids mg/L	Total Dissolved Solids mg/L	Turbidity, Lab NTU	Total Alkalinity (as CaCO3) mg/L	Alkalinity, Bicarbonate (as CaCO3) mg/L	Ammonia, total (as N) µg/L	Bromide mg/L	Chloride mg/L	Fluoride µg/L	Nitrate (as N) mg/L	Nitrite (as N) mg/L	Kjeldahl Nitrogen-N mg/L	Ortho-Phosphate mg/L	Total Phosphorous as P mg/L	Sulphate mg/L	Total Organic Carbon mg/L	Dissolved Organic Carbon mg/L
BC Standard																											
BCWQG Aquatic Life Short-term Maximum (AW)[a]			n/a	6.5-9.0	n/a	n/a	n/a	6.5-9.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5,680-24,500[d]	n/a	n/a	1,454-1,871[e]	32.8 (max)	0.06-0.6[f]	n/a	n/a	n/a	n/a	n/a	n/a
BCWQG Aquatic Life Long-term Average (AW)[b]			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	365-1,780[d]	n/a	n/a	n/a	3	0.02-0.2[f]	n/a	n/a	n/a	128-429[e]	n/a	n/a
CSR Aquatic Life (AW)[c]			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1,310-18,500[d]	n/a	1,500	2,000-3,000[e]	400	0.2-2[f]	n/a	n/a	n/a	1,280-4,290[e]	n/a	n/a
CSR Irrigation Watering (IW)			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100	1,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CSR Livestock Watering (LW)			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	600	1,000	100	10	n/a	n/a	n/a	1,000	n/a	n/a
CSR Drinking Water (DW)			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	250	1,500	10	1	n/a	n/a	n/a	500	n/a	n/a
Study Area 9 (Cont'd)																											
EV_MCgwD	EV_MCGWD_WG_2017-03-08_NP	2017 03 08	1.66	11.12	0.52	633	-	8.11	248	588	21.5	352	19.3	238	-	191	< 0.050	3.80	885	< 0.005	< 0.001	0.389	< 0.0010	0.0330	88.3	2.51	2.68
	EV_MCGWD_WG_2017-03-30_NP	2017 03 30	5.93	7.28	0.49	855	-	7.99	230	660	73.0	397	84.6	244	-	232	< 0.050	3.21	995	0.0091	0.0087	0.48	< 0.0010	0.0803	135	3.55	2.30
	EV_MCGWD_WG_2017-05-16_NP	2017 05 16	6.65	7.57	11.63	610	-	8.09	223	617	385	399	312	282	-	191	< 0.050	3.75	989	< 0.005	0.0022	0.524	0.0024	0.272	85.1	4.72	1.56
	EV_MCGWD_WG_2017-06-28_NP	2017 06 28	10.56	7.17	7.75	-	609	8.01	230	538	7.9	391	5.03	237	-	198	< 0.050	4.84	944	< 0.005	0.0040	0.280	< 0.0010	0.0111	69.4	1.41	1.64
	EV_MCGWD_WG_2017-08-16_NP	2017 08 16	12.6	7.36	4.2	-	553	8.19	235	512	17.3	321	13.5	228	-	121	0.059	4.21	848	0.059	0.0034	0.158	0.0031	0.0367	51.7	1.05	1.10
	EV_MCGWD_WG_2017-09-19_NP	2017 09 19	8.73	7.28	1.39	-	565	7.84	230	498	4.2	307	3.17	248	-	105	0.078	5.66	953	0.117	< 0.001	0.192	< 0.0010	0.0186	60.1	1.12	1.51
	EV_MCGWD_WG_2017-10-18_NP	2017 10 18	6.27	7.4	0.91	-	534	8.45	227	472	8.3	326	2.60	226	-	118	0.051	4.00	912	0.0639	0.0013	0.210	0.0035	0.0145	44.5	0.79	0.80
EV_BRgw	EV_BRGW_WG_2017-03-30_NP	2017 03 30	-	7.24	3.84	1,122	-	7.71	594	1,080	9.4	778	7.23	253	-	< 5.0	0.081	19.3	101	4.53	0.0025	0.33	0.0018	0.0066	357	0.60	0.59
	EV_BRGW_WG_2017-06-21_NP	2017 06 19	-	7.45	25.04	-	1,207	8.04	610	1,090	8.4	821	4.93	232	-	< 5.0	< 0.25	19.8	110	10.7	< 0.005	0.082	< 0.0010	0.0131	348	0.73	0.69
	EV_BRGW_WG_2017-06-28_NP	2017 06 28	-	7.24	4.91	-	1,206	7.85	602	1,050	24.0	937	7.82	231	-	< 5.0	< 0.25	21.5	120	11.3	< 0.005	0.111	< 0.0010	0.0097	358	0.64	0.64
	EV_BRGW_WG_2017-08-23_NP	2017 08 23	-	7.04	3.73	-	1,234	7.86	688	1,140	< 2.0	863	0.65	242	-	6.1	< 0.25	23.2	110	11.5	< 0.005	0.441	0.0017	0.0026	387	0.71	0.81
	EV_WH50GW_WG_2017-10-25_NP[g]	2017 10 25	-	7.71	9.56	-	1,259	8.21	726	1,180	1.2	970	0.50	256	-	< 5.0	0.35	21.3	< 100	9.18	< 0.005	0.247	0.0025	0.0026	399	0.84	3.16
	EV_BRGW_WG_2017-11-21_NP	2017 11 21	-	7.39	6.6	-	1,172	8.22	738	1,150	< 1.0	919	0.19	278	-	< 5.0	< 0.25	23.0	< 100	8.31	0.0275	< 0.20	0.0029	0.0033	395	0.69	0.56
EV_RCgw	EV_RCSGW_WG_2017-03-07_NP	2017 03 07	6.47	4.16	9.05	2,285	-	7.71	1,460	2,260	< 1.0	2,060	0.17	271	-	< 5.0	< 1.0	17.0	< 400	38.4	< 0.020	0.054	0.0045	0.0052	1,060	1.23	1.15
	EV_RCSGW_WG_2017-06-30_NP	2017 06 30	16.45	7.5	6.8	-	2,356	7.99	1,430	2,380	< 1.0	2,080	0.28	251	-	6.2	< 0.25	8.5	120	38.9	0.0503	0.522	0.0029	< 0.010	1,100	0.99	1.84
	EV_RCSGW_WG_2017-08-22_NP	2017 08 22	8.27	7.34	9.36	-	2,500	7.77	1,600	2,300	< 3.0	2,280	0.60	265	-	6.1	< 0.25	6.5	100	41.6	< 0.005	0.476	0.0050	0.0074	1,190	1.14	1.18
	EV_BRGW_WG_2017-10-25_NP[g]	2017 10 25	17.48	7.34	8.02	-	2,595	8.02	1,780	2,410	< 1.0	2,480	0.29	268	-	< 5.0	< 0.25	8.8	< 100	42.9	< 0.005	0.300	0.0030	0.0032	1,230	1.04	1.30
	EV_RCSGW_WG_2017-11-21_NP	2017 11 21	17.65	7.32	7.87	-	2,553	8.04	1,870	2,350	< 1.0	2,450	0.47	264	-	< 5.0	< 0.25	10.0	120	44.4	0.008	0.48	0.0030	0.0066	1,300	1.15	1.16
EV_WH50gw	EV_WH50GW_WG_2017-03-03_NP	2017 03 03	6.19	7.05	8.9	567	-	8.00	279	545	6.2	352	12.8	157	-	< 5.0	< 0.050	3.14	122	2.86	< 0.001	0.094	0.0044	0.0215	129	0.80	0.79
	EV_WH50GW_WG_2017-06-21_NP	2017 06 19	6.67	7.78	13.01	-	368	8.26	169	336	4.2	213	3.57	122	-	< 5.0	< 0.050	2.21	177	1.21	0.0011	0.067	0.0025	0.0107	53.6	1.10	1.28
	EV_WH50GW_WG_2017-06-28_NP	2017 06 28	8.3	7.8	8.07	-	392	8.18	172	341	8.8	268	7.01	121	-	< 5.0	< 0.050	2.21	182	1.30	< 0.001	0.092	0.0029	0.0202	61.0	1.15	1.12
	EV_WH50GW_WG_2017-08-22_NP	2017 08 22	13.09	7.61	4.08	-	502	8.04	256	482	6.7	318	14.5	173	-	5.5	< 0.050	1.71	121	1.49	< 0.001	< 0.050	0.0037	0.0215	94.1	0.87	0.85
	EV_RCSGW_WG_2017-10-25_NP[g]	2017 10 25	11.44	7.59	4.73	-	547	8.24	295	513	7.8	352	12.9	175	-	< 5.0	0.057	1.88	112	1.55	< 0.001	0.152	0.0040	0.0136	99.4	0.70	1.60
	EV_WH50GW_WG_2017-11-21_NP	2017 11 21	10.4	7.85	4.02	-	522	8.29	313	513	1.2	384	5.51	176	-	< 5.0	< 0.050	2.18	121	1.89	< 0.001	< 0.20	0.0026	0.0105	110	0.63	0.50
RG_DW-03-01	RG_DW-03-01_WP_2017-02-20_NP	2017 02 20	8.02	-	1.34	-	826	-	425	-	-	-	-	-	350	-	-	33.3	-	< 0.025	< 0.005	-	-	-	61.2	-	-
	RG_DW-DUP_WP_2017-02-20_NP	Duplicate	-	-	-	-	-	-	431	-	-	-	-	-	-	-	-	34.0	-	0.032	< 0.005	-	-	-	60.5	-	-
	QA/QC RPD%		*	-	*	-	*	-	1	-	-	-	-	-	-	-	-	2	-		*	-	-	-	1	-	-
	RG_DW-03-01_WP_2017-05-29_NP	2017 05 29	8.1	7.19	1.37	-	830	7.92	419	814	1.9	493	1.87	334	-	< 5.0	< 0.25	30.9	170	< 0.025	< 0.005	0.051	< 0.0010	< 0.0020	78.2	1.05	1.27
	RG_DW-03-01_WP_2017-08-22_NP	2017 08 22	7.9	7.1	2.6	-	796	7.94	413	809	2.7	494	1.03	308	-	< 5.0	< 0.25	34.3	160	0.082	< 0.005	< 0.050	< 0.0010	< 0.0020	48.4	1.09	0.99
	RG_DW-03-01_WP_Q4-2017_NP	2017 11 15	7.9	7.04	4.10	-	817	8.04	466	744	1.5	487	2.51	333	-	< 5.0	< 0.25	37.0	190	0.061	< 0.005	0.053	< 0.0010	< 0.0020	57.2	1.11	1.16
Study Area 10																											
EV_ECgw	EV_ECGW_WG_2017-06-20_NP	2017 06 20	6.59	7.63	4.12	-	433	8.04	167	403	161	285	180	229	-	144	< 0.050	0.56	806	0.0868	0.0479	0.417	0.0120	0.239	27.1	4.45	1.90
	EV_ECGW_WG_2017-08-23_NP	2017 08 23	9.65	5.86	1.72	-	434	8.22	174	384	49.2	265	59.5	202	-	174	< 0.050	< 0.50	718	0.0285	0.0042	0.310	0.0164	0.0651	25.8	< 2.5	1.75
	EV_ECGW_WG_2017-10-25_NP	2017 10 25	7.98	7.6	2.55	-	426	8.19	184	403	84.0	275	72.5	201	-	19.5	< 0.050	< 0.50	771	0.215	0.0029	0.241	0.0138	0.113	25.8	2.65	1.50
	EV_ECGW_WG_2017-11-23_NP	2017 11 22	6.33	6.5	3.55	-	450	8.32	177	406	75.8	245	72.1	213	-	166	< 0.050	0.70	871	0.121	0.0068	0.475	0.0015	0.115	26.1	2.7	1.85
Study Area 11																											
CM_MW1-DP	CM_MW1-DP_WG_2017Q1_N	2017 03 28	4.32	8.27	8.4	-	1,316	8.25	145	1,210	47.7	728	33.1	326	-	584	0.881	199	217	0.0149	0.002	0.780	< 0.0010	0.0203	4.97	2.68	2.79
	CM_MW1-DP_WG_Q2_2017_N	2017 06 27	7.94	7.68	3.82	-	983	8.19	182	964	2.7	531	4.02	279	-	234	0.513	128	270	0.0122	< 0.001	0.380	< 0.0010	0.0151	25.4	2.23	2.34
	CM_MW1-DP_WG_Q3_2017_N	2017 09 06	9.92	7.6	3.49	-	887	8.11	185	870	2.6	488	1.82	296	-	321	0.464	116	308	< 0.005	0.0017	0.350	< 0.0010	0.0035	9.64	1.90	1.93
	CM_MW1-DP_WG_Q4-2017_N	2017 12 07	2.49	7.78	5.63	-	1,354	8.40	143	1,370	7.1	716	13.5	354	-	590	0.88	224	150	0.056	0.0059	0.700	0.0219	0.0196	2.1	1.44	1.17

Data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
\- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.
** Comparison to BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline.

[a] Guideline to protect freshwater aquatic life, short-term maximum (i.e. "acute"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[b] Guideline to protect freshwater aquatic life, long-term average (i.e. "chronic"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[c] Standard to protect freshwater aquatic life.
[d] Guideline/standard varies with pH.
[e] Guideline/standard varies with Hardness.
[f] Guideline/standard varies with Chloride.
[g] Samples inferred to be mislabelled in field.

BOLD**	Concentration greater than BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline
BOLD	Concentration greater than CSR Aquatic Life (AW) standard
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard

TABLE 3 (Cont'd): Summary of Analytical Results compared to Primary Screening Criteria for Dissolved Inorganics in Groundwater

Sample Location	Sample ID	Sample Date (yyyy mm dd)	Field Parameters: Temperature °C	pH (field) pH	Dissolved Oxygen mg/L	Conductivity µS/cm	Specific Conductance µS/cm	Physical Parameters: pH pH	Hardness mg/L	Conductivity µS/cm	Total Suspended Solids mg/L	Total Dissolved Solids mg/L	Turbidity, Lab NTU	Total Alkalinity (as CaCO3) mg/L	Alkalinity, Bicarbonate (as CaCO3) mg/L	Dissolved Inorganics: Ammonia, total (as N) µg/L	Bromide mg/L	Chloride mg/L	Fluoride µg/L	Nitrate (as N) mg/L	Nitrite (as N) mg/L	Kjeldahl Nitrogen-N mg/L	Ortho-Phosphate mg/L	Total Phosphorous as P mg/L	Sulphate mg/L	Total Organic Carbon mg/L	Dissolved Organic Carbon mg/L
BC Standard																											
BCWQG Aquatic Life Short-term Maximum (AW)[a]			n/a	6.5-9.0	n/a	n/a	n/a	6.5-9.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5,680-24,500[d]	n/a	n/a	1,454-1,871[e]	32.8 (max)	0.06-0.6[f]	n/a	n/a	n/a	n/a	n/a	n/a
BCWQG Aquatic Life Long-term Average (AW)[b]			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	365-1,780[d]	n/a	n/a	n/a	3	0.02-0.2[f]	n/a	n/a	n/a	128-429[e]	n/a	n/a
CSR Aquatic Life (AW)[c]			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1,310-18,500[d]	n/a	1,500	2,000-3,000[e]	400	0.2-2[f]	n/a	n/a	n/a	1,280-4,290[e]	n/a	n/a
CSR Irrigation Watering (IW)			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100	1,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CSR Livestock Watering (LW)			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	600	1,000	100	10	n/a	n/a	n/a	1,000	n/a	n/a
CSR Drinking Water (DW)			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	250	1,500	10	1	n/a	n/a	n/a	500	n/a	n/a
Study Area 11 (Cont'd)																											
CM_MW1-OB	CM_MW1-OB_WG_2017Q1_N	2017 03 27	5.04	7.53	6.45	-	1,033	7.44	529	1,010	2.0	679	2.44	269	-	< 5.0	0.050	37.5	98	0.622	0.0016	< 0.050	0.0016	0.0097	250	1.33	1.34
	CM_MW1-OB_WG_Q2_2017_N	2017 06 19	9.83	7.43	7.34	-	1,095	7.94	524	1,140	< 1.0	773	0.46	286	-	12.6	< 0.25	30.5	< 100	1.82	< 0.005	0.154	0.0015	0.0057	297	1.13	1.17
	CM_MW1-OB_WG_Q3_2017_N	2017 08 28	12.5	7.13	6.9	-	916	7.97	416	914	< 1.0	591	0.54	269	-	< 50	0.071	21.3	95	0.751	< 0.001	< 0.050	0.0033	0.0023	206	1.08	1.03
	CM_MW1-OB_WG_Q4-2017_N	2017 12 07	3.21	7.31	5.34	-	1,133	7.88	556	1,190	< 1.0	789	0.59	275	-	< 50	0.532	54.9	66	1.05	< 0.001	0.169	0.0024	0.0042	287	0.61	0.65
CM_MW1-SH	CM_MW1-SH_WG_2017Q1_N	2017 03 21	4.56	8.56	5.67	-	1,139	8.24	96.2	1,150	3.4	632	3.22	198	-	54.2	1.04	**253**	984	< 0.005	< 0.001	0.071	0.0033	0.0046	24.1	0.90	0.86
	CM_MW1-SH_WG_Q2_2017_N	2017 06 19	10.3	8.19	1.57	-	1,178	8.27	105	991	1.0	512	2.62	212	-	54.8	0.65	**160**	540	0.040	< 0.005	0.083	< 0.0010	0.0029	19.2	1.24	1.35
	CM_MW1-SH_WG_Q3_2017_N	2017 08 28	11.19	7.84	1.2	-	978	8.28	127	1,020	< 1.0	525	2.48	207	-	60	0.760	**182**	847	< 0.005	< 0.001	0.103	0.0016	0.0061	18.5	1.21	1.29
	CM_MW1-SH_WG_Q4-2017_N	2017 12 07	1.62	7.83	3.28	-	1,001	8.00	140	1,010	1.3	505	4.41	227	-	80	0.642	**159**	689	< 0.005	< 0.001	0.172	< 0.0010	0.0103	17.2	0.75	0.83
RG_DW-07-01	RG_DW-07-01_WP_2017-02-20_NP	2017 02 20	3.96	7.09	8.6	-	1,466	-	824	-	-	-	-	-	289	-	-	10.4	-	3.72	< 0.005	-	-	-	**549**	-	-
	RG_DW-07-01_WP_2017-06-05_NP	2017 06 05	5	7.39	6.98	-	1,156	8.23	597	1,140	2.9	848	4.09	248	-	< 5.0	< 0.25	8.68	170	4.07	< 0.005	0.137	< 0.0010	0.0034	397	1.41	1.33
	RG_DW-07-01_WP_2017-08-30_NP	2017 08 30	8.5	7.16	6.73	-	1,453	7.49	799	1,400	5.8	1,130	6.74	286	-	13.1	< 0.25	6.60	150	3.99	< 0.005	0.181	< 0.0010	0.0061	**584**	1.47	1.23
	RG_DW-07-01_WP_Q4-2017_NP	2017 11 21	6.3	7.12	7.92	-	1,644	7.70	1,010	1,570	4.2	1,350	4.39	284	-	< 5.0	< 0.25	22.5	150	3.46	< 0.005	0.190	< 0.0010	0.0058	**663**	1.41	1.61
Study Area 12																											
EV_ER1gwS	EV_ER1GWS_WG_2017-02-15_NP	2017 02 15	1.94	9.83	10.29	505	-	8.23	269	498	< 1.0	315	0.10	173	-	< 5.0	< 0.050	3.30	180	2.69	< 0.001	0.071	0.0029	0.0033	89.5	< 0.50	< 0.50
	EV_ER1GWS_WG_2017-06-28_NP	2017 06 28	7.17	7.36	8.63	-	484	8.07	222	427	1.4	311	0.22	187	-	< 5.0	< 0.050	11.4	176	1.19	< 0.001	0.084	0.0028	< 0.010	42.1	0.70	1.39
	EV_ER1GWS_WG_2017-08-22_NP	2017 08 22	12.3	7.54	6.78	-	438	8.02	223	416	< 2.0	285	0.32	167	-	< 5.0	< 0.050	2.57	173	1.74	< 0.001	0.052	0.0039	0.0049	60.6	< 0.50	0.59
	EV_ER1GWS_WG_2017-10-24_NP	2017 10 24	8.6	7.51	8.54	-	480	8.11	233	475	5.0	343	2.72	165	-	< 5.0	< 0.050	3.40	187	1.55	0.0057	0.098	0.0043	0.0085	65.0	0.60	0.94
EV_ER1gwD	EV_ER1GWD_WG_2017-02-15_NP	2017 02 15	1.35	7.15	9.66	489	-	8.24	260	480	275	314	182	212	-	6.0	< 0.050	3.97	188	2.10	< 0.001	0.254	0.0041	0.334	73.8	1.77	< 0.50
	EV_ER1GWD_WG_2017-06-28_NP	2017 06 28	5.9	7.57	10.06	-	384	8.18	176	343	138	266	44.4	153	-	< 5.0	< 0.050	2.07	231	1.26	< 0.001	0.138	0.0030	0.0973	40.0	2.08	1.26
	EV_ER1GWD_WG_2017-08-22_NP	2017 08 22	11.88	7.6	6.53	-	436	8.08	223	411	2.4	263	1.45	173	-	< 5.0	< 0.050	2.58	192	1.48	0.0351	< 0.050	0.0051	0.0110	53.8	< 0.50	< 0.50
	EV_ER1GWD_WG_2017-10-24_NP	2017 10 24	8.69	7.61	7.43	-	476	8.12	233	434	3.2	347	1.24	174	-	< 5.0	< 0.050	2.48	170	1.93	0.0048	0.132	0.0035	0.0073	76.9	< 0.50	2.48
RG_DW-03-04	RG_DW-03-04_WP_2017-02-20_NP	2017 02 20	7.93	-	8	-	556	-	283	-	-	-	-	-	183	-	-	10.4	-	1.97	< 0.001	-	-	-	95.5	-	-
	RG_DW-03-04_WP_2017-05-31_NP	2017 05 31	6.3	7.6	8.17	-	518.4	8.24	252	532	< 1.0	322	< 0.10	178	-	< 5.0	< 0.050	19.7	155	1.18	< 0.001	0.082	0.0022	0.0028	70.3	0.96	1.01
	RG_DW-03-04_WP_2017-08-22_NP	2017 08 22	5.6	7.5	7.81	-	473.8	8.06	236	480	< 1.0	317	< 0.10	157	-	< 5.0	< 0.050	8.60	147	1.29	< 0.001	0.138	0.0023	0.0022	73.7	0.82	0.74
	RG_DW-03-04_WP_Q4-2017_NP	2017 11 21	7.4	7.50	6.57	-	548.6	8.05	301	530	< 1.0	351	0.12	177	-	< 5.0	< 0.050	7.73	150	1.78	< 0.001	0.120	0.0021	0.0023	101	0.74	0.77
Field Blanks																											
RG_DW	RG_DW-FB_WQ_2017-05-29_NP	2017 05 29	-	-	-	-	-	5.31	< 0.50	< 2.0	< 1.0	< 3.0	< 0.10	< 1.0	-	< 5.0	< 0.050	< 0.10	< 20	< 0.005	< 0.001	< 0.050	< 0.0010	< 0.0020	< 0.30	< 0.50	< 0.50
	RG_DW-FB_WQ_2017-08-21_NP	2017 08 21	-	-	-	-	-	6.62	< 0.50	< 2.0	< 1.0	< 3.0	< 0.10	1.9	-	< 5.0	< 0.050	< 0.10	< 20	< 0.005	< 0.001	< 0.050	< 0.0010	< 0.0020	< 0.30	< 0.50	< 0.50
	WP_Q4-2017_002	2017 11 15	-	-	-	-	-	5.65	< 0.50	< 2.0	< 1.0	< 3.0	< 0.10	< 1.0	-	< 5.0	< 0.050	< 0.10	< 20	< 0.005	< 0.001	< 0.050	< 0.0010	< 0.0020	< 0.30	< 0.50	< 0.50
Trip Blanks																											
RG_DW	RG_DW-TB_WQ_2017-05-29_NP	2017 05 29	-	-	-	-	-	5.4	< 0.50	< 2.0	< 1.0	< 3.0	< 0.10	< 1.0	-	23.7	< 0.050	< 0.10	< 20	< 0.005	< 0.001	< 0.050	< 0.0010	< 0.0020	< 0.30	< 0.50	-
	RG_DW-TB_WQ_2017-08-21_NP	2017 08 21	-	-	-	-	-	6.08	-	< 2.0	< 1.0	< 3.0	< 0.10	< 1.0	-	< 5.0	< 0.050	< 0.10	< 20	< 0.005	< 0.001	< 0.050	< 0.0010	< 0.0020	< 0.30	< 0.50	-
	WP_Q4-2017_003	2017 11 15	-	-	-	-	-	5.83	-	< 2.0	< 1.0	< 3.0	< 0.10	< 1.0	-	< 5.0	< 0.050	< 0.10	< 20	< 0.005	< 0.001	< 0.050	< 0.0010	< 0.0020	< 0.30	< 0.50	-

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< Denotes concentration less than indicated detection limit or RPD less than indicated value.
\- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.
** Comparison to BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline.

[a] Guideline to protect freshwater aquatic life, short-term maximum (i.e. "acute"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[b] Guideline to protect freshwater aquatic life, long-term average (i.e. "chronic"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[c] Standard to protect freshwater aquatic life.
[d] Guideline/standard varies with pH.
[e] Guideline/standard varies with Hardness.
[f] Guideline/standard varies with Chloride.
[g] Samples inferred to be mislabelled in field.

BOLD**	Concentration greater than BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline
BOLD	Concentration greater than CSR Aquatic Life (AW) standard
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard

TABLE 4: Summary of Analytical Results compared to Primary Screening Criteria for Dissolved Metals in Groundwater

Sample Location	Sample ID	Sample Date (yyyy mm dd)	Hardness mg/L	Aluminum µg/L	Antimony µg/L	Arsenic µg/L	Barium µg/L	Beryllium µg/L	Bismuth µg/L	Boron µg/L	Cadmium µg/L	Calcium mg/L	Chromium µg/L	Cobalt µg/L	Copper µg/L	Iron µg/L	Lead µg/L	Lithium µg/L	Magnesium mg/L	Manganese µg/L	Mercury µg/L	Molybdenum µg/L	Nickel µg/L	Potassium mg/L	Selenium µg/L	Silver µg/L	Sodium mg/L	Strontium µg/L	Thallium µg/L	Tin µg/L	Titanium µg/L	Uranium µg/L	Vanadium µg/L	Zinc[i] µg/L
			Dissolved Metals																															
BC Standard																																		
BCWQG Aquatic Life Short-term Maximum (AW)[a]			n/a	31-100[k]	n/a	5	n/a	n/a	n/a	n/a	0.038-2.8[d]	n/a	n/a	110	2.05-75.32[d]	350 (max)	3-1,116[d]	n/a	n/a	546-9,136[d]	0.02[g]	2,000	n/a	n/a	n/a	0.1-3[d]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	33-551[d]
BCWQG Aquatic Life Long-Term Average (AW)[b]			n/a	11-50[k]	9	n/a	1,000	0.13	n/a	1,200	0.018-0.457[d]	n/a	1 (Cr(+6))	4	2-31.2[d]	n/a	3-47[d]	n/a	n/a	607-4,037[d]	n/a	1,000	25-150[d]	n/a	2	0.05-1.5[d]	n/a	n/a	0.8	n/a	n/a	8.5	n/a	7.5-525[d]
CSR Aquatic Life (AW)[c]			n/a	n/a	90	50	10,000	1.5	n/a	12,000	0.5-4[d]	n/a	10[e]	40	20-90[d]	n/a	40-160[d]	n/a	n/a	n/a	0.25	10,000	250-1,500[d]	n/a	20	0.5-15[d]	n/a	n/a	3	n/a	1,000	85	n/a	75-2,400[d]
CSR Irrigation Watering (IW)			n/a	5,000	n/a	100	n/a	100	n/a	500	5	n/a	5[e]	50	200	5,000	200	2,500	n/a	200	1	10-30[h]	200	n/a	20	n/a	n/a	n/a	n/a	n/a	n/a	10	100	1,000-5,000[d]
CSR Livestock Watering (LW)			n/a	5,000	n/a	25	n/a	100	n/a	5,000	80	1,000	50[e]	1,000	300	n/a	100	5,000	n/a	n/a	2	50	1,000	n/a	30	n/a	n/a	n/a	n/a	n/a	n/a	200	100	2,000
CSR Drinking Water (DW)			n/a	9,500	6	10	1,000	8	n/a	5,000	5	n/a	50[e]	20[f]	1,500	6,500	10	8	n/a	1,500	1	250	80	n/a	10	20	200	2,500	n/a	2,500	n/a	20	20	3,000
Background																																		
FR_HMW5	FR_HMW5_QSW_03042017_N	2017 06 21	158	6.3	< 0.10	< 0.10	204	< 0.020	< 0.050	57	< 0.0050	33.1	< 0.10	< 0.10	< 0.20	< 10	< 0.050	**232**	18.3	47.2	< 0.00050	< 0.050	< 0.50	0.741	**14.8**	< 0.010	21.0	295	< 0.010	< 0.10	< 10	0.019	< 0.50	< 1.0
	FR_HMW5_QTR_2017-09-11_N	2017 09 18	162	6.1	< 0.10	< 0.10	190	< 0.020	< 0.050	48	< 0.0050	35.1	< 0.10	< 0.10	< 0.50	< 10	< 0.050	**218**	18.1	47.8	< 0.00050	< 0.050	< 0.50	0.687	0.334	< 0.010	14.5	331	< 0.010	< 0.10	< 10	0.016	< 0.50	< 3.0
	WG_2017-09-11_003	Duplicate	166	6.3	< 0.10	< 0.10	189	< 0.020	< 0.050	50	< 0.0050	35.9	< 0.10	< 0.10	< 0.50	< 10	< 0.050	**219**	18.4	47.7	< 0.00050	< 0.050	< 0.50	0.679	0.595	< 0.010	14.7	329	< 0.010	< 0.10	< 10	0.016	< 0.50	< 3.0
	QA/QC RPD%		2	3	*	*	1	*	*	4	*	2	*	*	*	*	*	< 1	2	< 1	*	*	*	1	56	*	1	1	*	*	*	*	*	*
	FR_HMW5_QTR_2017-10-02_N	2017 11 14	187	5.9	< 0.10	< 0.10	196	< 0.020	< 0.050	42	< 0.0050	41.5	< 0.10	< 0.10	< 0.50	< 10	< 0.050	**265**	20.2	48.5	< 0.00050	< 0.050	< 0.50	0.649	1.03	< 0.010	12.9	346	< 0.010	< 0.10	< 10	0.014	< 0.50	< 3.0
	WG_2017-10-02_005	Duplicate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.00050	-	-	-	-	-	-	-	-	-	-	-	-	-
	QA/QC RPD%		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Study Area 1																																		
FR_09-01-A	FR_09-01-A_QSW_02012017_N	2017 03 08	986	< 1.0	0.19	< 0.10	139	< 0.020	< 0.050	18	0.0571	214	< 0.10	0.31	< 0.20	< 10	< 0.050	**76.8**	110	< 0.10	< 0.0050	0.658	1.40	3.32	120	< 0.010	4.10	214	< 0.010	< 0.10	< 10	6.34	< 0.50	< 1.0
	FR_09-01-A_QSW_03042017_N	2017 06 01	557	< 1.0	0.27	< 0.10	70.0	< 0.020	< 0.050	13	0.0269	123	< 0.10	< 0.10	< 0.20	< 10	< 0.050	**51.4**	60.8	0.15	< 0.0050	1.81	< 0.50	2.57	112	< 0.010	2.52	115	< 0.010	< 0.10	< 10	4.77	< 0.50	2.5
	FR_09-01-A_QTR_2017-09-11_N	2017 09 12	738	< 3.0	0.34	< 0.10	99.9	< 0.020	< 0.050	27	0.0478	170	< 0.10	0.33	< 0.50	< 10	< 0.050	**65.5**	76.4	< 0.10	< 0.0050	0.804	1.37	3.43	68.1	< 0.010	4.27	163	< 0.010	< 0.10	< 10	4.26	< 0.50	< 3.0
	FR_09-01-A_QTR_2017-10-02_N	2017 11 22	1,050	< 3.0	0.24	< 0.10	144	< 0.020	< 0.050	23	0.0471	234	< 0.10	0.17	< 0.50	< 10	< 0.050	**68.0**	112	0.71	< 0.0050	0.603	0.74	3.64	166	< 0.010	4.10	222	< 0.010	< 0.10	< 10	5.36	< 0.50	< 3.0
FR_09-01-B	FR_09-01-B_QSW_02012017_N	2017 03 08	882	< 1.0	0.13	< 0.10	153	< 0.020	< 0.050	21	0.0536	184	0.13	0.52	< 0.20	< 10	< 0.050	**69.1**	103	< 0.10	< 0.0050	0.640	2.00	3.79	71.8	< 0.010	4.89	212	< 0.010	< 0.10	< 10	4.54	< 0.50	1.2
	FR_09-01-B_QSW_03042017_N	2017 06 01	636	< 1.0	0.11	< 0.10	126	< 0.020	< 0.050	17	0.0209	137	< 0.10	< 0.10	< 0.20	< 10	< 0.050	**54.7**	71.2	< 0.10	< 0.0050	0.565	< 0.50	3.14	126	< 0.010	3.63	155	< 0.010	< 0.10	< 10	3.21	< 0.50	< 1.0
	FR_09-01-B_QTR_2017-09-11_N	2017 09 12	613	< 3.0	0.14	< 0.10	117	< 0.020	< 0.050	16	0.0350	140	0.11	0.32	< 0.50	< 10	< 0.050	**54.3**	63.8	< 0.10	< 0.0050	0.966	1.25	3.08	44.2	< 0.010	3.79	148	< 0.010	< 0.10	< 10	4.79	< 0.50	< 3.0
	FR_09-01-B_QTR_2017-10-02_N	2017 11 22	890	< 3.0	0.15	< 0.10	156	< 0.020	< 0.050	23	0.0402	202	< 0.10	0.42	< 0.50	< 10	< 0.050	**67.7**	93.8	0.42	< 0.0050	0.835	1.32	3.50	91.5	< 0.010	4.84	208	< 0.010	< 0.10	< 10	5.30	< 0.50	< 3.0
FR_GHHW	FR_GHHW_QSW_02012017_N	2017 02 27	689	< 1.0	< 0.10	< 0.10	110	< 0.020	< 0.050	11	0.0515	169	< 0.10	< 0.10	1.98	91	0.080	**24.8**	64.7	1.93	< 0.0050	0.328	< 0.50	1.46	123	< 0.010	2.61	238	< 0.010	< 0.10	< 10	2.88	< 0.50	67.4
	FR_GHHW_QSW_03042017_N	2017 06 01	597	< 1.0	< 0.10	< 0.10	90.6	< 0.020	< 0.050	11	0.0408	143	< 0.10	< 0.10	1.96	47	0.070	**23.7**	58.2	5.93	< 0.0050	0.343	< 0.50	1.27	93.5	< 0.010	2.41	194	< 0.010	< 0.10	< 10	2.64	< 0.50	48.8
	FR_GHHW_QTR_2017-09-11_N	2017 09 13	527	< 3.0	< 0.10	< 0.10	82.3	< 0.020	< 0.050	< 10	0.0403	132	< 0.10	< 0.10	1.87	13	0.090	**21.9**	48.0	1.03	< 0.0050	0.290	< 0.50	1.18	82.2	< 0.010	2.15	169	< 0.010	< 0.10	< 10	2.35	< 0.50	90.3
FR_GH_WELL4	FR_GH_WELL4_QTR_2017-10-02_N	2017 11 15	590	< 3.0	< 0.10	< 0.10	83.1	< 0.020	< 0.050	< 10	0.0297	143	< 0.10	< 0.10	1.36	12	0.060	**24.9**	56.6	1.08	< 0.0050	0.322	< 0.50	1.19	92.8	< 0.010	2.26	185	< 0.010	< 0.10	< 10	2.50	< 0.50	20.5
Study Area 2																																		
LC_PIZDC1307	LC_PIZDC1307_WG_2017-03-13_NP	2017 03 16	171	1.1	< 0.10	0.94	**1,460**	< 0.020	< 0.050	23	0.0121	36.5	< 0.10	< 0.10	0.28	178	< 0.050	**69.3**	19.4	10.4	< 0.0050	**33.0**	1.93	4.91	< 0.050	< 0.010	12.7	132	< 0.010	< 0.10	< 10	0.114	< 0.50	3.6
	LC_PIZDC1307_WG_2017-06-12_NP	2017 06 12	164	1.3	< 0.10	1.51	**1,380**	< 0.020	< 0.050	21	0.0155	34.3	< 0.10	< 0.10	< 0.20	928	< 0.050	**66.9**	19.0	11.7	< 0.0050	**61.6**	1.68	4.75	< 0.050	< 0.010	13.4	125	< 0.010	< 0.10	< 10	0.034	< 0.50	7.1
	LC_PIZDC1307_WG_2017-09-11_NP	2017 09 19	177	< 3.0	< 0.10	1.28	**1,410**	< 0.020	< 0.050	22	< 0.015	38.2	< 0.10	< 0.10	< 0.50	672	< 0.050	**71.9**	19.9	9.22	0.0053	**36.5**	0.90	4.88	< 0.050	< 0.010	13.4	129	< 0.010	< 0.10	< 10	0.034	< 0.50	< 3.0
	LC_PIZDC1307_WG_2017-12-11_NP	2017 11 01	182	< 3.0	0.10	1.51	**1,430**	< 0.020	0.148	24	0.0337	38.7	< 0.10	< 0.10	< 0.50	795	0.088	**79.5**	20.7	10.1	< 0.0050	**35.4**	0.75	5.01	0.14	< 0.010	14.0	134	0.185	< 0.10	< 10	0.048	< 0.50	< 3.0
LC_PIZDC1308	LC_PIZDC1308_WG_2017-03-13_NP	2017 03 13	233	< 1.0	< 0.10	0.41	461	< 0.020	< 0.050	14	0.0091	59.8	< 0.10	1.26	< 0.20	906	< 0.050	**26.2**	20.3	101	< 0.0050	8.72	2.55	2.61	< 0.050	< 0.010	7.87	99.5	0.023	< 0.10	< 10	0.789	< 0.50	2.2
	LC_PIZDC1308_WG_2017-06-12_NP	2017 06 12	315	< 1.0	0.10	< 0.10	271	< 0.020	< 0.050	< 10	0.133	83.5	< 0.10	0.28	0.29	< 10	< 0.050	7.2	25.8	6.72	< 0.0050	1.47	1.31	1.94	0.301	< 0.010	1.37	91.7	0.021	< 0.10	< 10	1.10	< 0.50	2.1
	LC_PIZDC1308_WG_2017-09-11_NP	2017 09 19	211	< 3.0	< 0.10	0.22	361	< 0.020	< 0.050	12	0.0230	49.9	< 0.10	0.92	< 0.50	525	< 0.050	**19.0**	20.8	93.6	< 0.0050	8.19	1.77	2.58	< 0.050	< 0.010	6.80	84.6	0.023	< 0.10	< 10	0.446	< 0.50	< 3.0
	FD_WG_20170911_020	Duplicate	233	< 3.0	< 0.10	0.19	349	< 0.020	< 0.050	14	0.0253	59.5	< 0.10	0.92	< 0.50	537	< 0.050	**23.8**	20.5	92.2	< 0.0050	9.62	1.80	2.56	< 0.050	< 0.010	6.84	98.4	0.027	< 0.10	< 10	0.537	< 0.50	< 3.0
	QA/QC RPD%		10	*	*	15	3	*	*	*	*	18	*	0	*	2	*	22	1	2	*	16	2	1	*	*	1	15	*	*	*	19	*	*
	LC_PIZDC1308_WG_2017-12-11_NP	2017 11 01	240	< 3.0	< 0.10	0.37	396	< 0.020	< 0.050	15	0.0361	60.1	< 0.10	1.05	< 0.50	840	< 0.050	**26.3**	21.7	95.1	< 0.0050	9.71	2.28	2.70	< 0.050	< 0.010	7.90	102	0.037	< 0.10	< 10	0.629	< 0.50	< 3.0
	FD_WG_20171211_023	Duplicate	238	< 3.0	< 0.10	0.35	400	< 0.020	< 0.050	15	0.0259	59.4	< 0.10	1.07	< 0.50	828	< 0.050	**26.4**	21.7	93.7	< 0.0050	9.86	2.34	2.64	< 0.050	< 0.010	7.91	99.7	0.037	< 0.10	< 10	0.660	< 0.50	< 3.0
	QA/QC RPD%		1	*	*	6	1	*	*	*	33	1	*	2	*	1	*	< 1	0	1	*	2	3	2	*	*	< 1	2	*	*	*	5	*	*
Study Area 3																																		
GH_POTW09	GH_POTW09_WG_2017-02-07_NP	2017 02 07	398	< 1.0	< 0.10	0.44	32.4	< 0.020	< 0.050	19	0.0191	91.9	< 0.10	0.19	6.82	149	0.241	**11.9**	40.9	**207**	< 0.0050	2.68	26.8	1.54	0.951	< 0.010	6.15	342	0.019	< 0.10	< 10	1.85	< 0.50	32.2
	GH_POTW09_WG_2017-06-19_NP	2017 06 22	372	< 1.0	< 0.10	0.38	33.4	< 0.020	< 0.050	18	0.0085	88.6	< 0.10	0.18	2.92	143	< 0.050	**12.2**	36.7	188	< 0.0050	2.55	2.95	1.59	1.48	< 0.010	6.28	337	0.017	< 0.10	< 10	1.89	< 0.50	7.4
	GH_POTW09_WG_2017-06-19_FD	Duplicate	372	< 1.0	< 0.10	0.42	33.6	< 0.020	< 0.050	17	0.0111	88.5	< 0.10	0.17	3.02	149	< 0.050	**12.1**	36.6	186	< 0.0050	2.55	2.54	1.58	1.43	< 0.010	6.20	338	0.017	< 0.10	< 10	1.88	< 0.50	8.3
	QA/QC RPD%		0	*	*	10	1	*	*	*	*	< 1	*	*	3	4	*	1	< 1	1	*	0	15	1	3	*	1	< 1	*	*	*	1	*	11
	GH_POTW09_WG_2017-07-05_NP	2017 07 05	398	< 1.0	< 0.10	0.31	34.9	< 0.020	< 0.050	18	0.0191	92.4	< 0.10	0.17	0.86	< 10	< 0.050	**11.7**	40.5	186	< 0.0050	2.54	2.45	1.64	6.49	< 0.010	6.41	337	0.022	< 0.10	< 10	2.23	< 0.50	8.2
	GH_POTW09_WG_2017-07-01_NP	2017 09 25	392	< 3.0	< 0.10	0.41	32.8	< 0.020	< 0.050	21	0.0131	93.5	< 0.10	0.16	5.10	135	0.103	**11.5**	38.5	178	< 0.0050	2.30	11.5	1.49	0.91	< 0.010	5.87	313	0.018	< 0.10	< 10	2.00	< 0.50	18.1
	GH_POTW09_WG_2017-10-01_NP	2017 11 16	416	< 3.0	< 0.10	0.42	31.2	< 0.020	< 0.050	18	0.0115	92.8	< 0.10	0.17	3.70	139	< 0.050	**12.9**	44.8	197	< 0.0050	2.45	3.12	1.54	1.37	< 0.010	5.97	321	0.018	< 0.10	< 10	1.94	< 0.50	13.7
GH_POTW10	GH_POTW10_WG_2017-02-07_NP	2017 02 07	365	< 1.0	< 0.10	1.34	19.0	< 0.020	< 0.050	35	0.0072	85.7	< 0.10	0.12	< 0.20	728	< 0.050	**17.0**	36.7	47.0	< 0.0050	2.92	0.69	1.79	4.99	< 0.010	4.45	525	< 0.010	< 0.10	< 10	0.691	< 0.50	< 1.0
	GH_POTW10_WG_2017-02-07_FD	Duplicate	353	< 1.0	< 0.10	1.22	18.4	< 0.020	< 0.050	35	0.0073	83.2	< 0.10	0.11	< 0.20	667	< 0.050	**16.9**	35.3	45.9	< 0.0050	2.94	0.69	1.72	4.92	< 0.010	4.28	505	< 0.010	< 0.10	< 10	0.686	< 0.50	< 1.0
	QA/QC RPD%		3	*	*	9	3	*	*	0	*	3	*	*	*	9	*	1	4	2	*	1	0	4	1	*	4	4	*	*	*	1	*	*
	GH_POTW10_WG_2017-06-19_NP	2017 06 19	513	1.0	< 0.10	1.83	25.9	< 0.020	< 0.050	19	0.0184	128	< 0.10	0.26	< 0.20	831	0.058	**15.6**	47.2	**211**	< 0.0050	2.53	1.57	1.76	0.173	< 0.010	12.1	391	0.016	< 0.10	< 10	1.37	< 0.50	2.9
	GH_POTW10_WG_2017-07-01_NP	2017 09 25	381	< 3.0	< 0.10	1.10	19.2	< 0.020	< 0.050	38	0.0079	86.6	< 0.10	0.13	< 0.50	677	< 0.050	**15.5**	40.0	50.5	< 0.0050	2.55	0.99	1.62	3.17	< 0.010	4.43	468	< 0.010	< 0.10	< 10	0.672	< 0.50	< 3.0
	GH_POTW10_WG_2017-10-01_NP	2017 11 16	399	< 3.0	< 0.10	1.17	18.4	< 0.020	< 0.050	33	0.0101	86.3	< 0.10	0.17	< 0.50	881	< 0.050	**17.6**	44.4	58.2	< 0.0050	2.74	2.85	1.65	3.71	< 0.010	4.75	501	< 0.010	< 0.10	< 10	0.644	< 0.50	< 3.0

Data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.
** Comparison to BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline.

BOLD**	Concentration greater than BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline
BOLD	Concentration greater than CSR Aquatic Life (AW) standard
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard

[a] Guideline to protect freshwater aquatic life, short-term maximum (i.e. "acute"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[b] Guideline to protect freshwater aquatic life, long-term average (i.e. "chronic"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[c] Standard to protect freshwater aquatic life.
[d] Guideline/standard varies with Hardness.
[e] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[f] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[g] Total Mercury guideline is based on the % of MethylMercury present. WQG = 0.0001 / (MeHg/total Hg), where MeHg is mass (or concentration) of methyl mercury and THg. Guideline shown assumes MeHg<0.5% of Total Hg.
[h] Standard ranges between 10 to 30 ug/L and varies with crop, soil drainage and Mo:Cu ratio. Conservative standard of 10 ug/L was applied.
[i] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.
[j] Samples inferred to be mislabelled in field.
[k] Guideline/standard varies with pH.
[l] Reported metals values for Q1 are total metals.
[m] Reported metals values are total metals.

TABLE 4 (Cont'd): Summary of Analytical Results compared to Primary Screening Criteria for Dissolved Metals in Groundwater

				Dissolved Metals																														
Sample Location	Sample ID	Sample Date	Hardness	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Selenium	Silver	Sodium	Strontium	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc[i]
		(yyyy mm dd)	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BC Standard																																		
BCWQG Aquatic Life Short-term Maximum (AW)[a]			n/a	31-100[k]	n/a	5	n/a	n/a	n/a	n/a	0.038-2.8[d]	n/a	n/a	110	2.05-75.32[d]	350 (max)	3-1,116[d]	n/a	n/a	546-9,136[d]	0.02[g]	2,000	n/a	n/a	n/a	0.1-3[d]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	33-551[d]
BCWQG Aquatic Life Long-Term Average (AW)[b]			n/a	11-50[k]	9	n/a	1,000	0.13	n/a	1,200	0.018-0.457[d]	n/a	1 (Cr(+6))	4	2-31.2[d]	n/a	3-47[d]	n/a	n/a	607-4,037[d]	n/a	1,000	25-150[d]	n/a	2	0.05-1.5[d]	n/a	n/a	0.8	n/a	n/a	8.5	n/a	7.5-525[d]
CSR Aquatic Life (AW)[c]			n/a	n/a	90	50	10,000	1.5	n/a	12,000	0.5-4[d]	n/a	10[e]	40	20-90[d]	n/a	40-160[d]	n/a	n/a	n/a	0.25	10,000	250-1,500[d]	n/a	20	0.5-15[d]	n/a	n/a	3	n/a	1,000	85	n/a	75-2,400[d]
CSR Irrigation Watering (IW)			n/a	5,000	n/a	100	n/a	100	n/a	500	5	n/a	5[e]	50	200	5,000	200	2,500	n/a	200	1	10-30[h]	200	n/a	20	n/a	n/a	n/a	n/a	n/a	n/a	10	100	1,000-5,000[d]
CSR Livestock Watering (LW)			n/a	5,000	n/a	25	n/a	100	n/a	5,000	80	1,000	50[e]	1,000	300	n/a	100	5,000	n/a	n/a	2	50	1,000	n/a	30	n/a	n/a	n/a	n/a	n/a	n/a	200	100	2,000
CSR Drinking Water (DW)			n/a	9,500	6	10	1,000	8	n/a	5,000	5	n/a	50[e]	20[f]	1,500	6,500	10	8	n/a	1,500	1	250	80	n/a	10	20	200	2,500	n/a	2,500	n/a	20	20	3,000
Study Area 3 (Cont'd)																																		
GH_POTW15	GH_POTW15_WG_2017-02-07_NP	2017 02 07	464	< 1.0	< 0.10	1.46	22.5	< 0.020	< 0.050	19	0.0229	121	< 0.10	0.25	< 0.20	670	< 0.050	15.8	39.4	189	< 0.0050	2.63	1.14	1.68	0.197	< 0.010	9.29	377	0.019	< 0.10	< 10	1.45	< 0.50	1.3
	GH_POTW15_WG_2017-06-19_NP	2017 06 19	382	< 1.0	< 0.10	1.26	20.1	< 0.020	< 0.050	31	0.0077	84.7	< 0.10	0.16	< 0.20	936	< 0.050	15.9	41.4	55.4	< 0.0050	2.90	1.26	1.79	3.03	< 0.010	4.99	501	< 0.010	< 0.10	< 10	0.635	< 0.50	1.2
	GH_POTW15_WG_2017-07-01_NP	2017 09 25	475	< 3.0	< 0.10	1.49	21.8	< 0.020	< 0.050	21	0.0212	118	< 0.10	0.21	< 0.50	776	< 0.050	14.0	43.9	183	< 0.0050	2.18	1.59	1.47	0.103	< 0.010	9.20	342	0.017	< 0.10	< 10	1.47	< 0.50	< 3.0
	GH_POTW15_WG_2017-10-01_NP	2017 11 16	516	< 3.0	< 0.10	2.17	22.0	< 0.020	< 0.050	19	0.0078	127	< 0.10	0.23	< 0.50	1,020	0.146	16.3	48.6	202	< 0.0050	2.41	5.49	1.57	< 0.050	< 0.010	11.4	367	0.014	< 0.10	< 10	1.23	< 0.50	6.3
GH_POTW17	GH_POTW17_WG_2017-01-03_NP	2017 01 03	739	< 5.0	< 0.50	< 0.50	27.6	< 0.10	< 0.25	< 50	0.075	176	< 0.50	< 0.50	< 1.0	< 50	< 0.25	12.4	73.0	97.4	< 0.0050	1.25	2.6	1.69	5.15	< 0.050	7.30	426	< 0.050	< 0.50	< 10	2.10	< 2.5	10.7
	GH_POTW17_WG_2017-02-07_NP	2017 02 07	719	< 1.0	< 0.10	0.23	33.0	< 0.020	< 0.050	19	0.0665	177	< 0.10	0.24	0.24	174	0.066	13.0	67.5	81.4	< 0.0050	0.989	6.58	1.74	6.93	< 0.010	6.52	454	0.013	< 0.10	< 10	2.42	< 0.50	1.7
	GH_POTW17_WG_2017-06-19_NP	2017 06 19	737	< 1.0	< 0.10	0.18	32.2	< 0.020	< 0.050	17	0.0630	172	< 0.10	0.14	< 0.20	139	0.375	12.1	75.0	60.3	< 0.0050	1.05	2.92	1.71	9.83	< 0.010	7.26	441	0.012	< 0.10	< 10	2.20	< 0.50	1.7
	GH_POTW17_WG_2017-07-05_NP	2017 07 05	729	< 1.0	< 0.10	0.10	30.9	< 0.020	< 0.050	19	0.0671	173	< 0.10	0.19	0.45	< 10	< 0.050	12.3	72.3	78.5	< 0.0050	1.07	6.30	1.71	7.71	< 0.010	7.59	451	0.014	< 0.10	< 10	2.22	< 0.50	1.5
	GH_POTW17_WG_2017-07-01_NP	2017 09 25	709	< 3.0	< 0.10	0.13	26.9	< 0.020	< 0.050	24	0.0539	169	< 0.10	0.14	< 0.50	228	5.91	12.2	69.9	66.1	< 0.0050	0.962	18.1	1.53	4.98	< 0.010	6.46	428	0.014	< 0.10	< 10	2.28	< 0.50	10.1
	GH_POTW17_WG_2017-10-01_NP	2017 11 21	780	< 3.0	< 0.10	0.14	28.7	< 0.020	< 0.050	22	0.0429	181	< 0.10	0.15	< 0.50	145	0.333	13.8	79.5	68.3	< 0.0050	1.17	16.9	1.69	7.09	< 0.010	8.06	499	0.011	< 0.10	< 10	2.32	< 0.50	< 3.0
GH_MW-RLP-1D	GH_MW-RL-1D_WG_2017-02-02_NP	2017 02 02	255	1.6	< 0.10	0.33	48.3	< 0.020	< 0.050	16	< 0.0050	53.4	< 0.10	0.10	< 0.20	152	< 0.050	6.8	29.5	105	< 0.0050	3.41	0.73	1.25	2	< 0.010	3.70	205	< 0.010	< 0.10	< 10	1.05	< 0.50	< 1.0
	GH_MW-RL-1D_WG_2017-02-02_FD	Duplicate	274	1.6	< 0.10	0.37	51.7	< 0.020	< 0.050	16	< 0.0050	57.4	< 0.10	0.10	< 0.20	159	< 0.050	7.2	31.8	112	< 0.0050	3.58	0.62	1.33	2.45	< 0.010	3.92	220	< 0.010	< 0.10	< 10	1.13	< 0.50	< 1.0
	QA/QC RPD%		7	*	*	*	7	*	*	*	*	7	*	*	*	5	*	6	8	6	*	5	*	6	20	*	6	7	*	*	*	7	*	*
	GH_MW-RL-1D_WG_2017-06-19_NP	2017 06 22	235	2.9	< 0.10	< 0.10	45.5	< 0.020	< 0.050	16	< 0.0050	52.6	< 0.10	< 0.10	< 0.20	25	< 0.050	7.4	25.1	85.1	< 0.0050	1.04	< 0.50	1.29	0.08	< 0.010	3.79	188	< 0.010	< 0.10	< 10	0.730	< 0.50	21.9
	GH_MW-RLP_WG_2017-07-01_NP	2017 09 26	244	6.2	< 0.10	< 0.10	46.4	< 0.020	< 0.050	14	< 0.0050	50.5	< 0.10	< 0.10	< 0.50	93	< 0.050	8.0	28.6	18.6	< 0.0050	0.434	< 0.50	1.21	6.53	< 0.010	4.55	181	< 0.010	< 0.10	< 10	0.393	< 0.50	< 3.0
	GH_MW-RLP_WG_2017-10-01_NP	2017 12 13	220	3.5	< 0.10	0.13	51.7	< 0.020	< 0.050	15	< 0.0050	45.8	< 0.10	< 0.10	< 0.50	< 10	< 0.050	7.0	25.6	2.99	< 0.0050	0.230	< 0.50	1.28	2.09	< 0.010	4.82	185	< 0.010	< 0.10	< 10	0.184	< 0.50	< 3.0
Study Area 4																																		
GH_MW-ERSC-1	GH_MW-ERSC-1_WG_2017-01-31_NP	2017 01 31	311	< 3.0	< 0.10	0.33	147	< 0.020	< 0.050	20	0.0096	85.0	< 0.10	< 0.10	3.27	125	1.87	15.4	23.9	37.2	< 0.0050	4.85	1.38	1.07	1.03	< 0.010	6.10	269	< 0.010	< 0.10	< 10	0.662	< 0.50	6.0
	GH_MW-ERSC-1_WG_2017-01-31_FD	Duplicate	301	< 3.0	< 0.10	0.32	142	< 0.020	< 0.050	24	0.0103	82.1	< 0.10	< 0.10	< 0.50	114	< 0.050	15.4	23.2	36.1	< 0.0050	4.69	1.28	1.05	1.08	< 0.010	6.12	257	< 0.010	< 0.10	< 10	0.650	< 0.50	< 3.0
	QA/QC RPD%		3	*	*	3	3	*	*	*	*	3	*	*	*	9	*	0	3	3	*	3	8	2	5	*	< 1	5	*	*	*	2	*	*
	GH_MW-ERSC-1_WG_2017-06-19_NP	2017 06 20	-	1.5	< 0.10	< 0.10	64.9	< 0.020	< 0.050	< 10	0.0185	44.6	0.25	< 0.10	< 0.20	< 10	< 0.050	5.1	16.1	0.20	< 0.0050	1.89	0.58	0.622	2.85	< 0.010	1.48	148	< 0.010	< 0.10	< 10	0.692	< 0.50	30.0
	GH_ERSC-1_WG_2017-07-01_NP	2017 09 20	334	< 3.0	0.10	0.23	139	< 0.020	< 0.050	23	0.0349	91.6	0.15	< 0.10	< 0.50	19	< 0.050	11.4	25.7	9.87	< 0.0050	5.09	1.31	1.03	6.53	< 0.010	5.17	282	0.029	< 0.10	< 10	0.970	< 0.50	6.2
	GH_MW-ERSC-1_WG_2017-10-01_NP	2017 12 18	641	< 3.0	< 0.10	< 0.10	226	< 0.020	< 0.050	< 10	0.0777	160	0.17	< 0.10	0.60	< 10	< 0.050	9.5	59.0	1.18	< 0.0050	1.67	1.87	1.06	68.7	< 0.010	5.52	587	0.029	0.18	< 10	1.61	< 0.50	8.3
GH_GA-MW-1	GH_GA-MW-1_WG_2017-01-30_NP	2017 01 30	228	< 3.0	1.96	0.52	43.7	< 0.020	< 0.050	825	0.0272	50.3	0.34	0.33	1.86	33	< 0.050	142	24.8	168	< 0.0050	5.27	2.98	3.17	0.205	< 0.010	145	3,320	0.021	< 0.10	< 10	2.02	< 0.50	7.8
	GH_GA-MW-1_WG_2017-06-19_NP	2017 06 20	233	2.4	3.43	0.45	43.0	< 0.020	< 0.050	770	0.0307	47.8	0.68	< 0.10	2.94	< 10	< 0.050	156	27.7	6.53	< 0.0050	4.89	9.51	3.23	0.169	0.011	156	3,190	0.022	0.17	< 10	2.48	< 0.50	5.6
	GH_GA_MW-1_WG_2017-07-01_NP	2017 09 19	363	< 3.0	0.80	0.66	51.9	< 0.020	< 0.050	726	< 0.035	74.1	< 0.10	1.27	1.32	171	0.054	144	43.3	548	< 0.0050	85.7	5.40	3.70	0.137	< 0.010	174	4,950	0.041	0.43	< 10	2.65	1.57	59.8
	GH_GA-MW-1_WG_2017-10-01_NP	2017 10 19	296	< 3.0	1.65	0.56	46.0	< 0.020	< 0.050	717	0.0303	61.9	0.16	0.70	62.4	88	< 0.050	139	34.3	327	< 0.0050	21.4	4.15	3.62	0.109	< 0.010	163	4,470	0.032	< 0.10	< 10	2.32	< 0.50	55.8
GH_GA-MW-2	GH_GA-MW-2_WG_2017-01-30_NP	2017 01 30	362	< 3.0	1.17	0.26	84.5	< 0.020	< 0.050	23	0.0401	102	< 0.10	0.19	< 0.50	< 10	< 0.050	15.2	26.3	61.2	< 0.0050	27.2	3.56	1.10	7.87	< 0.010	8.17	441	< 0.010	< 0.10	< 10	3.30	< 0.50	5.3
	GH_GA-MW-2_WG_2017-06-19_NP	2017 06 20	366	1.1	1.55	0.22	69.3	< 0.020	< 0.050	27	0.0189	94.3	< 0.10	< 0.10	< 0.20	< 10	< 0.050	17.8	31.6	10.5	< 0.0050	30.5	2.36	1.18	7.41	< 0.010	8.35	442	< 0.010	< 0.10	< 10	3.11	< 0.50	2.1
	GH_GA-MW-2_WG_2017-07-01_NP	2017 09 20	423	< 3.0	1.50	0.24	73.5	< 0.020	< 0.050	20	< 0.0050	115	< 0.10	0.21	< 0.50	< 10	< 0.050	17.6	33.2	35.9	< 0.0050	35.4	4.12	1.20	9.49	< 0.010	9.07	522	< 0.010	< 0.10	< 10	3.58	< 0.50	< 3.0
	GH_GA-MW-2_WG_2017-07-01_FD	Duplicate	385	< 3.0	1.33	0.25	66.0	< 0.020	< 0.050	17	< 0.035	102	< 0.10	0.31	< 0.50	< 10	< 0.050	14.7	31.3	74.7	< 0.0050	31.4	4.43	1.12	6.6	< 0.010	8.67	447	< 0.010	< 0.10	< 10	3.52	< 0.50	6.7
	QA/QC RPD%		9	*	12	4	11	*	*	*	*	12	*	*	*	*	*	18	6	70	*	12	7	7	36	*	5	15	*	*	*	2	*	*
	GH_GA-MW-2_WG_2017-10-01_NP	2017 11 27	448	< 3.0	1.13	0.24	69.5	< 0.020	< 0.050	19	0.0584	120	< 0.10	0.19	18.7	< 10	< 0.050	17.1	35.9	41.1	< 0.0050	20.0	3.39	1.16	18.9	< 0.010	9.27	510	0.017	< 0.10	< 10	3.39	< 0.50	5.7
GH_GA-MW-3	GH_GA-MW-3_WG_2017-01-30_NP	2017 01 30	218	< 3.0	< 0.10	< 0.10	106	< 0.020	< 0.050	288	< 0.0050	40.8	0.13	< 0.10	< 0.50	< 10	< 0.050	95.8	28.3	10.0	< 0.010	0.096	< 0.50	2.54	0.231	< 0.010	38.0	2,100	< 0.010	< 0.10	< 10	0.055	< 0.50	< 3.0
	GH_GA-MW-3_WG_2017-06-19_NP	2017 06 19	281	2.9	< 0.10	0.23	58.8	< 0.020	< 0.050	212	< 0.0050	51.5	0.29	< 0.10	< 0.20	43	< 0.050	89.7	37.1	19.3	< 0.0050	0.101	0.64	2.55	0.354	< 0.010	35.8	1,910	< 0.010	< 0.10	< 10	0.262	< 0.50	< 3.0
	GH_GA-MW-3_WG_2017-07-01_NP	2017 09 20	256	< 3.0	< 0.10	0.11	110	< 0.020	< 0.050	258	< 0.0050	45.9	< 0.10	< 0.10	< 0.50	< 10	< 0.050	107	34.3	10.8	< 0.10	0.708	< 0.50	2.60	1.29	< 0.010	39.3	2,230	< 0.010	< 0.10	< 10	0.079	< 0.50	< 3.0
	GH_GA-MW-3_WG_2017-10-01_NP	2017 11 30	274	< 3.0	< 0.10	< 0.10	97.1	< 0.020	< 0.050	285	< 0.0050	48.3	< 0.10	< 0.10	< 0.50	< 10	< 0.050	100	37.2	8.71	< 0.0050	< 0.050	< 0.50	2.25	19.4	< 0.010	36.9	2,130	< 0.010	< 0.10	< 10	0.064	< 0.50	< 3.0
GH_GA-MW-4	GH_GA-MW-4_WG_2017-01-30_NP	2017 01 30	377	< 3.0	0.16	0.10	59.4	< 0.020	< 0.050	17	0.0128	89.9	0.17	< 0.10	< 0.50	< 10	< 0.050	41.4	37.1	< 0.10	< 0.0050	1.90	< 0.50	1.36	3.16	< 0.010	6.79	274	< 0.010	< 0.10	< 10	2.71	< 0.50	< 3.0
	GH_GA-MW-4_WG_2017-01-30_FD	Duplicate	367	< 3.0	0.16	< 0.10	62.3	< 0.020	< 0.050	15	0.0131	89.2	0.17	< 0.10	< 0.50	< 10	< 0.050	41.6	35.0	< 0.10	< 0.0050	1.83	< 0.50	1.36	3.03	< 0.010	6.44	269	< 0.010	< 0.10	< 10	2.62	< 0.50	< 3.0
	QA/QC RPD%		3	*	*	*	5	*	*	*	*	1	*	*	*	*	*	< 1	6	*	*	4	*	0	4	*	5	2	*	*	*	3	*	*
	GH_GA-MW-4_WG_2017-06-19_NP	2017 06 20	277	< 1.0	0.33	0.11	80.4	< 0.020	< 0.050	14	0.0104	54.5	0.19	< 0.10	0.29	< 10	< 0.050	26.8	34.1	0.38	< 0.0050	3.22	0.64	1.82	4.31	< 0.010	4.98	157	< 0.010	< 0.10	< 10	2.59	< 0.50	< 1.0
	GH_GA-MW-4_WG_2017-06-19_FD	Duplicate	-	1.1	0.32	0.11	77.1	< 0.020	< 0.050	12	0.0106	53.5	0.26	< 0.10	0.32	< 10	< 0.050	26.6	32.9	0.37	< 0.0050	3.07	0.63	1.76	4.05	< 0.010	4.77	152	< 0.010	< 0.10	< 10	2.60	< 0.50	< 1.0
	QA/QC RPD%		-	*	*	*	4	*	*	*	*	2	*	*	*	*	*	1	4	*	*	5	2	3	6	*	4	3	*	*	*	< 1	*	*
	GH_GA_MW-4_WG_2017-07-01_NP	2017 09 19	246	< 3.0	0.13	< 0.10	56.5	< 0.020	< 0.050	16	0.0053	57.2	0.16	< 0.10	< 0.50	< 10	< 0.050	26.6	25.1	0.23	< 0.0050	1.95	< 0.50	0.992	1.83	< 0.010	4.82	187	< 0.010	< 0.10	< 10	1.76	< 0.50	< 3.0
	GH_GA_MW-4_WG_2017-07-01_FD	Duplicate	248	< 3.0	0.12	< 0.10	56.0	< 0.020	< 0.050	23	0.0074	58.0	0.13	< 0.10	< 0.50	< 10	< 0.050	28.4	25.1	0.16	< 0.0050	2.05	< 0.50	0.990	1.77	< 0.010	4.90	189	< 0.010	< 0.10	< 10	1.82	< 0.50	< 3.0
	QA/QC RPD%		1	*	*	*	1	*	*	*	*	1	*	*	*	*	*	7	0	*	*	5	*	< 1	3	*	2	1	*	*	*	3	*	*
	GH_GA-MW-4_WG_2017-10-01_NP	2017 11 27	250	< 3.0	0.19	< 0.10	63.9	< 0.020	< 0.050	15	0.0092	55.5	0.16	< 0.10	< 0.50	< 10	< 0.050	27.5	27.0	< 0.10	< 0.0050	2.55	< 0.50	1.24	4.93	< 0.010	5.78	191	< 0.010	< 0.10	< 10	1.98	< 0.50	< 3.0
	WG_2017-10-01_009	Duplicate	251	< 3.0	0.20	0.11	63.3	< 0.020	< 0.050	16	0.0078	56.2	0.16	< 0.10	0.54	< 10	< 0.050	28.1	26.8	< 0.10	< 0.0050	2.70	< 0.50	1.27	5.23	< 0.010	5.82	200	< 0.010	< 0.10	< 10	1.98	< 0.50	< 3.0
	QA/QC RPD%		< 1	*	*	*	1	*	*	*	*	1	*	*	*	*	*	2	1	*	*	6	*	2	6	*	1	5	*	*	*	0	*	*

Data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.
** Comparison to BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline.

BOLD**	Concentration greater than BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline
BOLD	Concentration greater than CSR Aquatic Life (AW) standard
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard

[a] Guideline to protect freshwater aquatic life, short-term maximum (i.e. "acute"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[b] Guideline to protect freshwater aquatic life, long-term average (i.e. "chronic"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[c] Standard to protect freshwater aquatic life.
[d] Guideline/standard varies with Hardness.
[e] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[f] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[g] Total Mercury guideline is based on the % of MethylMercury present. WQG = 0.0001 / (MeHg/total Hg), where MeHg is mass (or concentration) of methyl mercury and THg. Guideline shown assumes MeHg<0.5% of Total Hg.
[h] Standard ranges between 10 to 30 ug/L and varies with crop, soil drainage and Mo:Cu ratio. Conservative standard of 10 ug/L was applied.
[i] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.
[j] Samples inferred to be mislabelled in field.
[k] Guideline/standard varies with pH.
[l] Reported metals values for Q1 are total metals.
[m] Reported metals values are total metals.

TABLE 4 (Cont'd): Summary of Analytical Results compared to Primary Screening Criteria for Dissolved Metals in Groundwater

Sample Location	Sample ID	Sample Date (yyyy mm dd)	Hardness mg/L	Aluminum µg/L	Antimony µg/L	Arsenic µg/L	Barium µg/L	Beryllium µg/L	Bismuth µg/L	Boron µg/L	Cadmium µg/L	Calcium mg/L	Chromium µg/L	Cobalt µg/L	Copper µg/L	Iron µg/L	Lead µg/L	Lithium µg/L	Magnesium mg/L	Manganese µg/L	Mercury µg/L	Molybdenum µg/L	Nickel µg/L	Potassium mg/L	Selenium µg/L	Silver µg/L	Sodium mg/L	Strontium µg/L	Thallium µg/L	Tin µg/L	Titanium µg/L	Uranium µg/L	Vanadium µg/L	Zinc[h] µg/L
BC Standard																																		
BCWQG Aquatic Life Short-term Maximum (AW)[a]			n/a	31-100[k]	n/a	5	n/a	n/a	n/a	n/a	0.038-2.8[d]	n/a	n/a	110	2.05-75.32[d]	350 (max)	3-1,116[d]	n/a	n/a	546-9,136[d]	0.02[g]	2,000	n/a	n/a	n/a	0.1-3[d]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	33-551[d]
BCWQG Aquatic Life Long-Term Average (AW)[b]			n/a	11-50[k]	9	n/a	1,000	0.13	n/a	1,200	0.018-0.457[d]	n/a	1 (Cr(+6))	4	2-31.2[d]	n/a	3-47[d]	n/a	n/a	607-4,037[d]	n/a	1,000	25-150[d]	n/a	2	0.05-1.5[d]	n/a	n/a	0.8	n/a	n/a	8.5	n/a	7.5-525[d]
CSR Aquatic Life (AW)[c]			n/a	n/a	90	50	10,000	1.5	n/a	12,000	0.5-4[d]	n/a	10[e]	40	20-90[d]	n/a	40-160[d]	n/a	n/a	n/a	0.25	10,000	250-1,500[d]	n/a	20	0.5-15[d]	n/a	n/a	3	n/a	1,000	85	n/a	75-2,400[d]
CSR Irrigation Watering (IW)			n/a	5,000	n/a	100	n/a	100	n/a	500	5	n/a	5[e]	50	200	5,000	200	2,500	n/a	200	1	10-30[h]	200	n/a	20	n/a	n/a	n/a	n/a	n/a	n/a	10	100	1,000-5,000[d]
CSR Livestock Watering (LW)			n/a	5,000	n/a	25	n/a	100	n/a	5,000	80	1,000	50[e]	1,000	300	n/a	100	5,000	n/a	n/a	2	50	1,000	n/a	30	n/a	n/a	n/a	n/a	n/a	n/a	200	100	2,000
CSR Drinking Water (DW)			n/a	9,500	6	10	1,000	8	n/a	5,000	5	n/a	50[e]	20[f]	1,500	6,500	10	8	n/a	1,500	1	250	80	n/a	10	20	200	2,500	n/a	2,500	n/a	20	20	3,000
Study Area 4 (Cont'd)																																		
RG_DW-01-03[l]	RG_DW_01-03_WP_2017-03-06_NP	2017 03 06	204	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.58	-	-	-	-	-	-	-	-	-
	RG_DW-01-03_WP_2017-05-31_NP	2017 05 31	200	< 3.0	< 0.10	< 0.10	79.7	< 0.020	< 0.050	< 10	0.0055	57.0	0.24	< 0.10	0.72	< 10	< 0.050	2.5	14.1	< 0.10	< 0.0050	0.922	< 0.50	0.453	2.8	< 0.010	1.43	217	< 0.010	< 0.10	< 10	0.853	< 0.50	5.7
	RG_DW-01-03_WP_2017-08-22_NP	2017 08 22	202	3.8	< 0.10	< 0.10	81.3	< 0.020	< 0.050	< 10	0.0069	58.2	0.25	< 0.10	1.30	< 10	0.105	2.7	13.9	< 0.10	< 0.0050	0.881	< 0.50	0.446	3.16	< 0.010	1.38	213	< 0.010	< 0.10	< 10	0.862	< 0.50	11.2
	RG_DW-01-03_WP_Q4-2017_NP	2017 11 21	202	< 3.0	< 0.10	< 0.10	76.5	< 0.020	< 0.050	< 10	0.0134	56.5	0.21	< 0.10	1.42	< 10	0.108	2.3	14.9	< 0.10	< 0.0050	0.922	< 0.50	0.388	2.53	< 0.010	1.47	197	< 0.010	< 0.10	< 10	0.762	< 0.50	32.7
RG_DW-01-07[l]	RG_DW-01-07_WP_2017-03-01_NP	2017 03 01	460	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.84	-	-	-	-	-	-	-	-	-
	RG_DW-01-07_WP_2017-05-29_NP	2017 05 29	527	< 3.0	< 0.10	< 0.10	139	< 0.020	< 0.050	20	0.0547	133	0.17	< 0.10	1.40	< 10	0.171	7.7	47.1	0.18	< 0.0050	4.06	0.58	0.998	1.68	< 0.010	5.53	331	< 0.010	< 0.10	< 10	2.03	< 0.50	9.0
	RG_DW-01-07_WP_2017-08-21_NP	2017 08 21	459	< 3.0	< 0.10	< 0.10	131	< 0.020	< 0.050	18	0.0437	116	< 0.10	< 0.10	1.64	< 10	0.068	6.0	41.0	0.18	< 0.0050	3.39	< 0.50	0.951	1.6	< 0.010	6.09	298	< 0.010	< 0.10	< 10	1.76	< 0.50	6.5
	RG_DW-DUP_WQ_2017-08-21_NP	Duplicate	437	< 3.0	< 0.10	< 0.10	108	< 0.020	< 0.050	19	0.0396	119	0.12	< 0.10	1.32	< 10	0.087	5.9	33.9	0.22	< 0.0050	3.42	< 0.50	0.767	1.78	< 0.010	5.06	303	< 0.010	< 0.10	< 10	1.79	< 0.50	4.8
	QA/QC RPD%		5	*	*	*	19	*	*	5	10	3	*	*	22	*	25	2	19	20	*	1	*	21	11	*	18	2	*	*	*	2	*	30
	RG_DW-01-07_WP_Q4-2017_NP	2017 11 15	501	< 3.0	< 0.10	< 0.10	123	< 0.020	< 0.050	18	0.0408	123	0.14	< 0.10	2.97	< 10	0.100	6.5	47.1	0.18	< 0.0050	3.56	< 0.50	0.844	1.92	< 0.010	5.74	278	< 0.010	< 0.10	< 10	1.50	< 0.50	8.9
Study Area 6																																		
LC_PIZP1101	LC_PIZP1101_WG_2017-03-13_N	2017 03 15	126	2.7	< 0.10	1.27	445	< 0.020	< 0.050	20	< 0.0050	25.8	< 0.10	0.26	< 0.20	286	< 0.050	9.5	15.0	253	< 0.0050	11.6	< 0.50	0.822	< 0.050	< 0.010	19.1	206	< 0.010	< 0.10	< 10	1.41	< 0.50	1.2
	LC_PIZP1101_WG_2017-06-12_N	2017 06 13	118	2.1	< 0.10	1.08	448	< 0.020	< 0.050	19	0.0058	24.6	< 0.10	0.23	< 0.20	< 10	< 0.050	9.7	13.8	203	< 0.0050	12.5	< 0.50	0.810	< 0.050	< 0.010	18.3	207	< 0.010	0.11	< 10	1.47	< 0.50	1.4
	LC_PIZP1101_WG_2017-09-11_N	2017 09 21	123	4.4	< 0.10	1.15	461	< 0.020	< 0.050	20	< 0.0050	26.4	< 0.10	0.24	< 0.50	215	< 0.050	9.8	13.9	211	< 0.0050	11.3	< 0.50	0.801	< 0.050	< 0.010	18.1	201	< 0.010	< 0.10	< 10	1.63	< 0.50	< 3.0
	LC_PIZP1101_WG_2017-12-11_N	2017 11 03	124	8.7	< 0.50	2.00	447	< 0.10	< 0.25	< 50	0.075	26.2	< 0.50	< 0.50	< 1.0	169	< 0.25	9.9	14.1	211	< 0.0050	13.6	< 2.5	0.66	< 0.25	< 0.050	18.0	206	< 0.050	< 0.50	< 10	1.43	< 2.5	< 5.0
Study Area 7																																		
EV_GV3gw	EV_GV3GW_WG_2017-03-29_NP	2017 03 29	336	< 1.0	< 0.10	< 0.10	17.7	< 0.020	< 0.050	15	0.0096	83.6	0.25	< 0.10	0.87	< 10	< 0.050	16.5	30.9	0.59	< 0.0050	1.24	0.88	1.05	3.83	< 0.010	3.15	571	< 0.010	< 0.10	< 10	1.61	< 0.50	< 1.0
	EV_GV3GW_WG_2017-06-28_NP	2017 06 27	343	10.1	< 0.10	< 0.030	19.3	< 0.020	< 0.050	12.0	0.0112	82.2	0.26	< 0.050	< 0.50	< 5.0	< 0.030	17.1	33.5	0.13	< 0.0050	0.902	< 0.10	0.991	3.78	< 0.010	3.42	540	< 0.010	< 0.050	< 10	1.64	< 0.50	< 3.0
	EV_EC5GW_WG_2017-06-28_NP	Duplicate	338	< 3.0	< 0.10	< 0.030	19.2	< 0.020	< 0.050	11.1	0.0088	81.3	0.24	< 0.050	< 0.50	< 5.0	< 0.030	16.3	32.8	0.21	< 0.0050	0.875	< 0.10	1.01	3.84	< 0.010	3.46	537	< 0.010	< 0.050	< 10	1.64	< 0.50	< 3.0
	QA/QC RPD%		1	*	*	*	1	*	*	*	*	1	*	*	*	*	*	5	2	*	*	3	*	2	2	*	1	1	*	*	*	0	*	*
	EV_GV3GW_WG_2017-08-15_NP	2017 08 15	336	< 3.0	0.28	< 0.10	17.7	< 0.020	< 0.050	11	0.0085	82.4	0.23	0.34	0.53	< 10	< 0.050	15.8	31.7	0.84	< 0.0050	0.895	< 0.50	1.01	3.9	< 0.010	3.25	543	< 0.010	< 0.10	< 10	1.72	< 0.50	< 3.0
	EV_EC5GW_WG_2017-08-15_NP	Duplicate	332	< 3.0	< 0.10	< 0.10	17.0	< 0.020	< 0.050	11	< 0.0050	82.5	0.21	< 0.10	< 0.50	< 10	< 0.050	16.1	30.6	< 0.10	< 0.0050	0.891	< 0.50	0.983	3.86	< 0.010	3.14	544	< 0.010	< 0.10	< 10	1.74	< 0.50	< 3.0
	QA/QC RPD%		1	*	*	*	4	*	*	*	*	< 1	*	*	*	*	*	2	4	*	*	< 1	*	3	1	*	3	< 1	*	*	*	1	*	*
	EV_GV3GW_WG_2017-08-29_NP	2017 08 29	285	< 3.0	< 0.10	< 0.10	17.7	< 0.020	< 0.050	11	0.0088	63.7	0.21	< 0.10	< 0.50	< 10	< 0.050	12.2	30.7	< 0.10	< 0.0050	0.729	< 0.50	0.938	3.89	< 0.010	3.01	424	< 0.010	< 0.10	< 10	1.49	< 0.50	< 3.0
	EV_GV3GW_WG_2017-10-17_NP	2017 10 17	318	< 3.0	< 0.10	< 0.10	17.3	< 0.020	< 0.050	12	0.0053	75.8	0.16	< 0.10	< 0.50	< 10	< 0.050	15.2	31.3	< 0.10	< 0.0050	0.865	< 0.50	0.935	3.87	< 0.010	3.27	543	< 0.010	< 0.10	< 10	1.48	< 0.50	< 3.0
	EV_EC5GW_WG_2017-10-17_NP	Duplicate	322	< 3.0	< 0.10	< 0.10	16.5	< 0.020	< 0.050	13	0.0078	78.7	0.20	< 0.10	< 0.50	< 10	< 0.050	15.4	30.6	< 0.10	< 0.0050	0.892	< 0.50	0.936	3.81	< 0.010	3.22	555	< 0.010	< 0.10	< 10	1.46	< 0.50	< 3.0
	QA/QC RPD%		1	*	*	*	5	*	*	*	*	4	*	*	*	*	*	1	2	*	*	3	*	< 1	2	*	2	2	*	*	*	1	*	*
RG_DW-02-20[l]	RG_DW-02-20_WP_2017-03-01_NP	2017 03 01	251	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-
	RG_DW-02-20_WP_2017-05-29_NP	2017 05 29	253	< 3.0	< 0.10	< 0.10	87.9	< 0.020	< 0.050	< 10	0.0085	66.9	0.20	< 0.10	6.25	< 10	0.129	6.6	20.9	1.30	< 0.0050	1.05	< 0.50	0.555	10.3	< 0.010	2.51	225	< 0.010	< 0.10	< 10	1.01	< 0.50	10.9
	RG_DW-DUP_WQ_2017-05-29_NP	Duplicate	251	< 3.0	< 0.10	< 0.10	86.8	< 0.020	< 0.050	< 10	0.0067	65.8	0.37	< 0.10	3.66	< 10	0.067	6.6	21.1	1.35	< 0.0050	1.06	< 0.50	0.549	10.5	< 0.010	2.47	222	< 0.010	< 0.10	< 10	1.03	< 0.50	6
	QA/QC RPD%		1	*	*	*	1	*	*	*	24	2	60	*	52	*	63	0	1	4	*	1	*	1	2	*	2	1	*	*	*	2	*	58
	RG_DW-02-20_WP_2017-08-21_NP	2017 08 21	221	< 3.0	< 0.10	< 0.10	83.7	< 0.020	< 0.050	< 10	0.0065	59.9	0.21	< 0.10	1.90	< 10	0.054	6.5	17.3	1.39	< 0.0050	0.973	< 0.50	0.604	7.65	< 0.010	2.36	213	< 0.010	< 0.10	< 10	0.919	< 0.50	< 3.0
	RG_DW-02-20_WP_Q4-2017_NP	2017 11 15	255	< 3.0	< 0.10	< 0.10	78.9	< 0.020	< 0.050	< 10	0.0062	67.8	0.18	< 0.10	5.11	< 10	0.123	6.1	20.7	1.40	< 0.0050	1.06	< 0.50	0.510	8.64	< 0.010	2.27	228	< 0.010	< 0.10	< 10	0.876	< 0.50	8.2
	WP_Q4-2017_001	Duplicate	253	< 3.0	< 0.10	< 0.10	80.2	< 0.020	< 0.050	< 10	0.0059	67.3	0.19	< 0.10	5.13	< 10	0.113	6.2	20.5	1.40	< 0.0050	1.10	< 0.50	0.516	8.58	< 0.010	2.26	231	< 0.010	< 0.10	< 10	0.872	< 0.50	9
	QA/QC RPD%		1	*	*	*	2	*	*	*	5	1	5	*	< 1	*	8	2	1	0	*	4	*	1	1	*	< 1	1	*	*	*	< 1	*	9
Study Area 8																																		
EV_LSgw	EV_LSGW_WG_2017-03-07_NP	2017 03 07	549	6.1	< 0.10	1.31	184	< 0.020	< 0.050	45	0.0062	103	< 0.10	0.77	< 0.50	1,410	< 0.050	62.3	70.7	826	< 0.0050	2.67	3.51	3.59	0.077	< 0.010	11.1	432	0.026	< 0.10	< 10	2.40	< 0.50	< 3.0
	EV_LSGW_WG_2017-06-28_NP	2017 06 27	651	< 3.0	< 0.10	2.44	231	< 0.020	< 0.050	46.1	0.0058	119	< 0.10	1.14	< 0.50	3,430	< 0.030	68.4	85.7	1,050	< 0.0050	2.60	4.39	4.16	0.065	< 0.010	9.84	497	0.040	< 0.050	< 10	1.54	< 0.50	< 3.0
	EV_LSGW_WG_2017-08-22_NP	2017 08 22	632	4.1	< 0.10	2.76	226	< 0.020	< 0.050	63	< 0.0050	130	< 0.10	1.00	< 0.50	3,470	< 0.050	66.2	87.8	1,020	< 0.0050	2.86	4.22	4.67	0.087	< 0.010	10.2	516	0.049	< 0.10	< 10	1.63	< 0.50	< 3.0
	EV_LSGW_WG_2017-10-17_NP	2017 10 17	594	3.3	< 0.10	2.62	205	< 0.020	< 0.050	55	< 0.0050	114	< 0.10	0.88	< 0.50	2,640	< 0.050	62.2	75.2	1,080	< 0.0050	3.22	4.37	4.38	0.082	< 0.010	8.86	545	0.042	0.11	< 10	1.45	< 0.50	5.1
EV_OCgw**	EV_OCGW_WG_2017-03-29_NP	2017 03 29	151	2.7	< 0.10	1.48	57.1	< 0.020	< 0.050	134	< 0.0050	27.8	< 0.10	0.15	< 0.20	256	< 0.050	26.6	19.7	98.0	< 0.00050	14.3	1.03	1.76	0.336	< 0.010	46.7	396	< 0.010	0.12	< 10	1.10	< 0.50	< 1.0
	EV_EC6GW_WG_2017-03-29_NP	Duplicate	150	2.4	< 0.10	1.47	57.3	< 0.020	< 0.050	131	0.0057	27.7	< 0.10	0.15	< 0.20	276	< 0.050	26.4	19.7	96.5	< 0.0050	14.2	0.93	1.75	0.302	< 0.010	46.1	391	< 0.010	< 0.10	< 10	1.10	< 0.50	< 1.0
	QA/QC RPD%		1	*	*	1	< 1	*	*	2	*	< 1	*	*	*	8	*	1	0	2	*	1	10	1	11	*	1	1	*	*	*	0	*	*
	EV_OCGW_WG_2017-06-21_NP	2017 06 19	147	22.2	< 0.10	1.26	47.3	< 0.020	< 0.050	123	0.0056	28.3	< 0.10	< 0.10	< 0.50	266	< 0.050	25.6	18.6	89.0	< 0.00050	14.0	< 0.50	1.55	0.149	< 0.010	42.6	373	< 0.010	< 0.10	< 10	1.11	< 0.50	< 3.0
	EV_MC5GW_WG_2017-06-21_NP	Duplicate	145	21.0	< 0.10	1.20	47.3	< 0.020	< 0.050	122	< 0.0050	27.3	< 0.10	< 0.10	< 0.50	268	< 0.050	25.7	18.5	88.7	< 0.00050	13.7	< 0.50	1.54	< 0.050	< 0.010	41.7	375	< 0.010	< 0.10	< 10	1.08	< 0.50	< 3.0
	QA/QC RPD%		1	6	*	5	0	*	*	1	*	4	*	*	*	1	*	< 1	1	< 1	*	2	*	1	*	*	2	1	*	*	*	3	*	*
	EV_OCGW_WG_2017-06-29_NP	2017 06 29	145	5.7	< 0.50	1.24	52.5	< 0.10	< 0.25	121	< 0.025	28.2	< 0.50	< 0.50	< 1.0	291	< 0.25	25.4	18.1	86.2	< 0.00050	13.6	< 2.5	1.61	0.76	< 0.050	41.2	381	< 0.050	< 0.50	< 10	0.956	< 2.5	< 5.0
	EV_MC6GW_WG_2017-06-29_NP	Duplicate	144	7.6	< 0.50	1.33	52.4	< 0.10	< 0.25	115	< 0.025	27.8	< 0.50	< 0.50	< 1.0	284	< 0.25	24.9	18.0	85.9	< 0.00050	13.2	< 2.5	1.59	0.64	< 0.050	40.7	372	< 0.050	< 0.50	< 10	0.935	< 2.5	< 5.0
	QA/QC RPD%		1	29	*	7	< 1	*	*	5	*	1	*	*	*	2	*	2	1	< 1	*	3	*	1	17	*	1	2	*	*	*	2	*	*

Data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
\- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.
** Comparison to BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline.

BOLD**	Concentration greater than BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline
BOLD	Concentration greater than CSR Aquatic Life (AW) standard
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard

[a] Guideline to protect freshwater aquatic life, short-term maximum (i.e. "acute"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[b] Guideline to protect freshwater aquatic life, long-term average (i.e. "chronic"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[c] Standard to protect freshwater aquatic life.
[d] Guideline/standard varies with Hardness.
[e] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[f] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[g] Total Mercury guideline is based on the % of MethylMercury present. WQG = 0.0001 / (MeHg/total Hg), where MeHg is mass (or concentration) of methyl mercury and THg. Guideline shown assumes MeHg<0.5% of Total Hg.
[h] Standard ranges between 10 to 30 ug/L and varies with crop, soil drainage and Mo:Cu ratio. Conservative standard of 10 ug/L was applied.
[i] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.
[j] Samples inferred to be mislabelled in field.
[k] Guideline/standard varies with pH.
[l] Reported metals values for Q1 are total metals.
[m] Reported metals values are total metals.

TABLE 4 (Cont'd): Summary of Analytical Results compared to Primary Screening Criteria for Dissolved Metals in Groundwater

Sample Location	Sample ID	Sample Date (yyyy mm dd)	Hardness mg/L	Aluminum µg/L	Antimony µg/L	Arsenic µg/L	Barium µg/L	Beryllium µg/L	Bismuth µg/L	Boron µg/L	Cadmium µg/L	Calcium mg/L	Chromium µg/L	Cobalt µg/L	Copper µg/L	Iron µg/L	Lead µg/L	Lithium µg/L	Magnesium mg/L	Manganese µg/L	Mercury µg/L	Molybdenum µg/L	Nickel µg/L	Potassium mg/L	Selenium µg/L	Silver µg/L	Sodium mg/L	Strontium µg/L	Thallium µg/L	Tin µg/L	Titanium µg/L	Uranium µg/L	Vanadium µg/L	Zinc[l] µg/L
BC Standard																																		
BCWQG Aquatic Life Short-term Maximum (AW)[a]			n/a	31-100[k]	n/a	5	n/a	n/a	n/a	n/a	0.038-2.8[d]	n/a	n/a	110	2.05-75.32[d]	350 (max)	3-1,116[d]	n/a	n/a	546-9,136[d]	0.02[g]	2,000	n/a	n/a	n/a	0.1-3[d]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	33-551[d]
BCWQG Aquatic Life Long-Term Average (AW)[b]			n/a	11-50[k]	9	n/a	1,000	0.13	n/a	1,200	0.018-0.457[d]	n/a	1 (Cr(+6))	4	2-31.2[d]	n/a	3-47[d]	n/a	n/a	607-4,037[d]	n/a	1,000	25-150[d]	n/a	2	0.05-1.5[d]	n/a	n/a	0.8	n/a	n/a	8.5	n/a	7.5-525[d]
CSR Aquatic Life (AW)[c]			n/a	n/a	90	50	10,000	1.5	n/a	12,000	0.5-4[d]	n/a	10[e]	40	20-90[d]	n/a	40-160[d]	n/a	n/a	n/a	0.25	10,000	250-1,500[d]	n/a	20	0.5-15[d]	n/a	n/a	3	n/a	1,000	85	n/a	75-2,400[d]
CSR Irrigation Watering (IW)			n/a	5,000	n/a	100	n/a	100	n/a	500	5	n/a	5[e]	50	200	5,000	200	2,500	n/a	200	1	10-30[h]	200	n/a	20	n/a	n/a	n/a	n/a	n/a	n/a	10	100	1,000-5,000[d]
CSR Livestock Watering (LW)			n/a	5,000	n/a	25	n/a	100	n/a	5,000	80	1,000	50[e]	1,000	300	n/a	100	5,000	n/a	n/a	2	50	1,000	n/a	30	n/a	n/a	n/a	n/a	n/a	n/a	200	100	2,000
CSR Drinking Water (DW)			n/a	9,500	6	10	1,000	8	n/a	5,000	5	n/a	50[e]	20[f]	1,500	6,500	10	8	n/a	1,500	1	250	80	n/a	10	20	200	2,500	n/a	2,500	n/a	20	20	3,000
Study Area 8 (Cont'd)																																		
EV_OCgw** (Cont'd)	EV_OCGW_WG_2017-08-15_NP	2017 08 15	144	< 3.0	< 0.10	1.23	52.0	< 0.020	< 0.050	110	< 0.0050	27.2	< 0.10	< 0.10	< 0.50	230	< 0.050	26.3	18.4	79.1	< 0.00050	13.9	< 0.50	1.54	< 0.050	< 0.010	42.1	383	< 0.010	< 0.10	< 10	1.09	< 0.50	< 3.0
	EV_MC5GW_WG_2017-08-15_NP	Duplicate	143	< 3.0	< 0.10	1.21	51.1	< 0.020	< 0.050	112	< 0.0050	27.6	< 0.10	< 0.10	< 0.50	222	< 0.050	26.0	18.0	76.3	< 0.00050	13.8	< 0.50	1.54	0.223	< 0.010	41.7	380	< 0.010	< 0.10	< 10	1.09	< 0.50	< 3.0
	QA/QC RPD%		1	*	*	2	2	*	*	2	*	1	*	*	*	4	*	1	2	4	*	1	*	0	*	*	1	1	*	*	*	0	*	*
	EV_OCGW_WG_2017-08-29_NP	2017 08 29	135	< 3.0	0.13	1.21	51.5	< 0.020	< 0.050	106	< 0.0050	24.3	< 0.10	0.22	< 0.50	240	< 0.050	22.4	18.0	78.2	< 0.00050	12.3	< 0.50	1.48	< 0.050	< 0.010	39.1	335	< 0.010	< 0.10	< 10	1.09	< 0.50	< 3.0
	EV_MC5GW_WG_2017-08-29_NP	Duplicate	142	< 3.0	< 0.10	1.21	53.1	< 0.020	< 0.050	120	< 0.0050	27.3	< 0.10	< 0.10	< 0.50	248	< 0.050	24.3	17.8	78.0	< 0.00050	13.3	< 0.50	1.48	0.129	< 0.010	38.2	371	< 0.010	< 0.10	< 10	1.13	< 0.50	< 3.0
	QA/QC RPD%		5	*	*	0	3	*	*	12	*	12	*	*	*	3	*	8	1	< 1	*	8	*	0	*	*	2	10	*	*	*	4	*	*
	EV_OCGW_WG_2017-09-21_NP	2017 09 21	141	< 3.0	< 0.10	1.19	55.5	< 0.020	< 0.050	126	< 0.0050	27.2	< 0.10	0.13	< 0.50	245	< 0.050	25.6	17.9	82.6	< 0.00050	12.7	< 0.50	1.63	< 0.050	< 0.010	41.6	380	< 0.010	< 0.10	< 10	1.10	< 0.50	< 3.0
	EV_OCGW_WG_2017-10-18_NP	2017 10 18	147	< 3.0	< 0.10	1.36	53.9	< 0.020	< 0.050	114	< 0.0050	28.9	< 0.10	0.17	< 0.50	276	< 0.050	28.2	18.1	93.6	< 0.00050	14.0	< 0.50	1.64	< 0.050	< 0.010	45.8	392	< 0.010	< 0.10	< 10	1.11	< 0.50	< 3.0
	EV_MC5GW_WG_2017-10-18_NP	Duplicate	143	< 3.0	< 0.10	1.44	56.4	< 0.020	< 0.050	106	< 0.0050	26.6	< 0.10	0.18	0.50	313	< 0.050	26.5	18.7	95.1	< 0.00050	13.3	< 0.50	1.68	< 0.050	< 0.010	45.1	370	< 0.010	0.15	< 10	1.07	< 0.50	< 3.0
	QA/QC RPD%		3	*	*	6	5	*	*	7	*	8	*	*	*	13	*	6	3	2	*	5	*	2	*	*	2	6	*	*	*	4	*	*
Study Area 9																																		
EV_BCgw	EV_BCGW_WG_2017-03-14_NP	2017 03 14	417	< 3.0	0.16	0.11	37.5	< 0.020	< 0.050	15	0.0335	103	0.12	< 0.10	< 0.50	< 10	< 0.050	22.8	39.1	< 0.10	< 0.0050	0.922	0.52	1.18	20.3	< 0.010	4.08	174	0.013	< 0.10	< 10	1.22	< 0.50	< 3.0
	EV_BCGW_WG_2017-03-30_NP	2017 03 30	522	< 1.0	0.18	0.13	51.3	< 0.020	< 0.050	17	0.0551	126	< 0.10	< 0.10	0.86	< 10	< 0.050	30.5	50.4	0.38	< 0.0050	0.817	1.66	1.35	37.7	< 0.010	5.36	234	0.015	< 0.10	< 10	1.58	< 0.50	2.1
	EV_BCGW_WG_2017-05-16_NP	2017 05 16	619	< 3.0	0.20	0.15	57.6	< 0.020	< 0.050	15	0.0609	146	0.13	< 0.10	0.65	< 10	< 0.050	34.2	61.7	0.11	< 0.0050	0.717	1.47	1.46	59	< 0.010	6.30	262	0.018	< 0.10	< 10	1.87	< 0.50	< 3.0
	EV_BCGW_WG_2017-06-28_NP	2017 06 27	336	< 3.0	0.24	0.150	46.5	< 0.020	< 0.050	10.5	0.0549	77.8	0.16	0.055	1.01	< 5.0	< 0.030	17.0	34.5	1.02	< 0.0050	1.22	4.31	1.09	17.9	< 0.010	4.80	140	< 0.010	0.076	< 10	0.916	< 0.50	5.6
	EV_BCGW_WG_2017-08-23_NP	2017 08 23	660	< 3.0	0.12	< 0.10	52.2	< 0.020	< 0.050	18	0.0603	159	0.10	< 0.10	< 0.50	< 10	< 0.050	36.5	66.4	< 0.10	< 0.0050	0.677	0.56	1.53	56.8	< 0.010	7.09	278	0.017	< 0.10	< 10	1.79	< 0.50	< 3.0
	EV_BCGW_WG_2017-10-18_NP	2017 10 18	475	< 3.0	0.12	< 0.10	43.6	< 0.020	< 0.050	17	0.0426	109	0.17	< 0.10	< 0.50	< 10	< 0.050	26.7	49.5	< 0.10	< 0.0050	0.799	0.60	1.32	34.5	< 0.010	5.97	203	0.014	< 0.10	< 10	1.40	< 0.50	< 3.0
EV_MCgwS	EV_MCGWS_WG_2017-03-08_NP	2017 03 08	371	< 3.0	0.11	1.57	20.1	< 0.020	< 0.050	24	< 0.0050	93.1	< 0.10	0.10	< 0.50	2,920	< 0.050	21.7	33.7	118	< 0.00050	4.40	1.42	1.95	< 0.050	< 0.010	22.7	293	< 0.010	< 0.10	< 10	1.59	< 0.50	< 3.0
	EV_MCGWS_WG_2017-03-30_NP	2017 03 30	386	19.2	< 0.10	0.95	24.9	< 0.020	< 0.050	26	0.0096	98.8	< 0.10	0.13	0.36	2,050	0.050	28.2	33.8	113	< 0.00050	5.12	8.79	1.92	< 0.050	< 0.010	29.3	309	< 0.010	< 0.10	< 10	2.04	< 0.50	1.3
	EV_MCGWS_WG_2017-05-16_NP	2017 05 16	380	< 3.0	< 0.10	1.51	21.2	< 0.020	< 0.050	22	< 0.0050	95.7	< 0.10	< 0.10	< 0.50	2,730	< 0.050	26.4	34.2	107	< 0.00050	2.40	0.88	1.77	0.073	< 0.010	17.1	265	< 0.010	< 0.10	< 10	1.47	< 0.50	< 3.0
	EV_MCGWS_WG_2017-06-28_NP	2017 06 28	369	< 3.0	< 0.10	1.45	22.3	< 0.020	< 0.050	26	< 0.0050	94.4	< 0.10	< 0.10	< 0.50	2,490	< 0.050	25.5	32.4	101	< 0.00050	2.71	0.55	1.75	< 0.050	< 0.010	17.3	282	< 0.010	< 0.10	< 10	1.73	< 0.50	< 3.0
	EV_MCGWS_WG_2017-08-16_NP	2017 08 16	412	< 3.0	< 0.10	0.67	23.2	< 0.020	< 0.050	25	< 0.0050	106	< 0.10	< 0.10	< 0.50	< 10	< 0.050	26.8	38.2	108	-	3.00	0.80	1.99	< 0.050	< 0.010	18.7	287	< 0.010	< 0.10	< 10	1.83	< 0.50	< 3.0
	EV_MCGWS_WG_2017-09-21_NP	2017 09 21	387	< 3.0	< 0.10	1.33	29.7	< 0.020	< 0.050	28	< 0.0050	96.7	< 0.10	< 0.10	< 0.50	2,250	< 0.050	27.3	35.2	110	< 0.00050	2.19	1.16	2.01	< 0.050	< 0.010	15.9	254	< 0.010	< 0.10	< 10	1.51	< 0.50	< 3.0
	EV_MCGWS_WG_2017-10-18_NP	2017 10 18	424	< 3.0	< 0.10	2.50	43.4	< 0.020	< 0.050	27	< 0.0050	100	< 0.10	< 0.10	< 0.50	2,280	< 0.050	27.4	42.1	134	< 0.00050	2.09	0.62	2.28	< 0.050	< 0.010	17.0	245	< 0.010	< 0.10	< 10	1.40	< 0.50	< 3.0
EV_MCgwD	EV_MCGWD_WG_2017-03-08_NP	2017 03 08	248	3.4	< 0.10	0.94	92.2	< 0.020	< 0.050	59	< 0.0050	57.2	< 0.10	0.41	< 0.50	1,120	< 0.050	7.6	25.5	515	< 0.00050	8.83	1.33	1.39	0.143	< 0.010	23.0	491	< 0.010	< 0.10	< 10	1.89	< 0.50	< 3.0
	EV_MCGWD_WG_2017-03-30_NP	2017 03 30	230	1.7	< 0.10	0.86	69.1	< 0.020	< 0.050	69	0.0081	50.4	< 0.10	0.44	< 0.20	414	< 0.050	11.2	25.4	573	< 0.00050	13.6	3.67	1.51	< 0.050	< 0.010	59.7	467	< 0.010	< 0.10	< 10	3.46	< 0.50	1.5
	EV_MCGWD_WG_2017-05-16_NP	2017 05 16	223	19.3	0.21	0.73	82.5	< 0.020	< 0.050	63	0.0151	49.0	< 0.10	0.69	< 0.50	10	< 0.050	9.3	24.5	512	< 0.00050	12.8	14.4	1.46	0.081	< 0.010	38.2	434	0.022	< 0.10	< 10	2.78	< 0.50	< 3.0
	EV_MCGWD_WG_2017-06-28_NP	2017 06 28	230	< 3.0	0.16	0.81	86.0	< 0.020	< 0.050	70	0.0434	51.0	< 0.10	0.75	0.63	29	< 0.050	9.3	24.8	389	< 0.00050	13.1	15.0	1.47	0.141	< 0.010	31.5	493	0.096	< 0.10	< 10	3.08	< 0.50	6.3
	EV_MCGWD_WG_2017-08-16_NP	2017 08 16	235	< 3.0	0.12	0.68	86.8	< 0.020	< 0.050	68	0.0470	52.5	< 0.10	0.52	1.05	12	< 0.050	8.5	27.8	369	-	11.6	14.2	1.57	0.115	< 0.010	24.6	478	0.092	< 0.10	< 10	2.36	< 0.50	13.4
	EV_MCGWD_WG_2017-09-19_NP	2017 09 19	230	7.2	0.14	0.59	85.8	< 0.020	< 0.050	76	0.0470	53.4	< 0.10	0.34	1.47	64	< 0.050	9.6	23.5	313	< 0.00050	11.2	15.3	1.48	0.133	0.058	26.0	461	0.077	< 0.10	< 10	2.45	< 0.50	20.0
	EV_MCGWD_WG_2017-10-18_NP	2017 10 18	227	< 3.0	0.11	0.81	86.6	< 0.020	< 0.050	71	0.0503	48.2	< 0.10	0.43	1.18	94	< 0.050	9.1	25.8	359	< 0.00050	10.9	13.2	1.53	0.075	< 0.010	23.5	446	0.071	< 0.10	< 10	2.17	< 0.50	17.6
EV_BRgw	EV_BRGW_WG_2017-03-30_NP	2017 03 30	594	< 1.0	< 0.10	< 0.10	74.4	< 0.020	< 0.050	34	0.141	156	< 0.10	< 0.10	0.84	26	< 0.050	46.8	49.4	2.32	< 0.0050	0.610	3.69	2.02	17.2	< 0.010	8.64	313	< 0.010	< 0.10	< 10	1.57	< 0.50	5.1
	EV_BRGW_WG_2017-06-21_NP	2017 06 19	610	< 3.0	0.11	< 0.10	62.4	< 0.020	< 0.050	27	0.0483	157	0.13	< 0.10	< 0.50	18	< 0.050	38.5	53.2	0.88	< 0.0050	0.715	3.00	1.77	45.9	< 0.010	7.78	291	< 0.010	< 0.10	< 10	1.54	< 0.50	< 3.0
	EV_BRGW_WG_2017-06-28_NP	2017 06 28	602	< 3.0	0.10	< 0.10	69.6	< 0.020	< 0.050	27	0.0497	158	0.11	< 0.10	< 0.50	19	< 0.050	40.7	50.1	1.08	< 0.0050	0.621	2.91	1.83	52.4	< 0.010	7.87	316	< 0.010	< 0.10	< 10	1.73	< 0.50	< 3.0
	EV_BRGW_WG_2017-08-23_NP	2017 08 23	688	< 3.0	0.31	< 0.10	75.3	< 0.020	< 0.050	35	0.0555	182	0.13	0.28	0.66	14	< 0.050	57.7	58.4	0.99	< 0.0050	0.555	2.33	2.18	56.2	< 0.010	9.28	370	0.010	< 0.10	< 10	1.51	< 0.50	< 3.0
	EV_WH50GW_WG_2017-10-25_NP[j]	2017 10 25	726	< 3.0	< 0.10	< 0.10	79.9	< 0.020	< 0.050	38	0.0671	180	0.26	< 0.10	0.90	< 10	< 0.050	58.9	67.3	2.02	< 0.0050	0.567	2.28	2.36	41.1	< 0.010	10.3	360	< 0.010	< 0.10	< 10	1.66	< 0.50	5.1
	EV_BRGW_WG_2017-11-21_NP	2017 11 21	738	< 3.0	0.10	< 0.10	77.6	< 0.020	< 0.050	39	0.0628	193	0.12	< 0.10	0.62	< 10	< 0.050	66.3	62.2	1.23	< 0.0050	0.659	2.17	2.40	44.5	< 0.010	10.2	398	0.011	< 0.10	< 10	1.63	< 0.50	3.4
EV_RCgw	EV_RCSGW_WG_2017-03-07_NP	2017 03 07	1,460	< 3.0	< 0.20	< 0.20	39.2	< 0.040	< 0.10	21	0.191	328	< 0.20	< 0.20	31.8	< 20	0.58	70.9	156	1.28	< 0.0050	1.43	2.0	3.55	195	< 0.020	6.73	390	< 0.020	< 0.20	< 10	7.92	< 1.0	39.0
	EV_RCSGW_WG_2017-06-30_NP	2017 06 30	1,430	9.7	< 0.50	< 0.50	40.1	< 0.10	< 0.25	< 50	0.233	310	< 0.50	< 0.50	141	< 50	1.14	49.7	158	1.44	< 0.0050	1.60	4.7	3.89	214	< 0.050	5.66	356	< 0.050	< 0.50	< 10	6.41	< 2.5	77.7
	EV_RCSGW_WG_2017-08-22_NP	2017 08 22	1,600	< 3.0	0.22	< 0.20	39.1	< 0.040	< 0.10	< 20	0.384	356	< 0.20	< 0.20	119	< 20	0.85	53.2	173	1.40	< 0.0050	1.32	2.2	3.54	221	< 0.020	4.69	379	< 0.020	< 0.20	< 10	6.32	< 1.0	57.2
	EV_BRGW_WG_2017-10-25_NP[j]	2017 10 25	1,780	< 3.0	0.20	0.12	50.6	< 0.020	< 0.050	16	0.299	370	0.27	< 0.10	102	< 10	0.589	59.9	207	1.28	< 0.0050	1.19	3.02	3.70	235	< 0.010	5.09	397	0.020	< 0.10	< 10	6.67	< 0.50	104
	EV_RCSGW_WG_2017-11-21_NP	2017 11 21	1,870	< 3.0	0.23	< 0.20	50.9	< 0.040	< 0.10	< 20	0.274	418	< 0.20	< 0.20	156	< 20	0.84	62.0	201	3.19	< 0.0050	1.59	3.1	3.67	266	< 0.020	5.23	471	0.027	< 0.20	< 10	7.03	< 1.0	182
EV_WH50gw	EV_WH50GW_WG_2017-03-03_NP	2017 03 03	279	< 1.0	0.20	< 0.10	105	< 0.020	< 0.050	10	0.0191	69.5	< 0.10	< 0.10	0.38	15	< 0.050	10.4	25.7	4.41	< 0.0050	1.19	< 0.50	0.929	14.3	< 0.010	3.53	163	< 0.010	< 0.10	< 10	1.30	< 0.50	1.5
	EV_WH50GW_WG_2017-06-21_NP	2017 06 19	169	< 3.0	0.22	0.10	59.3	< 0.020	< 0.050	15	0.0138	41.9	< 0.10	< 0.10	1.29	16	0.072	10.0	15.7	8.03	0.0077	1.74	< 0.50	0.874	6.12	< 0.010	3.77	96.2	< 0.010	< 0.10	< 10	0.788	< 0.50	< 3.0
	EV_WH50GW_WG_2017-06-28_NP	2017 06 28	172	< 3.0	0.31	< 0.10	70.9	< 0.020	< 0.050	13	0.0099	43.0	< 0.10	< 0.10	< 0.50	18	< 0.050	9.2	15.7	7.02	< 0.0050	1.60	< 0.50	0.963	6.89	< 0.010	3.07	105	< 0.010	< 0.10	< 10	0.841	< 0.50	< 3.0

Data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.
** Comparison to BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline.

BOLD **	Concentration greater than BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline
BOLD	Concentration greater than CSR Aquatic Life (AW) standard
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard

[a] Guideline to protect freshwater aquatic life, short-term maximum (i.e. "acute"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[b] Guideline to protect freshwater aquatic life, long-term average (i.e. "chronic"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[c] Standard to protect freshwater aquatic life.
[d] Guideline/standard varies with Hardness.
[e] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[f] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[g] Total Mercury guideline is based on the % of MethylMercury present. WQG = 0.0001 / (MeHg/total Hg), where MeHg is mass (or concentration) of methyl mercury and THg. Guideline shown assumes MeHg<0.5% of Total Hg.
[h] Standard ranges between 10 to 30 ug/L and varies with crop, soil drainage and Mo:Cu ratio. Conservative standard of 10 ug/L was applied.
[i] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.
[j] Samples inferred to be mislabelled in field.
[k] Guideline/standard varies with pH.
[l] Reported metals values for Q1 are total metals.
[m] Reported metals values are total metals.

TABLE 4 (Cont'd): Summary of Analytical Results compared to Primary Screening Criteria for Dissolved Metals in Groundwater

Sample Location	Sample ID	Sample Date (yyyy mm dd)	Hardness mg/L	Aluminum µg/L	Antimony µg/L	Arsenic µg/L	Barium µg/L	Beryllium µg/L	Bismuth µg/L	Boron µg/L	Cadmium µg/L	Calcium mg/L	Chromium µg/L	Cobalt µg/L	Copper µg/L	Iron µg/L	Lead µg/L	Lithium µg/L	Magnesium mg/L	Manganese µg/L	Mercury µg/L	Molybdenum µg/L	Nickel µg/L	Potassium mg/L	Selenium µg/L	Silver µg/L	Sodium mg/L	Strontium µg/L	Thallium µg/L	Tin µg/L	Titanium µg/L	Uranium µg/L	Vanadium µg/L	Zinc[i] µg/L
				Dissolved Metals																														
BC Standard																																		
BCWQG Aquatic Life Short-term Maximum (AW)[a]			n/a	31-100[k]	n/a	5	n/a	n/a	n/a	n/a	0.038-2.8[d]	n/a	n/a	110	2.05-75.32[d]	350 (max)	3-1,116[d]	n/a	n/a	546-9,136[d]	0.02[g]	2,000	n/a	n/a	n/a	0.1-3[d]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	33-551[d]
BCWQG Aquatic Life Long-Term Average (AW)[b]			n/a	11-50[k]	9	n/a	1,000	0.13	n/a	1,200	0.018-0.457[d]	n/a	1 (Cr(+6))	4	2-31.2[d]	n/a	3-47[d]	n/a	n/a	607-4,037[d]	n/a	1,000	25-150[d]	n/a	2	0.05-1.5[d]	n/a	n/a	0.8	n/a	n/a	8.5	n/a	7.5-525[d]
CSR Aquatic Life (AW)[c]			n/a	n/a	90	50	10,000	1.5	n/a	12,000	0.5-4[d]	n/a	10[e]	40	20-90[d]	n/a	40-160[d]	n/a	n/a	n/a	0.25	10,000	250-1,500[d]	n/a	20	0.5-15[d]	n/a	n/a	3	n/a	1,000	85	n/a	75-2,400[d]
CSR Irrigation Watering (IW)			n/a	5,000	n/a	100	n/a	100	n/a	500	5	n/a	5[e]	50	200	5,000	200	2,500	n/a	200	1	10-30[h]	200	n/a	20	n/a	n/a	n/a	n/a	n/a	n/a	10	100	1,000-5,000[d]
CSR Livestock Watering (LW)			n/a	5,000	n/a	25	n/a	100	n/a	5,000	80	1,000	50[e]	1,000	300	n/a	100	5,000	n/a	n/a	2	50	1,000	n/a	30	n/a	n/a	n/a	n/a	n/a	n/a	200	100	2,000
CSR Drinking Water (DW)			n/a	9,500	6	10	1,000	8	n/a	5,000	5	n/a	50[e]	20[f]	1,500	6,500	10	8	n/a	1,500	1	250	80	n/a	10	20	200	2,500	n/a	2,500	n/a	20	20	3,000
Study Area 9 (Cont'd)																																		
EV_WH50gw (Cont'd)	EV_WH50GW_WG_2017-08-22_NP	2017 08 22	256	< 3.0	0.21	< 0.10	114	< 0.020	< 0.050	15	0.0160	66.1	< 0.10	< 0.10	< 0.50	29	< 0.050	11.6	22.1	8.35	< 0.0050	1.06	< 0.50	1.18	10.8	< 0.010	3.12	151	< 0.010	< 0.10	< 10	1.03	< 0.50	< 3.0
	EV_RCSGW_WG_2017-10-25_NP[j]	2017 10 25	295	< 3.0	0.18	0.14	122	< 0.020	< 0.050	15	0.0206	71.2	0.28	< 0.10	0.70	25	< 0.050	14.2	28.6	6.53	< 0.0050	0.963	< 0.50	1.22	10.4	< 0.010	3.48	164	< 0.010	0.12	< 10	1.13	< 0.50	3.2
	EV_WH50GW_WG_2017-11-21_NP	2017 11 21	313	< 3.0	0.20	< 0.10	114	< 0.020	< 0.050	13	0.0100	78.7	< 0.10	< 0.10	< 0.50	13	< 0.050	15.3	28.2	6.18	< 0.0050	1.29	< 0.50	1.22	14.2	< 0.010	3.48	177	< 0.010	< 0.10	< 10	1.11	< 0.50	< 3.0
RG_DW-03-01[l]	RG_DW-03-01_WP_2017-02-20_NP	2017 02 20	425	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.098	-	-	-	-	-	-	-	-	-
	RG_DW-DUP_WP_2017-02-20_NP	Duplicate	431	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.102	-	-	-	-	-	-	-	-	-
	QA/QC RPD%		1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-
	RG_DW-03-01_WP_2017-05-29_NP	2017 05 29	419	< 3.0	< 0.10	< 0.10	150	< 0.020	< 0.050	44	0.0753	111	< 0.10	< 0.10	< 0.50	41	< 0.050	21.8	34.1	107	< 0.0050	3.32	2.49	2.03	0.088	< 0.010	15.1	410	0.096	< 0.10	< 10	1.06	< 0.50	< 3.0
	RG_DW-03-01_WP_2017-08-22_NP	2017 08 22	413	< 3.0	< 0.10	< 0.10	141	< 0.020	< 0.050	35	0.0749	112	< 0.10	< 0.10	< 0.50	43	< 0.050	20.6	32.4	121	< 0.0050	2.98	2.13	2.02	0.16	< 0.010	13.3	402	0.100	< 0.10	< 10	0.998	< 0.50	< 3.0
	RG_DW-03-01_WP_Q4-2017_NP	2017 11 15	466	< 3.0	< 0.10	< 0.10	126	< 0.020	< 0.050	35	0.0788	123	0.14	0.11	< 0.50	84	< 0.050	20.6	38.7	152	< 0.0050	3.30	2.29	1.78	0.176	< 0.010	14.0	418	0.085	< 0.10	< 10	0.880	< 0.50	< 3.0
Study Area 10																																		
EV_ECgw	EV_ECGW_WG_2017-06-20_NP	2017 06 20	167	43.0	0.18	0.38	53.6	< 0.020	< 0.050	104	0.0234	37.6	< 0.10	0.42	< 0.50	30	< 0.050	10.8	17.8	178	< 0.0050	13.1	1.68	0.986	0.129	< 0.010	25.0	423	0.060	< 0.10	< 10	1.32	< 0.50	< 3.0
	EV_ECGW_WG_2017-08-23_NP	2017 08 23	174	< 3.0	< 0.10	0.37	59.1	< 0.020	< 0.050	115	0.0134	41.7	< 0.10	0.31	< 0.50	< 10	< 0.050	10.3	19.4	178	< 0.0050	12.8	0.89	1.06	0.06	< 0.010	24.3	441	0.042	< 0.10	< 10	1.25	< 0.50	< 3.0
	EV_ECGW_WG_2017-10-25_NP	2017 10 25	184	< 3.0	< 0.10	0.47	57.3	< 0.020	< 0.050	112	0.0404	39.5	0.13	0.23	0.87	< 10	< 0.050	12.2	20.7	178	< 0.0050	13.2	3.65	1.16	0.056	< 0.010	29.1	434	0.034	0.20	< 10	1.34	< 0.50	10.8
	EV_ECGW_WG_2017-11-23_NP	2017 11 22	177	< 3.0	< 0.10	0.41	53.8	< 0.020	< 0.050	119	0.0429	40.2	< 0.10	0.30	2.31	< 10	< 0.050	11.2	18.7	170	< 0.0050	15.2	3.67	1.33	0.212	< 0.010	29.8	447	0.031	0.12	< 10	1.24	< 0.50	6.0
Study Area 11																																		
CM_MW1-DP	CM_MW1-DP_WG_2017Q1_N	2017 03 28	145	3.0	0.26	1.75	8,430	< 0.020	< 0.050	241	0.0092	31.4	0.10	1.29	0.67	< 10	< 0.050	697	16.3	225	< 0.0050	6.23	1.46	5.65	0.22	< 0.010	237	2,140	< 0.010	< 0.10	< 0.30	0.927	< 0.50	21.8
	CM_MW1-DP_WG_Q2_2017_N	2017 06 27	182	5.5	< 0.50	1.23	1,470	< 0.10	< 0.25	133	< 0.025	47.6	< 0.50	< 0.50	< 1.0	150	< 0.25	258	15.4	178	< 0.0050	13.0	< 2.5	3.07	< 0.25	< 0.050	124	991	< 0.050	< 0.50	< 1.5	1.14	< 2.5	< 5.0
	CM_MW1-DP_WG_Q3_2017_N	2017 09 06	185	2.1	< 0.10	1.26	4,280	< 0.020	< 0.050	148	0.0057	47.7	< 0.10	0.49	< 0.20	< 10	< 0.050	298	16.0	172	0.0066	7.74	< 0.50	3.07	< 0.050	< 0.010	122	1,240	< 0.010	< 0.10	< 0.30	1.28	< 0.50	5.7
	CM_MW1-DP_WG_Q4-2017_N	2017 12 07	143	3.3	< 0.10	2.36	***11,000***	< 0.020	< 0.050	215	< 0.0050	29.6	< 0.10	0.68	< 0.20	753	< 0.050	710	16.9	161	< 0.0050	4.12	< 0.50	5.49	0.093	< 0.010	238	2,340	< 0.010	< 0.10	< 0.30	0.758	< 0.50	6.2
CM_MW1-OB	CM_MW1-OB_WG_2017Q1_N	2017 03 27	529	2.3	0.30	0.11	79.4	< 0.020	< 0.050	32	0.122	143	0.21	0.33	1.39	< 10	< 0.050	17.0	41.8	17.6	< 0.0050	1.48	3.80	1.24	1.82	< 0.010	27.4	315	0.017	< 0.10	< 0.30	1.01	< 0.50	27.3
	CM_MW1-OB_WG_Q2_2017_N	2017 06 19	524	1.1	0.12	0.12	101	< 0.020	< 0.050	33	0.0653	138	0.35	< 0.10	0.51	< 10	< 0.050	16.8	43.6	3.40	< 0.0050	1.08	2.19	1.62	5.24	0.036	28.9	383	0.018	< 0.10	< 0.30	1.25	< 0.50	4.3
	CM_MW1-OB_WG_Q3_2017_N	2017 08 28	416	1.7	0.11	0.17	98.1	< 0.020	< 0.050	33	0.0474	103	0.32	< 0.10	0.35	< 10	< 0.050	15.5	38.5	1.48	< 0.0050	0.457	6.63	1.64	3.07	< 0.010	23.9	257	0.014	< 0.10	< 0.30	0.977	< 0.50	1.9
	CM_MW1-OB_WG_Q4-2017_N	2017 12 07	556	1.9	< 0.10	0.10	85.6	< 0.020	< 0.050	29	0.0799	149	0.23	< 0.10	0.37	< 10	< 0.050	19.3	44.5	0.85	< 0.0050	0.633	3.66	1.62	4.07	< 0.010	32.1	358	0.024	< 0.10	< 0.30	1.07	< 0.50	8.1
CM_MW1-SH	CM_MW1-SH_WG_2017Q1_N	2017 03 21	96.2	4.3	< 0.10	1.65	320	< 0.020	< 0.050	59	0.0251	23.2	< 0.10	0.22	0.27	310	< 0.050	24.2	9.33	144	< 0.0050	93.3	0.67	1.40	0.159	< 0.010	212	295	< 0.010	< 0.10	< 0.30	0.881	< 0.50	< 1.0
	CM_MW1-SH_WG_Q2_2017_N	2017 06 19	105	4.1	< 0.10	1.93	279	< 0.020	< 0.050	60	0.0218	24.8	< 0.10	0.24	< 0.20	221	< 0.050	21.4	10.5	147	< 0.0050	77.4	1.07	1.27	0.138	< 0.010	185	284	< 0.010	< 0.10	< 0.30	1.04	< 0.50	< 1.0
	CM_MW1-SH_WG_Q3_2017_N	2017 08 28	127	4.6	< 0.10	1.80	262	< 0.020	< 0.050	62	< 0.020	31.7	< 0.10	0.24	0.53	312	0.140	19.0	11.6	146	< 0.0050	60.0	1.63	1.15	0.404	< 0.010	153	293	< 0.010	0.12	< 0.30	1.24	< 0.50	7.3
	CM_MW1-SH_WG_Q4-2017_N	2017 12 07	140	2.6	< 0.10	1.79	288	< 0.020	< 0.050	58	< 0.020	35.2	0.11	0.27	< 0.20	485	< 0.050	17.2	12.7	185	< 0.0050	48.4	1.00	1.31	< 0.050	< 0.010	158	332	< 0.010	0.10	< 0.30	1.18	< 0.50	< 1.0
RG_DW-07-01[l]	RG_DW-07-01_WP_2017-02-20_NP	2017 02 20	824	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.85	-	-	-	-	-	-	-	-	-
	RG_DW-07-01_WP_2017-06-05_NP	2017 06 05	597	< 3.0	0.27	0.16	83.7	< 0.020	< 0.050	42	0.0274	147	0.13	< 0.10	1.56	95	< 0.050	19.5	55.6	17.3	< 0.0050	1.02	0.56	2.03	15.4	< 0.010	22.7	418	0.014	< 0.10	< 10	2.45	< 0.50	29.6
	RG_DW-07-01_WP_2017-08-30_NP	2017 08 30	799	< 3.0	0.27	0.18	124	< 0.020	< 0.050	53	0.0516	196	0.14	< 0.10	< 0.50	177	< 0.050	21.7	74.9	14.9	< 0.0050	0.841	0.71	2.26	11.6	< 0.010	24.3	588	0.016	< 0.10	< 10	3.08	< 0.50	71.4
	RG_DW-07-01_WP_Q4-2017_NP	2017 11 21	1,010	< 3.0	0.25	0.18	122	< 0.020	< 0.050	53	0.0545	236	0.20	< 0.10	< 0.50	255	< 0.050	22.9	101	24.0	< 0.0050	0.897	0.71	2.35	9.35	< 0.010	34.6	663	0.014	< 0.10	< 10	3.42	< 0.50	19.0
Study Area 12																																		
EV_ER1gwS	EV_ER1GWS_WG_2017-02-15_NP	2017 02 15	269	< 3.0	< 0.10	0.11	92.2	< 0.020	< 0.050	< 10	0.0090	69.4	0.25	< 0.10	< 0.50	< 10	< 0.050	7.1	23.2	< 0.10	< 0.0050	1.15	< 0.50	0.568	10.3	< 0.010	3.02	212	< 0.010	< 0.10	< 10	1.28	< 0.50	< 3.0
	EV_ER1GWS_WG_2017-06-28_NP	2017 06 28	222	< 3.0	< 0.10	0.12	98.3	< 0.020	< 0.050	< 10	0.0113	58.3	0.27	< 0.10	< 0.50	< 10	< 0.050	7.7	18.6	< 0.10	< 0.0050	1.08	< 0.50	0.776	4.95	< 0.010	7.10	194	< 0.010	< 0.10	< 10	1.03	< 0.50	< 3.0
	EV_ER1GWS_WG_2017-08-22_NP	2017 08 22	223	4.7	0.10	0.13	104	< 0.020	< 0.050	< 10	0.0114	65.7	0.24	< 0.10	< 0.50	< 10	< 0.050	8.2	19.3	< 0.10	< 0.0050	1.23	< 0.50	0.883	8.59	< 0.010	3.30	183	< 0.010	< 0.10	< 10	1.07	< 0.50	< 3.0
	EV_ER1GWS_WG_2017-10-24_NP	2017 10 24	233	12.8	0.13	0.26	88.6	< 0.020	< 0.050	< 10	< 0.0050	61.5	0.32	< 0.10	< 0.50	< 10	< 0.050	6.9	19.3	1.52	< 0.0050	1.42	< 0.50	0.695	7.74	< 0.010	2.70	202	< 0.010	0.12	< 10	1.36	< 0.50	< 3.0
EV_ER1gwD	EV_ER1GWD_WG_2017-02-15_NP	2017 02 15	260	9.9	< 0.10	< 0.10	85.0	< 0.020	< 0.050	< 10	< 0.0050	67.4	0.25	0.10	0.52	< 10	< 0.050	6.5	22.2	34.0	< 0.0050	1.27	< 0.50	0.603	8.16	< 0.010	2.93	209	< 0.010	< 0.10	< 10	1.30	< 0.50	< 3.0
	EV_ER1GWD_WG_2017-06-28_NP	2017 06 28	176	11.6	0.14	0.13	65.1	< 0.020	< 0.050	< 10	< 0.0050	45.4	0.23	< 0.10	< 0.50	< 10	< 0.050	6.6	15.2	4.06	< 0.0050	1.34	< 0.50	0.569	5.67	< 0.010	2.07	160	< 0.010	< 0.10	< 10	1.13	< 0.50	< 3.0
	EV_ER1GWD_WG_2017-08-22_NP	2017 08 22	223	14.9	< 0.10	0.14	85.2	< 0.020	< 0.050	10	< 0.0050	60.8	0.28	< 0.10	< 0.50	< 10	< 0.050	8.3	20.1	0.51	< 0.0050	1.35	< 0.50	0.793	6.95	< 0.010	2.61	188	< 0.010	< 0.10	< 10	1.26	< 0.50	< 3.0
	EV_ER1GWD_WG_2017-10-24_NP	2017 10 24	233	< 3.0	0.13	0.25	98.0	< 0.020	< 0.050	< 10	0.0103	61.7	0.27	< 0.10	< 0.50	< 10	< 0.050	6.8	19.2	< 0.10	< 0.0050	1.34	< 0.50	0.691	10.5	< 0.010	2.76	194	< 0.010	< 0.10	< 10	1.21	< 0.50	< 3.0
RG_DW-03-04[l]	RG_DW-03-04_WP_2017-02-20_NP	2017 02 20	283	-	-	-	-	-	-	-	0.0131	75,900	-	-	-	-	-	-	22,700	-	-	-	-	973	9.2	-	7,060	-	-	-	-	-	-	-
	RG_DW-03-04_WP_2017-05-31_NP	2017 05 31	252	< 3.0	< 0.10	0.10	149	< 0.020	< 0.050	< 10	0.0118	65.8	0.24	< 0.10	0.73	< 10	< 0.050	7.5	21.3	< 0.10	< 0.0050	0.967	< 0.50	0.933	6.21	< 0.010	16.0	150	< 0.010	< 0.10	< 10	0.827	< 0.50	< 3.0
	RG_DW-03-04_WP_2017-08-22_NP	2017 08 22	236	3.6	0.15	0.11	138	< 0.020	< 0.050	< 10	0.0129	62.9	0.15	< 0.10	1.00	< 10	< 0.050	7.9	19.2	< 0.10	< 0.0050	0.986	< 0.50	0.864	7.9	< 0.010	7.75	136	< 0.010	< 0.10	< 10	0.813	< 0.50	4.7
	RG_DW-03-04_WP_Q4-2017_NP	2017 11 21	301	< 3.0	0.10	0.11	175	< 0.020	< 0.050	12	0.0146	77.3	0.23	< 0.10	0.85	< 10	< 0.050	8.8	26.2	< 0.10	< 0.0050	0.980	< 0.50	0.923	11.5	< 0.010	7.33	168	< 0.010	< 0.10	< 10	0.910	< 0.50	6.2

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- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.
** Comparison to BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline.

BOLD**	Concentration greater than BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline
BOLD	Concentration greater than CSR Aquatic Life (AW) standard
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard

[a] Guideline to protect freshwater aquatic life, short-term maximum (i.e. "acute"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[b] Guideline to protect freshwater aquatic life, long-term average (i.e. "chronic"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[c] Standard to protect freshwater aquatic life.
[d] Guideline/standard varies with Hardness.
[e] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[f] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[g] Total Mercury guideline is based on the % of MethylMercury present. WQG = 0.0001 / (MeHg/total Hg), where MeHg is mass (or concentration) of methyl mercury and THg. Guideline shown assumes MeHg<0.5% of Total Hg.
[h] Standard ranges between 10 to 30 ug/L and varies with crop, soil drainage and Mo:Cu ratio. Conservative standard of 10 ug/L was applied.
[i] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.
[j] Samples inferred to be mislabelled in field.
[k] Guideline/standard varies with pH.
[l] Reported metals values for Q1 are total metals.
[m] Reported metals values are total metals.

TABLE 4 (Cont'd): Summary of Analytical Results compared to Primary Screening Criteria for Dissolved Metals in Groundwater

Sample Location	Sample ID	Sample Date (yyyy mm dd)	Hardness mg/L	Dissolved Metals: Aluminum µg/L	Antimony µg/L	Arsenic µg/L	Barium µg/L	Beryllium µg/L	Bismuth µg/L	Boron µg/L	Cadmium µg/L	Calcium mg/L	Chromium µg/L	Cobalt µg/L	Copper µg/L	Iron µg/L	Lead µg/L	Lithium µg/L	Magnesium mg/L	Manganese µg/L	Mercury µg/L	Molybdenum µg/L	Nickel µg/L	Potassium mg/L	Selenium µg/L	Silver µg/L	Sodium mg/L	Strontium µg/L	Thallium µg/L	Tin µg/L	Titanium µg/L	Uranium µg/L	Vanadium µg/L	Zinc[i] µg/L
BC Standard																																		
BCWQG Aquatic Life Short-term Maximum (AW)[a]			n/a	31-100[k]	n/a	5	n/a	n/a	n/a	n/a	0.038-2.8[d]	n/a	n/a	110	2.05-75.32[d]	350 (max)	3-1,116[d]	n/a	n/a	546-9,136[d]	0.02[g]	2,000	n/a	n/a	n/a	0.1-3[d]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	33-551[d]
BCWQG Aquatic Life Long-Term Average (AW)[b]			n/a	11-50[k]	9	n/a	1,000	0.13	n/a	1,200	0.018-0.457[d]	n/a	1 (Cr(+6))	4	2-31.2[d]	n/a	3-47[d]	n/a	n/a	607-4,037[d]	n/a	1,000	25-150[d]	n/a	2	0.05-1.5[d]	n/a	n/a	0.8	n/a	n/a	8.5	n/a	7.5-525[d]
CSR Aquatic Life (AW)[c]			n/a	n/a	90	50	10,000	1.5	n/a	12,000	0.5-4[d]	n/a	10[e]	40	20-90[d]	n/a	40-160[d]	n/a	n/a	n/a	0.25	10,000	250-1,500[d]	n/a	20	0.5-15[d]	n/a	n/a	3	n/a	1,000	85	n/a	75-2,400[d]
CSR Irrigation Watering (IW)			n/a	5,000	n/a	100	n/a	100	n/a	500	5	n/a	5[e]	50	200	5,000	200	2,500	n/a	200	1	10-30[h]	200	n/a	20	n/a	n/a	n/a	n/a	n/a	n/a	10	100	1,000-5,000[d]
CSR Livestock Watering (LW)			n/a	5,000	n/a	25	n/a	100	n/a	5,000	80	1,000	50[e]	1,000	300	n/a	100	5,000	n/a	n/a	2	50	1,000	n/a	30	n/a	n/a	n/a	n/a	n/a	n/a	200	100	2,000
CSR Drinking Water (DW)			n/a	9,500	6	10	1,000	8	n/a	5,000	5	n/a	50[e]	20[f]	1,500	6,500	10	8	n/a	1,500	1	250	80	n/a	10	20	200	2,500	n/a	2,500	n/a	20	20	3,000
Field Blanks																																		
RG_DW-03-01[l]	RG_DW-FB_WP_2017-02-20_NP	2017 02 20	-	-	-	-	-	-	-	-	< 0.0050	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-
RG_DW[m]	RG_DW-FB_WQ_2017-05-29_NP	2017 05 29	< 0.50	< 3.0	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.050	< 0.10	< 0.10	< 0.50	< 10	< 0.050	< 1.0	< 0.10	< 0.10	< 0.00050	< 0.050	< 0.50	< 0.050	< 0.050	< 0.010	< 0.050	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0
	RG_DW-FB_WQ_2017-08-21_NP	2017 08 21	< 0.50	< 3.0	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	0.051	< 0.10	< 0.10	< 0.50	< 10	< 0.050	< 1.0	< 0.10	< 0.10	< 0.00050	< 0.050	< 0.50	< 0.050	< 0.050	< 0.010	< 0.050	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0
	WP_Q4-2017_002	2017 11 15	< 0.50	< 3.0	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.050	< 0.10	< 0.10	< 0.50	< 10	< 0.050	< 1.0	< 0.10	< 0.10	< 0.00050	< 0.050	< 0.50	< 0.050	< 0.050	< 0.010	< 0.050	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0
Trip Blanks																																		
RG_DW-03-01[l]	RG_DW-TB_WP_2017-02-20_NP	2017 02 20	-	-	-	-	-	-	-	-	< 0.0050	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.050	-	-	-	-	-	-	-	-	-
RG_DW[m]	RG_DW-TB_WQ_2017-05-29_NP	2017 05 29	< 0.50	< 3.0	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.050	< 0.10	< 0.10	< 0.50	< 10	< 0.050	< 1.0	< 0.10	< 0.10	< 0.00050	< 0.050	< 0.50	< 0.050	< 0.050	< 0.010	< 0.050	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0
	RG_DW-TB_WQ_2017-08-21_NP	2017 08 21	< 0.50	< 3.0	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.050	< 0.10	< 0.10	< 0.50	< 10	< 0.050	< 1.0	< 0.10	< 0.10	< 0.00050	< 0.050	< 0.50	< 0.050	< 0.050	< 0.010	< 0.050	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0
	WP_Q4-2017_003	2017 11 15	< 0.50	< 3.0	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.050	< 0.10	< 0.10	< 0.50	< 10	< 0.050	< 1.0	< 0.10	< 0.10	< 0.00050	< 0.050	< 0.50	< 0.050	< 0.050	< 0.010	< 0.050	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0

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- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.
** Comparison to BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline.

BOLD **	Concentration greater than BCWQG Aquatic Life (AW) Short-term Maximum and/or Long-term Average guideline
BOLD	Concentration greater than CSR Aquatic Life (AW) standard
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard

[a] Guideline to protect freshwater aquatic life, short-term maximum (i.e. "acute"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[b] Guideline to protect freshwater aquatic life, long-term average (i.e. "chronic"). Guideline for surface water and Total Metals, shown here for comparison purposes only.
[c] Standard to protect freshwater aquatic life.
[d] Guideline/standard varies with Hardness.
[e] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[f] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[g] Total Mercury guideline is based on the % of MethylMercury present. WQG = 0.0001 / (MeHg/total Hg), where MeHg is mass (or concentration) of methyl mercury and THg. Guideline shown assumes MeHg<0.5% of Total Hg.
[h] Standard ranges between 10 to 30 ug/L and varies with crop, soil drainage and Mo:Cu ratio. Conservative standard of 10 ug/L was applied.
[i] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.
[j] Samples inferred to be mislabelled in field.
[k] Guideline/standard varies with pH.
[l] Reported metals values for Q1 are total metals.
[m] Reported metals values are total metals.

TABLE 5: Summary of Analytical Results compared to Secondary Screening Criteria for Selenium

Sample Location	Sample ID	Sample Date (yyyy mm dd)	SPO	Compliance Point	Selenium µg/L
Groundwater Quality Benchmarks					
Guidelines for Canadian Drinking Water Quality (DW)					50
SPO		Elk River [GH_ER1 (E206661)/EV_ER1 (0200393)]/[CM_MC2 (E258937)]			19
		Fording River [GH_FR1 (0200378)]			63
Compliance Point		Fording River [FR_FRCP1 (E300071)]			130
		Fording River [GH_FR1 (0200378)]			80
		Elk River [GH_ERC (E300090)]			15
		Michel Creek [EV_MC2 (E300091)]			28
Background					
FR_HMW5	FR_HMW5_QSW_03042017_N	2017 06 21	GH_FR1 (0200378)	FR_FRCP1 (E300071)	14.8
Study Area 1					
FR_09-01-A	FR_09-01-A_QSW_02012017_N	2017 03 08	GH_FR1 (0200378)	FR_FRCP1 (E300071)	***120***
	FR_09-01-A_QSW_03042017_N	2017 06 01	GH_FR1 (0200378)	FR_FRCP1 (E300071)	***112***
	FR_09-01-A_QTR_2017-09-11_N	2017 09 12	GH_FR1 (0200378)	FR_FRCP1 (E300071)	***68.1***
	FR_09-01-A_QTR_2017-10-02_N	2017 11 22	GH_FR1 (0200378)	FR_FRCP1 (E300071)	***166***
FR_09-01-B	FR_09-01-B_QSW_02012017_N	2017 03 08	GH_FR1 (0200378)	FR_FRCP1 (E300071)	***71.8***
	FR_09-01-B_QSW_03042017_N	2017 06 01	GH_FR1 (0200378)	FR_FRCP1 (E300071)	***126***
	FR_09-01-B_QTR_2017-09-11_N	2017 09 12	GH_FR1 (0200378)	FR_FRCP1 (E300071)	44.2
	FR_09-01-B_QTR_2017-10-02_N	2017 11 22	GH_FR1 (0200378)	FR_FRCP1 (E300071)	***91.5***
FR_GHHW	FR_GHHW_QSW_02012017_N	2017 02 27	GH_FR1 (0200378)	FR_FRCP1 (E300071)	***123***
	FR_GHHW_QSW_03042017_N	2017 06 01	GH_FR1 (0200378)	FR_FRCP1 (E300071)	***93.5***
	FR_GHHW_QTR_2017-09-11_N	2017 09 13	GH_FR1 (0200378)	FR_FRCP1 (E300071)	***82.2***
FR_GH_WELL4	FR_GH_WELL4_QTR_2017-10-02_N	2017 11 15	GH_FR1 (0200378)	FR_FRCP1 (E300071)	***92.8***
Study Area 4					
GH_MW-ERSC-1	GH_MW-ERSC-1_WG_2017-10-01_NP	2017 12 18	GH_ER1 (E206661)	GH_ERC (E3000090)	***68.7***
GH_GA-MW-2	GH_GA-MW-2_WG_2017-10-01_NP	2017 11 27	GH_ER1 (E206661)	GH_ERC (E3000090)	**18.9**
GH_GA-MW-3	GH_GA-MW-3_WG_2017-10-01_NP	2017 11 30	GH_ER1 (E206661)	GH_ERC (E3000090)	**19.4**
Study Area 7					
RG_DW-02-20	RG_DW-02-20_WP_2017-03-01_NP	2017 03 01	EV_ER1 (0200393)	n/a	11
	RG_DW-02-20_WP_2017-05-29_NP	2017 05 29	EV_ER1 (0200393)	n/a	10.3
Study Area 9					
EV_BCgw	EV_BCGW_WG_2017-03-14_NP	2017 03 14	EV_ER1 (0200393)	EV_MC2 (E3000091)	**20.3**
	EV_BCGW_WG_2017-03-30_NP	2017 03 30	EV_ER1 (0200393)	EV_MC2 (E3000091)	**37.7**
	EV_BCGW_WG_2017-05-16_NP	2017 05 16	EV_ER1 (0200393)	EV_MC2 (E3000091)	***59***
	EV_BCGW_WG_2017-06-28_NP	2017 06 27	EV_ER1 (0200393)	EV_MC2 (E3000091)	17.9
	EV_BCGW_WG_2017-08-23_NP	2017 08 23	EV_ER1 (0200393)	EV_MC2 (E3000091)	***56.8***
	EV_BCGW_WG_2017-10-18_NP	2017 10 18	EV_ER1 (0200393)	EV_MC2 (E3000091)	**34.5**
EV_BRgw	EV_BRGW_WG_2017-03-30_NP	2017 03 30	EV_ER1 (0200393)	EV_MC2 (E3000091)	17.2
	EV_BRGW_WG_2017-06-21_NP	2017 06 19	EV_ER1 (0200393)	EV_MC2 (E3000091)	**45.9**
	EV_BRGW_WG_2017-06-28_NP	2017 06 28	EV_ER1 (0200393)	EV_MC2 (E3000091)	***52.4***
	EV_BRGW_WG_2017-08-23_NP	2017 08 23	EV_ER1 (0200393)	EV_MC2 (E3000091)	***56.2***
	EV_WH50GW_WG_2017-10-25_NP [a]	2017 10 25	EV_ER1 (0200393)	EV_MC2 (E3000091)	**41.1**
	EV_BRGW_WG_2017-11-21_NP	2017 11 21	EV_ER1 (0200393)	EV_MC2 (E3000091)	**44.5**
EV_RCgw	EV_RCSGW_WG_2017-03-07_NP	2017 03 07	EV_ER1 (0200393)	EV_MC2 (E3000091)	***195***
	EV_RCSGW_WG_2017-06-30_NP	2017 06 30	EV_ER1 (0200393)	EV_MC2 (E3000091)	***214***
	EV_RCSGW_WG_2017-08-22_NP	2017 08 22	EV_ER1 (0200393)	EV_MC2 (E3000091)	***221***
	EV_BRGW_WG_2017-10-25_NP [a]	2017 10 25	EV_ER1 (0200393)	EV_MC2 (E3000091)	***235***
	EV_RCSGW_WG_2017-11-21_NP	2017 11 21	EV_ER1 (0200393)	EV_MC2 (E3000091)	***266***
EV_WH50gw	EV_WH50GW_WG_2017-03-03_NP	2017 03 03	EV_ER1 (0200393)	EV_MC2 (E3000091)	14.3
	EV_WH50GW_WG_2017-08-22_NP	2017 08 22	EV_ER1 (0200393)	EV_MC2 (E3000091)	10.8
	EV_RCSGW_WG_2017-10-25_NP [a]	2017 10 25	EV_ER1 (0200393)	EV_MC2 (E3000091)	10.4
	EV_WH50GW_WG_2017-11-21_NP	2017 11 21	EV_ER1 (0200393)	EV_MC2 (E3000091)	14.2
Study Area 11					
RG_DW-07-01	RG_DW-07-01_WP_2017-06-05_NP	2017 06 05	EV_ER1 (0200393)	CM_MC2 (E258937)	15.4
	RG_DW-07-01_WP_2017-08-30_NP	2017 08 30	EV_ER1 (0200393)	CM_MC2 (E258937)	11.6
Study Area 12					
EV_ER1gwS	EV_ER1GWS_WG_2017-02-15_NP	2017 02 15	EV_ER1 (0200393)	n/a	10.3
EV_ER1gwD	EV_ER1GWD_WG_2017-10-24_NP	2017 10 24	EV_ER1 (0200393)	n/a	10.5
RG_DW-03-04	RG_DW-03-04_WP_Q4-2017_NP	2017 11 21	EV_ER1 (0200393)	n/a	11.5

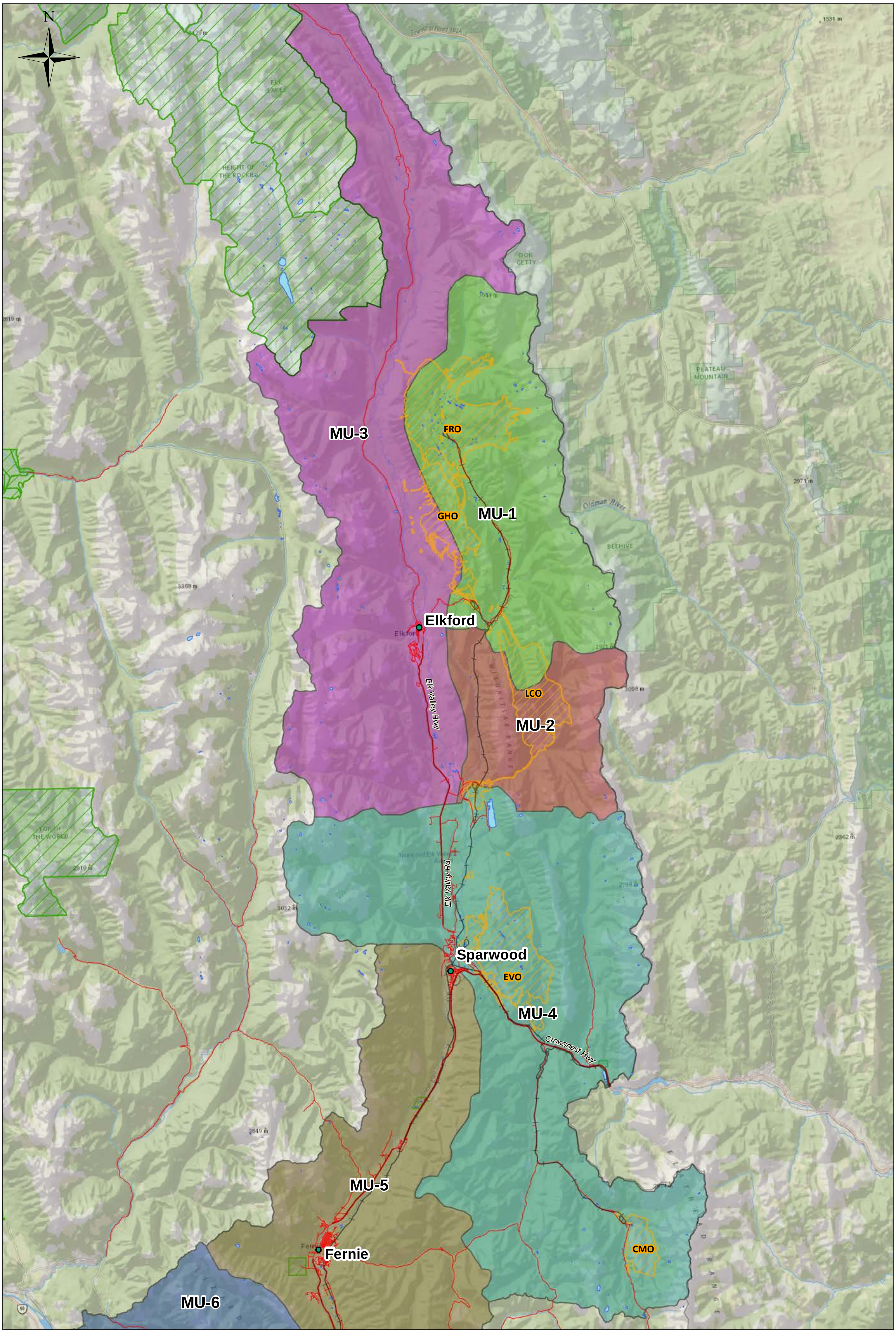
Data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
n/a Denotes no applicable standard/guideline.

BOLD	Concentration greater than or equal to Canadian Drinking Water Quality Drinking Water (DW) guideline.
SHADOW	Concentration greater than SPO by Area.
SHADED	Concentration greater than Compliance Point by Area.

[a] Samples inferred to be mislabelled in field.

Drawings

- 635544-301: Site Location and Management Units
- 635544-302: Surficial Geology - North Half of Study Area
- 635544-303: Surficial Geology - South Half of Study Area
- 635544-304: Bedrock Geology - North Half of Study Area
- 635544-305: Bedrock Geology - South Half of Study Area
- 635544-306: Groundwater Elevations from Q4 and Conceptual Regional Groundwater Flow – North Half of Study Area
- 635544-307: Groundwater Elevations from Q4 and Conceptual Regional Groundwater Flow – South Half of Study Area
- 635544-308: Study Areas 1 to 4 and Sample Location Plan
- 635544-309: Study Areas 5 – 7 and Sample Location Plan
- 635544-310: Study Areas 8 – 10 and 12 and Sample Location Plan
- 635544-311: Study Area 11 and Sample Location Plan
- 635544-312: Study Area 1 - Inferred Geological Cross Section A-A’
- 635544-313: Study Area 1 - Inferred Geological Cross Section B-B’
- 635544-314: Study Area 1 - Inferred Geological Cross Section C-C’
- 635544-315: Study Area 3 - Inferred Geological Cross Section D-D’
- 635544-316: Study Area 3 - Inferred Geological Cross Section E-E’
- 635544-317: Study Area 4 - Inferred Geological Cross Section F-F’
- 635544-318: Study Area 5/6 - Inferred Geological Cross Section G-G’
- 635544-319: Study Area 5/6 - Inferred Geological Cross Section H-H’
- 635544-320: Study Area 7 - Inferred Geological Cross Section I-I’
- 635544-321: Study Area 8 - Inferred Geological Cross Section J-J’
- 635544-322: Study Area 8 - Inferred Geological Cross Section K-K’
- 635544-323: Study Area 9 - Inferred Geological Cross Section L-L’
- 635544-324: Study Area 9 - Inferred Geological Cross Section M-M’
- 635544-325: Study Area 12 - Inferred Geological Cross Section N-N’
- 635544-326: Study Area 12 - Inferred Geological Cross Section O-O’
- 635544-327: Spatial Distribution of Selected Groundwater Analytical Data - Study Areas 1 to 4
- 635544-328: Spatial Distribution of Selected Groundwater Analytical Data - Study Areas 5 – 7
- 635544-329: Spatial Distribution of Selected Groundwater Analytical Data - Study Areas 8 – 10 and 12
- 635544-330: Spatial Distribution of Selected Groundwater Analytical Data - Study Area 11



Legend

- Rails
- Highway
- Secondary Road
- Mine Permitted Areas
- Surface Water
- Provincial Park

Management Units

- MU-1
- MU-2
- MU-3
- MU-4
- MU-5
- MU-6

Notes:
1. Original in colour.
2. Site location is approximate.

References:
1. Data provided by Teck Coal Ltd.
2. Service Layer Credits: Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Revisons:
0 - AO -2018-04-30 - DRAFT -LH
1 - AO -2018-05-10 - FINAL -LH

0 2 4 8 12 16 20 km

PROJECT LOCATION: Elk Valley, BC

CLIENT NAME: Teck Coal Ltd

SNC·LAVALIN

Site Location and Managment Units

CHK'D: LH	DATE: 2018/05/15	SCALE: 1:350,000	Ref Num:	REV: 1
BY: AO	COORD SYS: NAD 1983 UTM Zone 11N		635544-301	

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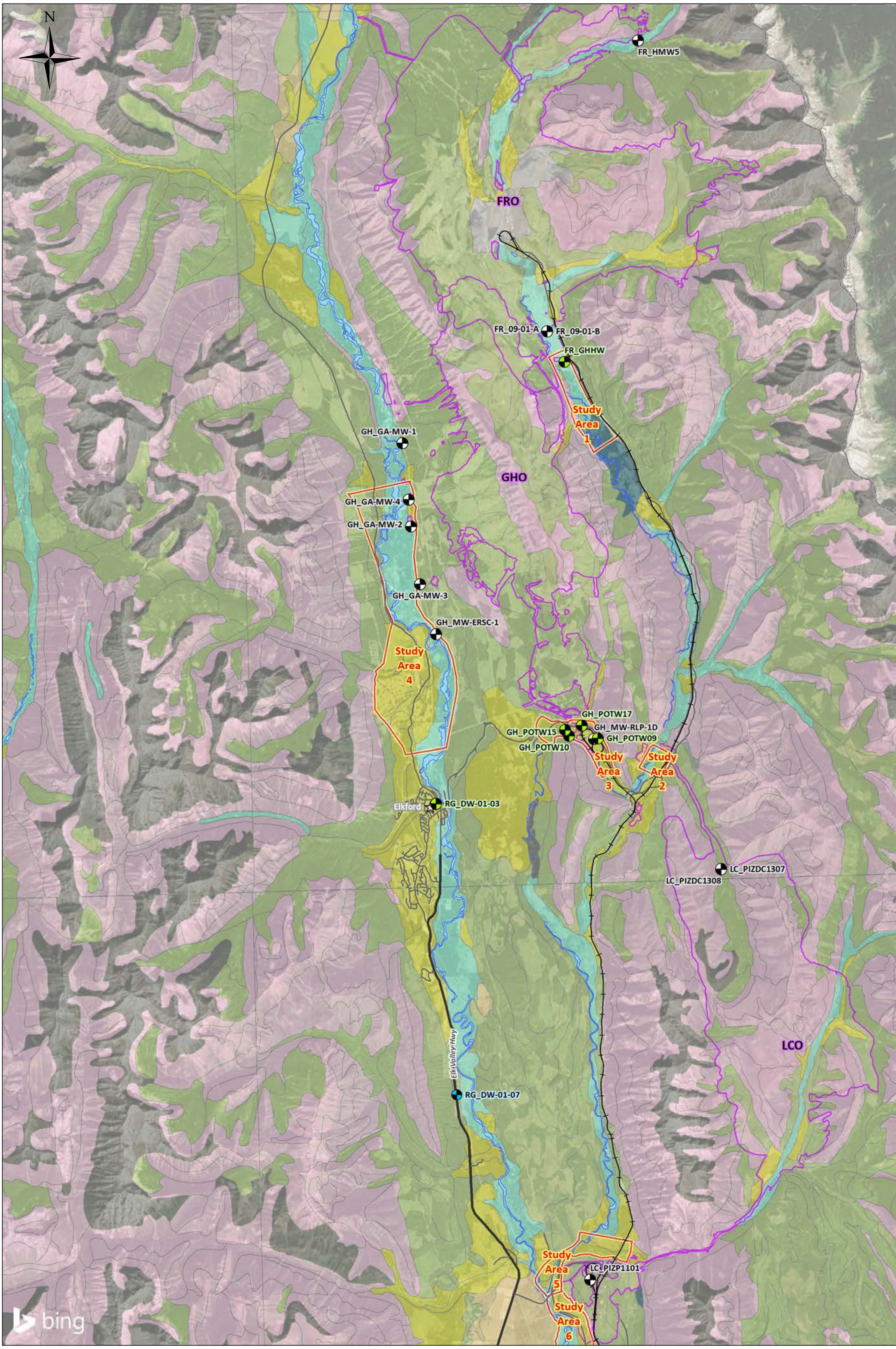
Project Path: \\sli2606\PROJECTS\Current Projects\Teck Coal Ltd\GIS\Exports\RGMP_AnnualReport_2017



Groundwater Stations
- Monitoring Well
- Supply Well
- Domestic Well

Site Features
- Study Areas
- BC-Alberta Border
- Rails
- Highway
- Secondary Road
- Mine Permitted Areas
- Surface Water

Surficial Unit
- Anthropogenic
- Colluvium
- Fluvial
- Glaciofluvial
- Glaciolacustrine
- Rock Outcrop
- Till
- Organic Soil

Notes:
1. Intended for illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
1. Data provided by Teck Coal Ltd.
2. Service Layer Credits: © 2018 Microsoft Corporation Earthstar Geographics SIO
3. George, H., W.A. Gorman, and D.F. VanDine, 1987. Late quaternary geology and geomorphology of the Elk Valley, southeastern British Columbia. Canadian Journal of Earth Science, 24, 741-751

Revisons:
0 - AO - 2018-03-28 - DRAFT - LH
1 - AO - 2018-05-10 - FINAL - LH

0 0.75 1.5 3 4.5 6 7.5 km

PROJECT LOCATION: Elk Valley, BC

CLIENT NAME: Teck Coal Ltd

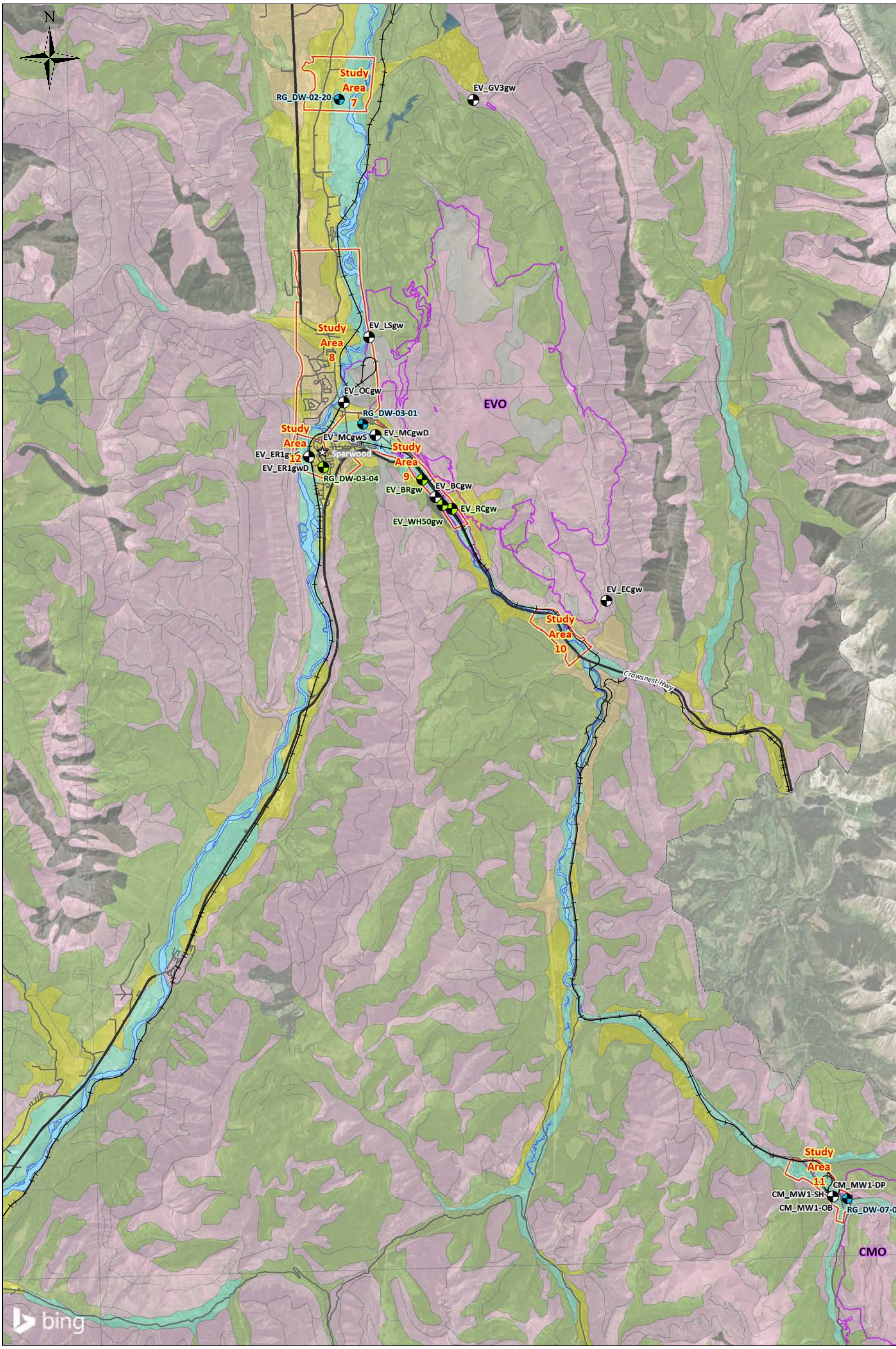
SNC·LAVALIN

Surficial Geology - North Half of Study Area

CHK'D: LH	DATE: 2018/05/15	SCALE: 1:120,000	Ref Num: 635544-302 REV: 1
BY: AO	COORD SYS: NAD 1983 UTM Zone 11N		

Project Path: P:\Current Projects\Teck Coal Ltd\SPO\635544\4.0 Execution\4.5 GIS and Drawings\Exports\2017 Annual Report

MXD Path: P:\Current Projects\Teck Coal Ltd\GIS\Map Series\RGMPAnnualReport_2017\635544-302-303_SurficialGeology_v1.mxd



Groundwater Stations
- Monitoring Well
- Supply Well
- Domestic Well

Site Features
- Study Areas
- BC-Alberta Border
- Rails
- Highway
- Secondary Road
- Mine Permitted Areas
- Surface Water

Surficial Unit
- Anthropogenic
- Colluvium
- Fluvial
- Glaciofluvial
- Glaciolacustrine
- Rock Outcrop
- Till
- Organic Soil

Notes:
1. Intended for illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
1. Data provided by Teck Coal Ltd.
2. Service Layer Credits: © 2018 Microsoft Corporation Earthstar Geographics SIO
3. George, H., W.A. Gorman, and D.F. VanDine, 1987. Late quaternary geology and geomorphology of the Elk Valley, southeastern British Columbia. Canadian Journal of Earth Science, 24, 741-751

Revisons:
0 - AO - 2018-03-28 - DRAFT - LH
1 - AO - 2018-05-10 - FINAL - LH

0 0.75 1.5 3 4.5 6 7.5 km

PROJECT LOCATION: Elk Valley, BC

CLIENT NAME: Teck Coal Ltd

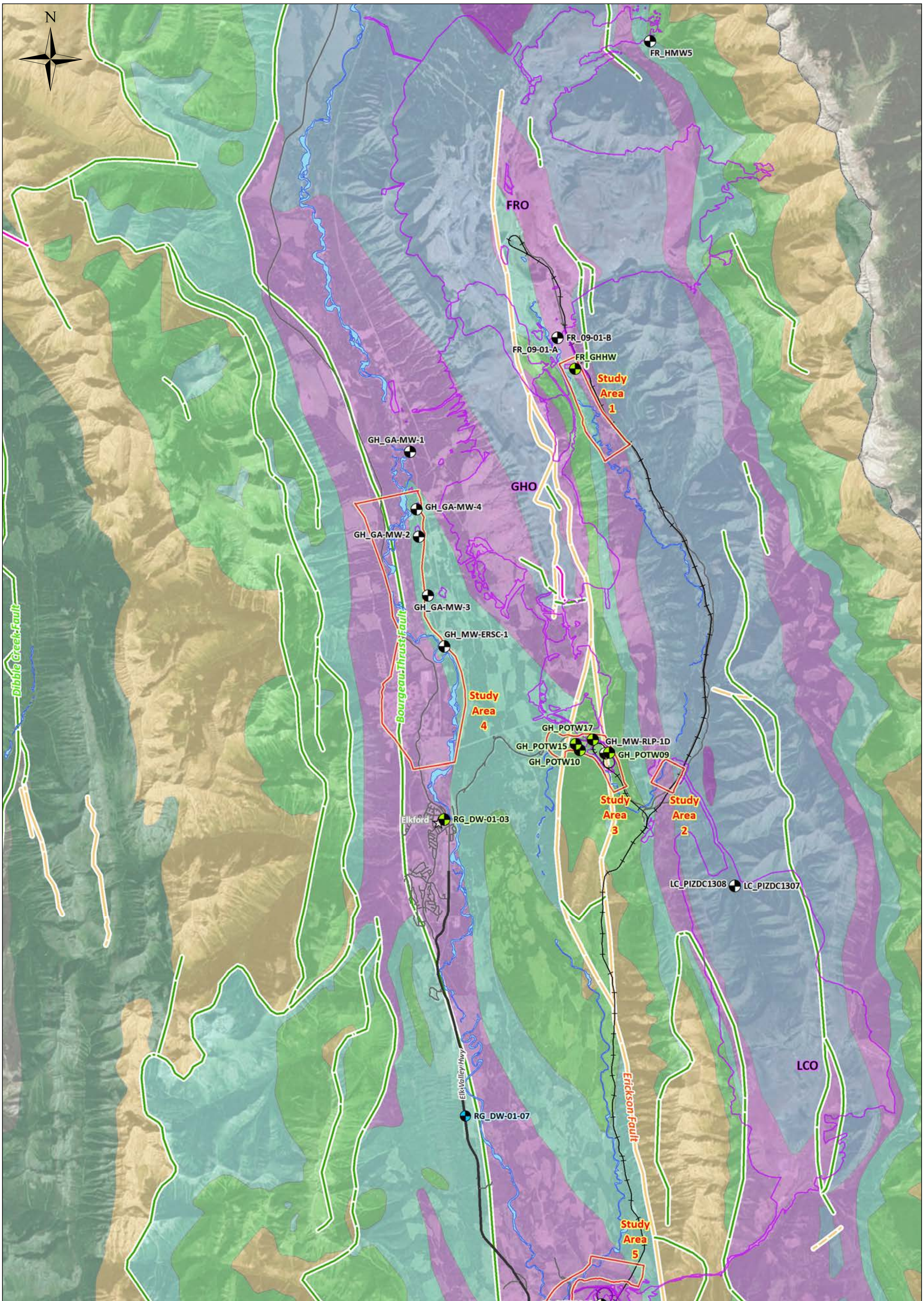
SNC · LAVALIN

Surficial Geology- South Half of Study Area

CHK'D: LH	DATE: 2018/05/15	SCALE: 1:120,000	Ref Num: 635544-303 REV: 1
BY: AO	COORD SYS: NAD 1983 UTM Zone 11N		

Project Path: P:\Current Projects\Teck Coal Ltd\SPO\635544\4.0 Execution\4.5 GIS and Drawings\Exports\2017 Annual Report

MXD Path: P:\Current Projects\Teck Coal Ltd\GIS\Map Series\RGMPAnnualReport_2017\635544-302-303_SurficialGeology_v1.mxd



Groundwater Stations
- Monitoring Well
- Supply Well
- Domestic Well
- BC-Alberta Border
- Study Areas
- Mine Permitted Areas
- Rails
- Highway
- Secondary Road
- Surface Water

Fault Type
- Fault
- Normal fault
- Thrust fault

Bedrock Geology
- Blairmore Group
- Kootenay Group
- Fernie Formation
- Spray River Group
- Rocky Mountain Formation
- Rundle Group
- Other

Notes:
1. Intended for illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
1. Data provided by Teck Coal Ltd.
2. Service Layer Credits: © 2018 Microsoft Corporation Earthstar Geographics SIO
3. Massey, N.W.D., MacIntyre, D.G., Desjardins, P.J., and Cooney, R.T. (2005): Geology of British Columbia, BC Ministry of Energy, Mines and Petroleum Resources, Geoscience Map 2005-3, (3 sheets), scale 1:1 000 000.

Revisons:
0 - AO - 2018-03-29 - DRAFT - LH
1 - AO - 2018-05-10 - FINAL - AO

0 0.5 1 2 3 4 5 km

PROJECT LOCATION: Elk Valley, BC

CLIENT NAME: Teck Coal Ltd

SNC·LAVALIN

Bedrock Geology- North Half of Study Area

CHK'D: LH
BY: AO
DATE: 2018/05/15
SCALE: 1:120,000
COORD SYS: NAD 1983 UTM Zone 11N
Ref Num: 635544-304
REV: 1

Project Path: P:\Current Projects\Teck Coal Ltd\SPO\635544\4.0 Execution\4.5 GIS and Drawings\Exports\2017 Annual Report

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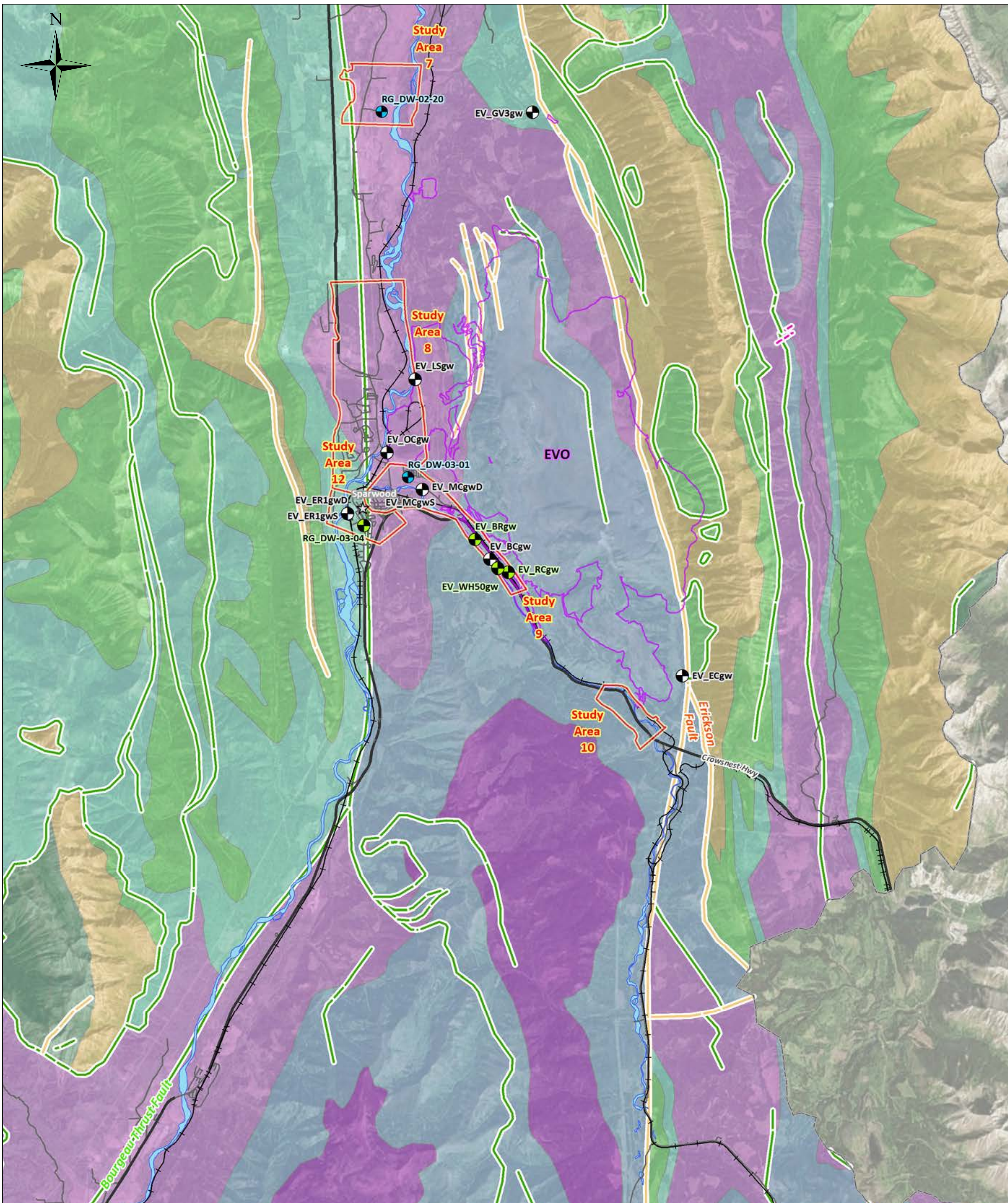

Groundwater Stations
- Monitoring Well
- Supply Well
- Domestic Well
- BC-Alberta Border
- Study Areas
- Mine Permitted Areas
- Rails
- Highway
- Secondary Road
- Surface Water

Fault Type
- Fault
- Normal fault
- Thrust fault

Bedrock Geology
- Blairmore Group
- Kootenay Group
- Fernie Formation
- Spray River Group
- Rocky Mountain Formation
- Rundle Group
- Other

Notes:
1. Intended for illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
1. Data provided by Teck Coal Ltd.
2. Service Layer Credits: © 2018 Microsoft Corporation Earthstar Geographics SIO
3. Massey, N.W.D., MacIntyre, D.G., Desjardins, P.J., and Cooney, R.T. (2005): Geology of British Columbia, BC Ministry of Energy, Mines and Petroleum Resources, Geoscience Map 2005-3, (3 sheets), scale 1:1 000 000.

Revisons:
0 - AO - 2018-03-29 - DRAFT - LH
1 - AO - 2018-05-10 - FINAL - AO

0 0.5 1 2 3 4 5 km

PROJECT LOCATION:
Elk Valley, BC

CLIENT NAME:
Teck Coal Ltd

SNC • LAVALIN

Bedrock Geology- South Half of Study Area

CHK'D: LH | DATE: 2018/05/15 | SCALE: 1:120,000 | Ref Num: | REV: 1
BY: AO | COORD SYS: NAD 1983 UTM Zone 11N | 635544-305

Project Path: P:\Current Projects\Teck Coal Ltd\SPO\635544\4.0 Execution\4.5 GIS and Drawings\Exports\2017 Annual Report

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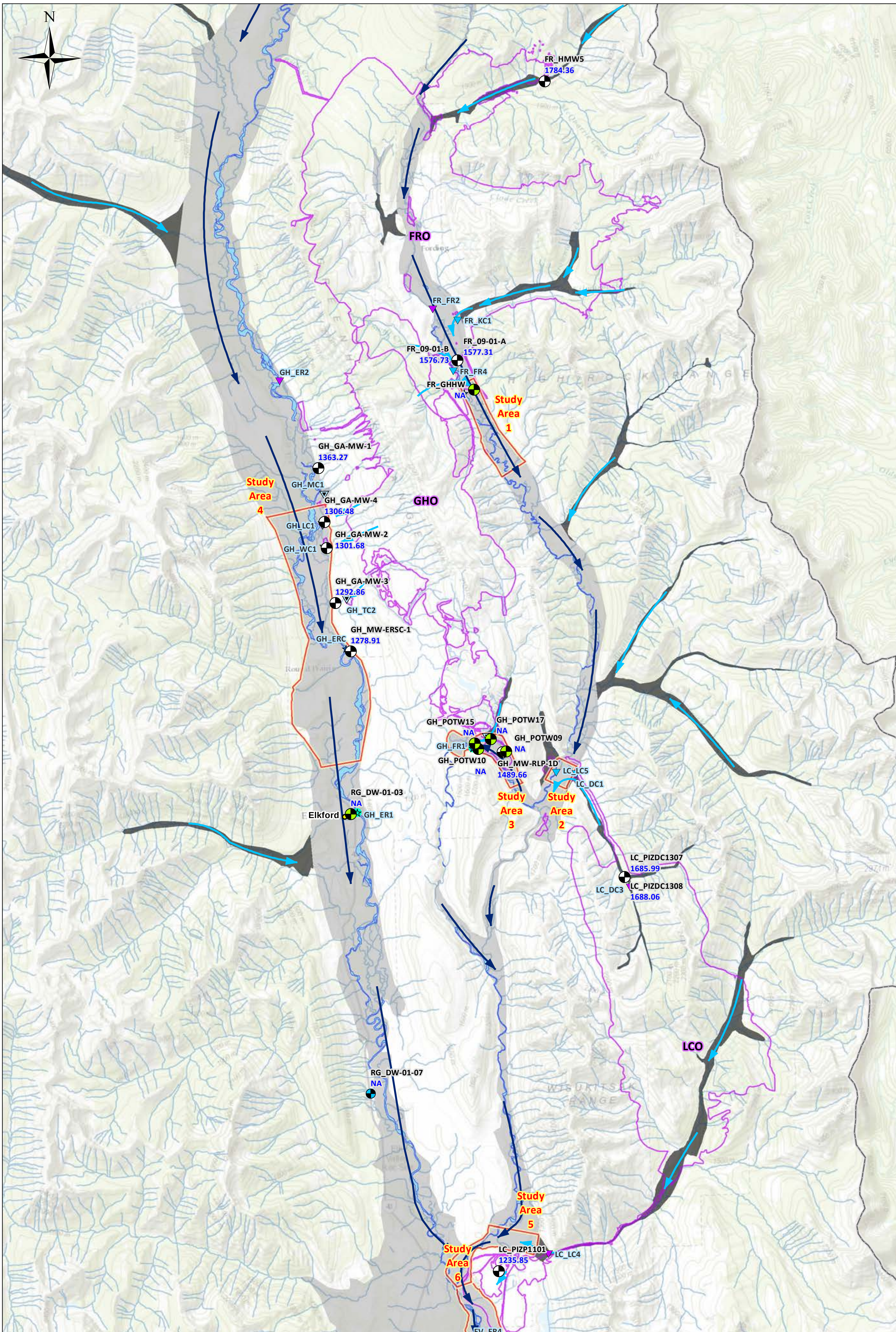


Legend

Groundwater Stations
- Monitoring Well
- Supply Well
- Domestic Well

Surface Water Stations
- Compliance Point
- Order Station
- Order Station and Compliance Point
- Receiving Environment
- Authorized Discharge
- Monitoring

Site Features
- Study Areas
- BC-Alberta Border
- Mine Permitted Areas
- Interpreted Tributary Valley-bottom Extent
- Interpreted Main Valley-bottom Extent

Water Features
- Water Features
- Rivers
- Inferred Valley-Bottom Flow Direction
- Inferred Upland or Tributary Valley-bottom Groundwater Flow

1287.77 Groundwater Elevation (masl) measured in 2017 Q4

Notes:
1. Intended for illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
1. Data provided by Teck Coal Ltd.
2. Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Revisons:
0 - AO - 2018-05-03 - DRAFT - AO
1 - AO - 2018-05-10 - FINAL - AO

0 0.75 1.5 3 4.5 6 7.5 km

PROJECT LOCATION:
Elk Valley, BC

CLIENT NAME:
Teck Coal Ltd

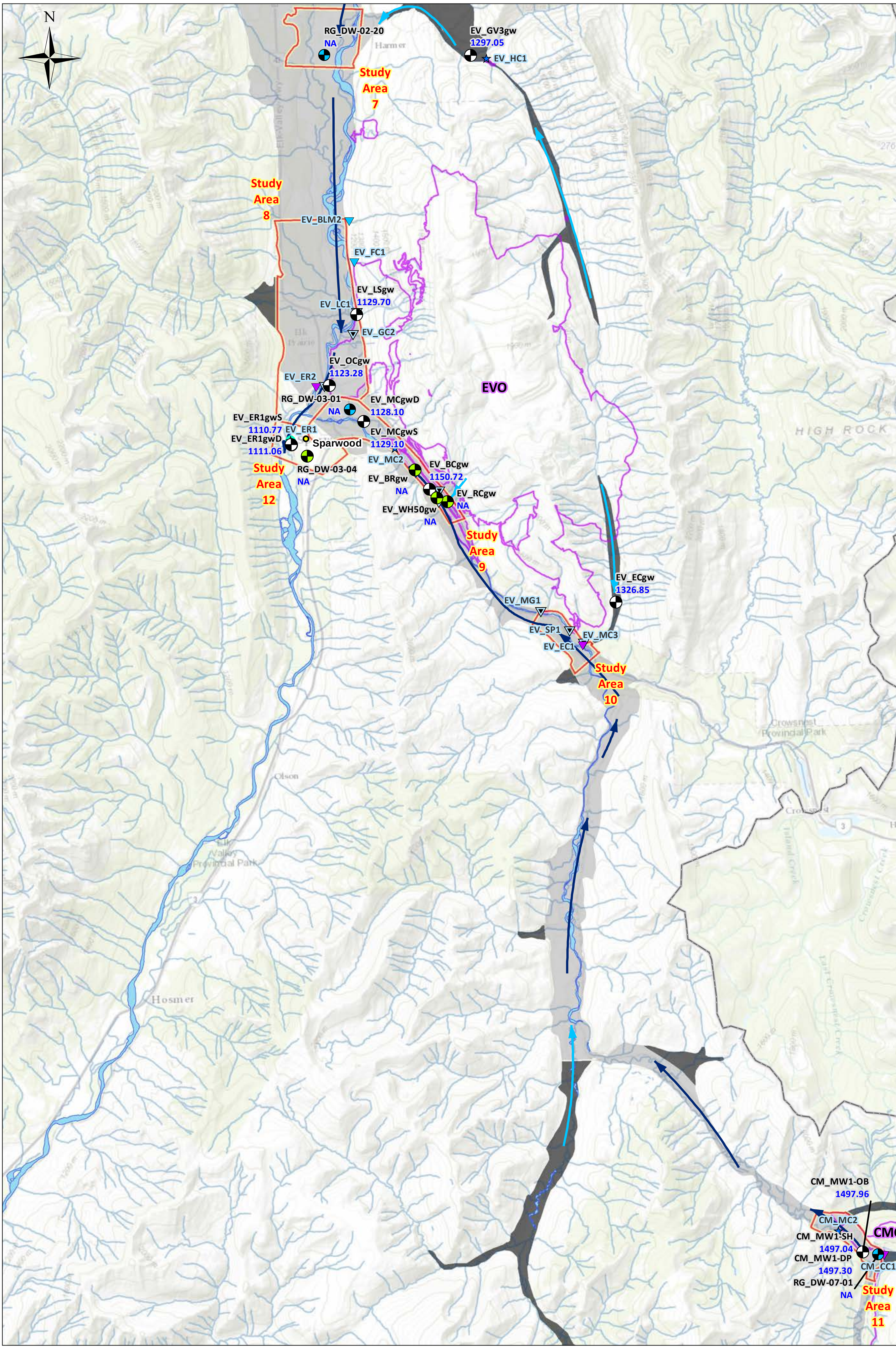
SNC·LAVALIN

Groundwater Elevations from Q4 and Conceptual Regional Groundwater Flow - North Half of Study Area

CHK'D: LH	DATE: 2018/05/15	SCALE: 1:120,000	Ref Num: 635544-306	REV: 1
BY: AO	COORD SYS: NAD 1983 UTM Zone 11N			

MXD Path: P:\Current Projects\Teck Coal Ltd\GIS\Map Series\RGMPAnnualReport_2017\635544-306-307_GroundwaterElevations.mxd

Project Path: \\sli2606\PROJECTS\Current Projects\Teck Coal Ltd\SPO\635544\4.0 Execution\4.5 GIS and Drawings\Exports\2016 Annual Report



Legend

Groundwater Stations
- Monitoring Well
- Supply Well
- Domestic Well

Surface Water Stations
- Compliance Point
- Order Station
- Receiving Environment
- Authorized Discharge
- Monitoring

Site Features
- Study Areas
- BC-Alberta Border
- Mine Permitted Areas
- Interpreted Tributary Valley-bottom Extent
- Interpreted Main Valley-bottom Extent

Water Features
- Water Features
- Rivers
- Inferred Valley-Bottom Flow Direction
- Inferred Upland or Tributary Valley-bottom Groundwater Flow

1287.77 Groundwater Elevation (masl) measured in 2017 Q4

Notes:
1. Intended for illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
1. Data provided by Teck Coal Ltd.
2. Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Revisons:
0 - AO - 2018-05-03 - DRAFT - AO
1 - AO - 2018-05-10 - FINAL - AO

0 0.5 1 2 3 4 5 km

PROJECT LOCATION: Elk Valley, BC

CLIENT NAME: Teck Coal Ltd

SNC·LAVALIN

Groundwater Elevations from Q4 and Conceptual Regional Groundwater Flow - South Half of Study Area

CHK'D: LH	DATE: 2018/05/15	SCALE: 1:120,000	Ref Num: 635544-307	REV: 1
BY: AO	COORD SYS: NAD 1983 UTM Zone 11N			

MXD Path: P:\Current Projects\Teck Coal Ltd\GIS\Map Series\RGMPAnnualReport_2017\635544-306-307_GroundwaterElevations.mxd

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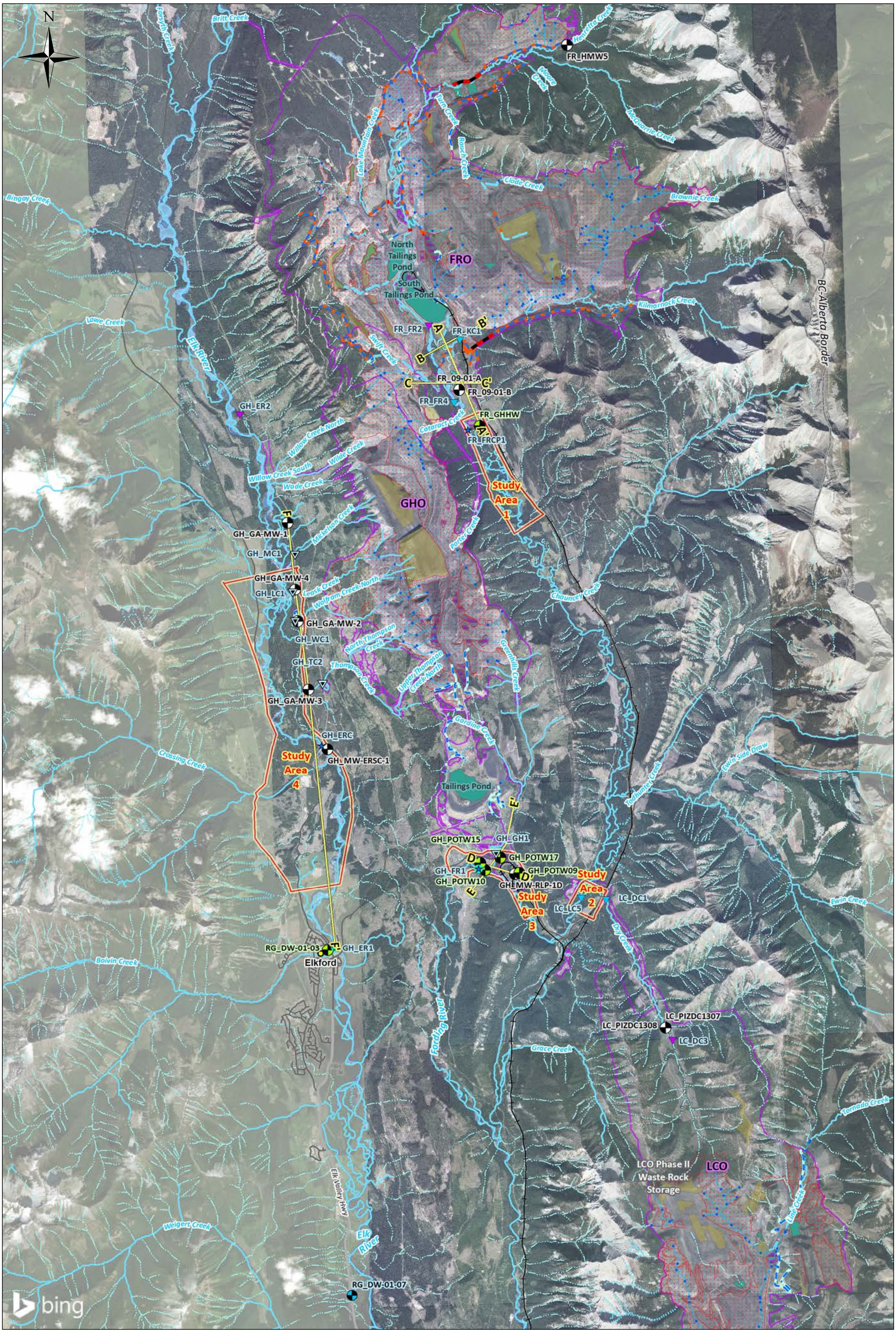


Surface Water Stations
- Compliance Point
- Order Station
- Order Station and Compliance Point
- Receiving Environment
- Authorized Discharge
- Monitoring

Groundwater Stations
- Monitoring Well
- Supply Well
- Domestic Well

Site Features
- Study Areas
- Geological Cross Section
- BC-Alberta Border
- Culvert
- Ditch
- Rock Drain
- Water Pipeline
- Highway
- Secondary Road
- Rails
- Mine Permitted Areas
- Pit
- Stockpiles
- Waste Dump (Spoils)

Water Features
- Intermittent Stream
- Stream Ditch
- Indefinite Stream
- Stream
- Subsurface
- River Bed
- Settling/Tailings Pond
- River Bed

Notes:
1. Intended for illustration purposes only.
2. Original in colour.
3. Site location is approximate.
4. Readers are referred to the RGMP dated September 29, 2017 for the locations of all wells included in cross sections

References:
1. Data provided by Teck Coal Ltd.
2. © 2018 Microsoft Corporation Earthstar Geographics SIO

Revisons:
0 - AO - 2018-03-28 -DRAFT - LH
1 - AO - 2018-05-10 - FINAL - AO

0 0.5 1 2 3 4 5 Kilometers

PROJECT LOCATION:
Elk Valley, BC

CLIENT NAME:
Teck Coal Ltd

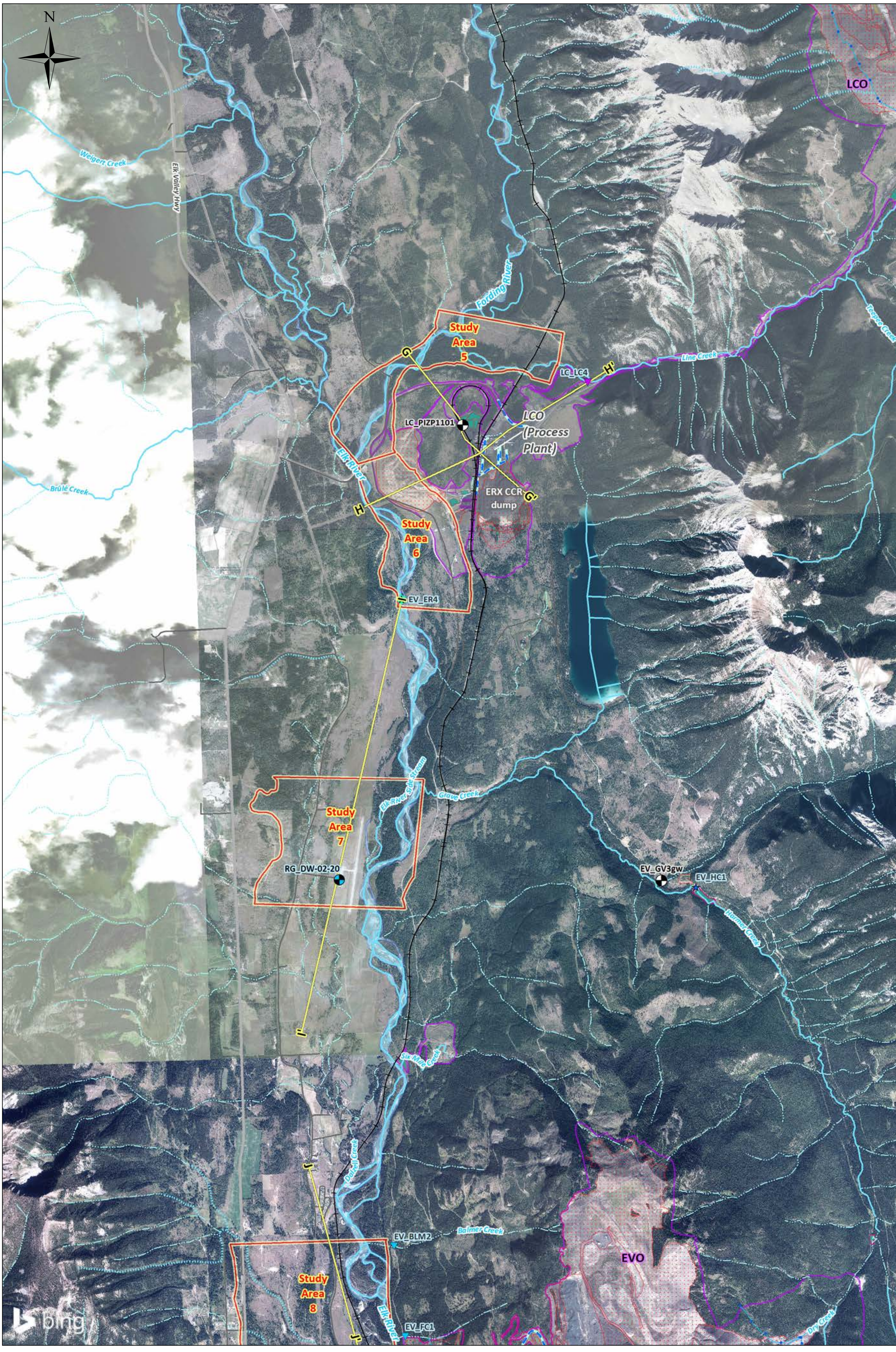
SNC·LAVALIN

Study Areas 1 to 4 and Sample Location Plan

CHK'D: LH	DATE: 2018/05/15	SCALE: 1: 100000	Ref Num:	REV: 1	
BY: AO	COORD SYS: NAD 1983 UTM Zone 11N		635544-308		

MXD Path: P:\Current Projects\Teck Coal Ltd\GIS\Map Series\RGMPAnnualReport_2017\635544-308-311_StudyAreas.mxd

Project Path: \\sli2606\PROJECTS\Current Projects\Teck Coal Ltd\SPO\635544\4.0 Execution\4.5 GIS and Drawings\Exports\2016 Annual Report



Surface Water Stations
- Compliance Point
- Order Station
- Receiving Environment
- Monitoring

Groundwater Stations
- Monitoring Well
- Domestic Well

Site Features
- Study Areas
- Geological Cross Section
- Highway
- Secondary Road
- Rails
- Mine Permitted Areas
- Pit
- Stockpiles
- Waste Dump (Spoils)

Water Features
- Intermittent Stream
- Stream Ditch
- Indefinite Stream
- Stream
- Subsurface
- River Bed
- Settling/Tailings Pond

Notes:
1. Intended for illustration purposes only.
2. Original in colour.
3. Site location is approximate.
4. Readers are referred to the RGMP dated September 29, 2017 for the locations of all wells included in cross sections

References:
1. Data provided by Teck Coal Ltd.
2. © 2018 Microsoft Corporation © 2018 DigitalGlobe ©CNES (2018) Distribution Airbus DS

Revisons:
0 - AO - 2018-03-28 -DRAFT - LH
1 - AO - 2018-05-10 - FINAL - AO

0 0.25 0.5 1 1.5 2 2.5 Kilometers

PROJECT LOCATION: Elk Valley, BC

CLIENT NAME: Teck Coal Ltd

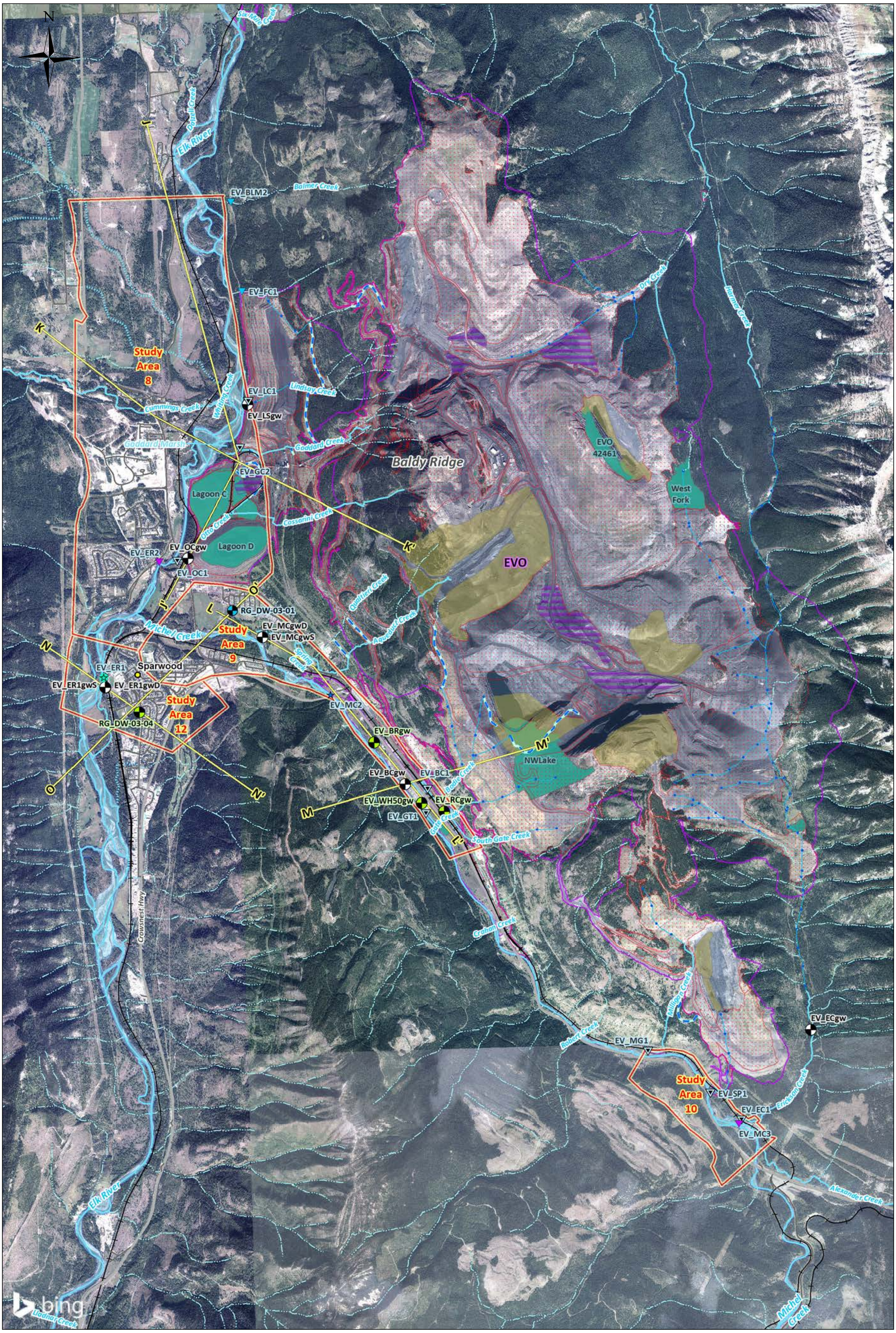
SNC·LAVALIN

Study Areas 5 – 7 and Sample Location Plan

CHK'D: LH	DATE: 2018/05/15 SCALE: 1: 50000	Ref Num: 635544-309	REV: 1
BY: AO	COORD SYS: NAD 1983 UTM Zone 11N		

MXD Path: P:\Current Projects\Teck Coal Ltd\GIS\Map Series\RGMPAnnualReport_2017\635544-308-311_StudyAreas.mxd

Project Path: \\sli2606\PROJECTS\Current Projects\Teck Coal Ltd\SPO\635544\4.0 Execution\4.5 GIS and Drawings\Exports\2016 Annual Report



Surface Water Stations
- Compliance Point
- Order Station
- Receiving Environment
- Authorized Discharge
- Monitoring

Groundwater Stations
- Monitoring Well
- Supply Well
- Domestic Well

Site Features
- Study Areas
- Geological Cross Section
- Highway
- Secondary Road
- Rails
- Mine Permitted Areas
- Pit
- Stockpiles
- Waste Dump (Spoils)

Water Features
- Intermittent Stream
- Stream Ditch
- Indefinite Stream
- Stream
- Subsurface
- River Bed
- Settling/Tailings Pond

Notes:
1. Intended for illustration purposes only.
2. Original in colour.
3. Site location is approximate.
4. Readers are referred to the RGMP dated September 29, 2017 for the locations of all wells included in cross sections

References:
1. Data provided by Teck Coal Ltd.
2. © 2018 Microsoft Corporation © 2018 DigitalGlobe ©CNES (2018) Distribution Airbus DS

Revisons:
0 - AO - 2018-03-28 -DRAFT - LH
1 - AO - 2018-05-10 - FINAL - AO

0 0.25 0.5 1 1.5 2 2.5 Kilometers

PROJECT LOCATION: Elk Valley, BC

CLIENT NAME: Teck Coal Ltd

SNC·LAVALIN

Study Areas 8 – 10 and 12 and Sample Location Plan

CHK'D: LH	DATE: 2018/05/15 SCALE: 1: 50000	Ref Num: REV: 1
BY: AO	COORD SYS: NAD 1983 UTM Zone 11N	635544-310

MXD Path: P:\Current Projects\Teck Coal Ltd\GIS\Map Series\RGMPAnnualReport_2017\635544-308-311_StudyAreas.mxd

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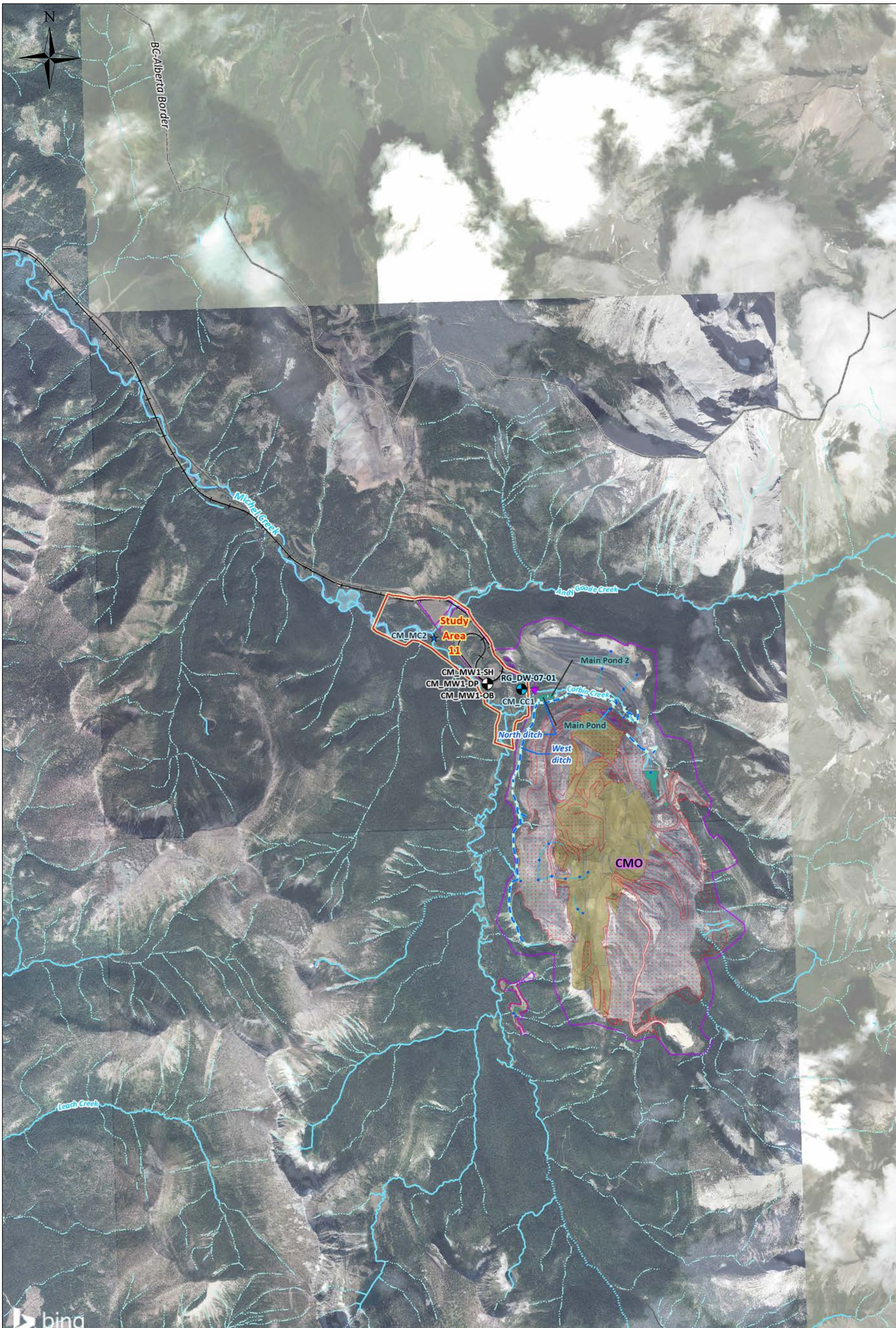


Surface Water Stations
- Compliance Point
- Receiving Environment

Groundwater Stations
- Monitoring Well
- Domestic Well

Site Features
- Study Areas
- BC-Alberta Border
- Secondary Road
- Rails
- Mine Permitted Areas
- Pit
- Stockpiles
- Waste Dump (Spoils)

Water Features
- Intermittent Stream
- Stream Ditch
- Indefinite Stream
- Stream
- Subsurface
- River Bed
- Settling/Tailings Pond

Notes:
1. Intended for illustration purposes only.
2. Original in colour.
3. Site location is approximate.
4. Readers are referred to the RGMP dated September 29, 2017 for the locations of all wells included in cross sections

References:
1. Data provided by Teck Coal Ltd.
2. © 2018 Microsoft Corporation © 2018 DigitalGlobe ©CNES (2018) Distribution Airbus DS

Revisons:
0 - AO - 2018-03-28 -DRAFT - LH
1 - AO - 2018-05-10 - FINAL - AO

0 0.25 0.5 1 1.5 2 2.5 Kilometers

PROJECT LOCATION: Elk Valley, BC

CLIENT NAME: Teck Coal Ltd

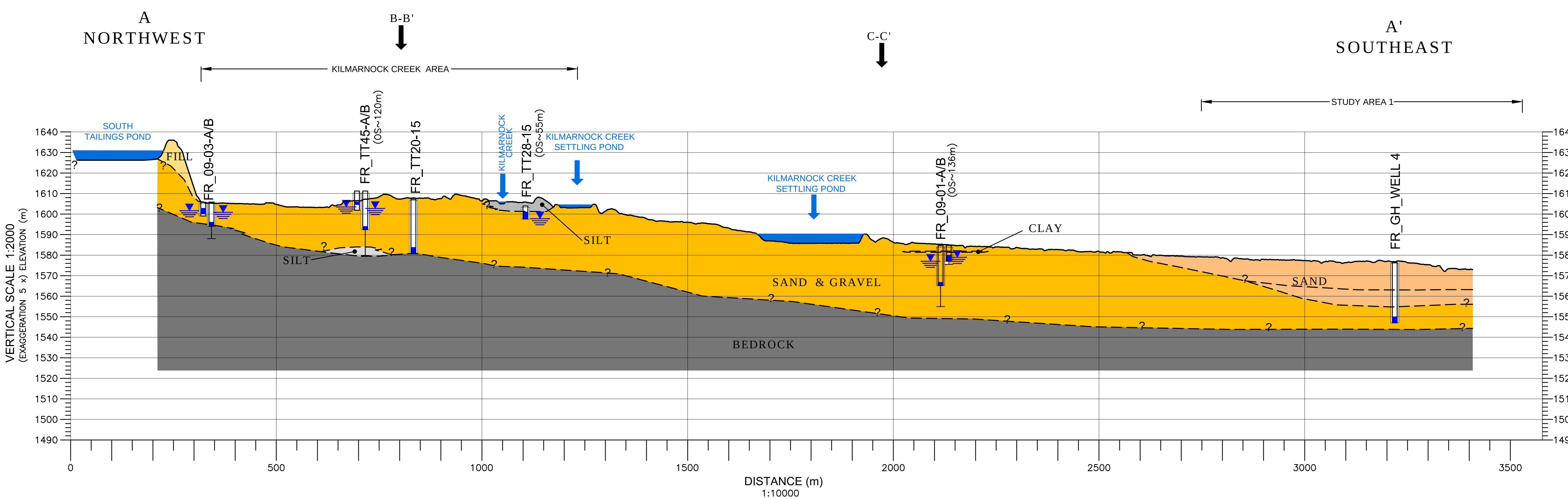
SNC·LAVALIN

Study Area 11 and Sample Location Plan

CHK'D: LH	DATE: 2018/05/15 SCALE: 1: 50000	Ref Num:	REV: 1
BY: AO	COORD SYS: NAD 1983 UTM Zone 11N	635544-311	

MXD Path: P:\Current Projects\Teck Coal Ltd\GIS\Map Series\RGMPAnnualReport_2017\635544-308-311_StudyAreas.mxd

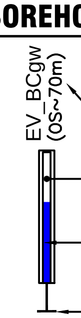
Project Path: \\sli2606\PROJECTS\Current Projects\Teck Coal Ltd\SPO\635544\4.0 Execution\4.5 GIS and Drawings\Exports\2016 Annual Report



LEGEND

- FILL
- COLLUVIUM
- SAND & GRAVEL
- SAND
- SILT
- CLAY
- BEDROCK
- INFERRED STRATIGRAPHIC BOUNDARY
- GROUNDWATER ELEVATION (2016 Q4 MANUAL WATER LEVEL MEASUREMENT)

BOREHOLE LEGEND



NOTES

1. THE CROSS SECTION DEPICTED IS BASED ON INTERPRETATION OF LIMITED GEOLOGICAL DATA. ACTUAL GEOLOGICAL CONDITIONS MAY BE DIFFERENT FROM THOSE INTERPRETED.
2. INFORMATION PRESENTED IS WITHIN 25m OF SECTION LINE UNLESS INDICATED OTHERWISE ON DRAWING.
3. ORIGINAL DRAWING IN COLOUR.
4. Q4 GROUNDWATER ELEVATIONS WERE NOT AVAILABLE FOR FR_GH WELL 4.)
5. GROUND ELEVATION FOR TT-SERIES LOCATIONS WERE ESTIMATED FROM LIDAR. GROUNDWATER ELEVATIONS AT THESE LOCATIONS WERE CALCULATED USING THESE GROUND SURFACE ELEVATIONS.

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
-	-	-

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
0	2017-09-28	ISSUED TO CLIENT	AJK	LH

SNC · LAVALIN

CLIENT NAME: TECK COAL LTD.

PROJECT LOCATION: ELK VALLEY BC

TITLE: STUDY AREA 1 INFERRED GEOLOGICAL CROSS SECTION A-A '

DWN BY: AJK	SCALE: AS SHOWN	DATE: 2017-06-01	DWG No:	REV.: 0
CHK'D: BH	PLOT: 20180510.1559	CADFILE: 635544-X2R2	635544-312	

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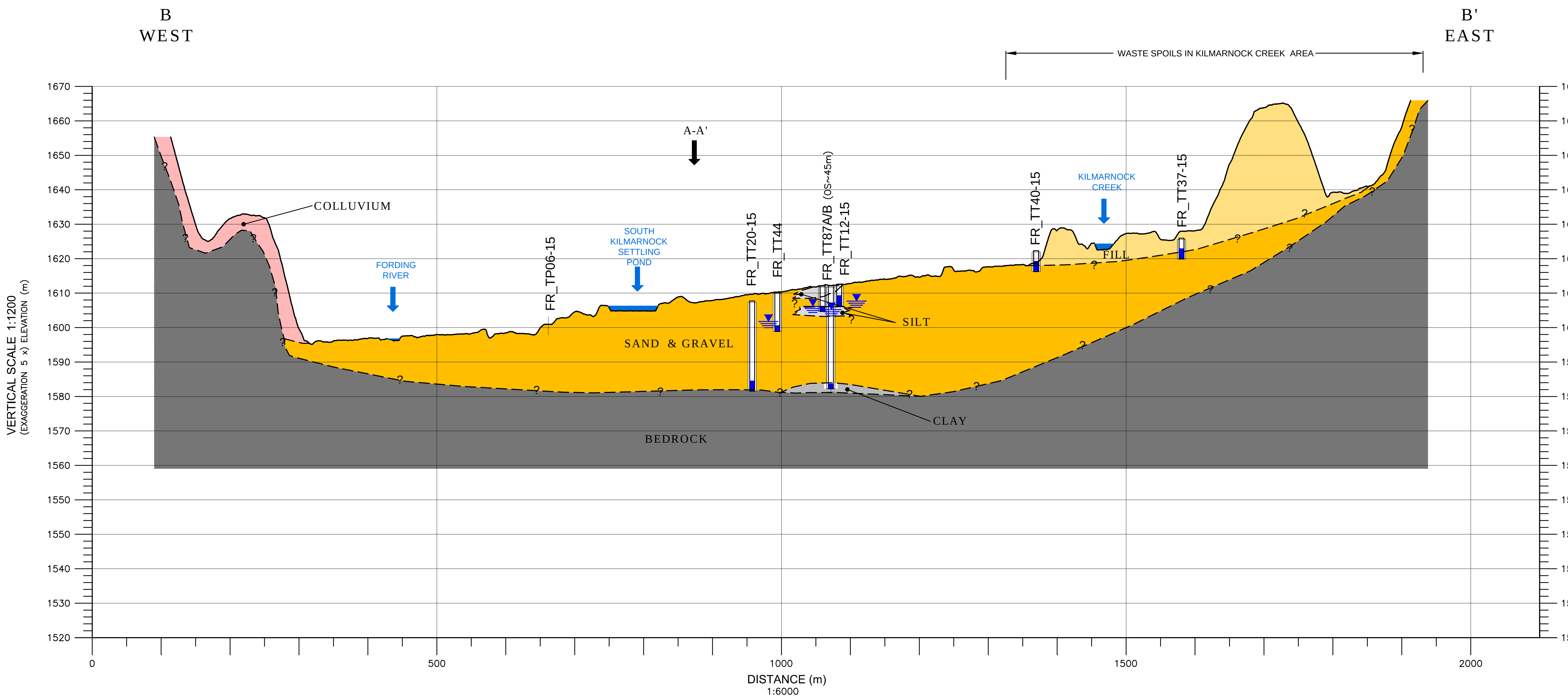


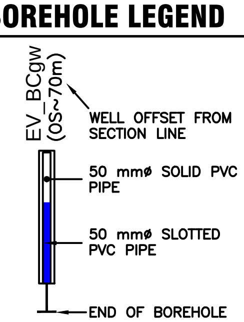
LEGEND

- FILL
- COLLUVIUM
- SAND & GRAVEL
- SAND
- SILT
- CLAY
- BEDROCK

INFERRED STRATIGRAPHIC BOUNDARY

GROUNDWATER ELEVATION (2016 Q4 MANUAL WATER LEVEL MEASUREMENT)

BOREHOLE LEGEND



NOTES

1. THE CROSS SECTION DEPICTED IS BASED ON INTERPRETATION OF LIMITED GEOLOGICAL DATA. ACTUAL GEOLOGICAL CONDITIONS MAY BE DIFFERENT FROM THOSE INTERPRETED.
2. INFORMATION PRESENTED IS WITHIN 25m OF SECTION LINE UNLESS INDICATED OTHERWISE ON DRAWING.
3. ORIGINAL DRAWING IN COLOUR.
4. GROUND ELEVATION FOR TT–SERIES LOCATIONS WERE ESTIMATED FROM LIDAR. GROUNDWATER ELEVATIONS AT THESE LOCATIONS WERE CALCULATED USING THESE GROUND SURFACE ELEVATIONS.

REFERENCE DRAWINGS

–	–	–
DWG. NO.	DATE	DESCRIPTION

REVISIONS

0	2017–09–28	ISSUED TO CLIENT	AJK	LH
REV.	DATE	DESCRIPTION	BY	CHK

SNC·LAVALIN

CLIENT NAME: TECK COAL LTD.

PROJECT LOCATION: ELK VALLEY BC

TITLE: STUDY AREA 1
INFERRED GEOLOGICAL CROSS SECTION B-B '

DWN BY: AJK	SCALE: AS SHOWN	DATE: 2017–06–01	DWG No: 635544-313 REV.: 0
CHK'D: BH	PLOT: 20180510.1559	CADFILE:635544–X2R2	

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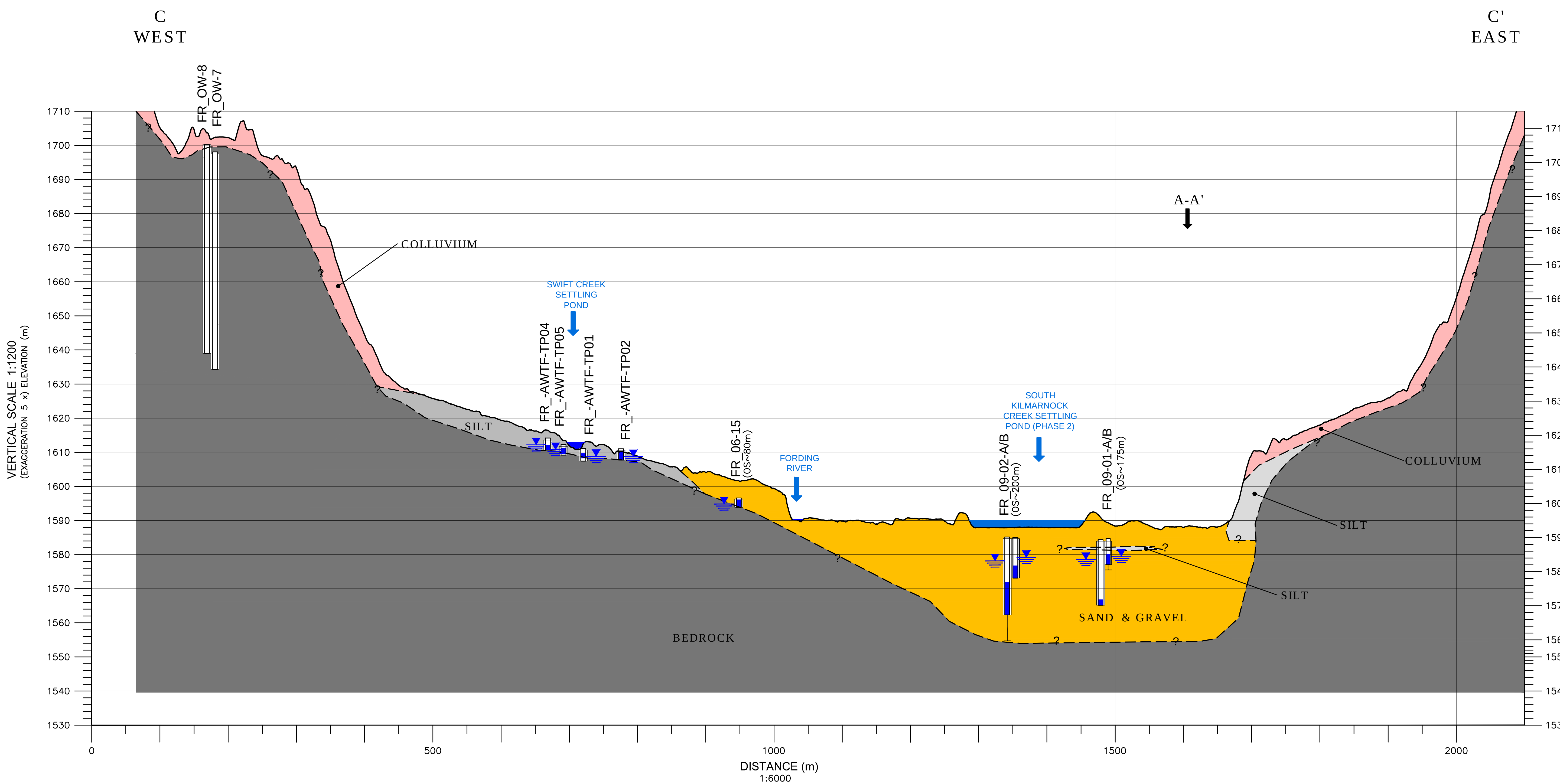

LEGEND

- FILL
- COLLUVIUM
- SAND & GRAVEL
- SAND
- SILT
- CLAY
- BEDROCK
- INFERRED STRATIGRAPHIC BOUNDARY
- GROUNDWATER ELEVATION (2016 Q4 MANUAL WATER LEVEL MEASUREMENT)

BOREHOLE LEGEND

EV_BCgw (OS~70m)
WELL OFFSET FROM SECTION LINE
50 mmø SOLID PVC PIPE
50 mmø SLOTTED PVC PIPE
END OF BOREHOLE

NOTES

1. THE CROSS SECTION DEPICTED IS BASED ON INTERPRETATION OF LIMITED GEOLOGICAL DATA. ACTUAL GEOLOGICAL CONDITIONS MAY BE DIFFERENT FROM THOSE INTERPRETED.
2. INFORMATION PRESENTED IS WITHIN 25m OF SECTION LINE UNLESS INDICATED OTHERWISE ON DRAWING.
3. ORIGINAL DRAWING IN COLOUR.
4. GROUND ELEVATION FOR TT–SERIES LOCATIONS WERE ESTIMATED FROM LIDAR. GROUNDWATER ELEVATIONS AT THESE LOCATIONS WERE CALCULATED USING THESE GROUND SURFACE ELEVATIONS.

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
–	–	–

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
0	2017–09–28	ISSUED TO CLIENT	AJK	LH

SNC • LAVALIN

CLIENT NAME: TECK COAL LTD.

PROJECT LOCATION: ELK VALLEY BC

TITLE: STUDY AREA 1
INFERRED GEOLOGICAL CROSS SECTION C-C '

DWN BY: AJK	SCALE: AS SHOWN	DATE: 2017–06–01	DWG No:	REV.: 0
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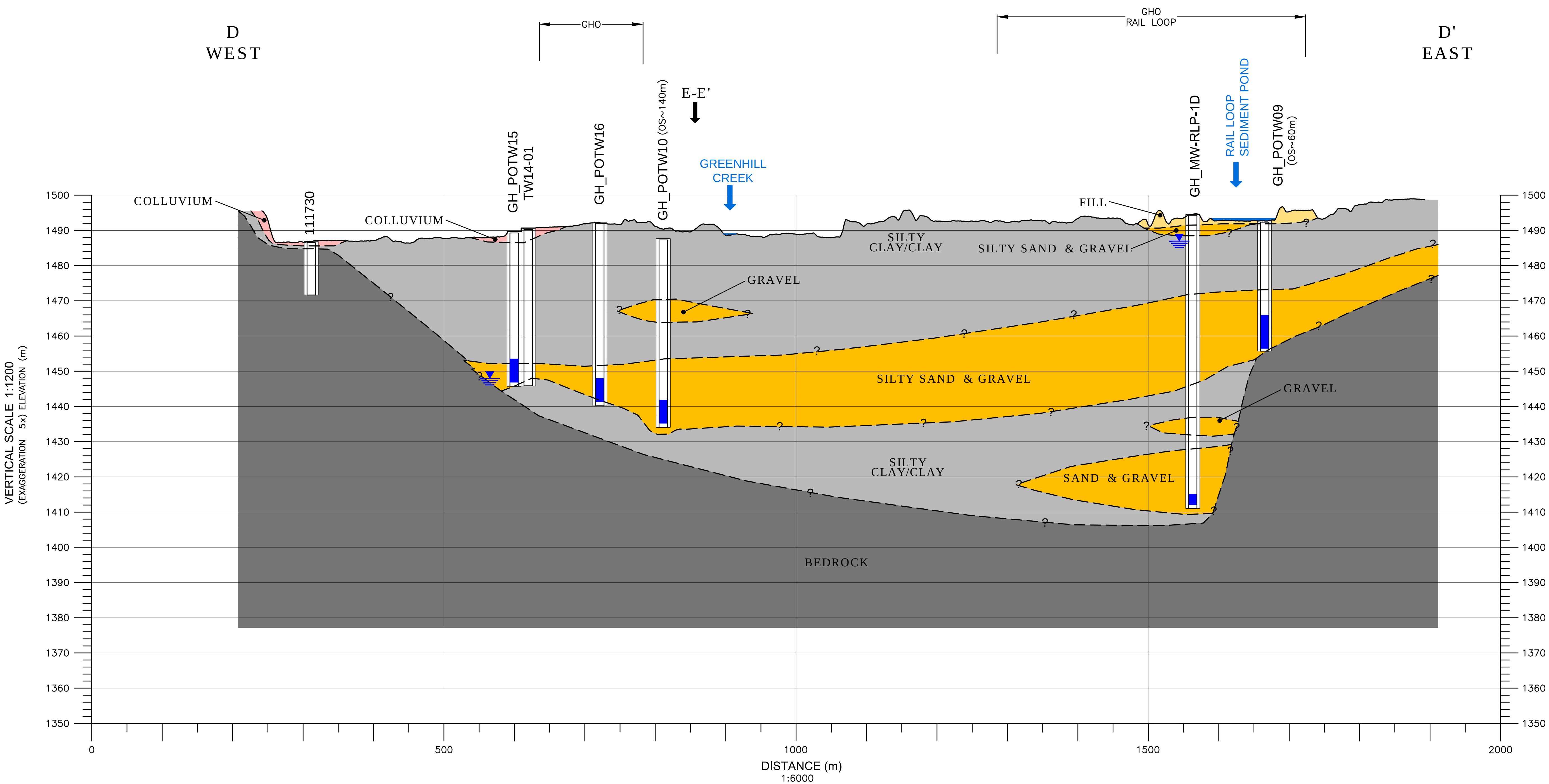

LEGEND

- FILL
- COLLUVIUM
- SAND & GRAVEL
- SAND
- SILT
- CLAY
- BEDROCK

INFERRED STRATIGRAPHIC BOUNDARY

GROUNDWATER ELEVATION (2016 Q4 MANUAL WATER LEVEL MEASUREMENT)

BOREHOLE LEGEND

EV_BCgw (OS~70m)

WELL OFFSET FROM SECTION LINE

50 mmø SOLID PVC PIPE

50 mmø SLOTTED PVC PIPE

END OF BOREHOLE

NOTES

1. THE CROSS SECTION DEPICTED IS BASED ON INTERPRETATION OF LIMITED GEOLOGICAL DATA. ACTUAL GEOLOGICAL CONDITIONS MAY BE DIFFERENT FROM THOSE INTERPRETED.
2. INFORMATION PRESENTED IS WITHIN 25m OF SECTION LINE UNLESS INDICATED OTHERWISE ON DRAWING.
3. ORIGINAL DRAWING IN COLOUR.
4. DETAILED INSTALL RECORDS WERE NOT AVAILABLE FOR WELLS GH_POTW15, GH_POTW09 AND GH_POTW10. ESTIMATED 6m SCREEN.
5. GROUND SURFACE ELEVATION OF WELLS WAS OBTAINED FROM LIDAR. GROUNDWATER ELEVATIONS SHOWN ON SECTIONS WERE CALCULATED USING LIDAR GROUND SURFACE ELEVATIONS.

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
–	–	–

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
0	2017–09–28	ISSUED TO CLIENT	AJK	LH

SNC·LAVALIN

CLIENT NAME: TECK COAL LTD.

PROJECT LOCATION: ELK VALLEY BC

TITLE: STUDY AREA 3 INFERRED GEOLOGICAL CROSS SECTION D-D '

DWN BY: AJK	SCALE: AS SHOWN	DATE: 2017–06–01	DWG No:	REV.: 0
CHK'D: BH	PLOT: 20180510.1559	CADFILE: 635544–X2R2	635544-315	

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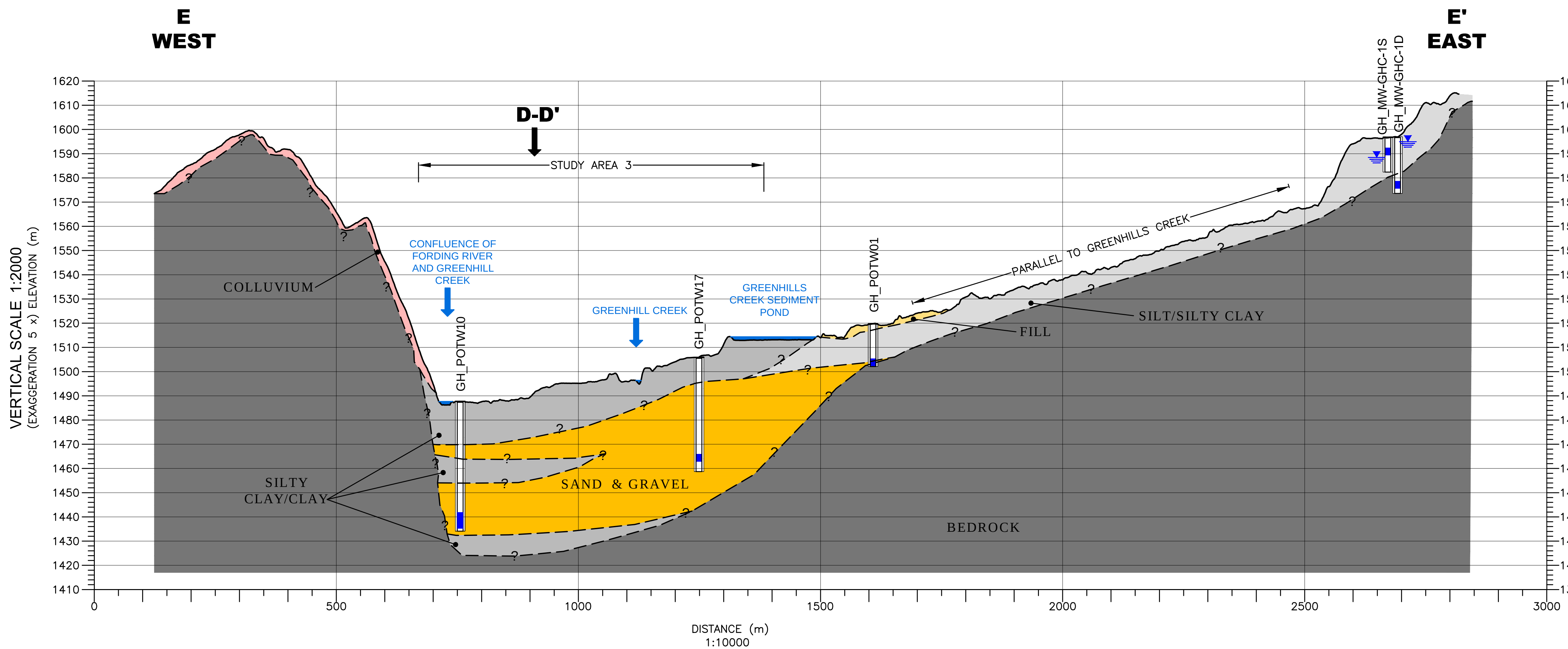

LEGEND

- FILL
- COLLUVIUM
- SAND & GRAVEL
- SAND
- SILT
- CLAY
- BEDROCK

INFERRED STRATIGRAPHIC BOUNDARY

GROUNDWATER ELEVATION (2016 Q4 MANUAL WATER LEVEL MEASUREMENT)

BOREHOLE LEGEND

EV_BCgw (OS~70m)

WELL OFFSET FROM SECTION LINE

50 mmø SOLID PVC PIPE

50 mmø SLOTTED PVC PIPE

END OF BOREHOLE

NOTES

1. THE CROSS SECTION DEPICTED IS BASED ON INTERPRETATION OF LIMITED GEOLOGICAL DATA. ACTUAL GEOLOGICAL CONDITIONS MAY BE DIFFERENT FROM THOSE INTERPRETED.
2. INFORMATION PRESENTED IS WITHIN 25m OF SECTION LINE UNLESS INDICATED OTHERWISE ON DRAWING.
3. ORIGINAL DRAWING IN COLOUR.
4. DETAILED INSTALL RECORDS WERE NOT AVAILABLE FOR WELL GH_POTW01 AND GH_POTW10. ESTIMATED 6m SCREEN.
5. GROUND SURFACE ELEVATION OF WELLS WAS OBTAINED FROM LIDAR. GROUNDWATER ELEVATIONS SHOWN ON SECTIONS WERE CALCULATED USING LIDAR GROUND SURFACE ELEVATIONS.

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
–	–	–

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
0	2017–09–28	ISSUED TO CLIENT	AJK	LH

SNC • LAVALIN

CLIENT NAME: TECK COAL LTD.

PROJECT LOCATION: ELK VALLEY BC

TITLE: STUDY AREA 3
INFERRED GEOLOGICAL CROSS SECTION E-E '

DWN BY: AJK	SCALE: AS SHOWN	DATE: 2017–06–01	DWG No: 635544-316	REV.: 0
CHK'D: BH	PLOT: 20180510.1559	CADFILE: 635544–X2R2		

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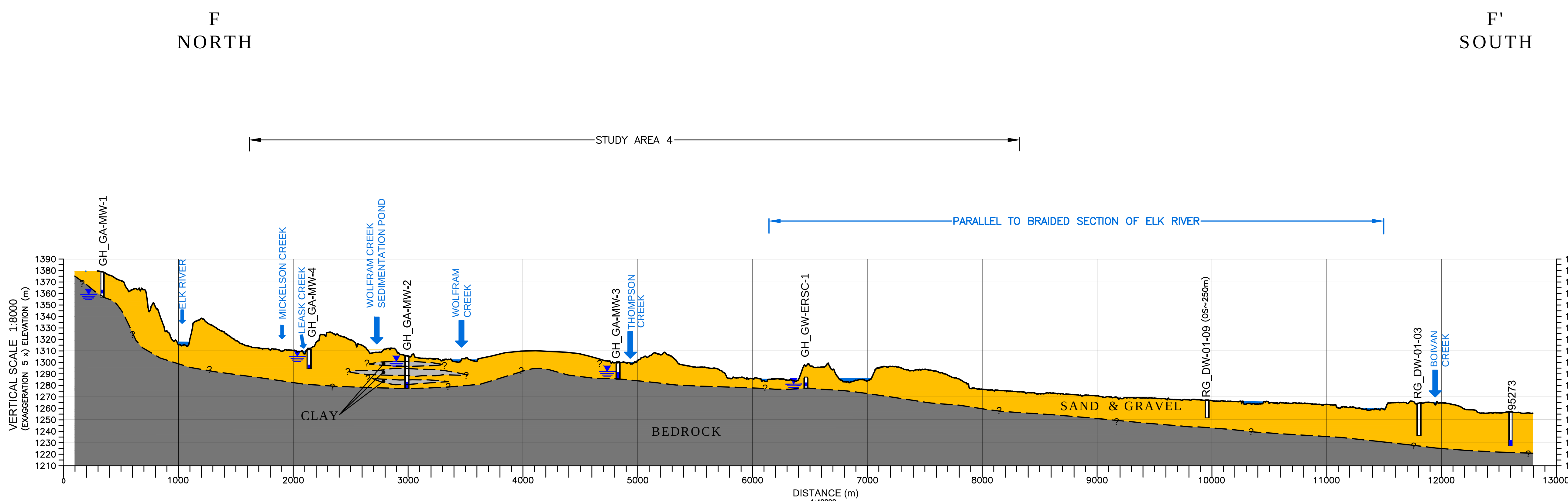

LEGEND

- FILL
- COLLUVIUM
- SAND & GRAVEL
- SAND
- SILT
- CLAY
- BEDROCK

INFERRED STRATIGRAPHIC BOUNDARY

GROUNDWATER ELEVATION (2016 Q4 MANUAL WATER LEVEL MEASUREMENT)

BOREHOLE LEGEND

EV_BCgw (OS~70m)

WELL OFFSET FROM SECTION LINE

50 mmø SOLID PVC PIPE

50 mmø SLOTTED PVC PIPE

END OF BOREHOLE

NOTES

1. THE CROSS SECTION DEPICTED IS BASED ON INTERPRETATION OF LIMITED GEOLOGICAL DATA. ACTUAL GEOLOGICAL CONDITIONS MAY BE DIFFERENT FROM THOSE INTERPRETED.
2. INFORMATION PRESENTED IS WITHIN 25m OF SECTION LINE UNLESS INDICATED OTHERWISE ON DRAWING.
3. ORIGINAL DRAWING IN COLOUR.
4. GROUND SURFACE ELEVATION OF WELLS WAS OBTAINED FROM LIDAR. GROUNDWATER ELEVATIONS SHOWN ON SECTIONS WERE CALCULATED USING LIDAR GROUND SURFACE ELEVATIONS.

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
–	–	–

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
0	2017–09–28	ISSUED TO CLIENT	AJK	LH

SNC·LAVALIN

CLIENT NAME: TECK COAL LTD.

PROJECT LOCATION: ELK VALLEY BC

TITLE: STUDY AREA 4
INFERRED GEOLOGICAL CROSS SECTION F-F '

DWN BY: AJK	SCALE: AS SHOWN	DATE: 2017–06–01	DWG No:	REV.: 0
CHK'D: BH	PLOT: 20180510.1559	CADFILE: 635544–X2R2	635544-317	

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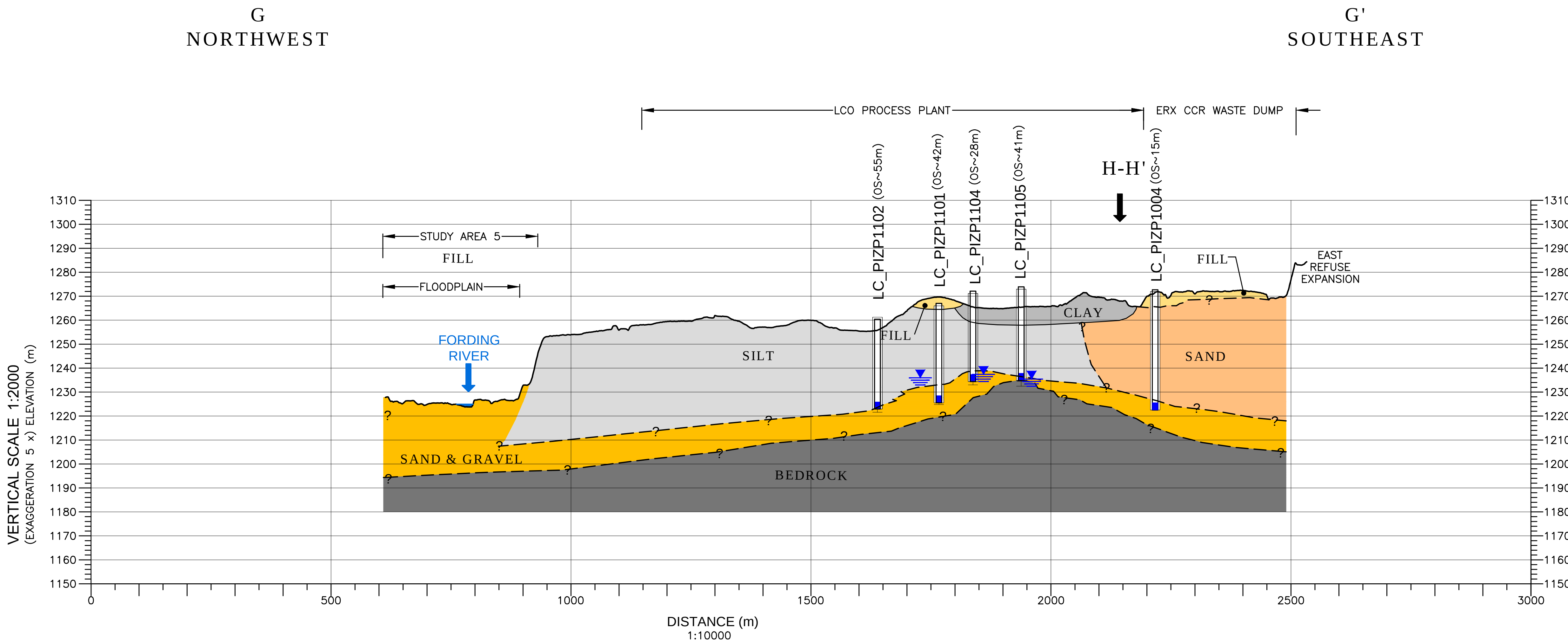

LEGEND

- FILL
- COLLUVIUM
- SAND & GRAVEL
- SAND
- SILT
- CLAY
- BEDROCK

BOREHOLE LEGEND

- INFERRED STRATIGRAPHIC BOUNDARY
- GROUNDWATER ELEVATION (2016 Q4 MANUAL WATER LEVEL MEASUREMENT)

EV_BCgw (OS~70m)

- WELL OFFSET FROM SECTION LINE
- 50 mmø SOLID PVC PIPE
- 50 mmø SLOTTED PVC PIPE
- END OF BOREHOLE

NOTES

1. THE CROSS SECTION DEPICTED IS BASED ON INTERPRETATION OF LIMITED GEOLOGICAL DATA. ACTUAL GEOLOGICAL CONDITIONS MAY BE DIFFERENT FROM THOSE INTERPRETED.
2. INFORMATION PRESENTED IS WITHIN 25m OF SECTION LINE UNLESS INDICATED OTHERWISE ON DRAWING.
3. ORIGINAL DRAWING IN COLOUR.
4. GROUND SURFACE ELEVATION OF WELLS WAS OBTAINED FROM LIDAR. GROUNDWATER ELEVATIONS SHOWN ON SECTIONS WERE CALCULATED USING LIDAR GROUND SURFACE ELEVATIONS.

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
–	–	–

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
0	2017-09-28	ISSUED TO CLIENT	AJK	LH

SNC • LAVALIN

CLIENT NAME: TECK COAL LTD.

PROJECT LOCATION: ELK VALLEY BC

TITLE: STUDY AREA 5/6 INFERRED GEOLOGICAL CROSS SECTION G-G '

DWN BY: AJK	SCALE: AS SHOWN	DATE: 2017-06-01	DWG No:	REV.: 0
CHK'D: BH	PLOT: 20180510.1559	CADFILE: 635544-X2R2	635544-318	

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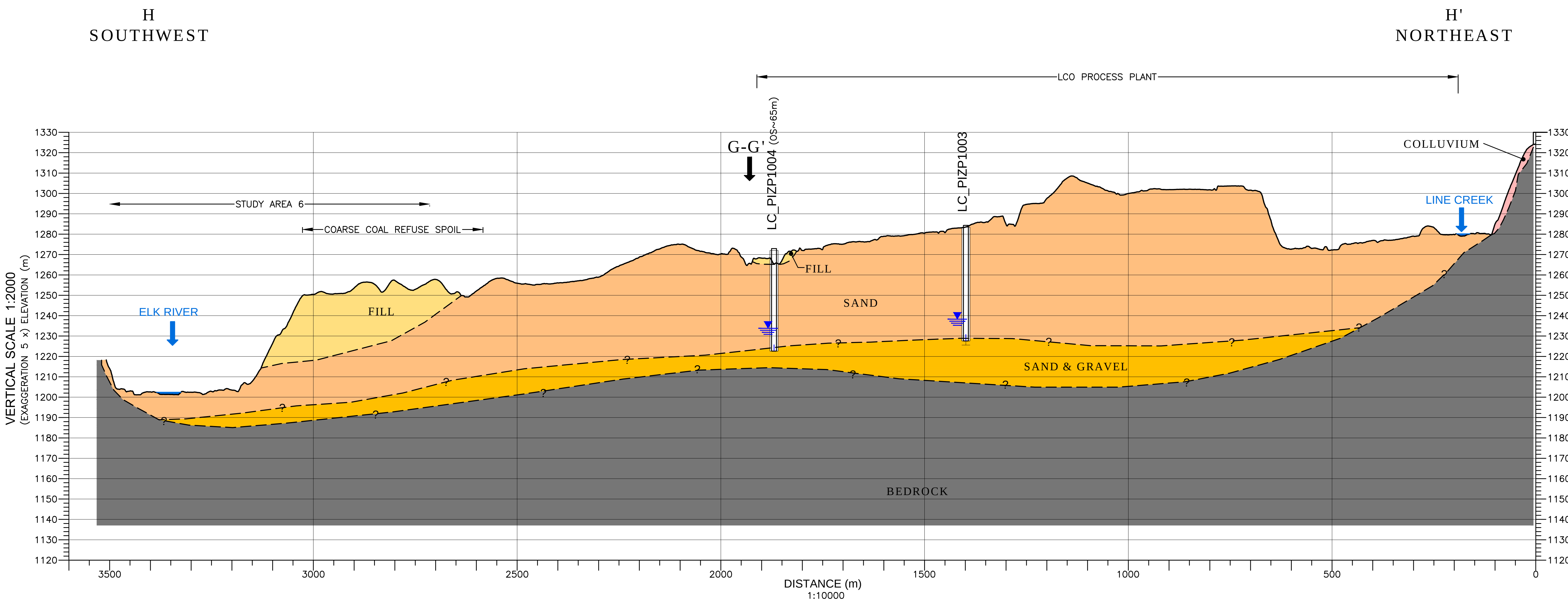

LEGEND

	FILL
	COLLUVIUM
	SAND & GRAVEL
	SAND
	SILT
	CLAY
	BEDROCK

INFERRED STRATIGRAPHIC BOUNDARY

GROUNDWATER ELEVATION (2010 Q1 MANUAL WATER LEVEL MEASUREMENT)

BOREHOLE LEGEND

EV_BCgw (OS~70m)

WELL OFFSET FROM SECTION LINE

50 mmø SOLID PVC PIPE

50 mmø SLOTTED PVC PIPE

END OF BOREHOLE

NOTES

1. THE CROSS SECTION DEPICTED IS BASED ON INTERPRETATION OF LIMITED GEOLOGICAL DATA. ACTUAL GEOLOGICAL CONDITIONS MAY BE DIFFERENT FROM THOSE INTERPRETED.
2. INFORMATION PRESENTED IS WITHIN 25m OF SECTION LINE UNLESS INDICATED OTHERWISE ON DRAWING.
3. ORIGINAL DRAWING IN COLOUR.
4. GROUND SURFACE ELEVATION OF WELLS WAS OBTAINED FROM LIDAR. GROUNDWATER ELEVATIONS SHOWN ON SECTIONS WERE CALCULATED USING LIDAR GROUND SURFACE ELEVATIONS.

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
-	-	-

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
0	2017-09-28	ISSUED TO CLIENT	AJK	LH

SNC • LAVALIN

CLIENT NAME: TECK COAL LTD.

PROJECT LOCATION: ELK VALLEY BC

TITLE: STUDY AREA 5/6 INFERRED GEOLOGICAL CROSS SECTION H-H '

DWN BY: AJK	SCALE: AS SHOWN	DATE: 2017-06-01	DWG No: 635544-319 REV.: 0
CHK'D: BH	PLOT: 20180510.1559	CADFILE: 635544-X2R2	

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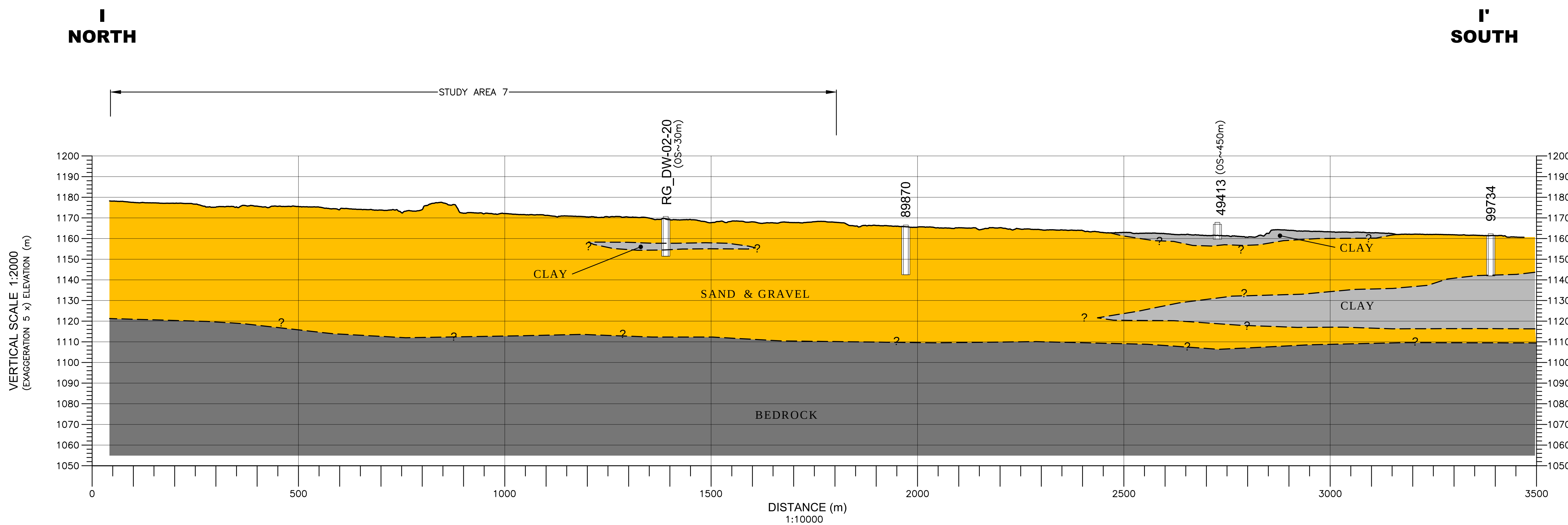

LEGEND

- FILL
- COLLUVIUM
- SAND & GRAVEL
- SAND
- SILT
- CLAY
- BEDROCK
- INFERRED STRATIGRAPHIC BOUNDARY

BOREHOLE LEGEND

EV_BCgw (OS~70m)

- WELL OFFSET FROM SECTION LINE
- 50 mmø SOLID PVC PIPE
- 50 mmø SLOTTED PVC PIPE
- END OF BOREHOLE

NOTES

1. THE CROSS SECTION DEPICTED IS BASED ON INTERPRETATION OF LIMITED GEOLOGICAL DATA. ACTUAL GEOLOGICAL CONDITIONS MAY BE DIFFERENT FROM THOSE INTERPRETED. REFER TO PLAN MAP 626147-104 FOR LOCATION OF CROSS SECTION LINE.
2. INFORMATION PRESENTED IS WITHIN 25m OF SECTION LINE UNLESS INDICATED OTHERWISE ON DRAWING.
3. ORIGINAL DRAWING IN COLOUR.
4. GROUND SURFACE ELEVATION OF WELLS WAS OBTAINED FROM LIDAR.

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
-	-	-

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
0	2017-09-28	ISSUED TO CLIENT	AJK	LH

SNC • LAVALIN

CLIENT NAME: TECK COAL LTD.	PROJECT LOCATION: ELK VALLEY BC

TITLE: STUDY AREA 7
INFERRED GEOLOGICAL CROSS SECTION I-I '

DWN BY: AJK	SCALE: AS SHOWN	DATE: 2017–06–01	DWG No: 635544-320 REV.: 0
CHK'D: BH	PLOT: 20180510.1559	CADFILE: 635544–X2R2	

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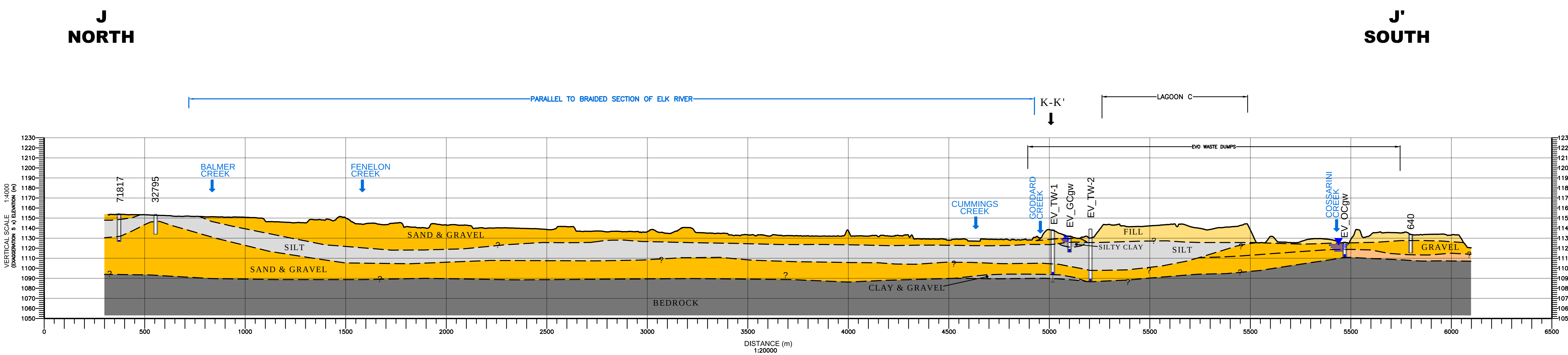

LEGEND

- FILL
- COLLUVIUM
- SAND & GRAVEL
- SAND
- SILT
- CLAY
- BEDROCK

INFERRED STRATIGRAPHIC BOUNDARY

GROUNDWATER ELEVATION (2016 Q4 MANUAL WATER LEVEL MEASUREMENT)

BOREHOLE LEGEND

EV_BCgw (OS~70m)

WELL OFFSET FROM SECTION LINE

50 mmø SOLID PVC PIPE

50 mmø SLOTTED PVC PIPE

END OF BOREHOLE

NOTES

1. THE CROSS SECTION DEPICTED IS BASED ON INTERPRETATION OF LIMITED GEOLOGICAL DATA. ACTUAL GEOLOGICAL CONDITIONS MAY BE DIFFERENT FROM THOSE INTERPRETED.
2. INFORMATION PRESENTED IS WITHIN 25m OF SECTION LINE UNLESS INDICATED OTHERWISE ON DRAWING.
3. ORIGINAL DRAWING IN COLOUR.
4. GROUND SURFACE ELEVATION OF WELLS WAS OBTAINED FROM LIDAR. GROUNDWATER ELEVATIONS SHOWN ON SECTIONS WERE CALCULATED USING LIDAR GROUND SURFACE ELEVATIONS.

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
-	-	-

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
0	2017-09-28	ISSUED TO CLIENT	AJK	LH

SNC·LAVALIN

CLIENT NAME: TECK COAL LTD.

PROJECT LOCATION: ELK VALLEY BC

TITLE: STUDY AREA 8 INFERRED GEOLOGICAL CROSS SECTION J-J '

DWN BY: AJK	SCALE: AS SHOWN	DATE: 2017-06-01	DWG No: 635544-321 REV.: 0
CHK'D: BH	PLOT: 20180510.1559	CADFILE: 635544-X2R2	

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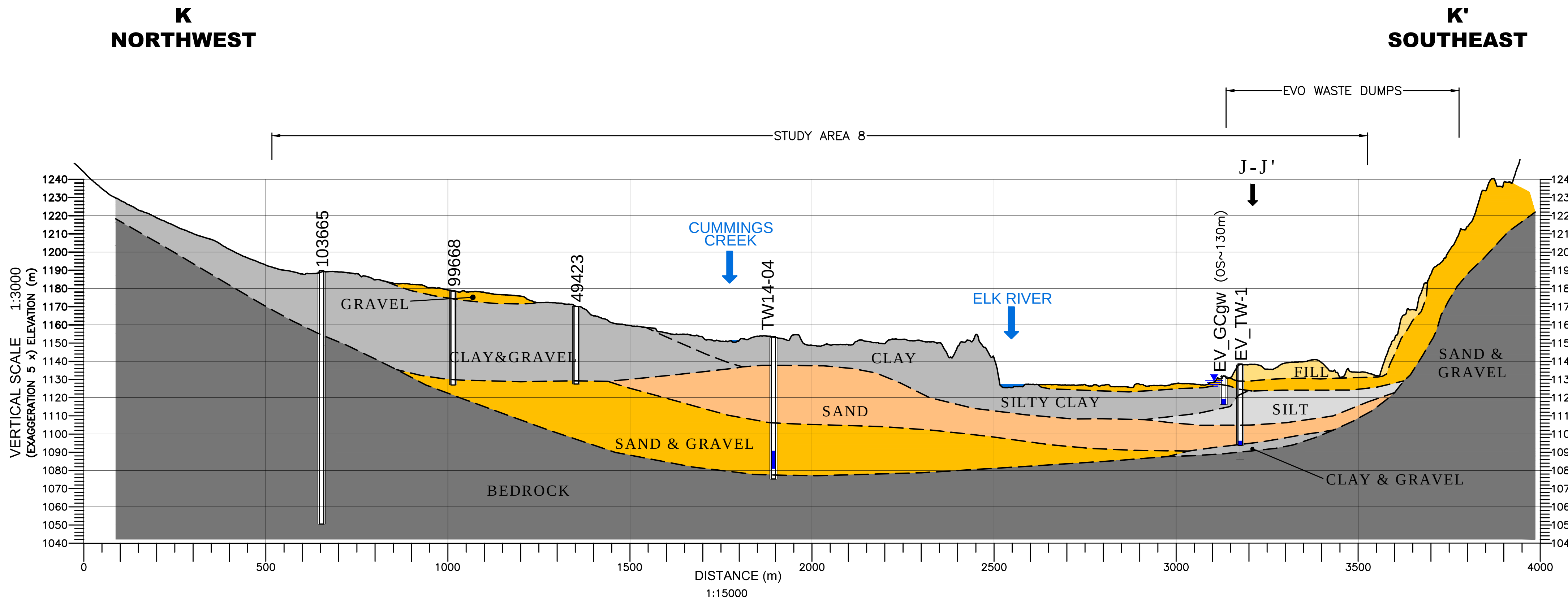

LEGEND

- FILL
- COLLUVIUM
- SAND & GRAVEL
- SAND
- SILT
- CLAY
- BEDROCK

INFERRED STRATIGRAPHIC BOUNDARY

GROUNDWATER ELEVATION (2016 Q4 MANUAL WATER LEVEL MEASUREMENT)

BOREHOLE LEGEND

EV_BCgw (OS~70m)

WELL OFFSET FROM SECTION LINE

50 mmø SOLID PVC PIPE

50 mmø SLOTTED PVC PIPE

END OF BOREHOLE

NOTES

1. THE CROSS SECTION DEPICTED IS BASED ON INTERPRETATION OF LIMITED GEOLOGICAL DATA. ACTUAL GEOLOGICAL CONDITIONS MAY BE DIFFERENT FROM THOSE INTERPRETED.
2. INFORMATION PRESENTED IS WITHIN 25m OF SECTION LINE UNLESS INDICATED OTHERWISE ON DRAWING.
3. ORIGINAL DRAWING IN COLOUR.
4. GROUND SURFACE ELEVATION OF WELLS WAS OBTAINED FROM LIDAR. GROUNDWATER ELEVATIONS SHOWN ON SECTIONS WERE CALCULATED USING LIDAR GROUND SURFACE ELEVATIONS.

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
–	–	–

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
0	2017–09–28	ISSUED TO CLIENT	AJK	LH

SNC·LAVALIN

CLIENT NAME: TECK COAL LTD.

PROJECT LOCATION: ELK VALLEY BC

TITLE: STUDY AREA 8 INFERRED GEOLOGICAL CROSS SECTION K-K'

DWN BY: AJK	SCALE: AS SHOWN	DATE: 2017–06–01	DWG No:	REV.: 0
CHK'D: BH	PLOT: 20180510.1559	CADFILE: 635544–X2R2	635544-322	

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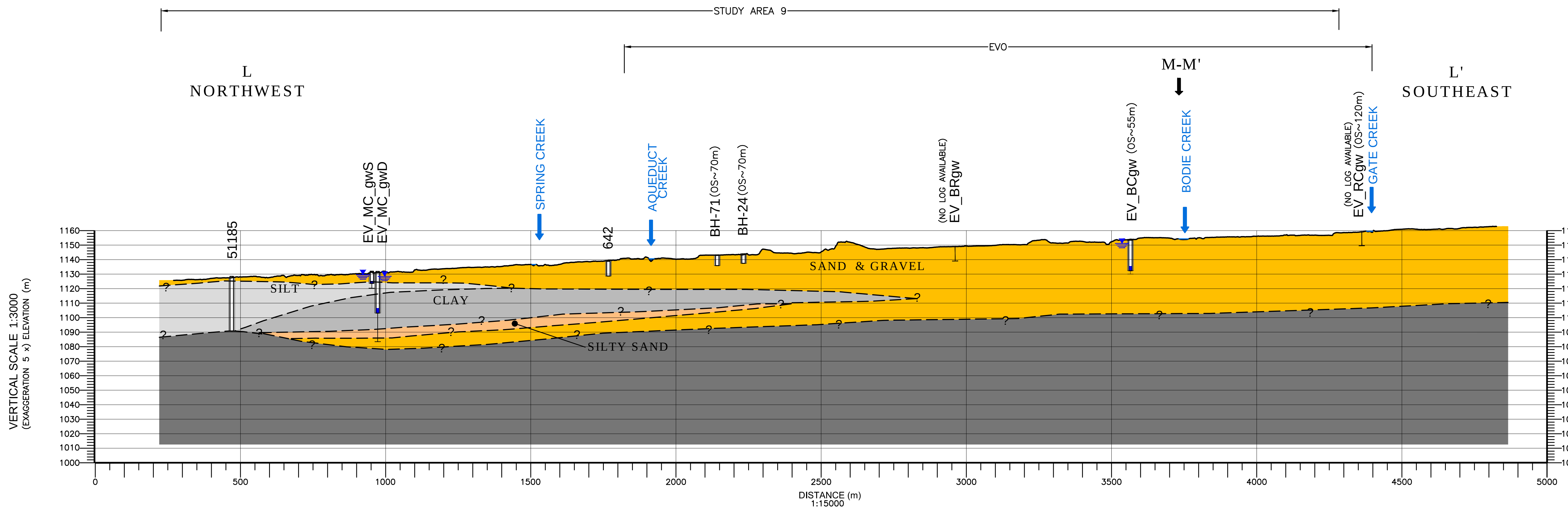

LEGEND

- FILL
- COLLUVIUM
- SAND & GRAVEL
- SAND
- SILT
- CLAY
- BEDROCK
- INFERRED STRATIGRAPHIC BOUNDARY
- GROUNDWATER ELEVATION (2016 Q4 MANUAL WATER LEVEL MEASUREMENT)

BOREHOLE LEGEND

EV_BCgw (OS~70m)

- WELL OFFSET FROM SECTION LINE
- 50 mmø SOLID PVC PIPE
- 50 mmø SLOTTED PVC PIPE
- END OF BOREHOLE

NOTES

1. THE CROSS SECTION DEPICTED IS BASED ON INTERPRETATION OF LIMITED GEOLOGICAL DATA. ACTUAL GEOLOGICAL CONDITIONS MAY BE DIFFERENT FROM THOSE INTERPRETED.
2. INFORMATION PRESENTED IS WITHIN 25m OF SECTION LINE UNLESS INDICATED OTHERWISE ON DRAWING.
3. ORIGINAL DRAWING IN COLOUR.
4. GROUND SURFACE ELEVATION OF WELLS WAS OBTAINED FROM LIDAR. GROUNDWATER ELEVATIONS SHOWN ON SECTIONS WERE CALCULATED USING LIDAR GROUND SURFACE ELEVATIONS.

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
–	–	–

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
0	2017-09-28	ISSUED TO CLIENT	AJK	LH

SNC · LAVALIN

CLIENT NAME: TECK COAL LTD.

PROJECT LOCATION: ELK VALLEY BC

TITLE: STUDY AREA 9
INFERRED GEOLOGICAL CROSS SECTION L-L '

DWN BY: AJK	SCALE: AS SHOWN	DATE: 2017-06-01	DWG No: 635544-323 REV.: 0
CHK'D: BH	PLOT: 20180510.1559	CADFILE: 635544-X2R2	

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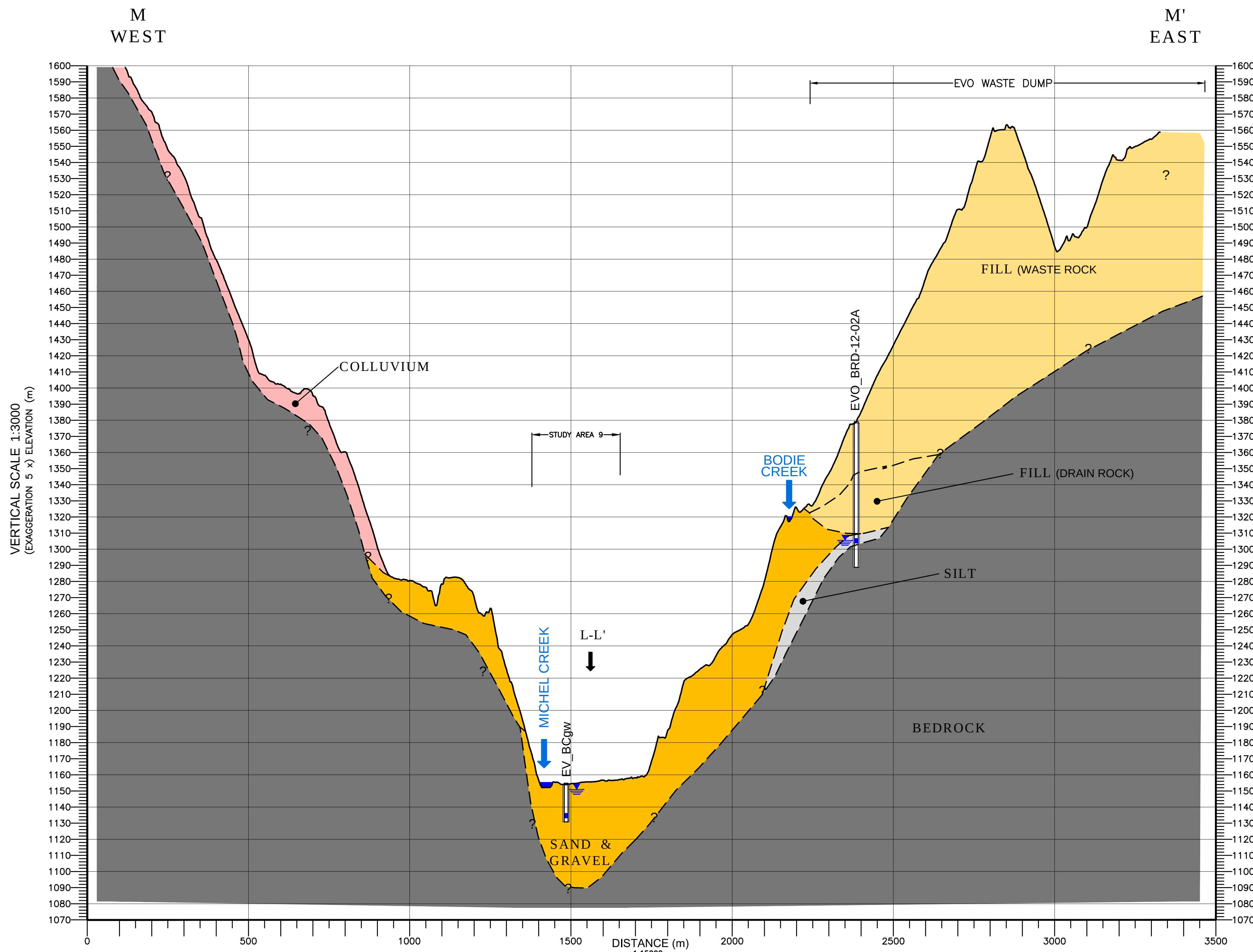


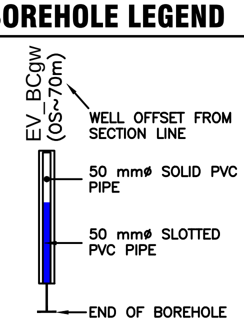
LEGEND

- FILL
- COLLUVIUM
- SAND & GRAVEL
- SAND
- SILT
- CLAY
- BEDROCK

INFERRED STRATIGRAPHIC BOUNDARY

GROUNDWATER ELEVATION (2016 Q4 MANUAL WATER LEVEL MEASUREMENT)

BOREHOLE LEGEND



NOTES

1. THE CROSS SECTION DEPICTED IS BASED ON INTERPRETATION OF LIMITED GEOLOGICAL DATA. ACTUAL GEOLOGICAL CONDITIONS MAY BE DIFFERENT FROM THOSE INTERPRETED.
2. INFORMATION PRESENTED IS WITHIN 25m OF SECTION LINE UNLESS INDICATED OTHERWISE ON DRAWING.
3. ORIGINAL DRAWING IN COLOUR.
4. GROUND ELEVATION FOR SECTIONS WAS OBTAINED FROM LIDAR. GROUNDWATER ELEVATIONS WERE CALCULATED USING LIDAR GROUND SURFACE ELEVATIONS.
5. DEPTH TO GROUNDWATER AT EVO_BRD-12-02A WAS MEASURED ON 2012/09/27.

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
–	–	–

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
0	2017–09–28	ISSUED TO CLIENT	AJK	LH

SNC · LAVALIN

CLIENT NAME: TECK COAL LTD.

PROJECT LOCATION: ELK VALLEY BC

TITLE: STUDY AREA 9 INFERRED GEOLOGICAL CROSS SECTION M-M '

DWN BY: AJK	SCALE: AS SHOWN	DATE: 2017–06–01	DWG No: 635544-324 REV.: 0
CHK'D: BH	PLOT: 20180510.1559	CADFILE:635544–X2R2	

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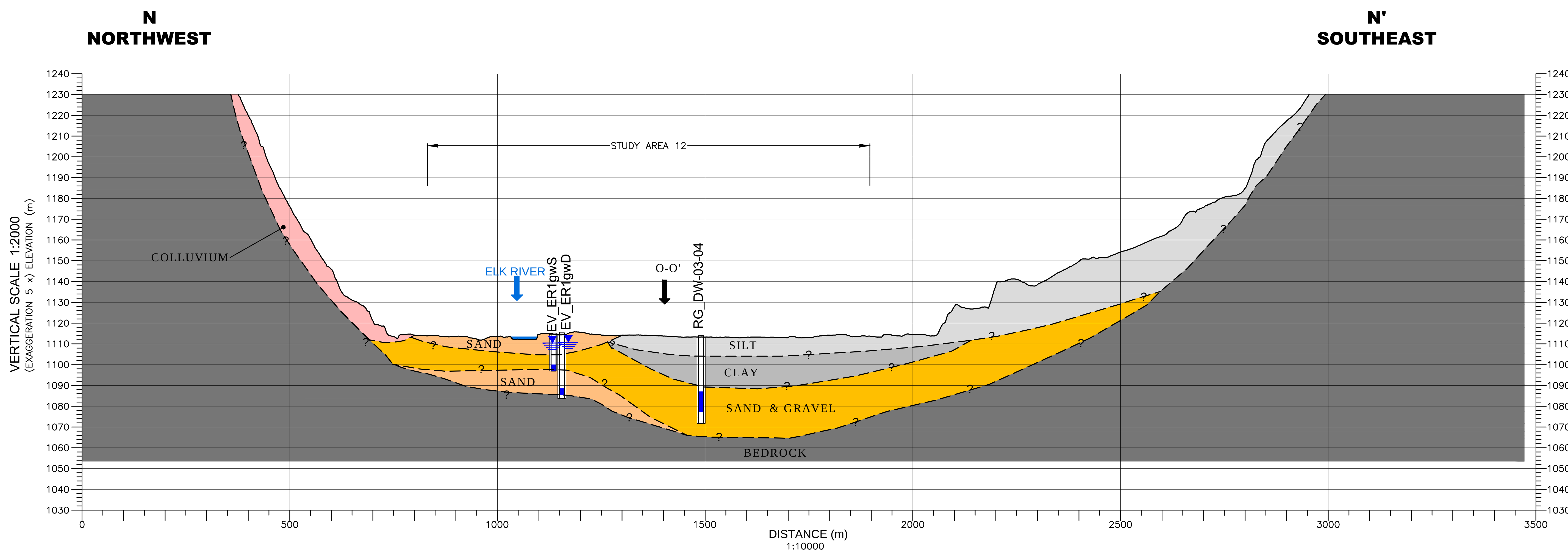

LEGEND

- FILL
- COLLUVIUM
- SAND & GRAVEL
- SAND
- SILT
- CLAY
- BEDROCK

INFERRED STRATIGRAPHIC BOUNDARY

GROUNDWATER ELEVATION (2016 Q4 MANUAL WATER LEVEL MEASUREMENT)

BOREHOLE LEGEND

EV_BCgw (OS~70m) — WELL OFFSET FROM SECTION LINE

50 mmø SOLID PVC PIPE

50 mmø SLOTTED PVC PIPE

END OF BOREHOLE

NOTES

1. THE CROSS SECTION DEPICTED IS BASED ON INTERPRETATION OF LIMITED GEOLOGICAL DATA. ACTUAL GEOLOGICAL CONDITIONS MAY BE DIFFERENT FROM THOSE INTERPRETED.
2. INFORMATION PRESENTED IS WITHIN 25m OF SECTION LINE UNLESS INDICATED OTHERWISE ON DRAWING.
3. ORIGINAL DRAWING IN COLOUR.
4. GROUND SURFACE ELEVATION OF WELLS WAS OBTAINED FROM LIDAR. GROUNDWATER ELEVATIONS SHOWN ON SECTIONS WERE CALCULATED USING LIDAR GROUND SURFACE ELEVATIONS.

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
-	-	-

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
0	2017-09-28	ISSUED TO CLIENT	AJK	LH

SNC • LAVALIN

CLIENT NAME: TECK COAL LTD.

PROJECT LOCATION: ELK VALLEY BC

TITLE: STUDY AREA 12 INFERRED GEOLOGICAL CROSS SECTION N-N '

DWN BY: AJK	SCALE: AS SHOWN	DATE: 2017-06-01	DWG No: REV.: 0
CHK'D: BH	PLOT: 20180510.1559	CADFILE:635544-X2R2	635544-325

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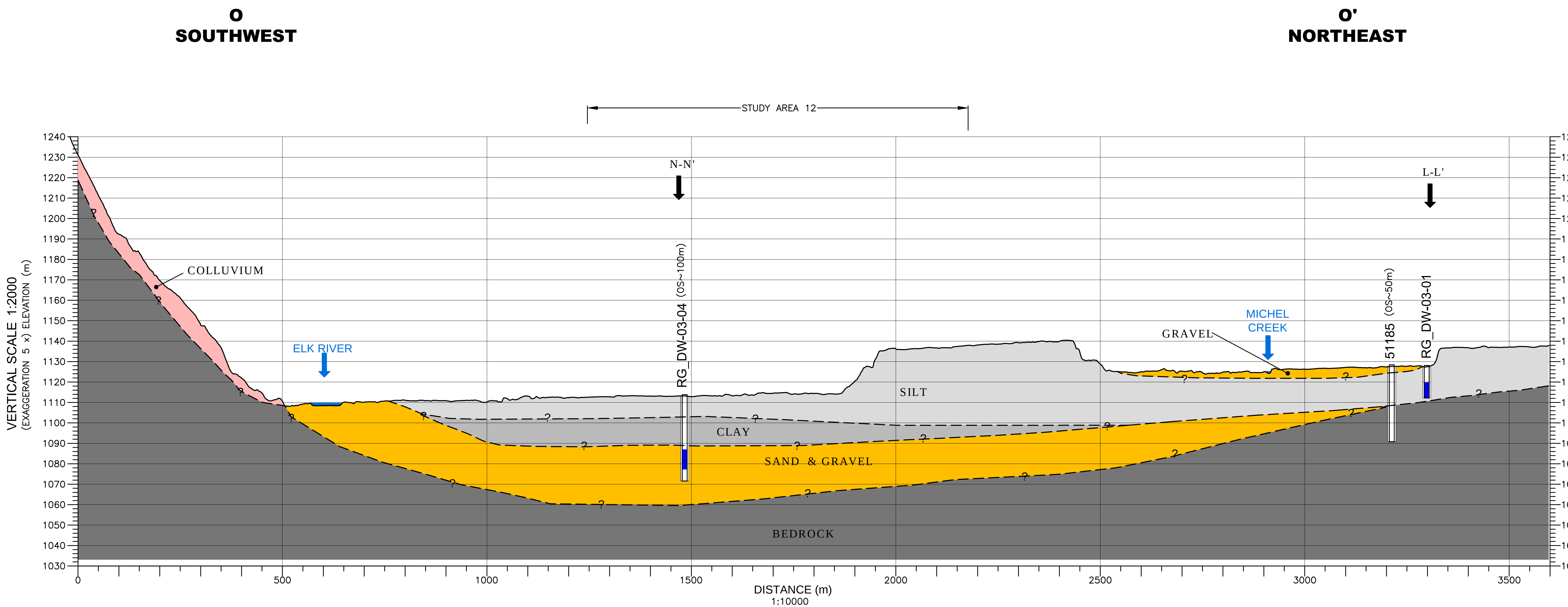

LEGEND

- FILL
- COLLUVIUM
- SAND & GRAVEL
- SAND
- SILT
- CLAY
- BEDROCK

— — — INFERRED STRATIGRAPHIC BOUNDARY

BOREHOLE LEGEND

EV_BCgw (OS~70m)

WELL OFFSET FROM SECTION LINE

50 mmø SOLID PVC PIPE

50 mmø SLOTTED PVC PIPE

END OF BOREHOLE

NOTES

1. THE CROSS SECTION DEPICTED IS BASED ON INTERPRETATION OF LIMITED GEOLOGICAL DATA. ACTUAL GEOLOGICAL CONDITIONS MAY BE DIFFERENT FROM THOSE INTERPRETED.
2. INFORMATION PRESENTED IS WITHIN 25m OF SECTION LINE UNLESS INDICATED OTHERWISE ON DRAWING.
3. ORIGINAL DRAWING IN COLOUR.
4. GROUND SURFACE ELEVATION OF WELLS WAS OBTAINED FROM LIDAR.

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
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REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
0	2017–09–28	ISSUED TO CLIENT	AJK	LH

SNC·LAVALIN

CLIENT NAME: TECK COAL LTD.

PROJECT LOCATION: ELK VALLEY BC

TITLE: STUDY AREA 12 INFERRED GEOLOGICAL CROSS SECTION O-O '

DWN BY: AJK	SCALE: AS SHOWN	DATE: 2017–06–01	DWG No: REV.: 0
CHK'D: BH	PLOT: 20180510.1559	CADFILE: 635544–X2R2	635544-326

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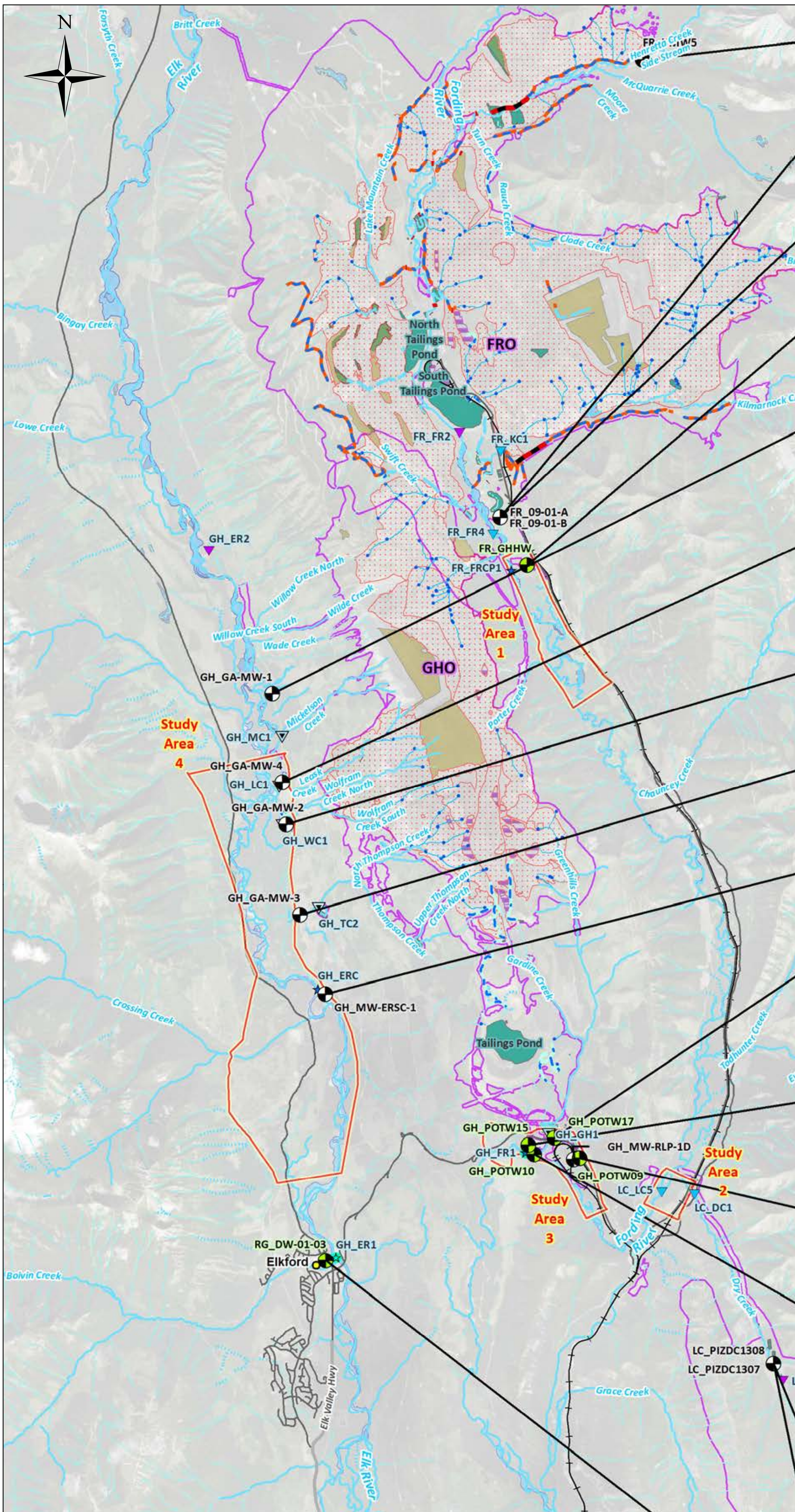

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
FR_HMW5	2017 06 21	< 0.005	43.2	< 0.0050	14.8
	2017 09 18	< 0.005	44.3	< 0.0050	0.334
	Duplicate	< 0.005	44.5	< 0.0050	0.595
	2017 11 14	< 0.005	45.4	< 0.0050	1.03
	Duplicate	-	-	-	-

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
FR_09-01-A	2017 03 08	47.2	481	0.0571	120
	2017 06 01	35.1	208	0.0269	112
	2017 09 12	21.2	347	0.0478	68.1
	2017 11 22	54.3	486	0.0471	166

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
FR_09-01-B	2017 03 08	25.9	409	0.0536	71.8
	2017 06 01	43.9	267	0.0209	126
	2017 09 12	12.7	296	0.035	44.2
	2017 11 22	29.6	407	0.0402	91.5

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
FR_GHHW	2017 02 27	46.6	287	0.0515	123
	2017 06 01	33.4	248	0.0408	93.5
	2017 09 13	27.3	195	0.0403	82.2
FR_GH_WELL4	2017 11 15	34.9	243	0.0297	92.8

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
GH_GA-MW-1	2017 01 30	1.27	204	0.0272	0.205
	2017 06 20	1.14	192	0.0307	0.169
	2017 09 19	0.177	344	< 0.035	0.137
	2017 10 19	0.523	295	0.0303	0.109

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
GH_GA-MW-4	2017 01 30	1.92	211	0.0128	3.16
	Duplicate	1.96	215	0.0131	3.03
	2017 06 20	3.18	63	0.0104	4.31
	Duplicate	3.17	63	0.0106	4.05
	2017 09 19	0.638	68	0.0053	1.83
	Duplicate	0.623	67.7	0.0074	1.77
	2017 11 27	1.73	66.4	0.0092	4.93
	Duplicate	1.74	66.7	0.0078	5.23

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
GH_GA-MW-2	2017 01 30	0.837	176	0.0401	7.87
	2017 06 20	1.50	171	0.0189	7.41
	2017 09 20	0.85	189	< 0.0050	9.49
	Duplicate	1.56	192	< 0.035	6.6
	2017 11 27	5.52	214	0.0584	18.9

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
GH_GA-MW-3	2017 01 30	< 0.005	33.3	< 0.0050	0.231
	2017 06 19	< 0.005	84	< 0.0050	0.354
	2017 09 20	< 0.005	38.7	< 0.0050	1.29
	2017 11 30	0.161	41.1	< 0.0050	19.4

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
GH_MW-ERSC-1	2017 01 31	0.018	15.8	0.0096	1.03
	Duplicate	0.020	16.1	0.0103	1.08
	2017 06 20	0.543	29.7	0.0185	2.85
	2017 09 20	0.608	59.6	0.0349	6.53
	2017 12 18	9.04	442	0.0777	68.7

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
GH_POTW17	2017 01 03	0.281	464	0.075	5.15
	2017 02 07	0.302	450	0.0665	6.93
	2017 06 19	0.505	475	0.063	9.83
	2017 07 05	0.414	448	0.0671	7.71
	2017 09 25	0.311	450	0.0539	4.98
	2017 11 21	0.415	450	0.0429	7.09

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
GH_POTW15	2017 02 07	0.0103	234	0.0229	0.197
	2017 06 19	0.390	190	0.0077	3.03
	2017 09 25	< 0.005	250	0.0212	0.103
	2017 11 16	< 0.005	254	0.0078	< 0.050

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
GH_POTW09	2017 02 07	0.0111	156	0.0191	0.951
	2017 06 22	0.0320	158	0.0085	1.48
	Duplicate	0.0323	158	0.0111	1.43
	2017 07 05	0.0375	159	0.0191	6.49
	2017 09 25	0.0154	160	0.0131	0.91
	2017 11 16	0.0184	162	0.0115	1.37

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
GH_POTW10	2017 02 07	0.675	182	0.0072	4.99
	Duplicate	0.677	182	0.0073	4.92
	2017 06 19	< 25	278	0.0184	0.173
	2017 09 25	0.453	191	0.0079	3.17
	2017 11 16	0.448	195	0.0101	3.71

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
LC_PIZDC1308	2017 03 13	0.0055	2.5	0.0091	< 0.050
	2017 06 12	0.159	4.74	0.133	0.301
	2017 09 19	< 0.005	1.92	0.023	< 0.050
	Duplicate	0.005	2.06	0.0253	< 0.050
	2017 11 01	0.0627	1.84	0.0361	< 0.050
	Duplicate	0.0075	2.02	0.0259	< 0.050

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
LC_PIZDC1307	2017 03 16	< 0.005	< 0.30	0.0121	< 0.050
	2017 06 12	< 0.005	< 0.30	0.0155	< 0.050
	2017 09 19	< 0.005	< 0.30	< 0.015	< 0.050
	2017 11 01	0.006	< 0.30	0.0337	0.14

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
RG_DW-01-03	2017 03 06	0.512	42.1	-	2.58
	2017 05 31	0.596	46	0.0055	2.8
	2017 08 22	0.655	44.8	0.0069	3.16
	2017 11 21	0.470	35.7	0.0134	2.53

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
RG_DW-01-07	2017 03 01	0.634	64.5	-	1.84
	2017 05 29	1.06	64	0.0547	1.68
	2017 08 21	0.997	65.1	0.0437	1.6
	2017 11 15	0.863	66.6	0.0408	1.92

Primary Screening Criteria	Nitrate Nitrogen (mg/L)	Sulphate (mg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
CSR Aquatic Life	400	1,280-4,290	0.5-4	20
CSR Irrigation Watering	n/a	n/a	5	20
CSR Livestock Watering	100	1,000	80	30
CSR Drinking Water	10	500	5	10

Secondary Screening Criteria	Dissolved Selenium (ug/L)
Guideline for Canadian Drinking Water Quality	50
Study Area 1	
Site Performance Objective: GH_FR1 (0200378)	80
Compliance Point: FR_FRCP1 (E300071)	130
Study Area 2 and 3	
Site Performance Objective: GH_FR1 (0200378)	80
Compliance Point: GH_FR1 (0200378)	80
Study Area 4	
Site Performance Objective: GH_ER1 (E206661)	19
Compliance Point: GH_ERC (E3000090)	15

Groundwater Stations
- Monitoring Well
- Supply Well
- Domestic Well

Surface Water Stations
- Compliance Point
- Order Station
- Order Station and Compliance Point
- Receiving Environment
- Authorized Discharge
- Monitoring

GREEN Below primary screening criteria
ORANGE Above at least one of the primary screening criteria
BLUE Selenium concentrations above at least one of the secondary screening criteria

Site Features
- Study Areas
- BC-Alberta Border
- Highway
- Secondary Road
- Rails
- Pit
- Stockpiles
- Waste Dump (Spoils)
- Mine Permitted Areas

Water Features
- Intermittent Stream
- Stream Ditch
- Indefinite Stream
- Stream
- Subsurface
- River Bed
- Settling/Tailings Pond
- River Bed
- Culvert
- Ditch
- Rock Drain
- Water Pipeline

Notes:
1. Intended for illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
1. Data provided by Teck Coal Ltd.
2. © 2018 Microsoft Corporation Earthstar Geographics SIO

Revisons:
0 - AO - 2018-03-28 -DRAFT - LH
1 - AO - 2018-05-10 - FINAL - AO

0 0.5 1 2 3 4 5 Kilometers

PROJECT LOCATION:
Elk Valley, BC

CLIENT NAME:
Teck Coal Ltd

SNC · LAVALIN

Spatial Distribution of Selected Groundwater Analytical Data - Study Areas 1 to 4

CHK'D: LH	DATE: 2018/05/15 SCALE: 1:100,000	Ref Num:	REV: 1
BY: AO	COORD SYS: NAD 1983 UTM Zone 11N	635544-327	

Project Path: P:\Current Projects\Teck Coal Ltd\SPO\635544\4.0 Execution\4.5 GIS and Drawings\Exports\2017 Annual Report

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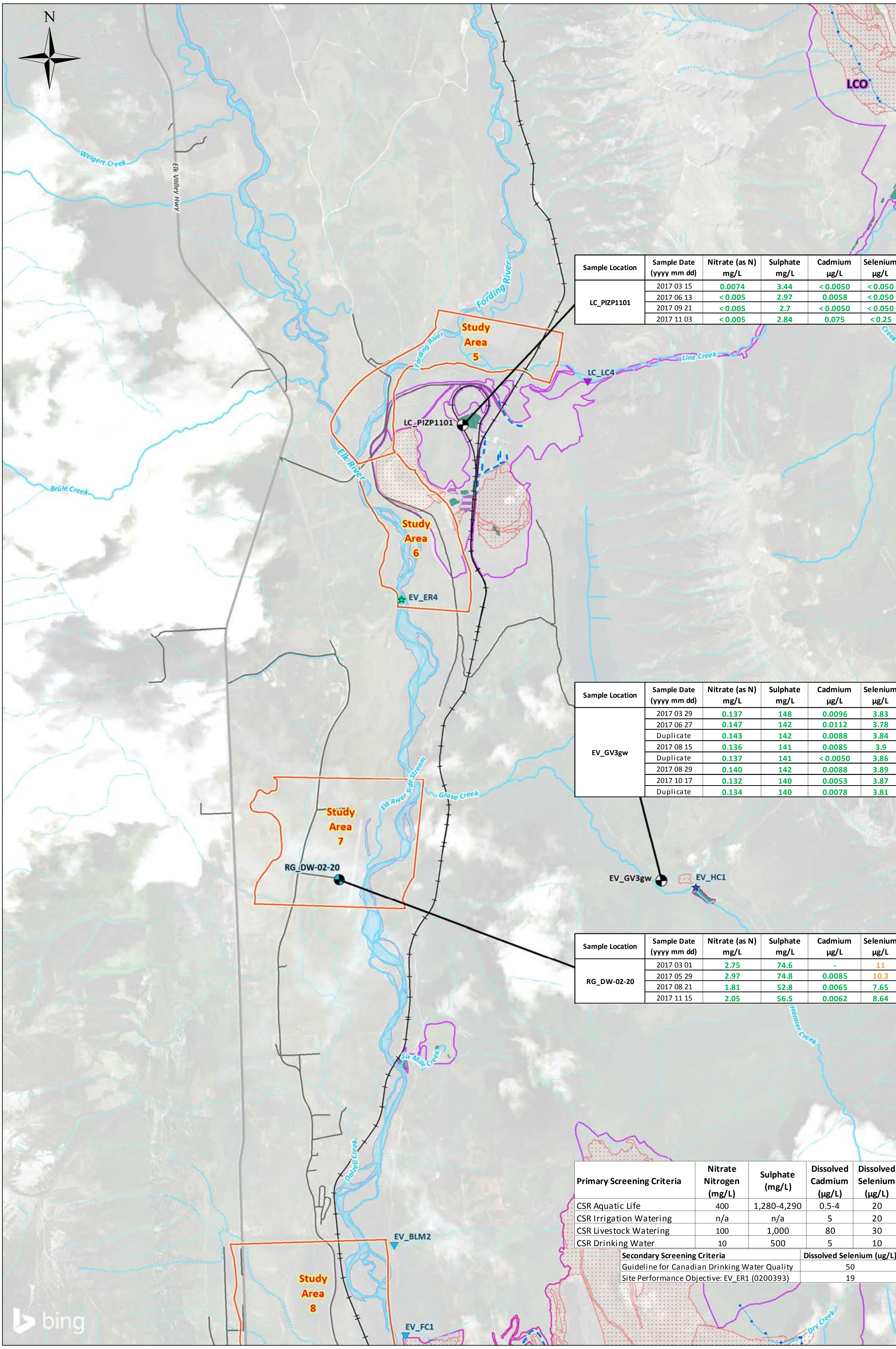

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
LC_PIZP1101	2017 03 15	0.0074	3.44	< 0.0050	< 0.050
	2017 06 13	< 0.005	2.97	0.0058	< 0.050
	2017 09 21	< 0.005	2.7	< 0.0050	< 0.050
	2017 11 03	< 0.005	2.84	0.075	< 0.25

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
EV_GV3gw	2017 03 29	0.137	148	0.0096	3.83
	2017 06 27	0.147	142	0.0112	3.78
	Duplicate	0.143	142	0.0088	3.84
	2017 08 15	0.136	141	0.0085	3.9
	Duplicate	0.137	141	< 0.0050	3.86
	2017 08 29	0.140	142	0.0088	3.89
	2017 10 17	0.132	140	0.0053	3.87
	Duplicate	0.134	140	0.0078	3.81

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
RG_DW-02-20	2017 03 01	2.75	74.6	-	11
	2017 05 29	2.97	74.8	0.0085	10.3
	2017 08 21	1.81	52.8	0.0065	7.65
	2017 11 15	2.05	56.5	0.0062	8.64

Primary Screening Criteria	Nitrate Nitrogen (mg/L)	Sulphate (mg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
CSR Aquatic Life	400	1,280-4,290	0.5-4	20
CSR Irrigation Watering	n/a	n/a	5	20
CSR Livestock Watering	100	1,000	80	30
CSR Drinking Water	10	500	5	10

Secondary Screening Criteria	Dissolved Selenium (ug/L)
Guideline for Canadian Drinking Water Quality	50
Site Performance Objective: EV_ER1 (0200393)	19

Groundwater Stations
- Monitoring Well
- Domestic Well

Surface Water Stations
- Compliance Point
- Order Station
- Receiving Environment
- Monitoring

Site Features
- Study Areas
- Highway
- Secondary Road
- Rails
- Pit
- Stockpiles
- Waste Dump (Spoils)
- Mine Permitted Areas

Water Features
- Intermittent Stream
- Stream Ditch
- Indefinite Stream
- Stream
- Subsurface
- River Bed
- Settling/Tailings Pond

GREEN Below primary screening criteria
ORANGE Above at least one of the primary screening criteria
BLUE Selenium concentrations above at least one of the secondary screening criteria

Notes:
1. Intended for illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
1. Data provided by Teck Coal Ltd.
2. © 2018 Microsoft Corporation © 2018 DigitalGlobe ©CNES (2018) Distribution Airbus DS

Revisons:
0 - AO - 2018-03-28 -DRAFT - LH
1 - AO - 2018-05-10 -FINAL - LH

0 0.25 0.5 1 1.5 2 2.5 Kilometers

PROJECT LOCATION:
Elk Valley, BC

CLIENT NAME:
Teck Coal Ltd

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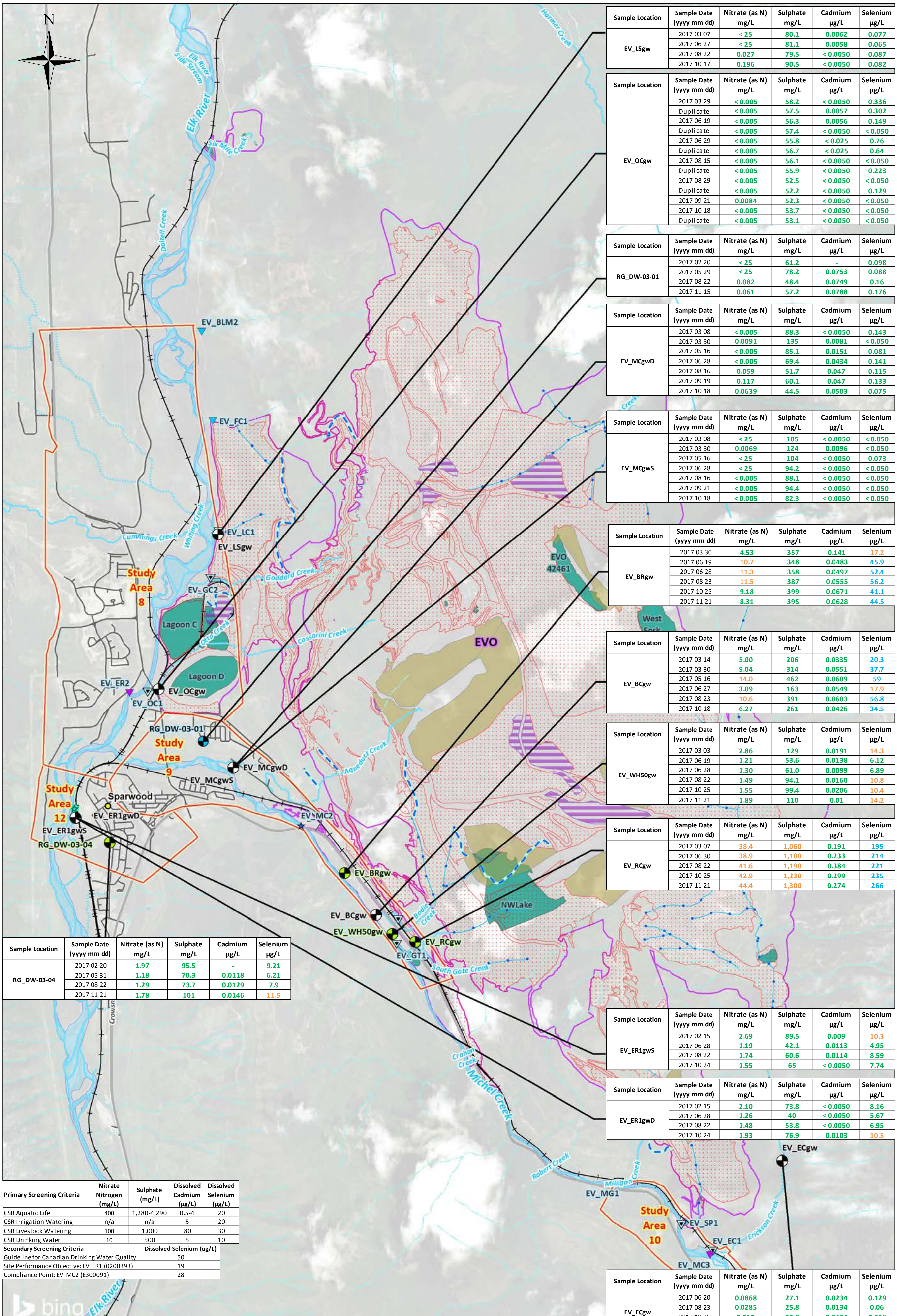
Spatial Distribution of Selected Groundwater Analytical Data - Study Areas 5 – 7

CHK'D: LH	DATE: 2018/05/15	SCALE: 1:50,000	Ref Num: 635544-328 REV: 1
BY: AO	COORD SYS: NAD 1983 UTM Zone 11N		

MXD Path: P:\Current Projects\Teck Coal Ltd\GIS\Map Series\RGMPAnnualReport_2017\635544-328_AnalyticalData.mxd

Project Path: P:\Current Projects\Teck Coal Ltd\SPO\635544\4.0 Execution\4.5 GIS and Drawings\Exports\2017 Annual Report



Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
EV_LSgw	2017 03 07	< 25	80.1	0.0062	0.077
	2017 06 27	< 25	81.1	0.0058	0.065
	2017 08 22	0.027	79.5	< 0.0050	0.087
	2017 10 17	0.196	90.5	< 0.0050	0.082

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
EV_OCgw	2017 03 29	< 0.005	58.2	< 0.0050	0.336
	Duplicate	< 0.005	57.5	0.0057	0.302
	2017 06 19	< 0.005	56.3	0.0056	0.149
	Duplicate	< 0.005	57.4	< 0.0050	< 0.050
	2017 06 29	< 0.005	55.8	< 0.025	0.76
	Duplicate	< 0.005	56.7	< 0.025	0.64
	2017 08 15	< 0.005	56.1	< 0.0050	< 0.050
	Duplicate	< 0.005	55.9	< 0.0050	0.223
	2017 08 29	< 0.005	52.5	< 0.0050	< 0.050
	Duplicate	< 0.005	52.2	< 0.0050	0.129
	2017 09 21	0.0084	52.3	< 0.0050	< 0.050
	2017 10 18	< 0.005	53.7	< 0.0050	< 0.050
	Duplicate	< 0.005	53.1	< 0.0050	< 0.050

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
RG_DW-03-01	2017 02 20	< 25	61.2	-	0.098
	2017 05 29	< 25	78.2	0.0753	0.088
	2017 08 22	0.082	48.4	0.0749	0.16
	2017 11 15	0.061	57.2	0.0788	0.176

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
EV_MCgwD	2017 03 08	< 0.005	88.3	< 0.0050	0.143
	2017 03 30	0.0091	135	0.0081	< 0.050
	2017 05 16	< 0.005	85.1	0.0151	0.081
	2017 06 28	< 0.005	69.4	0.0434	0.141
	2017 08 16	0.059	51.7	0.047	0.115
	2017 09 19	0.117	60.1	0.047	0.133
	2017 10 18	0.0639	44.5	0.0503	0.075

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
EV_MCgwS	2017 03 08	< 25	105	< 0.0050	< 0.050
	2017 03 30	0.0069	124	0.0096	< 0.050
	2017 05 16	< 25	104	< 0.0050	0.073
	2017 06 28	< 25	94.2	< 0.0050	< 0.050
	2017 08 16	< 0.005	88.1	< 0.0050	< 0.050
	2017 09 21	< 0.005	94.4	< 0.0050	< 0.050
	2017 10 18	< 0.005	82.3	< 0.0050	< 0.050

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
EV_BRgw	2017 03 30	4.53	357	0.141	17.2
	2017 06 19	10.7	348	0.0483	45.9
	2017 06 28	11.3	358	0.0497	52.4
	2017 08 23	11.5	387	0.0555	56.2
	2017 10 25	9.18	399	0.0671	41.1
	2017 11 21	8.31	395	0.0628	44.5

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
EV_BCgw	2017 03 14	5.00	206	0.0335	20.3
	2017 03 30	9.04	314	0.0551	37.7
	2017 05 16	14.0	462	0.0609	59
	2017 06 27	3.09	163	0.0549	17.9
	2017 08 23	10.6	391	0.0603	56.8
	2017 10 18	6.27	261	0.0426	34.5

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
EV_WH50gw	2017 03 03	2.86	129	0.0191	14.3
	2017 06 19	1.21	53.6	0.0138	6.12
	2017 06 28	1.30	61.0	0.0099	6.89
	2017 08 22	1.49	94.1	0.0160	10.8
	2017 10 25	1.55	99.4	0.0206	10.4
	2017 11 21	1.89	110	0.01	14.2

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
EV_RCgw	2017 03 07	38.4	1,060	0.191	195
	2017 06 30	38.9	1,100	0.233	214
	2017 08 22	41.6	1,190	0.384	221
	2017 10 25	42.9	1,230	0.299	235
	2017 11 21	44.4	1,300	0.274	266

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
RG_DW-03-04	2017 02 20	1.97	95.5	-	9.21
	2017 05 31	1.18	70.3	0.0118	6.21
	2017 08 22	1.29	73.7	0.0129	7.9
	2017 11 21	1.78	101	0.0146	11.5

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
EV_ER1gwS	2017 02 15	2.69	89.5	0.009	10.3
	2017 06 28	1.19	42.1	0.0113	4.95
	2017 08 22	1.74	60.6	0.0114	8.59
	2017 10 24	1.55	65	< 0.0050	7.74

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
EV_ER1gwD	2017 02 15	2.10	73.8	< 0.0050	8.16
	2017 06 28	1.26	40	< 0.0050	5.67
	2017 08 22	1.48	53.8	< 0.0050	6.95
	2017 10 24	1.93	76.9	0.0103	10.5

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
EV_ECgw	2017 06 20	0.0868	27.1	0.0234	0.129
	2017 08 23	0.0285	25.8	0.0134	0.06
	2017 10 25	0.215	25.8	0.0404	0.056
	2017 11 22	0.121	26.1	0.0429	0.212

Primary Screening Criteria	Nitrate Nitrogen (mg/L)	Sulphate (mg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
CSR Aquatic Life	400	1,280-4,290	0.5-4	20
CSR Irrigation Watering	n/a	n/a	5	20
CSR Livestock Watering	100	1,000	80	30
CSR Drinking Water	10	500	5	10

Secondary Screening Criteria	Dissolved Selenium (ug/L)
Guideline for Canadian Drinking Water Quality	50
Site Performance Objective: EV_ER1 (0200393)	19
Compliance Point: EV_MC2 (E300091)	28

Groundwater Stations
- Monitoring Well
- Supply Well
- Domestic Well

Surface Water Stations
- Compliance Point
- Order Station
- Receiving Environment
- Authorized Discharge
- Monitoring

Site Features
- Study Areas
- Highway
- Secondary Road
- Rails
- Pit
- Stockpiles
- Waste Dump (Spoils)
- Mine Permitted Areas

Water Features
- Intermittent Stream
- Stream Ditch
- Indefinite Stream
- Stream
- Subsurface
- River Bed
- Settling/Tailings Pond

GREEN Below primary screening criteria
ORANGE Above at least one of the primary screening criteria
BLUE Selenium concentrations above at least one of the secondary screening criteria

Notes:
1. Intended for illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
1. Data provided by Teck Coal Ltd.
2. © 2018 Microsoft Corporation © 2018 DigitalGlobe ©CNES (2018) Distribution Airbus DS

Revisons:
0 - AO - 2018-03-28 -DRAFT - LH
1 - AO - 2018-05-10 -FINAL - LH

0 0.25 0.5 1 1.5 2 2.5 Kilometers

PROJECT LOCATION: Elk Valley, BC

CLIENT NAME: Teck Coal Ltd

SNC·LAVALIN

Spatial Distribution of Selected Groundwater Analytical Data - Study Areas 8 – 10 and 12

CHK'D: LH | DATE: 2018/05/16 | SCALE: 1:50,000 | Ref Num: 635544-329 | REV: 1

BY: AO | COORD SYS: NAD 1983 UTM Zone 11N

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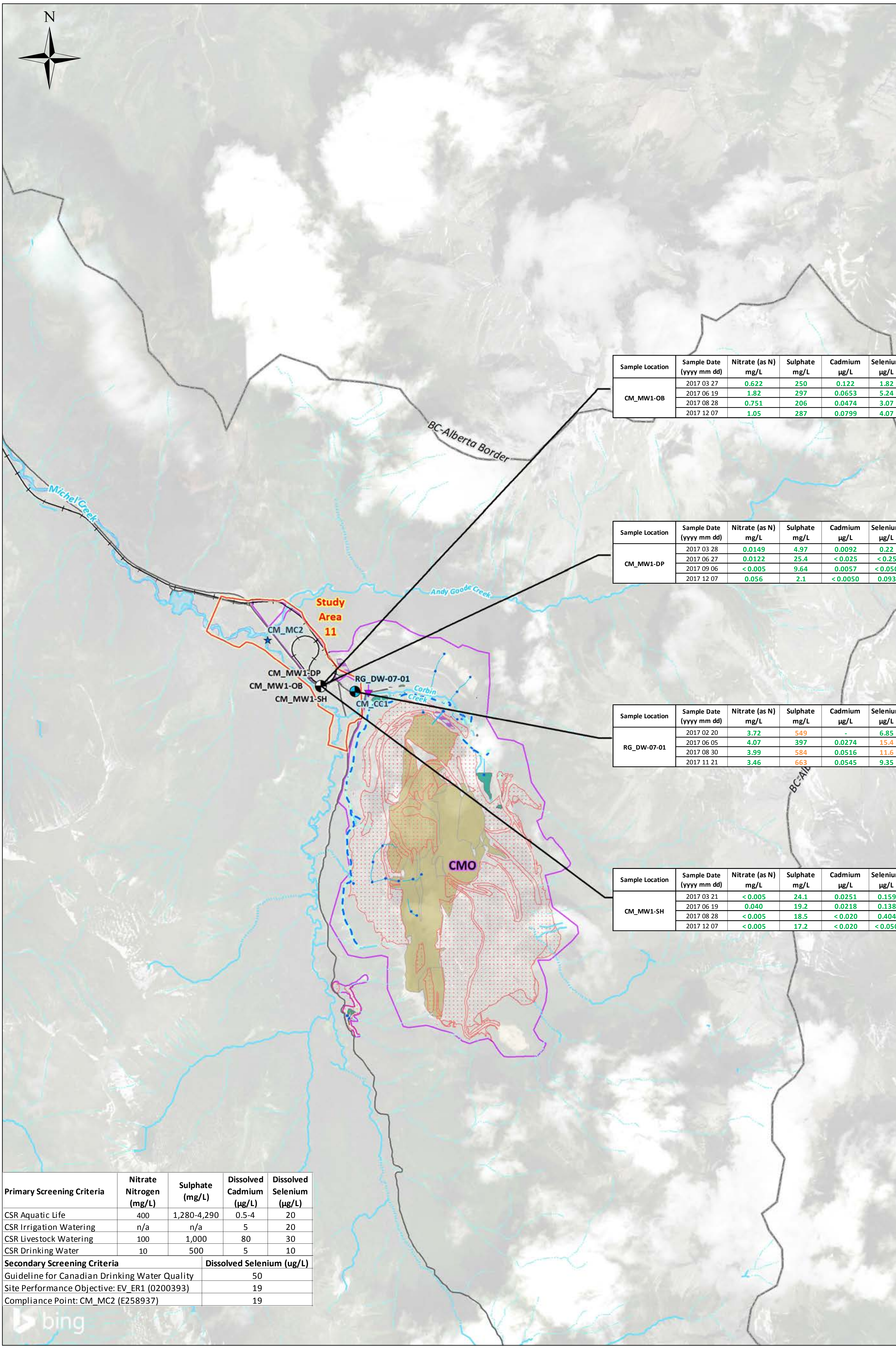

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
CM_MW1-OB	2017 03 27	0.622	250	0.122	1.82
	2017 06 19	1.82	297	0.0653	5.24
	2017 08 28	0.751	206	0.0474	3.07
	2017 12 07	1.05	287	0.0799	4.07

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
CM_MW1-DP	2017 03 28	0.0149	4.97	0.0092	0.22
	2017 06 27	0.0122	25.4	< 0.025	< 0.25
	2017 09 06	< 0.005	9.64	0.0057	< 0.050
	2017 12 07	0.056	2.1	< 0.0050	0.093

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
RG_DW-07-01	2017 02 20	3.72	549	-	6.85
	2017 06 05	4.07	397	0.0274	15.4
	2017 08 30	3.99	584	0.0516	11.6
	2017 11 21	3.46	663	0.0545	9.35

Sample Location	Sample Date (yyyy mm dd)	Nitrate (as N) mg/L	Sulphate mg/L	Cadmium µg/L	Selenium µg/L
CM_MW1-SH	2017 03 21	< 0.005	24.1	0.0251	0.159
	2017 06 19	0.040	19.2	0.0218	0.138
	2017 08 28	< 0.005	18.5	< 0.020	0.404
	2017 12 07	< 0.005	17.2	< 0.020	< 0.050

Primary Screening Criteria	Nitrate Nitrogen (mg/L)	Sulphate (mg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
CSR Aquatic Life	400	1,280-4,290	0.5-4	20
CSR Irrigation Watering	n/a	n/a	5	20
CSR Livestock Watering	100	1,000	80	30
CSR Drinking Water	10	500	5	10

Secondary Screening Criteria	Dissolved Selenium (ug/L)
Guideline for Canadian Drinking Water Quality	50
Site Performance Objective: EV_ER1 (0200393)	19
Compliance Point: CM_MC2 (E258937)	19

Groundwater Stations
- Monitoring Well
- Domestic Well

Surface Water Stations
- Compliance Point
- Receiving Environment

Site Features
- Study Areas
- BC-Alberta Border
- Secondary Road
- Rails
- Pit
- Stockpiles
- Waste Dump (Spoils)
- Mine Permitted Areas

Water Features
- Intermittent Stream
- Stream Ditch
- Indefinite Stream
- Stream
- Subsurface
- River Bed
- Settling/Tailings Pond

GREEN Below primary screening criteria
ORANGE Above at least one of the primary screening criteria
BLUE Selenium concentrations above at least one of the secondary screening criteria

Notes:
1. Intended for illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
1. Data provided by Teck Coal Ltd.
2. © 2018 Microsoft Corporation © 2018 DigitalGlobe ©CNES (2018) Distribution Airbus DS

Revisons:
0 - AO - 2018-03-28 -DRAFT - LH
1 - AO - 2018-05-10 -FINAL - LH

0 0.25 0.5 1 1.5 2 2.5 Kilometers

PROJECT LOCATION: Elk Valley, BC

CLIENT NAME: Teck Coal Ltd

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Spatial Distribution of Selected Groundwater Analytical Data - Study Area 11

CHK'D: LH | DATE: 2018/05/15 | SCALE: 1:50,000 | Ref Num: 635544-330 | REV: 1
BY: AO | COORD SYS: NAD 1983 UTM Zone 11N

MXD Path: P:\Current Projects\Teck Coal Ltd\GIS\Map Series\RGMPAnnualReport_2017\635544-330_AnalyticalData.mxd

Project Path: P:\Current Projects\Teck Coal Ltd\SPO\635544\4.0 Execution\4.5 GIS and Drawings\Exports\2017 Annual Report

Appendix I

Summary of SSGMP 2017 Annual Reports and Regional Conceptual Site Model

Appendix I-1: FRO 2017 Annual Groundwater Monitoring Summary and Recommendations
Appendix I-2: GHO 2017 Annual Groundwater Monitoring Summary and Recommendations
Appendix I-3: LCO 2017 Annual Groundwater Monitoring Summary and Recommendations
Appendix I-4: EVO 2017 Annual Groundwater Monitoring Summary and Recommendations
Appendix I-5: CMO 2017 Annual Groundwater Monitoring Summary and Recommendations
Appendix I-6: Regional Conceptual Site Model

Appendix I-1: FRO 2017 Annual Groundwater Monitoring Summary and Recommendations

Appendix I-1: Fording River Operations 2017 Annual Groundwater Monitoring

Summary

SNC-Lavalin Inc. (SNC-Lavalin, 2018a) completed the 2017 Annual Report for the Fording River Operations (FRO) Site Specific Groundwater Monitoring Program (SSGMP). FRO is located in southeastern British Columbia (BC), in the Fording River Valley and is one of Teck's five active coal mines in the Elk Valley. The following information was taken from the 2017 FRO Annual Report, which was completed to fulfill the reporting requirements outlined in Section 10.4 of Permit 107517 (October 13, 2017). The updated SSGMP was approved in April 2017 by the Ministry of Environment (MoE), now referred to as the Ministry of Environment & Climate Change Strategy (ENV).

The groundwater conceptual site model (CSM) for FRO identified surficial materials as the predominant pathway for groundwater flow and transport of constituents of interest (CI) and indicated that bedrock with lower permeability was a secondary pathway. The two main hydrogeological settings of surficial materials and associated groundwater recharge and flow are the upland areas and valley bottoms. Hydrogeology in the CSM was described with respect to the Fording River valley bottom setting with valley bottom tributaries including Henretta and Kilmarnock creeks and mountain tributaries including Clode, Lake Mountain, Cataract, and Swift creeks.

The FRO SSGMP includes fourteen monitoring wells that are monitored and sampled quarterly for a specific list of analytes. The wells monitored and sampled as part of the 2017 annual program are listed in Table A along with the associated rationale. Monitoring well locations are shown on Drawing 653244-002 attached (extracted from the 2017 FRO Annual Report). In 2017, quarterly monitoring and sampling were completed at each of the fourteen wells with two exceptions: the Q1 sample from FR_HMW5 could not be collected because the well was frozen; and in Q4 one and a half months of continuous water level and temperature data could not be retrieved from FR_HMW5 because the well was frozen. Samples from site-specific programs were submitted for all parameters on the analyte list.

The field QA/QC program and laboratory QA/QC results for groundwater samples indicated the data collected is acceptable for use in this report. With the exception of one RPD value greater than 50% for one parameter, the remaining RPD values for approximately 400 parameters sampled were less than 50%. The laboratory quality control results were considered reliable. Detectable concentrations of select parameters in trip and field blanks were, for the most part, marginally above the detection limit and well below applicable primary screening criteria and did not affect the reliability of the data. Field and trip blank data are provided in the attached Table 4 (extracted from the 2017 FRO Annual Report).

Groundwater quality at each monitoring location was compared to applicable primary and, for dissolved selenium only, secondary screening criteria. Presentation of results, data interpretation, and discussion of water level and chemistry trends for select CI, including nitrate, sulphate, and dissolved selenium, were completed in the Henretta Creek and Fording River valley-bottom drainages. To assess groundwater and surface water interactions, groundwater chemistry was compared to chemistry at nearby surface water stations.

Groundwater quality data for CI are shown in plan view in Drawing 653244-007 attached (extracted from the 2017 FRO Annual Report). In general, groundwater concentrations of CIs above primary and secondary screening criteria were consistent with 2015 and 2016 results. A brief summary of results and interpretation is found below in terms of main valley-bottoms and major tributaries:

› Reference groundwater quality results from the Henretta Valley were below the primary screening criteria for each CI with the exception of dissolved selenium in Q2, which may have resulted from cross-contamination. Approximately 20 L of hot water from FR_POTWELLS (with selenium concentrations of 22.2 µg/L) was added to FR_HMW5 in Q1 in an attempt to defrost the well. If the wells were not purged three well volumes prior to sampling, and instead the sampler waited for parameters to stabilize, then this may account for elevated selenium concentrations in FR_HMW5. The remaining concentrations of CI in groundwater (i.e., with the exception of selenium) were similar to those measured in reference surface water.
› Groundwater samples from the Henretta valley had CI concentrations above primary screening criteria and dissolved selenium above select secondary screening criteria. One well installed in spoils had the highest CI concentrations measured in the Henretta valley and displayed an increasing trend for dissolved selenium and sulphate. CI concentrations in surface water at downstream and upstream surface water stations were lower than CI concentrations measured in groundwater, suggesting limited loading to Henretta Creek from groundwater in the area of the backfilled pits and spoils.
› Groundwater from the Fording River valley north of the STP had dissolved selenium concentrations greater than the primary screening criteria in three quarters. Dissolved selenium concentrations in groundwater follow the same seasonal variation as concentrations measured in upgradient surface water. This suggests a strong interaction between Fording River surface water and recharge of valley-bottom groundwater from surface water in this area. Downgradient of Clode and Lake Mountain creek confluences with the Fording River, nitrate and dissolved selenium were above the primary screening criteria and selenium was above select secondary screening criteria in one quarter. CI concentrations above screening criteria were higher than those in upstream surface water and upgradient groundwater suggesting that there may be CI loading from Clode Creek drainage to the Fording River Valley groundwater in the area.
› In the Fording River valley downgradient of the STP, groundwater wells had dissolved selenium and nitrate concentrations greater than primary and secondary screening criteria in most quarters. However, in wells directly downgradient of the STP, CI concentrations were below primary screening criteria in 2017 and were probably low due to selenium attenuation in the STP. Concentrations in the Fording River surface water and in the valley bottom aquifer are increasing farther downgradient of the STP. Upland groundwater flow from Kilmarnock Creek drainage is a major source of mining-related constituents to Fording River valley-bottom groundwater in the area downgradient of the STP and possibly contributing to elevated CIs in monitoring wells farther downgradient from the STP.

Constituents other than CI that were measured above primary screening criteria were nitrite, dissolved manganese, lithium, and uranium. Lithium was not previously identified above the CSR DW standard; however, Stage 10 and Stage 11 Amendments to the CSR on November 1, 2017 resulted in a lower lithium standard changing from 730 µg/L to 8 µg/L. Dissolved manganese concentrations above the primary screening criteria were associated with low DO concentrations in deep wells as a result of limited exposure to atmospheric oxygen. Dissolved uranium was not identified as a CI related to mining activities as it probably originates from localized natural sources and a receptor was not identified for drinking water. Elevated nitrite concentrations were considered anomalous.

An update of the SSGMP is due in 2018 and the 2017 and historical groundwater monitoring results will be used in the development of an updated plan.

Recommendations

SNC-Lavalin had the following recommendations for future groundwater monitoring and sampling:

- Field-filter dissolved metals and dissolved organic carbon samples. It was noted that this was done for all samples after Q1 with the exception of one location in Q2 2017; therefore, we assume that the practice of field-filtering is established for 2018;
- Record the location where field blanks are collected;
- Collect manual and level logger measurements at approximately the same time of day to avoid possible discrepancies in data due to daily fluctuation of water table;
- Collect duplicate samples from wells with higher Cl concentrations instead of the reference well (FR_HMW5);
- Refrain from adding hot water from FR_POTWELLS to defrost frozen wells (specifically FR_HMW5); and
- Establish a common logging frequency between barometric and elevation level data loggers.

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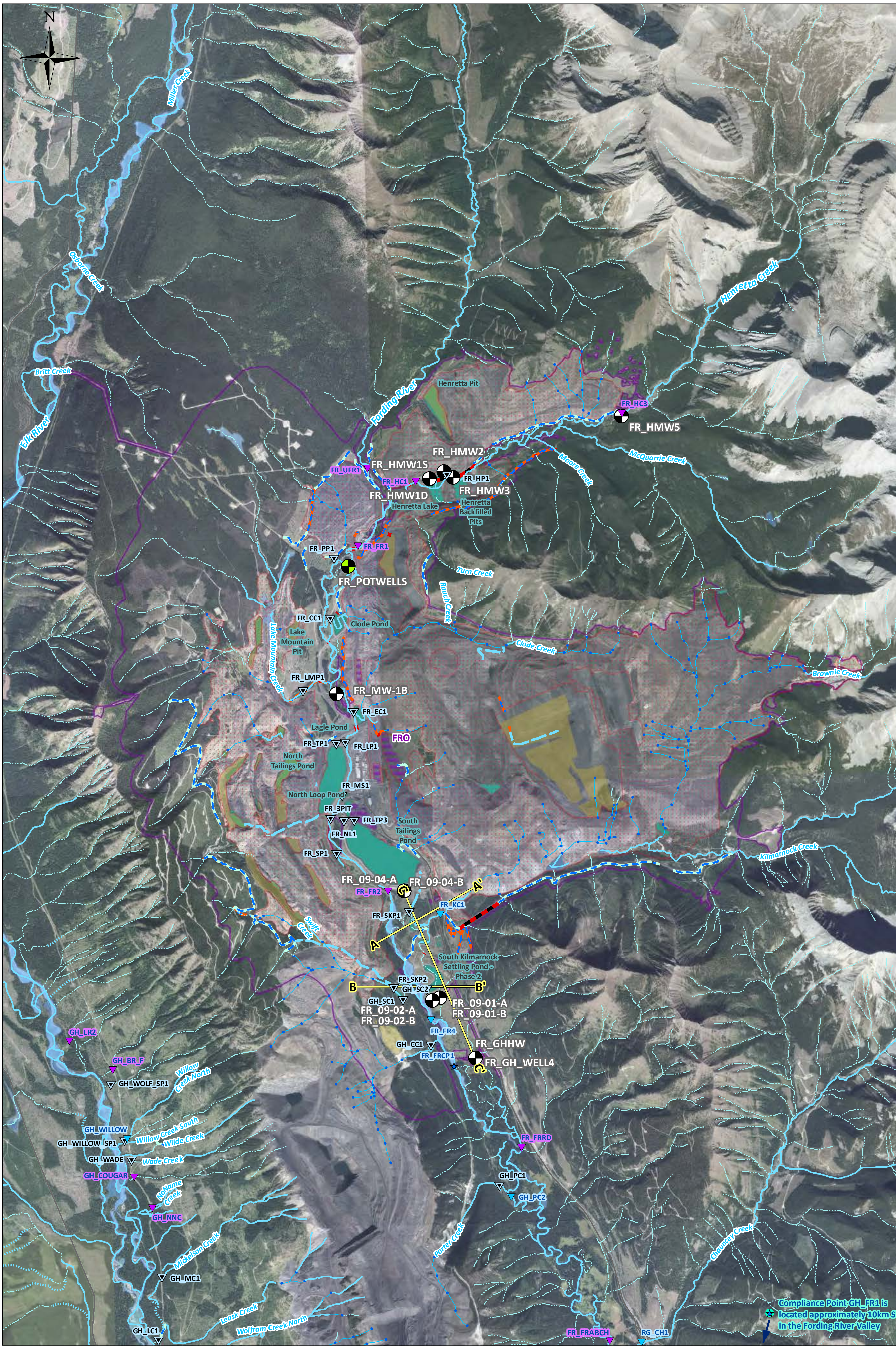
Table A: Summary of Groundwater Monitoring Locations and Rationale

Area	Well ID	Rationale
Henretta Valley	FR_HMW1S FR_HMW1D	Monitor groundwater in backfilled pits between the Henretta reclaimed channel and the spoils to the north, downgradient of the discharge area for the Henretta Pit sump water. Monitor deep groundwater system high in Cl in backfilled pits and continue to evaluate connectivity to surface water and shallow groundwater.
	FR_HMW2	Monitor upland groundwater high in Cl north of the Henretta reclaimed channel near the base of the spoil.
	FR_HMW3	Monitor groundwater in backfilled pits in the eastern portion of the former South Henretta Pit. This well provides local-scale triangulation to assess groundwater flow direction in the vicinity of the pits.
	FR_HMW5	Upgradient of mining impacts in Henretta valley bottom to monitor reference groundwater conditions.
Fording River Valley	FR_POTWELLS[a]	Monitor seepage and attenuation downgradient of Henretta Ridge and the Turnbull spoil.
	FR_MW-1B	Monitor seepage from upgradient spoils, Turnbull Pit, and Clode Creek and Lake Mountain Pit Lake.
	FR_09-04-A FR_09-04-B	Monitor selenium attenuation in shallow valley bottom sediments downgradient of the South Tailings Pond. Monitor seepage from the South Tailings Pond to overburden material immediately downgradient within the Fording River valley bottom.
	FR_09-02-A FR_09-02-B	Monitor selenium attenuation in shallow valley bottom sediments downgradient of the South Tailings Pond and Kilmarnock Settling Ponds. Assess influence of losing Fording River to valley bottom sediments.
	FR_09-01-A FR_09-01-B	Monitor selenium attenuation in shallow valley bottom sediments downgradient of the South Tailings Pond and Kilmarnock Settling Ponds. Monitor mine impact at the southern extent of the mine-permitted area. Monitor additional inputs to Fording River valley bottom sediments downgradient of the South Tailings Pond.
	FR_GHHW[b]	Monitor mine-impact downgradient of the FRO mining operations.

[a] FR_POTWELLS consists of six wells: FR_PW91, FR_PW92, FR_PW93, FR_PW94, FR_PW95, and FR_PW96.

[b] FR_GHHW consists of four wells including FR_GH_WELL1, FR_GH_WELL2, FR_GH_WELL3, and FR_GH_WELL4. As a recommendation of the hydrogeological assessment, monitoring of a dedicated well (FR_GH_WELL4) began in Q4 2017.



Legend

SSGMP Wells
- Monitoring Well
- Supply Well

Surface Water Stations
- Compliance Point
- Receiving Environment
- Authorized Discharge
- Monitoring

Water Features
- Intermittent Stream
- Stream Ditch
- Indefinite Stream
- Stream
- Subsurface
- River Bed
- Tailings/Settling Pond
- River Bed
- Mapped Aquifers

Site Features
- Geological Cross Sections
- Secondary Road
- Pit
- Stockpiles
- Waste Dump (Spoils)
- FRO Permitted Boundary
- Culvert
- Ditch
- Rock Drain
- Water Pipeline

Notes:
1. Intended for illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
1. Information provided by Teck Coal Ltd.
2. Mapped Aquifers are from Water Resources Atlas (BC ENV)

Revisons:
0 - AO - 2018-01-29 - DRAFT - LH
1 - AO - 2018-03-26 - FINAL - KM

0 0.5 1 2 3 Kilometers

PROJECT LOCATION: Fording River Operations, BC

CLIENT NAME: Teck Coal Ltd

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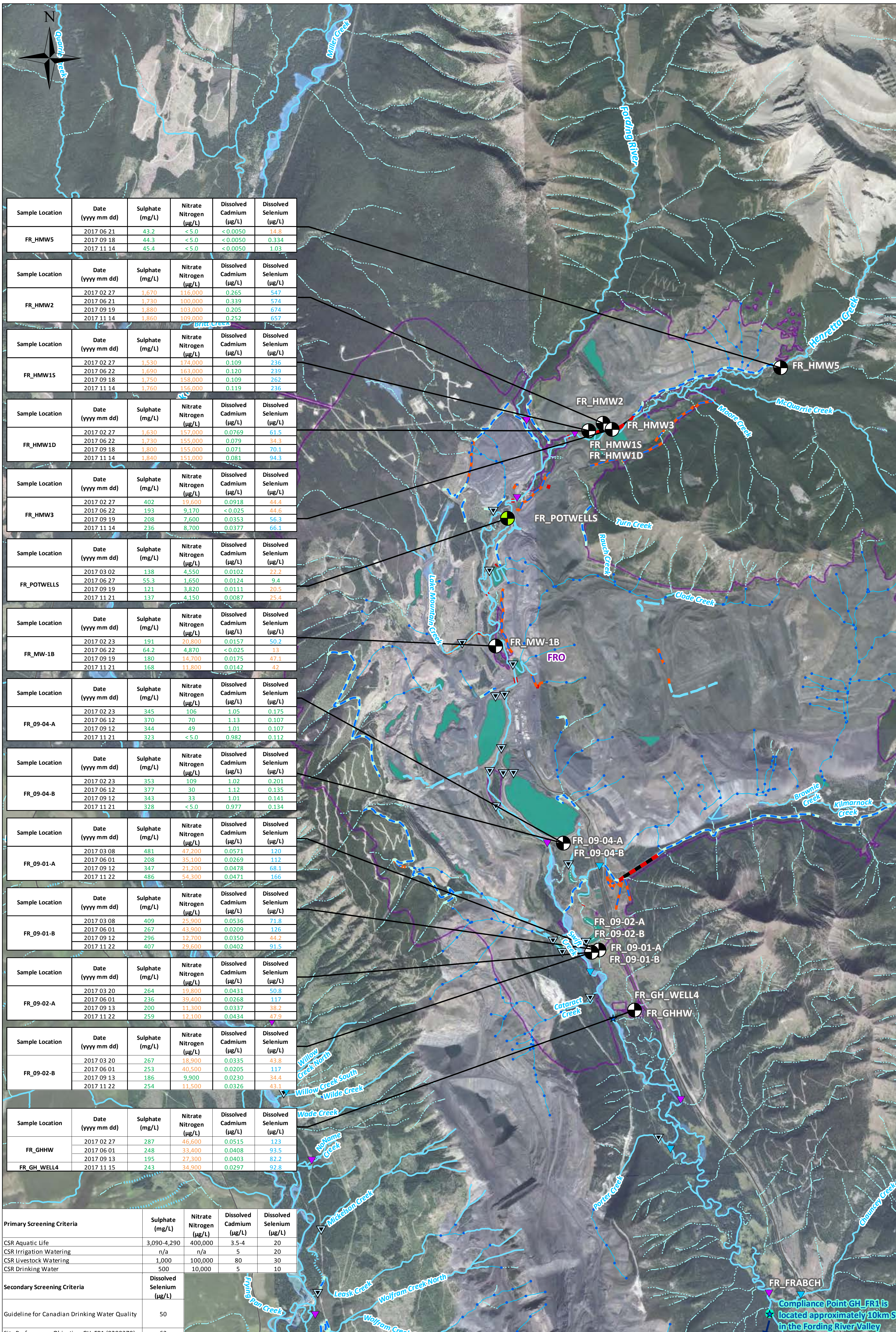
Site Features and Sample Location Plan

CHK'D: LH	DATE: 2018/03/28	SCALE: 1:60,000	Ref Num: 653244-002 REV: 0
BY: AO	COORD SYS: NAD 1983 UTM Zone 11N		

MXD Path: P:\Current Projects\Teck Coal Ltd\GIS\Map Series\2017 Annual Reports\653244-002_SiteFeaturesSampleLocPlan_FRO1.mxd

Project Path: P:\Current Projects\Teck Coal Ltd\GIS\Exports\ANNUAL REPORT



Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
FR_HMW5	2017 06 21	43.2	< 5.0	< 0.0050	14.8
	2017 09 18	44.3	< 5.0	< 0.0050	0.334
	2017 11 14	45.4	< 5.0	< 0.0050	1.03

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
FR_HMW2	2017 02 27	1,670	116,000	0.265	547
	2017 06 21	1,730	100,000	0.339	574
	2017 09 19	1,880	103,000	0.205	674
	2017 11 14	1,860	109,000	0.252	657

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
FR_HMW1S	2017 02 27	1,530	174,000	0.109	236
	2017 06 22	1,690	163,000	0.120	239
	2017 09 18	1,750	158,000	0.109	262
	2017 11 14	1,760	156,000	0.119	236

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
FR_HMW1D	2017 02 27	1,630	157,000	0.0769	61.5
	2017 06 22	1,730	155,000	0.079	34.3
	2017 09 18	1,800	155,000	0.071	70.1
	2017 11 14	1,840	151,000	0.081	94.3

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
FR_HMW3	2017 02 27	402	19,600	0.0918	44.4
	2017 06 22	193	9,170	< 0.025	44.6
	2017 09 19	208	7,600	0.0353	56.3
	2017 11 14	236	8,700	0.0377	66.1

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
FR_POTWELLS	2017 03 02	138	4,550	0.0102	22.2
	2017 06 27	55.3	1,650	0.0124	9.4
	2017 09 19	121	3,820	0.0111	20.5
	2017 11 21	137	4,150	0.0087	25.4

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
FR_MW-1B	2017 02 23	191	20,800	0.0157	50.2
	2017 06 22	64.2	4,870	< 0.025	13
	2017 09 19	180	14,700	0.0175	47.1
	2017 11 21	168	11,800	0.0142	42

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
FR_09-04-A	2017 02 23	345	106	1.05	0.175
	2017 06 12	370	70	1.13	0.107
	2017 09 12	344	49	1.01	0.107
	2017 11 21	323	< 5.0	0.982	0.112

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
FR_09-04-B	2017 02 23	353	109	1.02	0.201
	2017 06 12	377	30	1.12	0.135
	2017 09 12	343	33	1.01	0.141
	2017 11 21	328	< 5.0	0.977	0.134

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
FR_09-01-A	2017 03 08	481	47,200	0.0571	120
	2017 06 01	208	35,100	0.0269	112
	2017 09 12	347	21,200	0.0478	68.1
	2017 11 22	486	54,300	0.0471	166

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
FR_09-01-B	2017 03 08	409	25,900	0.0536	71.8
	2017 06 01	267	43,900	0.0209	126
	2017 09 12	296	12,700	0.0350	44.2
	2017 11 22	407	29,600	0.0402	91.5

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
FR_09-02-A	2017 03 20	264	19,800	0.0431	50.8
	2017 06 01	236	39,400	0.0268	117
	2017 09 13	200	11,300	0.0337	38.2
	2017 11 22	259	12,100	0.0434	47.9

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
FR_09-02-B	2017 03 20	267	18,900	0.0335	43.8
	2017 06 01	253	40,500	0.0205	117
	2017 09 13	186	9,900	0.0230	34.4
	2017 11 22	254	11,500	0.0326	43.1

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
FR_GHHW	2017 02 27	287	46,600	0.0515	123
	2017 06 01	248	33,400	0.0408	93.5
	2017 09 13	195	27,300	0.0403	82.2
FR_GH_WELL4	2017 11 15	243	34,900	0.0297	92.8

Primary Screening Criteria	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
CSR Aquatic Life	3,090-4,290	400,000	3.5-4	20
CSR Irrigation Watering	n/a	n/a	5	20
CSR Livestock Watering	1,000	100,000	80	30
CSR Drinking Water	500	10,000	5	10

Secondary Screening Criteria	Dissolved Selenium (µg/L)
Guideline for Canadian Drinking Water Quality	50
Site Performance Objective: GH_FR1 (0200378)	63
Compliance Point: FR_FRCP1 (E300071)	130

GREEN	Below primary screening criteria
ORANGE	Above at least one of the primary screening criteria
BLUE	Selenium concentrations above at least one of the secondary screening criteria

Legend

SSGMP Wells
- Monitoring Well
- Supply Well

Surface Water Stations
- Compliance Point
- Receiving Environment
- Authorized Discharge
- Monitoring

Water Features
- Intermittent Stream
- Stream Ditch
- Indefinite Stream
- Stream
- Subsurface
- Secondary Road
- River Bed
- Tailings/Settling Pond
- River Bed

Site Features
- FRO Permitted Boundary
- Culvert
- Ditch
- Rock Drain
- Water Pipeline

Notes:
1. Intended for illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
1. Information provided by Teck Coal Ltd.

Revisons:
0 - AO - 2018-01-29 - DRAFT - LH
1 - AO - 2018-03-26 - FINAL - KM

0 0.5 1 2 3 Kilometers

PROJECT LOCATION:
Fording River Operations, BC

CLIENT NAME:
Teck Coal Ltd

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Spatial Distribution of Constituents of Interest in Groundwater

CHK'D: LH | DATE: 2018/03/28 | SCALE: 1:60,000 | Ref Num: 653244-007 | REV: 0
BY: AO | COORD SYS: NAD 1983 UTM Zone 11N

MXD Path: P:\Current Projects\Teck Coal Ltd\GIS\Map Series\2017 Annual Reports\653244-007_SpatialDistofConstinGW_FRO1.mxd

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TABLE 1: Summary of Groundater Monitoring Program Locations

Area	Well ID	Monitoring Program	Well Type	Coordinates (UTM NAD 83)		LIDAR Ground Elevation	Ground Elevation	TOC Elevation	Stick Up Height	Drilled Depth	Well Diameter	Top of Screen Depth	Bottom of Screen Depth	Screened Formation	Depth to Bedrock	Hydraulic Conductivity
				Easting	Northing	masl	masl	masl	m	mbgs	mm	mbgs	mbgs		mbgs	m/s
Henretta Valley	FR_HMW1S	SSGMP	Monitoring	652441	5566518	1735.42	1732.30	1733.02	0.72	33.5	51	29.9	32.5	Gravel	33.5	-
	FR_HMW1D	SSGMP	Monitoring	652437	5566516	1734.87	1732.20	1732.97	0.77	54.3	51	51.2	54.3	Gravel / Coal / Bedrock	53.9	1.0E-04
	FR_HMW2	SSGMP	Monitoring	652666	5566634	1769.18	1767.30	1768.04	0.74	48.8	51	43.3	46.3	-	47.7	3.0E-03
	FR_HMW3	SSGMP	Monitoring	652810	5566540	1781.95	1728.20	1729.01	0.81	22.6	51	16.7	19.7	Silty Gravel	22.6	7.0E-04
	FR_HMW5	SSGMP, RGMP	Monitoring	655476	5567514	1793.23	1785.20	1786.03	0.83	12.6	51	7.30	10.40	Gravel	10.7	8.0E-03 9.0E-05
Fording River Valley	FR_POTWELLS[a]	SSGMP	Supply	651152	5565133	1686.77	-	-	-	-	-	-	-	-	-	-
	FR_MW-1B	SSGMP	Monitoring	650966	5563112	1670.16	1652.00	1652.67	0.67	8.2	51	5.2	8.2	Clay / Bedrock	7.3	4.0E-04
	FR_09-04-A	SSGMP	Monitoring	652033	5560000	1605.52	1604.98	1605.89	0.91	5.0	51	1.14	4.66	Sandy Gravel	-	3.0E-03
	FR_09-04-B	SSGMP	Monitoring	652033	5560000	1605.52	1605.03	1605.57	0.54	7.0	51	5.10	6.62	Gravel	6.5	9.6E-05
	FR_09-02-A	SSGMP	Monitoring	652482	5558261	1584.95	1584.69	1585.51	0.82	11.5	51	8.30	11.35	Sandy Gravel	-	1.0E-03
	FR_09-02-B	SSGMP	Monitoring	652842	5558261	1584.95	1584.73	1585.40	0.67	30.0	51	20.81	22.33	Gravel	-	9.9E-05
	FR_09-01-A	SSGMP, RGMP	Monitoring	652601	5558300	1584.64	1584.10	1584.95	0.85	8.4	51	3.83	6.88	Sandy Gravel	-	1.0E-03
	FR_09-01-B	SSGMP, RGMP	Monitoring	652601	5558300	1584.64	1584.10	1584.86	0.76	29.0	51	17.15	18.67	Gravel	-	1.5E-04
	FR_GHHW[b]	SSGMP, RGMP	Supply	653150	5557337	1576.45	1575.80	-	-	29.0	-	25.90	28.95	Sand and Gravel	-	-

Notes: a) FR_POTWELLS consists of six wells (FR_PW91, FR_PW92, FR_PW93, FR_PW94, FR_PW95, FR_PW96). Details for for FR_PW91 are provided above; b) FR_GHHW consists of four wells including FR_GH_WELL1, FR_GH_WELL2, FR_GH_WELL3, and FR_GH_WELL4. As a recommendation of the hydrogeological assessment, monitoring of a dedicated well (FR_GH_WELL4) began in Q4 2017. Details for FR_GH_WELL4 are provided above.

masl = metres above sea level
mbgs = metres below ground surface

TABLE 2: Summary of Groundwater Elevations and Calculated Vertical Gradients

Area	Well ID	Ground Elevation	TOC Elevation	Stick Up Height	Date of Static Water Level Measurement	Depth to Water	Water Level Elevation	Well Pairs	Date of Static Water Level Measurement	Calculated Vertical Gradient
		masl	masl	m	yyyy/mm/dd	mtoc	masl		yyyy/mm/dd	m/m
Henretta Valley	FR_HMW1S	1732.30	1733.02	0.72	2017/02/27	15.885	1717.135	FR_HMW1S and FR_HMW1D	2017/02/27	0.009
					2017/06/22	15.516	1717.504		2017/06/22	0.006
					2017/09/18	15.838	1717.182		2017/09/18	0.009
					2017/11/14	15.408	1717.612		2017/11/14	0.008
	FR_HMW1D	1732.20	1732.97	0.77	2017/02/27	15.645	1717.325			
					2017/06/22	15.331	1717.639			
					2017/09/18	15.603	1717.367			
					2017/11/14	15.189	1717.781			
	FR_HMW2	1767.30	1768.04	0.74	2017/02/27	45.264	1722.776			
					2017/06/21	45.049	1722.991			
					2017/09/19	43.763	1724.277			
					2017/11/14	45.106	1722.934			
	FR_HMW3	1728.20	1729.01	0.81	2017/02/27	7.879	1721.131			
					2017/06/22	7.353	1721.657			
					2017/09/19	7.786	1721.224			
					2017/11/14	7.836	1721.174			
	FR_HMW5	1785.20	1786.03	0.83	2017/06/21	1.491	1784.539			
					2017/09/18	1.642	1784.388			
					2017/11/14	1.672	1784.358			
Fording River Valley	FR_POTWELLS[a]	-	-	-	-	-	-			
	FR_MW-1B	1652.00	1652.67	0.67	2017/02/23	2.242	1650.428			
					2017/06/22	1.920	1650.750			
					2017/09/19	2.224	1650.446			
					2017/11/21	2.206	1650.464			
	FR_09-04-A	1604.98	1605.89	0.91	2017/02/23	2.017	1603.873	FR_09-04-A and FR_09-04-B	2017/02/23	-0.169
					2017/06/12	1.908	1603.982		2017/06/12	-0.173
					2017/09/12	2.126	1603.764		2017/09/12	-0.160
					2017/11/21	2.197	1603.693		2017/11/21	-0.151
	FR_09-04-B	1605.03	1605.57	0.54	2017/02/23	2.188	1603.382			
					2017/06/12	2.091	1603.479			
					2017/09/12	2.272	1603.298			
					2017/11/21	2.316	1603.254			
	FR_09-02-A	1584.69	1585.51	0.82	2017/03/20	7.085	1578.425	FR_09-02-A and FR_09-02-B	2017/03/20	-0.073
					2017/06/01	1.734	1583.776		2017/06/01	-0.095
					2017/09/13	7.228	1578.282		2017/09/13	-0.071
					2017/11/22	8.438	1577.072		2017/11/22	-0.060
	FR_09-02-B	1584.73	1585.40	0.67	2017/03/20	7.829	1577.571			
					2017/06/01	2.738	1582.662			
					2017/09/13	7.953	1577.447			
					2017/11/22	9.035	1576.365			
	FR_09-01-A	1584.10	1584.95	0.85	2017/03/08	7.357	1577.593	FR_09-01-A and FR_09-01-B	2017/03/08	-0.048
					2017/06/01	1.156	1583.794		2017/06/01	-0.042
					2017/09/12	6.405	1578.545		2017/09/12	-0.050
					2017/11/22	7.642	1577.308		2017/11/22	-0.046
	FR_09-01-B	1584.10	1584.86	0.76	2017/03/08	7.864	1576.996			
					2017/06/01	1.594	1583.266			
					2017/09/12	6.946	1577.914			
					2017/11/22	8.133	1576.727			
	FR_GHHW[b]	1575.80	-	-	-	-	-			

Notes: a) FR_POTWELLS consists of six wells (FR_PW91, FR_PW92, FR_PW93, FR_PW94, FR_PW95, FR_PW96). Details for for FR_PW91 are provided above; b) FR_GHHW consists of four wells including FR_GH_WELL1, FR_GH_WELL2, FR_GH_WELL3, and FR_GH_WELL4. As a recommendation of the hydrogeological assessment, monitoring of a dedicated well (FR_GH_WELL4) began in Q4 2017. Details for FR_GH_WELL4 are provided above.

masl = metres above sea level
mbgs = metres below ground surface

TABLE 3: Field Measured Parameters

Sample Location	Sample Date (yyyy mm dd)	Field Parameters				
		Temperature °C	pH pH	ORP mV	Dissolved Oxygen mg/L	Field Conductivity μS/cm
Henretta Valley						
FR_HMW1D	2017 02 27	4.4	7.06	48.5	1.97	3,367
	2017 06 22	3.9	7.18	139.6	1.89	3,638
	2017 09 18	3.8	7.03	173.9	0.05	3,542
	2017 11 14	3.6	6.77	204.6	0.31	3,627
FR_HMW1S	2017 02 27	4.3	7.08	57.8	1.32	3,347
	2017 06 22	3.7	7.04	144.1	1.52	3,612
	2017 09 18	3.6	7.03	181.7	0.19	3,482
	2017 11 14	3.6	6.88	78.8	0.54	3,425
FR_HMW2	2017 02 27	2.8	7.03	55.2	2.81	3,149
	2017 06 21	6.0	6.97	65.3	2.24	3,440
	2017 09 19	1.7	7.18	182.1	8.04	3,352
	2017 11 14	2.0	6.59	210.7	0.67	3,435
FR_HMW3	2017 02 27	4.3	7.36	47.8	0.91	1,105
	2017 06 22	3.5	7.53	174.2	2.84	687.3
	2017 09 19	5.5	7.73	74.9	1.24	703.6
	2017 11 14	5.3	7.35	-14.4	2.01	755.4
FR_HMW5	2017 06 21	3.4	8.01	-219.9	0.62	362.9
	2017 09 18	3.6	8.05	-174.7	0.34	348.6
	2017 11 14	3.6	8.22	-155.2	0.34	345.4
Fording River Valley						
FR_POTWELLS	2017 03 02	1.8	8.12	55.5	10.56	497.2
	2017 06 27	6.2	8.26	129.0	9.62	320.2
	2017 09 19	8.9	7.86	135.5	8.84	458.2
	2017 11 21	4.1	7.93	234.7	10.73	500.2
FR_MW-1B	2017 02 23	3.1	7.89	47.7	8.31	707.3
	2017 06 22	4.0	7.95	130.6	6.64	388.1
	2017 09 19	7.5	7.95	180.5	6.34	665.1
	2017 11 21	6.0	7.71	232.1	7.45	648.8
FR_09-04-A	2017 02 23	8.3	7.34	48.7	0.17	1,015
	2017 06 12	9.8	7.25	143.4	0.05	1,062
	2017 09 12	10.0	7.18	236.8	0.06	1,093
	2017 11 21	8.3	7.17	243.1	0.09	1,051
FR_09-04-B	2017 02 23	8.6	7.37	53.7	0.09	1,016
	2017 06 12	9.8	7.14	182.0	0.09	1,113
	2017 09 12	9.6	7.16	229.4	0.07	1,100
	2017 11 21	8.6	7.15	244.2	0.11	1,058
FR_09-02-A	2017 03 20	3.4	7.75	77.5	10.72	582.0
	2017 06 01	5.4	7.56	179.3	10.23	1,016
	2017 09 13	10.5	7.53	204.7	6.56	715.0
	2017 11 22	10.0	7.55	254.0	7.59	829.0
FR_09-02-B	2017 03 20	4.3	7.58	82.6	8.60	844.0
	2017 06 01	4.0	7.52	192.7	10.52	1,067
	2017 09 13	7.3	7.53	176.4	5.85	714.6
	2017 11 22	9.3	7.44	249.6	6.49	846.0
FR_09-01-A	2017 03 08	2.8	7.73	63.4	8.43	1,447
	2017 06 01	5.5	7.65	181.7	10.76	990.0
	2017 09 12	8.6	7.34	226.2	5.41	1,185
	2017 11 22	6.9	7.30	252.5	7.71	1,542
FR_09-01-B	2017 03 08	4.7	7.45	77.9	5.76	1,231
	2017 06 01	6.1	7.32	181.4	10.34	1,102
	2017 09 12	7.9	7.23	230.5	4.28	1,012
	2017 11 22	7.6	7.29	250.1	8.29	1,298
FR_GHHW[a]	2017 02 27	7.9	7.57	50.1	5.84	1,082
	2017 06 01	12.2	7.34	86.5	6.40	1,024
	2017 09 13	17.7	7.33	111.4	3.32	898.0
	2017 11 15	8.7	7.48	95.9	5.39	976.0

All terms defined within the body of SNC-Lavalin's report.

[a] In the fourth quarter of 2017, FR_GHHW was replaced with singular monitoring well FR_GH_WELL4 based on recommendations from the Hydrogeological Assessment (SNC-Lavalin, 2017b). Monitoring well FR_GH_WELL4 will be used in place of FR_GHHW in future sampling events.

TABLE 4: Groundwater Analytical Results compared to Primary Screening Criteria

Sample Location	Sample Date (yyyy mm dd)	Physical Parameters							Dissolved Inorganics										Organics	
		Laboratory pH pH	Hardness mg/L	Laboratory Conductivity µS/cm	Total Suspended Solids mg/L	Total Dissolved Solids mg/L	Turbidity NTU	Total Alkalinity (as CaCO3) mg/L	Ammonia, total (as N) µg/L	Bromide mg/L	Chloride mg/L	Fluoride µg/L	Nitrate (as N) µg/L	Nitrite (as N) µg/L	Kjeldahl Nitrogen-N mg/L	Ortho-Phosphate mg/L	Total Phosphorous as P mg/L	Sulphate mg/L	Total Organic Carbon mg/L	Dissolved Organic Carbon mg/L
BC Standard																				
CSR Aquatic Life (AW)[a]		n/a	n/a	n/a	n/a	n/a	n/a	n/a	3,700-18,500[b]	n/a	1,500	3,000	400,000	200-800[c]	n/a	n/a	n/a	3,090-4,290[d]	n/a	n/a
CSR Irrigation Watering (IW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100	1,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CSR Livestock Watering (LW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	600	1,000	100,000	10,000	n/a	n/a	n/a	1,000	n/a	n/a
CSR Drinking Water (DW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	250	1,500	10,000	1,000	n/a	n/a	n/a	500	n/a	n/a
Henretta Valley																				
FR_HMW1D	2017 02 27	7.07	2,470	3,760	2.5	3,710	0.45	427	317	< 0.25	2.5	190	157,000	17.0	0.474	0.0139	0.025	1,630	1.47	1.39
	2017 06 22	7.65	2,340	3,780	1.4	3,550	0.69	400	228	< 0.50	< 5.0	< 200	155,000	11	< 0.25	0.0025	0.0022	1,730	1.63	1.82
	2017 09 18	7.80	2,660	3,660	< 1.0	3,650	0.48	374	173	< 0.25	< 2.5	140	155,000	12.3	< 0.050	0.0034	0.0053	1,800	1.03	0.91
	2017 11 14	7.85	2,760	3,640	1.8	3,340	0.51	348	207	< 0.50	< 5.0	< 200	151,000	18	< 0.050	0.0029	0.0048	1,840	1.29	1.16
	Duplicate	7.88	2,920	3,680	1.0	3,990	0.56	341	208	< 0.50	< 5.0	< 200	153,000	20	< 0.050	0.0034	0.0049	1,860	1.27	1.05
	QA/QC RPD%	< 1	6	1	*	18	9	2	< 1	*	*	*	1	11	*	*	*	1	*	*
FR_HMW1S	2017 02 27	7.05	2,450	3,730	< 1.0	3,850	0.19	414	1,180	< 0.25	< 2.5	210	174,000	8.8	1.27	0.0101	0.0109	1,530	1.22	1.26
	2017 06 22	7.84	2,360	3,680	< 1.0	3,760	0.30	248	1,000	< 0.50	< 5.0	< 200	163,000	< 10	0.844	< 0.0010	< 0.0020	1,690	1.61	2.25
	Duplicate	7.83	2,330	3,760	1.0	4,130	0.22	363	1,020	< 0.50	< 5.0	< 200	157,000	10	1.05	< 0.0010	< 0.0020	1,630	1.91	2.32
	QA/QC RPD%	< 1	1	2	*	9	*	38	2	*	*	*	4	*	22	*	*	4	*	*
	2017 09 18	7.86	2,550	3,580	< 1.0	3,740	0.28	350	942	0.31	< 2.5	160	158,000	< 5.0	0.422	< 0.0010	0.0022	1,750	0.93	0.97
	2017 11 14	7.93	2,870	3,630	< 1.0	3,510	0.29	342	947	< 0.50	< 5.0	< 200	156,000	< 10	< 0.050	< 0.0010	0.0014	1,760	0.99	0.99
FR_HMW2	2017 02 27	7.06	2,410	3,570	663	3,480	696	432	12.0	< 0.25	< 2.5	130	116,000	10.7	0.109	0.0209	1.00	1,670	37.1	0.90
	2017 06 21	7.68	2,530	3,370	10.1	3,800	7.31	416	< 5.0	< 0.25	< 2.5	100	**100,000**	6.7	1.37	0.0069	0.0124	1,730	1.20	1.06
	2017 09 19	7.83	2,570	3,520	10.4	3,380	13.6	287	12.1	< 0.25	< 2.5	120	103,000	6.4	< 0.050	0.0065	0.0224	1,880	1.33	0.62
	2017 11 14	7.80	2,770	3,510	5.2	3,590	4.57	332	7.2	< 0.25	< 2.5	110	109,000	10.0	< 0.050	0.0082	0.0137	1,860	1.16	0.65
FR_HMW3	2017 02 27	7.31	736	1,250	2.9	979	1.71	282	52.1	< 0.050	1.00	248	**19,600**	42.5	< 0.050	0.0108	0.0197	402	1.65	1.26
	2017 06 22	8.24	355	718	1.0	546	0.82	157	18.8	< 0.050	< 0.50	210	9,170	3.0	0.281	0.0047	0.0050	193	0.93	1.54
	2017 09 19	8.25	414	756	5.2	559	2.12	180	71.6	< 0.050	< 0.50	259	7,600	12.0	< 0.050	0.0015	0.0108	208	0.85	0.58
	2017 11 14	8.40	489	827	1.0	584	1.04	201	70.5	< 0.050	0.57	240	8,700	5.9	0.303	0.0022	0.0059	236	0.72	0.50
FR_HMW5	2017 06 21	8.22	158	365	< 1.0	231	0.18	158	65	< 0.050	1.34	655	< 5.0	< 1.0	0.061	0.0246	0.0258	43.2	0.58	1.28
	2017 09 18	8.40	162	373	< 1.0	247	0.12	161	61.4	< 0.050	1.02	599	< 5.0	< 1.0	< 0.050	0.0227	0.0229	44.3	< 0.50	< 0.50
	Duplicate	8.33	166	370	< 1.0	232	0.29	163	61.1	< 0.050	1.07	593	< 5.0	< 1.0	< 0.050	0.0214	0.0229	44.5	< 0.50	< 0.50
	QA/QC RPD%	1	2	1	*	6	*	1	< 1	*	*	1	*	*	*	6	0	< 1	*	*
	2017 11 14	8.44	187	383	< 1.0	196	0.36	162	62.1	< 0.050	0.96	511	< 5.0	< 1.0	0.087	0.0214	0.0201	45.4	< 0.50	< 0.50
	2017 11 14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	QA/QC RPD%	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Fording River Valley																				
FR_POTWELLS	2017 03 02	7.81	294	529	< 1.0	340	0.16	141	11.5	< 0.050	< 0.50	172	4,550	2.2	0.457	0.0021	0.0079	138	0.62	0.57
	2017 06 27	8.14	174	344	< 1.0	220	0.14	128	< 5.0	< 0.050	< 0.50	181	1,650	< 1.0	0.063	0.0021	< 0.0020	55.3	1.38	1.39
	2017 09 19	8.46	268	513	< 1.0	352	0.13	142	6.4	< 0.050	< 0.50	173	3,820	< 1.0	0.152	< 0.0010	0.0032	121	< 0.50	< 0.50
	2017 11 21	8.26	314	560	< 1.0	386	0.14	143	5.3	< 0.050	< 0.50	171	4,150	< 1.0	0.115	0.0024	0.0028	137	< 0.50	< 0.50
FR_MW-1B	2017 02 23	7.84	420	795	2.3	534	4.02	177	< 5.0	< 0.050	0.55	142	**20,800**	< 1.0	< 0.050	0.0016	0.0085	191	0.99	0.75
	2017 06 22	8.44	188	417	1.0	275	3.58	122	< 5.0	< 0.050	< 0.50	138	4,870	< 1.0	0.277	0.0016	0.0053	64.2	1.37	1.96
	2017 09 19	8.19	381	705	< 1.0	531	0.75	147	10.6	< 0.050	< 0.50	139	**14,700**	< 1.0	< 0.050	< 0.0010	0.0027	180	1.15	0.52
	2017 11 21	8.27	411	712	2.0	499	2.58	185	7.1	< 0.050	< 0.50	145	**11,800**	< 1.0	0.111	0.0031	0.0054	168	0.57	0.62

Associated data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.

BOLD	Concentration greater than CSR Aquatic Life (AW) standard
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard

[a] Standard to protect freshwater aquatic life.
[b] Standard varies with pH.
[c] Standard varies with Chloride.
[d] Standard varies with Hardness.
[e] Standard varies with crop.
[f] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[g] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[h] Ultra trace mercury was sampled at FR_HMW5.
[i] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.
[j] In the fourth quarter of 2017, FR_GHHW was replaced with singular monitoring well FR_GH_WELL4 based on recommendations from the Hydrogeological Assessment (SNC-Lavalin, 2017b). Monitoring well FR_GH_WELL4 will be used in place of FR_GHHW in future sampling events.

TABLE 4 (Cont'd): Groundwater Analytical Results compared to Primary Screening Criteria

Sample Location	Sample Date (yyyy mm dd)	Aluminum µg/L	Antimony µg/L	Arsenic µg/L	Barium µg/L	Beryllium µg/L	Bismuth µg/L	Boron µg/L	Cadmium µg/L	Calcium mg/L	Chromium µg/L	Cobalt µg/L	Copper µg/L	Iron µg/L	Lead µg/L	Lithium µg/L	Magnesium mg/L	Manganese µg/L	Mercury[h] µg/L	Molybdenum µg/L	Nickel µg/L	Potassium mg/L	Selenium µg/L	Silver µg/L	Sodium mg/L	Strontium µg/L	Thallium µg/L	Tin µg/L	Titanium µg/L	Uranium µg/L	Vanadium µg/L	Zinc[i] µg/L
		Dissolved Metals																														
BC Standard																																
CSR Aquatic Life (AW)[a]		n/a	90	50	10,000	1.5	n/a	12,000	3.5-4[d]	n/a	10[f]	40	70-90[d]	n/a	60-160[d]	n/a	n/a	n/a	0.25	10,000	1,100-1,500[d]	n/a	20	15	n/a	n/a	3	n/a	1,000	85	n/a	900-2,400[d]
CSR Irrigation Watering (IW)		5,000	n/a	100	n/a	100	n/a	500-6,000[e]	5	n/a	5[f]	50	200	5,000	200	2,500	n/a	200	1	10	200	n/a	20	n/a	n/a	n/a	n/a	n/a	n/a	10	100	n/a
CSR Livestock Watering (LW)		5,000	n/a	25	n/a	100	n/a	5,000	80	1,000	50[f]	1,000	300	n/a	100	5,000	n/a	n/a	2	50	1,000	n/a	30	n/a	n/a	n/a	n/a	n/a	n/a	200	100	2,000
CSR Drinking Water (DW)		9,500	6	10	1,000	8	n/a	5,000	5	n/a	50[f]	20[g]	1,500	6,500	10	8	n/a	1,500	1	250	80	n/a	10	20	200	2,500	n/a	2,500	n/a	20	20	3,000
Henretta Valley																																
FR_HMW1D	2017 02 27	< 1.0	0.41	0.13	13.4	< 0.020	< 0.050	48	0.0769	506	< 0.10	4.60	0.23	< 10	< 0.050	87.1	294	588	< 0.0050	0.753	30.7	7.27	61.5	< 0.010	2.62	345	0.019	< 0.10	< 10	10.5	< 0.50	8.9
	2017 06 22	< 5.0	< 0.50	< 0.50	12.2	< 0.10	< 0.25	< 50	0.079	522	< 0.50	4.62	< 1.0	< 50	< 0.25	91.0	251	580	< 0.0050	0.71	31.8	6.92	34.3	< 0.050	2.30	328	< 0.050	< 0.50	< 10	9.94	< 2.5	8.0
	2017 09 18	< 3.0	0.42	< 0.20	12.0	< 0.040	< 0.10	48	0.071	569	< 0.20	4.90	< 0.50	< 20	< 0.10	91.0	300	623	< 0.0050	0.71	32.6	6.98	70.1	< 0.020	2.44	346	< 0.020	< 0.20	< 10	12.8	< 1.0	7.0
	2017 11 14	< 3.0	0.38	< 0.20	12.6	< 0.040	< 0.10	56	0.081	585	< 0.20	4.69	< 0.50	< 20	< 0.10	87.3	314	601	< 0.0050	0.87	32.5	7.45	94.3	< 0.020	2.29	354	< 0.020	< 0.20	< 10	11.2	< 1.0	< 7.0
	Duplicate	< 3.0	0.39	< 0.20	12.2	< 0.040	< 0.10	45	0.075	632	< 0.20	4.88	< 0.50	< 20	< 0.10	96.2	326	695	< 0.0050	0.76	33.3	7.57	95.6	< 0.020	2.49	346	< 0.020	< 0.20	< 10	11.4	< 1.0	6.8
	QA/QC RPD%	*	*	*	3	*	*	*	8	8	*	4	*	*	*	10	4	15	*	13	2	2	1	*	8	2	*	*	*	2	*	*
FR_HMW1S	2017 02 27	< 1.0	0.33	0.10	12.4	< 0.020	< 0.050	46	0.109	526	< 0.10	4.08	< 0.20	< 10	< 0.050	101	276	379	< 0.0050	0.909	38.7	8.52	236	< 0.010	2.37	370	0.032	< 0.10	< 10	10.3	< 0.50	7.8
	2017 06 22	< 5.0	< 0.50	< 0.50	12.0	< 0.10	< 0.25	< 50	0.120	518	< 0.50	4.65	< 1.0	< 50	< 0.25	97.5	258	368	< 0.0050	0.95	41.0	8.43	239	< 0.050	2.17	333	< 0.050	< 0.50	< 10	9.59	< 2.5	5.9
	Duplicate	< 5.0	< 0.50	< 0.50	11.8	< 0.10	< 0.25	< 50	0.121	510	< 0.50	4.72	< 1.0	< 50	< 0.25	96.1	256	368	< 0.0050	0.89	40.8	8.38	231	< 0.050	2.16	328	< 0.050	< 0.50	< 10	9.79	< 2.5	5.3
	QA/QC RPD%	*	*	*	2	*	*	*	1	2	*	1	*	*	*	1	1	0	*	7	< 1	1	3	*	< 1	2	*	*	*	2	*	11
	2017 09 18	< 3.0	0.35	< 0.20	10.8	< 0.040	< 0.10	42	0.109	533	< 0.20	4.38	< 0.50	< 20	< 0.10	86.8	295	360	< 0.0050	0.93	39.1	8.25	262	< 0.020	2.16	323	0.035	< 0.20	< 10	11.9	< 1.0	5.6
	2017 11 14	< 3.0	0.34	< 0.20	10.8	< 0.040	< 0.10	45	0.119	621	< 0.20	4.63	< 0.50	< 20	< 0.10	106	321	374	< 0.0050	0.88	40.7	8.87	236	< 0.020	2.38	348	0.033	< 0.20	< 10	10.9	< 1.0	< 5.5
FR_HMW2	2017 02 27	1.5	0.10	0.18	16.5	< 0.020	< 0.050	54	0.265	492	< 0.10	0.42	0.21	< 10	< 0.050	134	287	211	< 0.0050	0.529	16.4	7.27	547	< 0.010	2.69	317	0.046	< 0.10	< 10	10.2	< 0.50	8.2
	2017 06 21	2.0	< 0.10	0.15	12.8	< 0.020	< 0.050	50	0.339	516	< 0.10	0.57	< 0.20	< 10	< 0.050	130	302	305	0.0064	0.407	19.0	7.40	574	< 0.010	2.45	291	0.052	< 0.10	< 10	10.2	< 0.50	7.7
	2017 09 19	< 3.0	< 0.20	0.20	12.6	< 0.040	< 0.10	48	0.205	537	< 0.20	< 0.20	< 0.50	< 20	< 0.10	128	300	35.0	< 0.0050	0.48	17.4	7.79	674	< 0.020	1.96	292	0.064	< 0.20	< 10	10.9	< 1.0	6.6
	2017 11 14	< 3.0	< 0.20	< 0.20	12.2	< 0.040	< 0.10	48	0.252	586	< 0.20	0.20	< 0.50	< 20	< 0.10	150	317	63.8	< 0.0050	0.40	17.6	8.12	657	< 0.020	2.15	302	0.057	< 0.20	< 10	10.9	< 1.0	6.7
FR_HMW3	2017 02 27	1.4	0.18	< 0.10	51.4	< 0.020	< 0.050	28	0.0918	177	< 0.10	0.26	< 0.20	< 10	< 0.050	53.0	71.3	247	< 0.0050	0.901	3.32	3.16	44.4	< 0.010	2.24	178	0.015	< 0.10	< 10	3.47	< 0.50	5.5
	2017 06 22	< 5.0	< 0.50	< 0.50	24.0	< 0.10	< 0.25	< 50	< 0.025	84.9	< 0.50	< 0.50	< 1.0	< 50	< 0.25	24.5	34.8	50.1	< 0.0050	1.08	< 2.5	1.83	44.6	< 0.050	0.93	86.3	< 0.050	< 0.50	< 10	1.56	< 2.5	< 5.0
	2017 09 19	< 3.0	0.22	0.11	28.2	< 0.020	< 0.050	17	0.0353	98.2	< 0.10	0.17	< 0.50	52	< 0.050	27.3	41.0	106	< 0.0050	1.02	1.33	1.99	56.3	< 0.010	1.32	105	0.012	< 0.10	< 10	2.03	< 0.50	< 3.0
	2017 11 14	< 3.0	0.19	0.12	29.9	< 0.020	< 0.050	14	0.0377	119	0.10	0.17	< 0.50	81	< 0.050	27.2	46.9	96.5	< 0.0050	1.01	1.43	1.78	66.1	< 0.010	1.33	122	0.012	< 0.10	< 10	1.86	< 0.50	< 3.0
FR_HMW5	2017 06 21	6.3	< 0.10	< 0.10	204	< 0.020	< 0.050	57	< 0.0050	33.1	< 0.10	< 0.10	< 0.20	< 10	< 0.050	232	18.3	47.2	< 0.00050	< 0.050	< 0.50	0.741	14.8	< 0.010	21.0	295	< 0.010	< 0.10	< 10	0.019	< 0.50	< 1.0
	2017 09 18	6.1	< 0.10	< 0.10	190	< 0.020	< 0.050	48	< 0.0050	35.1	< 0.10	< 0.10	< 0.50	< 10	< 0.050	218	18.1	47.8	< 0.00050	< 0.050	< 0.50	0.687	0.334	< 0.010	14.5	331	< 0.010	< 0.10	< 10	0.016	< 0.50	< 3.0
	Duplicate	6.3	< 0.10	< 0.10	189	< 0.020	< 0.050	50	< 0.0050	35.9	< 0.10	< 0.10	< 0.50	< 10	< 0.050	219	18.4	47.7	< 0.00050	< 0.050	< 0.50	0.679	0.595	< 0.010	14.7	329	< 0.010	< 0.10	< 10	0.016	< 0.50	< 3.0
	QA/QC RPD%	3	*	*	1	*	*	*	*	2	*	*	*	*	*	< 1	2	< 1	*	*	*	1	56	*	1	1	*	*	*	*	*	*
	2017 11 14	5.9	< 0.10	< 0.10	196	< 0.020	< 0.050	42	< 0.0050	41.5	< 0.10	< 0.10	< 0.50	< 10	< 0.050	265	20.2	48.5	< 0.00050	< 0.050	< 0.50	0.649	1.03	< 0.010	12.9	346	< 0.010	< 0.10	< 10	0.014	< 0.50	< 3.0
	2017 11 14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.00050	-	-	-	-	-	-	-	-	-	-	-	-	-
	QA/QC RPD%	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Fording River Valley																																
FR_POTWELLS	2017 03 02	< 1.0	< 0.10	< 0.10	78.9	< 0.020	< 0.050	< 10	0.0102	76.0	< 0.10	< 0.10	8.76	< 10	0.665	5.3	25.3	0.23	< 0.0050	0.614	< 0.50	0.634	22.2	< 0.010	0.760	143	< 0.010	< 0.10	< 10	0.913	< 0.50	12.4
	2017 06 27	3.8	< 0.10	< 0.10	47.4	< 0.020	< 0.050	< 10	0.0124	46.2	< 0.10	< 0.10	1.89	< 10	0.090	4.5	14.3	0.32	< 0.0050	1.05	< 0.50	0.598	9.4	< 0.010	0.599	86.3	< 0.010	< 0.10	< 10	0.549	< 0.50	9.5
	2017 09 19	< 3.0	< 0.10	< 0.10	78.5	< 0.020	< 0.050	< 10	0.0111	70.0	< 0.10	< 0.10	1.10	< 10	< 0.050	6.3	22.6	0.11	< 0.0050	0.699	< 0.50	0.748	20.5	< 0.010	0.682	130	< 0.010	< 0.10	< 10	0.958	< 0.50	4.4
	2017 11 21	< 3.0	< 0.10	< 0.10	76.5	< 0.020	< 0.050	< 10	0.0087	78.6	0.22	< 0.10	1.75	< 10	0.056	5.7	28.5	0.12	< 0.0050	0.675	< 0.50	0.600	25.4	< 0.010	0.721	144	< 0.010	< 0.10	< 10	0.937	< 0.50	8.1
FR_MW-1B	2017 02 23	< 1.0	0.14	< 0.10	143	< 0.020	< 0.050	< 10	0.0157	106	0.10	< 0.10	< 0.20	< 10	< 0.050	38.1	37.7	0.25	< 0.0050	1.02	< 0.50	1.12	50.2	< 0.010	1.70	184	< 0.010	< 0.10	< 10	2.25	< 0.50	< 1.0
	2017 06 22	5.8	< 0.50	< 0.50	66.0	< 0.10	< 0.25	< 50	< 0.025	49.4	< 0.50	< 0.50	< 1.0	< 50	< 0.25	19.5	15.8	< 0.50	< 0.0050	1.02	< 2.5	0.91	13	< 0.050	0.82	88.2	< 0.050	< 0.50	< 10	0.860	< 2.5	< 5.0
	2017 09 19	5.0	0.17	< 0.10	131	< 0.020	< 0.050	< 10	0.0175	95.8	< 0.10	< 0.10	< 0.50	< 10	< 0.050	28.7	34.4	< 0.10	< 0.0050	0.968	< 0.50	1.32	47.1	< 0.010	1.37	166	< 0.010	< 0.10	< 10	1.90	< 0.50	< 3.0
	2017 11 21	< 3.0	0.12	< 0.10	126	< 0.020	< 0.050	< 10	0.0142	98.7	0.12	< 0.10	2.32	< 10	0.128	22.3	39.9	< 0.10	< 0.0050	0.894	< 0.50	1.12	42	< 0.010	1.43	171	< 0.010	< 0.10	< 10	1.76	< 0.50	< 3.0

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- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.

BOLD	Concentration greater than CSR Aquatic Life (AW) standard
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard

[a] Standard to protect freshwater aquatic life.
[b] Standard varies with pH.
[c] Standard varies with Chloride.
[d] Standard varies with Hardness.
[e] Standard varies with crop.
[f] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[g] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[h] Ultra trace mercury was sampled at FR_HMW5.
[i] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.
[j] In the fourth quarter of 2017, FR_GHHW was replaced with singular monitoring well FR_GH_WELL4 based on recommendations from the Hydrogeological Assessment (SNC-Lavalin, 2017b). Monitoring well FR_GH_WELL4 will be used in place of FR_GHHW in future sampling events.

TABLE 4 (Cont'd): Groundwater Analytical Results compared to Primary Screening Criteria

Sample Location	Sample Date (yyyy mm dd)	Physical Parameters: Laboratory pH (pH)	Hardness (mg/L)	Laboratory Conductivity (µS/cm)	Total Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Turbidity (NTU)	Total Alkalinity (as CaCO3) (mg/L)	Dissolved Inorganics: Ammonia, total (as N) (µg/L)	Bromide (mg/L)	Chloride (mg/L)	Fluoride (µg/L)	Nitrate (as N) (µg/L)	Nitrite (as N) (µg/L)	Kjeldahl Nitrogen-N (mg/L)	Ortho-Phosphate (mg/L)	Total Phosphorous as P (mg/L)	Sulphate (mg/L)	Organics: Total Organic Carbon (mg/L)	Dissolved Organic Carbon (mg/L)
BC Standard																				
CSR Aquatic Life (AW)[a]		n/a	n/a	n/a	n/a	n/a	n/a	n/a	3,700-18,500[b]	n/a	1,500	3,000	400,000	200-800[c]	n/a	n/a	n/a	3,090-4,290[d]	n/a	n/a
CSR Irrigation Watering (IW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100	1,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CSR Livestock Watering (LW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	600	1,000	100,000	10,000	n/a	n/a	n/a	1,000	n/a	n/a
CSR Drinking Water (DW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	250	1,500	10,000	1,000	n/a	n/a	n/a	500	n/a	n/a
Fording River Valley (Cont'd)																				
FR_09-04-A	2017 02 23	7.42	663	1,160	383	811	51.9	355	< 5.0	< 0.25	6.1	260	106	5.5	< 0.050	0.0028	0.0417	345	1.10	0.99
	Duplicate	7.39	672	1,150	4.7	823	0.45	353	< 5.0	< 0.25	6.3	280	108	< 5.0	< 0.050	0.0029	0.0309	347	0.98	0.93
	QA/QC RPD%	< 1	1	1	*	1	*	1	*	*	3	7	2	*	*	*	30	1	*	*
	2017 06 12	8.06	673	1,170	< 1.0	925	0.29	346	< 5.0	< 0.25	6.9	290	70	< 5.0	< 0.050	0.0024	< 0.0020	370	0.83	0.68
	2017 09 12	8.02	666	1,070	3.9	842	0.45	311	6.1	< 0.25	5.1	220	49	< 5.0	< 0.050	0.0018	0.0140	344	1.04	1.09
	2017 11 21	8.15	707	1,130	< 1.0	796	0.26	387	9.2	< 0.050	5.53	283	< 5.0	< 1.0	< 0.050	0.0040	0.0046	323	0.66	0.71
	Duplicate	8.21	688	1,120	< 1.0	827	0.27	370	8.5	< 0.25	5.0	260	< 25	5.0	< 0.050	0.0041	0.0052	337	0.72	0.73
	QA/QC RPD%	1	3	1	*	4	*	4	*	*	10	8	*	*	*	*	*	4	*	*
FR_09-04-B	2017 02 23	7.40	666	1,170	32.1	842	13.0	349	< 5.0	< 0.25	6.4	260	109	5.0	< 0.050	0.0035	0.116	353	1.37	0.77
	2017 06 12	7.85	672	1,200	1.2	902	0.50	370	6.5	< 0.25	6.8	270	30	< 5.0	< 0.050	0.0023	< 0.0020	377	0.83	0.82
	Duplicate	7.95	678	1,190	< 1.0	913	0.27	372	< 5.0	< 0.25	7.5	270	40	< 5.0	0.230	0.0025	0.0041	378	0.79	0.79
	QA/QC RPD%	1	1	1	*	1	*	1	*	*	10	0	29	*	*	*	*	< 1	*	*
	2017 09 12	7.56	671	1,070	< 1.0	830	0.36	323	< 5.0	< 0.25	5.2	210	33	< 5.0	< 0.050	0.0017	0.0043	343	0.96	1.04
	2017 11 21	8.13	730	1,120	< 1.0	840	0.25	341	7.2	< 0.050	5.72	266	< 5.0	< 1.0	< 0.050	0.0039	0.0044	328	0.68	0.64
FR_09-02-A	2017 03 20	7.94	488	907	12.2	688	22.6	197	< 5.0	< 0.050	1.44	161	**19,800**	< 1.0	1.05	0.0029	0.0214	264	0.85	0.50
	2017 06 01	8.11	583	1,070	< 1.0	850	0.91	226	< 5.0	< 0.25	< 2.5	170	**39,400**	< 5.0	0.502	0.0025	0.0044	236	0.76	0.55
	2017 09 13	8.12	420	750	11.2	509	5.18	176	< 5.0	< 0.050	1.09	185	**11,300**	< 1.0	0.353	0.0019	0.0192	200	0.85	0.57
	2017 11 22	7.97	532	867	3.3	639	5.94	195	< 5.0	< 0.050	1.64	162	**12,100**	1.1	0.213	0.0034	0.0138	259	0.83	0.57
FR_09-02-B	2017 03 20	7.79	498	940	3.2	681	2.90	210	< 5.0	< 0.050	1.80	148	**18,900**	1.2	1.29	0.0029	0.0251	267	< 0.50	< 0.50
	Duplicate	7.77	504	927	3.0	696	2.05	209	< 5.0	< 0.050	1.83	160	**18,900**	2.4	0.777	0.0025	0.0086	267	< 0.50	< 0.50
	QA/QC RPD%	< 1	1	1	*	2	34	< 1	*	*	*	8	0	*	50	*	*	0	*	*
	2017 06 01	8.08	601	1,090	4.7	853	3.39	241	< 5.0	< 0.25	< 2.5	150	**40,500**	< 5.0	< 0.050	0.0010	0.0044	253	0.70	0.51
	2017 09 13	8.03	424	759	< 1.0	492	0.39	201	9.2	< 0.050	1.22	160	9,900	< 1.0	0.337	0.0019	0.0043	186	0.79	< 0.50
	Duplicate	8.24	420	757	2.6	526	0.36	204	< 5	< 0.05	1.24	159	10,000	< 1	0.3	0.0015	0.0034	186	0.62	< 0.5
	QA/QC RPD%	3	1	< 1	*	7	*	1	*	*	*	1	1	*	12	*	*	0	*	*
	2017 11 22	7.93	546	884	< 1.0	666	0.11	214	< 5.0	< 0.050	1.94	154	**11,500**	< 1.0	0.232	0.0030	0.0059	254	0.65	< 0.50
FR_09-01-A	2017 03 08	7.51	986	1,540	< 1.0	1,240	0.15	305	< 5.0	< 0.25	3.2	120	**47,200**	< 5.0	0.165	0.0034	0.0083	481	< 0.50	< 0.50
	2017 06 01	8.04	557	1,030	< 1.0	789	0.86	231	< 5.0	< 0.25	< 2.5	200	**35,100**	< 5.0	0.486	0.0021	0.0029	208	0.76	0.53
	2017 09 12	8.08	738	1,170	< 1.0	927	0.13	298	< 5.0	< 0.25	3.0	< 100	**21,200**	< 5.0	< 0.050	0.0016	0.0233	347	0.63	0.74
	2017 11 22	7.79	1,050	1,590	< 1.0	1,350	0.29	328	< 5.0	< 0.25	< 2.5	< 100	**54,300**	12.7	0.449	0.0030	0.0039	486	0.58	< 0.50
FR_09-01-B	2017 03 08	7.45	882	1,320	36.4	1,040	11.2	307	< 5.0	< 0.25	4.1	120	**25,900**	< 5.0	0.613	0.0027	0.0154	409	< 0.50	< 0.50
	2017 06 01	8.18	636	1,160	< 1.0	907	0.27	236	5.0	< 0.25	< 2.5	170	**43,900**	< 5.0	0.457	0.0014	0.0044	267	0.54	< 0.50
	2017 09 12	8.19	613	987	< 1.0	738	0.35	258	< 5.0	< 0.25	3.0	140	**12,700**	< 5.0	< 0.050	0.0010	0.0028	296	0.78	0.88
	2017 11 22	7.85	890	1,330	2.3	1,050	1.26	336	< 5.0	< 0.25	3.1	140	**29,600**	< 5.0	0.294	0.0032	0.0055	407	0.70	< 0.50

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[a] Standard to protect freshwater aquatic life.
[b] Standard varies with pH.
[c] Standard varies with Chloride.
[d] Standard varies with Hardness.
[e] Standard varies with crop.
[f] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[g] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[h] Ultra trace mercury was sampled at FR_HMW5.
[i] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.
[j] In the fourth quarter of 2017, FR_GHHW was replaced with singular monitoring well FR_GH_WELL4 based on recommendations from the Hydrogeological Assessment (SNC-Lavalin, 2017b). Monitoring well FR_GH_WELL4 will be used in place of FR_GHHW in future sampling events.

TABLE 4 (Cont'd): Groundwater Analytical Results compared to Primary Screening Criteria

Sample Location	Sample Date (yyyy mm dd)	Aluminum µg/L	Antimony µg/L	Arsenic µg/L	Barium µg/L	Beryllium µg/L	Bismuth µg/L	Boron µg/L	Cadmium µg/L	Calcium mg/L	Chromium µg/L	Cobalt µg/L	Copper µg/L	Iron µg/L	Lead µg/L	Lithium µg/L	Magnesium mg/L	Manganese µg/L	Mercury[h] µg/L	Molybdenum µg/L	Nickel µg/L	Potassium mg/L	Selenium µg/L	Silver µg/L	Sodium mg/L	Strontium µg/L	Thallium µg/L	Tin µg/L	Titanium µg/L	Uranium µg/L	Vanadium µg/L	Zinc[i] µg/L
		Dissolved Metals																														
BC Standard																																
CSR Aquatic Life (AW)[a]		n/a	90	50	10,000	1.5	n/a	12,000	3.5-4[d]	n/a	10[f]	40	70-90[d]	n/a	60-160[d]	n/a	n/a	n/a	0.25	10,000	1,100-1,500[d]	n/a	20	15	n/a	n/a	3	n/a	1,000	85	n/a	900-2,400[d]
CSR Irrigation Watering (IW)		5,000	n/a	100	n/a	100	n/a	500-6,000[e]	5	n/a	5[f]	50	200	5,000	200	2,500	n/a	200	1	10	200	n/a	20	n/a	n/a	n/a	n/a	n/a	n/a	10	100	n/a
CSR Livestock Watering (LW)		5,000	n/a	25	n/a	100	n/a	5,000	80	1,000	50[f]	1,000	300	n/a	100	5,000	n/a	n/a	2	50	1,000	n/a	30	n/a	n/a	n/a	n/a	n/a	n/a	200	100	2,000
CSR Drinking Water (DW)		9,500	6	10	1,000	8	n/a	5,000	5	n/a	50[f]	20[g]	1,500	6,500	10	8	n/a	1,500	1	250	80	n/a	10	20	200	2,500	n/a	2,500	n/a	20	20	3,000
Fording River Valley (Cont'd)																																
FR_09-04-A	2017 02 23	< 1.0	0.11	0.10	106	< 0.020	< 0.050	31	1.05	141	< 0.10	1.11	0.26	< 10	< 0.050	**96.4**	75.5	**1,200**	< 0.0050	1.84	8.30	6.00	0.175	< 0.010	7.20	216	0.060	< 0.10	< 10	6.19	< 0.50	3.8
	Duplicate	< 1.0	0.11	0.10	107	< 0.020	< 0.050	32	1.04	145	< 0.10	1.10	0.22	< 10	< 0.050	**98.4**	75.4	**1,180**	< 0.0050	1.88	8.10	6.07	0.197	< 0.010	7.19	223	0.060	< 0.10	< 10	6.38	< 0.50	3.6
	QA/QC RPD%	*	*	*	1	*	*	*	1	3	*	1	*	*	*	2	< 1	2	*	2	2	1	*	*	< 1	3	0	*	*	3	*	*
	2017 06 12	< 1.0	0.12	< 0.10	108	< 0.020	< 0.050	34	1.13	140	< 0.10	1.23	0.25	< 10	< 0.050	**84.5**	78.8	**1,170**	< 0.0050	4.35	8.24	5.88	0.107	< 0.010	7.01	221	0.062	< 0.10	< 10	5.73	< 0.50	9.0
	2017 09 12	< 3.0	0.11	< 0.10	97.2	< 0.020	< 0.050	29	1.01	142	< 0.10	1.14	< 0.50	< 10	< 0.050	**90.9**	75.3	**1,220**	< 0.0050	1.78	7.08	5.86	0.107	< 0.010	7.12	206	0.057	< 0.10	< 10	5.62	< 0.50	3.6
	2017 11 21	< 3.0	< 0.10	< 0.10	96.0	< 0.020	< 0.050	28	0.982	143	< 0.10	1.05	< 0.50	< 10	< 0.050	**89.7**	85.2	**1,350**	< 0.0050	1.80	7.25	5.78	0.112	< 0.010	7.18	220	0.059	< 0.10	< 10	5.54	< 0.50	3.9
	Duplicate	< 3.0	< 0.10	< 0.10	95.6	< 0.020	< 0.050	25	0.985	134	< 0.10	1.04	< 0.50	< 10	< 0.050	**80.8**	86.1	**1,370**	< 0.0050	1.60	7.24	5.85	0.104	< 0.010	7.25	198	0.055	< 0.10	< 10	5.07	< 0.50	3.7
	QA/QC RPD%	*	*	*	< 1	*	*	*	< 1	6	*	1	*	*	*	10	1	1	*	12	< 1	1	*	*	1	11	7	*	*	9	*	*
FR_09-04-B	2017 02 23	< 1.0	0.12	< 0.10	102	< 0.020	< 0.050	32	1.02	143	< 0.10	1.18	0.52	< 10	< 0.050	**96.3**	75.2	**1,270**	< 0.0050	1.85	8.74	5.89	0.201	< 0.010	7.18	218	0.060	< 0.10	< 10	5.99	< 0.50	3.8
	2017 06 12	< 1.0	0.10	< 0.10	105	< 0.020	< 0.050	33	1.12	141	< 0.10	1.22	0.26	< 10	< 0.050	**84.8**	77.7	**1,220**	< 0.0050	3.41	8.34	5.70	0.135	< 0.010	6.92	221	0.062	< 0.10	< 10	5.52	< 0.50	8.5
	Duplicate	34.0	0.12	< 0.10	108	< 0.020	< 0.050	34	1.13	141	< 0.10	1.25	0.32	< 10	< 0.050	**90.7**	79.0	**1,240**	< 0.0050	5.29	8.52	5.65	0.147	0.038	6.98	223	0.064	< 0.10	< 10	5.58	< 0.50	9.7
	QA/QC RPD%	*	*	*	3	*	*	*	1	0	*	2	*	*	*	7	2	2	*	43	2	1	*	*	1	1	3	*	*	1	*	13
	2017 09 12	< 3.0	0.12	< 0.10	94.2	< 0.020	< 0.050	29	1.01	145	< 0.10	1.17	< 0.50	< 10	< 0.050	**90.6**	75.2	**1,230**	< 0.0050	1.63	7.44	5.76	0.141	< 0.010	7.11	204	0.059	< 0.10	< 10	5.45	< 0.50	3.4
	2017 11 21	< 3.0	< 0.10	< 0.10	94.2	< 0.020	< 0.050	27	0.977	150	< 0.10	1.06	< 0.50	< 10	< 0.050	**86.9**	86.4	**1,360**	< 0.0050	1.65	7.41	5.87	0.134	< 0.010	7.41	219	0.059	< 0.10	< 10	5.13	< 0.50	3.8
FR_09-02-A	2017 03 20	< 1.0	0.14	< 0.10	136	< 0.020	< 0.050	< 10	0.0431	116	0.19	< 0.10	0.33	< 10	< 0.050	**37.3**	47.9	< 0.10	< 0.0050	0.959	< 0.50	1.74	***50.8***	< 0.010	2.33	177	< 0.010	< 0.10	< 10	2.60	< 0.50	5.8
	2017 06 01	< 1.0	0.17	< 0.10	151	< 0.020	< 0.050	< 10	0.0268	132	< 0.10	< 0.10	0.31	< 10	< 0.050	**50.0**	61.2	0.13	< 0.0050	1.23	< 0.50	2.00	***117***	< 0.010	2.70	193	< 0.010	< 0.10	< 10	3.39	< 0.50	< 1.0
	2017 09 13	< 3.0	0.25	< 0.10	113	< 0.020	< 0.050	17	0.0337	107	< 0.10	< 0.10	1.80	< 10	0.071	**38.6**	37.1	0.48	< 0.0050	1.18	< 0.50	2.29	***38.2***	< 0.010	1.77	126	< 0.010	< 0.10	< 10	2.29	< 0.50	3.0
	2017 11 22	< 3.0	0.20	< 0.10	153	< 0.020	< 0.050	14	0.0434	128	< 0.10	< 0.10	< 0.50	< 10	< 0.050	**39.5**	51.5	< 0.10	< 0.0050	1.17	< 0.50	2.26	***47.9***	< 0.010	2.44	169	< 0.010	< 0.10	< 10	2.50	< 0.50	< 3.0
FR_09-02-B	2017 03 20	< 1.0	< 0.10	< 0.10	172	< 0.020	< 0.050	11	0.0335	119	< 0.10	0.13	< 0.20	< 10	< 0.050	**41.7**	48.9	< 0.10	< 0.0050	0.670	0.58	1.98	***43.8***	< 0.010	2.46	182	< 0.010	< 0.10	< 10	2.46	< 0.50	4.3
	Duplicate	< 1.0	0.13	< 0.10	174	< 0.020	< 0.050	11	0.0313	119	< 0.10	0.15	< 0.20	< 10	< 0.050	**42.0**	50.0	< 0.10	< 0.0050	0.658	0.55	2.06	***43.5***	< 0.010	2.50	183	< 0.010	< 0.10	< 10	2.45	< 0.50	4.1
	QA/QC RPD%	*	*	*	1	*	*	*	7	0	*	*	*	*	*	1	2	*	*	2	*	4	1	*	2	1	*	*	*	< 1	*	*
	2017 06 01	< 1.0	< 0.10	< 0.10	183	< 0.020	< 0.050	< 10	0.0205	137	< 0.10	< 0.10	0.33	< 10	< 0.050	**47.2**	63.1	0.11	< 0.0050	0.625	< 0.50	2.06	***117***	< 0.010	2.99	200	< 0.010	< 0.10	< 10	2.67	< 0.50	2.0
	2017 09 13	< 3.0	0.10	< 0.10	138	< 0.020	< 0.050	12	0.0230	102	0.10	0.13	< 0.50	< 10	< 0.050	**42.9**	41.1	< 0.10	< 0.0050	0.801	< 0.50	1.96	***34.4***	< 0.010	2.60	144	< 0.010	< 0.10	< 10	2.24	< 0.50	< 3.0
	Duplicate	< 3	0.1	< 0.1	137	< 0.02	< 0.05	12	0.0259	101	< 0.1	0.12	< 0.5	< 10	< 0.05	**42.4**	40.8	< 0.1	< 0.005	0.746	< 0.5	1.95	***33.1***	< 0.01	2.61	143	< 0.01	< 0.1	< 10	2.25	< 0.5	< 3
	QA/QC RPD%	*	*	*	1	*	*	*	*	1	*	*	*	*	*	1	1	*	*	7	*	< 1	4	*	< 1	1	*	*	*	< 1	*	*
	2017 11 22	< 3.0	0.12	< 0.10	172	< 0.020	< 0.050	15	0.0326	128	< 0.10	0.17	< 0.50	< 10	< 0.050	**45.7**	55.2	< 0.10	< 0.0050	0.795	0.61	2.25	***43.1***	< 0.010	2.99	177	< 0.010	< 0.10	< 10	2.54	< 0.50	< 3.0
FR_09-01-A	2017 03 08	< 1.0	0.19	< 0.10	139	< 0.020	< 0.050	18	0.0571	214	< 0.10	0.31	< 0.20	< 10	< 0.050	**76.8**	110	< 0.10	< 0.0050	0.658	1.40	3.32	***120***	< 0.010	4.10	214	< 0.010	< 0.10	< 10	6.34	< 0.50	< 1.0
	2017 06 01	< 1.0	0.27	< 0.10	70.0	< 0.020	< 0.050	13	0.0269	123	< 0.10	< 0.10	< 0.20	< 10	< 0.050	**51.4**	60.8	0.15	< 0.0050	1.81	< 0.50	2.57	***112***	< 0.010	2.52	115	< 0.010	< 0.10	< 10	4.77	< 0.50	2.5
	2017 09 12	< 3.0	0.34	< 0.10	99.9	< 0.020	< 0.050	27	0.0478	170	< 0.10	0.33	< 0.50	< 10	< 0.050	**65.5**	76.4	< 0.10	< 0.0050	0.804	1.37	3.43	***68.1***	< 0.010	4.27	163	< 0.010	< 0.10	< 10	4.26	< 0.50	< 3.0
	2017 11 22	< 3.0	0.24	< 0.10	144	< 0.020	< 0.050	23	0.0471	234	< 0.10	0.17	< 0.50	< 10	< 0.050	**68.0**	112	0.71	< 0.0050	0.603	0.74	3.64	***166***	< 0.010	4.10	222	< 0.010	< 0.10	< 10	5.36	< 0.50	< 3.0
FR_09-01-B	2017 03 08	< 1.0	0.13	< 0.10	153	< 0.020	< 0.050	21	0.0536	184	0.13	0.52	< 0.20	< 10	< 0.050	**69.1**	103	< 0.10	< 0.0050	0.640	2.00	3.79	***71.8***	< 0.010	4.89	212	< 0.010	< 0.10	< 10	4.54	< 0.50	1.2
	2017 06 01	< 1.0	0.11	< 0.10	126	< 0.020	< 0.050	17	0.0209	137	< 0.10	< 0.10	< 0.20	< 10	< 0.050	**54.7**	71.2	< 0.10	< 0.0050	0.565	< 0.50	3.14	***126***	< 0.010	3.63	155	< 0.010	< 0.10	< 10	3.21	< 0.50	< 1.0
	2017 09 12	< 3.0	0.14	< 0.10	117	< 0.020	< 0.050	16	0.0350	140	0.11	0.32	< 0.50	< 10	< 0.050	**54.3**	63.8	< 0.10	< 0.0050	0.966	1.25	3.08	***44.2***	< 0.010	3.79	148	< 0.010	< 0.10	< 10	4.79	< 0.50	< 3.0
	2017 11 22	< 3.0	0.15	< 0.10	156	< 0.020	< 0.050	23	0.0402	202	< 0.10	0.42	< 0.50	< 10	< 0.050	**67.7**	93.8	0.42	< 0.0050	0.835	1.32	3.50	***91.5***	< 0.010	4.84	208	< 0.010	< 0.10	< 10	5.30	< 0.50	< 3.0

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BOLD	Concentration greater than CSR Aquatic Life (AW) standard
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard

[a] Standard to protect freshwater aquatic life.
[b] Standard varies with pH.
[c] Standard varies with Chloride.
[d] Standard varies with Hardness.
[e] Standard varies with crop.
[f] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[g] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[h] Ultra trace mercury was sampled at FR_HMW5.
[i] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.
[j] In the fourth quarter of 2017, FR_GHHW was replaced with singular monitoring well FR_GH_WELL4 based on recommendations from the Hydrogeological Assessment (SNC-Lavalin, 2017b). Monitoring well FR_GH_WELL4 will be used in place of FR_GHHW in future sampling events.

TABLE 4 (Cont'd): Groundwater Analytical Results compared to Primary Screening Criteria

Sample Location	Sample Date (yyyy mm dd)	Laboratory pH (pH)	Hardness (mg/L)	Laboratory Conductivity (µS/cm)	Total Suspended Solids (mg/L)	Total Dissolved Solids (mg/L)	Turbidity (NTU)	Total Alkalinity (as CaCO3) (mg/L)	Ammonia, total (as N) (µg/L)	Bromide (mg/L)	Chloride (mg/L)	Fluoride (µg/L)	Nitrate (as N) (µg/L)	Nitrite (as N) (µg/L)	Kjeldahl Nitrogen-N (mg/L)	Ortho-Phosphate (mg/L)	Total Phosphorous as P (mg/L)	Sulphate (mg/L)	Total Organic Carbon (mg/L)	Dissolved Organic Carbon (mg/L)
		Physical Parameters							Dissolved Inorganics										Organics	
BC Standard																				
CSR Aquatic Life (AW)[a]		n/a	n/a	n/a	n/a	n/a	n/a	n/a	3,700-18,500[b]	n/a	1,500	3,000	400,000	200-800[c]	n/a	n/a	n/a	3,090-4,290[d]	n/a	n/a
CSR Irrigation Watering (IW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100	1,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CSR Livestock Watering (LW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	600	1,000	100,000	10,000	n/a	n/a	n/a	1,000	n/a	n/a
CSR Drinking Water (DW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	250	1,500	10,000	1,000	n/a	n/a	n/a	500	n/a	n/a
Fording River Valley (Cont'd)																				
FR_GHHW[j]	2017 02 27	7.58	689	1,230	< 1.0	957	0.30	263	< 5.0	< 0.050	1.52	96	46,600	1.9	< 0.050	0.0101	0.0155	287	0.87	0.78
	2017 06 01	8.09	597	1,090	< 1.0	844	0.88	271	7.5	< 0.25	2.9	< 100	33,400	< 5.0	< 0.050	< 0.0010	< 0.0020	248	0.76	0.60
	2017 09 13	8.26	527	942	< 1.0	637	1.32	242	9.2	< 0.050	1.67	94	27,300	***398***	0.499	< 0.0010	0.0014	195	2.08	1.57
	2017 11 15	8.35	590	1,050	< 1.0	772	0.38	248	< 5.0	< 0.25	< 2.5	< 100	34,900	19.1	0.240	< 0.0010	< 0.0020	243	0.93	0.77
Field Banks																				
	2017 02 23	5.45	<0.50	<2.0	<1.0	<10	<0.10	<1.0	< 5.0	<0.050	<0.50	< 20	< 5	< 1.0	<0.050	<0.0010	0.0041	<0.30	<0.50	<0.50
	2017 06 22	5.72	< 0.50	< 2.0	< 1.0	< 10	< 0.10	< 1.0	< 5.0	< 0.050	< 0.50	< 20	< 5	< 1.0	< 0.050	< 0.0010	< 0.0020	< 0.30	< 0.50	0.59
	2017 09 18	5.59	< 0.50	< 2.0	< 1.0	< 10	< 0.10	< 1.0	< 5.0	< 0.050	< 0.50	< 20	< 5	< 1.0	< 0.050	< 0.0010	< 0.0010	< 0.30	0.73	0.60
	2017 11 15	5.90	< 0.50	< 2.0	< 1.0	< 10	0.14	< 1.0	8.3	< 0.050	< 0.50	< 20	< 5	< 1.0	< 0.050	< 0.0010	< 0.0020	< 0.30	< 0.50	< 0.50
Trip Blanks																				
	2017 02 27	5.69	< 0.50	< 2.0	< 1.0	< 10	< 0.10	< 1.0	< 5.0	< 0.050	< 0.50	< 20	< 5	< 1.0	< 0.050	< 0.0010	0.0052	< 0.30	< 0.50	-
	2017 06 21	5.54	< 0.50	< 2.0	< 1.0	< 10	< 0.10	< 1.0	< 5.0	< 0.050	< 0.50	< 20	7.9	< 1.0	< 0.050	< 0.0010	< 0.0020	< 0.30	< 0.50	-
	2017 09 18	5.86	< 0.50	< 2.0	< 1.0	< 10	< 0.10	< 1.0	5.6	< 0.050	< 0.50	< 20	< 5	< 1.0	< 0.050	< 0.0010	< 0.0010	< 0.30	< 0.50	-
	2017 11 14	5.12	< 0.50	< 2.0	< 1.0	< 10	0.19	< 1.0	< 5.0	< 0.050	< 0.50	< 20	< 5	< 1.0	< 0.050	< 0.0010	< 0.0010	< 0.30	< 0.50	-

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[a] Standard to protect freshwater aquatic life.
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[g] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[h] Ultra trace mercury was sampled at FR_HMW5.
[i] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.
[j] In the fourth quarter of 2017, FR_GHHW was replaced with singular monitoring well FR_GH_WELL4 based on recommendations from the Hydrogeological Assessment (SNC-Lavalin, 2017b). Monitoring well FR_GH_WELL4 will be used in place of FR_GHHW in future sampling events.

TABLE 4 (Cont'd): Groundwater Analytical Results compared to Primary Screening Criteria

Sample Location	Sample Date (yyyy mm dd)	Dissolved Metals																														
		Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Mercury[h]	Molybdenum	Nickel	Potassium	Selenium	Silver	Sodium	Strontium	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc[i]
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BC Standard																																
CSR Aquatic Life (AW)[a]		n/a	90	50	10,000	1.5	n/a	12,000	3.5-4[d]	n/a	10[f]	40	70-90[d]	n/a	60-160[d]	n/a	n/a	n/a	0.25	10,000	1,100-1,500[d]	n/a	20	15	n/a	n/a	3	n/a	1,000	85	n/a	900-2,400[d]
CSR Irrigation Watering (IW)		5,000	n/a	100	n/a	100	n/a	500-6,000[e]	5	n/a	5[f]	50	200	5,000	200	2,500	n/a	200	1	10	200	n/a	20	n/a	n/a	n/a	n/a	n/a	n/a	10	100	n/a
CSR Livestock Watering (LW)		5,000	n/a	25	n/a	100	n/a	5,000	80	1,000	50[f]	1,000	300	n/a	100	5,000	n/a	n/a	2	50	1,000	n/a	30	n/a	n/a	n/a	n/a	n/a	n/a	200	100	2,000
CSR Drinking Water (DW)		9,500	6	10	1,000	8	n/a	5,000	5	n/a	50[f]	20[g]	1,500	6,500	10	8	n/a	1,500	1	250	80	n/a	10	20	200	2,500	n/a	2,500	n/a	20	20	3,000
Fording River Valley (Cont'd)																																
FR_GHHW[j]	2017 02 27	< 1.0	< 0.10	< 0.10	110	< 0.020	< 0.050	11	0.0515	169	< 0.10	< 0.10	1.98	91	0.080	**24.8**	64.7	1.93	< 0.0050	0.328	< 0.50	1.46	123	< 0.010	2.61	238	< 0.010	< 0.10	< 10	2.88	< 0.50	67.4
	2017 06 01	< 1.0	< 0.10	< 0.10	90.6	< 0.020	< 0.050	11	0.0408	143	< 0.10	< 0.10	1.96	47	0.070	**23.7**	58.2	5.93	< 0.0050	0.343	< 0.50	1.27	93.5	< 0.010	2.41	194	< 0.010	< 0.10	< 10	2.64	< 0.50	48.8
	2017 09 13	< 3.0	< 0.10	< 0.10	82.3	< 0.020	< 0.050	< 10	0.0403	132	< 0.10	< 0.10	1.87	13	0.090	**21.9**	48.0	1.03	< 0.0050	0.290	< 0.50	1.18	82.2	< 0.010	2.15	169	< 0.010	< 0.10	< 10	2.35	< 0.50	90.3
	2017 11 15	< 3.0	< 0.10	< 0.10	83.1	< 0.020	< 0.050	< 10	0.0297	143	< 0.10	< 0.10	1.36	12	0.060	**24.9**	56.6	1.08	< 0.0050	0.322	< 0.50	1.19	92.8	< 0.010	2.26	185	< 0.010	< 0.10	< 10	2.50	< 0.50	20.5
Field Banks																																
	2017 02 23	< 1.0	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 50	< 0.10	< 0.10	< 0.20	< 10	< 0.050	< 1.0	< 5	< 0.10	< 0.00050	< 0.050	< 0.50	< 50	< 0.050	< 0.010	< 50	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 1.0
	2017 06 22	< 1.0	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 50	< 0.10	< 0.10	< 0.20	< 10	< 0.050	< 1.0	< 5	< 0.10	< 0.0050	< 0.050	< 0.50	< 50	< 0.050	< 0.010	< 50	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	9.20
	2017 09 18	< 3.0	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 50	< 0.10	< 0.10	< 0.50	< 10	< 0.050	< 1.0	< 100	< 0.10	< 0.0050	< 0.050	< 0.50	< 50	< 0.050	< 0.010	< 50	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0
	2017 11 15	< 3.0	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 50	< 0.10	< 0.10	< 0.50	< 10	< 0.050	< 1.0	< 100	< 0.10	< 0.0050	< 0.050	< 0.50	< 50	< 0.050	< 0.010	< 50	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0
Trip Blanks																																
	2017 02 27	-	-	-	-	-	-	-	-	< 50	-	-	-	-	-	-	< 5	-	-	-	-	< 50	-	-	< 50	-	-	-	-	-	-	-
	2017 06 21	-	-	-	-	-	-	-	-	< 50	-	-	-	-	-	-	< 5	-	-	-	-	< 50	-	-	< 50	-	-	-	-	-	-	-
	2017 09 18	-	-	-	-	-	-	-	-	< 50	-	-	-	-	-	-	< 5	-	-	-	-	< 50	-	-	< 50	-	-	-	-	-	-	-
	2017 11 14	< 3.0	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 50	< 0.10	< 0.10	< 0.50	< 10	< 0.050	< 1.0	< 100	< 0.10	< 0.0050	< 0.050	< 0.50	< 50	< 0.050	< 0.010	< 50	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0

Associated data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.

BOLD	Concentration greater than CSR Aquatic Life (AW) standard
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard

[a] Standard to protect freshwater aquatic life.
[b] Standard varies with pH.
[c] Standard varies with Chloride.
[d] Standard varies with Hardness.
[e] Standard varies with crop.
[f] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[g] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[h] Ultra trace mercury was sampled at FR_HMW5.
[i] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.
[j] In the fourth quarter of 2017, FR_GHHW was replaced with singular monitoring well FR_GH_WELL4 based on recommendations from the Hydrogeological Assessment (SNC-Lavalin, 2017b). Monitoring well FR_GH_WELL4 will be used in place of FR_GHHW in future sampling events.

TABLE 5: Groundwater Analytical Results compared to Secondary Screening Criteria

Sample Location	Sample Date (yyyy mm dd)	Selenium µg/L
Groundwater Quality Criteria		
Guideline for Canadian Drinking Water Quality (DW)		50
Site Performance Objective: GH_FR1 (0200378)		63
Compliance Point: FR_FRCP1 (E300071)		130
Henretta Valley		
FR_HMW1D	2017 02 27	***61.5***
	2017 06 22	34.3
	2017 09 18	***70.1***
	2017 11 14	***94.3***
	Duplicate	***95.6***
	QA/QC RPD%	1
FR_HMW1S	2017 02 27	***236***
	2017 06 22	***239***
	Duplicate	***231***
	QA/QC RPD%	3
	2017 09 18	***262***
	2017 11 14	***236***
FR_HMW2	2017 02 27	***547***
	2017 06 21	***574***
	2017 09 19	***674***
	2017 11 14	***657***
FR_HMW3	2017 02 27	44.4
	2017 06 22	44.6
	2017 09 19	***56.3***
	2017 11 14	***66.1***
FR_HMW5	2017 06 21	14.8
Fording River Valley		
FR_POTWELLS	2017 03 02	22.2
	2017 09 19	20.5
	2017 11 21	25.4
FR_MW-1B	2017 02 23	***50.2***
	2017 06 22	13
	2017 09 19	47.1
	2017 11 21	42
FR_09-02-A	2017 03 20	***50.8***
	2017 06 01	***117***
	2017 09 13	38.2
	2017 11 22	47.9
FR_09-02-B	2017 03 20	43.8
	Duplicate	43.5
	QA/QC RPD%	1
	2017 06 01	***117***
	2017 09 13	34.4
	Duplicate	33.1
	QA/QC RPD%	4
	2017 11 22	43.1
FR_09-01-A	2017 03 08	***120***
	2017 06 01	***112***
	2017 09 12	***68.1***
	2017 11 22	***166***
FR_09-01-B	2017 03 08	***71.8***
	2017 06 01	***126***
	2017 09 12	44.2
	2017 11 22	***91.5***
FR_GHHW[a]	2017 02 27	***123***
	2017 06 01	***93.5***
	2017 09 13	***82.2***
	2017 11 15	***92.8***

Associated data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.

BOLD	Concentration greater than Canadian Drinking Water Quality guideline
SHADOW	Concentration greater than applicable Site Performance Objective
SHADED	Concentration greater than applicable Compliance Point

[a] In the fourth quarter of 2017, FR_GHHW was replaced with singular monitoring well FR_GH_WELL4 based on recommendations from the Hydrogeological Assessment (SNC-Lavalin, 2017b). Monitoring well FR_GH_WELL4 will be used in place of FR_GHHW in future sampling events.

Appendix I-2: GHO 2017 Annual Groundwater Monitoring Summary and Recommendations

Appendix I-2: Greenhills Operations 2017 Annual Groundwater Monitoring

Summary

SNC-Lavalin Inc. (SNC-Lavalin, 2018b) completed the 2017 Annual Report for the Greenhills Operations (GHO) Site Specific Groundwater Monitoring Program (SSGMP). GHO is located in southeastern British Columbia (BC), in the Elk Valley and is one of Teck's five active coal mines in the Elk Valley. The following information was taken from the 2017 GHO Annual Report, which was completed to fulfill the reporting requirements outlined in Section 10.4 of Permit 107517 (October 13, 2017). The SSGMP was developed in May 2014 and was approved by the Ministry of Environment (MoE) now referred to as the Ministry of Environment & Climate Change Strategy (ENV) in June 2016. This report summarizes the results from the 2017 quarterly groundwater monitoring and sampling activities conducted at GHO.

The groundwater conceptual site model (CSM) for GHO identified two main drainages: Elk River to the west and the Fording River to the east and south. Several creeks flow from the uplands towards these rivers which are the final receiving environments for surface water and much of the groundwater at GHO. Groundwater flow in the study area occurs predominantly through surficial materials compared to groundwater flow through bedrock. The two main hydrogeological settings in surficial materials are in the upland areas and the Elk River and Fording River valley bottoms.

As part of the 2017 SSGMP, a total of 11 monitoring well locations at GHO were monitored and sampled for select analytes during quarterly field events. The wells monitored and sampled as part of the 2017 annual program are listed in **Error! Reference source not found.** along with the associated rationale (extracted from the GHO 2017 Annual Report). Monitoring well locations are shown on Drawing 653246-002 (extracted from the GHO 2017 Annual Report). At the time of reporting, the Q4 water level at GH_GW-RLP-1D was not available for review. Groundwater samples were submitted for analysis of select constituents of interest (CIs) and non-CI parameters as outlined in the 2014 SSGMP. To assess groundwater and surface water interactions, groundwater chemistry was compared to chemistry at nearby surface water stations.

Groundwater quality screening followed the most recent procedures that have been discussed with ENV and summarized in the Regional Groundwater Monitoring Program (2017 RGMP; SNC-Lavalin, 2017b). Groundwater quality at all monitoring locations were compared to applicable primary screening criteria and secondary screening criteria if selenium concentrations were above primary screening. Presentation of results, data interpretation, and discussion of water level and chemistry trends for select constituents of interest (CI), including dissolved selenium and sulphate, were summarized by main transport pathways (i.e., main stem valley-bottoms and associated major tributary drainages) as defined by the CSM.

Groundwater quality data for CI are shown in plan view in Drawing 653246-007 (extracted from the GHO 2017 Annual Report). Groundwater quality data and field blank data are provided in the attached Table 4 (extracted from the 2017 GHO Annual Report).

In general, groundwater concentrations of CIs above primary and secondary screening criteria were consistent with 2015 and 2016 results. Results and interpretation are presented throughout the report based on valley-bottom drainages. A brief summary of results and interpretation is as follows:

- Elk River Valley: Groundwater samples from 2017 were above primary and secondary screening criteria for dissolved selenium in the Wolfram and Thompson Creek drainages. Selenium concentrations in groundwater were typically lower compared to concentrations in nearby tributary surface water from Thompson Creek, indicating surface water is the primary pathway for transport of CI to the Elk River valley-bottom.
- Fording River Valley:
  - Porter Creek: Concentrations of dissolved selenium in groundwater near Porter Creek were above the primary and secondary screening criteria in 2017. Similar concentrations and variations in selenium and sulphate were measured in surface water collected from Porter Creek. It is expected that surface water is the main transport pathway for loading of mine-influenced constituents to influence groundwater quality in this area.
  - Greenhills Creek: Groundwater samples from the Greenhills Creek drainage in 2017 were below the primary screening criteria for all CI. Dissolved selenium concentrations in surface water from Greenhills Creek have consistently been higher than in groundwater, indicating there is a potential for loading of mine-influenced constituents from tributary surface water to groundwater via infiltration. Consistent with previous years, a clear seasonal trend in sulphate concentrations in surface water and groundwater has been observed (low concentrations during freshet and high concentrations during times of lower flow); however, dissolved selenium does not follow this trend. It is interpreted that year-round low concentrations of selenium in groundwater in this area may be attributed to being preferentially attenuated in the aquifer due to reducing conditions in groundwater.
  - A clear seasonal trend in dissolved selenium and sulphate concentrations was observed in Fording River surface water and groundwater, consistent with the effect of dilution in a freshet dominated regime. Concentrations of surface water are one order-of-magnitude higher than groundwater indicating that the main transport pathway is via surface water infiltration in this area rather than tributary groundwater transport.
  - Groundwater selenium concentrations in overburden beneath the tailings dam are low, likely as a result of reducing conditions present in this well.
  - It is interpreted that a relatively continuous aquitard exists in the Fording River valley in the Greenhills Creek Monitoring Area, which isolates groundwater in the area from surface water infiltration.

Constituents other than CI that were measured above primary screening criteria included: sodium, fluoride, boron, copper, lithium, manganese, molybdenum, strontium, and zinc. Dissolved lithium and strontium did not previously exceed criteria; however, the drinking water *Contaminated Sites Regulation*[1] (CSR) standards recently reduced from 730 µg/L to 8 µg/L and 22,000 µg/L to 2,500 µg/L, respectively, on November 1, 2017. The remaining constituents above primary screening criteria were assessed in the 2017 RGMP and appeared to originate from natural sources (e.g., interaction with bedrock or unconsolidated materials), with the exception of zinc at GH_MW-UTC-1D (Elk River) and copper at GH_MW-PC (Porter Creek). These constituents appear to be locally sourced or anomalous in the case of copper and are not interpreted to be considered a concern.

An update of the SSGMP is due in 2018 and the 2017 and historical groundwater monitoring results will be used in the development of an updated plan.

[1] *Contaminated Sites Regulation* (CSR), B.C. Reg. 375/96, includes amendments up to B.C. Reg. 196/2017, November 1, 2017.

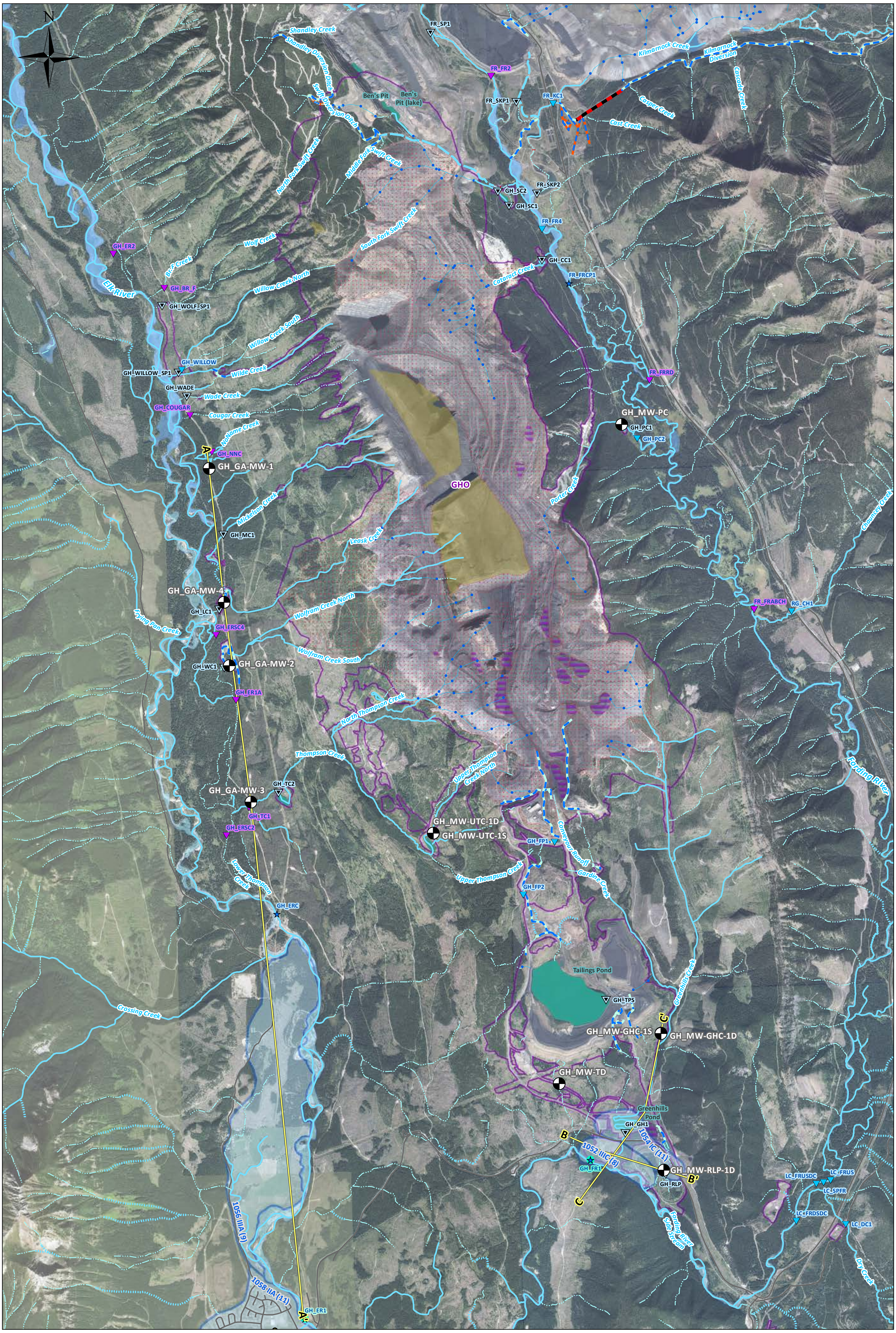
Recommendations

SNC-Lavalin had the following general recommendations:

- Analyze for all the parameters listed in the 2014 SSGMP;
- Increase the quarterly sampling periods from two months as indicated in the SSGMP to three months;
- Measure water level measurements manually prior to sampling, and before deploying or uploading data from level loggers;
- Re-confirm calibration of field probes if field measurement is identified out of expected range from historical data and re-measure field parameters prior to sampling;
- Complete hydraulic conductivity testing at monitoring wells which do not have these data; and
- Where data loggers are installed, record measurements for all four quarters in order to assess seasonal trends.

Table A: Summary of Groundwater Monitoring Locations and Rationale

Drainage	Well ID	Rationale
Elk River	GH_GA-MW-1	Monitor groundwater quality in the valley bottom.
	GH_GA-MW-4	Located downgradient of Leask Creek settling ponds. Selected to monitor groundwater quality associated with upland and tributary valley bottom influences.
	GH_GA-MW-2	Located downgradient of Wolfram Creek settling ponds. Selected to monitor groundwater quality associated with upland and tributary valley bottom influences.
	GH_GA-MW-3	Located downgradient of Thompson Creek settling ponds. Selected to monitor groundwater quality associated with upland and tributary valley bottom influences.
	GH_MW-UTC-IS	Monitor groundwater quality related to the Upper Thompson Creek pond.
	GH_MW-UTC-ID	
Fording River (Porter Creek)	GH_MW-PC	Monitor groundwater quality near Porter Creek sedimentation pond.
Fording River (Greenhills Creek)	GH_MW-GHC-1S	Monitor groundwater quality downgradient of Site A CCR.
	GH_MW-GHC-1D	
	GH_MW-TD	Monitor groundwater quality downgradient of the Tailings Dam.
	GH_MW-RLP-1D	Monitor groundwater quality in rail loop area.



Legend

SSGMP Wells

- Monitoring Well

Surface Water Stations

- Compliance Point
- Order Station
- Order Station and Compliance Point
- Receiving Environment
- Authorized Discharge
- Monitoring

Site Features

- Geological Cross Sections
- Secondary Road
- Pit
- Stockpiles
- Waste Dump (Spoils)
- Tailings/Settling Pond
- GHO Permitted Boundary

Water Features

- Intermittent Stream
- Stream Ditch
- Indefinite Stream
- Stream
- Subsurface
- Culvert
- Ditch
- Water Pipeline
- River Bed
- Mapped Aquifers

Notes:
1. Intended for illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
1. Information provided by Teck Coal Ltd.
2. Mapped Aquifers are from Water Resources Atlas (BC ENV)

Revisons:
0 - AO - 2018-01-29 - DRAFT - LH
1 - AO - 2018-03-27 - FINAL - LH

0 0.25 0.5 1 1.5 2 2.5 Kilometers

PROJECT LOCATION:
Greenhills Operations, BC

CLIENT NAME:
Teck Coal Ltd

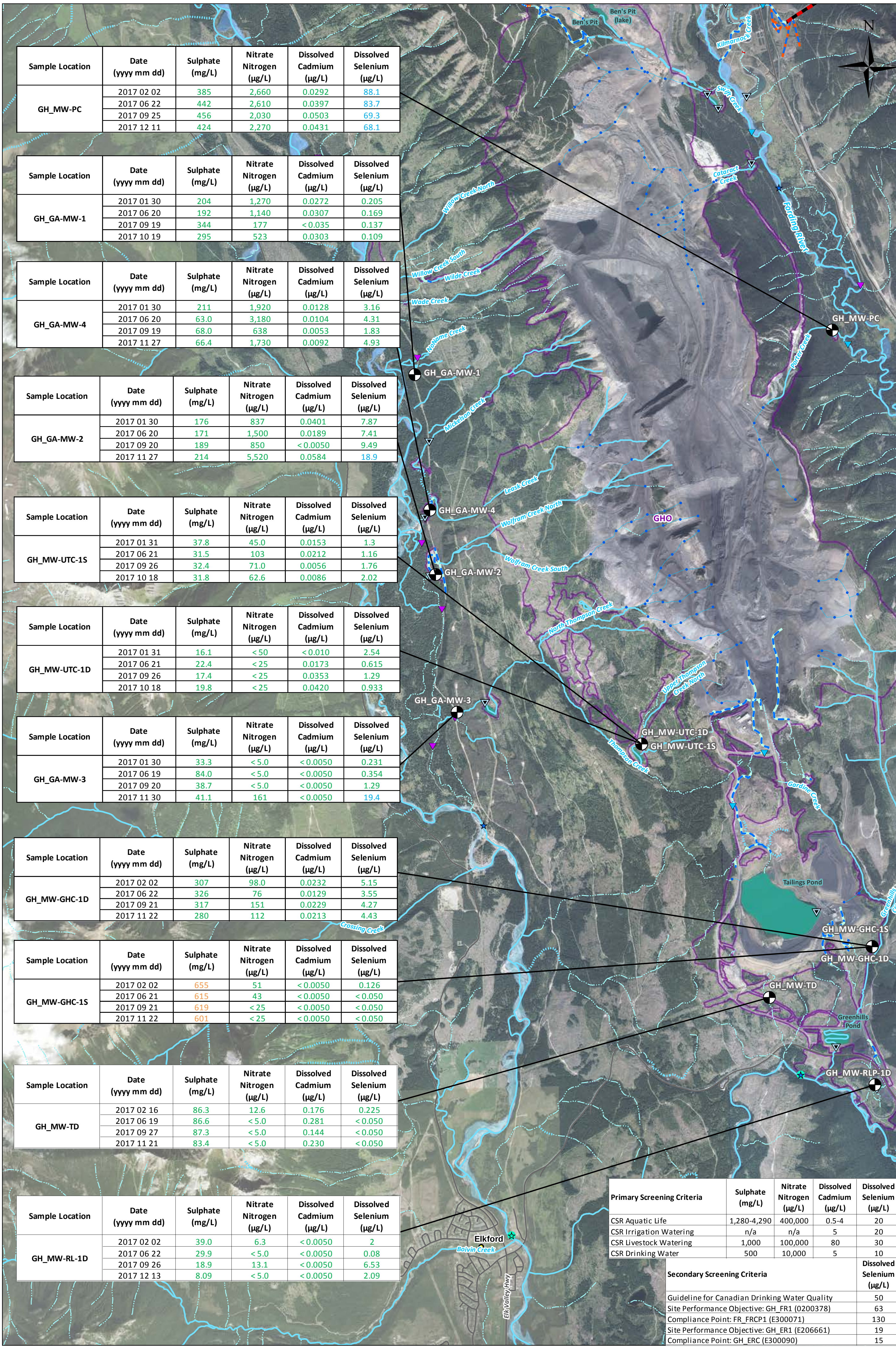
SNC·LAVALIN

Site Features and Sample Location Plan

CHK'D: LH	DATE: 2018/03/27	SCALE: 1:45,000	Ref Num:	REV: 0
BY: AO	COORD SYS: NAD 1983 UTM Zone 11N		653246-002	

MXD Path: P:\Current Projects\Teck Coal Ltd\GIS\Map Series\2017 Annual Reports\653246-002_SiteFeaturesSampleLocPlan_GHO1.mxd

Project Path: P:\Current Projects\Teck Coal Ltd\GIS\Exports\ANNUAL REPORT



Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
GH_MW-PC	2017 02 02	385	2,660	0.0292	88.1
	2017 06 22	442	2,610	0.0397	83.7
	2017 09 25	456	2,030	0.0503	69.3
	2017 12 11	424	2,270	0.0431	68.1

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
GH_GA-MW-1	2017 01 30	204	1,270	0.0272	0.205
	2017 06 20	192	1,140	0.0307	0.169
	2017 09 19	344	177	< 0.035	0.137
	2017 10 19	295	523	0.0303	0.109

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
GH_GA-MW-4	2017 01 30	211	1,920	0.0128	3.16
	2017 06 20	63.0	3,180	0.0104	4.31
	2017 09 19	68.0	638	0.0053	1.83
	2017 11 27	66.4	1,730	0.0092	4.93

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
GH_GA-MW-2	2017 01 30	176	837	0.0401	7.87
	2017 06 20	171	1,500	0.0189	7.41
	2017 09 20	189	850	< 0.0050	9.49
	2017 11 27	214	5,520	0.0584	18.9

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
GH_MW-UTC-1S	2017 01 31	37.8	45.0	0.0153	1.3
	2017 06 21	31.5	103	0.0212	1.16
	2017 09 26	32.4	71.0	0.0056	1.76
	2017 10 18	31.8	62.6	0.0086	2.02

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
GH_MW-UTC-1D	2017 01 31	16.1	< 50	< 0.010	2.54
	2017 06 21	22.4	< 25	0.0173	0.615
	2017 09 26	17.4	< 25	0.0353	1.29
	2017 10 18	19.8	< 25	0.0420	0.933

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
GH_GA-MW-3	2017 01 30	33.3	< 5.0	< 0.0050	0.231
	2017 06 19	84.0	< 5.0	< 0.0050	0.354
	2017 09 20	38.7	< 5.0	< 0.0050	1.29
	2017 11 30	41.1	161	< 0.0050	19.4

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
GH_MW-GHC-1D	2017 02 02	307	98.0	0.0232	5.15
	2017 06 22	326	76	0.0129	3.55
	2017 09 21	317	151	0.0229	4.27
	2017 11 22	280	112	0.0213	4.43

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
GH_MW-GHC-1S	2017 02 02	655	51	< 0.0050	0.126
	2017 06 21	615	43	< 0.0050	< 0.050
	2017 09 21	619	< 25	< 0.0050	< 0.050
	2017 11 22	601	< 25	< 0.0050	< 0.050

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
GH_MW-TD	2017 02 16	86.3	12.6	0.176	0.225
	2017 06 19	86.6	< 5.0	0.281	< 0.050
	2017 09 27	87.3	< 5.0	0.144	< 0.050
	2017 11 21	83.4	< 5.0	0.230	< 0.050

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
GH_MW-RL-1D	2017 02 02	39.0	6.3	< 0.0050	2
	2017 06 22	29.9	< 5.0	< 0.0050	0.08
	2017 09 26	18.9	13.1	< 0.0050	6.53
	2017 12 13	8.09	< 5.0	< 0.0050	2.09

Primary Screening Criteria	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
CSR Aquatic Life	1,280-4,290	400,000	0.5-4	20
CSR Irrigation Watering	n/a	n/a	5	20
CSR Livestock Watering	1,000	100,000	80	30
CSR Drinking Water	500	10,000	5	10

Secondary Screening Criteria	Dissolved Selenium (µg/L)
Guideline for Canadian Drinking Water Quality	50
Site Performance Objective: GH_FR1 (0200378)	63
Compliance Point: FR_FRCP1 (E300071)	130
Site Performance Objective: GH_ER1 (E206661)	19
Compliance Point: GH_ERC (E300090)	15

GREEN	Below primary screening criteria
ORANGE	Above at least one of the primary screening criteria
BLUE	Selenium concentrations above at least one of the secondary screening criteria

Legend

SSGMP Wells
- Monitoring Well

Surface Water Stations
- Compliance Point
- Order Station
- Order Station and Compliance Point
- Receiving Environment
- Authorized Discharge
- Monitoring

Water Features
- Intermittent Stream
- Stream Ditch
- Indefinite Stream
- Stream
- Subsurface
- Culvert
- Ditch
- Water Pipeline
- River Bed

Site Features
- GHO Permitted Boundary
- Secondary Road
- Tailings/Settling Pond

Notes:
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2. Original in colour.
3. Site location is approximate.

References:
1. Information provided by Teck Coal Ltd.

Revisons:
0 - AO - 2018-01-29 - DRAFT - LH
1 - AO - 2018-03-27 - FINAL - LH

0 0.25 0.5 1 1.5 2 2.5 Kilometers

PROJECT LOCATION:
Greenhills Operations, BC

CLIENT NAME:
Teck Coal Ltd

SNC·LAVALIN

Spatial Distribution of Constituents of Interest in Groundwater

CHK'D: LH | DATE: 2018/03/27 | SCALE: 1:45,000 | Ref Num: 653246-007 | REV: 0
BY: AO | COORD SYS: NAD 1983 UTM Zone 11N

MXD Path: P:\Current Projects\Teck Coal Ltd\GIS\Map Series\2017 Annual Reports\653246-007_SpatialDistofConstinGW_GHO1.mxd

Project Path: P:\Current Projects\Teck Coal Ltd\GIS\Exports\ANNUAL REPORT

TABLE 1: Summary of Groundater Monitoring Program Locations

Area	Well ID	Monitoring Program	Coordinates (UTM NAD 83)		LIDAR Ground Elevation	Ground Elevation	TOC Elevation	Stick Up Height	Drilled Depth	Well Diameter	Top of Screen Depth	Bottom of Screen Depth	Screened Interval	Depth to Bedrock	Hydraulic Conductivity
			Easting	Northing	masl	masl	masl	m	mbgs	mm	mbgs	mbgs		mbgs	m/s
Elk River	GH_GA-MW-1	SSGMP, RGMP	648019	5554750	1378.81	1379.21	1380.26	1.05	22.6	-	15.50	18.50	Clayey Sand	22.6	1.0E-12
	GH_GA-MW-4	SSGMP, RGMP	648217	5552963	1311.57	1312.15	1313.05	0.90	17.2	-	13.70	16.70	Sand and Gravel	-	1.0E-04
	GH_GA-MW-2	SSGMP, RGMP	648291	5552115	1305.23	1306.66	1307.68	1.02	29.6	-	23.00	29.00	Sand/Silt	28.5	1.0E-03
	GH_GA-MW-3	SSGMP, RGMP	648578	5550296	1299.62	1299.78	1300.75	0.97	14.4	-	8.00	14.00	Sand and Gravel	14.4	2.0E-06
	GH_MW-UTC-1S	SSGMP	651011	5549879	1601.63	1602.00	1603.22	1.22[b]	7.6	51	4.50	7.50	Clay/Bedrock	5.5	1.0E-06
	GH_MW-UTC-1D	SSGMP	651011	5549879	1601.63	1602.00	1603.22	1.22[b]	50.0	51	40.00	43.00	Bedrock	7.0	2.4E-08
Fording River	GH_MW-PC	SSGMP, RGMP[a]	653526	5555339	1573.37	1583.50	1582.28	1.22	45.0	51	3.50	6.50	Gravel and Cobbles	5.5	6.3E-07
	GH_MW-GHC-1S	SSGMP	654050[c]	5547205[c]	1597.60	1610.00	1610.80	0.80	14.6	51	4.58	7.63	Silty Gravel	14.6	3.0E-07
	GH_MW-GHC-1D	SSGMP	654052[c]	5547207[c]	1597.04	1610.00	1610.80	0.80	23.2	51	18.30	21.40	Bedrock	14.6	5.0E-05
	GH_MW-TD	SSGMP	652694	5546536	1590.84	1600.00	1600.75	0.75	38.1	51	31.39	34.44	Sand and Silt	35.1	-
	GH_MW-RLP-1D	SSGMP, RGMP[a]	654088	5545381	1494.78	1495.00	-	-	83.5	51	79.50	82.50	Sand and Gravel	-	-

Notes: a) Proposed in the 2017 RGMP; b) Stick up not surveyed but reported estimate was 1.2 m; c) UTM coordinates obtained from LIDAR.

masl = metres above sea level
mbgs = metres below ground surface

TABLE 2: Summary of Groundwater Elevations and Calculated Vertical Gradients

Area	Well ID	LIDAR Ground Elevation	Ground Elevation	TOC Elevation	Stick Up Height	Date of Static Water Level Measurement	Depth to Water	Water Level Elevation	Well Pair	Date of Static Water Level Measurement	Calculated Vertical Gradient
		masl	masl	masl	m	yyyy/mm/dd	mtoc	masl		yyyy/mm/dd	m/m
Elk River	GH_GA-MW-1	1378.81	1379.21	1380.26	1.05	2017/01/30	17.01	1363.25			
						2017/06/20	16.71	1363.55			
						2017/09/19	16.94	1363.32			
						2017/10/19	16.99	1363.27			
	GH_GA-MW-4	1311.57	1312.15	1313.05	0.90	2017/01/30	6.65	1306.40			
						2017/06/30	4.93	1308.12			
						2017/09/19	6.50	1306.55			
						2017/11/27	6.57	1306.48			
	GH_GA-MW-2	1305.23	1306.66	1307.68	1.02	2017/01/30	5.49	1302.19			
						2017/06/20	4.03	1303.65			
						2017/09/20	5.78	1301.90			
						2017/11/27	6.00[b]	1301.68			
	GH_GA-MW-3	1299.62	1299.78	1300.75	0.97	2017/01/30	6.49	1294.26			
						2017/06/19	6.20	1294.55			
						2017/09/20	8.99	1291.76			
						2017/11/30	7.89	1292.86			
	GH_MW-UTC-1S	1601.63	1602.00	1603.22	1.22[a]	2017/01/31	2.44	1600.78	GH_MW-UTC-1S and GH_MW-UTC-1D	2017/01/31	-0.027
						2017/06/21	2.07	1601.15		2017/06/21	-0.033
						2017/09/26	2.59	1600.63		2017/09/26	-0.030
						2017/10/18	2.55	1600.67		2017/10/18	-0.031
	GH_MW-UTC-1D	1601.63	1602.00	1603.22	1.22[a]	2017/01/31	3.40	1599.82			
						2017/06/21	3.24	1599.98			
						2017/09/26	3.65	1599.57			
						2017/10/18	3.66	1599.56			
Fording River	GH_MW-PC	1573.37	1583.50	1582.28	1.22	2017/02/02	3.91	1578.37			
						2017/06/22	3.90	1578.38			
						2017/09/25	4.26	1578.02			
						2017/12/11	4.20	1578.08			
	GH_MW-GHC-1S	1597.60	1610.00	1610.80	0.80	2017/02/02	2.40	1608.40	GH_MW_GHC-1S and GH_MW_GHC_1D	2017/02/02	-0.506
						2017/06/22	1.63	1609.17		2017/06/22	-0.456
						2017/09/21	3.10	1607.70		2017/09/21	-0.407
						2017/11/22	3.40	1607.40		2017/11/22	-0.405
	GH_MW-GHC-1D	1597.04	1610.00	1610.80	0.80	2017/02/02	9.35	1601.45			
						2017/06/22	7.90	1602.90			
						2017/09/21	8.70	1602.10			
						2017/11/22	8.96	1601.84			
	GH_MW-TD	1590.84	1600.00	1600.75	0.75	2017/02/16[c]	Artesian	> 1600.75			
						2017/06/19[c]	Artesian	> 1600.75			
						2017/09/27[c]	Artesian	> 1600.75			
						2017/11/21[c]	Artesian	> 1600.75			
	GH_MW-RLP-1D	1494.78	1495.00	1496.22	1.22[a]	2017/02/02	7.99	1488.23			
						2017/06/22	6.48	1489.74			
						2017/09/26	6.50	1489.72			
						2017/11/13	6.56	1489.66			

Notes: a) Stick up not surveyed but reported estimate was 4 ft; b) The depth to water measured at GH_GA-MW-2 was reported to be approximate due to issues with the water level probe; c) Assumed the date of static water level measurement was the same as the sample date

masl = metres above sea level
mbgs = metres below ground surface

TABLE 3: Field Measured Parameters

Sample Location	Sample Date (yyyy mm dd)	pH pH	Temperature ^{o}C	Conductivity μS/cm	ORP mV	Dissolved Oxygen mg/L	Turbidity NTU
		Field Parameters					
Elk River							
GH_GA-MW-1	2017 01 30	7.46	1.3	825.0	85.7	4.27	3.10
	2017 06 20	8.96	11.9	903.0	72.1	4.50	2.71
	2017 09 19	7.28	9.0	1,254	10.0	1.50	3.65
	2017 10 19	7.49	6.3	1,110	95.4	3.02	0.9
GH_GA-MW-4	2017 01 30	7.52	4.6	615.3	219.1	5.12	0.23
	2017 06 20	10.43	9.9	458.0	27.2	5.39	2.19
	2017 09 19	7.55	9.4	421.4	182.8	4.87	0.15
	2017 11 27	7.62	4.9	433.3	204.6	4.86	1.59
GH_GA-MW-2	2017 01 30	7.58	4.4	579.2	103.6	0.55	3.15
	2017 06 20	11	9.2	626.6	-18.1	0.67	0.80
	2017 09 20	7.54	7.5	648.0	42.5	4.01	1.31
	2017 11 27	7.47	6.0	740.0	169.3	0.49	2.40
GH_GA-MW-3	2017 01 30	7.7	4.4	483.6	-264.5	0.53	4.99
	2017 06 19	7.65	7.4	567.2	-204.6	1.06	2.44
	2017 09 20	7.6	6.1	522.0	-320.0	0.48	1.17
	2017 11 30	7.66	4.8	545.0	-317.6	0.16	4.49
GH_MW-UTC-1S	2017 01 31	7.55	4.7	410.9	76.1	2.01	129.2
	2017 06 21	7.7	7.3	411.4	16.8	4.45	68.69
	2017 09 26	7.5	8.5	391.0	30.9	3.80	5.03
	2017 10 18	7.57	7.0	423.4	57.0	3.88	5.77
GH_MW-UTC-1D	2017 01 31	8.58	3.4	1,279	57.6	0.55	51.58
	2017 06 21	8.48	8.1	1,392	70.7	0.52	37.22
	2017 09 26	8.56	8.0	1,320	-98.9	0.62	31.80
	2017 10 18	8.58	7.0	1,418	-21.9	0.49	29.60
Fording River							
GH_MW-PC	2017 02 02	7.66	1.0	870.0	104.7	8.35	4.17
	2017 06 22	7.65	6.5	971.0	107.2	6.40	11.02
	2017 09 25	7.53	8.9	931.0	166.9	4.65	6.43
	2017 12 11	7.25	2.5	988.0	228.4	6.61	46.00
GH_MW-GHC-1S	2017 02 02	7.17	4.2	1,230	-27.5	0.44	615.1
	2017 06 21	7.16	7.0	1,205	-33.1	0.48	5.99
	2017 09 21	7.08	6.9	1,223	-34.3	1.12	6.54
	2017 11 22	7.17	6.6	1,275	-31.4	0.15	16.9
GH_MW-GHC-1D	2017 02 02	7.16	4.4	853.0	90.6	0.74	18.50
	2017 06 22	7.16	8.1	882.0	14.5	1.02	67.3
	2017 09 21	7.1	5.5	885.0	107.8	1.41	19.70
	2017 11 22	7.18	5.9	912.0	122.2	1.26	16.00
GH_MW-TD	2017 02 16	7.2	4.9	623.2	-9.9	2.07	2.27
	2017 06 19	7.17	7.5	636.0	-6.0	11.18	2.97
	2017 09 27	7.27	9.0	69.3	-60.3	4.21	0.16
	2017 11 21	7.39	4.4	681.0	-13.7	5.42	1.09
GH_MW-RLP-1D	2017 02 02	7.7	1.5	399.7	-121.7	0.50	3.73
	2017 06 22	8.1	8.5	412.1	-190.7	0.42	22.20
	2017 09 26	7.98	11.2	394.4	-213.4	4.28	18.10
	2017 12 13	8.05	2.7	395.6	191.7	4.48	11.10

All terms defined within the body of SNC-Lavalin's report.

TABLE 4: Groundwater Analytical Results compared to Primary Screening Criteria

Sample Location	Sample Date (yyyy mm dd)	Physical Parameters: Dissolved Organic Carbon	Total Dissolved Solids	Hardness	Total Suspended Solids	Geochemical Indicators: Total Alkalinity (as CaCO3)	Ammonia, total (as N)	Bromide	Chloride	Dissolved Aluminum	Dissolved Calcium	Dissolved Iron	Dissolved Magnesium	Dissolved Manganese	Dissolved Potassium	Dissolved Sodium	Fluoride	Nitrate (as N)	Nitrite (as N)	Ortho-Phosphate	Sulphate	Total Organic Carbon	Total Phosphorous as P
		mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	µg/L	mg/L	µg/L	mg/L	µg/L	mg/L	mg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L
BC Standard																							
CSR Aquatic Life (AW)[a]		n/a	n/a	n/a	n/a	n/a	1,310-18,500[b]	n/a	1,500	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2,000-3,000[c]	400,000	200-2,000[d]	n/a	1,280-4,290[c]	n/a	n/a
CSR Irrigation Watering (IW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	100	5,000	n/a	5,000	n/a	200	n/a	n/a	1,000	n/a	n/a	n/a	n/a	n/a	n/a
CSR Livestock Watering (LW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	600	5,000	1,000	n/a	n/a	n/a	n/a	n/a	1,000	100,000	10,000	n/a	1,000	n/a	n/a
CSR Drinking Water (DW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	250	9,500	n/a	6,500	n/a	1,500	n/a	200	1,500	10,000	1,000	n/a	500	n/a	n/a
Elk River																							
GH_GA-MW-1	2017 01 30	2.76	641	228	7.6	337	94.6	< 0.25	10.1	< 3.0	50.3	33	24.8	168	3.17	145	640	1,270	< 5.0	0.0321	204	3.04	0.0508
	2017 06 20	2.04	639	233	4.2	351	9.3	0.208	8.07	2.4	47.8	< 10	27.7	6.53	3.23	156	590	1,140	12.0	0.0407	192	1.91	0.0433
	2017 09 19	8.83	822	363	9.6	358	222	0.42	21.7	< 3.0	74.1	171	43.3	**548**	3.70	174	390	177	8.1	0.0131	344	4.40	0.0497
	2017 10 19	5.17	825	296	1.7	393	229	0.46	23.8	< 3.0	61.9	88	34.3	**327**	3.62	163	380	523	5.4	0.0265	295	4.82	0.0419
GH_GA-MW-4	2017 01 30	0.70	506	377	< 1.0	203	49.8	< 0.25	4.66	< 3.0	89.9	< 10	37.1	< 0.10	1.36	6.79	150	1,920	< 5.0	0.0016	211	0.81	0.0022
	Duplicate	0.69	505	367	1.3	206	< 5.0	< 0.25	4.74	< 3.0	89.2	< 10	35.0	< 0.10	1.36	6.44	150	1,960	< 5.0	0.0015	215	0.82	< 0.0020
		*	< 1	3	*	1	*	*	2	*	1	*	6	*	0	5	0	2	*	*	2	*	*
	2017 06 20	2.45	309	277	< 1.0	213	< 5.0	< 0.050	1.11	< 1.0	54.5	< 10	34.1	0.38	1.82	4.98	190	3,180	< 1.0	0.0025	63.0	2.39	< 0.0040
	Duplicate	2.41	308	-	< 1.0	211	< 5.0	< 0.050	1.10	1.1	53.5	< 10	32.9	0.37	1.76	4.77	172	3,170	< 1.0	0.0020	63.0	2.32	< 0.0040
		*	< 1	*	*	1	*	*	1	*	2	*	4	*	3	4	10	< 1	*	*	0	*	*
	2017 09 19	0.74	297	246	< 1.0	180	24.3	< 0.050	2.46	< 3.0	57.2	< 10	25.1	0.23	0.992	4.82	139	638	< 1.0	< 0.0010	68.0	0.72	0.0014
	Duplicate	0.74	305	248	< 1.0	180	< 5.0	< 0.050	2.31	< 3.0	58.0	< 10	25.1	0.16	0.990	4.90	142	623	< 1.0	< 0.0010	67.7	0.76	0.0016
		*	3	1	*	0	*	*	6	*	1	*	0	*	0	2	2	2	*	*	< 1	*	*
	2017 11 27	0.85	303	250	< 1.0	189	< 5.0	< 0.050	3.27	< 3.0	55.5	< 10	27.0	< 0.10	1.24	5.78	183	1,730	< 1.0	0.0023	66.4	0.88	0.0013
	Duplicate	1.23	306	251	< 1.0	194	5.4	< 0.050	3.29	< 3.0	56.2	< 10	26.8	< 0.10	1.27	5.82	174	1,740	< 1.0	0.0024	66.7	2.56	0.0015
		*	1	< 1	*	3	*	*	1	*	1	*	1	*	2	1	5	1	*	*	< 1	*	*
GH_GA-MW-2	2017 01 30	0.75	488	362	4.5	215	< 5.0	< 0.25	8.01	< 3.0	102	< 10	26.3	61.2	1.10	8.17	120	837	69.1	0.0015	176	0.79	0.0065
	2017 06 20	0.86	489	366	1.4	214	< 5.0	< 0.050	7.12	1.1	94.3	< 10	31.6	10.5	1.18	8.35	104	1,500	< 1.0	< 0.0010	171	0.90	< 0.0040
	2017 09 20	0.61	538	423	10.3	177	12.6	0.067	7.23	< 3.0	115	< 10	33.2	35.9	1.20	9.07	102	850	94.4	< 0.0010	189	0.77	0.0092
	Duplicate	0.67	532	385	4.0	170	13.6	0.068	7.27	< 3.0	102	< 10	31.3	74.7	1.12	8.67	97	1,560	100	0.0010	192	0.71	0.0067
		*	1	9	*	4	*	*	1	*	12	*	6	70	7	5	*	59	6	*	2	*	31
	2017 11 27	0.86	619	448	1.6	221	< 5.0	< 0.050	7.44	< 3.0	120	< 10	35.9	41.1	1.16	9.27	98	5,520	38.4	0.0030	214	0.81	0.0047
GH_GA-MW-3	2017 01 30	0.72	356	218	16.7	259	372	< 0.050	6.87	< 3.0	40.8	< 10	28.3	10.0	2.54	38.0	700	< 5.0	< 1.0	< 0.0010	33.3	0.89	0.0190
	2017 06 19	1.03	407	281	4.9	258	334	< 0.050	6.93	2.9	51.5	43	37.1	19.3	2.55	35.8	593	< 5.0	1.8	< 0.0010	84.0	0.93	0.0260
	2017 09 20	< 0.50	331	256	7.3	258	363	< 0.050	5.73	< 3.0	45.9	< 10	34.3	10.8	2.60	39.3	647	< 5.0	< 1.0	0.0072	38.7	< 0.50	0.0250
	2017 11 30	0.56	324	274	4.7	292	362	< 0.050	5.84	< 3.0	48.3	< 10	37.2	8.71	2.25	36.9	652	161	2.0	0.0092	41.1	0.56	0.0151
GH_MW-UTC-1S	2017 01 31	1.23	316	236	158	229	< 5.0	< 0.050	8.30	< 3.0	64.4	< 10	18.2	19.0	1.30	15.6	141	45.0	< 1.0	0.0039	37.8	5.19	0.120
	2017 06 21	1.35	304	201	81.2	199	41.8	< 0.050	5.62	3.3	54.6	< 10	15.7	20.1	1.18	14.7	112	103	< 1.0	0.0013	31.5	3.43	0.0850
	2017 09 26	1.62	282	227	7.6	224	11.0	< 0.050	6.04	< 3.0	60.3	18	18.5	15.7	1.14	14.4	141	71.0	< 1.0	0.0016	32.4	1.91	0.0054
	2017 10 18	1.28	300	215	8.3	196	15.5	< 0.050	6.27	< 3.0	56.7	< 10	17.7	8.98	1.16	14.2	116	62.6	< 1.0	0.0021	31.8	0.94	0.0101
GH_MW-UTC-1D	2017 01 31	5.07	1,050	15.2	5.2	748	281	< 0.50	77.1	11.2	3.92	35	1.31	18.7	1.34	**403**	***6,080***	< 50	< 10	0.187	16.1	7.16	0.269
	2017 06 21	5.74	1,050	13.9	6.2	646	303	0.48	74.8	3.1	3.72	23	1.13	18.0	1.24	**391**	***6,340***	< 25	< 5.0	0.164	22.4	7.69	0.24
	2017 09 26	6.64	1,020	13.0	10.0	791	297	0.45	77.7	4.3	3.36	77	1.11	22.4	1.07	**403**	***6,280***	< 25	< 5.0	0.190	17.4	8.87	0.269
	2017 10 18	5.88	1,050	12.6	7.8	748	293	0.46	75.4	5.3	3.28	102	1.07	23.0	1.04	**407**	***5,920***	< 25	< 5.0	0.190	19.8	8.50	0.282

Associated data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
\- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.

[a] Standard to protect freshwater aquatic life.
[b] Standard varies with pH.
[c] Standard varies with Hardness.
[d] Standard varies with Chloride.
[e] Standard varies with crop.
[f] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[g] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[h] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.

BOLD	Concentration greater than CSR Aquatic Life (AW) standard
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard

TABLE 4 (Cont'd): Groundwater Analytical Results compared to Primary Screening Criteria

Sample Location	Sample Date (yyyy mm dd)	Dissolved Metals																								
		Antimony µg/L	Arsenic µg/L	Barium µg/L	Beryllium µg/L	Bismuth µg/L	Boron µg/L	Cadmium µg/L	Chromium µg/L	Cobalt µg/L	Copper µg/L	Lead µg/L	Lithium µg/L	Mercury µg/L	Molybdenum µg/L	Nickel µg/L	Selenium µg/L	Silicon µg/L	Silver µg/L	Strontium µg/L	Thallium µg/L	Tin µg/L	Titanium µg/L	Uranium µg/L	Vanadium µg/L	Zinc[h] µg/L
BC Standard																										
CSR Aquatic Life (AW)[a]		90	50	10,000	1.5	n/a	12,000	0.5-4[c]	10[f]	40	20-90[c]	40-160[c]	n/a	0.25	10,000	250-1,500[c]	20	n/a	0.5-15[c]	n/a	3	n/a	1,000	85	n/a	75-2,400[c]
CSR Irrigation Watering (IW)		n/a	100	n/a	100	n/a	500-6,000[e]	5	5[f]	50	200	200	2,500	1	10	200	20	n/a	n/a	n/a	n/a	n/a	n/a	10	100	n/a
CSR Livestock Watering (LW)		n/a	25	n/a	100	n/a	5,000	80	50[f]	1,000	300	100	5,000	2	50	1,000	30	n/a	n/a	n/a	n/a	n/a	n/a	200	100	2,000
CSR Drinking Water (DW)		6	10	1,000	8	n/a	5,000	5	50[f]	20[g]	1,500	10	8	1	250	80	10	n/a	20	2,500	n/a	2,500	n/a	20	20	3,000
Elk River																										
GH_GA-MW-1	2017 01 30	1.96	0.52	43.7	< 0.020	< 0.050	**825**	0.0272	0.34	0.33	1.86	< 0.050	**142**	< 0.0050	5.27	2.98	0.205	4,010	< 0.010	**3,320**	0.021	< 0.10	< 10	2.02	< 0.50	7.8
	2017 06 20	3.43	0.45	43.0	< 0.020	< 0.050	**770**	0.0307	0.68	< 0.10	2.94	< 0.050	**156**	< 0.0050	4.89	9.51	0.169	3,740	0.011	**3,190**	0.022	0.17	< 10	2.48	< 0.50	5.6
	2017 09 19	0.80	0.66	51.9	< 0.020	< 0.050	**726**	< 0.035	< 0.10	1.27	1.32	0.054	**144**	< 0.0050	**85.7**	5.40	0.137	4,130	< 0.010	**4,950**	0.041	0.43	< 10	2.65	1.57	59.8
	2017 10 19	1.65	0.56	46.0	< 0.020	< 0.050	**717**	0.0303	0.16	0.70	62.4	< 0.050	**139**	< 0.0050	**21.4**	4.15	0.109	3,740	< 0.010	**4,470**	0.032	< 0.10	< 10	2.32	< 0.50	55.8
GH_GA-MW-4	2017 01 30	0.16	0.10	59.4	< 0.020	< 0.050	17	0.0128	0.17	< 0.10	< 0.50	< 0.050	**41.4**	< 0.0050	1.90	< 0.50	3.16	2,700	< 0.010	274	< 0.010	< 0.10	< 10	2.71	< 0.50	< 3.0
	Duplicate	0.16	< 0.10	62.3	< 0.020	< 0.050	15	0.0131	0.17	< 0.10	< 0.50	< 0.050	**41.6**	< 0.0050	1.83	< 0.50	3.03	2,510	< 0.010	269	< 0.010	< 0.10	< 10	2.62	< 0.50	< 3.0
		*	*	5	*	*	*	*	*	*	*	*	< 1	*	4	*	4	7	*	2	*	*	*	3	*	*
	2017 06 20	0.33	0.11	80.4	< 0.020	< 0.050	14	0.0104	0.19	< 0.10	0.29	< 0.050	**26.8**	< 0.0050	3.22	0.64	4.31	2,390	< 0.010	157	< 0.010	< 0.10	< 10	2.59	< 0.50	< 1.0
	Duplicate	0.32	0.11	77.1	< 0.020	< 0.050	12	0.0106	0.26	< 0.10	0.32	< 0.050	**26.6**	< 0.0050	3.07	0.63	4.05	2,350	< 0.010	152	< 0.010	< 0.10	< 10	2.60	< 0.50	< 1.0
		*	*	4	*	*	*	*	*	*	*	*	1	*	5	*	6	2	*	3	*	*	*	0	*	*
	2017 09 19	0.13	< 0.10	56.5	< 0.020	< 0.050	16	0.0053	0.16	< 0.10	< 0.50	< 0.050	**26.6**	< 0.0050	1.95	< 0.50	1.83	2,400	< 0.010	187	< 0.010	< 0.10	< 10	1.76	< 0.50	< 3.0
	Duplicate	0.12	< 0.10	56.0	< 0.020	< 0.050	23	0.0074	0.13	< 0.10	< 0.50	< 0.050	**28.4**	< 0.0050	2.05	< 0.50	1.77	2,400	< 0.010	189	< 0.010	< 0.10	< 10	1.82	< 0.50	< 3.0
		*	*	1	*	*	*	*	*	*	*	*	7	*	5	*	3	0	*	1	*	*	*	3	*	*
	2017 11 27	0.19	< 0.10	63.9	< 0.020	< 0.050	15	0.0092	0.16	< 0.10	< 0.50	< 0.050	**27.5**	< 0.0050	2.55	< 0.50	4.93	2,470	< 0.010	191	< 0.010	< 0.10	< 10	1.98	< 0.50	< 3.0
	Duplicate	0.20	0.11	63.3	< 0.020	< 0.050	16	0.0078	0.16	< 0.10	0.54	< 0.050	**28.1**	< 0.0050	2.70	< 0.50	5.23	2,450	< 0.010	200	< 0.010	< 0.10	< 10	1.98	< 0.50	< 3.0
		*	*	1	*	*	*	*	*	*	*	*	2	*	6	*	6	1	*	5	*	*	*	0	*	*
GH_GA-MW-2	2017 01 30	1.17	0.26	84.5	< 0.020	< 0.050	23	0.0401	< 0.10	0.19	< 0.50	< 0.050	**15.2**	< 0.0050	**27.2**	3.56	7.87	3,650	< 0.010	441	< 0.010	< 0.10	< 10	3.30	< 0.50	5.3
	2017 06 20	1.55	0.22	69.3	< 0.020	< 0.050	27	0.0189	< 0.10	< 0.10	< 0.20	< 0.050	**17.8**	< 0.0050	**30.5**	2.36	7.41	3,540	< 0.010	442	< 0.010	< 0.10	< 10	3.11	< 0.50	2.1
	2017 09 20	1.50	0.24	73.5	< 0.020	< 0.050	20	< 0.0050	< 0.10	0.21	< 0.50	< 0.050	**17.6**	< 0.0050	**35.4**	4.12	9.49	3,580	< 0.010	522	< 0.010	< 0.10	< 10	3.58	< 0.50	< 3.0
	Duplicate	1.33	0.25	66.0	< 0.020	< 0.050	17	< 0.035	< 0.10	0.31	< 0.50	< 0.050	**14.7**	< 0.0050	**31.4**	4.43	6.6	3,440	< 0.010	447	< 0.010	< 0.10	< 10	3.52	< 0.50	6.7
		12	*	11	*	*	*	*	*	*	*	*	18	*	12	7	36	4	*	15	*	*	*	2	*	*
	2017 11 27	1.13	0.24	69.5	< 0.020	< 0.050	19	0.0584	< 0.10	0.19	18.7	< 0.050	**17.1**	< 0.0050	**20.0**	3.39	**18.9**	3,730	< 0.010	510	0.017	< 0.10	< 10	3.39	< 0.50	5.7
GH_GA-MW-3	2017 01 30	< 0.10	< 0.10	106	< 0.020	< 0.050	288	< 0.0050	0.13	< 0.10	< 0.50	< 0.050	**95.8**	< 0.010	0.096	< 0.50	0.231	4,920	< 0.010	2,100	< 0.010	< 0.10	< 10	0.055	< 0.50	< 3.0
	2017 06 19	< 0.10	0.23	58.8	< 0.020	< 0.050	212	< 0.0050	0.29	< 0.10	< 0.20	< 0.050	**89.7**	< 0.0050	0.101	0.64	0.354	4,840	< 0.010	1,910	< 0.010	< 0.10	< 10	0.262	< 0.50	< 1.0
	2017 09 20	< 0.10	0.11	110	< 0.020	< 0.050	258	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	**107**	< 0.10	0.708	< 0.50	1.29	4,720	< 0.010	2,230	< 0.010	< 0.10	< 10	0.079	< 0.50	< 3.0
	2017 11 30	< 0.10	< 0.10	97.1	< 0.020	< 0.050	285	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	**100**	< 0.0050	< 0.050	< 0.50	**19.4**	5,010	< 0.010	2,130	< 0.010	< 0.10	< 10	0.064	< 0.50	< 3.0
GH_MW-UTC-1S	2017 01 31	< 0.10	0.22	75.0	< 0.020	< 0.050	83	0.0153	< 0.10	0.35	< 0.50	< 0.050	**36.6**	< 0.0050	1.41	0.76	1.3	4,400	< 0.010	990	< 0.010	< 0.10	< 10	0.316	< 0.50	219
	2017 06 21	< 0.10	0.16	71.2	< 0.020	< 0.050	75	0.0212	< 0.10	0.36	< 0.20	< 0.050	**36.5**	< 0.0050	1.46	0.78	1.16	3,970	< 0.010	968	< 0.010	< 0.10	< 10	0.271	0.52	252
	2017 09 26	< 0.10	0.17	69.9	< 0.020	< 0.050	87	0.0056	< 0.10	0.21	< 0.50	< 0.050	**38.3**	< 0.0050	3.58	0.60	1.76	4,390	< 0.010	916	< 0.010	< 0.10	< 10	0.318	< 0.50	37.5
	2017 10 18	< 0.10	0.14	74.5	< 0.020	< 0.050	84	0.0086	< 0.10	0.10	< 0.50	< 0.050	**38.3**	< 0.0050	1.66	0.56	2.02	4,490	< 0.010	903	< 0.010	< 0.10	< 10	0.315	< 0.50	20.4
GH_MW-UTC-1D	2017 01 31	1.47	5.05	54.6	< 0.040	< 0.10	**875**	< 0.010	0.22	0.69	1.28	0.17	**1,020**	< 0.0050	**13.2**	6.4	2.54	2,970	< 0.020	123	< 0.020	< 0.20	< 10	7.19	2.0	***422***
	2017 06 21	1.06	3.80	49.6	< 0.020	< 0.050	**760**	0.0173	0.16	0.44	0.98	0.269	**1,390**	< 0.0050	**13.8**	4.27	0.615	2,940	< 0.010	122	< 0.010	< 0.10	< 10	5.56	1.45	***695***
	2017 09 26	0.93	3.85	45.5	< 0.020	< 0.050	**780**	0.0353	0.16	0.36	2.09	0.430	**1,010**	< 0.0050	**14.8**	4.19	1.29	2,780	0.012	121	< 0.010	0.11	< 10	6.61	1.38	***386***
	2017 10 18	0.83	3.61	48.3	< 0.020	< 0.050	**798**	0.0420	0.17	0.39	2.10	0.464	**1,040**	< 0.0050	**18.3**	5.15	0.933	2,920	0.013	124	< 0.010	0.16	< 10	6.25	1.46	***309***

Associated data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
\- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.

BOLD	Concentration greater than CSR Aquatic Life (AW) standard
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard

[a] Standard to protect freshwater aquatic life.
[b] Standard varies with pH.
[c] Standard varies with Hardness.
[d] Standard varies with Chloride.
[e] Standard varies with crop.
[f] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[g] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[h] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.

TABLE 4 (Cont'd): Groundwater Analytical Results compared to Primary Screening Criteria

Sample Location	Sample Date (yyyy mm dd)	Physical Parameters				Geochemical Indicators																	
		Dissolved Organic Carbon mg/L	Total Dissolved Solids mg/L	Hardness mg/L	Total Suspended Solids mg/L	Total Alkalinity (as CaCO3) mg/L	Ammonia, total (as N) µg/L	Bromide mg/L	Chloride mg/L	Dissolved Aluminum µg/L	Dissolved Calcium mg/L	Dissolved Iron µg/L	Dissolved Magnesium mg/L	Dissolved Manganese µg/L	Dissolved Potassium mg/L	Dissolved Sodium mg/L	Fluoride µg/L	Nitrate (as N) µg/L	Nitrite (as N) µg/L	Ortho-Phosphate mg/L	Sulphate mg/L	Total Organic Carbon mg/L	Total Phosphorous as P mg/L
BC Standard																							
CSR Aquatic Life (AW)[a]		n/a	n/a	n/a	n/a	n/a	1,310-18,500[b]	n/a	1,500	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2,000-3,000[c]	400,000	200-2,000[d]	n/a	1,280-4,290[c]	n/a	n/a
CSR Irrigation Watering (IW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	100	5,000	n/a	5,000	n/a	200	n/a	n/a	1,000	n/a	n/a	n/a	n/a	n/a	n/a
CSR Livestock Watering (LW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	600	5,000	1,000	n/a	n/a	n/a	n/a	n/a	1,000	100,000	10,000	n/a	1,000	n/a	n/a
CSR Drinking Water (DW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	250	9,500	n/a	6,500	n/a	1,500	n/a	200	1,500	10,000	1,000	n/a	500	n/a	n/a
Fording River																							
GH_MW-PC	2017 02 02	1.24	779	615	6.3	189	11.3	< 0.050	1.13	1.3	107	< 10	84.6	1.97	0.929	0.998	308	2,660	10.5	0.0063	385	1.19	0.0095
	2017 06 22	1.70	876	620	9.8	216	37.0	< 0.25	< 2.5	1.9	125	< 10	75.0	1.79	1.22	1.01	290	2,610	< 5.0	0.0058	442	1.90	0.0200
	2017 09 25	1.32	858	643	91.0	215	14.2	< 0.25	< 2.5	< 3.0	120	< 10	83.7	5.68	1.15	0.976	270	2,030	< 5.0	0.0077	456	1.86	0.0539
	2017 12 11	1.14	866	610	403	212	< 5.0	< 0.25	1.23	< 3.0	117	< 10	77.5	0.68	0.983	0.938	360	2,270	< 5.0	0.0076	424	5.01	0.0958
	Duplicate	1.20	865	618	277	212	< 5.0	< 0.25	1.26	< 3.0	121	< 10	77.0	0.74	1.01	0.965	370	2,360	< 5.0	0.0072	440	4.80	0.249
		*	< 1	1	37	0	*	*	2	*	3	*	1	8	3	3	3	4	*	5	4	4	89
GH_MW-GHC-1S	2017 02 02	2.94	1,190	982	281	255	28.9	< 0.25	4.7	< 1.0	268	1,460	76.3	**276**	2.29	5.25	150	51	5.7	0.0014	**655**	5.88	0.299
	2017 06 21	2.50	1,140	777	7.4	179	56.4	< 0.25	6.0	1.0	223	1,650	53.5	**420**	1.84	4.31	120	43	< 5.0	< 0.0010	**615**	2.35	0.0109
	2017 09 21	2.13	1,130	808	13.6	274	41.8	< 0.25	5.4	< 3.0	228	1,510	57.6	**394**	2.02	4.63	180	< 25	< 5.0	< 0.0010	**619**	2.25	0.0124
	2017 11 22	2.14	1,110	910	18.5	275	46.6	< 0.25	5.3	< 3.0	258	1,470	64.4	**386**	1.86	4.79	150	< 25	< 5.0	< 0.0010	**601**	2.32	0.0143
GH_MW-GHC-1D	2017 02 02	2.72	724	626	4.5	294	< 5.0	< 0.050	1.42	< 1.0	153	< 10	59.0	1.02	1.49	5.01	527	98.0	1.2	0.0020	307	1.54	0.0059
	2017 06 22	1.43	755	538	7.0	195	18.5	< 0.25	< 2.5	< 1.0	139	107	46.2	17.9	1.41	4.46	360	76	< 5.0	< 0.0010	326	1.40	0.0037
	2017 09 21	1.22	729	610	7.6	303	6.6	< 0.25	< 2.5	< 3.0	155	10	54.1	1.95	1.41	4.84	470	151	< 5.0	< 0.0010	317	1.20	0.0104
	2017 11 22	1.25	714	614	4.1	302	21.0	< 0.050	1.18	< 3.0	153	< 10	56.2	1.04	1.28	4.74	479	112	< 1.0	0.0033	280	1.18	0.0070
GH_MW-TD	2017 02 16	0.86	421	359	< 1.0	337	105	< 0.050	< 0.50	< 1.0	84.7	390	35.8	**565**	2.69	28.3	278	12.6	< 1.0	< 0.0010	86.3	0.85	0.0077
	2017 06 19	0.69	482	349	2.1	352	97.6	< 0.050	< 0.50	< 1.0	81.0	694	35.6	**611**	2.71	28.3	263	< 5.0	< 1.0	< 0.0010	86.6	1.17	< 0.0020
	2017 09 27	0.69	479	363	1.6	280	101	< 0.050	< 0.50	< 3.0	90.4	927	33.3	**609**	2.57	27.7	254	< 5.0	< 1.0	< 0.0010	87.3	0.62	< 0.0040
	2017 11 21	0.54	444	387	2.3	367	95.7	< 0.050	< 0.50	< 3.0	90.7	467	39.1	**696**	2.69	28.7	245	< 5.0	< 1.0	< 0.0010	83.4	0.56	0.0063
GH_MW-RLP-1D	2017 02 02	1.91	263	255	1.5	222	< 5.0	< 0.050	< 0.50	1.6	53.4	152	29.5	105	1.25	3.70	1,800	6.3	< 1.0	0.0012	39.0	1.68	0.0079
	Duplicate	1.71	258	274	1.5	225	< 5.0	< 0.050	< 0.50	1.6	57.4	159	31.8	112	1.33	3.92	1,790	< 5.0	< 1.0	< 0.0010	38.8	1.63	0.0067
		*	2	7	*	1	*	*	*	*	7	5	8	6	6	6	1	*	*	*	1	*	16
	2017 06 22	1.66	259	235	4.8	187	27.7	< 0.050	< 0.50	2.9	52.6	25	25.1	85.1	1.29	3.79	1,900	< 5.0	< 1.0	< 0.0010	29.9	1.50	< 0.0020
	2017 09 26	3.8	274	244	42.8	228	< 5.0	< 0.050	< 0.50	6.2	50.5	93	28.6	18.6	1.21	4.55	1,890	13.1	< 1.0	< 0.0010	18.9	4.4	0.0448
	2017 12 13	1.61	242	220	16.8	232	5.3	< 0.050	< 0.50	3.5	45.8	< 10	25.6	2.99	1.28	4.82	1,680	< 5.0	< 1.0	< 0.0010	8.09	1.52	0.0212
Field Blanks																							
GH_GA-MW-1	2017 06 20	< 0.50	< 10	< 0.50	< 1.0	< 1.0	< 5.0	< 0.050	< 0.50	< 1.0	< 0.050	< 10	0.0057	< 0.10	< 0.050	< 0.050	< 20	13.0	< 1.0	< 0.0010	< 0.30	< 0.50	< 0.0020
GH_GA-MW-2	2017 09 20	< 0.50	< 10	< 0.50	< 1.0	< 1.0	< 5.0	< 0.050	< 0.50	< 3.0	< 0.050	< 10	< 0.10	< 0.10	< 0.050	< 0.050	< 20	< 5.0	< 1.0	< 0.0010	< 0.30	< 0.50	< 0.0010
GH_GA-MW-3	2017 01 30	< 0.50	< 3.0	< 0.50	< 1.0	< 1.0	< 5.0	< 0.050	< 0.10	< 3.0	< 0.050	< 10	< 0.10	< 0.10	< 0.050	< 0.050	< 20	< 5.0	< 1.0	< 0.0010	< 0.30	< 0.50	< 0.0020
	2017 09 20	< 0.50	< 10	< 0.50	< 1.0	< 1.0	11.6	< 0.050	< 0.50	< 3.0	< 0.050	< 10	< 0.10	< 0.10	< 0.050	< 0.050	< 20	< 5.0	< 1.0	< 0.0010	< 0.30	< 0.50	< 0.0010
	2017 11 30	< 0.50	< 10	< 0.50	< 1.0	< 1.0	7.7	< 0.050	< 0.50	< 3.0	< 0.050	< 10	< 0.10	< 0.10	< 0.050	< 0.050	< 20	< 5.0	< 1.0	< 0.0010	< 0.30	< 0.50	< 0.0010
GH_MW-GHC-1S	2017 11 22	< 0.50	< 10	< 0.50	< 1.0	< 1.0	-	< 0.050	< 0.50	< 3.0	< 0.050	< 10	< 0.10	< 0.10	< 0.050	< 0.050	< 20	< 5.0	< 1.0	< 0.0010	< 0.30	< 0.50	-

Associated data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.

BOLD	Concentration greater than CSR Aquatic Life (AW) standard
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard

[a] Standard to protect freshwater aquatic life.
[b] Standard varies with pH.
[c] Standard varies with Hardness.
[d] Standard varies with Chloride.
[e] Standard varies with crop.
[f] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[g] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[h] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.

TABLE 4 (Cont'd): Groundwater Analytical Results compared to Primary Screening Criteria

Sample Location	Sample Date (yyyy mm dd)	Antimony µg/L	Arsenic µg/L	Barium µg/L	Beryllium µg/L	Bismuth µg/L	Boron µg/L	Cadmium µg/L	Chromium µg/L	Cobalt µg/L	Copper µg/L	Lead µg/L	Lithium µg/L	Mercury µg/L	Molybdenum µg/L	Nickel µg/L	Selenium µg/L	Silicon µg/L	Silver µg/L	Strontium µg/L	Thallium µg/L	Tin µg/L	Titanium µg/L	Uranium µg/L	Vanadium µg/L	Zinc[h] µg/L
		Dissolved Metals																								
BC Standard																										
CSR Aquatic Life (AW)[a]		90	50	10,000	1.5	n/a	12,000	0.5-4[c]	10[f]	40	20-90[c]	40-160[c]	n/a	0.25	10,000	250-1,500[c]	20	n/a	0.5-15[c]	n/a	3	n/a	1,000	85	n/a	75-2,400[c]
CSR Irrigation Watering (IW)		n/a	100	n/a	100	n/a	500-6,000[e]	5	5[f]	50	200	200	2,500	1	10	200	20	n/a	n/a	n/a	n/a	n/a	n/a	10	100	n/a
CSR Livestock Watering (LW)		n/a	25	n/a	100	n/a	5,000	80	50[f]	1,000	300	100	5,000	2	50	1,000	30	n/a	n/a	n/a	n/a	n/a	n/a	200	100	2,000
CSR Drinking Water (DW)		6	10	1,000	8	n/a	5,000	5	50[f]	20[g]	1,500	10	8	1	250	80	10	n/a	20	2,500	n/a	2,500	n/a	20	20	3,000
Fording River																										
GH_MW-PC	2017 02 02	< 0.10	0.19	102	< 0.020	< 0.050	< 10	0.0292	0.26	< 0.10	< 0.20	< 0.050	6.3	< 0.0050	2.68	0.67	***88.1***	2,330	< 0.010	150	< 0.010	< 0.10	< 10	4.35	< 0.50	648
	2017 06 22	< 0.10	0.18	128	< 0.020	< 0.050	13	0.0397	0.24	< 0.10	< 0.20	< 0.050	8.5	< 0.0050	2.90	3.47	***83.7***	2,720	< 0.010	161	< 0.010	< 0.10	< 10	4.99	< 0.50	88.8
	2017 09 25	< 0.10	0.19	114	< 0.020	< 0.050	< 10	0.0503	0.20	< 0.10	1.15	< 0.050	8.1	< 0.0050	**19.2**	0.84	***69.3***	2,640	< 0.010	150	< 0.010	< 0.10	< 10	5.47	< 0.50	18.1
	2017 12 11	< 0.10	0.19	97.8	< 0.020	< 0.050	< 10	0.0431	0.21	< 0.10	***350***	< 0.050	7.0	< 0.0050	2.37	0.75	***68.1***	2,480	< 0.010	142	< 0.010	< 0.10	< 10	4.28	< 0.50	5.0
	Duplicate	< 0.10	0.18	99.2	< 0.020	< 0.050	< 10	0.0481	0.20	< 0.10	***396***	< 0.050	6.9	< 0.0050	2.33	0.83	***66.9***	2,420	< 0.010	143	< 0.010	< 0.10	< 10	4.35	< 0.50	5.8
		*	*	1	*	*	*	11	*	*	12	*	1	*	2	*	2	2	*	1	*	*	*	2	*	15
GH_MW-GHC-1S	2017 02 02	< 0.10	2.07	36.6	< 0.020	< 0.050	42	< 0.0050	< 0.10	0.52	< 0.20	< 0.050	24.7	< 0.0050	1.25	1.41	0.126	5,930	< 0.010	873	< 0.010	< 0.10	< 10	2.12	< 0.50	3.5
	2017 06 21	< 0.10	1.52	25.2	< 0.020	< 0.050	35	< 0.0050	< 0.10	0.52	< 0.20	< 0.050	22.6	< 0.0050	1.07	1.21	< 0.050	5,810	< 0.010	716	< 0.010	< 0.10	< 10	1.79	< 0.50	3.2
	2017 09 21	< 0.10	1.65	26.6	< 0.020	< 0.050	43	< 0.0050	< 0.10	0.56	< 0.50	< 0.050	23.3	< 0.0050	**17.7**	1.25	< 0.050	6,290	< 0.010	670	< 0.010	< 0.10	< 10	2.13	< 0.50	3.0
	2017 11 22	< 0.10	1.55	26.8	< 0.020	< 0.050	46	< 0.0050	< 0.10	0.55	< 0.50	< 0.050	22.2	< 0.0050	1.10	1.66	< 0.050	6,190	< 0.010	694	< 0.010	< 0.10	< 10	2.05	< 0.50	< 3.0
GH_MW-GHC-1D	2017 02 02	< 0.10	< 0.10	98.8	< 0.020	< 0.050	37	0.0232	< 0.10	< 0.10	< 0.20	< 0.050	19.7	< 0.0050	0.795	0.89	5.15	4,740	< 0.010	522	0.024	< 0.10	< 10	2.88	< 0.50	3.1
	2017 06 22	< 0.10	< 0.10	82.1	< 0.020	< 0.050	31	0.0129	< 0.10	< 0.10	< 0.20	< 0.050	17.7	< 0.0050	0.625	1.31	3.55	4,330	< 0.010	463	0.013	< 0.10	< 10	2.21	< 0.50	8.7
	2017 09 21	< 0.10	< 0.10	85.3	< 0.020	< 0.050	35	0.0229	< 0.10	< 0.10	1.23	< 0.050	17.5	< 0.0050	8.79	0.90	4.27	4,460	< 0.010	463	0.020	< 0.10	< 10	2.97	< 0.50	4.3
	2017 11 22	< 0.10	< 0.10	83.1	< 0.020	< 0.050	33	0.0213	< 0.10	< 0.10	< 0.50	< 0.050	16.1	< 0.0050	0.912	0.99	4.43	4,540	< 0.010	441	0.022	< 0.10	< 10	2.74	< 0.50	< 3.0
GH_MW-TD	2017 02 16	< 0.10	0.13	23.0	< 0.020	< 0.050	384	0.176	< 0.10	0.30	< 0.20	< 0.050	43.8	< 0.0050	2.69	0.67	0.225	6,810	< 0.010	1,200	0.113	< 0.10	< 10	0.710	< 0.50	< 1.0
	2017 06 19	< 0.10	0.12	23.8	< 0.020	< 0.050	304	0.281	< 0.10	0.35	< 0.20	< 0.050	41.7	< 0.0050	2.60	0.75	< 0.050	6,480	< 0.010	1,140	0.108	< 0.10	< 10	0.743	< 0.50	1.4
	2017 09 27	< 0.10	0.11	24.3	< 0.020	< 0.050	346	0.144	< 0.10	0.34	< 0.50	< 0.050	47.0	< 0.0050	2.20	0.90	< 0.050	6,590	< 0.010	1,160	0.127	< 0.10	< 10	0.824	< 0.50	< 3.0
	2017 11 21	< 0.10	0.13	23.2	< 0.020	< 0.050	332	0.230	< 0.10	0.38	< 0.50	< 0.050	42.8	< 0.0050	2.82	0.78	< 0.050	6,420	< 0.010	1,240	0.134	< 0.10	< 10	0.881	< 0.50	< 3.0
GH_MW-RLP-1D	2017 02 02	< 0.10	0.33	48.3	< 0.020	< 0.050	16	< 0.0050	< 0.10	0.10	< 0.20	< 0.050	6.8	< 0.0050	3.41	0.73	2	4,540	< 0.010	205	< 0.010	< 0.10	< 10	1.05	< 0.50	< 1.0
	Duplicate	< 0.10	0.37	51.7	< 0.020	< 0.050	16	< 0.0050	< 0.10	0.10	< 0.20	< 0.050	7.2	< 0.0050	3.58	0.62	2.45	4,710	< 0.010	220	< 0.010	< 0.10	< 10	1.13	< 0.50	< 1.0
		*	*	7	*	*	*	*	*	*	*	*	6	*	5	*	20	4	*	7	*	*	*	7	*	*
	2017 06 22	< 0.10	< 0.10	45.5	< 0.020	< 0.050	16	< 0.0050	< 0.10	< 0.10	< 0.20	< 0.050	7.4	< 0.0050	1.04	< 0.50	0.08	4,610	< 0.010	188	< 0.010	< 0.10	< 10	0.730	< 0.50	21.9
	2017 09 26	< 0.10	< 0.10	46.4	< 0.020	< 0.050	14	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	8.0	< 0.0050	0.434	< 0.50	6.53	4,750	< 0.010	181	< 0.010	< 0.10	< 10	0.393	< 0.50	< 3.0
	2017 12 13	< 0.10	0.13	51.7	< 0.020	< 0.050	15	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	7.0	< 0.0050	0.230	< 0.50	2.09	4,790	< 0.010	185	< 0.010	< 0.10	< 10	0.184	< 0.50	< 3.0
Field Blanks																										
GH_GA-MW-1	2017 06 20	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.10	< 0.10	< 0.20	< 0.050	< 1.0	< 0.0050	< 0.050	< 0.50	< 0.050	< 50	< 0.010	0.34	< 0.010	< 0.10	< 10	< 0.010	< 0.50	3.7
GH_GA-MW-2	2017 09 20	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	< 1.0	< 0.0050	< 0.050	< 0.50	< 0.050	< 50	< 0.010	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0
GH_GA-MW-3	2017 01 30	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	< 1.0	< 0.0050	< 0.050	< 0.50	< 0.050	< 50	< 0.010	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0
	2017 09 20	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	< 1.0	< 0.0050	< 0.050	< 0.50	< 0.050	< 50	< 0.010	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0
	2017 11 30	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	< 1.0	< 0.0050	< 0.050	< 0.50	< 0.050	< 50	< 0.010	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0
GH_MW-GHC-1S	2017 11 22	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	< 1.0	< 0.0050	< 0.050	< 0.50	< 0.050	< 50	< 0.010	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0

Associated data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.

BOLD	Concentration greater than CSR Aquatic Life (AW) standard
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard

[a] Standard to protect freshwater aquatic life.
[b] Standard varies with pH.
[c] Standard varies with Hardness.
[d] Standard varies with Chloride.
[e] Standard varies with crop.
[f] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[g] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[h] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.

TABLE 5: Groundwater Analytical Results compared to Secondary Screening Criteria

Sample Location	Sample Date (yyyy mm dd)	Selenium µg/L
Groundwater Quality Criteria		
Guideline for Canadian Drinking Water Quality (DW)		50
Site Performance Objective: GH_FR1 (0200378)*		63
Compliance Point: FR_FRCP1 (E300071)*		130
Site Performance Objective: GH_ER1 (E206661)**		19
Compliance Point: GH_ERC (E300090)**		15
Elk River		
GH_GA-MW-2	2017 11 27	**18.9**
GH_GA-MW-3	2017 11 30	**19.4**
Fording River		
GH_MW-PC	2017 02 02	***88.1***
	2017 06 22	***83.7***
	2017 09 25	***69.3***
	2017 12 11	***68.1***

Associated data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.

BOLD	Concentration greater than Canadian Drinking Water Quality guideline
SHADOW	Concentration greater than applicable Site Performance Objective
SHADED	Concentration greater than applicable Compliance Point

* Applicable to GH_MW-PC
** Applicable to GH_GA-MW-2, GH_GA-MW-3

Appendix I-3: LCO 2017 Annual Groundwater Monitoring Summary and Recommendations

Appendix I-3: Line Creek Operations 2017 Annual Groundwater Monitoring

Summary

Golder Associates (Golder, 2018) completed the 2017 Annual Report for the Line Creek Operations (LCO) Site Specific Groundwater Monitoring Program (SSGMP). LCO is located in southeastern British Columbia (BC), approximately 20 km north of Sparwood, BC and is one of Teck's five active coal mines in the Elk Valley. The following information was taken from the 2017 LCO Annual Report, which was completed to fulfill the reporting requirements outlined in Section 10.4 of Permit 107517 (October 13, 2017). The SSGMP was developed in 2013 with monitoring commencing the same year. The SSGMP was updated in 2015 and the program was approved in November 2017 by the Ministry of Environment & Climate Change Strategy (ENV).

The groundwater conceptual site model (CSM) for LCO described by Golder (2018) identified groundwater flow through surficial materials is a more important pathway compared to groundwater flow through bedrock. Groundwater flow is topographically driven and is recharged on ridges and flanks (uplands) and the majority of groundwater discharges to valley-bottoms. Groundwater mounds below waste rock piles with the majority discharging to surface water at the toe of waste-rock spoils in combination with shallow groundwater before being directed to the nearest surface water body.

The 2017 Annual Report for the LCO SSGMP presented results for three general areas:

› Process Plant Area: located adjacent to the confluences of Line Creek, the Fording River and the Elk River, in the valley-bottom of the Elk River. Groundwater in this area is proximal to process plant ponds and Coarse Coal Rejects (CCR), which are possible sources of contact water, and groundwater near the Fording River and Elk River can potentially receive contact water via surface water from upstream mines. Additionally, groundwater from the active mining area is up-gradient of the Process Plant Area;
› Dry Creek Area: includes permitted areas for the Phase II mining of LCO, which includes waste rock storage at the southern portion of the Dry Creek watershed adjacent to and north of Phase I. Inputs of contact water from recently placed waste rock to groundwater in this area are expected to be potentially detectable; and
› Outside LCO (Off-site Wells): includes downgradient wells located downgradient of Dry Creek and downgradient of the Process Plant Area, which are part of the regional program but considered in this report for context).

The wells monitored and sampled as part of the 2017 annual program are listed in Table 1 (attached; extracted from the 2017 LCO Annual Report) along with the associated rationale. Monitoring well locations and spatial distribution of selected groundwater analytical data are shown on Figures 3, 6 and 7 attached (extracted from the 2017 LCO Annual Report). Field blank data are found in Appendix A (attached; extracted from the 2017 LCO Annual Report) and trip blank data are provided in attached table titled Appendix I-3.

A summary of results from the 2017 Annual Report for the LCO SSGMP from Golder (2018) is as follows:

- The LCO SSGMP is considered thorough and robust;
- No material quality assurance or quality control concerns were identified, with one exception addressed with re-sampling;
- The Regional and LCO site-specific groundwater monitoring programs support the presented conceptual groundwater model;
- In the Process Plant Area:
  - concentrations of CI were below CSR standards in all wells;
  - there were localized concentrations of dissolved manganese, molybdenum, fluoride, boron, mercury and chloride above CSR standards. The sources of these parameters were found to potentially be related to dissolution of naturally-occurring sedimentary minerals, including processes such as reductive dissolution, and cation exchange related to calcite saturation;
  - all wells contained dissolved lithium consistently above CSR DW standards.
- In Dry Creek wells:
  - concentrations of CI were below CSR standards in all wells;
  - there were localized exceedances of dissolved barium and molybdenum consistently encountered in two wells (LC_PIZDC1307 and LC_PIZDC1404D) but not in the four remaining wells. These two wells are drilled significantly deeper than the remaining wells (> 31.8 m versus < 16.5 m) and may be more influenced by upward flow from the underlying bedrock aquifer system given the upward hydraulic gradient;
  - LC_PIZDC1306, LC_PIZC1307 and LC_PIZDC1404D contained dissolved lithium above the CSR DW standard.
- Statistical analysis on CI in groundwater from select wells (LC_PIZP1104 from the Process Plant Area, LC_PIZDC0901 from the Dry Creek Area and off-site RG_DW-02-20) where apparent trends in groundwater concentrations were observed in time-series graphs, showed no statistical trends with the following exceptions:
  - nitrate concentrations at LC_PIZP1104 had a statistically significant upward trend over the period of 2014 to 2017, but concentrations remain well below the CSR standards. This trend is driven mainly by samples collected in 2017;
  - nitrate and total selenium at RG_DW-02-20 showed a decreasing trend over the period of 2014 to 2017.

An update of the SSGMP is due in 2018 and the 2017 and historical groundwater monitoring results will be used in the development of an updated plan.

Recommendations

Recommendations for the LCO SSGMP provided by Golder (2018) are as follows:

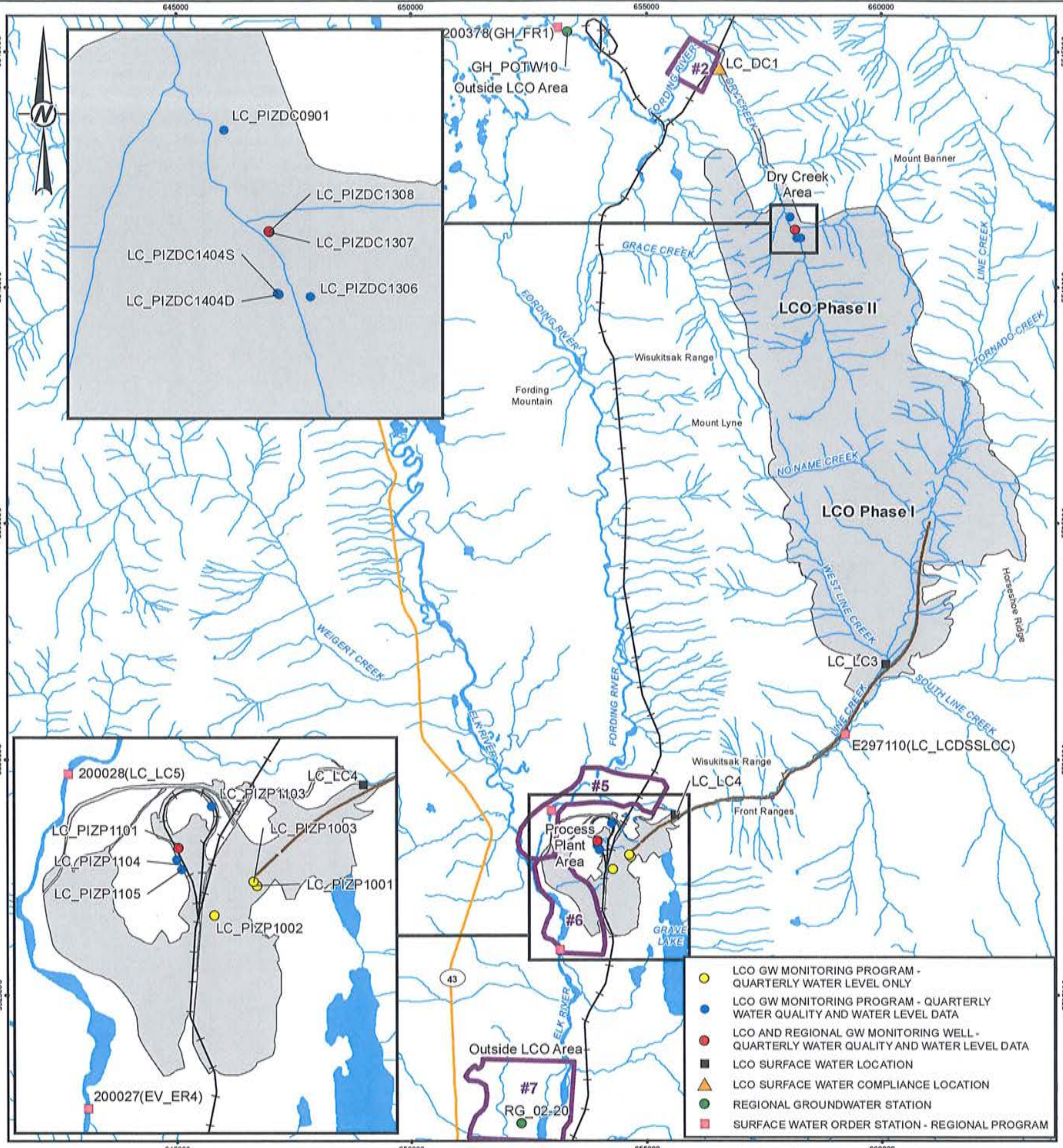
- To obtain continuous records of groundwater levels at LC_PIZP1001 and LC-PIZP1105, it is recommended to install pressure transducers as deep as possible to maximize transducer submergence below the water level while remaining within the head range of the transducer;

- To improve the continuous record of groundwater levels at LC_PIZP1101, consider replacing the pressure transducer;
- The current groundwater monitoring program should continue, along with continued coordination with the regional program and water treatment plant program, and the need for new wells will be evaluated every three years in alignment with Permit 107517 requirements to submit an updated SSGMP (next updated plan due October 31, 2018);
- In order to be better aligned with other Teck sampling programs, it is suggested that LCO uses the same analyte list as for the regional program (plus bicarbonate). The 2017 list of analytes was identical to the regional program except for extractable petroleum hydrocarbon (only completed at LC_PIZP1101 and LC_PIZP1105) and sulphur. Bismuth is included in the LCO list of analytes and is not included in the regional program; and
- The 2018 Annual Groundwater Monitoring Report should consider reducing sampling frequency starting in 2019 if there continue to be no trends of concern as seasonal variability is well established. For this case, sampling is recommended during the two hydrological extremes, during freshet when dilution is highest and during winter months when surface flow and groundwater levels are the lowest. This will be discussed in the updated site wide groundwater monitoring program (next updated iteration due October 31, 2018).

Table 1: Summary of Groundwater Sampling Locations

Area		Well Name	Alternate Well Name	MOE EMS1	Easting (m UTM)	Northing (m UTM)	Monitoring Program	Screened Lithology	Hydraulic Conductivity (m/s)	Depth (mbg)	Rationale	Sample Frequency	Parameters Reviewed
Process Plant		LC_PIZP1101	LC_MW11 (P)-01	E302410	653956	5528265	LCO, Regional	Coarse-grained sand	7.E-04	41.2	Monitor water quality to detect seepage from Process Plant ponds	Quarterly	Se, Cd, NO_3, SO_4
		LC_PIZP1103	LC_MW11 (P)-03	none	654250	5528634	LCO	Clayey silt above bedrock	6.E-08	41.2		Quarterly	Se, Cd, NO_3, SO_4
		LC_PIZP1104	LC_MW11 (P)-04	none	653940	5528165	LCO	Coarse-grained sand	3.E-04	38.1		Quarterly	Se, Cd, NO_3, SO_4
		LC_PIZP1105	-	E302411	653984	5528075	LCO	-	-	40.5		Quarterly	Se, Cd, NO_3, SO_4
Dry Creek		LC_PIZDC1306	-	none	658278	5541059	LCO	Valley-bottom sediments (Quaternary)	3.E-05	16.5	Monitor water quality to detect for seepage near diversion structure for proposed water treatment plant	Last 3 Quarters of 2017	Se, Cd, NO_3, SO_4
		LC_PIZDC1307	LC_MW13-1D	none	658169	5541230	LCO, Regional		1.E-07	34.6		Quarterly	Se, Cd, NO_3, SO_4
		LC_PIZDC1308	LC_MW13-1S	none	658168	5541232	LCO, Regional		7.E-07	9		Quarterly	Se, Cd, NO_3, SO_4
		LC_PIZDC1404S	-	none	658192	5541069	LCO		5.E-08	12.8		Quarterly	Se, Cd, NO_3, SO_4
		LC_PIZDC1404D	-	none	658192	5541069	LCO		-	31.8		Quarterly	Se, Cd, NO_3, SO_4
		LC_PIZDC0901	-	none	658048	5541500	LCO		9.E-09	9.4		First 3 Quarters of 2017	Se, Cd, NO_3, SO_4
Regional Wells	Downgradient of Dry Creek	GH_POTW10	-	none	653321	5545426	Regional	-	-	-	Monitor water quality to detect seepage downgradient of Dry Creek, Greenhills Operations, and Fording River Operations	Quarterly	Se, Cd, NO_3, SO_4
	Downgradient of Plant Site	RG_02-20	-	none	Private	Private	Regional	-	-	-	Monitor water quality to detect seepage downgradient of LCO Plant Site, Greenhills Operations, and Fording River Operations	Quarterly	Se, Cd, NO_3, SO_4

Notes
m UTM = metres on Universal Transverse Mercator projection, zone 11; m/s = metres per second; mbg = metres below ground; Se = selenium, Cd = cadmium, NO3 = nitrate, SO4 = sulphate; - = unknown or not applicable.



LEGEND

- CANADIAN PACIFIC RAILWAY
- EXISTING CABLE BELT
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- WATERCOURSE
- BRITISH COLUMBIA - ALBERTA BORDER
- KEY AREA IN THE REGIONAL GROUNDWATER MONITORING PROGRAM
- LINE CREEK OPERATIONS
- WATERBODY

0 2,500 5,000

1:120,000 METRES

REFERENCE(S)

RAILWAY OBTAINED FROM GEOGRATIS © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED. TRANSPORTATION DATA OBTAINED FROM GEOBASE®. HYDROLOGY AND OTHER PROJECT DATA OBTAINED FROM TECK COAL LIMITED.
PROJECTION: UTM ZONE 11 DATUM: NAD 83

CLIENT
TECK COAL LIMITED

PROJECT
TECK LINE CREEK OPERATIONS
ANNUAL GROUNDWATER MONITORING PROGRAM

TITLE
LCO GROUNDWATER MONITORING NETWORK - 2017

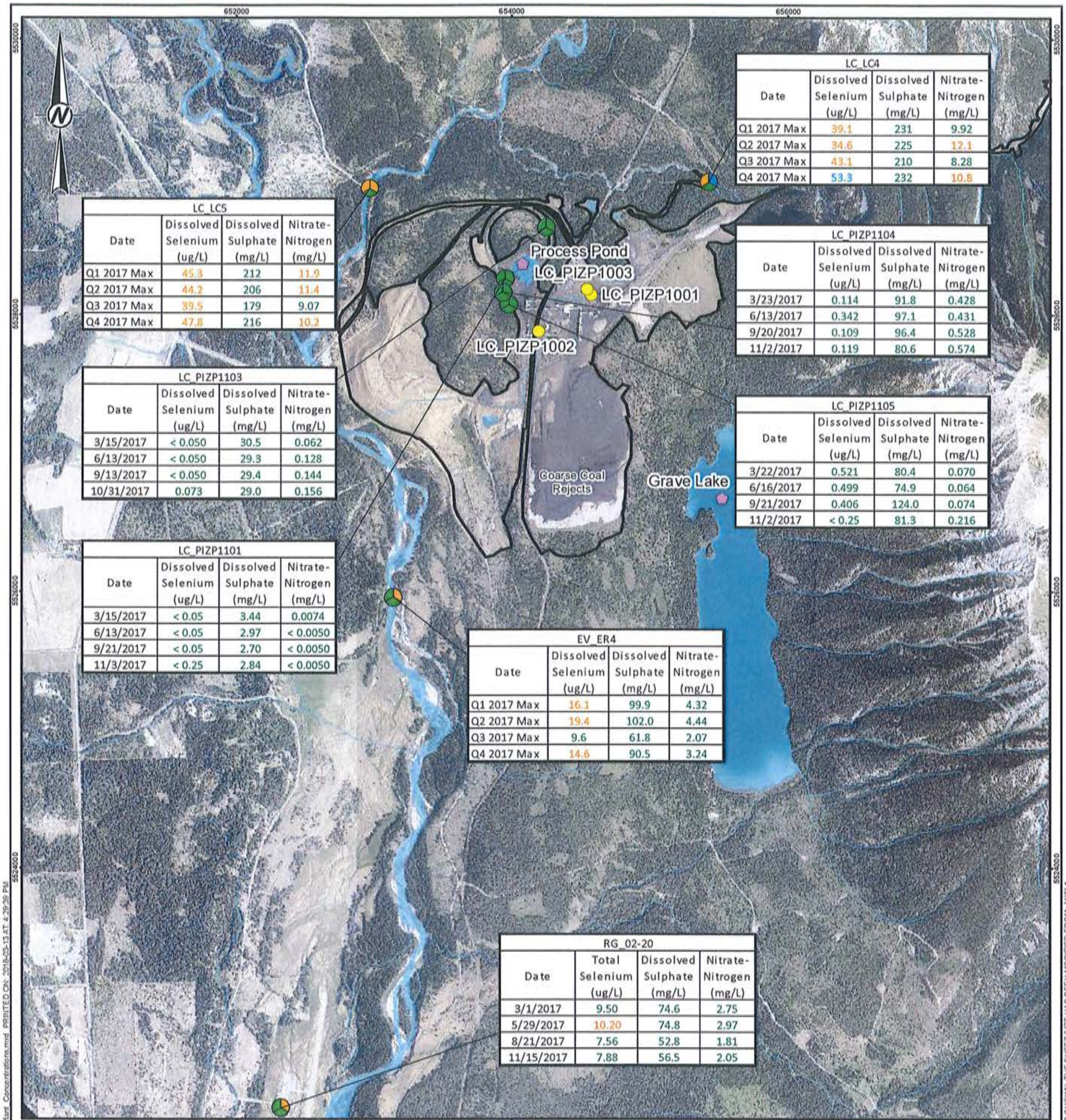
CONSULTANT

GOLDER

YYYY-MM-DD	2018-03-19
DESIGNED	EE
PREPARED	LMS
REVIEWED	NH
APPROVED	JW

PROJECT NO.	PHASE	REV.	FIGURE
1893949	1000	A	3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
25mm



LC_LC4			
Date	Dissolved Selenium (ug/L)	Dissolved Sulphate (mg/L)	Nitrate-Nitrogen (mg/L)
Q1 2017 Max	39.1	231	9.92
Q2 2017 Max	34.6	225	12.1
Q3 2017 Max	43.1	210	8.28
Q4 2017 Max	53.3	232	10.8

LC_LC5			
Date	Dissolved Selenium (ug/L)	Dissolved Sulphate (mg/L)	Nitrate-Nitrogen (mg/L)
Q1 2017 Max	45.3	212	11.9
Q2 2017 Max	44.2	206	11.4
Q3 2017 Max	39.5	179	9.07
Q4 2017 Max	47.8	216	10.2

LC_PIZP1104			
Date	Dissolved Selenium (ug/L)	Dissolved Sulphate (mg/L)	Nitrate-Nitrogen (mg/L)
3/23/2017	0.114	91.8	0.428
6/13/2017	0.342	97.1	0.431
9/20/2017	0.109	96.4	0.528
11/2/2017	0.119	80.6	0.574

LC_PIZP1103			
Date	Dissolved Selenium (ug/L)	Dissolved Sulphate (mg/L)	Nitrate-Nitrogen (mg/L)
3/15/2017	< 0.050	30.5	0.062
6/13/2017	< 0.050	29.3	0.128
9/13/2017	< 0.050	29.4	0.144
10/31/2017	0.073	29.0	0.156

LC_PIZP1105			
Date	Dissolved Selenium (ug/L)	Dissolved Sulphate (mg/L)	Nitrate-Nitrogen (mg/L)
3/22/2017	0.521	80.4	0.070
6/16/2017	0.499	74.9	0.064
9/21/2017	0.406	124.0	0.074
11/2/2017	< 0.25	81.3	0.216

LC_PIZP1101			
Date	Dissolved Selenium (ug/L)	Dissolved Sulphate (mg/L)	Nitrate-Nitrogen (mg/L)
3/15/2017	< 0.05	3.44	0.0074
6/13/2017	< 0.05	2.97	< 0.0050
9/21/2017	< 0.05	2.70	< 0.0050
11/3/2017	< 0.25	2.84	< 0.0050

EV_ER4			
Date	Dissolved Selenium (ug/L)	Dissolved Sulphate (mg/L)	Nitrate-Nitrogen (mg/L)
Q1 2017 Max	16.1	99.9	4.32
Q2 2017 Max	19.4	102.0	4.44
Q3 2017 Max	9.6	61.8	2.07
Q4 2017 Max	14.6	90.5	3.24

RG_02-20			
Date	Total Selenium (ug/L)	Dissolved Sulphate (mg/L)	Nitrate-Nitrogen (mg/L)
3/1/2017	9.50	74.6	2.75
5/29/2017	10.20	74.8	2.97
8/21/2017	7.56	52.8	1.81
11/15/2017	7.88	56.5	2.05

LEGEND

- WATERCOURSE
- WATERBODY
- PROJECT OPERATIONAL BOUNDARY
- LCO GW MONITORING PROGRAM - QUARTERLY WATER LEVEL ONLY
- WATER LEVEL ELEVATIONS OBTAINED FROM LIDAR
- BELOW PRIMARY SCREENING CRITERIA
- ABOVE AT LEAST ONE OF THE PRIMARY SCREENING CRITERIA
- SELENIUM CONCENTRATION ABOVE AT LEAST ONE OF THE SECONDARY SCREENING CRITERIA

NITRATE-NITROGEN SELENIUM
SULPHATE

0 800 1,600
1:40,000 METRES

REFERENCE(S)
IMAGERY, HYDROLOGY AND OTHER PROJECT DATA OBTAINED FROM TECK COAL LIMITED.
PROJECTION: UTM ZONE 11 DATUM: NAD 83

CLIENT
TECK COAL LIMITED

PROJECT
TECK LINE CREEK OPERATIONS
ANNUAL GROUNDWATER MONITORING PROGRAM

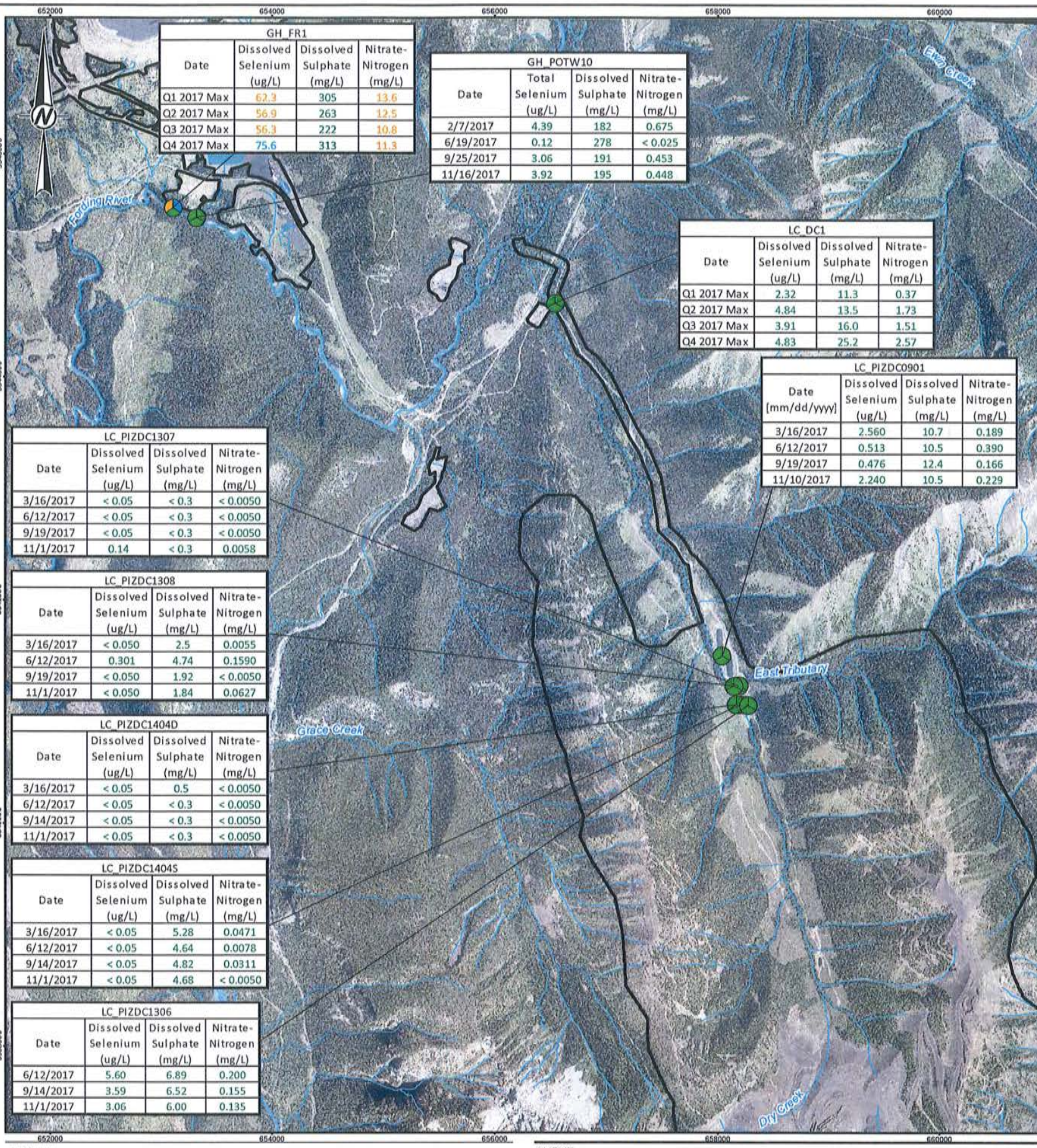
TITLE
LCO PROCESS PLANT AREA SPATIAL DISTRIBUTION OF SELECTED GROUNDWATER ANALYTICAL DATA

CONSULTANT

GOLDER

YYYY-MM-DD	2018-03-13
DESIGNED	EE
PREPARED	LMS
REVIEWED	NH
APPROVED	JW

PROJECT NO.	PHASE	REV.	FIGURE
1893949	1000	A	6



GH_FR1			
Date	Dissolved Selenium (ug/L)	Dissolved Sulphate (mg/L)	Nitrate-Nitrogen (mg/L)
Q1 2017 Max	62.3	305	13.6
Q2 2017 Max	56.9	263	12.5
Q3 2017 Max	56.3	222	10.8
Q4 2017 Max	75.6	313	11.3

GH_POTW10			
Date	Total Selenium (ug/L)	Dissolved Sulphate (mg/L)	Nitrate-Nitrogen (mg/L)
2/7/2017	4.39	182	0.675
6/19/2017	0.12	278	< 0.025
9/25/2017	3.06	191	0.453
11/16/2017	3.92	195	0.448

LC_DC1			
Date	Dissolved Selenium (ug/L)	Dissolved Sulphate (mg/L)	Nitrate-Nitrogen (mg/L)
Q1 2017 Max	2.32	11.3	0.37
Q2 2017 Max	4.84	13.5	1.73
Q3 2017 Max	3.91	16.0	1.51
Q4 2017 Max	4.83	25.2	2.57

LC_PIZDC0901			
Date [mm/dd/yyyy]	Dissolved Selenium (ug/L)	Dissolved Sulphate (mg/L)	Nitrate-Nitrogen (mg/L)
3/16/2017	2.560	10.7	0.189
6/12/2017	0.513	10.5	0.390
9/19/2017	0.476	12.4	0.166
11/10/2017	2.240	10.5	0.229

LC_PIZDC1307			
Date	Dissolved Selenium (ug/L)	Dissolved Sulphate (mg/L)	Nitrate-Nitrogen (mg/L)
3/16/2017	< 0.05	< 0.3	< 0.0050
6/12/2017	< 0.05	< 0.3	< 0.0050
9/19/2017	< 0.05	< 0.3	< 0.0050
11/1/2017	0.14	< 0.3	0.0058

LC_PIZDC1308			
Date	Dissolved Selenium (ug/L)	Dissolved Sulphate (mg/L)	Nitrate-Nitrogen (mg/L)
3/16/2017	< 0.050	2.5	0.0055
6/12/2017	0.301	4.74	0.1590
9/19/2017	< 0.050	1.92	< 0.0050
11/1/2017	< 0.050	1.84	0.0627

LC_PIZDC1404D			
Date	Dissolved Selenium (ug/L)	Dissolved Sulphate (mg/L)	Nitrate-Nitrogen (mg/L)
3/16/2017	< 0.05	0.5	< 0.0050
6/12/2017	< 0.05	< 0.3	< 0.0050
9/14/2017	< 0.05	< 0.3	< 0.0050
11/1/2017	< 0.05	< 0.3	< 0.0050

LC_PIZDC1404S			
Date	Dissolved Selenium (ug/L)	Dissolved Sulphate (mg/L)	Nitrate-Nitrogen (mg/L)
3/16/2017	< 0.05	5.28	0.0471
6/12/2017	< 0.05	4.64	0.0078
9/14/2017	< 0.05	4.82	0.0311
11/1/2017	< 0.05	4.68	< 0.0050

LC_PIZDC1306			
Date	Dissolved Selenium (ug/L)	Dissolved Sulphate (mg/L)	Nitrate-Nitrogen (mg/L)
6/12/2017	5.60	6.89	0.200
9/14/2017	3.59	6.52	0.155
11/1/2017	3.06	6.00	0.135

LEGEND

- WATERCOURSE
- WATERBODY
- PROJECT OPERATIONAL BOUNDARY
- BELOW PRIMARY SCREENING CRITERIA
- ABOVE AT LEAST ONE OF THE PRIMARY SCREENING CRITERIA
- SELENIUM CONCENTRATION ABOVE AT LEAST ONE OF THE SECONDARY SCREENING CRITERIA

NITRATE-NITROGEN SELENIUM SULPHATE

0 1,000 2,000

1:50,000 METRES

REFERENCE(S)

IMAGERY, HYDROLOGY AND OTHER PROJECT DATA OBTAINED FROM TECK COAL LIMITED.
PROJECTION: UTM ZONE 11 DATUM: NAD 83

CLIENT
TECK COAL LIMITED

PROJECT
TECK LINE CREEK OPERATIONS
ANNUAL GROUNDWATER MONITORING PROGRAM

TITLE
LCO DRY CREEK AREA SPATIAL DISTRIBUTION OF SELECTED GROUNDWATER ANALYTICAL DATA

CONSULTANT

GOLDER

YYYY-MM-DD	2018-03-27
DESIGNED	EE
PREPARED	LMS
REVIEWED	NH
APPROVED	JW

PROJECT NO.	PHASE	REV.	FIGURE
1893949	1000	A	7

Appendix A - Table 3 Field Blanks Collected As Part of LCO 2017 Groundwater Monitoring

			Location	LC_PIZP1104	
Analyte	FRACTION	RDL	Unit	23/03/2017	20/09/2017
ACIDITY TO pH 8.3 (As CaCO3)	N	1	mg/l	11.90	2.00
ALKALINITY, BICARBONATE (As CaCO3), lab measured.	N	1	mg/l	< 1.0	< 1.0
ALKALINITY, CARBONATE (As CaCO3), lab measured.	N	1	mg/l	< 1.0	< 1.0
ALKALINITY, HYDROXIDE (As CaCO3), lab measured.	N	1	mg/l	< 1.0	< 1.0
ALKALINITY, TOTAL (As CaCO3), lab measured.	N	1	mg/l	< 1.0	< 1.0
ALUMINUM	Dissolved	0.001	mg/l	< 0.0010	
ALUMINUM	Dissolved	0.003	mg/l		< 0.0030
ALUMINUM	Total	0.003	mg/l	< 0.0030	
ANTIMONY	Dissolved	0.0001	mg/l	< 0.00010	< 0.00010
ANTIMONY	Total	0.0001	mg/l	< 0.00010	
ARSENIC	Dissolved	0.0001	mg/l	< 0.00010	< 0.00010
ARSENIC	Total	0.0001	mg/l	< 0.00010	
BARIUM	Dissolved	0.00005	mg/l	< 0.000050	< 0.000050
BARIUM	Total	0.00005	mg/l	< 0.000050	
BERYLLIUM	Dissolved	0.00002	mg/l	< 0.000020	< 0.000020
BERYLLIUM	Total	0.00002	mg/l	< 0.000020	
BIOCHEMICAL OXYGEN DEMAND, FIVE DAY	N	2	mg/l		
BISMUTH	Dissolved	0.00005	mg/l	< 0.000050	< 0.000050
BISMUTH	Total	0.00005	mg/l	< 0.000050	
BORON	Dissolved	0.01	mg/l	< 0.010	< 0.010
BORON	Total	0.01	mg/l	< 0.010	
BROMIDE	Dissolved	0.05	mg/l	< 0.050	< 0.050
CADMIUM	Dissolved	0.000005	mg/l	< 0.0000050	< 0.0000050
CADMIUM	Total	0.000005	mg/l	< 0.0000050	
CALCIUM	Dissolved	0.05	mg/l	< 0.050	< 0.050
CALCIUM	Total	0.05	mg/l	0.05	
CARBON, DISSOLVED ORGANIC	Dissolved	0.5	mg/l	< 0.50	< 0.50
Cation - Anion Balance	N	0	%		0.00
CHLORIDE	Dissolved	0.5	mg/l	< 0.50	< 0.50
CHLORIDE	Dissolved	0.1	mg/l		
CHROMIUM	Dissolved	0.0001	mg/l	< 0.00010	< 0.00010
CHROMIUM	Total	0.0001	mg/l	< 0.00010	
COBALT	Dissolved	0.0001	mg/l	< 0.00010	< 0.00010
COBALT	Total	0.0001	mg/l	< 0.00010	
COLOUR TRUE	N	5	CU		
CONDUCTIVITY, LAB	N	2	us/cm	< 2.0	< 2.0
COPPER	Dissolved	0.0005	mg/l	< 0.00020	< 0.00050
COPPER	Total	0.0005	mg/l	0.00098	
FLUORIDE	Dissolved	0.02	mg/l	< 0.020	< 0.020
Hardness, Total or Dissolved CaCO3	N	0.5	mg/l	< 0.50	< 0.50
HYDROGEN SULFIDE	N	0.001	mg/l		
ION BALANCE	N		%	93.70	
IRON	Dissolved	0.01	mg/l	< 0.010	< 0.010
IRON	Total	0.01	mg/l	< 0.010	
LEAD	Dissolved	0.00005	mg/l	< 0.000050	< 0.000050
LEAD	Total	0.00005	mg/l	< 0.000050	
LITHIUM	Dissolved	0.001	mg/l	< 0.0010	< 0.0010
LITHIUM	Total	0.001	mg/l	< 0.0010	
MAGNESIUM	Dissolved	0.005	mg/l	< 0.0050	
MAGNESIUM	Dissolved	0.1	mg/l		< 0.10
MAGNESIUM	Total	0.005	mg/l	< 0.0050	
MAGNESIUM	Total	0.1	mg/l		
MAJOR ANION SUM	N	0	meq/l	< 0	< 0
MAJOR CATION SUM	N	0	meq/l	< 0	< 0
MANGANESE	Dissolved	0.0001	mg/l	< 0.00010	< 0.00010
MANGANESE	Total	0.0001	mg/l	< 0.00010	
MERCURY	Dissolved	0.000005	mg/l	< 0.0000050	< 0.0000050
MERCURY	Total	0.0005	mg/l		
MERCURY	Total	0.000005	mg/l	< 0.0000050	
MERCURY	Total	0.00001	mg/l		
METHYL MERCURY	Total	0.00005	ug/l		
MOLYBDENUM	Dissolved	0.00005	mg/l	< 0.000050	< 0.000050
MOLYBDENUM	Total	0.00005	mg/l	< 0.000050	
NICKEL	Dissolved	0.0005	mg/l	< 0.00050	< 0.00050
NICKEL	Total	0.0005	mg/l	< 0.00050	
NITRATE NITROGEN (NO3), AS N	N	0.005	mg/l	< 0.0050	< 0.0050
NITRITE NITROGEN (NO2), AS N	N	0.001	mg/l	0.00	< 0.0010
NITROGEN, AMMONIA (AS N)	N	0.005	mg/l	< 0.0050	< 0.0050
ORTHO-PHOSPHATE	N	0.001	mg/l	< 0.0010	< 0.0010
OXIDATION-REDUCTION POTENTIAL, LAB	N	1000	mv	403.00	426.00
pH, LAB	N	0.1	ph units	5.66	5.36
PHOSPHORUS	N	0.002	mg/l	< 0.0020	< 0.0010
POTASSIUM	Dissolved	0.05	mg/l	< 0.050	< 0.050
POTASSIUM	Total	0.05	mg/l	< 0.050	
SELENIUM	Dissolved	0.05	ug/l	< 0.050	< 0.050
SELENIUM	Total	0.05	ug/l	< 0.050	
SILICON	Dissolved	0.05	mg/l	< 0.050	< 0.050
SILICON	Total	0.1	mg/l		
SILICON	Total	0.05	mg/l	< 0.050	
SILVER	Dissolved	0.00001	mg/l	< 0.000010	< 0.000010
SILVER	Total	0.00001	mg/l	< 0.000010	
SODIUM	Dissolved	0.05	mg/l	< 0.050	< 0.050
SODIUM	Total	0.05	mg/l	< 0.050	
STRONTIUM	Dissolved	0.0002	mg/l	< 0.00020	< 0.00020
STRONTIUM	Total	0.0002	mg/l	< 0.00020	
SULFATE (AS SO4)	Dissolved	0.3	mg/l	< 0.30	< 0.30
SULFIDE (as S)	Total	0.001	mg/l		
THALLIUM	Dissolved	0.00001	mg/l	< 0.000010	< 0.000010
THALLIUM	Total	0.00001	mg/l	< 0.000010	
TIN	Dissolved	0.0001	mg/l	< 0.00010	< 0.00010
TIN	Total	0.0001	mg/l	< 0.00010	
TITANIUM	Dissolved	0.01	mg/l	< 0.010	< 0.010
TITANIUM	Total	0.01	mg/l	< 0.010	
TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)	N	10	mg/l	< 10	< 10
TOTAL DISSOLVED SOLIDS (RESIDUE, FILTERABLE)	N	3	mg/l		
TOTAL KJELDAHL NITROGEN	N	0.05	mg/l	< 0.050	
TOTAL ORGANIC CARBON	Total	0.5	mg/l	< 0.50	
TOTAL SUSPENDED SOLIDS, LAB	N	1	mg/l	< 1.0	< 1.0
TURBIDITY, LAB	N	0.1	ntu	< 0.10	< 0.10
URANIUM	Dissolved	0.00001	mg/l	< 0.000010	< 0.000010
URANIUM	Total	0.00001	mg/l	< 0.000010	
VANADIUM	Dissolved	0.0005	mg/l	< 0.00050	< 0.00050
VANADIUM	Total	0.0005	mg/l	< 0.00050	
ZINC	Dissolved	0.001	mg/l	< 0.0010	
ZINC	Dissolved	0.003	mg/l		
ZINC	Total	0.003	mg/l	< 0.0030	< 0.0030

Month	March	September
Count	89	55
Hits	4	1
% non-detect	95.5	98.2

NOTE:

APPENDIX I-3: LCO Trip Blank Data

			Physical Parameters							Dissolved Inorganics											Dissolved Metals			
Sample Location	Sample ID	Sample Date (yyyy mm dd)	pH, LAB ph units	Hardness, Total or Dissolved CaCO3 mg/L	CONDUCTIVITY, LAB us/cm	TOTAL SUSPENDED SOLIDS mg/L	TOTAL DISSOLVED SOLIDS mg/L	TURBIDITY, LAB ntu	ALKALINITY, TOTAL (as CaCO3) mg/L	AMMONIA, TOTAL (AS N) mg/L	BROMIDE mg/L	CHLORIDE mg/L	FLUORIDE mg/L	NITRATE, AS N mg/L	NITRITE , AS N mg/L	TOTAL KJELDAHL NITROGEN mg/L	ORTHO-PHOSPHATE mg/L	PHOSPHORUS mg/L	SULFATE (AS SO4) mg/L	TOTAL ORGANIC CARBON mg/L	CALCIUM mg/L	MAGNESIUM mg/L	POTASSIUM mg/L	SODIUM mg/L
LC_TBLANK	TB_WG_20170313_015	2017/03/23	5.60	-	< 2.0	< 1.0	< 10	< 0.10	< 1.0	< 0.0050	< 0.050	0.66	< 0.020	2.80	< 0.0010	< 0.050	< 0.0010	< 0.0020	15.6	< 0.50	-	-	-	-
	TB_WG_20170612_018	2017/06/13	5.58	-	< 2.0	< 1.0	< 10	0.18	< 1.0	0.0201	< 0.050	< 0.50	< 0.020	< 0.0050	< 0.0010	< 0.050	< 0.0010	0.0242	< 0.30	< 0.50	< 0.050	< 0.0050	< 0.050	< 0.050
	TB_WG_20170911_021	2017/09/21	6.05	< 0.50	< 2.0	< 1.0	< 10	< 0.10	1.2	0.0108	< 0.050	< 0.50	< 0.020	< 0.0050	< 0.0010	< 0.050	< 0.0010	< 0.0010	< 0.30	< 0.50	-	-	-	-

APPENDIX I-3 (Cont'd): LCO Trip Blank Data

Total Metals

Sample Location	Sample ID	Sample Date (yyyy mm dd)	ALUMINUM mg/L	ANTIMONY mg/L	ARSENIC mg/L	BARIUM mg/L	BERYLLIUM mg/L	BISMUTH mg/L	BORON mg/L	CADMIUM mg/L	CALCIUM mg/L	CHROMIUM mg/L	COBALT mg/L	COPPER mg/L	IRON mg/L	LEAD mg/L
LC_TBLANK	TB_WG_20170313_015	2017/03/23	< 0.0030	< 0.00010	< 0.00010	0.000058	< 0.000020	< 0.000050	< 0.010	< 0.0000050	0.064	< 0.00010	< 0.00010	0.00169	< 0.010	0.000076
	TB_WG_20170612_018	2017/06/13	< 0.0030	< 0.00010	< 0.00010	< 0.000050	< 0.000020	< 0.000050	< 0.010	< 0.0000050	< 0.050	< 0.00010	< 0.00010	< 0.00050	< 0.010	< 0.000050
	TB_WG_20170911_021	2017/09/21	< 0.0030	< 0.00010	< 0.00010	< 0.000050	< 0.000020	< 0.000050	< 0.010	< 0.0000050	< 0.050	< 0.00010	< 0.00010	< 0.00050	< 0.010	< 0.000050

Sample Location	Sample ID	Sample Date (yyyy mm dd)	LITHIUM mg/L	MAGNESIUM mg/L	MANGANESE mg/L	MERCURY mg/L	MOLYBDENUM mg/L	NICKEL mg/L	POTASSIUM mg/L	SELENIUM ug/l	SILVER mg/L	SODIUM mg/L	STRONTIUM mg/L	THALLIUM mg/L	TIN mg/L	TITANIUM mg/L	URANIUM mg/L	VANADIUM mg/L	ZINC mg/L
LC_TBLANK	TB_WG_20170313_015	2017/03/23	< 0.0010	0.0069	0.00012	< 0.0000050	< 0.000050	< 0.00050	< 0.050	< 0.050	0.000015	< 0.050	< 0.00020	< 0.000010	0.00012	< 0.010	< 0.000010	< 0.00050	< 0.0030
	TB_WG_20170612_018	2017/06/13	< 0.0010	< 0.0050	< 0.00010	< 0.0000050	< 0.000050	< 0.00050	< 0.050	< 0.050	< 0.000010	< 0.050	< 0.00020	< 0.000010	< 0.00010	< 0.010	< 0.000010	< 0.00050	< 0.0030
	TB_WG_20170911_021	2017/09/21	< 0.0010	< 0.10	< 0.00010	< 0.0000050	< 0.000050	< 0.00050	< 0.050	< 0.050	< 0.000010	< 0.050	< 0.00020	< 0.000010	< 0.00010	< 0.010	< 0.000010	< 0.00050	< 0.0030

Appendix I-4: EVO 2017 Annual Groundwater Monitoring Summary and Recommendations

SNC·LAVALIN

Appendix I-4: Elkview Operations 2017 Annual Groundwater Monitoring

Summary

SNC-Lavalin Inc. (SNC-Lavalin, 2018c) completed the 2017 Annual Report for the Elkview Operations (EVO) Site Specific Groundwater Monitoring Program (SSGMP). EVO is located in southeastern British Columbia (BC), directly east of the town of Sparwood, BC and is one of Teck's five active coal mines in the Elk Valley. The following information was taken from the 2017 EVO Annual Report, which was completed to fulfill the reporting requirements outlined in Section 10.4 of Permit 107517 (October 13, 2017). The SSGMP was developed in 2015 with monitoring commencing the same year and the program was approved in April 2017 by the Ministry of Environment (MoE), now referred to as the Ministry of Environment & Climate Change Strategy (ENV).

The groundwater conceptual site model (CSM) for EVO identified the groundwater flow through surficial materials is a more important pathway compared to groundwater flow through bedrock; the two main hydrogeological settings of surficial materials and associated groundwater recharge and flow are in upland areas and valley-bottoms. Hydrogeology in the CSM was described in terms of main stem valley-bottoms including the Elk River and Michel Creek and major tributary drainages including Grave Creek/Harmer Creek, which flow into the Elk River and Erickson Creek, which flows into Michel Creek.

The EVO SSGMP includes a total of 12 monitoring well locations which are monitored and sampled quarterly for a specific list of analytes. The wells monitored and sampled as part of the 2017 annual program are listed in Table A along with the associated rationale (extracted from the 2017 EVO Annual Report). Monitoring well locations are shown on Drawing 653245-002 attached (extracted from the 2017 EVO Annual Report). In 2017, quarterly sampling and monitoring were conducted at all wells with two exceptions: the Q1 sample from EV_ECgw, which could not be monitored or sampled due to a frozen well; and a manual water level measurement was not recorded from EV_WF_SW in Q2, likely due to a field transcription oversight. Samples from site-specific programs were submitted for all parameters on the analyte list except total nitrogen, which was only submitted for analysis for two samples in Q1 of 2017 and dissolved phosphorus, which was not submitted for analysis for any samples in 2017. These modifications to the EVO SSGMP do not affect the overall quality or interpretation of the data. Field and trip blank data are provided in the attached Table 4 (extracted from the 2017 EVO Annual Report).

Groundwater quality screening followed the most recent procedures that have been discussed with ENV and summarized in the Regional Groundwater Monitoring Program (2017 RGMP; SNC-Lavalin-2017c). Groundwater quality at all monitoring locations were compared to applicable primary screening criteria and secondary screening criteria if selenium concentrations were above primary screening. Presentation of results, data interpretation and discussion of water level and chemistry trends for select constituents of interest (CI), including nitrate-nitrogen, sulphate and dissolved selenium, were summarized by main transport pathways (i.e., main stem valley-bottom and major tributary drainage) as defined by the CSM. To assess groundwater and surface water interactions, groundwater chemistry was compared to chemistry at nearby surface water stations.

Groundwater quality data for CI are shown in plan view in Drawing 653245-007 attached (extracted from the 2017 EVO Annual Report). In general, groundwater concentrations of CI above primary and secondary screening criteria were consistent with 2015 and 2016 results. Results and interpretation are presented throughout the report by surface water drainage in order of flow (i.e., tributary drainages are presented prior to main stem valley-bottom drainages). A brief summary of results and interpretation is as follows:

› Grave Creek/Harmer Creek drainage: groundwater samples from 2017 were below primary screening criteria for all CI. Low selenium concentrations in groundwater compared to surface water in Harmer Creek and lack of seasonal variation in groundwater selenium concentrations suggested limited interactions between deep groundwater and surface water in the Harmer Creek/Grave Creek drainage. Based on relatively low groundwater selenium concentrations, groundwater transport of CI from the Harmer Creek/Grave Creek drainage was inferred to be minimal.
› Elk River drainage proximal to EVO: groundwater samples from 2017 were below primary screening criteria for all CI. Selenium concentrations in tributary surface water originating from the western slope of EVO and the Elk River were approximately two orders of magnitude higher compared to groundwater concentrations in the Elk River drainage indicating there is potential for loading of mine-influenced constituents from tributary surface water to groundwater via infiltration. However, based on review of groundwater selenium concentrations there does not appear to be a confirmed groundwater transport pathway between tributary surface water and Elk River valley-bottom.
› Erickson Creek drainage: groundwater samples in 2017 were below primary screening criteria for all CI. Selenium concentrations in groundwater in the Erickson Creek drainage were more than two orders of magnitude lower than surface water concentrations measured in Erickson Creek. Therefore, any effects to groundwater in the Michel Creek valley-bottom where Erickson Creek discharges to Michel Creek are likely the result of infiltration of mine-influenced surface water rather than tributary groundwater transport.
› Michel Creek drainage: groundwater samples were above primary screening criteria for nitrate-nitrogen and dissolved selenium for all sampling events in 2017. Selenium concentrations from select groundwater samples were also above secondary screening criteria. Groundwater selenium, nitrate and sulphate concentrations in groundwater were typically lower compared to concentrations in adjacent tributary surface water from Gate Creek and Bodie Creek and higher compared to nearby Michel Creek suggesting a groundwater transport pathway of CI exists.
› Elk River drainage distal to EVO: dissolved selenium concentrations in 2017 groundwater samples were marginally above primary screening criteria on two sampling events. Consistent with previous years, a clear seasonal trend in selenium concentrations was observed in both groundwater and the surface water (Elk River and Michel Creek) with lower concentrations in spring and summer and higher concentrations in the fall and winter, consistent with the effect of dilution in a freshet dominated regime. Selenium concentrations in groundwater in 2017 were lower than concentrations in Michel Creek and Elk River surface water.

Constituents other than CI were measured above primary screening criteria, including fluoride and dissolved iron, manganese, lithium, and molybdenum. Dissolved lithium did not previously exceed primary screening criteria; however, the drinking water CSR DW standard was recently changed from 730 µg/L to 8 µg/L on November 1, 2017 which it why it was flagged. The remaining constituents above primary screening criteria were assessed in the 2017 Regional Groundwater Monitoring Program (RGMP) and appeared to originate from natural sources (e.g., interaction with bedrock or unconsolidated materials) with the exception of zinc, which appears to be locally sourced in the Michel Creek valley-bottom.

An update of the SSGMP is due in 2018 and the 2017 and historical groundwater monitoring results will be used in the development of an updated plan.

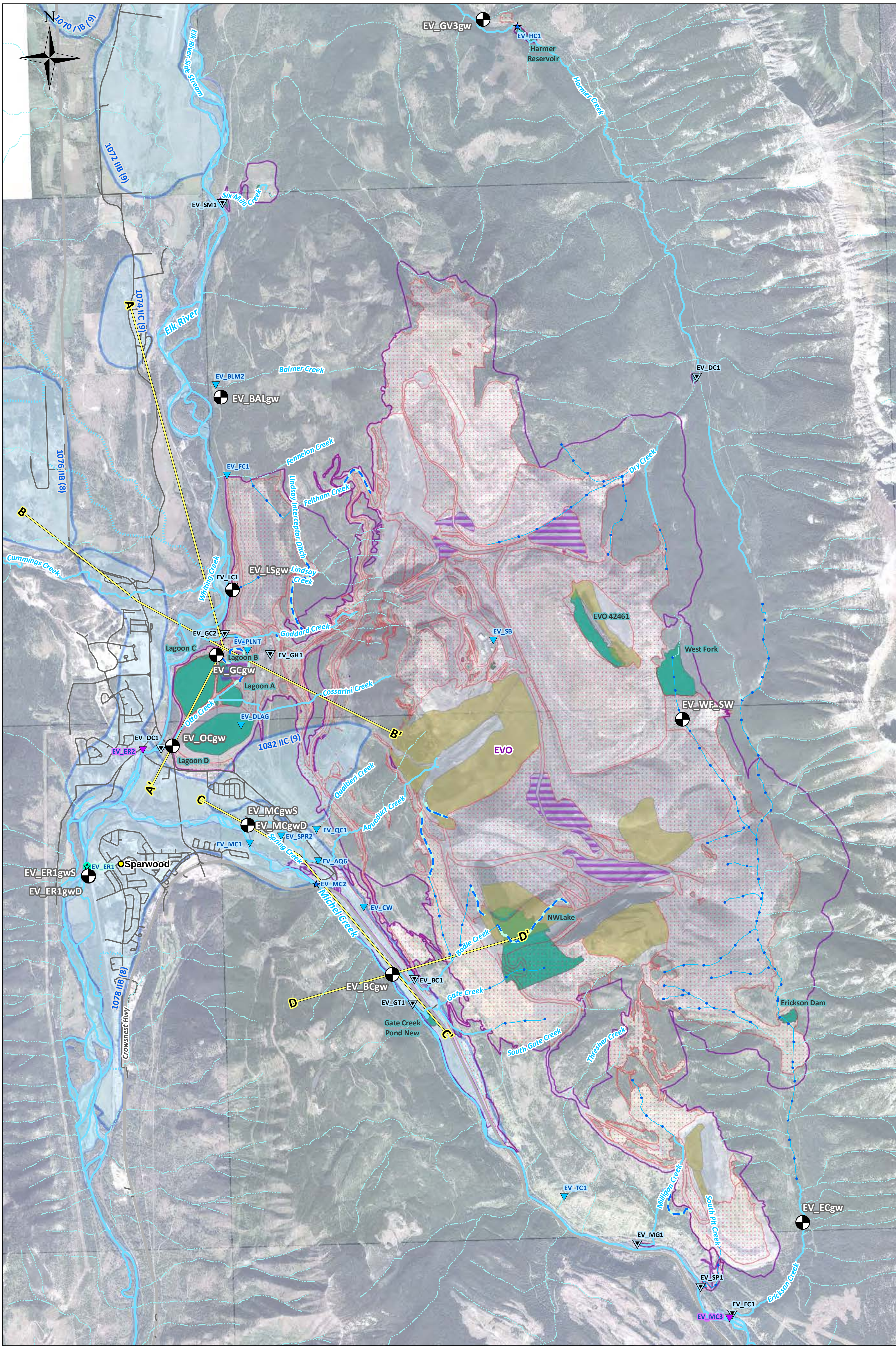
Recommendations

General recommendations are as follows:

- Analyze for all the parameters listed in the 2015 SSGMP for EVO, including total nitrogen and dissolved phosphorus. The analyte list should be re-evaluated as part of the planned 2018 SSGMP update;
- Collect water level measurements manually prior to sampling, and before deploying or uploading data from level loggers;
- Calibrate field probes prior to sampling; and
- For the 2018 update of the EVO SSGMP:
  - Consider removing the nested well EV_ER1gwS/D based on the fact that it is more applicable to the RGMP. Clear definitions of the differences between SSGMPs and the RGMP were developed in the 2017 RGMP (SNC-Lavalin, 2017c). The SSGMPs will focus on potential sources and transport pathways of mine related constituents to groundwater in the valley-bottom whereas the RGMP focuses on groundwater fate and transport in the valley-bottom of the main stems, and how they relate to applicable receptors. Well EV_ER1gwS/D is considered to represent groundwater transport in the valley-bottom of the main stem Elk River; and
  - Consider conducting a review hydraulic conductivity testing results of EV_series monitoring wells.

Table A: Summary of Groundwater Monitoring Locations and Rationale

Drainage	Well ID	Rationale
Grave/Harmer Creek	EV_GV3gw	Monitor groundwater quality and levels in the within valley fill sediments downgradient of the Dry Creek Spoil
Elk River Proximal to EVO	EV_BALgw	Monitor baseline groundwater quality and levels within valley fill sediments north of the CCR dump
	EV_LSgw	Monitor groundwater quality and levels in valley fill sediments near Lindsay Creek downgradient of Baldy Ridge
	EV_GCgw	Monitor groundwater quality and levels in the valley sediments near Goddard Creek downgradient of Baldy Ridge and adjacent to Lagoons B and C, Goddard Settling Ponds and the Goddard Marsh
	EV_OCgw	Monitor groundwater quality and levels in valley fill sediments near Otto Creek downgradient of the southern portion of Baldy Ridge and Lagoon D
Erickson Creek	EV_WF_SW	Designed to monitor downgradient flow from the West Fork Tailings Facility
	EV_ECgw	Monitor groundwater quality and levels within valley fill sediments downgradient of Erickson Spoils
Michel Creek	EV_MCgwS	Monitor groundwater quality and levels in valley fill sediments near Michel Creek
	EV_MCgwD	
	EV_BCgw	Monitor groundwater quality and levels in valley fill sediments near Michel Creek down gradient of Bodie Creek, Bodie Pond and Gate Creek
Elk River Distal to EVO	EV_ER1gwS	Monitor groundwater quality and levels in valley sediments near the Elk River
	EV_ER1gwD	



Legend

SSGMP Wells
- Monitoring Well

Surface Water Stations
- Compliance Point
- Order Station
- Receiving Environment
- Authorized Discharge
- Monitoring

Water Features
- Intermittent Stream
- Stream Ditch
- Indefinite Stream
- Stream
- Subsurface
- Mapped Aquifers

Site Features
- Geological Cross Sections
- EVO Permitted Boundary
- Pit
- Stockpiles
- Waste Dump (Spoils)
- Highway
- Secondary Road
- Tailings/Settling Pond
- Reservoir
- River Bed

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
1. Information provided by Teck Coal Ltd.
2. Mapped Aquifers are from Water Resources Atlas (BC ENV)

Revisons:
0 - AO - 2018-01-29 - DRAFT - LH
1 - AO - 2018-03-26 - FINAL - LH

0 0.3 0.6 1.2 1.8 2.4 3 km

PROJECT LOCATION: Elkview Operations, Sparwood, BC

CLIENT NAME: Teck Coal Ltd

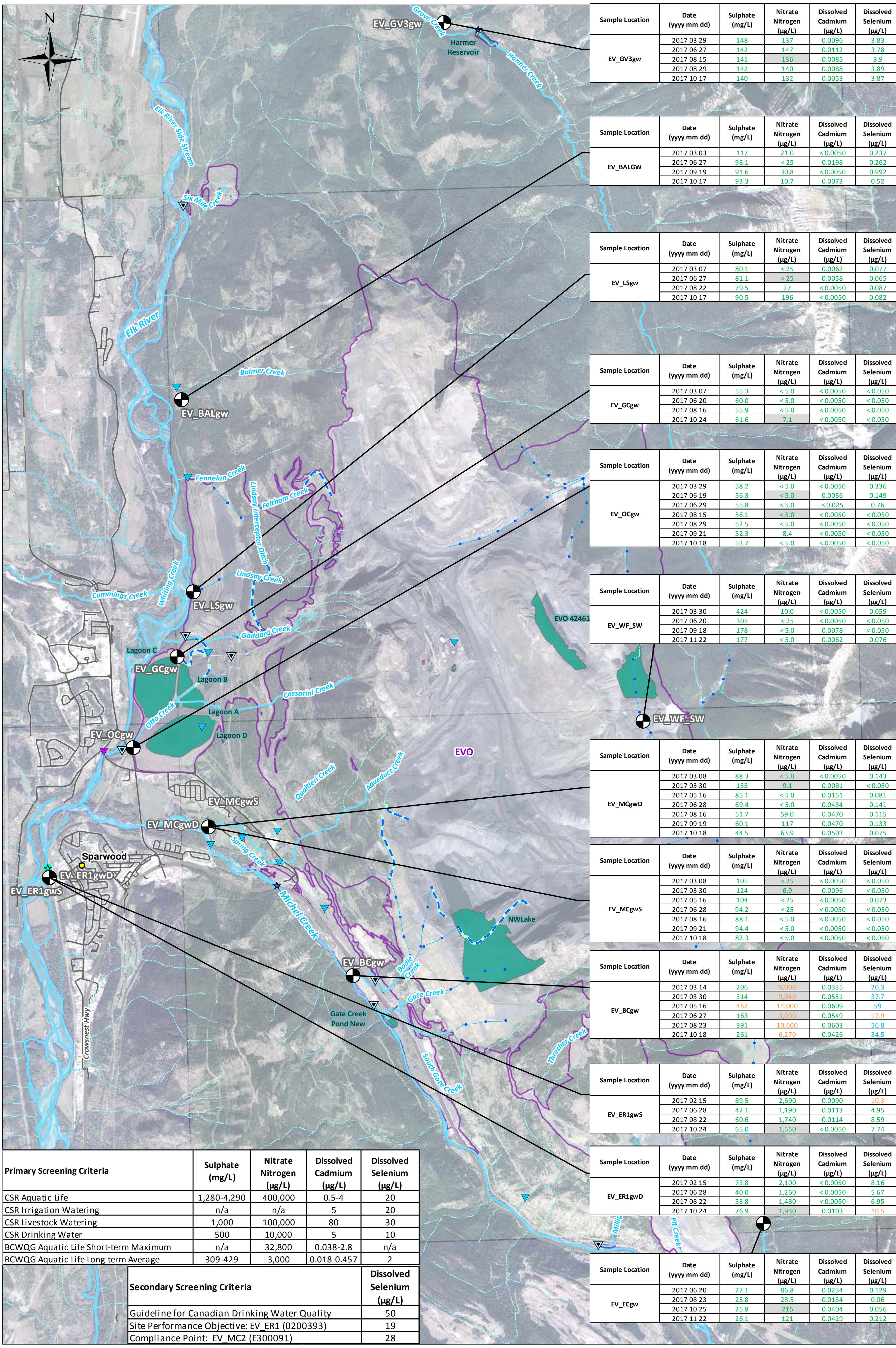
SNC · LAVALIN

Site Features and Sample Location Plan

CHK'D: LH	DATE: 2018/03/26	SCALE: 1:50,000	Ref Num:	REV: 0
BY: AO	COORD SYS: NAD 1983 UTM Zone 11N		653245-002	

Project Path: P:\Current Projects\Teck Coal Ltd\GIS\Exports\ANNUAL REPORT

MXD Path: P:\Current Projects\Teck Coal Ltd\GIS\Map Series\2017 Annual Reports\653245-002_SiteFeaturesSampleLocPlan_EVO.mxd



Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
EV_GV3gw	2017 03 29	148	137	0.0096	3.83
	2017 06 27	142	147	0.0112	3.78
	2017 08 15	141	136	0.0085	3.9
	2017 08 29	142	140	0.0088	3.89
	2017 10 17	140	132	0.0053	3.87

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
EV_BALGW	2017 03 03	117	21.0	< 0.0050	0.237
	2017 06 27	98.1	< 25	0.0198	0.262
	2017 09 19	91.6	30.8	< 0.0050	0.992
	2017 10 17	93.3	10.7	0.0073	0.52

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
EV_LSgw	2017 03 07	80.1	< 25	0.0062	0.077
	2017 06 27	81.1	< 25	0.0058	0.065
	2017 08 22	79.5	27	< 0.0050	0.087
	2017 10 17	90.5	196	< 0.0050	0.082

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
EV_GCgw	2017 03 07	55.3	< 5.0	< 0.0050	< 0.050
	2017 06 20	60.0	< 5.0	< 0.0050	< 0.050
	2017 08 16	55.9	< 5.0	< 0.0050	< 0.050
	2017 10 24	61.6	7.1	< 0.0050	< 0.050

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
EV_OCgw	2017 03 29	58.2	< 5.0	< 0.0050	0.336
	2017 06 19	56.3	< 5.0	0.0056	0.149
	2017 06 29	55.8	< 5.0	< 0.025	0.76
	2017 08 15	56.1	< 5.0	< 0.0050	< 0.050
	2017 08 29	52.5	< 5.0	< 0.0050	< 0.050
	2017 09 21	52.3	8.4	< 0.0050	< 0.050
	2017 10 18	53.7	< 5.0	< 0.0050	< 0.050

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
EV_WF_SW	2017 03 30	424	10.0	< 0.0050	0.059
	2017 06 20	305	< 25	< 0.0050	< 0.050
	2017 09 18	178	< 5.0	0.0078	< 0.050
	2017 11 22	177	< 5.0	0.0062	0.076

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
EV_MCgwD	2017 03 08	88.3	< 5.0	< 0.0050	0.143
	2017 03 30	135	9.1	0.0081	< 0.050
	2017 05 16	85.1	< 5.0	0.0151	0.081
	2017 06 28	69.4	< 5.0	0.0434	0.141
	2017 08 16	51.7	59.0	0.0470	0.115
	2017 09 19	60.1	117	0.0470	0.133
	2017 10 18	44.5	63.9	0.0503	0.075

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
EV_MCgwS	2017 03 08	105	< 25	< 0.0050	< 0.050
	2017 03 30	124	6.9	0.0096	< 0.050
	2017 05 16	104	< 25	< 0.0050	0.073
	2017 06 28	94.2	< 25	< 0.0050	< 0.050
	2017 08 16	88.1	< 5.0	< 0.0050	< 0.050
	2017 09 21	94.4	< 5.0	< 0.0050	< 0.050
	2017 10 18	82.3	< 5.0	< 0.0050	< 0.050

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
EV_BCgw	2017 03 14	206	5,000	0.0335	20.3
	2017 03 30	314	9,040	0.0551	37.7
	2017 05 16	462	14,000	0.0609	59
	2017 06 27	163	3,090	0.0549	17.9
	2017 08 23	391	10,600	0.0603	56.8
	2017 10 18	261	6,270	0.0426	34.5

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
EV_ER1gwS	2017 02 15	89.5	2,690	0.0090	10.3
	2017 06 28	42.1	1,190	0.0113	4.95
	2017 08 22	60.6	1,740	0.0114	8.59
	2017 10 24	65.0	1,550	< 0.0050	7.74

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
EV_ER1gwD	2017 02 15	73.8	2,100	< 0.0050	8.16
	2017 06 28	40.0	1,260	< 0.0050	5.67
	2017 08 22	53.8	1,480	< 0.0050	6.95
	2017 10 24	76.9	1,930	0.0103	10.5

Sample Location	Date (yyyy mm dd)	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
EV_ECgw	2017 06 20	27.1	86.8	0.0234	0.129
	2017 08 23	25.8	28.5	0.0134	0.06
	2017 10 25	25.8	215	0.0404	0.056
	2017 11 22	26.1	121	0.0429	0.212

Primary Screening Criteria	Sulphate (mg/L)	Nitrate Nitrogen (µg/L)	Dissolved Cadmium (µg/L)	Dissolved Selenium (µg/L)
CSR Aquatic Life	1,280-4,290	400,000	0.5-4	20
CSR Irrigation Watering	n/a	n/a	5	20
CSR Livestock Watering	1,000	100,000	80	30
CSR Drinking Water	500	10,000	5	10
BCWQG Aquatic Life Short-term Maximum	n/a	32,800	0.038-2.8	n/a
BCWQG Aquatic Life Long-term Average	309-429	3,000	0.018-0.457	2

Secondary Screening Criteria	Dissolved Selenium (µg/L)
Guideline for Canadian Drinking Water Quality	50
Site Performance Objective: EV_ER1 (0200393)	19
Compliance Point: EV_MC2 (E300091)	28

	Parameter exceeded hold time.
GREEN	Below primary screening criteria
ORANGE	Above at least one of the primary screening criteria
BLUE	Selenium concentrations above at least one of the secondary screening criteria

Legend

SSGMP Wells
- Monitoring Well

Surface Water Stations
- Compliance Point
- Order Station
- Receiving Environment
- Authorized Discharge
- Monitoring

Water Features
- Intermittent Stream
- Stream Ditch
- Indefinite Stream
- Stream
- Subsurface
- River Bed

Site Features
- EVO Permitted Boundary
- Highway
- Secondary Road
- Tailings/Settling Pond
- Reservoir

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.

References:
1. Information provided by Teck Coal Ltd.

Revisons:
0 - AO - 2018-01-29 - DRAFT - LH
1 - AO - 2018-03-26 - FINAL - LH

0 0.5 1 2 3 km

PROJECT LOCATION:
Elkview Operations, Sparwood, BC

CLIENT NAME:
Teck Coal Ltd

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Spatial Distribution of Constituents of Interest in Groundwater

CHK'D: LH	DATE: 2018/03/26	SCALE: 1:50,000	Ref Num: 653245-008	REV: 0
BY: AO	COORD SYS: NAD 1983 UTM Zone 11N			

MXD Path: P:\Current Projects\Teck Coal Ltd\GIS\Map Series\2017 Annual Reports\653245-008_SpatialDistofConstinGW_EVO.mxd

Project Path: P:\Current Projects\Teck Coal Ltd\GIS\Exports\ANNUAL REPORT

TABLE 1: Summary of Groundater Monitoring Program Locations

Drainage	Well ID	Monitoring Program	Well Type	Coordinates (UTM NAD 83)		LIDAR Ground Elevation	Ground Elevation	TOC Elevation	Stick Up Height	Drilled Depth	Well Diameter	Top of Screen Depth	Bottom of Screen Depth	Screened Interval	Depth to Bedrock	Hydraulic Conductivity
				Easting	Northing	masl	masl	masl	m	mbgs	mm	mbgs	mbgs		mbgs	m/s
Grave Creek / Harmer Creek	EV_GV3gw	SSGMP, RGMP	Monitoring	656580	5522255	1307.01	-	1307.96	0.91	25.0	60	22.85	24.38	Silty Gravel	-	-
Elk River Proximal to EVO	EV_BALgw	SSGMP	Monitoring	653121	5517271	1180.75	1181.00	1182.00	1.00	12.7	60	10.50	12.70	Bedrock	10.4	-
	EV_LSgw	SSGMP, RGMP	Monitoring	653274	5514731	1133.05	1133.00	1133.93	0.93	10.7	60	5.18	6.71	Sand and Gravel	-	1.0E-03
	EV_GCgw	SSGMP	Monitoring	653061	5513870	1131.68	1131.24	1131.96	0.72	15.6	60	12.55	15.60	Silty Clay	-	4.0E-06
	EV_OCgw	SSGMP, RGMP	Monitoring	652480	5512671	1125.48	1126.00	1126.89	0.89	15.5	60	11.58	14.63	Sand	14.5	7.0E-07
Erickson Creek	EV_WF_SW	SSGMP	Monitoring	659208	5513023	1694.31	1679.25	1678.57	0.68	163	152	151.5	159.4	Waste Rock[1]	-	-
	EV_ECgw	SSGMP, RGMP	Monitoring	660795	5506384	1327.17	1327.00	1327.74	0.74	11.0	60	2.59	4.12	Sand/Clay and Sand	-	1.0E-08
Michel Creek	EV_MCgwS	SSGMP, RGMP	Monitoring	653476	5511624	1131.04	1131.00	1131.96	0.96	10.7	60	5.79	7.32	Clayey Silt	-	7.0E-08
	EV_MCgwD	SSGMP, RGMP	Monitoring	653476	5511624	1131.04	1131.00	1131.84	0.84	47.6	60	24.50	27.55	Sand and Clay	-	3.0E-06
	EV_BCgw	SSGMP, RGMP	Monitoring	655381	5509659	1153.15	1153.00	1153.86	0.86	23.2	60	17.77	20.82	Gravel	-	1.0E-04
Elk River Distal to EVO	EV_ER1gwS	SSGMP, RGMP	Monitoring	651374	5510955	1114.41	1115.25	1115.96	0.71	17.6	60	14.56	17.61	Sand and Gravel	-	7.0E-04
	EV_ER1gwD	SSGMP, RGMP	Monitoring	651379	5510952	1114.35	1115.20	1115.91	0.71	30.8	60	25.82	28.87	Sand/Silty Sand	27.9	9.0E-04

1) AMEC (2011) reported waste rock in the screened interval which is not clear in the borehole log (provided in Appendix I).

masl = metres above sea level
mbgs = metres below ground surface

TABLE 2: Summary of Groundwater Elevations and Calculated Vertical Gradients

Drainage	Well ID	LIDAR Ground Elevation	Ground Elevation	TOC Elevation	Stick Up Height	Date of Static Water Level Measurement	Depth to Water	Water Level Elevation	Well Pair	Date of Static Water Level Measurement	Calculated Vertical Gradient
		masl	masl	masl	m	yyyy/mm/dd	mtoc	masl		yyyy/mm/dd	m/m
Grave Creek / Harmer Creek	EV_GV3gw	1307.01	-	1307.96	0.91	2017/03/29	10.58	1297.38			
						2017/06/27	10.69	1297.27			
						2017/08/15	10.82	1297.14			
						2017/08/29	10.86	1297.10			
						2017/10/17	10.91	1297.05			
Elk River Proximal to EVO	EV_BALgw	1180.75	1181.00	1182.00	1.00	2017/03/03	11.96	1170.04			
						2017/06/27	12.01	1169.99			
						2017/08/15	11.99	1170.01			
						2017/09/19	11.95	1170.05			
						2017/10/17	11.99	1170.01			
	EV_LSgw	1133.05	1133.00	1133.93	0.93	2017/03/07	5.43	1128.50			
						2017/06/27	3.77	1130.16			
						2017/08/22	4.09	1129.84			
						2017/10/17	4.23	1129.70			
	EV_GCgw	1131.68	1131.24	1131.96	0.72	2017/03/07	2.39	1129.57			
						2017/06/20	2.11	1129.85			
						2017/08/16	2.24	1129.72			
						2017/10/24	2.29	1129.67			
	EV_OCgw	1125.48	1126.00	1126.89	0.89	2017/03/29	3.20	1123.69			
						2017/06/19	3.44	1123.45			
						2017/06/29	3.55	1123.34			
						2017/08/15	3.64	1123.25			
						2017/08/29	4.32	1122.57			
						2017/09/21	5.29	1121.60			
						2017/10/18	3.61	1123.28			
Erickson Creek	EV_WF_SW	1694.31	1679.25	1678.57	0.68	2017/03/30	144.42	1534.15			
						2017/07/20	-	-			
						2017/09/18	147.09	1531.49			
						2017/11/22	145.47	1533.10			
	EV_ECgw	1327.17	1327.00	1327.74	0.74	2017/03/13	Frozen	-			
						2017/06/20	1.86	1325.88			
						2017/08/23	2.35	1325.39			
						2017/10/25	2.59	1325.15			
						2017/11/21	1.78	1325.96			
						2017/11/22	2.05	1325.69			
Michel Creek	EV_MCgwS	1131.04	1131.00	1131.96	0.96	2017/03/16	1.67	1130.29	EV_MCgwS and EV_MCgwD	2017/03/16	-0.054
						2017/06/28	2.24	1129.72		2017/06/28	-0.049
						2017/08/16	2.90	1129.06		2017/08/16	-0.045
						2017/09/21	4.80	1127.16[b]		2017/09/21	0.033[c]
						2017/10/18	6.38	1125.58[b]		2017/10/18	0.105[c]
	EV_MCgwD	1131.04	1131.00	1131.84	0.84	2017/03/16	2.61	1129.23			
						2017/06/28	3.07	1128.77			
						2017/08/16	3.65	1128.19			
						2017/09/19	4.03	1127.81[b]			
						2017/10/18	4.21	1127.63[b]			
	EV_BCgw	1153.15	1153.00	1153.86	0.86	2017/03/14	3.11	1150.75			
						2017/03/30	2.62	1151.24			
						2017/05/16	2.15	1151.71			
						2017/06/27	2.49[a]	1151.37			
						2017/08/23	3.01	1150.85			
						2017/10/18	3.14	1150.72			
Elk River Distal to EVO	EV_ER1gwS	1114.41	1115.25	1115.96	0.71	2017/02/15	5.75	1110.21	EV_ER1gwS and EV_ER1gwD	2017/02/15	0.027
						2017/06/28	4.30	1111.66		2017/06/28	0.025
						2017/08/22	5.03	1110.93		2017/08/22	0.026
						2017/10/24	5.19	1110.77		2017/10/24	0.026
	EV_ER1gwD	1114.35	1115.20	1115.91	0.71	2017/02/15	5.40	1110.51			
						2017/06/28	3.97	1111.94			
						2017/08/22	4.69	1111.22			
						2017/10/24	4.85	1111.06			

Notes: a) Reported depth to water was 0.49 m which was considered suspect based on other measurements collected on this day. Value was changed to 2.49 and discrepancy was considered to be a field transcription error;
b) Based on continuous water elevation data, depth to water measurements appear to have been collected while sampling; c) Calculated vertical gradients are considered suspect based on information presented in note b.

masl = metres above sea level
mbgs = metres below ground surface

TABLE 3: Field Measured Parameters

Sample Location	Sample Date (yyyy mm dd)	Field Parameters pH pH	Temperature °C	Conductivity µS/cm	ORP mV	Dissolved Oxygen mg/L
Grave Creek / Harmer Creek						
EV_GV3gw	2017 03 29	7.50	4.59	624	152.0	3.57
	2017 06 27	7.37	10.70	662	26.4	2.83
	2017 08 15	7.48	8.57	637	121.2	3.62
	2017 08 29	7.40	13.00	626	25.4	3.20
	2017 10 17	7.45	6.86	634	57.9	3.82
Elk River Elk River Proximal to EVO						
EV_BALgw	2017 03 03	7.45	4.19	835	91.3	0.65
	2017 06 27	6.87	10.77	813	14.9	0.52
	2017 08 15	7.12	7.70	761	35.4	1.00
	2017 09 19	6.84	6.62	766	53.7	1.51
	2017 10 17	7.14	9.93	772	28.7	1.54
EV_LSgw	2017 03 07	5.19	9.60	988	262.6	0.43
	2017 06 27	6.97	12.99	1,172	-105.7	0.70
	2017 08 22	7.10	15.42	1,150	-101.5	0.44
	2017 10 17	7.13	13.92	1,094	-115.3	0.49
EV_GCgw	2017 03 07	5.20	2.98	435	79.4	0.32
	2017 06 20	7.33	16.57	465	-153.8	0.55
	2017 08 16	7.46	15.38	436	-186.9	0.30
	2017 10 24	7.46	9.75	452	-169.4	0.28
EV_OCgw	2017 03 29	7.78	5.07	454	-114.9	0.39
	2017 06 19	7.63	10.45	472	-165.5	1.41
	2017 06 29	7.79	9.03	451	-148.1	0.26
	2017 08 15	7.84	10.92	455	-173.9	0.31
	2017 08 29	7.66	8.83	439[a]	-118.3	0.42
	2017 09 21	7.69	7.86	448	-113.5	0.47
	2017 10 18	7.87	9.09	458	-175.5	0.41
Erickson Creek						
EV_WF_SW	2017 03 30	7.36	5.04	1,162	86.7	6.19
	2017 06 20	8.11	12.36	948	-184.3	2.54
	2017 09 18	6.76	7.82	531	114.2	3.33
	2017 11 22	8.64	5.80	500	32.6	2.17
EV_ECgw	2017 06 20	7.63	6.59	433	157.9	4.12
	2017 08 23	5.86	9.65	434	261.6	1.72
	2017 10 25	7.60	7.98	426	114.3	2.55
	2017 11 22	6.50	6.33	450	206.8	3.55
Michel Creek						
EV_MCgwS	2017 03 08	11.55	4.05	853	40.7	1.90
	2017 03 30	7.55	6.29	682	9.5	4.61
	2017 05 16	7.28	5.85	803	-106.2	0.80
	2017 06 28	7.14	7.11	871	-101.1	1.67
	2017 08 16	7.19	9.10	822	-96.7	1.17
	2017 09 21	6.91	8.68	820	-48.6	0.54
	2017 10 18	7.24	7.93	809	-166.5	1.90
EV_MCgwD	2017 03 08	11.12	1.66	633	69.1	0.52
	2017 03 30	7.28	5.93	855	-31.5	0.49
	2017 05 16	7.57	6.65	610	125.4	11.63
	2017 06 28	7.17	10.56	609	41.5	7.75
	2017 08 16	7.36	12.60	553	178.0	4.20
	2017 09 19	7.28	8.73	565	-19.7	1.39
	2017 10 18	7.40	6.27	534	-36.5	0.91
EV_BCgw	2017 03 14	7.44	5.36	757	175.5	5.02
	2017 03 30	7.35	7.50	987	24.3	3.97
	2017 05 16	7.20	6.34	1,152	221.5	2.94
	2017 06 27	6.96	8.02	702	178.7	1.95
	2017 08 23	7.18	7.84	1,175	118.5	2.09
	2017 10 18	7.35	6.81	924	29.4	2.16
Elk River Distal to EVO						
EV_ER1gwS	2017 02 15	9.83	1.94	505	-154.6	10.29
	2017 06 28	7.36	7.17	484	73.0	8.63
	2017 08 22	7.54	12.30	438	102.2	6.78
	2017 10 24	7.51	8.60	480	164.4	8.54
EV_ER1gwD	2017 02 15	7.15	1.35	489	-152.2	9.66
	2017 06 28	7.57	5.90	384	13.5	10.06
	2017 08 22	7.60	11.88	436	104.9	6.53
	2017 10 24	7.61	8.69	476	-73.6	7.43

All terms defined within the body of SNC-Lavalin's report.

[a] Value inferred to be 439.

TABLE 4: Groundwater Analytical Results compared to Primary Screening Criteria

		Physical Parameters								Geochemical Indicators																											
Sample Location	Sample Date (yyyy mm dd)	Colour CU	Laboratory Conductivity µS/cm	Hardness mg/L	Oxidation Reduction Potential mV	Laboratory pH pH	Total Dissolved Solids mg/L	Total Suspended Solids mg/L	Laboratory Turbidity NTU	Acidity (pH 8.3) mg/L	Alkalinity, Bicarbonate (as CaCO3) mg/L	Alkalinity, Carbonate (as CaCO3) mg/L	Alkalinity, Hydroxide (as CaCO3) mg/L	Total Alkalinity (as CaCO3) mg/L	Total Anion meq/	Total Cations meq/L	Cation Anion Balance %	Bromide mg/L	Chloride mg/L	Fluoride µg/L	Sulphate mg/L	Dissolved Aluminum µg/L	Dissolved Calcium mg/L	Dissolved Iron µg/L	Dissolved Magnesium mg/L	Dissolved Manganese µg/L	Dissolved Potassium mg/L	Dissolved Sodium mg/L	Kjeldahl Nitrogen-N mg/L	Total Nitrogen-N mg/L	Ammonia, total (as N) µg/L	Nitrate (as N) µg/L	Nitrite (as N) µg/L	Total Phosphorous as P mg/L	Ortho-Phosphate mg/L	Dissolved Organic Carbon mg/L	Total Organic Carbon mg/L
BC Standard/Guideline																																					
CSR Aquatic Life (AW)[a]		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1,500	2,000-3,000[d]	1,280-4,290[d]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3,700-18,500[e]	400,000	200-2,000[f]	n/a	n/a	n/a	n/a
CSR Irrigation Watering (IW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100	1,000	n/a	5,000	n/a	5,000	n/a	200	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CSR Livestock Watering (LW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	600	1,000	1,000	5,000	1,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100,000	10,000	n/a	n/a	n/a	n/a
CSR Drinking Water (DW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	250	1,500	500	9,500	n/a	6,500	n/a	1,500	n/a	200	n/a	n/a	n/a	10,000	1,000	n/a	n/a	n/a	n/a
BCWQG Aquatic Life Short-term Maximum (AW)[b]		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	31.6-100[e]	n/a	350 (max)	n/a	546-7,813[d]	n/a	n/a	n/a	n/a	5,680-24,500[e] (15°C assumed)	32,800	60-600[f]	n/a	n/a	n/a	n/a
BCWQG Aquatic Life Long-term Average (AW)[c]		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	309-429[d]	11.2-50[e]	n/a	n/a	n/a	607-3,509[d]	n/a	n/a	n/a	n/a	365-1,780[e] (15°C assumed)	3,000	20-200[f]	n/a	n/a	n/a	n/a
Grave Creek / Harmer Creek																																					
EV_GV3gw	2017 03 29	< 5.0	600	336	298	8.04	421	1.9	2.51	4.5	195	< 1.0	< 1.0	195	7.06	6.88	-	< 0.050	1.53	517	148	< 1.0	83.6	< 10	30.9	0.59	1.05	3.15	< 0.050	-	< 5.0	137	< 1.0	0.0044	< 0.0010	< 0.50	< 0.50
	2017 06 27	< 5.0	647	343	413	8.06	483	1.6	0.14	3.5	204	< 1.0	< 1.0	204	7.12	7.04	-0.6	< 0.050	1.68	509	142	10.1	82.2	< 5.0	33.5	0.13	0.991	3.42	< 0.050	-	< 5.0	147	< 1.0	0.0083	0.0012	< 0.50	0.53
	Duplicate	< 5.0	642	338	453	8.08	485	1.0	< 0.10	3.3	205	< 1.0	< 1.0	205	7.14	6.93	-1.5	< 0.050	1.65	503	142	< 3.0	81.3	< 5.0	32.8	0.21	1.01	3.46	< 0.050	-	< 5.0	143	< 1.0	< 0.0020	0.0013	0.65	1.08
	QA/QC RPD%	*	1	1	*	< 1	< 1	*	*	*	< 1	*	*	< 1	*	*	*	*	2	1	0	*	1	*	2	*	2	1	*	-	*	3	*	*	*	*	*
	2017 08 15	< 5.0	646	336	448	7.92	404	< 1.0	< 0.10	5.3	196	< 1.0	< 1.0	196	6.94	6.88	-0.4	< 0.050	1.60	486	141	< 3.0	82.4	< 10	31.7	0.84	1.01	3.25	< 0.050	-	< 5.0	136	< 1.0	< 0.0020	0.0020	< 0.50	< 0.50
	Duplicate	< 5.0	641	332	452	7.90	429	1.3	< 0.10	5.6	197	< 1.0	< 1.0	197	6.95	6.79	-1.1	< 0.050	1.62	486	141	< 3.0	82.5	< 10	30.6	< 0.10	0.983	3.14	< 0.050	-	< 5.0	137	1.1	< 0.0020	0.0017	< 0.50	< 0.50
	QA/QC RPD%	*	1	1	*	0	6	*	*	6	1	*	*	1	*	*	*	*	1	0	0	*	< 1	*	4	*	3	3	*	-	*	1	*	*	*	*	*
	2017 08 29	< 5.0	618	285	281	8.10	393	< 1.0	0.16	4.1	212	< 1.0	< 1.0	212	7.25	5.86	-10.6	< 0.050	1.35	445	142	< 3.0	63.7	< 10	30.7	< 0.10	0.938	3.01	< 0.050	-	< 5.0	140	< 1.0	< 0.0020	< 0.0010	0.64	0.59
	2017 10 17	< 5.0	552	318	311	8.23	435	< 1.0	0.35	< 1.0	182	< 1.0	< 1.0	182	6.63	6.52	-0.8	0.053	1.28	410	140	< 3.0	75.8	< 10	31.3	< 0.10	0.935	3.27	0.210	-	6.5	132	< 1.0	0.0028	0.0016	0.50	< 0.50
	Duplicate	< 5.0	556	322	283	8.35	424	< 1.0	0.29	< 1.0	186	7.6	< 1.0	193	6.85	6.61	-1.8	< 0.050	1.29	428	140	< 3.0	78.7	< 10	30.6	< 0.10	0.936	3.22	< 0.050	-	6.9	134	< 1.0	< 0.0020	0.0016	< 0.50	< 0.50
	QA/QC RPD%	*	1	1	*	1	3	*	*	*	2	*	*	6	*	*	*	*	1	4	0	*	4	*	2	*	0	2	*	-	*	2	*	*	*	*	*
Elk River Proximal to EVO																																					
EV_BALgw	2017 03 03	< 5.0	792	359	375	7.63	494	3.0	2.02	25.3	342	< 1.0	< 1.0	342	9.32	8.74	-	< 0.050	1.76	209	117	< 1.0	97.2	16	28.2	21.6	2.43	34.5	0.108	-	40.4	21.0	1.8	0.0087	< 0.0010	1.16	1.22
	2017 06 27	< 5.0	802	362	415	7.95	512	7.6	1.48	8.3	340	< 1.0	< 1.0	340	8.91	9.06	0.8	< 0.25	2.22	220	98.1	34.0	91.3	60.1	32.4	61.7	2.91	40.0	0.117	-	47.9	< 25	< 5.0	0.0110	0.0012	1.21	1.00
	2017 09 19	< 5.0	640	317	383	8.07	458	< 1.0	0.61	6.0	278	< 1.0	< 1.0	278	7.52	7.78	1.7	< 0.050	1.64	193	91.6	< 3.0	85.2	14	25.4	37.9	2.56	31.3	0.121	-	43.8	30.8	2.6	0.0028	< 0.0010	2.04	0.91
	2017 10 17	< 5.0	738	347	288	8.05	480	1.2	2.09	5.8	323	< 1.0	< 1.0	323	8.45	8.49	0.3	0.052	1.50	177	93.3	< 3.0	89.3	20	30.1	56.2	2.66	34.1	0.140	-	51.5	10.7	3.1	0.0073	0.0034	1.13	1.03
EV_LSgw	2017 03 07	6.5	981	549	320	7.73	566	8.6	14.4	19.2	483	< 1.0	< 1.0	483	11.7	11.7	-	< 0.25	12.4	270	80.1	6.1	103	1,410	70.7	**826**	3.59	11.1	0.208	-	103	< 25	< 5.0	0.174	0.0013	1.94	2.44
	2017 06 27	5.6	1,120	651	284	7.94	703	30.6	39.1	15.0	564	< 1.0	< 1.0	564	13.3	13.8	1.8	< 0.25	10.7	280	81.1	< 3.0	119	3,430	85.7	**1,050**	4.16	9.84	0.269	-	171	< 25	< 5.0	0.0527	0.0018	3.20	2.89
	2017 08 22	< 5.0	1,080	632	215	7.74	642	7.6	46.9	10.0	608	< 1.0	< 1.0	608	14.1	14.3	0.8	< 0.25	10.2	190	79.5	4.1	130	3,470	87.8	**1,020**	4.67	10.2	0.198	-	203	27	< 5.0	0.0601	0.0012	2.45	2.64
	2017 10 17	< 5.0	816	594	236	8.15	653	18.7	43.0	4.1	450	< 1.0	< 1.0	450	11.2	12.6	5.9	< 0.25	9.5	210	90.5	3.3	114	2,640	75.2	**1,080**	4.38	8.86	0.73	-	208	196	< 5.0	0.111	< 0.0010	2.88	3.91
EV_GCgw	2017 03 07	< 5.0	430	221	319	7.99	264	2.6	3.41	4.2	174	< 1.0	< 1.0	174	4.77	4.60	-	< 0.050	3.70	493	55.3	< 3.0	61.1	189	16.5	82.9	0.789	3.70	< 0.050	-	27.9	< 5.0	< 1.0	0.0052	< 0.0010	0.60	0.61
	2017 06 20	< 5.0	430	216	328	8.06	284	3.0	1.83	3.1	176	< 1.0	< 1.0	176	4.90	4.52	-4.1	< 0.050	4.05	445	60.0	< 3.0	59.4	209	16.5	93.5	0.756	3.66	0.073	-	22.2	< 5.0	< 1.0	0.0081	< 0.0010	< 0.50	< 0.50
	2017 08 16	< 5.0	415	227	216	8.24	273	3.3	2.66	1.8	164	< 1.0	< 1.0	164	4.56	4.67	1.3	< 0.050	3.43	416	55.9	< 3.0	62.8	223	18.1	91.6	0.797	3.74	< 0.050	-	23.5	< 5.0	< 1.0	0.0075	< 0.0010	< 0.50	< 0.50
	2017 10 24	< 5.0	457	219	262	8.06	337	3.4	3.35	3.3	177	< 1.0	< 1.0	177	4.95	4.58	-3.9	< 0.050	3.85	444	61.6	4.5	60.1	196	16.9	91.7	0.730	3.76	< 0.050	-	21.7	7.1	3.6	0.0042	< 0.0010	1.14	0.76
EV_OCgw	2017 03 29	< 5.0	440	151	266	8.20	260	16.5	12.5	2.1	180	< 1.0	< 1.0	180	4.94	5.10	-	< 0.050	1.87	1,330	58.2	2.7	27.8	256	19.7	98.0	1.76	46.7	0.163	-	69.9	< 5.0	< 1.0	0.0175	0.0025	1.18	1.20
	Duplicate	< 5.0	428	150	285	8.22	277	7.5	7.12	2.3	182	< 1.0	< 1.0	182	4.97	5.07	-	< 0.050	1.94	1,320	57.5	2.4	27.7	276	19.7	96.5	1.75	46.1	0.159	-	68.2	< 5.0	< 1.0	0.0208	0.0029	1.01	1.12
	QA/QC RPD%	*	3	1	*	< 1	6	75	55	*	1	*	*	1	*	*	-	*	4	1	1	*	< 1	8	0	2	1	1	*	-	2	*	*	17	*	*	*
	2017 06 19	< 5.0	437	147	316	8.32	275	4.3	2.55	< 1.0	177	3.8	< 1.0	181	4.91	4.86	-0.4	< 0.050	2.13	1,190	56.3	22.2	28.3	266	18.6	89.0	1.55	42.6	0.100	-	71.8	< 5.0	< 1.0	0.0156	0.0048	0.78	1.02
	Duplicate	< 5.0	436	145	356	8.32	285	8.1	2.53	< 1.0	179	< 1.0	< 1.0	179	4.90	4.77	-1.4	< 0.050	2.06	1,210	57.4	21.0	27.3	268	18.5	88.7	1.54	41.7	0.198	-	75.5	< 5.0	< 1.0	0.0224	0.0039	1.13	0.87
	QA/QC RPD%	*	< 1	1	*	0	4	*	1	*	1	*	*	1	*	*	*	*	3	2	2	6	4	1	1	< 1	1	2	*	-	5	*	*	36	*	*	*

Associated data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
\- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.

Parameter exceeded hold time.

BOLD	Concentration greater than CSR Aquatic Life (AW) standard
BOLD**	Concentration greater than BCWQG Aquatic Life Short-term Maximum (AW) guideline or BCWQG Aquatic Life Long-term Average (AW) guideline (applicable to EV_BCgw, EV_MCgwD, EV_MCgwS, EV_OCgw)
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard

[a] Standard to protect freshwater aquatic life.
[b] Guideline to protect freshwater aquatic life, short-term maximum (i.e. "acute").
[c] Guideline to protect freshwater aquatic life, long-term average (i.e. "chronic").
[d] Standard varies with Hardness.
[e] Standard varies with pH.
[f] Standard varies with Chloride.
[g] Standard varies with crop.
[h] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[i] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[j] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.

TABLE 4 (Cont'd): Groundwater Analytical Results compared to Primary Screening Criteria

Sample Location	Sample Date (yyyy mm dd)	Dissolved Metals																								
		Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Chromium	Cobalt	Copper	Lead	Lithium	Mercury	Molybdenum	Nickel	Selenium	Silver	Silicon	Strontium	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc[j]
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BC Standard/Guideline																										
CSR Aquatic Life (AW)[a]		90	50	10,000	1.5	n/a	12,000	0.5-4[d]	10[h]	40	20-90[d]	40-160[d]	n/a	0.25	10,000	250-1,500[d]	20	0.5-15[d]	n/a	n/a	3	n/a	1,000	85	n/a	75-2,400[d]
CSR Irrigation Watering (IW)		n/a	100	n/a	100	n/a	500-6,000[g]	5	5[h]	50	200	200	2,500	1	10	200	20	n/a	n/a	n/a	n/a	n/a	n/a	10	100	n/a
CSR Livestock Watering (LW)		n/a	25	n/a	100	n/a	5,000	80	50[h]	1,000	300	100	5,000	2	50	1,000	30	n/a	n/a	n/a	n/a	n/a	n/a	200	100	2,000
CSR Drinking Water (DW)		6	10	1,000	8	n/a	5,000	5	50[h]	20[i]	1,500	10	8	1	250	80	10	20	n/a	2,500	n/a	2,500	n/a	20	20	3,000
BCWQG Aquatic Life Short-term Maximum (AW)[b]		n/a	5	n/a	n/a	n/a	n/a	0.038-2.8[d]	1 (Cr(+6))	110	2.05-64.0[d]	3-902[d]	n/a	n/a	2,000	n/a	n/a	0.1-3[d]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	33-460.5[d]
BCWQG Aquatic Life Long-term Average (AW)[c]		9	n/a	1,000	0.13	n/a	1,200	0.018-0.457[d]	n/a	4	2-26.4[d]	3-38.5[d]	n/a	n/a	1,000	25-150[d]	2	0.05-1.5[d]	n/a	n/a	0.8	n/a	n/a	8.5	n/a	7.5-435[d]
Grave Creek / Harmer Creek																										
EV_GV3gw	2017 03 29	< 0.10	< 0.10	17.7	< 0.020	< 0.050	15	0.0096	0.25	< 0.10	0.87	< 0.050	**16.5**	< 0.0050	1.24	0.88	3.83	< 0.010	3,480	571	< 0.010	< 0.10	< 10	1.61	< 0.50	< 1.0
	2017 06 27	< 0.10	< 0.030	19.3	< 0.020	< 0.050	12.0	0.0112	0.26	< 0.050	< 0.50	< 0.030	**17.1**	< 0.0050	0.902	< 0.10	3.78	< 0.010	3,380	540	< 0.010	< 0.050	< 10	1.64	< 0.50	< 3.0
	Duplicate	< 0.10	< 0.030	19.2	< 0.020	< 0.050	11.1	0.0088	0.24	< 0.050	< 0.50	< 0.030	**16.3**	< 0.0050	0.875	< 0.10	3.84	< 0.010	3,370	537	< 0.010	< 0.050	< 10	1.64	< 0.50	< 3.0
	QA/QC RPD%	*	*	1	*	*	*	*	*	*	*	*	5	*	3	*	2	*	< 1	1	*	*	*	0	*	*
	2017 08 15	0.28	< 0.10	17.7	< 0.020	< 0.050	11	0.0085	0.23	0.34	0.53	< 0.050	**15.8**	< 0.0050	0.895	< 0.50	3.9	< 0.010	3,210	543	< 0.010	< 0.10	< 10	1.72	< 0.50	< 3.0
	Duplicate	< 0.10	< 0.10	17.0	< 0.020	< 0.050	11	< 0.0050	0.21	< 0.10	< 0.50	< 0.050	**16.1**	< 0.0050	0.891	< 0.50	3.86	< 0.010	3,110	544	< 0.010	< 0.10	< 10	1.74	< 0.50	< 3.0
	QA/QC RPD%	*	*	4	*	*	*	*	*	*	*	*	2	*	< 1	*	1	*	3	< 1	*	*	*	1	*	*
	2017 08 29	< 0.10	< 0.10	17.7	< 0.020	< 0.050	11	0.0088	0.21	< 0.10	< 0.50	< 0.050	**12.2**	< 0.0050	0.729	< 0.50	3.89	< 0.010	3,220	424	< 0.010	< 0.10	< 10	1.49	< 0.50	< 3.0
	2017 10 17	< 0.10	< 0.10	17.3	< 0.020	< 0.050	12	0.0053	0.16	< 0.10	< 0.50	< 0.050	**15.2**	< 0.0050	0.865	< 0.50	3.87	< 0.010	3,290	543	< 0.010	< 0.10	< 10	1.48	< 0.50	< 3.0
	Duplicate	< 0.10	< 0.10	16.5	< 0.020	< 0.050	13	0.0078	0.20	< 0.10	< 0.50	< 0.050	**15.4**	< 0.0050	0.892	< 0.50	3.81	< 0.010	3,370	555	< 0.010	< 0.10	< 10	1.46	< 0.50	< 3.0
	QA/QC RPD%	*	*	5	*	*	*	*	*	*	*	*	1	*	3	*	2	*	2	2	*	*	*	1	*	*
Elk River Proximal to EVO																										
EV_BALgw	2017 03 03	0.19	0.15	32.0	< 0.020	< 0.050	200	< 0.0050	< 0.10	< 0.10	0.26	< 0.050	**130**	< 0.0050	1.54	< 0.50	0.237	< 0.010	4,450	2,490	< 0.010	< 0.10	< 10	0.245	< 0.50	< 1.0
	2017 06 27	0.32	0.410	37.8	< 0.020	< 0.050	167	0.0198	< 0.10	0.161	< 0.50	0.039	**132**	< 0.0050	1.34	0.51	0.262	< 0.010	4,650	2,240	0.013	< 0.050	< 10	0.227	< 0.50	< 3.0
	2017 09 19	< 0.10	0.33	33.8	< 0.020	< 0.050	170	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	**120**	< 0.0050	1.10	< 0.50	0.992	< 0.010	4,260	2,060	< 0.010	< 0.10	< 10	0.166	< 0.50	< 3.0
	2017 10 17	< 0.10	0.29	33.7	< 0.020	< 0.050	172	0.0073	0.16	0.13	0.50	< 0.050	**131**	< 0.0050	1.08	0.57	0.52	< 0.010	4,380	2,290	< 0.010	< 0.10	< 10	0.174	< 0.50	4.7
EV_LSgw	2017 03 07	< 0.10	1.31	184	< 0.020	< 0.050	45	0.0062	< 0.10	0.77	< 0.50	< 0.050	**62.3**	< 0.0050	2.67	3.51	0.077	< 0.010	4,330	432	0.026	< 0.10	< 10	2.40	< 0.50	< 3.0
	2017 06 27	< 0.10	2.44	231	< 0.020	< 0.050	46.1	0.0058	< 0.10	1.14	< 0.50	< 0.030	**68.4**	< 0.0050	2.60	4.39	0.065	< 0.010	4,990	497	0.040	< 0.050	< 10	1.54	< 0.50	< 3.0
	2017 08 22	< 0.10	2.76	226	< 0.020	< 0.050	63	< 0.0050	< 0.10	1.00	< 0.50	< 0.050	**66.2**	< 0.0050	2.86	4.22	0.087	< 0.010	5,080	516	0.049	< 0.10	< 10	1.63	< 0.50	< 3.0
	2017 10 17	< 0.10	2.62	205	< 0.020	< 0.050	55	< 0.0050	< 0.10	0.88	< 0.50	< 0.050	**62.2**	< 0.0050	3.22	4.37	0.082	< 0.010	5,090	545	0.042	0.11	< 10	1.45	< 0.50	5.1
EV_GCgw	2017 03 07	< 0.10	1.59	81.7	< 0.020	< 0.050	15	< 0.0050	< 0.10	0.19	< 0.50	< 0.050	**8.3**	< 0.0050	2.34	0.62	< 0.050	< 0.010	4,460	255	0.033	< 0.10	< 10	1.24	< 0.50	< 3.0
	2017 06 20	< 0.10	1.58	73.3	< 0.020	< 0.050	12	< 0.0050	< 0.10	0.19	< 0.50	< 0.050	7.3	< 0.0050	2.20	0.56	< 0.050	< 0.010	4,030	244	0.014	< 0.10	< 10	1.12	< 0.50	< 3.0
	2017 08 16	< 0.10	1.52	75.4	< 0.020	< 0.050	12	< 0.0050	< 0.10	0.17	< 0.50	< 0.050	7.4	< 0.0050	2.30	0.55	< 0.050	< 0.010	4,230	251	0.016	< 0.10	< 10	1.18	< 0.50	< 3.0
	2017 10 24	< 0.10	1.55	73.3	< 0.020	< 0.050	12	< 0.0050	< 0.10	0.18	< 0.50	< 0.050	7.2	< 0.0050	2.28	0.59	< 0.050	< 0.010	4,250	252	0.017	< 0.10	< 10	1.16	< 0.50	< 3.0
EV_OCgw	2017 03 29	< 0.10	1.48	57.1	< 0.020	< 0.050	134	< 0.0050	< 0.10	0.15	< 0.20	< 0.050	**26.6**	< 0.00050	**14.3**	1.03	0.336	< 0.010	4,570	396	< 0.010	0.12	< 10	1.10	< 0.50	< 1.0
	Duplicate	< 0.10	1.47	57.3	< 0.020	< 0.050	131	0.0057	< 0.10	0.15	< 0.20	< 0.050	**26.4**	< 0.0050	**14.2**	0.93	0.302	< 0.010	4,480	391	< 0.010	< 0.10	< 10	1.10	< 0.50	< 1.0
	QA/QC RPD%	*	1	< 1	*	*	2	*	*	*	*	*	1	*	1	10	11	*	2	1	*	*	*	0	*	*
	2017 06 19	< 0.10	1.26	47.3	< 0.020	< 0.050	123	0.0056	< 0.10	< 0.10	< 0.50	< 0.050	**25.6**	< 0.00050	**14.0**	< 0.50	0.149	< 0.010	4,220	373	< 0.010	< 0.10	< 10	1.11	< 0.50	< 3.0
	Duplicate	< 0.10	1.20	47.3	< 0.020	< 0.050	122	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	**25.7**	< 0.00050	**13.7**	< 0.50	< 0.050	< 0.010	4,220	375	< 0.010	< 0.10	< 10	1.08	< 0.50	< 3.0
	QA/QC RPD%	*	5	0	*	*	1	*	*	*	*	*	< 1	*	2	*	*	*	0	1	*	*	*	3	*	*

Associated data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
\- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.

Parameter exceeded hold time.

BOLD	Concentration greater than CSR Aquatic Life (AW) standard
BOLD**	Concentration greater than BCWQG Aquatic Life Short-term Maximum (AW) guideline or BCWQG Aquatic Life Long-term Average (AW) guideline (applicable to EV_BCgw, EV_MCgwD, EV_MCgwS, EV_OCgw)
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard

[a] Standard to protect freshwater aquatic life.
[b] Guideline to protect freshwater aquatic life, short-term maximum (i.e. "acute").
[c] Guideline to protect freshwater aquatic life, long-term average (i.e. "chronic").
[d] Standard varies with Hardness.
[e] Standard varies with pH.
[f] Standard varies with Chloride.
[g] Standard varies with crop.
[h] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[i] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[j] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.

TABLE 4 (Cont'd): Groundwater Analytical Results compared to Primary Screening Criteria

Sample Location	Sample Date	Physical Parameters								Geochemical Indicators																											
		Colour	Laboratory Conductivity	Hardness	Oxidation Reduction Potential	Laboratory pH	Total Dissolved Solids	Total Suspended Solids	Laboratory Turbidity	Acidity (pH 8.3)	Alkalinity, Bicarbonate (as CaCO3)	Alkalinity, Carbonate (as CaCO3)	Alkalinity, Hydroxide (as CaCO3)	Total Alkalinity (as CaCO3)	Total Anion	Total Cations	Cation Anion Balance	Bromide	Chloride	Fluoride	Sulphate	Dissolved Aluminum	Dissolved Calcium	Dissolved Iron	Dissolved Magnesium	Dissolved Manganese	Dissolved Potassium	Dissolved Sodium	Kjeldahl Nitrogen-N	Total Nitrogen-N	Ammonia, total (as N)	Nitrate (as N)	Nitrite (as N)	Total Phosphorous as P	Ortho-Phosphate	Dissolved Organic Carbon	Total Organic Carbon
	(yyyy mm dd)	CU	µS/cm	mg/L	mV	pH	mg/L	mg/L	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	meq/	meq/L	%	mg/L	mg/L	µg/L	mg/L	µg/L	mg/L	µg/L	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L
BC Standard/Guideline																																					
CSR Aquatic Life (AW)[a]		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1,500	2,000-3,000[d]	1,280-4,290[d]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3,700-18,500[e]	400,000	200-2,000[f]	n/a	n/a	n/a	n/a
CSR Irrigation Watering (IW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100	1,000	n/a	5,000	n/a	5,000	n/a	200	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CSR Livestock Watering (LW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	600	1,000	1,000	5,000	1,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100,000	10,000	n/a	n/a	n/a	n/a
CSR Drinking Water (DW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	250	1,500	500	9,500	n/a	6,500	n/a	1,500	n/a	200	n/a	n/a	n/a	10,000	1,000	n/a	n/a	n/a	n/a
BCWQG Aquatic Life Short-term Maximum (AW)[b]		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	31.6-100[e]	n/a	350 (max)	n/a	546-7,813[d]	n/a	n/a	n/a	n/a	5,680-24,500[e] (15°C assumed)	32,800	60-600[f]	n/a	n/a	n/a	n/a
BCWQG Aquatic Life Long-term Average (AW)[c]		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	309-429[d]	11.2-50[e]	n/a	n/a	n/a	607-3,509[d]	n/a	n/a	n/a	n/a	365-1,780[e] (15°C assumed)	3,000	20-200[f]	n/a	n/a	n/a	n/a
Elk River Proximal to EVO (Cont'd)																																					
EV_OCgw (Cont'd)	2017 06 29	< 5.0	457	145	472	8.29	269	3.8	3.12	< 1.0	182	< 1.0	< 1.0	182	4.91	4.76	-1.6	< 0.050	1.95	**1,190**	55.8	5.7	28.2	291	18.1	86.2	1.61	41.2	0.115	-	73.6	< 5.0	< 1.0	0.0249	0.0066	1.02	0.94
	Duplicate	5.8	458	144	471	8.27	258	4.0	3.82	< 1.0	184	< 1.0	< 1.0	184	4.97	4.70	-2.8	< 0.050	1.91	**1,210**	56.7	7.6	27.8	284	18.0	85.9	1.59	40.7	0.110	-	73.7	< 5.0	< 1.0	0.0230	0.0052	0.54	0.99
	QA/QC RPD%	*	< 1	1	*	< 1	4	*	20	*	1	*	*	1	*	*	*	*	2	2	2	29	1	2	1	< 1	1	1	*	-	< 1	*	*	8	24	*	*
	2017 08 15	< 5.0	468	144	300	8.20	271	2.5	1.58	1.2	180	< 1.0	< 1.0	180	4.89	4.76	-1.3	< 0.050	2.07	**1,190**	56.1	< 3.0	27.2	230	18.4	79.1	1.54	42.1	0.101	-	72.2	< 5.0	1.4	0.0122	0.0077	< 0.50	< 0.50
	Duplicate	< 5.0	461	143	309	8.23	275	2.1	1.31	< 1.0	175	2.0	< 1.0	177	4.81	4.73	-0.8	< 0.050	2.08	**1,190**	55.9	< 3.0	27.6	222	18.0	76.3	1.54	41.7	0.115	-	73.0	< 5.0	< 1.0	0.0113	0.0078	< 0.50	< 0.50
	QA/QC RPD%	*	2	1	*	< 1	1	*	19	*	3	*	*	2	*	*	*	*	< 1	0	< 1	*	1	4	2	4	0	1	*	-	1	*	*	8	1	*	*
	2017 08 29	< 5.0	440	135	223	8.26	250	1.7	1.98	1.5	187	< 1.0	< 1.0	187	4.95	4.44	-5.4	< 0.050	1.86	**1,170**	52.5	< 3.0	24.3	240	18.0	78.2	1.48	39.1	0.107	-	66.5	< 5.0	1.2	0.0066	0.0047	0.82	0.79
	Duplicate	< 5.0	444	142	223	8.28	256	1.5	2.03	1.7	193	< 1.0	< 1.0	193	5.05	4.54	-5.3	< 0.050	1.90	**1,180**	52.2	< 3.0	27.3	248	17.8	78.0	1.48	38.2	0.089	-	73.5	< 5.0	1.1	0.0098	0.0051	0.68	0.67
	QA/QC RPD%	*	1	5	*	< 1	2	*	2	*	3	*	*	3	*	*	*	*	2	1	1	*	12	3	1	< 1	0	2	*	-	10	*	*	39	*	*	*
	2017 09 21	< 5.0	422	141	286	8.53	245	1.2	2.62	< 1.0	182	8.4	< 1.0	191	5.01	4.70	-3.2	< 0.050	2.00	**1,170**	52.3	< 3.0	27.2	245	17.9	82.6	1.63	41.6	< 0.050	-	80.9	8.4	< 1.0	0.0129	0.0027	< 0.50	< 0.50
	2017 10 18	< 5.0	418	147	262	8.34	280	1.7	2.65	1.1	172	5.6	< 1.0	177	4.78	4.99	2.2	< 0.050	1.82	**1,230**	53.7	< 3.0	28.9	276	18.1	93.6	1.64	45.8	0.109	-	85.1	< 5.0	< 1.0	0.0163	0.0060	< 0.50	< 0.50
	Duplicate	< 5.0	438	143	263	8.42	290	1.7	2.82	1.1	180	12.2	< 1.0	192	5.06	4.90	-1.7	< 0.050	1.85	**1,230**	53.1	< 3.0	26.6	313	18.7	95.1	1.68	45.1	0.141	-	84.4	< 5.0	< 1.0	0.0156	0.0054	< 0.50	< 0.50
	QA/QC RPD%	*	5	3	*	1	4	*	6	*	5	74	*	8	*	*	*	*	2	0	1	*	8	13	3	2	2	2	*	-	1	*	*	4	11	*	*
Erickson Creek																																					
EV_WF_SW	2017 03 30	< 5.0	1,180	688	313	7.75	887	34.0	169	15.7	324	< 1.0	< 1.0	324	15.4	14.7	-	< 0.050	3.10	191	424	< 1.0	137	13,600	84.2	**458**	2.72	3.76	< 0.20	-	31.9	10.0	3.4	< 0.0020	< 0.0010	0.96	1.32
	Duplicate	< 5.0	1,180	632	297	7.78	891	61.5	154	16.1	316	< 1.0	< 1.0	316	15.1	13.5	-	< 0.050	3.03	191	419	< 1.0	122	11,400	79.4	**437**	2.75	3.82	< 0.20	-	26.7	11.5	3.4	0.0124	0.0010	1.37	2.57
	QA/QC RPD%	*	0	8	*	< 1	< 1	58	9	3	2	*	*	2	*	*	-	*	2	0	1	*	12	18	6	5	1	2	*	-	18	*	*	*	*	*	*
	2017 06 20	< 5.0	987	502	387	7.73	794	48.5	166	11.6	310	< 1.0	< 1.0	310	12.6	10.7	-8.4	< 0.25	2.75	200	305	< 3.0	69.8	6,900	79.5	**981**	2.91	3.96	0.118	-	12.0	< 25	< 5.0	0.0071	< 0.0010	0.84	1.51
	2017 09 18	-	519	237	281	8.14	326	40.0	32.1	< 1.0	89.2	< 1.0	< 1.0	89.2	5.57	5.04	-5.0	0.059	2.80	71	178	3.1	20.5	458	45.2	**306**	2.75	4.37	0.250	-	55.4	< 5.0	< 1.0	0.0421	< 0.0010	1.81	6.7
	2017 11 22	< 5.0	495	257	265	8.09	315	32.5	28.7	1.3	69.9	< 1.0	< 1.0	69.9	5.15	5.44	2.7	< 0.050	2.70	57	177	< 3.0	19.8	< 10	50.5	**306**	2.65	4.85	0.267	-	124	< 5.0	2.0	0.0207	< 0.0010	1.99	5.0
EV_ECgw	2017 06 20	< 5.0	403	167	326	8.04	285	161	180	3.4	224	4.6	< 1.0	229	5.20	4.48	-7.5	< 0.050	0.56	806	27.1	43.0	37.6	30	17.8	178	0.986	25.0	0.417	-	144	86.8	47.9	0.239	0.0120	1.90	4.45
	2017 08 23	< 5.0	384	174	205	8.22	265	49.2	59.5	3.5	202	< 1.0	< 1.0	202	4.61	4.77	1.7	< 0.050	< 0.50	718	25.8	< 3.0	41.7	< 10	19.4	178	1.06	24.3	0.310	-	174	28.5	4.2	0.0651	0.0164	1.75	< 2.5
	2017 10 25	< 5.0	403	184	251	8.19	275	84.0	72.5	1.9	201	< 1.0	< 1.0	201	4.61	4.97	3.8	< 0.050	< 0.50	771	25.8	< 3.0	39.5	< 10	20.7	178	1.16	29.1	0.241	-	19.5	215	2.9	0.113	0.0138	1.50	2.65
	2017 11 22	< 5.0	406	177	243	8.32	245	75.8	72.1	< 1.0	208	5.2	< 1.0	213	4.87	4.89	0.2	< 0.050	0.70	871	26.1	< 3.0	40.2	< 10	18.7	170	1.33	29.8	0.475	-	166	121	6.8	0.115	0.0015	1.85	2.7
Michel Creek																																					
EV_MCgwS	2017 03 08	< 5.0	838	371	312	7.92	523	24.5	45.3	11.1	297	< 1.0	< 1.0	297	9.42	8.62	-	< 0.25	45.4	310	105	< 3.0	93.1	***2,920*****	33.7	118	1.95	22.7	0.174	-	120	< 25	< 5.0	0.0174	< 0.0010	1.56	1.57
	2017 03 30	12.3	822	386	361	7.82	519	14.4	23.8	11.4	290	< 1.0	< 1.0	290	9.80	9.16	-	0.233	49.7	287	124	19.2	98.8	***2,050*****	33.8	113	1.92	29.3	0.22	-	102	6.9	7.9	0.0084	< 0.0010	2.11	2.13
	2017 05 16	< 5.0	843	380	371	7.86	526	15.0	40.5	8.6	290	< 1.0	< 1.0	290	9.55	8.53	-	0.26	56.0	340	104	< 3.0	95.7	***2,730*****	34.2	107	1.77	17.1	0.162	-	109	< 25	< 5.0	0.0146	< 0.0010	1.62	1.49
	2017 06 28	< 5.0	724	369	393	7.87	538	89.0	43.3	8.8	291	< 1.0	< 1.0	291	9.14	8.32	-4.7	< 0.25	48.0	290	94.2	< 3.0	94.4	***2,490*****	32.4	101	1.75	17.3	0.201	-	130	< 25	< 5.0	0.0855	< 0.0010	1.53	1.19
	2017 08 16	< 5.0	772	412	233	8.06	525	9.3	44.8	8.3	278	< 1.0	< 1.0	278	8.58	8.87	1.6	0.218	42.0	205	88.1	< 3.0	106	< 10	38.2	108	1.99	18.7	0.147	-	122	< 5.0	< 1.0	0.0157	< 0.0010	1.37	1.27
	2017 09 21	< 5.0	649	387	311	8.06	486	14.8	28.3	5.1	216	< 1.0	< 1.0	216	7.52	8.60	6.7	0.215	43.3	233	94.4	< 3.0	96.7	***2,250*****	35.2	110	2.01	15.9	0.104	-	113	< 5.0	< 1.0	0.0039	< 0.0010	1.06	1.03
	2017 10 18	< 5.0	748	424	289	8.02	516	179	48.0	4.9	262	< 1.0	< 1.0	262	8.11	9.41	7.4	0.204	40.7	200	82.3	< 3.0	100	***2,280*****	42.1	134	2.28	17.0	0.160	-	131	< 5.0	< 1.0	0.175	< 0.0010	1.00	1.06

Associated data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.

Parameter exceeded hold time. (light blue shading)

BOLD	Concentration greater than CSR Aquatic Life (AW) standard
BOLD**	Concentration greater than BCWQG Aquatic Life Short-term Maximum (AW) guideline or BCWQG Aquatic Life Long-term Average (AW) guideline (applicable to EV_BCgw, EV_MCgwD, EV_MCgwS, EV_OCgw)
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard

[a] Standard to protect freshwater aquatic life.
[b] Guideline to protect freshwater aquatic life, short-term maximum (i.e. "acute").
[c] Guideline to protect freshwater aquatic life, long-term average (i.e. "chronic").
[d] Standard varies with Hardness.
[e] Standard varies with pH.
[f] Standard varies with Chloride.
[g] Standard varies with crop.
[h] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[i] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[j] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.

TABLE 4 (Cont'd): Groundwater Analytical Results compared to Primary Screening Criteria

Sample Location	Sample Date (yyyy mm dd)	Dissolved Metals Antimony µg/L	Arsenic µg/L	Barium µg/L	Beryllium µg/L	Bismuth µg/L	Boron µg/L	Cadmium µg/L	Chromium µg/L	Cobalt µg/L	Copper µg/L	Lead µg/L	Lithium µg/L	Mercury µg/L	Molybdenum µg/L	Nickel µg/L	Selenium µg/L	Silver µg/L	Silicon µg/L	Strontium µg/L	Thallium µg/L	Tin µg/L	Titanium µg/L	Uranium µg/L	Vanadium µg/L	Zinc[j] µg/L
BC Standard/Guideline																										
CSR Aquatic Life (AW)[a]		90	50	10,000	1.5	n/a	12,000	0.5-4[d]	10[h]	40	20-90[d]	40-160[d]	n/a	0.25	10,000	250-1,500[d]	20	0.5-15[d]	n/a	n/a	3	n/a	1,000	85	n/a	75-2,400[d]
CSR Irrigation Watering (IW)		n/a	100	n/a	100	n/a	500-6,000[g]	5	5[h]	50	200	200	2,500	1	10	200	20	n/a	n/a	n/a	n/a	n/a	n/a	10	100	n/a
CSR Livestock Watering (LW)		n/a	25	n/a	100	n/a	5,000	80	50[h]	1,000	300	100	5,000	2	50	1,000	30	n/a	n/a	n/a	n/a	n/a	n/a	200	100	2,000
CSR Drinking Water (DW)		6	10	1,000	8	n/a	5,000	5	50[h]	20[i]	1,500	10	8	1	250	80	10	20	n/a	2,500	n/a	2,500	n/a	20	20	3,000
BCWQG Aquatic Life Short-term Maximum (AW)[b]		n/a	5	n/a	n/a	n/a	n/a	0.038-2.8[d]	1 (Cr(+6))	110	2.05-64.0[d]	3-902[d]	n/a	n/a	2,000	n/a	n/a	0.1-3[d]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	33-460.5[d]
BCWQG Aquatic Life Long-term Average (AW)[c]		9	n/a	1,000	0.13	n/a	1,200	0.018-0.457[d]	n/a	4	2-26.4[d]	3-38.5[d]	n/a	n/a	1,000	25-150[d]	2	0.05-1.5[d]	n/a	n/a	0.8	n/a	n/a	8.5	n/a	7.5-435[d]
Elk River Proximal to EVO (Cont'd)																										
EV_OCgw (Cont'd)	2017 06 29	< 0.50	1.24	52.5	< 0.10	< 0.25	121	< 0.025	< 0.50	< 0.50	< 1.0	< 0.25	25.4	< 0.00050	13.6	< 2.5	0.76	< 0.050	4,320	381	< 0.050	< 0.50	< 10	0.956	< 2.5	< 5.0
	Duplicate	< 0.50	1.33	52.4	< 0.10	< 0.25	115	< 0.025	< 0.50	< 0.50	< 1.0	< 0.25	24.9	< 0.00050	13.2	< 2.5	0.64	< 0.050	4,230	372	< 0.050	< 0.50	< 10	0.935	< 2.5	< 5.0
	QA/QC RPD%	*	7	< 1	*	*	5	*	*	*	*	*	2	*	3	*	17	*	2	2	*	*	*	2	*	*
	2017 08 15	< 0.10	1.23	52.0	< 0.020	< 0.050	110	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	26.3	< 0.00050	13.9	< 0.50	< 0.050	< 0.010	4,180	383	< 0.010	< 0.10	< 10	1.09	< 0.50	< 3.0
	Duplicate	< 0.10	1.21	51.1	< 0.020	< 0.050	112	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	26.0	< 0.00050	13.8	< 0.50	0.223	< 0.010	4,090	380	< 0.010	< 0.10	< 10	1.09	< 0.50	< 3.0
	QA/QC RPD%	*	2	2	*	*	2	*	*	*	*	*	1	*	1	*	*	*	2	1	*	*	*	0	*	*
	2017 08 29	0.13	1.21	51.5	< 0.020	< 0.050	106	< 0.0050	< 0.10	0.22	< 0.50	< 0.050	22.4	< 0.00050	12.3	< 0.50	< 0.050	< 0.010	4,250	335	< 0.010	< 0.10	< 10	1.09	< 0.50	< 3.0
	Duplicate	< 0.10	1.21	53.1	< 0.020	< 0.050	120	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	24.3	< 0.00050	13.3	< 0.50	0.129	< 0.010	4,340	371	< 0.010	< 0.10	< 10	1.13	< 0.50	< 3.0
	QA/QC RPD%	*	0	3	*	*	12	*	*	*	*	*	8	*	8	*	*	*	2	10	*	*	*	4	*	*
	2017 09 21	< 0.10	1.19	55.5	< 0.020	< 0.050	126	< 0.0050	< 0.10	0.13	< 0.50	< 0.050	25.6	< 0.00050	12.7	< 0.50	< 0.050	< 0.010	4,290	380	< 0.010	< 0.10	< 10	1.10	< 0.50	< 3.0
	2017 10 18	< 0.10	1.36	53.9	< 0.020	< 0.050	114	< 0.0050	< 0.10	0.17	< 0.50	< 0.050	28.2	< 0.00050	14.0	< 0.50	< 0.050	< 0.010	4,320	392	< 0.010	< 0.10	< 10	1.11	< 0.50	< 3.0
	Duplicate	< 0.10	1.44	56.4	< 0.020	< 0.050	106	< 0.0050	< 0.10	0.18	0.50	< 0.050	26.5	< 0.00050	13.3	< 0.50	< 0.050	< 0.010	4,510	370	< 0.010	0.15	< 10	1.07	< 0.50	< 3.0
	QA/QC RPD%	*	6	5	*	*	7	*	*	*	*	*	6	*	5	*	*	*	4	6	*	*	*	4	*	*
Erickson Creek																										
EV_WF_SW	2017 03 30	< 0.10	0.18	18.0	< 0.020	< 0.050	12	< 0.0050	< 0.10	4.28	< 0.20	< 0.050	24.6	< 0.0050	1.21	5.57	0.059	< 0.010	1,830	121	< 0.010	< 0.10	< 10	3.02	< 0.50	< 1.0
	Duplicate	< 0.10	0.18	16.1	< 0.020	< 0.050	11	0.0097	< 0.10	3.86	< 0.20	< 0.050	22.4	< 0.0050	1.12	5.02	0.113	< 0.010	1,570	106	< 0.010	< 0.10	< 10	2.55	< 0.50	1.3
	QA/QC RPD%	*	0	11	*	*	*	*	*	10	*	*	9	*	8	10	*	*	15	13	*	*	*	17	*	*
	2017 06 20	< 0.10	< 0.10	5.97	< 0.020	< 0.050	12	< 0.0050	< 0.10	0.25	< 0.50	< 0.050	22.3	< 0.0050	0.857	< 0.50	< 0.050	< 0.010	737	42.5	< 0.010	< 0.10	< 10	0.586	< 0.50	< 3.0
	2017 09 18	0.44	< 0.10	7.84	< 0.020	< 0.050	< 10	0.0078	< 0.10	0.13	1.82	< 0.050	12.9	< 0.0050	0.823	0.74	< 0.050	< 0.010	153	15.0	< 0.010	0.18	< 10	0.083	< 0.50	< 3.0
	2017 11 22	< 0.10	< 0.10	7.08	< 0.020	< 0.050	< 10	0.0062	< 0.10	< 0.10	< 0.50	< 0.050	11.9	< 0.0050	0.585	1.95	0.076	< 0.010	77	18.1	< 0.010	0.39	< 10	0.072	< 0.50	< 3.0
EV_ECgw	2017 06 20	0.18	0.38	53.6	< 0.020	< 0.050	104	0.0234	< 0.10	0.42	< 0.50	< 0.050	10.8	< 0.0050	13.1	1.68	0.129	< 0.010	4,430	423	0.060	< 0.10	< 10	1.32	< 0.50	< 3.0
	2017 08 23	< 0.10	0.37	59.1	< 0.020	< 0.050	115	0.0134	< 0.10	0.31	< 0.50	< 0.050	10.3	< 0.0050	12.8	0.89	0.06	< 0.010	4,450	441	0.042	< 0.10	< 10	1.25	< 0.50	< 3.0
	2017 10 25	< 0.10	0.47	57.3	< 0.020	< 0.050	112	0.0404	0.13	0.23	0.87	< 0.050	12.2	< 0.0050	13.2	3.65	0.056	< 0.010	5,080	434	0.034	0.20	< 10	1.34	< 0.50	10.8
	2017 11 22	< 0.10	0.41	53.8	< 0.020	< 0.050	119	0.0429	< 0.10	0.30	2.31	< 0.050	11.2	< 0.0050	15.2	3.67	0.212	< 0.010	5,090	447	0.031	0.12	< 10	1.24	< 0.50	6.0
Michel Creek																										
EV_MCgwS	2017 03 08	0.11	1.57	20.1	< 0.020	< 0.050	24	< 0.0050	< 0.10	0.10	< 0.50	< 0.050	21.7	< 0.00050	4.40	1.42	< 0.050	< 0.010	5,270	293	< 0.010	< 0.10	< 10	1.59	< 0.50	< 3.0
	2017 03 30	< 0.10	0.95	24.9	< 0.020	< 0.050	26	0.0096	< 0.10	0.13	0.36	0.050	28.2	< 0.00050	5.12	8.79	< 0.050	< 0.010	5,300	309	< 0.010	< 0.10	< 10	2.04	< 0.50	1.3
	2017 05 16	< 0.10	1.51	21.2	< 0.020	< 0.050	22	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	26.4	< 0.00050	2.40	0.88	0.073	< 0.010	4,450	265	< 0.010	< 0.10	< 10	1.47	< 0.50	< 3.0
	2017 06 28	< 0.10	1.45	22.3	< 0.020	< 0.050	26	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	25.5	< 0.00050	2.71	0.55	< 0.050	< 0.010	4,540	282	< 0.010	< 0.10	< 10	1.73	< 0.50	< 3.0
	2017 08 16	< 0.10	0.67	23.2	< 0.020	< 0.050	25	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	26.8	-	3.00	0.80	< 0.050	< 0.010	4,700	287	< 0.010	< 0.10	< 10	1.83	< 0.50	< 3.0
	2017 09 21	< 0.10	1.33	29.7	< 0.020	< 0.050	28	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	27.3	< 0.00050	2.19	1.16	< 0.050	< 0.010	4,840	254	< 0.010	< 0.10	< 10	1.51	< 0.50	< 3.0
	2017 10 18	< 0.10	2.50	43.4	< 0.020	< 0.050	27	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	27.4	< 0.00050	2.09	0.62	< 0.050	< 0.010	4,710	245	< 0.010	< 0.10	< 10	1.40	< 0.50	< 3.0

Associated data provided by Teck Coal Ltd.
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- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.

Parameter exceeded hold time.

BOLD Concentration greater than CSR Aquatic Life (AW) standard
BOLD** Concentration greater than BCWQG Aquatic Life Short-term Maximum (AW) guideline or BCWQG Aquatic Life Long-term Average (AW) guideline (applicable to EV_BCgw, EV_MCgwD, EV_MCgwS, EV_OCgw)
SHADOW Concentration greater than CSR Irrigation Watering (IW) standard
INVERSE Concentration greater than CSR Livestock Watering (LW) standard
SHADED Concentration greater than CSR Drinking Water (DW) standard

[a] Standard to protect freshwater aquatic life.
[b] Guideline to protect freshwater aquatic life, short-term maximum (i.e. "acute").
[c] Guideline to protect freshwater aquatic life, long-term average (i.e. "chronic").
[d] Standard varies with Hardness.
[e] Standard varies with pH.
[f] Standard varies with Chloride.
[g] Standard varies with crop.
[h] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[i] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[j] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.

TABLE 4 (Cont'd): Groundwater Analytical Results compared to Primary Screening Criteria

Sample Location	Sample Date	Physical Parameters								Geochemical Indicators																											
		Colour	Laboratory Conductivity	Hardness	Oxidation Reduction Potential	Laboratory pH	Total Dissolved Solids	Total Suspended Solids	Laboratory Turbidity	Acidity (pH 8.3)	Alkalinity, Bicarbonate (as CaCO3)	Alkalinity, Carbonate (as CaCO3)	Alkalinity, Hydroxide (as CaCO3)	Total Alkalinity (as CaCO3)	Total Anion	Total Cations	Cation Anion Balance	Bromide	Chloride	Fluoride	Sulphate	Dissolved Aluminum	Dissolved Calcium	Dissolved Iron	Dissolved Magnesium	Dissolved Manganese	Dissolved Potassium	Dissolved Sodium	Kjeldahl Nitrogen-N	Total Nitrogen-N	Ammonia, total (as N)	Nitrate (as N)	Nitrite (as N)	Total Phosphorous as P	Ortho-Phosphate	Dissolved Organic Carbon	Total Organic Carbon
	(yyyy mm dd)	CU	µS/cm	mg/L	mV	pH	mg/L	mg/L	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	meq/	meq/L	%	mg/L	mg/L	µg/L	mg/L	µg/L	mg/L	µg/L	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L
BC Standard/Guideline																																					
CSR Aquatic Life (AW)[a]		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1,500	2,000-3,000[d]	1,280-4,290[d]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3,700-18,500[e]	400,000	200-2,000[f]	n/a	n/a	n/a	n/a
CSR Irrigation Watering (IW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100	1,000	n/a	5,000	n/a	5,000	n/a	200	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CSR Livestock Watering (LW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	600	1,000	1,000	5,000	1,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100,000	10,000	n/a	n/a	n/a	n/a
CSR Drinking Water (DW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	250	1,500	500	9,500	n/a	6,500	n/a	1,500	n/a	200	n/a	n/a	n/a	10,000	1,000	n/a	n/a	n/a	n/a
BCWQG Aquatic Life Short-term Maximum (AW)[b]		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	31.6-100[e]	n/a	350 (max)	n/a	546-7,813[d]	n/a	n/a	n/a	n/a	5,680-24,500[e] (15°C assumed)	32,800	60-600[f]	n/a	n/a	n/a	n/a
BCWQG Aquatic Life Long-term Average (AW)[c]		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	309-429[d]	11.2-50[e]	n/a	n/a	n/a	607-3,509[d]	n/a	n/a	n/a	n/a	365-1,780[e] (15°C assumed)	3,000	20-200[f]	n/a	n/a	n/a	n/a
Michel Creek (Cont'd)																																					
EV_MCgwD	2017 03 08	< 5.0	588	248	332	8.11	352	21.5	19.3	5.9	238	< 1.0	< 1.0	238	6.75	6.08	-	< 0.050	3.80	885	88.3	3.4	57.2	1,120**	25.5	515	1.39	23.0	0.389	-	191	< 5.0	< 1.0	0.0330	< 0.0010	2.68	2.51
	2017 03 30	< 5.0	660	230	302	7.99	397	73.0	84.6	4.9	244	< 1.0	< 1.0	244	7.84	7.29	-	< 0.050	3.21	995	135	1.7	50.4	414**	25.4	573	1.51	59.7	0.48	-	232	9.1	8.7	0.0803	< 0.0010	2.30	3.55
	2017 05 16	< 5.0	617	223	298	8.09	399	385	312	3.1	282	< 1.0	< 1.0	282	7.56	6.20	-	< 0.050	3.75	989	85.1	19.3	49.0	10	24.5	512	1.46	38.2	0.524	-	191	< 5.0	2.2	0.272	0.0024	1.56	4.72
	2017 06 28	< 5.0	538	230	353	8.01	391	7.9	5.03	4.5	237	< 1.0	< 1.0	237	6.36	6.02	-2.7	< 0.050	4.84	944	69.4	< 3.0	51.0	29	24.8	389	1.47	31.5	0.280	-	198	< 5.0	4.0	0.0111	< 0.0010	1.64	1.41
	2017 08 16	< 5.0	512	235	223	8.19	321	17.3	13.5	2.2	228	< 1.0	< 1.0	228	5.80	6.03	1.9	0.059	4.21	848	51.7	< 3.0	52.5	12	27.8	369	1.57	24.6	0.158	-	121	59.0	3.4	0.0367	0.0031	1.10	1.05
	2017 09 19	< 5.0	498	230	252	7.84	307	4.2	3.17	2.9	248	< 1.0	< 1.0	248	6.42	5.79	-5.1	0.078	5.66	953	60.1	7.2	53.4	64	23.5	313	1.48	26.0	0.192	-	105	117	< 1.0	0.0186	< 0.0010	1.51	1.12
	2017 10 18	< 5.0	472	227	255	8.45	326	8.3	2.60	2.7	213	13.2	< 1.0	226	5.61	5.62	0.1	0.051	4.00	912	44.5	< 3.0	48.2	94	25.8	359	1.53	23.5	0.210	-	118	63.9	1.3	0.0145	0.0035	0.80	0.79
EV_BCgw	2017 03 14	< 5.0	768	417	310	8.00	528	4.1	1.40	5.0	184	< 1.0	< 1.0	184	8.50	8.54	-	< 0.25	6.04	150	206	< 3.0	103	< 10	39.1	< 0.10	1.18	4.08	0.082	-	< 5.0	5,000**	< 5.0	0.0073	0.0035	0.68	0.68
	2017 03 30	< 5.0	944	522	365	7.82	709	13.4	2.08	7.7	194	< 1.0	< 1.0	194	11.4	10.7	-	< 0.050	10.5	124	314	< 1.0	126	< 10	50.4	0.38	1.35	5.36	0.47	-	< 5.0	9,040**	3.1	0.0069	0.0035	0.77	0.80
	2017 05 16	< 5.0	1,210	619	404	7.96	930	6.6	2.06	6.1	215	< 1.0	< 1.0	215	15.5	12.7	-	< 0.25	19.3	160	462**	< 3.0	146	< 10	61.7	0.11	1.46	6.30	0.115	-	< 5.0	14,000**	< 5.0	0.019	0.0035	0.72	0.82
	2017 06 27	< 5.0	692	336	412	7.98	530	1.4	0.32	4.6	189	< 1.0	< 1.0	189	7.55	6.96	-4.1	< 0.050	5.09	170	163	< 3.0	77.8	< 5.0	34.5	1.02	1.09	4.80	0.178	-	61.5	3,090**	39.3	0.0084	0.0020	1.17	1.07
	2017 08 23	< 5.0	1,080	660	246	7.97	755	2.4	1.31	10.4	215	< 1.0	< 1.0	215	13.6	13.6	0.1	< 0.25	13.5	< 100	391	< 3.0	159	< 10	66.4	< 0.10	1.53	7.09	1.01	-	< 5.0	10,600**	< 5.0	0.0046	0.0027	0.75	25.4
	2017 10 18	< 5.0	784	475	291	8.02	696	4.3	2.28	2.3	160	< 1.0	< 1.0	160	9.31	9.79	2.5	< 0.050	8.33	118	261	< 3.0	109	< 10	49.5	< 0.10	1.32	5.97	< 0.050	-	6.9	6,270**	< 1.0	0.0081	0.0035	< 0.50	< 0.50
Elk River Distal to EVO																																					
EV_ER1gwS	2017 02 15	< 5.0	498	269	326	8.23	315	< 1.0	0.10	1.4	173	< 1.0	< 1.0	173	5.62	5.52	-	< 0.050	3.30	180	89.5	< 3.0	69.4	< 10	23.2	< 0.10	0.568	3.02	0.071	2.76	< 5.0	2,690	< 1.0	0.0033	0.0029	< 0.50	< 0.50
	2017 06 28	< 5.0	427	222	384	8.07	311	1.4	0.22	3.0	187	< 1.0	< 1.0	187	5.02	4.77	-2.6	< 0.050	11.4	176	42.1	< 3.0	58.3	< 10	18.6	< 0.10	0.776	7.10	0.084	-	< 5.0	1,190	< 1.0	< 0.010	0.0028	1.39	0.70
	2017 08 22	< 5.0	416	223	232	8.02	285	< 2.0	0.32	1.3	167	< 1.0	< 1.0	167	4.79	5.03	2.4	< 0.050	2.57	173	60.6	4.7	65.7	< 10	19.3	< 0.10	0.883	3.30	0.052	-	< 5.0	1,740	< 1.0	0.0049	0.0039	0.59	< 0.50
	2017 10 24	< 5.0	475	233	267	8.11	343	5.0	2.72	3.0	165	< 1.0	< 1.0	165	4.87	4.79	-0.8	< 0.050	3.40	187	65.0	12.8	61.5	< 10	19.3	1.52	0.695	2.70	0.098	-	< 5.0	1,550	5.7	0.0085	0.0043	0.94	0.60
EV_ER1gwD	2017 02 15	< 5.0	480	260	323	8.24	314	275	182	1.2	212	< 1.0	< 1.0	212	6.04	5.34	-	< 0.050	3.97	188	73.8	9.9	67.4	< 10	22.2	34.0	0.603	2.93	0.254	2.19	6.0	2,100	< 1.0	0.334	0.0041	< 0.50	1.77
	2017 06 28	< 5.0	343	176	320	8.18	266	138	44.4	1.3	153	< 1.0	< 1.0	153	4.05	3.62	-5.6	< 0.050	2.07	231	40.0	11.6	45.4	< 10	15.2	4.06	0.569	2.07	0.138	-	< 5.0	1,260	< 1.0	0.0973	0.0030	1.26	2.08
	2017 08 22	< 5.0	411	223	239	8.08	263	2.4	1.45	< 1.0	173	< 1.0	< 1.0	173	4.76	4.82	0.6	< 0.050	2.58	192	53.8	14.9	60.8	< 10	20.1	0.51	0.793	2.61	< 0.050	-	< 5.0	1,480	35.1	0.0110	0.0051	< 0.50	< 0.50
	2017 10 24	< 5.0	434	233	273	8.12	347	3.2	1.24	2.7	174	< 1.0	< 1.0	174	5.30	4.80	-5.0	< 0.050	2.48	170	76.9	< 3.0	61.7	< 10	19.2	< 0.10	0.691	2.76	0.132	-	< 5.0	1,930	4.8	0.0073	0.0035	2.48	< 0.50
Field Blanks																																					
EV_GV3gw	2017 06 27	< 5.0	< 2.0	< 0.50	470	5.80	< 3.0	< 1.0	< 0.10	1.9	< 1.0	< 1.0	< 1.0	< 1.0	< 0	< 0	0	< 0.050	< 0.10	< 20	< 0.30	< 3.0	< 0.050	< 5.0	< 0.10	< 0.10	< 0.050	< 0.010	< 0.050	-	< 5.0	< 5.0	< 1.0	< 0.0020	< 0.0010	< 0.50	1.21
	2017 08 15	< 5.0	< 2.0	< 0.50	494	6.79	< 3.0	< 1.0	< 0.10	1.6	< 1.0	< 1.0	< 1.0	< 1.0	< 0	< 0	0	< 0.050	< 0.10	< 20	< 0.30	< 3.0	< 0.050	< 10	< 0.10	< 0.10	< 0.050	< 0.050	< 0.050	-	< 5.0	< 5.0	< 1.0	< 0.0020	< 0.0010	< 0.50	< 0.50
	2017 10 17	< 5.0	< 2.0	< 0.50	393	5.63	< 10	< 1.0	0.42	1.2	1.0	< 1.0	< 1.0	1.0	< 0	< 0	-79.0	< 0.050	< 0.50	< 20	< 0.30	< 3.0	< 0.050	< 10	< 0.10	< 0.10	< 0.050	< 0.050	< 0.050	-	< 5.0	< 5.0	< 1.0	< 0.0020	< 0.0010	< 0.50	< 0.50
EV_OCgw	2017 03 29	< 5.0	< 2.0	< 0.50	415	5.61	< 10	< 1.0	< 0.10	1.8	< 1.0	< 1.0	< 1.0	< 1.0	< 0	< 0	-	< 0.050	< 0.50	< 20	< 0.30	< 1.0	< 0.050	< 10	< 0.0050	< 0.10	< 0.050	< 0.050	< 0.050	-	< 5.0	< 5.0	< 1.0	0.0030	< 0.0010	< 0.50	< 0.50
	2017 06 19	< 5.0	< 2.0	< 0.50	436	6.63	< 3.0	< 1.0	< 0.10	1.1	< 1.0	< 1.0	< 1.0	< 1.0	< 0	< 0	0	< 0.050	< 0.10	< 20	< 0.30	< 3.0	< 0.050	< 10	< 0.10	< 0.10	< 0.050	< 0.050	< 0.050	-	< 5.0	< 5.0	< 1.0	< 0.0020	< 0.0010	< 0.50	< 0.50
	2017 06 29	< 5.0	< 2.0	< 0.50	440	6.13	< 10	< 1.0	< 0.10	1.7	1.1	< 1.0	< 1.0	1.1	< 0	< 0	-93.5	< 0.050	< 0.50	< 20	< 0.30	< 1.0	< 0.050	< 10	< 0.0050	< 0.10	< 0.050	< 0.050	< 0.050	-	< 5.0	< 5.0	< 1.0	< 0.0010	< 0.0010	< 0.50	< 0.50
	2017 08 15	< 5.0	< 2.0	< 0.50	421	7.19	< 3.0	< 1.0	< 0.10	1.3	< 1.0	< 1.0	< 1.0	< 1.0	< 0	< 0	0	< 0.050	< 0.10	< 20	< 0.30	< 3.0	< 0.050	< 10	< 0.10	< 0.10	< 0.050	< 0.050	< 0.050	-	< 5.0	< 5.0	< 1.0	< 0.0020	< 0.0010	< 0.50	< 0.50
	2017 08 29	< 5.0	2.9	< 0.50	394	5.56	< 10	< 1.0	< 0.10	1.1	< 1.0	< 1.0	< 1.0	< 1.0	< 0	< 0	0	< 0.050	< 0.50	< 20	< 0.30	< 3.0	< 0.050	< 10	< 0.10	< 0.10	< 0.050	< 0.050	< 0.050	-	< 5.0	< 5.0	< 1.0	< 0.0020	< 0.0010	< 0.50	< 0.50
	2017 10 18	< 5.0	< 2.0	< 0.50	410	5.54	< 10	< 1.0	0.13	3.5	< 1.0	< 1.0	< 1.0	< 1.0	< 0	< 0	0	< 0.050	< 0.50	< 20	< 0.30	< 3.0	< 0.050	< 10	< 0.10	< 0.10	< 0.050	< 0.050	< 0.050	-	13.3	< 5.0	< 1.0	< 0.0020	< 0.0010	< 0.50	< 0.50
EV_WF_SW	2017 03 30	< 5.0	< 2.0	< 0.50	396	5.38	< 10	< 1.0	0.10	2.1	< 1.0	< 1.0	< 1.0	< 1.0	< 0	< 0	-	< 0.050	< 0.50	< 20	< 0.30	< 1.0	< 0.050	< 10	0.0061	< 0.10	< 0.050	< 0.050	< 0.20	-	< 5.0	9.6	2.9	0.0037	< 0.0010	< 0.50	< 0.50

Associated data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.

Parameter exceeded hold time.

BOLD	Concentration greater than CSR Aquatic Life (AW) standard
BOLD**	Concentration greater than BCWQG Aquatic Life Short-term Maximum (AW) guideline or BCWQG Aquatic Life Long-term Average (AW) guideline (applicable to EV_BCgw, EV_MCgwD, EV_MCgwS, EV_OCgw)
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard

[a] Standard to protect freshwater aquatic life.
[b] Guideline to protect freshwater aquatic life, short-term maximum (i.e. "acute").
[c] Guideline to protect freshwater aquatic life, long-term average (i.e. "chronic").
[d] Standard varies with Hardness.
[e] Standard varies with pH.
[f] Standard varies with Chloride.
[g] Standard varies with crop.
[h] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[i] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[j] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.

TABLE 4 (Cont'd): Groundwater Analytical Results compared to Primary Screening Criteria

Sample Location	Sample Date (yyyy mm dd)	Antimony µg/L	Arsenic µg/L	Barium µg/L	Beryllium µg/L	Bismuth µg/L	Boron µg/L	Cadmium µg/L	Chromium µg/L	Cobalt µg/L	Copper µg/L	Lead µg/L	Lithium µg/L	Mercury µg/L	Molybdenum µg/L	Nickel µg/L	Selenium µg/L	Silver µg/L	Silicon µg/L	Strontium µg/L	Thallium µg/L	Tin µg/L	Titanium µg/L	Uranium µg/L	Vanadium µg/L	Zinc[j] µg/L
		Dissolved Metals																								
BC Standard/Guideline																										
CSR Aquatic Life (AW)[a]		90	50	10,000	1.5	n/a	12,000	0.5-4[d]	10[h]	40	20-90[d]	40-160[d]	n/a	0.25	10,000	250-1,500[d]	20	0.5-15[d]	n/a	n/a	3	n/a	1,000	85	n/a	75-2,400[d]
CSR Irrigation Watering (IW)		n/a	100	n/a	100	n/a	500-6,000[g]	5	5[h]	50	200	200	2,500	1	10	200	20	n/a	n/a	n/a	n/a	n/a	n/a	10	100	n/a
CSR Livestock Watering (LW)		n/a	25	n/a	100	n/a	5,000	80	50[h]	1,000	300	100	5,000	2	50	1,000	30	n/a	n/a	n/a	n/a	n/a	n/a	200	100	2,000
CSR Drinking Water (DW)		6	10	1,000	8	n/a	5,000	5	50[h]	20[i]	1,500	10	8	1	250	80	10	20	n/a	2,500	n/a	2,500	n/a	20	20	3,000
BCWQG Aquatic Life Short-term Maximum (AW)[b]		n/a	5	n/a	n/a	n/a	n/a	0.038-2.8[d]	1 (Cr(+6))	110	2.05-64.0[d]	3-902[d]	n/a	n/a	2,000	n/a	n/a	0.1-3[d]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	33-460.5[d]
BCWQG Aquatic Life Long-term Average (AW)[c]		9	n/a	1,000	0.13	n/a	1,200	0.018-0.457[d]	n/a	4	2-26.4[d]	3-38.5[d]	n/a	n/a	1,000	25-150[d]	2	0.05-1.5[d]	n/a	n/a	0.8	n/a	n/a	8.5	n/a	7.5-435[d]
Michel Creek (Cont'd)																										
EV_MCgwD	2017 03 08	< 0.10	0.94	92.2	< 0.020	< 0.050	59	< 0.0050	< 0.10	0.41	< 0.50	< 0.050	7.6	< 0.00050	8.83	1.33	0.143	< 0.010	4,850	491	< 0.010	< 0.10	< 10	1.89	< 0.50	< 3.0
	2017 03 30	< 0.10	0.86	69.1	< 0.020	< 0.050	69	0.0081	< 0.10	0.44	< 0.20	< 0.050	**11.2**	< 0.00050	**13.6**	3.67	< 0.050	< 0.010	5,090	467	< 0.010	< 0.10	< 10	3.46	< 0.50	1.5
	2017 05 16	0.21	0.73	82.5	< 0.020	< 0.050	63	0.0151	< 0.10	0.69	< 0.50	< 0.050	**9.3**	< 0.00050	**12.8**	14.4	0.081	< 0.010	4,620	434	0.022	< 0.10	< 10	2.78	< 0.50	< 3.0
	2017 06 28	0.16	0.81	86.0	< 0.020	< 0.050	70	0.0434	< 0.10	0.75	0.63	< 0.050	**9.3**	< 0.00050	**13.1**	15.0	0.141	< 0.010	4,650	493	0.096	< 0.10	< 10	3.08	< 0.50	6.3
	2017 08 16	0.12	0.68	86.8	< 0.020	< 0.050	68	0.0470	< 0.10	0.52	1.05	< 0.050	**8.5**	-	**11.6**	14.2	0.115	< 0.010	4,820	478	0.092	< 0.10	< 10	2.36	< 0.50	13.4
	2017 09 19	0.14	0.59	85.8	< 0.020	< 0.050	76	0.0470	< 0.10	0.34	1.47	< 0.050	**9.6**	< 0.00050	**11.2**	15.3	0.133	0.058	4,790	461	0.077	< 0.10	< 10	2.45	< 0.50	20.0
	2017 10 18	0.11	0.81	86.6	< 0.020	< 0.050	71	0.0503	< 0.10	0.43	1.18	< 0.050	**9.1**	< 0.00050	**10.9**	13.2	0.075	< 0.010	4,990	446	0.071	< 0.10	< 10	2.17	< 0.50	17.6
EV_BCgw	2017 03 14	0.16	0.11	37.5	< 0.020	< 0.050	15	0.0335	0.12	< 0.10	< 0.50	< 0.050	**22.8**	< 0.0050	0.922	0.52	***20.3****	< 0.010	2,840	174	0.013	< 0.10	< 10	1.22	< 0.50	< 3.0
	2017 03 30	0.18	0.13	51.3	< 0.020	< 0.050	17	0.0551	< 0.10	< 0.10	0.86	< 0.050	**30.5**	< 0.0050	0.817	1.66	***37.7****	< 0.010	2,910	234	0.015	< 0.10	< 10	1.58	< 0.50	2.1
	2017 05 16	0.20	0.15	57.6	< 0.020	< 0.050	15	0.0609	0.13	< 0.10	0.65	< 0.050	**34.2**	< 0.0050	0.717	1.47	***59****	< 0.010	2,970	262	0.018	< 0.10	< 10	1.87	< 0.50	< 3.0
	2017 06 27	0.24	0.150	46.5	< 0.020	< 0.050	10.5	0.0549	0.16	0.055	1.01	< 0.030	**17.0**	< 0.0050	1.22	4.31	***17.9****	< 0.010	2,800	140	< 0.010	0.076	< 10	0.916	< 0.50	5.6
	2017 08 23	0.12	< 0.10	52.2	< 0.020	< 0.050	18	0.0603	0.10	< 0.10	< 0.50	< 0.050	**36.5**	< 0.0050	0.677	0.56	***56.8****	< 0.010	3,070	278	0.017	< 0.10	< 10	1.79	< 0.50	< 3.0
	2017 10 18	0.12	< 0.10	43.6	< 0.020	< 0.050	17	0.0426	0.17	< 0.10	< 0.50	< 0.050	**26.7**	< 0.0050	0.799	0.60	***34.5****	< 0.010	2,940	203	0.014	< 0.10	< 10	1.40	< 0.50	< 3.0
Elk River Distal to EVO																										
EV_ER1gwS	2017 02 15	< 0.10	0.11	92.2	< 0.020	< 0.050	< 10	0.0090	0.25	< 0.10	< 0.50	< 0.050	7.1	< 0.0050	1.15	< 0.50	**10.3**	< 0.010	1,930	212	< 0.010	< 0.10	< 10	1.28	< 0.50	< 3.0
	2017 06 28	< 0.10	0.12	98.3	< 0.020	< 0.050	< 10	0.0113	0.27	< 0.10	< 0.50	< 0.050	7.7	< 0.0050	1.08	< 0.50	4.95	< 0.010	2,590	194	< 0.010	< 0.10	< 10	1.03	< 0.50	< 3.0
	2017 08 22	0.10	0.13	104	< 0.020	< 0.050	< 10	0.0114	0.24	< 0.10	< 0.50	< 0.050	**8.2**	< 0.0050	1.23	< 0.50	8.59	< 0.010	2,480	183	< 0.010	< 0.10	< 10	1.07	< 0.50	< 3.0
	2017 10 24	0.13	0.26	88.6	< 0.020	< 0.050	< 10	< 0.0050	0.32	< 0.10	< 0.50	< 0.050	6.9	< 0.0050	1.42	< 0.50	7.74	< 0.010	2,870	202	< 0.010	0.12	< 10	1.36	< 0.50	< 3.0
EV_ER1gwD	2017 02 15	< 0.10	< 0.10	85.0	< 0.020	< 0.050	< 10	< 0.0050	0.25	0.10	0.52	< 0.050	6.5	< 0.0050	1.27	< 0.50	8.16	< 0.010	2,410	209	< 0.010	< 0.10	< 10	1.30	< 0.50	< 3.0
	2017 06 28	0.14	0.13	65.1	< 0.020	< 0.050	< 10	< 0.0050	0.23	< 0.10	< 0.50	< 0.050	6.6	< 0.0050	1.34	< 0.50	5.67	< 0.010	2,290	160	< 0.010	< 0.10	< 10	1.13	< 0.50	< 3.0
	2017 08 22	< 0.10	0.14	85.2	< 0.020	< 0.050	10	< 0.0050	0.28	< 0.10	< 0.50	< 0.050	**8.3**	< 0.0050	1.35	< 0.50	6.95	< 0.010	2,760	188	< 0.010	< 0.10	< 10	1.26	< 0.50	< 3.0
	2017 10 24	0.13	0.25	98.0	< 0.020	< 0.050	< 10	0.0103	0.27	< 0.10	< 0.50	< 0.050	6.8	< 0.0050	1.34	< 0.50	**10.5**	< 0.010	2,190	194	< 0.010	< 0.10	< 10	1.21	< 0.50	< 3.0
Field Blanks																										
EV_GV3gw	2017 06 27	< 0.10	< 0.030	< 0.050	< 0.020	< 0.050	< 5.0	< 0.0050	< 0.10	< 0.050	< 0.50	< 0.030	< 1.0	< 0.0050	< 0.050	< 0.10	< 0.050	< 0.010	< 50	< 0.20	< 0.010	< 0.050	< 10	< 0.010	< 0.50	< 3.0
	2017 08 15	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	< 1.0	0.0070	< 0.050	< 0.50	< 0.050	< 0.010	< 50	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0
	2017 10 17	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	< 1.0	< 0.0050	< 0.050	< 0.50	< 0.050	< 0.010	< 50	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0
EV_OCgw	2017 03 29	< 0.10	< 0.10	0.084	< 0.020	< 0.050	< 10	< 0.0050	< 0.10	< 0.10	< 0.20	< 0.050	< 1.0	< 0.0050	< 0.050	< 0.50	< 0.050	< 0.010	< 50	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 1.0
	2017 06 19	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	< 1.0	< 0.00050	< 0.050	< 0.50	< 0.050	< 0.010	< 50	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0
	2017 06 29	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.10	< 0.10	< 0.20	< 0.050	< 1.0	< 0.00050	< 0.050	< 0.50	< 0.050	< 0.010	< 50	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 1.0
	2017 08 15	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	< 1.0	< 0.00050	< 0.050	< 0.50	< 0.050	< 0.010	< 50	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0
	2017 08 29	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	< 1.0	< 0.00050	< 0.050	< 0.50	< 0.050	< 0.010	< 50	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0
	2017 10 18	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	< 1.0	< 0.00050	< 0.050	< 0.50	< 0.050	< 0.010	< 50	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0
EV_WF_SW	2017 03 30	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.10	< 0.10	< 0.20	< 0.050	< 1.0	< 0.00050	< 0.050	< 0.50	< 0.050	< 0.010	< 50	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 1.0

Associated data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
\- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.

Parameter exceeded hold time.

BOLD	Concentration greater than CSR Aquatic Life (AW) standard
BOLD**	Concentration greater than BCWQG Aquatic Life Short-term Maximum (AW) guideline or BCWQG Aquatic Life Long-term Average (AW) guideline (applicable to EV_BCgw, EV_MCgwD, EV_MCgwS, EV_OCgw)
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard

[a] Standard to protect freshwater aquatic life.
[b] Guideline to protect freshwater aquatic life, short-term maximum (i.e. "acute").
[c] Guideline to protect freshwater aquatic life, long-term average (i.e. "chronic").
[d] Standard varies with Hardness.
[e] Standard varies with pH.
[f] Standard varies with Chloride.
[g] Standard varies with crop.
[h] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[i] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[j] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.

TABLE 4 (Cont'd): Groundwater Analytical Results compared to Primary Screening Criteria

		Physical Parameters								Geochemical Indicators																											
Sample Location	Sample Date	Colour	Laboratory Conductivity	Hardness	Oxidation Reduction Potential	Laboratory pH	Total Dissolved Solids	Total Suspended Solids	Laboratory Turbidity	Acidity (pH 8.3)	Alkalinity, Bicarbonate (as CaCO3)	Alkalinity, Carbonate (as CaCO3)	Alkalinity, Hydroxide (as CaCO3)	Total Alkalinity (as CaCO3)	Total Anion	Total Cations	Cation Anion Balance	Bromide	Chloride	Fluoride	Sulphate	Dissolved Aluminum	Dissolved Calcium	Dissolved Iron	Dissolved Magnesium	Dissolved Manganese	Dissolved Potassium	Dissolved Sodium	Kjeldahl Nitrogen-N	Total Nitrogen-N	Ammonia, total (as N)	Nitrate (as N)	Nitrite (as N)	Total Phosphorous as P	Ortho-Phosphate	Dissolved Organic Carbon	Total Organic Carbon
Location	(yyyy mm dd)	CU	µS/cm	mg/L	mV	pH	mg/L	mg/L	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	meq/	meq/L	%	mg/L	mg/L	µg/L	mg/L	µg/L	mg/L	µg/L	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L
BC Standard/Guideline																																					
CSR Aquatic Life (AW)[a]		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1,500	2,000-3,000[d]	1,280-4,290[d]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3,700-18,500[e]	400,000	200-2,000[f]	n/a	n/a	n/a	n/a
CSR Irrigation Watering (IW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100	1,000	n/a	5,000	n/a	5,000	n/a	200	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CSR Livestock Watering (LW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	600	1,000	1,000	5,000	1,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100,000	10,000	n/a	n/a	n/a	n/a
CSR Drinking Water (DW)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	250	1,500	500	9,500	n/a	6,500	n/a	1,500	n/a	200	n/a	n/a	n/a	10,000	1,000	n/a	n/a	n/a	n/a
BCWQG Aquatic Life Short-term Maximum (AW)[b]		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	31.6-100[e]	n/a	350 (max)	n/a	546-7,813[d]	n/a	n/a	n/a	n/a	5,680-24,500[e] (15°C assumed)	32,800	60-600[f]	n/a	n/a	n/a	n/a
BCWQG Aquatic Life Long-term Average (AW)[c]		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	309-429[d]	11.2-50[e]	n/a	n/a	n/a	607-3,509[d]	n/a	n/a	n/a	n/a	365-1,780[e] (15°C assumed)	3,000	20-200[f]	n/a	n/a	n/a	n/a
Trip Blanks																																					
EV_ECgw	2017 03 30	< 5.0	< 2.0	< 0.50	403	5.56	< 10	< 1.0	< 0.10	2.1	< 1.0	< 1.0	< 1.0	< 1.0	< 0	< 0	-	< 0.050	< 0.50	< 20	< 0.30	< 1.0	< 0.050	< 10	< 0.0050	< 0.10	< 0.050	< 0.050	< 0.20	-	-	< 5.0	2.8	-	< 0.0010	-	< 0.50
	2017 06 28	< 5.0	< 2.0	< 0.50	483	5.77	< 3.0	< 1.0	< 0.10	1.9	< 1.0	< 1.0	< 1.0	< 1.0	< 0	< 0	0	< 0.050	< 0.10	< 20	< 0.30	< 3.0	< 0.050	< 10	< 0.10	< 0.10	< 0.050	< 0.050	< 0.050	-	-	< 5.0	< 1.0	-	< 0.0010	-	0.71
	2017 09 19	< 5.0	< 2.0	-	461	5.66	< 10	< 3.0	0.24	1.2	< 1.0	< 1.0	< 1.0	< 1.0	< 0	< 0	-1.7	< 0.050	< 0.50	< 20	< 0.30	-	< 0.050	-	< 0.0050	-	< 0.050	< 0.050	< 0.050	-	-	30.6	1.1	-	< 0.0010	-	< 0.50
	2017 10 17	< 5.0	< 2.0	< 0.50	421	5.53	< 10	< 1.0	0.20	1.6	< 1.0	< 1.0	< 1.0	< 1.0	< 0	< 0	0	< 0.050	< 0.50	< 20	< 0.30	< 3.0	< 0.050	< 10	< 0.10	< 0.10	< 0.050	< 0.050	< 0.050	-	-	< 5.0	< 1.0	-	< 0.0010	-	< 0.50
EV_MCgwD	2017 03 29	< 5.0	< 2.0	< 0.50	363	5.53	21	< 1.0	< 0.10	2.4	< 1.0	< 1.0	< 1.0	< 1.0	< 0	< 0	-	< 0.050	< 0.50	< 20	< 0.30	< 1.0	< 0.050	< 10	< 0.0050	< 0.10	< 0.050	< 0.050	0.056	-	-	< 5.0	< 1.0	-	< 0.0010	-	< 0.50
	2017 06 27	< 5.0	< 2.0	< 0.50	470	5.77	< 3.0	< 1.0	< 0.10	1.9	< 1.0	< 1.0	< 1.0	< 1.0	< 0	< 0	0	< 0.050	< 0.10	< 20	< 0.30	< 3.0	< 0.050	< 5.0	< 0.10	< 0.10	< 0.050	< 0.050	< 0.050	-	-	< 5.0	< 1.0	-	< 0.0010	-	< 0.50
	2017 09 19	< 5.0	< 2.0	-	461	5.60	< 10	< 3.0	0.14	2.4	< 1.0	< 1.0	< 1.0	< 1.0	< 0	< 0	29.2	< 0.050	< 0.50	< 20	< 0.30	-	< 0.050	-	< 0.0050	-	< 0.050	< 0.050	< 0.050	-	-	19.3	< 1.0	-	< 0.0010	-	< 0.50
	2017 10 17	< 5.0	< 2.0	< 0.50	409	5.79	< 10	< 1.0	0.19	1.2	< 1.0	< 1.0	< 1.0	< 1.0	< 0	< 0	0	< 0.050	< 0.50	< 20	< 0.30	< 3.0	< 0.050	< 10	< 0.10	< 0.10	< 0.050	< 0.050	< 0.050	-	-	< 5.0	< 1.0	-	< 0.0010	-	< 0.50

Associated data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
\- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.

Parameter exceeded hold time.

BOLD	Concentration greater than CSR Aquatic Life (AW) standard
BOLD**	Concentration greater than BCWQG Aquatic Life Short-term Maximum (AW) guideline or BCWQG Aquatic Life Long-term Average (AW) guideline (applicable to EV_BCgw, EV_MCgwD, EV_MCgwS, EV_OCgw)
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard

[a] Standard to protect freshwater aquatic life.
[b] Guideline to protect freshwater aquatic life, short-term maximum (i.e. "acute").
[c] Guideline to protect freshwater aquatic life, long-term average (i.e. "chronic").
[d] Standard varies with Hardness.
[e] Standard varies with pH.
[f] Standard varies with Chloride.
[g] Standard varies with crop.
[h] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[i] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[j] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.

TABLE 4 (Cont'd): Groundwater Analytical Results compared to Primary Screening Criteria

Sample Location	Sample Date (yyyy mm dd)	Dissolved Metals Antimony µg/L	Arsenic µg/L	Barium µg/L	Beryllium µg/L	Bismuth µg/L	Boron µg/L	Cadmium µg/L	Chromium µg/L	Cobalt µg/L	Copper µg/L	Lead µg/L	Lithium µg/L	Mercury µg/L	Molybdenum µg/L	Nickel µg/L	Selenium µg/L	Silver µg/L	Silicon µg/L	Strontium µg/L	Thallium µg/L	Tin µg/L	Titanium µg/L	Uranium µg/L	Vanadium µg/L	Zinc[j] µg/L
BC Standard/Guideline																										
CSR Aquatic Life (AW)[a]		90	50	10,000	1.5	n/a	12,000	0.5-4[d]	10[h]	40	20-90[d]	40-160[d]	n/a	0.25	10,000	250-1,500[d]	20	0.5-15[d]	n/a	n/a	3	n/a	1,000	85	n/a	75-2,400[d]
CSR Irrigation Watering (IW)		n/a	100	n/a	100	n/a	500-6,000[g]	5	5[h]	50	200	200	2,500	1	10	200	20	n/a	n/a	n/a	n/a	n/a	n/a	10	100	n/a
CSR Livestock Watering (LW)		n/a	25	n/a	100	n/a	5,000	80	50[h]	1,000	300	100	5,000	2	50	1,000	30	n/a	n/a	n/a	n/a	n/a	n/a	200	100	2,000
CSR Drinking Water (DW)		6	10	1,000	8	n/a	5,000	5	50[h]	20[i]	1,500	10	8	1	250	80	10	20	n/a	2,500	n/a	2,500	n/a	20	20	3,000
BCWQG Aquatic Life Short-term Maximum (AW)[b]		n/a	5	n/a	n/a	n/a	n/a	0.038-2.8[d]	1 (Cr(+6))	110	2.05-64.0[d]	3-902[d]	n/a	n/a	2,000	n/a	n/a	0.1-3[d]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	33-460.5[d]
BCWQG Aquatic Life Long-term Average (AW)[c]		9	n/a	1,000	0.13	n/a	1,200	0.018-0.457[d]	n/a	4	2-26.4[d]	3-38.5[d]	n/a	n/a	1,000	25-150[d]	2	0.05-1.5[d]	n/a	n/a	0.8	n/a	n/a	8.5	n/a	7.5-435[d]
Trip Blanks																										
EV_ECgw	2017 03 30	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.10	< 0.10	< 0.20	< 0.050	< 1.0	< 0.00050	< 0.050	< 0.50	< 0.050	< 0.010	< 50	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 1.0
	2017 06 28	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	< 1.0	< 0.0050	< 0.050	< 0.50	< 0.050	< 0.010	< 50	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0
	2017 09 19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2017 10 17	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	< 1.0	< 0.0050	< 0.050	< 0.50	< 0.050	< 0.010	< 50	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0
EV_MCgwD	2017 03 29	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.10	< 0.10	< 0.20	< 0.050	< 1.0	< 0.00050	< 0.050	< 0.50	< 0.050	< 0.010	< 50	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 1.0
	2017 06 27	< 0.10	< 0.030	< 0.050	< 0.020	< 0.050	< 5.0	< 0.0050	< 0.10	< 0.050	< 0.50	< 0.030	< 1.0	< 0.0050	< 0.050	< 0.10	< 0.050	< 0.010	< 50	< 0.20	< 0.010	< 0.050	< 10	< 0.010	< 0.50	< 3.0
	2017 09 19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2017 10 17	< 0.10	< 0.10	< 0.050	< 0.020	< 0.050	< 10	< 0.0050	< 0.10	< 0.10	< 0.50	< 0.050	< 1.0	< 0.0050	< 0.050	< 0.50	< 0.050	< 0.010	< 50	< 0.20	< 0.010	< 0.10	< 10	< 0.010	< 0.50	< 3.0

Associated data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
RPD Denotes relative percent difference.
* RPDs are not calculated where one or more concentrations are less than five times RDL.

Parameter exceeded hold time.

BOLD	Concentration greater than CSR Aquatic Life (AW) standard
BOLD*	Concentration greater than BCWQG Aquatic Life Short-term Maximum (AW) guideline or BCWQG Aquatic Life Long-term Average (AW) guideline (applicable to EV_BCgw, EV_MCgwD, EV_MCgwS, EV_OCgw)
SHADOW	Concentration greater than CSR Irrigation Watering (IW) standard
INVERSE	Concentration greater than CSR Livestock Watering (LW) standard
SHADED	Concentration greater than CSR Drinking Water (DW) standard

[a] Standard to protect freshwater aquatic life.
[b] Guideline to protect freshwater aquatic life, short-term maximum (i.e. "acute").
[c] Guideline to protect freshwater aquatic life, long-term average (i.e. "chronic").
[d] Standard varies with Hardness.
[e] Standard varies with pH.
[f] Standard varies with Chloride.
[g] Standard varies with crop.
[h] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[i] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[j] There is no Zinc standard specified for H > 400; therefore, the standard for H=300-<400 is applied as a conservative comparison.

TABLE 5: Groundwater Analytical Results compared to Secondary Screening Criteria

Sample Location	Sample Date (yyyy mm dd)	Selenium µg/L
Groundwater Quality Criteria		
Guideline for Canadian Drinking Water Quality (DW)		50
Site Performance Objective: EV_ER1 (0200393)		19
Compliance Point: EV_MC2 (E300091)		28
Michel Creek		
EV_BCgw	2017 03 14	20.3
	2017 03 30	37.7
	2017 05 16	***59***
	2017 06 27	17.9
	2017 08 23	***56.8***
	2017 10 18	34.5
Elk River Distal to EVO		
EV_ER1gwS	2017 02 15	10.3
EV_ER1gwD	2017 10 24	10.5

Associated data provided by Teck Coal Ltd.
All terms defined within the body of SNC-Lavalin's report.

BOLD	Concentration greater than Canadian Drinking Water Quality guideline
SHADOW	Concentration greater than applicable Site Performance Objective
SHADED	Concentration greater than applicable Compliance Point

Appendix I-5: CMO 2017 Annual Groundwater Monitoring Summary and Recommendations

Appendix I-5: Coal Mountain Operations 2017 Annual Groundwater Monitoring

Summary

Teck Coal Ltd. (Teck, 2018) completed the 2017 Annual Report for the Coal Mountain Operations (CMO) Site Specific Groundwater Monitoring Program (SSGMP). CMO is located in southeastern British Columbia (BC), approximately 25 km southeast of the town of Sparwood, and is one of Teck's five active coal mines in the Elk Valley. The following information was taken from the 2017 CMO Annual Report, which was completed to fulfill the reporting requirements outlined in Section 10.4 of Permit 107517 (October 13, 2017).

According to the groundwater conceptual site model (CSM) for CMO described by Teck (2018), hydrostratigraphy in the valleys includes a layer of clay overlying bedrock, and a thin layer of gravel overlying clay. The clay layer can be silty, sandy, and/or bouldery, and is typically 3 to 5 m thick, but is over 10 m thick at some locations and not present at other locations. The gravel layer and relatively shallow fractured or weathered bedrock are believed to be the main water bearing units. The clay layer may be acting as a confining unit, and/or a relatively low permeability aquitard allowing the shallow gravel to potentially be perched above the deeper bedrock. Groundwater flow is largely driven by differences in topography between the mountain tops and the valley bottoms. Flow in the surficial gravel unit is currently interpreted to originate from shallow recharge along the valley walls and in the valley bottoms.

The CMO SSGMP includes a total of 15 monitoring wells located in the Michel Creek and Corbin Creek valleys and within the mine footprint which are monitored and sampled quarterly for a specific list of analytes. The wells monitored and sampled as part of the 2017 annual program are listed in Table 3 along with the associated rationale. Monitoring well locations are shown on Figure 1 attached (extracted from the 2017 CMO Annual Report). There were zero non-compliances in 2017. Groundwater quality samples were collected from all wells in all quarters of 2017, except E305217 (CM_MW4-DP). This well was frozen at the time of sampling, thus, a sample could not be collected. Samples were collected using low-flow sampling techniques. Samples collected in December and March from E305213 [CM_MW4-SH] did not pass QA/QC checks due to the turbidity and the charge balance being above acceptable levels.

CMO's groundwater data were compared to the BC Contaminated Sites Regulation (CSR) water quality standards for aquatic life, drinking water, livestock, and irrigation, in addition to surface water concentration limits or SPOs for constituents of interest from Permit 107517: cadmium (dissolved), nitrate-N, total selenium and sulphate. Eighty (individual parameter) results were elevated above at least one of the CSR standards in 2017. Groundwater quality data for CI are shown in plan view in Figures 16, 18, 20 and 22 attached (extracted from the 2017 CMO Annual Report).

Concentrations above the CSR standards were measured for barium, cadmium, chloride, fluoride, magnesium, manganese, molybdenum, nitrate, selenium, sodium, and sulphate. Concentrations of many parameters were elevated in both background wells and downstream wells and are not interpreted to be a result of mining activities. Concentrations of selenium, nitrate and sulphate in mine influenced wells are associated with elevated loadings from mining activity. The reason for the remaining exceedances is uncertain, however it may be that the bedrock in the area has naturally elevated levels of some

constituents, as observed in the well upstream of the site, CM_MW3. No synthetic additives were used during drilling of the wells. Sulfate and selenium concentrations were relatively high in shallow groundwater at the northern end of the property, in the Corbin Creek valley and Michel Creek valley (downstream of the confluence with Corbin Creek), compared to deep groundwater and locations to the southern end of the site. Deep groundwater is relatively unaffected in these areas.

Groundwater levels (thus flows) have not changed significantly from 2016.

In general, while there are some local impacts to groundwater quality around open pits or other mine facilities, the impacts are considered to be relatively insignificant. When compared to Permit 107517 secondary screening criteria (for surface water), groundwater quality was below those limits. There were some exceedances of CSR guidelines at MW7 wells adjacent to the 34 pit, but no trends of concern. Overall, groundwater contributions to surface water are considered to be minor.

An update of the SSGMP is due in 2018 and the 2017 and historical groundwater monitoring results will be used in the development of an updated plan.

Recommendations

Recommendations were made for the 2018 SSGMP, including continued monitoring at existing locations and collection of additional field blanks for quality assurance/quality control (QA/QC) as follows:

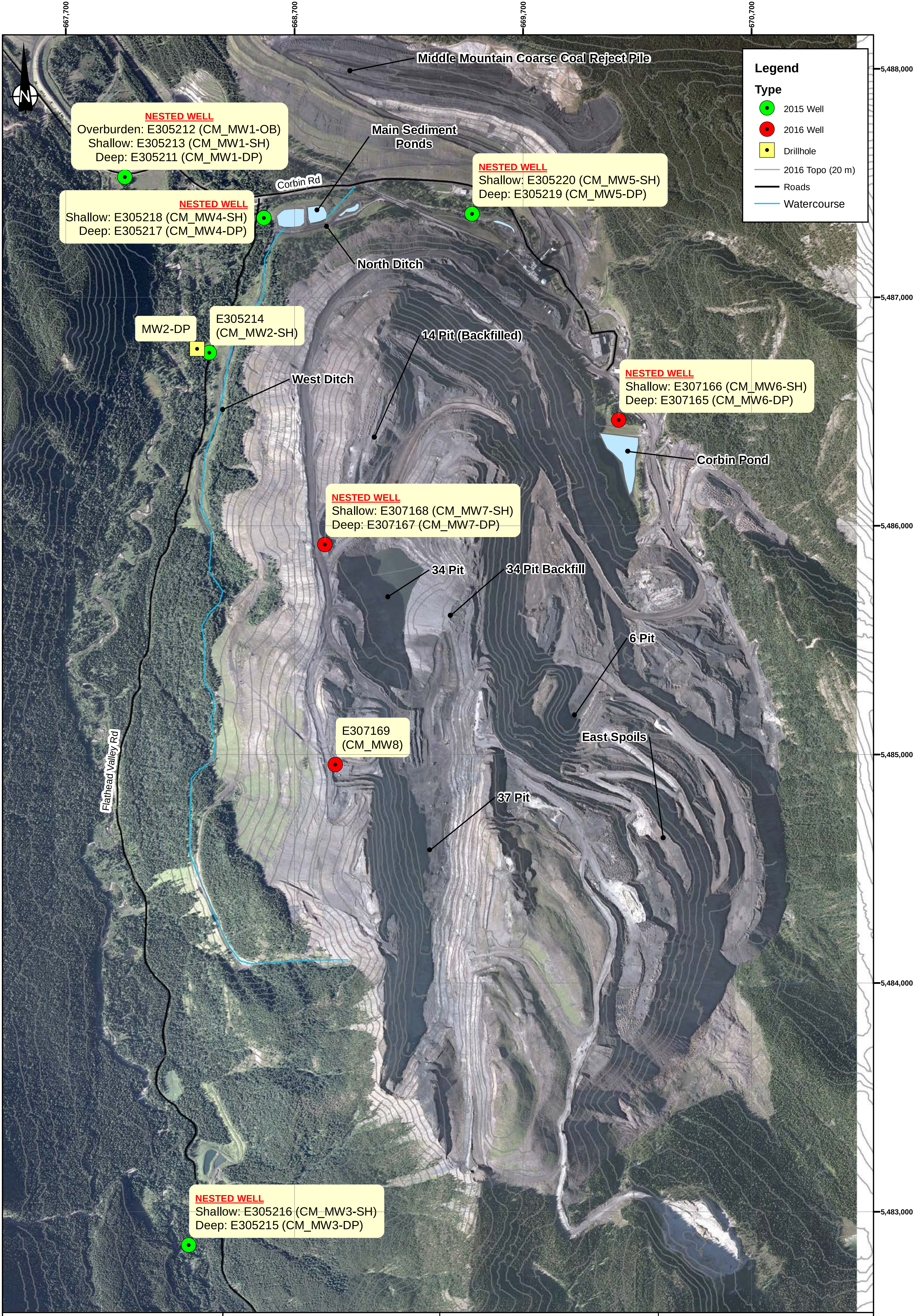
› Continue monitoring at all groundwater monitoring locations;
› Confirm collection of appropriate numbers of quality assurance samples. Add a second duplicate and field blank for monitoring rounds that exceed ten (10) samples;
› Conduct internal review of anomalous (outlier) data as quickly as possible after receipt of the laboratory data; and
  For the 2018 annual monitoring report, review data at E307168 (CM_MW7-SH) and E307167 (CM_MW7-DP) in relation to 34 Pit water level and water quality data to better assess potential effects of 34 pit seepage on groundwater quality. Assess water quality trends to determine if the observed increasing trend in cadmium continues.

Table 3: Summary of Groundwater Monitoring Locations

EMS ID	Site ID*	UTMs		Monitoring Program	Rationale	Hydraulic Conductivity (m/s)	Depth (mbgs)	Sampling/Water Level Monitoring Frequency[6]
		Easting	Northing					
E305211	CM_MW1-DP[1]	667958	5487527	Site and Elk Valley Regional	Furthest downgradient well from CMO. Provides information on valley lithology and groundwater (GW) quality, to the receiving environment from the mine, at different depths (deep bedrock, shallow bedrock and overburden).	6.0×10^{-6}	37.27	Quarterly
E305212	CM_MW1-OB[2]			Site and Elk Valley Regional		6.6×10^{-5} to 1.2×10^{-4}	4.39	Quarterly
E305213	CM_MW1-SH[3]			Site and Elk Valley Regional		1.2×10^{-7} to 2.0×10^{-7}	23.49	Quarterly
E305214	CM_MW2-SH	668327	5486758	Site	Downgradient of CMO in the Michel Creek Valley. Provides information on lithology and GW quality (influence from CMO dumps). Well is completed in overburden.	$6.9 \times 10^{-5} – 2.6 \times 10^{-4}$	4.43	Quarterly
E305215	CM_MW3-DP	668237	5482854	Site	Upgradient of CMO in the Michel Creek Valley. Provides information on lithology and background GW quality, at different depths (shallow bedrock and overburden).	$5.0 \times 10^{-8} – 4.7 \times 10^{-7}$	16.27	Quarterly
E305216	CM_MW3-SH			Site		$1.3 \times 10^{-4} – 6.5 \times 10^{-4}$	6.62	Quarterly
E305217	CM_MW4-DP	668566	5487348	Site	Downgradient of CMO in the Corbin Creek Valley. Provides information on lithology and GW quality influenced by main sediment pond at different depths (deep and shallow bedrock).	N/A[4]	28.19	Quarterly
E305218	CM_MW4-SH			Site		N/A[4]	19.05	Quarterly
E305219	CM_MW5-DP	669476	5487365	Site	Downgradient of CMO in the Corbin Creek Valley central. Provides information on lithology and GW quality influenced by 14 Pit and North ditch, at different depths (shallow bedrock and shallow overburden)	$2.2 \times 10^{-6} – 5.1 \times 10^{-6}$	25.86	Quarterly/Continuous
E305220	CM_MW5-SH			Site		$7.2 \times 10^{-5} – 1.5 \times 10^{-5}$	10.11	Quarterly/Continuous
E307166	CM_MW6-SH	670118	5486464	Site	Downgradient of Corbin Pond. Provides information on groundwater quality downgradient of Corbin Pond, spoils, and the Corbin rock drain at different depths (shallow bedrock and overburden).	$< 1 \times 10^{-7}$	20.73	Quarterly
E307165	CM_MW6-DP			Site		2×10^{-6}	41.70	Quarterly
E307168	CM_MW7-SH	668833	5485920	Site	Within the mine footprint, northwest of 34 Pit. Provides information on the water level between 34 Pit and Michel Creek and on groundwater quality of seepage from 34 pit.	$\approx 3 \times 10^{-5}$[5]	50.60	Quarterly
E307167	CM_MW7-DP			Site		3×10^{-5}	67.54	Quarterly
E307169	CM_MW8	668878	5484957	Site	Within the mine footprint, west of the northern end of 37 Pit. Provides information on the water level between 37 Pit and Michel Creek and on groundwater quality adjacent to 37 Pit.	$\approx 5 \times 10^{-9}$[5]	104.02	Quarterly

***Notes:**

1. DP = deep well completion (completed in bedrock)
2. OB = near surface overburden well completion
3. SH = shallow well completion (completed in overburden or bedrock, as noted)
4. N/A = Hydraulic tests not completed at CM_MW4 as they became flowing artesian once completed
5. ≈ = Specific hydraulic tests not completed but estimate of hydraulic conductivity made from recovery time after development/purging
6. All water levels monitored quarterly at time of sampling with the exception of CM_MW5 where both wells have a sensor for continuous monitoring



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Note: Orthophoto is from 2014 and is provided by Teck, All coordinates in UTM and contour interval is 20 m.

srk consulting	Teck	2017 Annual Groundwater Report
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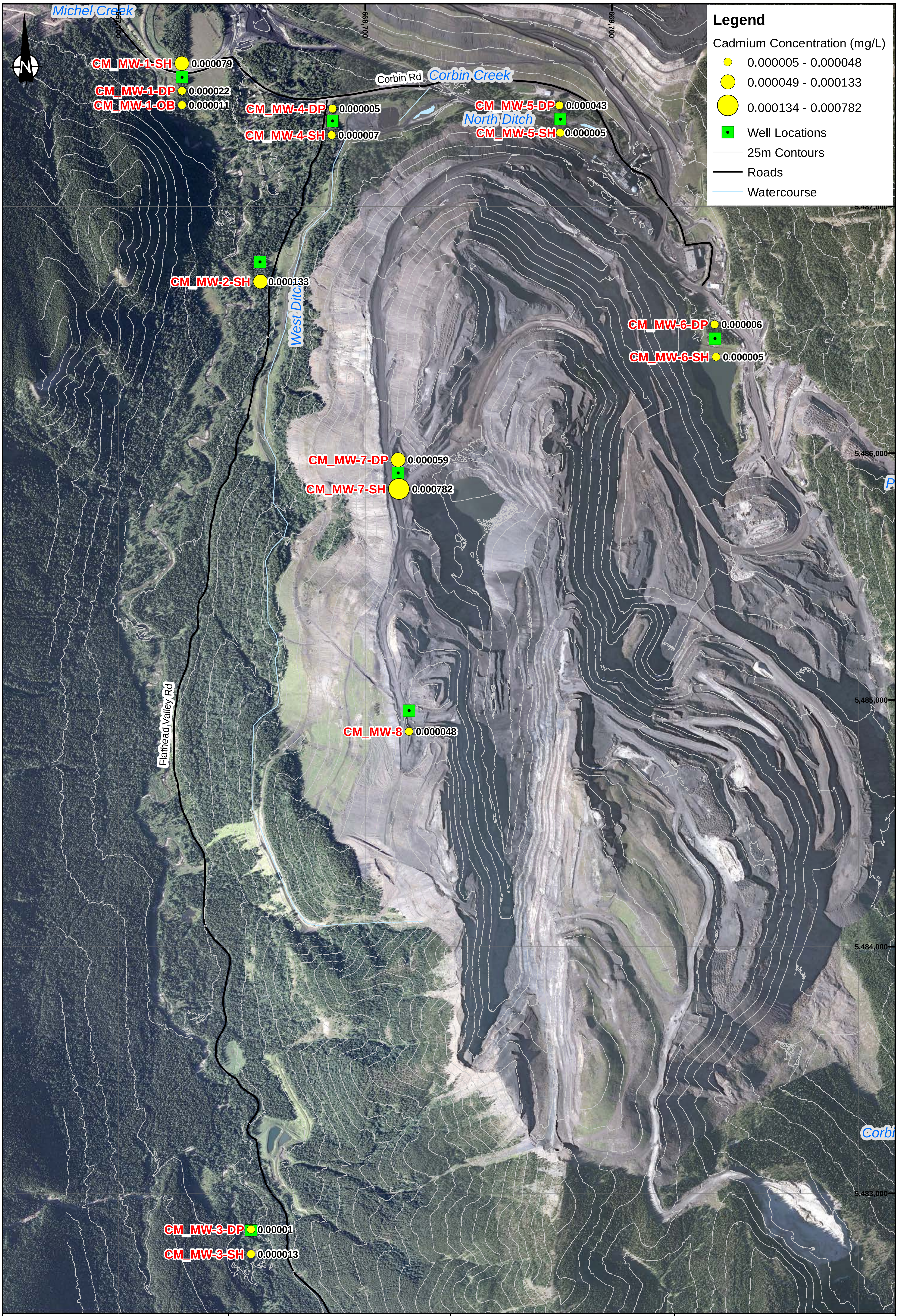
Filename: Fig1_SiteLayout_1CT017.168_rev2_eh1	Coal Mountain	Date: March 2018 · Approved: EH · Figure: 1



0 160 320 480 640 Meters

Note: Orthophoto is from 2014 and is provided by Teck, All coordinates in UTM and 2016 contours interval is 25 m.

srk consulting

Job No: 1CT017.168

Filename: 1CT017_168_coal_mtn_Fig16_CdBubble

Teck

Coal Mountain

2017 Annual Groundwater Report

Average Cadmium Concentrations in 2017 Monitoring Wells

Date:	Approved:	Figure:
March 2018	RB	16

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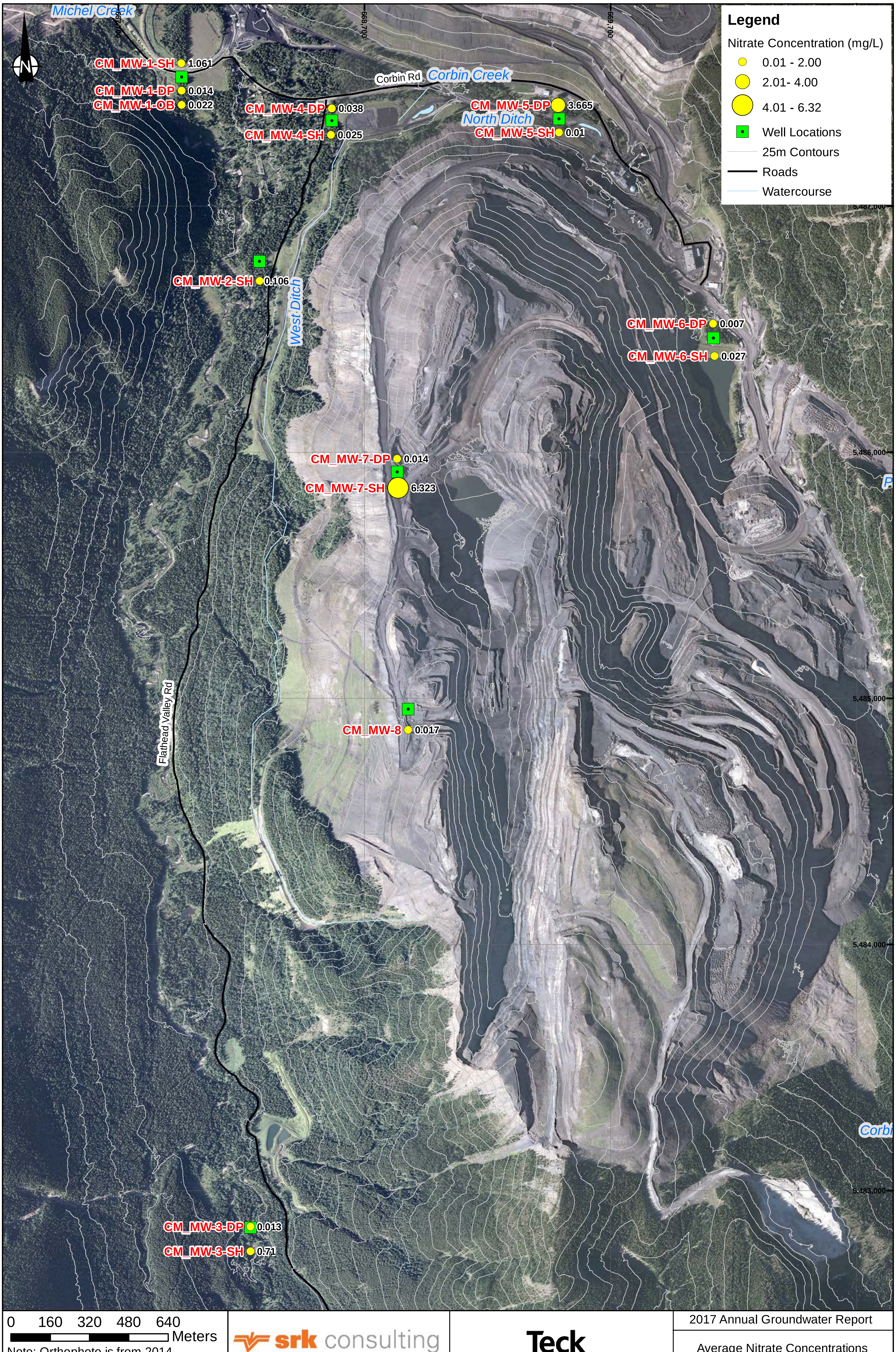

Note: Orthophoto is from 2014 and is provided by Teck, All coordinates in UTM and 2016 contours interval is 25 m.

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Teck

2017 Annual Groundwater Report

Average Nitrate Concentrations in 2017 Monitoring Wells

Job No: 1CT017.168

Filename: 1CT017_168_coal_mtn_Fig18_NO3Bubble

Coal Mountain

Date: March 2018

Approved: RB

Figure: 18

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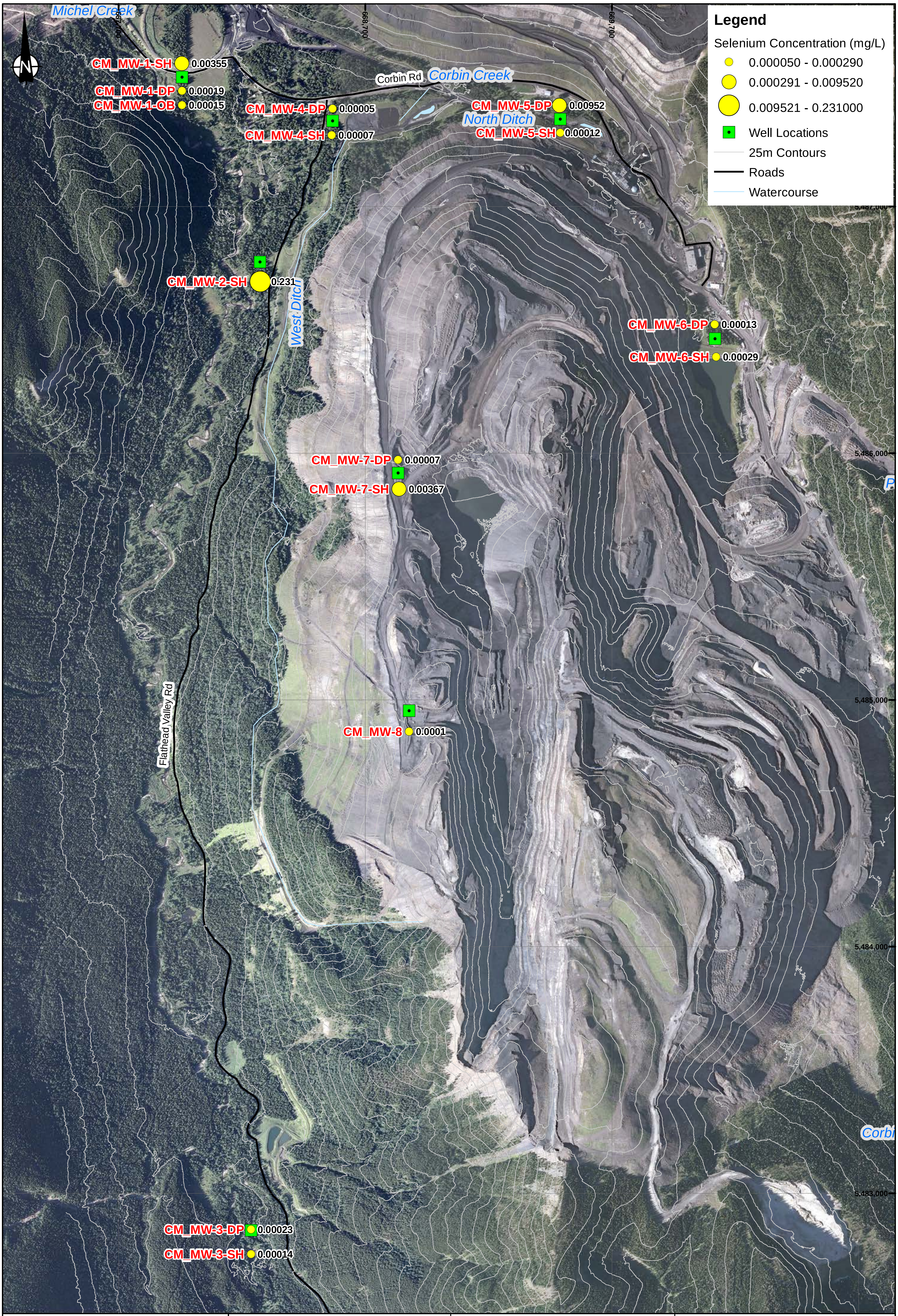

0 160 320 480 640 Meters

Note: Orthophoto is from 2014 and is provided by Teck, All coordinates in UTM and 2016 contours interval is 25 m.

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Job No: 1CT017.168

Filename: 1CT017_168_coal_mtn_Fig20_SeBubble

Teck

Coal Mountain

2017 Annual Groundwater Report

Average Selenium Concentrations in 2017 Monitoring Wells

Date:	Approved:	Figure:
March 2018	RB	20

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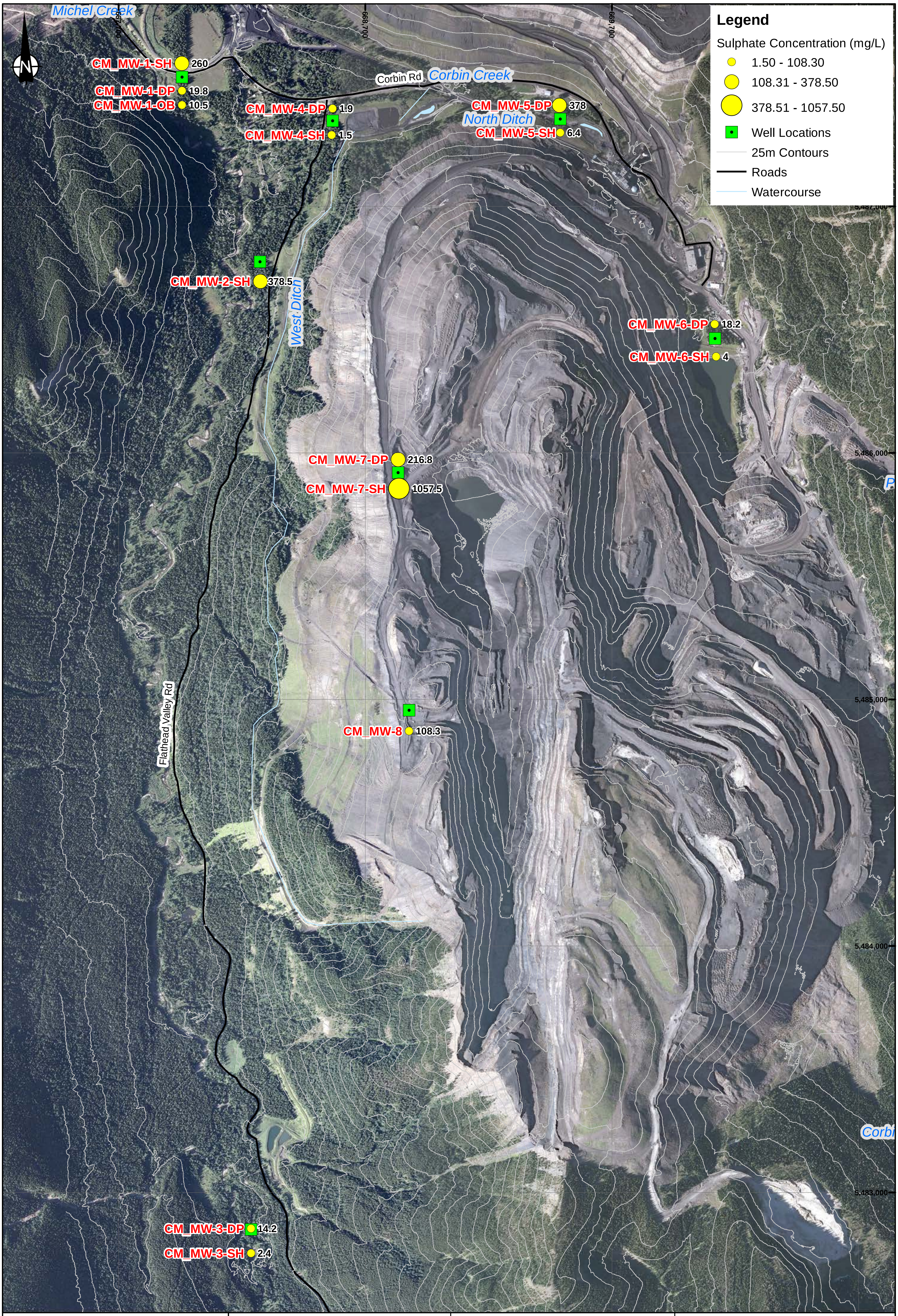

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0 160 320 480 640 Meters

Note: Orthophoto is from 2014 and is provided by Teck, All coordinates in UTM and 2016 contours interval is 25 m.

srk consulting

Job No: 1CT017.168

Filename: 1CT017_168_coal_mtn_Fig22_SO4Bubble

Teck

Coal Mountain

2017 Annual Groundwater Report

Average Sulphate Concentrations in 2017 Monitoring Wells

Date: March 2018

Approved: RB

Figure: 22

Appendix I-6: Regional Conceptual Site Model

Appendix I-6: Regional Conceptual Site Model

The Regional CSM is described below with salient points summarized in Section 2 of the main body of the report. The description below builds on the Regional CSM developed for the Synthesis Report (SNC-Lavalin, 2015) using updated information from annual groundwater monitoring data (SNC-Lavalin, 2016, 2017) and recent investigations. Localized conceptual hydrogeology discussion by Study Area and supporting data are provided in Section 5.

Geology

For reference, bedrock geology for northern and southern portions of MUs 1-4 is shown on Drawings 635544-304 and -305. Stratigraphy is summarized Table I-A and comprises Lower Cretaceous to Mississippian siliciclastic sedimentary rocks deposited in a coastal environment. The Kootenay Group hosts the coal-bearing Mist Mountain Formation and overlies the Fernie Formation, the Spray River Group, the Rocky Mountain Formation, and the Rundle Group. Open-pit mining is used to extract coal from the Mist Mountain Formation along the ridge-tops of the mountain ranges bordering the Elk Valley and tributary drainages to the east. The Alexander Creek syncline is the dominant structure within the coal-bearing units. Rocks are generally folded in large gentle folds and faulted by westward dipping thrust and normal faults, such as the Erickson normal fault. Older carbonate rocks lie to the east of the fault and younger coal-bearing rocks lie to the west. In general, the more resistant rocks are in upland areas and valley-bottoms are eroded into weaker Mesozoic rocks and faulted areas.

Table I-A: Stratigraphy of the Study Area

Geologic Period	Lithostratigraphic Units		Principal Rock Types
Lower Cretaceous	Blairmore Group		massive bedded sandstones and conglomerates
Lower Cretaceous to Upper Jurassic	Kootenay Group	Elk Formation	sandstone, siltstone, shale, mudstone, chert pebble conglomerate, minor coal
		Mist Mountain Formation	sandstone, siltstone, shale, mudstone, thick coal seams
		Morrissey Formation	fine- to coarse-grained, slightly ferruginous quartz-chert sandstone
Jurassic	Fernie Formation		shale, siltstone, fine-grained sandstone
Triassic	Spray River Group		sandy shale, shale quartzite
Permian and Carboniferous (Pennsylvanian)	Rocky Mountain Formation		quartzite, calcareous sandstone
Carboniferous (Mississippian)	Rundle Group		limestone and shale

After Golder, 2013

Surficial geology for northern and southern portions of the Study Area is inferred from soil mapping (Kelly and Sprout, 1956) and is shown on Drawings 635544-302 and -303. George et. al., 1987 provides an excellent description of the Quaternary history of the Elk Valley and, in addition to mapping, was used to infer subsurface conditions in areas where well data was not available. The Elk Valley in MUs 1-4 was ice-free for much of Quaternary Period, and underwent a single ice advance during the late Wisconsin glaciation (George et al., 1987). The advance and subsequent retreat of the ice sheet shaped the surficial landscape. The highest elevations are dominated by exposed bedrock and thin colluvial deposits, often less than a metre thick. Compact, massive morainal till deposits, ranging from about 6 m to 15 m, and thicker colluvial deposits (e.g., talus piles, weathered rock, and landslide debris) are common in middle elevations along valley flanks and locally within the valley-bottoms. In some locations, till was deposited into the main valley-bottoms by tributary glaciers.

The valley-bottoms are infilled with a mixture of overlapping glacial meltwater channels, glaciolacustrine sediments, deltaic deposits, terraces, modern fluvial sediments and till, which are generally on the order of tens of metres thick (collectively referred to as “valley-bottom deposits”). A significant portion of the Elk Valley above the confluence with the Fording River is covered by sandy glacial outwash. Below the confluence with the Fording River, surficial deposits are mostly clay-rich till, glaciolacustrine clay, and alluvial terrace deposits. Smaller alluvial fans are common at the outflow of tributary streams. Within the Elk River and Michel Creek floodplains, alluvial sediments are ubiquitous, consisting of interlayered sand, silt, gravel, and clay, with sand as the dominant component (Kelly and Sprout, 1956).

Hydrogeology

General physical hydrogeology of the Elk Valley in MUs 1-4 is discussed below.

Groundwater Recharge

In upland areas (i.e., valley flanks and ridges), rainfall and snow melt recharges groundwater at higher elevations infiltrating through relatively thin overburden, mining spoils, and bedrock. Recharge from precipitation across mine sites will be highly variable, depending on soil/bedrock hydraulic properties, water management strategies, and the presence of mine features such as spoils/dumps, pits and roads. Estimated recharge rates in upland areas of the Elk Valley ranged between 2% (Summit, 2009) and 30% (Harrison et al., 2000a, 2000b), with most water balance and numerical models using between 9 and 24% of the average annual precipitation rate.

In valley-bottoms, recharge to groundwater will be a combination of localized rainfall/snow melt in the valley-bottom and recharge from surface water where the elevation of the surface water body is higher than the groundwater phreatic surface (i.e., groundwater table).

Bedrock Hydrogeology

Groundwater occurrence in bedrock is predominantly limited to fracture flow within bedding, joints, or along faults, and groundwater flow in bedrock generally represents a relatively small contribution to the groundwater in the valley-bottoms in the Fording River and Elk Valley. Golder (2017) and Hemmera (2017) indicated that flow velocities in bedrock are approximately 1 m/year in comparison to hundreds of metres per year in overburden. The bedrock flow system can be generally divided up into shallow, intermediate and deep flow systems (SNC-Lavalin, 2015; Golder, 2014, 2015; Harrison et al., 2000a, 2000b; Forster and Smith 1988a, 1988b; Toth, 1963):

› The shallow bedrock flow system consists of groundwater present in weathered or fractured bedrock that is at or near the surface, or near the overburden contact. Groundwater in shallow bedrock is directly hydraulically connected to the overburden flow system and; therefore, localized flow in shallow bedrock is expected both within the existing mining footprint and on the flanks of the mountains.
› The intermediate bedrock flow system has longer flow paths and residence times than the shallow system, with discharge to the valley flanks and not the valley-bottoms of the main stems. The intermediate flow system is controlled by variations in bedrock permeability where more permeable units outcrop on the valley flank, such as where fractured interburden rocks exist between coal seams or overlie a lower permeability unit. Discharge from these exposures occurs along ridges or flanks of upland areas and results in surface or shallow groundwater flow in the tributary drainage; therefore, the intermediate flow system is still relatively localized and does not play an important role in regional groundwater flow.
› A deeper, regional flow system exists that ultimately discharges to the valley-bottom sediments; however, the deep system represents a relatively small portion of total regional groundwater flow. Also, residence times for the deep flow system have been modelled to be on the order of decades to millennia at LCO (Teck, 2011) and EVO (Golder, 2015). Consequently, from a water balance perspective, regional flow through deeper bedrock is negligible compared to flow through overburden.

Shallow and intermediate systems discharge to either the valley flanks or upland overburden materials on the valley flanks, and only the deep bedrock system is considered to contribute to the regional flow system. This is further supported by academic studies of groundwater flow systems:

› Harrison et al. (2000a, 2000b) indicated little to no groundwater inputs from deep bedrock to valley-bottom-sediments; and
› Gleeson and Manning (2008) indicated deep regional groundwater flow through bedrock in areas of moderate to high relief would only be important on the geologic timescale (i.e., millennia).

To support the conclusion that regional flow through bedrock is minimal, hydraulic conductivity data from bedrock hydraulic testing programs at each Operation were reviewed, compiled and presented below in Table I-B.

A geometric mean was calculated for each of the Operations; it is noted that the geometric mean at EVO includes the 55 boreholes tested using airlifting techniques (although specific hydraulic conductivity values are not shown for these locations). The following can be concluded from the data and review of the related reports:

- The geometric means for bedrock hydraulic conductivity range between 1 x 10^{-6} to 5 x 10^{-8} m/s, which is two to five orders of magnitude less than typical values for surficial sediments, with the exception of till deposits.
- Data from the extensive testing at EVO indicate a depth dependency (Golder, 2015), where shallow bedrock has a higher hydraulic conductivity than deeper bedrock. In general, this is consistent with findings at other Operations as the relatively shallower boreholes and monitoring wells had higher values than deeper. There were some exceptions where deeper boreholes at LCO and FRO indicated a higher hydraulic conductivity; however, the assessment of these locations was that the aquifer was of limited extent and therefore not connected to a regional flow system.

The hydraulic conductivity data and observed decreases with depth indicate that the bulk rock hydraulic conductivity is relatively low, and supports the concept that the relative contribution to the valley bottoms is minimal. Consequently, the Regional CSM does not consider groundwater flowing through bedrock to be important for understanding pathways of mine-influenced groundwater.

Table I-B: Summary of Relevant Hydraulic Testing Completed in Bedrock

Operation	MW or BH	MW/BH ID	Test Method	Hydraulic Conductivity [K] [m/s]	Reference	Geometric Mean K (m/s)
FRO	BH	FR_2408	Pumping Test	$3x10^{-7}$	Golder (2014)	$4x10^{-7}$
FRO	BH	FR_3001	Pumping Test	$3x10^{-8}$	Golder (2014)	
FRO	BH	FR_3041	Pumping Test	$6x10^{-8}$	Golder (2014)	
FRO	BH	FR_3109	Pumping Test	$8x10^{-7}$	Golder (2014)	
FRO	BH	FR_3109	Observation	$1x10^{-6}$	Golder (2014)	
FRO	BH	FR_3096	Pumping Test	$2x10^{-7}$	Golder (2014)	
FRO	BH	4-184	Single Well Pressure Response (Packer) Tests	3×10^{-6}	Golder (2012)	
FRO	BH	4-189	Single Well Pressure Response (Packer) Tests	7×10^{-6} – 4×10^{-5}	Golder (2012)	
FRO	BH	5-238	Single Well Pressure Response (Packer) Tests	7×10^{-8}	Golder (2012)	
FRO	BH	5-240	Single Well Pressure Response (Packer) Tests	1×10^{-8} – 2×10^{-8}	Golder (2012)	
FRO	BH	5-247	Single Well Pressure Response (Packer) Tests	2×10^{-8}	Golder (2012)	
FRO	BH	5-249	Single Well Pressure Response (Packer) Tests	8×10^{-8}	Golder (2012)	
FRO	BH	3313	Single Well Pressure Response (Packer) Tests	2×10^{-9} – 1×10^{-6}	Golder (2016)	
FRO	BH	3325	Single Well Pressure Response (Packer) Tests	3×10^{-7} – 7×10^{-6}	Golder (2016)	
FRO	BH	3326	Single Well Pressure Response (Packer) Tests	2×10^{-9} – 2×10^{-5}	Golder (2016)	
GHO	MW	GH_MW-GHC-1D	Packer Test in open BH; Slug Test - rising head	$5x10^{-5}$	Hemmera (2015)	$1x10^{-6}$
GHO	MW	GH_MW-UTC-1D	Slug test	$2.4x10^{-8}$	Hemmera (2017)	
LCO	BH	LC_RC2453	Slug Test - falling head	$1x10^{-8}$	Teck (2011)	$3x10^{-7}$
LCO	BH	LC_RC2453	Constant Rate Test @ 9 hrs	$2x10^{-7}$	Teck (2011)	
LCO	BH	LC_BR0524	Slug Test - falling head	$4x10^{-6}$	Teck (2011)	
LCO	BH	LC_BR0524	Constant Rate Test @ 8 hrs	$3x10^{-7}$	Teck (2011)	
LCO	BH	LC_MM0702	Slug Test - falling head	$2x10^{-6}$	Teck (2011)	
LCO	BH	LC_MM0702	Rate measurement from flowing artesian BHs	$7x10^{-8}$	Teck (2011)	
LCO	BH	LC_MM0901	Constant Rate Test @ 6 hrs	$3x10^{-5}$	Teck (2011)	
LCO	BH	LC_MM0909	Slug Test - falling head	$1x10^{-6}$	Teck (2011)	
LCO	BH	LC_MM0706	Rate measurement from flowing artesian BHs	$1x10^{-7}$	Teck (2011)	
LCO	MW	LCO-WLC-12-10c	Slug Test - falling head	$7.6x10^{-8}$	Szmigielski (2015)	
LCO	MW	LCO-WLC-12-06c	Slug Test - falling head	$1.4x10^{-8}$	Szmigielski (2015)	
EVO	MW	EV_BALgw	Slug Test - falling head	$1x10^{-6}$	Golder (2015)	$5x10^{-8}$
EVO	BH	22115	Constant Rate Test @ 5.5 hrs	$7x10^{-7}$	Golder (2015)	
EVO	BH	22118	Constant Rate Test @ 6 hrs	$9x10^{-6}$	Golder (2015)	
EVO	BH	22205	Constant Rate Test @ 1.8 hrs	$4x10^{-7}$	Golder (2015)	
EVO	BH	96107	Constant Rate Test @ 5 hrs	$3x10^{-6}$	Golder (2015)	
EVO	BH	55 exploration BHs	Airlift	$4x10^{-9}$ - $2x10^{-6}$	Golder (2015)	
CMO	MW	CM_MW5_DP	Slug Test - falling head	$2.2x10^{-6}$- $5.1x10^{-6}$	Teck (2017)	$2x10^{-6}$
CMO	MW	CM_MW6_DP	Slug Test - falling head	$2x10^{-6}$	Teck (2017)	
CMO	MW	CM_MW7_DP	Slug Test - falling head	$3x10^{-5}$	Teck (2017)	
CMO	MW	CM_MW7_SH	Slug Test - falling head	$3x10^{-5}$	Teck (2017)	
CMO	MW	CM_MW8	Slug Test - falling head	$5x10^{-9}$	Teck (2017)	

Overburden or Surficial Hydrogeology

As indicated above, the surficial geology within MUs 1-4 can be highly variable on the regional scale. In general, groundwater can be broadly classified into two general hydrogeologic settings for the overburden or surficial sediments:

- The upland setting, where groundwater typically occurs as a thin saturated zone in surficial deposits on the valley flanks, generally consisting of colluviums, alluvial or moraine/till deposits as well as anthropogenic deposits such as spoils. Infiltration and recharge occurs in the upland setting and consistent with topographically-driven flow and all groundwater within the upland setting eventually flows to valley-bottom surficial deposits, either as surface water or groundwater. The groundwater flow regime is generally governed by the surface of low permeability units (i.e., bedrock or low permeability till), with flow directions typically diverging along drainage divides, and groundwater discharging to mountain streams as base flow where topographic lows are present.
- The valley bottom setting, where groundwater is typically present in surficial deposits such as glaciofluvial, glaciolacustrine, and fluvial deposits, with some till and colluvium also present in valley bottoms. The valley bottom is where the main aquifers exist in the Elk Valley, with the most significant and continuous aquifers in the main stems (i.e., Elk River, Fording River, Michel Creek); however, smaller but still significant aquifers may exist in larger tributaries. Variable degrees of groundwater-surface water interaction occur in the valley-bottom, dependent on local morphology and river gradient, permeability of the underlying materials, and seasonality.

Additional discussion on each of the settings is provided in the Synthesis Report (SNC-Lavalin, 2015). The Synthesis Report also provides a detailed summary of hydraulic conductivity testing results for monitoring wells installed in various hydrostratigraphic units; Table I-C below provides a summary of ranges and typical values for hydraulic conductivities of surficial materials in the Elk Valley.

Table I-C: Summary of Hydraulic Conductivities in Surficial Sediments

Hydrostratigraphic Unit	Hydraulic Conductivity (m/s)	
	Range	Typical
Waste Rock	10^{-4}- 10^{-2}	10^{-4}
Fluvial/Glaciofluvial Sediments	10^{-8}- 10^{-3}	10^{-4}
Till (upland and valley-bottom)	10^{-9} – 10^{-6}	10^{-7}
Colluvial Deposits	10^{-5} – 10^{-3}	10^{-4}

Valley-Bottom Regional Flow Patterns

Regionally, the main valley-bottom rivers (i.e., Fording River, Elk River, Michel Creek) are gaining on a watershed basis, suggesting a net discharge of groundwater to surface water (i.e., base flow) as is expected in a topographically-driven groundwater flow regime. However, local-scale down-valley flow in the main stem valley bottoms is known to occur, resulting in groundwater recharge from a losing stream. Figure I-A shows the conceptual relationship between gaining and losing streams and groundwater, and the resultant end-member conceptual flows (i.e., base flow vs. underflow).

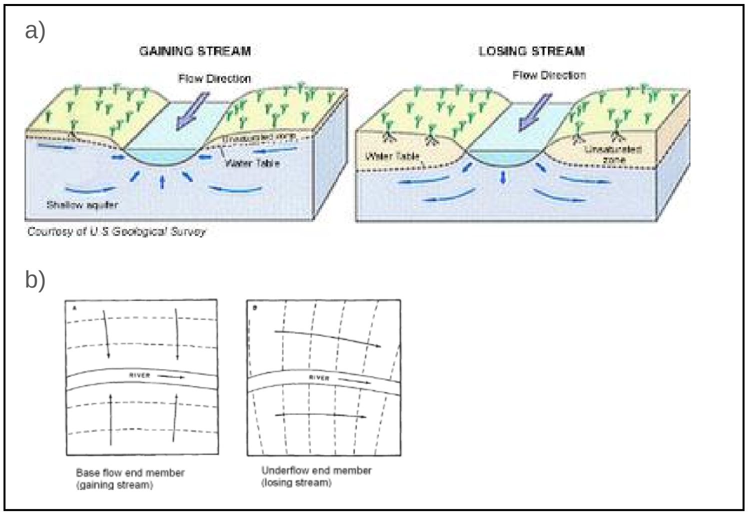

Figure I-A: Diagrams showing a) conceptual relationship between losing and gaining streams and groundwater, with resultant b) conceptual groundwater flow end-members

Within MUs 1-4, an example of underflow occurs near FRO where the Fording River seasonally dries up. Recent studies have identified an underflow component that is parallel or subparallel to the Fording River, which is supported by both groundwater contours and chemistry (see Section 5, Study Area 1 for more details). Other evidence for a local-scale down-valley flow component resulting in groundwater recharge from surface water is the similarity in water quality between a number of groundwater wells and the nearby surface water body (e.g., Elk River and RG_DW-02-20 in Study Area 7, Elk River and EV_ER1gwS/D in Study Area 12; see Section 5 for more details).

While these examples provide evidence for an underflow component resulting in down-valley flow, they are local in scale and the potential for 'regional' groundwater flow via underflow is low. The groundwater flow direction would roughly parallel the valley and the river or creek can provide continuous recharge to the underlying sediments.

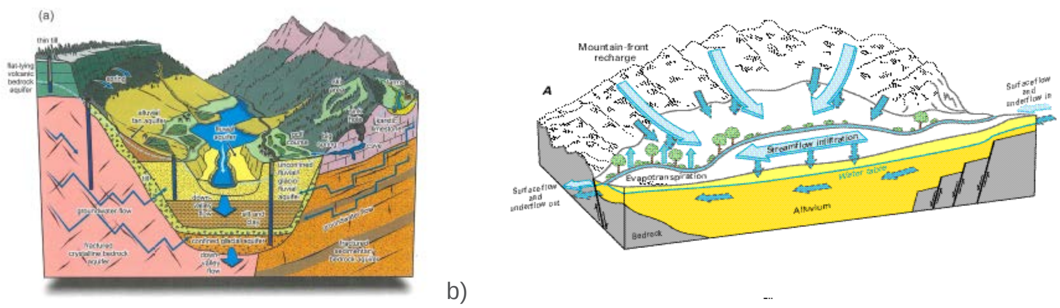

Figure I-B: Diagrams showing underflow and resultant down-valley flow in valley bottoms in a mountainous environment (Sources: a): Canada's Groundwater Resources, Alfonso River 2014; and, b): Groundwater Atlas of the United States, USGS 2016)

However, in the Elk Valley, groundwater regularly interchanges with surface water through frequent local scale recharge and discharge (see Figure I-C). Surface water-groundwater interaction has a high degree of spatial and temporal variability as it is dependent on a number of variables including relative levels in the river and groundwater system, river morphology, river gradient, hydraulic properties of the streambed and valley-bottom deposits, distance from river and pumping from wells. The likelihood for groundwater recharge from surface water is anticipated to be seasonal and highest when freshet occurs.

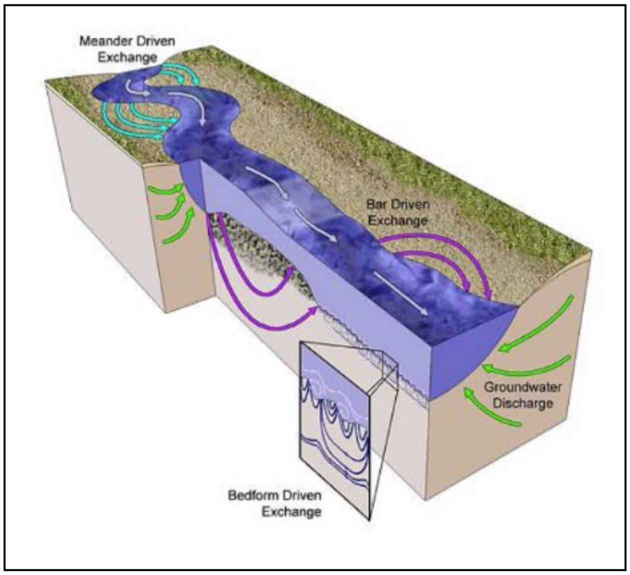

Figure I-C: Diagram showing local-scale exchange between groundwater and surface water (from Golder, 2017)

Delineation of Valley-Bottom Sediments in Main Stems

Because the main stem valley bottoms are the only features that span the region of MUs 1-4, regional flow is only considered possible in the down-valley direction of the main stem valley-bottoms. In the Synthesis Report (SNC-Lavalin, 2015), the extent of the valley-bottom aquifers was approximated and mapped. This mapping was performed qualitatively using topography, morphology, and interpreted surficial geology. In some cases, where fluvial terrace deposits, alluvial fans, or glaciofluvial channels were present, the valley-bottom was extended to include the lower slope of the adjacent upland. The interpreted extent of the valley-bottom aquifers, along with groundwater level data from Q4 2017 for wells in the RGMP, is presented in Drawings 635544-306 and -307, along with vulnerability and aquifer-risk mapping for surficial aquifers in the Elk Valley using the BC aquifer classification system (BC MWLAP, 2002).

Mining Influences on Regional Groundwater Quality

Results from the 2015 and 2016 Annual Regional Groundwater Monitoring Reports indicated that mining influences on groundwater currently exist in MUs 1-4; the evidence for this was elevated CI concentrations above screening criteria at a number of monitoring locations. In general, the best indicator of mine-influenced groundwater was the assemblage of nitrate, sulphate, and dissolved selenium.

The Regional CSM considers the influence or potential influence that Teck’s Operations may have on groundwater quality in the main stem valley bottoms. Although down-valley flow is considered to be local due to heterogeneity, the main stem valley bottom sediments are considered the primary potential pathway for regional transport of mine-influenced groundwater. This is because of the presence of relatively continuous transmissive units, larger saturated thicknesses and high degree of interaction with surface water elevated in mining-related constituents.

In the main stem valley bottom, transport and discharge is expected on the local scale (i.e., 10s of metres to kilometres), but not on the regional scale (i.e., 10s to 100s of kilometres). In addition, mixing with additional inputs of groundwater occurs along the valley, leading to dilution of mining-related constituents in groundwater down-valley from sources of CI.

Groundwater Transport Pathways

Groundwater transport of CI to the valley bottoms of the main stems can occur from potential sources in upland areas; however, typically, groundwater transport from upland areas is minimal and tributary surface water transport is dominant due to one or more of the following factors: low permeability overburden; steep relief; or thin or non-existent overburden. There are some cases where the thickness and permeability of the valley bottom sediments in a tributary can be sufficient enough to transport CI in groundwater. Down-valley flow in the tributary can occur, and transport to the valley bottom is independent of surface water transport (e.g. Kilmarnock Creek; see Study Area 1, Section 5). Figure I-D below provides an illustration of this.

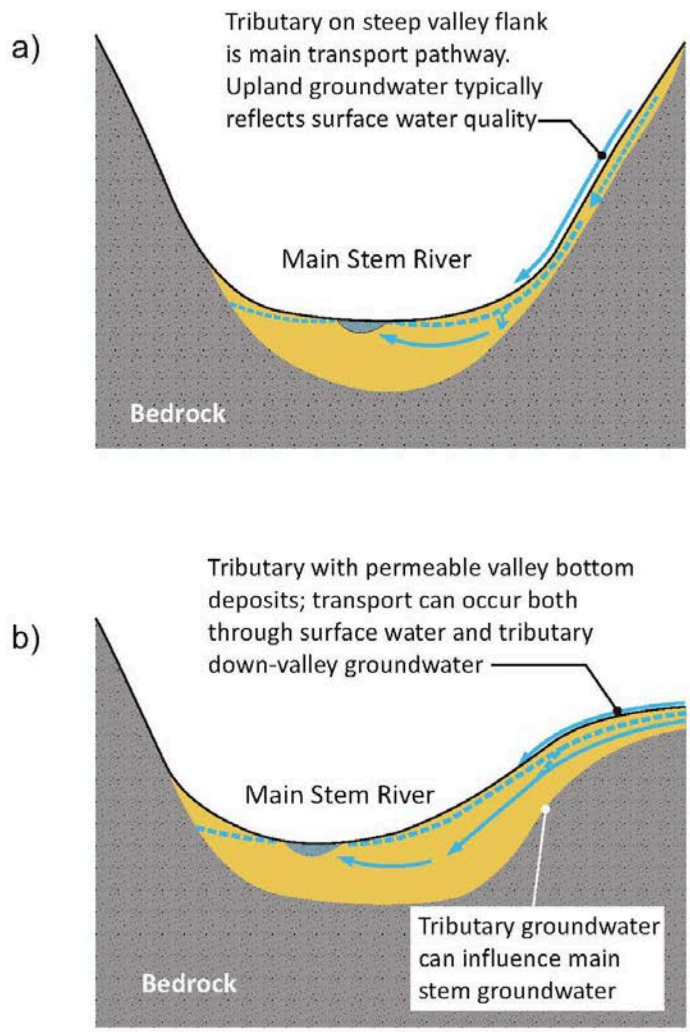

Figure I-D: Diagrams showing Conceptual Transport of CI to Valley Bottom

In Figure I-Ca, tributary surface water is the main transport pathway to the valley bottom. Tributary surface water infiltration can locally affect groundwater quality in both the tributary and main stem sediments. Figure I-Cb shows a tributary that has permeable sediments in the valley bottom, such as glaciofluvial sediments. These tributaries can be large and have an alluvial fan that extends to the valley-bottom. In this scenario, groundwater transport from the tributary valley bottom sediments can occur as well as infiltration of tributary surface water.

Both of these transport scenarios can lead to localized areas of mine-influenced groundwater in the valley bottom and these are referred to as “the groundwater pathway” (formerly called “source release to groundwater”). Potential sources and transport pathways of CI to the main stem valley-bottoms have been developed/defined on the local scale for each Study Area; these are summarized in Section 5.

Groundwater Recharge from Surface Water

Surface water in the main stems through MUs 1-4 exhibits mining influence. Results from the Drinking Water Evaluation (SNC-Lavalin, 2014) indicated that groundwater distal to Operations can be elevated in CI due to groundwater recharge from surface water in these main stems. This is because of the high degree of interchange with shallow groundwater that occurs in the valley bottoms. Local-scale groundwater recharge from surface water may result in CI concentrations reflective of surface water (i.e., "the surface water pathway"). Unless additional loading of CI occurs along the valley bottom, groundwater quality distal to source inputs is expected to be similar to surface water. Examples, along with supporting data are discussed in Section 5.

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Appendix II

Borehole Logs

DATA ENTRY: KJM

PROJECT No.: 09-1324-1039

RECORD OF MONITORING WELL: 09-01A

SHEET 1 OF 1

LOCATION: East of Old Stream Bed Kilmarnock Alluvium

BORING DATE: October 14, 2009

DATUM: Local

BORING METHOD: Barber Rig - DR-24 - 9" Hole Diameter; Beck Drilling and Environmental Services Ltd.

DEPTH SCALE METRES	DESCRIPTION	ELEV. / DEPTH (m)	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface	1584.1	Stickup =0.85 m
0	Silty SAND, trace gravel, loose, dry, light brown	0.0	
	Sandy GRAVEL, trace silt, loose, moist, medium brown	1583.6 / 0.5	Bentonite
2	Clayey SILT, some sand and gravel, soft, low to medium plasticity, moist, medium brown	1582.1 / 2.0	
	Sandy GRAVEL, loose, moist, medium brown	1581.6 / 2.5	Granular Filter; Slotted Section; Oct. 16, 2009 ∇; Slough
8	End of MONITORING WELL.	1575.7 / 8.4	

Column headings: SOIL PROFILE; SAMPLES (NUMBER, TYPE, BLOWS/0.3m); DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - O; 10, 20, 30, 40); HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}); WATER CONTENT PERCENT (Wp, W, Wl; 10, 20, 30, 40); ADDITIONAL LAB. TESTING; STRATA PLOT.

Depth scale: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

DEPTH SCALE

1 : 100

Golder Associates

LOGGED: EA

CHECKED: MB

PROJECT No.: 09-1324-1039

RECORD OF MONITORING WELL: 09-01B

LOCATION: East of Old Stream Bed Kilmarnock Alluvium

BORING DATE: October 14, 2009

DATUM: Local

BORING METHOD: Barber Rig - DR-24 - 9" Hole Diameter; Beck Drilling and Environmental Services Ltd.

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	ELEV. / DEPTH (m)	PIEZOMETER OR STANDPIPE INSTALLATION
			Stickup =0.76 m
0	Ground Surface	1584.1	
	Silty SAND, trace gravel, loose, dry, light brown	0.0	
	Sandy GRAVEL, trace silt, loose, moist, medium brown	1583.6 / 0.5	
2	Clayey SILT, some sand and gravel, soft, low to medium plasticity, moist, medium brown	1582.1 / 2.0	
	Sandy GRAVEL, loose, moist, medium brown	1581.6 / 2.5	Bentonite
4			
6			
			Oct 16, 2009 ▽
8			
10	Coarse GRAVEL, trace sand, loose, saturated, grey to medium brown	1574.1 / 10.0	Slough
12	— Some silty sand from 12.5 to 13.0 m		
14			
16			Bentonite
			Slotted Section
18	— Medium to coarse gravel, light grey to brown from 18.0 to 23.0 m		
			Slough
20			

Column headings also printed: SAMPLES (NUMBER, TYPE, BLOWS/0.3m); DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - O (10, 20, 30, 40); HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}); WATER CONTENT PERCENT Wp ⊢—O W—⊣ Wl (10, 20, 30, 40); ADDITIONAL LAB. TESTING; STRATA PLOT.

CONTINUED NEXT PAGE

DEPTH SCALE 1 : 100

Golder Associates

LOGGED: EA

CHECKED: MB

DATA ENTRY: KJM

PROJECT No.: 09-1324-1039

RECORD OF MONITORING WELL: 09-01B

LOCATION: East of Old Stream Bed Kilmarnock Alluvium

BORING DATE: October 14, 2009

DATUM: Local

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - O (10 20 30 40)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp —O W— Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
20	Barber Rig - DR-24 - 9" Hole Diameter; Beck Drilling and Environmental Services Ltd.	Coarse GRAVEL, trace sand, loose, saturated, grey to medium brown *(continued)*									
22											
24											Slough
26											
28		— Silty sand, saturated, medium brown from 28.5 to 29.0 m		1555.1							
		End of MONITORING WELL.		29.0							
30											
32											
34											
36											
38											
40											

DEPTH SCALE
1 : 100

Golder Associates

LOGGED: EA
CHECKED: MB

BRITISH COLUMBIA

TABLE A-1 - Detailed Well Record For Well #3

Well Tag Number: 819
Driller: R. J. Drilling
Owner: FORDING COAL LTD PUR
WELL LOCATION:
KOOTENAY Land District
District Lot: 6687 Plan: Lot:
BCGS Number (NAD 27): 082J006421 Well: 2 WATER QUALITY:
Diameter: 6.0 inches
Well Depth: 40 feet

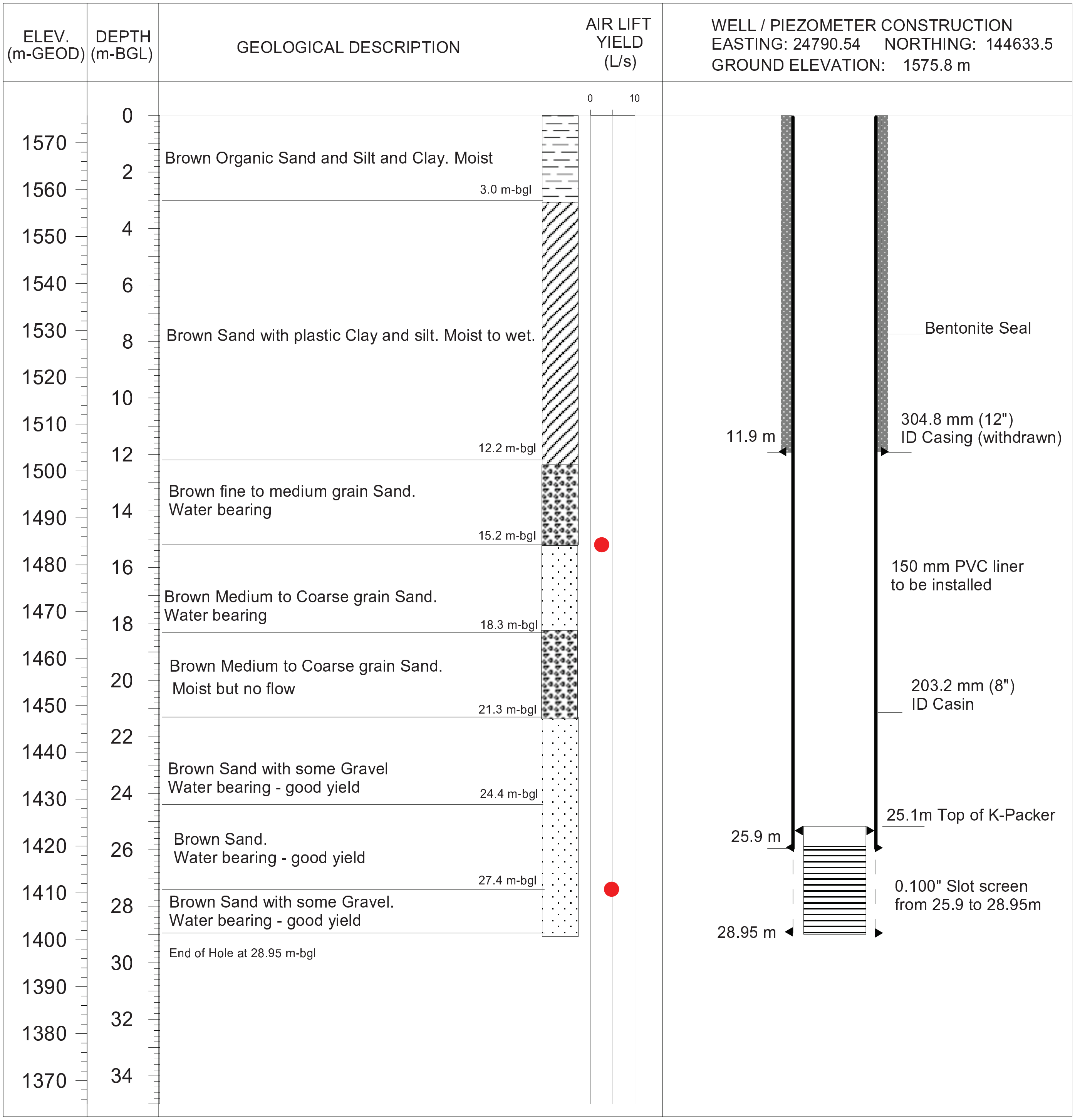
GENERAL REMARKS:
YIELD: 80 GPM COMMERCIAL & INDUSTRIAL

LITHOLOGY INFORMATION:

From 0 to 15 Ft. TILL
From 15 to 40 Ft. GRAVEL

H:\Project\3149\Well_Log\[Web_log.xls]819(well#3)

H:\Project\3149\Well Log\Drilled Well4 Greenhouse.grf



LEGEND

- Overburden
- Clay
- Sand

DRILLING CONTRACTOR:	J.R. Drilling Ltd.
DRILLING METHOD:	DUAL ROTARY / AIR HAMMER
START DATE:	08-Nov-12
END DATE:	09-Nov-12
HYDROGEOLOGY:	Eric Pastora

KERR WOOD LEIDAL ASSOCIATES LTD.
HYDROGEOLOGICAL ASSESSMENT
FORDING RIVER GREENHOUSE, ELKFORD, BC

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

HYDROGEOLOGICAL LOG FOR WELL No 4

BY	DATE
EP	DEC 12
APPROVED	FIG.
ATH	1

DATA ENTRY: VI

PROJECT No.: 11.1348.0020.2000

RECORD OF BOREHOLE: GA-HMW5

SHEET 1 OF 1

LOCATION: See Location Plan

N: 655476 E: 5567514

BORING DATE: August 09, 2011

DATUM: Geodetic

BORING METHOD: Barber Rig H24 Air Rotary; BECK Drilling & Environmental Services Ltd.

DEPTH SCALE METRES	DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	TYPE	PIEZOMETER OR STANDPIPE INSTALLATION
0	Ground Surface	1785.20			
0	Very loose, non-plastic, dry, grey to brown, loose grained to cobble size GRAVEL, non-cohesive with some medium grained, angular to subangular, (with little matrix) (ALLUVIUM)	0.00			
			1	GRAB	13 Aug 2011 ∇
	--- Soft, low plasticity, damp, non-cohesive, with more grey CLAY				
			2	GRAB	
	Hard layer, angular fragments, low returns GRAVEL	1778.50			
	Very loose, low plasticity, damp, grey to brown, loose grained to cobble size GRAVEL, non-cohesive with some medium grained, angular to subangular (with little matrix) (ALLUVIUM)	6.90			
			3	GRAB	
	--- Clay becomes dark brown, damp, cohesive and very dense				
			4	GRAB	
	Very loose fragments (drill cut-up), wet, massive, light to dark grey, angular BEDROCK	1774.50 10.70			
			5	GRAB	
	End of BOREHOLE.	1772.40 12.80			

Column headings: DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa (nat V. + Q - ●; rem V. ⊕ U - O) (20 40 60 80); HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT (Wp —O W— Wl) (10 20 30 40); ADDITIONAL LAB. TESTING; STRATA PLOT; BLOWS/0.3m

DEPTH SCALE

1 : 75

Golder Associates

LOGGED: TC

CHECKED: JW

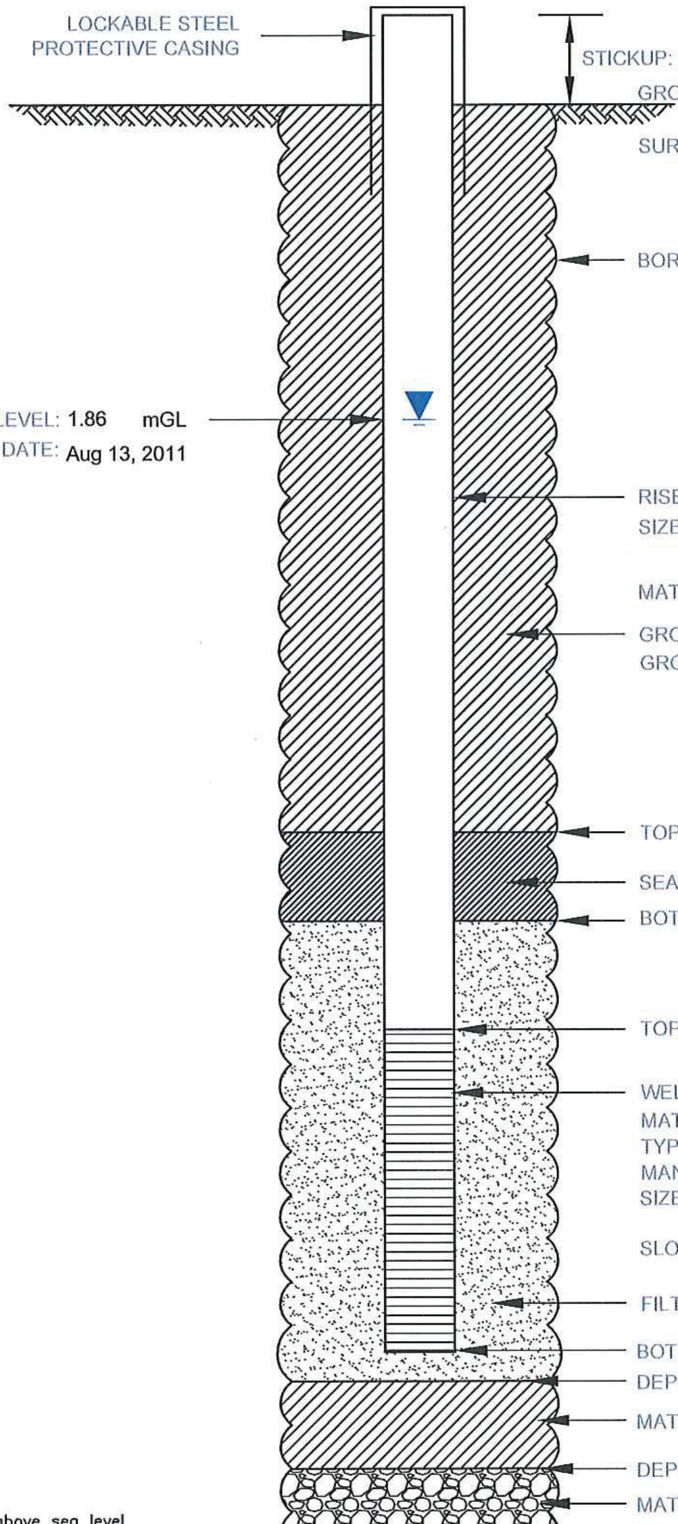
FR_HMW5

MONITORING WELL CONSTRUCTION DETAILS

Short Well ID		
H5	Well Owner: Teck Coal Fording River Operations Well Name: GA-HMW5	Spud Date: Aug 9, 2011 Project Short Title: Teck Coal FRO - Henretta Project Number: 11.1348.0020-1000-2000 Site Geologist: T.Crowell

Drilling Method:	Development:	
Air Rotary	Method: Air Lift	Duration: 1.75 Hours

SCHEMATIC ONLY–NOT TO SCALE



NOTES:
1. masl – metres above sea level
2. mGL – metres below ground level
3. TD – Total Depth

Golder Associates

File Path: R:\Active_2011\1348\11-1348-0020 Teck Coal Henretta Ridge Assessment\Phase 2000 Drilling Report\Final

PROJECT No.: 11.1422.0052

RECORD OF MONITORING WELL: GA-MW-01

LOCATION: See Location Plan

N: 5554750 E: 648019

BORING DATE: September 21, 2012

DATUM: UTM Zone 11 (Nad 83)

Column headings (no values recorded in these columns): DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa — nat V. + Q - ●, rem V. ⊕ U - O (20, 40, 60, 80); HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}); WATER CONTENT PERCENT Wp — W — Wl (10, 20, 30, 40); ADDITIONAL LAB. TESTING

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface	1357.00				Stick-up = 1.05 m
0	Barber Rig – Air Rotary; Tervita	(SP) SAND, coarse-grained, sub-angular, poorly-graded, dark grey	0.00				
2				1	GRAB		
4		(GP) CLAYEY GRAVEL, coarse-grained, poorly-graded, sub-rounded clay, brown, firm	1353.00 / 4.00				
5							Bentonite Pellets
6.5				2	GRAB		
9		(SP) SAND, coarse-grained, poorly-graded, trace gravel, sub-angular, trace clay, dark grey	1348.00 / 9.00				
9.5				3	GRAB		
10							

CONTINUED NEXT PAGE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: TG

CHECKED: JW

PROJECT No.: 11.1422.0052

RECORD OF MONITORING WELL: GA-MW-01

LOCATION: See Location Plan

N: 5554750 E: 648019

BORING DATE: September 21, 2012

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	PIEZOMETER OR STANDPIPE INSTALLATION
10	Barber Rig – Air Rotary, Tervita	(SP) SAND, coarse-grained, poorly-graded, trace gravel, sub-angular, trace clay, dark grey *(continued)*				
12						Bentonite Pellets
				4	GRAB	
15						10/20 Sand
15		(SC) CLAYEY SAND, medium-grained, poorly-graded, dark grey	1342.00 15.00			
16						Slotted Section 10/20 Sand
17				5	GRAB	23 Sep 2012 ∇
19		(SP) SAND, coarse-grained, sub-angular, poorly-graded, dark grey	1338.00 19.00			Bentonite Pellets
				6	GRAB	
20						

Column headings also printed (no data on this sheet): SOIL PROFILE; STRATA PLOT; SAMPLES; BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - O (20 40 60 80); HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢ OW ⊣ Wl (10 20 30 40); ADDITIONAL LAB. TESTING

CONTINUED NEXT PAGE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: TG

CHECKED: JW

PROJECT No.: 11.1422.0052

RECORD OF MONITORING WELL: GA-MW-01

LOCATION: See Location Plan

N: 5554750 E: 648019

BORING DATE: September 21, 2012

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa (nat V. + Q- ● rem V. ⊕ U- O) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp — W — Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
20	Barber Rig – Air Rotary, Tervita	(SP) SAND, coarse-grained, sub-angular, poorly-graded, dark grey *(continued)*									
21					6	GRAB					Bentonite Pellets
22		— Bedrock at 22.6 m		1334.40 / 22.60	7	GRAB					
		End of MONITORING WELL.									
23		NOTES: Hit BEDROCK at 22.6 m. Standpipe installed to 18.6 m. Groundwater level measured at at 17.5 mGL on September 23, 2012.									
24											
25											
26											
27											
28											
29											
30											

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TG
CHECKED: JW

PROJECT No.: 11.1422.0052

RECORD OF MONITORING WELL: GA-MW-02

LOCATION: See Location Plan

N: 5552115 E: 648291

BORING DATE: September 19, 2012

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢ O W ⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		1310.00							Stick-up = 1.02 m
0	Barber Rig – Air Rotary, Tervita	(SP) SAND, coarse-grained, trace fine gravel, angular, poorly-graded, grey		0.00							
					1	GRAB					
											19 Sep 2012 ∇
5		(GP) GRAVEL, coarse-grained, sub-rounded, brown		1305.00 5.00							Bentonite Pellets
					2	GRAB					
7		(CI) SILTY CLAY, some fine gravel, brown, cohesive, water content is close to plastic limit, very soft		1303.00 7.00							
					3	GRAB					
10				1300.00							

CONTINUED NEXT PAGE

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TG
CHECKED: JW

PROJECT No.: 11.1422.0052

RECORD OF MONITORING WELL: GA-MW-02

LOCATION: See Location Plan

N: 5552115 E: 648291

BORING DATE: September 19, 2012

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	BLOWS/0.3m	PIEZOMETER OR STANDPIPE INSTALLATION
10	Barber Rig – Air Rotary, Tervita	(GW) GRAVEL, coarse-grained, sub-angular, well graded, grey		10.00				
					4	GRAB		
11.50		(CI) SILTY CLAY, with some fine gravel, brown, cohesive, very soft, w~PL		1298.50 / 11.50				
					5	GRAB		Bentonite Pellets
17.20		(SP) SAND, coarse-grained, some fine gravel, angular, poorly-graded, dark grey		1292.80 / 17.20				
					6	GRAB		
19.50		(GW) GRAVEL, coarse-grained, sub-angular, well graded, grey		1290.50 / 19.50				
					7	GRAB		

Other column headings: DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - O; 20, 40, 60, 80); HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}); WATER CONTENT PERCENT (Wp, W, Wl; 10, 20, 30, 40); ADDITIONAL LAB. TESTING

CONTINUED NEXT PAGE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: TG

CHECKED: JW

PROJECT No.: 11.1422.0052

RECORD OF MONITORING WELL: GA-MW-02

LOCATION: See Location Plan

BORING DATE: September 19, 2012

DATUM: UTM Zone 11 (Nad 83)

N: 5552115 E: 648291

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE – DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES – NUMBER	TYPE	BLOWS/0.3m	PIEZOMETER OR STANDPIPE INSTALLATION
20	Barber Rig – Air Rotary / Tervita	(GW) GRAVEL, coarse-grained, sub-angular, well graded, grey *(continued)*					Bentonite Pellets
21				7	GRAB		10/20 Sand
23		(ML) SILT, some fine gravel, trace coarse gravel, dark grey, non-cohesive, dry	1287.00 / 23.00	8	GRAB		
24		(SP) SAND, coarse-grained, some fine gravel, angular, poorly-graded, dark grey	1286.00 / 24.00				
26				9	GRAB		Slotted Section 10/20 Sand
28		— Bedrock at 28.5 m					
29		(SP) SAND, coarse-grained, coarse gravel, bits of bedrock, sub-angular, poorly-graded, light grey	1280.50 / 29.60	10	GRAB		Bentonite Pellets
30		End of MONITORING WELL.					

NOTES:
Encountered BEDROCK at 28.5 m.
Standpipe installed to 29.0 m.
Groundwater level measured at 11.0 mGL on September 19, 2012.

Column headings also include: DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - O (20 40 60 80); HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢—O W—⊣ Wl (10 20 30 40); ADDITIONAL LAB. TESTING; STRATA PLOT.

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: TG

CHECKED: JW

PROJECT No.: 11.1422.0052

RECORD OF MONITORING WELL: GA-MW-04

LOCATION: See Location Plan

N: 5552963 E: 648217

BORING DATE: September 20, 2012

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢—O W—⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		1304.00							Stick-up = 0.9 m
0	Barber Rig – Air Rotary; Tervita	(SP) GRAVELLY SAND, coarse-grained, fine gravel, sub-angular, poorly-graded, dark grey		0.00							
4.5					1	GRAB					
5											Bentonite Pellets
5.9											24 Sep 2012 ∇
9		(SM) SILTY SAND, medium to fine-grained, sub-rounded, poorly-graded, brown and dark grey		1295.00 9.00							
9.5					2	GRAB					
10				1294.00							

CONTINUED NEXT PAGE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: TG

CHECKED: JW

PROJECT No.: 11.1422.0052

RECORD OF MONITORING WELL: GA-MW-04

LOCATION: See Location Plan

N: 5552963 E: 648217

BORING DATE: September 20, 2012

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH Cu, kPa	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10	Barber Rig – Air Rotary, Tervita	(SP) GRAVELLY SAND, coarse-grained, fine gravel, sub-angular, poorly-graded, dark grey		10.00							Bentonite Pellets
12					3	GRAB					
13											10/20 Sand
14		(SM) SILTY SAND, medium to fine-grained, sub-rounded, poorly-graded, brown and dark grey		1290.00 14.00	4	GRAB					
		(GW) GRAVEL, fine with coarse, sub-angular to sub-rounded, well graded, grey		1289.50 14.50							Slotted Section 10/20 Sand
16					5	GRAB					
17		(SP) GRAVELLY SAND, coarse-grained, fine gravel, poorly-graded, sub-angular, dark grey		1287.00 17.00	6	GRAB					Bentonite Pellets
		End of MONITORING WELL.		17.20							

Chart scales: Dynamic penetration 20, 40, 60, 80; Shear strength nat V. + Q - ● rem V. ⊕ U - O, 20, 40, 60, 80; Hydraulic conductivity 10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}; Water content Wp ⊢—O W—⊣ Wl, 10, 20, 30, 40.

NOTES:
Standpipe installed to 16.7 m.
Groundwater present at 6.0 m on September 24, 2012.

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TG
CHECKED: JW

PROJECT No.: 11.1422.0052

RECORD OF MONITORING WELL: GA-MW-3S

LOCATION: See Location Plan

N: 5550296 E: 648578

BORING DATE: September 23, 2012

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp —O W— Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Barber Rig – Air Rotary; Tervita	Ground Surface		1294.00							
		(SP) SAND, coarse-grained, sub-angular, poorly-graded, dark grey, homogenous, moist		0.00							
2					1	GRAB					
3											Bentonite Pellets
4.5		(SP) GRAVELY SAND, coarse-grained, fine gravel, poorly-graded, sub-angular, grey		1289.50 / 4.50							
7											10/20 Sand
7					2	GRAB					
											23 Sep 2012 ∇
9											Slotted Section 10/20 Sand
10											

CONTINUED NEXT PAGE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: TG

CHECKED: JW

PROJECT No.: 11.1422.0052

RECORD OF MONITORING WELL: GA-MW-3S

LOCATION: See Location Plan

N: 5550296 E: 648578

BORING DATE: September 23, 2012

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH Cu, kPa	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10	Barber Rig – Air Rotary / Tervita	(SP) GRAVELY SAND, coarse-grained, fine gravel, poorly-graded, sub-angular, grey *(continued)*									
11					3	GRAB					
12											Slotted Section 10/20 Sand
13					4	GRAB					
14				1279.60 / 14.40							Bentonite Pellets
		End of MONITORING WELL.									
		NOTES: Encountered BEDROCK at 14.4 m									
15											
16											
17											
18											
19											
20											

Dynamic penetration scale: 20 40 60 80. Shear strength: nat V. + Q - ●, rem V. ⊕ U - O; 20 40 60 80.
Hydraulic conductivity: 10^{-6} 10^{-5} 10^{-4} 10^{-3}. Water content: Wp ⊢—O W—⊣ Wl; 10 20 30 40.

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: TG

CHECKED: JW

Log of Monitoring Well: GH_MW-ERSC-1

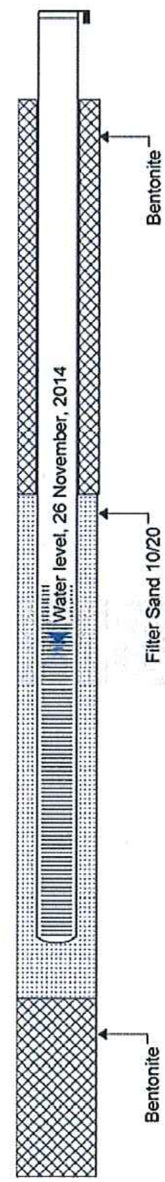
HEMMERA

Project Name/No: Greenhills Ops Elkford BC/577-016.04
Drilling Company: JR Drilling
Client: Teck Coal Ltd.
Drilling Method: Dual air rotary
Date Drilled: November 24, 2014
Logged by: RM
Site Location: Greenhills Operations, BC

SUBSURFACE PROFILE: Description	Depth/Elev (m)	Sample ID	Analysed Y,N	Sample Type	Vapour ppm (0 250 500)	LEL % (0 50 100)
Ground Surface	1293.00 / 0.00					
TOPSOIL Black, dry, loose, organic soil						
TILL Gravelly Till (rounded to subrounded, medium to coarse grain), brown, dry, dense, well graded, lots of rock cuttings.						
Sandy Till (medium grain) and Gravel (rounded to subrounded, medium to coarse grain), brown, moist, dense, well graded, lots of rock cuttings.	1288.73 / 4.27					
Below 5.2 m, a water bearing seam <0.31 m width.	1287.82 / 5.18					
Sandy Till (medium grain) and Gravel (rounded to subrounded, medium to coarse grain), brown, moist, dense, well graded, lots of rock cuttings.	1287.51 / 5.49					
BEDROCK Siltstone, grey, dry, competent, very hard	1286.90 / 6.10					
Between 6.7 m and 7.0 m, fracture zone, moist	1286.29 / 6.71					
Below 7.2 m material is dry, very hard, uniform size cuttings, dusty drilling conditions	1285.99 / 7.01					
End of Log	1283.86 / 9.14					

Depth: ft -2 to 30; m 1 to 9

Backfill details



Well location: 5,548,704 N, 649,081 E
Well casing diameter: 2"
Depth of well (TOC): 7.924 m
Depth to water level (TOC): 5.349 m
Well casing material: Sch. 80 PVC
Well Elevation (TOC): 1293.75 m
Date of water level: 26 November, 2014
Well screen slot size: 010
Ground Elevation: 1293 m
Borehole diameter: 0.17 m
Well screen interval (bgs): 4.12 m - 7.17 m

BRITISH COLUMBIA

Greenhills Well 9

Report 1 - Detailed Well Record

GH_POTW09

Well Tag Number: 85223 Owner: ELK VALLEY COAL - GREENHILLS OPERATION Address: Area: GREENHILLS WELL LOCATION: Land District District Lot: 4588 Plan: 11279 Lot: 1 Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 83): Well: 5 Class of Well: Subclass of Well: Orientation of Well: Status of Well: Well Use: Observation Well Number: Observation Well Status: Construction Method: Diameter: 10.75 inches Casing drive shoe: Well Depth: 117 feet Elevation: feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: 117 feet Lithology Info Flag: Y File Info Flag: N Sieve Info Flag: N Screen Info Flag: Y Site Info Details: Other Info Flag: Other Info Details:	Construction Date: 1992-06-29 00:00:00 Driller: Well Identification Plate Number: 15802 Plate Attached By: KIMBERLY RASMUSSEN Where Plate Attached: WELL CASING PRODUCTION DATA AT TIME OF DRILLING: Well Yield: (Driller's Estimate) Development Method: Pump Test Info Flag: N Artesian Flow: UNKNOWN YIELD Artesian Pressure (ft): Static Level: WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: N Field Chemistry Info Flag: Site Info (SEAM): N Water Utility: N Water Supply System Name: GREENHILLS WATER SUPPLY SYSTEM Water Supply System Well Name: WELL 9 SURFACE SEAL: Flag: Y Material: Method: Depth (ft): 88 feet Thickness (in): WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:

Screen from	to feet	Type	Slot Size
88	119		.25
null	null		.12

Casing from	to feet	Diameter	Material	Drive Shoe
0	88	10.75	Other	null

GENERAL REMARKS:

LITHOLOGY INFORMATION:

```
From     0 to  19.7 Ft.   GRAVELY CLAY    0 nothing entered
From  19.7 to  21.4 Ft.   GRAVELY CLAY    0 nothing entered
From  21.4 to    43 Ft.   GRAVELY CLAY COLLUVIUM    0 nothing entered
From    43 to    65 Ft.   SILTY CLAY - LACUSTRINE    0 nothing entered
From    65 to    70 Ft.   GRAVEL- DIRTY - WATER    0 nothing entered
From    70 to 98.43 Ft.   CLEANER GRAVEL    0 nothing entered
From 98.43 to   118 Ft.   GRAVEL SILTY    0 nothing entered
From 118.4 to 121.4 Ft.   SANDSTONE AND SHALE    0 nothing entered
```


- Return to Main
- Return to Search Options
- Return to Search Criteria

BRITISH COLUMBIA

Greenhills Well 10

Report 1 - Detailed Well Record

GH_POTW10

Well Tag Number: 85218 Owner: ELK VALLEY COAL - GREENHILLS OPERATION Address: Area: GREENHILLS WELL LOCATION: Land District District Lot: 4588 Plan: 11279 Lot: 1 Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 83): Well: 5 Class of Well: Subclass of Well: Orientation of Well: Status of Well: Well Use: Observation Well Number: Observation Well Status: Construction Method: Diameter: 8" inches Casing drive shoe: Well Depth: 176 feet Elevation: feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: Y File Info Flag: N Sieve Info Flag: N Screen Info Flag: N Site Info Details: Other Info Flag: Other Info Details:	Construction Date: 2001-06-22 00:00:00 Driller: Well Identification Plate Number: 15805 Plate Attached By: Where Plate Attached: PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 50 (Driller's Estimate) Development Method: Pump Test Info Flag: N Artesian Flow: Artesian Pressure (ft): Static Level: WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: N Field Chemistry Info Flag: Site Info (SEAM): N Water Utility: N Water Supply System Name: GREENHILLS WATER SUPPLY SYSTEM Water Supply System Well Name: WELL 10 SURFACE SEAL: Flag: N Material: Method: Depth (ft): Thickness (in): WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:

Screen from	to feet	Type	Slot Size

Casing from	to feet	Diameter	Material	Drive Shoe
0	176	null	Other	null

GENERAL REMARKS:
WATER QUALITY GUARANTEED BY CONTRACTOR

LITHOLOGY INFORMATION:

```
From      0 to     58 Ft.   CLAY     0 nothing entered
From     58 to     78 Ft.   GRAVEL AND BOULDERS     0 nothing entered
From     78 to    110 Ft.   CLAY AND GRAVEL     0 nothing entered
From    110 to    176 Ft.   COURSE GRAVEL     0 nothing entered
```


- Return to Main
- Return to Search Options
- Return to Search Criteria

BRITISH COLUMBIA

Greenhills Well 15

Report 1 - Detailed Well Record

GH_POTW15

Well Tag Number: 85221 Owner: ELK VALLEY COAL - GREENHILLS OPERATION Address: Area: WELL LOCATION: Land District District Lot: 4588 Plan: 11279 Lot: 1 Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 83): Well: 7 Class of Well: Subclass of Well: Orientation of Well: Status of Well: Well Use: Observation Well Number: Observation Well Status: Construction Method: Diameter: inches Casing drive shoe: Well Depth: 144 feet Elevation: feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: Y File Info Flag: N Sieve Info Flag: N Screen Info Flag: N Site Info Details: Other Info Flag: Other Info Details:	Construction Date: 2001-11-01 00:00:00 Driller: Well Identification Plate Number: 15803 Plate Attached By: KIMBERLY RASMUSSEN Where Plate Attached: WELL CASING PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 100 (Driller's Estimate) Development Method: Pump Test Info Flag: N Artesian Flow: Artesian Pressure (ft): Static Level: 11 feet WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: N Field Chemistry Info Flag: Site Info (SEAM): N Water Utility: N Water Supply System Name: GREENHILLS WATER SUPPLY SYSTEM Water Supply System Well Name: WELL 15 SURFACE SEAL: Flag: N Material: Method: Depth (ft): Thickness (in): WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:

Screen from	to feet	Type	Slot Size

Casing from	to feet	Diameter	Material	Drive Shoe
0	144	null	Other	null

GENERAL REMARKS:
WATER QUALITY GUARANTEED BY CONTRACTOR

LITHOLOGY INFORMATION:

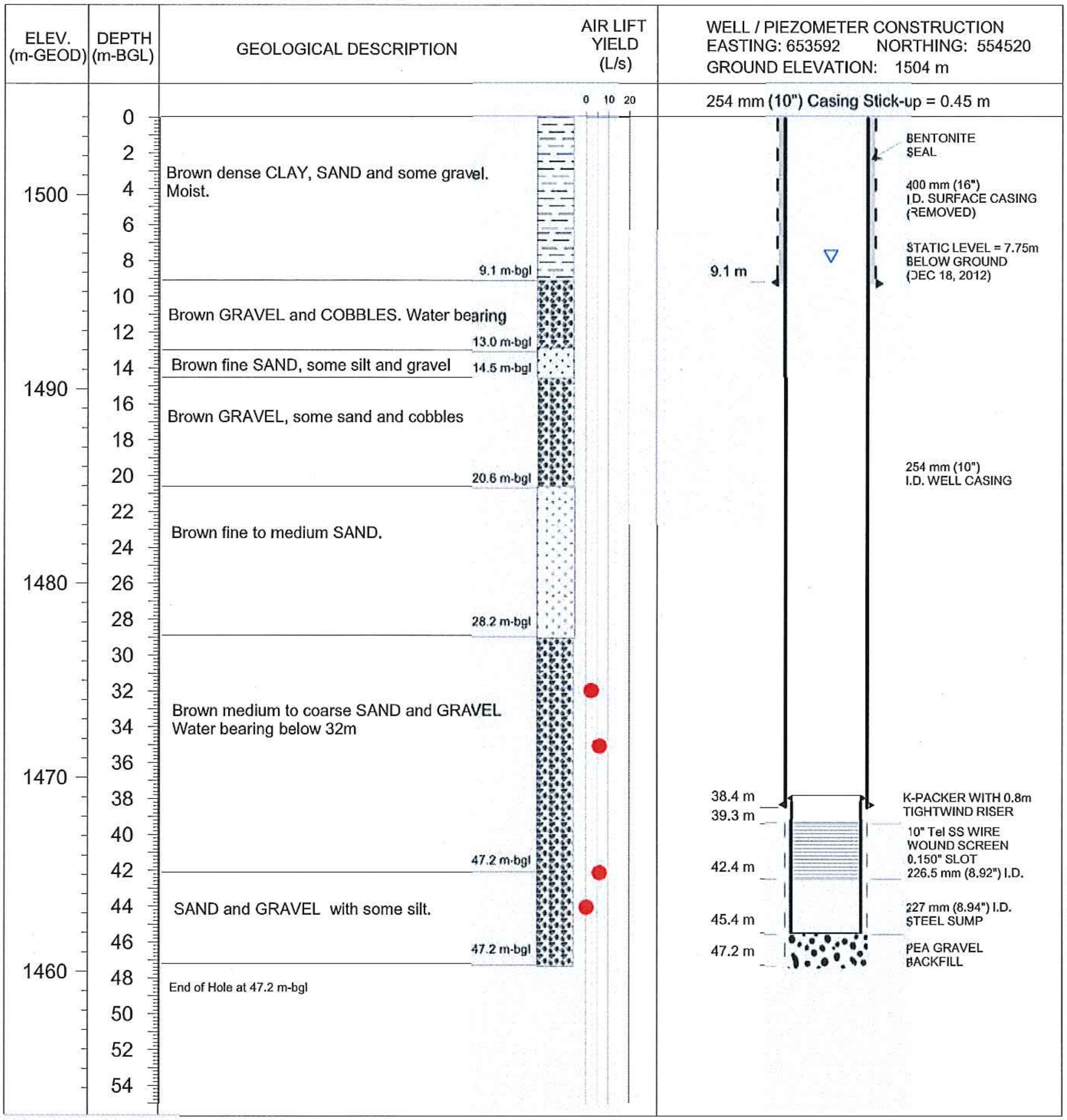
From	0 to	7 Ft.	FILL	0	nothing entered
From	7 to	15 Ft.	CLAY AND GRAVEL	0	nothing entered
From	15 to	125 Ft.	SILTY CLAY	0	nothing entered
From	125 to	144 Ft.	COARSE GRAVEL AND COBBLE	0	nothing entered

- Return to Main
- Return to Search Options
- Return to Search Criteria

Information Disclaimer

The Province disclaims all responsibility for the accuracy of information provided. Information provided should not be used as a basis for making financial or any other commitments.

H:\Project\3148\Well_Log\Well17_Greenhill.grf



LEGEND

- Clay
- Gravel
- Sand

Note:
Coordinates and elevation not surveyed

DRILLING CONTRACTOR:	J.R. Drilling Ltd.
DRILLING METHOD:	DUAL ROTARY
START DATE:	19-Nov-12
END DATE:	21-Nov-12
HYDROGEOLOGY:	Eric Pastora

KERR WOOD LEIDAL ASSOCIATES LTD.
TECK COAL LTD. - GREENHILLS OPERATIONS
GROUNDWATER SUPPLY ASSESSMENT

PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

WELL 17 LOG

BY	DATE
EP	JAN 13
APPROVED	FIG.
ATH	2

Log of Monitoring Well: GH_MW-RLP-1D

HEMMERA

Project Name/No: 577-016.07

Client: Teck Coal Greenhills Operation

Date Drilled: September 3rd-4th, 2016

Site Location: Elkford, BC

Drilling Company: JR Drilling

Drilling Method: Dual Rotary

Logged by: TK

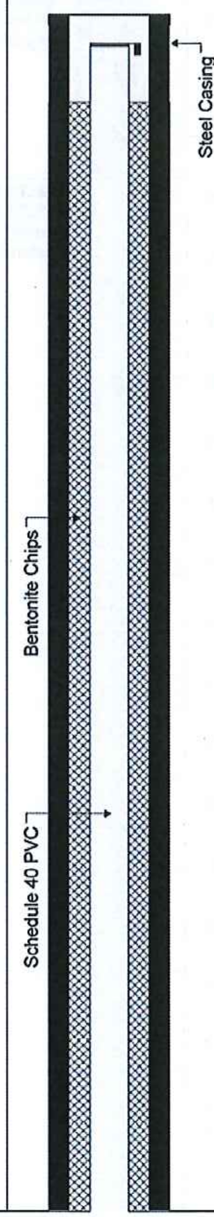
Sheet: 1 of 14

SUBSURFACE PROFILE / SAMPLE

Depth (m)	Description	Depth/Elev (m)	Sample ID	Analysed Y,N	Sample Type	Vapour ppm (0 250 500)	LEL % (0 50 100)
0	Ground Surface	0.00 / 0.00					
0.00–2.00	**TOPSOIL** TOPSOIL, silt, fine sand and fine sub-angular/sub-rounded gravel with rootlets, grayish-brown, dry (likely fill)	-2.00 / 2.00					
2.00–2.50	**TOPSOIL** TOPSOIL, silt, fine sand and fine to medium sub-angular/sub-rounded gravel with rootlets and wood debris, dark brown, dry (likely native topsoil)	-2.50 / 2.50					
2.50–5.00	**SILT, SAND and GRAVEL** SILT, SAND and GRAVEL, light brown, fine sand, fine to medium sub-angular/sub-rounded gravel with rootlets, dry Moist from 4.5m	-5.00 / 5.00					

Depth scale: ft -3 to 16; m 0 to 5

Backfill details



Well location: Rail Loop

Well casing diameter: 50.8mm

Depth of well (TOC): -

Depth to water level (TOC): -

Well casing material: Schedule 40 PVC

Well Elevation (TOC): -

Date of water level: -

Well screen slot size: 0.25mm

Ground Elevation: -

Borehole diameter: 15.24cm

Well screen interval (bgs): 82.5-79.5

Log of Monitoring Well: GH_MW-RLP-1D

HEMMERA

Project Name/No: 577-016.07
Client: Teck Coal Greenhills Operation
Date Drilled: September 3rd-4th, 2016
Site Location: Elkford, BC

Drilling Company: JR Drilling
Drilling Method: Dual Rotary
Logged by: TK

SUBSURFACE PROFILE			SAMPLE						
Depth (ft / m)	Symbol	Description	Depth/Elev (m)	Sample ID	Analysed Y,N	Sample Type	Vapour ppm (0 250 500)	LEL % (0 50 100)	Backfill details
17–20 ft (to 6 m)		**SAND and GRAVEL (TILL)** SAND and GRAVEL, fine grained, fine to coarse sub-angular/sub-rounded gravel up to 2cm, moist							
20–36 ft (6–11 m)		**SILTY CLAY (TILL)** SILTY CLAY, trace fine sand, some blocky silt, dark brown, homogenous, low to moderate plasticity, saturated	-6.00 6.00						

Depth scale: 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36 (ft); 6, 7, 8, 9, 10, 11 (m)

Well location: Rail Loop
Depth to water level (TOC): -
Date of water level: -
Borehole diameter: 15.24cm

Well casing diameter: 50.8mm
Well casing material: Schedule 40 PVC
Well screen slot size: 0.25mm
Well screen interval (bgs): 82.5-79.5

Depth of well (TOC): -
Well Elevation (TOC): -
Ground Elevation: -

Log of Monitoring Well: GH_MW-RLP-1D

HEMMERA

Project Name/No: 577-016.07
Drilling Company: JR Drilling
Client: Teck Coal Greenhills Operation
Drilling Method: Dual Rotary
Date Drilled: September 3rd-4th, 2016
Logged by: TK
Site Location: Elkford, BC

SUBSURFACE PROFILE			SAMPLE						
Depth	Symbol	Description	Depth/Elev (m)	Sample ID	Analysed Y,N	Sample Type	Vapour ppm 0 250 500	LEL % 0 50 100	Backfill details
37–56 ft (12–17 m)									

Well location: Rail Loop
Well casing diameter: 50.8mm
Depth of well (TOC): -
Depth to water level (TOC): -
Well casing material: Schedule 40 PVC
Well Elevation (TOC): -
Date of water level: -
Well screen slot size: 0.25mm
Ground Elevation: -
Borehole diameter: 15.24cm
Well screen interval (bgs): 82.5-79.5

Log of Monitoring Well: GH_MW-RLP-1D

HEMMERA

Project Name/No: 577-016.07

Client: Teck Coal Greenhills Operation

Date Drilled: September 3rd-4th, 2016

Site Location: Elkford, BC

Drilling Company: JR Drilling

Drilling Method: Dual Rotary

Logged by: TK

SUBSURFACE PROFILE			SAMPLE						
Depth	Symbol	Description	Depth/Elev (m)	Sample ID	Analysed Y,N	Sample Type	Vapour ppm (0 250 500)	LEL % (0 50 100)	Backfill details
57–72 (ft) / 18–22 (m)									
72 / 22		**SILTY SAND and GRAVEL (TILL)** SILTY SAND and GRAVEL, coarse grained, gravel fine to coarse (~1cm), sub-angular, saturated Increasingly clayey, with finer sub-angular gravel from 24-25mbgs Decreasing gravel/sand with depth, clay/silt from 30-31 mbgs is more consolidated	-22.00 22.00						
73–76 (ft) / 23 (m)									

Well location: Rail Loop

Depth to water level (TOC): -

Date of water level: -

Borehole diameter: 15.24cm

Well casing diameter: 50.8mm

Well casing material: Schedule 40 PVC

Well screen slot size: 0.25mm

Well screen interval (bgs): 82.5-79.5

Depth of well (TOC): -

Well Elevation (TOC): -

Ground Elevation: -

Log of Monitoring Well: GH_MW-RLP-1D

HEMMERA

Project Name/No: 577-016.07
Drilling Company: JR Drilling
Client: Teck Coal Greenhills Operation
Drilling Method: Dual Rotary
Date Drilled: September 3rd-4th, 2016
Logged by: TK
Site Location: Elkford, BC

SUBSURFACE PROFILE			SAMPLE						
Depth	Symbol	Description	Depth/Elev (m)	Sample ID	Analysed Y,N	Sample Type	Vapour ppm 0 250 500	LEL % 0 50 100	Backfill details
77–96 ft (24–29 m)									

Well location: Rail Loop
Well casing diameter: 50.8mm
Depth of well (TOC): -
Depth to water level (TOC): -
Well casing material: Schedule 40 PVC
Well Elevation (TOC): -
Date of water level: -
Well screen slot size: 0.25mm
Ground Elevation: -
Borehole diameter: 15.24cm
Well screen interval (bgs): 82.5-79.5

Log of Monitoring Well: GH_MW-RLP-1D

HEMMERA

Project Name/No: 577-016.07
Drilling Company: JR Drilling
Client: Teck Coal Greenhills Operation
Drilling Method: Dual Rotary
Date Drilled: September 3rd-4th, 2016
Logged by: TK
Site Location: Elkford, BC

SUBSURFACE PROFILE			SAMPLE						
Depth	Symbol	Description	Depth/Elev (m)	Sample ID	Analysed Y,N	Sample Type	Vapour ppm (0 250 500)	LEL % (0 50 100)	Backfill details
97–101 ft (30–31 m)									
102–116 ft (31–35 m)		**SILT, SAND and GRAVEL (TILL)** SILT, SAND and GRAVEL, coarse sand, fine to medium sub-angular gravel, saturated Blocky silt/clay at 34 and 42 mbgs	-31.00 31.00						

Well location: Rail Loop
Well casing diameter: 50.8mm
Depth of well (TOC): -
Depth to water level (TOC): -
Well casing material: Schedule 40 PVC
Well Elevation (TOC): -
Date of water level: -
Well screen slot size: 0.25mm
Ground Elevation: -
Borehole diameter: 15.24cm
Well screen interval (bgs): 82.5-79.5

Log of Monitoring Well: GH_MW-RLP-1D

HEMMERA

Project Name/No: 577-016.07
Drilling Company: JR Drilling
Client: Teck Coal Greenhills Operation
Drilling Method: Dual Rotary
Date Drilled: September 3rd-4th, 2016
Logged by: TK
Site Location: Elkford, BC

SUBSURFACE PROFILE			SAMPLE						
Depth	Symbol	Description	Depth/Elev (m)	Sample ID	Analysed Y,N	Sample Type	Vapour ppm (0 250 500)	LEL % (0 50 100)	Backfill details
17									
18 (36)									
19									
20									
21 (37)									
22									
23									
24									
25 (38)									
26									
27									
28 (39)									
29									
30									
31 (40)									
32									
33									
34 (41)									
35									
36									

Well location: Rail Loop
Well casing diameter: 50.8mm
Depth of well (TOC): -
Depth to water level (TOC): -
Well casing material: Schedule 40 PVC
Well Elevation (TOC): -
Date of water level: -
Well screen slot size: 0.25mm
Ground Elevation: -
Borehole diameter: 15.24cm
Well screen interval (bgs): 82.5-79.5

Log of Monitoring Well: GH_MW-RLP-1D

HEMMERA

Project Name/No: 577-016.07
Drilling Company: JR Drilling
Client: Teck Coal Greenhills Operation
Drilling Method: Dual Rotary
Date Drilled: September 3rd-4th, 2016
Logged by: TK
Site Location: Elkford, BC

Depth	Symbol	Description	Depth/Elev (m)	Sample ID	Analysed Y,N	Sample Type	Vapour ppm (0 250 500)	LEL % (0 50 100)	Backfill details
37–41									
41–56		**SAND and GRAVEL (TILL)** SAND and GRAVEL, coarse sand, fine to coarse sub-angular gravel, saturated Fine content increases from 46-48 mbgs	-43.00 43.00						

Depth scale (ft): 42, 43, 44, 45, 46, 47

Well location: Rail Loop
Well casing diameter: 50.8mm
Depth of well (TOC): -
Depth to water level (TOC): -
Well casing material: Schedule 40 PVC
Well Elevation (TOC): -
Date of water level: -
Well screen slot size: 0.25mm
Ground Elevation: -
Borehole diameter: 15.24cm
Well screen interval (bgs): 82.5-79.5

Log of Monitoring Well: GH_MW-RLP-1D

HEMMERA

Project Name/No: 577-016.07
Drilling Company: JR Drilling
Client: Teck Coal Greenhills Operation
Drilling Method: Dual Rotary
Date Drilled: September 3rd-4th, 2016
Logged by: TK
Site Location: Elkford, BC

SUBSURFACE PROFILE			SAMPLE						
Depth	Symbol	Description	Depth/Elev (m)	Sample ID	Analysed Y,N	Sample Type	Vapour ppm (0 250 500)	LEL % (0 50 100)	Backfill details
57–48			-48.00						
58		**SILTY CLAY (TILL)** SILTY CLAY with trace sub-angular medium gravel, dark brown, competent, high plasticity, saturated	48.00						

Depth scale (ft / m): 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76 / 48, 49, 50, 51, 52, 53

Well location: Rail Loop
Well casing diameter: 50.8mm
Depth of well (TOC): -
Depth to water level (TOC): -
Well casing material: Schedule 40 PVC
Well Elevation (TOC): -
Date of water level: -
Well screen slot size: 0.25mm
Ground Elevation: -
Borehole diameter: 15.24cm
Well screen interval (bgs): 82.5-79.5

Log of Monitoring Well: GH_MW-RLP-1D

HEMMERA

Project Name/No: 577-016.07
Drilling Company: JR Drilling
Client: Teck Coal Greenhills Operation
Drilling Method: Dual Rotary
Date Drilled: September 3rd-4th, 2016
Logged by: TK
Site Location: Elkford, BC

SUBSURFACE PROFILE			SAMPLE						Backfill details
Depth	Symbol	Description	Depth/Elev (m)	Sample ID	Analysed Y,N	Sample Type	Vapour ppm (0 250 500)	LEL % (0 50 100)	
77–87 (ft); 54–57 (m)									
87–96 (ft); 57–59 (m)		**GRAVEL (TILL)** GRAVEL, fine to coarse, sub-angular, with fine to coarse sand Increased fine content with depth	-57.00 57.00						

Well location: Rail Loop
Well casing diameter: 50.8mm
Depth of well (TOC): -
Depth to water level (TOC): -
Well casing material: Schedule 40 PVC
Well Elevation (TOC): -
Date of water level: -
Well screen slot size: 0.25mm
Ground Elevation: -
Borehole diameter: 15.24cm
Well screen interval (bgs): 82.5-79.5

Log of Monitoring Well: GH_MW-RLP-1D

HEMMERA

Project Name/No: 577-016.07
Drilling Company: JR Drilling
Client: Teck Coal Greenhills Operation
Drilling Method: Dual Rotary
Date Drilled: September 3rd-4th, 2016
Logged by: TK
Site Location: Elkford, BC

SUBSURFACE PROFILE			SAMPLE						
Depth (ft / m)	Symbol	Description	Depth/Elev (m)	Sample ID	Analysed Y,N	Sample Type	Vapour ppm (0 250 500)	LEL % (0 50 100)	Backfill details
197–203 / 60–62	Gravel								
203–216 / 62–66	Clay	**CLAY (TILL)** CLAY, with trace fine to coarse sub-angular gravel (~ 1-2cm), competent and very firm, high plasticity, moist/wet High difficulty drilling through this section	-62.00 62.00						
			-66.00 66.00						

Well location: Rail Loop
Well casing diameter: 50.8mm
Depth of well (TOC): -
Depth to water level (TOC): -
Well casing material: Schedule 40 PVC
Well Elevation (TOC): -
Date of water level: -
Well screen slot size: 0.25mm
Ground Elevation: -
Borehole diameter: 15.24cm
Well screen interval (bgs): 82.5-79.5

Log of Monitoring Well: GH_MW-RLP-1D

HEMMERA

Project Name/No: 577-016.07

Drilling Company: JR Drilling

Client: Teck Coal Greenhills Operation

Drilling Method: Dual Rotary

Date Drilled: September 3rd-4th, 2016

Logged by: TK

Site Location: Elkford, BC

Sheet: 12 of 14

SUBSURFACE PROFILE			SAMPLE						
Depth	Symbol	Description	Depth/Elev (m)	Sample ID	Analysed Y,N	Sample Type	Vapour ppm (0 250 500)	LEL % (0 50 100)	Backfill details
217–236 (ft) / 66–72 (m)		**SAND and GRAVEL (TILL)** SAND and GRAVEL, fine to coarse grained sand, fine to coarse (~1-2cm) sub-angular gravel, saturated							

Depth scale (ft): 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236

Depth scale (m): 66, 67, 68, 69, 70, 71, 72

Well location: Rail Loop

Well casing diameter: 50.8mm

Depth of well (TOC): -

Depth to water level (TOC): -

Well casing material: Schedule 40 PVC

Well Elevation (TOC): -

Date of water level: -

Well screen slot size: 0.25mm

Ground Elevation: -

Borehole diameter: 15.24cm

Well screen interval (bgs): 82.5-79.5

Log of Monitoring Well: GH_MW-RLP-1D

HEMMERA

Project Name/No: 577-016.07
Client: Teck Coal Greenhills Operation
Date Drilled: September 3rd-4th, 2016
Site Location: Elkford, BC

Drilling Company: JR Drilling
Drilling Method: Dual Rotary
Logged by: TK

SUBSURFACE PROFILE			SAMPLE						
Depth	Symbol	Description	Depth/Elev (m)	Sample ID	Analysed Y,N	Sample Type	Vapour ppm 0 250 500	LEL % 0 50 100	Backfill details
237									
238									
239									
73									
240									
241									
242									
74									
243									
244									
245									
246									
75									
247									
248									
249									
76									
250									
251									
252									
77									
253									
254									
255									
256									
78									

Well location: Rail Loop
Depth to water level (TOC): -
Date of water level: -
Borehole diameter: 15.24cm

Well casing diameter: 50.8mm
Well casing material: Schedule 40 PVC
Well screen slot size: 0.25mm
Well screen interval (bgs): 82.5-79.5

Depth of well (TOC): -
Well Elevation (TOC): -
Ground Elevation: -

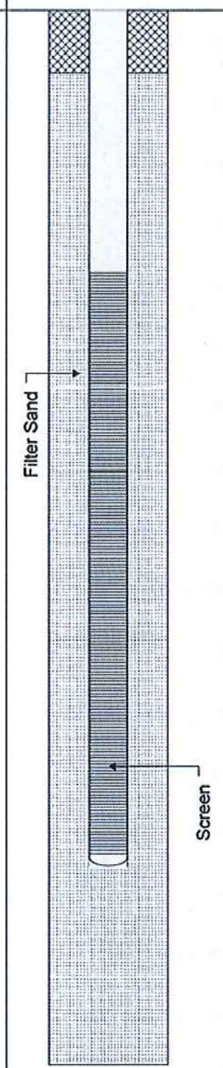
Log of Monitoring Well: GH_MW-RLP-1D

HEMMERA

Project Name/No: 577-016.07
Client: Teck Coal Greenhills Operation
Date Drilled: September 3rd-4th, 2016
Site Location: Elkford, BC

Drilling Company: JR Drilling
Drilling Method: Dual Rotary
Logged by: TK

SUBSURFACE PROFILE			SAMPLE						
Depth	Symbol	Description	Depth/Elev (m)	Sample ID	Analysed Y,N	Sample Type	Vapour ppm (0 250 500)	LEL % (0 50 100)	Backfill details
79		Clayey from 79-81 mbgs							
82		Increased sand content from 82-83.5 mbgs							
83.5		End of Log	-83.50 83.50						



Well location: Rail Loop
Depth to water level (TOC): -
Date of water level: -
Borehole diameter: 15.24cm

Well casing diameter: 50.8mm
Well casing material: Schedule 40 PVC
Well screen slot size: 0.25mm
Well screen interval (bgs): 82.5-79.5

Depth of well (TOC): -
Well Elevation (TOC): -
Ground Elevation: -

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_BCgw

LOCATION: See Location Plan

N: 5509659 E: 655381

BORING DATE: October 22, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa (20 40 60 80) nat V. + Q - ● rem V. ⊕ U - O	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp —O W— Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		353.26							Stick-up =0.86 m
0	Sonic 127 mm (ID) Casing 152.4 mm (OD); JR Drilling	SANDY GRAVEL, fine-grained with occasional coarse grains, rounded to sub-rounded, moderately graded, dry, very loose		0.00							
1											
		GRAVEL, trace sand, fine-grained with occasional coarse grains, rounded to sub-rounded, poorly graded, very loose		351.74 / 1.52							
2		— Moist at 2.1 m									12 Nov 2013 ∇
3											
4											
5											Bentonite Chips
6		Silty SANDY GRAVEL, fine-grained with occasional coarse grains, sub-rounded to sub-angular, poorly graded, wet, very loose		347.17 / 6.10							
7											
8											
9											
				343.51 / 9.75							
10											

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DEPTH SCALE
1 : 50

Golder Associates

LOGGED: RT
CHECKED: CD

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_BCgw

LOCATION: See Location Plan

N: 5509659 E: 655381

BORING DATE: October 22, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢—○W—⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10	Sonic 127 mm (ID) Casing 152.4 mm (OD) JR Drilling	GRAVEL, some sand, trace silt, fine-grained, sub-angular to angular, poorly graded, wet, very loose *(continued)*									
11											
12											
13											Bentonite Chips
14											
15		— Occasional coarse grains from 15.2 m									
16											
17											Silica Sand
18											
19											Slotted Section
20											

CONTINUED NEXT PAGE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: RT

CHECKED: CD

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_BCgw

LOCATION: See Location Plan

N: 5509659 E: 655381

BORING DATE: October 22, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q- ● rem V. ⊕ U- O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
20	Sonic 127 mm (ID) Casing 152.4 mm (OD) JR Drilling	GRAVEL, some sand, trace silt, fine-grained, sub-angular to angular, poorly graded, wet, very loose *(continued)*									Slotted Section
21											
22				331.17							Silica Sand
		Sandy SILTY GRAVEL, fine-grained, sub-angular to angular, poorly graded, wet, very loose		22.10							
23				330.10							
		End of BOREHOLE.		330.10 23.10							
		NOTES: Standpipe installed to 20.7 m upon well completion. Groundwater level measured at 2.4 mbgs on October 23, 2013. Groundwater level measured at 2.2 mbgs on November 12, 2013.									
24											
25											
26											
27											
28											
29											
30											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: RT

CHECKED: CD

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_ECgw

LOCATION: See Location Plan

N: 5506384 E: 660795

BORING DATE: October 27, 2013

DATUM: UTM Zone 11 (Nad 83)

BORING METHOD: Sonic 127 mm (ID) Casing 152.4 mm (OD), JR Drilling

DEPTH SCALE METRES	DESCRIPTION	ELEV. / DEPTH (m)	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface	406.30	Stick-up =0.74 m
0	GRAVELLY SAND, medium and coarse-grained sand with occasional fine gravel grains, rounded to sub-rounded, moderately graded, dry, very loose	0.00	16 Nov 2014 ▽; Bentonite Chips
1.52	SAND, trace gravel, medium-grained, rounded to sub-rounded, moderately graded, dry, very loose	404.77 / 1.52	Silica Sand; Slotted Section
3.81	CLAY and SAND, medium-grained with occasional coarse grains, rounded to sub-rounded, moderately graded, moist, firm	402.49 / 3.81	Silica Sand
5.18	SANDY CLAY, medium-grained with occasional coarse grains, rounded to sub-rounded, moderately graded, moist, firm	401.12 / 5.18	Bentonite Pellets
6.86	CLAY, some sand, medium-grained, rounded to sub-rounded, moderately graded, moist, semi-firm	399.44 / 6.86	

Column headings: SOIL PROFILE (DESCRIPTION, STRATA PLOT, ELEV. DEPTH (m)); SAMPLES (NUMBER, TYPE, BLOWS/0.3m); DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - O) (20, 40, 60, 80); HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}); WATER CONTENT PERCENT (Wp ⊢—○W—⊣ Wl) (10, 20, 30, 40); ADDITIONAL LAB. TESTING

CONTINUED NEXT PAGE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: RT

CHECKED: CD

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_ECgw

LOCATION: See Location Plan

N: 5506384 E: 660795

BORING DATE: October 27, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa (nat V. + Q- ●; rem V. ⊕ U- ○) (20, 40, 60, 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}); WATER CONTENT PERCENT Wp ⊢ ○W ⊣ Wl (10, 20, 30, 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10	JR Drilling	CLAY, some sand, medium-grained, rounded to sub-rounded, moderately graded, moist, semi-firm *(continued)*		395.33 / 10.97							Bentonite Pellets
11		End of BOREHOLE.									
		NOTES: Standpipe installed to 4.1 m upon well completion. Groundwater level measured at 1.8 mbgs on November 12, 2013.									
12											
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: RT

CHECKED: CD

DATA ENTRY: IPG

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_ER1gwD

SHEET 1 OF 4

LOCATION: See Location Plan

N: 5510952 E: 651379

BORING DATE: 29 and 31 October, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp —W— Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		339.85							Stick-up =0.71 m
0	Sonic 127 mm (ID) Casing 152.4 mm (OD) JR Drilling	SILTY SAND, fine-grained with occasional medium grains, rounded to sub-rounded, moderately graded, minor organics (roots), dry, very loose		0.00							
1				338.33 / 1.52							
2		SAND, medium and coarse-grained, and fine-grained with some coarse-grained GRAVEL, poorly sorted, sub-rounded, sub-angular and angular clasts, dry, very loose									
3–9											16 Nov 2013 ∇; Bentonite Chips
10				329.95 / 9.91							
		CONTINUED NEXT PAGE									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: RT

CHECKED: CD

BOREHOLE - EXPANDED ADD. LAB TESTING 12.1349.0013 BH LOGS.GPJ CALGARY.GDT 4/8/14

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_ER1gwD

LOCATION: See Location Plan
N: 5510952 E: 651379

BORING DATE: 29 and 31 October, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q- ● rem V. ⊕ U- O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢ ○W ⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10	Sonic 127 mm (ID) Casing 152.4 mm (OD) JR Drilling	SANDY GRAVEL, fine-grained with some coarse grains, sub-rounded to sub-angular, poorly sorted, wet, very loose *(continued)*									
11											
12											
13											
14											
15											Bentonite Chips
16				322.94 16.92							
17		SAND, medium to coarse-grained, some fine-grained gravel, angular to sub-angular, moderately sorted, wet, very loose									
18											
19											
20											

CONTINUED NEXT PAGE

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: RT
CHECKED: CD

DATA ENTRY: IPG

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_ER1gwD

SHEET 3 OF 4

LOCATION: See Location Plan

N: 5510952 E: 651379

BORING DATE: 29 and 31 October, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. DEPTH (m)	PIEZOMETER OR STANDPIPE INSTALLATION
20	Sonic 127 mm (ID) Casing 152.4 mm (OD) JR Drilling	SAND, medium to coarse-grained, some fine-grained gravel, angular to sub-angular, moderately sorted, wet, very loose *(continued)*		
21				Bentonite Chips
24				Silica Sand
27				Slotted Section
28		SILTY SAND, fine to medium-grained, occasional angular gravel, rounded to sub-rounded, moderately graded, dry, very loose (BEDROCK)	311.96 27.89	
29				Silica Sand; Bentonite Pellets; Slough
30				

Column headings: SOIL PROFILE (DESCRIPTION, STRATA PLOT, ELEV. DEPTH (m)); SAMPLES (NUMBER, TYPE, BLOWS/0.3m); DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - O (20, 40, 60, 80); HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}); WATER CONTENT PERCENT Wp ⊢—O W—⊣ Wl (10, 20, 30, 40); ADDITIONAL LAB. TESTING; PIEZOMETER OR STANDPIPE INSTALLATION

CONTINUED NEXT PAGE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: RT

CHECKED: CD

BOREHOLE - EXPANDED ADD. LAB TESTING 12.1349.0013 BH LOGS.GPJ CALGARY.GDT 4/8/14

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_ER1gwD

LOCATION: See Location Plan

N: 5510952 E: 651379

BORING DATE: 29 and 31 October, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa natV. + Q- ● remV. ⊕ U- O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢ O W ⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
30	JR Drilling	SILTY SAND, fine to medium-grained, occasional angular gravel, rounded to sub-rounded, moderately graded, dry, very loose (BEDROCK) *(continued)*		309.07 30.78							Slough
		End of BOREHOLE.									
31											
		NOTES: Standpipe installed to 28.9 m upon well completion. Groundwater level measured at 4.6 mbgs on November 16, 2013.									
32											
33											
34											
35											
36											
37											
38											
39											
40											

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: RT
CHECKED: CD

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_ER1gwS

LOCATION: See Location Plan

N: 5510955 E: 651374

BORING DATE: October 30, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q- ● rem V. ⊕ U- O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢—⊖W—⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		339.85							Stick-up =0.96 m
0	Sonic 127 mm (ID) Casing 152.4 mm (OD); JR Drilling	SAND, medium and coarse-grained with some fine grains, rounded to sub-rounded, moderately graded, dry, very loose		0.00							
1											
2											
3											
4											16 Nov 2013 ∇
5											Bentonite Chips
6											
7		SAND, medium to coarse-grained, some fine-grained gravel, sub-rounded, sub-angular, moderately sorted, dry, very loose		333.15 6.71							
8		SAND, medium to coarse-grained, some fine-grained gravel, sub-rounded, sub-angular and angular, moderately sorted, wet, very loose		331.32 8.53							
9											
10											

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DEPTH SCALE
1 : 50

Golder Associates

LOGGED: RT
CHECKED: CD

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_ER1gwS

LOCATION: See Location Plan

N: 5510955 E: 651374

BORING DATE: October 30, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢—OW—⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10	Sonic 127 mm (ID) Casing 152.4 mm (OD) JR Drilling	SAND, medium to coarse-grained, some fine-grained gravel, sub-rounded, sub-angular and angular, moderately sorted, wet, very loose *(continued)*									
11											Bentonite Chips
12											
13											
14											Silica Sand
15											
16											Slotted Section
17				322.24 17.61							
		End of BOREHOLE.									
18		NOTES: Standpipe installed to 17.6 m upon well completion. Groundwater level measured at 8.2 mbgs on October 30, 2013. Groundwater level measured at 4.7 mbgs on November 16, 2013.									
19											
20											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: RT

CHECKED: CD

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_GV3gw

LOCATION: See Location Plan
N: 5522255 E: 656580

BORING DATE: October 23, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q- ● rem V. ⊕ U- O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢ OW ⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		400.51							Stick-up =0.91 m
0	Sonic 127 mm (ID) Casing 152.4 mm (OD) JR Drilling	SANDY GRAVEL, fine-grained, sub-angular to angular, moderately graded, dry, very loose		0.00							
		SAND, some gravel, fine to coarse-grained, sub-rounded to sub-angular, moderately graded, dry, very loose		398.98 1.52							
		SANDY GRAVEL, fine-grained, sub-angular to angular, moderately graded, dry, very loose		397.61 2.90							
		SAND, some gravel, localized thin zones of gravel, fine to coarse-grained, sub-rounded to sub-angular, moderately graded, moist, very loose		395.94 4.57							Bentonite Chips
10											15 Nov 2013 ∇

CONTINUED NEXT PAGE

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: RT
CHECKED: CD

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_GV3gw

LOCATION: See Location Plan

N: 5522255 E: 656580

BORING DATE: October 23, 2013

DATUM: UTM Zone 11 (Nad 83)

Boring method: Sonic 127 mm (ID) Casing 152.4 mm (OD), JR Drilling

DEPTH SCALE METRES	SOIL PROFILE – DESCRIPTION	ELEV. DEPTH (m)	PIEZOMETER OR STANDPIPE INSTALLATION
10	SAND, some gravel, localized thin zones of gravel, fine to coarse-grained, sub-rounded to sub-angular, moderately graded, moist, very loose *(continued)*		
13	SILTY GRAVEL, fine-grained, sub-rounded to sub-angular, poorly graded, wet, very loose	387.55 / 12.95	
14–15	GRAVEL, fine-grained, sub-rounded to sub-angular, well graded, moist, very loose	385.88 / 14.63	Bentonite Chips
16	SAND, some gravel, fine to coarse-grained, sub-rounded to sub-angular, moderately graded, moist, very loose	384.35 / 16.15	
17–18	GRAVEL, some silt, fine-grained, sub-rounded to sub-angular, poorly graded, moist, very loose	382.98 / 17.53	
19	SILTY GRAVEL, fine-grained, sub-rounded to sub-angular, poorly graded, wet, very loose	381.46 / 19.05	
20			

Column headings also printed: SAMPLES (NUMBER, TYPE, BLOWS/0.3m); DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa (nat V. + Q- ● rem V. ⊕ U- O) (20, 40, 60, 80); HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}); WATER CONTENT PERCENT (Wp —O W— Wl) (10, 20, 30, 40); ADDITIONAL LAB. TESTING

CONTINUED NEXT PAGE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: RT

CHECKED: CD

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_GV3gw

LOCATION: See Location Plan

N: 5522255 E: 656580

BORING DATE: October 23, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q- ● rem V. ⊕ U- O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢—O^W—⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
20	Sonic 127 mm (ID) Casing 152.4 mm (OD) JR Drilling	SILTY GRAVEL, fine-grained, sub-rounded to sub-angular, poorly graded, wet, very loose *(continued)*									
21		SILTY GRAVEL, fine and coarse-grained, sub-angular to angular, poorly graded, wet, very loose		379.63 20.88							Bentonite Chips
22											Silica Sand
23											Slotted Section
24											Silica Sand
25		End of BOREHOLE. NOTES: Standpipe installed to 24.4 m upon well completion. Groundwater level measured at 9.9 mbgs on November 15, 2013.		375.51 25.00							
26											
27											
28											
29											
30											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: RT

CHECKED: CD

PROJECT No.: 12.1349.0013

LOCATION: See Location Plan

N: 5514731 E: 653274

RECORD OF BOREHOLE: EV_LSgw

BORING DATE: October 24, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa nat V. + Q- ● rem V. ⊕ U- O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT Wp ⊢—O W—⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		345.03							Stick-up =0.93 m
0	Sonic 127 mm (ID) Casing 152.4 mm (OD) JR Drilling	FILL - Sand sized particles, medium to coarse-grained, sub-rounded to sub-angular, well graded, dark black carbonaceous, moist, very loose		0.00							
1		SANDY GRAVEL, some silt, fine-grained, sub-rounded to sub-angular, poorly graded, moist, very loose		343.51 1.52							
2											Bentonite Chips
3											14 Nov 2013 ∇
4		GRAVELY SAND, coarse-grained with fine-grained gravel, sub-rounded to sub-angular, poorly graded, moist, very loose		341.22 3.81							
5											Silica Sand
6											Slotted Section
7		SANDY SILT, fine to medium-grained, wet, mud		338.18 6.86							
8											Silica Sand
9											
10											

CONTINUED NEXT PAGE

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: RT
CHECKED: CD

DATA ENTRY: IPG

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_LSgw

SHEET 2 OF 2

LOCATION: See Location Plan

N: 5514731 E: 653274

BORING DATE: October 24, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢—○W—⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10	JR Drilling	SANDY SILT, fine to medium-grained, wet, mud *(continued)*		334.36 10.67							Silica Sand
		End of BOREHOLE.									
11		NOTES: Standpipe installed to 6.7 m upon well completion. Groundwater level measured at 3.4 mbgs on November 14, 2013.									
12											
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: RT

CHECKED: CD

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_MCgwD

LOCATION: See Location Plan

N: 5511616 E: 653475

BORING DATE: November 3, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	ELEV. DEPTH (m)	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface	344.73	Stick-up =0.84 m
0	Sonic 127 mm (ID) Casing 152.4 mm (OD); JR Drilling	SAND, coarse and medium-grained, and fine-grained GRAVEL, rounded to sub-rounded, moderately graded, wet, very loose	0.00	15 Nov 2013 ▽
3.66		SAND, fine and medium-grained, sub-rounded to sub-angular, well graded, dry, very loose	341.07 / 3.66	Bentonite Pellets
5.64		SILT, some fine-grained sand, well graded, very loose — Wet at 5.8 m	339.09 / 5.64	
8.08		CLAY, some fine-grained sand, well-sorted, moist, compact	336.65 / 8.08	
10				

Column headings also printed (no data entered): STRATA PLOT; SAMPLES: NUMBER, TYPE, BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - O (20 40 60 80); HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢ ⊖W ⊣ Wl (10 20 30 40); ADDITIONAL LAB. TESTING.

CONTINUED NEXT PAGE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: RT

CHECKED: CD

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_MCgwD

LOCATION: See Location Plan

N: 5511616 E: 653475

BORING DATE: November 3, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa nat V. + Q- ● rem V. ⊕ U- O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT Wp —O W— Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10	Sonic 127 mm (ID) Casing 152.4 mm (OD) JR Drilling	CLAY, some fine-grained sand, well-sorted, moist, compact *(continued)*									
		SILT, some fine-grained sand, well graded, wet, very loose		333.30 / 11.43							
		CLAY, some fine-grained sand, well-sorted, wet, soft		330.40 / 14.33							Bentonite Pellets
		CLAY, some fine-grained sand, well-sorted, moist, compact		328.88 / 15.85							
		CLAY, some fine-grained sand, well-sorted, moist, loose		327.36 / 17.37							
20		*CONTINUED NEXT PAGE*									

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: RT

CHECKED: CD

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_MCgwD

LOCATION: See Location Plan

N: 5511616 E: 653475

BORING DATE: November 3, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢—○W—⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
20	Sonic 127 mm (ID) Casing 152.4 mm (OD) JR Drilling	CLAY, some fine-grained sand, well-sorted, moist, loose *(continued)*									
21											Bentonite Pellets
22											
23											Silica Sand
24											
25											
26											Slotted Section
27											
28											Silica Sand
29											Bentonite Pellets
30											Slough

CONTINUED NEXT PAGE

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: RT
CHECKED: CD

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_MCgwD

LOCATION: See Location Plan

N: 5511616 E: 653475

BORING DATE: November 3, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q- ● rem V. ⊕ U- O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢ OW ⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
30	Sonic 127 mm (ID) Casing 152.4 mm (OD) JR Drilling	CLAY, some fine-grained sand, well-sorted, moist, loose *(continued)*									
		CLAY, some fine-grained sand, well-sorted, wet, soft		314.28 30.45							
35											Slough
		SAND, coarse-grained, sub-angular to angular, well graded, wet, very loose		307.54 37.19							
		SILT and SAND, coarse-grained, sub-angular, moderately-sorted, wet, very loose		305.87 38.86							
40											

CONTINUED NEXT PAGE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: RT

CHECKED: CD

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_MCgwD

LOCATION: See Location Plan

N: 5511616 E: 653475

BORING DATE: November 3, 2013

DATUM: UTM Zone 11 (Nad 83)

BORING METHOD: Sonic 127 mm (ID) Casing 152.4 mm (OD) JR Drilling

Depth (m)	Description	Elev. / Depth (m)	Piezometer or Standpipe Installation
40	SILT and SAND, coarse-grained, sub-angular, moderately-sorted, wet, very loose *(continued)*	304.34 / 40.39	
	SANDY SILT, fine-grained, moderately-sorted, wet, very loose	302.06 / 42.67	
	CLAYEY SAND, fine-grained, some coarse-grained gravel, angular, moderately-sorted, brown, wet, very loose	300.69 / 44.04	Slough
	GRAVEL, fine-grained, sub-rounded, moderately-sorted, grey to brown, very loose, wet	299.92 / 44.81	
	SAND, medium-grained with some fine grains, sub-rounded, poorly graded, mainly black to grey and brown, wet	297.18 / 47.55	
	End of BOREHOLE.		

NOTES:
Sloughing present to 29.9 m.
Standpipe installed to 27.6 m upon well completion.
Groundwater level measured at 2.5 mbgs on November 7, 2013.
Groundwater level measured at 3.4 mbgs on November 15, 2013.

Column headings: DEPTH SCALE METRES; BORING METHOD; SOIL PROFILE (DESCRIPTION, STRATA PLOT, ELEV. DEPTH (m)); SAMPLES (NUMBER, TYPE, BLOWS/0.3m); DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m 20 40 60 80; SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - O 20 40 60 80; HYDRAULIC CONDUCTIVITY, k, cm/s 10^{-6} 10^{-5} 10^{-4} 10^{-3}; WATER CONTENT PERCENT Wp —O W— Wl 10 20 30 40; ADDITIONAL LAB. TESTING; PIEZOMETER OR STANDPIPE INSTALLATION

Depth scale: 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: RT
CHECKED: CD

DATA ENTRY: IPG

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_MCgwS

SHEET 1 OF 2

LOCATION: See Location Plan

N: 5511624 E: 653476

BORING DATE: November 6, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢—OW—⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		344.73							Stick-up =0.96 m
0	Sonic 127 mm (ID) Casing 152.4 mm (OD) JR Drilling	SAND, coarse and medium-grained, and fine-grained GRAVEL, rounded to sub-rounded, moderately graded, dark brown, damp, very loose		0.00							
1		SAND, fine and medium-grained, sub-rounded to sub-angular, poorly graded, brown, dry, very loose		343.81 0.91							15 Nov 2013 ∇
2–4											Bentonite Pellets
5		CLAYEY SILT, some fine-grained sand, dark brown to grey, moist, soft to very loose		340.16 4.57							
6–8		CLAYEY SILT, some fine-grained sand, dark brown to grey, wet, very soft, very loose (runny)		339.24 5.49							Silica Sand; Slotted Section; Slough
9–10		CLAY, some fine-grained sand, well-sorted, moist, compact		335.58 9.14							

CONTINUED NEXT PAGE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: RT

CHECKED: CD

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_MCgwS

LOCATION: See Location Plan

N: 5511624 E: 653476

BORING DATE: November 6, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q- ● rem V. ⊕ U- O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢—O W—⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10	JR Drilling	CLAY, some fine-grained sand, well-sorted, moist, compact *(continued)*		334.06 10.67							Slough
		End of BOREHOLE. NOTES: Standpipe installed to 7.32 m upon well completion. Groundwater level measured at 3.8 mbgs on November 7, 2013. Groundwater level measured at 1.1 mbgs on November 15, 2013.									
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: RT

CHECKED: CD

DATA ENTRY: IPG

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_OCgw

SHEET 1 OF 2

LOCATION: See Location Plan

N: 5512671 E: 652480

BORING DATE: November 7, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q- ● rem V. ⊕ U- O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢—OW—⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		342.60							Stick-up =0.89 m
0	Sonic 127 mm (ID) Casing 152.4 mm (OD) JR Drilling	SANDY GRAVEL, fine-grained with occasional coarse grains, rounded to sub-rounded, moderately graded, dry, very loose		0.00							
1.52		SAND and GRAVEL, coarse sand and fine gravel, rounded to sub-rounded, angular, poorly graded, moist, very loose — Hole is being drilled on the edge of a waste rock pile — Moisture at 2.1 m		341.07 1.52							15 Nov 2013 ∇
3.66		GRAVEL, trace sand, fine to coarse-grained, sub-rounded to rounded, poorly graded, moist, loose		338.94 3.66							Bentonite Chips
6.71		SAND, fine to medium-grained with occasional coarse grains, some gravel, fine to coarse-grained, sub-angular to sub-rounded, dry to moist, loose,		335.89 6.71							
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: RT
CHECKED: CD

PROJECT No.: 12.1349.0013

RECORD OF BOREHOLE: EV_OCgw

LOCATION: See Location Plan
N: 5512671 E: 652480

BORING DATE: November 7, 2013

DATUM: UTM Zone 11 (Nad 83)

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	PIEZOMETER OR STANDPIPE INSTALLATION
10	Sonic 127 mm (ID) Casing 152.4 mm (OD) / JR Drilling	SAND, fine to medium-grained with occasional coarse grains, some gravel, fine to coarse-grained, sub-angular to sub-rounded, dry to moist, loose, *(continued)*			Bentonite Chips
11					Silica Sand
12					
13		SAND, fine to medium-grained with occasional coarse grains, some fine-grained gravel, sub-angular to sub-rounded, moist, loose to compact		329.79 12.80	Slotted Section
14		BEDROCK		328.12 14.46	
15					Silica Sand Tail Pipe
		End of BOREHOLE.		327.06 15.54	
16		NOTES: Standpipe installed to 14.6 m upon well completion. Groundwater level measured at 2.1 mbgs on November 15, 2013.			
17					
18					
19					
20					

Column headers also printed (no data entered): SAMPLES (NUMBER, TYPE, BLOWS/0.3m); DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa (nat V. + Q - ● ; rem V. ⊕ U - O) (20, 40, 60, 80); HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}); WATER CONTENT PERCENT (Wp, W, Wl) (10, 20, 30, 40); ADDITIONAL LAB. TESTING.

DEPTH SCALE
1 : 50

Golder Associates

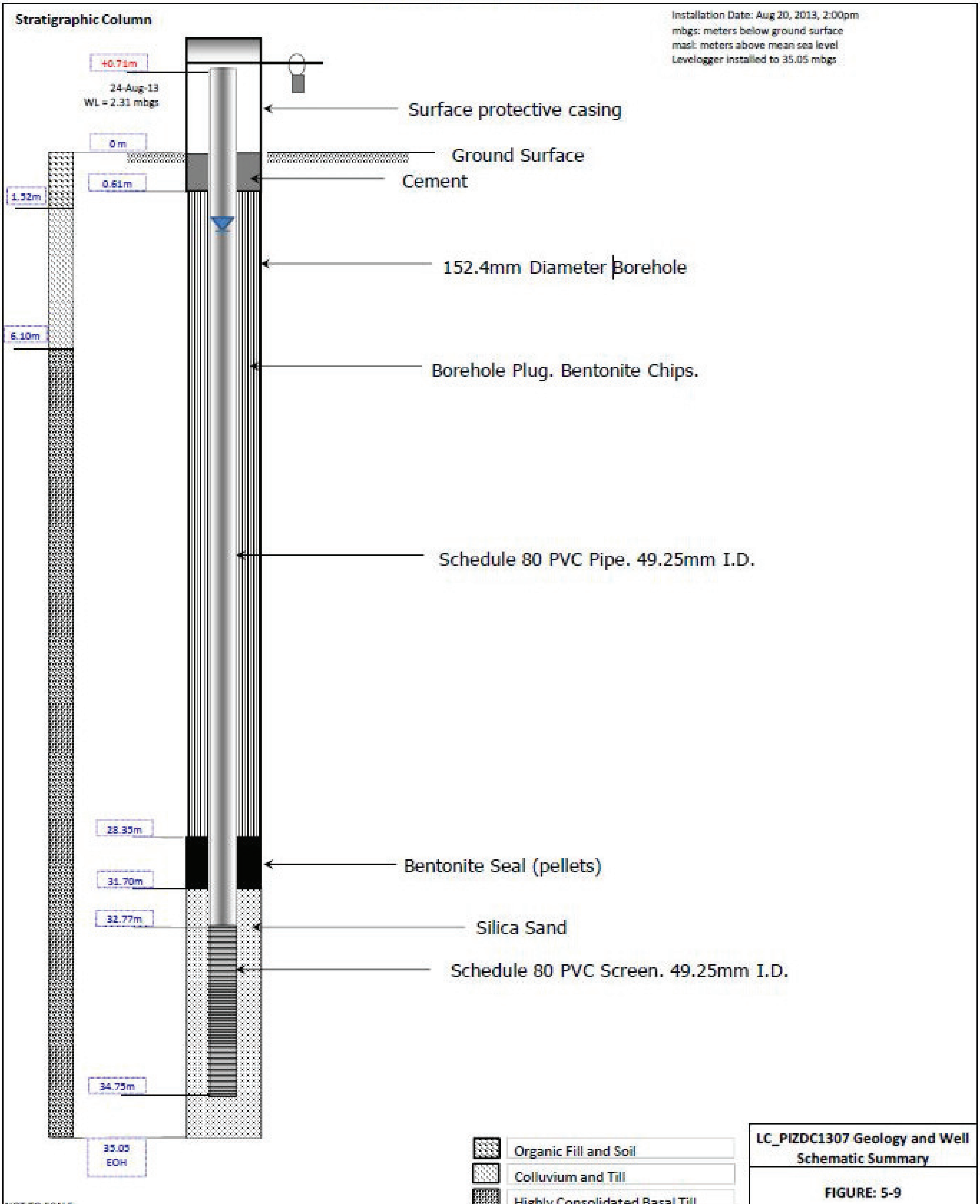
LOGGED: RT
CHECKED: CD

LC_MW13-1D

MONITORING WELL

Borehole: LC_PIZDC1307 **Location:** 5541229.683N, 658168.846E - 1690.506 masl

DRY CREEK PROJECT - 13-1345-0010



LC_PIZDC1307 Geology and Well Schematic Summary

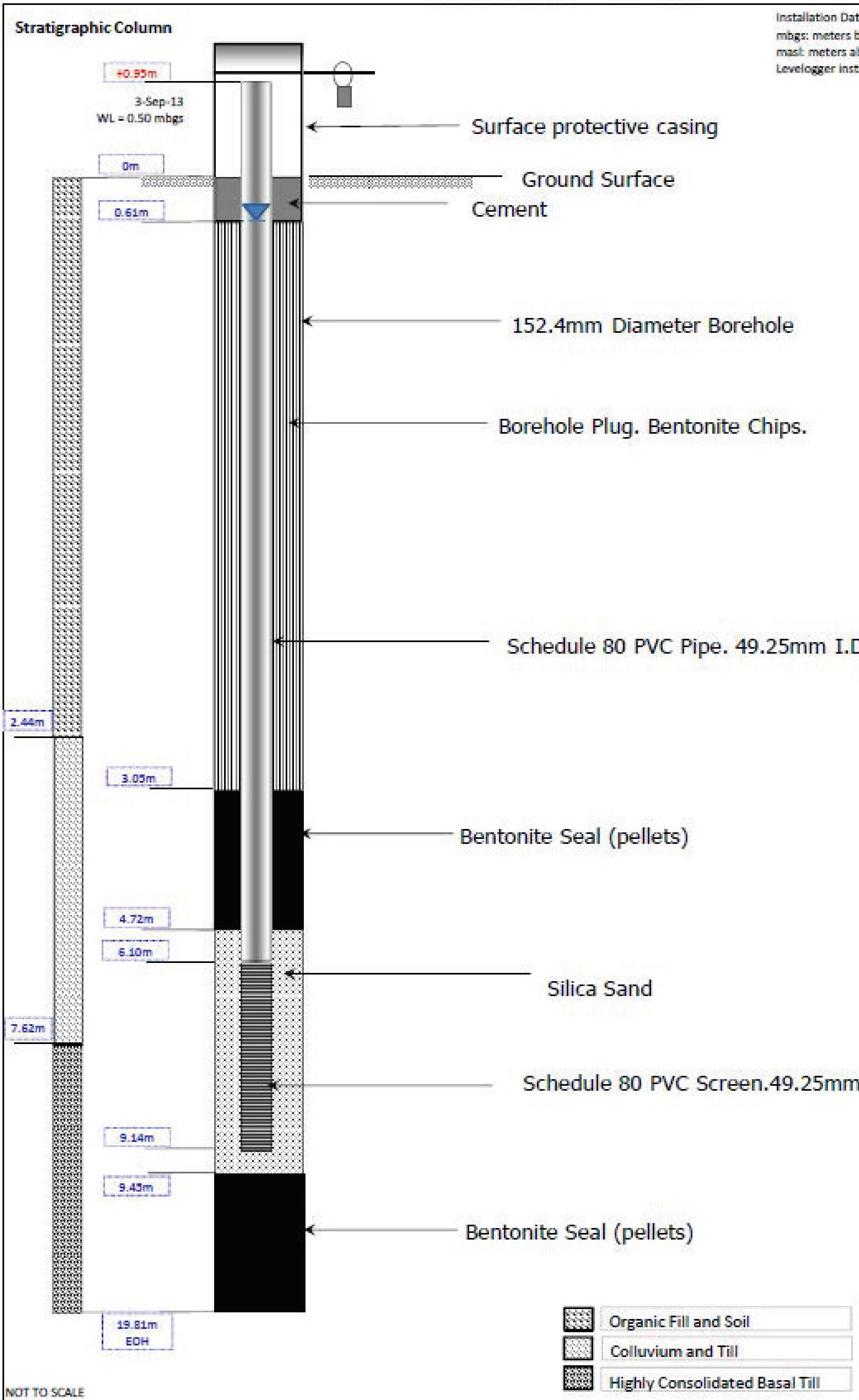
FIGURE: 5-9

MONITORING WELL

LC_MW13-1S

Borehole: LC_PIZDC1308 **Location:** 5541232.170N, 658167.863E - 1690.424 masl

DRY CREEK PROJECT - 13-1345-0010



LC_PIZDC1308 Geology and Well Schematic Summary

FIGURE: 5-10

CLIENT: Teck Coal Ltd.	PROJECT: GW Assessment - Effluent Ponds	BOREHOLE NO: **MW11(P)-01**
DRILLER: JR Drilling	LOCATION: Teck - LCO	PROJECT NO: BX06169
DRILL/METHOD: DR-12/ Air Rotary	BOREHOLE LOCATION: Refer to site plan	ELEVATION: 1266.06 m

SAMPLE TYPE: Shelby Tube | No Recovery | SPT Test (N) | Grab Sample | Split-Pen | Core

BACKFILL TYPE: Bentonite | Pea Gravel | Slough | Grout | Drill Cuttings | Sand

◆ GASTECH VAPOUR ◆ 200 400 600 800
■ STANDARD PEN (N) ■ 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80

Depth (m)	SOIL DESCRIPTION	SAMPLE NO	OTHER TESTS COMMENTS
0	**SAND**, silty, some gravel, trace clay, loose, compact, medium brown, dry -gravelly	1, 2, 3	Top of casing (TOC) elevation is 1267.06 mASL. Stick-up = 1.0 m.
2.4	**SILT**, sandy, some cobbles, some gravel, compact, grey brown, damp	4, 5, 6	
6.1	**SILTY SAND**, some gravel, compact, medium brown, dry	7	
9.1	**SILT** , some cobbles, trace FG sand, firm, medium brown, damp -damp (20) -dry (21) -damp (28)	8, 9, 10, 11, 12, 13, 14, 15	Depth to groundwater was 30.81 m from TOC 23 November 2011 (1236.25 mASL). 150 mm steel casing installed from surface to 33.5 m.
33.5	**SAND AND GRAVEL**, dense, brown grey, moist (sub-rounded gravel)	16	
35.4	**CG SAND**, some gravel, dense, brown grey, wet (sub rounded to sub angular) -wet	17	A 50 mm Schedule 40 slotted PVC screen was installed from 37.5 m to 40.5 m. K = 7.4 x 10^{-4}m/s
41.2	**END OF HOLE AT 41.2 m** Borehole wet at completion. Monitoring well installed.		

Depth (m): 0–45; ELEVATION (m): 1265–1222

amec

AMEC Environment & Infrastructure
Medicine Hat, Alberta

LOGGED BY: RH	COMPLETION DEPTH: 40.50 m
REVIEWED BY: LH	COMPLETION DATE: 11/15/11

srk consulting

Teck

HOLE ID:	**MW-1**	COORDINATES:	667969 E 5487521 N
LOCATION:	CMO	DATUM:	UTM Zone 11
PROJECT NO:	1CT017.098	GROUND ELEV (masl):	1500.44
DRILLING CONTRACTOR:	AquaPro Drilling Ltd.	COLLAR DIP:	-90
		EOH ELEV. (masl):	1463.25
DRILLING TYPE:	Air Rotary	TOTAL DEPTH (mbgs):	37.19
LOGGED BY:	LC	STICKUP HEIGHT (magl):	0.85
BORING DATE:	8/12/2015 to 8/13/2015	CASING STICKUP (magl):	0.85

PROJECT: Phase 1 Groundwater Monitoring

CLIENT: Teck Coal Ltd. - CMO

AREA: **Michel Creek**

Lithological Symbol

CL-Clay, LO-Loam, SI-Silt, SA-Sand, GV-Gravel, SS-Sandstone, ST-Siltstone

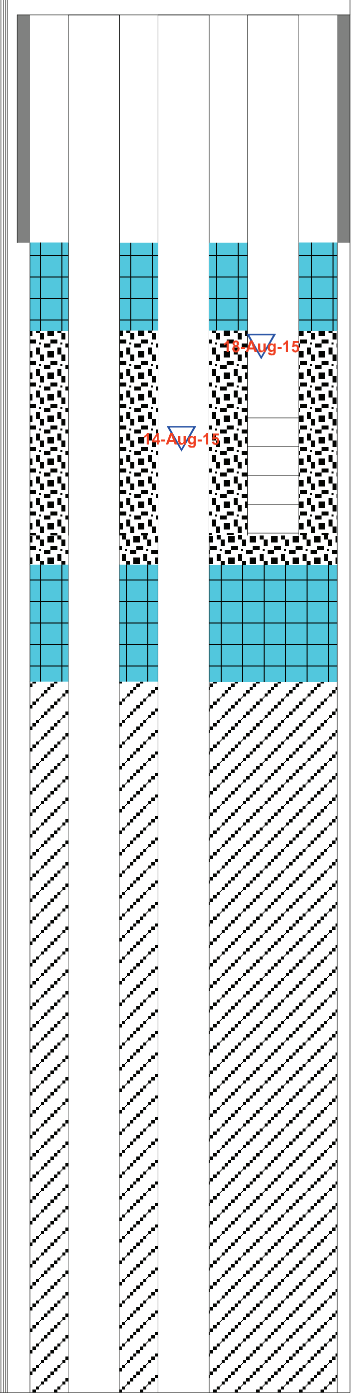
Hydraulic Conductivity (m/s)

1E-8, 1E-7, 1E-6, 1E-5, 0.0001, 0.001

Well Installation

Sand, Screen, PVC, Pellets, Cave, Chips, Chips/Backfill, Backfill, Casing

Depth (m)	Lithology Description	Drilling Notes and Additional Comments
-2		
0	Gravel and sand (GM); Some silt. Very dark brown, well graded, moist, sub-rounded, non-plastic, non-cohesive.	
2	Gravel (GW); Sandy, trace silt. Grayish brown, well graded, dry, sub-angular, non-plastic, non-cohesive.	
	Gravel and sand (GM); Some silt. Very dark grayish brown, well graded, moist, rounded, non-plastic, non-cohesive.	Very fast drilling (through sand)
4	Silt and sand (ML); Gravelly. Very dark grayish brown, well graded, wet, sub-rounded, non-plastic, cohesive.	Hit very wet material, holding for 20 - 30 minutes to determine SWL
6	Clay (CH); Trace sand. Very dark grayish brown, wet, high-plasticity, cohesive.	Very wet, firm clay on drillbit at end of first run
8		
10		Second run just wet clay (added about 50% of the water observed)
12		



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Teck

HOLE ID:	**MW-1**	COORDINATES:	667969 E 5487521 N
LOCATION:	CMO	DATUM:	UTM Zone 11
PROJECT NO:	1CT017.098	GROUND ELEV (masl):	1500.44
DRILLING CONTRACTOR:	AquaPro Drilling Ltd.	COLLAR DIP:	-90
		EOH ELEV. (masl):	1463.25
DRILLING TYPE:	Air Rotary	TOTAL DEPTH (mbgs):	37.19
LOGGED BY:	LC	STICKUP HEIGHT (magl):	0.85
BORING DATE:	8/12/2015 to 8/13/2015	CASING STICKUP (magl):	0.85

PROJECT: Phase 1 Groundwater Monitoring

CLIENT: Teck Coal Ltd. - CMO

AREA: **Michel Creek**

Depth (m)

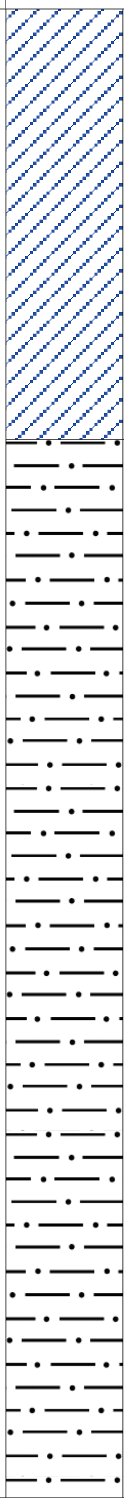
Lithological Symbol

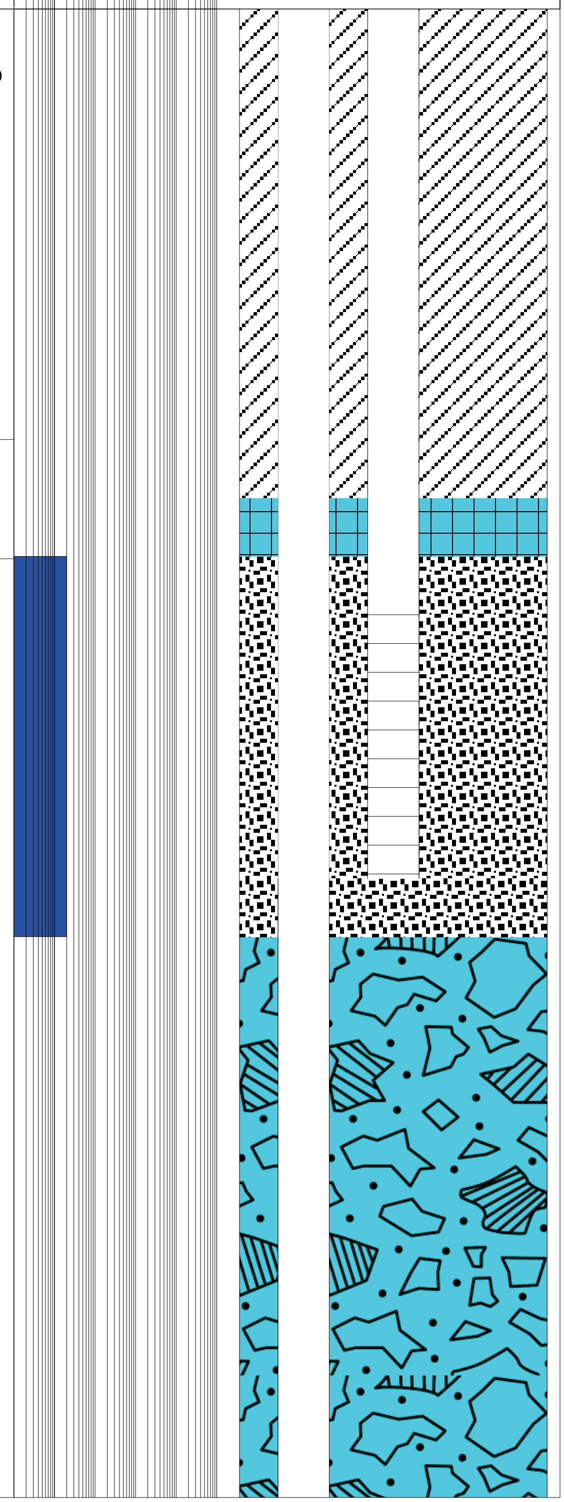
CL-Clay, SA-Sand, SS-Sandstone, LO-Loam, GV-Gravel, ST-Siltstone, SI-Silt

Hydraulic Conductivity (m/s): 1E-8, 1E-7, 1E-6, 1E-5, 0.0001, 0.001

Well Installation

Sand, Chips, Screen, Chips/Backfill, PVC, Backfill, Pellets, Casing, Cave





Depth (m)	Lithology Description	Drilling Notes and Additional Comments
14–18		Same clay all the way to bedrock
18	Siltstone bedrock; Black, wet.	Bedrock is mix of black siltstone, grey fine sandstone, and light tan sandstone
19.2–29		Mix of rock chips - light and dark sandstone and siltstone

Depth ticks: 14, 16, 18, 20, 22, 24, 26, 28

srk consulting

Teck

HOLE ID:	**MW-1**	COORDINATES:	667969 E 5487521 N
LOCATION:	CMO	DATUM:	UTM Zone 11
PROJECT NO:	1CT017.098	GROUND ELEV (masl):	1500.44
DRILLING CONTRACTOR:	AquaPro Drilling Ltd.	COLLAR DIP:	-90
		EOH ELEV. (masl):	1463.25
DRILLING TYPE:	Air Rotary	TOTAL DEPTH (mbgs):	37.19
LOGGED BY:	LC	STICKUP HEIGHT (magl):	0.85
BORING DATE:	8/12/2015 to 8/13/2015	CASING STICKUP (magl):	0.85

PROJECT: Phase 1 Groundwater Monitoring

CLIENT: Teck Coal Ltd. - CMO

AREA: **Michel Creek**

Depth (m)

Lithological Symbol

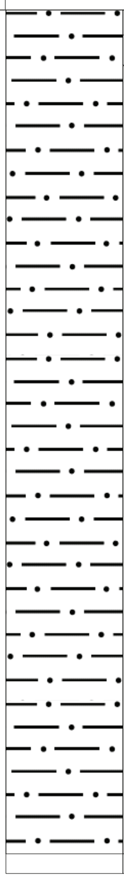
CL-Clay, SA-Sand, SS-Sandstone, LO-Loam, GV-Gravel, ST-Siltstone, SI-Silt

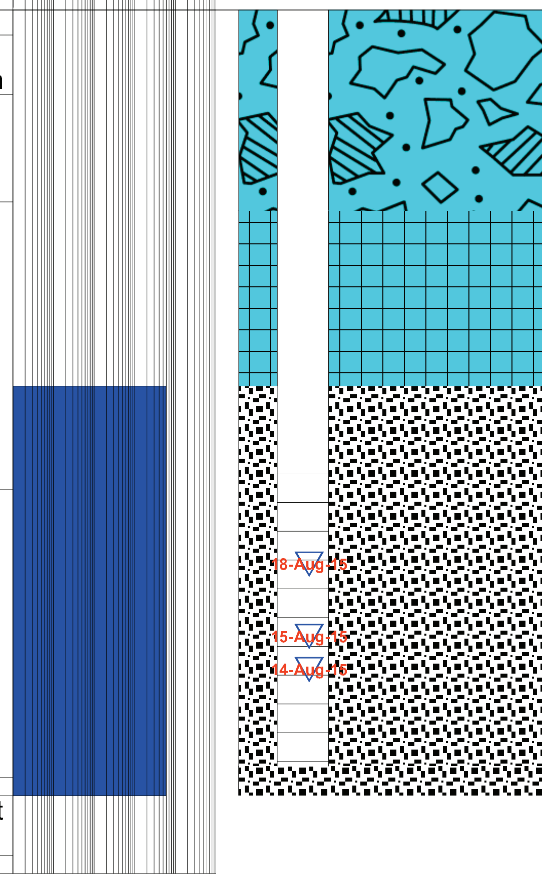
Hydraulic Conductivity (m/s): 1E-8, 1E-7, 1E-6, 1E-5, 0.0001, 0.001

Well Installation

Sand, Chips, Screen, Chips/Backfill, PVC, Backfill, Pellets, Casing, Cave

Depth (m)	**Lithology Description**	**Drilling Notes and Additional Comments**
	Siltstone bedrock; Silty. Black, wet.	Layer of clayey bedrock at approximately 29.3 m
30	Siltstone bedrock; Black, dry.	
		Switch to gray sandstone, dry
32		
34		
36		Intermittent dusty zones for last 3 m
		Finished drilling to target potentially wet area
38		





BRITISH COLUMBIA

Report 1 - Detailed Well Record

RG_01-03 (Elkford Supply Well)

Well Tag Number: 42698 Owner: VILLAGE OF ELKFORD Address: BOIVIN CK & ELK RIVER Area: WELL LOCATION: Land District District Lot: 12378 Plan: Lot: Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: BCGS Number (NAD 83): Well: 5 Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Observation Well Number: Observation Well Status: Construction Method: Diameter: 0.0 inches Casing drive shoe: Well Depth: 0 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Site Info Details: Other Info Flag: Other Info Details:	Construction Date: 1979-07-01 00:00:00 Driller: Well Identification Plate Number: Plate Attached By: Where Plate Attached: PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 0 (Driller's Estimate) Development Method: Pump Test Info Flag: Y Artesian Flow: Artesian Pressure (ft): Static Level: WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Y Field Chemistry Info Flag: Site Info (SEAM): Water Utility: Water Supply System Name: Water Supply System Well Name: SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in): WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:

Screen from	to feet	Type	Slot Size

Casing from	to feet	Diameter	Material	Drive Shoe

GENERAL REMARKS:
YIELD:NO DATA EXPLORATORY & WATER WELL

LITHOLOGY INFORMATION:

From	0 to	0 Ft.	MEASURED IN METERS
From	0 to	12.2 Ft.	DRY MED. FINE SAND SOME SILT TRACE OF
From	0 to	0 Ft.	GRAVEL.

From	12.2	to	18.3	Ft.	DRY GRAVEL SOME SILT & TRACE OF SAND.
From	0	to	0	Ft.	GRAVEL WELL ROUNDED TO @ 1.5cm
From	18.3	to	21.3	Ft.	DRY GRAVEL SOME BOULDERS & SILT,TRACE
From	0	to	0	Ft.	OF SAND.
From	21.3	to	22.9	Ft.	SANDY GRAVEL SOME SILT & CLAY
From	22.9	to	33.5	Ft.	DRY GRAVEL,SOME SAND,TRACE OF SILT &
From	0	to	0	Ft.	BROWN CLAY.
From	33.5	to	47.2	Ft.	MOIST STICKY GRAVEL,SOME SAND,TRACE OF
From	0	to	0	Ft.	SILT & CLAY.
From	47.2	to	48.8	Ft.	BOULDER,PREDOMINANTLY SHALE
From	48.8	to	57.3	Ft.	GRAVEL SOME SAND,TRACE OF SILT,SUB-
From	0	to	0	Ft.	-ROUNDED PEBBLES TO @ 2cm.
From	57.3	to	67.1	Ft.	SANDY GRAVEL WITH SOME COBBLES & TRACE
From	0	to	0	Ft.	OF SILT.SAND IS MOSTLY COARSE.GRAVEL
From	0	to	0	Ft.	FROM FINE TO COARSE.
From	67.1	to	70.7	Ft.	SANDY GRAVEL & TRACE OF SILT.ABUNDENT
From	0	to	0	Ft.	MUD & FINE SAND.
From	70.7	to	77.4	Ft.	SANDY GRAVEL WITH SOME COBBLES & TRACE
From	0	to	0	Ft.	OF SILT.
From	77.4	to	79.3	Ft.	SANDY GRAVEL WITH SOME FINE SAND & SILT
From	79.3	to	81.4	Ft.	SANDY GRAVEL WITH SOME COBBLES & TRACE
From	0	to	0	Ft.	OF SILT.
From	81.4	to	84.4	Ft.	SANDY GRAVEL WITH TRACE COBBLES & SILT.
From	0	to	0	Ft.	SUBROUNDED GRAVEL 1-3 cm.
From	84.4	to	89.3	Ft.	FINE SANDY GRAVEL TRACE COBBLES & SILT
From	90.5	to	91.7	Ft.	SILTY SAND WITH SOME GRAVEL & COBBLES

- Return to Main
- Return to Search Options
- Return to Search Criteria

BRITISH COLUMBIA

Report 1 - Detailed Well Record

RG_DW-01-07

Well Tag Number: 55014

Owner: JOE SMITHIES

Address: 5 M BEFORE

Area: ELKFORD

WELL LOCATION:
KOOTENAY Land District
District Lot: 7995 Plan: 13618 Lot: 3
Township: Section: Range:
Indian Reserve: Meridian: Block:
Quarter:
Island:
BCGS Number (NAD 83): 082G096144 Well: 1

Class of Well:
Subclass of Well:
Orientation of Well:
Status of Well: New
Well Use: Private Domestic
Observation Well Number:
Observation Well Status:
Construction Method: Drilled
Diameter: 6.0 inches
Casing drive shoe:
Well Depth: 32 feet
Elevation: 0 feet (ASL)
Final Casing Stick Up: inches
Well Cap Type:
Bedrock Depth: feet
Lithology Info Flag:
File Info Flag:
Sieve Info Flag:
Screen Info Flag:

Site Info Details:
Other Info Flag:
Other Info Details:

Construction Date: 1985-07-22 00:00:00.0

Driller: Owen's Drilling Ltd.
Well Identification Plate Number:
Plate Attached By:
Where Plate Attached:

PRODUCTION DATA AT TIME OF DRILLING:
Well Yield: 2.5 (Driller's Estimate) Gallons per Minute (U.S./Imperial)
Development Method:
Pump Test Info Flag:
Artesian Flow:
Artesian Pressure (ft):
Static Level: 22 feet

WATER QUALITY:
Character:
Colour:
Odour:
Well Disinfected: N
EMS ID:
Water Chemistry Info Flag:
Field Chemistry Info Flag:
Site Info (SEAM):

Water Utility:
Water Supply System Name:
Water Supply System Well Name:

SURFACE SEAL:
Flag:
Material:
Method:
Depth (ft): 0 feet
Thickness (in):
Liner from To: feet

WELL CLOSURE INFORMATION:
Reason For Closure:
Method of Closure:
Closure Sealant Material:
Closure Backfill Material:
Details of Closure:

Screen from	to feet	Type	Slot Size
0	0		0
0	0		0
0	0		0
0	0		0

Casing from	to feet	Diameter	Material	Drive Shoe
0	0	0	null	null

GENERAL REMARKS:

LITHOLOGY INFORMATION:
From 0 to 31 Ft. sandy gravel and clay wet
From 31 to 32 Ft. sandy gravel

- Return to Main
- Return to Search Options
- Return to Search Criteria

BRITISH COLUMBIA

Report 1 - Detailed Well Record

RG_DW-02-20

Well Tag Number: 101942

Owner: ELK VALLEY FLYING CLUB

Address:

Area:

WELL LOCATION:
KOOTENAY Land District
District Lot: 4144 Plan: Lot:
Township: Section: Range:
Indian Reserve: Meridian: Block:
Quarter:
Island:
BCGS Number (NAD 27): 082G086231 Well: 4

Class of Well: Water supply
Subclass of Well: Domestic
Orientation of Well: Vertical
Status of Well: New
Well Use: Private Domestic
Observation Well Number:
Observation Well Status:
Construction Method:
Diameter: inches
Casing drive shoe: Y
Well Depth: 60 feet
Elevation: feet (ASL)
Final Casing Stick Up: inches
Well Cap Type:
Bedrock Depth: feet
Lithology Info Flag: N
File Info Flag: N
Sieve Info Flag: N
Screen Info Flag: N

Site Info Details:
Other Info Flag:
Other Info Details:

Construction Date: 2002-04-02 00:00:00

Driller: J. R. Drilling
Well Identification Plate Number:
Plate Attached By:
Where Plate Attached:

PRODUCTION DATA AT TIME OF DRILLING:
Well Yield: 60 (Driller's Estimate) U.S. Gallons per Minute
Development Method: Air lifting
Pump Test Info Flag: N
Artesian Flow:
Artesian Pressure (ft):
Static Level: 7 feet

WATER QUALITY:
Character:
Colour:
Odour:
Well Disinfected: N
EMS ID:
Water Chemistry Info Flag: N
Field Chemistry Info Flag:
Site Info (SEAM):

Water Utility:
Water Supply System Name:
Water Supply System Well Name:

SURFACE SEAL:
Flag: N
Material:
Method:
Depth (ft):
Thickness (in):
Liner from To: feet

WELL CLOSURE INFORMATION:
Reason For Closure:
Method of Closure:
Closure Sealant Material:
Closure Backfill Material:
Details of Closure:

Screen from	to feet	Type	Slot Size

Casing from	to feet	Diameter	Material	Drive Shoe
0	60	6	Steel	Y

GENERAL REMARKS:
MEASUREMENTS: TOP OF CASING. PITLESS UNIT: WELDED. SHOE: BARBER. WATER QUALITY AND QUANTITY NOT GUARANTEED BY CONTRACTOR.

LITHOLOGY INFORMATION:

From	0	to	47	Ft.	gravel
From	47	to	52	Ft.	clay
From	52	to	60	Ft.	gravel

- Return to Main
- Return to Search Options
- Return to Search Criteria

BRITISH COLUMBIA

Report 1 - Detailed Well Record

RG_DW-03-01

Well Tag Number: 94779	Construction Date: 2008-02-28 00:00:00
Owner: SPARDELL MOBILE HOME PARK LTD	Driller: Owen's Drilling Ltd.
Address: 100 INDUSTRIAL ROAD #1	Well Identification Plate Number: 26287
Area: SPARWOOD	Plate Attached By: MIKE CALDWELL
WELL LOCATION:	Where Plate Attached: TOP OF CASING
KOOTENAY Land District	PRODUCTION DATA AT TIME OF DRILLING:
District Lot: 4588 Plan: 1358 & NEP 64776 Lot: 13 & 1	Well Yield: 30 (Driller's Estimate) U.S. Gallons per Minute
Township: Section: Range:	Development Method: Air lifting
Indian Reserve: Meridian: Block:	Pump Test Info Flag: N
Quarter:	Artesian Flow:
Island:	Artesian Pressure (ft):
BCGS Number (NAD 83): 082G076233 Well: 9	Static Level:
Class of Well: Water supply	WATER QUALITY:
Subclass of Well: Domestic	Character:
Orientation of Well: Vertical	Colour:
Status of Well: New	Odour:
Licence General Status: UNLICENSED	Well Disinfected: N
Well Use: Water Supply System	EMS ID:
Observation Well Number:	Water Chemistry Info Flag: N
Observation Well Status:	Field Chemistry Info Flag:
Construction Method:	Site Info (SEAM):
Diameter: inches	Water Utility:
Casing drive shoe: Y	Water Supply System Name:
Well Depth: 50 feet	Water Supply System Well Name:
Elevation: 3697 feet (ASL)	SURFACE SEAL:
Final Casing Stick Up: 12 inches	Flag: Y
Well Cap Type: BOLT ON	Material: Bentonite clay
Bedrock Depth: feet	Method: Poured
Lithology Info Flag: Y	Depth (ft): 15 feet
File Info Flag: N	Thickness (in): 2 inches
Sieve Info Flag: N	Liner from To: feet
Screen Info Flag: Y	WELL CLOSURE INFORMATION:
	Reason For Closure:
Site Info Details:	Method of Closure:
Other Info Flag:	Closure Sealant Material:
Other Info Details:	Closure Backfill Material:
	Details of Closure:

Screen from	to feet	Type	Slot Size
46	50		30

Casing from	to feet	Diameter	Material	Drive Shoe
0	46	6	Steel	Y

```
GENERAL REMARKS:



LITHOLOGY INFORMATION:

From      0 to     15 Ft.  Medium CLAY & TOP SOIL    brown

From     15 to     30 Ft.  Medium     brown

From     30 to     45 Ft.  Medium CLAY & GRAVEL    brown

From     45 to     50 Ft.  Medium  30 U.S. Gallons per Minute  brown
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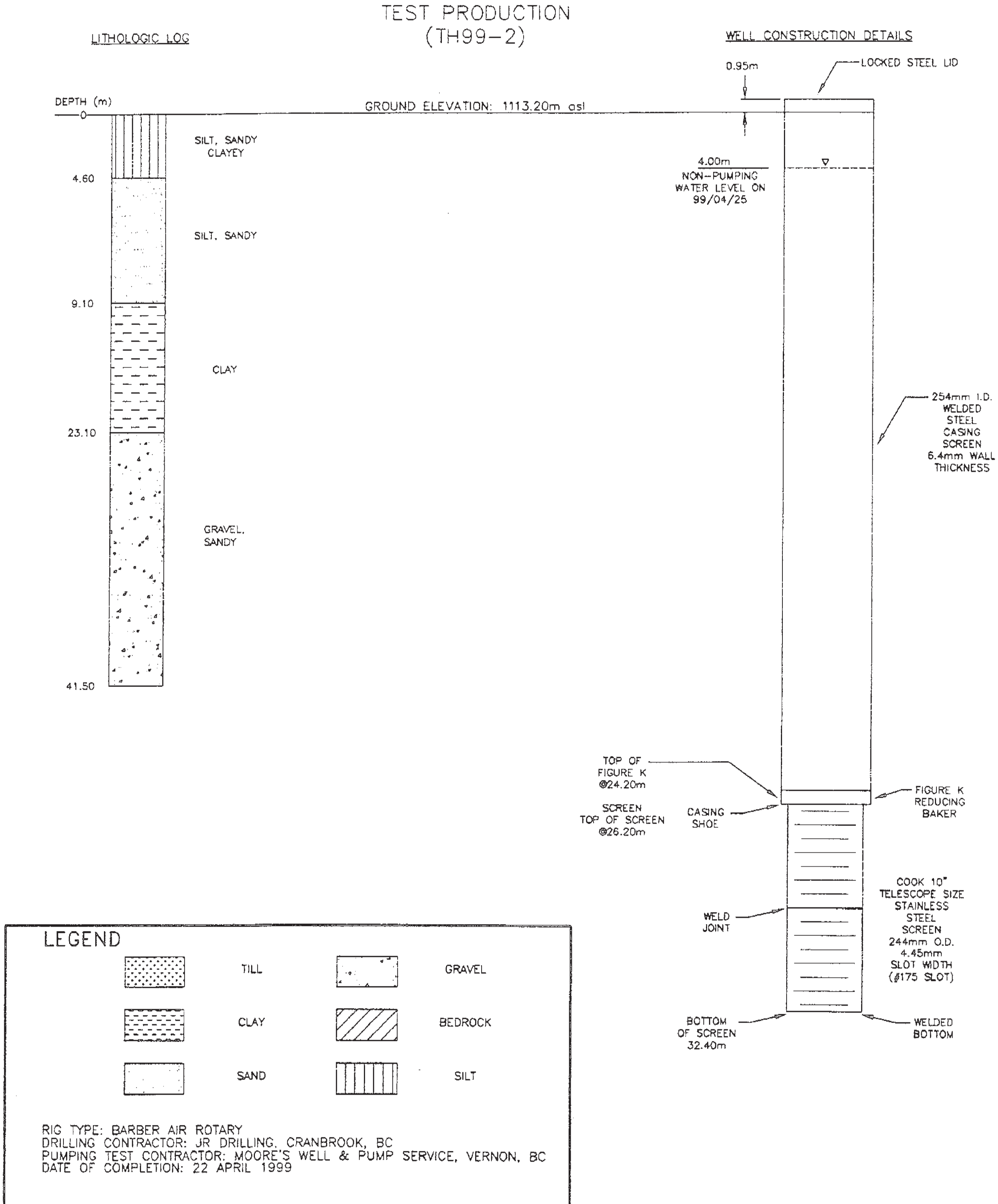
- Return to Main
- Return to Search Options
- Return to Search Criteria

RG_DW-03-04



NOT TO SCALE

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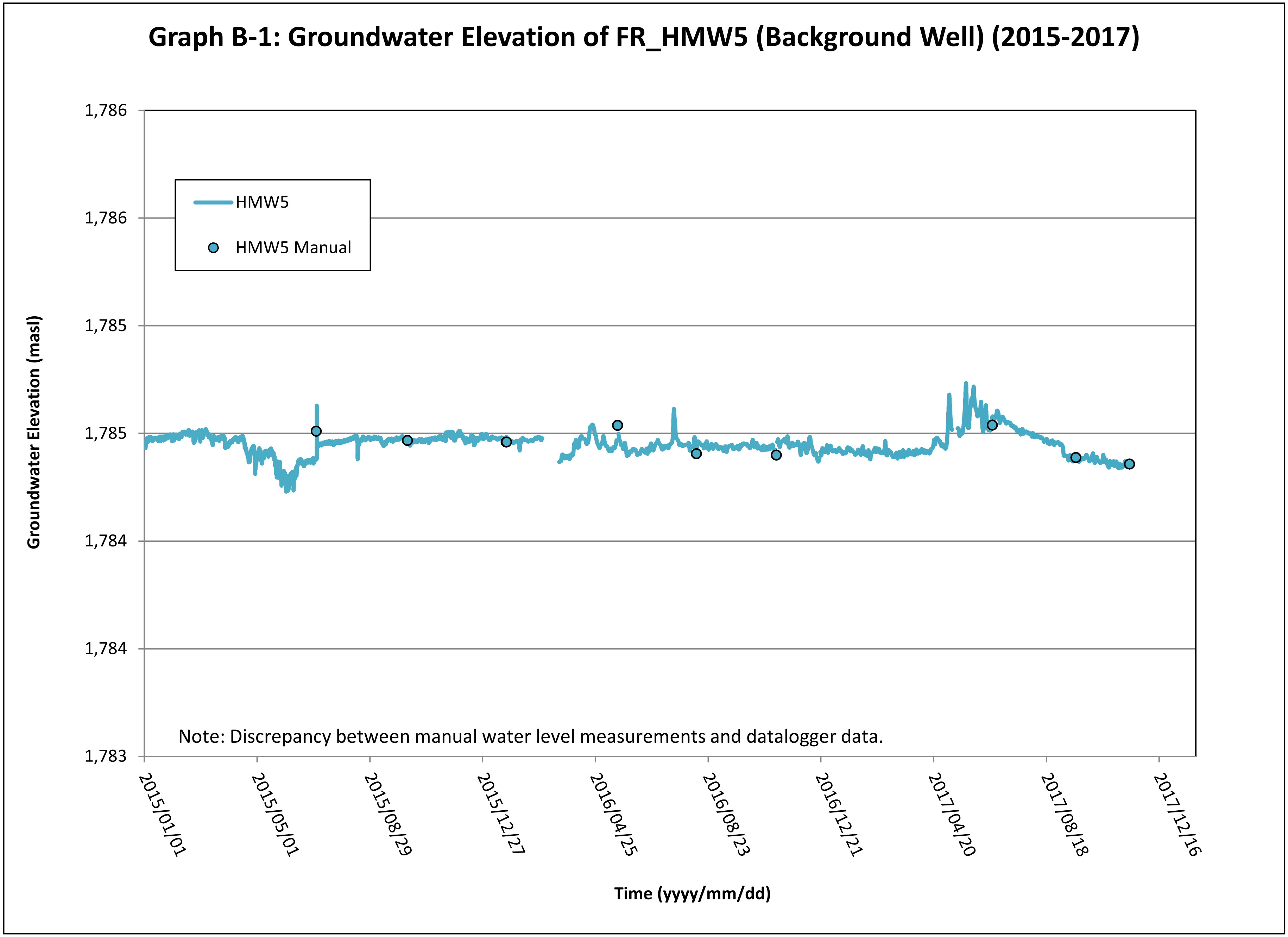
HYDROGEOLOGICAL EVALUATION OF A NEW TEST WELL
DISTRICT OF SPARWOOD, BC

FIG. 3

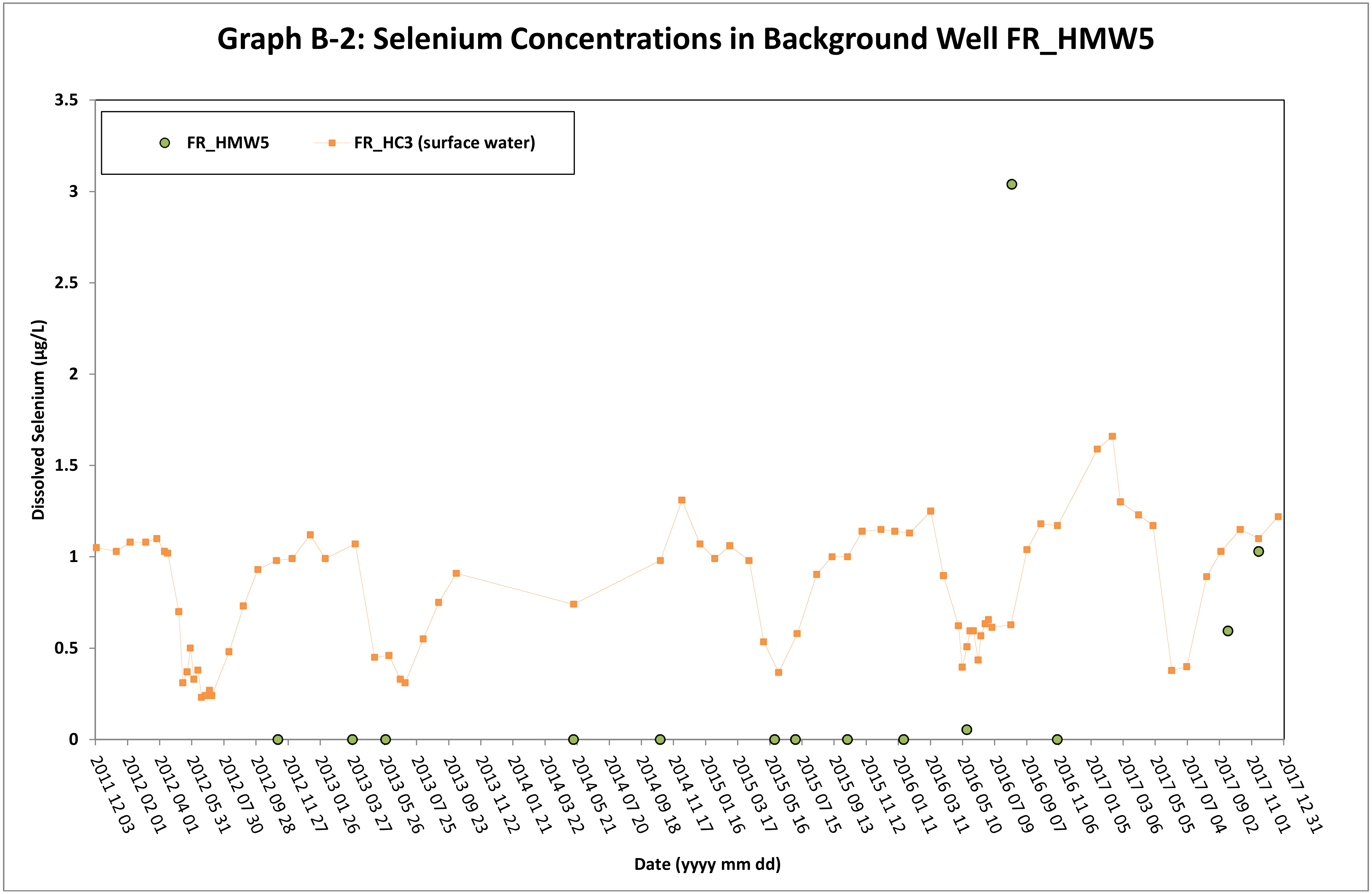
JOB# 0764-206-00-02

Appendix III

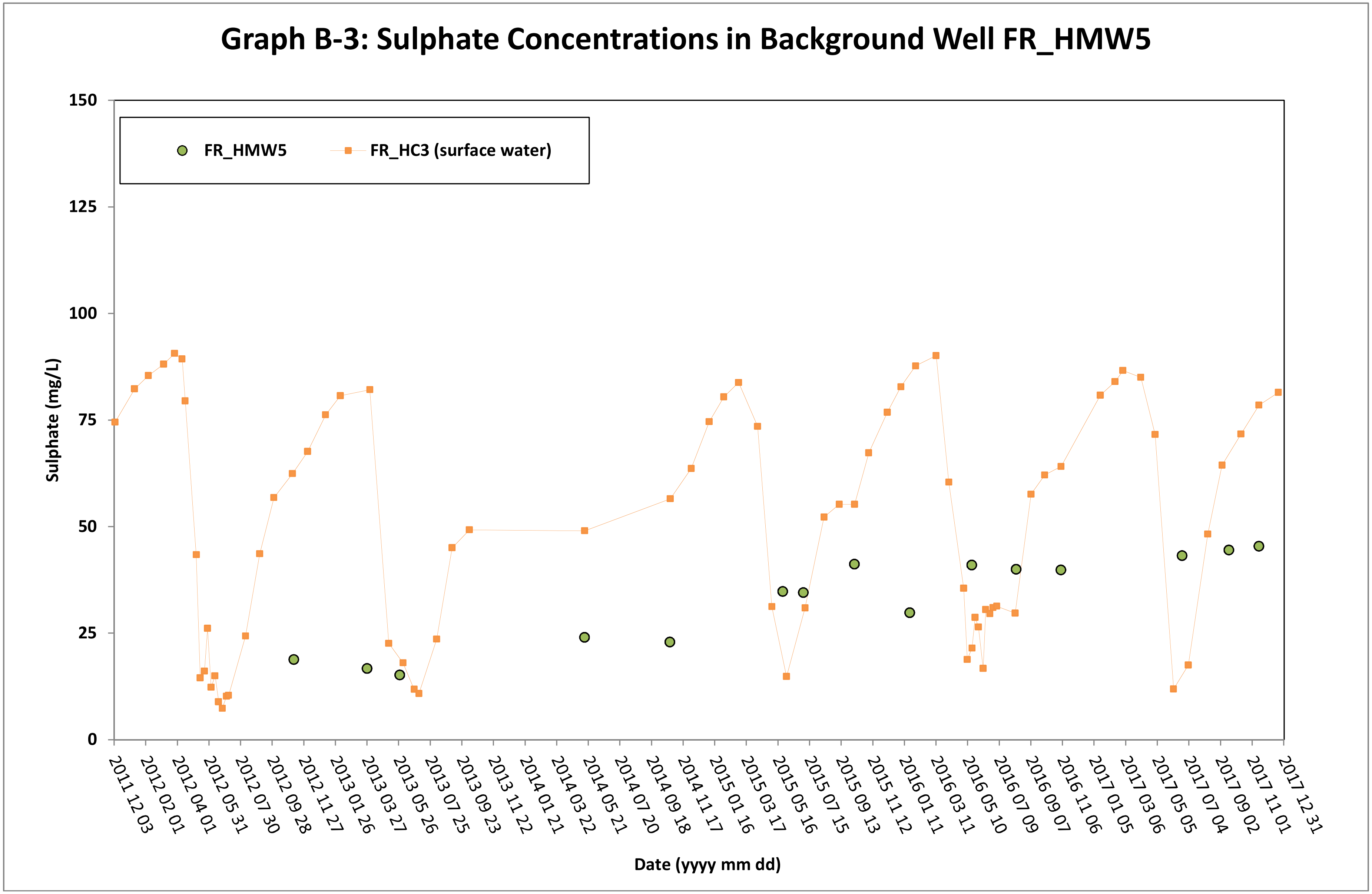
Time-Series Graphs



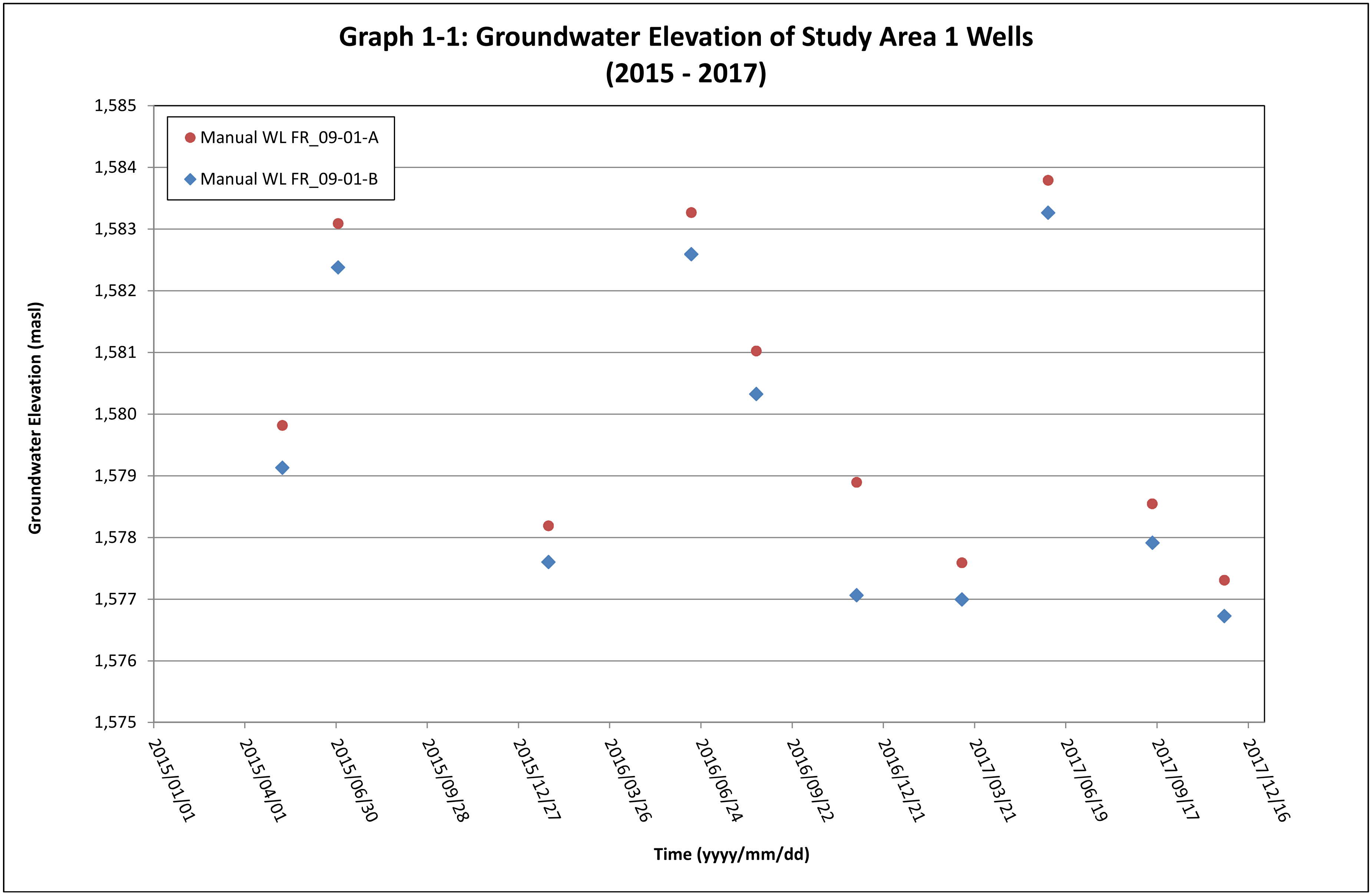
Graph B-1: Groundwater Elevation of FR_HMW5 (Background Well) (2015-2017)
HMW5
HMW5 Manual
1,786
1,786
1,785
1,785
1,784
1,784
1,783
Groundwater Elevation (masl)
Note: Discrepancy between manual water level measurements and datalogger data.
2015/01/01
2015/05/01
2015/08/29
2015/12/27
2016/04/25
2016/08/23
2016/12/21
2017/04/20
2017/08/18
2017/12/16
Time (yyyy/mm/dd)



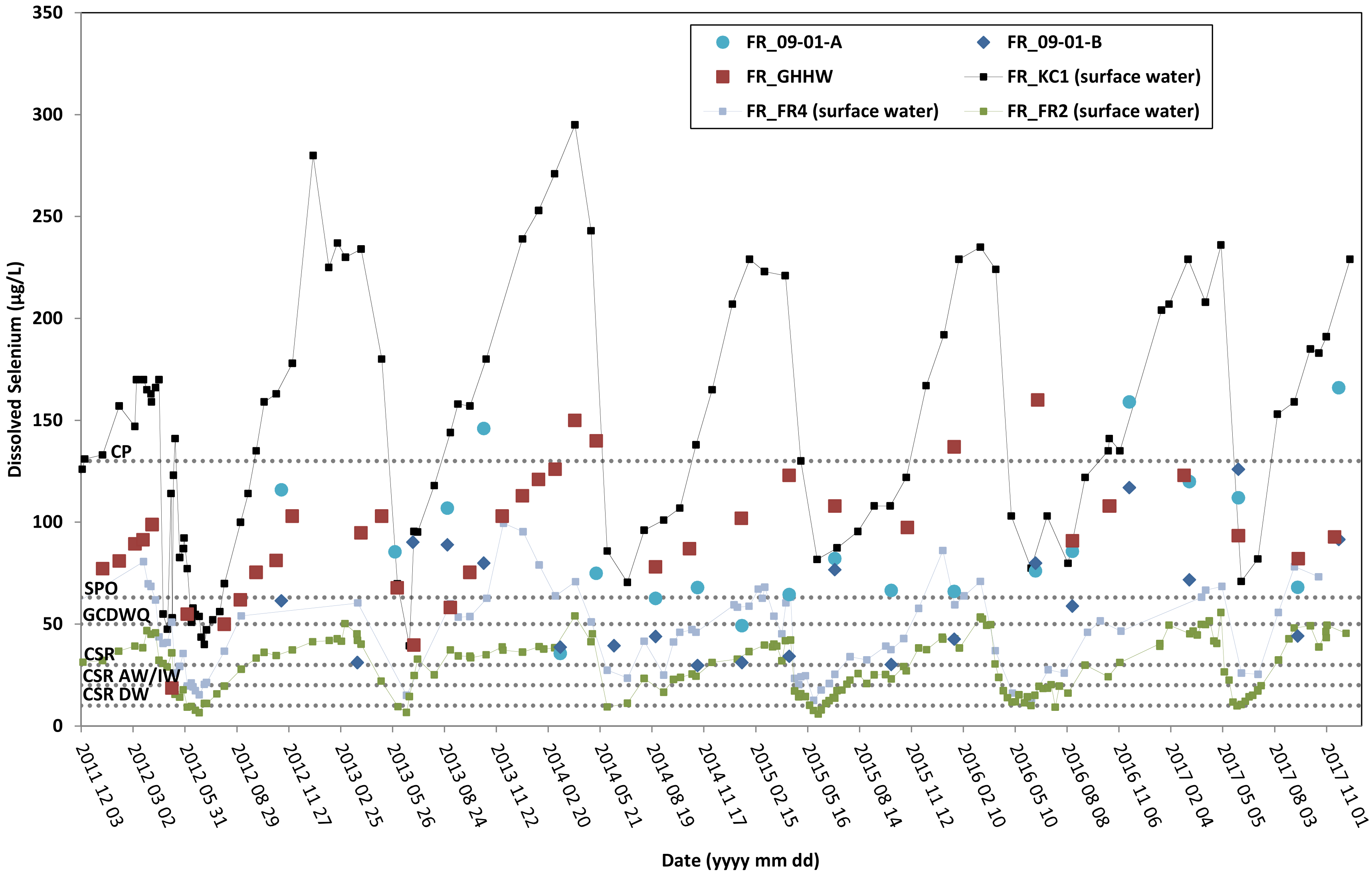
Graph B-2: Selenium Concentrations in Background Well FR_HMW5
FR_HMW5
FR_HC3 (surface water)
Dissolved Selenium (µg/L)
3.5
3
2.5
2
1.5
1
0.5
0
2011 12 03
2012 02 01
2012 04 01
2012 05 31
2012 07 30
2012 09 28
2012 11 27
2013 01 26
2013 03 27
2013 05 26
2013 07 25
2013 09 23
2013 11 22
2014 01 21
2014 03 22
2014 05 21
2014 07 20
2014 09 18
2014 11 17
2015 01 16
2015 03 17
2015 05 16
2015 07 15
2015 09 13
2015 11 12
2016 01 11
2016 03 11
2016 05 10
2016 07 09
2016 09 07
2016 11 06
2017 01 05
2017 03 06
2017 05 05
2017 07 04
2017 09 02
2017 11 01
2017 12 31
Date (yyyy mm dd)

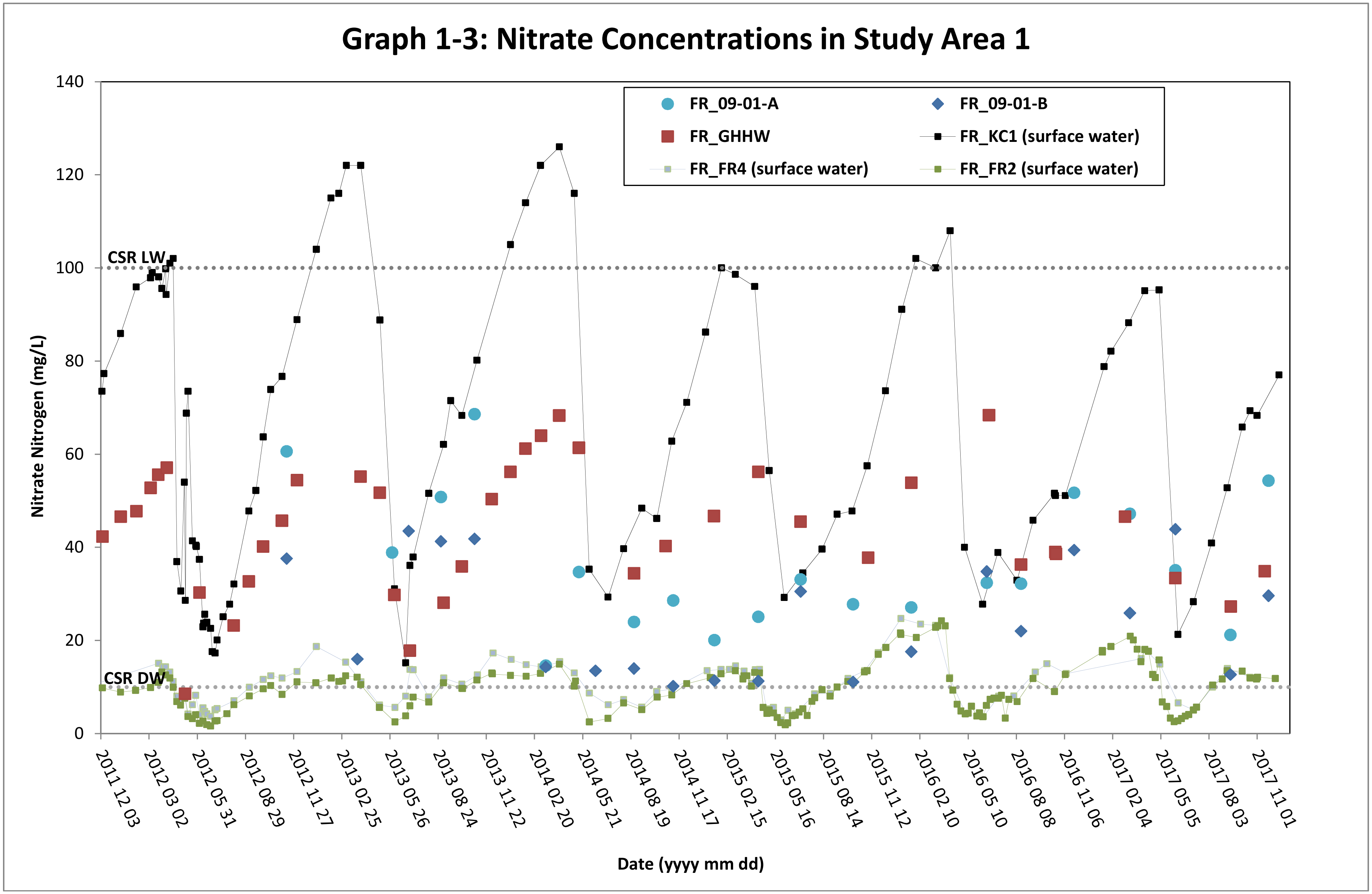


Graph B-3: Sulphate Concentrations in Background Well FR_HMW5
FR_HMW5
FR_HC3 (surface water)
Sulphate (mg/L)
150
125
100
75
50
25
0
2011 12 03
2012 02 01
2012 04 01
2012 05 31
2012 07 30
2012 09 28
2012 11 27
2013 01 26
2013 03 27
2013 05 26
2013 07 25
2013 09 23
2013 11 22
2014 01 21
2014 03 22
2014 05 21
2014 07 20
2014 09 18
2014 11 17
2015 01 16
2015 03 17
2015 05 16
2015 07 15
2015 09 13
2015 11 12
2016 01 11
2016 03 11
2016 05 10
2016 07 09
2016 09 07
2016 11 06
2017 01 05
2017 03 06
2017 05 05
2017 07 04
2017 09 02
2017 11 01
2017 12 31
Date (yyyy mm dd)

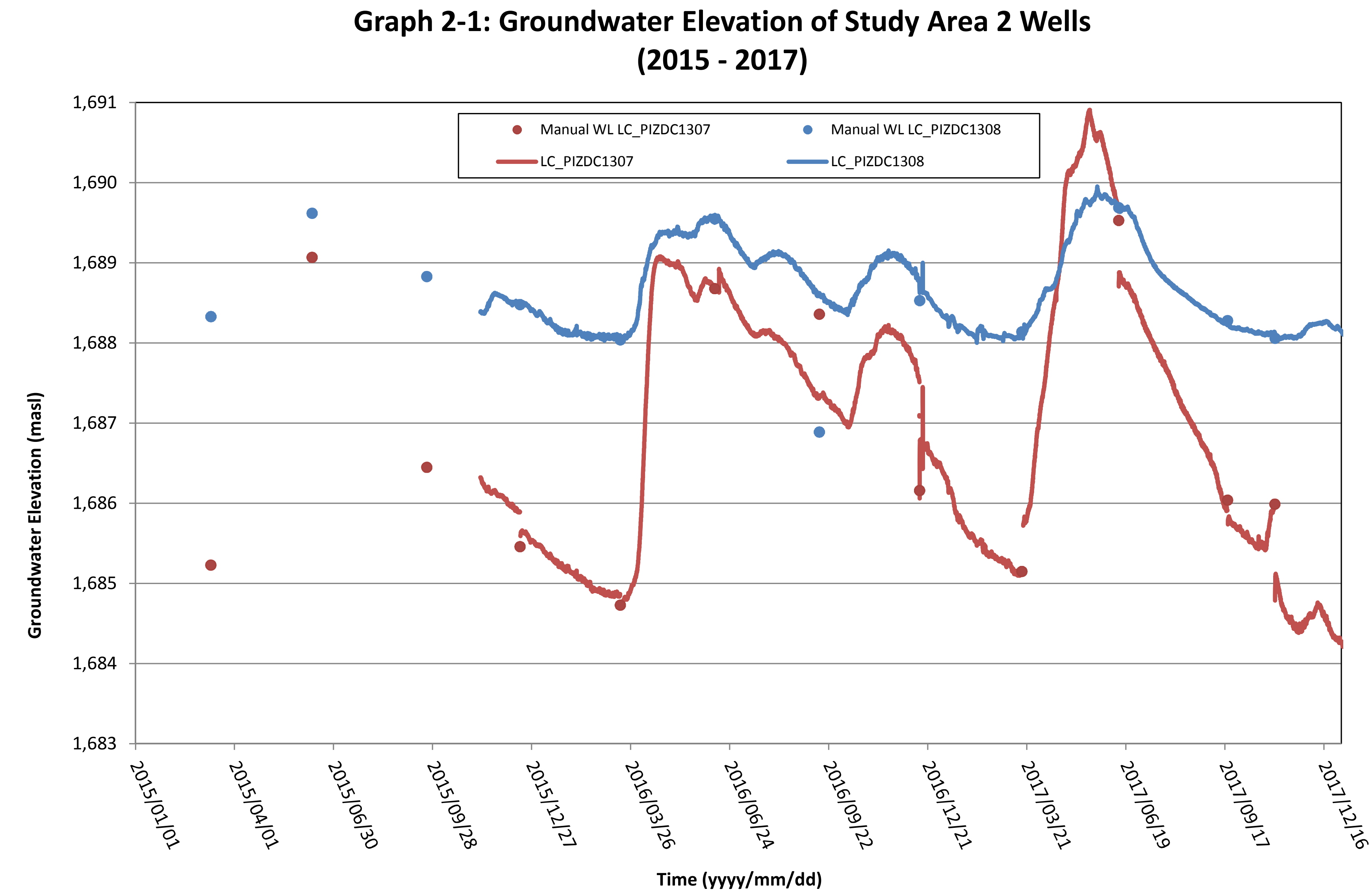

Graph 1-1: Groundwater Elevation of Study Area 1 Wells
(2015 - 2017)
Manual WL FR_09-01-A
Manual WL FR_09-01-B
Groundwater Elevation (masl)
1,585
1,584
1,583
1,582
1,581
1,580
1,579
1,578
1,577
1,576
1,575
2015/01/01
2015/04/01
2015/06/30
2015/09/28
2015/12/27
2016/03/26
2016/06/24
2016/09/22
2016/12/21
2017/03/21
2017/06/19
2017/09/17
2017/12/16
Time (yyyy/mm/dd)

Graph 1-2: Selenium Concentrations in Study Area 1



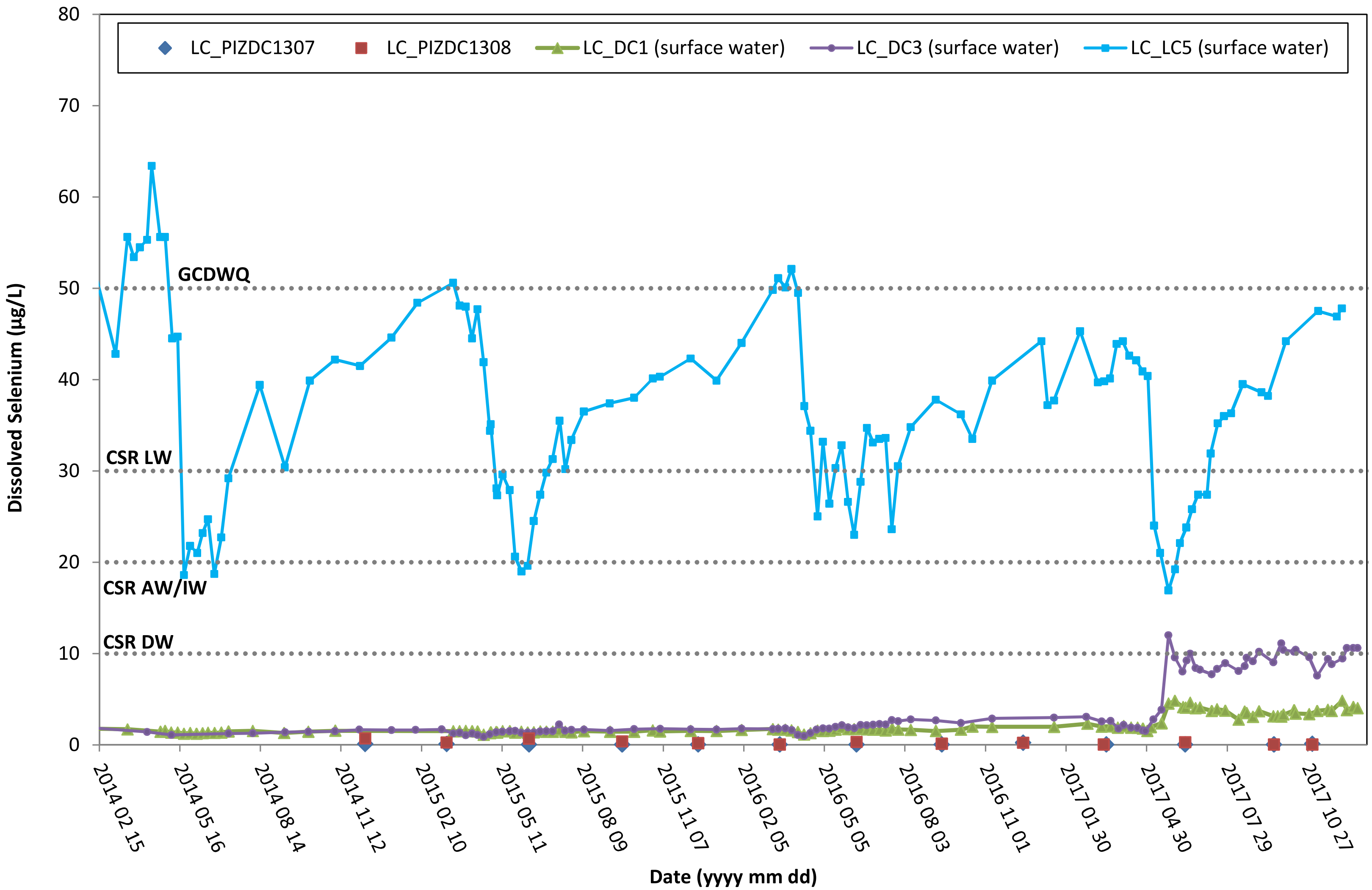


Graph 1-3: Nitrate Concentrations in Study Area 1
FR_09-01-A
FR_09-01-B
FR_GHHW
FR_KC1 (surface water)
FR_FR4 (surface water)
FR_FR2 (surface water)
CSR LW
CSR DW
Nitrate Nitrogen (mg/L)
0
20
40
60
80
100
120
140
2011 12 03
2012 03 02
2012 05 31
2012 08 29
2012 11 27
2013 02 25
2013 05 26
2013 08 24
2013 11 22
2014 02 20
2014 05 21
2014 08 19
2014 11 17
2015 02 15
2015 05 16
2015 08 14
2015 11 12
2016 02 10
2016 05 10
2016 08 08
2016 11 06
2017 02 04
2017 05 05
2017 08 03
2017 11 01
Date (yyyy mm dd)

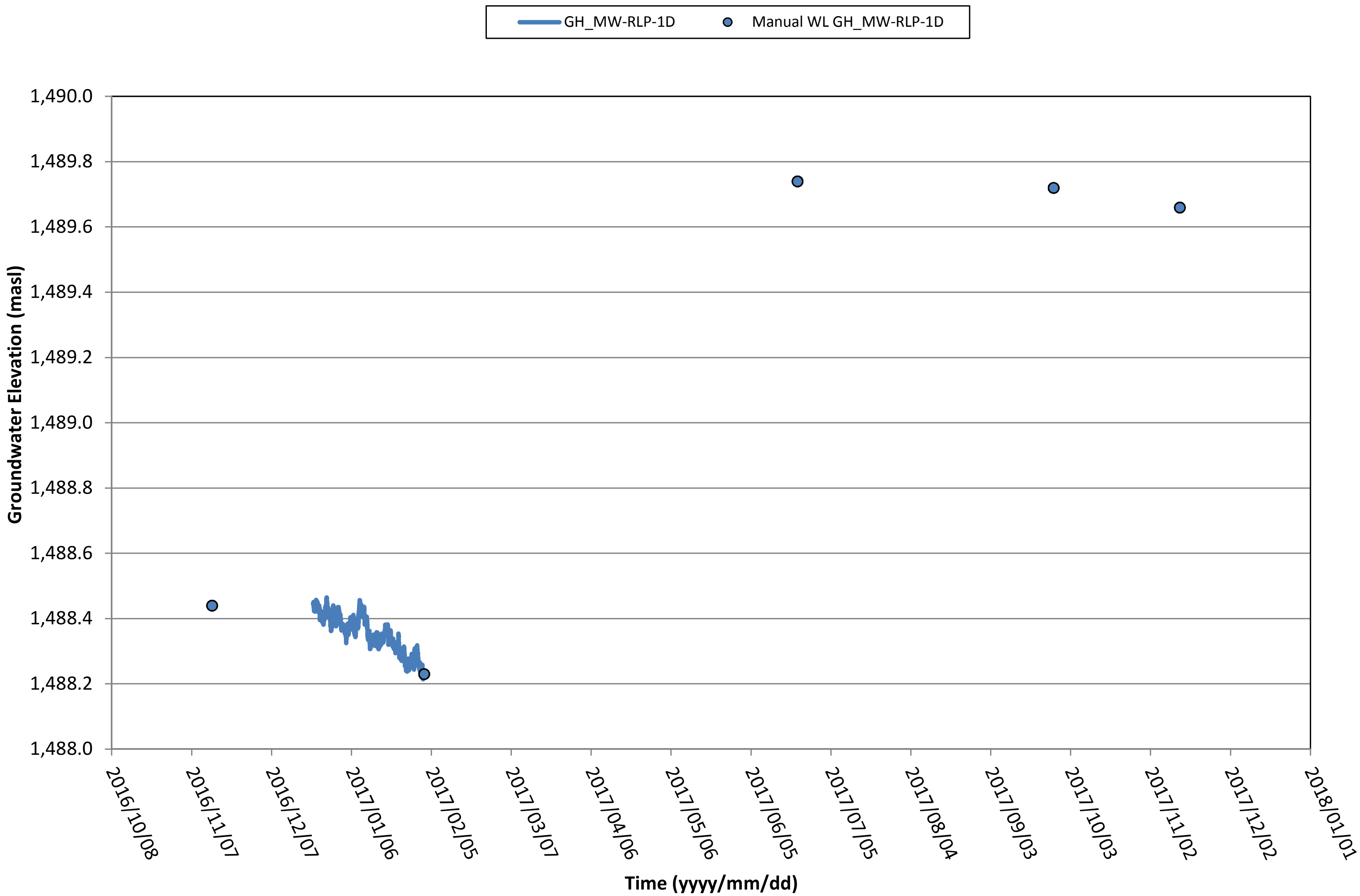


Note: Data was removed where suspected removal of datalogger occurred. September 2016 depth to water values and calculated potentiometric values for LC_PIZDC1307 and LC_PIZDC1308 are suspected to be switched

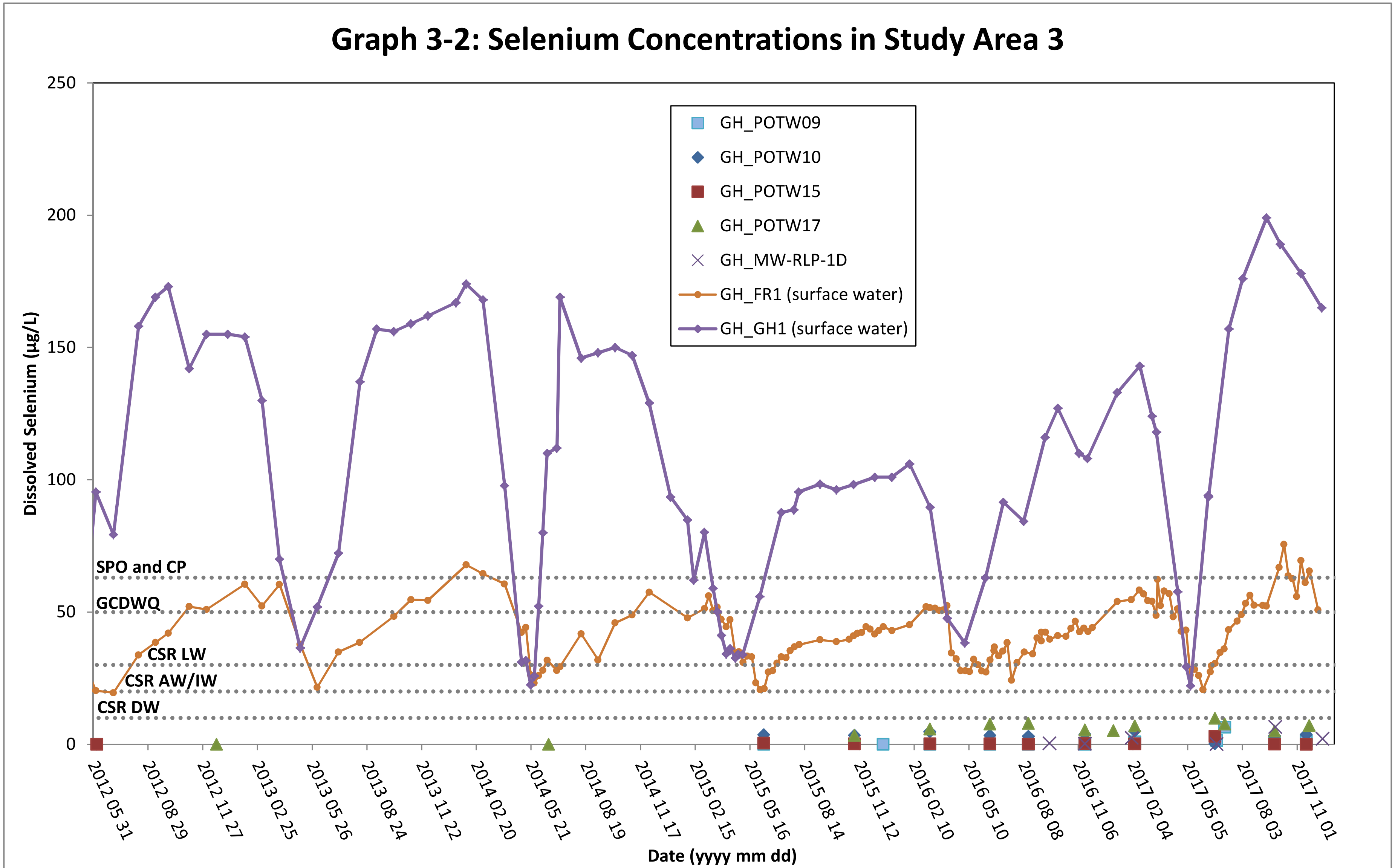
Graph 2-2: Selenium Concentrations in Study Area 2



Graph 3-1: Groundwater Elevation of Study Area 3 Well (2016 - 2017)

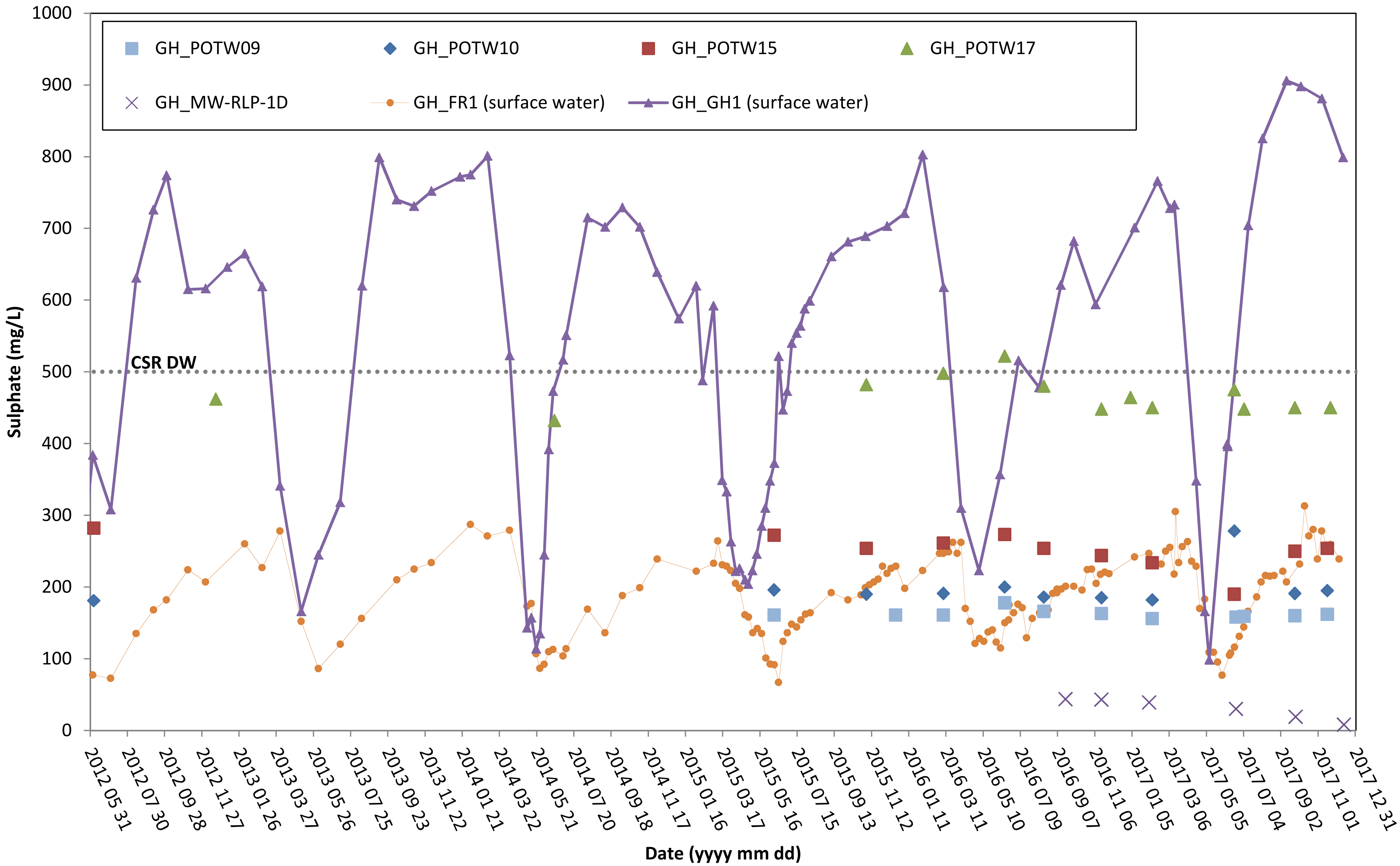


Note: Data was removed where suspected datalogger removal occurred.

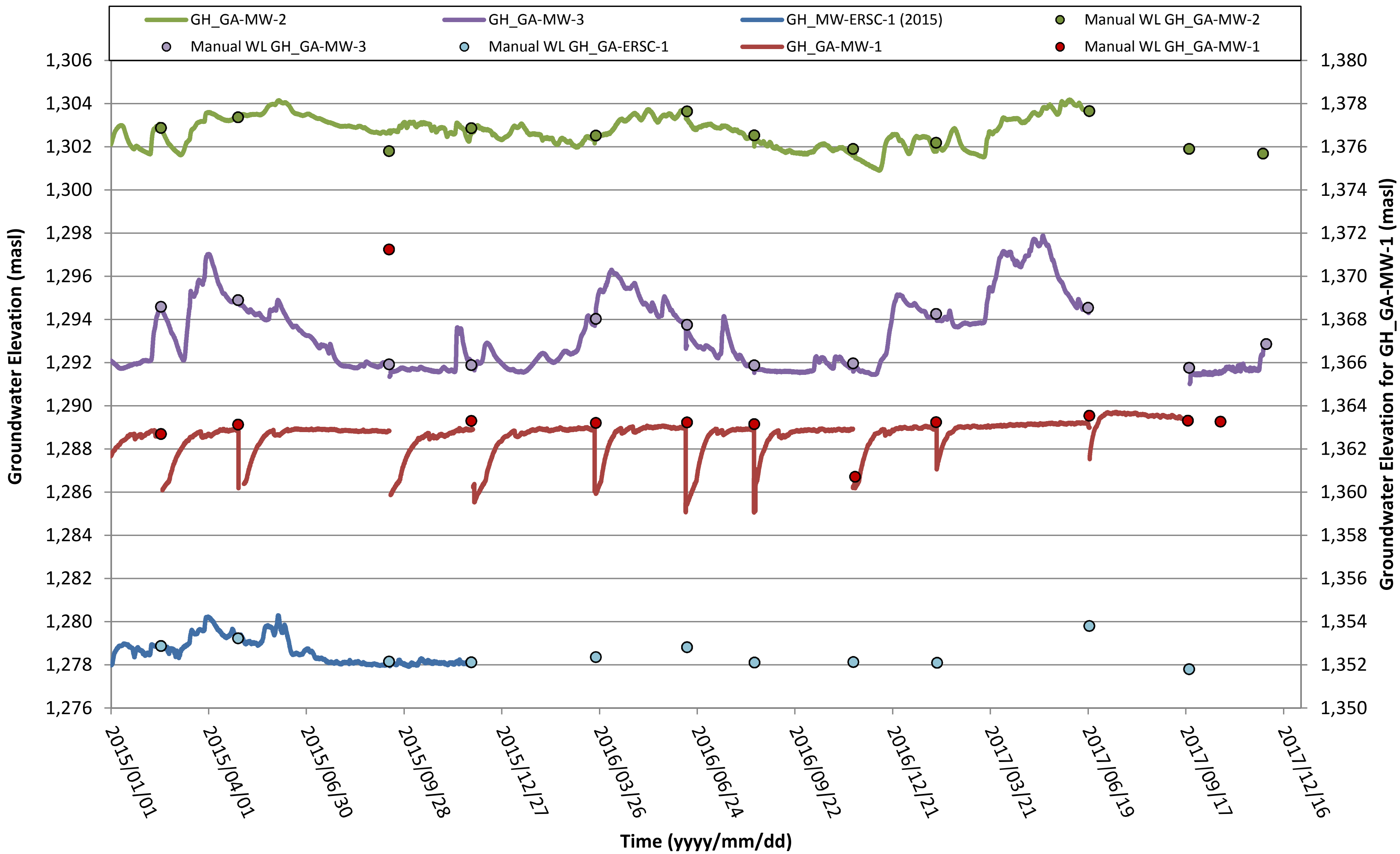


Note: Total metals concentrarions were used for GH_FR1 and GH_GH1 when dissolved concentrations were not available.

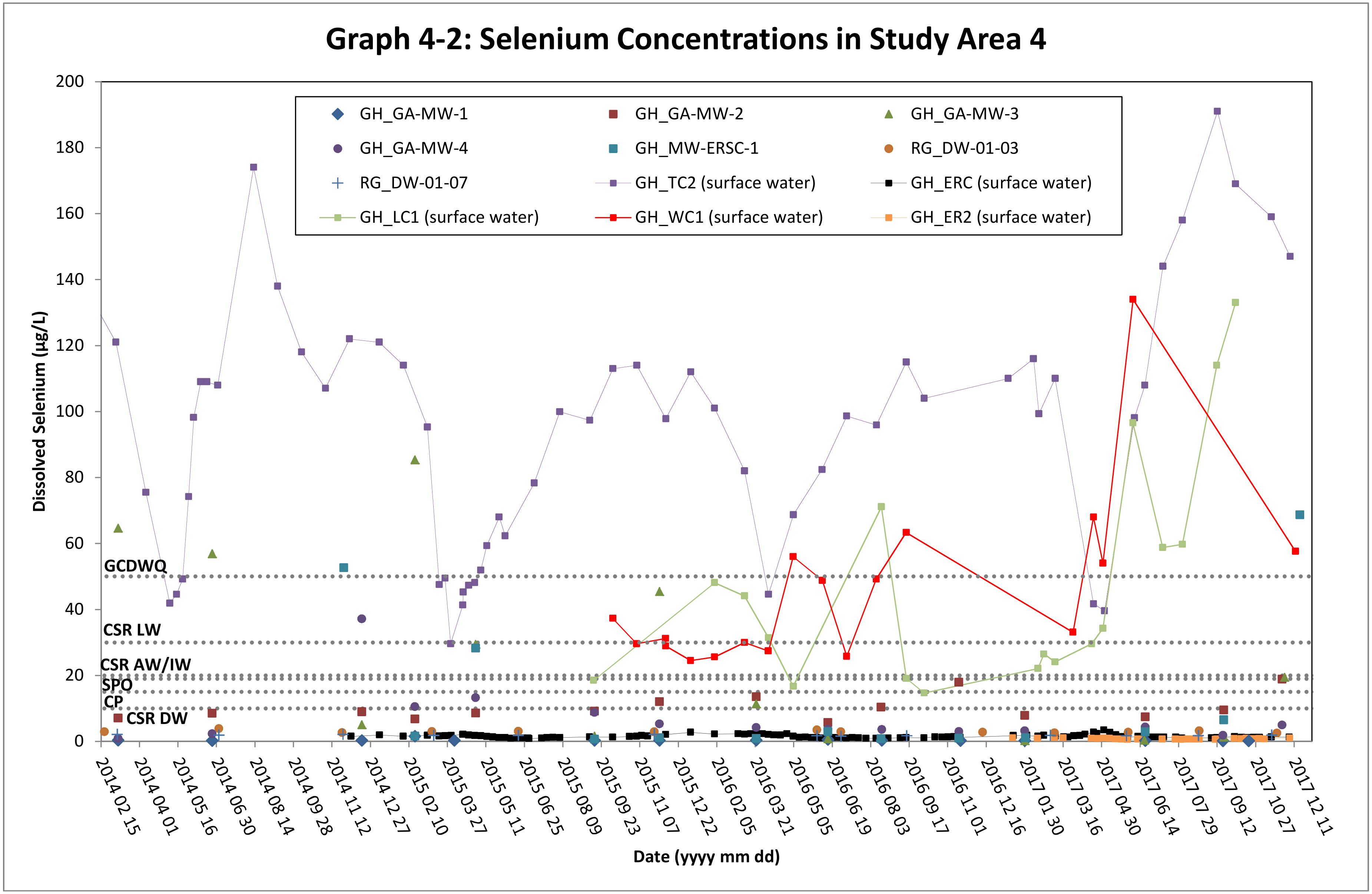
Graph 3-3: Sulphate Concentrations in Study Area 3



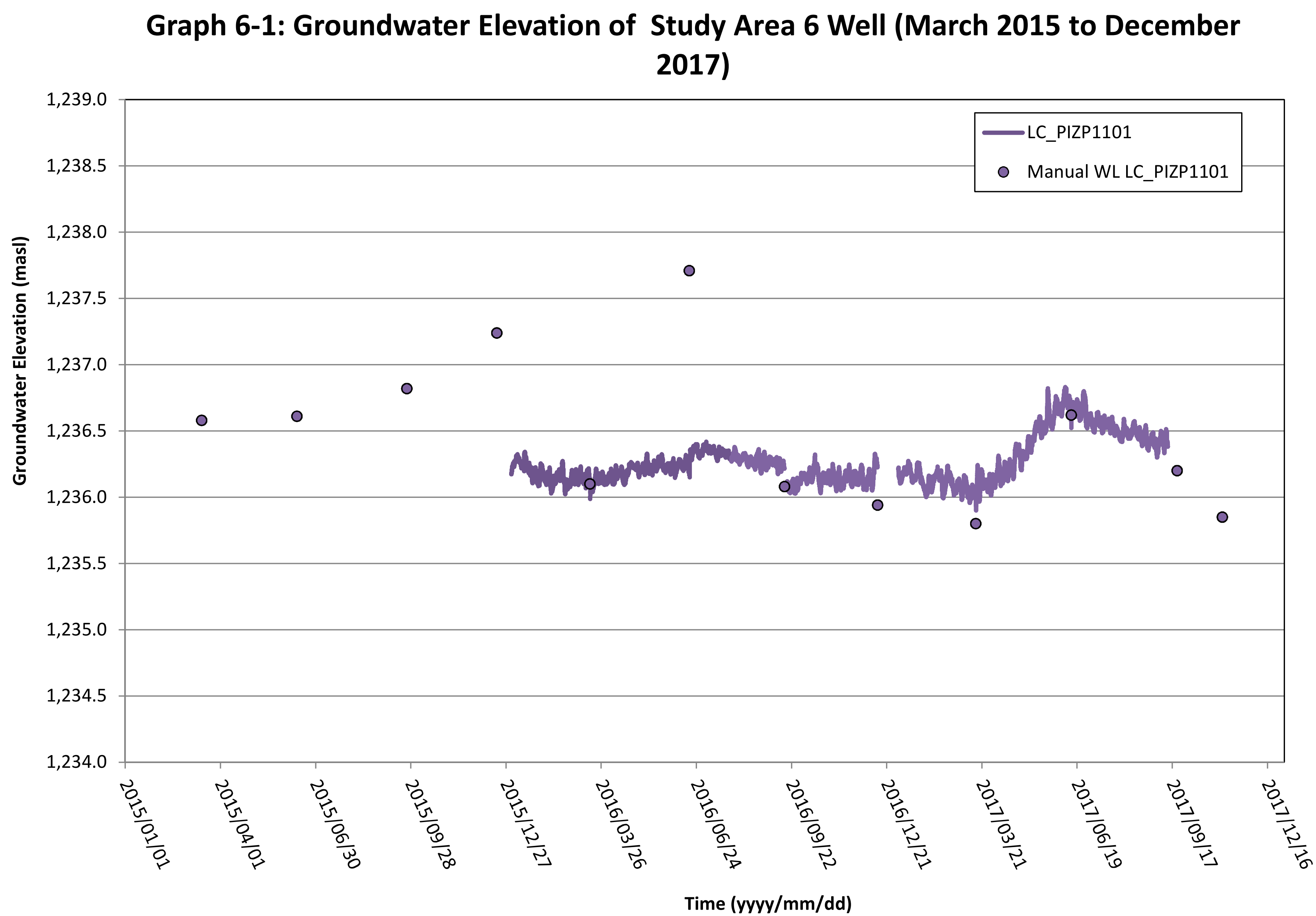
Graph 4-1: Groundwater Elevation of Study Area 4 Wells (2015 - 2017)



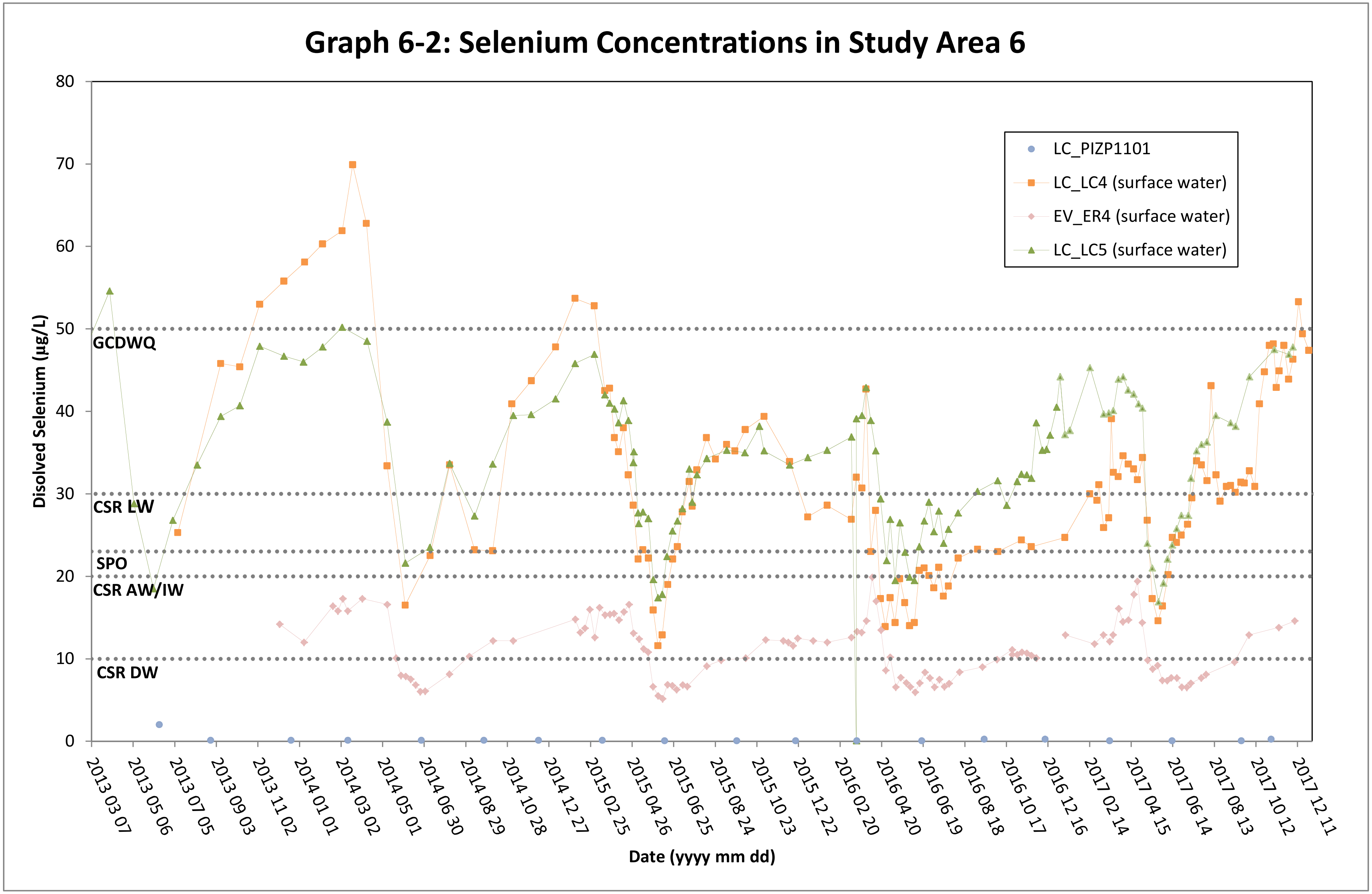
Note: Data was removed where suspected datalogger removal occurred. In well GH_GA-MW-1, water levels returned to static levels approximately 30 days after sampling.

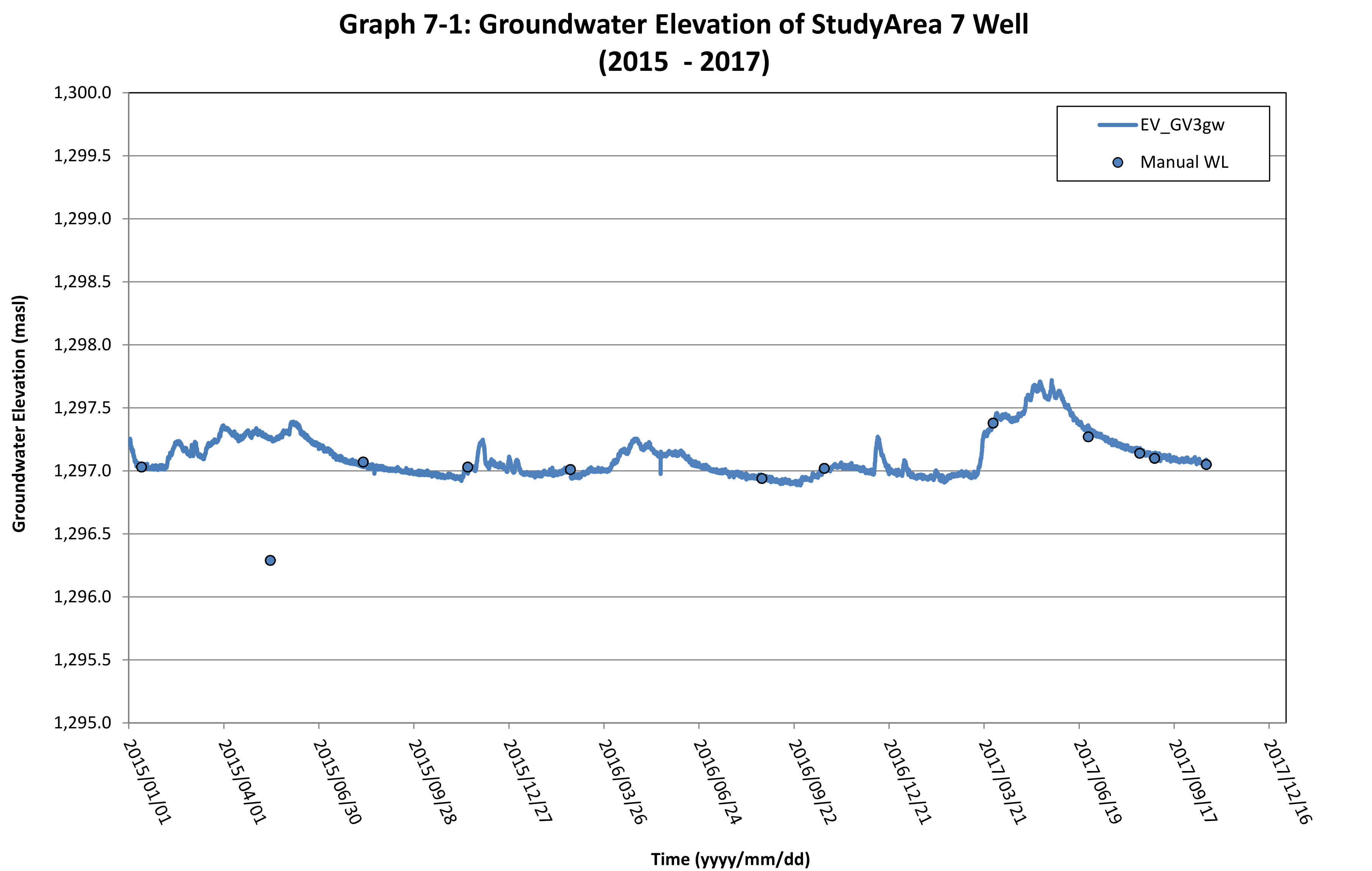


Graph 4-2: Selenium Concentrations in Study Area 4
200
180
160
140
120
100
80
60
40
20
0
Dissolved Selenium (µg/L)
GH_GA-MW-1
GH_GA-MW-2
GH_GA-MW-3
GH_GA-MW-4
GH_MW-ERSC-1
RG_DW-01-03
RG_DW-01-07
GH_TC2 (surface water)
GH_ERC (surface water)
GH_LC1 (surface water)
GH_WC1 (surface water)
GH_ER2 (surface water)
GCDWQ
CSR LW
CSR AW/IW
SPO
CP
CSR DW
2014 02 15
2014 04 01
2014 05 16
2014 06 30
2014 08 14
2014 09 28
2014 11 12
2014 12 27
2015 02 10
2015 03 27
2015 05 11
2015 06 25
2015 08 09
2015 09 23
2015 11 07
2015 12 22
2016 02 05
2016 03 21
2016 05 05
2016 06 19
2016 08 03
2016 09 17
2016 11 01
2016 12 16
2017 01 30
2017 03 16
2017 04 30
2017 06 14
2017 07 29
2017 09 12
2017 10 27
2017 12 11
Date (yyyy mm dd)

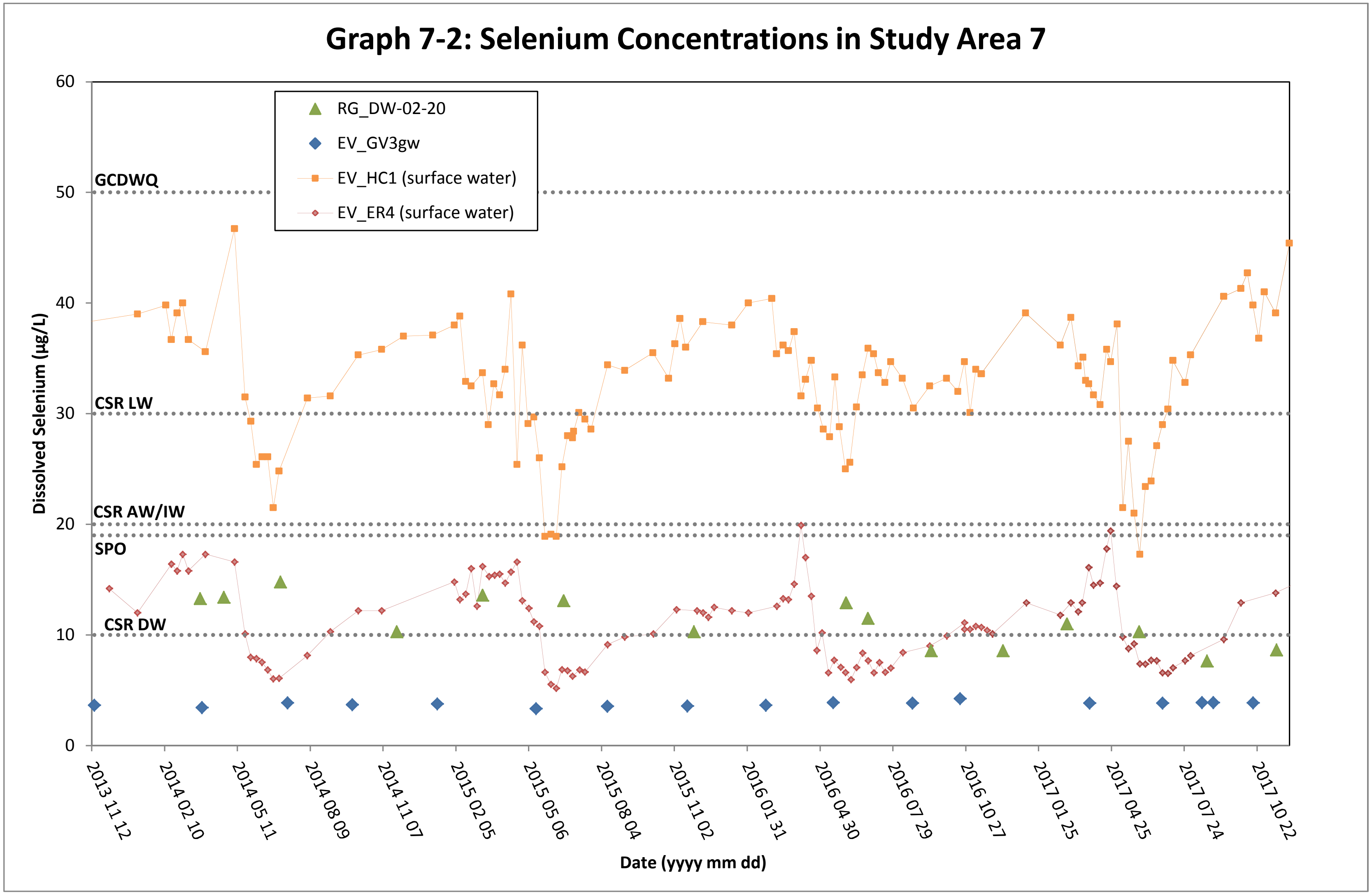


Note: Data was removed where suspected datalogger removal occurred.

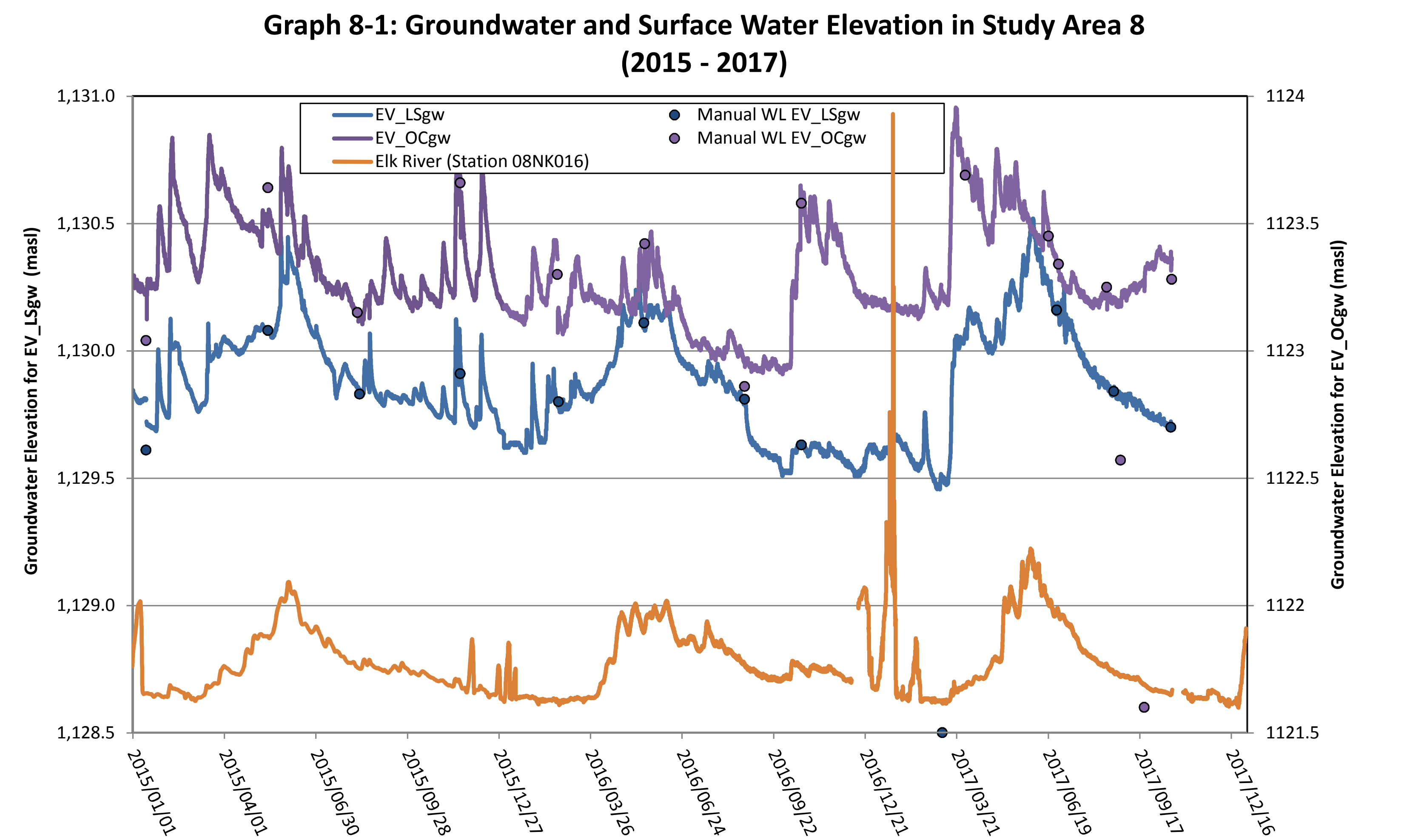

Graph 6-2: Selenium Concentrations in Study Area 6
Disolved Selenium (µg/L)
Date (yyyy mm dd)
LC_PIZP1101
LC_LC4 (surface water)
EV_ER4 (surface water)
LC_LC5 (surface water)
GCDWQ
CSR LW
SPO
CSR AW/IW
CSR DW
0
10
20
30
40
50
60
70
80
2013 03 07
2013 05 06
2013 07 05
2013 09 03
2013 11 02
2014 01 01
2014 03 02
2014 05 01
2014 06 30
2014 08 29
2014 10 28
2014 12 27
2015 02 25
2015 04 26
2015 06 25
2015 08 24
2015 10 23
2015 12 22
2016 02 20
2016 04 20
2016 06 19
2016 08 18
2016 10 17
2016 12 16
2017 02 14
2017 04 15
2017 06 14
2017 08 13
2017 10 12
2017 12 11



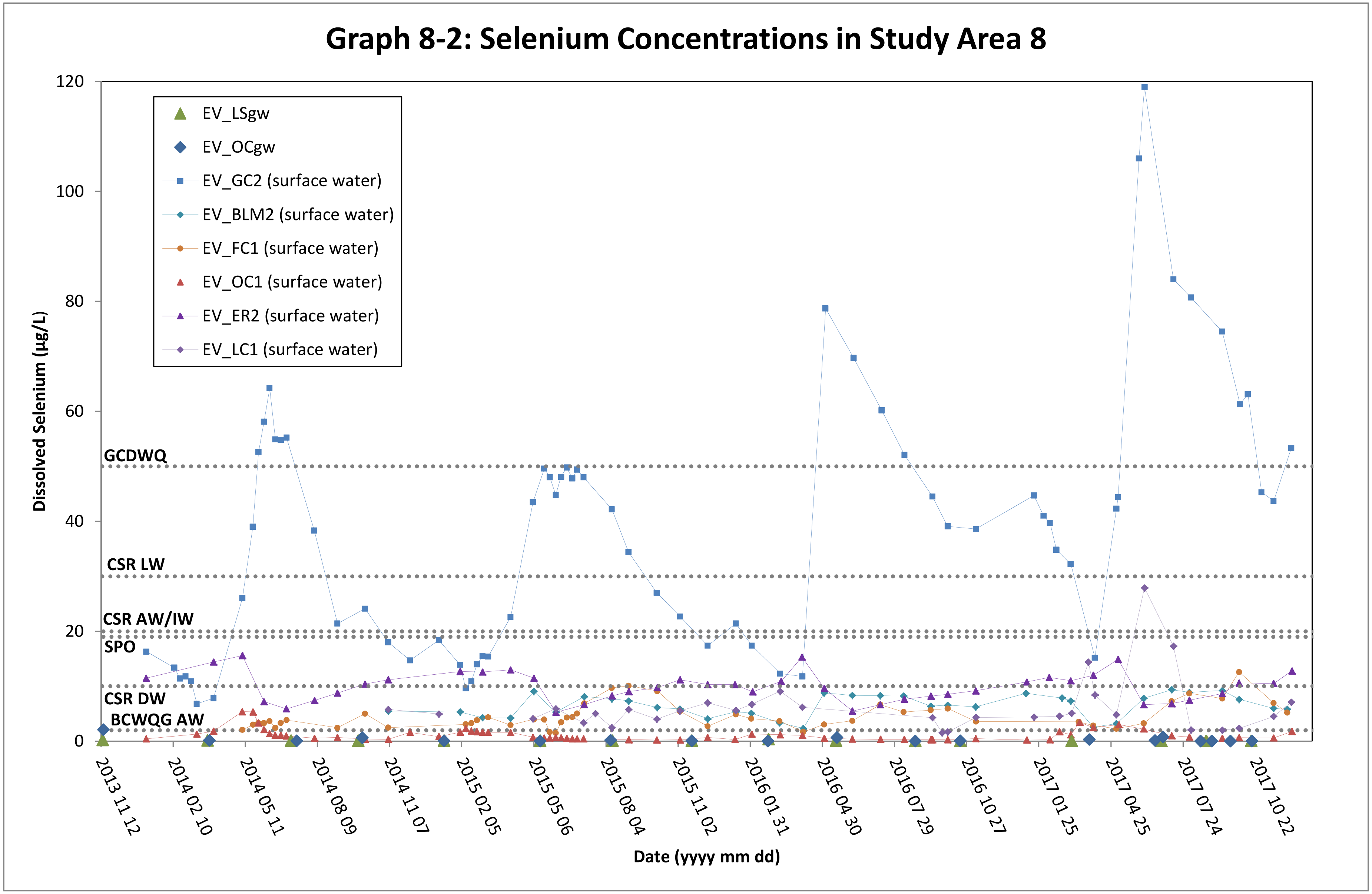
Note: Data was removed where suspected datalogger removal occurred.



Graph 7-2: Selenium Concentrations in Study Area 7
RG_DW-02-20
EV_GV3gw
EV_HC1 (surface water)
EV_ER4 (surface water)
GCDWQ
CSR LW
CSR AW/IW
SPO
CSR DW
Dissolved Selenium (µg/L)
0
10
20
30
40
50
60
2013 11 12
2014 02 10
2014 05 11
2014 08 09
2014 11 07
2015 02 05
2015 05 06
2015 08 04
2015 11 02
2016 01 31
2016 04 30
2016 07 29
2016 10 27
2017 01 25
2017 04 25
2017 07 24
2017 10 22
Date (yyyy mm dd)

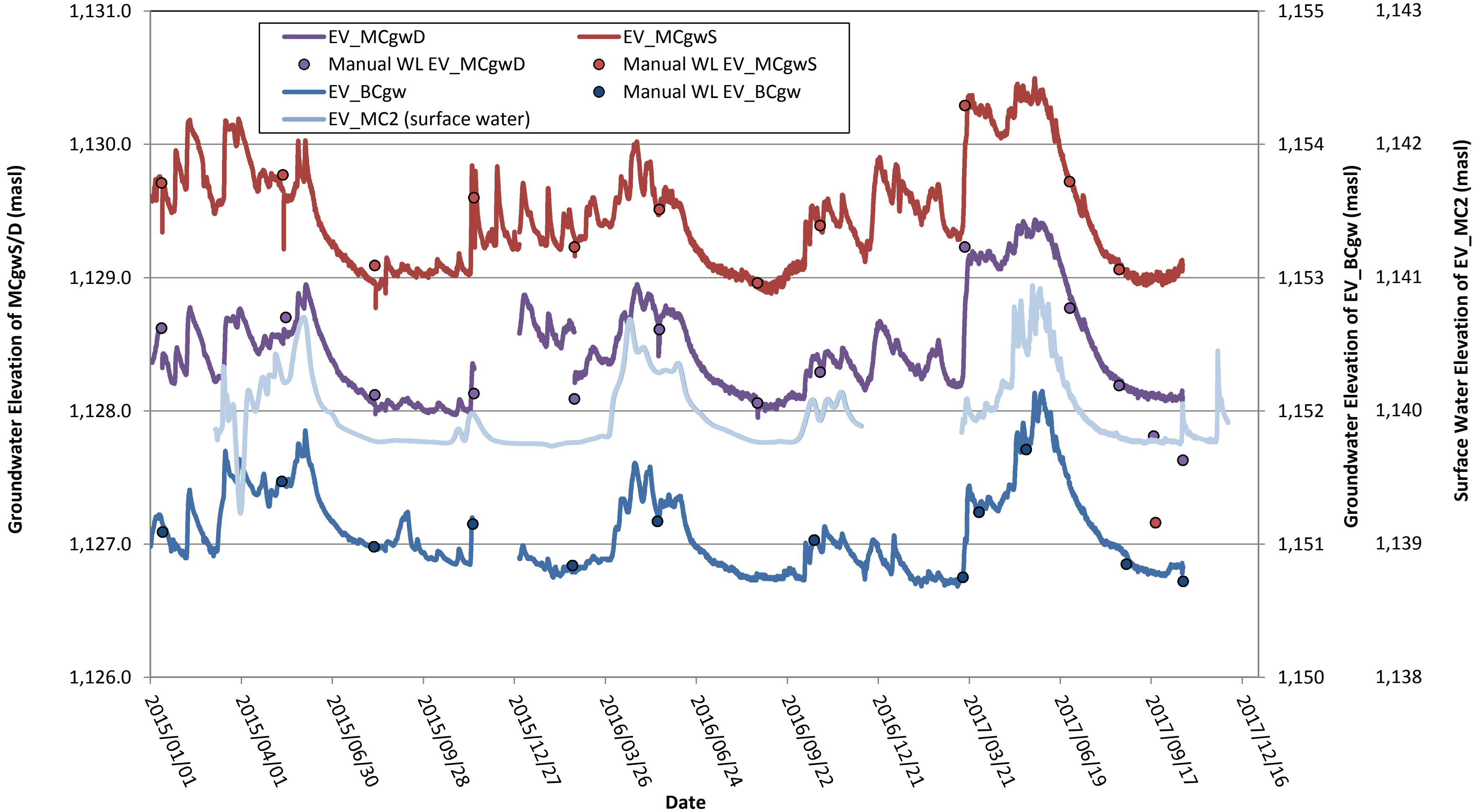


Note: Data was removed where suspected datalogger removal occurred.
Elk River values shown are displacement (not elevation) values measured at the station (for discussion purposes).

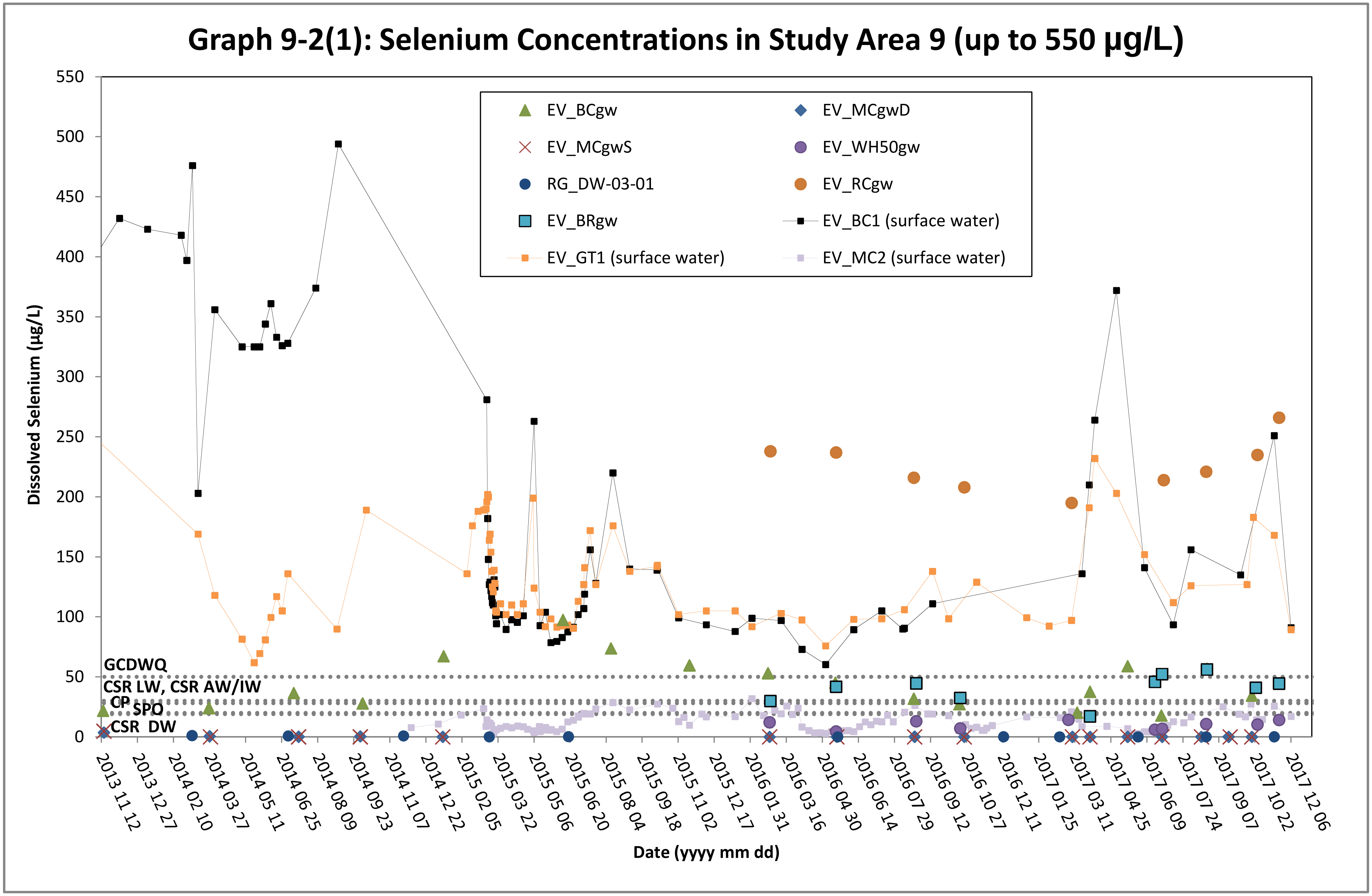


Graph 8-2: Selenium Concentrations in Study Area 8
Dissolved Selenium (µg/L)
Date (yyyy mm dd)
EV_LSgw
EV_OCgw
EV_GC2 (surface water)
EV_BLM2 (surface water)
EV_FC1 (surface water)
EV_OC1 (surface water)
EV_ER2 (surface water)
EV_LC1 (surface water)
GCDWQ
CSR LW
CSR AW/IW
SPO
CSR DW
BCWQG AW
0
20
40
60
80
100
120
2013 11 12
2014 02 10
2014 05 11
2014 08 09
2014 11 07
2015 02 05
2015 05 06
2015 08 04
2015 11 02
2016 01 31
2016 04 30
2016 07 29
2016 10 27
2017 01 25
2017 04 25
2017 07 24
2017 10 22

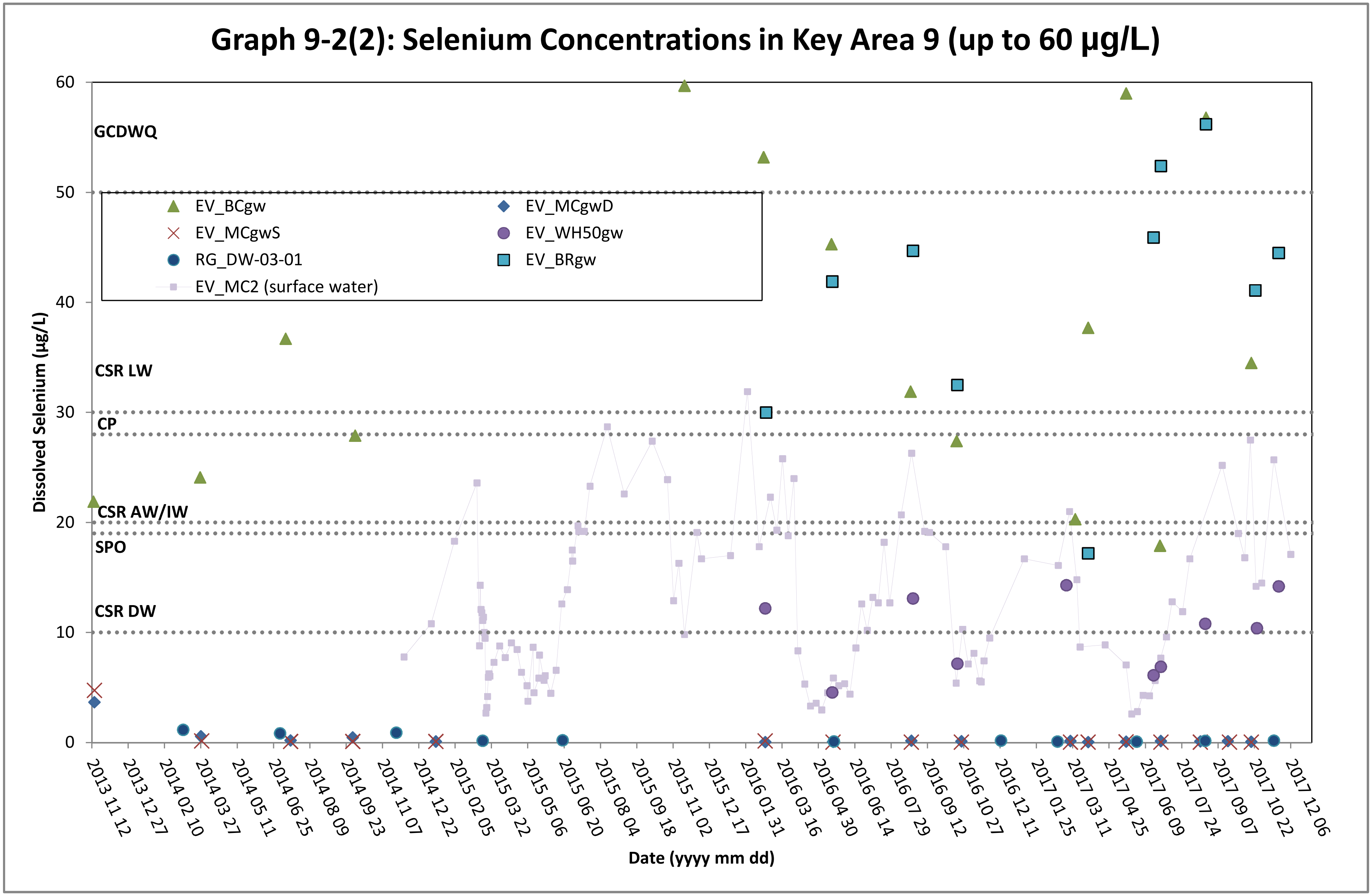
Graph 9-1: Groundwater and Surface Water Elevation in Study Area 9 (2015 - 2017)



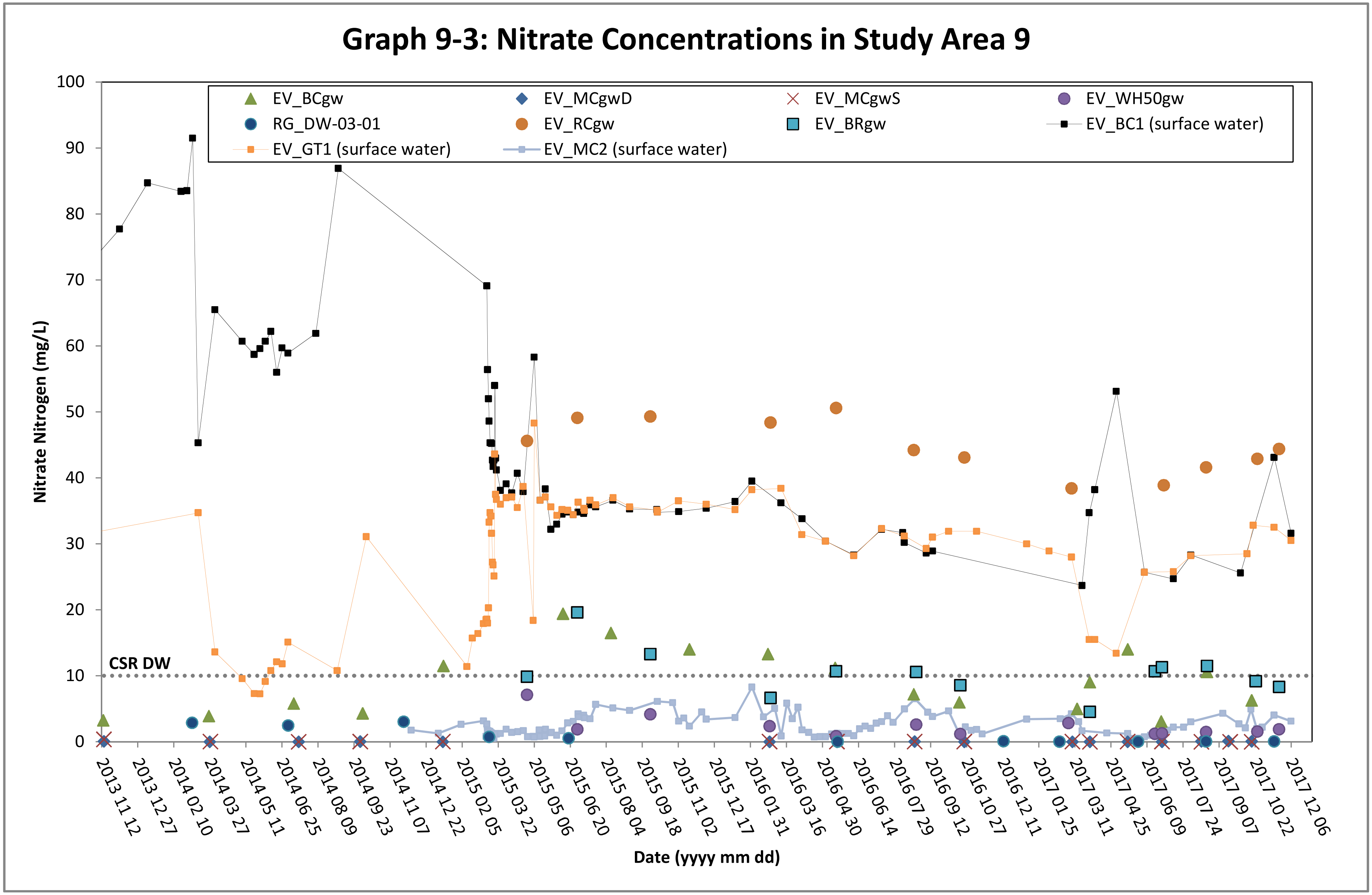
Note: Data was removed where suspected datalogger removal occurred. Dataloggers MCgwD and MCgwS were switched on November 17, 2015.
Surface water elevations at EV_MC2 are approximate and based on Lidar values and staff gauge height measurements.



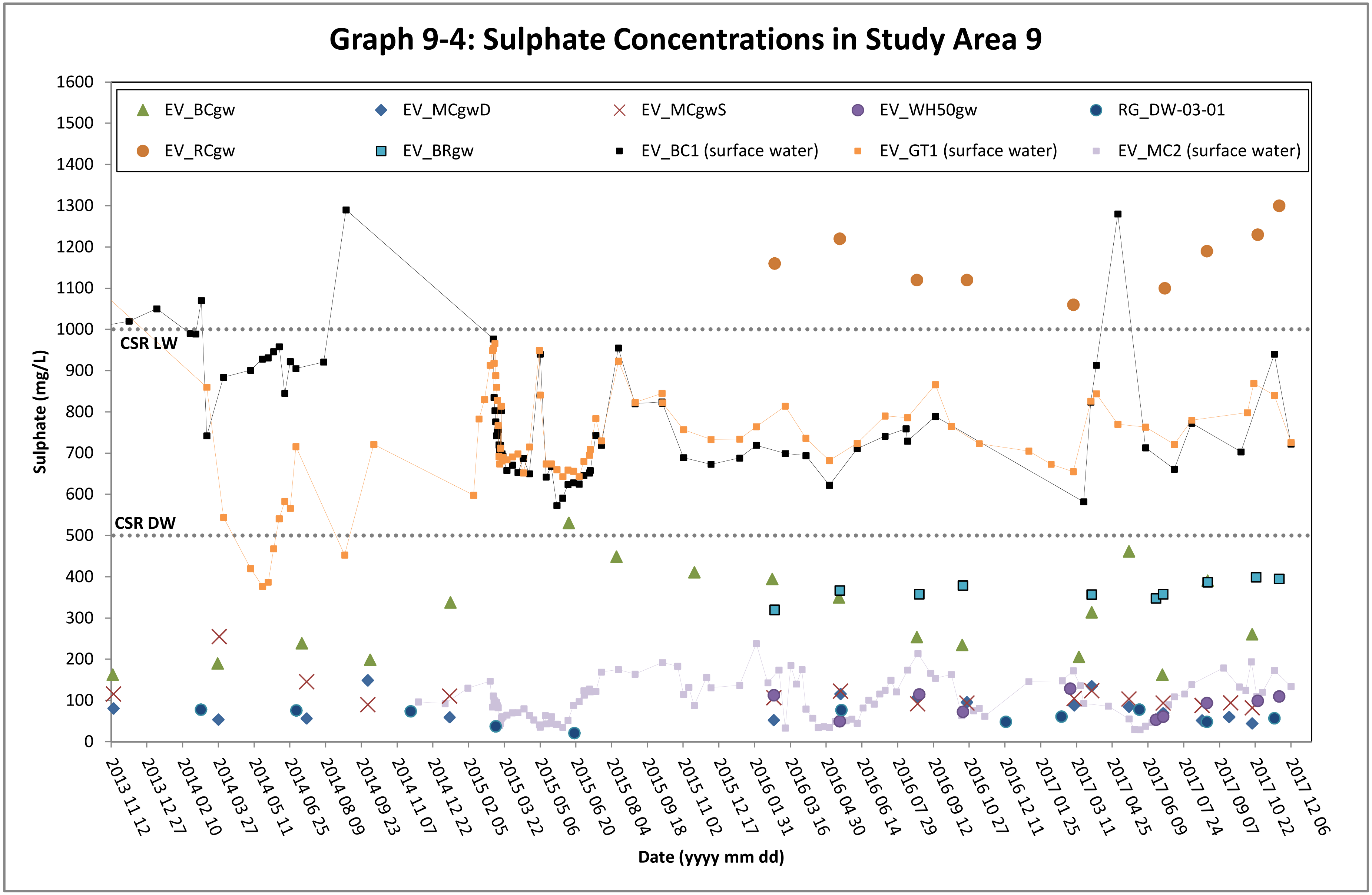
Graph 9-2(1): Selenium Concentrations in Study Area 9 (up to 550 µg/L)
EV_BCgw
EV_MCgwD
EV_MCgwS
EV_WH50gw
RG_DW-03-01
EV_RCgw
EV_BRgw
EV_BC1 (surface water)
EV_GT1 (surface water)
EV_MC2 (surface water)
GCDWQ
CSR LW, CSR AW/IW
CP
SPO
CSR DW
Dissolved Selenium (µg/L)
Date (yyyy mm dd)
550
500
450
400
350
300
250
200
150
100
50
0
2013 11 12
2013 12 27
2014 02 10
2014 03 27
2014 05 11
2014 06 25
2014 08 09
2014 09 23
2014 11 07
2014 12 22
2015 02 05
2015 03 22
2015 05 06
2015 06 20
2015 08 04
2015 09 18
2015 11 02
2015 12 17
2016 01 31
2016 03 16
2016 04 30
2016 06 14
2016 07 29
2016 09 12
2016 10 27
2016 12 11
2017 01 25
2017 03 11
2017 04 25
2017 06 09
2017 07 24
2017 09 07
2017 10 22
2017 12 06

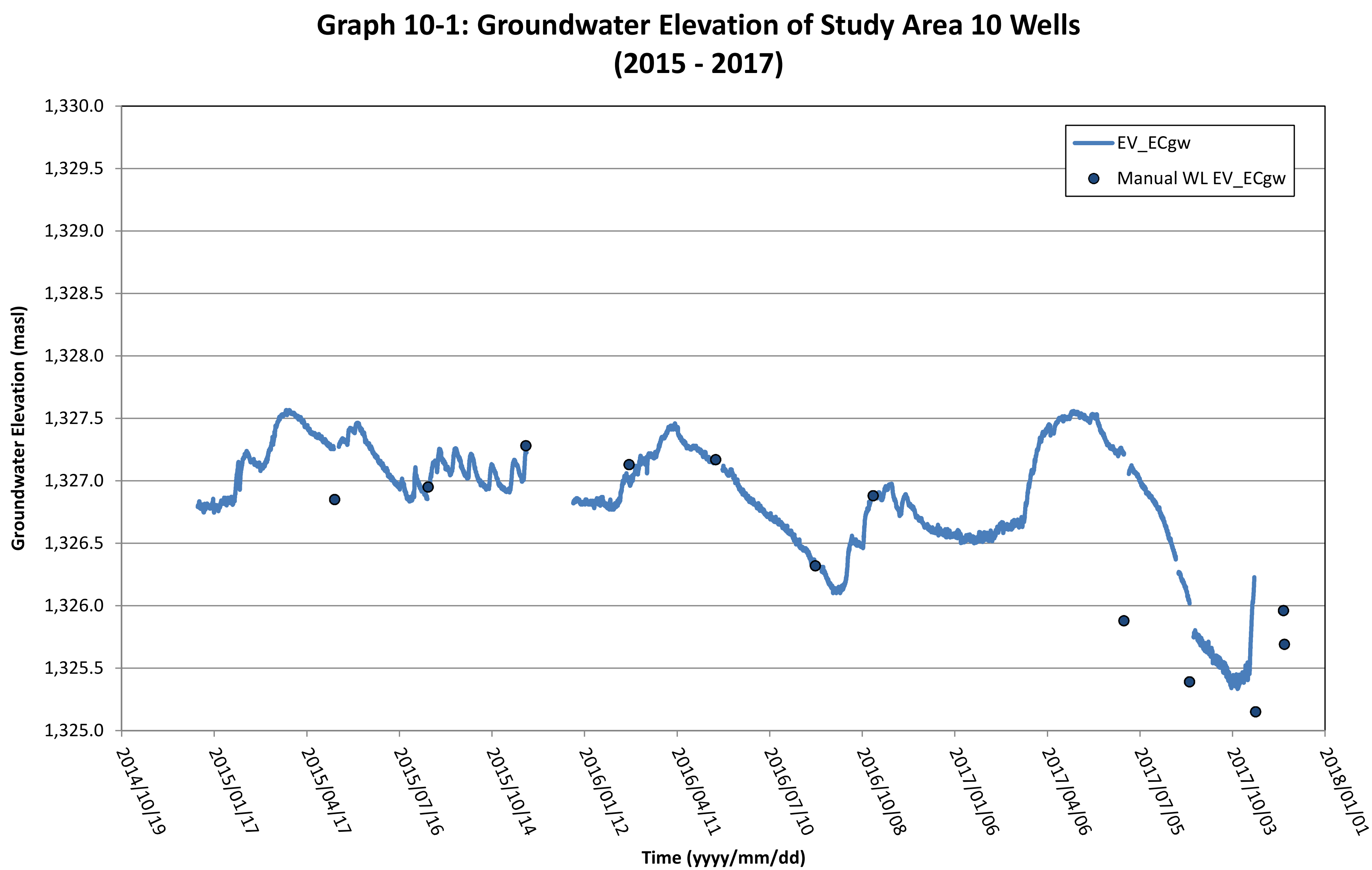


Graph 9-2(2): Selenium Concentrations in Key Area 9 (up to 60 µg/L)
Dissolved Selenium (µg/L)
Date (yyyy mm dd)
GCDWQ
CSR LW
CP
CSR AW/IW
SPO
CSR DW
EV_BCgw
EV_MCgwS
RG_DW-03-01
EV_MC2 (surface water)
EV_MCgwD
EV_WH50gw
EV_BRgw
0
10
20
30
40
50
60
2013 11 12
2013 12 27
2014 02 10
2014 03 27
2014 05 11
2014 06 25
2014 08 09
2014 09 23
2014 11 07
2014 12 22
2015 02 05
2015 03 22
2015 05 06
2015 06 20
2015 08 04
2015 09 18
2015 11 02
2015 12 17
2016 01 31
2016 03 16
2016 04 30
2016 06 14
2016 07 29
2016 09 12
2016 10 27
2016 12 11
2017 01 25
2017 03 11
2017 04 25
2017 06 09
2017 07 24
2017 09 07
2017 10 22
2017 12 06

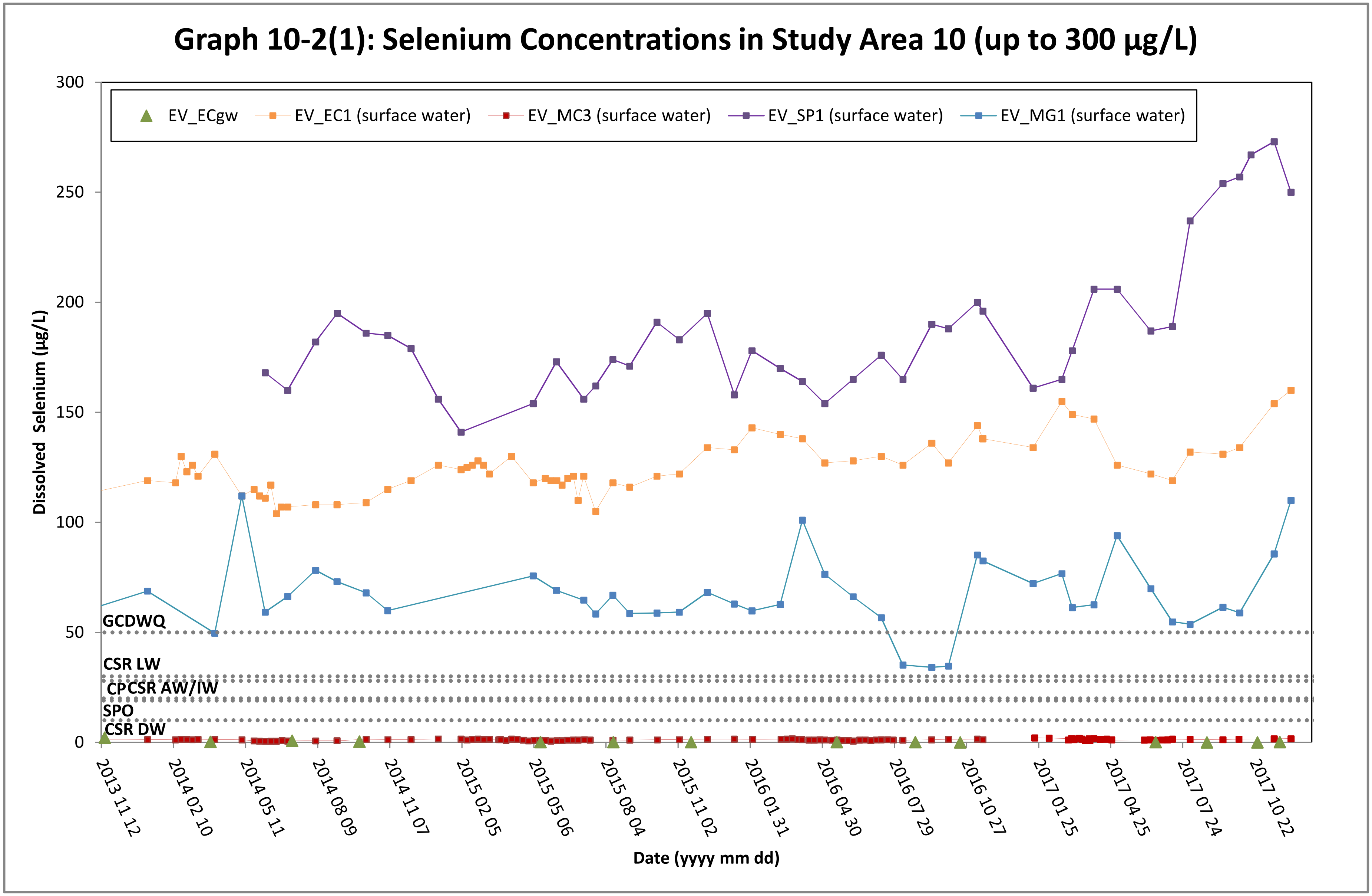


Graph 9-3: Nitrate Concentrations in Study Area 9
EV_BCgw
EV_MCgwD
EV_MCgwS
EV_WH50gw
RG_DW-03-01
EV_RCgw
EV_BRgw
EV_BC1 (surface water)
EV_GT1 (surface water)
EV_MC2 (surface water)
CSR DW
Nitrate Nitrogen (mg/L)
100
90
80
70
60
50
40
30
20
10
0
2013 11 12
2013 12 27
2014 02 10
2014 03 27
2014 05 11
2014 06 25
2014 08 09
2014 09 23
2014 11 07
2014 12 22
2015 02 05
2015 03 22
2015 05 06
2015 06 20
2015 08 04
2015 09 18
2015 11 02
2015 12 17
2016 01 31
2016 03 16
2016 04 30
2016 06 14
2016 07 29
2016 09 12
2016 10 27
2016 12 11
2017 01 25
2017 03 11
2017 04 25
2017 06 09
2017 07 24
2017 09 07
2017 10 22
2017 12 06
Date (yyyy mm dd)

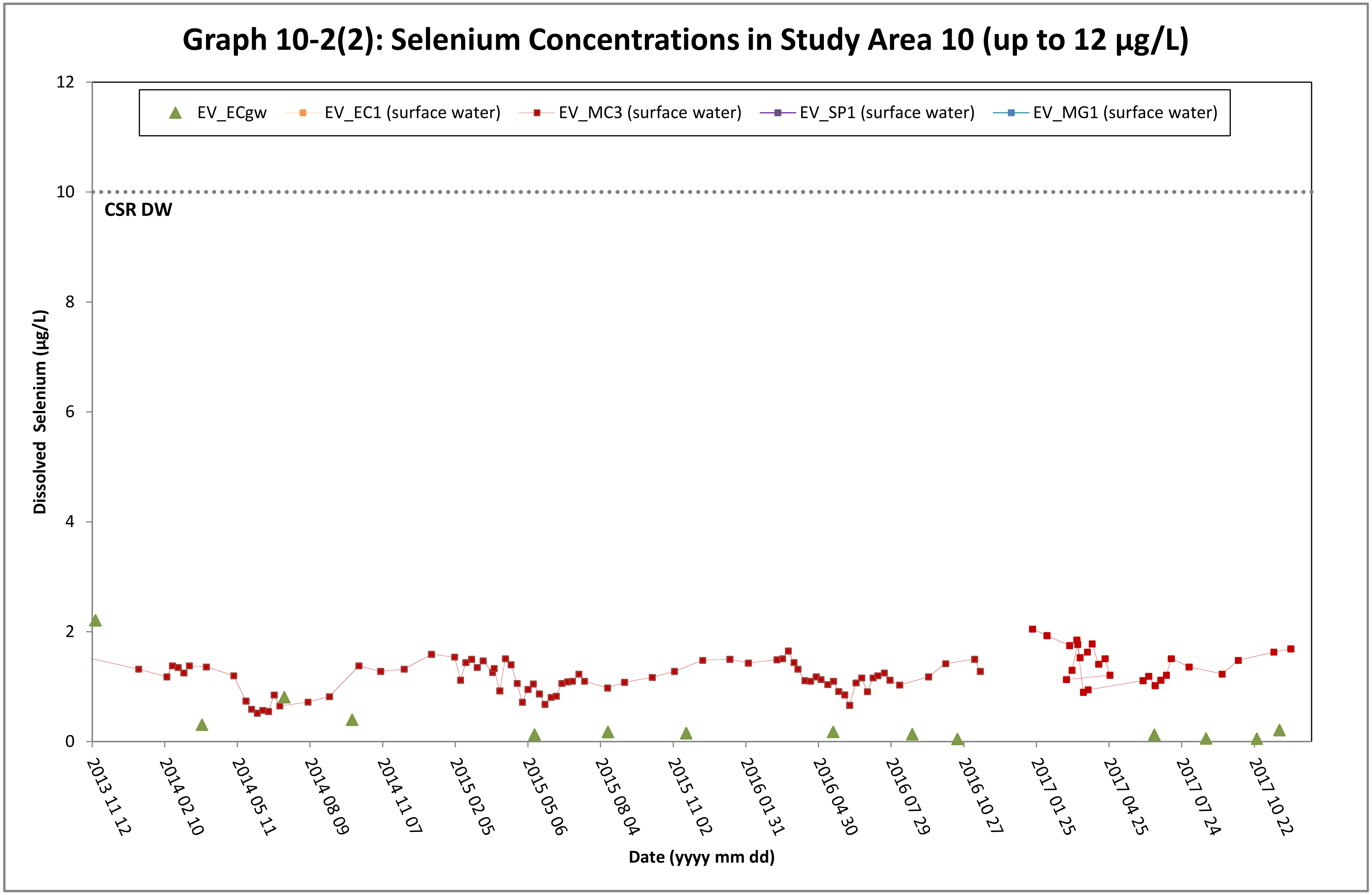

Graph 9-4: Sulphate Concentrations in Study Area 9
EV_BCgw
EV_MCgwD
EV_MCgwS
EV_WH50gw
RG_DW-03-01
EV_RCgw
EV_BRgw
EV_BC1 (surface water)
EV_GT1 (surface water)
EV_MC2 (surface water)
CSR LW
CSR DW
Sulphate (mg/L)
Date (yyyy mm dd)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
2013 11 12
2013 12 27
2014 02 10
2014 03 27
2014 05 11
2014 06 25
2014 08 09
2014 09 23
2014 11 07
2014 12 22
2015 02 05
2015 03 22
2015 05 06
2015 06 20
2015 08 04
2015 09 18
2015 11 02
2015 12 17
2016 01 31
2016 03 16
2016 04 30
2016 06 14
2016 07 29
2016 09 12
2016 10 27
2016 12 11
2017 01 25
2017 03 11
2017 04 25
2017 06 09
2017 07 24
2017 09 07
2017 10 22
2017 12 06

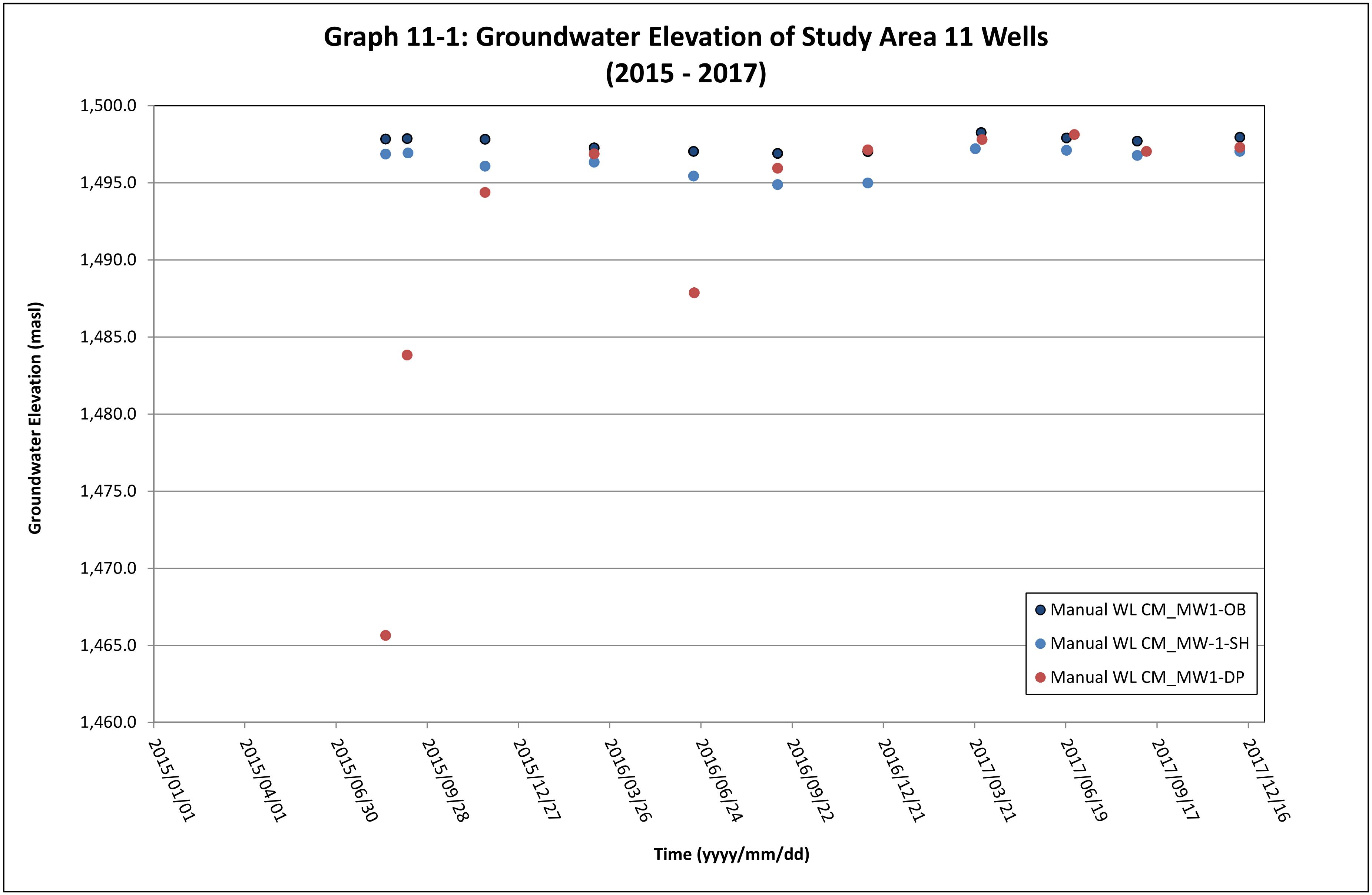


Note: Data was removed where suspected datalogger removal occurred. Dataloggers MCgwD and MCgwS were switched on November 17, 2015.

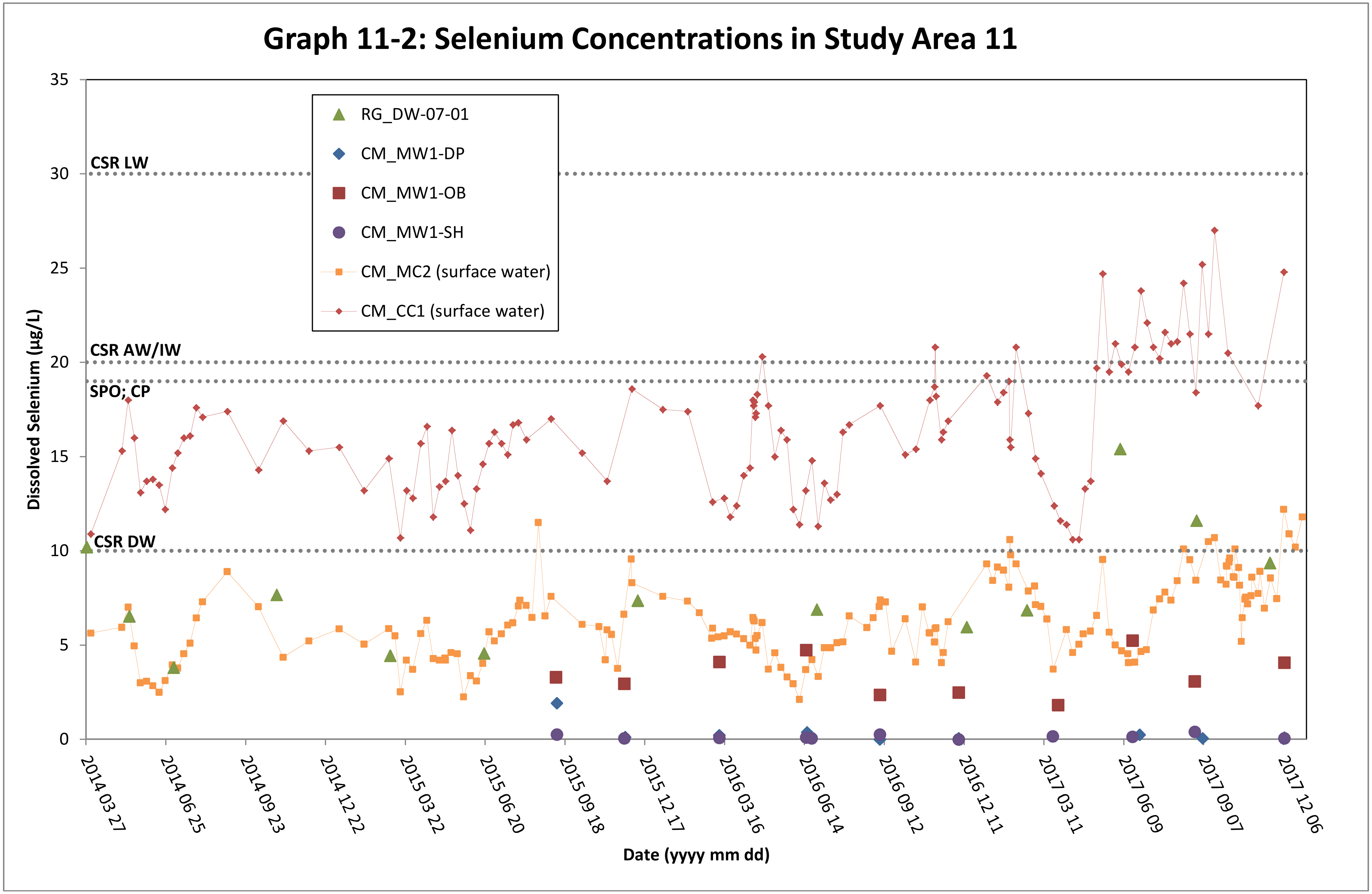


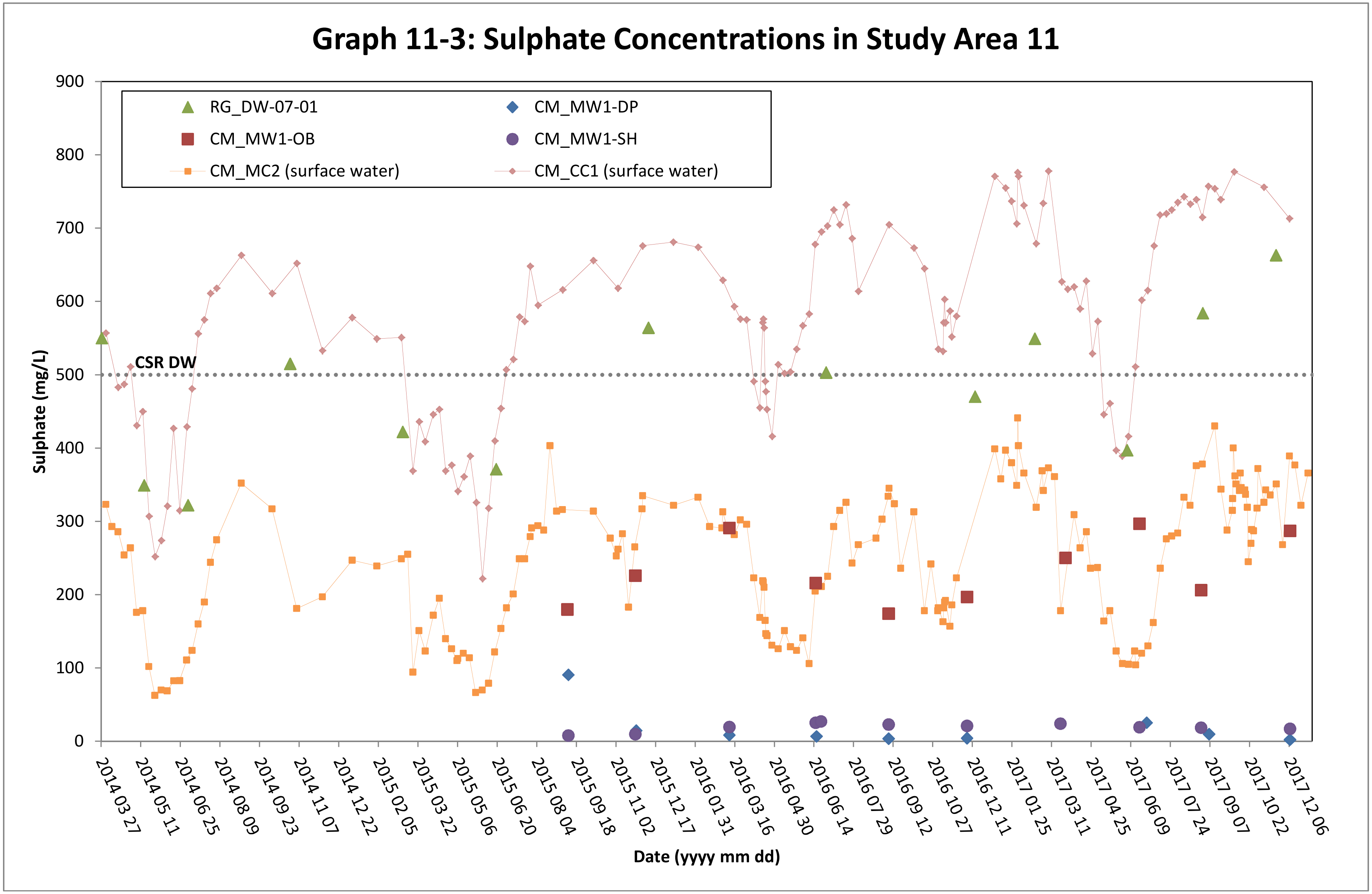
Graph 10-2(1): Selenium Concentrations in Study Area 10 (up to 300 µg/L)
EV_ECgw
EV_EC1 (surface water)
EV_MC3 (surface water)
EV_SP1 (surface water)
EV_MG1 (surface water)
Dissolved Selenium (µg/L)
300
250
200
150
100
50
0
GCDWQ
CSR LW
CPCSR AW/IW
SPO
CSR DW
2013 11 12
2014 02 10
2014 05 11
2014 08 09
2014 11 07
2015 02 05
2015 05 06
2015 08 04
2015 11 02
2016 01 31
2016 04 30
2016 07 29
2016 10 27
2017 01 25
2017 04 25
2017 07 24
2017 10 22
Date (yyyy mm dd)


Graph 10-2(2): Selenium Concentrations in Study Area 10 (up to 12 µg/L)
EV_ECgw
EV_EC1 (surface water)
EV_MC3 (surface water)
EV_SP1 (surface water)
EV_MG1 (surface water)
CSR DW
Dissolved Selenium (µg/L)
0
2
4
6
8
10
12
2013 11 12
2014 02 10
2014 05 11
2014 08 09
2014 11 07
2015 02 05
2015 05 06
2015 08 04
2015 11 02
2016 01 31
2016 04 30
2016 07 29
2016 10 27
2017 01 25
2017 04 25
2017 07 24
2017 10 22
Date (yyyy mm dd)

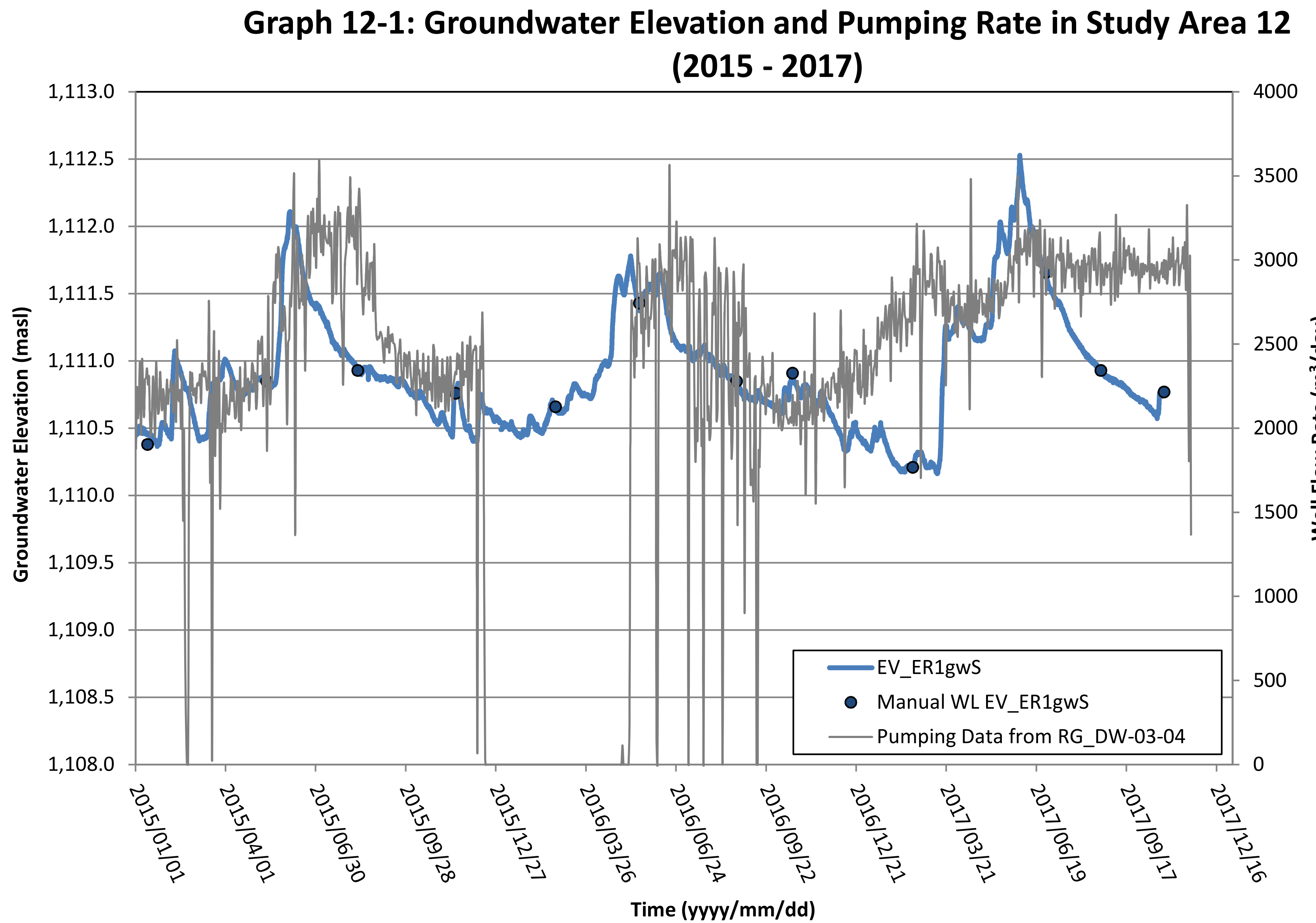


Graph 11-1: Groundwater Elevation of Study Area 11 Wells
(2015 - 2017)
Groundwater Elevation (masl)
1,500.0
1,495.0
1,490.0
1,485.0
1,480.0
1,475.0
1,470.0
1,465.0
1,460.0
2015/01/01
2015/04/01
2015/06/30
2015/09/28
2015/12/27
2016/03/26
2016/06/24
2016/09/22
2016/12/21
2017/03/21
2017/06/19
2017/09/17
2017/12/16
Time (yyyy/mm/dd)
Manual WL CM_MW1-OB
Manual WL CM_MW-1-SH
Manual WL CM_MW1-DP

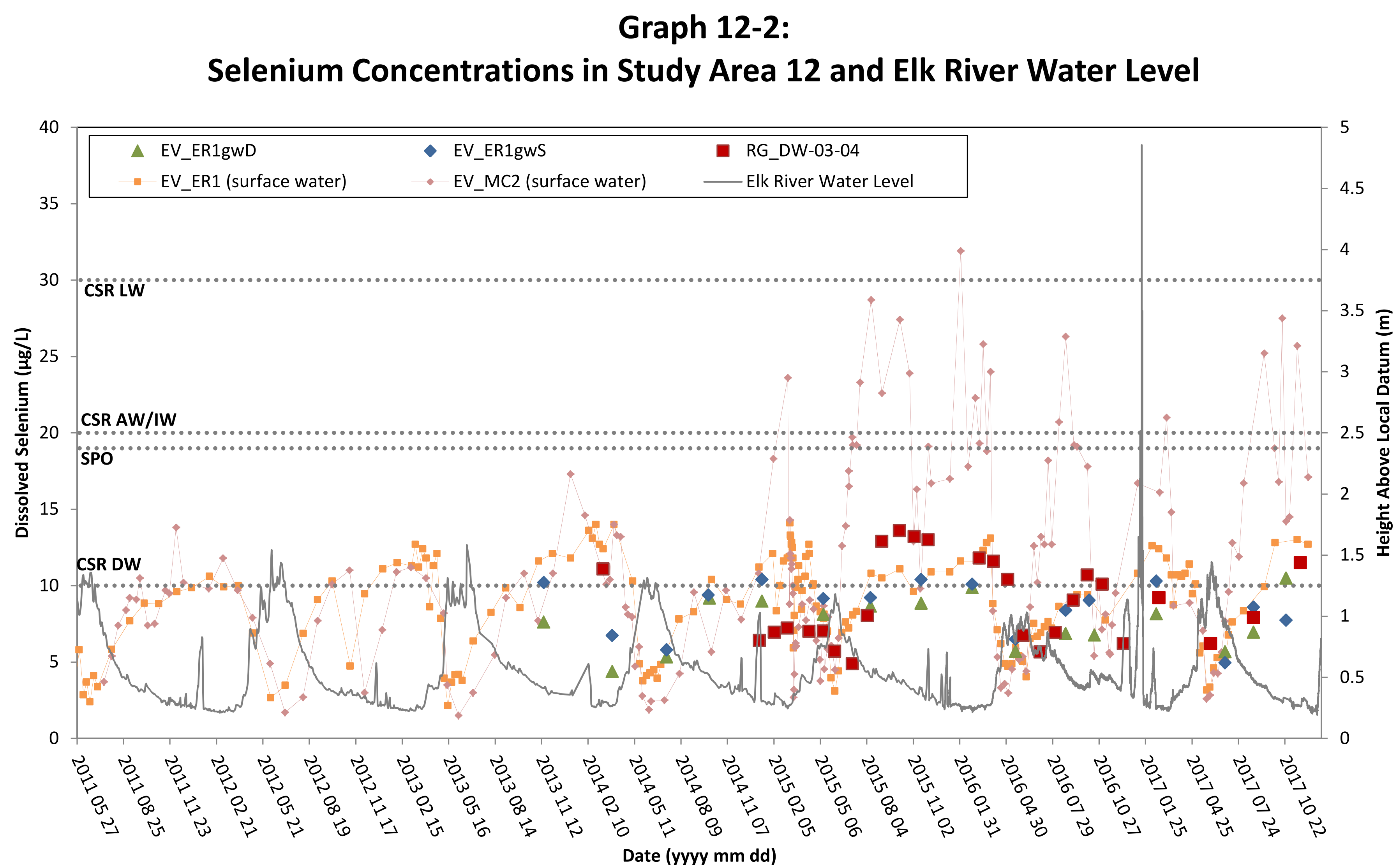

Graph 11-2: Selenium Concentrations in Study Area 11
Dissolved Selenium (µg/L)
Date (yyyy mm dd)
CSR LW
CSR AW/IW
SPO; CP
CSR DW
RG_DW-07-01
CM_MW1-DP
CM_MW1-OB
CM_MW1-SH
CM_MC2 (surface water)
CM_CC1 (surface water)
0
5
10
15
20
25
30
35
2014 03 27
2014 06 25
2014 09 23
2014 12 22
2015 03 22
2015 06 20
2015 09 18
2015 12 17
2016 03 16
2016 06 14
2016 09 12
2016 12 11
2017 03 11
2017 06 09
2017 09 07
2017 12 06



Graph 11-3: Sulphate Concentrations in Study Area 11
RG_DW-07-01
CM_MW1-DP
CM_MW1-OB
CM_MW1-SH
CM_MC2 (surface water)
CM_CC1 (surface water)
CSR DW
Sulphate (mg/L)
900
800
700
600
500
400
300
200
100
0
2014 03 27
2014 05 11
2014 06 25
2014 08 09
2014 09 23
2014 11 07
2014 12 22
2015 02 05
2015 03 22
2015 05 06
2015 06 20
2015 08 04
2015 09 18
2015 11 02
2015 12 17
2016 01 31
2016 03 16
2016 04 30
2016 06 14
2016 07 29
2016 09 12
2016 10 27
2016 12 11
2017 01 25
2017 03 11
2017 04 25
2017 06 09
2017 07 24
2017 09 07
2017 10 22
2017 12 06
Date (yyyy mm dd)



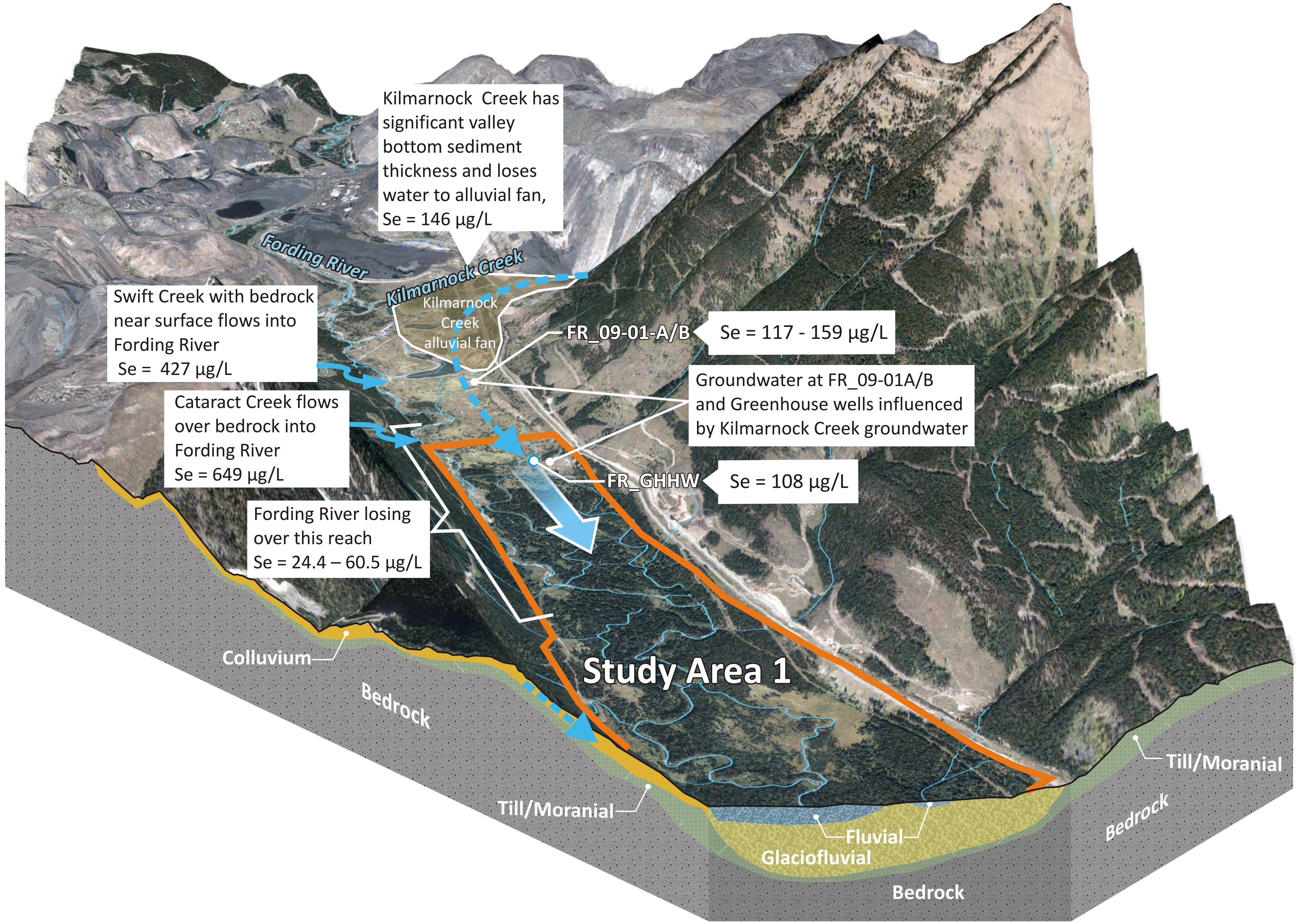
Note: Data was removed where suspected datalogger removal occurred.



Note: Total selenium concentrations shown at RG_DW-03-04 and EV_ER1gwD prior to 2017 02 20.
Elk River water levels were obtained from Environment Canada Station 08NK016 (https://wateroffice.ec.gc.ca)

Appendix IV

Block Diagrams



Flow Legend

Main Stem Down-Valley Groundwater

Upland or Tributary Groundwater

Surface Water

REFERENCES:
1. GRAPHICS BY BRICK TUDOR STUDIOS, LLC
2. BCGOV ILMB Crown Registry and Geographic Base Branch (CRGB) (data accessed through www.GeoBC.gov.bc.ca)

NOTES:
1. Original in colour.
2. Intended for illustration purposes, accuracy has not been verified for construction or navigation purposes.
3. All concentrations shown are for Q4 2016 unless otherwise stated.
4. Sub-surface geology not to scale.
5. Vertical exaggeration 2x for topographic profile.

REVISIONS:

CLIENT: Teck Coal Ltd

PROJECT LOCATION: Elk Valley, BC

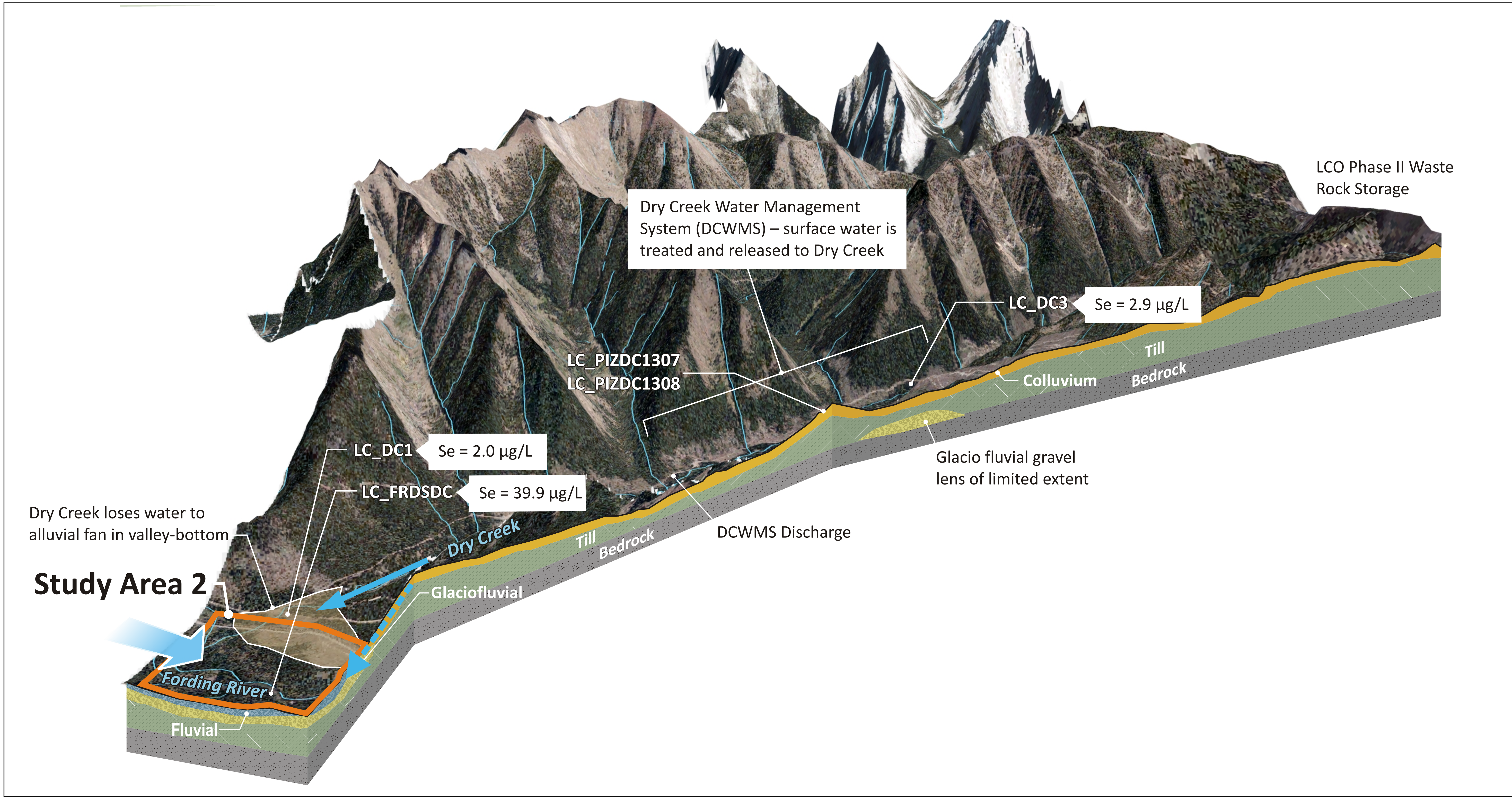
SNC·LAVALIN

Block Diagram Showing 3D Conceptual Hydrogeology and Transport Pathways of Constituents of Interest in Study Area 1

BY:	SCALE:	DATE:	REF No:	REV: 0
CHK'D:	Proj Coord Sys:		FIGURE 1	

MXD Path:

Project Path:



Flow Legend

Main Stem Down-Valley Groundwater

Upland or Tributary Groundwater

Surface Water

REFERENCES:
1. GRAPHICS BY BRICK TUDOR STUDIOS, LLC
2. BCGOV ILMB Crown Registry and Geographic Base Branch (CRGB) (data accessed through www.GeoBC.gov.bc.ca)

NOTES:
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5. Vertical exaggeration 2x for topographic profile.

REVISIONS:

CLIENT: Teck Coal Ltd

PROJECT LOCATION: Elk Valley, BC

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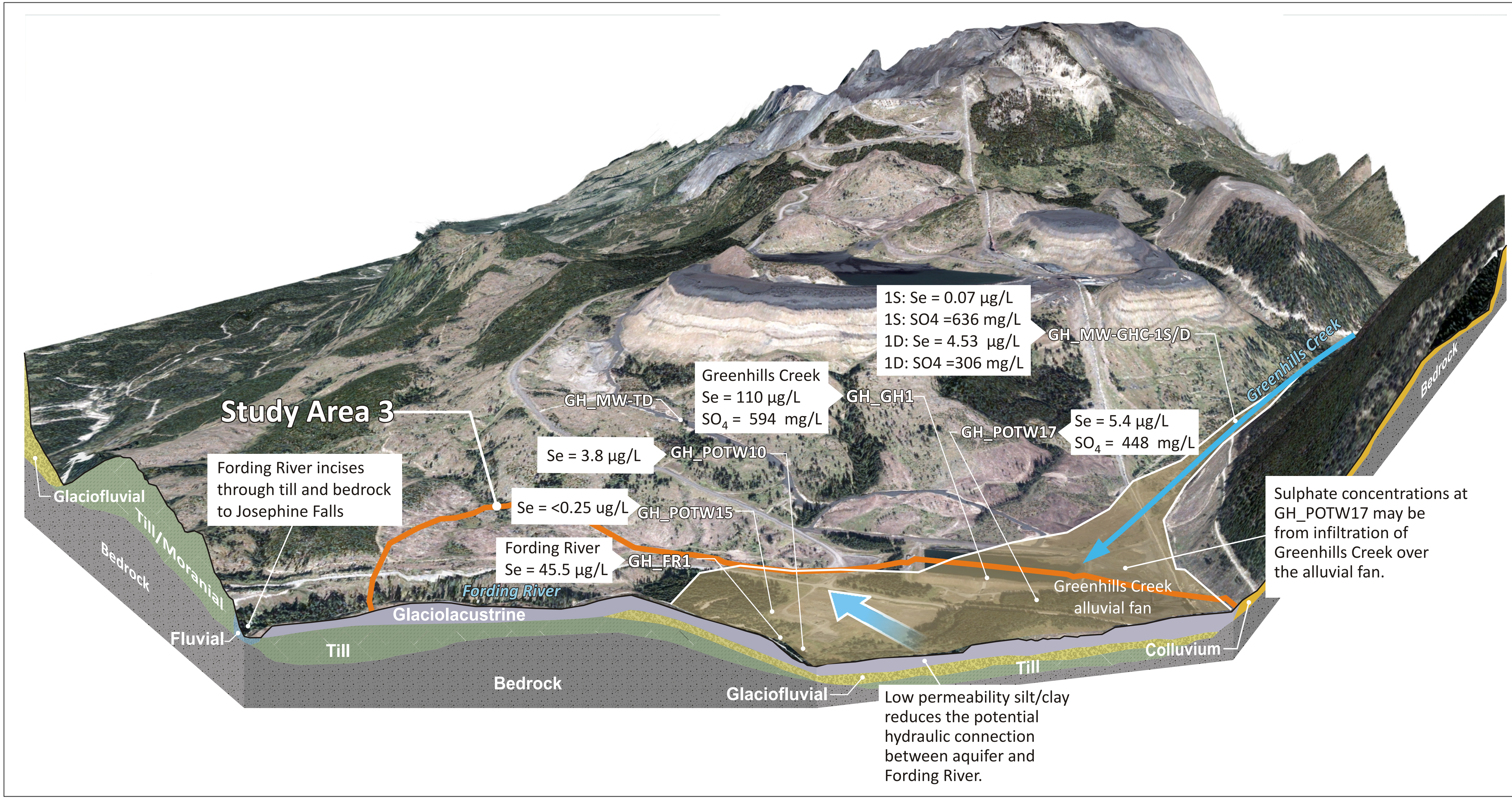
Block Diagram Showing 3D Conceptual Hydrogeology and Transport Pathways of Constituents of Interest in Study Area 2

BY: | SCALE: | DATE: | REF No: | REV: 0

CHK'D: | Proj Coord Sys: | **FIGURE 2**

MXD Path:

Project Path:



Flow Legend

Main Stem Down-Valley Groundwater

Upland or Tributary Groundwater

Surface Water

REFERENCES:
1. GRAPHICS BY BRICK TUDOR STUDIOS, LLC
2. BCGOV ILMB Crown Registry and Geographic Base Branch (CRGB) (data accessed through www.GeoBC.gov.bc.ca)

NOTES:
1. Original in colour.
2. Intended for illustration purposes, accuracy has not been verified for construction or navigation purposes.
3. All concentrations shown are for Q4 2016 unless otherwise stated.
4. Sub-surface geology not to scale.
5. Vertical exaggeration 2x for topographic profile.

REVISIONS:

CLIENT: Teck Coal Ltd

PROJECT LOCATION: Elk Valley, BC

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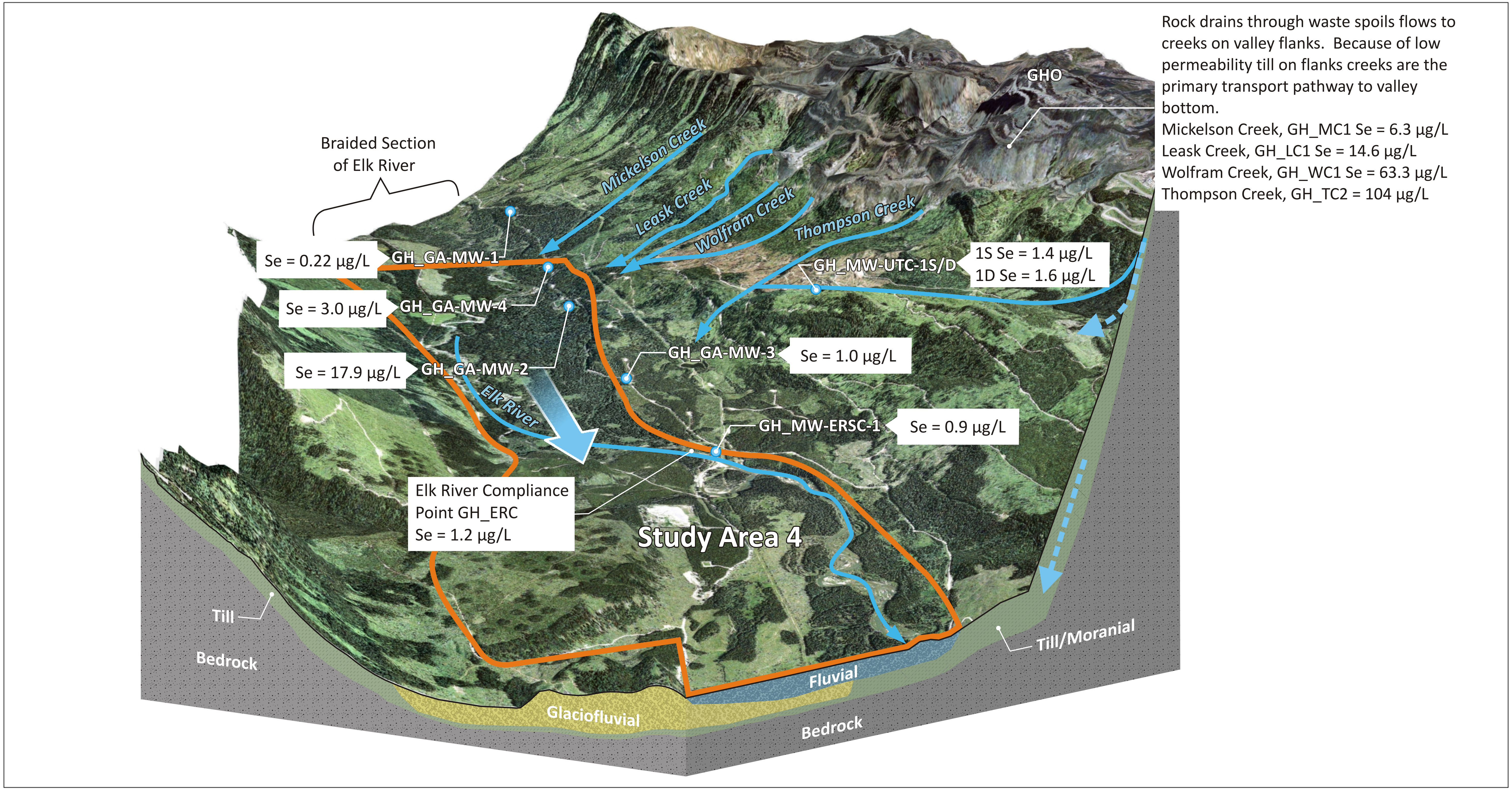
Block Diagram Showing 3D Conceptual Hydrogeology and Transport Pathways of Constituents of Interest in Study Area 3

BY:	SCALE:	DATE:	REF No:	REV: 0
CHK'D:	Proj Coord Sys:		FIGURE 3	

MXD Path:

Project Path:



Flow Legend

Main Stem Down-Valley Groundwater

Upland or Tributary Groundwater

Surface Water

REFERENCES:
1. GRAPHICS BY BRICK TUDOR STUDIOS, LLC
2. BCGOV ILMB Crown Registry and Geographic Base Branch (CRGB)
(data accessed through www.GeoBC.gov.bc.ca)

NOTES:
1. Original in colour.
2. Intended for illustration purposes, accuracy has not been verified for construction or navigation purposes.
3. All concentrations shown are for Q4 2016 unless otherwise stated.
4. Sub-surface geology not to scale.
5. Vertical exaggeration 2x for topographic profile.

REVISIONS:

CLIENT: Teck Coal Ltd

PROJECT LOCATION: Elk Valley, BC

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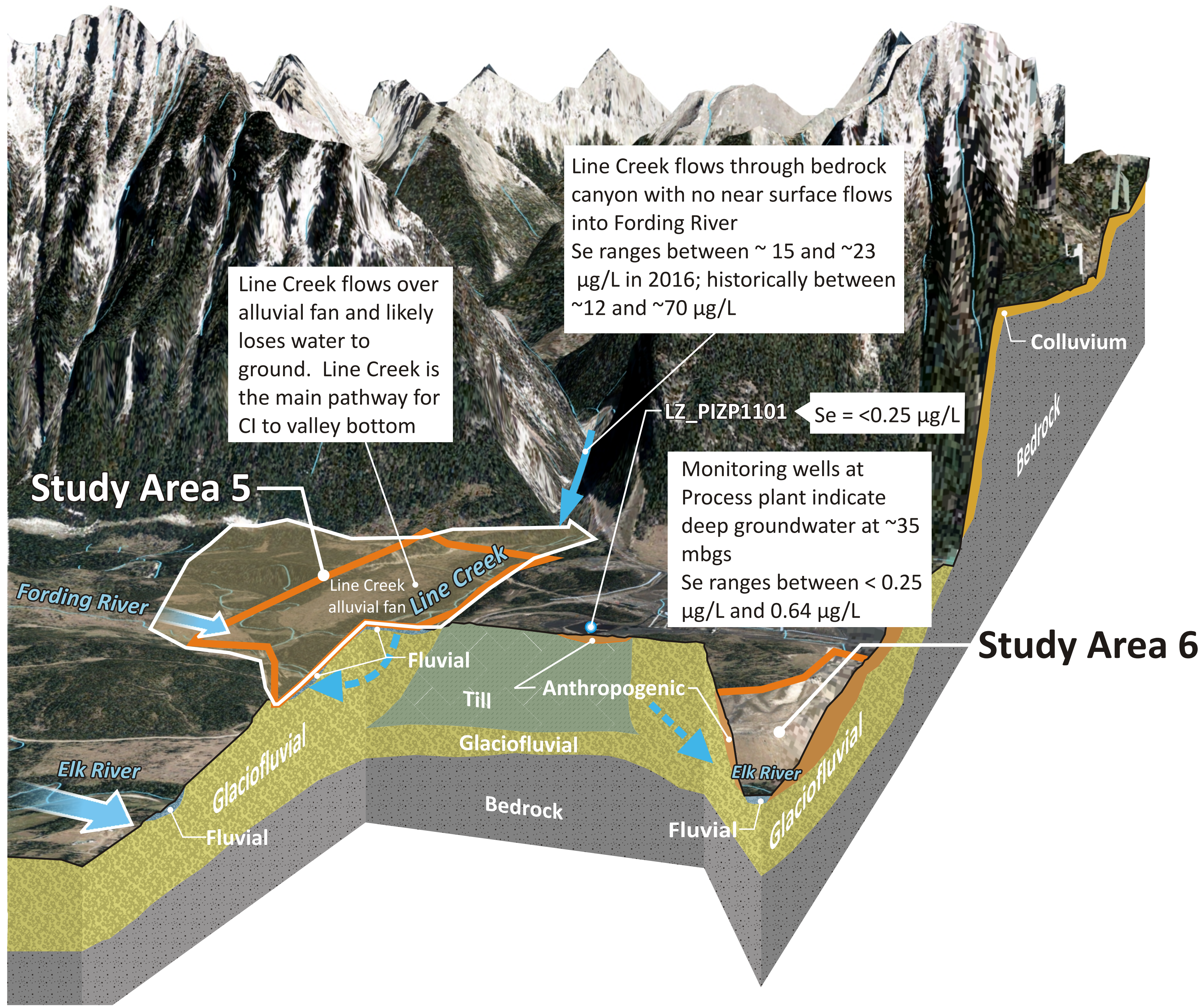
Block Diagram Showing 3D Conceptual Hydrogeology and Transport Pathways of Constituents of Interest in Study Area 4

BY:	SCALE:	DATE:	REF No: REV: 0
CHK'D:	Proj Coord Sys:		FIGURE 4

MXD Path:

Project Path:



Flow Legend

Main Stem Down-Valley Groundwater

Upland or Tributary Groundwater

Surface Water

REFERENCES:
1. GRAPHICS BY BRICK TUDOR STUDIOS, LLC
2. BCGOV ILMB Crown Registry and Geographic Base Branch (CRGB)
(data accessed through www.GeoBC.gov.bc.ca)

NOTES:
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3. All concentrations shown are for Q4 2016 unless otherwise stated.
4. Sub-surface geology not to scale.
5. Vertical exaggeration 2x for topographic profile.

REVISIONS:

CLIENT: Teck Coal Ltd

PROJECT LOCATION: Elk Valley, BC

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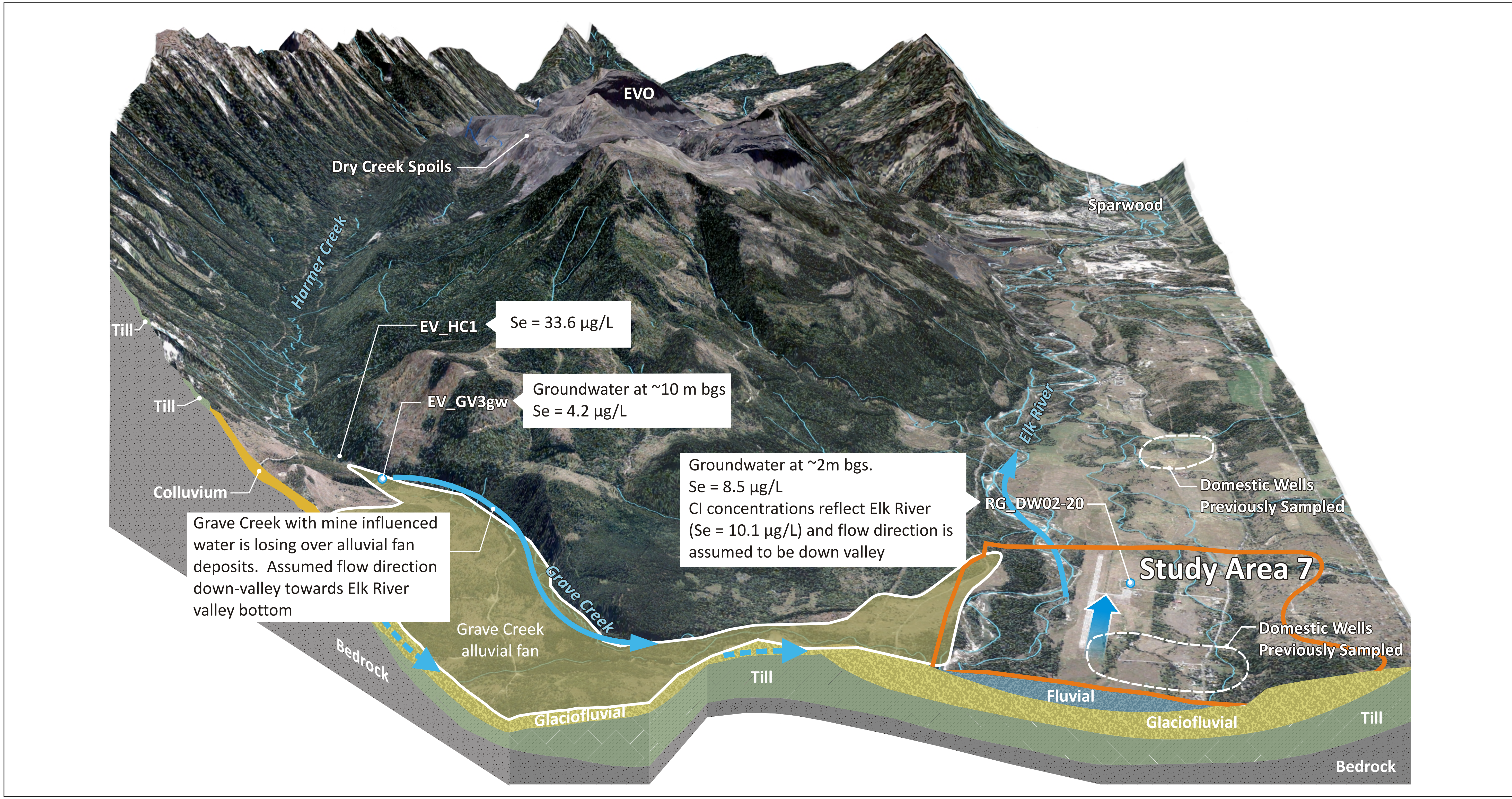
Block Diagram Showing 3D Conceptual Hydrogeology and Transport Pathways of Constituents of Interest in Study Areas 5/6

BY:	SCALE:	DATE:	REF No:	REV: 0
CHK'D:	Proj Coord Sys:		FIGURE 5	

MXD Path:

Project Path:



Flow Legend

Main Stem Down-Valley Groundwater

Upland or Tributary Groundwater

Surface Water

REFERENCES:
1. GRAPHICS BY BRICK TUDOR STUDIOS, LLC
2. BCGOV ILMB Crown Registry and Geographic Base Branch (CRGB)
(data accessed through www.GeoBC.gov.bc.ca)

NOTES:
1. Original in colour.
2. Intended for illustration purposes, accuracy has not been verified for construction or navigation purposes.
3. All concentrations shown are for Q4 2016 unless otherwise stated.
4. Sub-surface geology not to scale.
5. Vertical exaggeration 2x for topographic profile.

REVISIONS:

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PROJECT LOCATION: Elk Valley, BC

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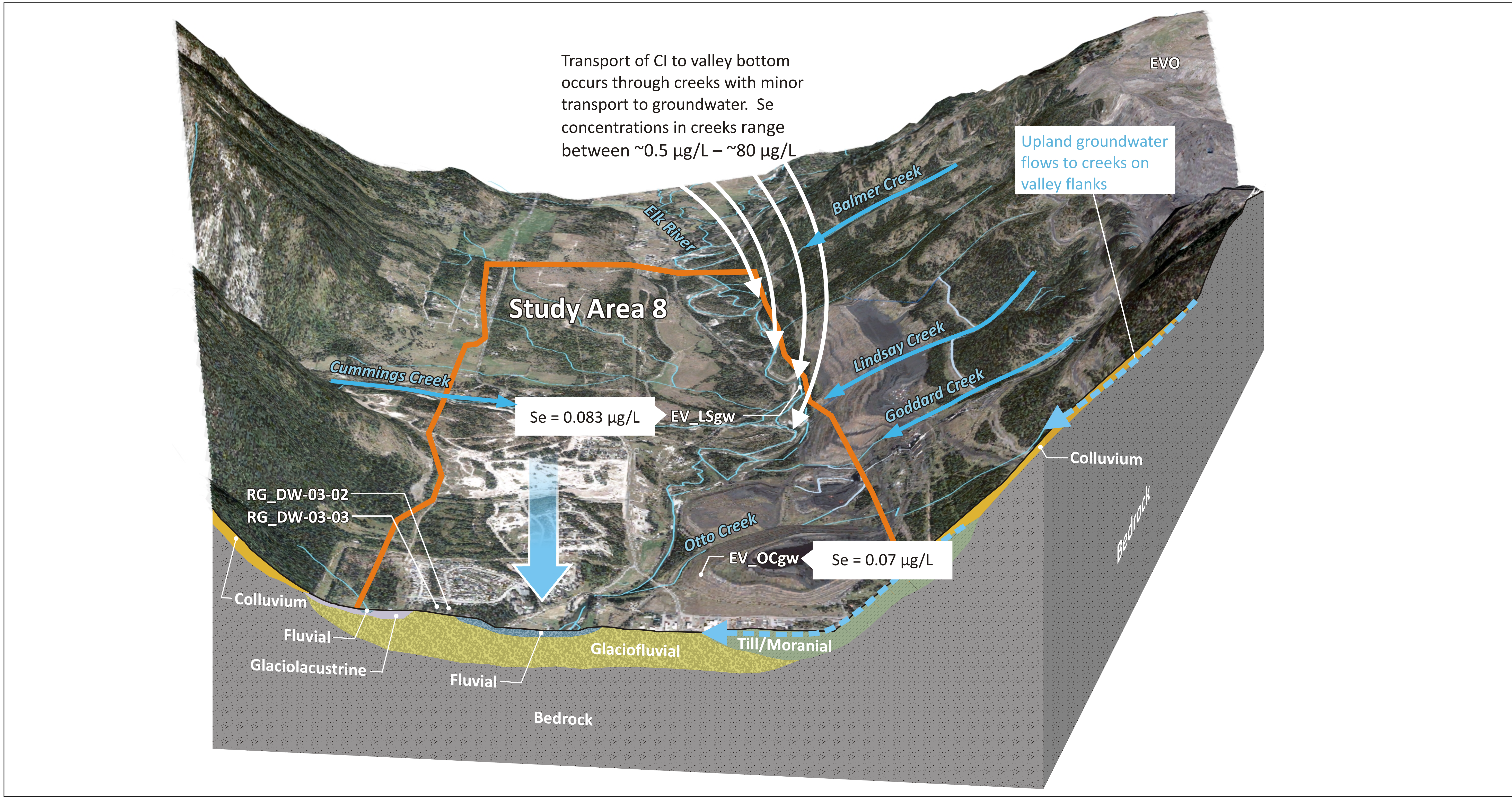
Block Diagram Showing 3D Conceptual Hydrogeology and Transport Pathways of Constituents of Interest in Study Area 7

BY:	SCALE:	DATE:	REF No:	REV: 0
CHK'D:	Proj Coord Sys:		FIGURE 6	

MXD Path:

Project Path:



Flow Legend

Main Stem Down-Valley Groundwater

Upland or Tributary Groundwater

Surface Water

REFERENCES:
1. GRAPHICS BY BRICK TUDOR STUDIOS, LLC
2. BCGOV ILMB Crown Registry and Geographic Base Branch (CRGB) (data accessed through www.GeoBC.gov.bc.ca)

NOTES:
1. Original in colour.
2. Intended for illustration purposes, accuracy has not been verified for construction or navigation purposes.
3. All concentrations shown are for Q4 2016 unless otherwise stated.
4. Sub-surface geology not to scale.
5. Vertical exaggeration 2x for topographic profile.

REVISIONS:

CLIENT: Teck Coal Ltd

PROJECT LOCATION: Elk Valley, BC

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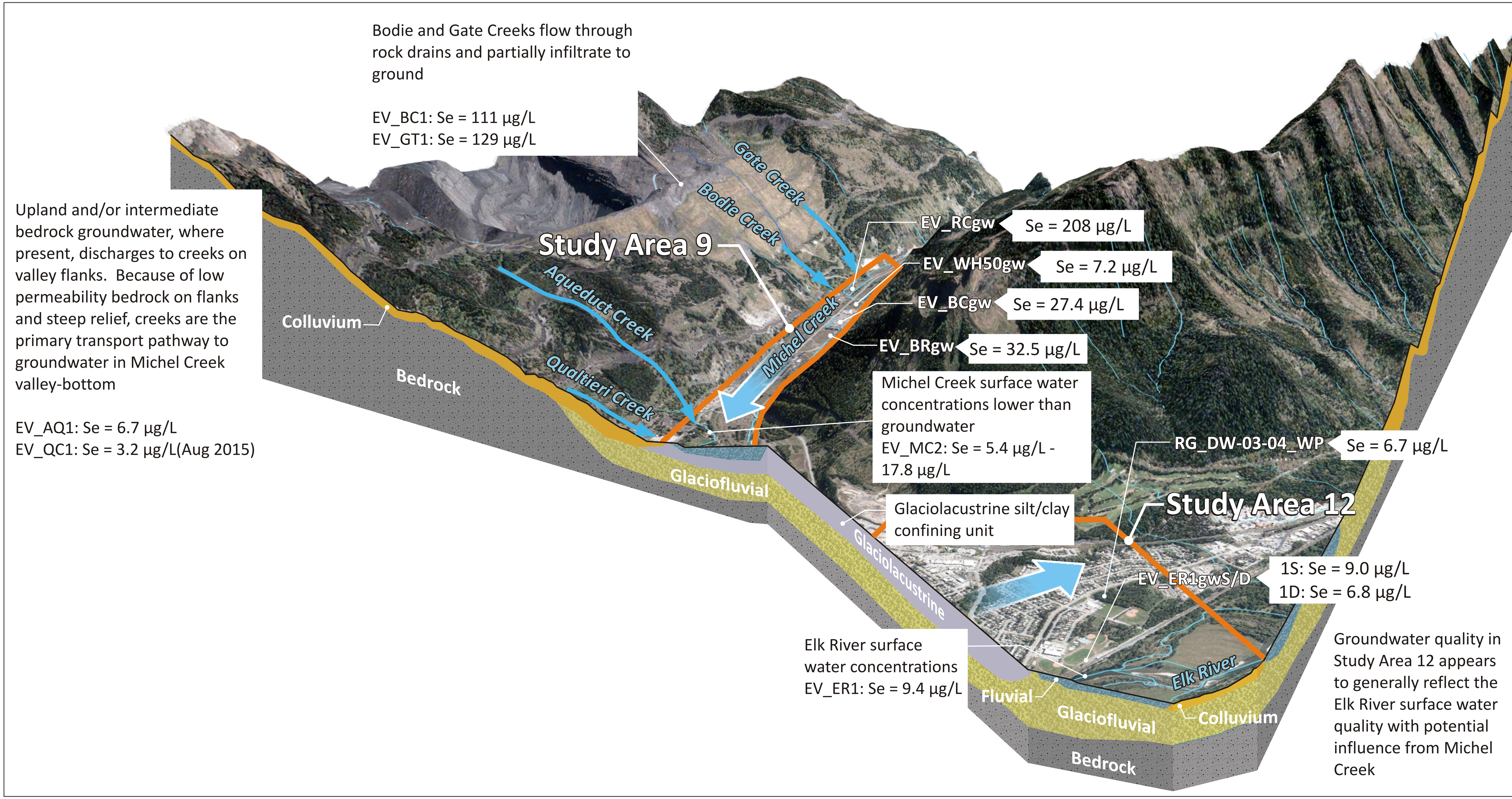
Block Diagram Showing 3D Conceptual Hydrogeology and Transport Pathways of Constituents of Interest in Study Area 8

BY:	SCALE:	DATE:	REF No:	REV: 0
CHK'D:	Proj Coord Sys:		FIGURE 7	

MXD Path:

Project Path:



Flow Legend

Main Stem Down-Valley Groundwater

Upland or Tributary Groundwater

Surface Water

REFERENCES:
1. GRAPHICS BY BRICK TUDOR STUDIOS, LLC
2. BCGOV ILMB Crown Registry and Geographic Base Branch (CRGB) (data accessed through www.GeoBC.gov.bc.ca)

NOTES:
1. Original in colour.
2. Intended for illustration purposes, accuracy has not been verified for construction or navigation purposes.
3. All concentrations shown are for Q4 2016 unless otherwise stated.
4. Sub-surface geology not to scale.
5. Vertical exaggeration 2x for topographic profile.

REVISIONS:

CLIENT: Teck Coal Ltd

PROJECT LOCATION: Elk Valley, BC

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Block Diagram Showing 3D Conceptual Hydrogeology and Transport Pathways of Constituents of Interest in Study Areas 9 and 12

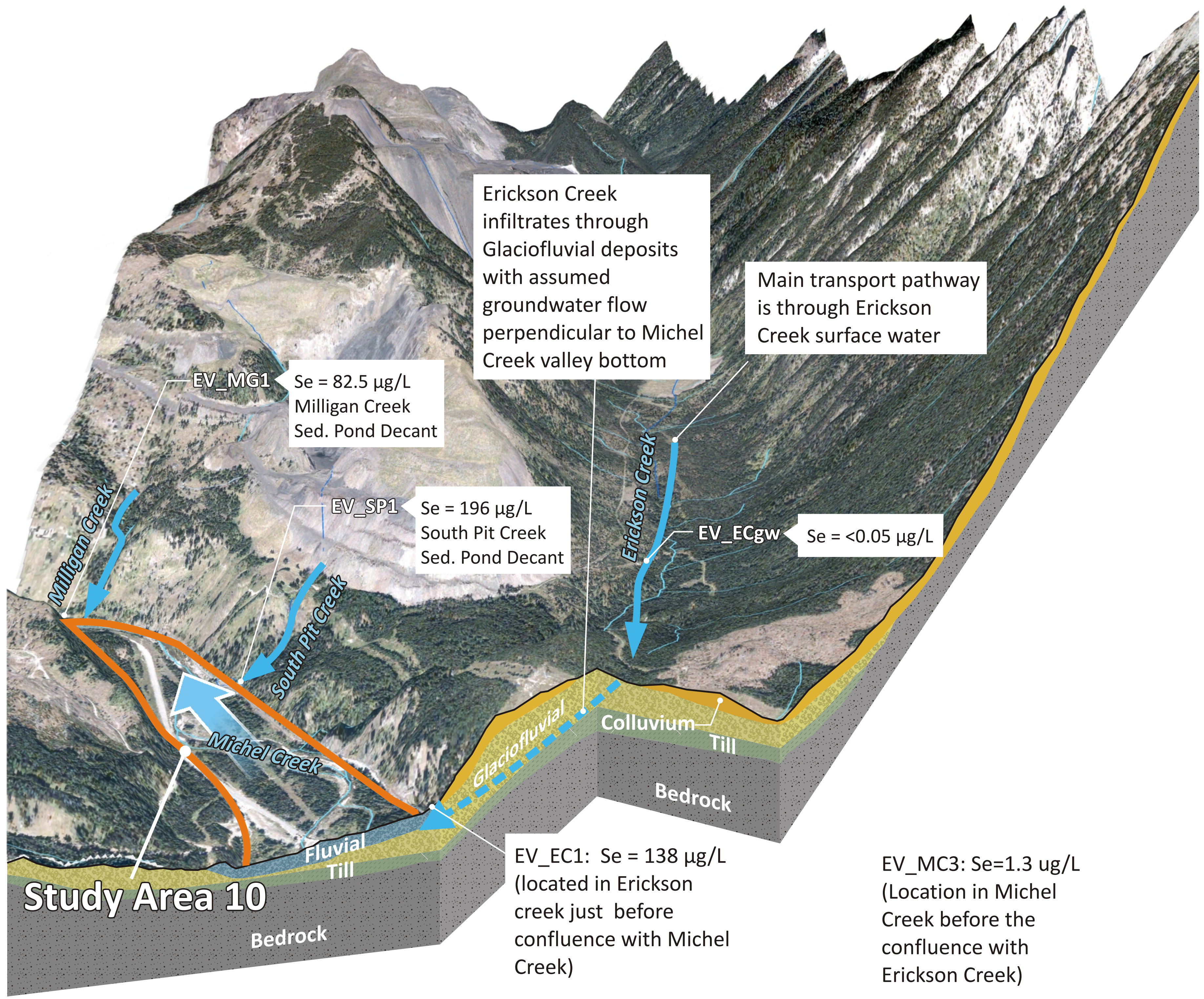
BY: | SCALE: | DATE: | REF No: | REV: 0

CHK'D: | Proj Coord Sys:

FIGURE 8

MXD Path:

Project Path:



Flow Legend

Main Stem Down-Valley Groundwater

Upland or Tributary Groundwater

Surface Water

REFERENCES:
1. GRAPHICS BY BRICK TUDOR STUDIOS, LLC
2. BCGOV ILMB Crown Registry and Geographic Base Branch (CRGB)
(data accessed through www.GeoBC.gov.bc.ca)

NOTES:
1. Original in colour.
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3. All concentrations shown are for Q4 2016 unless otherwise stated.
4. Sub-surface geology not to scale.
5. Vertical exaggeration 2x for topographic profile.

REVISIONS:

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Teck Coal Ltd

PROJECT LOCATION:
Elk Valley, BC

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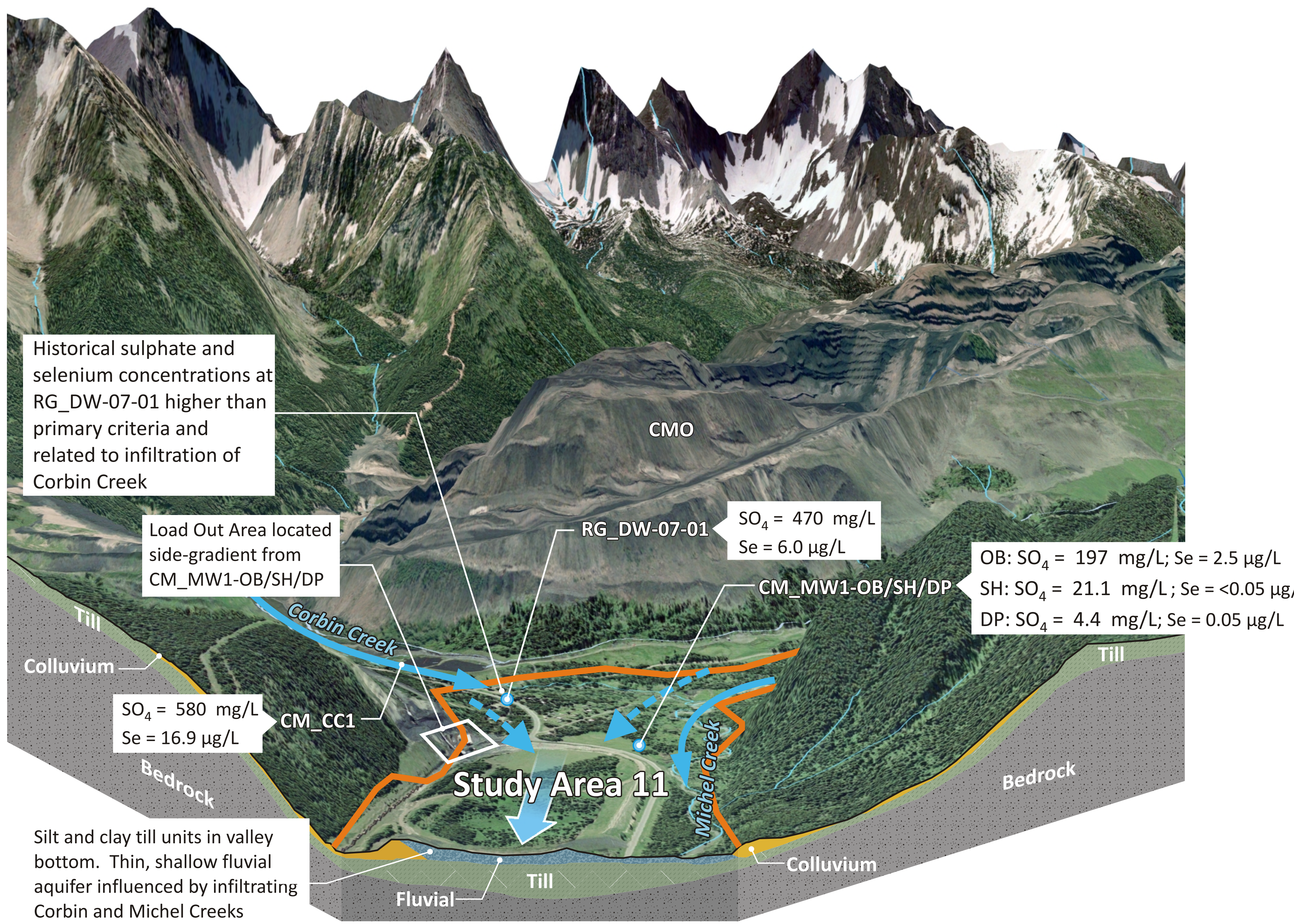
Block Diagram Showing 3D Conceptual Hydrogeology and Transport Pathways of Constituents of Interest in Study Area 10

BY:	SCALE:	DATE:	REF No: REV: 0
CHK'D:	Proj Coord Sys:		FIGURE 9

MXD Path:

Project Path:



Flow Legend

Main Stem Down-Valley Groundwater

Upland or Tributary Groundwater

Surface Water

REFERENCES:
1. GRAPHICS BY BRICK TUDOR STUDIOS, LLC
2. BCGOV ILMB Crown Registry and Geographic Base Branch (CRGB)
(data accessed through www.GeoBC.gov.bc.ca)

NOTES:
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3. All concentrations shown are for Q4 2016 unless otherwise stated.
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5. Vertical exaggeration 2x for topographic profile.

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PROJECT LOCATION: Elk Valley, BC

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Block Diagram Showing 3D Conceptual Hydrogeology and Transport Pathways of Constituents of Interest in Study Area 11

BY: | SCALE: | DATE: | REF No: | REV: 0

CHK'D: | Proj Coord Sys:

FIGURE 10

MXD Path:

Project Path:

Appendix V

Vertical Hydraulic Gradient Calculation

Appendix V: Summary of Vertical Gradient Calculations

Key Area	Well IDs	Date of Static Water Level Measurement (yyyy/mm/dd)	Screen Elevation Difference (m)	Head Difference (m)	Vertical Hydraulic Gradient
1	FR_09-01-A/B	2017/03/08	12.56	-0.60	-0.05
		2017/06/01		-0.53	-0.04
		2017/09/12		-0.63	-0.05
		2017/11/22		-0.58	-0.05
2	LC_PIZDC1308/1307	2017/03/16	26.14	-2.99	-0.11
		2017/06/12		-0.16	-0.01
		2017/09/19		-2.24	-0.09
		2017/11/01		-2.07	-0.08
9	EV_MCgwS/D	2017/03/16	19.47	-1.06	-0.05
		2017/06/28		-0.95	-0.05
		2017/08/16		-0.87	-0.04
		2017/09/21		-	-
		2017/10/18		-	-
11	CM_MW1-OB/SH	2017/03/27	18.34	-1.04	-0.06
		2017/06/19		-0.79	-0.04
		2017/08/28		-0.93	-0.05
		2017/12/07		-0.92	-0.05
	CM_MW1-SH/DP	-	13.78	-	-
		-		-	-
		-		-	-
		2017/12/07		0.26	0.02
12	EV_ER1gwS/D	2017/02/15	11.26	0.30	0.03
		2017/06/28		0.28	0.02
		2017/08/22		0.29	0.03
		2017/10/24		0.29	0.03

* Vertical gradient values were not calculated between EV_MCgwS/D in September and October 2017 as depth to water values and calculated potentiometric elevations are considered suspect based on level logger data. In addition, vertical gradients were not calculated bewteen CM_MW1-SH/DP in Q1, Q2, and Q3 as the depth to water measurements were not collected on the same date.

SNC-Lavalin Inc.
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250.354.1664
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