Elk Valley Environmental Monitoring Committee 2015 Public Report

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Glossary

Active water treatment: A method of removing constituents of concern from water that requires regular and/or frequent human intervention and management.

Acute toxicity: The adverse effects of a substance on an organism that result either from a single exposure or from multiple exposures in a short space of time.

Adaptive management: A systematic process for learning from management actions to confirm that a plan's objectives are being met and to adjust and improve management actions during implementation.

Benthic invertebrates: Organisms that live in or on the bottom sediments of rivers, streams and lakes, including some aquatic insect species.

Bioaccumulation: The accumulation of substances, including both toxic and benign substances, within the tissues of an organism.

Biological treatment: A method of treating water through the use of organisms such as bacteria and other microfauna.

Bryophytes: Seedless plants (e.g., moss) that play a vital role in regulating ecosystems.

Calcite: A mineral composed of calcium, carbon and oxygen. Calcite used in this assessment is from the carbonate class of minerals, and has the chemical formula CaCO3.

Chronic toxicity: Adverse effects on an organism as a result of long term exposure to a toxicant or other stressor.

Compliance point: An effluent monitoring location specified in the EMA permit at which discharge limits apply.

Constituents of interest: An element or ionic compound that may pose a threat to ecological or human health when present at sufficient concentrations.

Designated Area: A portion of southeastern British Columbia that contains the Elk Valley and is geographically defined by the Order.

Effect benchmark: A concentration of a constituent in tissue that has been shown to produce effects on an organism.

Groundwater: That part of the subsurface water that occurs beneath the water table, in soils and geologic formations.

Larval Life Stage: Newly hatched, and not fully developed stage animals. Normally there is a fundamental change in form that is required to get from a larval form to an adult form.

Management unit: A portion of the Designated Area specified for water quality management purposes.

Order (the): A directive issued by the BC Minister of Environment in April 2013 requiring Teck to develop an Area Based Management Plan (also known as the Elk Valley Water Quality Plan).

Order station: A monitoring location specified by the Order to monitor water quality in the Designated Area.

Periphyton: Algae, bacteria and other associated microorganisms attached to a submerged surface.

Productivity: A technical term for the amount of plant or animal matter that is grows in a year on a per unit area (i.e., a square meter) basis.

Reference stream: A watercourse that is not affected by point sources of contamination; used to compare the effects of mining activity on constituents of interest and calcite formation.

Site performance objective: An authorization limit or standard, applicable to the receiving environment and imposed by the statutory decision maker (e.g., MoE Director) that may be an adopted guideline or site specific water quality objective, or another limit set by the statutory decision maker after weighing multiple factors.

Toxicity test: A test to determine how a certain concentration of a constituent—selenium, nitrate, sulphate and cadmium—affects the survival and reproduction of a specific species.

Water quality guideline: The concentration of a constituent of concern developed to protect ecological or human health; may be federal or provincial.

Abbreviations

ABMP	Area Based Management Plan (also known as the Elk Valley Water Quality Plan)
AMP	Adaptive Management Plan
AWTF	Active Water Treatment Facility
CMO	Coal Mountain Operations
EMA	Environmental Management Act
EMC	Environmental Monitoring Committee
EVO	Elkview Operations
FRO	Fording River Operations
GHO	Greenhills Operations
HHRA	Human Health Risk Assessment
MoE	BC Ministry of Environment
MEM	BC Ministry of Energy and Mines
KNC	Ktunaxa Nation Council
LAEMP	Local Aquatic Effects Monitoring Program
LCO	Line Creek Operations
R&D	Research and Development
RAEMP	Regional Aquatic Effects Monitoring Program
RGMP	Regional Groundwater Monitoring Program
TEP	Tributary Evaluation Program
TMP	Tributary Management Plan
WQG	Water Quality Guideline

Overview of Environmental Monitoring Committee Public Report

In April 2013, the BC Minister of Environment (MoE) under Section 89 of the *Environmental Management Act* (EMA) of BC issued Ministerial Order No. M113 (the Order) to Teck requiring that the company prepare an Area Based Management Plan (ABMP) for the Elk Valley to remediate water quality effects of past coal mining activities and to guide future development.

The Order was initiated as a result of evidence of increasing concentrations of selenium, cadmium, nitrate and sulphate in watercourses in the Elk Valley, as well as evidence of calcite formation in some of these watercourses. These issues are largely associated with historical and current mining activity, and in particular, leaching from waste rock dumps. By addressing water quality effects of mining activities, the Order was intended to create a path forward for mining development in the area that ensures the protection of ecological and human health while taking into account socio-economic factors.

In July 2014, Teck submitted the ABMP, also known as the Elk Valley Water Quality Plan, to the MoE as required by the Order. Following approval of the ABMP by the MoE, an EMA permit (107517) was issued in November 2014 authorizing effluent discharges from Teck's steelmaking coal operations in the Elk Valley.

One requirement of the permit was the formation of an Environmental Monitoring Committee (EMC)—that will be active throughout mine operations as required by the EMA permit—to review monitoring submissions required under the permit in order to provide technical and Traditional Knowledge[1] advice and improve technical aquatic monitoring submissions to the Director. The first EMC meeting was held on March 10, 2015.

The public report you are reading is an annual deliverable listed in the EMC Terms of Reference (See Appendix B). Its purpose is to summarize the information reviewed by the EMC on a yearly basis and provide an update on EMC-reviewed programs and studies.

Where available, results of EMC-reviewed monitoring programs have been summarized. Where results are not yet available, a summary of activity to date has been provided. Advice and input provided by members of the EMC to date in 2015 and how this has been considered by Teck is summarized in Appendix A of this report.

In conjunction with the release of the report, a public open house will be held each year where members of the EMC and Teck representatives will discuss information reviewed by the EMC and answer questions.

The 2015 Elk Valley EMC open house is scheduled for October 27, 2015, from 4 – 9 p.m. at the Park Place Lodge in Fernie.

1. Introduction

1.1. Elk Valley Permit, Area Based Management Plan & Environmental Monitoring Committee

To address water quality challenges related to mining, in April 2013, the BC Ministry of Environment (MoE) directed Teck to develop an Area Based Management Plan (ABMP), available at www.teckelkvalley.com and the MoE Mining and Smelting website. The goal of the ABMP is to stabilize and reduce increasing selenium and nitrate water concentrations, as well as cadmium and sulphate levels and calcite formation associated with historical and current mining activity (See Section 1.3 of this report).

Subsequently, an Environmental Management Act (EMA) permit (the permit) was issued authorizing continued water discharges from Teck's Elk Valley operations. The permit directed the formation of an Environmental Monitoring Committee (EMC) to review monitoring and reporting submissions required under the permit and provide technical advice to Teck and the MoE Director. (See Section 2 of this report.)

In its Terms of Reference (see Appendix B), the EMC committed to provide the public with an annual plain-language report—the report you are reading—to communicate the results of monitoring undertaken under the permit, the status of the implementation of activities and commitments under the ABMP, and an appendix listing all non-confidential recommendations made by the committee.

1.2. About the Environmental Monitoring Committee

The EMC Terms of Reference—developed in April 2015—describes scope, membership, goals and objectives and other roles and responsibilities of the EMC until such time as the Terms of Reference are revised.

1.2.1. Membership

The EMC is made up of the following representatives from government, industry, academia and First Nations:

- BC Ministry of Environment (MoE)
- BC Ministry of Energy and Mines (MEM)
- Ktunaxa Nation Council (KNC)
- Teck
- Interior Health Authority
- Independent scientist

[1]Traditional Knowledge (TK) refers to knowledge, skills and practices that are developed, sustained and passed on from generation to generation within a community, often forming part of its cultural or spiritual identity.

Each member of the EMC, with the exception of the KNC, appointed one representative and one alternate. The KNC has three representatives on the committee, combining both technical and Traditional Knowledge perspectives, and one alternate participant.

An independent facilitator appointed by consensus of the BC Government, Teck and KNC, facilitates EMC meetings and acts as the EMC secretariat. The facilitator provides administrative support to the EMC, including organizing logistics for meetings, providing notice of meetings to EMC members, receiving and distributing meeting information to members, finalizing and distributing meeting agendas, and taking and preparing meeting notes.

1.2.2. Role

The EMC is primarily a forum to share technical information and Traditional Knowledge related to the environmental matters of the monitoring, adaptive management and reporting activities of the ABMP and the permits. It is a non-regulatory body that will be active throughout mine operations as required by the permit. The geographical area under the purview of the EMC is the Elk River watershed and the Canadian portion of the Koocanusa Reservoir.

The EMC's objectives, as outlined in the Terms of Reference, are as follows:

- Provide science-based and/or Traditional Knowledge-based advice to Teck, the KNC and the Director on issues related to:
  - Recommended revisions to the water quality targets specified in the ABMP, based on the review of monitoring results and Adaptive Management Plan reports;
  - Environmental monitoring programs, data assessments, and adaptive management associated with implementation of the ABMP and EMA permits;
  - Maximizing effectiveness and coordination of environmental monitoring activities conducted under the ABMP and the EMA permits; and
  - Facilitate integration of Traditional Knowledge into environmental monitoring and activities conducted under the ABMP and EMA permits
- Support communication of environmental monitoring results collected under the ABMP and the EMA permits to Ktunaxa Nation members and the public by:
  - Compiling and analyzing relevant environmental data and information; and
  - Providing information in a plain language format
- Provide advice to support continual improvement in monitoring activities conducted under the ABMP and EMA permits.

According to Section 12.2 of the permit, the EMC will review submissions and provide technical advice to Teck and to the Director regarding monitoring submissions in sections:

- Section 9.2 Elk Valley Groundwater Monitoring
- Section 9.3 Local Aquatic Effects Monitoring
- Section 9.4 Regional Aquatic Effects Monitoring
- Section 9.5 Calcite Monitoring
- Section 9.8 Chronic Toxicity Testing
- Section 9.9 Human Health Risk Assessment
- Section 11 Adaptive Management
- Section 12.3 Third Party Audit

The EMC will also provide input to Teck regarding reports which are required under sections:

- Section 2.7 Re-evaluation of Limits
- Section 5.1 Tributary Evaluation and Management
- Section 9.7 Lake Koocanusa Burbot Baseline Study 2015
- Section 10.2.4 Annual Reporting
- Section 10.3 Groundwater
- Section 10.4 LAEMP
- Section 10.5 RAEMP
- Section 10.6 Calcite
- Section 10.7 Lake Koocanusa
- Section 10.8 Water Quality Modelling
- Section 11 Adaptive Management
- Section 12.3 Third Party Audit

The EMC may also review other pertinent monitoring data relevant to water quality and aquatic life in the Fording and Elk Rivers and Lake Koocanusa.

The EMC is to hold a minimum of four face-to-face meetings per year, plus at least one annual public meeting for the first two years. The 2015 public meeting will be held October 27, 2015, from 4 – 9 p.m. at the Park Place Lodge in Fernie.

1.2.3. EMC Activities in 2015

As of October 15, 2015, the EMC has held four in-person meetings and 13 conference calls for the year. A further two in-person meetings are scheduled for 2015.

- March 17 (conference call)
- April 13 (conference call)
- May 27-28 (face to face)
- June 16-17 (face to face)

[2]The EMC does not replace the regulatory responsibilities of government agencies, direct government-to-government agreements or discussions, direct Teck-to-Ktunaxa Nation agreements or discussions; it is supplemental. The EMC does not prevent or restrict the Ktunaxa Nation and Teck from interacting directly with the Province and Teck on matters within the scope of the EMC.

- June 29 (conference call)—Calcite Biological Effects Monitoring Program Study Design
- July 9 (conference call)—Regional Groundwater Monitoring Program
- July 13 (conference call)—Adaptive Management Plan
- September 3 (conference call)—EMC Public Report
- September 10 (conference call)—RAEMP Sediment Toxicity Testing
- September 15 (conference call)—RAEMP Sediment Toxicity Testing Sites
- September 17 (conference call)—EMC Public Meeting October 2015 Planning Call No. 1
- September 25 (conference call)—Public Meeting Planning Call No. 2
- September 30 (conference call)—Public Meeting Planning Call No. 3
- October 6 (conference call)—Public Meeting Planning Call No. 4
- October 15 (conference call)—Public Meeting Planning Call No. 5
- October 27, 28, 29 (face to face)
- November 24, 25, 26 (face to face)

In addition, the EMC has reviewed and provided scientific and / or Traditional Knowledge advice and input on 19 reports and study outlines or designs as per the table below. These items are discussed in Section 2 of this report. The EMC's advice—and Teck's responses—is summarized in Appendix A.

1.2.4. EMC Next Steps

As of October 15, 2015, the EMC has a further six in-person meeting days scheduled for the year, and will hold a minimum of four face-to-face meetings in 2016, in addition to conference calls and the annual public meeting. The EMC will continue to review the results of ongoing monitoring and study programs, evaluate proposed study designs, and provide technical and traditional knowledge advice. The next edition of this public report and a further public open house is planned for Fall 2016.

Permit Section	Document Reviewed by EMC	Date Submitted to EMC
Advice		
9.2.1	Regional Groundwater Synthesis Report	April 30, 2015
9.3.1	Line Creek Operations (LCO) Local Aquatic Effects Monitoring Program (LAEMP) Study Design	May 29, 2015
9.4	Regional Aquatic Effects Monitoring Program (RAEMP) Calcite Biological Effects Study Design	July 24, 2015
9.4	RAEMP Periphyton Community Structure Study Design	October 31, 2014
9.4	RAEMP Sediment Toxicity Study Design	December 19, 2014
9.5.1	Seasonal Calcite Study Design	February 28, 2015
9.8.2	Sublethal Toxicity Study Design	March 25, 2015
9.9	Human Health Risk Assessment Terms of Reference and Work Plan	April 20, 2015 and May 22, 2015 respectively
11	Adaptive Management Uncertainty Hierarchy	July 7, 2015
11	Adaptive Management Terms of Reference	February 15, 2015
Input		
2.7.1	Elkview Operations (EVO) Harmer Compliance Point Selenium Evaluation	May 28, 2015
5	Tributary Evaluation Draft Data Matrix Template	July 24, 2015
5	Tributary Evaluation Study Design	May 1, 2015
5	Tributary Evaluation Inventory and Map, plus Data Matrix for Fording	September 30, 2015
9.7	Lake Koocanusa Burbot Study Results	July 31, 2015
10.2.4	2014 Annual Water Reports	July 13, 2015
10.4	LCO LAEMP 2014 Report	May 29, 2015
10.6	2014 Calcite Monitoring and Statistical Power Report	May 29, 2015
10.7	Lake Koocanusa 2014 Monitoring Report	March 31, 2015

Figure 1: List of Teck deliverables reviewed to date by the EMC

1.3 Mining and Water Quality in the Elk Valley

This next section of the report is included to provide the reader with an overview of mining in the Elk Valley and monitoring of water quality required under the permit.

The Elk Valley

The Elk Valley of southeastern British Columbia includes the communities of Elkford, Sparwood, Hosmer, Fernie and Elko. The Elk Valley watershed contains the main stem Elk River and many tributaries, including the Fording River, and flows into the Kootenay River at Lake Koocanusa.

The Elk Valley has a long history of mining activity dating back to 1897 and is currently home to five steelmaking coal operations owned and operated by Teck Resources Limited (Teck). These operations directly employ more than 4,000 people.

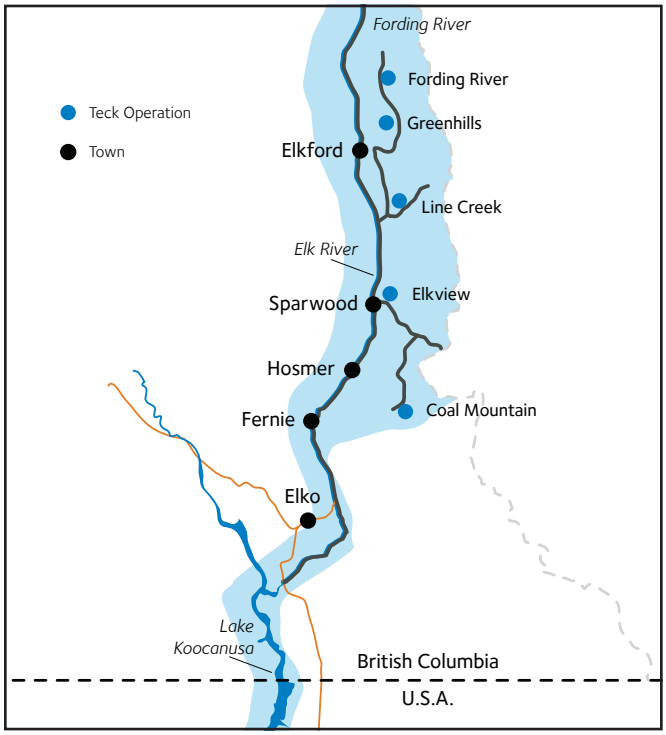


Figure 2: The Elk Valley and Teck's operations

Mining and Water Quality

Steelmaking coal occurs as layers or seams within rock. To access the coal, large quantities of this rock, referred to as waste rock, are mined and placed in piles within and adjacent to the mine pits (Step 1 in Figure 3). Water from both precipitation and runoff flows through these waste rock piles and carries substances, including selenium, cadmium and sulphate as well as nitrate from blasting residue, into the local watershed. (Steps 2 and 3 in Figure 3).

Selenium is a common element found naturally in rock and is an essential nutrient for living things. In an aquatic environment, selenium can be taken up from water by algae and other microorganisms and transferred through the food web to aquatic invertebrates, fish, birds and other vertebrates. Selenium in elevated concentrations can interfere with reproductive processes in egg-laying vertebrates (fish, birds, amphibians and reptiles).

Geochemical studies indicate that waste rock piles continue to release selenium for a very long time after it is mined. Waste rock placed decades ago continues to release selenium and is expected to continue doing so for many decades more.

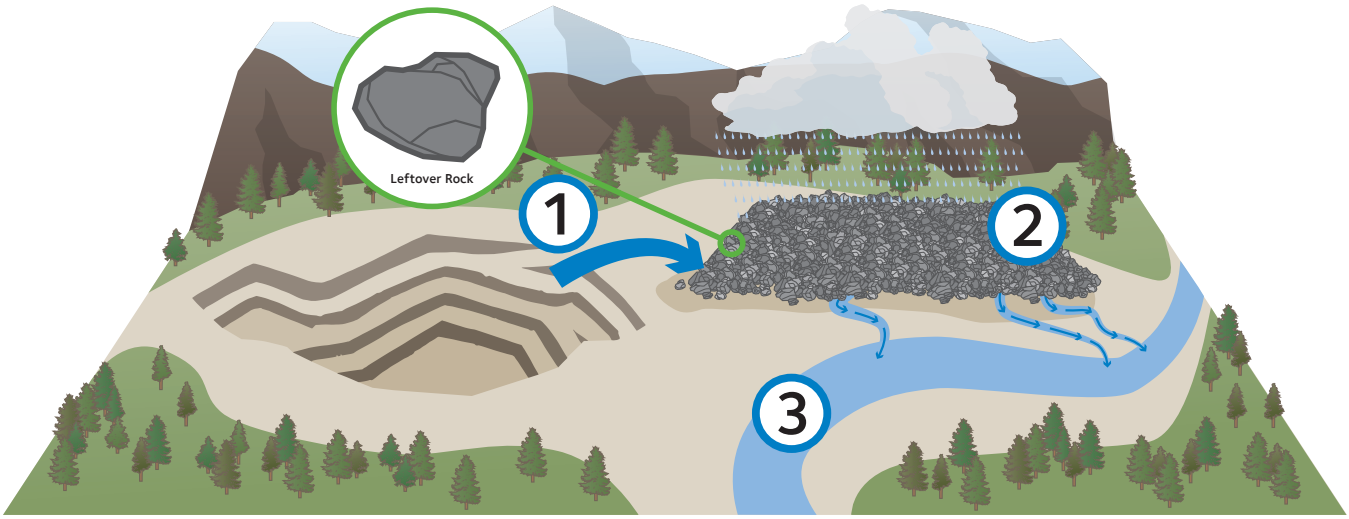


Figure 3: The coal mining process and water quality

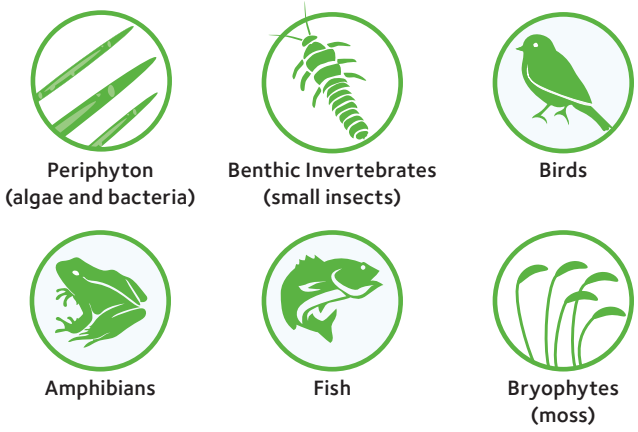
In addition to selenium, cadmium, nitrate, sulphate and calcite have also been identified as mining-related constituents of interest.

- Cadmium is a metal that can be harmful at elevated concentrations. As with selenium, mining can accelerate the release of cadmium to the environment by exposing waste rock to air and water. Unlike selenium, the primary concern with cadmium is from direct contact of aquatic organisms with surface waters rather than bioaccumulation in fish tissue. Cadmium at elevated concentrations can interfere with the uptake of calcium by fish and other aquatic organisms.
- Nitrate is an inorganic compound that is carried by water from waste rock piles containing blasting chemicals used in mining. High nitrate can be toxic to fish and other aquatic organisms disrupting oxygen consumption, and impairing growth and development particularly in young (larval) life stages. As with cadmium, the primary concern is exposure of aquatic organisms through direct contact with surface water, which in some cases can contribute to eutrophication, a process where water bodies receive excess nutrients that stimulate excessive plant growth.
- Sulphate—a naturally occurring substance that contains sulphur and oxygen—is released from waste rock through oxidation of sulphide minerals. Sulphate can accumulate to higher levels in mining environments when it interacts with other substances. Direct contact of aquatic organisms with elevated concentrations of sulphate can interfere with osmoregulation—what keeps an organism's fluids from becoming either too diluted or too concentrated—and cellular membrane function. Rainbow trout has been identified as the most sensitive aquatic species to sulphate.
- Calcite is a white or colourless mineral consisting of calcium carbonate. As water travels through the ground or through mining waste rock, calcium carbonate is dissolved and carried downstream, where it may precipitate forming 'calcite'. The scaling seen in kettles involves a similar chemistry. High calcite buildup can change the characteristics of the stream by cementing rocks together, adversely affecting habitat for fish and invertebrates. See Section 2.8 of this report for more information on calcite.

2. EMC Activities

Under the permit, Teck is required to undertake extensive monitoring of aquatic health and water quality. This section of the report outlines for the reader the various activities and studies Teck has undertaken as per the permit and for which the EMC has provided technical advice and input on throughout the past year. (See Figure 5 for a step-by-step look at how a Teck deliverable makes its way through the EMC review process.)

Aquatic Organisms



Environment

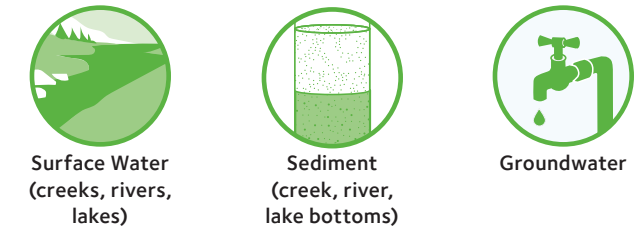


Figure 4: What is being monitored

Step 1
Condition 12.2 of EMA permit 107517 outlines which deliverables require review by the EMC
Step 2
Teck prepares draft deliverable
Step 3
As outlined in condition 12.2 of the EMA permit, Teck delivers the draft deliverable to the EMC for review and to provide advice to Teck, the Director, and the KNC on the contents of the deliverable
Step 4
EMC members review the deliverable and submit their input and advice in table format to the independent facilitator acting as the EMC secretariat
Step 5
The Facilitator compiles all the advice received from the EMC in table format and sends to Teck
Step 6
Teck reviews the compiled advice table and provides written responses for each line item. The deliverable is then updated to consider the technical advice received from the EMC. A rationale is given in the response column for any piece of advice that is not incorporated into the deliverable.
Step 7
Teck submits the revised deliverable that considers EMC input to the MoE as required by the condition of the permit
Step 8
The MoE reviews the revised deliverable that considers the advice provided by the EMC

Figure 5: Process by which a deliverable[3] makes its way through the EMC

2.1. Surface Water Monitoring

Background

The permit requires Teck to meet site Performance Objectives at seven Order Stations (see Figure 6 for locations) to monitor water quality across the Elk Valley watershed.

The permit also established site Performance Objectives for seven additional Compliance Points (see Figure 7 for locations). These Compliance Points are situated adjacent to Teck's operations on the Fording and Elk rivers and Michel, Harmer and Line creeks. Teck is to ensure that concentrations of specific substances do not exceed specified limits at these Compliance Points.

Section 10.2.4 of the permit outlines Teck's responsibilities regarding annual reporting of surface water monitoring. Specifically, Teck must prepare on an annual basis a report or series of reports summarizing activities, incidents, and discharge/receiving environment monitoring results. The annual report must be submitted to the Director by March 31 of each year following the data collection calendar year.

Status

Teck collects water samples on a monthly or weekly basis, from each of the seven Order Stations and seven Compliance Points, and submits those samples to an accredited, third-party laboratory for testing. Teck submitted 2014 Annual Water Reports to the EMC on July 13, 2015.

EMC Activities

The EMC did not review Teck's 2014 Annual Water Reports.

[3]A deliverable is an action Teck must take and then report on to the MoE in order to stay compliant with the EMA permit 107517.

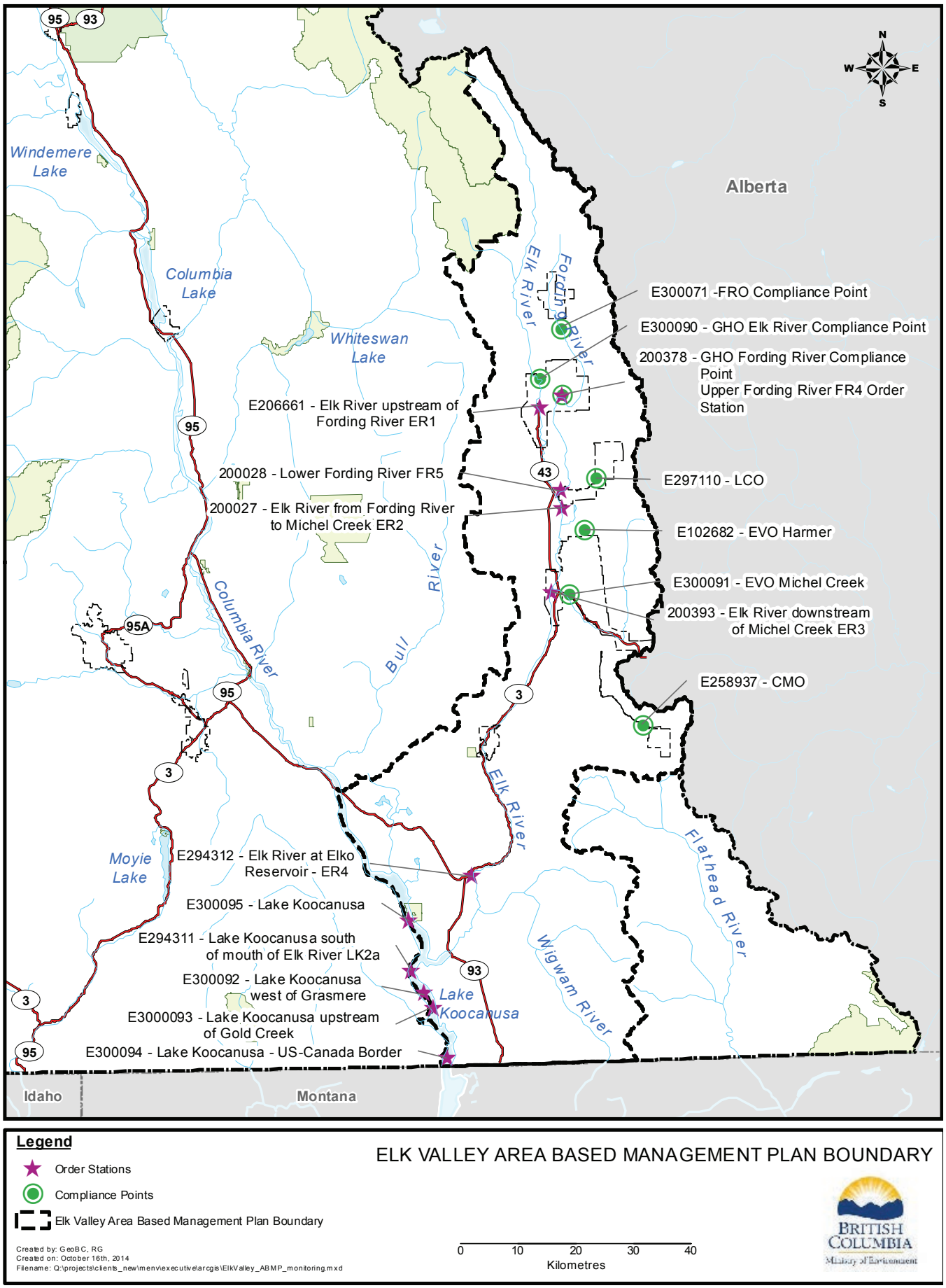
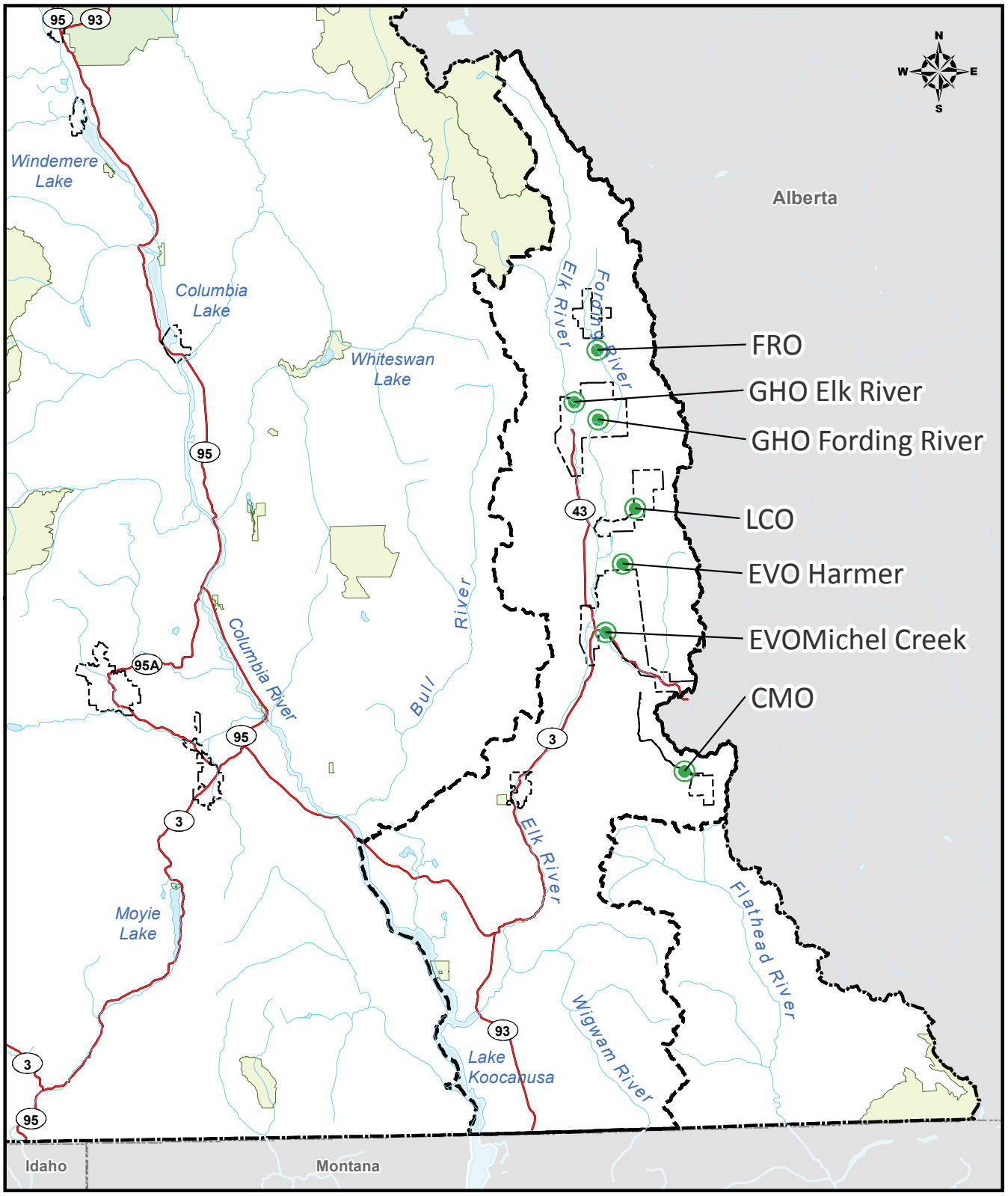


Figure 6: Teck Sampling Locations Overview Map—Order Stations



Legend

Compliance Points

Elk Valley Area Based Management Plan Boundary

Created by: GeoBC, AM
Created on: November18th, 2014
Filename: Q:\projects\clients_new\menv\executive\arcgis\ElkValley_ABMP_comp_points_OverviewMap.mxd

ELK VALLEY AREA BASED MANAGEMENT PLAN BOUNDARY
Compliance Points

0 10 20 30 40
Kilometres

BRITISH COLUMBIA
Ministry of Environment

Figure 7: Teck Sampling Locations Map—Compliance Points

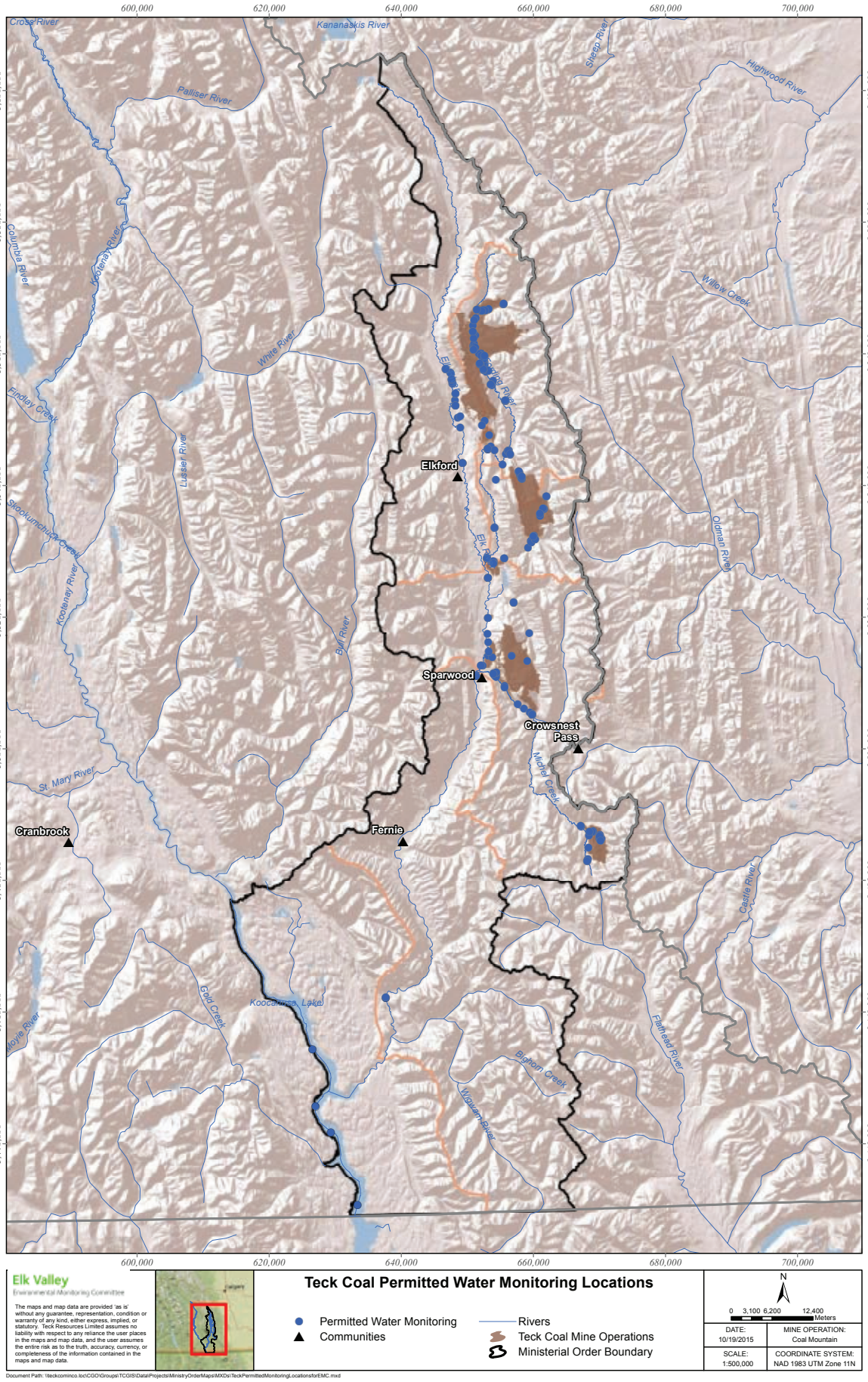


Figure 8: Teck Coal Permitted Water Monitoring Locations

2.2. Toxicity Testing

Background

In addition to surface water quality monitoring, Teck is testing the toxicity of constituents in mine affected waters to fish and other aquatic organisms. These tests determine the likely responses of aquatic organisms to current and future conditions. Toxicity tests include short term 'acute' tests to determine whether constituents affect organisms quickly, and longer term 'chronic' tests to determine whether constituents affect longer-term growth and reproduction of organisms.

Teck started short-term acute toxicity testing in late 2014 at mine site water discharge locations (e.g., outlets of creeks/settling ponds that drain the mine site). This monitoring is being conducted in alignment with other required discharge water quality sampling.

Status

The first year of the acute toxicity testing program will be completed in late 2015, with the results collected in an annual report due in March 2016 and presented to the EMC for review.

Teck started the longer-term chronic toxicity testing in 2015. Under the permit, Teck is required to develop and implement a chronic toxicity testing program for receiving environments affected by coal mining operations. The purpose of the program is to evaluate chronic toxicity at Compliance Points and other locations throughout the Elk Valley (typically in major creeks and rivers downstream of mining operations). The EMC will be reviewing results of the chronic toxicity testing program and providing advice on submissions.

The suite of toxicity tests will be reviewed on an annual basis by the EMC and recommendations provided to Teck, KNC and the Director for consideration.

Teck must also develop—with input from the EMC—and implement a toxicity testing program specifically to assess sulphate toxicity at high hardness concentrations. Results will be used to support the finalization of long-term sulphate Site Performance Objectives.

In addition, to meet condition 9.8.2 of the permit, Teck submitted a study design on April 30, 2015—that considered input from the EMC—for a Sublethal Toxicity Study to confirm that surface waters meeting the Site Performance Objectives for the Order Stations are not toxic to sensitive aquatic receptors.

EMC Activities

The EMC reviewed the Sublethal Toxicity Study Design and submitted 38 pieces of advice to Teck, the Director, and KNC on this submission. The EMC advice and Teck's response to this advice can be read in Appendix A at page 115.

2.3. Tributary Evaluation

Background

As part of the permit, Teck must develop and implement a Tributary Evaluation Program (TEP) and Tributary Management Plan (TMP). The program and plan must include all tributaries directly connected to the Fording, Elk or Michel rivers affected or potentially influenced by Teck's current operations and future development plans as defined in the ABMP.

The objective of the TEP is to evaluate the ecological value of tributaries to the Elk and Fording rivers. Data collected during the TEP will be compiled into a written report and submitted to the EMC by March 31, 2016.

Status

In May 2015, Teck submitted a phased study design for the TEP to the MoE. The study design—which describes the six phases that will be involved in completing the TEP, including deliverables and a schedule for each phase—considered input from the EMC. The six phases are as follows:

1. Inventory of all tributaries to the Elk and Fording rivers that are located in Management Units 1, 2, 3 and 4 (as defined by the ABMP) that are affected or potentially influenced by Teck's current and future development plans;

2. Maps of Management Units 1, 2, 3 and 4 showing the locations of the tributaries of the Elk and Fording rivers, and identifying the tributaries that are affected or potentially influenced by Teck's current and future development plans;

3. Collation of existing and readily available data and information on each tributary, including surface water chemistry, surface water toxicity, sediment chemistry, sediment toxicity, calcification, flow, habitat value ranking, benthic invertebrate community structure, and habitat use by fish and/or sensitive aquatic dependent wildlife (i.e., water birds);

4. Evaluation of historical (i.e., conditions relevant to the 1980 timeframe, where available) and current habitat value, based on surface water quality, sediment quality, extent of calcification, flow, amount of habitat available, habitat types, physical features, connectivity to fish habitat, status of riparian habitat, and habitat use by fish and sensitive aquatic dependent wildlife species;

5. Evaluation of the potential for rehabilitation of aquatic and riparian habitat and potential for improvement of water quality conditions; and

6. Prioritization of each tributary for ongoing protection and/or restoration based on the evaluation of current ecological value, potential for rehabilitation, and potential to contribute to the objectives of the ABMP.

Figure 9: Routine water sampling locations.

Following the evaluation of the tributaries in the TEP, Teck will develop and implement a TMP intended to incorporate protection and rehabilitation goals for tributaries that align with the objectives of the ABMP. The TMP will identify the tributaries that should be targeted for protection from future mine-related degradation, as well as the identification of mine-influenced tributaries that should be targeted for restoration / rehabilitation.

The interim plan is due to the EMC by October 31, 2016 and shall be submitted to the MoE by December 31, 2016.

EMC Activities

The EMC reviewed the Tributary Evaluation Draft Data Matrix Template and the Tributary Evaluation Study Design and submitted 17 and 45 pieces of advice respectively to Teck, the Director, and KNC on the submissions. The EMC advice and Teck's response to this advice can be read in Appendix A at pages 6 and 10 respectively.

2.4. Aquatic Effects Monitoring

Regional Aquatic Effects Monitoring Program

Background

The Regional Aquatic Effects Monitoring Program (RAEMP) is the foundation for monitoring and evaluating changes in the aquatic environment and the potential effects of mining activity. The RAEMP builds on information collected in watershed-wide monitoring programs in 2006, 2009, 2012 and in numerous supporting studies. The RAEMP is intended to be a flexible, adaptive, long-term aquatic monitoring program that involves sampling of water, sediment, fish and other organisms in the receiving environment of the Elk River watershed and Lake Koocanusa.

The goal of the RAEMP is to answer the following questions:

- What are the mine-related chemical and physical changes to aquatic ecosystems and where do they occur?
- Are mine-related chemical and physical changes to the aquatic environment resulting in unacceptable biological effects and where do they occur?
- What are the specific mine-related sources of any unacceptable changes to chemical, physical, or biological conditions?
- How are chemical, physical and biological conditions changing over time?
- What are the consequences of observed biological effects to the aquatic ecosystem?
- Are the mine-related chemical and physical changes and/or biological effects impacting water and aquatic ecosystem uses?

Status

Teck developed a detailed study plan (study design) for the RAEMP in late 2014 and early 2015, that considered advice from the MoE and KNC prior to the formation of the EMC. Data collected through the RAEMP will support interpretation of biological data to evaluate changes and potential effect of mine activity on aquatic ecosystems.

Sampling under the RAEMP study design began in May 2015 and incorporates the following:

- Sampling water for chemical analysis
- Sediment sampling for chemical analysis
- Assessment of periphyton productivity
- Benthic invertebrate community assessment
- Evaluation of longnose sucker populations and linkages to westslope cutthroat trout population work in the upper Fording River
- Evaluation of tissue selenium concentrations for representative species and locations.

A number of supporting studies are being conducted in 2015 to further evaluate additional monitoring endpoints or techniques to determine whether these assist in meeting the objectives of the RAEMP and evaluating mine influenced changes in the aquatic environment.

An interpretive report will be prepared to summarize results of the RAEMP every three years and submitted to the MoE and KNC. The EMC will review and provide input into this report.

EMC Activities

The EMC reviewed the RAEMP Calcite Biological Effects Study design and the RAEMP Sediment Toxicity Study design and submitted 45 pieces and 14 pieces of advice respectively to Teck, the Director, and KNC on the submissions. The EMC advice and Teck's response to this advice can be read in Appendix A at pages 47 and 65 respectively.

The EMC also reviewed the RAEMP Periphyton Community Structure Study Design and submitted 50 pieces of advice to Teck, the Director, and KNC on this submission. The EMC advice can be read in Appendix A at page 57. Teck's responses to this advice is still in progress.

Local Aquatic Effects Monitoring Program (Line Creek Operations)

Background

The development of a local aquatic effects monitoring program (LAEMP) for Line Creek at Teck's Line Creek Operations (LCO) was requested by the MoE through the permit. The LAEMP is intended to complement the RAEMP, but focus monitoring efforts on evaluating potential effects

of the West Line Creek Selenium Active Water Treatment Facility (AWTF) effluent on biological productivity and tissue selenium accumulation downstream of the discharge point.

The Line Creek LAEMP was first implemented in 2014 and examines nutrient and selenium concerns in Line Creek by monitoring four main components:

- Periphyton (algae on rocks) productivity
- Bryophyte (moss) productivity
- Benthic invertebrate biomass and tissue selenium concentrations
- Water concentrations of nutrients[4] and selenium species

In the first year of the program, plant and algae productivity, selenium concentration in insect tissues, and important chemical constituents were observed to generally follow the pattern of higher levels closest to the mine discharges with decreasing levels as you move downstream away from the discharges.

Status

The AWTF began discharging under the permit on July 24, 2014 with biological sampling between September 2 and 8. Teck shut down the AWTF on October 17, 2014 in response to observations of fish mortality downstream of the treatment facility.

Work to restart the water treatment facility is ongoing, and commissioning is now anticipated to begin in the fall of 2015, with full operation to be achieved in 2016. The additional time will enable Teck to address all comments on the restart plan to improve operation of the plant, including improvements intended to prevent a reoccurrence of the fish mortality incident.

In 2015, monitoring continued to focus on the area in Line Creek downstream of both the AWTF discharge and South Line Creek. Samples are collected annually in late summer (e.g., early September) to correspond with maximum growth and to facilitate evaluation of productivity. Note that in 2015 this sampling occurred during a period when the AWTF remained shut down.

EMC Activities

The EMC reviewed the LCO LAEMP Study Design and the LCO LAEMP 2014 Report and submitted 34 pieces and 31 pieces of advice respectively to Teck, the Director, and KNC on the submissions. The EMC advice can be read in Appendix A at pages 38 and 96 respectively. Teck's responses to this advice is still in progress.

2.5. Lake Koocanusa Monitoring

Background

Mine-related water discharges report directly or indirectly via tributaries, to the Elk River, which flows into Lake Koocanusa, a reservoir created by the completion of the Libby Dam in 1972, which is managed by the U.S. Army Corps of Engineers. Based on concerns about rising selenium and other constituents of interest within the Elk River basin, Teck initiated monitoring of chemical and biological conditions in Lake Koocanusa. Prior to 2014, Teck's sampling activities within Lake Koocanusa were limited to surface water and sediment.

A Lake Koocanusa Monitoring and Research Working Group is being established by the BC and Montana governments to oversee this work. As required by the permit, Teck will participate in this Working Group.

Status

A sampling program was initiated in 2014 to complete an initial characterization of chemical and biological conditions in Lake Koocanusa. This program represents the first of three consecutive years of planned sampling. One of the objectives for the sampling program is to monitor the chemistry of water, sediments, fish tissues and tissues of other aquatic organisms to assess potential mine-related influences.

A Lake Koocanusa Burbot Baseline Study was also conducted, in which burbot were sampled to evaluate the potential for selenium-related effects and a report summarizing the winter and spring burbot monitoring completed in 2014 and 2015 was submitted to the MoE in July 2015. Selenium concentrations in muscles of burbot from Lake Koocanusa were higher than in fish from Moyie Lake, but were generally below the MoE guideline except for one muscle sample from a burbot collected at the mouth of the Elk River.

EMC Activities

The EMC reviewed the Lake Koocanusa Burbot Study Results and the Lake Koocanusa 2014 Monitoring Report and submitted 19 pieces and 23 pieces of advice respectively to Teck, the Director, and KNC on the submissions. The EMC advice can be read in Appendix A at pages 133 and 104 respectively. Teck's responses to the advice is still in progress.

2.6. Elk Valley Groundwater Monitoring

Background

The Regional Groundwater Monitoring Program (RGMP) is another element of the ABMP and a requirement of the permit for which the EMC has and will continue to provide advice.

Status

The RGMP is intended to align with the site-specific groundwater monitoring programs at each of the five Elk Valley mine sites and the ongoing Regional Drinking Water Sampling Program to monitor for potential regional effects of mining activity on groundwater.

[4]Nutrients in this context mean phosphorus, nitrogen and carbon in various forms, which are available to algae for growth.

EMC Activities

The EMC reviewed the Regional Groundwater Synthesis Report and submitted 36 pieces of advice to Teck, the Director and KNC on the submission. The EMC advice can be read in Appendix A at page 27. Teck's responses to 36 of the 50 pieces of advice can be viewed here as well. Teck continues to work on the remaining 14 pieces of advice.

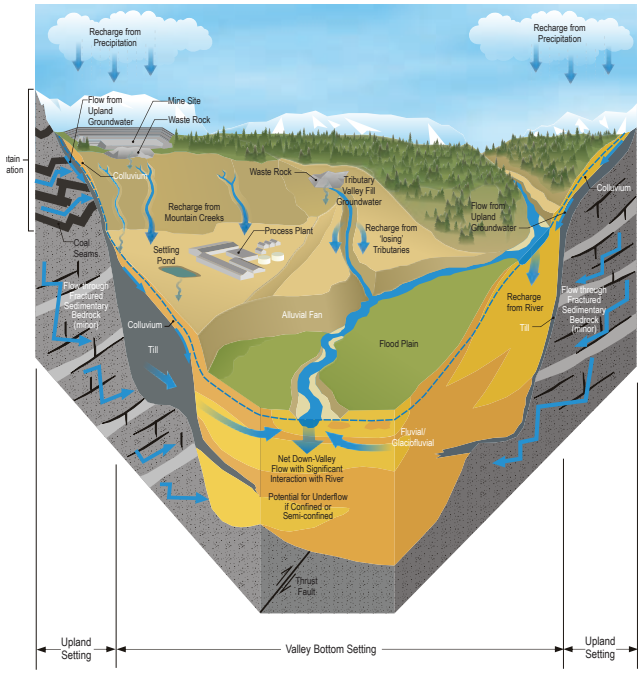


Figure 9: Illustration of conceptual hydrogeology in the Elk Valley

2.7.Human Health Risk Assessment

Background

Under the permit, Teck is required to conduct a Human Health Risk Assessment (HHRA) in consultation with the EMC to examine the potential risks[5] resulting from contact with mine-related constituents, specifically selenium, mercury, cadmium, chromium, copper, manganese, nickel, vanadium and zinc. The purpose of the HHRA is to identify any needed adaptive management actions to address any identified human health risks and comply with the permit.

Status

On May 30, 2015, the HHRA Terms of Reference and work plan were reviewed by the EMC and submitted to the MoE for approval. Data needed to complete the HHRA, such as constituent concentrations in surface water and fish tissue, are being collected throughout the study area as part of Teck's on-going environmental monitoring programs.

As required under the permit, the HHRA will be provided to the MoE by March 31, 2016 and will address the following:

- How people may contact selenium and other mine-related constituents that may be present in plants, fish, and game used for food or medicine, and present in currently known potable water sources.
- First Nations risks, based on information from a variety of sources, such as traditional use studies, consultation records, and country foods[6] consumption surveys.
- Potential health risks for Elk Valley communities resulting from contact with mine-related constituents.
- Identification of additional sampling programs to address data needs.

The HHRA results will be ranked by risk level within each management unit, and then prioritized for development of risk management and mitigation actions. The risk management actions will be included in the adaptive management plan.

More information on the HHRA results will be summarized as available in future editions of this EMC public report.

EMC Activities

As referenced above, the EMC reviewed the HHRA Terms of Reference and Work Plan and submitted 50 pieces of advice respectively to Teck, the Director, and KNC on the submissions. The EMC advice and Teck's response to this advice can be read in Appendix A at page 87.

2.8. Calcite Monitoring

Background

The precipitation of calcium carbonate, or calcite, can occur naturally in streams, but can be intensified as a result of mining activities. Calcite can become a water quality concern when the degree and amount of calcite formation results in the cementing of the stream bed to the point that it impacts aquatic habitats.

Calcite formation has been observed in the Elk Valley watershed downstream of mining activities, and, to a lesser extent, naturally in streams unaffected by mining. In limited reaches of certain streams, calcite precipitation completely covers portions of the stream bed, making the gravels largely immovable and potentially affecting the ability of invertebrates to live in the gravels, and of fish to spawn and incubate eggs in the gravels.

Four streams—Greenhills Creek, Corbin Creek, Dry Creek (at Elkview Operations) and Erickson Creek have been identified as the potential priority streams for calcite management because calcite formation is high in these tributaries and because they provide habitat to fish.

Status

Monitoring results of the 2014 Calcite Monitoring Plan were presented to the EMC. A summary of these results are as follows:

- Calcite surveys were conducted from September 19-25, 2014; a total of 368 kilometres were assessed and mapped.

[5]Risk here is defined as the probability or likelihood of a person being harmed through exposure to the listed chemicals either through inhalation, absorption through skin, or consumption through food or water.

[6]A Country Food Assessment involves a chemical analysis of the typical natural food items of a First Nations community member's diet.

- Calcite formation is being monitored in 2015. After the 2015 survey is examined, a new long-term monitoring program will be developed.
- Relationships between calcite formation and water chemistry will be examined in 2016 in order to develop an understanding of the factors that contribute to calcite formation in the valley.

EMC Activities

The EMC has reviewed the Seasonal Calcite Study Design and the 2014 Calcite Monitoring and Statistical Power Report and submitted 71 and 22 pieces of advice respectively to Teck, the Director, and KNC on the submissions. The EMC advice and Teck's response to this advice can be read in Appendix A at pages 70 and 101 respectively.

Figure 10: Calcite monitoring photos taken from Teck's 2014 Calcite Monitoring Annual Report

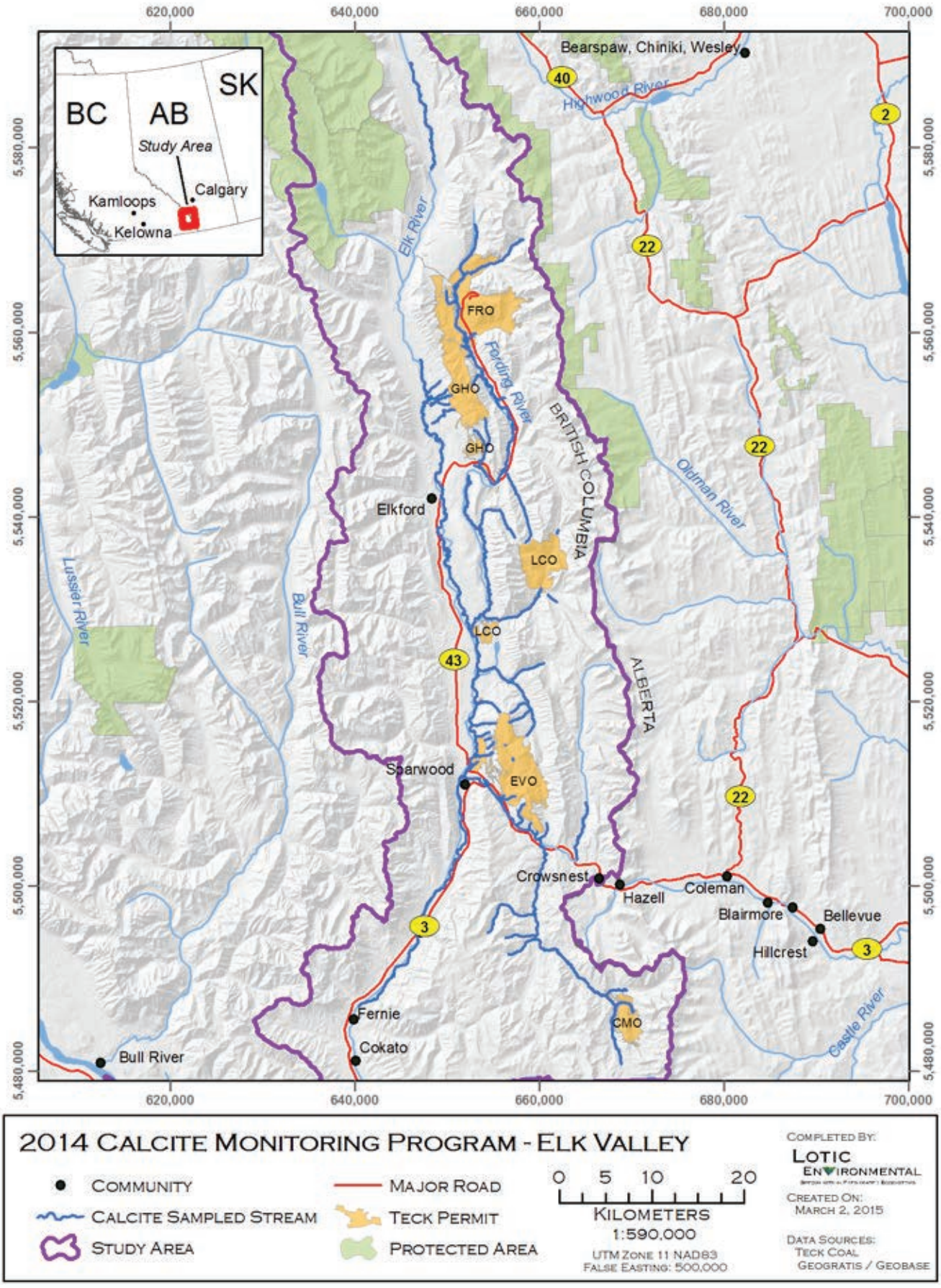


Figure 11: Map of the Elk Valley with waterways where calcite monitoring is located indicated

2.9 Adaptive Management Plan

Background

Adaptive management is a a systematic process for learning from management actions to confirm that a plan's objectives are being met and to adjust and improve management actions during implementation. This process has been applied to a wide range of resource and ecosystem management projects throughout North America and Teck is applying it to the ABMP for the Elk Valley. The adaptive management cycle consists of six steps as per Figure 13.

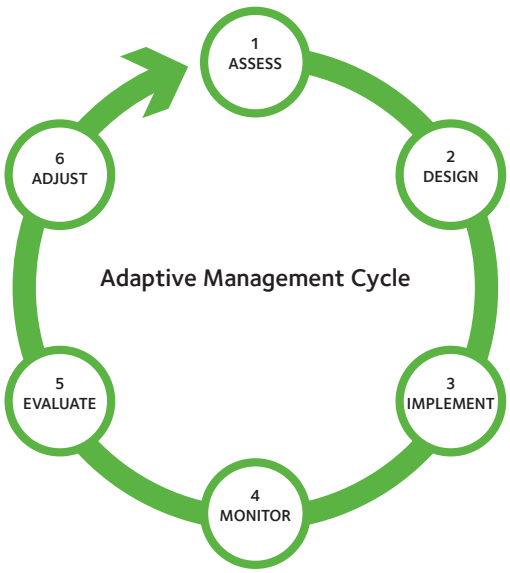


Figure 12: Adaptive management cycle

Status

The goal of Teck's Adaptive Management Plan (AMP) is to support the implementation of the ABMP, 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.

The application of adaptive management principles will require Teck to:

- Identify uncertainties and hypotheses
- Develop and periodically improve experimental designs to test hypotheses, and develop decision rules for actions based on outcomes
- Develop early-warning triggers for management actions or more intensive monitoring
- Conduct monitoring and evaluation activities to test hypotheses, assess early warning triggers, and evaluate compliance with permit conditions
- Periodically validate and if necessary refine targets, limits and site performance objectives
- Periodically improve hydrology, water quality and bioaccumulation models used to predict the consequences of management actions
- Provide a systematic approach for reliable data management, timely data analysis and reporting on what has been learned
- Make adjustments to the actions, plans, programs, policies and decisions, along with adjustments to the Plan itself, based on what is learned.

On February 15, 2015, Teck submitted Terms of Reference for its AMP to the EMC and on July 7, 2015, submitted an Adaptive Management Uncertainty Hierarchy. The timeframe for the AMP will cover the period of implementation of the ABMP for the Elk Valley, which currently extends to 2034. Development of the AMP will be completed by February 29, 2016 and the Plan will be reviewed and updated on a three-year cycle.

EMC Activities

The EMC reviewed the Adaptive Management Terms of Reference and Adaptive Management Uncertainty Hierarchy and submitted 4 and 43 pieces of advice respectively to Teck, the Director and KNC on the submissions. The EMC advice with regards to the Terms of Reference and Teck's response can be read in Appendix A at page 114. Teck's responses to the EMC advice on the Adaptive Management Uncertainty Hierarchy (See page 108 Appendix A) is still in progress.

NB: The following are additional reports for which the EMC has either reviewed and provided input or will review in subsequent years.

2.10 Third Party Audit

Background

Monitoring data for the permit and its analysis is subject to review and audit by a third-party qualified professional on a two-year cycle, with the first cycle to be completed by October 31, 2016. The audit may include a review of monitoring data and data analysis for all reports submitted under this permit for the previous two years (since the issuance of this permit for the first cycle) and must consider at least one of the following topic areas:

- Data quality and completeness
- Compliance with permit requirements
- Protocols and procedures from the QA/QC plan for the monitoring program
- Current water quality guidance documents established by the MoE; or
- Standard operating procedures and data handling protocols in place for Teck

The Third Party Audit Report must be submitted to the EMC for advice and to the Director, by October 31 of each audit year. The first Third Party Audit Annual Report will be submitted to the Director by October 31, 2017.

2.11 Re-evaluation of Harmer Compliance Point Limits

Background

Section 2.7.1 of the permit states that Teck must develop and establish selenium limits and timeframes for the EVO Harmer Compliance Point and submit a report detailing the results to the satisfaction of the Director.

Status

The Evaluation Report was submitted by Teck on June 30, 2015 and included input from the EMC.

EMC Activities

During its review of the EVO Harmer Compliance Point Selenium Evaluation, the EMC submitted 14 pieces of input respectively to Teck, the Director and KNC on the submissions. The EMC input and Teck's responses can be read in Appendix A on page 1.

2.12 Water Quality Modelling

Background

Section 10.8 of the permit requires that Teck update the water quality model and complete a water quality prediction report for each mine site and the Designated Area by October 31, 2017. This report must be updated every three years or more frequently as required, based on changes to the mine plan, when observed water quality and water quantity are regularly and significantly different from predicted values, or as otherwise required by the Director in writing.

3. Conclusion

The EMC will hold its next public meeting in Fall 2016. If you have comments or feedback on this report or general questions about the EMC, please email emcpermit107517@gmail.com

Elk Valley Environmental Monitoring Committee 2015 Public Report

Appendix A:
EMC Advice Table

Elk Valley
Environmental Monitoring Committee

Appendix A: EMC Advice and Input Table

NB: The Teck Response column reflects only Teck's responses to EMC input and advice; not the responses of the KNC or Director.

#	Submission	Input and Advice	EMC Member	Teck Response
1	Harmer Compliance Point Se Evaluation Report	Option #1 - Remove access to the Harmer Sediment Pond may not be acceptable to the KNC.	Ktunaxa Nation Council	Acknowledged.
2	Harmer Compliance Point Se Evaluation Report	Clarification is required on how restrictive the fish barriers are to fish movement (upstream and downstream). Does the bedrock cascade act as a completely impassable fish barrier, or does this vary seasonally? This will affect the applicability of using the benchmark for reproductive effects to WCT, rather than Brown Trout in the integrated assessment.	Ministry of Environment	The bedrock cascade near the mouth of Grave Creek is 5.8 m high and acts as a completely impassible barrier to upstream fish movement year-round. Section 2.2 has been updated to provide this clarification.
3	Harmer Compliance Point Se Evaluation Report	Lotic (2014) indicated that while the channel from Grave Lake is poor quality for fish movement there isn't actually an impassable fish barrier present. A cursory look at Habitat Wizard indicates multiple captures of several species including Kokanee and Bull Trout in Grave Creek in the 1990's. Again, the presence of multiple fish species in Grave Creek will affect the applicability of the benchmark for reproductive effects to WCT, rather than Brown Trout in the integrated assessment.	Ministry of Environment	Individual fish from Grave Lake have been recorded to occasionally stray into Grave Creek. However, Grave Creek does not appear to be a normal part of the range of the fish populations that inhabit Grave Lake. No spawning or juvenile rearing, and few individual adults of species other than WCT have been recorded in Grave Creek. The only species with a resident population in Grave Creek is WCT. Section 2.2 has been updated to provide this clarification.
4	Harmer Compliance Point Se Evaluation Report	My current understanding is that the Se targets and SPOs identified in the EVWQP for MU4 will apply to the lower reach of Grave Creek below the first fish barrier (bedrock cascade) because multiple fish species are present, not just WCT. Clarification is required as to whether or not the integrated assessment included Harmer Pond as fish accessible lentic habitat (i.e., used the lentic bioaccumulation model for this habitat sub-unit) and assumed that WCT are the only fish species present in Grave and Harmer Creeks (i.e., used only benchmarks derived from reproductive effects to WCT, or were targets derived using benchmarks for Brown Trout) when targets and SPOs were derived for the EVWQP. That is, are the assumptions around habitat type and fish species present that are being used in this evaluation consistent with what was originally used to derive the targets for the EVWQP?	Ministry of Environment	The assumptions around habitat type and fish species present that are being used in this evaluation represent an update of what was originally used to derive the targets for the EVWQP. The fish barriers near the mouth of Grave and Harmer creeks were not identified at the time the EVWQP was prepared. Therefore, the integrated assessment for MU4 included all fish-accessible reaches of Grave, Harmer, and Dry creeks, including Harmer Sediment Pond, and used benchmarks for brown trout, considering that fish species other than WCT may use these creeks. Similarly, the presence of lentic habitat in Harmer Sediment Pond was not identified at the time the EVWQP was prepared. All reaches of Grave, Harmer, and Dry creeks were modelled for the assessment using the EVWQP bioaccumulation model (not the lentic model from the AEMP), including the Harmer Sediment Pond. The updated fish access information indicates that fish in the Elk River have less access to mine-affected portions of Grave, Harmer, and Dry creeks, and

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#	Submission	Input and Advice	EMC Member	Teck Response
				therefore the targets derived for MU4 represent a higher level of protection than was assumed in the EVWQP. Section 2.2 has been updated to provide this clarification.
5	Harmer Compliance Point Se Evaluation Report	The accuracy of the assumption that fish use is proportional to fish accessible habitat is still unknown. Further studies will likely be required. This assumption may overestimate fish use in Harmer Pond, as multiple sampling events resulted in a single fish being captured. Further assessment of fish use and the importance of Harmer Pond as overwintering habitat for WCT will likely be required as part of the Fisheries Act authorization.	Ministry of Environment	Acknowledged.
6	Harmer Compliance Point Se Evaluation Report	Habitat Management Option c highlights field studies that would support assumptions and minimize uncertainty associated with the selected management option. The potential studies identified in this section should be considered to support the selected management option.	Ministry of Environment	Acknowledged.
7	Harmer Compliance Point Se Evaluation Report	The proposed water quality mitigation option of collecting and conveying Dry Creek water to either Grave Creek or the Elk River doesn't result in a reduction of Se loadings to the system. An alternative option of collecting and conveying mine influenced water from Dry Creek to Erickson Creek, where it would report to the EVO AWTF was not considered in this assessment. This option would pose the same risks as conveyance in the other direction (e.g., reduction in flows to Harmer and Grave Creeks), but would result in reductions in Se loadings to the Elk River.	Ministry of Environment	Acknowledged. Note that selenium loads from Dry Creek represent a relatively small input to the Elk River. Regarding the comment of conveying mine influenced water from Dry Creek to Erickson Creek, while not explicitly outlined in the Evaluation Report, it was considered in the evaluation under Option 5 and noted in the presentation provided to the EMC (*Option 5: Conveyance of Dry Creek flows to the Elk River or another location*). As correctly outlined in the comment, this option does pose the same fish habitat loss risks in Harmer and Grave Creeks. Section 3.2 in the Evaluation Report has been updated to reflect this consideration.
8	Harmer Compliance Point Se Evaluation Report	Alternative waste spoil configuration (i.e., directing waste rock from Dry Creek to the Erickson Valley) was deemed unfavorable due to economics and greenhouse gas emissions associated with the increased waste haul distance. As above, this option would see mine influenced water reporting to the EVO AWTF.	Ministry of Environment	It is acknowledged that placing the waste rock from Dry Creek into the Erickson valley would allow mine influenced water to report to the EVO AWTF. Section 3.2 in the Evaluation Report has been updated to reflect this consideration. However as outlined in Section 3.3 of the Selenium Evaluation Report, the environmental assessment for the BRE Project completed an alternatives assessment, including assessing the

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#	Submission	Input and Advice	EMC Member	Teck Response
				alternative of placing the additional waste rock from the Dry Creek spoil to Erickson Valley; this alternative was evaluated and determined to be less preferred. The alternatives assessment reflects Teck's adherence to best management practices in project design and implementation for the management of selenium in the Elk Valley. The following are considerations Teck completes in identifying locations of waste rock spoils: • access and haul distances; • geotechnical stability and safety; • backfill opportunities of pit voids; • reclamation considerations; • visual considerations; and • effects to the natural environment from waste rock spoil placement (i.e. minimize disturbance; locations that can readily divert clean water around spoils).
				The alternative to waste rock placement in Dry Creek were evaluated and determined to be less preferred for the following reasons. Mine planning for the BRE Project has maximized the volume of back-fill available at EVO. Dry Creek is a disturbed watershed that already contains legacy waste rock and placement of waste rock elsewhere would not only result in additional ground disturbance and loss of habitat in another watershed, but result in other environmental concerns associated with longer hauls, such as increased air emissions and dust generation. The location of spoil material in the upper valley is a best management practice that limits contact with clean water. The economics of moving waste rock from Dry Creek Spoil to the Erickson Valley is unfavourable. The feasibility of treatment is discussed in Section 4.3 of the Selenium Evaluation Report. In brief, active water treatment would have significant technical challenges given the remote location and high cost, result in other environmental management concerns (e.g. phosphorus release), and would provide limited benefits at the watershed scale.
9	Harmer Compliance Point Se Evaluation Report	The selected habitat management option (i.e., removing fish access to lentic habitat in Harmer Pond) doesn't change predicted Se concentrations in Harmer or Grave Creeks, nor does it remove the exposure pathway to	Ministry of Environment	Section 3.3 has been updated to reflect this concern.

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#	Submission	Input and Advice	EMC Member	Teck Response
		potentially sensitive bird and amphibian species.		
10	Harmer Compliance Point Se Evaluation Report	The longer-term limits for selenium that were proposed by Golder (2015) are not consistent with the intent of the Ministerial Order to develop the ABMP. The ABMP calls for: 1. Immediate establishment of short-term concentration targets and time-frames to stabilize water quality concentrations of selenium; 2. Establishment of medium-term concentration targets and time-frames to demonstrate progressive improvement in water quality in a phased approach, from the short-term targets to the long-term targets; and,3. Development of long-term concentration targets for selenium that consider current concentrations, current and emerging economically-achievable treatment technologies, sustainable balancing of environmental, economic, and social benefits, and current and emerging science regarding the fate and effects of contaminants. The short-term target for selenium is consistent with current conditions at the Harmer Compliance Point (i.e., it is equal to the maximum concentration that was measured between 2012 and 2014). However, the medium-term and long-term limits do not demonstrate progressive improvement in water quality. On the contrary, the proposed limits demonstrate a progressive degradation of water quality at the Harmer Compliance Point over time. Hence, the proposed long-term limit for selenium is not consistent with the intent of the Ministerial Order.	Ktunaxa Nation Council	As required by the Ministerial Order, the EVWQP provides for progressive improvement in water quality at a watershed scale, not at an individual catchment scale. The proposed long-term limit is consistent with the intent of the Ministerial Order, in that it forms one component of an Area-Based Management Plan to meet environmental protection objectives at the scale of the management units of the Elk River watershed. Furthermore, as required by both the Ministerial Order and EMA Permit 107517, the proposed long-term limit considers current concentrations, current and emerging economically-achievable treatment technologies, sustainable balancing of environmental, economic, and social benefits, and current and emerging science regarding the fate and effects of contaminants. As described in Section 4 of the Selenium Evaluation Report, the selected management option balances currently available technologies with economic considerations and other social factors, while achieving environmental protection goals consistent with the EVWQP. Section 4.4 has been updated to reflect this concern.
11	Harmer Compliance Point Se Evaluation Report	The approach to managing discharges of selenium-rich wastewater to the environment is not consistent with generally-accepted principles for managing wastewater discharges, including: 1. Water quality in the receiving environment shall be maintained at a level that allows for current and future uses; and, 2. The amount of waste to be deposited to the receiving environment shall be minimized. Golder (2015) has not demonstrated that the proposed long-term limit for	Ktunaxa Nation Council	Please refer to response to KNC #3 in addressing the first part of this comment. As required by Section 2.7.1 of EMA Permit 107517, the focus of the Selenium Evaluation Report was on selenium. Consideration was given to stressors other than selenium in the selection of 10% reproductive effect as a protection goal. This approach is consistent with guidance from a US Geological Survey study of protective critical effect sizes for aquatic life (Mebane 2010). Mebane (2010) evaluated the ecological

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		selenium at the Harmer Compliance Point would be protective of current and future uses. Rather, Golder (2015) has assumed that selenium is the only stressor on WCT populations or other uses within the Harmer-Grave watersheds. Hence, Golder (2015) concluded that selenium concentrations that corresponded to a 10% reduction in WCT reproduction would be protective of the environment. This assumption is incorrect when the effects of other stressors on WCT and/or effects on other uses are considered.		significance of early life stage mortality rates in wild fish populations, and concluded that reductions of 10% or less for growth or mortality endpoints are supportable for use in defining an acceptable low-effects threshold for fish populations subject to multiple stressors, with larger magnitude reductions in survival or growth also sustainable in stable fish populations that are not significantly influenced by other stressors. However, the comment is correct that other potential stressors were not explicitly evaluated in the selenium evaluation. An evaluation of selenium and other potential stressors will be conducted as part of the environmental assessment for the BRE Project. Section 2.1 has been updated to reflect this concern. Mebane CA. 2010. Cadmium risks to freshwater life: Derivation and validation of low-effect criteria values using laboratory and field studies (version 1.2): U.S. Geological Survey Scientific Investigations Report 2006-5245, 130 p.
12	Harmer Compliance Point Se Evaluation Report	In addition to uncertainties associated with the protectiveness of the proposed long-term limit, KNC is concerned that the proposed mitigation does nothing to minimize the deposit of waste to the environment. The approach to managing discharges of selenium-rich wastewater to the environment is not consistent with the waste prevention/minimization hierarchy for guiding waste management practices (i.e., which represents best management practices), which includes: 1. Source Reduction - Waste should be prevented or reduced at the source whenever feasible; 2. Reuse/Recycle - Waste that cannot be prevented should be recycled in an environmentally-safe manner whenever feasible; 3. Treatment - Waste that cannot be prevented or recycled should be treated in an environmentally-safe manner whenever feasible; and, 4. Discharge - Discharge or deposit of waste into the environment should be employed only as a last resort and must meet effluent quality criteria. While options are available to reduce contamination at	Ktunaxa Nation Council	Section 3.3 has been updated to provide more details mine planning and the reasons why waste rock is placed in this catchment and the alternatives considered for the Dry Creek Spoil. As outlined in Section 3.3 of the Selenium Evaluation Report, the environmental assessment for the BRE Project will present an alternatives assessment, including assessing alternatives to additional placement of waste rock into the existing spoil within Dry Creek. The alternatives assessment reflects Teck's adherence to best management practices in project design and implementation for the management of selenium in the Elk Valley. Key criteria in identifying locations of waste rock spoils for the BRE project, which takes into consideration the waste prevention/minimization hierarchy mentioned in the comment, include: • access and haul distances; • geotechnical stability and safety; • backfill opportunities of pit voids; • reclamation considerations; • visual considerations; and • effects to the natural environment from waste rock spoil placement (i.e. minimize disturbance; locations that can readily divert clean water around spoils).

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#	Submission	Input and Advice	EMC Member	Teck Response
		the source (i.e., by employing alternative methods for waste rock disposal, use of clean-water diversions, etc.) and treating contaminated wastewater, Golder (2015) recommends an option that does nothing to reduce selenium loadings to the environment. This represents a serious concern relative to the approach to mitigation that will be applied within the Harmer/Grave watershed and elsewhere in the Elk Valley.		For the BRE Project, alternatives to waste rock placement in Dry Creek were evaluated and determined to be less preferred. Mine planning for the BRE Project has maximized the volume of back-fill available at EVO. Dry Creek is a disturbed watershed that already contains legacy waste rock and placement of waste rock elsewhere would not only result in additional ground disturbance and loss of habitat in another watershed, but result in other environmental concerns associated with longer hauls, such as increased air emissions and dust generation. The location of spoil material in the upper valley is a best management practice that limits contact with clean water. As the mine plan proposed for the BRE Project has already maximized the potential for in-pit backfill, and in consideration of the above reasons; the need for placing additional waste rock into the environment and into the Dry Creek spoil waste spoil is considered optimized and is the preferred means for undertaking the BRE Project.
13	Harmer Compliance Point Se Evaluation Report	The results of water quality modelling for Grave Creek indicate that concentrations of selenium at the mouth are expected to reach 65 µg/L. Higher concentrations may be observed in tributaries to Grave Creek or the upstream portion of the main stem. As such concentrations exceed the BC water quality guideline for selenium (i.e., 2 µg/L). This information suggests that limits in selenium concentrations are also required for Grave Creek.	Ktunaxa Nation Council	The feasibility of treatment is discussed in Section 4.3 of the Selenium Evaluation Report. In brief, active water treatment would have significant technical challenges given the remote location and high cost, result in other environmental management concerns (e.g. phosphorus release) and would provide limited benefits at the watershed scale.
14	Harmer Compliance Point Se Evaluation Report	The approach to developing Se compliance values needs to be re-evaluated to reflect the intent of EVWQP (i.e., stabilize, reduce, and further reduce loading of Se to watershed).	Ktunaxa Nation Council	
1	Tributary Evaluation Draft Data Matrix	Do you expect any additional data or site differences for a site that is impacted by current mining activities vs. the three site types used?	Ministry of Environment	No additional data or site differences are expected. The "test" sites in the draft matrix should have indicated that Kilmarnock Creek also has current mining activity. A column has been added to the matrix to indicate when mining activities have occurred, are occurring or will occur on each tributary (i.e., historical, current or future mining activities). Time frames for historical, current and future will also be developed for clarity.

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2	Tributary Evaluation Draft Data Matrix	How will the data be incorporated - what is the metric? As a pass/fail? Will chronic toxicity tests also be included, if information is available?	Ministry of Environment	Where available, acute toxicity test data will be presented as % survival and chronic test results will be presented as IC25 (for each test species).
3	Tributary Evaluation Draft Data Matrix	List of tributaries that data is collated for should include those within Teck's tenure that will remain un-impacted in the future. (in addition to those that will be potentially affected by future mining activities)	Ministry of Environment	We are pulling together information to determine if there are additional permanent streams within Teck's tenure that have not been included. In addition, Teck owns biodiversity conservation lands within the Elk Valley that will not be impacted by future mining activities. Where available, existing data will be collated for all permanent wetted tributaries within the biodiversity conservation lands. Conservation lands are intended for management under our biodiversity program. Reference streams within Management Units 1, 2, 3 and 4 that are not impacted by mining activities will also be included for comparison and it will be indicated if Teck has tenure on these tributaries.
4	Tributary Evaluation Draft Data Matrix	Do all of the tributaries only have one monitoring site? Will tributaries with more than one site have more than one entry?	Ministry of Environment	There are some tributaries that may have more than one monitoring site. There will only be one entry per tributary. The majority of existing data are available for the lower portions of each tributary, reflecting the effects of combined upstream sources. Data for upstream reaches are scarce and inconsistent in terms of sampling methods, timing, and reported endpoints. The summary table is intended to support comparisons among tributaries, therefore, using data from lower portions of tributaries is appropriate. The availability of existing information from other monitoring sites will be documented in either a supporting table or in a text description for the tributary that will accompany the matrix in the final report.
5	Tributary Evaluation Draft Data Matrix	How will the historical data be summarized? Will the more recent data be summarized as well?	Ministry of Environment	The matrix is intended to provide an overview of current conditions in each tributary. Through consultation with the EMC in Phases C and D, questions and uncertainties will likely need to be resolved in Phase E using historical and recent data, where available. The historical and recent data will be documented and summarized in Phase E of the TEP fulfilling the permit condition of evaluating historical and current data. Feedback loops to Phases C and D from Phase E will aid in resolving questions and uncertainties once the historical and

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				recent data that is needed is summarized. This iterative process will continue until questions and uncertainties are addressed. Where available, historical data will be used for tributaries to identify and prioritize options for tributary improvement. The form in which it will be summarized (table or text) will likely evolve from the discussion with the EMC during Phases C and D.
6	Tributary Evaluation Draft Data Matrix	Please include a column in the data matrix table that identifies which constituents (if any) exceeded guidelines for the tributary. An example of this column is found in Table D1-4 of Winward 2014.	Ministry of Environment	A ratio in parentheses will be added to the surface water chemistry columns below the median concentrations of selenium, nitrate, and sulphate that reflects the # of samples exceeding the corresponding benchmark of the total # of samples analyzed. WQI presented in the table is based on those three constituents. Exceedances of water quality guidelines for other constituents will be documented in a supporting table or described in a text description for the tributary that will accompany the matrix in the final report.
7	Tributary Evaluation Draft Data Matrix	Were the hazard quotients calculated using the TRVs outlined in Appendix C of Winward 2014?	Ministry of Environment	Yes, the hazard quotients were calculated using the TRVs outlined in Appendix C of Winward 2014.
8	Tributary Evaluation Draft Data Matrix	Why were % EPT and % Ephemeroptera chosen as the benthic invertebrate indices to be summarized in the tributary evaluation report? Are there others that could be valuable?	Ministry of Environment	As described in Windward et al. (2014; Synthesis Report), Minnow et al. (2014; 2012 Regional Monitoring Program), and Minnow 2015 (RAEMP design for 2015), analysis of regional monitoring data collected in 2012, supported by previous studies in the Elk Valley (e.g., Frenette 2008) and the scientific literature, indicate that %EPT and %E are the community endpoints most likely to reflect the effects of coal mining. Additional community endpoints are evaluated and reported as part of on-going cycles of regional monitoring (e.g., richness, % chironomidae, community structure as summarized by the multivariate ordination technique known as non-metric multidimensional scaling) and will be incorporated where applicable. These endpoints are also relevant for assessing overall ecosystem health and therefore provide useful information for the tributary evaluation program.
9	Tributary Evaluation Draft Data Matrix	Include some numerical fish endpoint in the matrix that allows fish use or reproduction to be compared across tributaries. Examples/ideas - redd counts, count/electrofishing seconds, presence/absence of adults and	Ministry of Environment	Quantitative data have not been consistently collected among streams that could be used for comparative purposes based on differences in the timing or methods of sampling, species collected, and/or the endpoints reported. The

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		juveniles.		availability of relevant information will be documented in a supporting table or described in a text description for the tributary that will accompany the matrix in the final report.
10	Tributary Evaluation Draft Data Matrix	A similar table should be collated for all of the tributaries that identifies the sources of the data summarized in Table 1	Ministry of Environment	Table 2 provides the information sources. As the matrix becomes more complex the sources will be divided accordingly and could be similar to Table 1 with information sources.
11	Tributary Evaluation Draft Data Matrix	Include similar marked up orthophotos in the final document.	Ministry of Environment	Similar marked up orthophotos will be included.
12	Tributary Evaluation Draft Data Matrix	Consider organizing columns under broader categories: (1) watershed descriptors; (2) stressors (i.e., current mine influences, future mine influences, water quality, sediment quality); (3) biological responses (i.e., periphyton, benthos, fish).	Independent Scientist	The columns will be organized into the suggested broader categories.
13	Tributary Evaluation Draft Data Matrix	This table lists water and sediment toxicity tests, but I didn't see them in Table 1. I assume they should be in table 1 as well. They would fit well with water quality measures/descriptors.	Independent Scientist	These columns will be added to Table 1.
14	Tributary Evaluation Draft Data Matrix	An inventory of all available tributary data should be compiled.	Ktunaxa Nation Council	To address this input, a draft information matrix including the metrics cited in the Permit was developed and submitted to the EMC on July 24, 2015 for input. The draft information matrix follows the phased approach in the study design of providing a summary of existing and readily available information on all tributaries during Phase B of the TEP (i.e., the current phase), followed by more detailed collation of existing information, including consideration of the measurement endpoints identified by the KNC in their June 29 letter, as required to support the objectives of the TEP, during phases C and D.
15	Tributary Evaluation Draft Data Matrix	Include median cadmium concentration under surface water chemistry.	Ktunaxa Nation Council	A column will be added to the table showing the median cadmium concentrations and the proportion of samples exceeding the benchmark will be added.
16	Tributary Evaluation Draft Data Matrix	Include sediment chemistry and sediment toxicity headers in Table 1 (leaving cells below blank).	Ktunaxa Nation Council	Where available, acute toxicity test data will be presented as % survival and chronic test results will be presented as IC25 (for each test species).
17	Tributary Evaluation Draft	Include acute water toxicity sampling frequencies.	Ktunaxa Nation Council	Test frequency will be shown in the table for now, but these will be replaced by the

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	Data Matrix			actual test results before the end of the year.
1	Tributary Evaluation Draft Study Design	The EMA Permit 107517 indicates that Teck must submit a Phased Study Design for the Tributary Evaluation Program to the EMC by May 1, 2015 and to the Director by May 31, 2015. The subject document (Tributary Evaluation and Management Plan Design; Weech and Orr 2015) does not fulfill this requirement. Therefore, the subject document must be revised to provide a Phased Study Design for the Tributary Evaluation Program.	Ktunaxa Nation Council	The draft phased study design does fulfill this requirement and was revised to reflect this input. Refer to the Phased Study Design submitted to the Director on May 29, 2015 and to Slide 4 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
2	Tributary Evaluation Draft Study Design	Environmental Management Act (EMA) Permit 107517 indicates that a phased study design for the Tributary Evaluation Program (TEP) must be submitted to the Director by May 30, 2015. In addition, The EMA permit indicates that the Terms of Reference for the Tributary Management Plan (TMP) be submitted to the Environmental Monitoring Committee (EMC) by March 31, 2016 (i.e., following the evaluation of the tributaries). Hence, the TMP needs to be informed by the results of the TEP. In contrast, Weech and Orr (2015) describe a Tributary Evaluation and Management Plan Design. As the tributary evaluation has not been completed, it is premature to develop the TMP. Hence, the sections of the document that relate to tributary management should be removed. Or, stated another way, the document needs to be revised to describe the TEP only.	Ktunaxa Nation Council	The draft phased study design was revised to describe the TEP only. Refer to the Phased Study Design submitted to the Director on May 29, 2015 and to Slide 3 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
3	Tributary Evaluation Draft Study Design	Section 1.3 describes the requirements for the TMP. This information is not directly relevant to the development of a TEP and should be removed from the document. This information could be included in an appendix if there is a need to refer to it.	Ktunaxa Nation Council	The requirements for the TMP were not removed from Section 1.3. The permit requirements related to the TMP were presented as context for the TEP. Refer to the Phased Study Design submitted to the Director on May 29, 2015 and to Slide 3 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
4	Tributary Evaluation Draft Study Design	Section 1.4.1 of the document indicates that the tributaries that are or will be affected by mine development are already being evaluated through the Regional Aquatic Effects Monitoring Program (RAEMP) and Environmental Assessment (EA)	Ktunaxa Nation Council	The initial summary (Phase B) will rely on existing information from EA, RAEMP and the synthesis report and subsequent phases (Phase E) of the TEP will address data gaps. Refer to Slide 7 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June

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		processes. It is not clear from the information provided that all of the tributaries that could be affected by reasonably foreseeable developments are being currently evaluated. It is also not clear to what extent ongoing evaluations would satisfy the information requirements for determining historical and current habitat values, for evaluating the potential for rehabilitation, or for prioritization of affected and potentially affected tributaries for protection and/or restoration. Therefore, the applicability of existing evaluation activities to the TEP may be, and likely is, overstated.		16, 2015.
5	Tributary Evaluation Draft Study Design	Section 1.4.1 of the document indicates that a "broader framework is required for collectively and integratively evaluating the combined influences of future mine developments within each watershed in terms of protecting key ecological values and identifying opportunities to improve conditions." This statement suggests that the tributary evaluation will be conducted on a watershed-level basis (e.g., Fording, Elk, Michel). In contrast, the requirements specified in EMA Permit 107517 indicate that the evaluation of habitat value must be conducted on a tributary-specific basis.	Ktunaxa Nation Council	Information will be summarized for each tributary. Refer to Slide 7 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
6	Tributary Evaluation Draft Study Design	Section 1.4.1 of the document indicates that the TEP will need to consider chemical alterations, habitat alterations, and offsetting plans being evaluated and managed in accordance with the Fisheries Act. In contrast, EMA Permit 107517 indicates that the evaluation of habitat value must consider surface-water quality, sediment quality, extent of calcification, flow, amount of available habitat, and habitat use by fish and sensitive aquatic-dependent wildlife species. Nowhere in the description of the requirements of the TEP is the need for consideration of offsetting plans (as evaluated and managed in accordance with the Fisheries Act) described. Therefore, reference to offsetting plans should be removed from the document.	Ktunaxa Nation Council	The reference to offsetting plans remained included since the TEP and TMP will need to consider them for fish habitat protection/rehabilitation. Refer to Slide 8 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
7	Tributary Evaluation Draft	Section 1.4.2 of the document indicates that the concept of ecological	Ktunaxa Nation Council	Ecological value will be defined during the TEP and the prioritization of resources will

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	Study Design	value of a tributary depends on which species is considered of greatest value. This approach to tributary evaluation is inconsistent with the Ktunaxa world view, where all components of aquatic and riparian ecosystems -water, soil/sediment, plants, and animals are equally valued and must be afforded the same level of protection. Therefore, Ktunaxa nation Council (KNC) cannot support the concept of identifying the species of greatest value and evaluating conditions within the tributaries relative to that species or group of species. Rather, conditions in tributaries should be evaluated relative to baseline conditions and conditions necessary to protect the most sensitive receptors.		be identified through the establishment of protection and rehabilitation goals. Refer to Slide 8 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
8	Tributary Evaluation Draft Study Design	Section 1.5 of the document describes the proposed approach for addressing the requirements identified in EMA Permit 107517 for developing the TEP and the TMP. As indicated previously, it is premature to develop the TMP. Therefore, the elements of the approach that relate to the TMP should be removed from the document.	Ktunaxa Nation Council	The draft phased study design was revised to describe the TEP only. Refer to the Phased Study Design submitted to the Director on May 29, 2015 and to Slide 3 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
9	Tributary Evaluation Draft Study Design	The phased approach for developing the TEP described in Section 1.5 of the document is not consistent with the requirements identified in EMA Permit 107517. More specifically, this section of the document describes eight steps that lead to updating or maintaining the existing Tributary Evaluation and Management Plan. While these steps could be implemented in phases as described, they would not fulfill the requirements of the EMA Permit. Rather, the phased approach should include the following steps: 1. Identify data requirements for evaluating habitat values in tributaries, including surface-water chemistry, surface-water toxicity, sediment chemistry, sediment toxicity, primary productivity, benthic invertebrate community structure, stream-bed substrate composition, magnitude and extent of calcite deposits, physical features (e.g., barriers, gradient, etc.), streamflow, habitat use by fish, habitat use by wildlife, etc.;	Ktunaxa Nation Council	The phased study design does fulfill the requirements of the EMA permit. Revised text incorporates more of the language used in the permit to clarify how and when the permit conditions will be addressed. Refer to the Phased Study Design submitted to the Director on May 29, 2015 and to Slide 4 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.

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		2. Develop the Phased Study Design for the TEP, that needs to include development of the inventory of tributaries and associated maps, preparation of the inventory of data and information on the tributaries, evaluation of historical and current habitat value, evaluation of potential for aquatic habitat restoration, and prioritization of each tributary for ongoing protection and/or restoration; 3. Submit the Phased Study Design for the TEP to the EMC for review. Incorporate comments into the Phased Study Design for the TEP; 4. Submit the Phased Study Design for the TEP to the Director for approval; 5. Implement the TEP as approved, with efforts initially focused on tributaries potentially affected by projects undergoing environmental assessment, including FRO-Swift, Baldy Ridge Extension, Coal Mountain II, and Cougar Pit Extension; 6. Prepare a preliminary report on the habitat value of the tributaries potentially affected by projects undergoing environmental assessment. Submit the report to EMC, KNC, Environmental Assessment Office (EAO), and the Director for review; 7. Identify data gaps relative to the evaluation of historical and current habitat value of tributaries to the Elk River, Fording River, and Michel Creek; 8. Develop a sampling and analysis plan (SAP; consisting of a field sampling plan, quality assurance project plan, and health and safety plan) to support the acquisition of the data and information needed to address data gaps, in consultation with the EMC; 9. Revise SAP to incorporate EMC suggestions; 10. Implement the revised SAP; 11. Prepare the report on the habitat value of tributaries, incorporating		

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		supplemental data and information acquired to fill data gaps, analyzing and interpreting TEP data, and prioritizing tributaries for protection and future rehabilitation. Submit report to EMC for review; and, 12. Finalize the report on the habitat value of tributaries, incorporating comments provided by the EMC.		
10	Tributary Evaluation Draft Study Design	The flowchart presented in Figure 1.2 describes the steps for developing and updating the Tributary Evaluation and Management Plan. Again, this process does not meet the requirements set forth in EMA Permit 107517 because it does not provide a basis for developing and implementing a TEP and for developing and implementing a TMP. Therefore, the flowchart needs to be revised to reflect the phased approach described above.	Ktunaxa Nation Council	The draft phased study design was revised to describe the TEP only. Refer to the Phased Study Design submitted to the Director on May 29, 2015 and to Slide 3 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
11	Tributary Evaluation Draft Study Design	Table 2.1 provides an inventory and characteristics of tributaries that are currently influenced by coal mining activities or expected to be in the future. While this preliminary inventory of influenced or potentially-influenced tributaries is helpful, it may not be complete. Based on a preliminary review of the inventory, it appears that at least some of the tributaries potentially affected by Teck operations are not included (e.g., Wilde Creek, Porter Creek, etc.). In addition, it would be helpful to identify the tributaries that could be influenced by other mining developments and/or other activities in the watershed. This additional step is recommended because changes in tributary productivity in the Elk River valley can occur in response to many stressors and the receptors that depend on the tributary productivity will be affected by overall productivity in the valley (not just the productivity in tributaries affected by Teck operations).	Ktunaxa Nation Council	The table provides a complete list of all tributaries that are currently affected by mining or will be potentially affected in the future based on current mine development plans and will be updated if there are future mine development changes. Refer to Slide 9 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
12	Tributary Evaluation Draft Study Design	Section 3.0 of the document indicates that information in the EA applications will provide the necessary and sufficient basis for identifying tributaries potentially affected by coal-mining. While this information source will certainly be relevant, it is unlikely to provide a comprehensive basis for	Ktunaxa Nation Council	Combined response for Items 12 and 13: The initial summary (Phase B) will rely on existing information from EA application and Mines Act amendment application (e.g., CPX), RAEMP and the synthesis report and subsequent phases (Phase E) of the TEP will address data gaps. Refer

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		identifying potentially affected tributaries. In addition, tributaries potentially affected by projects that do not qualify for inclusion in the formal EA process (e.g., CPX) and by projects that have not advanced to the EA process will also need to be included in the inventory.		to Slide 7 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
13	Tributary Evaluation Draft Study Design	Section 3.0 of the document indicates that the Aquatic Synthesis Report, EA applications, and RAEMP/LAEMPs represent the primary sources of information on the affected and potentially-affected tributaries. While this is true, it is not appropriate to simply refer to these documents, as has been done in other documentation (i.e., EA Applications have been referring to the EVWQP and Aquatic Synthesis Report, rather than presenting the required data and information). More information is required in this section to describe the types of data that will be compiled and the data sources that will be accessed to obtain the required information.	Ktunaxa Nation Council	See above (Item 12).
14	Tributary Evaluation Draft Study Design	Section 4.0 of the document describes the protection and rehabilitation goals for the watershed. Based on the information presented, it is apparent that westslope cutthroat trout may be selected, or has been selected, as the most valuable species. While this species is clearly an important resource, it is not the most important resource or even the most sensitive species relative to various stressors or portions of tributaries. Development of protection and rehabilitation goals requires an understanding of linkages between stressors and receptors in the tributary watersheds (i.e., through conceptual site modelling) and an understanding of the resource services that the tributaries deliver to the ecosystem as a whole. Together, this information provides a basis for establishing criteria for evaluating aquatic and riparian habitats. In turn, such criteria will support the evaluation of historical and current habitat values. While this section of the document recognizes the importance of developing linkages between stressors and receptors, it proposes to develop those linkages only for valued	Ktunaxa Nation Council	WCT were identified as an example of an important and sensitive resource, not necessarily the most important. The prioritization of resources will be identified through the establishment of protection and rehabilitation goals. Refer to Slide 8 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.

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		species/habitats. This is not appropriate and, hence, the approach needs to be reconsidered.		
15	Tributary Evaluation Draft Study Design	Section 5.0 of the document describes the proposed approach for tributary evaluation and management. Again, it is premature to develop a plan for tributary management at this stage of the process. Therefore, Section 5.2.2 and 5.3 need to be removed from the document.	Ktunaxa Nation Council	The draft phased study design was revised to describe the TEP only. Refer to Slide 3 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
16	Tributary Evaluation Draft Study Design	Section 5.0 of the document does not describe a phased approach to tributary evaluation and, hence needs to be revised. The phased approach to tributary evaluation described earlier in this review should be used to revise the approach to tributary evaluation.	Ktunaxa Nation Council	The draft phased study design is a phased approach and was revised to reflect this input. Refer to Slide 4 and 6 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
17	Tributary Evaluation Draft Study Design	In summary, the draft Tributary Evaluation and Management Plan Design does not provide an appropriate Phased Study Design for the TEP. Therefore, the study design, as presented, does not meet the requirements identified in EMA Permit 107517. Therefore, the document needs to be revised to meet the requirements identified in EMA Permit 107517. It is recommended that KNC review the revised study design when it is submitted to the Director to ensure that the deficiencies have been adequately addressed.	Ktunaxa Nation Council	The draft phased study design does fulfill this requirement and was revised to reflect this input. The revised study design was submitted to the Director and the EMC on May 29, 2015 and discussed further at the EMC Meeting on June 16, 2015. Refer to Slide 4 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
18	Tributary Evaluation Draft Study Design	Add a statement including the intent of the TEP as stated in Section 5 of PE-107517: "…to evaluate the ecological value of tributaries to the Elk and Fording Rivers to support identification of tributaries that play a significant role in supporting the health of the ecosystem as a whole." PE-107517 also states that the purpose of the evaluation is to provide context for develop management objectives	Ministry of Environment	This statement was added to the phased study design submitted to the Director on May 29, 2015.
19	Tributary Evaluation Draft Study Design	Edit the figure to reflect other advice in the current review.	Ministry of Environment	The figure was edited to reflect the revisions to describe the TEP only. Refer to the Phased Study Design submitted to the Director on May 29, 2015.
20	Tributary Evaluation Draft Study Design	The intent and purpose of the TEP (i.e. not the TMP) is to evaluate the ecological value of tributaries to the Elk and Fording Rivers and to provide the context to develop management	Ministry of Environment	The draft phased study design was revised to describe the TEP only. Refer to the Phased Study Design submitted to the Director on May 29, 2015 and to Slide 3 in PowerPoint presentation titled Tributary

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		objectives; EIS views this as the initial "Assess" step of adaptive management. The TMP is intended to incorporate protection and rehab goals after exploring alternative management actions (rehab/improvement). It is EIS' desire that the steps identified as Permit Conditions #1-#6 for TEP should be completed before exploring management objectives. EIS understands that 'ecological value', as mentioned in the intent of the TEP, refers to the ecological state/health of each ecosystem component identified in the six TEP tasks/conditions, e.g. Calcite Indices in each Trib, riparian habitat indices in each Trib, number & integrity of sensitive spp in each trib, fish habitat use metrics in each trib. Likely the proponent will need to develop a kind of matrix/table of ecosystem components and present informative metrics for each component, where data is available or as data is collected, in each Trib (conditions #3 and #4). And per condition #5, EIS expects they will present a measure of the potential for habitat rehab and/or water quality improvement - at the very least a yes/no opinion of that potential. Then per condition #6, present a table prioritizing the tributaries based on the 'state' metrics (#3 and #4) and the potential for rehab/improvement (#5).		Evaluation Program from EMC Meeting #4 on June 16, 2015.
21	Tributary Evaluation Draft Study Design	The implementation of the TEP might look something like this: Deliverable (target date) 1) Trib inventory, maps, data source inventory, data matrix template that will be used to document the known 'state' of each ecosystem component in each trib (July 31/15) 2) Data compilation into the 'state of trib' data matrix, gap identification, data collection to fill gaps (Dec 31/15) 3) Report written summarizing steps 1 & 2 and presenting the results of those steps (March 31/16) The March 31, 2016 deadline is set in PE-107517.	Ministry of Environment	A section for schedule and deliverables was added to the phased study design submitted to the Director on May 29, 2015. Refer to Slide 5 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
22	Tributary Evaluation Draft Study Design	Alternative actions will need to be explored after the assessment conducted in the TEP is done. EIS	Ministry of Environment	The draft phased study design was revised to describe the TEP only. Refer to the Phased Study Design submitted to the

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		see the goals mentioned in this section coming into the process after the 'state' of each trib is defined in the March 31, 2016 report. At that point, Teck will need to characterize each tributary in terms of its potential for protection and rehabilitation (considering environmental and other constraints). When these potentials for each tributary are defined, then Teck will need to define decision criteria for prioritization (and associated protection & rehabilitation goals) and propose those to EMC. Once EMC agrees on the goals and decision criteria (spring of 2016), then Teck will need to apply those criteria to the tributaries and write the TEP report required by PE-107517 at the August 31, 2016 deadline. Then, in the second step of adaptive management- "Design", Teck will need to explore the alternative protection and rehabilitation actions that emerge from the tributary prioritization completed through the TEP. Further from that, as per the Trib Management Plan that will be designed, test hypotheses can be created, actions implemented, results monitored and assessed for further iterations of protection/rehab implementation.		Director on May 29, 2015 and to Slide 3 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
23	Tributary Evaluation Draft Study Design	These are important and relevant points in the context of decision criteria and making management decisions. Suggest editing this (and the next section) to reflect that the 'ecological value' mentioned in the permit condition is understood to mean 'ecological state' or 'state of the tributary', such that the TEP is a program built to, first, communicate the current state of environment in each tributary and, second, support the prioritization of each tributary for ongoing protection and/or restoration. The first phases of the TEP should support prioritization by providing a common understanding of the environmental state of tribs and their potential for rehabilitation/improvement. The final phase of the TEP will require interaction with EMC so that prioritization is also based on agreed-upon valued components in the tribs, mainstems and whole valley.	Ministry of Environment	The draft phased study design was revised to reflect this input. Refer to the Phased Study Design submitted to the Director on May 29, 2015 and to Slide 5 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.

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24	Tributary Evaluation Draft Study Design	The inventory and maps should also include all tributaries that are potentially influenced by mining. I take this to mean tributaries that could potentially be impacted by Teck mining in the near- mid- or far future; they may be tribs not currently flowing through planned mine boundaries but flow through areas where Teck's mine tenure exists. Not sure if I'm using the correct 'mine' language here and I'm happy to try to clarify on request. The associated intent is to identify unimpacted streams that might be good candidates for permanent protection.	Ministry of Environment	The table provides a complete list of all tributaries that are currently affected by mining or will be potentially affected in the future based on current mine development plans and will be updated if there are future mine development changes. Refer to Slide 9 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
25	Tributary Evaluation Draft Study Design	This step should include some assessment of potential for rehabilitation of habitat and improvement of water quality. For e.g., if water quality is currently heavily impacted in a tributary, and mine plans/mitigation indicate the impact will continue for 20 years and improve slowly thereafter, then we would probably tag that tributary with low potential for improvement of water quality. Scale/depth of assessment comes into question here (as in other steps) - I think that an initial assessment and statement of potential should be included in this step before Step C/D.	Ministry of Environment	Phase B involves collation of existing and readily available information related to surface water and sediment chemistry and toxicity, calcite levels, flow, benthic invertebrate community composition, documented use by fish and other vertebrate species (including species at risk or otherwise "special"), habitat information (e.g., stream size, physical features, and connectivity or barriers, sensitive habitats), historical (pre-mining) conditions, and future mine-related alterations. An assessment and statement of potential for rehabilitation of habitat and improvement of water quality will be completed in Phases C and D.
26	Tributary Evaluation Draft Study Design	We should move Step C to be a part of Step D, or in parallel with Step D. "In consultation with the EMC, identify protection and rehabilitation goals, and evaluate the results of Step B in the context of those goals to identify opportunities for protection, improvement or rehabilitation to be considered for the TMP."	Ministry of Environment	Phase C (Identification of protection and rehabilitation goals) was changed to be undertaken concurrent with Phase D (Evaluation) since they will inform each other. Refer to Slide 6 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
27	Tributary Evaluation Draft Study Design	KNC noted that the proposed approach varies from the two-step process outlined in the permit.	Ktunaxa Nation Council	The draft phased study design was revised to describe the TEP only. Refer to the phased study design submitted to the Director on May 29, 2015 and to Slide 3 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
28	Tributary Evaluation Draft Study Design	KNC wants information as outlined in Section 5 of the permit, page 20, 3rd bullet - surface water chemistry, surface water toxicity, sediment chemistry, sediment toxicity,	Ktunaxa Nation Council	Revised text incorporates more of the language used in the permit to clarify how and when the permit conditions will be addressed. Refer to Slide 4 in PowerPoint presentation titled Tributary Evaluation

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		calcification, flow, habitat value ranking, benthic invertebrate community structure, and habitat use by fish and/or sensitive aquatic dependent wildlife (i.e. water birds).		Program from EMC Meeting #4 on June 16, 2015.
29	Tributary Evaluation Draft Study Design	Understanding the current water quality and habitat conditions is critical to informing Ktunaxa leadership and supporting their decision making.	Ktunaxa Nation Council	The text clarifies the intention to do this in Phase B (Collation of existing data). Refer to Slide 5 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
30	Tributary Evaluation Draft Study Design	The Terms of Reference should provide detail on the steps that will be undertaken as part of the evaluation.	Ktunaxa Nation Council	The draft phased study design was revised to reflect this input. Refer to the phased study design submitted to the Director on May 29, 2015 and to Slide 4 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
31	Tributary Evaluation Draft Study Design	The KNC will not support a submission that includes both a tributary evaluation plan and a management plan.	Ktunaxa Nation Council	The draft phased study design was revised to describe the TEP only. Refer to the phased study design submitted to the Director on May 29, 2015 and to Slide 3 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
32	Tributary Evaluation Draft Study Design	MOE confirmed its interest in knowing the historic and current habitat in relevant tributaries as a first step toward planning management and restoration actions.	Ministry of Environment	The text clarifies the intention to do this in Phase B (Collation of existing data). Refer to Slide 5 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
33	Tributary Evaluation Draft Study Design	Define the key metrics for assessing status of tributaries and how they have changed over time. Identify the list of metrics, and why they are important. ID what info is available for each metric (i.e. what samples, when collected, etc.). Then determine if we have enough data to assess the status of the tributaries and have basis for taking the next steps.	Ktunaxa Nation Council	Combined response to Items 33 through 37: To address this input, a draft information matrix including the metrics cited in the Permit was developed and submitted to the EMC on July 24, 2015 for input. The draft information matrix follows the phased approach in the study design of providing a summary of existing and readily available information on all tributaries during Phase B of the TEP (i.e., the current phase), followed by more detailed collation of existing information, including consideration of the measurement endpoints identified by the KNC in their June 29 letter, as required to support the objectives of the TEP, during phases C and D.
34	Tributary Evaluation Draft Study Design	Fording River metrics may not be suitable.	Ktunaxa Nation Council	See above (Item 33)
35	Tributary Evaluation Draft	Share draft matrix for input from EMC for review to confirm the list of key info	Ktunaxa Nation Council	See above (Item 33)

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	Study Design	requirements. List in report is not comprehensive. What is being captured in each cell of the matrix? What are the data inputs that are important to assess the tributary?		
36	Tributary Evaluation Draft Study Design	Need to ID info needs before we start to collate info (measurement end-point such as surface water chemistry levels, what metrics).	Ktunaxa Nation Council	See above (Item 33)
37	Tributary Evaluation Draft Study Design	Need to understand measurement endpoints to understand status of tributaries. We need to understand the end-points right, before we compile info.	Ktunaxa Nation Council	See above (Item 33)
38	Tributary Evaluation Draft Study Design	Study process is not clearly stated in the report. Use protection goals emphasize WCT. Study should consider all living things.	Ktunaxa Nation Council	The study process is clearly stated in the phased study design, see Figure 1.2 and text in the phased study design. WCT were identified as an example of a sensitive and important resource; it was not intended to prescribe protection goals based on WCT. The prioritization of resources will be identified through the establishment of protection and rehabilitation goals. Refer to Slide 8 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
39	Tributary Evaluation Draft Study Design	Cover broad perspective about the value of tributaries.	Ktunaxa Nation Council	Ecological value will be defined during the TEP and the prioritization of resources will be identified through the establishment of protection and rehabilitation goals. Refer to Slide 8 in PowerPoint presentation titled Tributary Evaluation Program from EMC Meeting #4 on June 16, 2015.
40	Tributary Evaluation Draft Study Design	Group tributaries upstream and downstream of the Elk River separately.	Ktunaxa Nation Council	The TEP will group tributaries upstream and downstream of the Elk River separately. The tributaries will be grouped similar to the management units in the Permit as follows: the Upper Fording River Watershed (MU-1), the Lower Fording River Watershed (MU-2), the Elk River Watershed upstream of the Fording River (MU-3), the Elk River Watershed downstream of the Fording River and upstream of Michel Creek (MU-4), Michel Creek Watershed (MU-4), the Elk River Watershed downstream of Michel Creek (MU-5).
41	Tributary Evaluation Draft Study Design	Headwater lakes should be included as part of tributaries.	Ktunaxa Nation Council	During Phase B, existing and readily available information will be included where available for headwater lakes that are part of tributaries. Potential filling of data gaps or collection of new information will be evaluated in subsequent phases

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				(Phases C, D, E) of the TEP in consultation with the EMC.
42	Tributary Evaluation Draft Study Design	Technical Advice: Develop a problem formulation and project-specific CSM that provide the scientific basis for designing a TEP that effectively detects and quantifies mining-related effects within the tributaries. More specifically, the design of the TEP needs to be informed by a comprehensive problem formulation that includes: 1. Sources and releases of contaminants and other stressors; 2. Identification of COPCs; 3. Evaluation of the transport and fate of COPCs; 4. Evaluation of the ecological and health effects of the COPCs; 5. Identification of key exposure pathways; 6. Identification of ecological receptors and human populations potentially exposed to COPCs; 7. Development of a CSM; and, 8. Selection of Assessment Endpoints and Measurement Endpoints. Technical Advice: Use the problem formulation and CSM to guide the design of the TEP.	Ktunaxa Nation Council	Sources and releases of COPCs and responses of ecological receptors in tributaries were considered when developing the study design for the tributary evaluation program. Sources and releases of COPCs and responses of ecological receptors were included in CSMs developed as part of the Elk Valley Water Quality Plan, which can be referenced, as required, during development of the tributary evaluation program.
43	Tributary Evaluation Draft Study Design	Technical Advice: The following assessment endpoints should be included in this section of the aquatic effects monitoring program (AEMP) study design document: 1. Protection of Human Health; 2. Protection of Aquatic Life; 3. Protection of Wildlife; 4. Protection of Traditional and Cultural Uses; 5. Protection of Recreation and Aesthetics; and, 6. Maintenance of Biodiversity. Information on the extent to which each of these assessment endpoints are currently being protected or compromised in each tributary will be essential for developing a tributary management plan that focuses resources on the protection and/or restoration of tributaries throughout the Elk River watershed. Technical Advice: The following measurement endpoints should be included in the TEP because they provide essential information for	Ktunaxa Nation Council	We were unclear how advice pertaining to assessment endpoints that should be included in the aquatic effects monitoring program (AEMP) is relevant to the tributary evaluation program (TEP). As specified in Section 5 of Permit 107517, the TEP "is intended to evaluate the ecological value of tributaries to the Elk and Fording Rivers to support identification of tributaries that play a significant role in supporting the health of the ecosystem as a whole". Consistent with intent, the TEP is focused on protection of aquatic ecosystem health as an assessment endpoint. Human health, wildlife, traditional and cultural uses, recreation and aesthetics and maintenance are addressed by other activities within and outside of the scope of the EVWQP, but are not assessment endpoints for the TEP. There are other provisions in Permit 107517 that address human health (i.e., Section 9.9). Protection of wildlife, traditional and cultural uses, recreation and aesthetics, and maintenance of biodiversity are being

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#	Submission	Input and Advice	EMC Member	Teck Response
		evaluating the historical and current status of the tributaries: 1. Assessment Endpoint - Protection of Human Health Recommended Measurement Endpoints: i. Concentrations of conventional variables, major ions, nutrients, total metals, and dissolved metals in surface water and, ii. Concentrations of metals and other bioaccumulative substances in aquatic and riparian plants, freshwater mussels, fish, amphibians, and wildlife tissues. 2. Assessment Endpoint - Protection of Aquatic Life Recommended Measurement Endpoints: i. Concentrations of conventional variables, major ions, nutrients, total metals, and dissolved metals in surface water; ii. Survival, growth, and reproduction of aquatic plants in surface water toxicity tests with indicator species; iii. Survival, growth, and reproduction of aquatic invertebrates and fish in long-term surface water toxicity tests with indicator species; iv. Concentrations of conventional variables, total metals, simultaneously extracted metals (SEM), acid volatile sulfides (AVS), polycyclic aromatic hydrocarbons (PAHs), total organic carbon (TOC) in sediment and pore water; v. Concentrations of conventional variables, major ions,nutrients, total metals, and dissolved metals in pore water from site sediments; vi. Survival, growth, and reproduction of aquatic invertebrates in long-term sediment toxicity tests with indicator species; vii. Calcite levels; viii. Concentrations of metals and other bioaccumulative substances in aquatic plants, benthic invertebrates, freshwater mussels, fish, and amphibian tissues; ix. Diversity and abundance of the species that comprise aquatic plant, benthic invertebrate, freshwater mussel, fish, and amphibian communities, including species at risk; and,x. Habitat characteristics, as indicated by flow, stream order and length, gradient, total catchment		addressed through management plans or programs that fall outside the scope of Permit 107517 and the TEP. If there are management implications specific to tributaries that arise from these other management plans or programs, they can be considered during development of the TMP. Similarly, if issues related to wildlife, traditional and cultural uses, recreation and aesthetics, and maintenance of biodiversity are identified through input from the Environmental Monitoring Committee (EMC), then these can be noted and recommendations can provided to the management plans and programs that address these assessment endpoints. Focusing the TEP on the protection of aquatic ecosystem health is further supported by considering the intent of the TMP, which the TEP is intended to support. As specified in Section 5 of Permit 107517, the TMP "is intended to incorporate protection and rehabilitation goals for tributaries that will support achieving the area-based objectives of the Elk Valley Water Quality Plan". The following are the area-based objectives of the EVWQP: 1. protection of aquatic ecosystem health; 2. management of bioaccumulation of constituents in the receiving environment (including fish tissue); 3. protection of human health; and 4. protection of groundwater. As discussed above, protection of human health is addressed through requirements in Section 9.9 of Permit 107517, and protection of groundwater is considered as part of human health requirements and separately through requirements in Section 9.2. Consequently, the TMP will focus on protection of aquatic ecosystem health, which includes consideration of managing bioaccumulation of constituents in the receiving environment. The technical advice provided by the KNC includes a long list of analytes that should be included in the TEP. Teck agrees that these analytes can and should be considered in the TEP, to the extent that they can help evaluate the ecological value of tributaries or otherwise support the development of specific management objectives for tributaries. However, we do

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		area, stream size, physical features, connectivity or barriers, and sensitive habitats. 3. Measurement Endpoint - Protection of Wildlife: Recommended Measurement Endpoints: i. Concentrations of conventional variables, major ions, nutrients, total metals, and dissolved metals in surface water; ii. Concentrations of metals and other bioaccumulative substances in aquatic and riparian plants, benthic invertebrate, freshwater mussel, fish, and amphibian tissues; and, iii. Diversity and abundance of the species that comprise aquaticdependent bird and aquatic-dependent mammal communities. 4. Measurement Endpoint - Protection of Traditional and Cultural Uses Recommended Measurement Endpoints: i. Concentrations of conventional variables, major ions, nutrients, total metals, and dissolved metals in surface water; ii. Concentrations of metals and other bioaccumulative substances in aquatic and riparian plants, benthic invertebrates, freshwater mussels, fish, amphibians, and wildlife tissues; iii. Diversity and abundance of the species that comprise aquatic plant, riparian plant, benthic invertebrate, mussel, fish, amphibian, aquatic-dependent bird, and aquatic-dependent mammal communities; and, iv. Perceptions regarding environmental quality conditions and associated behavioural changes in resource use patterns (as evaluated using a traditional knowledge-based approach). 5. Measurement Endpoint - Protection of Recreation and Aesthetics: Recommended Measurement Endpoints: i. Concentrations of conventional variables, major ions, nutrients, total metals, and dissolved metals in surface water. 6. Measurement Endpoint - Maintenance of Biodiversity:		not agree with including all of these analytes in the collation of existing and readily available and data and information on each tributary, which was provided to the EMC on July 24th as a draft template for a matrix of existing and readily available information. The purpose of the matrix is to support the development of protection and rehabilitation goals, and the identification and prioritization of opportunities for protection, improvement and rehabilitation. The information provided in the draft matrix provides the important information for each tributary at an summary level; including the level of detail outlined in the advice would not assist with the intended purpose of the matrix and would make it more difficult to distinguish differences between tributaries. Further response is provided below for the water, tissue and sediment measurement endpoints/analytes that were requested: Analytes requested in water and tissue: i. Concentrations of conventional variables, major ions, nutrients, total metals, and dissolved metals in surface water; ii. Concentrations of metals and other bioaccumulative substances in aquatic and riparian plants, benthic invertebrates, freshwater mussels, fish, amphibians, and wildlife tissues; Response: The tributary data shows a clear correlation between water quality and key metrics of the benthic invertebrate community structure, which is reflected by the metrics included in the summary table (i.e., water quality index, median water selenium, nitrate and sulphate concentrations, and %EPT and % Ephemerotera for benthic invertebrates. Providing a broader range of water analytes or tissue analytes would make the matrix unwieldy and will not provide information necessary to differentiate between tributaries. In fact, including all analytes in a matrix would make it more difficult to differentiate between tributaries and would detract from its usefulness. Analytes requested for sediment iv. Concentrations of conventional variables, total metals, simultaneously extracted metals (SEM), acid volatile sulfides (AVS), polycyclic aromatic hydrocarbons (PAHs), total organic

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		Recommended Measurement Endpoints: i. Diversity and abundance of the species that comprise the aquatic plant community; ii. Diversity and abundance of the species that comprise the riparian plant community; iii. Diversity and abundance of the species that comprise the benthic invertebrate community; iv. Diversity and abundance of the species that comprise the fish community; v. Diversity and abundance of the species that comprise the amphibian community; vi. Diversity and abundance of the species that comprise the aquatic-dependent bird community; and, vii. Diversity and abundance of the species that comprise the aquatic-dependent mammal community. Technical Advice: For each tributary stream, develop a matrix that identifies the information that is available to describe historical conditions and current conditions. The matrix should include all of the measurement endpoints identified above and provide a clear summary of the information that is available for each measurement endpoint (i.e., number of samples, period of record, analytes measured, parameters measured or calculated, etc.). The matrix should provide a basis for determining what is known about the tributary and what is currently unknown (i.e., data gaps). A draft matrix that includes all of the necessary data types should be prepared and provided to the Environmental Monitoring Committee (EMC) for comment by July 15, 2015. Technical Advice: Conduct a detailed gap analysis using the compiled data and information on each mining-affected and potentially-mining affected tributary in the watershed. This gap analysis will be used to identify time critical assessment and monitoring activities to support tributary management in the Elk Valley		carbon (TOC) in sediment and pore water; v. Concentrations of conventional variables, major ions, nutrients, total metals, and dissolved metals in pore water from site sediments; Response: Water quality is a much better indicator of potential for effects than sediment quality or sediment toxicity. Adding this information to the matrix would not help to differentiate between tributaries. As described in the draft TEP study design document, collation and analysis of additional measurement endpoints/analytes and/or more detailed analysis of endpoints included in the draft matrix of existing and readily available information will be undertaken as required to support steps D and E (see Figure 1.2 of TEP Study Design). This step-wise or phased approach to data collation and analysis will be more efficient and effective than collating all information up-front.

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44	Tributary Evaluation Draft Study Design	Technical Advice: Revise the TEP to reflect the need to identify sensitive assessment endpoints, rather than the most important species or habitats, to guide decisions on tributary management.	Ktunaxa Nation Council	As discussed in the response to Input Item 43, the tributary evaluation program and tributary management plan is focused on protection of aquatic ecosystem health. The study design allows for the identification and evaluation of sensitive endpoints to guide development of the tributary management plan; therefore no modifications to the study design are required to address this technical advice.
45	Tributary Evaluation Draft Study Design	Technical Advice: The TEP should include the following phases (in the order identified): 1. Prepare an inventory of mining-affected and potentially-mining affected tributaries; 2. Prepare maps of Management Units 1 to 4, showing the locations of mining-affected and potentially-mining-affected tributaries; 3. Develop a matrix to support compilation of the data and information needed to evaluate the current status and historical condition of each tributary; 4. From the comprehensive suite of measurement endpoints, identify key measurement endpoints for which data and information are required to evaluate the tributary conditions relative to the most sensitive assessment endpoints; 5. Identify critical data gaps relative to conducting a comprehensive evaluation of historical and current conditions in each tributary (initiate a program to fill critical data gaps); 6. Conduct a preliminary evaluation of historical and current habitat value relative to the most sensitive assessment endpoints for each tributary, using the existing and readily-available data and information; 7. Evaluate the potential for rehabilitation of aquatic and riparian habitats and the potential for improving water quality conditions; and, 8. Prioritize each tributary for ongoing protection and/or restoration based on current ecological value, potential for rehabilitation, and potential to contribute to the objectives of the Elk Valley Water Quality Plan. Technical Advice: Revised the TEP to include the above phases and identify how the EMC will provide technical	Ktunaxa Nation Council	The phases identified in Figure 1.2 do reflect a logical order as they correspond to the phases in the TEP permit conditions for a phased approach to development of the tributary evaluation program (TEP). Phase A addresses TEP Permit conditions #1 and #2 by preparing a tabular inventory and maps of streams that are or will be influenced by mining. This phase corresponds with bullets 1 and 2 in Input Item 45. Phase B addresses TEP Permit condition #3 and involves developing a matrix describing the ecological characteristics and future mine development plans for each tributary based on existing information presented in EA documents, monitoring reports, and other documents. Phase B will include a summary of existing readily available information on current conditions (e.g., water and sediment quality and toxicity, calcite levels, benthic invertebrate community composition, and documented use by fish and other vertebrate species), expected future disturbances (locations, types, degrees of mine disturbance), and planned mitigation actions for each tributary in each watershed. Historical (pre-mining conditions) will also be described, if known. Habitat information will also be summarized, such as stream size, physical features, and connectivity or barriers. A draft information matrix based on existing readily available information was submitted to the EMC July 24 for review and comment. The approach for the draft information matrix in regards to the comprehensive suite of measurement endpoints provided by KNC is responded to in Input Item 44. EMC comments received on the draft information matrix will be considered in its development. Gaps in information are already being

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		advice on each phase.		identified as surface water toxicity and sediment toxicity information is not currently existing and readily available. These steps correspond to bullets 3, 4, and 5 in Input Item 45. Phase C will likely be undertaken in conjunction with the implementation of Phase D. Phase D addresses TEP Permit condition #4 and #5. Phase C and D will be completed in consultation with the EMC. Phase C involves defining "ecological value" by identifying protection and rehabilitation goals in order to evaluate the tributary information. Phase D will evaluate the information matrices in the context of the protection and rehabilitation goals defining "ecological value" including the evaluation of historical and current information and the evaluation for the potential for rehabilitation of aquatic and riparian habitat and potential for improvement of water quality conditions. These phases correspond to bullets 6 and 7 in Input Item 45. Phase E will involve identifying gaps, questions or uncertainties in the information collated and evaluated that need to be resolved. Additional current and/or historical data will be collated and evaluated to address any gaps, questions or uncertainties. Phase E will also include conducting supporting studies to gather new information, if required. This information will then be added to the evaluation in Phases C/D. Phase E further addresses TEP Permit Conditions #3 and #4 and feeds back into Phase D. These phases correspond to repeating bullets 5, 6, and 7 of Input Item 45. Once uncertainties, questions, gaps are addressed, Phase F will prioritize the tributaries for protection or rehabilitation addressing TEP Permit Condition #6. This phase corresponds to bullet 8 in Input Item 45.
1	Elk Valley Regional Groundwater Synthesis Report	Use livestock numbers as a surrogate for wildlife numbers for groundwater in MU 1 to 4.	Ktunaxa Nation Council	We will compare to livestock for all Mus as suggested. Synthesis report will be updated and reference to all appropriate data screening will be included in the Regional Groundwater Monitoring Program submission.
2	Elk Valley Regional	Use a single set of benchmarks for	Ktunaxa Nation	Based on additional technical guidance

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	Groundwater Synthesis Report	screening. Valley bottom benchmarks are more conservative and using a single set of benchmarks will address all groundwater types.	Council	from MOE, screening against BCWQG and CSR standards (ie., aquatic life, drinking water and livestock) will be used for the initial screening steps. An additional screening step to compare water quality to established Level 1 Benchmarks developed during the EVWQP will be completed for selenium, nitrate, sulphate and cadmium where applicable to provide additional context for potential ecological effects/risk.
3	Elk Valley Regional Groundwater Synthesis Report	Add a process flow chart to the synthesis report to aid in communicating the process.	Ktunaxa Nation Council	The process flow chart will be added to the Final version of the Regional Groundwater Synthesis Report.
4	Elk Valley Regional Groundwater Synthesis Report	KNC wants a complete list of major ions, nutrients, metals, conventional variables, and ground water specific variables	Ktunaxa Nation Council	A complete list of groundwater parameters for ongoing monitoring with rationale for inclusion will be incorporated in the Regional Groundwater Monitoring Plan.
5	Elk Valley Regional Groundwater Synthesis Report	KNC wants benchmarks for all of the above (major ions, nutrients, metals, conventional variables, and ground water specific variables).	Ktunaxa Nation Council	Where applicable, screening benchmarks for the remainder of constituents will also be provided in the Regional Groundwater Monitoring Plan to inform data screening process for data captured within the program.
6	Elk Valley Regional Groundwater Synthesis Report	In the Executive Summary of the report, the intended objective of the report is to satisfy Permit 107517, Section 9.2.1, requirement (ii). The TOR for the report indicated that the report would satisfy requirements i, ii, iii, iv and v, and portions of vi. Please clarify.	Ministry of Environment	Modified the Executive Summary and Section 1.2 Scope of Work and Report Objectives to make clear what portions of Section 9.2.1 of Permit 107517 are addressed by the Regional Groundwater Synthesis Report.
7	Elk Valley Regional Groundwater Synthesis Report	The word "limited" should be added before "… release of water quality constituents and calcite…" in the first sentence of the final paragraph. The word "limited" clarifies the intent of the authorization.	Ministry of Environment	Statement will be reworded to clarify "in accordance with the permit". The very nature of the permit states what the authorized discharge limits are so will align referencing to make this clear.
8	Elk Valley Regional Groundwater Synthesis Report	The objective of the report is stated as identifying key areas where off-site transport of mine-related constituents may be occurring or occur in the future. Please define "off-site".	Ministry of Environment	Section now reads "outside of mine-permitted areas ("off-site")"
9	Elk Valley Regional Groundwater Synthesis Report	It is noted that the data gaps (as required in the Permit) were identified based on applicable screening benchmarks. As discussed below, the benchmarks used were not the most conservative and may not be applicable. As well, not all data (parameters or locations) were included in the report. Data gaps should be re-assessed once the data	Ministry of Environment	See discussion in comments 10 and 13 for applicability of screening benchmarks. The locations selected for inclusion into the report were those considered important to the regional groundwater understanding. If a location was not selected, it is because it was not considered relevant to the regional understanding and addressed in the site groundwater monitoring programs.

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		has been re-generated.		Comment 28 discusses the inclusion of all parameters; in short, the report focuses on the main indicator parameters related to mining in the valley. Extraction of these data from multiple sources and formats was extremely difficult and error-prone, and if all data are to be included the time and effort needed for high quality data will be significant. The level of effort required to compile and synthesize all available data for all parameters is not a beneficial use of resources as it will be prone to data quality issues and manually intensive. As such, we propose inclusion of ready-available digital data from Teck's database to be included for available locations, and subsequent inclusion of all parameters in the annual report after regional groundwater monitoring commences in 2015. We are confident that the data gaps identified in the Synthesis Report should cover any additional parameters; however, parameters will be revisited during the annual reporting review (i.e., March 2016) as per the proposed iterative process in the TOR.
10	Elk Valley Regional Groundwater Synthesis Report	The first paragraph on the page suggests that the BCWQGs are "overly conservative", based on them being orders of magnitude less than the Permit 107517 Compliance Point and SPO concentrations. The BCWQGs are protective of aquatic life, wildlife, agriculture (irrigation and livestock watering), drinking water sources, and recreation and aesthetics. In contrast, the Compliance Point and SPO concentrations included site-specific conditions or socio-economic factors and are not considered protective of the environment.	Ministry of Environment	Removed "overly" from the sentence and will provide additional clarity on screening benchmarks used and their technical rational for use. To clarify, the 'overly conservative' remark was based on comparison to the BC CSR groundwater standards, the Health Canada Se guideline and the criteria outlined in the permit, which was based on ecological based studies completed to support the development of the EVWQP. The criteria used to support compliance and SPO concentrations in the permit were based on Level 1 benchmarks while considering an area-based management plan approach. The area-based approach and established benchmarks (as well as permit criteria), are designed to meet long-term water quality targets that protect aquatic ecosystem health at a management unit scale (e.g. upper Fording River was defined as a management unit with protection of Westslope Cutthroat trout population as the most sensitive endpoint for selenium targets). The essence of the area-based approach is that the integrated effect within each management unit is sufficiently small to protect sensitive populations and aquatic communities.

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				Socio-economic factors where not incorporated into Level 1 benchmark development or the resulting permit criteria. As mentioned in response to input/advice #2, screening will begin with BCWQG as requested, but also to CSR-AW for wells that are greater than 10 m of the high water mark. Screening for comparison against criteria in the Permit Level 1 benchmarks will also be completed due to the high degree of connection between surface water and groundwater and the potential for recharge and/or discharge at any given point along the flow path.
11	Elk Valley Regional Groundwater Synthesis Report	BC CSR (GW-AW) standard for Cd should be 0.1-0.6 ug/L (based on hardness) instead of 0.6-1.1, as per Schedule 6 of the CSR.	Ministry of Environment	The BC CSR (GW-AW) standard for Cd was presented in this table for comparison purposes only, and used a hardness range measured in the main surface water bodies to illustrate differences in criteria. This approach is conservative as hardness values in groundwater samples can be much higher (e.g., greater than 900 ug/L). The low value of the standard presented (0.6 ug/L) is for hardness range 150 -< 210 mg/L comes from Schedule 6 of the CSR and the higher value standard presented (1.1 ug/L) is calculated using BC CSR Protocol 10 for samples with hardness greater than 210 mg/L. This range is based on the average hardness found in the Elk River (200 mg/L) and the Fording River (360 mg/L) (EVWQP Chapter 8).
12	Elk Valley Regional Groundwater Synthesis Report	The first paragraph on Page 14 states that ,"TG 15 indicates that within 10 m of the 'high water mark' … surface water quality criteria should apply to groundwater." In fact, TG 15 states that at the high water mark, BC WQGs should be used, and further than 10 m away from the aquatic receiving environment (ARE) the BC CSR AW apply. A risk-based approach is recommended in the area within 10 m of the ARE.	Ministry of Environment	This section now reads "TG 15 indicates that at the 'high water mark', generally defined by vegetation, surface water quality guidelines should apply to groundwater (#2 in Figure), and further than 10 m from the high water mark the BC CSR GW-AW applies. TG 15 also defines a 'dilution zone' (#3 in Figure) in between these two points where a high degree of exchange with surface water may be occurring. Within the dilution zone concentration limits are not specified, and TG 15 recommends a risk-based approach in cases where the concentration limits at the high water mark and 10 m from the high water mark cannot be met."
13	Elk Valley Regional Groundwater Synthesis Report	As discussed above, the Compliance Points and SPOs are not considered protective of aquatic life. Their use as benchmarks for the synthesis report is not appropriate. As well, the use of	Ministry of Environment	Per Comment 10 above, long-term SPOs and the underlying level 1 benchmarks were established to protect aquatic ecosystem health and are considered protective, just not to the same degree as

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		different benchmarks in different areas of the system is not appropriate for the synthesis report. The synthesis report is to provide information regarding the quality of groundwater in the Elk Valley, and therefore the standards used to assess the data must be consistent across the area.		BCWQGs. For example, short and medium term SPOs and compliance values were established to meet requirements for stabilization (short term) and demonstrating progress towards meeting long-term targets (medium term); they were not developed as protective values. Given the high degree of connection between surface water and groundwater and the potential for recharge and/or discharge at any given point along the flow path, use of these screening benchmarks is considered appropriate for the regional program. However, as requested, we will be screening against BCWQG and BC CSR standards as the primary screening step and following through with additional screening against the level 1 benchmarks.
14	Elk Valley Regional Groundwater Synthesis Report	It is agreed that in general at most sites samples collected from groundwater wells are analysed for dissolved metals, and so it is understood why the proponent suggests sampling for dissolved concentrations of metals and not total metals. However, since one of the purposes of the groundwater program is to assess how the groundwater and surface water are interacting, samples should be collected for total metals analyses (as well as dissolved) in order for the results to be compared directly to the surface water results.	Ministry of Environment	We disagree with the collection of total metals in groundwater. As discussed in the synthesis report, the potential for bias due to well construction and fines in the formation leads to potential data quality issues. This is supported by the full length companion to MoE's TG8 (the document referenced below in comment 33) which indicates that "where groundwater samples are obtained for quantifying metals concentrations, it is important that the samples be filtered in the field or immediately after retrieval, and prior to preserving the sample...Because aquifers normally act as filters and prevent significant migration of particulates, analysis of samples containing particulates will not represent actual groundwater conditions". We also disagree that the collection of total metals in groundwater allows for more direct comparison with surface water results as water chemistry, particularly metals, pH and bicarbonate can undergo significant changes due to interactions with atmosphere.
15	Elk Valley Regional Groundwater Synthesis Report	Health Canada GCDWQ new Maximum Acceptable Concentration for Se of 50 ug/L was used for comparison purposes in the report. However, BC has not adopted this new value and is currently evaluating its applicability in BC based on the risk of exceeding the tolerable daily intake (Health Canada 2010) of Se. The current BC CSR Standard and BC WQG for Se is 10 ug/L, and this value	Ministry of Environment	Primary data screening will be against current BC WQG (i.e., 10 ug/L) but where exceedances are flagged, secondary screening against other established drinking water quality guidelines will be completed (e.g., Health Canada guideline of 50 ug/L).

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		should be used in the comparison instead of 50 ug/L. (Note: 10 ug/L Se was put forward by Teck as the screening level for drinking water quality in their "Elk Valley Water Quality Plan & Permit Implementation: Human Health Risk Assessment Work Plan [Draft]", dated May 2015.)		
16	Elk Valley Regional Groundwater Synthesis Report	BC WQG (SW-IW) value should be 10 ug/L instead of N/A, as per the Ambient Water Quality Guidelines for Selenium Update, 2014	Ministry of Environment	BC WQG (SW-IW) value changed to 10 ug/L
17	Elk Valley Regional Groundwater Synthesis Report	BC CSR (GW-IW) value for Se has been set at 50 ug/L, assuming intermittent application on crops. Unless Teck has control on the application of groundwater on crops, the more conservative value (20 ug/L) should be used in the comparison.	Ministry of Environment	The more conservative screening of 20 ug/L will be applied to assess on a regional perspective and if exceedances to this screening occur, will need to further evaluate the localized area taking a risk based approach and getting further understanding on actual application use.
18	Elk Valley Regional Groundwater Synthesis Report	Location FR_GHHW #2/3/4 is not shown on Figure 626147-007 as indicated. Please complete a thorough review of the report and cross-references.	Ministry of Environment	All of the FR_Greenhouse wells are located in close proximity to one another. The final report will address this to provide an insert on the figure and necessary level of detail.
19	Elk Valley Regional Groundwater Synthesis Report	It is noted in this section that there is an ongoing groundwater monitoring and sampling program at FRO, which includes sampling of some wells on a quarterly basis. However, the analytical results for some of these are not included on the tables. All analytical data available should be included in the synthesis report.	Ministry of Environment	The Site Groundwater Monitoring Program at FRO includes a number of wells at various locations throughout the Site. From a regional perspective we are only interested in wells that are at or downgradient of the boundary of the site. We have included all applicable data including the quarterly monitoring results from several monitoring points near the southern boundary of FRO (FR09-01A/B, FR_09-02A/B, and FR_Greenhouse Wells) in the Regional Groundwater Synthesis Report.
20	Elk Valley Regional Groundwater Synthesis Report	In the text at the top of the page, it is noted that selenium exceeded guidelines in one domestic well, as indicated in Table 4.15. However, Table 4.15 does not mention selenium; it mentions sulphate. Which is correct?	Ministry of Environment	The exceedance was for sulphate. The text will be updated to clarify.
21	Elk Valley Regional Groundwater Synthesis Report	The Site Conceptual Model should also show where receptors may be the most sensitive, and these should be identified as key areas for assessment.	Ministry of Environment	The report and subsequent site conceptual model considered all receptors/uses of groundwater which includes the most sensitive receptors. Since the focus of the study was regional in scale, the receptors were considered on the MU scale and not at the local scale. For example, receptors/uses of groundwater in the MU1 included aquatic life, drinking water, irrigation and livestock

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				watering, which accounts for all sensitive receptors. To address this and Comment #1, we will be applying these receptors to all MUs.
22	Elk Valley Regional Groundwater Synthesis Report	Groundwater pumping (potentially drawing impacts to the area) and irrigation (potential infiltration of impacted water) should be identified as potential sources of groundwater contamination as well, and should be assessed.	Ministry of Environment	Known groundwater pumping was described in Key Areas where sufficient pumping is known to draw in surface water. An assessment of water quality in higher capacity wells with the potential to capture surface water was done in the 2014 Drinking Water Evaluation. The only well identified to capture surface water through induced gradients from pumping was the District of Sparwood Well #3. Although this well is discussed in the draft Regional Synthesis report additional reference to pumping will be provided in the final report.
23	Elk Valley Regional Groundwater Synthesis Report	Hydraulic conductivity values for colluvium were not measured. This should be considered a data gap, since the Site Conceptual Model shows a large amount of colluvium in the area.	Ministry of Environment	We added references to literature that provide a range of values for colluvium in the Regional Synthesis Report. Colluvium generally has a high permeability and exists in upland areas (e.g., mine sites). The saturated thickness (i.e., amount of groundwater) in colluvium in the Study Area is inferred to be limited in comparison to valley-bottom sediments and due to high permeability flow direction will follow bedrock topography. We believe the lack of available hydraulic data for colluvium does not detract from the understanding of regional groundwater and as such is not considered a data gap for this program.
24	Elk Valley Regional Groundwater Synthesis Report	Last sentence of this section says that there is little information on effects of backfilled pits, removal of surficial materials, and reclamation practices on groundwater at mine sites. This should be considered a data gap.	Ministry of Environment	This is not considered a data gap for the regional groundwater monitoring program and is more relevant to the site-specific groundwater monitoring programs because the effects are considered to be local in scale, not regional. For example, the effect on groundwater of any given backfilled pit is highly dependent on degree of localized recharge, extent and degree of fractured bedrock, backfill grain size and dumping method, and local site water management strategies. Similarly, the effects of removal of surficial materials and reclamation materials are local and relevant to the site specific groundwater programs. At the site (operation) scale, groundwater generally flows to the tributary valley bottoms and discharges to surface water; as such, reclamation practices likely won't influence groundwater on the regional scale.

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25	Elk Valley Regional Groundwater Synthesis Report	Some Key Areas and Data Gaps have been identified based on unproven and/or incorrect assumptions made in the report. Data Gaps for the synthesis report should include information that is lacking or uncertain, such as actual measured groundwater flow direction and velocity, potential migration pathways, vertical and lateral delineation of impacts in all identified aquifers, background groundwater quality, extent of deposits, groundwater and surface water interactions, groundwater recharge and discharge zones, long term storage capacity of impacts in the aquifers, groundwater quality with respect to changes in groundwater table elevation, etc.	Ministry of Environment	Key Areas have been defined based on areas where site monitoring programs have identified the potential for offsite transport of constituents to the main river valleys (i.e., regional groundwater). We have re-reviewed the site monitoring report and assumptions for these Key Areas and consider them to be appropriate in the context of groundwater transport from the Operations. If there is a particular Key Area which was identified based on unproven and/or incorrect assumptions it should be identified and discussed. In the report we noted that the boundaries of these Key Areas are subject to change as new information arises. For data gaps, groundwater flow regime and quality were generally identified as gaps in Key Areas #1, 4, 5, 6, 9 and 11. The terms groundwater flow regime and quality were chosen as they are general and cover a number of the items listed in the comment (e.g., groundwater flow direction and velocity, migration pathways, delineation, interactions with surface water, recharge and discharge, etc.); however, we can provide more specifics on the gaps. We note that some of the requested items appear to reflect requirements for a baseline EIA where pathways are and potential impacts are unknown. In this application, pathways at most mines are understood and some impacts to groundwater have already been identified, which is one of the reasons why the synthesis report focuses on Key Areas instead of a more blanket approach as suggested in the input/advice. As discussed in Comment 10, data gaps will be re-evaluated based on the screening to BCWQG and BC CSR. Based on the updated screening, Key Areas and data gaps will be reassessed and reported in the Synthesis Report. If there is uncertainty in data gaps upon re-screening, suggest a focussed discussion to resolve any uncertainty for the regional groundwater monitoring program.
26	Elk Valley Regional Groundwater Synthesis Report	We do not agree that the monitoring programs should only assess the constituents discussed in Permit 107517. As discussed earlier in the report (Section 4), other parameters have been shown to be valuable in assessing for mine-affected	Ministry of Environment	The intent of the bullet was to align all groundwater monitoring programs with a common parameter list. We will be recommending a much larger suite for analyses, which includes constituents in the Permit, but also a suite of metals, major ions, and other field and inorganic

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		groundwater.		geochemical indicator parameters. We will provide a comprehensive table of recommended parameters in the Regional Groundwater Monitoring Plan.
27	Elk Valley Regional Groundwater Synthesis Report	Section 9.2.1 (i) of Permit 107517 states, "Evaluate the regional effects of the Permittee's operations on groundwater in management units 1, 2, 3 and 4, and assess potential surface water to groundwater interaction effects related to the Permittee's operations in all management units compared to all applicable standards." (emphasis added.) - Management units (MUs) 1 to 4 are included in the document, but no data or assessment of MUs 5 and 6 are included. MUs 5 and 6 should be included in the report. - Data has been compared to 'benchmarks', some of which are for surface water and so are not applicable to groundwater. CSR AW Standards and BC WQGs should be added to the comparison tables.	Ministry of Environment	The regional groundwater synthesis report must integrate all available information collected by the Permittee. The focus of the report was to assess regional effects from groundwater (i.e., where groundwater transport may be occurring (MUs 1-4)). Some discussion has already been provided in the synthesis report on what GW quality is like leaving MU4. Teck will confirm whether addition permittee collected groundwater information is available and incorporate where applicable. The Drinking Water Sampling Program will not be included in the Regional Groundwater Synthesis report to maintain privacy commitments made to well owners but general inference to groundwater quality and surface water/groundwater interaction areas will be discussed. Applicable screening benchmarks have been addressed in response to input/advice #10.
28	Elk Valley Regional Groundwater Synthesis Report	Section 9.2.1 (ii) of Permit 107517 states, "Complete a regional groundwater synthesis report that must integrate all available groundwater information collected by the Permittee. The report must include information collected as part of operational investigations carried out for diverse purposes (e.g. as part of permitting applications, water supply assessments, geotechnical investigations, etc.). " (emphasis added.) Only Se, Cd, nitrate and sulphate are included in the report. Other data may be very valuable in assessing the quality and interaction of groundwater across the area. - The purpose of the synthesis report is to report the data available. As discussed in the Permit at the end of Section 9.2.1, a Groundwater Management Plan may be required at a later date. - All analytical results should be added to the table(s). The earliest data shown on the analytical table is from 2009; it is unclear if earlier data is available. - Monitoring data (groundwater elevations) should be provided and	Ministry of Environment	We agree that other data may be useful in evaluating groundwater conditions; however, in obtaining all available information it became apparent that the data were in multiple formats and variable degrees of QA/QC. There were over 100 reports to review (hard copy, pdf and secured pdf) as well as over 70 data files (spreadsheet, database and lab files). Therefore, the data mining process for synthesizing all available data was highly intensive and involved a lot of manual manipulation, which is very prone to errors. As such we considered it more effective to focus on the main indicator parameters for mining influences, which are also those listed in the Permit. Review of each of the site-specific reports indicated that these indicator parameters were the most appropriate for assessing mine-influenced groundwater. We took a similar approach for the groundwater monitoring levels, relying on site monitoring reports listed in the bibliography. We believe that the effort required to compile and synthesize all available data for all parameters is not a beneficial use of resources as it may be prone to error/data quality issues and manually intensive. As described in

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		used to assess groundwater flow direction, laterally and vertically within the aquifers. If there isn't enough data to assess groundwater flow, this should be considered a gap that requires further investigation. (It is noted that inferred flow directions are included on some of the figures; these should be verified or refuted with actual data.)		Comment 9, we propose to include any readily available data (i.e., within Teck's database) in the report as well as reference any additional parameters of note from the existing monitoring programs (i.e., where other parameters of concern were identified in site reports) as part of the Regional Synthesis report. We will also be proposing that additional parameters will be included and evaluated as part of the annual reporting process. going forward. The compilation of data from a centralized location will be much more efficient and effective going forward as Teck has made a change to EQuIS (centralized database). As indicated in the TOR, this is consistent with an iterative approach to groundwater monitoring where the conceptual model is revisited with continuing data collection and evaluation.
29	Elk Valley Regional Groundwater Synthesis Report	Colour-coded drawings showing the locations and parameter concentrations would be very valuable in assessing the information and prioritizing areas for further assessment. Please incorporate these in the final report.	Ministry of Environment	We will be providing colour-coded drawings with locations and constituent concentrations for the key mine parameters (i.e., selenium, sulphate, cadmium and nitrate). However, these will be limited to constituents of interest; please see Comment #28 for explanation.
30	Elk Valley Regional Groundwater Synthesis Report	No regional cross-sections were included in the report. These are expected in a regional groundwater report. Please incorporate these in the final report.	Ministry of Environment	Based on the recent July 9, 2015 call with the EMC, we agree that the three dimensional component (i..e., cross-sections) is not well illustrated. However, we suggest regional cross-sections (e.g., extending the length of valley bottoms) will not provide value as there are large swaths of the river bottoms with little or no available data, including the provincial well database. We suggest cross sections for Key Areas are more illustrative and informative in the regional groundwater understanding. In the report we have included one series of cross sections for Key Area #3 (GHO), and we will provide additional cross sections in the final report where data density allows, including some wells from the provincial database provided sufficient data quality.
31	Elk Valley Regional Groundwater Synthesis Report	In-text table reference numbers within the report need to be checked and edited to reflect actual table numbers.	Ministry of Environment	This will be addressed in the final updated report.
32	Elk Valley Regional Groundwater Synthesis Report	A summary table of the groundwater monitoring well locations, completion details, purpose, etc. is expected in the synthesis report. Please incorporate these in the final report.	Ministry of Environment	A summary table of monitoring wells in the Study Area will be included in the final report.

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33	Elk Valley Regional Groundwater Synthesis Report	The suitability of the wells for the defensible collection of groundwater samples should be assessed against criteria available in BC CSR Technical Guidance 8 and other relevant guidance. For example, the Borehole Log for well GA-MW-3S shows approximately 6 m of water column when monitored in 2012. It is inferred that this is sample location GH_GA-MW-3 shown on the analytical table, which has elevated concentrations of nitrate, sulphate and selenium. It should be ascertained whether the results for all locations are potentially skewed based on the water thickness or other well installation parameters.	Ministry of Environment	In the case of GH_GA-MW-3S, the well was screened above the bedrock in a single hydrostratigraphic (aquifer) unit, as is recommended in the British Columbia Field Sampling Manual and TG8. The Site Groundwater Monitoring Program indicates the well is sampled using a low-flow sampling method, which will provide a discrete sample from a given depth in the well since flow to the pump intake is radial, not vertical. From a regional perspective, this well is considered suitable for assessing groundwater quality for that particular groundwater unit. We will evaluate existing wells for suitability for the Regional Groundwater Monitoring Program in the Groundwater Monitoring Plan. Comments will take into consideration TG8 and the BC Field Sampling Manual.
34	Elk Valley Regional Groundwater Synthesis Report	There are many sample locations shown on the analytical table with no corresponding borehole logs provided. For example, all of the Fording River Operations borehole logs are missing. Conversely, there are a number of borehole logs included in the appendix for which there are no analytical results included. Please verify that all borehole logs and all analytical results are included in the final report. As well, please ensure that the titles/names of the wells on the logs match the sample locations exactly so that no interpretation/inference is required on the part of the reader.	Ministry of Environment	We will relabel existing borehole logs to make more consistent with groundwater quality data. Borehole logs for the Drinking Water Sampling Program have been omitted out of concern for the privacy of the well owners. All available missing borehole logs (excluding the Drinking Water Sampling Program information) will be included in final synthesis report.
35	Elk Valley Regional Groundwater Synthesis Report	Gap analysis should be completed on an aquifer-by-aquifer basis to ensure that each individual aquifer is adequately assessed and ultimately protected.	Ministry of Environment	Individual 'aquifers' were not identified as the valley bottom deposits are considered to be heterogeneous and spatially variable; however, we did identify local permeable units where groundwater impacts were identified and listed data gaps associated with these impacts. It may be more appropriate and conservative to consider the shallow groundwater in the valley bottom as one aquifer due to similar depositional environment and hydraulic connection with surface water.
36	Elk Valley Regional Groundwater Synthesis Report	A regional water balance is recommended. Data gaps in the water balance should be addressed.	Ministry of Environment	In our experience, water balances on the regional scale tend to treat groundwater like a 'black box' and does not provide useful information on aquifers, groundwater-surface water interactions, recharge/discharge areas, etc. that are

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				mentioned in Comment #25. Furthermore, broad assumptions on precipitation, infiltration, aquifer extents, storage, permeability, surface water interactions will need to be made which will lead to large uncertainties. We believe that a robust regional conceptual model separated into Key Areas and revisited on an annual basis is the most appropriate approach to the understanding of regional groundwater in the Elk Valley.
1	Local Aquatic Effects Monitoring Program 2015 Study Design	Revise the purpose of the 2015 Line Creek LAEMP. The objective of the 2015 Line Creek LAEMP should be to provide the data and information needed to: 1. Determine if aquatic ecosystems and their uses are being adequately protected in the vicinity of the project; 2. Identify and evaluate the short-term and long-term project-related effects on the aquatic environment; 3. Evaluate the accuracy of predictions regarding the effects of the project on water quality conditions, on the aquatic environment, and on human health; and, 4. Assess the need for, and efficacy of, measures to mitigate the short- term and/or long-term effects of the project on the aquatic environment.	Ktunaxa Nation Council	
2	Local Aquatic Effects Monitoring Program 2015 Study Design	Develop a problem formulation and project-specific CSM that provide the scientific basis for designing an LAEMP that effectively detects and quantifies project-related effects within the Line Creek watershed, including effects associated with all project-related activities. More specifically, the design of the AEMP needs to be informed by a comprehensive problem formulation that includes: 1. Description of the geographic scope of the study area; 2. Sources and releases of contaminants and other stressors; 3. Identification of COPCs; 4. Evaluation of the transport and fate of COPCs; 5. Evaluation of the ecological and health effects of the COPCs; 6. Identification of key exposure pathways; 7. Identification of ecological receptors and human populations	Ktunaxa Nation Council	

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		potentially exposed to COPCs; 8. Development of a CSM; and, 9. Selection of assessment endpoints and measurement endpoints.		
3	Local Aquatic Effects Monitoring Program 2015 Study Design	Use the problem formulation and CSM to guide the design of the 2015 LAEMP.	Ktunaxa Nation Council	
4	Local Aquatic Effects Monitoring Program 2015 Study Design	The following assessment endpoints should be included in this section of the AEMP study design document: 1. Protection of Human Health; 2. Protection of Aquatic Life; 3. Protection of Wildlife; 4. Protection of Traditional and Cultural Uses; 5. Protection of Recreation and Aesthetics; and, 6. Maintenance of Biodiversity.	Ktunaxa Nation Council	
5	Local Aquatic Effects Monitoring Program 2015 Study Design	The following measurement endpoints should be described in the LAEMP study design document: 1. Assessment Endpoint - Protection of Human Health Recommended Measurement Endpoints: i. Concentrations of conventional variables, major ions, nutrients, total metals, and dissolved metals in surface water; and, ii. Concentrations of metals and other bioaccumulative substances in aquatic and riparian plants, freshwater mussels, fish, amphibians, and wildlife tissues. 2. Assessment Endpoint - Protection of Aquatic Life Recommended Measurement Endpoints: i. Concentrations of conventional variables, major ions, nutrients, total metals, and dissolved metals in surface water; ii. Survival, growth, and reproduction of aquatic plants in surface water toxicity tests with indicator species; iii. Survival, growth, and reproduction of aquatic invertebrates and fish in long-term surface water toxicity tests with indicator species; iv. Concentrations of conventional variables, total metals, simultaneously extracted metals (SEM), acid volatile sulfides (AVS), polycyclic aromatic hydrocarbons (PAHs), total organic	Ktunaxa Nation Council	

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		carbon (TOC) in sediment; v. Concentrations of conventional variables, major ions, nutrients, total metals, and dissolved metals in pore water from site sediments; vi. Survival, growth, and reproduction of aquatic invertebrates in long-term sediment toxicity tests with indicator species; vii. Calcite levels; viii. Concentrations of metals and other bioaccumulative substances in benthic invertebrates, freshwater mussels, fish, and amphibian tissues; and, ix. Diversity and abundance of the species that comprise aquatic plant, benthic invertebrate, fish, and amphibian communities. 3. Measurement Endpoint - Protection of Wildlife: Recommended Measurement Endpoints: i. Concentrations of conventional variables, major ions, nutrients, total metals, and dissolved metals in surface water; ii. Concentrations of metals and other bioaccumulative substances in aquatic and riparian plants, benthic invertebrate, freshwater mussel, fish, and amphibian tissues; and, iii. Diversity and abundance of the species that comprise aquatic-dependent bird and aquatic-dependent mammal communities. 4. Measurement Endpoint - Protection of Traditional and Cultural Uses Recommended Measurement Endpoints: i. Concentrations of conventional variables, major ions, nutrients, total metals, and dissolved metals in surface water; ii. Concentrations of metals and other bioaccumulative substances in aquatic and riparian plants, benthic invertebrates, freshwater mussels, fish, amphibians, and wildlife tissues; iii. Diversity and abundance of the species that comprise aquatic plant, riparian plant, benthic invertebrate, mussel, fish, amphibian, aquatic-dependent bird, and aquatic-dependent mammal communities; and, iv. Perceptions regarding		

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		environmental quality conditions and associated behavioural changes in resource use patterns (as evaluated using a traditional knowledge-based approach). 5. Measurement Endpoint - Protection of Recreation and Aesthetics: Recommended Measurement Endpoints: i. Concentrations of conventional variables, major ions, nutrients, total metals, and dissolved metals in surface water. 6. Measurement Endpoint - Maintenance of Biodiversity: Recommended Measurement Endpoints: i. Diversity and abundance of the species that comprise the aquatic plant community; ii. Diversity and abundance of the species that comprise the riparian plant community; iii. Diversity and abundance of the species that comprise the benthic invertebrate community; iv. Diversity and abundance of the species that comprise the fish community; v. Diversity and abundance of the species that comprise the amphibian community; vi. Diversity and abundance of the species that comprise the aquatic-dependent bird community; and, vii. Diversity and abundance of the species that comprise the aquatic-dependent mammal community.		
6	Local Aquatic Effects Monitoring Program 2015 Study Design	The surface water sampling component of the LAEMP should be designed to evaluate attainment of BC water quality guidelines (WQGs), to assess temporal trends in water quality conditions, to assess spatial trends in water quality conditions, and to support interpretation of other types of data. To achieve this objective, the surface-water chemistry component of the LAEMP needs to be designed to provide spatially-relevant data for reference and treatment areas, include a broad suite of analytes (i.e., conventional variables, major ions, nutrients, total and dissolved metals, and other analytes as informed by the problem formulation), and include	Ktunaxa Nation Council	

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		routine (e.g., monthly) and intensive (i.e., two 5-samples in 30-day sampling events) sampling at each station. For certain key variables, more intensive sampling may be required to document exposure of ecological receptors to environmental stressors.		
7	Local Aquatic Effects Monitoring Program 2015 Study Design	Performance criteria for measurement data need to be defined in the LAEMP study design, including accuracy, precision, detection limits, and completeness targets. Target detection limits should be < 20% of the lower of the BC or Canadian Council of Ministers of the Environment (CCME) WQGs.	Ktunaxa Nation Council	
8	Local Aquatic Effects Monitoring Program 2015 Study Design	At minimum, surface water toxicity should be evaluated immediately upstream and downstream of the AWTF discharge, at the South Line Creek reference station (SLINE), and at Line Creek downstream of South Line Creek (LIDSL) on a quarterly basis using the following toxicity tests: 1. 30-d early-life stage toxicity test with rainbow trout (Oncorhynchus mykiss); 2. 30-d early life stage toxicity test with fathead minnows (Pimephales promelas); 3. 42-d toxicity test with amphipods (Hyalella azteca); 4. 7-d toxicity test with cladocerans (Ceriodaphnia dubia); and, 5. 72-h toxicity test with algae (Pseudokirchneriella subcapitata).	Ktunaxa Nation Council	
9	Local Aquatic Effects Monitoring Program 2015 Study Design	Splits of the surface water samples collected for toxicity testing need to be prepared on each sampling date and submitted for full chemical analysis. This is required to provide the information needed to interpret the results of the surface water toxicity tests.	Ktunaxa Nation Council	
10	Local Aquatic Effects Monitoring Program 2015 Study Design	The standard operating procedures for collecting water samples should be included as an appendix to the LAEMP study design. The extent to which these procedures are consistent with the requirements identified by BCMOE (Clark 2003) should be discussed explicitly. In addition, procedures for collecting large-volume water samples necessary for conducting surface-water toxicity tests need to be described.	Ktunaxa Nation Council	

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11	Local Aquatic Effects Monitoring Program 2015 Study Design	The LAEMP study design needs to be revised to include sediment chemistry, pore-water chemistry, and sediment toxicity. The following toxicity tests would be conducted using splits of each sediment sample collected for chemical analysis: 1. 10-d whole-sediment toxicity tests with the midge, Chironomus dilutus (Endpoints: Survival, growth, and biomass); and 2. 42-d whole-sediment toxicity tests with the amphipod, Hyalella azteca (Endpoints: Survival, growth, biomass, and reproduction).	Ktunaxa Nation Council	
12	Local Aquatic Effects Monitoring Program 2015 Study Design	1. This component of the LAEMP should be designed to determine if effluent discharges from the mine site are resulting in changes to the trophic status of receiving waters or changes in the composition of periphyton communities. 2. The sampling methods that are described are not appropriate. Importantly, it is not possible to randomly select rocks for the purpose of periphyton sampling. Periphyton is visually distinct and, hence, sampling bias is a major concern relative to the proposed sampling methods. An alternative approach involves the use of transect-based methods, which involve identification of an appropriate sampling reach at each station (i.e., a riffle area at or nearby the sampling location), establishing a transect at a location at the midpoint of the reach, identifying three to five nodes on the transect (i.e., the nodes are equally-spaced across the transect; e.g., at ¼, ½, and ¾ of the wetted width), and collecting the stones located closest to the identified nodes. This type of approach minimizes the bias that occurs due to visual cues that periphyton provides to samplers. 3. Ontario Ministry of the Environment (OMOE 2011) have developed standard protocols for periphyton sampling. These protocols should be considered for adoption in the Line Creek LAEMP. 4. While full taxonomic classification could be conducted on each periphyton sample, identification of	Ktunaxa Nation Council	

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		periphyton is difficult to determine to the species level. Moreover, the LAEMP should focus on determination of differences in algal biomass among stations (i.e., based on chlorophyll-a, chlorophyll-c, and ash-free dry weight analyses) and on evaluation of changes in major algal taxonomic groups (i.e., abundance of diatoms, green algae, blue-green algae, etc.). 5. At minimum, the application of artificial substrates for periphyton sampling should be evaluated in 2015. More specifically, a pilot study should be conducted to evaluate the reliability of both sampling methods (i.e., natural substrates vs. artificial substrates).		
13	Local Aquatic Effects Monitoring Program 2015 Study Design	The LAEMP study design needs to be revised to include a QA/QC section to describe how data quality will be measured and evaluated.	Ktunaxa Nation Council	
14	Local Aquatic Effects Monitoring Program 2015 Study Design	In addition to evaluating benthic invertebrate biomass and tissue-selenium concentrations, benthic invertebrate community structure must be included as a central component of the LAEMP.	Ktunaxa Nation Council	
15	Local Aquatic Effects Monitoring Program 2015 Study Design	A detailed analysis plan needs to be developed and included in the LAEMP study design. The analysis plan needs to describe how each type of data will be used to address the objectives of the LAEMP.	Ktunaxa Nation Council	
16	Local Aquatic Effects Monitoring Program 2015 Study Design	Revise the LAEMP study design to include a meaningful and significant TK component, in consultation with KNC.	Ktunaxa Nation Council	
17	Local Aquatic Effects Monitoring Program 2015 Study Design	Revise the 2015 LAEMP study design to address all of the comments provided by KNC and other EMC members. Submit the revised LAEMP design document to the Environmental Monitoring Committee for review.	Ktunaxa Nation Council	
18	Local Aquatic Effects Monitoring Program 2015 Study Design	Professional Designations (e.g. RPBio) are not shown for the report authors . Ensure that these designations are included in all study designs and reports.	Ministry of Environment	
19	Local Aquatic Effects Monitoring Program 2015 Study Design	Provide rationale for discriminating against highly angular rocks or rocks with uncharacteristic surface texture and any implications this may have on results. Will the associated	Ministry of Environment	

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		minimization of natural habitat variability cause a misrepresentation of the productivity actually occurring at the sampling locations? What are the risks associated with biasing the results in this way? (See related comment on 2014 report.)		
20	Local Aquatic Effects Monitoring Program 2015 Study Design	Consider increasing the number of periphyton samples in an effort to decrease the large variability of periphyton results. (Acknowledged that this is somewhat contradictory to the comment above related to minimizing natural habitat variability.) Perhaps a power analysis could be conducted to determine an appropriate target for number of periphyton samples. Please discuss in the study design how sampling methods will be adjusted to address (i.e. reduce) variability in periphyton results.	Ministry of Environment	
21	Local Aquatic Effects Monitoring Program 2015 Study Design	Recommend that the same two representative benthic invertebrate (BI) taxa that were targeted for tissue Se sampling in 2014 - Ephemeroptera and Rhyacophilia sp. - continue to be used in 2014 so that data can be compared between years. If different BI taxa are targeted in 2015, provide rationale for this in the study design and forthcoming (2015) report.	Ministry of Environment	
22	Local Aquatic Effects Monitoring Program 2015 Study Design	Please include statistical data analysis and discussion of the results in the study design and forthcoming (2015) report.	Ministry of Environment	
23	Local Aquatic Effects Monitoring Program 2015 Study Design	Please include a Discussion section in the 2015 report to discuss what the observed data are telling us regarding local aquatic effects and the management of these effects.	Ministry of Environment	
24	Local Aquatic Effects Monitoring Program 2015 Study Design	Please consider the following questions and provide answers to them in the 2015 report: What was the chemical composition of the water at the time of biological sampling? What periods of the AWTF activation/proper functioning/ etc. do the biological communities represent? Please interpret the data in the report in the context of the implementation of the AWTF.	Ministry of Environment	
25	Local Aquatic Effects Monitoring Program 2015	Bryophytes were mentioned specifically in the meeting presentation. Please identify in the	Ministry of Environment	

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	Study Design	study design why bryophytes will be sampled, what bryophyte metrics will be measured, what the ecological significance of this data are, how the data will be analyzed, and what information these results will tell us about the impact of mining activities on the receiving environment. All of these items should be clearly discussed in the 2015 report. For instance, here are some questions to consider: Will bryophytes be sampled and analyzed for genera and differences between sites compared and discussed? Are there pollution-tolerant and pollution-intolerant taxa of bryophytes, and if so are different ones observed at each site? Will bryophyte density or abundance be measured, and if so, what will this tell us about the impact of mining activities on the environment? Why was observed bryophyte growth greatest at stream margins? Will bryophyte sampling results provide information on differences in nutrient status between reference and impacted sites?		
26	Local Aquatic Effects Monitoring Program 2015 Study Design	Please include a %EPT graph between sites if the data are available.	Ministry of Environment	
27	Local Aquatic Effects Monitoring Program 2015 Study Design	Recommend that weekly sampling continue at sites LILC3, LIDSL, and LI8 until the completion of biological sampling to give a better picture of the water quality that the BIs are exposed to during the growing season (i.e. through the summer). Weekly sampling should also be considered during the next commissioning period for the AWTF.	Ministry of Environment	
28	Local Aquatic Effects Monitoring Program 2015 Study Design	In the 2015 report, please answer the following questions: How quickly do BIs uptake Se into their tissues? How long would the observed BIs have been present in the stream for (i.e. how long do ephemeroptera larvae reside in the stream) before emerging? Would the higher Se tissue concentrations at LILC3 and LIDSL show a response to changes in the AWTF operation, or do they reflect longer-term Se exposure?	Ministry of Environment	
29	Local Aquatic Effects Monitoring	Wants early detection of disastrous conditions related to re-commissioning	Ktunaxa Nation Council	

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	Program 2015 Study Design	of AWTF.		
30	Local Aquatic Effects Monitoring Program 2015 Study Design	Scope of LAEMP is too narrow.	Ktunaxa Nation Council	
31	Local Aquatic Effects Monitoring Program 2015 Study Design	Needs to be designed to study effects in local area.	Ktunaxa Nation Council	
32	Local Aquatic Effects Monitoring Program 2015 Study Design	What are the right things to monitor, and where?	Ktunaxa Nation Council	
33	Local Aquatic Effects Monitoring Program 2015 Study Design	Purpose? Key questions? End-points? Design should look at assessment and end-points. Need to look at the effect of all activities not just the AWTF on Line Creek.	Ktunaxa Nation Council	
34	Local Aquatic Effects Monitoring Program 2015 Study Design	LAEMP needs to be more robust, linked to other things going on -- see effects on sediment chem / toxicity, impacts on benthic community, etc. so we get information that allows us to report on status of water, and resources that rely on water.	Ktunaxa Nation Council	
1	2015 Calcite Biological Study Design	Replicate sampling in a site - disturbing the site to collect benthos to spatially match the sample of calcite.	Ktunaxa Nation Council	As described in the conference call on June 29th, and reflected in the study design dated July 2015, calcite will be measured on 100 pebbles collected very near the benthic invertebrate kick sampling path. Results from sampling done this way in 2014 indicates the approach will reflect adequate spatial matching because statistically significant relationships were observed between calcite index values and numerous community endpoints.
2	2015 Calcite Biological Study Design	Use artificial stream approach to monitor calcium and benthos and do exposures in controlled ways.	Ktunaxa Nation Council	It would be very challenging (and potentially impossible based on current knowledge and technology) to accurately replicate the range of calcite and biological community conditions observed in the Elk Valley using artificial streams. Therefore, study of actual conditions within the valley is currently preferred. Potential use of artificial streams will be considered among other options if the effects of calcite cannot be adequately characterized based on direct sampling in Elk Valley streams in 2014-16.
3	2015 Calcite	As outlined, this does meet permit requirement for density. How will this	Ktunaxa Nation Council	In response to this advice, which was discussed subsequently in the conference

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	Biological Study Design	be addressed?		call of June 29th, the study design was updated to include density-based measurements. These density measurements will be made at a sub-set of 15 areas representing a range of calcite index values to determine if density is a more informative community endpoint than the others being evaluated (e.g., richness, %EPT, %E, %chironomids, and NMS Axes 1 and 2).
4	2015 Calcite Biological Study Design	Need to look at how we use the data and consider alternative ways of looking at data to address variability in assessing periphyton productivity.	Ktunaxa Nation Council	Sampling programs completed in 2013 and 2014 show inherently large within-area variability in periphyton productivity, even when the sampling approach attempts to minimize the effects of natural habitat variation by standardizing water depth, water velocity, etc. where samples are collected. Input from the EMC regarding how to further improve either sampling for 2016 program or data analysis methods for 2015 and 2016 results to reduce the effects of natural variability would be welcome.
5	2015 Calcite Biological Study Design	One year of peripypton data may not be adequate to inform next steps.	Ktunaxa Nation Council	Results from 2014 were analyzed and interpreted as input to the design for 2015. As specified in the study design, monitoring is scheduled to be completed over three consecutive years (2014-2016, inclusive).
6	2015 Calcite Biological Study Design	Need to develop criteria to determine how data will be assessed to determine future next steps.	Ktunaxa Nation Council	In response to this advice, the study design was updated to clarify that the results of the 2015 monitoring program will be discussed with the EMC along with next steps for 2016 monitoring.
7	2015 Calcite Biological Study Design	What about monitoring incident radiation with meters ... deploy this in various locations to estimate canopy. This could be way to assess light intensity. And then can normalize and adjust results based on light intensity.....	Ktunaxa Nation Council and Ministry of Environment	As noted in previous documents and communications (e.g., periphyton supporting study, study design and report for Line Creek LAEMP), periphyton coverage can be highly variable, even on the surface of individual rocks, due to the many macro- and micro-habitat variables that affect periphyton growth, including rock texture and mineralogy, water velocity across uneven rock surfaces, depth, water temperature, etc. Overall light availability depends not just on the amount of canopy, but also the stream aspect (e.g., compass direction and stream gradient relative to the sun), the time of day that measurements are made, and probably other factors. Samples collected in low versus high light conditions within two streams in 2013 were not consistent with respect to the effects of light on productivity (Minnow

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				2014 periphyton study). Therefore, it is unlikely that within-area variability can be substantively reduced or controlled through measurement of incident light. Nevertheless, densiometer readings are collected to support CABIN invertebrate samples being collected at the same areas, so the data will be available for incorporation in analysis and interpretation of periphyton endpoints.
8	2015 Calcite Biological Study Design	Design study to consider multiple stressors on benthos to create realistic exposure scenario.	Ktunaxa Nation Council	The study design takes into account that observed effects may be due to more than just calcite, such as selenium, nitrate, and/or sulphate concentrations in water.
9	2015 Calcite Biological Study Design	... we are missing interactions between stressors – is this an important Q -	Ministry of Environment	See comment above.
10	2015 Calcite Biological Study Design	Be clear at the start which biological endpoints are being evaluated.	Ministry of Environment	In response to this advice, the study design was updated to clarify the endpoints that will be evaluated and reported.
11	2015 Calcite Biological Study Design	Starting at "among the recommendations" the origins and purpose of this biological program is described. It is almost lost in the introduction and the long paragraph.	Ministry of Environment	In response to this advice, the sentence was clarified in the study design.
12	2015 Calcite Biological Study Design	Under objective 2 it would be useful here or below to briefly describe why this is the first step or what the phased approach is or what the next steps might be.	Ministry of Environment	In response to this advice, Section 1.1 of the updated study design was updated to explain the necessity of using a phased approach, the scope of which will be guided by the EMC.
13	2015 Calcite Biological Study Design	Could data not still be collected on Erickson Creek and stratified or taken out of the overall analysis?	Ministry of Environment	Data were collected in 2014 from Erickson Creek, and presented in the calcite report, but eliminated as an outlier from the figures summarizing results. Erickson Creek will also be sampled in 2015 as part of the RAEMP, along with measurements of calcite index, and results will be included in the calcite report.
14	2015 Calcite Biological Study Design	Harmer and North Thompson Creek are listed as a potential additional areas to be sampled in the text, but in the table they are only listed as an area already sampled.	Ministry of Environment	Areas of Harmer and North Thompson creeks in addition to those being repeated from the 2014 calcite study may be sampled, if field crews find that nearby reaches have notably higher or lower calcite levels but likely have similar water quality. An explanatory footnote was added to the study design to make this clearer.
15	2015 Calcite Biological Study Design	Document says samples with be collected at approximately 120 areas distributed among about 100 steams but table 2.1 list far fewer than 100 creeks. The text indicates that there	Ministry of Environment	The areas listed in Table 2.1 are considered to have highest likelihood of corresponding with the calcite index values being targeted for characterizing calcite effects on periphyton and benthic

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		are more sites from the RAEMP that will be sampled		invertebrates. They will represent about 35 areas in total, although some flexibility for in-field modification of the design is needed because 2015 calcite levels at some areas may differ from those expected based on observations in previous years. Of the areas listed in Table 2.1, 15 areas are also included in the RAEMP design (e.g., data will serve two purposes). Calcite will also be measured at the other 85 RAEMP monitoring locations because this can be done with little incremental effort; all 100 RAEMP sampling areas are shown on Figures 2.1-2.3 of the calcite effects study design and represent more than 40 streams (not 100). Multiple areas will be sampled on many streams, resulting in about 120 samples in total. The bullets in Section 1.2 of the study design and the text in Section 2.1.1 were revised to explain this more clearly. Also see response to comment #22.
16	2015 Calcite Biological Study Design	It would be helpful to have the appropriate tests identified in the study design.	Ministry of Environment	The 2014 and 2015 sampling programs represent the exploratory (baseline) phase of data collection. The lack of relevant historical data precluded definitive a priori determination of required sample sizes and statistical methods for data analyses. The goals for data analysis in 2015 were discussed with Dr. Schwarz during his review of the draft 2014 study report and the 2015 study design reflects his recommendations for paired sampling on some streams. The statistical tests for analysis of data collected in 2015 will be selected, in consultation with Dr. Schwarz and the EMC, based on the observed characteristics of the data set and the different questions the data will attempt to answer (e.g., [1] What is the calcite index value at which biological effects begin to occur?; [2] How much of the observed effect can be attributed to calcite index versus other factors such as water quality?; [3] Possibly other questions). The analyses will need to partition within- versus among-stream variance and among-year variance. This will likely be done using a linear mixed model with 'area', 'stream', and 'year' as random effects to account for repeated measures. This explanation was added to the study design. Also see response to comment #35.
17	2015 Calcite	NMS , EPT etc should be spelled out	Ministry of	The figure was updated in response to

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	Biological Study Design	in the figure description. EPT is described on the next page but NMS is not explained until a footnote on page 13.	Environment	this advice.
18	2015 Calcite Biological Study Design	DO monitoring is not being started this year.	Ministry of Environment	DO monitoring is being proposed in response to the recommendation by KNC to investigate potential calcite effects on DO levels within redds, which has not been investigated previously. As described in the study design, monitoring of potential effects of calcite on interstial oxygen levels of redds will be investigated in 2015 and implemented in 2016 based on specific recommendations from KNC.
19	2015 Calcite Biological Study Design	Could a field study be performed to investigate the behaviour of the fish trying to spawn in calcite-affected areas? Do they attempt to build a redd and then abandon the location if the substrate is too concreted? This could be done by field staff observing, or maybe by in-stream cameras.)	Ministry of Environment	Cutthroat trout typically spawn near peak freshet when high water flows and turbidity preclude direct observations of spawning behaviour or the specific locations or number of redds. Consequently, a suitable method for evaluating the effects of calcite on spawning behaviour has not yet been identified. Discussions will continue with the EMC in an effort to identify approaches that could be used to investigate calcite effects on spawning or incubation success.
20	2015 Calcite Biological Study Design	Does background/historical data exist on the number of redds at the different spawning areas that will be targeted for sampling? If so, does any of this data represent pre-calcite effects? (or different calcite conditions)	Ministry of Environment	See response above. Data regarding the number and locations of cutthroat trout redds are available only for 2015 because of unusually low flows and good water clarity. Previously, spawning locations were inferred, but could not be confirmed, based on movements of tagged fish the radio telemetry study being conducted in the upper Fording River.
21	2015 Calcite Biological Study Design	Document was well written and generally easy to read/follow. Maps are superb. Graphs are easy to read.	Independent Scientist	Thank you
22	2015 Calcite Biological Study Design	Consider a power analysis to justify the number of observations.	Independent Scientist	The calcite study is specifically targeting about 35 areas in 2015, which will likely be sufficient to define a statistical relationship between calcite and the biological endpoints (along with data from 2014). However, an unknown number of additional samples are needed to statistically tease out the relative effects from calcite from those attributable to water quality. See response to comment #15.
23	2015 Calcite Biological Study Design	Define WCT	Independent Scientist	This was corrected in the study design.

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24	2015 Calcite Biological Study Design	Tighten up sampling nomenclature	Independent Scientist	The study design was updated in accordance with the comment.
25	2015 Calcite Biological Study Design	Discuss, briefly, how normal will be quantified.	Independent Scientist	The study design has been updated to briefly explain how the "normal" range will be defined.
26	2015 Calcite Biological Study Design	Clarify number of sample areas for the 2015 program.	Independent Scientist	See response to comment #15.
27	2015 Calcite Biological Study Design	Clarify which Minnow (2015) the graphs are from (2015a,b or c?).	Independent Scientist	The graphs are modified from Minnow (2015b - the 2014 calcite study report), but the reference to Minnow 2015 in the figure caption refers to Minnow 2015c ("Statistical Evaluation of Historical Data…"), which slightly re-defined the reference ranges for community endpoint that were reported by Minnow (2014a - 2012 regional monitoring report). The figure caption has been updated.
28	2015 Calcite Biological Study Design	Clarify how many areas will be sampled.	Independent Scientist	See response to comment #15.
29	2015 Calcite Biological Study Design	Indicate that technicians have received formal training by Environment Canada to carry out the CABIN protocol, if that is the case.	Independent Scientist	All 2-person field crews will include at least one person that has completed Environment Canada's CABIN training. This was mentioned in Section 9.0 of the RAEMP design (Minnnow 2015a) which describes the Quality Management Plan for the RAEMP and will be applicable to relevant portions of the calcite study. The same crews will be involved in both programs.
30	2015 Calcite Biological Study Design	Consider eliminating idea that use of Hess would confound interpretation.	Independent Scientist	Collection of the area-based samples by a totally different method than that used in the 2015 RAEMP cycle and for the calcite monitoring in 2014 could confound attempts to compare results by introducing a new source of variability (i.e., the potential effect on results of using different methods in addition to the effect of a timed- versus area-based approach). The study design was modified to explain this.
31	2015 Calcite Biological Study Design	I recommend setting n = 15 as the minimum for quantitative samples unless power analyses can justify fewer.	Independent Scientist	The study design has been updated to say 15 areas will be targeted.
32	2015 Calcite Biological Study Design	Clarify what 'location' means, or use 'area'.	Independent Scientist	The study design was updated to say "area".
33	2015 Calcite	Say when WCT work was done. Give	Independent	Sampling occurred June 7-11, 2015 and

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	Biological Study Design	actual dates since it already happened.	Scientist	this has been noted in the updated study design.
34	2015 Calcite Biological Study Design	Description of the statistical approaches should be more fully described.	Independent Scientist	See response to comment #16.
35	2015 Calcite Biological Study Design	Consider incorporating the noted statistical variations in the comment.	Independent Scientist	Invertebrate samples have been identified to LPL but, based on exploration of data from the 2012 regional monitoring program, family-level taxonomy was ultimately chosen for data analysis and interpretation. As discussed by Bailey et al. (2005) variability associated with the "use of LPL in RCA designs that cover large geographic areas can result in reduced detection of difference from reference areas relative to that of family level taxonomy". This is because use of family level taxonomy tends to reduce (improve) confidence limits surrounding reference community endpoints. However, potential use of LPL will be considered again during initial statistical exploration of the data collected in 2015. Agree with suggestions 2 to 4. The study design was updated accordingly.
36	2015 Calcite Biological Study Design	Indicate how variation among years will be dealt with.	Independent Scientist	See response to comment #16.
37	2015 Calcite Biological Study Design	Justify sample sizes perhaps on the basis of power analysis.	Independent Scientist	See response to comment #22.
38	2015 Calcite Biological Study Design	The study should include a problem formulation that describes the linkages between sources and releases of calcite precursors (i.e., calcium, carbonate, pH influencing variables), fate and transport of calcite precursors, exposure pathways and modes of toxicity, and receptors potentially at risk. Such a problem formulation will provide a basis for identifying assessment endpoints (survival and growth of periphyton, survival, growth, and reproduction of benthic invertebrates, and reproduction of fish) and measurement endpoints (e.g.,periphyton ash-free dry weight, total abundance of benthic invertebrates, etc.).	Ktunaxa Nation Council	The study is currently focused on simple characterization of the relationships between the amount of calcite present (CI) and biological endpoints indicative of potential effects. This advice will be taken into account if future management decisions related to mitigating calcite effects necessitate better understanding of calcite precursors and mechanisms of calcite effects.
39	2015 Calcite Biological Study Design	The study plan identifies a series of measurement endpoints, without providing clear rationale for their selection. It is not sufficient to indicate that the measurement endpoints were	Ktunaxa Nation Council	The assessment endpoints for the calcite effects study are consistent with those being used in the RAEMP, namely effects on benthic invertebrate community structure (with measurement endpoints of

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#	Submission	Input and Advice	EMC Member	Teck Response
		selected because they were used in the 2014 monitoring program. Based on the requirements identified in EMA Permit 107517, the study must "include multiple locations and assess seasonal variation in the rate of calcite formation or dissolution, water quality, and presence and density of algae, and the presence and density of benthic invertebrates.		richness, %ETP, %E, %chironomids, NMS Axis scores, and potentially others such as total abundance, abundance or proportions of other dominant taxa, or community indices, depending on results of exploratory data evaluation) and effects on periphyton productivity (with measurement endpoints of chlorophyll-a and ash-free dry mass). Water quality is being measured at all biological sampling areas. Periphyton density and community structure (and calcite) will be reported for the 100 areas sampled as part of the RAEMP. Density of invertebrates will be reported at a sub-set of 15 areas. A separate study is also underway to investigate seasonal variation in calcite formation and dissolution. The results will be analyzed and interpreted in consultation with the EMC to determine if additional future study is required to support management decisions related to mitigation of calcite effects.
40	2015 Calcite Biological Study Design	The measurement endpoints for this study must, at minimum, include the following: 1. Periphyton biomass (as measured by chlorophyll a and ash-free dry mass per unit areas); 2. Periphyton community structure (as measured as abundance of major taxonomic groups; i.e., percent greens, percent blue-greens, percent diatoms, etc.); 3. Benthic invertebrate abundance (as measured by total abundance, abundance of Ephemeroptera, Plecoptera, Tripchoptera [EPT] taxa, abundance of stoneflies, abundance of caddisflies, abundance of mayflies, abundance of chironomids, etc.); 4. Benthic invertebrate density (as measured by number of each taxon/m2) 5. Benthic invertebrate taxon richness (as measured by species richness, genus richness, family richness, etc.); 6. Benthic invertebrate diversity and equitability (e.g., as measured using	Ktunaxa Nation Council	See response to 18, 19 and 39 above.

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		Simpson's diversity index, evenness, etc.); and, 7. EPT Index. For fish, it will be difficult to measure the effects of calcite accumulation on reproductive success directly. For this reason, indirect measurements of reproductive success should be made within known and suspected spawning locations (e.g., streambed permeability, inter-gravel dissolved oxygen concentrations). A literature review should be conducted that summarizes the existing literature on the methods for evaluating effects on fish associated with changes in streambed permeability and other analogs of calcite formation. The results of this literature review should be provided to the EMC in the form of a discussion paper on approaches for evaluating the effects of calcite deposition on fish and fish reproduction.		
41	2015 Calcite Biological Study Design	The study plan indicates that periphyton and benthic invertebrate samples will be collected in 60 mine-exposed areas and 41 reference areas. However, no rationale was provided for selecting 101 sampling areas or allocating them among the mining-exposed and reference tributaries. The text needs to indicate why 101 sampling locations is sufficient to provide the information needed to understand the relationship.	Ktunaxa Nation Council	See responses to comments #15, 16, and 22.
42	2015 Calcite Biological Study Design	The study plan indicates that periphyton and benthic invertebrate samples will be collected at 40 reference areas to statistically define normal conditions. However, defining normal conditions for the periphyton or benthic invertebrate communities is not identified as a study objective. Rather, the study is being conducted to "further characterize the relationships between	Ktunaxa Nation Council	The 40 reference areas are being sampled concurrently as part of the RAEMP, not specifically for the calcite study, but the data will serve both programs. By statistically defining normal conditions for periphyton and invertebrate endpoints we can identify areas where conditions can be considered indicative of stressor effects. In the context of the calcite study, we seek to identify the level of calcite associated with community characteristics that are outside of the

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		degree of substrate calcification and benthic invertebrate community structure and periphyton productivity". If so, why is 40% of the sampling effort being directed at sites that are not mining affected. A better approach would be to direct most of the sampling effort toward mining-influenced locations with a gradient of calcite levels (i.e., with a CI ranging between 0.5 and 1.5).		normal range. The majority (80 of ~120) of total sampling areas are mine-influenced areas, and the 2015 calcite study is specifically focussing on sampling the limited number of areas having CI around 1-1.5, which is consistent with the advice provided.
43	2015 Calcite Biological Study Design	The current study design will not result in matching calcite index and biological effects data. More specifically, the design will provide information on calcite index, as determined using a longitudinal transect within a 100 m stream section, whereas the benthic invertebrate community structure data will be collected within a single cross-sectional transect selected within the 100 m stream section. For this design to be appropriate, it would need to be demonstrated that multiple longitudinal transects sampled within a 100 m stream section yield the same estimates of calcite index AND multiple cross-sectional transect samples within the 100 m stream section yield the same estimates of benthic invertebrate community (and periphyton) metrics. Therefore, the study design should be refined to support the collection of matching calcite and biological effects data.	Ktunaxa Nation Council	As described in the calcite effects study design, the regional calcite monitoring program involves sampling pebbles over numerous 100-m areas throughout the watershed, whereas, for the biological effects study, calcite index is being measured on 100 pebbles collected in the immediate vicinity of where benthic invertebrate and periphyton are sampled (e.g., a 10-20 m area within the 100-m areas sampled for the regional monitoring) to avoid sampling where disturbance of substrate has already occurred. At a sub-set of 15 areas being targeted specifically for the calcite effects study, triplicate density-based invertebrate kick samples will be collected. Also, as described in the RAEMP design, three samples are being collected in each area for periphyton community assessment. Replicate samples are being collected at a subset (~10%) of areas to evaluate within-area variability for invertebrate communities (3 per area) and periphyton productivity (10 per area). Therefore, the current sampling design involves both spatial matching of biological and calcite measurements and replication of samples for assessment of within area variability.
44	2015 Calcite Biological Study Design	The study design indicates that biological sampling will utilize CABIN-based protocols, which do not support the evaluation of the density of benthic organisms (as required under EMA Permit 107517). Therefore, this study, the Regional Aquatic Effects Monitoring Program (RAEMP), and the Seasonal Calcite Supporting Study will not satisfy the requirements identified in EMA Permit 107517.	Ktunaxa Nation Council	As noted in the study design, triplicate density-based kick samples will be collected in 15 areas representing a range of CI values.
45	2015 Calcite Biological Study	There is a need to collect matching calcite and biological effects data	Ktunaxa Nation Council	See response to comment #43.

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	Design	within the study area. This can be achieved using a replicate sampling-based approach that employs quantitative sampling methods to collect calcite benthic invertebrate samples (e.g., using cylindrical Hess samplers; Beatty et al. 2006). Using this approach, 10-20 pebbles within the Hess sampler can be inspected to determine calcite presence/absence and degree of concretion. Then, the pebbles can be returned to the sampler to facilitate benthic invertebrate sampling. Such a sampling design will require collection of multiple (i.e., 5 to 10) replicate samples at each sampling station on each sampling date to evaluate the relationship between calcite index and the nature and magnitude of biological effects.		
1	Periphyton Supporting Study Design	Test the effectiveness of using artificial substrates to assess periphyton community structure or provide rationale for using only natural substances. Use of artificial substrates may reduce uncertainty associated with differences in substrates within and across sampling locations.	Ministry of Environment	
2	Periphyton Supporting Study Design	Ensure that the sampling design, study implementation and results analysis are consistent with the core RAEMP. For example, sample full suite of water chemistry parameters (synchronized with core RAEMP sampling) as periphyton has a strong relationship to stream chemistry.	Ministry of Environment	
3	Periphyton Supporting Study Design	Obtain sample rocks randomly (i.e., bend down to lightly touch the bed sediments without looking at what is there) from equally spaced intervals/transect or provide rationale for how the collection design is randomly structured. Randomly collected rocks will help reduce bias	Ministry of Environment	

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		(i.e., systematic error) (Biggs, 2000).		
4	Periphyton Supporting Study Design	Include rapid assessment procedures, in which the colour and thickness of algae are noted at each site (Biggs, 2000).	Ministry of Environment	
5	Periphyton Supporting Study Design	Include laboratory analysis on Percent Aberrant Diatoms: The percent of diatoms in a sample that have anomalies in striae patterns or frustule shape (i.e, long cells that are bent or cells with indentations) (Barbour et al. 1999). Some anthropogenic contamination can contribute to diatom frustule. An examination of the proportional abundance of these deformities has the potential to be used as a measure of metal contamination.	Ministry of Environment	
6	Periphyton Supporting Study Design	Integrate diatoms and soft algae in as many metrics as possible, especially in cases such as species and generic richness when great variability in relative abundance is not an issue (Barbour et al. 1999).	Ministry of Environment	
7	Periphyton Supporting Study Design	The statistical analysis of the evaluation of the periphyton community data is focused on using a Reference Condition Approach through use of Benthic Assessment of Sediment (BEAST) and Assessment by Nearest Neighbour Analysis (ANNA). While this approach is supported, also evaluate samples collected from upstream and downstream method (i.e, before-after control-impact style of analysis). This method will aid in assessing any differences in sensitivity between the two methods and controlling for inter-annual and inter-seasonal variation.	Ministry of Environment	
8	Periphyton Supporting Study Design	Where possible, compared the data at species level. Comparison of 2013 to 2015 data may not be useful if the emphasis is at the genus level, as that level likely can't determine any year to year variability or implication.	Ministry of Environment	
9	Periphyton Supporting Study Design	Evaluate climatic conditions between 2013 and 2015, such as seasonal and interannual variation in precipitation and temperature in the results assessment to evaluate changes in the periphyton community.	Ministry of Environment	
10	Periphyton	Include raw data (i.e, in appendix) in	Ministry of	

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	Supporting Study Design	the report for 2013 and 2015, including periphyton, benthic invertebrates and water quality in a format so that a comprehensive review can be conducted.	Environment	
11	Periphyton Supporting Study Design	Key study goals include comparing results to those obtained in 2013. However, it is not stated whether samples locations or methods are consistent to those performed in 2013. Whether the sampling methods and site locations are equivalent as used in 2013 should be confirmed. If changes exist, they should be emphasized with rationale.	Ministry of Environment	
12	Periphyton Supporting Study Design	The collection of samples with pre-defined choices of habitat variables will assist with data standardization and ease comparisons across multiple sites (i.e., only sampling riffle habitat). However, if mining-induced eutrophication is or may be occurring, slower moving pool or glide habitat may be areas impacted. These sites (i.e, upstream and downstream of West Line Creek Active Water Treatment Facility) should be considered as it will help answer key study goals.	Ministry of Environment	
13	Periphyton Supporting Study Design	Sampling is to occur in September as it's similar to 2013 and concurrent to collection of benthic invertebrate samples. While sampling in September has benefits, it may not represent peak periphyton biomass. The periphyton community in September has likely been subject to grazing pressure (i.e., implications on community structure). July may represent peak periphyton biomass and sampling throughout the growing season should be considered for seasonal differences. Sampling benthic algae during peak biomass may best detect nutrient problems. Other periods in the year when response in community structure could be more sensitive to contaminants of concern and linked to subsequent response in benthic invertebrates should be assessed.	Ministry of Environment	
14	Periphyton Supporting Study Design	Where possible, the data should be compared to other periphyton studies in the Elk Valley.	Ministry of Environment	
15	Periphyton	The methodologies for how sample	Ministry of	

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	Supporting Study Design	splitting will be performed should be included and/or clarified to ensure sample bias does not occur.	Environment	
16	Periphyton Supporting Study Design	When completing the sampling design, implementing the program and reporting results, Teck should consider that periphyton community structure may be uniquely placed in the ecosystem as an early indicator of nutrient enrichment in addition to potentially indicating effects from calcite and Order, or other water quality, constituents.	Ministry of Environment	
17	Periphyton Supporting Study Design	It is important to note that data collected to evaluate periphyton community structure may provide additional and certainly unique information (e.g., changes in primary productivity, eutrophication, shifts in structure to inedible or harmful species) to evaluate the potential for adverse effects related to coal-mining operations.	Ktunaxa Nation Council	
18	Periphyton Supporting Study Design	An additional key question that should be included as a study objective is to determine if periphyton community structure provides unique information in the evaluation of potential adverse effects related to coal-mining operations to distinguish it as a valuable line-of-evidence.	Ktunaxa Nation Council	
19	Periphyton Supporting Study Design	It is stated that the periphyton samples will be collected at the same locations and at the same time as the benthic invertebrate samples collected as part of the Regional Aquatic Effects Monitoring Program (RAEMP). However, it is not stated whether or not these sampling locations and times (i.e., September) are consistent with the sampling locations and times. As the main objective of the study is to determine the effectiveness of using periphyton community data to assess the potential for adverse effects related to coal-mining operations by, in part, comparing the results to the 2013 results, the section would benefit by including a summary of the previous sampling design. In addition, if the sampling designs are discordant, including specific details regarding the assumptions and uncertainties of such a comparison are warranted.	Ktunaxa Nation Council	

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20	Periphyton Supporting Study Design	During the development of the Elk Valley Water Quality Plan, the Technical Advisory Committee (TAC) recommended that periphyton monitoring be conducted during peak periphyton biomass. While the goal of collecting samples during September is to have synoptic periphyton and benthic invertebrate samples, the periphyton community has likely been subject to significant grazing pressure (with implications for community structure) at this stage of the season (i.e., coinciding with peak benthic invertebrate biomass). However no reference to this recommendation is provided in the draft study design.	Ktunaxa Nation Council	
21	Periphyton Supporting Study Design	Tables 2 and 3, as well as Figures 1 - 3, which are referenced in the draft study design are not included in the October 31 version reviewed here. These tables and figures are important to the review of the sampling locations and should be provided.	Ktunaxa Nation Council	
22	Periphyton Supporting Study Design	During discussions on the RAEMP, BCMOE recommended that the potential for use of artificial substrates to assess periphyton community structure be explored as a way of reducing the uncertainty associated with differences in substrates within and across sampling locations; KNC supports the exploration of this approach to assessing periphyton community structure. However, the topic of artificial substrates is not addressed in this study design. The potential for use of artificial substrates to assess periphyton community structure needs to be explored.	Ktunaxa Nation Council	
23	Periphyton Supporting Study Design	It is inferred from the draft study design that this study is a single-year study. No rationale is provided to state that objectives of the study can be achieved within this time-frame. Our concerns with a single year study, include: > Are the sampling methods proposed in this draft study design consistent with the procedures used in 2013, such that direct comparisons to those results can be made? > Based on data and information collected previously, is it expected that	Ktunaxa Nation Council	

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		there is substantial inter-annual variability in periphyton community structure, such that it is difficult to determine if there is the potential for adverse effects related to coal-mining operations in a single year?		
24	Periphyton Supporting Study Design	The draft study design does not state the taxonomic level to which the samples will be identified. However, it is assumed that organisms would be identified to the species level when possible. This should be explicitly stated in this section.	Ktunaxa Nation Council	
25	Periphyton Supporting Study Design	The Ontario Ministry of Environment has developed a standardized protocol for use in periphyton assessments that could be adapted for use in the Elk Valley (OMOE 2011). The adoption of this type of standardized protocol for sample collection, identification, and analysis may help in explaining the observed variability in samples collected within and across stations.	Ktunaxa Nation Council	
26	Periphyton Supporting Study Design	The statistical analysis of the periphyton data will be conducted using a Reference Condition Approach (RCA), analogous to the analysis of the benthic invertebrate community structure data. It is recommended that at minimum, the synoptic upstream and downstream samples collected to evaluate recruitment, be collected in a manner that facilitates a before-after control-impact style of analysis to evaluate any differences in sensitivity between the two methods to evaluate productivity and changes to the periphyton community.	Ktunaxa Nation Council	
27	Periphyton Supporting Study Design	It is implied, but not stated explicitly, that the stations identified and used to characterize the reference condition for the benthic invertebrate sampling program would be used to characterize the reference condition for periphyton community assessment. No evaluation of the habitat variables that are of highest import to the periphyton community has been provided in the study design to ensure that the reference stations used in the benthic invertebrate sampling program are appropriate for use in the periphyton sampling program.	Ktunaxa Nation Council	
28	Periphyton	The draft study design infers that the	Ktunaxa Nation	

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	Supporting Study Design	contracted laboratory is not the same lab that analyzed the 2013 periphyton samples. As the main objective of the study is to determine the effectiveness of using periphyton community data to assess the potential for adverse effects related to coal-mining operations by, in part, comparing the results to the 2013 results, it is unclear how well inter-annual variability can be described. Therefore, extending the supporting study beyond a single year is warranted.	Council	
29	Periphyton Supporting Study Design	It is stated that additional statistical approaches may also be considered in consultation with Dr. Carl Schwarz and BCMOE; KNC and their consultants should be added to this list.	Ktunaxa Nation Council	
30	Periphyton Supporting Study Design	It is not stated in this section of the draft study design how the data collected from this effort will be used to address the questions that this study is meant to address: > Is periphyton community assessment a useful indicator of potential coal-mine related effects on the aquatic environment? Reproducibility and reliability of data will be assessed as part of this question; > Is periphyton community more or less sensitive to potential effects of coal mining than benthic invertebrate community assessment? > Are periphyton productivity measures a suitable surrogate for periphyton taxonomy? And the additional question, posed above: > Does periphyton community structure provide unique information in the evaluation of potential adverse effects related to coal-mining operations to distinguish it as a valuable line-of-evidence?	Ktunaxa Nation Council	
31	Periphyton Supporting Study Design	A priori evaluation criteria should be developed within the study design to allow reviewers to determine the likelihood that the study design will generate the data required to answer these questions. For example, it is stated that reproducibility and reliability of data will be assessed to answer whether or not periphyton community assessment is a useful indicator of potential coal-mine related effects on the aquatic environment. To achieve	Ktunaxa Nation Council	

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		this, it is proposed that information on within-station variability (i.e., using replicates) may be used to assess reproducibility; however, no specific criteria are proposed for determining if the data are indeed reproducible or reliable.		
32	Periphyton Supporting Study Design	It is stated that the collected data will be used to investigate whether productivity endpoints may act as surrogates for community changes identified through detailed taxonomic evaluation. Without information on what specific analyses will be used to conduct this evaluation, it is difficult to determine whether or not the proposed study design will generate the data needed to conduct this type of analysis.	Ktunaxa Nation Council	
33	Periphyton Supporting Study Design	Given that extensive work has been conducted by Minnow Environmental Inc. on the inter-laboratory variability in the taxonomic identification of previously collected samples, it is presumed that the second independent taxonomist would be using the same standard operating procedure (SOP) and taxonomic keys. This should be stated here explicitly.	Ktunaxa Nation Council	
34	Periphyton Supporting Study Design	It is not stated in this section of the draft study design how the "flagged" samples will be treated in the analysis of the data. It may be appropriate to re-analyze all samples that exhibit a greater than 20% exceedance of any dominant species, to ensure that interpretation of the results in the context of evaluating reproducibility, reliability, and sensitivity is robust.	Ktunaxa Nation Council	
35	Periphyton Supporting Study Design	It is expected that the report will include the raw data in an Appendix and be made available to reviewers (in Excel format) so that a comprehensive review can be conducted.	Ktunaxa Nation Council	
36	Periphyton Supporting Study Design	How will the results of this study be used to determine if this is an "important" line of evidence?	Ministry of Environment	
37	Periphyton Supporting Study Design	How will this "sensitivity" be measured and presented?	Ministry of Environment	
38	Periphyton Supporting Study Design	How will "surrogate suitability" be measured?	Ministry of Environment	

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39	Periphyton Supporting Study Design	Are there any other periods in the year when response in community structure could be more sensitive to COPCs and be linked to subsequent response in inverts?	Ministry of Environment	
40	Periphyton Supporting Study Design	Drift algae sampling is mentioned in the Lab Analysis section - not mentioned here	Ministry of Environment	
41	Periphyton Supporting Study Design	Do you mean Table 5.1 in the final RAEMP design? A subset of those areas listed in Table 5.1?	Ministry of Environment	
42	Periphyton Supporting Study Design	Is this a lake sampling protocol (e.g. plankton tow)? This is not discussed in the sample collection section.	Ministry of Environment	
43	Periphyton Supporting Study Design	Invert food?	Ministry of Environment	
44	Periphyton Supporting Study Design	Please identify how variation will be communicated (conf intervals / std dev)	Ministry of Environment	
45	Periphyton Supporting Study Design	Is the plan to only use one of the replicates per area for analysis except in some cases analyze all 3 or pool all 3 replicates for analysis & in some cases analyze the 3 separately? a bit confused	Ministry of Environment	
46	Periphyton Supporting Study Design	Need to communicate clear rationale for the taxonomic level at which data is reviewed & analyzed	Ministry of Environment	
47	Periphyton Supporting Study Design	This is happening because you are redefining the taxonomy and applying that to all 2013 and 2015 data? Are there multiple taxonomists used in the 2015 assessment? a bit confused	Ministry of Environment	
48	Periphyton Supporting Study Design	Again, wondering how the 'surrogate suitability' will be measured/characterized.	Ministry of Environment	
49	Periphyton Supporting Study Design	I assume this second taxonomist will be using the same taxonomic definitions and methods	Ministry of Environment	
50	Periphyton Supporting Study Design	Please attempt to understand and explain outliers.	Ministry of Environment	
1	Sediment Toxicity Supporting Study Design	This study should be designed to provide an additional line of evidence for evaluating the effects on benthic invertebrates associated with exposure to mine-related contaminants. In	Ktunaxa Nation Council	In response to this advice, additional samples for long term toxicity testing were added to the final study design (7 instead of 3). All recommended toxicity tests were included in the design based on

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		addition, the study should be designed to evaluate the sensitivity of he 42-d toxicity test with amphipods and the 56-d toxicity test with midge, relative to the shorter duration toxicity tests that were used in the 2011 or 2013 investigations.		consultation with KNC and MOE representatives. The results will be reviewed on consultation with the EMC to determine which test species, endpoint(s) and duration(s) provide the most useful information for management.
2	Sediment Toxicity Supporting Study Design	The design of the sediment chemistry monitoring component of the program should be expanded to provide broad spatial coverage of the study area, including both depositional and transitional habitats (see the recommended number of site samples and reference samples provided in Section 3.0).	Ktunaxa Nation Council	"The study design states that, following the initial study in 2015, if toxicity is observed, the investigation will proceed to the next phase, during which the following approaches will be considered: • Evaluation of sediments in ""transitional"" habitats; • Confirmatory toxicity testing of sediments in the affected area(s) [using the most appropriate and sensitive test duration(s) and species]; • Assessment of pore water chemistry; • Toxicity identification evaluation studies; • Concurrent evaluation of in situ benthic invertebrate community structure; and/or • Evaluation of toxicity associated with the overlying water column. The sediment chemistry program is part of the approved RAEMP study design."
3	Sediment Toxicity Supporting Study Design	Redesign the sediment chemistry monitoring program to include at least 10 candidate reference areas. Such a design will provide a robust basis for selecting reference areas that will be included in the sediment toxicity component of the program. The sampling program should not target reference locations with elevated levels of metals or PAHs, but rather should be designed to understand the natural background range of chemicals of potential concern (COPCs) concentrations.	Ktunaxa Nation Council	The sediment chemistry program does not specifically target reference areas with elevated COPCs, but instead includes reference areas that represent a range of natural reference conditions (e.g., varying natural levels of COPCs). Some reference areas were sampled in 2013 and 2 new locations have been added, which will result in data for a total of 10 reference areas (between the 2013 and 2015 programs) that can be used as a basis for evaluating concentrations in sediments sampled in mine-exposed areas in 2015.
4	Sediment Toxicity Supporting Study Design	A standard definition of reference sediment should be adopted for use in the study. For example, USEPA (2000) and ASTM (2014 - E1706) define a reference sediment as "A whole sediment near an area of concern used to assess sediment conditions exclusive of material(s) of interest. The reference sediment may be used as an indicator of localized sediment conditions exclusive of the specific pollutant input of concern. Such	Ktunaxa Nation Council	The way reference areas have been defined for the sediment program is consistent with the advice provided. None of the reference areas are downstream of mining activities and thus reflect regional background conditions. Also see response to Comment #3.

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		sediment would be collected near the site of concern and would represent the background conditions resulting from any localised pollutant inputs as well as global pollutant input". The following definition of a reference sediment is recommended: A reference sediment is a whole sediment that is collected near the area of concern that is used to define background concentrations of COPCs and to evaluate the background levels of sediment toxicity.		
5	Sediment Toxicity Supporting Study Design	Eliminate the study objective that is focussed on evaluation of temporal differences in sediment chemistry between 2013 and 2015. If this is to be an objective of the monitoring program going forward, then the design of the monitoring program needs to be sufficiently robust to meet this objective. In particular, the sediment chemistry sampling component of the program must include a sufficient number of samples in each sampling area to facilitate statistical comparison of results collected during two or more time periods.	Ktunaxa Nation Council	Many of the sampling areas are small, so collection of 6 to 8 cores at each of 5 stations per area will yield data that are adequately spatially representative and will also quantify spatial variability within and among areas. Graphs comparing historical concentrations of COPCs in sediment to those observed in 2015 will be included in the report. Data from 2013 and 2015 will also be statistically analyzed to identify the "effect size" that could be reasonably detected over time based on observed spatial and temporal variability.
6	Sediment Toxicity Supporting Study Design	The sediment toxicity component of the study should be redesigned to include measurements of COPCs in pore water sampled at the start of the exposures (e.g., by centrifugation), including conventional variables, major ions, dissolved organic carbon, pH, ammonia, nutrients, and metals. The pore water should also be obtained using peepers placed in chemistry-only replicates prepared with the amphipod exposures to sample COPCs.	Ktunaxa Nation Council	The study design states that, following the initial study in 2015, if toxicity is observed, the investigation will proceed to the next phase, during which the following approaches will be considered: • Evaluation of sediments in ""transitional"" habitats; • Confirmatory toxicity testing of sediments in the affected area(s) [using the most appropriate and sensitive test duration(s) and species]; • Assessment of pore water chemistry; • Toxicity identification evaluation studies; • Concurrent evaluation of in situ benthic invertebrate community structure; and/or • Evaluation of toxicity associated with the overlying water column.
7	Sediment Toxicity Supporting Study Design	The sediment toxicity component of the study should be redesigned to include testing of a minimum of 24 sediment samples from mine affected areas and a minimum of six (6) sediment samples from reference areas. This design will facilitate testing	Ktunaxa Nation Council	As reflected in the study design, the 2015 sediment toxicity testing program will evaluate potential sediment toxicity associated with samples collected from a sub-set of areas that are being sampled for sediment chemistry in the RAEMP. The areas will be selected in consultation

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		of sediment samples from a range of exposure areas and provide sufficient information for developing a reference envelope to support interpretation of the resultant data.		with the EMC once chemistry data are available (early September) and the testing will include the recommended suite of test organisms and test durations. Testing of additional areas and potential inclusion of other investigative techniques (see response to comment #2) will be considered following completion of this assessment.
8	Sediment Toxicity Supporting Study Design	Develop an alternative design to support sediment toxicity testing in the Elk River Watershed (See Section 3.0 for specific guidance on the development of an alternative study design).	Ktunaxa Nation Council	The study design was revised to include toxicity testing on sediments collected from 7 areas. Data for each test will be statistically analyzed according to the respective test method. The test results will be evaluated in consultation with the EMC to identify which test species, endpoint(s), and duration(s) provide the most useful information for management.
9	Sediment Toxicity Supporting Study Design	The objective of this study should be to evaluate sediment chemistry and toxicity in exposure areas located proximal to discharges from the mine sites. Such areas may not be located within strongly depositional habitats. However, low gradient streams still accumulate fine sediment in the streambed. Such fine-grained sediments can be sampled using methods that are appropriate for these habitats, such a modified Besser samplers [e.g., to a depth of about 10 cm based on USEPA (2000) and ASTM (E1706; 2014) guidance]. Sediments from such areas can and should be collected and tested in the sediment toxicity supporting study. Sediments from all sampling locations should be press sieved to <2.00 mm in the field (using sieve buckets or other appropriate methods).	Ktunaxa Nation Council	Sampling to a depth of 2 cm is justified, as that is the depth at which the majority of benthic invertebrates reside (Kirchner 1975). Deeper samples may influence results through incorporation of historical chemical deposits or cleaner sediments into the sample, which could confound interpretation of the newly deposited (surface) sediments to which organisms are exposed. Tests that involve separation of fine sediments from the coarse surrounding matrix are difficult to interpret because the consequences of physical sample manipulation (e.g. press sieving of wet sediments) on chemical speciation and bioavailability are unknown and results are not indicative of the whole substrate matrix to which organisms are exposed (i.e., both coarse and fine particles). The 2015 design focuses sampling on areas most likely to represent "worst-case" sediment conditions, which are slow flowing habitats (including several low-gradient stream habitats) where fine sediment particles accumulate along with any constituents that have tendency to adsorb to particles. Potential future testing of additional areas (e.g., low gradient streams) will be considered depending on results of the 2015 program.
10	Sediment Toxicity Supporting Study Design	A number of candidate reference areas should be identified based on their proximity to mine-affected areas, absence of mine influence, and likely absence of contaminants of interest. While it is understood that local mineralogy results in some candidate	Ktunaxa Nation Council	As noted in responses to comments #3 and #4, reference areas being evaluated for sediment chemistry have been selected to represent a range of natural conditions within the region (i.e., uninfluenced by mining). Of those being assessed for chemistry, the two reference

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		reference areas having somewhat elevated levels of certain metals and/or PAHs. Such areas should not be targeted for the purpose of obtaining reference sediment samples. Rather, reference sediment samples (by definition) should be collected in areas that have low levels of contaminants.		areas to be sampled for toxicity testing will be determined in consultation with the EMC following receipt and evaluation of sediment chemistry data.
11	Sediment Toxicity Supporting Study Design	All 34 parent and alkylated PAHs identified in USEPA (2003) should be measured in each sediment sample that is collected.	Ktunaxa Nation Council	Parent and alkylated PAHs will be measured in sediment samples collected for toxicity testing.
12	Sediment Toxicity Supporting Study Design	It is recommended that a phased-approach be used to select toxicity-based methods for assessing effects on the benthic community that includes the following: (see Section pg 8 - 9 of KNC document)	Ktunaxa Nation Council	The recommended suite of toxicity test species and test durations shown on Pages 8-9 of the KNC document was incorporated into the sediment toxicity study design. Also, see response to Comment #2, above. Teck will continue to work with the EMC to address concerns related to the approach being used for benthic invertebrate community assessment within the RAEMP.
13	Sediment Toxicity Supporting Study Design	EIS would like to know the a priori thresholds for 'evidence' and 'obvious' in these two questions posed (among others) in the Introduction: > Is there evidence of elevated concentrations of mine-related constituents in sediment relative to reference concentrations and provincial sediment quality guidelines? > Are there any obvious changes in sediment chemistry since 2013?	Ministry of Environment	All sediment chemistry results will be compared to reference area concentrations and provincial sediment quality guidelines (SQGs). Constituents that exceed both reference area concentrations and SQGs will be interpreted as probable "evidence" of mine-related influence and the data will be scrutinized for patterns that support that hypothesis (e.g., higher concentrations of a relatively consistent suite of constituents in areas closest to major mine load sources would represent further evidence). Graphs comparing concentrations in sediment in 2015 to those observed in 2013 will illustrate any visually "obvious" changes, but statistical tests will also be applied to test for differences between mine-exposed and reference areas as well as between years for any constituents that appear to be mine-related based on the "evidence" described above. The availability of two years of sediment data (2013, 2015) collected using the same methods will allow for quantification of variability within and among areas, and over time. This information can then be used to identify the magnitudes of difference for mine-related constituents that will be statistically detectable between reference and mine-exposed areas and over time (i.e., critical effect sizes) based on various realistic

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				scenarios of sampling frequency and replication. These statistical results will serve as input to the design for future sediment monitoring, if warranted.
14	Sediment Toxicity Supporting Study Design	EIS understands from the Sample Collection and Chemical Analysis section that there will be three concurrent tests for the additional "sensitivity evaluation" of different endpoints (they add reproduction endpoints and longer durations to the test suite) and that results of these tests will be used to inform the usefulness of ongoing sediment chemistry and toxicity sampling. EIS believes that these extra tests may add to the understanding of the relative sensitivity of the tests proposed and that the limited number of the extra tests necessarily limits the power to completely resolve the 'usefulness' of the various tests that could be implemented in the future. EIS expects that the results will be discussed in the context of the rationale for test selection that is presented in the Dec 2014 submission and within the context of the larger body of science and ongoing research.	Ministry of Environment	In response to this advice, additional samples for long term toxicity testing were added to the final study design (7 instead of 3). All recommended toxicity tests were included in the design based on consultation with KNC and MOE representatives. The results will be reviewed on consultation with the EMC to determine which test species, endpoint(s) and duration(s) provide the most useful information for management.
1	Seasonal Calcite Supporting Study Design	The Study Design is signed off by a professional engineer. Since part of this study will assess potential relationships between calcite formation and biological effects, please confirm that this professional designation is appropriate.	Ministry of Environment	This phase of the study will attempt to find sites where seasonal variation does exist, so that the next phase of the study can evaluate biological effects if/where seasonal variation is identified. The professional engineer has signed off on this phase of the study only.
2	Seasonal Calcite Supporting Study Design	Future documents should include page numbers and numbered tables for more efficient reviewing and should be dated.	Ministry of Environment	Done.
3	Seasonal Calcite Supporting Study Design	Naming conventions for sample locations in the Study Design are inconsistent with the Permit and the Regional Aquatic Effects Management Program (RAEMP) Study Design, both of which will include sampling (water quality, benthic invertebrate and periphyton) that will inform the calcite study. A table should be provided that clearly correlates the site names from all related documents so that overlaps between sites, or lack there-of, can be confirmed.	Ministry of Environment	Done.
4	Seasonal Calcite	Data that will be assessed as part of	Ministry of	The revised table and map show the

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	Supporting Study Design	this Study Design include water chemistry, benthic invertebrates (BIs), and periphyton. These data will presumably be collected by different groups as they align with different pieces of the Elk Valley monitoring program (i.e. via the Permit and the RAEMP). The author(s) of the Study Design should provide evidence of communication with each of the groups to confirm that data collection will occur at the same sites and at similar times. Furthermore, since the RAEMP Study Design for 2015-2018 is still in the process of being finalized (personal communication with Sheldon Reddekopp, March 23, 2015), how will the authors ensure that their sites and sampling schedules will overlap with the calcite sampling?	Environment	locations of the seasonal calcite study and the overlapping locations from the RAEMP. The seasonal calcite study will take place over the entire year, ensuring temporal overlap with RAEMP. The program for the 2015 RAEMP is still being finalized; Teck will ensure that the sites in the 2015 study will overlap with the seasonal calcite study.
5	Seasonal Calcite Supporting Study Design	The RAEMP Approval Letter, dated November 14, 2014, states in bullet 4 that, "Teck shall complete the assessment to determine the potential relationships between calcite and benthic invertebrate community structure, periphyton productivity, and fish spawning and incubation success." This Study Design does not mention fish spawning or incubation success; the Proponent should identify when this aspect of the calcite program will occur.	Ministry of Environment	The evaluation of calcite biological effects is being completed as a separate supporting study to the RAEMP; study design will be provided to the EMC for review and input as discussed during June 29th conference call. Fish spawning or incubation success will be considered as part of the biological effects supporting study and is not a component of the calcite seasonal supporting study.
6	Seasonal Calcite Supporting Study Design	The Proponent proposes to assess the seasonality of calcite formation and potential dissolution in 2015. Calcite-specific BI and periphyton monitoring are not scheduled for monitoring in 2015, although the proponent states that the biological sampling being conducted in September 2015 as a component of the RAEMP will be evaluated to determine if calcite has effects on biota. These results will be used to determine if additional biological sampling should occur in 2016 to further characterize calcite effects on biota. This is concerning because the second phase of the study, which is meant to characterise seasonal variations in periphyton and BIs, appears to be based on outcomes of the 2014-2015 biological monitoring and an evaluation of relationships between Calcite Index (CI) and biological health. Based on this	Ministry of Environment	This study is principally a study on seasonal calcite precipitation/dissolution, and the effect of seasonal variations in calcite on biology. It is not a seasonal study on algae and benthic invertebrates in the absence of seasonal variations of calcite. The study design for the 2015 RAEMP and the supporting study for Calcite Biological Effects contains components to explore the relationship between calcite and biological communities. (Study Design to Evaluate Calcite Effects on Biota, Minnow Environmental, In Preparation).

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		approach it is possible that no biological monitoring related to calcite will be deemed necessary for 2016, even though Section 1.2 states that, "the second phase of the study – seasonal variations in algae and benthic invertebrates – will be planned for 2016." The Proponent should confirm if this approach is acceptable and consistent with the intent of Section 9.5.1 of the Permit, and communicate how the Calcite and RAEMP Programs are coordinated spatially and temporally such that Teck meets regulated requirements and study objectives.		
7	Seasonal Calcite Supporting Study Design	The Study Design states that biological communities vary seasonally, based on a number of factors, and for these reasons periphyton and BIs will only be assessed in late summer. If biological communities do indeed vary seasonally, and if (part of) the intent of this study is to identify seasonality of calcite deposition and associated biological communities, sampling for periphyton and BIs should be occurring seasonally to coincide with seasonal calcite sampling and not just in late summer. Based on the information provided, it appears that late summer may represent the "worst case" conditions for calcite and therefore may represent highest impact to biological communities. However, if the intent of the study is to assess seasonal variation in calcite and impacts to biological communities, a clear rationale should be provided explaining why seasonal sampling of biological communities is not required. Is focussing on late summer as the main season of concern for effects to biota consistent with the intentions of Section 9.5.1 of the Permit?	Ministry of Environment	The intent of this phase of the study is to identify conditions under which seasonal variation in calcite occurs. After (and if) seasonal variation in calcite is identified, the second phase of supporting study for Calcite Biological Effects will evaluate seasonal variation in biological communities.
8	Seasonal Calcite Supporting Study Design	The Study Design mentions that the current sampling method for BIs provide information on taxa richness and relative abundance of key types of organisms. The Proponent should confirm that these metrics will enable the assessment of calcite effects on biota and the potential relationships between calcite and BI community structure (as stated in the RAEMP Approval Letter).	Ministry of Environment	Please refer to the Preliminary (2014) Calcite Biological Effects Monitoring Program Results (Minnow, in preparation)

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9	Seasonal Calcite Supporting Study Design	The Study Design states that during times of high water flow, ice cover, or high avalanche hazard it may not be possible to collect data for the CI. The schedule indicates that 2015 data will be collected from May 1 to December 31, 2015. Looking at the Water Survey of Canada hydrograph for Line Creek (station 08NK022), this timeframe appears to cover freshet, summer, and fall low flows, but may miss the very low winter flows that can be seen from January to May. How often will calcite be sampled during this time frame? Will this frequency be adequate to characterize seasonal differences, given that a number of factors may prohibit data collection, and that the sampling period may not cover winter low flows? Extending the sampling window into the low flow period, as practicable, will provide a more fulsome, and potentially better, interpretation of seasonality.	Ministry of Environment	The intent of this phase of the study is to carry through the seasonal data collection to the extent practical through 2016. The primary evidence of seasonality is expected to come from the substrate sample data, rather than through CI measurements (as the ability to detect change from CI data appears to be limited [Lotic 2015]). During periods of high flow, it may not be safe to collect CI data, however it will likely be possible to set out substrate samples in safe areas of the stream, as long as the stream itself does not become inaccessible due to safety hazards. The sample sites have not been studied to assess what areas, if any, remain uncovered by ice during winter. If open areas on streams are evident, then substrate samples will be deployed there. Nevertheless, there is a risk that some data may be lost due to ice cover.
10	Seasonal Calcite Supporting Study Design	I am not able to review this section as it is outside of my area of expertise. This section should be reviewed by someone with geochemistry experience to determine if the proposed approach is acceptable. The Saturation Index is mentioned in the Permit, but methodology is not discussed so I am not clear if the approach in the Study Design has been reviewed and accepted.	Ministry of Environment	No comment.
11	Seasonal Calcite Supporting Study Design	Please refer to Appendix A of this memo for Carl Schwarz's review and comments on this section of the Study Design.	Ministry of Environment	Comments are provided below.
12	Seasonal Calcite Supporting Study Design	QA/QC procedures were not discussed in the Study Design. The Proponent should describe the QA/QC procedures that will be followed as well as the Data Quality Objectives for this study. Is the intent to follow the QA/QC procedures outlined in Section 6 of Appendix 4 of the Permit? Please refer to Appendix A of this memo for Carl Schwarz's review and comments on this section of the Study Design.	Ministry of Environment	QA/QC procedures have been updated in the plan. Comments on C. Schwarz advice are provided below.
13	Seasonal Calcite Supporting Study Design	Section 7.1 – Site Selection does not clearly explain how the list of 133 reaches listed in Appendix 1 of the	Ministry of Environment	This section of the study design has been revised. The program as laid out is intensive, and the sites were selected to

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		Calcite Monitoring Plan in the Permit were pared down to 10 for this study. The Proponent should submit a clear rationale indicating why the proposed 10 sites were selected, and why the other sites identified for inclusion in the Calcite Monitoring Plan in 2013-2015 were excluded in the 2015 study design.		maximize the possibility of detecting seasonal variations in calcite and explore observed variations in calcite deposition.
14	Seasonal Calcite Supporting Study Design	The proposed sample locations for calcite monitoring are listed in the unnamed and unnumbered table (the Table) provided in Section 7.1 of the Study Design. These sampling locations are either not included or are named differently in the following tables: - Table 6.1 of the RAEMP Study Design document which details the BI monitoring locations, - Table 5.1 of the RAEMP Study Design which details the periphyton monitoring locations, - the water quality receiving environment sites listed in Section 9.1.1 of the Permit, and - the Elk Valley calcite monitoring reach names listed in Appendix 1 of Appendix 4 of the Permit.	Ministry of Environment	The table has been updated to cross-reference locations in the RAEMP study design.
15	Seasonal Calcite Supporting Study Design	If the Study Design is to identify, as stated in Section 1.2, the relationship between Calcite Index and biological health, and if these outcomes will be used to decide if further biological sampling is required in 2016, the Proponent should clearly show that the calcite sampling locations are the same as those that will be sampled in 2015 for water chemistry, BIs, and periphyton. It would also be helpful to have sampling location names that are consistent with previous calcite sample locations.	Ministry of Environment	Tables and maps have been updated to include additional information to indicate linkage with other monitoring programs.
16	Seasonal Calcite Supporting Study Design	The Study Design states that, "sites should be chosen that reflect a range of chemical and calcification conditions." The sampling locations listed in the Table cover CI ranges from 0-1 and 2-3, but no sites are included with CI ranges from 1-2. The Proponent should provide rationale for the exclusion of sites with CI ranges of 1-2.	Ministry of Environment	There are very few sites that show a CI range of 1-2, however three of the study sites are in that range.
17	Seasonal Calcite Supporting Study	The proposed sampling locations listed in the Table include seven sites with	Ministry of Environment	There are also very few sites that have shown a variation greater than |0.5|,

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	Design	changes in the CI (from 2013-2014) of less than |0.50|, and three sites with changes in the CI greater than |0.50 |. The Study Design states that a minimum of three sites exhibiting each of the preceding characteristics is required to conduct a statistical analysis, and change in the absolute value of CI from 2013-2014 of greater than |0.50| is listed as one of these characteristics. Of the ten proposed sampling sites, only three show a change in CI of >|0.50|, and one of these three barely meets this requirement (change in CI of -0.51). Since three is the minimum number of sites the Proponent has identified as being required to run statistics, and since study sites with a greater yearly change in CI may better illustrate a seasonal pattern, the Proponent should provide rationale why the majority of sites selected for study in 2015 have a change in CI of <|0.50|.		however four sites have been included in the study.
18	Seasonal Calcite Supporting Study Design	In the Table, please include columns for each criteria considered in site selection including the following: - demonstrated variation in water chemistry, - lotic environments downstream of waste dumps, - accessible year-round, and - located at existing water quality monitoring stations. If any of these and other site selection criteria are not met, the Proponent should describe how these will be addressed. For example, if a study site is not located at an existing RAEMP or water quality monitoring station, how will the lack of associated data be addressed?	Ministry of Environment	The site selection criteria have been updated in the revised report.
19	Seasonal Calcite Supporting Study Design	Do the proposed calcite sampling sites exhibit different forms of calcite deposition (e.g. calcified algae, calcareous laminate, calcite scale, etc.)? This information would be helpful when looking at the type of calcified substrate that will be deployed at each study site (refer to comments below about Substrate Rock Selection). Please describe the primary calcite forms observed at each sampling site in 2013-2014. This information could be included in the Table. Please refer to Appendix A of	Ministry of Environment	Calcite morphology for each sampling location has been included in Table 1.

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#	Submission	Input and Advice	EMC Member	Teck Response
		this memo for Carl Schwarz's review and comments on this section of the Study Design.		
20	Seasonal Calcite Supporting Study Design	Calcite sampling should be coordinated as closely as possible with monthly water quality sampling dates. The Proponent should confirm that the proposed water quality sampling schedule will provide enough data to answer Study Question 2b.	Ministry of Environment	It is not necessary to coordinate monthly water quality sampling with calcite sampling. Water quality sample represent data at an instant in time, whereas the calcite samples will reflect changes that have occurred over the previous time interval. Seasons last longer than one month, so there is little risk that monthly water quality data will not provide data relevant to this study.
21	Seasonal Calcite Supporting Study Design	Will the same substrates be re-deployed after each sampling event? Will new substrate rocks be deployed after each sampling event?	Ministry of Environment	The methodology has been clarified in the revised study design. The intent of the study is to continuously have substrate samples in the streams, and to re-use them (i.e. there will be two sets of substrate for each site).
22	Seasonal Calcite Supporting Study Design	Please confirm which substrate type will be used to assess formation of calcite and dissolution of calcite.	Ministry of Environment	This has been clarified in the revised study design. Samples with pre-existing calcite will be compared to samples without calcite to assess calcite dissolution.
23	Seasonal Calcite Supporting Study Design	It is unclear how substrate rocks that include calcite will be collected from one stream and deployed in another. - Will attempts be made to deploy calcite substrate rocks with similar calcite formation in streams exhibiting that type of calcite formation (e.g. if a site shows rocks with calcified alga on it, will attempts be made to deploy calcite substrate rocks with the same type and extent of calcified alga?). Or is the intent to only focus on calcite scale?	Ministry of Environment	The intent is to focus on calcite scale. This has been clarified in the revised study design.
24	Seasonal Calcite Supporting Study Design	Will substrate rocks with calcite scale be deployed in streams where calcite scale is not seen?	Ministry of Environment	This has been clarified in the revised study design. Substrate rocks with calcite will be deployed in streams that do not show calcite currently.
25	Seasonal Calcite Supporting Study Design	If some deployed rocks will already have calcite on them, please explain how (or if) these will be chosen to represent the calcite conditions at the sampling site. For instance, how will concretion conditions be dealt with? Will attempts be made to deploy rocks with the same calcite thickness/extent/formation as observed at the sample site?	Ministry of Environment	Rocks exhibiting calcite scale will be used. As concreted rocks are not generally removable, concreted samples will not be used.
26	Seasonal Calcite Supporting Study	How will substrate rocks without calcite be prepared before deployment? Will	Ministry of Environment	This has been clarified in the revised study design. Generally, substrate rocks

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	Design	they be scrubbed/cleaned to remove any sediment or biota, or just dried?		will be be dried and only loose sediment or biota will be removed.
27	Seasonal Calcite Supporting Study Design	How will substrate rocks with calcite be prepared before deployment? Will any measurements be taken?	Ministry of Environment	This has been clarified in the revised study design. Total mass and plan-view area will be the only measurements taken. Measuring the thickness of calcite risks disturbing the existing scale, making it more readily removable in the stream.
28	Seasonal Calcite Supporting Study Design	This section states that a minimum of five rocks will be set out for each test. What is the target/preferred number of rocks that will be used for each test? Will the minimum of five rocks at each sampling site provide enough data to ensure robust statistics? Please provide a figure showing a proposed substrate deployment layout at a sampling site.	Ministry of Environment	This has been clarified in the revised study design, and a figure has been added. Ten rock samples (five with and five without calcite) is the target for each test.
29	Seasonal Calcite Supporting Study Design	"At each sample site, a minimum of five rocks will be set out for each test of precipitation and dissolution – i.e. five rocks with no calcite; five rocks with calcite." Do the rocks with no calcite correspond to the test of precipitation, and the rocks with calcite correspond to the test of dissolution?	Ministry of Environment	This has been clarified in the revised study design.
30	Seasonal Calcite Supporting Study Design	It is unclear in this section how substrate rocks will be deployed and measured for calcite at each sampling location. - Will some substrate rocks stay in the stream for the duration of the 2015 field season? Or will new substrate rocks be deployed during each sampling event?	Ministry of Environment	This has been clarified in the revised study design. The intent is to replace all the samples approximately monthly.
31	Seasonal Calcite Supporting Study Design	How many rocks will be removed and sent for lab analysis during each sampling event? Will enough substrate samples be deployed (e.g. minimum of five) to allow for multiple rocks to be sent for lab analysis at each sampling event?	Ministry of Environment	This has been clarified in the revised study design.
32	Seasonal Calcite Supporting Study Design	How many sampling events are anticipated? Will the number of deployed rocks be adequate to ensure substrate samples are available during each sampling event?	Ministry of Environment	This has been clarified in the revised study design.
33	Seasonal Calcite Supporting Study Design	"Tile" is mentioned repeatedly. Please confirm if "tile" is referring to a deployed rock.	Ministry of Environment	This has been clarified in the revised study design.
34	Seasonal Calcite Supporting Study Design	How will substrate samples be transported from the field to the laboratory to ensure that calcite is not	Ministry of Environment	This has been described in the revised study design. Rocks will be wrapped in bubble wrap to provide protection.

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		disturbed or damaged during transport?		
35	Seasonal Calcite Supporting Study Design	What laboratory will perform the calcite analysis? Is the lab accredited to do so? What are the lab's QA/QC procedures? I realize that the Proponent is conducting cutting-edge research in this area and that laboratory accreditation for this work is unlikely, but it would be helpful to know that the same lab will be analyzing all samples based on the same methodology and employing consistent QA/QC procedures.	Ministry of Environment	The laboratory will be used to provide drying ovens, collect photographic data, and weights. One of Teck's on-site labs will be used for this, and the lab has procedures in place to verify the calibration of its laboratory equipment. Those procedures have been referenced in the study design.
36	Seasonal Calcite Supporting Study Design	The map provided is acceptable for a general overview of sites, but the scale is inadequate to accurately show where the sampling sites are located. The sampling points (blue) are difficult see with the colour scheme.	Ministry of Environment	The map has been updated.
37	Seasonal Calcite Supporting Study Design	Section 7.1 indicates that "a minimum of three sites exhibiting each of the preceding characteristics" will be chosen. Presumably this implies that at least nine sites will be chosen. There are 10 sites listed in the table in Section 7.1 – presumably these are the sites to be studied?	Carl Schwarz for Ministry of Environment	The table has been clarified.
38	Seasonal Calcite Supporting Study Design	It is unclear if the retrieved rocks are redeployed back to the same sites and locations within the sites, or if a new substrates will be used for the next batch of substrates. It is also unclear if any new calcite found on a previously clean rock will be removed before redeployment?	Carl Schwarz for Ministry of Environment	New calcite will not be removed; the rocks will be re-deployed in the condition recovered. During the interim re-assessment, this practice will be re-examined.
39	Seasonal Calcite Supporting Study Design	The difference in weight between the deployment and retrieval will be used to estimate the deposition rate using the equation in Section 5.3. The proponents will also measure the calcite index at each site in each month. I don't have access to the Robinson and MacDonald (2014) study, but did review a previous draft where I believe that three samples will be selected at each site.	Carl Schwarz for Ministry of Environment	The cited report is the annual calcite survey, in which three samples are used to characterize a reach. In this seasonal study, only a single site is being characterized. One Calcite Index measurement will be made at each site per month.
40	Seasonal Calcite Supporting Study Design	It is unclear when the water chemistry reading will be taken. It would appear that these will be taken monthly? The document does not provide information on how the water chemistry data will be modified/interpolated where these are known to vary monthly. It is	Carl Schwarz for Ministry of Environment	This has been described more completely in the revised study design.

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		implicitly assumed that these water chemistry values will remain constant during the month of deployment of the substrates.		
41	Seasonal Calcite Supporting Study Design	The mean calcite index will be compared across the months of the study using a single factor CRD ANOVA for EACH site using the three samples/site/moth. However, with only three samples per month per site, the power to detect small changes in the mean calcite index within a site is likely to be small. A power analysis is needed to ensure that sufficient calcite measurements are taken at each site in each month to detect important changes.	Carl Schwarz for Ministry of Environment	As noted in item #39, only one Calcite Index measurement will be made at each site per month, to characterize the site, as opposed to characterizing the reach (as was done for the regional calcite monitoring program). It is the power to detect changes at the reach level that is small (Robinson and MacDonald, 2015). During the 2013 annual calcite survey, replication at the site level was tested. The primary purpose of that test was to examine variability among crews (observer bias). Ten sites were sampled by three field crews, each with independent crew pairings. Difference in mean CI scores from the 10 sites was below 5% for all potential pairings. Paired t-test results suggest there was no significant difference between crew pairings (Robinson and MacDonald, 2014). Based on those results, we do not feel that conducting multiple surveys at each site is warranted, however we will discuss this practice during the interim re-assessment with the EMC at the October or November meeting.
42	Seasonal Calcite Supporting Study Design	There will be five measurements of net precipitation (starting from 0 using the bare rocks) and five measurements of net precipitation/dissolution (starting from rocks with calcite already present) for each site for each month. There is a potential problem in starting with bare rocks because any net precipitation that is "negative" in a month cannot be recorded (you can't lose calcite from a bare rock) and so this potential censoring (a zero reading indicates that the net precipitation is 0 or less and not that no precipitation took place) must be accounted for in the analysis.	Carl Schwarz for Ministry of Environment	The data from bare rocks will be treated separately from the rock with calcite in the analysis.
43	Seasonal Calcite Supporting Study Design	Without information on variability in the deposition rate likely to be encountered (due to the retrieval process chipping rocks; sample preparation; errors in determining changes in weight, and/or area of the rock; natural variation in the deposition rate in a stream bed; etc.) it is impossible to know if five substrates/site/month will give	Carl Schwarz for Ministry of Environment	An interim analysis after five months of data collection will consider this question.

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		estimates with adequate precision.		
44	Seasonal Calcite Supporting Study Design	It is also unclear how the two types of measurements (e.g. from bare rocks and from partially covered rocks) will be integrated together into a single analysis, especially if censoring will be present.	Carl Schwarz for Ministry of Environment	The two types of results will be analyzed separately, and compared against each other.
45	Seasonal Calcite Supporting Study Design	In a similar fashion to the season variation of the calcite index, the deposition rates will be compared across months using a variant of ANOVA. It is unclear how the two types of substrate measurements will be integrated together. Again, without information about variability, it is impossible to determine if five (or ten) measurements per month per site are adequate.	Carl Schwarz for Ministry of Environment	The two types of results will be analyzed separately, and compared against each other.
46	Seasonal Calcite Supporting Study Design	This will now combine the data from the 10 sites over all months. The multiple substrates deployed at one site for a month are all pseudo-replicates (Hurlbert, 1984) and so the individual estimated rates must be averaged before usage in this analysis. This would then give one measurement of net precipitation starting from 0 (using clean rocks) and one measurement of net precipitation/dissolution (using partially covered rocks) per stream per month. Again it is unclear how to combine both of these observations for a site.	Carl Schwarz for Ministry of Environment	The data will be analyzed separately.
47	Seasonal Calcite Supporting Study Design	Water chemistry will be measured monthly and a Saturation Index will be computed for the month. It will be assumed that the Saturation Index will be constant for the month of interest. It is not clear how water chemistry values will be interpolated at sited with large monthly variations.	Carl Schwarz for Ministry of Environment	The revised study design describes how water quality data will be treated to provide a matching value for the other observations. The method does assume constant values between water sampling events.
48	Seasonal Calcite Supporting Study Design	The analysis will then be a variation of a regression analysis but some adjustment will be needed to account for the multiple monthly samples from a single site (a form of blocking). The document simply says that a "test of independence" will be used, but this is not appropriate because of the multiple measurements from each site.	Carl Schwarz for Ministry of Environment	Acknowledged.
49	Seasonal Calcite Supporting Study Design	Without information on variability, it is not possible to determine what degree of relationship between the SI and precipitation index can be detected.	Carl Schwarz for Ministry of Environment	Acknowledged.

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50	Seasonal Calcite Supporting Study Design	A similar analysis and concerns occur here as in the previous section. An additional concern is that unlike the saturation index, the calcite index will be very imprecisely determined based only on three readings/site/month.	Carl Schwarz for Ministry of Environment	Acknowledged. Please also see response to item 41.
51	Seasonal Calcite Supporting Study Design	"Seasons, for the purpose of this test, will be established as groupings of consecutive months with a similar value of the Calcite Index. A seasonal grouping will be considered valid if the difference between the calcite indices is not significantly > 0. (The significance and probability will be calculated based on the variance around the mean). The null hypothesis will be rejected if the difference between mean Calcite Indexes between seasons is > 0. The statistical validity of rejecting the null hypothesis will be tested based on observations of the variance around the mean." There are a number of concerns about this paragraph (a) Just because a statistical test does not detect a difference in the mean calcite, it does not imply that there is no difference. So using failure to detect a different to establish seasons is incorrect. (b) "The significance and probability will be calculated based on the variance around the mean". A variant of ANOVA will be required that uses more than the mean and variance around the mean to compute the test statistics and p-values. (c) "The null hypothesis will be rejected if the difference between mean Calcite Indexes between seasons is > 0." This is not true. The difference in the mean Calcite index must exceed the variation seen within the three samples in a site. (d) "The statistical validity of rejecting the null hypothesis will be tested based on observations of the variance around the mean." It is unclear what is meant by this sentence.	Carl Schwarz for Ministry of Environment	The revised study proposes to carry out statistical analysis by first plotting the results against time, and visually examining the data for evidence of seasonal patterns. If seasonal patterns are observed, then, in consultation with the Environmental Monitoring Committee, statistical tests can be considered to determine if the apparent patterns are in fact statistically significant. An early review of the data and statistical methods can be done at the October or November 2015 EMC meetings.
52	Seasonal Calcite Supporting Study Design	"Null Hypothesis: Rates of calcite precipitation/dissolution cannot be measured. The null hypothesis will be rejected if mean rates of calcite precipitation/dissolution at a site (based on multiple substrate samples)	Carl Schwarz for Ministry of Environment	The study question has been re-worded in the revised study design, and the description of the analysis has been revised as in the previous section.

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		are > 0. The statistical validity of rejecting the null hypothesis will be tested based in the variance around the mean, based on multiple substrate samples placed at each sample location." There are a number of concerns about this paragraph (a) It is unclear what is mean by "measured" in the hypothesis. Perhaps "detected" is a better choice of words, or "measured with sufficient precision to be useful"? In any case, a statistical test is NOT the proper way to assess this questions. (b) The criteria for rejecting the null hypothesis is incorrect – see previous comments. (c) The comment about statistical validity is problematic – see previous comments.		
53	Seasonal Calcite Supporting Study Design	"Null Hypothesis: There is no seasonal pattern to rates of calcite precipitation/dissolution. Seasons, for the purpose of this test, will be established as groupings of consecutive months of similar rates of calcite precipitation/dissolution. A seasonal grouping will be considered valid if the difference between the mean rates is not significantly > 0. (The significance and probability will be calculated based on the variance around the mean). The null hypothesis will be rejected if the difference between mean rates of calcite precipitation/dissolution between seasons is > 0. The statistical validity of rejecting the null hypothesis will be tested based on the variance around the mean. There are a number of concerns about this paragraph which are identical to those expressed in previous sections.	Carl Schwarz for Ministry of Environment	The description of the analysis has been revised as in the previous sections.
54	Seasonal Calcite Supporting Study Design	"For Study Question 2b: If there is seasonal variation in rates of calcite precipitation/dissolution, does this correlate with seasonal variations in water chemistry? Null Hypothesis: This is no correlation between seasonal variations in Calcite Index and seasonal variations in water chemistry. For seasons (consecutive months) identified from Study Question 1 or 2a, the mean calcite Saturation Index will be calculated, and compared	Carl Schwarz for Ministry of Environment	The description of the analysis has been revised as in the previous sections. The data (calcite index and saturation index) will be plotted on a scatterplot, and examined visually for a pattern, followed by regression and correlation analysis

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		to the mean rates of calcite precipitation/dissolution at a sample location. The null hypothesis will be rejected if a statistical test for independence demonstrates that the Saturation Index is not independent of the calcite precipitation/dissolution rates, to a level of significance that will be determined after examining the data." There are a number of concerns about this paragraph (a) A correlational analysis is not appropriate as noted earlier. (b) There is no reason to create seasons based on previous analysis. Just use the monthly data directly. (c) The level of significance is not determined after examining the data, but is set prior to analysis (typically at alpha=0.05).		
55	Seasonal Calcite Supporting Study Design	"For Study Question 2c: If there is seasonal variation in rates of calcite precipitation/dissolution,does this correlate with seasonal variations in the Calcite Index? Null Hypothesis: Seasonal variations in calcite precipitation/dissolution rates are independent of the Calcite Index. The null hypothesis will be tested if seasonal variation is shown to occur (through either Study Question 1 or 2a) and rejected if the difference in the mean Calcite Index between seasons is >0. The statistical validity of rejecting the null hypothesis will be tested based in the variance around the mean." There are a number of concerns about this paragraph (a) The decision rule is incorrect. (b) The sentence on statistical validity is incorrect.	Carl Schwarz for Ministry of Environment	As in the previous sections, the data (calcite index and precipitation/dissolution data) will be plotted on a scatterplot, and examined visually for a pattern, followed by regression and correlation analysis.
56	Seasonal Calcite Supporting Study Design	"Because the variability of the data to be collected is not known (these data have not been collected before; there is no estimate of sample variance), it is not possible to pre-select confidence levels for the statistical tests. Instead each statistical test will be accompanied by a confidence level determined by the data (e.g. "there is a 70% probability that the null hypothesis is false")." There are a number of concerns about this paragraph	Carl Schwarz for Ministry of Environment	After five months of data collection, the data and study design will be assessed and modified if deemed necessary.

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		(a) The confidence levels are typically set prior to data analysis, usually at the 95% level. (b) The interpretation of the "probability that the null hypothesis is false" is an incorrect interpretation of a confidence interval.		
57	Seasonal Calcite Supporting Study Design	It would be helpful to number the pages, number tables, and number figures for ease of reference.	Carl Schwarz for Ministry of Environment	Done.
58	Seasonal Calcite Supporting Study Design	The document could also benefit from some reorganization as details of the study design are scattered over a number of sections. For example, it is still not clear to me if the substrates will be redeployed monthly; will some substrates be left for longer than a month?	Carl Schwarz for Ministry of Environment	The document has been re-organized, and the specific question has been clarified: as described in item 32, the intent is to replace all the substrate samples approximately monthly.
59	Seasonal Calcite Supporting Study Design	The author acknowledges (Section 6) that a lack of information on variability of the measurement makes it difficult to do proper determination if the sample sizes (number of sites, number of months per site, number of substrates per site per month) are adequate (i.e. it is impossible to do a power analysis). I agree – consequently, it is important to gather some preliminary information before committing to this particular study plan – especially if this monitoring needs to be dramatically improved. The first six months of data collection should therefore be seen as a preliminary sample to get this variability information and not as a final stud.	Carl Schwarz for Ministry of Environment	We will review the data with the Environmental Monitoring Committee at the October or November meeting
60	Seasonal Calcite Supporting Study Design	As KNC has indicated previously, there is a critical need to understand the extent of calcite formation in the Elk Valley and associated effects on aquatic plants, benthic invertebrates, and fish utilizing aquatic habitats within the study area. While the seasonal calcite supporting study is likely to yield relevant information on the formation, distribution, and dissolution of calcite, it will not provide relevant information for evaluating the effects of calcite on aquatic receptors in 2015. Based on the requirements identified in EMA Permit 107517, the study must "include multiple locations and assess seasonal variation in the rate of calcite formation or dissolution, water quality, and presence and density of algae,	Ktunaxa Nation Council	Section 9.5.1 of Permit 107517 requires a Seasonal Calcite Supporting study - 2015 and 2016 be developed but does not stipulate specific requirements for the study design. Teck is proposing a phased approach to the design first identifying if/where seasonal calcite formation is found which would inform the second phase of the assessment to determine seasonality influence on presence and density of algae and benthic invertebrates. Further evaluation of calcite biological effects is being completed as a separate supporting study to the RAEMP; study design will be provided to the EMC for review and input as discussed during June 29th conference call (Study Design to Evaluate Calcite Effects on Biota, Minnow Environmental, In Preparation).

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		and the presence and density of benthic invertebrates." The proposed study design does not include any biological monitoring in 2015 and, hence, is not compliant with the conditions of EMA Permit 107517.		
61	Seasonal Calcite Supporting Study Design	The study design document indicates that biological sampling related to calcite will be conducted in September as a component of the Regional Aquatic Effects Monitoring Program (RAEMP). However, the benthic invertebrate community structure (BICS) sampling described in the RAEMP will utilize CABIN-based protocols, which do not support the evaluation of the density of benthic organisms (as required under EMA Permit 107517). Therefore, neither the RAEMP nor the Seasonal Calcite Supporting Study will satisfy the requirements identified in EMA Permit 107517.	Ktunaxa Nation Council	The Study Design to Evaluate Calcite Effect on Biota (in preparation) has been updated to include area-based monitoring of benthic invertebrates at a subset of sampling locations to evaluate potential effects of calcite on benthic invertebrate densities based on input from EMC members during the June 29th conference call on study design development.
62	Seasonal Calcite Supporting Study Design	The study goals articulated in the study design document represent only a subset of the goals that need to be established for this study. At minimum, the study goals need to be expanded to include " to assess seasonal variation in the rate of calcite formation or dissolution, water quality, and presence and density of algae, and the presence and density of benthic invertebrates at multiple locations in the study area," as per the requirements of EMA Permit 107517.	Ktunaxa Nation Council	Section 9.5.1 of Permit 107517 requires a Seasonal Calcite Supporting study - 2015 and 2016 be developed but does not stipulate specific requirements for the study design by year. Teck is proposing a phased approach to the design first identifying if/where seasonal calcite formation is found which would inform the second phase of the assessment to determine seasonality influence on presence and density of algae and benthic invertebrates.
63	Seasonal Calcite Supporting Study Design	As the preliminary study design does not meet the requirements identified in EMA Permit 107517, the study needs to be re-designed to include the following components: 1. Intragravel water quality conditions, including dissolved oxygen concentrations at calcite-affected and reference sites; 2. Calcite Index; 3. Presence and density of algae; and, 4. Presence and density of benthic invertebrates. These metrics need to be measured at each replicate sampling location that is	Ktunaxa Nation Council	Teck has approached this study in two phases: first, to establish evidence regarding the seasonal formation of calcite, and then to expand the study to understand the effect of the seasonal calcite on the presence and density of algae and the presence and density of benthic invertebrates. The study does incorporate the calcite index as a measurement endpoint, but reference conditions are not incorporated into the study. Further evaluation of calcite biological effects is being completed as a separate supporting study to the RAEMP; study design will be provided to the EMC for review and input as discussed during June 29th conference call (Study Design to Evaluate Calcite Effects on Biota, Minnow Environmental, In Preparation).

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		evaluated at each sampling station on each sampling date. Such a design will provide matching calcite and biological effects data that can be used to relate measurements of calcite index to effects on benthic invertebrates and, potentially, algae.		
64	Seasonal Calcite Supporting Study Design	The study design document appropriately indicates that the methods that are currently being used in the RAEMP to evaluate BICS in the study area do not provide a basis for assessing organism density. This is correct. Therefore, quantitative sampling methods should be employed to collect benthic invertebrate samples (i.e., cylindrical Hess, Waters-Knapp, or Neill samplers; Beatty et al. 2006). Such a sampling design will require collection of multiple (i.e., 5 to 8) replicate samples at each sampling station on each sampling date to evaluate the relationship between calcite index and the nature and magnitude of biological effects.	Ministry of Environment	The Study Design to Evaluate Calcite Effect on Biota (in preparation) has been updated to include area-based monitoring of benthic invertebrates at a subset of sampling locations to evaluate potential effects of calcite on benthic invertebrate densities based on input from EMC members during the June 29th conference call on study design development.
65	Seasonal Calcite Supporting Study Design	In summary, the study design, as presented, does not meet the requirements identified in EMA Permit 107517. Therefore, the study needs to be re-designed to facilitate the collection of matching calcite and biological effects data. It is recommended that KNC review the revised study design when it is submitted for review.	Ktunaxa Nation Council	Teck has approached this study in two phases: first, to establish evidence regarding the seasonal formation of calcite, and then to expand the study to understand the effect of the seasonal calcite on the presence and density of algae and the presence and density of benthic invertebrates. The study does incorporate the calcite index as a measurement endpoint, but reference conditions are not incorporated into the study. Further evaluation of calcite biological effects is being completed as a separate supporting study to the RAEMP; study design will be provided to the EMC for review and input as discussed during June 29th conference call (Study Design to Evaluate Calcite Effects on Biota, Minnow Environmental, In Preparation).
66	Seasonal Calcite Supporting Study Design	Use standard size quartz rocks.	Ministry of Energy and Mines	During calcite sampling, Teck has observed that quartz rocks have sometimes shown markedly less calcite deposition than other rock types in the stream. Teck feels that using quartz would bias the results towards an under-reporting of calcite presence in streams.
67	Seasonal Calcite Supporting Study Design	Take a learning approach and start with options and test them as part of this monitoring work. Standardizing the	Ministry of Energy and Mines/ Ktunaxa	Teck has incorporated this learning approach into the study design (Section 8), and will provide an interim assessment

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		approach will aid in monitoring in future years. For example, use a standard size of rock, material (i.e., rock selection) and the current "monitoring" rock approach.	Nation Council / Ministry of Environment	of results in October 2015.
68	Seasonal Calcite Supporting Study Design	Place consistent mass in the stream so it simplifies comparison of data at later date. Attempt to standardize and reduce variability.	Ktunaxa Nation Council /Ministry of Energy and Mines / Ministry of Environment	Teck has considered this approach, but the use of consistent total mass (assuming that the mass of individual rocks does vary) would result in an inconsistent number of rocks being placed in the stream for each sampling event. For example, the same mass could be achieved by using three larger rocks or ten smaller ones. Teck feels that standardizing the results by normalizing based on plan-view surface area represents a reasonable approach to the study design that can be evaluated during the interim assessment in October 2015.
69	Seasonal Calcite Supporting Study Design	Incorporate biological data in both years of the study.	Ktunaxa Nation Council	Section 9.5.1 of Permit 107517 requires a Seasonal Calcite Supporting study - 2015 and 2016 be developed but does not stipulate specific requirements for the study design. Teck is proposing a phased approach to the design first identifying if/where seasonal calcite formation is found which would inform the second phase of the assessment to determine seasonality influence on presence and density of algae and benthic invertebrates. Further evaluation of calcite biological effects is being completed as a separate supporting study to the RAEMP; study design will be provided to the EMC for review and input as discussed during June 29th conference call (Study Design to Evaluate Calcite Effects on Biota, Minnow Environmental, In Preparation).
70	Seasonal Calcite Supporting Study Design	Work plan should outline the process for determining reference concentrations.	Ktunaxa Nation Council	The study design is based on the conceptual model of calcite formation downstream of waste dumps. It is not intended to study seasonal calcite formation in reference areas.
71	Seasonal Calcite Supporting Study Design	Identify the spatial and temporal gaps in data that prevent assessments in the future.	Ktunaxa Nation Council	Teck anticipates that spatial/temporal gaps in the data acquisition may occur through the course of the study through such occurrences as ice cover, avalanche hazard or during periods of high flow. Teck does not have records of ice cover, and does not have data as to when high flow rates constitute a hazard, and therefore cannot predict when such data gaps may occur.
1	Human Health Risk	The proposed approach to human	Ktunaxa Nation	The final TOR and work plan were revised

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	Assessment Terms of Reference and Work Plan	health risk assessment (HHRA) may provide useful information for guiding the development of risk management or mitigation actions in the Elk Valley. However, it will not provide KNC with the information needed to describe the risks to Ktunaxa Citizens associated with exposure to contaminants from all exposure pathways.	Council	to address this concern. While the required focus of the HHRA is to describe risks associated with the Elk River, including consumption of fish, riparian plants, and game, a pathway analysis will be included to consider other pathways unaffected by surface water, such as soil contact and inhalation. The HHRA may also draw upon the multi-pathway HHRAs being conducted for EAs to understand the relative importance of all potential exposure pathways.
2	Human Health Risk Assessment Terms of Reference and Work Plan	The draft Terms of Reference and the draft Work Plan for the HHRA require substantial revision before they can be used to direct the development of a HHRA for the Elk Valley	Ktunaxa Nation Council	The final TOR and HHRA work plan issued on May 31, 2015 include revisions based on comments received during the KNC risk assessment workshop held on May 25, 2015.
3	Human Health Risk Assessment Terms of Reference and Work Plan	The HHRA must evaluate risks to human health associated with exposure to contaminants from all exposure routes (air, water, vegetation, fish, wildlife, and other sources) for each management unit (MU) in the Elk Valley. This HHRA must be comprehensive and stand alone from work conducted previously under the various environmental assessments (however, relevant data and information collected previously should be used).	Ktunaxa Nation Council	The intent of the HHRA is to identify any needed adaptive management actions to comply with Permit 107517, by examining the potential for effects on water quality of mine-related parameters of concern. Due to the concerns raised by the KNC, evaluation of exposures via other pathways will also be considered, as stated in the final HHRA work plan. A pathway analysis will rely on data generated to support the EVWQP and also will draw on the results of the multi-pathway EA HHRAs for the Fording River, Swift Creek, and Baldy Ridge extension projects.
4	Human Health Risk Assessment Terms of Reference and Work Plan	The HHRA needs to be supported by a robust problem formulation and analysis plan. The problem formulation needs to include descriptions of the geographic scope of the study area (including MUs), sources and releases of contaminants, transport and fate processes, effects of contaminants, complete and potentially-complete exposure pathways, and populations potentially at risk. In addition, the problem formulation needs to include a description of the conceptual site model (CSM), including CSM diagrams. The analysis plan needs to describe how the data and information that are compiled will be interpreted to assess exposure to contaminants, assess the effects of the contaminants, and to characterize risks to human populations.	Ktunaxa Nation Council	The final HHRA work plan includes a detailed problem formulation that provides a conceptual site model, geographic scope of the study area, and descriptions of Elk Valley populations and water uses. Discussion of the specific sources and releases of contaminants, transport, and fate processes is not included in the HHRA work plan because it has been described elsewhere in the water quality plan. The work plan includes the approach for assessing exposure and characterizing risks. The HHRA report will provide a detailed description of how the data and information were compiled and interpreted to assess exposure to contaminants and to characterize risks to human populations.
5	Human Health Risk Assessment Terms	The problem formulation and analysis plan need to clearly identify data	Ktunaxa Nation Council	Data to support the HHRA are still being collected and compiled. For that reason,

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	of Reference and Work Plan	requirements to support the HHRA, provide an inventory and evaluation of existing data and information, and document data gaps (i.e., a full data gap analysis needs to be conducted and reported).		an inventory and evaluation of existing data and information, and documentation of data gaps cannot be completed until the HHRA is being prepared. Data gaps and data needs identified during the HHRA will be discussed, noting that all data gaps do not necessarily translate into data needs if filling them would not influence the results or provide useful information to support risk management or adaptive management decisions.
6	Human Health Risk Assessment Terms of Reference and Work Plan	A strategy for filling key data gaps needs to be developed and implemented. Sampling plans need to be reviewed and evaluated by KNC representatives. The implications of any residual data gaps need to be discussed in the uncertainty section of the HHRA.	Ktunaxa Nation Council	Data gaps and data needs will be discussed in the HHRA, as described in the response above. As the HHRA progresses, discussion with the EMC will continue and address input on data gaps/needs.
7	Human Health Risk Assessment Terms of Reference and Work Plan	A comprehensive list of chemicals of potential concern (COPCs) should be considered in the HHRA (i.e., not just the contaminants identified in the EVWQP). After assembling all of the available data and information on COPC concentrations in the various media types and associated toxicity reference values (TRVs), a COPC refinement step may be implemented provided it does not result in elimination of exposure pathways and is appropriately conservative;	Ktunaxa Nation Council	As in the 2014 EVWQP Human Health Evaluation, the HHRA will conduct an initial screening of the maximum concentration of all monitored constituents against guideline values. The final HHRA work plan identifies sources of screening levels that will be used to refine the list of constituents for which risks will be calculated. This screening process is very conservative, and will not result in elimination of pathways for the constituents that are retained.
8	Human Health Risk Assessment Terms of Reference and Work Plan	The process for identifying concentrations of contaminants in environmental media at reference stations needs to be fully described and submitted to the EMC prior to implementation.	Ktunaxa Nation Council	An approach for estimating constituent concentrations at reference stations and comparison with concentrations monitored in each MU will be developed and discussed with the EMC prior to implementation.
9	Human Health Risk Assessment Terms of Reference and Work Plan	The bioaccumulation models used to estimate the concentrations of contaminants in plants and/or animals should be developed and/or refined with input from KNC representatives;	Ktunaxa Nation Council	Tissue concentrations for plants and animals will be obtained from field sampling when possible. When/if bioaccumulation models are used to estimate tissue concentrations, methods applied in the EA HHRAs will be used (e.g., site-specific bioaccumulation factors will be used when available) which continue to consider KNC input (i.e., conference call with KNC/BRE project team July 20, 2015).
10	Human Health Risk Assessment Terms of Reference and Work Plan	The HHRA needs to identify use impairments and describe how quickly uses can be restored within each management unit, as well as the action levels for contaminants that need to be	Ktunaxa Nation Council	It is not within the scope of the HHRA to address management of use impairments. The results of the HHRA will be used to inform risk management decisions, including whether or not exposure to

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		achieved in each media type (water, fish tissue), to restore uses;		water, fish tissue, etc. results in risks exceeding BC MoE thresholds. In the event that risks exceed thresholds, Teck will support IHA or other relevant entity to manage or limit exposures.
11	Human Health Risk Assessment Terms of Reference and Work Plan	The HHRA must incorporate both existing and preferred fish and game consumption rates in the analysis of current and future risks to human (KNC) consumers;	Ktunaxa Nation Council	The HHRA will focus on reported fish and game consumption rates. If preferred rates are provided, these will be considered.
12	Human Health Risk Assessment Terms of Reference and Work Plan	HHRA technical findings must be clearly and transparently communicated to KNC and the public, with strong involvement of KNC representatives;	Ktunaxa Nation Council	Teck will work with KNC and IHA on clearly and transparently communicating the results of the HHRA to KNC and the public.
13	Human Health Risk Assessment Terms of Reference and Work Plan	All documents that are submitted to the Government of British Columbia related to the HHRA must be submitted simultaneously to KNC, including, but not limited to, terms of reference, work plans, draft HHRA reports, final HHRA reports, and annual reports.	Ktunaxa Nation Council	All HHRA documents produced to address Permit 107517 conditions and submitted to Government of BC will also be submitted to KNC.
14	Human Health Risk Assessment Terms of Reference	"and baseline and monitoring data for mine-related parameters of concern." > This is clearly stating that exposure to all mine-related chemicals from other exposure routes need to be considered as well.	Ktunaxa Nation Council	The final TOR and work plan were revised to clarify the required focus of the HHRA to describe risks associated with the Elk River, including consumption of fish, riparian plants, and game. A pathway analysis will be included to consider other pathways unaffected by surface water, such as soil contact and inhalation. The HHRA may also draw upon the multi-pathway HHRAs being conducted for EAs to understand the relative importance of all potential exposure pathways.
15	Human Health Risk Assessment Terms of Reference	Suggest replacing with "While other media such as air, soil, and terrestrial vegetation were not relevant to development of the EVWQP, it is important to access the risk of contaminant exposure from the water in the context of total exposure of the mining related contaminants from other sources and routes in each of the management unit within the Elk Valley." This HHRA should include information collected from the environmental assessments for new projects at multiple Teck operations to establish the relationship between the water objectives and the relative risk of chemical exposure in a multi-pathway HHRAs.	Ktunaxa Nation Council	The HHRA may also draw upon the multi-pathway HHRAs being conducted for EAs to understand the relative importance of all potential exposure pathways.
16	Human Health Risk	Does this mean that a hazard quotient	Ktunaxa Nation	Consistent with BC MoE guidance, an HQ

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	Assessment Terms of Reference	of 0.2 will be used for risk assessment for non-carcinogenic endpoints? TRV from most regulatory agency like Health Canada is for total oral exposure. Instead of using a generic 20% assumption, it is better to use the EA information collected to estimate the total exposure risk and compare the risk of water-related pathway exposure in such context.	Council	of 0.2 will be used when evaluating non-cancer hazards for a single exposure pathway. This threshold will be used to determine if further assessment of potential non-cancer hazards is needed. In cases where the HQs exceed this threshold, it may be appropriate to incorporate information from the EA HHRAs to gain a better understanding of total risks, including risks for water-related pathways.
17	Human Health Risk Assessment Terms of Reference	A clear rationale on the criteria for inclusion and why some chemicals such as mercury was not included should be added.	Ktunaxa Nation Council	The final HHRA work plan provides a rationale for identifying constituents for which risks will be calculated. For the 2014 EVWQP Human Health Evaluation, risks for mercury were not quantified because concentrations did not exceed screening values and because it was not a constituent of concern identified in the Order (i.e., nitrate, sulphate, selenium, cadmium).
18	Human Health Risk Assessment Terms of Reference	It is not ideal to assume the background intake for First Nation residents in the Elk Valley would have the same intake from residents in Toronto. There is comprehensive dietary information including both market food and traditional food available for BC First Nations. It is recommended to evaluate the background selenium intake using BC First Nation specific data.	Ktunaxa Nation Council	Background selenium intake for a population similar to the KNC or other Elk Valley residents was not available for use. The BC First Nations data rely heavily on intakes from coastal populations which consume much higher quantities of marine fish and shellfish, which would not be relevant to interior populations. During planning meetings with the TAC, it was agreed that the study of Toronto residents was more appropriate for use than the coastal population studies.
19	Human Health Risk Assessment Terms of Reference	add "and site specific bioaccumulation factors" after "diet study updates"	Ktunaxa Nation Council	The comment pertains to text in the draft TOR that described a secondary, pathway-specific screening step. The final TOR and HHRA work plan no longer include this second screening step. See previous comment to address use of bioaccumulation models to estimate tissue concentrations.
20	Human Health Risk Assessment Terms of Reference	regarding "hazard quotient of 1" > Should this be 0.2 if the assumption is only 20 percent of the safe dose was allowed for an individual pathway?	Ktunaxa Nation Council	The comment pertains to text in the draft TOR that described a secondary, pathway-specific screening step. The final TOR and HHRA work plan were revised to eliminate this step.
21	Human Health Risk Assessment Terms of Reference	Suggest to add 5c: The relative risk from the water-specific exposure in relationship to the total exposure from multiple-pathways in each of the management unit will be evaluated.	Ktunaxa Nation Council	The HHRA will include a pathway analysis that will consider the relative contributions of each pathway.
22	Human Health Risk Assessment Terms of Reference	Suggest to add: Uncertainties and data gaps will be evaluated every year by the Technical Committee to determine	Ktunaxa Nation Council	The Adaptive Management Plan will directly address this comment. As part of the adaptive management process,

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#	Submission	Input and Advice	EMC Member	Teck Response
		future monitoring programs as part of the adaptive management plan		uncertainties underlying the draft question, "Are groundwater quality, surface water quality and aquatic biota tissue concentrations at levels that are protective of human health?" will be continually considered and monitoring programs will be adjusted as needed to reduce uncertainties and inform management decisions. The timing for evaluation and reporting will be outlined in the AMP, but will not be addressed in the HHRA.
23	Human Health Risk Assessment Terms of Reference and Work Plan	KNC needs to understand total risk in the Elk Valley and in order to do this we have to look at all exposure pathways	Ktunaxa Nation Council	The HHRA will include a pathway analysis that will consider the relative contributions of each pathway.
24	Human Health Risk Assessment Terms of Reference and Work Plan	It is KNCs interpretation of the EVWQP Permit that the assessment needs to include vegetation, wildlife, fish and water pathways	Ktunaxa Nation Council	As stated in the TOR and HHRA work plan, the HHRA will include pathways directly related to surface water, including fish consumption. Additional pathways with more limited influence from constituents in surface water that will be considered in the pathway analysis include ingestion of plants and game.
25	Human Health Risk Assessment Terms of Reference and Work Plan	KNC is not confident that the project specific EA HHRAs can provide a comprehensive HHRA that is consistent with permit conditions (from EVWQP and LCO Phase II Permit) and looks at the relative contribution of all media pathways	Ktunaxa Nation Council	We agree that the EA HHRAs have a focus that may eliminate some constituents that are being evaluated in the EVWQP HHRA. For that reason, the EVWQP HHRA will not rely only on the EA HHRAs in assessing other exposure pathways.
26	Human Health Risk Assessment Terms of Reference and Work Plan	Based on workshop discussions, KNC understands that Teck will consider adjusting the HHRA TOR for the EVWQP in order to provide a comprehensive HHRA possibly reported as total exposure in each of the management units	Ktunaxa Nation Council	The HHRA will include a pathway analysis that will consider the relative contributions of each pathway.
27	Human Health Risk Assessment Terms of Reference and Work Plan	KNC representatives highlighted the importance of the communication component of the EVWQP and LCO II commitments	Ktunaxa Nation Council	Comment noted and Work Plan was updated to include plain language summaries of the risk assessment to support risk communication and outreach to the community.
28	Human Health Risk Assessment Terms of Reference and Work Plan	Show risks from all exposures: pathways under direct surface water influence, pathways with limited surface water influence, and pathways not related to surface water. This will support adaptive management.	Ktunaxa Nation Council	The HHRA will include a pathway analysis that will consider the relative contributions of each pathway.
29	Human Health Risk Assessment Terms of Reference	A statement indicating that the HHRA will be conducted under the oversight of an appropriate qualified professional (e.g. CSAP risk assessment specialist)	Ministry of Environment	Dr. Rosalind Schoof, the project director, has over 25 years of experience conducting HHRAs and is a long time member of the Science Advisory Board for

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		is strongly recommended.		Contaminated Sites in British Columbia. While not a CSAP risk assessment specialist, she has conducted HHRAs in BC under the CSR and also led the human health evaluation for the EVWQP last year. Project manager Alma Feldpausch has more than 15 years of experience conducting HHRAs, including experience with CSR methods. As specified in the permit, the HHRAs will use CSR-approved methodologies. We will also consult with CSAP risk assessment specialist, Audrey Wagonaar, regarding methods to be used. No changes made.
30	Human Health Risk Assessment Terms of Reference	The scope of the HHRA is limited to water quality effects on human health as outlined in the Permit. This is not typical for risk assessments conducted for sites as overall health impacts are not evaluated.	Ministry of Environment	Authorized discharges specified in Permit 107517 are assessed via compliance points in rivers throughout the Elk Valley. The purpose of the HHRA is to identify any needed adaptive management actions to comply with the permit. This is not a site HHRA. Site HHRAs have been conducted separately as needed for expansion of the individual operations. Text has been clarified.
31	Human Health Risk Assessment Terms of Reference	The temporal scope of the HHRA is also not typical in that the baseline or current condition will be evaluated, but ongoing deterioration of the environment is likely given that mining is planned to continue in the area, so it should be made clear that the results of the HHRA are only for a "snapshot in time".	Ministry of Environment	The purpose of the HHRA is to identify any needed adaptive management actions to comply with the permit, thus ensuring there will ongoing protection of human health. Current baseline data will be used for that purpose. The purpose of the HHRA has been clarified.
32	Human Health Risk Assessment Terms of Reference	The HHRA will be limited to evaluating only the most sensitive receptors with the assumption that if no risks are identified for these sensitive individuals, then other receptors would be protected as well. This may or may not be the case. Typically, an HHRA is conducted for the most sensitive receptor as well as a toddler and an adult and including these receptors in the assessment is recommended.	Ministry of Environment	The TOR has been revised to indicate that toddler and adult life stages will be included.
33	Human Health Risk Assessment Terms of Reference	The approach for the cumulative impacts assessment is also unclear as it does not appear as though other sources of contamination will be considered but that this assessment will be used to conduct a secondary screening and then the deterministic risk assessment which is part of a HHRA and does not actually address cumulative effects.	Ministry of Environment	The terminology has been revised. Consistent with other advice, the secondary screening step was eliminated. Risks for all applicable pathways will be compiled. Multi-pathway HHRAs support the individual project EA process.

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34	Human Health Risk Assessment Terms of Reference	Provide the concerns raised by Interior Health Authority so the reviewer can ensure the HHRA approach will address these issues.	Ministry of Environment	No concerns have been raised by Interior Health. This statement was just intended to explain what the permit says: "The Permittee is responsible for developing the HHRA design and addressing any concerns raised by the Interior Health Authority." The text has been clarified.
35	Human Health Risk Assessment Terms of Reference	Clarify the intent of the reference to following the BC CSR in the permit and ensure that the scope of the HHRA is clear.	Ministry of Environment	The purpose of the HHRA to support the adaptive management plan under the permit has been clarified in the text. Text has also been added to clarify that the HHRA is not a contaminated site HHRA, and that it is the applicable risk assessment methodologies in the CSR that are relevant to conducting this EVWQP HHRA, not the scope and purpose of CSR that are relevant.
36	Human Health Risk Assessment Terms of Reference	Clarification regarding what will be "risk ranked" is recommended (i.e., is a designated area wide HHRA sufficient or will individual HHRAs for each management unit be required to meet the intent of this condition).	Ministry of Environment	The text has been clarified to note that the risk ranking will apply to management units specified in the permit.
37	Human Health Risk Assessment Terms of Reference	Consider eliminating the secondary screening step as this approach is not supported by Health Canada and BC MOE.	Ministry of Environment	The final TOR and HHRA work plan no longer include this second screening step
38	Human Health Risk Assessment Terms of Reference	Provide the "population-specific exposure information" to be used in developing the pathway-specific benchmarks.	Ministry of Environment	This section is describing what was done in the human health evaluation completed in 2014 in support of the EVWQP. A discussion of population-specific information that might be needed for this HHRA is included in the work plan.
39	Human Health Risk Assessment Terms of Reference	Inclusion of a statement indicating that the site was not subject to preliminary or detailed site investigation is recommended although indications of whether or not delineation of plumes of constituents of concern was achieved may be warranted to provide context and scope for the reader of the HHRA.	Ministry of Environment	This is not a contaminated site in the sense defined by the CSR. An extensive environmental monitoring program is in place to characterize water quality in the plan area. In the baseline evaluation conducted in 2014, monitoring data were compared with baseline health and ecological screening levels by MU to characterize current conditions. Detailed site characterization has been conducted as part of the EA process for individual expansion projects.
40	Human Health Risk Assessment Terms of Reference	Provide a description of the screening step that was conducted for the fish tissue data as there are currently no fish tissue standards for screening purposes in the CSR.	Ministry of Environment	Fish tissue data were screened using MOE and Health Canada values where available (Se and Hg) and USEPA regional screening levels for other constituents. This is detailed in the work plan, and no changes have been made in the TOR.
41	Human Health Risk	Consider eliminating the secondary	Ministry of	The final TOR and HHRA work plan no

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	Assessment Terms of Reference	screening step as this approach is not supported by Health Canada and BC MOE; it is important to note that all nine constituents of concern identified by the EMC were eliminated from the cumulative effects assessment by the secondary screening step (selenium was carried forward despite passing this step).	Environment	longer include this second screening step.
42	Human Health Risk Assessment Terms of Reference	The proposed approach indicated that background risk would not be quantified for all constituents. Health Canada considers an acceptable threshold of 1 to be appropriate as long as the background sources of exposure to constituents (from soil, air, water, food, etc., not from the site) are considered, as well as exposure from all media at the site. As this is not the case for this risk assessment, an acceptable threshold of 0.2 is recommended for non-carcinogens. In addition, hazard indices should be calculated to evaluate overall potential risks to human health.	Ministry of Environment	The risk characterization will discuss risks for constituents exceeding HQs of 0.2 and 1.0.
43	Human Health Risk Assessment Terms of Reference	Consider eliminating the secondary screening step as this approach is not supported by Health Canada and BC MOE.	Ministry of Environment	The final TOR and HHRA work plan no longer include this second screening step.
44	Human Health Risk Assessment Terms of Reference	Clarification regarding what a qualitative assessment would include is recommended.	Ministry of Environment	TOR text has been clarified. More detail is provided in the work plan.
45	Human Health Risk Assessment Terms of Reference	Constituents that do not have human health-based guidelines or background data and should be identified as constituents of concern and fully evaluated in the quantitative risk assessment.	Ministry of Environment	If no TRV is available for a constituent, it may not be possible to quantify risks. That is why a qualitative assessment is needed. The text has been clarified on how such constituents will be addressed and more detail is provided in the work plan.
46	Human Health Risk Assessment Terms of Reference	Please indicate how the HHRA will address potential risks from the following constituents: chromium, copper, manganese, mercury, nickel, vanadium and zinc for which according to Table 2, monitoring data is lacking for groundwater. Also, it appears as though some constituents of potential concern are proposed to be eliminated from further assessment when groundwater data is lacking for many constituents. Please confirm whether additional monitoring will be conducted to fill in these apparent data gaps prior to conducting the HHRA.	Ministry of Environment	A limited domestic well monitoring program has been implemented voluntarily by Teck to assess whether surface water constituents have influenced drinking water wells. Site-specific groundwater monitoring programs as well as a regional groundwater monitoring program are required in Permit 107517. Monitoring includes a full suite of parameters and available data will be considered in the HHRA as appropriate.

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47	Human Health Risk Assessment Terms of Reference	While a secondary screening step is not supported by MOE, if Teck proceeds with this methodology then toxicity profiles for all pathway-specific exposure benchmarks used in this step should be provided to ensure that use of these benchmarks is appropriate.	Ministry of Environment	The secondary screening step was eliminated. Brief toxicity profiles will be provided.
48	Human Health Risk Assessment Terms of Reference	Please confirm that incremental lifetime cancer risk (ILCR) will be calculated according to Health Canada methodology which gives preference to cancer risk evaluated over an 80 (not a 70) year life span where receptors are known or reasonably likely to be exposed to the area over their entire lifetime.	Ministry of Environment	Confirmed.
49	Human Health Risk Assessment Terms of Reference	Please confirm that for those non-carcinogenic substances for which a hazard index is calculated, an acceptable threshold of 0.2 will be used. The Canadian Council of Ministers of the Environment environmental quality guidelines were calculated based on 100% exposure to five environmental media (soil, water, air, food and "commercial products"). As the HHRA is proposed to be limited to a single media (water), an acceptable threshold of 20% or 0.2 is recommended.	Ministry of Environment	The HHRA will address potential risk associated with all constituents for which hazard indices exceed 0.2 and 1.0. It should be noted that the HHRA will not be limited to a single medium.
50	Human Health Risk Assessment Terms of Reference	Inclusion of a completed Problem Formulation as a deliverable of the HHRA TOR for review by MOE and the EMC is recommended.	Ministry of Environment	The initial problem formulation is provided in the work plan, lacking only the screening against guidelines. The results of screening against guidelines and proposals regarding disposition of constituents lacking guidelines will be provided in a slide presentation for consultation at an EMC meeting.
1	Line Creek LAEMP Report 2014	Professional Designations (e.g. RPBio) are not shown for the report authors. Ensure that professional designations of report authors are clearly stated in the report.	Ministry of Environment	
2	Line Creek LAEMP Report 2014	If total selenium (Se) will be reduced by the AWTF, why would organoselenium species not be reduced by the treatment process, since they are "more bioavailable and readily accumulated by aquatic biota"? Why won't they be taken up by the organisms in the AWTF? Please discuss in the report how the various species of Se will interact with the	Ministry of Environment	

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		biota in the AWTF and how this should impact the Se concentrations observed in the receiving environment downstream of the plant.		
3	Line Creek LAEMP Report 2014	Please add dates of sampling to this table to easily illustrate that monitoring was conducted concurrently.	Ministry of Environment	
4	Line Creek LAEMP Report 2014	Please confirm in the report that the rock selection process for periphyton sampling was random and rocks were not chosen based on visual assessment of periphyton coverage. Why were highly angular rocks or rocks with uncharacteristic surface texture discriminated against? How would this discrimination, which "minimized some of the natural habitat variability" potentially impact/bias results? Provide more description in the report methodology on how and why certain rocks were discriminated against and any potential impacts this may have had on the results.	Ministry of Environment	
5	Line Creek LAEMP Report 2014	Please confirm in the report if areas of similar phytoplankton density on each rock were selected for the chlorophyll-a and AFDM scrapings.	Ministry of Environment	
6	Line Creek LAEMP Report 2014	Please indicate in the report if the procedures used for analysis of AFDM and chlorophyll-a are in accordance with those listed in Section B, Physical, Inorganic and Miscellaneous Constituents, of the BC Environmental Laboratory Manual 2009 (BCELM). It appears that the methods for AFDM differ: the LAEMP Report cites using EPA Method 445.0 for chlorophyll-a and APHA Method 10300C for AFDM, while the BCELM refers to APHA method 10200H for chlorophyll-a and the APHA Method 10200I for AFDM. It may be that the procedures used are more up-to-date; please confirm if this is the case. (Here is the link to the BC Environmental Lab Manual: http://www.env.gov.bc.ca/epd/wamr/labsys/lab-man-09/pdf/section-b-2009.pdf)	Ministry of Environment	
7	Line Creek LAEMP Report 2014	In the report, please discuss the findings that reference areas had lower bryophytes than mine-influenced sites and discuss reasons why this was observed in context of impacts of mine-influenced water to the receiving	Ministry of Environment	

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		environment.		
8	Line Creek LAEMP Report 2014	Statistical data analysis should be conducted on the data and discussed in the report to compare between reference sites and impacted sites, even though there was only a brief period of AWTF discharge. Data analysis and Interpretation was included in the 2014 Study Design for Local Aquatic Effects Monitoring in Line Creek (Feb 27 ,2014).	Ministry of Environment	
9	Line Creek LAEMP Report 2014	In the report please discuss potential changes to sampling methodologies that could reduce the large variability in periphyton results (namely Chlorophyll-a). Would increasing the sample size help? Please implement any recommended changes in the 2015 study design. Include triggers for management action on Graph 3.1 (25 mg/m2).	Ministry of Environment	
10	Line Creek LAEMP Report 2014	Please ensure that page numbers are included on all pages of the report (they are missing on the pages with the graphs which makes filling in the page numbers in this comment table difficult).	Ministry of Environment	
11	Line Creek LAEMP Report 2014	Please explain the reasons for the spikes in phosphorus at LILC3 in August and September in the report.	Ministry of Environment	
12	Line Creek LAEMP Report 2014	Please include applicable water quality guidelines and relevant permitted levels on these graphs.	Ministry of Environment	
13	Line Creek LAEMP Report 2014	Please include another chart comparing the % EPT between the sites.	Ministry of Environment	
14	Line Creek LAEMP Report 2014	Please include applicable water quality guidelines and relevant permitted levels on these graphs.	Ministry of Environment	
15	Line Creek LAEMP Report 2014	Please explain the linkages between efficacy of the AWTF and the observation that "total and dissolved selenium concentrations in water were not noticeably different after commissioning of the AWTF compared to before." Does this mean that while the AWTF was operating, it was not removing Se from the water as expected? Please discuss what the results for the various Se species means in terms of potential impacts to biota in lentic and lotic aquatic environments.	Ministry of Environment	

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16	Line Creek LAEMP Report 2014	Please discuss potential reasons for the observed difference in pattern of periphyton Chl-a and AFDM in 2013 compared to 2014 (highest levels observed at LI8 in 2013 versus LILC3 in 2014).	Ministry of Environment	
17	Line Creek LAEMP Report 2014	Agreed that monitoring should continue as per the 2014 study design, unless changes could be made in sampling design to reduce the large variability in periphyton results (see comment above). Please include statistical analyses of data in the 2015 report.	Ministry of Environment	
18	Line Creek LAEMP Report 2014	Please include a Discussion section in the report to discuss what the observed data are telling us regarding local aquatic effects, the management of these effects, the health of the local ecosystem, and any changes to the local ecosystem that are being observed over time.	Ministry of Environment	
19	Line Creek LAEMP Report 2014	The Line Creek Local Aquatic Effects Monitoring Program (LAEMP), 2014 (Minnow Environmental Inc. 2015a) describes the results of first year of data collection for the Line Creek LAEMP. The 2014 LAEMP for Line Creek included four components: periphyton productivity; bryophyte productivity; benthic invertebrate biomass and tissue selenium concentrations; and, water concentrations of nutrients (nitrogen and phosphorus) and selenium. A detailed review of this report was not conducted because the results of a preliminary review of the draft indicated that there are numerous deficiencies. Nevertheless, the following general comments are offered on this document.	Ktunaxa Nation Council	
20	Line Creek LAEMP Report 2014	Develop a project-specific CSM that provides the scientific basis for designing an LAEMP that effectively detects and quantifies project-related effects within the Line Creek watershed, including effects associated with all project-related activities.	Ktunaxa Nation Council	
21	Line Creek LAEMP Report 2014	Revise the purpose of the Line Creek LAEMP. The objective of the Line Creek LAEMP should be to provide the data and information needed to:	Ktunaxa Nation Council	

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		1. Determine if aquatic ecosystems and their uses are being adequately protected in the vicinity of the project; 2. Identify and evaluate the short-term and long-term project-related effects on the aquatic environment; 3. Evaluate the accuracy of predictions regarding the effects of the project on water quality conditions, on the aquatic environment, and on human health; and, 4. Assess the need for, and efficacy of, measures to mitigate the short- term and/or long-term effects of the project on the aquatic environment.		
22	Line Creek LAEMP Report 2014	Expand the scope of the Line Creek LAEMP to include all relevant assessment and measurement endpoints. To the extent that data were collected in 2014 on additional assessment and measurement endpoints (e.g., surface-water chemistry, surface-water toxicity, sediment chemistry, sediment toxicity, benthic invertebrate community structure, invertebrate-tissue chemistry, fish-tissue chemistry, fish health, fish population and community status, etc.), the results of such monitoring activities should be presented in the 2014 LAEMP report for Line Creek.	Ktunaxa Nation Council	
23	Line Creek LAEMP Report 2014	Increase the scope of the LAEMP to include all of the surface-water chemistry data collected within the Line Creek watershed in 2014. These data need to be evaluated to determine if the performance criteria for measurement data have been met and analysed to evaluate project-related effects on water quality, including but not limited to the effects of the AWTF on water quality conditions.	Ktunaxa Nation Council	
24	Line Creek LAEMP Report 2014	Revise the LAEMP report to include all of the relevant information on the 2014 fish kill downstream of the Line Creek AWTF.	Ktunaxa Nation Council	
25	Line Creek LAEMP Report 2014	Revise the 2014 Line Creek LAEMP report to address all comments provided by KNC and other EMC members. Re-submit the 2014 LAEMP report to the EMC for further review and evaluation.	Ktunaxa Nation Council	

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26	Line Creek LAEMP Report 2014	Wants early detection of disastrous conditions related to re-commissioning of AWTF.	Ktunaxa Nation Council	
27	Line Creek LAEMP Report 2014	Scope of LAEMP is too narrow.	Ktunaxa Nation Council	
28	Line Creek LAEMP Report 2014	Needs to be designed to study effects in local area.	Ktunaxa Nation Council	
29	Line Creek LAEMP Report 2014	What are the right things to monitor, and where?	Ktunaxa Nation Council	
30	Line Creek LAEMP Report 2014	Purpose? Key questions? End-points? Design should look at assessment and end-points. Need to look at the effect of all activities not just the AWTF on Line Creek.	Ktunaxa Nation Council	
31	Line Creek LAEMP Report 2014	LAEMP needs to be more robust, linked to other things going on -- see effects on sediment chem / toxicity, impacts on benthic community, etc. so we get information that allows us to report on status of water, and resources that rely on water.	Ktunaxa Nation Council	
1	2014 Calcite Monitoring and Statistical Power Report	For each 2013 site that was excluded and each new site that was added to the Calcite Monitoring Program, indicate in the body or appendices the rationale for exclusion/inclusion. For example, in Section 2.2 the report states ""Clode West Exfiltration - Not Identified in 2013"" and the Appendices state ""New. Not identified in 2013"". These statements should be expanded to make clear why the addition was made.	Ministry of Environment	The requested level of detail will be provided in the 2015 report.
2	2014 Calcite Monitoring and Statistical Power Report	It is understood that the lowest three reaches of Dry Creek are maintained in the program, while the upper reaches have been removed because they are now isolated from the rest of the stream. However, the portion of Reach 4 between East Tributary and Reach 3 is not addressed. Provide rational for not including the portion of Reach 4 between East Tributary and Reach 3 in the Monitoring Program going forward.	Ministry of Environment	Teck will review the noted portion of Reach 4, and consider inclusion in the 2015 calcite monitoring program. The results will be provided in the 2015 report.
3	2014 Calcite Monitoring and Statistical Power Report	Provide rationale for the change in assessment techniques at constructed settling ponds between 2013 and 2014.	Ministry of Environment	A rationale will be provided in the 2015 report.
4	2014 Calcite	Please describe how the observed	Ministry of	For both GODD3 and SPSE1, multiple

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	Monitoring and Statistical Power Report	increase in concretion (>1 ΔC) will be addressed at GODD3 and SPSE1 in year 3 of the monitoring program.	Environment	flow paths may have resulted in inconsistent sampling (as to absolute location) year-on-year. These sites will be investigated for the 2015 program, and appropriate long-term sampling locations selected.
5	2014 Calcite Monitoring and Statistical Power Report	Provide more detailed analysis and discussion of the monitoring results, including in-depth interpretation of spatial and temporal variability and linkages to management decisions. For example, a deliverable in the Valley Permit is to select a priority stream for calcite treatment by March 31, 2016. The monitoring report should speak to how the collected data supports this deliverable. Another example is the 2014 report indicates that the 2013 flooding events may have impacted calcite deposition. The report should address what those impacts might be.	Ministry of Environment	The monitoring report does provide some, but not all of the data that will support Teck's management decision to select a priority stream by 2016. Other information to support Teck's decision will come from the tributary evaluation, the adaptive management program, and other studies that Teck is undertaking. The evaluation required to support the selection of a priority stream by March 31, 2016 will be prepared as a separate document. The 2014 report mentions the 2013 flood as it could have, in places, removed calcite deposition from stream beds or substrates, affecting the 2013 results. However, without data to support this hypothesis, Teck felt that it was inappropriate to speculate within the monitoring report. Teck anticipates that the third year of data may provide a basis for more detailed analysis and discussion of the monitoring results, and will provide a more in-depth discussion in the 2015 report.
6	2014 Calcite Monitoring and Statistical Power Report	Increase number of sampling sites in reaches where there are notable differences. Generate data for CI at each of 15 - 20 sites, then do series of random selections of three sites repeatedly, to determine how frequently the variability appears, based on larger sample size.	Ktunaxa Nation Council / Ministry of Environment	Teck will increase the sample size (i.e. greater than three) at selected locations in the 2015 program. Care will need to be taken in analyzing the results, as some degree of autocorrelation (similar results from adjacent sites) is likely.
7	2014 Calcite Monitoring and Statistical Power Report	Re-sample the data multiple times to determine the estimate of the mean, and the variability around the mean.	Ktunaxa Nation Council / Ministry of Environment	At selected sites in the 2015 program, Teck will re-sample the data three times (i.e. conduct three modified Wolman pebble counts) to determine the estimate of the mean CI and variability around the mean CI. This will be done at nine sites, three each within the CI ranges of 0 to 1, 1 to 2, and 2 to 3. The data will be re-sampled on the same day, and by the same crew.
8	2014 Calcite Monitoring and Statistical Power Report	Select stations where there appears to be stability and confirm that those locations are in fact stable (i.e. temporal stability).	KNC/ Ministry of Environment	Data will be collected as part of the 2015 sampling program; stability will be assessed using data from all three years of the study.
9	2014 Calcite Monitoring and	Use third year to nail down spatial variability in reaches where there is the	Ktunaxa Nation Council	Data will be collected as part of the 2015 sampling program; spatial variability will

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	Statistical Power Report	length t do so at the reach level.		be assessed using data from all three years of the study.
10	2014 Calcite Monitoring and Statistical Power Report	Develop draft criteria for long-term monitoring and discuss with EMC.	Ktunaxa Nation Council	Teck will develop draft criteria for long term calcite monitoring after the conclusion of the 2015 monitoring program.
11	2014 Calcite Monitoring and Statistical Power Report	Consider reducing the number of sampling reaches, or justify why > 100 reaches are required	Independent Scientist	We designed this as a three year study, with the intent of modifying the study design after three years. The intent of this study is to document the extent of calcite in mine-affected streams, and comparing it to reference sites. After the third year of data (2015) we will revise the study design for our longer-term monitoring, considering this advice.
12	2014 Calcite Monitoring and Statistical Power Report	Indicate how canopy cover was estimated.	Independent Scientist	We will update our field manual to describe the method, and incorporate this into our longer-term monitoring plan.
13	2014 Calcite Monitoring and Statistical Power Report	Indicate what the various channel measurements were. In Appendix 3 provide definitions for measured endpoints (acronyms are provided currently).	Independent Scientist	Acknowledged. We will provide clarity in the 2015 report.
14	2014 Calcite Monitoring and Statistical Power Report	Identify any water quality measurements collected at time of calcite measurement	Independent Scientist	The intent of this study is to document calcite extent, as opposed to studying the conditions under which calcite forms. The calcite observations reflect deposition (or dissolution) over the past year, while the water chemistry represents an instant in time, and it is known that the water chemistry varies both seasonally and diurnally.
15	2014 Calcite Monitoring and Statistical Power Report	Consider examining the relationships between the CI and water quality and stream physical attributes in order to understand causes of variation in calcite production to a greater degree.	Independent Scientist	This is a study area for the management of calcite, but not within the scope of the monitoring report.
16	2014 Calcite Monitoring and Statistical Power Report	Consider variability in variance at CI's between 0.5 and 2.5, and how that will site-specifically influence likelihood of detecting change.	Independent Scientist	Acknowledged. We will consider this advice while preparing the 2015 report.
17	2014 Calcite Monitoring and Statistical Power Report	Consider incorporating water quality models that predict calcite production, and see if there are correlations between predicted production and actual production (i.e., CI).	Independent Scientist	This is a study area for the management of calcite, but not within the scope of the monitoring report.
18	2014 Calcite Monitoring and Statistical Power	Need more justification why the program needs to stay status quo.	Independent	Acknowledged. We will consider this advice while designing the longer-term monitoring program.

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#	Submission	Input and Advice	EMC Member	Teck Response
	Report		Scientist	
19	2014 Calcite Monitoring and Statistical Power Report	Need more justification why we should develop a protocol for ponds/wetlands.	Independent Scientist	Acknowledged. We will consider this advice for the 2015 monitoring program.
20	2014 Calcite Monitoring and Statistical Power Report	Consider adding a seasonal component to the study to determine season-related variation in CI.	Independent Scientist	This is the subject of a separate study.
21	2014 Calcite Monitoring and Statistical Power Report	Elaborate on what is meant by selecting stations that avoid flow alterations. Can you explain whether it is possible to modify the Wolman pebble count to more precise locations, and be less random?	Independent Scientist	We want to be sure that we have consistent location reporting year-on-year, while recognizing that flow paths may vary over time. During the development of the monitoring program, we considered using a point-intercept method to select the pebbles. We found that there was no significant difference in the data between methods, and selected the pebble count method as it was more efficient. (Ref. Teck, January 2013. Approach and Methodology to Monitor and Assess Calcite Impact.) During the 2013 program, we assessed observer variability, and found no significant difference between crews while assessing the same sites. (Ref. Robinson and MacDonald, 2014. Teck Coal Limited 2013 Calcite Monitoring Program.)
22	2014 Calcite Monitoring and Statistical Power Report	Consider developing a QA method that will 'calibrate' CI scores among crews, or at least quantify the variations in CI attributable to crews.	Independent Scientist	Acknowledged. Although we have assessed the variability among crews (see note in row 13), we will consider this advice while designing the longer-term monitoring program, with updates to field procedures.
1	Lake Koocanusa 2014 Data Summary Report	Rather than conducting a detailed review of the data that were collected and the associated data interpretation, we have focused our review on the Recommendations for 2015.	Ktunaxa Nation Council	
2	Lake Koocanusa 2014 Data Summary Report	Although the Program Report provides recommendations for 2015, the proposed design of the 2015 Koocanusa Reservoir monitoring program was not presented in MEI (2015). In addition, we have been unable to locate the 2015 Koocanusa Reservoir monitoring program design in any other document authored by Teck Coal Ltd. or its consultants. Therefore, the 2015 Koocanusa Reservoir monitoring program design should be immediately requested from Teck Coal Ltd. to provide KNC with an	Ktunaxa Nation Council	

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		opportunity to review and comment prior to implementation of the monitoring program.		
3	Lake Koocanusa 2014 Data Summary Report	The approach to evaluating baseline sediment quality conditions in the Koocanusa Reservoir is not sufficient. Sediment quality conditions should be evaluated using matching sediment chemistry, sediment toxicity, and benthic invertebrate community structure (BICS) data at, at minimum, six locations in the Koocanusa Reservoir, including three stations located upstream of the Elk River and three locations downstream of the Elk River. Collection of matching data requires use of a side-by-side van Veen grab sampler (or similar sampler) that facilitates simultaneous collection of sediment samples for chemistry and toxicity evaluation and for BICS evaluation. Three toxicity tests need to be conducted, including 42-d exposures with amphipods (Endpoints: survival and growth), 20-d exposures with midge (Endpoints: survival and growth), and 21-d exposures with mayflies (Endpoints: survival and growth).	Ktunaxa Nation Council	
4	Lake Koocanusa 2014 Data Summary Report	More information is required on how field-meter collected chlorophyll-a data will be verified using traditional field filtering and laboratory analysis techniques (i.e., number of locations, sampling frequency, interpretation of results, etc.).	Ktunaxa Nation Council	
5	Lake Koocanusa 2014 Data Summary Report	More information is required on the process that will be used for identifying, evaluating, and selecting BICS sampling stations. In addition, the process for interpreting any spatial and/or temporal trends in BICS metrics at reference stations needs to be described, based on the recommendation that reference stations should be re-located in 2015.	Ktunaxa Nation Council	
6	Lake Koocanusa 2014 Data Summary Report	More information is required on the statistical approach that will be used to evaluate spatial or temporal trends in metals concentrations in benthic invertebrates (i.e., how will the data be evaluated in the absence of sample replication). KNC has previously indicated that sediment bioaccumulation testing provides a	Ktunaxa Nation Council	

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		suitable approach for evaluating the accumulation of metals in the tissues of benthic invertebrates, particularly considering the challenges associated with acquiring sufficient sample mass in the field. KNC has also recommended the use of micro-analysis of benthic invertebrate tissues to facilitate determination of metals concentrations with small sample masses (i.e., about 1 gram). The status of investigations into laboratories with micro-analysis capabilities needs to be provided to KNC.		
7	Lake Koocanusa 2014 Data Summary Report	Recommendation 6 indicates that collection of a variety of fish species should be continued for tissue analysis (i.e., including bull trout, burbot and various other species). However, Recommendation 9 indicates that collection and analysis of burbot tissues should be discontinued. Collection of data on the concentrations of metals in burbot tissues has been identified as a high priority by KNC. Therefore, further characterization of the levels of selenium and other metals in burbot tissues is required. Previously, KNC indicated that Teck should coordinate with KNC citizens in Tobacco Plains and elsewhere to obtain sub-samples of burbot tissues that are harvested in the food fishery. Therefore, KNC would appreciate a status report on the efforts that were made to facilitate such coordination.	Ktunaxa Nation Council	
8	Lake Koocanusa 2014 Data Summary Report	Want baseline info - where there is, and is not, toxicity - as a baseline against which change can be measured at future date (i.e. if toxicity levels become present or change).	Ktunaxa Nation Council	
9	Lake Koocanusa 2014 Data Summary Report	It is important to discuss what data analysis methods will be done before the data collection starts.	Ktunaxa Nation Council / Ministry of Environment	
10	Lake Koocanusa 2014 Data Summary Report	Regardless of data collection, a data analysis plan that defines how data will be analyzed is important.	Ktunaxa Nation Council	
11	Lake Koocanusa 2014 Data Summary Report	It's hard to find enough benthic inver tissue therefore, lab-bioaccumulation tests may be an alternate approach.	Ktunaxa Nation Council	

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12	Lake Koocanusa 2014 Data Summary Report	Use RAEMP monitoring end-point summary table as a planning tool for 2016.	Ministry of Environment	
13	Lake Koocanusa 2014 Data Summary Report	Tagging of fish would allow for monitoring ranges.	Ktunaxa Nation Council	
14	Lake Koocanusa 2014 Data Summary Report	This is a comprehensive study. Conventional monitoring components were collected using a good level of effort. I have some suggestions on how the data might be differently assessed, but I don't think different analyses will produce drastically different conclusions.	Independent Scientist	
15	Lake Koocanusa 2014 Data Summary Report	Ensure that non-spawning fish are not included in analysis of body size / organ size analyses, since the analysis is generally carried out on 'adult' or spawning fish.	Independent Scientist	
16	Lake Koocanusa 2014 Data Summary Report	Consider using a multivariate technique to illustrate temporal and spatial variations in catch data.	Independent Scientist	
17	Lake Koocanusa 2014 Data Summary Report	Recommend not changing the level of effort in the identification of ostracods.	Independent Scientist	
18	Lake Koocanusa 2014 Data Summary Report	Recommend that if this component is retained, that the organisms be separated at least into major groups; e.g., worms, chironomids, clams, before tissue analysis is done. This would result potentially in analysis on three groups.	Independent Scientist	
19	Lake Koocanusa 2014 Data Summary Report	Recommend putting tissue concentrations into context using tissue/consumption guidelines.	Independent Scientist	
20	Lake Koocanusa 2014 Data Summary Report	Recommend only measuring Hg in fish that are regularly consumed (assuming this isn't the case now).	Independent Scientist	
21	Lake Koocanusa 2014 Data Summary Report	Consider sampling the nearshore with dip nets during periods of low water. Appropriate protocol would be the CABIN kick and sweep.	Independent Scientist	
22	Lake Koocanusa 2014 Data Summary Report	Consider using multivariate techniques to illustrate spatial variations in composition, and to generate indices of composition that could be used to test for differences in composition.	Independent Scientist	
23	Lake Koocanusa 2014 Data	Consider expanding the upstream reference area with a larger sample	Independent	

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	Summary Report	size of potentially n=10, if it is difficult to find a different reference area that has more similar substrate texture to the downstream transect.	Scientist	
1	Adaptive Management Uncertainty Hierarchy	Consider providing some verbiage that provides the linkage between this Uncertainty Hierarchy and the various adaptive management related requirements in the Permit. That is, make sure the document indicates how this uncertainty hierarchy is helping us address the AMP requirement?	Independent Scientist	
2	Adaptive Management Uncertainty Hierarchy	Consider integrating present and future tense in the phrasing of the question, or clarifying so that the Big Question and associated Uncertainties are in the same tense, or tenses.	Independent Scientist	
3	Adaptive Management Uncertainty Hierarchy	Omit?	Independent Scientist	
4	Adaptive Management Uncertainty Hierarchy	Clarify what is meant by seasonal fluctuations…i.e., in what?	Independent Scientist	
5	Adaptive Management Uncertainty Hierarchy	Consider omitting. Potentially redundant with CU2.1	Independent Scientist	
6	Adaptive Management Uncertainty Hierarchy	Modify uncertainty to "What do we do if a Compliance Limit is exceeded?"	Independent Scientist	
7	Adaptive Management Uncertainty Hierarchy	Consider re-phrasing to: "If water quality targets (limits and SPOs) for selenium, nitrate, sulphate and cadmium are met, is it likely that water uses will be protected.	Independent Scientist	
8	Adaptive Management Uncertainty Hierarchy	Consider re-phrasing : "Is it likely that other water quality constituents will affect water uses…"	Independent Scientist	
9	Adaptive Management Uncertainty Hierarchy	Consider rephrasing	Independent Scientist	
10	Adaptive Management Uncertainty Hierarchy	Rephrase "Are there key populations of aquatic organisms, that may not be protected by achieving water quality targets?"	Independent Scientist	

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11	Adaptive Management Uncertainty Hierarchy	Rephrase the question?	Independent Scientist	
12	Adaptive Management Uncertainty Hierarchy	I think we should add as an underlying uncertainty the following: "What measures can be used to indicate 'early warning' of current or impending degradation of a VEC.	Independent Scientist	
13	Adaptive Management Uncertainty Hierarchy	General comment	Independent Scientist	
14	Adaptive Management Uncertainty Hierarchy	While future-state thinking is warranted, the emphasis of this initial AMP should be on the short-term immediate purpose of the ABMP to immediately begin to stabilize water quality concentrations of selenium, cadmium, nitrate, and sulphate, and the rate of formation of calcite. Uncertainty questions should be directed at this purpose.	Ministry of Environment	
15	Adaptive Management Uncertainty Hierarchy	The Valley Permit specifies that the AMP must 1) support implementation of the ABMP, 2) achieve water quality targets, 3) ensure that human health is protected, 4) ensure that the environment is protected, 5) the environment is restored where necessary and 6) facilitate continuous improvement of water quality. Each Big Question / Critical uncertainty should fall under the heading of one of these 6 requirements. I would expect there to be some uncertainties around #1 to do with project management, roles/responsibilities, plan execution and # 5) when is restoration necessary or what can be restored immediately (i.e., calcified stream channels).	Ministry of Environment	
16	Adaptive Management Uncertainty Hierarchy	Consider re-wording this big question. E.g. "How will targets and timeframes be met?", "Are targets and timeframes being met?". We need to ensure that each BQ and Critical Uncertainty is satisfying a goal stated in the AMP clause of the Valley Permit. Perhaps it would be good to indicate which goal is being met by each BQ and Critical Uncertainty.	Ministry of Environment	
17	Adaptive Management	Section 9 of the Valley Permit outlines the evaluation requirements. The	Ministry of	

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	Uncertainty Hierarchy	underlying uncertainties need to be very clear - we need to be careful about what is MOE's responsibility to define and what is Teck's responsibility.	Environment	
18	Adaptive Management Uncertainty Hierarchy	There is an established requirement for non-compliance reporting in 10.2.1 of the Permit. Change the wording of this uncertainty to be clear that it does not include the permit requirements for reporting non-compliance.	Ministry of Environment	
19	Adaptive Management Uncertainty Hierarchy	At this early stage, resources might be better applied to answering questions related to stabilizing the current upward trends rather than trying to determine whether limits and SPOs are too stringent.	Ministry of Environment	
20	Adaptive Management Uncertainty Hierarchy	These appear to say the same thing. Defining "appropriate" and "sufficient" may clarify a difference (for example a difference in scale).	Ministry of Environment	
21	Adaptive Management Uncertainty Hierarchy	Add another CU: "How will R&D and monitoring results be incorporated into mine management?" or "How will the AMP-ABMP connection be constructed and maintained?" The idea here follows from previous comments about the BQs and CUs needing to be directed at Permitted AMP purposes and uncertainties regarding the effective implementation of the ABMP (permit requirement for the AMP to support the implementation of the ABMP).	Ministry of Environment	
22	Adaptive Management Uncertainty Hierarchy	These are great questions for R&D as they are directly addressing the most critical issue which is reducing constituent concentrations.	Ministry of Environment	
23	Adaptive Management Uncertainty Hierarchy	Underlying uncertainty for CU 3.1: How will disasters/toxicity events be addressed?	Ministry of Environment	
24	Adaptive Management Uncertainty Hierarchy	Can PWT be incorporated into permits as a water quality management component? - MOE feels that the answer to this is yes and may not be an underlying uncertainty.	Ministry of Environment	
25	Adaptive Management Uncertainty Hierarchy	MOE feels this is an appropriate critical uncertainty given the uncertainty present in models and many concerns raised through ongoing permitting and EA certificate processes.	Ministry of Environment	

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26	Adaptive Management Uncertainty Hierarchy	This question embodies cumulative effect thinking which is good. This is a critical uncertainty for the Ministry also when it comes to the other proponents' mine proposals and industrial operations in the Valley, and cumulative effects in the Valley in general. "How will the ABMP be connected to the CEMF?" may be a CU that doesn't fall under any of the current BQs. Our concern here is that the AMP should support the implementation of the ABMP in the context of other ongoing and new projects and regulatory processes in the valley. Many underlying uncertainties are being addressed through the many plans and programs required by the Valley-wide and site permits - any connection between the AMP CUs and UUs and ongoing activities (RAEMP, HHRA, SLERA, CEMF) need to be clearly stated.	Ministry of Environment	
27	Adaptive Management Uncertainty Hierarchy	The UUs for this BQ need to include the uncertainties that are being addressed by the current seasonal and biological studies on calcite.	Ministry of Environment	
28	Adaptive Management Uncertainty Hierarchy	Considering that the AMP is required to address restoring the environment where necessary - more consideration should be given to uncertainties and R&D questions around rehabilitating calcified stream channels (how, when, where).	Ministry of Environment	
29	Adaptive Management Uncertainty Hierarchy	Calcite precipitation can also be a sink for Phosphorus - acting as a negative feedback to eutrophication. An aspect that should be monitored during calcite studies.	Ministry of Environment	
30	Adaptive Management Uncertainty Hierarchy	5.1. What is the ongoing state of aquatic ecosystem health – are there effects under ongoing conditions? This CU appears to be a restatement of the BQ. Consider breaking this down by ecological category/high-level component into multiple CUs: "What is the state of fish health?" "What is the state of fish population health?" "What is the state of benthic invertebrate health?" "What is the state of health at the lowest trophic levels?" Consider including the RAEMP key questions.	Ministry of Environment	

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		Again, make sure that the ongoing plans/programs/projects are clearly stated if they are connected to the UUs in the AMP.		
31	Adaptive Management Uncertainty Hierarchy	6.1 is a higher order question than 6; therefore, 6.1 should be the BQ and 6 the critical uncertainty.	Ministry of Environment	
32	Adaptive Management Uncertainty Hierarchy	These UUs look like CUs and may be more appropriate as Level 2 questions with level 3 questions needed beneath them.	Ministry of Environment	
33	Adaptive Management Uncertainty Hierarchy	This UU, which MOE feels is actually a CU, is a good example of a 'management' uncertainty that we have raised in previous comments. This question could be copied under BG#5 by changing it to "Are Teck's management procedures sufficiently protective of aquatic health?" - definitely a Level 1 or Level 2 question. What are critical or underlying uncertainties that could be posed under these 'management procedure' questions? What is meant by 'management procedures?	Ministry of Environment	
34	Adaptive Management Uncertainty Hierarchy	The identification of big questions should be informed by a detailed problem formulation and conceptual site model that describes the linkages between minerelated activities and potential effects on human health and the environment. Such a problem formulation and conceptual site model would provide a common understanding of the stressors that are associated with coal-mining activities, the transport and fate of chemicals of potential concern (COPCs), the effects of COPCs and other stressors on receptors, the exposure pathways of interest, the receptors potentially at risk, and the locations where effects are likely to be observed. In turn, this information provides a basis for identifying the assessment endpoints and measurement endpoints that should be used to evaluate the effects of mining activities and the measures that are proposed to mitigate such effects. The problem formulation and conceptual site model are important for identifying critical uncertainties and underlying uncertainties associated with the big questions that are selected	Ktunaxa Nation Council	

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		for evaluation under the AMP.		
35	Adaptive Management Uncertainty Hierarchy	"The following big questions are recommended: 1. Are the short-term, medium-term, and long-term water quality targets (including permit limits and site-performance objectives) protective of all water uses in the Elk River watershed?"	Ktunaxa Nation Council	
36	Adaptive Management Uncertainty Hierarchy	"2. Will the short-term, medium-term, and long-term water quality targets (including permit limits and site-performance objectives) be met at all compliance locations within the timeframes identified in the Elk Valley Water Quality Plan and valley-wide permit?"	Ktunaxa Nation Council	
37	Adaptive Management Uncertainty Hierarchy	3. What are the most effective measures for minimizing releases of contaminants into the environment and what factors are influencing their application in the Elk River watershed?	Ktunaxa Nation Council	
38	Adaptive Management Uncertainty Hierarchy	"4. What are the most effective measures for mitigating the effects of contaminants after they have been released into the environment?"	Ktunaxa Nation Council	
39	Adaptive Management Uncertainty Hierarchy	5. What are the most effective measures for minimizing the formation of calcite in receiving waters within the Elk River watershed?	Ktunaxa Nation Council	
40	Adaptive Management Uncertainty Hierarchy	6. What are the effects of coal-mining activities on environmental conditions and aquatic ecosystem health (including riparian habitats) in the tributaries, mainstem areas, and lacustrine habitats within the Elk River watershed?	Ktunaxa Nation Council	
41	Adaptive Management Uncertainty Hierarchy	"7. What are the cumulative effects of multiple stressors associated with all anthropogenic activities in the tributaries, mainstem areas, and lacustrine habitats within the Elk River watershed?"	Ktunaxa Nation Council	
42	Adaptive Management	"8. What are the effects on human health associated with exposure to	Ktunaxa Nation Council	

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	Uncertainty Hierarchy	contaminants through all exposure pathways, including surface water, groundwater, and biological tissues?"		
43	Adaptive Management Uncertainty Hierarchy	Refinement of the big questions will necessitate prioritizing and, in some case, developing new critical uncertainties and underlying uncertainties. This step in the process should be undertaken after agreement has been reached on the big questions.	Ktunaxa Nation Council	
1	Adaptive Management Plan Terms of Reference	Define the goals more broadly to address so the plan considers a long-term - seven generations - look into the future, not just 20 years into the future.	Ktunaxa Nation Council	As per permit 107517 (Section 11), the objective of the Adaptive Management Plan (AMP) is to support the "implementation of the ABMP (Area Based Management Plan or 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". As the AMP is intended to compliment the ABMP, the timeframes of the two documents need to be consistent in order to focus on meeting the ABMP environmental management objectives. As required by permit 107571, the AMP will be updated on a three-year cycle, which will include an update to the planning horizon for the AMP.
2	Adaptive Management Plan Terms of Reference	During the review of the draft ToR, EIS listed two extra elements that would fit into Figure 2. EIS will carry these, and probably more, elements into plan development, and in this review offers some additional rationale for MOE and Teck to consider in support of the coming work. EIS expects that Figure 2, "Examples of where EVWQP elements fit into the adaptive management cycle", will form a foundation for the elements of each AMP stage in the final plan, and expects to reiterate the following, non-exhaustive, edits to the lists in Figure 2.	Ministry of Environment	We appreciate MOE's helpful suggestions of additional items to include as examples in Figure 2 in the TOR. We have amended Figure 2 to include MOE's suggested additions to stages 1 (Assess) and 2 (Design), using concise terminology which captures the intent of MOE's suggestions as per the responses in the following two advice items (#2 and #3). Figure 2 is meant to show "Examples of where EVWQP elements fit into the adaptive management cycle", and is not meant to be a comprehensive list of all of the elements that will be incorporated into the adaptive management plan, since a comprehensive list could not be feasibly incorporated into a schematic figure on one page.
3	Adaptive Management Plan Terms of Reference	Preamble: Fig 2, "1.Assess" includes a bullet: "Develop hypotheses for critical uncertainties in: aquatic health, hydrology, water quality…". The health of the populations of Westslope Cutthroat Trout (WCT), other fish	Ministry of Environment	The Assess step in Figure 2 was updated from "- Develop hypotheses for critical uncertainties in: aquatic health, hydrology, water quality, calcite, alternative methods of reducing contaminants, efficacy of mitigation methods" to "- Develop

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		species and other biota are valued by Elk Valley stakeholders. Edit: The Assess stage of the AMP will involve considering hypotheses addressing the critical uncertainties around the health of WCT and other important biotic populations.		hypotheses for critical uncertainties in: aquatic health, hydrology, water quality, fish, other biota, calcite, alternative methods of reducing contaminants, efficacy of mitigation methods".
4	Adaptive Management Plan Terms of Reference	Preamble: Fig 2, "2.Design" includes a bullet: "Predict trends in contaminants, establish early warning triggers." This stage of adaptive management is meant to include the design of alternative management actions and the identification of expected outcomes and responses. Edit: The Design stage of the AMP will involve the prediction of trends in ecosystem components, including contaminants and appropriate receptors (e.g. Se concentrations-fish reproduction, calcite index scores-benthic invertebrate community structure metrics).	Ministry of Environment	The Design step in Figure 2 was updated from "- Predict trends in contaminates, establish early warning triggers" to "- Predict trends in contaminants and changes to biological receptors, establish early warning triggers".
1	Sublethal Toxicity Study Design	The document indicates that a phased approach to sublethal toxicity testing that integrates results of other sublethal testing requirements may be proposed. However, it is not clear what the phases of the study are or which toxicity testing activities would be included in the various phases. Therefore, more information is required to provide the reader with an understanding of the phased approach that is being proposed.	Ktunaxa Nation Council	Note: KNC comments on the draft study design (received May 4, 2015) were provided after the submission of the final study design to the Director on April 30, 2015 and hence changes to the study design in response to KNC comments could not be made. Responses below provide additional information and highlight where related changes to final study design were made independent of KNC comments: Teck agrees that the reference to a phased approach to sublethal toxicity testing as outlined in the draft 9.8.2 study design was confusing. The final 9.8.2 study design was adjusted to focus specifically on the requirements of 9.8.2, while mentioning that results from other ongoing testing programs (e.g. 9.8 (i) and 9.8 (ii) of EMA Permit 107517) may be evaluated at the end of 2015 to identify potential chronic toxicity follow-up testing (See section 2.3 of the final 9.8.2 Study Design).
2	Sublethal Toxicity Study Design	Three objectives are identified for the testing with westslope cutthroat trout gametes. Of the three objectives identified, the most important is to	Ktunaxa Nation Council	Note: KNC comments on the draft study design (received May 4, 2015) were provided after the submission of the final

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		obtain a gradient of egg selenium concentrations representative of conditions within the Fording River and associated tributary and lentic habitats. Therefore, if conflicts arise relative to implementing the study in a manner that meets some of the objectives imperfectly, Study Objective 2 should be given priority.		study design to the Director on April 30, 2015 and hence changes to the study design in response to KNC comments could not be made. Responses below provide additional information and highlight where related changes to final study design were made independent of KNC comments: We agree that obtaining a gradient of representative egg selenium concentrations is an important objective, and multiple locations in the Fording River and associated habitats will be sampled to achieve it. The revised final study design provided additional information on sampling details to achieve this objective.
3	Sublethal Toxicity Study Design	While the source of the control water is described, the water quality characteristics of the control water are not presented. Therefore, more information is needed to describe any amendments that are planned for control water (i.e., hardness addition). A control chart for cutthroat trout sources from high hardness water bodies and tested in low hardness municipal drinking water should be provided to demonstrate that appropriate levels of egg fertilization and gamete survival can be obtained in the selected laboratory control water.	Ktunaxa Nation Council	Note: KNC comments on the draft study design (received May 4, 2015) were provided after the submission of the final study design to the Director on April 30, 2015 and hence changes to the study design in response to KNC comments could not be made. Responses below provide additional information and highlight where related changes to final study design were made independent of KNC comments: No amendments are planned for the laboratory control water. The water source will be consistent with control water used by Nautilus Environmental and Rudolph et al. (2008) in evaluating effects thresholds for maternally-derived selenium for WCT. These previous studies showed that eggs collected from the Elk Valley could be effectively reared under soft water conditions. Because these WCT tests are specialized and infrequent, there is no formal control chart record as would be the case for routine test protocols. However, experience from previous investigations has been considered by the laboratory toxicologists in the selection of appropriate control water. Specifically, Nautilus Environmental has recommended using the same lab water type used in previous studies, partly to avoid additional sources of variance and partly to facilitate comparison of the results from this study to the previous ones.

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				Note that gametes have not been exposed directly to water quality conditions associated with the site, so they are not experiencing a change in water hardness that would require acclimation (i.e., they are harvested directly from bodies of ripe gravid females rather than from spawning beds in the river).
4	Sublethal Toxicity Study Design	The concentrations of cadmium, nitrate, selenium, and sulphate that will be targeted for amending Fording River water are not reported in the document. This information needs to be added to the study design document.	Ktunaxa Nation Council	Note: KNC comments on the draft study design (received May 4, 2015) were provided after the submission of the final study design to the Director on April 30, 2015 and hence changes to the study design in response to KNC comments could not be made. Responses below provide additional information and highlight where related changes to final study design were made independent of KNC comments: The amendments of Fording River water will entail adjustment to the long-term FR-4 Site Performance Objectives (SPOs) as specified in the Permit 107517. The applicable values are: - selenium at 53 ug/L Se - nitrate at 11 mg/L N (at 360 mg/L hardness as CaCO3) - sulphate at 429 mg/L SO4 - cadmium at 0.39 ug/L N (at 360 mg/L hardness as CaCO3) Because the nitrate and cadmium SPOs are hardness-dependent, the exact concentrations cannot be specified in advance. However, based on typical seasonal patterns of hardness and the anticipated timing of egg availability, the concentration targets for nitrate and cadmium in SPO mixture testing will be somewhat higher than the values shown above. To prepare SPO mixtures, Teck will submit field-collected water samples to the analytical laboratory several days prior to the use of water in gamete exposures. Water hardness and concentrations of

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				cadmium, nitrate, selenium, and sulphate will be determined through rush analysis. Next, the degree of sulphate amendment required to achieve the long-term sulphate SPO will be calculated, along with the estimated new hardness level resulting from addition of calcium and magnesium as counter-ions in the sulphate amendment. Once the new hardness level has been estimated, the laboratory will supplement with nitrate and cadmium salts to achieve the hardness-dependent SPOs for nitrate and cadmium.
5	Sublethal Toxicity Study Design	The approach to the collection, evaluation, and compositing of milt to fertilize the eggs is well-reasoned and appropriate.	Ktunaxa Nation Council	We thank the reviewer for the feedback.
6	Sublethal Toxicity Study Design	As adverse effects on fertilization of eggs can be observed in fish exposed to certain chemicals of potential concern (COPCs), it is appropriate to utilize COPC-amended Fording River water during egg fertilization.	Ktunaxa Nation Council	Note - KNC comments on the draft study design (received May 4, 2015) were provided after the submission of the final study design on April 30, 2015 and hence changes to the study design in response to KNC comments could not be made. Responses below provide additional information and highlight where related changes to final study design were made independent of KNC comments: The test protocol for early life stage testing of salmonids requires that eggs be fertilized with milt in the laboratory, and further requires dry fertilization. Appendix D of Environment Canada (1998) states that "" although fertilization can take place with water, this technique must be avoided since it triggers closure of the micropyle before the freshly fertilized eggs are exposed to test solutions. Accordingly, the dry method of fertilization must be used."" To remain consistent with both the Environment Canada method for early life stage tests and to follow usual hatchery practice, dry fertilization will be used. Eggs will be added to the exposure waters following fertilization, so water hardening of the eggs will occur in the different water types. Even if a deviation from standard protocol was considered desirable for WCT, it would be difficult, and would introduce considerable variability, to attempt to wet fertilize WCT eggs. As a result of the very short duration of sperm motility, achieving

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				a high and consistent rate of fertilization is difficult in water, and would increase project risks (i.e., failure to effectively fertilize sufficient numbers of eggs, potentially compromising the test program given the limited supply window for viable gametes). There is also no standard method for wet fertilization.
7	Sublethal Toxicity Study Design	The experimental design for the cutthroat trout gamete exposures to site water in laboratory control and amended Fording River water appears to be appropriate.	Ktunaxa Nation Council	We thank the reviewer for the feedback.
8	Sublethal Toxicity Study Design	The five toxicity tests selected for conducting the surface water toxicity testing are appropriate;	Ktunaxa Nation Council	We thank the reviewer for the feedback.
9	Sublethal Toxicity Study Design	It is appropriate to amend surface water from the Elk Valley to achieve the long-term Site Performance Objective (SPO) concentrations. However, it is also important to evaluate the toxicity of surface water that is amended to achieve the short-term and medium-term SPO concentrations for cadmium, nitrate, selenium, and sulphate (see Table 1 attached). That is, KNC needs to understand the toxicity of surface water under all three scenarios;	Ktunaxa Nation Council	Note: KNC comments on the draft study design (received May 4, 2015) were provided after the submission of the final study design to the Director on April 30, 2015 and hence direct changed to the study design in response to KNC comments could not be made. Responses below provide additional information and highlight where related changes to final study design were made independent of KNC comments: This comment is similar to feedback received from BC MOE (advice item #29) following their review of the draft study design. We have summarized our responses below: We do not propose to conduct testing of short-term or medium-term SPO concentrations because the objective of Section 9.8.2 is to confirm that science-based SPOs developed for the protection of aquatic life (i.e., the long-term SPOs) are not toxic to sensitive aquatic receptors. The intent of Section 9.8.2 testing is to establish that waters in the Elk River watershed with concentrations of selenium, nitrate, sulphate and cadmium at SPOs at Order Stations will not be toxic to sensitive aquatic organisms. Testing of other combinations of Order constituents between now and the long-term SPO implementation dates is not the focus of the study. The intent of Section 9.8.2 was discussed at the May

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				27, 2015 EMC meeting where MOE confirmed alignment with the scope of the study as presented in the Study Design. Notwithstanding the above, given the timing of the water collections, it is expected that nitrate in the test solutions may approach or exceed the short-term SPO of 20 mg/L N because elevated hardness from introduction of sulphate salts would increase water hardness and require additional nitrate amendment to match the hardness-based long-term SPO. Note that Section 9.8.2 testing is only one part of a broader program under Permit #107517 and other requirements; results from routine chronic testing (Section 9.8.ii), the Nitrate Toxicity Study, the Sulphate Toxicity at High Hardness study (Section 9.8.1), and other chronic toxicity studies will all contribute to the evaluation of responses at concentrations different from the SPOs.
10	Sublethal Toxicity Study Design	Two Order Stations are included in the design of the surface water toxicity testing program. However, Section 9.8.2 of EMA Permit 107517 requires the permittee to confirm that surface waters meeting the SPOs are not toxic to sensitive aquatic receptors. It is unclear why the other Order Stations are not included in the chronic toxicity testing program. Additional discussion regarding the stations to be included and respective SPOs that are to be targeted is required;	Ktunaxa Nation Council	Note: KNC comments on the draft study design (received May 4, 2015) were provided after the submission of the final study design to the Director on April 30, 2015 and hence changes to the study design in response to KNC comments could not be made. Responses below provide additional information and highlight where related changes to final study design were made independent of KNC comments: The rational for selecting ER2 and FR4 vs testing all order stations was discussed at the May 27, 2015 EMC meeting. The Order Stations FR4 and ER2 were selected for SPO mixture testing because: - They have the highest concentrations of selenium, nitrate, and sulphate in the mainstem Fording River and Elk River, respectively (relative to other Order Stations). - Higher concentrations of selenium, nitrate, and sulphate in field-collected

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				samples require the least degree of sample manipulation (i.e., sample spiking or amendment) in the laboratory to achieve SPOs. - Inclusion of one station from each river allows the study to characterize broad differences in water quality characteristics (e.g., hardness) between the two rivers. Furthermore, because the samples are being adjusted (both for Order constituents and water hardness) to achieve long-term SPOs, it would be redundant to sample numerous stations and adjust them to similar water quality characteristics prior to testing.
11	Sublethal Toxicity Study Design	Although it is appropriate to calculate the 20% effect concentration for the COPC mixtures that are being tested, 10% effect concentrations must also be calculated. The rationale provided for designating treatments with < 20% effects as not toxic is not appropriate and is not supported; and,	Ktunaxa Nation Council	Note: KNC comments on the draft study design (received May 4, 2015) were provided after the submission of the final study design to the Director on April 30, 2015 and hence changes to the study design in response to KNC comments could not be made. Responses below provide additional information and highlight where related changes to final study design were made independent of KNC comments: We agree that retaining multiple response sizes in the Study Design is advisable, at least until the data have been collected. To be consistent with the approach used in the development of the Elk Valley Water Quality Plan, the final study design was updated to include the calculation of inhibition concentration estimates (ICX values) associated with 10%, 20%, and 50% effect sizes, and with associated confidence bands. Then, as suggested by MOE in their review comments (advice item 36) , the variance of the estimates and risk of false positives (and negatives) can be evaluated.
12	Sublethal Toxicity Study Design	The methods for analysis of the resultant data are generally supported. However, additional discussion regarding the methods for data analysis and interpretation of the resultant data is required.	Ktunaxa Nation Council	Note: KNC comments on the draft study design (received May 4, 2015) were provided after the submission of the final study design to the Director on April 30, 2015 and hence changes to the study design in response to KNC comments could not be made. Responses below provide additional information and highlight where related changes to final

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				study design were made independent of KNC comments: It is difficult to prescribe formal decision rules a priori for interpretation of data when the variances of the response data are unknown in advance. Statistical significance tests (comparison of treatment responses to reference responses) will be one tool for interpretation, and we will use alpha (α) of 0.05 as the default level for statistical significance. However, other considerations (e.g., magnitude of difference in endpoint response [adverse effect size], evaluation of atypical replicate responses, and consistency of concentration-response relationships) will also be considered in the data interpretation. Data analysis was discussed at the May 27, 2015 EMC meeting. The following action item was taken: Adrian DeBruyn, Golder to seek input from Carl Schwarz on techniques to compare two concentration response curves and then share Carl's response with the EMC via the facilitator .
13	Sublethal Toxicity Study Design	This study only focusses on one site on the Fording River – Order Station FR4 and associated long-term SPO concentrations. Is this enough to satisfy the intent of this clause in the permit? If not, we may want to recommend adding another test site, perhaps one of the downstream Order Stations. Also consider replicating this study to demonstrate effects from the short, medium, and long–term SPO concentrations, rather than just focussing on long-term concentrations. If we recommend another site or additional SPO concentrations, more eggs/milt may be required.	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design (dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference: "We believe that the proposed program satisfies the intent of the clause, because the mixture testing evaluates exposure conditions that have the greatest potential to elicit adverse responses to westslope cutthroat trout (WCT) from combined exposures to mine-related constituents. The proposed WCT testing includes a maternal transfer pathway for selenium in fish eggs, plus water-borne concentrations at long-term SPOs for all Order constituents. The exposure concentrations for both pathways (tissue and water exposures) are greatest at FR4 relative to all other Order locations. If there are no

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				effects from tests using Fording River fish and long-term SPOs for FR4, we would not expect effects for any downstream locations in the Fording or Elk rivers. We do not propose to conduct additional testing of short-term or medium-term SPO concentrations because the objective of Section 9.8.2 is to confirm that science-based SPOs developed for the protection of aquatic life (i.e., the long-term SPOs) are not toxic to sensitive aquatic receptors. However, it is expected that nitrate in the test solutions may approach or exceed the short-term SPO of 20 mg/L N because elevated hardness from introduction of sulphate salts would increase water hardness and require additional nitrate amendment to match the hardness-based long-term SPO."
14	Sublethal Toxicity Study Design	Will the four male fish used to supply the milt be taken from different locations in the Fording and Elk Rivers?	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design (dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference: "Milt will be collected from fish collected at different locations; however, the milt from males will be pooled rather than matched to females collected from the same locations. The purpose of the milt is simply to fertilize the eggs, and is not a reproductive endpoint of interest in the study (i.e., there is no evidence of adverse effects of selenium on sperm viability). Milt with good motility will be pooled from a minimum of three males, and the identity of the males used for fertilization will be documented. Fertilization of eggs on each sampling day will be conducted using a single composite of sperm, regardless of the source of eggs. Fertilization with pooled milt is preferred to fertilizing with males matched to sites where females were collected; this approach will reduce the variability in either fertilization success or deformities related to sperm source, neither or which is related to selenium exposure."
15	Sublethal Toxicity Study Design	What is the estimated time (# days) for this study? They mention conducting	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a

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		monthly metals testing of the laboratory water, and this may mean only one metals scan if the test is less than two months in length.		letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design(dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference: "The test duration is not a set number of days, but rather time to reach a developmental stage (approximately two months duration for WCT from fertilized eggs, through alevin stages, to the swim-up fry stage). The laboratory water will be submitted for chemistry analysis on three occasions (i.e., at test initiation, at 4 weeks, and before termination at approximately 8 weeks."
16	Sublethal Toxicity Study Design	Will the fish collected from this study be collected from different locations in the Elk Valley (including the Fording and Elk Rivers) so as to represent the different egg-selenium concentrations that may be observed in the different habitats (e.g. Fording R mainstem, tributaries, lentic habitats, etc)? Will the male fish also be collected from different locations? This is not specified in the study design. A map should be provided with the report showing where each fish was collected.	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design (dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference: "We can provide a map after the fish have been collected, but cannot specify in advance because the exact locations are dependent on the spawning migration of the WCT. Fish sampling areas may include Henretta Lake, Fording River (upstream of FRO; between GHO and FRO), Fording River Oxbow, lower Greenhills Creek, Dry Creek, Chauncey Creek, and Ewin Creek. Some of these locations may not yield ripe adult fish; however, collectively the sampling efforts at these locations should provide fish that are representative of the Fording river system. This will fulfill the requirement indicated by in Section 9.8 (i) to sample fish utilizing habitats in the Fording River, tributaries and associated lentic habitats."
17	Sublethal Toxicity Study Design	Does selenium sampling of the fish eggs destroy them, or potentially impact the egg viability? It sounds like the same eggs that will be sampled for Se will be fertilized and used in the test.	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design (dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference:

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				"Yes, selenium analysis of the gametes will consume the eggs that are submitted for chemical analysis. However, because eggs are collected in clutches, with numerous eggs representing the same maternal exposure, it is possible to subsample each clutch. Clutches of eggs will be gently sorted into aliquots that contain multiple eggs, with one portion going to the lab for selenium analysis (and destroyed in process) with the remaining portion retained for the toxicology study."
18	Sublethal Toxicity Study Design	Is there some way for the lab to specify or note the degree of egg sac absorption at swim-up stage? In a previous study that I reviewed there were discrepancies between the results based on some fish having more or less egg sac left (and therefore a higher weight) at swim-up stage.	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design(dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference: "Once fish have reached swim-up (i.e., the point at which they have completely absorbed the yolk sac and are actively feeding), lengths and wet weights will be recorded. At this stage, we can document the nature of egg sac absorption using a visual assessment (i.e., it is not expected that the laboratory will attempt to weigh the residual egg sac)."
19	Sublethal Toxicity Study Design	The Fording River water will be "refreshed weekly" whereas later on in the text it is stated that "a 60% renewal of culture water three times per week" will occur. Please clarify if there's any difference between the meaning of "refreshed" and "renewed" and, if so, if this could impact the study. Also please clarify the frequency of water renewal/refreshing for all test organisms.	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design(dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference: "We have modified the wording in the study design to restrict use of the words ""refresh"" or ""renewal"" to the replacement of water in the experimental vessels. The proposed refresh rate of three times per week for salmonid testing will then be clear. The referenced ""weekly"" rate refers to how often the field crew will transport samples of Fording River water to the laboratory, where they are held in cool dark conditions prior to individual refreshes. We have now called the provision of water

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				to the laboratory a ""weekly water supply"" to avoid confusion. For other test organisms, we have also included in the final Study Design a Summary of Test Conditions that specifies refresh rate and other pertinent experimental conditions."
20	Sublethal Toxicity Study Design	Lab water metals will be measured "monthly by ICP scan"; I recommend that they use ICP-MS to ensure low enough detection limits.	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design (dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference: "We will adopt the recommendation to use ICP-MS for the laboratory water analysis."
21	Sublethal Toxicity Study Design	"Calcium and magnesium will be added at a ratio equivalent to that currently observed in the Fording River" – at which site in the Fording River? Are they referring to reference Ca:Mg ratios, or mine-influenced Ca:Mg ratios?	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design, (dated April 30, 2015). Feedback was considered during the development of the final study design. Response below is are provided for reference: "The ratio refers to mine-influenced conditions; we will use ratios reflective of recent water quality monitoring in the vicinity of FR4."
22	Sublethal Toxicity Study Design	"water in a subset of the developmental chambers will be monitored daily for temperature, dissolved oxygen, conductivity and pH." Recommend that these parameters be monitored daily in all of the chambers, not just a subset (unless it's disruptive to the test).	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design,(dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference: "The test will be conducted following the Environment Canada (1998) protocol , which does not require monitoring of daily water quality in every test replicate (chamber), but rather requires daily measurements in ""representative chambers,"" and monitoring of high, medium, low, and control treatments within multi-concentration tests. As suggested by the reviewer, this procedure is intended to minimize disturbance to the test organisms during a sensitive life

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				stage."
23	Sublethal Toxicity Study Design	Please define the statistical methods that will be used to determine if there are changes between the two Se dose response curves. We may want to have Carl Schwarz or another statistician to confirm that their approach and their study design (i.e. number of male and female fish and numbers of eggs) is appropriately robust to ensure meaningful statistical results	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design (dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference: "Selenium concentration-response curves will be compared between treatments using a non-linear form of analysis of covariance. The analysis will describe the relationship between effects and egg selenium concentration, and will test whether this relationship is affected by the water quality treatment. We would be interested in talking to Dr. Schwarz about this before undertaking the analysis, as he would undoubtedly have valuable input to offer. However, it is unlikely that we would be able to conduct an a priori power analysis to evaluate the study design. The power of the test will depend on the number of fish tested, but also on the distribution of egg selenium concentrations and the strength of the concentration-response relationship (i.e., the amount of residual variance). Sampling will be undertaken to try to obtain a wide and even distribution of egg selenium concentrations, but the actual distribution will not be known until sampling is complete. Similarly, residual variance around the concentration-response relationship will not be known until the test is complete. Previous tests did not include the planned concentrations of nitrate and sulphate, and therefore may not provide a good estimate of the residual variance that will be obtained. Furthermore, the study design is ultimately constrained by logistics. Based on previous experience, it is expected that the planned sample size of 30 fish is a reasonable estimate of the number of mature, ripe female fish that can be captured and spawned within the spawning window."
24	Sublethal Toxicity Study Design	In this study design, water toxicity testing is for only the fall of 2015 at two compliance points: FR4 and ER2. This differs from the frequencies and locations specified in PE-107517	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design (dated April 30, 2015).

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		which are as follows: o 30-day Rainbow Trout - permit requires spring AND fall o C. dubia and P. subcapitata - permit requires quarterly at all compliance points o H. Azteca and P. promelas – permit requires quarterly at all compliance points on the Fording R and Michel Ck.		Feedback was considered during the development of the final study design. The response below is provided for reference: "As indicated in the Study Design, the scope of this study was limited to Section 9.8.2 of Permit #107517. The quarterly and semi-annual tests are an important part of the overall Permit requirements, but have been dealt with elsewhere under Section 9.8(ii). Sampling was completed for first quarter (Q1) testing in March 2015, and the field program for second quarter (Q2) testing has just begun."
25	Sublethal Toxicity Study Design	The test lengths (number of days) are the same as specified in the permit, but the study design does not specify the endpoints. Recommend that the proponent clarify that the endpoints are the same as those specified in the permit.	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design (dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference: "We have provided tabular summaries of test conditions for all of the routine tests as an attachment to the final Study Design. These tests and endpoints match those used for the routine (quarterly and semi-annual) testing specified under Section 9.8(ii), with one exception. Specifically, Section 9.8(ii) lists endpoints of survival, hatching, growth, deformities, and behaviour for the rainbow trout embryo-alevin (EA) test. However, the Environment Canada (1998) protocol does not require quantification of growth or behaviour endpoints for this life stage. In the EA test, the number and percentage of nonviable alevins (i.e., failure to reach alevin stage in a timely and normal manner) is the primary biological endpoint, for which the protocol requires calculation of formal statistical endpoints. In addition to the percentage of nonviable alevins, the protocol for the EA test also requires narrative statements to be made regarding observations of delayed hatching (either time required to achieve median hatch, or proportion hatched) and presence of deformed

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				alevins. As such, the endpoints of growth and behaviour, which are appropriate for embryo-alevin-fry (EAF) tests , are not appropriate for the 30-d EA test. This issue was discussed with the toxicology laboratory (Nautilus) in February 2015, which confirmed that endpoints of behaviour and growth in an EA test using rainbow trout would be inappropriate to quantify as formal test endpoints. They indicated that because the test is terminated at the alevin stage of development, limited growth occurs and behavioural changes are difficult to discern relative to the swim-up fry stage, where such endpoints become relevant."
26	Sublethal Toxicity Study Design	What is the rationale for selecting Order Stations FR4 and ER2 (as opposed to other order stations)?	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design(dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference: "The Order Stations FR4 and ER2 were selected for SPO mixture testing because: - They have the highest concentrations of selenium, nitrate, and sulphate in the main stem Fording River and Elk River, respectively (relative to other Order Stations). - Higher concentrations of selenium, nitrate, and sulphate in field-collected samples require the least degree of sample manipulation (i.e., sample spiking or amendment) in the laboratory to achieve SPOs. - Inclusion of one station from each river allows the study to characterize broad differences in water quality characteristics (e.g., hardness) between the two rivers."
27	Sublethal Toxicity Study Design	Is the intent of this tox testing to look at toxicity based on current hardness and proposed constituent concentrations? Or to look at toxicity based on predicted hardness and proposed constituent concentrations?	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design (dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference:

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				"The intent is to evaluate toxicity under predicted hardness and proposed constituent concentrations. This is to provide a realistic assessment of potential future mine-influenced conditions, as the SPOs cannot be reached without causing associated changes in other water quality parameters (including hardness)."
28	Sublethal Toxicity Study Design	Will the "applicable ratio of calcium to magnesium" that will be used represent current hardness levels, or is it meant to simulate future/predicted hardness levels? How does this fit in with the intent of this toxicity testing?	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design (dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference: "The applicable ratio is intended to simulate future/predicted hardness levels, by using ratios of major ions that reflect mine-influenced conditions. This aligns with the purpose of the testing program, which is to evaluate potential for mixture effects where multiple mine-related constituents are simultaneously elevated. "
29	Sublethal Toxicity Study Design	The proposed dilution series appear to be based on the long-term SPO concentrations and three dilution levels. Will this dilution series cover the range of biologically-relevant COC concentrations expected to be seen at the two Order Stations between now and the long-term SPO implementation dates? If not, recommend discussing the actual concentrations and the linkages to the intent of this study.	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design (dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference: "The intent of Section 9.8.2 testing is to establish that waters in the Elk River watershed with concentrations of selenium, nitrate, sulphate and cadmium at SPOs at Order Stations will not be toxic to sensitive aquatic organisms. Testing of other combinations of Order constituents between now and the long-term SPO implementation dates is not the focus of the study. The dilution series is intended to supplement the analysis at full strength SPO concentrations, which is the primary purpose of Section 9.8.2 testing. The results from the dilutions will provide information on whether a concentration-response pattern is evident, increasing the ability of the analysis discern variability in test organism performance from actual

Appendix A: EMC Advice and Input Table

NB: The Teck Response column reflects only Teck's responses to EMC input and advice; not the responses of the KNC or Director.

#	Submission	Input and Advice	EMC Member	Teck Response
				toxicity. The dilution series will also indicate whether adverse effects (if present) at full strength SPO concentrations would be ameliorated by reducing aqueous exposure concentrations. The dilution series approach will provide information on concentrations that are lower than SPOs; however, that is not the primary purpose of the study. Section 9.8.2 testing is only one part of a broader program under Permit #107517 and other legal requirements; results from routine chronic testing, the Nitrate Toxicity Study, the Sulphate Toxicity at High Hardness study, and other chronic toxicity studies will all contribute to the evaluation of responses at concentrations different from the SPOs. "
30	Sublethal Toxicity Study Design	Will a lab control be included in addition to the two reference water controls?	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design (dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference: "Yes, a laboratory control is always included per standard protocols. Detailed on control water are provided in the Summary of Test Conditions appended to the Final Study Design."
31	Sublethal Toxicity Study Design	My understanding of the test treatments are as follows: o One lab water control o Elk River Reference o Fording River Reference o Order Stn ER2 at 100% of long-term SPO concentrations o Order Stn ER2 at 67% of long-term SPO concentrations o Order Stn ER2 at 44% of long-term SPO concentrations o Order Stn ER2 at 30% of long-term SPO concentrations o Order Stn FR4 at 100% of long-term SPO concentrations o Order Stn FR4 at 67% of long-term SPO concentrations	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design (dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference: "The summary of treatments is not quite accurate. The dilutions proposed in the Study Design are expressed as percentages on a volumetric (vol/vol) basis, not on a contaminant mass or concentration basis. Because the dilution waters will contain low (background) concentrations of each substance, the ""percentages of long-term SPO concentrations"" will vary by constituent, and will be slightly higher than those indicated by the reviewer."

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#	Submission	Input and Advice	EMC Member	Teck Response
		o Order Stn FR4 at 44% of long-term SPO concentrations o Order Stn FR4 at 30% of long-term SPO concentrations		
32	Sublethal Toxicity Study Design	The study design does not mention the number of organisms that will be exposed to each treatment, or if each treatment/control will be replicated. This data would be useful for a statistician to review in advance to ensure that enough data will be obtained for robust statistical analyses.	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design (dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference: "The test replicates and number of organisms per replicate are summarized in the Summary of Test Conditions tables, which we have appended to the Study Design."
33	Sublethal Toxicity Study Design	There do not appear to be test solutions / treatments for Order Stn ER2 and Order Stn FR4 at current concentrations; why were these excluded?	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design (dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference: "These tests are being conducted under the routine quarterly and semi-annual testing under Permit #107517 Section 9.8(ii). Those tests are occurring outside the scope of the Section 9.8.2 study design."
34	Sublethal Toxicity Study Design	What test statistic result and level will be used to determine if the reference site data exhibit statistically significant difference in endpoint response (e.g. $p<0.05$)?	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design (dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference:: "We will use alpha (α) of 0.05 as the default level for statistical significance; however, other considerations (e.g., magnitude of difference in endpoint response, evaluation of atypical replicate responses) will also be considered in determining whether reference data from the two stations should be pooled."

Appendix A: EMC Advice and Input Table

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#	Submission	Input and Advice	EMC Member	Teck Response
35	Sublethal Toxicity Study Design	Is it possible to manipulate nitrate, selenium, cadmium, sulphate, calcium, and magnesium concentrations to concentrations to match the SPO concentrations and dilution levels by adding the stated chemicals? (I'm not a chemist but it seems to me that it could be tricky to achieve 67% of each of the SPO values for six COCs based on adding five different substances.)	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design (dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference: "This issue is linked to the comment discussed in Response 2h (Item 31) regarding dilutions. Use of volumetric dilutions is straightforward, and yields different degrees of concentration dilution for each substance (i.e., dependent on ratios of SPOs to reference concentrations for each substance)."
36	Sublethal Toxicity Study Design	The study design proposes that, "an adverse response size of greater than 20% (standardized to reference) will be interpreted as a finding of toxicity, provided that the difference is statistically significant." The 20% criteria is based on the Level 2 Benchmark. I don't agree that the rationale provided (page 6) for excluding the Level 1 Benchmark of 10% effect is sufficient. I recommend that the Level 1 Benchmark of 10% effect be calculated, included in the dataset, and discussed with the study results. If, after looking at the data, it can be shown that there is too high of risk of false positives, then perhaps these results can be omitted at this point.	Ministry of Environment	The following response was previously provided to MOE on April 30, 2015 in a letter titled Section 9.8.2 of EMA Permit 107517 - Response to Ministry Feedback on Study Design (dated April 30, 2015). Feedback was considered during the development of the final study design. The response below is provided for reference: "We agree that retaining multiple response sizes in the Study Design is advisable, at least until the data have been collected. To be consistent with the approach used in the development of the Elk Valley Water Quality Plan, we recommend calculation of inhibition concentration estimates (ICX values) associated with 10%, 20%, and 50% effect sizes, and with associated confidence bands. Then, as suggested by MOE, the variance of the estimates and risk of false positives (and negatives) can be evaluated."
37	Sublethal Toxicity Study Design	Conduct testing at all locations in order to see a range of concentrations in various conditions and settings and to determine long--term targets at multiple locations.	Ktunaxa Nation Council	This comment is similar to feedback received previously from KNC (Item 10) and BC MOE (Item 26). Please refer to the responses to those items.
38	Sublethal Toxicity Study Design	Fill data gaps related to gradient and Se concentration in eggs.	Ktunaxa Nation Council	We agree that obtaining a gradient of representative egg selenium concentrations is an important study objective. Please refer to response to Item 2 for additional information provided on this subject.
1	Lake Koocanusa	MOE generally prefers a conservative	Ministry of	

Appendix A: EMC Advice and Input Table

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#	Submission	Input and Advice	EMC Member	Teck Response
	Burbot Baseline Study Results	approach to screening and would have chosen the selenium guideline based on high consumption to screen against.	Environment	
2	Lake Koocanusa Burbot Baseline Study Results	MOE would like to clarify whether either or both the screening level for arsenic and/or the arsenic concentrations screened were adjusted before arsenic was screened.	Ministry of Environment	
3	Lake Koocanusa Burbot Baseline Study Results	MOE would like to clarify the standard data method that was used to determine the DQOs of 30% for CRMs and laboratory duplicates, and how the data QA would change with a DQO of 20%.	Ministry of Environment	
4	Lake Koocanusa Burbot Baseline Study Results	MOE would like to clarify if the muscle tissue samples were handled in the same way as the lab duplicate, and if so, how this could potentially affect the report results and conclusions.	Ministry of Environment	
5	Lake Koocanusa Burbot Baseline Study Results	MOE agrees that burbot be excluded from regular monitoring for the current monitoring (RAEMP) cycle and that Teck be prepared for opportunistic sampling.	Ministry of Environment	
6	Lake Koocanusa Burbot Baseline Study Results	MOE suggests that burbot be considered during the design of sampling in future monitoring (RAEMP) cycles.	Ministry of Environment	
7	Lake Koocanusa Burbot Baseline Study Results	Report states that ""burbot have been a target species in the past"". Text should reflect current practices which include burbot fishing in Lake Koocanusa.	Ktunaxa Nation Council	
8	Lake Koocanusa Burbot Baseline Study Results	Reported R2 should be 0.46, not 0.032 as in the text.	Ktunaxa Nation Council	
9	Lake Koocanusa Burbot Baseline Study Results	Reported p value should be 0.026, not 0.0026 as in the text.	Ktunaxa Nation Council	
10	Lake Koocanusa Burbot Baseline Study Results	Collection of data on the concentrations of metals in burbot tissues has been identified as a high priority by KNC. Therefore, continued monitoring of the levels of selenium and other metals in these tissues is required.	Ktunaxa Nation Council	
11	Lake Koocanusa Burbot Baseline Study Results	Change the r2 from 0.032 to 0.46. Please then also change the text to say something like this is a reasonable amount of explained variance, and not	Independent Scientist	

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#	Submission	Input and Advice	EMC Member	Teck Response
		"considerable unexplained variability".		
12	Lake Koocanusa Burbot Baseline Study Results	Please recalculate the fraction of fish that are likely to have ovary Se values that exceed 15.2 ug/g, assuming a variety of muscle Se values.	Independent Scientist	
13	Lake Koocanusa Burbot Baseline Study Results	Delete second instance of "guideline" in the figure title.	Independent Scientist	
14	Lake Koocanusa Burbot Baseline Study Results	Recommend adding the Health Canada general consumption limit of 0.5 mg/kg ww, to be consistent with the appendix.	Independent Scientist	
15	Lake Koocanusa Burbot Baseline Study Results	Modify values in the table or figure, as necessary, and then re-evaluate conclusions as they pertain to human health.	Independent Scientist	
16	Lake Koocanusa Burbot Baseline Study Results	No action required. I agree that burbot should not be targeted in future sampling.	Independent Scientist	
17	Lake Koocanusa Burbot Baseline Study Results	Please explain why HQ's for the various substances are not summed.	Independent Scientist	
18	Lake Koocanusa Burbot Baseline Study Results	Please discuss mercury concentrations in other species, and whether it is likely that Hg concentrations in burbot are likely to be similar to those from other species. If Hg concentrations in other species are higher/lower than in burbot please indicate how the results of the risk assessment would change if at all.	Independent Scientist	
19	Lake Koocanusa Burbot Baseline Study Results	Recommend that the report not base any conclusions on a burbot only fish consumption rate.	Independent Scientist	

Elk Valley Environmental Monitoring Committee 2015 Public Report

Appendix B:
EMC Terms of Reference to April 2016

Elk Valley
Environmental Monitoring Committee

TERMS OF REFERENCE

FOR THE

ENVIRONMENTAL MONITORING COMMITTEE

WITH RESPECT TO THE

ELK VALLEY PERMIT 107517

FINAL as of
April 13, 2015

TERMS OF REFERENCE FOR ELK VALLEY PERMIT ENVIRONMENTAL MONITORING COMMITTEE (EMC)

1 KEY CONTACTS

Teck Coal Limited:	Mark Digel: mark.digel@teck.com
	Christian Baxter: christian.baxter@teck.com
Ministry of Environment:	Jeanien Carmody-Fallows: Jeanien.CarmodyFallows@gov.bc.ca
	Lana Miller: lana.miller@gov.bc.ca
Ktunaxa Nation:	Bill Green: bgreen@ccrifc.org
	Kerri Garner: kgarner@ktunaxa.org

2 BACKGROUND

In 2014, the Elk Valley Area Based Management Plan (ABMP), also known as the Elk Valley Water Quality Plan was submitted to the Ministry of Environment (MOE) as required by Ministerial Order M113. Following approval of the ABMP by the Minister of Environment, Permit 107517 was issued authorizing effluent discharges from Teck Coal mining operations in the Elk Valley. A requirement of the permit is the formation an Environmental Monitoring Committee (EMC) to review monitoring submissions required under the permit and provide technical advice to the Permittee (Teck Coal Limited), the Ktunaxa Nation Council (KNC), and the Director. These Terms of Reference (TOR) set out the operating parameters of the EMC.

3 SCOPE

The scope of the EMC is defined in section 12.2 of Permit Number 107517 (the Permit) issued to Teck Coal Ltd. on November 19, 2014. The EMC is primarily a forum to share technical information and Traditional Knowledge, and for problem-solving related to the environmental matters of monitoring, adaptive management and reporting activities of the ABMP and the EMA permits.

The EMC will be active throughout mine operations as required by the Permit. The area to be considered by the EMC is the designated area (the Elk River watershed and Canadian portion of Koocanusa Reservoir).

The EMC is a non-regulatory body.

4 EMC MEMBERSHIP

Notwithstanding the regulatory obligations of the BC Ministry of Environment and Teck, it is the responsibility of all member agencies to appoint staff to sit on the EMC and to determine their level of participation.

Members:

- Ministry of Environment (MoE)
- Ministry of Energy and Mines (MEM)
- Environment Canada (EC)
- Ktunaxa Nation (KNC)- three representatives (technical rep, CCRIFC rep and Traditional Knowledge representative)
- Teck Coal Limited (Teck)
- Interior Health Authority (IHA) - (limited to health related monitoring and assessments)
- Independent scientist/academic

Each member agency/organization is expected to appoint one representative (except for the KNC, which has three representatives) and one alternate participant. The function of the alternate is to attend meetings when the member is unavailable, to ensure, as much as possible, that each member organization/agency is represented at all EMC meetings.

The Traditional Knowledge (TK) representative will be appointed by KNC in order to ensure that the Ktunaxa worldview and TK is meaningfully considered within the preparation of advice. Additional groups and individuals (e.g. First Nations, Non-Government Organizations, etc.) are welcome to attend the annual public meetings offered by the EMC.

The EMC may be supported from time to time by technical working groups to provide specific technical advice. Technical working groups will be decided by the EMC depending on the topic being discussed.

An independent facilitator (the "Facilitator") will be appointed by consensus of the Province, Teck and KNC, to facilitate EMC meetings and to act as the EMC secretariat. The Facilitator will provide administrative support to the EMC, including organizing logistics for meetings, providing notice of meetings to EMC members, receiving and distributing meeting information to members, finalizing and distributing meeting agendas, and taking and preparing meeting notes. Notes of the meetings will be circulated for approval by all members of the EMC.

The Facilitator is not considered a member of the EMC and as such the Facilitator's role is to meet administrative requirements of the EMC.

4.1 Term of Appointment for EMC members

In order to ensure transfer of knowledge and continuity within the EMC, EMC memberappointments are expected to be for three years with the opportunity for re-appointment based upon the decision of each member agency. A staged rotation of members is desirable to ensure continuity within the committee.

5 GOALS AND OBJECTIVES OF THE EMC

The Objectives of the EMC as outlined in Permit 107517 are as follows:

- Provide science-based and/or traditional knowledge based advice to Teck, the KNC and the Director on issues related to :
    - recommended revisions to the water quality targets specified in the EVWQP, based on the review of monitoring results and Adaptive Management Plan reports;
    - environmental monitoring programs, data assessments ,and adaptive management associated with implementation of the ABMP and the EMA permits;
    - maximizing effectiveness and coordination of environmental monitoring activities conducted under the ABMP and the EMA permits; and
    - facilitate integration of traditional knowledge into environmental monitoring and activities conducted under the ABMP and the EMA permits.
- Support communication of environmental monitoring results collected under the ABMP and the EMA permits to Ktunaxa Nation members and the public by:
    - Compiling and analyzing relevant environmental data and information; and
    - Providing information in a plain language format.
- Provide advice to support continual improvement in monitoring activities conducted under the ABMP and the EMA permits.

The committee reviews submissions and associated supporting studies required in condition 12.2 of the permit. Specifically, the EMC will review submissions and provide technical advice to Teck, the KNC and to the Director regarding monitoring submissions in sections:

- Section 9.2 Elk Valley Groundwater Monitoring
- Section 9.3 Local Aquatic Effects Monitoring
- Section 9.4 Regional Aquatic Effects Monitoring
- Section 9.5 Calcite Monitoring

The EMC will also provide input to Teck regarding reports which are required under sections:

- Section 2.7 Re-evaluation of Limits
- Section 5.1 Tributary Evaluation and Management
- Section 9.7 Lake Koocanusa Burbot Baseline Study 2015
- Section 9.8 Chronic Toxicity Testing
- Section 9.9 Human Health Risk Assessment

- Section 10.2.4 Annual Reporting
- Section 10.3 Groundwater
- Section 10.4 LAEMP
- Section 10.5 RAEMP
- Section 10.6 Calcite
- Section 10.7 Lake Koocanusa
- Section 10.8 Water Quality Modelling
- Section 11. Adaptive Management
- Section 12.3 Third Part Audit

The EMC confirms the scope of the third party audit (as required in Permit 107517) a minimum of 9 months prior to the audit submission deadline.

The EMC may also review other pertinent monitoring data relevant to water quality and fish in the Fording and Elk Rivers and Lake Koocanusa.

The EMC must recognize the extent and limitations of its mandate.

6 RELATIONSHIP TO OTHER COMMITTEES

The existence of the EMC does not preclude other relationships between Provincial Agencies, the Ktunaxa Nation, and Teck. In addition, the EMC is one component of Provincial-Ktunaxa engagement regarding Teck Coal mining operations and does not fully discharge the Crown's obligations to consult and accommodate Aboriginal title and rights.

The EMC may serve a role in information sharing with other committees ("Information"). The EMC will not distribute or make available Information without the express permission of the member that made the information available to allow for redacting of proprietary or business sensitive communication. The Facilitator will be responsible for coordination and dissemination of Information to other committees. A list of these committees and a summary of what they do is provided below.

Elk Valley Cumulative Effects Framework

The Cumulative Effects Framework is a new approach for assessing and managing cumulative effects in BC, with policy, procedures and tools to enable periodic assessment of cumulative effects at a broad strategic scale. The framework includes defining values for the assessment, assembling data on the current conditions, identifying trends including likely future impacts, assessing and reporting of the current conditions against management objective. An Interagency team reviews the assessment report and provides recommendations for mitigating emerging risks.

Lake Koocanusa Monitoring and Research Working Group

The primary role of the Lake Koocanusa Monitoring and Research Working Group is to monitor transboundary environmental impacts to Koocanusa Reservoir through identification and implementation of monitoring and research in the reservoir. Additional roles can be found in the Lake Koocanusa MR working group proposal document. The working group exchanges information with and provides advice to the EMC. The EMC may also provide recommendations to the Lake Koocanusa Monitoring and Research Working Group

Traditional Knowledge Working Group

The EMC will consider Ktunaxa Traditional Knowledge (TK) in reviewing and preparing recommendations with respect to all aspects of its mandate. It is anticipated that TK will be provided from an Elk Valley TK Working Group which will be established through other agreements or mechanisms.
The primary role of the Traditional Knowledge Working Group will be to ensure that Traditional Knowledge is considered in all aspects of monitoring, management, and regulatory initiatives in the Elk Valley. The WG will consist of Ktunaxa knowledge holders and the Traditional Knowledge representative on the EMC. The working group will provide recommendations to the EMC on issues in regards to its mandate.

Kootenay Mine Development Review Committee

The KMDRC is a committee set out under Section 6 of the *Mines Act* for the review of mining projects. It is chaired by the Province, and serves as a forum for authorization processes related to the mines including the *Mines Act* permit (mine infrastructure, reclamation, bonding), *Environmental Management Act* permits (waste management), and others. Its membership is project-dependent, and for the SE Coal projects it is made up of provincial agencies, First Nations, regional and local government, and federal agencies. Meetings and agendas are based on provincial needs associated with authorization processes occurring from time to time over the life of the project.

Government-to-Government Forum/Strategic Engagement Agreement

The Government-to-Government Forum is chaired by Ministry of Aboriginal Relations and Reconciliation, and serves as a forum for government-level discussions between the Province and the Ktunaxa Nation.

South East Coal Permitting Program

The South East Coal Permitting Program (SECPP) has been established to ensure that the environmental assessments and permitting for current and future Teck Coal Ltd (Teck) operations, as well as activities related to the Elk Valley Area Based Management Plan, are conducted in a high quality and timely manner in accordance with regulations and current agreements. Governance for SECPP is provided by the Southeast Coal Board (Board). The project scope of SECPP is the five coal mines that Teck operates in southeastern British Columbia. All of the mines require a significant number of regulatory approvals over the next three years, including up to three Environmental Assessments, to maintain coal production. The SECPP is linked to the provinces engagement with the KNC though the establishment if a SE coal Sub Committees under the SEA.

Limitations

1. The EMC cannot direct Statutory Decisions. The EMC may advise the Province in matters pertaining to the Director's regulatory role.
2. The EMC does not prevent/restrict the Ktunaxa Nation and Teck from interacting directly with the Province and Teck on matters within the scope of the EMC.
3. The EMC cannot stop or interrupt the Permittee from carrying on its operations or making decisions regarding permits applications, subject to regulatory requirements.
4. The EMC is not a replacement for direct Government-to-Government agreements or discussions, direct Teck-to-Ktunaxa Nation agreements or discussions, or direct Teck-to-BC Government discussions; rather it is supplemental.
5. EMC does not deal with Health and Safety considerations.

7 MEETINGS

The EMC will hold a minimum of 4 face to face meetings per year, plus one or more annual public meeting(s) for the first two years. Thereafter, the frequency of meetings will be determined by the committee.

Special meetings may be called at any time by the chair with agreement of committee members to address issues as they arise.

The EMC annual public meeting will be held in a different community (e.g., Fernie, Sparwood, Elkford, Tobacco Plains/Grasmere, Cranbrook) in the Elk Valley area each year. The meeting format will be determined by the EMC and will include participation by a majority of the EMC.

Conference calls will be utilized for the majority of the other meetings.

8 DELIVERABLES

- Committee meeting minutes drafted by the Facilitator and distributed to EMC members and pre-determined public interest groups;
- EMC Technical recommendations based upon reviews of monitoring information provided to the Director, KNC, and Teck and recorded in meeting minutes or EMC approved memorandum;
- An annual interpretative plain language report prepared by Teck or its consultant and approved by the EMC for presentation to the general public in the Elk Valley regarding the results of the monitoring undertaken under the EMA permit, the status of implementation of activities and commitments under the ABMP, and an appendix listing all non-confidential recommendations made by the committee.

9 ISSUE MANAGEMENT AND DISPUTE RESOLUTION

The EMC will strive for consensus when making recommendations and decisions. There may be situations when consensus may not be reached. The minutes shall document the issues and opinions along with the views and conclusions of EMC members. The minutes of the EMC will be reviewed by Teck and the Director to inform actions and decisions relating to the EMA Permit monitoring and ABMP implementation.

Consultation by the Ministry of Environment may be undertaken with specific members to fully understand the differing opinion. Where a decision is before the Director, the Director may seek a resolution prior to making the decision.

For EMA related decisions by the Director, once a decision is made, should a person feel aggrieved by the decision, there is an appeal mechanism available to the Environmental Appeal Board.

10 LIMITS OF THESE TERMS OF REFERENCE

Nothing in these Terms of Reference limits or abrogates the responsibilities or duties assigned to individual ministries or agencies under their own legislation.

11 AMENDMENT

These TOR may be revised at any time upon request of a committee member. These TOR will be reviewed 1 year after the acceptance date. Consensus of all committee members must be obtained on any amendment to the TOR.

12 SUPPORT

Teck will consult with the Ktunaxa Nation Council on a funding mechanism for the participation of the three Ktunaxa Nation Council representatives on the committee. Teck will resource the Independent Facilitator and Independent Scientist/academic participation on the committee.