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Technical Report Overview

Report: Line Creek Local Aquatic Effects Monitoring Program (LAEMP) Report 2019

Overview: This report presents the 2019 results of the local aquatic effects monitoring program developed for Teck's Line Creek Operations. The report presents data and evaluation of potential effects of the West Line Creek Active Water Treatment Facility on biological productivity and tissue selenium accumulation downstream of the facility.

This report was prepared for Teck by Minnow Environmental Inc.

For More Information

If you have questions regarding this report, please:

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Future studies will be made available at **teck.com/elkvalley**

Line Creek Local Aquatic Effects Monitoring Program (LAEMP) Report, 2019

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Line Creek Local Aquatic Effects Monitoring Program (LAEMP) Report, 2019

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EXECUTIVE SUMMARY

The Line Creek Local Aquatic Effects Monitoring Program (LAEMP) was primarily designed to evaluate changes related to the commissioning of the West Line Creek (WLC) Active Water Treatment Facility (AWTF) at the Line Creek Operation (LCO). There are three main foci to the monitoring in relation to the operation of the AWTF. Firstly, the fluidized bed reactor technology used at the WLC AWTF for selenium and nitrate removal requires the addition of phosphorus to the treatment process. Although the WLC AWTF is managed to minimize the amount of residual phosphorus in treated effluent, there is potential for phosphorus concentrations to increase in Line Creek downstream from the WLC AWTF discharge and potentially cause increased algal growth and changes to the trophic status and biotic community structure. Secondly, selenium removal from water involves microbial uptake, which deceases total selenium loads to Line Creek, but has the potential to biotransform selenium into reduced and more readily available forms of selenium to biota (i.e., selenite and organoselenium). The third focus of the LAEMP is to monitor other conditions related to active water treatment that could potentially adversely influence the receiving environment, other than those addressed by the first two foci.

Based on the above, the objectives for the Line Creek LAEMP were expressed as the following study questions: (1) Is active water treatment affecting biological productivity downstream in Line Creek? (2) Are tissue selenium concentrations reduced downstream from the WLC AWTF? and (3) Is WLC AWTF operation affecting aquatic biota through thermal effects, effects on dissolved oxygen concentrations, or concentrations of treatment-related constituents other than nutrients or selenium? This report evaluates monitoring data up to the end of the 2019 calendar year.

The WLC AWTF was recommissioned in 2018 with an Advanced Oxidation Process (AOP[1]), which is designed to reverse the shift in selenium species in AWTF effluent from chemically-reduced species back to a selenate-dominated condition. This change in treatment process was implemented in response to monitoring in 2016 and 2017 that confirmed elevated aqueous concentrations of chemically-reduced selenium in AWTF effluent (which have greater potential for bioaccumulation selenate) and correspondingly elevated selenium concentrations in benthic invertebrates. Discharge to the receiving environment from the AWTF with AOP began on October 29, 2018 with variable flow, and stabilization of the AWTF with AOP operations began in late December 2018. Stabilization of the AWTF with AOP operations continued until the end of March 2020 (the scope of the present report covers until the end of December 2019), after

[1] AOP refers to the advanced oxidation process and associated AWTF process modifications.

which steady-state operations of the AWTF (consistent treatment flow near the maximum capacity of the facility) began.

Biological productivity downstream in Line Creek was uninfluenced by AWTF with AOP operation in 2019. Periphyton coverage at both mine-exposed and reference areas was moderate in 2019 (based on visual assessment) and showed temporal consistency with results from 2017 and 2018. Benthic invertebrate biomass and density at mine-exposed areas of Line Creek also showed no significant change in 2019 related to operation of the AWTF with AOP. Benthic invertebrate community endpoints, as determined from kick and sweep sample collection, indicated no adverse change in community characteristics related to operation stabilization of the AWTF with AOP in 2019. Rather, an increase in the percentage of sensitive taxa (Ephemeroptera) in 2019 at areas of Line Creek furthest downstream from the AWTF discharge was suggestive of an improvement in benthic invertebrate community structure in lower Line Creek areas. Overall, biological productivity downstream from the WLC AWTF in 2019 (when the AWTF with AOP was in the operations stabilization phase throughout the year) did not change relative to previous years.

Concentrations of non-selenate forms of aqueous selenium and selenium in benthic invertebrate tissues were significantly lower in Line Creek during operation of the AWTF with AOP in 2019 compared to steady-state AWTF operation (without AOP). As a result, mean benthic invertebrate selenium concentrations in 2019 were below the Level 1 Elk Valley Water Quality Plan (EVWQP) benchmark at all areas downstream of the AWTF discharge. Temporal changes in benthic invertebrate selenium concentrations within 2019 (during AWTF with AOP operation) were also consistent with changes in concentrations of aqueous non-selenate species. Comparison of benthic invertebrate selenium concentrations to the selenium bioaccumulation model indicated that selenium bioaccumulation was within the prediction range. Selenium concentrations in tissues of juvenile bull trout and westslope cutthroat trout captured near the AWTF discharge in 2019 were substantially lower than those reported in 2017. Combined, the results from the 2019 LCO LAEMP indicated that the recommissioned AWTF with AOP is functioning as intended to decrease the non-selenate species in AWTF effluent, resulting in selenium accumulation in benthic invertebrates from Line Creek that would be expected based on the selenium bioaccumulation model.

Operation of the AWTF with AOP in 2019 did not result in an obvious change in water temperature or dissolved oxygen concentrations downstream in Line Creek. Evaluation of water quality analytes with early warning triggers also demonstrated no changes in analyte concentrations in 2019 related to operation of the AWTF with AOP. Also, acute and chronic toxicity test data did not reliably indicate greater toxicity in 2019 compared to previous years.

Overall, operation of the WLC AWTF with AOP in 2019 functioned as designed to remove aqueous total selenium and nitrate from effluent. Recommissioning of the AWTF with AOP resulted in reduced selenium bioaccumulation downstream in Line Creek relative to AWTF operation without AOP by decreasing the concentrations of non-selenate species in AWTF effluent. In addition, operation of the AWTF with AOP in 2019 did not influence the receiving environment through effects to biological productivity, or through potential effects related to factors other than nutrients or selenium. Results of the LCO LAEMP provide information that supports Teck's Adaptive Management Program and inform adjustments to monitoring. In 2019, additional tissue sampling events were implemented to allow for more detailed evaluation of AWTF performance during operation stabilization with AOP, and results from the 2019 LCO LAEMP were used to inform adjustments to monitoring for 2020 LCO LAEMP study design. The timing of benthic invertebrate selenium monitoring in 2020 has therefore been adapted to focus on biologically relevant times rather than on AWTF operational timing.

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ACRONYMS AND ABBREVIATIONS

AMP – Adaptive Management Plan

ANOVA – Analysis of Variance

AOP – Advanced Oxidation Process

AWTF – Active Water Treatment Facility

BCWQG – British Columbia Water Quality Guideline

CABIN – Canadian Aquatic Biomonitoring Network

CMO – Coal Mountain Operation

EMC – Environmental Monitoring Committee

ENV – British Columbia Ministry of Environment and Climate Change Strategy

EPT – Ephemeroptera (mayflies), Plecoptera (stoneflies), Trichoptera (caddisflies)

EVO – Elkview Operation

EVWQP – Elk Valley Water Quality Plan

FLNRORD – Ministry of Forests, Lands, Natural Resource Operations and Rural Development

FRO – Fording River Operation

GHO – Greenhills Operation

GPS – Global Positioning System

HR-ICP-MS – Inductively Coupled Plasma Mass Spectrometry

K-M – Kaplan-Meier Method

LAEMP – Local Aquatic Effects Monitoring Program

LCO – Line Creek Operation

LPL – Lowest Practical Level, referring to taxonomic identification of benthic invertebrates

LRL – Laboratory Reporting Limit

Qx – referring to calendar quarters

QA/QC – Quality Assurance / Quality Control

RAEMP – Regional Aquatic Effects Monitoring Program

SPO – Site Performance Objective

SRC – Saskatchewan Research Council

TTF – Trophic Transfer Factors

WLC – West Line Creek

1 INTRODUCTION

1.1 Background

Teck Coal Limited (Teck) operates five steelmaking coal mines in the Elk River watershed, including the Fording River Operation (FRO), Greenhills Operation (GHO), Line Creek Operation (LCO), Elkview Operation (EVO), and Coal Mountain Operation (CMO; Figure 1.1). Discharges from the mines to the Elk River watershed are authorized by the British Columbia Ministry of Environment and Climate Change Strategy (ENV) through permits that are periodically issued under provisions of the *Environmental Management Act*. Permit 107517 specifies the terms and conditions associated with discharges from Teck's five Elk Valley mine operations.

Section 9.3.1 of Permit 107517 (version April 4, 2019) outlines the requirements for the Line Creek Local Aquatic Effects Monitoring Program (LAEMP) as follows:

> *"The Permittee must develop and implement a Local Aquatic Effects Monitoring program to determine the effects of the Line Creek discharge on the receiving environment. An annual study design for the program must be prepared in consultation with the EMC*[2] *and submitted to the Director for approval by May 1 each year."*

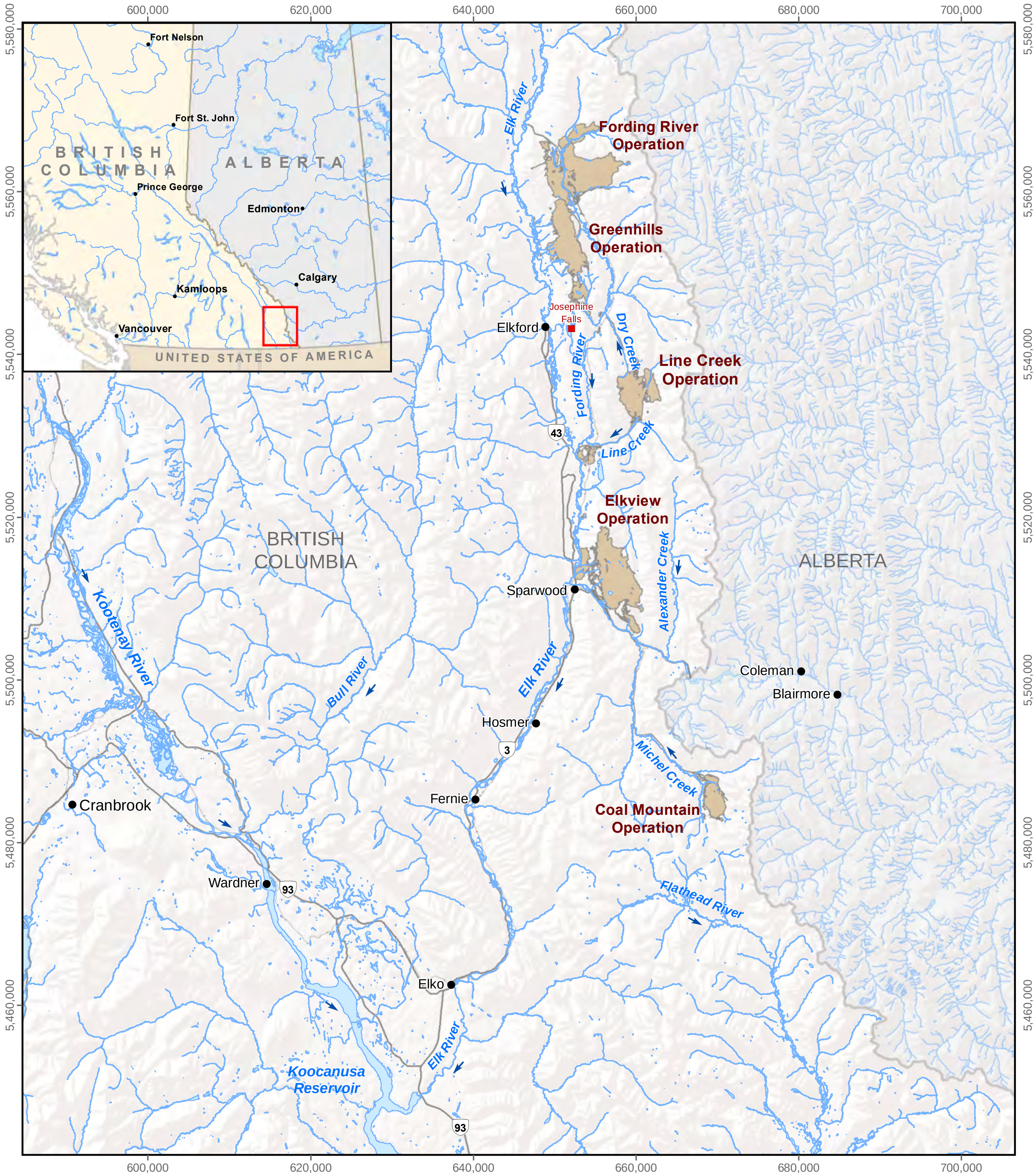
Also, Section 10.5 of Permit 107517 states:

> *The LAEMP Annual Reports must be reported on in accordance with generally accepted standards of good scientific practice in a written report and submitted to the Director by April 30 of each year following the data collection calendar year.*

In addition to monitoring under the LAEMP, Teck's Regional Aquatic Effects Monitoring Program (RAEMP) is a requirement under Permit 107517, and provides comprehensive routine monitoring and assessment of potential mine-related effects on the aquatic environment downstream from Teck's mines in the Elk Valley (i.e., annual sampling and more comprehensive monitoring every three years, with the next cycle of annual sampling to be completed in September 2020).

Teck conducts a variety of additional programs to monitor, evaluate, and/or manage the aquatic effects of mining operations within the Elk Valley at local and regional scales:

[2] EMC refers to the Environmental Monitoring Committee, which Teck was required to form under Permit 107517. The EMC consists of representatives from Teck, ENV, the Ministry of Energy and Mines, Environment Canada, the Ktunaxa Nation Council, Interior Health Authority, and an independent scientist. Environment Canada has agreed to provide input on a case-by-case basis when requested by the other members of the EMC but has not yet been called upon to participate. The EMC reviews submissions and provides technical advice to Teck and the ENV Director regarding monitoring programs.



LEGEND

Teck Coal Mine Operation

Teck's Coal Mine Operations within the Elk River Watershed, Southeast British Columbia

0 10 20 40 km

N W E S

Projection: North American Datum 1983 UTM Zone 11

Date: April 2020
Project 197202.0006

minnow environmental inc.

Figure 1.1

Document Path: S:\Projects\197202\197202.0006 - Teck 2019 Line Creek LAEMP\4 - GIS\Report\19-06 Figure 1.1 Teck Coal Limited Operation.mxd

- Water quality monitoring
- Calcite monitoring
- Fish and fish habitat management
- Chronic Toxicity Testing Program
- Regional Aquatic Effects Monitoring Program
- Tributary Management Plan
- Adaptive Management Plan

The goal of the Line Creek LAEMP is to assess site-specific conditions (e.g., commissioning of active water treatment) on a more frequent and localized basis than the RAEMP, as required until sufficient data have been collected, concerns no longer exist, or relevant monitoring can be incorporated into the RAEMP.

1.2 Study Questions

Although the broader objective of the Line Creek LAEMP is to assess site-specific conditions at LCO, the LAEMP was designed with the primary focus of monitoring aquatic health and evaluating potential effects related to the commissioning of the West Line Creek (WLC) Active Water Treatment Facility (AWTF) at LCO. Monitoring related to the operation of the WLC AWTF includes three main foci for the assessment of potential adverse effects to the receiving environment. These three foci are as follows:

1. The potential for changes in productivity, trophic status, and biological community structure downstream of the WLC AWTF. The fluidized bed reactor technology used at the WLC AWTF for selenium and nitrate removal requires the addition of phosphorus to the treatment process. Although the WLC AWTF is managed to minimize the amount of residual phosphorus in treated effluent, there is potential for phosphorus concentrations to increase in Line Creek downstream from the WLC AWTF discharge. Increased phosphorus concentrations in Line Creek could potentially cause increased algal growth and changes to trophic status and biological community structure.

2. The potential for a change in the chemical form of selenium released into Line Creek from the WLC AWTF. Selenium in surface waters of the Elk River watershed (including downstream of Teck's mines) is predominantly in the form of selenate, as would be expected in the well-oxygenated, flowing stream habitats that dominate this watershed. At the WLC AWTF, aqueous selenium is removed via uptake into microorganisms within the treatment system where it is transformed to chemically-reduced forms

(e.g., selenite and organoselenium species). In aquatic receiving environments, some reduced selenium species are accumulated into the base of the food web more readily than selenate (Ogle et al. 1988; Riedel et al. 1996; Stewart et al. 2010). In response to increased concentrations of non-selenate selenium species in the receiving environment and increased selenium accumulation in aquatic biota observed during AWTF operation, the WLC was recommissioned with an Advanced Oxidation Process (AOP) to potentially resolve this issue (see Section 1.3 for details).

3. The potential for other conditions related to active water treatment to adversely influence the receiving environment (e.g., an increase in temperature or a decrease in dissolved oxygen concentrations in treated water being released to Line Creek; discharge of treatment-related constituents; or an increase in other aqueous constituents of concern).

Based on the above, the objectives for the Line Creek LAEMP were expressed as the following study questions:

1. Is active water treatment affecting biological productivity downstream in Line Creek?
2. Are tissue selenium concentrations reduced downstream from the WLC AWTF?
3. Is WLC AWTF operation affecting aquatic biota through thermal effects, effects on dissolved oxygen concentrations, or concentrations of treatment-related constituents other than nutrients or selenium?

1.3 Line Creek LAEMP Reporting Relative to AWTF Operation

Sampling for the Line Creek LAEMP began in September 2013 prior to initial commissioning of the WLC AWTF in 2014 (Table 1.1). Interpretive reports of the LAEMP results have been submitted annually beginning in May 2015 (Minnow 2015, 2016a, 2017a, 2018d, 2019b).

The AWTF operated briefly in 2014 (July 24 to October 26) but was shut down due to challenges with the performance of the facility. It was recommissioned in late 2015, with steady state operation commencing at the end of January 2016 (Table 1.1). In late 2016 and early 2017, monitoring data identified elevated aqueous concentrations of chemically-reduced selenium species in Line Creek downstream from the AWTF, along with elevated concentrations of selenium in tissues of aquatic biota (Minnow 2017a). Sampling completed in September 2017 showed that tissue selenium concentrations continued to be elevated (Minnow 2018d). In response to these results, Teck worked with regulators to obtain necessary authorizations to

Table 1.1: Dates Associated with Phases of WLC AWTF Operation

Phase		Start	End	Approximate Flow (m^3/day)
Initial AWTF Commissioning Phase		24-Jul-14	26-Aug-14	Variable flow
Initial AWTF Discharge		27-Aug-14	16-Oct-14	Variable flow
AWTF Shutdown (no flow)		17-Oct-14	26-Oct-15	0
AWTF Discharge Begins		26-Oct-15	30-Jan-16	Variable flow
AWTF Steady State Operation		31-Jan-16	15-Oct-17	~5,300 to 5,500
AWTF Flow Reduction		16-Oct-17	7-Mar-18	~2,500
AWTF Intakes Closed, System Dewatered		27-Feb-18	8-Mar-18	Variable flow
AWTF Shutdown (flow ceases)		8-Mar-18	29-Aug-18	0
AWTF/AOP Recommissioning Phase[a]	No Discharge	30-Aug-18	28-Oct-18	0
	Initial Discharge	29-Oct-18	28-Dec-18[a]	0 to 5,500
AWTF/AOP Operation Stabilization		29-Dec-18[a]	~spring 2020	0 to ~7,500
AWTF/AOP Steady State Operation		~spring 2020	indefinitely	~7,500

[a] 120 days after recommissioning date.

decrease effluent flow through the AWTF by approximately half[3] (starting on October 16, 2017) and subsequently shut down the WLC AWTF temporarily (starting on March 8, 2018; Table 1.1). A monitoring plan was approved by ENV (2018) to support the AWTF flow reduction and shutdown process and augment the monitoring that was proposed in the 2017 Line Creek LAEMP study design (Minnow 2017c). The AWTF remained shut down until recommissioning with an advanced oxidation process (AOP[4]) which was initiated on August 30, 2018 (no discharge to the environment occurred during this initial recommissioning). The AOP is designed to reverse the shift in selenium species in AWTF effluent from chemically-reduced species back to a (chemically-oxidized) selenate-dominated condition. Discharge to the receiving environment from the AWTF with AOP began on October 29, 2018 with variable flow (Table 1.1). Stabilization of AWTF with AOP operations (i.e., variable influent flow rates to the AWTF during optimization of the treatment processes) began in late December 2018 (120 days after the start of recommissioning with AOP)[5] and continued until late March 2020, after which steady-state operation of the AWTF with AOP began (i.e., consistent influent flow rates to the AWTF at or near the maximum treatment capacity).

1.4 Linkages to Teck's Adaptive Management Plan

As required in Permit 107517 Section 11, Teck has developed an Adaptive Management Plan (AMP). The purpose of the AMP is to support implementation of the Elk Valley Water Quality Plan (EVWQP) to achieve water quality and calcite targets, to be protective of human health and the environment, and where necessary, restorative, and to facilitate continuous improvement of water quality in the Elk Valley (Teck 2018). Following an adaptive management framework, the AMP identifies six Management Questions that will be re-evaluated at regular intervals as part of AMP updates throughout EVWQP implementation. Data from the RAEMP (Minnow 2018c) and the various LAEMPs (including the present monitoring program) will feed into the adaptive management process to address these Management Questions that collectively address the environmental management objectives of the AMP (Teck 2018) and the EVWQP (Teck 2014). The AMP also identifies key uncertainties that need to be reduced to fill gaps in current understanding and support achievement of the EVWQP objectives.

The Line Creek LAEMP was primarily designed to monitor conditions associated with the WLC AWTF operation as well as to answer site-specific questions on an annual basis (Section 1.2). Management actions may be triggered at any time during the course of each annual LAEMP cycle

[3] AWTF effluent flow was approximately 5,300 - 5,500 m^3/day during steady-state operations, then was reduced to approximately 2,500 m^3/day during the flow reduction period.

[4] AOP refers to the advanced oxidation process and associated AWTF process modifications.

[5] AWTF effluent flow was 0 to approximately 7,500 m^3/day during operation stabilization of AWTF with AOP.

(results are reported on April 30th of each year for the preceding calendar year) depending on the answers to site-specific LAEMP questions and on available data. For example, the Line Creek LAEMP Question #2 is: "Are tissue selenium concentrations reduced downstream from the WLC AWTF?". Monitoring in 2016 and 2017 identified that tissue selenium concentrations were elevated in aquatic biota collected downstream from the AWTF despite decreased total selenium loads (Minnow 2017a, 2018d). This prompted Teck to immediately initiate further investigations, which confirmed that the elevated tissue selenium concentrations were the result of elevated concentrations of chemically-reduced forms of aqueous selenium in effluent from the AWTF. Therefore, Teck worked with regulators to obtain necessary authorizations to temporarily shut down the WLC AWTF until a technical solution could be implemented. Benthic invertebrate tissue selenium monitoring was conducted throughout the shutdown period according to the approved shutdown monitoring plan (ENV 2018) to evaluate conditions while the AWTF was offline. Additional investigation and pilot-scale trials initiated by Teck indicated that an AOP would reverse the shift in selenium species in AWTF effluent from chemically-reduced species back to a selenate-dominated condition. The AWTF resumed operation with the newly-commissioned AOP process on October 29, 2018. Benthic invertebrate tissue selenium monitoring was completed as part of the Line Creek LAEMP just prior to the AWTF with AOP operation (in September 2018), and following the initiation of discharge (in December 2018, and January, February, April 2019). Adjustments were made to the timing of sampling events, as required, to accommodate changes in the AWTF with AOP implementation schedule. Finally, additional tissue sampling events in 2019 were also implemented (monthly monitoring between May and August) to allow for more detailed evaluation of AWTF performance during operation stabilization with AOP. Monitoring plans and schedules will continue to adapt to findings in the field and operational needs.

In addition to addressing questions specific to the Line Creek LAEMP on an annual basis, monitoring data from the LAEMP will contribute to the broader data set assessed every three years within the RAEMP. The RAEMP is designed to evaluate AMP Management Question #5 (i.e., "Does monitoring indicate that mine-related changes in aquatic ecosystem conditions are consistent with expectations?"). During the development of the AMP, a number of uncertainties related to Management Question #5 were identified that were summarized as Key Uncertainty 5.1 (i.e., "How will monitoring data be used to identify potentially important mine-related effects on the aquatic ecosystem?"). Teck is working with its consultants and the EMC to develop the methodology that will address Key Uncertainty 5.1 and its underlying uncertainties prior to submission of the next RAEMP report in 2020.

Data from the LAEMPs and RAEMP will also contribute to answering AMP Management Question #2, (i.e., "Will aquatic ecosystem health be protected by meeting the long-term site performance objectives?). A Key Uncertainty associated with Management Question #2 is "How will the science-based benchmarks be validated and updated?" with underlying uncertainty about how aquatic monitoring data will be used to validate and update the benchmarks. Progress on reducing these uncertainties, and associated learnings, will be described in annual AMP Reports.

The first annual AMP report was submitted in July 2019 and included data from 2018 (Teck 2019c). This report identified a trigger of the AMP response framework for aqueous nitrate concentrations that exceeded the Site Performance Objective (SPO; monthly average and daily maximum) at the Line Creek Compliance Point in 2018. Actions associated with the AMP response to elevated nitrate concentrations are outlined in detail in the 2018 Annual AMP report (Teck 2019c). The investigation of cause identified blasting residue on waste rock as the source of nitrate in Line Creek. Several adjustments were completed as part of the AMP response framework, including operation of the AWTF throughout 2019 (which functions to remove aqueous total selenium and nitrate, and was not fully functional in 2018 due to recommissioning), among others (Teck 2019c). Furthermore, additional mitigation is planned through long-term adjustments outlined in the 2019 Implementation Plan Adjustment (Teck 2019c). Concentrations of aqueous total selenium also exceeded the SPO (monthly average and daily maximum) at the Line Creek Compliance Point in 2018 (Teck 2019c). Selenium monitoring related to the LCO LAEMP is focused on concentrations in biota, and management actions related to this monitoring have been implemented based on changes to the AWTF operational status as well as in response to biological tissue selenium results (see earlier in this section for details). The implementation of these adaptive management actions are not constrained to the AMP or LAEMP annual reporting cycles, but may be (and have been) triggered at any time during the reporting cycle. For example, additional monthly monitoring of benthic invertebrate selenium concentrations was implemented between May and August 2019 (as described above) to support better understanding of the AWTF with AOP performance during this time.

For more information on the adaptive management framework, the Management Questions, the key uncertainties, the Response Framework, Continuous Improvement, linkages between the AMP and other EVWQP programs, and AMP reporting, refer to the AMP (Teck 2018) and the 2018 Annual AMP report (Teck 2019c).

2 METHODS

2.1 Overview

The general approach for the Line Creek LAEMP (see Table 2.1) includes explanation of the collected data and data evaluation in relation to each of the study questions. This report includes data up to the end of the 2019 calendar year for all parameters. Historical data are also presented where appropriate.

Water quality and biological samples were collected from established monitoring areas in Line Creek and the Fording River (Table 2.2, Figure 2.1). These monitoring areas represent the same locations that were sampled for the LAEMP in 2014 and 2015, with the addition of RG_LCUT (LC_LCUSWLC) in 2016, and RG_LISP24 (WL_DCP_SP24) and RG_LIDCOM (LC_LCC) in 2017.[6] RG_LCUT is situated upstream from the AWTF and mainly reflects water quality influences farther upstream on the main stem of Line Creek (LC_LCUSWLC) when the AWTF is operating. When West Line Creek flows are not being diverted to the AWTF for treatment (i.e., during reduction of effluent flow through the AWTF or during AWTF shutdown) water quality at RG_LCUT also reflects input from West Line Creek. RG_LISP24 and RG_LIDCOM are monitoring areas downstream from the WLC AWTF that were added to the LAEMP to provide additional spatial resolution of the potential influence of the AWTF. Continuous water temperature is also monitored at several locations (Figure 2.2, Table 2.3).

To address the study questions described in Section 1.2, the 2019 Line Creek LAEMP included evaluation of the following components:

- Periphyton visual coverage scores;
- Benthic invertebrate biomass, community, and tissue selenium concentrations (composite-taxa samples);
- Fish tissue selenium concentrations;
- Concentrations of nutrients, total selenium, selenium species, and other analytes (i.e., those listed in Section 2.2.1) in water, based on routine water quality monitoring;
- *In situ* water quality (including temperature and dissolved oxygen) at routine water quality monitoring locations;

[6] RG_LISP23 (WL_LCUCP_SP23) was also established in 2017 (Minnow 2018d) but monitoring at this location was discontinued in 2018 (Minnow 2018b). Refer to Minnow (2018d) for details of this monitoring area.

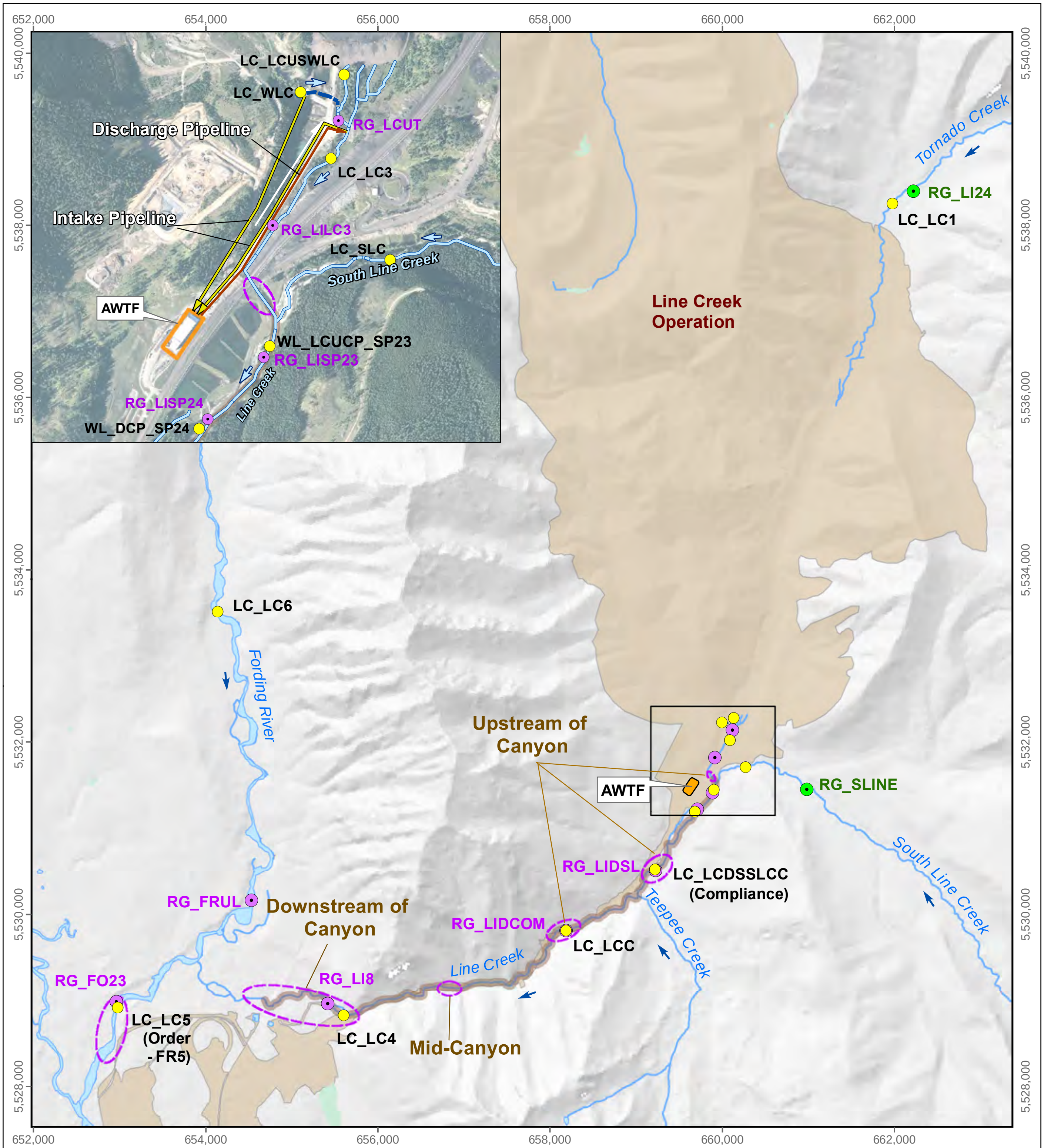
Table 2.1: General Approach for the 2019 Line Creek LAEMP, as Presented in the LAEMP Study Design (Minnow 2019)

Key Questions	Assessment Endpoints	Measurement Endpoints				How Data will be Evaluated to Address Key Question[a]
		Water	Sampling Areas	Biological	Sampling Areas	
Is active water treatment affecting biological productivity downstream in Line Creek?	Biological productivity downstream from the AWTF discharge post-compared to pre-AWTF commissioning, among AWTF operational phases, and relative to productivity observed upstream from the discharge	Nutrient concentrations	LC_LC1, LC_SLC, LC_WLC, LC_LCUSWLC, LC_LC3, WL_DCP_SP24, LC_LCDSSLCC, LC_LCC, LC_LC4, LC_LC6 , LC_LC5 (see Table 2.4 for timing)	Periphyton coverage, Benthic invertebrate biomass, Benthic invertebrate community structure	Benthic Invertebrate Biomass - RG_LI24, RG_SLINE, RG_LILC3, RG_LIDSL Periphyton Coverage and Benthic Invertebrate Community - RG_LI24, RG_SLINE, RG_LCUT, RG_LILC3, RG_LISP24, RG_LIDSL, RG_LIDCOM, RG_LI8, RG_FRUL, RG_FO23	Determine if there is an increase in periphyton coverage, benthic invertebrate biomass, or shift in community structure that has been demonstrated to correspond with changes in AWTF operational status and changes in parameters associated with productivity (e.g., nutrient concentrations)
Are tissue selenium concentrations reduced downstream from the AWTF?	Tissue selenium concentrations downstream from the AWTF discharge post- compared to pre-AWTF commissioning, among AWTF operational phases, and relative to concentrations observed upstream from the discharge	Total and dissolved selenium concentrations	LC_LC1, LC_SLC, LC_WLC, LC_LCUSWLC, LC_LC3, WL_DCP_SP24, LC_LCDSSLCC, LC_LCC, LC_LC4, LC_LC6 , LC_LC5 (see Table 2.4 for timing)	Benthic invertebrate tissue selenium (composite-taxa samples) Fish tissue selenium (Westslope cutthroat trout and bull trout)	Benthic invertebrate -RG_LI24, RG_SLINE, RG_LCUT, RG_LILC3, RG_LISP24, RG_LIDSL, RG_LIDCOM, RG_LI8, RG_FRUL, RG_FO23 Fish - Area 1 (upstream from canyon: RG_LILC3 to RG_LIDCOM); Area 2 (downstream from canyon: RG_LI8)	Determine if there is a change in benthic invertebrate and fish tissue selenium concentrations over time that corresponds to changes in total selenium concentrations or selenium speciation in water. Benthic invertebrate community data being collected for other purposes can be used as supporting evidence of ecosystem health status downstream from the AWTF.
		Selenium speciation	LC_LC1, LC_SLC, LC_WLC, LC_LCUSWLC, LC_LC3, WL_DCP_SP24, LC_LCDSSLCC, LC_LCC, LC_LC4, LC_LC6 , LC_LC5 (see Table 2.4 for timing)			
Is AWTF operation affecting aquatic biota through thermal effects, effects on dissolved oxygen concentrations or concentrations of treatment-related constituents other than nutrients or selenium?	Biological community structure downstream from the AWTF discharge post- compared to pre-AWTF commissioning, among AWTF operational phases, and relative to community structure observed upstream from the discharge	Temperature (data loggers)	5 locations in the effluent mixing zone, and 1 location upstream of the AWTF discharge (see Figure 2.2 and Table 2.3)	Benthic invertebrate community structure	RG_LI24, RG_SLINE, RG_LCUT, RG_LILC3, RG_LISP24, RG_LIDSL, RG_LIDCOM, RG_LI8, RG_FRUL, RG_FO23 (annually)	Temperatures that are above/below the guideline, and dissolved oxygen concentrations that are above the threshold for effects to fish outside of the initial mixing zone, and confirmation that the mixing zone is small, will be indicative of effective management of treated water discharge. Benthic invertebrate community data being collected for other purposes can be used as supporting evidence of ecosystem health status downstream from the AWTF.
		Dissolved oxygen	LC_LC1, LC_SLC, LC_WLC, LC_LCUSWLC, LC_LC3, WL_DCP_SP24, LC_LCDSSLCC, LC_LCC, LC_LC4, LC_LC6 , LC_LC5 (see Table 2.4 for timing)			
		Toxicity	WL_BFWB_OUT_SP21, LC_LCDSSLCC (LIDSL) (see Table 2.4 for timing)			Determine if there is a change in benthic invertebrate community endpoints away from the reference condition that does not correspond to observed changes in nutrients or selenium concentrations.

[a] Data evaluation approach presented differs slightly from the evaluation criteria in Table 2.1 of the study design. The data evaluation approach displayed herein is integrated for water and biological endpoints, and these were presented separately in the study design.

Table 2.2: Monitoring Areas Associated with Line Creek LAEMP, 2019

Area	Water Quality Sampling Station					Biological Sampling			
	Teck Location Code	EMS Number	Location Description	UTM (11U)		Station ID	Location Description	UTM (11U)	
				Easting	Northing			Easting	Northing
Reference	LC_LC1	E216142	Line Creek upstream of LCO and MSA North Pit	661979	5538254	RG_LI24	Tornado Creek (south fork of upper Line Creek)	662214	5538393
	LC_SLC	E282149	South Line Creek west side of Main Rock Drain, upstream of Line Creek	660271	5531737	RG_SLINE	South Line Creek upstream of Line Creek and LCO	661122	5531374
Mine-exposed Line Creek	LC_LCUSWLC	E293369	Line Creek downstream of rock drain, upstream of West Line Creek and AWTF outfall	660125	5532281	RG_LCUT	Line Creek downstream of rock drain, downstream of West Line Creek and upstream of AWTF outfall	660114	5532140
	LC_LC3	0200337	Line Creek downstream of West Line Creek and AWTF outfall	660090	5532023	RG_LILC3	Line Creek downstream of West Line Creek and AWTF outfall	659911	5531818
	WL_DCP_SP24	N/A	Line Creek downstream of LC_WTF_OUT, approximately 50 m downstream of contingency pond discharge	659902	5531445	RG_LISP24	Line Creek downstream of LC_WTF_OUT, approximately 50 m downstream of contingency pond discharge	659674	5531168
	LC_LCDSSLCC (compliance)	E297110	Line Creek immediately downstream of South Line Creek confluence	659218	5530522	RG_LIDSL	Line Creek downstream of South Line Creek confluence	659294	5530583
	LC_LCC	N/A	Line Creek downstream of the compliance point	658184	5529814	RG_LIDCOM	Line Creek downstream of the compliance point	658184	5529814
	LC_LC4	020044	Line Creek canyon, upstream of Process Plant	655604	5528824	RG_LI8	Line Creek downstream of the canyon	655426	5528959
Mine-exposed Fording River	LC_LC6	0200338	Fording River downstream of Grace Creek, upstream of Line Creek	654140	5533513	RG_FRUL	Fording River downstream of Grace Creek, upstream of Line Creek	654530	5530162
	LC_LC5 (Order - FR5)	0200028	Fording River downstream of Line Creek	652977	5528919	RG_FO23	Fording River downstream of Line Creek	652808	5528334



LEGEND

- Teck Water Quality Station
- Mine-exposed Biological Sampling Area
- Reference Biological Sampling Area
- Fish Tissue Monitoring Area
- Active Water Treatment Facility (AWTF) Operational-Dependent Flow
- Active Water Treatment Facility (AWTF)
- Bull Trout Spawning Area (Smithson and Robinson 2018)
- Teck Coal Mine Operation

Line Creek LAEMP Biological Monitoring Areas and Teck Water Quality Stations, 2019

0 1 2 4 km

N W E S

Map Projection: UTM Zone 11N NAD 1983
Data Source: Reproduced under licence from Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.

Date: April 2020
Project 197202.0006

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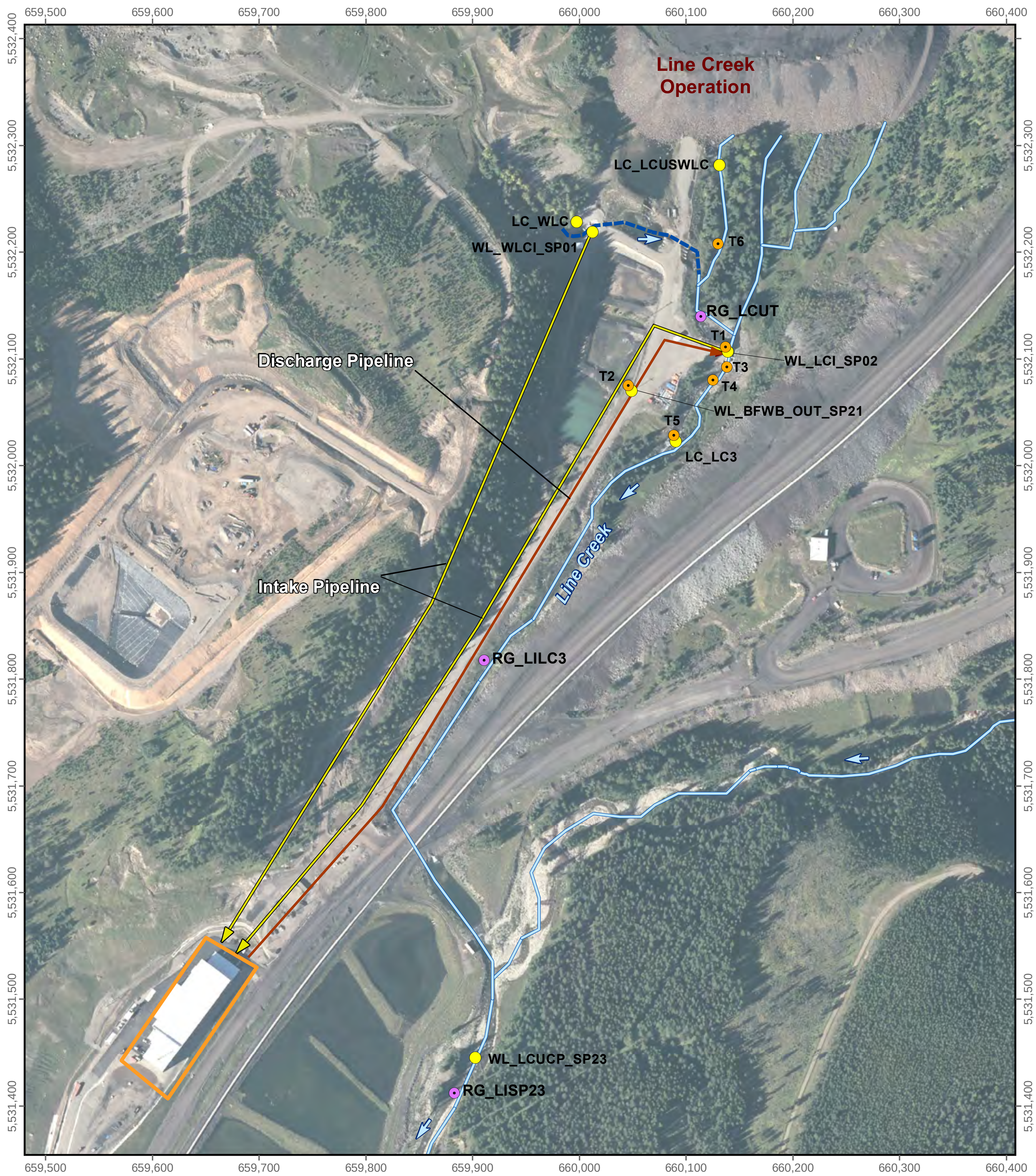
Figure 2.1

Document Path: S:\Projects\197202\197202.0006 - Teck 2019 Line Creek LAEMP\4 - GIS\Report\19-06 Figure 2.1 LC LAEMP Bio Monitoring Areas and Teck WQ Stations.mxd



LEGEND

- Temperature Data Logger
- Biological Monitoring Area
- Teck Water Quality Station
- Active Water Treatment Facility (AWTF) Operational-Dependent Flow
- Active Water Treatment Facility (AWTF)

Line Creek LAEMP Monitoring Areas and Teck Water Quality Stations in Upper Line Creek, 2019

0 85 170 340 Meters

N E S W

Projection: North American Datum 1983 UTM Zone 11

Date: April 2020
Project 197202.0006

minnow environmental inc.

Figure 2.2

Document Path: S:\Projects\197202\197202.0006 - Teck 2019 Line Creek LAEMP\4 - GIS\Report\19-06 Figure 2.2 Line Creek LAEMP Monitoring Areas and Teck WQ in Upper Line CK.mxd

Table 2.3: Temperature Data Logger Locations, 2019

Logger ID	Location Description	UTM (NAD83, 11U)	
		Easting	Northing
T1	Temperature upstream of LC Intake	660137	5532111
T2	Temperature of Buffer Pond outlet box	660046	5532074
T3	Temperature in V-Notch Discharge	660140	5532096
T4	Temperature 5m Downstream of Discharge	660130	5532076
T5	Temperature at LC3 (100m DS of outfall)	660092	5532030
T6	Temperature at LCUT (upstream of LC Intake and T1 data logger)	660130	5532208

- Water temperature upstream and downstream of the WLC AWTF recorded continuously with data loggers; and
- Toxicity of WLC AWTF effluent and surface water samples collected downstream of the AWTF outfall.

Water quality monitoring results presented in this report include requirements specified under Permit 107517. Acute and chronic water toxicity testing results include the requirements specified under Permit 107517, with chronic toxicity testing following the requirements of Permit 107517 and Permit 106970, which were integrated under an amendment to Permit 107517 on March 4th 2019 (ENV 2019).

Biological sampling in 2019 was completed in accordance with the 2018 and 2019 LCO LAEMP study designs (Minnow 2018b, 2019b). Benthic invertebrate tissue selenium sampling events were completed in February and April 2019 as specified in the 2018 LCO LAEMP study design (Minnow 2018b). These monitoring events were planned with the acknowledgement that the timing may be adjusted if recommissioning of the AWTF was delayed. Due to changes in the AWTF recommissioning schedule, the timing of these sampling events was adjusted slightly to include three sampling events in 2019 (January, February, and April), after discussion with the EMC in October 2018. The 2019 LCO LAEMP study design specified benthic invertebrate tissue selenium sampling events in September and December (Minnow 2019b) and this monitoring was completed as planned. Additional benthic invertebrate tissue selenium sampling was also completed monthly between May and August 2019 at a subset of monitoring areas to further evaluate AWTF with AOP performance during operation stabilization.

2.2 Water Quality

2.2.1 Routine Water Quality

Water quality data assessed as part of the Line Creek LAEMP included data for routine monitoring managed by Teck (Tables 2.4 and 2.5), and water samples collected at the biological monitoring stations concurrently with biological sampling (Table 2.2, Figure 2.1)[7]. Water quality data were downloaded from Teck's EQuIS™ database, including:

- Nutrient concentrations (i.e., nitrate, nitrite, ammonia, total phosphorus, and orthophosphate);

[7] The routine water quality monitoring locations and the biological monitoring locations for some areas differ slightly (e.g. LC_LCUSWLC; Figure 2.1).

Table 2.4: Summary of Water Quality Monitoring for Permit 107517

Location Description	Teck Water Station Code (associated Biological Station Code in brackets)	EMS Number	UTM (NAD83, 11U)		Water Quality Samples				
			Easting	Northing	Area Type	Field Parameters[a]	All Other Parameters Required Under Mine Permits[b]	Toxicity[e] Acute[f]	Toxicity[e] Chronic[g]
Line Creek upstream of LCO	LC_LC1 (RG_LI24)	E216142	661979	5538254	Reference	M	M	-	-
South Line Creek	LC_SLC (RG_SLINE)	E282149	660271	5531737	Reference	M	M	-	Q/SA
Line Creek upstream of WLC AWTF	LC_LCUSWLC (RG_LCUT)	E293369	660114	5532140	Mine-exposed	M	M	-	-
West Line Creek (WLC)	LC_WLC (RG_LCUT)	E261958	5532227	659998	Mine-exposed	M	M	-	-
Line Creek AWTF Influent	WL_LCI_SP02	E293371	660138	5532109	Mine-exposed	D	M	-	-
West Line Creek AWTF Influent	WL_WLCI_SP01	E293370	660011	5532218	Mine-exposed	D	M	-	-
AWTF Effluent (buffer pond discharge)	WL_BFWB_OUT_SP21	E291569	660050	5532070	Mine-exposed	D	M[c]	Q	Q
Line Creek ~200 m downstream of the WLC AWTF	LC_LC3 (RG_LILC3)	0200337	660090	5532023	Mine-exposed	W/M	W/M[h]	-	Q/SA
Line Creek	WL_DCP_SP24 (RG_LISP24)	-	659684	5531191	Mine-exposed	S	S	-	-
Line Creek downstream South Line Creek Confluence	LC_LCDSSLCC (RG_LIDSL)	E297110	659218	5530522	Mine-exposed	W/M	W/M[d,h]	-	Q/SA
Line Creek downstream of compliance	LC_LCC (RG_LIDCOM)	-	658185	5529820	Mine-exposed	S	S	-	-
Line Creek upstream of the process plant and ~5,550 m downstream of the WLC AWTF	LC_LC4 (RG_LI8)	0200044	655604	5528824	Mine-exposed	W/M	W/M[i]	-	-
Fording River upstream Line Creek	LC_LC6 (RG_FRUL)	0200338	654140	5533513	Mine-exposed	S	S	-	-
Fording River downstream Line Creek	LC_LC5 (RG_FO23)	0200028	652977	5528919	Mine-exposed	W/M	W/M	-	Q/SA

Notes: "-" = Sampling will not be completed at this area; D = daily; T = twice monthly; M = monthly; W = weekly; W/M = weekly during freshet (March 15 to July 15); Q = quarterly; S = September (once). September sampling at WL_DCP_SP24, LC_LCC, and LC_LC6 is not included in Permit 107517. Sampling frequency is currently managed through the permit, and after one year of data collection during sustained operation of the AWTF with AOP sampling frequency may be adjusted.

[a] Dissolved oxygen, water temperature, specific conductance, pH (see Table 2.5).
[b] Parameters consistent with Permit 107517 (see Table 2.5 for details).
[c] Three times weekly for total selenium and 5-day Biochemical Oxygen Demand. Selenium speciation, sulphide, bromate, hydrogen peroxide, and ozone measured at frequency shown (in addition ot parameters listed in footnote b).
[d] Total phosphorus every two weeks from June 15th to September 30th.
[e] Acute and chronic as per Permit 107517 requirements.
[f] Q = Quarterly 96-hr rainbow trout LT_{50}; 48-hr Daphnia spp. LT_{50}.
[g] Q = Quarterly 7-day *C. dubia* growth and survival, 72-hr *P. subcapitata* growth tests; SA = Semi-annual 28-day *H. azteca* growth and survival tests in spring and fall, 30-day early life stage rainbow trout tests in spring and fall, 30-day early life stage fathead minnow tests in summer and winter.
[h] 5-day Biochemical Oxygen Demand, sulfide, bromate, hydrogen peroxide measured at frequency shown (in addition to parameters listed in footnote b).
[i] Bromate and hydrogen peroxide measured at frequency shown (in addition to parameters listed in footnote b).

Table 2.5: Water Quality Parameters Required Under Permit 107517[a]

Category	Parameter
Field Parameters	water temperature, specific conductance, dissolved oxygen, pH
Conventional Parameters	specific conductance, total dissolved solids, total suspended solids, hardness, alkalinity, dissolved organic carbon, total organic carbon, and turbidity
Major Ions	bromide, fluoride, calcium, chloride, magnesium, potassium, sodium, sulphate
Nutrients	ammonia, nitrate, nitrite, total Kjeldahl nitrogen, orthophosphate, total phosphorus
Total and Dissolved Metals	total and dissolved concentrations of: aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, and zinc

[a] Parameters are consistent with those outlined in Table 18 of Permit 107517.

- Selenium concentrations (i.e., total and dissolved selenium concentrations, and selenium speciation results including concentrations of selenate, selenite, dimethylselenoxide, methylseleninic acid, selenocyanate, selenomethionine, selenosulphate, and unknown selenium species);
- Concentrations of analytes with early warning triggers under the AMP [i.e., total dissolved solids, sulphate, total concentrations of antimony, barium, boron, lithium, manganese, molybdenum, nickel, selenium (previously noted above), uranium and zinc, and dissolved concentrations of cadmium and cobalt]; and
- *In situ* water quality data (i.e., temperature, pH, specific conductivity, and dissolved oxygen).

Quality assurance and quality control (QA/QC) associated with routine water quality monitoring were discussed in the annual water quality report for Permit 107517 (Teck 2020). Quality control results associated with water samples collected concurrently with biological samples will be reported in the next RAEMP report (i.e., 2020).

2.2.2 Toxicity Testing

Effluent samples from the WLC AWTF (WL_BFWB_OUT_SP21) were collected for acute toxicity testing, as stipulated in Permit 107517 (Table 2.4). The following acute toxicity tests were performed:

- Single concentration acute toxicity test (96-hour LT_{50}) using rainbow trout (*Oncorhynchus mykiss*); universal method: EPS 1/RM/9 (Environment Canada 2007a); and
- Single concentration acute toxicity test (48-hour LT_{50}) using *Daphnia* spp.; universal method: EPS 1/RM/11 (Environment Canada 1996).

Chronic toxicity tests were also completed on water samples collected quarterly and semi-annually in 2019 at two mine-exposed areas of Line Creek (Compliance Point [LC_LCDSSLCC] and LC_LC3) and at one mine-exposed area of the Fording River (LC_LC5; Table 2.4, Figure 2.1), as per the Permit 107517 and 106970 Chronic Toxicity Program integration amendment (March 4, 2019). Chronic toxicity tests were also completed on water samples from one reference area (LC_SLC) in 2019 to develop a within-watershed reference location for Line Creek. The quarterly and semi-annual tests were completed as follows:

Quarterly tests:

- 72-hour growth/inhibition test using a freshwater alga (*Pseudokirchneriella subcapitata*), conducted using method: EPS1/RM/25 (Environment Canada 2007b); and

- 7-day test of reproduction and survival using a cladoceran (*Ceriodaphnia dubia*), conducted using method: EPS1/RM/21 (Environment Canada 2007c).

Semi-annual tests - Q2 and Q4:

- 28-day water-only test of growth and survival using a freshwater amphipod (*Hyalella azteca*), conducted using methods adapted from USEPA (2000); and
- 30-day early life stage toxicity test using rainbow trout, conducted using method: EPS 1/RM/28- 1E (Environment Canada 1998).

Semi-annual tests - Q1 and Q3:

- 30-day early life stage toxicity test using fathead minnow (*Pimephales promelas*), conducted using methods: EPA-712-C-96-121; USEPA 1996; and E1241-05; ASTM 2013.

Toxicity tests and associated QA/QC measures were completed and reported by the biological testing laboratory contracted by Teck. The results were summarized in reports completed in accordance with Permit 107517 (Teck 2020, Golder 2020). Applicable results (i.e., for monitoring stations in Line Creek associated with the LAEMP) are summarized in this report.

2.3 Primary Productivity

Periphyton coverage was visually scored during the September 2019 sampling event at each of the ten sampling areas where benthic invertebrates were collected by kick sampling (Table 2.6), consistent with the 2019 monitoring design (Minnow 2019b). Scores were recorded for five stations located a minimum of 5 m apart in each area, and were based on the categories defined in the Canadian Aquatic Biomonitoring Network (CABIN) sampling method (Environment Canada 2012a):

1. Rocks not slippery, no obvious colour (<0.5 mm thick);
2. Rocks slightly slippery, yellow-brown to light green colour (0.5 - 1 mm thick);
3. Rocks have noticeable slippery feel, patches of thicker green to brown algae (1 – 5 mm thick);
4. Rocks are very slippery, numerous clumps (5 - 20 mm thick); and
5. Rocks mostly obscured by algae mat, may have long strands (>20 mm thick).

2.4 Secondary Productivity and Invertebrate Community Structure (Hess Sampling)

Samples for analysis of benthic invertebrate density, biomass, and community structure were collected in September 2019 from two areas in Line Creek downstream from the WLC AWTF

Table 2.6: Primary and Secondary Productivity and Benthic Invertebrate Community Sampling Completed in Line Creek and Fording River in 2019 Compared to the 2019 LAEMP Study Design (Minnow 2019b)

Area Type	Biological Area Code	Biological Sampling		
		Periphyton	Benthic Invertebrates	
		Visual Coverage Score	Kick Sampling (Community)	Hess Sampling (Density, Biomass, Community)
		September	September	September
Reference	RG_SLINE	n=5 (√)	n=3 (√)	n=5 (√)
	RG_LI24	n=5 (√)	n=3 (√)	n=5 (√)
Mine-exposed Line Creek	RG_LCUT	n=5 (√)	n=1 (√)	-
	RG_LILC3	n=5 (√)	n=3 (√)	n=10 (√)
	RG_LISP24	n=5 (√)	n=1 (√)	-
	RG_LIDSL	n=5 (√)	n=3 (√)	n=10 (√)
	RG_LIDCOM	n=5 (√)	n=1 (√)	-
	RG_LI8	n=5 (√)	n=3 (√)	-
Mine-exposed Fording River	RG_FRUL	n=5 (√)	n=1 (√)	-
	RG_FO23	n=5 (√)	n=1 (√)	-

Notes: "-" = not sampled; "√" = target sample size was met.

(RG_LILC3 and RG_LIDSL), and at two reference areas (RG_SLINE and RG_LI24). Five samples were collected at each reference area and 10 at each mine-exposed area (Table 2.6, Figure 2.1). The samples were collected using a Hess sampler (0.1 m^2 sampling area) with 500 µm mesh. Stations were located a minimum of 5 m apart to represent the overall area.

A single sample was collected at each station by carefully inserting the base of the Hess sampler into the substrate to a depth of approximately 5 to 10 cm. Gravel or cobble enclosed within the Hess sampler was carefully washed while allowing the current to carry dislodged organisms into the mesh collection net. Organisms collected into the net were rinsed into the bottom of the net, and then into a labelled wide-mouth plastic jar. Samples were preserved to a nominal concentration of 10% buffered formalin in ambient water within approximately 6 hours of collection, so biomass was not lost through predation or decomposition of tissues before the samples were sorted at the laboratory.

Benthic invertebrate biomass samples were sent to ZEAS Inc. (lead taxonomist Danuta Zaranko) in Nobleton, ON, for sorting and taxonomic identification. Preserved organisms in each sample were sorted from the sample debris into groups separated at the family-level of taxonomy for weighing. Each family group of organisms was placed onto a fine cloth to drain excess surface moisture before being weighed to the nearest 0.1 mg. Total and family-level density and biomass were reported for each sample (preserved wet weight; see Appendix A for raw data).

2.5 Benthic Invertebrate Community Structure (Kick Sampling)

Three replicate samples were collected during the September 2019 sampling event from areas downstream from the AWTF outfall that have been monitored consistently over time (RG_LILC3, RG_LIDSL, and RG_LI8) and at each reference area (RG_SLINE, RG_LI24; Table 2.6). Replicates were collected from stations spaced a minimum of 50 m apart, where habitat allowed (i.e., riffle habitat was present) and sampling could be completed safely. Single samples were also collected from riffle habitat at RG_LCUT (located upstream from the AWTF discharge), RG_LISP24, and RG_LIDCOM to provide additional spatial resolution of community characteristics (Table 2.6).

Benthic invertebrate community sampling followed the CABIN protocol, which involved a 3-minute travelling kick to dislodge organisms into a net having a triangular aperture measuring 36 cm per side and mesh having 400 µm openings (Environment Canada 2012a). During sampling, the field technician moved across the stream channel (from bank to bank, depending on stream depth and width) in an upstream direction. With the net being held immediately downstream of the technician's feet, the detritus and invertebrates disturbed from the substrate were passively collected in the kick-net by the stream current.

After three minutes of sampling time, the sampler returned to the stream bank with the sample. The kick-net was rinsed with water to move all debris and invertebrates into the collection cup at the bottom of the net. The collection cup was then removed, and the contents poured into a labelled plastic jar and preserved to a nominal concentration of 10% buffered formalin in ambient water.

Benthic invertebrate community samples were sent to Cordillera Consulting (lead taxonomist Scott Finlayson), in Summerland BC, for sorting and taxonomic identification to the lowest practical level (LPL; typically genus or species). At the beginning of the sorting process, the total number of preserved organisms in each sample was estimated. If the total number was estimated to be greater than 300, then the sample was sub-sampled for sorting and enumeration. A minimum of 5% of each sample was sorted, consistent with requirements specified by Environment Canada (2012b, 2014). Sorting efficiency and sub-sampling accuracy and precision were quantified using methods outlined by Environment Canada (2012b, 2014). Total organism abundance was reported for each sample (see Appendix A for raw data).

2.6 Tissue Selenium Concentrations

2.6.1 Overview

As outlined in Section 2.1, tissue selenium monitoring in 2019 was completed in accordance with the 2018 and 2019 LCO LAEMP study designs (Minnow 2018b, 2019b), with some adjustments and additions to the planned benthic invertebrate tissue selenium monitoring to better align with the AWTF recommissioning schedule. Specifically, the timing of benthic invertebrate tissue sampling events in early 2019 was adjusted slightly (after discussion with the EMC in October 2018) to include three sampling events in early 2019 (January, February, and April) rather than the two sampling events outlined in the 2018 study design (February and April, 2019; Minnow 2018b). This adjustment was due to changes in the AWTF with AOP recommissioning schedule (Minnow 2019a). Additional sampling was also completed monthly between May and August 2019 at a subset of monitoring areas to further evaluate AWTF with AOP performance during operation stabilization (see Table 2.7). The resulting monitoring in 2019 therefore included sampling at all ten monitoring areas in January, February, April, September, and December, and at six of the ten monitoring areas (RG_SLINE, RG_LI24, RG_LCUT, RG_LILC3, RG_LIDSL, RG_LI8) in May, June, July, and August (Figures 2.1 and 2.3, Tables 2.2 and 2.7). All monitoring in 2019 was completed during the stabilization period of AWTF with AOP operations (Figure 2.3, Table 2.7).

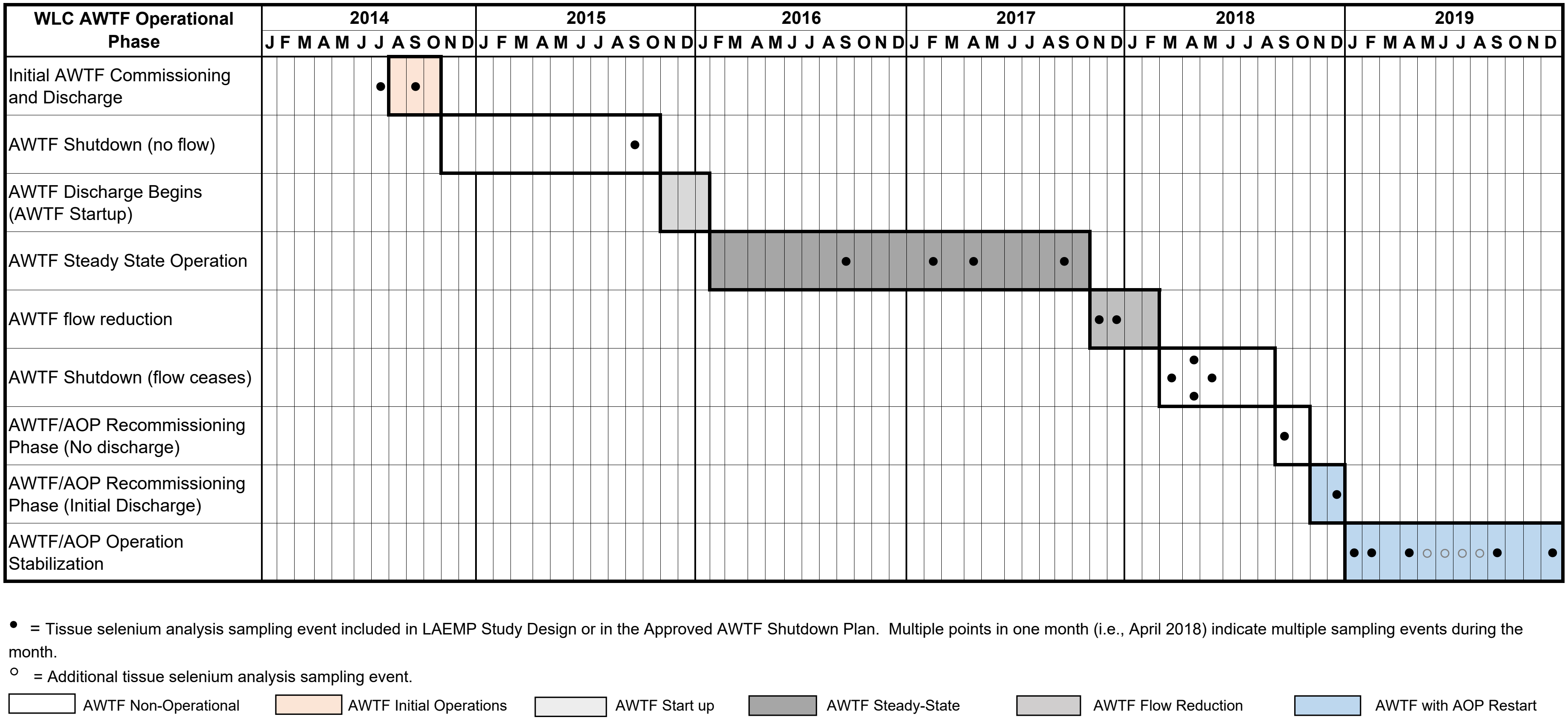


Figure 2.3: Overview of Completed Benthic Invertebrate Tissue Selenium Sampling Events in Relation to Phases of WLC AWTF Operation, 2014 to 2019

Table 2.7: Tissue Selenium Sampling Completed in Line Creek and Fording River in 2019 Compared to the 2018 and 2019 LAEMP Study Designs (Minnow 2018b, 2019b)

Area Type	Biological Area Code	AWTF with AOP Operation Stabilization											
		Jan 14-17[a]	Feb 25-Mar 7	Apr 22-26	May 22-24[b]	June 17-19[b]	July 15-23[b]	Aug 12-13[b]	Sept 5-12 (Regular LAEMP Timing)				Dec 2-6
		Benthic Invertebrates	Benthic Invertebrates	Benthic Invertebrates	Benthic Invertebrates	Benthic Invertebrates	Benthic Invertebrates	Benthic Invertebrates	Benthic Invertebrates	Fish Muscle Tissue	Fish Egg Tissue	Fish Muscle Tissue	Benthic Invertebrates
		Composite Taxa	Composite Taxa	Composite Taxa	Composite Taxa	Composite Taxa	Composite Taxa	Composite Taxa	Composite Taxa	Westslope Cutthroat Trout		Bull Trout	Composite Taxa
		10	10	10	10	10	10	10	10	8	NA	8	10
Reference	RG_SLINE	√	√	√	√	√	√	√	√	-	-	-	√
	RG_LI24	0 (frozen)	1	√	√	√	√	√	√	-	-	-	6
Mine-exposed	RG_LCUT	9	0 (frozen)	5	√	√	√	√	√				√
	RG_LILC3	√	√	√	√	√	√	√	√				√
	RG_LISP24	√	√	√	-	-	-	-	√	8	-	8[c]	√
	RG_LIDSL	√	√	√	√	√	√	√	√				√
	RG_LIDCOM	√	√	√	-	-	-	-	√				√
	RG_LI8	√	√	√	√	√	√	√	√	7	1	4	√
	RG_FRUL	5	√	√	-	-	-	-	√	-	-	-	√
	RG_FO23	√	4	√	-	-	-	-	√	-	-	-	√

Notes: "√" = target sample size was met, otherwise the actual number of samples collected is shown; "T" = target sample size; "-" = no data / not recorded.

[a] Benthic invertebrate selenium sampling specified in the 2018 Line Creek LAEMP study design included 1 or 2 events before the end of 2018 (depending on when discharge from AWTF/AOP was initiated). Discharge from the AWTF/AOP was initiated on October 29, 2018, therefore sampling timing was adjusted (after obtaining agreement from the EMC) and one sampling event was completed in early December 2018, and one in mid-January 2019.

[b] Exceeds sampling specified between May and September in the 2019 Line Creek LAEMP study design. Monthly tissue selenium monitoring was completed between May and August 2019 to evaluate AWTF performance during AOP stabilization.

[c] Target sample size of eight fish achieved. Nine individuals sampled in total.

2.6.2 Benthic Invertebrates

Benthic invertebrate tissue samples were collected for selenium analysis using the CABIN kick and sweep sampling method described in Section 2.4, except that sampling was not timed. All sampling events (including additional monitoring completed monthly between May and August 2019) included collection of a composite sample of a variety of benthic invertebrate taxa (composite-taxa samples). These samples are useful for comparison to baseline data, and as an estimate of dietary selenium exposure for consumer organisms (e.g., fish, birds).

Once the kick and sweep sampling method was completed, as many organisms as possible were carefully removed from sample debris using tweezers until about 2 g of wet tissue was obtained. Invertebrate tissue samples were then photographed to document taxa composition, placed into labelled vials, and stored in a cooler with ice packs until transfer to a freezer later in the day. Tissue samples were kept in a freezer until they were transported by courier in coolers with ice packs to the Saskatchewan Research Council (SRC) laboratory in Saskatoon, SK, where they were freeze-dried and subsequently analyzed for selenium using High Resolution Inductively Coupled Plasma Mass Spectrometry (HR-ICP-MS). Results were reported on a dry weight basis along with moisture content to allow conversion to wet weight values, as required.

2.6.3 Fish Tissue

Muscle samples for selenium analysis were collected non-lethally from westslope cutthroat trout (*Oncorhynchus clarkii lewisii*) and bull trout (*Salvelinus confluentus*) captured in Line Creek. Fishing efforts targeted eight individuals of each species from downstream of the WLC AWTF outfall to upstream of the canyon (i.e., between RG_LILC3 and RG_LIDCOM), and downstream of the canyon in the vicinity of RG_LI8 (Table 2.7, Figure 2.1).

Fish collections involved two anglers targeting a diverse range of habitat in the two areas of Line Creek, including deep pools, glides, side channels, and areas with large woody debris. Fish collection and sampling efforts were authorized under Scientific Fish Collection Permit CB19-528076 issued by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD). Supporting information recorded during each angling effort included duration of sampling effort, Global Positioning System (GPS) coordinates, catch results, number of samples collected, and deformities or abnormalities observed. No fish mortalities occurred during these sampling efforts.

Upon capture, each fish was subjected to length and weight measures and non-lethal tissue sampling prior to release near the site of capture. Body mass (in grams) and fork length (in millimeters) was measured using Pesola^{TM} spring scales (accurate to 0.3%) and a length board (± 1 mm), respectively. Muscle samples were then collected by inserting a 4 mm biopsy punch into the dorsal musculature and applying light pressure while turning (twisting) the punch. The tissue sample was removed from the biopsy punch using a clean pair of forceps, and the skin was removed. Light pressure was applied to the abdomen of each fish in the normal course of processing and also to help with sex determination. If eggs were released with minimal pressure during handling, a sample was collected for chemical analysis. Collected tissues were each placed into a labelled vial and stored in a cooler with ice packs until transfer to a freezer later in the day. Tissue samples were kept in a freezer until they were transported by courier in coolers with ice packs to SRC, where they were freeze-dried and subsequently analyzed for metals (including mercury and selenium) using HR-ICP-MS. Results were reported on a dry weight basis along with moisture content to allow conversion to wet weight values, as required.

2.7 Data Analysis

2.7.1 Water Quality

Water quality data were downloaded from Teck's EQuIS database and included both routine monitoring results collected by Teck and samples collected concurrently with biological sampling. Routine water quality results were paired with the closest biological monitoring station (Table 2.2). The location of routine water quality and biological monitoring stations differed slightly for some areas, therefore samples collected concurrently with biological sampling were named according to the biological monitoring location (Table 2.2). For instance, the biological monitoring area RG_LCUT is situated upstream from the AWTF and mainly reflects water quality influences farther upstream on the main stem of Line Creek (LC_LCUSWLC) when the AWTF is operating, but also reflects input from West Line Creek (LC_WLC) when the AWTF is not operational (and flows are not being diverted to the AWTF for treatment; see Section 2.1). Accordingly, water quality data for RG_LCUT in 2019 were associated with routine water quality monitoring data from LC_LCUSWLC for data analysis because the AWTF was operational throughout the year (AWTF with AOP operation stabilization; Table 1.1). Water quality data collected concurrently with biological sampling at other areas were associated with the corresponding routine water quality monitoring station (Table 2.2) for data analysis.

Annual means of water quality data were computed by first taking a mean of results within months and then averaging monthly means. If replicate sample results were available, the Kaplan-Meier (K-M) mean of the replicates was used. Monthly means were also calculated using the K-M method. This method involved transforming the left censored (i.e., < value) dataset to a right censored (i.e., > value) dataset, and then using the K-M estimator (used to estimate the mean survival time in survival analysis) to estimate the mean. The calculation was conducted using the survfit() function in the *survival* package (Therneau 2017) in R software (R Core Team 2019) and involved calculating the area under the K-M *survival* curve. The K-M method is non-parametric and can accommodate multiple Laboratory Reporting Limits (LRLs).

The method described in Minnow (2017b) was used to visually explore temporal changes in total phosphorus and orthophosphate concentrations during AWTF operation. The method involves two steps. First, the monthly upper limits of total phosphorus and orthophosphate concentrations (97.5^{th} percentile) were computed for the baseline (pre-AWTF operation) period at LC_LC3. Second, the monthly concentrations were plotted as a ratio of the monthly 97.5^{th} percentile of the concentrations (i.e., monthly mean concentration: monthly 97.5^{th} concentration). These trend plots help visualize deviations from the pre-AWTF range. Total phosphorus concentrations at the Compliance Point (LC_LCDSSLCC [RG_LIDSL]) between June 15^{th} and September 30^{th} were also plotted relative to the phosphorus Site Performance Objective (SPO; ≤ 0.02 mg/L) outlined in Permit 107517.

Potential effects of the WLC AWTF on nutrients (nitrate, total phosphorus, and orthophosphate) were assessed using a mass-balance analysis in the 2018 Line Creek LAEMP report (Minnow 2019a) in response to input and advice received from the EMC that recommended use of this approach. A similar approach was intended for use in the present report, but an equipment malfunction[8] resulted in a lack of flow data at LC_LC3 for the majority of 2019 (flow data were available for portions of January, May, and June only; KWL 2020). Furthermore, the flow data available in each of these three months was limited due to damage to the instrumentation that made most of the data unusable (KWL 2020). Flow data at LC_LC3 are central to the mass-balance calculations (see Minnow 2019a). Therefore, the mass-balance analysis of nutrients was excluded from the present report.

A temporal analysis for total selenium at LC_LC1 was conducted on monthly mean concentrations among years using an Analysis of Variance (ANOVA) model with factors *Year* and *Month*. The factor *Month* was included in the model to control for seasonal effects within a year. A log-normal distribution was assumed for all data (i.e., data were $\log_{10}$-transformed prior to analysis). If the *Year* term of the model was identified as statistically significant ($\alpha < 0.05$), the variability within years (controlling for month) was used to test for significant differences among all pairwise comparisons of years. Significance of the pairwise comparisons was assessed using a Tukey's honestly significant difference test with an α of 0.05. Using this method, potential differences in total selenium concentrations between 2019 relative to multiple previous years (2012 to 2018) and relative to 2018 only were assessed. The analysis was completed twice, once

[8] Damage to the flow measurement unit installed at LC_LC3 resulted in unusable data through most of January to May 2019, and further failure of the flow measurement unit occurred in June 2019. The unit was removed in July for service, after which no flow data were recorded (KWL 2020).

including all data, and once excluding one outlying result from 2012. The magnitude of difference in selenium concentrations for a given year relative to the first year of available data (i.e., 2012) was calculated as:

Magnitude of Difference = $(\bar{x}_i - \bar{x}_{2012})/\bar{x}_{2012}$ × 100%

where $\bar{x}_i$ is the observed mean for a given year and $\bar{x}_{2012}$ is the observed mean in 2012 (i.e., the base year; the first year with available data).

Routine water quality monitoring results were screened against British Columbia Water Quality Guidelines (BCWQG; BCMOE 2017, BCMOECCS 2019) as part of Teck's Annual Water Quality Monitoring Report under Permit 107517 (Teck 2020). In addition, further screening against BCWQG and water quality benchmarks (Teck 2014, Golder 2017b; see Appendix Table C.1 for screening values) was completed for select analytes during the 2019 calendar year. These analytes included nutrients (i.e., nitrate, nitrite, total phosphorus, and orthophosphate); total and dissolved selenium, and other selected analytes (i.e., those with early warning triggers under the AMP: total dissolved solids, sulphate, total concentrations of antimony, barium, boron, lithium, manganese, molybdenum, nickel, uranium and zinc, and dissolved concentrations of cadmium and cobalt; Section 2.2.1). Plots of these select analytes were prepared using available data from 2012 to 2019 for each monitoring station individually relative to BCWQG and water quality benchmarks (where applicable), and as combined plots to allow for visual comparison among stations. Aqueous selenium speciation results were plotted as monthly mean concentrations for each monitoring area, with results below the LRL excluded from the plots.

Temperature and dissolved oxygen concentrations in Line Creek were also graphically evaluated relative to BCWQG. British Columbia water temperature guidelines for bull trout and westslope cutthroat trout specify a maximum ± 1 °C change from the optimum temperature range for different life stages of these species (spawning, incubation, and rearing; BCMOE 2001). Dissolved oxygen guidelines are also specific to life stage (buried embryo/alevin and all other life stages; BCMOE 1997). Guidelines for both these parameters were applied to periods of the year relevant to the specific life stage of each of the two species, with the time periods approximated from available literature (McPhail and Baxter 1996; McPhail 2007; COSEWIC 2016). Temperature data recorded continuously at locations immediately upstream and downstream of the AWTF discharge (using data loggers) were plotted relative to discrete temperature measurements recorded further upstream at LC_LCUSWLC[9] (Figure 2.2, Table 2.3).

[9] A continuous temperature data logger was installed upstream of the AWTF discharge (near LC_LCUSWLC) in September 2019 (Data logger T6; Figure 2.2, Table 2.3). Temperature data from this logger were not available for inclusion in the present report but will be included in the 2020 LCO LAEMP report.

2.7.2 Secondary Productivity Endpoints

Potential effects of AWTF operation on benthic invertebrate biomass and density were analyzed among areas and years using an ANOVA model. The model was used to assess changes in the difference in benthic invertebrate biomass or density between mine-exposed and reference areas among years. Data were included for the two mine-exposed areas (RG_LIDSL and RG_LILC3) and two reference areas (RG_SLINE and RG_LI24) sampled in 2019, and included all available results from 2014 to 2019. As recommended by the EMC, the analyses were completed by separately evaluating changes at each mine-exposed area relative to the two reference areas. Outliers with studentized residuals with magnitude greater than four were removed from the analysis, and one sample from RG_SLINE in 2018 was excluded due to issues with sample preservation identified by the laboratory.

The ANOVA model that was fit to the data for each mine-exposed area (and both reference areas) was:

$$Y = CI + Year + Area(CI) + Year \times CI + Year \times Area(CI) + \epsilon$$

where:

- Y = response variable;
- CI = a fixed factor for area type with two levels (control [reference] and impact [mine-exposed]);
- $Year$ = a fixed factor for year (2014 to 2019);
- $Area(CI)$ = a fixed factor for area because there are two reference areas (nested in CI because each area can only be assigned to one level of CI);
- $Year \times CI$ = the interaction between $Year$ and CI with a significant effect suggesting the difference between mine-exposed and reference areas varies among years;
- $Year \times Area(CI)$ = the interaction between $Year$ and $Area$ with a significant effect suggesting the difference between mine-exposed and reference results depends on which reference area the mine-exposed area is being compared to; and
- ϵ = the error term.

The ANOVA model was used to test for CI effects (i.e., changes in the difference between mine-exposed and reference areas among years). These changes were assessed by testing the significance of the interaction terms containing the $Year$ and CI terms. An α of 0.1 was used to test the significance of the interaction terms.

Interpretation of the ANOVA table began by assessing the significance of the interaction between $Area(CI)$ and $Year$. If the interaction term was significant, then the differences among areas changed over time, but it depended on which years and areas were compared. In that case, separate ANOVA models were run for each reference area with factors for $Area$ (one mine-exposed and one reference), $Year$ and $Year \times Area$. If there was a significant interaction, contrasts were conducted (with Bonferroni correction for the number of tests) to test for significant changes between the mine-exposed area and reference area among years.

If the interaction term between $Area(CI)$ and $Year$ was not significant, then the interpretation of the ANOVA table continued by assessing the significance of the interaction between CI and $Year$. This term in the model assessed whether the relative differences among area types depended on year. If this interaction term was significant, then contrasts were conducted to determine the changes between the mine-exposed area and the reference areas among years.

Testing the significance of the interaction terms is the key hypothesis of interest in the ANOVA model as it tests for changes in the relative differences among areas over time. If all interaction terms are not significant, then it can be concluded that there are no Year effects that can be compared to AWTF operation schedules. Data were $\log_{10}$-transformed prior to analysis. The ANOVA models and contrasts were conducted in R (R Core Team 2019) using customized scripts. Plots for visualizing the ANOVA results were prepared in Microsoft Excel, and data were presented on $\log_{10}$-transformed y-axes for consistency with the statistical approach.

Temporal differences in benthic invertebrate biomass and density at mine-exposed areas (RG_LILC3 and RG_LIDSL) were also assessed over the same time period (2014 to 2019) using an ANOVA for each area and endpoint. Prior to analysis, data were transformed if required ($\log_{10}$, square root, fourth root) to meet the assumptions of the analysis. The transformation with the highest p-value from a Shapiro-Wilk test for normality that also passed a Levene's test for homogeneity of variances was selected. If assumptions could not be met, data were rank-transformed. When the overall ANOVA was significant ($\alpha < 0.1$), a Tukey's *post hoc* test was conducted for all pairwise comparisons. Graphical plots of the data were prepared using Microsoft Excel, and letters were used to indicate which years differed significantly from one another.

2.7.3 Selenium Tissue Chemistry – Benthic Invertebrates

Selenium concentrations measured in tissues of benthic invertebrates and fish were plotted over time relative to corresponding site-specific effect benchmarks (Table 2.8).

Table 2.8: Selenium Benchmarks for Benthic Invertebrates and Fish Tissues in the Elk Valley

Endpoint	Tissue Type	Benchmark			Source
		Value (µg/g dw)	Type	Description	
Benthic Invertebrates	Whole body	4[a]	BC guideline	Interim guideline for aquatic dietary tissue based on weight of evidence of lowest published toxicity thresholds and no uncertainty factor applied	BCMOE (2014)
	Whole body	13	Site-specific benchmark	Level 1 (~10% effect) benchmark for growth, reproduction and survival of invertebrates	Teck (2014)
	Whole body	20	Site-specific benchmark	Level 2 (~20% effect) benchmark for growth, reproduction and survival of invertebrates	Teck (2014)
	Whole body	27	Site-specific benchmark	Level 3 (~50% effect) benchmark for growth, reproduction and survival of invertebrates	Golder (2014)
	Whole body	11[b]	Site-specific benchmark	Level 1 (~10% effect) benchmark for dietary effects to juvenile fish (growth)	Teck (2014)
	Whole body	18	Site-specific benchmark	Level 2 (~20% effect) benchmark for dietary effects to juvenile fish (growth)	Teck (2014)
	Whole body	26	Site-specific benchmark	Level 3 (~50% effect) benchmark for dietary effects to juvenile fish (growth)	Golder (2014)
	Whole body	15	Site-specific benchmark	Level 1 (~10% effect) benchmark for dietary effects to juvenile birds	Teck (2014)
	Whole body	22	Site-specific benchmark	Level 2 (~20% effect) benchmark for dietary effects to juvenile birds	Teck (2014)
	Whole body	41	Site-specific benchmark	Level 3 (~50% effect) benchmark for dietary effects to juvenile birds	Golder (2014)
Westslope cutthroat trout	Egg/ovary	25	Site-specific benchmark	Level 1 (~10% effect) benchmark for westslope cutthroat trout reproduction	Teck (2014)
	Egg/ovary	27	Site-specific benchmark	Level 2 (~20% effect) benchmark for westslope cutthroat trout reproduction	Teck (2014)
	Egg/ovary	33	Site-specific benchmark	Level 3 (~50% effect) benchmark for westslope cutthroat trout reproduction	Golder (2014)
	Muscle/ muscle plug	15.5	Site-specific benchmark	Muscle equivalent to the 25 mg/kg dw ovary benchmark, based on the relationship observed between selenium in muscle and ovary in westslope cutthroat trout	Nautilus Environmental and Interior Reforestation (2011)
Other Fish	Egg/ovary	18	Site-specific benchmark	Level 1 (~10% effect) benchmark for reproduction effects to other species than westslope cutthroat trout	Teck (2014)
	Egg/ovary	22	Site-specific benchmark	Level 2 (~50% effect) benchmark for reproduction effects to other species than westslope cutthroat trout	Teck (2014)
	Egg/ovary	31	Site-specific benchmark	Level 3 (~50% effect) benchmark for reproduction effects to other species than westslope cutthroat trout	Golder (2014)
	Muscle	18	Site-specific benchmark	Muscle equivalent to the 18 mg/kg dw ovary benchmark, based on the relationship observed between selenium in muscle and ovary in longnose sucker	Minnow (2018a)
	Egg/ovary	11	BC guideline	Combination of weight of evidence and mean of published effects data with an uncertainty factor of 2 applied	BCMOE (2014)
	Whole body	4	BC guideline	Combination of weight of evidence and mean of published effects data with an uncertainty factor of 2 applied	BCMOE (2014)
	Muscle/ muscle plug	4	BC guideline	Whole-body translation to derive muscle benchmark with no additional uncertainty factor	BCMOE (2014)

[a] BC guidelines were not used in assessment of benthic invertebrate and fish tissue selenium concentrations. Assessment was completed relative to site-specific benchmarks only.

[b] Site-specific benchmark is not applicable to effects to juvenile westslope cutthroat trout because studies with Yellowstone cutthroat trout have reported no effects at the Level 1 benchmark (see Teck [2014], Annex E, Appendix D [Elk Valley Water Quality Plan – Selenium Toxicity Literature Review]).

Potential effects of AWTF operation on tissue selenium concentrations were evaluated for composite-taxa benthic invertebrate samples from each of the eight mine-exposed sampling areas using an ANOVA model. As recommended by the EMC, the analyses were completed by separately evaluating changes at each mine-exposed area relative to the two reference areas.

The ANOVA model that was fit to the data for each mine-exposed area (and both reference areas[10]) was:

$$Y = CI + Period + Time(Period) + Period \times CI + Time(Period) \times CI + \epsilon$$

where:

- Y = response variable;
- CI = a fixed factor for area type with two levels (control [reference] and impact [mine-exposed]);
- $Period$ = a fixed factor for time with up to five levels (Before [September 2012], Initial Operations [August to October 2014], Steady-state [February 2016 to October 2017], Shutdown [October 2014 to October 2015, March to August 2018] [11], and Restart [October to December 2019]) depending on data availability, where each period included between one to ten individual sampling events and reflected the operational status of the WLC AWTF;
- $Period \times \mathrm{CI}$ = the interaction between $Period$ and CI with a significant effect suggesting the difference between mine-exposed and reference areas varies among periods;
- $Time(Period) \times \mathrm{CI}$ = the interaction between $Time(Period)$ and CI with a significant effect suggesting the difference between mine-exposed and reference areas varies among periods, but it depends on which sampling months are being compared; and
- ϵ = the error term.

Only one data-point was collected for a given area in some years (i.e., no replicate sampling). Individual data points were used in the analyses rather than means (where n > 1 at an area), thus

[10] Benthic invertebrate selenium concentration data from both reference areas (RG_LI24 and RG_SLINE) were used in the ANOVA model, if available. If data from both reference areas were not available for a given sampling event, data from a single reference area were used. Results reported for RG_LI24 on May 3, 2018 were excluded from analyses because these were identified as anomalous and likely the result of a field error (see Minnow 2019a).

[11] Commissioning-phase discharge from the AWTF began August 27, 2014, and the facility was shut down on October 17, 2014, and recommissioned in October 2015. Composite-taxa benthic invertebrate tissue selenium monitoring was completed in September 2015. Due to the brief period of exposure to less-than-capacity AWTF effluent, benthic invertebrate tissue selenium data from September 2015 are not considered representative of steady-state AWTF operation but also do not represent a no-discharge condition. They were therefore excluded from ANOVA analyses, but are displayed in plots for context.

variation was assumed to be consistent across years. Because replicates within areas were not available for all years, an Area(CI) x Year interaction could not be tested, and this term was excluded from the model.

Interpretation of the ANOVA table began by assessing the significance of the interaction between $Time(Period)$ and CI. If the interaction was significant, then the differences among mine-exposed and reference areas varied among periods, but it depended on which sample months were compared. In that case, contrasts were conducted to determine differences between periods for each sampling event using an α = 0.1, with a Bonferroni correction for the number of tests. Contrasts were limited to those between the "Restart" period relative to the "Before" and "Steady-state" periods (contrasts to the "Initial Operations" and "Shutdown" periods were excluded), because these are the most relevant contrasts for evaluating changes during the "Restart" period. Differences among sampling events within a given period were not statistically contrasted, with the exception of the "Restart" period. Contrasts among sampling events within the "Restart" period were completed to facilitate evaluation of AWTF with AOP performance during this period of operation stabilization.

The magnitude of difference for a significant contrast was expressed in terms of the number of standard deviations as follows:

Magnitude of Difference = $\frac{(\bar{X}_1 - \bar{X}_2)}{S_r}$

where:

- $\bar{X}_1$ = difference between the $\log_{10}$(mean) for the mine-exposed and the $\log_{10}$(mean) for the reference areas in Sampling Event 1;
- $\bar{X}_2$ = difference between the $\log_{10}$(mean) for the mine-exposed and the $\log_{10}$(mean) for the reference areas in Sampling Event 2, and
- S_r= the standard deviation of the residuals in the ANOVA.

If the interaction term between $Time(Period)$ and CI was not significant, then the interpretation of the ANOVA table continued by assessing the significance of the interaction between $Period$ and CI. This term in the model assessed whether the relative differences between mine-exposed and reference area depended on period and if significant, contrasts (with Bonferroni correction) were used to compare among all time periods.

The magnitude of difference for a significant contrast was expressed in terms of the number of standard deviations using the equation above, where:

- $\bar{X}_1$ = difference between the $\log_{10}$(mean) for the mine-exposed and the $\log_{10}$(mean) for the reference areas in Time Period 1;
- $\bar{X}_2$ = difference between the $\log_{10}$(mean) for the mine-exposed and the $\log_{10}$(mean) for the reference areas in Time Period 2; and
- S_r= the standard deviation of the residuals in the ANOVA.

The ANOVA model outlined above was also used to evaluate changes in the difference of tissue selenium concentrations between sampling areas located upstream (RG_FRUL) and downstream (RG_FO23) of Line Creek on the Fording River.

Similar to the ANOVA model used to assess secondary productivity, testing the significance of the interaction terms is the key hypothesis of interest in these ANOVA models, as it tests for changes in the relative differences between the mine-exposed and reference areas over time. If all interaction terms are not significant, then it can be concluded that there are no period effects that can be attributed to AWTF operation schedules. If the interaction terms are significant, then the contrasts among sampling events within the "Restart" period also present a key tool for the purpose of evaluating AWTF performance during operation stabilization with AOP. Data were $\log_{10}$-transformed prior to analysis using ANOVA. The ANOVA model analysis and contrasts were conducted in R (R Core Team 2019) using customized scripts. Plots for visualizing the ANOVA results were prepared in Microsoft Excel, and data were presented on $\log_{10}$-transformed y-axes for consistency with the statistical approach.

Spatial differences in tissue selenium concentrations among areas during each sampling event during stabilization of AWTF with AOP operations (December 2018 to December 2019) were tested using an ANOVA. Prior to analysis, data were transformed if required ($\log_{10}$, square root, fourth root) to meet the assumptions of the analysis. The transformation with highest p-value from a Shapiro-Wilk test for normality that also passed a Levene's test for homogeneity of variances was selected. If assumptions could not be met, data were rank-transformed. When the overall ANOVA was significant ($\alpha < 0.05$), a Tukey's *post hoc* test was conducted for all pairwise comparisons. The ANOVA models and contrasts were conducted in R (R Core Team 2019) using customized scripts. Graphical plots of the data were prepared using Microsoft Excel, and letters were used to indicate which years differed significantly from one another.

Composite-taxa benthic invertebrate tissue selenium results from September 2012 to December 2019 were plotted relative to total selenium concentrations measured in water samples collected at or near the same time (within approximately three days) as the tissue samples. A line representing the regional one-step water-to-invertebrate selenium bioaccumulation model was also presented on the plot (Teck 2014). Confidence limits (95% percentile) for the model were calculated using the formula below (as described in Whitmore 1986):

$$\hat{Y} \pm t_{\frac{\alpha}{2},n-2} S_r \sqrt{(1 + \frac{1}{n} + \frac{(x - \bar{x})^2}{(n-1)S_x^2})}$$

where:

- $\hat{Y}$= the fitted regression value at X
- S_r= the root mean square deviation of the fitted regression model (= 0.220; $\log_{10}$ transformed)
- n = sample size (= 291)
- $\bar{X}$ = mean of the sample X_i values (= 0.488)
- S_x^2 = variance of the sample X_i values (= 0.885).

2.7.4 Benthic Invertebrate Community Data

Community endpoints that were evaluated included density (Hess samples) or sample abundance (kick samples), family richness (Hess and kick samples), richness at the Lowest Practical Level of taxonomy (LPL richness; kick samples), and the abundances of major taxonomic groups, including the combined orders of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies), collectively known as EPT, Ephemeroptera alone, and Chironomidae (midges; absolute and relative abundances for kick samples, and density for Hess samples). Community data for kick samples were plotted to show changes over time relative to normal ranges computed from reference area data in the RAEMP (Minnow 2018a).[12]

[12] Data collected for RAEMP monitoring (where available) were plotted in addition to those collected specifically for the LCO LAEMP as outlined in the monitoring design (Minnow 2018b).

3 PRODUCTIVITY

3.1 Overview

Monitoring data were evaluated in this section to address Study Question #1: Is active water treatment affecting biological productivity downstream in Line Creek? To address this study question, primary and secondary productivity monitoring endpoints and concentrations of aqueous nutrients were evaluated in relation to the AWTF operational status. The AWTF with AOP was operational throughout 2019 (in the operation stabilization phase), with discharge to the receiving environment occurring over the entire year.

3.2 Site Performance Objectives and Aqueous Nutrient Concentrations

As outlined in Section 1.2, the AWTF treatment process requires the addition of phosphorus, and there is the potential for increased phosphorus concentrations downstream in Line Creek during AWTF operation. In 2019, aqueous total phosphorus concentrations at the Compliance Point were consistently below the SPO of 0.02 mg/L during both the growing season (June 15 to September 30) and the remainder of 2019 (Figure 3.1).

In 2019, aqueous total phosphorus concentrations downstream of the AWTF discharge were within the range of concentrations reported prior to AWTF operation (i.e., 2013 to 2015, excluding initial operations in 2014; Figure 3.2; Appendix Figure A.1). Aqueous orthophosphate concentrations in 2019 were also within the range of results reported prior to AWTF operation (i.e., 2012 to 2015, excluding initial operations in 2014), despite an increase late 2018 when the AWTF was in the early stages of operation stabilization with AOP (Figure 3.3; Appendix Figure A.2).

Total phosphorus and orthophosphate concentrations were further evaluated using an approach recommended in the Proposal to Update the Site Performance Objective for Phosphorus in Line Creek (see Section 2.7.1; Minnow 2017b[13]). The purpose of this approach was to facilitate the early detection of potential changes in concentrations of these aqueous nutrients downstream of the AWTF. The evaluation involves the comparison of monthly mean concentrations of total phosphorus and orthophosphate to the upper range (97.5th percentile) of concentrations observed in each month during the baseline (pre-AWTF) period at LC_LC3 (upper panels in Figures 3.4 and 3.5). Monthly mean concentrations were then expressed as a ratio of the baseline 97.5th percentile for each month (bottom panels in Figures 3.4 and 3.5).

[13] Included as Appendix C in Minnow (2017b).

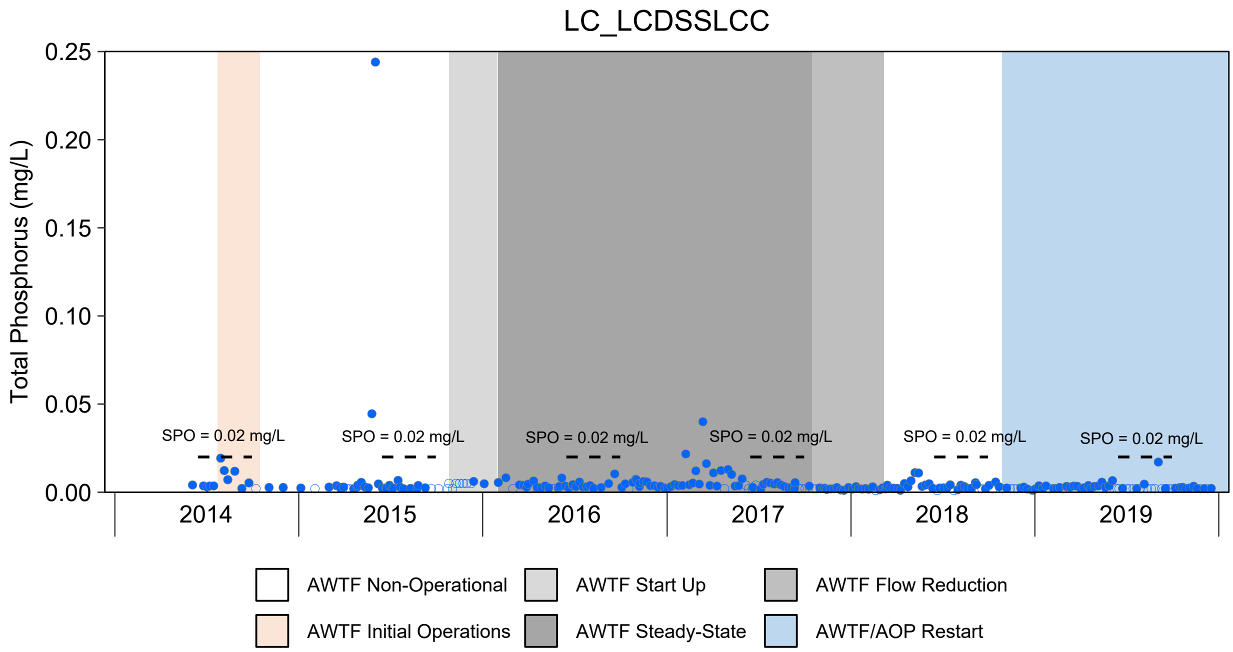


Figure 3.1: Total Phosphorus Concentrations in Water Collected from the Line Creek Compliance Point (LC_LCDSSLCC), 2014 to 2019

Notes: SPO = Site Performance Objective (0.02 mg/L), this pertains to the compliance point (LC_LCDSSLCC) only, as a growing season average calculated from measurements collected every two weeks between June 15th and September 30th, annually. If multiple results existed for a given location and day, the Kaplan-Meier mean of the duplicates was presented, hollow symbols represent results below the laboratory reporting limit (LRL).

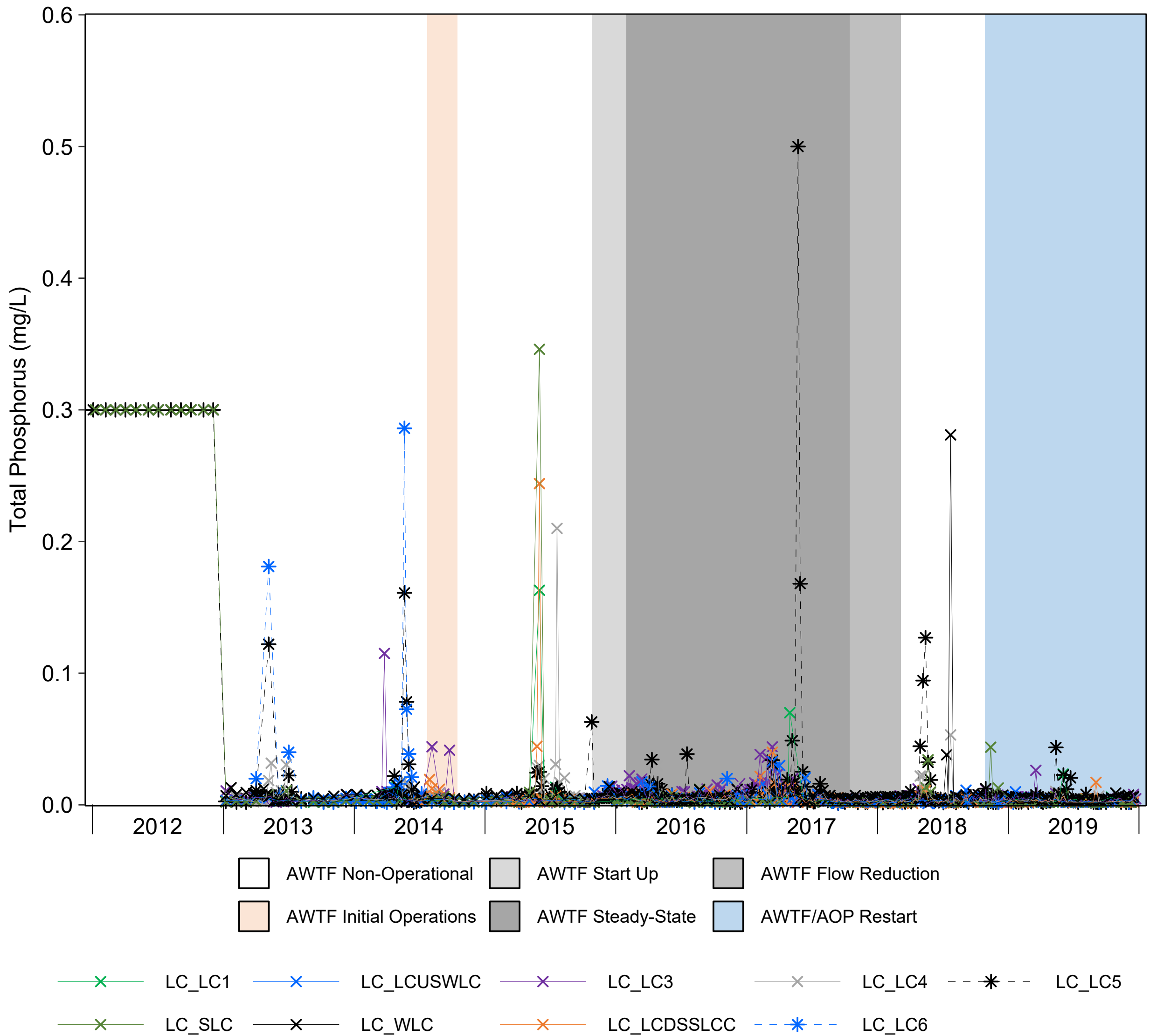


Figure 3.2: Time Series Plots for Aqueous Total Phosphorus Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (LRLs between 0.0010 and 0.30 mg/L). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

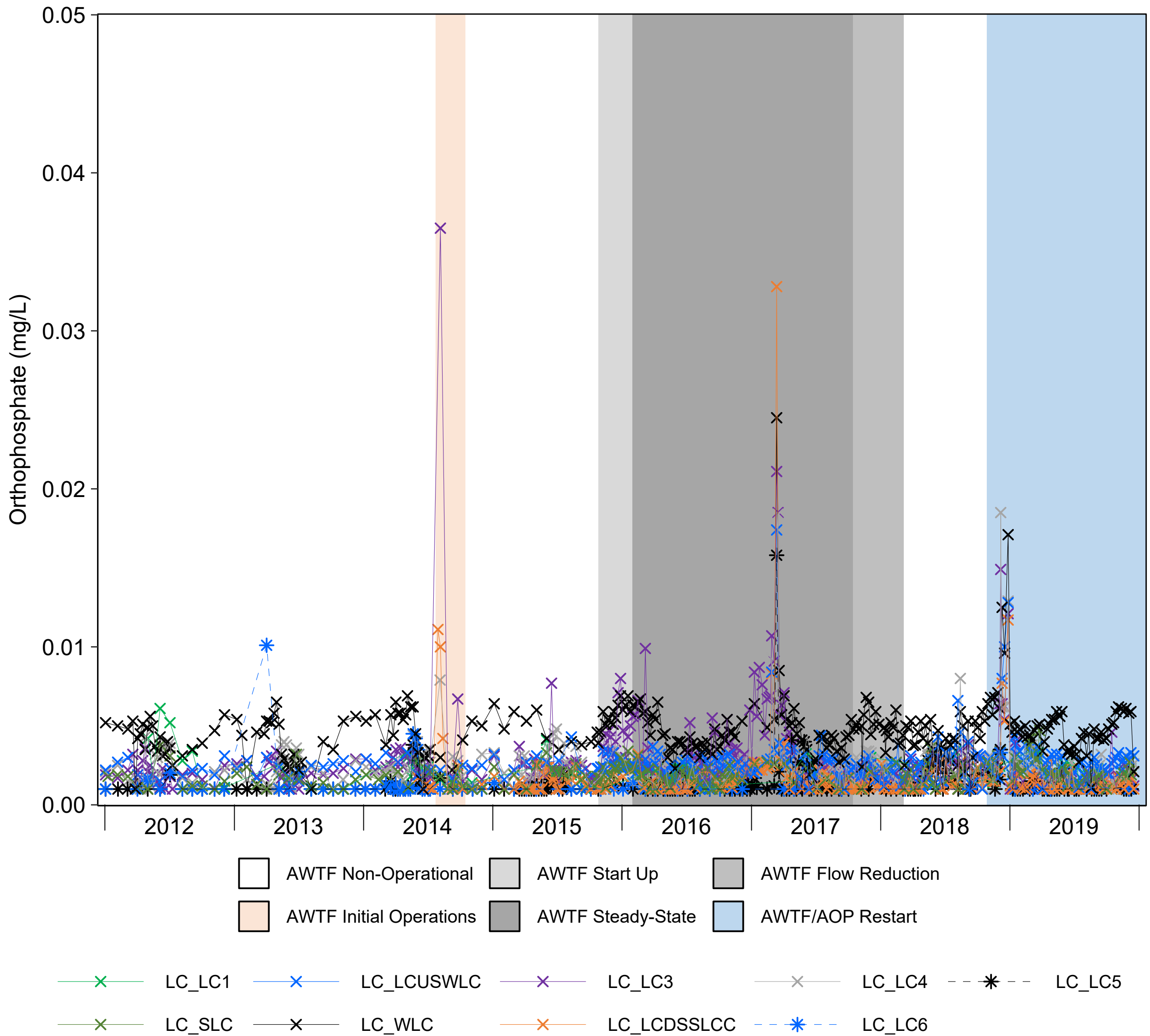


Figure 3.3: Time Series Plots for Aqueous Orthophosphate Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (0.0010 mg/L). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

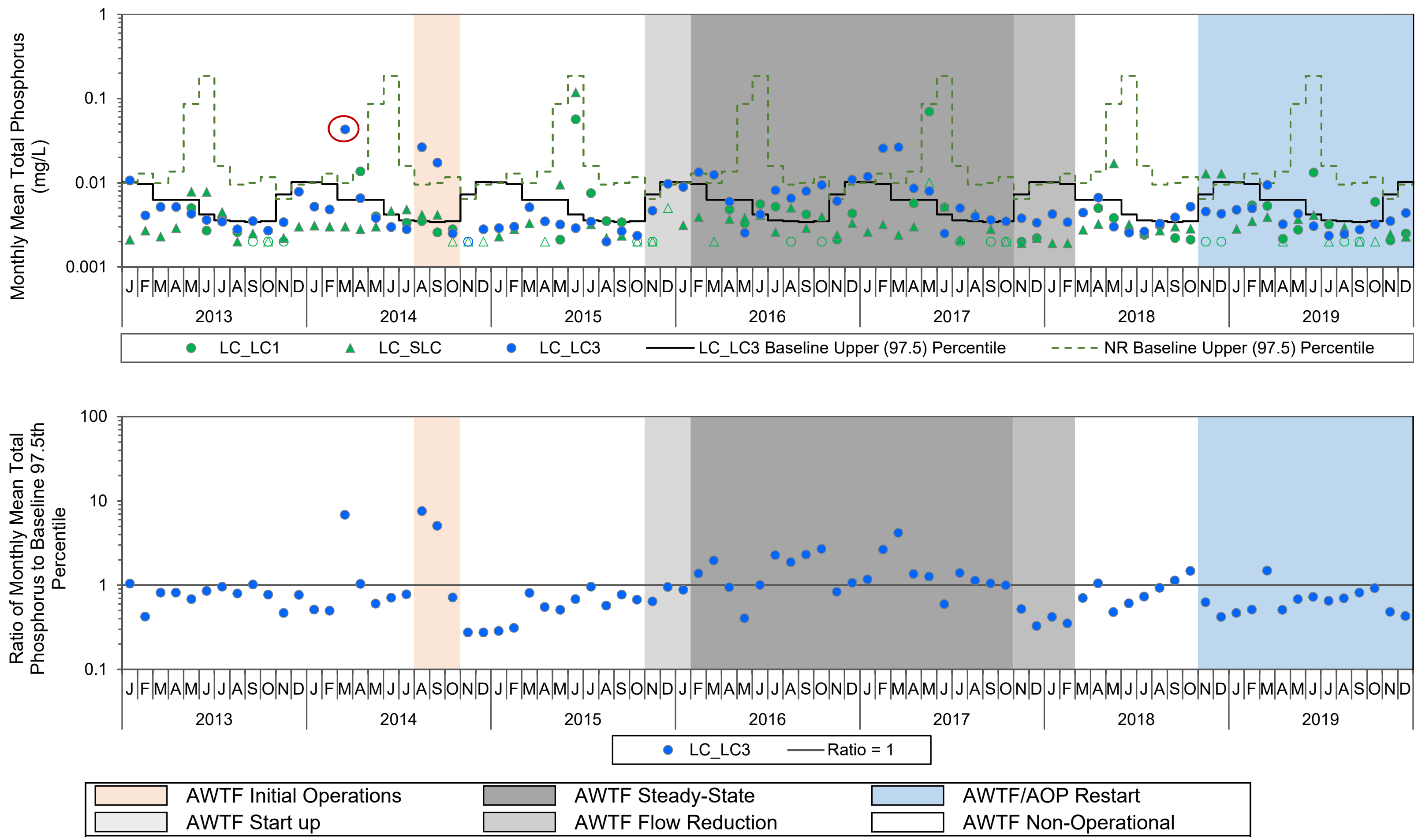


Figure 3.4: Total Phosphorus at LC_LC3 During AWTF Operation Relative to Pre-Operational Baseline Concentrations

Notes: Top panel shows monthly mean concentrations at LC_LC3 and reference stations relative to the monthly percentiles for the baseline period prior to Active Water Treatment Facility (AWTF) operation. The data used to define the baseline 97.5th percentile for each month were concentrations for the specified month. The preceding month and the following month for unshaded months prior to 2018 shown in panels. The normal range (NR) was calculated from the 97.5 percentile in the RAEMP (Minnow, 2018a). Concentrations less than the laboratory reporting limit (LRL) are shown as hollow symbols at the LRL. Red circle indicates outlier excluded from the calculation of baseline percentile. Bottom panel presents the ratio of monthly mean concentrations at LC_LC3 relative to the baseline 97.5th percentile for the corresponding month.

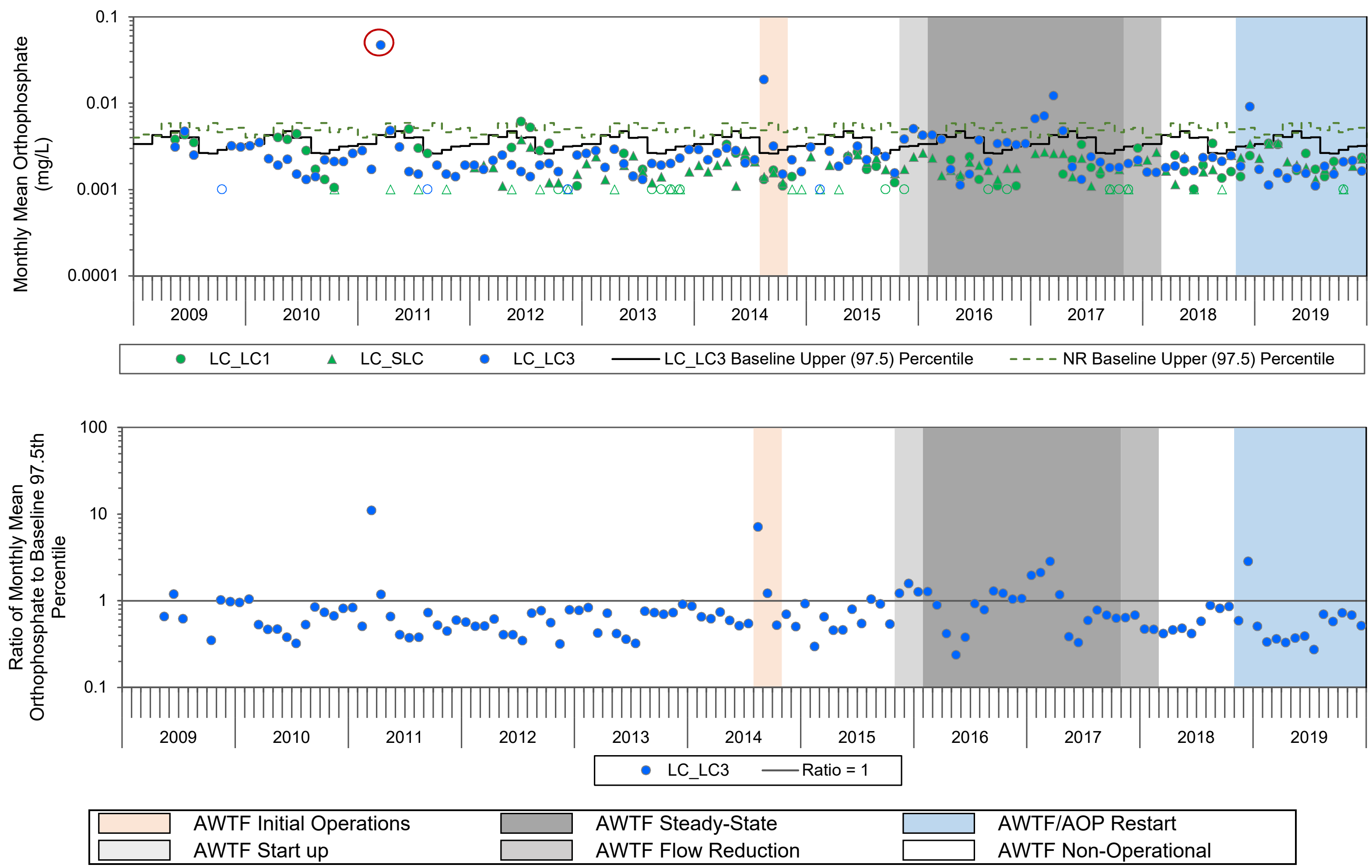


Figure 3.5: Orthophosphate at LC_LC3 During AWTF Operation Relative to Pre-Operational Baseline Concentrations

Notes: Top panel shows monthly mean concentrations at LC_LC3 and reference stations relative to the monthly percentiles for the baseline period prior to Active Water Treatment Facility (AWTF) operation. The data used to define the baseline 97.5th percentile for each month were concentrations for the specified month. The preceding month and the following month for unshaded months prior to 2018 shown in panels. The normal range (NR) was calculated from the 97.5 percentile in the RAEMP (Minnow, 2018a). Concentrations less than the laboratory reporting limit (LRL) are shown as hollow symbols at the LRL. Red circle indicates outlier excluded from the calculation of baseline percentile. Bottom panel presents the ratio of monthly mean concentrations at LC_LC3 relative to the baseline 97.5th percentile for the corresponding month.

Throughout 2019, total phosphorus and orthophosphate concentrations at LC_LC3 were below the baseline 97.5th percentiles, with one exception. Specifically, the mean total phosphorus concentration at LC_LC3 exceeded the baseline 97.5th percentile slightly in March 2019 (Figure 3.4). In contrast, the total phosphorus and orthophosphate concentrations during steady-state operation of the AWTF without AOP (in 2016 and 2017) were frequently greater than the baseline 97.5th percentiles at LC_LC3 (more frequently for total phosphorus than orthophosphate; Figures 3.4 and 3.5). Operation of the AWTF with AOP appears to have been more successful thus far at minimizing phosphorus and orthophosphate contributions to the receiving environment than steady-state operation of the AWTF without AOP (in 2016 and 2017), although flow through the AWTF (and therefore loadings) during the operation stabilization with AOP was more variable.

One function of the AWTF is to decrease nitrate loads to the receiving environment, and the AWTF with AOP removed 29,587 kg of nitrate during operations in 2019 (Teck 2020). Aqueous nitrate concentrations at the Compliance Point in 2019 were below the SPO Daily Maximum Limit of 9 mg/L during the majority of 2019, but exceeded the SPO for 4 days in the spring (March/April) and again in the late fall (November/December; see Teck 2019c, 2020 for details). Despite this, aqueous nitrate concentrations downstream of the AWTF discharge in 2019 were towards the low end of the range of concentrations reported prior to AWTF operation (i.e., 2012 to 2015, excluding initial operations in 2014; Figure 3.6; Appendix Figure A.3). In 2019, as with previous years, nitrate concentrations in samples from mine-exposed monitoring stations upstream and downstream of the AWTF discharge were above the long-term BCWQG (Appendix Figure A.3). Nitrate concentrations also exceeded the EVWQP Level 1 and 2 benchmarks in mine-exposed samples from upstream (LC_LCUSWLC and LC_WLC) and immediately downstream of the AWTF discharge (LC_LC3; Appendix Tables C.1 and C.2; Appendix Figure A.3).

3.3 Primary Productivity Indicators

In 2019, periphyton coverage was moderate at both mine-exposed and reference areas (Appendix Figure A.4, Appendix Table A.1), with the majority (92%) of visual scores between two and three (of a possible range from one [rocks not slippery and no obvious colour] to five [rocks mostly obscured by algae mat]). These results were consistent with periphyton coverage observations in 2017 and 2018 (Minnow 2018d, 2019a), indicating temporal consistency.

3.4 Secondary Productivity Indicators

Analyses of the potential changes in benthic invertebrate biomass and density at mine-exposed areas (RG_LILC3 and RG_LIDSL; sampling areas immediately downstream of the AWTF

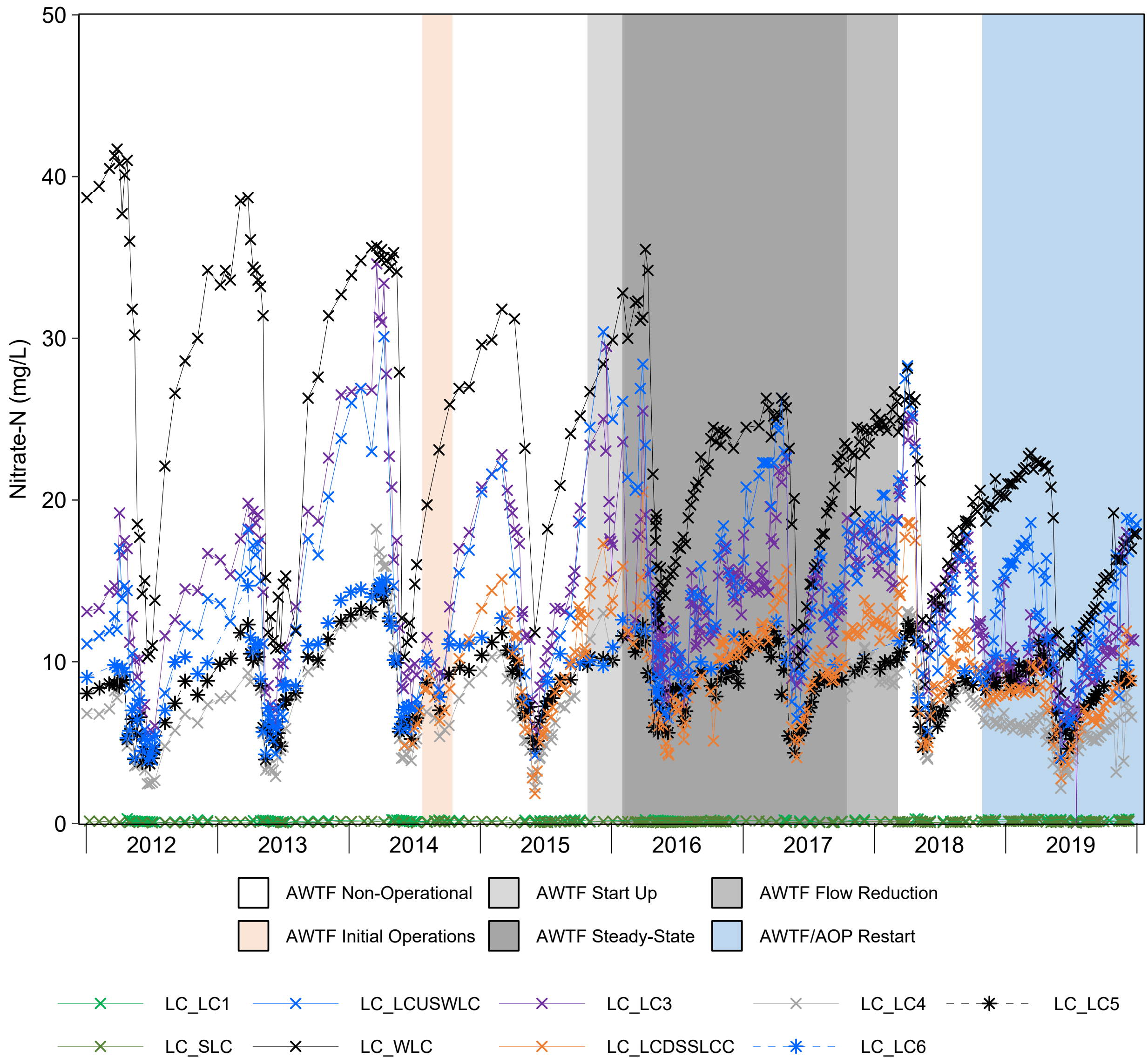


Figure 3.6: Time Series Plots for Aqueous Nitrate (NO_3 as N) Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Note: West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

discharge and the Compliance Point, respectively) relative to changes at the reference areas (RG_LI24 and RG_SLINE) over the same time were performed excluding two outlying values for the reference area RG_SLINE; one in 2017 and one in 2018 (Figures 3.7 and 3.8; see Section 2.7.2 for data ANOVA methods, including outlier removal). Results of these analyses (based on Hess sampling, 2014 to 2019) showed no significant difference in the change in biomass at RG_LILC3 relative to the change at the reference areas among years (Figure 3.7; Appendix Tables A.2 and A.3). At the Compliance Point (RG_LIDSL), the change in biomass among years differed significantly relative to the change at the reference areas. Specifically, benthic invertebrate biomass at RG_LIDSL was more similar to reference in 2019 (i.e., the difference between biomass at RG_LIDSL and reference was smaller in 2019) than in 2014 or 2017 (Figure 3.7; Appendix Table A.2). Combined, the results at RG_LILC3 and RG_LIDSL did not indicate an increase in benthic invertebrate biomass associated with AWTF operation (with AOP) in 2019.

Analyses of benthic invertebrate density indicated that differences in density between the mine-exposed and reference areas were dependent on which of the two reference areas (RG_LI24 or RG_SLINE) were used for comparison. The difference in organism density between RG_LILC3 and reference did not change among years when compared against RG_LI24 but changed significantly among years when compared against RG_SLINE (Figure 3.8; Appendix Tables A.3 and A.4). The difference in organism density between the Compliance Point and the two reference areas changed significantly among years when either reference area (RG_LI24 or RG_SLINE) was used for comparison (Figure 3.8; Appendix Table A.4). Specifically, the differences at both mine-exposed areas (RG_LILC3 and RG_LIDSL) relative to RG_SLINE were smaller in 2019 (mean density was 7.2 and 1.9-times higher at RG_LILC3 and RG_LIDSL than reference, respectively) than in 2014 (mean density was 19.8 and 5.5-times higher at RG_LILC3 and RG_LIDSL than reference, respectively; Figure 3.8, Table 3.1; Appendix Tables A.3 and A.4). This change appeared to be related to a 2.7-fold increase in mean density at the reference area RG_ SLINE between 2014 and 2019 rather than a decrease at the mine-exposed areas (Figure 3.8; Table 3.1). Similarly, the difference in density at the Compliance Point relative to RG_LI24 was smaller in 2019 (mean density was 2.4-times higher) compared to 2018 (mean density was 5.9-times higher), but this also appeared to be related to an increase in mean density at the reference area (1.6-times increase between 2018 and 2019; Figure 3.8, Table 3.1). Overall, these results indicated that benthic invertebrate biomass and density at the two mine-exposed areas was not influenced by the AWTF with AOP operation in 2019. This was corroborated by the similarity among years in biomass and density at both mine-exposed areas when considered independently from reference results, with the exception of biomass at

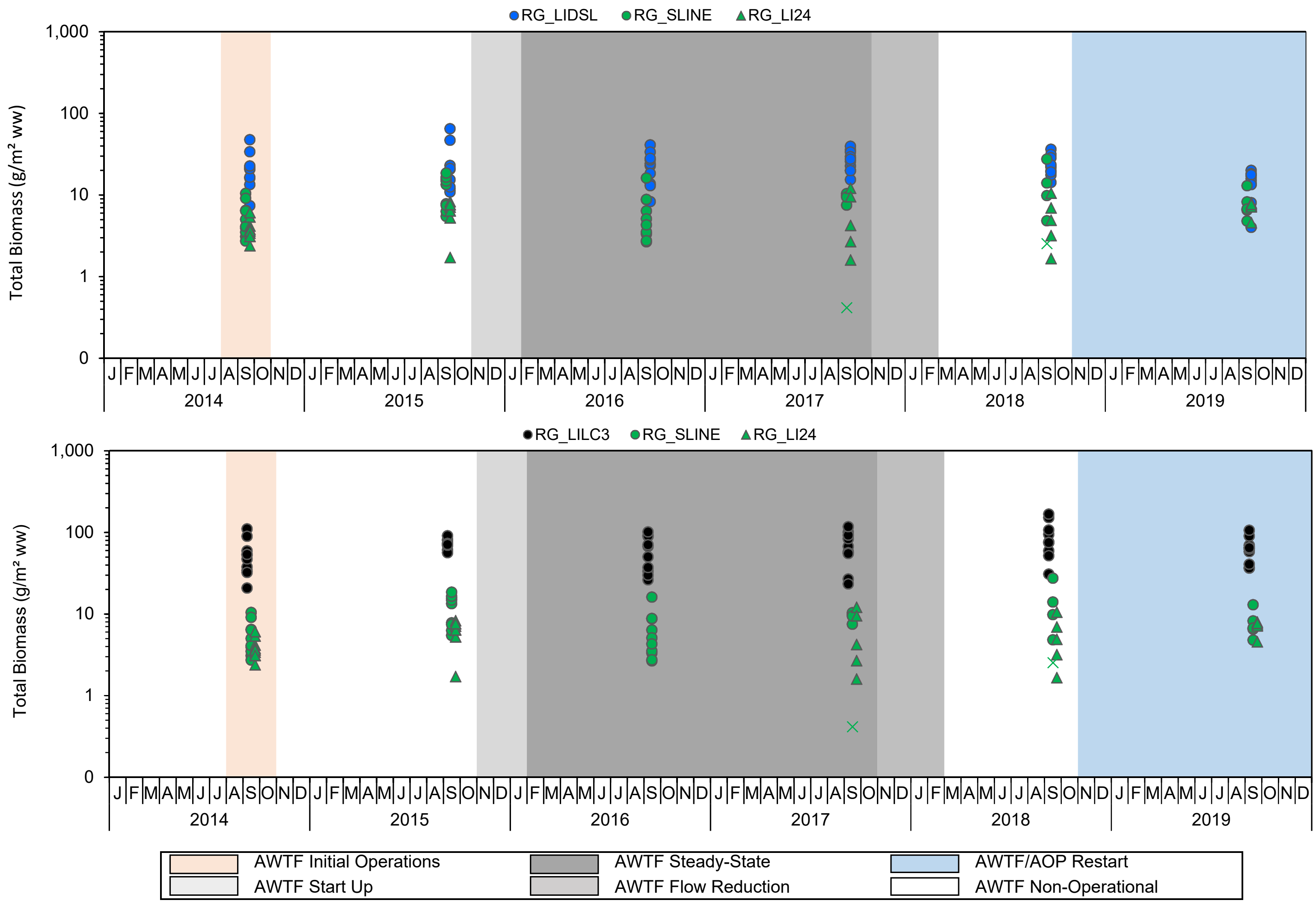


Figure 3.7: Total Benthic Invertebrate Biomass (Hess Sampling), for RG_LIDSL and RG_LILC3 (Mine-exposed Areas) Relative to RG_SLINE and RG_LI24 (Reference Areas), 2012 to 2018

Notes: Two outliers from RG_SLINE were removed from the statistical analyses and are plotted with the × symbol. The sampling dates for RG_SLINE and RG_LI24 are shifted slightly to show overlapping points. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas.

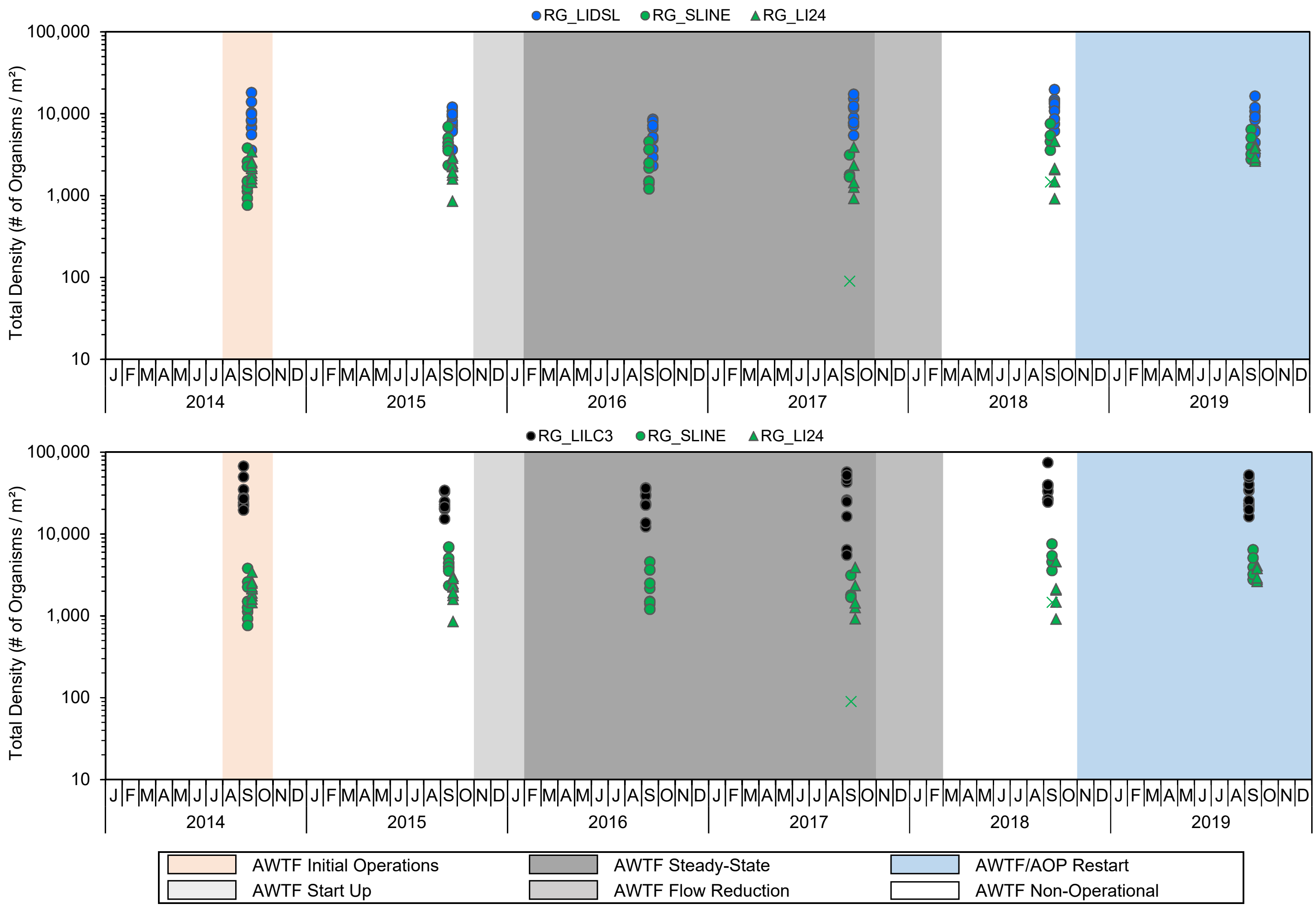


Figure 3.8: Total Benthic Invertebrate Density (Hess Sampling), for RG_LIDSL and RG_LILC3 (Mine-exposed Areas) Relative to RG_SLINE and RG_LI24 (Reference Areas), 2012 to 2018

Notes: Two outliers from RG_SLINE were removed from the statistical analyses and are plotted with the × symbol. The sampling dates for RG_SLINE and RG_LI24 are shifted slightly to show overlapping points. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas.

Table 3.1: Geometric Means of Benthic Invertebrate Density for Hess Sampling in Areas of Line Creek, 2014 to 2019

Area	Benthic Density (# organisms/m^2)					
	Brief AWTF Operation	No AWTF Operation	AWTF Steady-State Operation (without AOP)		AWTF Shutdown	AWTF with AOP Restart
	2014	2015	2016	2017	2018	2019
RG_LI24	2,120	2,028	-	1,723	1,933	3,182
RG_SLINE	1,508	4,300	2,072	1,072	5,062	4,067
RG_SLINE[a]	1,508	4,300	2,072	1,993	3,947	4,067
RG_LILC3	29,805	24,136	24,564	27,162	34,153	29,481
RG_LIDSL	8,276	7,690	5,024	9,910	11,452	7,718

Note: "-" = no data/not recorded.

[a] One outlier removed in 2017 and 2018.

RG_LIDSL which was significantly lower in 2019 relative to 2017 and 2018, but similar to 2014 to 2016 (Appendix Figure A.5; Appendix Tables A.2 and A.4).

Benthic invertebrate abundance in kick and sweep samples from 2019 was above the regional normal range[14] in one or more replicates at mine-exposed areas of Line Creek both upstream and downstream of the AWTF discharge, and in the Fording River downstream of Line Creek (Appendix Figure A.6; Appendix Table A.5). Total sample abundance at most areas downstream of the AWTF discharge was above the range of previous years, with the exception of RG_LILC3 (located immediately downstream of the AWTF discharge; Appendix Figure A.6). At RG_LILC3, total organism abundance at RG_LILC3 was generally in the range of results prior to AWTF operation (2012 to 2015; Appendix Figure A.6). The similarity of organism abundance to previous years at the sampling area located closest to the AWTF discharge (RG_LILC3) indicates that the temporal increase in abundance observed at areas further downstream was not likely related to an influence of AWTF with AOP operation in 2019. This was consistent with the biomass and density results discussed above.

In summary, monitoring data indicated that secondary productivity in Line Creek was not affected by the operational stabilization of the AWTF with AOP in 2019. This is consistent with the similarity in aqueous nutrient concentrations (Section 3.2) and primary productivity results (Section 3.3) in 2019 relative to previous years, including prior to AWTF operation.

3.5 Benthic Invertebrate Community Structure

Endpoints related to benthic invertebrate community structure were evaluated relative to regional normal ranges defined in the RAEMP (Minnow 2018a). Community taxon richness (i.e., number of different taxa identified to lowest practical level of identification) was within or above the normal range at all sampling areas in 2019, with the exception of one replicate at RG_LCUT (upstream of the AWTF discharge) and RG_LILC3 (immediately downstream of the AWTF discharge; Appendix Figure A.7; Appendix Table A.5). Despite the richness of one replicate at RG_LILC3 falling below the normal range in 2019, taxon richness at this area in 2018 and 2019 was more similar to results in 2012 and 2013 (prior to AWTF operation) than in more recent sampling years (2014 to 2017; Appendix Figure A.7). In 2019, richness at RG_LCUT was lower than in previous monitoring years (2016 to 2018), but this area is located upstream of the AWTF discharge and is not influenced by ATWT operations. At RG_LI8, richness was higher than most prior years (with the exception of 2015; Appendix Figure A.7) indicating some temporal improvement at this area located the furthest downstream from the AWTF discharge in Line Creek.

[14] The regional normal range is defined as the 2.5th and 97.5th percentiles of the 2012 and 2015 reference area data from the RAEMP collected by the CABIN kick and sweep method (Minnow 2018a).

Percent Ephemeroptera (mayflies) values in 2019 were lower than the normal range in samples from mine-exposed areas upstream (RG_LCUT) and immediately downstream of the AWTF discharge (RG_LILC3), and in a subset of samples from the Fording River downstream of Line Creek (two replicates at RG_FO23; Appendix Figure A.8). However, Ephemeroptera and EPT (Ephemeroptera [mayflies], Plecoptera [stoneflies], and Trichoptera [caddisflies]) percentages at these areas in 2019 were within the observed ranges from previous years (Appendix Figures A.8 and A.9; Appendix Table A.5). Percent Ephemeroptera at monitoring areas located further downstream from the AWTF discharge was higher in 2019 than previous years (RG_LIDSL, RG_LIDCOM, RG_LI8; Appendix Figure A.8).

Chironomids typically represent 27% or less of benthic invertebrate communities sampled in reference riffle habitats of the Elk Valley but are sometimes found in greater relative abundance in areas that are heavily disturbed by mining or have naturally soft substrates (Minnow 2018a). In 2019, percent chironomids was above the reference normal range at areas immediately upstream (RG_LCUT) and downstream from the AWTF (particularly RG_LILC3, RG_LISP24, RG_LIDSL, and RG_LIDCOM: Appendix Figure A.10; Appendix Table A.5). Percent chironomids at RG_LCUT was slightly higher in 2019 compared to previous years, but this area is located upstream of the AWTF discharge. At the remainder of sampling areas, percent chironomids in 2019 was within the range of previous years (Appendix Figure A.10).

3.6 Summary

Total phosphorus concentrations at the Compliance Point (LC_LCDSSLCC) were below the SPO of 0.02 mg/L during the 2019 growing season (June 15 to September 30), consistent with previous years. Aqueous nutrient concentrations (total phosphorus, orthophosphate, and nitrate) in 2019 were generally within the range observed prior to AWTF operation. In addition, results suggested that operation of the AWTF with AOP in 2019 was more successful at minimizing phosphorus and orthophosphate contributions to the receiving environment than the period of AWTF steady-state operation without AOP (in 2016 and 2017).

Periphyton coverage at both mine-exposed and reference areas was moderate in 2019 (based on the CABIN visual assessment, see Section 2.3) and was temporally consistent with results from 2017 and 2018. Benthic invertebrate biomass and density at mine-exposed areas of Line Creek also showed no significant change in 2019 that could be related to operation of the AWTF with AOP. Benthic invertebrate total abundance (measured by kick and sweep) was higher in 2019 than previous years at most mine-exposed areas, but the absence of a change closest to the AWTF discharge indicated that this was likely unrelated to AWTF with operation (consistent with the biomass and density results). Benthic invertebrate community endpoints, as determined from kick and sweep sample collection, indicated no adverse change in community characteristics related to operation stabilization of the AWTF with AOP in 2019. Rather, an increase in the percentage of sensitive taxa (Ephemeroptera) in 2019 at areas of Line Creek furthest downstream from the AWTF discharge was suggestive of an improvement in benthic invertebrate community structure. Overall, biological productivity downstream from the WLC AWTF did not appear to be affected by the operational stabilization of the AWTF with AOP throughout 2019, relative to previous years.

4 SELENIUM CONCENTRATIONS

4.1 Overview

Monitoring data were evaluated in this section to address Study Question #2: Are tissue selenium concentrations reduced downstream from the WLC AWTF? To address this study question, selenium concentrations in benthic invertebrate tissue and fish tissue were evaluated in relation to the AWTF operational status.

4.2 Historical Composite-Taxa Benthic Invertebrate Selenium Concentrations

The WLC AWTF initially operated in 2014 for approximately 3 months, during which time concentrations of selenium in benthic invertebrate composite-taxa samples from downstream of the AWTF increased relative to baseline (2012; Figure 4.1, Table 4.1). An increase in selenium concentrations in benthic invertebrates was noted again after recommissioning of the AWTF in 2015 and resumption of discharge to the receiving environment (i.e., increased benthic invertebrate selenium concentrations at RG_LILC3 in September 2016; Table 1.1, Figure 4.1). Following this, Teck identified challenges in the performance of the WLC AWTF with respect to selenium treatment. Although treatment successfully resulted in lower aqueous total selenium concentrations in Line Creek, aqueous concentrations of chemically-reduced selenium species were elevated in AWTF effluent. These selenium species have greater potential for bioavailability to aquatic biota than selenate, which is the dominant form in the influent and other areas of the watershed (Minnow 2017a).

Continued monitoring in 2016 and 2017 confirmed that selenium concentrations in benthic invertebrates were significantly elevated downstream of the AWTF discharge relative to historical levels (Figure 4.1; Minnow 2018d), and Teck temporarily suspended AWTF operations in response to these results (after receiving appropriate authorization; see Section 1.3; Table 1.1). During the shutdown period, concentrations of chemically-reduced aqueous selenium species decreased substantially, as did selenium concentrations in benthic invertebrate tissues (at RG_LILC3 in particular; Figure 4.1; Minnow 2019a).

The AWTF was recommissioned in 2018 with an AOP, to reverse the shift in selenium speciation in AWTF effluent from chemically-reduced species back to a selenate-dominated condition, thereby reducing the bioavailability of selenium in Line Creek (see Section 1.3; Table 1.1). The AWTF with AOP was operational throughout 2019 (in the operation stabilization phase; Table 1.1), with discharge to the receiving environment occurring over the entire year.

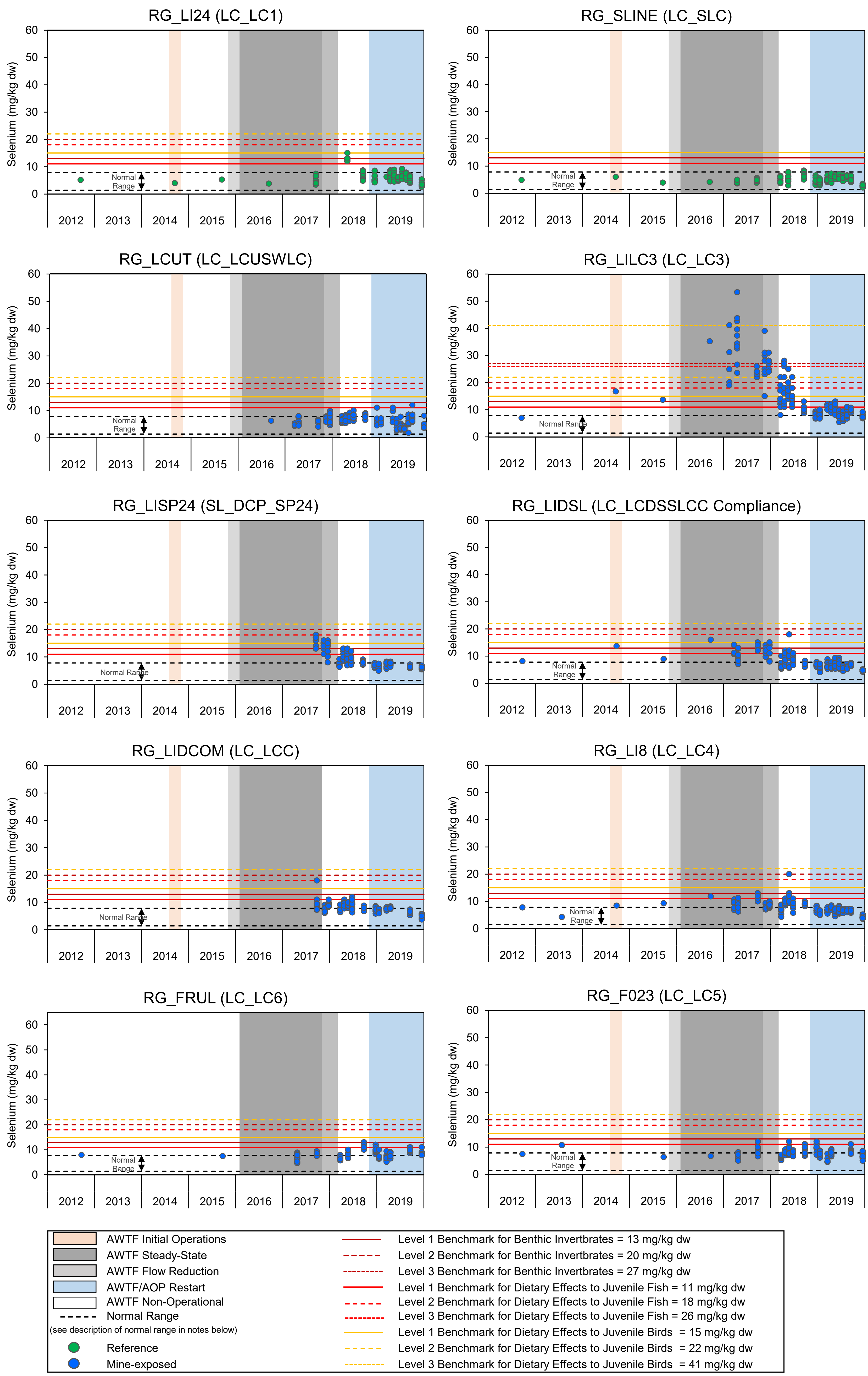


Figure 4.1: Tissue Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples from Line Creek and Fording River, 2012 to 2019

Notes: Results shown in green represent reference stations, and those in blue represent mine-exposed stations. Dashed black lines represent the normal range defined as the 2.5th and 97.5th percentiles of the 2012 and 2015 reference area data from the Regional Aquatic Environmental Monitoring Program (RAEMP). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

Table 4.1: Mean[a] Selenium Concentrations (mg/kg dw) in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, 2006 to 2019

Area		Biological Area Code	Biological Area Description	Teck Water Station Code	Prior to AWTF Operation									Initial AWTF Operation (July 24 to Oct 16, 2014	No AWTF Operation (Oct 17, 2014 to Oct 26, 2015)	AWTF Steady State Operation (Jan 31, 2016 to Oct 15, 2017)				AWTF Flow Reduction (Oct 16, 2017 to Mar 7, 2018)	
					2006 (August)	2009 (May/ June)	2009 (August/ September)	2010 (May)	2010 (August)	2011 (August)	2012 (September)	2013 (July)	2014 (July)	2014 (September)	2015 (September)	2016 (September)	2017 (February/ March)	2017 (April)	2017 (September)	2017 (November) 3 weeks	2017 (December) 7 weeks
Sample Size (n)					1	1	4	3	3	1	1	1	1	1	1	1	5	10	10	10	10
Line Creek	Reference	RG_LI24	South fork of upper Line Creek (Tornado Creek) upstream of LCO and Teck water station LC_LC1	LC_LC1	1.4	4.4	-	-	-	-	5.1	-	-	4.0	5.3	3.8	-	-	5.2	-	-
Line Creek	Reference	RG_SLINE	South Line Creek upstream of Line Creek and LCO	LC_SLC	-	-	-	-	-	-	4.8	-	-	6.0	3.9	4.1	-	4.1	4.8	-	-
Line Creek	Mine-exposed	RG_LCUT	Line Creek downstream of rock drain, downstream of West Line Creek and upstream of AWTF outfall	LC_LCUSWLC/ LC_WLC	-	-	-	-	-	-	-	-	-	-	-	6.2	5.0	6.4	5.9	6.7	6.9
Line Creek	Mine-exposed	RG_LILC3	Line Creek downstream of West Line Creek and AWTF outfall	LC_LC3	-	-	-	-	-	-	7.0	-	-	17	13	35	27	37	24	26	27
Line Creek	Mine-exposed	RG_LISP24	Line Creek downstream of LC_WTF_OUT, approximately 50 m downstream of contingency pond discharge	WL_DCP_SP24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	14	13
Line Creek	Mine-exposed	RG_LIDSL	Line Creek downstream of South Line Creek confluence	LC_LCDSSLCC (Compliance Point)	-	-	-	-	-	-	8.1	-	5.6	14	8.9	16	12	10	14	12	11
Line Creek	Mine-exposed	RG_LIDCOM	Line Creek downstream of the compliance point	LC_LCC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.6	7.4	9.4
Line Creek	Mine-exposed	RG_LI8	Line Creek downstream of the canyon	LC_LC4	7.8	11	9.0	-	6.3[d]	8.4	7.8	4.3	-	8.4	9.3	12	8.9	8.6	11	8.3	8.9
Fording River	Mine-exposed	RG_FRUL	Fording River downstream of Grace Creek, upstream of Line Creek	LC_LC6	-	-	-	-	-	-	7.9	-	-	-	7.5	-	-	7.0	8.1	-	-
Fording River	Mine-exposed	RG_FO23	Fording River downstream of Line Creek	LC_LC5	10	5.8	8.83	5.0	5.9	8.8	7.5	11	8.8	-	6.4	6.7	-	6.6	8.9	-	-

Notes: "-" = no data. FRUL=FOUL prior to 2016. Calculation of the mean for RG_LIa) in Sept 2018 included results from both RG_LI24 and RG_DSLI24, RG_DSLI24 was sampled in Sept 2018 to investigate anomalous results at RG_LI24 reported in May 2018, but results from both areas were similar in Sept 2018, therefore data were pooled (Minnow 2019a).

[a] Means are only presented where the number of samples > 1, all other data are individual values.

[b] Sample size n = 9.

[c] Sample size n = 5.

[d] Sample size n = 1.

[e] Sample size n = 4.

[f] Sample size n = 6.

Table 4.1: Mean[a] Selenium Concentrations (mg/kg dw) in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, 2006 to 2019

Area		Biological Area Code	Biological Area Description	Teck Water Station Code	AWTF Operation Suspended (Mar 8, 2018 to Oct 28, 2018)					AWTF/AOP Discharge Begins (Oct 29 to Dec 28, 2018)	AWTF/AOP Operations Stabilization (Dec 29, 2018 to present)								
					2018 (Mar 8 - 11) 0 weeks	2018 (Apr 3 - 5) 4 weeks	2018 (Apr 30 - May 4) 8 weeks	2018 (May 28 - 29) 12 weeks	2018 (September 6 -13) 26 weeks	2018 (December 3-6) 5 weeks	2019 (January 14-17) 11 weeks	2019 (Feb 25 - Mar 7) 17 weeks	2019 (April 22 - 26) 25 weeks	2019 (May 22 - 24) 29 weeks	2019 (June 17 - 19) 33 weeks	2019 (July 15 - 23) 37 weeks	2019 (August 12 - 13) 41 weeks	2019 (September 5 - 12) 44 weeks	2019 (December 2-6) 58 weeks
Sample Size (n)					10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Line Creek	Reference	RG_LI24	South fork of upper Line Creek (Tornado Creek) upstream of LCO and Teck water station LC_LC1	LC_LC1	(frozen)	-	13	-	7.0	5.6	(frozen)	6.3[d]	6.8	6.7	5.4	6.6	6.8	5.4	3.7[f]
Line Creek	Reference	RG_SLINE	South Line Creek upstream of Line Creek and LCO	LC_SLC	5.2	-	5.7	-	6.6	4.3	4.0	4.9	5.9	5.9	6.1	5.7	6.0	5.1	2.7
Line Creek	Mine-exposed	RG_LCUT	Line Creek downstream of rock drain, downstream of West Line Creek and upstream of AWTF outfall	LC_LCUSWLC/ LC_WLC	6.3	7.0	7.6	7.5	7.9	6.5	6.1[b]	(frozen)	8.7[c]	4.0[b]	4.2	3.3	5.5	7.8	4.6
Line Creek	Mine-exposed	RG_LILC3	Line Creek downstream of West Line Creek and AWTF outfall	LC_LC3	14	19	18	15	10	8.2	8.5	11	11	10	7.8	7.2	8.1	9.7	7.6
Line Creek	Mine-exposed	RG_LISP24	Line Creek downstream of LC_WTF_OUT, approximately 50 m downstream of contingency pond discharge	WL_DCP_SP24	7.4	11	10	8.9	8.2	6.7	6.2	7.1	7.4	-	-	-	-	6.6	5.9
Line Creek	Mine-exposed	RG_LIDSL	Line Creek downstream of South Line Creek confluence	LC_LCDSSLCC (Compliance Point)	6.6	9.3	10	9.3	7.2	6.7	5.7	6.6	6.0	7.1	6.8	5.4	6.0	7.0	4.7
Line Creek	Mine-exposed	RG_LIDCOM	Line Creek downstream of the compliance point	LC_LCC	7.7	9.3	9.1	9.4	7.7	7.4	7.0	7.7	8.0	-	-	-	-	6.5	5.3
Line Creek	Mine-exposed	RG_LI8	Line Creek downstream of the canyon	LC_LC4	6.9	10	12	8.6	9.0	7.2	5.8	6.6	7.4	6.1	6.7	6.4	6.7	6.5	4.2
Fording River	Mine-exposed	RG_FRUL	Fording River downstream of Grace Creek, upstream of Line Creek	LC_LC6	6.9	-	8.1	-	11	10	7.5[c]	6.9	8.1	-	-	-	-	10	8.5
Fording River	Mine-exposed	RG_FO23	Fording River downstream of Line Creek	LC_LC5	6.4	7.9	8.7	7.6	9.4	9.8	7.3	5.7[e]	7.6	-	-	-	-	8.5	6.7

Notes: "-" = no data. FRUL=FOUL prior to 2016. Calculation of the mean for RG_LI24 in Sept 2018 included results from both RG_LI24 and RG_DSLI24, RG_DSLI24 was sampled in Sept 2018 to investigate anomalous results at RG_LI24 reported in May 2018, but results from both areas were similar in Sept 2018, therefore data were pooled (Minnow 2019a).

[a] Means are only presented where the number of samples > 1, all other data are individual values.

[b] Sample size n = 9.

[c] Sample size n = 5.

[d] Sample size n = 1.

[e] Sample size n = 4.

[f] Sample size n = 6.

4.3 2019 Selenium Concentrations in Composite-Taxa Benthic Invertebrate Samples

Benthic invertebrate selenium concentrations at mine-exposed areas downstream of the AWTF on Line Creek were significantly lower during the AWTF with AOP restart period than during AWTF steady-state operation (without AOP), when compared to changes at the reference areas over the same time frame (Figure 4.2; Appendix Figures B.1 to B.3; Appendix Tables B.2 to B.8). With the exception of RG_LIDCOM, this significant decrease relative to AWTF steady-state operation was observed for all sampling events during the AWTF with AOP restart period (i.e., for each of the six sampling events between October 2018 and December 2019 for all Line Creek monitoring areas downstream of the AWTF discharge, and for each of the 10 sampling events at a subset of areas [RG_LI24, RG_SLINE, RG_LCUT, RG_LILC3, RG_LIDSL, RG_LI8] over the same period; Table 4.1; Appendix Table B.2). At RG_LIDCOM, benthic invertebrate selenium concentrations in May and September 2019 were significantly lower than in September 2017 (during steady-state without AOP), but were similar to other sampling events (Appendix Figure B.2; Appendix Table B.7). Benthic invertebrate selenium concentrations were also similar to before AWTF operation (2012), where data exist for this comparison (RG_LILC3, RG_LIDSL, RG_LI8; Figure 4.2, Appendix Figure B.2; Appendix Tables B.4, B.6, and B.8).

Within the AWTF with AOP restart period (December 2018 to December 2019), changes in benthic invertebrate selenium concentrations at each mine-exposed area were compared to changes at the reference areas over the same time frame. The purpose of this comparison was to evaluate AWTF performance during operation stabilization with AOP. Results of this analysis indicated that selenium concentrations in benthic invertebrates changed differently at each of the mine-exposed areas than they did at the reference areas during this period (Appendix Tables B.9 to B.14). Some common patterns in the significant changes at the mine-exposed areas relative to reference were observed. Benthic invertebrate tissue selenium concentrations tended to be significantly lower during the middle of the AWTF with AOP restart period (between April and August/September 2019) compared to both earlier (December to April 2019) and later in the restart period (September and/or December 2019; Figure 4.2; Appendix Tables B.9 to B.14; Appendix Figures B.1 and B.2). These changes relative to reference were observed both upstream (RG_LCUT) and downstream of the AWTF (RG_LIDCOM and RG_LI8; Appendix Tables B.9 to B.14), suggesting that the differences may be seasonally-related and not entirely attributable to AWTF with AOP operation. At RG_LILC3 and RG_LIDCOM, benthic invertebrate tissue selenium concentrations were significantly higher in December 2019 than during most of the earlier sampling events within the AWTF with AOP restart period, compared to the change at reference over the same period (Figure 4.2; Appendix Figure B.2; Appendix Tables B.10 and B.13). However, this difference was related to a decrease in selenium concentrations at the reference areas in December 2019 rather than an increase at the mine-exposed areas.

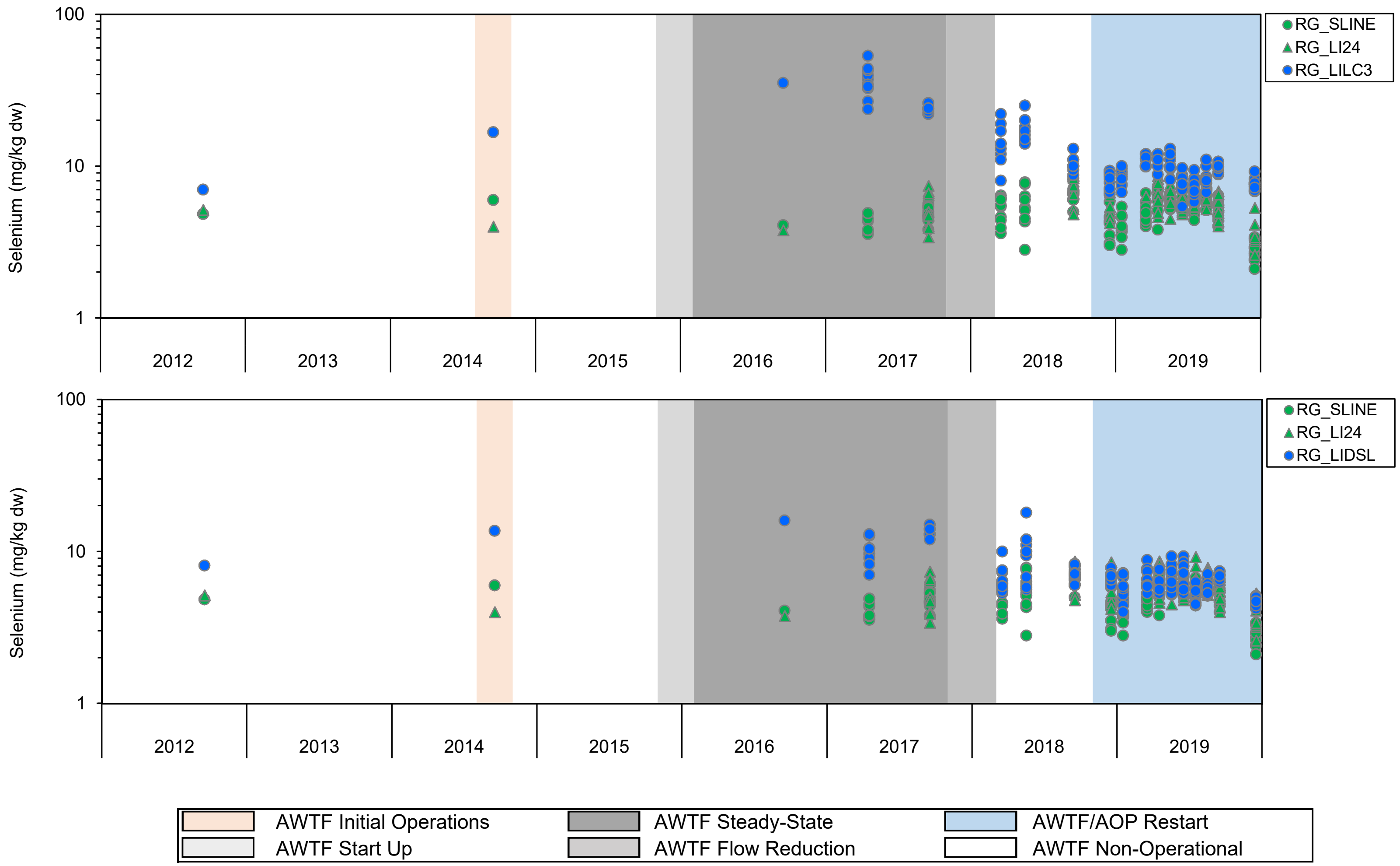


Figure 4.2: Benthic Invertebrate Selenium Concentrations, for RG_LILC3 and RG_LIDSL (Mine-exposed Areas) Relative to RG_SLINE and RG_LI24 (Reference Areas), 2012 to 2019

Notes: Due to a brief period of exposure to less-than-capacity AWTF effluent in 2014, benthic invertebrate tissue selenium data from September 2015 were not considered representative of steady-state AWTF operation, but also not representative of a no-discharge condition. These data were therefore excluded from analyses, and are displayed in plots for context only. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

With the exception of immediately downstream of the AWTF discharge (RG_LILC3), selenium concentrations of benthic invertebrates collected from downstream of the AWTF discharge in Line Creek were similar to reference and/or upstream of the discharge (RG_LCUT) throughout the AWTF with AOP restart period (December 2018 to December 2019; Figure 4.3, Table 4.1; Appendix Table B.2). Selenium concentrations in benthic invertebrate tissue from RG_LILC3 were significantly higher than reference and/or RG_LCUT during most sampling events (except July and August 2019), as was RG_LISP24 in December 2019 (Figure 4.3). This indicates that the spatial extent of elevated benthic invertebrate selenium concentrations had decreased substantially from during AWTF steady-state operation without AOP (e.g., Minnow 2018d), and is limited to immediately downstream of the AWTF.

Mean selenium concentrations in benthic invertebrates were below the EVWQP Level 1 benchmark for effects to invertebrates (13 mg/kg dw) at all mine-exposed areas throughout the AWTF with AOP restart period (Figure 4.3, Table 4.1). This represents a substantial improvement relative to 2016 and 2017 (during AWTF steady-state operation without AOP) when tissue selenium concentrations exceeded the EVWQP Level 2 and Level 3 benchmarks for effects to benthic invertebrates (Figure 4.1, Table 4.1; Minnow 2017a, 2018d). With the exception of RG_LILC3, the majority of benthic invertebrate selenium concentrations reported downstream of the AWTF discharge in 2019 were within the regional normal range in 2019 (Figure 4.1, Table 4.1; Appendix Table B.2).

Selenium concentrations in benthic invertebrates collected in the Fording River were similar downstream compared to upstream of Line Creek during sampling events throughout the AWTF with AOP restart period (October 2018 to December 2019) with the exception of December 2019 (Figure 4.4). In December 2019, tissue selenium concentrations upstream of Line Creek on the Fording River (RG_FRUL) were higher than those downstream of Line Creek (RG_FO23), suggesting an influence unrelated to Line Creek (Figure 4.4, Table 4.1). Selenium concentrations in benthic invertebrates from RG_FO23 (downstream of Line Creek) were significantly lower during AWTF with AOP restart (March and April 2019) than during AWTF steady-state operation (without AOP; September 2017), relative to changes at the reference areas over the same time period (Appendix Figure B.3; Appendix Table B.16). However, changes in benthic invertebrate selenium concentrations at RG_FO23 (downstream of Line Creek) among AWTF operational phases did not differ from those at RG_FRUL (upstream of Line Creek), with the exception of December 2019 described above (i.e., higher tissue selenium concentrations at RG_FRUL than RG_FO23; Figure 4.4; Appendix Table B.17). Within the AWTF with AOP restart period, changes in selenium concentrations of benthic invertebrates from RG_FO23 (downstream of Line Creek) differed from reference, but these were similar to RG_FRUL (upstream of Line Creek; Figure 4.4; Appendix Figure B.3; Appendix Tables B.18 to B.20). Overall, these results indicated that benthic

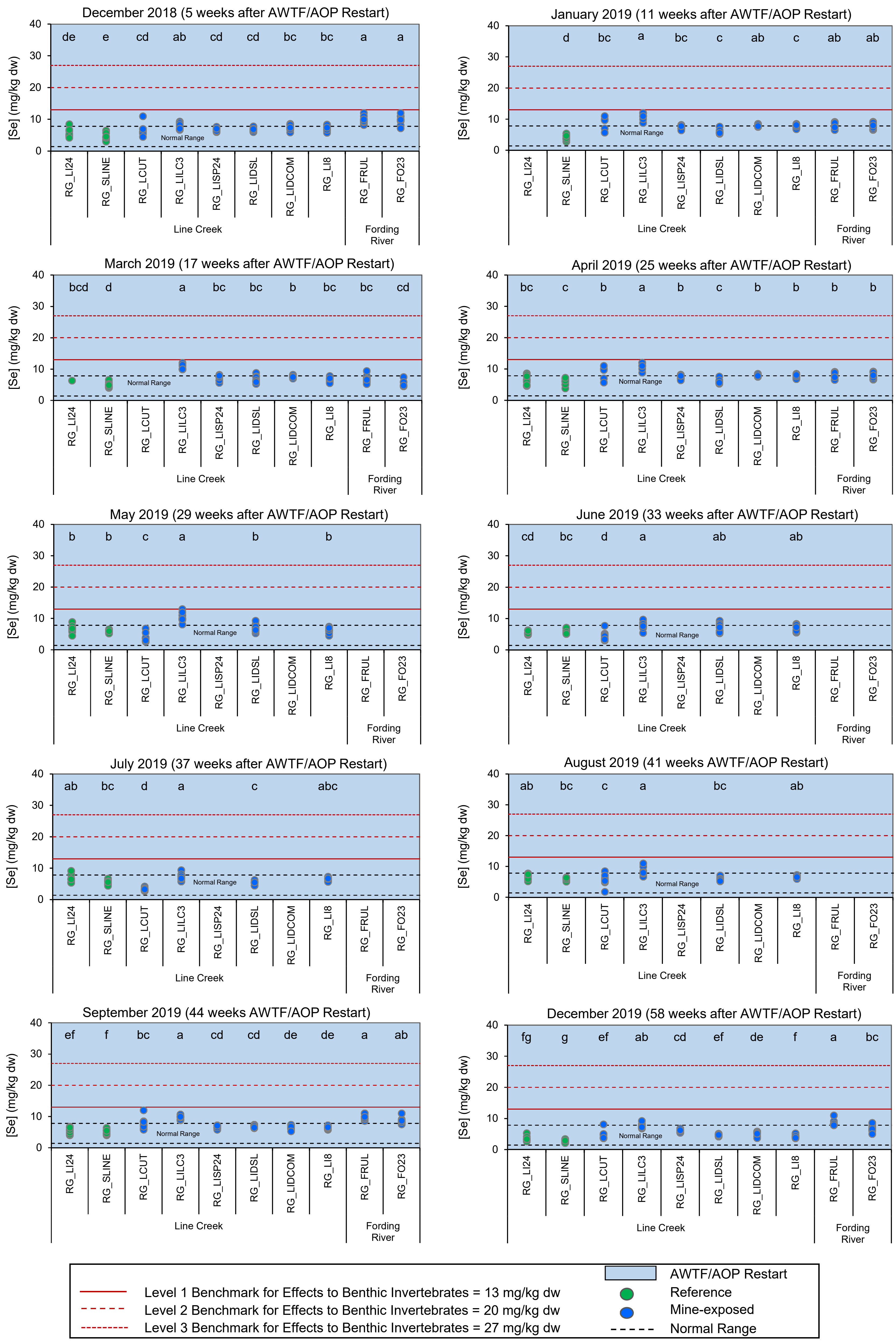


Figure 4.3: Selenium Concentrations in Composite-Taxa Benthic Invertebrate Samples Collected at Reference (Green) and Mine-exposed (Blue) Areas of Line Creek and Fording River, 2018 to 2019

Notes: West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas downstream of the AWTF discharge. Dashed black lines represent the normal range defined as the 2.5th and 97.5th percentiles of the 2012 and 2015 reference area data from the Regional Aquatic Environmental Monitoring Program (RAEMP). Areas that do not share a letter (e.g. a,b,c) are significantly different (α = 0.05) in a Tukey's HSD test following a one-way ANOVA by area. The best transformation (log10, square root, fourth root, or none) was chosen as the highest p-value from a Shapiro-Wilk test for normality that also passed a Levene's test for homogeneity of variances. If assumptions could not be met, data were rank-transformed. Transformations were variable, therefore data are shown on untransformed axes.

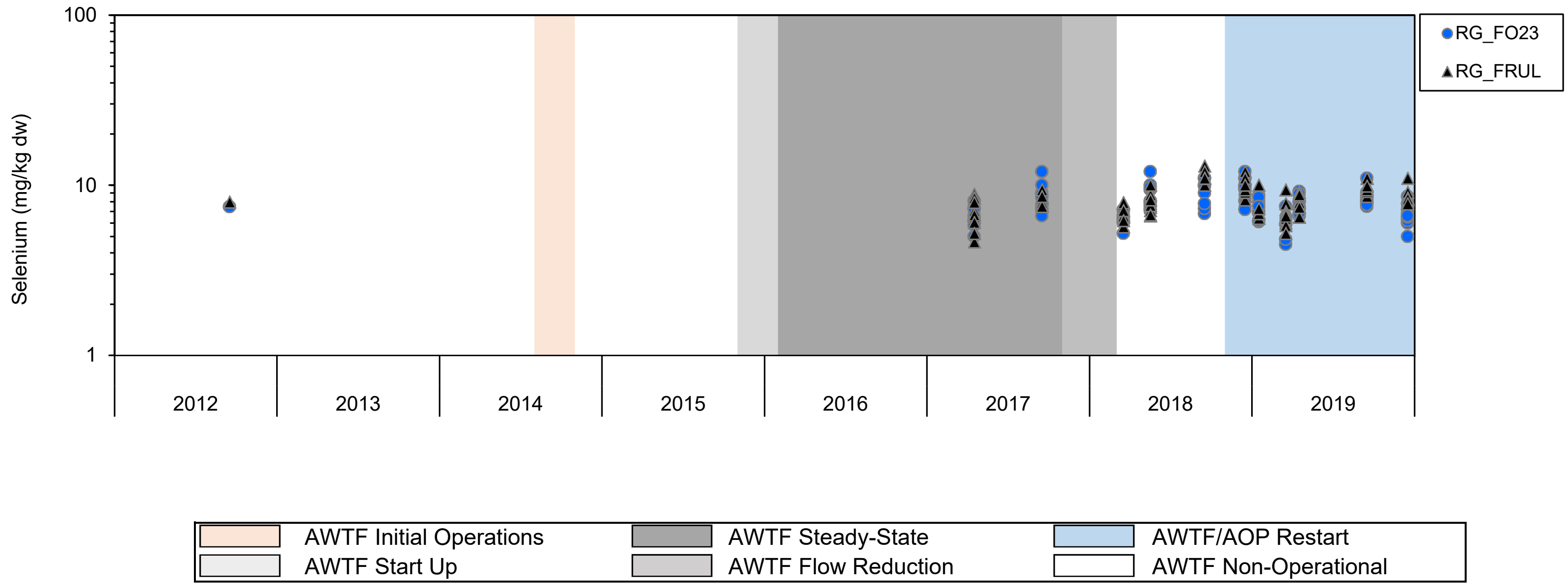


Figure 4.4: Benthic Invertebrate Selenium Concentrations, for RG_FO23 (Fording River Downstream of Line Creek) Relative to RG_FRUL (Fording River Upstream of Line Creek), 2012 to 2019

Notes: Due to a brief period of exposure to less-than-capacity AWTF effluent in 2014, benthic invertebrate tissue selenium data from September 2015 were not considered representative of steady-state AWTF operation, but also not representative of a no-discharge condition. These data were therefore excluded from analyses, and are displayed in plots for context only. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

invertebrate selenium concentrations in the Fording River were not influenced by Line Creek in 2019, which is consistent with the decreased tissue selenium results in Line Creek during AWTF with AOP restart relative to AWTF steady-state operation (without AOP), and with previous findings (Minnow 2018d, 2019a).

4.4 Aqueous Selenium and Bioaccumulation

When operational, the AWTF with AOP was effective at decreasing the aqueous total selenium concentrations downstream in Line Creek in 2019 (particularly at LC_LC3) compared to when the AWTF was not operational (Figure 4.5; Appendix Figures B.4 to B.6[15]). Operation of the AWTF with AOP ceased briefly in November 2019 for scheduled maintenance (the AWTF was in internal circulation from November 15th to 21st, 2019; Teck 2020), and aqueous total selenium in Line Creek (LC_LC3) increased during this time (Figure 4.6).

Previous evaluation of aqueous total selenium concentrations at the LC_LC1 (RG_LI24) reference area identified significant increases in aqueous total selenium since 2014 (Minnow 2018d). Further analysis of temporal changes indicated that concentrations in 2018 and 2019 had not changed significantly compared to 2017 but remained higher than concentrations measured in 2012 to 2015[16] (Appendix Table B.21). Routine monitoring at this reference location will continue in 2020, and analysis of potential temporal changes in total selenium will be repeated in 2020 (Minnow 2020).

Aqueous selenium throughout the Elk Valley is primarily in the oxidized form, selenate (Figure 4.7; Appendix Figure B.7; Appendix Table B.1). Aqueous selenium in chemically-reduced forms such as selenite or organoselenium species are present at much lower concentrations than selenate. The combined total of non-selenate selenium species typically represents ~1% of the total aqueous selenium (e.g., LC_LCUSWLC in Appendix Figure B.8[17]; Appendix Table B.1). Some of these non-selenate selenium species are known to be more readily accumulated by aquatic biota than selenate (Ogle et al. 1988; Riedel et al. 1996; Stewart et al. 2010). As described in Sections 1.3 and 4.2, in response to increased concentrations of chemically-reduced forms of aqueous selenium in AWTF effluent, the AWTF was recommissioned with an AOP to reverse the shift in selenium species back to a selenate-dominated condition. Concentrations of

[15] Appendix Figure B.4 presents total aqueous selenium results with LC_WLC excluded for greater resolution of results.

[16] Results discussed herein are excluding one outlier from the analysis. No significant differences among years were found with inclusion of the outlier (Appendix Table B.15). Results for the contrast of 2017 vs. 2016 differed slightly in the present report compared to the previous evaluation (Minnow 2018d) due the use of different statistical analyses. The ANOVA model described in Section 2.7.1 is the preferred method for this temporal analysis because it can detect temporal increases or decreases in concentrations. The repeated measures ANOVA used in Minnow (2018d) only has the ability to detect step-wise increases.

[17] Note the differences in the y-axis scales of Figures 4.7 versus Appendix Figure B.8.

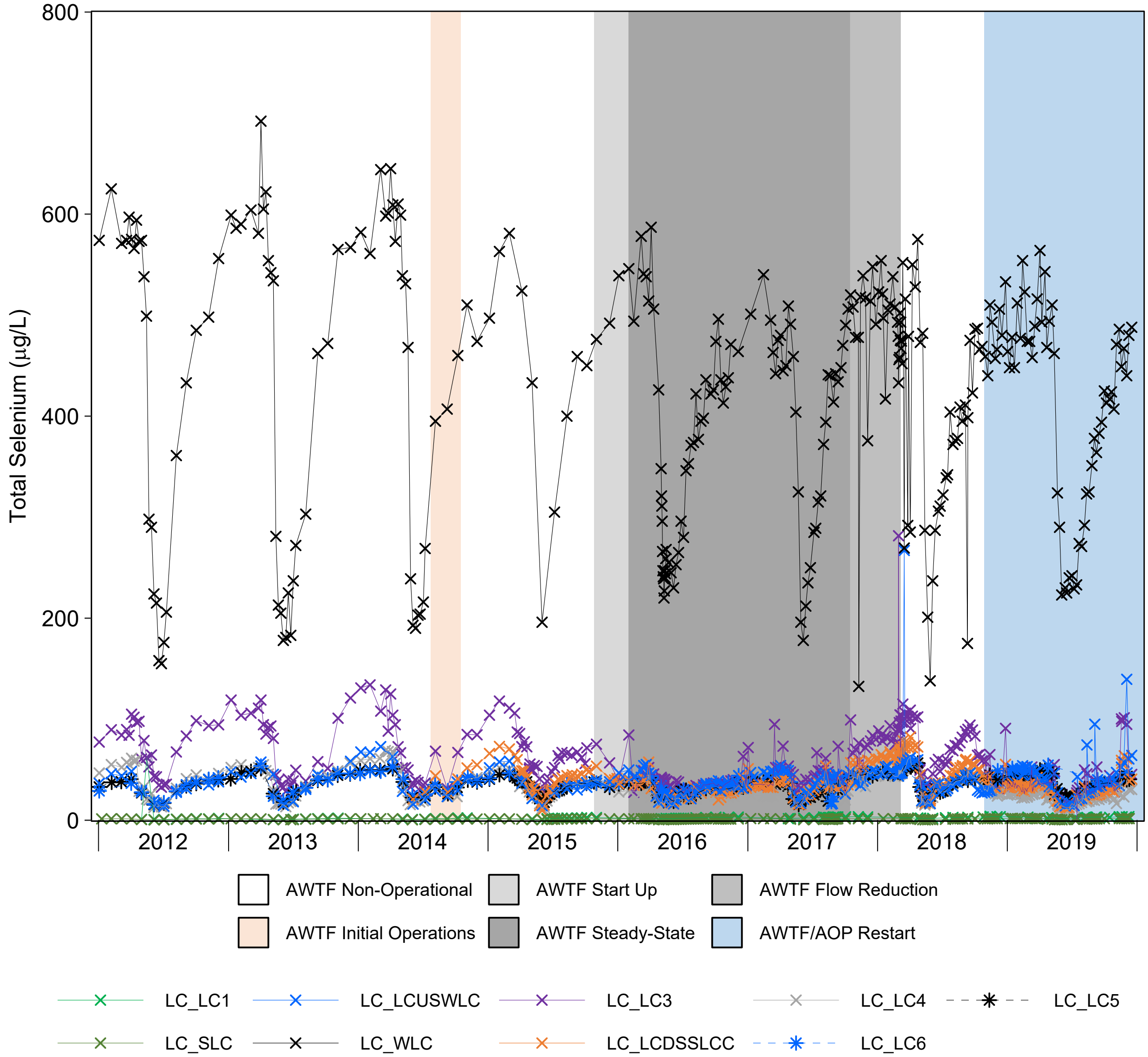


Figure 4.5: Time Series Plots for Aqueous Total Selenium Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Note: West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

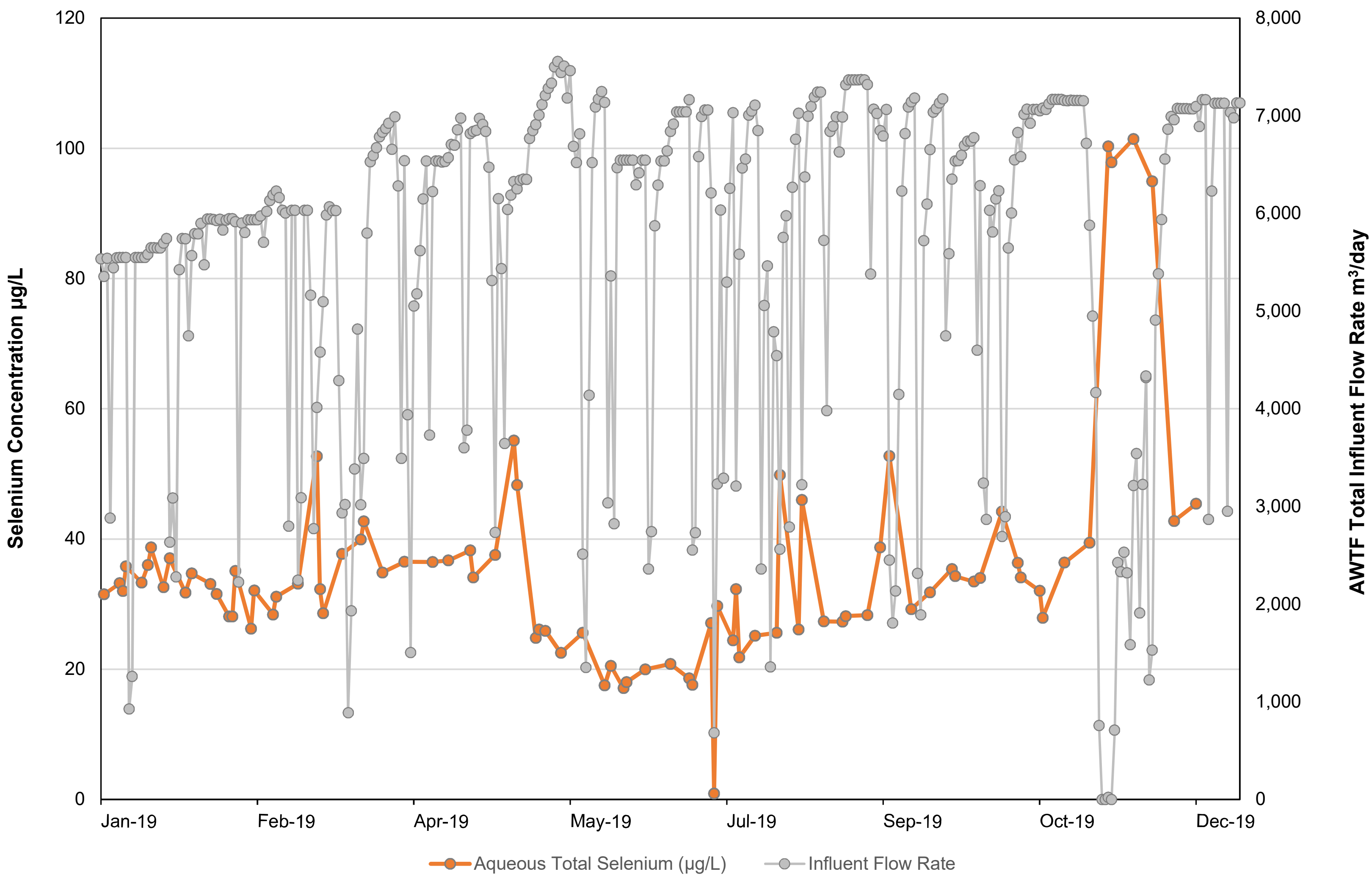


Figure 4.6: Total Aqueous Selenium Concentrations at LC_LC3 Relative to Total AWTF Influent Flow Rate, 2019

Note: Influent flow to the AWTF ceased briefly from November 15 to 21, 2019 while the AWTF was in internal circulation for scheduled maintenance (Teck 2020). This brief suspension of AWTF operations resulted in increased concentrations of aqueous total selenium downstream of the AWTF during this time.

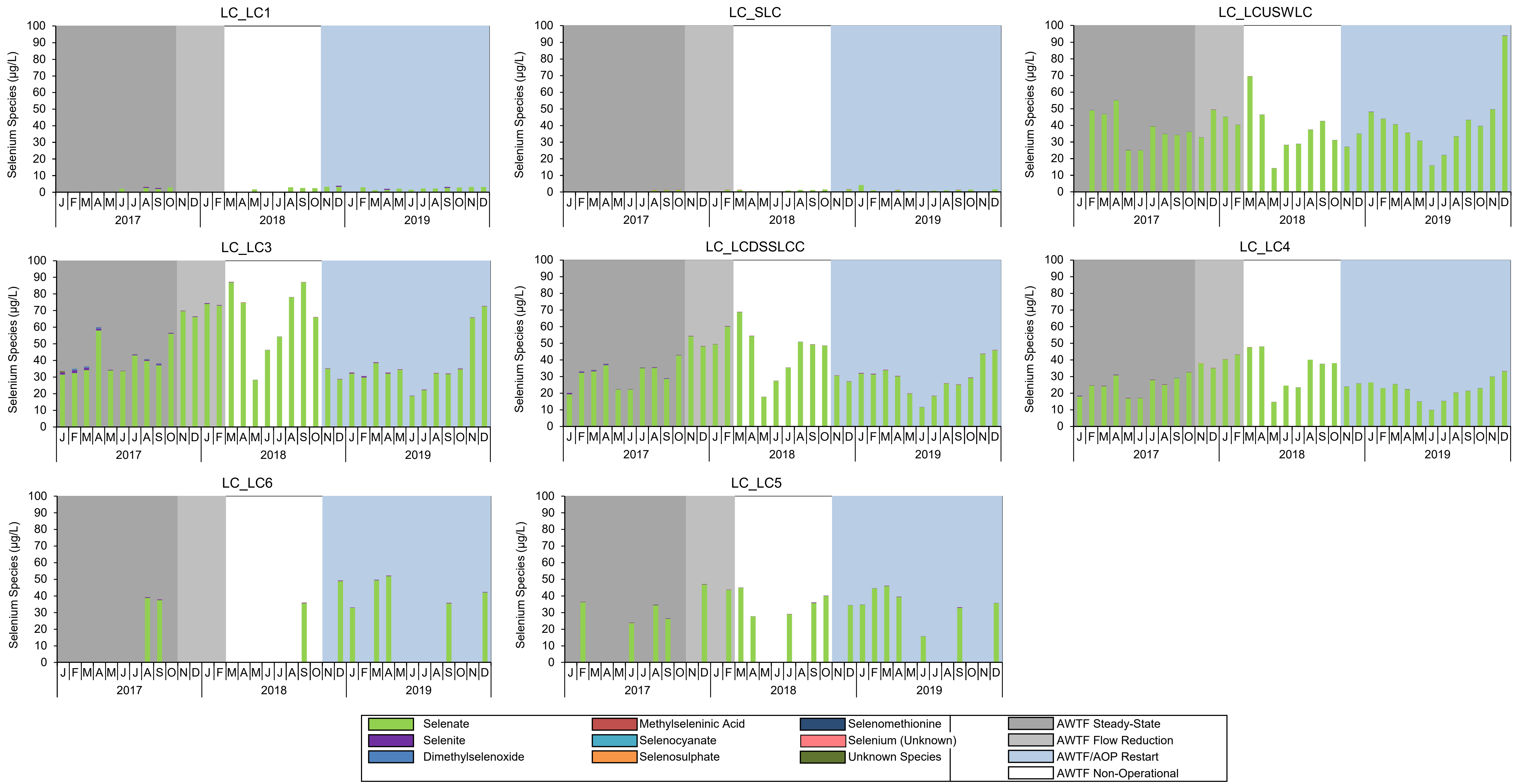


Figure 4.7: Aqueous Concentrations of Selenium Species at Mine-exposed (LC_LCUSWLC, LC_WLC, LC_LC3, LC_LCDSSLCC, LC_LC4, LC_LC6, LC_LC5) and Reference (LC_LC1, LC_SLC) Stations in Line Creek and Fording River, January 2017 to December 2019

Notes: Values below the Laboratory Reporting Limit are not included in the concentrations. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge. Results for LC_LC1 and LC_SLC are not evident due to consistent y-axis scaling among plots. Refer to Appendix Figure B.4 for the full set of plots, which include results for LC_WLC. Selenium (unknown) represents an unknown selenium species that elutes at a retention time of ~3.7 and is a product of the oxidation of volatile selenium species.

non-selenate species (including organoselenium species such as dimethylseleneoxide and methylseleninic acid) were substantially lower in Line Creek immediately downstream of the AWTF (at LC_LC3) throughout 2019, when the AWTF with AOP was operational, compared to AWTF steady-state operations without AOP in 2017 (Figure 4.8; Appendix Figure B.8; Appendix Table B.1). These results were corroborated by selenium concentrations in benthic invertebrates from downstream of the AWTF discharge in Line Creek, which were significantly lower during AWTF with AOP operation than during AWTF steady-state operation without AOP, relative to reference (Figure 4.9; see Section 4.3). Within 2019, concentrations of non-selenate selenium species were highest early in the AWTF with AOP restart period (January to April) and lowest between May and August when concentrations were similar to AWTF shutdown in 2018 (Figure 4.8; Appendix Figure B.8; Appendix Table B.1). This pattern in concentrations of non-selenate selenium species (i.e., lowest in the middle of the year) is consistent with the pattern of selenium concentrations in benthic invertebrate tissues in 2019, which were also lowest during the middle of the restart period (see Section 4.3; Figure 4.9).

Benthic invertebrate tissue selenium results from 2012 to 2019 were also plotted relative to the regional one-step water-to-invertebrate selenium accumulation model (Figure 4.10; Teck 2014). The model is based on observed relationships between aqueous and benthic invertebrate tissue selenium values from samples collected previously in Line Creek and in other areas of the Elk River watershed (Teck 2014). Most plotted values were within or below the 95% prediction limits of the model, except for samples collected nearest the AWTF in 2016 and 2017 (e.g., RG_LILC3 in Figure 4.10[18]). Samples at RG_LILC3 that plotted above the model 95% prediction limits included those collected during AWTF steady-state and flow reduction phases (in 2016 and 2017), while those collected during AWTF with AOP restart (in late 2018 and throughout 2019) plotted at or just below the model line (Figure 4.11). This supports the conclusion that selenium accumulation in Line Creek during AWTF steady-state operation was related to higher-than-normal concentrations of non-selenate forms of selenium, and that the recommissioning of the AWTF with AOP has been functioning to decrease non-selenate forms and associated accumulation in aquatic biota.

Combined, the decreased concentrations of aqueous non-selenate selenium species, significant decrease in benthic invertebrate selenium concentrations, consistency between seasonal changes in concentrations of aqueous non-selenate species and benthic invertebrate tissue selenium concentrations, and results relative to the selenium bioaccumulation model clearly

[18] Tissue selenium concentrations for RG_LILC3 that were close to model predictions at very high aqueous Se concentrations (>100 µg/L) were collected in March 2018 after the AWTF was shut down (i.e., reflecting combined inputs from West Line Creek [untreated] and Line Creek) and aqueous selenium was predominantly in selenate form.

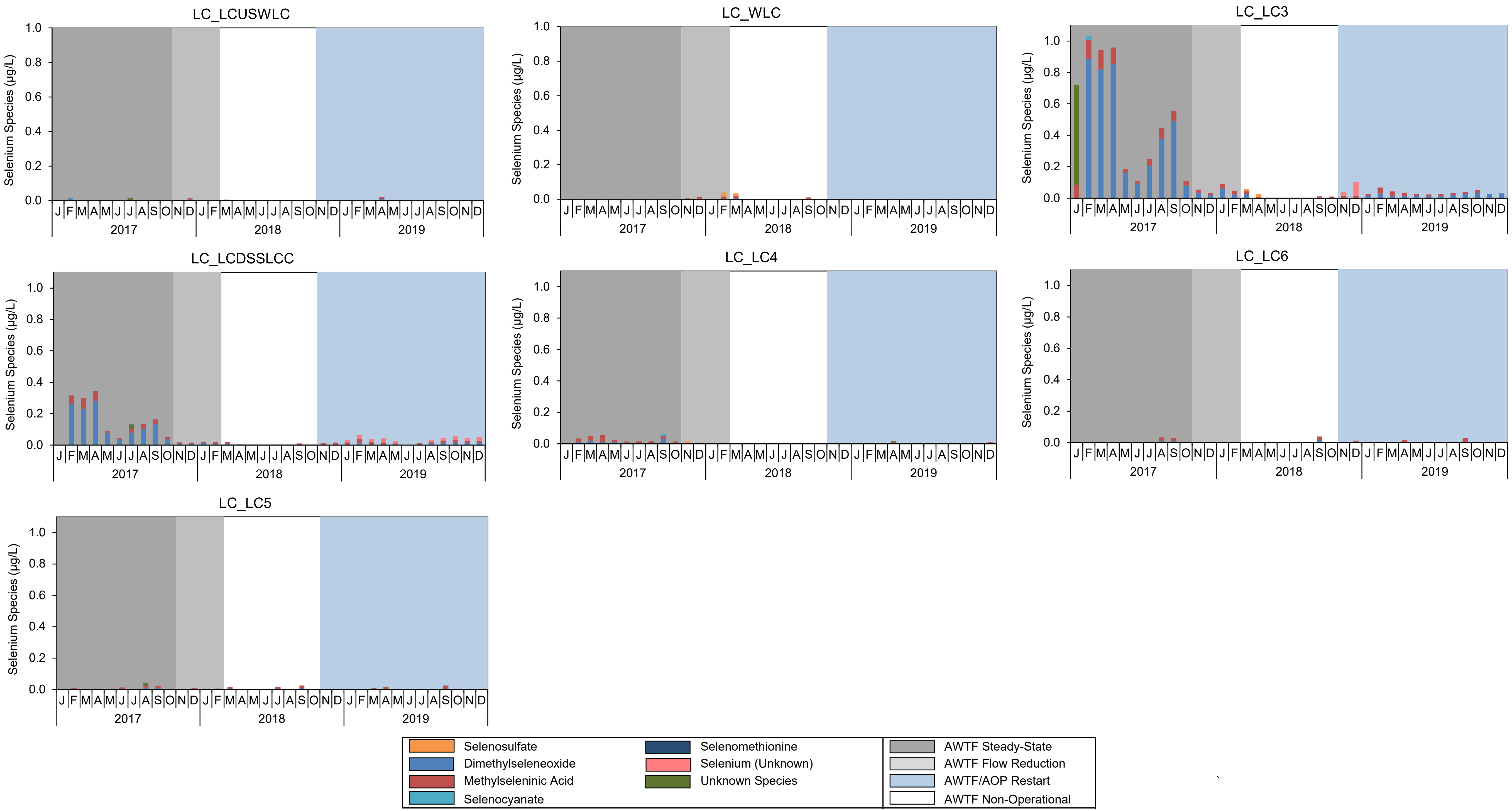


Figure 4.8: Aqueous Concentrations of Organoselenium Species at Mine-exposed (LC_LCUSWLC, LC_WLC, LC_LC3, LC_LCDSSLCC, LC_LC4, LC_LC6, LC_LC5) Stations in Line Creek and Fording River, January 2017 to December 2019

Notes: Values below the Laboratory Reporting Limit are not included in the concentrations. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge. Data are not displayed for reference stations (LC_LC1, LC_SLC) because all results for organoselenium species were below the Laboratory Reporting Limit (LRL). Selenium (unknown) represents an unknown selenium species that elutes at a retention time of ~3.7 and is a product of the oxidation of volatile selenium species.

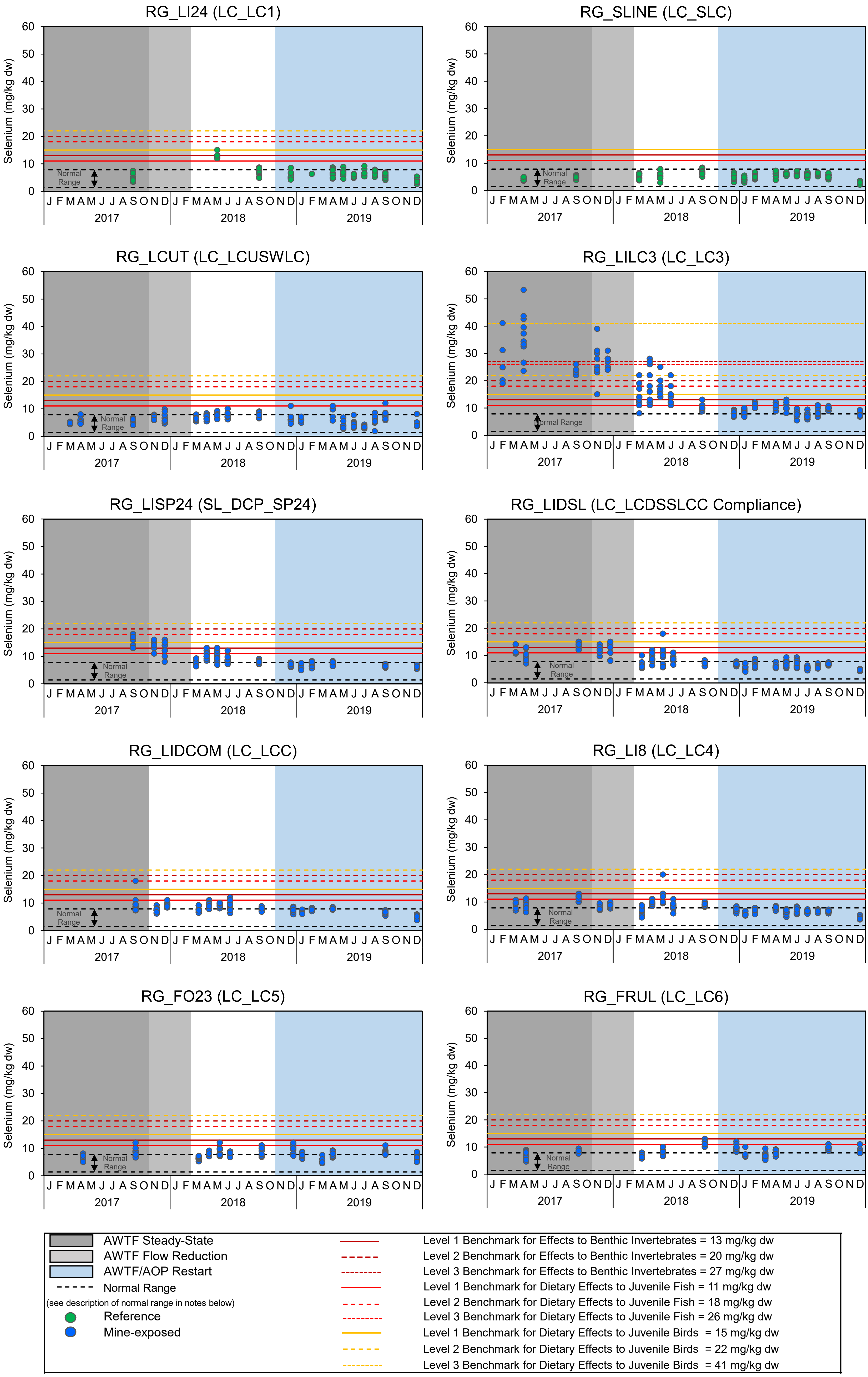


Figure 4.9: Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples from Line Creek and Fording River, 2017 to 2019

Notes: Results shown in green represent reference stations, and those in blue represent mine-exposed stations. Dashed black lines represent the normal range defined as the 2.5th and 97.5th percentiles of the 2012 and 2015 reference area data from the Regional Aquatic Environmental Monitoring Program (RAEMP). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

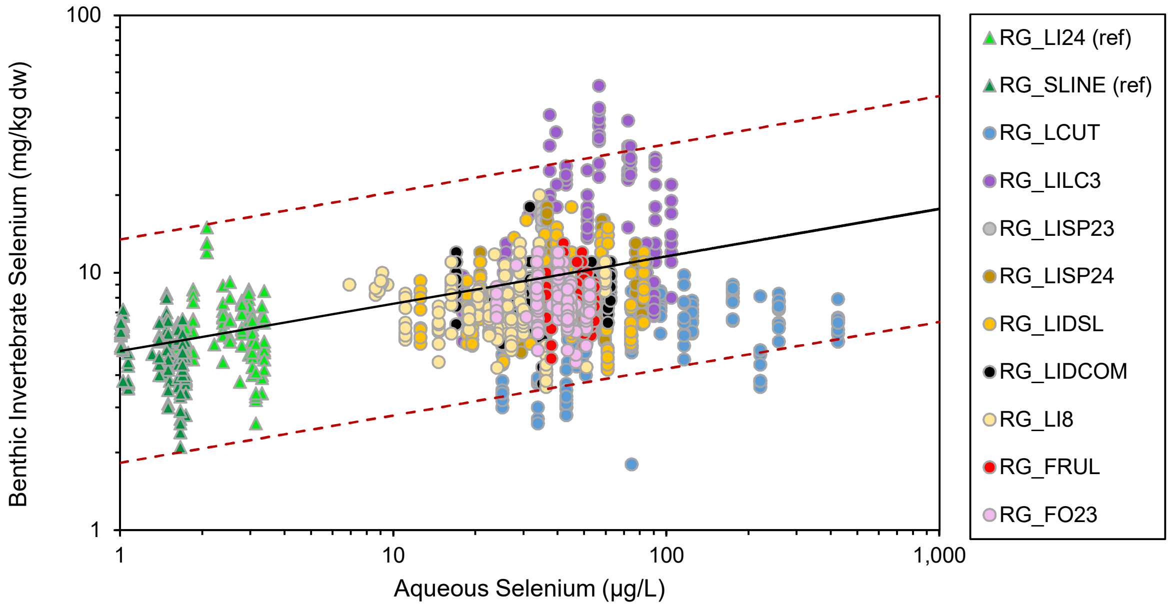


Figure 4.10: Observed and Modelled[a] Selenium Concentrations in Benthic Invertebrate Composite Samples Relative to Aqueous Selenium Concentrations at Stations Upstream and Downstream of Line Creek Operations, 2012 to 2019

Notes: One data point for station FO23 on September 16th, 2015 is the average of two duplicate measurements. Triangles indicate reference stations and circles indicate mine-exposed stations.

[a] Mean benthic invertebrate selenium concentrations (solid black line) were estimated using a one-step water to benthic invertebrate selenium accumulation model: $\log_{10}[Se]_{benthic\ invertebrate} = 0.696+0.184 \times \log_{10}[Se]_{aq}$ (Teck 2014). The 95% prediction limits for a single value from the one-step water to benthic invertebrate selenium accumulation model are plotted as dashed red lines.

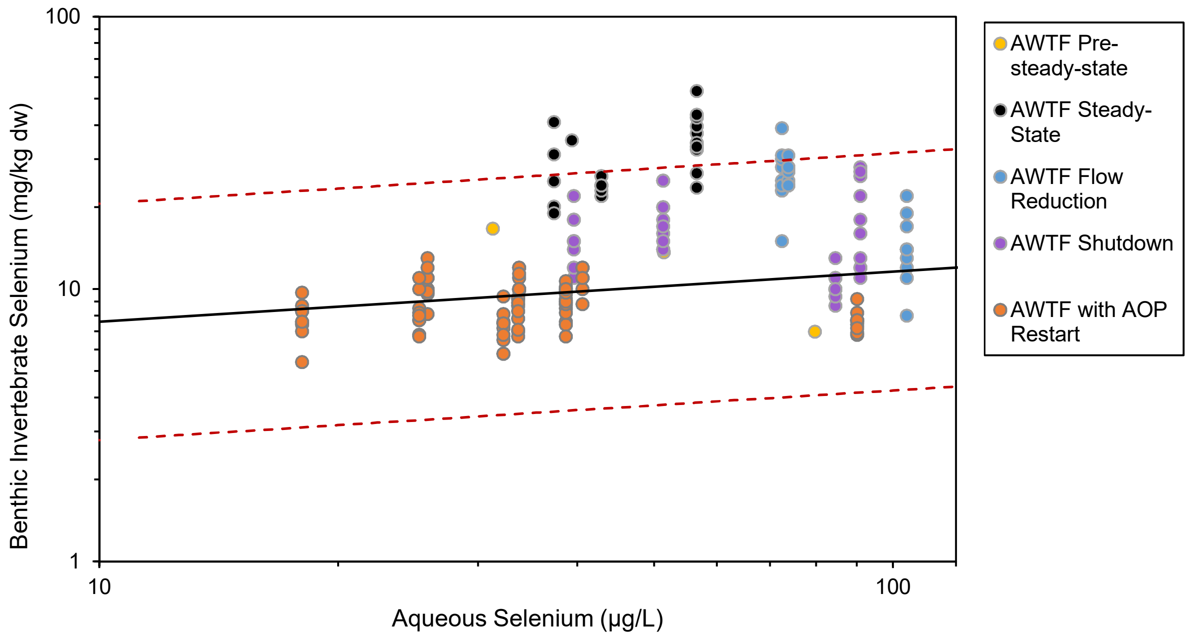


Figure 4.11: Observed and Modelled[a] Selenium Concentrations in Benthic Invertebrate Composite Samples Relative to Aqueous Selenium Concentrations at RG_LILC3, Line Creek, 2012 to 2019

[a] Mean benthic invertebrate selenium concentrations (solid black line) were estimated using a one-step water to benthic invertebrate selenium accumulation model: $\log_{10}[Se]_{benthic\ invertebrate}=0.696+0.184\times\log_{10}[Se]_{aq}$ (Teck 2014). The 95% prediction limits for a single value from the one-step water to benthic invertebrate selenium accumulation model are plotted as dashed red lines.

indicate that the AWTF with AOP functioned as intended throughout 2019 to limit selenium accumulation by aquatic biota.

4.5 Fish Tissue Selenium Concentrations

4.5.1 Muscle

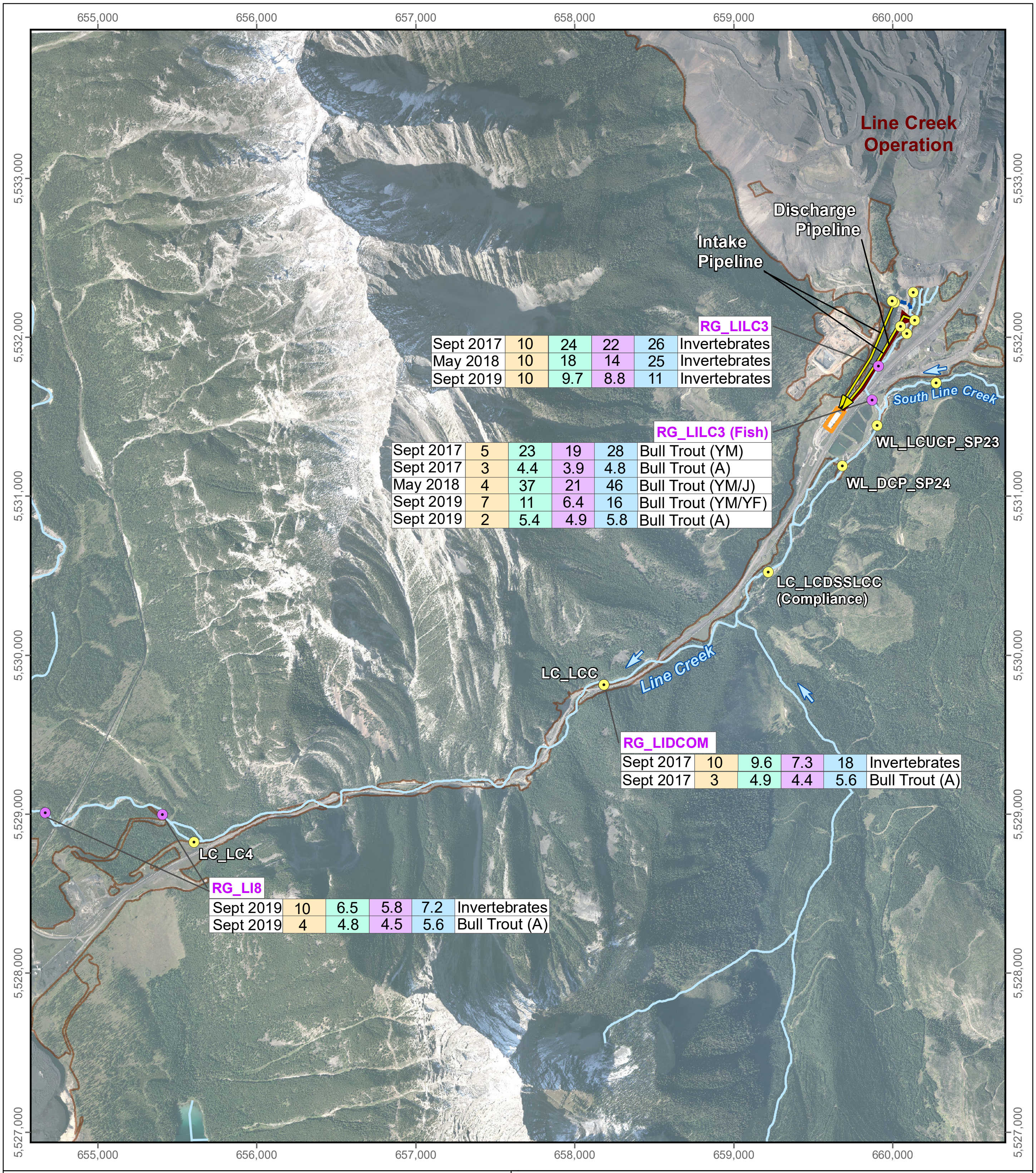
Trophic transfer factors (TTF) represent ratios of consumer to dietary tissue selenium concentrations and are often used to describe selenium transfer in aquatic food webs. Selenium concentrations in fish muscle are usually similar to dietary exposure concentrations, as reflected in TTFs of approximately one for a wide range of small-bodied versus large-bodied and marine versus freshwater fish species (Table 4.2).

Young bull trout (i.e., < 29 cm fork length) captured in Line Creek in September 2019 had muscle selenium concentrations similar to or higher than those in benthic invertebrates collected in the same vicinity (Figures 4.12; Appendix Table B.22). This is consistent with results in previous years (Minnow 2018d, 2019a) and suggests that these bull trout were resident individuals feeding near the capture area. Larger adult bull trout (i.e., > approximately 60 cm fork length) captured in 2019 had muscle selenium concentrations lower than those in benthic invertebrates (particularly near RG_LILC3; Figure 4.12), suggesting non-residency. This is also consistent with previous results observed for adult bull trout in 2017 (Figure 4.12; Minnow 2018d). Line Creek is a regionally important stream for bull trout spawning (Minnow 2016b), with bull trout typically spawning in Line Creek between approximately mid-September until mid-October under base flow conditions (Lotic 2016). Therefore, these larger adult bull trout captured in September 2019 were likely individuals that had recently migrated into Line Creek to spawn.

The ratio of muscle selenium concentrations of bull trout to benthic invertebrate selenium concentrations was higher for juveniles captured in September 2019 than for adults (Figure 4.13). The TTF for juvenile bull trout captured in 2019 was slightly above one while it was below one for adult bull trout (Figure 4.13). This further supports that juvenile bull trout are likely residents of Line Creek feeding near the capture area while adults were likely migrating to Line Creek for spawning purposes. The TTFs of juvenile bull trout were much lower than observed in 2018 and more similar to those in September 2017 (Figure 4.13; Minnow 2018d, 2019a). This discrepancy in TTFs relative to 2018 is likely related to the change in AWTF operational status (shutdown) that occurred shortly prior to bull trout sampling in 2018 (8 weeks prior). Given that the primary exposure route of selenium to these fish is dietary, it is anticipated that changes in fish tissue selenium concentrations would be delayed relative changes in selenium concentrations of their diet (i.e., benthic invertebrates). The slower growth rate and lower specific feeding (i.e., feeding per unit mass of consumer) of fish compared to benthic invertebrates may also

Table 4.2: Trophic Transfer Factors (TTF) for Fish Muscle or Whole Body Relative to Diet (Presser and Luoma 2010)

Common Name	Scientific Name	TTF
Chinese mudskipper	*Periophthalmus cantonensis*	0.84
Striped bass (juvenile)	*Morone saxatilis*	0.89
Sucker	*Catostomus sp.*	0.97
Rainbow trout	*Oncorhynchus mykiss*	0.98
Fathead minnow (larval and adult)	*Pimephales promelas*	1.0
Largemouth bass	*Micropterus salmoides*	1.0
Cutthroat trout	*Oncorhynchus clarkii*	1.0
Bluegill	*Lepomis macrochirus*	1.1
Mangrove snapper	*Lutjanus argentimaculatus*	1.1
European sea bass	*Dicentrarchus labrax*	1.1
Chub	*Gila sp.*	1.2
Yellowfin goby	*Acanthogobius flavimanus*	1.2
Western mosquitofish	*Gambusia affinis*	1.3
White sturgeon	*Acipenser transmontanus*	1.3
Brown trout	*Salmo trutta*	1.3
Mountain whitefish	*Prosopium williamsoni*	1.3
Sailfin molly	*Poecilia latipinna*	1.4
Mottled sculpin	*Cottus bairdi*	1.4
Longnose dace	*Rhinichthys cataractae*	1.5
Redside shiner	*Richardsonius balteatus*	1.5
Starry flounder	*Platichthys stellatus*	1.6



LEGEND

- Teck Water Quality Station
- Biological Sampling Station
- Active Water Treatment Facility (AWTF) Operational-Dependent Flow
- Active Water Treatment Facility (AWTF)

Bull Trout Muscle and Benthic Invertebrate Selenium Concentrations (mg/kg dw)

n | mean | min | max

(A) = Adult
(YF) = Young Female
(YM) = Young Male
(J) = Juvenile, Sex Unknown

Bull Trout Muscle versus Benthic Invertebrate Selenium Concentrations, Line Creek, 2017 to 2019

0 500 1,000 2,000 Meters

N E S W

Projection: North American Datum 1983 UTM Zone 11
Reproduced under licence from Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada.

Date: April 2020
Project 197202.0006

minnow environmental inc.

Figure 4.12

Document Path: S:\Projects\197202\197202.0006 - Teck 2019 Line Creek LAEMP\4 - GIS\Report\19-06 Figure 4.12 Bull Trout Muscle VS BI Selenium Concentrations.mxd

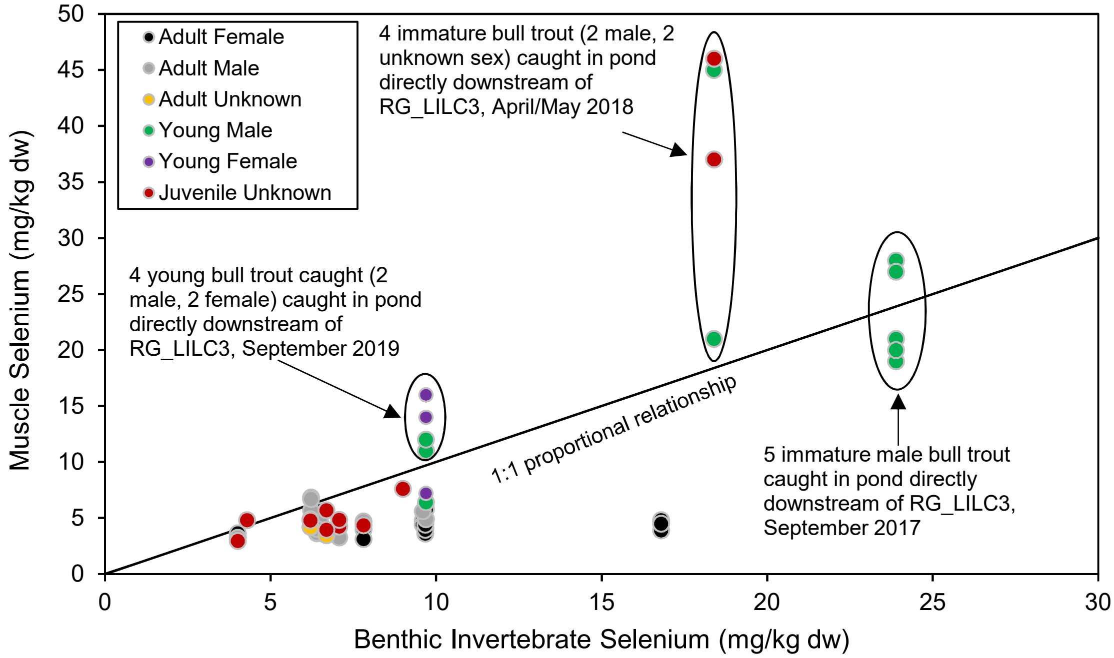


Figure 4.13: Bull Trout Muscle Selenium Concentrations Compared to Selenium Concentrations in Composite-Taxa Benthic Invertebrate Samples Collected in the Same Area

Notes: Data reflect bull trout captured in Line Creek in 2017 LAEMP (Minnow 2018d), 2018 LAEMP (Minnow 2019a), 2019 LAEMP, and in 2006 regional selenium monitoring (Minnow et al. 2007). Muscle selenium concentrations for fish caught downstream of RG_LILC3 were compared to composite benthic invertebrate selenium concentrations measured at RG_LILC3 in September 2017, April/May 2018, and September 2019. Muscle selenium concentrations of fish caught Mid-Canyon were compared to composite benthic invertebrate selenium concentrations measured at RG_LI8 in September 2018.

potentially contribute. In 2019, the lower TTFs for selenium in juvenile bull trout are therefore likely attributable to the longer time frame since a change in AWTF operational status (over a year prior to tissue sampling), allowing time for changes in fish tissue selenium concentrations to occur relative to dietary exposure.

Muscle selenium concentrations of juvenile bull trout in 2019 were substantially lower (2.3-times lower on average) than those reported in 2017 during AWTF steady-state operation (without AOP; Figure 4.14; Appendix Table B.22). The substantial decrease in muscle selenium concentrations of these (likely resident) bull trout in 2019 indicates that recommissioning of the AWTF with AOP has been successful at shifting selenium speciation in AWTF effluent from chemically-reduced species back to a selenate-dominated condition, thereby reducing the bioavailability of selenium in Line Creek.

Selenium concentrations in tissues of westslope cutthroat trout have been monitored in Line Creek since 2001 (Golder 2005). In 2019, selenium concentrations in muscle from westslope cutthroat were below the site-specific muscle benchmark of 15.5 mg/kg (Nautilus Environmental and Interior Reforestation 2011), with the exception of one sample. Selenium concentrations were similar in muscle of westslope cutthroat trout captured closest to the AWTF discharge (near RG_LILC3, and at RG_LIDCOM approximately 2.8 km downstream from the AWTF discharge) and approximately 6.1 km downstream from the AWTF discharge (near RG_LI8; Figure 4.15). This differed from results in 2017 when muscle selenium concentrations were 3.5-times higher (on average) in fish captured near RG_LILC3 than those captured near RG_LI8 (Figure 4.15; Appendix Table B.23). This represents a substantial decrease in muscle selenium concentrations of fish captured near RG_LILC3 and/or RG_LIDCOM between 2017 (during AWTF steady-state operation without AOP) and 2019 (during AWTF with AOP operation), with tissue selenium concentrations in 2019 more similar to concentrations observed between 2001 and 2012 (prior to AWTF operation; Figure 4.15).

No external deformities or abnormalities were noted in bull trout or westslope cutthroat trout captured in Line Creek in 2019 (Appendix Tables B.22 and B.23).

4.5.2 Ovaries

Measurement of selenium in eggs or ripening ovaries is the most direct way to evaluate potential effects of selenium on fish reproduction compared to measurement of selenium in water or other tissue types (Janz et al. 2010; Golder 2014; USEPA 2016). For this reason, site-specific benchmarks were derived in the EVWQP based on fish egg/ovary selenium concentrations (Golder 2014). However, it is challenging to align sampling events with when fish are ripe so that eggs can be harvested non-lethally from females (by applying gentle abdominal pressure). If non-lethal expression of eggs is not possible, collection of ovaries requires that fish

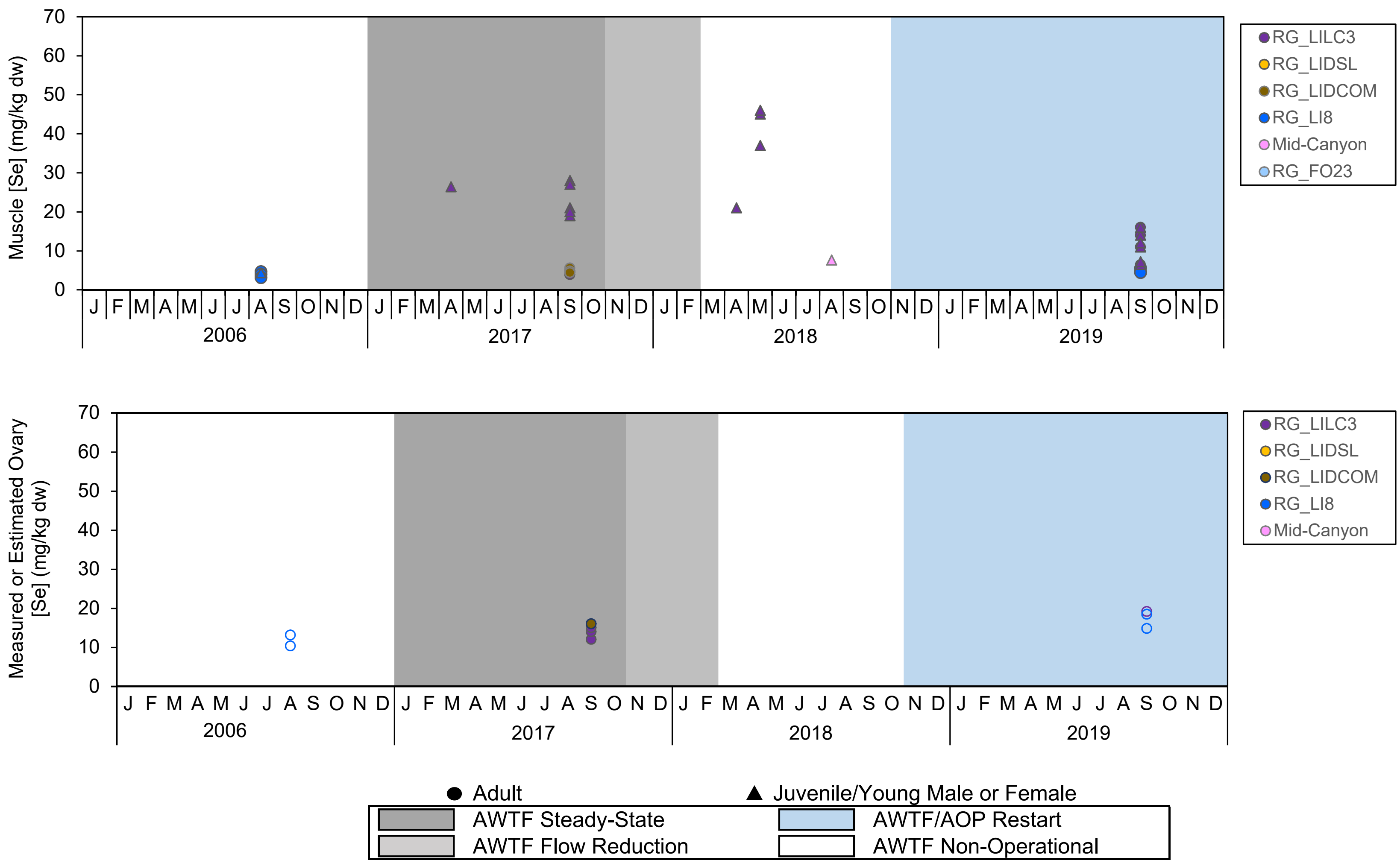


Figure 4.14: Selenium Concentrations in Muscle and Ovaries of Bull Trout Sampled From Line Creek, 2006 to 2019

Notes: Ovary concentrations that were estimated from muscle selenium concentrations based on the average ovary-to-muscle concentration relationship of 3.3:1 (Minnow 2018d) are plotted with open circles. Measured ovary selenium concentrations are plotted as solid circles. Ovary selenium was estimated only for adult individuals lacking measured ovary concentrations (if female) or if sex of an adult individual was unknown.

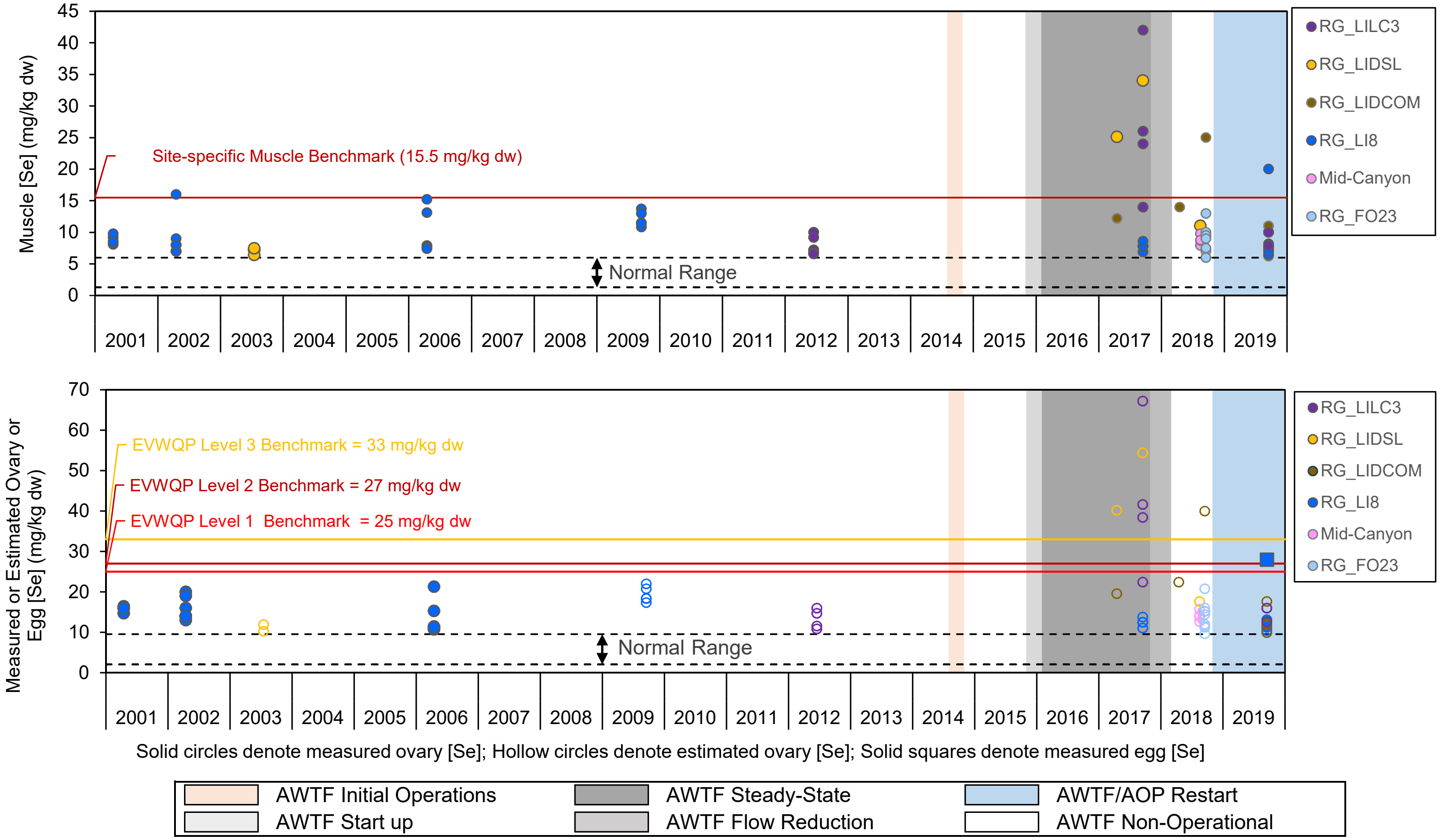


Figure 4.15: Selenium Concentrations in Muscle and Ovaries of Westslope Cutthroat Trout Sampled From Line Creek, 2001 to 2019

Notes: Measured muscle and ovary selenium concentrations are plotted as solid circles. Selenium was measured in ripe eggs collected non-lethally from one adult female in 2019, and this is plotted as a solid square. Ovary concentrations that were estimated from muscle selenium concentrations (based on the ovary-to-muscle concentration relationship of 1.6:1 presented by Nautilus and Interior Reforestation 2011) are plotted with open circles. Ovary selenium was estimated only for individuals lacking measured egg/ovary concentrations (if female). Dashed black lines represent the muscle normal range defined as the 2.5th and 97.5th percentiles of the 1998 to 2015 reference area muscle data from the Regional Aquatic Environmental Monitoring Program (RAEMP). Ovary normal range was estimated from the muscle values multiplied by the 1.6:1 conversion presented by Nautilus and Interior Reforestation 2011.

be sacrificed. Therefore, monitoring of selenium in fish has often involved non-lethal collection of muscle plugs for selenium analysis. Selenium concentrations in fish eggs/ovaries can be estimated from muscle for fish species that exhibit a strong muscle-to-ovary selenium relationship, as an indirect means of evaluating potential effects of selenium on fish reproduction. Such relationships have been described for a variety of fish species from data in the scientific literature (USEPA 2016) and based on studies in the Elk Valley (Table 4.3). Ovary-to-muscle selenium ratios are typically <3:1 but can range up to 7:1 for some species.

A strong ovary-to-muscle relationship for selenium concentrations has been characterized for westslope cutthroat trout, which indicates that egg/ovary selenium concentrations are typically about 1.6-times the concentrations in muscle of the same fish (Nautilus and Interior Reforestation 2011). Estimated ovary selenium concentrations for westslope cutthroat trout in Line Creek in 2019 were below the EVWQP Level 1 benchmark of 25 mg/kg dw (Golder 2014). Estimated ovary selenium concentrations from fish collected near the AWTF discharge (near RG_LILC3) were substantially lower in 2019 than 2017 (when the AWTF was in steady-state operation), and were more similar to concentrations in 2001 to 2012 (prior to AWTF operation) which were all below the EVWQP Level 1 benchmark (Figure 4.15).

A single egg sample was collected from a female westslope cutthroat trout during fishing efforts in September 2019 by applying minimal pressure to the abdomen of the fish (consistent with usual handing during non-lethal sample collection). Selenium concentrations in this egg sample exceeded the EVWQP Level 1 and 2 benchmarks (Figure 4.15; Appendix Table B.23; Golder 2014). Westslope cutthroat trout spawn in the spring, and based on literature (Scott and Crossman 1998; McPhail 2007; GOC 2016) and field observations in the East Kootenay Region (Cope 2019, pers. Comm.), the likelihood of westslope cutthroat trout in Line Creek with a fall-spawning life history is very low. Therefore, the incidental collection of eggs in September likely represents an anomaly observed in this single individual.

Selenium monitoring data in the Elk Valley are more limited for bull trout than for westslope cutthroat trout. Available tissue selenium concentration data indicated an ovary-to-muscle ratio of approximately 3.3 (Minnow 2018d). Ovary selenium concentrations were estimated for three adult female bull trout sampled non-lethally in 2019[19] (Figure 4.14; Appendix Table B.22), and

[19] Sex of adult fish was determined based on non-lethal evaluation of physical characteristics.

Table 4.3: **Ovary to Muscle Selenium Relationships for Different Fish Species in the Elk Valley and Various Locations in the Literature**

Location	Source	Common Name	Scientific Name	Ovary to Muscle Concentration Ratios[a]				Regression[b]	
				n	Min	Max	Median	p	r^2
Elk Valley	Koocanusa Reservoir	Kokanee	*Oncorhynchus nerka*	16	1.6	3.1	2.1	0.61	-
		Largescale Sucker	*Catostomus macrocheilus*	17	0.78	2.5	1.4	<0.001	0.89
		Northern Pikeminnow	*Ptychocheilus oregonensis*	64	2.0	10	3.6	<0.001	0.55
		Peamouth Chub	*Mylocheilus caurinus*	90	1.1	7.8	3.3	<0.001	0.43
		Rainbow Trout	*Oncorhynchus mykiss*	9	3.2	12	4.3	0.81	-
		Redside Shiner	*Richardsonius balteatus*	51	2.8	15	7.3	<0.001	0.42
		Yellow Perch	*Perca flavescens*	54	1.1	1.5	1.2	<0.001	0.78
	RAEMP (Minnow 2018a)	Longnose Sucker	*Catostomus catostomus*	19	0.64	2.1	1.1	<0.001	0.96
		Mountain Whitefish	*Prosopium williamsoni*	106	1.8	16	6.5	<0.001	0.52
	Nautilus and IR (2011)	Westslope Cutthroat Trout	*Oncorhynchus clarki lewisi*	>100	0.5[c]	6[c]	1.6[c]	<0.001	0.82
Various	USEPA (2016)	Black Bullhead	*Ameiurus melas*	10	3.4	19	6.8	0.25	-
		Bluegill	*Lepomis macrochirus*	29	0.14	2.4	1.4	<0.001	0.65
		Bluehead Sucker	*Catostomus discobolus*	7	0.94	1.8	1.5	<0.001	0.91
		Brook Trout	*Salvelinus fontinalis*	17	0.54	2.3	1.1	<0.001	0.91
		Brown Trout	*Salmo trutta*	4	0.38	11	7.0	0.71	-
		Channel Catfish	*Ictaluris punctatus*	4	3.7	8.7	5.8	0.67	-
		Common Carp	*Cyprinus carpio*	6	0.39	1.5	1.1	0.007	0.84
		Cutthroat Trout	*Oncorhynchus clarkii*	69	1.0	11	1.8	<0.001	0.82
		Dolly Varden	*Salvelinus malma*	17	0.71	3.6	1.3	<0.001	0.90
		Flannelmouth Sucker	*Catostomus latipinnis*	7	0.85	1.4	1.1	0.036	0.58
		Green Sunfish	*Lepomis cyanellus*	38	0.79	1.8	1.2	<0.001	0.89
		Largemouth Bass	*Micropterus salmoides*	13	0.77	1.8	1.1	0.22	-
		Mountain Whitefish	*Prosopium williamsoni*	27	3.5	8.2	5.8	<0.001	0.33
		Northern Pike	*Esox lucius*	14	1.0	3.9	1.9	<0.001	0.83
		Rainbow Trout	*Oncorhynchus mykiss*	47	0.04	4.4	1.9	<0.001	0.96
		Razorback Sucker	*Xyrauchen texanus*	34	1.1	5.2	2.3	<0.001	0.80
		Roundtail Chub	*Gila robusta*	7	1.5	2.5	2.0	0.026	0.62
		Smallmouth Bass	*Micropterus dolomieu*	6	0.94	1.6	1.2	0.006	0.85
		White Sturgeon	*Acipenser transmontanus*	6	1.6	21	1.3	0.006	0.86
		White Sucker	*Catostomus commersonii*	40	0.47	2.1	1.0	<0.001	0.59

Note: "-" = no data/not recorded.
[a] Ratio of ovary to muscle for individual fish as listed by USEPA (2016), augmented by data from Elk Valley studies.
[b] r^2 presented for significant relationships ($p<0.05$).
[c] Estimated from a figure in Nautilus and IR (2011).

these exceeded the EVWQP Level 1 Benchmark of 18 mg/kg dw[20] (Golder 2014) but were well below the EC_{10} for Dolly Varden of 56.2 mg/kg dw[21] (USEPA 2016).

4.6 Summary

Concentrations of non-selenate forms of selenium in Line Creek water were decreased during operation of the AWTF with AOP in 2019. Benthic invertebrate tissue monitoring in Line Creek identified substantially lower selenium concentrations in 2019 during operation stabilization of AWTF with AOP compared to concentrations that were observed during steady-state operation of the AWTF. In 2019, mean benthic invertebrate selenium concentrations were below the EVWQP Level 1 benchmark at all areas downstream of the AWTF discharge. Temporal changes in benthic invertebrate selenium concentrations during AWTF with AOP operation in 2019 were consistent with changes in concentrations of aqueous non-selenate species, and comparison of benthic invertebrate selenium concentrations throughout 2019 to the selenium bioaccumulation model indicated that selenium bioaccumulation was as expected. Selenium concentrations of tissues of juvenile bull trout and westslope cutthroat trout captured near the AWTF discharge in 2019 were substantially lower than those reported in 2017 for fish from a similar area. Furthermore, selenium concentrations in westslope cutthroat tissues in 2019 were below the EVWQP Level 1 benchmark (except a single sample). Combined, the aqueous selenium speciation, benthic invertebrate tissue selenium, and fish tissue selenium monitoring results all indicated that the recommissioned AWTF with AOP is functioning as intended to shift selenium speciation in AWTF effluent from chemically-reduced species back to a selenate-dominated condition, thereby reducing the bioavailability of selenium in Line Creek.

[20] Benchmark applies to fish species other than westslope cutthroat trout.

[21] The Effect Concentration (EC_{10}) screening value of 56.2 mg/kg dw identified for Dolly Varden was applied to bull trout ovary selenium concentrations. Bull trout (*Salvelinus confluentus*) belong to a relatively tolerant genus. McDonald et al. (2010) reported an EC10 of 54 mg/kg dw in eggs for Dolly Varden (*Salvelinus malma*), later recalculated as 56.2 mg/kg dw in eggs by USEPA (2016). Holm et al. (2005) reported no effects to brook trout (*Salvelinus fontinalis*) across a wide range of egg selenium concentrations. USEPA (2016) concluded that "the effect threshold [for brook trout] appears to be substantially higher [than the reported no-effect concentration] based on the absence of any consistent concentration-response relationship up to the maximum observed egg concentration of 18.9 mg Se/kg ww or 48.7 mg Se/kg dw". As such, the selected screening value of 56.2 mg/kg dw in ovary tissue would be a conservative basis for evaluating potential risk to members of the genus *Salvelinus*, including bull trout.

5 OTHER POTENTIAL INFLUENCES OF THE WLC AWTF

5.1 Overview

Monitoring data were evaluated in this section to address Study Question #3: Is WLC AWTF operation affecting aquatic biota through thermal effects, effects on dissolved oxygen concentrations, or concentrations of treatment-related constituents other than nutrients or selenium? To address this study question, water temperature and dissolved oxygen results in 2019 were evaluated upstream and downstream of the AWTF, and water quality and toxicity testing results were evaluated in relation to changes in AWTF operational status. The AWTF with AOP was operational throughout 2019 (in the operation stabilization phase), with discharge to the receiving environment occurring over the entire year.

5.2 Temperature

Water temperatures measured by continuous loggers in Line Creek upstream (LC Intake Pond [Data logger T1]) and downstream (LC Mixing Zone Discharge [Data logger T4] and LC3 Downstream [Data logger T5]) of the AWTF were generally similar to each other (Figure 5.1). These temperatures were also relatively similar to discrete temperature measurements collected further upstream during routine monitoring (LC_LCUSWLC) between January and July, but were lower than those measured further upstream (at LC_LCUSWLC) in summer (July to October; Figure 5.1) indicating no temperature increase associated with the AWTF operation.

British Columbia guidelines for water temperature are defined as a maximum ± 1º C change from the optimum temperature range for different fish life stages (BCMOE 2001). Line Creek water temperatures throughout 2019 were within, or lower than, the optimum temperature ranges specified for different life stages of bull trout and westslope cutthroat trout (Figure 5.2).

5.3 Dissolved Oxygen

Dissolved oxygen concentrations measured in 2019 upstream and downstream of the AWTF discharge were above the instantaneous minimum criterion for the protection of the most sensitive fish (embryo/alevin) life stages (9 mg/L; BCMOE 1997) and the 30-day mean for all other fish life stages (8 mg/L; Figure 5.3). However, monthly mean concentrations of dissolved oxygen were below the 30-day mean criterion of 11 mg/L for the most sensitive fish life stages (buried embryo/alevin) at all stations in at least one month (between June and October). Concentrations were below the criterion in more than one month both upstream (LC_LCUSWLC; 4 months) and downstream of the AWTF (LC_LC3 and LC_LCDSSLCC [3 months] and LC_LC4 [2 months]; Table 5.1). The pattern of average dissolved oxygen

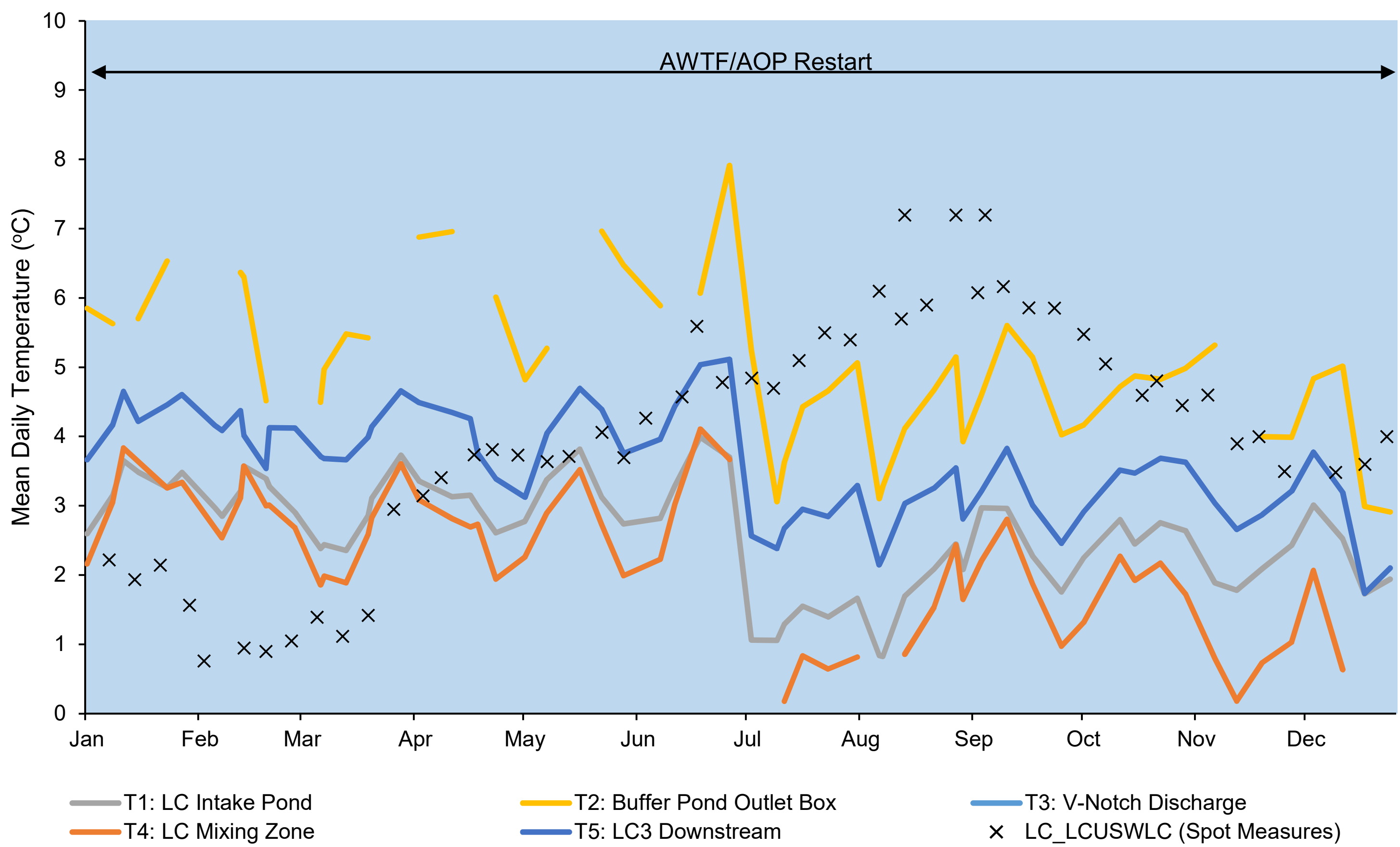


Figure 5.1: Mean Daily Water Temperature (°C) Recorded by Temperature Data Loggers[a], Line Creek LAEMP, 2019

Notes: Due to equipment malfunction, several measurements recorded by temperature data loggers were excluded from the plot and are shown as gaps in the plotted data. These include: the majority of Buffer Pond Outlet temperature measures reported prior to July; the majority of V Notch Weir temperature measures reported prior to April, temperatures below zero reported for the LC Mixing Zone, and several temperatures for LC_LCUSWLC.

[a] Temperatures displayed for LC_LCUSWLC are based on single discrete measures recorded during spot sampling. These are shown to provide context of water temperatures upstream.

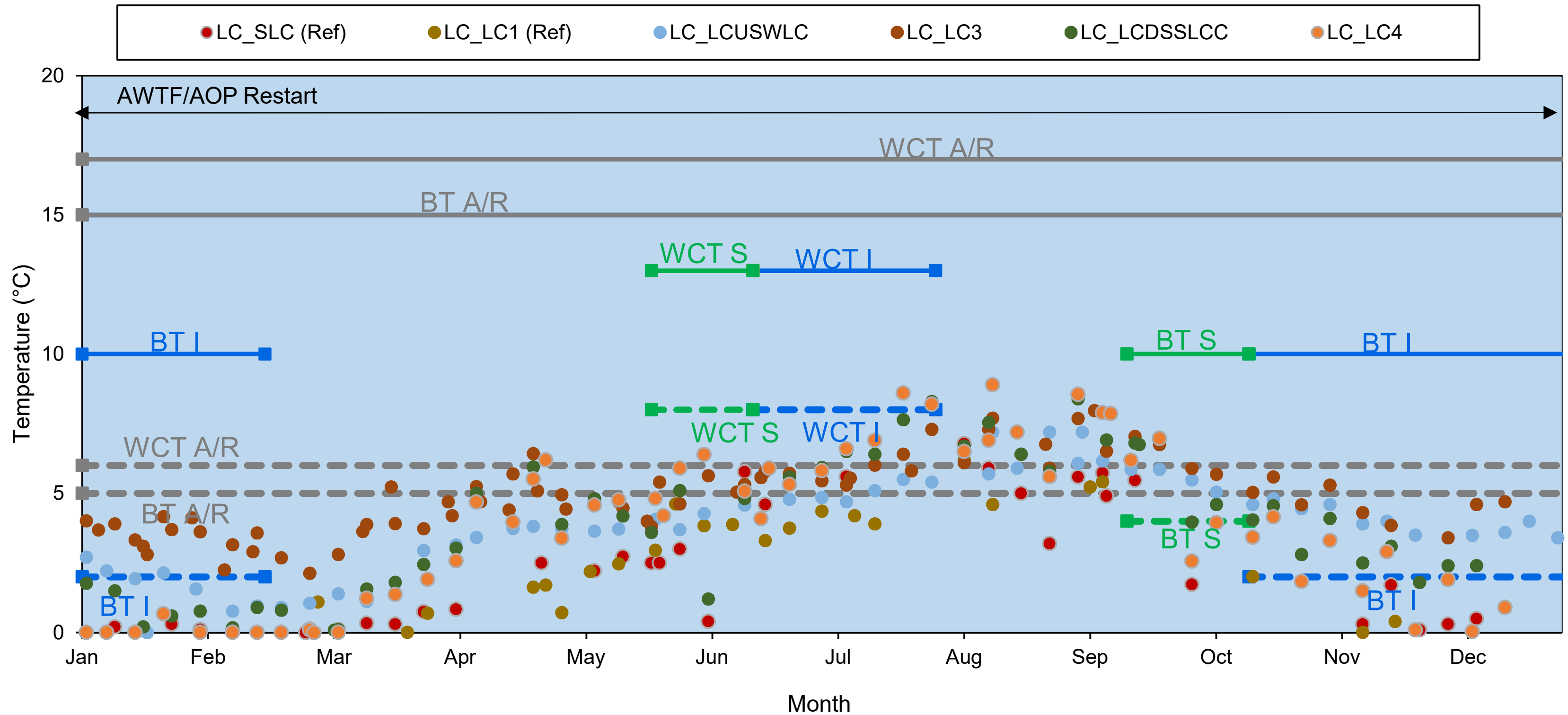


Figure 5.2: Water Temperatures at Monitoring Stations in Line Creek in 2019 Relative to BCMOE (2001b) Guidelines for Maximum (Solid Lines) and Minimum (Dotted Lines) Temperatures for Protection of Fish Species Found in Line Creek

Notes: BT = bull trout; WCT = westslope cutthroat trout; S = spawning; I = incubation; A/R = alevin/rearing. The timing of fish life history stages was approximated from COSEWIC (2016), McPhail and Baxter (1996), and McPhail (2007).

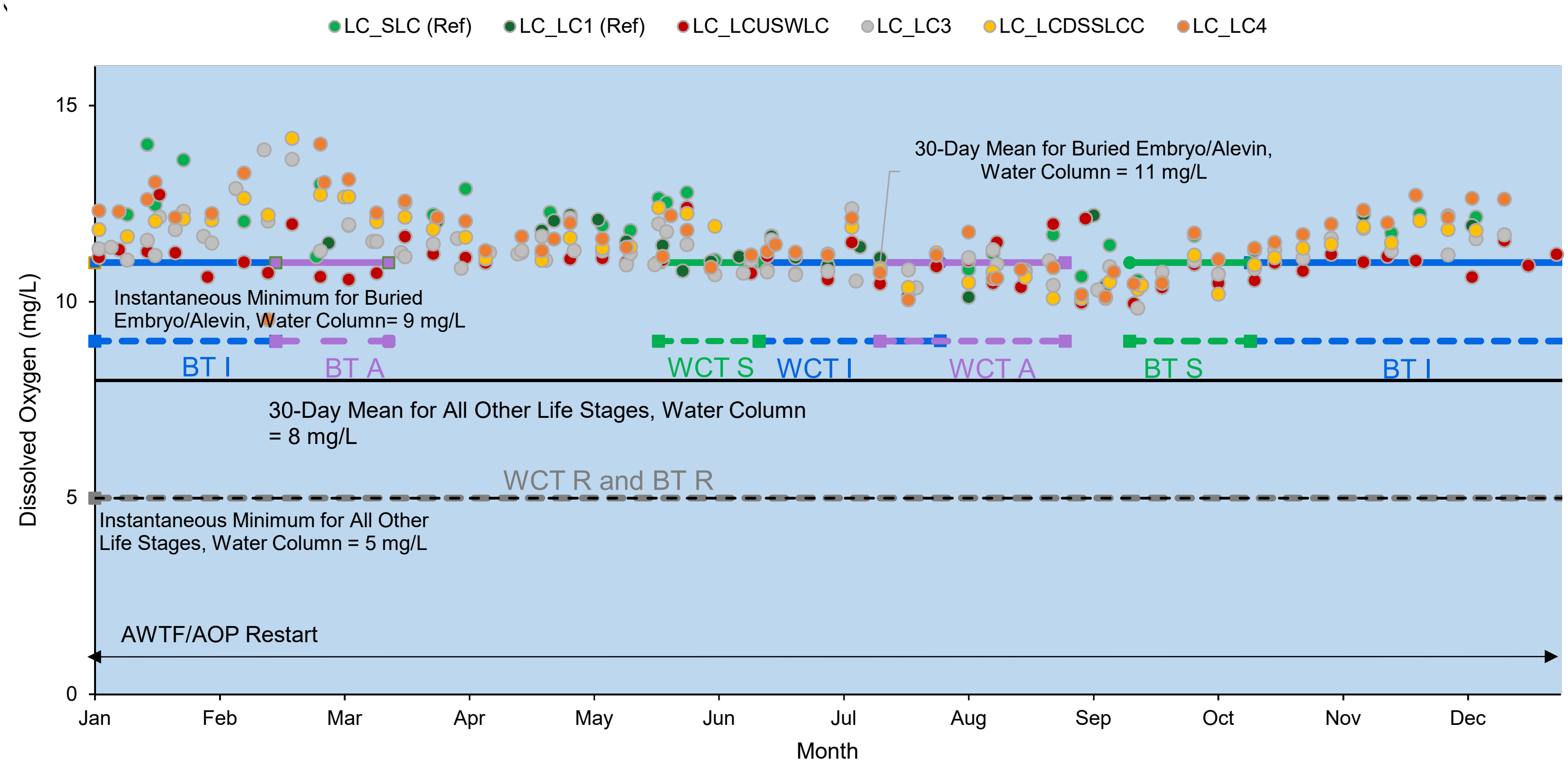


Figure 5.3: Dissolved Oxygen Concentrations at Sampling Stations in Line Creek in 2019, Relative to the BCMOE (1997) Criteria for the Protection of Fish Life Stages

Notes: BT = bull trout; WCT = westslope cutthroat trout; S = spawning; I = incubation; A/R = alevin/rearing. The timing of fish life history stages was approximated from COSEWIC (2016), McPhail and Baxter (1996), and McPhail (2007). Spawning, incubation, and alevin stages were included in application of buried embryo/alevin guideline values.

Table 5.1: Monthly Mean Dissolved Oxygen Concentrations (mg/L) in Line Creek, 2019

Month	LC_LC1	LC_SLC	LC_LCUSWLC	LC_WLC	LC_LC3	LC_LCDSSLCC	LC_LCC	LC_LC4
January	-	12.9	11.4	11.3	11.6	12.0	13.2	12.4
February	11.5	12.1	11.1	11.6	12.7	12.9	13.4	13.2
March	14.3	12.2	11.0	11.5	11.5	12.3	-	12.5
April	12.0	12.6	11.1	11.3	11.4	11.4	12.7	11.7
May	11.5	12.3	11.4	11.5	11.4	11.9	-	11.6
June	11.2	11.2	10.9	11.2	10.9	11.4	-	11.2
July	11.2	11.9	10.7	11.6	11.0	11.1	-	11.1
August	10.8	11.1	11.1	11.2	10.9	10.5	-	10.9
September	11.3	10.8	10.5	10.8	10.5 [a]	10.4	10.7	10.4
October	11.3	11.7	10.8	11.0	11.0	11.0	-	11.5
November	12.2	12.1	11.1	11.2	11.6	11.7	-	12.3
December	11.9	12.2	11.1	11.3	11.5	11.8	-	12.5

Less than 30-day water column mean criterion of 11 mg/L for buried embryo/alevin life stages (guideline was applied to all months except April, see notes for details).

Notes: "-" = no data/not recorded. Spawning, incubation, and alevin stages for bull trout and westslope cutthroat trout were included in the application of buried embryo/alevin guideline values, and were applicable to at least some portion of each month except April. The timing of life history stages for these species was approximated from COSEWIC (2016), McPhail and Baxter (1996), and McPhail (2007). See Figure 5.3 for graphical diplay of these life history stages.

[a] Average was calculated excluding one anomalous value recorded on September 3, 2019 (546 mg/L).

concentrations below the 30-day criterion both upstream and downstream of the AWTF discharge suggests the decreased dissolved oxygen concentrations were not related to AWTF operation.

5.4 Water Quality Analytes with Early Warning Triggers

Evaluation of analytes with early warning triggers under the AMP relative to BCWQG (see Sections 2.2.1 and 2.7.1) indicated that concentrations of nitrate, ammonia, sulphate, total mercury and selenium, and dissolved cadmium and copper were above the long-term BCWQG in samples from stations in Line Creek upstream (and at reference for total mercury and selenium and dissolved copper) and downstream of the AWTF discharge in 2019 (Appendix Tables C.1 and C.2; Appendix Figures C.1 to C.28). The short-term BCWQG was also exceeded in 2019 for dissolved cadmium (at LC_WLC only, 14% of samples) and ammonia (at LC_LCUSWLC and LC_WLC in 4% of samples, and at LC_LC3 in 20% of samples; Appendix Table C.2).

Total dissolved solids, sulphate and dissolved cadmium concentrations were above the EVWQP Level 1 benchmark, and nitrate and total selenium concentrations were above both the EVWQP Level 1 and 2 benchmarks in samples from upstream and downstream of the AWTF discharge. Total nickel concentrations were above the Level 1 interim screening value in samples from upstream and downstream of the AWTF discharge, the Level 2 interim screening value in samples from LC_LCUSWLC, and both the Level 2 and Level 3 interim screening values in samples from LC_WLC (Appendix Table C.2; Appendix Figures C.1 to C.28).

Visual inspection of results from 2012 to 2019 indicated no obvious temporal increases in analyte concentrations at monitoring stations downstream of the AWTF discharge in 2019 (Appendix Figures C.1 to C.28). The lack of temporal change in analyte concentrations in 2019 relative to previous years indicates that AWTF with AOP operation did not influence downstream concentrations of these analytes.

5.5 Toxicity Results

Effluent samples from WL_BFWB_OUT_SP21 were collected for acute toxicity testing. Of the 54 samples collected for acute testing of the water flea *Daphnia magna*, or the 54 samples collected for acute testing of rainbow trout in 2019, none caused >50% mortality to either organism (Table 5.2; Appendix Table C.3). On October 7, 2019, Teck and ENV each collected an effluent sample. The Teck sample exhibited ten percent mortality to rainbow trout and no effect to *D. magna*, and the ENV sample exhibited no effect to rainbow trout and 100% mortality to *D. magna.* Teck has initiated discussion with ENV to understand the implications of these conflicting results (Teck 2020).

Chronic toxicity testing is performed quarterly on samples collected at LC_LC3 and the Compliance Point (LC_LCDSSLCC) to evaluate potential effects to *Ceriodaphnia dubia* and

Table 5.2: Summary of Acute Toxicity Test Results for Line Creek Monitoring Stations, 2019

Water Station		Water Flea *(Daphnia magna)*		Rainbow Trout *(Oncorhynchus mykiss)*	
Teck Code	Description	# Tests > 50% Mortality	Total # tests	# Tests > 50% Mortality	Total # tests
WL_BFWB_OUT_SP21	West Line Creek AWTF effluent outfall	0	54	0	54

Acute toxicity test failure(s) (> 50% test mortality).

Pseudokirchneriella subcapitata. *C. dubia* reproduction was significantly decreased at LC_LC3 in Q4 of 2019 (in protocol-specified length tests and 8-day tests)[22] relative to results from the Elk River and Michel River reference areas, respectively (Table 5.3; Golder 2019). Due to the low effect-size relative to reference (13%) and results falling within the local and normal range, this difference was categorized as no adverse response according to decision criteria (Golder 2020). No effects to *C. dubia* were observed in samples collected in the remaining quarters (Q1 to Q3; Table 5.3). Testing completed between 2015 and 2017 also resulted in decreased *C. dubia* reproduction in one quarterly sample relative to one or more Elk Valley reference samples in each year, and two quarterly samples in 2018 relative to all four reference station samples (Table 5.3).

P. subcapitata cell-yield at LC_LC3 and LC_LCDSSLCC was significantly decreased in Q3 of 2019 compared to all four reference samples (Table 5.3). Mean cell-yield for the Q3 tests were below the local normal range of responses, indicating a likely adverse response to the test water (Golder 2020). Cell-yield in Q3 reference samples was lower than the negative laboratory control, despite being within the requirements for test validity. In addition, a low cell yield for a high number of Elk Valley test samples (relative to reference) was also observed in Q3. The combined observation of a high number of likely adverse responses across Elk Valley test samples and unusually low reference water cell yield raises questions about the reliability of the findings for Q3 *P. subcapitata tests* (Golder 2020). Testing completed in 2015, 2016, 2017, and 2018 also resulted in reduced algal growth relative to one or more reference samples in one of the quarterly samples (Table 5.3).

Chronic toxicity testing is performed semi-annually to evaluate potential effects to *Hyalella azteca*, rainbow trout, and fathead minnow at LC_LC3 and at the Compliance Point. The dry weight of *H. azteca* at LC_LC3 and LC_LCDSSLCC was significantly decreased in Q3[23] of 2019 compared to one or more Elk Valley reference samples (Table 5.3). *H. Azteca* survival was also significantly decreased in Q3 at LC_LC3 (relative to the South Line Creek reference sample) and at both LC_LCDSSLCC and LC_LC3 in Q4, relative to two or more Elk Valley reference samples (Table 5.3). According to decision criteria, the effect on dry weight in Q3 was categorized as a possible adverse response, and the effect on survival in Q3 and Q4 as a likely adverse response

[22] Two toxicity test lengths were used to evaluate potential effects on the timing and quantity of *Ceriodaphnia dubia* reproduction in 2019. This was in accordance with advice provided by EMC members (Golder 2020). These included: 1) a protocol-specified test length (i.e., reproduction was measured when ≥60 % of controls produced three or more broods; as per Environment Canada [2007c]); and 2) an 8-day test duration (Golder 2020). These two test lengths were to evaluate potential brood effect. Prior to 2019, the protocol-specified test length was used.

[23] Although *H. azteca* chronic toxicity testing is required in the spring (Q2) and fall (Q4) under the Permit 107517 and 106970 Chronic Toxicity Program integration amendment, the amendment approval was issued (March 4, 2019) after testing in early 2019 was initiated. Testing in 2019 was therefore completed in Q3 and Q4 according to the previous permit requirements (Permit 107517; see Golder 2020 for details).

Table 5.3: Results of Quarterly and Semi-Annual Chronic Toxicity Tests at LC_LCDSSLCC in 2015 to 2019and LC_LC3 in 2019[a] (Golder 2016, 2017a, 2018a, 2019, 2020)

Area	Quarter		Water Flea (*Ceriodaphnia dubia*)[b]			Amphipod (*Hyalella azteca*)[c]		Green Alga (*Pseudokirchneriella subcapitata*)	Rainbow Trout (*Oncorhynchus mykiss*)				Fathead Minnow (*Pimephales promelas*)[d]				
			Survival (% control-normalized)	Reproduction (% control-normalized; Protocol-specified)	Reproduction (% control-normalized; 8-day)	Survival (% control-normalized)	Dry Weight (% control-normalized)	Cell Yield ($x10^4$ cells/ml)	Survival (% control-normalized)	Viability (% control-normalized)	Length (% control-normalized)	Wet Weight (% control-normalized)	Hatch (% control-normalized)	Survival (% control-normalized)	Biomass (% control-normalized)	Length (% control-normalized)	Normal Development (% control-normalized)
LC_LCDSSLCC	2015	Q1	100 ± 0	98 ± 14	-	-	-	117 ± 2.2	-	-	-	-	-	-	-	-	-
		Q2	100 ± 0	**82 ± 12**	-	-	-	**69.2 ± 5.7**	102 ± 3	101 ± 6	101 ± 4	101 ± 5	-	-	-	-	-
		Q3	100 ± 0	107 ± 20	-	-	-	83 ± 21	-	-	-	-	-	-	-	-	-
		Q4	100 ± 0	80 ± 24	-	-	-	94 ± 18	88 ± 9	87 ± 9	98 ± 4	103 ± 4	-	-	-	-	-
	2016	Q1	100 ± 0	109 ± 16	-	-	-	129.5 ± 5.3	-	-	-	-	-	-	-	-	-
		Q2	100 ± 0	**67 ± 39**	-	-	-	**91.0 ± 4.8**	78 ± 6	88 ± 16	104 ± 2	97 ± 12	-	-	-	-	-
		Q3	100 ± 0	83 ± 21	-	-	-	119.5 ± 5.5	-	-	-	-	-	-	-	-	-
		Q4	100 ± 0	94 ± 18	-	-	-	156.0 ± 4.5	**70 ± 10**	**69 ± 8**	104 ± 1	116 ± 11	-	-	-	-	-
	2017	Q1	100 ± 0	**92 ± 38**	-	-	-	211.8 ± 15.4	-	-	-	-	-	-	-	-	-
		Q2	100 ± 0	124 ± 11	-	-	-	134.0 ± 4.2	99 ± 8	93 ± 18	107 ± 6	125 ± 10	-	-	-	-	-
		Q3	100 ± 0	104 ± 25	-	-	-	146.8 ± 10.1	-	-	-	-	-	-	-	-	-
		Q4	100 ± 0	127 ± 15	-	-	-	103.5 ± 4.4	**41 ± 44**	**41 ± 44**	109 ± 3	119 ± 5	-	-	-	-	-
	2018	Q1	100 ± 0	75 ± 19	-	-	-	164.3 ± 10.3	-	-	-	-	-	-	-	-	-
		Q2	100 ± 0	***40 ± 12***	-	96 ± 15	108 ± 35	147.5 ± 4.8	102 ± 3	103 ± 2	104 ± 5	109 ± 16	-	-	-	-	-
		Q3	100 ± 0	106 ± 18	-	109 ± 10	150 ± 30	97.0 ± 12.2	-	-	-	-	-	-	-	-	-
		Q4	100 ± 35	***63 ± 23***	-	74 ± 30	***35 ± 20***	***87.7 ± 8.2***	100 ± 9	103 ± 11	106 ± 1	110 ± 4	-	-	-	-	-
	2019	Q1	100 ± 0	92 ± 21	92 ± 21	-	-	81.5 ± 4.5	-	-	-	-	100 ± 0	89 ± 14	87 ± 6	***90 ± 3***	98 ± 5
		Q2	100 ± 0	81 ± 6	81 ± 6	-	-	*110.8 ± 2.6*	101 ± 11	101 ± 15	104 ± 3	115 ± 5	-	-	-	-	-
		Q3	80 ± 42	92 ± 23	86 ± 19	90 ± 17	*51 ± 26*	***29.8 ± 3.3***	-	-	-	-	100 ± 0	***64 ± 12***	**71 ± 8**	104 ± 5	96 ± 7
		Q4	100 ± 0	88 ± 17	90 ± 21	**73 ± 35**	84 ± 51	***104.0 ± 10.0***	90 ± 6	86 ± 4	103 ± 2	107 ± 3	-	-	-	-	-
LC_LC3	2019	Q1	100 ± 0	86 ± 12	86 ± 12	-	-	79.5 ± 8.0	-	-	-	-	100 ± 0	86 ± 4	89 ± 4	96 ± 1	100 ± 0
		Q2	100 ± 0	85 ± 12	85 ± 12	-	-	*113.8 ± 11.4*	92 ± 14	94 ± 13	104 ± 2	118 ± 8	-	-	-	-	-
		Q3	100 ± 0	105 ± 20	89 ± 17	75 ± 17	67 ± 26	***27.0 ± 3.6***	-	-	-	-	100 ± 0	95 ± 13	92 ± 5	105 ± 2	100 ± 0
		Q4	90 ± 32	*76 ± 22*	*73 ± 21*	***67 ± 45***	153 ± 25	122.8 ± 8.5	90 ± 5	83 ± 17	101 ± 3	104 ± 10	-	-	-	-	-

Bold result significantly lower than Fording River reference (FR_UFR1).

Underline result significantly lower than Elk River reference (GH_ER2).

Italic result significantly lower than Michel Creek reference (CM_MC1).

[shaded box] result significantly lower than South Line Creek reference (LC_SLC).

Note: Q_x = Calendar year quarters.

[a] Results presented as percent survival or endpoint ± standard deviation. Chronic toxicity testing at LC_LC3 was initiated in 2019.

[b] Two test lengths were used to evaluate potential effects *on Ceriodaphnia dubia* reproduction in 2019. These included: 1) a protocol-specified test length (i.e., reproduction was measured when≥60 % of controls produced three or more broods; as per Environment Canada [2007c]); and 2) an 8-day test duration (Golder 2020). These two test lengths were used in 2019 to evaluate potential brood effect. Prior to 2019, the protocol-specified test length was used.

[c] Based on the Permit 107517 and 106970 Chronic Toxicity Program integration amendment (March 4, 2019), chronic toxicity testing of*Hyalella azteca* (28-day test) is required on a semi-annual basis (spring and fall; see Section 2.2.2). Collection of toxicity test samples in early 2019 (Q1) began before the amendment was issued. Therefore, toxicity testing of *H. azteca* in Q1 was completed according to the previous requirements (Permit 107517). *H. azteca* testing was completed in Q3 and Q4 in 2019.

[d] Fathead minnow chronic toxicity testing (30-day early life stage test) at LC_LCDSSLC and LC_LC3 was initiated in 2019.

to test water (Golder 2020). However, inconsistency among test replicates of the same site water were noted in 2019 in both exposed and reference samples, especially in Q4. This variability indicates higher uncertainty in 2019 than for previous years of testing. Testing completed in 2018 also resulted in significantly decreased dry weight in Q4 (after restart of the AWTF with AOP) but survival did not differ from reference throughout 2018 (Table 5.3). Effects to survival of *H. azteca* were therefore comparatively greater in 2019 (during AWTF with AOP restart) than in 2018 (when the AWTF was only operational for 4 months), but the test variability was also higher in 2019.

Fathead minnow chronic toxicity testing was initiated in 2019 at both the Compliance Point (LC_LCDSSLCC) and LC_LC3. Fathead minnow length was significantly reduced at the Compliance Point in Q1 of 2019 relative to all reference samples except South Line Creek (RG_SLC; Table 5.3), and this difference was categorized as no adverse response (Golder 2020). In Q3, decreased survival and biomass were also observed at the Compliance Point relative to two of the four reference samples (Table 5.3) and these effects were categorized as possible adverse responses (Golder 2020). The absence of effects at LC_LC3 (which is located closer to the AWTF discharge than the Compliance Point; Table 5.3) suggests that the observed effects at the Compliance Point may not be related to AWTF operation.

No effects to the early-life-stage survival and viability of rainbow trout were observed in either of the two semi-annual tests conducted in Q2 (spring) and Q4 (fall) at LC_LCDSSLC and LC_LC3 (Table 5.3; Golder 2020). Tests conducted in 2015 at LC_LCDSSLCC (when the AWTF was not operational) also resulted in no significant effects on rainbow trout test endpoints relative to Elk Valley reference samples. Semi-annual tests completed in 2016 (during steady-state AWTF operation) and in 2017 (Q4 only, during AWTF steady-state operation/flow reduction) demonstrated effects in two of four endpoints (Tables 1.1 and 5.3). No effects to rainbow trout were observed 2019 (during AWTF with AOP stabilization), indicating lower toxicity compared to previous time periods when the AWTF was operational.

Overall, acute toxicity testing of AWTF effluent showed no test failures in 2019. Chronic toxicity testing at LC_LC3 and the Compliance Point (LC_LCDSSLCC) indicated that results in 2019 were similar to or showed less toxicity than in prior years (e.g., 2015, 2016, 2017, and 2018) with the exception of *H. azteca*. Greater effects to *H. azteca* survival were observed in 2019 than previous, but test variability was also higher than in previous years. Effects to fathead minnow were observed in 2019 at the Compliance Point, but the spatial pattern of effects (no significant effects at LC_LC3 which is closest to the AWTF discharge) suggested these were not related to AWTF operation. These results were also generally consistent with findings of benthic invertebrate community monitoring over the same time period that indicated no obvious adverse change in community characteristics associated with the AWTF with AOP operation in 2019, but rather an increase in sensitive taxa (Ephemeroptera) at areas furthest downstream from the AWTF discharge which is suggestive of an improvement in benthic invertebrate community structure in 2019.

5.6 Summary

Operation of the AWTF with AOP in 2019 did not significantly change water temperature or dissolved oxygen concentrations downstream in Line Creek. Evaluation of water quality analytes with early warning triggers also demonstrated no increases in analyte concentrations in 2019 during AWTF with AOP operation relative to previous years. Also, toxicity test data did not reliably indicate greater toxicity in 2019 compared to previous years. Overall, there did not appear to be influences on aquatic biota associated with the WLC AWTF with AOP operations in 2019 that were not already being addressed through monitoring related to Study Questions #1 (productivity) and #2 (tissue selenium accumulation).

6 SUMMARY

Potential effects to the aquatic environment related to the commissioning of the WLC AWTF were evaluated by addressing three study questions which focus on: 1) potential effects to biological productivity; 2) selenium concentrations in biota; and 3) potential effects related to factors other than nutrients or selenium.

Evaluation of Study Question #1 (potential influences on biological productivity) indicated that aqueous total phosphorus concentrations at the Compliance Point (LC_LCDSSLCC) were consistently below the SPO of 0.02 mg/L during the 2019 growing season. In 2019, concentrations of nutrients (total phosphorus, orthophosphate, and nitrate) were generally in the ranges of concentrations observed in previous years (Table 6.1). In addition, results suggested that operation of the AWTF with AOP in 2019 was more successful at minimizing phosphorus and orthophosphate contributions to the receiving environment than operation of the AWTF without AOP (in 2016 and 2017).

Periphyton coverage at both mine-exposed and reference areas was moderate in 2019 (based on visual assessment) and was temporally consistent with results from 2017 and 2018. Benthic invertebrate biomass and density at mine-exposed areas of Line Creek also showed no significant change in 2019 related to operation of the AWTF with AOP. Benthic invertebrate total abundance (measured by kick and sweep) was higher in 2019 than previous years at most mine-exposed areas, but the absence of a change closest to the AWTF discharge indicated that this was likely unrelated to AWTF with AOP operation (consistent with the biomass and density results). Benthic invertebrate community endpoints, as determined from kick and sweep sample collection, indicated no adverse change in community characteristics related to operation stabilization of the AWTF with AOP in 2019. Rather, an increase in the percentage of sensitive taxa (Ephemeroptera) in 2019 at areas of Line Creek furthest downstream from the AWTF discharge was suggestive of an improvement in benthic invertebrate community structure (Table 6.1).

Overall, assessment of Study Question #1 indicated that biological productivity downstream from the WLC AWTF was not affected by the operational stabilization of the AWTF with AOP throughout 2019, relative to previous years.

Evaluation of Study Question #2 (assessment of selenium concentrations) focused on aqueous selenium concentrations and selenium concentrations in biota. Aqueous selenium throughout the Elk Valley is primarily in the oxidized form, selenate, and chemically-reduced forms of aqueous selenium (such as selenite or organoselenium species) are present at much lower concentrations (typically ~1% of the total aqueous selenium). Although the WLC AWTF without AOP successfully

Table 6.1: Summary of Measurement Endpoints, Analyses, and Results of Line Creek LAEMP, 2019

Study Question	Water				Biological			
	Measurement Endpoint	Indicator	Analysis/Evaluation	Result	Measurement Endpoint	Indicator	Analysis/Evaluation	Result
Is active water treatment affecting biological productivity downstream in Line Creek?	Nutrient concentrations	Nitrate	**1)** Comparison to SPO **2)** Comparison to BCWQG and Water Quality Benchmarks	**1)** Nitrate in 2019 was below the SPO except for 4 days in March/April and 4 days in November/December. **2)** Concentrations > BCWQG at all exposed areas. Concentrations > Level 1 and Level 2 benchmarks at exposed areas of Line Creek upstream and immediately downstream of the AWTF discharge.	Periphyton productivity	Visual Coverage Scores	Coverage scored according to CABIN guidance (Environment Canada 2012)	Coverage scored as moderate at mine-exposed and mild-moderate at reference stations, similar to previous years.
					Benthic invertebrate productivity	Biomass	ANOVA analysis among years = 2014 to 2019 Areas: Ref = RG_SLINE, RG_LI24; Exp = RG_LILC3, RG_LIDSL	No adverse effect associated with AWTF with AOP operation in 2019. Significant decrease in 2019 compared to 2014 and 2017 at RG_LIDSL (relative to reference over the same time period), but this represents a change towards greater similarity with reference.
						Density	ANOVA analysis among years = 2014 to 2019 Areas: Ref = RG_SLINE, RG_LI24; Exp = RG_LILC3, RG_LIDSL	No adverse effect associated with AWTF with AOP operation in 2019. Significant decrease in 2019 compared to 2014 at Exp areas, relative to RG_SLINE reference over the same time period. Significant decrease in 2019 compared to 2018 at RG_LIDSL, relative to RG_LI24 reference over the same time period. Significant differences relative to Ref areas related to an increase in density at the Ref areas in 2019 rather than deceased density at the Exp areas.
		Total Phosphorus	**1)** Comparison to SPO **2)** Comparison to the LC_LC3 baseline 97.5th percentile	**1)** Phosphorus did not exceed SPO in 2019. **2)** Concentrations in 2019 below the LC_LC3 baseline with the exception of March.	Benthic invertebrate community structure	Abundance	Comparison to past observations and reference normal range (NR)	No evidence of adverse effect on secondary productivity associated with AWTF with AOP operation in 2019. Organism abundance at Exp areas within or higher than NR in 2019, and showed a temporal increase from prior years except at RG_LILC3. Absence of temporal increase immediately downstream of AWTF discharge indicates increase is likely not related to AWTF operation.
						Richness	Comparison to past observations and reference normal range (NR)	No evidence of adverse effect associated with AWTF with AOP operation in 2019. Majority of results within or above NR, except one replicate at RG_LCUT and RG_LILC3. Richness at RG_LILC3 in 2019 was more similar to before AWTF operation (2012 and 2013), therefore results not indicative of an adverse effect of AWTF operation.
		Orthophosphate	Comparison to the LC_LC3 baseline 97.5th percentile	Concentrations in 2019 below the LC_LC3 baseline.		%EPT, %Ephemeroptera (%E), %Chironomidae (%C)	Comparison to past observations and reference normal range (NR)	No evidence of adverse effect associated with AWTF with AOP operation in 2019. %E and % EPT below NR (particularly immediately downstream of the AWTF discharge) but within range of previous years. %E in 2019 increased further downstream from AWTF discharge (RG_LIDSL, RG_LIDCOM, RG_LI8) and within NR. %C downstream of AWTF discharge within range of previous years.

Notes: Ref = Reference sampling station/area; Exp = Mine-exposed sampling station/area; SPO = Site Performance Objective; BCWQG = British Columbia Water Quality Guideline; NR = Regional normal range of reference area data from the RAEMP (see Minnow 2018a for details); BT = Bull trout; WCT = Westslope cutthroat trout. Water quality benchmarks are those outlined in Teck (2014).

Table 6.1: Summary of Measurement Endpoints, Analyses, and Results of Line Creek LAEMP, 2019

<table>
<tr><th rowspan="2">Study Question</th><th colspan="4">Water</th><th colspan="4">Biological</th></tr>
<tr><th>Measurement Endpoint</th><th>Indicator</th><th>Analysis/Evaluation</th><th>Result</th><th>Measurement Endpoint</th><th>Indicator</th><th>Analysis/Evaluation</th><th>Result</th></tr>
<tr><td rowspan="6">Are tissue selenium concentrations reduced downstream from the AWTF?</td><td colspan="2">Total and dissolved selenium concentrations</td><td>1) ANOVA analysis: 2012 to 2019 for total Se at LC_LC1

2) Visual inspection of data</td><td>1) Significant increases in total Se in 2014, 2015, and 2017. No change between 2017 and 2019.

2) General decrease in total [Se] downstream of the AWTF discharge during AWTF with AOP operation in 2019, except November 2019 when AWTF was in scheduled maintenance for 7 days.</td><td rowspan="3">Tissue Selenium</td><td rowspan="2">Composite-taxa samples</td><td rowspan="2">1) ANOVA analysis: Before = 2012; Initial Operations = 2014; Steady-state without AOP = 2016 to 2017; Shutdown = Mar to Aug 2018; AWTF with AOP Restart = Oct 2018 to Dec 2019; Post-hoc contrasts limited to AWTF with AOP restart vs. Steady-state and Before, and within AWTF with AOP restart period.
Areas: Ref = RG_SLINE, RG_LI24; Exp = RG_LCUT, RG_LILC3, RG_LISP24, RG_LIDSL, RG_LIDCOM, RG_LI8, RG_FRUL, RG_FO23

2) Spatial analysis using ANOVA during each sampling event (Dec 2018 to Dec 2019)

3) Comparison to reference normal range (NR)

4) Comparison to site-specific benchmarks</td><td rowspan="2">1) Significant decrease in tissue [Se] during AWTF with AOP restart compared to steady-state (without AOP) at all Exp areas downstream of the AWTF, relative to change at reference over the same period. Tissue [Se] in AWTF with AOP period similar to Before period (where data available), relative to change at reference. During the AWTF with AOP restart, tissue [Se] was lower between Apr and Sept than earlier and later in the restart period (relative to changes in reference over the same period) which is consistent with lower concentrations of aqueous non-selenate species in these months.

2) Tissue [Se] in Line Creek downstream of AWTF discharge similar to reference and/or upstream of AWTF (RG_LCUT) throughout AWTF with AOP restart period, except RG_LILC3. Spatial extent of elevated tissue [Se] limited to immediately downstream of AWTF discharge.

3) The majority of tissue [Se] results at Exp areas in Line Creek downstream of the AWTF (except RG_LILC3) were within or only slightly higher than NR.

4) Mean tissue [Se] at Line Creek areas downstream of AWTF discharge were below the EVWQP Level 1 Benchmark throughout AWTF with AOP restart.</td></tr>
<tr><td colspan="2" rowspan="2">Selenium speciation</td><td rowspan="2">Comparison downstream relative to upstream from the AWTF, and of Line Creek input to Fording River</td><td rowspan="2">Lower concentrations of selenite and other non-selenate species in Line Creek downstream of the AWTF discharge during AWTF with AOP restart relative to concentrations during steady-state without AOP.

Concentrations of non-selenate concentrations in 2019 highest early in the AWTF with AOP restart period (Jan to Apr 2019) and lowest during summer (May to August).</td></tr>
<tr><td>Fish (WCT and BT)</td><td>Comparison to past observations and site-specific benchmarks</td><td>WCT: Fish muscle [Se] and estimated ovary [Se] were below Level 1 benchmark and similar to initial AWTF operation ranges (2001 to 2012), except for a single sample of eggs released during non-lethal sampling. Tissue [Se] of fish captured near the AWTF discharge were much lower in 2019 than 2017.

BT: Muscle [Se] of young male/female bull trout from near the AWTF discharge was much lower in 2019 than during AWTF steady-state operation without AOP. Muscle [Se] remains higher in fish presumed to be resident (juveniles) than in larger adults presumed to be migratory spawners, consistent with previous results (Minnow 2018d, 2019a).</td></tr>
<tr><td colspan="2" rowspan="3">Selenium bioaccumulation model</td><td rowspan="3">Comparison of composite-taxa benthic tissue selenium results to one-step water-to-invertebrate model</td><td rowspan="3">All tissue selenium concentrations reported during the AWTF with AOP restart period fall within the model prediction intervals.</td><td rowspan="3">Benthic invertebrate community structure</td><td>Abundance</td><td>Comparison to past observations and reference normal range (NR)</td><td>No evidence of adverse effect on secondary productivity associated with AWTF with AOP operation in 2019. Organism abundance at Exp areas within or higher than NR in 2019, and showed a temporal increase from prior years except at RG_LILC3. Absence of temporal increase immediately downstream of AWTF discharge indicates increase is likely not related to AWTF operation.</td></tr>
<tr><td>Richness</td><td>Comparison to past observations and reference normal range (NR)</td><td>No evidence of adverse effect associated with AWTF with AOP operation in 2019. Majority of results within or above NR, except one replicate at RG_LCUT and RG_LILC3. Richness at RG_LILC3 in 2019 was more similar to before AWTF operation (2012 and 2013), therefore results not indicative of an adverse effect of AWTF operation.</td></tr>
<tr><td>%EPT, %E, %C</td><td>Comparison to past observations and reference normal range (NR)</td><td>No evidence of adverse effect associated with AWTF with AOP operation in 2019. %E and % EPT below NR (particularly immediately downstream of the AWTF discharge) but within range of previous years. %E in 2019 increased further downstream from AWTF discharge (RG_LIDSL, RG_LIDCOM, RG_LI8) and within NR. %C downstream of AWTF discharge within range of previous years.</td></tr>
</table>

Notes: Ref = Reference sampling station/area; Exp = Mine-exposed sampling station/area; SPO = Site Performance Objective; BCWQG = British Columbia Water Quality Guideline; NR = Regional normal range of reference area data from the RAEMP (see Minnow 2018a for details); BT = Bull trout; WCT = Westslope cutthroat trout. Water quality benchmarks are those outlined in Teck (2014).

Table 6.1: Summary of Measurement Endpoints, Analyses, and Results of Line Creek LAEMP, 2019

Study Question	Water				Biological			
	Measurement Endpoint	Indicator	Analysis/Evaluation	Result	Measurement Endpoint	Indicator	Analysis/Evaluation	Result
Is AWTF operation affecting aquatic biota through thermal effects, effects on dissolved oxygen concentrations or concentrations of treatment-related constituents other than nutrients or selenium?	Temperature	Data loggers	Comparison downstream relative to upstream of the AWTF	No evidence that AWTF with AOP operation increased downstream temperature in 2019 when compared to upstream data logger and discrete temperature measures.	Benthic invertebrate community structure	Abundance	Comparison to past observations and reference normal range (NR)	No evidence of adverse effect on secondary productivity associated with AWTF with AOP operation in 2019. Organism abundance at Exp areas within or higher than NR in 2019, and showed a temporal increase from prior years except at RG_LILC3. Absence of temporal increase immediately downstream of AWTF discharge indicates increase is likely not related to AWTF operation.
	Temperature	Routine monitoring	Comparison to BCWQG	Temperatures within or below guideline temperature ranges for both bull trout and westslope cutthroat trout.				
	Dissolved oxygen		Comparison to BCWQG	DO concentrations in 2019 > instantaneous minimum criterion and > 30-day average for all other life stages but < 30-day criterion for sensitive life stages. Mean DO < BCWQG both upstream and downstream of AWTF in 2019, suggesting this was not due to AWTF with AOP operation.		Richness	Comparison to past observations and reference normal range (NR)	No evidence of adverse effect associated with AWTF with AOP operation in 2019. Majority of results within or above NR, except one replicate at RG_LCUT and RG_LILC3. Richness at RG_LILC3 in 2019 was more similar to before AWTF operation (2012 and 2013), therefore results not indicative of an adverse effect of AWTF operation.
	Analytes with Early Warning Triggers		**1)** Comparison to past results **2)** Comparison to BCWQG **3)** Comparison to Water Quality Benchmarks	**1)** No obvious temporal increases in analyte concentrations associated with AWTF with AOP operation in 2019. **2)** Long-term BCWQG exceeded in 2019 by [NO$_3$], [NH$_3$], [SO$_4$], total [Se] and [Hg], dissolved [Cd] and [Cu] upstream and downstream of AWTF discharge. Short-term BCWQG exceeded by [NH$_3$] and dissolved [Cd] upstream of the AWTF only. **3)** Level 1 EVWQP benchmark exceeded by [TDS], [SO$_4$], and dissolved [Cd], and Level 2 EVWQP benchmark exceeded by [NO$_3$] and total [Se] upstream and downstream of AWTF discharge. Interim Level 1 benchmark for total [Ni] exceeded upstream and downstream of AWTF, and interim Level 2 and 3 benchmarks exceeded upstream of ATWF only.				
	Toxicity		Comparison of acute and chronic toxicity test results to reference, and past results	All acute toxicity testing met criterion (< 50% mortality). Majority of chronic toxicity testing results at Compliance Point similar to or showed less toxicity than past years (2015 to 2018) except *H. azteca*. Chronic effects to fathead minnow were not spatially consistent with an AWTF-related effect. Overall, results do not reliably suggest greater toxicity in 2019 associated with AWTF with AOP operation. Chronic toxicity testing was initiated at LC_LC3 in 2019.		%EPT, %E, %C	Comparison to past observations and reference normal range (NR)	No evidence of adverse effect associated with AWTF with AOP operation in 2019. %E and % EPT below NR (particularly immediately downstream of the AWTF discharge) but within range of previous years. %E in 2019 increased further downstream from AWTF discharge (RG_LIDSL, RG_LIDCOM, RG_LI8) and within NR. %C downstream of AWTF discharge within range of previous years.

Notes: Ref = Reference sampling station/area; Exp = Mine-exposed sampling station/area; SPO = Site Performance Objective; BCWQG = British Columbia Water Quality Guideline; NR = Regional normal range of reference area data from the RAEMP (see Minnow 2018a for details); BT = Bull trout; WCT = Westslope cutthroat trout. Water quality benchmarks are those outlined in Teck (2014).

decreased concentrations of total selenium in Line Creek, the effluent contained higher proportions of chemically-reduced selenium species, some of which are known to be more readily accumulated than selenate by aquatic biota. The AWTF was recommissioned in 2018 with an AOP, which is designed to reverse the shift in selenium species in AWTF effluent from chemically-reduced species back to a selenate-dominated condition, thereby reducing the bioavailability of selenium in Line Creek.

Benthic invertebrate tissue monitoring in Line Creek identified substantially lower selenium concentrations in 2019, during operation stabilization of AWTF with AOP, compared to concentrations during steady-state operation of the AWTF without AOP. In 2019, mean benthic invertebrate selenium concentrations were below the EVWQP Level 1 benchmark at all areas downstream of the AWTF discharge. Temporal changes in benthic invertebrate selenium concentrations during operation of the AWTF with AOP in 2019 were consistent with the observed temporal changes in concentrations of aqueous non-selenate species, and comparison of benthic invertebrate selenium concentrations throughout 2019 to the selenium bioaccumulation model indicated that selenium bioaccumulation was "as expected". Selenium concentrations in juvenile bull trout and westslope cutthroat trout captured near the AWTF discharge in 2019 were substantially lower than those reported in 2017 (Table 6.1). Furthermore, selenium concentrations in westslope cutthroat tissues in 2019 were below the EVWQP Level 1 benchmark, with the exception of a single sample.

Overall, assessment of Study Question #2 in 2019 indicated that aqueous selenium speciation, benthic invertebrate tissue selenium, and fish tissue selenium monitoring results support the conclusion that the recommissioned AWTF with AOP is functioning as intended to decrease the concentrations of non-selenate species in AWTF effluent, and reduce selenium bioaccumulation in Line Creek. Further monitoring during the transition of the AWTF with AOP from operation stabilization to full operations (i.e., steady-state operation) will be useful in confirming these results.

Evaluation of Study Question #3 (potential effects related to factors other than nutrients or selenium). Operation of the AWTF with AOP in 2019 did not significantly change water temperature or dissolved oxygen concentrations downstream in Line Creek. Evaluation of water quality analytes with early warning triggers also demonstrated no changes in analyte concentrations in 2019 related to operation of the AWTF with AOP. Also, toxicity test data did not reliably indicate greater toxicity in 2019 compared to previous years. Overall, there did not appear to be influences on aquatic biota associated with the WLC AWTF with AOP operations in 2019 that were not already being addressed through monitoring related to Study Questions #1 (productivity) and #2 (tissue selenium accumulation; Table 6.1).

The results from the Line Creek LAEMP provide information that supports Teck's Adaptive Management Program (Teck 2018) and Table 6.2 summarizes material presented in this report that is relevant to the AMP. The AWTF entered into the steady-state phase of operation (with AOP) in late March 2020, and operational changes in 2020 are not anticipated. As such, benthic invertebrate selenium monitoring requirements will not be driven by the AWTF operational timeline in 2020, but will focus on aligning with long term monitoring cycles and adapting the timing of monitoring to be more biologically relevant (i.e., before and after westslope cutthroat trout spawning in the spring; Minnow 2020).

Table 6.2: **Summary of Findings, Responses and Adjustments Related to the LCO LAEMP in 2019**

Key Question(s)	Data Evaluation Process	Outcome(s)	Responses & Adjustments in 2019	EMC Engagement
Is active water treatment affecting biological productivity downstream in Line Creek?	1. Determine if there is an increase in benthic invertebrate biomass, or shift in community structure that has been demonstrated to correspond with changes in AWTF operational status and changes in parameters associated with productivity (e.g., nutrient concentrations)	No evidence of effect on productivity associated with WLC AWTF with AOP operation in 2019.	None	-Proposed 2019 study design discussed at in-person meeting March 5, 2019. -2019 Study Design submitted to ENV/EMC May 1, 2019. -Draft data package of subset of 2019 results submitted to EMC October 25, 2019. -Written input from EMC on November draft data package received November 29, 2019 -Draft data package of 2019 results and outline of proposed 2020 Study Design submitted to EMC February 12, 2020 and discussed by tele-conference February 18, 2020. - Written input from EMC on February draft data package and proposed 2020 Study Design received March 11, 2020
Are tissue selenium concentrations reduced downstream from the WLC AWTF?	2. Determine if there is a change in benthic invertebrate and fish tissue selenium concentrations over time that corresponds to changes in total selenium concentrations or selenium speciation in water. Benthic invertebrate community data being collected for other purposes can be used as supporting evidence of ecosystem health status downstream from the AWTF.	The WLC AWTF was recommissioned with an AOP in late 2018 in response to significantly increased concentrations of chemically-reduced aqueous selenium species and increase selenium concentrations in tissues of aquatic biota downstream of the AWTF outfall in Line Creek in 2016 and 2017. Monitoring results from 2019 indicated the recommissioned AWTF with AOP is functioning as intended to decrease aqueous concentrations of non-selenate species in AWTF effluent and reduce selenium bioaccumulation in Line Creek.	- WLC AWTF was re-commissioned in August 2018 with AOP to modify chemically reduced selenium species in effluent back to a selenate-dominated condition having lower selenium bioavailability. The AWTF with AOP operated in a stabilization phase throughout 2019 - Adjustment of timing of benthic invertebrate tissue selenium sampling in early 2019 to better align with changes in the AWTF recommissioning schedule (sampling was completed in January and February). - Addition of monthly benthic invertebrate tissue selenium sampling between May and August 2019 to further evaluate AWTF with AOP performance during operation stabilization. This monthly sampling was beyond the scope of the 2019 LCO LAEMP study design. -Adjustment of benthic invertebrate tissue selenium sampling events for the 2020 LCO LAEMP study design to focus on biologically	

Table 6.2: **Summary of Findings, Responses and Adjustments Related to the LCO LAEMP in 2019**

Key Question(s)	Data Evaluation Process	Outcome(s)	Responses & Adjustments in 2019	EMC Engagement
Are tissue selenium concentrations reduced downstream from the WLC AWTF?			relevant times (e.g., before and after westslope cutthroat trout spawning) rather than AWTF operational timelines.	
Is AWTF operation affecting aquatic biota through thermal effects, effects on dissolved oxygen concentrations or concentrations of treatment-related constituents other than nutrients or selenium?	3a. Temperatures that are above/below the guideline, and dissolved oxygen concentrations that are above the threshold for effects to fish outside of the initial mixing zone, and confirmation that the mixing zone is small, will be indicative of effective management of treated water discharge. Benthic invertebrate community data being collected for other purposes can be used as supporting evidence of ecosystem health status downstream from the AWTF. 3b. Determine if there is a change in benthic invertebrate community endpoints away from the reference condition that does not correspond to observed changes in nutrients or selenium concentrations. 3c. Determine if there is a change in acute or chronic toxicity testing results that corresponds with a change in WLC AWTF operational status.	AWTF operations did not significantly influence water temperature or dissolved oxygen concentrations. Evaluation of water quality parameters, including treatment-related constituents, demonstrated no obvious increases in concentrations during AWTF with AOP operation. Acute and chronic toxicity test data did not reliably indicate greater toxicity in 2019 compared to previous years.	None	

WLC = West Line Creek; ATWF = Active Water Treatment Facility; LAEMP = Local Aquatic Effects Monitoring Program; AOP = Advanced Oxidation Process.

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APPENDIX A
SUPPORTING DATA – PRODUCTIVITY EVALUATION

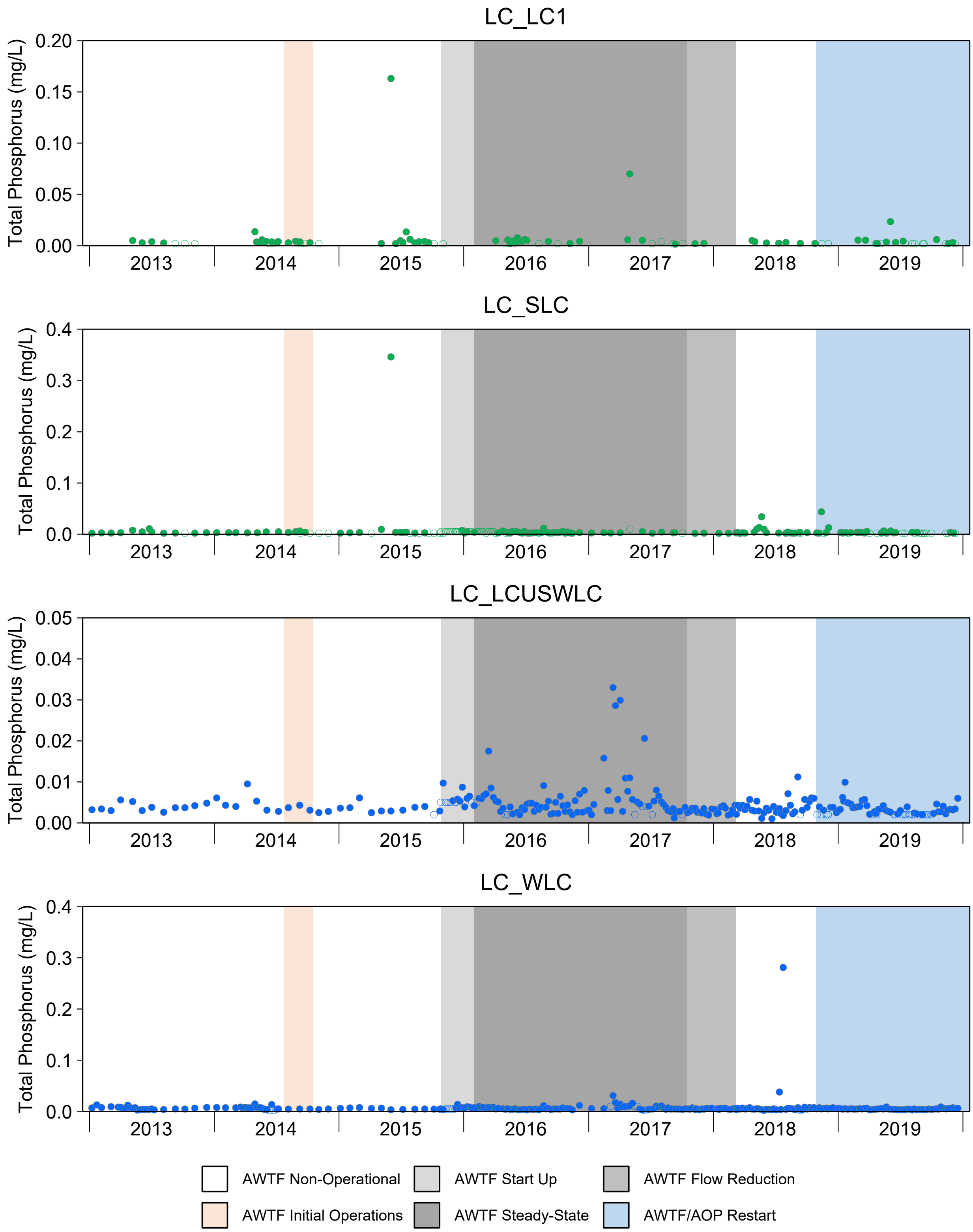
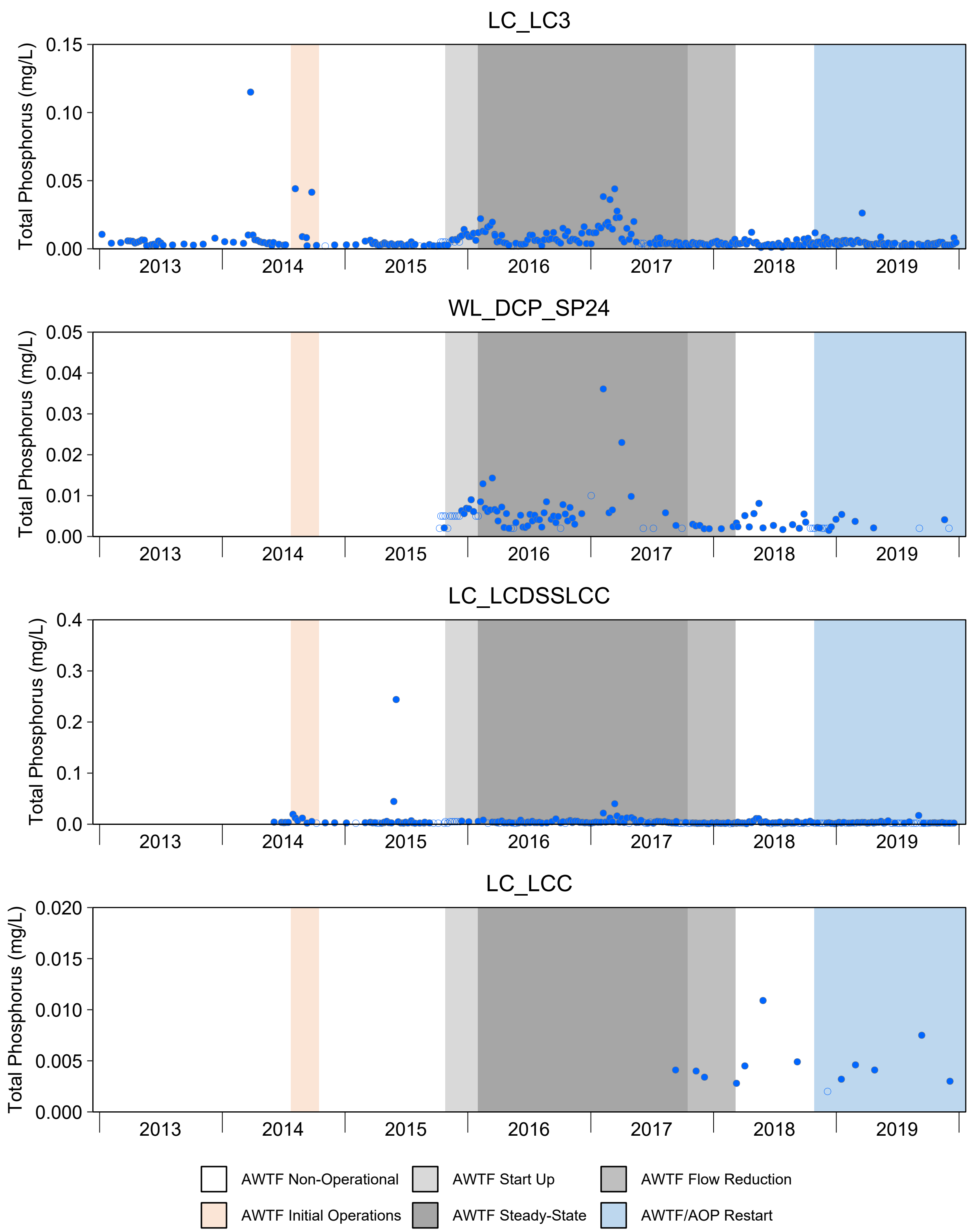


Figure A.1: Time Series Plots for Aqueous Total Phosphorus Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.



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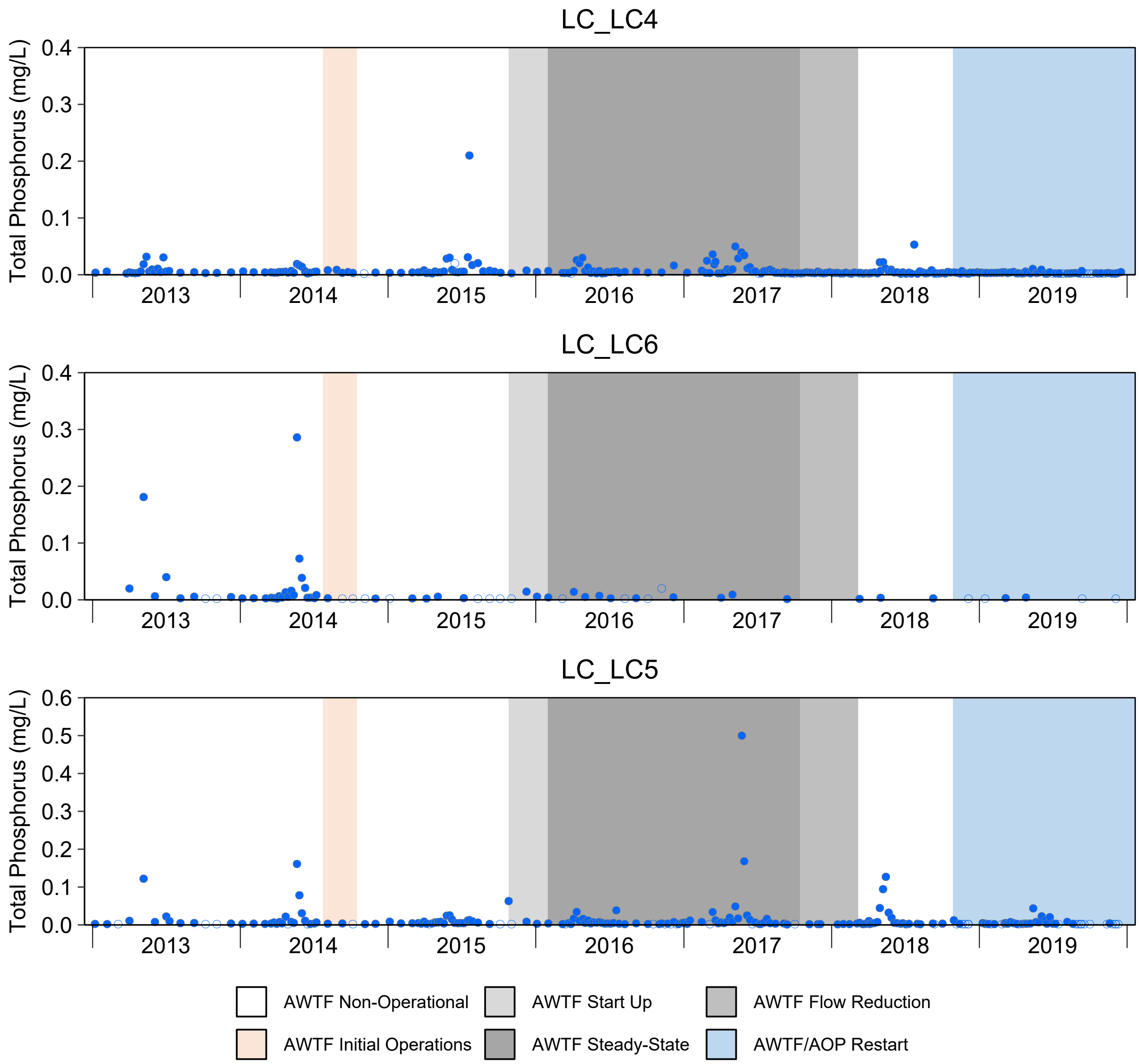

Figure A.1: Time Series Plots for Aqueous Total Phosphorus Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

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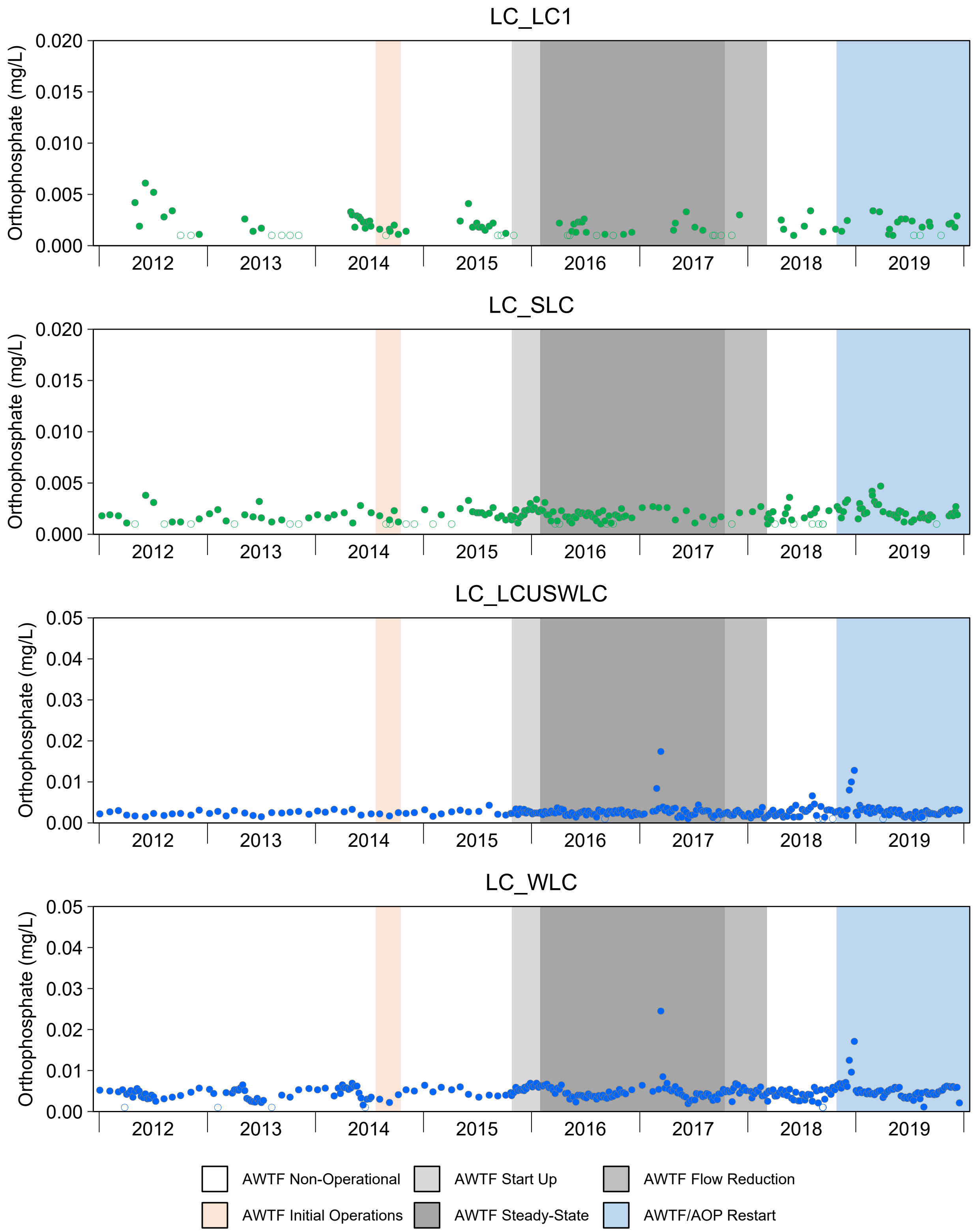

Figure A.2: Time Series Plots for Aqueous Orthophosphate Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

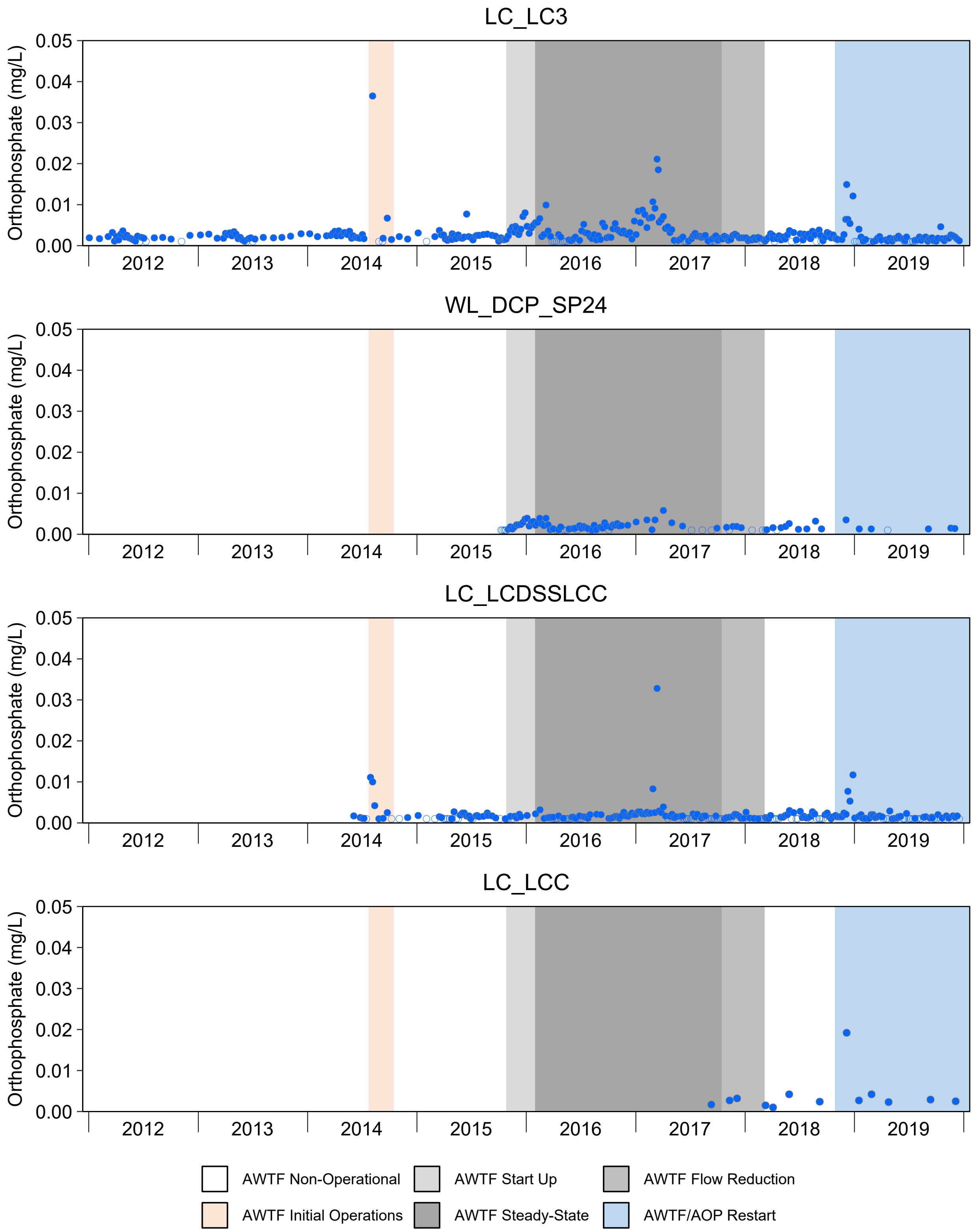

Figure A.2: Time Series Plots for Aqueous Orthophosphate Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

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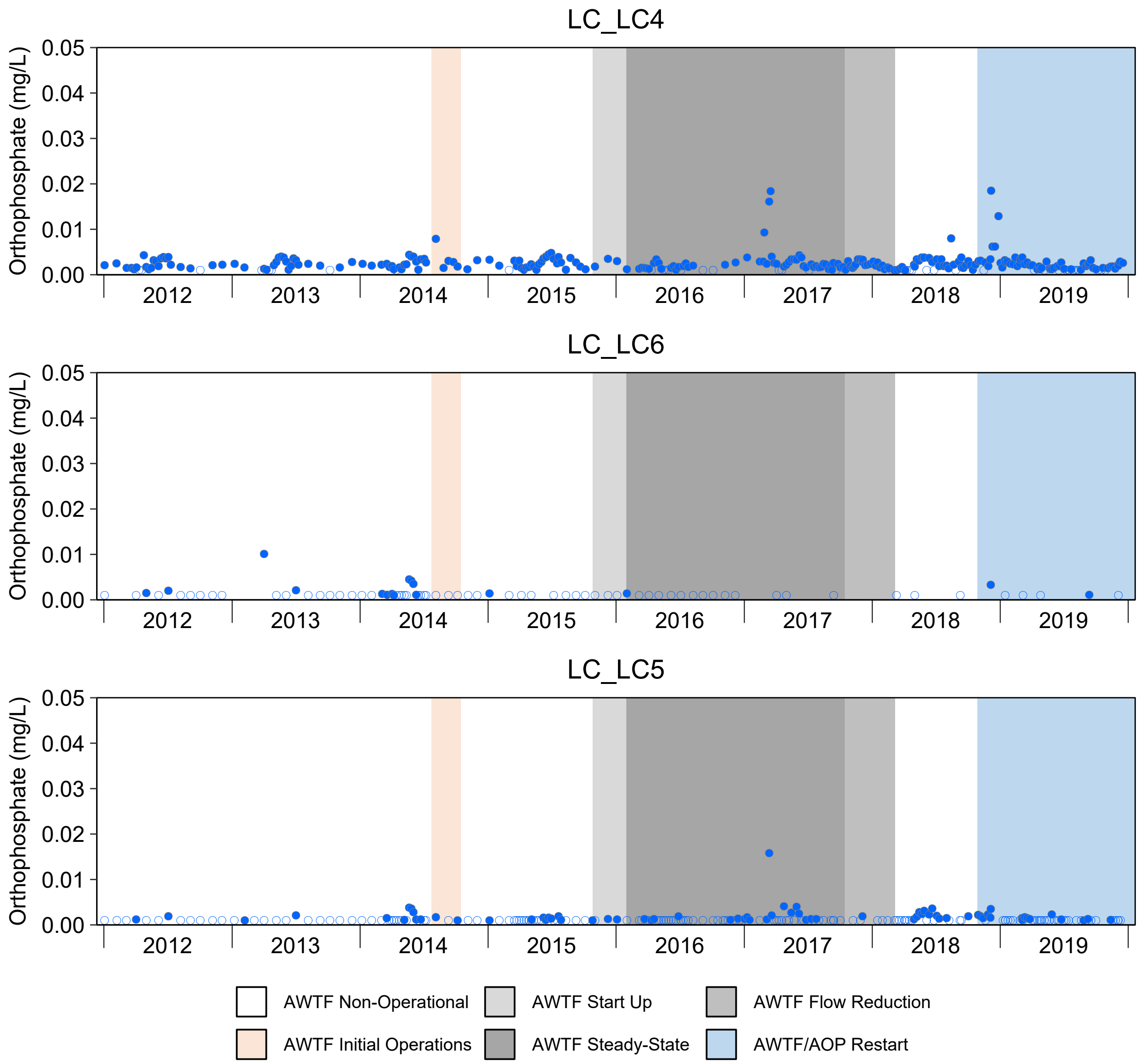

Figure A.2: Time Series Plots for Aqueous Orthophosphate Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

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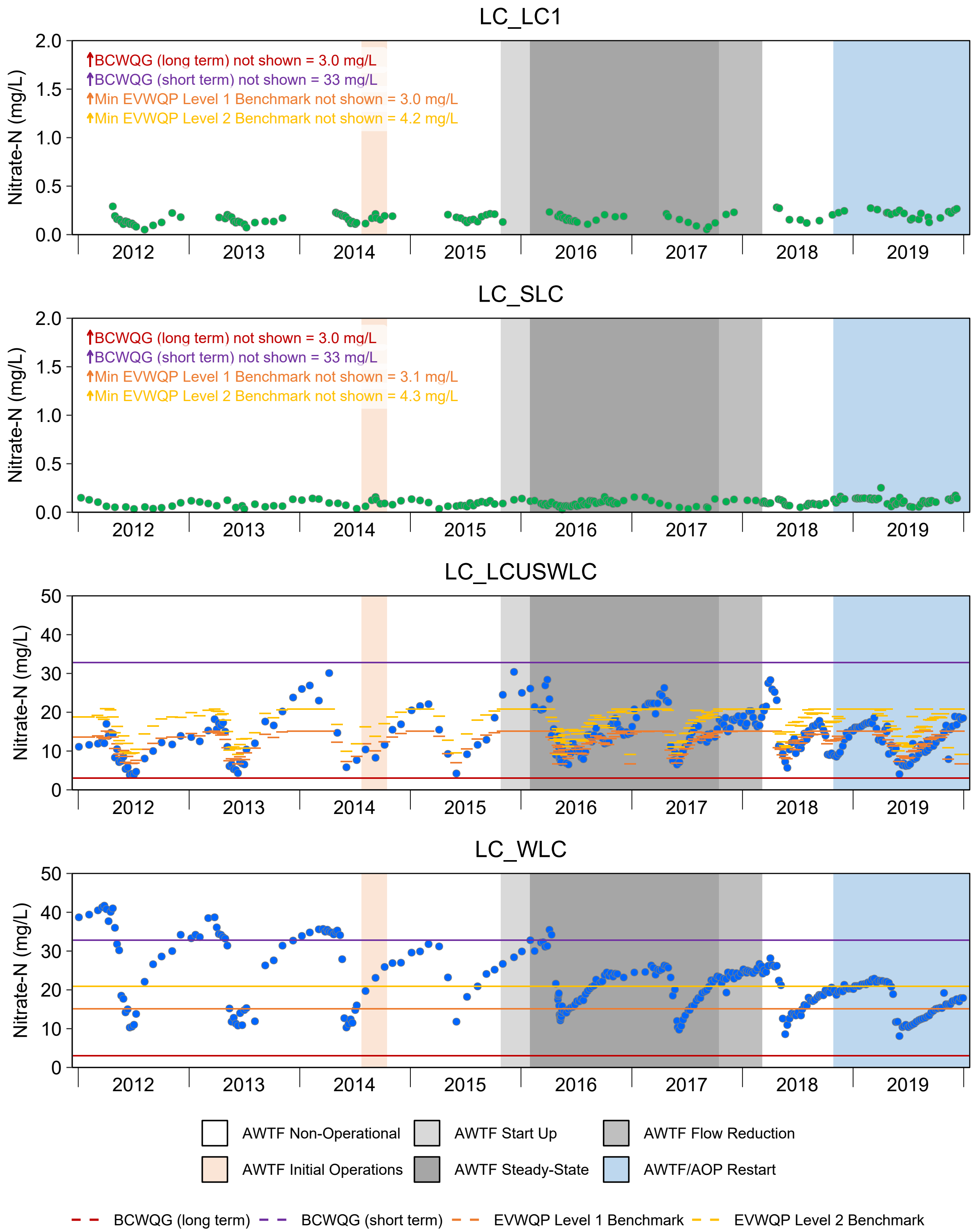

Figure A.3: Time Series Plots for Aqueous Total Nitrate (NO_3 as N) Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines; EVWQP = Elk Valley Water Quality Plan. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Benchmark values are dependent on water hardness. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

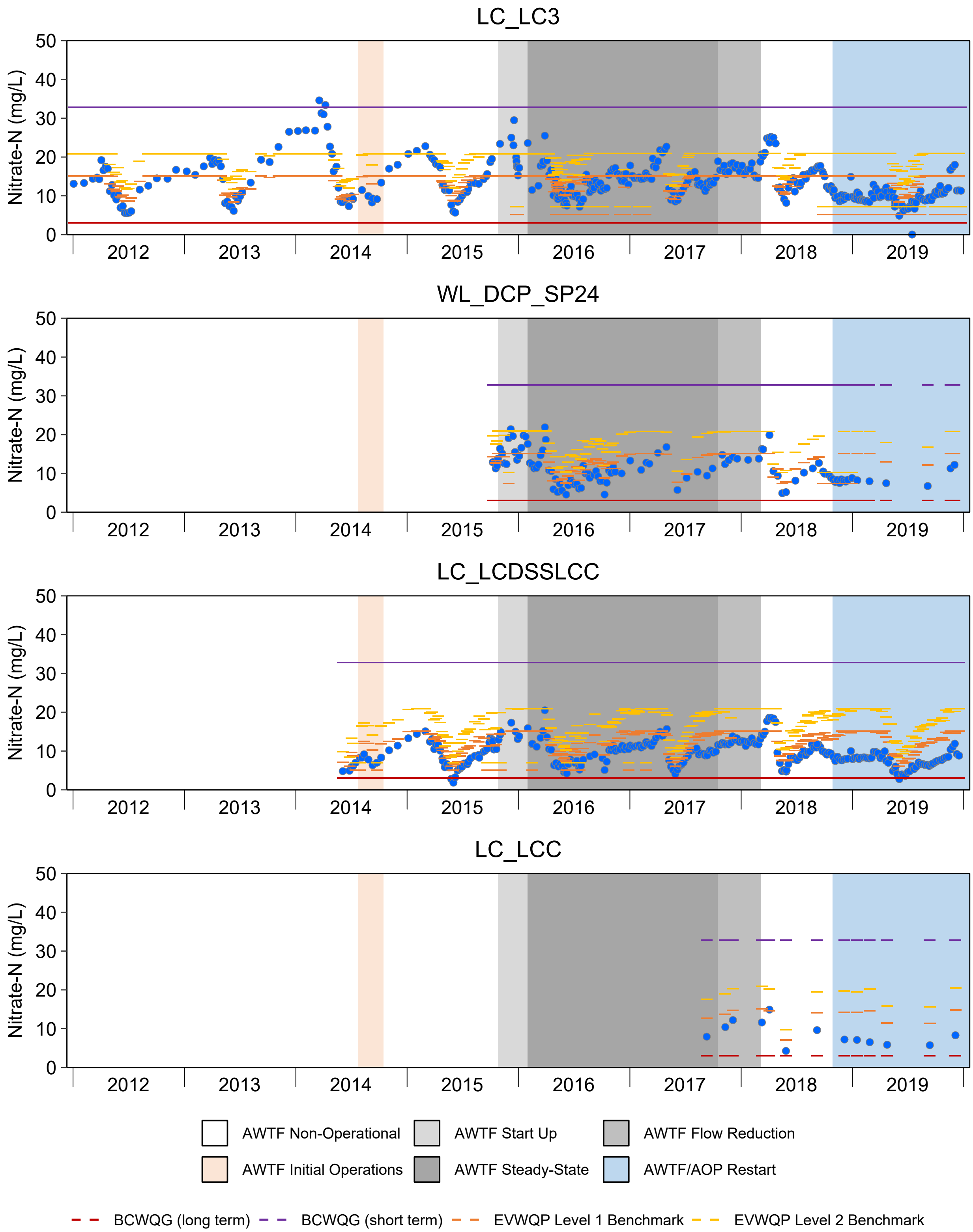

Figure A.3: Time Series Plots for Aqueous Total Nitrate (NO3 as N) Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines; EVWQP = Elk Valley Water Quality Plan. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Benchmark values are dependent on water hardness. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

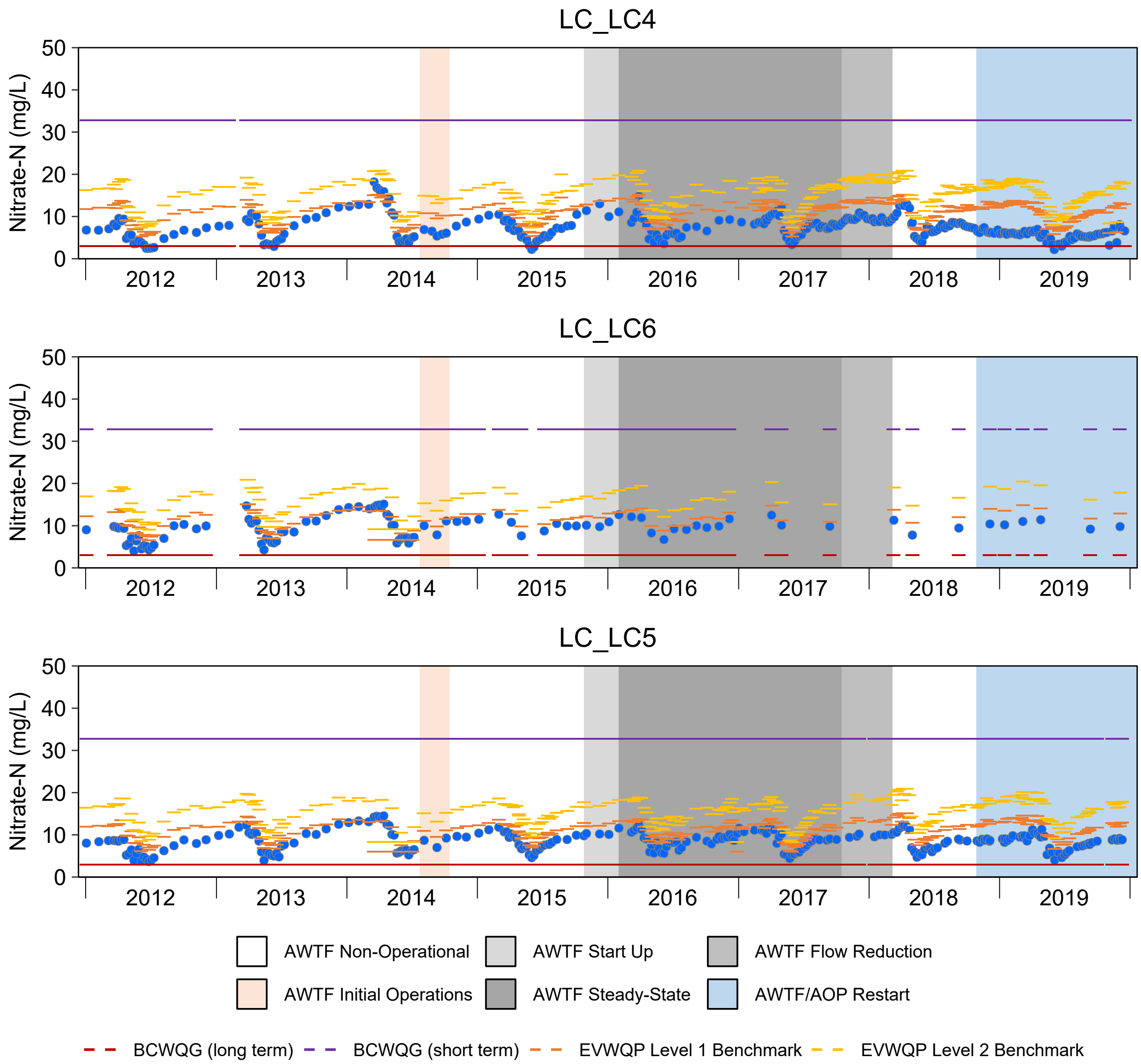

Figure A.3: Time Series Plots for Aqueous Total Nitrate (NO3 as N) Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines; EVWQP = Elk Valley Water Quality Plan. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Benchmark values are dependent on water hardness. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

Figure A.4: Periphyton Coverage and Site Photograph at Station RG_LI24 (Reference), September 2019

Note: Site photo was taken looking upstream.

Figure A.4: Periphyton Coverage and Site Photograph at RG_SLINE (Reference), September 2019

Note: Site photo was taken looking upstream.

Figure A.4: Periphyton Coverage and Site Photograph at RG_LCUT (Exposed), September 2019

Note: Site photo was taken looking upstream.

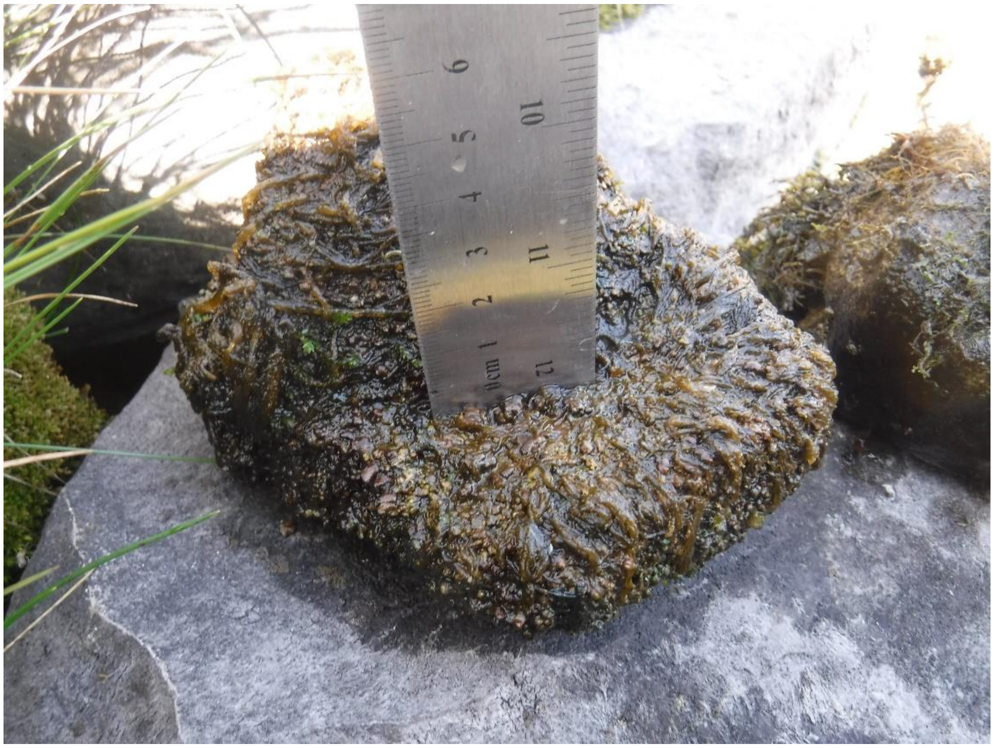

Figure A.4: Periphyton Coverage and Site Photograph at RG_LILC3 (Exposed), September 2019

Note: Site photo was taken looking upstream.

Figure A.4: Periphyton Coverage and Site Photograph at RG_LISP24 (Exposed), September 2019

Note: Site photo was taken looking upstream.

Figure A.4: Periphyton Coverage and Site Photograph at RG_LIDSL (Exposed), September 2019

Note: Site photo was taken looking upstream.

Figure A.4: Periphyton Coverage and Site Photograph at RG_LIDCOM (Exposed), September 2019

Note: Site photo was taken looking upstream.

Figure A.4: Periphyton Coverage and Site Photograph at RG_LI8 (Exposed), September 2019

Note: Site photo was taken looking upstream.

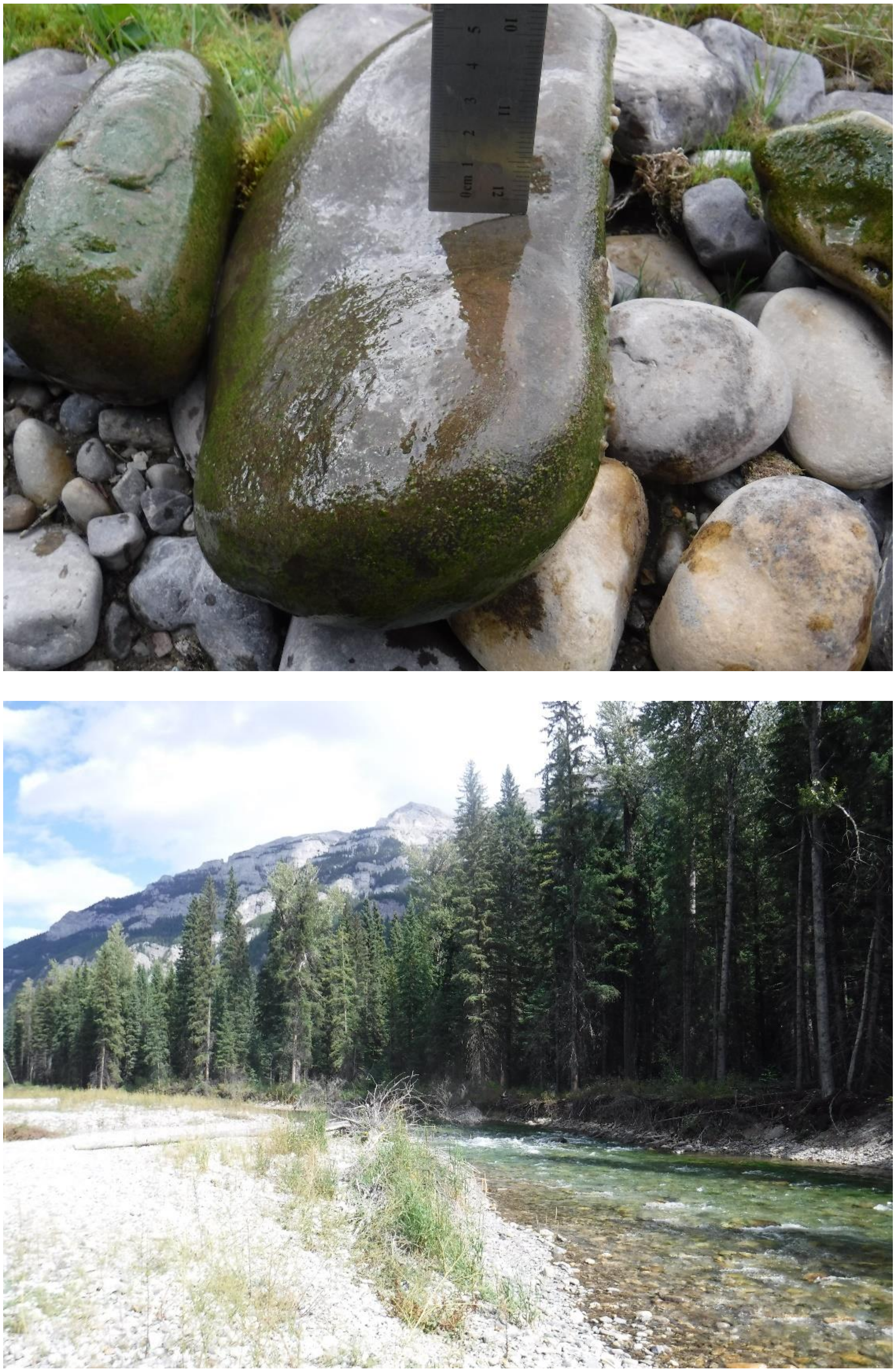

Figure A.4: Periphyton Coverage and Site Photograph at RG_FRUL (Exposed), September 2019

Note: Site photo was taken looking upstream.

Figure A.4: Periphyton Coverage and Site Photograph at RG_FO23 (Exposed), September 2019

Note: Site photo was taken looking upstream.

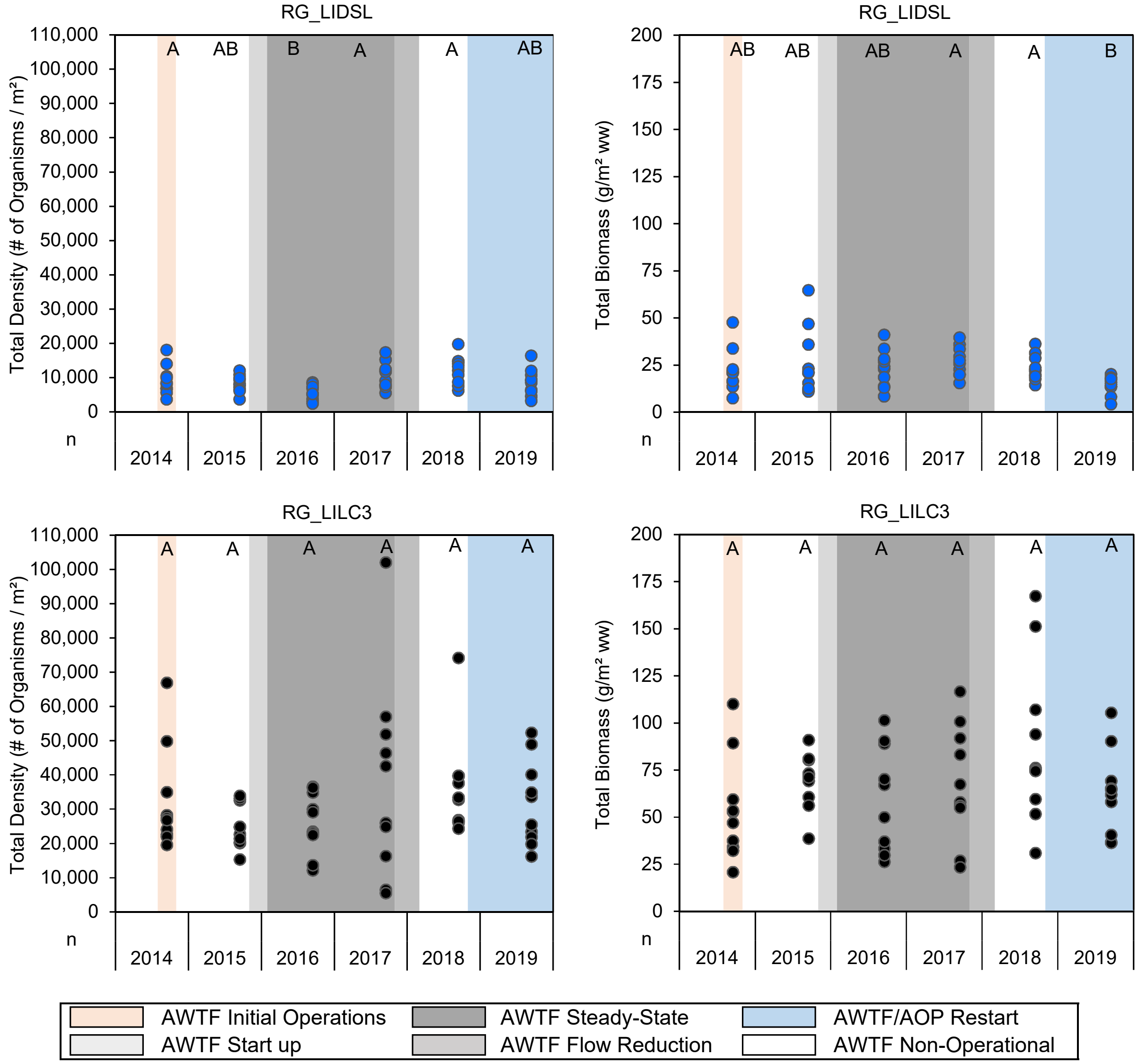

Figure A.5: Total Benthic Invertebrate Density and Biomass (Hess Sampling), for RG_LIDSL and RG_LILC3 Over Time, 2014 to 2019

Notes: Years that share a letter (e.g., A,B) are not significantly different (α=0.1). Letters assigned such that the year with the highest mean value is assigned the letter A.

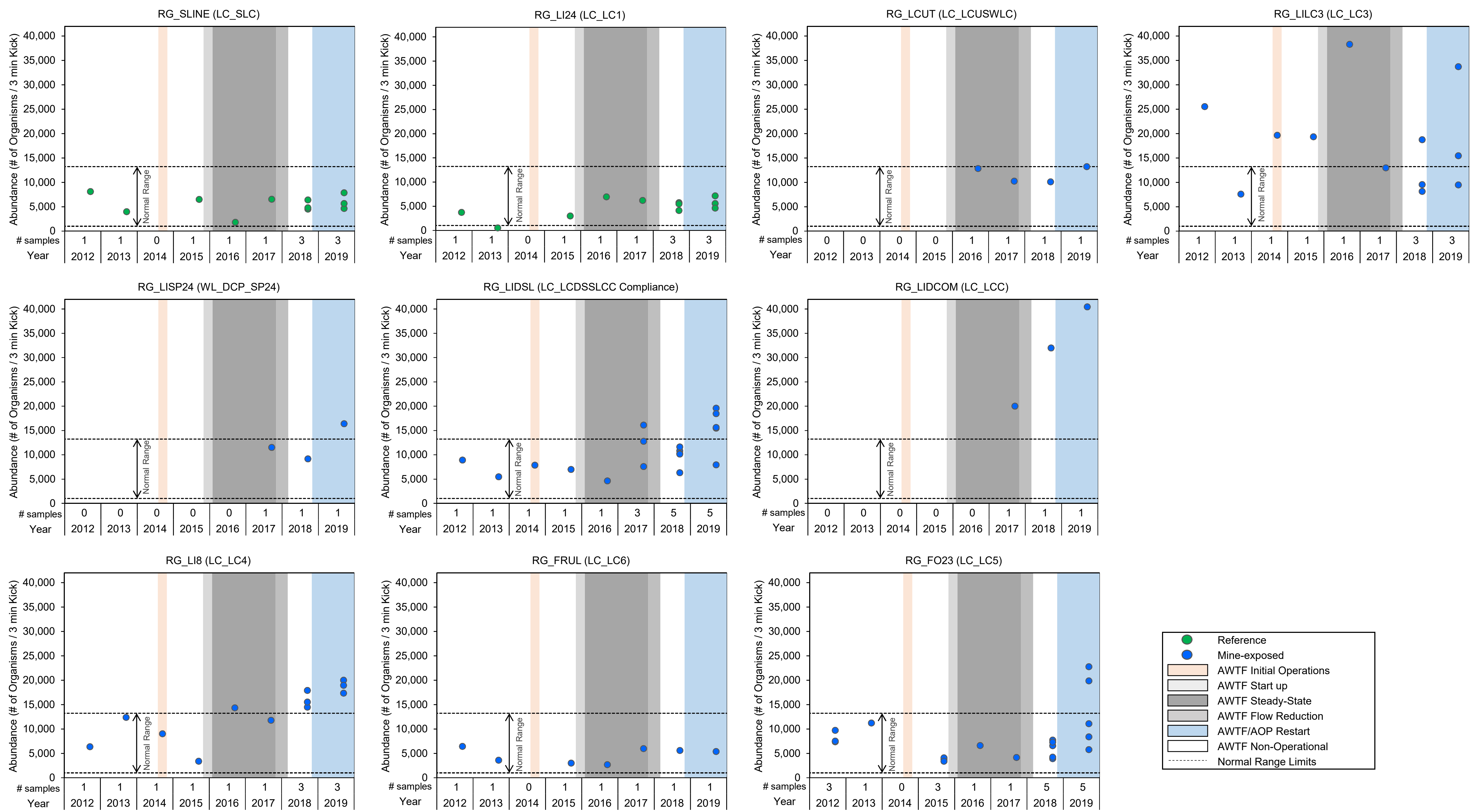

Figure A.6: Benthic Invertebrate Community Abundance (3-Minute Kick and Sweep Sampling), Line Creek and Fording River, 2012 to 2019

Notes: Horizontal dashed lines represent the upper and lower limits of the normal range defined as the 2.5th and 97.5th percentiles of the 2012 and 2015 reference area data from the Regional Aquatic Environmental Monitoring Program (RAEMP). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

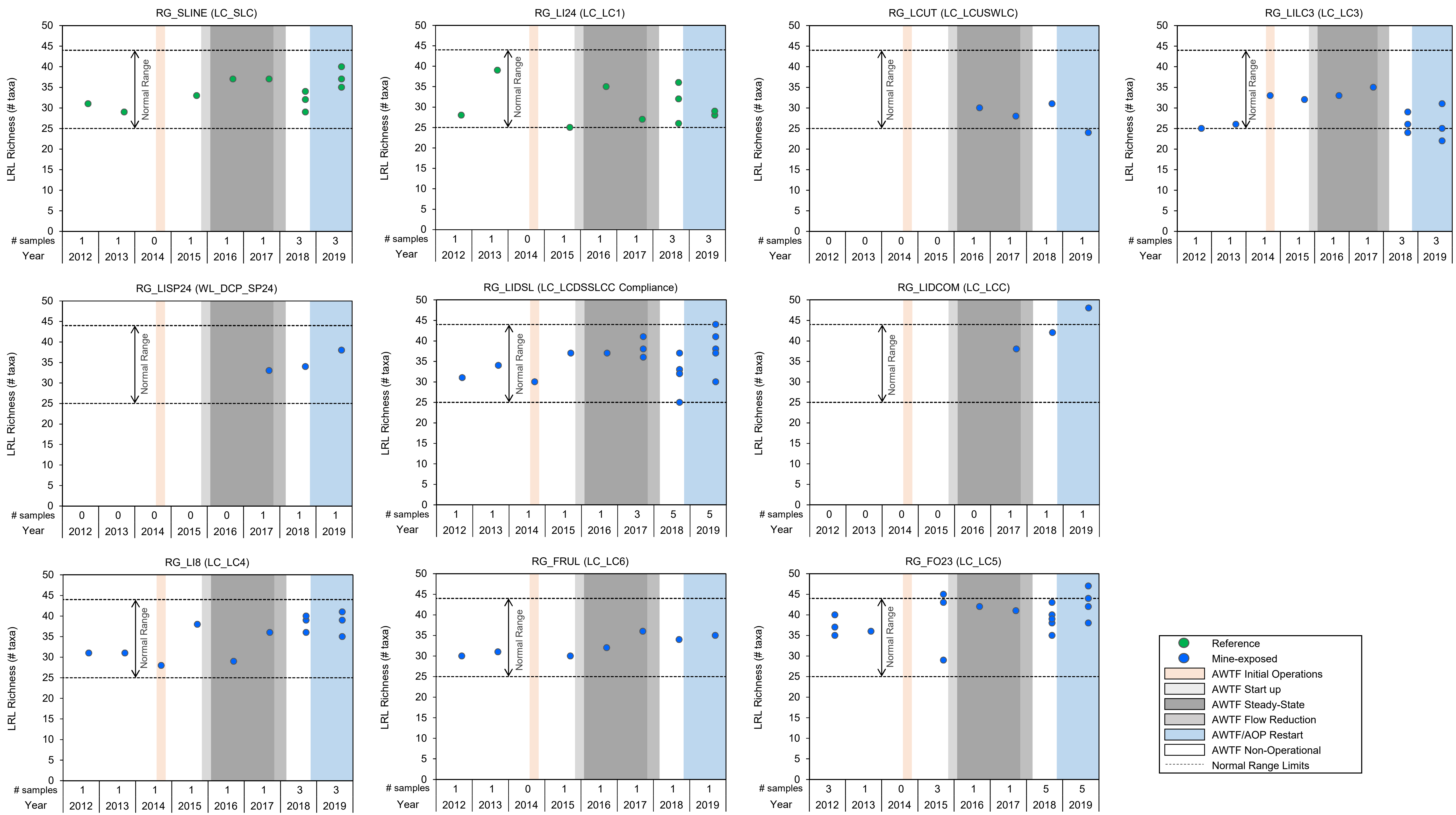

Figure A.7: Benthic Invertebrate Community Richness (Lowest Practical Level; 3-Minute Kick and Sweep Sampling), Line Creek and Fording River, 2012 to 2019

Notes: Horizontal dashed lines represent the upper and lower limits of the normal range defined as the 2.5th and 97.5th percentiles of the 2012 and 2015 reference area data from the Regional Aquatic Environmental Monitoring Program (RAEMP). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

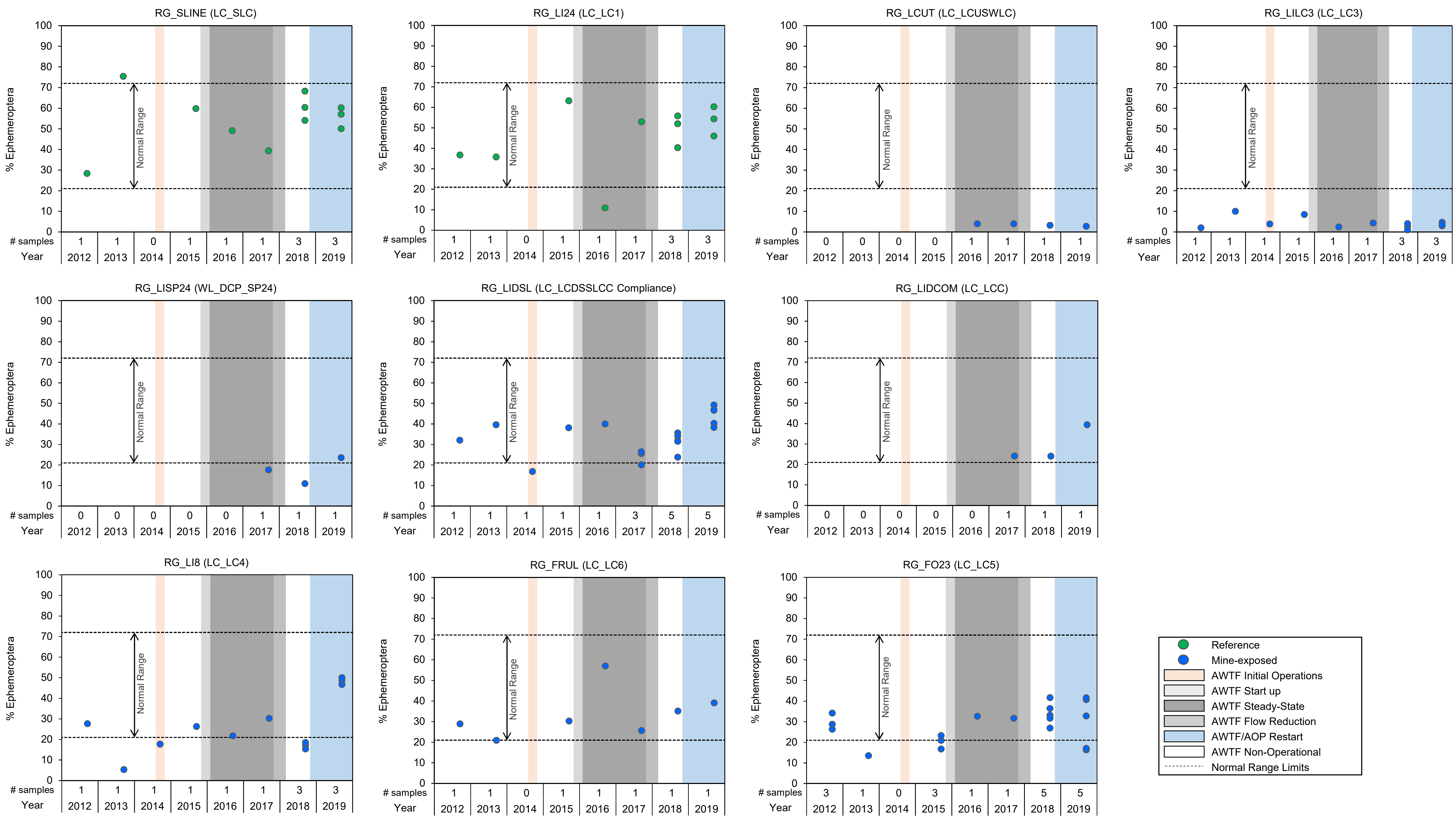

Figure A.8: Benthic Invertebrate Community Relative Ephemeroptera Abundance (E%; 3-Minute Kick and Sweep Sampling), Line Creek and Fording River, 2012 to 2019

Notes: Horizontal dashed lines represent the upper and lower limits of the normal range defined as the 2.5th and 97.5th percentiles of the 2012 and 2015 reference area data from the Regional Aquatic Environmental Monitoring Program (RAEMP). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

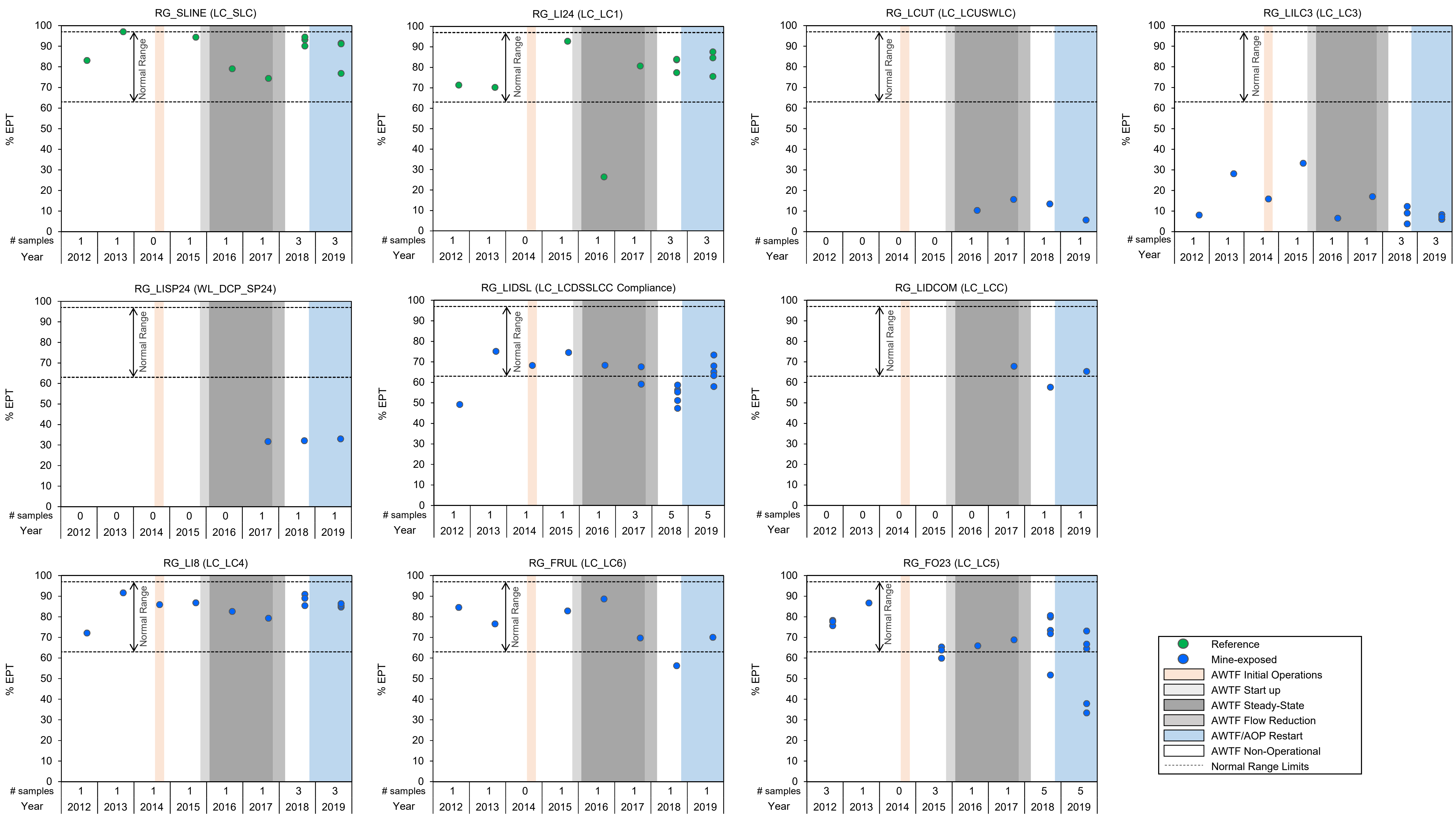

Figure A.9: Benthic Invertebrate Community Relative Ephemeroptera, Plecoptera, and Trichoptera Abundance (EPT%; 3-Minute Kick and Sweep Sampling), Line Creek and Fording River, 2012 to 2019

Notes: Horizontal dashed lines represent the upper and lower limits of the normal range defined as the 2.5th and 97.5th percentiles of the 2012 and 2015 reference area data from the Regional Aquatic Environmental Monitoring Program (RAEMP). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

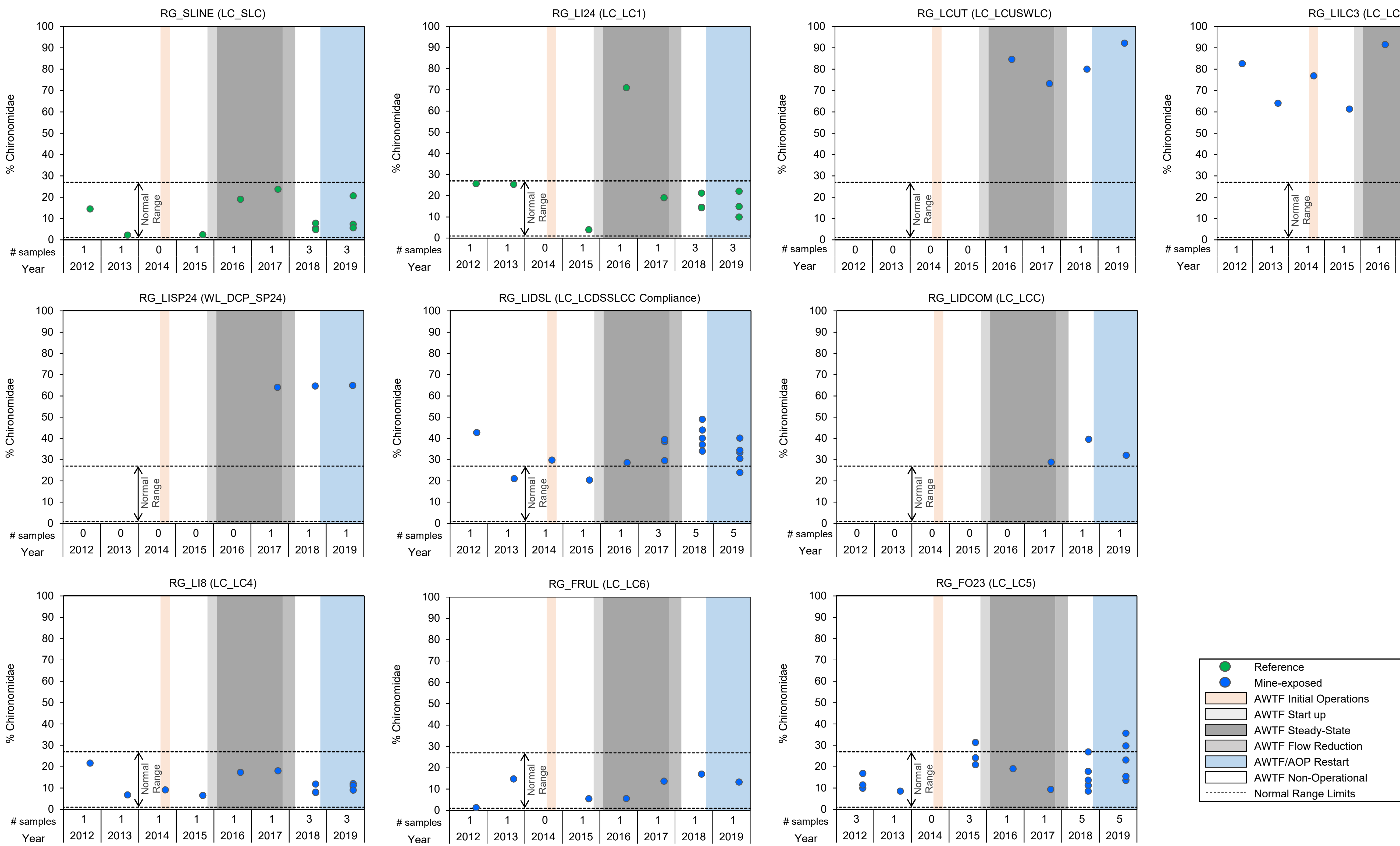

Figure A.10: Benthic Invertebrate Community Relative Chironomidae Abundance (%Chiron; 3-Minute Kick and Sweep Sampling), Line Creek and Fording River, 2012 to 2019

Notes: Horizontal dashed lines represent the upper and lower limits of the normal range defined as the 2.5th and 97.5th percentiles of the 2012 and 2015 reference area data from the Regional Aquatic Environmental Monitoring Program (RAEMP). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

Table A.1: Visual Periphyton Coverage Scores from Line Creek and Fording River, September 2019

Area		Biological Area Code	Replicate A	Replicate B	Replicate C	Replicate D	Replicate E	Mean	Standard Deviation
Line Creek	Reference	RG_LI24	2	2	2	3	2	2	0.4
		RG_SLINE	2	2	2	2	2	2	0
	Mine-exposed	RG_LCUT	3	3	3	3	3	3	0
		RG_LILC3	3	3	4	3	4	3	0.5
		RG_LISP24	3	3	3	2	2	3	0.5
		RG_LIDSL	2	3	3	3	3	3	0.4
		RG_LIDCOM	3	3	3	4	4	3	0.5
		RG_LI8	2	2	2	2	2	2	0
Fording River	Mine-exposed	RG_FRUL	2	3	3	2	2	2	0.5
		RG_FO23	2	2	2	2	3	3	0.4

Periphyton Coverage Scores (Environment Canada, 2012):
1 = Rocks not slippery, no obvious colour (<0.5mm thick)
2 = Rocks slightly slippery, yellow-brown to light green colour (0.5-1mm thick)
3 = Rocks have noticeable slippery feel, patches of thicker green to brown algae (1-5mm thick)
4 = Rocks are very slippery, numerous clumps (5-20mm thick)
5 = Rocks mostly obscured by algae mat, may have long strands (>20mm thick)

Table A.2: Statistical Comparisons of Total Benthic Invertebreate Biomass (Hess Samples) Over Time and Relative to Reference (RG_SLINE and RG_LI24) for RG_LIDSL and RG_LILC3, 2014 to 2019

Area	Comparison	Term	DF	F-Statistic	P-value	Comparisons Among Years					
						2014	2015	2016	2017	2018	2019
RG_LIDSL	RG_LIDSL over time	Year	5	2.58	0.037	AB	AB	AB	A	A	B
	RG_LIDSL vs RG_SLINE and RG_LI24 over time	CI	1	201	<0.001						
		Year	5	3.61	0.004						
		Area(CI)	1	16.55	<0.001						
		CI×Year	5	3.00	0.014	A	AB	AB	A	AB	B
		Area(CI)×Year	4	1.47	0.215						
		Error	121								
RG_LILC3	RG_LILC3 over time	Year	5	1.549	0.190	A	A	A	A	A	A
	RG_LILC3 vs RG_SLINE and RG_LI24 over time	CI	1	746	<0.001						
		Year	5	5.08	<0.001						
		Area(CI)	1	16.80	<0.001						
		CI×Year	5	0.64	0.669	A	A	A	A	A	A
		Area(CI)×Year	4	1.50	0.208						
		Error	121								

Area×Year p-value < 0.1.

Area(CI)×Year p-value < 0.1. Analysis was then conducted separately by reference area.

Notes: Years that share a letter (e.g., A,B) are not significantly different (α=0.1). Letters assigned such that the year with the highest mean value (for the Year term) or highest difference between mine-exposed and reference (for the Area×Year term) is assigned the letter A. The p-value used to determine differences were adjusted using Tukey's honestly significant differences method (for the Year term) and Bonferroni method (for the Area(CI)×Year term).

Table A.3: Summary Metrics for Benthic Invertebrate Endpoints Collected by Hess Sampler at Line Creek, September 2019

Area	Biological Area Code	Sample Code	Total Density (org/m^2)[a]	Biomass (g/m^2 ww)[a]	EPT Density (org/m^2)	Ephemeroptera Density (org/m^2)	Chironomidae Density (org/m^2)
Reference	RG_LI24	RG_LI24-01	4,080	7.36	2,400	1,360	180
		RG_LI24-02	2,780	4.56	1,530	800	107
		RG_LI24-03	2,630	7.16	2,100	1,550	50
		RG_LI24-04	3,770	7.95	2,200	1,390	100
		RG_LI24-05	2,900	7.62	2,540	1,460	150
	RG_SLINE	RG_SLINE-01	3,890	8.18	2,970	1,690	290
		RG_SLINE-02	6,420	12.9	3,840	2,240	634
		RG_SLINE-03	5,060	6.52	4,040	2,520	420
		RG_SLINE-04	2,760	4.76	2,100	1,260	230
		RG_SLINE-05	3,190	6.68	2,170	1,290	180
Mine-exposed	RG_LILC3	RG_LILC3-01	23,310	58.0	2,350	1,160	15,000
		RG_LILC3-02	16,160	36.5	1,400	640	11,360
		RG_LILC3-03	21,850	69.1	1,210	480	14,200
		RG_LILC3-04	33,630	65.0	1,710	960	17,760
		RG_LILC3-05	34,800	36.3	960	160	23,680
		RG_LILC3-06	25,450	61.9	1,890	800	14,480
		RG_LILC3-07	40,040	40.5	1,200	760	21,680
		RG_LILC3-08	48,920	90.1	1,960	480	32,240
		RG_LILC3-09	19,770	64.6	1,650	400	13,720
		RG_LILC3-10	52,240	105	3,600	800	37,440
	RG_LIDSL	RG_LIDSL-01	6,290	13.4	3,510	2,450	2,150
		RG_LIDSL-02	16,280	19.9	7,690	5,870	6,580
		RG_LIDSL-03	4,430	8.01	2,110	1,450	1,690
		RG_LIDSL-04	8,400	17.0	4,330	2,830	3,000
		RG_LIDSL-05	10,660	18.2	5,730	3,500	3,700
		RG_LIDSL-06	9,210	15.6	5,120	3,120	2,580
		RG_LIDSL-07	5,980	14.5	3,300	2,530	1,430
		RG_LIDSL-08	3,090	4.00	1,350	600	1,170
		RG_LIDSL-09	11,870	17.5	6,810	5,430	3,540
		RG_LIDSL-10	9,140	13.3	4,210	3,390	3,779

Notes: org = organims; ww = wet weight; EPT = Ephemeroptera, Plecoptera, Trichoptera

[a] Total density and biomass are reported for all organisms in the sample.

Table A.4: Statistical Comparisons of Total Benthic Invertebrate Density (Hess Samples) Over Time and Relative to Reference (RG_SLINE and RG_LI24) for RG_LIDSL and RG_LILC3, 2014 to 2019

Area	Comparison	Term	DF	F-Statistic	P-value	Comparisons Among Years					
						2014	2015	2016	2017	2018	2019
RG_LIDSL	RG_LIDSL over time	Year	5	4.63	0.001	A	AB	B	A	A	AB
	RG_LIDSL vs RG_SLINE and RG_LI24 over time	CI	1	281	<0.001						
		Year	5	7.99	<0.001						
		Area(CI)	1	9.30	0.003						
		CI×Year	5	3.97	0.002						
		Area(CI)×Year	4	6.16	<0.001	CI×Year effect depends on Area					
		Error	121								
	RG_LIDSL vs RG_SLINE over time	Area	1	151	<0.001						
		Year	5	9.4	<0.001						
		Area×Year	5	5.79	<0.001	A	C	BC	AB	ABC	BC
		Error	91								
	RG_LIDSL vs RG_LI24 over time	Area	1	242	<0.001						
		Year	5	3.95	0.003						
		Area×Year	4	2.73	0.035	AB	AB	-	AB	A	B
		Error	84								
RG_LILC3	RG_LILC3 over time	Year	5	0.673	0.646	A	A	A	A	A	A
	RG_LILC3 vs RG_SLINE and RG_LI24 over time	CI	1	951	<0.001						
		Year	5	4.11	0.002						
		Area(CI)	1	7.57	0.007						
		CI×Year	5	2.62	0.028						
		Area(CI)×Year	4	5.01	0.001	CI×Year effect depends on Area					
		Error	121								
	RG_LILC3 vs RG_SLINE over time	Area	1	576	<0.001						
		Year	5	4.25	0.002						
		Area×Year	5	4.68	0.001	A	B	AB	AB	B	B
		Error	91								
	RG_LILC3 vs RG_LI24 over time	Area	1	611	<0.001						
		Year	5	0.989	0.429						
		Area×Year	4	0.999	0.413	A	A	-	A	A	A
		Error	84								

(grey) Area×Year p-value < 0.1.

(blue) Area(CI)×Year p-value < 0.1. Analysis was then conducted separately by reference area.

Notes: Years that share a letter (e.g., A,B) are not significantly different (α=0.1). Letters assigned such that the year with the highest mean value (for the Year term) or highest difference between mine-exposed and reference (for the Area×Year term) is assigned the letter A. The p-value used to determine differences were adjusted using Tukey's honestly significant differences method (for the Year term) and Bonferroni method (for the Area(CI)×Year term).

Table A.5: Summary of Benthic Invertebrate Endpoints Collected by 3-Minute Kick and Sweep Sampling at Line Creek and Fording River, September 2019

Area	Biological Area Code	Sample Code	Abundance (# org/ 3-min kick)	LPL Richness (# of taxa)	Family Richness	EPT Abundance (# org/ 3-min kick)	EPT Relative Abundance (%)	Ephemeroptera Abundance (# org/ 3-min kick)	Ephemeroptera Relative Abundance (%)	Chironomidae Abundance (# org/ 3-min kick)	Chironomidae Relative Abundance (%)
Reference	RG_LI24	RG_LI24-01	7,140	28	15	6,040	84.6	3,880	54.3	1,060	14.8
		RG_LI24-02	5,583	28	16	4,217	75.5	2,567	46.0	1,233	22.1
		RG_LI24-03	4,600	29	16	4,029	87.6	2,771	60.2	457	9.94
	RG_SLINE	RG_SLINE-01	4,670	35	17	4,270	91.4	2,810	60.2	340	7.28
		RG_SLINE-02	5,667	37	19	4,350	76.8	2,833	50.0	1,167	20.6
		RG_SLINE-03	7,860	40	22	7,160	91.1	4,480	57.0	440	5.60
Mine-exposed	RG_LILC3	RG_LILC3-01	15,480	25	13	1,280	8.27	720	4.65	13,320	86.0
		RG_LILC3-02	9,480	22	10	560	5.91	280	2.95	8,540	90.1
		RG_LILC3-03	33,720	31	16	2,420	7.18	1,120	3.32	30,340	90.0
	RG_LIDSL	RG_LIDSL-01	15,480	38	18	10,520	68.0	7,260	46.9	4,720	30.5
		RG_LIDSL-02	15,620	37	20	11,440	73.2	7,680	49.2	3,740	23.9
		RG_LIDSL-03	7,940	30	15	5,160	65.0	3,700	46.6	2,640	33.2
		RG_LIDSL-04	19,580	44	25	12,380	63.2	7,880	40.2	6,720	34.3
		RG_LIDSL-05	18,460	41	21	10,680	57.9	7,060	38.2	7,400	40.1
	RG_LIDCOM	RG_LIDCOM-01	40,420	48	25	26,380	65.3	15,900	39.3	12,940	32.0
	RG_LCUT	RG_LCUT-01	13,240	24	12	740	5.59	360	2.72	12,200	92.1
	RG_LI8	RG_LI8-01	20,000	41	20	16,940	84.7	9,340	46.7	2,400	12.0
		RG_LI8-02	17,340	35	17	14,800	85.4	8,440	48.7	1,920	11.1
		RG_LI8-03	18,960	39	19	16,380	86.4	9,480	50.0	1,700	8.97
	RG_LISP24	RG_LISP24-01	16,400	38	20	5,400	32.9	3,860	23.5	10,640	64.9
	RG_FO23	RG_FO23-01	22,760	47	27	7,580	33.3	3,720	16.3	8,120	35.7
		RG_FO23-02	11,100	38	26	7,160	64.5	3,640	32.8	2,560	23.1
		RG_FO23-03	8,400	42	22	6,140	73.1	3,420	40.7	1,140	13.6
		RG_FO23-04	5,770	44	26	3,850	66.7	2,400	41.6	890	15.4
		RG_FO23-05	19,880	44	25	7,520	37.8	3,400	17.1	5,900	29.7
	RG_FRUL	RG_FRUL-01	5,383	35	23	3,767	70.0	2,100	39.0	717	13.3

Notes: LPL= Lowest Practical Level; EPT= Ephemeroptera, Plecoptera, and Trichoptera.

Table A.6: Benthic Invertebrate Community Quality Control Results, 2019

A) Organism Recovery

Sample ID	Laboratory ID	Number of Organisms Recovered (Initial Sort)	Number of Organisms in Re-sort	Percent Recovery
RG_LILC3_BIC-1	CC201031	774	27	96.5%
RG_LCUT_BIC	CC201039	662	25	96.2%
RG_LISP24_BIC	CC201040	820	18	97.8%
			Average Recovery	**96.8%**

B) Subsampling Accuracy and Precision

Sample Name		RG_F023_BIC-4	RG_SLINE_BIC-1	RG_LIDSL_BIC-3
Number of Organisms in Subsample		572	482	405
		566	465	435
		517	435	433
		639	484	415
		643	461	414
		588	441	372
		571	438	408
		554	512	429
		556	435	431
		553	529	423
		-	-	380
		-	-	404
		-	-	415
		-	-	371
		-	-	400
		-	-	445
		-	-	398
		-	-	464
		-	-	397
		-	-	436
Sorter Initials		SQ	KC	CJ
Time Sorted		930	665	1,140
Actual Total		5,759	4,682	8,275
Precision Error	Min (%)	0.175	0	0
	Max (%)	19.6	17.8	20.0
Accuracy Error	Min (%)	0.677	0.683	0.0604
	Max (%)	11.7	13.0	12.1

Note: "-" indicates no data available.

C) Taxonomic Quality Control[a]

Sample ID	Laboratory ID	Laboratory Count	Quality Control Audit Count	TIR (%)	PDE (%)	PTD (%)	BCDI
RG_LILC3_BIC-1	CC201031	774	774	0	0.0	0.388	0.00388
RG_SLINE_BIC-1	CC201041	467	469	0	0.214	1.07	0.00855
RG_LIDSL_BIC-2	CC201050	781	778	0	0.192	0.768	0.00577

Values did not meet the data quality objective of < 5% for TIR.

Notes: TIR = Total Identification Error Rate; PDE = Percent Difference in Enumeration; PTD = Percent Taxonomic Disagreement; BCDI = Bray Curtis Dissimilarity Index to quantify differences in identifications.

[a]For error rationale and calculations, refer to Cordillera report (Appendix G).

Table A.7: Benthic Macroinvertebrates Collected Through Kick Sampling from Teck Line Creek, 2019 (Abundance per 3-min Kick)

Project: Teck Line Creek LAEMP 2019 (197202.0006) - Kick Sampling

Taxonomist: Scott Finlayson 250-494-7553
scottfinlayson@cordilleraconsulting.ca

Site:	2019	2019	2019	2019	2019	2019	2019
Sample:	RG_LILC3_BIC-1	RG_LILC3_BIC-2	RG_LILC3_BIC-3	RG_FO23_BIC-1	RG_FO23_BIC-2	RG_FO23_BIC-3	RG_FO23_BIC-4
Sample Collection Date:	07-Sep-19	07-Sep-19	07-Sep-19	08-Sep-19	08-Sep-19	08-Sep-19	08-Sep-19
CC#:	CC201031	CC201032	CC201033	CC201034	CC201035	CC201036	CC201037
Phylum: Arthropoda	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0
Ameletus	0	0	0	20	0	0	0
| Family: Baetidae	0	0	20	1,060	0	0	10
Acentrella	20	20	0	20	0	0	20
Baetis	160	80	500	1,280	1,420	1,080	770
Baetis rhodani group	120	80	40	260	1,060	660	480
| Family: Ephemerellidae	20	0	80	180	80	160	20
Drunella	60	0	0	20	0	0	10
Drunella coloradensis	0	0	0	0	0	0	0
Drunella doddsii	40	0	60	40	160	160	140
Drunella spinifera	0	0	0	40	0	20	0
| Family: Heptageniidae	300	100	420	800	840	1,300	850
Cinygmula	0	0	0	0	0	0	0
Epeorus	0	0	0	0	40	20	10
Rhithrogena	0	0	0	0	40	20	90
| Family: Leptophlebiidae	0	0	0	0	0	0	0
Neoleptophlebia	0	0	0	0	0	0	0
| Order: Plecoptera	0	0	0	0	0	0	0
| Family: Capniidae	40	0	0	380	180	280	50
Utacapnia	0	0	0	0	0	220	50
| Family: Chloroperlidae	20	0	20	40	100	160	180
Suwallia	20	0	0	0	0	0	0
Sweltsa	0	0	80	40	100	100	50
| Family: Leuctridae	0	0	0	60	200	0	50
Paraleuctra	0	0	0	0	0	40	30
| Family: Nemouridae	60	20	60	400	80	0	0
Visoka cataractae	0	0	0	0	0	0	0
Zapada	0	0	280	1,420	660	360	200
Zapada oregonensis group	200	60	360	0	0	0	10
Zapada cinctipes	0	0	0	80	480	240	30
Zapada columbiana	0	20	60	0	20	0	0
| Family: Peltoperlidae	0	0	0	0	20	0	0
Yoraperla	0	0	0	0	0	0	0
| Family: Perlidae	0	0	0	540	220	260	30
Hesperoperla	0	0	0	20	220	160	60
| Family: Perlodidae	0	0	0	0	0	20	0
Kogotus	40	0	100	60	120	20	30
Megarcys	0	20	0	0	0	0	0
Setvena	0	0	0	0	0	0	0
| Family: Taeniopterygidae	0	0	0	140	800	560	370
Taenionema	0	0	0	0	0	0	90
| Order: Trichoptera	20	0	0	40	20	20	0
| Family: Apataniidae	0	0	0	0	0	0	0
Apatania	0	0	0	0	0	0	0
| Family: Brachycentridae	0	0	0	240	200	180	90
Brachycentrus	0	0	0	140	0	0	0
Brachycentrus americanus	0	0	0	0	0	40	0
Micrasema	0	0	0	20	0	0	0
| Family: Glossosomatidae	0	0	0	0	20	0	20
Glossosoma	0	0	0	0	0	20	0
| Family: Hydropsychidae	20	40	60	0	20	0	0
Parapsyche	40	20	80	0	0	0	0
Parapsyche elsis	100	80	140	0	0	0	0
| Family: Hydroptilidae	0	0	0	0	0	0	0
Hydroptila	0	0	0	80	0	0	0
| Family: Limnephilidae	0	0	20	0	0	0	0
| Family: Rhyacophilidae	0	0	0	0	0	0	0
Rhyacophila	0	20	40	60	60	20	110
Rhyacophila betteni group	0	0	0	0	0	20	0
Rhyacophila brunnea/vemna group	0	0	0	100	0	0	0
Rhyacophila hyalinata group	0	0	0	0	0	0	0
Rhyacophila vofixa group	0	0	0	0	0	0	0
Rhyacophila narvae	0	0	0	0	0	0	0
| Family: Uenoidae	0	0	0	0	0	0	0
Neothremma	0	0	0	0	0	0	0
| Order: Coleoptera	0	0	0	0	0	0	0
| Family: Elmidae	0	0	0	0	0	40	10
Heterlimnius	0	0	0	0	0	0	20
Narpus	0	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0
| Family: Athericidae	0	0	0	0	0	0	0
Atherix	0	0	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0	0
Mallochohelea	0	0	0	20	0	0	10

Table A.7: Benthic Macroinvertebrates Collected Through Kick Sampling from Teck Line Creek, 2019 (Abundance per 3-min Kick)

Cordillera Consulting

Project: Teck Line Creek LAEMP 2019 (197202.0006) - Kick Sampling

Taxonomist: Scott Finlayson 250-494-7553
scottfinlayson@cordilleraconsulting.ca

Site:	2019	2019	2019	2019	2019	2019	2019
Sample:	RG_LILC3_BIC-1	RG_LILC3_BIC-2	RG_LILC3_BIC-3	RG_FO23_BIC-1	RG_FO23_BIC-2	RG_FO23_BIC-3	RG_FO23_BIC-4
Sample Collection Date:	07-Sep-19	07-Sep-19	07-Sep-19	08-Sep-19	08-Sep-19	08-Sep-19	08-Sep-19
CC#:	CC201031	CC201032	CC201033	CC201034	CC201035	CC201036	CC201037
| Family: Chironomidae	2,180	1,080	3,020	300	200	120	110
| Subfamily: Chironominae	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0
Polypedilum	0	0	0	0	0	60	0
| Tribe: Tanytarsini	0	0	0	260	60	0	20
Micropsectra	40	60	60	160	120	80	30
Stempellinella	0	0	0	0	0	0	0
| Subfamily: Diamesinae	0	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0
Diamesa	960	660	560	0	0	0	0
Pagastia	960	520	1,840	500	0	20	50
Pseudodiamesa	0	0	40	0	0	0	0
| Subfamily: Orthocladiinae	0	0	0	0	0	0	20
Brillia	0	0	0	0	0	0	0
Corynoneura	20	20	60	0	0	0	20
Cricotopus (Nostococladius)	0	0	0	0	0	0	0
Eukiefferiella	1,100	1,000	1,740	960	840	280	70
Hydrobaenus	60	60	540	460	0	0	0
Krenosmittia	0	0	0	40	0	0	0
Limnophyes	0	0	0	0	0	20	0
Nanocladius	0	0	0	20	0	0	10
Orthocladius complex	5,420	4,380	11,580	4,620	180	180	480
Parametriocnemus	0	0	0	20	0	0	0
Parorthocladius	0	0	100	480	0	0	0
Rheocricotopus	1,560	420	5,080	160	180	80	40
Thienemanniella	0	0	0	0	0	0	0
Tvetenia	1,020	340	5,720	0	980	300	40
| Subfamily: Tanypodinae	0	0	0	0	0	0	0
| Tribe: Pentaneurini	0	0	0	0	0	0	0
Thienemannimyia group	0	0	0	140	0	0	0
| Family: Empididae	0	0	100	260	120	120	40
Clinocera	0	0	60	120	0	20	0
Neoplasta	0	0	0	100	0	80	70
Oreogeton	0	0	0	0	0	0	0
| Family: Pelecorhynchidae	0	0	0	0	0	0	0
Glutops	0	0	0	0	0	0	0
| Family: Psychodidae	0	0	0	0	0	0	0
Pericoma/Telmatoscopus	0	0	0	680	200	300	240
| Family: Simuliidae	0	0	0	0	80	0	0
Prosimulium	0	0	0	0	0	0	0
Prosimulium/Helodon	0	0	0	0	0	0	0
Simulium	0	0	0	0	80	0	10
| Family: Stratiomyidae	0	0	0	0	0	0	10
| Family: Tipulidae	0	0	0	180	20	0	20
Antocha	0	0	0	0	0	0	10
Dicranota	0	0	0	0	0	0	0
Gonomyodes	0	0	0	0	0	0	0
Hexatoma	0	0	0	20	40	80	10
Limnophila	0	0	0	0	0	0	0
| Order: Hemiptera	0	0	0	0	0	0	0
| Family: Corixidae	0	0	0	0	0	0	0
Callicorixa	0	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0	0
| Order: Trombidiformes	20	0	20	140	0	20	0
| Family: Aturidae	0	0	0	0	0	0	0
Aturus	60	0	40	800	80	0	0
| Family: Feltriidae	0	0	0	0	0	0	0
Feltria	360	120	220	120	20	0	0
| Family: Hydryphantidae	0	0	0	0	0	0	0
Protzia	0	0	0	0	0	0	0
| Family: Hygrobatidae	0	0	0	0	0	0	0
Atractides	0	0	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0	0
Lebertia	140	60	160	520	40	120	170
| Family: Mideopsidae	0	0	0	0	0	0	0
Mideopsis	0	0	0	20	0	0	0
| Family: Sperchontidae	0	0	0	0	0	0	0
Sperchon	300	200	340	60	0	20	30
| Family: Torrenticolidae	0	0	0	0	0	0	0
Testudacarus	0	0	0	160	40	20	10
Torrenticola	0	0	0	0	0	0	0
Suborder: Prostigmata	0	0	0	0	0	0	0
| Family: Stygothrombidiidae	0	0	0	0	0	0	0
Stygothrombium	0	0	0	40	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0	0
| Order: Oribatida	0	0	0	0	20	0	0
| Family: Hydrozetidae	0	0	0	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0
| Order: Lumbriculida	0	0	0	0	0	0	0
| Family: Lumbriculidae	0	0	0	0	0	0	0
Rhynchelmis	0	0	20	0	0	0	40
| Order: Tubificida	0	0	0	0	0	0	0
| Family: Naididae	0	0	0	1,720	0	0	110
Nais	0	0	0	2,100	460	260	220
| Subfamily: Tubificinae without	0	0	0	0	180	40	0
Totals:	**15,480**	**9,480**	**33,720**	**22,760**	**11,100**	**8,400**	**5,770**
Taxa present but not included:							
Phylum: Arthropoda	0	0	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0	0
| Class: Ostracoda	20	20	20	20	20	20	10
| Class: Maxillipoda	0	0	0	0	0	0	0
| Class: Copepoda	0	0	0	20	0	0	0
Phylum: Nemata	20	20	20	20	20	20	10
Phylum: Platyhelminthes	0	0	0	0	0	0	0
| Class: Turbellaria	0	0	20	20	0	20	0
Totals:	**40**	**40**	**60**	**80**	**40**	**60**	**20**

Table A.7: Benthic Macroinvertebrates Collected Through Kick Sampling from Teck Line Creek, 2019 (Abundance per 3-min Kick)

Cordillera Consulting

Project: Teck Line Creek LAEMP 2019 (197202.0006) - Kick Sampling

Taxonomist: Scott Finlayson 250-494-7553
scottfinlayson@cordilleraconsulting.ca

Site:	2019	2019	2019	2019	2019	2019	2019
Sample:	RG_FO23_BIC-5	RG_LCUT_BIC	RG_LISP24_BIC	RG_SLINE_BIC-1	RG_SLINE_BIC-2	RG_SLINE_BIC-3	RG_LI24_BIC-1
Sample Collection Date:	08-Sep-19	04-Sep-19	05-Sep-19	09-Sep-19	09-Sep-19	09-Sep-19	06-Sep-19
CC#:	CC201038	CC201039	CC201040	CC201041	CC201042	CC201043	CC201044
Phylum: Arthropoda	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0
Ameletus	20	0	80	140	283	120	60
| Family: Baetidae	780	20	80	30	0	0	0
Acentrella	0	0	0	0	0	0	0
Baetis	1,180	20	420	50	33	20	20
Baetis rhodani group	320	40	980	70	0	40	20
| Family: Ephemerellidae	80	0	260	450	700	1,100	300
Drunella	0	0	20	90	133	80	40
Drunella coloradensis	0	0	0	0	0	40	0
Drunella doddsii	0	0	140	10	17	80	0
Drunella spinifera	0	0	0	0	0	0	0
| Family: Heptageniidae	940	280	1,760	1,790	1,500	2,580	3,040
Cinygmula	0	0	0	10	17	40	380
Epeorus	20	0	120	160	83	140	0
Rhithrogena	40	0	0	10	67	240	20
| Family: Leptophlebiidae	0	0	0	0	0	0	0
Neoleptophlebia	20	0	0	0	0	0	0
| Order: Plecoptera	0	0	0	0	0	0	0
| Family: Capniidae	220	100	60	0	0	0	0
Utacapnia	0	80	0	0	0	0	0
| Family: Chloroperlidae	20	0	20	340	33	380	100
Suwallia	0	0	40	150	17	140	20
Sweltsa	0	0	40	40	50	80	40
| Family: Leuctridae	0	0	20	30	67	40	0
Paraleuctra	0	0	0	0	0	0	0
| Family: Nemouridae	560	20	120	0	67	120	40
Visoka cataractae	0	0	0	0	0	20	0
Zapada	1,640	20	0	30	17	20	120
Zapada oregonensis group	0	0	500	60	183	100	40
Zapada cinctipes	340	0	0	0	0	0	0
Zapada columbiana	0	20	260	210	217	260	1,320
| Family: Peltoperlidae	0	0	0	20	0	40	0
Yoraperla	0	0	0	10	0	0	20
| Family: Perlidae	820	0	0	0	0	0	0
Hesperoperla	120	0	0	0	0	0	0
| Family: Perlodidae	0	40	40	60	117	120	20
Kogotus	100	0	40	0	17	0	0
Megarcys	0	0	0	70	100	340	80
Setvena	0	20	0	0	0	0	0
| Family: Taeniopterygidae	40	0	140	40	83	80	280
Taenionema	0	0	0	0	0	0	0
| Order: Trichoptera	40	0	20	90	67	240	0
| Family: Apataniidae	0	0	0	0	0	0	0
Apatania	0	0	0	0	0	0	0
| Family: Brachycentridae	180	0	0	0	0	0	0
Brachycentrus	0	0	0	0	0	0	0
Brachycentrus americanus	0	0	0	0	0	0	0
Micrasema	0	0	0	0	0	0	0
| Family: Glossosomatidae	20	0	0	30	33	40	0
Glossosoma	0	0	0	40	33	40	0
| Family: Hydropsychidae	0	20	60	30	0	0	0
Parapsyche	0	0	0	0	0	0	0
Parapsyche elsis	0	0	80	20	33	20	20
| Family: Hydroptilidae	0	0	0	0	0	0	0
Hydroptila	0	0	0	0	0	0	0
| Family: Limnephilidae	0	0	0	0	17	240	40
| Family: Rhyacophilidae	0	0	0	0	0	0	0
Rhyacophila	20	60	60	120	283	220	0
Rhyacophila betteni group	0	0	0	10	0	0	0
Rhyacophila brunnea/vemna group	0	0	0	40	0	40	0
Rhyacophila hyalinata group	0	0	40	0	0	0	0
Rhyacophila vofixa group	0	0	0	20	83	80	0
Rhyacophila narvae	0	0	0	0	0	0	0
| Family: Uenoidae	0	0	0	0	0	0	0
Neothremma	0	0	0	0	0	20	20
| Order: Coleoptera	0	0	0	0	0	0	0
| Family: Elmidae	0	0	0	0	0	0	0
Heterlimnius	0	0	0	0	0	0	0
Narpus	0	0	0	0	0	0	0
| Order: Diptera	0	0	0	0	0	0	0
| Family: Athericidae	0	0	0	0	0	0	0
Atherix	20	0	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0	0
Mallochohelea	0	0	0	0	0	0	0

Table A.7: Benthic Macroinvertebrates Collected Through Kick Sampling from Teck Line Creek, 2019 (Abundance per 3-min Kick)

Cordillera Consulting

Project: Teck Line Creek LAEMP 2019 (197202.0006) - Kick Sampling

Taxonomist: Scott Finlayson 250-494-7553
scottfinlayson@cordilleraconsulting.ca

Site:	2019	2019	2019	2019	2019	2019	2019
Sample:	RG_FO23_BIC-5	RG_LCUT_BIC	RG_LISP24_BIC	RG_SLINE_BIC-1	RG_SLINE_BIC-2	RG_SLINE_BIC-3	RG_LI24_BIC-1
Sample Collection Date:	08-Sep-19	04-Sep-19	05-Sep-19	09-Sep-19	09-Sep-19	09-Sep-19	06-Sep-19
CC#:	CC201038	CC201039	CC201040	CC201041	CC201042	CC201043	CC201044
| **Family: Chironomidae**	360	1,840	2,100	60	100	180	80
| **Subfamily: Chironominae**	0	0	0	0	0	0	0
| **Tribe: Chironomini**	0	0	0	0	0	0	0
Polypedilum	0	0	0	0	0	0	0
| **Tribe: Tanytarsini**	0	0	0	0	0	0	0
Micropsectra	100	0	20	0	0	0	0
Stempellinella	20	0	0	0	0	0	0
| **Subfamily: Diamesinae**	0	0	0	0	0	0	0
| **Tribe: Diamesini**	0	0	0	0	0	0	0
Diamesa	0	580	240	0	33	0	0
Pagastia	400	1,040	560	0	33	0	0
Pseudodiamesa	20	0	0	0	0	0	0
| **Subfamily: Orthocladiinae**	0	0	0	0	0	0	0
Brillia	0	0	0	10	0	0	0
Corynoneura	100	0	0	0	0	0	20
Cricotopus (Nostococladius)	0	0	0	0	0	0	0
Eukiefferiella	940	1,560	1,440	20	200	40	100
Hydrobaenus	80	320	180	0	17	20	0
Krenosmittia	0	0	0	0	0	0	0
Limnophyes	20	0	0	0	0	0	0
Nanocladius	20	0	20	0	0	0	0
Orthocladius complex	2,920	4,740	3,760	30	317	20	120
Parametriocnemus	0	0	0	0	0	0	0
Parorthocladius	0	60	0	10	50	40	40
Rheocricotopus	80	280	1,100	170	283	100	460
Thienemanniella	0	60	20	0	0	0	0
Tvetenia	700	1,720	1,200	40	133	40	240
| **Subfamily: Tanypodinae**	140	0	0	0	0	0	0
| **Tribe: Pentaneurini**	0	0	0	0	0	0	0
Thienemannimyia group	0	0	0	0	0	0	0
| **Family: Empididae**	320	0	0	0	17	0	0
Clinocera	40	0	20	0	17	0	0
Neoplasta	20	0	0	0	0	0	0
Oreogeton	0	0	0	0	33	120	0
| **Family: Pelecorhynchidae**	0	0	0	0	0	0	0
Glutops	0	0	0	0	0	0	0
| **Family: Psychodidae**	0	0	0	0	0	0	0
Pericoma/Telmatoscopus	360	0	0	0	0	0	20
| **Family: Simuliidae**	0	0	0	0	0	0	0
Prosimulium	0	0	20	0	0	0	0
Prosimulium/Helodon	0	0	40	0	0	0	0
Simulium	0	0	20	0	0	0	0
| **Family: Stratiomyidae**	0	0	0	0	0	0	0
| **Family: Tipulidae**	100	0	0	0	17	20	0
Antocha	0	0	0	0	0	0	0
Dicranota	0	0	0	0	0	0	0
Gonomyodes	0	0	0	0	0	0	0
Hexatoma	20	20	0	0	0	0	0
Limnophila	20	0	0	0	0	0	0
| **Order: Hemiptera**	0	0	0	0	0	0	0
| **Family: Corixidae**	0	0	0	0	0	0	0
Callicorixa	0	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0
| **Class: Arachnida**	0	0	0	0	0	0	0
| **Order: Trombidiformes**	100	0	0	0	0	0	0
| **Family: Aturidae**	0	0	0	0	0	0	0
Aturus	300	0	20	0	0	0	0
| **Family: Feltriidae**	0	0	0	0	0	0	0
Feltria	120	40	80	0	0	0	0
| **Family: Hydryphantidae**	0	0	0	0	0	0	0
Protzia	0	0	0	0	0	0	0
| **Family: Hygrobatidae**	0	0	0	0	0	0	0
Atractides	0	0	0	0	33	0	0
| **Family: Lebertiidae**	0	0	0	0	0	0	0
Lebertia	520	140	20	30	17	20	20
| **Family: Mideopsidae**	0	0	0	0	0	0	0
Mideopsis	0	0	0	0	0	0	0
| **Family: Sperchontidae**	0	0	0	0	0	0	0
Sperchon	80	100	120	10	17	20	0
| **Family: Torrenticolidae**	40	0	0	0	0	0	0
Testudacarus	220	0	0	0	0	0	0
Torrenticola	0	0	0	0	0	0	0
Suborder: Prostigmata	0	0	0	0	0	0	0
| **Family: Stygothrombidiidae**	0	0	0	0	0	0	0
Stygothrombium	0	0	0	0	0	0	0
| **Order: Sarcoptiformes**	0	0	0	0	0	0	0
| **Order: Oribatida**	0	0	0	0	0	0	0
| **Family: Hydrozetidae**	0	0	0	0	0	20	0
Phylum: Annelida	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0
| **Class: Oligochaeta**	0	0	0	0	0	0	0
| **Order: Lumbriculida**	0	0	0	0	0	0	0
| **Family: Lumbriculidae**	0	0	0	20	0	0	0
Rhynchelmis	0	0	0	0	0	60	0
| **Order: Tubificida**	0	0	0	0	0	0	0
| **Family: Naididae**	1,540	0	0	0	0	0	0
Nais	2,640	0	20	0	0	0	0
| **Subfamily: Tubificinae without**	0	0	0	0	0	0	0
Totals:	**19,880**	**13,240**	**16,400**	**4,670**	**5,667**	**7,860**	**7,140**
Taxa present but not included:							
Phylum: Arthropoda	0	0	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0	0
| **Class: Ostracoda**	20	20	20	10	17	20	20
| **Class: Maxillipoda**	0	0	0	0	0	0	0
| **Class: Copepoda**	20	0	0	0	0	0	0
Phylum: Nemata	20	20	20	10	17	0	0
Phylum: Platyhelminthes	0	0	0	0	0	0	0
| **Class: Turbellaria**	0	20	0	0	17	0	0
Totals:	**60**	**60**	**40**	**20**	**51**	**20**	**20**

Table A.7: Benthic Macroinvertebrates Collected Through Kick Sampling from Teck Line Creek, 2019 (Abundance per 3-min Kick)

Cordillera Consulting

Project: Teck Line Creek LAEMP 2019 (197202.0006) - Kick Sampling

Taxonomist: Scott Finlayson 250-494-7553
scottfinlayson@cordilleraconsulting.ca

Site:	2019	2019	2019	2019	2019	2019	2019
Sample:	RG_LI24_BIC-2	RG_LI24_BIC-3	RG_LIDCOM_BIC	RG_FRUL_BIC	RG_LIDSL_BIC-1	RG_LIDSL_BIC-2	RG_LIDSL_BIC-3
Sample Collection Date:	06-Sep-19	06-Sep-19	12-Sep-19	12-Sep-19	10-Sep-19	10-Sep-19	10-Sep-19
CC#:	CC201045	CC201046	CC201047	CC201048	CC201049	CC201050	CC201051
Phylum: Arthropoda	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0
Ameletus	33	29	220	0	320	140	60
| Family: Baetidae	33	14	0	83	140	120	40
Acentrella	0	0	0	0	0	0	0
Baetis	0	0	1,560	717	520	460	160
Baetis rhodani group	33	0	2,480	250	900	1,080	980
| Family: Ephemerellidae	133	43	740	50	760	400	120
Drunella	50	29	240	0	20	0	20
Drunella coloradensis	0	0	0	0	20	0	40
Drunella doddsii	0	29	1,980	50	60	220	40
Drunella spinifera	0	0	0	0	0	0	0
| Family: Heptageniidae	1,917	2,271	8,440	950	4,480	5,140	2,160
Cinygmula	200	243	20	0	20	20	0
Epeorus	50	29	220	0	20	100	80
Rhithrogena	117	86	0	0	0	0	0
| Family: Leptophlebiidae	0	0	0	0	0	0	0
Neoleptophlebia	0	0	0	0	0	0	0
| Order: Plecoptera	0	0	0	0	0	0	0
| Family: Capniidae	33	14	20	50	20	20	20
Utacapnia	0	0	0	0	0	0	0
| Family: Chloroperlidae	0	100	100	100	220	60	40
Suwallia	33	43	40	0	20	20	0
Sweltsa	0	71	80	33	200	120	60
| Family: Leuctridae	17	0	120	167	20	0	0
Paraleuctra	0	0	0	0	0	0	0
| Family: Nemouridae	0	57	920	17	0	120	100
Visoka cataractae	0	14	0	0	0	0	20
Zapada	50	0	1,380	183	500	280	60
Zapada oregonensis group	50	0	1,340	0	620	1,140	380
Zapada cinctipes	0	0	40	183	0	0	0
Zapada columbiana	867	700	580	0	200	320	180
| Family: Peltoperlidae	0	14	0	0	0	0	0
Yoraperla	0	0	0	0	0	0	0
| Family: Perlidae	0	0	0	117	0	0	0
Hesperoperla	0	0	0	233	0	0	0
| Family: Perlodidae	167	43	60	0	0	40	20
Kogotus	0	0	200	50	200	260	100
Megarcys	200	71	240	0	40	0	60
Setvena	0	0	0	0	0	0	0
| Family: Taeniopterygidae	217	129	3,160	217	160	440	180
Taenionema	0	0	0	0	0	0	0
| Order: Trichoptera	0	0	340	33	620	340	100
| Family: Apataniidae	0	0	0	0	0	0	0
Apatania	0	0	80	0	80	0	0
| Family: Brachycentridae	0	0	0	0	0	0	0
Brachycentrus	0	0	0	133	0	0	0
Brachycentrus americanus	0	0	0	0	0	0	0
Micrasema	0	0	0	0	0	0	0
| Family: Glossosomatidae	0	0	40	0	0	40	0
Glossosoma	0	0	0	0	0	0	0
| Family: Hydropsychidae	0	0	780	0	200	360	120
Parapsyche	0	0	0	0	0	0	0
Parapsyche elsis	0	0	40	0	20	20	0
| Family: Hydroptilidae	0	0	0	0	0	0	0
Hydroptila	0	0	0	0	0	0	0
| Family: Limnephilidae	0	0	40	0	0	0	0
| Family: Rhyacophilidae	0	0	0	0	0	0	0
Rhyacophila	0	0	720	150	20	60	0
Rhyacophila betteni group	0	0	60	0	40	0	0
Rhyacophila brunnea/vemna group	0	0	20	0	80	100	20
Rhyacophila hyalinata group	17	0	60	0	0	0	0
Rhyacophila vofixa group	0	0	0	0	0	0	0
Rhyacophila narvae	0	0	0	0	0	20	0
| Family: Uenoidae	0	0	0	0	0	0	0
Neothremma	0	0	20	0	0	0	0
| Order: Coleoptera	0	0	0	0	0	0	0
| Family: Elmidae	0	0	0	0	0	0	0
Heterlimnius	0	0	0	0	0	0	0
Narpus	0	0	0	17	0	0	0
| Order: Diptera	0	0	0	0	0	0	0
| Family: Athericidae	0	0	0	0	0	0	0
Atherix	0	0	0	17	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0	0
Mallochohelea	0	0	0	0	0	0	0

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Project: Teck Line Creek LAEMP 2019 (197202.0006) - Kick Sampling

Taxonomist: Scott Finlayson 250-494-7553 scottfinlayson@cordilleraconsulting.ca

Site:	2019	2019	2019	2019	2019	2019	2019
Sample:	RG_LI24_BIC-2	RG_LI24_BIC-3	RG_LIDCOM_BIC	RG_FRUL_BIC	RG_LIDSL_BIC-1	RG_LIDSL_BIC-2	RG_LIDSL_BIC-3
Sample Collection Date:	06-Sep-19	06-Sep-19	12-Sep-19	12-Sep-19	10-Sep-19	10-Sep-19	10-Sep-19
CC#:	CC201045	CC201046	CC201047	CC201048	CC201049	CC201050	CC201051
| Family: Chironomidae	117	29	2,340	150	1,220	1,200	640
| Subfamily: Chironominae	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0
Polypedilum	0	0	0	33	0	0	0
| Tribe: Tanytarsini	0	0	0	0	0	0	0
Micropsectra	0	29	80	100	140	0	0
Stempellinella	0	0	0	0	0	0	0
| Subfamily: Diamesinae	0	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0
Diamesa	267	29	2,520	33	40	40	40
Pagastia	17	0	320	0	520	480	240
Pseudodiamesa	0	0	0	0	0	0	0
| Subfamily: Orthocladiinae	0	0	0	0	0	0	0
Brillia	0	0	0	0	0	0	0
Corynoneura	0	0	0	17	20	0	0
Cricotopus (Nostococladius)	0	0	20	0	0	0	0
Eukiefferiella	467	57	1,300	0	280	240	300
Hydrobaenus	0	0	660	0	740	160	140
Krenosmittia	0	0	0	0	0	0	0
Limnophyes	0	0	0	0	0	0	0
Nanocladius	0	0	0	0	0	0	0
Orthocladius complex	233	43	3,360	200	660	760	620
Parametriocnemus	0	0	0	0	0	0	0
Parorthocladius	0	14	0	0	0	0	0
Rheocricotopus	67	214	840	33	760	560	300
Thienemanniella	0	0	0	0	0	0	0
Tvetenia	67	43	1,500	150	340	300	360
| Subfamily: Tanypodinae	0	0	0	0	0	0	0
| Tribe: Pentaneurini	0	0	0	0	0	0	0
Thienemannimyia group	0	0	0	0	0	0	0
| Family: Empididae	0	0	20	33	0	60	20
Clinocera	0	0	0	0	0	0	0
Neoplasta	0	0	0	17	0	0	20
Oreogeton	0	0	0	17	0	0	0
| Family: Pelecorhynchidae	0	0	0	0	0	0	0
Glutops	0	0	20	0	0	0	0
| Family: Psychodidae	0	0	0	0	0	0	0
Pericoma/Telmatoscopus	0	0	180	483	20	80	0
| Family: Simuliidae	0	0	120	0	0	20	0
Prosimulium	0	0	0	0	0	0	0
Prosimulium/Helodon	0	14	40	0	0	0	0
Simulium	0	0	120	33	0	60	0
| Family: Stratiomyidae	0	0	0	0	0	0	0
| Family: Tipulidae	17	0	60	0	0	40	0
Antocha	0	0	0	0	0	0	0
Dicranota	0	0	0	17	0	0	0
Gonomyodes	0	14	0	0	0	0	0
Hexatoma	0	0	40	33	0	20	0
Limnophila	0	0	0	0	0	0	0
| Order: Hemiptera	0	0	0	0	0	0	0
| Family: Corixidae	0	0	0	0	0	0	0
Callicorixa	17	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0	0
| Order: Trombidiformes	17	0	100	0	0	0	0
| Family: Aturidae	0	0	0	0	0	0	0
Aturus	0	0	60	0	0	0	0
| Family: Feltriidae	0	0	0	0	0	0	0
Feltria	0	0	120	0	0	20	0
| Family: Hydryphantidae	0	0	0	0	0	0	0
Protzia	0	0	0	0	0	0	0
| Family: Hygrobatidae	0	0	0	0	0	0	0
Atractides	0	14	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0	0
Lebertia	33	43	0	83	80	100	80
| Family: Mideopsidae	0	0	0	0	0	0	0
Mideopsis	0	0	0	0	0	0	0
| Family: Sperchontidae	0	0	0	0	0	0	0
Sperchon	50	29	220	0	120	40	20
| Family: Torrenticolidae	0	0	0	0	0	0	0
Testudacarus	0	0	0	0	0	0	0
Torrenticola	0	0	0	17	0	0	0
Suborder: Prostigmata	0	0	0	0	0	0	0
| Family: Stygothrombidiidae	0	0	0	0	0	0	0
Stygothrombium	0	0	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0	0
| Order: Oribatida	0	0	0	0	0	0	0
| Family: Hydrozetidae	0	0	0	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0
| Order: Lumbriculida	0	0	0	0	0	0	0
| Family: Lumbriculidae	0	0	0	33	20	0	0
Rhynchelmis	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0
| Family: Naididae	0	0	0	0	0	0	0
Nais	0	0	0	100	0	0	0
| Subfamily: Tubificinae without	0	0	0	0	0	0	0
Totals:	**5,586**	**4,601**	**40,420**	**5,382**	**15,480**	**15,620**	**7,940**
Taxa present but not included:							
Phylum: Arthropoda	0	0	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0	0
| Class: Ostracoda	17	14	20	17	20	20	20
| Class: Maxillipoda	0	0	0	0	0	0	0
| Class: Copepoda	0	0	0	0	0	0	0
Phylum: Nemata	17	14	20	0	0	20	20
Phylum: Platyhelminthes	0	0	0	0	0	0	0
| Class: Turbellaria	0	0	0	0	20	20	20
Totals:	**34**	**28**	**40**	**17**	**40**	**60**	**60**

Table A.7: Benthic Macroinvertebrates Collected Through Kick Sampling from Teck Line Creek, 2019 (Abundance per 3-min Kick)

Cordillera Consulting

Project: Teck Line Creek LAEMP 2019 (197202.0006) - Kick Sampling

Taxonomist: Scott Finlayson 250-494-7553
scottfinlayson@cordilleraconsulting.ca

Site:	2019	2019	2019	2019	2019
Sample:	RG_LIDSL_BIC-4	RG_LIDSL_BIC-5	RG_LI8_BIC-1	RG_LI8_BIC-2	RG_LI8_BIC-3
Sample Collection Date:	10-Sep-19	11-Sep-19	11-Sep-19	11-Sep-19	11-Sep-19
CC#:	CC201052	CC201053	CC201054	CC201055	CC201056
Phylum: Arthropoda	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0
| Class: Insecta	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0
Ameletus	320	280	20	300	200
| Family: Baetidae	40	0	300	0	120
Acentrella	0	0	0	0	20
Baetis	560	660	460	1,260	540
Baetis rhodani group	1,320	1,400	1,460	1,380	1,440
| Family: Ephemerellidae	540	600	420	860	140
Drunella	0	0	20	0	0
Drunella coloradensis	0	0	0	0	0
Drunella doddsii	160	160	620	0	560
Drunella spinifera	0	0	0	0	0
| Family: Heptageniidae	4,500	3,740	5,560	4,400	5,080
Cinygmula	0	0	0	0	0
Epeorus	420	220	300	200	980
Rhithrogena	20	0	180	40	400
| Family: Leptophlebiidae	0	0	0	0	0
Neoleptophlebia	0	0	0	0	0
| Order: Plecoptera	0	0	0	0	0
| Family: Capniidae	0	60	0	0	0
Utacapnia	0	0	0	0	0
| Family: Chloroperlidae	40	0	40	0	0
Suwallia	40	20	0	0	0
Sweltsa	140	120	0	0	0
| Family: Leuctridae	0	0	120	40	0
Paraleuctra	0	0	0	0	0
| Family: Nemouridae	640	380	220	820	640
Visoka cataractae	0	0	0	0	0
Zapada	260	360	1,420	1,620	1,620
Zapada oregonensis group	820	600	680	240	760
Zapada cinctipes	0	0	0	0	0
Zapada columbiana	160	260	500	100	220
| Family: Peltoperlidae	0	0	0	0	0
Yoraperla	0	0	0	0	0
| Family: Perlidae	0	0	0	0	0
Hesperoperla	0	0	0	0	0
| Family: Perlodidae	0	20	20	0	0
Kogotus	280	80	240	160	200
Megarcys	80	60	300	180	200
Setvena	0	0	0	0	0
| Family: Taeniopterygidae	600	260	2,420	1,900	1,760
Taenionema	0	0	0	0	0
| Order: Trichoptera	600	400	360	420	640
| Family: Apataniidae	0	0	0	0	0
Apatania	0	60	0	0	0
| Family: Brachycentridae	0	0	0	0	0
Brachycentrus	0	0	0	0	0
Brachycentrus americanus	0	0	0	0	0
Micrasema	0	0	0	0	0
| Family: Glossosomatidae	40	0	0	0	0
Glossosoma	0	20	0	0	0
| Family: Hydropsychidae	160	420	360	200	200
Parapsyche	0	0	0	0	0
Parapsyche elsis	220	240	40	0	0
| Family: Hydroptilidae	0	0	0	0	0
Hydroptila	0	0	0	0	0
| Family: Limnephilidae	20	20	0	0	0
| Family: Rhyacophilidae	0	0	0	0	0
Rhyacophila	40	100	440	300	240
Rhyacophila betteni group	40	20	20	60	80
Rhyacophila brunnea/vemna group	140	100	400	300	280
Rhyacophila hyalinata group	80	20	20	20	60
Rhyacophila vofixa group	0	0	0	0	0
Rhyacophila narvae	100	0	0	0	0
| Family: Uenoidae	0	0	0	0	0
Neothremma	0	0	0	0	0
| Order: Coleoptera	0	0	0	0	0
| Family: Elmidae	0	0	0	0	0
Heterlimnius	20	0	0	0	20
Narpus	0	0	0	0	0
| Order: Diptera	0	0	0	0	0
| Family: Athericidae	0	0	0	0	0
Atherix	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0
Mallochohelea	0	0	0	0	0

Table A.7: Benthic Macroinvertebrates Collected Through Kick Sampling from Teck Line Creek, 2019 (Abundance per 3-min Kick)

Cordillera Consulting

Project: Teck Line Creek LAEMP 2019 (197202.0006) - Kick Sampling

Taxonomist: Scott Finlayson 250-494-7553 scottfinlayson@cordilleraconsulting.ca

Site:	2019	2019	2019	2019	2019
Sample:	RG_LIDSL_BIC-4	RG_LIDSL_BIC-5	RG_LI8_BIC-1	RG_LI8_BIC-2	RG_LI8_BIC-3
Sample Collection Date:	10-Sep-19	11-Sep-19	11-Sep-19	11-Sep-19	11-Sep-19
CC#:	CC201052	CC201053	CC201054	CC201055	CC201056
| Family: Chironomidae	2,200	1,640	1,100	840	700
| Subfamily: Chironominae	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0
Polypedilum	0	0	0	0	0
| Tribe: Tanytarsini	0	0	0	0	0
Micropsectra	60	20	20	60	0
Stempellinella	0	0	0	0	20
| Subfamily: Diamesinae	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0
Diamesa	0	40	20	0	0
Pagastia	660	660	0	0	0
Pseudodiamesa	0	0	0	0	20
| Subfamily: Orthocladiinae	0	0	0	0	0
Brillia	0	0	0	20	0
Corynoneura	0	0	0	20	20
Cricotopus (Nostococladius)	0	0	0	0	20
Eukiefferiella	520	560	160	120	60
Hydrobaenus	380	420	180	200	120
Krenosmittia	0	0	0	0	0
Limnophyes	0	0	40	0	0
Nanocladius	0	0	0	0	0
Orthocladius complex	2,040	3,100	60	80	140
Parametriocnemus	0	0	0	0	0
Parorthocladius	0	0	0	0	0
Rheocricotopus	420	380	740	560	460
Thienemanniella	0	20	0	0	0
Tvetenia	440	560	80	20	140
| Subfamily: Tanypodinae	0	0	0	0	0
| Tribe: Pentaneurini	0	0	0	0	0
Thienemannimyia group	0	0	0	0	0
| Family: Empididae	20	0	40	0	20
Clinocera	0	0	0	0	0
Neoplasta	0	0	0	20	60
Oreogeton	0	0	0	0	0
| Family: Pelecorhynchidae	0	0	0	0	0
Glutops	20	0	0	0	0
| Family: Psychodidae	0	0	0	0	0
Pericoma/Telmatoscopus	20	60	60	160	100
| Family: Simuliidae	20	80	140	80	20
Prosimulium	0	0	0	0	0
Prosimulium/Helodon	0	0	100	20	20
Simulium	40	40	40	40	0
| Family: Stratiomyidae	0	0	0	0	0
| Family: Tipulidae	0	0	0	0	0
Antocha	0	0	0	0	0
Dicranota	0	0	0	0	0
Gonomyodes	0	0	0	0	0
Hexatoma	20	0	20	0	20
Limnophila	0	0	0	0	0
| Order: Hemiptera	0	0	0	0	0
| Family: Corixidae	0	0	0	0	0
Callicorixa	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0
| Order: Trombidiformes	60	0	0	0	0
| Family: Aturidae	0	0	0	0	0
Aturus	0	0	0	0	0
| Family: Feltriidae	0	0	0	0	0
Feltria	20	60	20	0	0
| Family: Hydryphantidae	0	0	0	0	0
Protzia	0	0	0	20	20
| Family: Hygrobatidae	0	0	0	0	0
Atractides	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0
Lebertia	80	40	60	0	20
| Family: Mideopsidae	0	0	0	0	0
Mideopsis	0	0	0	0	0
| Family: Sperchontidae	0	0	0	0	0
Sperchon	60	80	80	60	60
| Family: Torrenticolidae	0	0	0	0	0
Testudacarus	60	0	0	0	0
Torrenticola	0	0	0	0	0
Suborder: Prostigmata	0	0	0	0	0
| Family: Stygothrombidiidae	0	0	0	0	0
Stygothrombium	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0
| Order: Oribatida	20	0	0	0	0
| Family: Hydrozetidae	0	0	0	0	0
Phylum: Annelida	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0
| Order: Lumbriculida	0	0	0	0	0
| Family: Lumbriculidae	20	0	80	200	260
Rhynchelmis	0	20	20	20	260
| Order: Tubificida	0	0	0	0	0
| Family: Naididae	0	0	0	0	0
Nais	0	0	0	0	0
| Subfamily: Tubificinae without	0	0	0	0	0
Totals:	**19,580**	**18,460**	**20,000**	**17,340**	**18,960**
Taxa present but not included:					
Phylum: Arthropoda	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0
| Class: Ostracoda	20	20	20	20	20
| Class: Maxillipoda	0	0	0	0	0
| Class: Copepoda	0	0	0	0	0
Phylum: Nemata	20	20	20	20	20
Phylum: Platyhelminthes	0	0	0	0	0
| Class: Turbellaria	20	20	20	20	20
Totals:	**60**	**60**	**60**	**60**	**60**

Table A.8: Benthic Macroinvertebrates Collected Through Hess Sampling (Sampling Area = 0.1m^2) from Teck Line Creek, 2019 (Densities Expressed per Sampled Area)

Station	LILC3																			
	1		2		3		4		5		6		7		8		9		10	
ROUNDWORMS																				
P. Nemata	204	0.0212	88	0.0084	148	0.0180	184	0.0192	184	0.0224	176	0.0140	312	0.0200	552	0.0376	152	0.0188	72	0.0104
FLATWORMS																				
P. Platyhelminthes																				
Cl. Turbellaria																				
F. Planariidae	8	0.1056	36	0.0440	20	0.0628	32	0.2448	24	0.1256	36	0.1420	48	0.1176	8	0.1032	100	0.1684	80	0.3504
ANNELIDS																				
P. Annelida																				
WORMS																				
Cl. Oligochaeta																				
F. Enchytraeidae	-	-	-	-	-	-	-	-	40	0.0016	4	0.0004	12	0.0012	-	-	-	-	-	-
F. Lumbricidae	4	0.0208	-	-	-	-	-	-	8	0.0416	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae	-	-	4	0.0040	4	0.0096	8	0.0352	-	-	-	-	16	0.0976	-	-	-	-	16	0.0984
ARTHROPODS																				
MITES																				
Cl. Arachnida																				
Subcl. Acari	-	-	-	-	-	-	-	-	-	-	-	-	4	0.0004	-	-	-	-	-	-
F. Hydryphantidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Lebertiidae	12	0.0040	8	0.0048	32	0.0220	72	0.0384	56	0.0232	24	0.0108	12	0.0076	24	0.0192	16	0.0072	32	0.0080
F. Sperchonidae	68	0.0404	80	0.0312	60	0.0392	112	0.0656	72	0.0392	68	0.0300	52	0.0208	40	0.0272	4	0.0008	32	0.0112
SEED SHRIMPS																				
Cl. Ostracoda	276	0.0684	120	0.0288	364	0.0920	968	0.2440	624	0.1480	588	0.1368	1,240	0.3152	768	0.1960	140	0.0356	840	0.1976
INSECTS																				
Cl. Insecta																				
BEETLES																				
O. Coleoptera																				
F. Elmidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	0.0184
MAYFLIES																				
O. Ephemeroptera																				
F. Ameletidae	4	0.0012	-	-	4	0.0008	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Baetidae	8	0.0316	4	0.0188	8	0.0024	24	0.0744	-	-	12	0.0044	8	0.0436	24	0.1264	4	0.0024	8	0.0056
F. Ephemerellidae	8	0.0016	-	-	8	0.0064	8	0.0056	-	-	12	0.0044	4	0.0156	-	-	16	0.0036	8	0.0072
F. Heptageniidae	96	0.0280	60	0.0176	28	0.0112	64	0.0200	16	0.0936	56	0.0160	64	0.0148	24	0.0088	20	0.0068	64	0.0232
STONEFLIES																				
O. Plecoptera																				
F. Capniidae	-	-	-	-	-	-	-	-	-	-	-	-	4	0.0164	-	-	4	0.0108	-	-
F. Chloroperlidae	24	0.0712	8	0.0168	-	-	-	-	40	0.1072	28	0.0668	4	0.0100	8	0.0192	12	0.0184	176	0.6792
F. Leuctridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	0.0008
F. Nemouridae	28	0.1368	32	0.1652	20	0.1848	16	0.1296	16	0.0976	24	0.1516	16	0.0764	40	0.2888	28	0.1644	24	0.2312
F. Perlodidae	20	0.2928	8	0.0848	4	0.0004	8	0.1248	8	0.0032	-	-	8	0.1288	8	0.0056	4	0.0520	-	-
F. Peltoperlidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Taeniopterygidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CADDISFLIES																				
O. Trichoptera																				
immature *	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Apataniidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Brachycentridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Glossosomatidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Hydropsychidae	19	1.1802	8	0.9816	13	1.4294	3	0.3121	-	-	13	1.2316	-	-	28	1.7202	25	1.6956	16	0.8536
F. Hydroptilidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Limnephilidae	-	-	4	0.0004	-	-	8	0.0024	-	-	4	0.0008	8	0.0020	8	0.0016	-	-	-	-
F. Rhyacophilidae	28	1.8776	16	0.7384	36	2.6128	40	2.6312	16	0.6576	40	2.0168	4	0.7204	56	2.6800	52	2.8628	56	4.1984
F. Uenoidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TRUE FLIES																				
O. Diptera																				
indeterminate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pupae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Ceratopogonidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Chironomidae	1,500	1.8660	1,136	1.5016	1,420	2.3800	1,776	2.4984	2,368	2.2552	1,448	2.3260	2,168	2.3356	3,224	3.3824	1,372	1.3516	3,744	3.7680
F. Empididae	24	0.0528	4	0.0080	16	0.0364	32	0.0584	8	0.0136	12	0.0360	16	0.0336	64	0.1432	20	0.0452	40	0.0760
F. Ephydridae	-	-	-	-	-	-	8	0.0008	-	-	-	-	-	-	-	-	-	-	-	-
F. Muscidae	-	-	-	-	-	-	-	-	-	-	-	-	4	0.0708	-	-	4	0.0088	-	-
F. Pelecorhyncidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	0.2304	-	-	-	-
F. Psychodidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Simuliidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Tipulidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	0.0248	4	0.0068	-	-
TOTAL NUMBER OF ORGANISMS PER SAMPLE	2,331		1,616		2,185		3,363		3,480		2,545		4,004		4,892		1,977		5,224	
TOTAL NUMBER OF TAXA[a]	17		16		16		17		14		16		20		17		18		17	
TOTAL BIOMASS (g)		5.8002		3.6544		6.9082		6.5049		3.6296		6.1884		4.0484		9.0146		6.4600		10.5376

[a] Bold entries excluded from taxa count

*Immature Trichoptera excluded from taxa count if Uenoidae were also present in sample

Table A.8: Benthic Macroinvertebrates Collected Through Hess Sampling (Sampling Area = 0.1m²) from Teck Line Creek, 2019 (Densities Expressed per Sampled Area)

Station	LIDSL																			
	1		2		3		4		5		6		7		8		9		10	
ROUNDWORMS																				
P. Nemata	1	0.0001	26	0.0076	14	0.0014	7	0.0003	4	0.0004	16	0.0012	2	0.0010	4	0.0002	8	0.0004	8	0.0012
FLATWORMS																				
P. Platyhelminthes																				
Cl. Turbellaria																				
F. Planariidae	19	0.0462	14	0.0374	1	0.0005	16	0.0485	46	0.1300	22	0.0560	15	0.0297	9	0.0160	29	0.1090	10	0.0135
ANNELIDS																				
P. Annelida																				
WORMS																				
Cl. Oligochaeta																				
F. Enchytraeidae	-	-	4	0.0010	-	-	-	-	-	-	2	0.0004	-	-	-	-	2	0.0002	-	-
F. Lumbricidae	-	-	-	-	-	-	-	-	2	0.0068	-	-	-	-	1	0.0040	-	-	-	-
F. Lumbriculidae	-	-	14	0.0606	3	0.0090	3	0.0050	9	0.0377	4	0.0216	3	0.0080	-	-	24	0.0994	13	0.0638
ARTHROPODS																				
MITES																				
Cl. Arachnida																				
Subcl. Acari	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Hydryphantidae	-	-	2	0.0002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Lebertiidae	4	0.0015	18	0.0066	1	0.0005	5	0.0017	2	0.0008	4	0.0018	6	0.0016	1	0.0001	-	-	8	0.0045
F. Sperchonidae	-	-	8	0.0020	-	-	1	0.0006	1	0.0004	6	0.0024	1	0.0007	-	-	-	-	3	0.0015
SEED SHRIMPS																				
Cl. Ostracoda	21	0.0035	42	0.0096	11	0.0025	18	0.0043	46	0.0106	34	0.0070	71	0.0158	14	0.0045	56	0.0132	48	0.0119
INSECTS																				
Cl. Insecta																				
BEETLES																				
O. Coleoptera																				
F. Elmidae	-	-	-	-	1	0.0004	1	0.0005	-	-	-	-	-	-	7	0.0095	-	-	1	0.0008
MAYFLIES																				
O. Ephemeroptera																				
F. Ameletidae	16	0.0032	20	0.0060	4	0.0014	17	0.0040	20	0.0149	14	0.0042	11	0.0143	-	-	16	0.0048	13	0.0040
F. Baetidae	18	0.0480	42	0.1642	6	0.0190	10	0.0266	3	0.0306	20	0.0774	13	0.0565	-	-	18	0.0644	17	0.0620
F. Ephemerellidae	16	0.0054	91	0.0585	30	0.0074	15	0.0050	14	0.0073	28	0.0100	25	0.0628	10	0.0088	49	0.0672	42	0.0594
F. Heptageniidae	195	0.0814	434	0.2252	105	0.0305	241	0.0721	313	0.1723	250	0.2178	204	0.1066	50	0.0316	460	0.1524	267	0.1532
STONEFLIES																				
O. Plecoptera																				
F. Capniidae	1	0.0002	-	-	-	-	1	0.0006	3	0.0064	2	0.0020	1	0.0006	-	-	4	0.0038	1	0.0006
F. Chloroperlidae	19	0.0460	22	0.0414	7	0.0131	54	0.1339	102	0.1380	42	0.0792	16	0.0274	9	0.0087	58	0.2098	38	0.0867
F. Leuctridae	2	0.0041	20	0.0178	6	0.0056	2	0.0031	2	0.0007	-	-	2	0.0004	3	0.0020	6	0.0084	7	0.0083
F. Nemouridae	49	0.2083	78	0.4084	38	0.1730	57	0.2211	72	0.2151	72	0.3632	30	0.1952	19	0.0753	24	0.1466	8	0.0415
F. Perlodidae	8	0.1283	8	0.0592	3	0.0195	6	0.0368	17	0.2419	10	0.1482	7	0.0759	5	0.0438	8	0.0630	5	0.0268
F. Peltoperlidae	1	0.0083	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Taeniopterygidae	-	-	2	0.0004	-	-	3	0.0006	-	-	-	-	-	-	3	0.0007	14	0.0022	2	0.0003
CADDISFLIES																				
O. Trichoptera																				
immature *	-	-	14	0.0008	2	0.0001	-	-	-	-	38	0.0026	3	0.0001	**2**	0.0002	4	0.0002	6	0.0003
F. Apataniidae	2	0.0001	26	0.0070	1	0.0007	-	-	-	-	4	0.0016	2	0.0006	-	-	4	0.0006	4	0.0006
F. Brachycentridae	-	-	-	-	-	-	1	0.0002	-	-	-	-	-	-	-	-	-	-	-	-
F. Glossosomatidae	1	0.0026	-	-	-	-	-	-	-	-	-	-	2	0.0050	1	0.0150	-	-	-	-
F. Hydropsychidae	3	0.1980	2	0.0002	3	0.1166	6	0.4899	4	0.0796	4	0.0004	2	0.0778	-	-	4	0.1983	-	-
F. Hydroptilidae	1	0.0017	-	-	-	-	1	0.0015	-	-	-	-	-	-	-	-	-	-	-	-
F. Limnephilidae	-	-	-	-	-	-	-	-	-	-	-	-	5	0.0014	-	-	-	-	3	0.0009
F. Rhyacophilidae	19	0.3612	10	0.0758	6	0.0290	19	0.2924	23	0.2715	28	0.2594	7	0.2194	32	0.0995	12	0.1624	8	0.2906
F. Uenoidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.0002	-	-	-	-
TRUE FLIES																				
O. Diptera																				
indeterminate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.0003
pupae	-	-	-	-	-	-	-	-	1	0.0074	-	-	-	-	-	-	-	-	-	-
F. Ceratopogonidae	-	-	4	0.0036	-	-	3	0.0018	3	0.0043	-	-	3	0.0029	-	-	4	0.0046	4	0.0042
F. Chironomidae	215	0.1681	658	0.5574	169	0.2005	300	0.2360	369	0.3628	258	0.1838	143	0.1982	117	0.0714	354	0.2942	377	0.4659
F. Empididae	8	0.0141	30	0.0572	18	0.0352	9	0.0157	5	0.0099	20	0.0334	7	0.0100	1	0.0017	20	0.0376	12	0.0215
F. Ephydridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Muscidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Pelecorhyncidae	1	0.0113	12	0.0678	1	0.1309	5	0.0100	1	0.0012	27	0.0884	11	0.0114	9	0.0053	2	0.0060	-	-
F. Psychodidae	9	0.0004	26	0.0078	12	0.0022	31	0.0050	1	0.0002	16	0.0018	4	0.0005	11	0.0015	6	0.0012	7	0.0013
F. Simuliidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Tipulidae	-	-	1	0.1106	1	0.0015	8	0.0825	3	0.0679	-	-	2	0.3281	-	-	1	0.1049	1	0.0036
TOTAL NUMBER OF ORGANISMS PER SAMPLE	629		1,628		443		840		1,066		921		598		309		1,187		914	
TOTAL NUMBER OF TAXA[a]	23		27		23		27		25		23		27		20		25		27	
TOTAL BIOMASS (g)		1.3420		1.9943		0.8005		1.6997		1.8187		1.5638		1.4519		0.4000		1.7548		1.3292

[a] Bold entries excluded from taxa count

*Immature Trichoptera excluded from taxa count if Uenoidae were also present in sample

Table A.8: Benthic Macroinvertebrates Collected Through Hess Sampling (Sampling Area = 0.1m²) from Teck Line Creek, 2019 (Densities Expressed per Sampled Area)

Station	LI24										SLINE									
	1		2		3		4		5		1		2		3		4		5	
ROUNDWORMS																				
P. Nemata	2	0.0016	2	0.0024	1	0.0001	1	0.0001	-	-	1	0.0004	4	0.0034	4	0.0032	1	0.0001	1	0.0007
FLATWORMS																				
P. Platyhelminthes																				
Cl. Turbellaria																				
F. Planariidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	0.0036	2	0.0023	1	0.0005
ANNELIDS																				
P. Annelida																				
WORMS																				
Cl. Oligochaeta																				
F. Enchytraeidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Lumbricidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae	2	0.0040	1	0.0148	1	0.0038	-	-	-	-	24	0.0796	14	0.0394	14	0.0374	-	-	7	0.0212
ARTHROPODS																				
MITES																				
Cl. Arachnida																				
Subcl. Acari	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**	0.0001
F. Hydryphantidae	-	-	-	-	-	-	-	-	1	0.0002	1	0.0003	-	-	4	0.0008	-	-	-	-
F. Lebertiidae	2	0.0002	1	0.0011	1	0.0005	2	0.0007	3	0.0016	-	-	2	0.0010	-	-	-	-	-	-
F. Sperchonidae	-	-	1	0.0014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.0007
SEED SHRIMPS																				
Cl. Ostracoda	118	0.0316	104	0.0271	42	0.0103	141	0.0336	15	0.0028	18	0.0058	150	0.0366	8	0.0038	31	0.0077	57	0.0140
INSECTS																				
Cl. Insecta																				
BEETLES																				
O. Coleoptera																				
F. Elmidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAYFLIES																				
O. Ephemeroptera																				
F. Ameletidae	12	0.0246	9	0.0094	6	0.0066	8	0.0113	5	0.0104	3	0.0244	26	0.0974	2	0.0100	3	0.0159	7	0.0342
F. Baetidae	2	0.0064	1	0.0052	1	0.0027	1	0.0025	2	0.0115	1	0.0067	3	0.0125	2	0.0036	-	-	1	0.0019
F. Ephemerellidae	2	0.0002	-	-	7	0.0316	2	0.0061	1	0.0005	46	0.1265	19	0.0654	112	0.0810	12	0.0781	18	0.0491
F. Heptageniidae	120	0.4322	70	0.1913	141	0.3090	128	0.3442	138	0.2801	119	0.1444	176	0.2578	136	0.1046	111	0.1173	103	0.1712
STONEFLIES																				
O. Plecoptera																				
F. Capniidae	2	0.0020	3	0.0009	2	0.0017	6	0.0059	3	0.0025	-	-	-	-	-	-	-	-	2	0.0024
F. Chloroperlidae	16	0.0368	50	0.1050	26	0.2586	28	0.0918	36	0.1208	79	0.1133	60	0.1360	36	0.0404	35	0.0618	51	0.0889
F. Leuctridae	6	0.0084	2	0.0028	4	0.0082	3	0.0040	12	0.0193	6	0.0058	4	0.0090	8	0.0086	10	0.0046	3	0.0016
F. Nemouridae	72	0.0816	11	0.0090	11	0.0118	30	0.0370	36	0.0439	4	0.0094	10	0.0084	8	0.0144	15	0.0304	7	0.0109
F. Perlodidae	2	0.0456	4	0.0692	6	0.0620	7	0.0827	11	0.1352	2	0.0626	3	0.0687	4	0.0132	4	0.0529	8	0.1665
F. Peltoperlidae	-	-	-	-	-	-	-	-	-	-	1	0.0081	-	-	6	0.0234	1	0.0066	-	-
F. Taeniopterygidae	2	0.0006	-	-	3	0.0008	3	0.0006	-	-	2	0.0008	2	0.0002	4	0.0004	-	-	-	-
CADDISFLIES																				
O. Trichoptera																				
immature *	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Apataniidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Brachycentridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Glossosomatidae	-	-	-	-	-	-	-	-	-	-	28	0.0617	48	0.1308	60	0.0926	11	0.0379	5	0.0247
F. Hydropsychidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Hydroptilidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Limnephilidae	2	0.0048	1	0.0003	2	0.0007	2	0.1618	7	0.1194	1	0.0003	16	0.0092	-	-	1	0.0003	5	0.0021
F. Rhyacophilidae	-	-	-	-	-	-	-	-	-	-	5	0.0848	17	0.3032	26	0.1564	6	0.0135	7	0.0402
F. Uenoidae	2	0.0008	2	0.0029	1	0.0006	2	0.0004	3	0.0015	-	-	-	-	-	-	1	0.0005	-	-
TRUE FLIES																				
O. Diptera																				
indeterminate	-	-	1	0.0007	-	-	-	-	-	-	-	-	2	0.0146	-	-	-	-	-	-
pupae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Ceratopogonidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Chironomidae	18	0.0068	10	0.0057	5	0.0026	10	0.0042	15	0.0043	29	0.0100	62	0.0266	42	0.0196	23	0.0082	18	0.0057
F. Empididae	10	0.0158	4	0.0063	3	0.0040	1	0.0021	1	0.0027	16	0.0183	10	0.0222	22	0.0272	7	0.0227	12	0.0297
F. Ephydridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Muscidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Pelecorhyncidae	-	-	-	-	-	-	-	-	-	-	2	0.0005	4	0.0066	4	0.0082	1	0.0135	4	0.0018
F. Psychodidae	-	-	1	0.0005	-	-	-	-	-	-	-	-	2	0.0008	-	-	-	-	-	-
F. Simuliidae	2	0.0078	-	-	-	-	1	0.0058	1	0.0049	-	-	2	0.0002	-	-	-	-	-	-
F. Tipulidae	14	0.0242	-	-	-	-	1	0.0003	-	-	1	0.0546	6	0.0382	-	-	1	0.0017	-	-
TOTAL NUMBER OF ORGANISMS PER SAMPLE	408		278		263		377		290		389		642		506		276		319	
TOTAL NUMBER OF TAXA[a]	20		19		18		19		17		21		23		20		19		20	
TOTAL BIOMASS (g)		0.7360		0.4560		0.7156		0.7951		0.7616		0.8183		1.2882		0.6524		0.4760		0.6681

[a] Bold entries excluded from taxa count

*Immature Trichoptera excluded from taxa count if Uenoidae were also present in sample

APPENDIX B
SUPPORTING DATA – SELENIUM MONITORING

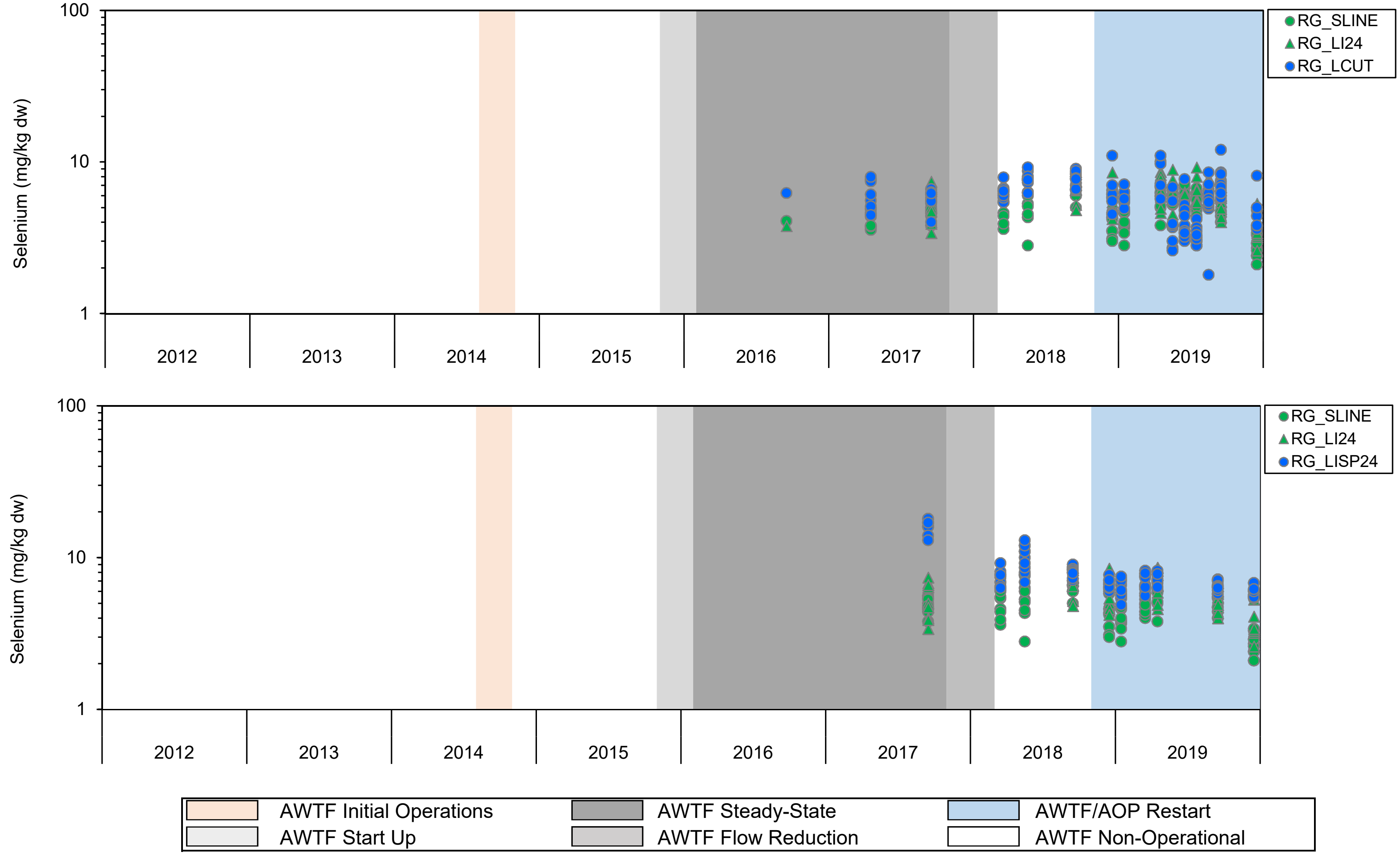

Figure B.1: Benthic Invertebrate Selenium Concentrations, for RG_LCUT and RG_LISP24 (Mine-exposed Areas) Relative to RG_SLINE and RG_LI24 (Reference Areas), 2012 to 2019

Notes: Due to a brief period of exposure to less-than-capacity AWTF effluent in 2014, benthic invertebrate tissue selenium data from September 2015 were not considered representative of steady-state AWTF operation, but also not representative of a no-discharge condition, these data were therefore excluded from analyses, and are displayed in plots for context only, West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

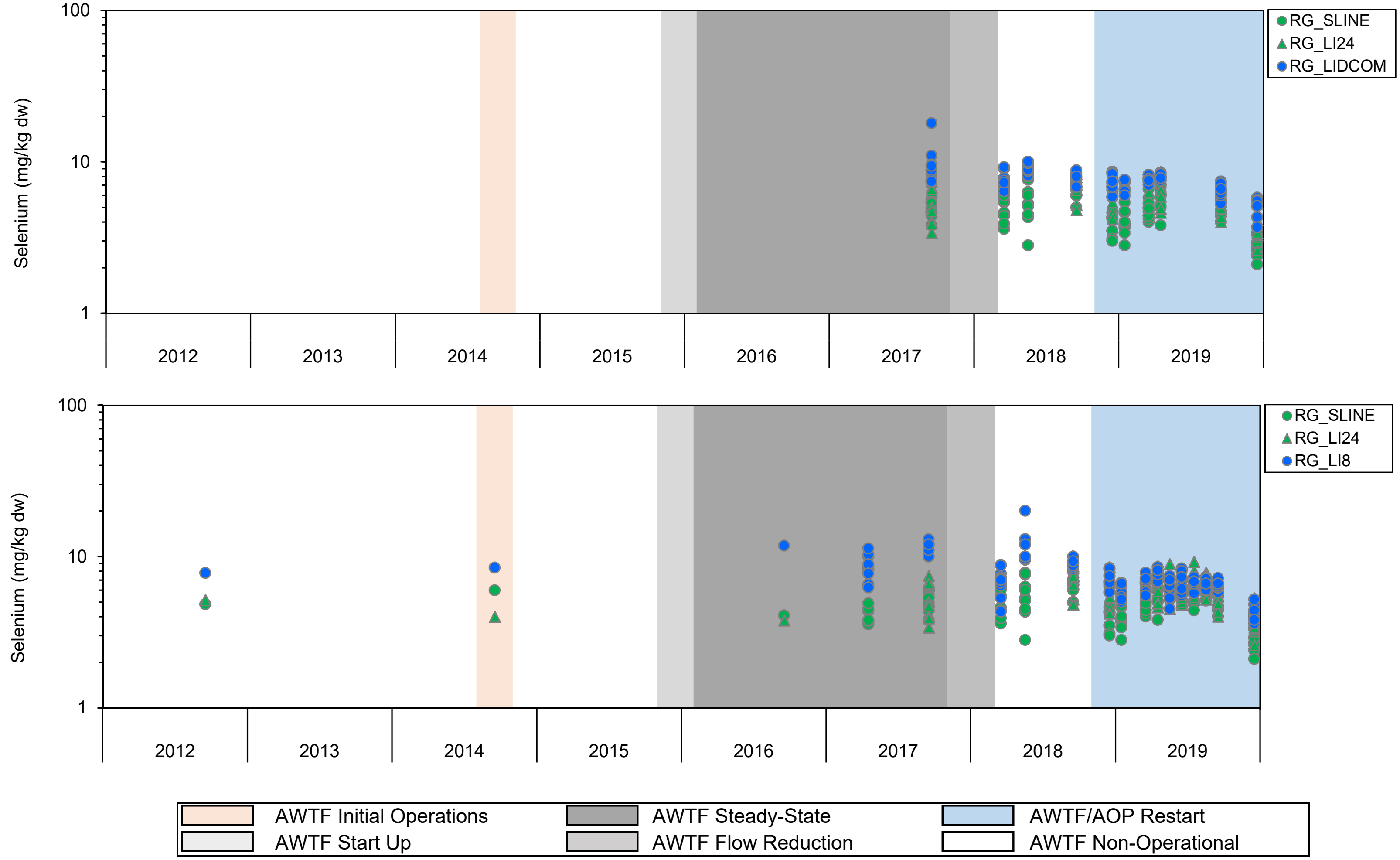

Figure B.2: Benthic Invertebrate Selenium Concentrations, for RG_LIDCOM and RG_LI8 (Mine-exposed Areas) Relative to RG_SLINE and RG_LI24 (Reference Areas), 2012 to 2019

Notes: Due to a brief period of exposure to less-than-capacity AWTF effluent in 2014, benthic invertebrate tissue selenium data from September 2015 were not considered representative of steady-state AWTF operation, but also not representative of a no-discharge condition. These data were therefore excluded from analyses, and are displayed in plots for context only. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

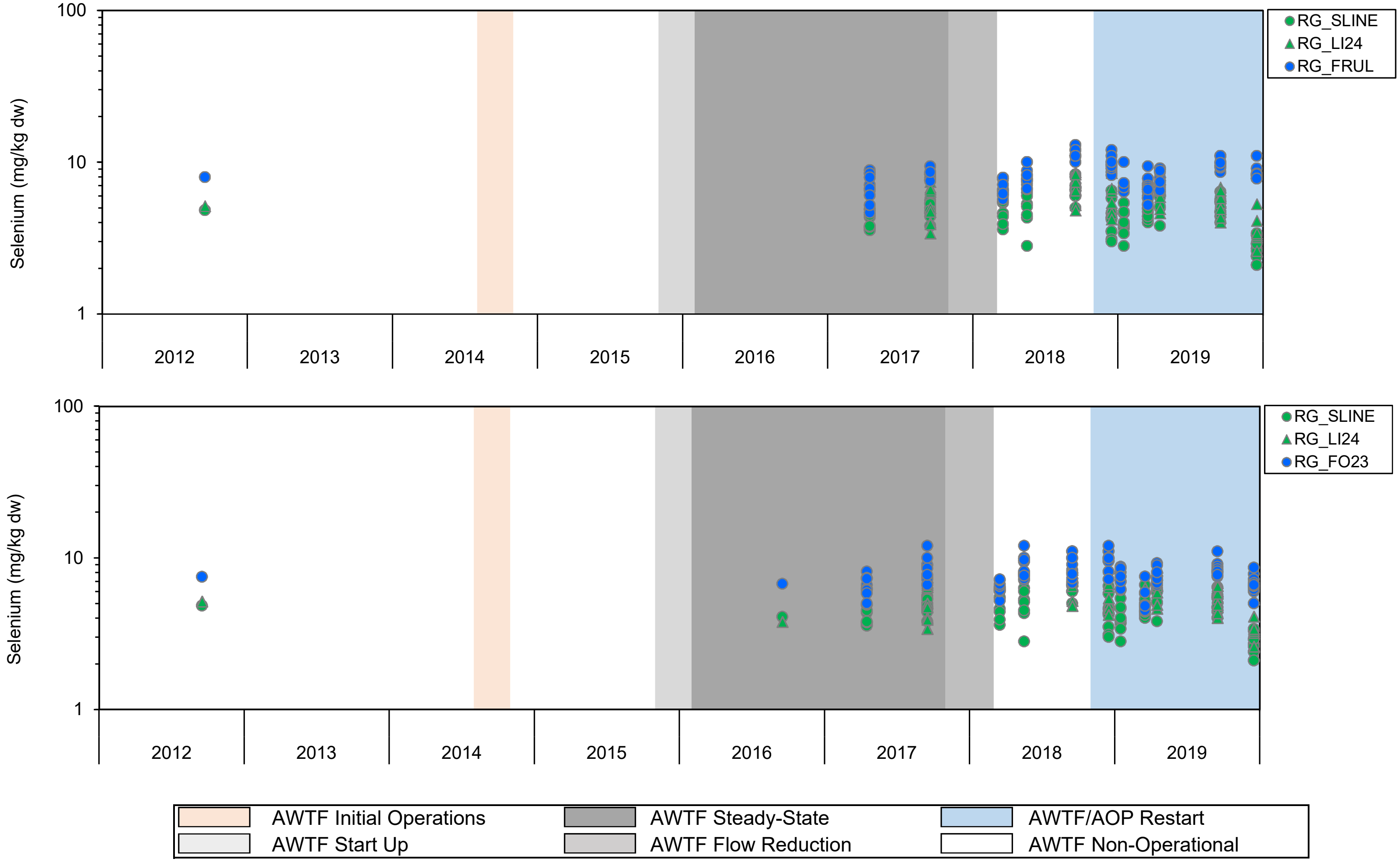

Figure B.3: Benthic Invertebrate Selenium Concentrations, for RG_FRUL and RG_FO23 (Mine-exposed Areas) Relative to RG_SLINE and RG_LI24 (Reference Areas), 2012 to 2019

Notes: Due to a brief period of exposure to less-than-capacity AWTF effluent in 2014, benthic invertebrate tissue selenium data from September 2015 were not considered representative of steady-state AWTF operation, but also not representative of a no-discharge condition. These data were therefore excluded from analyses, and are displayed in plots for context only. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

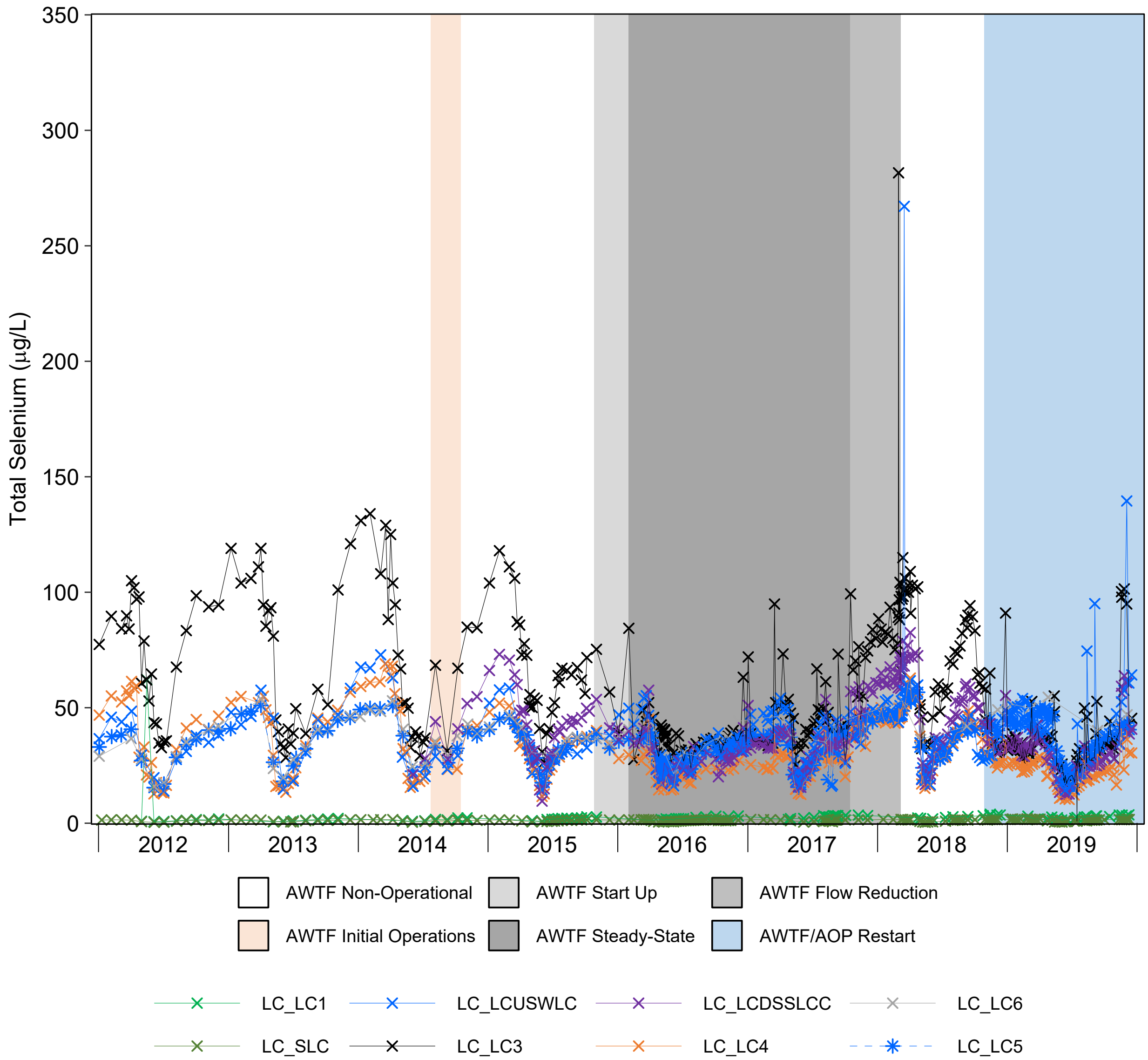

Figure B.4: Time Series Plots for Aqueous Total Selenium Concentrations from the Line Creek LAEMP Sampling Stations (Excluding LC_WLC), 2012 to 2019

Note: West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

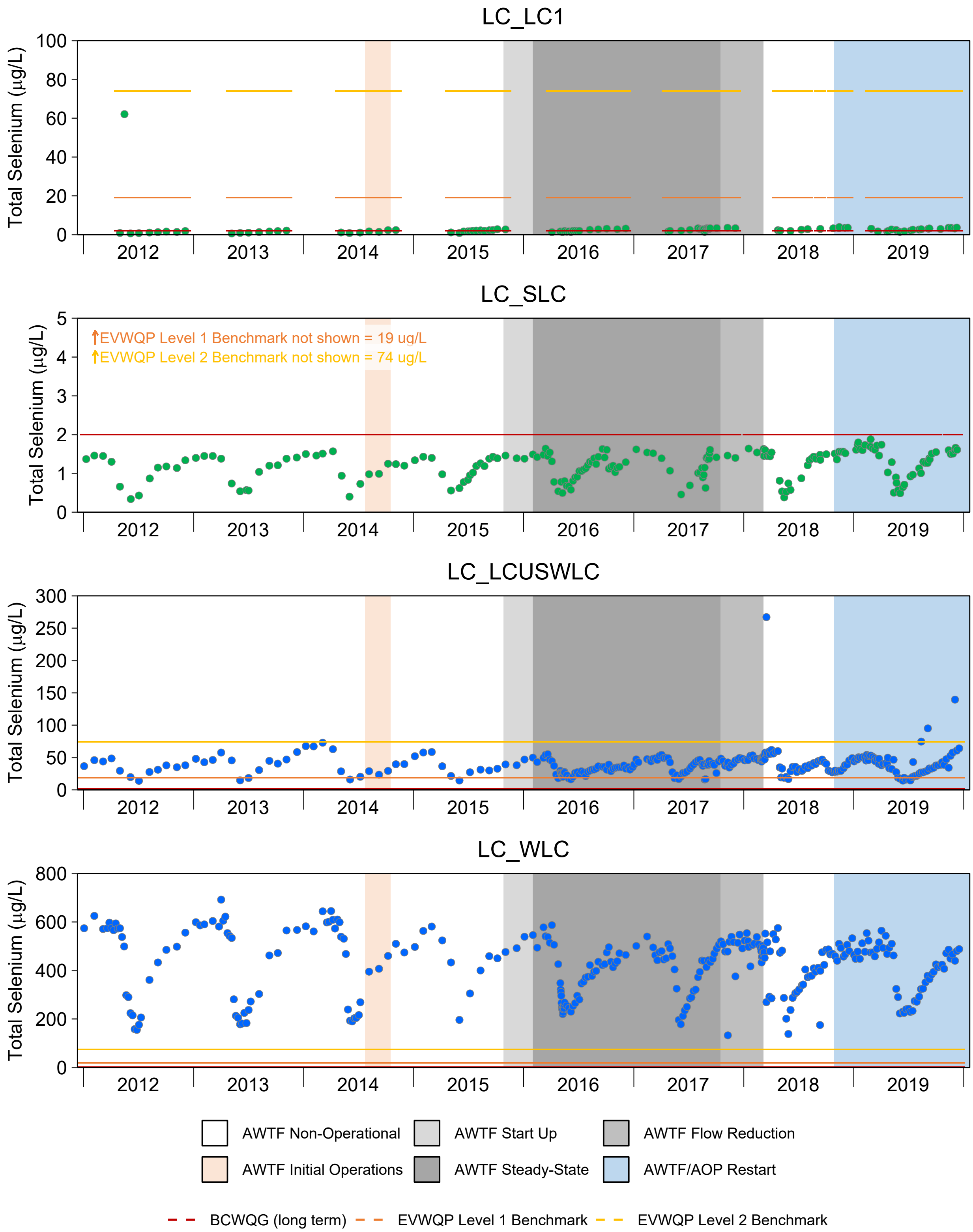

Figure B.5: Time Series Plots for Aqueous Total Selenium Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Active Water Treatment Facility (   )

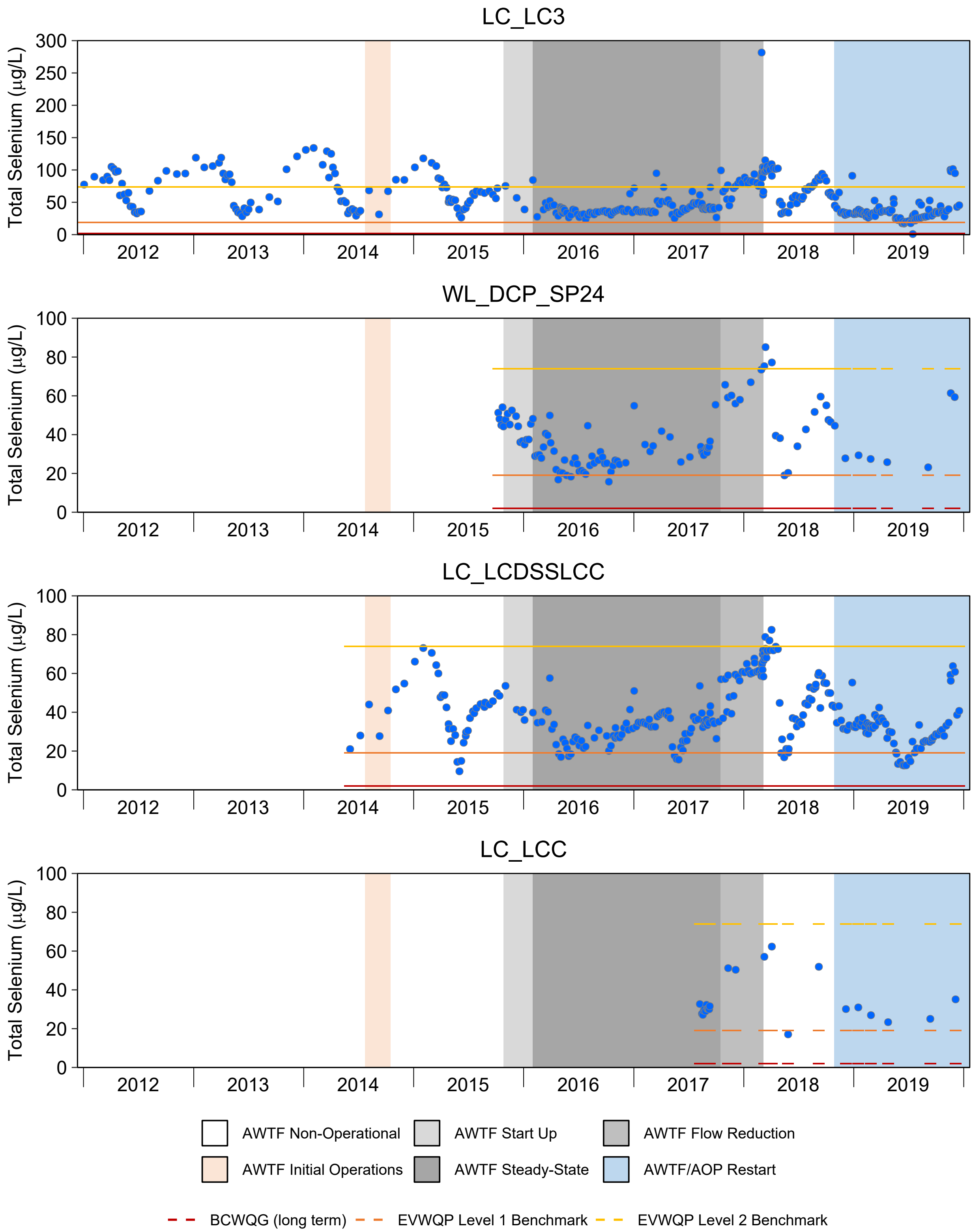

Figure B.5: Time Series Plots for Aqueous Total Selenium Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: EVWQP = Elk Valley Water Quality Plan. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

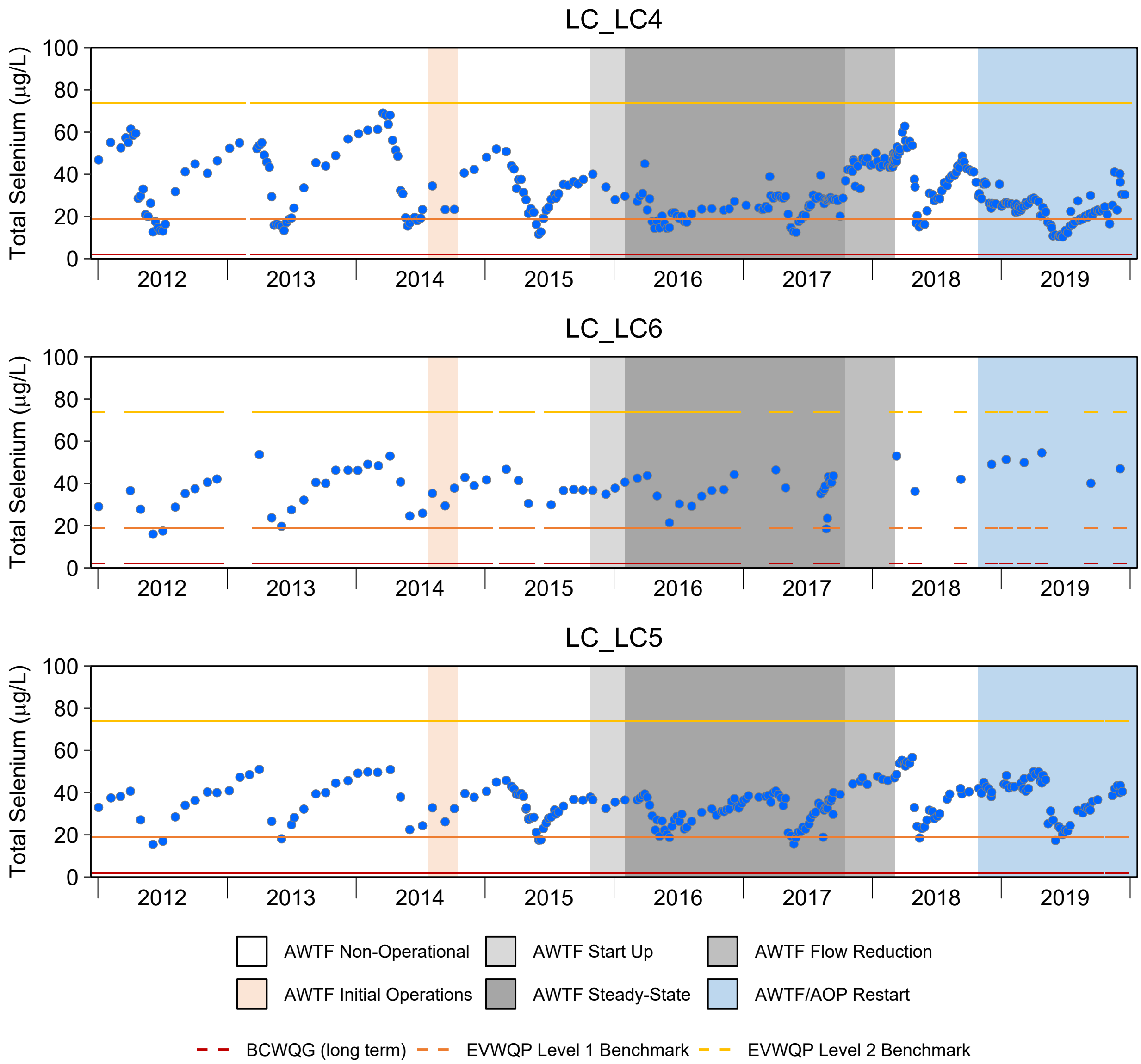

Figure B.5: Time Series Plots for Aqueous Total Selenium Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: EVWQP = Elk Valley Water Quality Plan. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

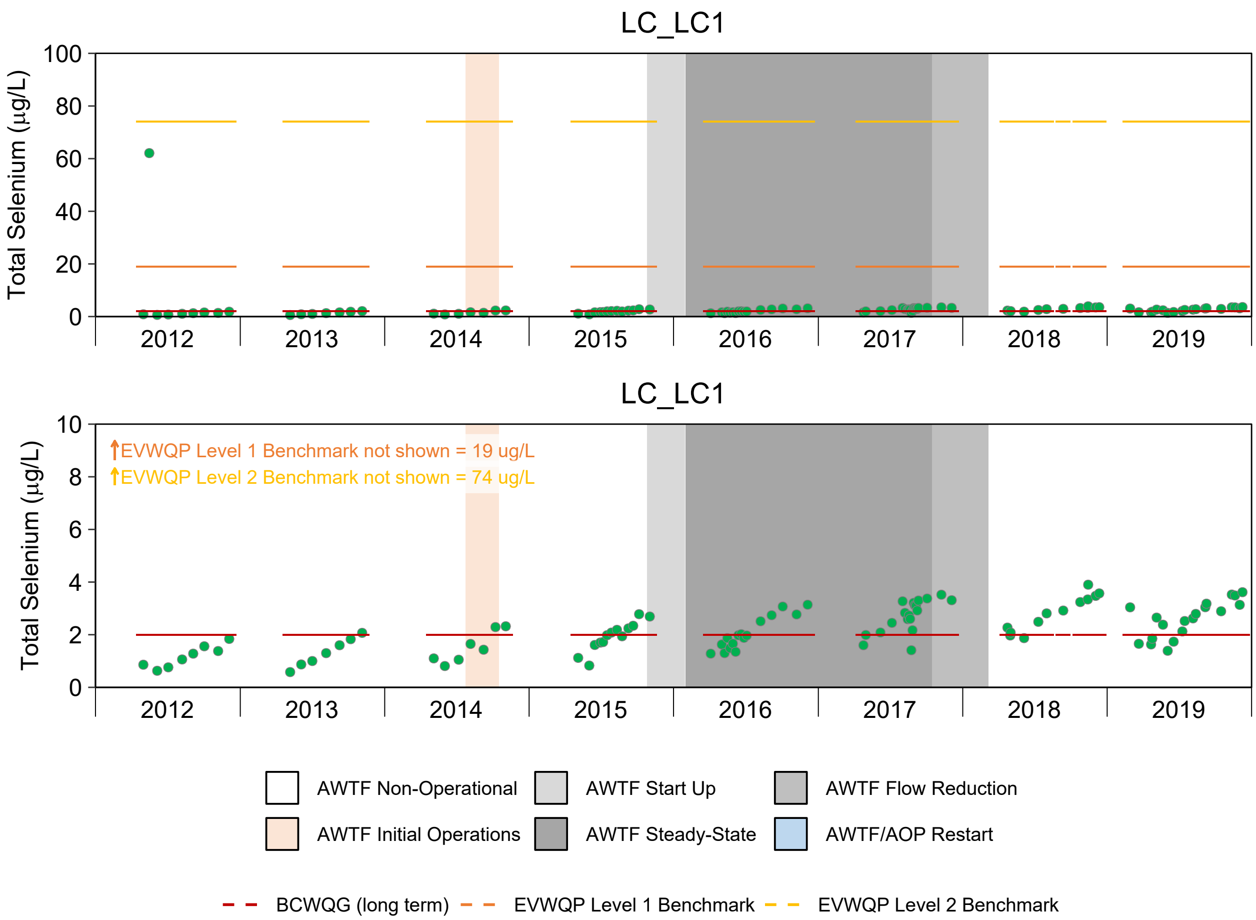

Figure B.6: Time Series Plots for Aqueous Total Selenium Concentrations from the Line Creek LAEMP Sampling Station LC_LC1, With (Upper Panel) and Without (Lower Panel) an Outlier, 2012 to 2019

Note : Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

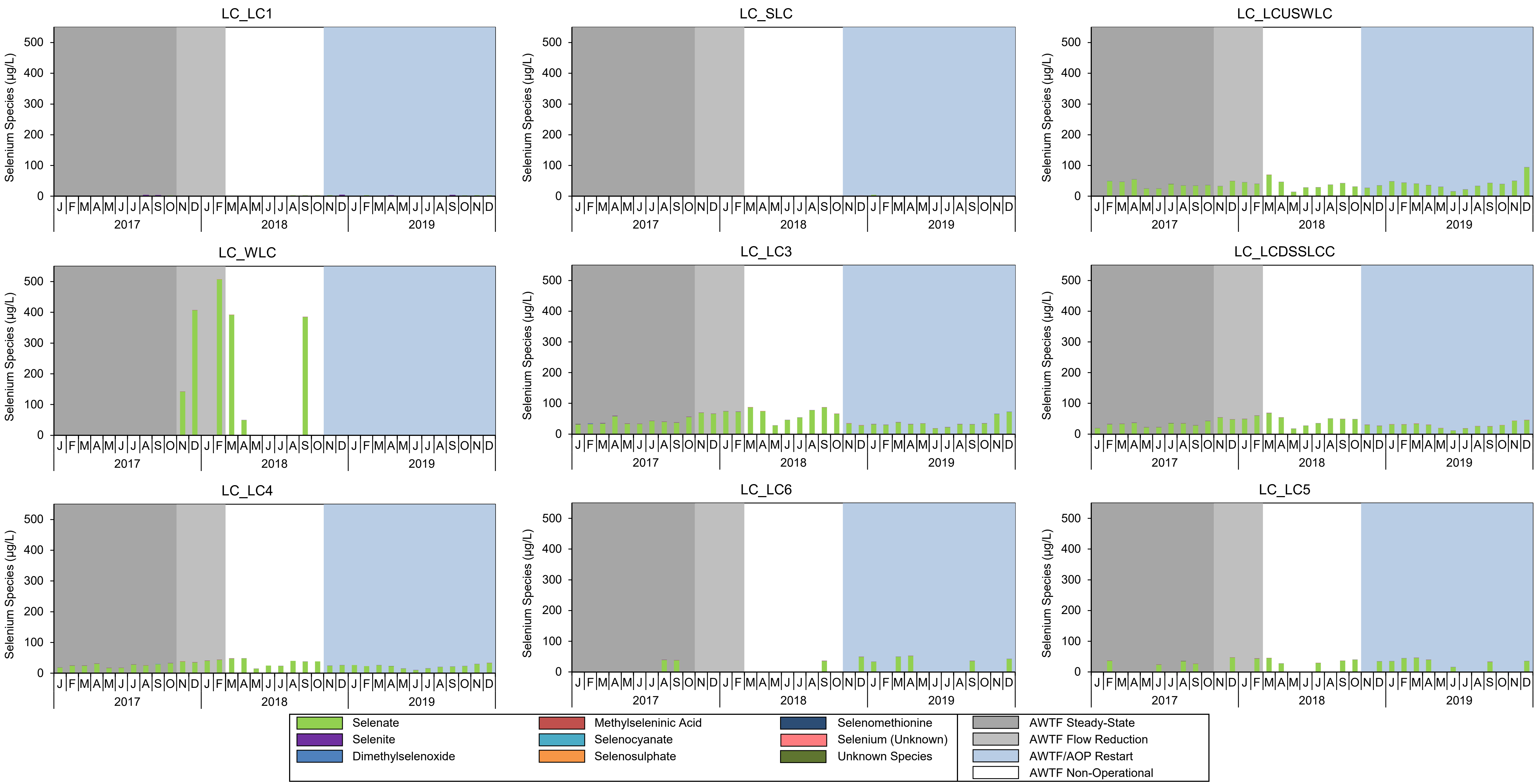

Figure B.7: Aqueous Concentrations of Selenium Species at Mine-exposed (LC_LCUSWLC, LC_WLC, LC_LC3, LC_LCDSSLCC, LC_LC4, LC_LC6, LC_LC5) and Reference (LC_LC1, LC_SLC) Stations in Line Creek and Fording River, January 2017 to December 2019

Notes: Values below the Laboratory Reporting Limit are not included in the concentrations. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge. Results for LC_LC1 and LC_SLC are not evident due to consistent y-axis scaling among plots. Refer to Figure 4.7 for greater resolution of these data (Figure 4.7 excludes results for LC_WLC). Selenium (unknown) represents an unknown selenium species that elutes at a retention time of ~3.7 and is a product of the oxidation of volatile selenium species.

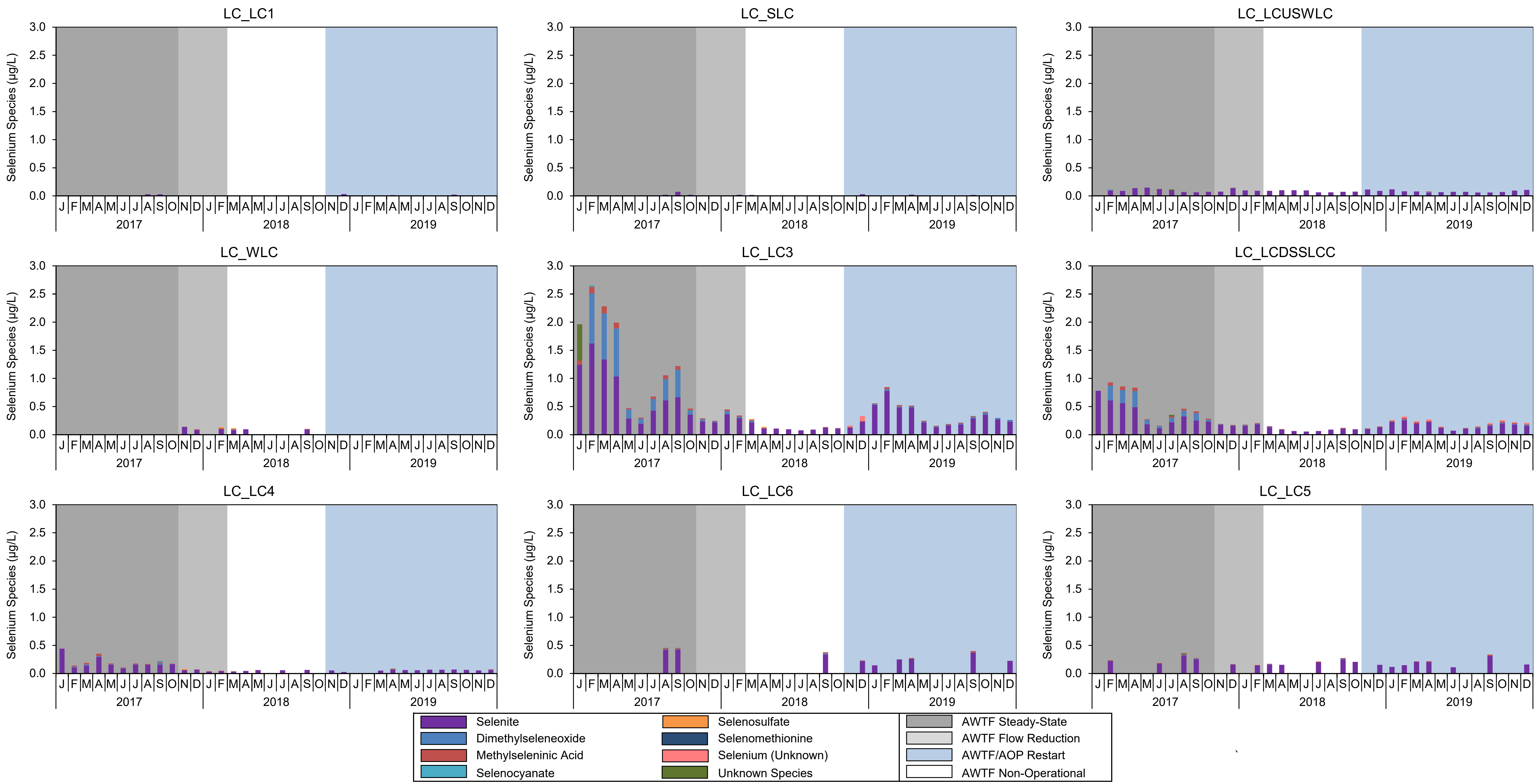

Figure B.8: Aqueous Concentrations of Non-Selenate Selenium Species at Mine-exposed (LC_LCUSWLC, LC_WLC, LC_LC3, LC_LCDSSLCC, LC_LC4, LC_LC6, LC_LC5) and Reference (LC_LC1, LC_SLC) Stations in Line Creek and Fording River, January 2017 to December 2019

Notes: Values below the Laboratory Reporting Limit are not included in the concentrations. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge. Selenium (unknown) represents an unknown selenium species that elutes at a retention time of ~3.7 and is a product of the oxidation of volatile selenium species.

Table B.1: Concentrations of Selenium Species Measured in Water Samples from Line Creek and Fording River, January to December, 2019

Waterbody		Teck Water Station Code	Sample Date	Selenium Species (µg/L)									
				Selenate	Selenite	Dimethylselenoxide	Methylseleninic Acid	Selenocyanate	Selenomethionine	Selenosulphate	Selenium (Unknown)	Unknown Species	Sum of Species
Line Creek	Reference	LC_LC1 (RG_LI24)	28-Feb-19	3.0	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	3.0
			22-Mar-19	1.3	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	1.3
			22-Apr-19	1.6	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	1.6
			25-Apr-19	1.8	0.015	<0.010	<0.010	<0.040	<0.010	-	<0.010	<0.060	1.8
			22-May-19	2.2	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	2.2
			18-Jun-19	1.5	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	1.5
			10-Jul-19	2.2	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	2.2
			16-Jul-19	2.3	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	2.3
			13-Aug-19	2.3	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	2.3
			6-Sep-19	2.8	0.023	<0.010	<0.010	<0.040	<0.010	-	<0.010	<0.060	2.8
			16-Oct-19	2.9	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	2.9
			12-Nov-19	3.2	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	3.2
			2-Dec-19	3.2	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	3.2
			9-Dec-19	3.2	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	3.2
		LC_SLC (RG_SLINE)	14-Jan-19	4.2	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	4.2
			25-Feb-19	1.1	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	1.1
			3-Apr-19	1.4	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	1.4
			24-Apr-19	0.95	0.024	<0.010	<0.010	<0.040	<0.010	-	<0.010	<0.060	0.97
			23-May-19	0.67	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	0.67
			18-Jun-19	0.56	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	0.56
			8-Jul-19	0.73	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	0.73
			16-Jul-19	0.83	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	0.83
			12-Aug-19	0.98	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	0.98
			9-Sep-19	1.3	0.018	<0.010	<0.010	<0.040	<0.010	-	<0.010	<0.060	1.3
			1-Oct-19	1.5	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	1.5
			5-Dec-19	1.6	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	1.6
	Mine-exposed	LC_LCUSWLC (RG_LCUT)	2-Jan-19	48	0.081	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	48
			7-Jan-19	48	0.086	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	48
			14-Jan-19	50	0.089	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	50
			17-Jan-19	46	0.24	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	46
			21-Jan-19	51	0.085	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	51
			29-Jan-19	46	0.11	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	46
			7-Feb-19	51	0.076	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	51
			13-Feb-19	51	0.12	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	51
			19-Feb-19	51	0.084	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	51
			26-Feb-19	23	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	23
			5-Mar-19	49	0.076	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	49
			13-Mar-19	44	0.12	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	44
			19-Mar-19	39	0.068	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	39
			26-Mar-19	31	0.052	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	31
			3-Apr-19	28	0.051	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	28
			8-Apr-19	41	0.062	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	41
			17-Apr-19	34	0.053	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	34
			22-Apr-19	31	0.055	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	31
			24-Apr-19	49	0.069	0.016	0.013	<0.040	<0.010	-	<0.010	<0.060	49
			29-Apr-19	30	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	30
			7-May-19	31	0.054	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	31
			13-May-19	48	0.091	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	48
			22-May-19	26	0.069	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	26
			28-May-19	18	0.051	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	18
			3-Jun-19	17	0.097	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	17
			13-Jun-19	13	0.065	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	13
			17-Jun-19	17	0.067	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	17
			24-Jun-19	16	0.065	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	16
			2-Jul-19	15	0.082	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	15
			8-Jul-19	15	0.077	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	15
			15-Jul-19	21	0.071	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	21
			17-Jul-19	41	0.063	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	41
			22-Jul-19	21	0.081	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	21
			29-Jul-19	20	0.067	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	20
			6-Aug-19	26	0.068	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	26
			12-Aug-19	23	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	23
			13-Aug-19	63	0.069	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	63
			19-Aug-19	29	0.066	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	29
			27-Aug-19	25	0.056	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	25
			3-Sep-19	32	0.060	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	32
			4-Sep-19	89	0.086	<0.010	<0.010	<0.040	<0.010	-	<0.010	<0.060	89
			9-Sep-19	31	0.057	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	31
			16-Sep-19	32	0.055	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	32
			23-Sep-19	32	0.053	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	32
			1-Oct-19	38	0.068	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	38
			7-Oct-19	40	0.066	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	40
			16-Oct-19	39	0.063	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	39
			21-Oct-19	40	0.081	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	40
			28-Oct-19	41	0.066	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	41
			4-Nov-19	45	0.092	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	45
			12-Nov-19	49	0.077	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	49
			18-Nov-19	50	0.080	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	50
			25-Nov-19	54	0.13	<0.010	<0.010	<0.040	<0.010	<0.11	<0.010	<0.060	54
			3-Dec-19	133	0.11	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	133
			9-Dec-19	54	0.11	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	55

Notes: The sum of species was calculated using zero for values reported as < LRL. Effluent from West Line Creek was diverted to the AWTF during AWTF/AOP restart (Oct 29th 2018 to present), therefore water quality measured routinely upstream of West Line Creek (LC_LCUSWLC) was most representative of water quality slightly further downstream at RG_LCUT. Water quality results from LC_LCUSWLC and RG_LCUT were combined during this period for data interpretation. "-" indicates no data available.

Table B.1: Concentrations of Selenium Species Measured in Water Samples from Line Creek and Fording River, January to December, 2019

Waterbody		Teck Water Station Code	Sample Date	Selenium Species (µg/L)									
				Selenate	Selenite	Dimethylselenoxide	Methylseleninic Acid	Selenocyanate	Selenomethionine	Selenosulphate	Selenium (Unknown)	Unknown Species	Sum of Species
Line Creek	Mine-exposed	LC_LC3 (RG_LILC3)	2-Jan-19	36	0.46	<0.010	<0.010	<0.040	<0.010	<0.060	0.13	<0.060	37
			7-Jan-19	33	0.49	0.017	<0.010	<0.040	<0.010	<0.060	0.17	<0.060	34
			8-Jan-19	33	0.54	0.012	0.012	<0.040	<0.010	<0.060	0.19	<0.060	34
			14-Jan-19	33	0.44	<0.010	<0.010	<0.040	<0.010	<0.060	0.11	<0.060	34
			16-Jan-19	33	0.41	<0.010	<0.010	<0.040	<0.010	<0.060	0.13	<0.060	34
			17-Jan-19	28	0.44	0.013	0.015	<0.040	<0.010	<0.060	0.046	<0.060	28
			21-Jan-19	34	0.78	0.026	0.022	<0.040	<0.010	<0.060	0.17	<0.060	35
			23-Jan-19	36	0.55	0.017	0.012	<0.040	<0.010	<0.060	0.12	<0.060	37
			28-Jan-19	31	0.74	0.023	<0.010	<0.040	<0.010	<0.060	0.19	<0.060	32
			30-Jan-19	23	0.48	<0.010	<0.010	<0.040	<0.010	<0.060	0.13	<0.060	24
			5-Feb-19	32	1.1	0.040	0.12	<0.040	<0.010	<0.060	0.16	<0.060	34
			7-Feb-19	31	0.79	0.028	0.023	<0.040	<0.010	<0.060	0.23	<0.060	32
			12-Feb-19	31	0.94	0.035	0.015	<0.040	<0.010	<0.060	0.26	<0.060	32
			13-Feb-19	29	0.78	0.034	0.011	<0.040	<0.010	<0.060	0.26	<0.060	30
			19-Feb-19	33	0.62	0.023	0.034	<0.040	<0.010	<0.060	0.36	<0.060	34
			26-Feb-19	22	0.49	0.018	0.024	<0.040	<0.010	<0.060	0.14	<0.060	23
			5-Mar-19	31	0.42	0.011	<0.010	<0.040	<0.010	<0.060	0.15	<0.060	32
			11-Mar-19	56	0.49	<0.010	0.063	<0.040	<0.010	<0.060	0.12	<0.060	56
			13-Mar-19	29	0.75	0.030	<0.010	<0.040	<0.010	<0.060	0.37	<0.060	30
			19-Mar-19	35	0.41	<0.010	0.030	<0.040	<0.010	<0.060	0.10	<0.060	35
			26-Mar-19	41	0.37	0.014	0.025	<0.040	<0.010	<0.060	0.11	<0.060	42
			1-Apr-19	36	0.62	<0.010	0.022	<0.040	<0.010	<0.060	0.15	<0.060	37
			8-Apr-19	36	0.63	0.015	0.019	<0.040	<0.010	<0.060	0.16	<0.060	36
			17-Apr-19	27	0.49	0.014	0.029	<0.040	<0.010	<0.060	0.14	<0.060	27
			22-Apr-19	32	0.47	0.017	0.028	<0.040	<0.010	<0.060	<0.010	<0.060	32
			29-Apr-19	33	0.37	0.018	0.012	<0.040	<0.010	<0.060	0.12	<0.060	33
			30-Apr-19	31	0.34	0.018	<0.010	<0.040	<0.010	<0.060	0.12	<0.060	31
			7-May-19	32	0.36	0.020	0.018	<0.040	<0.010	<0.060	0.14	<0.060	33
			13-May-19	60	0.23	<0.010	0.011	<0.040	<0.010	<0.060	0.059	<0.060	60
			14-May-19	52	0.17	<0.010	<0.010	<0.040	<0.010	<0.060	0.022	<0.060	52
			20-May-19	26	0.22	0.013	0.024	<0.040	<0.010	<0.060	0.059	<0.060	26
			21-May-19	25	0.20	<0.010	0.017	<0.040	<0.010	<0.060	0.050	<0.060	25
			23-May-19	25	0.18	<0.010	0.021	<0.040	<0.010	<0.060	0.045	<0.060	25
			28-May-19	22	0.20	<0.010	0.017	<0.040	<0.010	<0.060	0.058	<0.060	22
			4-Jun-19	24	0.13	<0.010	0.011	<0.040	<0.010	<0.060	<0.010	<0.060	24
			11-Jun-19	17	0.15	0.014	0.013	<0.040	<0.010	<0.060	0.026	<0.060	18
			13-Jun-19	18	0.13	<0.010	0.015	<0.040	<0.010	<0.060	0.024	<0.060	18
			17-Jun-19	15	0.13	0.011	0.012	<0.040	<0.010	<0.060	0.016	<0.060	16
			18-Jun-19	17	0.10	<0.010	0.011	<0.040	<0.010	<0.060	0.015	<0.060	17
			24-Jun-19	20	0.18	<0.010	0.015	<0.040	<0.010	<0.060	<0.010	<0.060	20
			2-Jul-19	19	0.18	<0.010	0.015	<0.040	<0.010	<0.060	0.016	<0.060	19
			8-Jul-19	19	0.18	0.016	<0.010	<0.040	<0.010	<0.060	0.019	<0.060	19
			9-Jul-19	19	0.19	<0.010	0.026	<0.040	<0.010	<0.060	0.023	<0.060	20
			15-Jul-19	24	0.18	0.011	0.017	<0.040	<0.010	<0.060	0.031	<0.060	24
			17-Jul-19	29	0.089	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	29
			22-Jul-19	24	0.17	0.011	0.017	<0.040	<0.010	<0.060	0.018	<0.060	25
			24-Jul-19	23	0.15	0.013	0.013	<0.040	<0.010	<0.060	<0.010	<0.060	23
			29-Jul-19	22	0.18	0.011	0.016	<0.040	<0.010	<0.060	0.033	<0.060	22
			5-Aug-19	27	0.22	0.021	0.025	<0.040	<0.010	<0.060	0.041	<0.060	28
			6-Aug-19	52	0.084	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	52
			12-Aug-19	24	0.17	0.016	0.011	<0.040	<0.010	<0.060	0.018	<0.060	24
			13-Aug-19	44	0.13	0.011	0.018	<0.040	<0.010	<0.060	0.018	<0.060	44
			20-Aug-19	29	0.24	0.025	0.012	<0.040	<0.010	<0.060	0.050	<0.060	29
			26-Aug-19	26	0.22	0.025	<0.010	<0.040	<0.010	<0.060	0.051	<0.060	26
			27-Aug-19	25	0.21	0.022	<0.010	<0.040	<0.010	<0.060	0.044	<0.060	26
			3-Sep-19	27	0.26	0.032	<0.010	<0.040	<0.010	<0.060	0.091	<0.060	28
			7-Sep-19	35	0.24	<0.010	0.018	<0.040	<0.010	-	0.038	<0.060	35
			10-Sep-19	30	0.37	0.024	<0.010	<0.040	<0.010	<0.060	0.12	<0.060	30
			17-Sep-19	35	0.34	0.029	0.013	<0.040	<0.010	<0.060	0.12	<0.060	35
			23-Sep-19	30	0.26	0.028	0.013	<0.040	<0.010	<0.060	0.069	<0.060	30
			30-Sep-19	35	0.29	0.025	0.020	<0.040	<0.010	<0.060	0.085	<0.060	35
			1-Oct-19	34	0.35	0.024	0.023	<0.040	<0.010	<0.060	0.080	<0.060	35
			7-Oct-19	37	0.45	0.057	<0.010	<0.040	<0.010	<0.060	0.12	<0.060	38
			9-Oct-19	33	0.39	0.023	0.054	<0.040	<0.010	<0.060	0.059	<0.060	33
			16-Oct-19	47	0.17	0.025	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	47
			21-Oct-19	34	0.38	0.040	<0.010	<0.040	<0.010	<0.060	0.12	<0.060	35
			22-Oct-19	34	0.40	0.053	0.014	<0.040	<0.010	<0.060	0.12	<0.060	34
			28-Oct-19	21	0.22	0.020	<0.010	<0.040	<0.010	<0.060	0.081	<0.060	21
			29-Oct-19	38	0.50	0.025	<0.010	<0.040	<0.010	<0.060	0.14	<0.060	38
			4-Nov-19	36	0.43	0.036	<0.010	<0.040	<0.010	<0.060	0.12	<0.060	37
			12-Nov-19	36	0.38	0.042	<0.010	<0.040	<0.010	<0.060	0.12	<0.060	37
			18-Nov-19	92	0.14	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	92
			26-Nov-19	98	0.14	<0.010	<0.010	<0.040	<0.010	<0.11	<0.010	<0.060	98

Notes: The sum of species was calculated using zero for values reported as < LRL. Effluent from West Line Creek was diverted to the AWTF during AWTF/AOP restart (Oct 29th 2018 to present), therefore water quality measured routinely upstream of West Line Creek (LC_LCUSWLC) was most representative of water quality slightly further downstream at RG_LCUT. Water quality results from LC_LCUSWLC and RG_LCUT were combined during this period for data interpretation. "-" indicates no data available.

Table B.1: Concentrations of Selenium Species Measured in Water Samples from Line Creek and Fording River, January to December, 2019

Waterbody		Teck Water Station Code	Sample Date	Selenium Species (µg/L)									
				Selenate	Selenite	Dimethylselenoxide	Methylseleninic Acid	Selenocyanate	Selenomethionine	Selenosulphate	Selenium (Unknown)	Unknown Species	Sum of Species
Line Creek	Mine-exposed	LC_LC3 (RG_LILC3)	3-Dec-19	108	0.13	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	108
			10-Dec-19	38	0.34	0.052	<0.010	<0.040	<0.010	<0.060	0.19	<0.060	38
		WL_DCP_SP24 (RG_LISP24)	17-Jan-19	22	0.36	<0.010	0.022	<0.040	<0.010	<0.060	0.023	<0.060	23
			26-Feb-19	17	0.33	0.011	0.034	<0.040	<0.010	<0.060	0.059	<0.060	17
			22-Apr-19	24	0.25	0.0070	0.026	<0.040	<0.010	<0.060	<0.010	<0.060	24
			5-Sep-19	21	0.20	<0.010	0.017	<0.040	<0.010	-	0.023	<0.060	21
			2-Dec-19	65	0.14	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	66
		LC_LCDSSLCC (Compliance) (RG_LIDSL)	2-Jan-19	21	0.15	<0.010	0.011	<0.040	<0.010	<0.060	<0.010	<0.060	22
			7-Jan-19	34	0.25	<0.010	0.022	<0.040	<0.010	<0.060	0.018	<0.060	35
			16-Jan-19	34	0.22	<0.010	0.019	<0.040	<0.010	<0.060	0.012	<0.060	35
			23-Jan-19	34	0.26	<0.010	0.016	<0.040	<0.010	<0.060	0.018	<0.060	34
			30-Jan-19	35	0.26	<0.010	0.019	<0.040	<0.010	<0.060	0.016	<0.060	35
			7-Feb-19	35	0.29	<0.010	0.023	<0.040	<0.010	<0.060	0.021	<0.060	35
			13-Feb-19	33	0.29	0.012	0.026	<0.040	<0.010	<0.060	0.033	<0.060	33
			19-Feb-19	31	0.25	<0.010	0.047	<0.040	<0.010	<0.060	0.032	<0.060	32
			26-Feb-19	26	0.21	<0.010	0.023	<0.040	<0.010	<0.060	0.016	<0.060	27
			5-Mar-19	30	0.21	<0.010	0.021	<0.040	<0.010	<0.060	0.025	<0.060	30
			13-Mar-19	34	0.21	<0.010	0.030	<0.040	<0.010	<0.060	0.016	<0.060	34
			19-Mar-19	31	0.18	<0.010	0.012	<0.040	<0.010	<0.060	<0.010	<0.060	31
			26-Mar-19	41	0.19	<0.010	0.022	<0.040	<0.010	<0.060	0.020	<0.060	41
			3-Apr-19	37	0.28	<0.010	0.016	<0.040	<0.010	<0.060	0.034	<0.060	37
			8-Apr-19	35	0.26	<0.010	0.020	<0.040	<0.010	<0.060	0.028	<0.060	36
			17-Apr-19	28	0.21	<0.010	0.017	<0.040	<0.010	<0.060	0.029	<0.060	29
			22-Apr-19	24	0.21	<0.010	0.017	<0.040	<0.010	<0.060	0.024	<0.060	24
			29-Apr-19	26	0.17	<0.010	0.015	<0.040	<0.010	<0.060	0.021	<0.060	27
			7-May-19	25	0.20	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	25
			14-May-19	25	0.10	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	25
			21-May-19	19	0.11	<0.010	<0.010	<0.040	<0.010	<0.060	0.016	<0.060	19
			23-May-19	18	0.11	<0.010	0.013	<0.040	<0.010	<0.060	0.020	<0.060	18
			28-May-19	13	0.084	<0.010	0.012	<0.040	<0.010	<0.060	0.011	<0.060	13
			4-Jun-19	14	0.076	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	14
			13-Jun-19	8.1	0.058	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	8.2
			17-Jun-19	11	0.079	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	11
			24-Jun-19	13	0.074	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	13
			2-Jul-19	15	0.11	<0.010	0.011	<0.040	<0.010	<0.060	<0.010	<0.060	15
			8-Jul-19	15	0.13	<0.010	0.014	<0.040	<0.010	<0.060	<0.010	<0.060	15
			15-Jul-19	25	0.075	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	25
			22-Jul-19	18	0.12	<0.010	0.017	<0.040	<0.010	<0.060	<0.010	<0.060	19
			29-Jul-19	19	0.11	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	19
			6-Aug-19	36	0.088	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	36
			12-Aug-19	20	0.12	<0.010	0.012	<0.040	<0.010	<0.060	0.012	<0.060	20
			20-Aug-19	26	0.14	0.011	0.014	<0.040	<0.010	<0.060	<0.010	<0.060	26
			27-Aug-19	22	0.13	0.011	0.013	<0.040	<0.010	<0.060	<0.010	<0.060	22
			3-Sep-19	27	0.17	0.013	0.016	<0.040	<0.010	<0.060	0.015	<0.060	27
			10-Sep-19	24	0.17	<0.010	0.017	<0.040	<0.010	<0.060	0.020	<0.060	24
			17-Sep-19	24	0.16	0.017	0.018	<0.040	<0.010	<0.060	0.020	<0.060	25
			23-Sep-19	26	0.15	<0.010	0.013	<0.040	<0.010	<0.060	<0.010	<0.060	26
			1-Oct-19	28	0.18	<0.010	0.022	<0.040	<0.010	<0.060	0.020	<0.060	28
			7-Oct-19	31	0.21	0.016	0.025	<0.040	<0.010	<0.060	0.018	<0.060	31
			16-Oct-19	29	0.17	<0.010	0.017	<0.040	<0.010	<0.060	0.024	<0.060	29
			21-Oct-19	30	0.22	0.014	0.018	<0.040	<0.010	<0.060	0.024	<0.060	30
			28-Oct-19	29	0.24	0.017	0.018	<0.040	<0.010	<0.060	0.029	<0.060	29
			4-Nov-19	31	0.24	0.015	0.023	<0.040	<0.010	<0.060	0.025	<0.060	31
			12-Nov-19	31	0.24	0.015	0.014	<0.040	<0.010	<0.060	0.019	<0.060	32
			18-Nov-19	55	0.12	<0.010	0.012	<0.040	<0.010	<0.060	<0.010	<0.060	55
			26-Nov-19	57	0.13	<0.010	<0.010	<0.040	<0.010	<0.11	<0.010	<0.060	57
			3-Dec-19	62	0.12	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	62
			10-Dec-19	30	0.20	0.024	0.012	<0.040	<0.010	<0.060	0.029	<0.060	30
		LC_LCC (RG_LIDCOM)	16-Jan-19	33	0.14	<0.010	0.011	<0.040	<0.010	<0.060	<0.010	<0.060	33
			27-Feb-19	23	0.10	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	23
			25-Apr-19	22	0.14	<0.010	0.013	<0.040	<0.010	-	<0.010	0.010	22
			12-Sep-19	21	0.11	<0.010	<0.010	<0.040	<0.010	-	<0.010	<0.060	22
			5-Dec-19	34	0.12	<0.010	0.015	<0.040	<0.010	<0.060	<0.010	<0.060	34
		LC_LC4 (RG_LI8)	2-Jan-19	26	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	26
			7-Jan-19	27	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	27
			14-Jan-19	29	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	29
			16-Jan-19	24	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	24
			21-Jan-19	27	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	27
			30-Jan-19	27	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	27
			7-Feb-19	26	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	26
			13-Feb-19	25	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	25
			19-Feb-19	24	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	24
			26-Feb-19	25	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	25
			27-Feb-19	15	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	15
			5-Mar-19	22	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	22
			13-Mar-19	25	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	25
			19-Mar-19	23	0.053	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	23
			27-Mar-19	32	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	32
			3-Apr-19	27	0.063	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	27
			8-Apr-19	28	0.070	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	28
			17-Apr-19	20	0.055	<0.010	<0.010	<0.040	<0.010	<0.060	0.059	<0.060	21
			22-Apr-19	18	0.069	<0.010	<0.010	<0.040	<0.010	<0.060	0.012	<0.060	18
			25-Apr-19	19	0.097	<0.010	0.011	<0.040	<0.010	-	<0.010	0.0080	19

Notes: The sum of species was calculated using zero for values reported as < LRL. Effluent from West Line Creek was diverted to the AWTF during AWTF/AOP restart (Oct 29th 2018 to present), therefore water quality measured routinely upstream of West Line Creek (LC_LCUSWLC) was most representative of water quality slightly further downstream at RG_LCUT. Water quality results from LC_LCUSWLC and RG_LCUT were combined during this period for data interpretation. "-" indicates no data available.

Table B.1: **Concentrations of Selenium Species Measured in Water Samples from Line Creek and Fording River, January to December, 2019**

Waterbody		Teck Water Station Code	Sample Date	Selenium Species (µg/L)									
				Selenate	Selenite	Dimethylselenoxide	Methylseleninic Acid	Selenocyanate	Selenomethionine	Selenosulphate	Selenium (Unknown)	Unknown Species	Sum of Species
Line Creek	Mine-exposed	LC_LC4 (RG_LI8)	29-Apr-19	22	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	22
			7-May-19	19	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	19
			13-May-19	17	0.058	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	17
			22-May-19	15	0.065	<0.010	<0.010	<0.040	<0.010	<0.060	0.013	<0.060	15
			24-May-19	14	0.055	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	14
			28-May-19	10	0.078	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	10
			3-Jun-19	11	0.063	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	11
			13-Jun-19	9.4	0.054	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	9.5
			17-Jun-19	9.8	0.065	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	9.9
			19-Jun-19	9.1	0.052	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	9.1
			24-Jun-19	10	0.057	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	10
			2-Jul-19	12	0.061	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	12
			8-Jul-19	13	0.078	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	13
			15-Jul-19	16	0.053	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	16
			17-Jul-19	21	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	21
			22-Jul-19	15	0.075	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	15
			29-Jul-19	16	0.082	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	16
			6-Aug-19	28	0.056	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	28
			12-Aug-19	16	0.074	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	16
			13-Aug-19	16	0.085	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	16
			19-Aug-19	25	0.064	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	25
			27-Aug-19	18	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	18
			3-Sep-19	21	0.14	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	21
			9-Sep-19	20	0.051	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	20
			11-Sep-19	26	0.054	<0.010	<0.010	<0.040	<0.010	-	<0.010	<0.060	26
			16-Sep-19	20	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	20
			23-Sep-19	20	0.053	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	20
			1-Oct-19	23	0.051	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	23
			7-Oct-19	24	0.051	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	24
			16-Oct-19	23	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	0.011	<0.060	23
			21-Oct-19	23	0.068	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	23
			28-Oct-19	22	0.10	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	22
			4-Nov-19	24	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	0.013	<0.060	24
			12-Nov-19	24	0.059	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	24
			18-Nov-19	39	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	39
			25-Nov-19	33	0.057	<0.010	<0.010	<0.040	<0.010	<0.11	<0.010	<0.060	33
			3-Dec-19	40	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	40
			4-Dec-19	33	0.083	<0.010	0.014	<0.040	<0.010	<0.060	<0.010	<0.060	33
			9-Dec-19	27	<0.050	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	27
Fording River		LC_LC5 (RG_FO23)	15-Jan-19	35	0.12	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	35
			7-Feb-19	45	0.15	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	45
			7-Mar-19	46	0.21	<0.010	0.0080	<0.040	<0.010	<0.060	<0.010	<0.060	46
			26-Apr-19	39	0.20	<0.010	0.016	<0.040	<0.010	<0.060	<0.010	<0.060	40
			4-Jun-19	16	0.11	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	16
			3-Sep-19	35	0.31	<0.010	0.022	<0.040	<0.010	<0.060	<0.010	<0.060	35
			8-Sep-19	31	0.31	<0.010	0.028	<0.040	<0.010	<0.060	<0.010	<0.060	31
			3-Dec-19	32	0.14	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	33
			4-Dec-19	39	0.18	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	39
		LC_LC6 (RG_FRUL)	15-Jan-19	33	0.14	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	33
			7-Mar-19	49	0.25	<0.010	<0.010	<0.040	<0.010	-	<0.010	<0.060	50
			26-Apr-19	52	0.26	<0.010	0.017	<0.040	<0.010	-	<0.010	<0.060	52
			12-Sep-19	35	0.37	<0.010	0.028	<0.040	<0.010	-	<0.010	<0.060	36
			4-Dec-19	42	0.23	<0.010	<0.010	<0.040	<0.010	<0.060	<0.010	<0.060	42

Notes: The sum of species was calculated using zero for values reported as < LRL. Effluent from West Line Creek was diverted to the AWTF during AWTF/AOP restart (Oct 29th 2018 to present), therefore water quality measured routinely upstream of West Line Creek (LC_LCUSWLC) was most representative of water quality slightly further downstream at RG_LCUT. Water quality results from LC_LCUSWLC and RG_LCUT were combined during this period for data interpretation. "-" indicates no data available.

Table B.2: Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, January to December 2019

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw) Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Reference	RG_LI24 (LC_LC1)	RG_LI24-1_INV	28-Feb-19	6.3	6.3	6.3	6.3	6.3	-
			RG_LI24-1_INV	25-Apr-19	4.6	6.6	4.6	8.6	6.8	1.4
			RG_LI24-2_INV	25-Apr-19	8.6					
			RG_LI24-3_INV	25-Apr-19	6.6					
			RG_LI24-4_INV	25-Apr-19	6.5					
			RG_LI24-5_INV	25-Apr-19	6.5					
			RG_LI24-6_INV	25-Apr-19	8.6					
			RG_LI24-7_INV	25-Apr-19	5.9					
			RG_LI24-8_INV	25-Apr-19	4.9					
			RG_LI24-9_INV	25-Apr-19	8.2					
			RG_LI24-10_INV	25-Apr-19	7.7					
			RG_LI24-1_INV	22-May-19	8.9	6.8	4.5	8.9	6.7	1.2
			RG_LI24-2_INV	22-May-19	7.1					
			RG_LI24-3_INV	22-May-19	7.1					
			RG_LI24-4_INV	22-May-19	6.0					
			RG_LI24-5_INV	22-May-19	7.6					
			RG_LI24-6_INV	22-May-19	6.7					
			RG_LI24-7_INV	22-May-19	6.4					
			RG_LI24-8_INV	22-May-19	5.7					
			RG_LI24-9_INV	22-May-19	6.8					
			RG_LI24-10_INV	22-May-19	4.5					
			RG_LI24-1_INV	18-Jun-19	5.1	5.4	4.8	6.3	5.4	0.5
			RG_LI24-2_INV	18-Jun-19	5.5					
			RG_LI24-3_INV	18-Jun-19	5.5					
			RG_LI24-4_INV	18-Jun-19	4.8					
			RG_LI24-5_INV	18-Jun-19	5.4					
			RG_LI24-6_INV	18-Jun-19	5.0					
			RG_LI24-7_INV	18-Jun-19	6.3					
			RG_LI24-8_INV	18-Jun-19	5.4					
			RG_LI24-9_INV	18-Jun-19	5.3					
			RG_LI24-10_INV	18-Jun-19	6.1					
			RG_LI24-1_INV	16-Jul-19	5.4	6.5	5.4	9.2	6.6	1.2
			RG_LI24-2_INV	16-Jul-19	6.6					
			RG_LI24-3_INV	16-Jul-19	8.0					
			RG_LI24-4_INV	16-Jul-19	6.5					
			RG_LI24-5_INV	16-Jul-19	5.6					
			RG_LI24-6_INV	16-Jul-19	5.4					
			RG_LI24-7_INV	16-Jul-19	9.2					
			RG_LI24-8_INV	16-Jul-19	6.6					
			RG_LI24-9_INV	16-Jul-19	6.5					
			RG_LI24-10_INV	16-Jul-19	6.5					
			RG_LI24-1_INV	13-Aug-19	5.8	7.0	5.2	7.8	6.8	0.9
			RG_LI24-2_INV	13-Aug-19	7.8					
			RG_LI24-3_INV	13-Aug-19	7.6					
			RG_LI24-4_INV	13-Aug-19	7.0					
			RG_LI24-5_INV	13-Aug-19	5.2					
			RG_LI24-6_INV	13-Aug-19	6.9					
			RG_LI24-7_INV	13-Aug-19	6.1					
			RG_LI24-8_INV	13-Aug-19	6.0					
			RG_LI24-9_INV	13-Aug-19	7.7					
			RG_LI24-10_INV	13-Aug-19	7.5					
			RG_LI24_INV-1	6-Sep-19	4.7	5.5	4.0	6.8	5.4	0.9
			RG_LI24_INV-2	6-Sep-19	4.0					
			RG_LI24_INV-3	6-Sep-19	4.3					
			RG_LI24_INV-4	6-Sep-19	5.5					
			RG_LI24_INV-5	6-Sep-19	5.4					
			RG_LI24_INV-6	6-Sep-19	6.0					
			RG_LI24_INV-7	6-Sep-19	4.9					
			RG_LI24_INV-8	6-Sep-19	6.8					
			RG_LI24_INV-9	6-Sep-19	5.8					
			RG_LI24_INV-10	6-Sep-19	6.5					
			RG_LI24_INV-1	2-Dec-19	3.2	3.4	2.6	5.3	3.7	0.9
			RG_LI24_INV-2	2-Dec-19	2.6					
			RG_LI24_INV-3	2-Dec-19	3.3					
			RG_LI24_INV-4	2-Dec-19	5.3					
			RG_LI24_INV-5	2-Dec-19	4.1					
			RG_LI24_INV-6	2-Dec-19	3.4					
		RG_SLINE (LC_SLC)	RG_SLINE1_INV	14-Jan-19	4.6	3.9	2.8	5.4	4.0	0.7
			RG_SLINE2_INV	14-Jan-19	5.4					
			RG_SLINE3_INV	14-Jan-19	3.7					
			RG_SLINE4_INV	14-Jan-19	3.8					
			RG_SLINE5_INV	14-Jan-19	3.7					
			RG_SLINE6_INV	14-Jan-19	3.9					
			RG_SLINE7_INV	14-Jan-19	2.8					
			RG_SLINE8_INV	14-Jan-19	3.4					
			RG_SLINE9_INV	14-Jan-19	4.0					
			RG_SLINE10_INV	14-Jan-19	4.7					

Table B.2: **Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, January to December 2019**

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Reference	RG_SLINE (LC_SLC)	RG_SLINE1_INV	25-Feb-19	4.7	4.8	4.0	6.6	4.9	0.8
			RG_SLINE2_INV	25-Feb-19	5.8					
			RG_SLINE3_INV	25-Feb-19	4.0					
			RG_SLINE4_INV	25-Feb-19	4.4					
			RG_SLINE5_INV	25-Feb-19	4.2					
			RG_SLINE6_INV	25-Feb-19	4.4					
			RG_SLINE7_INV	25-Feb-19	5.0					
			RG_SLINE8_INV	25-Feb-19	6.6					
			RG_SLINE9_INV	25-Feb-19	5.3					
			RG_SLINE10_INV	25-Feb-19	4.9					
			RG_SLINE1_INV	24-Apr-19	5.0	6.1	3.8	7.2	5.9	1.0
			RG_SLINE2_INV	24-Apr-19	3.8					
			RG_SLINE3_INV	24-Apr-19	6.0					
			RG_SLINE4_INV	24-Apr-19	6.2					
			RG_SLINE5_INV	24-Apr-19	6.8					
			RG_SLINE6_INV	24-Apr-19	5.9					
			RG_SLINE7_INV	24-Apr-19	5.1					
			RG_SLINE8_INV	24-Apr-19	6.9					
			RG_SLINE9_INV	24-Apr-19	6.3					
			RG_SLINE10_INV	24-Apr-19	7.2					
			RG_SLINE1_INV	23-May-19	5.4	6.0	5.2	6.6	5.9	0.5
			RG_SLINE2_INV	23-May-19	5.2					
			RG_SLINE3_INV	23-May-19	5.7					
			RG_SLINE4_INV	23-May-19	5.3					
			RG_SLINE5_INV	23-May-19	6.0					
			RG_SLINE6_INV	23-May-19	6.5					
			RG_SLINE7_INV	23-May-19	6.1					
			RG_SLINE8_INV	23-May-19	6.1					
			RG_SLINE9_INV	23-May-19	6.6					
			RG_SLINE10_INV	23-May-19	6.0					
			RG_SLINE1_INV	18-Jun-19	5.5	6.0	5.1	7.1	6.1	0.7
			RG_SLINE2_INV	18-Jun-19	7.0					
			RG_SLINE3_INV	18-Jun-19	6.2					
			RG_SLINE4_INV	18-Jun-19	6.8					
			RG_SLINE5_INV	18-Jun-19	6.2					
			RG_SLINE6_INV	18-Jun-19	5.6					
			RG_SLINE7_INV	18-Jun-19	5.1					
			RG_SLINE8_INV	18-Jun-19	7.1					
			RG_SLINE9_INV	18-Jun-19	5.8					
			RG_SLINE10_INV	18-Jun-19	5.2					
			RG_SLINE1_INV	16-Jul-19	6.2	5.8	4.4	6.7	5.7	0.7
			RG_SLINE2_INV	16-Jul-19	6.1					
			RG_SLINE3_INV	16-Jul-19	4.8					
			RG_SLINE4_INV	16-Jul-19	5.1					
			RG_SLINE5_INV	16-Jul-19	5.7					
			RG_SLINE6_INV	16-Jul-19	6.3					
			RG_SLINE7_INV	16-Jul-19	4.4					
			RG_SLINE8_INV	16-Jul-19	6.7					
			RG_SLINE9_INV	16-Jul-19	5.9					
			RG_SLINE10_INV	16-Jul-19	5.6					
			RG_SLINE1_INV	12-Aug-19	6.5	6.0	5.1	6.5	6.0	0.5
			RG_SLINE2_INV	12-Aug-19	6.1					
			RG_SLINE3_INV	12-Aug-19	6.5					
			RG_SLINE4_INV	12-Aug-19	5.7					
			RG_SLINE5_INV	12-Aug-19	6.4					
			RG_SLINE6_INV	12-Aug-19	5.2					
			RG_SLINE7_INV	12-Aug-19	5.1					
			RG_SLINE8_INV	12-Aug-19	5.8					
			RG_SLINE9_INV	12-Aug-19	5.9					
			RG_SLINE10_INV	12-Aug-19	6.4					
			RG_SLINE_INV-1	9-Sep-19	5.5	5.1	4.0	6.4	5.1	0.7
			RG_SLINE_INV-2	9-Sep-19	5.5					
			RG_SLINE_INV-3	9-Sep-19	5.7					
			RG_SLINE_INV-4	9-Sep-19	4.7					
			RG_SLINE_INV-5	9-Sep-19	5.4					
			RG_SLINE_INV-6	9-Sep-19	4.0					
			RG_SLINE_INV-7	9-Sep-19	4.4					
			RG_SLINE_INV-8	9-Sep-19	4.7					
			RG_SLINE_INV-9	9-Sep-19	6.4					
			RG_SLINE_INV-10	9-Sep-19	4.7					
			RG_SLINE_INV-1	5-Dec-19	2.4	2.7	2.1	3.4	2.7	0.5
			RG_SLINE_INV-2	5-Dec-19	2.4					
			RG_SLINE_INV-3	5-Dec-19	2.7					
			RG_SLINE_INV-4	5-Dec-19	3.3					
			RG_SLINE_INV-5	5-Dec-19	3.4					
			RG_SLINE_INV-6	5-Dec-19	2.1					
			RG_SLINE_INV-7	5-Dec-19	2.6					
			RG_SLINE_INV-8	5-Dec-19	2.9					
			RG_SLINE_INV-9	5-Dec-19	2.1					
			RG_SLINE_INV-10	5-Dec-19	2.9					

Table B.2: Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, January to December 2019

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Mine-exposed	RG_LCUT (LC_LCUSWLC / LC_WLC)	RG_LCUT1-INV	17-Jan-19	6.3	5.9	4.9	7.1	6.1	0.7
			RG_LCUT2-INV	17-Jan-19	5.5					
			RG_LCUT3-INV	17-Jan-19	7.1					
			RG_LCUT4-INV	17-Jan-19	5.9					
			RG_LCUT5-INV	17-Jan-19	5.8					
			RG_LCUT6-INV	17-Jan-19	4.9					
			RG_LCUT7-INV	17-Jan-19	6.3					
			RG_LCUT8-INV	17-Jan-19	5.7					
			RG_LCUT9-INV	17-Jan-19	7.1					
			RG_LCUT1_INV	24-Apr-19	7.0	9.7	5.7	11	8.7	2.2
			RG_LCUT2_INV	24-Apr-19	10					
			RG_LCUT3_INV	24-Apr-19	5.7					
			RG_LCUT4_INV	24-Apr-19	9.7					
			RG_LCUT5_INV	24-Apr-19	11					
			RG_LCUT1-INV	22-May-19	3.8	3.8	2.6	6.8	4.0	1.4
			RG_LCUT2-INV	22-May-19	3.7					
			RG_LCUT3-INV	22-May-19	3.8					
			RG_LCUT4-INV	22-May-19	2.7					
			RG_LCUT5-INV	22-May-19	3.9					
			RG_LCUT6-INV	22-May-19	2.6					
			RG_LCUT7-INV	22-May-19	6.8					
			RG_LCUT8-INV	22-May-19	5.5					
			RG_LCUT9-INV	22-May-19	3.0					
			RG_LCUT1_INV	17-Jun-19	3.4	3.7	3.0	7.7	4.2	1.4
			RG_LCUT2_INV	17-Jun-19	5.2					
			RG_LCUT3_INV	17-Jun-19	3.0					
			RG_LCUT4_INV	17-Jun-19	4.8					
			RG_LCUT5_INV	17-Jun-19	7.7					
			RG_LCUT6_INV	17-Jun-19	3.8					
			RG_LCUT7_INV	17-Jun-19	3.5					
			RG_LCUT8_INV	17-Jun-19	4.4					
			RG_LCUT9_INV	17-Jun-19	3.2					
			RG_LCUT10_INV	17-Jun-19	3.4					
			RG_LCUT1_INV	17-Jul-19	3.0	3.2	2.8	4.2	3.3	0.4
			RG_LCUT2_INV	17-Jul-19	4.2					
			RG_LCUT3_INV	17-Jul-19	3.0					
			RG_LCUT4_INV	17-Jul-19	3.7					
			RG_LCUT5_INV	17-Jul-19	2.8					
			RG_LCUT6_INV	17-Jul-19	2.8					
			RG_LCUT7_INV	17-Jul-19	3.2					
			RG_LCUT8_INV	17-Jul-19	3.1					
			RG_LCUT9_INV	17-Jul-19	3.5					
			RG_LCUT10_INV	17-Jul-19	3.3					
			RG_LCUT1_INV	13-Aug-19	8.5	5.3	1.8	8.5	5.5	1.7
			RG_LCUT2_INV	13-Aug-19	4.9					
			RG_LCUT3_INV	13-Aug-19	6.2					
			RG_LCUT4_INV	13-Aug-19	5.7					
			RG_LCUT5_INV	13-Aug-19	5.2					
			RG_LCUT6_INV	13-Aug-19	5.1					
			RG_LCUT7_INV	13-Aug-19	7.1					
			RG_LCUT8_INV	13-Aug-19	1.8					
			RG_LCUT9_INV	13-Aug-19	5.2					
			RG_LCUT10_INV	13-Aug-19	5.4					
			RG_LCUT_INV-1	5-Sep-19	7.5	7.4	5.8	12	7.8	1.7
			RG_LCUT_INV-2	5-Sep-19	8.3					
			RG_LCUT_INV-3	5-Sep-19	8.5					
			RG_LCUT_INV-4	5-Sep-19	7.3					
			RG_LCUT_INV-5	5-Sep-19	7.1					
			RG_LCUT_INV-6	5-Sep-19	5.8					
			RG_LCUT_INV-7	5-Sep-19	6.8					
			RG_LCUT_INV-8	5-Sep-19	8.3					
			RG_LCUT_INV-9	5-Sep-19	12					
			RG_LCUT_INV-10	5-Sep-19	6.2					
			RG_LCUT_INV-1	3-Dec-19	3.8	4.1	3.6	8.1	4.6	1.3
			RG_LCUT_INV-2	3-Dec-19	5.0					
			RG_LCUT_INV-3	3-Dec-19	8.1					
			RG_LCUT_INV-4	3-Dec-19	3.7					
			RG_LCUT_INV-5	3-Dec-19	3.6					
			RG_LCUT_INV-6	3-Dec-19	4.8					
			RG_LCUT_INV-7	3-Dec-19	3.8					
			RG_LCUT_INV-8	3-Dec-19	4.4					
			RG_LCUT_INV-9	3-Dec-19	5.0					
			RG_LCUT_INV-10	3-Dec-19	3.8					

Table B.2: **Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, January to December 2019**

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Mine-exposed	RG_LILC3 (LC_LC3)	RG_LILC3-1-INV	17-Jan-19	8.8	8.7	6.7	10.0	8.5	1.0
			RG_LILC3-2-INV	17-Jan-19	7.6					
			RG_LILC3-3-INV	17-Jan-19	9.6					
			RG_LILC3-4-INV	17-Jan-19	9.2					
			RG_LILC3-5-INV	17-Jan-19	9.0					
			RG_LILC3-6-INV	17-Jan-19	7.4					
			RG_LILC3-7-INV	17-Jan-19	8.5					
			RG_LILC3-8-INV	17-Jan-19	8.2					
			RG_LILC3-9-INV	17-Jan-19	6.7					
			RG_LILC3-10-INV	17-Jan-19	10.0					
			RG_LILC3-1-INV	26-Feb-19	11	10	9.9	12	11	0.9
			RG_LILC3-2-INV	26-Feb-19	12					
			RG_LILC3-3-INV	26-Feb-19	10					
			RG_LILC3-4-INV	26-Feb-19	9.9					
			RG_LILC3-5-INV	26-Feb-19	10					
			RG_LILC3-6-INV	26-Feb-19	10					
			RG_LILC3-7-INV	26-Feb-19	10					
			RG_LILC3-8-INV	26-Feb-19	12					
			RG_LILC3-9-INV	26-Feb-19	11					
			RG_LILC3-10-INV	26-Feb-19	10					
			RG_LILC3-1_INV	22-Apr-19	11	11	8.8	12	11	1.0
			RG_LILC3-2_INV	22-Apr-19	12					
			RG_LILC3-3_INV	22-Apr-19	12					
			RG_LILC3-4_INV	22-Apr-19	12					
			RG_LILC3-5_INV	22-Apr-19	8.8					
			RG_LILC3-6_INV	22-Apr-19	11					
			RG_LILC3-7_INV	22-Apr-19	11					
			RG_LILC3-8_INV	22-Apr-19	10					
			RG_LILC3-9_INV	22-Apr-19	12					
			RG_LILC3-10_INV	22-Apr-19	11					
			RG_LILC3-1_INV	23-May-19	11	10	8.1	13	10	1.4
			RG_LILC3-2_INV	23-May-19	9.7					
			RG_LILC3-3_INV	23-May-19	13					
			RG_LILC3-4_INV	23-May-19	9.6					
			RG_LILC3-5_INV	23-May-19	10					
			RG_LILC3-6_INV	23-May-19	10					
			RG_LILC3-7_INV	23-May-19	11					
			RG_LILC3-8_INV	23-May-19	8.1					
			RG_LILC3-9_INV	23-May-19	12					
			RG_LILC3-10_INV	23-May-19	9.8					
			RG_LILC3-1_INV	18-Jun-19	5.4	7.6	5.4	9.7	7.8	1.1
			RG_LILC3-2_INV	18-Jun-19	7.5					
			RG_LILC3-3_INV	18-Jun-19	8.7					
			RG_LILC3-4_INV	18-Jun-19	9.7					
			RG_LILC3-5_INV	18-Jun-19	8.3					
			RG_LILC3-6_INV	18-Jun-19	7.4					
			RG_LILC3-7_INV	18-Jun-19	8.3					
			RG_LILC3-8_INV	18-Jun-19	7.6					
			RG_LILC3-9_INV	18-Jun-19	7.0					
			RG_LILC3-10_INV	18-Jun-19	7.6					
			RG_LILC3-1_INV	23-Jul-19	5.8	7.4	5.8	9.4	7.2	1.1
			RG_LILC3-2_INV	23-Jul-19	7.2					
			RG_LILC3-3_INV	23-Jul-19	9.4					
			RG_LILC3-4_INV	23-Jul-19	7.6					
			RG_LILC3-5_INV	23-Jul-19	7.5					
			RG_LILC3-6_INV	23-Jul-19	8.1					
			RG_LILC3-7_INV	23-Jul-19	7.5					
			RG_LILC3-8_INV	23-Jul-19	5.8					
			RG_LILC3-9_INV	23-Jul-19	6.5					
			RG_LILC3-10_INV	23-Jul-19	6.8					
			RG_LILC3-1_INV	12-Aug-19	6.8	7.9	6.7	11	8.1	1.4
			RG_LILC3-2_INV	12-Aug-19	7.7					
			RG_LILC3-3_INV	12-Aug-19	6.8					
			RG_LILC3-4_INV	12-Aug-19	8.5					
			RG_LILC3-5_INV	12-Aug-19	10					
			RG_LILC3-6_INV	12-Aug-19	8.2					
			RG_LILC3-7_INV	12-Aug-19	6.7					
			RG_LILC3-8_INV	12-Aug-19	7.7					
			RG_LILC3-9_INV	12-Aug-19	8.0					
			RG_LILC3-10_INV	12-Aug-19	11					
			RG_LILC3_INV-1	7-Sep-19	10	9.9	8.8	11	9.7	0.6
			RG_LILC3_INV-2	7-Sep-19	11					
			RG_LILC3_INV-3	7-Sep-19	9.8					
			RG_LILC3_INV-4	7-Sep-19	9.0					
			RG_LILC3_INV-5	7-Sep-19	10					
			RG_LILC3_INV-6	7-Sep-19	8.8					
			RG_LILC3_INV-7	7-Sep-19	9.0					
			RG_LILC3_INV-8	7-Sep-19	9.9					
			RG_LILC3_INV-9	7-Sep-19	9.7					
			RG_LILC3_INV-10	7-Sep-19	10					

Table B.2: Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, January to December 2019

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Mine-exposed	RG_LILC3 (LC_LC3)	RG_LILC3_INV-1	3-Dec-19	7.4	7.7	6.8	9.2	7.6	0.7
			RG_LILC3_INV-2	3-Dec-19	7.7					
			RG_LILC3_INV-3	3-Dec-19	6.8					
			RG_LILC3_INV-4	3-Dec-19	6.9					
			RG_LILC3_INV-5	3-Dec-19	8.2					
			RG_LILC3_INV-6	3-Dec-19	7.6					
			RG_LILC3_INV-7	3-Dec-19	7.7					
			RG_LILC3_INV-8	3-Dec-19	7.7					
			RG_LILC3_INV-9	3-Dec-19	9.2					
			RG_LILC3_INV-10	3-Dec-19	7.2					
		RG_LISP24 (WL_DCP_SP24)	RG_LISP24-1-INV	17-Jan-19	7.2	6.0	4.9	7.5	6.2	0.9
			RG_LISP24-2-INV	17-Jan-19	5.6					
			RG_LISP24-3-INV	17-Jan-19	5.4					
			RG_LISP24-4-INV	17-Jan-19	6.6					
			RG_LISP24-5-INV	17-Jan-19	7.0					
			RG_LISP24-6-INV	17-Jan-19	5.9					
			RG_LISP24-7-INV	17-Jan-19	5.7					
			RG_LISP24-8-INV	17-Jan-19	6.1					
			RG_LISP24-9-INV	17-Jan-19	7.5					
			RG_LISP24-10-INV	17-Jan-19	4.9					
			RG_LISP24-1-INV	26-Feb-19	7.6	7.5	5.6	8.2	7.1	0.9
			RG_LISP24-2-INV	26-Feb-19	6.5					
			RG_LISP24-3-INV	26-Feb-19	6.2					
			RG_LISP24-4-INV	26-Feb-19	7.8					
			RG_LISP24-5-INV	26-Feb-19	5.6					
			RG_LISP24-6-INV	26-Feb-19	6.4					
			RG_LISP24-7-INV	26-Feb-19	7.5					
			RG_LISP24-8-INV	26-Feb-19	8.2					
			RG_LISP24-9-INV	26-Feb-19	7.4					
			RG_LISP24-10-INV	26-Feb-19	7.9					
			RG_LISP24-1_INV	22-Apr-19	7.7	7.4	6.4	8.2	7.4	0.6
			RG_LISP24-2_INV	22-Apr-19	7.0					
			RG_LISP24-3_INV	22-Apr-19	8.1					
			RG_LISP24-4_INV	22-Apr-19	8.0					
			RG_LISP24-5_INV	22-Apr-19	7.0					
			RG_LISP24-6_INV	22-Apr-19	7.0					
			RG_LISP24-7_INV	22-Apr-19	7.1					
			RG_LISP24-8_INV	22-Apr-19	8.2					
			RG_LISP24-9_INV	22-Apr-19	6.4					
			RG_LISP24-10_INV	22-Apr-19	7.8					
			RG_LISP24_INV-1	5-Sep-19	7.0	6.5	5.8	7.2	6.6	0.4
			RG_LISP24_INV-2	5-Sep-19	5.8					
			RG_LISP24_INV-3	5-Sep-19	6.6					
			RG_LISP24_INV-4	5-Sep-19	7.2					
			RG_LISP24_INV-5	5-Sep-19	6.5					
			RG_LISP24_INV-6	5-Sep-19	7.1					
			RG_LISP24_INV-7	5-Sep-19	6.5					
			RG_LISP24_INV-8	5-Sep-19	6.1					
			RG_LISP24_INV-9	5-Sep-19	6.4					
			RG_LISP24_INV-10	5-Sep-19	6.3					
			RG_LISP24_INV-1	2-Dec-19	5.4	5.9	5.4	6.8	5.9	0.4
			RG_LISP24_INV-2	2-Dec-19	6.1					
			RG_LISP24_INV-3	2-Dec-19	5.7					
			RG_LISP24_INV-4	2-Dec-19	5.5					
			RG_LISP24_INV-5	2-Dec-19	6.0					
			RG_LISP24_INV-6	2-Dec-19	5.6					
			RG_LISP24_INV-7	2-Dec-19	5.5					
			RG_LISP24_INV-8	2-Dec-19	6.8					
			RG_LISP24_INV-9	2-Dec-19	6.0					
			RG_LISP24_INV-10	2-Dec-19	6.2					
		RG_LIDSL (LC_LCDSSLCC) Compliance	RG_LIDSL1-INV	16-Jan-19	4.9	5.8	4.0	7.2	5.7	1.1
			RG_LIDSL2-INV	16-Jan-19	5.8					
			RG_LIDSL3-INV	16-Jan-19	5.2					
			RG_LIDSL4-INV	16-Jan-19	4.4					
			RG_LIDSL5-INV	16-Jan-19	7.2					
			RG_LIDSL6-INV	16-Jan-19	6.8					
			RG_LIDSL7-INV	16-Jan-19	4.0					
			RG_LIDSL8-INV	16-Jan-19	5.7					
			RG_LIDSL9-INV	16-Jan-19	5.9					
			RG_LIDSL10-INV	16-Jan-19	7.1					
			RG_LIDSL1-INV	26-Feb-19	8.8	6.1	5.3	8.8	6.6	1.1
			RG_LIDSL2-INV	26-Feb-19	7.7					
			RG_LIDSL3-INV	26-Feb-19	5.3					
			RG_LIDSL4-INV	26-Feb-19	7.4					
			RG_LIDSL5-INV	26-Feb-19	6.1					
			RG_LIDSL6-INV	26-Feb-19	6.1					
			RG_LIDSL7-INV	26-Feb-19	5.9					
			RG_LIDSL8-INV	26-Feb-19	6.5					
			RG_LIDSL9-INV	26-Feb-19	6.0					
			RG_LIDSL10-INV	26-Feb-19	5.9					

Table B.2: Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, January to December 2019

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Mine-exposed	RG_LIDSL (LC_LCDSSLCC)	RG_LIDSL1_INV	22-Apr-19	5.7	5.8	5.3	7.6	6.0	0.6
			RG_LIDSL2_INV	22-Apr-19	7.6					
			RG_LIDSL3_INV	22-Apr-19	5.6					
			RG_LIDSL4_INV	22-Apr-19	6.0					
			RG_LIDSL5_INV	22-Apr-19	5.8					
			RG_LIDSL6_INV	22-Apr-19	5.3					
			RG_LIDSL7_INV	22-Apr-19	5.7					
			RG_LIDSL8_INV	22-Apr-19	6.1					
			RG_LIDSL9_INV	22-Apr-19	6.4					
			RG_LIDSL10_INV	22-Apr-19	5.6					
			RG_LIDSL1_INV	23-May-19	7.6	7.3	5.3	9.3	7.1	1.2
			RG_LIDSL2_INV	23-May-19	5.3					
			RG_LIDSL3_INV	23-May-19	6.6					
			RG_LIDSL4_INV	23-May-19	8.2					
			RG_LIDSL5_INV	23-May-19	9.3					
			RG_LIDSL6_INV	23-May-19	7.4					
			RG_LIDSL7_INV	23-May-19	7.1					
			RG_LIDSL8_INV	23-May-19	5.8					
			RG_LIDSL9_INV	23-May-19	7.4					
			RG_LIDSL10_INV	23-May-19	6.3					
			RG_LIDSL1_INV	17-Jun-19	6.1	6.1	5.3	9.3	6.8	1.4
			RG_LIDSL2_INV	17-Jun-19	5.6					
			RG_LIDSL3_INV	17-Jun-19	9.3					
			RG_LIDSL4_INV	17-Jun-19	6.1					
			RG_LIDSL5_INV	17-Jun-19	5.3					
			RG_LIDSL6_INV	17-Jun-19	8.5					
			RG_LIDSL7_INV	17-Jun-19	8.0					
			RG_LIDSL8_INV	17-Jun-19	6.0					
			RG_LIDSL9_INV	17-Jun-19	5.6					
			RG_LIDSL10_INV	17-Jun-19	7.2					
			RG_LIDSL1_INV	15-Jul-19	5.7	5.6	4.5	6.3	5.4	0.5
			RG_LIDSL2_INV	15-Jul-19	5.6					
			RG_LIDSL3_INV	15-Jul-19	5.2					
			RG_LIDSL4_INV	15-Jul-19	5.3					
			RG_LIDSL5_INV	15-Jul-19	4.6					
			RG_LIDSL6_INV	15-Jul-19	4.5					
			RG_LIDSL7_INV	15-Jul-19	5.6					
			RG_LIDSL8_INV	15-Jul-19	5.6					
			RG_LIDSL9_INV	15-Jul-19	6.3					
			RG_LIDSL10_INV	15-Jul-19	5.5					
			RG_LIDSL1_INV	12-Aug-19	6.2	6.0	5.2	7.1	6.0	0.6
			RG_LIDSL2_INV	12-Aug-19	6.4					
			RG_LIDSL3_INV	12-Aug-19	5.7					
			RG_LIDSL4_INV	12-Aug-19	6.7					
			RG_LIDSL5_INV	12-Aug-19	5.5					
			RG_LIDSL6_INV	12-Aug-19	5.2					
			RG_LIDSL7_INV	12-Aug-19	7.1					
			RG_LIDSL8_INV	12-Aug-19	6.1					
			RG_LIDSL9_INV	12-Aug-19	5.8					
			RG_LIDSL10_INV	12-Aug-19	5.3					
			RG_LIDSL_INV-1	10-Sep-19	7.4	7.0	6.3	7.4	7.0	0.4
			RG_LIDSL_INV-2	10-Sep-19	7.0					
			RG_LIDSL_INV-3	10-Sep-19	6.6					
			RG_LIDSL_INV-4	10-Sep-19	6.3					
			RG_LIDSL_INV-5	10-Sep-19	7.0					
			RG_LIDSL_INV-6	10-Sep-19	6.5					
			RG_LIDSL_INV-7	10-Sep-19	7.4					
			RG_LIDSL_INV-8	10-Sep-19	7.4					
			RG_LIDSL_INV-9	10-Sep-19	7.0					
			RG_LIDSL_INV-10	10-Sep-19	6.9					
			RG_LIDSL_INV-1	3-Dec-19	5.1	4.7	4.2	5.1	4.7	0.3
			RG_LIDSL_INV-2	3-Dec-19	4.9					
			RG_LIDSL_INV-3	3-Dec-19	4.3					
			RG_LIDSL_INV-4	3-Dec-19	4.4					
			RG_LIDSL_INV-5	3-Dec-19	4.6					
			RG_LIDSL_INV-6	3-Dec-19	4.9					
			RG_LIDSL_INV-7	3-Dec-19	5.0					
			RG_LIDSL_INV-8	3-Dec-19	4.2					
			RG_LIDSL_INV-9	3-Dec-19	4.4					
			RG_LIDSL_INV-10	3-Dec-19	4.7					
		RG_LIDCOM (LC_LCC)	RG_LIDCOM1-INV	16-Jan-19	7.5	7.4	6.0	7.6	7.0	0.6
			RG_LIDCOM2-INV	16-Jan-19	7.3					
			RG_LIDCOM3-INV	16-Jan-19	6.6					
			RG_LIDCOM4-INV	16-Jan-19	7.4					
			RG_LIDCOM5-INV	16-Jan-19	7.5					
			RG_LIDCOM6-INV	16-Jan-19	6.6					
			RG_LIDCOM7-INV	16-Jan-19	7.4					
			RG_LIDCOM8-INV	16-Jan-19	7.6					
			RG_LIDCOM9-INV	16-Jan-19	6.4					
			RG_LIDCOM10-INV	16-Jan-19	6.0					

Table B.2: **Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, January to December 2019**

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Mine-exposed	RG_LIDCOM (LC_LCC)	RG_LIDCOM1-INV	27-Feb-19	7.3	7.7	7.0	8.2	7.7	0.4
			RG_LIDCOM2-INV	27-Feb-19	7.7					
			RG_LIDCOM3-INV	27-Feb-19	7.0					
			RG_LIDCOM4-INV	27-Feb-19	7.6					
			RG_LIDCOM5-INV	27-Feb-19	7.9					
			RG_LIDCOM6-INV	27-Feb-19	8.2					
			RG_LIDCOM7-INV	27-Feb-19	7.8					
			RG_LIDCOM8-INV	27-Feb-19	8.2					
			RG_LIDCOM9-INV	27-Feb-19	7.7					
			RG_LIDCOM10-INV	27-Feb-19	7.5					
			RG_LIDCOM1_INV	25-Apr-19	8.5	8.0	7.5	8.5	8.0	0.3
			RG_LIDCOM2_INV	25-Apr-19	8.4					
			RG_LIDCOM3_INV	25-Apr-19	8.0					
			RG_LIDCOM4_INV	25-Apr-19	7.6					
			RG_LIDCOM5_INV	25-Apr-19	7.9					
			RG_LIDCOM6_INV	25-Apr-19	7.9					
			RG_LIDCOM7_INV	25-Apr-19	8.0					
			RG_LIDCOM8_INV	25-Apr-19	8.3					
			RG_LIDCOM9_INV	25-Apr-19	7.5					
			RG_LIDCOM10_INV	25-Apr-19	7.8					
			RG_LIDCOM_INV-1	12-Sep-19	7.4	6.5	5.3	7.4	6.5	0.6
			RG_LIDCOM_INV-2	12-Sep-19	6.3					
			RG_LIDCOM_INV-3	12-Sep-19	6.8					
			RG_LIDCOM_INV-4	12-Sep-19	5.3					
			RG_LIDCOM_INV-5	12-Sep-19	6.6					
			RG_LIDCOM_INV-6	12-Sep-19	6.0					
			RG_LIDCOM_INV-7	12-Sep-19	6.4					
			RG_LIDCOM_INV-8	12-Sep-19	6.2					
			RG_LIDCOM_INV-9	12-Sep-19	7.2					
			RG_LIDCOM_INV-10	12-Sep-19	6.6					
			RG_LIDCOM_INV-1	5-Dec-19	5.8	5.6	3.7	5.8	5.3	0.7
			RG_LIDCOM_INV-2	5-Dec-19	5.8					
			RG_LIDCOM_INV-3	5-Dec-19	5.5					
			RG_LIDCOM_INV-4	5-Dec-19	4.3					
			RG_LIDCOM_INV-5	5-Dec-19	5.7					
			RG_LIDCOM_INV-6	5-Dec-19	3.7					
			RG_LIDCOM_INV-7	5-Dec-19	5.8					
			RG_LIDCOM_INV-8	5-Dec-19	5.6					
			RG_LIDCOM_INV-9	5-Dec-19	5.5					
			RG_LIDCOM_INV-10	5-Dec-19	5.1					
		RG_LI8 (LC_LC4)	RG_LI8-1-INV	16-Jan-19	6.4	5.7	5.0	6.7	5.8	0.6
			RG_LI8-2-INV	16-Jan-19	5.1					
			RG_LI8-3-INV	16-Jan-19	5.7					
			RG_LI8-4-INV	16-Jan-19	6.7					
			RG_LI8-5-INV	16-Jan-19	5.0					
			RG_LI8-6-INV	16-Jan-19	5.6					
			RG_LI8-7-INV	16-Jan-19	5.8					
			RG_LI8-8-INV	16-Jan-19	5.4					
			RG_LI8-9-INV	16-Jan-19	6.6					
			RG_LI8-10-INV	16-Jan-19	5.2					
			RG_LI8-1-INV	27-Feb-19	6.6	6.7	5.5	7.8	6.6	0.7
			RG_LI8-2-INV	27-Feb-19	6.6					
			RG_LI8-3-INV	27-Feb-19	6.1					
			RG_LI8-4-INV	27-Feb-19	6.7					
			RG_LI8-5-INV	27-Feb-19	5.8					
			RG_LI8-6-INV	27-Feb-19	5.5					
			RG_LI8-7-INV	27-Feb-19	7.1					
			RG_LI8-8-INV	27-Feb-19	6.9					
			RG_LI8-9-INV	27-Feb-19	7.8					
			RG_LI8-10-INV	27-Feb-19	7.1					
			RG_LI8-1_INV	25-Apr-19	7.2	7.3	6.8	8.5	7.4	0.6
			RG_LI8-2_INV	25-Apr-19	8.5					
			RG_LI8-3_INV	25-Apr-19	7.4					
			RG_LI8-4_INV	25-Apr-19	7.2					
			RG_LI8-5_INV	25-Apr-19	7.4					
			RG_LI8-6_INV	25-Apr-19	6.9					
			RG_LI8-7_INV	25-Apr-19	6.8					
			RG_LI8-8_INV	25-Apr-19	6.8					
			RG_LI8-9_INV	25-Apr-19	7.6					
			RG_LI8-10_INV	25-Apr-19	8.1					
			RG_LI8-1_INV	24-May-19	4.5	6.3	4.5	7.4	6.1	0.8
			RG_LI8-2_INV	24-May-19	6.2					
			RG_LI8-3_INV	24-May-19	5.9					
			RG_LI8-4_INV	24-May-19	6.3					
			RG_LI8-5_INV	24-May-19	6.0					
			RG_LI8-6_INV	24-May-19	7.4					
			RG_LI8-7_INV	24-May-19	5.3					
			RG_LI8-8_INV	24-May-19	6.3					
			RG_LI8-9_INV	24-May-19	6.4					
			RG_LI8-10_INV	24-May-19	7.0					

Table B.2: Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, January to December 2019

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Line Creek	Mine-exposed	RG_LI8 (LC_LC4)	RG_LI8-1_INV	19-Jun-19	5.6	6.3	5.5	8.3	6.7	1.1
			RG_LI8-2_INV	19-Jun-19	5.8					
			RG_LI8-3_INV	19-Jun-19	5.5					
			RG_LI8-4_INV	19-Jun-19	6.4					
			RG_LI8-5_INV	19-Jun-19	5.7					
			RG_LI8-6_INV	19-Jun-19	8.1					
			RG_LI8-7_INV	19-Jun-19	8.3					
			RG_LI8-8_INV	19-Jun-19	8.0					
			RG_LI8-9_INV	19-Jun-19	6.1					
			RG_LI8-10_INV	19-Jun-19	7.3					
			RG_LI8-1_INV	17-Jul-19	6.3	6.5	5.7	7.3	6.4	0.5
			RG_LI8-2_INV	17-Jul-19	5.9					
			RG_LI8-3_INV	17-Jul-19	7.3					
			RG_LI8-4_INV	17-Jul-19	6.6					
			RG_LI8-5_INV	17-Jul-19	5.9					
			RG_LI8-6_INV	17-Jul-19	5.8					
			RG_LI8-7_INV	17-Jul-19	6.8					
			RG_LI8-8_INV	17-Jul-19	5.7					
			RG_LI8-9_INV	17-Jul-19	6.6					
			RG_LI8-10_INV	17-Jul-19	6.8					
			RG_LI8-1_INV	13-Aug-19	6.9	6.8	6.0	7.3	6.7	0.4
			RG_LI8-2_INV	13-Aug-19	6.6					
			RG_LI8-3_INV	13-Aug-19	6.2					
			RG_LI8-4_INV	13-Aug-19	7.3					
			RG_LI8-5_INV	13-Aug-19	6.9					
			RG_LI8-6_INV	13-Aug-19	6.0					
			RG_LI8-7_INV	13-Aug-19	7.2					
			RG_LI8-8_INV	13-Aug-19	6.6					
			RG_LI8-9_INV	13-Aug-19	7.1					
			RG_LI8-10_INV	13-Aug-19	6.6					
			RG_LI8_INV-1	11-Sep-19	5.8	6.4	5.8	7.2	6.5	0.4
			RG_LI8_INV-2	11-Sep-19	6.2					
			RG_LI8_INV-3	11-Sep-19	6.7					
			RG_LI8_INV-4	11-Sep-19	6.2					
			RG_LI8_INV-5	11-Sep-19	7.1					
			RG_LI8_INV-6	11-Sep-19	6.4					
			RG_LI8_INV-7	11-Sep-19	6.2					
			RG_LI8_INV-8	11-Sep-19	7.2					
			RG_LI8_INV-9	11-Sep-19	6.4					
			RG_LI8_INV-10	11-Sep-19	6.6					
			RG_LI8_INV-1	4-Dec-19	4.0	4.2	3.6	5.2	4.2	0.5
			RG_LI8_INV-2	4-Dec-19	4.8					
			RG_LI8_INV-3	4-Dec-19	4.2					
			RG_LI8_INV-4	4-Dec-19	3.6					
			RG_LI8_INV-5	4-Dec-19	5.2					
			RG_LI8_INV-6	4-Dec-19	4.1					
			RG_LI8_INV-7	4-Dec-19	4.0					
			RG_LI8_INV-8	4-Dec-19	4.2					
			RG_LI8_INV-9	4-Dec-19	4.4					
			RG_LI8_INV-10	4-Dec-19	3.8					
Fording River	Mine-exposed	RG_FRUL (LC_LC6)	RG_FRUL1-INV	15-Jan-19	10.0	6.9	6.4	10.0	7.5	1.44
			RG_FRUL2-INV	15-Jan-19	6.4					
			RG_FRUL3-INV	15-Jan-19	6.9					
			RG_FRUL4-INV	15-Jan-19	6.8					
			RG_FRUL5-INV	15-Jan-19	7.3					
			RG_FRUL1-INV	7-Mar-19	7.2	6.7	5.2	9.4	6.8	1.2
			RG_FRUL2-INV	7-Mar-19	7.8					
			RG_FRUL3-INV	7-Mar-19	6.0					
			RG_FRUL4-INV	7-Mar-19	7.0					
			RG_FRUL5-INV	7-Mar-19	6.4					
			RG_FRUL6-INV	7-Mar-19	6.8					
			RG_FRUL7-INV	7-Mar-19	5.8					
			RG_FRUL8-INV	7-Mar-19	5.2					
			RG_FRUL9-INV	7-Mar-19	6.6					
			RG_FRUL10-INV	7-Mar-19	9.4					
			RG_FRUL1_INV	26-Apr-19	6.5	8.3	6.5	9.1	8.1	1.0
			RG_FRUL2_INV	26-Apr-19	7.5					
			RG_FRUL3_INV	26-Apr-19	6.5					
			RG_FRUL4_INV	26-Apr-19	9.1					
			RG_FRUL5_INV	26-Apr-19	9.1					
			RG_FRUL6_INV	26-Apr-19	7.9					
			RG_FRUL7_INV	26-Apr-19	8.6					
			RG_FRUL8_INV	26-Apr-19	9.1					
			RG_FRUL9_INV	26-Apr-19	8.8					
			RG_FRUL10_INV	26-Apr-19	7.4					

Table B.2: Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Collected from Line Creek and Fording River, Line Creek LAEMP, January to December 2019

Waterbody		Biological Area Code	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
					Sample	Area Median	Area Minimum	Area Maximum	Area Mean	Area Standard Deviation
Fording River	Mine-exposed	RG_FRUL (LC_LC6)	RG_FRUL_INV-1	12-Sep-19	11	9.9	8.6	11	10	0.8
			RG_FRUL_INV-2	12-Sep-19	11					
			RG_FRUL_INV-3	12-Sep-19	8.6					
			RG_FRUL_INV-4	12-Sep-19	9.2					
			RG_FRUL_INV-5	12-Sep-19	9.9					
			RG_FRUL_INV-6	12-Sep-19	9.5					
			RG_FRUL_INV-7	12-Sep-19	10					
			RG_FRUL_INV-8	12-Sep-19	9.4					
			RG_FRUL_INV-9	12-Sep-19	11					
			RG_FRUL_INV-10	12-Sep-19	9.9					
			RG_FRUL_INV-1	4-Dec-19	8	8.3	7.8	11	8.5	1.0
			RG_FRUL_INV-2	4-Dec-19	9					
			RG_FRUL_INV-3	4-Dec-19	8.1					
			RG_FRUL_INV-4	4-Dec-19	11					
			RG_FRUL_INV-5	4-Dec-19	8.4					
			RG_FRUL_INV-6	4-Dec-19	8.3					
			RG_FRUL_INV-7	4-Dec-19	8					
			RG_FRUL_INV-8	4-Dec-19	7.8					
			RG_FRUL_INV-9	4-Dec-19	8					
			RG_FRUL_INV-10	4-Dec-19	7.8					
		RG_FO23 (LC_LC5)	RG_F023-1-INV	15-Jan-19	6.1	7.3	6.1	8.7	7.3	0.9
			RG_F023-2-INV	15-Jan-19	6.9					
			RG_F023-3-INV	15-Jan-19	8.7					
			RG_F023-4-INV	15-Jan-19	7.5					
			RG_F023-5-INV	15-Jan-19	7.0					
			RG_F023-6-INV	15-Jan-19	8.0					
			RG_F023-7-INV	15-Jan-19	8.5					
			RG_F023-8-INV	15-Jan-19	6.2					
			RG_F023-9-INV	15-Jan-19	7.0					
			RG_F023-10-INV	15-Jan-19	7.5					
			RG_F023-1-INV	7-Mar-19	7.5	5.4	4.5	7.5	5.7	1.4
			RG_F023-2-INV	7-Mar-19	4.5					
			RG_F023-3-INV	7-Mar-19	5.9					
			RG_F023-4-INV	7-Mar-19	4.8					
			RG_FO23-1_INV	26-Apr-19	6.6	7.4	6.6	9.2	7.6	0.9
			RG_FO23-2_INV	26-Apr-19	7.4					
			RG_FO23-3_INV	26-Apr-19	6.6					
			RG_FO23-4_INV	26-Apr-19	9.2					
			RG_FO23-5_INV	26-Apr-19	6.8					
			RG_FO23-6_INV	26-Apr-19	7.5					
			RG_FO23-7_INV	26-Apr-19	7.4					
			RG_FO23-8_INV	26-Apr-19	8.9					
			RG_FO23-9_INV	26-Apr-19	7.3					
			RG_FO23-10_INV	26-Apr-19	8.0					
			RG_FO23_INV-1	8-Sep-19	8.0	8.2	7.5	11	8.5	1.0
			RG_FO23_INV-2	8-Sep-19	7.5					
			RG_FO23_INV-3	8-Sep-19	9.1					
			RG_FO23_INV-4	8-Sep-19	11					
			RG_FO23_INV-5	8-Sep-19	8.2					
			RG_FO23_INV-6	8-Sep-19	8.7					
			RG_FO23_INV-7	8-Sep-19	8.4					
			RG_FO23_INV-8	8-Sep-19	8.0					
			RG_FO23_INV-9	8-Sep-19	8.1					
			RG_FO23_INV-10	8-Sep-19	7.7					
			RG_FO23_INV-1	4-Dec-19	6.4	6.6	5.0	8.6	6.7	1.0
			RG_FO23_INV-2	4-Dec-19	7.8					
			RG_FO23_INV-3	4-Dec-19	7.2					
			RG_FO23_INV-4	4-Dec-19	6.8					
			RG_FO23_INV-5	4-Dec-19	6.0					
			RG_FO23_INV-6	4-Dec-19	6.2					
			RG_FO23_INV-7	4-Dec-19	8.6					
			RG_FO23_INV-8	4-Dec-19	6.5					
			RG_FO23_INV-9	4-Dec-19	6.6					
			RG_FO23_INV-10	4-Dec-19	5.0					

Table B.3: ANOVA Table for the Asymmetric BACI Model Comparing Benthic Invertebrate Selenium Concentrations at RG_LCUT During the Steady State (SS), Shutdown (SD), and Restart (RS) Periods Relative to the Reference Areas (RG_LI24 and RG_SLINE)

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	2	0.54	0.27	35	<0.001
CI	1	0.10	0.10	13	<0.001
Period×CI	2	0.26	0.13	16	<0.001
Time(Period)	12	1.5	0.12	16	<0.001
Time(Period)×CI	12	1.7	0.146	19	<0.001
Error	345			-	

Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[c]**
SS (2016_9)	RS(2018_12)	-	-
	RS(2019_1)	-	-
	RS(2019_4)	-	-
	RS(2019_5)	<0.001	-4.7 SD
	RS(2019_6)	0.002	-3.9 SD
	RS(2019_7)	<0.001	-5.4 SD
	RS(2019_8)	-	-
	RS(2019_9)	-	-
	RS(2019_12)	-	-
SS (2017_4)	RS(2018_12)	-	-
	RS(2019_1)	-	-
	RS(2019_4)	-	-
	RS(2019_5)	<0.001	-4.6 SD
	RS(2019_6)	<0.001	-3.8 SD
	RS(2019_7)	<0.001	-5.2 SD
	RS(2019_8)	<0.001	-3.1 SD
	RS(2019_9)	-	-
	RS(2019_12)	-	-
SS (2017_9)	RS(2018_12)	-	-
	RS(2019_1)	-	-
	RS(2019_4)	-	-
	RS(2019_5)	<0.001	-3.3 SD
	RS(2019_6)	<0.001	-2.6 SD
	RS(2019_7)	<0.001	-4.0 SD
	RS(2019_8)	<0.001	-1.9 SD
	RS(2019_9)	-	-
	RS(2019_12)	-	-

p-value for **Period×CI** or **Time(Period)×CI** factors < 0.1

Contrast p-value < 0.1/27 and in an increasing direction

Contrast p-value < 0.1/27 and in a decreasing direction

Notes: "-" = no data. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error.

[a] SS = sum of squares of ANOVA model.

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

Table B.4: ANOVA Table for the Asymmetric BACI Model Comparing Benthic Invertebrate Selenium Concentrations at RG_LILC3 During the Before (B), Initial Operations (IO), Steady State (SS), Shutdown (SD), and Restart (RS) Periods Relative to the Reference Areas (RG_LI24 and RG_SLINE)

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	4	1.7	0.42	70	<0.001
CI	1	10	10	1700	<0.001
Period×CI	4	3.5	0.88	147	<0.001
Time(Period)	13	1.5	0.11	19	<0.001
Time(Period)×CI	13	1.2	0.095	16	<0.001
Error	373	-			

Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[c]**
B	RS(2018_12)	-	-
	RS(2019_1)	-	-
	RS(2019_3)	-	-
	RS(2019_4)	-	-
	RS(2019_5)	-	-
	RS(2019_6)	-	-
	RS(2019_7)	-	-
	RS(2019_8)	-	-
	RS(2019_9)	-	-
	RS(2019_12)	-	-
SS (2016_9)	RS(2018_12)	<0.001	-9.3 SD
	RS(2019_1)	<0.001	-8.0 SD
	RS(2019_3)	<0.001	-8.1 SD
	RS(2019_4)	<0.001	-9.1 SD
	RS(2019_5)	<0.001	-9.5 SD
	RS(2019_6)	<0.001	-10.7 SD
	RS(2019_7)	<0.001	-11.4 SD
	RS(2019_8)	<0.001	-11 SD
	RS(2019_9)	<0.001	-8.8 SD
	RS(2019_12)	<0.001	-7.0 SD
SS (2017_4)	RS(2018_12)	<0.001	-9.2 SD
	RS(2019_1)	<0.001	-8.0 SD
	RS(2019_3)	<0.001	-8.0 SD
	RS(2019_4)	<0.001	-9.0 SD
	RS(2019_5)	<0.001	-9.4 SD
	RS(2019_6)	<0.001	-10.6 SD
	RS(2019_7)	<0.001	-11.3 SD
	RS(2019_8)	<0.001	-10.9 SD
	RS(2019_9)	<0.001	-8.7 SD
	RS(2019_12)	<0.001	-6.9 SD
SS (2017_9)	RS(2018_12)	<0.001	-5.9 SD
	RS(2019_1)	<0.001	-4.6 SD
	RS(2019_3)	<0.001	-4.7 SD
	RS(2019_4)	<0.001	-5.7 SD
	RS(2019_5)	<0.001	-6.1 SD
	RS(2019_6)	<0.001	-7.3 SD
	RS(2019_7)	<0.001	-8.0 SD
	RS(2019_8)	<0.001	-7.6 SD
	RS(2019_9)	<0.001	-5.4 SD
	RS(2019_12)	<0.001	-3.6 SD

p-value for **Period×CI** or **Time(Period)×CI** factors < 0.1

Contrast p-value < 0.1/40 and in an increasing direction

Contrast p-value < 0.1/40 and in a decreasing direction

Notes: "-" = no data. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error.

[a] SS = sum of squares of ANOVA model.

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

Table B.5: ANOVA Table for the Asymmetric BACI Model Comparing Benthic Invertebrate Selenium Concentrations at RG_LISP24 During the Steady State (SS), Shutdown (SD), and Restart (RS) Periods Relative to the Reference Areas (RG_LI24 and RG_SLINE)

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	2	0.91	0.46	72	<0.001
CI	1	2.3	2.3	370	<0.001
Period×CI	2	0.78	0.39	61	<0.001
Time(Period)	7	1.0	0.15	24	<0.001
Time(Period)×CI	7	0.29	0.041	6.5	<0.001
Error	240	-			

Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[c]**
SS (2017_9)	RS(2018_12)	<0.001	-4.7 SD
	RS(2019_1)	<0.001	-4.1 SD
	RS(2019_3)	<0.001	-4.6 SD
	RS(2019_4)	<0.001	-5.6 SD
	RS(2019_9)	<0.001	-5.3 SD
	RS(2019_12)	<0.001	-2.8 SD

- (grey) p-value for **Period×CI** or **Time(Period)×CI** factors < 0.1
- (blue) Contrast p-value < 0.1/6 and in an increasing direction
- (green) Contrast p-value < 0.1/6 and in a decreasing direction

Notes: Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error.

[a] SS = sum of squares of ANOVA model.

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

Table B.6: ANOVA Table for the Asymmetric BACI Model Comparing Benthic Invertebrate Selenium Concentrations at RG_LIDSL During the Before (B), Initial Operations (IO), Steady State (SS), Shutdown (SD), and Restart (RS) Periods Relative to the Reference Areas (RG_LI24 and RG_SLINE)

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	4	0.48	0.12	20	<0.001
CI	1	1.6	1.6	258	<0.001
Period×CI	4	1.4	0.36	58	<0.001
Time(Period)	13	1.8	0.14	22	<0.001
Time(Period)×CI	13	0.6	0.045	7.2	<0.001
Error	373	-			

Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[c]**
B	RS(2018_12)	-	-
	RS(2019_1)	-	-
	RS(2019_3)	-	-
	RS(2019_4)	-	-
	RS(2019_5)	-	-
	RS(2019_6)	-	-
	RS(2019_7)	-	-
	RS(2019_8)	-	-
	RS(2019_9)	-	-
	RS(2019_12)	-	-
SS (2016_9)	RS(2018_12)	<0.001	-5.9 SD
	RS(2019_1)	<0.001	-5.8 SD
	RS(2019_3)	<0.001	-6.3 SD
	RS(2019_4)	<0.001	-8.0 SD
	RS(2019_5)	<0.001	-7.1 SD
	RS(2019_6)	<0.001	-6.9 SD
	RS(2019_7)	<0.001	-8.4 SD
	RS(2019_8)	<0.001	-8.1 SD
	RS(2019_9)	<0.001	-6.2 SD
	RS(2019_12)	<0.001	-5.3 SD
SS (2017_4)	RS(2018_12)	<0.001	-3.2 SD
	RS(2019_1)	<0.001	-3.2 SD
	RS(2019_3)	<0.001	-3.6 SD
	RS(2019_4)	<0.001	-5.4 SD
	RS(2019_5)	<0.001	-4.4 SD
	RS(2019_6)	<0.001	-4.3 SD
	RS(2019_7)	<0.001	-5.8 SD
	RS(2019_8)	<0.001	-5.4 SD
	RS(2019_9)	<0.001	-3.5 SD
	RS(2019_12)	<0.001	-2.6 SD
SS (2017_9)	RS(2018_12)	<0.001	-3.7 SD
	RS(2019_1)	<0.001	-3.7 SD
	RS(2019_3)	<0.001	-4.2 SD
	RS(2019_4)	<0.001	-5.9 SD
	RS(2019_5)	<0.001	-5.0 SD
	RS(2019_6)	<0.001	-4.8 SD
	RS(2019_7)	<0.001	-6.3 SD
	RS(2019_8)	<0.001	-6.0 SD
	RS(2019_9)	<0.001	-4.0 SD
	RS(2019_12)	<0.001	-3.2 SD

p-value for **Period×CI** or **Time(Period)×CI** factors < 0.1

Contrast p-value < 0.1/40 and in an increasing direction

Contrast p-value < 0.1/40 and in a decreasing direction

Notes: "-" = no data. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error.

[a] SS = sum of squares of ANOVA model.

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

Table B.7: ANOVA Table for the Asymmetric BACI Model Comparing Benthic Invertebrate Selenium Concentrations at RG_LIDCOM During the Steady State (SS), Shutdown (SD), and Restart (RS) Periods Relative to the Reference Areas (RG_LI24 and RG_SLINE)

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	2	0.47	0.24	36	<0.001
CI	1	1.9	1.9	284	<0.001
Period×CI	2	0.10	0.048	7.2	<0.001
Time(Period)	7	1.2	0.17	26	<0.001
Time(Period)×CI	7	0.23	0.032	4.9	<0.001
Error	240	-			

Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[c]**
SS (2017_9)	RS(2018_12)	-	-
	RS(2019_1)	-	-
	RS(2019_3)	-	-
	RS(2019_4)	<0.001	-2.1 SD
	RS(2019_9)	<0.001	-2.3 SD
	RS(2019_12)	-	-

p-value for **Period×CI** or **Time(Period)×CI** factors < 0.1

Contrast p-value < 0.1/6 and in an increasing direction

Contrast p-value < 0.1/6 and in a decreasing direction

Notes: "-" = no data. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error.

[a] SS = sum of squares of ANOVA model.

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

Table B.8: ANOVA Table for the Asymmetric BACI Model Comparing Benthic Invertebrate Selenium Concentrations at RG_LI8 During the Before (B), Initial Operations (IO), Steady State (SS), Shutdown (SD), and Restart (RS) Periods Relative to the Reference Areas (RG_LI24 and RG_SLINE)

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	4	0.56	0.14	25	<0.001
CI	1	1.8	1.8	331	<0.001
Period×CI	4	0.80	0.20	36	<0.001
Time(Period)	13	2.2	0.17	31	<0.001
Time(Period)×CI	13	0.41	0.031	5.6	<0.001
Error	373	-			

Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[c]**
B	RS(2018_12)	-	-
	RS(2019_1)	-	-
	RS(2019_3)	-	-
	RS(2019_4)	-	-
	RS(2019_5)	-	-
	RS(2019_6)	-	-
	RS(2019_7)	-	-
	RS(2019_8)	-	-
	RS(2019_9)	-	-
	RS(2019_12)	-	-
SS (2016_9)	RS(2018_12)	0.002	-4.0 SD
	RS(2019_1)	0.001	-4.2 SD
	RS(2019_3)	<0.001	-4.8 SD
	RS(2019_4)	<0.001	-5.4 SD
	RS(2019_5)	<0.001	-6.5 SD
	RS(2019_6)	<0.001	-5.6 SD
	RS(2019_7)	<0.001	-6.1 SD
	RS(2019_8)	<0.001	-6.0 SD
	RS(2019_9)	<0.001	-5.1 SD
	RS(2019_12)	<0.001	-4.4 SD
SS (2017_4)	RS(2018_12)	0.001	-1.9 SD
	RS(2019_1)	<0.001	-2.1 SD
	RS(2019_3)	<0.001	-2.7 SD
	RS(2019_4)	<0.001	-3.3 SD
	RS(2019_5)	<0.001	-4.4 SD
	RS(2019_6)	<0.001	-3.4 SD
	RS(2019_7)	<0.001	-4.0 SD
	RS(2019_8)	<0.001	-3.9 SD
	RS(2019_9)	<0.001	-3.0 SD
	RS(2019_12)	<0.001	-2.2 SD
SS (2017_9)	RS(2018_12)	<0.001	-2.5 SD
	RS(2019_1)	<0.001	-2.8 SD
	RS(2019_3)	<0.001	-3.3 SD
	RS(2019_4)	<0.001	-3.9 SD
	RS(2019_5)	<0.001	-5.1 SD
	RS(2019_6)	<0.001	-4.1 SD
	RS(2019_7)	<0.001	-4.7 SD
	RS(2019_8)	<0.001	-4.5 SD
	RS(2019_9)	<0.001	-3.6 SD
	RS(2019_12)	<0.001	-2.9 SD

p-value for **Period×CI** or **Time(Period)×CI** factors < 0.1

Contrast p-value < 0.1/40 and in an increasing direction

Contrast p-value < 0.1/40 and in a decreasing direction

Notes: "-" = no data. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error.

[a] SS = sum of squares of ANOVA model.

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

Table B.9: **ANOVA Table for the Asymmetric BACI Model Comparing Benthic Invertebrate Selenium Concentrations at RG_LCUT Within the Restart Period Relative to the Reference Areas (RG_LI24 and RG_SLINE)**

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	2	0.54	0.27	35	<0.001
CI	1	0.10	0.10	13	<0.001
Period×CI	2	0.26	0.13	16	<0.001
Time(Period)	12	1.5	0.12	16	<0.001
Time(Period)×CI	12	1.7	0.15	19	<0.001
Error	345	-			

Within Restart Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[c]**
2018_12	2019_1	-	-
	2019_4	-	-
	2019_5	<0.001	-3.8 SD
	2019_6	<0.001	-3.1 SD
	2019_7	<0.001	-4.5 SD
	2019_8	<0.001	-2.4 SD
	2019_9	-	-
	2019_12	-	-
2019_1	2019_4	-	-
	2019_5	<0.001	-4.5 SD
	2019_6	<0.001	-3.7 SD
	2019_7	<0.001	-5.2 SD
	2019_8	<0.001	-3.0 SD
	2019_9	-	-
	2019_12	-	-
2019_4	2019_5	<0.001	-3.9 SD
	2019_6	<0.001	-3.1 SD
	2019_7	<0.001	-4.6 SD
	2019_8	<0.001	-2.4 SD
	2019_9	-	-
	2019_12	-	-
2019_5	2019_6	-	-
	2019_7	-	-
	2019_8	-	-
	2019_9	<0.001	4.3 SD
	2019_12	<0.001	4.4 SD
2019_6	2019_7	-	-
	2019_8	-	-
	2019_9	<0.001	3.6 SD
	2019_12	<0.001	3.7 SD
2019_7	2019_8	<0.001	2.1 SD
	2019_9	<0.001	5.0 SD
	2019_12	<0.001	5.1 SD
2019_8	2019_9	<0.001	2.9 SD
	2019_12	<0.001	3.0 SD
2019_9	2019_12	-	-

(grey) P-value for **Period×CI** or **Time(Period)×CI** factors < 0.1
(blue) Contrast P-value < 0.1/36 and in an increasing direction
(green) Contrast P-value < 0.1/36 and in a decreasing direction

Notes: "-" = no data. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error.

[a] SS = sum of squares of ANOVA model.

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

Table B.10: ANOVA Table for the Asymmetric BACI Model Comparing Benthic Invertebrate Selenium Concentrations at RG_LILC3 Within the Restart Period Relative to the Reference Areas (RG_LI24 and RG_SLINE)

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	4	1.7	0.42	70	<0.001
CI	1	10	10	1700	<0.001
Period×CI	4	3.5	0.88	147	<0.001
Time(Period)	13	1.5	0.11	19	<0.001
Time(Period)×CI	13	1.2	0.095	16	<0.001
Error	373		-		

Within Restart Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[c]**
2018_12	2019_1	-	-
	2019_3	-	-
	2019_4	-	-
	2019_5	-	-
	2019_6	-	-
	2019_7	<0.001	-2.1 SD
	2019_8	-	-
	2019_9	-	-
	2019_12	<0.001	2.3 SD
2019_1	2019_3	-	-
	2019_4	-	-
	2019_5	-	-
	2019_6	<0.001	-2.6 SD
	2019_7	<0.001	-3.4 SD
	2019_8	<0.001	-2.9 SD
	2019_9	-	-
	2019_12	-	-
2019_3	2019_4	-	-
	2019_5	-	-
	2019_6	<0.001	-2.6 SD
	2019_7	<0.001	-3.3 SD
	2019_8	<0.001	-2.9 SD
	2019_9	-	-
	2019_12	-	-
2019_4	2019_5	-	-
	2019_6	-	-
	2019_7	<0.001	-2.3 SD
	2019_8	<0.001	-1.8 SD
	2019_9	-	-
	2019_12	<0.001	2.1 SD
2019_5	2019_6	-	-
	2019_7	<0.001	-1.9 SD
	2019_8	-	-
	2019_9	-	-
	2019_12	<0.001	2.5 SD
2019_6	2019_7	-	-
	2019_8	-	-
	2019_9	<0.001	1.9 SD
	2019_12	<0.001	3.7 SD
2019_7	2019_8	-	-
	2019_9	<0.001	2.6 SD
	2019_12	<0.001	4.4 SD
2019_8	2019_9	<0.001	2.2 SD
	2019_12	<0.001	4.0 SD
2019_9	2019_12	0.001	1.8 SD

p-value for **Period×CI** or **Time**(**Period**)**×CI** factors < 0.1

Contrast p-value < 0.1/45 and in an increasing direction

Contrast p-value < 0.1/45 and in a decreasing direction

Notes: "-" = no data. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error.

[a] SS = sum of squares of ANOVA model.

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

Table B.11: ANOVA Table for the Asymmetric BACI Model Comparing Benthic Invertebrate Selenium Concentrations at RG_LISP24 Within the Restart Period Relative to the Reference Areas (RG_LI24 and RG_SLINE)

ANOVA Model

Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	2	0.91	0.46	72	<0.001
CI	1	2.3	2.3	370	<0.001
Period×CI	2	0.78	0.39	61	<0.001
Time(Period)	7	1.0	0.15	24	<0.001
Time(Period)×CI	7	0.29	0.041	6.5	<0.001
Error	240	-			

Within Restart Contrasts (P-value and Magnitude of Difference)

Period 1	**Period 2**	**P-value**	**MOD[c]**
2018_12	2019_1	-	-
	2019_3	-	-
	2019_4	-	-
	2019_9	-	-
	2019_12	<0.001	1.9 SD
2019_1	2019_3	-	-
	2019_4	-	-
	2019_9	-	-
	2019_12	-	-
2019_3	2019_4	-	-
	2019_9	-	-
	2019_12	0.002	1.8 SD
2019_4	2019_9	-	-
	2019_12	<0.001	2.8 SD
2019_9	2019_12	<0.001	2.5 SD

p-value for **Period×CI** or **Time(Period)×CI** factors < 0.1

Contrast p-value < 0.1/15 and in an increasing direction

Contrast p-value < 0.1/15 and in a decreasing direction

Note: "-" = no data. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error.

[a] SS = sum of squares of ANOVA model.

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

Table B.12: ANOVA Table for the Asymmetric BACI Model Comparing Benthic Invertebrate Selenium Concentrations at RG_LIDSL Within the Restart Period Relative to the Reference Areas (RG_LI24 and RG_SLINE)

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	4	0.48	0.12	20	<0.001
CI	1	1.6	1.6	258	<0.001
Period×CI	4	1.4	0.36	58	<0.001
Time(Period)	13	1.8	0.14	22	<0.001
Time(Period)×CI	13	0.6	0.045	7.2	<0.001
Error	373			-	

Within Restart Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[c]**
2018_12	2019_1	-	-
	2019_3	-	-
	2019_4	<0.001	-2.2 SD
	2019_5	-	-
	2019_6	-	-
	2019_7	<0.001	-2.6 SD
	2019_8	<0.001	-2.2 SD
	2019_9	-	-
	2019_12	-	-
2019_1	2019_3	-	-
	2019_4	<0.001	-2.2 SD
	2019_5	-	-
	2019_6	-	-
	2019_7	<0.001	-2.6 SD
	2019_8	<0.001	-2.2 SD
	2019_9	-	-
	2019_12	-	-
2019_3	2019_4	-	-
	2019_5	-	-
	2019_6	-	-
	2019_7	<0.001	-2.1 SD
	2019_8	-	-
	2019_9	-	-
	2019_12	-	-
2019_4	2019_5	-	-
	2019_6	-	-
	2019_7	-	-
	2019_8	-	-
	2019_9	<0.001	1.9 SD
	2019_12	<0.001	2.7 SD
2019_5	2019_6	-	-
	2019_7	-	-
	2019_8	-	-
	2019_9	-	-
	2019_12	0.001	1.8 SD
2019_6	2019_7	-	-
	2019_8	-	-
	2019_9	-	-
	2019_12	-	-
2019_7	2019_8	-	-
	2019_9	<0.001	2.3 SD
	2019_12	<0.001	3.2 SD
2019_8	2019_9	<0.001	1.9 SD
	2019_12	<0.001	2.8 SD
2019_9	2019_12	-	-

p-value for **Period×CI** or **Time(Period)×CI** factors < 0.1

Contrast p-value < 0.1/45 and in an increasing direction

Contrast p-value < 0.1/45 and in a decreasing direction

Notes: "-" = no data. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error.

[a] SS = sum of squares of ANOVA model.

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

Table B.13: **ANOVA Table for the Asymmetric BACI Model Comparing Benthic Invertebrate Selenium Concentrations at RG_LIDCOM Within the Restart Period Relative to the Reference Areas (RG_LI24 and RG_SLINE)**

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	2	0.47	0.24	36	<0.001
CI	1	1.9	1.9	284	<0.001
Period×CI	2	0.10	0.05	7.2	<0.001
Time(Period)	7	1.2	0.17	26	<0.001
Time(Period)×CI	7	0.23	0.032	4.9	<0.001
Error	240	-			

Within Restart Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[c]**
2018_12	2019_1	-	-
	2019_3	-	-
	2019_4	-	-
	2019_9	-	-
	2019_12	-	-
2019_1	2019_3	-	-
	2019_4	0.003	-1.8 SD
	2019_9	0.001	-1.9 SD
	2019_12	-	-
2019_3	2019_4	-	-
	2019_9	-	-
	2019_12	-	-
2019_4	2019_9	-	-
	2019_12	0.002	1.7 SD
2019_9	2019_12	<0.001	1.9 SD

p-value for **Period×CI** or **Time(Period)×CI** factors < 0.1

Contrast p-value < 0.1/15 and in an increasing direction

Contrast p-value < 0.1/15 and in a decreasing direction

Notes: "-" = no data. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error.

[a] SS = sum of squares of ANOVA model.

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

Table B.14: ANOVA Table for the Asymmetric BACI Model Comparing Benthic Invertebrate Selenium Concentrations at RG_LI8 Within the Restart Period Relative to the Reference Areas (RG_LI24 and RG_SLINE)

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	4	0.56	0.14	25	<0.001
CI	1	1.8	1.8	331	<0.001
Period×CI	4	0.80	0.20	36	<0.001
Time(Period)	13	2.2	0.17	31	<0.001
Time(Period)×CI	13	0.41	0.031	5.6	<0.001
Error	373			-	

Within Restart Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[c]**
2018_12	2019_1	-	-
	2019_3	-	-
	2019_4	-	-
	2019_5	<0.001	-2.5 SD
	2019_6	-	-
	2019_7	<0.001	-2.1 SD
	2019_8	<0.001	-2.0 SD
	2019_9	-	-
	2019_12	-	-
2019_1	2019_3	-	-
	2019_4	-	-
	2019_5	<0.001	-2.3 SD
	2019_6	-	-
	2019_7	0.001	-1.9 SD
	2019_8	-	-
	2019_9	-	-
	2019_12	-	-
2019_3	2019_4	-	-
	2019_5	-	-
	2019_6	-	-
	2019_7	-	-
	2019_8	-	-
	2019_9	-	-
	2019_12	-	-
2019_4	2019_5	-	-
	2019_6	-	-
	2019_7	-	-
	2019_8	-	-
	2019_9	-	-
	2019_12	-	-
2019_5	2019_6	-	-
	2019_7	-	-
	2019_8	-	-
	2019_9	-	-
	2019_12	<0.001	2.2 SD
2019_6	2019_7	-	-
	2019_8	-	-
	2019_9	-	-
	2019_12	-	-
2019_7	2019_8	-	-
	2019_9	-	-
	2019_12	0.001	1.8 SD
2019_8	2019_9	-	-
	2019_12	-	-
2019_9	2019_12	-	-

p-value for **Period×CI** or **Time**(**Period**)**×CI** factors < 0.1

Contrast p-value < 0.1/45 and in an increasing direction

Contrast p-value < 0.1/45 and in a decreasing direction

Notes: "-" = no data. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error.

[a] SS = sum of squares of ANOVA model.

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

Table B.15: ANOVA Table for the Asymmetric BACI Model Comparing Benthic Invertebrate Selenium Concentrations at RG_FRUL During the Before (B), Steady State (SS), Shutdown (SD), and Restart (RS) Periods Relative to the Reference Areas (RG_LI24 and RG_SLINE)

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	3	0.34	0.11	17	<0.001
CI	1	3.4	3.4	530	<0.001
Period×CI	3	0.084	0.028	4.3	0.005
Time(Period)	8	1.2	0.15	23	<0.001
Time(Period)×CI	8	0.53	0.066	10	<0.001
Error	254	-			

Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[c]**
B	RS(2018_12)	-	-
	RS(2019_1)	-	-
	RS(2019_3)	-	-
	RS(2019_4)	-	-
	RS(2019_9)	-	-
	RS(2019_12)	-	-
SS (2017_4)	RS(2018_12)	-	-
	RS(2019_1)	-	-
	RS(2019_3)	-	-
	RS(2019_4)	-	-
	RS(2019_9)	-	-
	RS(2019_12)	<0.001	2.8 SD
SS (2017_9)	RS(2018_12)	-	-
	RS(2019_1)	-	-
	RS(2019_3)	-	-
	RS(2019_4)	-	-
	RS(2019_9)	-	-
	RS(2019_12)	<0.001	2.9 SD

p-value for **Period×CI** or **Time(Period)×CI** factors < 0.1

Contrast p-value < 0.1/18 and in an increasing direction

Contrast p-value < 0.1/18 and in a decreasing direction

Notes: "-" = no data. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error.

[a] SS = sum of squares of ANOVA model.

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

Table B.16: ANOVA Table for the Asymmetric BACI Model Comparing Benthic Invertebrate Selenium Concentrations at RG_FO23 During the Before (B), Steady State (SS), Shutdown (SD), and Restart (RS) Periods Relative to the Reference Areas (RG_LI24 and RG_SLINE)

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	3	0.32	0.11	16	<0.001
CI	1	2.7	2.7	391	<0.001
Period×CI	3	0.1	0.032	4.7	0.003
Time(Period)	9	1.3	0.14	21	<0.001
Time(Period)×CI	9	0.42	0.047	6.9	<0.001
Error	254	-			

Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[c]**
B	RS(2018_12)	-	-
	RS(2019_1)	-	-
	RS(2019_3)	-	-
	RS(2019_4)	-	-
	RS(2019_9)	-	-
	RS(2019_12)	-	-
SS (2016_9)	RS(2018_12)	-	-
	RS(2019_1)	-	-
	RS(2019_3)	-	-
	RS(2019_4)	-	-
	RS(2019_9)	-	-
	RS(2019_12)	-	-
SS (2017_4)	RS(2018_12)	-	-
	RS(2019_1)	-	-
	RS(2019_3)	-	-
	RS(2019_4)	-	-
	RS(2019_9)	-	-
	RS(2019_12)	-	-
SS (2017_9)	RS(2018_12)	-	-
	RS(2019_1)	-	-
	RS(2019_3)	<0.001	-2.5 SD
	RS(2019_4)	<0.001	-2.1 SD
	RS(2019_9)	-	-
	RS(2019_12)	-	-

p-value for **Period×CI** or **Time(Period)×CI** factors < 0.1

Contrast p-value < 0.1/24 and in an increasing direction

Contrast p-value < 0.1/24 and in a decreasing direction

Notes: "-" = no data. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error.

[a] SS = sum of squares of ANOVA model,

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

Table B.17: ANOVA Table for the Asymmetric BACI Model Comparing Benthic Invertebrate Selenium Concentrations at RG_FO23 (Downstream of Line Creek) During the Before (B), Steady State (SS), Shutdown (SD), and Restart (RS) Periods Relative to RG_FRUL (Upstream of Line Creek)

ANOVA Model					
Term	DF	SS	MS	F-Ratio	P-Value
Period	3	0.038	0.013	3.4	0.019
CI	1	0.052	0.052	14	<0.001
Period×CI	3	0.022	0.0073	2.0	0.123
Time(Period)	8	0.87	0.11	29	<0.001
Time(Period)×CI	8	0.084	0.010	2.8	0.006
Error	187	-			

Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD**
B	RS(2018_12)	-	-
	RS(2019_1)	-	-
	RS(2019_3)	-	-
	RS(2019_4)	-	-
	RS(2019_9)	-	-
	RS(2019_12)	-	-
SS (2017_4)	RS(2018_12)	-	-
	RS(2019_1)	-	-
	RS(2019_3)	-	-
	RS(2019_4)	-	-
	RS(2019_9)	-	-
	RS(2019_12)	-	-
SS (2017_9)	RS(2018_12)	-	-
	RS(2019_1)	-	-
	RS(2019_3)	-	-
	RS(2019_4)	-	-
	RS(2019_9)	-	-
	RS(2019_12)	<0.001	-2.2 SD

p-value for **Period×CI** or **Time(Period)×CI** factors < 0.1

Contrast p-value < 0.1/15 and in an increasing direction

Contrast p-value < 0.1/15 and in a decreasing direction

Note: "-" indicates no data.

Table B.18: ANOVA Table for the Asymmetric BACI Model Comparing Benthic Invertebrate Selenium Concentrations at RG_FRUL Within the Restart Period Relative to the Reference Areas (RG_LI24 and RG_SLINE)

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	3	0.3	0.11	17	<0.001
CI	1	3.4	3.4	530	<0.001
Period×CI	3	0.08	0.028	4.3	0.005
Time(Period)	8	1.2	0.15	23	<0.001
Time(Period)×CI	8	0.5	0.066	10	<0.001
Error	254	-			

Within Restart Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[c]**
2018_12	2019_1	-	-
	2019_3	<0.001	-2.2 SD
	2019_4	<0.001	-2.5 SD
	2019_9	-	-
	2019_12	0.001	1.8 SD
2019_1	2019_3	-	-
	2019_4	0.002	-2.1 SD
	2019_9	-	-
	2019_12	<0.001	2.3 SD
2019_3	2019_4	-	-
	2019_9	0.001	1.9 SD
	2019_12	<0.001	4.0 SD
2019_4	2019_9	<0.001	2.2 SD
	2019_12	<0.001	4.3 SD
2019_9	2019_12	<0.001	2.2 SD

(grey) p-value for **Period×CI** or **Time(Period)×CI** factors < 0.1

(blue) Contrast p-value < 0.1/15 and in an increasing direction

(green) Contrast p-value < 0.1/15 and in a decreasing direction

Notes: "-" = no data. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error.

[a] SS = sum of squares of ANOVA model.

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

Table B.19: ANOVA Table for the Asymmetric BACI Model Comparing Benthic Invertebrate Selenium Concentrations at RG_FO23 Within the Restart Period Relative to the Reference Areas (RG_LI24 and RG_SLINE)

ANOVA Model					
Term	DF	SS[a]	MS[b]	F-Ratio	P-Value
Period	3	0.32	0.11	16	<0.001
CI	1	2.7	2.7	391	<0.001
Period×CI	3	0.10	0.032	4.7	0
Time(Period)	9	1.3	0.14	21	<0.001
Time(Period)×CI	9	0.42	0.047	6.9	<0.001
Error	254	-			

Within Restart Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD[c]**
2018_12	2019_1	-	-
	2019_3	<0.001	-3.2 SD
	2019_4	<0.001	-2.8 SD
	2019_9	-	-
	2019_12	-	-
2019_1	2019_3	<0.001	-2.7 SD
	2019_4	<0.001	-2.3 SD
	2019_9	-	-
	2019_12	-	-
2019_3	2019_4	-	-
	2019_9	0.005	2.0 SD
	2019_12	<0.001	3.7 SD
2019_4	2019_9	0.005	1.6 SD
	2019_12	<0.001	3.3 SD
2019_9	2019_12	0.002	1.7 SD

p-value for **Period×CI** or **Time(Period)×CI** factors < 0.1

Contrast p-value < 0.1/19 and in an increasing direction

Contrast p-value < 0.1/19 and in a decreasing direction

Notes: "-" = no data. Selenium results from RG_LI24 collected on May 3rd, 2018 were excluded from the analyses because these were identified as anomalous, and likely the result of a field error.

[a] SS = sum of squares of ANOVA model,

[b] MS = mean sum of squares of ANOVA model.

[c] Magnitude of difference (MOD) was calculated as the difference in period 2 - difference in period 1/pooled standard deviation (SD).

Table B.20: **ANOVA Table for the Asymmetric BACI Model Comparing Benthic Invertebrate Selenium Concentrations at RG_FO23 (Downstream of Line Creek) Within the Restart Period Relative to the RG_FRUL (Upstream of Line Creek)**

ANOVA Model					
Term	DF	SS	MS	F-Ratio	P-Value
Period	3	0.038	0.013	3.4	0.019
CI	1	0.052	0.052	14	<0.001
Period×CI	3	0.022	0.0073	2.0	0.123
Time(Period)	8	0.87	0.11	29	<0.001
Time(Period)×CI	8	0.084	0.010	2.8	0.006
Error	187	-			

Within Restart Contrasts (P-value and Magnitude of Difference)			
Period 1	**Period 2**	**P-value**	**MOD**
2018_12	2019_1	-	-
	2019_3	-	-
	2019_4	-	-
	2019_9	-	-
	2019_12	-	-
2019_1	2019_3	-	-
	2019_4	-	-
	2019_9	-	-
	2019_12	-	-
2019_3	2019_4	-	-
	2019_9	-	-
	2019_12	-	-
2019_4	2019_9	-	-
	2019_12	-	-
2019_9	2019_12	-	-

p-value for **Period×CI** or **Time(Period)×CI** factors < 0.1

Contrast p-value < 0.1/15 and in an increasing direction

Contrast p-value < 0.1/15 and in a decreasing direction

Note: "-" indicates no data.

Table B.21: Temporal Changes in Water Chemistry Analytes at Stations in the Line Creek LAEMP, 2012 to 2019

Parameter	Status	Station	Annual Variation[a]		Q1. Is there a positive or negative change in concentrations since the base year (b) of monitoring? Magnitude of Difference (MOD)[b] and Significance (bolded) from Base Year (b)[c]								Q2. Is the 2019 annual mean greater or less than all annual historical means (2012 to 2018) and the previous year (2019)?[c]									
			DF	P-Value	2012	2013	2014	2015	2016	2017	2018	2019	2012	2013	2014	2015	2016	2017	2018	2019	2019 vs. 2012-2018	2019 vs. 2018
Total Selenium	Reference	LC_LC1 no outlier[d]	7	<0.001	b	7.4	15	32	40	49	52	48	D	CD	C	B	AB	A	A	A	-	-
		LC_LC1 with outlier	7	0.017	b	-13	-7.1	6	14	22	23	21	A	A	A	A	A	A	A	A	-	-

p-value < 0.05 (annual variation)

\> 25% Increase in concentration

\> 50% Increase in concentration

\> 75% Increase in concentration

\> 100% Increase in concentration

***Bold** Significant increase or decrease from base year (b)

Significantly less than all historical years (or 2017)

Significantly greater than all historical years (or 2017)

Note: "-" = not available.

[a] The presence of annual variation was determined by a significant Year term (α = 0.05) using an ANOVA with factors Year and Month.

[b] Magnitude of Difference (MOD) was calculated as the concentrations in each year minus the concentration in the first year divided by the concentration in the fist year × 100.

[c] Significance between each year determined using all pairwise comparisons with Tukey correction.

[d] One outlier with a value of 0.031 mg/L in May 2012 was removed from the analysis.

Table B.22: Physical Measures and Tissue Selenium Concentrations for Bull Trout Sampled from Line Creek, 2006 to 2019

AWTF Operation Phase	Area	Year	Capture Location UTM (NAD83, 11U)		Study	Processing Date	Fish ID	Total Length	Fork Length	Body Weight	Sex[a]	Life Stage[b]	Age	Tissue Selenium Concentration (mg/kg dw)				Recorded Deformities (DELT)[d]
			Easting	Northing				(cm)	(cm)	(g)				Muscle	Ovary	Ovary (Estimated[c])	Liver	
Prior to AWTF Operation	RG_LI8	2006	656892	5529139	Minnow et al. 2007	23-Aug-06	LI8101	-	74.0	4,309	M	A	-	4.7	-	-	-	-
	RG_LI8	2006	656892	5529139		23-Aug-06	LI8102	-	63.3	2,948	F	A	-	4.0	-	13	-	-
	RG_LI8	2006	656892	5529139		23-Aug-06	LI8103	-	63.5	2,722	F	A	-	3.1	-	10	-	-
	RG_LI8	2006	656892	5529139		23-Aug-06	LI8104	-	23.3	162	U	J	-	4.4	-	-	-	-
AWTF Steady State Operation	RG_LILC3	2017	659887	5531590	2017 LCO LAEMP (Minnow 2018d)	27-Apr-17	LILC3-BT-01	40.0	38.5	550	-	J	-	26	-	-	-	none
	RG_LIDCOM	2017	658185	5529820		10-Sep-17	LIDCOM-BT-07	77.6	75.2	4,220	M	A	10	5.6	-	-	30	none
	RG_LIDCOM	2017	658185	5529820		11-Sep-17	LIDCOM-BT-11	65.9	63.2	2,660	F	A	-	4.8	16	-	-	none
	RG_LIDCOM	2017	658185	5529820		11-Sep-17	LIDCOM-BT-12	73.6	68.5	3,160	F	A	-	4.4	16	-	-	cut on tail due to tagging
	RG_LILC3	2017	659892	5531560		10-Sep-17	LILC3-BT-06	63.1	60.5	2,260	F	A	8	4.8	12	-	16	none
	RG_LILC3	2017	659892	5531560		11-Sep-17	LILC3-BT-08	61.8	60.0	2,080	F	A	-	3.9	14	-	-	none
	RG_LILC3	2017	659892	5531560		11-Sep-17	LILC3-BT-10	63.2	61.9	1,840	F	A	-	4.5	15	-	-	none
	RG_LILC3	2017	659892	5531560		8-Sep-17	LILC3-BT-01	25.5	24.2	146	M	YM	3	21	-	-	58	none
	RG_LILC3	2017	659892	5531560		8-Sep-17	LILC3-BT-02	27.9	26.6	210	M	YM	3	19	-	-	65	none
	RG_LILC3	2017	659892	5531560		8-Sep-17	LILC3-BT-03	27.8	26.1	199	M	YM	3	28	-	-	61	abrasion on back
	RG_LILC3	2017	659892	5531560		8-Sep-17	LILC3-BT-04	28.0	26.6	209	M	YM	3	20	-	-	63	none
	RG_LILC3	2017	659892	5531560		8-Sep-17	LILC3-BT-05	32.3	30.9	342	M	YM	4	27	-	-	100	none
AWTF Shutdown	RG_LILC3	2018	659880	5531582	2018 LCO LAEMP (Minnow 2019a)	30-Apr-18	LILC3-BT-01	45.9	44.1	800	M	YM	-	21	-	-	-	none
	RG_LILC3	2018	659880	5531582		2-May-18	LILC3-BT-02	44.0	42.0	939	M	YM	-	45	-	-	-	none
	RG_LILC3	2018	659880	5531582		2-May-18	LILC3-BT-03	26.6	25.5	155	U	J	-	37	-	-	-	none
	RG_LILC3	2018	659880	5531582		3-May-18	LILC3-BT-04	39.3	37.7	669	U	J	-	46	-	-	-	none
	Mid-Canyon	2018	656825	5529140		21-Aug-18	RG_LI8_BT-1-M_20180821	-	20.2	87	U	J	-	7.6	-	-	-	none
After AWTF/AOP Operations Stabilize	RG_LILC3	2019	659870	5531576	2019 LCO LAEMP	4-Sep-19	LILC3_BT-01	28.5	27.1	245	F	YF	-	14	-	-	-	none
	RG_LILC3	2019	659870	5531576		4-Sep-19	LILC3_BT-02	27.7	26.4	210	F	YF	-	16	-	-	-	none
	RG_LILC3	2019	659870	5531576		4-Sep-19	LILC3_BT-03	26.0	24.4	160	M	YM	-	6.4	-	-	-	none
	RG_LILC3	2019	659870	5531576		5-Sep-19	LILC3_BT-04	27.8	26.5	112	M	YM	-	11	-	-	-	none
	RG_LILC3	2019	659870	5531576		5-Sep-19	LILC3_BT-05	28.6	27.4	205	F	YF	-	7.2	-	-	-	none
	RG_LILC3	2019	659870	5531576		5-Sep-19	LILC3_BT-06	68.7	66.6	3,150	F	A	-	5.8	-	19	-	none
	RG_LILC3	2019	659870	5531576		5-Sep-19	LILC3_BT-07	26.9	25.5	164	M	YM	-	11	-	-	-	none
	RG_LILC3	2019	659870	5531576		5-Sep-19	LILC3_BT-08	25.7	24.3	142	M	YM	-	12	-	-	-	none
	RG_LILC3	2019	659870	5531576		5-Sep-19	LILC3_BT-09	59.2	57.0	1,900	M	A	-	4.9	-	-	-	none
	RG_LI8	2019	655378	5529048		6-Sep-19	LI8_BT-01	75.0	72.5	3,950	F	A	-	5.6	-	18	-	none
	RG_LI8	2019	655378	5529048		6-Sep-19	LI8_BT-02	65.5	63.3	2,460	M	A	-	4.5	-	-	-	none
	RG_LI8	2019	654671	5529013		7-Sep-19	LI8_BT-03	70.6	67.5	3,200	M	A	-	4.7	-	-	-	none
	RG_LI8	2019	654671	5529013		7-Sep-19	LI8_BT-04	72.2	69.3	3,350	F	A	-	4.5	-	15	-	none

Ovary selenium concentration exceeding the Level 1 site-specific benchmark for "other fish" of 18 mg/kg dw (Elk Valley Water Quality Plan; Teck 2014).

Ovary selenium concentration exceeding the US EPA Effect Concentration (EC10) of 56.2 mg/kg dw for Dolly Varden trout (USEPA 2016).

Notes: "-" = no data recorded; AWTF = Active Water Treatment Facility; LCO = Line Creek Operations; LAEMP = Local Aquatic Effects Monitoring Program; AOP = Advanced Oxidation Process.

[a] F = female; M = male; U = unknown (sex of fish could not be determined, either because fish was not sufficiently mature or samples were collected non-lethally and sex could not be determined based on non-lethal evaluation of physical characteristics).

[b] A = adult; J = juvenile; YM = young male; YF = young female.

[c] Ovary concentrations were estimated from muscle selenium concentrations based on the average ovary-to-muscle concentration relationship of 3.3:1 (Minnow 2018d). Ovary selenium was estimated only for adult individuals lacking measured ovary concentrations (if female) or if sex of an adult individual was unknown.

[d] DELT = Deformities, erosions, lesions, tumors. DELT observations were initiated in 2017 following the start of AWTF operation.

Table B.23: Physical Measures and Tissue Selenium Concentrations for Westslope Cutthroat Trout Sampled from Line Creek, 2001 to 2019

AWTF Operation Phase	Waterbody	Area	Year	Capture Location UTM (NAD83, 11U)		Study	Processing Date	Fish ID	Total Length	Fork Length	Body Weight	Sex[a]	Age	Tissue Selenium (mg/kg dw)				Recorded Deformities (DELT)[d]
				Easting	Northing				(cm)	(cm)	(g)			Muscle	Ovary	Egg[b]	Estimated Ovary[c]	
Prior to AWTF Operation	Line Creek	RG_LI8	2001	654480	5529034	Golder 2005	Apr-2001	L1-1	-	34.0	530	M	5	9.2	-	-	-	-
		RG_LI8	2001	654480	5529034		Apr-2001	L1-2	-	32.0	475	M	3	8.1	-	-	-	-
		RG_LI8	2001	654480	5529034		Apr-2001	L1-4	-	34.6	680	M	4	8.5	-	-	-	-
		RG_LI8	2001	654480	5529034		Apr-2001	L1-3	-	36.1	725	F	4	8.4	15	-	-	-
		RG_LI8	2001	654480	5529034		Apr-2001	L1-5	-	32.9	550	F	4	9.8	16	-	-	-
		RG_LI8	2001	654480	5529034		Apr-2001	L1-6	-	32.5	500	F	5	8.5	16	-	-	-
		RG_LI8	2002	654480	5529034		Apr-2002	LN-1	-	38.5	780	M	7	8.0	-	-	-	-
		RG_LI8	2002	654480	5529034		Apr-2002	LN-2	-	39.0	750	F	7	16	20	-	-	-
		RG_LI8	2002	654480	5529034		Apr-2002	LN-3	-	34.7	615	F	5	7.0	14	-	-	-
		RG_LI8	2002	654480	5529034		Apr-2002	LN-4	-	32.5	480	F	6	8.0	19	-	-	-
		RG_LI8	2002	654480	5529034		Apr-2002	LN-5	-	34.5	550	F	7	7.0	14	-	-	-
		RG_LI8	2002	654480	5529034		Apr-2002	LN-6	-	37.8	785	F	6	7.0	14	-	-	-
		RG_LI8	2002	654480	5529034		Apr-2002	LN-7	-	38.5	850	F	7	9.0	16	-	-	-
		RG_LI8	2002	654480	5529034		Apr-2002	LN-8	-	33.6	525	F	6	7.0	13	-	-	-
		RG_LI8	2002	654480	5529034		Apr-2002	LN-9	-	30.1	400	F	5	7.0	14	-	-	-
		RG_LI8	2002	654480	5529034		Apr-2002	LN-10	-	37.8	675	F	6	8.0	14	-	-	-
		RG_LIDSL	2003	659281	5530548	Minnow 2004	Jul-2003	LC-CT1	-	39.1	800	M	6	7.2	-	-	-	-
		RG_LIDSL	2003	659281	5530548		Jul-2003	LC-CT2	-	34.8	700	F	4	6.4	-	-	10	-
		RG_LIDSL	2003	659281	5530548		Jul-2003	LC-CT3	-	31.5	470	F	4	7.4	-	-	12	-
		RG_LI8	2006	657406	5529218	Minnow et al. 2007	Apr-2006	LI8001	-	30.6	435	F	5	7.9	11	-	-	-
		RG_LI8	2006	657406	5529218		Apr-2006	LI8002	-	31.7	427	F	5	7.7	11	-	-	-
		RG_LI8	2006	657406	5529218		Apr-2006	LI8003	-	27.4	288	F	5	7.4	21	-	-	-
		RG_LI8	2006	657406	5529218		Apr-2006	LI8004	-	21.4	132	F	6	15	11	-	-	-
		RG_LI8	2006	657406	5529218		Apr-2006	LI8005	-	20.5	117	F	5	13	15	-	-	-

Muscle selenium concentration exceeding the site-specific benchmark for WCT of 15.5 mg/kg dw (Nautilus and Interior Reforestation 2011).

Ovary selenium concentration exceeding the Level 1 site-specific benchmark (equivalent of EC_{10}) for WCT of 25 mg/kg dw (Elk Valley Water Quality Plan; Golder 2014).

Ovary selenium concentration exceeding the Level 2 site-specific benchmark (equivalent of EC_{20}) for WCT of 27 mg/kg dw (Elk Valley Water Quality Plan; Golder 2014).

Ovary selenium concentration exceeding the Level 3 site-specific benchmark (equivalent of EC_{50}) for WCT of 33 mg/kg dw (Elk Valley Water Quality Plan; Golder 2014).

Notes: "-" = no data recorded; AWTF = Active Water Treatment Facility; LCO = Line Creek Operations; LAEMP = Local Aquatic Effects Monitoring Program; AOP = Advanced Oxidation Process.

[a] F = female; M = male; U = unknown (sex of fish could not be determined, either because fish was not sufficiently mature or samples were collected non-lethally and sex could not be determined based on non-lethal evaluation of physical characteristics).

[b] Ripe egg tissue was collected from one individual sampled non-lethally in 2019. Although westslope cutthroat trout spawn in the spring, this female released ripe eggs with minimal abdominal pressure during the collection of physical measures (length and weight).

[c] Ovary concentrations were estimated from muscle selenium concentrations based on the average ovary-to-muscle concentration relationship of 1.6:1 presented by Nautilus and Interior Reforestation (2011). Ovary selenium was estimated only for individuals lacking measured egg/ovary concentrations (if female) or if sex was unknown.

[d] DELT = Deformities, erosions, lesions, tumors. - = DELT observations were not recorded. DELT observations were initiated in 2017 following the start of AWTF operation.

Table B.23: Physical Measures and Tissue Selenium Concentrations for Westslope Cutthroat Trout Sampled from Line Creek, 2001 to 2019

AWTF Operation Phase	Waterbody	Area	Year	Capture Location UTM (NAD83, 11U)		Study	Processing Date	Fish ID	Total Length	Fork Length	Body Weight	Sex[a]	Age	Tissue Selenium (mg/kg dw)				Recorded Deformities (DELT)[d]
				Easting	Northing				(cm)	(cm)	(g)			Muscle	Ovary	Egg[b]	Estimated Ovary[c]	
Prior to AWTF Operation	Line Creek	RG_LI8	2009	657406	5529218	Minnow et al. 2011	Sep-2009	LI8a	-	30.5	435	F	5	12	-	-	18	-
		RG_LI8	2009	657406	5529218		Sep-2009	LI8b	-	28.8	327	F	6	11	-	-	17	-
		RG_LI8	2009	657406	5529218		Sep-2009	LI8c	-	22.1	184	F	6	11	-	-	18	-
		RG_LI8	2009	657406	5529218		Sep-2009	LI8d	-	21.2	112	F	4	14	-	-	22	-
		RG_LI8	2009	657406	5529218		Sep-2009	LI8e	-	21.3	132	F	4	13	-	-	21	-
		RG_LILC3	2012	660085	5532021	Minnow 2014	24-May-12	LILC3-WCT1	-	21.1	135	F	-	10	-	-	16	-
		RG_LILC3	2012	660085	5532021		24-May-12	LILC3-WCT2	-	18.2	63	U	-	7.2	-	-	12	-
		RG_LILC3	2012	660085	5532021		24-May-12	LILC3-WCT3	-	18.0	58	U	-	9.2	-	-	15	-
		RG_LILC3	2012	660085	5532021		24-May-12	LILC3-WCT4	-	17.7	57	U	-	6.8	-	-	11	-
		RG_LILC3	2012	660085	5532021		1-Jun-12	LILC3-WCT5	-	20.0	79	M	-	6.6	-	-	-	-
AWTF Steady State Operation	Line Creek	RG_LI8	2017	655320	5529059	2017 LCO LAEMP (Minnow 2018d)	7-Sep-17	LI8-WCT-01	36.7	35.1	645	U	-	6.9	-	-	11	none
		RG_LI8	2017	655320	5529059		7-Sep-17	LI8-WCT-02	44.6	42.8	1,005	U	-	7.8	-	-	12	slight jaw malformation
		RG_LI8	2017	655320	5529059		7-Sep-17	LI8-WCT-03	32.1	30.4	382	U	-	7.8	-	-	12	none
		RG_LI8	2017	655320	5529059		8-Sep-17	LI8-WCT-04	40.1	38.7	750	U	-	7.8	-	-	12	bite on stomach from another fish
		RG_LI8	2017	655320	5529059		8-Sep-17	LI8-WCT-05	31.7	30.5	355	U	-	8.6	-	-	14	none
		RG_LIDCOM	2017	658185	5529820		28-Apr-17	LIDCOM-WCT-01	36.5	35.5	570	U	-	12	-	-	20	none
		RG_LIDSL	2017	659293	5530590		26-Apr-17	LIDSL-WCT-01	27.0	26.5	220	U	-	25	-	-	40	none
		RG_LIDSL	2017	659293	5530590		8-Sep-17	LIDSL-WCT-01	41.4	39.8	885	U	-	34	-	-	54	none
		RG_LILC3	2017	659892	5531560		8-Sep-17	LILC3-WCT-02	30.7	29.4	345	U	-	26	-	-	42	bite marks from another fish
		RG_LILC3	2017	659892	5531560		8-Sep-17	LILC3-WCT-03	26.2	25.3	230	U	-	14	-	-	22	none
		RG_LILC3	2017	659892	5531560		8-Sep-17	LILC3-WCT-04	27.4	26.2	230	U	-	24	-	-	38	none
		RG_LILC3	2017	659892	5531560		8-Sep-17	LILC3-WCT-05	23.4	22.2	122	U	-	42	-	-	67	none

Muscle selenium concentration exceeding the site-specific benchmark for WCT of 15.5 mg/kg dw (Nautilus and Interior Reforestation 2011).

Ovary selenium concentration exceeding the Level 1 site-specific benchmark (equivalent of EC_{10}) for WCT of 25 mg/kg dw (Elk Valley Water Quality Plan; Golder 2014).

Ovary selenium concentration exceeding the Level 2 site-specific benchmark (equivalent of EC_{20}) for WCT of 27 mg/kg dw (Elk Valley Water Quality Plan; Golder 2014).

Ovary selenium concentration exceeding the Level 3 site-specific benchmark (equivalent of EC_{50}) for WCT of 33 mg/kg dw (Elk Valley Water Quality Plan; Golder 2014).

Notes: "-" = no data recorded; AWTF = Active Water Treatment Facility; LCO = Line Creek Operations; LAEMP = Local Aquatic Effects Monitoring Program; AOP = Advanced Oxidation Process.

[a] F = female; M = male; U = unknown (sex of fish could not be determined, either because fish was not sufficiently mature or samples were collected non-lethally and sex could not be determined based on non-lethal evaluation of physical characteristics).

[b] Ripe egg tissue was collected from one individual sampled non-lethally in 2019. Although westslope cutthroat trout spawn in the spring, this female released ripe eggs with minimal abdominal pressure during the collection of physical measures (length and weight).

[c] Ovary concentrations were estimated from muscle selenium concentrations based on the average ovary-to-muscle concentration relationship of 1.6:1 presented by Nautilus and Interior Reforestation (2011). Ovary selenium was estimated only for individuals lacking measured egg/ovary concentrations (if female) or if sex was unknown.

[d] DELT = Deformities, erosions, lesions, tumors. - = DELT observations were not recorded. DELT observations were initiated in 2017 following the start of AWTF operation.

Table B.23: Physical Measures and Tissue Selenium Concentrations for Westslope Cutthroat Trout Sampled from Line Creek, 2001 to 2019

AWTF Operation Phase	Waterbody	Area	Year	Capture Location UTM (NAD83, 11U)		Study	Processing Date	Fish ID	Total Length	Fork Length	Body Weight	Sex[a]	Age	Tissue Selenium (mg/kg dw)				Recorded Deformities (DELT)[d]
				Easting	Northing				(cm)	(cm)	(g)			Muscle	Ovary	Egg[b]	Estimated Ovary[c]	
AWTF Shutdown	Line Creek	RG_LIDCOM	2018	658135	5529841	2018 LCO LAEMP (Minnow 2019a)	30-Apr-18	LIDCOM-WCT-01	35.2	34.6	450	U	-	14	-	-	22	-
		RG_LIDSL	2018	659232	5530500		20-Aug-18	RG_LIDSL_WCT-2-M_20180820	-	17.8	83	U	-	11	-	-	18	none
		Mid-Canyon	2018	656825	5529140		21-Aug-18	RG_LI8_WCT-2-M_20180821	-	19.5	99	U	-	7.9	-	-	13	none
		Mid-Canyon	2018	656825	5529140		21-Aug-18	RG_LI8_WCT-3-M_20180821	-	30.3	315	U	-	8.7	-	-	14	none
		Mid-Canyon	2018	656825	5529140		21-Aug-18	RG_LI8_WCT-4-M_20180821	-	32.0	414	U	-	9.8	-	-	16	none
		Mid-Canyon	2018	656825	5529140		21-Aug-18	RG_LI8_WCT-5-M_20180821	-	24.6	182	U	-	8.8	-	-	14	none
		RG_LIDCOM	2018	658185	5529798		12-Sep-18	RG_LIDCOM_WCT-1-M_20180912	30.4	29.1	345	U	-	25	-	-	40	none
		RG_LI8	2018	654584	5529020		12-Sep-18	RG_LI8_WCT-1-M_20180912	26.2	24.9	210	U	-	9.5	-	-	15	none
	Fording River	RG_FO23	2018	652956	5528903		05-Sep-18	RG_FO23_WCT-1-M_20180905	40.0	38.5	710	U	-	10	-	-	16	none
		RG_FO23	2018	652956	5528903		05-Sep-18	RG_FO23_WCT-2-M_20180905	41.4	38.8	730	U	-	7.2	-	-	12	angling scarring around mouth
		RG_FO23	2018	652956	5528903		05-Sep-18	RG_FO23_WCT-3-M_20180905	34.9	33.4	455	U	-	7.0	-	-	11	none
		RG_FO23	2018	652956	5528903		05-Sep-18	RG_FO23_WCT-4-M_20180905	32.4	30.3	310	U	-	9.5	-	-	15	none
		RG_FO23	2018	652956	5528903		05-Sep-18	RG_FO23_WCT-5-M_20180905	22.7	21.5	121	U	-	7.5	-	-	12	none
		RG_FO23	2018	652874	5528402		05-Sep-18	RG_FO23_WCT-6-M_20180905	42.0	40.2	750	U	-	9.0	-	-	14	none
		RG_FO23	2018	652874	5528402		05-Sep-18	RG_FO23_WCT-7-M_20180905	33.2	31.4	385	U	-	6.0	-	-	10	scarring around mouth
		RG_FO23	2018	652874	5528402		05-Sep-18	RG_FO23_WCT-8-M_20180905	30.8	29.2	315	U	-	13	-	-	21	none
After AWTF/AOP Operations Stabilize	Line Creek	RG_LILC3	2019	659870	5531576	2019 LCO LAEMP	05-Sep-19	RG_LILC3_WCT-01	20.7	19.7	98	F	SA	7.9	-	-	13	none
		RG_LILC3	2019	659870	5531576		06-Sep-19	RG_LILC3_WCT-04	41.7	39.2	945	M	A	10	-	-	16	none
		RG_LIDCOM	2019	658185	5529820		05-Sep-19	RG_LIDCOM_WCT-02	37.5	35.5	625	F	A	11	-	-	18	none
		RG_LIDCOM	2019	658185	5529820		05-Sep-19	RG_LIDCOM_WCT-03	40.7	39.0	840	M	A	6.2	-	-	10	none
		RG_LIDCOM	2019	658185	5529820		06-Sep-19	RG_LIDCOM_WCT-05	32.2	30.7	420	M	A	7.6	-	-	12	none
		RG_LIDCOM	2019	658185	5529820		06-Sep-19	RG_LIDCOM_WCT-06	38.1	36.5	840	M	A	7.4	-	-	12	none
		RG_LIDCOM	2019	658185	5529820		06-Sep-19	RG_LIDCOM_WCT-07	34.3	32.9	545	M	A	7.9	-	-	13	none
		RG_LIDCOM	2019	658185	5529820		06-Sep-19	RG_LIDCOM_WCT-08	29.9	28.7	360	F	A	10	-	-	16	none
		RG_LI8	2019	655378	5529048		06-Sep-19	RG_LI8_WCT-01	48.5	46.8	1,140	M	A	7.7	-	-	12	none
		RG_LI8	2019	655378	5529048		06-Sep-19	RG_LI8_WCT-02	33.2	32.0	410	F	A	7.2	-	-	12	none
		RG_LI8	2019	654671	5529013		07-Sep-19	RG_LI8_WCT-03	36.3	35.0	515	F	A	8.1	-	-	13	none
		RG_LI8	2019	654671	5529013		07-Sep-19	RG_LI8_WCT-04	25.6	24.5	195	M	A	6.5	-	-	10	none
		RG_LI8	2019	654671	5529013		07-Sep-19	RG_LI8_WCT-05	44.7	43.3	900	F	A	20	-	28	-	none
		RG_LI8	2019	655378	5529048		07-Sep-19	RG_LI8_WCT-06	45.2	43.4	980	F	A	8.2	-	-	13	none
		RG_LI8	2019	655378	5529048		07-Sep-19	RG_LI8_WCT-07	40.6	39	760	M	A	7.0	-	-	11	none

Muscle selenium concentration exceeding the site-specific benchmark for WCT of 15.5 mg/kg dw (Nautilus and Interior Reforestation 2011).

Ovary selenium concentration exceeding the Level 1 site-specific benchmark (equivalent of EC_{10}) for WCT of 25 mg/kg dw (Elk Valley Water Quality Plan; Golder 2014).

Ovary selenium concentration exceeding the Level 2 site-specific benchmark (equivalent of EC_{20}) for WCT of 27 mg/kg dw (Elk Valley Water Quality Plan; Golder 2014).

Ovary selenium concentration exceeding the Level 3 site-specific benchmark (equivalent of EC_{50}) for WCT of 33 mg/kg dw (Elk Valley Water Quality Plan; Golder 2014).

Notes: "-" = no data recorded; AWTF = Active Water Treatment Facility; LCO = Line Creek Operations; LAEMP = Local Aquatic Effects Monitoring Program; AOP = Advanced Oxidation Process.

[a] F = female; M = male; U = unknown (sex of fish could not be determined, either because fish was not sufficiently mature or samples were collected non-lethally and sex could not be determined based on non-lethal evaluation of physical characteristics).

[b] Ripe egg tissue was collected from one individual sampled non-lethally in 2019. Although westslope cutthroat trout spawn in the spring, this female released ripe eggs with minimal abdominal pressure during the collection of physical measures (length and weight).

[c] Ovary concentrations were estimated from muscle selenium concentrations based on the average ovary-to-muscle concentration relationship of 1.6:1 presented by Nautilus and Interior Reforestation (2011). Ovary selenium was estimated only for individuals lacking measured egg/ovary concentrations (if female) or if sex was unknown.

[d] DELT = Deformities, erosions, lesions, tumors. - = DELT observations were not recorded. DELT observations were initiated in 2017 following the start of AWTF operation.

APPENDIX C

SUPPORTING DATA – OTHER POTENTIAL EFFECTS OF AWTF OPERATION

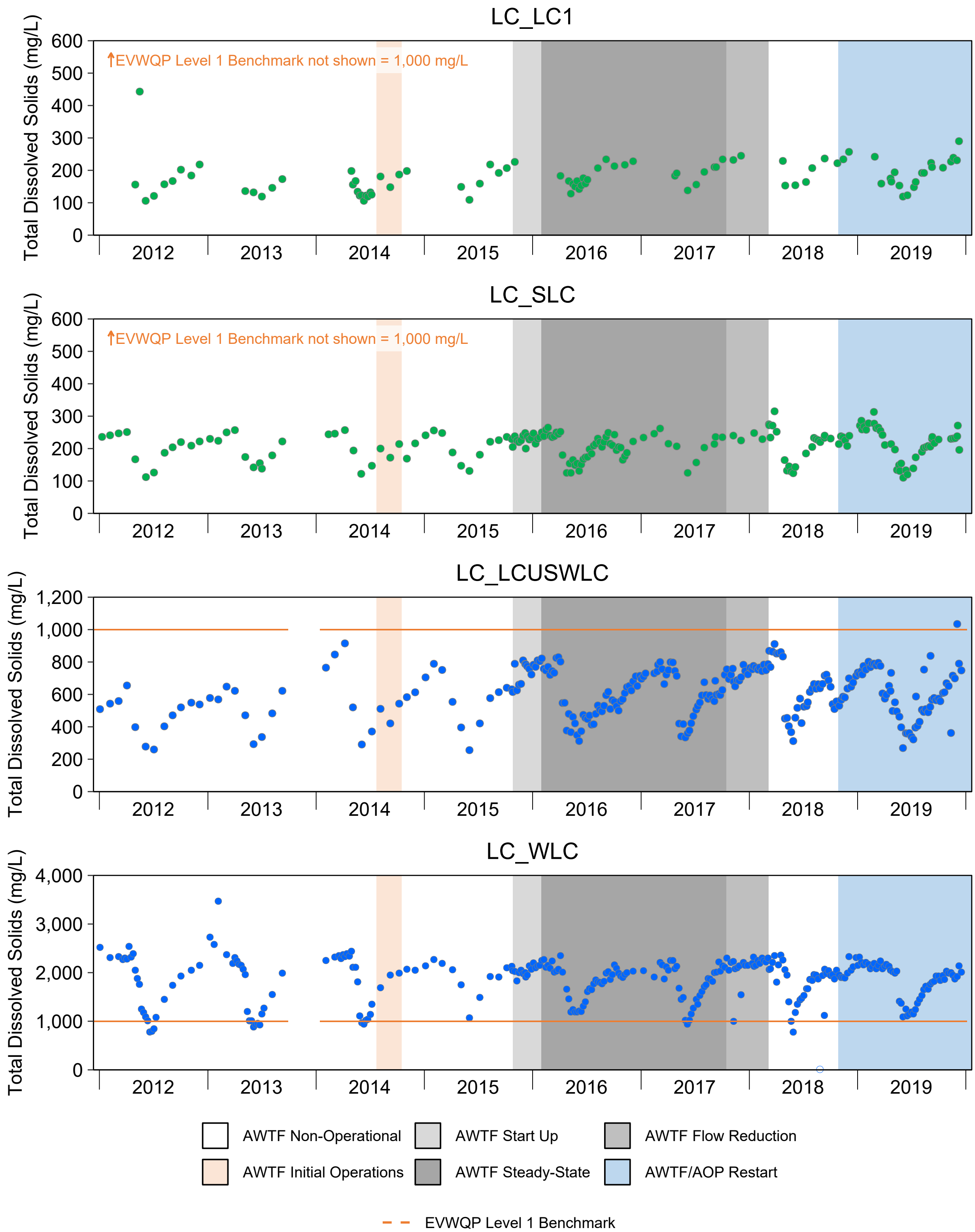

Figure C.1: Time Series Plots for Aqueous Total Dissolved Solids Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: EVWQP = Elk Valley Water Quality Plan. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

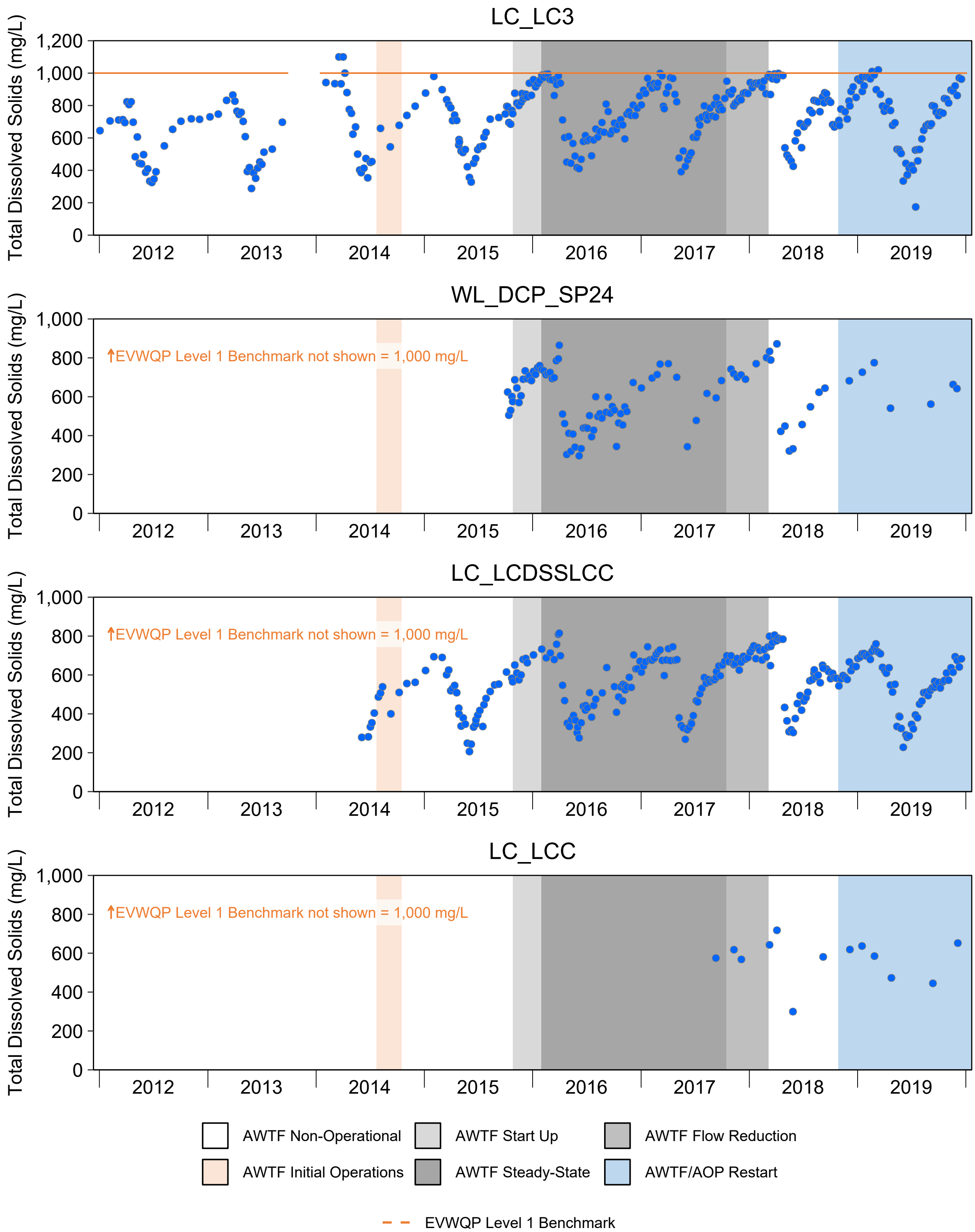

Figure C.1: Time Series Plots for Aqueous Total Dissolved Solids Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: EVWQP = Elk Valley Water Quality Plan. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

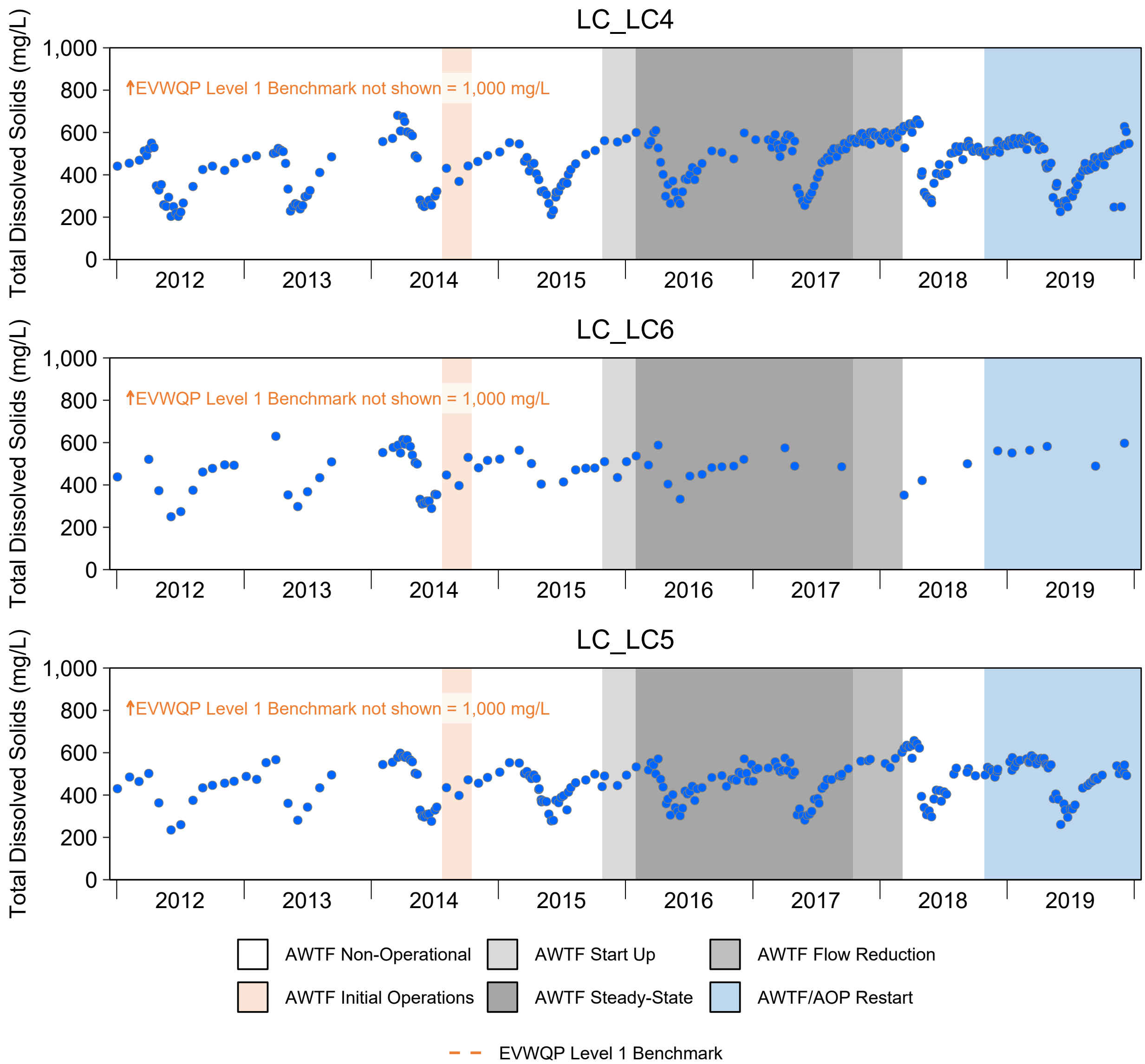

Figure C.1: Time Series Plots for Aqueous Total Dissolved Solids Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: EVWQP = Elk Valley Water Quality Plan. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

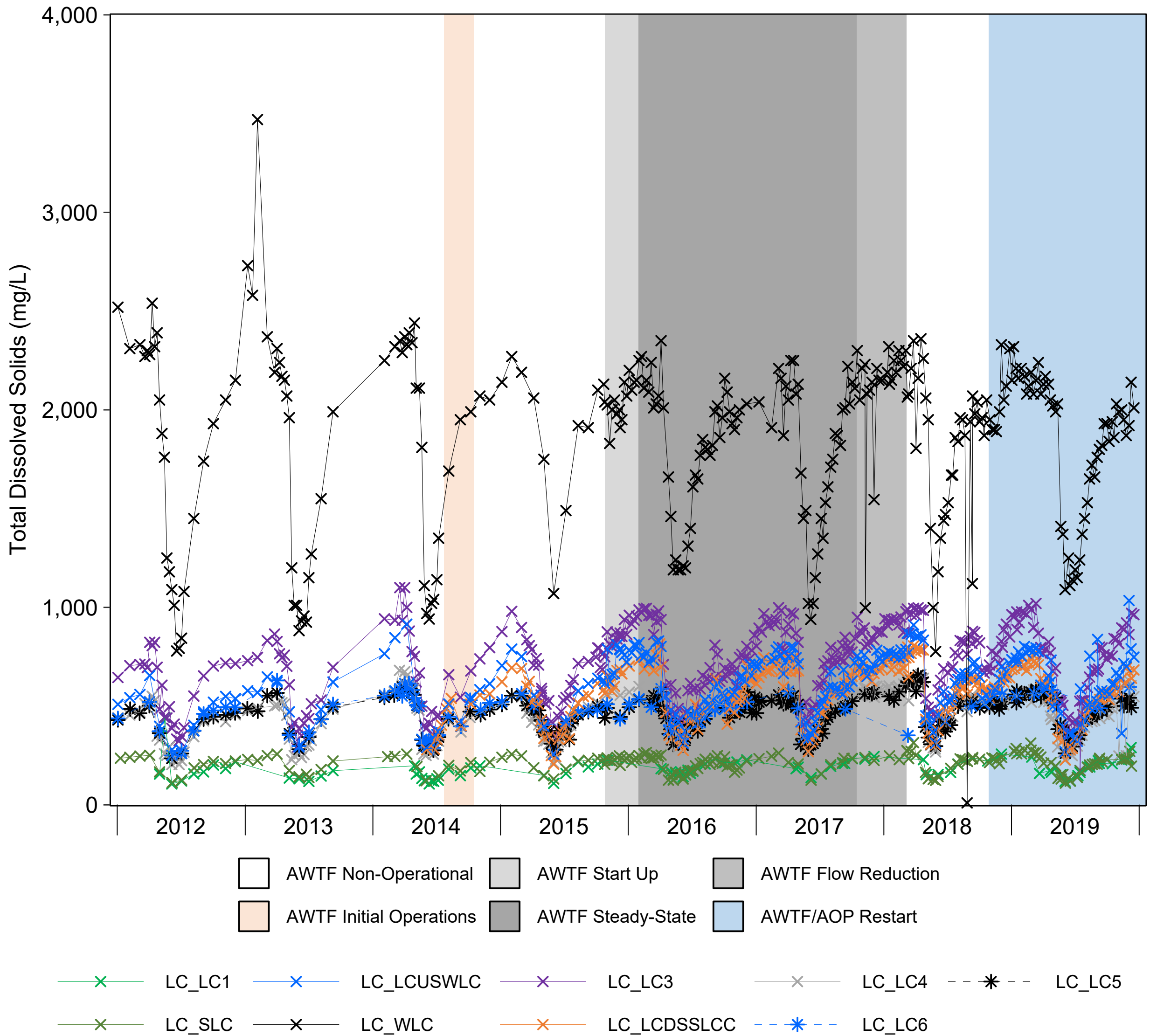

Figure C.2: Time Series Plots for Aqueous Total Dissolved Solids Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (LRLs between 10 and 10 mg/L). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

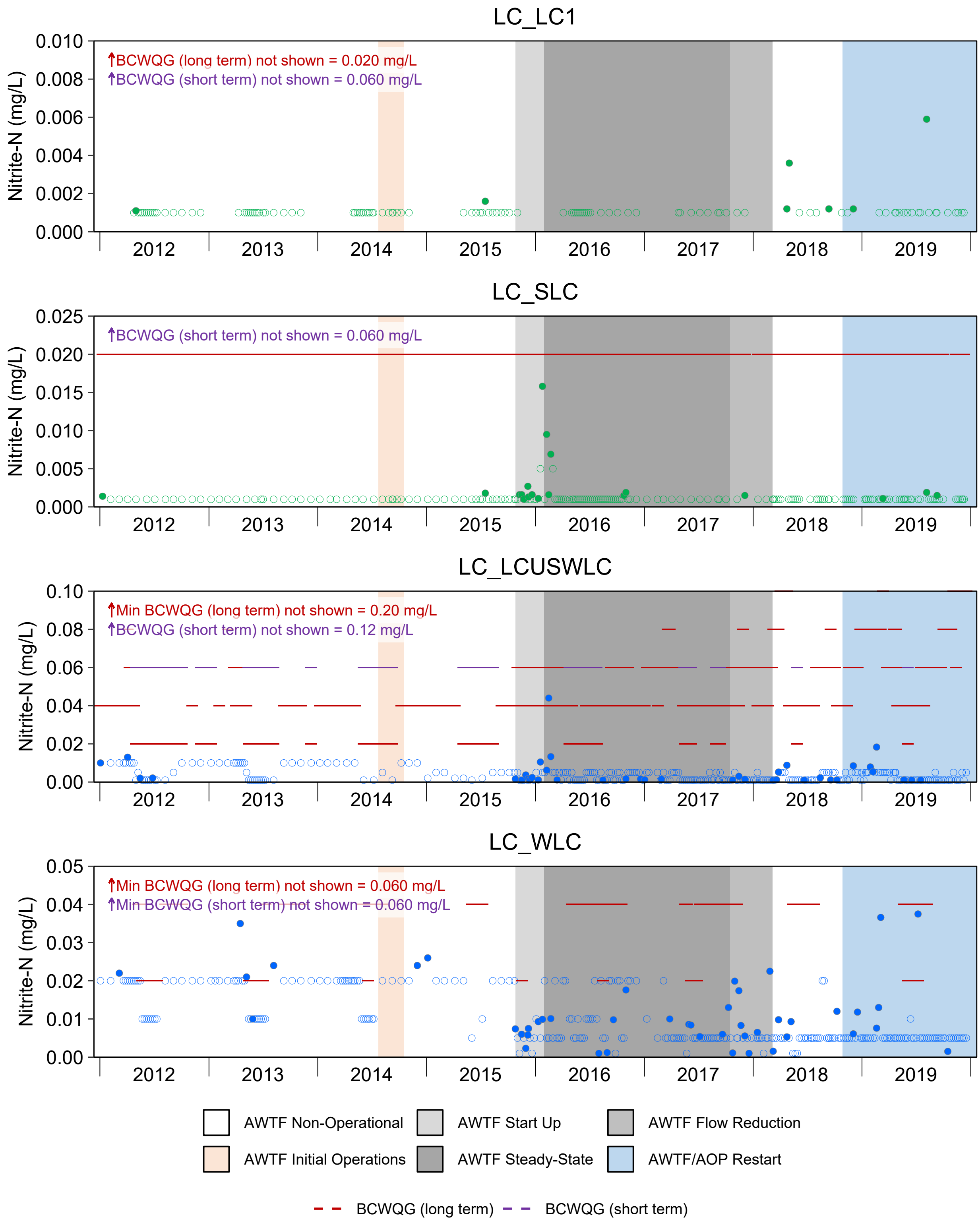

Figure C.3: **Time Series Plots for Aqueous Nitrite-N Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019**

BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concen rations and the varying are shown as coloured dashes. Where guideline values exceed the rage of the y-axis, the minimum value of the guidelines that exceeds the range of the y-axis is listed. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

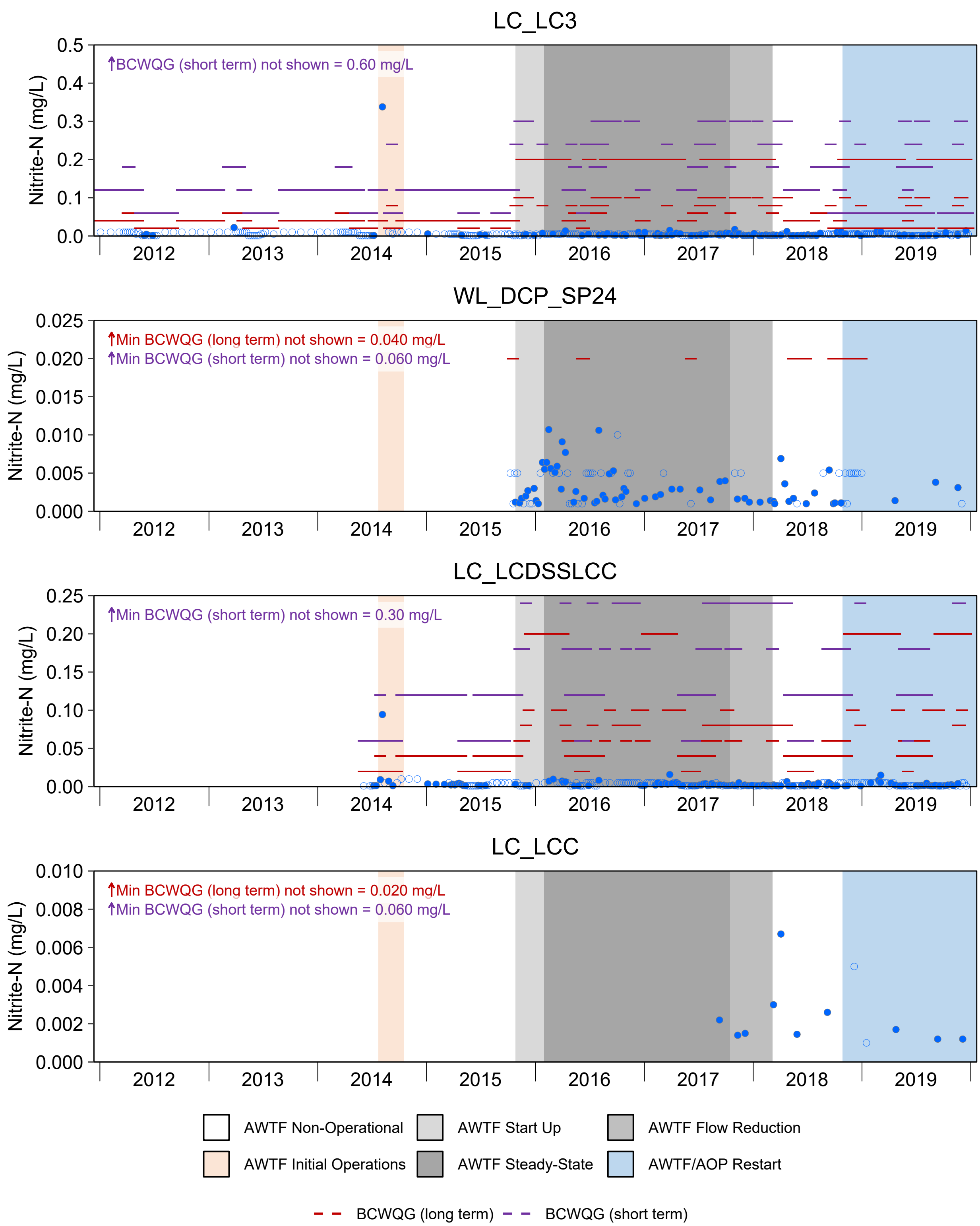

Figure C.3: Time Series Plots for Aqueous Nitrite-N Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations and the varying guidelines are shown as coloured dashes. Where guideline values exceed the rage of the y-axis, the minimum value of the guidelines that exceeds the range of the y-axis is listed. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

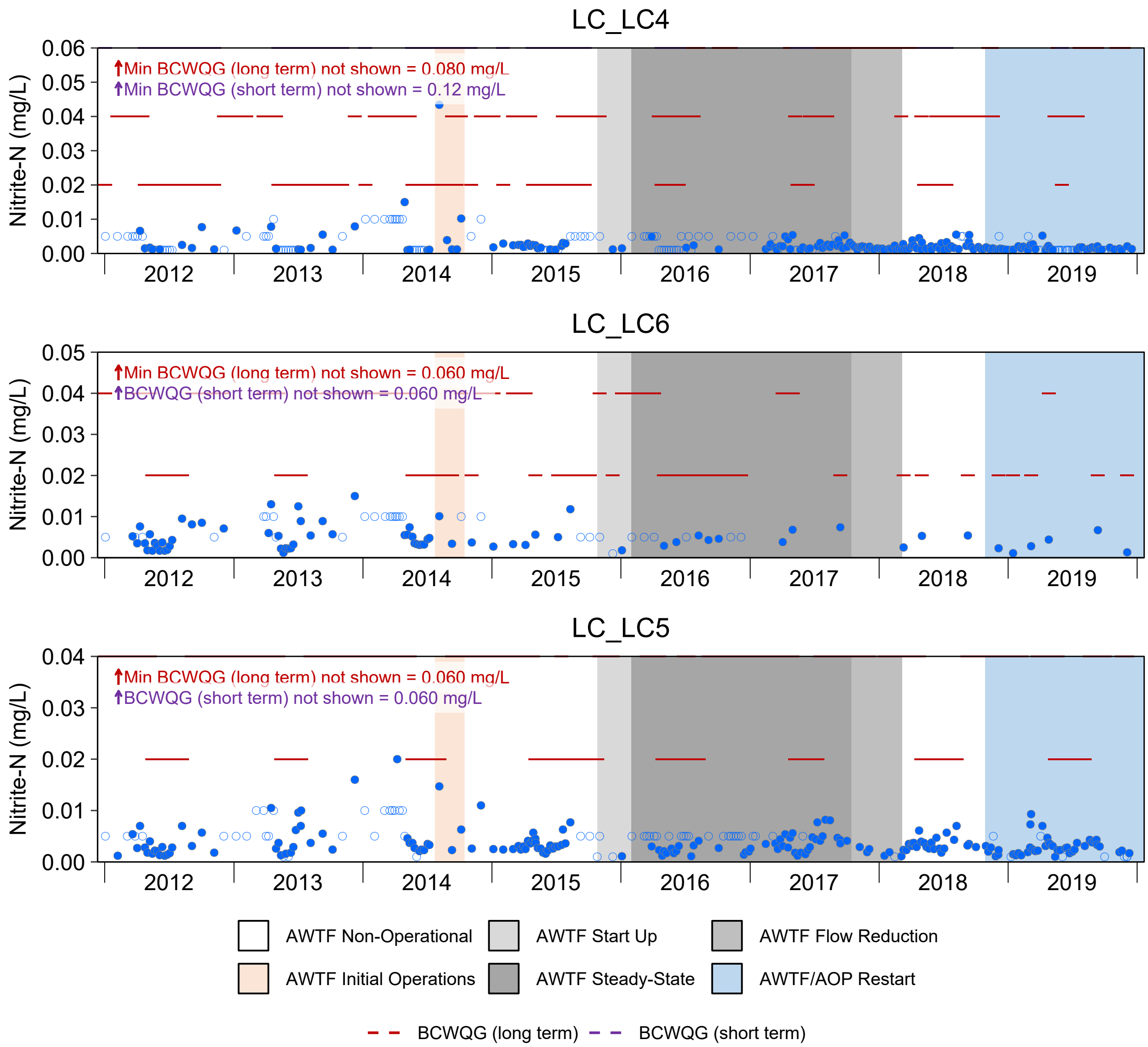

Figure C.3: Time Series Plots for Aqueous Nitrite-N Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations and the varying guidelines are shown as coloured dashes. Where guideline values exceed the rage of the y-axis, the minimum value of the guidelines that exceeds the range of the y-axis is listed. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

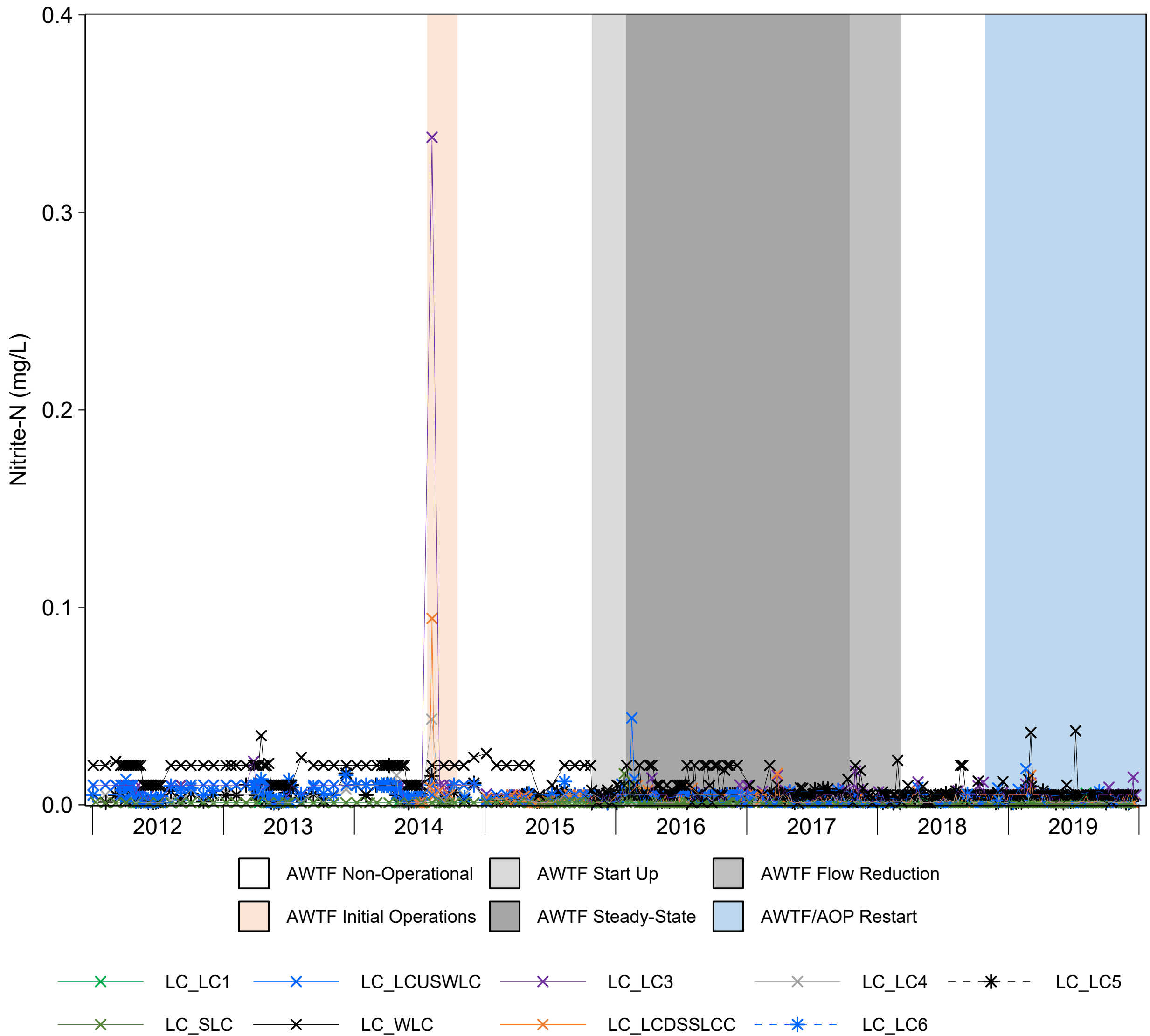

Figure C.4: Time Series Plots for Aqueous Nitrite-N Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (LRLs between 0.0010 and 0.020 mg/L). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

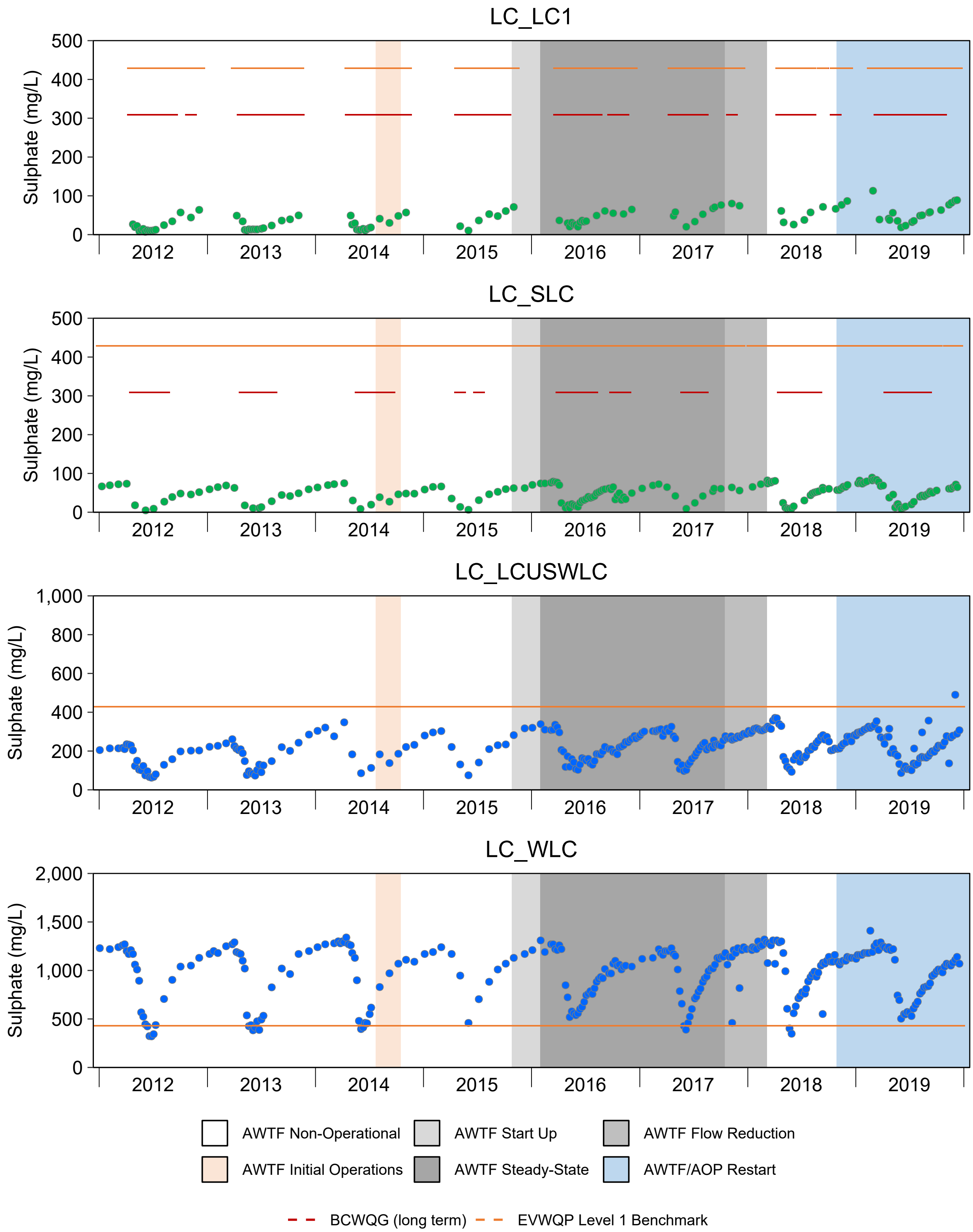

Figure C.5: Time Series Plots for Aqueous Sulphate Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: EVWQP = Elk Valley Water Quality Plan; BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. The EVWQP Level 1 Benchmark is shown in plots where the EVWQP Level 1 Benchmark and the BCWQG are equal. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

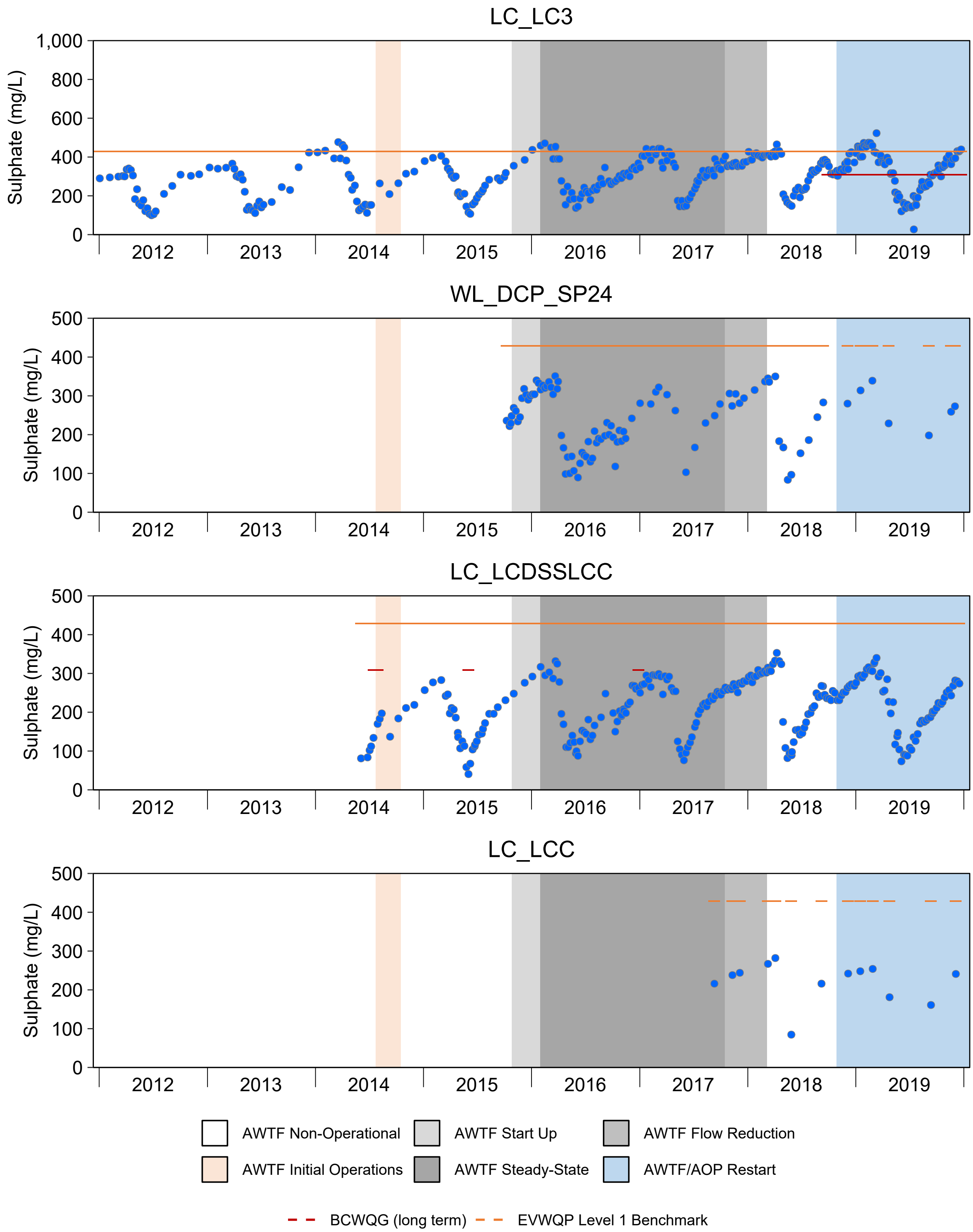

Figure C.5: Time Series Plots for Aqueous Sulphate Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: EVWQP = Elk Valley Water Quality Plan; BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. The EVWQP Level 1 Benchmark is shown in plots where the EVWQP Level 1 Benchmark and the BCWQG are equal. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

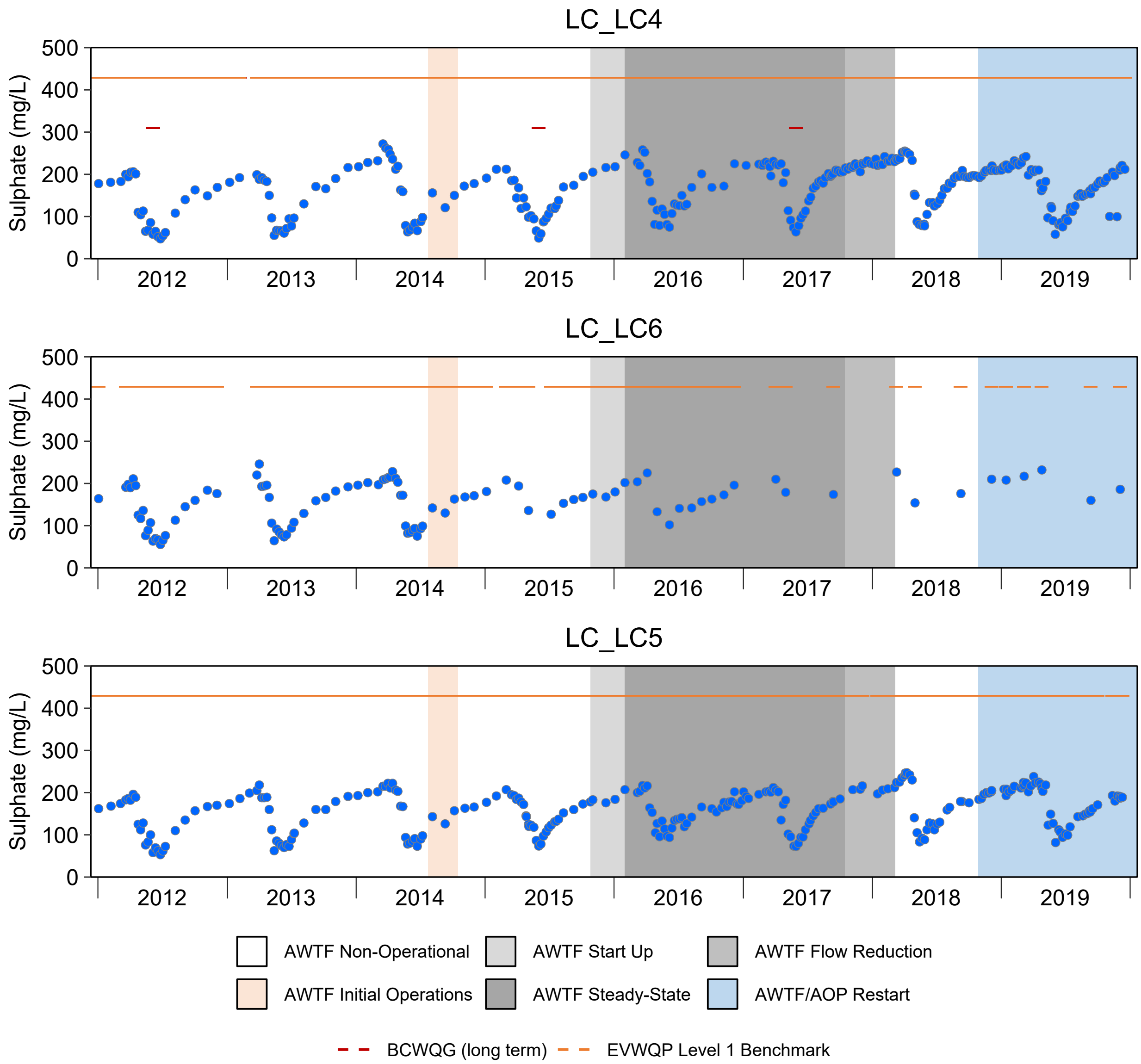

Figure C.5: Time Series Plots for Aqueous Sulphate Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: EVWQP = Elk Valley Water Quality Plan; BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. The EVWQP Level 1 Benchmark is shown in plots where the EVWQP Level 1 Benchmark and the BCWQG are equal. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

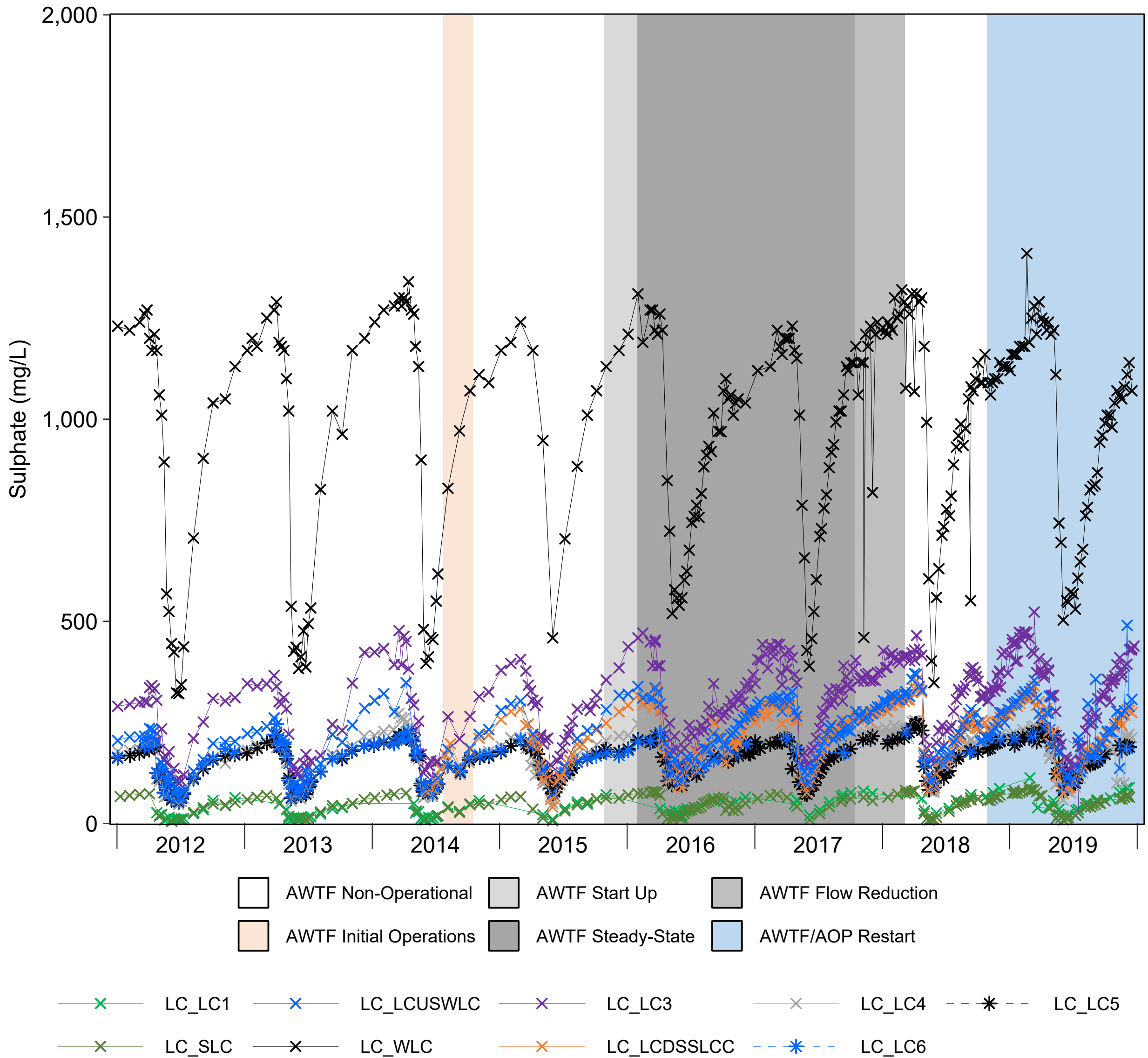

Figure C.6: Time Series Plots for Aqueous Sulphate Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Note: West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

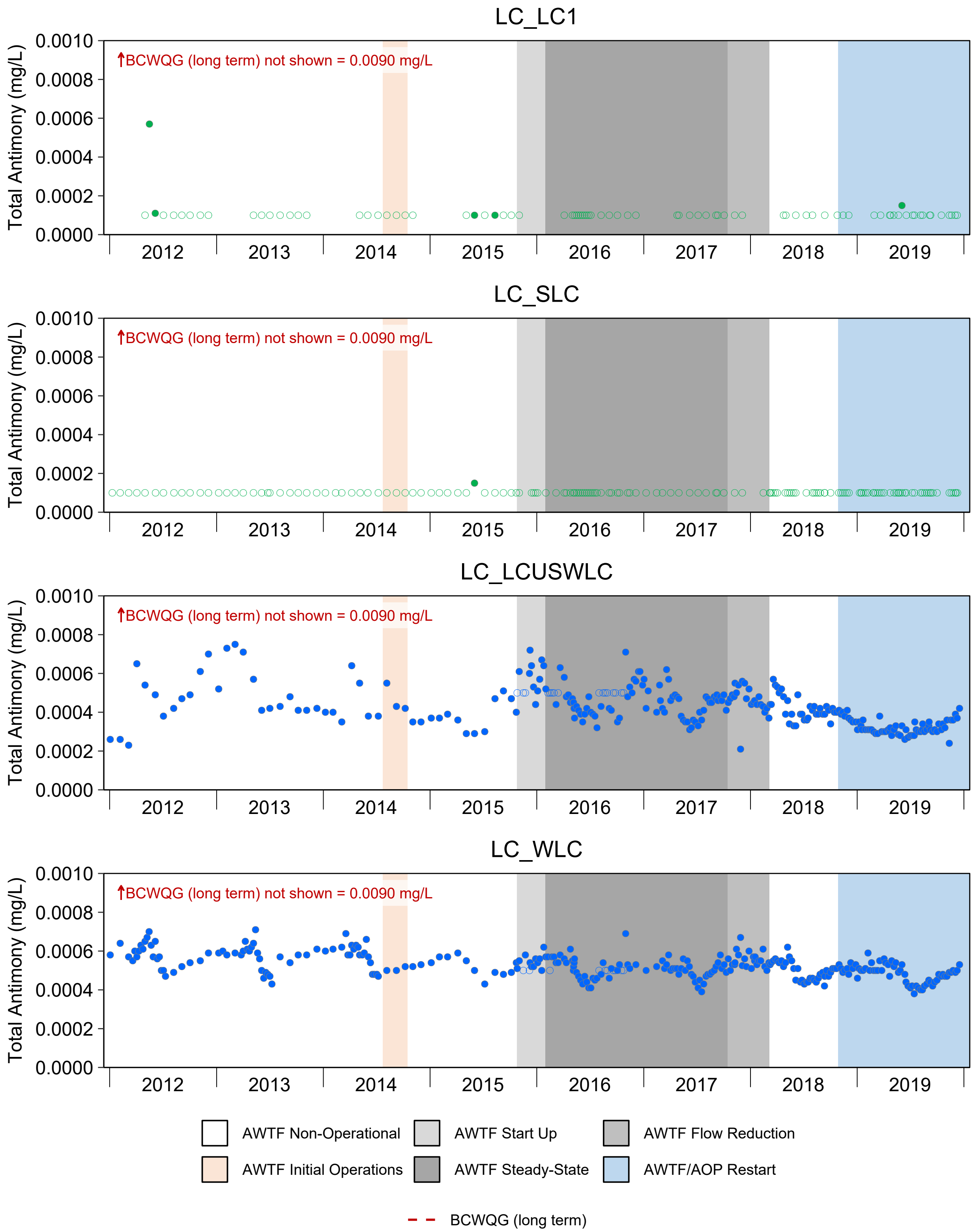

Figure C.7: Time Series Plots for Aqueous Total Antimony Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

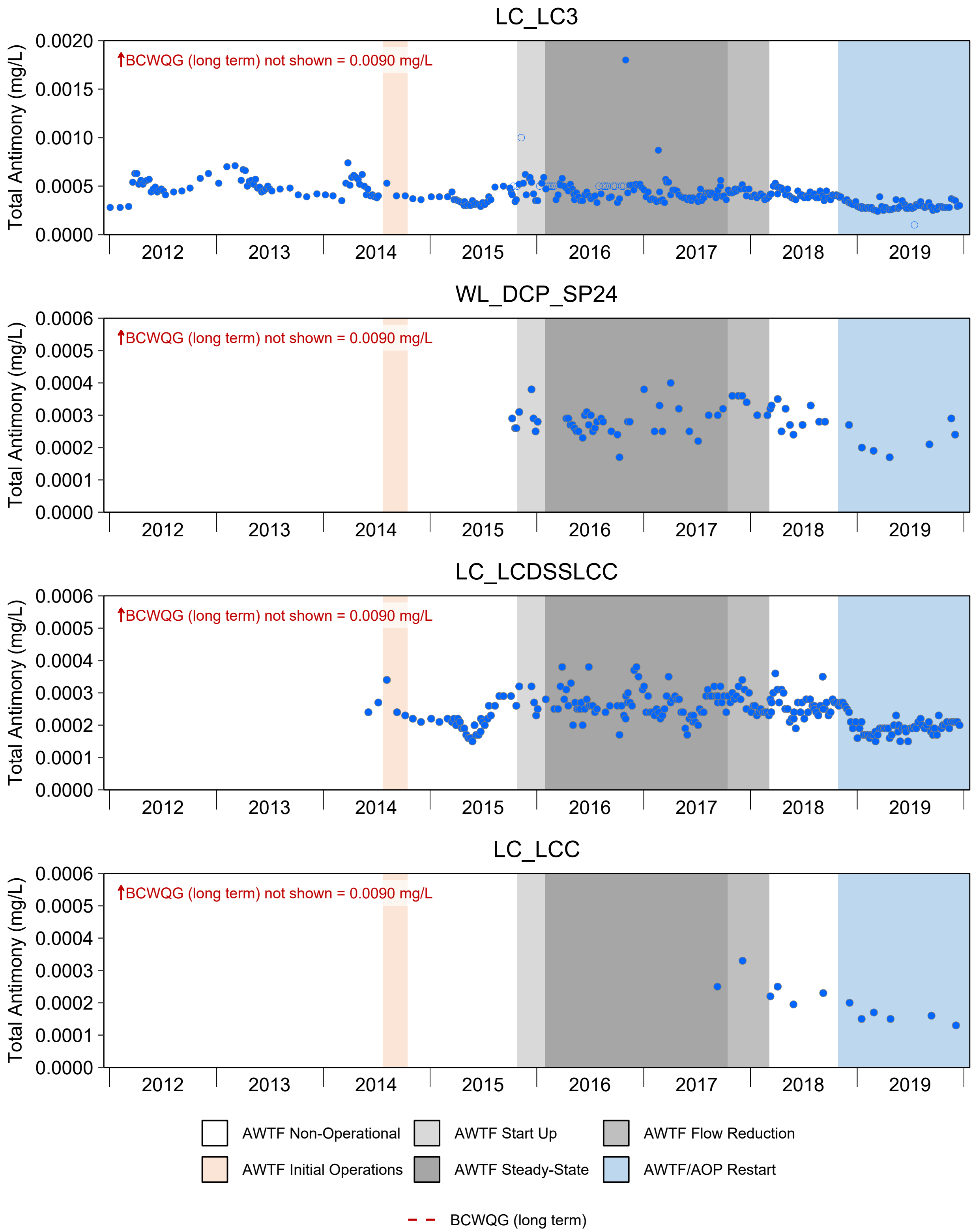

Figure C.7: Time Series Plots for Aqueous Total Antimony Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

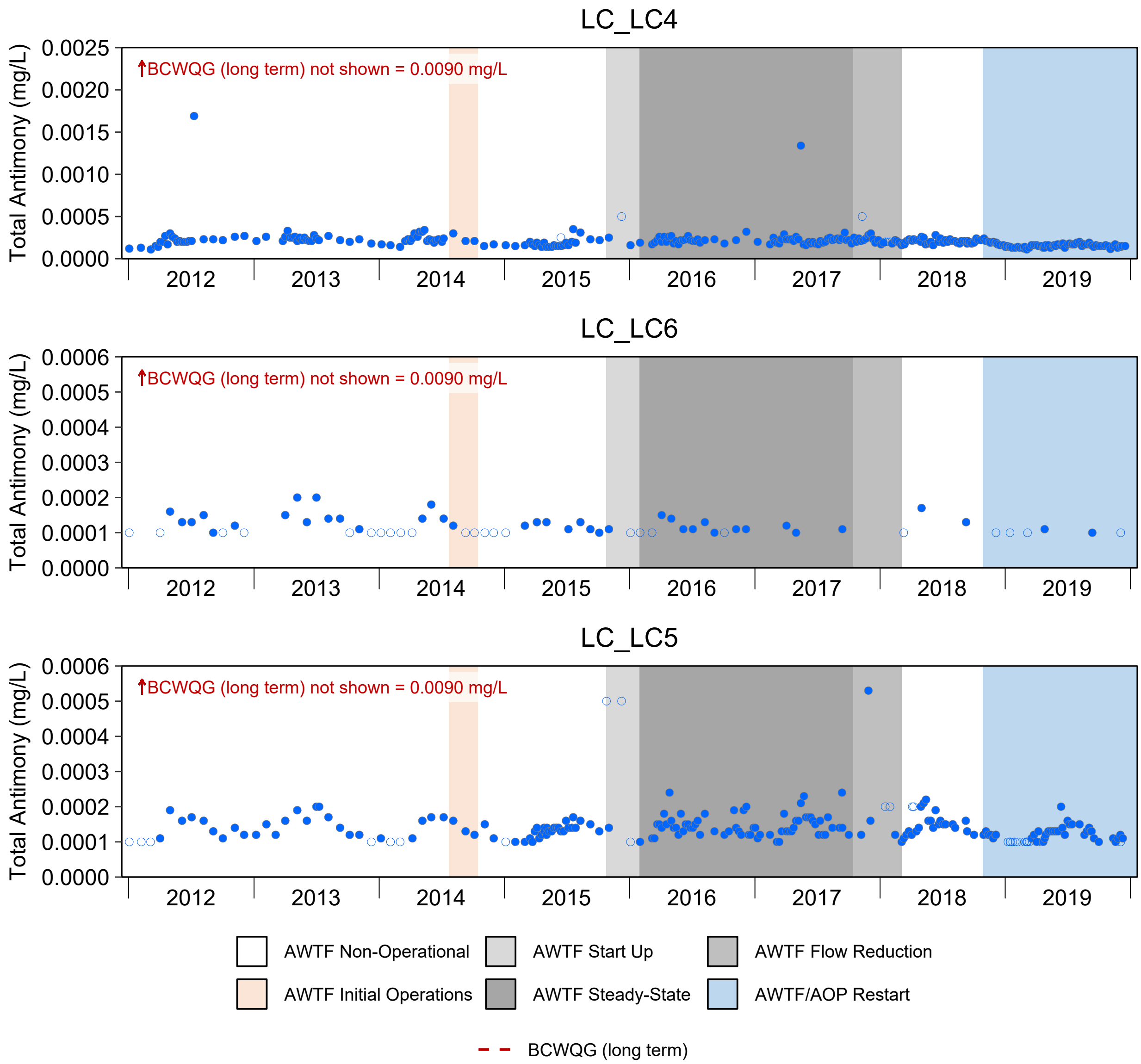

Figure C.7: Time Series Plots for Aqueous Total Antimony Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

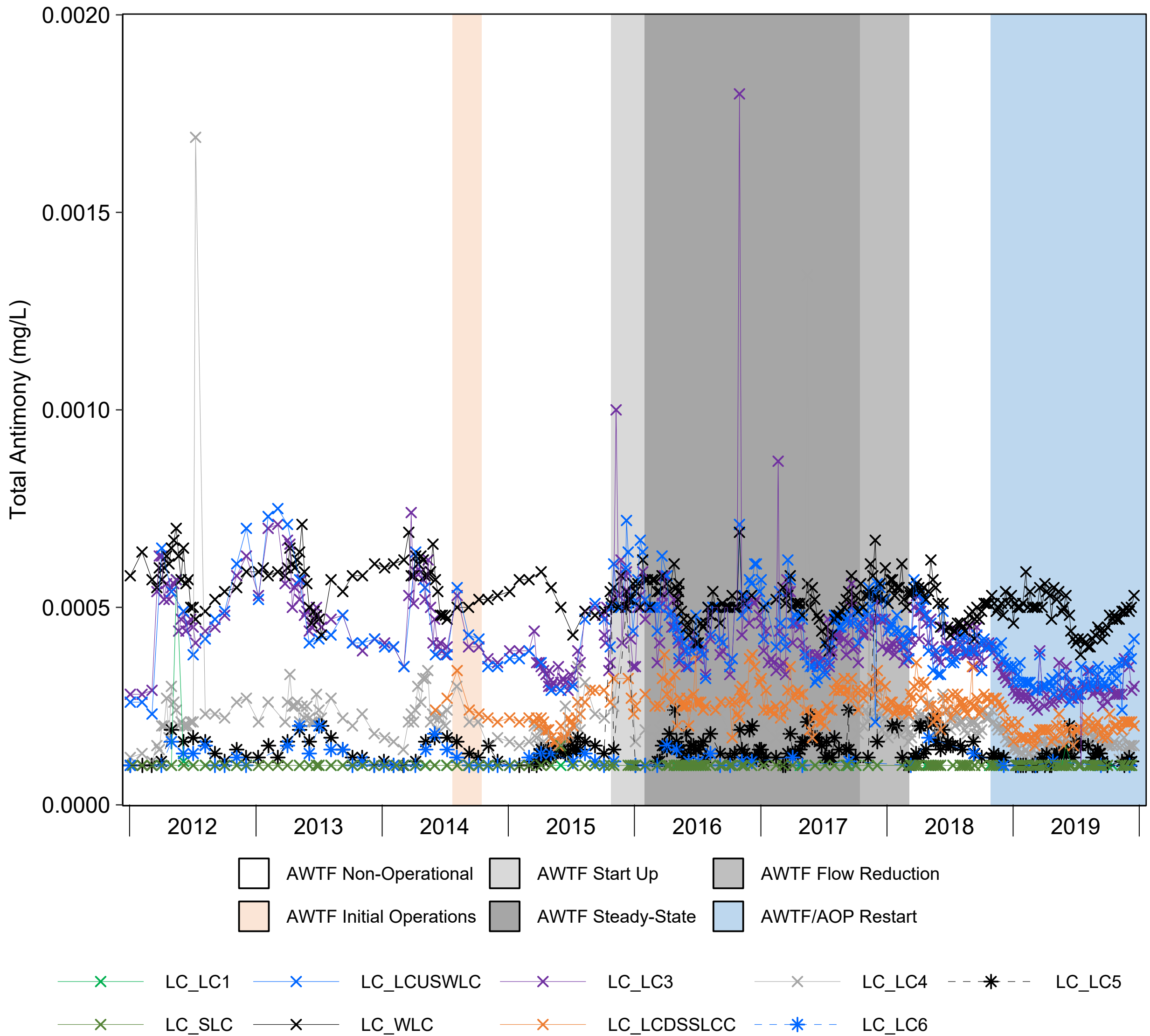

Figure C.8: Time Series Plots for Aqueous Total Antimony Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (0.0010 mg/L). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

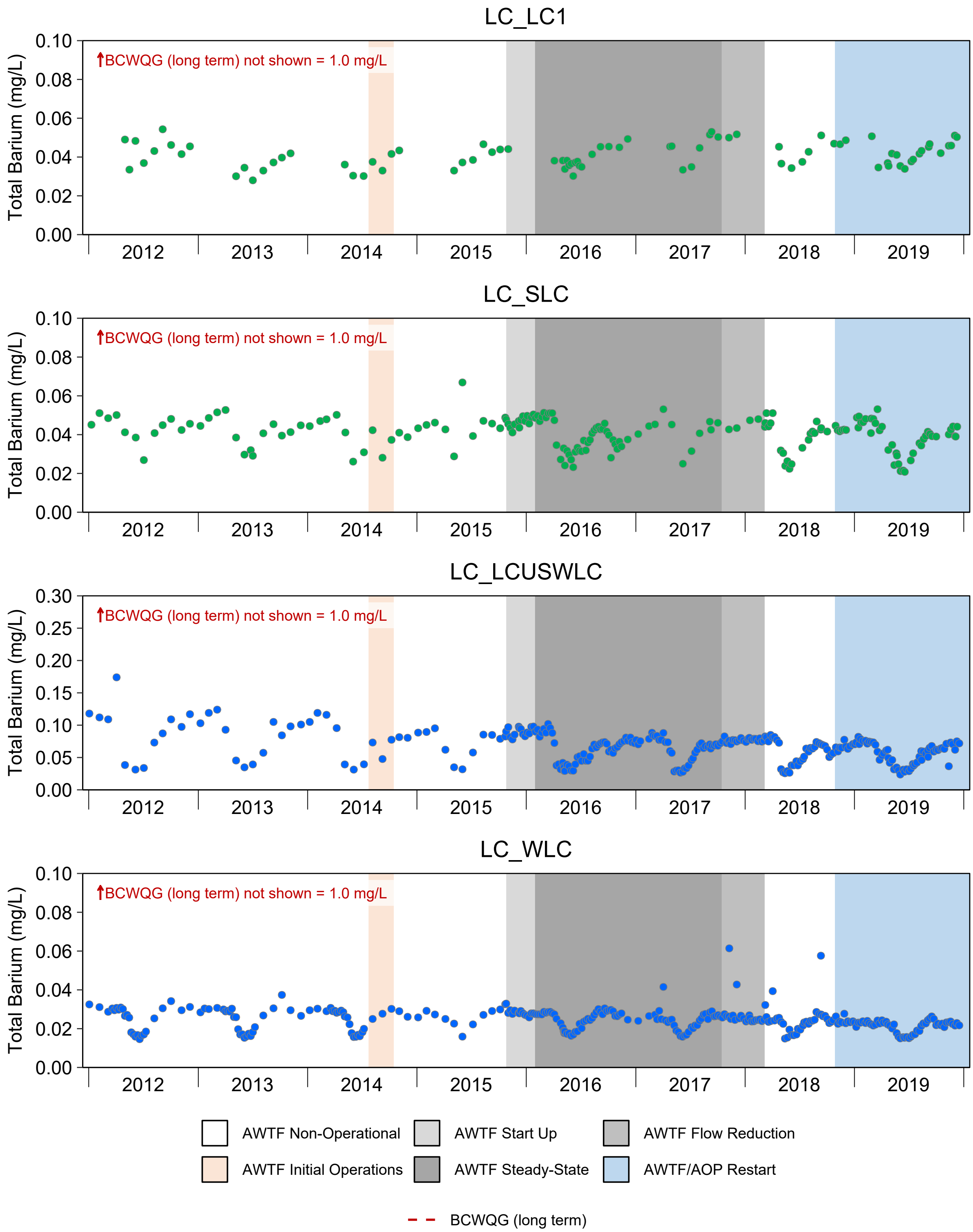

Figure C.9: Time Series Plots for Aqueous Total Barium Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

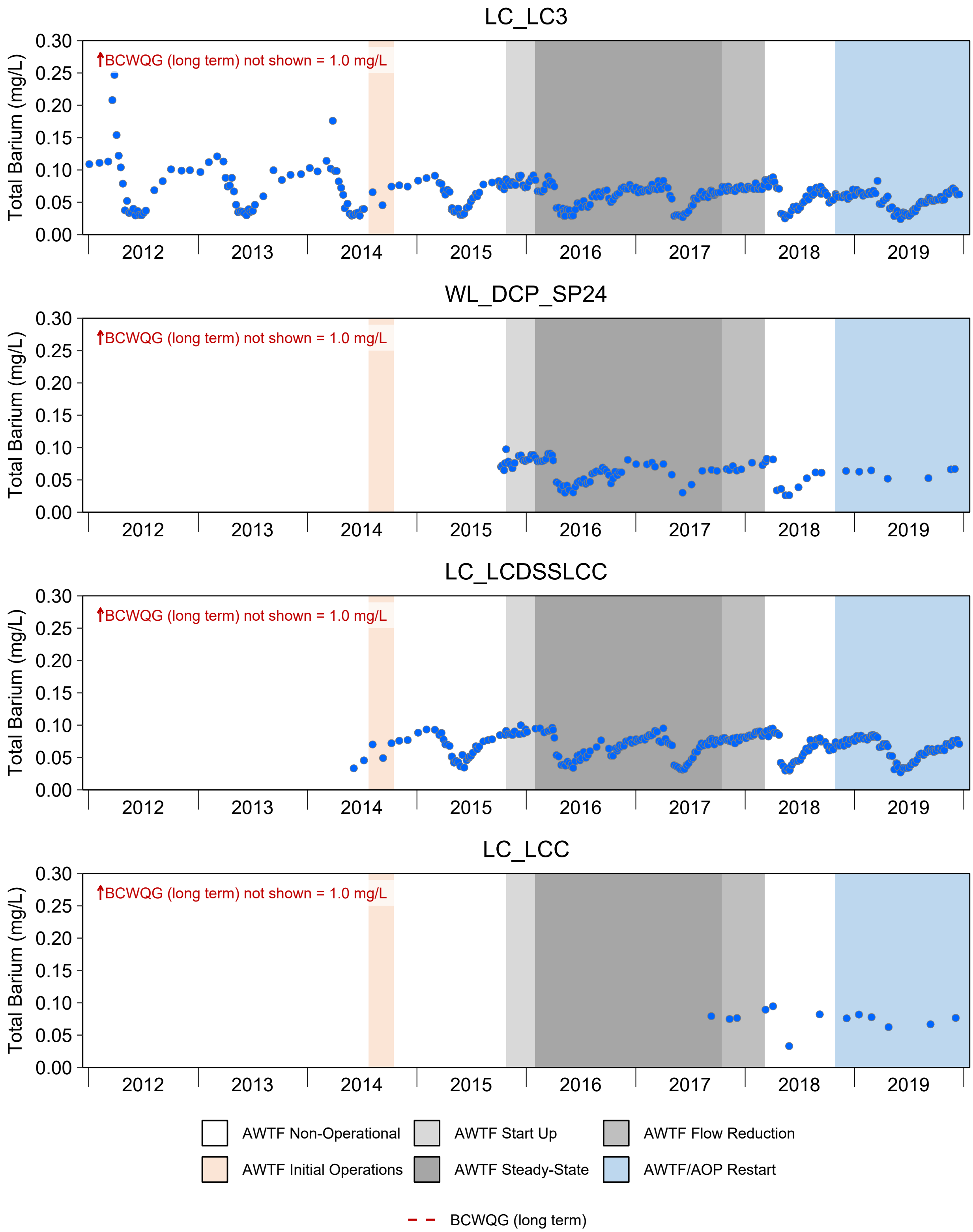

Figure C.9: Time Series Plots for Aqueous Total Barium Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

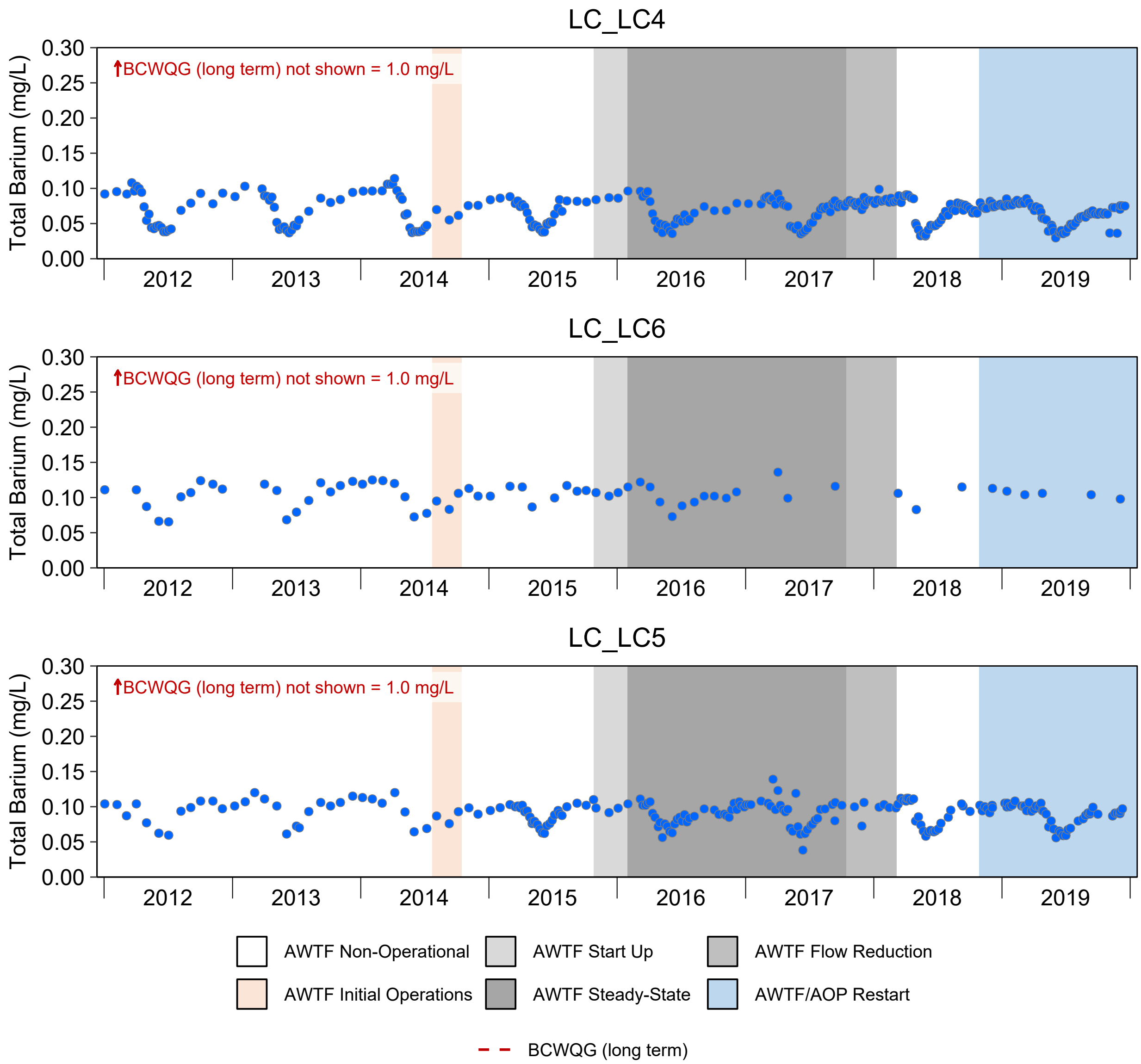

Figure C.9: Time Series Plots for Aqueous Total Barium Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

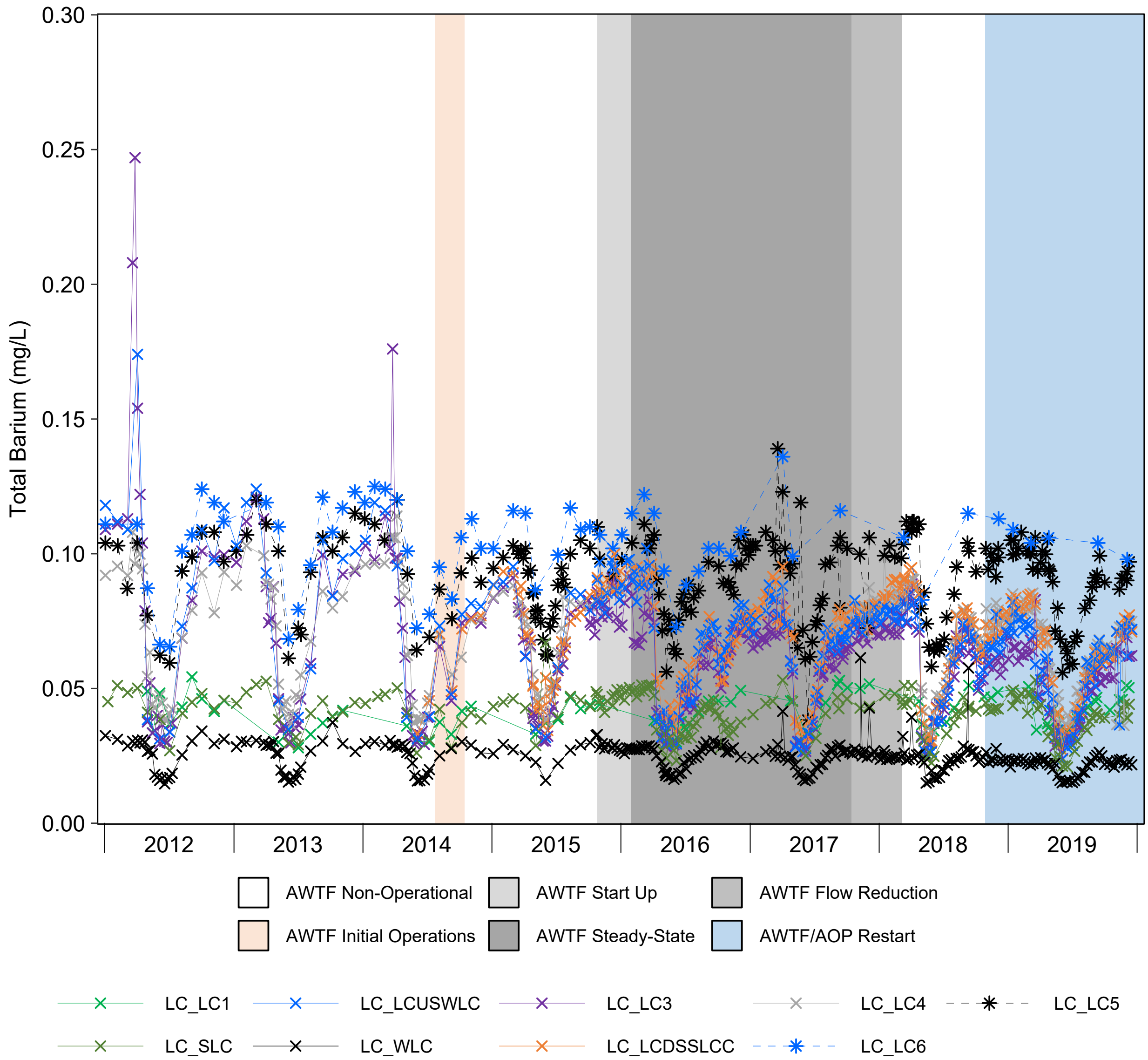

Figure C.10: Time Series Plots for Aqueous Total Barium Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Note: West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

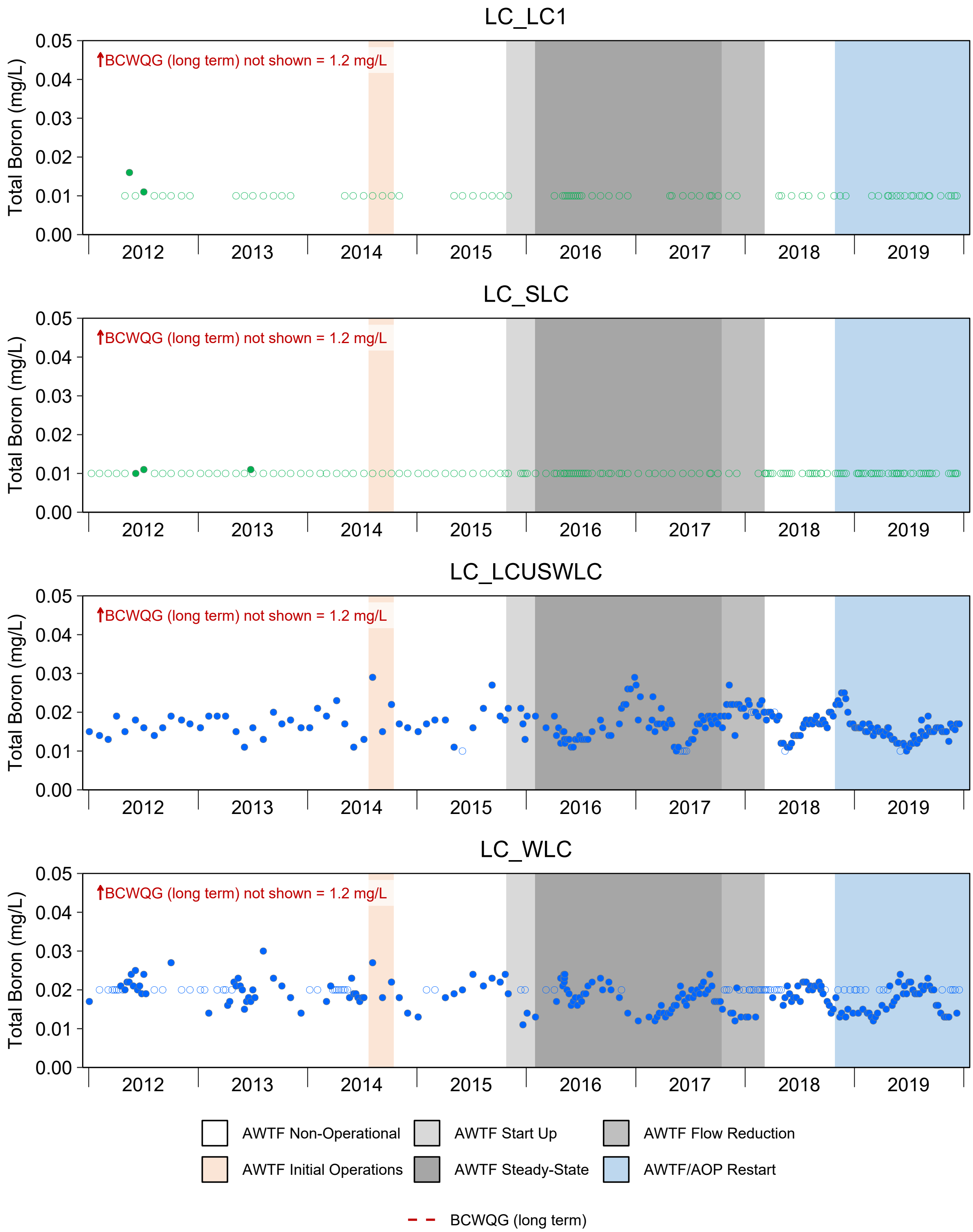

Figure C.11: Time Series Plots for Aqueous Total Boron Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

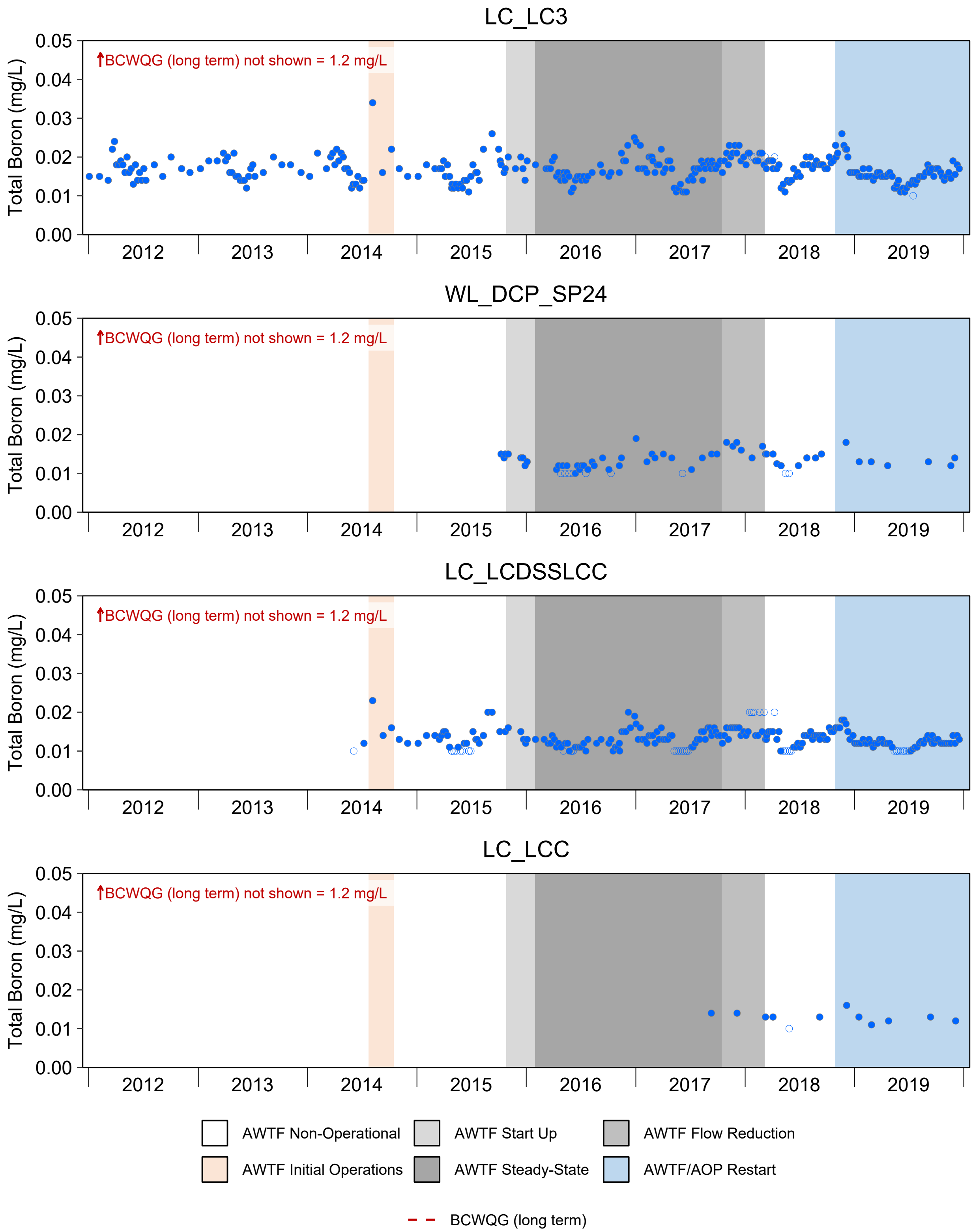

Figure C.11: Time Series Plots for Aqueous Total Boron Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

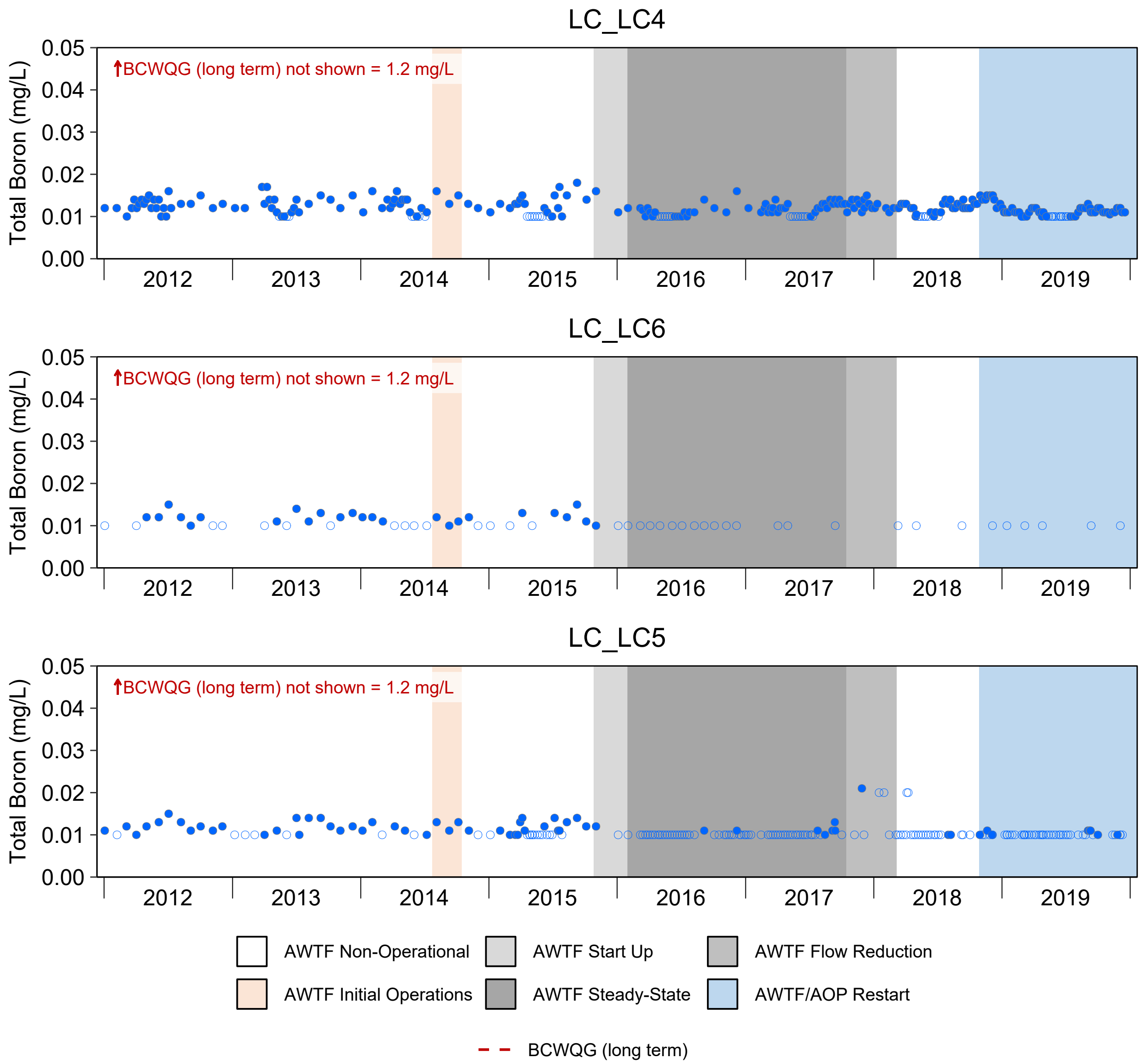

Figure C.11: Time Series Plots for Aqueous Total Boron Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

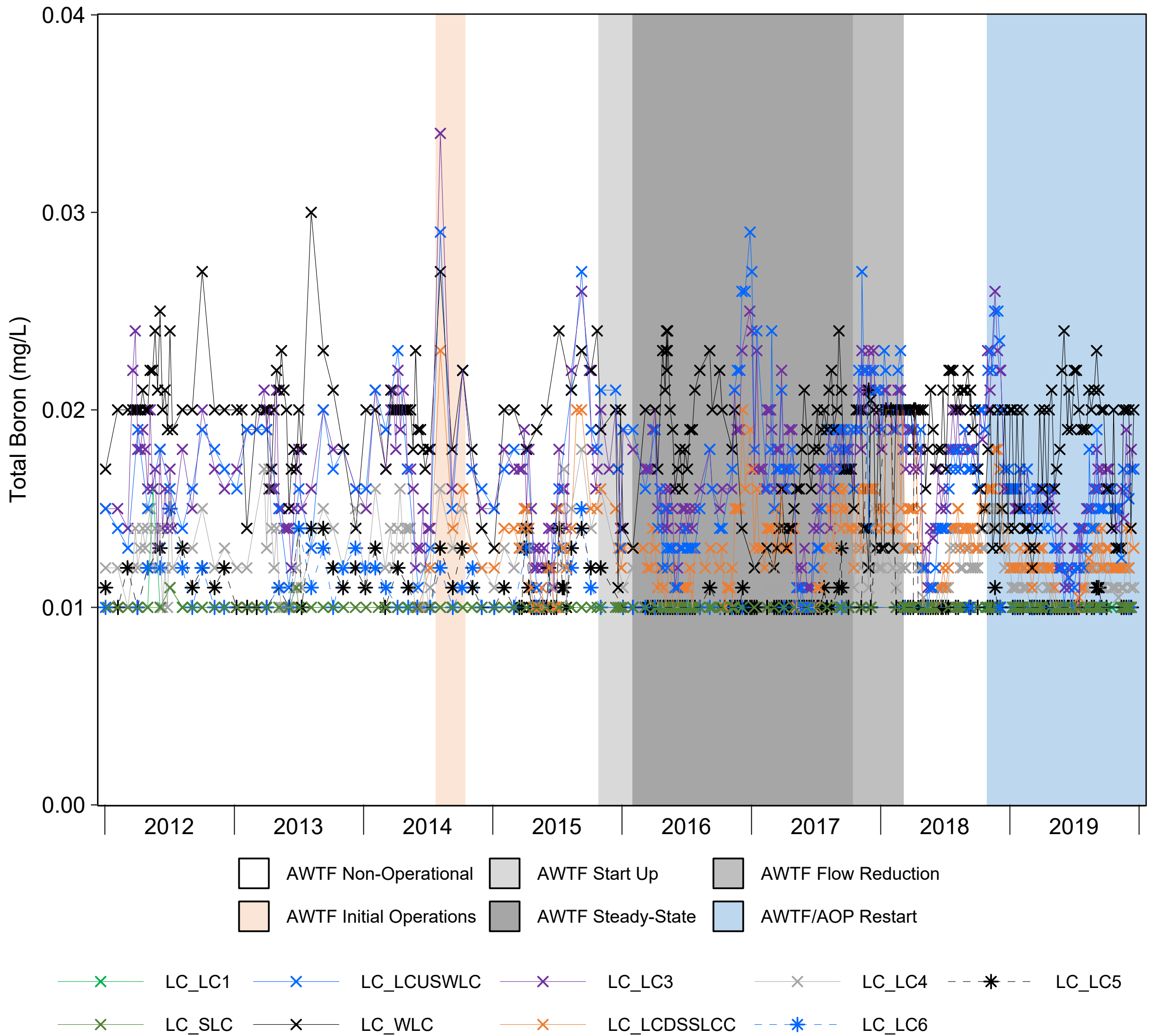

Figure C.12: Time Series Plots for Aqueous Total Boron Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (LRLs between 0.010 and 0.020 mg/L). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

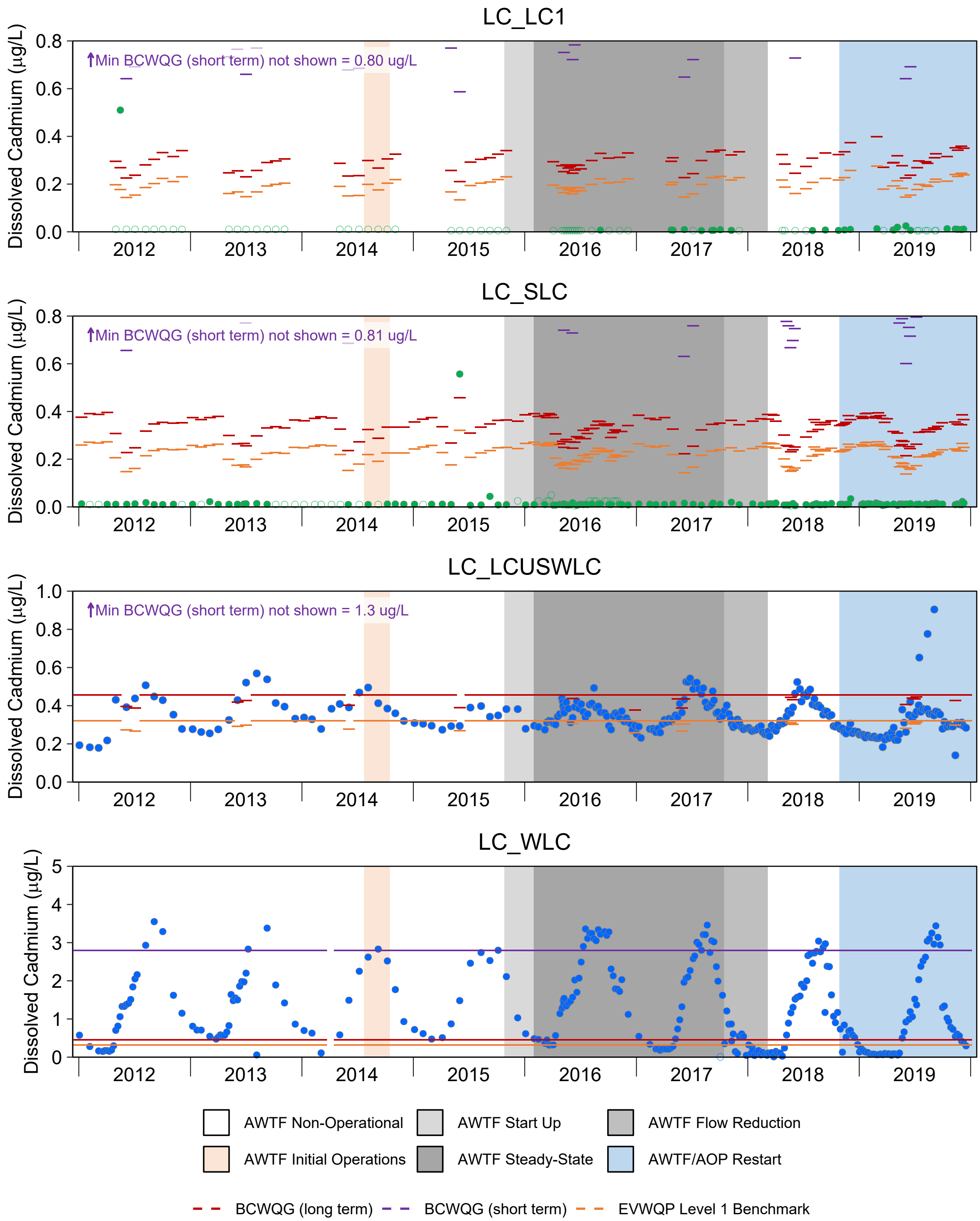

Figure C.13: Time Series Plots for Aqueous Dissolved Cadmium Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines; EVWQP = Elk Valley Water Quality Plan. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. BCWQG values are dependent on water hardness. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

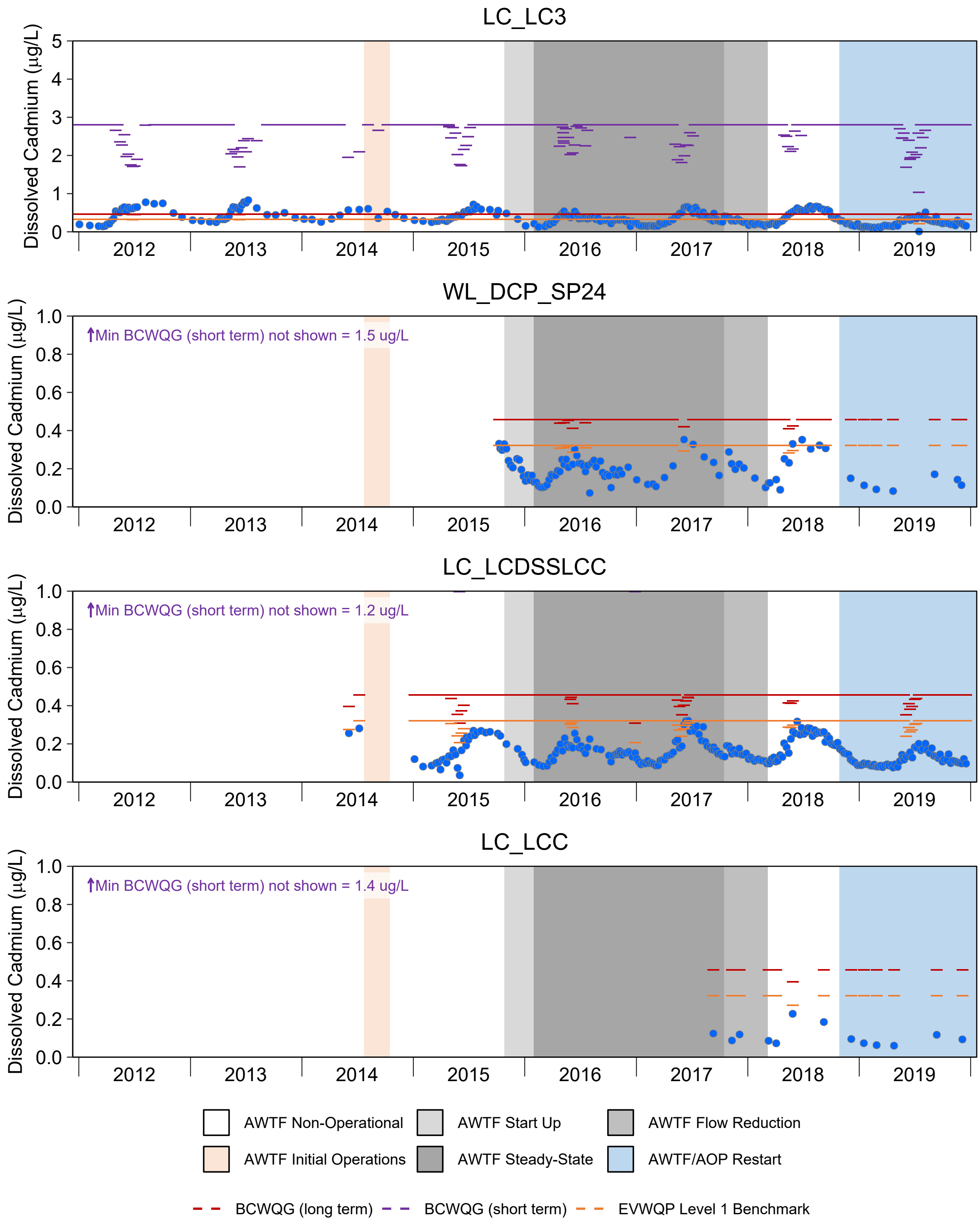

Figure C.13: Time Series Plots for Aqueous Dissolved Cadmium Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines; EVWQP = Elk Valley Water Quality Plan. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. BCWQG values are dependent on water hardness. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

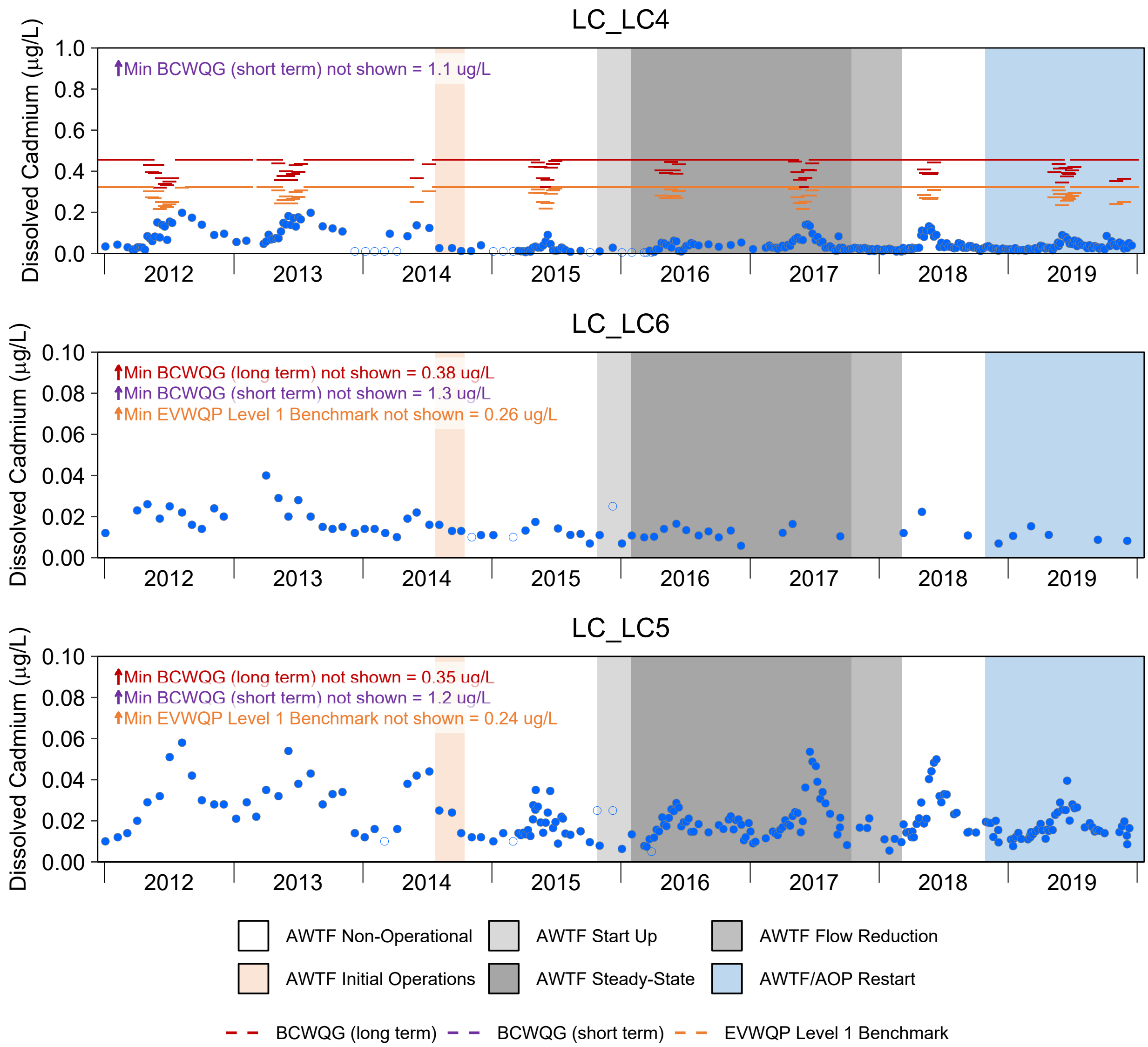

Figure C.13: Time Series Plots for Aqueous Dissolved Cadmium Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines; EVWQP = Elk Valley Water Quality Plan. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. BCWQG values are dependent on water hardness. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

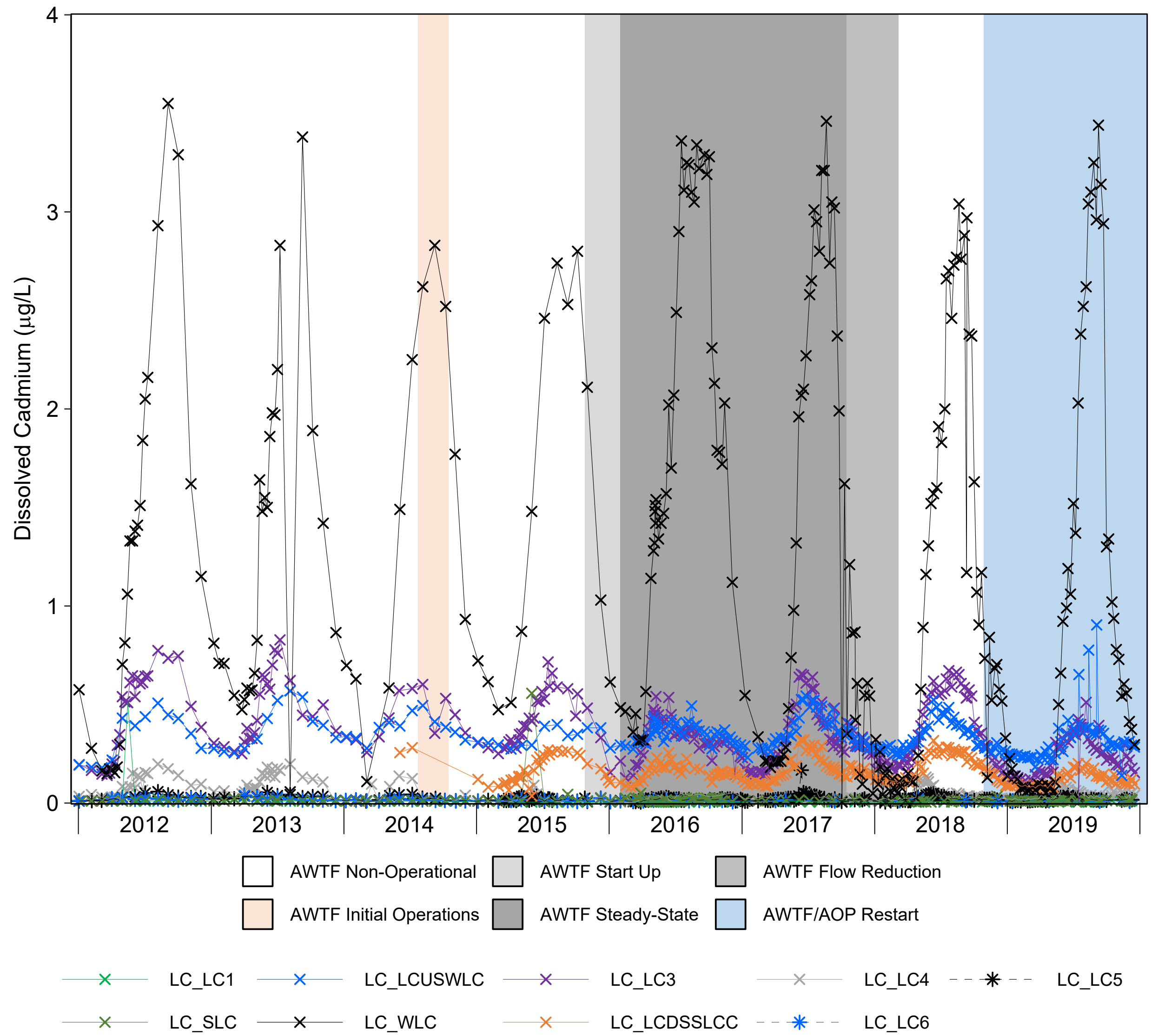

Figure C.14: Time Series Plots for Aqueous Dissolved Cadmium Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (0.050 mg/L). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

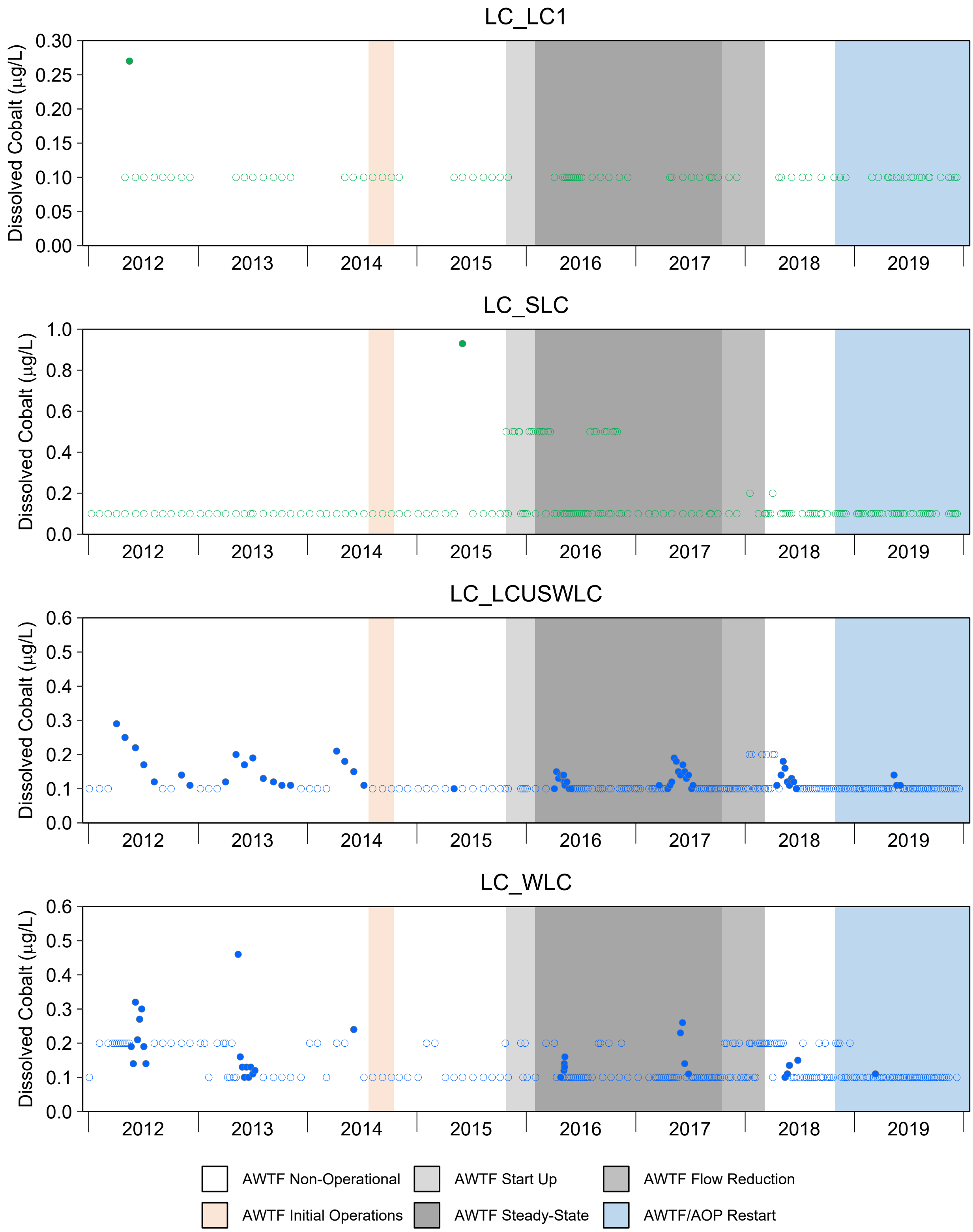

Figure C.15: Time Series Plots for Aqueous Dissolved Cobalt Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

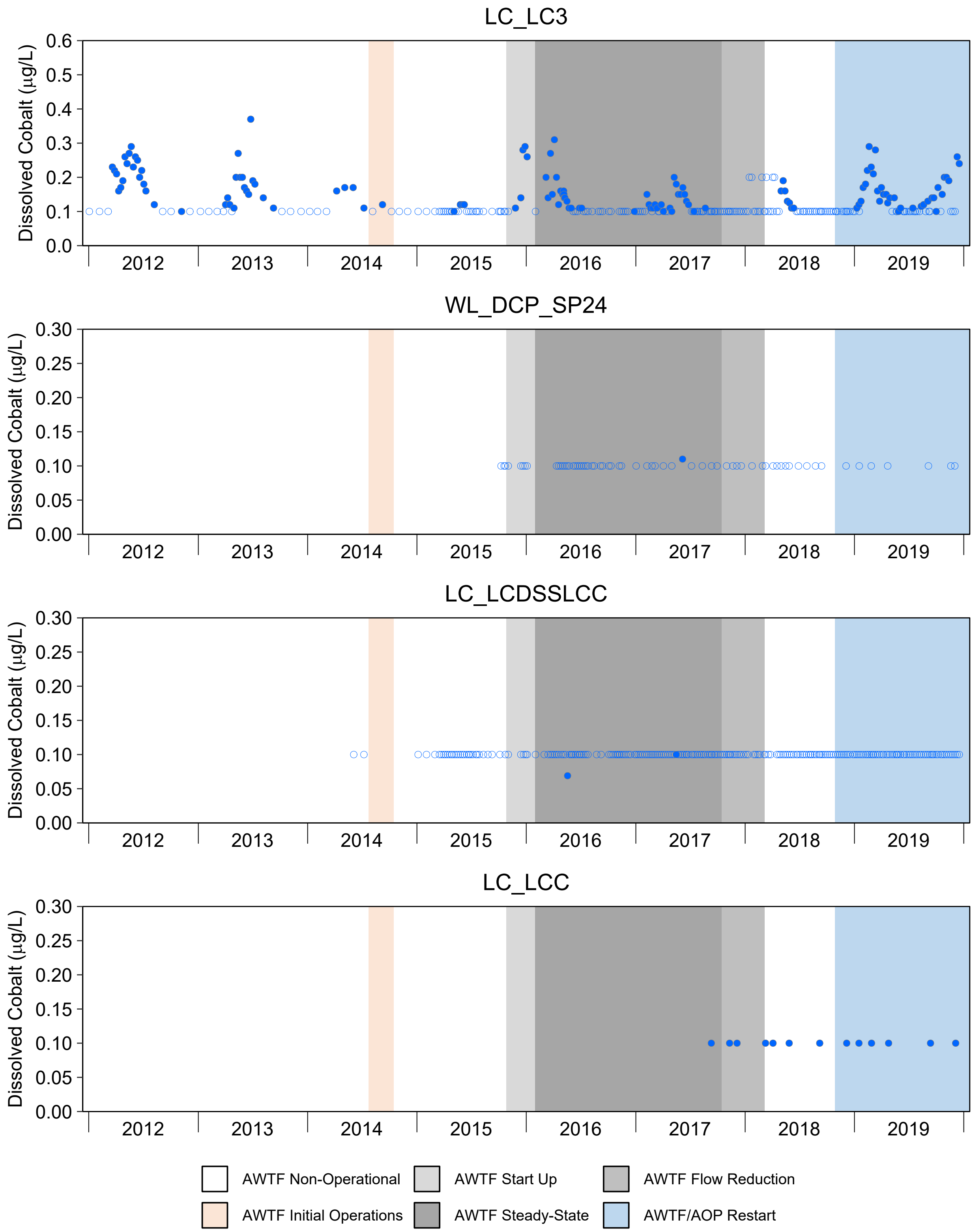

Figure C.15: Time Series Plots for Aqueous Dissolved Cobalt Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

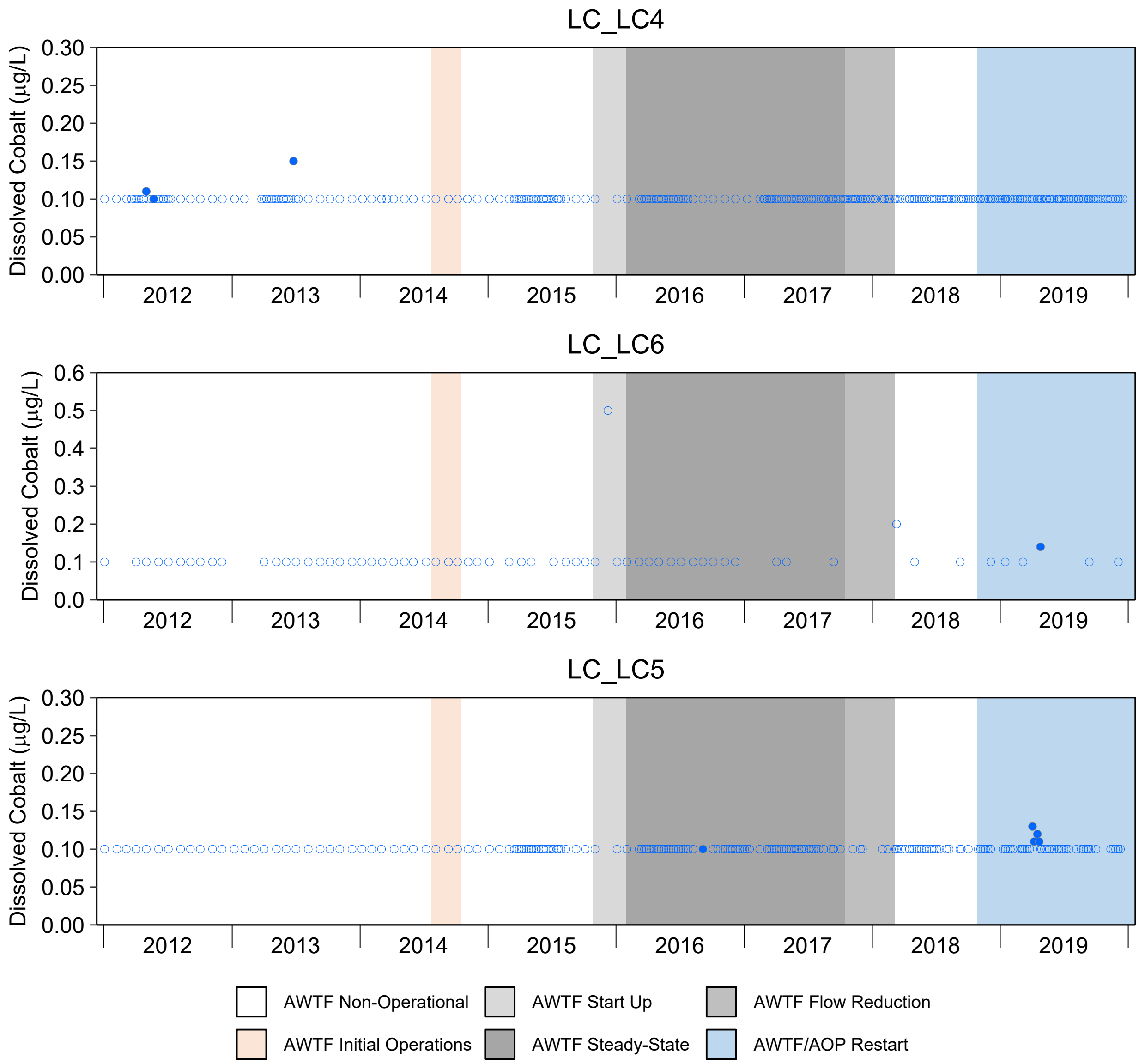

Figure C.15: Time Series Plots for Aqueous Dissolved Cobalt Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

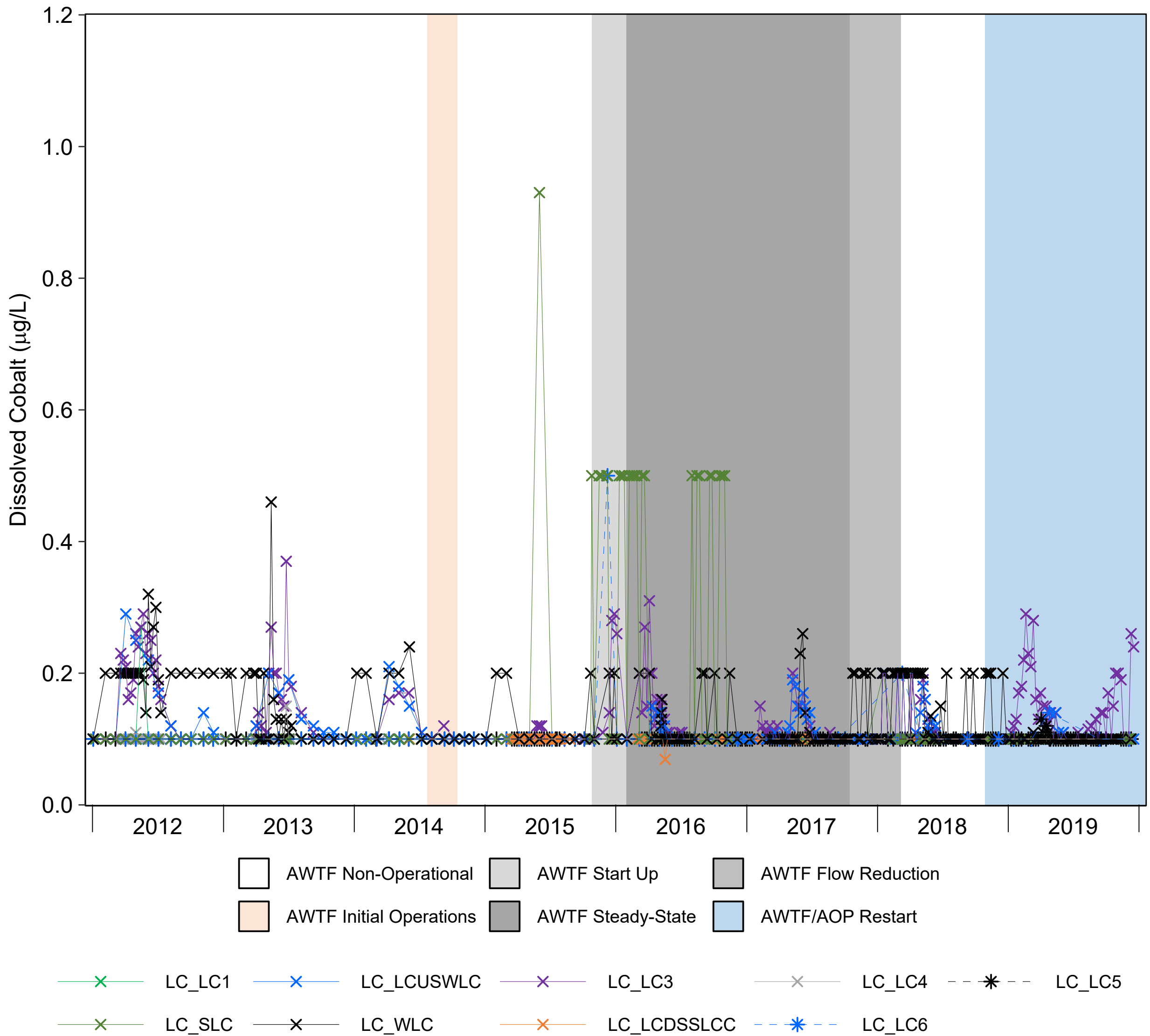

Figure C.16: Time Series Plots for Aqueous Dissolved Cobalt Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (LRLs between 0.10 and 0.50 mg/L). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

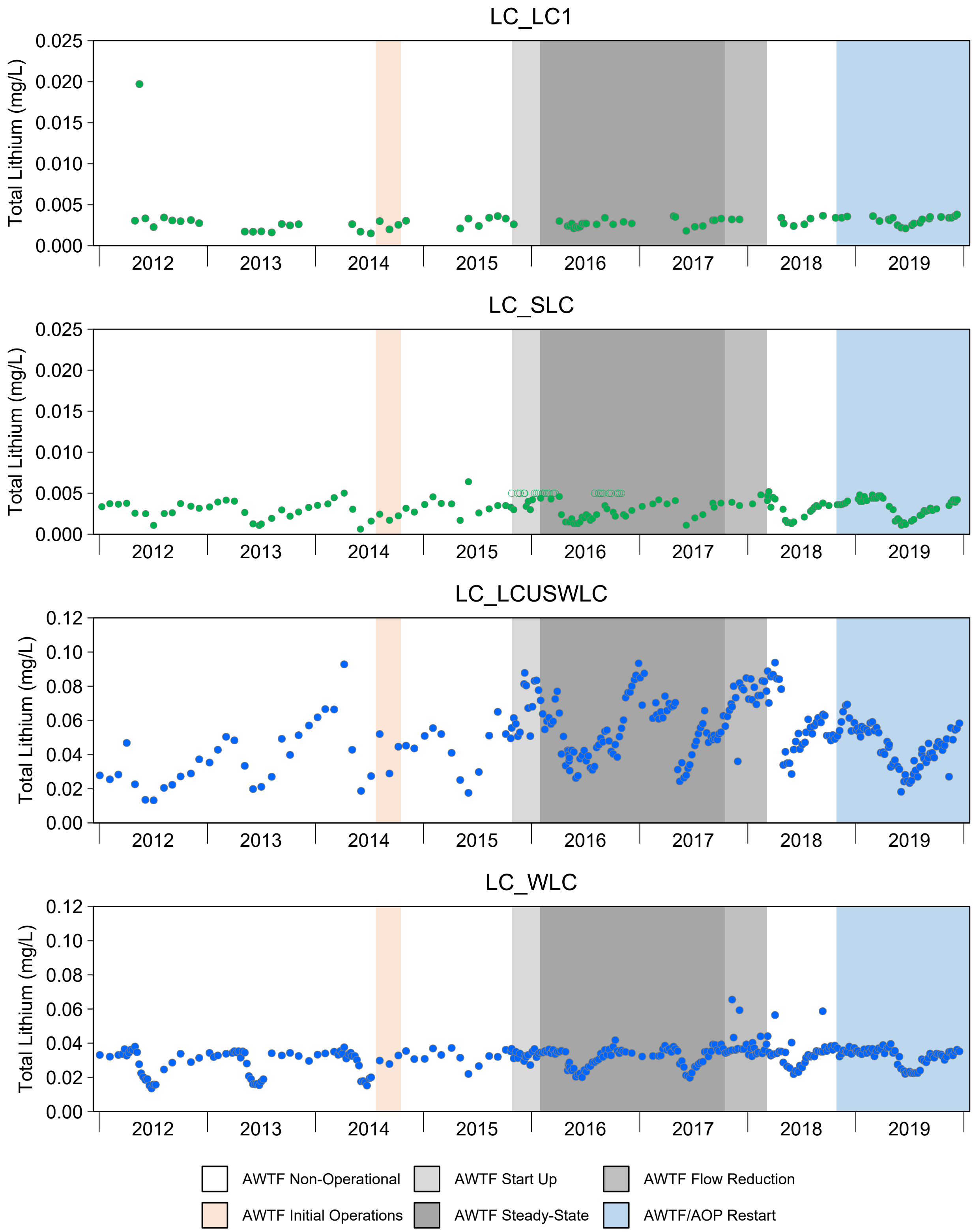

Figure C.17: Time Series Plots for Aqueous Total Lithium Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

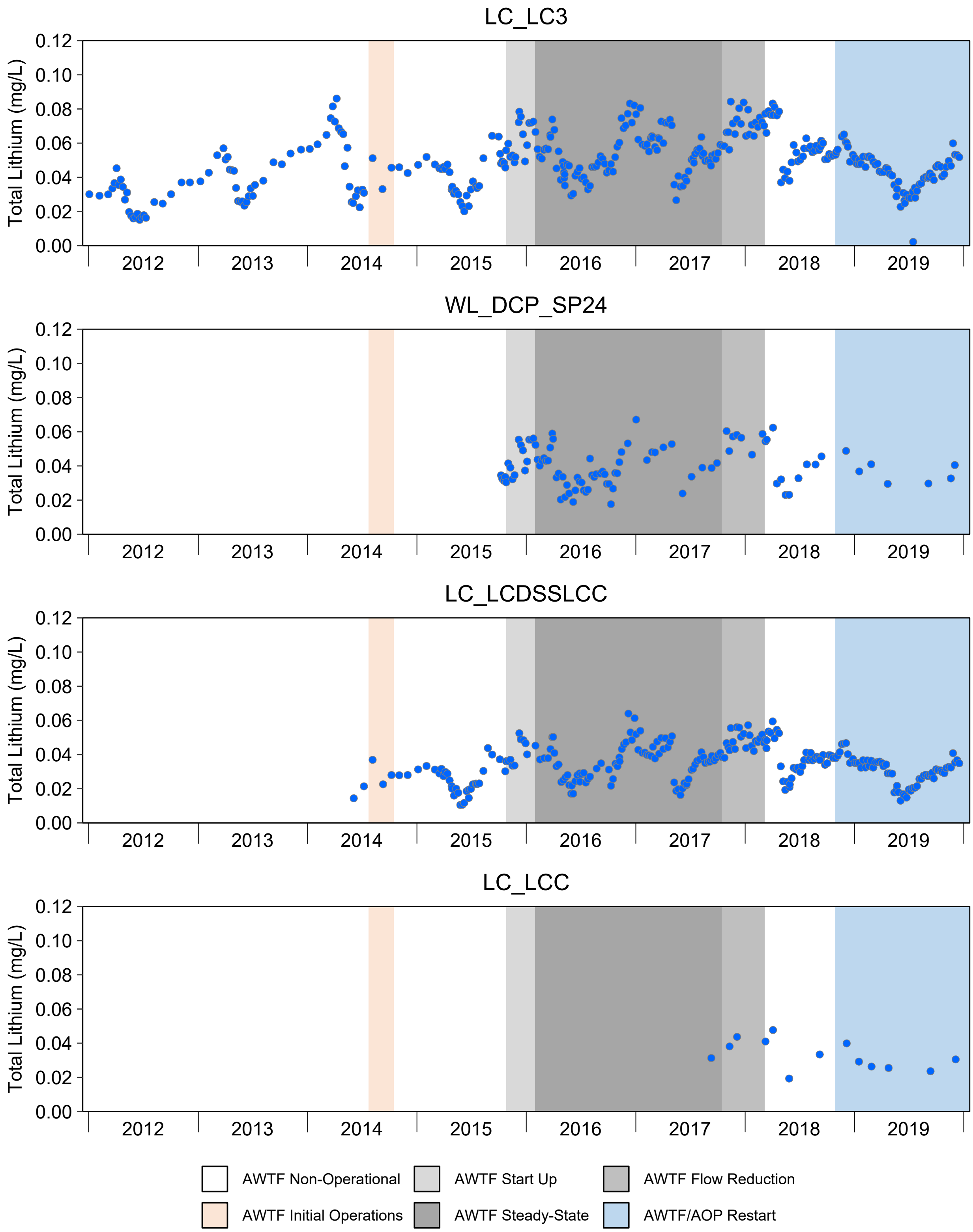

Figure C.17: Time Series Plots for Aqueous Total Lithium Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

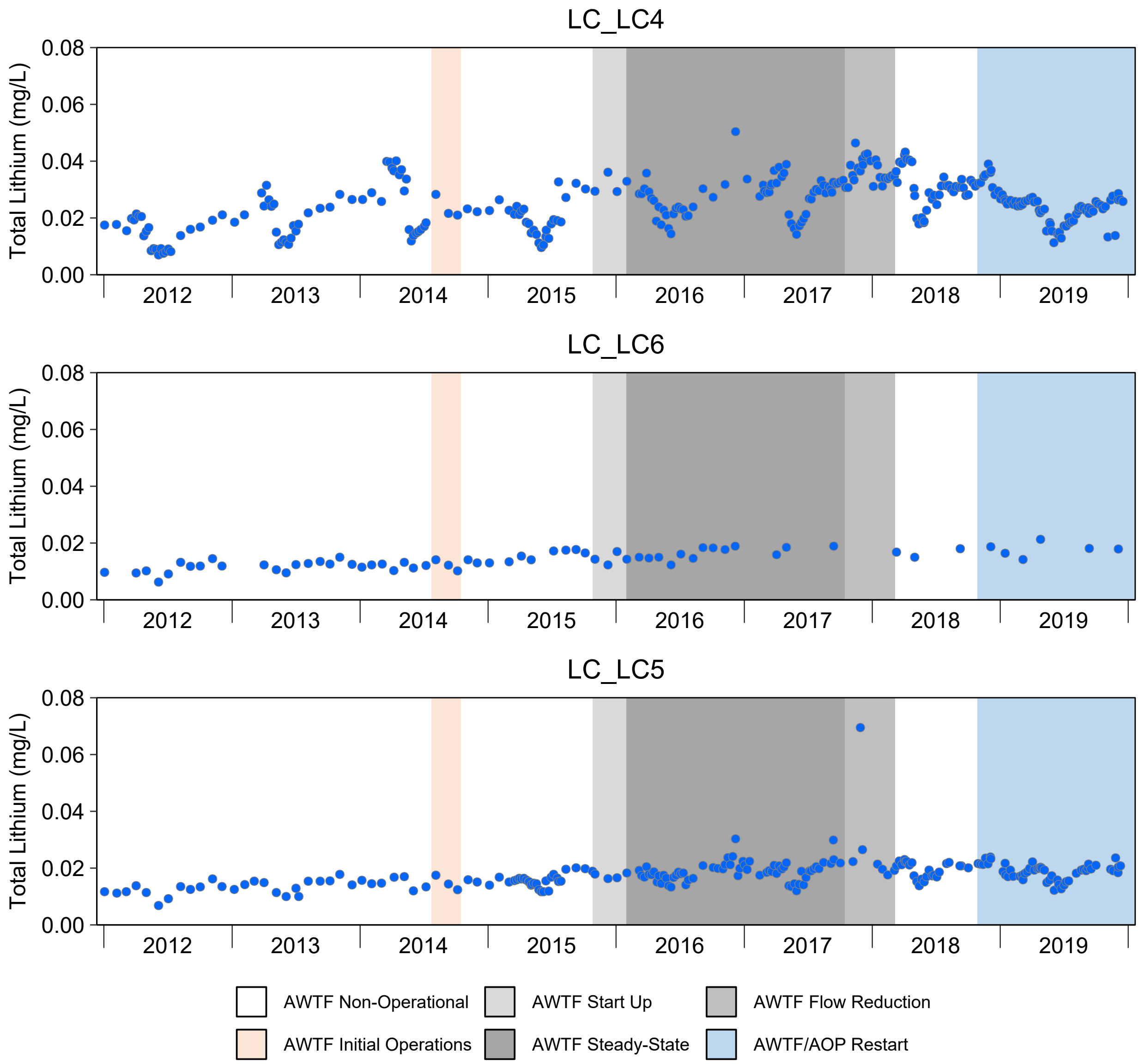

Figure C.17: Time Series Plots for Aqueous Total Lithium Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

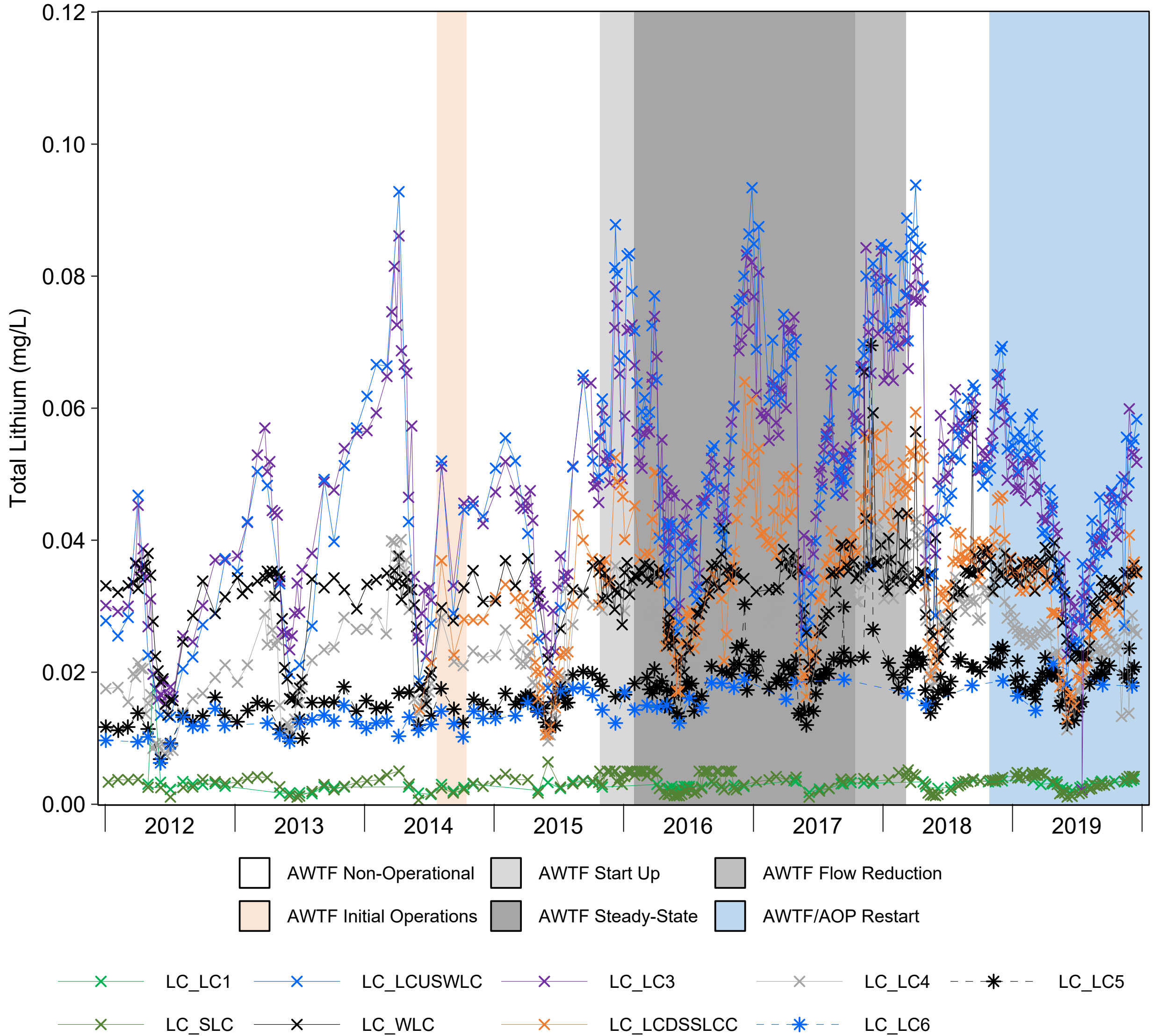

Figure C.18: Time Series Plots for Aqueous Total Lithium Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (0.0050 mg/L). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

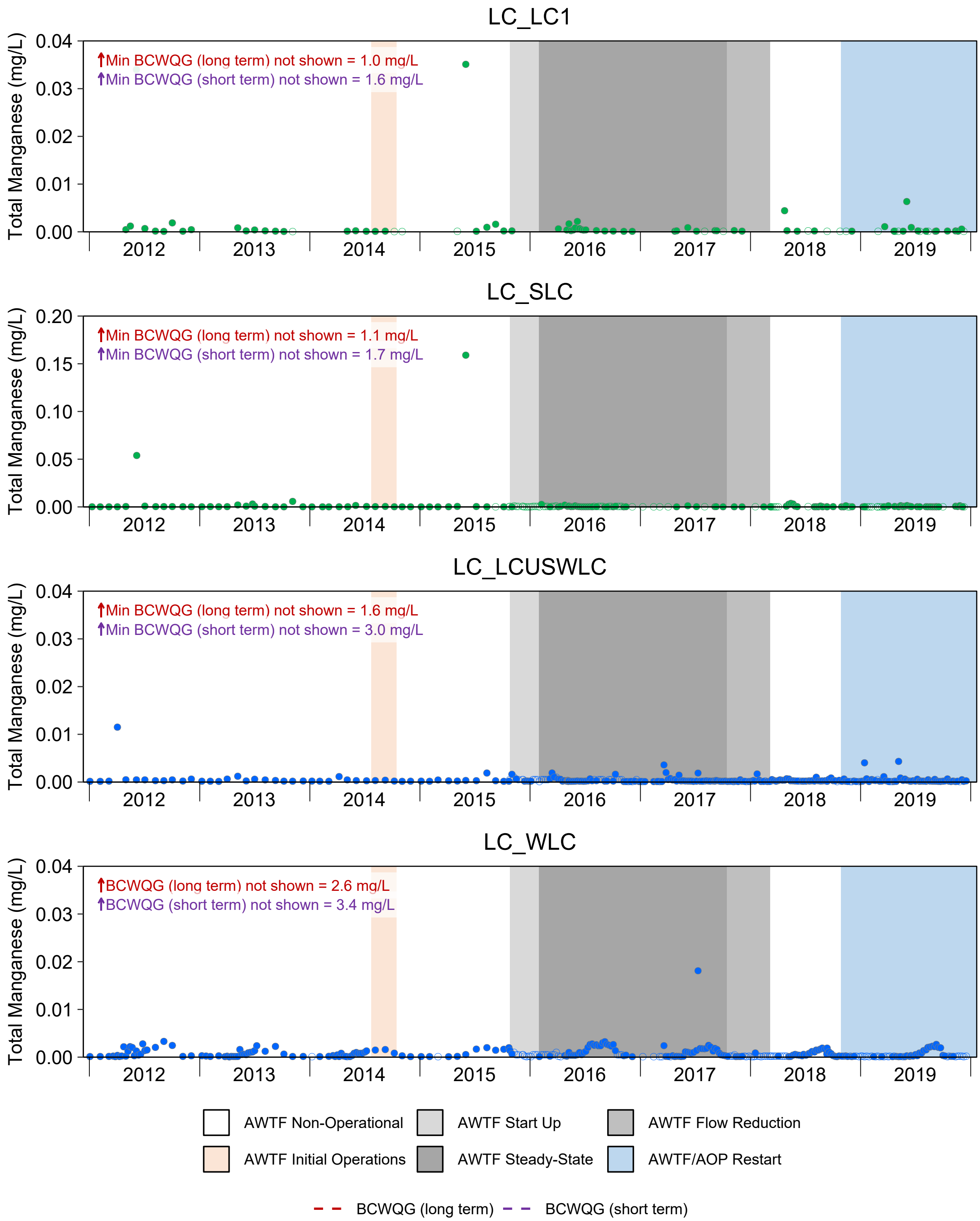

Figure C.19: Time Series Plots for Aqueous Total Manganese Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. BCWQG values are dependent on water hardness. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

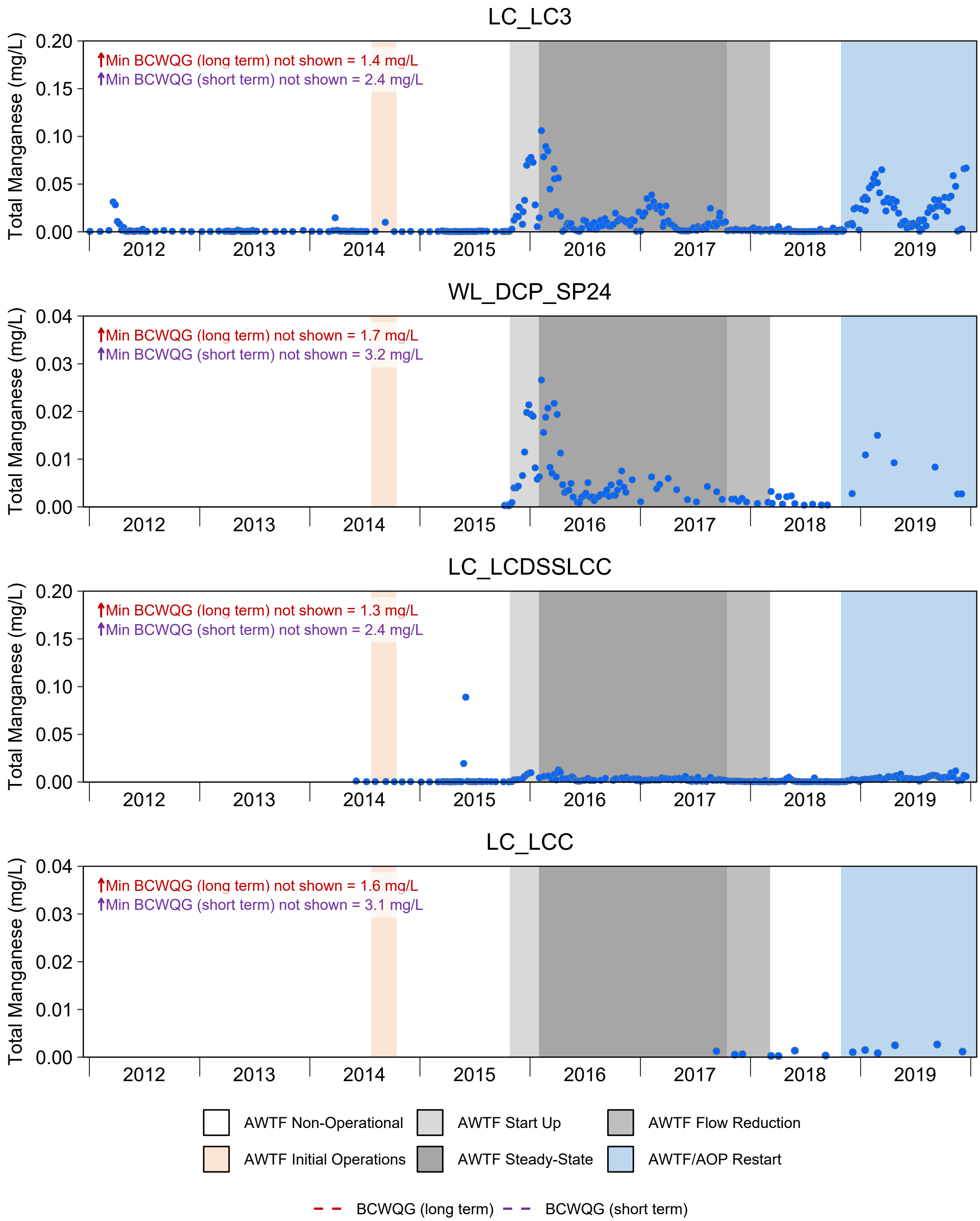

Figure C.19: Time Series Plots for Aqueous Total Manganese Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. BCWQG values are dependent on water hardness. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

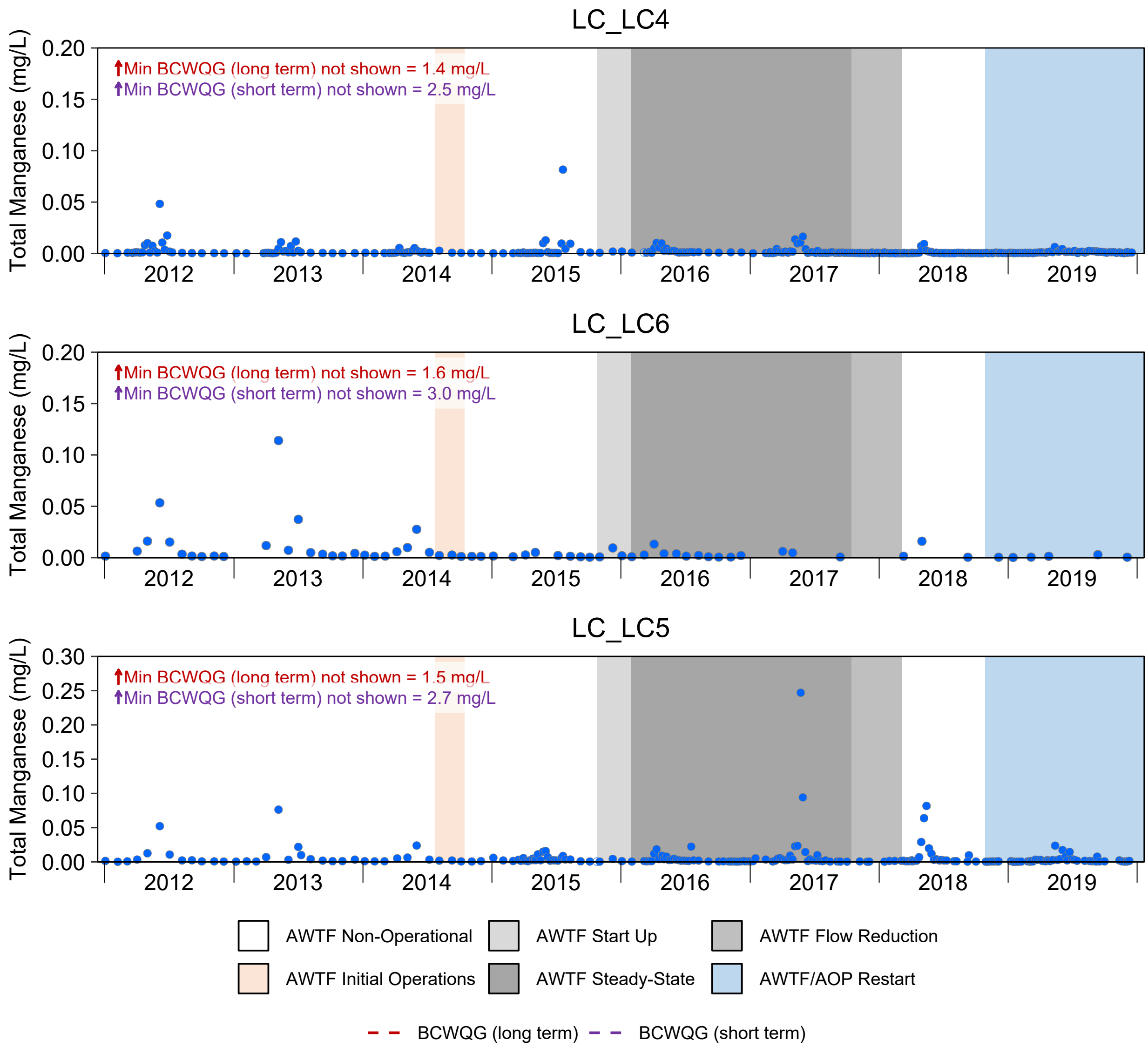

Figure C.19: Time Series Plots for Aqueous Total Manganese Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. BCWQG values are dependent on water hardness. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

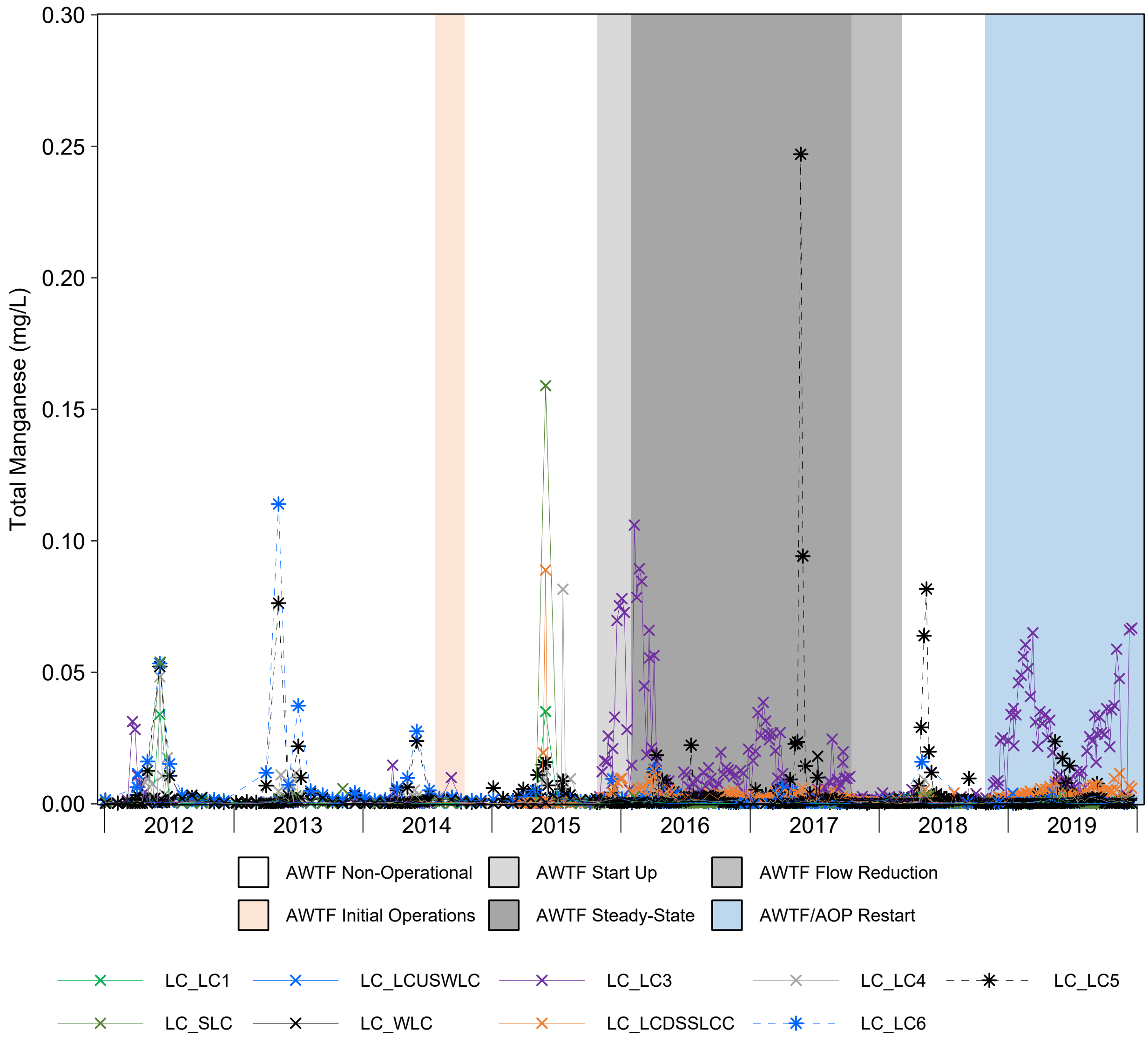

Figure C.20: Time Series Plots for Aqueous Total Manganese Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (LRLs between 0.000050 and 0.0010 mg/L). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

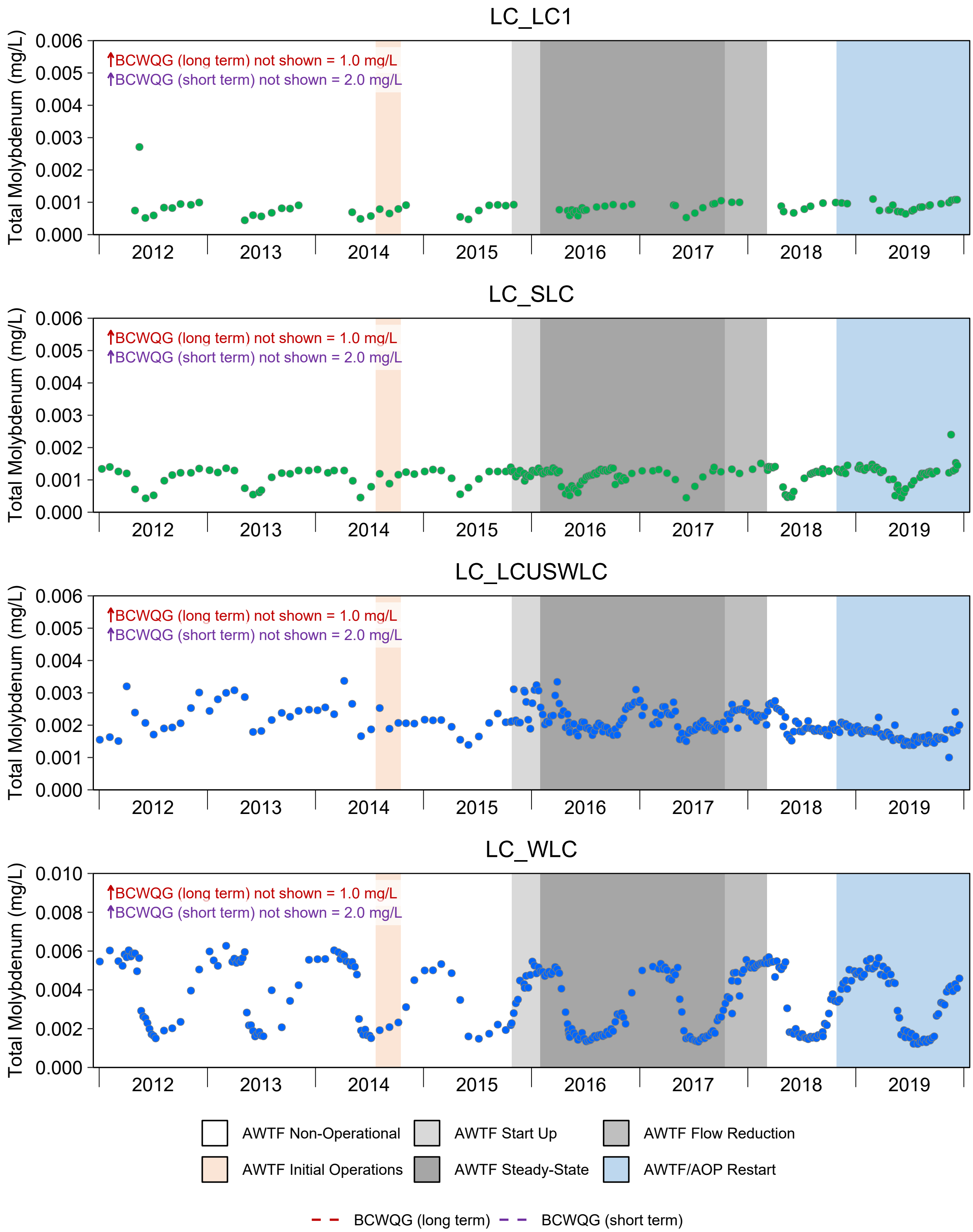

Figure C.21: Time Series Plots for Aqueous Total Molybdenum Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

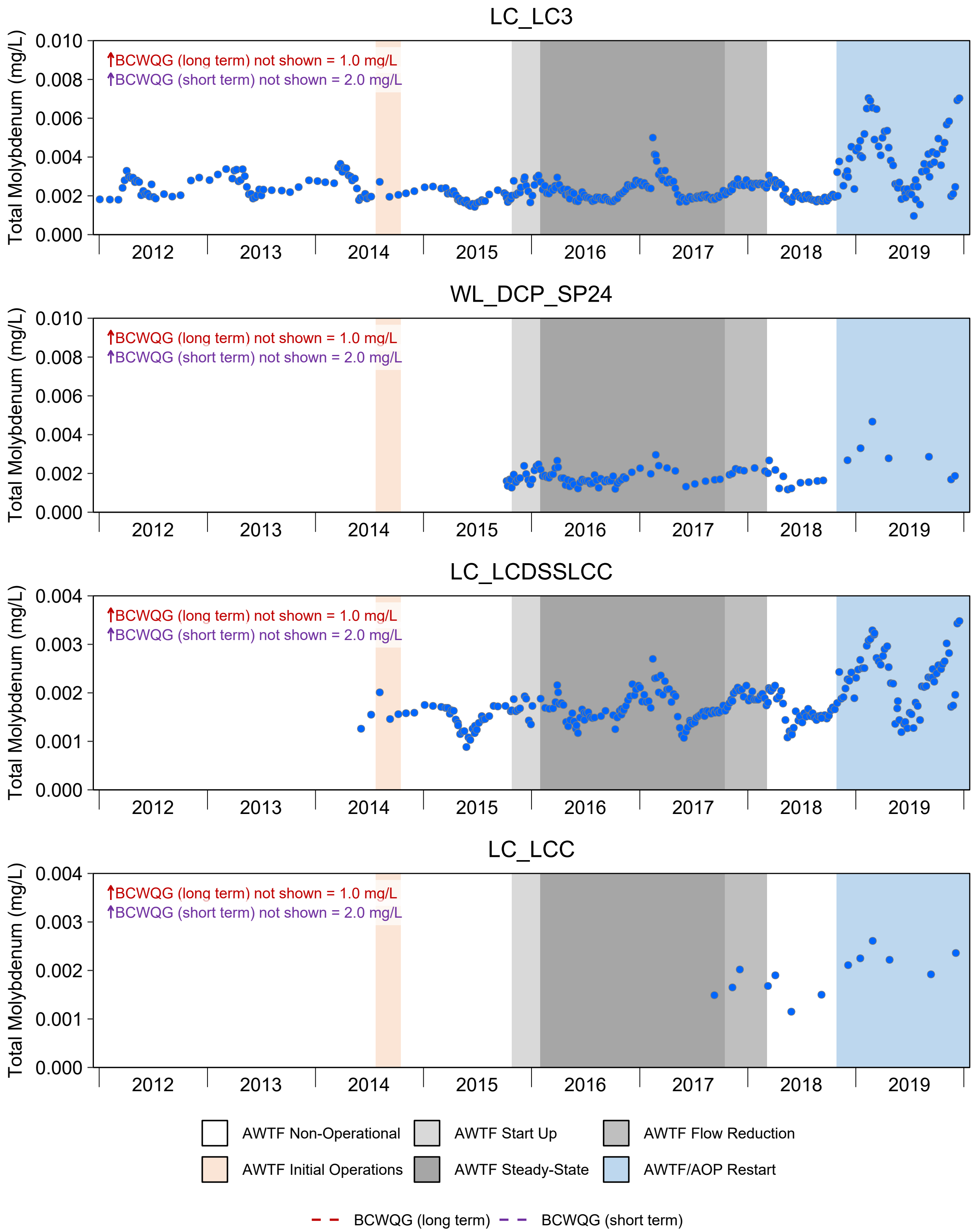

Figure C.21: Time Series Plots for Aqueous Total Molybdenum Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

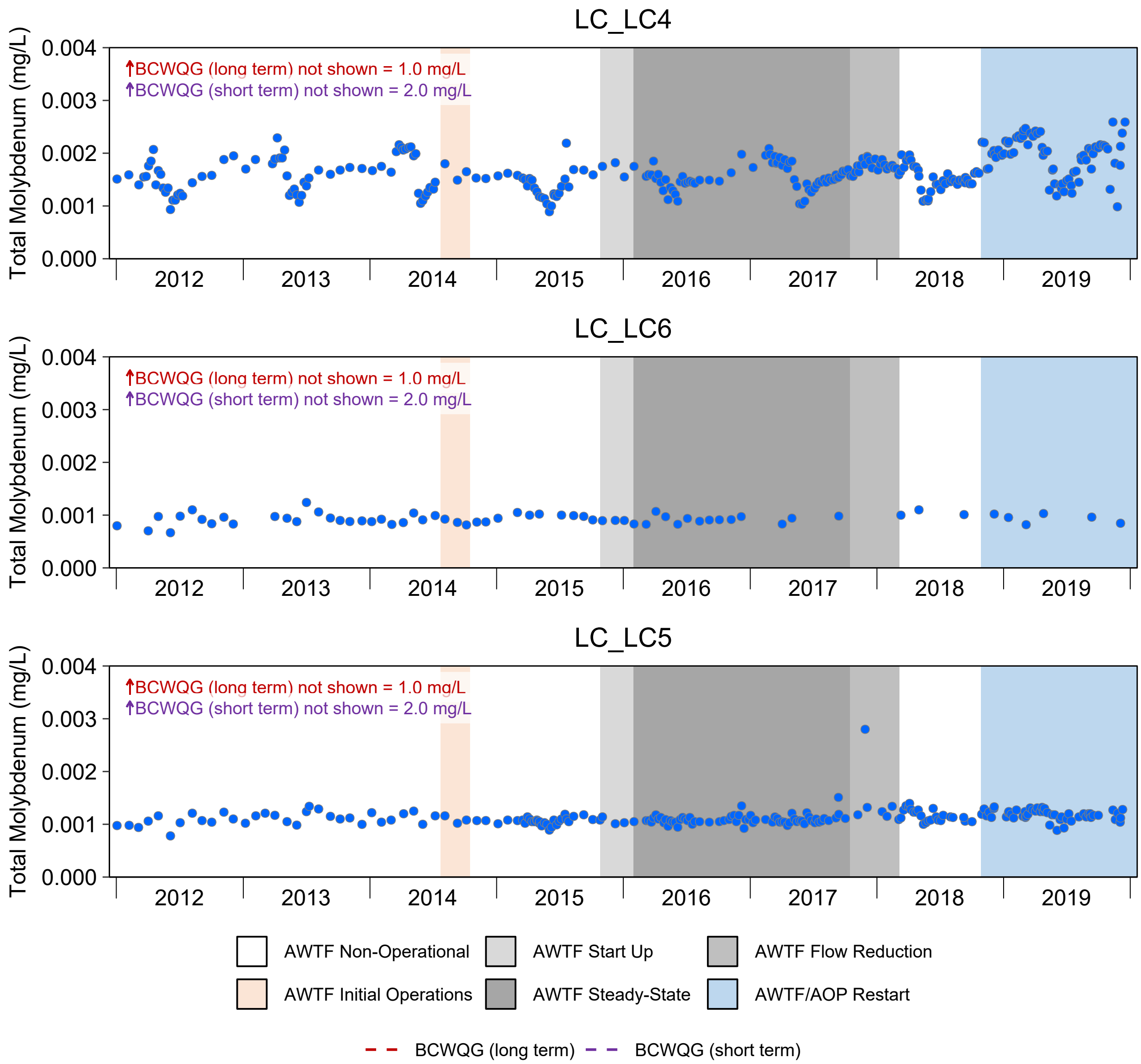

Figure C.21: Time Series Plots for Aqueous Total Molybdenum Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

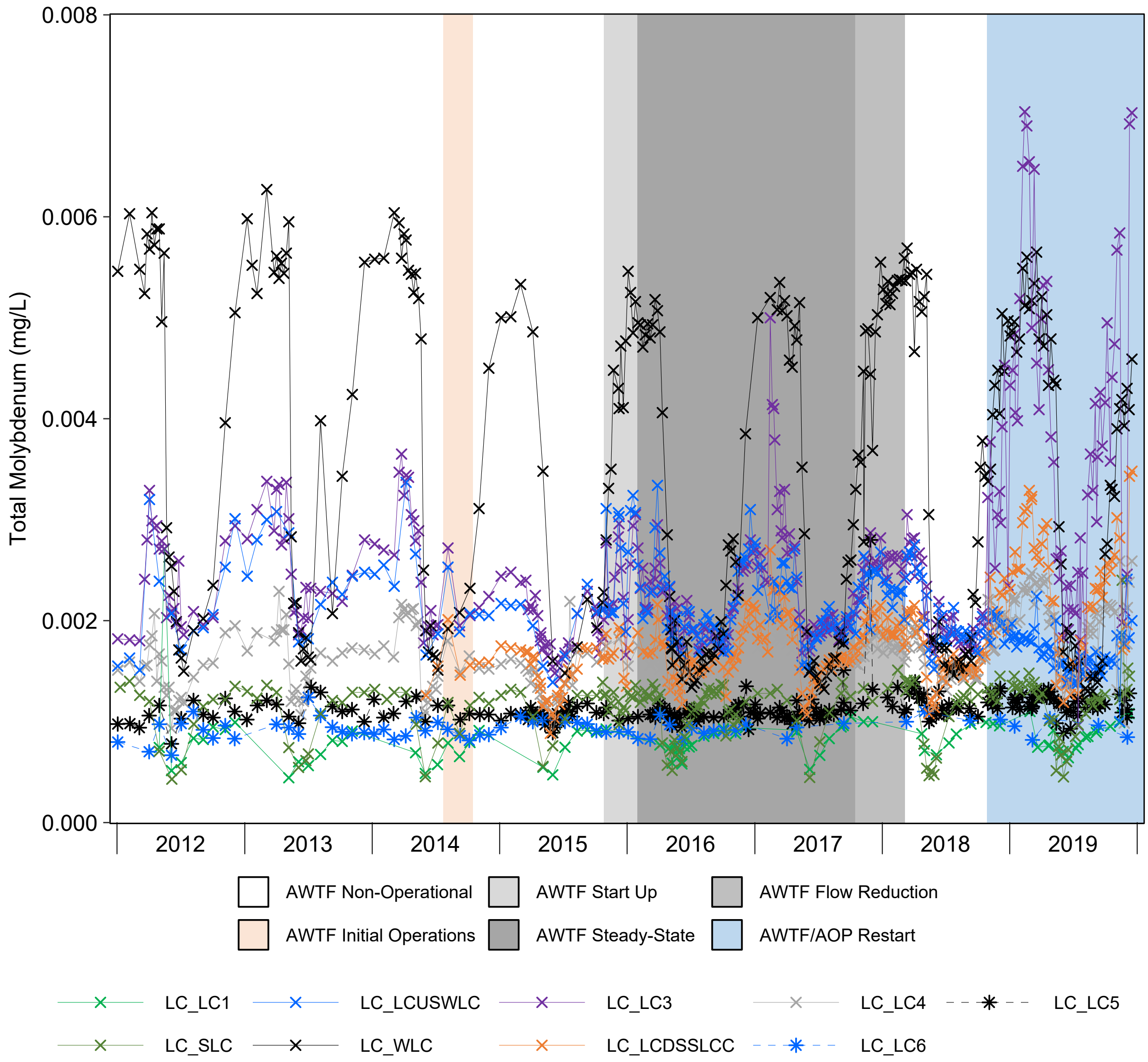

Figure C.22: Time Series Plots for Aqueous Total Molybdenum Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Note: West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

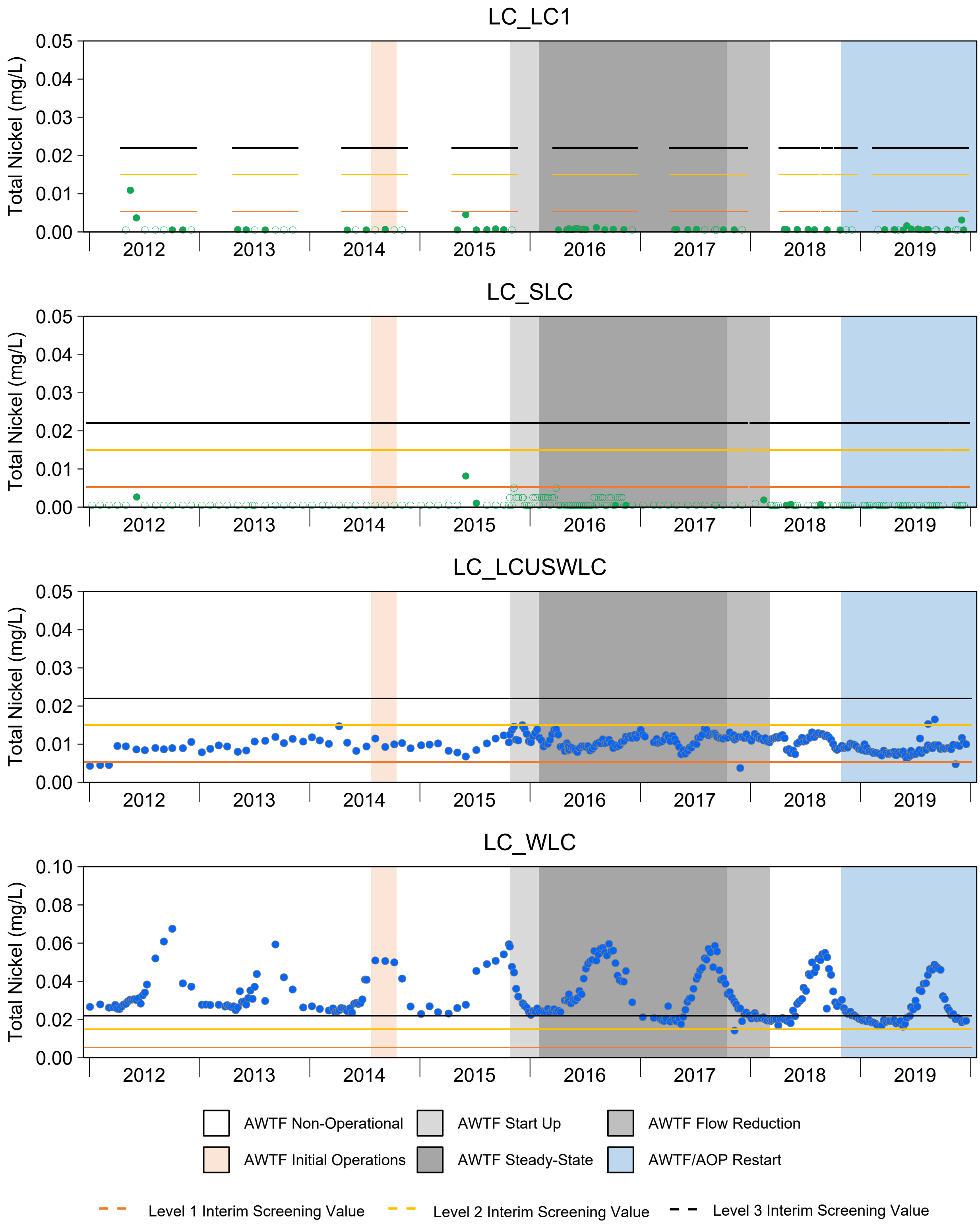

Figure C.23: Time Series Plots for Aqueous Total Nickel Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. BCWQG values are dependent on water hardness. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

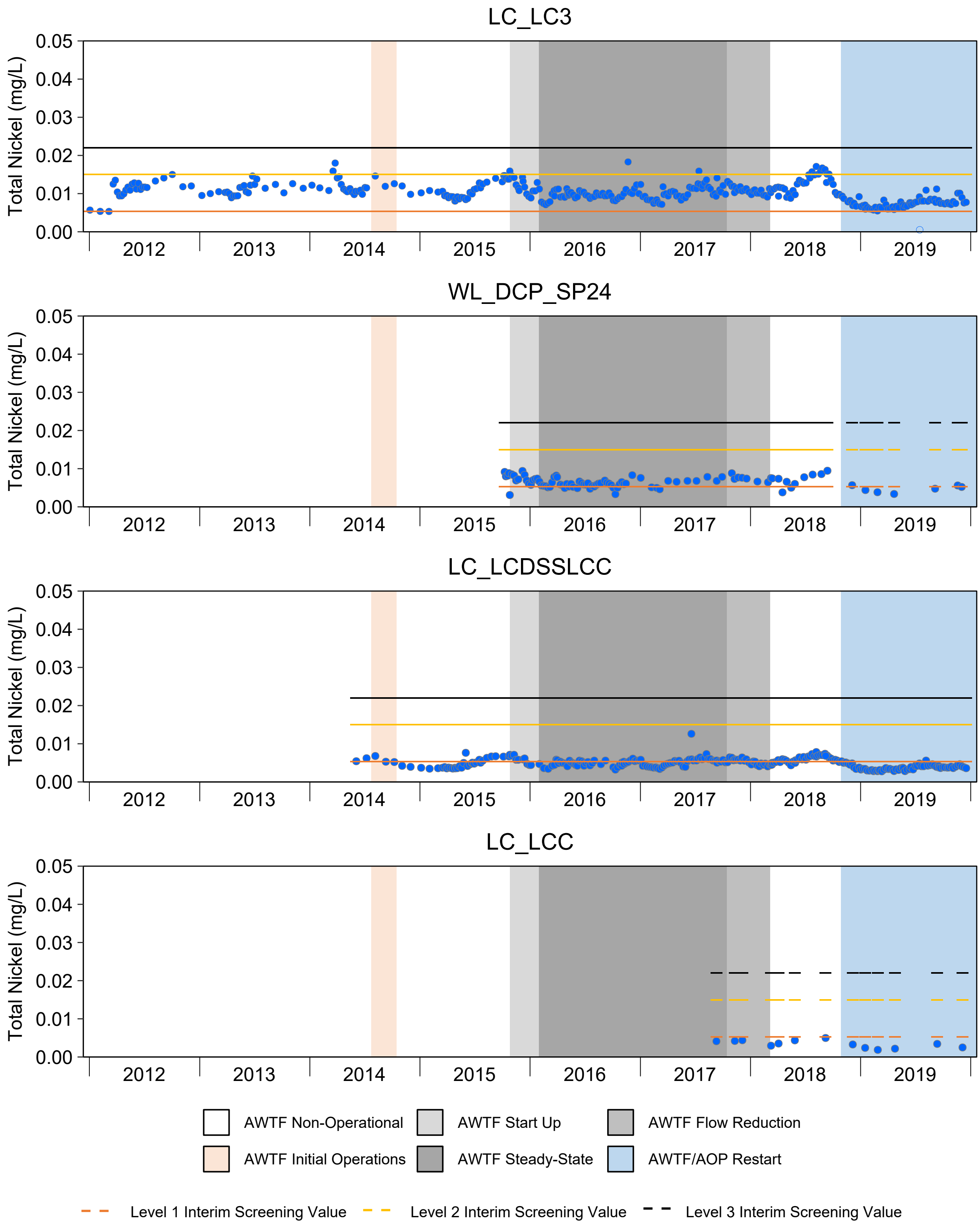

Figure C.23: Time Series Plots for Aqueous Total Nickel Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. BCWQG values are dependent on water hardness. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

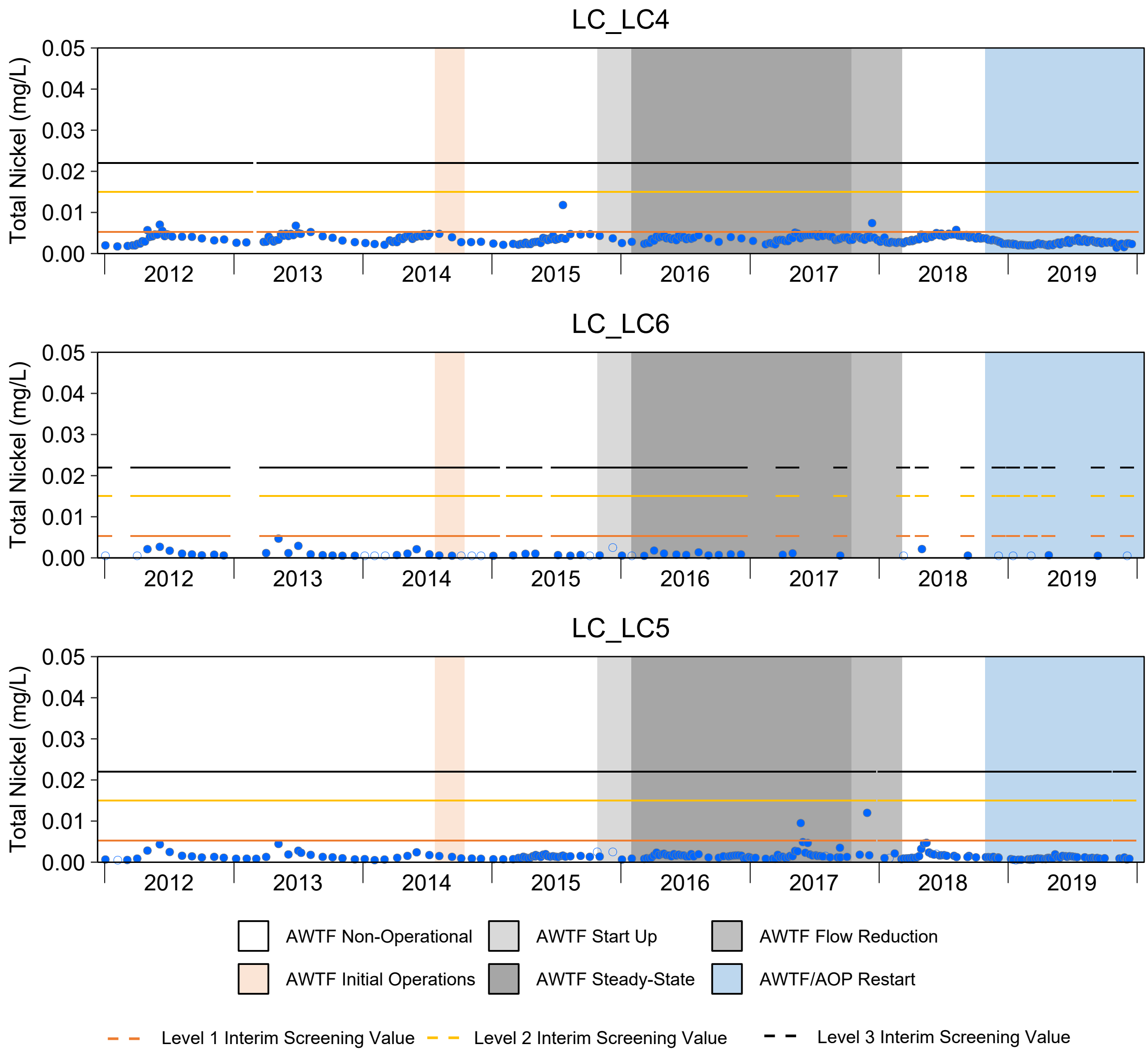

Figure C.23: Time Series Plots for Aqueous Total Nickel Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. BCWQG values are dependent on water hardness. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

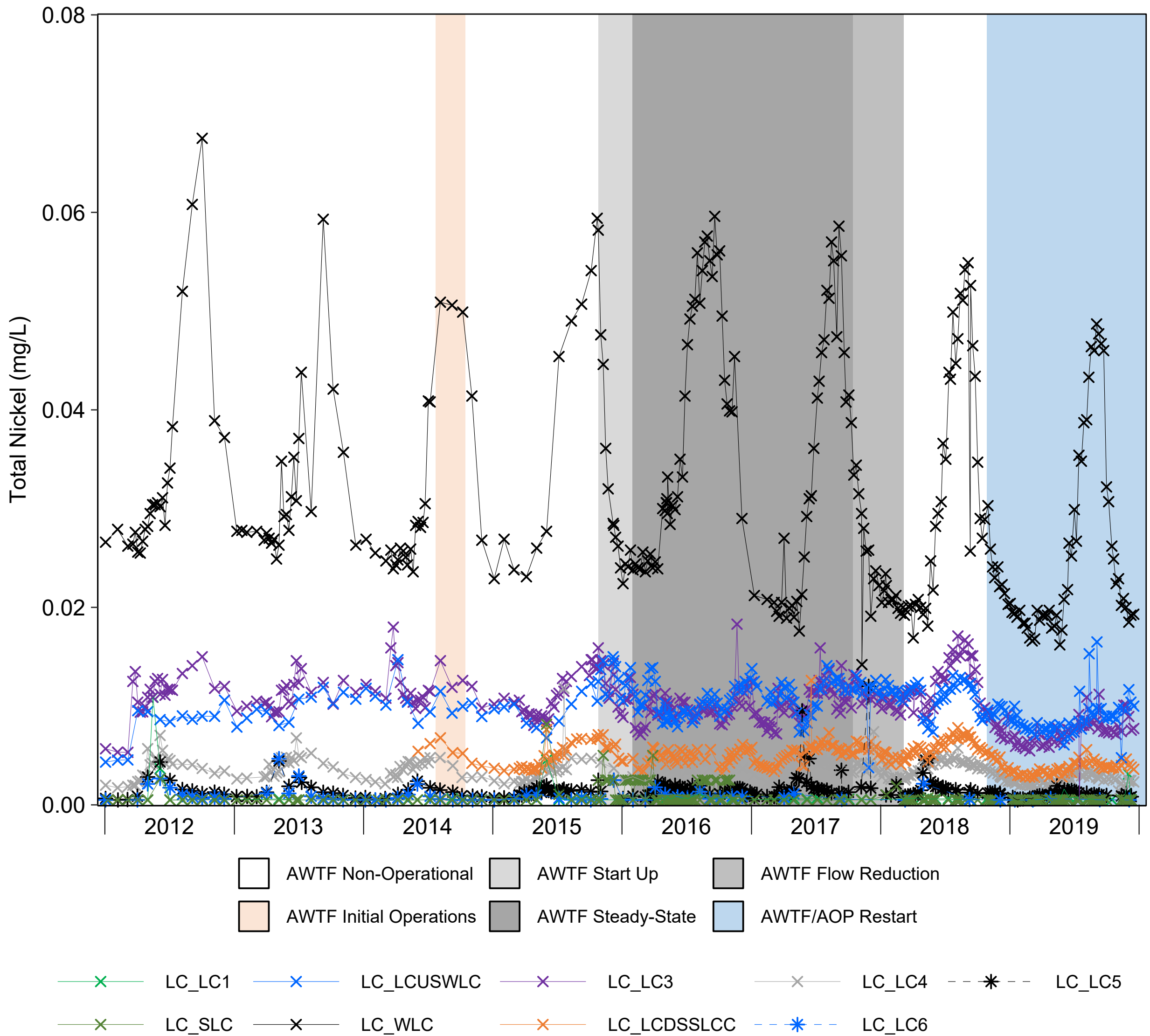

Figure C.24: Time Series Plots for Aqueous Total Nickel Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (0.0050 mg/L). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

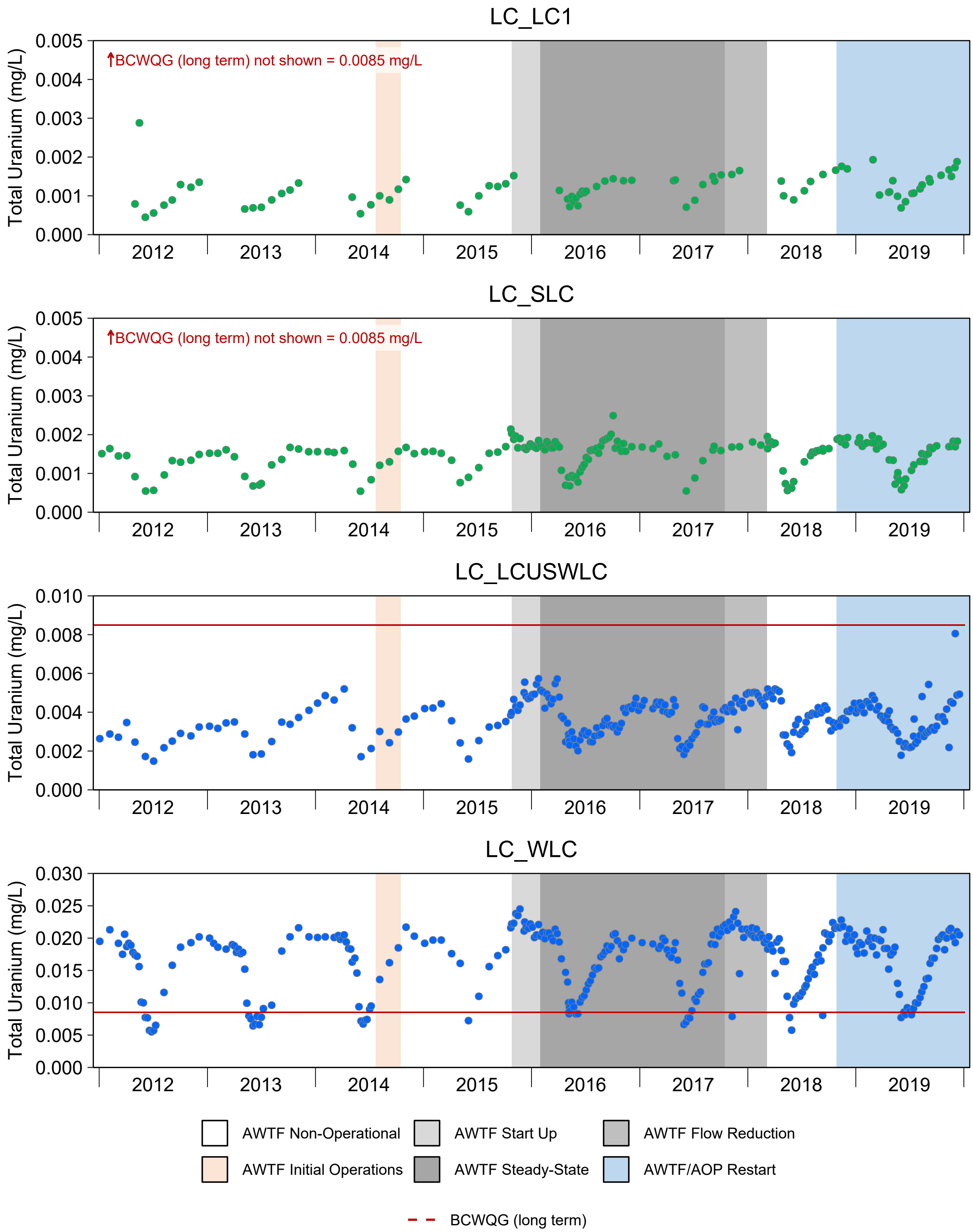

Figure C.25: **Time Series Plots for Aqueous Total Uranium Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019**

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

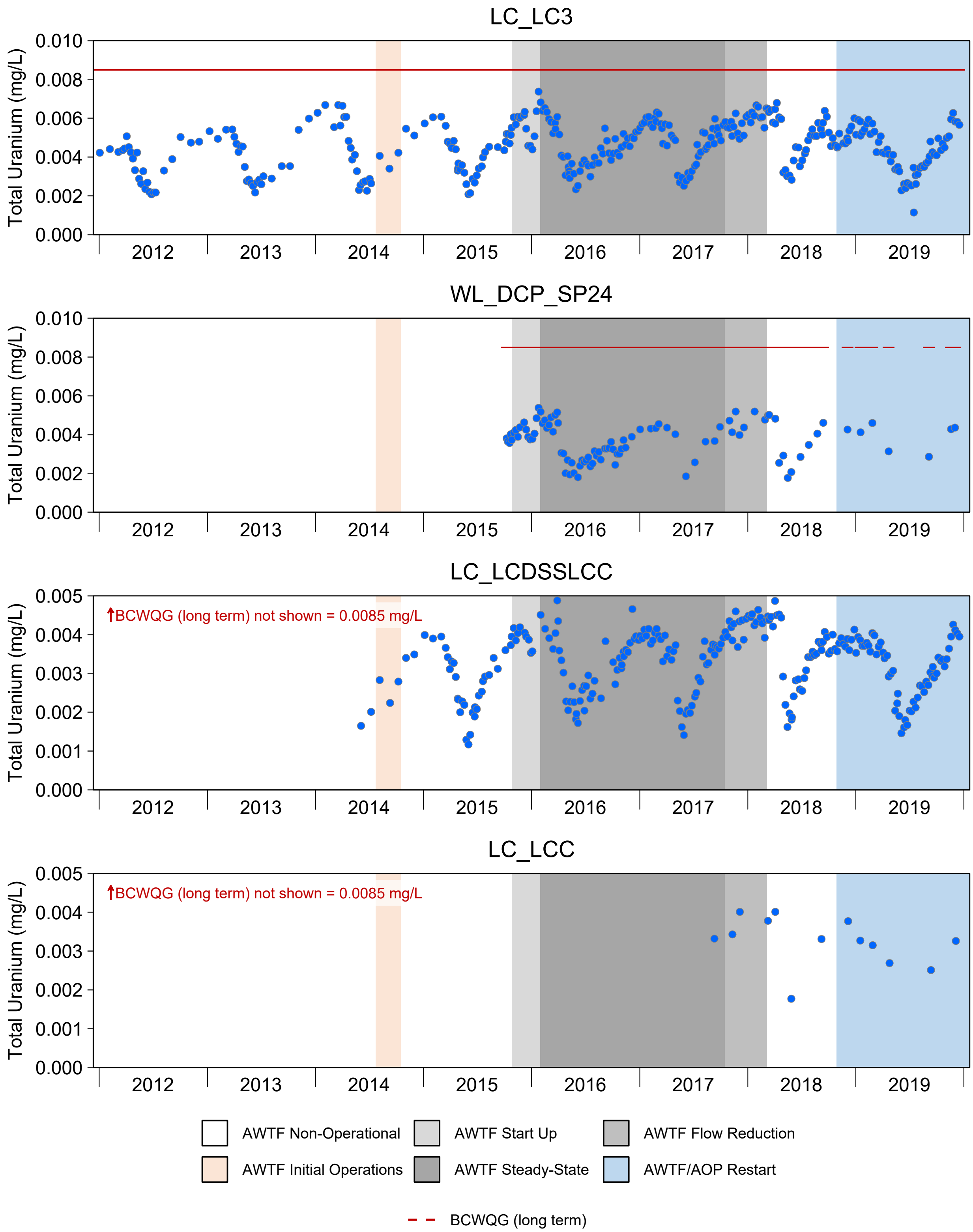

Figure C.25: Time Series Plots for Aqueous Total Uranium Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

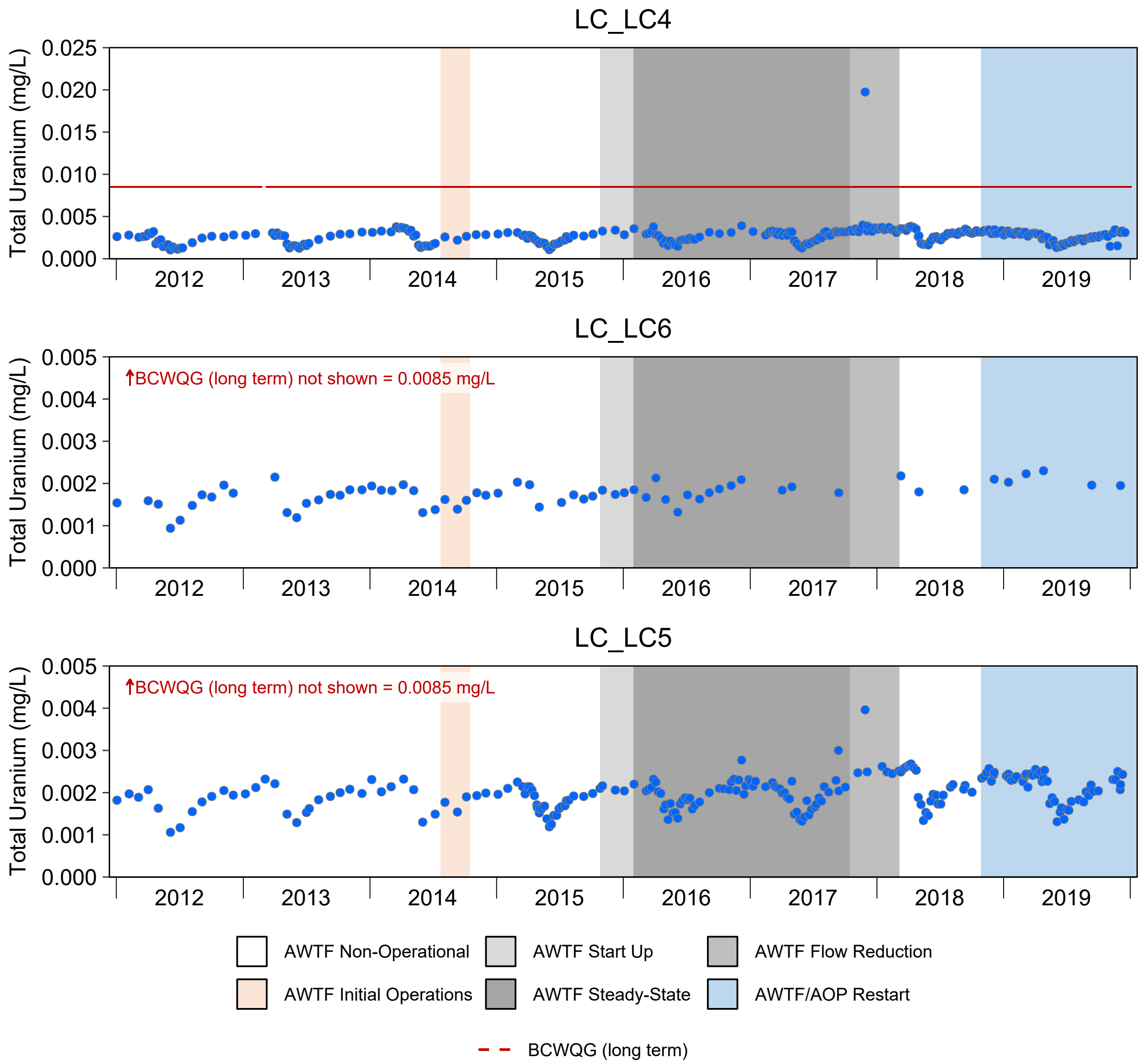

Figure C.25: Time Series Plots for Aqueous Total Uranium Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines are displayed for each monitoring area to provide context, but pertain only to mine-exposed monitoring areas downstream of the AWTF discharge.

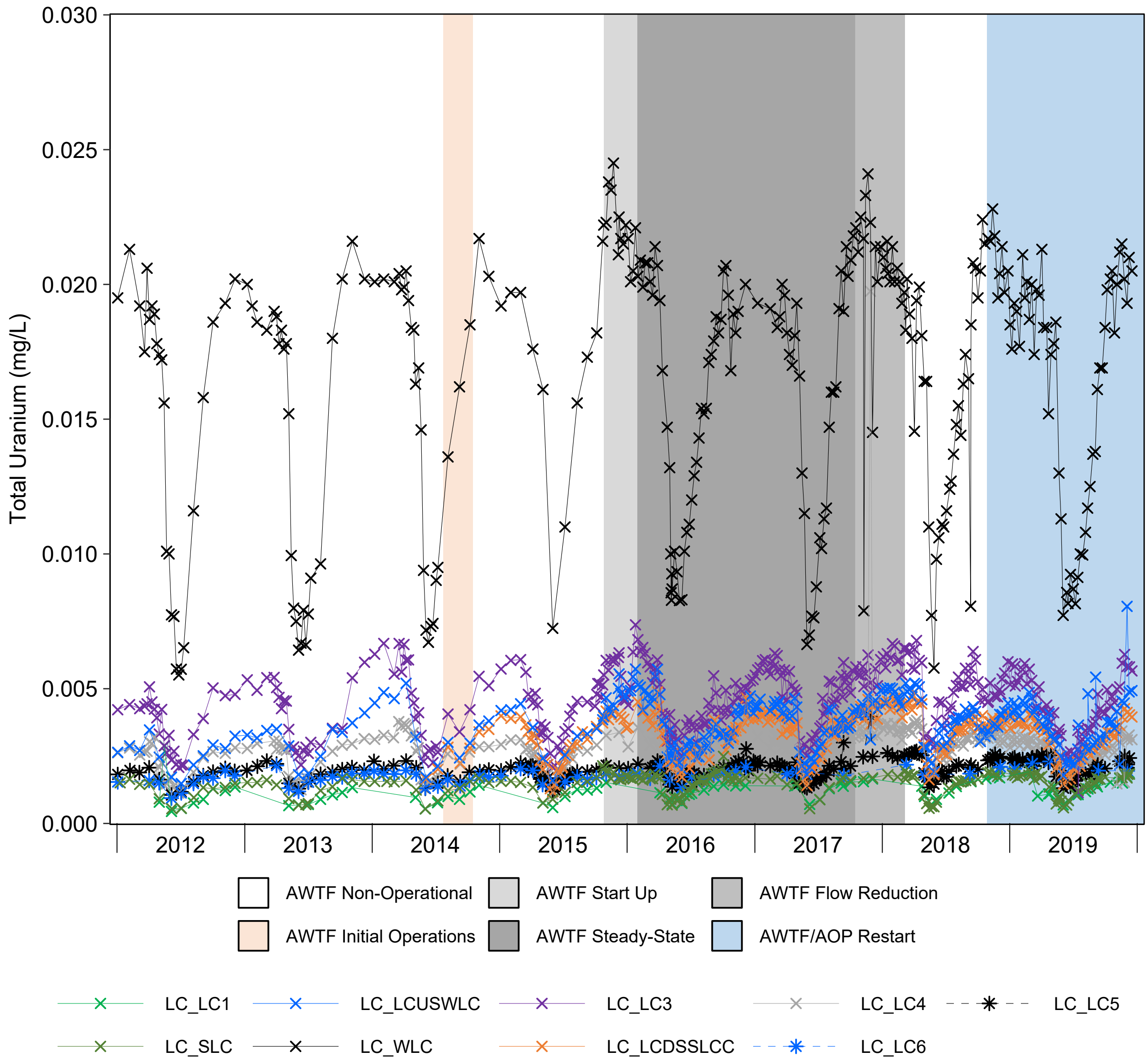

Figure C.26: Time Series Plots for Aqueous Total Uranium Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Note: West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

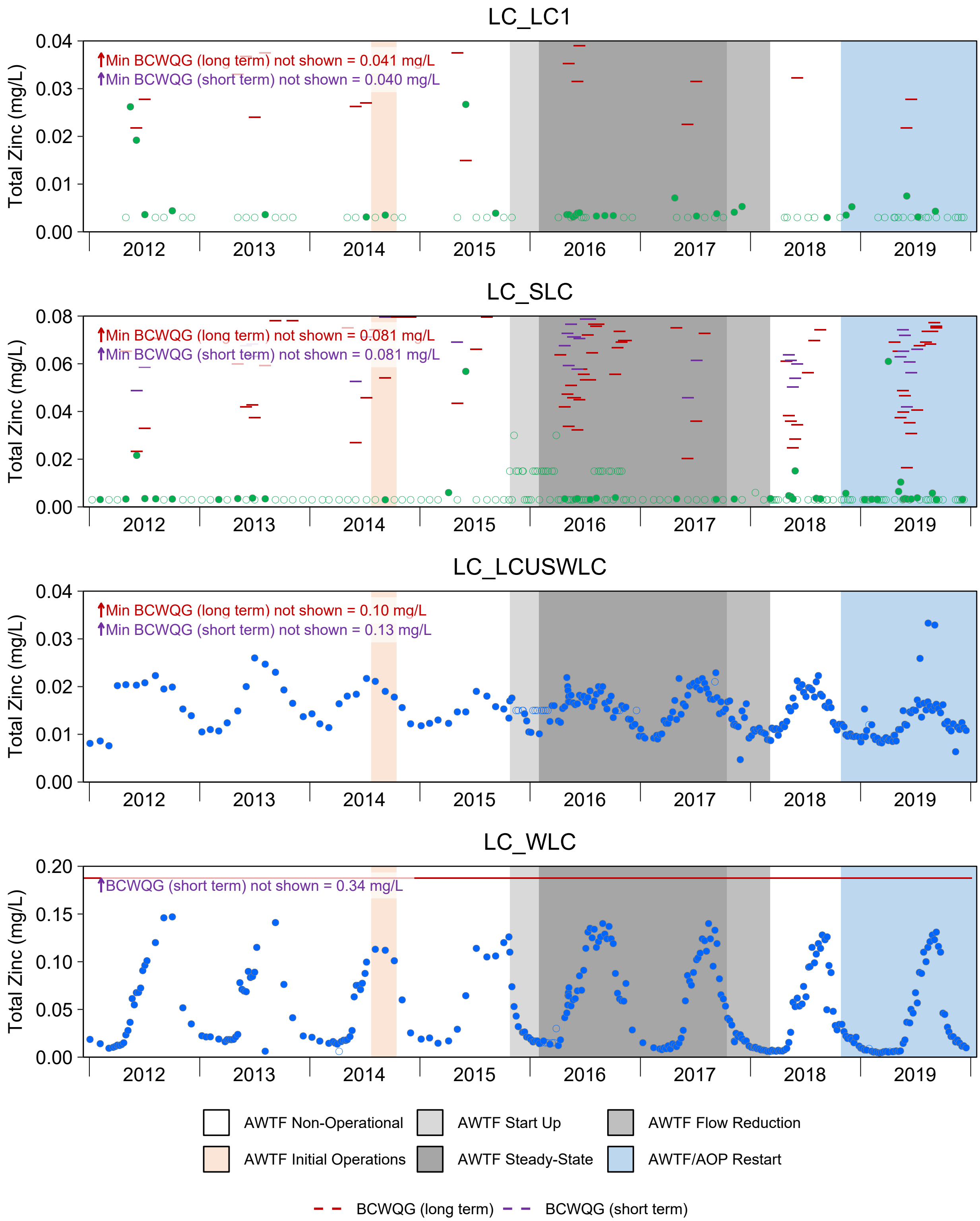

Figure C.27: Time Series Plots for Aqueous Total Zinc Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines; AWTF = Active Water Treatment Facility. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. BCWQG values are dependent on water hardness.

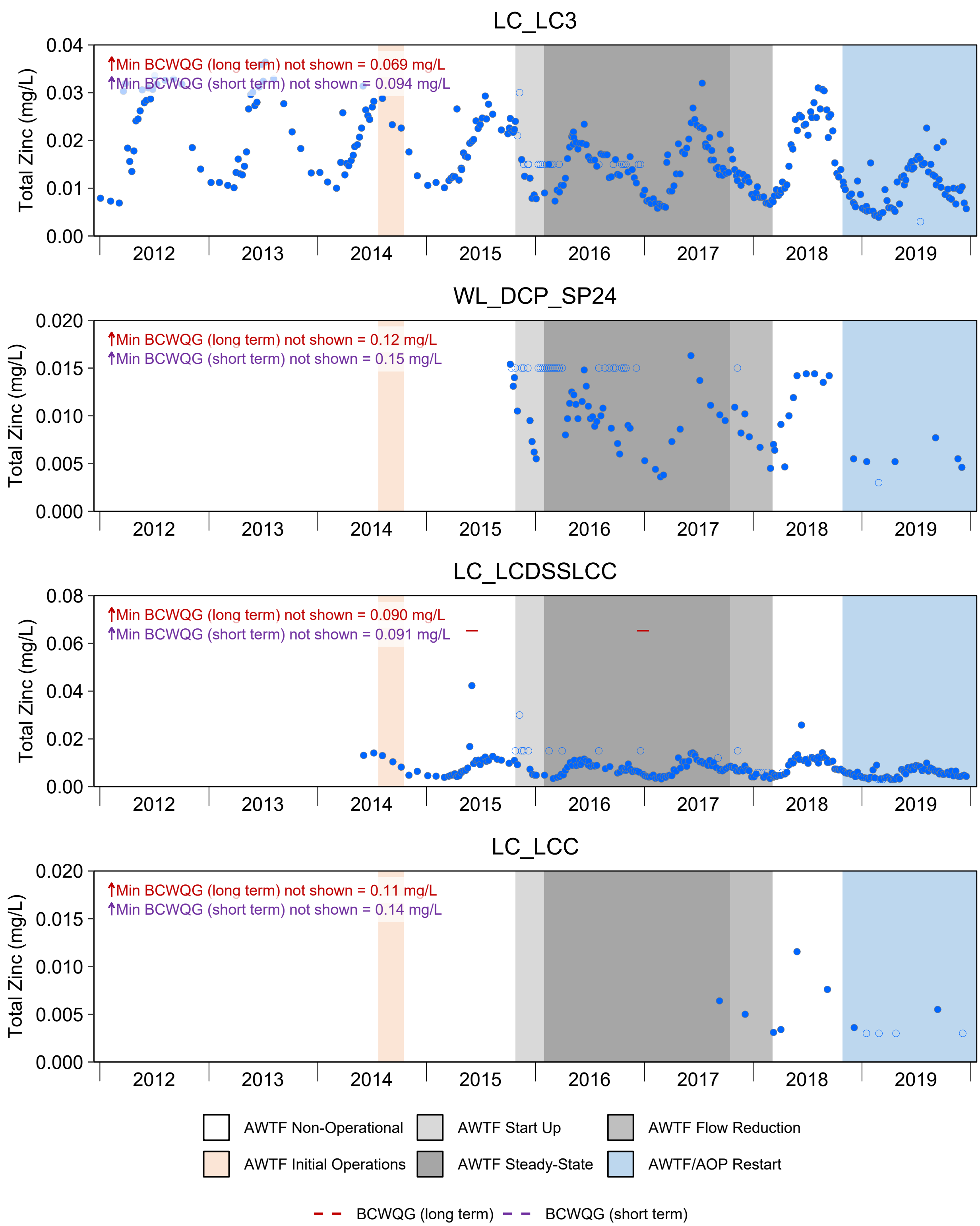

Figure C.27: Time Series Plots for Aqueous Total Zinc Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019

Notes: BCWQG = British Columbia Water Quality Guidelines; AWTF = Active Water Treatment Facility. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. BCWQG values are dependent on water hardness.

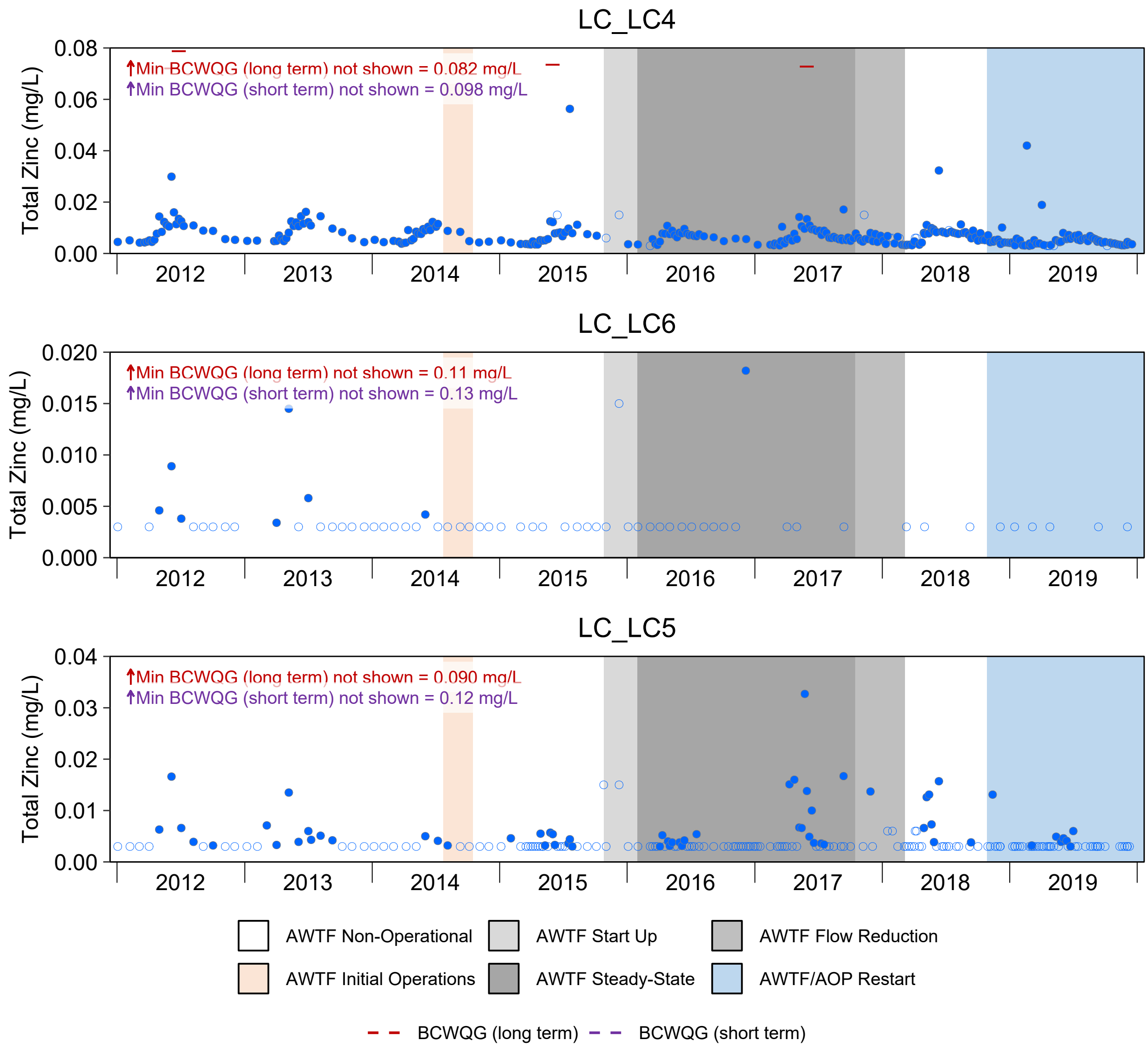

Figure C.27: **Time Series Plots for Aqueous Total Zinc Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019**

Notes: BCWQG = British Columbia Water Quality Guidelines; AWTF = Active Water Treatment Facility. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. BCWQG values are dependent on water hardness.

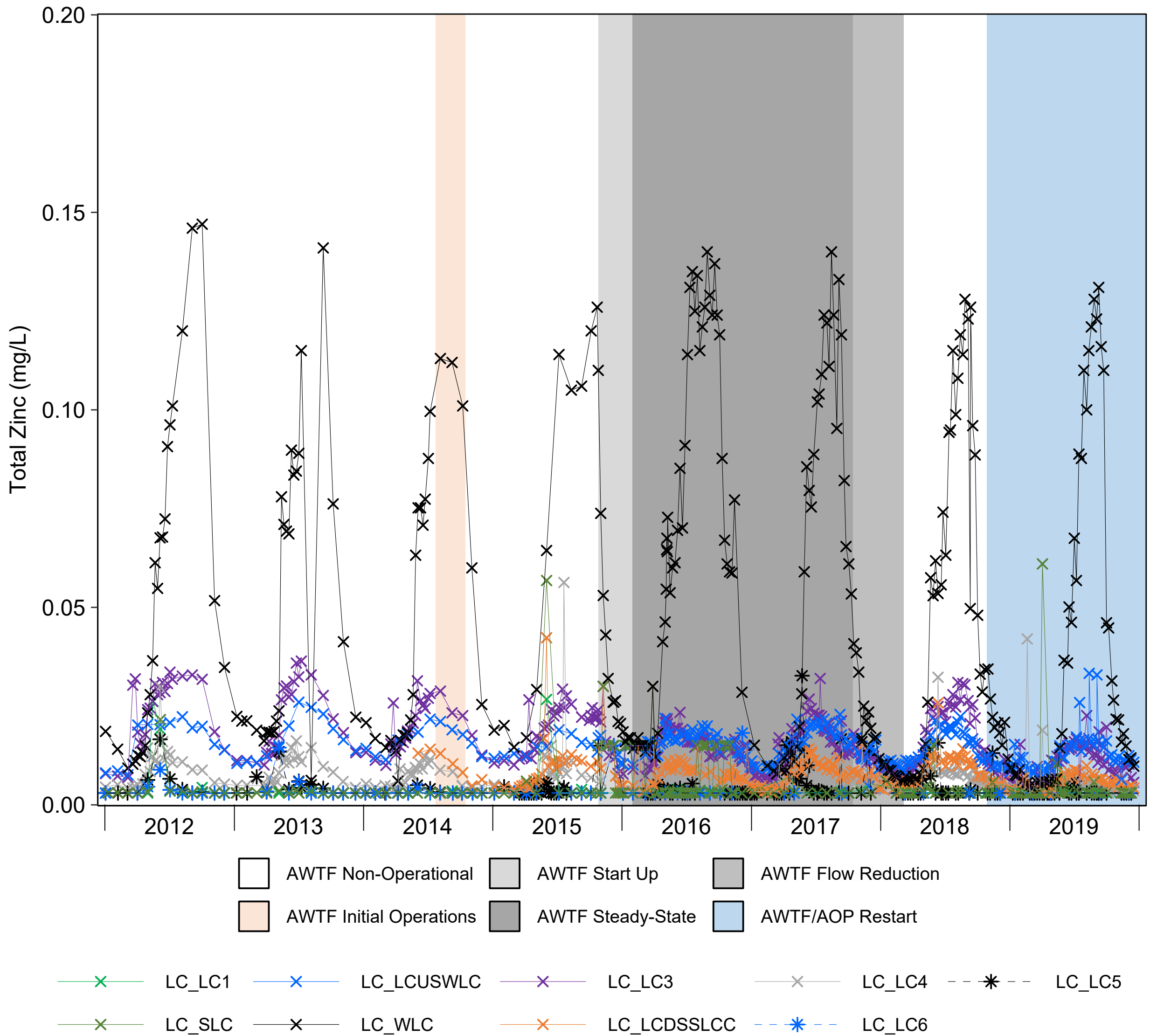

Figure C.28: **Time Series Plots for Aqueous Total Zinc Concentrations from the Line Creek LAEMP Sampling Stations, 2012 to 2019**

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (LRLs between 0.0030 and 0.030 mg/L). West Line Creek (WLC) Active Water Treatment Facility (AWTF) operational timelines pertain only to mine-exposed monitoring areas located downstream of the AWTF discharge.

Table C.1: British Columbia Water Quality Guidelines (BCWQG), Site-Specific Elk Valley Water Quality Plan (EVWQP) Benchmarks, and Interim Screening Values for Parameters Assessed in Line Creek LAEMP, 2019

Variable			Units	British Columbia Water Quality Guidelines[a]				Site-Specific Benchmark[b]
				Long-term Average	Short-term Maximum	Year	Status	
Non-Metals		Total Alkalinity	mg/L	For dissolved calcium = < 4mg/L, BCWQG = <10 For dissolved calcium = 4 to 8 mg/L, BCWQG = 10 to 20 For dissolved calcium = > 8 mg/L, BCWQG = > 20	-	2015	Working	-
Non-Metals		Unionized Ammonia[c]	mg/L	pH and Temperature dependent (tabular)	pH and Temperature dependent (tabular)	2009	Approved	-
Non-Metals		Chloride	mg/L	150	600	2003	Approved	-
Non-Metals		Fluoride	mg/L	-	For hardness ≤ 10 mg/L, BCWQG = 0.4 For hardness > 10 mg/L, BCWQG = [-51.73 + 92.57 × log10(hardness)]×0.01 Maximum applicable hardness = 385 mg/L	1990	Approved	-
Non-Metals		Nitrate-N	mg/L	3	33	2009	Approved	Level 1 EVWQP benchmark= $10^{1.0003[\log(hardness)]-1.52}$ Maximum applicable hardness = 500 mg/L Level 2 EVWQP benchmark= $10^{1.0003[\log(hardness)]-1.38}$ Maximum applicable hardness = 500 mg/L
Non-Metals		Nitrite-N[d]	mg/L	0.02 to 0.20	0.06 to 0.60	2009	Approved	-
Non-Metals		Dissolved oxygen[e]	mg/L	For buried embryo/alevin life stages, BCWQG (water column) = 11 BCWQG (interstitial) = 8 For other life stages, BCWQG (water column) = 8	For buried embryo/alevin life stages, BCWQG (water column) = 9 BCWQG (interstitial) = 6 For other life stages, BCWQG (water column) = 5	1997	Approved	-
Non-Metals		pH[f]	pH units	6.5 - 9.0		1991	Approved	-
Non-Metals		Sulphate[g]	mg/L	128 to 429 Maximum applicable hardness = 250 mg/L	-	2013	Approved	Level 1 EVWQP Benchmark = BCWQG = 429
Non-Metals		Total Dissolved Solids	mg/L	-	-	-	-	Level 1 EVWQP Benchmark = 1000
Metals and Metalloids	Total	Antimony (III)	mg/L	0.009	-	2015	Working	-
Metals and Metalloids	Total	Arsenic	mg/L	-	0.005	2002	Approved	-
Metals and Metalloids	Total	Barium	mg/L	1	-	2015	Working	-
Metals and Metalloids	Total	Beryllium	mg/L	0.00013	-	2015	Working	-
Metals and Metalloids	Total	Boron	mg/L	1.2	-	2003	Approved	-
Metals and Metalloids	Total	Chromium[h]	mg/L	For Cr(VI), BCWQG = 0.001 For Cr(III), BCWQG = 0.0089	-	2015	Working	-
Metals and Metalloids	Total	Cobalt	mg/L	0.004	0.11	2004	Approved	-
Metals and Metalloids	Total	Iron	mg/L	-	1	2008	Approved	-
Metals and Metalloids	Total	Lead[g]	mg/L	For hardness ≤ 8 mg/L, none proposed For hardness 8 to 360 mg/L, BCWQG = 0.001×{3.31+ exp[1.273 × ln(hardness) - 4.704]} No more than 20% of samples in a 30-d period should be >1.5X the guideline. Maximum applicable hardness = 360 mg/L	For hardness ≤ 8 mg/L, BCWQG ≤ 0.003 For hardness 8 to 360 mg/L, BCWQG = 0.001×{exp[1.273 × ln(hardness) - 1.460]} Maximum applicable hardness = 360 mg/L	1987	Approved	-
Metals and Metalloids	Total	Manganese[g]	mg/L	For hardness 37 to 450 mg/L, BCWQG ≤ 0.004 × hardness + 0.605 Maximum applicable hardness = 450 mg/L	For hardness 25 to 259 mg/L, BCWQG ≤ 0.01102 × hardness + 0.54 Maximum applicable hardness = 259 mg/L	2001	Approved	-
Metals and Metalloids	Total	Mercury[i]	mg/L	MeHg ≤ 0.5% of THg, BCWQG = 0.00002 Else, BCWQG = [0.0001/(MeHg/THg)] OR When MeHg = 0.5% of THg, BCWQG= 0.00002 When MeHg = 1.0% of THg, BCWQG = 0.00001 When MeHg = 8.0% of THg, BCWQG= 0.00000125	-	2001	Approved	-
Metals and Metalloids	Total	Molybdenum	mg/L	1	2	1986	Approved	-
Metals and Metalloids	Total	Nickel[g]	mg/L	-	-	-	-	Level 1 Interim Screening Value = 0.0053 Level 2 Interim Screening Value = 0.015 Level 3 Interim Screening Value = 0.022
Metals and Metalloids	Total	Selenium	μg/L	2	-	2014	Approved	Level 1 EVWQP Benchmark = 19 Level 2 EVWQP Benchmark = 74
Metals and Metalloids	Total	Silver[f]	mg/L	For hardness ≤ 100 mg/L, BCWQG = 0.00005 For hardness > 100 mg/L, BCWQG = 0.0015	For hardness ≤ 100 mg/L, BCWQG = 0.0001 For hardness > 100 mg/L, BCWQG = 0.003	1996	Approved	-
Metals and Metalloids	Total	Thallium	mg/L	0.0008	-	1997	Working	-
Metals and Metalloids	Total	Uranium	mg/L	0.0085	-	2011	Working	-
Metals and Metalloids	Total	Zinc[g]	mg/L	For hardness ≤ 90 mg/L, BCWQG = 0.0075 For hardness 90 to 330 mg/L, BCWQG = [7.5 + 0.75 (hardness - 90)]×0.001; Maximum applicable hardness = 330 mg/L	For hardness ≤ 90 mg/L, BCWQG = 0.033 For hardness 90 to 500 mg/L, BCWQG = [33 + 0.75 (hardness - 90)]×0.001; Maximum applicable hardness = 500 mg/L	1999	Approved	-
Metals and Metalloids	Dissolved	Aluminum	mg/L	When pH ≥ 6.5, BCWQG = 0.05 When pH < 6.5, BCWQG = exp[1.6 - 3.327(median pH)+ 0.402(median pH)2]	When pH ≥ 6.5, BCWQG = 0.1 When pH < 6.5, BCWQG = exp[1.209 - 2.426(pH)+ 0.286 (pH)2]	2001	Approved	-
Metals and Metalloids	Dissolved	Cadmium[g]	μg/L	For hardness = 3.4 to 285 mg/L, BCWQG = {exp[0.736×ln(hardness) - 4.943]} Maximum applicable hardness = 285 mg/L	For hardness = 7 to 455 mg/L, BCWQG = {exp[1.03×ln(hardness)-5.274]} Maximum applicable hardness = 455 mg/L	2015	Approved	Level 1 EVWQP Benchmark = $10^{0.83(\log(hardness))-2.53}$ Maximum applicable hardness = 285 mg/L
Metals and Metalloids	Dissolved	Copper	mg/L	Biotic Ligand Model	Biotic Ligand Model	2019	Approved	-
Metals and Metalloids	Dissolved	Iron	mg/L	-	BCWQG = 0.35 mg/L	2008	Approved	-

Note: "-" = no data available.

[a] British Columbia Working (BCMOE 2017) or Accepted (BCMOECCS 2019) Water Quality Guidelines for the Protection of Aquatic Life. For guidelines dependent on other analytes (e.g., hardness), guidelines were screened using concurrent values.

[b] When appropriate, site-specific Elk Valley Water Quality Plan Benchmarks (EVWQP; Teck 2014) or interim screening values were applied in addition to or instead of BC water quality guidelines. Interim screening values are displayed for nickel (Golder 2017b).

[c] Temperature and pH dependent; range of minimum and maximum values.

[d] Dependent on concurrent chloride, range of values reported (BCMOECCS 2019)

[e] Dissolved oxygen guidelines represent a minimum value, and so exceedances were quantified below this guideline.

[f] Unrestricted change permitted within this pH range.

[g] For hardness-based guidelines, concurrent hardness values were used for calculating guidelines. If hardness values exceeding the maximum applicable hardness, then guidelines were determined using the maximum applicable hardness. If hardness values is lower than the minimum hardness, then guidelines were determined using the minimum hardness.

[h] Chromium(VI) is the dominant oxidation state in oxygenated environments, and so its guideline was applied.

[i] The most conservative guideline (0.00000125 mg/L) was applied.

Table C.2: Summary of Water Chemistry Data for Key Parameters for the Line Creek LAEMP Monitoring Stations, 2019

Station	Summary Statistic	Total Dissolved Solids (mg/L)	Lab pH	Field pH	Dissolved Oxygen (mg/L)	Alkalinity (mg/L)	Nitrate-N (mg/L)	Nitrite-N (mg/L)	Ammonia (mg/L)	Sulphate (mg/L)	Total Chloride (mg/L)	Total Fluoride (mg/L)	Total Antimony (mg/L)	Total Arsenic (mg/L)	Total Barium (mg/L)	Total Beryllium (mg/L)	Total Boron (mg/L)	Total Chromium (mg/L)	Total Cobalt (mg/L)
	n	19	15	26	25	19	19	19	19	19	19	19	19	19	19	19	19	19	19
	Annual Minimum	119	8.07	6.83	10.1	94.1	0.126	<0.0010	<0.0050	18.6	<0.500	0.252	<0.00010	0.000140	0.0339	<0.000020	<0.0100	0.000160	<0.00010
	Annual Maximum	290	8.38	8.43	16.5	169	0.273	0.00590	0.0237	113	0.600	0.474	0.000150	0.000390	0.0511	<0.000020	<0.0100	0.00640	<0.00010
	Annual Mean	192	8.23	7.99	11.6	121	0.213	0.00126	0.00969	55.0	0.505	0.366	0.000103	0.000181	0.0420	<0.000020	<0.0100	0.000558	<0.00010
	Annual Median	192	8.27	8.07	11.5	120	0.222	<0.0010	0.00620	49.9	<0.500	0.361	<0.00010	0.000160	0.0418	<0.000020	<0.0100	0.000200	<0.00010
LC_LC1	% < LRL	0%	0%	0%	0%	0%	0%	95%	42%	0%	95%	0%	95%	0%	0%	100%	100%	0%	100%
	% > BCWQG[a]	-	0%	0%	0%	0%	0%	0%	0%	0%	0%	-	0%	-	0%	0%	0%	5%	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	0%	0%	-	0%	-	-	-	-	0%
	% > Level 1 Benchmark	0%	-	-	-	-	0%	-	-	0%	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	n	39	35	37	37	39	39	39	39	39	39	39	39	39	39	39	39	39	39
	Annual Minimum	110	7.94	7.00	10.4	104	0.0524	<0.0010	<0.0050	8.59	<0.500	0.195	<0.00010	<0.00010	0.0208	<0.000020	<0.0100	0.000120	<0.00010
	Annual Maximum	313	8.39	8.57	14.0	181	0.252	0.00190	0.0630	89.4	0.830	0.448	<0.00010	0.000180	0.0531	<0.000020	<0.0100	0.000450	<0.00010
	Annual Mean	216	8.23	8.05	11.9	139	0.120	0.00104	0.0124	53.0	0.559	0.323	<0.00010	0.000126	0.0384	<0.000020	<0.0100	0.000183	<0.00010
	Annual Median	228	8.24	8.14	12.0	140	0.122	<0.0010	0.00720	56.0	<0.500	0.332	<0.00010	0.000120	0.0401	<0.000020	<0.0100	0.000170	<0.00010
LC_SLC	% < LRL	0%	0%	0%	0%	0%	0%	92%	36%	0%	59%	0%	100%	10%	0%	100%	100%	3%	100%
	% > BCWQG[a]	-	0%	0%	0%	0%	0%	0%	0%	0%	0%	-	0%	-	0%	0%	0%	0%	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	0%	0%	-	0%	-	-	-	-	0%
	% > Level 1 Benchmark	0%	-	-	-	-	0%	-	-	0%	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	n	56	54	55	55	56	58	56	56	56	56	56	56	56	56	56	56	56	56
	Annual Minimum	269	6.77	6.68	9.96	46.8	4.06	<0.0010	<0.0050	86.8	1.29	0.0830	0.000240	0.000110	0.0237	<0.000020	<0.0100	0.000115	<0.00010
	Annual Maximum	1,030	8.42	8.64	12.7	257	18.9	0.0183	0.0407	490	22.8	0.266	0.000420	0.000270	0.0820	<0.000020	0.0190	0.000500	0.000350
	Annual Mean	604	8.15	7.85	11.0	193	12.8	0.00151	0.00846	234	6.17	0.214	0.000316	0.000147	0.0562	<0.000020	0.0146	0.000189	0.000111
	Annual Median	602	8.18	7.86	11.0	198	13.0	<0.0010	<0.0050	232	5.73	0.228	0.000310	0.000140	0.0604	<0.000020	0.0150	0.000170	<0.00010
LC_LCUSWLC	% < LRL	0%	0%	0%	0%	0%	0.0%	89%	55%	0%	0%	0%	0%	0%	0%	100%	2%	0%	88%
	% > BCWQG[a]	-	0%	0%	0%	0%	100%	0%	4%	2%	0%	-	0%	-	0%	0%	0%	0%	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	4%	-	0%	0%	-	0%	-	-	-	-	0%
	% > Level 1 Benchmark	2%	-	-	-	-	43%	-	-	2%	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	3%	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	n	51	51	53	53	51	53	51	51	51	51	51	51	51	51	51	51	51	51
	Annual Minimum	1,090	8.03	7.30	10.5	280	8.09	0.00150	<0.0050	503	<2.50	<0.100	0.000380	0.000140	0.0150	<0.000020	0.0120	<0.00010	<0.00010
	Annual Maximum	2,320	8.39	9.09	13.2	414	22.9	0.0375	0.0573	1,410	6.80	0.280	0.000590	0.000430	0.0263	<0.000040	0.0240	0.000660	<0.00020
	Annual Mean	1,840	8.23	7.88	11.3	347	16.8	0.00324	0.0106	987	4.82	0.189	0.000480	0.000252	0.0213	<0.000020	0.0170	0.000156	<0.00010
	Annual Median	1,950	8.23	7.93	11.2	344	17.0	0.00150	<0.0050	1,060	5.10	0.180	0.000490	0.000250	0.0222	<0.000020	0.0160	0.000130	<0.00010
LC_WLC	% < LRL	0%	0%	0%	0%	0%	0.0%	90%	55%	0%	6%	4%	0%	0%	0%	100%	24%	27%	100%
	% > BCWQG[a]	-	0%	2%	0%	0%	100%	2%	4%	100%	0%	-	0%	-	0%	0%	0%	0%	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	4%	-	0%	0%	-	0%	-	-	-	-	0%
	% > Level 1 Benchmark	100%	-	-	-	-	62%	-	-	100%	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	32%	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

> 5% of samples exceed the guideline or benchmark.
> 50% of samples exceed the guideline or benchmark.
> 95% of samples exceed the guideline or benchmark.

Notes: "LRL" = laboratory reporting limit, "BCWQG" = British Columbia Working or Accepted Water Quality Guideline

[a] Long-term average BCQWG for the Protection of Aquatic Life.

[b] Short-term maximum BCQWG for the Protection of Aquatic Life. For guidelines dependent on other analytes (e.g., hardness or chloride), guidelines were screened using concurrent concentrations. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the guidelines or benchmark. All summary statistics are reported to 3 significant figures.

Table C.2: Summary of Water Chemistry Data for Key Parameters for the Line Creek LAEMP Monitoring Stations, 2019

Station	Summary Statistic	Total Dissolved Solids (mg/L)	Lab pH	Field pH	Dissolved Oxygen (mg/L)	Alkalinity (mg/L)	Nitrate-N (mg/L)	Nitrite-N (mg/L)	Ammonia (mg/L)	Sulphate (mg/L)	Total Chloride (mg/L)	Total Fluoride (mg/L)	Total Antimony (mg/L)	Total Arsenic (mg/L)	Total Barium (mg/L)	Total Beryllium (mg/L)	Total Boron (mg/L)	Total Chromium (mg/L)	Total Cobalt (mg/L)
	n	57	55	74	74	81	81	81	81	81	57	57	57	57	57	57	57	57	57
	Annual Minimum	174	7.34	6.08	9.85	134	0.0256	<0.0010	<0.0050	26.8	<0.500	<0.100	<0.00010	<0.00010	0.0239	<0.000020	<0.0100	<0.00010	<0.00010
	Annual Maximum	1,020	8.47	8.24	546	284	18.0	0.0140	0.283	523	50.4	0.279	0.000390	0.000210	0.0830	0.0000200	0.0190	0.000880	0.000390
	Annual Mean	725	8.19	7.74	18.6	207	9.79	0.00172	0.0175	324	19.3	0.216	0.000286	0.000128	0.0515	0.0000200	0.0148	0.000189	0.000161
	Annual Median	765	8.18	7.83	11.3	211	9.64	<0.0010	0.00700	356	20.9	0.222	0.000280	0.000120	0.0536	<0.000020	0.0150	0.000165	0.000140
LC_LC3	% < LRL	0%	0%	0%	0%	0%	0%	83%	32%	0%	2%	2%	2%	25%	0%	98%	2%	7%	14%
	% > BCWQG[a]	-	0%	1%	0%	0%	99%	0%	20%	35%	0%	-	0%	-	0%	0%	0%	0%	0%
	% > BCWQG[b]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 1 Benchmark	4%	-	-	-	-	33%	-	-	21%	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	27%	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	n	6	2	4	4	6	6	4	6	6	6	6	6	6	6	6	6	6	6
	Annual Minimum	541	8.37	7.67	10.1	192	6.75	<0.0010	<0.0050	198	5.87	0.208	0.000170	<0.00010	0.0519	<0.000020	0.0120	0.000140	<0.00010
	Annual Maximum	775	8.40	8.35	12.6	231	12.2	0.00380	0.0114	339	22.9	0.276	0.000290	0.000170	0.0668	<0.000020	0.0140	0.000200	<0.00010
	Annual Mean	652	8.38	8.08	11.6	203	8.99	0.00232	0.00885	269	12.7	0.241	0.000217	0.000130	0.0608	<0.000020	0.0128	0.000167	<0.00010
	Annual Median	652	8.38	8.14	11.8	198	8.12	0.00225	0.00960	266	11.6	0.237	0.000205	0.000130	0.0637	<0.000020	0.0130	0.000160	<0.00010
WL_DCP_SP24	% < LRL	0%	0%	0%	0%	0%	0.0%	25%	17%	0%	0%	0%	0%	33%	0%	100%	0%	0%	100%
	% > BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%	0%	0%	-	0%	-	0%	0%	0%	0%	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	0%	0%	-	0%	-	-	-	-	0%
	% > Level 1 Benchmark	0%	-	-	-	-	0%	-	-	0%	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	n	54	54	52	52	54	54	54	54	54	54	54	54	54	54	54	54	54	54
	Annual Minimum	228	6.65	7.49	10.1	100	2.77	<0.0010	<0.0050	73.5	1.72	<0.100	0.000150	<0.00010	0.0269	<0.000020	<0.0100	<0.00010	<0.00010
	Annual Maximum	760	8.50	8.47	14.2	224	11.9	0.0150	0.0499	340	23.4	0.272	0.000230	0.000190	0.0850	<0.000020	0.0140	0.000640	0.000160
	Annual Mean	552	8.25	8.13	11.5	186	7.34	0.00203	0.0127	219	10.9	0.222	0.000188	0.000121	0.0616	<0.000020	0.0118	0.000191	0.000101
	Annual Median	566	8.27	8.16	11.5	191	7.67	0.00100	0.00690	226	10.4	0.230	0.000190	0.000120	0.0638	<0.000020	0.0120	0.000170	<0.00010
LC_LCDSSLCC	% < LRL	0%	0%	0%	0%	0%	0.0%	57%	39%	0%	0%	2%	0%	28%	0%	100%	17%	4%	98%
	% > BCWQG[a]	-	0%	0%	0%	0%	98%	0%	0%	0%	0%	-	0%	-	0%	0%	0%	0%	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	0%	0%	-	0%	-	-	-	-	0%
	% > Level 1 Benchmark	0%	-	-	-	-	0%	-	-	0%	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	n	5	2	4	4	5	5	4	5	5	5	5	5	5	5	5	5	5	5
	Annual Minimum	445	8.29	7.60	10.7	183	5.74	<0.0010	<0.0050	161	7.62	0.149	0.000130	0.000110	0.0624	<0.000020	0.0110	0.000120	<0.00010
	Annual Maximum	652	8.34	8.12	13.4	225	8.30	0.00170	0.00940	254	15.1	0.249	0.000170	0.000160	0.0818	<0.000020	0.0130	0.000180	<0.00010
	Annual Mean	558	8.32	7.94	12.5	197	6.70	0.00127	0.00608	217	11.4	0.220	0.000152	0.000126	0.0731	<0.000020	0.0122	0.000144	<0.00010
	Annual Median	585	8.32	8.02	13.0	189	6.51	0.00120	0.00510	241	12.4	0.234	0.000150	0.000120	0.0766	<0.000020	0.0120	0.000140	<0.00010
LC_LCC	% < LRL	0%	0%	0%	0%	0%	0.0%	25%	20%	0%	0%	0%	0%	0%	0%	100%	0%	0%	100%
	% > BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%	0%	0%	-	0%	-	0%	0%	0%	0%	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	0%	0%	-	0%	-	-	-	-	0%
	% > Level 1 Benchmark	0%	-	-	-	-	0%	-	-	0%	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Table C.2: Summary of Water Chemistry Data for Key Parameters for the Line Creek LAEMP Monitoring Stations, 2019

Station	Summary Statistic	Total Dissolved Solids (mg/L)	Lab pH	Field pH	Dissolved Oxygen (mg/L)	Alkalinity (mg/L)	Nitrate-N (mg/L)	Nitrite-N (mg/L)	Ammonia (mg/L)	Sulphate (mg/L)	Total Chloride (mg/L)	Total Fluoride (mg/L)	Total Antimony (mg/L)	Total Arsenic (mg/L)	Total Barium (mg/L)	Total Beryllium (mg/L)	Total Boron (mg/L)	Total Chromium (mg/L)	Total Cobalt (mg/L)
LC_LC4	n	60	56	57	58	60	60	60	60	60	60	60	60	60	60	60	60	60	60
	Annual Minimum	226	6.83	7.64	9.55	85.5	2.18	<0.0010	<0.0050	57.9	1.51	0.111	0.000110	<0.00010	0.0297	<0.000020	<0.0100	0.000130	<0.00010
	Annual Maximum	628	8.53	8.65	16.1	248	8.09	0.00520	0.116	242	15.6	0.332	0.000200	0.000240	0.0854	<0.000020	0.0130	0.000610	<0.00010
	Annual Mean	451	8.29	8.29	11.7	173	5.44	0.00137	0.0119	167	7.98	0.269	0.000152	0.000133	0.0619	<0.000020	0.0109	0.000202	<0.00010
	Annual Median	466	8.33	8.30	11.7	178	5.72	0.00100	0.00580	178	8.32	0.282	0.000150	0.000130	0.0640	<0.000020	0.0110	0.000180	<0.00010
	% < LRL	0%	0%	0%	0%	0%	0.0%	45%	37%	0%	0%	0%	0%	8%	0%	100%	23%	0%	100%
	% > BCWQG[a]	-	0%	0%	0%	0%	97%	0%	0%	0%	0%	-	0%	-	0%	0%	0%	0%	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	0%	0%	-	0%	-	-	-	-	0%
	% > Level 1 Benchmark	0%	-	-	-	-	0%	-	-	0%	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LC_LC6	n	5	2	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Annual Minimum	489	8.35	7.10	10.7	197	9.18	0.00110	<0.0050	160	1.33	0.150	<0.00010	<0.00010	0.0979	<0.000020	<0.0100	0.000110	<0.00010
	Annual Maximum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Annual Mean	557	8.36	7.84	12.9	216	10.3	0.00326	0.0211	201	1.82	0.168	0.000102	0.000112	0.104	<0.000020	<0.0100	0.000124	0.000108
	Annual Median	564	8.36	8.00	12.7	204	10.2	0.00280	0.00830	208	1.80	0.163	<0.00010	0.000100	0.104	<0.000020	<0.0100	0.000130	<0.00010
	% < LRL	0%	0%	0%	0%	0%	0.0%	0%	20%	0%	0%	0%	60%	40%	0%	100%	100%	0%	80%
	% > BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%	0%	0%	-	0%	-	0%	0%	0%	0%	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	0%	0%	-	0%	-	-	-	-	0%
	% > Level 1 Benchmark	0%	-	-	-	-	0%	-	-	0%	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LC_LC5	n	44	41	42	43	44	44	44	44	44	44	44	44	44	44	44	44	44	44
	Annual Minimum	261	6.88	7.21	9.37	140	4.04	<0.0010	<0.0050	81.7	0.990	0.123	<0.00010	<0.00010	0.0559	<0.000020	<0.0100	<0.00010	<0.00010
	Annual Maximum	586	8.51	8.43	15.4	257	11.3	0.00930	0.0480	238	4.90	0.241	0.000200	0.000250	0.108	<0.000020	0.0110	0.000440	0.000240
	Annual Mean	486	8.28	8.18	11.8	192	8.27	0.00276	0.0131	176	3.30	0.200	0.000119	0.000124	0.0890	<0.000020	0.0101	0.000177	0.000110
	Annual Median	520	8.31	8.24	11.9	191	8.76	0.00230	0.00710	192	3.76	0.208	0.000110	0.000110	0.0928	<0.000020	<0.0100	0.000170	<0.00010
	% < LRL	0%	0%	0%	0%	0%	0.0%	16%	36%	0%	0%	0%	30%	39%	0%	100%	89%	5%	70%
	% > BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%	0%	0%	-	0%	-	0%	0%	0%	0%	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	0%	0%	-	0%	-	-	-	-	0%
	% > Level 1 Benchmark	0%	-	-	-	-	0%	-	-	0%	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Table C.2: Summary of Water Chemistry Data for Key Parameters for the Line Creek LAEMP Monitoring Stations, 2019

Station	Summary Statistic	Total Iron (mg/L)	Total Lead (mg/L)	Total Lithium (mg/L)	Total Manganese (mg/L)	Total Mercury (mg/L)	Total Molybdenum (mg/L)	Total Nickel (mg/L)	Total Selenium (mg/L)	Total Silver (mg/L)	Total Thallium (mg/L)	Total Uranium (mg/L)	Total Zinc (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)
LC_LC1	n	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
	Annual Minimum	<0.0100	<0.000050	0.00210	<0.00010	<0.00000050	0.000642	<0.00050	0.00139	<0.000010	<0.000010	0.000689	<0.0030	<0.0030	<0.0000050	<0.00020	<0.0100
	Annual Maximum	0.240	0.000333	0.00380	0.00634	0.00000232	0.00110	0.00311	0.00362	0.0000110	0.0000210	0.00193	0.00750	0.00340	0.0000248	<0.00050	<0.0100
	Annual Mean	0.0236	0.0000649	0.00309	0.000569	0.000000603	0.000870	0.000746	0.00259	0.0000101	0.0000106	0.00130	0.00331	0.00305	0.00000914	<0.00020	<0.0100
	Annual Median	<0.0100	<0.000050	0.00320	0.000130	<0.00000050	0.000853	0.000530	0.00265	<0.000010	<0.000010	0.00128	<0.0030	<0.0030	0.00000740	<0.00050	<0.0100
	% < LRL	79%	95%	0%	32%	79%	0%	32%	0%	95%	95%	0%	84%	79%	42%	100%	100%
	% > BCWQG[a]	-	0%	-	0%	5%	0%	-	74%	0%	0%	0%	0%	0%	0%	53%	-
	% > BCWQG[b]	0%	0%	-	0%	-	0%	-	-	0%	-	-	0%	0%	0%	0%	0%
	% > Level 1 Benchmark	-	-	-	-	-	-	0%	0%	-	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	0%	0%	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-
LC_SLC	n	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
	Annual Minimum	<0.0100	<0.000050	0.00110	<0.00010	<0.00000050	0.000452	<0.00050	0.000488	<0.000010	<0.000010	0.000581	<0.0030	<0.0030	0.00000640	<0.00020	<0.0100
	Annual Maximum	0.0310	0.0000810	0.00480	0.00140	0.00000115	0.00240	<0.00050	0.00188	0.0000110	<0.000010	0.00197	0.0610	0.00400	0.0000226	<0.00050	0.0160
	Annual Mean	0.0116	0.0000508	0.00327	0.000335	0.000000566	0.00118	<0.00050	0.00133	0.0000100	<0.000010	0.00149	0.00492	0.00303	0.0000118	0.000267	0.0102
	Annual Median	<0.0100	<0.000050	0.00340	0.000170	<0.00000050	0.00124	<0.00050	0.00150	<0.000010	<0.000010	0.00167	<0.0030	<0.0030	0.0000118	0.000220	<0.0100
	% < LRL	79%	97%	0%	28%	74%	0%	100%	0%	97%	100%	0%	64%	95%	0%	90%	97%
	% > BCWQG[a]	-	0%	-	0%	0%	0%	-	0%	0%	0%	0%	0%	0%	0%	41%	-
	% > BCWQG[b]	0%	0%	-	0%	-	0%	-	-	0%	-	-	0%	0%	0%	0%	0%
	% > Level 1 Benchmark	-	-	-	-	-	-	0%	0%	-	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	0%	0%	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-
LC_LCUSWLC	n	56	56	56	56	56	56	56	61	56	56	56	56	56	56	56	56
	Annual Minimum	<0.0100	<0.000050	0.0182	<0.00010	<0.00000050	0.00100	0.00478	0.0142	<0.000010	<0.000010	0.00178	0.00635	<0.0030	0.000140	0.000230	<0.0100
	Annual Maximum	0.145	0.000216	0.0591	0.00432	0.00000207	0.00241	0.0165	0.140	<0.000010	0.0000220	0.00806	0.0333	0.00950	0.000904	0.000790	<0.0100
	Annual Mean	0.0149	0.0000541	0.0424	0.000420	0.000000559	0.00168	0.00869	0.0418	<0.000010	0.0000129	0.00363	0.0131	0.00312	0.000318	0.000349	<0.0100
	Annual Median	<0.0100	<0.000050	0.0428	0.000200	<0.00000050	0.00164	0.00838	0.0408	<0.000010	0.0000130	0.00366	0.0120	<0.0030	0.000292	0.000320	<0.0100
	% < LRL	82%	93%	0%	7%	84%	0%	0%	0%	100%	9%	0%	2%	98%	0%	73%	100%
	% > BCWQG[a]	-	0%	-	0%	2%	0%	-	100%	0%	0%	0%	0%	0%	5%	70%	-
	% > BCWQG[b]	0%	0%	-	0%	-	0%	-	-	0%	-	-	0%	0%	0%	0%	0%
	% > Level 1 Benchmark	-	-	-	-	-	-	98%	89%	-	-	-	-	-	36%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	4%	5%	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-
LC_WLC	n	39	51	51	51	51	51	51	51	51	51	51	51	51	51	51	43
	Annual Minimum	<0.0100	<0.000050	0.0220	<0.00010	0.000000820	0.00121	0.0162	0.223	<0.000010	0.0000210	0.00772	0.00440	<0.0030	0.0000513	0.000530	<0.0100
	Annual Maximum	0.0140	0.000129	0.0396	0.00267	0.00000124	0.00565	0.0487	0.564	<0.000020	0.0000330	0.0215	0.131	0.00430	0.00344	0.00182	0.0150
	Annual Mean	0.0105	0.0000515	0.0320	0.000512	0.00000108	0.00343	0.0257	0.408	<0.000010	0.0000259	0.0163	0.0383	0.00303	0.000990	0.000852	0.0101
	Annual Median	<0.0100	<0.000050	0.0336	0.000130	0.00000111	0.00393	0.0202	0.448	<0.000010	0.0000260	0.0182	0.0159	<0.0030	0.000557	0.000830	<0.0100
	% < LRL	67%	98%	0%	45%	0%	0%	0%	0%	100%	0%	0%	6%	98%	0%	0%	95%
	% > BCWQG[a]	-	0%	-	0%	0%	0%	-	100%	0%	0%	94%	0%	0%	55%	57%	-
	% > BCWQG[b]	0%	0%	-	0%	-	0%	-	-	0%	-	-	0%	0%	14%	0%	0%
	% > Level 1 Benchmark	-	-	-	-	-	-	100%	100%	-	-	-	-	-	59%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	100%	100%	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	41%	-	-	-	-	-	-	-	-	-

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Table C.2: Summary of Water Chemistry Data for Key Parameters for the Line Creek LAEMP Monitoring Stations, 2019

Station	Summary Statistic	Total Iron (mg/L)	Total Lead (mg/L)	Total Lithium (mg/L)	Total Manganese (mg/L)	Total Mercury (mg/L)	Total Molybdenum (mg/L)	Total Nickel (mg/L)	Total Selenium (mg/L)	Total Silver (mg/L)	Total Thallium (mg/L)	Total Uranium (mg/L)	Total Zinc (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)
	n	57	57	57	57	57	57	57	85	57	57	57	57	57	57	57	57
	Annual Minimum	<0.0100	<0.000050	0.00220	0.000550	<0.00000050	0.000963	<0.00050	0.000892	<0.000010	<0.000010	0.00114	<0.0030	<0.0010	0.00000900	0.000230	<0.0100
	Annual Maximum	0.334	0.000303	0.0599	0.0668	0.00000236	0.00704	0.0112	0.101	<0.000010	0.0000250	0.00627	0.0226	0.00320	0.000511	0.000680	0.132
	Annual Mean	0.0904	0.0000553	0.0410	0.0261	0.000000561	0.00388	0.00732	0.0352	<0.000010	0.0000113	0.00423	0.0103	0.00104	0.000232	0.000330	0.0122
	Annual Median	0.0680	<0.000050	0.0423	0.0251	<0.00000050	0.00382	0.00735	0.0326	<0.000010	0.0000100	0.00423	0.0100	<0.0030	0.000218	0.000320	<0.0100
LC_LC3	% < LRL	4%	95%	0%	0%	89%	0%	2%	0%	100%	46%	0%	2%	98%	0%	77%	96%
	% > BCWQG[a]	-	0%	-	0%	2%	0%	-	99%	0%	0%	0%	0%	0%	2%	67%	-
	% > BCWQG[b]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 1 Benchmark	-	-	-	-	-	-	98%	93%	-	-	-	-	-	23%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	0%	5%	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-
	n	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	Annual Minimum	<0.0100	<0.000050	0.0295	0.00271	<0.00000050	0.00169	0.00337	0.0232	<0.000010	<0.000010	0.00286	<0.0030	0.00160	0.0000830	<0.00020	<0.0100
	Annual Maximum	0.0610	<0.000050	0.0410	0.0150	<0.00000050	0.00467	0.00560	0.0614	<0.000010	0.0000110	0.00460	0.00770	<0.0030	0.000171	0.000850	<0.0100
	Annual Mean	0.0273	<0.000050	0.0350	0.00815	<0.00000050	0.00286	0.00452	0.0378	<0.000010	0.0000102	0.00389	0.00520	0.00160	0.000119	0.000308	<0.0100
	Annual Median	0.0230	<0.000050	0.0348	0.00880	<0.00000050	0.00282	0.00457	0.0284	<0.000010	<0.000010	0.00420	0.00520	0.00160	0.000114	<0.00050	<0.0100
WL_DCP_SP24	% < LRL	17%	100%	0%	0%	100%	0%	0%	0%	100%	83%	0%	17%	83%	0%	83%	100%
	% > BCWQG[a]	-	0%	-	0%	0%	0%	-	100%	0%	0%	0%	0%	0%	0%	33%	-
	% > BCWQG[b]	0%	0%	-	0%	-	0%	-	-	0%	-	-	0%	0%	0%	0%	0%
	% > Level 1 Benchmark	-	-	-	-	-	-	17%	100%	-	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	0%	0%	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-
	n	54	54	54	54	54	54	54	62	54	54	54	54	54	54	54	54
	Annual Minimum	<0.0100	<0.000050	0.0130	0.00102	<0.00000050	0.00119	0.00278	0.0126	<0.000010	<0.000010	0.00146	<0.0030	<0.0030	0.0000756	<0.00020	<0.0100
	Annual Maximum	0.0730	0.0000520	0.0408	0.0116	0.00000123	0.00348	0.00559	0.0638	<0.000010	<0.000010	0.00426	0.00990	<0.0030	0.000201	0.000680	<0.0100
	Annual Mean	0.0183	0.0000500	0.0288	0.00446	0.000000538	0.00231	0.00366	0.0306	<0.000010	<0.000010	0.00310	0.00550	<0.0030	0.000118	0.000297	<0.0100
	Annual Median	0.0150	<0.000050	0.0302	0.00408	<0.00000050	0.00236	0.00363	0.0314	<0.000010	<0.000010	0.00325	0.00530	<0.0030	0.000108	0.000240	<0.0100
LC_LCDSSLCC	% < LRL	20%	98%	0%	0%	87%	0%	0%	0%	100%	100%	0%	6%	100%	0%	83%	100%
	% > BCWQG[a]	-	0%	-	0%	0%	0%	-	100%	0%	0%	0%	0%	0%	0%	28%	-
	% > BCWQG[b]	0%	0%	-	0%	-	0%	-	-	0%	-	-	0%	0%	0%	0%	0%
	% > Level 1 Benchmark	-	-	-	-	-	-	2%	87%	-	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	0%	0%	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-
	n	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Annual Minimum	<0.0100	<0.000050	0.0236	0.000850	<0.00000050	0.00192	0.00187	0.0234	<0.000010	<0.000010	0.00251	<0.0030	<0.0030	0.0000600	<0.00020	<0.0100
	Annual Maximum	0.0180	<0.000050	0.0305	0.00266	0.000000550	0.00261	0.00343	0.0351	<0.000010	<0.000010	0.00327	0.00550	<0.0030	0.000117	<0.00050	<0.0100
	Annual Mean	0.0130	<0.000050	0.0270	0.00173	0.000000510	0.00227	0.00247	0.0283	<0.000010	<0.000010	0.00298	0.00350	<0.0030	0.0000812	<0.00020	<0.0100
	Annual Median	<0.0100	<0.000050	0.0263	0.00149	<0.00000050	0.00225	0.00239	0.0270	<0.000010	<0.000010	0.00315	<0.0030	<0.0030	0.0000731	<0.00050	<0.0100
LC_LCC	% < LRL	60%	100%	0%	0%	80%	0%	0%	0%	100%	100%	0%	80%	100%	0%	100%	100%
	% > BCWQG[a]	-	0%	-	0%	0%	0%	-	100%	0%	0%	0%	0%	0%	0%	60%	-
	% > BCWQG[b]	0%	0%	-	0%	-	0%	-	-	0%	-	-	0%	0%	0%	0%	0%
	% > Level 1 Benchmark	-	-	-	-	-	-	0%	100%	-	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	0%	0%	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-

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[b] Short-term maximum BCQWG for the Protection of Aquatic Life. For guidelines dependent on other analytes (e.g., hardness or chloride), guidelines were screened using concurrent concentrations. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the guidelines or benchmark. All summary statistics are reported to 3 significant figures.

Table C.2: Summary of Water Chemistry Data for Key Parameters for the Line Creek LAEMP Monitoring Stations, 2019

Station	Summary Statistic	Total Iron (mg/L)	Total Lead (mg/L)	Total Lithium (mg/L)	Total Manganese (mg/L)	Total Mercury (mg/L)	Total Molybdenum (mg/L)	Total Nickel (mg/L)	Total Selenium (mg/L)	Total Silver (mg/L)	Total Thallium (mg/L)	Total Uranium (mg/L)	Total Zinc (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)
LC_LC4	n	60	60	60	60	60	60	60	64	60	60	60	60	60	60	60	60
	Annual Minimum	<0.0100	<0.000050	0.0113	0.000335	<0.00000050	0.000985	0.00142	0.0103	<0.000010	<0.000010	0.00132	<0.0030	<0.0030	0.0000135	<0.00020	<0.0100
	Annual Maximum	0.102	0.000108	0.0286	0.00632	0.00000129	0.00259	0.00379	0.0411	<0.000010	<0.000010	0.00343	0.0420	0.00320	0.0000895	<0.00050	<0.0100
	Annual Mean	0.0132	0.0000515	0.0223	0.00132	0.000000530	0.00193	0.00252	0.0224	<0.000010	<0.000010	0.00252	0.00543	0.00300	0.0000363	0.000228	<0.0100
	Annual Median	<0.0100	<0.000050	0.0236	0.00122	<0.00000050	0.00202	0.00247	0.0230	<0.000010	<0.000010	0.00260	0.00450	<0.0030	0.0000310	<0.00020	<0.0100
	% < LRL	70%	95%	0%	2%	88%	0%	0%	0%	100%	100%	0%	8%	98%	0%	90%	100%
	% > BCWQG[a]	-	0%	-	0%	2%	0%	-	100%	0%	0%	0%	0%	0%	0%	23%	-
	% > BCWQG[b]	0%	0%	-	0%	-	0%	-	-	0%	-	-	0%	0%	0%	0%	0%
	% > Level 1 Benchmark	-	-	-	-	-	-	0%	72%	-	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	0%	0%	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-
LC_LC6	n	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Annual Minimum	<0.0100	<0.000050	0.0142	0.000270	<0.00000050	0.000819	<0.00050	0.0401	<0.000010	<0.000010	0.00195	<0.0030	<0.0030	0.00000820	<0.00020	<0.0100
	Annual Maximum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Annual Mean	0.0100	<0.000050	0.0176	0.00111	<0.00000050	0.000922	0.000532	0.0486	<0.000010	<0.000010	0.00209	<0.0030	<0.0030	0.0000108	<0.00020	<0.0100
	Annual Median	<0.0100	<0.000050	0.0179	0.000540	<0.00000050	0.000955	<0.00050	0.0499	<0.000010	<0.000010	0.00203	<0.0030	<0.0030	0.0000106	<0.00050	<0.0100
	% < LRL	60%	100%	0%	0%	100%	0%	60%	0%	100%	100%	0%	100%	100%	0%	100%	100%
	% > BCWQG[a]	-	0%	-	0%	0%	0%	-	100%	0%	0%	0%	0%	0%	0%	40%	-
	% > BCWQG[b]	0%	0%	-	0%	-	0%	-	-	0%	-	-	0%	0%	0%	0%	0%
	% > Level 1 Benchmark	-	-	-	-	-	-	0%	100%	-	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	0%	0%	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-
LC_LC5	n	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44
	Annual Minimum	<0.0100	<0.000050	0.0122	0.000270	<0.00000050	0.000885	<0.00050	0.0174	<0.000010	<0.000010	0.00131	<0.0030	<0.0030	0.00000770	<0.00020	<0.0100
	Annual Maximum	0.264	0.000273	0.0236	0.0237	0.00000210	0.00132	0.00192	0.0499	0.0000110	0.0000100	0.00255	0.00600	0.00530	0.0000395	<0.00050	<0.0100
	Annual Mean	0.0342	0.0000638	0.0183	0.00293	0.000000595	0.00117	0.000956	0.0375	0.0000100	0.0000100	0.00212	0.00320	0.00305	0.0000172	0.000269	<0.0100
	Annual Median	0.0115	<0.000050	0.0190	0.00125	<0.00000050	0.00119	0.000905	0.0412	<0.000010	<0.000010	0.00226	<0.0030	<0.0030	0.0000155	0.000250	<0.0100
	% < LRL	41%	82%	0%	0%	86%	0%	2%	0%	98%	95%	0%	84%	98%	0%	91%	100%
	% > BCWQG[a]	-	0%	-	0%	7%	0%	-	100%	0%	0%	0%	0%	0%	0%	16%	-
	% > BCWQG[b]	0%	0%	-	0%	-	0%	-	-	0%	-	-	0%	0%	0%	0%	0%
	% > Level 1 Benchmark	-	-	-	-	-	-	0%	98%	-	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	0%	0%	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-

> 5% of samples exceed the guideline or benchmark.
> 50% of samples exceed the guideline or benchmark.
> 95% of samples exceed the guideline or benchmark.

Notes: "LRL" = laboratory reporting limit; "BCWQG" = British Columbia Working or Accepted Water Quality Guideline.

[a] Long-term average BCQWG for the Protection of Aquatic Life.

[b] Short-term maximum BCQWG for the Protection of Aquatic Life. For guidelines dependent on other analytes (e.g., hardness or chloride), guidelines were screened using concurrent concentrations. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the guidelines or benchmark. All summary statistics are reported to 3 significant figures.

Table C.3: Acute Toxicity Results for Line Creek Operations, 2019

Water Station		*Daphnia magna*		*Oncorhynchus mykiss*	
Teck Code	Description	Date	Percent Mortality	Date	Percent Mortality
WL_BFWB_OUT_SP21	West Line Creek AWTF effluent outfall	7-Jan-19	0%	7-Jan-19	0%
		14-Jan-19	0%	14-Jan-19	0%
		21-Jan-19	0%	21-Jan-19	0%
		28-Jan-19	0%	28-Jan-19	0%
		4-Feb-19	0%	4-Feb-19	0%
		11-Feb-19	0%	11-Feb-19	0%
		19-Feb-19	0%	19-Feb-19	0%
		25-Feb-19	0%	25-Feb-19	10%
		4-Mar-19	0%	4-Mar-19	0%
		11-Mar-19	0%	11-Mar-19	0%
		18-Mar-19	0%	18-Mar-19	0%
		25-Mar-19	0%	25-Mar-19	0%
		1-Apr-19	0%	1-Apr-19	0%
		8-Apr-19	0%	8-Apr-19	0%
		15-Apr-19	0%	15-Apr-19	0%
		15-Apr-19	0%	15-Apr-19	0%
		23-Apr-19	0%	23-Apr-19	0%
		29-Apr-19	0%	29-Apr-19	0%
		6-May-19	0%	6-May-19	0%
		13-May-19	0%	13-May-19	0%
		20-May-19	0%	20-May-19	0%
		27-May-19	0%	27-May-19	0%
		3-Jun-19	0%	3-Jun-19	0%
		10-Jun-19	0%	10-Jun-19	0%
		17-Jun-19	3%	17-Jun-19	0%
		24-Jun-19	0%	24-Jun-19	0%
		2-Jul-19	0%	2-Jul-19	0%
		8-Jul-19	0%	8-Jul-19	0%
		15-Jul-19	0%	15-Jul-19	0%
		22-Jul-19	0%	22-Jul-19	0%
		29-Jul-19	0%	29-Jul-19	0%
		6-Aug-19	0%	6-Aug-19	0%
		12-Aug-19	0%	12-Aug-19	0%
		19-Aug-19	0%	19-Aug-19	0%
		26-Aug-19	0%	26-Aug-19	0%
		3-Sep-19	0%	3-Sep-19	0%
		9-Sep-19	0%	9-Sep-19	0%
		16-Sep-19	0%	16-Sep-19	0%
		18-Sep-19	0%	18-Sep-19	0%
		23-Sep-19	0%	23-Sep-19	0%
		30-Sep-19	0%	30-Sep-19	0%
		7-Oct-19	0%	7-Oct-19	10%
		14-Oct-19	0%	14-Oct-19	0%
		21-Oct-19	0%	21-Oct-19	0%
		28-Oct-19	0%	28-Oct-19	0%
		4-Nov-19	0%	4-Nov-19	0%
		11-Nov-19	0%	11-Nov-19	0%
		21-Nov-19	0%	21-Nov-19	0%
		25-Nov-19	0%	25-Nov-19	0%
		4-Dec-19	0%	4-Dec-19	0%
		9-Dec-19	0%	9-Dec-19	0%
		16-Dec-19	0%	16-Dec-19	0%
		23-Dec-19	0%	23-Dec-19	0%
		30-Dec-19	0%	30-Dec-19	0%

APPENDIX D
OTHER SUPPORTING INFORMATION

Table D.1: ***In Situ*** **Water Quality Measures Collected for the Line Creek LAEMP, 2019**

Exposure	Area	Station ID	Easting	Northing	Sampling Date	Temperature	Dissolved Oxygen	Dissolved Oxygen	Specific Conductivity	pH	ORP
						°C	mg/L	%	µS/cm	pH units	mV
Reference	RG_LI24	-	662214	5538393	14-Jan-19	-	-	-	-	-	-
		-	662214	5538393	28-Feb-19	1.1	11.50	81.5	501	6.83	261.0
		-	662214	5538393	25-Apr-19	1.7	12.07	86.1	288	7.94	110.6
		-	662214	5538393	22-May-19	2.9	11.85	87.8	269	8.27	52.7
		-	662214	5538393	18-Jun-19	3.3	11.67	87.5	231	7.98	204.1
		-	662214	5538393	16-Jul-19	4.1	11.92	91.4	295	8.17	-
		-	662214	5538393	13-Aug-19	4.6	11.52	89.4	256	7.61	-
		Station 1	662165	5538411	6-Sep-16	5.0	12.32	116.6	323.9	7.96	-
		Station 2	662214	5538393	6-Sep-16	5.3	12.17	116.2	322.7	8.07	-
		Station 3	662221	5538429	6-Sep-16	5.4	12.12	116.4	322.3	8.00	-
		-	662214	5538393	2-Dec-19	0.0	14.28	91.5	374	7.30	-
	RG_SLINE	-	661122	5531374	14-Jan-19	-0.1	14.01	95.8	609	7.00	72.8
		-	661122	5531374	25-Feb-19	0.0	11.15	76.9	432	7.73	187.4
		-	661122	5531374	24-Apr-19	2.5	12.28	89.3	314	7.93	141.6
		-	661122	5531374	23-May-19	2.5	12.53	92.0	259	8.19	27.7
		-	661122	5531374	18-Jun-19	4.6	11.68	90.6	226	8.27	200.1
		-	661122	5531374	16-Jul-19	5.8	11.49	91.8	297	8.39	-
		-	661122	5531374	12-Aug-19	5.9	11.24	90.0	268	7.83	-
		Station 1	661071	5531404	9-Sep-19	5.6	10.28	98.2	338.1	7.94	-
		Station 2	661135	5531366	9-Sep-19	5.8	10.68	102.5	337.4	7.96	-
		Station 3	661184	5531324	9-Sep-19	5.8	10.30	98.5	334.7	7.98	-
		-	661122	5531374	3-Dec-19	1.0	12.86	90.1	360	7.82	104.3
Mine-exposed (Line Creek)	RG_LCUT	-	660114	5532140	17-Jan-19	0.0	12.73	87.6	1,366	6.68	43.2
		-	660114	5532140	28-Feb-19	-	-	-	-	-	-
		-	660114	5532140	24-Apr-19	5.2	12.17	96.2	978	7.92	141.4
		-	660114	5532140	22-May-19	4.3	11.40	87.8	762	7.83	70.0
		-	660114	5532140	17-Jun-19	5.6	11.32	90.2	661	7.74	136.6
		-	660114	5532140	17-Jul-19	5.8	11.69	93.7	866	7.74	-
		-	660114	5532140	13-Aug-19	7.2	11.52	95.3	828	7.60	-
		Station 1	660113	5532143	4-Sep-16	7.2	12.12	119.1	1,011	7.26	-
		-	660114	5532140	3-Dec-19	3.6	12.26	93.6	1,528	8.36	218.8
	RG_LILC3	-	659911	5531818	17-Jan-19	2.8	12.16	90.3	1,607	7.32	68.1
		-	659911	5531818	26-Feb-19	3.0	9.82	73.5	1,252	8.09	166.8
		-	659911	5531818	22-Apr-19	6.5	11.83	96.5	1,041	8.11	160.2
		-	659911	5531818	23-May-19	5.4	11.79	93.7	756	7.99	75.1
		-	659911	5531818	18-Jun-19	5.8	11.58	93.0	616	8.05	229.6
		-	659911	5531818	23-Jul-19	6.6	11.80	96.4	585	8.02	-
		-	659911	5531818	12-Aug-19	7.8	11.66	98.7	721	7.69	-
		Station 1	659869	5531744	7-Sep-19	7.0	10.42	101.5	909	7.81	-
		Station 2	659898	5531781	7-Sep-19	8.0	10.24	102.8	900	7.73	-
		Station 3	659933	5531833	7-Sep-19	8.9	10.25	104.8	904	7.50	-
		-	659911	5531818	3-Dec-19	3.4	11.88	89.0	1,087	8.02	217.1
	RG_LISP24	-	659674	5531168	17-Jan-19	1.9	12.63	91.4	1,340	7.67	61.0
		-	659674	5531168	26-Feb-19	0.8	10.08	71.0	1,078	8.14	163.3
		-	659674	5531168	22-Apr-19	5.0	11.67	87.0	787	8.07	150.6
		Station 1	659673	5531169	5-Sep-19	9.0	11.93	121.4	720	8.35	-
		-	659674	5531168	2-Dec-19	2.3	11.86	86.7	880	8.25	167.6
	RG_LIDSL	-	659294	5530583	16-Jan-19	0.1	13.27	91.3	1,201	7.40	55.9
		-	659294	5530583	26-Feb-19	0.1	10.38	71.5	1,018	8.11	130.1
		-	659294	5530583	23-May-19	4.9	11.86	92.7	594	8.24	59.6
		-	659294	5530583	17-Jun-19	5.7	11.47	91.6	473	8.23	125.6
		-	659294	5530583	15-Jul-19	6.9	11.55	94.8	639	8.24	-
		Station 1	659262	5530538	10-Sep-19	6.8	10.34	100.2	731	7.95	-
		Station 2	659288	5530577	10-Sep-19	7.1	10.31	100.5	745	7.99	-
		Station 3	659316	5530615	10-Sep-19	7.7	10.24	101.4	741	8.11	-
		Station 4	659345	5530663	10-Sep-19	7.6	10.32	101.8	734	8.08	-
		Station 5	659365	5530726	10-Sep-19	6.2	11.16	105.9	705	8.07	-
		-	659294	5530583	3-Dec-19	2.3	12.37	90.6	8	865.90	204.6
	RG_LIDCOM	-	658184	5529814	16-Jan-19	-0.1	13.17	90.6	1,093	7.60	71.5
		-	658184	5529814	27-Feb-19	0.0	13.39	91.7	964	8.01	145.3
		-	658184	5529814	25-Apr-19	4.0	12.73	97.6	702	8.12	153.5
		Station 1	658183	5529815	12-Sep-19	5.9	10.71	100.3	640	8.03	-
		-	658184	5529814	5-Dec-19	1.7	12.41	89.2	798	8.29	118.6
	RG_LI8	-	655426	5528959	16-Jan-19	-0.1	13.05	89.6	985	7.64	85.2
		-	655426	5528959	27-Feb-19	0.0	13.04	89.5	879	8.16	153.0
		-	655426	5528959	25-Apr-19	6.2	11.60	93.9	641	8.32	140.7
		-	655426	5528959	24-May-19	4.2	12.20	93.6	521	8.37	13.0
		-	655426	5528959	19-Jun-19	5.9	11.46	91.8	455	8.41	217.0
		-	655426	5528959	17-Jul-19	6.1	11.65	94.0	590	8.41	-
		-	655426	5528959	13-Aug-19	8.9	10.60	92.1	526	8.44	-
		Station 1	655450	5528950	11-Sep-19	7.1	11.06	105.8	631	8.26	-
		Station 2	655492	5528892	11-Sep-19	7.9	10.91	106.7	627	8.24	-
		Station 3	655570	5528837	11-Sep-19	8.6	10.32	102.6	627	8.26	-
		-	655426	5528959	4-Dec-19	2.8	12.35	91.1	721	8.36	120.8
Mine-exposed (Fording River)	RG_FRUL	-	654530	5530162	15-Jan-19	-0.1	15.39	101.1	1,207	7.10	47.1
		-	654530	5530162	7-Mar-19	0.0	13.06	89.7	837	8.08	149.7
		-	654530	5530162	26-Apr-19	3.6	12.34	93.9	843	8.26	130.9
		Station 1	654549	5530169	12-Sep-19	10.8	10.70	111.7	651	7.92	-
		-	654530	5530162	4-Dec-19	0.5	13.06	91.4	694	7.85	130.1
	RG_FO23	-	652808	5528334	15-Jan-19	-0.1	15.41	102.1	1,168	7.21	65.0
		-	652808	5528334	7-Mar-19	0.0	12.90	88.5	815	7.99	177.9
		-	652808	5528334	26-Apr-19	4.2	12.08	93.0	784	8.32	149.0
		Station 1	652769	5528294	8-Sep-19	8.8	10.74	107.3	661.7	7.99	-
		Station 2	652856	5528378	8-Sep-19	9.2	10.47	105.7	661.4	8.10	-
		Station 3	652950	5528537	8-Sep-19	10.3	10.39	107.8	660.4	8.10	-
		Station 4	652929	5528648	8-Sep-19	10.9	9.92	104.4	658	8.11	-
		Station 5	652933	5528766	8-Sep-19	11.0	9.76	102.9	656	8.05	-
		-	652808	5528334	4-Dec-19	0.9	12.82	89.4	692	8.06	123.3

Note: "-" indicates no data.

Table D.2: Supporting Substrate and Calcite Measures for Sampling Area RG_LI24, Line Creek, 2019

RG_LI24_BIC_1					RG_LI24_BIC_2				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	3.4	-	1	0	0	8.7	-
2	0	0	5.1	-	2	0	0	7.0	-
3	0	0	7.1	-	3	0	0	5.3	-
4	0	0	3.8	-	4	0	0	7.1	-
5	0	0	2.9	-	5	0	0	9.1	-
6	0	0	8.3	-	6	0	0	16.6	-
7	0	0	5.4	-	7	0	0	41.5	-
8	0	0	4.2	-	8	0	0	8.1	-
9	0	0	8.8	-	9	0	0	12.6	-
10	0	0	9.6	25%	10	0	0	4.0	0%
11	0	0	3.6	-	11	0	0	32.2	-
12	0	0	11.7	-	12	0	0	2.4	-
13	0	0	8.4	-	13	0	0	6.3	-
14	0	0	10.3	-	14	0	0	10.0	-
15	0	0	7.8	-	15	0	0	2.5	-
16	0	0	9.0	-	16	0	0	10.9	-
17	0	0	9.1	-	17	0	0	16.6	-
18	0	0	5.6	-	18	0	0	4.9	-
19	0	0	9.1	-	19	0	0	10.6	-
20	0	0	18.6	0%	20	0	0	10.1	0%
21	0	0	9.3	-	21	0	0	7.6	-
22	0	0	7.9	-	22	0	0	18.1	-
23	0	0	4.6	-	23	0	0	8.1	-
24	0	0	13.2	-	24	0	0	7.4	-
25	0	0	11.2	-	25	0	0	11.6	-
26	0	0	9.8	-	26	0	0	6.2	-
27	0	0	19.4	-	27	0	0	13.4	-
28	0	0	5.0	-	28	0	0	4.6	-
29	0	0	3.2	-	29	0	0	10.7	-
30	0	0	9.5	0%	30	0	0	6.2	25%
31	0	0	14.5	-	31	0	0	12.2	-
32	0	0	4.7	-	32	0	0	11.9	-
33	0	0	10.3	-	33	0	0	15.5	-
34	0	0	6.0	-	34	0	0	11.1	-
35	0	0	17.1	-	35	0	0	4.9	-
36	0	0	34.3	-	36	0	0	6.5	-
37	0	0	5.0	-	37	0	0	5.1	-
38	0	0	8.6	-	38	0	0	7.7	-
39	0	0	16.5	-	39	0	0	17.1	-
40	0	0	14.4	50%	40	0	0	9.3	50%
41	0	0	2.9	-	41	0	0	9.1	-
42	0	0	5.6	-	42	0	0	9.7	-
43	0	0	24.2	-	43	0	0	7.8	-
44	0	0	5.8	-	44	0	0	6.3	-
45	0	0	7.4	-	45	0	0	8.1	-
46	0	0	9.1	-	46	0	0	2.6	-
47	0	0	10.5	-	47	0	0	5.9	-
48	0	0	4.4	-	48	0	0	12.9	-
49	0	0	19.3	-	49	0	0	27.0	-
50	0	0	6.6	25%	50	0	0	19.3	25%
51	0	0	15.7	-	51	0	0	5.2	-
52	0	0	13.6	-	52	0	0	4.1	-
53	0	0	12.8	-	53	0	0	2.3	-
54	0	0	13.7	-	54	0	0	23.4	-
55	0	0	5.4	-	55	0	0	8.5	-
56	0	0	9.0	-	56	0	0	3.6	-
57	0	0	5.3	-	57	0	0	8.3	-
58	0	0	4.1	-	58	0	0	10.6	-
59	0	0	13.8	-	59	0	0	4.9	-
60	0	0	16.1	75%	60	0	0	15.5	25%
61	0	0	7.6	-	61	0	0	3.4	-
62	0	0	3.5	-	62	0	0	25.5	-
63	0	0	5.6	-	63	0	0	5.5	-
64	0	0	10.2	-	64	0	0	27.0	-
65	0	0	25.2	-	65	0	0	7.2	-
66	0	0	4.5	-	66	0	0	34.0	-
67	0	0	3.8	-	67	0	0	3.5	-
68	0	0	16.6	-	68	0	0	10.7	-
69	0	0	6.5	-	69	0	0	7.4	-
70	0	0	5.8	0%	70	0	0	5.6	25%
71	0	0	7.7	-	71	0	0	9.0	-
72	0	0	5.5	-	72	0	0	18.5	-
73	0	0	20.1	-	73	0	0	29.0	-
74	0	0	6.6	-	74	0	0	20.2	-
75	0	0	6.6	-	75	0	0	6.5	-
76	0	0	5.9	-	76	0	0	8.7	-
77	0	0	6.4	-	77	0	0	39.5	-
78	0	0	17.8	-	78	0	0	4.6	-
79	0	0	3.5	-	79	0	0	24.5	-
80	0	0	19.5	50%	80	0	0	42.8	25%
81	0	0	6.1	-	81	0	0	7.0	-
82	0	0	6.0	-	82	0	0	5.2	-
83	0	0	15.5	-	83	0	0	6.8	-
84	0	0	5.5	-	84	0	0	23.7	-
85	0	0	6.7	-	85	0	0	23.0	-
86	0	0	7.1	-	86	0	0	5.6	-
87	0	0	7.2	-	87	0	0	4.9	-
88	0	0	6.3	-	88	0	0	12.8	-
89	0	0	9.8	-	89	0	0	15.2	-
90	0	0	5.8	0%	90	0	0	13.0	75%
91	0	0	8.1	-	91	0	0	4.6	-
92	0	0	8.5	-	92	0	0	3.7	-
93	0	0	8.8	-	93	0	0	3.5	-
94	0	0	8.4	-	94	0	0	25.5	-
95	0	0	3.7	-	95	0	0	0.8	-
96	0	0	42.5	-	96	0	0	3.5	-
97	0	0	3.1	-	97	0	0	5.1	-
98	0	0	14.5	-	98	0	0	12.3	-
99	0	0	7.5	-	99	0	0	103.0	-
100	0	0	3.6	0%	100	0	0	6.5	50%
Minimum	**0**	**0**	**2.9**	**0%**	**Minimum**	**0**	**0**	**0.8**	**0%**
Maximum	**0**	**0**	**42.5**	**75.0%**	**Maximum**	**0**	**0**	**103.0**	**75.0%**
Mean	**0**	**0**	**9.6**	**22.5%**	**Mean**	**0**	**0**	**12.4**	**30.0%**
Median	**0**	**0**	**7.8**	**12.5%**	**Median**	**0**	**0**	**8.4**	**25.0%**
Standard Dev.	**0**	**0**	**6.47**	**27.5%**	**Standard Dev.**	**0**	**0**	**12.7**	**23.0%**

Notes: "-" indicates data not collected; embeddedness was only measured for every 10th (n=10) particle; Calcite Concreted Status: 0 = not concreted, 1 = partially concreted, 2 = fully concreted; Calcite Presence: 0 = calcite absent, 1 = calcite present.

Table D.2: Supporting Substrate and Calcite Measures for Sampling Area RG_LI24, Line Creek, 2019

RG_LI24_BIC_3				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	4.2	-
2	0	0	46.0	-
3	0	0	10.6	-
4	0	0	10.5	-
5	0	0	5.8	-
6	0	0	12.1	-
7	0	0	10.6	-
8	0	0	11.4	-
9	0	0	11.7	-
10	0	0	14.4	50%
11	0	0	25.2	-
12	0	0	5.1	-
13	0	0	10.8	-
14	0	0	11.5	-
15	0	0	7.7	-
16	0	0	14.2	-
17	0	0	25.6	-
18	0	0	10.4	-
19	0	0	39.7	-
20	0	0	5.0	0%
21	0	0	11.4	-
22	0	0	7.7	-
23	0	0	6.4	-
24	0	0	4.9	-
25	0	0	9.3	-
26	0	0	2.4	-
27	0	0	12.4	-
28	0	0	10.4	-
29	0	0	4.3	-
30	0	0	7.0	75%
31	0	0	10.2	-
32	0	0	4.8	-
33	0	0	3.9	-
34	0	0	4.7	-
35	0	0	19.8	-
36	0	0	10.5	-
37	0	0	4.8	-
38	0	0	13.4	-
39	0	0	10.0	-
40	0	0	10.9	25%
41	0	0	10.0	-
42	0	0	9.5	-
43	0	0	11.5	-
44	0	0	42.0	-
45	0	0	2.0	-
46	0	0	21.7	-
47	0	0	10.5	-
48	0	0	35.1	-
49	0	0	8.6	-
50	0	0	3.6	75%
51	0	0	5.3	-
52	0	0	4.1	-
53	0	0	5.6	-
54	0	0	6.3	-
55	0	0	6.9	-
56	0	0	2.5	-
57	0	0	34.5	-
58	0	0	6.9	-
59	0	0	14.5	-
60	0	0	21.8	25%
61	0	0	13.7	-
62	0	0	9.3	-
63	0	0	10.3	-
64	0	0	2.5	-
65	0	0	3.0	-
66	0	0	12.0	-
67	0	0	23.0	-
68	0	0	10.7	-
69	0	0	12.8	-
70	0	0	3.3	25%
71	0	0	8.8	-
72	0	0	45.5	-
73	0	0	9.2	-
74	0	0	28.0	-
75	0	0	3.1	-
76	0	0	11.5	-
77	0	0	5.5	-
78	0	0	2.8	-
79	0	0	33.5	-
80	0	0	9.3	75%
81	0	0	10.0	-
82	0	0	4.4	-
83	0	0	5.5	-
84	0	0	10.3	-
85	0	0	5.5	-
86	0	0	6.1	-
87	0	0	8.2	-
88	0	0	13.0	-
89	0	0	7.2	-
90	0	0	5.5	25%
91	0	0	6.6	-
92	0	0	5.5	-
93	0	0	15.3	-
94	0	0	3.0	-
95	0	0	12.4	-
96	0	0	35.7	-
97	0	0	10.3	-
98	0	0	14.9	-
99	0	0	5.1	-
100	0	0	5.4	25%
Minimum	**0**	**0**	**2.0**	**0%**
Maximum	**0**	**0**	**46.0**	**75.0%**
Mean	**0**	**0**	**11.7**	**40.0%**
Median	**0**	**0**	**10.0**	**25.0%**
Standard Dev.	**0**	**0**	**9.7**	**26.9%**

Notes: "-" indicates data not collected; embeddedness was only measured for every 10th (n=10) particle; Calcite Concreted Status: 0 = not concreted, 1 = partially concreted, 2 = fully concreted; Calcite Presence: 0 = calcite absent, 1 = calcite present.

Table D.3: Supporting Substrate and Calcite Measures for Sampling Area RG_SLINE, Line Creek, 2019

RG_SLINE_BIC_1					RG_SLINE_BIC_2				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	11.9	-	1	0	0	2.9	-
2	0	0	7.3	-	2	0	0	2.8	-
3	0	0	3.6	-	3	0	0	2.8	-
4	0	0	17.1	-	4	0	0	1.4	-
5	0	0	15.1	-	5	0	0	29.0	-
6	0	0	13.2	-	6	0	0	32.5	-
7	0	0	17.5	-	7	0	0	3.8	-
8	0	0	10.5	-	8	0	0	32.5	-
9	0	0	21.8	-	9	0	0	3.4	-
10	0	0	10.7	25%	10	0	0	10.5	75%
11	0	0	5.8	-	11	0	0	6.2	-
12	0	0	10.2	-	12	0	0	8.2	-
13	0	0	9.8	-	13	0	0	9.0	-
14	0	0	14.6	-	14	0	0	22.0	-
15	0	0	1.0	-	15	0	0	8.4	-
16	0	0	14.0	-	16	0	0	28.0	-
17	0	0	23.0	-	17	0	0	7.0	-
18	0	0	15.0	-	18	0	0	22.1	-
19	0	0	9.1	-	19	0	0	12.1	-
20	0	0	3.5	75%	20	0	0	12.5	25%
21	0	0	3.5	-	21	0	0	2.2	-
22	0	0	5.1	-	22	0	0	17.6	-
23	0	0	14.5	-	23	0	0	9.0	-
24	0	0	5.3	-	24	0	0	2.2	-
25	0	0	9.5	-	25	0	0	13.0	-
26	0	0	3.5	-	26	0	0	26.0	-
27	0	0	17.5	-	27	0	0	2.6	-
28	0	0	38.8	-	28	0	0	2.2	-
29	0	0	5.4	-	29	0	0	10.5	-
30	0	0	8.1	75%	30	0	0	13.3	50%
31	0	0	15.5	-	31	0	0	7.5	-
32	0	0	11.0	-	32	0	0	10.9	-
33	0	0	5.5	-	33	0	0	6.5	-
34	0	0	14.5	-	34	0	0	3.5	-
35	0	0	24.5	-	35	0	0	4.7	-
36	0	0	6.2	-	36	0	0	7.4	-
37	0	0	7.0	-	37	0	0	12.5	-
38	0	0	17.5	-	38	0	0	10.6	-
39	0	0	4.8	-	39	0	0	24.5	-
40	0	0	43.5	75%	40	0	0	10.8	75%
41	0	0	41.0	-	41	0	0	7.4	-
42	0	0	6.2	-	42	0	0	10.6	-
43	0	0	5.0	-	43	0	0	12.2	-
44	0	0	13.5	-	44	0	0	10.2	-
45	0	0	9.5	-	45	0	0	32.9	-
46	0	0	19.0	-	46	0	0	40.5	-
47	0	0	46.5	-	47	0	0	15.9	-
48	0	0	14.5	-	48	0	0	19.5	-
49	0	0	9.8	-	49	0	0	10.7	-
50	0	0	4.1	50%	50	0	0	9.6	25%
51	0	0	30.8	-	51	0	0	10.8	-
52	0	0	13.7	-	52	0	0	29.5	-
53	0	0	18.5	-	53	0	0	17.0	-
54	0	0	9.6	-	54	0	0	2.7	-
55	0	0	13.5	-	55	0	0	8.4	-
56	0	0	7.0	-	56	0	0	26.8	-
57	0	0	53.0	-	57	0	0	8.0	-
58	0	0	15.6	-	58	0	0	11.0	-
59	0	0	10.6	-	59	0	0	10.5	-
60	0	0	9.5	50%	60	0	0	10.9	50%
61	0	0	12.5	-	61	0	0	13.1	-
62	0	0	15.0	-	62	0	0	8.7	-
63	0	0	8.5	-	63	0	0	16.3	-
64	0	0	6.3	-	64	0	0	10.9	-
65	0	0	27.5	-	65	0	0	12.0	-
66	0	0	8.4	-	66	0	0	4.5	-
67	0	0	15.2	-	67	0	0	9.5	-
68	0	0	6.4	-	68	0	0	5.2	-
69	0	0	1.1	-	69	0	0	8.4	-
70	0	0	21.2	75%	70	0	0	12.5	50%
71	0	0	37.0	-	71	0	0	6.4	-
72	0	0	10.5	-	72	0	0	5.8	-
73	0	0	10.0	-	73	0	0	3.4	-
74	0	0	52.5	-	74	0	0	6.8	-
75	0	0	54.3	-	75	0	0	0.4	-
76	0	0	16.3	-	76	0	0	6.3	-
77	0	0	13.4	-	77	0	0	4.6	-
78	0	0	12.7	-	78	0	0	9.7	-
79	0	0	2.6	-	79	0	0	5.3	-
80	0	0	23.3	50%	80	0	0	3.2	50%
81	0	0	6.6	-	81	0	0	9.8	-
82	0	0	6.4	-	82	0	0	14.8	-
83	0	0	1.2	-	83	0	0	6.5	-
84	0	0	18.5	-	84	0	0	3.2	-
85	0	0	1.2	-	85	0	0	6.8	-
86	0	0	1.4	-	86	0	0	8.0	-
87	0	0	23.0	-	87	0	0	8.9	-
88	0	0	5.3	-	88	0	0	11.5	-
89	0	0	5.4	-	89	0	0	11.1	-
90	0	0	11.1	25%	90	0	0	45.5	50%
91	0	0	7.1	-	91	0	0	10.4	-
92	0	0	12.6	-	92	0	0	19.3	-
93	0	0	32.0	-	93	0	0	18.4	-
94	0	0	12.3	-	94	0	0	12.2	-
95	0	0	8.2	-	95	0	0	12.1	-
96	0	0	51.0	-	96	0	0	14.3	-
97	0	0	12.0	-	97	0	0	4.5	-
98	0	0	0.8	-	98	0	0	17.7	-
99	0	0	1.4	-	99	0	0	10.8	-
100	0	0	7.2	50%	100	0	0	7.2	75%
Minimum	**0**	**0**	**0.8**	**25.0%**	**Minimum**	**0**	**0**	**0.4**	**25.0%**
Maximum	**0**	**0**	**54.3**	**75.0%**	**Maximum**	**0**	**0**	**45.5**	**75.0%**
Mean	**0**	**0**	**14.3**	**55.0%**	**Mean**	**0**	**0**	**11.7**	**52.5%**
Median	**0**	**0**	**10.9**	**50.0%**	**Median**	**0**	**0**	**10.3**	**50.0%**
Standard Dev.	**0**	**0**	**12.17**	**19.7%**	**Standard Dev.**	**0**	**0**	**8.6**	**18.4%**

Notes: "-" indicates data not collected; embeddedness was only measured for every 10th (n=10) particle; Calcite Concreted Status: 0 = not concreted, 1 = partially concreted, 2 = fully concreted; Calcite Presence: 0 = calcite absent, 1 = calcite present.

Table D.3: **Supporting Substrate and Calcite Measures for Sampling Area RG_SLINE, Line Creek, 2019**

RG_SLINE_BIC_3				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	11.4	-
2	0	0	7.5	-
3	0	0	17.8	-
4	0	0	11.5	-
5	0	0	19.5	-
6	0	0	11.7	-
7	0	0	13.1	-
8	0	0	25.0	-
9	0	0	9.5	-
10	0	0	13.8	25%
11	0	0	8.1	-
12	0	0	2.8	-
13	0	0	13.3	-
14	0	0	15.3	-
15	0	0	27.4	-
16	0	0	8.3	-
17	0	0	15.0	-
18	0	0	40.0	-
19	0	0	46.5	-
20	0	0	5.5	50%
21	0	0	6.0	-
22	0	0	11.1	-
23	0	0	5.8	-
24	0	0	36.0	-
25	0	0	4.2	-
26	0	0	13.3	-
27	0	0	11.4	-
28	0	0	7.1	-
29	0	0	2.1	-
30	0	0	11.2	25%
31	0	0	7.3	-
32	0	0	10.0	-
33	0	0	10.5	-
34	0	0	2.0	-
35	0	0	10.6	-
36	0	0	19.0	-
37	0	0	8.5	-
38	0	0	23.8	-
39	0	0	4.0	-
40	0	0	5.1	50%
41	0	0	12.1	-
42	0	0	17.5	-
43	0	0	5.8	-
44	0	0	6.0	-
45	0	0	14.5	-
46	0	0	8.4	-
47	0	0	25.5	-
48	0	0	4.0	-
49	0	0	12.2	-
50	0	0	10.1	50%
51	0	0	11.5	-
52	0	0	10.2	-
53	0	0	4.8	-
54	0	0	35.3	-
55	0	0	12.5	-
56	0	0	14.0	-
57	0	0	15.1	-
58	0	0	17.8	-
59	0	0	3.2	-
60	0	0	8.5	50%
61	0	0	2.5	-
62	0	0	9.2	-
63	0	0	9.3	-
64	0	0	23.5	-
65	0	0	5.2	-
66	0	0	8.5	-
67	0	0	14.3	-
68	0	0	15.4	-
69	0	0	1.7	-
70	0	0	15.0	25%
71	0	0	9.0	-
72	0	0	11.7	-
73	0	0	3.9	-
74	0	0	8.6	-
75	0	0	13.1	-
76	0	0	11.5	-
77	0	0	7.2	-
78	0	0	6.3	-
79	0	0	3.2	-
80	0	0	62.5	25%
81	0	0	10.3	-
82	0	0	5.8	-
83	0	0	26.2	-
84	0	0	11.4	-
85	0	0	21.2	-
86	0	0	17.5	-
87	0	0	18.5	-
88	0	0	15.8	-
89	0	0	18.3	-
90	0	0	6.4	75%
91	0	0	6.7	-
92	0	0	13.9	-
93	0	0	34.1	-
94	0	0	37.3	-
95	0	0	6.1	-
96	0	0	15.5	-
97	0	0	25.3	-
98	0	0	15.7	-
99	0	0	8.7	-
100	0	0	7.5	50%
Minimum	**0**	**0**	**1.7**	**25.0%**
Maximum	**0**	**0**	**62.5**	**75.0%**
Mean	**0**	**0**	**13.4**	**42.5%**
Median	**0**	**0**	**11.4**	**50.0%**
Standard Dev.	**0**	**0**	**10.0**	**16.9%**

Notes: "-" indicates data not collected; embeddedness was only measured for every 10th (n=10) particle; Calcite Concreted Status: 0 = not concreted, 1 = partially concreted, 2 = fully concreted; Calcite Presence: 0 = calcite absent, 1 = calcite present.

Table D.4: Supporting Substrate and Calcite Measures for Sampling Area RG_LCUT, Line Creek, 2019

RG_LCUT				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	1	11.7	-
2	0	0	2.0	-
3	0	1	11.0	-
4	0	1	12.8	-
5	0	1	20.6	-
6	0	0	6.5	-
7	0	0	2.0	-
8	0	1	14.2	-
9	0	0	1.2	-
10	0	0	4.6	0%
11	0	1	19.5	-
12	0	0	8.5	-
13	0	0	8.9	-
14	0	0	6.7	-
15	0	0	11.5	-
16	0	1	32.1	-
17	0	0	1.1	-
18	0	0	1.0	-
19	0	0	2.4	-
20	0	1	8.2	25%
21	0	0	3.1	-
22	0	0	3.4	-
23	0	1	17.2	-
24	0	1	6.5	-
25	0	0	3.6	-
26	0	0	5.3	-
27	0	1	6.7	-
28	0	0	5.4	-
29	0	0	7.5	-
30	0	1	17.7	0%
31	0	1	13.2	-
32	0	1	9.8	-
33	0	1	29.5	-
34	0	1	14.1	-
35	0	1	16.3	-
36	0	0	11.5	-
37	0	1	10.1	-
38	0	0	2.0	-
39	0	1	31.2	-
40	0	1	7.5	50%
41	0	1	15.4	-
42	0	1	7.7	-
43	0	0	11.4	-
44	0	1	12.4	-
45	0	1	4.9	-
46	0	1	2.7	-
47	0	1	8.4	-
48	0	0	1.5	-
49	0	1	7.1	-
50	0	1	9.1	25%
51	0	1	8.6	-
52	0	1	8.3	-
53	0	1	7.5	-
54	0	1	8.3	-
55	0	0	2.2	-
56	0	1	8.4	-
57	0	1	7.9	-
58	0	1	8.5	-
59	0	1	7.9	-
60	0	1	5.1	50%
61	0	1	6.6	-
62	0	1	7.1	-
63	0	0	2.5	-
64	0	0	0.6	-
65	0	1	15.1	-
66	0	1	13.0	-
67	0	1	8.7	-
68	0	1	9.0	-
69	0	0	5.6	-
70	0	0	0.5	100%
71	0	1	6.5	-
72	0	1	14.5	-
73	0	1	5.6	-
74	0	1	17.9	-
75	0	1	6.8	-
76	0	1	9.6	-
77	0	0	3.5	-
78	0	1	18.5	-
79	0	1	10.9	-
80	0	1	31.2	25%
81	0	1	5.5	-
82	0	1	20.5	-
83	0	1	7.1	-
84	0	1	2.2	-
85	0	1	3.5	-
86	0	1	15.5	-
87	0	1	10.4	-
88	0	1	12.4	-
89	0	1	10.1	-
90	0	0	3.6	0%
91	0	1	20.6	-
92	0	1	44.3	-
93	1	1	7.4	-
94	0	1	10.4	-
95	0	1	4.4	-
96	0	1	25.0	-
97	0	1	19.6	-
98	1	1	8.5	-
99	0	1	10.6	-
100	1	1	18.5	50%
Minimum	**0**	**0**	**0.5**	**0%**
Maximum	**1**	**1**	**44.3**	**100%**
Mean	**0**	**1**	**10.2**	**32.5%**
Median	**0**	**1**	**8.4**	**25.0%**
Standard Dev.	**0**	**0**	**7.68**	**31.3%**

Notes: "-" indicates data not collected; embeddedness was only measured for every 10th (n=10) particle; Calcite Concreted Status: 0 = not concreted, 1 = partially concreted, 2 = fully concreted; Calcite Presence: 0 = calcite absent, 1 = calcite present.

Table D.5: Supporting Substrate and Calcite Measures for Sampling Area RG_LILC3, Line Creek, 2019

RG_LILC3_BIC_1					RG_LILC3_BIC_2				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	18.6	-	1	0	1	13.5	-
2	0	1	8.5	-	2	0	1	17.8	-
3	0	1	12.9	-	3	0	1	11.1	-
4	0	1	16.2	-	4	0	1	12.2	-
5	0	1	10.2	-	5	0	1	21.1	-
6	0	1	8.1	-	6	0	0	8.5	-
7	0	1	7.5	-	7	0	1	25.5	-
8	0	1	10.4	-	8	0	1	12.9	-
9	0	1	14.5	-	9	0	1	17.6	-
10	0	0	8.7	50%	10	0	1	10.9	25%
11	0	1	36.5	-	11	0	1	13.9	-
12	0	1	7.7	-	12	0	1	32.5	-
13	0	1	12.1	-	13	0	1	18.2	-
14	0	1	26.7	-	14	0	1	16.5	-
15	0	1	7.3	-	15	0	1	13.0	-
16	0	1	14.4	-	16	0	1	7.2	-
17	0	1	12.2	-	17	0	1	7.0	-
18	0	1	9.0	-	18	0	0	2.7	-
19	0	1	28.0	-	19	0	1	29.5	-
20	0	1	8.5	50%	20	0	1	4.7	50%
21	0	1	3.5	-	21	0	0	3.5	-
22	0	1	16.1	-	22	0	1	23.3	-
23	0	1	17.0	-	23	0	1	13.6	-
24	0	1	21.5	-	24	0	1	5.5	-
25	0	1	13.4	-	25	0	1	19.9	-
26	0	1	16.2	-	26	0	0	14.2	-
27	0	1	15.5	-	27	0	1	34.5	-
28	0	1	15.5	-	28	0	1	11.6	-
29	0	1	9.4	-	29	0	1	17.9	-
30	1	1	21.5	50%	30	0	1	5.7	75%
31	0	1	4.8	-	31	0	1	19.2	-
32	0	1	10.6	-	32	0	1	30.5	-
33	0	1	6.7	-	33	0	1	15.1	-
34	0	1	12.6	-	34	0	1	19.2	-
35	0	1	13.8	-	35	0	1	20.5	-
36	0	1	9.4	-	36	0	1	14.7	-
37	0	1	14.2	-	37	0	1	10.4	-
38	0	1	6.0	-	38	0	1	14.5	-
39	0	1	7.8	-	39	0	1	11.0	-
40	0	1	5.7	0%	40	0	1	13.6	0%
41	0	1	14.5	-	41	0	1	20.3	-
42	0	1	6.4	-	42	0	1	13.5	-
43	0	1	9.8	-	43	0	1	19.7	-
44	0	1	11.0	-	44	0	1	11.3	-
45	0	1	10.0	-	45	0	1	26.5	-
46	0	1	9.4	-	46	0	1	22.8	-
47	0	1	8.5	-	47	0	1	40.5	-
48	0	1	22.7	-	48	0	1	18.5	-
49	0	1	22.0	-	49	0	1	9.6	-
50	0	1	8.6	25%	50	0	1	14.8	25%
51	0	1	40.0	-	51	0	1	19.3	-
52	0	1	16.7	-	52	0	1	8.9	-
53	0	1	29.5	-	53	0	1	26.5	-
54	0	1	6.4	-	54	0	1	16.5	-
55	0	0	6.0	-	55	0	1	27.5	-
56	0	1	13.0	-	56	0	1	15.1	-
57	0	1	15.0	-	57	0	1	10.5	-
58	0	1	9.3	-	58	0	1	9.8	-
59	0	1	20.8	-	59	0	1	19.0	-
60	0	1	10.7	25%	60	0	1	11.1	25%
61	0	1	4.1	-	61	0	1	4.5	-
62	0	1	17.5	-	62	0	1	31.8	-
63	0	1	20.2	-	63	0	1	8.6	-
64	0	1	5.2	-	64	0	1	24.5	-
65	0	1	12.2	-	65	0	1	7.5	-
66	0	1	8.7	-	66	0	1	23.0	-
67	0	1	30.0	-	67	0	1	16.0	-
68	0	1	12.5	-	68	0	1	18.5	-
69	0	1	9.4	-	69	0	1	24.5	-
70	0	0	2.3	100%	70	1	1	14.5	50%
71	0	1	10.7	-	71	0	1	20.0	-
72	0	0	2.8	-	72	0	1	17.2	-
73	0	0	2.2	-	73	0	1	15.5	-
74	0	1	34.5	-	74	0	1	13.8	-
75	0	1	18.5	-	75	0	1	39.5	-
76	0	0	2.9	-	76	0	0	3.0	-
77	0	0	2.6	-	77	0	1	6.5	-
78	0	1	2.0	-	78	0	1	21.5	-
79	0	1	7.6	-	79	0	1	13.1	-
80	0	1	11.5	75%	80	0	1	11.6	25%
81	0	1	5.0	-	81	0	1	18.5	-
82	0	1	15.2	-	82	0	1	9.2	-
83	0	0	38.0	-	83	0	1	13.1	-
84	0	0	1.4	-	84	0	1	8.3	-
85	0	1	69.5	-	85	0	1	29.5	-
86	0	1	4.9	-	86	0	1	19.5	-
87	0	1	32.0	-	87	0	1	20.2	-
88	0	1	12.5	-	88	0	1	11.3	-
89	0	1	5.0	-	89	0	1	3.2	-
90	0	1	25.8	50%	90	0	1	5.9	50%
91	0	1	9.8	-	91	0	1	15.4	-
92	0	1	13.5	-	92	0	1	32.1	-
93	0	1	17.5	-	93	1	1	13.9	-
94	0	0	3.7	-	94	0	1	8.4	-
95	0	1	23.5	-	95	0	1	5.8	-
96	0	1	14.0	-	96	0	1	8.4	-
97	0	1	7.0	-	97	0	1	9.9	-
98	0	1	10.6	-	98	0	0	10.6	-
99	0	1	10.1	-	99	0	0	16.5	-
100	0	1	22.1	0%	100	0	1	6.5	50%
Minimum	**0**	**0**	**1.4**	**0%**	**Minimum**	**0**	**0**	**2.7**	**0%**
Maximum	**1**	**1**	**69.5**	**100%**	**Maximum**	**1**	**1**	**40.5**	**75.0%**
Mean	**0**	**1**	**13.7**	**42.5%**	**Mean**	**0**	**1**	**15.8**	**37.5%**
Median	**0**	**1**	**10.9**	**50.0%**	**Median**	**0**	**1**	**14.5**	**37.5%**
Standard Dev.	**0**	**0**	**10.04**	**31.3%**	**Standard Dev.**	**0**	**0**	**8.1**	**21.2%**

Notes: "-" indicates data not collected; embeddedness was only measured for every 10th (n=10) particle; Calcite Concreted Status: 0 = not concreted, 1 = partially concreted, 2 = fully concreted; Calcite Presence: 0 = calcite absent, 1 = calcite present.

Table D.5: Supporting Substrate and Calcite Measures for Sampling Area RG_LILC3, Line Creek, 2019

RG_LILC3_BIC_3				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	17.3	-
2	0	1	16.8	-
3	0	1	7.0	-
4	0	1	6.0	-
5	0	1	9.9	-
6	0	1	7.1	-
7	0	1	5.4	-
8	0	1	4.1	-
9	0	1	0.5	-
10	0	1	8.9	25%
11	0	1	14.1	-
12	0	1	6.3	-
13	0	1	12.1	-
14	0	1	3.9	-
15	0	1	11.8	-
16	0	1	12.4	-
17	0	1	4.7	-
18	0	1	4.9	-
19	0	1	3.1	-
20	0	1	15.0	50%
21	0	1	8.5	-
22	0	1	10.5	-
23	0	1	4.6	-
24	0	1	7.7	-
25	0	1	18.5	-
26	0	1	6.5	-
27	0	1	13.7	-
28	0	1	5.3	-
29	0	1	11.6	-
30	0	1	13.4	25%
31	0	1	10.7	-
32	0	1	18.4	-
33	0	1	12.5	-
34	0	1	66.5	-
35	0	1	2.4	-
36	0	1	3.3	-
37	0	1	3.2	-
38	0	1	3.4	-
39	0	1	9.8	-
40	0	1	3.5	0%
41	0	1	5.2	-
42	0	1	4.7	-
43	0	1	6.3	-
44	0	1	9.9	-
45	0	1	6.0	-
46	0	1	5.6	-
47	0	1	8.0	-
48	0	1	9.3	-
49	0	0	2.2	-
50	0	1	14.5	50%
51	0	1	17.0	-
52	0	1	7.3	-
53	0	1	9.5	-
54	0	1	12.0	-
55	0	0	9.3	-
56	0	1	27.5	-
57	0	0	8.0	-
58	0	1	25.5	-
59	0	1	17.0	-
60	0	1	6.7	25%
61	0	1	9.6	-
62	0	1	5.6	-
63	0	1	14.4	-
64	0	1	6.9	-
65	0	1	5.3	-
66	0	1	7.1	-
67	0	1	3.9	-
68	0	1	4.2	-
69	0	1	4.9	-
70	0	1	10.1	75%
71	0	0	2.1	-
72	0	1	11.9	-
73	0	1	11.7	-
74	0	1	10.5	-
75	0	1	8.9	-
76	0	1	10.9	-
77	0	1	14.4	-
78	0	1	8.6	-
79	0	1	5.4	-
80	0	1	5.7	0%
81	0	1	8.0	-
82	0	1	12.9	-
83	0	1	13.6	-
84	0	1	4.2	-
85	0	1	11.2	-
86	0	1	11.3	-
87	0	1	3.5	-
88	0	1	12.2	-
89	0	1	13.8	-
90	0	1	8.1	0%
91	0	1	10.1	-
92	0	1	12.9	-
93	0	1	3.4	-
94	0	1	5.6	-
95	0	1	4.2	-
96	0	1	1.9	-
97	0	1	4.6	-
98	0	1	4.2	-
99	0	1	6.1	-
100	-	1	6.2	25%
Minimum	**0**	**0**	**0.5**	**0%**
Maximum	**0**	**1**	**66.5**	**75.0%**
Mean	**0**	**1**	**9.4**	**27.5%**
Median	**0**	**1**	**8.0**	**25.0%**
Standard Dev.	**0**	**0**	**7.6**	**24.9%**

Notes: "-" indicates data not collected; embeddedness was only measured for every 10th (n=10) particle; Calcite Concreted Status: 0 = not concreted, 1 = partially concreted, 2 = fully concreted; Calcite Presence: 0 = calcite absent, 1 = calcite present.

Table D.6: Supporting Substrate and Calcite Measures for Sampling Area RG_LISP24, Line Creek, 2019

RG_LISP24				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	0	3.6	-
2	0	1	47.5	-
3	0	0	4.8	-
4	0	1	8.1	-
5	0	1	11.8	-
6	0	1	6.6	-
7	0	0	6.8	-
8	0	1	5.6	-
9	0	1	7.4	-
10	0	1	11.8	0%
11	0	1	19.3	-
12	0	1	11.1	-
13	0	1	17.8	-
14	0	0	3.2	-
15	0	1	21.2	-
16	0	0	8.4	-
17	0	1	20.5	-
18	0	1	10.9	-
19	0	1	8.4	-
20	0	1	8.2	0%
21	0	1	18.4	-
22	0	1	27.0	-
23	0	1	9.3	-
24	0	1	14.0	-
25	0	1	30.5	-
26	0	1	23.6	-
27	0	1	13.0	-
28	0	1	12.0	-
29	0	1	15.0	-
30	0	1	8.5	25%
31	0	1	8.5	-
32	0	1	10.3	-
33	0	0	10.0	-
34	0	1	1.5	-
35	0	0	5.5	-
36	0	0	7.5	-
37	0	0	10.0	-
38	0	0	3.6	-
39	0	1	8.4	-
40	0	0	0.9	0%
41	0	1	20.2	-
42	0	1	13.0	-
43	0	0	5.1	-
44	0	1	7.2	-
45	0	1	6.7	-
46	0	1	17.5	-
47	0	0	10.4	-
48	0	1	26.4	-
49	0	1	71.0	-
50	0	1	4.0	50%
51	0	1	32.6	-
52	0	1	8.5	-
53	0	1	13.0	-
54	0	1	16.2	-
55	0	1	7.2	-
56	0	0	4.6	-
57	0	1	36.5	-
58	0	1	19.6	-
59	0	1	37.0	-
60	0	1	15.5	25%
61	0	1	13.9	-
62	0	1	15.8	-
63	0	1	16.0	-
64	0	1	17.2	-
65	0	1	12.7	-
66	0	1	35.5	-
67	0	1	13.1	-
68	0	1	29.5	-
69	0	0	7.0	-
70	0	0	6.4	0%
71	0	1	6.7	-
72	0	1	15.8	-
73	0	0	8.7	-
74	0	1	12.5	-
75	0	1	10.3	-
76	0	1	17.7	-
77	0	1	6.7	-
78	0	1	13.7	-
79	0	1	27.2	-
80	0	1	12.0	25%
81	0	1	11.6	-
82	0	0	4.7	-
83	0	1	11.6	-
84	0	1	15.6	-
85	0	1	34.5	-
86	0	1	28.5	-
87	0	1	70.5	-
88	0	1	10.5	-
89	0	1	15.6	-
90	0	1	10.5	50%
91	0	1	9.5	-
92	0	1	18.6	-
93	0	1	13.5	-
94	0	1	5.9	-
95	0	1	8.5	-
96	0	1	29.8	-
97	0	1	4.5	-
98	0	0	3.9	-
99	0	1	13.8	-
100	0	1	12.7	25%
Minimum	**0**	**0**	**0.9**	**0%**
Maximum	**0**	**1**	**71.0**	**50.0%**
Mean	**0**	**1**	**14.9**	**20.0%**
Median	**0**	**1**	**11.8**	**25.0%**
Standard Dev.	**0**	**0**	**11.97**	**19.7%**

Notes: "-" indicates data not collected; embeddedness was only measured for every 10th (n=10) particle; Calcite Concreted Status: 0 = not concreted, 1 = partially concreted, 2 = fully concreted; Calcite Presence: 0 = calcite absent, 1 = calcite present.

Table D.7: Supporting Substrate and Calcite Measures for Sampling Area RG_LIDSL, Line Creek, 2019

RG_LIDSL_BIC_1					RG_LIDSL_BIC_2				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	13.5	-	1	0	1	6.5	-
2	0	1	7.6	-	2	0	1	5.5	-
3	0	1	8.5	-	3	0	1	14.8	-
4	0	1	12.6	-	4	0	1	13.0	-
5	0	1	18.8	-	5	0	0	3.1	-
6	0	1	11.5	-	6	0	1	11.1	-
7	0	1	7.5	-	7	0	1	21.8	-
8	0	0	4.2	-	8	0	0	3.1	-
9	0	1	11.7	-	9	0	1	16.4	-
10	0	1	11.4	25%	10	0	1	16.8	25%
11	0	1	25.7	-	11	0	1	6.7	-
12	0	1	21.2	-	12	0	1	6.1	-
13	0	1	8.8	-	13	0	0	6.3	-
14	0	0	8.4	-	14	0	1	30.4	-
15	0	1	9.1	-	15	0	1	17.5	-
16	0	0	7.5	-	16	0	0	5.4	-
17	0	0	8.0	-	17	0	1	17.5	-
18	0	0	13.2	-	18	0	1	9.2	-
19	0	1	16.4	-	19	0	0	8.6	-
20	0	1	8.5	0%	20	0	1	18.5	50%
21	0	1	9.4	-	21	0	0	5.4	-
22	0	0	6.4	-	22	0	0	8.7	-
23	0	0	2.4	-	23	0	1	16.8	-
24	0	1	11.5	-	24	0	0	12.5	-
25	0	0	7.4	-	25	0	0	9.5	-
26	0	1	14.0	-	26	0	0	2.3	-
27	0	1	5.2	-	27	0	1	31.0	-
28	0	1	9.5	-	28	0	1	11.0	-
29	0	0	8.1	-	29	0	1	10.4	-
30	0	1	13.2	25%	30	0	0	5.8	0%
31	0	0	12.5	-	31	0	1	10.4	-
32	0	1	6.7	-	32	0	1	10.4	-
33	0	1	6.8	-	33	0	1	5.9	-
34	0	0	4.2	-	34	0	1	7.3	-
35	0	1	16.5	-	35	0	1	21.5	-
36	0	1	7.6	-	36	0	1	2.4	-
37	0	1	12.9	-	37	0	0	14.7	-
38	0	1	7.4	-	38	0	1	26.6	-
39	0	0	8.0	-	39	0	1	22.5	-
40	0	0	4.9	50%	40	0	1	9.4	50%
41	0	0	5.4	-	41	0	1	35.5	-
42	0	0	8.9	-	42	0	1	15.8	-
43	0	1	13.3	-	43	0	1	39.5	-
44	0	1	10.7	-	44	0	1	3.2	-
45	0	0	5.2	-	45	0	1	13.8	-
46	0	0	9.2	-	46	0	1	4.7	-
47	0	1	22.0	-	47	0	0	6.3	-
48	0	1	37.5	-	48	0	1	10.6	-
49	0	1	8.7	-	49	0	0	2.2	-
50	0	0	6.4	0%	50	0	1	16.5	25%
51	0	1	23.5	-	51	0	1	15.3	-
52	0	1	12.1	-	52	0	0	9.9	-
53	0	1	11.5	-	53	0	1	7.5	-
54	0	1	7.7	-	54	0	0	8.1	-
55	0	1	8.3	-	55	0	1	4.9	-
56	0	1	15.2	-	56	0	1	9.6	-
57	0	1	7.5	-	57	0	0	4.2	-
58	0	0	4.9	-	58	0	1	10.8	-
59	0	0	6.8	-	59	0	1	4.9	-
60	0	0	10.5	50%	60	0	1	5.9	25%
61	0	1	12.2	-	61	0	1	16.1	-
62	0	1	8.3	-	62	0	1	14.5	-
63	0	1	8.2	-	63	0	1	18.5	-
64	0	1	20.0	-	64	0	1	9.6	-
65	0	0	7.2	-	65	0	0	4.5	-
66	0	0	12.4	-	66	0	0	5.6	-
67	0	1	8.0	-	67	0	0	7.8	-
68	0	1	18.2	-	68	0	0	9.9	-
69	0	1	28.6	-	69	0	1	8.3	-
70	0	0	5.4	0%	70	0	1	28.0	50%
71	0	0	6.1	-	71	0	0	6.5	-
72	0	1	13.6	-	72	0	1	6.4	-
73	0	1	7.8	-	73	0	1	24.0	-
74	0	1	19.9	-	74	0	0	6.4	-
75	0	1	7.0	-	75	0	1	7.5	-
76	0	0	3.4	-	76	0	0	3.5	-
77	0	0	7.9	-	77	0	0	5.3	-
78	0	1	7.7	-	78	0	1	10.5	-
79	0	1	14.5	-	79	0	0	10.9	-
80	0	1	22.0	25%	80	0	0	5.3	50%
81	0	1	13.3	-	81	0	1	24.5	-
82	0	1	18.7	-	82	0	1	8.8	-
83	0	1	31.2	-	83	0	1	22.0	-
84	0	0	7.7	-	84	0	1	12.4	-
85	0	1	32.3	-	85	0	0	3.4	-
86	0	0	7.6	-	86	0	0	4.7	-
87	0	1	10.9	-	87	0	1	4.5	-
88	0	1	8.8	-	88	0	1	6.5	-
89	0	0	16.8	-	89	0	1	12.8	-
90	0	0	6.3	75%	90	0	1	13.5	50%
91	0	0	19.1	-	91	0	1	8.9	-
92	0	1	18.1	-	92	0	0	10.0	-
93	0	0	5.7	-	93	0	1	9.5	-
94	0	0	13.5	-	94	0	1	12.5	-
95	0	1	8.8	-	95	0	1	9.7	-
96	0	0	4.8	-	96	0	1	12.0	-
97	0	1	13.4	-	97	0	1	7.6	-
98	0	1	10.0	-	98	0	1	27.5	-
99	0	1	14.1	-	99	0	1	12.1	-
100	0	1	9.7	50%	100	0	0	3.4	25%
Minimum	**0**	**0**	**2.4**	**0%**	**Minimum**	**0**	**0**	**2.2**	**0%**
Maximum	**0**	**1**	**37.5**	**75.0%**	**Maximum**	**0**	**1**	**39.5**	**50.0%**
Mean	**0**	**1**	**11.5**	**30.0%**	**Mean**	**0**	**1**	**11.5**	**35.0%**
Median	**0**	**1**	**9.2**	**25.0%**	**Median**	**0**	**1**	**9.6**	**37.5%**
Standard Dev.	**0**	**0**	**6.47**	**25.8%**	**Standard Dev.**	**0**	**0**	**7.6**	**17.5%**

Notes: "-" indicates data not collected; embeddedness was only measured for every 10th (n=10) particle; Calcite Concreted Status: 0 = not concreted, 1 = partially concreted, 2 = fully concreted; Calcite Presence: 0 = calcite absent, 1 = calcite present.

Table D.7: Supporting Substrate and Calcite Measures for Sampling Area RG_LIDSL, Line Creek, 2019

RG_LIDSL_BIC_3					RG_LIDSL_BIC_4				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**	**Rock**	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	0	5.6	-	1	0	1	7.0	-
2	0	0	6.4	-	2	0	1	22.0	-
3	0	1	6.1	-	3	0	0	7.2	-
4	0	0	4.0	-	4	0	1	20.2	-
5	0	0	7.0	-	5	0	0	10.5	-
6	0	0	9.5	-	6	0	1	12.6	-
7	0	0	5.4	-	7	0	1	18.2	-
8	0	1	15.4	-	8	0	0	9.3	-
9	0	1	11.5	-	9	0	1	23.0	-
10	0	1	9.0	25%	10	0	1	5.5	50%
11	0	0	4.3	-	11	0	0	10.2	-
12	0	1	11.7	-	12	0	1	34.3	-
13	0	1	14.0	-	13	0	0	9.1	-
14	0	1	25.0	-	14	0	0	8.4	-
15	0	1	19.4	-	15	0	0	10.9	-
16	0	1	14.5	-	16	0	0	6.5	-
17	0	1	15.7	-	17	0	0	5.0	-
18	0	0	8.2	-	18	0	1	15.4	-
19	0	1	17.0	-	19	0	0	2.9	-
20	0	1	11.0	50%	20	0	1	12.9	50%
21	0	1	22.2	-	21	0	1	6.5	-
22	0	0	3.0	-	22	0	0	12.7	-
23	0	1	6.6	-	23	0	1	8.4	-
24	0	1	16.3	-	24	0	0	5.8	-
25	0	1	6.7	-	25	0	1	8.5	-
26	0	0	3.4	-	26	0	0	21.0	-
27	0	1	26.0	-	27	0	1	18.5	-
28	0	1	16.4	-	28	0	1	12.5	-
29	0	0	2.9	-	29	0	1	9.3	-
30	0	0	9.2	25%	30	0	1	27.5	25%
31	0	1	9.3	-	31	0	1	18.1	-
32	0	1	18.5	-	32	0	0	6.0	-
33	0	1	19.1	-	33	0	0	10.0	-
34	0	1	22.3	-	34	0	1	8.8	-
35	0	1	15.4	-	35	0	0	1.0	-
36	0	1	22.8	-	36	0	1	14.0	-
37	0	0	10.3	-	37	0	1	16.3	-
38	0	1	22.3	-	38	0	1	9.4	-
39	0	1	3.9	-	39	0	1	15.4	-
40	0	1	2.8	0%	40	0	1	11.7	75%
41	0	1	4.3	-	41	0	1	36.5	-
42	0	0	5.6	-	42	0	1	7.8	-
43	0	1	11.7	-	43	0	1	7.2	-
44	0	1	5.7	-	44	0	1	11.3	-
45	0	1	11.5	-	45	0	1	19.5	-
46	0	1	20.8	-	46	0	0	8.2	-
47	0	1	16.0	-	47	0	1	7.6	-
48	0	1	18.7	-	48	0	1	6.1	-
49	0	0	6.5	-	49	0	1	23.0	-
50	0	1	15.0	50%	50	0	1	18.2	25%
51	0	0	6.8	-	51	0	1	13.2	-
52	0	0	20.5	-	52	0	0	8.8	-
53	0	1	19.5	-	53	0	0	7.2	-
54	0	0	8.9	-	54	0	1	18.0	-
55	0	0	4.4	-	55	0	0	8.8	-
56	0	1	11.4	-	56	0	0	5.3	-
57	0	1	13.5	-	57	0	1	10.0	-
58	0	1	12.2	-	58	0	0	9.5	-
59	0	1	12.0	-	59	0	1	8.3	-
60	0	0	7.0	0%	60	0	0	4.2	0%
61	0	1	8.4	-	61	0	0	3.5	-
62	0	1	7.8	-	62	0	0	3.4	-
63	0	0	14.4	-	63	0	1	14.8	-
64	0	1	18.1	-	64	0	1	14.5	-
65	0	1	9.8	-	65	0	0	13.2	-
66	0	1	11.0	-	66	0	0	4.3	-
67	0	1	10.5	-	67	0	1	6.4	-
68	0	0	4.0	-	68	0	1	11.3	-
69	0	1	13.5	-	69	0	0	9.2	-
70	0	0	4.4	0%	70	0	0	4.6	25%
71	0	0	10.4	-	71	0	1	10.0	-
72	0	1	26.5	-	72	0	1	22.1	-
73	0	1	5.5	-	73	0	0	13.9	-
74	0	0	8.2	-	74	0	1	13.2	-
75	0	0	5.5	-	75	0	1	11.4	-
76	0	0	7.0	-	76	0	0	8.8	-
77	0	0	3.9	-	77	0	1	6.8	-
78	0	0	4.2	-	78	0	0	5.8	-
79	0	0	10.0	-	79	0	1	33.7	-
80	0	0	5.8	25%	80	0	0	5.5	50%
81	0	1	8.0	-	81	0	1	28.0	-
82	0	0	5.0	-	82	0	0	5.5	-
83	0	0	5.7	-	83	0	1	20.0	-
84	0	1	7.5	-	84	0	0	7.0	-
85	0	0	12.2	-	85	0	0	4.0	-
86	0	1	11.5	-	86	0	1	42.5	-
87	0	0	5.3	-	87	0	0	7.6	-
88	0	0	11.6	-	88	0	0	12.0	-
89	0	0	6.6	-	89	0	1	14.5	-
90	0	0	4.4	0%	90	0	1	18.1	75%
91	0	0	5.7	-	91	0	1	9.8	-
92	0	1	46.0	-	92	0	0	14.5	-
93	0	0	4.6	-	93	0	1	22.0	-
94	0	1	9.7	-	94	0	0	8.8	-
95	0	1	7.5	-	95	0	1	17.0	-
96	0	0	10.4	-	96	0	1	17.8	-
97	0	1	6.8	-	97	0	1	13.2	-
98	0	0	2.3	-	98	0	1	25.0	-
99	0	1	9.0	-	99	0	1	8.1	-
100	0	1	7.0	0%	100	0	0	10.9	50%
Minimum	**0**	**0**	**2.3**	**0%**	**Minimum**	**0**	**0**	**1.0**	**0%**
Maximum	**0**	**1**	**46.0**	**50.0%**	**Maximum**	**0**	**1**	**42.5**	**75.0%**
Mean	**0**	**1**	**10.9**	**17.5%**	**Mean**	**0**	**1**	**12.5**	**42.5%**
Median	**0**	**1**	**9.3**	**12.5%**	**Median**	**0**	**1**	**10.1**	**50.0%**
Standard Dev.	**0**	**0**	**6.9**	**20.6%**	**Standard Dev.**	**0**	**0**	**7.6**	**23.7%**

Notes: "-" indicates data not collected; embeddedness was only measured for every 10th (n=10) particle; Calcite Concreted Status: 0 = not concreted, 1 = partially concreted, 2 = fully concreted; Calcite Presence: 0 = calcite absent, 1 = calcite present.

Table D.7: Supporting Substrate and Calcite Measures for Sampling Area RG_LIDSL, Line Creek, 2019

RG_LIDSL_BIC_5				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	1	20.5	-
2	0	1	8.6	-
3	0	0	5.0	-
4	0	1	13.2	-
5	0	0	6.5	-
6	0	0	7.3	-
7	0	1	10.1	-
8	0	1	7.9	-
9	0	1	28.8	-
10	0	1	14.6	75%
11	0	1	38.5	-
12	0	1	11.4	-
13	0	1	35.5	-
14	0	0	10.5	-
15	0	1	16.3	-
16	0	1	16.5	-
17	0	1	13.4	-
18	0	1	32.8	-
19	0	1	10.3	-
20	0	1	39.5	25%
21	0	0	6.6	-
22	0	1	19.5	-
23	0	1	11.6	-
24	0	1	9.0	-
25	0	1	9.9	-
26	0	0	3.8	-
27	0	1	10.2	-
28	0	1	22.0	-
29	0	1	7.6	-
30	0	1	9.5	25%
31	0	1	22.5	-
32	0	1	27.0	-
33	0	1	12.1	-
34	0	1	13.6	-
35	0	0	6.1	-
36	0	0	2.1	-
37	0	1	28.5	-
38	0	0	6.1	-
39	0	0	12.0	-
40	0	1	11.2	50%
41	0	0	30.0	-
42	0	0	5.5	-
43	0	1	10.9	-
44	0	0	5.3	-
45	0	0	5.4	-
46	0	1	14.3	-
47	0	0	3.6	-
48	0	0	4.8	-
49	0	1	13.2	-
50	0	0	5.2	75%
51	0	1	16.0	-
52	0	0	9.6	-
53	0	0	9.2	-
54	0	0	4.0	-
55	0	1	15.9	-
56	0	1	13.8	-
57	0	0	7.8	-
58	0	1	37.3	-
59	0	1	7.2	-
60	0	0	11.5	75%
61	0	1	14.3	-
62	0	1	13.3	-
63	0	1	23.3	-
64	0	1	7.4	-
65	0	1	25.2	-
66	0	1	14.6	-
67	0	1	21.2	-
68	0	1	35.5	-
69	0	1	22.3	-
70	0	1	11.3	25%
71	0	1	14.5	-
72	0	1	18.4	-
73	0	1	10.6	-
74	0	1	15.2	-
75	0	0	6.4	-
76	0	1	12.1	-
77	0	1	6.5	-
78	0	1	23.2	-
79	0	0	12.2	-
80	0	0	8.5	75%
81	0	0	9.0	-
82	0	1	8.6	-
83	0	0	13.2	-
84	0	1	10.4	-
85	0	0	9.6	-
86	0	0	6.6	-
87	0	0	18.3	-
88	0	1	25.0	-
89	0	1	12.2	-
90	0	0	7.8	50%
91	0	1	18.3	-
92	0	1	8.7	-
93	0	0	3.0	-
94	0	0	7.5	-
95	0	0	4.0	-
96	0	0	17.2	-
97	0	0	11.6	-
98	0	1	8.8	-
99	0	1	9.3	-
100	0	1	10.4	75%
Minimum	**0**	**0**	**2.1**	**25.0%**
Maximum	**0**	**1**	**39.5**	**75.0%**
Mean	**0**	**0.64**	**13.6**	**55.0%**
Median	**0**	**1**	**11.4**	**62.5%**
Standard Dev.	**0**	**0.48**	**8.5**	**23.0%**

Notes: "-" indicates data not collected; embeddedness was only measured for every 10th (n=10) particle; Calcite Concreted Status: 0 = not concreted, 1 = partially concreted, 2 = fully concreted; Calcite Presence: 0 = calcite absent, 1 = calcite present.

Table D.8: Supporting Substrate and Calcite Measures for Sampling Area RG_LIDCOM, Line Creek, 2019

RG_LIDCOM				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	0	1.4	-
2	0	0	4.8	-
3	0	0	3.6	-
4	0	0	4.2	-
5	0	1	14.9	-
6	0	0	28.3	-
7	0	0	16.6	-
8	0	0	11.7	-
9	0	0	13.6	-
10	0	0	8.8	50%
11	0	0	7.8	-
12	0	1	5.8	-
13	0	0	9.0	-
14	0	1	12.6	-
15	0	0	8.1	-
16	0	0	10.2	-
17	0	0	5.8	-
18	0	1	14.6	-
19	0	0	9.9	-
20	0	0	5.8	50%
21	0	0	6.8	-
22	0	0	13.9	-
23	0	0	14.5	-
24	0	0	6.0	-
25	0	1	20.7	-
26	0	0	14.9	-
27	0	0	7.3	-
28	0	1	11.4	-
29	0	1	18.4	-
30	0	0	5.5	50%
31	0	1	13.1	-
32	0	1	14.7	-
33	0	0	15.0	-
34	0	1	17.4	-
35	0	0	10.3	-
36	0	1	20.1	-
37	0	0	10.7	-
38	0	0	8.2	-
39	0	0	6.4	-
40	0	0	5.4	50%
41	0	0	3.8	-
42	0	0	10.0	-
43	0	0	3.4	-
44	0	0	3.5	-
45	0	0	3.8	-
46	0	1	17.7	-
47	0	0	4.6	-
48	0	0	4.2	-
49	0	0	3.3	-
50	0	0	5.5	25%
51	0	1	23.3	-
52	0	0	7.4	-
53	0	0	11.5	-
54	0	0	6.2	-
55	0	0	16.6	-
56	0	1	24.1	-
57	0	1	19.0	-
58	0	1	7.5	-
59	0	1	8.6	-
60	0	1	15.0	25%
61	0	0	2.0	-
62	0	1	11.6	-
63	0	0	6.1	-
64	0	1	38.0	-
65	0	0	3.8	-
66	0	1	35.4	-
67	0	0	14.9	-
68	0	0	11.2	-
69	0	0	5.6	-
70	0	1	4.8	50%
71	0	1	31.5	-
72	0	0	7.5	-
73	0	0	5.5	-
74	0	0	8.3	-
75	0	0	13.5	-
76	0	0	10.8	-
77	0	0	6.0	-
78	0	0	4.1	-
79	0	1	20.2	-
80	0	0	8.2	50%
81	0	0	10.2	-
82	0	0	9.5	-
83	0	1	43.5	-
84	-	-	Bedrock	-
85	0	0	7.2	-
86	0	1	15.7	-
87	-	-	Bedrock	-
88	0	0	6.0	-
89	0	1	30.0	-
90	0	1	20.6	50%
91	0	0	6.7	-
92	0	0	12.3	-
93	0	1	11.2	-
94	0	0	5.9	-
95	0	0	6.2	-
96	0	0	5.4	-
97	0	1	7.9	-
98	0	0	6.5	-
99	0	0	6.5	-
100	0	0	5.1	50%
Minimum	**0**	**0**	**1.4**	**25.0%**
Maximum	**0**	**1**	**43.5**	**50.0%**
Mean	**0**	**0**	**11.3**	**45.0%**
Median	**0**	**0**	**8.7**	**50.0%**
Standard Dev.	**0**	**0**	**7.9**	**10.5%**

Notes: "-" indicates data not collected; embeddedness was only measured for every 10th (n=10) particle; Calcite Concreted Status: 0 = not concreted, 1 = partially concreted, 2 = fully concreted; Calcite Presence: 0 = calcite absent, 1 = calcite present.

Table D.9: Supporting Substrate and Calcite Measures for Sampling Area RG_LI8, Line Creek, 2019

RG_L18_BIC_1					RG_L18_BIC_2				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	11.5	-	1	0	1	33.2	-
2	0	0	10.2	-	2	0	1	22.1	-
3	0	1	26.5	-	3	0	0	8.4	-
4	0	0	11.2	-	4	0	1	10.4	-
5	0	1	33.5	-	5	0	0	7.3	-
6	0	0	6.4	-	6	0	1	29.3	-
7	0	1	13.9	-	7	0	0	10.0	-
8	0	1	17.6	-	8	0	1	15.7	-
9	0	1	11.0	-	9	0	0	5.6	-
10	0	0	12.1	75%	10	0	0	9.2	50%
11	0	1	36.0	-	11	0	1	34.4	-
12	0	0	13.5	-	12	0	1	38.0	-
13	0	0	4.7	-	13	0	0	13.5	-
14	0	0	8.3	-	14	0	0	9.0	-
15	0	0	7.0	-	15	0	0	6.7	-
16	0	0	10.5	-	16	0	0	13.5	-
17	0	0	4.4	-	17	0	1	20.5	-
18	0	0	19.5	-	18	0	0	6.0	-
19	0	0	8.8	-	19	0	1	13.8	-
20	0	0	4.2	0%	20	0	1	15.0	50%
21	0	0	12.7	-	21	0	0	12.4	-
22	0	1	23.3	-	22	0	1	15.2	-
23	0	1	16.3	-	23	0	0	7.8	-
24	0	0	15.3	-	24	0	1	23.0	-
25	0	0	10.5	-	25	0	0	15.5	-
26	0	0	17.5	-	26	0	0	6.7	-
27	0	0	19.8	-	27	0	1	51.3	-
28	0	1	15.7	-	28	0	0	8.8	-
29	0	1	26.0	-	29	0	0	13.5	-
30	0	1	15.3	75%	30	0	0	5.9	25%
31	0	0	9.2	-	31	0	0	2.7	-
32	0	0	8.8	-	32	0	1	10.5	-
33	0	1	15.4	-	33	0	0	3.0	-
34	0	0	4.3	-	34	0	0	4.2	-
35	0	0	16.5	-	35	0	0	9.0	-
36	0	0	2.2	-	36	0	0	17.5	-
37	0	1	34.0	-	37	0	0	2.6	-
38	0	0	9.6	-	38	0	0	9.3	-
39	0	1	48.5	-	39	0	0	8.7	-
40	0	1	20.4	75%	40	0	0	3.8	75%
41	0	0	10.3	-	41	0	1	24.5	-
42	0	0	8.5	-	42	0	0	8.4	-
43	0	0	7.1	-	43	0	0	10.8	-
44	0	1	16.1	-	44	0	1	12.7	-
45	0	0	2.6	-	45	0	0	1.8	-
46	0	0	7.3	-	46	0	0	9.4	-
47	0	0	17.5	-	47	0	1	13.5	-
48	0	0	2.8	-	48	0	0	9.8	-
49	0	0	20.5	-	49	0	0	10.8	-
50	0	1	23.3	50%	50	0	1	8.2	75%
51	0	0	14.7	-	51	0	0	10.6	-
52	0	1	18.7	-	52	0	0	13.7	-
53	0	1	17.2	-	53	0	1	24.8	-
54	0	0	12.5	-	54	0	0	15.3	-
55	0	0	13.0	-	55	0	0	13.8	-
56	0	1	45.0	-	56	0	0	13.2	-
57	0	0	10.3	-	57	0	1	18.5	-
58	0	0	11.8	-	58	0	0	23.5	-
59	0	0	1.7	-	59	0	1	25.6	-
60	0	1	9.5	50%	60	0	0	5.9	50%
61	0	0	3.7	-	61	0	0	17.7	-
62	0	0	5.8	-	62	0	0	7.2	-
63	0	1	9.0	-	63	0	1	22.3	-
64	0	0	10.0	-	64	0	1	10.8	-
65	0	1	10.3	-	65	0	0	10.8	-
66	0	1	16.9	-	66	0	1	13.8	-
67	0	0	8.6	-	67	0	0	10.9	-
68	0	1	15.6	-	68	0	1	25.5	-
69	0	0	4.6	-	69	0	1	18.5	-
70	0	1	45.0	25%	70	0	0	6.0	50%
71	0	0	5.2	-	71	0	0	6.1	-
72	0	1	18.1	-	72	0	1	15.4	-
73	0	0	8.8	-	73	0	1	9.6	-
74	0	0	11.5	-	74	0	1	21.6	-
75	0	0	6.2	-	75	0	1	13.2	-
76	0	1	13.5	-	76	0	1	13.5	-
77	0	1	15.0	-	77	0	0	4.6	-
78	0	0	16.3	-	78	0	0	7.8	-
79	0	0	5.0	-	79	0	1	29.8	-
80	0	0	3.6	25%	80	0	1	10.3	75%
81	0	0	4.1	-	81	0	0	8.8	-
82	0	1	16.2	-	82	0	1	21.3	-
83	0	0	5.6	-	83	0	0	1.7	-
84	0	0	6.1	-	84	0	1	44.5	-
85	0	1	18.0	-	85	0	0	6.3	-
86	0	0	6.6	-	86	0	0	5.5	-
87	0	1	20.3	-	87	0	0	9.3	-
88	0	0	6.5	-	88	0	0	14.5	-
89	0	1	3.0	-	89	0	0	3.8	-
90	0	0	18.2	75%	90	0	1	14.7	50%
91	0	0	10.8	-	91	0	0	6.2	-
92	0	1	11.3	-	92	0	1	42.3	-
93	0	1	16.7	-	93	0	0	7.3	-
94	0	0	3.2	-	94	0	0	6.8	-
95	0	0	7.5	-	95	0	1	16.0	-
96	0	1	27.8	-	96	0	0	15.5	-
97	0	0	10.0	-	97	0	0	46.0	-
98	0	0	20.1	-	98	0	0	5.1	-
99	0	0	13.8	-	99	0	1	13.4	-
100	0	1	15.8	75%	100	0	1	10.2	75%
Minimum	**0**	**0**	**1.7**	**0%**	**Minimum**	**0**	**0**	**1.7**	**25.0%**
Maximum	**0**	**1**	**48.5**	**75.0%**	**Maximum**	**0**	**1**	**51.3**	**75.0%**
Mean	**0**	**0**	**13.6**	**52.5%**	**Mean**	**0**	**0**	**14.0**	**57.5%**
Median	**0**	**0**	**11.5**	**62.5%**	**Median**	**0**	**0**	**10.8**	**50.0%**
Standard Dev.	**0**	**0**	**9.09**	**27.5%**	**Standard Dev.**	**0**	**0**	**9.9**	**16.9%**

Notes: "-" indicates data not collected; embeddedness was only measured for every 10th (n=10) particle; Calcite Concreted Status: 0 = not concreted, 1 = partially concreted, 2 = fully concreted; Calcite Presence: 0 = calcite absent, 1 = calcite present.

Table D.9: Supporting Substrate and Calcite Measures for Sampling Area RG_LI8, Line Creek, 2019

RG_L18_BIC_3				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	1	13.2	-
2	0	1	12.1	-
3	0	1	28.0	-
4	0	1	7.8	-
5	0	1	18.5	-
6	0	1	13.5	-
7	0	0	13.2	-
8	0	1	13.0	-
9	0	1	17.2	-
10	0	1	12.4	50%
11	0	0	6.8	-
12	0	1	23.0	-
13	0	0	3.8	-
14	0	1	21.5	-
15	0	0	8.4	-
16	0	0	16.0	-
17	0	0	7.3	-
18	0	0	4.8	-
19	0	0	9.2	-
20	0	1	6.3	50%
21	0	0	6.7	-
22	0	0	7.6	-
23	0	0	7.0	-
24	0	0	8.3	-
25	0	0	12.5	-
26	0	0	14.8	-
27	0	0	6.0	-
28	0	0	11.8	-
29	0	0	8.2	-
30	0	1	13.5	50%
31	0	0	1.0	-
32	0	0	6.8	-
33	0	0	8.0	-
34	0	0	5.0	-
35	0	0	5.6	-
36	0	0	10.5	-
37	0	0	4.0	-
38	0	1	28.8	-
39	0	0	11.5	-
40	0	1	12.4	50%
41	0	0	12.8	-
42	0	1	35.5	-
43	0	0	6.7	-
44	0	1	24.2	-
45	0	0	6.0	-
46	0	1	13.3	-
47	0	0	7.8	-
48	0	1	26.5	-
49	0	0	6.3	-
50	0	0	9.1	25%
51	0	0	6.5	-
52	0	1	7.8	-
53	0	1	19.5	-
54	0	1	11.8	-
55	0	1	13.9	-
56	0	1	16.7	-
57	0	0	9.6	-
58	0	0	10.0	-
59	0	1	12.5	-
60	0	0	7.6	50%
61	0	0	13.1	-
62	0	0	8.5	-
63	0	0	6.6	-
64	0	1	12.3	-
65	0	0	6.8	-
66	0	0	10.5	-
67	0	1	23.3	-
68	0	0	9.7	-
69	0	1	10.5	-
70	0	1	15.2	50%
71	0	1	11.4	-
72	0	1	6.8	-
73	0	0	4.3	-
74	0	1	19.5	-
75	0	0	4.9	-
76	0	0	16.0	-
77	0	0	5.9	-
78	0	0	19.8	-
79	0	0	12.2	-
80	0	1	13.0	50%
81	0	0	8.8	-
82	0	0	15.5	-
83	0	1	41.5	-
84	0	0	13.2	-
85	0	0	5.6	-
86	0	1	25.5	-
87	0	0	12.0	-
88	0	0	22.0	-
89	0	1	22.8	-
90	0	0	14.0	25%
91	0	0	13.9	-
92	0	1	28.5	-
93	0	0	7.8	-
94	0	1	32.0	-
95	0	0	12.3	-
96	0	0	7.0	-
97	0	0	3.2	-
98	0	0	6.1	-
99	0	0	8.2	-
100	0	0	7.1	25%
Minimum	**0**	**0**	**1.0**	**25.0%**
Maximum	**0**	**1**	**41.5**	**50.0%**
Mean	**0**	**0**	**12.5**	**42.5%**
Median	**0**	**0**	**11.5**	**50.0%**
Standard Dev.	**0**	**0**	**7.4**	**12.1%**

Notes: "-" indicates data not collected; embeddedness was only measured for every 10th (n=10) particle; Calcite Concreted Status: 0 = not concreted, 1 = partially concreted, 2 = fully concreted; Calcite Presence: 0 = calcite absent, 1 = calcite present.

Table D.10: Supporting Substrate and Calcite Measures for Sampling Area RG_FRUL, Line Creek, 2019

RG_FRUL				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	0	2.9	-
2	0	0	7.5	-
3	0	0	6.5	-
4	0	0	6.3	-
5	0	0	18.0	-
6	0	0	11.8	-
7	0	0	4.3	-
8	0	0	4.2	-
9	0	0	7.4	-
10	0	0	7.2	50%
11	0	0	11.8	-
12	0	0	3.4	-
13	0	0	5.5	-
14	0	0	7.2	-
15	0	0	6.6	-
16	0	0	13.2	-
17	0	0	20.3	-
18	0	0	4.8	-
19	0	0	11.5	-
20	0	0	4.6	25%
21	0	0	9.2	-
22	0	0	7.8	-
23	0	0	4.6	-
24	0	0	9.6	-
25	0	0	15.5	-
26	0	0	10.2	-
27	0	0	3.7	-
28	0	0	8.8	-
29	0	0	9.4	-
30	0	0	10.0	25%
31	0	0	6.4	-
32	0	0	6.2	-
33	0	0	15.4	-
34	0	0	9.5	-
35	0	0	12.4	-
36	0	0	21.8	-
37	0	0	5.2	-
38	0	0	13.6	-
39	0	0	20.5	-
40	0	0	6.8	25%
41	0	0	26.5	-
42	0	0	11.8	-
43	0	0	14.5	-
44	0	0	5.4	-
45	0	0	7.8	-
46	0	0	17.4	-
47	0	0	15.2	-
48	0	0	9.5	-
49	0	0	4.6	-
50	0	0	11.6	0%
51	0	0	4.9	-
52	0	0	3.6	-
53	0	0	20.7	-
54	0	0	15.2	-
55	0	0	6.4	-
56	0	0	5.6	-
57	0	0	1.7	-
58	0	0	4.4	-
59	0	0	10.3	-
60	0	0	4.1	25%
61	0	0	11.4	-
62	0	0	6.2	-
63	0	0	10.3	-
64	0	0	5.3	-
65	0	0	10.0	-
66	0	0	13.3	-
67	0	0	5.6	-
68	0	0	4.9	-
69	0	0	3.4	-
70	0	0	8.0	25%
71	0	0	27.0	-
72	0	0	11.3	-
73	0	0	4.5	-
74	0	0	12.2	-
75	0	0	5.2	-
76	0	0	7.8	-
77	0	0	10.3	-
78	0	0	6.5	-
79	0	0	21.5	-
80	0	0	4.5	0%
81	0	0	5.1	-
82	0	0	4.5	-
83	0	0	2.2	-
84	0	0	7.8	-
85	0	0	8.3	-
86	0	0	4.6	-
87	0	0	3.5	-
88	0	0	9.6	-
89	0	0	26.5	-
90	0	0	6.5	0%
91	0	0	6.3	-
92	0	0	15.5	-
93	0	0	14.2	-
94	0	0	4.8	-
95	0	0	14.9	-
96	0	0	10.5	-
97	0	0	6.4	-
98	0	0	7.0	-
99	0	0	30.5	-
100	0	0	11.5	25%
Minimum	**0**	**0**	**1.7**	**0%**
Maximum	**0**	**0**	**30.5**	**50.0%**
Mean	**0**	**0**	**9.6**	**20.0%**
Median	**0**	**0**	**7.8**	**25.0%**
Standard Dev.	**0**	**0**	**5.9**	**15.8%**

Notes: "-" indicates data not collected; embeddedness was only measured for every 10th (n=10) particle; Calcite Concreted Status: 0 = not concreted, 1 = partially concreted, 2 = fully concreted; Calcite Presence: 0 = calcite absent, 1 = calcite present.

Table D.11: Supporting Substrate and Calcite Measures for Sampling Area RG_FO23, Line Creek, 2019

RG_FO23_BIC_1					RG_FO23_BIC_2				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	25.5	-	1	0	0	5.2	-
2	0	1	19.5	-	2	0	0	6.7	-
3	0	1	6.4	-	3	0	1	12.3	-
4	0	1	7.6	-	4	0	0	8.9	-
5	0	1	21.4	-	5	0	1	7.5	-
6	0	1	27.2	-	6	0	0	10.2	-
7	0	1	4.2	-	7	0	1	18.9	-
8	0	1	14.7	-	8	0	0	8.6	-
9	0	0	2.3	-	9	0	1	18.6	-
10	0	1	46.0	50%	10	0	0	7.4	25%
11	0	1	7.5	-	11	0	0	3.4	-
12	0	1	6.2	-	12	0	0	4.5	-
13	0	1	29.9	-	13	0	0	14.6	-
14	0	1	9.7	-	14	0	0	9.2	-
15	0	1	6.4	-	15	0	0	6.1	-
16	0	1	38.5	-	16	0	1	14.7	-
17	0	1	31.5	-	17	0	0	0.6	-
18	0	1	9.5	-	18	0	0	16.0	-
19	0	1	17.5	-	19	0	0	5.1	-
20	0	1	11.5	50%	20	0	0	8.0	25%
21	0	1	11.0	-	21	0	0	8.5	-
22	0	1	14.5	-	22	0	0	11.6	-
23	0	1	6.0	-	23	0	1	10.5	-
24	0	1	15.5	-	24	0	0	10.2	-
25	0	1	12.2	-	25	0	0	13.2	-
26	0	1	51.5	-	26	0	0	15.6	-
27	0	1	12.5	-	27	0	0	3.5	-
28	0	1	5.5	-	28	0	0	9.9	-
29	0	1	29.0	-	29	0	0	5.0	-
30	0	1	10.6	25%	30	0	0	6.6	50%
31	0	1	14.0	-	31	0	0	5.8	-
32	0	1	11.2	-	32	0	0	13.2	-
33	0	1	11.0	-	33	0	1	10.2	-
34	0	1	32.5	-	34	0	0	4.2	-
35	0	1	35.5	-	35	0	1	12.2	-
36	0	1	21.5	-	36	0	1	10.4	-
37	0	1	6.5	-	37	0	0	15.3	-
38	0	1	49.0	-	38	0	0	4.6	-
39	0	1	12.0	-	39	0	1	7.9	-
40	0	0	7.1	0%	40	0	0	6.8	50%
41	0	1	9.2	-	41	0	0	6.8	-
42	0	1	7.0	-	42	0	1	14.2	-
43	0	1	11.2	-	43	0	0	6.5	-
44	0	0	5.4	-	44	0	1	13.5	-
45	0	1	10.3	-	45	0	1	13.6	-
46	0	0	9.2	-	46	0	1	9.5	-
47	0	1	24.0	-	47	0	0	7.8	-
48	0	0	4.0	-	48	0	1	20.2	-
49	0	0	2.0	-	49	0	0	11.3	-
50	0	0	5.2	0%	50	0	0	9.5	50%
51	0	1	22.7	-	51	0	0	9.1	-
52	0	0	5.9	-	52	0	0	10.5	-
53	0	0	3.8	-	53	0	0	5.2	-
54	0	0	19.2	-	54	0	1	23.5	-
55	0	0	3.4	-	55	0	0	6.2	-
56	0	0	12.5	-	56	0	1	26.5	-
57	0	0	5.4	-	57	0	0	10.4	-
58	0	1	27.5	-	58	0	0	8.2	-
59	0	1	21.6	-	59	0	0	6.0	-
60	0	0	4.0	0%	60	0	0	10.9	25%
61	0	0	8.0	-	61	0	0	6.3	-
62	0	1	34.5	-	62	0	0	5.3	-
63	0	0	7.5	-	63	0	1	18.2	-
64	0	0	15.5	-	64	0	1	14.3	-
65	0	0	2.2	-	65	0	0	13.0	-
66	0	0	9.2	-	66	0	1	8.2	-
67	0	0	4.7	-	67	0	1	10.4	-
68	0	0	4.0	-	68	0	1	11.3	-
69	0	0	36.5	-	69	0	0	9.7	-
70	0	0	8.5	50%	70	0	0	6.6	25%
71	0	0	4.6	-	71	0	0	17.0	-
72	0	0	1.5	-	72	0	0	2.3	-
73	0	0	4.1	-	73	0	0	6.6	-
74	0	0	9.0	-	74	0	1	8.6	-
75	0	0	10.0	-	75	0	0	8.0	-
76	0	0	16.4	-	76	0	0	3.8	-
77	0	0	3.6	-	77	0	0	13.0	-
78	0	0	4.5	-	78	0	0	3.5	-
79	0	0	8.6	-	79	0	0	10.0	-
80	0	0	15.5	25%	80	0	0	5.5	75%
81	0	0	8.2	-	81	0	0	14.2	-
82	0	0	9.4	-	82	0	0	2.2	-
83	0	0	3.2	-	83	0	1	13.5	-
84	0	0	30.5	-	84	0	0	7.4	-
85	0	0	5.2	-	85	0	0	3.4	-
86	0	0	4.2	-	86	0	1	21.2	-
87	0	0	7.2	-	87	0	0	7.6	-
88	0	0	6.2	-	88	0	0	4.8	-
89	0	0	5.5	-	89	0	0	8.8	-
90	0	0	7.8	0%	90	0	0	10.5	50%
91	0	0	4.4	-	91	0	0	18.0	-
92	0	0	13.5	-	92	0	0	8.5	-
93	0	0	15.5	-	93	0	1	10.5	-
94	0	0	6.4	-	94	0	0	6.5	-
95	0	0	9.5	-	95	0	0	8.0	-
96	0	0	16.8	-	96	0	0	9.2	-
97	0	0	8.2	-	97	0	0	6.6	-
98	0	0	11.9	-	98	0	0	9.2	-
99	0	0	1.2	-	99	0	0	4.5	-
100	0	0	4.8	0%	100	0	1	9.0	50%
Minimum	**0**	**0**	**1.2**	**0%**	**Minimum**	**0**	**0**	**0.6**	**25.0%**
Maximum	**0**	**1**	**51.5**	**50.0%**	**Maximum**	**0**	**1**	**26.5**	**75.0%**
Mean	**0**	**0**	**13.1**	**20.0%**	**Mean**	**0**	**0**	**9.7**	**42.5%**
Median	**0**	**0**	**9.3**	**12.5%**	**Median**	**0**	**0**	**9.0**	**50.0%**
Standard Dev.	**0**	**1**	**10.91**	**23.0%**	**Standard Dev.**	**0**	**0**	**4.8**	**16.9%**

Notes: "-" indicates data not collected; embeddedness was only measured for every 10th (n=10) particle; Calcite Concreted Status: 0 = not concreted, 1 = partially concreted, 2 = fully concreted; Calcite Presence: 0 = calcite absent, 1 = calcite present.

Table D.11: Supporting Substrate and Calcite Measures for Sampling Area RG_FO23, Line Creek, 2019

RG_FO23_BIC_3					RG_FO23_BIC_4				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	19.5	-	1	0	0	3.2	-
2	0	0	24.0	-	2	0	0	11.2	-
3	0	1	10.4	-	3	0	0	10.2	-
4	0	0	15.5	-	4	0	0	13.0	-
5	0	0	6.0	-	5	0	0	7.3	-
6	0	0	20.5	-	6	0	0	8.0	-
7	0	0	5.4	-	7	0	0	12.5	-
8	0	0	7.9	-	8	0	0	6.1	-
9	0	0	4.3	-	9	0	0	4.2	-
10	0	0	23.5	50%	10	0	0	5.6	50%
11	0	0	3.2	-	11	0	0	30.4	-
12	0	1	8.9	-	12	0	0	8.6	-
13	0	0	4.4	-	13	0	0	22.0	-
14	0	0	6.5	-	14	0	0	7.2	-
15	0	0	2.0	-	15	0	0	6.5	-
16	0	0	6.8	-	16	0	0	4.5	-
17	0	0	8.1	-	17	0	0	7.5	-
18	0	0	10.7	-	18	0	0	36.5	-
19	0	0	13.5	-	19	0	0	8.0	-
20	0	0	5.1	0%	20	0	0	7.5	25%
21	0	0	11.2	-	21	0	0	15.5	-
22	0	0	2.6	-	22	0	0	13.7	-
23	0	0	3.6	-	23	0	0	18.5	-
24	0	0	11.1	-	24	0	0	6.2	-
25	0	0	4.7	-	25	0	0	27.0	-
26	0	0	3.4	-	26	0	0	8.2	-
27	0	0	10.2	-	27	0	0	26.5	-
28	0	0	7.7	-	28	0	0	8.6	-
29	0	0	3.1	-	29	0	0	8.1	-
30	0	0	5.5	0%	30	0	0	5.1	0%
31	0	0	15.6	-	31	0	0	6.2	-
32	0	0	4.6	-	32	0	0	6.7	-
33	0	0	12.3	-	33	0	0	11.5	-
34	0	0	4.9	-	34	0	0	18.5	-
35	0	0	5.8	-	35	0	0	5.2	-
36	0	0	6.0	-	36	0	0	13.4	-
37	0	0	0.5	-	37	0	0	14.1	-
38	0	0	12.2	-	38	0	0	31.5	-
39	0	0	22.5	-	39	0	0	36.0	-
40	0	0	9.6	25%	40	0	0	5.5	75%
41	0	0	15.8	-	41	0	0	27.0	-
42	0	0	12.9	-	42	0	0	6.0	-
43	0	0	9.6	-	43	0	0	2.7	-
44	0	0	2.0	-	44	0	0	17.0	-
45	0	0	12.9	-	45	0	0	10.3	-
46	0	0	15.6	-	46	0	0	12.5	-
47	0	0	7.4	-	47	0	0	36.5	-
48	0	0	6.2	-	48	0	0	6.4	-
49	0	0	2.5	-	49	0	0	4.7	-
50	0	0	7.5	50%	50	0	0	14.2	25%
51	0	0	7.7	-	51	0	0	2.3	-
52	0	0	6.1	-	52	0	0	15.6	-
53	0	0	7.8	-	53	0	0	19.0	-
54	0	0	15.0	-	54	0	0	36.0	-
55	0	0	3.0	-	55	0	1	32.5	-
56	0	0	2.5	-	56	0	0	10.6	-
57	0	0	10.4	-	57	0	0	4.3	-
58	0	0	7.7	-	58	0	0	9.6	-
59	0	0	5.3	-	59	0	1	24.0	-
60	0	1	26.0	0%	60	0	0	1.2	100%
61	0	0	12.5	-	61	0	0	6.2	-
62	0	0	11.4	-	62	0	0	18.1	-
63	0	0	0.8	-	63	0	0	19.2	-
64	0	0	9.2	-	64	0	1	33.0	-
65	0	0	9.5	-	65	0	0	19.5	-
66	0	0	15.2	-	66	0	0	13.2	-
67	0	0	7.2	-	67	0	0	6.5	-
68	0	0	7.5	-	68	0	0	18.0	-
69	0	0	22.5	-	69	0	1	26.0	-
70	0	1	21.0	25%	70	0	0	18.0	75%
71	0	0	9.5	-	71	0	0	5.2	-
72	0	1	12.1	-	72	0	0	10.5	-
73	0	0	13.9	-	73	0	0	29.5	-
74	0	1	40.5	-	74	0	0	13.0	-
75	0	1	11.8	-	75	0	0	9.0	-
76	0	1	13.2	-	76	0	0	8.6	-
77	0	1	17.5	-	77	0	0	26.0	-
78	0	0	10.5	-	78	0	0	2.1	-
79	0	1	11.8	-	79	0	1	16.1	-
80	0	0	6.6	25%	80	0	0	5.5	25%
81	0	1	17.4	-	81	0	0	20.2	-
82	0	1	1.5	-	82	0	0	25.0	-
83	0	1	15.5	-	83	0	0	10.4	-
84	0	1	15.5	-	84	0	0	6.1	-
85	0	0	9.2	-	85	0	0	3.6	-
86	0	1	14.3	-	86	0	0	4.5	-
87	0	1	19.5	-	87	0	0	9.1	-
88	0	0	6.4	-	88	0	0	16.5	-
89	0	0	10.4	-	89	0	0	6.4	-
90	0	0	11.4	25%	90	0	1	20.4	25%
91	0	0	13.5	-	91	0	1	25.5	-
92	0	0	16.0	-	92	0	0	17.7	-
93	0	0	23.5	-	93	0	0	9.8	-
94	0	0	6.0	-	94	0	0	20.0	-
95	0	1	15.0	-	95	0	1	25.0	-
96	0	0	7.5	-	96	0	0	9.3	-
97	0	0	2.8	-	97	0	0	7.3	-
98	0	0	8.4	-	98	0	0	20.4	-
99	0	0	27.3	-	99	0	1	43.5	-
100	0	0	7.9	50%	100	0	0	17.5	50%
Minimum	**0**	**0**	**0.5**	**0%**	**Minimum**	**0**	**0**	**1.2**	**0%**
Maximum	**0**	**1**	**40.5**	**50.0%**	**Maximum**	**0**	**1**	**43.5**	**100%**
Mean	**0**	**0**	**10.6**	**25.0%**	**Mean**	**0**	**0**	**14.2**	**45.0%**
Median	**0**	**0**	**9.5**	**25.0%**	**Median**	**0**	**0**	**10.9**	**37.5%**
Standard Dev.	**0**	**0**	**6.8**	**20.4%**	**Standard Dev.**	**0**	**0**	**9.6**	**30.7%**

Notes: "-" indicates data not collected; embeddedness was only measured for every 10th (n=10) particle; Calcite Concreted Status: 0 = not concreted, 1 = partially concreted, 2 = fully concreted; Calcite Presence: 0 = calcite absent, 1 = calcite present.

Table D.11: Supporting Substrate and Calcite Measures for Sampling Area RG_FO23, Line Creek, 2019

RG_FO23_BIC_5				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	0	6.2	-
2	0	0	7.8	-
3	0	0	8.3	-
4	0	0	8.5	-
5	0	0	4.6	-
6	0	1	5.8	-
7	0	0	7.5	-
8	0	0	5.7	-
9	0	0	9.1	-
10	0	0	14.4	25%
11	0	0	6.9	-
12	0	0	7.1	-
13	0	1	5.8	-
14	0	0	2.8	-
15	0	0	4.0	-
16	0	1	14.5	-
17	0	1	9.2	-
18	0	0	3.2	-
19	0	1	16.3	-
20	0	0	4.9	50%
21	0	1	8.9	-
22	0	1	13.0	-
23	0	0	10.0	-
24	0	0	12.4	-
25	0	1	5.8	-
26	0	0	3.7	-
27	0	1	12.2	-
28	0	0	10.8	-
29	0	1	10.9	-
30	0	0	5.7	25%
31	0	0	15.5	-
32	0	1	18.5	-
33	0	0	5.8	-
34	0	1	10.6	-
35	0	0	7.7	-
36	0	0	8.6	-
37	0	1	15.4	-
38	0	0	5.3	-
39	0	1	16.2	-
40	0	0	5.5	50%
41	0	0	6.5	-
42	0	0	15.5	-
43	0	0	5.6	-
44	0	1	13.5	-
45	0	0	6.8	-
46	0	1	16.5	-
47	0	0	4.5	-
48	0	0	2.5	-
49	0	1	14.7	-
50	0	1	10.9	0%
51	0	0	7.5	-
52	0	0	5.9	-
53	0	0	13.0	-
54	0	0	6.5	-
55	0	1	14.3	-
56	0	1	13.5	-
57	0	0	3.5	-
58	0	0	3.7	-
59	0	1	14.5	-
60	0	0	3.6	75%
61	0	0	5.5	-
62	0	0	9.2	-
63	0	1	14.0	-
64	0	0	8.0	-
65	0	0	19.5	-
66	0	0	9.3	-
67	0	0	6.5	-
68	0	0	7.5	-
69	0	0	14.0	-
70	0	0	5.0	0%
71	0	1	14.1	-
72	0	0	7.5	-
73	0	0	9.5	-
74	0	1	9.4	-
75	0	1	15.5	-
76	0	0	7.8	-
77	0	0	7.2	-
78	0	1	20.5	-
79	0	0	18.0	-
80	0	0	6.5	50%
81	0	0	15.9	-
82	0	1	15.5	-
83	0	0	11.2	-
84	0	0	9.8	-
85	0	1	25.5	-
86	0	1	19.2	-
87	0	0	5.9	-
88	0	1	16.8	-
89	0	1	23.0	-
90	0	1	8.4	25%
91	0	0	7.0	-
92	0	0	5.6	-
93	0	0	14.5	-
94	0	1	16.4	-
95	0	1	7.9	-
96	0	0	9.3	-
97	0	1	6.4	-
98	0	0	5.8	-
99	0	0	15.5	-
100	0	0	7.5	25%
Minimum	**0**	**0**	**2.5**	**0%**
Maximum	**0**	**1**	**25.5**	**75.0%**
Mean	**0**	**0**	**10.0**	**32.5%**
Median	**0**	**0**	**8.6**	**25.0%**
Standard Dev.	**0**	**0**	**4.9**	**23.7%**

Notes: "-" indicates data not collected; embeddedness was only measured for every 10th (n=10) particle; Calcite Concreted Status: 0 = not concreted, 1 = partially concreted, 2 = fully concreted; Calcite Presence: 0 = calcite absent, 1 = calcite present.

Table D.12: Supporting Measures Associated with Hess Benthic Invertebrate Community Sampling at Line Creek and Fording River, September 2019

Replicate				1	2	3	4	5	6	7	8	9	10
Reference	RG_LI24	Date		6-Sep-19	6-Sep-19	6-Sep-19	6-Sep-19	6-Sep-19	-	-	-	-	-
		Time		10:15	10:43	11:39	13:10	13:33	-	-	-	-	-
		UTM	Easting	662168	662179	662207	662224	662223	-	-	-	-	-
			Northing	5538395	5538396	5538386	5538421	5538429	-	-	-	-	-
		Depth (cm)		21	17	17	20	17	-	-	-	-	-
		Velocity (m/s)		0.309	0.248	0.266	0.364	0.315	-	-	-	-	-
	RG_SLINE	Date		9-Sep-19	9-Sep-19	9-Sep-19	9-Sep-19	9-Sep-19	-	-	-	-	-
		Time		9:45	10:09	12:14	12:41	14:24	-	-	-	-	-
		UTM	Easting	661065	661063	661129	661140	661187	-	-	-	-	-
			Northing	5531412	5531417	5531390	5531370	5531342	-	-	-	-	-
		Depth (cm)		25	17	15	16	16	-	-	-	-	-
		Velocity (m/s)		0.263	0.306	0.377	0.306	0.255	-	-	-	-	-
Mine-Exposed	RG_LILC3	Date		7-Sep-19	7-Sep-19	7-Sep-19	7-Sep-19	7-Sep-19	7-Sep-19	7-Sep-19	7-Sep-19	7-Sep-19	7-Sep-19
		Time		8:47	9:09	9:30	11:23	11:40	12:40	13:41	14:06	14:45	15:07
		UTM	Easting	659866	659875	659871	659897	659899	659904	659934	659935	659940	659935
			Northing	5531742	5531746	5531751	5531773	5531777	5531787	5531832	5531837	5531842	5531844
		Depth (cm)		18	19	17	23	20	23	16	17	15	21
		Velocity (m/s)		0.282	0.268	0.315	0.311	0.248	0.333	0.295	0.313	0.341	0.219
	RG_LIDSL	Date		10-Sep-19	10-Sep-19	10-Sep-19	10-Sep-19	10-Sep-19	10-Sep-19	10-Sep-19	10-Sep-19	11-Sep-19	11-Sep-19
		Time		8:16	9:07	10:35	11:00	12:38	13:14	14:32	15:21	8:41	9:33
		UTM	Easting	659257	659267	659293	659290	659316	659317	659343	659340	659365	659367
			Northing	5530524	5530546	5530753	5530584	5530620	5530614	5530662	5530679	5530728	5530730
		Depth (cm)		15	19	15	17	15	21	17	15	17	19
		Velocity (m/s)		0.329	0.271	0.288	0.362	0.214	0.274	0.189	0.360	0.247	0.260

Note: "-" = data not collected/not available.

Table D.13: Supporting Measures Associated with 3-Minute Kick and Sweep Benthic Invertebrate Community Sampling at Line Creek and Fording River, September 2019

Waterbody	Biological Area Code						
Reference	RG_LI24	**Sample ID: RG_L124_1_BIC**					
		Date		6-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		9:09	1	13.0	0.523
		UTM	Easting	662165	2	14.0	0.502
			Northing	5538411	3	16.0	0.727
		Total Kick Distance (m)		7	4	13.0	0.152
		Sampling Time (min)		3	5	16.0	0.678
		Full Transect?		Yes			
		# Transects		5			
		Sample ID: RG_L124_2_BIC					
		Date		6-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		12:05	1	15.0	0.424
		UTM	Easting	662214	2	18.0	0.238
			Northing	5538393	3	16.0	0.845
		Total Kick Distance (m)		6	4	22.0	0.550
		Sampling Time (min)		3	5	19.0	0.596
		Full Transect?		Yes			
		# Transects		5			
		Sample ID: RG_L124_3_BIC					
		Date		6-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		14:08	1	18.5	0.168
		UTM	Easting	662221	2	18.0	1.003
			Northing	5538429	3	15.0	0.413
		Total Kick Distance (m)		8	4	12.0	0.659
		Sampling Time (min)		3	5	13.0	0.444
		Full Transect?		Yes			
		# Transects		6			
	RG_SLINE	**Sample ID: RG_SLINE_1_BIC**					
		Date		9-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		10:55	1	26.0	0.341
		UTM	Easting	661071	2	27.0	0.324
			Northing	5531404	3	23.0	0.613
		Total Kick Distance (m)		15	4	25.0	0.299
		Sampling Time (min)		3	5	14.0	0.283
		Full Transect?		Yes			
		# Transects		5			
		Sample ID: RG_SLINE_2_BIC					
		Date		9-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		13:22	1	21.0	0.385
		UTM	Easting	661135	2	29.0	0.375
			Northing	5531366	3	22.0	0.260
		Total Kick Distance (m)		12	4	10.0	0.334
		Sampling Time (min)		3	5	16.0	0.296
		Full Transect?		Yes			
		# Transects		2.5			
		Sample ID: RG_SLINE_3_BIC					
		Date		9-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		15:10	1	20.0	0.189
		UTM	Easting	661184	2	20.0	0.435
			Northing	5531324	3	22.0	0.345
		Total Kick Distance (m)		11	4	22.0	0.202
		Sampling Time (min)		3	5	29.0	0.444
		Full Transect?		Yes			
		# Transects		3.5			
Mine-exposed (Line Creek)	RG_LCUT	**Sampling ID: RG_LCUT_1_BIC**					
		Date		4-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		14:57	1	14.0	0.489
		UTM	Easting	660113	2	22.0	0.246
			Northing	5532141	3	26.0	0.412
		Total Kick Distance (m)		11	4	24.0	0.545
		Sampling Time (min)		3	5	16.0	0.237
		Full Transect?		Yes			
		# Transects		6			
	RG_LILC3	**Sample ID: LILC3_1_BIC**					
		Date		7-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		9:37	1	22.0	0.459
		UTM	Easting	659869	2	25.0	0.312
			Northing	5531744	3	44.0	1.082
		Total Kick Distance (m)		8	4	29.0	0.741
		Sampling Time (min)		3	5	24.0	0.629
		Full Transect?		Yes			
		# Transects		5.5			
		Sample ID: LILC3_2_BIC					
		Date		7-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		12:00	1	17.0	0.256
		UTM	Easting	659898	2	28.0	0.499
			Northing	5531781	3	34.0	0.377
		Total Kick Distance (m)		9	4	32.0	0.670
		Sampling Time (min)		3	5	24.0	0.233
		Full Transect?		Yes			
		# Transects		6			
	RG_LILC3	**Sample ID: LILC3_3_BIC**					
		Date		7-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		14:30	1	17.0	0.768
		UTM	Easting	659933	2	23.0	1.059
			Northing	5531833	3	19.0	1.333
		Total Kick Distance (m)		4	4	13.0	0.661
		Sampling Time (min)		3	5	20.0	0.419
		Full Transect?		Yes			
		# Transects		3			

Table D.13: Supporting Measures Associated with 3-Minute Kick and Sweep Benthic Invertebrate Community Sampling at Line Creek and Fording River, September 2019

Waterbody	Biological Area Code	Sample ID: RG_LISP24_1_BIC					
Mine-exposed (Line Creek)	RG_LISP24	Date		5-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		13:34	1	17.0	0.290
		UTM	Easting	659673	2	27.0	0.358
			Northing	5531169	3	34.5	0.229
		Total Kick Distance (m)		6	4	33.0	0.457
		Sampling Time (min)		3	5	23.0	0.475
		Full Transect?		Yes			
		# Transects		2			
	RG_LIDSL	**Sample ID: RG_LIDSL_1_BIC**					
		Date		10-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		9:12	1	19.0	0.303
		UTM	Easting	659262	2	27.0	0.518
			Northing	5530538	3	29.0	0.725
		Total Kick Distance (m)		30	4	19.0	0.388
		Sampling Time (min)		3	5	35.0	0.304
		Full Transect?		Yes			
		# Transects		5			
	RG_LIDSL	**Sample ID: RG_LIDSL_2_BIC**					
		Date		10-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		11:13	1	9.0	0.506
		UTM	Easting	659288	2	24.0	0.433
			Northing	5530577	3	35.0	0.727
		Total Kick Distance (m)		20	4	22.0	0.247
		Sampling Time (min)		3	5	15.0	0.568
		Full Transect?		Yes			
		# Transects		2			
		Sample ID: RG_LIDSL_3_BIC					
		Date		10-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		13:24	1	22.0	0.388
		UTM	Easting	659316	2	29.0	0.369
			Northing	5530615	3	39.0	0.303
		Total Kick Distance (m)		16	4	37.0	0.570
		Sampling Time (min)		3	5	29.0	0.470
		Full Transect?		Yes			
		# Transects		3.5			
		Sample ID: RG_LIDSL_4_BIC					
		Date		10-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		14:58	1	28.0	0.541
		UTM	Easting	659345	2	25.0	0.773
			Northing	5530663	3	32.0	0.637
		Total Kick Distance (m)		15	4	27.0	0.338
		Sampling Time (min)		3	5	11.0	0.395
		Full Transect?		Yes			
		# Transects		2.5			
		Sample ID: RG_LIDSL_5_BIC					
		Date		10-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		10:09	1	19.0	0.504
		UTM	Easting	659365	2	17.0	0.275
			Northing	5530726	3	33.0	0.333
		Total Kick Distance (m)		15	4	30.0	0.657
		Sampling Time (min)		3	5	38.0	0.272
		Full Transect?		Yes			
		# Transects		2.5			
	RG_LIDCOM	**Sampling ID: RG_LIDCOM_1_BIC**					
		Date		12-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		9:34	1	31.0	0.148
		UTM	Easting	658183	2	32.0	0.579
			Northing	5529815	3	16.0	0.374
		Total Kick Distance (m)		18	4	20.0	0.678
		Sampling Time (min)		3	5	49.0	0.644
		Full Transect?		Yes			
		# Transects		3			
	RG_LI8	**Sample ID: RG_LI8_1_BIC**					
		Date		11-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		12:10	1	28.0	0.366
		UTM	Easting	655450	2	31.0	1.132
			Northing	5528950	3	16.0	0.596
		Total Kick Distance (m)		18	4	21.0	0.697
		Sampling Time (min)		3	5	33.0	0.460
		Full Transect?		Yes			
		# Transects		2			
	RG_LI8	**Sample ID: RG_LI8_2_BIC**					
		Date		11-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		13:39	1	27.5	0.177
		UTM	Easting	655492	2	24.0	0.398
			Northing	5528892	3	26.0	0.516
		Total Kick Distance (m)		22	4	40.0	0.475
		Sampling Time (min)		3	5	22.0	0.956
		Full Transect?		Yes			
		# Transects		2.25			
		Sample ID: RG_LI8_3_BIC					
		Date		11-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		15:20	1	31.0	0.770
		UTM	Easting	655570	2	27.0	0.732
			Northing	5528837	3	22.0	0.540
		Total Kick Distance (m)		18	4	24.0	0.485
		Sampling Time (min)		3	5	19.0	0.682
		Full Transect?		Yes			
		# Transects		2			

Table D.13: Supporting Measures Associated with 3-Minute Kick and Sweep Benthic Invertebrate Community Sampling at Line Creek and Fording River, September 2019

Waterbody	Biological Area Code						
		Sampling ID: RG_FRUL_1_BIC					
Mine-exposed (Fording River)	RG_FRUL	Date		12-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		14:52	1	11.0	0.744
		UTM	Easting	654549	2	37.0	0.587
			Northing	5530169	3	47.0	0.820
		Total Kick Distance (m)		21	4	32.0	0.463
		Sampling Time (min)		3	5	43.0	0.830
		Full Transect?		No			
		# Transects		3			
	RG_FO23	Sampling ID: RG_FO23_1_BIC					
		Date		8-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		9:01	1	15.0	0.282
		UTM	Easting	652769	2	26.0	0.569
			Northing	5528294	3	32.0	0.657
		Total Kick Distance (m)		15	4	46.0	0.657
		Sampling Time (min)		3	5	37.0	0.540
		Full Transect?		No			
		# Transects		0.75			
		Sampling ID: RG_FO23_2_BIC					
		Date		8-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		10:36	1	22.0	0.367
		UTM	Easting	652856	2	27.0	0.718
			Northing	5528378	3	35.0	1.001
		Total Kick Distance (m)		12	4	36.0	0.763
		Sampling Time (min)		3	5	31.0	0.836
		Full Transect?		No			
		# Transects		3			
		Sampling ID: RG_FO23_3_BIC					
		Date		8-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		13:11	1	38.0	0.341
		UTM	Easting	652950	2	32.0	0.632
			Northing	5528537	3	17.0	0.680
		Total Kick Distance (m)		15	4	35.0	0.697
		Sampling Time (min)		3	5	36.0	1.019
		Full Transect?		No			
		# Transects		0.75			
		Sampling ID: RG_FO23_4_BIC					
		Date		8-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		14:39	1	31.0	0.455
		UTM	Easting	652929	2	38.0	0.517
			Northing	5528648	3	56.0	0.532
		Total Kick Distance (m)		20	4	36.0	0.782
		Sampling Time (min)		3	5	38.0	0.468
		Full Transect?		No			
		# Transects		3.5			
		Sampling ID: RG_FO23_5_BIC					
		Date		8-Sep-19	Replicate	Depth (cm)	Velocity (m/s)
		Time		16:14	1	39.0	0.554
		UTM	Easting	652933	2	26.0	0.549
			Northing	5528766	3	19.0	0.700
		Total Kick Distance (m)		20	4	22.0	0.455
		Sampling Time (min)		3	5	35.0	0.655
		Full Transect?		No			
		# Transects		1			

Table D.14: **Habitat Information Associated with Benthic Invertebrate Community Sampling at Mine-Exposed and Reference Areas at Line Creek, September 2019**

Station ID		Reference		Mine-exposed Line Creek			
		RG_LI24	RG_SLINE	RG_LCUT	RG_LILC3	RG_LISP24	RG_LIDSL
Waterbody		Line Creek	South Line Creek	Line Creek	Line Creek	Line Creek	Line Creek
Date Sampled		6-Sep-19	9-Sep-19	5-Sep-19	7-Sep-19	5-Sep-19	10-Sep-19
UTM (NAD83, 11U)	Easting	662221	661135	660113	659898	659673	659262
	Northing	5538429	5531366	5532141	5531781	5531169	5530538
Elevation		1,658	1,493	1,442	1,438	1,422	-
Habitat Characteristics							
Surrounding Land Use		Forest, Mining	Forest	Mining	Mining	Forest, Mining	Mining
Anthropogenic Influences		Mine access road downstream and adjacent mine activities (blasting).	Bridge downstream.	Mining operations upstream. Site downstream of WLC input.	AWTF discharge upstream. Surrounding mine influence and WLC discharge.	Upstream mining influence. Site downstream of contingency pond.	Upstream AWTF discharge. Adjacent road with side channel input downstream of K+S-5.
Length of Reach Assessed (m)		50	50	50	50	50	100
Substrate	% Bedrock	0	0	0	0	0	0
	% Boulder	15	40	5	15	5	45
	% Cobble	50	35	50	55	40	30
	% Gravel	30	20	30	25	50	20
	% Sand/Finer	5	5	10	5	5	5
	% Fines	0	0	5	0	0	0
Canopy Coverage (%)		1 to 25	1 to 25	1 to 25	0	0	0
Macrophyte Coverage (%):		0	0	0	0	0	0
Streamside Vegetation		Shrubs, coniferous trees	-	Ferns/grasses	Ferns/grasses, shrubs	Ferns/grasses, shrubs, coniferous trees	Shrubs, coniferous trees
Periphyton Coverage		Rocks slightly slippery, yellow-brown to light green colour (0.5 to 1mm thick)	Rocks slightly slippery, yellow-brown to light green colour (0.5 to 1mm thick)	Rocks have noticeable slippery feel, patches of thicker green to brown algae (1 to 5mm)	Rocks have noticeable slippery feel, patches of thicker green to brown algae (1 to 5mm)	Rocks have noticeable slippery feel, patches of thicker green to brown algae (1 to 5mm)	Rocks slightly slippery, yellow-brown to light green colour (0.5 to 1mm thick)
Bank Stability		Unstable, substantial erosion	Unstable, substantial erosion	Stable, no erosion	Moderate	Unstable, substantial erosion	Unstable, substantial erosion
Water Colour & Clarity		Colourless, clear	Colourless, clear	Colourless, clear	Colourless, clear	Colourless, clear	Colourless, clear
Channel Measurements	Bankfull Width (m)	6.5	14.8	8.6	5.6	18.7	13.4
	Wetted Width (m)	3.8	9.2	6.4	4.7	12.4	12.1
	Bankfull-Wetted Depth (cm)	39	39	42	31	44	12.5
Comments/Notes		Water collected at K+S-1 replicate location. Habitat assessed at K+S-3 replicate location. Water collected before any other work completed. Bank erosion evident in K+S-2 and K+S-3 areas.	Water collected before sampling at K+S-1. Habitat assessed at K+S-2. Bank erosion evident throughout sampling area. Braided channel at assessed station.	Water sample collected on September 4, 2019 at 14:27 before site disturbed.	Water sample collected at K+S-3 before any sampling.	Bank erosion along right upstream bank. Water samples collected before any other measures. Cobble/gravel mid bars present. Riparian mostly grasses with initial spruce growth. No mature spruce >10m from stream.	Water collected at K+S-1. Sediment replicate 4 taken in small side channel between K+S-4 and K+S-5. Side channel borders road at points. Sediment 5 collected on 11-Sept-19, including DUP at 9:59. Two sediment duplicates collected at LIDSL.

Notes: "-" = no data/not recorded; WLC = West Line Creek; AWTF = Active Water Treatment Facility; K+S = Kick and Sweep; DUP = field duplicate.

Table D.14: **Habitat Information Associated with Benthic Invertebrate Community Sampling at Mine-Exposed and Reference Areas at Line Creek, September 2019**

Station ID		Mine-exposed Line Creek		Mine-exposed Fording River	
		RG_LIDCOM	**RG_LI8**	**RG_FRUL**	**RG_FO23**
Waterbody		Line Creek	Line Creek	Fording River	Fording River
Date Sampled		12-Sep-19	11-Sep-19	12-Sep-19	8-Sep-19
UTM (NAD83, 11U)	Easting	658183	655450	654529	652856
	Northing	5529815	5528950	5530163	5528378
Elevation		1,385	1,286	1,245	1,228
Habitat Characteristics					
Surrounding Land Use		Forest, Mining	Forest, Mining	Forest, Mining	Forest, Mining
Anthropogenic Influences		Upstream AWTF discharge, adjacent coal conveyor station just upstream bridge.	-	Teck mining facilities upstream. No immediate anthropogenic impacts.	Upstream mining influence. Adjacent road and bridge upstream.
Length of Reach Assessed (m)		50	50	100	100
Substrate	% Bedrock	5	0	0	0
	% Boulder	20	25	10	25
	% Cobble	30	50	50	35
	% Gravel	35	20	30	30
	% Sand/Finer	5	5	5	5
	% Fines	5	0	5	5
Canopy Coverage (%)		1 to 25	26 to 50	0	0
Macrophyte Coverage (%):		0	0	0	0
Streamside Vegetation		Ferns/grasses, coniferous trees	Deciduous and coniferous trees	Ferns/grasses, deciduous and coniferous trees	Shrubs
Periphyton Coverage		Rocks have noticeable slippery feel, patches of thicker green to brown algae (1 to 5mm)	Rocks have noticeable slippery feel, patches of thicker green to brown algae (1 to 5mm)	Rocks have noticeable slippery feel, patches of thicker green to brown algae (1 to 5mm)	Rocks slightly slippery, yellow-brown to light green colour (0.5 to 1mm thick)
Bank Stability		Stable, no erosion	Moderate	Unstable, substantial erosion	Unstable, substantial erosion
Water Colour & Clarity		Colourless, clear	Colourless, clear	Colourless, clear	Colourless, clear
Channel Measurements	Bankfull Width (m)	9.9	12.4	21.9	31.5
	Wetted Width (m)	8.8	10.7	13.8	22.1
	Bankfull-Wetted Depth (cm)	47	18	23	52
Comments/Notes		Water sample collected before any sampling completed. Thick algae growth in places.	Water sample collected before K+S work at station.	Water sample collected downstream of kick location but before all sampling.	Water collected at K+S-1 before K+S sampling completed. Habitat evaluated at K+S transect 2. Substantial bank erosion on both banks.

Notes: "-" = no data/not recorded; WLC = West Line C

Notes: "-" = no data/not recorded; WLC = West Line Creek; AWTF = Active Water Treatment Facility; K+S = Kick and Sweep; DUP = field duplicate.

Table D.15: Angling Records for Fish Tissue Sampling in Line Creek in September, 2019

Area	UTM (NAD83, Zone 11U)		Set Date	Start Time	End Time	Angling Hours (hrs)	No. of Lines	Effort (angler days)	Bull Trout			Westslope Cutthroat Trout		
	Easting	Northing							Catch	Mortalities	CPUE[a]	Catch	Mortalities	CPUE[a]
RG_LILC3	659870	5531576	04-Sep-19	13:40	16:10	2.50	2	0.21	3	0	14.4	2	0	9.6
	659870	5531576	05-Sep-19	7:30	12:05	4.58	2	0.38	6	0	15.7	2	0	5.2
	659281	5530548	05-Sep-19	12:30	13:30	1.00	2	0.08	0	0	0.0	1	0	12.0
	659870	5531576	06-Sep-19	7:30	9:50	2.33	2	0.19	1	0	5.1	1	0	5.1
RG_LIDCOM	658185	5529820	05-Sep-19	13:45	15:30	1.75	2	0.15	0	0	0.0	2	0	13.7
	658185	5529820	06-Sep-19	10:10	12:30	2.33	2	0.19	0	0	0.0	4	0	20.6
RG_LI8	655378	5529048	06-Sep-19	13:00	16:00	3.00	2	0.25	2	0	8.0	2	0	8.0
	654671	5529013	07-Sep-19	8:00	11:40	3.67	2	0.31	2	0	6.5	3	0	9.8
	655378	5529048	07-Sep-19	12:00	15:45	3.75	2	0.31	0	0	0.0	2	0	6.4
							Total	**2.1**	**14**	**0**	**6.7**	**19**	**0**	**9.2**

Notes: UTM = Universal Transverse Mercator; NAD = North American Datum; CPUE = catch-per-unit-effort.

[a] CPUE is calculated as the number of fish captured per angler day.