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Technical Report Overview

Report: Fording River Operations Local Aquatic Effects Monitoring Program (LAEMP) 2018 Report

Overview: This report presents the 2018 results of the local aquatic effects monitoring program (LAEMP) developed for Teck's Fording River Operations (FRO). The report presents data and evaluation of current condition and collects baseline data to support future evaluation of changes related to commissioning of an active water treatment facility that will be treating waters from Cataract, Swift, and Kilmarnock creeks at FRO.

This report was prepared for Teck by Minnow Environmental Inc. and Lotic Environmental Ltd.

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**

Fording River Operations Local Aquatic Effects Monitoring Program (LAEMP) 2018 Report

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May 2019

Fording River Operation
Local Aquatic Effects Monitoring
Program 2018 Report

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EXECUTIVE SUMMARY

Discharges from Teck's coal mines to the Elk River watershed are authorized by the British Columbia Ministry of Environment and Climate Change Strategy (ENV) through permits that are issued under provisions of the Environmental Management Act. Permit 107517 specifies the terms and conditions associated with those discharges. Permit 107517 also requires that Teck develop a local aquatic effects monitoring program (LAEMP) related to continued development of Fording River Operation (FRO) and the future commissioning of the Fording River Operations Active Water Treatment Facility - South (FRO AWTF-S) that will be treating waters from Cataract, Swift and Kilmarnock creeks at FRO.

The FRO LAEMP study design for 2016 to 2018 was submitted in accordance with the Permit requirement on June 1, 2016 (Minnow 2016) and subsequently approved by ENV on October 24, 2016. In consideration of potential existing and future mine-related influences at FRO, the following study questions were developed in consultation with the EMC during study design development (Minnow 2016) and in response to data evaluation in the first two years of the FRO LAEMP cycle (Minnow 2017a, Minnow and Lotic 2018):

1. Are nitrate concentrations increasing, and if so, are they adversely affecting biota?
2. Is active water treatment affecting biological productivity downstream in the Fording River?
3. Are tissue selenium concentrations reduced downstream from the AWTF?
4. Is AWTF operation affecting aquatic biota through thermal effects or concentrations of treatment-related constituents other than nutrients or selenium?
5. Is re-direction of water potentially affecting biota in the Fording River?
6. What are the factors contributing to the variations in percent Ephemeroptera?
7. What is the benthic invertebrate community structure in the reach of the Fording River that goes dry, and can changes be correlated with flow conditions?

The first annual LAEMP report was submitted on May 31, 2017 (Minnow 2017a). Based on discussions with the EMC in 2017 regarding a temporal and spatial decrease (i.e., in an upstream to downstream direction) in the relative abundance of mayflies (% Ephemeroptera) in the upper Fording River in the area downstream of Kilmarnock Creek to between Chauncey Creek and Ewin Creek (Minnow 2017a), an updated sampling plan was submitted in September, 2017 (Minnow 2017b). Additional benthic invertebrate community (BIC) and biomass sampling, along with the installation of data loggers (temperature and level) and an evaluation of the extent of seasonal drying associated with the winter low flow period, were also added to satisfy both the FRO LAEMP and the FRO water licensing Operational Environmental Monitoring Program (OEMP).

Following completion of sampling in 2017, the second annual report was submitted on May 31, 2018 (Minnow and Lotic 2018). A single, direct cause of the decrease in % Ephemeroptera in the upper Fording River was not identified. Rather, analysis suggested that a combination of both mine-related and natural factors (e.g., water quality, calcite, substrate size, flow) were contributing to the observed decrease. Based on discussion with the EMC, additional changes to the monitoring design were submitted to ENV on May 31, 2018 (Minnow 2018a; Appendix A). These changes included the addition of replicate kick and sweep samples (BIC and tissue) at each of the LAEMP areas in September to increase statistical power, and the addition of BIC monitoring in June and August to assess seasonal differences in community structure. In addition, in response to flows in the upper Fording River consisting of predominantly Cataract Creek water at the Compliance Point in November due to upstream drying, additional BIC and benthic invertebrate tissue samples were collected in December and February (following Teck's adaptive management response framework).

The baseline data being collected to address study questions #2 to #5 will continue in 2019 and 2020, and the approach for data analysis will be discussed with the EMC prior to the commissioning of the FRO AWTF-S in late 2020.

The evaluation of data related to Study Question #1 did not identify any increasing trends in nitrate concentrations in mine-exposed areas. Nitrate concentrations have not been changing concurrently with the observed decrease in % Ephemeroptera, nor are the highest nitrate concentrations observed where the effects are most prominent (see below, study question #6). Nitrate concentrations are, however, consistently higher than benchmarks in all areas monitored in the FRO LAEMP where changes in BIC are observed and nitrate statistically correlated with key BIC endpoints, suggesting that nitrate is a contributing factor.

Evaluation of data to support study question #6 identified a spatial decrease from upstream to downstream in % Ephemeroptera consistent with previous LAEMPs. Further evaluation of the BIC determined that the effect was related to a substantial shift in the community structure, rather than simply the loss of Ephemeroptera. Both % Ephemeroptera and Correspondence Analysis axis 1(CA1; the axis that captures the taxa differences in areas where effects are observed) were most strongly correlated with D84 (a metric of substrate size), principal component analysis axis 2 (PC2), and individual water quality constituents that were associated with PC2 (e.g., nitrate, total and dissolved selenium, and temperature). Furthermore, effects are being observed downstream of sections of the Fording River that go dry seasonally. These areas receive groundwater input, which may be affecting annual mean water temperatures and provide a temperature regime favorable to a different community structure than upstream areas that freeze or dry.

Monitoring to support Study Question #7 determined that the section of the upper Fording River downstream of the FRO Compliance Point became dry earlier in 2018 compared to 2017. Two additional dry sections were also identified in the Fording River upstream of Cataract Creek and upstream Swift Creek, respectively.

While data analysis identified a strong correlation between water quality and BIC metrics, suggesting that water quality is a factor influencing the variation in % Ephemeroptera, it is clear that habitat factors are also contributing to observed changes. Further investigation will be required to differentiate the influence of habitat components from that of water quality and other mine-related stressors (e.g., calcite, changes in flow).

A study design for the 2019 to 2020 cycle of the FRO LAEMP will be submitted on June 1st, 2019, and will incorporate recommendations based on discussions with the Environmental Monitoring Committee (EMC) and the results of the 2018 report. Results will also provide supporting information to answer Management Question 5 from Teck's adaptive management program (Teck 2018).

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ACRONYMS AND ABBREVIATIONS

ALS – ALS Environmental

AMP – Adaptive Management Plan

ANOVA – Analysis of Variance

AWTF – Active Water Treatment Facility

BCWQG – British Columbia Water Quality Guidelines

BACI – Before-after control-impact

BIC – Benthic invertebrate community

CA – Correspondence Analysis

CAx – (as in CA1) referring to one of the summary variables resulting from a Correspondence Analysis

CABIN – Canadian Aquatic Biomonitoring Network

CI – Calcite Index

CMO – Coal Mountain Operation

CRC – Collision Reaction Cell

CSM – Conceptual Site Model

CVAFS - Cold Vapour Atomic Fluorescence Spectroscopy

DO – Dissolved oxygen

dw – Dry Weight

EFN – Environmental Flow Needs

EMC – Environmental Monitoring Committee

EMPR – Ministry of Energy, Mines and Petroleum Resources

ENV – Ministry of Environment

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

EVO – Elkview Operation

EVWQP – Elk Valley Water Quality Plan

EWT – Early Warning Trigger

FRO – Fording River Operation

FRO AWTF-S – Fording River Operations Active Water Treatment Facility - South

GC/MS – Gas Chromatography with Mass Spectrometric Detection

GHO – Greenhills Operation

GPS – Global Positioning System

ICP-MS – Inductively Coupled Plasma-Mass Spectrophotometry

KNC – Ktunaxa Nation Council

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

NAD - North American Datum

OEMP – Operational Environmental Monitoring Program

PAH – Polycyclic aromatic hydrocarbon

PCA – Principal component analysis

PCx – (as in PC1) referring to one of the summary variables resulting from a principal component analysis

QA/QC – Quality Assurance / Quality Control

RAEMP – Regional Aquatic Effects Monitoring Program

RISC – Resources Information Standards Committee

SRC – Saskatchewan Research Council

TOC – Total organic carbon

TDS – Total dissolved solids

UTM – Universal Transverse Mercator system

WCT – Westslope Cutthroat Trout

WSQG – Working Sediment Quality Guideline

1 INTRODUCTION

1.1 Background

Teck Coal Limited (Teck) operates five steelmaking coal mines in the Elk River watershed, which are 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 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.

Permit 107517 required that Teck develop a local aquatic effects monitoring program (LAEMP) related to ongoing mining at FRO and the future commissioning of the Fording River Operation Active Water Treatment Facility - South (FRO AWTF-S) that will treat waters from Cataract, Swift, and Kilmarnock Creeks (Figure 1.2). Section 9.3.2 of Permit 107517 outlines the LAEMP requirements as follows:

> "*The Permittee must complete to the satisfaction of MOE a study design for a LAEMP which will focus on the upper Fording River for 2016-2018 by June 1, 2016. The study design must be reviewed by the EMC*[1] *and be designed to an appropriate temporal scale to capture short term, local effects to the immediate receiving environment.*"

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 May 31 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 sampling to be completed in September 2019). Teck conducts

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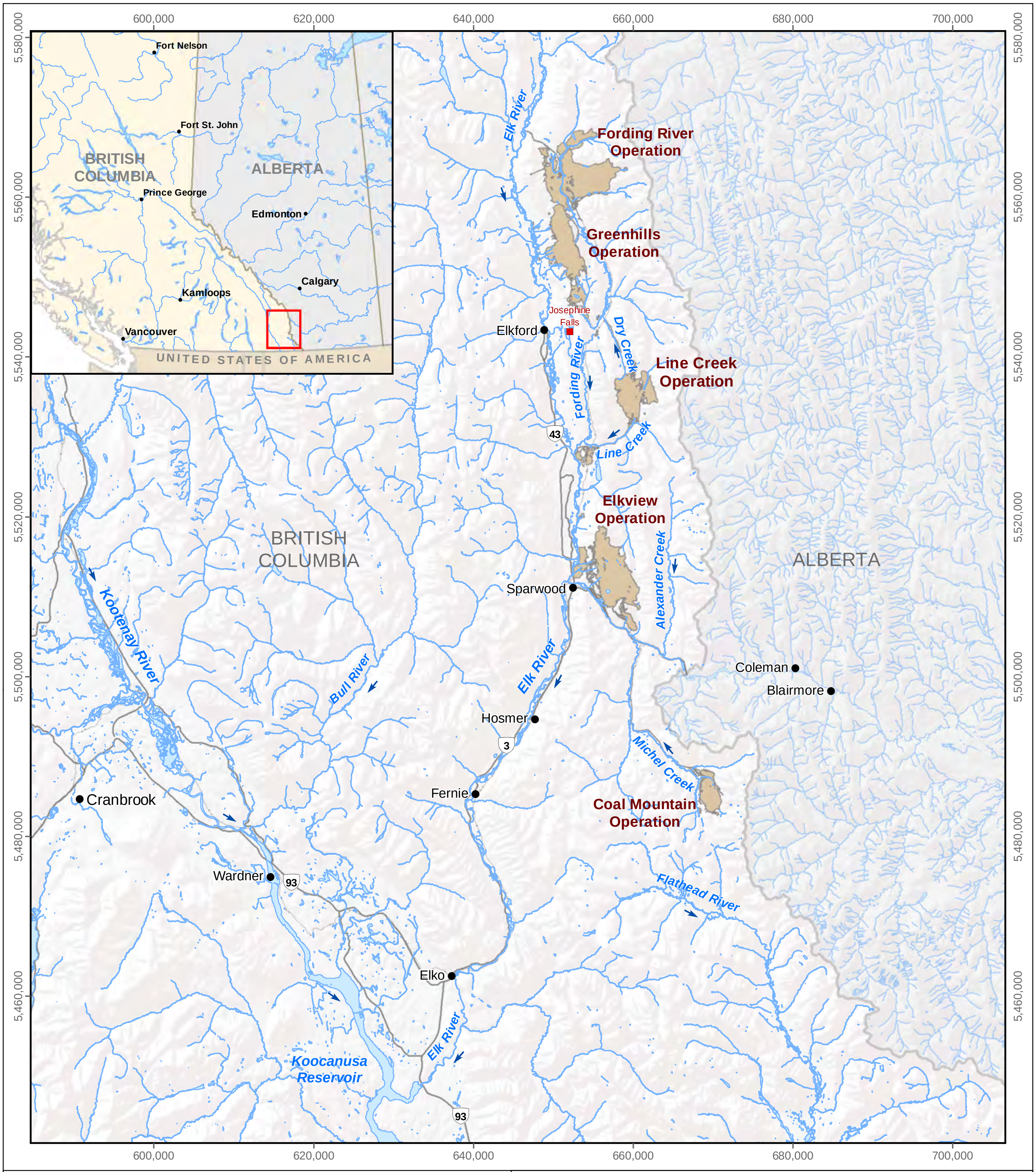
[1] EMC refers to the Environmental Monitoring Committee, which Teck was required to form under Permit 107517. The EMC consists of representatives from Teck, ENV, the Ministry of Energy, Mines and Petroleum Resources (EMPR), Environment Canada, the Ktunaxa Nation Council (KNC), Interior Health Authority, 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

Projection: North American Datum 1983 UTM Zone 11 U
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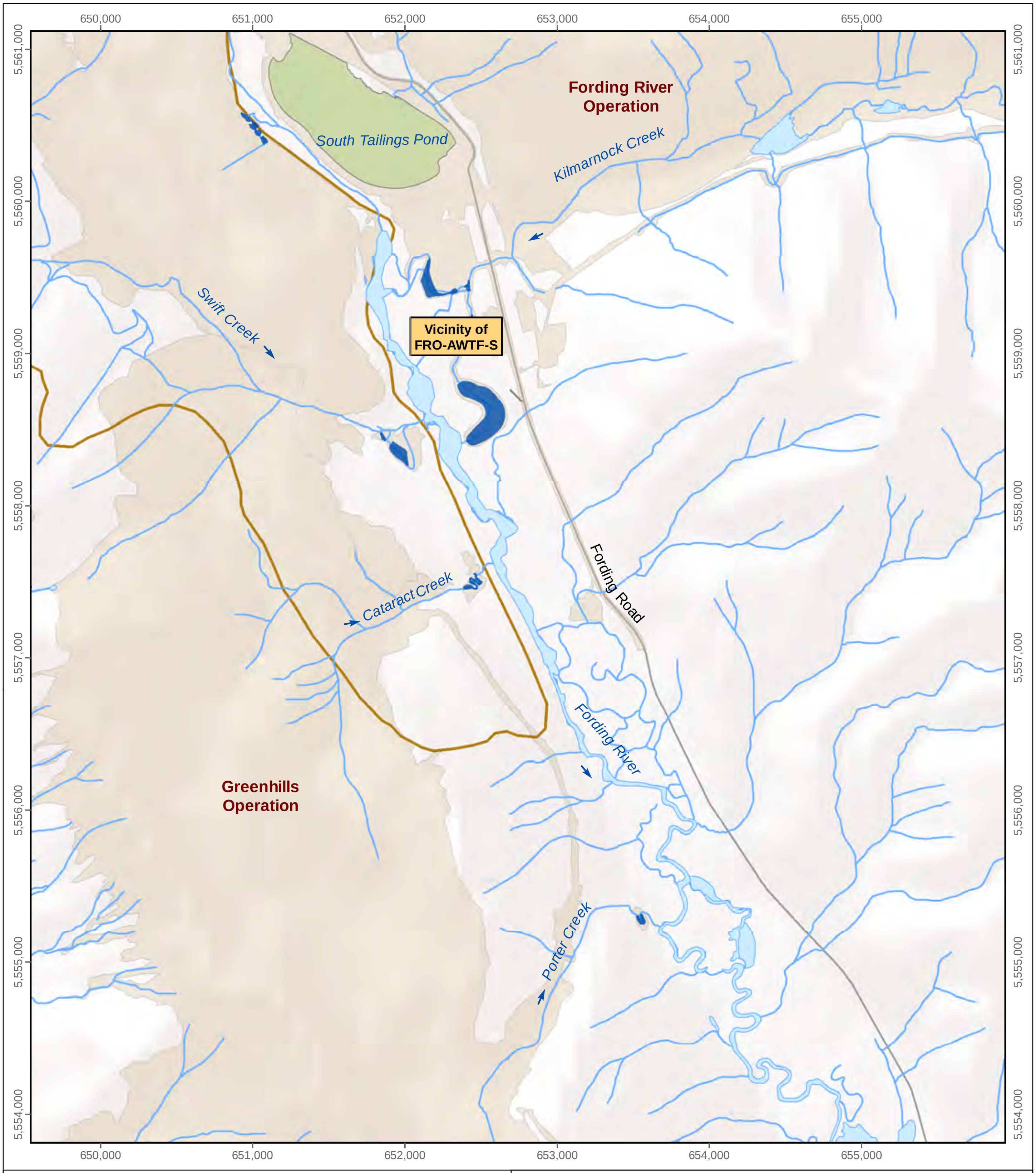
Figure 1.1

Document Path: S:\Projects\187202\187202.0022 - FRO LAEMP 2018\GIS\Report\Figures\18-22 Figure 1.1 Teck Coal Limited Operation.mxd



LEGEND

🟦 Settling Pond

🟩 Tailings Pond

▭ Fording Swift Project Footprint

▨ Teck Coal Mine Operation

Fording River Operations South AWTF

0 0.5 1 2 km

N E S W

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Figure 1.2

Document Path: S:\Projects\187202\187202.0022 - FRO LAEMP 2018\GIS\Report\Figures\18-22 Figure 1.2 Fording River Operations South AWTF.mxd 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:

- water quality monitoring
- calcite monitoring
- chronic toxicity testing
- fish and fish habitat management
- Tributary Management Plan

The FRO LAEMP study design was submitted in accordance with the Permit requirement on June 1, 2016 (Minnow 2016) and subsequently approved by ENV on October 24, 2016. The first cycle of the FRO LAEMP, encompassing the 2016 to 2018 sampling years, represented a period of baseline monitoring with respect to future active water treatment. In addition to the need for baseline monitoring data prior to active water treatment, there were also concerns related to potential increases in aqueous nitrate concentrations in the Fording River prior to initiation of water treatment, as projected in the Elk Valley Water Quality Plan (EVWQP; Teck 2014). Changes in biota related to increased or decreased flows in portions of the Fording River as a result of re-direction of water (i.e., re-direction of flows from Cataract, Swift, and Kilmarnock creeks for treatment or water management purposes) were also considered in the LAEMP design.

The goal of the FRO LAEMP is to assess site-specific conditions (e.g., potential aquatic effects in the Fording River in advance of or after implementation of active water treatment) on a more frequent and localized basis, as required until sufficient data have been collected, concerns no longer exist, or relevant monitoring can be incorporated into the RAEMP. With this goal in mind, the FRO LAEMP was designed to address the study questions described in Section 1.2.

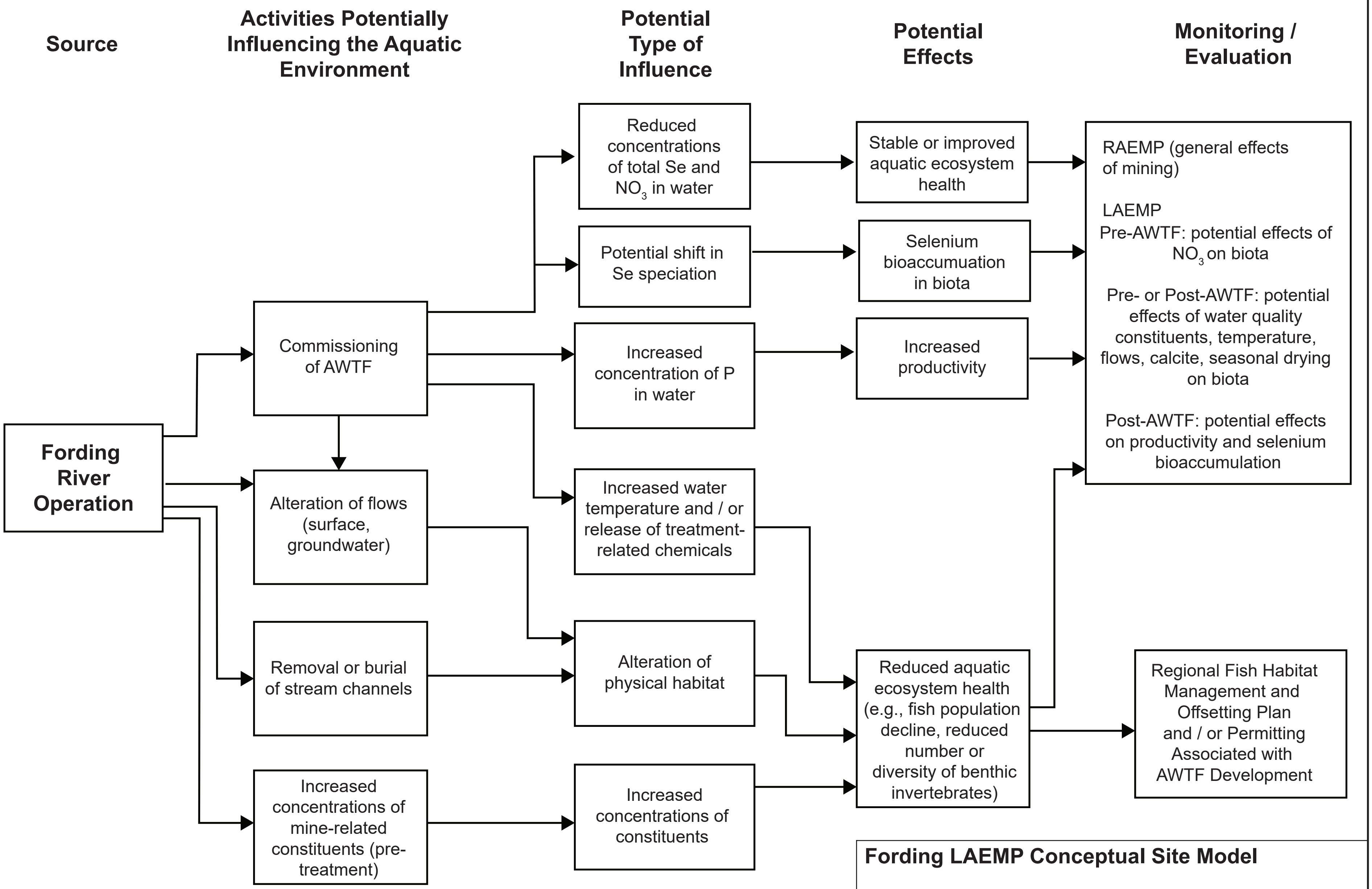
The first annual LAEMP report was submitted on May 31, 2017 (Minnow 2017a). Based on discussions with the EMC in 2017 regarding a temporal and spatial decrease in the relative abundance of mayflies (% Ephemeroptera) in the upper Fording River in the area downstream of Kilmarnock Creek to between Chauncey Creek and Ewin Creek (Minnow 2017a), an updated sampling plan was submitted in September, 2017 (Minnow 2017b). Additional benthic invertebrate community (BIC) and biomass sampling, along with the installation of data loggers (temperature and level) and an evaluation of seasonal drying associated with the winter low flow period, were also added to satisfy both the FRO LAEMP and the FRO water licensing Operational Environmental Monitoring Program (OEMP).

Following completion of sampling in 2017, the second annual report was submitted on May 31, 2018 (Minnow and Lotic 2018). A single, direct cause of the decrease in % Ephemeroptera in the upper Fording River was not identified. Rather, analysis suggested that a combination of both mine-related and natural factors (e.g., water quality, calcite, substrate size, flow) were contributing to the observed decrease. Based on discussion with the EMC, additional changes to the monitoring design were submitted to ENV on May 31, 2018 (Minnow 2018a; Appendix A). These changes included the addition of replicate kick and sweep samples (BIC and tissue) at each of the LAEMP areas in September to increase statistical power, and the addition of BIC monitoring in June and August to assess seasonal differences to further evaluate observed changes in community structure. In November 2018, Fording River flows consisted predominantly of Cataract Creek water at the FRO Compliance Point. In response to elevated water quality concentrations at the Fording River compliance point during the winter months, additional BIC and benthic invertebrate tissue sampling events were completed in December and February (following Teck's adaptive management response framework).

1.2 Conceptual Site Model

A conceptual site model (CSM) is a written and/or illustrative depiction of relationships between human activities that disturb the environment and the ways such disturbances can alter the ecosystem and affect biological receptors. Figure 1.3 presents a CSM for potential effects on aquatic receptors in the upper Fording River both prior to and after the commissioning of the future FRO AWTF-S in late 2020. Assessment endpoints are the valued attributes of an ecosystem upon which management actions focus (USEPA 1998, 2003). Assessment endpoints considered in the FRO LAEMP are described in Table 2.1 of Section 2.1. Assessment endpoints are evaluated using measurement endpoints. Typically, multiple measurement endpoints are used to support evaluation and interpretation of each assessment endpoint to conclude if the assessment endpoints/receptors are being protected.

As illustrated by the CSM, assessment and measurement endpoints may be affected through physical and/or chemical processes related to mining and operation of the AWTF. Biological measurements relating directly to population or community characteristics are referred to as direct indicators. Mine-related stressors (such as tissue selenium concentrations) will also be monitored as part of the FRO LAEMP and are referred to as indirect indicators. Laboratory chronic toxicity data (semi-direct indicators) are incorporated into the FRO LAEMP, as appropriate. Measurement of indirect and semi-direct indicators contribute to understanding if observed effects on individual receptors are mine-related. Effects may act singly or in combination to influence aquatic populations and/or communities by changing the abundance or resilience of aquatic receptors (Figure 1.2), and are evaluated by monitoring benthic invertebrates as biological receptors within the FRO LAEMP. The study questions (Section 1.3) were developed in consideration of the potential effects identified in Figure 1.3.



Fording LAEMP Conceptual Site Model

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Figure 1.3

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1.3 Study Questions

Study questions were developed in consultation with the EMC during study design development (Minnow 2016) and in response to data evaluation in the first two years of the FRO LAEMP cycle (Minnow 2017a, Minnow and Lotic 2018):

1. Are nitrate concentrations increasing, and if so, are they adversely affecting biota?
2. Is active water treatment affecting biological productivity downstream in the Fording River?
3. Are tissue selenium concentrations reduced downstream from the AWTF?
4. Is AWTF operation affecting aquatic biota through thermal effects or concentrations of treatment-related constituents other than nutrients or selenium?
5. Is re-direction of water potentially affecting biota in the Fording River?
6. What are the factors contributing to the variations in percent Ephemeroptera?
7. To support monitoring associated with the requirements of the water license and environmental flow needs assessment, what is the benthic invertebrate community structure in the reach of the Fording River that goes dry, and can changes be correlated with flow conditions?

Study question #1 and related investigations are being addressed through monitoring of BIC structure as part of annual sampling in the FRO LAEMP, RAEMP monitoring in 2018, as well as Teck's routine water quality monitoring for stations along the upper Fording River and its tributaries. Additional information related to habitat (e.g., seasonal drying reaches, flow, substrate type, calcite, temperature) and biological requirements for benthic invertebrate taxa are being used to support findings and discussion.

Study questions #2 to #5 relate specifically to active water treatment at Fording River South (FRO AWTF-S), which has been postponed until late 2020. Therefore, the initial years of the LAEMP include collection of baseline information to aid in the interpretation of potential changes in aquatic conditions after water treatment commences. Effects related to changes in physical habitat, including changes in flows (i.e., study question #5), will be addressed through Teck's routine monitoring of flows at three stations in the upper Fording River (FR_FRNTP [continuous], FR_FRCP1 [Permit requirement for monthly monitoring, and weekly from March 15th to July 15th], and FR_FRABCHf [established to support proposed compliance point]), as well as through the evaluation of hydrology and seasonal drying. Relevant information obtained under other programs, such as the regional calcite and chronic toxicity monitoring programs are also summarized in the LAEMP, as appropriate.

Study question #6 was added to the FRO LAEMP to help direct analysis, interpretation, and discussion related to the observed decrease in % Ephemeroptera. This question is being addressed through a detailed evaluation of the benthic invertebrate communities in the upper Fording River, and through an integrated interpretation of the results compared to regional normal ranges, local reference areas, and chemical and physical stressors.

Study question #7 was added to the FRO LAEMP to increase understanding of seasonal drying in the upper Fording River. It is being addressed through monthly monitoring of surface flow conditions (August to April) in the Fording River from the south tailings pond (FR_FR2) downstream to Chauncey Creek, as well as year-round continuous monitoring of water level and temperature at ten locations within this area. Biological data being collected to support study question #6 are being incorporated into the evaluation of study question #7, as appropriate.

The results of the third year (2018 calendar year – January to December) of monitoring for the FRO LAEMP are the subject of this report, which includes comparison to previous years of data.

1.4 Linkages to the Adaptive Management Plan for Teck Coal in the Elk Valley

As required in Permit 107517 Section 11, Teck has developed an Adaptive Management Plan (AMP) to support implementation of the EVWQP to achieve water quality and calcite targets, protect human health, groundwater and aquatic ecosystem health (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. 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 FRO LAEMP was designed to monitor conditions in the upper Fording River in advance of FRO AWTF-S operation and answer specific questions on an annual basis (Section 1.2). During or at the conclusion of each annual LAEMP cycle (results are reported on May 31st of each year for the preceding calendar year), management actions may be triggered, depending on the answers to those questions. For example, the 2016 FRO LAEMP report identified a temporal and spatial decrease in the relative abundance of % Ephemeroptera in the upper Fording River in the area downstream of Kilmarnock Creek to between Chauncey Creek and Ewin Creek (Minnow 2017a). In response, additional monitoring areas were added to the LAEMP to increase spatial coverage. Also, the 2017 FRO LAEMP report identified a potential data gap surrounding the understanding of seasonal variability in BIC structure, thus, additional sampling was added to the LAEMP in June and August of 2018 (Minnow and Lotic 2018). Lastly, due to seasonal drying between Swift and Cataract Creeks in late 2018, flows in the Fording River at the FRO Compliance Point consisted of predominantly water from Cataract Creek. To evaluate the potential effects on biota in the area downstream of Cataract Creek, two additional biological sampling events were included in December 2018 and February 2019.

In addition to addressing questions specific to the FRO 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 summed up 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 the next RAEMP report in 2020.

LAEMP and RAEMP data 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.

Please refer to the AMP (Teck 2018) 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.

2 METHODS

2.1 Overview

The general approach for the FRO LAEMP is summarized in Table 2.1, which identifies the data that were collected and evaluated in relation to each of the study questions. Monitoring locations listed in Table 2.1 are shown in Figure 2.1.

Biological samples were collected in June, August, September, and December 2018, from locations along the Fording River extending from the headwaters of the Fording River and Henretta Creek (upstream of FRO) through FRO to upstream of Ewin Creek (Figure 2.2). RG_FO26 was inaccessible due to mine activities in August thus was not sampled. No sampling occurred at RG_FRCP1SW in September and December due to this section of the river being dry (i.e., subsurface). Winter conditions prevented access to RG_FO26 and RG_HENUP in December, so RG_UFR1 was added as a reference area for December. Descriptions of each sampling area and samples collected are provided in Table 2.2. Teck water quality monitoring stations associated with the FRO LAEMP are presented in Table 2.3. Water level and temperature were monitored continuously at established gauges between Kilmarnock Creek and Chauncey Creek (Table 2.4; Figure 2.2). Drying surveys were conducted monthly between January and April (see Minnow and Lotic 2018) and August and December (Table 2.4; Figure 2.2). Data were incorporated from other monitoring programs, as needed, to contribute to data evaluation and interpretation.

2.2 Benthic Invertebrates

2.2.1 Community Structure

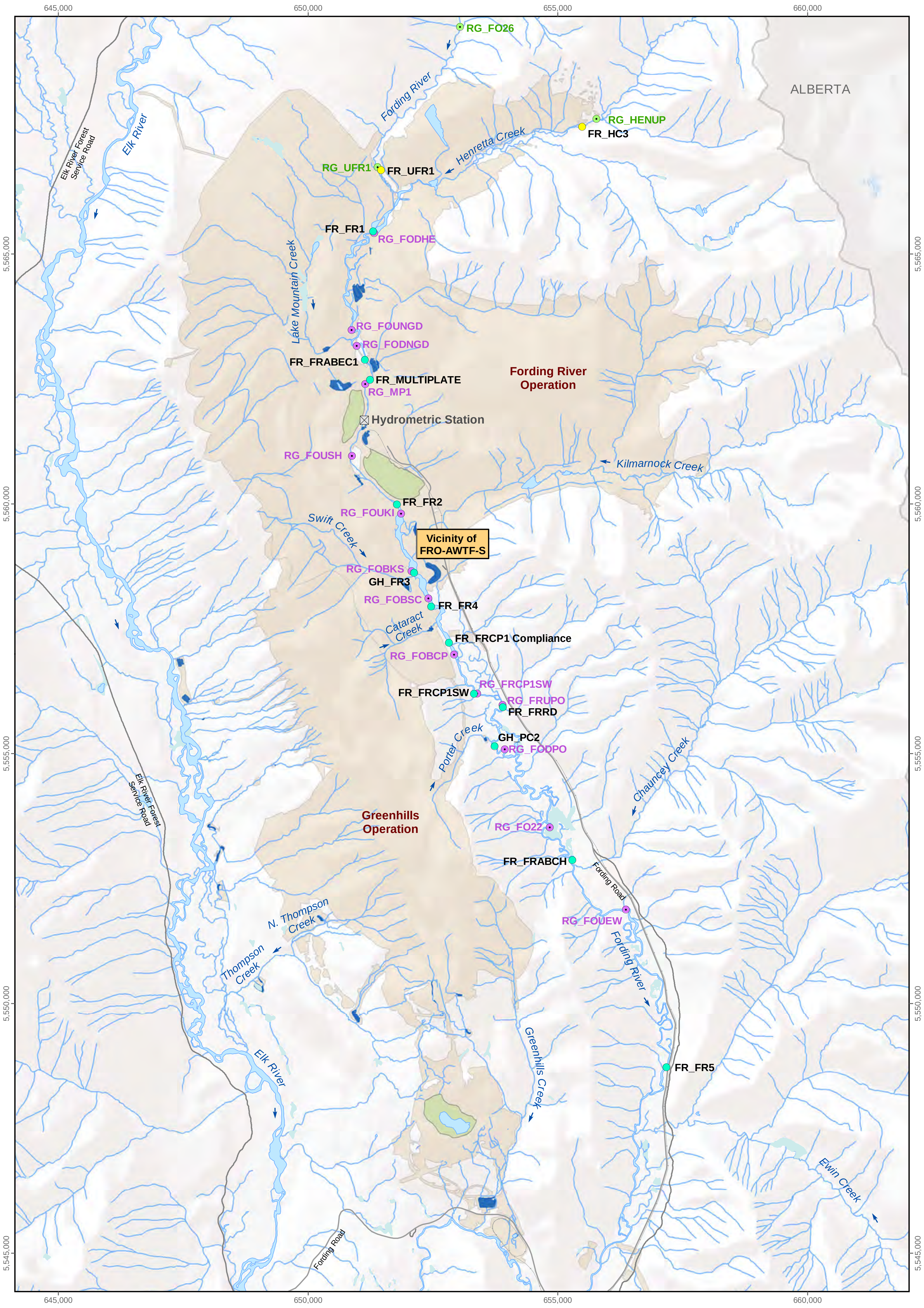
2.2.1.1 Sample Collection

BIC sampling followed the Canadian Aquatic Biomonitoring Network (CABIN) method, which involved 3-minute travelling kick sampling in riffle habitats into a net with 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 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

Table 2.1: Summary of the 2018 FRO LAEMP

Study Questions	Context	Assessment Endpoints	Measurement Endpoints[a]				How Data Will be Evaluated to Address Study Question
			Water	Water Sampling Stations	Biological	Biological Sampling Areas	
1. Are nitrate concentrations increasing and, if so, are they adversely affecting aquatic biota?	Nitrate concentrations are predicted (in the EVWQP) to increase prior to commissioning of the AWTF.	Benthic invertebrate community relative to nitrate concentrations in the upper Fording River.	Nitrate concentrations in water, surface water chronic toxicity tests (quarterly and semi-annually)	FR_UFR1, FR_HC3, FR_FR1, FR_FRABEC1, FR_MULTIPLATE, FR_FR2, GH_FR3, FR_FR4, FR_FRCP1, FR_FRCP1SW, FR_FRRD, FR_FRABCH, GH_PC2, FR_FR5; Chronic toxicity tests at FR_UFR1 and FR_FRCP1 only	Benthic invertebrate community structure (September)	RG_FO26 (Ref), RG_HENUP (Ref), RG_FODHE, RG_FOUNGD, RG_FODNGD, RG_MP1, RG_FOUSH, RG_FOUKI, RG_FOBKS, RG_FOBSC, RG_FOBCP, RG_FRCP1SW, RG_FRUPO, RG_FODPO, RG_FO22, RG_FOUEW	1. Evaluate nitrate concentrations relative to predictions in the EVWQP. 2. Determine if benthic invertebrate community endpoints are outside of regional reference condition or moving away from the reference condition in accordance with observed nitrate concentrations. 3. Determine if benthic invertebrate community results correspond with expectations based on nitrate concentrations in water relative to the site-specific benchmark for nitrate.
2. Is active water treatment affecting biological productivity downstream in the Fording River?	The AWTF is not scheduled to be commissioned until late 2020, so sampling in 2019 and 2020 will be collection of baseline data so that questions can be answered after the AWTF operation commences.	Biological productivity downstream from the AWTF discharge post-compared to pre-AWTF commissioning and relative to productivity observed upstream from the discharge.	Nutrient concentrations	FR_UFR1, FR_HC3, FR_FR1, FR_FRABEC1, FR_MULTIPLATE, FR_FR2, GH_FR3, FR_FR4, FR_FRCP1, FR_FRCP1SW, FR_FRRD, FR_FRABCH, GH_PC2, FR_FR5	Benthic invertebrate biomass (September), benthic invertebrate community structure (September)	Community - as above; Biomass - RG_FO26 (Ref), RG_HENUP (Ref), RG_FOBKS, RG_FOBSC, RG_FOBCP, RG_FRUPO, RG_FO22	Pre-AWTF Commissioning - Continue to collect baseline data indicative of productivity based on benthic invertebrate samples collected upstream and downstream of the future treatment system discharge.
3. Are tissue selenium concentrations reduced downstream from the AWTF?		Tissue selenium concentrations downstream from the AWTF discharge post- compared to pre-AWTF commissioning and relative to concentrations observed upstream from the discharge.	Total and dissolved selenium concentrations, and selenium speciation	FR_UFR1, FR_FR1, FR_FRABEC1, FR_MULTIPLATE, FR_FR2, GH_FR3, FR_FR4, FR_FRCP1, FR_FRCP1SW, FR_FRRD, FR_FRABCH, GH_PC2, FR_FR5	Benthic invertebrate tissue selenium (composite-taxa samples), WCT tissue samples (once every three years as part of the RAEMP)	Invertebrate tissue - RG_FO26 (Ref), RG_HENUP (Ref), RG_FOBKS, RG_FOBSC, RG_FOBCP, RG_FRCP1SW, RG_FRUPO, RG_FODPO, RG_FO22, RG_FOUEW; WCT - Fording River u/s of Josephine Falls	Pre-AWTF Commissioning - Continue to collect baseline tissue selenium data from benthic invertebrates sampled upstream and downstream of the future treatment system discharge.
4. Is AWTF operation affecting aquatic biota through thermal effects or concentrations of treatment-related constituents other than nutrients or selenium?		Potential thermal effects or other treatment related constituents of interest on biota downstream from the AWTF.	Chronic toxicity tests in receiving environment (quarterly); Field *in situ* water quality (in association with water chemistry sampling); Temperature data loggers (when treatment begins); Acute toxicity tests on effluent (when treatment begins)	Effluent mixing zone, FR_UFR1, FR_FR2, FR_FR4, FR_FRCP1, FR_FRRD, FR_FRABCH, FR_FR5 Chronic toxicity tests at FR_UFR1 and FR_FRCP1 only	Benthic invertebrate community structure (September)	Community - RG_FOBKS, RG_FOBSC, RG_FOBCP, RG_FODPO, RG_FOUEW	Pre-AWTF Commissioning - Continue to collect baseline temperature data through routine monitoring stations upstream and downstream of the future treatment system discharge. Temperature loggers in the expected mixing zone of the future discharge will provide continuous temperature monitoring. Continue routine water quality monitoring upstream versus downstream of the future treatment system discharge. Biological data collected for other purposes (above) will also serve as baseline data for this question.
5. Is re-direction of water potentially affecting biota in the Fording River?	As mining development progresses, water will be re-routed for treatment, which may alter water flows in the upper Fording River compared to current conditions.	Potential effects on biota.	To be determined	To be determined	To be determined	To be determined	Evaluation of potential effects on biota, including fish, in relation to changes in flows will be monitored through the LAEMP as well as further investigations completed by FRO in the development of the FRO-AWTF-S.
6. What are the factors contributing to the variations in percent Ephemeroptera?	A consistent spatial (upstream to downstream) and temporal decrease in percent Ephemeroptera has been observed in the upper Fording River. Data collected during the 2019-2020 FRO LAEMP will build on the investigation of cause initiated in the previous LAEMP cycle.	Benthic invertebrate community, tissue chemistry, water quality, sediment quality, and habitat (e.g., seasonal drying, flow, substrate type, calcite, temperature).	Order constituents, plus nickel and other WQ constituents with Early Warning Triggers (EWT) in surface water, chronic toxicity tests (quarterly and semi-annually)	FR_UFR1, FR_HC3, FR_FR1, FR_FRABEC1, FR_MULTIPLATE, FR_FR2, GH_FR3, FR_FR4, FR_FRCP1, FR_FRCP1SW, FR_FRRD, FR_FRABCH, GH_PC2, FR_FR5; Chronic toxicity tests at FR_UFR1 and FR_FRCP1 only	Benthic invertebrate community structure (June, August, September) and composite-taxa tissue chemistry (September, and December)	RG_FO26 (Ref), RG_HENUP (Ref), RG_FODHE, RG_FOUNGD, RG_FODNGD, RG_MP1, RG_FOUSH, RG_FOUKI, RG_FOBKS, RG_FOBSC, RG_FOBCP, RG_FRCP1SW, RG_FRUPO, RG_FODPO, RG_FO22, RG_FOUEW	1. Determine if benthic invertebrate community endpoints are outside of regional reference condition or moving away from the reference condition in accordance with observed sulphate, selenium, nickel and/or other water quality constituent concentrations. 2. Determine if benthic invertebrate community endpoints are outside of regional reference condition or moving away from the reference condition in accordance with other potential stressors, both mine-related and/or natural. 3. Determine if mine-related and/or natural stressors correlate with % Ephemeroptera and other BIC metrics.
7. What is the benthic invertebrate community structure in the reach of the Fording River that goes dry, and can changes be correlated with flow conditions?	A section of the upper Fording River has been observed to dry in the winter. The spatial and temporal extent of drying will be characterized, and the effects on benthic invertebrate communities will be assessed.	Monthly surveys of dry sections between August and April (annual), benthic invertebrate community.	Temperature and level data loggers (continuous). Field *in situ* water quality	FR_FR2, FR_AWTF-S GH_FR3, FR_FR4, FR_FRCP1, FR_FRCP1SW, FR_FRRD, GH_PC2, FR_FRABCH, FR_FRABCH-new	N/A	Community in dry section(s) (i.e. FR_FRCP1SW)	1. Determine the spatial and temporal extent and annual variability of seasonal dewatering in the upper Fording River. 2. Evaluate benthic invertebrate community in the dewatered section.

[a] Sediment samples were also be collected at RG_HENUP, RG_FO26, RG_FOBKS, RG_FOBSC, RG_FOBCP, RG_FRUPO, and RG_FO22 to support various LAEMP and operational requirements.



LEGEND

Water Monitoring Station

- ● Mine-exposed
- ● Reference

Biological Sampling Area

- ⊙ Mine-exposed
- ⊙ Reference

☒ Hydrometric Station

▇ Settling Pond

▇ Tailings Pond

▇ Teck Coal Mine Operation

Monitoring Locations in Upper Fording River, FRO LAEMP, 2018

0 1 2 4
km

N W E S

Projection: North American Datum 1983 UTM Zone 11 U
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Date: May 2019
Project 187202.0022

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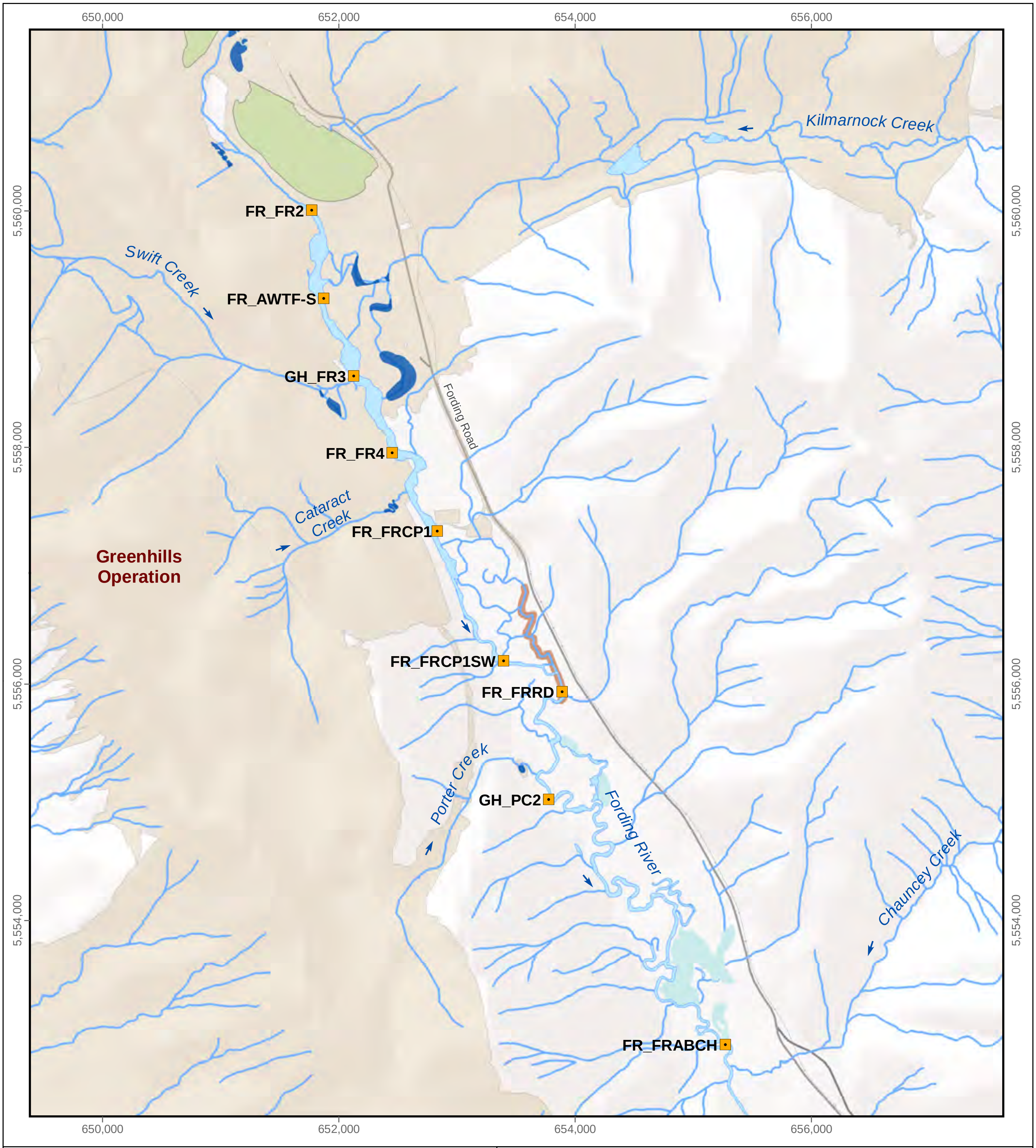
Figure 2.1

Document Path: S:\Projects\187202\187202.0022 - FRO LAEMP 2018\GIS\Report\Figures\18-22 Figure 2.1 Monitoring Locations in Upper Fording River. 2018.mxd



LEGEND

- ■ Hydrology Site Location
- ━ Greenhouse Groundwater Channel
- 🟦 Settling Pond
- 🟩 Tailings Pond
- ⬜ Teck Coal Mine Operation

Monthly Survey of Dry Reaches and Hydrometric Stations in the Upper Fording River, FRO LAEMP, 2018

0 0.5 1 2 km

N W E S

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Figure 2.2

Document Path: S:\Projects\187202\187202.0022 - FRO LAEMP 2018\GIS\Report\Figures\18-22 Figure 2.2 FRO Dewatering.mxd

Table 2.2: Summary of Samples Collected for the FRO LAEMP, 2018

Biological Monitoring Area (Teck Water Quality Station)		Area Description	Biological Monitoring Area UTM Coordinates		Water Chemistry (# of samples)				Sediment Quality (# of samples)				Benthic Invertebrates											
													Hess				Kick and Sweep							
													Biomass and Density (# of samples)				Community (# of samples)				Composite-taxon Tissue Chemistry (# of samples)			
			Easting	Northing	June	Aug	Sept	Dec	June	Aug	Sept	Dec	June	Aug	Sept	Dec	June	Aug	Sept	Dec	June	Aug	Sept	Dec
Reference	RG_HENUP (FR_HC3)	Henretta Creek u/s all mine operations	655771	5567710	1	1	1	-	-	-	3	-	-	-	10	-	1	1	3	-	-	-	3	-
	RG_FO26 (FR_UFR1)	Fording River u/s Henretta (u/s all mines)	653044	5569552	1	-	1	-	-	-	3	-	-	-	10	-	1	-	3	-	-	-	3	-
	RG_UFR1 (FR_UFR1)	Fording River u/s Henretta at Teck WQ station	651350	5566774	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	3
Mine-exposed	RG_FODHE (FR_FR1)	Fording River d/s Henretta Creek	651320	5565422	1	1	1	1	-	-	-	-	-	-	-	-	1	1	3	-	-	-	3	3
	RG_FOUNGD	Fording River u/s NGD	650870	5563476	1	1	1	1	-	-	-	-	-	-	-	-	1	1	3	-	-	-	3	3
	RG_FODNGD (FR_FRABEC1)	d/s Lake Mountain Creek/ North Greenhills Diversion	650972	5563162	1	1	1	1	-	-	-	-	-	-	-	-	1	1	3	-	-	-	3	3
	RG_MP1 (FR_MULTIPLATE)	Fording Multiplate d/s Eagle Ponds	651143	5562400	1	1	1	1	-	-	-	-	-	-	-	-	1	1	3	-	-	-	3	3
	RG_FOUSH (FR_FRNTP)	Fording River u/s Shandley Creek	650876	5560957	1	1	1	1	-	-	-	-	-	-	-	-	1	1	3	-	-	-	3	3
	RG_FOUKI (FR_FR2)	Fording River u/s Kilmarnock Creek	651859	5559804	1	1	1	1	-	-	5	-	-	-	10	-	1	1	3	3	-	-	3	3
	RG_FOBKS (GH_FR3)	Fording River between Kilmarnock Creek & Swift Creek	652074	5558652	1	1	1	1	-	-	5	-	-	-	10	-	1	1	3	-	-	-	3	3
	RG_FOBSC (FR_FR4)	Fording River d/s Swift Creek, u/s Cataract Creek	652407	5558109	1	1	1	1	-	-	-	-	-	-	10	-	1	1	3	3	-	-	3	3
	RG_FOBCP (FR_FRCP1)	Fording River between Cataract & Porter Creek	652920	5556982	1	1	1	1	-	-	5	-	-	-	10	-	1	1	5	3	-	-	5	3
	RG_FRCP1SW (FR_FRCP1SW)	Fording River ~1150 m d/s of Compliance Point	653387	5556201	1	1	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
	RG_FRUPO (FR_FRRD)	Fording River u/s of Porter Creek	653894	5555975	1	1	1	1	-	-	5	-	-	-	10	-	1	1	3	3	-	-	3	3
	RG_FODPO (GH_PC2)	Fording River d/s Porter Creek, u/s Chauncey Creek	653935	5555085	1	1	1	1	-	-	-	-	-	-	-	-	1	1	3	3	-	-	3	3
	RG_FO22 (FR_FRABCH)	u/s Chauncey Creek	654841	5553523	1	1	1	1	-	-	5	-	-	-	10	-	1	1	5	-	-	-	5	3
	RG_FOUEW (FR_FR5)	Fording River d/s Chauncey Creek, u/s Ewin Creek	656365	5551875	1	1	1	1	-	-	-	-	-	-	-	-	1	1	3	3	-	-	3	3

Note: "-" indicates no data available

Table 2.3: Summary of Teck Routine Water Quality Monitoring Associated with the FRO LAEMP

Location Description	Water Station ID	EMS Number	UTM (11U)		Water Quality Samples			
			Easting	Northing	Designation	Field parameters[a]	All other parameters required under mine permits[b]	Toxicity[c]
Fording River upstream of FRO	FR_UFR1	E216777	651459	5566677	Reference	M	M	Q[d]
Henretta Creek upstream of FRO	FR_HC3	E300096	655489	5567547	Reference	M	M	-
Fording River downstream of Henretta Creek	FR_FR1	0200251	651304	5565451	Exposed	M	M	-
d/s Lake Mountain Creek/ North Greenhills Diversion	FR_FRABEC1[e]	N/A	651138	5562882	Exposed	M	M	-
Multiplate Culvert on Greenhills Access Road	FR_MULTIPLATE[e]	N/A	651238	5562482	Exposed	M[e]	M[e]	-
Fording River downstream of the North Tailings Pond	FR_FRNTP[e]	N/A	651122	5561675	Exposed	M[e]	M[e]	-
Fording River upstream of the proposed AWTF discharge	FR_FR2	0200201	651781	5559984	Exposed	W/M	W/M	-
Fording River immediately downstream of the proposed AWTF discharge	GH_FR3[e]	N/A	652125	5558620	Exposed	M[e]	M[e]	-
Fording River between Swift and Cataract	FR_FR4[e]	0200311	652464	5557943	Exposed	M	M	-
Fording River Compliance Point	FR_FRCP1	E300071	652823	5557220	Exposed	W/M	W/M	Q
Fording River ~1150 m downstream of the Compliance Point	FR_FRCP1SW[e]	N/A	653324	5556197	Exposed	M[e]	M[e]	-
Fording River upstream Porter Creek	FR_FRRD	E300097	653897	5555925	Exposed	M	M	-
Fording River downstream of Porter	GH_PC2[e]	E287431	653734	5555147	Exposed	M[e]	M[e]	-
Fording River u/s Chauncey Cr.	FR_FRABCH[e]	N/A	655293	5552865	Exposed	M[e]	M[e]	Q[f]
Fording River upstream of Ewin Creek	FR_FR5[e]	N/A	657174	5548724	Exposed	M[e]	M[e]	-

Notes: M - monthly; W/M - weekly during freshet (March 15 to July 15); Q - quarterly; N/A - Not Applicable; "-" indicates no data available

[a] Dissolved oxygen, temperature, specific conductance, pH.

[b] Total and dissolved metals, total and dissolved organic carbon, nutrients, major ions, etc. as per Table 18 of Permit 107517.

[c] Chronic toxicity as per Permit 107517 requirements.

[d] Not required by Permit 107517, this locaiton is used as a reference location in the chronic toxicity program. Frequency may change depending on the needs of the program.

[e] Non permitted location, frequency may change.

[f] Chronic toxicity started in Q4 2018 at this location.

Table 2.4: Summary of Hydrometric and Water Temperature Monitoring Locations

Water Station ID		Location Description	UTM (11U)		Dewatering Survey Frequency	Data Loggers	
			Easting	Northing		Water Level (Flow)	Temperature
Mine-exposed	FR_FR2	Fording River upstream of the proposed AWTF discharge	651781	5559984	M	C	C
	FR_AWTF-S	Fording River at the proposed AWTF site	651874	5559260	M	C	C
	GH_FR3	Fording River immediately downstream of the proposed AWTF discharge	652125	5558620	M	C	C
	FR_FR4	Fording River between Swift and Cataract	652464	5557943	M	C	C
	FR_FRCP1	Fording River Compliance Point	652823	5557220	M	C	C
	FR_FRCP1SW^e	Fording River ~1150 m downstream of the Compliance Point	653324	5556197	M	C	C
	FR_FRRD	Fording River upstream Porter Creek	653897	5555925	M	C	C
	GH_PC2	Fording River downstream of Porter	653734	5555147	M	C	C
	FR_FRABCH	Fording River upstream of Chauncey Creek	655293	5552865	M	C	C

Notes: M - monthly (August to April); C - Continuous to a level of 10% buffered formalin in ambient water. Replicate samples were spaced either in separate riffles or a minimum of 50 m apart (when the area was a continuous riffle).

Triplicate BIC samples were collected at each of the LAEMP areas in September 2018 (Table 2.2), with the exception of RG_FOBCP and RG_FO22 where five replicate samples were collected to fulfill requirements under the 2018 to 2020 RAEMP study design (Minnow 2018c). A single BIC sample was collected in each monitoring area in June and August (Table 2.2), and triplicate samples were collected at a subset of areas around the Compliance Point (FR_FRCP1; Table 2.2) in December to evaluate the influence of elevated water quality concentrations on biota from predominantly Cataract Creek flow in this section of the upper Fording River.

Due to a laboratory analysis delay, BIC data from December were not included in the current report, but will be incorporated into the next LAEMP report. .

2.2.1.2 Laboratory Analysis

BIC samples were sent to Cordillera Consulting (lead taxonomist Scott Finlayson), in Summerland BC, for sorting and taxonomic identification. Organisms were identified to the lowest practical level (LPL) (typically genus or species). At the beginning of the sorting process, each sample was examined and evaluated for estimation of total invertebrate numbers. If the total number was estimated to be greater than 600, then the laboratory's sub-sampling protocol was followed. A minimum of 5% of each sample was sorted, in accordance with Quality Assurance/Quality Control (QA/QC) requirements of Environment Canada (2014). Sorting efficiency and sub-sampling accuracy and precision were quantified using methods specified by Environment Canada (2012b, 2014) (data in Appendix G). Based on the QA/QC results, the BIC data were judged to be of acceptable quality (Appendix G).

2.2.1.3 Supporting Measures

Consistent with the requirements of the CABIN sampling protocol, supporting habitat information (i.e., water velocity and depth, *in situ* water quality [temperature, dissolved oxygen (DO), conductivity, pH], canopy cover, substrate characteristics [Wolman 100-pebble count]) was collected concurrent with benthic invertebrate communities sampled in riffle habitats (Environment Canada 2012a).

2.2.1.4 Data Analysis

To address the investigation into the changes in BIC structure, endpoints of total sample abundance, richness (LPL taxonomy), percent (%) and total abundance of Ephemeroptera-Plecoptera-Trichoptera (EPT) combined, Ephemeroptera, Plecoptera, and Trichoptera individually, and total abundance of key Ephemeroptera families (Baetidae, Heptageniidaie, Ephemerellidae) were computed for each monitoring area from CABIN kick samples. Values were compared to normal (reference area) ranges defined as the 2.5th and 97.5th percentiles of the distribution of reference area data (pooled 2012 and 2015 data) reported in the 2015-2016 RAEMP report (Minnow 2018b), the 2017 FRO LAEMP report (Minnow and Lotic 2018), and in Appendix Tables B.1 and B.2. Endpoints were plotted over time (2012 to 2018) for each area where data were available.

Temporal changes in benthic endpoints calculated from September kick and sweep data were evaluated for 2012 to 2018. For some (but not all) years there were replicate data for a given station within a year. Thus, for each endpoint, an overall ANOVA with factors *Year*, *Area* and *Year* × *Area* was fit. The best transformation for each endpoint was chosen as the transformation for which a Shapiro-Wilk's test on the residuals gave the highest P-value (i.e., most normally distributed). If there was a significant *Year* term, the variability within years and areas from the full model was used to test for significant differences between all pairwise comparisons of year for each area (i.e., is the difference between year *i* and year *j* greater than would be expected given the variability within areas for all stations for which we have replicates). This assumes the variability to be consistent among areas and years, but allows for comparisons between years without replicates. Significance of the pairwise comparisons was assessed with an α of 0.05 in a Tukey's Honestly Significant Difference test (HSD) which corrects for the number of comparisons.

For each year, a percent magnitude of difference from the base year (i.e., first year with data) was calculated as:

$$\frac{Year_i - Base\ Year}{Base\ Year} \times 100\ \%$$

and the significant difference between 2018 and previous years was assessed. All statistics were conducted in R (R Core Team 2019).

BIC structure was also assessed using a multivariate ordination technique known as correspondence analysis (CA), which is used to create synthetic species abundance axes extracted in a sequential manner. Each score (number) on a CA axis is the sum of a weighted vector of species abundances. Species with correlated abundances vary together and have similar weights and scores on a CA axis. When depicted in two-dimensional plots, taxa that tend to co-occur plot together, while those that rarely co-occur plot farther apart. Similarly, stations sharing many taxa plot closest to one another, while those with little in common plot furthest apart. The greatest variation among either taxa or stations is explained by the first axis, with other axes accounting for progressively less variation. Therefore, this type of multivariate analysis describes not only which stations have distinct benthic communities, but also how these benthic communities differ among stations (i.e., which particular taxa differ in abundance). Prior to CA, the data were screened for rare taxa, as these can distort results. Taxa occurring at 10% or fewer of the stations, and constituting less than 1% of the total organism abundance, were removed. After screening and data reduction, abundances were log (x+1) transformed. Scores for both taxa and stations were calculated using the vegan package (Oksanen et al. 2019) in R (R Core Team 2019) to evaluate the associations of organisms and stations.

Spearman rank correlations were conducted to evaluate monotonic trends between benthic invertebrate endpoints (family level CA1 and CA2, % Ephemeroptera) and physical and chemical parameters (Calcite Index [CI], pebble size, water velocity, water depth, temperature; see Sections 2.3 and 2.4), using data from 2018. Correlations were performed using the *Hmisc* package (version 4.1-1; Harrell 2017) in R. Correlations with a correlation coefficient (r) with magnitude greater than 0.6 were considered strong (Milton and Arnold 2002), and significance was tested at $\alpha = 0.05$.

2.2.2 Tissue Selenium

2.2.2.1 Sample Collection

Composite-taxa benthic invertebrate tissue samples were collected for selenium analysis from all areas (Table 2.2) using the kick sampling method described in Section 2.2.1, except that the sampling was not timed and kicking continued until sufficient sample was collected. Replicate samples were collected either in separate riffles or a minimum of 50 m apart (when the area was a continuous riffle).

Three samples were collected in September and December from the reference and mine-exposed areas in the FRO LAEMP, with the exception of RG_FOBCP and RG_FO22, where five samples were collected in September to support the RAEMP requirements (Minnow 2018c). No samples were collected at RG_HENUP and RG_FO26 in December due to inaccessibility. RG_UFR1 was used as an alternate reference area in December.

Invertebrates were picked free of debris in the field, placed into sterile labelled cryovials and stored in a cooler with ice packs until they were transferred to a freezer later in the day. Approximately 2 g of wet tissue were collected for each sample where possible.

2.2.2.2 Laboratory Analysis

Benthic invertebrate tissue samples were kept in a freezer until they were shipped in coolers on ice to SRC Environmental Analytical Laboratories (SRC) in Saskatoon, SK. At the laboratory, samples were freeze-dried and analyzed for metals (including selenium and mercury) using

Inductively Coupled Plasma-Mass Spectrometry (ICP-MS). Results were reported on a dry weight (dw) basis, along with moisture content (based on the difference between wet and freeze-dried sample weights).

2.2.2.3 Data Analysis

Composite-taxa benthic invertebrate tissue selenium concentrations were plotted relative to:

- the normal (reference area) range, defined as the 2.5th and 97.5th percentiles of tissue selenium concentrations measured in reference areas that have not been disturbed by mining in historical studies completed in the Elk River watershed from 2006 to 2015 (Minnow 2018);
- data from previous sampling periods from 2012 to present, where available; and
- the Level 1 EVWQP benchmarks for effects to invertebrates (13 milligrams/kilogram [mg/kg] dry weight [dw]), dietary effects to birds (15 mg/kg dw), and dietary effects to juvenile fish (11 mg/kg dw; Golder 2014).

Additionally, tissue selenium concentrations were paired with corresponding water selenium concentrations and compared to the selenium bioaccumulation model (Golder 2018a).

2.2.3 Biomass

2.2.3.1 Sample Collection

Ten stations were sampled at each of eight areas (RG_FO26, RG_HENUP, RG_FOUKI, RG_FOBKS, RG_FOBSC, RG_FOBCP, RG_ FRUPO, and RG_FO22) in September for analysis of benthic invertebrate biomass and density (Table 2.2; Figure 2.1). Benthic invertebrates were collected using a Hess sampler with 500 µm mesh, for measurement of biomass and community endpoints relative to the area sampled. Stations were located a minimum of 5 m apart so they were representative of the overall monitoring 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 level of 10% buffered formalin in ambient water within approximately 6 hours of collection to ensure that biomass was not lost through predation or decomposition of tissues before the samples were sorted at the laboratory.

2.2.3.2 Laboratory Analysis

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 0.0001 g. Total biomass and density were reported for each sample (preserved wet weight).

2.2.3.3 Data Analysis

Laboratory data for benthic invertebrate Hess samples were converted to units of number of organisms per square metre (org/m^2) based on the known area sampled. Baseline biomass and density data from 2017 and 2018 were plotted, and statistically compared to both reference areas separately using an ANOVA model with Area and an α of 0.1. When there was a significant Area term, differences between each exposed area and each reference area were tested using a Dunnett's test. All analyses were conducted in Minitab 1.7.

2.3 Water Quality

2.3.1 Sample Collection

Water quality assessment focused on constituents with early warning triggers (EWTs; i.e., dissolved cadmium, nitrate, total selenium, sulphate, total antimony, total barium, total boron, dissolved cobalt, total lithium, total manganese, total molybdenum, total nickel, nitrite, total dissolved solids, total uranium, and total zinc) and total mercury. Total mercury was considered but further analysis was not completed due to an evaluation that concluded that the source of mercury concentrations in the Elk Valley were not affected by mining (Teck 2019).

ENV's letter approving the FRO LAEMP study design included a requirement to collect water samples concurrently with biological sampling. In addition, routine water quality monitoring data collected by Teck were downloaded from Teck's EQuIS^{TM} database for the monitoring stations that correspond with biological sampling areas in the LAEMP (Table 2.3 and Figure 2.2). Data included:

- nutrient concentrations (i.e., nitrate, total phosphorus, and ortho-phosphate);
- total and dissolved selenium concentrations;
- sulphate concentrations;

- other constituents with early warning triggers (EWTs; i.e., dissolved cadmium, sulphate, total antimony, total barium, total boron, dissolved cobalt, total lithium, total manganese, total molybdenum, total nickel, nitrite, total dissolved solids, total uranium, and total zinc)
- total hardness as $CaCO_3$; and
- *in situ* water quality data (i.e., temperature, flow, pH, conductivity, and DO).

QA/QC associated with water sampling is described by Teck in annual water quality reports submitted under Permit 107517 (e.g., Teck 2019).

Water temperature and discharge measurements from Teck's continuous monitoring station, FR_FRNTP, were also acquired from Teck. Measurements were recorded in 15 minute intervals and were used to evaluate changes in temperature and discharge over time in the upper Fording River.

2.3.2 Data Analysis

Data extracted from Teck's EQuIS database were screened for text values and converted to a common unit (e.g., all metal concentrations were converted to mg/L). Values reported as less than a poor laboratory reporting limit (LRL) were removed from the data set, unless they consisted of 80% or more of the data. Poor LRLs were defined as a values reported as < LRL and the LRL exceeding the maximum observed (detected) value for that parameter.

Routine water quality monitoring results were screened against British Columbia Water Quality Guidelines (BCWQG; BCMOE 2017, 2018) as part of Teck's Annual Water Quality Monitoring Report under Permit 107517 (Teck 2019). Constituents with EWTs were compared to BCWQG and/or EVWQP benchmarks and interim screening benchmarks for nickel, as applicable, for the 2018 calendar year. Plots of these constituent concentrations from 2012 to 2018 were prepared individually for each monitoring station relative to BCWQG, benchmarks and screening values (where applicable), and also as combined plots to allow for visual comparison among stations.

Potential changes in aqueous concentrations of nitrate, total sulphate, total selenium, and total nickel at individual stations over time were analyzed statistically to evaluate (1) if there was an increase or decrease since the base year of monitoring (2012 or the earliest year if monitoring was initiated post-2012), (2) whether the annual mean was within the range of historical annual means, and (3) if the current monitoring year (2018) was different from the previous monitoring year (2017). Nitrate, sulphate, and selenium were chosen because they are Order Constituents (Teck 2014) identified in the EVWQP. Cadmium was excluded as concentrations were not above the Level 1 benchmark at the areas included in the FRO LAEMP. Nickel was included due to uncertainty in the current BCWQG as a screening value to be protective to aquatic biota (Teck 2017).

Monthly mean concentrations were estimated using the Kaplan-Meier (K-M) method. The method involves transforming the left censored (i.e., < value) data set to a right censored (i.e., > value) data set, 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 and involves calculating the area under the K-M survival curve. The K-M method is non-parametric and can accommodate multiple LRLs. The method of estimating the mean is equivalent to using the distribution of detectable values below the LRL to represent values that are < LRL. For example, the mean of the data set {1, 2, <4, 5} is estimated as the mean of 1, 2, [½×1 + ½×2], and 5 which is 2.375. The value <4 is replaced by the distribution of values below 4 (i.e., 1 and 2 with equal weight of ½). Similarly, the mean of the data set {1, 1.6, 2, 2.1, <4, 5} is estimated as the mean of 1, 1.6, 2, 2.1, [¼×1 + ¼×1.6 + ¼×2 + ¼×2.1], and 5 which is 2.229. Again, the value <4 is replaced by the distribution of values below 4 (i.e., 1, 1.6, 2, and 2.1 with equal weight of ¼). If there is only one LRL and no detected values below the LRL, then the K-M estimate of the mean is equivalent to replacing the value below the LRL with the LRL (i.e., the best estimate for the values < LRL is the LRL).

Temporal changes in monthly mean concentrations for water quality parameters were evaluated for each station (reference and mine-exposed) from 2012 to 2018. Only years with at least six months and only stations with at least three years of data were included in the analysis. Because of the presence of LRLs for most parameters, a censored regression ANOVA model with factors *Year* and *Month* and assuming a log-normal distribution of the response variable was fit with maximum likelihood estimation for each station. The significance of each term in the model was assessed using likelihood-ratio tests to determine if there is a significant change in log-likelihood with the addition of the term in the model. This tested for an overall difference among years (including the *Month* term in the model controlled for seasonal effects within a year). If the *Year* term was significant (α = 0.05) then post-hoc contrasts were conducted to test for pairwise differences among years with an α = 0.05 in a Tukey’s HSD test which corrects for the number of comparisons.

For each year, a percent magnitude of difference from the base year (i.e., first year with minimum number of months) was calculated as:

$$\frac{Year_i - Base\ Year}{Base\ Year} \times 100\ \%$$

and the significant difference between 2018 and previous years was assessed.

Temperature and discharge data were also acquired from the Teck's continuous monitoring station, FR_FRNTP, located in the upper Fording River. Data were collected every 15 minutes, and monthly means were calculated and plotted between 2010 and 2018. A gap exists from June 2013 to early 2014 as the monitoring station was damaged in the 2013 flood. Potential temporal trends in discharge and temperature at FR_FRNTP were assessed using the method described above for water constituents.

A principal component analysis (PCA) is a multivariate approach which transforms a group of 'n' variables into a smaller new set of uncorrelated variables (the principal components; PCs). The principal components are defined to be linear combinations of the original 'n' variables. Any parameters with >50% of the values below the LRL were excluded from the PCA. For most parameters, the number of LRLs was more than one with many detected values below the maximum non-detected value. To avoid censoring at the high LRL and losing a significant amount of information, all values were replaced with their respective u-score ranks and used the PCA analysis. U-scores are the basis for the Mann-Whitney U test and are the sum of the algebraic sign of differences comparing each value to all other values of the parameter. When comparisons were made between censored data with overlapping intervals, the sign of the difference is zero (e.g., <5 and 2 are assigned equal ranks). U-score ranks have been applied to multivariate data sets (Wittkowski et al. 2008) and are recommended by Helsel (2012) when using data with multiple LRLs. The contribution of individual parameters to the first two principal components were quantified by calculating their correlation using a Pearson's correlation coefficient. The PCA and correlation analysis were conducted in R.

2.4 Substrate Quality

2.4.1 Sediment

2.4.1.1 Sample Collection

Sediment quality samples were collected concurrently with benthic invertebrate samples at seven areas, RG_HENUP, RG_FO26, RG_FOUKI, RG_FOBKS, RG_FOBCP, RG_FRUPO, and RG_FO22 (Table 2.2). Five replicates were collected at mine-exposed areas, and three replicates were collected at reference areas, consistent with methods outlined in the 2018 to 2020 RAEMP study design (Minnow 2018c). Sediment samples were collected using a stainless steel spoon and were transferred into glass jars for analysis of polycyclic aromatic hydrocarbons (PAHs), and into polyethylene bags for all other analyses (i.e., metals, moisture content, total organic carbon, and particle size distribution). Samplers took care to remove only the top 1 to 2 cm of sediment, and continued to collect sediment until sufficient sample volume was retrieved.

For QA/QC purposes, duplicate (split) samples were collected at a frequency of approximately 10% of the total number of samples (based on samples collected for the overall 2018 RAEMP sampling; Minnow 2018c) to permit assessment of field precision (i.e., two sets of field duplicate samples). Following collection, samples were placed in a refrigerator at approximately 4°C until submission to the analytical laboratory.

2.4.1.2 Laboratory Analysis

Samples for chemical analysis were sent to ALS Environmental (Calgary, AB). The laboratory was instructed to thoroughly homogenize each sediment sample (according to standard laboratory protocols), to confirm the aliquots taken for analysis were representative and comparable.

Sediment samples were analyzed using the following methods: metals by Collision Reaction Cell Inductively Coupled Plasma-Mass Spectrometry (CRC ICP-MS; EPA 200.2/6020A), mercury by Cold Vapour Atomic Fluorescence Spectroscopy (CVAFS; EPA 200.2/245.7), total organic carbon (TOC) by combustion method (Bartels and Sparks 2009), and PAHs by rotary extraction using hexane/acetone (EPA 3570/8270) followed by capillary column gas chromatography with mass spectrometric detection (GC/MS). Particle size distribution was determined by dry sieving (coarse particles), wet sieving (sand), and the pipette sedimentation method (fine particles). Moisture content was determined gravimetrically by drying the sample at 105°C. QA/QC for sediment samples included the collection of two field duplicate samples (RG_FOUKI and RG_HENUP), and assessment of laboratory duplicates, spike recoveries, and certified reference materials. Based on the results provided for QC samples, the sediment data collected for the FRO LAEMP were determined to be of acceptable quality (Appendix G).

2.4.1.3 Data Analysis

Sediment quality data were tabulated, summarized and compared to BC Working Sediment Quality Guidelines (WSQGs), where available. Data from 2017 and 2018 were plotted for all parameters for which a WSQG was available and visually assessed for temporal changes.

2.4.2 Calcite

Calcite measurements were collected concurrently with BIC sampling in 2018. For each of the rocks measured during the 100-pebble count (see Section 2.2.1.3), calcite presence (score = 1) or absence (score = 0) was recorded and the degree of concretion was assessed by determining if the rock was removed with negligible resistance (not concreted; score = 0), noticeable resistance (partially concreted; score = 1), or was immovable (fully concreted; score = 2). If distinct particles were not visible due to heavy calcification, values of 1 (for presence) and 2 (for concretion) were recorded. Similarly, if fines were encountered and calcite presence could not be visually confirmed, values of 0 (for presence) and 0 (for concretion) were recorded. If rocks were visible under fine material, the rock was selected for calcite characterization.

2.4.2.1 Data Analysis

A calcite index (CI) was calculated as follows (Teck 2016b):

$CI = CI_p + CI_c$

Where:

$$CI = Calcite\ Index$$

$$CI_p = Calcite\ Presence\ Score = \frac{Number\ of\ particles\ with\ calcite}{Number\ of\ particles\ counted}$$

$$CI_c = Calcite\ Concretion\ Score = \frac{Sum\ of\ particle\ concretion\ scores}{Number\ of\ particles\ counted}$$

Calcite data collected as part of the Calcite Monitoring Program (Robinson et al. 2013, Robinson and MacDonald 2014, 2015, Robinson et al. 2016, Smithson and Robinson 2017) were considered but were not used in analyses as the calcite measurements taken concurrently with biological sampling were deemed more appropriate because they are specific to the areas sampled for benthic invertebrates.

Calcite measurements made among 40 reference areas sampled in 2015 were used to characterize the normal range as part of the previous RAEMP report (Minnow 2018b), and the upper limit (97.5th percentile) was defined as CI = 1.0.

Pebble size metrics (D16 and D84) were calculated as the 16th and 84th percentiles of 100 pebbles collected from the 100 pebble count and used as an indicator of particle size in correlation analyses.

2.5 Hydrology

2.5.1 Seasonal Drying

2.5.1.1 Field Methods

Monthly surveys (August to December 2018) were completed to evaluate the surface flow conditions along the Fording River. The survey covered a 12.8 kilometre (km) long section of the Fording River from Chauncey Creek (FR_FRABCH) upstream to the South Tailings Pond (FR_FR2). This section was selected because it has known sections that dry in the fall and remain dry until spring snowmelt (McPherson and Robinson 2011). Field crews walked the section during each survey and delineated wet/dry areas by marking them with a handheld Global Positioning System (GPS) unit (in Universal Transverse Mercator [UTM] coordinates, using North American

Datum [NAD] 83) to facilitate mapping. An iPad with a geo-referenced map was used to record tracks and to facilitate estimates of the length of the dry section. Isolated pools were also marked.

2.5.1.2 Data analysis

The GPS locations and tracks collected in the field were mapped to display the dry sub-sections of the upper Fording River. Results of monthly surveys were used to identify when an area had become dry between visits. These observations where then corroborated by using water temperature and level logger records to estimate the exact dates when sections of the Fording went dry (see Section 2.5.2).

2.5.2 Water Level and Temperature

2.5.2.1 Data Collection

Water level (i.e., stream stage) and temperature were continuously monitored using Onset Hobo U-20 level-loggers at eight previously established (2017), and two new (2018) stream stations, including one (FR_FR4) with a barometric logger (Figure 2.2; Table 2.4). Site FR_AWTF-S was installed in August 2018 to monitor conditions around the original FRO AWTF-S outfall proposed at the time of survey, while a new site at FR_FRABCH was installed in October to better align with Teck's water sampling location just upstream of the Chauncey Creek confluence. Water level and water temperature measurements were recorded at 15-minute intervals. Each station was visited monthly and discharge measurements were completed where surface water existed and conditions permitted (i.e., wadeable, excessive snow and ice cover did not interfere). Benchmark surveys (i.e., surveys to established markers in the field) were also completed to comply with Resources Information Standards Committee (RISC) standards (RISC 2009). Data were downloaded routinely from the loggers to avoid data loss. During the winter, the loggers were winterized to prevent freezing and damage.

2.5.2.2 Data Analysis

Water level data were corrected for barometric pressure using Onset Hoboware Pro (version 3.7.16) and a reference water stage relative to the staff gauge. Correcting the data for atmospheric pressure created a continuous record of water stage in meters. Stage, however, is only a locally referenced point relative to the staff gauge at a given site and cannot be used to compare water quantity between sites. Water levels and water temperatures were plotted from October 2017 to October 2018 for each site, with the exception FR_AWTF-S and FR_FRABCH as insufficient data were available for 2018. Data from these sites will be reported in future reports. The results were cross-referenced with observations made during monthly surveys. When a site was observed to have become dry between two surveys, the logger record was used to refine the date when the site dried.

2.5.3 Flow

2.5.3.1 Data Collection

Flow measurements were made when possible at all ten water level loggers (Figure 2.2) during monthly visits. Flow measurements were consistent with those reported by Minnow and Lotic (2018), which followed standards provided in the Manual of British Columbia Hydrometric Standards (RISC 2009). During ice covered visits, a transect was either cleared of snow and ice, or three to five holes were drilled through the ice to get an estimate for discharge. Flow measurements collected through ice are unlikely to serve as reliable data points to create a stage-discharge relationship. Flow measurements were not possible where sites were dry or when conditions were unsafe to access the stream cross-section.

2.5.3.2 Data Analysis

Typically, flow measurements provide an instantaneous pairing of water stage (as recorded on the staff gauge and by the logger) and stream discharge used to create a stage-discharge relationship. To date, high flow measurements required to calculate the relationship have not been collected. As such, these data assess water level only, as an interim measure until proper stage-discharge relationships can be determined.

3 STUDY QUESTION #1

3.1 Overview

To address study question #1 (Are nitrate concentrations increasing, and if so, are they adversely affecting biota?), aqueous nitrate concentrations and biological data were collected in the upper Fording River. An evaluation of biological data collected for the FRO LAEMP is summarized in Section 5 to support study question #6, but results are referenced in Section 3.2 (below) as they relate to study question #1.

3.2 Nitrate Concentrations in the Upper Fording River

Monitoring data collected at the FRO Compliance Point (FR_FRCP1) indicate that surface water flow at this location is predominantly discharge water from Cataract Creek during winter low flow periods (Golder 2018b). Therefore, the location is not representative of the combined and mixed contributions of FRO discharges under all conditions, and comparison of monitored to modelled concentrations is not informative with respect to understanding prevailing conditions in the Fording River.

Nitrate concentrations were also modelled in the EVWQP for the GHO Fording River Compliance Point which is also the Fording River Order Station (GH_FR1), farther downstream. Monitored concentrations at GH_FR1 have been consistently lower than model projections (Golder 2017, Golder 2018b), and updated projections for 2017 onward at this location do not suggest a continued increase in nitrate concentrations (Figures 3.1 and 3.2; Golder 2019). GH_FR1 is located downstream from additional tributaries to the Fording River including two reference tributaries, Chauncey Creek and Ewin Creek, and mine-exposed tributaries, Greenhills Creek and LCO Dry Creek.

Nitrate concentrations were elevated above the EVWQP Level 1 and 2 benchmarks in one or more samples at most monitoring stations in the Fording River downstream from mining activities, particularly at the areas downstream from Cataract Creek (FR_FRCP1, FR_FRRD, FR_FRABCH, FR_FR5; Appendix Figure C.1; Appendix Table C.1). The highest nitrate concentrations were observed at FR_FRCP1 in the last quarter of 2018, which corresponded with seasonal drying in the Fording River between Swift and Cataract Creeks in November, resulting in the majority of flow at the Compliance Point consisting of water from Cataract Creek (Teck 2019).

To evaluate changes over time, nitrate concentrations from 2012 to 2018 were statistically analyzed for temporal trends (Appendix Table C.2; Appendix Figure C.37). Note that data were limited for some stations where monitoring has only occurred over the most recent three to four years (e.g., FR_FRCP1, FR_FRRD, and FR_FRABCH; Appendix Figure C.1). Of the

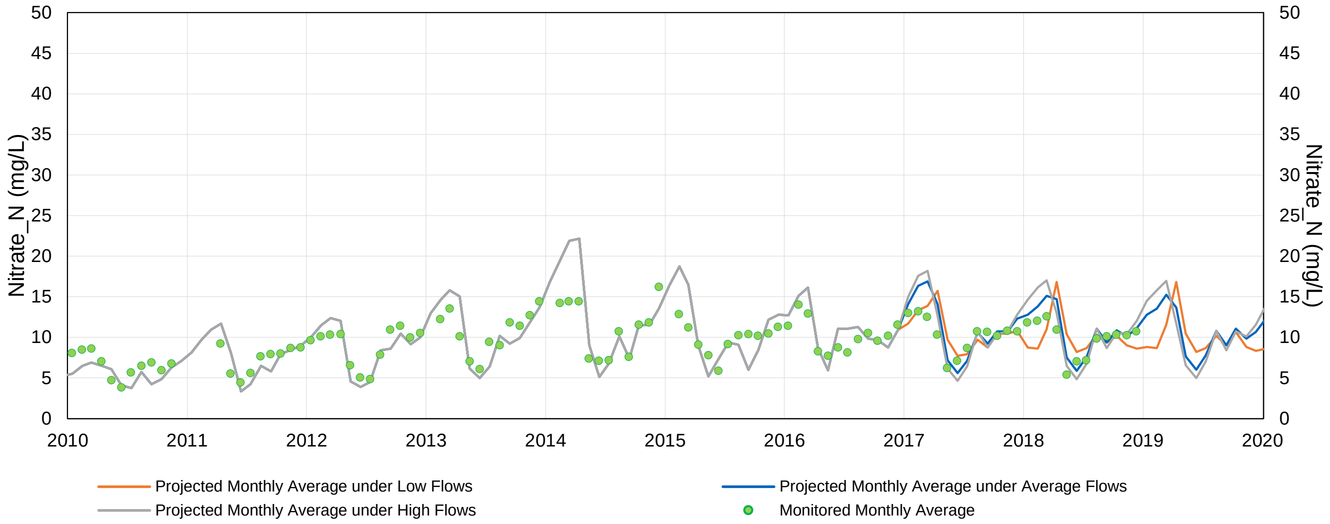


Figure 3.1: **Modelled Nitrate Concentrations at GH_FR1 Generated Using a Range of Historical Monthly Flow Statistics**

Notes: GHO Fording River Compliance Point - Upper Fording River, 205 m downstream of Greenhills Creek (GH_FR1, 0200378)

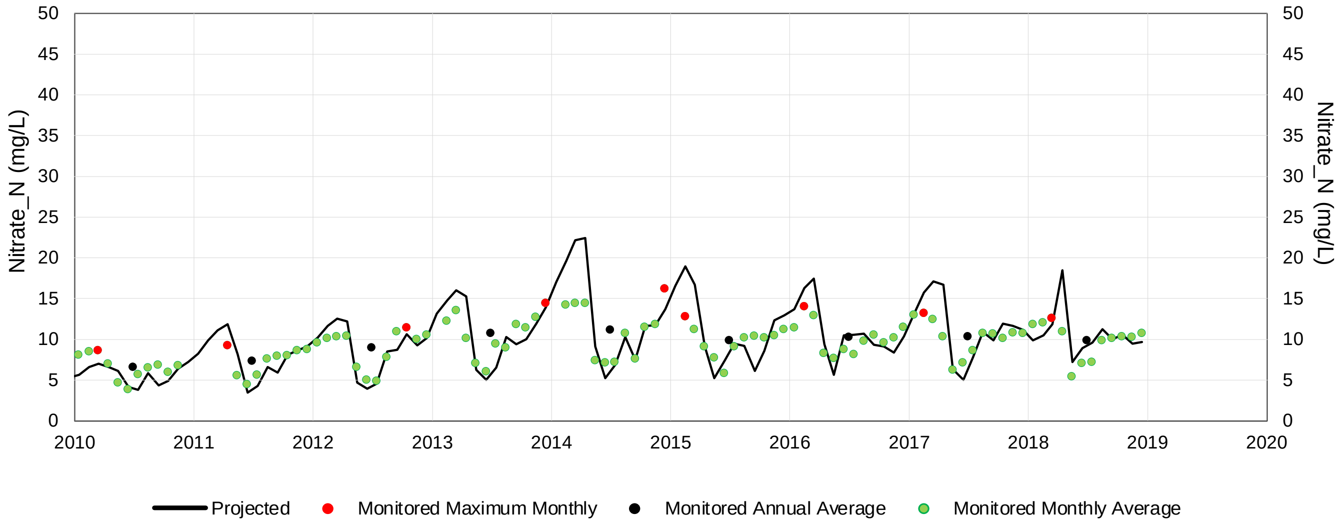


Figure 3.2: **Modelled Nitrate Concentrations at GH_FR1 Derived Using Historical Monitored Flows**

Notes: GHO Fording River Compliance Point - Upper Fording River, 205 m downstream of Greenhills Creek (GH_FR1, 0200378) mine- exposed areas examined, only FR_FR2 (RG_FOUKI, located upstream of Kilmarnock Creek) had nitrate concentrations that were higher in 2018 compared to the base year of 2012 (Appendix Table C.2). Contrary to projections, no consistent linear increase in nitrate concentrations was observed at the mine-exposed stations. In contrast, nitrate concentrations have increased compared to the base year in both reference areas (FR_UFR1 and FR_HC3), but have not statistically changed since 2014 (Appendix Table C.2) and are well below the Level 1 benchmark (Appendix Table C.1).

BIC structure is described in detail in Section 5 and changes in BIC cannot be solely attributed to spatial and temporal patterns in nitrate concentrations. Nitrate concentrations have not been increasing concurrent with the observed decrease in % Ephemeroptera, nor are the highest nitrate concentrations observed where the effects are most prominent (e.g., RG_FODPO and RG_FO22). Nitrate may be a contributing factor as concentrations are consistently higher than benchmarks in all areas where effects are observed (Section 5).

4 STUDY QUESTIONS #2 TO #5

4.1 Overview

To address study questions #2 through #5 (Section 1.2), baseline data are being collected prior to the commissioning of the FRO AWTF-S. The study questions will be specifically addressed after the AWTF is commissioned in 2020.

4.2 Study Question #2

Study question #2 is: "Is active water treatment affecting biological productivity downstream in the Fording River?"

Concentrations of phosphorus and ortho-phosphate are routinely monitored at stations along the Fording River as part of Teck's requirements under Permit 107517 (Appendix Figures C.2 and C.3). Data currently being collected represent baseline conditions prior to AWTF operation. Benthic invertebrate biomass samples were also collected as part of the LAEMP in 2017 and 2018 to provide the first of two years of pre-operational baseline biological productivity data (Figure 4.1). It is currently anticipated that an approach similar to that being used in the Line Creek LAEMP (e.g., Minnow 2019) will also be used in the FRO LAEMP to evaluate potential changes in productivity over time [e.g., before-after control-impact (BACI)].

4.3 Study Question #3

Study question #3 is: "Are tissue selenium concentrations reduced downstream from the AWTF?"

Selenium concentrations in composite-taxa benthic invertebrate samples are being monitored in the FRO LAEMP to support study question #6 (See Section 5.3). Tissue selenium concentrations have generally remained below the Level 1 benchmark for invertebrates, fish, and birds and fall within prediction limits based on aqueous selenium concentrations using the selenium bioaccumulation model (Section 5.3). These data, combined with data collected in 2019 and 2020, will be used to characterize conditions prior to AWTF operation, and will be used to compare to conditions after the AWTF is operational (i.e., using a BACI approach similar to that being used in the Line Creek LAEMP; Minnow 2019).

4.4 Study Question #4

Study question #4 is: "Is AWTF operation affecting aquatic biota through thermal effects or concentrations of treatment-related constituents other than nutrients or selenium?"

Water temperature is recorded during routine monitoring at Teck water stations and concurrently with biological monitoring (see Appendix F). Water temperature trends from Teck's continuous monitoring station, FR_FRNTP, are discussed in Section 5.4.3 to support study question #6.

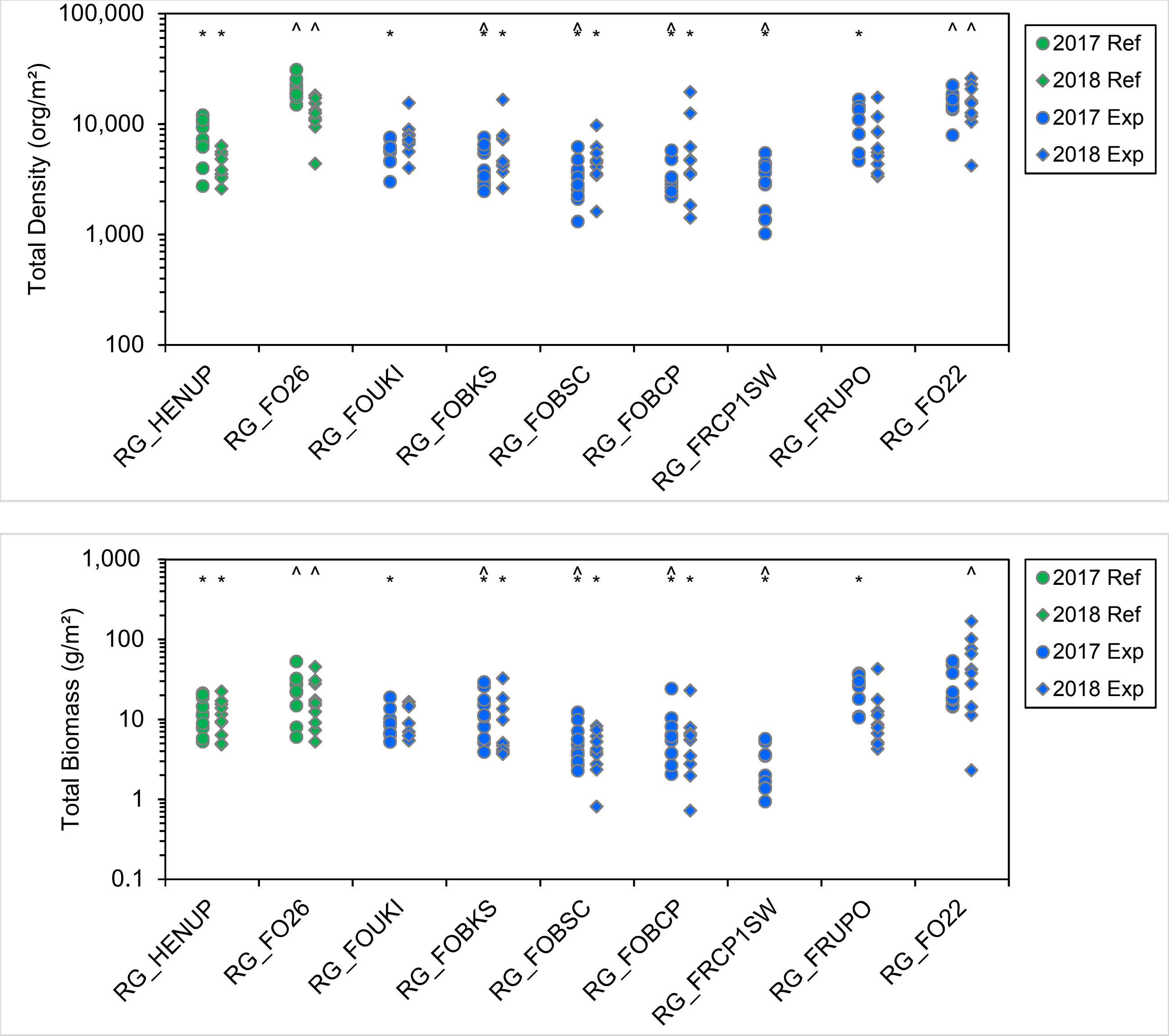


Figure 4.1: Total Benthic Invertebrate Density and Biomass (Hess Sampling) by Area, 2017 and 2018

Notes:

* = significantly different (α = 0.1) from RG_FO26 within the given year.

^ = significantly different (α = 0.1) from RG_HENUP within the given year.

Temperature and level loggers are currently installed throughout the extent of the Fording River LAEMP study area, including upstream and downstream of the proposed AWTF discharge location to support monitoring of seasonal drying for study question #7 (see Sections 2.5 and Section 6). Water temperature will continue to be monitored as part of the FRO LAEMP to characterize conditions prior to AWTF operation.

4.5 Study Question #5

Study question #5 is: “Is re-direction of water potentially affecting biota in the Fording River?”

Water flow is recorded during routine monitoring at Teck water stations. Water discharge trends from Teck’s continuous monitoring station, FR_FRNTP, are discussed in Section 5.4.3 to support study question #6. As described in Section 4.4, temperature and level loggers are currently installed upstream and downstream of the future AWTF discharge location and further downstream to support monitoring of seasonal drying as part of study question #7 (See Section 2.5 and Section 6). Water level data will be used to calculate discharge, and can be used to compare water flow conditions before and after AWTF operation.

4.6 Summary

Baseline data collection to address study questions #2 to 5 will continue in 2019 and 2020 prior to active water treatment coming online in late 2020. A study design will be prepared through consultation with the EMC for June 1st, 2021, that will outline the approach for data collection and analysis for the post-AWTF commissioning timeframe.

5 STUDY QUESTION #6

5.1 Overview

To address study question #6 (What are the factors contributing to the variations in percent Ephemeroptera?), biological, chemical, and physical data were collected in the upper Fording River in June, August, and September. The 2017 FRO LAEMP report did not identify a single, direct cause of the decrease in % Ephemeroptera in the upper Fording River; rather, analysis suggested that a combination of both mine-related and natural factors (e.g., water quality, calcite, substrate size, flow) were contributing to the observed effects (Minnow and Lotic 2018). The FRO LAEMP was further adjusted in 2018 to include replicate sampling in September and to include seasonal sampling (June, August) to increase the understanding of benthic invertebrate communities in the upper Fording River. The following sections describe the results and interpretation as they relate to study question #6.

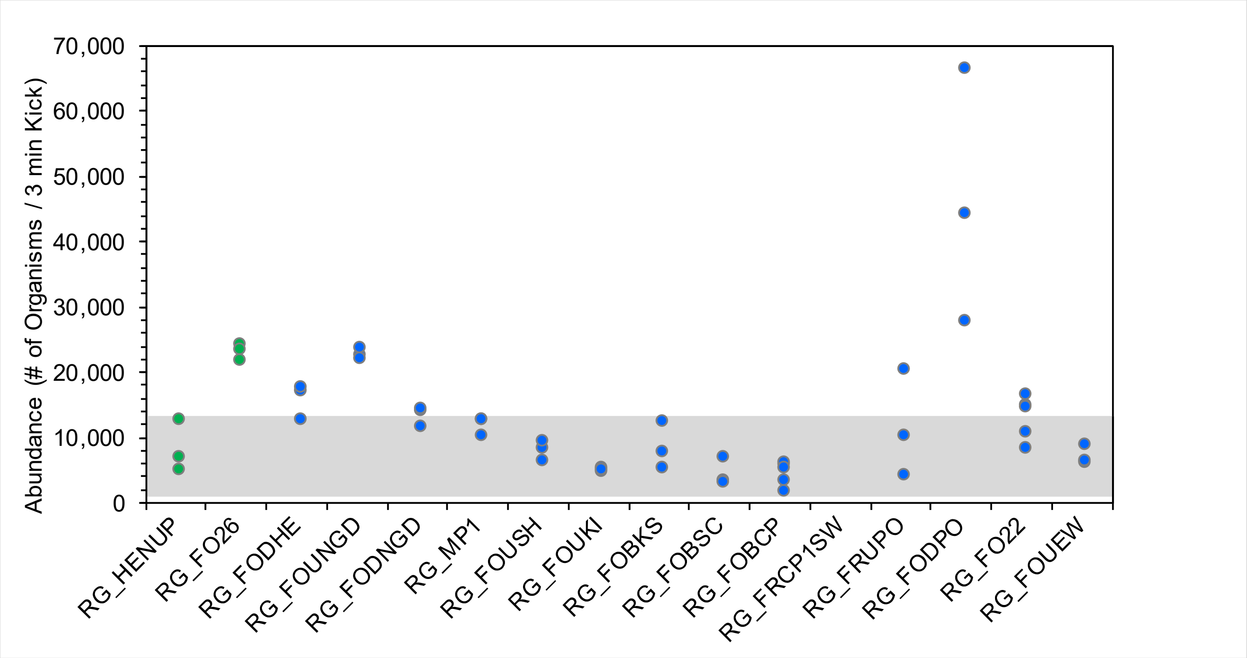
5.2 Benthic Invertebrate Community Structure

5.2.1 Spatial Variation in September 2018

The 2016 FRO LAEMP report identified a temporal and spatial decreasing trend in % Ephemeroptera below the normal range in the upper Fording River, from downstream of Cataract Creek (RG_FOBCP) to upstream of Ewin Creek (RG_FOUEW) (Minnow 2017b). This effect persisted in 2017, with % Ephemeroptera again being below the regional normal range at all areas downstream of Cataract Creek (Minnow and Lotic 2018). Closer examination of the abundance of Ephemeroptera taxa identified two families as being the primary source of the observed decrease: Heptageniidae and Ephemerellidae. The abundance of a third family present in appreciable numbers, Baetidae, did not appear to change temporally and spatially. In addition to % Ephemeroptera, several areas also exhibited a decrease in % EPT below the normal range, but this was directly related to the decrease in % Ephemeroptera, as % Plecoptera and % Trichoptera were highest in the areas where % Ephemeroptera was lowest (Minnow and Lotic 2018).

To further assess community structure in 2018, regional normal ranges were developed for total abundances of Ephemeroptera, Plecoptera, Trichoptera, combined EPT, Baetidae, Heptageniidae, and Ephemerellidae (Appendix Tables B.1 and B.2).

BIC metrics calculated based on September 2018 data were plotted spatially and compared to regional normal ranges (Figures 5.1 to 5.7). BIC data collected in September 2018 again exhibited a distinct decreasing spatial pattern from upstream to downstream in both % Ephemeroptera and total Ephemeroptera abundance (Figures 5.2 and 5.4), although



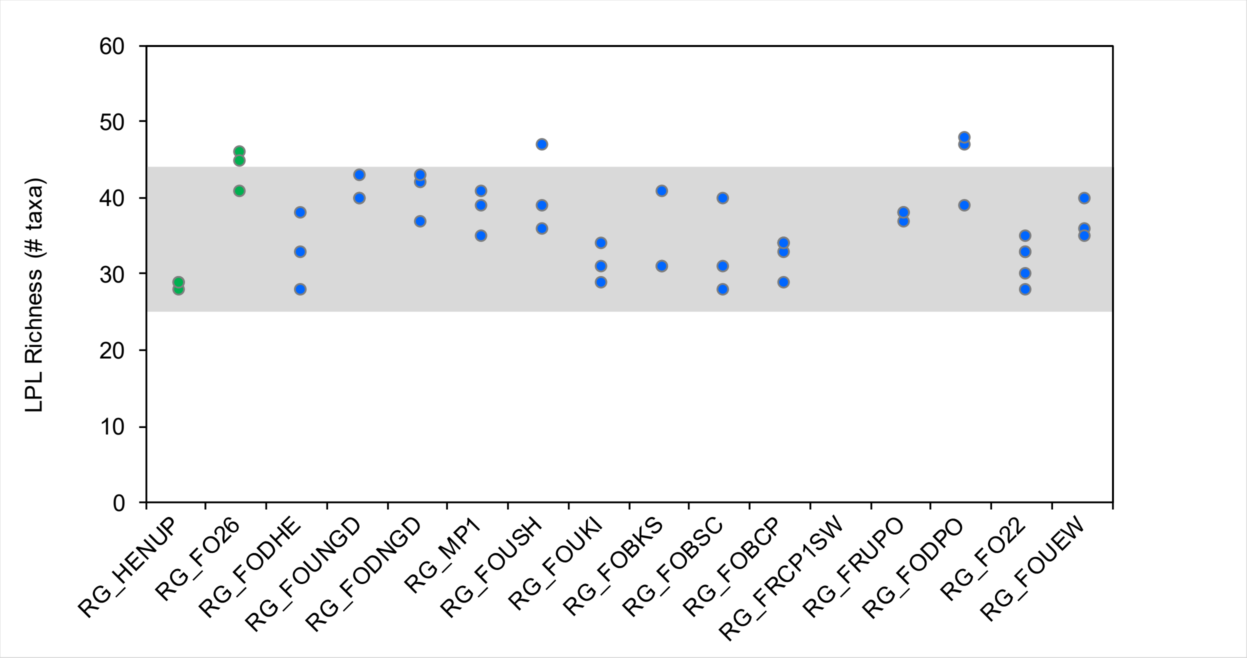
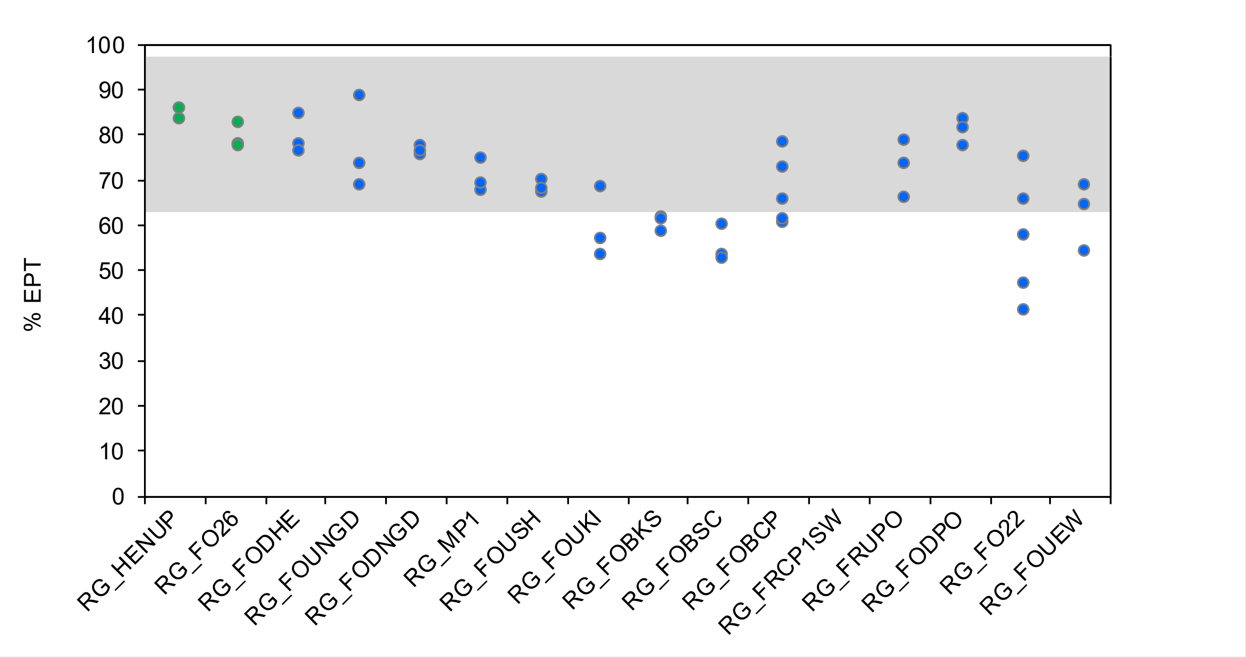


Figure 5.1: **Benthic Invertebrate Community Abundance and LRL Richness, FRO LAEMP, September 2018**

Note: Grey shading 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). RG_FRCP1SW was dry in September 2018 so was not sampled.



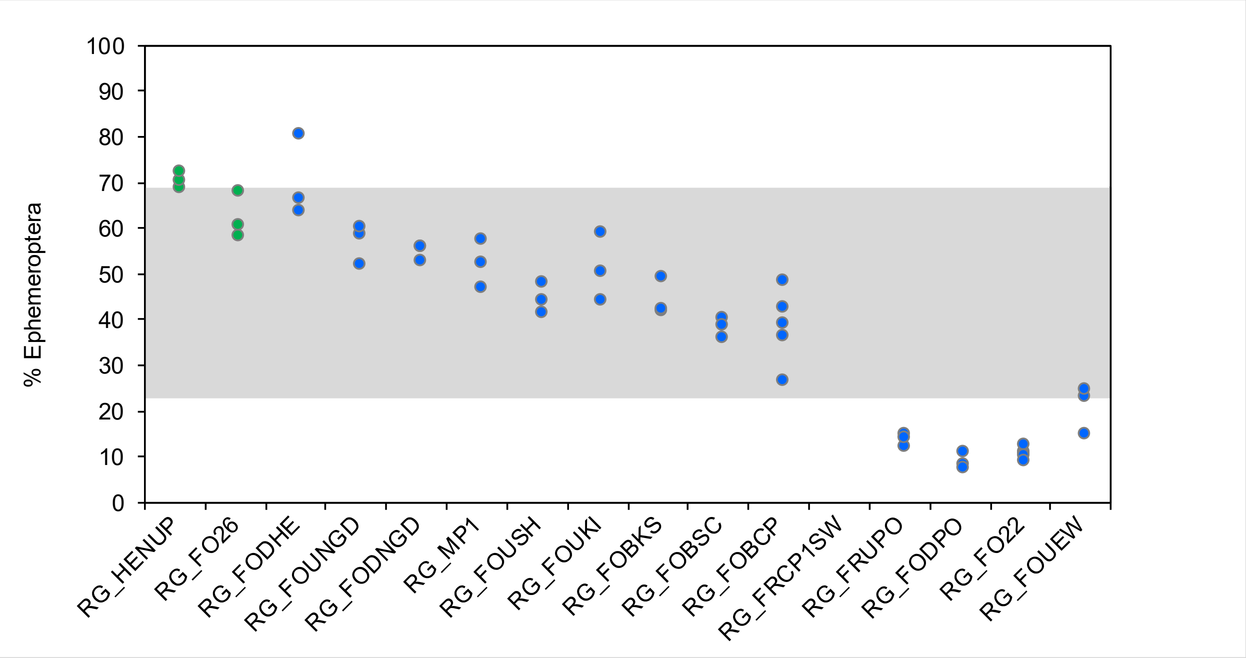


Figure 5.2: **Benthic Invertebrate Community % EPT and % Ephemeroptera, FRO LAEMP, September 2018**

Note: Grey shading 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). RG_FRCP1SW was dry in September 2018 so was not sampled.

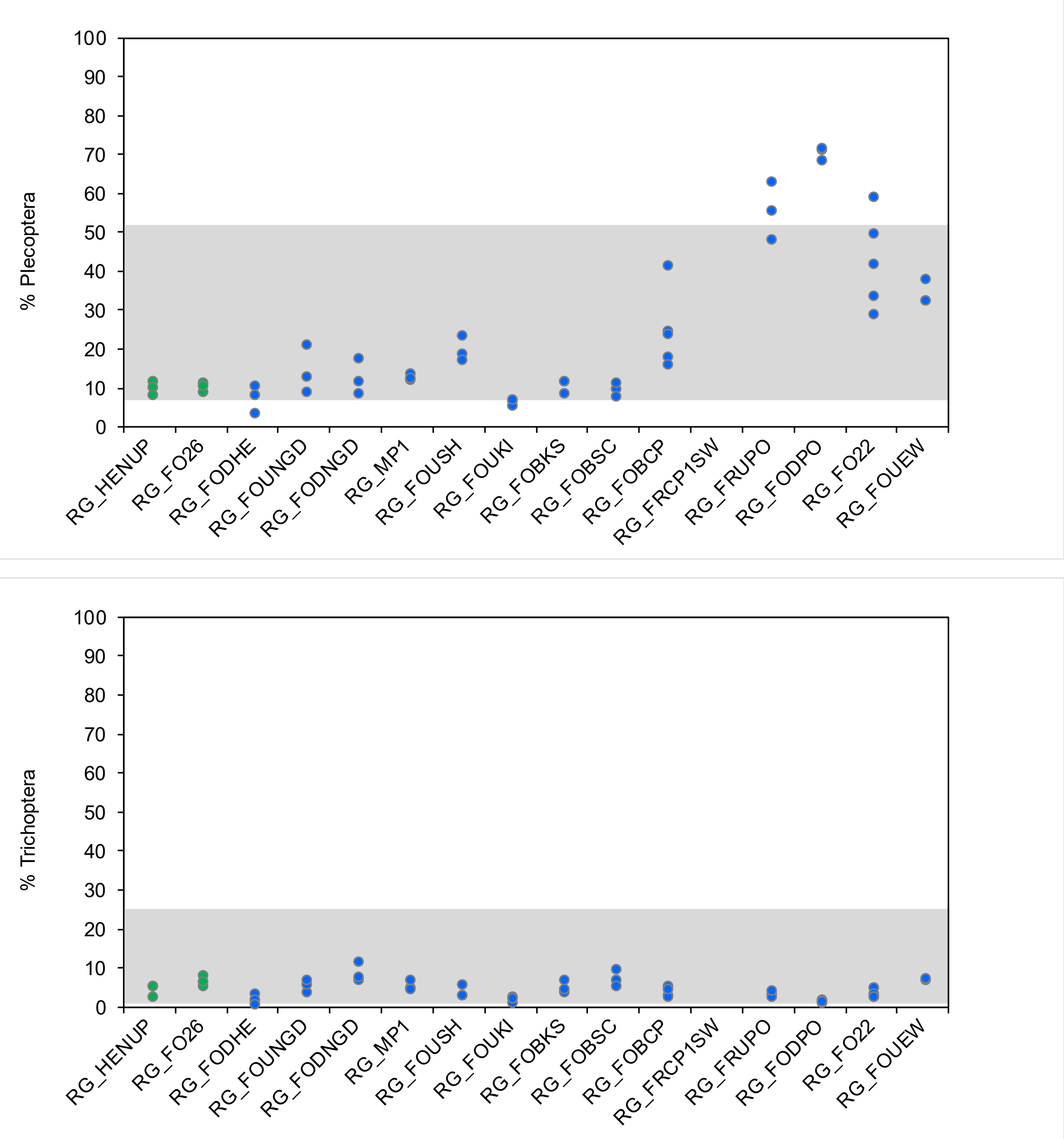


Figure 5.3: Benthic Invertebrate Community % Plecoptera and % Trichoptera, FRO LAEMP, September 2018

Note: Grey shading 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). RG_FRCP1SW was dry in September 2018 so was not sampled.

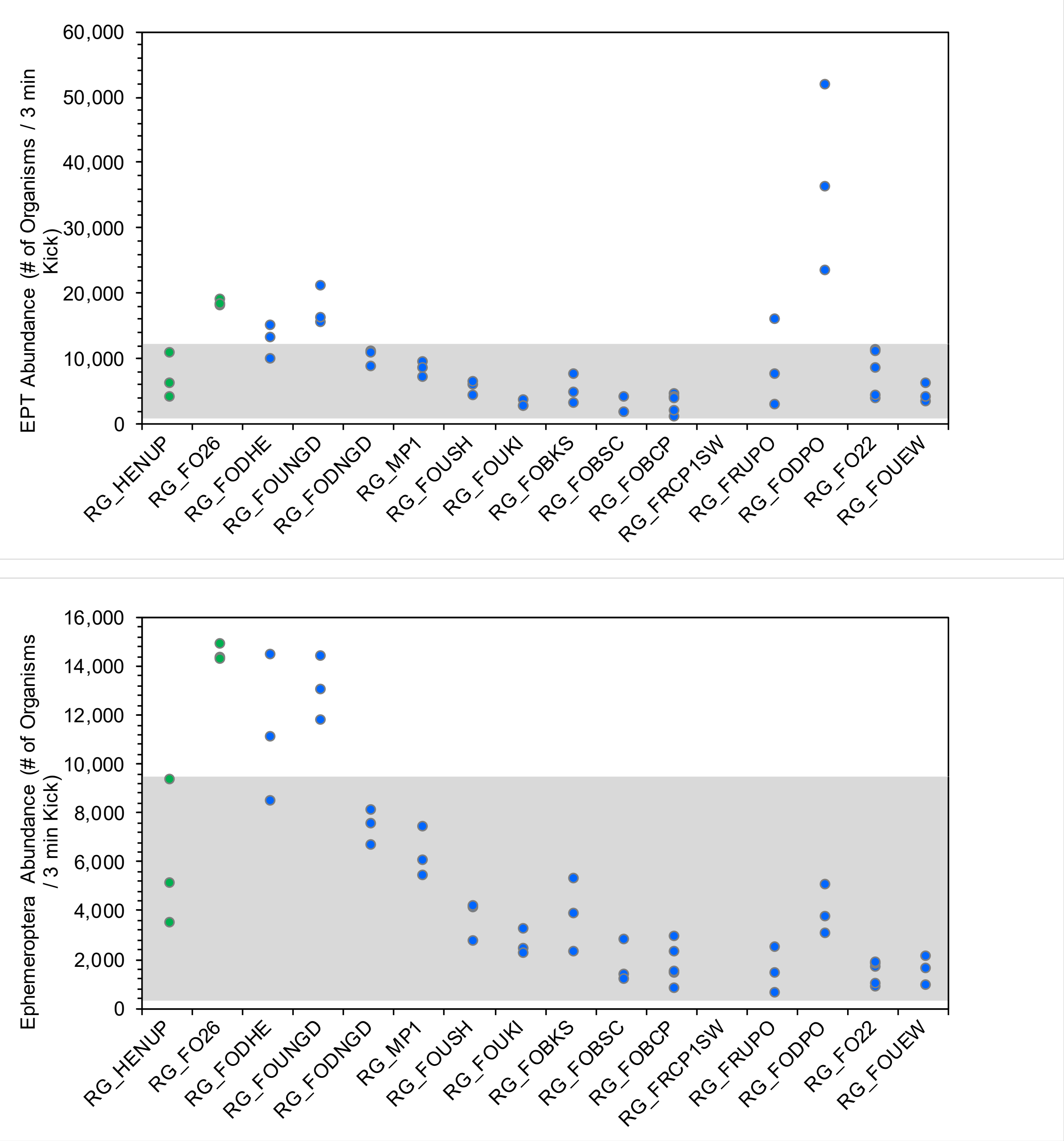
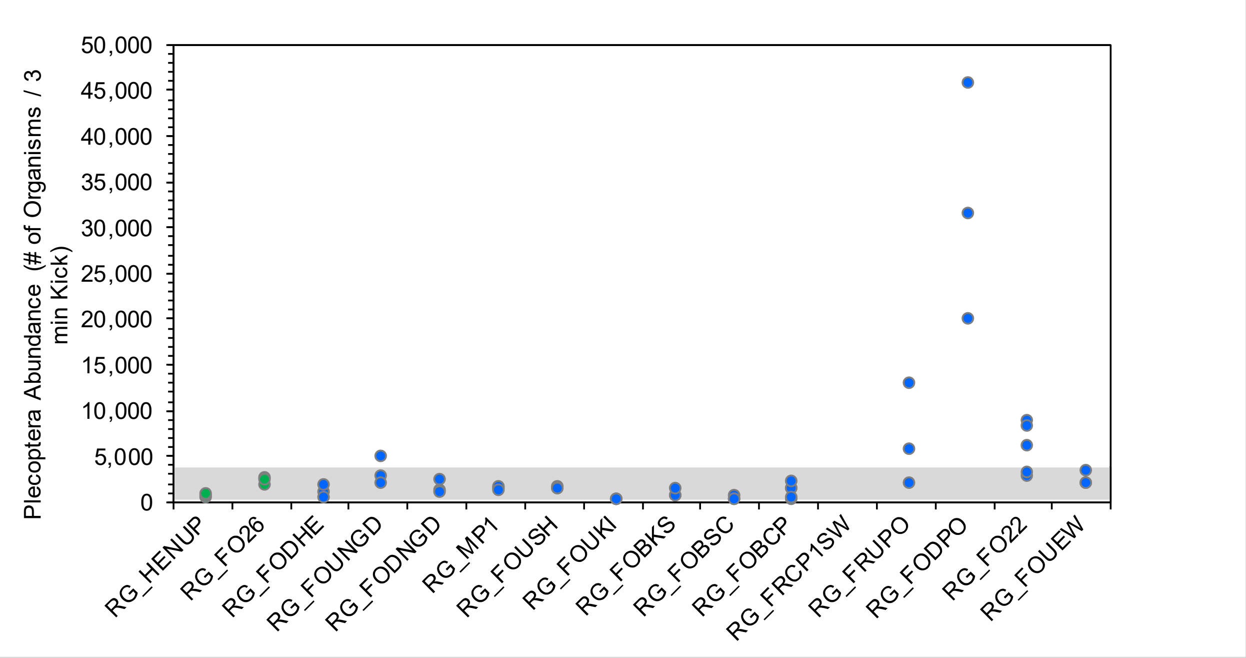


Figure 5.4: **Benthic Invertebrate Community EPT and Ephemeroptera Abundance , FRO LAEMP, September 2018**

Note: Grey shading 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). RG_FRCP1SW was dry in September 2018 so was not sampled.



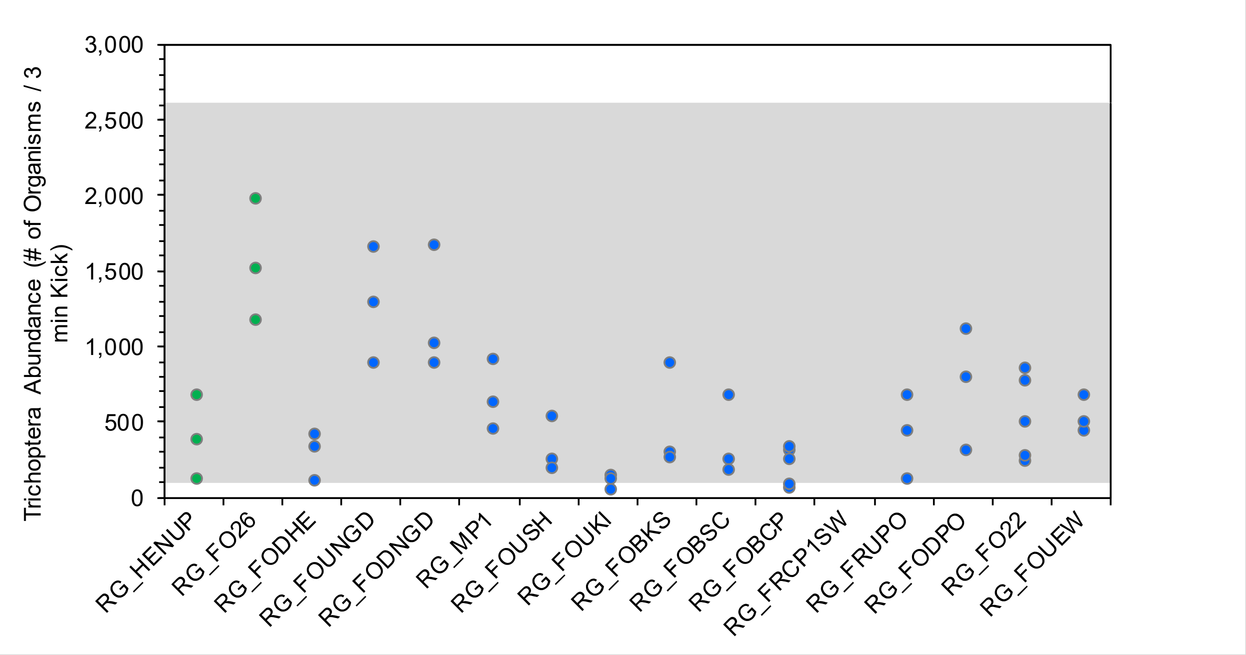


Figure 5.5: **Benthic Invertebrate Community Plecoptera and Trichoptera Abundance, FRO LAEMP, September 2018**

Note: Grey shading 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). RG_FRCP1SW was dry in September 2018 so was not sampled.

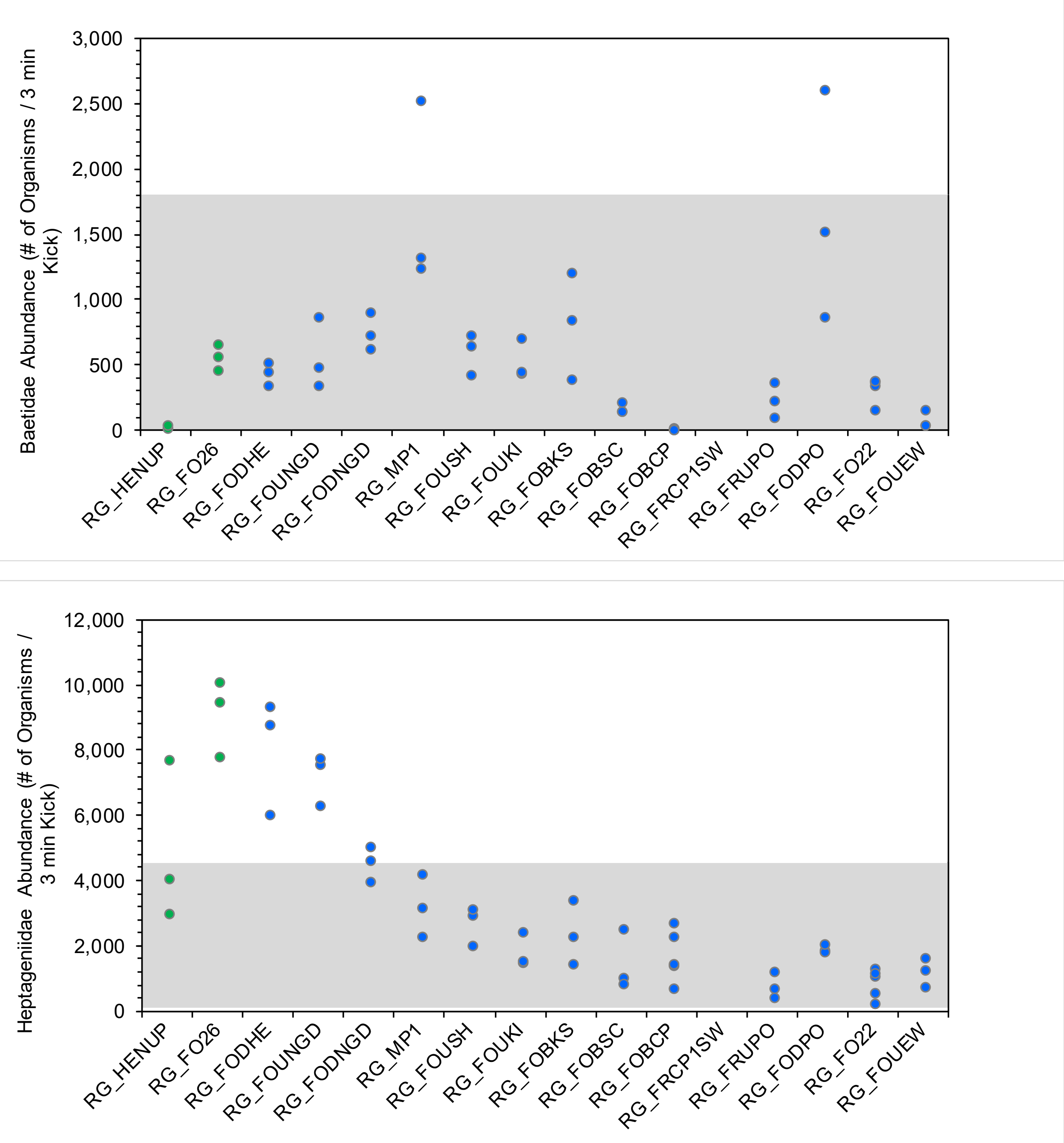


Figure 5.6: Benthic Invertebrate Community Baetidae and Heptageniidae Abundance, FRO LAEMP, September 2018

Note: Grey shading 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). RG_FRCP1SW was dry in September 2018 so was not sampled.

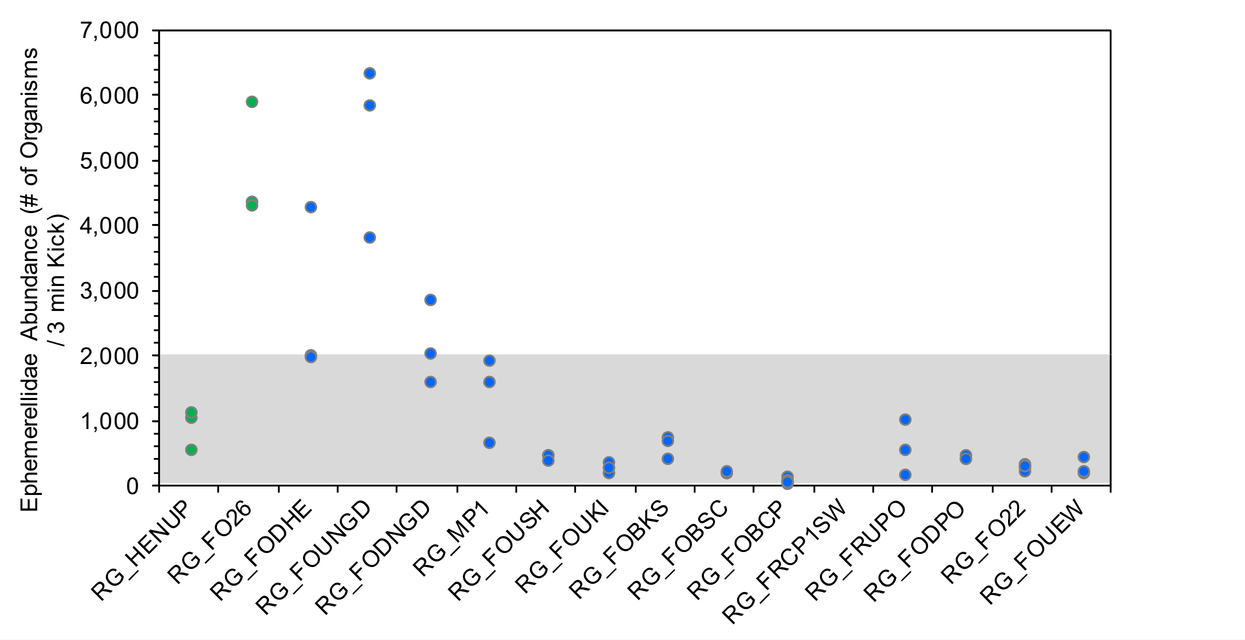


Figure 5.7: **Benthic Invertebrate Community Ephemerellidae Abundance, FRO LAEMP, September 2018**

Note: Grey shading 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). RG_FRCP1SW was dry in September 2018 so was not sampled

Ephemeroptera abundance remained within the regional normal range (Figure 5.4). Percent Ephemeroptera was below the normal range at the four most downstream stations (i.e., RG_FRUPO, RG_FODPO, RG_FO22, and RG_FOUEW); however, the overall spatial extent was less than in previous years, when RG_FOBCP also exhibited % Ephemeroptera below the normal range (Appendix Figure B.5; Minnow 2017b, Minnow and Lotic 2018). In addition, % Ephemeroptera increased slightly at RG_FOUEW (only one replicate below the normal range in 2018), suggesting possible recovery, although Ephemeroptera abundance did not show a similar increase (Figure 5.4).

Both % Plecoptera and total Plecoptera abundance were high at the areas where Ephemeroptera were low (Figures 5.3 and 5.5), similar to 2017 (Minnow and Lotic 2018). This was particularly noticeable at RG_FODPO, downstream of Porter Creek, where % Plecoptera was above the upper limit of the normal range, comprising approximately 70% of the organisms in all replicates (Figures 5.3 and 5.5). Due to high Plecoptera abundance, % EPT and EPT abundance were generally within the normal range in areas where % Ephemeroptera was low (Figures 5.2 and 5.4); however, several other areas (RG_FOUKI, RG_FOBKS, RG_FOBSC, and RG_FOBCP) had at least one replicate with % EPT below the normal range.

When the total abundance of Ephemeroptera families was examined, the two families identified as contributing to lower % Ephemeroptera in 2017 (i.e., Heptageniidae and Ephemerellidae), followed the same decreasing spatial pattern from upstream to downstream as % Ephemeroptera and Ephemeroptera abundance (Figures 5.6 and 5.7). Baetidae, on the other hand, did not exhibit any obvious spatial pattern (Figure 5.6). Abundances were within their respective normal ranges for each family of Ephemeroptera; however, the normal ranges are very broad (i.e., lower extent close to zero in all cases; Figures 5.5 and 5.6).

Total benthic invertebrate abundance in the upper Fording River was within or above the normal range in 2018 (Figure 5.1). The highest abundance was observed downstream of Porter Creek (RG_FODPO), an area with low % Ephemeroptera. Total abundance above normal range was also observed at RG_FO26 (reference area), and the two most upstream mine-exposed areas (RG_FODHE and RG_FOUNGD). LPL richness was within the normal range at all areas in 2018 (Figure 5.1).

To provide additional information on the benthic invertebrate communities in the upper Fording River, correspondence analysis (CA) was conducted on family-level relative abundance data (Tables 5.1 and 5.2; Figure 5.8), with CA axis 1 (CA1) and CA axis 2 (CA2) explaining 39.2% and 15.0% of the variability in the community, respectively. The four most downstream areas (RG_FRUPO, RG_FODPO, RG_FO22, and RG_FOUEW) were separated from the rest of the areas along CA1, with RG_FO22 identified as the most divergent area (Figure 5.8). The taxa driving the separation in the negative direction were the riffle beetle (Family Elmidae), with a significant influence of Nemouridae, while Heptageniidae and Psychodidae influenced the separation in the positive direction (Figure 5.8). Reference and mine-exposed areas were separated along CA2, which was driven predominantly by Diptera families (Tables 5.1and 5.2; Figure 5.8). Ephemeroptera taxa were most strongly associated with positive CA1 scores, and clustered around zero on CA2, and did not have relatively high or low CA scores on either axis. A CA was also conducted using LPL relative abundance data, and yielded similar results although the taxa appear in a somewhat different order on CA2 (Appendix Tables B.3 and B.4, Appendix Figure B.1).

5.2.2 Temporal Variation based on September Data

BIC metrics were plotted relative to previous years and to the regional normal range, by area (Appendix Figures B.2 to B.14). BIC metrics were examined statistically to determine whether a change has occurred since the previous year, and/or compared to the historical data set (Appendix Tables B.5 to B.16, Appendix Figures B.2 to B.14).

No areas experienced a significant change in total benthic invertebrate abundance in 2018 compared to previous years (Appendix Table B.5). LPL richness increased compared to the base

Table 5.1: Taxa Scores from Corresondence Analysis on Family Level Benthic Invertebrate Communities from the Fording River, September 2018

Order	Family	CA1 (39.2%)	CA2 (15.0%)
Trombidiformes	Lebertiidae	-0.272	-0.271
	Sperchontidae	0.481	0.524
Ephemeroptera	Ameletidae	0.622	0.068
	Baetidae	0.142	-0.411
	Ephemerellidae	0.307	0.448
	Heptageniidae	0.264	0.249
Plecoptera	Chloroperlidae	0.180	2.109
	Capniidae	-0.894	-1.028
	Nemouridae	-0.500	-0.064
	Perlodidae	-0.356	-0.290
	Taeniopterygidae	-0.002	0.204
Coleoptera	Elmidae	-3.068	0.166
Trichoptera	Hydropsychidae	0.675	0.979
	Rhyacophilidae	0.130	-0.104
Diptera	Ceratopogonidae	0.758	-0.851
	Chironomidae	-0.004	0.320
	Empididae	-0.411	0.135
	Psychodidae	0.656	-0.528
	Simuliidae	0.318	-1.161

Notes:

Numbers in parentheses in column names correspond to the variance explained by that axis

Correspondence Analysis preformed on $\log_{10}(x+1)$ relative abundances to reduce skew and kurtosis

Taxa that occur in fewer than 1% of samples were excluded from analysis

Table 5.2: Biological Monitoring Areas Scores from Correspondence Analysis on Family Level Benthic Invertebrate Communities from the Fording River, September 2018

Status	Area	CA1 (39.2%)	CA2 (15.0%)
Reference	RG_HENUP	0.259	1.407
		0.362	1.685
		0.463	1.526
	RG_FO26	0.366	0.630
		0.401	0.893
		0.343	0.914
Mine-Exposed	RG_FODHE	0.388	0.221
		0.425	-0.027
		0.497	0.223
	RG_FOUNGD	0.361	-0.146
		0.458	0.104
		0.292	0.292
	RG_FODNGD	0.324	0.150
		0.275	0.187
		0.375	0.195
	RG_MP1	0.283	0.050
		0.263	-0.134
		0.282	-0.236
	RG_FOUSH	0.299	0.030
		0.271	0.022
		0.251	-0.283
	RG_FOUKI	0.455	-0.472
		0.571	-0.620
		0.476	-0.533
	RG_FOBKS	0.481	-0.579
		0.515	-0.467
		0.380	-0.444
	RG_FOBSC	0.430	-0.495
		0.414	-0.368
		0.364	-0.413
	RG_FOBCP	0.259	-0.036
		0.176	-0.402
		0.169	0.012
		0.219	-0.303
		0.100	-0.489
	RG_FRUPO	-0.068	-0.256
		-0.266	-0.552
		-0.199	-0.436
	RG_FODPO	-0.796	-0.048
		-0.608	-0.279
		-0.486	-0.423
	RG_FO22	-1.270	-0.120
		-1.564	-0.144
		-1.596	-0.003
		-1.804	0.014
		-1.855	0.090
	RG_FOUEW	-1.051	0.413
		-0.958	0.560
		-0.695	0.093

Notes:

Numbers in parentheses in column names correspond to the variance explained by that axis

Correspondence Analysis preformed on $\log_{10}(x+1)$ relative abundances to reduce skew and kurtosis

Taxa that occur in fewer than 1% of samples were excluded from analysis

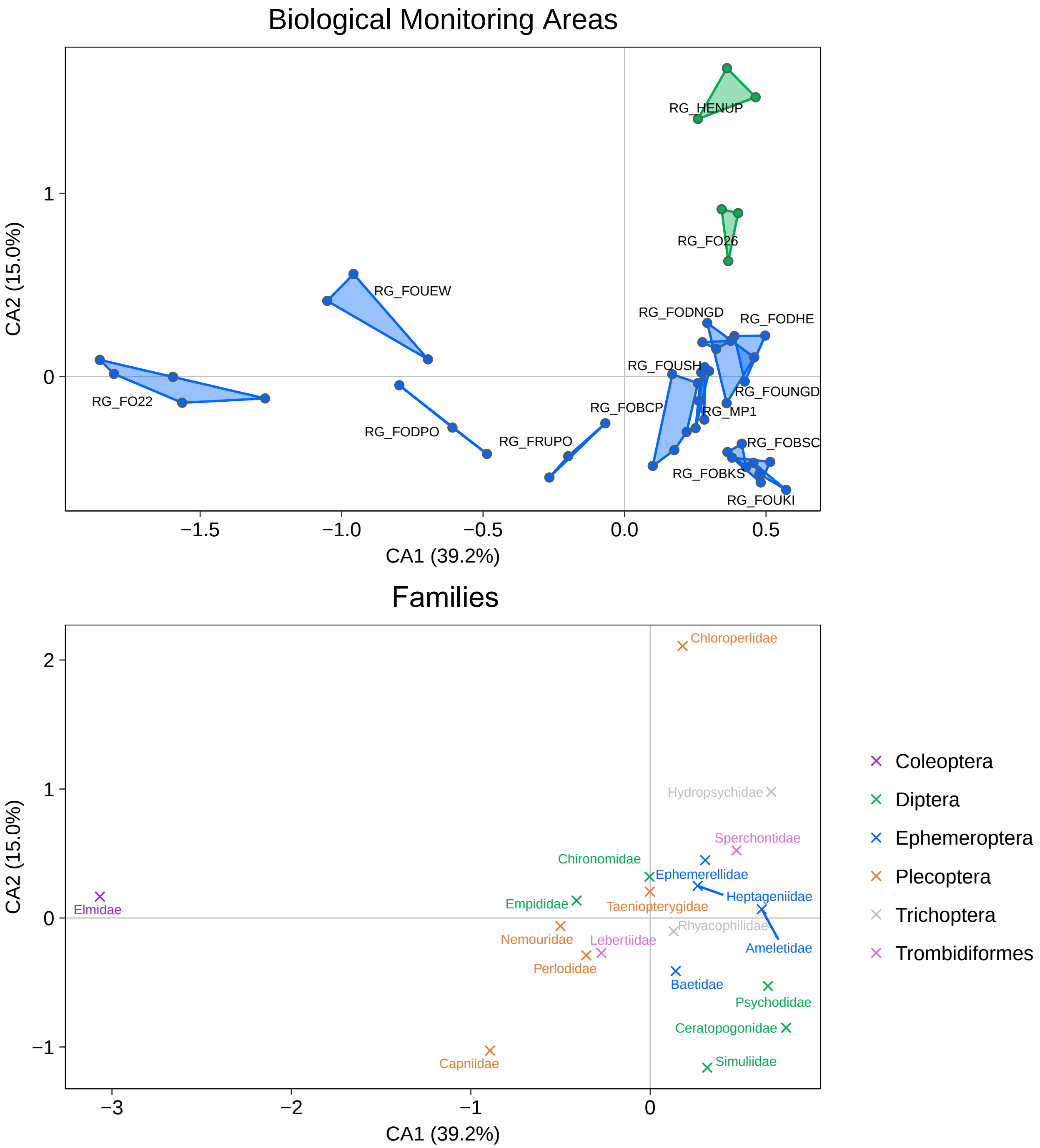


Figure 5.8: Scatterplot of Correspondence Analysis (CA) Axis Scores for Benthic Invertebrate Relative Proportions at the Family Level, FRO LAEMP, September 2018

Notes:
Relative taxa proportions were $\log_{10}[x+1]$ transformed before CA calculations.
Taxa present inat less than 1% of samples were excluded from the analysis.

year at RG_FODNGD, RG_MP1, RG_FOUSH, RG_FOBKS, and was significantly higher than 2017 at RG_FOUNGD and RG_FODPO (Appendix Table B.6). Percent EPT was only significantly lower than 2012 at RG_FOUKI (Appendix Table B.7), where % EPT was also below the regional normal range (Appendix Figure B.2). Percent Ephemeroptera was statistically lower than the base year at the majority of mine-exposed areas; however, the magnitude of difference was lower in 2018 compared to recent years in most cases (Appendix Table B.8). Two areas (RG_FOBCP and RG_FO22) exhibited % Ephemeroptera that was significantly higher in 2018 compared to 2017 (Appendix Table B.8). No significant decreases in % Plecoptera and % Trichoptera were observed in any area compared to the base year (Appendix Tables B.9 and B.10); however, % Trichoptera decreased in a number of areas, including one reference area (RG_FO26) in 2018 compared to 2017 (Appendix Table B.10). Total Ephemeroptera abundance was significantly lower than the base year at RG_FOUSH, RG_FOUKI, and RG_FOBCP (Appendix Table B.11), but not significantly different from the base year at areas with % Ephemeroptera below the normal range. Total Plecoptera and Trichoptera abundance has not changed over time in most areas (Appendix Table B.12 and B.13). Of the Ephemeroptera families, only Ephemerellidae decreased significantly from the base year in the areas experiencing % Ephemeroptera below the normal range (Appendix Tables B.14 to B.16).

Overall, while % Ephemeroptera has decreased over time in many areas, other BIC endpoints have been more stable since the base year of 2012.

5.2.3 Seasonal Variation

Seasonal changes in BIC were evaluated using data collected in June, August, and September 2018. Relative BIC composition was visually compared among the three sampling periods and across areas (Figure 5.9). A clear seasonal progression of the community was observed, with communities in June generally dominated by Heptageniidae and Chironomidae. The proportion of Baetidae increased in August in many mine-exposed areas, while the spatial pattern of decreasing % Ephemeroptera was apparent starting in August and continuing in September.

BIC composition was visibly different in the most downstream areas in all sampling periods, but was most notable in September (Figure 5.9). In particular, the four areas with % Ephemeroptera below the normal range had a high proportion of one particular family of Plecoptera, the winter-emerging family Nemouridae. In addition, the riffle beetle, Elmidae, made up a large proportion of the community at RG_FO22 and RG_FOUEW, was present at low proportions at RG_FODPO, and not present in other areas at any time period. These results are consistent with CA results (Section 5.2.1).

The key BIC metrics described in Section 5.2.1 were plotted for the three sampling periods (Appendix Figures B.15 to B.21). Data were not compared to normal ranges as normal ranges

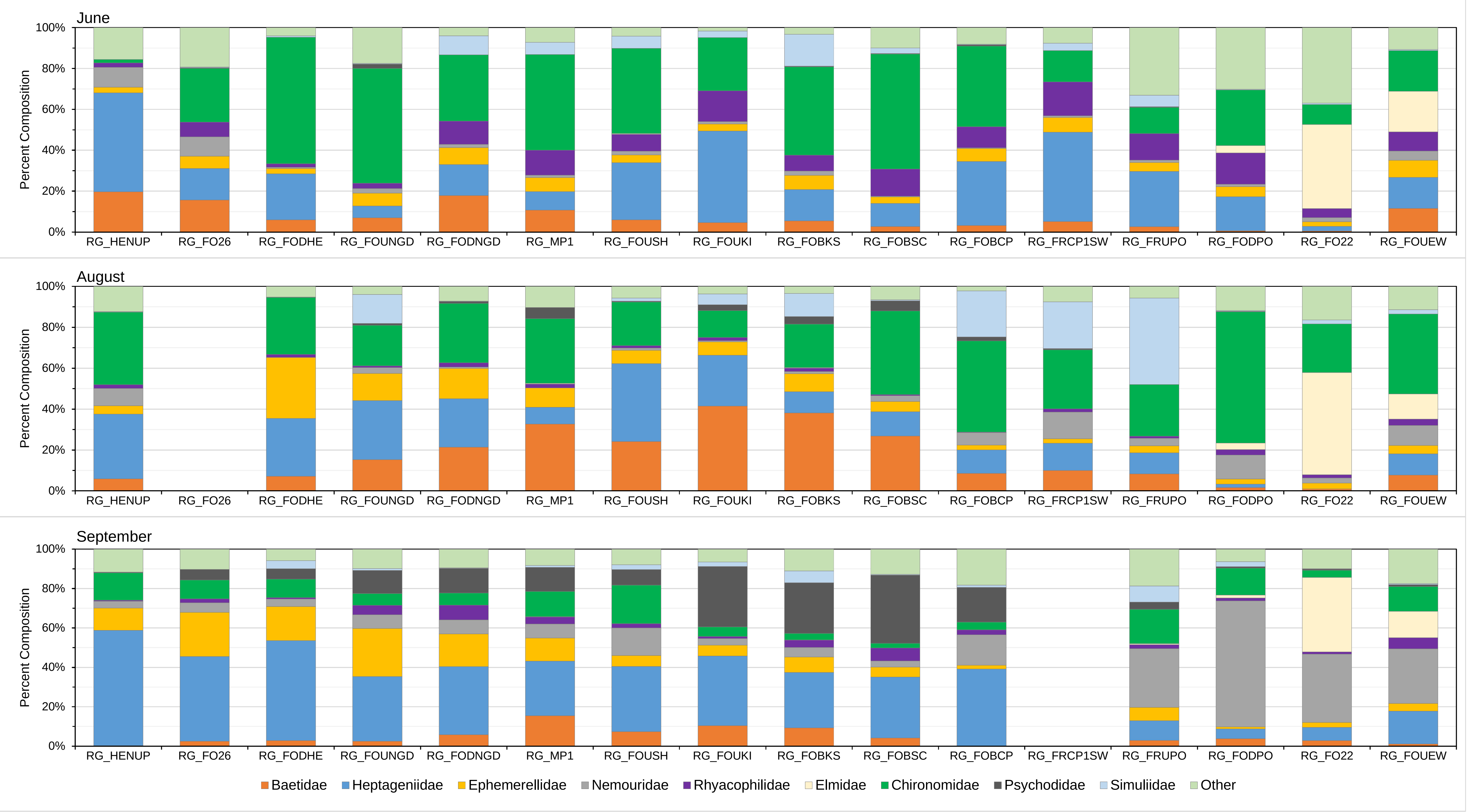


Figure 5.9: **Benthic Invertebrate Community Percent Composition, FRO LAEMP, June to September 2018**

are applicable to September data only. Total abundance was the lowest in June at every area, while LPL richness did not appear to vary seasonally (Appendix Figure B.15). As described above, no spatial pattern of decreasing % Ephemeroptera was observed in June, but August and September both exhibited a similar pattern with respect to % Ephemeroptera, total Ephemeroptera abundance, and the abundance of the key families (Appendix Figures B.16, B.18, B.20, and B.21).

5.3 Tissue Selenium

Benthic invertebrate tissue samples were collected in March, September, and December of 2018. Data from March 2018 were reported in the 2017 FRO LAEMP report (Minnow and Lotic 2018). In September, selenium concentrations in composite-taxa benthic invertebrate tissue samples were generally below the Level 1 benchmarks for fish, benthic invertebrates, and birds, with the exception of RG_FODHE where two replicates exceeded one or more of the benchmarks (Figure 5.10; Appendix Table B.17). Selenium concentrations were greater than the upper limit of the reference normal range in the majority of the samples collected from mine-exposed areas in September, with concentrations generally decreasing from upstream to downstream (Figure 5.10; Appendix Table B.17). Selenium concentrations in tissue were lower in December compared to September, with most samples within the reference normal range and all samples below the Level 1 benchmark for effects to fish with the exception of one replicate from RG_FOBCP with a concentration of 39 mg/kg dw (Appendix Table B.18). Visual inspection of selenium concentrations in tissue from 2012 to 2018 indicated no obvious increases in selenium concentrations over time (Appendix Figure B.22), although concentrations appeared higher in September 2018 compared to recent years.

Paired water and composite-taxa tissue selenium concentrations were plotted against the selenium bioaccumulation model (Golder 2018a), with values generally falling below the model line, but within the prediction limit (Figure 5.11; Appendix Table B.19).

5.4 Water Quality

5.4.1 Routine Water Quality

Dissolved cadmium concentrations were below the Level 1 benchmark at all stations (Appendix Table C.1; Appendix Figure C.7) in 2018, and sulphate concentrations were only above the Level 1 benchmark at FR_FRCP1 and FR_FRCP1SW (50% and 20% of samples, respectively; Appendix Table C.1; Appendix Figure C.15). Nitrate (discussed in Section 3), total selenium, and total nickel concentrations were higher than the Level 1 benchmark (or interim screening benchmark, in the case of nickel) in samples from most mine-exposed areas (with the exception of FR_FR1 where no samples were higher than the benchmarks; Appendix Table C.1; Appendix

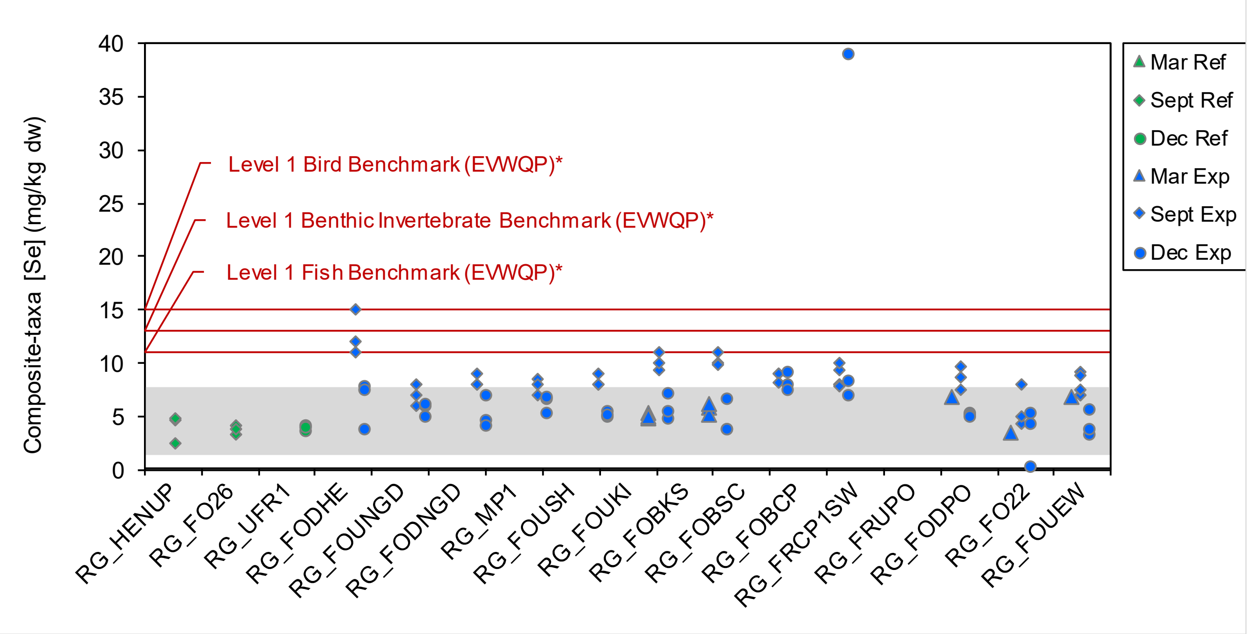


Figure 5.10: **Benthic Invertebrate Tissue Selenium Concentration, FRO LAEMP, March to December 2018**

Notes: Gray shading represents the reference area normal range defined as the 2.5th and 97.5th percentiles of the distribution of reference area data (pooled 1996 to 2015 data) reported in the RAEMP). RG_FRCP1SW was dewatered during all sampling events in 2018.
* 15 µg/g Level 1 Benchmark (Elk Valley Water Quality Plan [EVWQP]; Golder, 2014) for dietary effects to juvenile birds.
* 13 µg/g Level 1 Benchmark (Elk Valley Water Quality Plan [EVWQP]; Golder, 2014) for growth, reproduction, and survival of benthic invertebrates.
* 11 µg/g Level 1 Benchmark (Elk Valley Water Quality Plan [EVWQP]; Golder, 2014) for dietary effects to juvenile fish

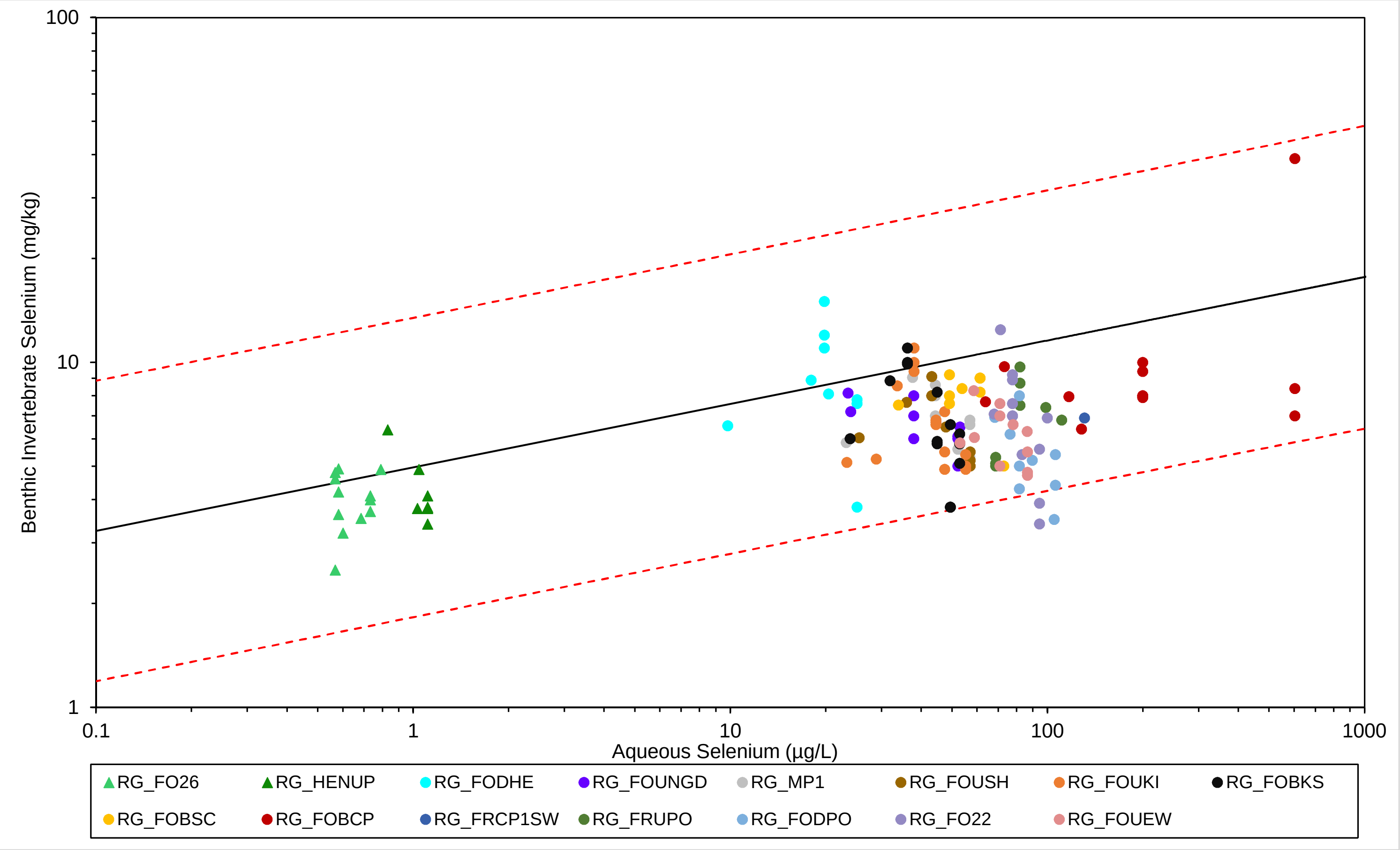


Figure 5.11: **Observed and Modelled[a] Selenium Concentrations in Benthic Invertebrate Composite Samples Relative to Aqueous Selenium Concentrations At Stations Upstream and Downstream of Fording River Operations, 2012 to 2018**

[a] Mean benthic invertebrate selenium concentrations (solid black line) were estimated using a one-step water to benthic invertebrate selenium accumulation model: $\log_{10}[\mathrm{Se}]_{\mathrm{benthicinvertebrate}}=0.696+0.184\times\log_{10}[\mathrm{Se}]_{\mathrm{aq}}$ (Golder 2018a). 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.

Figures C.1, C.12, and C.14). Nitrate concentrations were also higher than the Level 2 benchmark in samples from FR_FRCP1, FR_FRRD, GH_PC2, and FR_FRABCH, while selenium concentrations were higher than the Level 2 benchmark only in samples from FR_FRCP1 (Appendix Table C.1; Appendix Figures C.1 and C.14). Nickel concentrations were higher than the Level 2 and Level 3 interim screening benchmarks in samples from FR_FRCP1 (Appendix Table C.1; Appendix Figure C.12). Total dissolved solids (TDS) were also above the benchmark (Teck 2018) at FR_FRCP1 (46% of samples) and FR_FRCP1SW (20% of samples; Appendix Table C.1). None of the other constituents having EWTs were above relevant guidelines or benchmarks.

Concentrations of water quality constituents are typically the highest in the winter months related to lower flow conditions. Constituent concentrations higher than benchmarks at FR_FRCP1 were in part related to winter low flows, and in particular, the influence of predominantly Cataract Creek flow at FR_FRCP1 in the fourth quarter of 2018 as a result of drying between Swift and Cataract Creeks.

To evaluate changes over time, nitrate (discussed in Section 3), sulphate, total selenium, and total nickel concentrations from 2012 to 2018 were statistically analyzed for temporal trends (Appendix Table C.2; Appendix Figures C.37 to C.40). Annual mean sulphate concentrations were significantly higher at GH_PC2 and FR_FR5 in 2018 compared to the base year (Appendix Table C.2). Total selenium concentrations increased compared to the base year at both reference (FR_HC3 and FR_UFR1) and mine-exposed (FR_FR2, GH_PC2, FR_FR5) areas (Appendix Table C.2). Nickel concentrations remained unchanged from the base year in all areas except FR_FRCP1 where concentrations have significantly increased in 2018, likely driven by Cataract Creek flow, and GH_PC2, where concentrations have significantly decreased (Appendix Table C.2). In general, linear trends were not observed, with the exception of total selenium and nitrate in both reference areas (Appendix Table C.2). Visual evaluation of the remaining constituents from 2012 to 2018 indicated no obvious increases (Appendix Figures C.1 to C.18), with the exception of total lithium, which correlates with total selenium.

A principal component analysis (PCA) was conducted on water quality samples collected as part of Teck's routine water monitoring at mine-exposed stations included in the FRO LAEMP (Table 5.3). Principal component axis 1 (PC1) and principal component axis 2 (PC2) explained 43.3% and 25.7% of the variation in water chemistry, respectively. PC1 was primarily driven by positive loadings for sulphate, TDS, and total and dissolved uranium, with selenium also having a relatively high score (Table 5.3). PC2 was influenced by nitrate and selenium in the negative direction, and temperature, total aluminum, total chromium, and total mercury in the positive direction (Table 5.3). Loadings on both axes were low overall, due to the high correlation among

Table 5.3: Loadings From Principal Components Analysis (PCA) of Water Chemistry Describing the Contributions of Parameters to Each PCA Axis

Parameter	PCA 1 (43.3 % Explained Variation)	PCA 2 (25.7 % Explained Variation)
Temperature	0.02	-0.31
Total Dissolved Solids	0.30	0.15
Nitrate	0.25	0.20
Nitrite	-0.11	-0.24
Sulphate	0.30	0.13
Dissloved Aluminum	-0.21	-0.13
Total Aluminum	0.04	-0.29
Dissolved Cadmium	0.26	-0.15
Total Cadmium	0.27	-0.18
Dissolved Chromium	0.01	0.14
Total Chromium	0.04	-0.29
Total Cobalt	0.13	-0.25
Total Iron	0.14	-0.18
Total Mercury	-0.03	-0.34
Dissolved Nickel	0.25	-0.21
Total Nickel	0.24	-0.23
Dissolved Selenium	0.27	0.20
Total Selenium	0.28	0.20
Dissolved Uranium	0.32	0.08
Total Uranium	0.32	0.08
Dissolved Zinc	0.17	-0.21
Total Zinc	0.16	-0.27

🟩 [a] Greatest Negative Contribution to Axis
🟦 [a] Greatest Positive Contribution to Axis

Note: The top three positive and negative contributing variables are shaded.

constituents. As a result, the explanatory power of each axis was high, but the influence of individual constituents remained low (Table 5.3).

5.4.2 Chronic Toxicity

Chronic toxicity tests were completed at the FRO Compliance Point (FR_FRCP1) and FR_UFR1 on a quarterly basis and results are summarized quarterly and annually in accordance with Permit

107517. In the fourth quarter (Q4) of 2018, chronic toxicity tests were also conducted at FR_FRABCH to inform the investigation of the Fording River Compliance Point relocation (Golder 2019b). Results are reported in Table 5.4 and summarized below using the effects ratings of no adverse response, possible adverse response, and likely adverse response, as presented in the 2018 Chronic Toxicity Report (Golder 2019b).

At FR_FRCP1, no adverse responses were observed in 3 of 14 endpoints: *Ceriodaphnia dubia* survival and *Pimephales promelas* hatch and development. One possible adverse response was observed in Q2 for *Pseudokirchneriella subcapitata* cell yield. Likely adverse responses were observed in 10 of 14 endpoints: *C. dubia* reproduction (Q1 to Q4), *P. subcapitata* cell yield (Q1 and Q4), *Hyalella azteca* survival (Q4) and dry weight (Q1 and Q4), *Oncorhynchus mykiss* survival, viability, length, and weight (Q4), and *P. promelas* survival (Q3 and Q4), biomass (Q3 and Q4), and length (Q4).

At FR_FRABCH, for samples collected in Q4, no adverse responses were observed for most test endpoints (9 of 14). Possible adverse responses were observed in 3 of 14 endpoints: *H. azteca* dry weight and *O. mykiss* survival and viability. Likely adverse responses were observed in 2 of 14 endpoints: *P. promelas* survival and biomass.

Several parameters were identified as potentially contributing to the observed chronic toxicity responses, including nitrate, nickel, TDS, sulphate, and selenium (Golder 2019b). Toxicity at FR_FRCP1 occurred most often in the fourth quarter; however, water quality under winter low flow conditions at the Compliance Point is not representative of conditions in the upper Fording River (Golder 2019b). Station FR_FRABCH was added to the program in Q4 of 2018 to evaluate mixed conditions downstream of Fording River Operations.

5.4.3 Temperature and Discharge

5.4.3.1 Temperature

The 2016 FRO LAEMP report identified a statistically significant increase in temperature at several stations in the upper Fording River using data from 2012 to 2016 (Seasonal Kendall analysis; Minnow 2017b), leading to the hypothesis that temperature increases may be contributing to the decrease in % Ephemeroptera, possibly through the initiation of early emergence. In 2017, no trend was identified using continuous temperature data from FR_FRNTP, and aside from a small but statistically significant increase in temperature that in the month of June at several mine-exposed areas (using temperature data collected concurrently with routine water quality monitoring), no other temperature increases were observed. The latter analysis was not updated using 2018 data due to the influence of sampling time on the measurements, as well as the small sample size per month, making interpretation difficult.

Table 5.4: Results of Quarterly and Semi-Annual Toxicity Tests (Golder 2019b)

Quarter	Location	*Ceriodaphnia dubia*			*Pseudokirchneriella subcapitata*	*Hyalella azteca*		*Pimephales promelas*[a]					*Oncorhynchus mykiss*			
		% Survival	Reproduction	Broods	Cell Yield [x 10^4 cells/mL]	% Survival	Dry Weight [mg]	% Hatch	% Survival	Biomass [mg]	Length [mm]	% Normal Development	% Survival	% Viability	Length [mm]	Wet Weight [mg]
Q1	FR_UFR1	100 ± 0	88 ± 24	72 ± 20	167.1 ± 9.4	98 ± 4	79 ± 6	102 ± 0	89 ± 9	97 ± 10	96 ± 6	100 ± 5	-			
	FR_FRCP1	80 ± 42	***21 ± 23***	***31 ± 30***	***66.5 ± 5.3***	*86 ± 26*	***39 ± 13***	95 ± 6	84 ± 19	107 ± 8	100 ± 6	100 ± 0	-			
Q2	FR_UFR1	100 ± 0	*101 ± 42*	*83 ± 18*	*75.4 ± 5.6*	*102 ± 6*	119 ± 6	100 ± 0	6 ± 8	39 ± 3	150 ± 19	107 ± 0	96 ± 9	99 ± 11	101 ± 1	100 ± 17
	FR_FRCP1	100 ± 0	***64 ± 24***	***63 ± 25***	*94.0 ± 4.5*	104 ± 5	127 ± 6	93 ± 5	*104 ± 5*	93 ± 8	**97 ± 6**	101 ± 4	*92 ± 14*	*93 ± 12*	103 ± 4	108 ± 18
Q3	FR_UFR1	90 ± 32	111 ± 39	93 ± 23	100.4 ± 6.9	107 ± 6	180 ± 28	102 ± 0	102 ± 13	87 ± 7	97 ± 5	100 ± 0	-			
	FR_FRCP1	80 ± 42	***46 ± 28***	72 ± 38	113.0 ± 5.9	111 ± 5	144 ± 18	100 ± 0	***2 ± 4***	***23 ± 0***	140 ± 0	100 ± 0	-			
Q4	FR_UFR1	100 ± 35	111 ± 37	100 ± 11	109.1 ± 6.8	94 ± 23	57 ± 23	100 ± 0	109 ± 4	99 ± 5	103 ± 2	100 ± 0	94 ± 4	95 ± 4	102 ± 1	102 ± 3
	FR_FRCP1	100 ± 35	***6 ± 10***	***14 ± 24***	***7.0 ± 1.8***	***17 ± 24***	***19 ± 7***	98 ± 3	***2 ± 3***	***5 ± 9***	31 ± 62	100 ± 0	***23 ± 23***	***19 ± 17***	***55 ± 48***	***58 ± 50***
	FR_FRABCH	100 ± 35	97 ± 33	*93 ± 17*	**92.0 ± 5.6**	94 ± 14	*51 ± 41*	100 ± 0	**62 ± 25**	***59 ± 3***	99 ± 11	100 ± 0	77 ± 21	80 ± 24	*99 ± 4*	99 ± 5

Value = result siginificantly lower than Fording River reference (FR_UFR1).
Value = result significantly lower than Elk River reference (GH_ER2).
Value = result significantly lower than Michel Creek reference (CM_MC1).
Value = result significantly lower than South Line Creek reference.

Notes: - = not tested; mg = milligrams; mL = millilitre; mm = millimetres; % = percent; ± = plus or minus.

[a] Results for copper-amended samples are provided; reference site results are samples amended with 10 µg/L. Laboratory control results are provided for laboratory control + 10 µg/L copper (Cu) and laboratory control + 20 µg/L Cu.

Monthly mean temperature from the continuous monitoring station, FR_FRNTP, was calculated for the 2010 to 2018 period and plotted (Figure 5.12). Seasonal-Kendall analysis did not detect a change in temperature over time (Appendix Table C.3). However, when temporal trends were analyzed using ANOVA, temperature was significantly higher in 2012 compared to 2018 (Table 5.5)

5.4.3.2 Discharge

Monthly mean discharge from the continuous monitoring station, FR_FRNTP, was calculated for the 2010 to 2018 period and plotted (Figure 5.12). Seasonal-Kendall analysis identified a small but significant decreasing trend over time (Appendix Table C.3). When temporal trends were analyzed using ANOVA, discharge in the upper Fording River was determined to be significantly higher in 2012 compared to both 2015 and 2018 (Table 5.5).

5.5 Substrate Quality

5.5.1 Sediment Chemistry

Suspended and bed sediments can play an important role in the transport and fate of chemicals in aquatic systems, particularly with respect to hydrophobic chemicals that adsorb to particle surfaces (Jain and Ram 1997). Settling of particles from the water column to substrates is inversely related to particle size and water velocity (Chin 2006), such that streams that are continuously or seasonally fast flowing tend to be dominated by coarse particles.

Sediment chemistry data were collected to support the questions related to BIC structure. Samples collected from mine-exposed areas in September 2018 had concentrations of cadmium, and manganese that were higher than the upper working sediment quality guidelines (WSQGs), and concentrations of nickel, selenium, and zinc that were higher than the lower WSQGs in one or more areas (Appendix Table D.1; Appendix Figure D.1). Samples collected from RG_FO26 (reference) had concentrations of arsenic, cadmium, manganese, nickel, and zinc that were higher than the lower WSQG (Appendix Table D.1; Appendix Figure D.1). In general, metal concentrations were the lowest at RG_HENUP (reference), and similar among mine-exposed areas and RG_FO26. Concentrations were comparable between years at each area, with the exception of selenium and zinc at RG_FOUKI, which were higher in 2018 compared to 2017 (Appendix Table D.1; Appendix Figure D.1).

Concentrations of 11 PAHs where higher than the lower or upper WSQGs in sediment (Appendix Table D.1; Appendix Figure D.2). Each PAH exhibited the same pattern, with the highest concentrations observed in the most upstream mine-exposed area (RG_FOUKI) and concentrations decreasing with distance downstream. RG_FOUKI is downstream of the FRO South tailings pond (STP) and train loading area, which are potential sources of additional coal

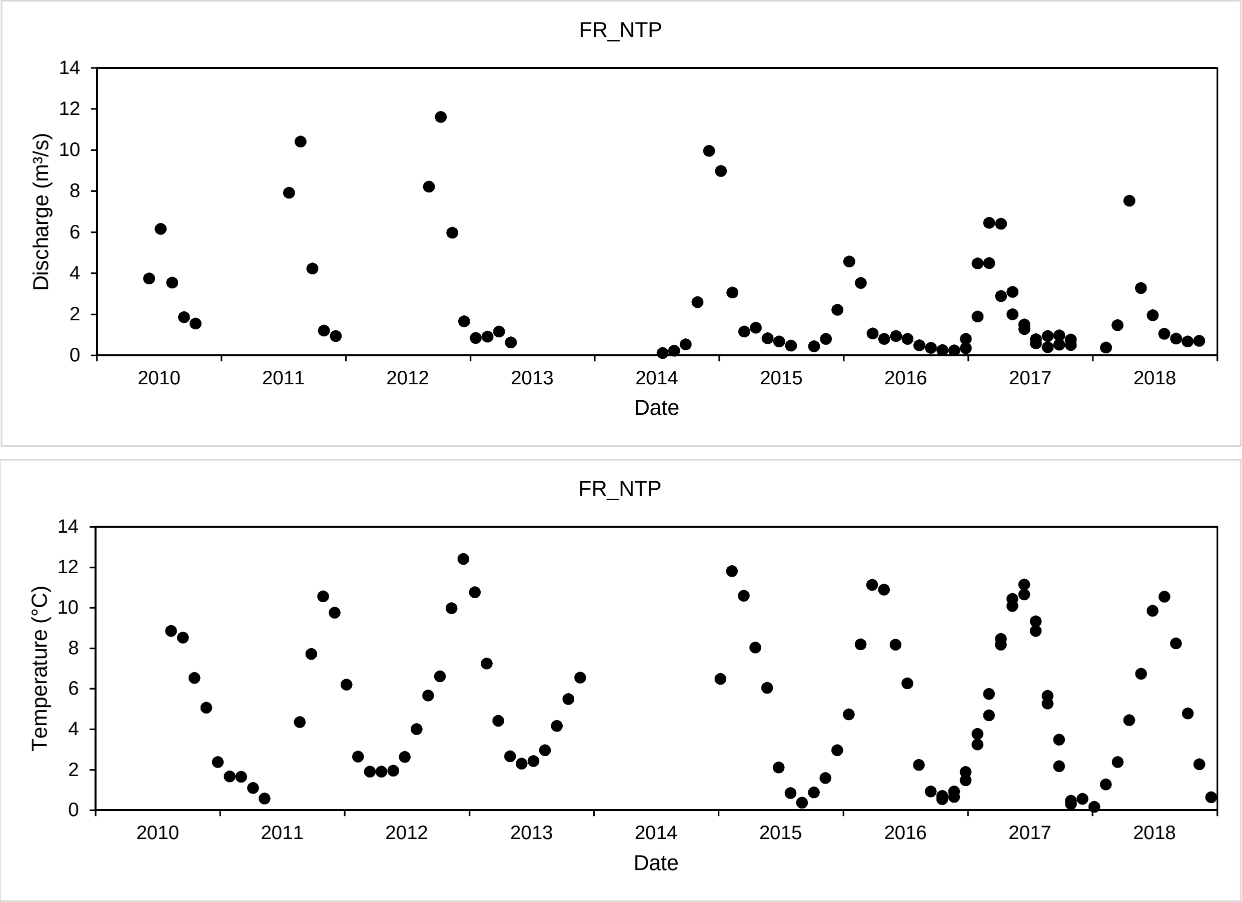


Figure 5.12: **Time Series Plot of Monthly Means for Discharge and Water Temperature at Station FR_FR_NTP 2010 to 2018**

Table 5.5. Temporal Changes in Discharge and Water Temperature at FR_FRNTP in the Fording River, 2010 to 2018

Parameter	Annual Variation [a]		Q1. Is there a positive or negative change since the base year (b) of monitoring?									Q2. Is the 2018 annual mean greater or less than all annual historical means (2010 - 2017) and the previous year (2017)?[c]										
			Magnitude of Difference (MOD)[b] and Significance (bolded) from Base Year (b) [c]																			
	DF	P-Value	2010	2011	2012	2013	2014	2015	2016	2017	2018	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018 vs. 2012-2017	2018 vs. 2017
Discharge	7	0.022	b	11.2	21.6	-	-12.3	-31.2	-16	-25	-33	AB	AB	A	-	AB	B	AB	AB	B	ns	ns
Temperature	8	<0.001	b	20.5	**57.5**	**55.0**	27.8	31	35	29	16	C	BC	A	AB	ABC	ABC	ABC	ABC	C	ns	ns

▨ P-value < 0.05 (annual variation)

🟩 > 20% Decrease
🟩 > 33% Decrease
🟩 > 43% Decrease
🟩 > 50% Decrease
🟦 > 25% Increase
🟦 > 50% Increase
🟦 > 75% Increase
🟦 > 100% Increase
***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)

Notes: "ns" = not significant; "-" insufficient data for comparison

[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.

dust and other inputs. As with metals, PAH concentrations at RG_FO26 were higher than RG_HENUP, and were above the lower WSQGs for chrysene, fluorene, naphthalene, and phenanthrene, and the upper WSQG for 2-methylnaphthalene (Appendix Table D.1; Appendix Figure D.2). PAH concentrations were similar between years in all areas. The highest metal and PAH concentrations were not associated with areas where effects were observed on BIC in 2018. PAHs and selenium concentrations in sediment were the highest at RG_FOUKI.

5.5.2 Calcite

Calcite Index (CI) was measured concurrently with BIC sampling in June, August, September, and December 2018 (Table 5.6). Consistent with previous years, CI values measured in the FRO LAEMP monitoring locations in September 2018 were greater than 1.0 at most areas in the Fording River downstream of Swift Creek to upstream of Ewin Creek (Table 5.6). Calcite indices associated with biological sampling targeted riffle habitat in the immediate proximity of BIC sample collection. In contrast, the Calcite Monitoring Program assesses 100-m-long reaches which may contain a variety of habitat types (i.e., riffle, run, pool). The Calcite Monitoring Program did not identify any areas with a CI greater than 1.0 in the Fording River in September 2018. CI was less than 1.0 in all areas assessed during biological monitoring in both June and August, but was similar to September when assessed in December, with the exception of RG_FRUPO (CI = 0.2; Table 5.6).

5.6 Integrated Summary

While a clear, causal link for the spatial and temporal reduction in % Ephemeroptera has not been determined to date, the evaluation of data collected in 2018 to support study questions #6 (What are the factors contributing to the variations in percent Ephemeroptera?) has furthered the understanding of the BIC in the upper Fording River (results summarized in Table 5.7).

Consistent with data from 2015 to 2017, biological monitoring areas in the upper Fording River exhibited % Ephemeroptera below the regional reference normal range in September 2018. Compared to 2015 to 2017, however, the spatial extent was reduced, extending from RG_FRUPO to RG_FOUEW, rather than RG_FOBCP to RG_FOUEW as observed in previous study years. In addition, % Ephemeroptera was higher in 2018 compared to 2017 at most mine-exposed areas, and a statistically significant increase was observed at RG_FOBCP and RG_FO22.

In 2017, a decrease in the total abundance of two Ephemeroptera families (Heptageniidae and Ephemerellidae) was identified as the primary source of the observed decrease in % Ephemeroptera (Minnow and Lotic 2018). To address this more closely, normal ranges were developed for total abundance metrics, including EPT and Ephemeroptera families (Heptageniidae, Ephemerellidae, and Baetidae). None of the abundance metrics were below

Table 5.6: Calcite Index Values in Fording River from 2013 to 2018

Biological Monitoring Area	Teck Water Station	Calcite Reach*	Teck Regional Calcite Monitoring (Calcite Index)						Calcite Index at Benthic Invertebrate Monitoring Areas									
			2013	2014	2015	2016	2017	2018	2015	2016	2017	2018						
												June	August	September				December
RG_FO26	FR_UFR1	FORD12	0.0	0.0	0.0	0.3	-	0.3	0.9	0.8	0.6	0.4	-	0.9	1.0	0.7	-	-	0.0[a]
RG_HENUP	FR_HC3	HENR3	0.0	0.0	0.0	-	-	-	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-
RG_FODHE	FR_FR1	FORD11	0.0	0.0	0.0	-	-	0.3	0.9	0.0	0.9	0.0	0.0	0.6	0.4	0.8	-	-	-
RG_FOUNGD	-								0.8	-	0.6	0.6	0.0	1.0	1.1	0.9	-	-	-
RG_FODNGD	FR_FRABEC1	-	-	-	-	-	-	-	0.8	-	1.0	0.1	0.1	0.9	0.9	1.0	-	-	-
RG_MP1	FR_MULTIPLATE	FORD10	0.0	0.0	0.0	-	-	0.6	1.0	-	1.0	0.0	0.3	1.4	1.1	1.1	-	-	-
RG_FOUSH	-								1.0	-	0.9	0.7	0.6	1.0	1.0	0.9	-	-	-
RG_FOUKI	FR_FR2								1.0	1.8	0.8	0.3	0.3	0.6	0.8	0.6	-	-	0.0
RG_FOBKS	GH_FR3	FORD9	0.0	0.0	0.0	0.0	0.3	0.7	0.9	2.0	0.5	0.4	0.5	0.8	0.5	0.7	-	-	-
RG_FOBSC	FR_FR4								1.2	1.8	1.1	0.6	0.6	1.0	1.0	1.0	-	-	0.9
RG_FOBCP	FR_FRCP1								1.3	1.6	1.1	0.3	0.5	0.9	1.2	1.1	1.4	1.4	1.1
RG_FRCP1SW	FR_FRCP1SW	-	-	-	-	-	-	-	-	-	1.0	0.0	0.0	-	-	-	-	-	-
RG_FRUPO	FR_FRRD	FORD8	0.3	0.5	0.5	-	-	0.6	-	-	1.0	0.1	0.1	1.0	1.0	1.0	-	-	0.2
RG_FODPO	GH_PC2								0.9	1.0	0.9	0.1	0.8	0.9	0.9	1.0	-	-	1.0
RG_FO22	FR_FRABCH								0.8	-	1.0	0.7	0.6	1.0	0.8	1.0	0.9	1.0	-
RG_FOUEW	FR_FR5	FORD7/6	0.6	0.7	1.0	0.6	0.7	0.8	1.0	1.0	1.0	0.5	0.6	1.1	1.0	1.0	-	-	1.0

Note: Refer to Appendix Figure B.2 for calcite reaches; "-" indicate that no calcite monitoring was completed.

[a] Calcite index taken at RG_UFR1

Table 5.7: Summary of Results (Study Questions #1, #6, #7) for the 2018 FRO LAEMP

Evaluation	Assessment Endpoint	Indicator Type	Measurement Endpoint	Evaluation Criteria	Results	Conclusion
Are nitrate concentrations increasing, and if so, are they adversely affecting biota?	Benthic invertebrate abundance and assemblage	Direct	Benthic invertebrate community endpoints (See Study Question #6)	Benthic invertebrate community relative to nitrate concentrations in the upper Fording River	See Study Question #6	Nitrate concentrations are higher than benchmark(s) in most areas where changes in BIC occur, and nitrate concentrations are highly correlated with % Ephemeroptera and CA1 (See Study Question #6), however spatial and temporal patterns in nitrate concentration do not correspond exactly to observed patterns in BIC.
		Indirect	Surface water nitrate concentrations	Evaluate nitrate concentrations relative to predictions in the EVWQP, benchmarks, and past observations	Nitrate higher than benchmark(s) at most mine-exposed areas	
What are the factors contributing to the variations in percent Ephemeroptera?	Benthic invertebrate abundance and assemblage	Direct	Benthic invertebrate community endpoints (abundance, richness (LPL taxonomy), percent (%) and total abundance of Ephemeroptera-Plecoptera-Trichoptera (EPT), Ephemeroptera, Plecoptera, and Trichoptera, and total abundance of key Ephemeroptera families [Baetidae, Heptageniidaie, Ephemerellidae])	Comparison to reference areas (NR) and past observations for September, assessed seasonally for June, August and September.	% Ephemeroptera below NR between RG_FRUPO and RG_FOUEW, but higher compared to past observations in most areas (significantly at RG_FOBCP and RG_FO22). Ephemeroptera abundance and abundance of Heptageniidae and Ephemerellidae followed the samesame spatial pattern. Plecoptera (% and abundance) was higher where Ephemeroptera was low. A similar pattern was observed in August but no obvious spatial pattern was observed in June.	Data analysis identified a strong correlation between water quality and BIC metrics, suggesting that water quality is an important factor influencing variations in % Ephemeroptera. Analysis also suggested that habitat factors including substrate size and temperature may be important in explaining differences in BIC.
			Community Composition	Correspondence analysis (CA) to assess difference in community structure among areas in 2018.	CA1 identified a clear difference in community composition was observed in areas experiencing low % Ephemeroptera related to higher abundance of taxa other than Ephemeroptera (i.e., Nemouridae, Elmidae). CA2 separated reference from mine-exposed areas.	
		Indirect	Tissue selenium concentrations	Concentrations relative to effect benchmarks and past observations	Two composite-taxa tissue selenium samples from RG_FODHE wer above effects benchmarks in September; one sample from RG_FOBCP was above effects benchmarks in December.	
			Surface water chemistry	Concentrations of mine-related constituents relative to effect benchmarks and past observations.	Water quality constituentes were highest in winter months. Nitrate was higher than benchmarks at most mine-exposed areas; sulphate, nickel, and selenium were frequently higher than benchmarks at FR_FRCP1, and less often downstream; very few other consituents were higher than BCWQGs; Few increasing temporal trends observed in mine-exposed areas (nitrate, sulphate, selenium, nickel)	
				Principal component analysis (PCA) to assess variability in water quality among areas	The majority of variabilty in water quality explained by PC1 (43.3%) and PC2 (25.7%)	
			Temperature and Flow	Temperature and discharge at FR_FRNTP (continuous monitoring) evaluated over time (2010 to 2018)	Temporal analysis identified a signifiant increase in temperature and discharge 2012	
			Sediment chemistry	Concentrations relative to BC working sediment quality guidelines (WSQGs)	Cadmium, manganese, nickel, selenium, and zinc exceeded lower and/or upper WSQG, with highest concentrations at typically at RG_FOBCP or RG_FOUKI (selenium only); eleven PAHs exceeded lower and/or upper WSQG, all with concentrations decreasing from upstream (RG_FOUKI) to downstream (RG_FO22)	
			Calcite	Calcite index relative to known or suspected effect levels and past observations	Calcite index was highest in mine-exposed areas bewtween RG_FOBCP and RG_FOUEW), similar compared to past observations	
			Correlations between physical and chemical factors, and BIC metrics	Physical: CI, pebble size, water velocity, water depth; chemical: PC1, PC2, individual constituents; BIC metrics: % Ephemeroptera, CA1, CA2	% Ephemeroptera was positively correlated with pebble size and nitrite, an negatively correlated with PC2, nitrate, and selenium. CA1 was positively correlated with pebble size and temperature, and negatively correlated with PC2, nitrate, and selenium. CA2 was negatively correlated only with cadmium.	
To support monitoring associated with the requirements of the water license and environmental flow needs assessment, what is the benthic invertebrate community structure in the reach of the Fording River that goes dry, and can changes be correlated with flow conditions?	Assessment of dewatering in the upper Fording River	Direct	Monthly dewatering surveys, Temperature and level data loggers (continuous). Field *in situ* water quality.	Spatial and temporal extent of seasonal dewatering	Three sections of the upper Fording River dewatered between September and December 2018 (between FR_FRRD and FR_FRCP1, upstream of FR_FRCP1, and upstream of FR_FR4).	The spatial and temporal extent of dewatering was greater in 2018 compared to 2017.

Note: NR = Normal Range

reference condition; however, normal ranges extended almost to zero. This likely reflects the greater variability in total abundance metrics compared to relative abundance metrics using a timed kick and sweep method. Despite being within the normal range, Ephemeroptera abundance, along with Ephemerellidae and Heptageniidae abundance, decreased spatially from upstream to downstream similar to % Ephemeroptera. The spatial pattern was especially notable compared to RG_FO26, where Ephemeroptera abundance metrics were consistently higher than their respective normal ranges.

It has become clear through the evaluation of the BIC data in the upper Fording that the areas that experience low % Ephemeroptera have a markedly different community structure than those where % Ephemeroptera is within the normal range, and this difference is apparent across seasons even in light of natural seasonal variability, due to environmental factors (e.g., temperature, resource abundance, photoperiod, discharge; Linke et al. 1999). The reduction in % Ephemeroptera does not appear to co-occur with losses in specific genera (i.e., all genera are present in each area, albeit at lower abundances, however, other taxa are much more abundant). Of particular note is the family Nemouridae, a winter emerging family of Plecoptera, which comprises a large proportion of the community at areas experiencing low % Ephemeroptera. Nemouridae are shredders, utilizing leaf litter and other coarse particulate organic matter (CPOM) as a food source (USGS 2016), as opposed to the prevalent families of Ephemeroptera, which tend to be predators, scrapers, and/or collectors/gatherers (USGS 2016). A second notable taxon is Elmidae, a family of riffle beetles. Elmid taxa are both scrapers and collector-gatherers (USGS 2016), suggesting that there is appropriate food available for the functional feeding groups occupied by Ephemeroptera taxa. It is not yet clear why these particular non-Ephemeroptera taxa are present in such high numbers in the areas where Ephemeroptera abundance is low.

Total abundance within the normal range, and in particular a high abundance of Plecoptera, in areas where % Ephemeroptera and Ephemeroptera abundance are low suggests that there is sufficient food for fish regardless of changes in community structure. It has been previously hypothesized that a strong year class of westslope cutthroat trout (WCT) may also be a contributing factor to the observed effect; however, due to high total abundance of benthic invertebrates, it is unlikely that predation by WCT would lead to a taxa-specific change in BIC.

There is a paucity of information on critical life stages and sensitivities to specific mine-related parameters for Ephemeroptera taxa present in the upper Fording River. That said, reduced % Ephemeroptera was observed at high elevation coal mining operations (e.g., Central Appalachian Mountains, Elk Valley, and McLeod River), and Heptageniidae and Ephemerellidae were the most sensitive taxa (Pond et al. 2008, Kuchapski and Rasmussen 2015; Boehme et al. 2016). Mine-related changes in water quality and substrate were most strongly associated with the changes in BIC in these studies, but no clear cause was established.

While it is not unexpected that the BIC could naturally change over a spatial gradient (Vannote et al. 1980), especially in high elevation mountain streams, the short distance over which the observed effect is occurring (i.e., approximately 9 km) suggests that additional causes other than river continuum could be contributing. Understanding how stressor variables (both natural and mine-related) are related to BIC structure is essential for understanding the cause of the observed effects.

To further integrate findings, correlations between chemical and physical parameters (PC1, PC2, key water quality constituents, CI, pebble size [D16, D84], water velocity, water depth) and BIC metrics (% Ephemeroptera, CA1, and CA2) were completed (Table 5.8). Both % Ephemeroptera and CA1 (i.e., the axis that captures the taxa differences in areas where effects are observed) were most strongly correlated with D84, nitrate, nitrite, total and dissolved selenium, and temperature, as well as PC2. The similarity between the two BIC metrics supports the shift in community structure away from Ephemeroptera taxa described by CA1 and indicates that the variability captured by CA1 includes the observed effects on % Ephemeroptera.

As mentioned above, aqueous selenium and nitrate are correlated with effects on BIC. Nitrate concentrations were frequently higher than the Level 1 benchmark in areas where % Ephemeroptera was low, and often also higher than the Level 2 benchmark. The highest concentrations were observed in the winter months when water levels were the lowest. While the spatial pattern of nitrate concentrations does not mirror the change in % Ephemeroptera exactly, nitrate does appear to be a contributing factor in combination with other stressors and environmental variables. Selenium concentrations, on the other hand, while often higher than the Level 1 benchmark in water in the areas where effects on BIC were observed, were below benchmarks in composite-taxa benthic invertebrate tissue samples.

The importance of habitat factors on the structure of BIC in the upper Fording is becoming increasingly clear. As was shown in the 2017 FRO LAEMP report (Minnow and Lotic 2018), pebble size was highly correlated with % Ephemeroptera in 2018. Analysis also suggests that mean annual water temperature may be important, especially as it relates to CA1. The areas where % Ephemeroptera is low are thought to receive significant groundwater influence (Section 6), which may be affecting annual mean temperatures and providing a temperature regime favorable to a different community structure than upstream areas that freeze or dry (i.e., subsurface flow). Interestingly, temporal analysis of discharge and temperature data from FR_FRNTP identified 2012 as a wet and warm year. It is possible that BIC in 2012 was unusual; however, without consistent biological data prior to 2012 this hypothesis cannot be confirmed.

Table 5.8: Spearman Rank Correlations Between Benthic Invertebrate Endpoints and Physical and Chemical Parameters

Parameter	% E		CA1		CA2	
	r_s	p-value	r_s	p-value	r_s	p-value
Cl	-0.217	0.219	-0.372	0.03	0.121	0.494
D16	0.462	0.006	0.493	0.003	-0.237	0.177
D84	0.712	<0.001	0.626	<0.001	-0.234	0.183
Water Velocity	-0.167	0.345	-0.344	0.046	0.426	0.012
Water Depth	-0.023	0.896	-0.223	0.206	0.252	0.151
PC1	-0.297	0.088	-0.366	0.033	-0.077	0.667
PC2	-0.673	<0.001	-0.779	<0.001	0.338	0.051
Temperature	0.43	0.011	0.641	<0.001	-0.355	0.039
Total Dissolved Solids	-0.28	0.109	-0.485	0.004	0.111	0.533
Nitrate	-0.862	<0.001	-0.798	<0.001	0.028	0.877
Nitrite	0.638	<0.001	0.444	0.008	0.241	0.170
Sulphate	-0.332	0.055	-0.51	0.002	0.157	0.374
Dissloved Aluminum	0.275	0.116	0.279	0.11	0.018	0.920
Total Aluminum	0.123	0.488	0.321	0.064	-0.377	0.028
Dissolved Cadmium	0.296	0.089	0.586	<0.001	-0.733	<0.001
Total Cadmium	0.251	0.153	0.482	0.004	-0.675	<0.001
Dissolved Chromium	-0.126	0.479	-0.192	0.276	-0.057	0.748
Total Chromium	0.055	0.755	0.329	0.057	-0.519	0.002
Total Cobalt	0.433	0.011	0.488	0.003	-0.422	0.013
Total Iron	0.002	0.990	0.25	0.154	-0.47	0.005
Total Mercury	0.378	0.027	0.518	0.002	-0.282	0.106
Dissolved Nickel	0.24	0.172	0.333	0.054	-0.481	0.004
Total Nickel	0.259	0.139	0.342	0.048	-0.499	0.003
Dissolved Selenium	-0.633	<0.001	-0.639	<0.001	0.014	0.939
Total Selenium	-0.621	<0.001	-0.669	<0.001	0.05	0.779
Dissolved Uranium	-0.243	0.166	-0.296	0.09	-0.161	0.362
Total Uranium	-0.243	0.166	-0.296	0.089	-0.161	0.362
Dissolved Zinc	0.194	0.271	0.343	0.047	-0.433	0.011
Total Zinc	0.265	0.129	0.377	0.028	-0.497	0.003

▨ P-value < 0.05

🟦 $r_s \leq -0.6$ or $r_s \geq 0.6$

While data analysis identified a strong correlation between water quality and BIC metrics, suggesting that water quality is an important factor influencing variations in % Ephemeroptera, it is clear that habitat factors are also contributing to observed changes. Future analyses to tease out the influence of different habitat components from that of water quality and other mine-related stressors (e.g., calcite and changes in flow) will be essential to answer study question #6.

6 STUDY QUESTION #7

6.1 Overview

Seasonal drying is known to occur in the upper Fording River during fall/winter low flow conditions. To address study question #7 (What is the benthic invertebrate community structure in the reach of the Fording River that goes dry, and can changes be correlated with flow conditions?), baseline flow, temperature and hydrological monitoring was conducted in 2018 (Figure 2.2; Table 2.4).

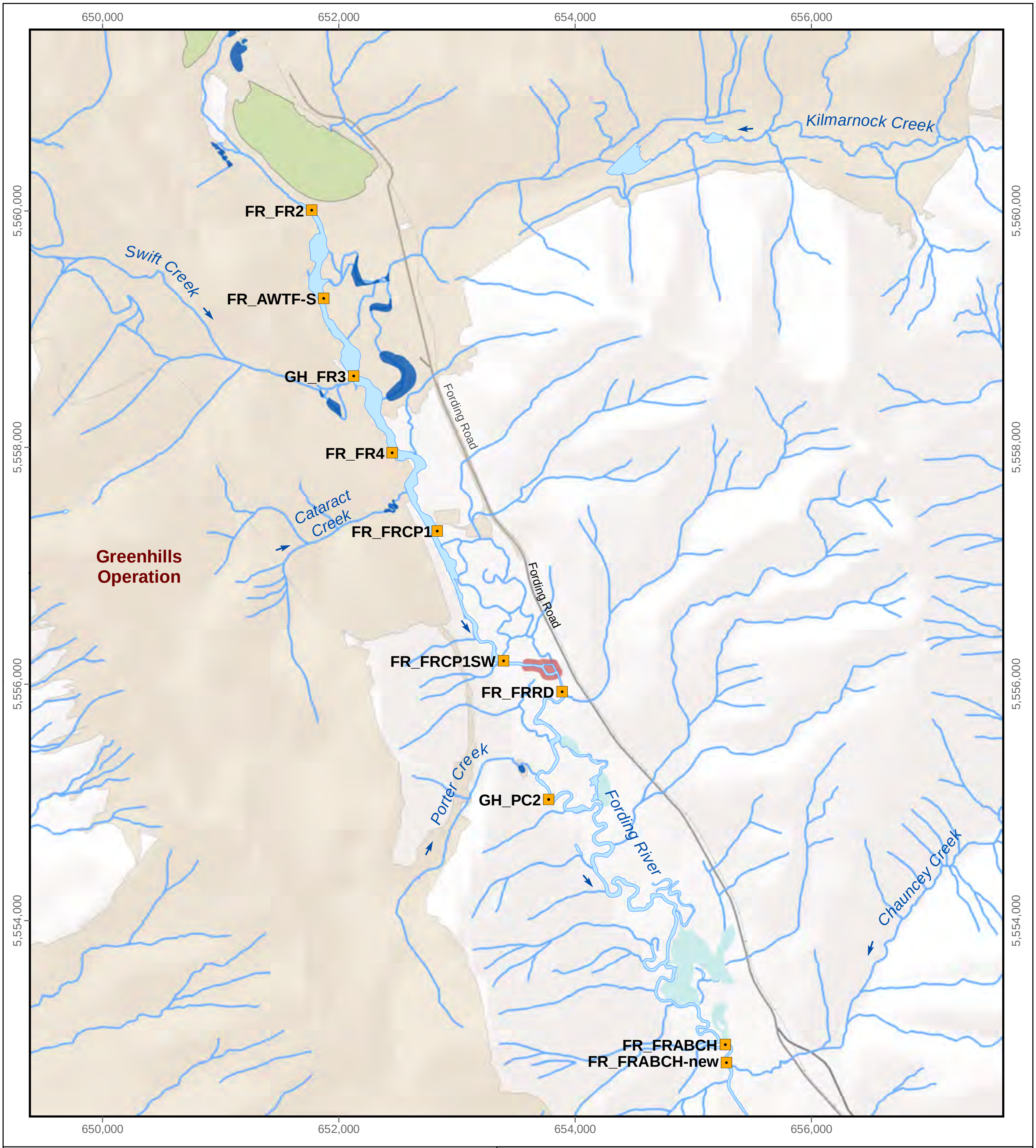
The 2017 FRO LAEMP report described a 1.5 km dry section downstream of the FRO Compliance Point (FR_FRCP1) to just upstream of FR_FRRD from December 2017 to March 2018 (Minnow and Lotic 2018), encompassing one FRO LAEMP biological monitoring area (RG_FRCP1SW). The following sections describe surveys conducted between August and December 2018 to assess dry sections, and summarize water temperature and level data from continuous logger records from October 2017 to October 2018. BIC structure was also assessed within the areas that dry to address this study question, as well as study question #6 (Section 5).

6.2 Seasonal Surveys of Dry Sections

Monthly surveys began in August 2018, as flow conditions between March and August are sufficiently high that drying is not expected. In August and September 2018, the full 12.8 km section of the Fording River included in the FRO LAEMP contained flowing surface water. In October, a dry section of approximately 280 m was found between FR_FRRD and FR_FRCP1SW (Figure 6.1). Through water level data (Section 6.3) and field observations, it appeared that FR_FRCP1SW first went dry around September 8, 2018 (Table 6.1). In November, the extent of the dry section increased to 1,190 m. November surveys also identified a second dry section of approximately 170 m, located upstream of the Cataract Creek confluence (Figure 6.2). In December, the dry section at FR_FRCP1SW covered approximately 1,650 m and extended from upstream of FR_FRRD to just downstream of FR_FRCP1 (Figure 6.3). The dry section near the Cataract Creek confluence lengthened to approximately 480 m, and a third dry section was identified upstream of FR_FR4 and downstream of the Kilmarnock Creek settling pond outlet (Figure 6.3), covering a distance of approximately 630 m. The logger at FR_FR4 remained wetted.

6.3 Temperature

The water temperature loggers were used to plot daily low, mean, and maximum temperatures from October 2017 to October 2018 (Appendix Figures E.1 to E.8). The 2017 FRO LAEMP data (Minnow and Lotic 2018) indicated three distinct overwintering thermal regimes. However, as logger downloads occurred before winter (October) to access prior to freeze up, this could not be



Dry Section in Upper Fording River, FRO LAEMP, October 2018

Projection: North American Datum 1983 UTM Zone 11 U
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Date: May 2019
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Figure 6.1

Document Path: S:\Projects\187202\187202.0022 - FRO LAEMP 2018\GIS\Report\Figures\18-22 Figure 6.1 FRO Dewatering - Oct.mxd

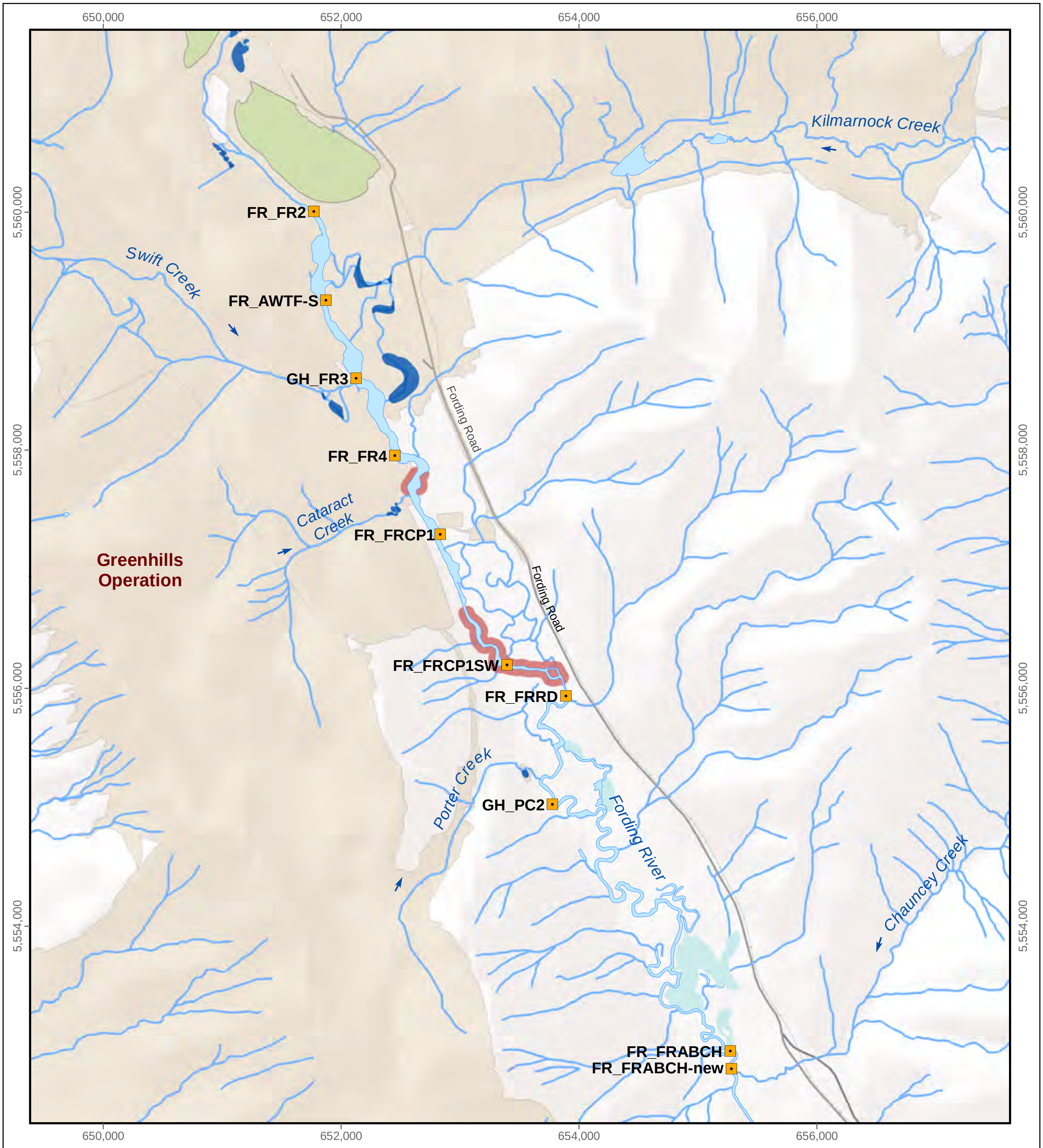
Table 6.1: **Summary of Wet and Dry Areas During Dewatering Survey in the Upper Fording River, August to December, 2018**

Area	August	September	October	November	December
FR_FR2	🟦	🟦	🟦	🟦	🟦
FR_AWTF-S	🟦	🟦	🟦	🟦	🟦
GH_FR3	🟦	🟦	🟦	🟦	🟦
FR_FR4	🟦	🟦	🟦	🟦	🟦
FR_FRCP1	🟦	🟦	🟦	🟦	🟦
FR_FRCP1SW	🟦	▨ 10-Sep-18	▨	▨	▨
FR_FRRD	🟦	🟦	🟦	🟦	🟦
GH_PC2	🟦	🟦	🟦	🟦	🟦
FR_FRABCH	🟦	🟦	🟦	🟦	🟦

Note: Areas are ordered from upstream to downstream

🟦 Surface Flow

▨ Dewatered



LEGEND

- 🟧 Hydrology Site Location
- ▭ Dewatered Section
- 🟦 Settling Pond
- 🟩 Tailings Pond
- ⬜ Teck Coal Mine Operation

Dry Sections in Upper Fording River, FRO LAEMP, November 2018

0 0.5 1 2 km

N W E S

Projection: North American Datum 1983 UTM Zone 11 U
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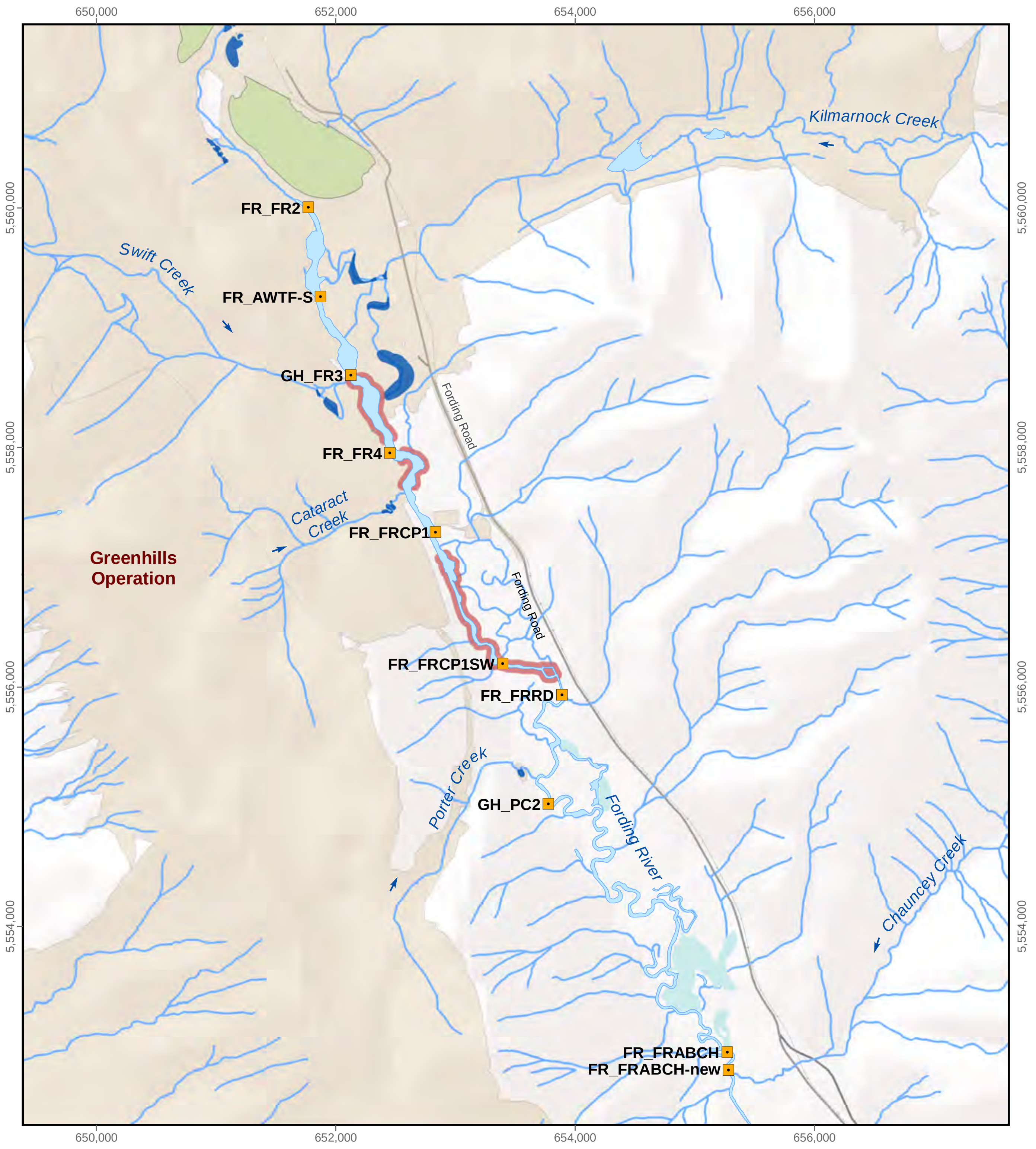
Figure 6.2

Document Path: S:\Projects\187202\187202.0022 - FRO LAEMP 2018\GIS\Report\Figures\18-22 Figure 6.2 FRO Dewatering - Nov.mxd



LEGEND

■ Hydrology Site Location

🟥 Dewatered Section

🟦 Settling Pond

🟩 Tailings Pond

⬜ Teck Coal Mine Operation

Dry Sections in Upper Fording River, FRO LAEMP, December 2018

Projection: North American Datum 1983 UTM Zone 11 U
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Date: May 2019
Project 187202.0022

minnow environmental inc.

Figure 6.3

Document Path: S:\Projects\187202\187202.0022 - FRO LAEMP 2018\GIS\Report\Figures\18-22 Figure 6.3 FRO Dewatering - Dec.mxd described for November and December 2018. Water temperatures generally remained within the BCWQG for optimal fish (cutthroat trout) rearing (7.0 to 16.0°C; ENV 2018). Some temperatures above this range were noted in late July and August from FR_FR4 downstream to FR_FRCP1SW. Maximum daily temperatures decreased downstream of previously suspected groundwater influence. Groundwater input at FR_FRRD was first reported by McPherson and Robinson (2011), when flows were observed entering the Fording River from a side channel originating close to the FRO greenhouse (Figure 2.2). The side channel flows were ice-free during winter surveys at a time when the main stem Fording River contained dry and ice-covered sections upstream of the confluence with the side channel. Conditions were consistent with previous observations in 2017 and earlier in 2018. The ice-free conditions coupled with the Fording River temperature records suggest that groundwater is contributing to flows near FR_FRRD. Additional work is underway to improve understanding of groundwater flow paths in the upper Fording River through instream sinks study (SRK Consulting 2019) and monitoring/evaluation to support the FRO-S AWTF-S application. Relevant data and learnings from this work will be reviewed with the EMC during future discussions to support answering the FRO LAEMP study questions.

6.4 Water Level and Flows

Continuous water level data were collected and corrected for barometric pressure from October 2017 to October 2018. Stage-discharge relationships were not derived due to a lack of an insufficient number of data points to date during high flows and ice-free conditions to create relationships. Therefore, the reported water stage values are local and cannot be compared to other locations until a stage-discharge relationship can be obtained.

Similar to water temperature and water levels reported in 2017, the surveyed section of the Fording River could be differentiated into three sub-sections based on hydrologic conditions. The upstream-most sub-section, encompassing stations FR_FR2, FR_AWTF-S, GH_FR3, and FR_FRCP1, showed water level patterns of locations that remained wetted but had minimal groundwater influence (Appendix Figures E.9 to E.14). An exception was FR_FR4, which became dry in December 2018 (Figure 6.3).

The middle sub-section (containing FR_FRCP1SW) did not sustain surface flow throughout winter, similar to 2017 (Minnow and Lotic 2018). The water level record was inconsistent at FR_FRCP1SW in late September, with a series of apparent drying/rewatering events (Appendix Figure E.14). Drying period identified by water level record in early September (September 8) was corroborated with field observations during September biological sampling. Drying appeared to be more consistent by September 28, 2018 when the water level record ended with the fall logger download. On November 6, 2018, FR_FRCP1SW was confirmed dry (Figure 6.2) and it remained dry through December (Figure 6.3).

Mean daily discharge measured at the long term hydrometric station near the North Tailings Pond (FR_FRNTP; 6 to 7 km upstream from FR_FRCP1SW) was examined to understand flow conditions in the upper Fording River on the dates when FR_FRCP1SW was visually confirmed to be dry. Mean daily discharge on September 8, 2018 was 0.99 m^3/s and on November 6, 2018, was 0.67 m^3/s. By contrast, FR_FRCP1SW was reported to dry on approximately December 14, 2019, when the mean daily discharge at FR_FRNTP was 0.45 m^3/s. It remains to be seen whether data from FR_FRNTP can be used as a predictor of drying further downstream.

Similar to observations in 2017 (Minnow and Lotic 2018), water stage in the furthest downstream sub-section (encompassing FR_FRRD, GH_PC2, FR_FRABCH), demonstrated a flow regime indicative of a groundwater dominated site (Appendix Figures E.14 to E.16). Water level and temperature did not vary substantially across seasons, and water temperature was maintained above zero and ice-free in the winter months.

6.5 Summary

The section of the upper Fording River around FR_FRCP1SW dried earlier in 2018 compared to 2017 (Minnow and Lotic 2018). Two additional dry sections were also identified upstream of Cataract Creek and upstream of FR_FR4, respectively. To address the biological component of study question #7, the BIC was to be assessed at RG_FRCP1SW in September by comparing community metrics to normal ranges and assessing the community in relation to areas close to dry sections as well as reference areas. However, due to the early drying event on September 8, 2018 (Section 6.2), BIC sampling could not be completed in September at FR_FRCP1SW (Section 5). Data from June and August, 2018 (Section 5.3.2), suggested that the community was similar to that at RG_FOBCP. Drying in the previous winter is unlikely to impact communities in September given the timeframe for recolonization. Generally, in areas with seasonally predictable drying, recolonization of benthic invertebrate communities tends to occur quite rapidly (e.g., <2 months; Wallace 1990); thus, a more targeted investigation will be required to fully address study question #7.

7 CONCLUSIONS AND RECOMMENDATIONS

The results of the 2018 FRO LAEMP identified a spatial decrease in % Ephemeroptera from upstream to downstream, consistent with previous LAEMPs. Further evaluation of the BIC determined that the change was related to a substantial shift in the community structure, rather than simply the loss of Ephemeroptera. Both % Ephemeroptera and CA1 (the axis that captures the taxa differences in areas where effects are observed) were most strongly correlated with D84 (a metric of substrate size), water quality constituents (nitrate, total and dissolved selenium, PC2) and temperature. Furthermore, changes in BIC are being observed downstream of sections of the Fording River that seasonally dry. These areas receive groundwater input, which may be affecting annual mean temperature and providing a temperature regime favorable to a different community structure than upstream areas that freeze or dry.

While data analysis identified a strong correlation between water quality and BIC metrics, suggesting that water quality is a factor influencing the variation in % Ephemeroptera, it is clear that habitat factors are also contributing to observed changes. Further analytical investigation will be essential to differentiate the influence of habitat components from those of water quality and other mine-related stressors (e.g., calcite, changes in flow). Following discussion with the EMC in March and April, 2019, and based on interpretation of 2018 results, the following recommendations are made to support the FRO LAEMP during the 2019 to 2020 cycle:

- Develop and refine a regression-based habitat model to better understand the relationship between stressors (e.g., water chemistry, water quality, calcite) and habitat variables as they relate to the BIC in the upper Fording River.
- Consider the influence of groundwater in areas where changes in BIC are observed.
- Initiate a targeted investigation of the BIC recolonization in the section(s) of the upper Fording River that dry to help support study question #7.

The 2019 to 2020 FRO LAEMP cycle will include biological sampling in June, September, and December to add to the understanding of seasonal variation and to continue to monitor changes in BIC both spatially and over a longer time period.

The results from the 2018 FRO LAEMP report provide supporting information to answer Management Question 5 from Teck’s Adaptive Management Plan (Teck 2018) and Table 7.1 summarizes Key Uncertainty 5.1 material presented in this report.

Table 7.1: Summary of Key Uncertainty 5.1 Reduction Activities, FRO LAEMP, 2018

Topics	**Summary for KU 5.1**
Activities undertaken to reduce the KU (and when), and any noteworthy deviations from activities that were planned	Biological sampling (benthic invertebrate community; BIC), with supporting chemistry sampling (composite-taxa benthic invertebrate tissue, water, sediment) and habitat measurements were conducted in June, August, and September (where appropriate), and dewatering surveys were conducted monthly between August and December under the FRO LAEMP according to the updated study plan, submitted May 31, 2018. Additional sampling (BIC, tissue, water, habitat) was included in December 2018 and February 2019 in response flows in the upper Fording River consisting of predominantly Cataract Creek water at the Compliance Point in November due to upstream dewatering.
Results	Consistent with previous years, the relative abundance of mayflies (Ephemeroptera; %E) in September 2018 was below the regional normal range (NR) in a stretch of the upper Fording River between the Fording River Road bridge upstream of Porter Creek, and upstream of Ewin Creek. The total abundance of mayflies and key mayfly families remained within the NR but exhibited a similar spatial pattern. The total and relative abundance of other taxa (i.e. stoneflies and riffle beetles) were high in the same areas. Total abundance was within the NR at all areas associated with the FRO LAEMP. The areas with low %E exhibited distinct differences in community compared to reference areas and other mine-exposed areas. Water quality and habitat factors were strongly correlated with key BIC endpoints. Dewatering occurred earlier in 2018 than 2017, with a total of three dewatered sections identified by December 2018.
Responses to results (actions done, and still needed), including any adjustments	Biological sampling will be conducted in June, September, and December of 2019 and 2020 to further assess seasonal changes in BIC. Dewatering surveys will continue in 2019 and 2020.
Future activities planned (and when (by year)) to reduce this KU	Additional BIC sampling in the drying reaches of the upper Fording River is planned for early spring 2020 to further understand the biological community in those areas of the river.
How these future activities will contribute to reducing the KU	Annual sampling in June, September, and December will provide information on changes over time, both annually and seasonally. In addition, there is a lack of understanding of the impact of dewatering on the biological community in the upper Fording River. The data acquired will help to tease apart natural effects of dewatering from mine-related effects within the same areas, and will help identify any potential cumulative effects.
What has been learned?	Both water quality and habitat factors are likely contributing to the observed effects on BIC.
Have new KUs arisen from this work?	No new KUs have arisen from the FRO LAEMP based on work conducted in 2018. Data will be used to address UU 5.1.1. Ongoing work being conducted under the RAEMP will address UU 5.1.2 to 5.1.4.

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APPENDIX A
STUDY DESIGN UPDATES

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September 5, 2017

Ms. Carla Fraser
Manager, Environmental Compliance
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V0B 2G0

Re: Updated Sampling Design for 2017 FRO LAEMP

Dear Carla,

This letter has been prepared in response to discussions with the Environmental Monitoring Committee (EMC) in June regarding the need to update the 2017 Fording River Operation (FRO) Local Aquatic Effects Monitoring Program (LAEMP) sampling design based on findings from the 2016 program and the requirements of the FRO water licensing Operational Environmental Monitoring Program.

The FRO LAEMP design was developed in consultation with the EMC, submitted to the Ministry of Environment and Climate Change Strategy (ENV) in May 2016 (Minnow 2016[1]) in accordance with the requirements of Permit 107517, and subsequently approved by the ENV Director on October 24, 2016. The objective of the LAEMP is to monitor potential aquatic effects related to continued development of FRO and the future commissioning of an active water treatment facility (AWTF) that is planned to treat waters from Cataract, Swift and Kilmarnock creeks (Figure 1). Table 1 presents the scope of biological monitoring that was approved for the FRO LAEMP in 2016. Field work associated with the first cycle of implementation occurred in September, 2016, and the final report of the 2016 FRO LAEMP results was submitted May 31, 2017.

The original study design was intended to cover the 2016 to 2018 time period; however the 2016 LAEMP identified a spatial pattern of decreasing relative Ephemeroptera (mayfly) abundance in the Fording River from upstream of Kilmarnock Creek to between Chauncey and Ewin Creek. The data also suggested that invertebrate abundance and relative Ephemeroptera abundance had declined at many of the Fording River monitoring areas since 2012. The report investigated potential relationships with mine-related stressors (e.g., nitrate, sulphate, and selenium, calcite) and other factors (e.g., water temperatures and flow), but none could conclusively account for the observed patterns in invertebrate data. Based on discussion of the report results and recommendations with the EMC in May and June 2017, it was agreed that the scope of the FRO LAEMP should be modified in 2017 to improve the understanding of cause(s) for the reduced Ephemeroptera abundance.

As discussed, it is proposed that benthic invertebrate sample collection be increased in September as reflected in Table 2.

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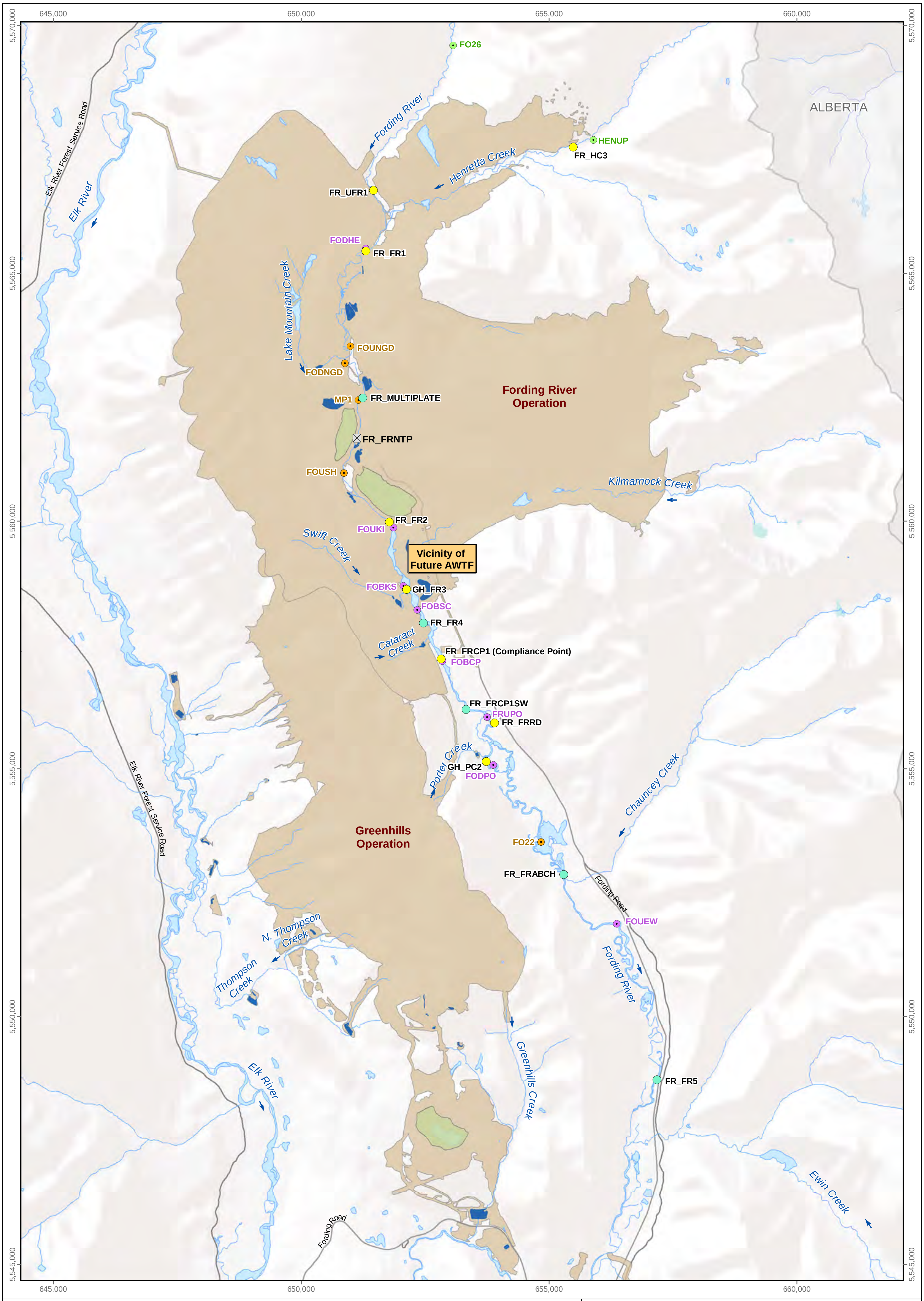
[1] Minnow Environmental Inc. 2016. Study Design for the Fording Swift Local Aquatic Effects Monitoring Program (LAEMP). Project #167202.0047



LEGEND

- ☒ Hydrometric Station
- ● Water Monitoring Station (Non-permit)
- ● Water Monitoring Station (Permit)
- ■ Settling Pond
- ■ Tailings Pond
- ■ Teck Coal Mine Operation

Biological Sampling Area

- ⊙ Mine-Exposed
- ⊙ Reference
- ⊙ RAEMP Only

Monitoring Locations in Upper Fording River

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km

N
W E
S

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Date: September 2017
Project 167202.0075

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Figure 1

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Table 1: Summary of Biological Monitoring Associated with the FRO LAEMP Study Design Approved in 2016[a]

Location Description		Biological Sampling			September 2016 - 2018			
					Benthic Invertebrates			
		Station ID (Teck water quality Station ID in brackets)	UTM (11U)		Biomass (# of samples annually starting in 2017)	Community (# of samples annually)	Rhyacophilidae Selenium (# of samples annually)	Composite-taxon Selenium (# of samples annually)
			Easting	Northing				
Reference	Fording River upstream of FRO	FO26 (FR_UFR1)	653064	5569601	-	1	1	1
	Henretta Creek upstream of FRO	HENUP	655887	5567716	-	1	1	1
Mine-exposed	Fording River downstream of Henretta Creek	FODHE (FR_FR1)	651295	5565429	-	1	-	-
	Fording River upstream of the proposed AWTF discharge	FOUKI (FR_FR2)	651838	5559855	10	1	1	1
	Fording River immediately downstream of the proposed AWTF discharge	FOBKS	652065	5558691	-	1	-	-
	Fording River between Swift and Cataract	FOBSC (FR_FR4)	652342	5558207	-	1	-	-
	Fording River Compliance Point	FOBCP (FR_FRCP1)	652864	5557150	10	1	1	1
	Fording River downstream of Porter	FODPO (FR_ABCH1)	653901	5555074	-	1	1	1
	Fording River upstream of Ewin Creek	FOUEW (FR_FR5)	656362	5551883	-	1	1	1

[a] The approved design was intended to be applied in 2016 through 2018.

Table 2: Summary of Biological Monitoring Proposed for the 2017 FRO LAEMP

	Location Description	Biological Sampling			Water Quality Sample[a]	Sediment Quality	Benthic Invertebrates					
		Station ID (Teck water quality Station ID in brackets)	UTM (11U)				Hess	Kick and Sweep				
			Easting	Northing			Biomass and community (# of samples annually starting in 2017)	Community (# of samples annually)	Rhyacophilidae Selenium (# of samples annually)	Ephemeroptera Selenium (# of samples annually)	Parapsyche Selenium (# of samples annually)	Composite-taxon Selenium (# of samples annually)
Reference	Fording River upstream of FRO	FO26 (FR_UFR1)	653064	5569601	1	-	10	1	1	1	3	1
	Henretta Creek upstream of FRO	HENUP (FR_HC3)	655887	5567716	1	-	10	1	1	1	3	1
Mine-exposed	Fording River downstream of Henretta Creek	FODHE (FR_FR1)	651295	5565429	1	-	-	1	1	1	3	1
	Fording u/s North Greenhills Diversion	FOUNGD	650993	5563529	1	-	-	1	1	1	3	1
	d/s Lake Mountain Creek/ North Greenhills Diversion	FODNGD	650883	5563190	1	-	-	1	1	1	3	1
	Multiplate Culvert on Greenhills Access Road	MP1 (FR_MULTIPLATE)	651158	5562442	1	-	-	1	1	1	3	1
	u/s Shandley Cr.	FOUSH (FR_FRNTP)	650863	5560970	1	-	-	1	1	1	3	1
	Fording River upstream of the proposed AWTF discharge	FOUKI (FR_FR2)	651838	5559855	1	5	10	3	3	3	3	3
	Fording River immediately downstream of the proposed AWTF discharge	FOBKS (GH_FR3; Historical)	652065	5558691	1	5	10	3	3	3	3	3
	Fording River between Swift and Cataract	FOBSC (FR_FR4)	652342	5558207	1	-	10	1	1	1	3	1
	Fording River Compliance Point	FOBCP (FR_FRCP1)	652864	5557150	1	5	10	1	1	1	3	1
	Fording River ~1150 m downstream of the Compliance Point	FR_FRCP1SW	653324	5556197	1	-	10	1	1	1	3	1
	Fording River upstream Porter Creek	FRUPO (FR_FRRD)	653899	5555938	1	5	10	1	1	1	3	1
	Fording River downstream of Porter	FODPO (GH_PC2)	653901	5555074	1	-	-	1	1	1	3	1
	u/s Chauncey Cr.	FO22 (FR_FRABCH)	654841	5553523	1	5	10	1	1	1	3	1
	Fording River upstream of Ewin Creek	FOUEW (FR_FR5)	656362	5551883	1	-	-	1	1	1	3	1

🟦 RAEMP biological sampling area not formerly included in FRO LAEMP (see Table 1).

🟩 New biological sampling area added to the FRO LAEMP.

🟧 Additional sampling proposed for 2017 FRO LAEMP compared to design approved in 2016 (see Table 1).

[a] Water sample taken concurrently with biological data.

Table 3: Summary of Water Quality Monitoring Associated with the LAEMP

Location Description	Water Station ID (associated biological Station ID in brackets)	EMS Number	UTM (11U)		Water Quality Samples				Data Logger Install	
			Easting	Northing	Designation	Field parameters[a]	All other parameters required under mine permits[b]	Toxicity[c]	Water Level (Flow)	Temperature
Fording River upstream of FRO	FR_UFR1 (FO26)	E216777	651459	5566677	Reference	M	M	Q[d]	-	-
Henretta Creek upstream of FRO	FR_HC3 (HENUP)	E300096	655489	5567547	Reference	M	M	-	-	-
Fording River downstream of Henretta Creek	FR_FR1 (FODHE)	0200251	651304	5565451	Exposed	M	M	-	-	-
Multiplate Culvert on Greenhills Access Road	FR_MULTIPLATE[e] (MP1)	N/A	651238	5562482	Exposed	M[e]	M[e]	-	-	-
Fording River downstream of the North Tailings Pond	FR_FRNTP[e] (FOUSH)	N/A	651122	5561675	Exposed	M[e]	M[e]	-	-	-
Fording River upstream of the proposed AWTF discharge	FR_FR2 (FOUKI)	0200201	651781	5559984	Exposed	W/M	W/M	-	X	X
Fording River immediately downstream of the proposed AWTF discharge	GH_FR3[e] (FOBKS)	N/A	652125	5558620	Exposed	M[e]	M[e]	-	X	X
Fording River between Swift and Cataract	FR_FR4[e] (FOBSC)	0200311	652464	5557943	Exposed	M	M	-	X	X
Fording River Compliance Point	FR_FRCP1 (FOBCP)	E300071	652823	5557220	Exposed	W/M	W/M	Q	X	X
Fording River ~1150 m downstream of the Compliance Point	FR_FRCP1SW[e]	N/A	653324	5556197	Exposed	M[e]	M[e]	-	X	X
Fording River upstream Porter Creek	FR_FRRD (FRUPO)	E300097	653897	5555925	Exposed	M	M	-	X	X
Fording River downstream of Porter	GH_PC2[e] (FODPO)	E287431	653734	5555147	Exposed	M[e]	M[e]	-	X	X
Fording River u/s Chauncey Cr.	FR_FRABCH[e] (FO22)	N/A	655293	5552865	Exposed	M[e]	M[e]	-	X	X
Fording River upstream of Ewin Creek	FR_FR5[e] (FOUEW)	N/A	657174	5548724	Exposed	M[e]	M[e]	-	-	-

M - monthly; W/M - weekly during freshet (March 15 to July 15); Q - quarterly; S - September (once).

[a] Dissolved oxygen, water temperature, specific conductance, pH.

[b] Total and dissolved metals, total and dissolved organic carbon, nutrients, major ions, etc. as per Table 18 of Permit 107517.

[c] Chronic toxicity as per Permit 107517 requirements.

[d] Not required by Permit 107517, this locaiton is used as a reference location in the chronic toxicity program. Frequency may change depending on the needs of the program.

[e] Non permitted location, frequency may change.

🟩	Water quality sampling location not formally included in FRO LAEMP.
🟥	Additional sampling proposed for 2017 FRO LAEMP compared to design approved in 2016.

The proposed changes are explained as follows:

- Increase the number of biomass (Hess) sampling areas from two to nine to include the two upstream reference areas (HENUP and FO26) as well as five more mine-exposed areas (FOBKS, FOBSC, FR_FRCP1SW, FRUPO, and FO22; Table 2 compared to Table 1). The proposed sampling areas include those in the original, approved FRO study design. Hess samples yield results for a defined sampling area (i.e., biomass or density per square metre) so replicate samples collected by this method allow for detailed quantification of differences among areas and over time throughout the study area.
- Include five more areas for analysis of community structure and tissue selenium endpoints based on the CABIN kick and sweep sampling method (Environment Canada 2012[2]). The additional areas were sampled as part of the Regional Aquatic Effects Monitoring Program (RAEMP) in 2012 and 2015 (FOUNGD, FODNGD, MP1, FOUSH and FO22; Table 1 and Figure 1). Data from these extra sampling areas will provide more spatial and temporal resolution of community structure and tissue selenium concentrations within the Fording River.
- Include two new area for analysis of community structure and tissue selenium endpoints based on the CABIN kick and sweep sampling method (Environment Canada 2012). These areas are, FR_FRCP1SW and FRUPO (Fording River upstream Porter Creek).
- Collect replicate *Parapsyche* tissue selenium samples at all biological monitoring areas, because these organisms are large enough to be analyzed individually.
- Collect additional samples of individual taxa at all areas for selenium analysis.
- Collect replicate kick samples for community and tissue selenium analysis at the two biological sampling areas that most closely bracket upstream and downstream of the future AWTF discharge (FOUKI and FOBKS) for quality-assurance-quality control purposes.

Also, additional supporting information will be collected by Teck about other potential abiotic stressors that might contribute to the observed biological patterns, which include:

- Measurement of calcite at all biological sampling areas. Teck will be conducting a field audit in fall 2017 to ensure that all consultants are using similar methods for calcite measurement.
- Routine water quality monitoring for permit and non-permit parameters (Table 3).
- Measurement and characterization of sediment within the Fording River at the following locations; FOUKI, FOBKS, FOBCP, FRUPO, and FO22.
- Continued measurement of water temperatures and flow measurements as per Permit 107517 requirements at all permitted water monitoring stations, as well as installation of data loggers (temperature and level) at the following locations (FR_FR2, GH_FR3, FR_FR4, FR_FRCP1, FR_FRCP1SW, FR_FRRD, GH_PC2, FR_FRABCH).
- Evaluation of seasonal dewatering associated with the winter low flow period throughout the study area where changes in benthic invertebrate community structure have been observed. Monthly surveys will begin in Q4 and occur until surface water is fully re-connected in the following March/April. This would include GPS mapping of the wet/dry extents between FR2 and FRABCH, downloading water data logger data, and conducting discharge measurements at the water data logger locations.

It is expected that the above modifications to the 2017 study design will contribute to better understanding of the decreased Ephemeroptera abundance reported in the 2016 FRO LAEMP study report and support the needs of the FRO water licensing Operational Environmental

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[2] Environment Canada. 2012. Field Manual: Wadeable Streams. Canadian Aquatic Biomonitoring Network (CABIN).

Monitoring Program. If you have any questions or comments please do not hesitate to contact either me or Patti Orr.

Sincerely,

Minnow Environmental Inc.

COLLEGE OF APPLIED BIOLOGY
Shari A. Weech
R.P. Bio
#1784
CAB

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Senior Aquatic Toxicologist

cc. Patti Orr, Senior Aquatic Scientist
Tyrell Worrall, Aquatic Ecologist

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May 31, 2018

Ms. Carla Fraser
Manager, Regional Water Monitoring
Teck Coal Limited
PO Box 1777
Sparwood BC, V0B 2G0

Re: Updated Sampling Design for 2018 FRO LAEMP

Dear Carla,

This letter has been prepared in response to discussions with the Environmental Monitoring Committee (EMC) in April and May regarding updates to the 2018 Fording River Operations (FRO) Local Aquatic Effects Monitoring Program (LAEMP) sampling design based on findings from the 2017 program.

The FRO LAEMP design was developed in consultation with the EMC, submitted to the Ministry of Environment and Climate Change Strategy (ENV) in May 2016 (Minnow 2016) in accordance with the requirements of Permit 107517, and subsequently approved by the ENV Director on October 24, 2016. The objective of the LAEMP is to monitor potential aquatic effects related to continued development of FRO and the future commissioning of an active water treatment facility (AWTF) that is planned to treat waters from Cataract, Swift and Kilmarnock creeks (Figure 1). In consideration of potential existing and future mine-related influences at FRO, the following key questions were developed in consultation with the EMC to guide study design development:

1. Are nitrate concentrations increasing, and if so, are they adversely affecting biota?
2. Is active water treatment affecting biological productivity downstream in the Fording River?
3. Are tissue selenium concentrations reduced downstream from the AWTF?
4. Is AWTF operation affecting aquatic biota through thermal effects or concentrations of treatment-related constituents other than nutrients or selenium?
5. Is re-direction of water potentially affecting biota in the Fording River?

The original study design was intended to cover the 2016 to 2018 time period; however results of the 2016 LAEMP identified a spatial and temporal decrease in % Ephemeroptera below the normal range in the reach extending between Swift Creek and Ewin Creek (Minnow 2017a). Following an adaptive management framework, this prompted a study design adjustment for the 2017 FRO LAEMP sampling period dated September 5, 2017, and submitted to ENV on October 3, 2017 (Table 1; Minnow 2017b). The intent of the adjustment was to increase spatial resolution in the area experiencing changes in benthic invertebrate community structure, and to further investigate the cause(s) of the observed change. The study design was also adjusted to address sampling requirements associated with the FRO water licensing Operational Environmental Monitoring Program.

In May 2018, two additional Key Questions were added to the LAEMP to address the 2017 to 2018 study design adjustments, as follows:

6. What are the factors contributing to the variations in percent Ephemeroptera?
7. To support monitoring associated with the requirements of the water license and environmental flow needs assessment, what is the benthic invertebrate community structure in the reach of the Fording River that goes dry, and can changes be correlated with flow conditions?

The results of the 2017 FRO LAEMP did not identify a single, direct cause of the decrease in % Ephemeroptera in the upper Fording River; however, analysis did suggest that the observed change was likely due to a combination of both mine-related and natural factors (e.g., water quality, calcite, substrate size and flow) (Minnow 2018a).

Based on findings and discussions with the EMC, several changes to the sampling design for 2018 are proposed (Table 1 and 2):

- To increase statistical power and help characterize the variance between areas, triplicate kick samples for benthic invertebrate community will be collected in September 2018. The exceptions are RG_FOBCP and RG_FO22, where five replicates will be collected to fulfill requirements under the 2018 to 2020 RAEMP study design (Minnow 2018b).
- Benthic invertebrate tissue chemistry sampling will consist of composite-taxa samples only, as analysis showed no advantage of individual-taxon samples over composite-taxa samples to detect changes over time (Minnow 2018b).

In addition, to further understand EMC concerns regarding early emergence as a cause of the decrease in % Ephemeroptera (Key Question #6), it is also proposed that additional benthic invertebrate community sampling be completed in late June and early August to characterize the temporal changes in benthic invertebrate community structure in the upper Fording River over the post-freshet open water season (Table 3). These sampling periods will likely bracket the emergence of the Ephemeroptera taxa of interest (USGS 2016), and will cover the timeframe when an increasing trend in temperature was observed in the upper Fording River (Minnow 2018a). Sampling will include a single kick sample for benthic invertebrate community, with an associated water sample and supporting habitat measurements (e.g., pebble size, calcite index, water velocity, *in situ* water quality, etc.).

To support a greater characterization of the dewatered reach in the upper Fording River (Key Question #7), the dewatering survey completed in 2017 will be repeated as follows:

- Continued data logging (temperature and level) at the following locations (FR_FR2, FR_FR4, FR_FRCP1, FR_FRCP1SW, FR_FRRD, GH_PC2, FR_FRABCH) and reinstallation of the data logger at GH_FR3, which was damaged/lost in February/March 2018.
- Evaluation of seasonal dewatering associated with the winter low flow period throughout the study area where changes in benthic invertebrate community structure have been observed. Monthly surveys will begin in Q4 and occur until surface water is fully reconnected in the following March/April. This will include mapping of the wet/dry extents between FR_FR2 and FR_FRABCH and conducting discharge measurements where feasible at the data logger locations.

It is expected that the above modifications to the 2018 sampling design will contribute to better understanding of the decrease in % Ephemeroptera reported in the 2016 and 2017 FRO LAEMP reports (Key Question #6) and will support the needs of the FRO water licensing Operational Environmental Monitoring Program (Key Question #7). If you have any questions or comments, please do not hesitate to contact either me or Shari Weech.

Sincerely,

Minnow Environmental Inc.

Jennifer Ings, Ph.D.

Aquatic Scientist

cc: Shari Weech, Ph.D., R.P. Bio., Senior Aquatic Toxicologist

References

Minnow (Minnow Environmental Inc.). 2016. Study Design for the Fording Swift Local Aquatic Effects Monitoring Program (LAEMP). Project #167202.0047

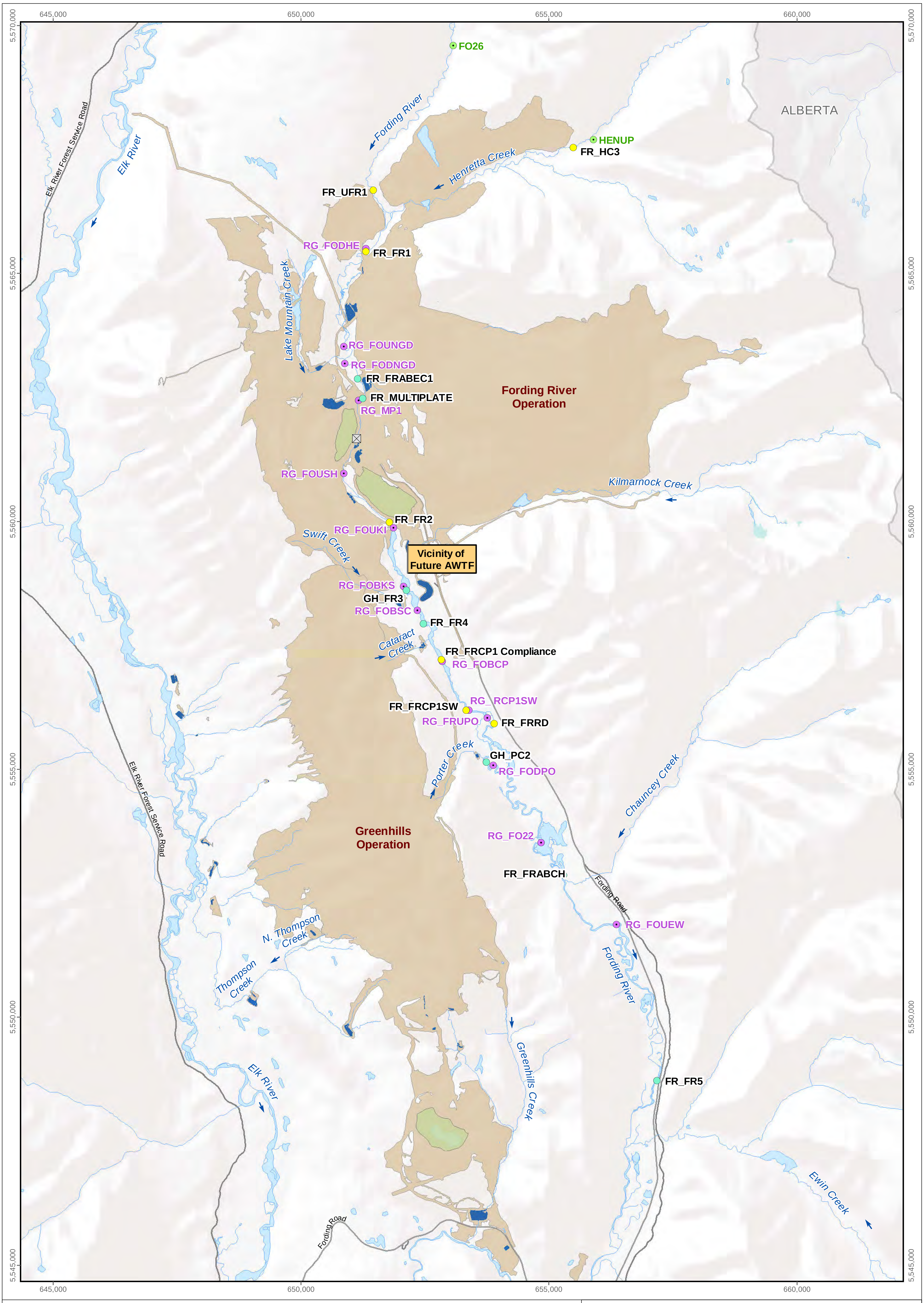
Minnow. 2017a. Fording River Operations Local Aquatic Effects Monitoring Program (LAEMP) Report, 2016. Prepared for Teck Coal Limited, Sparwood, British Columbia. May. Project #167202.0075.

Minnow. 2017b. Updated Sampling Design for 2017 FRO LAEMP. Prepared for Teck Coal Limited, Sparwood, British Columbia. September. Project #167202.0075.

Minnow. 2018a. Fording River Operations Local Aquatic Effects Monitoring Program (LAEMP) Report, 2017. Prepared for Teck Coal Limited, Sparwood, British Columbia. May. Project #177202.0022. In preparation.

Minnow. 2018b. Study Design for the Regional Aquatic Effects Monitoring Program, 2018 to 2020. Project #177202.0053.

USGS (U.S. Geological Survey). 2016. A Database of Lotic Invertebrate Traits for North America. Available: https://pubs.usgs.gov/ds/ds187/ (accessed March 15, 2018).



LEGEND

☒ Hydrometric Station

● Water Monitoring Station (Non-permit)

● Water Monitoring Station (Permit)

Biological Sampling Area

● Mine-exposed

● Reference

▨ Settling Pond

▨ Tailings Pond

▨ Teck Coal Mine Operation

Monitoring Locations in Upper Fording River

0 1 2 4
km

N
W E
S

Projection: North American Datum 1983 UTM Zone 11
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Date: May 2018
Project 187202.0022

Figure 1

Document Path: S:\Projects\187202\187202.0022 - FRO LAEMP 2018\GIS\SD Letter\18-22 Fig 1.mxd

Table 1: Summary of Changes to FRO LAEMP Biological Monitoring for September, 2018

Teck Water Quality		Water Quality Sample[a]			Sediment Quality			Benthic Invertebrates																	
								Hess			Kick and Sweep														
								Biomass and community (# of samples)			Community (# of samples)			Rhyacophilidae Selenium (# of samples)			Ephemeroptera Selenium (# of samples)			Parapsyche Selenium (# of samples)			Composite-taxon Selenium[a] (# of samples)		
		2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018
Reference	RG_FO26 (FR_UFR1)	1	1	1	-	-	3	-	10	10	1	1	3	1	1	-	-	1	-	-	3	-	1	1	3
	RG_HENUP (FR_HC3)	1	1	1	-	-	3	-	10	10	1	1	3	1	1	-	-	1	-	-	3	-	1	1	3
Mine-exposed	RG_FODHE (FR_FR1)	1	1	1	-	-	-	-	-	-	1	1	3	-	1	-	-	1	-	-	3	-	1	1	3
	RG_FOUNGD	-	1	1	-	-	-	-	-	-	-	1	3	-	1	-	-	1	-	-	3	-	-	1	3
	RG_FODNGD	-	1	1	-	-	-	-	-	-	-	1	3	-	1	-	-	1	-	-	3	-	-	1	3
	RG_MP1 (FR_MULTIPLATE)	-	1	1	-	-	-	-	-	-	-	1	3	-	1	-	-	1	-	-	3	-	-	1	3
	RG_FOUSH (FR_FRNTP)	-	1	1	-	-	-	-	-	-	-	1	3	-	1	-	-	1	-	-	3	-	-	1	3
	RG_FOUKI (FR_FR2)	1	1	1	-	5	5	10	10	10	3	3	3	1	3	-	-	3	-	-	3	-	3	3	3
	RG_FOBKS (GH_FR3)	1	1	1	-	5	5	-	10	10	3	3	3	-	3	-	-	3	-	-	3	-	3	3	3
	RG_FOBSC (FR_FR4)	1	1	1	-	-	-	-	10	10	1	1	3	-	1	-	-	1	-	-	3	-	1	1	3
	RG_FOBCP (FR_FRCP1)	1	1	1	-	5	5	10	10	10	1	1	5	1	1	-	-	1	-	-	3	-	1	1	5
	RG_FRCP1SW (FR_FRCP1SW)	-	1	1	-	-	-	-	10	10	-	1	3	-	1	-	-	1	-	-	3	-	-	1	3
	RG_FRUPO (FR_FRRD)	-	1	1	-	5	5	-	10	10	-	1	3	-	1	-	-	1	-	-	3	-	-	1	3
	RG_FODPO (GH_PC2)	1	1	1	-	-	-	-	-	-	1	1	3	1	1	-	-	1	-	-	3	-	1	1	3
	RG_FO22 (FR_FRABCH)	-	1	1	-	5	5	-	10	10	-	1	5	1	1	-	-	1	-	-	3	-	-	1	5
	RG_FOUEW (FR_FR5)	1	1	1	-	-	-	-	-	-	1	1	3	1	1	-	-	1	-	-	3	-	1	1	3

[a] Analysis will include a full suite of metals in 2018

Table 2: Summary of Water Quality Monitoring Associated with the LAEMP

Location Description	Water Station ID (associated biological Station ID in brackets)	EMS Number	UTM (11U)		Water Quality Samples				Data Loggers	
			Easting	Northing	Designation	Field parameters[a]	All other parameters required under mine permits[b]	Toxicity[c]	Water Level (Flow)	Temperature
Fording River upstream of FRO	FR_UFR1	E216777	651459	5566677	Reference	M	M	Q[d]	-	-
Henretta Creek upstream of FRO	FR_HC3	E300096	655489	5567547	Reference	M	M	-	-	-
Fording River downstream of Henretta Creek	FR_FR1	0200251	651304	5565451	Exposed	M	M	-	-	-
Multiplate Culvert on Greenhills Access Road	FR_MULTIPLATE[e]	N/A	651238	5562482	Exposed	M[e]	M[e]	-	-	-
Fording River downstream of the North Tailings Pond	FR_FRNTP[e]	N/A	651122	5561675	Exposed	M[e]	M[e]	-	-	-
Fording River upstream of the proposed AWTF discharge	FR_FR2	0200201	651781	5559984	Exposed	W/M	W/M	-	X	X
Fording River immediately downstream of the proposed AWTF discharge	GH_FR3[e]	N/A	652125	5558620	Exposed	M[e]	M[e]	-	X	X
Fording River between Swift and Cataract	FR_FR4[e]	0200311	652464	5557943	Exposed	M	M	-	X	X
Fording River Compliance Point	FR_FRCP1	E300071	652823	5557220	Exposed	W/M	W/M	Q	X	X
Fording River ~1150 m downstream of the Compliance Point	FR_FRCP1SW[e]	N/A	653324	5556197	Exposed	M[e]	M[e]	-	X	X
Fording River upstream Porter Creek	FR_FRRD	E300097	653897	5555925	Exposed	M	M	-	X	X
Fording River downstream of Porter	GH_PC2[e]	E287431	653734	5555147	Exposed	M[e]	M[e]	-	X	X
Fording River u/s Chauncey Cr.	FR_FRABCH[e]	N/A	655293	5552865	Exposed	M[e]	M[e]	-	X	X
Fording River upstream of Ewin Creek	FR_FR5[e]	N/A	657174	5548724	Exposed	M[e]	M[e]	-	-	-

M - monthly; W/M - weekly during freshet (March 15 to July 15); Q - quarterly; S - September (once).

[a] Dissolved oxygen, water temperature, specific conductance, pH.

[b] Total and dissolved metals, total and dissolved organic carbon, nutrients, major ions, etc. as per Table 18 of Permit 107517.

[c] Chronic toxicity as per Permit 107517 requirements.

[d] Not required by Permit 107517, this locaiton is used as a reference location in the chronic toxicity program. Frequency may change depending on the needs of the program.

[e] Non permitted location, frequency may change.

■	Water quality sampling location not formally included in FRO LAEMP.
□	Additional sampling proposed for 2017/2018 FRO LAEMP compared to design approved in 2016.

Table 3: Samples Collected for the 2018 FRO LAEMP in June and August

Stream Name	Biological Area Code	Biological Monitoring Area UTM Coordinates		Water	Benthic Invertebrates
		Easting	Northing	Chemistry	CABIN kick sample
Fording River	RG_FO26	653049	5569608	1	1
Henretta Creek	RG_HENUP	655782	5567704	1	1
Fording River	RG_FODHE	651311	5565421	1	1
Fording River	RG_FOUNGD	650993	5563529	1	1
Fording River	RG_FODNGD	650883	5563190	1	1
Fording River	RG_MP1	651158	5562442	1	1
Fording River	RG_FOUSH	650863	5560970	1	1
Fording River	RG_FOUKI	651841	5559848	1	1
Fording River	RG_FOBKS	652084	5558649	1	1
Fording River	RG_FOBSC	652340	5558197	1	1
Fording River	RG_FOBCP	652865	5557150	1	1
Fording River	RG_FRCP1SW	653324	5556197	1	1
Fording River	RG_FRUPO	653899	5555938	1	1
Fording River	RG_FODPO	653899	5555080	1	1
Fording River	RG_FO22	654841	5553523	1	1
Fording River	RG_FOUEW	656360	5551884	1	1

APPENDIX B
BENTHIC INVERTEBRATES

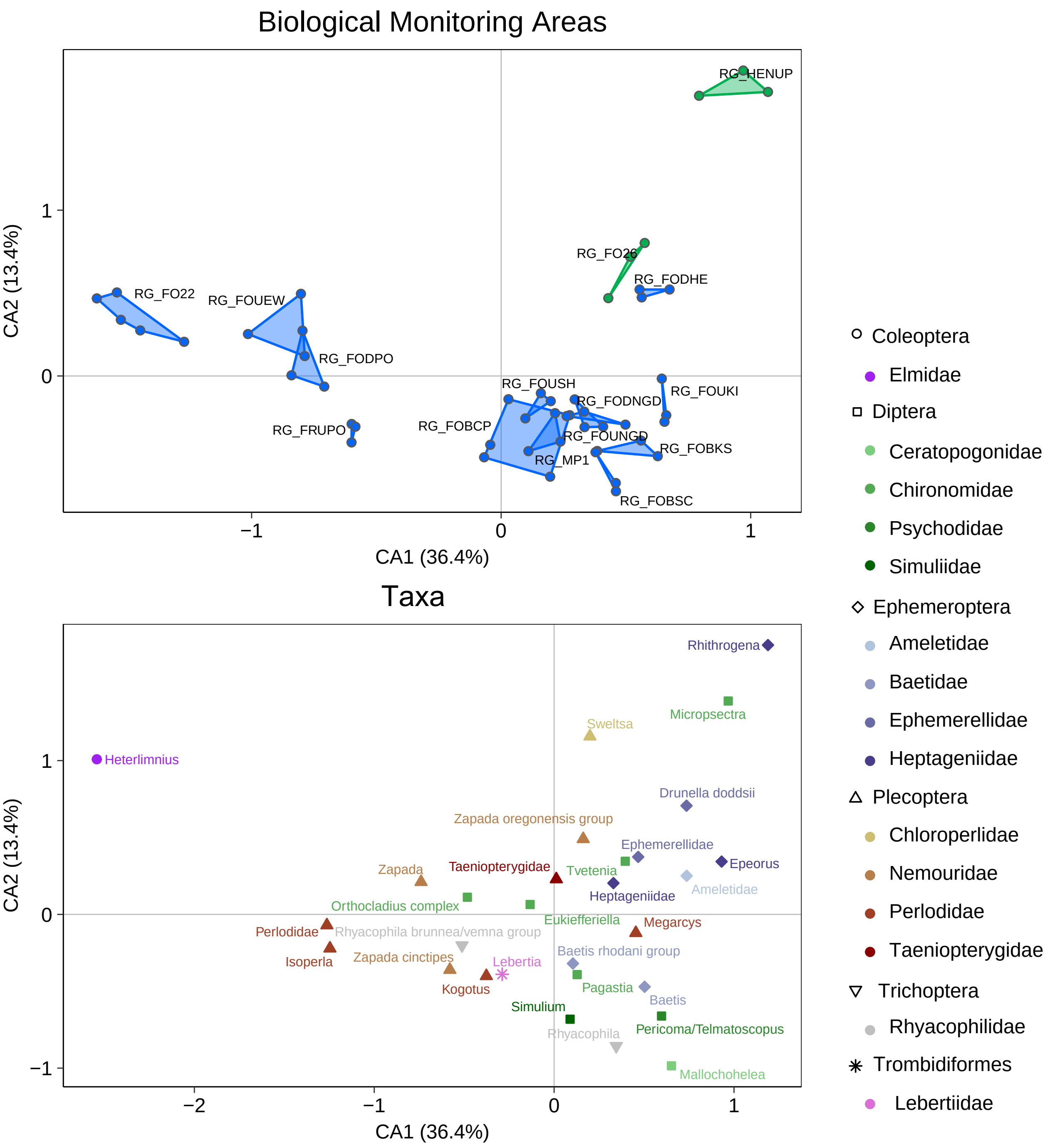


Figure B.1: Scatterplot of Correspondence Analysis (CA) Axis Scores for Benthic Invertebrate Relative Proportions at the Lowest Practical Level, FRO LAEMP 2018

Notes: Relative taxa proportions were $\log_{10}[x+1]$ transformed before CA calculations. Taxa present in less than 1% of samples were excluded from the analysis. Symbol shape depicts Order whereas species of each Family are represented by the same colour.

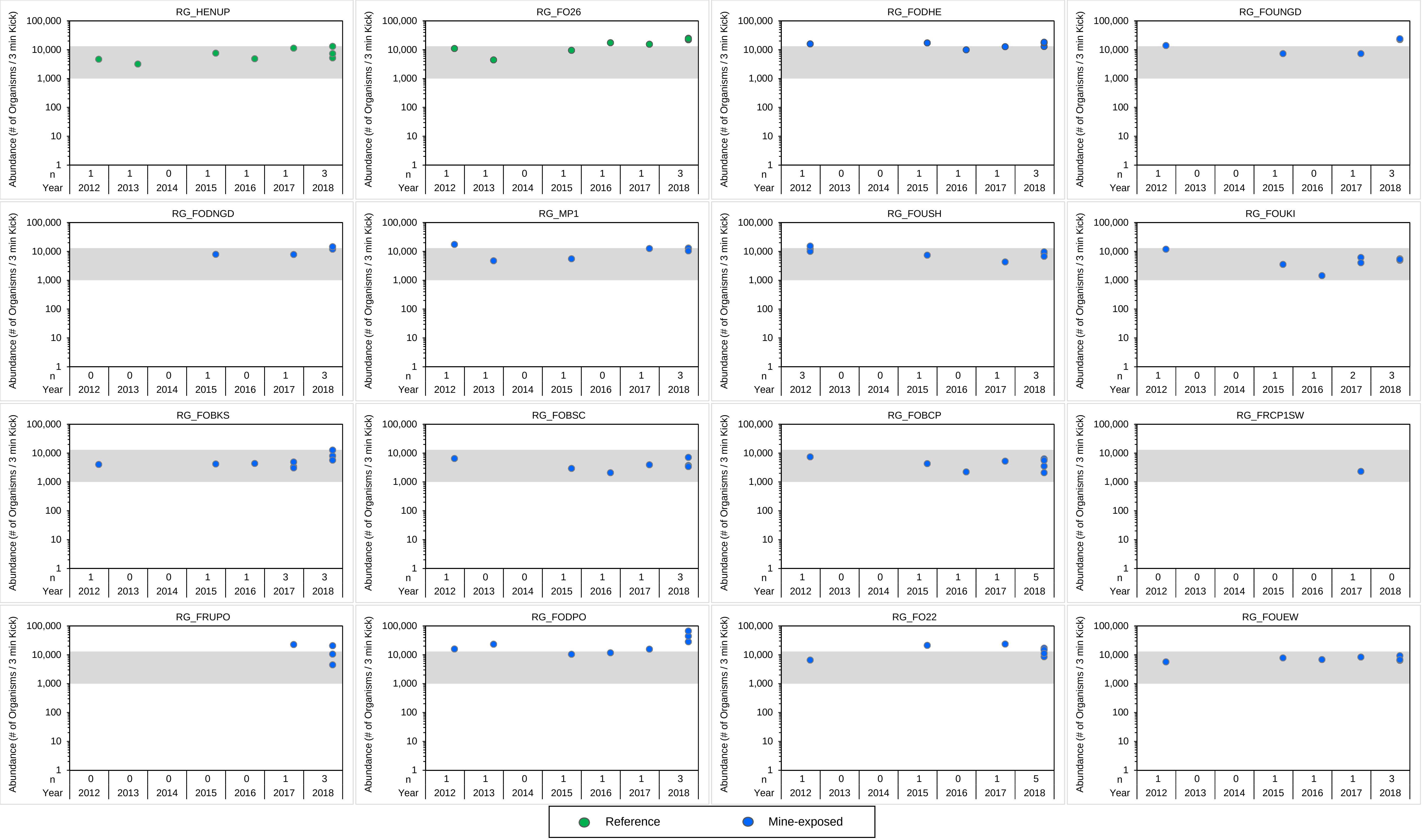


Figure B.2: **Benthic Invertebrate Community Abundance, FRO LAEMP, 2012 to 2018**

Notes: Grey shading represents 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). RG_FRCP1SW was dry in September 2018 so it was not sampled.

n = the sample size for a given year.

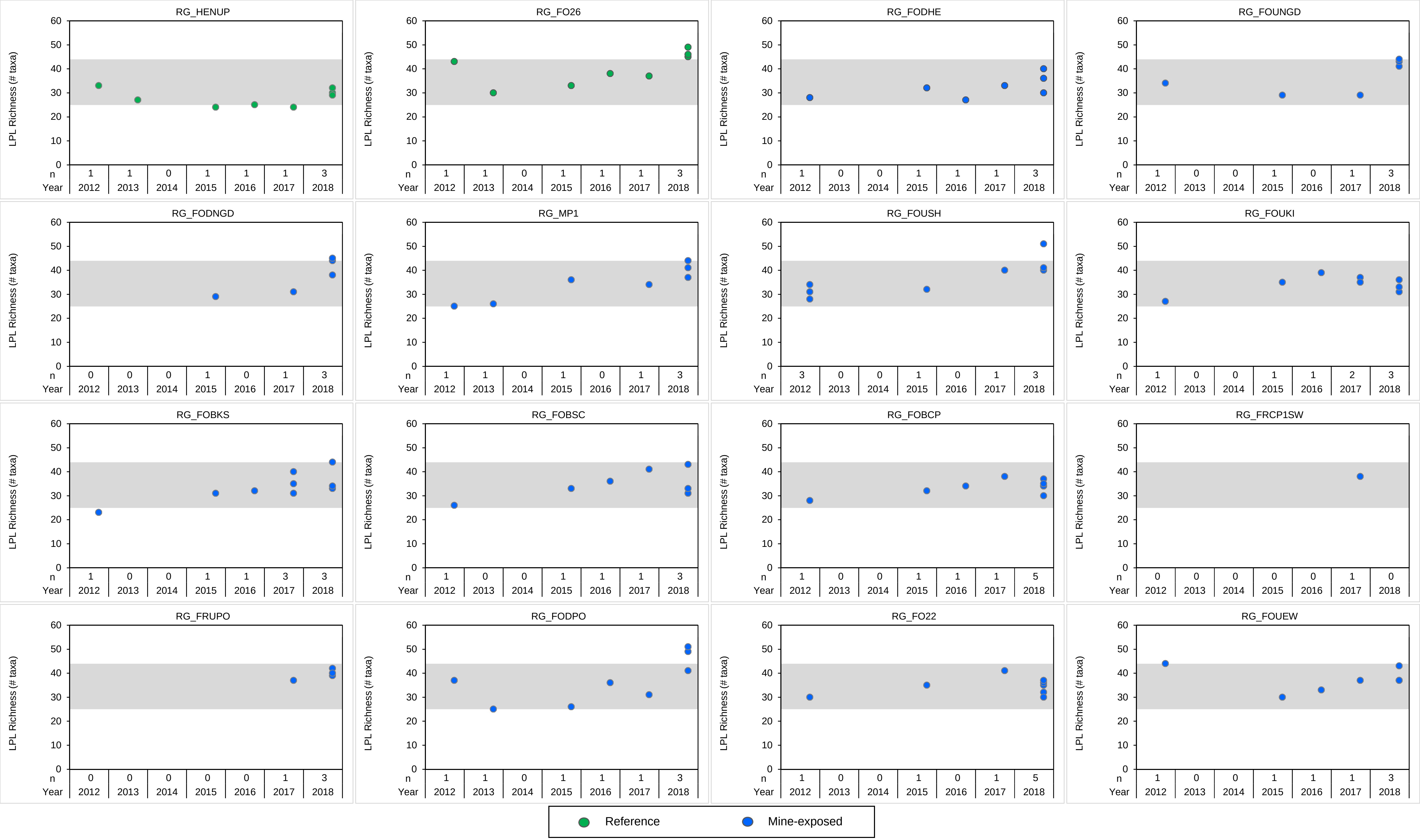


Figure B.3: **Benthic Invertebrate LPL Richness, FRO LAEMP, 2012 to 2018**

Note: Grey shading represents 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). RG_FRCP1SW was dry in September 2018 so it was not sampled.

n = the sample size for a given year.

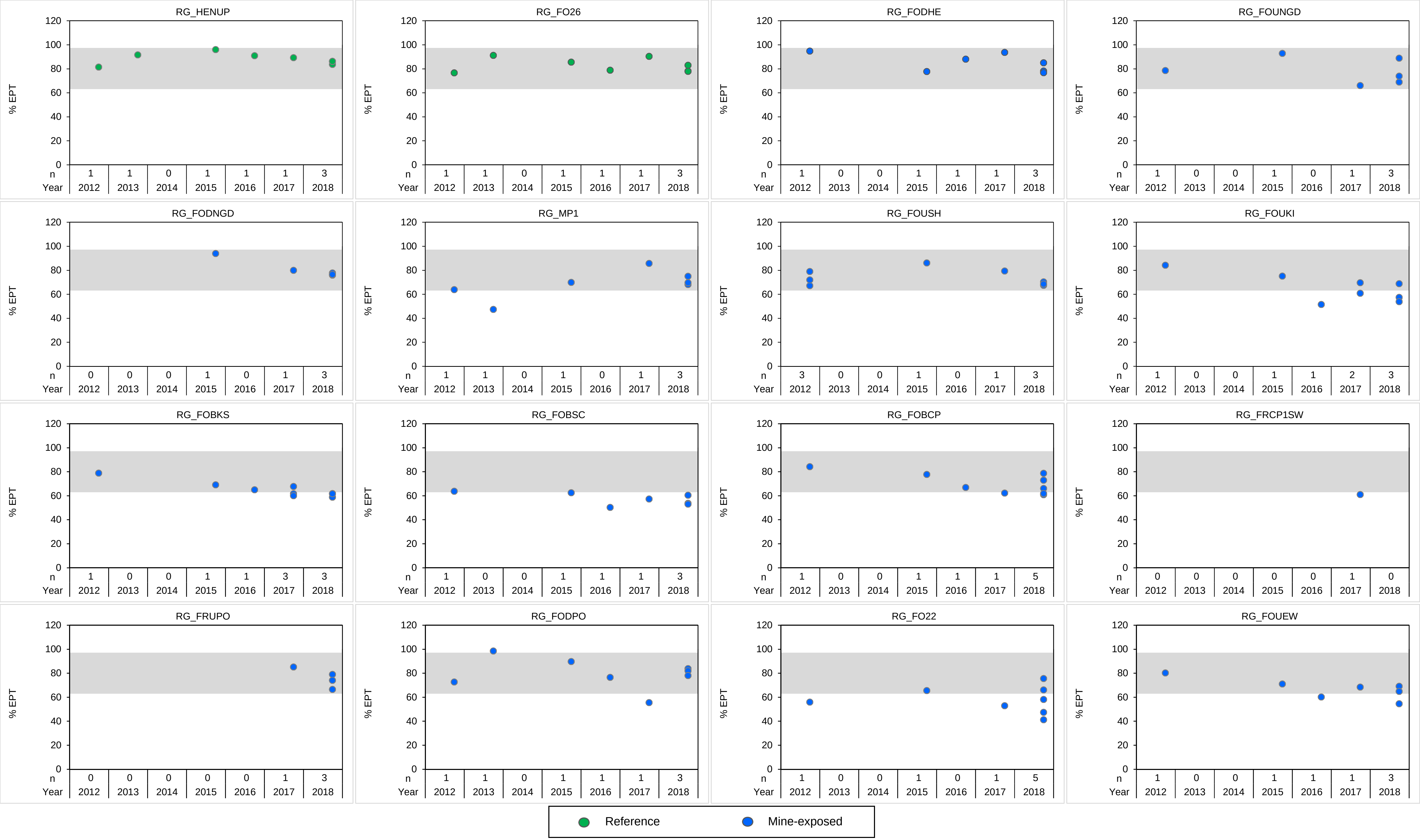


Figure B.4: **Benthic Invertebrate % EPT, FRO LAEMP, 2012 to 2018**

Note: Grey shading represents 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). RG_FRCP1SW was dry in September 2018 so it was not sampled.

n = the sample size for a given year.

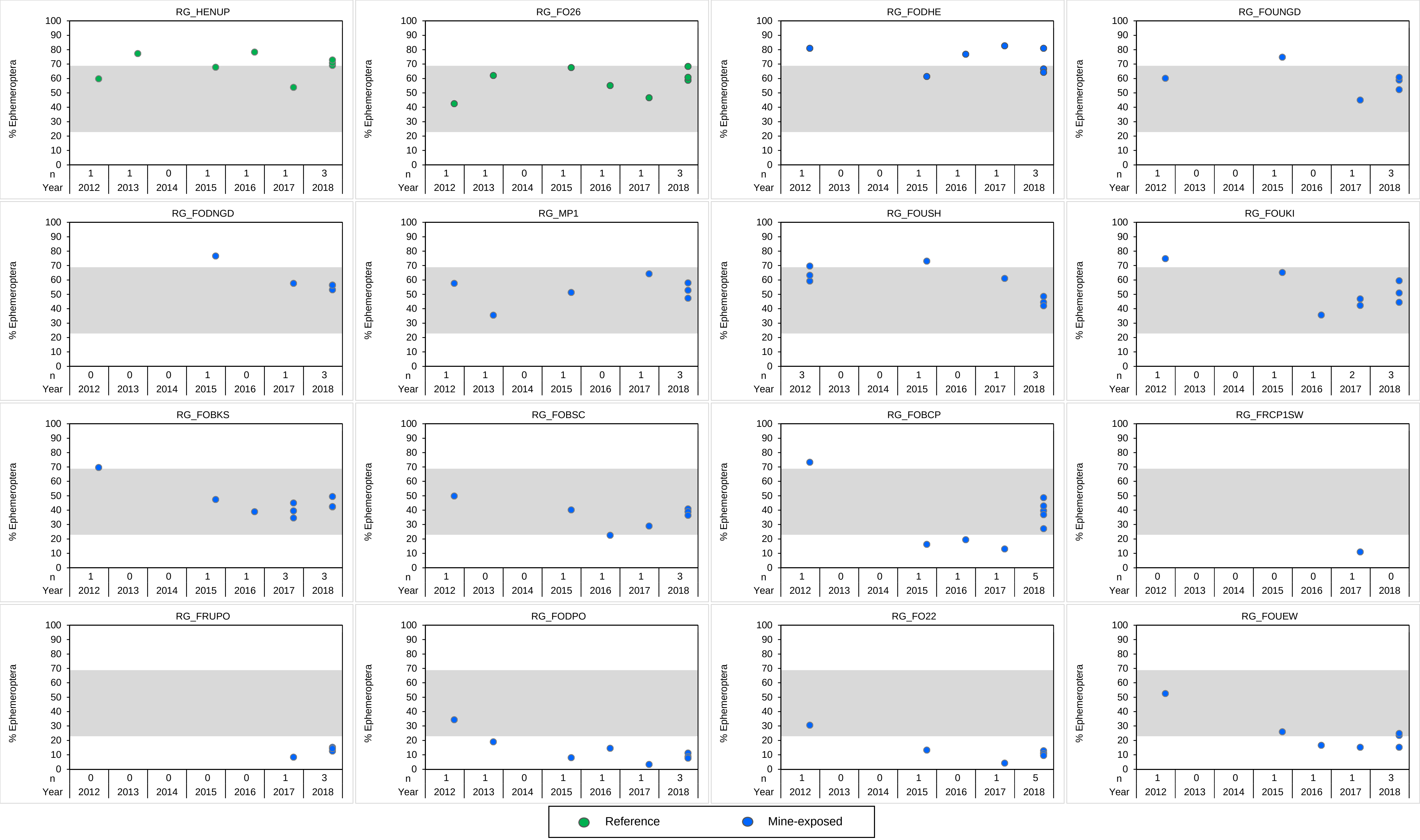


Figure B.5: **Benthic Invertebrate % Ephemeroptera, FRO LAEMP, 2012 to 2018**

Note: Grey shading represents 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). RG_FRCP1SW was dry in September 2018 so it was not sampled.

n = the sample size for a given year.

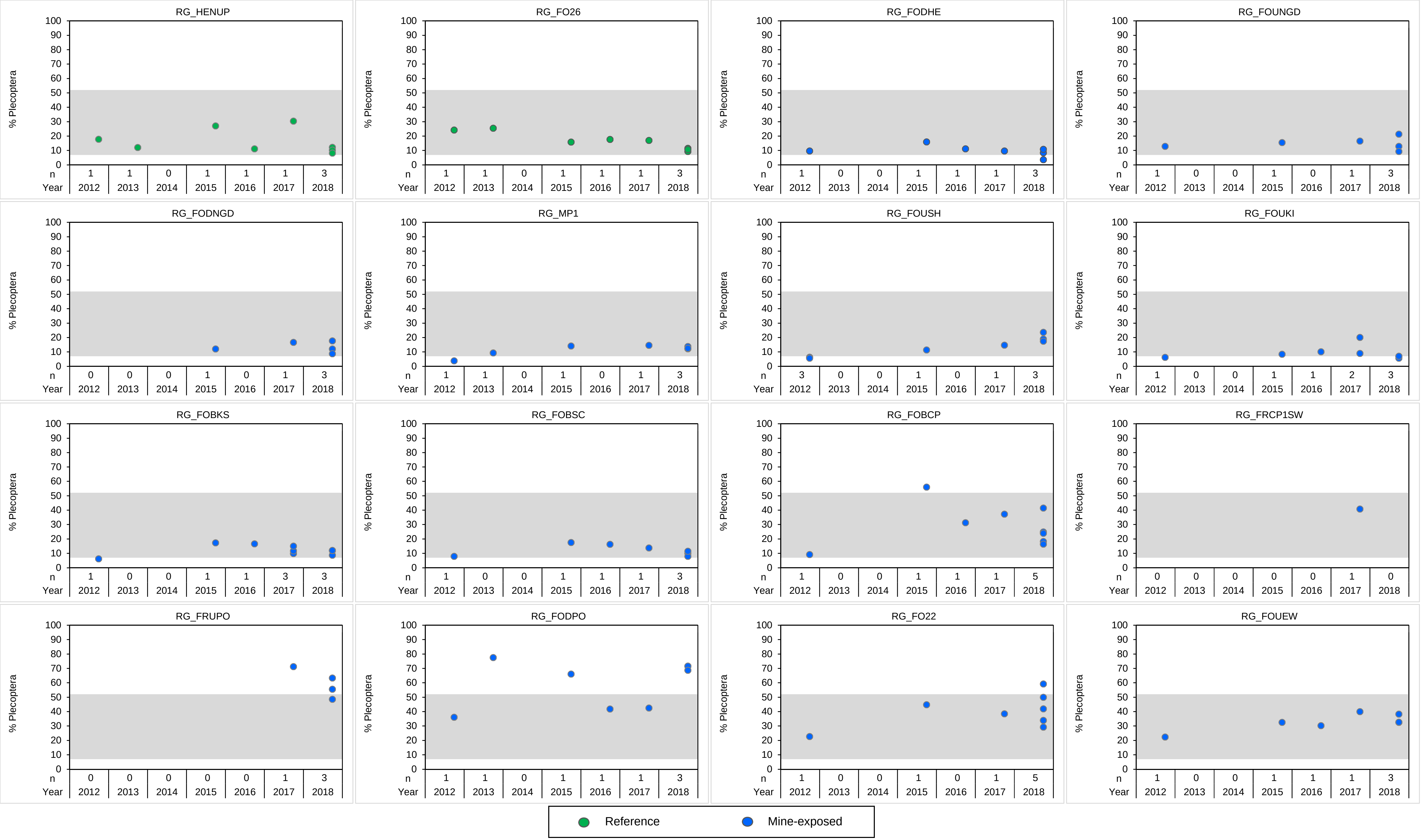


Figure B.6: **Benthic Invertebrate % Plecoptera, FRO LAEMP, 2012 to 2018**

Note: Grey shading represents 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). RG_FRCP1SW was dry in September 2018 so it was not sampled.

n = the sample size for a given year.

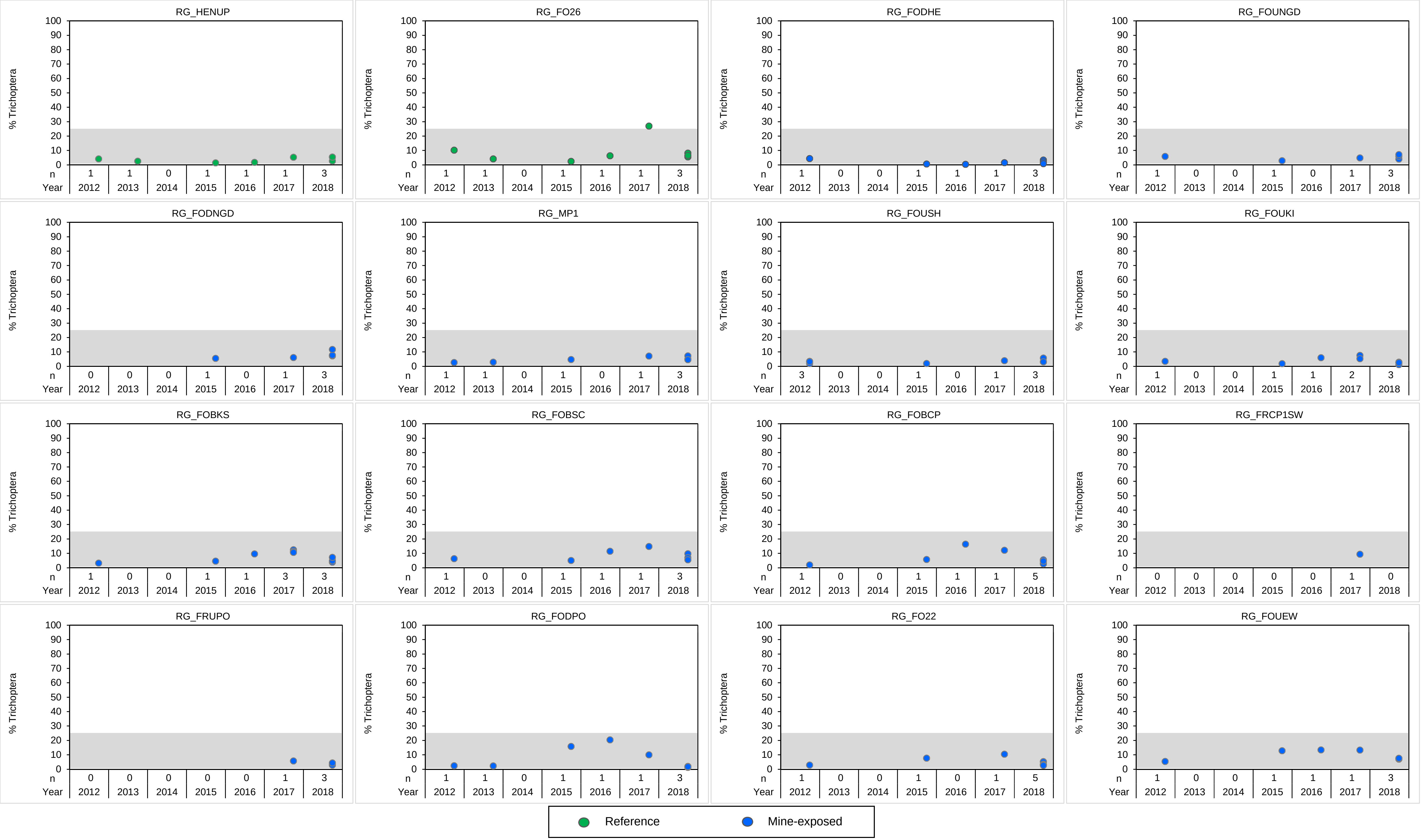


Figure B.7: Benthic Invertebrate % Trichoptera, FRO LAEMP, 2012 to 2018

Note: Grey shading represents the normal range defined as the 2.5^{th} and 97.5^{th} percentiles of the 2012 and 2015 reference area data from the Regional Aquatic Environmental Monitoring Program (RAEMP). RG_FRCP1SW was dry in September 2018 so it was not sampled.

n = the sample size for a given year.

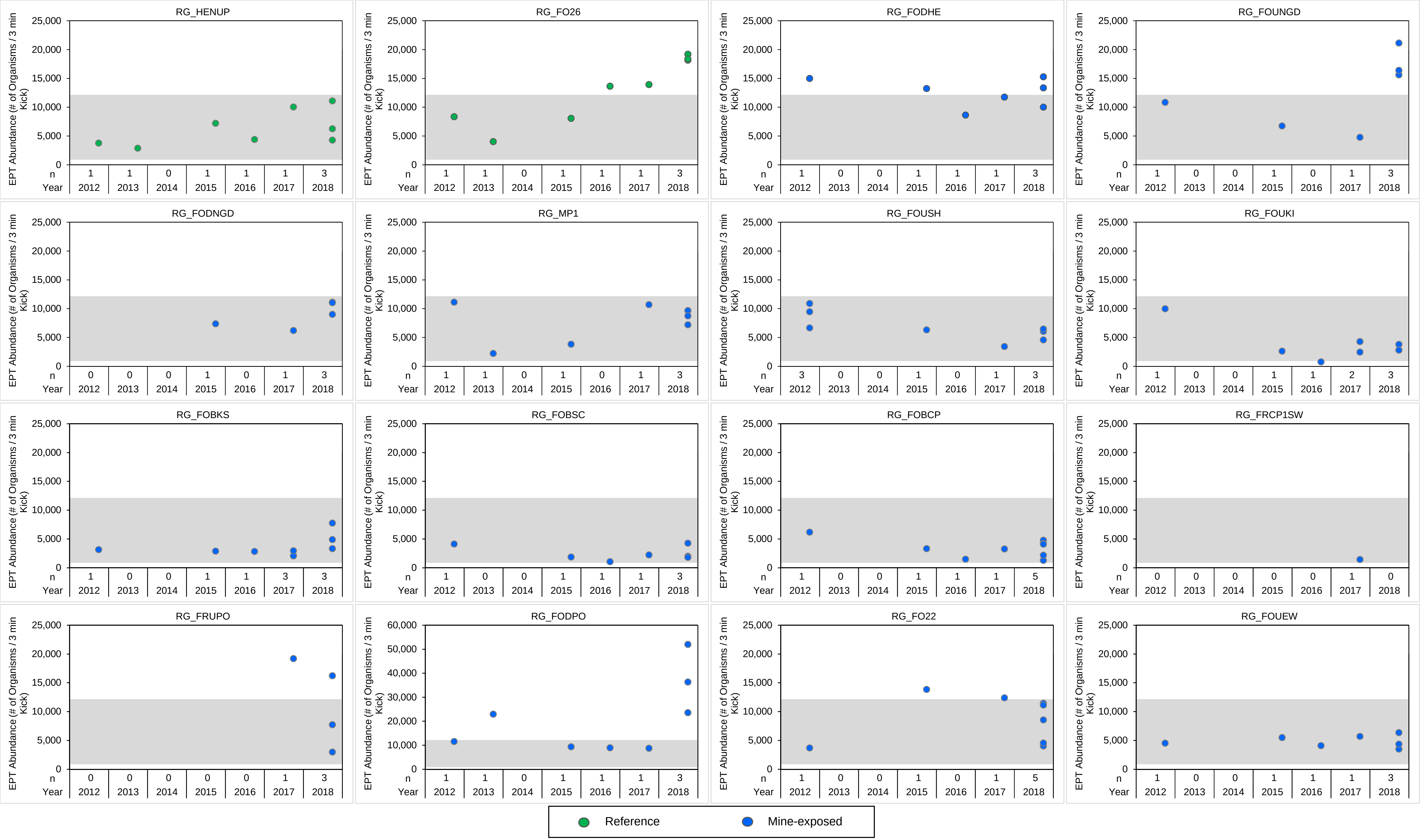


Figure B.8: **Benthic Invertebrate EPT Abundance , FRO LAEMP, 2012 to 2018**

Note: Grey shading represents 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). RG_FRCP1SW was dry in September 2018 so it was not sampled.

n = the sample size for a given year.

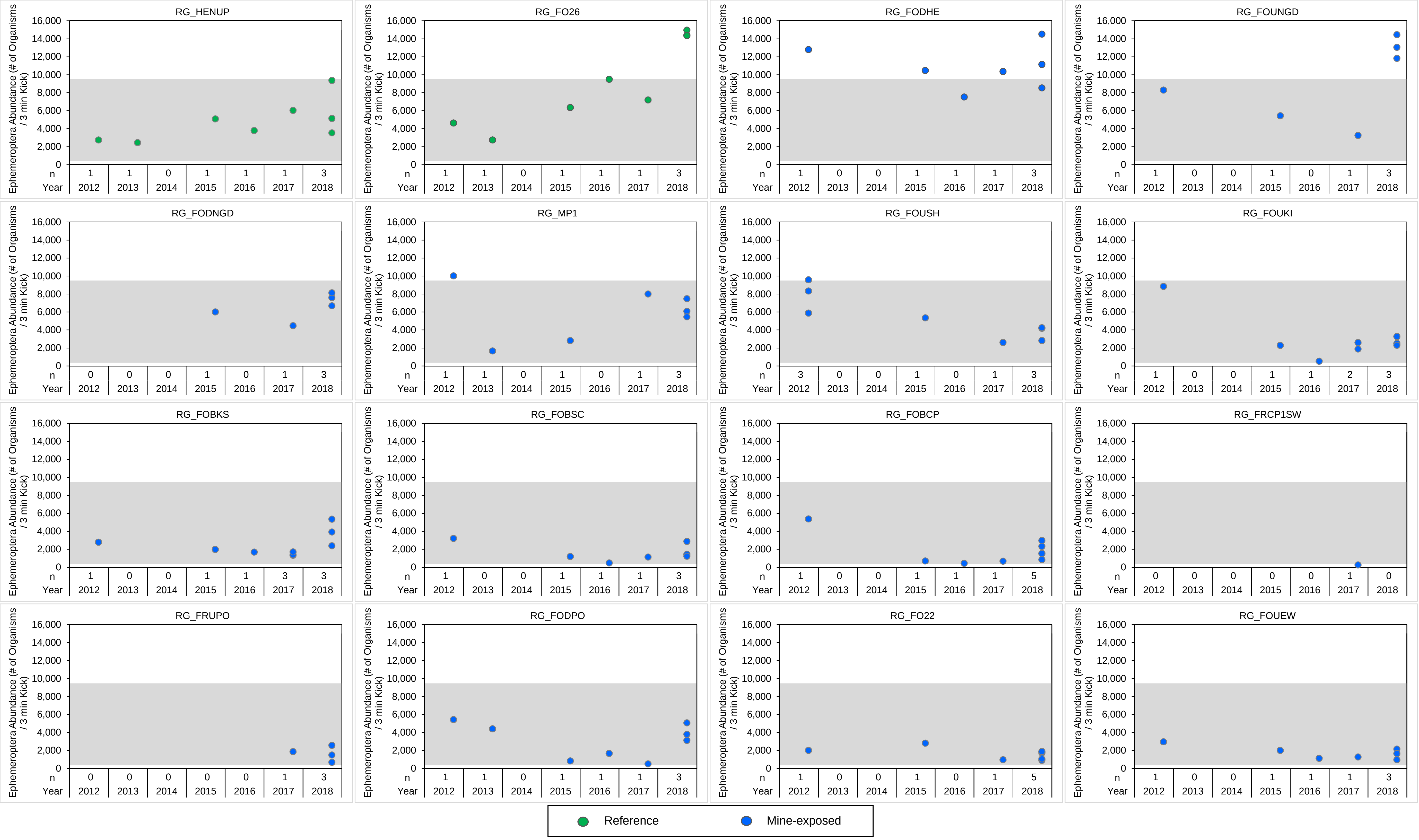


Figure B.9: **Benthic Invertebrate Ephemeroptera Abundance, FRO LAEMP, 2012 to 2018**

Note: Grey shading represents 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). RG_FRCP1SW was dry in September 2018 so it was not sampled.

n = the sample size for a given year.

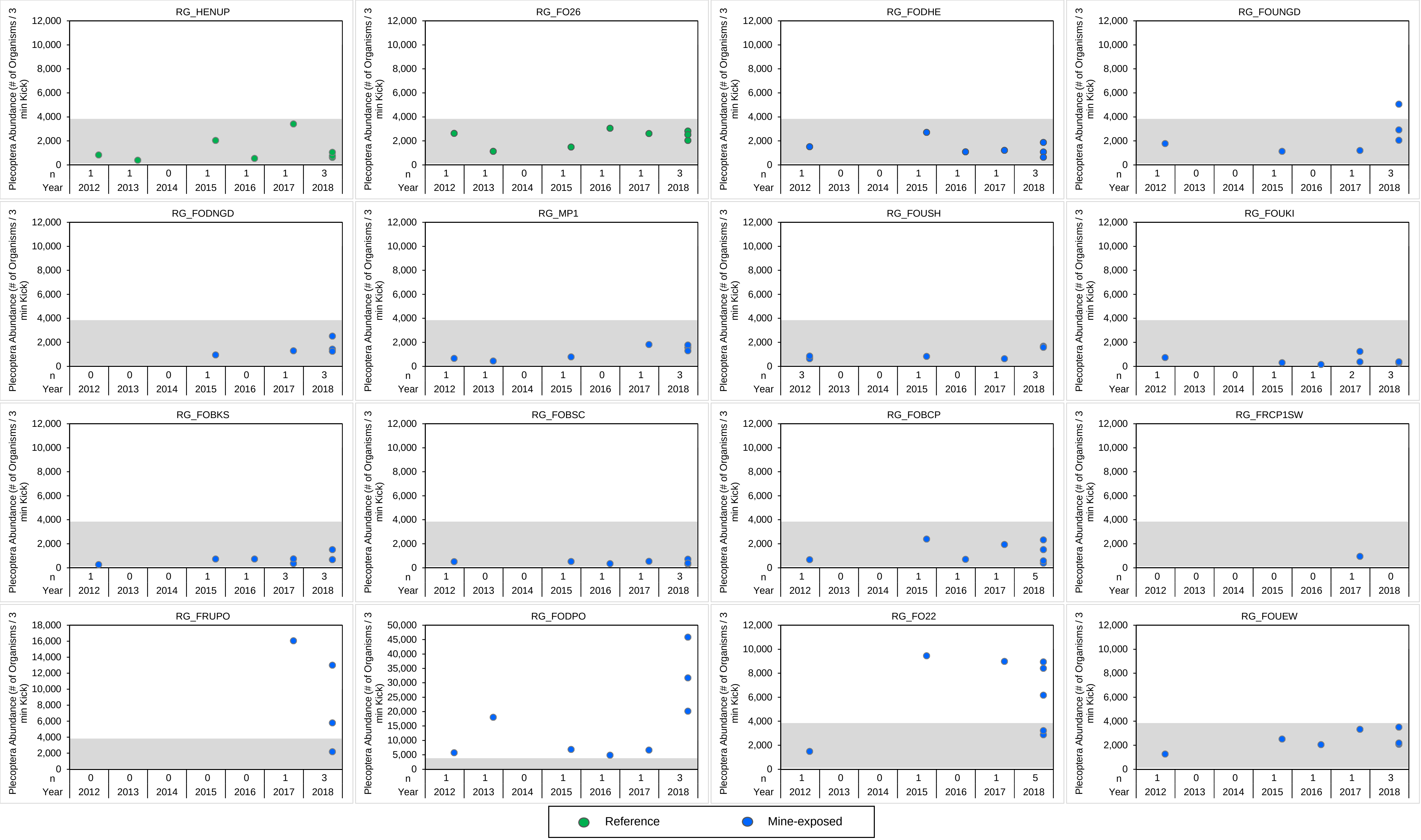


Figure B.10: **Benthic Invertebrate Plecoptera Abundance, FRO LAEMP, 2012 to 2018**

Note: Grey shading represents 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). RG_FRCP1SW was dry in September 2018 so it was not sampled.

n = the sample size for a given year.

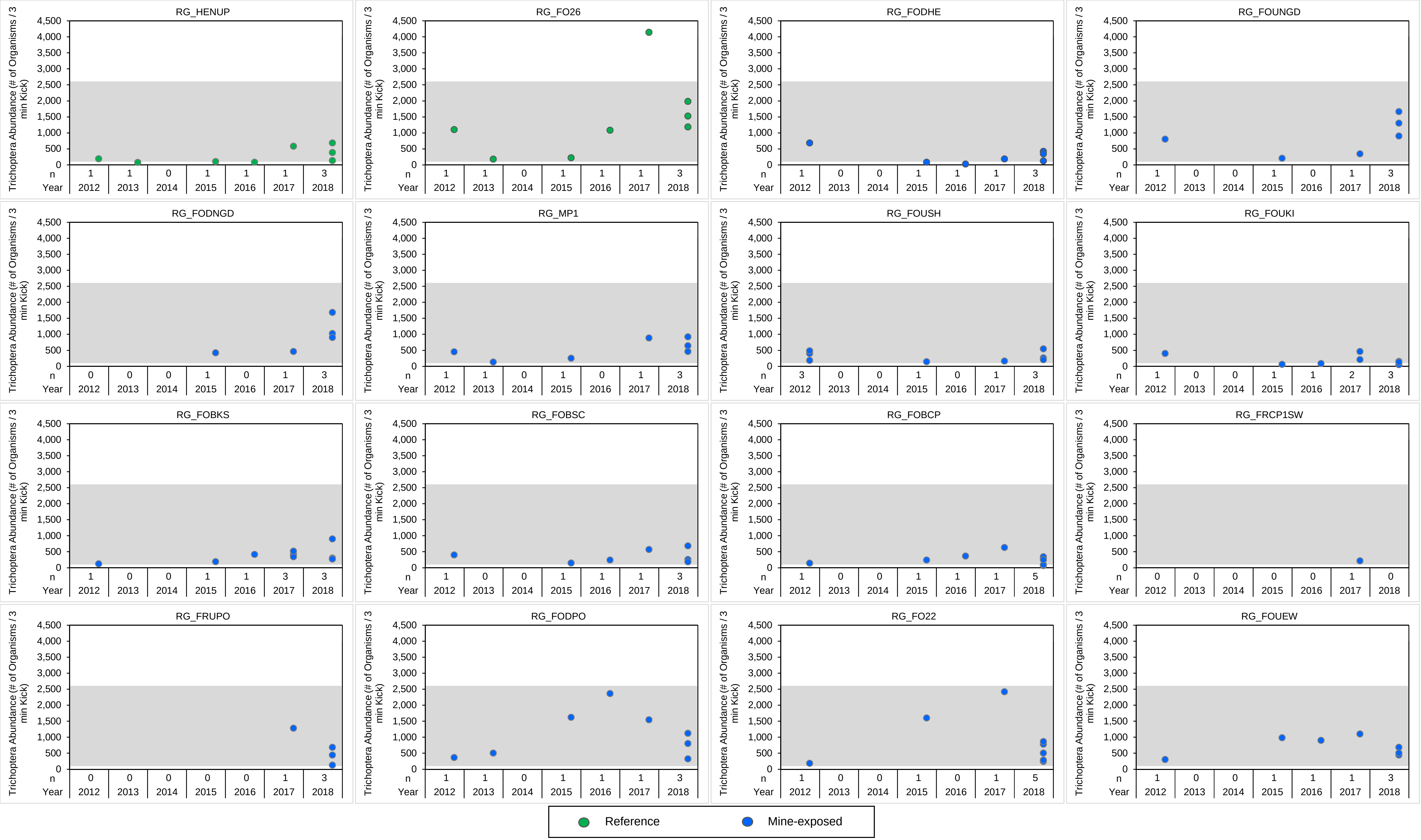


Figure B.11: **Benthic Invertebrate Trichoptera Abundance, FRO LAEMP, 2012 to 2018**

Note: Grey shading represents 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). RG_FRCP1SW was dry in September 2018 so it was not sampled.

n = the sample size for a given year.

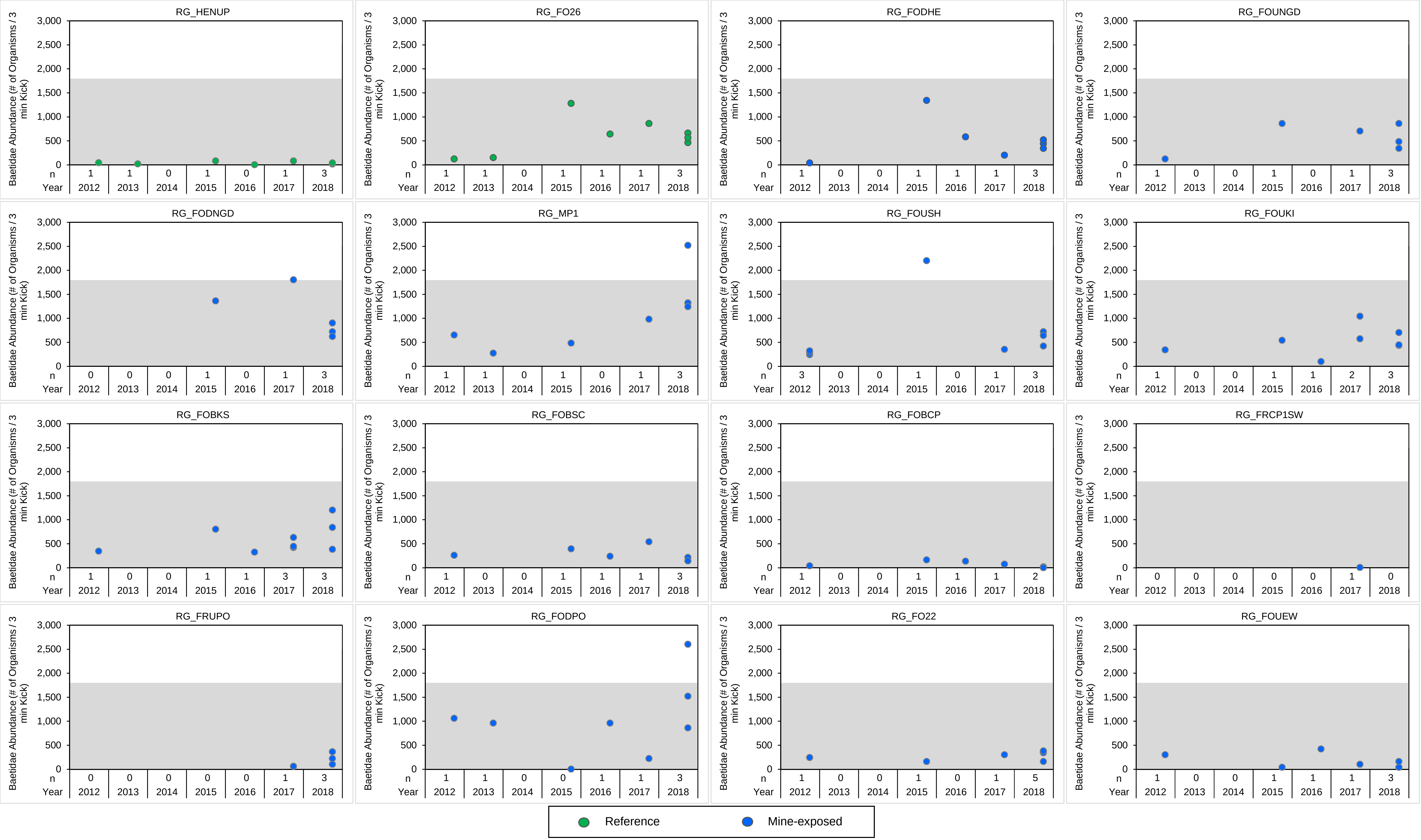


Figure B.12: **Benthic Invertebrate Baetidae Abundance, FRO LAEMP, 2012 to 2018**

Note: Grey shading represents 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). RG_FRCP1SW was dry in September 2018 so it was not sampled.

n = the sample size for a given year.

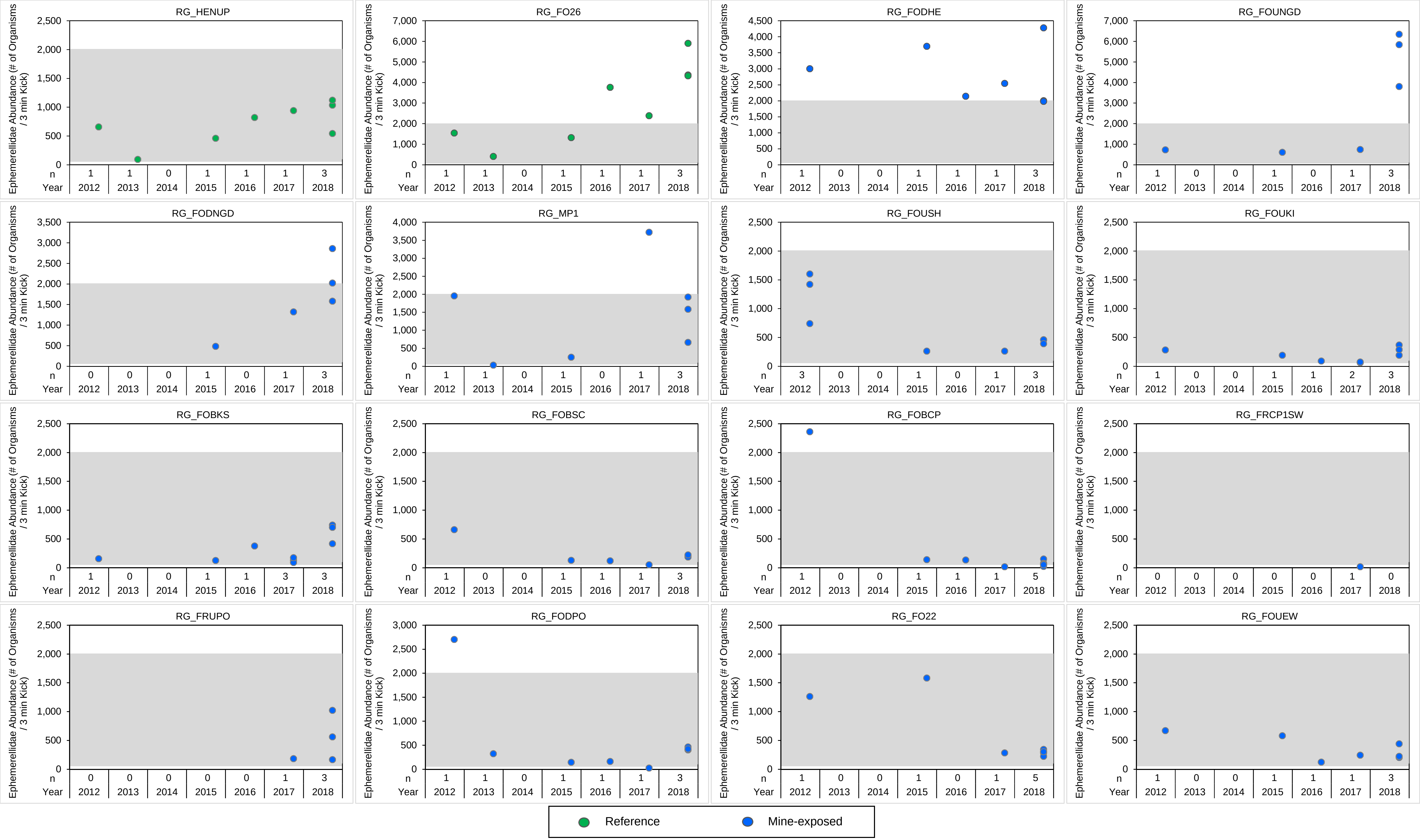


Figure B.13: Benthic Invertebrate Ephemerellidae Abundance, FRO LAEMP, 2012 to 2018

Note: Grey shading represents 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). RG_FRCP1SW was dry in September 2018 so it was not sampled.

n = the sample size for a given year.

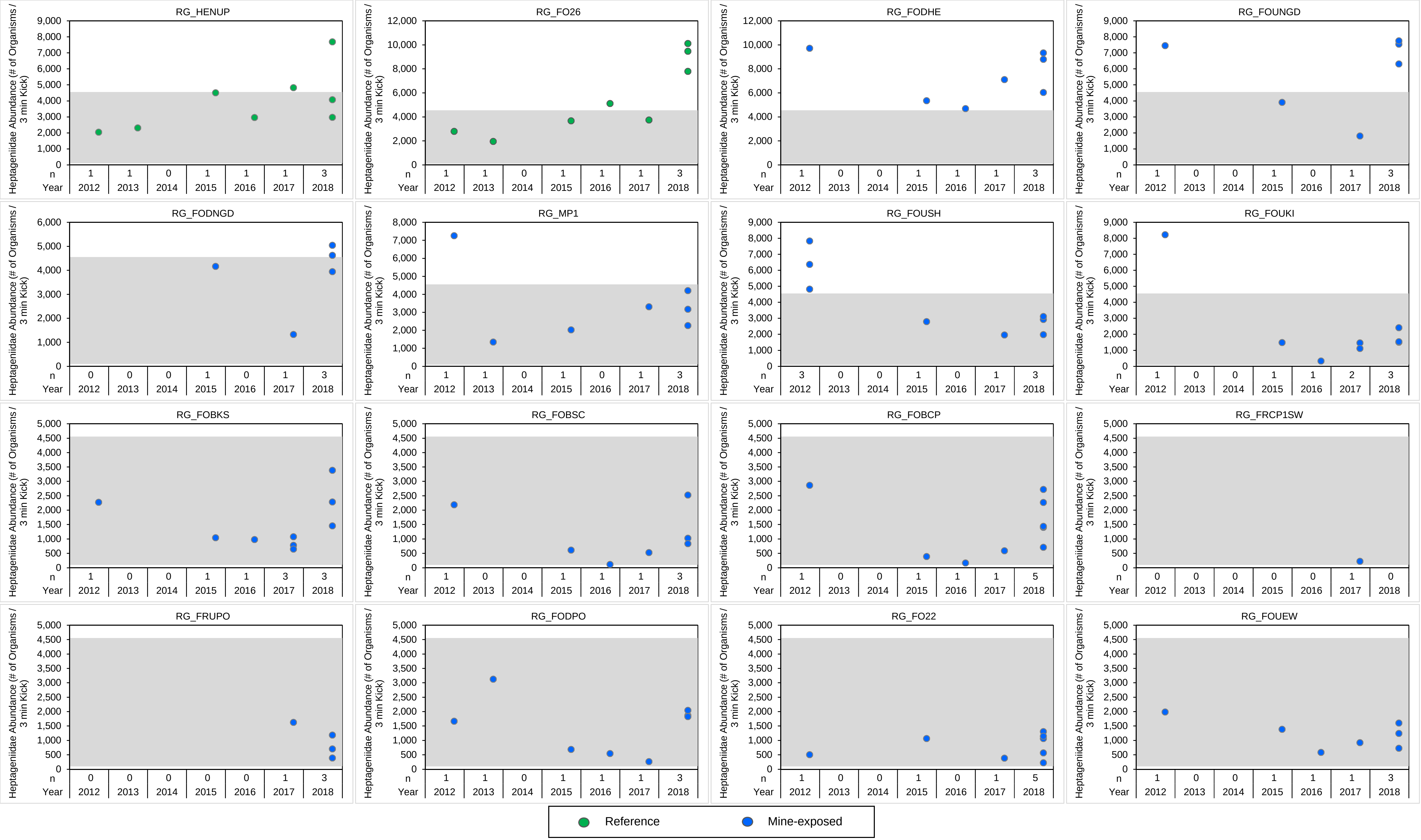


Figure B.14: **Benthic Invertebrate Heptageniidae Abundance, FRO LAEMP, 2012 to 2018**

Note: Grey shading represents 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). RG_FRCP1SW was dry in September 2018 so it was not sampled.

n = the sample size for a given year.

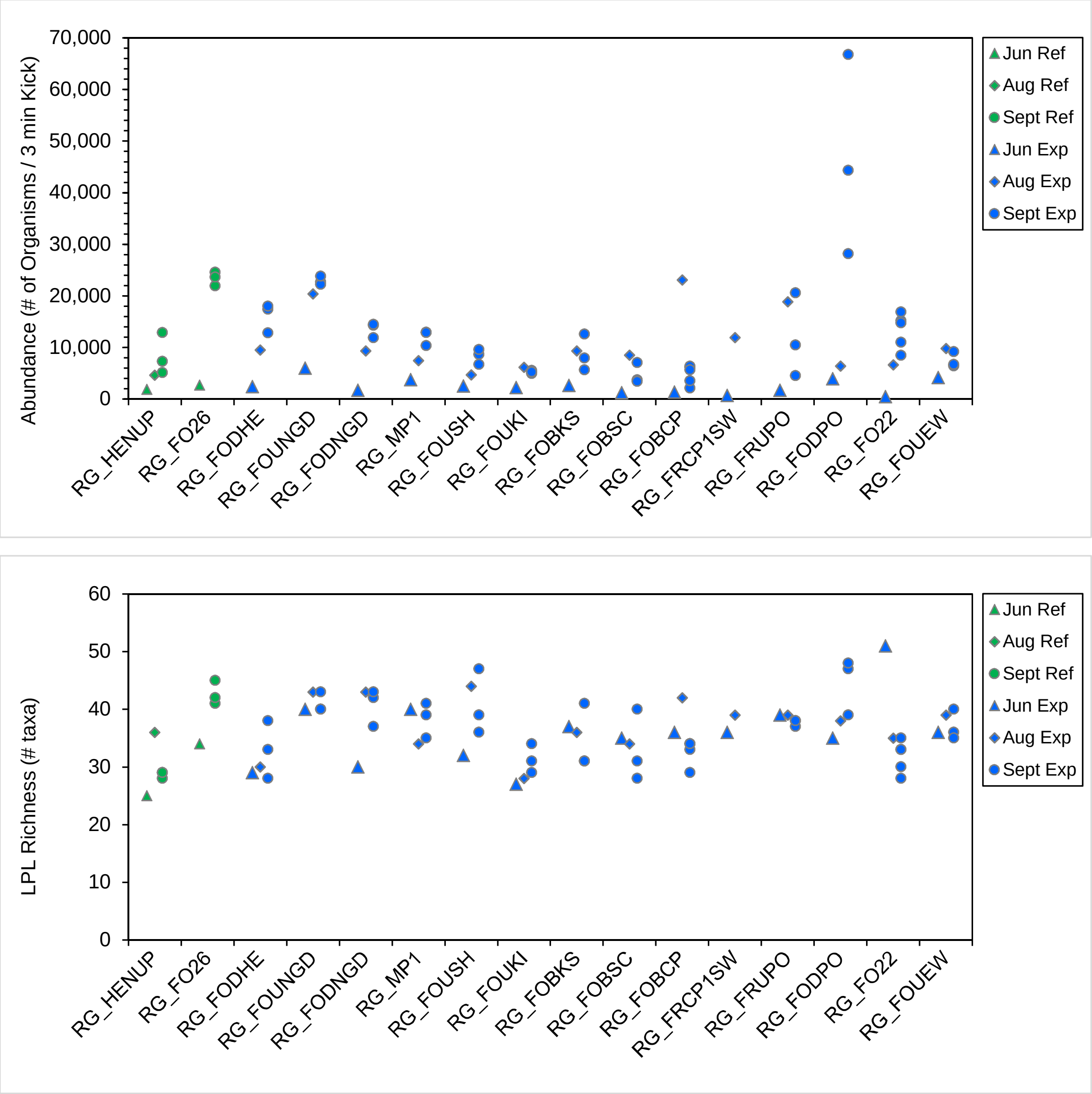
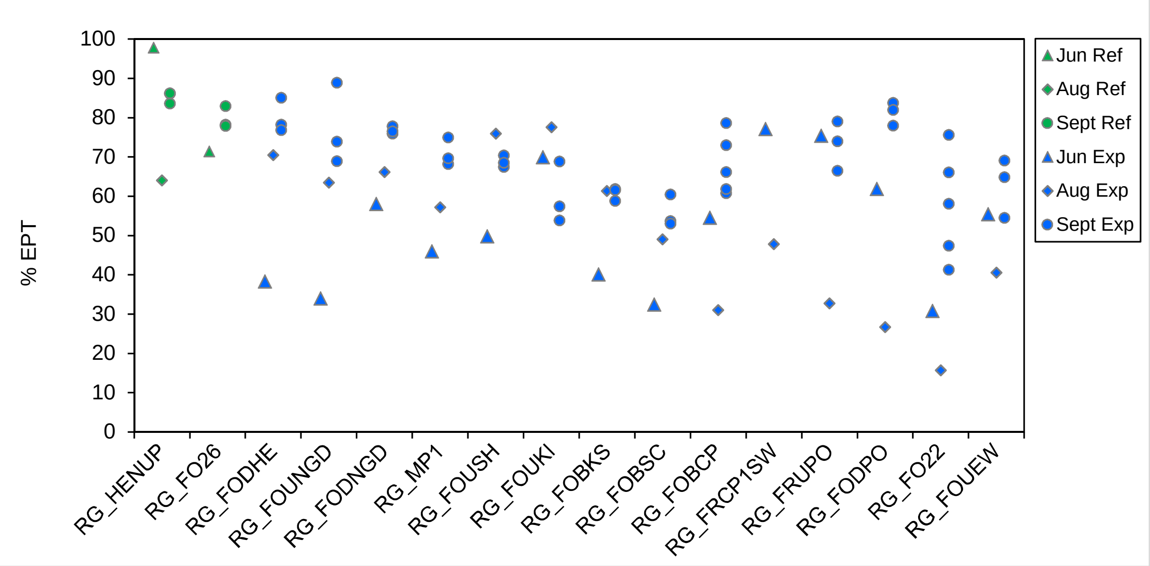


Figure B.15: **Benthic Invertebrate Community Abundance and LPL Richness, FRO LAEMP, June to September 2018**

Notes: Access to RG_FO26 was restricted in August 2018 so it was not sampled. RG_FRCP1SW was dry in September 2018 so it was not sampled.



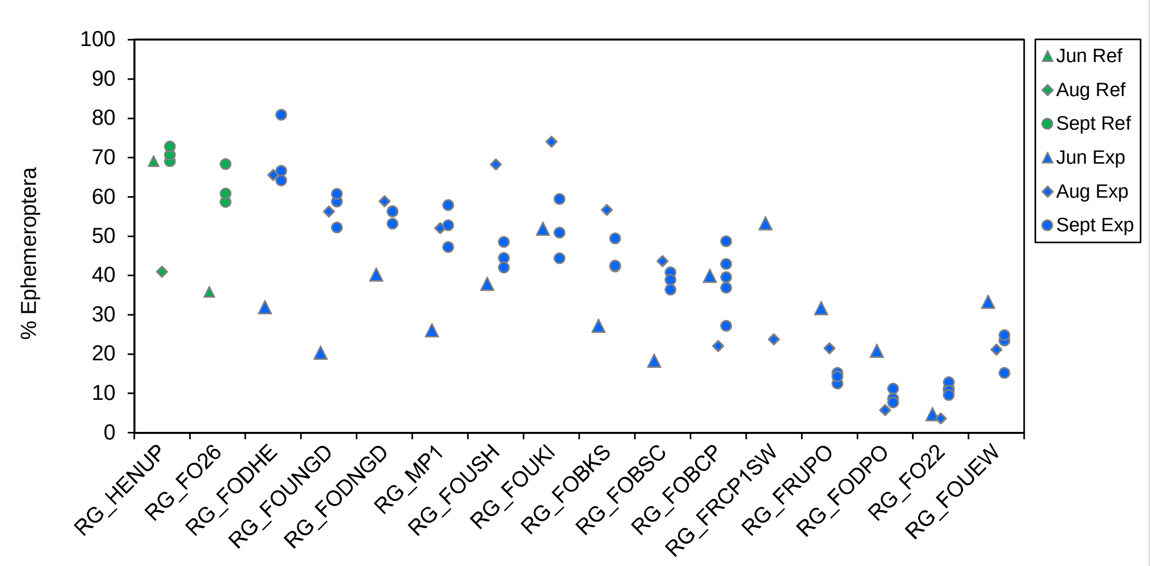


Figure B.16: **Benthic Invertebrate Community % EPT and % Ephemeroptera, FRO LAEMP, June to September 2018**

Notes: Access to RG_FO26 was restricted in August 2018 so it was not sampled. RG_FRCP1SW was dry in September 2018 so it was not sampled.

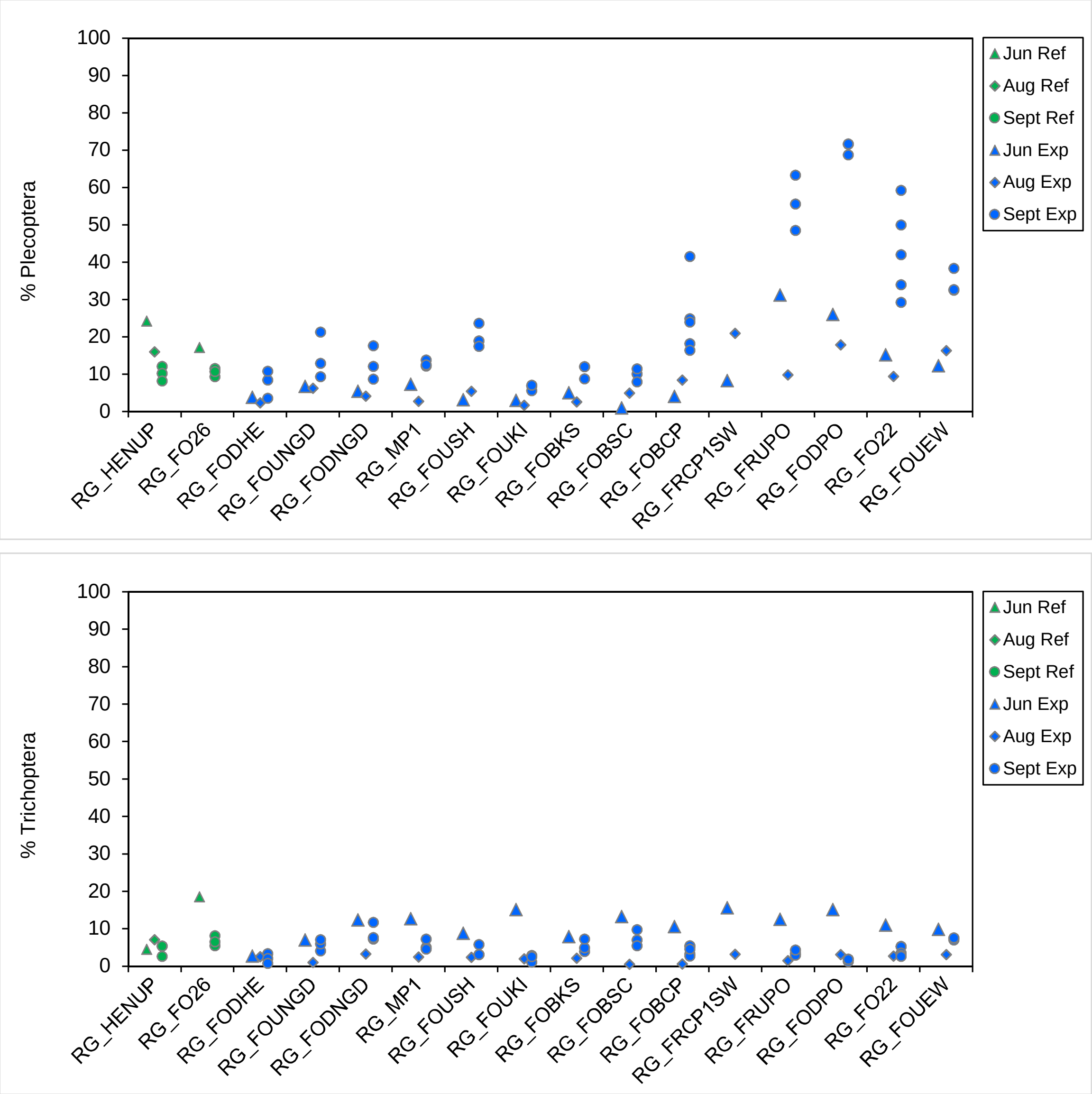
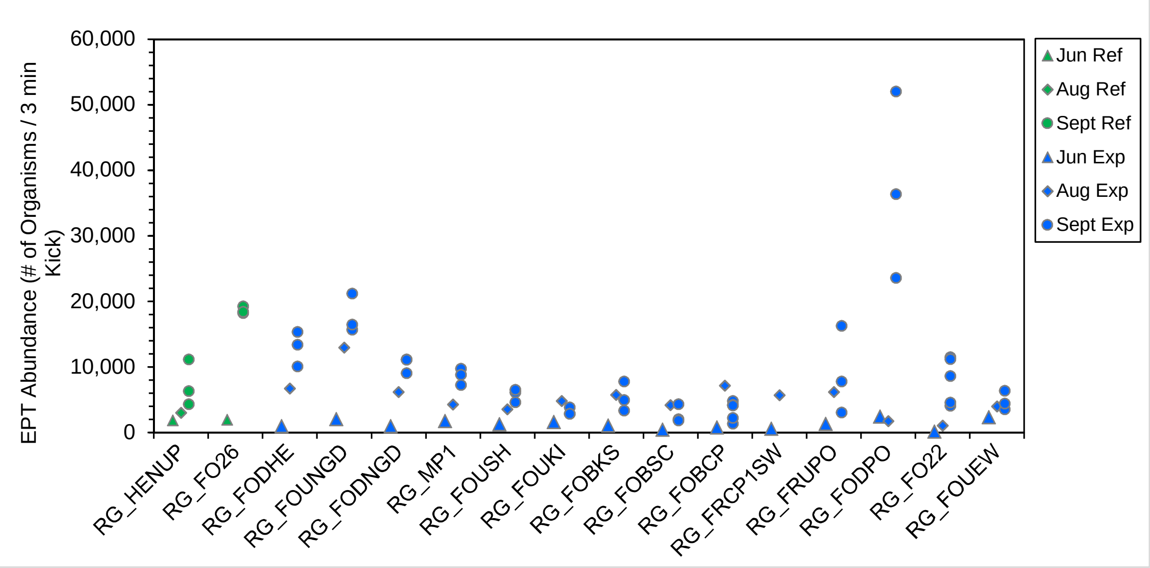


Figure B.17: **Benthic Invertebrate Community % Plecoptera and % Trichoptera, FRO LAEMP, June to September 2018**

Notes: Access to RG_FO26 was restricted in August 2018 so it was not sampled. RG_FRCP1SW was dry in September 2018 so it was not sampled.



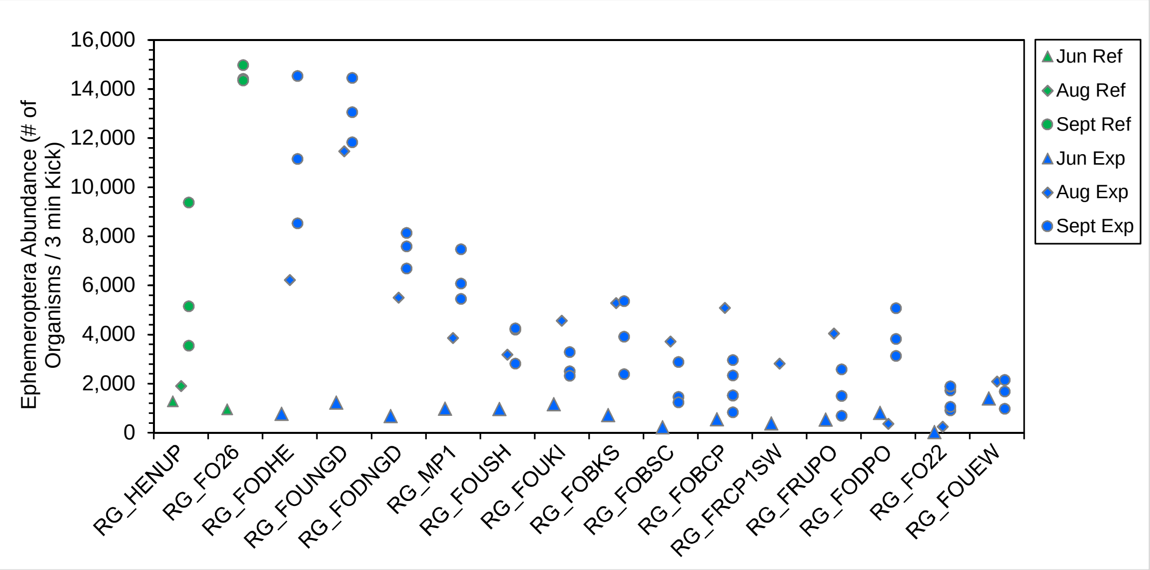
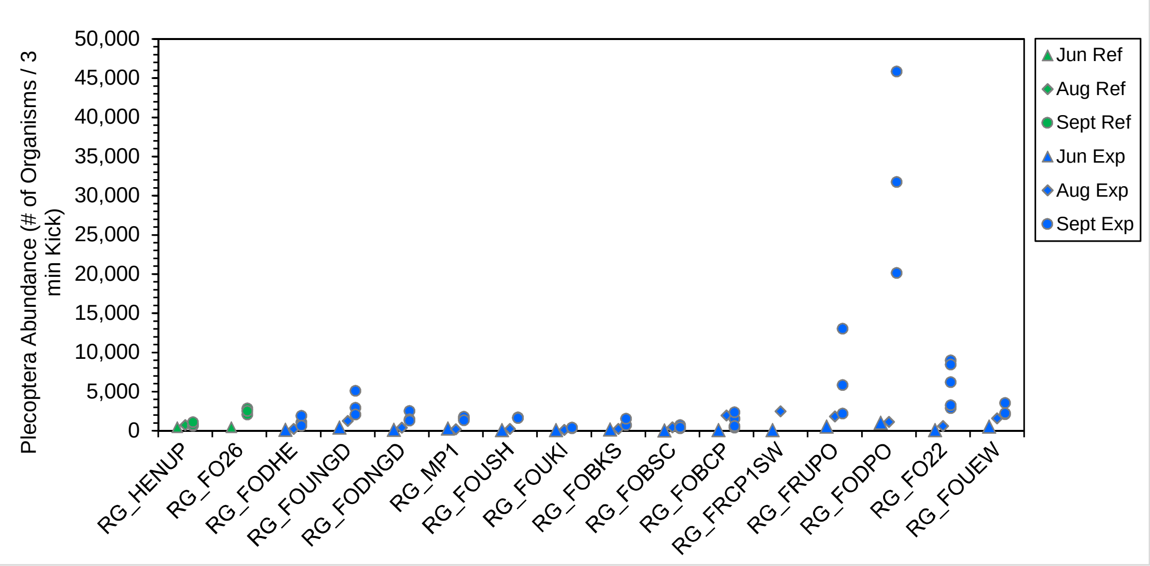


Figure B.18: **Benthic Invertebrate Community EPT and Ephemeroptera Abundance, FRO LAEMP, June to September 2018**

Notes: Access to RG_FO26 was restricted in August 2018 so it was not sampled. RG_FRCP1SW was dry in September 2018 so it was not sampled.



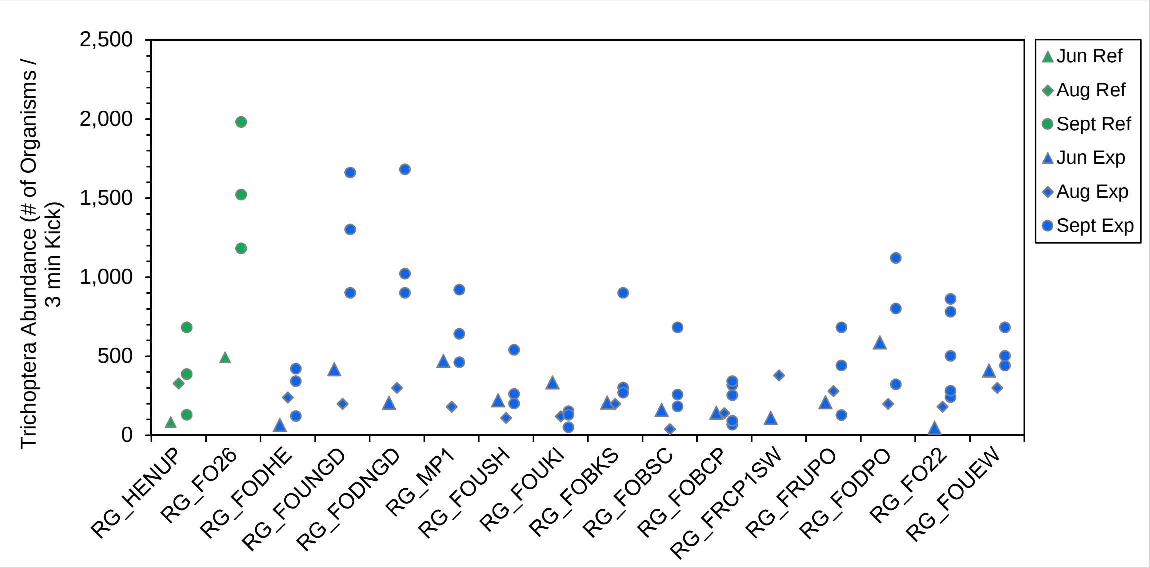


Figure B.19: **Benthic Invertebrate Community Plecoptera and Trichoptera Abundance, FRO LAEMP, June to September 2018**

Notes: Access to RG_FO26 was restricted in August 2018 so it was not sampled. RG_FRCP1SW was dry in September 2018 so it was not sampled.

Table B.1: Comparison of Reference Area Data Distributions for Ephemeroptera (E), Plecoptera (P), Trichoptera (T), and EPT Abundance to Percentiles Derived from the Pooled 2012 (n = 35) and 2015 (n = 40) Reference Area Values

Watershed	Management Unit	Percentile	Ephemeroptera Abundance (# org/3 min kick)				Plecoptera Abundance (# org/3 min kick)				Trichoptera Abundance (# org/3 min kick)				EPT Abundance (# org/3 min kick)			
			All Areas		Upper Kootenay Areas Removed		All Areas		Upper Kootenay Areas Removed		All Areas		Upper Kootenay Areas Removed		All Areas		Upper Kootenay Areas Removed	
		n	75		51		75		51		75		51		75		51	
		2.5	213		348		60		124		8.6		100		385		878	
		5	246		536		80		277		11		110		406		1,516	
		10	257		1,061		141		391		18		124		516		1,977	
		25	655		1,703		297		830		60		216		999		3,193	
		50	1,780		2,840		900		1,470		222		320		3,467		5,860	
		75	3,920		4,990		1,871		2,060		640		850		6,855		8,080	
		90	5,960		6,380		2,764		2,980		1,040		1,155		9,160		9,675	
		95	7,062		8,580		3,020		3,170		1,518		1,940		10,714		10,940	
		97.5	9,000		9,480		3,426		3,849		2,298		2,610		11,265		12,165	
		Area	2012	2015	2012	2015	2012	2015	2012	2015	2012	2015	2012	2015	2012	2015	2012	2015
Kootenay	N/A	ALB	700	-			659	-			41	-			1,400	-		
	N/A	BU2	-	815			-	285			-	295			-	1,395		
	N/A	BU40	875	1,190			706	450			31	440			1,613	2,080		
	N/A	BUUQ	581	1,230			310	1,100			16	210			906	2,540		
	N/A	CRUKO	255	261			220	219			39	47			514	527		
	N/A	KO1	-	623			-	60			-	10			-	693		
	N/A	KODCR	180	314			128	59			24	21			332	394		
	N/A	KOUCR	173	247			66	118			9	33			248	398		
	N/A	KOUVE	814	688			166	169			24	6			1,004	863		
	N/A	PADAL	458	288			397	208			12	22			867	518		
	N/A	PAUKO	244	219			242	169			28	22			514	410		
	N/A	VEUKO	470	504			437	91			87	0			993	595		
	N/A	VEUP	262	252			281	160			15	74			557	486		
	N/A	WIHR	1,357	-			2,614	-			200	-			4,171	-		
Oldman	N/A	DACK	3,960	5,180	3,960	5,180	3,320	2,100	3,320	2,100	1,080	840	1,080	840	8,360	8,120	8,360	8,120
	N/A	DUCK	982	1,383	982	1,383	1,309	617	1,309	617	236	667	236	667	2,527	2,667	2,527	2,667
	N/A	OLDDU	1,860	719	1,860	719	1,470	238	1,470	238	140	388	140	388	3,470	1,344	3,470	1,344
	N/A	OLDLI	1,061	3,957	1,061	3,957	611	1,471	611	1,471	17	300	17	300	1,689	5,729	1,689	5,729
	N/A	OLDLOW	347	1,391	347	1,391	87	391	87	391	124	1,155	124	1,155	558	2,936	558	2,936
	N/A	OLUP	2,840	-	2,840	-	1,800	-	1,800	-	300	-	300	-	4,940	-	4,940	-
	N/A	RACK	1,108	1,780	1,108	1,780	685	520	685	520	185	200	185	200	1,977	2,500	1,977	2,500
	N/A	VICK	1,111	3,380	1,111	3,380	900	2,260	900	2,260	222	220	222	220	2,233	5,860	2,233	5,860
Fording	1	CHCK	6,380	5,600	6,380	5,600	1,220	3,020	1,220	3,020	980	660	980	660	8,580	9,280	8,580	9,280
	1	DRCK	14,860	-	14,860	-	3,020	-	3,020	-	2,220	-	2,220	-	20,100	-	20,100	-
	1	EWCK	8,880	3,700	8,880	3,700	2,920	940	2,920	940	740	660	740	660	12,540	5,300	12,540	5,300
	2	LC_GRCK	-	1,340	-	1,340	-	2,180	-	2,180	-	2,740	-	2,740	-	6,260	-	6,260
	1	FO26	4,620	6,340	4,620	6,340	2,620	1,480	2,620	1,480	1,100	220	1,100	220	8,340	8,040	8,340	8,040
	1	HENUP	2,743	5,080	2,743	5,080	814	2,020	814	2,020	186	100	186	100	3,743	7,200	3,743	7,200
Line	2	LI24	1,367	1,900	1,367	1,900	1,167	755	1,167	755	122	136	122	136	2,656	2,791	2,656	2,791
	2	SLINE	2,300	3,883	2,300	3,883	4,025	1,317	4,025	1,317	425	933	425	933	6,750	6,133	6,750	6,133
Michel	4	AGCK	9,680	4,900	9,680	4,900	860	1,760	860	1,760	120	320	120	320	10,660	6,980	10,660	6,980
	4	AL4	8,280	6,200	8,280	6,200	1,940	1,880	1,940	1,880	620	900	620	900	10,840	8,980	10,840	8,980
	4	ALUSM	-	3,620	-	3,620	-	820	-	820	-	1,660	-	1,660	-	6,100	-	6,100
	4	MI25	250	3,360	250	3,360	1,144	2,260	1,144	2,260	487	360	487	360	1,881	5,980	1,881	5,980
Elk	N/A	CADCK	4,400	6,540	4,400	6,540	1,720	2,860	1,720	2,860	280	260	280	260	6,400	9,660	6,400	9,660
	N/A	EL12	5,460	5,220	5,460	5,220	1,400	1,880	1,400	1,880	100	320	100	320	6,960	7,420	6,960	7,420
	3	ELUGH	4,100	2,211	4,100	2,211	2,980	1,289	2,980	1,289	200	211	200	211	7,280	3,711	7,280	3,711
	4	GRUHA	3,725	2,213	3,725	2,213	5,200	1,863	5,200	1,863	750	588	750	588	9,675	4,663	9,675	4,663
	5	MCCR	-	2,820	-	2,820	-	1,980	-	1,980	-	6,240	-	6,240	-	11,040	-	11,040
	5	WWRL	1,625	1,971	1,625	1,971	1,525	357	1,525	357	300	1,457	300	1,457	3,450	3,786	3,450	3,786
	5	WWRU	-	353	-	353	-	53	-	53	-	318	-	318	-	723	-	723
Flathead	N/A	FLAD	-	2,740	-	2,740	-	900	-	900	-	860	-	860	-	4,500	-	4,500
	N/A	FLAU	-	2,400	-	2,400	-	840	-	840	-	860	-	860	-	4,100	-	4,100
	N/A	FLRU	-	2,833	-	2,833	-	317	-	317	-	317	-	317	-	3,467	-	3,467

🟩 Final dataset used to defined the normal range
▨ Value excluded from normal range calculation
🟦 Value < 2.5th percentile of reference distribution
🟦 Value < 5th percentile of reference distribution
🟦 Value < 10th percentile of reference distribution
🟦 Value < 25th percentile of reference distribution
🟨 Value > 75th percentile of reference distribution
🟨 Value > 90th percentile of reference distribution
🟨 Value > 95th percentile of reference distribution
🟧 Value > 97.5th percentile of reference distribution

Table B.2: Comparison of Reference Area Data Distributions for Ephemeroptera Family Abundance Based on Percentiles Derived from the Pooled 2012 (n = 35) and 2015 (n = 40) Reference Area Results

Main Watershed	Management Unit	Percentile	Baetidae				Ephemerellidae				Heptageniidae			
			All Areas (No Outliers Identified)		Kootenay Areas Removed		All Areas		Kootenay Areas Removed		All Areas		Kootenay Areas Removed	
		n	75		51		75		51		75		51	
		2.5	0		0		22.0		51.3		40.3		101	
		5	0		0		25.8		76.5		48.5		128.0	
		10	3.40		9.00		36.4		96.0		81.2		158.0	
		25	17.5		21.0		71		176		146		335	
		50	76.0		111		240		461		530		940	
		75	270		416		672		835		1,190		1,682	
		90	938		1,100		1,304		1,380		2,866		3,400	
		95	1,334		1,540		1,646		1,730		3,894		4,470	
		97.5	1,800		2,520		1,842		2,010		4,512		4,560	
		Area	2012	2015	2012	2015	2012	2015	2012	2015	2012	2015	2012	2015
Kootenay	N/A	ALB	14	-			32	-			114	-		
	N/A	BU2	-	55			-	85			-	670		
	N/A	BU40	0	250			143	400			328	530		
	N/A	BUUQ	10	220			46	280			142	710		
	N/A	CRUKO	36	57			46	43			45	157		
	N/A	KO1	-	8			-	16			-	476		
	N/A	KODCR	4	101			36	23			50	112		
	N/A	KOUCR	15	76			52	37			41	88		
	N/A	KOUVE	20	137			272	68			50	338		
	N/A	PADAL	3	70			27	131			60	78		
	N/A	PAUKO	2	69			12	59			134	86		
	N/A	VEUKO	20	5			63	48			180	344		
	N/A	VEUP	0	96			23	36			36	110		
	N/A	WIHR	14	-			228	-			86	-		
Oldman	N/A	DACK	20	2,820	20	2,820	2,080	1,280	2,080	1,280	620	1,000	620	1,000
	N/A	DUCK	9	550	9	550	309	667	309	667	300	150	300	150
	N/A	OLDDU	20	206	20	206	470	157	470	157	310	306	310	306
	N/A	OLDLI	22	386	22	386	428	672	428	672	123	2,899	123	2,899
	N/A	OLDLOW	4	282	4	282	96	781	96	781	93	209	93	209
	N/A	OLUP	20	-	20	-	240	-	240	-	780	-	780	-
	N/A	RACK	23	160	23	160	461	370	461	370	270	1,200	270	1,200
	N/A	VICK	44	940	44	940	455	540	455	540	200	1,820	200	1,820
Fording	1	CHCK	20	280	20	280	180	820	180	820	1,160	4,440	1,160	4,440
	1	DRCK	100	-	100	-	1,220	-	1,220	-	3,400	-	3,400	-
	1	EWCK	0	460	0	460	360	1,380	360	1,380	1,880	1,860	1,880	1,860
	2	LC_GRCK	-	280	-	280	-	120	-	120	-	940	-	940
	1	FO26	180	1,280	180	1,280	120	1,320	120	1,320	1,540	3,660	1,540	3,660
	1	HENUP	14	80	14	80	43	460	43	460	657	4,500	657	4,500
Line	2	LI24	111	0	111	0	134	73	134	73	133	1,664	133	1,664
	2	SLINE	125	83	125	83	175	767	175	767	650	2,817	650	2,817
Michel	4	AGCK	80	60	80	60	100	80	100	80	1,060	4,580	1,060	4,580
	4	AL4	20	2,840	20	2,840	1,340	1,800	1,340	1,800	1,700	1,560	1,700	1,560
	4	ALUSM	-	260	-	260	-	2,660	-	2,660	-	700	-	700
	4	MI25	13	520	13	520	44	1,660	44	1,660	25	1,100	25	1,100
Elk	N/A	CADCK	60	1,100	60	1,100	220	480	220	480	300	4,960	300	4,960
	N/A	EL12	40	1,620	40	1,620	1,640	560	1,640	560	360	2,980	360	2,980
	3	ELUGH	0	389	0	389	740	334	740	334	480	1,488	480	1,488
	4	GRUHA	100	951	100	951	375	176	375	176	450	1,076	450	1,076
	5	MCCR	-	1,460	-	1,460	-	680	-	680	-	680	-	680
	5	WWRL	0	443	0	443	113	671	113	671	602	858	602	858
	5	WWRU	-	101	-	101	-	89	-	89	-	158	-	158
Flathead	N/A	FLAD	-	380	-	380	-	1,160	-	1,160	-	1,200	-	1,200
	N/A	FLAU	-	140	-	140	-	960	-	960	-	1,180	-	1,180
	N/A	FLRU	-	934	-	934	-	850	-	850	-	917	-	917

Notes: Results were before and after the removal of potential outliers. Coloured cells show individual reference area values that were at the low (blue shade) and high (gold shade) ends of the distribution range. Green highlights the reference area data set recommended for the evaluation of communities in mine-exposed areas.

🟩	Data set was used to define the normal range (2.5th and 97.5th percentiles)
▨	Outlier or value removed from estimation of percentiles
🟦	Value < 2.5th percentile of reference distribution
🟦	Value < 5th percentile of reference distribution
🟦	Value < 10th percentile of reference distribution
🟦	Value < 25th percentile of reference distribution
🟨	Value > 75th percentile of reference distribution
🟨	Value > 90th percentile of reference distribution
🟨	Value > 95th percentile of reference distribution
🟨	Value > 97.5th percentile of reference distribution

Table B.3: **Taxa Scores from Correspondence Analysis on Lowest-Practical-Level Benthic Invertebrate Communities from the Fording River, September 2018**

Order	Family	Taxa	CA1 (36.4%)	CA2 (13.4%)
Trombidiformes	Lebertiidae	*Lebertia*	-0.289	-0.390
Ephemeroptera	Ameletidae	Ameletidae	0.737	0.251
	Baetidae	*Baetis*	0.503	-0.471
		Baetis rhodani group	0.105	-0.319
	Ephemerellidae	*Drunella doddsii*	0.736	0.707
		Ephemerellidae	0.467	0.374
	Heptageniidae	*Epeorus*	0.931	0.344
		Heptageniidae	0.330	0.203
		Rhithrogena	1.189	1.752
Plecoptera	Perlodidae	*Isoperla*	-1.246	-0.221
		Kogotus	-0.377	-0.401
		Megarcys	0.454	-0.120
		Perlodidae	-1.263	-0.070
	Chloroperlidae	*Sweltsa*	0.199	1.158
	Taeniopterygidae	Taeniopterygidae	0.012	0.229
	Nemouridae	*Zapada*	-0.740	0.211
		Zapada cinctipes	-0.580	-0.360
		Zapada oregonensis group	0.162	0.490
Coleoptera	Elmidae	*Heterlimnius*	-2.542	1.009
Trichoptera	Rhyacophilidae	*Rhyacophila*	0.345	-0.856
		Rhyacophila brunnea/vemna group	-0.512	-0.202
Diptera	Ceratopogonidae	*Mallochohelea*	0.652	-0.985
	Chironomidae	*Eukiefferiella*	-0.133	0.064
		Micropsectra	0.968	1.388
		Orthocladius complex	-0.482	0.112
		Pagastia	0.128	-0.392
	Chironomidae	*Tvetenia*	0.395	0.346
	Psychodidae	*Pericoma/Telmatoscopus*	0.597	-0.661
	Simuliidae	*Simulium*	0.089	-0.682

Notes: Numbers in parentheses in column names correspond to the variance explained by that axis. Correspondence Analysis preformed on $\log_{10}(x+1)$ relative abundances to reduce skew and kurtosis. Taxa that occur in fewer than 1% of samples were excluded from analysis.

Table B.4: Biological Monitoring Area Scores from Correspondence Analysis on Lowest-Practical-Level Benthic Invertebrate Communities from the Fording River, September 2018

Status	Area	CA1 (36.4%)	CA2 (13.4%)
Reference	RG_HENUP	0.793	1.690
		0.970	1.842
		1.069	1.713
	RG_FO26	0.429	0.469
		0.575	0.802
		0.517	0.719
Mine-Exposed	RG_FO22	-1.270	0.206
		-1.446	0.275
		-1.524	0.339
		-1.540	0.504
		-1.620	0.468
	RG_FOBCP	0.029	-0.140
		0.275	-0.237
		-0.068	-0.490
		0.197	-0.607
		-0.043	-0.415
	RG_FOBKS	0.560	-0.390
		0.628	-0.484
		0.385	-0.452
	RG_FOBSC	0.459	-0.645
		0.460	-0.695
		0.378	-0.460
	RG_FODHE	0.563	0.474
		0.555	0.521
		0.675	0.522
	RG_FODNGD	0.333	-0.215
		0.262	-0.242
		0.498	-0.293
	RG_FODPO	-0.796	0.273
		-0.840	0.004
		-0.709	-0.064
	RG_FOUEW	-1.015	0.253
		-0.802	0.495
		-0.787	0.120
	RG_FOUKI	0.644	-0.016
		0.662	-0.237
		0.655	-0.276
	RG_FOUNGD	0.334	-0.309
		0.409	-0.306
		0.295	-0.141
	RG_FOUSH	0.159	-0.104
		0.199	-0.152
		0.097	-0.256
	RG_FRUPO	-0.599	-0.290
		-0.584	-0.306
		-0.600	-0.401
	RG_MP1	0.216	-0.224
		0.109	-0.453
		0.238	-0.395

Notes: Numbers in parentheses in column names correspond to the variance explained by that axis. Correspondence Analysis preformed on $\log_{10}(x+1)$ relative abundances to reduce skew and kurtosis. Taxa that occur in fewer than 1% of samples were excluded from analysis.

Table B.5: Temporal Changes in Benthic Invertebrate Abundance for Reference and Mine-exposed Areas in the FRO LAEMP, 2012 to 2018

Status	Area	Year P-value[a]	Q1. Is there a positive or negative change since the base year (b) of monitoring?							Q2. Is the 2018 annual mean greater or less than all annual historical means (2012 - 2017) and the previous year (2017)?[c]								
			Magnitude of Difference (MOD)[b] and Significance (bolded) from Base Year (b) [c]															
			2012	2013	2014	2015	2016	2017	2018	2012	2013	2014	2015	2016	2017	2018	2012-2017	2018
Reference	RG_HENUP	0.106	ns	ns	-	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns
	RG_FO26	0.002	b	-2.7	-	-0.44	1.4	1.0	2.3	AB	B	-	AB	AB	AB	A	ns	ns
Mine-exposed	RG_FODHE	0.816	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOUNGD	0.055	ns	-	-	ns	-	ns	ns	ns	-	-	ns	-	ns	ns	ns	ns
	RG_FODNGD	0.718	-	-	-	ns	-	ns	ns	-	-	-	ns	-	ns	ns	ns	ns
	RG_MP1	0.088	ns	ns	-	ns	-	ns	ns	ns	ns	-	ns	-	ns	ns	ns	ns
	RG_FOUSH	0.104	ns	-	-	ns	-	ns	ns	ns	-	-	ns	-	ns	ns	ns	ns
	RG_FOUKI	0.001	b	-	-	-3.6	**-6.2**	-2.6	-2.4	A	-	-	AB	B	AB	A	ns	ns
	RG_FOBKS	0.059	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOBSC	0.193	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOBCP	0.146	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FRCP1SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	RG_FRUPO	0.297	-	-	-	-	-	ns	ns	-	-	-	-	-	ns	ns	ns	ns
	RG_FODPO	0.008	b	1.1	-	-1.3	-0.91	-0.042	3.0	AB	AB	-	B	B	AB	A	ns	ns
	RG_FO22	0.106	ns	-	-	ns	-	ns	ns	ns	-	-	ns	-	ns	ns	ns	ns
	RG_FOUEW	0.961	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns

⬛	P-value < 0.05		
🟩	> 2 SD Increase	🟦	> 2 SD Decrease
🟩	> 3 SD Increase	🟦	> 3 SD Decrease
🟩	> 4 SD Increase	🟦	> 4 SD Decrease
🟩	> 5 SD Increase	🟦	> 5 SD Decrease
bold	Significant increase or decrease from base year (b)		
🟩	Significantly > than all historical years (or 2017)		
🟦	Significantly < than all historical years (or 2017)		

Notes: "ns" = not significant; "-" insufficient data for comparison

[a] *Year* p-value from an ANOVA with factors *Year* and *Month.*

[b] Magnitude of Difference (MOD) = $[\text{Mean}_{\text{given year}} - \text{Mean}_{\text{year b}}] / \text{Mean}_{\text{year b}} \times 100\%$.

[c] Significance among year determined using all pairwise comparisons using Tukey's honestly signifciant differences method. Years that share a letter are not significantly different. Letters assigned such that the mean with with highest magnitude is assigned "A".

Table B.6: Temporal Changes in Benthic Invertebrate LPL Richness for Reference and Mine-exposed Areas in the FRO LAEMP, 2012 to 2018

Status	Area	Year P-value[a]	Q1. Is there a positive or negative change since the base year (b) of monitoring? Magnitude of Difference (MOD)[b] and Significance (bolded) from Base Year (b) [c]							Q2. Is the 2018 annual mean greater or less than all annual historical means (2012 - 2017) and the previous year (2017)?[c]								
			2012	2013	2014	2015	2016	2017	2018	2012	2013	2014	2015	2016	2017	2018	2012-2017	2018
Reference	RG_HENUP	0.245	ns	ns	-	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns
	RG_FO26	0.006	b	-3.6	-	-2.6	-1.2	-1.5	0.81	AB	B	-	AB	AB	AB	A	ns	ns
Mine-exposed	RG_FODHE	0.237	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOUNGD	0.023	b	-	-	-1.6	-	-1.6	2.3	AB	-	-	B	-	B	A	ns	↑
	RG_FODNGD	0.028	-	-	-	b	-	0.66	**3.7**	-	-	-	B	-	AB	A	ns	ns
	RG_MP1	0.002	b	0.39	-	3.6	-	3.1	**4.8**	B	B	-	AB	-	AB	A	ns	ns
	RG_FOUSH	0.002	b	-	-	0.35	-	2.6	**3.4**	B	-	-	AB	-	AB	A	ns	ns
	RG_FOUKI	0.126	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOBKS	0.003	b	-	-	3.0	3.3	**4.2**	**4.6**	B	-	-	AB	AB	A	A	ns	ns
	RG_FOBSC	0.030	b	-	-	2.4	3.2	**4.5**	3.0	B	-	-	AB	AB	A	AB	ns	ns
	RG_FOBCP	0.287	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FRCP1SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	RG_FRUPO	0.976	-	-	-	-	-	ns	ns	-	-	-	-	-	ns	ns	ns	ns
	RG_FODPO	<0.001	b	-3.9	-	-3.5	-0.27	-1.8	2.3	AB	B	-	B	AB	B	A	ns	↑
	RG_FO22	0.264	ns	-	-	ns	-	ns	ns	ns	-	-	ns	-	ns	ns	ns	ns
	RG_FOUEW	0.100	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns

▨ P-value < 0.05

🟩 > 2 SD Increase

🟩 > 3 SD Increase

🟩 > 4 SD Increase

🟩 > 5 SD Increase

🟦 > 2 SD Decrease

🟦 > 3 SD Decrease

🟦 > 4 SD Decrease

🟦 > 5 SD Decrease

bold Significant increase or decrease from base year (b)

🟩 Significantly > than all historical years (or 2017)

🟦 Significantly < than all historical years (or 2017)

Notes: "ns" = not significant; "-" insufficient data for comparison

[a] *Year* p-value from an ANOVA with factors *Year* and *Month.*

[b] Magnitude of Difference (MOD) = $[\text{Mean}_{\text{given year}} - \text{Mean}_{\text{year b}}] / \text{Mean}_{\text{year b}} \times 100\%$.

[c] Significance among year determined using all pairwise comparisons using Tukey's honestly signifciant differences method. Years that share a letter are not significantly different. Letters assigned such that the mean with with highest magnitude is assigned "A".

Table B.7: Temporal Changes in EPT Relative Abundance for Reference and Mine-exposed Areas in the FRO LAEMP, 2012 to 2018

Status	Area	Year P-value[a]	Q1. Is there a positive or negative change since the base year (b) of monitoring?							Q2. Is the 2018 annual mean greater or less than all annual historical means (2012 - 2017) and the previous year (2017)?[c]								
			Magnitude of Difference (MOD)[b] and Significance (bolded) from Base Year (b) [c]															
			2012	2013	2014	2015	2016	2017	2018	2012	2013	2014	2015	2016	2017	2018	2012-2017	2018
Reference	RG_HENUP	0.658	ns	ns	-	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	-	-
	RG_FO26	0.655	ns	ns	-	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns
Mine-exposed	RG_FODHE	0.437	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOUNGD	0.082	ns	-	-	ns	-	ns	ns	ns	-	-	ns	-	ns	ns	ns	ns
	RG_FODNGD	0.272	-	-	-	ns	-	ns	ns	-	-	-	ns	-	ns	ns	ns	ns
	RG_MP1	0.004	b	-2.4	-	0.88	-	3.2	1.0	AB	B	-	AB	-	A	AB	ns	ns
	RG_FOUSH	0.261	ns	-	-	ns	-	ns	ns	ns	-	-	ns	-	ns	ns	ns	ns
	RG_FOUKI	0.019	b	-	-	-1.3	**-4.8**	-2.8	**-3.5**	A	-	-	AB	B	AB	B	ns	ns
	RG_FOBKS	0.222	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOBSC	0.728	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOBCP	0.226	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FRCP1SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	RG_FRUPO	0.653	-	-	-	-	-	ns	ns	-	-	-	-	-	ns	ns	ns	ns
	RG_FODPO	<0.001	b	3.8	-	2.5	0.57	-2.5	1.3	AB	A	-	A	AB	B	A	ns	↑
	RG_FO22	0.779	ns	-	-	ns	-	ns	ns	ns	-	-	ns	-	ns	ns	ns	ns
	RG_FOUEW	0.260	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns

▨	P-value < 0.05		
🟩	> 2 SD Increase	🟦	> 2 SD Decrease
🟩	> 3 SD Increase	🟦	> 3 SD Decrease
🟩	> 4 SD Increase	🟦	> 4 SD Decrease
🟩	> 5 SD Increase	🟦	> 5 SD Decrease
bold	Significant increase or decrease from base year (b)		
🟩	Significantly > than all historical years (or 2017)		
🟦	Significantly < than all historical years (or 2017)		

Notes: "ns" = not significant

Notes: "ns" = not significant; "-" insufficient data for comparison

[b] Magnitude of Difference (MOD) = $[\text{Mean}_{\text{given year}} - \text{Mean}_{\text{year b}}] / \text{Mean}_{\text{year b}} \times 100\%$.

[c] Significance among year determined using all pairwise comparisons using Tukey's honestly signifciant differences method. Years that share a letter are not significantly different. Letters assigned such that the mean with with highest magnitude is assigned "A".

Table B.8: Temporal Changes in Ephemeroptera Relative Abundance for Reference and Mine-exposed Areas in the FRO LAEMP, 2012 to 2018

Status	Area	Year P-value[a]	Q1. Is there a positive or negative change since the base year (b) of monitoring? Magnitude of Difference (MOD)[b] and Significance (bolded) from Base Year (b)[c]							Q2. Is the 2018 annual mean greater or less than all annual historical means (2012 - 2017) and the previous year (2017)?[c]								
			2012	2013	2014	2015	2016	2017	2018	2012	2013	2014	2015	2016	2017	2018	2012-2017	2018
Reference	RG_HENUP	0.074	ns	ns	-	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns
	RG_FO26	0.032	b	3.6	-	**4.5**	2.4	0.83	**3.7**	B	AB	-	A	AB	AB	A	ns	ns
Mine-exposed	RG_FODHE	0.200	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOUNGD	0.010	b	-	-	2.4	-	-2.8	-0.50	AB	-	-	A	-	B	AB	ns	ns
	RG_FODNGD	0.048	-	-	-	b	-	-3.1	**-3.5**	-	-	-	A	-	AB	B	ns	ns
	RG_MP1	0.006	b	**-4.3**	-	-1.1	-	1.1	-0.89	A	B	-	AB	-	A	AB	ns	ns
	RG_FOUSH	0.002	b	-	-	1.5	-	-0.49	**-3.4**	A	-	-	A	-	AB	B	ns	ns
	RG_FOUKI	<0.001	b	-	-	-1.5	**-7.1**	**-5.2**	**-3.9**	A	-	-	AB	C	C	BC	ns	ns
	RG_FOBKS	<0.001	b	-	-	-3.9	**-5.6**	**-5.4**	**-4.4**	A	-	-	AB	B	B	B	ns	ns
	RG_FOBSC	0.001	b	-	-	-1.9	**-6.1**	**-4.4**	-2.2	A	-	-	ABC	C	BC	AB	ns	ns
	RG_FOBCP	<0.001	b	-	-	**-12**	**-11**	**-13**	**-6.2**	A	-	-	C	C	C	B	ns	↑
	RG_FRCP1SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	RG_FRUPO	0.385	-	-	-	-	-	ns	ns	-	-	-	-	-	ns	ns	ns	ns
	RG_FODPO	<0.001	b	-4.0	-	**-8.0**	**-5.4**	**-11**	**-7.5**	A	AB	-	BCD	BC	D	CD	ns	ns
	RG_FO22	<0.001	b	-	-	**-5.0**	-	**-9.2**	**-5.8**	A	-	-	B	-	C	B	ns	↑
	RG_FOUEW	<0.001	b	-	-	**-5.7**	**-8.4**	**-8.8**	**-7.1**	A	-	-	B	B	B	B	ns	ns

▨	P-value < 0.05		
🟩	> 2 SD Increase	🟦	> 2 SD Decrease
🟩	> 3 SD Increase	🟦	> 3 SD Decrease
🟩	> 4 SD Increase	🟦	> 4 SD Decrease
🟩	> 5 SD Increase	🟦	> 5 SD Decrease
bold	Significant increase or decrease from base year (b)		
🟩	Significantly > than all historical years (or 2017)		
🟦	Significantly < than all historical years (or 2017)		

Notes: "ns" = not significant; "-" insufficient data for comparison

[a] *Year* p-value from an ANOVA with factors *Year* and *Month.*

[b] Magnitude of Difference (MOD) = $[\text{Mean}_{\text{given year}} - \text{Mean}_{\text{year b}}] / \text{Mean}_{\text{year b}} \times 100\%$.

[c] Significance among year determined using all pairwise comparisons using Tukey's honestly signifciant differences method. Years that share a letter are not significantly different. Letters assigned such that the mean with with highest magnitude is assigned "A".

Table B.9: Temporal Changes in Plecoptera Relative Abundance for Reference and Mine-exposed Areas in the FRO LAEMP, 2012 to 2018

Status	Area	Year P-value[a]	Q1. Is there a positive or negative change since the base year (b) of monitoring?							Q2. Is the 2018 annual mean greater or less than all annual historical means (2012 - 2017) and the previous year (2017)?[c]								
			Magnitude of Difference (MOD)[b] and Significance (bolded) from Base Year (b)[c]															
			2012	2013	2014	2015	2016	2017	2018	2012	2013	2014	2015	2016	2017	2018	2012-2017	2018
Reference	RG_HENUP	0.014	b	-1.4	-	1.5	-1.7	1.9	-2.1	AB	AB	-	A	AB	A	B	ns	↓
	RG_FO26	0.079	ns	ns	-	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns
Mine-exposed	RG_FODHE	0.103	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOUNGD	0.988	ns	-	-	ns	-	ns	ns	ns	-	-	ns	-	ns	ns	ns	ns
	RG_FODNGD	0.929	-	-	-	ns	-	ns	ns	-	-	-	ns	-	ns	ns	ns	ns
	RG_MP1	0.005	b	3.2	-	**4.8**	-	**4.9**	**4.4**	B	AB	-	A	-	A	A	ns	ns
	RG_FOUSH	<0.001	b	-	-	2.3	-	3.3	**4.3**	B	-	-	AB	-	AB	A	ns	ns
	RG_FOUKI	0.057	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOBKS	0.114	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOBSC	0.326	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOBCP	<0.001	b	-	-	**6.6**	**4.5**	**5.1**	**3.5**	B	-	-	A	A	A	A	ns	ns
	RG_FRCP1SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	RG_FRUPO	0.968	-	-	-	-	-	ns	ns	-	-	-	-	-	ns	ns	ns	ns
	RG_FODPO	0.302	ns	ns	-	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns
	RG_FO22	0.358	ns	-	-	ns	-	ns	ns	ns	-	-	ns	-	ns	ns	ns	ns
	RG_FOUEW	0.669	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns

▨ P-value < 0.05

🟩 > 2 SD Increase

🟩 > 3 SD Increase

🟩 > 4 SD Increase

🟩 > 5 SD Increase

🟦 > 2 SD Decrease

🟦 > 3 SD Decrease

🟦 > 4 SD Decrease

🟦 > 5 SD Decrease

bold Significant increase or decrease from base year (b)

🟩 Significantly > than all historical years (or 2017)

🟦 Significantly < than all historical years (or 2017)

Notes: "ns" = not significant; "-" insufficient data for comparison

[a] *Year* p-value from an ANOVA with factors *Year* and *Month.*

[b] Magnitude of Difference (MOD) = [$\text{Mean}_{\text{given year}}$ – $\text{Mean}_{\text{year b}}$] /$\text{Mean}_{\text{year b}}$ × 100%.

[c] Significance among year determined using all pairwise comparisons using Tukey's honestly signifciant differences method. Years that share a letter are not significantly different. Letters assigned such that the mean with with highest magnitude is assigned "A".

Table B.10: Temporal Changes in Trichoptera Relative Abundance for Reference and Mine-exposed Areas in the FRO LAEMP, 2012 to 2018

Status	Area	Year P-value[a]	Q1. Is there a positive or negative change since the base year (b) of monitoring?							Q2. Is the 2018 annual mean greater or less than all annual historical means (2012 - 2017) and the previous year (2017)?[c]								
			Magnitude of Difference (MOD)[b] and Significance (bolded) from Base Year (b)[c]															
			2012	2013	2014	2015	2016	2017	2018	2012	2013	2014	2015	2016	2017	2018	2012-2017	2018
Reference	RG_HENUP	0.163	ns	ns	-	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns
	RG_FO26	<0.001	b	-3.7	-	**-5.1**	-2.1	**6.2**	-1.9	B	BC	-	C	BC	A	BC	ns	↓
Mine-exposed	RG_FODHE	0.012	b	-	-	**-4.3**	**-5.0**	-2.7	-2.3	A	-	-	B	B	AB	AB	ns	ns
	RG_FOUNGD	0.440	ns	-	-	ns	-	ns	ns	ns	-	-	ns	-	ns	ns	ns	ns
	RG_FODNGD	0.540	-	-	-	ns	-	ns	ns	-	-	-	ns	-	ns	ns	ns	ns
	RG_MP1	0.217	ns	ns	-	ns	-	ns	ns	ns	ns	-	ns	-	ns	ns	ns	ns
	RG_FOUSH	0.653	ns	-	-	ns	-	ns	ns	ns	-	-	ns	-	ns	ns	ns	ns
	RG_FOUKI	0.007	b	-	-	-1.6	1.8	2.1	-1.3	AB	-	-	B	AB	A	B	ns	↓
	RG_FOBKS	0.001	b	-	-	1.2	4.2	**5.0**	1.6	B	-	-	B	AB	A	B	ns	↓
	RG_FOBSC	0.013	b	-	-	-0.82	2.8	4.2	0.59	AB	-	-	B	AB	A	B	ns	↓
	RG_FOBCP	<0.001	b	-	-	3.1	**8.3**	**6.5**	2.0	C	-	-	BC	A	AB	C	ns	↓
	RG_FRCP1SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	RG_FRUPO	0.705	-	-	-	-	-	ns	ns	-	-	-	-	-	ns	ns	ns	ns
	RG_FODPO	<0.001	b	-0.13	-	**7.6**	**9.3**	**5.1**	-0.85	C	C	-	AB	A	B	C	ns	↓
	RG_FO22	0.009	b	-	-	3.4	-	**4.8**	0.85	B	-	-	AB	-	A	B	ns	↓
	RG_FOUEW	0.057	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns

▨	P-value < 0.05		
🟩	> 2 SD Increase	🟦	> 2 SD Decrease
🟩	> 3 SD Increase	🟦	> 3 SD Decrease
🟩	> 4 SD Increase	🟦	> 4 SD Decrease
🟩	> 5 SD Increase	🟦	> 5 SD Decrease
bold	Significant increase or decrease from base year (b)		
🟩	Significantly > than all historical years (or 2017)		
🟦	Significantly < than all historical years (or 2017)		

Notes: "ns" = not significant; "-" insufficient data for comparison

[a] *Year* p-value from an ANOVA with factors *Year* and *Month.*

[b] Magnitude of Difference (MOD) = $[\text{Mean}_{\text{given year}} - \text{Mean}_{\text{year b}}] / \text{Mean}_{\text{year b}} \times 100\%$.

[c] Significance among year determined using all pairwise comparisons using Tukey's honestly signifciant differences method. Years that share a letter are not significantly different. Letters assigned such that the mean with with highest magnitude is assigned "A".

Table B.11: Temporal Changes in Ephemeroptera Abundance for Reference and Mine-exposed Areas in the FRO LAEMP, 2012 to 2018

Status	Area	Year P-value[a]	Q1. Is there a positive or negative change since the base year (b) of monitoring?							Q2. Is the 2018 annual mean greater or less than all annual historical means (2012 - 2017) and the previous year (2017)?[c]								
			Magnitude of Difference (MOD)[b] and Significance (bolded) from Base Year (b) [c]															
			2012	2013	2014	2015	2016	2017	2018	2012	2013	2014	2015	2016	2017	2018	2012-2017	2018
Reference	RG_HENUP	0.204	ns	ns	-	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	-	-
	RG_FO26	<0.001	b	-1.7	-	1.1	2.7	1.6	**4.5**	BC	C	-	ABC	AB	ABC	A	ns	ns
Mine-exposed	RG_FODHE	0.644	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOUNGD	<0.001	b	-	-	-1.6	-	-3.3	1.9	AB	-	-	B	-	B	A	ns	↑
	RG_FODNGD	0.613	-	-	-	ns	-	ns	ns	-	-	-	ns	-	ns	ns	ns	ns
	RG_MP1	0.002	b	**-5.9**	-	**-4.5**	-	-0.89	-1.8	A	C	-	BC	-	AB	AB	ns	ns
	RG_FOUSH	0.029	b	-	-	-1.4	-	**-3.7**	**-2.6**	A	-	-	AB	-	B	B	ns	ns
	RG_FOUKI	<0.001	b	-	-	**-4.6**	**-8.1**	**-4.7**	**-4.1**	A	-	-	BC	C	BC	B	ns	ns
	RG_FOBKS	0.024	b	-	-	-0.98	-1.4	-1.8	0.91	AB	-	-	AB	AB	B	A	ns	↑
	RG_FOBSC	0.022	b	-	-	-2.7	**-4.7**	-2.8	-1.7	A	-	-	AB	B	AB	AB	ns	ns
	RG_FOBCP	<0.001	b	-	-	**-5.6**	**-6.6**	**-5.7**	**-3.5**	A	-	-	B	B	B	B	ns	ns
	RG_FRCP1SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	RG_FRUPO	0.990	-	-	-	-	-	ns	ns	-	-	-	-	-	ns	ns	ns	ns
	RG_FODPO	<0.001	b	-0.71	-	**-5.3**	-3.6	**-6.3**	-1.1	A	A	-	B	AB	B	A	ns	↑
	RG_FO22	0.371	ns	-	-	ns	-	ns	ns	ns	-	-	ns	-	ns	ns	ns	ns
	RG_FOUEW	0.454	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns

▨	P-value < 0.05		
🟩	> 2 SD Increase	🟦	> 2 SD Decrease
🟩	> 3 SD Increase	🟦	> 3 SD Decrease
🟩	> 4 SD Increase	🟦	> 4 SD Decrease
🟩	> 5 SD Increase	🟦	> 5 SD Decrease
bold	Significant increase or decrease from base year (b)		
🟩	Significantly > than all historical years (or 2017)		
🟦	Significantly < than all historical years (or 2017)		

Notes: "ns" = not significant

Notes: "ns" = not significant; "-" insufficient data for comparison

[b] Magnitude of Difference (MOD) = [Mean$_{\text{given year}}$ – Mean$_{\text{year b}}$] /Mean$_{\text{year b}}$ × 100%.

[c] Significance among year determined using all pairwise comparisons using Tukey's honestly signifciant differences method. Years that share a letter are not significantly different. Letters assigned such that the mean with with highest magnitude is assigned "A".

Table B.12: Temporal Changes in Plecoptera Abundance for Reference and Mine-exposed Areas in the FRO LAEMP, 2012 to 2018

Status	Area	Year P-value[a]	Q1. Is there a positive or negative change since the base year (b) of monitoring?							Q2. Is the 2018 annual mean greater or less than all annual historical means (2012 - 2017) and the previous year (2017)?[c]								
			Magnitude of Difference (MOD)[b] and Significance (bolded) from Base Year (b) [c]															
			2012	2013	2014	2015	2016	2017	2018	2012	2013	2014	2015	2016	2017	2018	2012-2017	2018
Reference	RG_HENUP	0.030	b	-1.6	-	1.9	-0.88	2.9	-0.097	AB	B	-	AB	AB	A	AB	-	-
	RG_FO26	0.690	ns	ns	-	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns
Mine-exposed	RG_FODHE	0.572	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOUNGD	0.469	ns	-	-	ns	-	ns	ns	ns	-	-	ns	-	ns	ns	ns	ns
	RG_FODNGD	0.918	-	-	-	ns	-	ns	ns	-	-	-	ns	-	ns	ns	ns	ns
	RG_MP1	0.237	ns	ns	-	ns	-	ns	ns	ns	ns	-	ns	-	ns	ns	ns	ns
	RG_FOUSH	0.343	ns	-	-	ns	-	ns	ns	ns	-	-	ns	-	ns	ns	ns	ns
	RG_FOUKI	0.134	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOBKS	0.227	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOBSC	0.986	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOBCP	0.440	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FRCP1SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	RG_FRUPO	0.405	-	-	-	-	-	ns	ns	-	-	-	-	-	ns	ns	ns	ns
	RG_FODPO	0.024	b	2.4	-	0.38	-0.33	0.31	**3.5**	B	AB	-	AB	B	AB	A	ns	ns
	RG_FO22	0.099	ns	-	-	ns	-	ns	ns	ns	-	-	ns	-	ns	ns	ns	ns
	RG_FOUEW	0.715	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns

▨ P-value < 0.05
🟩 > 2 SD Increase
🟩 > 3 SD Increase
🟩 > 4 SD Increase
🟩 > 5 SD Increase
🟦 > 2 SD Decrease
🟦 > 3 SD Decrease
🟦 > 4 SD Decrease
🟦 > 5 SD Decrease
bold Significant increase or decrease from base year (b)
🟩 Significantly > than all historical years (or 2017)
🟦 Significantly < than all historical years (or 2017)

Notes: "ns" = not significant

Notes: "ns" = not significant; "-" insufficient data for comparison

[b] Magnitude of Difference (MOD) = $[\text{Mean}_{\text{given year}} - \text{Mean}_{\text{year b}}] / \text{Mean}_{\text{year b}} \times 100\%$.

[c] Significance among year determined using all pairwise comparisons using Tukey's honestly signifciant differences method. Years that share a letter are not significantly different. Letters assigned such that the mean with with highest magnitude is assigned "A".

Table B.13: Temporal Changes in Trichoptera Abundance for Reference and Mine-exposed Areas in the FRO LAEMP, 2012 to 2018

Status	Area	Year P-value[a]	Q1. Is there a positive or negative change since the base year (b) of monitoring? Magnitude of Difference (MOD)[b] and Significance (bolded) from Base Year (b)[c]							Q2. Is the 2018 annual mean greater or less than all annual historical means (2012 - 2017) and the previous year (2017)?[c]								
			2012	2013	2014	2015	2016	2017	2018	2012	2013	2014	2015	2016	2017	2018	2012-2017	2018
Reference	RG_HENUP	0.248	ns	ns	-	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	-	-
	RG_FO26	<0.001	b	-3.4	-	-3.1	-0.042	3.6	0.80	AB	B	-	B	AB	A	A	ns	ns
Mine-exposed	RG_FODHE	0.018	b	-	-	-3.4	**-4.8**	-2.3	-1.7	A	-	-	AB	B	AB	AB	ns	ns
	RG_FOUNGD	0.044	b	-	-	-2.5	-	-1.6	1.0	AB	-	-	B	-	AB	A	ns	ns
	RG_FODNGD	0.459	-	-	-	ns	-	ns	ns	-	-	-	ns	-	ns	ns	ns	ns
	RG_MP1	0.196	ns	ns	-	ns	-	ns	ns	ns	ns	-	ns	-	ns	ns	ns	ns
	RG_FOUSH	0.854	ns	-	-	ns	-	ns	ns	ns	-	-	ns	-	ns	ns	ns	ns
	RG_FOUKI	0.407	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOBKS	0.529	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOBSC	0.601	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOBCP	0.393	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FRCP1SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	RG_FRUPO	0.228	-	-	-	-	-	ns	ns	-	-	-	-	-	ns	ns	ns	ns
	RG_FODPO	0.054	ns	ns	-	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	ns	ns
	RG_FO22	0.006	b	-	-	**4.3**	-	**5.4**	1.7	C	-	-	AB	-	A	BC	ns	↓
	RG_FOUEW	0.470	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns

▨	P-value < 0.05		
🟩	> 2 SD Increase	🟦	> 2 SD Decrease
🟩	> 3 SD Increase	🟦	> 3 SD Decrease
🟩	> 4 SD Increase	🟦	> 4 SD Decrease
🟩	> 5 SD Increase	🟦	> 5 SD Decrease
bold	Significant increase or decrease from base year (b)		
🟩	Significantly > than all historical years (or 2017)		
🟦	Significantly < than all historical years (or 2017)		

Notes: "ns" = not significant

Notes: "ns" = not significant; "-" insufficient data for comparison

[b] Magnitude of Difference (MOD) = [Mean$_{\text{given year}}$ – Mean$_{\text{year b}}$] /Mean$_{\text{year b}}$ × 100%.

[c] Significance among year determined using all pairwise comparisons using Tukey's honestly signifciant differences method. Years that share a letter are not significantly different. Letters assigned such that the mean with with highest magnitude is assigned "A".

Table B.14: Temporal Changes in Baetidae Abundance for Reference and Mine-exposed Areas in the FRO LAEMP, 2012 to 2018

Status	Area	Year P-value^a	Q1. Is there a positive or negative change since the base year (b) of monitoring? Magnitude of Difference (MOD)^b and Significance (bolded) from Base Year (b)^c							Q2. Is the 2018 annual mean greater or less than all annual historical means (2012 - 2017) and the previous year (2017)?^{c}								
			2012	2013	2014	2015	2016	2017	2018	2012	2013	2014	2015	2016	2017	2018	2012-2017	2018
Reference	RG_HENUP	0.049	b	-1.1	-	0.91	-3.3	0.91	-0.82	AB	AB	-	A	B	A	AB	-	-
	RG_FO26	0.003	b	0.40	-	**5.7**	3.6	**4.5**	3.3	C	BC	-	A	ABC	AB	ABC	ns	ns
Mine-exposed	RG_FODHE	<0.001	b	-	-	**7.5**	**5.1**	2.6	**4.3**	C	-	-	A	AB	BC	AB	ns	ns
	RG_FOUNGD	0.034	b	-	-	**4.5**	-	3.9	3.2	B	-	-	A	-	AB	AB	ns	ns
	RG_FODNGD	0.186	-	-	-	ns	-	ns	ns	-	-	-	ns	-	ns	ns	ns	ns
	RG_MP1	0.002	b	-2.1	-	-0.76	-	1.2	2.8	AB	B	-	B	-	AB	A	ns	ns
	RG_FOUSH	<0.001	b	-	-	**5.9**	-	0.51	1.8	B	-	-	A	-	B	B	ns	ns
	RG_FOUKI	0.007	b	-	-	1.1	-2.5	2.1	1.0	AB	-	-	AB	B	A	A	ns	ns
	RG_FOBKS	0.471	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOBSC	0.220	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOBCP	0.002	b	-	-	2.2	1.9	0.82	-2.5	AB	-	-	A	A	AB	B	ns	ns
	RG_FRCP1SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	RG_FRUPO	0.453	-	-	-	-	-	ns	ns	-	-	-	-	-	ns	ns	ns	ns
	RG_FODPO	<0.001	b	-0.30	-	**-10**	-0.30	-3.9	1.2	AB	AB	-	C	AB	B	A	ns	↑
	RG_FO22	0.805	ns	-	-	ns	-	ns	ns	ns	-	-	ns	-	ns	ns	ns	ns
	RG_FOUEW	0.044	b	-	-	-3.5	0.77	-2.1	-2.7	AB	-	-	B	A	AB	B	ns	ns

▨	P-value < 0.05		
🟩	> 2 SD Increase	🟦	> 2 SD Decrease
🟩	> 3 SD Increase	🟦	> 3 SD Decrease
🟩	> 4 SD Increase	🟦	> 4 SD Decrease
🟩	> 5 SD Increase	🟦	> 5 SD Decrease
bold	Significant increase or decrease from base year (b)		
🟩	Significantly > than all historical years (or 2017)		
🟦	Significantly < than all historical years (or 2017)		

Notes: "ns" = not significant

Notes: "ns" = not significant; "-" insufficient data for comparison

[b] Magnitude of Difference (MOD) = $[\text{Mean}_{\text{given year}} - \text{Mean}_{\text{year b}}] / \text{Mean}_{\text{year b}} \times 100\%$.

[c] Significance among year determined using all pairwise comparisons using Tukey's honestly signifciant differences method. Years that share a letter are not significantly different. Letters assigned such that the mean with with highest magnitude is assigned "A".

Table B.15: Temporal Changes in Ephemerellidae Abundance for Reference and Mine-exposed Areas in the FRO LAEMP, 2012 to 2018

Status	Area	Year P-value[a]	Q1. Is there a positive or negative change since the base year (b) of monitoring?							Q2. Is the 2018 annual mean greater or less than all annual historical means (2012 - 2017) and the previous year (2017)?[c]								
			Magnitude of Difference (MOD)[b] and Significance (bolded) from Base Year (b)[c]															
			2012	2013	2014	2015	2016	2017	2018	2012	2013	2014	2015	2016	2017	2018	2012-2017	2018
Reference	RG_HENUP	0.003	b	-3.9	-	-0.86	0.57	0.94	0.73	AB	B	-	AB	A	A	A	-	-
	RG_FO26	<0.001	b	-3.6	-	-0.47	3.1	1.4	**4.1**	BC	C	-	BC	AB	AB	A	ns	ns
Mine-exposed	RG_FODHE	0.723	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOUNGD	<0.001	b	-	-	-0.46	-	0.071	**6.6**	B	-	-	B	-	B	A	↑	↑
	RG_FODNGD	0.010	-	-	-	b	-	2.7	**4.2**	-	-	-	B	-	AB	A	ns	ns
	RG_MP1	<0.001	b	**-8.6**	-	**-5.3**	-	2.3	-1.3	AB	C	-	C	-	A	B	ns	↓
	RG_FOUSH	0.027	b	-	-	**-3.7**	-	**-3.7**	**-2.6**	A	-	-	B	-	B	B	ns	ns
	RG_FOUKI	0.109	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOBKS	0.004	b	-	-	-0.37	1.7	-0.36	2.8	AB	-	-	AB	AB	B	A	ns	↑
	RG_FOBSC	0.018	b	-	-	-3.4	-3.5	**-4.8**	-2.6	A	-	-	AB	AB	B	AB	ns	ns
	RG_FOBCP	<0.001	b	-	-	**-7.1**	**-7.1**	**-10**	**-8.3**	A	-	-	B	B	B	B	ns	ns
	RG_FRCP1SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	RG_FRUPO	0.488	-	-	-	-	-	ns	ns	-	-	-	-	-	ns	ns	ns	ns
	RG_FODPO	<0.001	b	**-5.9**	-	**-7.5**	**-7.3**	**-10**	**-5.3**	A	BC	-	BC	BC	C	B	ns	↑
	RG_FO22	0.004	b	-	-	0.69	-	-3.7	**-3.7**	AB	-	-	A	-	BC	C	ns	ns
	RG_FOUEW	0.150	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns

▨	P-value < 0.05		
▨	> 2 SD Increase	▨	> 2 SD Decrease
▨	> 3 SD Increase	▨	> 3 SD Decrease
▨	> 4 SD Increase	▨	> 4 SD Decrease
▨	> 5 SD Increase	▨	> 5 SD Decrease
bold	Significant increase or decrease from base year (b)		
🟩	Significantly > than all historical years (or 2017)		
🟦	Significantly < than all historical years (or 2017)		

Notes: "ns" = not significant

Notes: "ns" = not significant; "-" insufficient data for comparison

[b] Magnitude of Difference (MOD) = $[\text{Mean}_{\text{given year}} - \text{Mean}_{\text{year b}}] / \text{Mean}_{\text{year b}} \times 100\%$.

[c] Significance among year determined using all pairwise comparisons using Tukey's honestly signifciant differences method. Years that share a letter are not significantly different. Letters assigned such that the mean with with highest magnitude is assigned "A".

Table B.16: Temporal Changes in Heptageniidae Abundance for Reference and Mine-exposed Areas in the FRO LAEMP, 2012 to 2018

Status	Area	Year P-value[a]	Q1. Is there a positive or negative change since the base year (b) of monitoring?							Q2. Is the 2018 annual mean greater or less than all annual historical means (2012 - 2017) and the previous year (2017)?[c]								
			Magnitude of Difference (MOD)[b] and Significance (bolded) from Base Year (b) [c]															
			2012	2013	2014	2015	2016	2017	2018	2012	2013	2014	2015	2016	2017	2018	2012-2017	2018
Reference	RG_HENUP	0.185	ns	ns	-	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	ns	-	-
	RG_FO26	<0.001	b	-1.0	-	0.91	2.2	0.97	**5.0**	B	B	-	B	AB	B	A	ns	↑
Mine-exposed	RG_FODHE	0.152	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOUNGD	0.001	b	-	-	-2.8	-	**-5.1**	-0.18	A	-	-	AB	-	B	A	ns	↑
	RG_FODNGD	0.036	-	-	-	b	-	-3.3	0.32	-	-	-	AB	-	B	A	ns	↑
	RG_MP1	0.003	b	**-5.7**	-	**-4.7**	-	-3.2	-3.4	A	B	-	B	-	AB	AB	ns	ns
	RG_FOUSH	0.004	b	-	-	-3.1	-	**-4.1**	**-3.3**	A	-	-	AB	-	B	B	ns	ns
	RG_FOUKI	<0.001	b	-	-	**-6.1**	**-8.5**	**-6.4**	**-5.7**	A	-	-	B	B	B	B	ns	ns
	RG_FOBKS	0.083	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOBSC	0.051	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns
	RG_FOBCP	0.019	b	-	-	-4.0	**-4.8**	-3.4	-1.5	A	-	-	AB	B	AB	AB	ns	ns
	RG_FRCP1SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	RG_FRUPO	0.749	-	-	-	-	-	ns	ns	-	-	-	-	-	ns	ns	ns	ns
	RG_FODPO	0.024	b	1.8	-	-1.7	-2.0	-2.9	0.34	AB	A	-	AB	AB	B	AB	ns	ns
	RG_FO22	0.886	ns	-	-	ns	-	ns	ns	ns	-	-	ns	-	ns	ns	ns	ns
	RG_FOUEW	0.544	ns	-	-	ns	ns	ns	ns	ns	-	-	ns	ns	ns	ns	ns	ns

▩ P-value < 0.05

🟩 > 2 SD Increase 🟦 > 2 SD Decrease

🟩 > 3 SD Increase 🟦 > 3 SD Decrease

🟩 > 4 SD Increase 🟦 > 4 SD Decrease

🟩 > 5 SD Increase 🟦 > 5 SD Decrease

bold Significant increase or decrease from base year (b)

🟩 Significantly > than all historical years (or 2017)

🟦 Significantly < than all historical years (or 2017)

Notes: "ns" = not significant

Notes: "ns" = not significant; "-" insufficient data for comparison

[b] Magnitude of Difference (MOD) = $[\text{Mean}_{\text{given year}} - \text{Mean}_{\text{year b}}] / \text{Mean}_{\text{year b}} \times 100\%$.

[c] Significance among year determined using all pairwise comparisons using Tukey's honestly signifciant differences method. Years that share a letter are not significantly different. Letters assigned such that the mean with with highest magnitude is assigned "A".

Table B.17: Composite-Taxa Benthic Invertebrate Tissue Selenium Concentrations, FRO LAEMP, September 2018

Exposure Type	Biological Monitoring Area	Sample ID	Composite-Taxa Tissue Selenium (mg/kg dw)
Reference	RG_HENUP	RG_HENUP1_INV_20180906	2.5
		RG_HENUP2_INV_20180906	4.6
		RG_HENUP3_INV_20180906	4.8
	RG_FO26	RG_FO26-1_INV_20180907	3.4
		RG_FO26-2_INV_20180907	4.1
		RG_FO26-3_INV_20180907	3.8
Mine-exposed	RG_FODHE	RG_FODHE1_INV_20180905	11
		RG_FODHE2_INV_20180905	12
		RG_FODHE3_INV_20180905	15
	RG_FOUNGD	RG_FOUNGD1_INV_20180913	6
		RG_FOUNGD2_INV_20180913	7
		RG_FOUNGD3_INV_20180913	8
	RG_FODNGD	RG_FODNGD1_INV_20180912	9
		RG_FODNGD2_INV_20180912	8
		RG_FODNGD3_INV_20180912	8
	RG_MP1	RG_MP1-1_INV_20180911	7
		RG_MP1-2_INV_20180911	8.6
		RG_MP1-3_INV_20180911	8
	RG_FOUSH	RG_FOUSH1_INV_20180911	8
		RG_FOUSH2_INV_20180911	8
		RG_FOUSH3_INV_20180911	9.1
	RG_FOUKI	RG_FOUKI1_INV_20180907	9.4
		RG_FOUKI2_INV_20180907	10
		RG_FOUKI3_INV_20180907	11
	RG_FOBKS	RG_FOBKS1_INV_20180908	11
		RG_FOBKS2_INV_20180908	10
		RG_FOBKS3_INV_20180908	9.9
	RG_FOBSC	RG_FOBSC1_INV_20180910	9
		RG_FOBSC2_INV_20180910	9
		RG_FOBSC3_INV_20180910	8.2
	RG_FOBCP	RG_FOBCP1_INV_20180909	9.4
		RG_FOBCP2_INV_20180909	8
		RG_FOBCP3_INV_20180909	10
		RG_FOBCP4_INV_20180909	8
		RG_FOBCP5_INV_20180909	7.9
	RG_FRUPO	RG_FRUPO1_INV_20180909	7.5
		RG_FRUPO2_INV_20180909	9.7
		RG_FRUPO3_INV_20180909	8.7
	RG_FODPO	RG_FODPO1_INV_20180913	4.3
		RG_FODPO2_INV_20180913	8
		RG_FODPO3_INV_20180913	5
	RG_FO22	RG_FO22-1_INV_20180908	7
		RG_FO22-2_INV_20180908	9.2
		RG_FO22-3_INV_20180908	7
		RG_FO22-4_INV_20180908	8.9
		RG_FO22-5_INV_20180908	7.6
	RG_FOUEW	RG_FOUEW1_INV_20180906	7.6
		RG_FOUEW2_INV_20180906	7
		RG_FOUEW3_INV_20180906	5

🟦	Value > EVWQP level 1 benchmark of 11 mg/kg dw for dietary effects to fish (Teck 2014). Level 1 benchmark for effects to invertebrates is 13 mg/kg dw.
▨	Value > upper limit of normal range of (7.79 mg/kg dw; Minnow 2018).

Table B.18: Composite-Taxa Benthic Invertebrate Tissue Selenium Concentrations, FRO LAEMP, December 2018

Exposure Type	Biological Monitoring Area	Sample ID	Composite-Taxa Tissue Selenium (mg/kg dw)
	RG_UFR1	RG_UFR1_BIT01_20181205	4.1
		RG_UFR1_BIT02_20181205	3.7
		RG_UFR1_BIT03_20181205	4
Mine-exposed	RG_FODHE	RG_FODHE_BIT01_20181205	7.8
		RG_FODHE_BIT02_20181205	7.6
		RG_FODHE_BIT03_20181205	3.8
	RG_FOUNGD	RG_FOUNGD_BIT01_20181205	6
		RG_FOUNGD_BIT02_20181205	6.1
		RG_FOUNGD_BIT03_20181205	5
	RG_FODNGD	RG_FODNGD_BIT01_20181205	4.7
		RG_FODNGD_BIT02_20181205	4.2
		RG_FODNGD_BIT03_20181205	7
	RG_MP1	RG_MP1_BIT01_20181206	6.6
		RG_MP1_BIT02_20181206	6.8
		RG_MP1_BIT03_20181206	5.3
	RG_FOUSH	RG_FOUSH_BIT01_20181206	5.5
		RG_FOUSH_BIT02_20181206	5
		RG_FOUSH_BIT03_20181206	5.2
	RG_FOUKI	RG_FOUKI_BIT01_20181204	4.9
		RG_FOUKI_BIT02_20181204	5.5
		RG_FOUKI_BIT03_20181204	7.2
	RG_FOBKS	RG_FOBKS_BIT01_20181204	3.8
		RG_FOBKS_BIT02_20181204	3.8
		RG_FOBKS_BIT03_20181204	6.6
	RG_FOBSC	RG_FOBSC_BIT01_20181204	8
		RG_FOBSC_BIT02_20181204	9.2
		RG_FOBSC_BIT03_20181204	7.6
	RG_FOBCP	RG_FOBCP_BIT01_20181203	39
		RG_FOBCP_BIT02_20181203	8.4
		RG_FOBCP_BIT03_20181203	7
	RG_FRUPO	RG_FRUPO_BIT01_20181204	5.3
		RG_FRUPO_BIT02_20181204	5.1
		RG_FRUPO_BIT03_20181204	5
	RG_FODPO	RG_FODPO_BIT01_20181204	0.33[a]
		RG_FODPO_BIT02_20181204	4.4
		RG_FODPO_BIT03_20181204	5.4
	RG_FO22	RG_FO22_BIT01_20181205	3.4
		RG_FO22_BIT02_20181205	3.9
		RG_FO22_BIT03_20181205	5.6
	RG_FOUEW	RG_FOUEW_BIT01_20181205	4.8
		RG_FOUEW_BIT02_20181205	5.5
		RG_FOUEW_BIT03_20181205	4.7

🟦 Value > EVWQP level 1 benchmark of 11 mg/kg dw for dietary effects to fish (Teck 2014). Level 1 benchmark for effects to invertebrates is 13 mg/kg dw.

▨ Value > upper limit of normal range of (7.79 mg/kg dw; Minnow 2018).

[a] Possible laboratory error, but insufficient sample remained for re-analysis.

Table B.19: Paired Tissue and Water Selenium Concentrations for the FRO LAEMP, 2012 to 2018

Watershed	Exposure Status	Minnow Biological Monitoring Area	Associated Teck Water Monitoring Station Code	Year	Total Selenium in Water		Selenium in Tissue	
					Sample Date	µg/L	Sample Date	mg/kg dw
Fording River	Reference	RG_HENUP	FR_HC3	2012	18-Sep-12	0.83	18-Sep-12	6.4
				2015	15-Sep-15	1.03	15-Sep-15	3.8
				2016	7-Sep-16	1.11	12-Sep-16	3.8
				2017	15-Sep-17	1.04	15-Sep-17	4.9
				2018	6-Sep-18	1.11	6-Sep-18	3.4
				2018	6-Sep-18	1.11	6-Sep-18	4.1
				2018	6-Sep-18	1.11	6-Sep-18	3.8
		RG_FO26	FR_UFR1	2012	18-Sep-12	0.58	18-Sep-12	4.9
				2012	18-Sep-12	0.58	18-Sep-12	3.6
				2012	18-Sep-12	0.58	18-Sep-12	4.2
				2015	14-Sep-15	0.79	14-Sep-15	4.9
				2016	20-Sep-16	0.68	12-Sep-16	3.5
				2017	12-Sep-17	0.60	12-Sep-17	3.2
				2018	7-Sep-18	0.57	7-Sep-18	2.5
				2018	7-Sep-18	0.57	7-Sep-18	4.6
				2018	7-Sep-18	0.57	7-Sep-18	4.8
		RG_UFR1	FR_UFR1	2018	5-Dec-18	0.73	5-Dec-18	4.1
				2018	5-Dec-18	0.73	5-Dec-18	3.7
				2018	5-Dec-18	0.73	5-Dec-18	4.0
	Mine-exposed	RG_FODHE	FR_FR1	2012	19-Sep-12	18.0	19-Sep-12	8.9
				2015	14-Sep-15	9.8	14-Sep-15	6.6
				2017	15-Sep-17	20.4	15-Sep-17	8.1
				2018	5-Sep-18	19.8	5-Sep-18	11.0
				2018	5-Sep-18	19.8	5-Sep-18	12.0
				2018	5-Sep-18	19.8	5-Sep-18	15.0
				2018	5-Dec-18	25.1	5-Dec-18	7.8
				2018	5-Dec-18	25.1	5-Dec-18	7.6
				2018	5-Dec-18	25.1	5-Dec-18	3.8
		RG_FOUNGD	-	2012	12-Sep-12	23.5	12-Sep-12	8.2
				2015	15-Sep-15	24.0	15-Sep-15	7.2
				2017	16-Sep-17	53.0	16-Sep-17	6.5
				2018	13-Sep-18	37.9	13-Sep-18	6.0
				2018	13-Sep-18	37.9	13-Sep-18	7.0
				2018	13-Sep-18	37.9	13-Sep-18	8.0
				2018	5-Dec-18	52.2	5-Dec-18	6.0
				2018	5-Dec-18	52.2	5-Dec-18	6.1
				2018	5-Dec-18	52.2	5-Dec-18	5.0
		RG_FODNGD	FR_FRABEC1	2015	14-Sep-15	23.4	14-Sep-15	6.2
				2017	16-Sep-17	54.3	16-Sep-17	5.6
				2018	12-Sep-18	42.0	12-Sep-18	9.0
				2018	12-Sep-18	42.0	12-Sep-18	8.0
				2018	12-Sep-18	42.0	12-Sep-18	8.0
				2018	5-Dec-18	51.8	5-Dec-18	4.7
				2018	5-Dec-18	51.8	5-Dec-18	4.2
				2018	5-Dec-18	51.8	5-Dec-18	7.0
		RG_MP1	FR_MULTIPLATE	2012	18-Sep-12	37.6	18-Sep-12	9.0
				2015	15-Sep-15	23.2	15-Sep-15	5.9
				2017	12-Sep-17	52.2	12-Sep-17	5.6
				2018	11-Sep-18	44.3	11-Sep-18	7.0
				2018	11-Sep-18	44.3	11-Sep-18	8.6
				2018	11-Sep-18	44.3	11-Sep-18	8.0
				2018	6-Dec-18	57.0	6-Dec-18	6.6
				2018	6-Dec-18	57.0	6-Dec-18	6.8
				2018	6-Dec-18	57.0	6-Dec-18	5.3
		RG_FOUSH	FR_FRNTP	2012	13-Sep-12	36.0	13-Sep-12	7.6
				2015	15-Sep-15	25.5	15-Sep-15	6.0
				2017	14-Sep-17	47.9	14-Sep-17	6.5
				2018	11-Sep-18	43.2	11-Sep-18	8.0
				2018	11-Sep-18	43.2	11-Sep-18	8.0
				2018	11-Sep-18	43.2	11-Sep-18	9.1
				2018	6-Dec-18	57.1	6-Dec-18	5.5
				2018	6-Dec-18	57.1	6-Dec-18	5.0
				2018	6-Dec-18	57.1	6-Dec-18	5.2
		RG_FOUKI	FR_FR2	2012	14-Sep-12	33.6	14-Sep-12	8.5
				2015	16-Sep-15	23.3	16-Sep-15	5.1
				2016	8-Sep-16	28.9	12-Sep-16	5.2

Table B.19: Paired Tissue and Water Selenium Concentrations for the FRO LAEMP, 2012 to 2018

Watershed	Exposure Status	Minnow Biological Monitoring Area	Associated Teck Water Monitoring Station Code	Year	Total Selenium in Water		Selenium in Tissue	
					Sample Date	µg/L	Sample Date	mg/kg dw
Fording River	Mine-exposed	RG_FOUKI	FR_FR2	2017	12-Sep-17	44.5	12-Sep-17	6.7
				2017	12-Sep-17	44.5	12-Sep-17	6.6
				2017	12-Sep-17	44.5	12-Sep-17	6.8
				2018	6-Mar-18	55.3	6-Mar-18	4.9
				2018	6-Mar-18	55.3	6-Mar-18	5.4
				2018	6-Mar-18	55.3	6-Mar-18	5.0
				2018	7-Sep-18	38.0	7-Sep-18	9.4
				2018	7-Sep-18	38.0	7-Sep-18	10.0
				2018	7-Sep-18	38.0	7-Sep-18	11.0
				2018	4-Dec-18	47.4	4-Dec-18	4.9
				2018	4-Dec-18	47.4	4-Dec-18	5.5
				2018	4-Dec-18	47.4	4-Dec-18	7.2
		RG_FOBKS	GH_FR3	2012	14-Sep-12	31.9	14-Sep-12	8.8
				2015	16-Sep-15	23.9	16-Sep-15	6.0
				2017	13-Sep-17	44.9	13-Sep-17	5.8
				2017	13-Sep-17	44.9	13-Sep-17	8.2
				2017	13-Sep-17	44.9	13-Sep-17	5.9
				2018	12-Mar-18	52.9	12-Mar-18	5.8
				2018	12-Mar-18	52.9	12-Mar-18	5.1
				2018	12-Mar-18	52.9	12-Mar-18	6.2
				2018	8-Sep-18	36.2	8-Sep-18	11.0
				2018	8-Sep-18	36.2	8-Sep-18	10.0
				2018	8-Sep-18	36.2	8-Sep-18	9.9
				2018	4-Dec-18	49.4	4-Dec-18	3.8
				2018	4-Dec-18	49.4	4-Dec-18	3.8
				2018	4-Dec-18	49.4	4-Dec-18	6.6
		RG_FOBSC	FR_FR4	2012	15-Sep-12	53.8	15-Sep-12	8.4
				2015	17-Sep-15	33.9	17-Sep-15	7.5
				2017	15-Sep-17	72.9	15-Sep-17	5.0
				2018	10-Sep-18	61.3	10-Sep-18	9.0
				2018	10-Sep-18	61.3	10-Sep-18	9.0
				2018	10-Sep-18	61.3	10-Sep-18	8.2
				2018	4-Dec-18	49.1	4-Dec-18	8.0
				2018	4-Dec-18	49.1	4-Dec-18	9.2
				2018	4-Dec-18	49.1	4-Dec-18	7.6
		RG_FOBCP	FR_FRCP1	2012	15-Sep-12	117	15-Sep-12	7.9
				2015	17-Sep-15	63.8	17-Sep-15	7.7
				2016	13-Sep-16	73.2	12-Sep-16	9.7
				2017	14-Sep-17	128	14-Sep-17	6.4
				2018	9-Sep-18	200	9-Sep-18	9.4
				2018	9-Sep-18	200	9-Sep-18	8.0
				2018	9-Sep-18	200	9-Sep-18	10.0
				2018	9-Sep-18	200	9-Sep-18	8.0
				2018	9-Sep-18	200	9-Sep-18	7.9
				2018	3-Dec-18	603	3-Dec-18	39.0
				2018	3-Dec-18	603	3-Dec-18	8.4
				2018	3-Dec-18	603	3-Dec-18	7.0
		RG_FRCP1SW	FR_FRCP1SW	2017	14-Sep-17	131	14-Sep-17	6.9
		RG_FRUPO	FR_FRRD	2017	15-Sep-17	98.9	15-Sep-17	7.4
				2018	7-Mar-18	111	7-Mar-18	6.8
				2018	9-Sep-18	82	9-Sep-18	7.5
				2018	9-Sep-18	82	9-Sep-18	9.7
				2018	9-Sep-18	82	9-Sep-18	8.7
				2018	4-Dec-18	69	4-Dec-18	5.3
				2018	4-Dec-18	69	4-Dec-18	5.1
				2018	4-Dec-18	69	4-Dec-18	5.0
		RG_FODPO	GH_PC2	2012	17-Sep-12	76.3	17-Sep-12	6.2
				2015	15-Sep-15	68.2	15-Sep-15	6.9
				2017	13-Sep-17	89.6	13-Sep-17	5.2
				2018	7-Mar-18	105	7-Mar-18	3.5
				2018	13-Sep-18	82	13-Sep-18	4.3
				2018	13-Sep-18	82	13-Sep-18	8.0
				2018	13-Sep-18	82	13-Sep-18	5.0
				2018	4-Dec-18	106	4-Dec-18	0.3
				2018	4-Dec-18	106	4-Dec-18	4.4
				2018	4-Dec-18	106	4-Dec-18	5.4

Table B.19: **Paired Tissue and Water Selenium Concentrations for the FRO LAEMP, 2012 to 2018**

Watershed	Exposure Status	Minnow Biological Monitoring Area	Associated Teck Water Monitoring Station Code	Year	Total Selenium in Water		Selenium in Tissue	
					Sample Date	µg/L	Sample Date	mg/kg dw
Fording River	Mine-exposed	RG_FO22	FR_FRABCH	2012	16-Sep-12	71.1	16-Sep-12	12.4
				2015	12-Sep-15	68.0	12-Sep-15	7.1
				2017	14-Sep-17	83.3	14-Sep-17	5.4
				2018	12-Mar-18	100	12-Mar-18	6.9
				2018	8-Sep-18	78	8-Sep-18	7.0
				2018	8-Sep-18	78	8-Sep-18	9.2
				2018	8-Sep-18	78	8-Sep-18	7.0
				2018	8-Sep-18	78	8-Sep-18	8.9
				2018	8-Sep-18	78	8-Sep-18	7.6
				2018	5-Dec-18	94	5-Dec-18	3.4
				2018	5-Dec-18	94	5-Dec-18	3.9
				2018	5-Dec-18	94	5-Dec-18	5.6
		RG_FOUEW	FR_FR5	2012	16-Sep-12	58.6	16-Sep-12	8.3
				2015	13-Sep-15	58.8	13-Sep-15	6.1
				2016	8-Sep-16	53.0	12-Sep-16	5.8
				2017	13-Sep-17	77.9	13-Sep-17	6.6
				2018	7-Mar-18	86.3	7-Mar-18	6.3
				2018	6-Sep-18	70.9	6-Sep-18	7.6
				2018	6-Sep-18	70.9	6-Sep-18	7.0
				2018	6-Sep-18	70.9	6-Sep-18	5.0
				2018	5-Dec-18	86.6	5-Dec-18	4.8
				2018	5-Dec-18	86.6	5-Dec-18	5.5
				2018	5-Dec-18	86.6	5-Dec-18	4.7

Notes: No concurrent water selenium data were available for 2016 tissue samples, so concentrations from the closest sample date from each associated Teck WQ monitoring station was used. No selenium water data was available for MP1 in 2012, so the corresponding data from FR_MULTIPLATE was used for that data point only in 2012.

Table B.20: Benthic Invertebrate Density and Biomass from Reference and Mine-exposed Areas, FRO LAEMP, September 2018

Station	FO26-BM																				FOBCP-BM																			
Replicate	1		2		3		4		5		6		7		8		9		10		1		2		3		4		5		6		7		8		9		10	
ROUNDWORMS																																								
P. Nemata	12	0.0016	12	0.0014	12	0.0028	6	0.0006	36	0.0108	18	0.0026	11	0.0063	24	0.0060	4	0.0010	-	-	2	0.0002	8	0.0048	7	0.0030	3	0.0019	6	0.0006	-	-	5	0.0033	1	0.0001	3	0.0004	-	-
FLATWORMS																																								
P. Platyhelminthes																																								
Cl. Turbellaria																																								
F. Planariidae	-	-	8	0.0278	2	0.0042	22	0.0740	-	-	-	-	-	-	-	-	2	0.0100	2	0.0127	2	0.0016	6	0.0486	1	0.0089	1	0.0006	4	0.0316	2	0.0112	1	0.0026	2	0.0082	2	0.0023	-	-
ANNELIDS																																								
P. Annelida																																								
WORMS																																								
Cl. Oligochaeta																																								
F. Enchytraeidae	-	-	-	-	2	0.0006	2	0.0016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	0.0014	1	0.0026	3	0.0009	-	-	-	-	2	0.0004	6	0.0019	7	0.0014	2	0.0003
F. Lumbricidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Naididae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ARTHROPODS																																								
MITES																																								
Cl. Arachnida																																								
Subcl. Acari indet	-	-	4	0.0002	-	-	-	-	-	-	2	0.0002	1	0.0001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.0002	-	-	-	-	-	-	-	-	-	-
F. Hydryphantidae	-	-	-	-	-	-	-	-	4	0.0008	-	-	1	0.0001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Hygrobatidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.0001	-	-	-	-
F. Lebertiidae	14	0.0028	30	0.0086	18	0.0120	14	0.0048	12	0.0040	22	0.0090	12	0.0054	20	0.0044	12	0.0034	5	0.0015	306	0.0896	120	0.0244	45	0.0137	29	0.0090	184	0.0418	112	0.0234	40	0.0107	96	0.0224	28	0.0068	79	0.0167
F. Sperchontidae	20	0.0062	14	0.0078	10	0.0026	-	-	12	0.0032	8	0.0022	8	0.0018	20	0.0060	12	0.0042	11	0.0025	26	0.0082	8	0.0022	-	-	1	0.0007	6	0.0024	-	-	3	0.0007	3	0.0005	1	0.0002	1	0.0002
F. Torrenticolidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.0002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SEED SHRIMPS																																								
Cl. Ostracoda	6	0.0006	6	0.0020	14	0.0044	70	0.0148	4	0.0012	20	0.0076	15	0.0045	12	0.0036	4	0.0010	2	0.0004	-	-	-	-	-	-	-	-	-	-	2	0.0004	-	-	1	0.0002	-	-	-	-
INSECTS																																								
Cl. Insecta																																								
BEETLES																																								
O. Coleoptera																																								
F. Curculionidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Dytiscidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.0096	-	-	-	-	2	0.0065	3	0.0094	-	-
F. Elmidae	-	-	-	-	2	0.0006	2	0.0002	-	-	-	-	1	0.0002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	0.0086	2	0.0004	-	-	2	0.0017	4	0.0004	7	0.0042
F. Staphylinidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAYFLIES																																								
O. Ephemeroptera																																								
F. Ameletidae	2	0.0014	8	0.0024	8	0.0024	8	0.0426	-	-	12	0.0036	6	0.0029	-	-	-	-	2	0.0002	8	0.0384	2	0.0002	3	0.0182	1	0.0008	2	0.0510	8	0.0712	3	0.0230	4	0.0148	6	0.0473	1	0.0079
F. Baetidae	8	0.0330	22	0.0544	20	0.0856	34	0.1766	12	0.0692	6	0.0216	16	0.0765	16	0.0364	10	0.0480	2	0.0041	4	0.0004	2	0.0020	-	-	-	-	-	-	-	-	-	-	1	0.0052	2	0.0089	3	0.0093
F. Ephemerellidae	140	0.1106	148	0.0954	194	0.1846	154	0.0308	184	0.1424	172	0.0832	201	1.1083	204	0.3512	162	0.1482	71	0.1123	20	0.0364	14	0.0278	3	0.0005	3	0.0040	18	0.0534	8	0.0156	7	0.0141	6	0.0175	8	0.0183	4	0.0146
F. Heptageniidae	196	0.0748	392	0.1474	890	0.3502	240	0.0856	968	0.3200	340	0.1490	485	0.1688	316	0.1976	752	0.3022	209	0.1061	560	0.2540	956	0.3538	47	0.0216	30	0.0124	188	0.1156	218	0.1098	205	0.0832	68	0.0362	54	0.0369	10	0.0051
STONEFLIES																																								
O. Plecoptera																																								
F. Capniidae	-	-	-	-	-	-	2	0.0006	-	-	-	-	-	-	-	-	-	-	3	0.0004	-	-	2	0.0002	-	-	-	-	-	-	-	-	-	-	-	-	4	0.0003	-	-
F. Chloroperlidae	12	0.0106	4	0.0230	32	0.0798	78	0.1092	48	0.0560	58	0.0758	12	0.0322	36	0.0844	52	0.1468	36	0.0713	2	0.0022	2	0.0058	-	-	1	0.0015	2	0.0032	2	0.0022	2	0.0003	2	0.0013	3	0.0028	1	0.0002
F. Leuctridae	28	0.0222	6	0.0024	34	0.0352	48	0.0258	8	0.0044	26	0.0158	2	0.0026	4	0.0124	8	0.0062	16	0.0103	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Nemouridae	44	0.1142	44	0.1214	80	0.3300	6	0.0148	68	0.1728	6	0.0224	21	0.0603	44	0.1400	28	0.0926	6	0.0023	46	0.0128	274	0.0780	6	0.0057	3	0.0016	62	0.0182	14	0.0026	22	0.0058	11	0.0034	20	0.0047	18	0.0044
F. Perlidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	0.0126	-	-	4	0.0021	2	0.0008	2	0.0752	2	0.0006	1	0.0005	3	0.0015	-	-
F. Perlodidae	28	0.2454	18	0.0788	22	0.0950	14	0.0634	24	0.1436	10	0.0766	16	0.0335	36	0.4680	14	0.2354	5	0.0635	32	0.0138	106	0.6974	18	0.0779	4	0.0937	28	0.1812	34	0.1586	31	0.3353	5	0.0170	6	0.0822	3	0.0014
F. Peltoperlidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Taeniopterygidae	8	0.0034	-	-	2	0.0004	-	-	8	0.0012	-	-	-	-	24	0.0112	6	0.0028	1	0.0001	10	0.0012	20	0.0026	-	-	3	0.0012	4	0.0002	-	-	2	0.0002	6	0.0006	2	0.0001	2	0.0003
CADDISFLIES																																								
O. Trichoptera																																								
immature (?Uenoidae)	**52**	**0.0034**	**368**	**0.0234**	**212**	**0.0148**	**58**	**0.0032**	**52**	**0.0036**	**108**	**0.0056**	**40**	**0.0016**	**16**	**0.0008**	**42**	**0.0022**	**15**	**0.0008**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**0.0001**	**2**	**0.0001**	**-**	**-**
pupae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.0008	-	-	-	-
F. Apataniidae	2	0.0006	-	-	4	0.0050	4	0.0020	-	-	4	0.0018	1	0.0003	-	-	2	0.0004	1	0.0005	8	0.0100	4	0.0018	2	0.0010	1	0.0009	-	-	2	0.0010	1	0.0009	9	0.0061	1	0.0009	-	-
F. Brachycentridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.0288	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Glossosomatidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	0.0182	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Hydropsychidae	18	0.0738	6	0.2152	46	1.3996	-	-	24	1.8932	4	0.0014	2	0.0414	24	2.6896	2	0.3636	-	-	4	0.0268	74	0.5568	-	-	-	-	-	-	-	-	-	-	1	0.0127	1	0.0073	-	-
F. Limnephilidae	-	-	6	0.0002	2	0.0002	-	-	8	0.0012	20	0.0022	2	0.0001	-	-	6	0.0002	-	-	-	-	-	-	-	-	1	0.0001	-	-	-	-	-	-	2	0.0003	-	-	1	0.0001
F. Rhyacophilidae	36	0.4784	12	0.2756	16	0.1074	6	0.0334	24	0.1856	20	0.3034	11	0.1045	40	0.2104	16	0.1834	4	0.1102	34	0.2338	52	0.2540	8	0.1122	6	0.0257	10	0.1116	6	0.0620	3	0.0663	8	0.1206	3	0.0373	1	0.0001
F. Uenoidae	12	0.0010	118	0.0128	38	0.0072	20	0.0016	8	0.0012	16	0.0008	4	0.0002	8	0.0012	14	0.0006	6	0.0013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.0005	-	-
TRUE FLIES																																								
O. Diptera																																								
indeterminate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.0001	-	-	-	-	-	-	1	0.0002	-	-	2	0.0006	-	-	-	-	-	-	-	-
F. Ceratopogonidae	18	0.0072	4	0.0004	18	0.0052	18	0.0042	4	0.0008	2	0.0024	2	0.0006	-	-	2	0.0014	1	0.0004	-	-	6	0.0026	2	0.0009	3	0.0013	6	0.0024	6	0.0038	7	0.0029	5	0.0022	3	0.0010	2	0.0003
F. Chironomidae	418	0.2850	224	0.1164	32	0.0318	62	0.0260	76	0.0136	140	0.0710	157	0.0505	376	0.2816	78	0.0558	20	0.0169	44	0.0110	50	0.0134	16	0.0045	13	0.0085	8	0.0014	6	0.0012	11	0.0024	15	0.0085	15	0.0019	5	0.0041
F. Empididae	22	0.0176	8	0.0064	4	0.0042	-	-	36	0.0344	34	0.0438	18	0.0177	36	0.0372	4	0.0046	2	0.0020	4	0.0078	2	0.0050	2	0.0025	2	0.0034	2	0.0048	-	-	2	0.0013	3	0.0039	2	0.0034	1	0.0015
F. Pelecorhyncidae	-	-	-	-	-	-	-	-	-	-	-	-	2	0.0091	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Psychodidae	34	0.0082	86	0.0200	108	0.0216	78	0.0148	104	0.0212	52	0.0096	32	0.0055	68	0.0212	18	0.0044	16	0.0058	138	0.0376	164	0.0592	23	0.0050	71	0.0254	74	0.0262	50	0.0148	116	0.0008	76	0.0220	161	0.0429	-	-
F. Simuliidae	2	0.0066	-	-	-	-	-	-	-	-	-	-	-	-	4	0.0032	2	0.0002	-	-	2	0.0048	36	0.1036	-	-	-	-	2	0.0038	-	-	-	-	23	0.0347	4	0.0057	1	0.0014
F. Tipulidae	6	0.0022	2	0.0006	-	-	2	0.0028	-	-	-	-	-	-	-	-	-	-	1	0.0004	-	-	-	-	-	-	1	0.0012	4	0.0006	-	-	2	0.0003	-	-	1	0.2996	-	-
CLAMS																																								
Cl. Bivalvia																																								
F. Sphaeriidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL NUMBER OF ORGANISMS per sample	1,138		1,550		1,822		948		1,724		1,100		1,079		1,328		1,252		438		1,252		1,952		184		185		620		476		467		362		350		142	
TOTAL NUMBER OF TAXA [a]	23		23		25		22		21		22		25		19		23		23		19		26		15		22		22		17		20		28		27		18	
TOTAL BIOMASS (g)		1.5108		1.2440		2.7874		0.7334		3.0844		0.9116		1.7350		4.5664		1.6186		0.5261		0.7906		2.3054		0.2782		0.1971		0.6692		0.5540		0.5551		0.3500		0.6245		0.0721

Notes: Densities expressed per sampled area

[a] Bold entries excluded from taxa count

Table B.20: Benthic Invertebrate Density and Biomass from Reference and Mine-exposed Areas, FRO LAEMP, September 2018

Station	FOBKS-BM																			
Replicate	1		2		3		4		5		6		7		8		9		10	
ROUNDWORMS																				
P. Nemata	3	0.0012	6	0.0064	3	0.0018	11	0.0098	7	0.0021	4	0.0028	4	0.0014	1	0.0001	-	-	16	0.0050
FLATWORMS																				
P. Platyhelminthes																				
Cl. Turbellaria																				
F. Planariidae	-	-	1	0.0093	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANNELIDS																				
P. Annelida																				
WORMS																				
Cl. Oligochaeta																				
F. Enchytraeidae	6	0.0022	1	0.0003	3	0.0009	13	0.0027	3	0.0002	12	0.0080	2	0.0002	2	0.0001	6	0.0008	10	0.0030
F. Lumbricidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae	2	0.0968	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Naididae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ARTHROPODS																				
MITES																				
Cl. Arachnida																				
Subcl. Acari indet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Hydryphantidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Hygrobatidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Lebertiidae	11	0.0016	4	0.0004	8	0.0013	13	0.0031	6	0.0021	72	0.0192	22	0.0042	17	0.0046	34	0.0076	-	-
F. Sperchontidae	-	-	-	-	-	-	-	-	1	0.0002	8	0.0032	2	0.0012	3	0.0007	-	-	-	-
F. Torrenticolidae	-	-	-	-	-	-	-	-	-	-	-	-	2	0.0002	-	-	-	-	-	-
SEED SHRIMPS																				
Cl. Ostracoda	-	-	-	-	2	0.0009	1	0.0003	-	-	-	-	-	-	-	-	-	-	-	-
INSECTS																				
Cl. Insecta																				
BEETLES																				
O. Coleoptera																				
F. Curculionidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Dytiscidae	-	-	-	-	-	-	1	0.0015	-	-	4	0.0060	-	-	-	-	-	-	-	-
F. Elmidae	-	-	-	-	-	-	-	-	1	0.0012	-	-	-	-	-	-	2	0.0014	-	-
F. Staphylinidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAYFLIES																				
O. Ephemeroptera																				
F. Ameletidae	-	-	-	-	1	0.0007	5	0.0092	-	-	-	-	-	-	1	0.0004	2	0.0010	2	0.0122
F. Baetidae	20	0.0435	14	0.0266	13	0.0325	10	0.0193	9	0.0149	44	0.0584	22	0.0446	26	0.0569	8	0.0256	42	0.1054
F. Ephemerellidae	26	0.0418	19	0.0218	20	0.0084	30	0.0273	19	0.0192	72	0.1068	22	0.0490	11	0.0148	16	0.0168	20	0.0328
F. Heptageniidae	261	0.2221	130	0.1357	138	0.0936	224	0.1238	182	0.1247	396	0.3044	218	0.1576	132	0.0965	158	0.0596	156	0.1684
STONEFLIES																				
O. Plecoptera																				
F. Capniidae	-	-	1	0.0001	-	-	-	-	-	-	4	0.0024	-	-	-	-	-	-	-	-
F. Chloroperlidae	1	0.0001	-	-	-	-	-	-	4	0.0080	-	-	-	-	1	0.0022	2	0.0002	8	0.0112
F. Leuctridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.0026
F. Nemouridae	9	0.0157	8	0.0056	2	0.0020	6	0.0011	7	0.0020	164	0.0760	70	0.0580	4	0.0026	10	0.0138	30	0.0092
F. Perlidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Perlodidae	13	0.1201	11	0.0337	6	0.0295	5	0.0222	6	0.1022	52	0.2996	26	0.1670	4	0.1364	10	0.1470	46	0.7636
F. Peltoperlidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Taeniopterygidae	14	0.0054	3	0.0008	4	0.0019	1	0.0002	1	0.0003	4	0.0008	-	-	-	-	-	-	2	0.0004
CADDISFLIES																				
O. Trichoptera																				
immature (?Uenoidae)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pupae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Apataniidae	-	-	-	-	-	-	-	-	1	0.0011	-	-	-	-	-	-	-	-	-	-
F. Brachycentridae	1	0.0003	-	-	-	-	-	-	-	-	8	0.0008	6	0.0014	-	-	-	-	2	0.0002
F. Glossosomatidae	5	0.0005	2	0.0024	1	0.0001	-	-	1	0.0003	4	0.0004	8	0.0076	-	-	2	0.0006	2	0.0020
F. Hydropsychidae	9	0.0586	3	0.0100	4	0.0168	2	0.0022	8	0.0408	96	1.0880	62	0.2952	-	-	10	0.0054	34	0.1822
F. Limnephilidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Rhyacophilidae	13	0.1660	10	0.1194	7	0.0101	12	0.1314	7	0.0865	64	0.1380	24	0.3268	5	0.0578	18	0.0056	32	0.1924
F. Uenoidae	-	-	-	-	1	0.0001	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TRUE FLIES																				
O. Diptera																				
indeterminate	-	-	-	-	-	-	-	-	-	-	4	0.0020	-	-	-	-	-	-	-	-
F. Ceratopogonidae	9	0.0042	1	0.0005	2	0.0010	9	0.0027	4	0.0013	20	0.0108	6	0.0012	2	0.0012	2	0.0020	18	0.0054
F. Chironomidae	33	0.0142	13	0.0115	16	0.0150	16	0.0061	17	0.0352	52	0.0276	32	0.0170	11	0.0148	16	0.0238	22	0.0074
F. Empididae	-	-	1	0.0009	1	0.0011	1	0.0012	1	0.0016	8	0.0080	2	0.0030	-	-	4	0.0062	2	0.0012
F. Pelecorhyncidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Psychodidae	315	0.1801	132	0.0568	187	0.1490	101	0.0276	117	0.0411	136	0.0420	126	0.0546	37	0.0185	154	0.0422	234	0.0946
F. Simuliidae	8	0.0149	11	0.0255	13	0.0208	3	0.0042	14	0.0243	432	1.0664	66	0.1676	6	0.0137	6	0.0082	108	0.2464
F. Tipulidae	-	-	-	-	-	-	-	-	1	0.0003	-	-	2	0.0002	-	-	-	-	2	0.0002
CLAMS																				
Cl. Bivalvia																				
F. Sphaeriidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL NUMBER OF ORGANISMS per sample	759		371		432		464		417		1,660		724		263		460		790	
TOTAL NUMBER OF TAXA [a]	19		19		20		19		22		22		20		16		18		21	
TOTAL BIOMASS (g)		0.9893		0.4677		0.3875		0.3959		0.5096		3.2716		1.3580		0.4213		0.3678		1.8458

Station	FOBSC-BM																			
Replicate			2		3		4		5		6		7		8		9		10	
ROUNDWORMS																				
P. Nemata	5	0.0039	1	0.0001	7	0.0025	-	-	2	0.0024	1	0.0002	2	0.0002	22	0.0074	2	0.0002	-	-
FLATWORMS																				
P. Platyhelminthes																				
Cl. Turbellaria																				
F. Planariidae	-	-	1	0.0008	3	0.0031	2	0.0005	-	-	-	-	-	-	-	-	-	-	-	-
ANNELIDS																				
P. Annelida																				
WORMS																				
Cl. Oligochaeta																				
F. Enchytraeidae	6	0.0017	1	0.0002	4	0.0004	1	0.0001	1	0.0006	3	0.0011	8	0.0019	11	0.0038	10	0.0016	4	0.0012
F. Lumbricidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.3595
F. Lumbriculidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Naididae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ARTHROPODS																				
MITES																				
Cl. Arachnida																				
Subcl. Acari indet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.0004	-	-
F. Hydryphantidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Hygrobatidae	1	0.0002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.0002	-	-
F. Lebertiidae	7	0.0020	5	0.0005	13	0.0022	19	0.0043	34	0.0062	16	0.0037	11	0.0017	32	0.0066	46	0.0098	28	0.0053
F. Sperchontidae	-	-	-	-	1	0.0003	1	0.0006	1	0.0003	2	0.0006	2	0.0005	3	0.0007	-	-	-	-
F. Torrenticolidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SEED SHRIMPS																				
Cl. Ostracoda	3	0.0007	-	-	1	0.0001	-	-	-	-	-	-	-	-	-	-	2	0.0006	-	-
INSECTS																				
Cl. Insecta																				
BEETLES																				
O. Coleoptera																				
F. Curculionidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Dytiscidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.0066	-	-
F. Elmidae	-	-	1	0.0001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.0005
F. Staphylinidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAYFLIES																				
O. Ephemeroptera																				
F. Ameletidae	5	0.0273	4	0.0432	-	-	2	0.0136	1	0.0059	-	-	-	-	1	0.0072	16	0.0374	8	0.0103
F. Baetidae	8	0.0179	13	0.0219	32	0.0677	5	0.0089	6	0.0084	9	0.1447	14	0.0295	9	0.0157	8	0.0180	6	0.0105
F. Ephemerellidae	7	0.0092	11	0.0063	26	0.0110	10	0.0063	9	0.0065	10	0.0126	2	0.0001	18	0.0182	8	0.0134	7	0.0009
F. Heptageniidae	52	0.0201	169	0.0677	384	0.2044	367	0.2254	186	0.0892	175	0.1361	72	0.0232	220	0.1239	128	0.0614	117	0.0686
STONEFLIES																				
O. Plecoptera																				
F. Capniidae	1	0.0001	-	-	2	0.0009	1	0.0001	-	-	1	0.0012	-	-	-	-	-	-	1	0.0001
F. Chloroperlidae	-	-	6	0.0057	6	0.0037	12	0.0221	-	-	-	-	1	0.0002	1	0.0019	-	-	1	0.0017
F. Leuctridae	-	-	2	0.0003	-	-	-	-	-	-	1	0.0013	-	-	-	-	-	-	1	0.0007
F. Nemouridae	2	0.0004	1	0.0001	11	0.0033	6	0.0022	4	0.0020	4	0.0014	2	0.0003	3	0.0041	10	0.0194	4	0.0008
F. Perlidae	-	-	-	-	-	-	1	0.0002	1	0.0009	1	0.0005	-	-	1	0.0022	-	-	-	-
F. Perlodidae	4	0.0055	14	0.1459	44	0.2214	21	0.1834	13	0.1026	25	0.2131	14	0.0048	18	0.0447	14	0.2348	8	0.0335
F. Peltoperlidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Taeniopterygidae	-	-	1	0.0001	12	0.0028	12	0.0019	-	-	1	0.0003	1	0.0001	3	0.0017	-	-	2	0.0004
CADDISFLIES																				
O. Trichoptera																				
immature (?Uenoidae)	-	-	-	-	-	-	-	-	**1**	**0.0001**	-	-	-	-	**1**	**0.0001**	-	-	-	-
pupae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Apataniidae	-	-	-	-	3	0.0019	1	0.0003	-	-	-	-	-	-	3	0.0021	4	0.0012	2	0.0032
F. Brachycentridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Glossosomatidae	-	-	-	-	4	0.0053	-	-	-	-	3	0.0015	2	0.0004	1	0.0005	-	-	-	-
F. Hydropsychidae	-	-	-	-	2	0.0129	-	-	2	0.0075	7	0.0156	-	-	4	0.0121	-	-	-	-
F. Limnephilidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.0001	-	-	-	-
F. Rhyacophilidae	10	0.0293	6	0.0207	18	0.1252	8	0.0750	12	0.0672	17	0.1771	4	0.0112	23	0.1378	10	0.0312	6	0.0328
F. Uenoidae	1	0.0001	-	-	2	0.0002	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TRUE FLIES																				
O. Diptera																				
indeterminate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Ceratopogonidae	42	0.0132	26	0.0068	5	0.0012	2	0.0002	4	0.0014	5	0.0013	5	0.0012	14	0.0045	28	0.0096	12	0.0036
F. Chironomidae	7	0.0093	7	0.0022	10	0.0011	6	0.0080	5	0.0074	10	0.0097	-	-	7	0.0067	8	0.0110	7	0.0137
F. Empididae	1	0.0002	4	0.0020	3	0.0028	-	-	1	0.0010	-	-	2	0.0005	-	-	-	-	3	0.0015
F. Pelecorhyncidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Psychodidae	300	0.1291	176	0.0655	380	0.1466	142	0.0613	126	0.0497	51	0.0155	20	0.0053	73	0.0212	248	0.0708	138	0.0449
F. Simuliidae	3	0.0033	-	-	1	0.0008	2	0.0027	2	0.0069	1	0.0015	-	-	3	0.0056	-	-	-	-
F. Tipulidae	2	0.0021	1	0.0001	-	-	-	-	-	-	1	0.0002	-	-	-	-	-	-	-	-
CLAMS																				
Cl. Bivalvia																				
F. Sphaeriidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL NUMBER OF ORGANISMS per sample	467		450		974		621		411		344		162		472		548		357	
TOTAL NUMBER OF TAXA [a]	20		20		24		20		19		21		16		23		19		20	
TOTAL BIOMASS (g)		0.2756		0.3902		0.8218		0.6171		0.3662		0.7392		0.0811		0.4288		0.5276		0.5937

Notes: Densities expressed per sampled area
[a] Bold entries excluded from taxa count

Table B.20: Benthic Invertebrate Density and Biomass from Reference and Mine-exposed Areas, FRO LAEMP, September 2018

Station	FOUKI-BM																				FO22-BM																			
Replicate	1		2		3		4		5		6		7		8		9		10		1		2		3		4		5		6		7		8		9		10	
ROUNDWORMS																																								
P. Nemata	4	0.0002	10	0.0072	8	0.0050	5	0.0022	4	0.0023	3	0.0025	2	0.0002	7	0.0051	2	0.0002	3	0.0009	4	0.0004	12	0.0020	4	0.0020	4	0.0004	6	0.0014	1	0.0001	10	0.0082	1	0.0001	4	0.0002	-	-
FLATWORMS																																								
P. Platyhelminthes																																								
Cl. Turbellaria																																								
F. Planariidae	6	0.0286	10	0.0148	10	0.0384	4	0.0177	3	0.0094	-	-	-	-	-	-	-	-	-	-	8	0.0080	60	0.0948	8	0.0240	4	0.0150	4	0.0132	-	-	12	0.0126	-	-	-	-	4	0.0042
ANNELIDS																																								
P. Annelida																																								
WORMS																																								
Cl. Oligochaeta																																								
F. Enchytraeidae	-	-	4	0.0004	8	0.0012	-	-	2	0.0003	-	-	-	-	3	0.0004	3	0.0008	-	-	-	-	8	0.0004	8	0.0004	-	-	-	-	-	-	-	-	7	0.0008	8	0.0020	-	-
F. Lumbricidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Naididae	-	-	-	-	10	0.0012	-	-	-	-	3	0.0003	6	0.0038	-	-	4	0.0004	-	-	16	0.0004	8	0.0004	-	-	-	-	6	0.0002	-	-	10	0.0014	-	-	-	-	2	0.0002
ARTHROPODS																																								
MITES																																								
Cl. Arachnida																																								
Subcl. Acari indet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.0001	-	-	-	-	-	-	-	-	4	0.0008	-	-	-	-	-	-	-	-	6	0.0008	-	-
F. Hydryphantidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Hygrobatidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Lebertiidae	14	0.0038	4	0.0012	6	0.0026	12	0.0037	5	0.0020	6	0.0017	4	0.0008	4	0.0008	17	0.0037	5	0.0015	40	0.0108	12	0.0028	64	0.0156	36	0.0096	30	0.0050	4	0.0008	52	0.0100	3	0.0003	18	0.0044	20	0.0034
F. Sperchontidae	2	0.0004	-	-	-	-	1	0.0005	1	0.0001	-	-	-	-	-	-	-	-	1	0.0001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Torrenticolidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SEED SHRIMPS																																								
Cl. Ostracoda	10	0.0028	5	0.0020	10	0.0028	1	0.0002	6	0.0017	-	-	2	0.0005	3	0.0011	3	0.0006	7	0.0015	-	-	-	-	-	-	10	0.0070	-	-	1	0.0001	-	-	-	-	2	0.0008	-	-
INSECTS																																								
Cl. Insecta																																								
BEETLES																																								
O. Coleoptera																																								
F. Curculionidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.0044	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Dytiscidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.0012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Elmidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.0001	-	-	-	-	540	0.3696	624	0.5228	536	0.5468	370	0.4372	256	0.2570	419	0.6112	722	0.0140	256	0.1111	686	0.8516	72	0.0768
F. Staphylinidae	-	-	2	0.0064	-	-	-	-	-	-	1	0.0001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAYFLIES																																								
O. Ephemeroptera																																								
F. Ameletidae	2	0.0010	6	0.0024	10	0.0058	8	0.0256	-	-	4	0.0239	1	0.0028	2	0.0075	3	0.0098	10	0.0036	-	-	-	-	-	-	6	0.0026	-	-	-	-	-	-	-	-	-	-	-	-
F. Baetidae	42	0.1258	14	0.0368	36	0.1024	12	0.0263	18	0.0487	18	0.0395	18	0.0497	18	0.0462	16	0.0438	16	0.0449	16	0.0956	24	0.1152	56	0.3472	34	0.2970	14	0.0830	14	0.0545	18	0.1134	7	0.0355	28	0.1320	40	0.1902
F. Ephemerellidae	14	0.0172	26	0.0404	382	0.0434	11	0.0189	11	0.0244	9	0.0326	10	0.0147	5	0.0119	10	0.0160	9	0.0161	24	0.1808	8	0.0108	28	0.0524	20	0.0936	8	0.0136	11	0.0100	48	0.1794	4	0.0018	26	0.0860	22	0.0876
F. Heptageniidae	414	0.3106	282	0.1746	382	0.3640	133	0.1000	165	0.1346	113	0.1168	131	0.1500	221	0.1839	280	0.1607	288	0.2138	204	0.0668	120	0.0284	144	0.0456	150	0.0552	112	0.0504	115	0.0499	98	0.0326	10	0.0025	62	0.0178	80	0.0308
STONEFLIES																																								
O. Plecoptera																																								
F. Capniidae	2	0.0042	4	0.0032	2	0.0028	1	0.0014	-	-	-	-	-	-	-	-	-	-	5	0.0020	-	-	4	0.0056	12	0.0320	10	0.0378	6	0.0300	8	0.0068	16	0.0572	-	-	4	0.0110	4	0.0082
F. Chloroperlidae	8	0.0228	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.0214	3	0.0179	4	0.0080	36	0.0176	8	0.0028	20	0.0444	4	0.0014	1	0.0003	4	0.0016	9	0.0017	-	-	-	-
F. Leuctridae	-	-	-	-	2	0.0022	-	-	-	-	-	-	-	-	-	-	3	0.0006	2	0.0002	-	-	-	-	-	-	-	-	-	-	1	0.0004	-	-	-	-	-	-	-	-
F. Nemouridae	12	0.0256	44	0.0440	12	0.0106	3	0.0054	4	0.0057	4	0.0022	10	0.0061	2	0.0010	7	0.0071	14	0.0091	####	0.5052	848	0.2400	752	0.2124	516	0.2134	334	0.1406	345	0.1538	252	0.1648	21	0.0051	360	0.1334	702	0.3242
F. Perlidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.5581	-	-	-	-	2	0.0092	-	-	-	-	-	-	-	-	-	-	-	-
F. Perlodidae	14	0.0632	20	0.3966	10	0.0472	4	0.0024	8	0.1201	1	0.0007	10	0.2427	4	0.0351	8	0.0221	5	0.0378	180	0.3492	204	0.3000	248	0.2444	108	0.2458	128	0.2844	177	0.6005	130	0.1272	48	0.0355	196	0.1636	162	0.1958
F. Peltoperlidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.0056	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Taeniopterygidae	6	0.0010	4	0.0010	2	0.0012	-	-	1	0.0003	-	-	4	0.0032	1	0.0002	1	0.0002	2	0.0001	8	0.0008	44	0.0132	12	0.0052	6	0.0056	8	0.0018	39	0.0075	2	0.0004	4	0.0007	6	0.0040	6	0.0014
CADDISFLIES																																								
O. Trichoptera																																								
immature (?Uenoidae)	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**0.0001**	**2**	**0.0003**	**16**	**0.0020**	**-**	**-**	**8**	**0.0076**	**18**	**0.0006**	**2**	**0.0002**	**-**	**-**	**-**	**-**	**-**	**-**	**6**	**0.0002**	**-**	**-**
pupae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Apataniidae	-	-	-	-	-	-	5	0.0052	-	-	1	0.0007	-	-	-	-	1	0.0012	1	0.0007	-	-	-	-	16	0.0208	20	0.0002	-	-	2	0.0014	12	0.0114	-	-	-	-	-	-
F. Brachycentridae	-	-	-	-	2	0.0006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	0.0020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Glossosomatidae	-	-	4	0.0056	4	0.0006	3	0.0017	6	0.0051	4	0.0008	6	0.0015	-	-	1	0.0001	1	0.0003	-	-	4	0.0060	4	0.0064	-	-	-	-	-	-	4	0.0004	-	-	2	0.0002	2	0.0088
F. Hydropsychidae	4	0.0334	2	0.0096	4	0.0114	-	-	1	0.0009	1	0.0006	5	0.0130	-	-	2	0.0563	2	0.0092	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Limnephilidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.0002	-	-	172	0.0204	4	0.0036	72	0.0096	152	0.0250	24	0.0038	8	0.0009	26	0.0020	1	0.0001	28	0.0036	10	0.0014
F. Rhyacophilidae	22	0.2582	22	0.5860	8	0.3066	4	0.0471	7	0.1284	5	0.1510	3	0.0454	3	0.0318	6	0.1061	3	0.0280	60	0.5568	32	0.7576	12	0.1024	16	0.0820	10	0.1548	19	0.0257	12	0.0376	16	0.0179	24	0.1672	8	0.0526
F. Uenoidae	-	-	-	-	-	-	1	0.0003	2	0.0002	-	-	-	-	-	-	1	0.0001	-	-	12	0.0008	-	-	-	-	-	-	2	0.0002	-	-	-	-	-	-	-	-	-	-
TRUE FLIES																																								
O. Diptera																																								
indeterminate	-	-	2	0.0018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Ceratopogonidae	8	0.0024	6	0.0020	18	0.0084	11	0.0043	7	0.0022	6	0.0013	19	0.0072	13	0.0045	2	0.0005	3	0.0011	-	-	8	0.0036	12	0.0016	-	-	-	-	-	-	-	-	-	-	2	0.0004	-	-
F. Chironomidae	26	0.0416	108	0.0552	30	0.0156	26	0.0239	17	0.0216	19	0.0184	30	0.0288	15	0.0210	37	0.0246	33	0.0243	176	0.0900	132	0.0552	20	0.0060	26	0.0214	76	0.0388	6	0.0037	80	0.0348	8	0.0021	44	0.0274	84	0.0398
F. Empididae	2	0.0038	2	0.0012	4	0.0036	1	0.0009	1	0.0020	1	0.0015	-	-	-	-	4	0.0061	2	0.0032	16	0.0128	24	0.0184	16	0.0180	6	0.0048	-	-	1	0.0001	8	0.0068	-	-	6	0.0052	6	0.0048
F. Pelecorhyncidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Psychodidae	280	0.1670	222	0.1148	584	0.4164	313	0.2309	511	0.3724	199	0.1469	430	0.3179	354	0.2726	301	0.2041	298	0.1770	24	0.0044	8	0.0012	4	0.0012	2	0.0002	-	-	-	-	6	0.0016	-	-	2	0.0008	8	0.0028
F. Simuliidae	2	0.0064	6	0.0158	16	0.0524	3	0.0070	5	0.0120	2	0.0041	3	0.0071	2	0.0048	-	-	1	0.0053	8	0.0136	-	-	-	-	2	0.0092	12	0.0378	2	0.0001	-	-	1	0.0040	-	-	8	0.0156
F. Tipulidae	2	0.5348	-	-	-	-	2	0.0189	1	0.0004	-	-	-	-	-	-	4	0.0118	4	0.0174	14	1.3315	58	#####	16	2.0685	12	6.0097	1	0.0040	6	1.2614	23	5.7781	7	0.0028	23	8.5486	20	0.3838
CLAMS																																								
Cl. Bivalvia																																								
F. Sphaeriidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	44	0.0520	4	0.0004	16	0.0092	58	0.0544	2	0.0030	2	0.0023	14	0.0202	17	0.0100	4	0.0040	-	-
TOTAL NUMBER OF ORGANISMS per sample	896		809		1,560		564		786		400		694		659		720		722		2,596		2,290		2,076		1,612		1,045		1,182		1,559		420		1,547		1,260	
TOTAL NUMBER OF TAXA ^{a}	22		23		24		22		22		19		18		18		26		27		22		24		24		26		20		21		22		17		23		19	
TOTAL BIOMASS (g)		1.6548		1.5230		1.4464		0.5445		0.8948		0.5456		0.8954		0.6292		0.6987		0.6263		4.2380		#####		3.7821		7.6821		1.1246		2.7915		6.6157		0.2320		######		1.4324

Notes: Densities expressed per sampled area

[a] Bold entries excluded from taxa count

Table B.20: Benthic Invertebrate Density and Biomass from Reference and Mine-exposed Areas, FRO LAEMP, September 2018

Station	FRUPO-BM																				HENUP-BM																			
Replicate	1		2		3		4		5		6		7		8		9		10		1		2		3		4		5		6		7		8		9		10	
ROUNDWORMS																																								
P. Nemata	12	0.0084	4	0.0018	8	0.0084	-	-	-	-	1	0.0001	4	0.0010	8	0.0158	24	0.0260	-	-	1	0.0002	2	0.0004	-	-	-	-	2	0.0004	2	0.0001	-	-	-	-	2	0.0002	1	0.0001
FLATWORMS																																								
P. Platyhelminthes																																								
Cl. Turbellaria																																								
F. Planariidae	6	0.0094	4	0.0110	-	-	2	0.0060	-	-	1	0.0002	2	0.0012	2	0.0018	2	0.0082	-	-	2	0.0044	2	0.0020	1	0.0011	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANNELIDS																																								
P. Annelida																																								
WORMS																																								
Cl. Oligochaeta																																								
F. Enchytraeidae	-	-	2	0.0002	2	0.0002	-	-	1	0.0001	1	0.0001	2	0.0002	4	0.0024	-	-	3	0.0002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Lumbricidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.0070	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Naididae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ARTHROPODS																																								
MITES																																								
Cl. Arachnida																																								
Subcl. Acari indet	-	-	-	-	-	-	10	0.0020	-	-	-	-	-	-	4	0.0014	-	-	-	-	-	-	-	-	1	0.0001	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Hydryphantidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.0006	-	-	1	0.0002	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Hygrobatidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Lebertiidae	92	0.0174	144	0.0312	54	0.0110	66	0.0132	48	0.0105	34	0.0070	64	0.0146	44	0.0122	32	0.0076	39	0.0076	1	0.0002	2	0.0002	1	0.0002	2	0.0006	4	0.0014	-	-	-	-	2	0.0010	-	-	-	-
F. Sperchontidae	-	-	4	0.0006	2	0.0008	-	-	2	0.0009	-	-	-	-	-	-	2	0.0016	1	0.0009	4	0.0013	3	0.0020	3	0.0013	1	0.0004	-	-	1	0.0007	-	-	4	0.0012	2	0.0017	-	-
F. Torrenticolidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SEED SHRIMPS																																								
Cl. Ostracoda	-	-	4	0.0010	-	-	-	-	2	0.0005	-	-	-	-	-	-	-	-	1	0.0003	-	-	3	0.0008	-	-	2	0.0004	2	0.0008	1	0.0003	-	-	1	0.0001	3	0.0006	-	-
INSECTS																																								
Cl. Insecta																																								
BEETLES																																								
O. Coleoptera																																								
F. Curculionidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Dytiscidae	-	-	-	-	4	0.0068	-	-	-	-	-	-	-	-	-	-	-	-	1	0.0038	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Elmidae	-	-	8	0.0072	-	-	2	0.0012	-	-	-	-	2	0.0002	-	-	4	0.0092	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Staphylinidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.0008	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAYFLIES																																								
O. Ephemeroptera																																								
F. Ameletidae	2	0.0434	6	0.0358	-	-	8	0.1192	-	-	3	0.0655	4	0.0364	-	-	-	-	-	-	3	0.0006	6	0.0014	3	0.0004	-	-	-	-	-	-	-	-	-	-	-	-	8	0.0014
F. Baetidae	4	0.0018	10	0.0014	4	0.0282	2	0.0052	2	0.0038	4	0.0118	6	0.0370	8	0.0568	28	0.2022	10	0.0750	-	-	4	0.0252	1	0.0035	-	-	2	0.0022	-	-	-	-	1	0.0009	1	0.0055	1	0.0004
F. Ephemerellidae	32	0.0102	78	0.1606	10	0.0378	52	0.0276	27	0.0397	15	0.0303	24	0.0140	14	0.0644	20	0.0470	22	0.0463	17	0.0239	20	0.0556	18	0.0466	8	0.0178	14	0.0032	16	0.0718	4	0.0169	9	0.0687	5	0.0134	4	0.0873
F. Heptageniidae	36	0.0168	94	0.0004	42	0.0138	40	0.0108	33	0.0114	32	0.0367	56	0.0282	42	0.0224	76	0.0718	25	0.0137	305	0.2958	302	0.4815	184	0.2613	300	0.3848	272	0.4120	332	0.7002	250	0.2265	149	0.3438	193	0.3015	186	0.1957
STONEFLIES																																								
O. Plecoptera																																								
F. Capniidae	2	0.7212	2	0.0002	-	-	2	0.0002	3	0.0003	-	-	-	-	-	-	-	-	-	-	2	0.0009	-	-	-	-	-	-	-	-	1	0.0001	-	-	-	-	-	-	-	-
F. Chloroperlidae	6	0.0028	26	0.0290	14	0.0120	8	0.0106	-	-	1	0.0005	-	-	-	-	2	0.0042	-	-	55	0.1173	62	0.2563	30	0.0689	90	0.2129	34	0.1504	72	0.2645	13	0.0467	31	0.0907	37	0.1385	16	0.0597
F. Leuctridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	0.0116	4	0.0060	4	0.0037	4	0.0021	4	0.0032	34	0.0416	1	0.0012	4	0.0056	4	0.0043	1	0.0011
F. Nemouridae	90	0.0276	144	0.0534	16	0.0114	66	0.0182	29	0.0117	36	0.0107	32	0.0158	116	0.0352	108	0.0444	31	0.0117	7	0.0250	32	0.0685	8	0.0210	12	0.0171	12	0.0456	30	0.0562	6	0.0143	37	0.0611	9	0.0369	3	0.0030
F. Perlidae	-	-	2	0.0008	2	0.0008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Perlodidae	242	0.3010	320	0.4176	202	0.3920	288	0.5024	96	0.2245	85	0.0591	98	0.0772	140	0.1646	418	0.4496	55	0.1085	8	0.2444	7	0.1589	1	0.0321	10	0.1404	12	0.2818	9	0.1994	5	0.1317	14	0.2718	4	0.1328	3	0.1146
F. Peltoperlidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Taeniopterygidae	12	0.0028	62	0.0142	6	0.0010	28	0.0084	2	0.0003	1	0.0002	2	0.0028	6	0.0018	40	0.0168	22	0.0034	17	0.0040	20	0.0048	10	0.0018	8	0.0021	30	0.0066	19	0.0032	6	0.0013	4	0.0023	7	0.0023	3	0.0006
CADDISFLIES																																								
O. Trichoptera																																								
immature (?Uenoidae)	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**0.0006**	**1**	**0.0001**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**0.0001**	**1**	**0.0001**	**1**	**0.0001**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
pupae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Apataniidae	10	0.0122	14	0.0204	4	0.0082	8	0.0128	1	0.0027	11	0.0027	14	0.0192	-	-	-	-	18	0.0235	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Brachycentridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Glossosomatidae	4	0.0014	6	0.0008	4	0.0016	-	-	2	0.0024	1	0.0006	4	0.0430	4	0.0116	18	0.2470	-	-	12	0.0428	23	0.1373	26	0.1198	35	0.1822	32	0.1820	4	0.0209	3	0.0099	6	0.0235	15	0.0597	2	0.0069
F. Hydropsychidae	8	0.0156	-	-	-	-	2	0.0082	-	-	1	0.1583	-	-	2	0.0030	10	0.0224	-	-	4	0.0779	12	0.2433	6	0.0010	1	0.0831	2	0.2220	11	0.2311	1	0.0003	16	1.3074	4	0.1594	-	-
F. Limnephilidae	4	0.0002	2	0.0002	-	-	2	0.0002	1	0.0001	2	0.0004	6	0.0018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Rhyacophilidae	26	0.3812	28	0.3566	5	0.1172	28	0.2530	10	0.1354	7	0.1346	2	0.0484	12	0.2296	12	0.0218	5	0.1246	3	0.0260	1	0.0201	2	0.0240	5	0.0480	2	0.0450	3	0.0516	2	0.0122	1	0.0361	-	-	1	0.0032
F. Uenoidae	-	-	-	-	-	-	-	-	-	-	1	0.0001	2	0.0002	-	-	2	0.0002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TRUE FLIES																																								
O. Diptera																																								
indeterminate	-	-	-	-	2	0.0002	-	-	2	0.0002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Ceratopogonidae	14	0.0056	4	0.0020	2	0.0004	6	0.0018	2	0.0007	1	0.0008	-	-	-	-	4	0.0012	7	0.0026	-	-	-	-	-	-	-	-	-	-	-	-	1	0.0009	-	-	1	0.0004	-	-
F. Chironomidae	154	0.1494	144	0.0956	128	0.1098	168	0.0906	147	0.0633	71	0.1342	142	0.0550	130	0.0690	192	0.1086	47	0.0320	60	0.0192	115	0.0565	30	0.0463	71	0.0355	48	0.0158	98	0.0440	60	0.0172	41	0.0278	91	0.0700	31	0.0233
F. Empididae	6	0.0128	4	0.0014	10	0.0136	6	0.0110	7	0.0018	7	0.0019	2	0.0036	10	0.0164	6	0.0096	8	0.0145	13	0.0185	11	0.0220	1	0.0010	11	0.0180	10	0.0110	4	0.0112	1	0.0052	3	0.0034	6	0.0139	-	-
F. Pelecorhyncidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.0021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Psychodidae	76	0.0212	44	0.0100	10	0.0020	50	0.0098	16	0.0043	17	0.0075	40	0.0104	32	0.0120	36	0.0176	57	0.0154	4	0.0008	2	0.0004	-	-	-	-	2	0.0006	1	0.0001	-	-	1	0.0001	-	-	-	-
F. Simuliidae	-	-	6	0.0060	24	0.0826	4	0.0074	-	-	1	0.0011	4	0.0148	18	0.0496	704	2.9742	2	0.0048	-	-	-	-	-	-	1	0.0030	-	-	-	-	-	-	-	-	-	-	-	-
F. Tipulidae	6	0.0052	4	0.0006	-	-	8	0.0052	2	0.0003	2	0.0031	4	0.0010	4	0.0146	-	-	2	0.0024	-	-	-	-	-	-	1	0.0124	-	-	-	-	-	-	-	-	-	-	-	-
CLAMS																																								
Cl. Bivalvia																																								
F. Sphaeriidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL NUMBER OF ORGANISMS per sample	844		1,170		555		856		437		337		516		602		1,740		358		532		634		332		562		484		638		353		324		384		260	
TOTAL NUMBER OF TAXA [a]	22		27		22		23		22		24		22		20		21		21		21		21		20		17		17		17		13		17		16		13	
TOTAL BIOMASS (g)		1.7676		1.2600		0.8598		1.1250		0.5155		0.6676		0.4260		0.7916		4.2912		0.4934		0.9155		1.5433		0.6351		1.1608		1.3840		1.6970		0.4843		2.2455		0.9411		0.4973

Notes: Densities expressed per sampled area

[a] Bold entries excluded from taxa count

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	June							
	RG_HENUP	RG_FO26	RG_FODHE	RG_FOUNGD	RG_FODNGD	RG_MP1	RG_FOUSH	RG_FOUKI
Phylum: Arthropoda	0	0	0	0	0	0	0	0
| Order: Collembola	0	0	0	0	0	0	0	0
| Family: Sminthuridae	0	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0	0
Ameletus	11	8	40	117	0	30	14	0
| Family: Baetidae	83	62	0	17	0	0	0	0
Acentrella	0	0	0	0	0	0	0	0
Baetis	161	123	35	100	75	40	29	10
Baetis fuscatus gr.	0	0	0	0	0	0	0	0
Baetis rhodani group	28	69	45	133	100	100	57	25
Baetis bicaudatus	78	146	60	150	115	240	64	65
| Family: Ephemerellidae	6	8	5	217	50	180	43	45
Caudatella	0	0	0	0	0	0	0	0
Drunella	0	0	10	0	0	0	7	0
Drunella grandis group	0	0	0	0	0	0	0	0
Drunella coloradensis	22	138	35	150	80	60	43	25
Drunella doddsii	22	8	10	0	5	0	0	5
Drunella grandis	0	0	0	0	0	0	0	0
Drunella spinifera	0	0	0	0	0	0	0	0
Serratella	0	0	0	0	0	0	0	0
| Family: Heptageniidae	511	277	245	300	120	130	236	155
Cinygmula	0	0	0	0	0	0	0	0
Epeorus	178	85	285	33	125	180	443	825
Rhithrogena	172	31	0	0	0	10	21	0
| Order: Plecoptera	0	0	0	0	0	0	7	0
| Family: Capniidae	0	0	5	0	0	0	0	0
| Family: Chloroperlidae	83	0	5	0	5	0	7	0
Haploperla	0	8	0	0	15	10	0	0
Neaviperla	0	0	0	0	0	0	0	0
Paraperla	44	15	0	0	0	0	0	0
Suwallia	50	23	0	0	0	0	0	0
Sweltsa	28	46	0	67	0	30	0	0
| Family: Leuctridae	6	8	0	0	0	0	0	0
Paraleuctra	0	0	0	0	0	0	0	0
| Family: Nemouridae	0	8	0	50	10	30	0	0
Malenka	0	0	0	0	0	0	0	0
Prostoia	0	0	0	0	0	0	0	0
Visoka cataractae	0	0	0	0	0	0	0	0
Zapada	56	8	10	0	0	0	0	0
Zapada oregonensis group	117	223	5	83	15	10	36	25
Zapada cinctipes	0	0	0	0	0	0	0	0
Zapada columbiana	0	0	0	0	0	0	7	0
| Family: Peltoperlidae	0	0	0	0	0	0	0	0
Yoraperla	0	0	0	0	0	0	0	0
| Family: Perlidae	0	0	0	0	0	0	0	0
Hesperoperla	0	0	0	0	0	0	0	0
| Family: Perlodidae	50	77	40	50	30	160	0	15
Diura	0	0	0	0	0	0	0	0
Isoperla	0	0	0	0	0	10	0	0
Kogotus	0	8	25	133	15	20	21	20
Megarcys	11	31	0	17	0	0	0	5
Rickera sorpta	0	0	0	0	0	0	0	0
Skwala	0	0	0	0	0	0	0	0
| Family: Taeniopterygidae	0	0	0	0	0	0	0	0
| Order: Trichoptera	0	0	0	0	0	0	0	0
| Family: Apataniidae	0	0	0	0	0	0	0	0
Apatania	0	0	0	0	0	0	0	0
Pedomoecus sierra	0	0	0	0	0	0	0	0
| Family: Brachycentridae	0	0	0	0	0	0	0	0
Brachycentrus	0	0	0	0	0	0	0	0
Brachycentrus americanus	0	0	0	0	0	0	0	0
Micrasema	0	0	0	0	0	0	0	0
| Family: Glossosomatidae	0	0	0	0	0	0	0	0
Glossosoma	0	0	0	0	0	0	0	0
| Family: Hydropsychidae	0	0	0	0	0	0	0	0
Arctopsyche	0	0	0	0	0	0	0	0
Hydropsyche	0	0	0	0	0	0	0	0
Parapsyche	0	0	0	0	0	0	0	0
Parapsyche elsis	11	0	0	0	0	0	7	0
| Family: Hydroptilidae	0	0	0	33	0	0	0	0
Hydroptila	0	0	0	33	0	0	0	0
| Family: Lepidostomatidae	0	0	0	0	0	0	0	0
Lepidostoma	0	0	0	0	0	0	0	0
| Family: Limnephilidae	0	0	0	17	0	0	0	5
Dicosmoecus	0	0	0	0	0	0	0	0
Ecclisomyia	0	0	0	33	0	0	0	0
| Family: Rhyacophilidae	0	0	0	0	0	0	0	0
Rhyacophila	0	46	25	67	30	40	36	75
Rhyacophila angelita group	0	0	0	33	70	40	0	150
Rhyacophila betteni group	0	0	0	0	0	0	0	0
Rhyacophila brunnea/vemna group	11	0	0	17	20	30	7	15
Rhyacophila hyalinata group	6	69	5	0	5	30	43	25
Rhyacophila vobara subgroup	0	0	0	0	0	0	0	0
Rhyacophila vofixa group	0	0	0	0	0	0	0	0
Rhyacophila alberta group	11	54	5	0	10	60	21	0
Rhyacophila atrata complex	11	15	5	17	50	230	100	65
Rhyacophila narvae	0	0	0	0	0	0	0	0
Rhyacophila verrula group	0	0	0	17	0	0	0	0
| Family: Thremmatidae	0	0	0	0	0	0	0	0
Oligophlebodes	33	308	25	150	20	40	7	0
| Order: Coleoptera	0	0	0	0	0	0	0	0
| Family: Dytiscidae	0	0	0	0	0	0	0	0
Liodessus	0	0	0	0	0	0	0	0
Oreodytes	0	0	0	0	0	0	0	0
Sanfilippodytes	0	0	0	0	0	0	0	0
Stictotarsus	0	0	0	0	0	0	0	0
| Subfamily: Hydroporinae	0	0	0	0	0	0	0	0
| Family: Elmidae	0	0	0	0	0	0	0	0
Heterlimnius	0	0	0	0	0	0	7	0

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	June							
	RG_HENUP	RG_FO26	RG_FODHE	RG_FOUNGD	RG_FODNGD	RG_MP1	RG_FOUSH	RG_FOUKI
| Order: Diptera	0	0	0	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0	7	0
Bezzia/ Palpomyia	0	0	0	0	0	0	0	0
Mallochohelea	6	0	0	67	10	20	21	0
| Family: Chironomidae	6	8	50	0	5	20	86	40
| Subfamily: Chironominae	0	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0	0
Paracladopelma	0	0	0	0	0	0	0	0
Phaenopsectra	0	0	0	0	0	0	0	0
Polypedilum	0	0	0	17	0	10	0	0
| Tribe: Tanytarsini	0	31	45	283	5	0	21	5
Micropsectra	0	31	20	183	15	0	0	0
Stempellina	0	0	0	0	0	0	0	0
Stempellinella	0	0	0	17	0	0	0	0
Sublettea	0	0	0	0	0	0	0	0
Tanytarsus	0	0	0	0	0	30	7	0
| Subfamily: Diamesinae	0	0	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0	0
Diamesa	17	46	230	0	35	90	43	55
Pagastia	0	8	0	483	20	60	14	20
Potthastia gaedii group	0	0	0	0	0	0	0	0
Pseudodiamesa	0	0	0	0	0	0	0	0
| Subfamily: Orthocladiinae	0	15	0	0	0	0	0	0
Brillia	0	0	5	0	0	0	0	0
Corynoneura	0	8	0	0	0	0	0	0
Cricotopus (Nostococladius)	0	0	0	0	0	0	0	0
Diplocladius cultriger	0	0	0	0	0	0	0	0
Eukiefferiella	6	62	0	0	0	50	0	0
Heleniella	0	0	0	100	0	0	0	0
Hydrobaenus	0	0	0	0	0	0	0	0
Krenosmittia	0	0	0	0	0	0	0	0
Limnophyes	0	0	0	0	0	0	0	0
Orthocladius complex	0	438	990	1,967	405	1,270	836	430
Orthocladius lignicola	0	0	0	0	0	0	0	0
Parakiefferiella	0	0	0	0	0	0	0	0
Parametriocnemus	0	0	70	100	10	80	21	5
Paraphaenocladius	0	0	0	0	0	0	0	0
Parorthocladius	0	0	0	0	0	0	0	0
Rheocricotopus	0	0	10	17	5	0	0	0
Rheosmittia	0	0	0	0	0	0	0	0
Thienemanniella	0	0	15	17	5	20	7	10
Tvetenia	0	23	20	0	20	10	7	5
| Subfamily: Tanypodinae	0	0	0	0	0	0	0	0
Zavrelimyia	0	0	0	0	0	0	0	0
| Tribe: Macropelopiini	0	0	0	0	0	0	0	0
Macropelopia	0	0	0	0	0	0	0	0
| Tribe: Pentaneurini	0	0	0	0	0	0	0	0
Thienemannimyia group	0	0	0	67	0	10	0	0
| Tribe: Procladiini	0	0	0	0	0	0	0	0
Procladius	0	0	0	0	0	0	0	0
| Family: Dolichopodidae	0	0	0	0	0	0	0	0
| Family: Empididae	0	0	0	0	0	0	0	0
Chelifera/ Metachela	0	8	0	0	0	0	7	0
Clinocera	6	0	0	0	0	0	0	0
Hemerodromia	0	0	0	0	0	0	7	0
Neoplasta	0	0	0	0	0	0	0	0
Oreogeton	0	0	0	0	0	0	0	0
Roederiodes	0	0	0	0	0	0	0	0
Trichoclinocera	0	0	0	17	0	0	0	0
| Family: Muscidae	0	0	0	0	0	0	0	0
Limnophora	0	0	0	0	0	0	0	0
| Family: Oreoleptidae	0	0	0	0	0	0	0	0
Oreoleptis	0	0	0	0	0	0	0	0
| Family: Pelecorhynchidae	0	0	0	0	0	0	0	0
Glutops	0	0	0	0	0	0	0	0
| Family: Psychodidae	0	0	0	0	0	0	0	0
Pericoma/Telmatoscopus	0	8	0	117	0	0	0	0
| Family: Sciaridae	0	0	0	0	0	0	0	0
| Family: Simuliidae	0	0	0	0	10	20	0	0
Helodon	0	0	0	0	5	0	0	5
Prosimulium	0	0	0	0	10	0	0	0
Prosimulium/Helodon	0	0	0	0	0	10	0	5
Simulium	0	0	15	17	125	180	150	60
Twinnia	0	8	0	0	0	0	0	0
| Family: Stratiomyidae	0	0	0	0	0	0	0	0
Nemotelus	0	0	0	0	0	0	0	0
| Family: Tipulidae	0	0	0	17	0	0	0	15
Antocha	0	0	0	50	0	0	0	5
Dicranota	0	0	5	0	0	10	0	5
Erioptera	0	0	0	0	0	10	0	0
Hesperoconopa	0	0	0	17	10	10	0	0
Hexatoma	0	0	0	0	0	10	0	5
Limnophila	0	0	0	33	0	0	0	0
Rhabdomastix	0	0	0	0	0	10	0	0
Tipula	0	0	0	17	0	0	0	0
| Order: Hemiptera	0	0	0	0	0	0	0	0
| Order: Megaloptera	0	0	0	0	0	0	0	0
| Family: Sialidae	0	0	0	0	0	0	0	0
Sialis	0	0	0	17	0	0	0	0
| Order: Thysanoptera	0	0	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0	0	0
| Order: Trombidiformes	0	0	0	0	0	0	0	0
Albaxona	0	0	0	0	0	0	0	0
| Family: Aturidae	0	0	0	0	0	0	0	0
Aturus	0	0	0	0	0	0	0	0
| Family: Feltriidae	0	0	0	0	0	0	0	0
Feltria	0	0	0	17	0	10	0	0
| Family: Hydryphantidae	0	0	0	0	0	0	0	0
Wandesia	0	0	0	0	0	0	0	0
| Family: Hygrobatidae	0	0	0	0	0	0	0	0
Hygrobates	0	0	0	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0	0	0
Lebertia	0	15	0	300	5	50	14	0
| Family: Sperchontidae	0	0	0	0	0	0	0	0
Sperchon	0	54	10	17	0	0	14	0
| Family: Torrenticolidae	0	0	0	0	0	0	0	0
Testudacarus	0	0	0	0	0	0	0	0

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	June							
	RG_HENUP	RG_FO26	RG_FODHE	RG_FOUNGD	RG_FODNGD	RG_MP1	RG_FOUSH	RG_FOUKI
Suborder: Prostigmata	0	0	0	0	0	0	0	0
| Family: Stygothrombidiidae	0	0	0	0	0	0	0	0
Stygothrombium	0	0	0	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0	0	0
| Order: Oribatida	0	0	0	0	0	0	0	0
| Family: Hydrozetidae	0	0	5	0	0	0	0	0
Phylum: Mollusca	0	0	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	0	0	0	0	0
Pisidium	0	0	0	0	0	0	0	0
| Class: Gastropoda	0	0	0	0	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	20	0	0
Enchytraeus	0	0	0	0	0	0	0	0
| Family: Naididae	0	0	0	0	0	0	0	0
Chaetogaster	0	0	0	0	0	0	0	0
Nais	0	0	0	0	0	0	0	0
Pristina	0	0	0	0	0	0	0	0
| Subfamily: Tubificinae with hair chaetae	0	0	0	0	0	0	0	0
| Subfamily: Tubificinae without hair chaetae	0	0	0	0	0	0	0	0
Totals:	**1,841**	**2,665**	**2,415**	**5,988**	**1,665**	**3,720**	**2,525**	**2,225**

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	June							
	RG_FOBKS	RG_FOBSC	RG_FOBCP	RG_FRCP1SW	RG_FRUPO	RG_FODPO	RG_FO22	RG_FOUEW
Phylum: Arthropoda	0	0	0	0	0	0	0	0
| Order: Collembola	0	0	4	0	0	0	0	0
| Family: Sminthuridae	0	0	0	2	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0	0
Ameletus	8	14	4	4	5	0	0	0
| Family: Baetidae	0	4	0	4	5	0	1	10
Acentrella	0	0	0	0	0	0	0	0
Baetis	31	0	0	8	9	0	0	40
Baetis fuscatus gr.	0	0	0	0	0	0	0	0
Baetis rhodani group	54	11	27	20	18	22	1	150
Baetis bicaudatus	54	18	15	2	9	0	0	260
| Family: Ephemerellidae	85	21	65	38	68	178	9	200
Caudatella	0	0	0	0	0	0	0	0
Drunella	8	0	0	0	0	0	0	10
Drunella grandis group	0	0	0	0	0	0	0	0
Drunella coloradensis	62	18	19	8	0	0	0	120
Drunella doddsii	23	0	0	2	0	0	0	0
Drunella grandis	0	0	0	0	0	0	0	0
Drunella spinifera	0	0	0	0	0	0	0	0
Serratella	0	0	0	0	0	0	0	0
| Family: Heptageniidae	38	18	23	50	82	111	5	250
Cinygmula	0	0	42	0	59	78	0	90
Epeorus	354	118	346	240	277	422	4	250
Rhithrogena	0	0	0	0	0	0	0	10
| Order: Plecoptera	0	0	0	0	0	0	0	0
| Family: Capniidae	0	0	0	4	264	656	19	20
| Family: Chloroperlidae	0	0	0	0	36	11	2	0
Haploperla	0	0	8	6	73	78	8	0
Neaviperla	0	0	0	0	0	0	0	0
Paraperla	0	0	0	0	0	0	0	0
Suwallia	0	0	0	0	0	0	0	0
Sweltsa	0	0	0	0	0	0	1	90
| Family: Leuctridae	8	0	0	0	0	0	0	0
Paraleuctra	0	0	0	0	0	0	0	0
| Family: Nemouridae	23	4	4	4	9	0	1	10
Malenka	0	0	0	0	5	11	0	50
Prostoia	8	0	0	0	5	0	1	0
Visoka cataractae	0	0	0	0	0	0	0	0
Zapada	0	0	0	0	0	0	0	0
Zapada oregonensis group	15	0	0	2	0	33	3	120
Zapada cinctipes	8	0	0	0	0	0	3	0
Zapada columbiana	0	0	0	0	0	0	0	0
| Family: Peltoperlidae	0	0	0	0	0	0	0	0
Yoraperla	0	0	0	0	0	0	0	0
| Family: Perlidae	0	0	0	0	0	0	0	10
Hesperoperla	0	0	0	0	0	0	0	0
| Family: Perlodidae	46	7	27	28	73	100	11	130
Diura	0	0	0	0	0	0	0	0
Isoperla	0	0	0	0	9	11	14	10
Kogotus	15	0	15	14	50	111	2	60
Megarcys	8	0	0	0	0	0	0	10
Rickera sorpta	0	0	0	0	0	0	0	0
Skwala	0	0	0	0	0	0	0	0
| Family: Taeniopterygidae	0	0	0	0	0	0	0	0
| Order: Trichoptera	0	0	0	0	0	22	0	0
| Family: Apataniidae	0	0	0	0	0	0	0	0
Apatania	0	0	0	0	0	0	0	0
Pedomoecus sierra	0	0	4	0	0	11	12	20
| Family: Brachycentridae	0	0	0	0	0	0	0	0
Brachycentrus	0	0	0	0	0	0	0	0
Brachycentrus americanus	0	0	0	0	0	0	0	0
Micrasema	0	0	0	0	0	0	0	0
| Family: Glossosomatidae	0	0	0	0	0	0	0	10
Glossosoma	0	0	0	0	0	0	0	10
| Family: Hydropsychidae	0	0	0	0	0	0	0	0
Arctopsyche	0	0	0	0	0	0	0	0
Hydropsyche	0	0	0	0	0	0	0	0
Parapsyche	0	0	0	0	0	0	0	0
Parapsyche elsis	8	0	0	0	0	0	0	0
| Family: Hydroptilidae	0	0	0	0	0	0	0	0
Hydroptila	0	0	0	0	0	0	0	0
| Family: Lepidostomatidae	0	0	0	0	0	0	0	0
Lepidostoma	0	0	0	0	0	0	0	0
| Family: Limnephilidae	0	0	0	0	0	11	0	0
Dicosmoecus	0	0	0	0	0	0	0	0
Ecclisomyia	0	0	0	0	5	0	17	0
| Family: Rhyacophilidae	0	0	0	0	0	0	0	0
Rhyacophila	46	32	12	38	95	33	3	50
Rhyacophila angelita group	62	64	119	48	36	233	2	70
Rhyacophila betteni group	0	0	0	0	0	0	0	0
Rhyacophila brunnea/vemna group	23	21	0	2	14	78	3	110
Rhyacophila hyalinata group	38	14	0	4	5	0	0	0
Rhyacophila vobara subgroup	0	0	0	0	0	0	0	0
Rhyacophila vofixa group	0	0	0	0	0	0	0	0
Rhyacophila alberta group	23	4	0	14	36	33	0	20
Rhyacophila atrata complex	0	25	4	4	9	111	8	120
Rhyacophila narvae	0	0	0	0	5	44	1	0
Rhyacophila verrula group	8	0	0	0	0	11	1	0
| Family: Thremmatidae	0	0	0	0	0	0	0	0
Oligophlebodes	0	0	4	0	5	0	0	0
| Order: Coleoptera	0	0	0	0	0	0	0	0
| Family: Dytiscidae	0	0	0	0	0	0	0	0
Liodessus	0	0	0	0	0	0	0	0
Oreodytes	0	0	0	0	0	0	0	10
Sanfilippodytes	0	0	0	2	0	0	0	0
Stictotarsus	0	0	0	0	0	0	2	0
| Subfamily: Hydroporinae	0	0	0	0	0	0	0	0
| Family: Elmidae	0	0	0	0	0	33	45	300
Heterlimnius	0	0	0	0	0	100	120	490

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	June							
	RG_FOBKS	RG_FOBSC	RG_FOBCP	RG_FRCP1SW	RG_FRUPO	RG_FODPO	RG_FO22	RG_FOUEW
| Order: Diptera	0	0	4	0	0	0	0	0
| Family: Ceratopogonidae	8	4	0	0	9	22	0	10
Bezzia/ Palpomyia	0	0	0	0	0	11	0	0
Mallochohelea	0	7	8	0	27	89	1	30
| Family: Chironomidae	31	54	12	0	0	11	2	0
| Subfamily: Chironominae	0	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0	0
Paracladopelma	0	0	0	0	0	0	1	0
Phaenopsectra	0	0	0	0	0	0	0	0
Polypedilum	0	0	0	0	5	0	1	0
| Tribe: Tanytarsini	0	4	0	2	0	0	1	10
Micropsectra	0	0	12	2	0	11	0	0
Stempellina	0	0	0	0	0	0	0	0
Stempellinella	0	0	0	2	0	0	0	10
Sublettea	0	0	0	0	0	0	0	0
Tanytarsus	23	0	0	0	0	0	0	0
| Subfamily: Diamesinae	0	0	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0	0
Diamesa	115	61	23	10	9	33	1	0
Pagastia	8	18	12	4	68	200	1	20
Potthastia gaedii group	0	0	0	0	0	0	0	0
Pseudodiamesa	0	0	0	0	0	0	0	0
| Subfamily: Orthocladiinae	0	0	0	0	5	0	2	0
Brillia	0	0	0	6	0	0	0	0
Corynoneura	0	0	0	0	5	0	1	0
Cricotopus (Nostococladius)	0	0	0	0	0	0	0	0
Diplocladius cultriger	0	0	0	0	0	0	0	0
Eukiefferiella	8	0	0	0	5	0	0	30
Heleniella	0	0	4	0	0	0	0	0
Hydrobaenus	0	0	0	0	0	0	0	0
Krenosmittia	0	0	0	2	0	0	0	0
Limnophyes	0	0	0	0	0	0	0	0
Orthocladius complex	885	500	427	50	77	722	18	710
Orthocladius lignicola	0	0	0	0	0	0	0	0
Parakiefferiella	0	0	0	2	5	0	0	0
Parametriocnemus	0	7	12	14	0	0	6	0
Paraphaenocladius	0	0	0	0	0	0	0	0
Parorthocladius	0	0	0	0	0	0	0	0
Rheocricotopus	0	7	0	2	0	0	2	0
Rheosmittia	0	4	4	4	0	0	1	0
Thienemanniella	8	11	0	0	5	22	1	0
Tvetenia	23	0	4	0	9	0	0	0
| Subfamily: Tanypodinae	0	0	0	0	0	0	0	10
Zavrelimyia	0	0	0	2	0	0	1	0
| Tribe: Macropelopiini	0	0	0	0	0	0	0	0
Macropelopia	8	0	0	0	0	0	0	0
| Tribe: Pentaneurini	0	0	0	0	0	0	0	0
Thienemannimyia group	0	11	4	0	5	0	0	0
| Tribe: Procladiini	0	0	0	0	0	0	0	0
Procladius	0	0	0	0	0	0	0	0
| Family: Dolichopodidae	0	4	0	0	0	0	0	0
| Family: Empididae	0	0	0	0	0	0	0	0
Chelifera/ Metachela	8	29	8	0	0	11	0	0
Clinocera	8	11	12	4	0	0	0	0
Hemerodromia	0	0	0	0	0	0	0	0
Neoplasta	0	0	0	0	5	0	0	0
Oreogeton	0	0	0	0	0	0	0	0
Roederiodes	0	0	0	0	0	0	0	0
Trichoclinocera	0	0	0	0	0	0	2	0
| Family: Muscidae	0	0	0	0	0	0	0	0
Limnophora	0	0	0	0	0	0	0	0
| Family: Oreoleptidae	0	0	0	0	0	0	0	0
Oreoleptis	0	0	0	0	0	0	1	0
| Family: Pelecorhynchidae	0	0	0	0	0	0	0	0
Glutops	0	0	0	0	0	0	0	10
| Family: Psychodidae	0	0	0	0	0	0	0	0
Pericoma/Telmatoscopus	8	4	8	0	5	0	0	0
| Family: Sciaridae	0	0	0	0	0	0	0	0
| Family: Simuliidae	0	0	0	0	0	0	0	10
Helodon	23	0	0	0	0	0	0	0
Prosimulium	0	0	0	0	0	0	0	0
Prosimulium/Helodon	0	0	0	0	0	0	0	0
Simulium	354	21	4	22	14	0	3	10
Twinnia	23	11	0	2	73	11	0	0
| Family: Stratiomyidae	0	0	0	0	0	0	0	0
Nemotelus	0	0	0	0	0	0	2	0
| Family: Tipulidae	0	0	4	0	32	33	4	0
Antocha	0	7	0	0	0	0	1	0
Dicranota	0	0	0	0	0	0	3	0
Erioptera	0	0	0	0	0	0	0	0
Hesperoconopa	15	4	0	0	0	0	17	0
Hexatoma	0	0	0	0	0	0	0	0
Limnophila	0	0	0	0	0	0	0	0
Rhabdomastix	0	0	0	0	0	56	3	0
Tipula	0	0	4	0	0	22	2	0
| Order: Hemiptera	0	0	0	0	0	0	0	0
| Order: Megaloptera	0	0	0	0	0	0	0	0
| Family: Sialidae	0	0	0	0	0	0	0	0
Sialis	0	0	0	0	0	0	0	0
| Order: Thysanoptera	0	0	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0	0	0
| Order: Trombidiformes	0	0	0	0	5	0	0	0
Albaxona	0	0	0	0	0	0	0	0
| Family: Aturidae	0	0	0	0	0	0	0	0
Aturus	0	0	0	0	0	11	0	0
| Family: Feltriidae	0	0	0	0	0	0	0	0
Feltria	0	0	0	0	0	0	1	0
| Family: Hydryphantidae	0	0	0	0	0	0	0	0
Wandesia	0	0	0	0	0	0	1	0
| Family: Hygrobatidae	0	0	0	0	0	0	0	0
Hygrobates	0	0	0	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0	0	0
Lebertia	23	32	23	22	41	78	36	150
| Family: Sperchontidae	0	0	0	0	0	0	0	0
Sperchon	0	4	4	0	0	11	0	10
| Family: Torrenticolidae	0	0	0	0	0	0	0	0
Testudacarus	0	0	4	0	0	0	0	0

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	June							
	RG_FOBKS	RG_FOBSC	RG_FOBCP	RG_FRCP1SW	RG_FRUPO	RG_FODPO	RG_FO22	RG_FOUEW
Suborder: Prostigmata	0	0	0	0	0	0	0	0
| Family: Stygothrombidiidae	0	0	0	0	0	0	0	0
Stygothrombium	0	0	0	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0	0	0
| Order: Oribatida	0	0	0	0	0	0	0	0
| Family: Hydrozetidae	0	0	0	0	0	0	0	0
Phylum: Mollusca	0	0	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	0	0	0	0	20
Pisidium	0	0	0	0	0	0	5	10
| Class: Gastropoda	0	0	0	0	0	0	5	0
Phylum: Annelida	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0	0
| Family: Enchytraeidae	0	4	8	6	5	0	0	0
Enchytraeus	0	0	0	0	0	0	0	0
| Family: Naididae	0	0	0	0	0	0	0	0
Chaetogaster	0	0	0	0	0	0	0	0
Nais	0	0	0	0	0	0	3	0
Pristina	0	0	0	0	0	0	0	10
| Subfamily: Tubificinae with hair chaetae	0	0	0	0	0	0	1	0
| Subfamily: Tubificinae without hair chaetae	0	0	8	0	0	0	0	0
Totals:	**2,635**	**1,212**	**1,355**	**706**	**1,680**	**3,896**	**429**	**4,170**

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	August							
	RG_HENUP	RG_FODHE	RG_FOUNGD	RG_FODNGD	RG_MP1	RG_FOUSH	RG_FOUKI	RG_FOBKS
Phylum: Arthropoda	0	0	0	0	0	0	0	0
| Order: Collembola	0	0	0	0	0	0	0	0
| Family: Sminthuridae	0	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	20	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0	0
Ameletus	0	140	40	0	160	50	100	20
| Family: Baetidae	14	80	480	180	640	370	520	1,160
Acentrella	0	0	20	60	0	0	20	20
Baetis	86	180	340	840	1,480	620	1,800	1,820
Baetis fuscatus gr.	0	0	0	0	0	0	0	0
Baetis rhodani group	171	400	2,180	880	280	110	200	500
Baetis bicaudatus	0	0	0	0	0	0	0	0
| Family: Ephemerellidae	14	560	620	600	360	60	0	220
Caudatella	0	0	0	0	0	0	0	0
Drunella	0	0	0	0	0	0	40	20
Drunella grandis group	0	20	80	80	160	0	0	220
Drunella coloradensis	29	120	220	60	40	30	0	0
Drunella doddsii	143	2,020	900	360	0	100	120	80
Drunella grandis	0	0	0	0	0	0	0	0
Drunella spinifera	0	0	0	0	0	0	0	0
Serratella	0	60	820	260	140	110	240	260
| Family: Heptageniidae	714	1,880	5,160	1,940	560	1,450	1,420	720
Cinygmula	71	220	20	60	20	50	0	0
Epeorus	414	540	560	180	20	200	100	240
Rhithrogena	243	0	0	0	0	30	0	0
| Order: Plecoptera	0	0	0	0	0	0	0	0
| Family: Capniidae	14	0	40	20	20	0	0	0
| Family: Chloroperlidae	0	40	20	0	0	0	20	0
Haploperla	0	0	0	0	0	0	0	0
Neaviperla	0	20	0	0	0	0	0	0
Paraperla	186	0	0	0	0	0	0	0
Suwallia	0	0	0	0	0	60	0	0
Sweltsa	71	0	180	140	100	10	0	0
| Family: Leuctridae	0	0	0	0	0	0	0	0
Paraleuctra	0	0	0	0	0	0	0	0
| Family: Nemouridae	0	0	0	0	0	0	0	0
Malenka	0	0	0	0	0	0	0	0
Prostoia	0	0	0	0	0	0	0	0
Visoka cataractae	0	0	0	0	0	0	0	0
Zapada	129	0	260	0	0	40	40	80
Zapada oregonensis group	186	0	260	60	0	10	0	0
Zapada cinctipes	0	0	0	0	0	0	0	0
Zapada columbiana	71	0	40	0	0	0	0	20
| Family: Peltoperlidae	0	0	0	0	0	0	0	0
Yoraperla	0	0	0	0	0	0	0	0
| Family: Perlidae	0	0	0	0	0	0	0	20
Hesperoperla	0	0	0	0	0	10	0	0
| Family: Perlodidae	14	40	100	80	20	70	40	60
Diura	0	0	0	0	0	0	0	0
Isoperla	0	0	0	0	0	0	0	0
Kogotus	0	0	0	20	40	0	0	20
Megarcys	71	120	360	60	20	40	0	40
Rickera sorpta	0	0	0	0	0	0	0	0
Skwala	0	0	0	0	0	0	0	0
| Family: Taeniopterygidae	0	0	0	0	0	10	0	0
| Order: Trichoptera	0	0	0	20	80	0	0	20
| Family: Apataniidae	0	0	0	0	0	0	0	0
Apatania	0	0	0	20	0	0	0	0
Pedomoecus sierra	0	0	0	0	0	0	0	0
| Family: Brachycentridae	0	0	0	0	0	0	0	0
Brachycentrus	0	0	0	0	0	0	0	0
Brachycentrus americanus	0	0	0	0	0	0	0	0
Micrasema	0	0	0	0	0	0	0	0
| Family: Glossosomatidae	57	0	0	0	0	0	0	0
Glossosoma	143	0	40	0	0	0	0	0
| Family: Hydropsychidae	0	0	0	0	0	20	20	0
Arctopsyche	0	0	0	0	0	0	0	0
Hydropsyche	0	0	0	0	0	0	0	0
Parapsyche	0	0	0	0	0	0	0	0
Parapsyche elsis	29	0	0	0	0	0	0	20
| Family: Hydroptilidae	0	0	0	0	0	0	0	0
Hydroptila	0	0	0	20	0	20	0	20
| Family: Lepidostomatidae	0	0	0	0	0	0	0	0
Lepidostoma	0	0	0	0	0	10	0	0
| Family: Limnephilidae	14	100	0	60	20	10	0	0
Dicosmoecus	0	0	0	0	0	0	0	0
Ecclisomyia	0	0	0	0	0	0	0	0
| Family: Rhyacophilidae	0	0	0	0	0	0	0	0
Rhyacophila	0	20	80	60	60	0	0	20
Rhyacophila angelita group	0	60	40	0	0	20	40	0
Rhyacophila betteni group	0	0	20	0	0	10	0	40
Rhyacophila brunnea/vemna group	0	0	0	20	20	0	20	40
Rhyacophila hyalinata group	71	60	0	0	0	10	40	40
Rhyacophila vobara subgroup	0	0	0	20	0	0	0	0
Rhyacophila vofixa group	0	0	0	0	0	0	0	0
Rhyacophila alberta group	14	0	0	20	0	10	0	0
Rhyacophila atrata complex	0	0	0	60	0	0	0	0
Rhyacophila narvae	0	0	20	0	0	0	0	0
Rhyacophila verrula group	0	0	0	0	0	0	0	0
| Family: Thremmatidae	0	0	0	0	0	0	0	0
Oligophlebodes	0	0	0	0	0	0	0	0
| Order: Coleoptera	0	0	0	0	0	0	0	0
| Family: Dytiscidae	0	0	0	0	0	0	0	0
Liodessus	0	0	0	0	0	0	0	0
Oreodytes	0	0	0	0	0	0	0	0
Sanfilippodytes	0	0	0	0	0	0	0	0
Stictotarsus	0	0	0	0	0	0	0	0
| Subfamily: Hydroporinae	0	0	0	0	60	0	0	0
| Family: Elmidae	0	0	0	0	0	0	0	0
Heterlimnius	0	0	0	0	20	0	0	20

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	August							
	RG_HENUP	RG_FODHE	RG_FOUNGD	RG_FODNGD	RG_MP1	RG_FOUSH	RG_FOUKI	RG_FOBKS
| Order: Diptera	0	0	0	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0	0	0
Bezzia/ Palpomyia	0	0	0	0	0	0	0	0
Mallochohelea	0	80	200	80	100	10	40	80
| Family: Chironomidae	400	480	360	220	180	130	80	260
| Subfamily: Chironominae	0	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0	0
Paracladopelma	0	0	0	0	0	0	0	0
Phaenopsectra	0	0	0	0	0	0	0	0
Polypedilum	0	0	0	0	0	10	0	0
| Tribe: Tanytarsini	0	0	80	0	0	10	20	0
Micropsectra	100	60	80	100	240	80	80	40
Stempellina	0	0	0	0	0	0	0	0
Stempellinella	114	400	400	860	500	140	180	80
Sublettea	0	0	0	0	0	10	0	0
Tanytarsus	0	0	0	0	0	0	0	0
| Subfamily: Diamesinae	0	0	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0	0
Diamesa	129	20	0	20	0	20	0	0
Pagastia	14	120	40	60	20	20	0	80
Potthastia gaedii group	0	0	0	0	0	0	0	0
Pseudodiamesa	14	0	0	20	0	0	0	0
| Subfamily: Orthocladiinae	14	20	80	0	100	10	0	0
Brillia	0	0	20	0	0	0	0	0
Corynoneura	14	0	60	0	0	0	0	20
Cricotopus (Nostococladius)	0	0	0	0	0	0	0	0
Diplocladius cultriger	0	0	20	20	0	0	0	0
Eukiefferiella	57	0	180	20	0	0	20	160
Heleniella	0	0	80	0	80	20	20	60
Hydrobaenus	14	200	40	0	400	0	20	0
Krenosmittia	29	0	0	0	0	0	0	0
Limnophyes	0	0	0	0	0	0	0	0
Orthocladius complex	71	780	1,900	1,120	640	320	180	780
Orthocladius lignicola	0	0	0	0	0	0	0	20
Parakiefferiella	0	0	0	0	0	0	0	0
Parametriocnemus	214	60	40	0	20	0	0	0
Paraphaenocladius	0	0	0	0	0	10	0	0
Parorthocladius	0	0	0	0	0	0	0	0
Rheocricotopus	329	340	140	40	80	40	40	0
Rheosmittia	0	0	0	0	0	0	0	0
Thienemanniella	0	0	0	0	0	20	0	0
Tvetenia	100	120	420	160	60	90	120	460
| Subfamily: Tanypodinae	0	0	0	0	0	0	0	0
Zavrelimyia	0	0	0	0	0	0	0	0
| Tribe: Macropelopiini	0	0	0	0	0	0	0	0
Macropelopia	0	0	0	0	0	0	0	0
| Tribe: Pentaneurini	0	0	0	0	0	0	0	0
Thienemannimyia group	0	0	0	20	0	40	40	0
| Tribe: Procladiini	0	0	0	0	0	0	0	0
Procladius	0	0	0	0	0	0	0	0
| Family: Dolichopodidae	0	0	0	0	0	0	0	0
| Family: Empididae	0	0	0	20	0	0	0	0
Chelifera/ Metachela	0	0	0	0	20	10	0	0
Clinocera	29	0	40	20	0	0	0	60
Hemerodromia	0	0	0	0	0	0	0	0
Neoplasta	0	20	0	0	0	0	0	0
Oreogeton	14	0	0	0	0	0	0	0
Roederiodes	0	0	0	0	0	0	0	0
Trichoclinocera	0	0	0	0	0	0	0	0
| Family: Muscidae	0	0	0	0	0	0	0	0
Limnophora	0	0	0	0	0	0	0	0
| Family: Oreoleptidae	0	0	0	0	0	0	0	0
Oreoleptis	0	0	0	0	0	0	0	0
| Family: Pelecorhynchidae	0	0	0	0	0	0	0	0
Glutops	0	0	0	0	0	0	0	0
| Family: Psychodidae	0	0	0	0	0	0	0	0
Pericoma/Telmatoscopus	0	20	180	80	400	20	180	340
| Family: Sciaridae	0	0	0	0	0	0	0	0
| Family: Simuliidae	0	0	60	0	0	0	0	20
Helodon	0	0	0	0	0	0	0	0
Prosimulium	0	0	0	0	0	0	0	0
Prosimulium/Helodon	0	0	0	0	0	0	0	0
Simulium	14	0	2,740	20	0	70	320	1,020
Twinnia	0	0	0	0	0	0	0	0
| Family: Stratiomyidae	0	0	0	0	0	0	0	0
Nemotelus	0	0	0	0	0	0	0	0
| Family: Tipulidae	0	0	0	0	0	10	0	0
Antocha	0	0	0	0	0	0	0	0
Dicranota	0	0	0	0	0	0	0	0
Erioptera	0	0	0	0	0	0	0	0
Hesperoconopa	0	0	0	0	0	0	0	0
Hexatoma	0	0	0	0	0	0	0	0
Limnophila	0	0	0	0	0	0	0	0
Rhabdomastix	0	0	0	0	0	0	0	0
Tipula	0	0	0	0	0	0	0	0
| Order: Hemiptera	0	0	0	0	0	0	0	0
| Order: Megaloptera	0	0	0	0	0	0	0	0
| Family: Sialidae	0	0	0	0	0	0	0	0
Sialis	0	0	0	0	0	0	0	0
| Order: Thysanoptera	0	0	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0	0	0
| Order: Trombidiformes	0	0	60	0	0	0	0	0
Albaxona	0	0	0	0	0	0	0	0
| Family: Aturidae	0	0	0	0	0	0	0	0
Aturus	0	0	40	20	40	0	0	0
| Family: Feltriidae	0	0	0	0	0	0	0	0
Feltria	0	40	60	20	0	0	0	0
| Family: Hydryphantidae	0	0	0	0	0	0	0	0
Wandesia	0	0	0	0	0	0	0	0
| Family: Hygrobatidae	0	0	0	0	0	0	0	0
Hygrobates	0	0	0	0	40	0	20	0
| Family: Lebertiidae	0	0	0	0	0	0	0	0
Lebertia	0	40	80	160	140	30	20	60
| Family: Sperchontidae	0	0	0	0	0	0	0	0
Sperchon	0	0	40	60	40	0	0	20
| Family: Torrenticolidae	0	0	0	0	0	0	0	0
Testudacarus	0	0	0	0	0	0	0	0

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	August							
	RG_HENUP	RG_FODHE	RG_FOUNGD	RG_FODNGD	RG_MP1	RG_FOUSH	RG_FOUKI	RG_FOBKS
Suborder: Prostigmata	0	0	0	0	0	0	0	0
| Family: Stygothrombidiidae	0	0	0	0	0	0	0	0
Stygothrombium	0	0	0	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0	0	0
| Order: Oribatida	0	0	0	0	0	0	0	0
| Family: Hydrozetidae	0	0	0	0	0	0	0	0
Phylum: Mollusca	0	0	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	0	0	0	0	0
Pisidium	0	0	0	0	0	0	0	0
| Class: Gastropoda	0	0	0	0	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0	0	0
Enchytraeus	0	0	0	0	0	0	0	20
| Family: Naididae	0	0	0	0	0	0	0	0
Chaetogaster	0	0	0	20	0	0	0	0
Nais	0	0	0	0	0	0	0	0
Pristina	0	0	0	0	0	0	0	0
| Subfamily: Tubificinae with hair chaetae	0	0	0	0	0	0	0	0
| Subfamily: Tubificinae without hair chaetae	0	0	0	0	0	0	0	0
Totals:	**4,639**	**9,480**	**20,360**	**9,340**	**7,420**	**4,660**	**6,160**	**9,320**

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	August						
	RG_FOBSC	RG_FOBCP	RG_FRCP1SW	RG_FRUPO	RG_FODPO	RG_FO22	RG_FOUEW
Phylum: Arthropoda	0	0	0	0	0	0	0
| Order: Collembola	0	0	0	0	0	0	0
| Family: Sminthuridae	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	17	0	20
| Family: Ameletidae	0	0	0	0	0	0	0
Ameletus	60	20	20	20	0	0	0
| Family: Baetidae	420	440	340	1,040	33	60	460
Acentrella	0	40	40	20	17	0	0
Baetis	1,500	560	300	120	0	0	100
Baetis fuscatus gr.	0	0	0	0	0	0	0
Baetis rhodani group	320	900	420	340	50	0	160
Baetis bicaudatus	0	0	0	0	0	0	0
| Family: Ephemerellidae	100	220	20	360	50	80	160
Caudatella	0	0	0	0	0	0	0
Drunella	0	0	20	0	0	0	0
Drunella grandis group	60	0	0	40	83	40	40
Drunella coloradensis	0	0	20	0	0	0	40
Drunella doddsii	120	180	100	180	0	20	140
Drunella grandis	20	0	0	0	0	0	0
Drunella spinifera	0	0	0	0	0	0	0
Serratella	120	120	80	40	17	40	0
| Family: Heptageniidae	880	2,360	1,200	1,800	100	0	760
Cinygmula	20	0	0	0	0	0	0
Epeorus	100	220	140	60	0	0	200
Rhithrogena	0	20	120	20	0	0	0
| Order: Plecoptera	0	0	20	0	0	0	0
| Family: Capniidae	0	20	120	420	233	60	60
| Family: Chloroperlidae	0	0	0	80	0	0	60
Haploperla	0	0	0	20	0	0	0
Neaviperla	0	0	0	0	0	0	0
Paraperla	0	0	0	0	0	0	0
Suwallia	0	0	20	0	0	0	0
Sweltsa	0	0	0	40	33	0	100
| Family: Leuctridae	0	0	0	0	0	0	0
Paraleuctra	0	0	0	0	0	0	0
| Family: Nemouridae	0	0	0	0	0	0	20
Malenka	0	0	0	0	0	0	0
Prostoia	0	0	0	0	0	0	0
Visoka cataractae	0	0	0	0	0	0	0
Zapada	220	1,300	1,420	660	667	80	700
Zapada oregonensis group	20	60	0	0	67	60	180
Zapada cinctipes	0	0	0	20	0	20	20
Zapada columbiana	0	20	0	0	0	0	0
| Family: Peltoperlidae	0	0	0	0	0	0	0
Yoraperla	0	0	0	0	0	0	0
| Family: Perlidae	0	100	0	0	0	0	0
Hesperoperla	20	20	0	0	0	0	20
| Family: Perlodidae	120	280	460	400	50	240	160
Diura	0	0	0	0	0	0	0
Isoperla	0	0	0	0	0	0	0
Kogotus	20	60	180	40	50	140	80
Megarcys	20	60	220	80	33	0	160
Rickera sorpta	0	0	0	20	0	0	40
Skwala	0	0	0	0	0	0	0
| Family: Taeniopterygidae	0	20	40	60	0	20	0
| Order: Trichoptera	20	0	0	0	0	0	0
| Family: Apataniidae	0	0	0	0	0	0	0
Apatania	0	20	100	20	0	20	0
Pedomoecus sierra	0	0	0	0	0	20	0
| Family: Brachycentridae	0	0	0	0	0	0	0
Brachycentrus	0	0	0	0	0	0	0
Brachycentrus americanus	0	0	0	20	0	0	0
Micrasema	0	0	0	0	0	0	0
| Family: Glossosomatidae	0	0	0	0	0	0	20
Glossosoma	0	0	20	20	0	0	0
| Family: Hydropsychidae	0	40	0	20	0	0	0
Arctopsyche	0	0	0	0	0	0	0
Hydropsyche	0	0	0	0	0	0	0
Parapsyche	0	0	0	0	0	0	0
Parapsyche elsis	0	0	0	0	0	0	0
| Family: Hydroptilidae	0	0	0	0	0	0	0
Hydroptila	0	0	0	0	0	0	0
| Family: Lepidostomatidae	0	0	0	0	0	0	0
Lepidostoma	0	0	0	0	0	0	0
| Family: Limnephilidae	0	0	80	20	33	40	0
Dicosmoecus	0	0	0	0	0	0	0
Ecclisomyia	0	0	0	0	0	0	0
| Family: Rhyacophilidae	0	0	0	0	0	0	0
Rhyacophila	0	20	0	60	33	40	60
Rhyacophila angelita group	20	20	120	120	50	0	0
Rhyacophila betteni group	0	0	0	0	0	0	20
Rhyacophila brunnea/vemna group	0	0	40	0	33	60	80
Rhyacophila hyalinata group	0	0	20	0	0	0	0
Rhyacophila vobara subgroup	0	0	0	0	0	0	0
Rhyacophila vofixa group	0	0	0	0	0	0	0
Rhyacophila alberta group	0	20	0	0	0	0	0
Rhyacophila atrata complex	0	0	0	0	50	0	120
Rhyacophila narvae	0	20	0	0	0	0	0
Rhyacophila verrula group	0	0	0	0	0	0	0
| Family: Thremmatidae	0	0	0	0	0	0	0
Oligophlebodes	0	0	0	0	0	0	0
| Order: Coleoptera	0	0	0	0	0	0	0
| Family: Dytiscidae	0	0	0	0	0	0	0
Liodessus	0	0	0	0	0	0	0
Oreodytes	0	0	0	0	0	0	0
Sanfilippodytes	0	0	0	0	0	0	0
Stictotarsus	0	0	0	0	0	0	0
| Subfamily: Hydroporinae	0	0	0	0	0	0	0
| Family: Elmidae	0	0	0	0	100	1,740	320
Heterlimnius	0	0	0	0	100	1,380	840

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	August						
	RG_FOBSC	RG_FOBCP	RG_FRCP1SW	RG_FRUPO	RG_FODPO	RG_FO22	RG_FOUEW
| Order: Diptera	0	0	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0	0
Bezzia/ Palpomyia	0	0	0	0	0	0	0
Mallochohelea	120	80	0	140	0	0	40
| Family: Chironomidae	160	940	340	280	183	220	300
| Subfamily: Chironominae	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0
Paracladopelma	0	0	0	0	0	0	0
Phaenopsectra	0	0	0	0	0	0	0
Polypedilum	0	0	0	0	0	0	0
| Tribe: Tanytarsini	40	0	0	0	0	0	0
Micropsectra	200	120	120	40	17	40	60
Stempellina	0	0	0	0	0	0	0
Stempellinella	0	20	20	20	0	0	0
Sublettea	0	0	0	0	0	0	0
Tanytarsus	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	0	20	0	0	0	0	0
Pagastia	40	40	20	180	100	80	0
Potthastia gaedii group	0	0	0	0	17	0	0
Pseudodiamesa	0	0	0	0	0	0	0
| Subfamily: Orthocladiinae	0	0	40	60	83	0	40
Brillia	0	0	0	0	0	0	20
Corynoneura	20	80	0	0	0	0	0
Cricotopus (Nostococladius)	0	0	0	0	0	0	0
Diplocladius cultriger	0	0	0	0	0	0	0
Eukiefferiella	240	700	160	120	217	60	200
Heleniella	40	80	0	0	0	20	20
Hydrobaenus	80	0	0	0	317	0	0
Krenosmittia	0	0	0	0	0	0	0
Limnophyes	0	0	0	0	0	40	0
Orthocladius complex	420	4,520	980	3,220	2,667	840	2,320
Orthocladius lignicola	0	0	0	0	0	0	0
Parakiefferiella	0	0	0	0	0	0	0
Parametriocnemus	40	0	0	0	0	0	0
Paraphaenocladius	0	0	0	0	0	0	0
Parorthocladius	0	0	0	0	0	0	0
Rheocricotopus	40	80	20	20	150	80	60
Rheosmittia	0	0	0	0	0	0	0
Thienemanniella	20	80	60	0	33	0	0
Tvetenia	2,080	3,420	1,420	680	200	100	640
| Subfamily: Tanypodinae	0	0	0	0	17	0	0
Zavrelimyia	0	0	0	0	0	0	0
| Tribe: Macropelopiini	0	0	0	0	0	0	0
Macropelopia	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
| Tribe: Procladiini	0	0	0	0	0	0	0
Procladius	0	0	0	0	0	0	0
| Family: Dolichopodidae	0	0	0	0	0	0	0
| Family: Empididae	0	0	0	0	0	20	0
Chelifera/ Metachela	0	0	60	0	33	20	0
Clinocera	20	0	20	0	33	0	40
Hemerodromia	0	0	0	0	0	0	0
Neoplasta	0	0	0	0	0	40	0
Oreogeton	0	0	0	0	0	0	0
Roederiodes	0	0	0	0	0	0	0
Trichoclinocera	0	0	0	0	0	0	0
| Family: Muscidae	0	0	0	0	0	0	0
Limnophora	0	0	0	0	0	0	0
| Family: Oreoleptidae	0	0	0	0	0	0	0
Oreoleptis	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	420	440	60	0	17	0	0
| Family: Sciaridae	0	0	0	0	0	0	20
| Family: Simuliidae	0	200	180	440	0	0	20
Helodon	0	0	0	0	0	0	0
Prosimulium	0	0	0	0	0	0	0
Prosimulium/Helodon	0	0	0	0	0	0	0
Simulium	40	4,900	2,340	7,280	17	120	180
Twinnia	0	0	0	0	0	0	0
| Family: Stratiomyidae	0	0	0	0	0	0	0
Nemotelus	0	0	0	0	0	0	0
| Family: Tipulidae	0	0	20	0	17	0	0
Antocha	0	0	0	0	0	0	20
Dicranota	0	0	0	20	0	0	0
Erioptera	0	0	0	0	0	0	0
Hesperoconopa	0	0	0	0	0	0	0
Hexatoma	0	0	20	20	0	0	0
Limnophila	0	0	0	0	0	20	20
Rhabdomastix	0	0	0	0	0	0	0
Tipula	0	20	0	0	17	20	0
| Order: Hemiptera	0	0	0	0	0	0	0
| Order: Megaloptera	0	0	0	0	0	0	0
| Family: Sialidae	0	0	0	0	0	0	0
Sialis	0	0	0	0	0	0	0
| Order: Thysanoptera	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	0	0	20	0	0	0	20
Albaxona	0	0	0	0	0	0	0
| Family: Aturidae	0	0	0	0	0	0	0
Aturus	20	20	0	0	100	100	40
| Family: Feltriidae	0	0	0	0	0	0	0
Feltria	20	0	20	20	50	40	20
| Family: Hydryphantidae	0	0	0	0	0	0	0
Wandesia	0	0	20	0	0	0	0
| Family: Hygrobatidae	0	0	0	0	0	0	0
Hygrobates	0	0	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0	0
Lebertia	80	80	160	120	150	540	580
| Family: Sperchontidae	0	0	0	0	0	0	0
Sperchon	0	20	0	0	0	0	20
| Family: Torrenticolidae	0	0	0	0	0	0	0
Testudacarus	0	0	0	0	17	0	0

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	August						
	RG_FOBSC	RG_FOBCP	RG_FRCP1SW	RG_FRUPO	RG_FODPO	RG_FO22	RG_FOUEW
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: Mollusca	0	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	0	0	0	0
Pisidium	0	0	0	0	0	40	0
| Class: Gastropoda	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: Tubificida	0	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0	0
Enchytraeus	200	60	100	0	0	20	0
| Family: Naididae	0	0	0	0	0	0	0
Chaetogaster	0	0	0	0	0	0	0
Nais	0	0	0	0	17	0	0
Pristina	0	0	0	0	0	0	0
| Subfamily: Tubificinae with hair chaetae	0	0	0	0	0	0	0
| Subfamily: Tubificinae without hair chaetae	0	0	0	0	0	0	0
Totals:	**8,520**	**23,080**	**11,880**	**18,820**	**6,368**	**6,620**	**9,820**

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September					
	RG_HENUP1	RG_HENUP2	RG_HENUP3	RG_FO26-1	RG_FO26-2	RG_FO26-3
Phylum: Arthropoda	0	0	0	0	0	0
| Order: Collembola	0	0	0	0	0	0
| Family: Sminthuridae	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0
Ameletus	14	17	520	60	40	0
| Family: Baetidae	0	0	0	180	60	160
Acentrella	0	0	0	0	0	0
Baetis	0	0	20	60	60	120
Baetis fuscatus gr.	0	0	0	0	0	0
Baetis rhodani group	14	17	0	420	340	280
Baetis bicaudatus	0	0	20	0	0	0
| Family: Ephemerellidae	457	917	980	5,120	3,820	3,500
Caudatella	0	0	0	0	0	0
Drunella	0	0	0	0	0	0
Drunella grandis group	0	0	0	0	0	0
Drunella coloradensis	0	17	0	0	0	20
Drunella doddsii	86	100	140	780	540	780
Drunella grandis	0	0	0	0	0	0
Drunella spinifera	0	0	0	0	0	0
Serratella	0	0	0	0	0	20
| Family: Heptageniidae	2,671	3,733	7,180	7,700	9,920	9,260
Cinygmula	0	0	0	0	20	0
Epeorus	57	67	100	40	100	100
Rhithrogena	229	267	400	40	60	100
| Order: Plecoptera	0	0	0	60	40	80
| Family: Capniidae	0	0	0	0	0	0
| Family: Chloroperlidae	0	17	20	100	160	140
Haploperla	0	0	0	0	0	0
Neaviperla	0	0	0	0	0	0
Paraperla	43	183	200	0	0	60
Suwallia	14	0	40	0	0	0
Sweltsa	71	50	140	180	240	380
| Family: Leuctridae	0	0	0	60	80	40
Paraleuctra	14	0	0	40	40	0
| Family: Nemouridae	0	0	0	0	0	0
Malenka	0	0	0	0	0	0
Prostoia	0	0	0	0	0	0
Visoka cataractae	0	0	0	0	20	0
Zapada	114	50	100	1,080	500	560
Zapada oregonensis group	57	83	120	480	220	400
Zapada cinctipes	14	0	0	0	0	0
Zapada columbiana	14	100	160	160	120	100
| Family: Peltoperlidae	0	0	0	0	0	0
Yoraperla	0	0	0	0	0	20
| Family: Perlidae	0	0	0	0	0	0
Hesperoperla	0	0	0	0	0	0
| Family: Perlodidae	14	0	0	60	20	60
Diura	0	0	0	0	0	0
Isoperla	0	0	0	0	20	0
Kogotus	0	0	0	240	280	220
Megarcys	71	67	120	200	100	320
Rickera sorpta	0	0	0	0	0	0
Skwala	0	0	0	0	0	0
| Family: Taeniopterygidae	186	183	140	140	180	120
| Order: Trichoptera	57	150	380	1,260	740	520
| Family: Apataniidae	0	0	0	0	0	0
Apatania	0	0	0	0	0	20
Pedomoecus sierra	0	0	0	0	0	0
| Family: Brachycentridae	0	0	0	0	0	0
Brachycentrus	0	0	0	0	0	0
Brachycentrus americanus	0	0	0	0	0	0
Micrasema	0	0	0	0	0	0
| Family: Glossosomatidae	0	17	0	0	0	0
Glossosoma	29	67	60	0	0	0
| Family: Hydropsychidae	43	100	80	220	100	200
Arctopsyche	0	0	0	0	0	0
Hydropsyche	0	0	0	0	0	0
Parapsyche	0	0	0	0	0	0
Parapsyche elsis	0	17	80	40	120	280
| Family: Hydroptilidae	0	0	0	0	0	0
Hydroptila	0	0	0	0	0	0
| Family: Lepidostomatidae	0	0	0	0	0	0
Lepidostoma	0	0	0	0	0	0
| Family: Limnephilidae	0	0	20	60	60	80
Dicosmoecus	0	0	0	0	0	0
Ecclisomyia	0	0	20	0	0	0
| Family: Rhyacophilidae	0	0	0	0	0	0
Rhyacophila	0	0	20	60	0	40
Rhyacophila angelita group	0	0	0	0	0	0
Rhyacophila betteni group	0	0	0	0	0	20
Rhyacophila brunnea/vemna group	0	17	0	0	0	20
Rhyacophila hyalinata group	0	17	20	160	40	80
Rhyacophila vobara subgroup	0	0	0	0	0	0
Rhyacophila vofixa group	0	0	0	80	20	100
Rhyacophila alberta group	0	0	0	0	0	0
Rhyacophila atrata complex	0	0	0	20	20	0
Rhyacophila narvae	0	0	0	0	20	0
Rhyacophila verrula group	0	0	0	0	0	0
| Family: Thremmatidae	0	0	0	0	0	0
Oligophlebodes	0	0	0	80	60	160
| Order: Coleoptera	0	0	0	0	0	0
| Family: Dytiscidae	0	0	0	0	0	0
Liodessus	0	0	0	0	0	0
Oreodytes	0	0	0	0	0	0
Sanfilippodytes	0	0	0	0	0	0
Stictotarsus	0	0	0	0	0	0
| Subfamily: Hydroporinae	0	0	0	0	0	0
| Family: Elmidae	0	0	0	0	0	20
Heterlimnius	0	0	0	0	0	0

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September					
	RG_HENUP1	RG_HENUP2	RG_HENUP3	RG_FO26-1	RG_FO26-2	RG_FO26-3
| Order: Diptera	0	0	0	0	900	0
| Family: Ceratopogonidae	0	0	0	0	0	0
Bezzia/ Palpomyia	0	0	0	0	0	0
Mallochohelea	0	0	0	180	60	0
| Family: Chironomidae	329	400	580	140	80	220
| Subfamily: Chironominae	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0
Paracladopelma	0	0	0	0	0	0
Phaenopsectra	0	0	0	0	0	0
Polypedilum	0	0	0	0	20	0
| Tribe: Tanytarsini	186	250	360	520	600	560
Micropsectra	0	0	20	40	0	40
Stempellina	0	0	0	0	0	0
Stempellinella	0	0	0	0	0	0
Sublettea	0	0	0	0	0	0
Tanytarsus	0	0	0	0	0	0
| Subfamily: Diamesinae	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0
Diamesa	0	0	20	60	20	100
Pagastia	14	17	20	340	140	180
Potthastia gaedii group	0	0	0	0	0	0
Pseudodiamesa	0	0	0	0	0	40
| Subfamily: Orthocladiinae	0	0	0	40	0	0
Brillia	0	0	0	40	20	60
Corynoneura	0	0	0	0	0	0
Cricotopus (Nostococladius)	0	0	0	220	220	220
Diplocladius cultriger	0	0	0	0	0	0
Eukiefferiella	14	17	0	200	0	60
Heleniella	0	0	0	0	0	0
Hydrobaenus	0	17	120	80	20	120
Krenosmittia	0	0	0	0	0	0
Limnophyes	0	0	0	0	0	0
Orthocladius complex	14	0	0	1,140	360	660
Orthocladius lignicola	0	0	0	0	0	0
Parakiefferiella	0	0	0	0	0	0
Parametriocnemus	0	0	0	0	0	0
Paraphaenocladius	0	0	0	0	0	0
Parorthocladius	0	0	0	0	0	20
Rheocricotopus	171	183	480	20	20	40
Rheosmittia	0	0	0	0	0	0
Thienemanniella	0	0	0	0	0	0
Tvetenia	43	50	80	60	40	180
| Subfamily: Tanypodinae	0	0	0	0	0	0
Zavrelimyia	0	0	0	0	0	0
| Tribe: Macropelopiini	0	0	0	0	0	0
Macropelopia	0	0	0	0	0	0
| Tribe: Pentaneurini	0	0	0	0	0	0
Thienemannimyia group	0	0	0	0	0	0
| Tribe: Procladiini	0	0	0	0	0	0
Procladius	0	0	0	0	0	0
| Family: Dolichopodidae	0	0	0	0	0	0
| Family: Empididae	14	0	0	0	0	0
Chelifera/ Metachela	0	0	0	80	40	100
Clinocera	0	0	0	0	0	0
Hemerodromia	0	0	0	0	0	0
Neoplasta	0	17	20	40	60	0
Oreogeton	0	0	0	0	0	0
Roederiodes	0	0	0	0	0	0
Trichoclinocera	0	0	0	0	0	0
| Family: Muscidae	0	0	0	0	0	0
Limnophora	14	0	0	0	0	0
| Family: Oreoleptidae	0	0	0	0	0	0
Oreoleptis	0	0	0	0	0	0
| Family: Pelecorhynchidae	0	0	0	0	0	0
Glutops	0	0	0	0	0	20
| Family: Psychodidae	0	0	0	0	0	0
Pericoma/Telmatoscopus	29	17	60	1,280	740	1,780
| Family: Sciaridae	0	0	0	0	0	0
| Family: Simuliidae	0	0	0	0	0	0
Helodon	0	0	0	0	0	0
Prosimulium	0	0	0	0	0	0
Prosimulium/Helodon	0	0	0	0	0	0
Simulium	0	0	0	0	0	0
Twinnia	0	0	0	0	0	0
| Family: Stratiomyidae	0	0	0	0	0	0
Nemotelus	0	0	0	0	0	0
| Family: Tipulidae	0	0	0	0	0	0
Antocha	0	0	0	0	0	0
Dicranota	0	0	0	20	20	0
Erioptera	0	0	0	0	0	0
Hesperoconopa	0	0	0	0	0	0
Hexatoma	0	0	0	20	0	0
Limnophila	0	0	0	0	20	0
Rhabdomastix	0	0	0	0	0	0
Tipula	0	0	0	0	0	0
| Order: Hemiptera	0	0	0	0	20	0
| Order: Megaloptera	0	0	0	0	0	0
| Family: Sialidae	0	0	0	0	0	0
Sialis	0	0	0	0	0	0
| Order: Thysanoptera	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0
| Order: Trombidiformes	0	0	0	0	20	20
Albaxona	0	0	0	0	0	0
| Family: Aturidae	0	0	0	0	0	0
Aturus	0	0	0	0	0	0
| Family: Feltriidae	0	0	0	0	0	0
Feltria	0	0	0	80	0	160
| Family: Hydryphantidae	0	0	0	0	0	0
Wandesia	0	0	0	0	0	0
| Family: Hygrobatidae	0	0	0	0	0	0
Hygrobates	0	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0
Lebertia	14	0	0	560	200	420
| Family: Sperchontidae	0	0	0	0	0	0
Sperchon	0	50	20	200	160	220
| Family: Torrenticolidae	0	0	0	0	0	0
Testudacarus	0	0	0	0	0	0

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September					
	RG_HENUP1	RG_HENUP2	RG_HENUP3	RG_FO26-1	RG_FO26-2	RG_FO26-3
Suborder: Prostigmata	0	0	0	0	0	0
| Family: Stygothrombidiidae	0	0	0	0	0	0
Stygothrombium	0	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0
| Order: Oribatida	0	0	0	0	0	0
| Family: Hydrozetidae	0	0	0	0	0	0
Phylum: Mollusca	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	0	0	0
Pisidium	0	0	0	0	0	0
| Class: Gastropoda	0	0	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0
Enchytraeus	0	0	0	0	0	0
| Family: Naididae	0	0	0	0	0	0
Chaetogaster	0	0	0	0	0	0
Nais	0	0	0	0	0	0
Pristina	0	0	0	0	0	0
| Subfamily: Tubificinae with hair chaetae	0	0	0	0	0	0
| Subfamily: Tubificinae without hair chaetae	0	0	0	20	0	0
Totals:	**5,111**	**7,271**	**12,860**	**24,560**	**21,940**	**23,600**

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September					
	RG_FODHE1	RG_FODHE2	RG_FODHE3	RG_FOUNGD1	RG_FOUNGD2	RG_FOUNGD3
Phylum: Arthropoda	0	0	0	0	0	0
| Order: Collembola	0	0	0	0	0	0
| Family: Sminthuridae	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0
Ameletus	60	40	400	0	60	0
| Family: Baetidae	20	60	20	20	120	220
Acentrella	0	0	0	0	0	0
Baetis	100	40	280	80	40	60
Baetis fuscatus gr.	0	0	0	0	0	0
Baetis rhodani group	320	0	220	380	180	580
Baetis bicaudatus	0	240	0	0	0	0
| Family: Ephemerellidae	1,240	880	3,420	3,460	6,020	5,640
Caudatella	0	20	0	20	0	0
Drunella	0	0	0	0	0	0
Drunella grandis group	0	0	0	0	0	0
Drunella coloradensis	0	20	20	0	0	0
Drunella doddsii	760	1,020	800	280	280	180
Drunella grandis	0	0	0	0	0	0
Drunella spinifera	0	0	0	40	20	0
Serratella	0	40	40	0	20	20
| Family: Heptageniidae	5,700	8,120	9,160	7,480	6,260	7,620
Cinygmula	0	0	0	0	0	0
Epeorus	180	340	140	60	20	60
Rhithrogena	140	320	20	0	20	60
| Order: Plecoptera	0	0	0	0	0	0
| Family: Capniidae	0	0	0	0	0	40
| Family: Chloroperlidae	0	20	0	0	0	60
Haploperla	0	60	0	0	0	0
Neaviperla	0	0	0	0	0	0
Paraperla	0	0	0	0	0	0
Suwallia	0	0	0	0	0	0
Sweltsa	0	20	0	120	100	200
| Family: Leuctridae	0	0	0	20	0	0
Paraleuctra	40	0	0	0	0	0
| Family: Nemouridae	0	0	0	80	20	300
Malenka	0	0	0	0	0	0
Prostoia	0	0	0	0	0	0
Visoka cataractae	0	0	0	0	0	0
Zapada	340	640	320	340	260	720
Zapada oregonensis group	120	40	40	320	220	360
Zapada cinctipes	80	80	40	580	220	1,020
Zapada columbiana	20	60	0	40	60	40
| Family: Peltoperlidae	0	0	0	0	0	0
Yoraperla	0	0	0	0	0	20
| Family: Perlidae	0	0	0	0	20	0
Hesperoperla	0	0	0	0	0	0
| Family: Perlodidae	0	80	60	0	40	0
Diura	0	0	0	0	0	0
Isoperla	0	40	0	0	0	40
Kogotus	160	80	120	680	560	700
Megarcys	60	280	40	440	280	360
Rickera sorpta	0	0	0	0	0	0
Skwala	0	0	0	0	0	0
| Family: Taeniopterygidae	240	460	0	280	260	1,180
| Order: Trichoptera	100	80	80	20	20	0
| Family: Apataniidae	0	0	0	0	0	0
Apatania	20	0	20	0	20	0
Pedomoecus sierra	0	0	0	0	0	0
| Family: Brachycentridae	0	0	0	0	0	0
Brachycentrus	0	0	0	0	0	20
Brachycentrus americanus	0	0	0	0	0	0
Micrasema	0	0	0	0	0	0
| Family: Glossosomatidae	0	0	0	0	0	0
Glossosoma	0	0	0	0	80	0
| Family: Hydropsychidae	60	180	0	0	20	0
Arctopsyche	0	0	0	0	0	0
Hydropsyche	0	0	0	0	0	0
Parapsyche	40	20	0	0	40	80
Parapsyche elsis	0	0	0	0	20	0
| Family: Hydroptilidae	0	0	0	0	0	0
Hydroptila	0	0	0	0	0	0
| Family: Lepidostomatidae	0	0	0	0	0	0
Lepidostoma	60	0	0	0	0	0
| Family: Limnephilidae	0	0	0	60	0	0
Dicosmoecus	0	0	0	0	0	0
Ecclisomyia	0	0	0	0	0	0
| Family: Rhyacophilidae	0	0	0	0	0	0
Rhyacophila	80	0	0	520	760	1,280
Rhyacophila angelita group	0	0	0	0	0	0
Rhyacophila betteni group	20	0	0	0	0	20
Rhyacophila brunnea/vemna group	20	0	0	120	120	80
Rhyacophila hyalinata group	20	60	0	0	0	20
Rhyacophila vobara subgroup	0	0	20	0	0	0
Rhyacophila vofixa group	0	0	0	0	0	20
Rhyacophila alberta group	0	0	0	0	0	0
Rhyacophila atrata complex	0	0	0	20	40	20
Rhyacophila narvae	0	0	0	80	40	40
Rhyacophila verrula group	0	0	0	0	0	0
| Family: Thremmatidae	0	0	0	0	0	0
Oligophlebodes	0	0	0	80	140	80
| Order: Coleoptera	0	0	0	0	0	0
| Family: Dytiscidae	0	0	0	0	0	0
Liodessus	0	0	0	0	0	0
Oreodytes	0	0	0	0	0	0
Sanfilippodytes	0	0	0	0	0	0
Stictotarsus	0	0	0	0	0	0
| Subfamily: Hydroporinae	0	0	0	0	0	0
| Family: Elmidae	0	0	0	0	0	0
Heterlimnius	0	0	0	0	0	0

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September					
	RG_FODHE1	RG_FODHE2	RG_FODHE3	RG_FOUNGD1	RG_FOUNGD2	RG_FOUNGD3
| Order: Diptera	0	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0
Bezzia/ Palpomyia	0	0	0	0	0	0
Mallochohelea	40	120	80	380	480	340
| Family: Chironomidae	320	500	320	40	80	60
| Subfamily: Chironominae	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0
Paracladopelma	0	0	0	0	0	0
Phaenopsectra	0	0	0	0	0	0
Polypedilum	0	0	0	0	0	0
| Tribe: Tanytarsini	120	0	120	140	0	80
Micropsectra	120	200	220	40	40	0
Stempellina	0	0	0	0	20	20
Stempellinella	20	0	0	0	0	0
Sublettea	0	0	0	0	0	0
Tanytarsus	0	0	0	0	0	0
| Subfamily: Diamesinae	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0
Diamesa	80	60	20	40	0	20
Pagastia	80	20	80	480	340	80
Potthastia gaedii group	0	0	0	0	0	0
Pseudodiamesa	0	0	0	0	0	0
| Subfamily: Orthocladiinae	0	0	0	0	0	0
Brillia	0	0	0	0	0	0
Corynoneura	0	0	0	0	0	20
Cricotopus (Nostococladius)	0	0	0	0	0	0
Diplocladius cultriger	0	0	0	0	0	0
Eukiefferiella	60	180	0	300	180	40
Heleniella	0	0	0	0	0	0
Hydrobaenus	20	60	100	0	0	0
Krenosmittia	0	0	0	0	0	0
Limnophyes	0	0	0	0	0	0
Orthocladius complex	580	200	460	980	580	240
Orthocladius lignicola	0	0	0	0	0	0
Parakiefferiella	0	0	0	0	0	0
Parametriocnemus	0	0	0	0	0	0
Paraphaenocladius	0	0	0	0	0	0
Parorthocladius	0	0	0	0	0	0
Rheocricotopus	20	0	0	0	0	0
Rheosmittia	0	0	0	0	0	0
Thienemanniella	0	0	0	20	0	0
Tvetenia	120	140	80	0	0	0
| Subfamily: Tanypodinae	0	0	0	0	0	0
Zavrelimyia	0	0	0	0	0	0
| Tribe: Macropelopiini	0	0	0	0	0	0
Macropelopia	0	0	0	0	0	0
| Tribe: Pentaneurini	0	0	0	0	0	0
Thienemannimyia group	0	0	0	20	0	0
| Tribe: Procladiini	0	0	0	0	0	0
Procladius	0	0	0	0	0	0
| Family: Dolichopodidae	0	0	0	0	0	0
| Family: Empididae	20	0	0	0	0	20
Chelifera/ Metachela	20	0	20	60	20	20
Clinocera	0	0	0	0	0	0
Hemerodromia	0	0	0	0	0	0
Neoplasta	0	0	0	20	0	0
Oreogeton	0	0	0	0	0	0
Roederiodes	0	0	0	0	0	0
Trichoclinocera	0	0	0	0	0	0
| Family: Muscidae	0	0	0	0	0	0
Limnophora	0	0	0	0	0	20
| Family: Oreoleptidae	0	0	0	0	0	0
Oreoleptis	0	0	0	0	0	0
| Family: Pelecorhynchidae	0	0	0	0	0	0
Glutops	0	0	0	0	0	0
| Family: Psychodidae	0	0	0	0	0	0
Pericoma/Telmatoscopus	900	520	1,000	3,000	3,340	1,320
| Family: Sciaridae	0	0	0	0	0	0
| Family: Simuliidae	0	920	0	40	0	0
Helodon	0	0	0	0	0	0
Prosimulium	0	0	0	0	0	0
Prosimulium/Helodon	0	0	0	0	0	0
Simulium	60	1,080	0	560	40	0
Twinnia	0	0	0	0	0	0
| Family: Stratiomyidae	0	0	0	0	0	0
Nemotelus	0	0	0	0	0	0
| Family: Tipulidae	0	0	0	0	0	0
Antocha	0	0	0	20	20	0
Dicranota	0	0	0	20	80	60
Erioptera	0	0	0	0	0	0
Hesperoconopa	0	0	0	0	0	0
Hexatoma	0	0	0	0	0	0
Limnophila	0	0	0	0	0	0
Rhabdomastix	0	0	0	0	0	0
Tipula	0	0	0	0	0	0
| Order: Hemiptera	0	0	0	0	0	0
| Order: Megaloptera	0	0	0	0	0	0
| Family: Sialidae	0	0	0	0	0	0
Sialis	0	0	0	0	0	0
| Order: Thysanoptera	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0
| Order: Trombidiformes	20	0	0	0	0	0
Albaxona	0	0	0	0	0	0
| Family: Aturidae	0	0	0	0	0	0
Aturus	0	40	0	0	20	0
| Family: Feltriidae	0	0	0	0	0	0
Feltria	0	0	0	40	0	80
| Family: Hydryphantidae	0	0	0	0	0	0
Wandesia	0	0	0	0	0	0
| Family: Hygrobatidae	0	0	0	0	0	0
Hygrobates	0	0	40	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0
Lebertia	120	0	120	420	360	100
| Family: Sperchontidae	0	0	0	0	0	0
Sperchon	60	0	40	260	220	120
| Family: Torrenticolidae	0	0	0	0	0	0
Testudacarus	0	0	0	0	0	0

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September					
	RG_FODHE1	RG_FODHE2	RG_FODHE3	RG_FOUNGD1	RG_FOUNGD2	RG_FOUNGD3
Suborder: Prostigmata	0	0	0	0	0	0
| Family: Stygothrombidiidae	0	0	0	0	0	0
Stygothrombium	0	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0
| Order: Oribatida	0	0	0	0	0	0
| Family: Hydrozetidae	0	0	0	0	0	0
Phylum: Mollusca	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	0	0	0
Pisidium	20	0	0	0	0	0
| Class: Gastropoda	0	0	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0
Enchytraeus	0	0	0	180	0	20
| Family: Naididae	0	0	0	0	0	0
Chaetogaster	0	0	0	0	0	0
Nais	0	0	0	0	0	0
Pristina	0	0	0	0	0	0
| Subfamily: Tubificinae with hair chaetae	0	0	0	0	0	0
| Subfamily: Tubificinae without hair chaetae	0	0	0	0	0	0
Totals:	**12,800**	**17,380**	**17,960**	**22,680**	**22,200**	**23,800**

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September					
	RG_FODNGD1	RG_FODNGD2	RG_FODNGD3	RG_MP1-1	RG_MP1-2	RG_MP1-3
Phylum: Arthropoda	0	0	0	0	0	0
| Order: Collembola	0	0	0	0	0	0
| Family: Sminthuridae	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0
Ameletus	60	0	20	20	80	0
| Family: Baetidae	260	200	60	200	300	380
Acentrella	0	0	0	0	0	0
Baetis	60	40	60	180	80	120
Baetis fuscatus gr.	0	0	0	0	0	0
Baetis rhodani group	580	480	500	940	860	2,020
Baetis bicaudatus	0	0	0	0	0	0
| Family: Ephemerellidae	1,380	1,940	2,720	1,800	1,580	560
Caudatella	0	0	0	0	0	0
Drunella	0	0	0	0	0	20
Drunella grandis group	0	0	0	0	0	0
Drunella coloradensis	0	0	0	0	0	0
Drunella doddsii	180	60	120	100	0	40
Drunella grandis	0	0	0	0	0	0
Drunella spinifera	0	0	0	0	0	40
Serratella	20	20	20	20	0	0
| Family: Heptageniidae	4,940	3,900	4,500	4,160	3,120	2,160
Cinygmula	0	0	20	0	0	0
Epeorus	100	40	100	20	40	100
Rhithrogena	0	0	0	20	0	0
| Order: Plecoptera	0	0	0	0	0	0
| Family: Capniidae	0	0	0	0	0	0
| Family: Chloroperlidae	0	0	0	0	0	0
Haploperla	0	0	0	0	0	0
Neaviperla	0	0	0	0	0	0
Paraperla	0	0	0	0	0	0
Suwallia	0	0	0	0	0	0
Sweltsa	100	60	120	40	0	20
| Family: Leuctridae	0	0	0	0	0	0
Paraleuctra	0	0	0	0	20	0
| Family: Nemouridae	60	80	60	60	120	80
Malenka	0	0	0	0	0	0
Prostoia	0	0	0	0	0	0
Visoka cataractae	0	0	0	0	0	0
Zapada	220	300	40	120	180	140
Zapada oregonensis group	220	100	80	160	20	100
Zapada cinctipes	880	420	220	260	620	420
Zapada columbiana	20	60	20	0	60	60
| Family: Peltoperlidae	0	0	0	0	0	0
Yoraperla	0	0	0	0	0	0
| Family: Perlidae	0	0	0	60	40	0
Hesperoperla	0	0	0	0	0	20
| Family: Perlodidae	40	0	20	40	20	20
Diura	0	0	0	0	0	0
Isoperla	60	0	20	20	80	0
Kogotus	100	60	280	460	340	340
Megarcys	320	220	240	140	160	60
Rickera sorpta	0	0	0	0	0	0
Skwala	0	0	0	0	0	0
| Family: Taeniopterygidae	480	120	140	200	100	20
| Order: Trichoptera	60	0	80	80	60	20
| Family: Apataniidae	0	0	0	0	0	0
Apatania	0	0	60	20	0	0
Pedomoecus sierra	0	0	0	0	0	0
| Family: Brachycentridae	0	0	0	0	0	0
Brachycentrus	40	0	20	80	20	0
Brachycentrus americanus	0	0	0	0	0	0
Micrasema	0	0	0	0	0	0
| Family: Glossosomatidae	0	20	0	0	0	0
Glossosoma	0	20	100	0	0	0
| Family: Hydropsychidae	0	0	0	20	20	0
Arctopsyche	0	0	0	0	0	0
Hydropsyche	0	0	0	0	0	20
Parapsyche	40	0	20	0	20	20
Parapsyche elsis	0	0	0	0	20	0
| Family: Hydroptilidae	0	0	0	0	0	0
Hydroptila	0	0	20	0	0	0
| Family: Lepidostomatidae	0	0	0	0	0	0
Lepidostoma	0	0	0	0	0	0
| Family: Limnephilidae	20	0	20	0	0	0
Dicosmoecus	0	0	0	0	0	0
Ecclisomyia	0	0	0	0	0	0
| Family: Rhyacophilidae	0	0	0	0	0	0
Rhyacophila	700	680	860	120	200	300
Rhyacophila angelita group	0	0	0	0	0	0
Rhyacophila betteni group	0	20	20	0	20	40
Rhyacophila brunnea/vemna group	120	100	20	40	140	40
Rhyacophila hyalinata group	20	0	0	60	60	20
Rhyacophila vobara subgroup	0	0	0	0	0	0
Rhyacophila vofixa group	0	20	0	0	0	0
Rhyacophila alberta group	0	0	0	0	0	0
Rhyacophila atrata complex	0	40	180	40	20	0
Rhyacophila narvae	0	0	20	0	20	0
Rhyacophila verrula group	0	0	0	0	0	0
| Family: Thremmatidae	0	0	0	0	0	0
Oligophlebodes	20	0	260	180	320	0
| Order: Coleoptera	0	0	0	0	0	0
| Family: Dytiscidae	0	0	0	0	0	0
Liodessus	0	0	0	0	0	0
Oreodytes	0	0	0	0	0	0
Sanfilippodytes	0	0	0	0	0	0
Stictotarsus	0	0	0	0	0	0
| Subfamily: Hydroporinae	0	0	0	0	0	0
| Family: Elmidae	0	0	0	0	0	0
Heterlimnius	0	0	0	0	0	20

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September					
	RG_FODNGD1	RG_FODNGD2	RG_FODNGD3	RG_MP1-1	RG_MP1-2	RG_MP1-3
| Order: Diptera	0	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0
Bezzia/ Palpomyia	0	0	0	0	0	0
Mallochohelea	60	20	80	40	0	40
| Family: Chironomidae	120	100	20	60	80	160
| Subfamily: Chironominae	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0
Paracladopelma	0	0	0	0	0	0
Phaenopsectra	0	0	0	0	0	0
Polypedilum	0	0	0	0	0	0
| Tribe: Tanytarsini	0	60	80	0	0	0
Micropsectra	60	0	0	20	60	80
Stempellina	0	0	0	0	0	0
Stempellinella	0	0	0	0	0	0
Sublettea	0	0	0	0	0	0
Tanytarsus	0	0	0	0	0	0
| Subfamily: Diamesinae	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0
Diamesa	0	0	0	0	20	0
Pagastia	220	260	180	180	340	200
Potthastia gaedii group	0	0	0	0	0	0
Pseudodiamesa	0	0	0	0	0	0
| Subfamily: Orthocladiinae	0	0	0	0	0	0
Brillia	0	0	0	0	0	0
Corynoneura	0	0	0	0	0	0
Cricotopus (Nostococladius)	0	0	0	0	0	0
Diplocladius cultriger	0	0	0	0	20	0
Eukiefferiella	60	200	140	40	100	200
Heleniella	0	0	0	0	0	0
Hydrobaenus	0	0	0	0	0	0
Krenosmittia	0	0	0	0	0	0
Limnophyes	0	0	0	0	0	0
Orthocladius complex	120	460	40	1,100	1,080	520
Orthocladius lignicola	0	0	0	0	0	0
Parakiefferiella	0	0	0	0	0	0
Parametriocnemus	0	0	0	0	0	0
Paraphaenocladius	0	0	0	0	0	0
Parorthocladius	0	0	0	0	0	0
Rheocricotopus	20	0	0	0	0	0
Rheosmittia	0	0	0	0	0	0
Thienemanniella	20	0	0	0	0	0
Tvetenia	80	20	40	60	60	40
| Subfamily: Tanypodinae	0	0	0	0	0	0
Zavrelimyia	0	0	0	0	0	0
| Tribe: Macropelopiini	0	0	0	0	0	0
Macropelopia	0	0	0	0	0	0
| Tribe: Pentaneurini	0	0	0	0	0	0
Thienemannimyia group	20	20	20	0	0	0
| Tribe: Procladiini	0	0	0	0	0	0
Procladius	0	0	0	0	0	0
| Family: Dolichopodidae	0	0	0	0	0	0
| Family: Empididae	0	40	0	0	20	0
Chelifera/ Metachela	20	0	20	0	0	0
Clinocera	0	0	0	0	20	0
Hemerodromia	0	0	0	0	0	0
Neoplasta	20	0	40	0	0	0
Oreogeton	0	0	0	0	0	0
Roederiodes	0	0	0	0	60	0
Trichoclinocera	0	0	0	0	0	0
| Family: Muscidae	0	0	0	0	0	0
Limnophora	0	0	0	0	0	0
| Family: Oreoleptidae	0	0	0	0	0	0
Oreoleptis	0	0	0	0	0	0
| Family: Pelecorhynchidae	0	0	0	0	0	0
Glutops	0	0	0	0	0	0
| Family: Psychodidae	0	0	0	0	0	0
Pericoma/Telmatoscopus	1,860	1,060	2,100	1,040	1,480	1,600
| Family: Sciaridae	0	0	0	0	0	0
| Family: Simuliidae	20	0	0	0	0	40
Helodon	0	0	0	0	0	0
Prosimulium	0	0	0	0	0	0
Prosimulium/Helodon	0	0	0	0	0	0
Simulium	20	20	0	40	180	60
Twinnia	0	0	0	0	0	0
| Family: Stratiomyidae	0	0	0	0	0	0
Nemotelus	0	0	0	0	0	0
| Family: Tipulidae	0	0	0	20	0	0
Antocha	60	20	0	40	20	20
Dicranota	20	20	40	20	20	0
Erioptera	0	0	0	0	0	0
Hesperoconopa	0	0	0	0	0	20
Hexatoma	40	0	0	20	0	0
Limnophila	0	0	0	0	0	0
Rhabdomastix	0	0	0	0	0	0
Tipula	0	0	0	0	0	0
| Order: Hemiptera	0	0	0	0	0	0
| Order: Megaloptera	0	0	0	0	0	0
| Family: Sialidae	0	0	0	0	0	0
Sialis	0	0	0	0	0	0
| Order: Thysanoptera	0	0	0	0	0	20
Subphylum: Chelicerata	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0
| Order: Trombidiformes	0	0	20	0	0	0
Albaxona	0	20	0	0	0	0
| Family: Aturidae	0	0	0	0	0	0
Aturus	0	0	0	0	0	0
| Family: Feltriidae	0	0	0	0	0	0
Feltria	60	40	60	20	20	0
| Family: Hydryphantidae	0	0	0	0	0	0
Wandesia	0	0	0	0	0	0
| Family: Hygrobatidae	0	0	0	0	0	0
Hygrobates	0	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0
Lebertia	140	300	360	440	420	40
| Family: Sperchontidae	0	0	0	0	0	0
Sperchon	140	180	160	100	80	40
| Family: Torrenticolidae	0	0	0	0	0	0
Testudacarus	0	20	0	0	0	0

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September					
	RG_FODNGD1	RG_FODNGD2	RG_FODNGD3	RG_MP1-1	RG_MP1-2	RG_MP1-3
Suborder: Prostigmata	0	0	0	0	0	0
| Family: Stygothrombidiidae	0	0	0	0	0	0
Stygothrombium	0	0	0	0	20	0
| Order: Sarcoptiformes	0	0	0	0	0	0
| Order: Oribatida	0	0	0	0	0	0
| Family: Hydrozetidae	0	0	0	0	0	0
Phylum: Mollusca	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	0	0	0
Pisidium	0	0	0	0	0	0
| Class: Gastropoda	0	0	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0
Enchytraeus	0	0	0	0	0	60
| Family: Naididae	0	0	0	0	0	0
Chaetogaster	0	0	0	0	0	0
Nais	0	0	0	0	0	0
Pristina	0	0	0	0	0	0
| Subfamily: Tubificinae with hair chaetae	0	0	0	0	0	0
| Subfamily: Tubificinae without hair chaetae	0	0	0	0	0	0
Totals:	**14,280**	**11,860**	**14,440**	**12,900**	**12,840**	**10,340**

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September					
	RG_FOUSH1	RG_FOUSH2	RG_FOUSH3	RG_FOUKI1	RG_FOUKI2	RG_FOUKI3
Phylum: Arthropoda	0	0	0	0	0	0
| Order: Collembola	0	0	0	0	0	0
| Family: Sminthuridae	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0
Ameletus	80	40	20	67	100	43
| Family: Baetidae	80	120	90	0	120	0
Acentrella	0	0	0	0	0	0
Baetis	160	60	20	133	210	229
Baetis fuscatus gr.	20	0	0	0	0	0
Baetis rhodani group	460	460	310	300	370	214
Baetis bicaudatus	0	0	0	0	0	0
| Family: Ephemerellidae	400	400	350	183	120	214
Caudatella	0	0	0	0	0	0
Drunella	0	0	0	0	0	0
Drunella grandis group	0	0	0	0	0	0
Drunella coloradensis	0	0	0	0	0	0
Drunella doddsii	40	20	20	167	40	57
Drunella grandis	0	0	0	0	0	0
Drunella spinifera	0	20	20	0	0	14
Serratella	20	20	0	17	30	0
| Family: Heptageniidae	2,800	2,940	1,880	2,300	1,370	1,343
Cinygmula	0	20	0	0	0	0
Epeorus	120	100	90	67	120	171
Rhithrogena	0	40	0	33	10	14
| Order: Plecoptera	0	0	770	17	10	0
| Family: Capniidae	20	0	20	50	0	29
| Family: Chloroperlidae	0	0	0	0	0	0
Haploperla	0	0	0	0	0	0
Neaviperla	0	0	0	0	0	0
Paraperla	0	0	0	0	0	0
Suwallia	0	0	0	0	0	0
Sweltsa	20	20	10	0	0	0
| Family: Leuctridae	0	0	0	0	0	0
Paraleuctra	0	0	0	0	0	0
| Family: Nemouridae	0	60	10	0	0	0
Malenka	0	0	0	0	0	0
Prostoia	0	0	0	0	0	0
Visoka cataractae	0	0	0	0	0	0
Zapada	380	100	110	83	90	100
Zapada oregonensis group	20	60	70	17	0	0
Zapada cinctipes	680	940	250	83	80	43
Zapada columbiana	20	40	70	0	0	0
| Family: Peltoperlidae	0	0	0	0	0	0
Yoraperla	0	0	0	0	0	0
| Family: Perlidae	40	100	20	0	0	0
Hesperoperla	0	20	0	0	0	0
| Family: Perlodidae	40	40	10	0	0	29
Diura	0	0	0	0	0	0
Isoperla	120	60	40	17	30	0
Kogotus	60	100	40	17	10	29
Megarcys	80	100	60	17	40	129
Rickera sorpta	0	0	0	0	0	0
Skwala	0	0	0	0	0	0
| Family: Taeniopterygidae	140	20	90	67	10	0
| Order: Trichoptera	20	0	0	0	0	0
| Family: Apataniidae	0	0	0	0	0	0
Apatania	0	0	0	0	0	0
Pedomoecus sierra	0	0	0	0	0	0
| Family: Brachycentridae	0	0	0	0	0	0
Brachycentrus	0	80	20	0	0	14
Brachycentrus americanus	0	0	0	0	0	0
Micrasema	0	0	0	0	0	0
| Family: Glossosomatidae	0	0	0	0	0	0
Glossosoma	0	0	0	0	10	14
| Family: Hydropsychidae	20	40	0	17	10	0
Arctopsyche	20	20	0	0	0	43
Hydropsyche	0	0	0	0	0	0
Parapsyche	80	60	40	17	0	14
Parapsyche elsis	0	20	10	0	10	0
| Family: Hydroptilidae	0	0	0	0	0	0
Hydroptila	0	0	0	0	10	0
| Family: Lepidostomatidae	0	0	0	0	0	0
Lepidostoma	0	0	0	0	0	0
| Family: Limnephilidae	0	0	0	0	0	0
Dicosmoecus	0	0	0	0	0	0
Ecclisomyia	0	0	0	0	0	0
| Family: Rhyacophilidae	0	0	0	0	0	0
Rhyacophila	80	140	50	50	0	0
Rhyacophila angelita group	0	0	0	0	0	0
Rhyacophila betteni group	0	20	0	0	0	0
Rhyacophila brunnea/vemna group	0	20	20	17	10	14
Rhyacophila hyalinata group	40	100	50	33	0	29
Rhyacophila vobara subgroup	0	0	0	0	0	0
Rhyacophila vofixa group	0	0	0	0	0	0
Rhyacophila alberta group	0	0	0	0	0	0
Rhyacophila atrata complex	0	0	0	0	0	0
Rhyacophila narvae	0	0	0	17	0	0
Rhyacophila verrula group	0	0	0	0	0	0
| Family: Thremmatidae	0	0	0	0	0	0
Oligophlebodes	0	40	10	0	0	0
| Order: Coleoptera	0	0	0	0	0	0
| Family: Dytiscidae	0	0	0	0	0	0
Liodessus	0	0	0	0	0	0
Oreodytes	0	0	0	0	0	0
Sanfilippodytes	0	0	0	0	0	0
Stictotarsus	0	0	0	0	0	0
| Subfamily: Hydroporinae	0	0	0	0	0	0
| Family: Elmidae	0	0	0	0	0	0
Heterlimnius	0	0	0	0	0	0

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September					
	RG_FOUSH1	RG_FOUSH2	RG_FOUSH3	RG_FOUKI1	RG_FOUKI2	RG_FOUKI3
| Order: Diptera	0	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0
Bezzia/ Palpomyia	0	0	0	0	0	0
Mallochohelea	0	80	40	17	70	114
| Family: Chironomidae	180	260	90	33	40	86
| Subfamily: Chironominae	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0
Paracladopelma	0	0	0	0	0	0
Phaenopsectra	0	0	0	0	0	14
Polypedilum	0	0	0	0	0	0
| Tribe: Tanytarsini	0	0	0	0	60	14
Micropsectra	80	60	0	67	50	29
Stempellina	0	0	10	0	0	0
Stempellinella	0	0	0	0	0	0
Sublettea	0	0	0	0	0	0
Tanytarsus	0	0	0	0	0	0
| Subfamily: Diamesinae	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0
Diamesa	40	20	10	0	10	0
Pagastia	100	100	70	0	20	14
Potthastia gaedii group	0	0	0	0	0	0
Pseudodiamesa	0	0	0	0	0	0
| Subfamily: Orthocladiinae	0	0	0	0	0	0
Brillia	0	0	0	0	0	0
Corynoneura	0	0	0	0	0	0
Cricotopus (Nostococladius)	0	0	0	0	0	0
Diplocladius cultriger	0	0	0	0	0	0
Eukiefferiella	80	240	110	17	30	29
Heleniella	0	0	0	0	0	0
Hydrobaenus	0	0	0	0	0	14
Krenosmittia	0	0	0	0	0	0
Limnophyes	0	0	0	0	0	0
Orthocladius complex	780	860	650	17	0	14
Orthocladius lignicola	20	0	0	0	0	0
Parakiefferiella	0	0	10	0	0	0
Parametriocnemus	0	0	0	0	0	0
Paraphaenocladius	0	0	0	0	0	0
Parorthocladius	0	0	0	0	0	0
Rheocricotopus	0	20	0	0	10	0
Rheosmittia	0	0	0	0	0	0
Thienemanniella	0	0	0	0	0	0
Tvetenia	240	480	140	33	80	43
| Subfamily: Tanypodinae	0	0	0	0	0	0
Zavrelimyia	0	0	0	0	0	0
| Tribe: Macropelopiini	0	0	0	0	0	0
Macropelopia	0	0	0	0	0	0
| Tribe: Pentaneurini	0	0	0	0	0	0
Thienemannimyia group	20	20	50	0	0	14
| Tribe: Procladiini	0	0	0	0	0	0
Procladius	0	0	0	0	0	0
| Family: Dolichopodidae	0	0	0	0	0	0
| Family: Empididae	0	0	0	0	0	14
Chelifera/ Metachela	0	0	0	0	0	0
Clinocera	0	0	0	0	0	0
Hemerodromia	0	0	0	0	0	0
Neoplasta	0	0	0	0	0	0
Oreogeton	0	0	0	0	0	0
Roederiodes	0	60	0	0	0	0
Trichoclinocera	0	0	0	0	0	0
| Family: Muscidae	0	0	0	0	0	0
Limnophora	0	0	0	0	0	0
| Family: Oreoleptidae	0	0	0	0	0	0
Oreoleptis	0	0	0	0	0	0
| Family: Pelecorhynchidae	0	0	0	0	0	0
Glutops	0	0	0	0	0	0
| Family: Psychodidae	0	0	0	0	0	0
Pericoma/Telmatoscopus	800	540	520	1,367	1,490	1,800
| Family: Sciaridae	0	0	0	0	0	0
| Family: Simuliidae	20	0	10	67	70	43
Helodon	0	0	0	0	0	0
Prosimulium	0	0	0	0	0	0
Prosimulium/Helodon	0	0	0	0	0	0
Simulium	100	80	330	67	80	14
Twinnia	0	0	0	0	0	0
| Family: Stratiomyidae	0	0	0	0	0	0
Nemotelus	0	0	0	0	0	0
| Family: Tipulidae	0	20	0	0	0	0
Antocha	0	20	0	0	0	0
Dicranota	0	0	0	0	0	0
Erioptera	0	0	0	0	0	0
Hesperoconopa	0	0	0	0	0	0
Hexatoma	0	20	0	0	10	14
Limnophila	0	0	0	0	0	0
Rhabdomastix	0	0	0	0	0	0
Tipula	0	0	0	0	0	0
| Order: Hemiptera	0	0	0	0	0	0
| Order: Megaloptera	0	0	0	0	0	0
| Family: Sialidae	0	0	0	0	0	0
Sialis	0	0	0	0	0	0
| Order: Thysanoptera	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0
| Order: Trombidiformes	0	0	0	0	0	0
Albaxona	0	0	0	0	0	0
| Family: Aturidae	0	0	0	0	0	0
Aturus	0	20	0	0	0	0
| Family: Feltriidae	0	0	0	0	0	0
Feltria	20	20	0	0	0	0
| Family: Hydryphantidae	0	0	0	0	0	0
Wandesia	0	0	0	0	0	0
| Family: Hygrobatidae	0	0	0	0	0	0
Hygrobates	0	0	0	0	10	0
| Family: Lebertiidae	0	0	0	0	0	0
Lebertia	40	160	20	33	40	100
| Family: Sperchontidae	0	0	0	0	0	0
Sperchon	20	20	10	0	0	0
| Family: Torrenticolidae	0	0	0	0	0	0
Testudacarus	0	20	0	0	0	0

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	**September**					
	RG_FOUSH1	**RG_FOUSH2**	**RG_FOUSH3**	**RG_FOUKI1**	**RG_FOUKI2**	**RG_FOUKI3**
Suborder: Prostigmata	0	0	0	0	0	0
| Family: Stygothrombidiidae	0	0	0	0	0	0
Stygothrombium	0	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0
| Order: Oribatida	0	0	0	0	0	0
| Family: Hydrozetidae	0	0	10	0	0	0
Phylum: Mollusca	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	0	0	0
Pisidium	0	0	0	0	0	0
| Class: Gastropoda	0	0	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0
Enchytraeus	20	0	30	0	0	0
| Family: Naididae	0	0	0	0	20	0
Chaetogaster	0	0	0	0	0	0
Nais	0	0	0	0	0	29
Pristina	0	0	0	0	0	0
| Subfamily: Tubificinae with hair chaetae	0	0	0	0	0	0
| Subfamily: Tubificinae without hair chaetae	0	0	0	0	0	0
Totals:	**8,620**	**9,560**	**6,680**	**5,504**	**4,900**	**5,185**

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September					
	RG_FOBKS1	RG_FOBKS2	RG_FOBKS3	RG_FOBSC1	RG_FOBSC2	RG_FOBSC3
Phylum: Arthropoda	0	0	0	0	0	0
| Order: Collembola	0	0	0	0	0	0
| Family: Sminthuridae	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0
Ameletus	40	117	60	0	20	30
| Family: Baetidae	100	0	120	0	30	20
Acentrella	0	0	0	0	0	0
Baetis	220	167	320	20	75	30
Baetis fuscatus gr.	0	0	120	0	5	0
Baetis rhodani group	520	217	640	120	105	90
Baetis bicaudatus	0	0	0	0	0	0
| Family: Ephemerellidae	680	150	600	180	120	160
Caudatella	0	0	0	0	0	0
Drunella	0	17	0	0	0	0
Drunella grandis group	0	0	0	0	0	0
Drunella coloradensis	0	0	0	0	0	0
Drunella doddsii	40	133	100	20	30	30
Drunella grandis	0	0	0	0	0	0
Drunella spinifera	20	117	0	0	35	30
Serratella	0	0	0	0	0	0
| Family: Heptageniidae	2,200	1,350	3,220	2,440	975	790
Cinygmula	0	0	0	0	0	0
Epeorus	20	50	100	0	45	10
Rhithrogena	60	50	60	80	0	30
| Order: Plecoptera	0	0	0	0	0	0
| Family: Capniidae	0	0	0	40	0	10
| Family: Chloroperlidae	0	0	0	0	0	0
Haploperla	0	0	0	0	0	0
Neaviperla	0	0	0	0	0	0
Paraperla	0	0	0	0	0	0
Suwallia	0	0	0	0	0	0
Sweltsa	0	0	20	0	10	0
| Family: Leuctridae	0	0	0	0	0	0
Paraleuctra	0	0	0	0	0	0
| Family: Nemouridae	0	0	0	0	0	10
Malenka	0	0	0	0	0	0
Prostoia	0	0	0	0	0	0
Visoka cataractae	0	0	0	0	0	0
Zapada	60	133	560	40	35	70
Zapada oregonensis group	0	50	60	60	20	10
Zapada cinctipes	140	67	260	60	25	60
Zapada columbiana	0	0	20	0	0	0
| Family: Peltoperlidae	0	0	0	0	0	0
Yoraperla	0	0	0	0	0	0
| Family: Perlidae	80	33	20	0	5	10
Hesperoperla	20	17	0	20	10	0
| Family: Perlodidae	0	0	20	60	10	40
Diura	0	0	0	0	0	0
Isoperla	40	33	80	0	5	40
Kogotus	60	33	140	180	110	60
Megarcys	60	233	120	60	25	70
Rickera sorpta	0	0	0	0	0	0
Skwala	0	0	0	0	0	0
| Family: Taeniopterygidae	220	67	200	180	35	0
| Order: Trichoptera	0	0	0	0	10	10
| Family: Apataniidae	0	0	0	0	0	0
Apatania	20	0	0	0	15	0
Pedomoecus sierra	0	0	0	0	0	0
| Family: Brachycentridae	0	0	0	0	0	0
Brachycentrus	0	0	60	20	0	0
Brachycentrus americanus	0	0	0	0	0	0
Micrasema	0	17	0	0	0	0
| Family: Glossosomatidae	0	0	40	0	0	0
Glossosoma	0	0	0	0	10	0
| Family: Hydropsychidae	0	33	20	20	0	0
Arctopsyche	0	0	200	60	5	10
Hydropsyche	0	0	0	0	0	0
Parapsyche	0	33	0	0	0	0
Parapsyche elsis	20	17	0	0	0	0
| Family: Hydroptilidae	0	0	0	0	0	0
Hydroptila	0	0	0	0	0	0
| Family: Lepidostomatidae	0	0	0	0	0	0
Lepidostoma	0	0	0	0	0	0
| Family: Limnephilidae	0	0	0	0	0	0
Dicosmoecus	0	0	0	0	0	0
Ecclisomyia	0	0	0	0	0	0
| Family: Rhyacophilidae	0	0	0	0	0	0
Rhyacophila	180	150	480	500	185	100
Rhyacophila angelita group	0	0	0	0	0	0
Rhyacophila betteni group	20	0	0	20	0	20
Rhyacophila brunnea/vemna group	0	0	60	40	25	10
Rhyacophila hyalinata group	60	17	0	0	5	20
Rhyacophila vobara subgroup	0	0	0	0	0	0
Rhyacophila vofixa group	0	0	0	0	0	0
Rhyacophila alberta group	0	0	0	0	0	0
Rhyacophila atrata complex	0	0	20	20	0	0
Rhyacophila narvae	0	0	0	0	0	0
Rhyacophila verrula group	0	0	0	0	0	0
| Family: Thremmatidae	0	0	0	0	0	0
Oligophlebodes	0	0	20	0	0	10
| Order: Coleoptera	0	0	0	0	0	0
| Family: Dytiscidae	0	0	0	0	0	0
Liodessus	0	0	0	0	0	0
Oreodytes	0	0	0	0	0	0
Sanfilippodytes	0	0	0	0	0	0
Stictotarsus	0	0	0	0	0	0
| Subfamily: Hydroporinae	0	0	0	0	0	0
| Family: Elmidae	0	0	0	0	0	0
Heterlimnius	0	0	40	0	5	0

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September					
	RG_FOBKS1	RG_FOBKS2	RG_FOBKS3	RG_FOBSC1	RG_FOBSC2	RG_FOBSC3
| Order: Diptera	0	0	0	0	640	0
| Family: Ceratopogonidae	0	0	0	0	0	0
Bezzia/ Palpomyia	0	0	0	0	0	0
Mallochohelea	20	183	380	160	45	70
| Family: Chironomidae	40	0	120	0	0	10
| Subfamily: Chironominae	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0
Paracladopelma	0	0	0	0	0	0
Phaenopsectra	0	0	0	0	0	0
Polypedilum	0	0	0	0	0	0
| Tribe: Tanytarsini	60	0	0	0	0	0
Micropsectra	60	0	100	0	10	30
Stempellina	0	0	0	0	0	0
Stempellinella	0	0	0	0	0	0
Sublettea	0	0	0	0	0	0
Tanytarsus	0	0	0	0	0	0
| Subfamily: Diamesinae	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0
Diamesa	0	17	0	0	0	0
Pagastia	80	17	240	0	40	50
Potthastia gaedii group	0	0	0	0	0	0
Pseudodiamesa	0	0	0	0	0	0
| Subfamily: Orthocladiinae	0	0	0	0	0	0
Brillia	0	0	0	0	0	0
Corynoneura	0	0	0	0	0	0
Cricotopus (Nostococladius)	0	0	0	0	0	0
Diplocladius cultriger	0	0	0	0	0	0
Eukiefferiella	0	0	20	0	0	0
Heleniella	0	0	0	0	0	0
Hydrobaenus	0	0	0	0	0	0
Krenosmittia	0	0	0	0	0	0
Limnophyes	0	0	0	0	0	0
Orthocladius complex	20	0	20	0	5	0
Orthocladius lignicola	0	0	0	0	0	0
Parakiefferiella	0	0	0	0	0	0
Parametriocnemus	0	0	0	0	0	0
Paraphaenocladius	0	0	0	0	0	0
Parorthocladius	0	0	0	0	0	0
Rheocricotopus	0	0	0	0	0	0
Rheosmittia	0	0	0	0	0	0
Thienemanniella	0	0	20	0	5	0
Tvetenia	0	17	160	0	0	0
| Subfamily: Tanypodinae	0	0	0	0	0	0
Zavrelimyia	0	0	0	0	0	0
| Tribe: Macropelopiini	0	0	0	0	0	0
Macropelopia	0	0	0	0	0	0
| Tribe: Pentaneurini	0	0	0	0	0	0
Thienemannimyia group	0	0	0	20	15	0
| Tribe: Procladiini	0	0	0	0	0	0
Procladius	0	0	0	0	0	0
| Family: Dolichopodidae	0	0	0	0	0	0
| Family: Empididae	0	0	0	0	0	10
Chelifera/ Metachela	0	33	20	0	0	10
Clinocera	0	0	0	0	0	0
Hemerodromia	0	0	0	0	0	0
Neoplasta	20	0	0	0	5	0
Oreogeton	0	0	0	0	0	0
Roederiodes	0	17	0	20	0	10
Trichoclinocera	0	0	0	0	0	0
| Family: Muscidae	0	0	0	0	0	0
Limnophora	0	0	0	0	0	0
| Family: Oreoleptidae	0	0	0	0	0	0
Oreoleptis	0	0	0	0	0	0
| Family: Pelecorhynchidae	0	0	0	0	0	0
Glutops	0	0	0	0	0	0
| Family: Psychodidae	0	0	0	0	0	0
Pericoma/Telmatoscopus	1,660	1,733	2,840	2,340	635	1,160
| Family: Sciaridae	0	0	0	0	0	0
| Family: Simuliidae	60	0	20	0	0	0
Helodon	0	0	0	0	0	0
Prosimulium	0	0	0	0	0	0
Prosimulium/Helodon	0	0	0	0	0	0
Simulium	840	117	480	20	15	0
Twinnia	0	0	0	0	0	0
| Family: Stratiomyidae	0	0	0	0	0	0
Nemotelus	0	0	0	0	0	0
| Family: Tipulidae	20	0	0	0	0	0
Antocha	0	0	0	0	5	0
Dicranota	20	0	20	0	0	0
Erioptera	0	0	0	0	0	0
Hesperoconopa	0	0	0	0	0	0
Hexatoma	20	0	0	0	0	0
Limnophila	0	0	0	0	0	0
Rhabdomastix	0	0	0	0	0	0
Tipula	0	0	0	0	0	0
| Order: Hemiptera	0	0	0	0	0	0
| Order: Megaloptera	0	0	0	0	0	0
| Family: Sialidae	0	0	0	0	0	0
Sialis	0	0	0	0	0	0
| Order: Thysanoptera	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0
| Order: Trombidiformes	0	0	0	0	5	0
Albaxona	0	0	0	0	0	0
| Family: Aturidae	0	0	0	0	0	0
Aturus	0	0	0	0	5	0
| Family: Feltriidae	0	0	0	0	0	0
Feltria	0	0	0	20	5	0
| Family: Hydryphantidae	0	0	0	0	0	0
Wandesia	0	0	0	0	0	0
| Family: Hygrobatidae	0	0	0	0	0	0
Hygrobates	0	0	0	0	5	0
| Family: Lebertiidae	0	0	0	0	0	0
Lebertia	60	133	220	160	175	180
| Family: Sperchontidae	0	0	0	0	0	0
Sperchon	40	33	0	0	35	20
| Family: Torrenticolidae	0	0	0	0	0	0
Testudacarus	0	0	0	20	0	0

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September					
	RG_FOBKS1	RG_FOBKS2	RG_FOBKS3	RG_FOBSC1	RG_FOBSC2	RG_FOBSC3
Suborder: Prostigmata	0	0	0	0	0	0
| Family: Stygothrombidiidae	0	0	0	0	0	0
Stygothrombium	0	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0
| Order: Oribatida	0	0	0	0	0	0
| Family: Hydrozetidae	0	0	0	0	0	0
Phylum: Mollusca	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	0	0	0
Pisidium	0	0	0	0	0	0
| Class: Gastropoda	0	0	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0
Enchytraeus	0	0	60	0	65	30
| Family: Naididae	0	0	0	0	0	0
Chaetogaster	0	0	0	0	0	0
Nais	0	0	20	20	0	0
Pristina	0	0	0	0	0	0
| Subfamily: Tubificinae with hair chaetae	0	17	0	0	0	0
| Subfamily: Tubificinae without hair chaetae	0	0	60	0	0	0
Totals:	**7,900**	**5,618**	**12,580**	**7,020**	**3,705**	**3,360**

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September							
	RG_FOBCP1	RG_FOBCP2	RG_FOBCP3	RG_FOBCP4	RG_FOBCP5	RG_FRUPO1	RG_FRUPO2	RG_FRUPO3
Phylum: Arthropoda	0	0	0	0	0	0	0	0
| Order: Collembola	0	0	0	0	0	0	0	0
| Family: Sminthuridae	0	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0	0
Ameletus	67	30	40	40	33	0	25	0
| Family: Baetidae	0	0	0	0	0	60	0	0
Acentrella	0	0	0	0	0	0	0	0
Baetis	0	0	0	0	0	40	13	20
Baetis fuscatus gr.	0	0	0	0	0	0	0	0
Baetis rhodani group	17	10	0	0	0	260	88	200
Baetis bicaudatus	0	0	0	0	0	0	0	0
| Family: Ephemerellidae	67	40	0	10	17	840	138	500
Caudatella	0	0	0	0	0	0	0	0
Drunella	0	0	0	0	0	0	0	0
Drunella grandis group	0	0	0	0	0	0	0	0
Drunella coloradensis	0	0	0	0	0	0	0	0
Drunella doddsii	83	25	20	10	33	120	13	0
Drunella grandis	0	0	0	0	0	0	0	0
Drunella spinifera	0	10	0	40	0	60	13	60
Serratella	0	0	0	0	0	0	0	0
| Family: Heptageniidae	2,633	685	2,240	1,390	1,367	1,160	388	680
Cinygmula	0	0	0	0	0	0	0	0
Epeorus	33	5	0	0	33	0	0	20
Rhithrogena	50	15	20	10	33	20	0	0
| Order: Plecoptera	0	0	0	0	0	0	0	0
| Family: Capniidae	0	15	0	30	100	100	113	120
| Family: Chloroperlidae	0	0	40	0	0	120	0	0
Haploperla	0	0	0	0	0	0	0	0
Neaviperla	0	0	0	0	0	0	0	0
Paraperla	0	0	0	0	0	0	0	0
Suwallia	0	0	0	0	0	0	0	0
Sweltsa	17	0	0	0	0	100	0	40
| Family: Leuctridae	0	0	0	0	0	0	0	0
Paraleuctra	0	0	0	0	0	20	0	0
| Family: Nemouridae	0	0	0	20	17	0	0	180
Malenka	0	0	0	0	0	0	0	0
Prostoia	0	0	0	0	0	0	0	0
Visoka cataractae	0	0	0	0	0	0	0	0
Zapada	533	95	160	100	600	1,880	500	1,460
Zapada oregonensis group	33	0	0	0	0	40	38	100
Zapada cinctipes	250	50	640	240	950	1,700	400	760
Zapada columbiana	0	0	0	0	0	0	0	0
| Family: Peltoperlidae	0	0	0	0	0	0	0	0
Yoraperla	0	0	0	0	0	0	0	0
| Family: Perlidae	83	25	80	10	33	0	25	0
Hesperoperla	33	0	0	0	0	0	0	0
| Family: Perlodidae	67	0	60	10	33	2,040	313	660
Diura	0	0	0	0	0	0	13	0
Isoperla	100	15	140	10	83	4,900	463	1,600
Kogotus	217	120	200	100	367	940	188	440
Megarcys	17	50	60	30	17	200	63	120
Rickera sorpta	0	0	0	0	0	0	0	0
Skwala	0	0	0	10	0	0	0	0
| Family: Taeniopterygidae	150	5	120	10	117	940	50	300
| Order: Trichoptera	17	20	20	10	17	340	0	20
| Family: Apataniidae	0	0	0	0	0	0	0	0
Apatania	0	5	0	10	33	120	13	120
Pedomoecus sierra	0	0	0	0	0	0	0	0
| Family: Brachycentridae	0	0	0	0	0	0	0	0
Brachycentrus	0	0	0	0	17	0	0	0
Brachycentrus americanus	0	0	0	0	0	0	0	0
Micrasema	0	5	0	0	0	0	0	40
| Family: Glossosomatidae	0	0	0	0	0	0	0	0
Glossosoma	0	0	0	0	0	20	38	0
| Family: Hydropsychidae	33	0	0	0	0	20	13	0
Arctopsyche	67	0	80	10	83	40	0	0
Hydropsyche	0	0	0	0	0	0	0	0
Parapsyche	33	0	20	10	0	0	0	0
Parapsyche elsis	0	0	0	0	0	0	0	0
| Family: Hydroptilidae	0	0	0	0	0	0	0	0
Hydroptila	0	0	0	0	0	0	0	0
| Family: Lepidostomatidae	0	0	0	0	0	0	0	0
Lepidostoma	0	0	0	0	0	0	0	0
| Family: Limnephilidae	0	0	0	0	0	20	25	0
Dicosmoecus	17	0	0	0	0	0	0	0
Ecclisomyia	0	0	0	0	0	20	0	0
| Family: Rhyacophilidae	0	0	0	0	0	0	0	0
Rhyacophila	133	10	120	30	67	60	0	100
Rhyacophila angelita group	0	0	0	0	0	0	0	0
Rhyacophila betteni group	17	20	0	0	0	0	0	0
Rhyacophila brunnea/vemna group	0	5	40	10	17	20	25	0
Rhyacophila hyalinata group	0	0	20	10	0	0	0	20
Rhyacophila vobara subgroup	0	0	0	0	0	0	0	0
Rhyacophila vofixa group	0	0	0	0	0	0	0	0
Rhyacophila alberta group	0	0	0	0	0	0	0	0
Rhyacophila atrata complex	0	0	40	0	17	20	13	120
Rhyacophila narvae	0	0	0	0	0	0	0	0
Rhyacophila verrula group	0	0	0	0	0	0	0	0
| Family: Thremmatidae	0	0	0	0	0	0	0	0
Oligophlebodes	0	0	0	0	0	0	0	20
| Order: Coleoptera	0	0	0	0	0	0	0	0
| Family: Dytiscidae	0	0	0	0	0	0	0	0
Liodessus	0	0	20	0	0	0	0	0
Oreodytes	0	5	0	0	0	0	0	0
Sanfilippodytes	0	0	0	0	0	0	0	0
Stictotarsus	0	0	0	0	0	0	0	0
| Subfamily: Hydroporinae	0	0	0	0	0	0	0	0
| Family: Elmidae	0	0	0	0	0	0	0	0
Heterlimnius	0	0	0	0	0	40	38	20

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September							
	RG_FOBCP1	RG_FOBCP2	RG_FOBCP3	RG_FOBCP4	RG_FOBCP5	RG_FRUPO1	RG_FRUPO2	RG_FRUPO3
| Order: Diptera	0	0	0	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0	0	0
Bezzia/ Palpomyia	0	0	0	0	0	0	0	0
Mallochohelea	17	5	20	40	50	120	0	160
| Family: Chironomidae	17	10	20	30	50	180	75	140
| Subfamily: Chironominae	0	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0	0
Paracladopelma	0	0	0	0	0	0	0	0
Phaenopsectra	0	0	0	0	0	0	0	0
Polypedilum	0	0	0	0	0	0	0	0
| Tribe: Tanytarsini	0	10	20	0	0	0	0	0
Micropsectra	33	5	0	10	33	20	13	0
Stempellina	0	0	0	0	0	0	0	0
Stempellinella	0	0	0	0	0	0	0	0
Sublettea	0	0	0	0	0	0	0	0
Tanytarsus	0	0	0	0	0	0	0	0
| Subfamily: Diamesinae	0	0	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0	0
Diamesa	0	0	0	0	0	0	0	0
Pagastia	67	15	60	60	83	100	125	160
Potthastia gaedii group	0	0	0	0	0	0	0	0
Pseudodiamesa	0	0	0	0	0	0	25	0
| Subfamily: Orthocladiinae	0	0	20	10	0	0	0	0
Brillia	0	0	0	0	0	0	0	0
Corynoneura	0	0	0	0	0	0	0	0
Cricotopus (Nostococladius)	0	0	0	0	0	0	0	0
Diplocladius cultriger	0	0	0	0	0	0	0	0
Eukiefferiella	17	0	0	0	17	60	38	20
Heleniella	0	0	0	0	0	0	0	0
Hydrobaenus	17	0	0	0	0	0	13	0
Krenosmittia	0	0	0	0	0	0	0	0
Limnophyes	0	0	0	0	0	0	13	0
Orthocladius complex	83	5	0	0	17	1,040	400	600
Orthocladius lignicola	0	0	0	0	0	0	0	0
Parakiefferiella	0	0	0	0	0	0	0	0
Parametriocnemus	0	0	0	0	0	0	0	0
Paraphaenocladius	0	0	0	0	0	0	0	0
Parorthocladius	0	0	0	0	0	0	0	0
Rheocricotopus	0	0	0	0	17	20	88	80
Rheosmittia	0	0	0	0	0	0	0	0
Thienemanniella	0	0	0	0	0	0	0	0
Tvetenia	17	0	40	10	50	200	25	60
| Subfamily: Tanypodinae	0	0	0	0	0	0	0	0
Zavrelimyia	0	0	0	0	0	0	0	0
| Tribe: Macropelopiini	0	0	0	0	0	0	0	0
Macropelopia	0	0	0	0	0	0	0	0
| Tribe: Pentaneurini	0	0	0	0	0	0	0	0
Thienemannimyia group	17	0	20	10	0	0	0	20
| Tribe: Procladiini	0	0	0	0	0	0	0	0
Procladius	0	0	0	0	0	0	0	0
| Family: Dolichopodidae	0	0	0	0	0	0	0	0
| Family: Empididae	0	5	0	0	0	0	25	40
Chelifera/ Metachela	0	0	0	10	0	0	13	60
Clinocera	0	0	0	0	0	0	0	20
Hemerodromia	0	0	0	0	0	0	0	0
Neoplasta	0	0	0	20	0	0	0	20
Oreogeton	0	0	0	0	0	0	0	0
Roederiodes	0	5	40	0	0	0	0	0
Trichoclinocera	0	0	0	0	0	0	0	0
| Family: Muscidae	0	0	0	0	0	0	0	0
Limnophora	0	0	0	0	0	0	0	0
| Family: Oreoleptidae	0	0	0	0	0	0	0	0
Oreoleptis	0	0	0	0	0	0	0	0
| Family: Pelecorhynchidae	0	0	0	0	0	0	0	0
Glutops	0	0	0	0	0	0	0	0
| Family: Psychodidae	0	0	0	0	0	0	0	0
Pericoma/Telmatoscopus	433	490	1,020	810	650	360	263	0
| Family: Sciaridae	0	0	0	0	0	0	0	0
| Family: Simuliidae	83	0	0	0	133	620	150	460
Helodon	0	0	0	0	0	0	0	0
Prosimulium	0	0	0	0	0	0	0	0
Prosimulium/Helodon	0	0	0	0	0	0	0	0
Simulium	83	5	20	0	0	820	50	120
Twinnia	0	0	0	0	0	0	0	0
| Family: Stratiomyidae	0	0	0	0	0	0	0	0
Nemotelus	0	0	0	0	0	0	0	0
| Family: Tipulidae	17	5	0	0	0	0	0	0
Antocha	0	0	0	0	0	0	0	0
Dicranota	0	0	0	0	33	20	0	20
Erioptera	0	0	0	0	0	0	0	0
Hesperoconopa	0	0	0	0	0	0	0	0
Hexatoma	0	0	0	0	0	20	0	0
Limnophila	0	0	0	0	0	0	0	0
Rhabdomastix	0	0	0	0	0	0	0	0
Tipula	0	0	0	0	0	0	0	20
| Order: Hemiptera	0	0	0	0	0	0	0	0
| Order: Megaloptera	0	0	0	0	0	0	0	0
| Family: Sialidae	0	0	0	0	0	0	0	0
Sialis	0	0	0	0	0	0	0	0
| Order: Thysanoptera	0	0	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0	0	0
| Order: Trombidiformes	0	0	0	0	0	0	0	0
Albaxona	0	0	0	0	0	0	0	0
| Family: Aturidae	0	0	0	0	0	0	0	0
Aturus	0	0	0	0	0	0	0	0
| Family: Feltriidae	0	0	0	0	0	0	0	0
Feltria	0	0	0	0	0	20	0	40
| Family: Hydryphantidae	0	0	0	0	0	0	0	0
Wandesia	0	0	0	0	0	0	0	0
| Family: Hygrobatidae	0	0	0	0	0	0	0	0
Hygrobates	0	0	0	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0	0	0
Lebertia	383	230	820	210	233	660	138	600
| Family: Sperchontidae	0	0	0	0	0	0	0	0
Sperchon	17	10	0	10	17	20	13	40
| Family: Torrenticolidae	0	0	0	0	0	0	0	0
Testudacarus	0	0	20	0	33	0	0	20

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September							
	RG_FOBCP1	**RG_FOBCP2**	**RG_FOBCP3**	**RG_FOBCP4**	**RG_FOBCP5**	**RG_FRUPO1**	**RG_FRUPO2**	**RG_FRUPO3**
Suborder: Prostigmata	0	0	0	0	0	0	0	0
| Family: Stygothrombidiidae	0	0	0	0	0	0	0	0
Stygothrombium	0	0	0	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0	0	0
| Order: Oribatida	0	0	0	0	0	0	0	0
| Family: Hydrozetidae	0	0	0	0	0	0	0	0
Phylum: Mollusca	0	0	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	0	0	0	0	0
Pisidium	0	0	0	0	0	0	0	0
| Class: Gastropoda	0	0	0	0	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0	0	0
Enchytraeus	0	5	0	70	0	0	0	0
| Family: Naididae	0	0	0	0	0	0	0	0
Chaetogaster	0	0	0	0	0	0	0	0
Nais	0	0	0	0	0	0	0	0
Pristina	0	0	0	0	0	0	0	0
| Subfamily: Tubificinae with hair chaetae	0	0	0	0	0	0	0	0
| Subfamily: Tubificinae without hair chaetae	0	5	0	40	100	0	0	0
Totals:	**6,068**	**2,075**	**6,300**	**3,500**	**5,600**	**20,540**	**4,476**	**10,420**

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September							
	RG_FODPO1	RG_FODPO2	RG_FODPO3	RG_FO22-1	RG_FO22-2	RG_FO22-3	RG_FO22-4	RG_FO22-5
Phylum: Arthropoda	0	0	0	0	0	0	0	0
| Order: Collembola	0	0	0	0	0	0	0	0
| Family: Sminthuridae	0	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0	0
Ameletus	0	0	0	0	0	20	0	20
| Family: Baetidae	180	240	1,060	20	40	40	0	0
Acentrella	0	0	0	0	0	0	0	0
Baetis	120	80	160	40	40	40	40	60
Baetis fuscatus gr.	0	0	0	0	0	0	0	0
Baetis rhodani group	560	1,200	1,380	300	260	300	340	100
Baetis bicaudatus	0	0	0	0	0	0	0	0
| Family: Ephemerellidae	320	320	240	220	100	80	180	120
Caudatella	0	0	0	0	0	0	0	0
Drunella	0	0	20	0	0	20	20	0
Drunella grandis group	0	0	0	0	0	0	0	0
Drunella coloradensis	0	0	0	0	0	0	0	0
Drunella doddsii	0	20	100	20	40	60	60	0
Drunella grandis	0	0	0	0	0	0	0	0
Drunella spinifera	80	100	40	20	60	120	20	180
Serratella	0	20	20	20	20	60	20	0
| Family: Heptageniidae	1,860	1,820	2,040	1,040	1,300	1,140	220	540
Cinygmula	0	0	0	0	0	0	0	0
Epeorus	0	0	0	0	0	0	0	20
Rhithrogena	0	0	0	20	0	0	0	0
| Order: Plecoptera	0	60	0	0	0	0	0	0
| Family: Capniidae	640	560	640	20	60	80	80	20
| Family: Chloroperlidae	80	20	300	0	0	0	20	20
Haploperla	0	0	0	0	0	0	0	0
Neaviperla	0	0	0	0	0	0	0	0
Paraperla	0	0	0	0	0	0	0	0
Suwallia	0	0	0	0	0	0	0	0
Sweltsa	0	60	160	0	0	0	0	0
| Family: Leuctridae	0	0	0	0	0	0	0	0
Paraleuctra	0	0	20	0	0	0	0	0
| Family: Nemouridae	240	620	1,040	0	0	0	0	0
Malenka	0	20	20	0	20	0	0	0
Prostoia	0	0	0	0	0	0	0	0
Visoka cataractae	0	0	0	0	0	0	0	0
Zapada	11,580	25,960	34,800	5,740	4,620	2,020	1,220	1,700
Zapada oregonensis group	280	240	600	60	20	100	0	60
Zapada cinctipes	5,180	20	20	1,320	1,880	2,060	500	580
Zapada columbiana	0	0	0	0	0	0	0	0
| Family: Peltoperlidae	0	0	0	0	0	0	0	0
Yoraperla	0	0	0	0	0	0	0	0
| Family: Perlidae	0	40	100	20	0	0	0	0
Hesperoperla	0	0	20	0	0	0	0	0
| Family: Perlodidae	340	1,480	2,660	780	500	420	240	200
Diura	0	0	0	0	0	0	0	0
Isoperla	520	1,340	2,080	360	560	860	460	360
Kogotus	420	900	1,540	320	520	460	200	220
Megarcys	60	20	260	60	40	20	20	40
Rickera sorpta	0	0	0	0	0	0	0	0
Skwala	0	0	0	0	0	0	0	0
| Family: Taeniopterygidae	760	360	1,540	260	180	140	120	0
| Order: Trichoptera	0	40	20	60	20	0	0	40
| Family: Apataniidae	0	0	0	0	0	0	0	0
Apatania	20	20	0	0	20	0	40	20
Pedomoecus sierra	0	0	0	0	0	0	0	0
| Family: Brachycentridae	0	0	0	0	0	0	0	0
Brachycentrus	0	0	20	0	0	0	0	0
Brachycentrus americanus	0	0	20	0	0	0	0	0
Micrasema	0	0	0	0	0	0	0	0
| Family: Glossosomatidae	0	0	0	100	0	0	0	0
Glossosoma	0	20	20	40	120	40	80	0
| Family: Hydropsychidae	0	0	0	0	0	0	0	0
Arctopsyche	0	0	0	0	0	0	0	0
Hydropsyche	0	0	0	0	0	0	0	0
Parapsyche	0	0	20	0	0	0	0	0
Parapsyche elsis	0	0	0	0	0	0	0	0
| Family: Hydroptilidae	0	0	0	0	0	0	0	0
Hydroptila	0	0	0	0	0	0	0	0
| Family: Lepidostomatidae	0	0	0	0	0	0	0	0
Lepidostoma	0	0	0	0	0	0	0	0
| Family: Limnephilidae	60	80	60	240	600	300	100	120
Dicosmoecus	0	0	0	0	0	0	0	0
Ecclisomyia	0	0	0	0	20	0	0	0
| Family: Rhyacophilidae	0	0	0	0	0	0	0	0
Rhyacophila	60	280	460	120	20	0	0	20
Rhyacophila angelita group	0	0	0	0	0	0	0	0
Rhyacophila betteni group	0	40	0	0	0	40	0	0
Rhyacophila brunnea/vemna group	40	120	220	200	20	60	0	80
Rhyacophila hyalinata group	0	0	0	0	0	0	0	0
Rhyacophila vobara subgroup	0	0	0	0	0	0	0	0
Rhyacophila vofixa group	0	0	0	0	0	0	0	0
Rhyacophila alberta group	0	0	0	0	0	0	0	0
Rhyacophila atrata complex	20	100	180	20	20	20	20	0
Rhyacophila narvae	120	100	100	0	0	20	0	0
Rhyacophila verrula group	0	0	0	0	0	0	0	0
| Family: Thremmatidae	0	0	0	0	0	0	0	0
Oligophlebodes	0	0	0	0	20	20	0	0
| Order: Coleoptera	0	0	0	0	0	0	0	0
| Family: Dytiscidae	0	0	0	0	0	0	0	0
Liodessus	0	0	0	0	0	0	0	0
Oreodytes	0	0	0	0	0	0	0	0
Sanfilippodytes	0	0	0	0	0	0	0	0
Stictotarsus	0	0	0	0	0	0	0	0
| Subfamily: Hydroporinae	20	0	0	0	0	0	0	0
| Family: Elmidae	80	120	80	660	1,440	1,200	1,560	2,080
Heterlimnius	420	420	720	1,720	3,180	3,560	2,080	3,580

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September							
	RG_FODPO1	RG_FODPO2	RG_FODPO3	RG_FO22-1	RG_FO22-2	RG_FO22-3	RG_FO22-4	RG_FO22-5
| Order: Diptera	0	0	0	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	0	0	0
Bezzia/ Palpomyia	0	0	0	0	0	0	0	0
Mallochohelea	20	40	60	40	0	0	0	0
| Family: Chironomidae	420	1,280	2,000	80	0	80	0	60
| Subfamily: Chironominae	0	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0	0
Paracladopelma	0	0	0	0	0	0	0	0
Phaenopsectra	0	0	0	0	0	0	0	0
Polypedilum	0	0	0	0	0	0	0	0
| Tribe: Tanytarsini	0	0	0	0	0	0	0	0
Micropsectra	280	60	20	0	20	0	0	0
Stempellina	0	0	0	0	0	0	0	0
Stempellinella	0	0	0	0	0	0	0	0
Sublettea	0	0	0	0	0	0	0	0
Tanytarsus	0	0	0	0	0	0	0	0
| Subfamily: Diamesinae	0	0	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0	0	0
Diamesa	0	0	0	0	0	20	0	0
Pagastia	140	520	800	0	0	20	20	0
Potthastia gaedii group	0	0	0	0	0	0	0	0
Pseudodiamesa	100	0	20	0	0	0	0	0
| Subfamily: Orthocladiinae	0	0	0	0	0	0	0	0
Brillia	0	0	40	0	0	0	0	0
Corynoneura	0	0	40	0	0	0	0	0
Cricotopus (Nostococladius)	0	0	0	0	0	0	0	0
Diplocladius cultriger	0	0	0	0	0	0	0	0
Eukiefferiella	60	240	820	160	40	60	20	20
Heleniella	0	0	0	0	0	0	0	0
Hydrobaenus	520	40	0	0	0	0	0	0
Krenosmittia	0	0	0	0	0	0	0	0
Limnophyes	0	0	0	0	0	0	0	0
Orthocladius complex	1,580	3,520	4,280	520	300	460	180	100
Orthocladius lignicola	0	0	0	0	0	0	0	0
Parakiefferiella	0	0	0	0	0	0	0	0
Parametriocnemus	0	0	0	0	0	0	0	0
Paraphaenocladius	0	0	0	0	0	0	0	0
Parorthocladius	0	20	0	0	0	0	0	0
Rheocricotopus	80	0	0	0	20	0	0	0
Rheosmittia	0	0	0	0	0	0	0	0
Thienemanniella	0	0	0	0	0	0	20	0
Tvetenia	80	120	500	0	0	0	20	0
| Subfamily: Tanypodinae	0	0	0	0	0	0	0	0
Zavrelimyia	0	0	0	0	0	0	0	0
| Tribe: Macropelopiini	0	0	0	0	0	0	0	0
Macropelopia	0	0	0	0	0	0	0	0
| Tribe: Pentaneurini	0	0	0	0	0	0	0	0
Thienemannimyia group	0	60	0	0	0	0	0	0
| Tribe: Procladiini	0	0	0	0	0	0	0	0
Procladius	20	0	0	0	0	0	0	0
| Family: Dolichopodidae	0	0	0	0	0	0	0	0
| Family: Empididae	80	60	100	0	0	0	0	0
Chelifera/ Metachela	40	60	180	60	0	20	20	80
Clinocera	0	0	0	0	0	0	0	20
Hemerodromia	0	0	0	0	0	0	0	0
Neoplasta	0	60	20	20	0	0	0	0
Oreogeton	0	0	0	0	0	0	0	0
Roederiodes	0	0	0	0	0	0	0	0
Trichoclinocera	0	0	0	0	0	0	0	0
| Family: Muscidae	0	0	0	0	0	0	0	0
Limnophora	0	0	0	0	0	0	0	0
| Family: Oreoleptidae	0	0	0	0	0	0	0	0
Oreoleptis	0	0	0	0	0	0	0	0
| Family: Pelecorhynchidae	0	0	0	0	0	0	0	0
Glutops	0	0	0	20	0	0	0	0
| Family: Psychodidae	0	0	0	0	0	0	0	0
Pericoma/Telmatoscopus	0	580	560	0	320	0	0	60
| Family: Sciaridae	0	0	0	0	0	0	0	0
| Family: Simuliidae	0	40	1,960	0	20	0	0	0
Helodon	0	0	0	0	0	0	0	0
Prosimulium	0	0	0	0	0	0	0	0
Prosimulium/Helodon	0	0	0	0	0	0	0	0
Simulium	20	140	2,280	160	0	0	0	0
Twinnia	0	0	0	0	0	0	0	0
| Family: Stratiomyidae	0	0	0	0	0	0	0	0
Nemotelus	0	0	0	0	0	0	0	0
| Family: Tipulidae	60	0	0	0	20	0	0	0
Antocha	0	20	0	0	0	20	0	20
Dicranota	100	60	40	20	60	20	100	0
Erioptera	0	0	0	0	0	0	0	0
Hesperoconopa	0	0	20	0	0	0	0	0
Hexatoma	0	0	0	0	0	0	0	0
Limnophila	0	20	0	0	0	0	0	0
Rhabdomastix	0	0	0	0	0	0	0	0
Tipula	120	0	20	60	0	40	40	60
| Order: Hemiptera	0	0	0	0	0	0	0	0
| Order: Megaloptera	0	0	0	0	0	0	0	0
| Family: Sialidae	0	0	0	0	0	0	0	0
Sialis	0	0	0	0	0	0	0	0
| Order: Thysanoptera	0	0	0	0	0	0	0	0
Subphylum: Chelicerata	0	0	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0	0	0
| Order: Trombidiformes	20	0	0	0	0	0	0	0
Albaxona	0	0	0	0	0	0	0	0
| Family: Aturidae	0	0	0	0	0	0	0	0
Aturus	20	20	0	0	0	20	0	0
| Family: Feltriidae	0	0	0	0	0	0	0	0
Feltria	0	40	20	0	0	0	0	0
| Family: Hydryphantidae	0	0	0	0	0	0	0	0
Wandesia	0	0	0	0	0	0	0	0
| Family: Hygrobatidae	0	0	0	0	0	0	0	0
Hygrobates	0	0	0	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0	0	0
Lebertia	260	380	120	120	260	600	220	340
| Family: Sperchontidae	0	0	0	0	0	0	0	0
Sperchon	0	0	20	0	0	20	0	0
| Family: Torrenticolidae	0	0	0	0	0	0	0	0
Testudacarus	0	0	0	0	0	0	0	0

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September							
	RG_FODPO1	RG_FODPO2	RG_FODPO3	RG_FO22-1	RG_FO22-2	RG_FO22-3	RG_FO22-4	RG_FO22-5
Suborder: Prostigmata	0	0	0	0	0	0	0	0
| Family: Stygothrombidiidae	0	0	0	0	0	0	0	0
Stygothrombium	0	0	0	0	0	0	0	0
| Order: Sarcoptiformes	0	0	0	0	0	0	0	0
| Order: Oribatida	0	0	20	0	0	0	0	0
| Family: Hydrozetidae	20	0	0	0	0	0	0	0
Phylum: Mollusca	0	0	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	0	0	0	0	0
Pisidium	20	0	0	0	40	0	60	0
| Class: Gastropoda	0	0	0	0	0	0	0	0
Phylum: Annelida	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	80	0
| Order: Tubificida	0	0	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0	0	0
Enchytraeus	0	80	20	0	0	0	0	0
| Family: Naididae	0	0	0	0	0	0	0	0
Chaetogaster	0	0	0	0	0	0	0	0
Nais	0	0	0	60	20	40	40	40
Pristina	0	0	0	0	0	0	0	0
| Subfamily: Tubificinae with hair chaetae	0	0	0	0	0	0	0	0
| Subfamily: Tubificinae without hair chaetae	0	20	0	0	0	0	0	0
Totals:	**28,120**	**44,320**	**66,740**	**15,120**	**16,860**	**14,720**	**8,460**	**10,980**

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	**September**		
	RG_FOUEW1	**RG_FOUEW2**	**RG_FOUEW3**
Phylum: Arthropoda	0	0	0
| Order: Collembola	0	0	0
| Family: Sminthuridae	0	0	0
Subphylum: Hexapoda	0	0	0
| Class: Insecta	0	0	0
| Order: Ephemeroptera	0	0	0
| Family: Ameletidae	0	0	0
Ameletus	0	60	40
| Family: Baetidae	20	0	0
Acentrella	0	0	0
Baetis	0	0	40
Baetis fuscatus gr.	0	0	0
Baetis rhodani group	0	40	120
Baetis bicaudatus	20	0	0
| Family: Ephemerellidae	180	380	180
Caudatella	0	0	0
Drunella	0	0	0
Drunella grandis group	0	0	0
Drunella coloradensis	0	0	0
Drunella doddsii	0	40	20
Drunella grandis	0	0	0
Drunella spinifera	20	20	20
Serratella	0	0	0
| Family: Heptageniidae	720	1,580	1,240
Cinygmula	0	0	0
Epeorus	0	20	0
Rhithrogena	0	0	0
| Order: Plecoptera	0	0	0
| Family: Capniidae	60	0	20
| Family: Chloroperlidae	20	40	0
Haploperla	0	0	0
Neaviperla	0	0	0
Paraperla	0	0	0
Suwallia	0	0	0
Sweltsa	20	100	60
| Family: Leuctridae	20	20	0
Paraleuctra	0	0	0
| Family: Nemouridae	40	0	0
Malenka	0	0	0
Prostoia	0	0	0
Visoka cataractae	0	0	0
Zapada	1,180	1,900	1,160
Zapada oregonensis group	20	120	60
Zapada cinctipes	420	760	280
Zapada columbiana	0	0	0
| Family: Peltoperlidae	0	0	0
Yoraperla	0	0	0
| Family: Perlidae	0	20	0
Hesperoperla	0	60	20
| Family: Perlodidae	40	40	60
Diura	0	0	0
Isoperla	40	100	240
Kogotus	120	180	220
Megarcys	0	60	40
Rickera sorpta	0	0	0
Skwala	0	0	0
| Family: Taeniopterygidae	80	100	20
| Order: Trichoptera	0	20	60
| Family: Apataniidae	0	0	0
Apatania	0	40	0
Pedomoecus sierra	20	0	0
| Family: Brachycentridae	0	0	0
Brachycentrus	0	0	0
Brachycentrus americanus	0	0	0
Micrasema	0	0	0
| Family: Glossosomatidae	0	0	0
Glossosoma	20	120	40
| Family: Hydropsychidae	40	20	0
Arctopsyche	0	0	0
Hydropsyche	0	0	0
Parapsyche	0	0	0
Parapsyche elsis	0	0	20
| Family: Hydroptilidae	0	0	0
Hydroptila	0	0	0
| Family: Lepidostomatidae	0	0	0
Lepidostoma	0	0	0
| Family: Limnephilidae	20	20	0
Dicosmoecus	0	20	40
Ecclisomyia	0	0	0
| Family: Rhyacophilidae	0	0	0
Rhyacophila	80	120	20
Rhyacophila angelita group	0	0	0
Rhyacophila betteni group	0	0	0
Rhyacophila brunnea/vemna group	180	120	100
Rhyacophila hyalinata group	0	0	0
Rhyacophila vobara subgroup	0	0	0
Rhyacophila vofixa group	0	0	0
Rhyacophila alberta group	0	0	0
Rhyacophila atrata complex	80	200	220
Rhyacophila narvae	0	0	0
Rhyacophila verrula group	0	0	0
| Family: Thremmatidae	0	0	0
Oligophlebodes	0	0	0
| Order: Coleoptera	0	0	0
| Family: Dytiscidae	0	0	0
Liodessus	0	0	0
Oreodytes	0	0	0
Sanfilippodytes	0	0	0
Stictotarsus	0	0	0
| Subfamily: Hydroporinae	0	0	0
| Family: Elmidae	180	320	60
Heterlimnius	820	900	540

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September		
	RG_FOUEW1	RG_FOUEW2	RG_FOUEW3
| Order: Diptera	0	0	0
| Family: Ceratopogonidae	0	0	0
Bezzia/ Palpomyia	0	0	0
Mallochohelea	0	0	0
| Family: Chironomidae	220	140	140
| Subfamily: Chironominae	0	0	0
| Tribe: Chironomini	0	0	0
Paracladopelma	0	0	0
Phaenopsectra	0	0	0
Polypedilum	0	0	0
| Tribe: Tanytarsini	0	0	0
Micropsectra	0	40	0
Stempellina	0	0	0
Stempellinella	0	0	0
Sublettea	0	0	0
Tanytarsus	0	0	0
| Subfamily: Diamesinae	0	0	0
| Tribe: Diamesini	0	0	0
Diamesa	0	0	0
Pagastia	180	40	40
Potthastia gaedii group	0	0	0
Pseudodiamesa	0	0	0
| Subfamily: Orthocladiinae	0	0	0
Brillia	0	0	0
Corynoneura	0	0	20
Cricotopus (Nostococladius)	0	0	0
Diplocladius cultriger	0	0	0
Eukiefferiella	160	40	0
Heleniella	0	0	0
Hydrobaenus	0	0	0
Krenosmittia	0	0	0
Limnophyes	20	0	0
Orthocladius complex	460	280	580
Orthocladius lignicola	0	0	0
Parakiefferiella	0	0	0
Parametriocnemus	0	0	0
Paraphaenocladius	0	0	0
Parorthocladius	0	0	0
Rheocricotopus	0	0	0
Rheosmittia	0	0	0
Thienemanniella	0	0	0
Tvetenia	20	0	60
| Subfamily: Tanypodinae	0	0	20
Zavrelimyia	0	0	0
| Tribe: Macropelopiini	0	0	0
Macropelopia	0	0	0
| Tribe: Pentaneurini	0	0	0
Thienemannimyia group	0	20	0
| Tribe: Procladiini	0	0	0
Procladius	0	0	0
| Family: Dolichopodidae	0	0	0
| Family: Empididae	0	0	0
Chelifera/ Metachela	80	20	20
Clinocera	20	0	20
Hemerodromia	0	0	0
Neoplasta	80	20	0
Oreogeton	0	0	0
Roederiodes	0	0	0
Trichoclinocera	0	0	0
| Family: Muscidae	0	0	0
Limnophora	0	0	0
| Family: Oreoleptidae	0	0	0
Oreoleptis	0	0	0
| Family: Pelecorhynchidae	0	0	0
Glutops	0	0	0
| Family: Psychodidae	0	0	0
Pericoma/Telmatoscopus	20	20	140
| Family: Sciaridae	0	0	0
| Family: Simuliidae	0	20	40
Helodon	0	0	0
Prosimulium	0	0	0
Prosimulium/Helodon	0	0	0
Simulium	0	0	40
Twinnia	0	0	0
| Family: Stratiomyidae	0	0	0
Nemotelus	0	0	0
| Family: Tipulidae	0	0	0
Antocha	0	20	0
Dicranota	20	0	0
Erioptera	0	0	0
Hesperoconopa	0	0	0
Hexatoma	0	0	0
Limnophila	0	0	0
Rhabdomastix	0	0	0
Tipula	0	20	0
| Order: Hemiptera	0	0	0
| Order: Megaloptera	0	0	0
| Family: Sialidae	0	0	0
Sialis	0	0	0
| Order: Thysanoptera	0	0	0
Subphylum: Chelicerata	0	0	0
| Class: Arachnida	0	0	0
| Order: Trombidiformes	0	20	20
Albaxona	0	0	0
| Family: Aturidae	0	0	0
Aturus	20	0	0
| Family: Feltriidae	0	0	0
Feltria	0	0	0
| Family: Hydryphantidae	0	0	0
Wandesia	0	0	0
| Family: Hygrobatidae	0	0	0
Hygrobates	0	0	0
| Family: Lebertiidae	0	0	0
Lebertia	400	640	580
| Family: Sperchontidae	0	0	0
Sperchon	60	20	20
| Family: Torrenticolidae	0	0	0
Testudacarus	0	0	0

Table B.21: Raw Benthic Invertebrate Community Data, FRO LAEMP, June, August, and September 2018

Sample:	September		
	RG_FOUEW1	RG_FOUEW2	RG_FOUEW3
Suborder: Prostigmata	0	0	0
| Family: Stygothrombidiidae	0	0	0
Stygothrombium	0	0	0
| Order: Sarcoptiformes	0	0	0
| Order: Oribatida	0	0	0
| Family: Hydrozetidae	0	0	0
Phylum: Mollusca	0	0	0
| Class: Bivalvia	0	0	0
| Order: Veneroida	0	0	0
| Family: Pisidiidae	0	20	0
Pisidium	0	0	0
| Class: Gastropoda	0	0	0
Phylum: Annelida	0	0	0
Subphylum: Clitellata	0	0	0
| Class: Oligochaeta	0	0	0
| Order: Tubificida	0	0	0
| Family: Enchytraeidae	0	0	0
Enchytraeus	0	0	0
| Family: Naididae	0	0	0
Chaetogaster	0	0	0
Nais	100	240	20
Pristina	0	0	0
| Subfamily: Tubificinae with hair chaetae	0	0	0
| Subfamily: Tubificinae without hair chaetae	40	0	0
Totals:	**6,360**	**9,160**	**6,700**

Table B.22: Composite-Taxa Benthic Invertebrate Tissue Chemistry, FRO LAEMP, September 2018

Exposure Type	Biological Monitoring Area	Aluminum ug/g	Antimony ug/g	Arsenic ug/g	Barium ug/g	Beryllium ug/g	Boron ug/g	Cadmium ug/g	Chromium ug/g
Reference	RG_HENUP	1,700	<1	0.8	15	<0.1	<10	0.3	<5
		1,200	<0.2	1.3	8.2	0.05	2	0.61	4
		820	<1	0.9	8	<0.1	<10	0.5	<5
	RG_FO26	2,500	<1	1.5	32	<0.1	<10	0.6	<5
		1,300	<1	1.1	24	<0.1	<10	0.5	<5
		2,300	<1	1.4	36	<0.1	<10	0.7	<5
Mine-exposed	RG_FODHE	4,500	<1	1	46	0.2	<10	1.8	7
		1,400	<0.2	0.6	22	0.04	8	1.5	2
		1,500	<0.2	0.7	23	0.05	5	2.5	2
	RG_FOUNGD	1,800	<2	<1	27	<0.2	<20	1.7	<10
		4,100	<2	2	57	<0.2	<20	2	<10
		1,500	<2	<1	30	<0.2	<20	2.1	<10
	RG_FODNGD	1,200	<2	<1	50	<0.2	<20	1.8	<10
		1,200	<2	<1	21	<0.2	<20	1.6	<10
		3,800	<2	1	54	<0.2	<20	2.3	<10
	RG_MP1	1,000	<2	<1	18	<0.2	<20	2	<10
		1,600	<0.2	0.6	30	0.05	3	1.8	2
		2,300	<2	<1	29	<0.2	<20	1.7	<10
	RG_FOUSH	2,800	<2	1	46	<0.2	<20	2.3	<10
		2,000	<2	<1	35	<0.2	<20	2.3	<10
		2,100	<1	0.6	37	<0.1	<10	1	<5
	RG_FOUKI	2,000	<1	1.3	22	<0.1	<10	6.2	<5
		1,400	<1	0.8	21	<0.1	<10	3.1	<5
		3,300	<1	1.3	54	0.1	<10	4.6	<5
	RG_FOBKS	440	<1	<0.5	7.1	<0.1	<10	2.7	<5
		760	<1	0.5	14	<0.1	<10	3.4	<5
		970	<1	0.8	17	<0.1	<10	4.2	<5
	RG_FOBSC	1,600	<0.2	0.6	23	0.06	3	3.1	2
		1,300	<1	0.6	23	<0.1	<10	1.7	<5
		710	<0.2	0.5	13	0.02	<2	2.3	1
	RG_FOBCP	200	<1	<0.5	17	<0.1	<10	1.2	<5
		570	<2	<1	16	<0.2	<20	2.9	<10
		2,200	<2	<1	38	<0.2	<20	2.5	<10
		450	<2	<1	12	<0.2	<20	2.8	<10
		740	<0.2	0.5	20	0.03	<2	2.4	1
	RG_FRUPO	1,900	<1	0.7	30	<0.1	<10	2	<5
		510	<1	<0.5	12	<0.1	<10	4.3	<5
		320	<1	<0.5	8	<0.1	<10	4.5	<5
	RG_FODPO	5,800	<1	2	66	0.2	10	1.7	9
		2,800	<0.2	1.2	36	0.11	7	2.9	4
		3,600	<2	1	54	<0.2	<20	1.6	<10
	RG_FO22	2,600	<2	<1	33	<0.2	<20	1.1	<10
		4,400	<1	1.6	53	0.2	<10	1	7
		5,500	<2	2	64	0.2	<20	2	<10
		4,800	<1	1.8	61	0.2	<10	1.6	8
		6,200	<1	1.8	64	0.2	10	1.5	10
	RG_FOUEW	5,800	<0.2	1.3	165	0.19	9	1.7	8
		10,100	<2	2	94	0.3	<20	1.2	10
		12,100	<1	2.9	120	0.5	20	1.4	18

Table B.22: Composite-Taxa Benthic Invertebrate Tissue Chemistry, FRO LAEMP, September 2018

Exposure Type	Biological Monitoring Area	Cobalt ug/g	Copper ug/g	Iron ug/g	Lead ug/g	Manganese ug/g	Mercury ug/g	Molybdenum ug/g	Nickel ug/g
Reference	RG_HENUP	0.6	4.9	930	0.7	45	<0.05	<1	3.7
		0.54	6	750	0.54	45	<0.01	0.3	5
		0.3	7.9	520	0.4	39	<0.05	<1	4
	RG_FO26	0.8	9.9	1,500	0.8	120	<0.05	<1	3.4
		0.4	9.9	700	0.5	79	<0.05	<1	1.8
		0.9	11	1,500	1	130	<0.05	<1	3.5
Mine-exposed	RG_FODHE	2.2	14	2,200	1.3	180	<0.05	<1	6.4
		1.3	12	740	0.43	120	0.02	0.3	4
		2	14	1,100	0.66	120	0.01	0.3	6.4
	RG_FOUNGD	1.2	13	1,200	0.7	70	<0.1	<2	10
		1.9	14	2,800	1.6	110	<0.1	<2	15
		1.5	13	1,000	0.6	86	<0.1	<2	8
	RG_FODNGD	3	15	740	0.5	140	<0.1	<2	11
		2.5	15	760	0.5	86	<0.1	<2	6
		3.6	17	2,500	1.4	120	<0.1	<2	13
	RG_MP1	1.4	16	580	0.4	60	<0.1	<2	6
		3	16	850	0.56	79	0.01	0.4	6
		1.9	17	1,000	0.7	65	<0.1	<2	7
	RG_FOUSH	2.2	17	3,000	1	220	<0.1	<2	11
		1.8	15	2,600	0.7	200	<0.1	<2	9
		1.2	15	2,300	0.6	190	<0.05	<1	6.1
	RG_FOUKI	3.1	16	1,200	0.8	250	<0.05	<1	13
		1.9	16	650	0.3	330	<0.05	<1	10
		3.8	17	2,300	1.2	620	<0.05	<1	17
	RG_FOBKS	1.1	16	360	0.2	53	<0.05	<1	3.8
		1.2	19	640	0.3	97	<0.05	<1	5
		2	23	790	0.4	86	<0.05	<1	7.2
	RG_FOBSC	1.4	24	870	0.67	82	0.01	0.3	8.2
		1.1	17	2,000	0.6	130	<0.05	<1	7.9
		1.3	20	550	0.24	71	0.02	0.2	6.7
	RG_FOBCP	0.6	18	190	0.1	62	<0.05	<1	7.1
		1.1	21	830	0.4	56	<0.1	<2	9
		1.7	18	1,600	0.9	120	<0.1	<2	14
		1.1	21	340	<0.2	39	<0.1	<2	8
		1.3	26	520	0.37	73	0.01	0.3	10
	RG_FRUPO	1.1	14	1,400	0.7	100	<0.05	<1	8.9
		2	14	420	0.2	49	<0.05	<1	2.7
		2.1	15	280	0.1	58	<0.05	<1	2.2
	RG_FODPO	1.8	10	4,500	1.9	120	<0.05	<1	10
		1.4	19	2,200	1.2	75	0.02	0.5	7.7
		1.6	12	3,000	1.6	110	<0.1	<2	8
	RG_FO22	1.2	13	2,000	0.9	160	<0.1	<2	7
		1.7	15	3,100	1.6	220	<0.05	<1	14
		2.1	16	4,000	1.9	210	<0.1	<2	12
		1.9	13	3,700	1.8	200	<0.05	<1	13
		1.9	16	3,900	2.1	190	<0.05	<1	14
	RG_FOUEW	1.6	13	2,800	1.5	160	0.01	0.3	7.8
		2.2	16	4,800	2.8	180	<0.1	<2	19
		3.1	14	9,700	3.5	280	<0.05	<1	17

Table B.22: Composite-Taxa Benthic Invertebrate Tissue Chemistry, FRO LAEMP, September 2018

Exposure Type	Biological Monitoring Area	Selenium ug/g	Silver ug/g	Strontium ug/g	Thallium ug/g	Tin ug/g	Titanium ug/g	Uranium ug/g	Vanadium ug/g
Reference	RG_HENUP	2.5	<0.1	76	<0.5	<0.5	9.6	0.36	5
		4.6	0.04	61	<0.1	<0.1	12	0.37	3.4
		4.8	<0.1	20	<0.5	<0.5	6.3	0.24	2
	RG_FO26	3.4	<0.1	7	<0.5	<0.5	22	0.12	8
		4.1	<0.1	7	<0.5	<0.5	16	0.1	4
		3.8	<0.1	12	<0.5	<0.5	26	0.17	7
Mine-exposed	RG_FODHE	11	<0.1	20	<0.5	<0.5	32	0.21	14
		12	0.07	11	<0.1	<0.1	11	0.09	4.1
		15	0.07	13	<0.1	<0.1	17	0.13	4.6
	RG_FOUNGD	6	<0.2	8	<1	<1	10	0.2	6
		7	<0.2	16	<1	<1	22	0.3	17
		8	<0.2	7	<1	<1	8	0.2	5
	RG_FODNGD	9	<0.2	9	<1	<1	11	0.1	4
		8	<0.2	6	<1	<1	9	<0.1	4
		8	<0.2	14	<1	<1	20	0.2	14
	RG_MP1	7	<0.2	6	<1	<1	8	0.2	3
		8.6	0.1	9.3	<0.1	<0.1	13	0.12	5.4
		8	<0.2	10	<1	<1	14	0.1	8
	RG_FOUSH	8	<0.2	15	<1	<1	16	0.2	10
		8	<0.2	9	<1	<1	13	0.2	8
		9.1	<0.1	8	<0.5	<0.5	14	0.13	8
	RG_FOUKI	9.4	0.1	6	<0.5	<0.5	12	0.1	6
		10	0.1	5	<0.5	<0.5	7.1	0.11	3
		11	0.1	14	<0.5	<0.5	16	0.29	10
	RG_FOBKS	11	0.2	3	<0.5	<0.5	3.1	<0.05	1
		10	0.2	5	<0.5	<0.5	9.1	0.06	3
		9.9	0.1	6	<0.5	<0.5	9.1	0.07	3
	RG_FOBSC	9	0.16	9.4	<0.1	<0.1	8.8	0.14	4.8
		9	0.1	10	<0.5	<0.5	5.4	0.1	5
		8.2	0.17	7.7	<0.1	<0.1	6	0.05	2.3
	RG_FOBCP	9.4	0.1	7	<0.5	<0.5	2.3	0.14	<1
		8	<0.2	8	<1	<1	6	0.1	2
		10	<0.2	14	<1	<1	9	0.2	7
		8	<0.2	6	<1	<1	4	<0.1	<2
		7.9	0.12	8.9	<0.1	<0.1	4.6	0.18	2.8
	RG_FRUPO	7.5	<0.1	10	<0.5	<0.5	13	0.2	7
		9.7	<0.1	4	<0.5	<0.5	4.2	0.06	2
		8.7	<0.1	2	<0.5	<0.5	4.3	<0.05	1
	RG_FODPO	4.3	<0.1	21	<0.5	<0.5	22	0.4	21
		8	0.1	10	<0.1	<0.1	17	0.32	9.2
		5	<0.2	16	<1	<1	18	0.3	14
	RG_FO22	7	<0.2	8	<1	<1	34	0.2	8
		9.2	0.1	12	<0.5	<0.5	29	0.23	14
		7	<0.2	17	<1	<1	39	0.3	19
		8.9	0.1	17	<0.5	<0.5	30	0.33	16
		7.6	0.2	16	<0.5	<0.5	37	0.32	20
	RG_FOUEW	7.6	0.15	94	0.1	0.1	28	0.28	16
		7	<0.2	27	<1	<1	58	0.6	29
		5	0.1	40	<0.5	<0.5	49	0.68	41

Table B.22: Composite-Taxa Benthic Invertebrate Tissue Chemistry, FRO LAEMP, September 2018

Exposure Type	Biological Monitoring Area	Zinc ug/g	Moisture %
Reference	RG_HENUP	100	67.06
		160	70.6
		170	82.01
	RG_FO26	130	79.39
		130	81.42
		130	81.5
Mine-exposed	RG_FODHE	260	81.2
		210	82.66
		270	84.97
	RG_FOUNGD	170	80.1
		210	81.22
		200	82.28
	RG_FODNGD	200	78.75
		180	79.31
		220	81.68
	RG_MP1	180	83.81
		260	86.05
		200	87.59
	RG_FOUSH	210	86.52
		230	82.41
		220	81.2
	RG_FOUKI	320	81.36
		230	79.93
		240	80.36
	RG_FOBKS	470	67.54
		370	71.11
		280	80.92
	RG_FOBSC	260	86.62
		300	79.98
		450	72.97
	RG_FOBCP	320	79.27
		520	79.35
		300	81.78
		310	80.74
		220	83.95
	RG_FRUPO	150	82.6
		220	76.89
		180	77.68
	RG_FODPO	83	83.92
		130	86.98
		100	78.97
	RG_FO22	110	86.29
		130	84.66
		120	86.63
		94	85.43
		86	85.16
	RG_FOUEW	250	77.43
		110	82.62
		150	72

Table B.23: Composite-Taxa Benthic Invertebrate Tissue Chemistry, FRO LAEMP, December 2018

Exposure Type	Biological Monitoring Area	Aluminum ug/g	Antimony ug/g	Arsenic ug/g	Barium ug/g	Beryllium ug/g	Boron ug/g	Cadmium ug/g	Chromium ug/g
Reference	RG_HENUP	1,400	0.09	1.7	30	0.08	5	1.8	2.7
		680	0.02	0.81	15	0.04	7	1.6	1.2
		610	0.02	0.74	20	0.02	7	2.3	1.4
Mine-exposed	RG_FODHE	330	0.03	0.31	8.4	<0.02	<2	1.6	0.6
		540	0.04	0.32	11	0.02	2	2.3	1
		1,200	0.04	0.61	13	0.08	<5	1	14
	RG_FOUNGD	620	0.04	0.76	17	<0.02	<5	1.1	1
		5,600	0.04	1	53	0.14	5	5.3	4
		260	0.02	0.72	6.6	<0.02	<2	3.5	0.5
	RG_FODNGD	1,200	0.08	0.66	31	0.06	3	1.2	2.2
		610	0.05	0.72	16	0.03	2	1.4	1.1
		600	0.04	0.61	23	0.02	<2	1.5	1
	RG_MP1	500	0.05	0.91	47	0.02	<5	1.3	1.6
		260	0.02	0.7	17	<0.02	<5	0.92	1.2
		320	0.03	0.78	16	<0.02	<5	0.54	1
	RG_FOUSH	1,900	0.08	0.86	37	0.08	<5	3.7	3.1
		1,100	0.06	0.64	29	0.06	3	1.2	2.1
		790	0.05	0.68	18	0.04	2	1.5	1.4
	RG_FOUKI	230	0.03	0.85	7.9	<0.02	<5	0.61	<0.5
		1,900	0.09	0.68	46	0.07	5	2.2	3.4
		1,700	0.09	0.64	27	0.06	4	4	2.4
	RG_FOBKS	2,600	0.13	1.3	52	0.1	6	1	4.3
		5,000	0.21	1.5	82	0.2	10	1.3	8.1
		900	0.16	0.37	41	0.04	<2	1.7	1.7
	RG_FOBSC	750	0.04	0.34	24	0.02	<5	0.6	1.2
		420	0.06	0.26	11	0.02	<1	0.39	0.72
		580	0.03	0.22	13	<0.02	<5	5.2	0.9
	RG_FOBCP	390	0.1	1.6	22	0.01	<1	7.9	0.69
		850	0.07	0.25	36	0.03	2	0.42	1.3
		640	0.05	0.2	29	0.02	1	0.7	1
	RG_FRUPO	2,300	0.06	0.74	33	0.09	6	2.1	3.4
		2,300	0.07	0.95	40	0.09	7	1.3	3.5
		6,600	0.12	2.2	190	0.34	13	1.5	10
	RG_FODPO	180	<0.01	0.08	3.6	<0.01	<1	0.06	0.28
		1,600	0.03	0.53	22	0.06	<5	0.44	2.7
		3,600	0.08	1.4	45	0.15	10	1.2	6
	RG_FO22	9,800	0.11	2.7	150	0.4	16	0.76	16
		6,700	0.15	1.7	92	0.31	13	0.79	13
		7,300	0.1	1.9	91	0.36	14	0.67	13
	RG_FOUEW	600	<0.02	0.28	14	0.02	4	0.92	1
		1,900	0.04	0.71	36	0.08	<5	0.77	3.1
		1,700	0.05	0.97	29	0.07	7	1.1	2.8

Table B.23: Composite-Taxa Benthic Invertebrate Tissue Chemistry, FRO LAEMP, December 2018

Exposure Type	Biological Monitoring Area	Cobalt ug/g	Copper ug/g	Iron ug/g	Lead ug/g	Manganese ug/g	Mercury ug/g	Molybdenum ug/g	Nickel ug/g
Reference	RG_HENUP	0.54	12	2,400	1.4	96	0.03	0.7	2.6
		0.41	9.3	700	0.39	62	0.016	0.28	2
		<0.5	9.4	350	0.54	51	0.02	0.26	1.4
Mine-exposed	RG_FODHE	1.5	18	240	0.18	120	0.02	0.27	4
		1.3	20	360	0.22	160	0.01	0.23	3.8
		1.2	11	1,100	0.84	190	<0.01	0.24	4.9
	RG_FOUNGD	0.8	12	390	0.34	46	<0.01	0.29	6.4
		1.8	11	8,800	1.7	370	0.02	0.22	18
		2.7	12	170	0.14	28	<0.01	0.27	7.4
	RG_FODNGD	2.6	17	940	0.55	80	0.01	0.31	12
		2.4	17	420	0.26	52	<0.01	0.22	8.7
		3.6	13	370	0.3	93	0.01	0.3	9.1
	RG_MP1	0.7	14	3,800	0.19	110	<0.01	0.23	7.6
		<0.5	17	3,600	0.11	20	<0.01	0.16	6.2
		<0.5	19	2,600	0.15	31	<0.01	0.22	8.1
	RG_FOUSH	6.8	19	1,500	0.93	180	<0.01	0.58	11
		2.9	14	800	0.69	150	<0.01	0.4	8
		0.8	19	580	0.37	31	0.01	0.33	5.7
	RG_FOUKI	0.6	18	380	0.06	52	<0.01	0.23	7
		1.9	13	1,400	0.69	400	0.02	0.34	8.8
		2	13	1,200	0.53	370	0.02	0.38	9.7
	RG_FOBKS	1.5	19	2,300	0.91	200	0.01	0.42	13
		2	24	3,500	1.6	320	<0.01	0.54	16
		2.2	14	740	0.33	620	0.02	0.4	10
	RG_FOBSC	<0.5	24	490	0.23	99	0.01	0.28	4.8
		0.58	12	320	0.18	97	0.011	0.82	3.4
		1.3	17	420	0.37	260	0.02	0.25	7.1
	RG_FOBCP	0.68	10	330	0.13	34	0.12	0.53	15
		0.79	7.7	470	0.27	92	0.013	0.44	22
		0.62	12	380	0.22	43	0.011	0.17	15
	RG_FRUPO	1	12	1,600	0.85	63	<0.01	0.28	3.5
		0.9	14	1,400	0.86	69	<0.01	0.31	3.9
		1.9	14	5,000	2.6	140	0.01	0.62	9.8
	RG_FODPO	0.06	1.1	120	0.06	4.2	<0.005	0.03	0.3
		<0.5	14	980	0.41	35	<0.01	0.21	2.4
		1.2	12	2,900	1.5	88	0.01	0.45	6
	RG_FO22	2.6	11	9,600	3.4	320	0.01	0.66	14
		1.8	11	4,900	2.2	230	0.01	0.58	8.9
		1.9	12	5,900	2.8	290	0.02	0.57	9.6
	RG_FOUEW	0.41	15	420	0.21	110	<0.01	0.18	1.7
		0.9	14	1,600	0.67	230	0.01	0.29	3.8
		1	13	1,200	0.65	130	<0.01	0.26	4

Table B.23: Composite-Taxa Benthic Invertebrate Tissue Chemistry, FRO LAEMP, December 2018

Exposure Type	Biological Monitoring Area	Selenium ug/g	Silver ug/g	Strontium ug/g	Thallium ug/g	Tin ug/g	Titanium ug/g	Uranium ug/g	Vanadium ug/g
Reference	RG_HENUP	4.1	0.05	8.2	0.05	<0.1	3.9	0.12	6.3
		3.7	0.04	2	0.026	<0.05	4	0.047	2.1
		4	0.04	3.6	0.02	<0.2	5.1	0.16	3.1
Mine-exposed	RG_FODHE	7.8	0.1	5.8	0.02	<0.1	3.8	0.06	1.2
		7.6	0.11	5.1	0.03	<0.1	8.8	0.05	2
		3.8	0.12	20	0.05	<0.2	6.9	0.36	6.2
	RG_FOUNGD	6	0.05	4.8	0.02	<0.2	4.6	0.09	2
		6.1	0.07	12	0.07	<0.2	8.4	0.21	12
		5	0.04	3.4	0.02	<0.1	2.3	0.08	1
	RG_FODNGD	4.7	0.08	11	0.04	<0.1	11	0.14	5.5
		4.2	0.06	7.2	0.02	<0.1	5.8	0.06	2.4
		7	0.05	4.3	0.02	<0.1	5.9	0.06	2.3
	RG_MP1	5.5	0.05	18	0.02	<0.2	6.4	0.11	3.6
		5	0.08	3.5	0.01	<0.2	3.3	0.05	2.6
		5.2	0.08	5.2	0.02	<0.2	3.8	0.05	2.5
	RG_FOUSH	6.6	0.06	7.8	0.08	<0.2	13	0.12	6.5
		6.8	0.06	7.6	0.04	<0.1	7.6	0.09	4.4
		5.3	0.12	6.8	0.03	<0.1	7.3	0.06	3.2
	RG_FOUKI	4.9	0.06	3.8	0.02	<0.2	2.1	0.03	0.9
		5.5	0.06	15	0.06	<0.1	9.6	0.14	7.5
		7.2	0.07	8.3	0.05	<0.1	12	0.11	4.6
	RG_FOBKS	3.8	0.08	20	0.07	<0.2	20	0.21	9.8
		3.8	0.11	32	0.12	<0.2	40	0.35	18
		6.6	0.09	15	0.03	<0.1	7.8	0.14	3.3
	RG_FOBSC	8	0.12	8.1	0.03	<0.2	6.3	0.08	2
		9.2	0.05	4.2	0.019	<0.05	5.6	0.039	1.3
		7.6	0.09	6.8	0.07	<0.2	6.3	0.05	2
	RG_FOBCP	39	0.19	19	0.06	<0.05	3.8	1.2	1.4
		8.4	0.02	30	0.082	<0.05	7.9	1.5	2.6
		7	0.09	30	0.068	<0.05	6.6	1.6	2.1
	RG_FRUPO	5.3	0.06	11	0.05	<0.1	12	0.23	7.5
		5.1	0.09	12	0.04	<0.2	15	0.27	7.3
		5	0.09	78	0.13	<0.2	26	0.67	23
	RG_FODPO	0.33	<0.01	1.3	<0.005	<0.05	1	0.03	0.6
		4.4	0.05	7.1	0.04	<0.2	8.9	0.13	6
		5.4	0.08	16	0.08	<0.2	18	0.44	12
	RG_FO22	3.4	0.08	50	0.16	<0.2	33	0.54	37
		3.9	0.08	27	0.16	<0.2	34	0.31	30
		5.6	0.1	30	0.15	<0.2	27	0.5	27
	RG_FOUEW	4.8	0.12	9	0.02	<0.1	5.1	0.12	2
		5.5	0.12	13	0.04	<0.2	7.5	0.16	6.9
		4.7	0.12	10	0.04	<0.2	9.2	0.14	5.8

Table B.23: **Composite-Taxa Benthic Invertebrate Tissue Chemistry, FRO LAEMP, December 2018**

Exposure Type	Biological Monitoring Area	Zinc ug/g	Moisture %
Reference	RG_HENUP	170	81.7
		130	74.56
		150	74.94
Mine-exposed	RG_FODHE	230	94.03
		210	88.27
		130	86.17
	RG_FOUNGD	160	79.14
		170	83.58
		250	81.22
	RG_FODNGD	210	76.68
		190	83.39
		190	75.2
	RG_MP1	200	75.37
		130	72.84
		150	80.3
	RG_FOUSH	350	73.38
		170	71.49
		280	75.45
	RG_FOUKI	260	77.77
		240	85.21
		250	90.25
	RG_FOBKS	150	74.72
		240	79.11
		230	73.87
	RG_FOBSC	250	74.07
		180	70.77
		300	81.08
	RG_FOBCP	310	79.49
		84	74.33
		400	67.11
	RG_FRUPO	160	87.03
		160	84.68
		140	75.09
	RG_FODPO	14	85.42
		140	81.1
		110	75.86
	RG_FO22	120	67.43
		100	77.73
		83	74.94
	RG_FOUEW	310	80.86
		210	74.85
		200	88.39

APPENDIX C

WATER

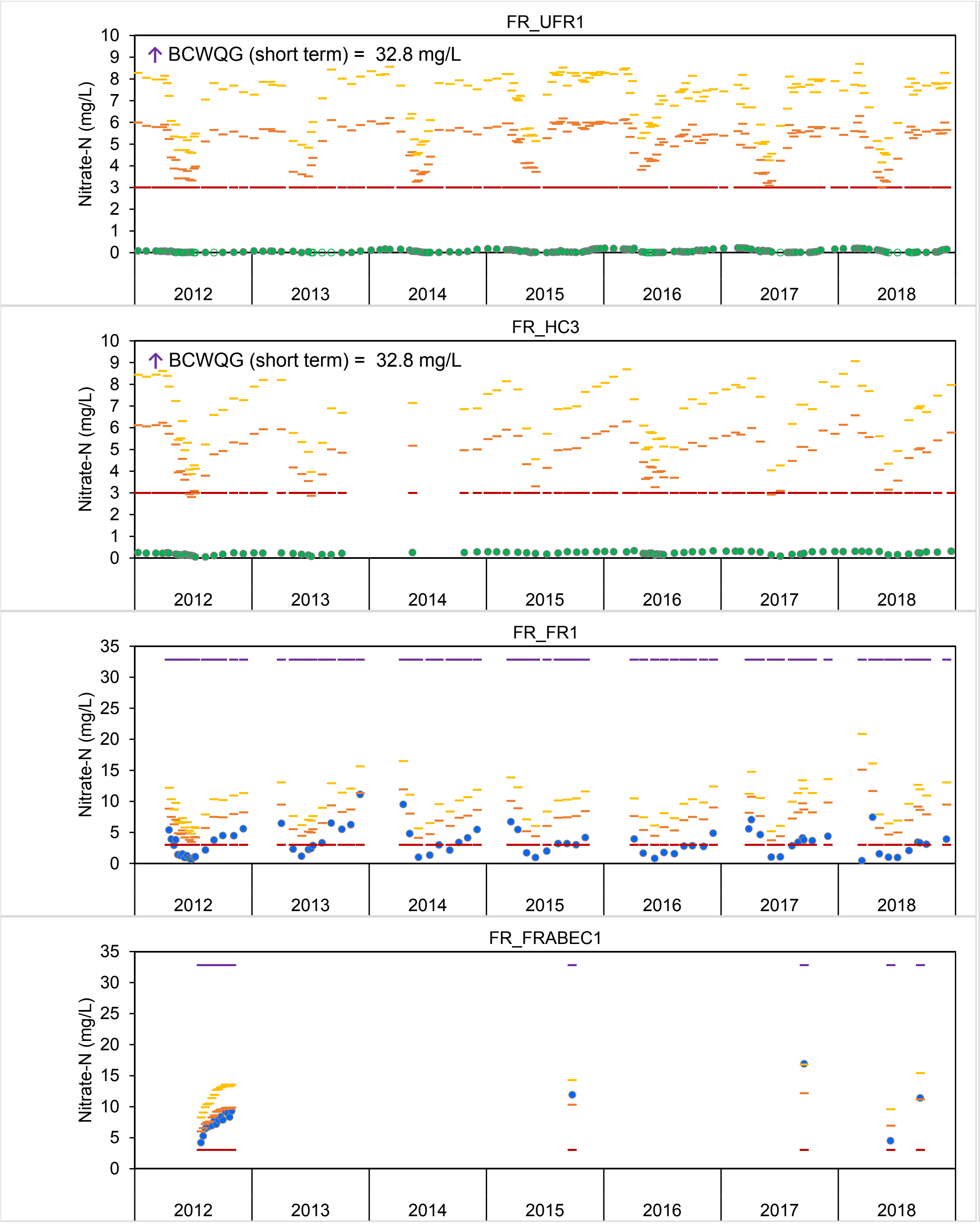


Figure C.1: Time Series Plots for Aqueous Nitrate-N Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term); – – = Level 1 Benchmark; – – = Level 2 Benchmark

● = Mine -exposed; ● = Reference.

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

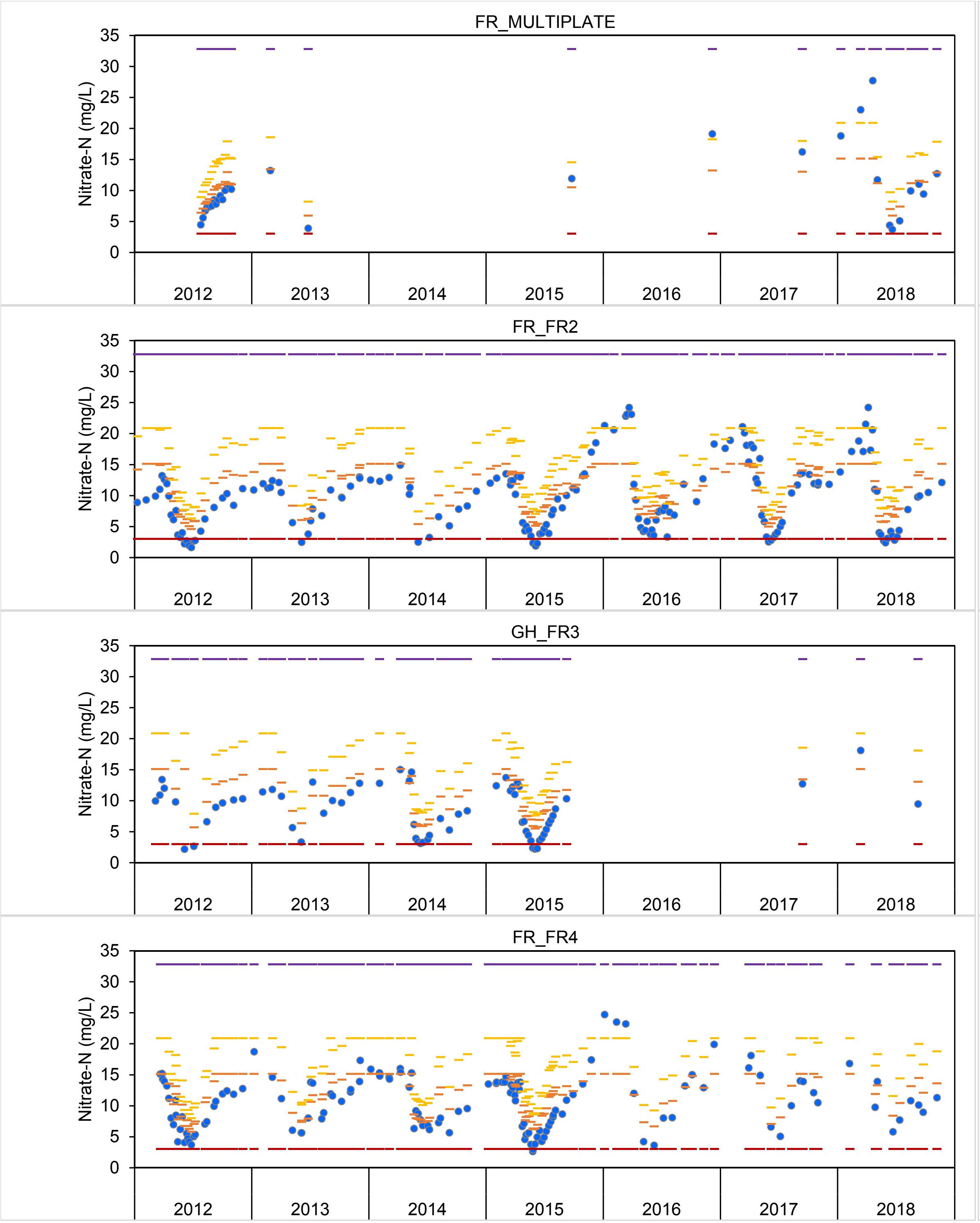


Figure C.1: Time Series Plots for Aqueous Nitrate-N Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term); – – = Level 1 Benchmark; – – = Level 2 Benchmark

● = Mine -exposed; ● = Reference.

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

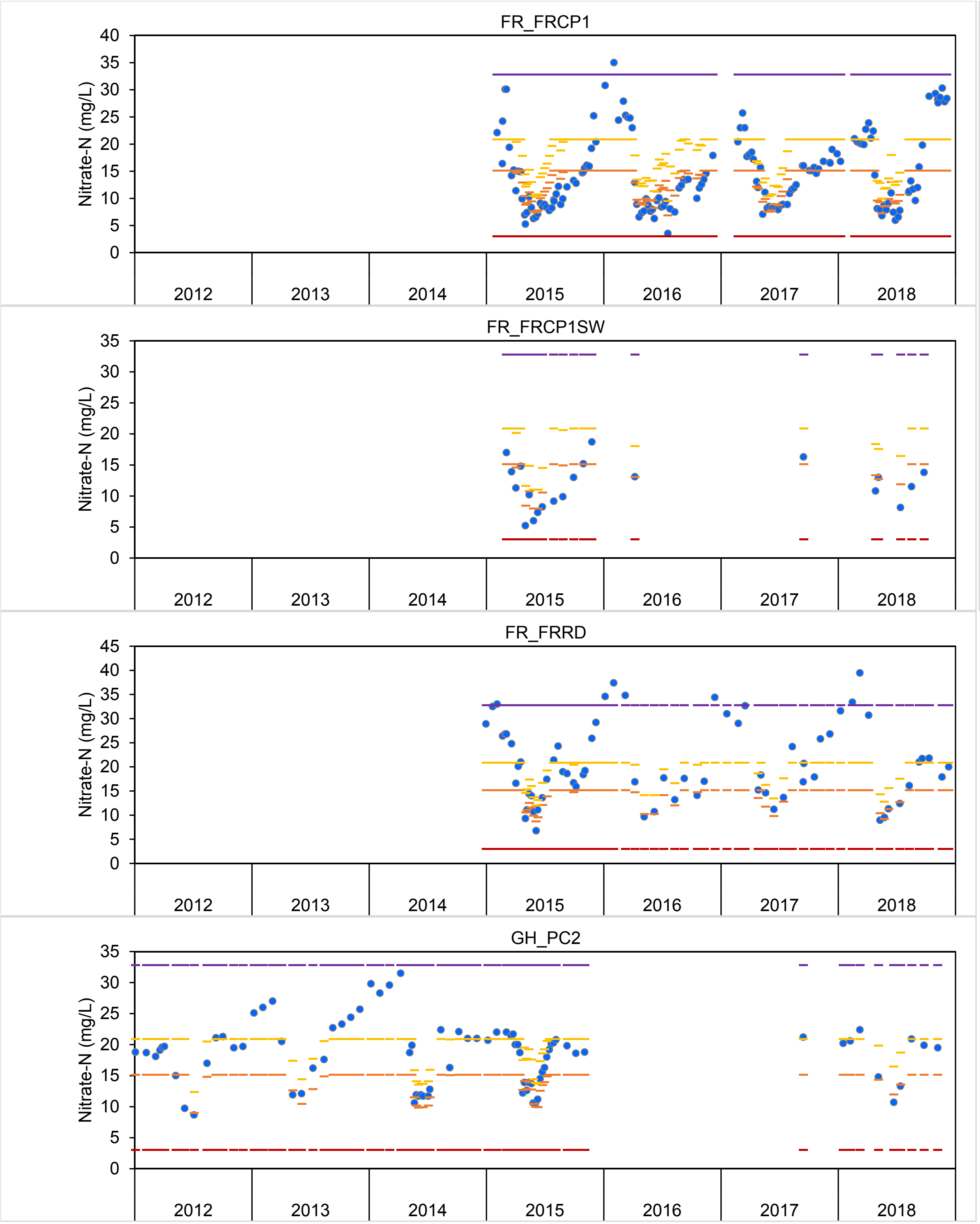


Figure C.1: Time Series Plots for Aqueous Nitrate-N Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term); – – = Level 1 Benchmark; – – = Level 2 Benchmark

● = Mine -exposed; ● = Reference.

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

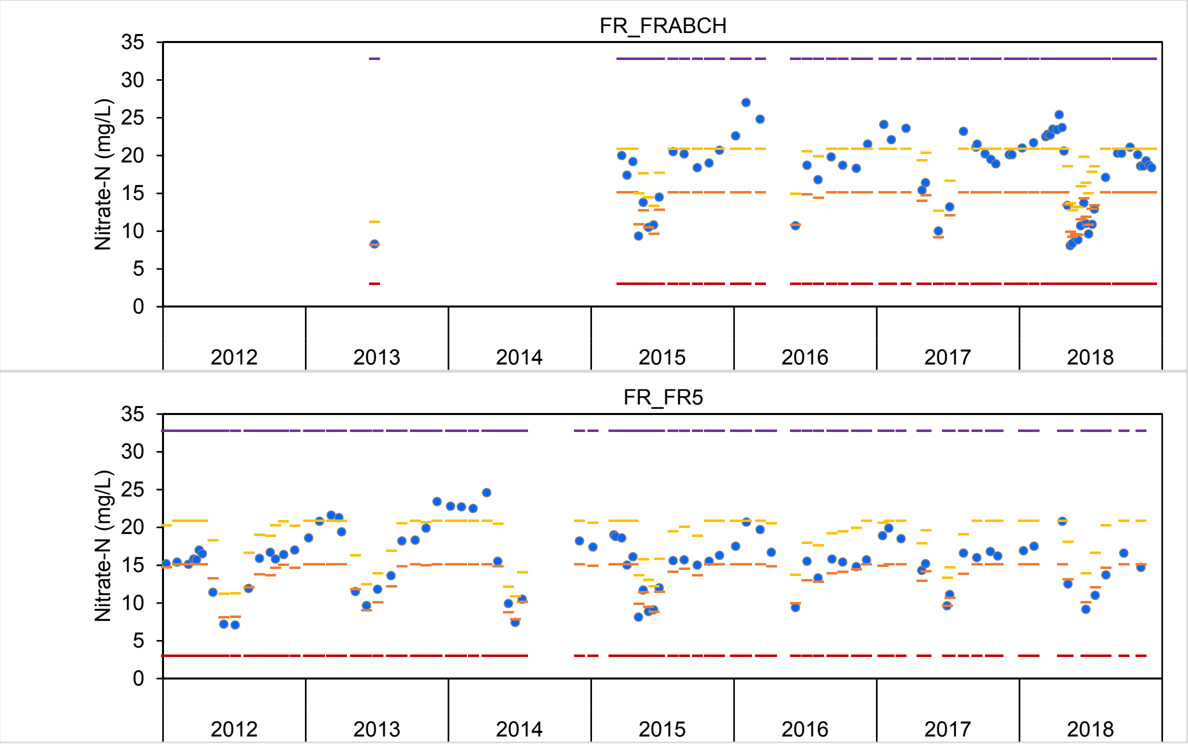


Figure C.1: Time Series Plots for Aqueous Nitrate-N Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term); – – = Level 1 Benchmark; – – = Level 2 Benchmark

● = Mine -exposed; ● = Reference.

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

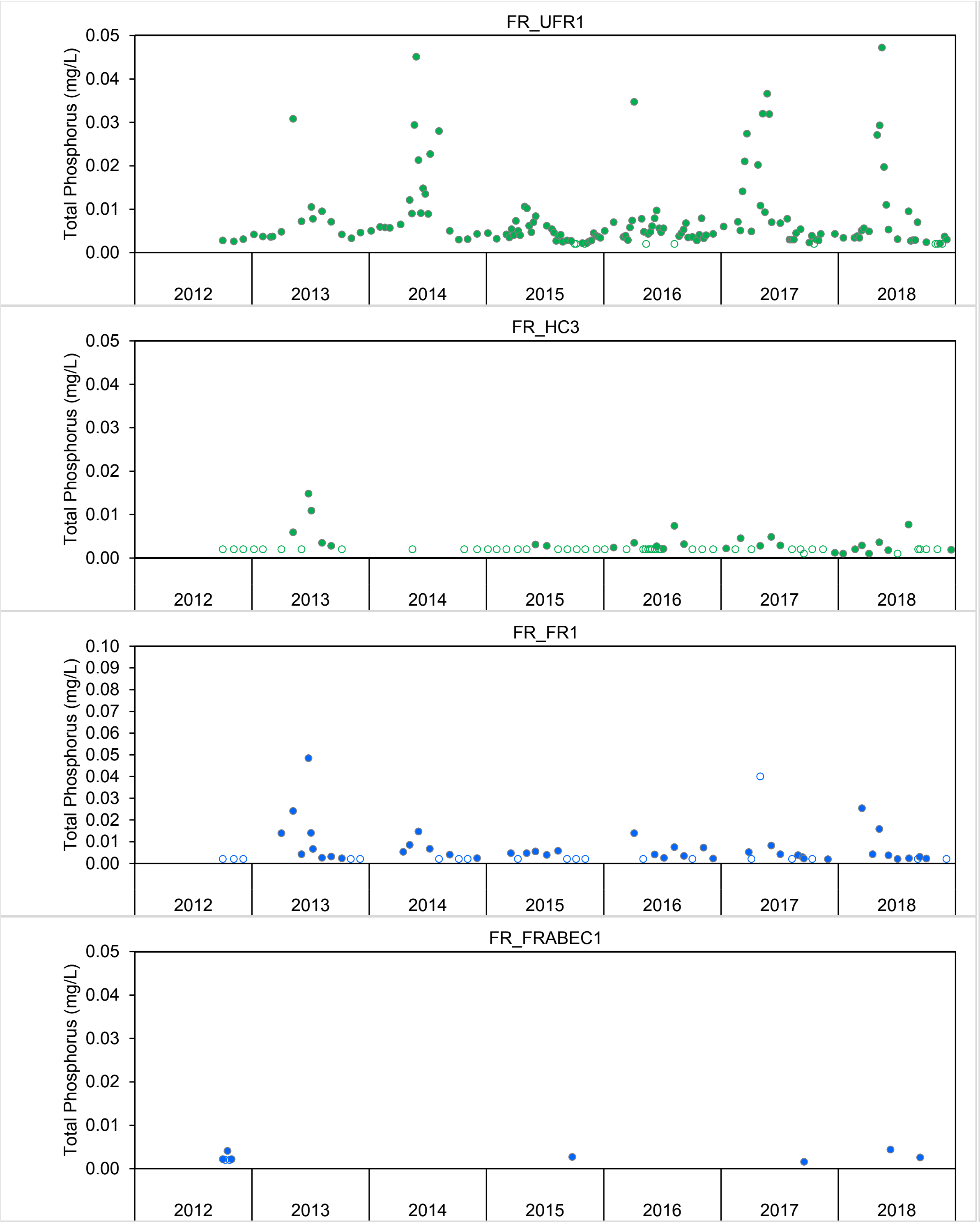


Figure C.2: Time Series Plots for Aqueous Total Phosphorus Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

● = Mine -exposed; ● = Reference.

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

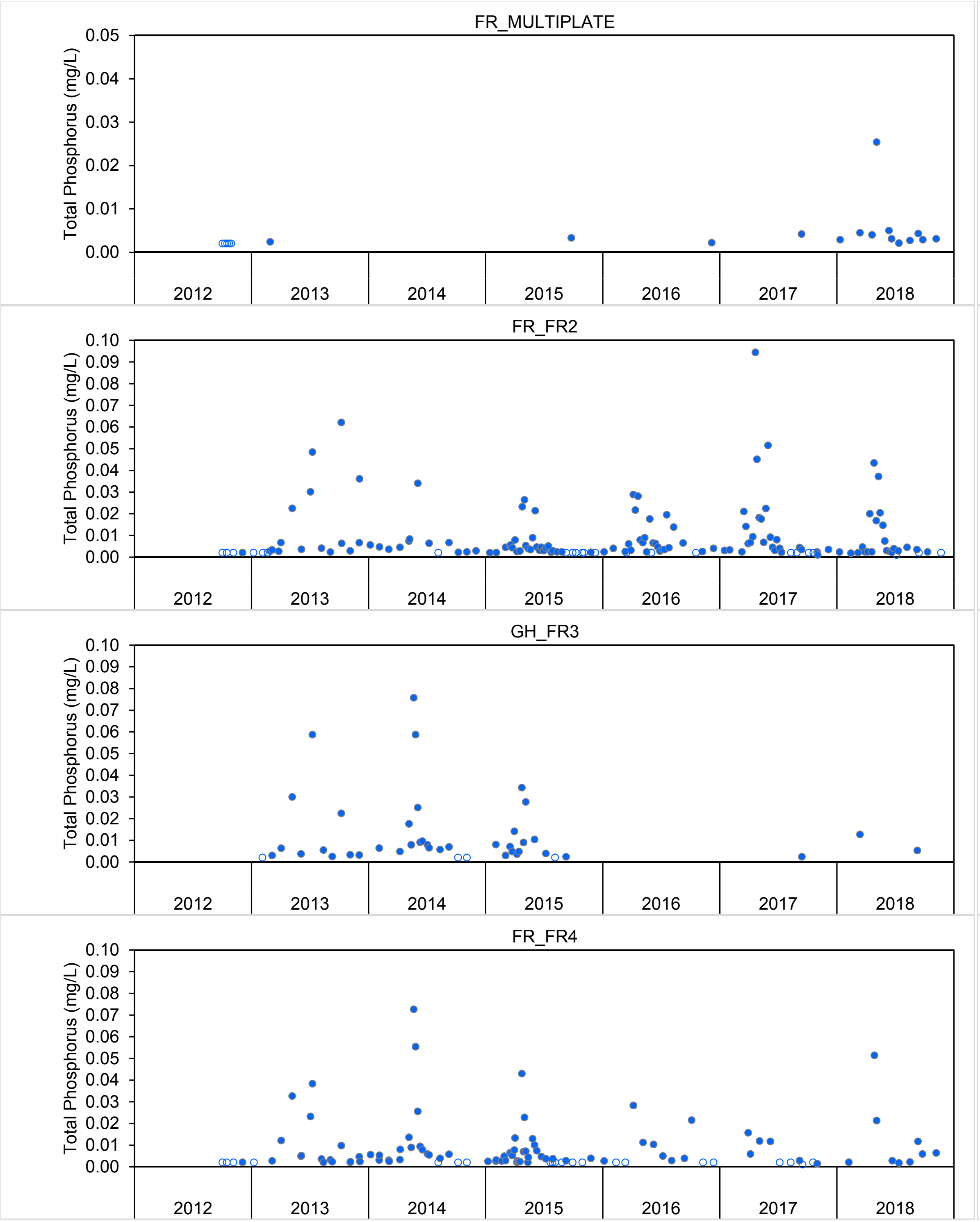


Figure C.2: Time Series Plots for Aqueous Total Phosphorus Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

● = Mine -exposed; ● = Reference.
Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

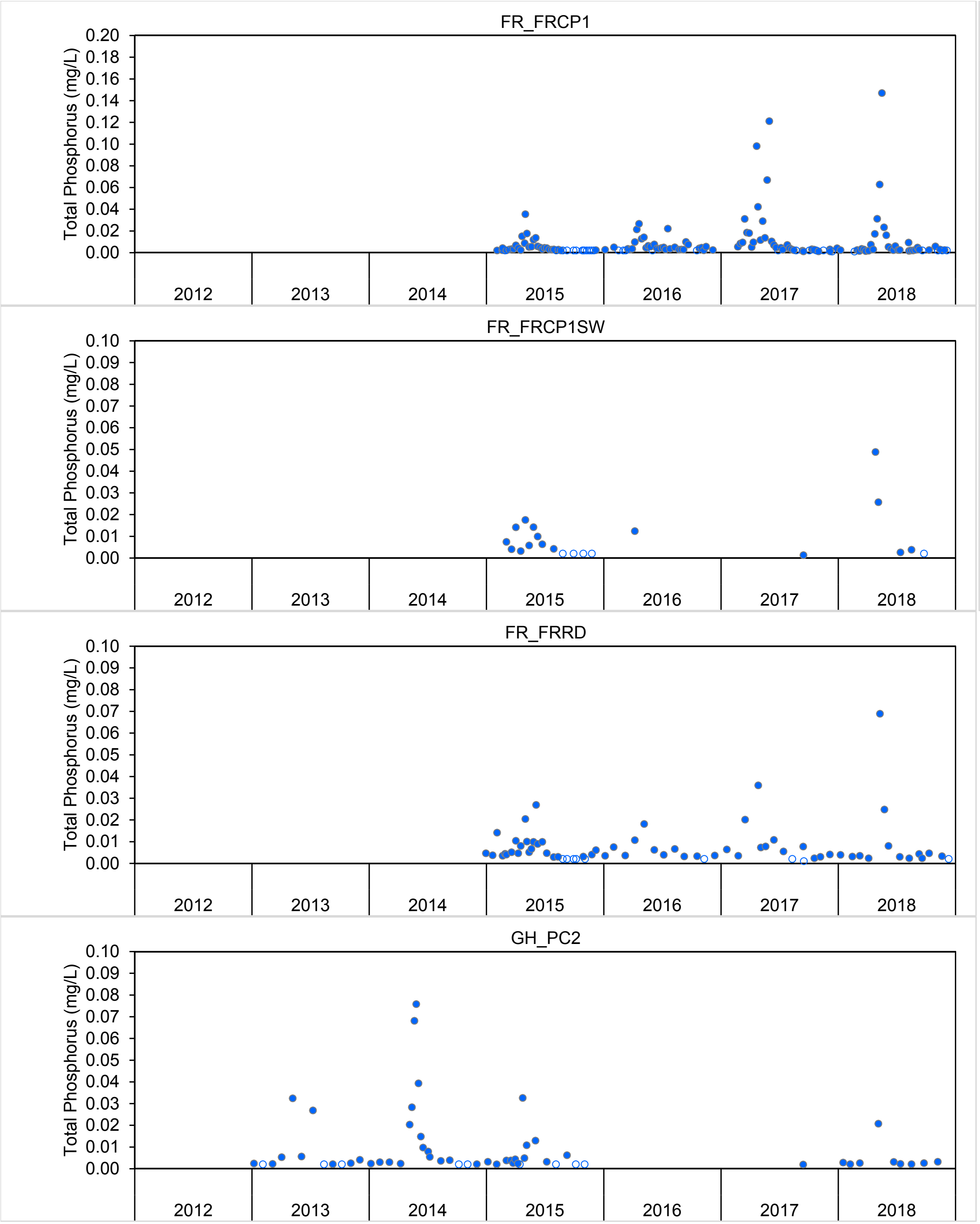


Figure C.2: Time Series Plots for Aqueous Total Phosphorus Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

● = Mine -exposed; ● = Reference.

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

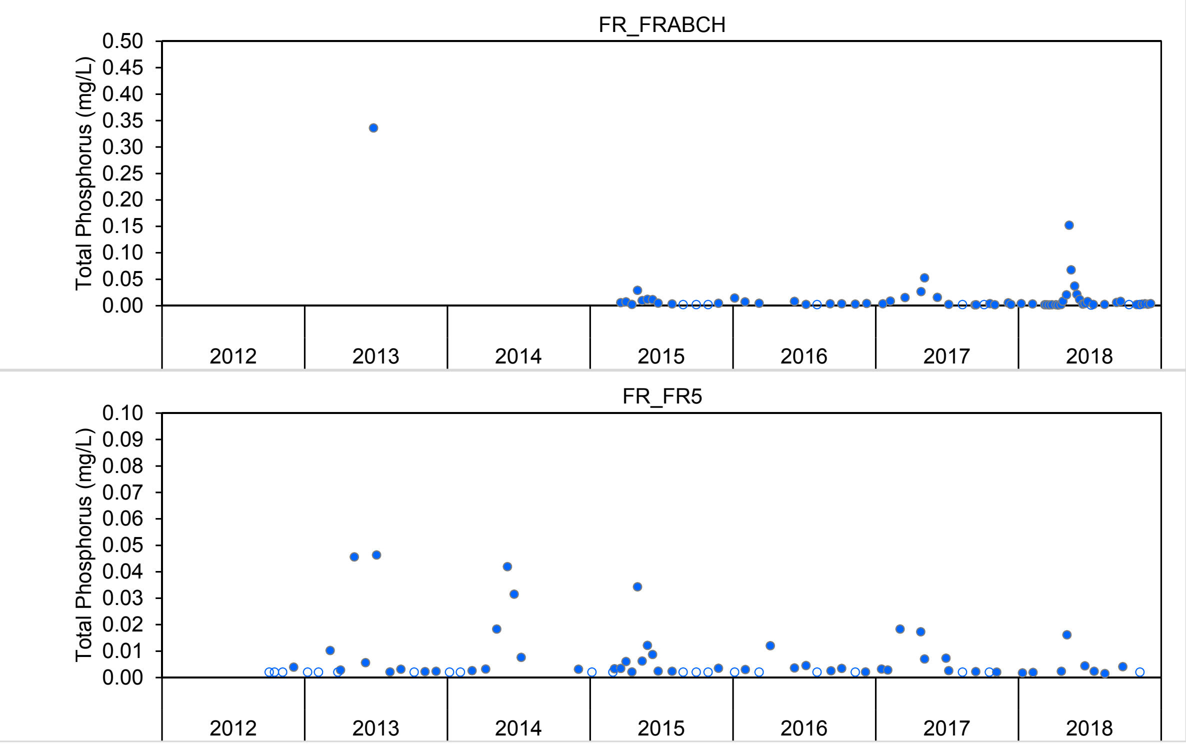


Figure C.2: Time Series Plots for Aqueous Total Phosphorus Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

● = Mine -exposed; ● = Reference.

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

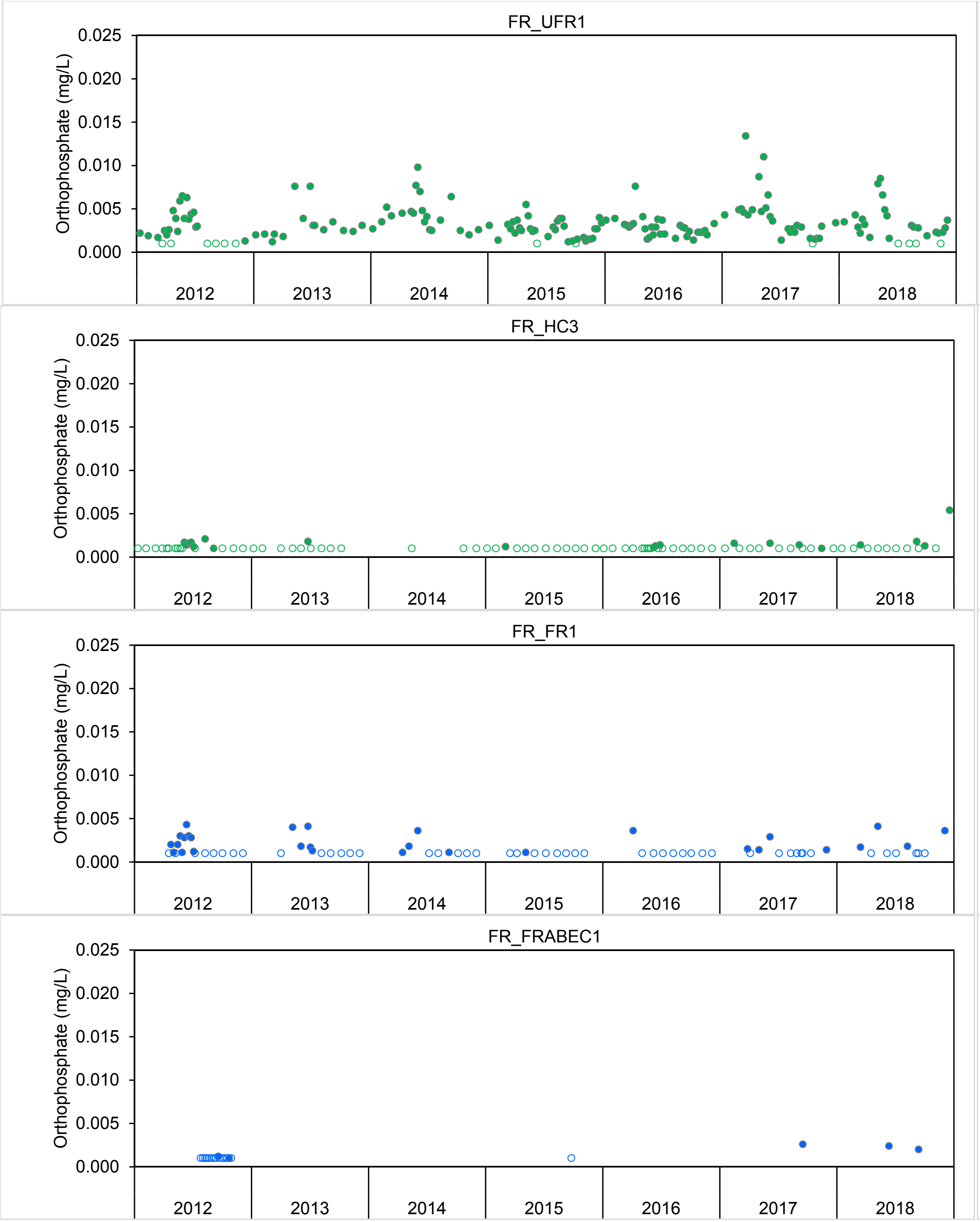


Figure C.3: **Time Series Plots for Aqueous Orthophosphate Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018**

● = Mine -exposed; ● = Reference.

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

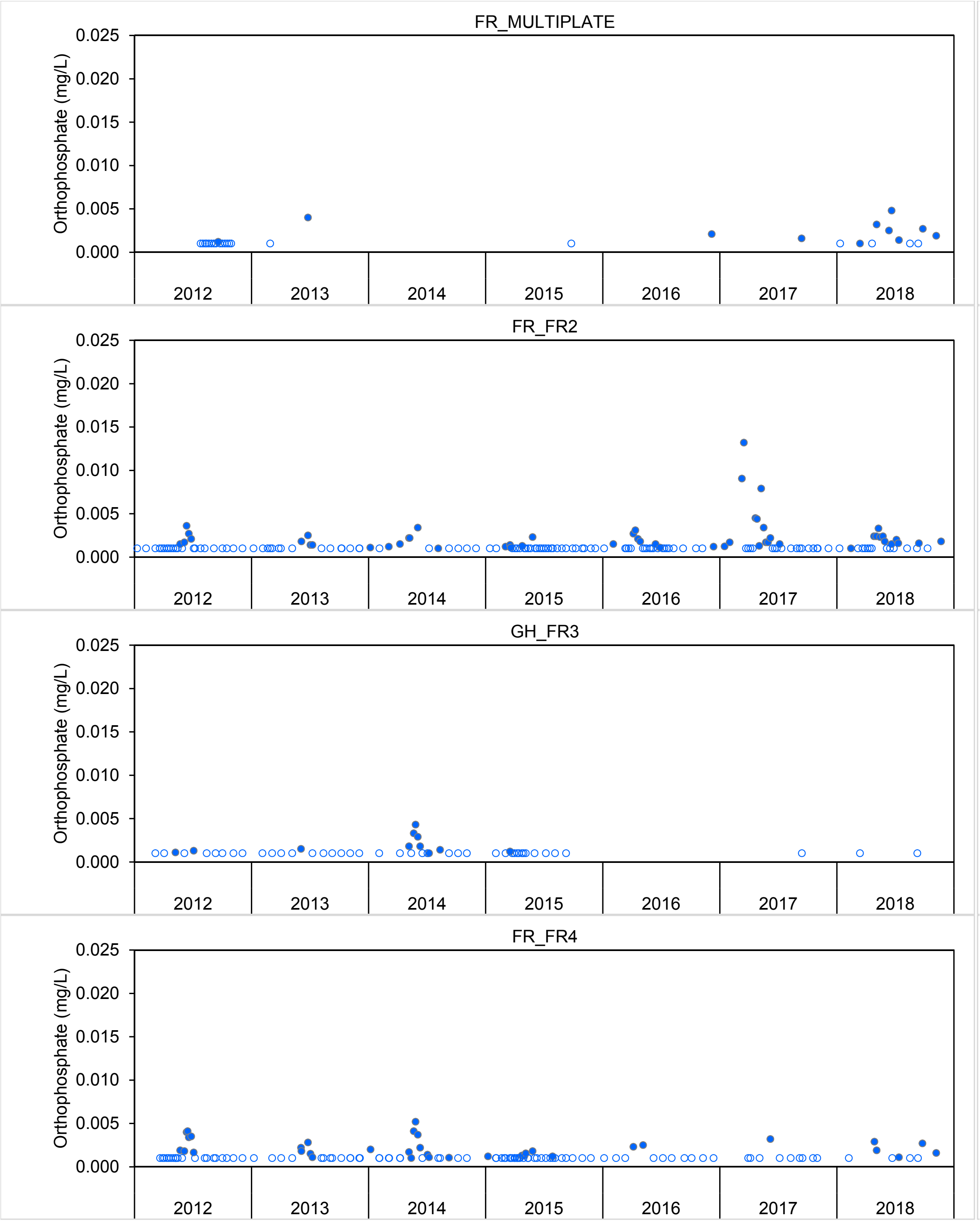


Figure C.3: **Time Series Plots for Aqueous Orthophosphate Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018**

● = Mine -exposed; ● = Reference.

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

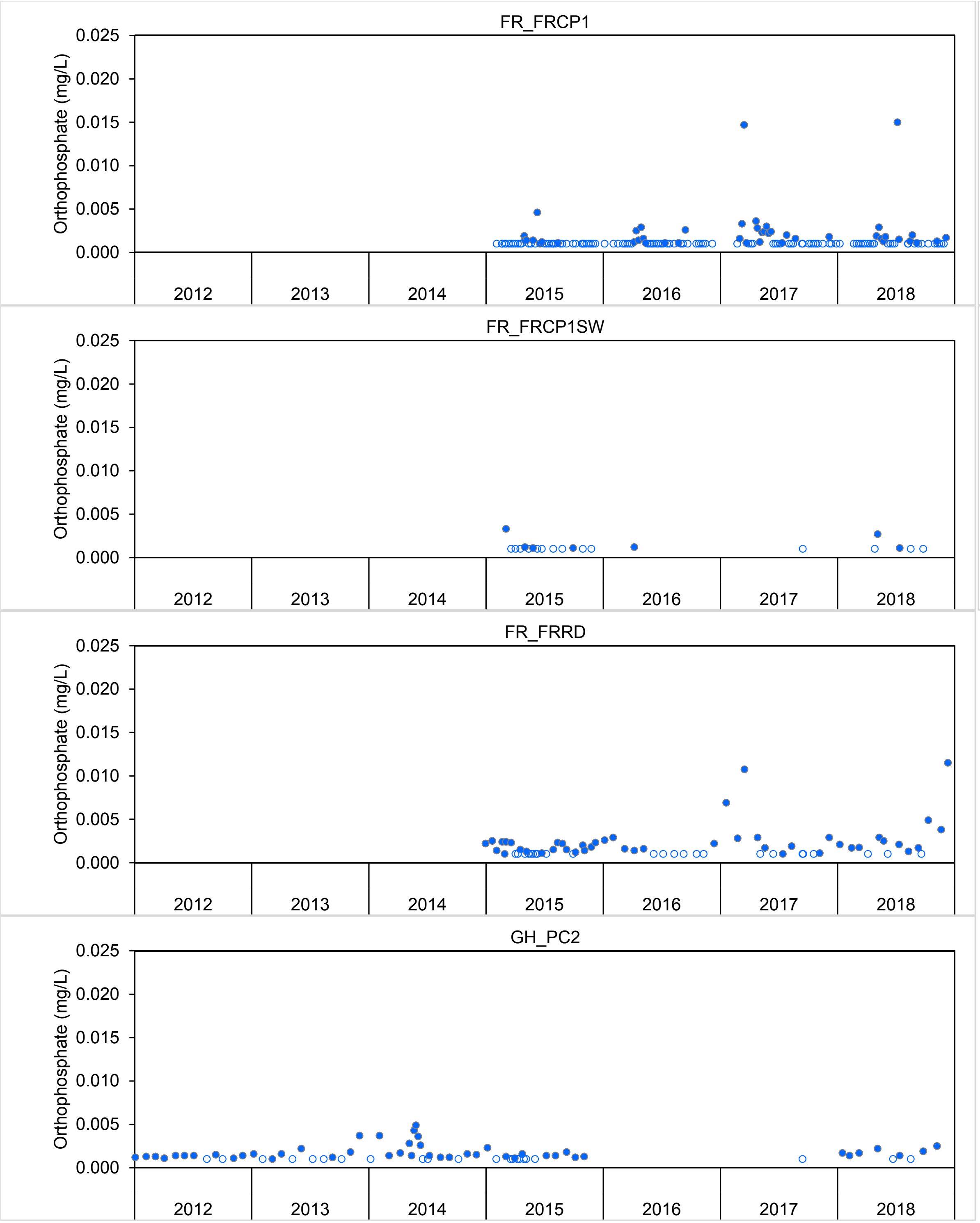


Figure C.3: **Time Series Plots for Aqueous Orthophosphate Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018**

● = Mine -exposed; ● = Reference.

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

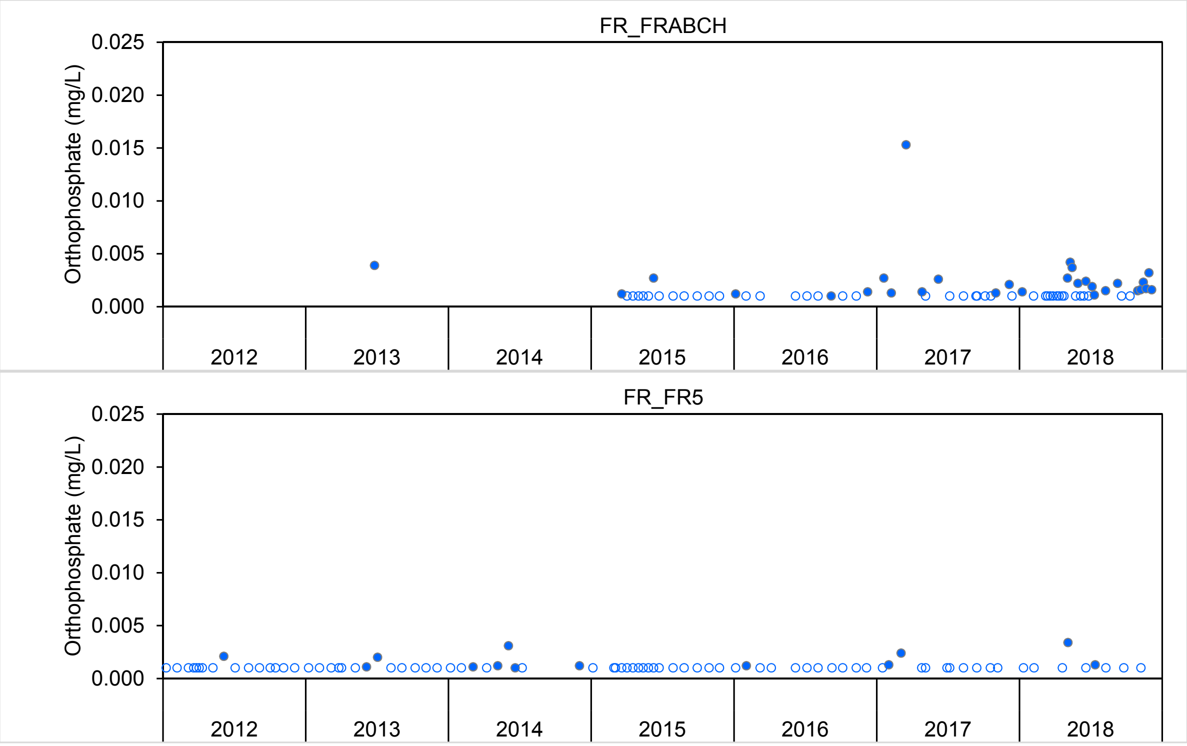


Figure C.3: Time Series Plots for Aqueous Orthophosphate Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

● = Mine -exposed; ● = Reference.

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

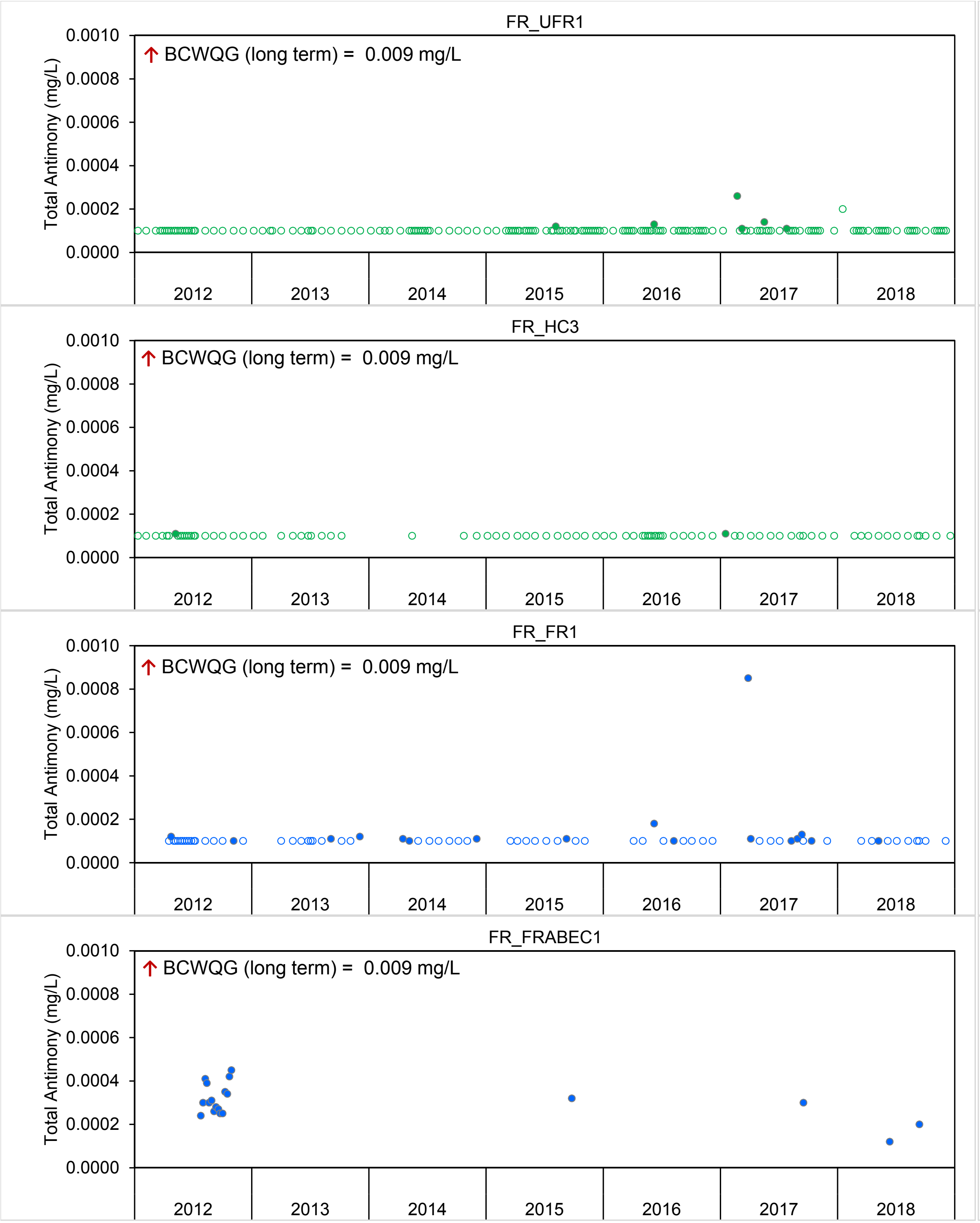


Figure C.4: Time Series Plots for Total Antimony Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term)

● = Mine -exposed; ● = Reference.

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

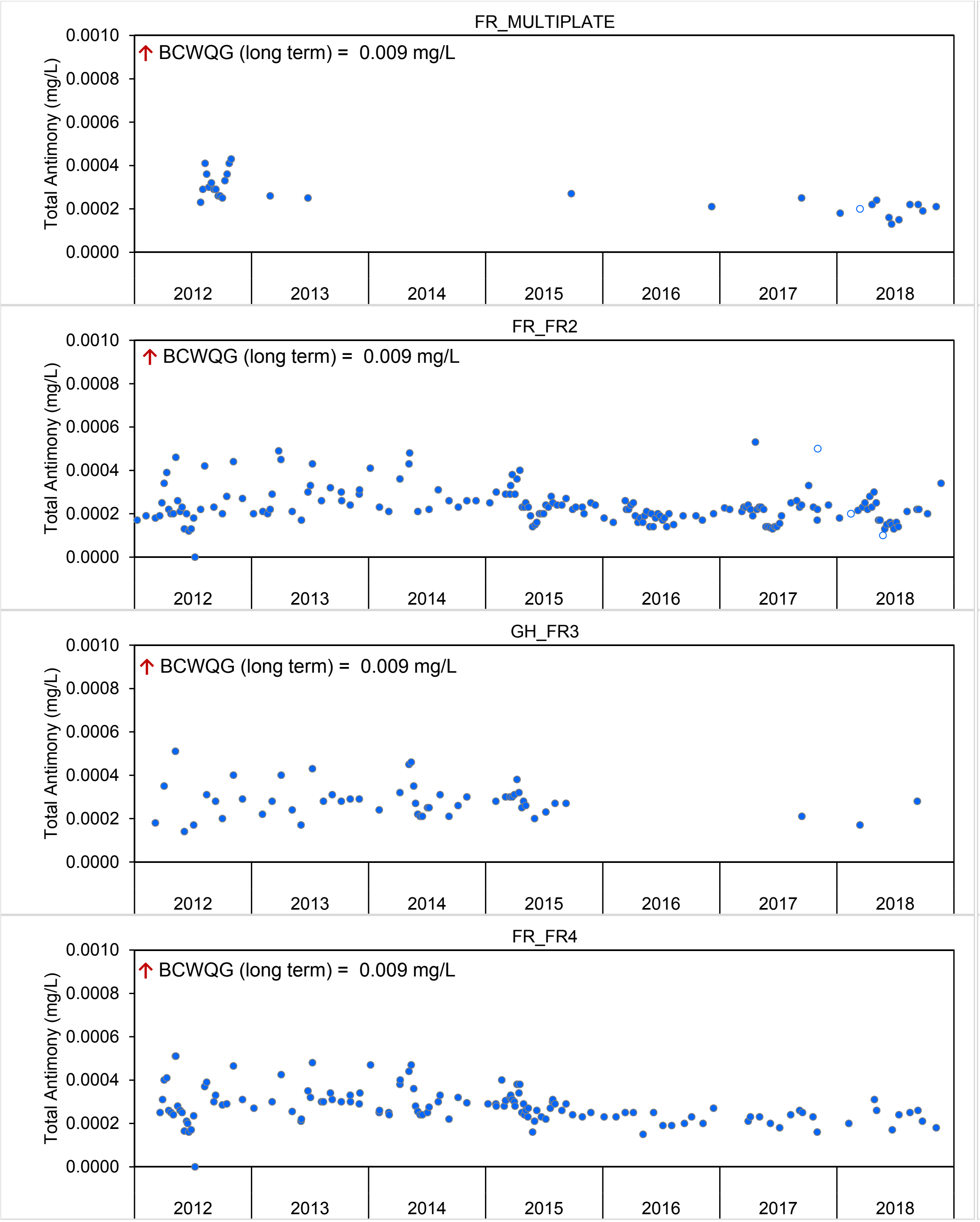


Figure C.4: **Time Series Plots for Total Antimony Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018**

– – = BCWQG (long term)

● = Mine -exposed; ● = Reference.

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

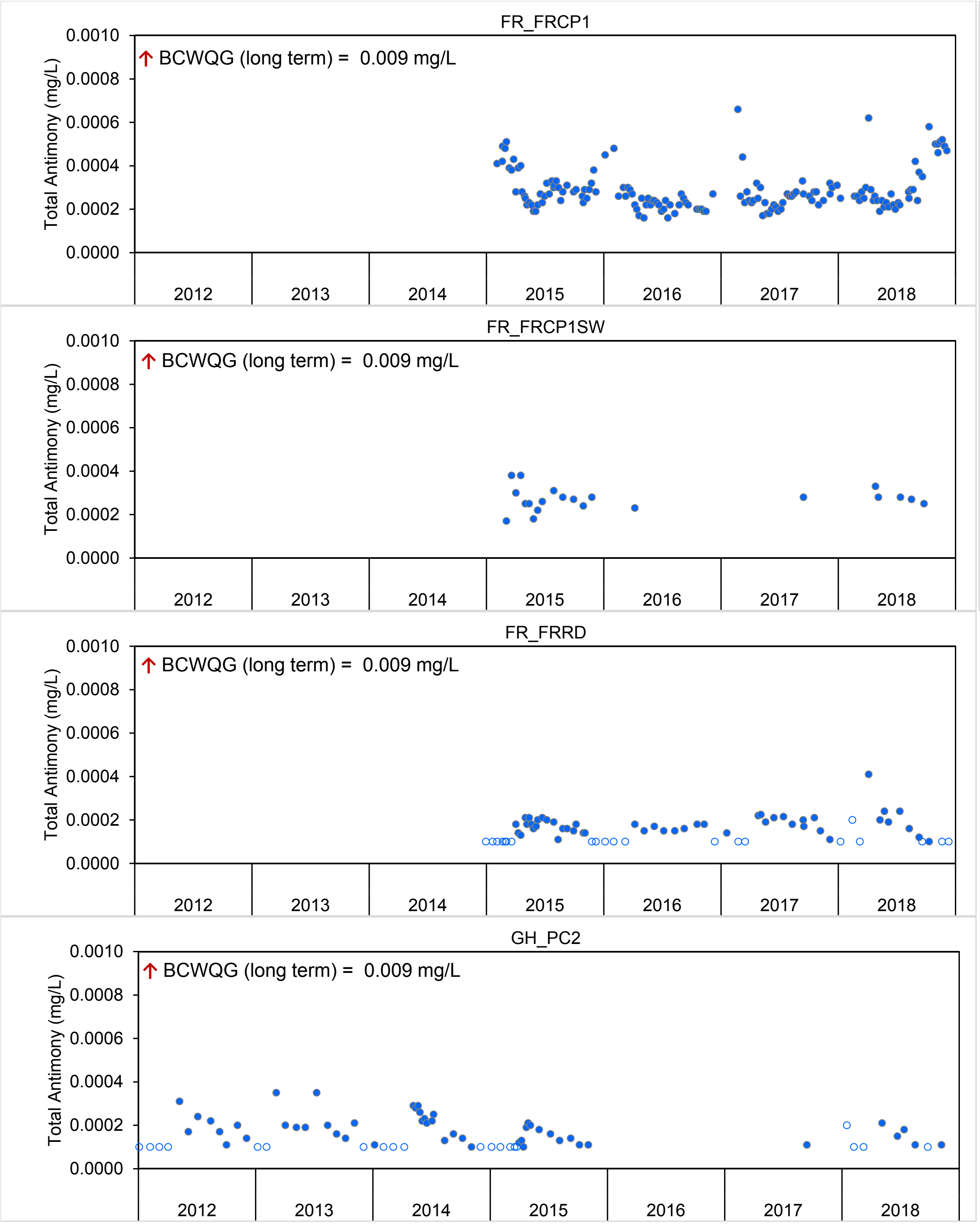


Figure C.4: Time Series Plots for Total Antimony Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term)

● = Mine -exposed; ● = Reference.

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

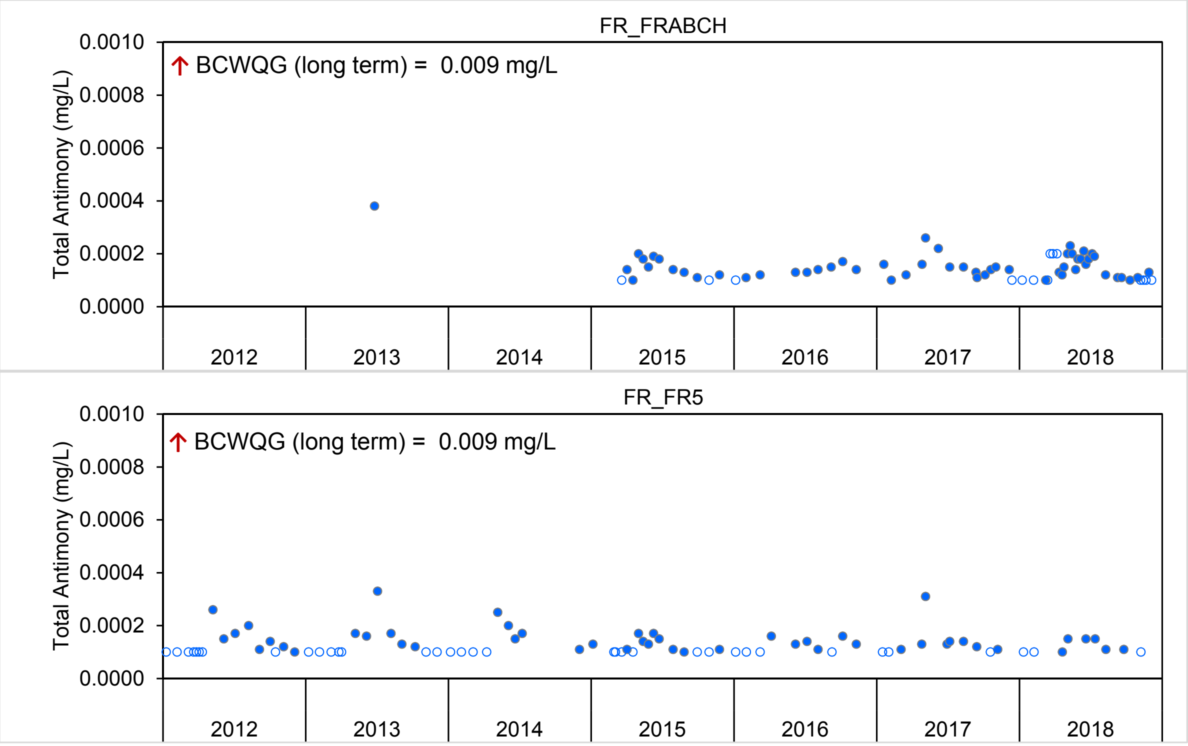


Figure C.4: Time Series Plots for Total Antimony Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term)

● = Mine -exposed; ● = Reference.

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

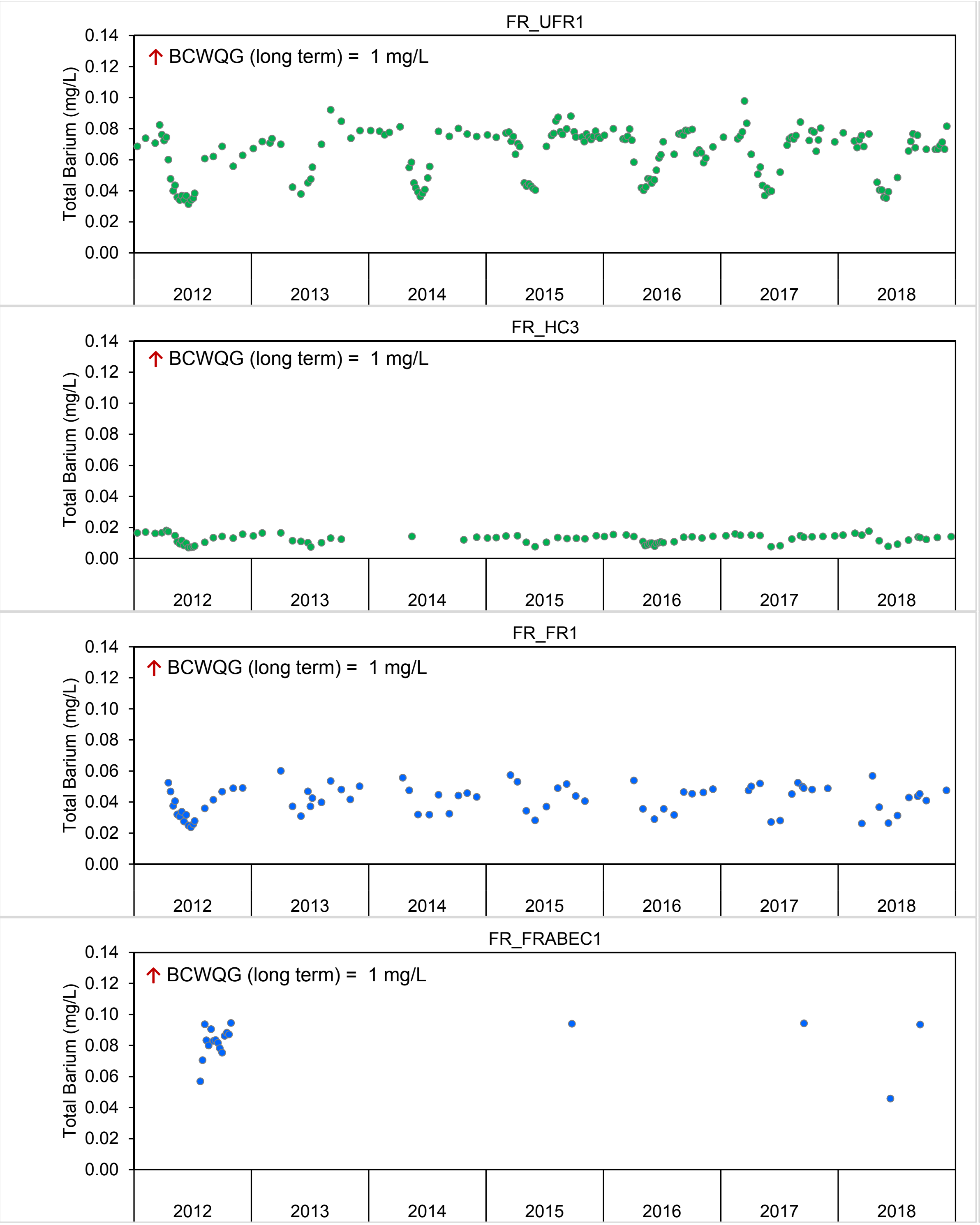


Figure C.5: Time Series Plots for Aqueous Total Barium Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

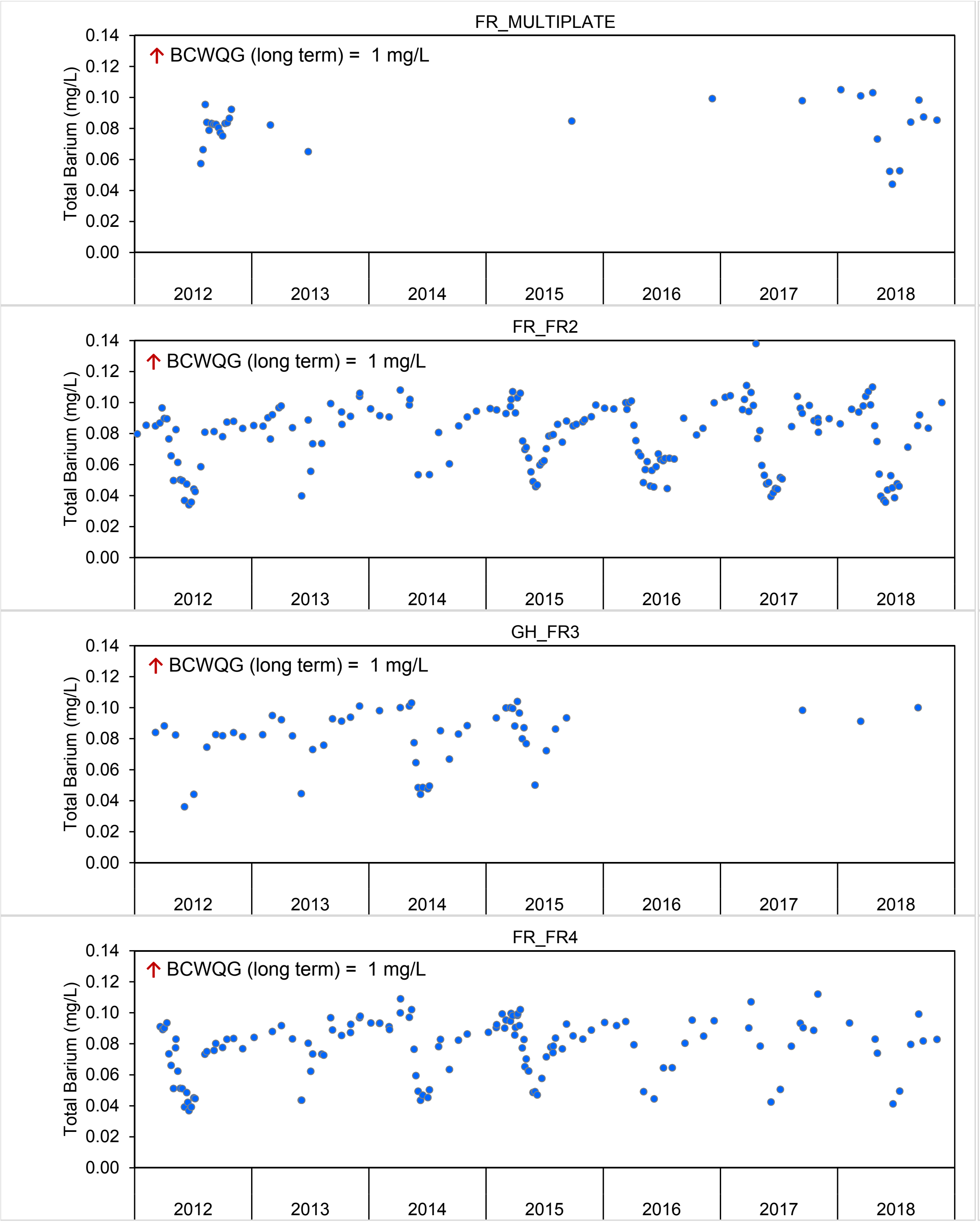


Figure C.5: Time Series Plots for Aqueous Total Barium Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

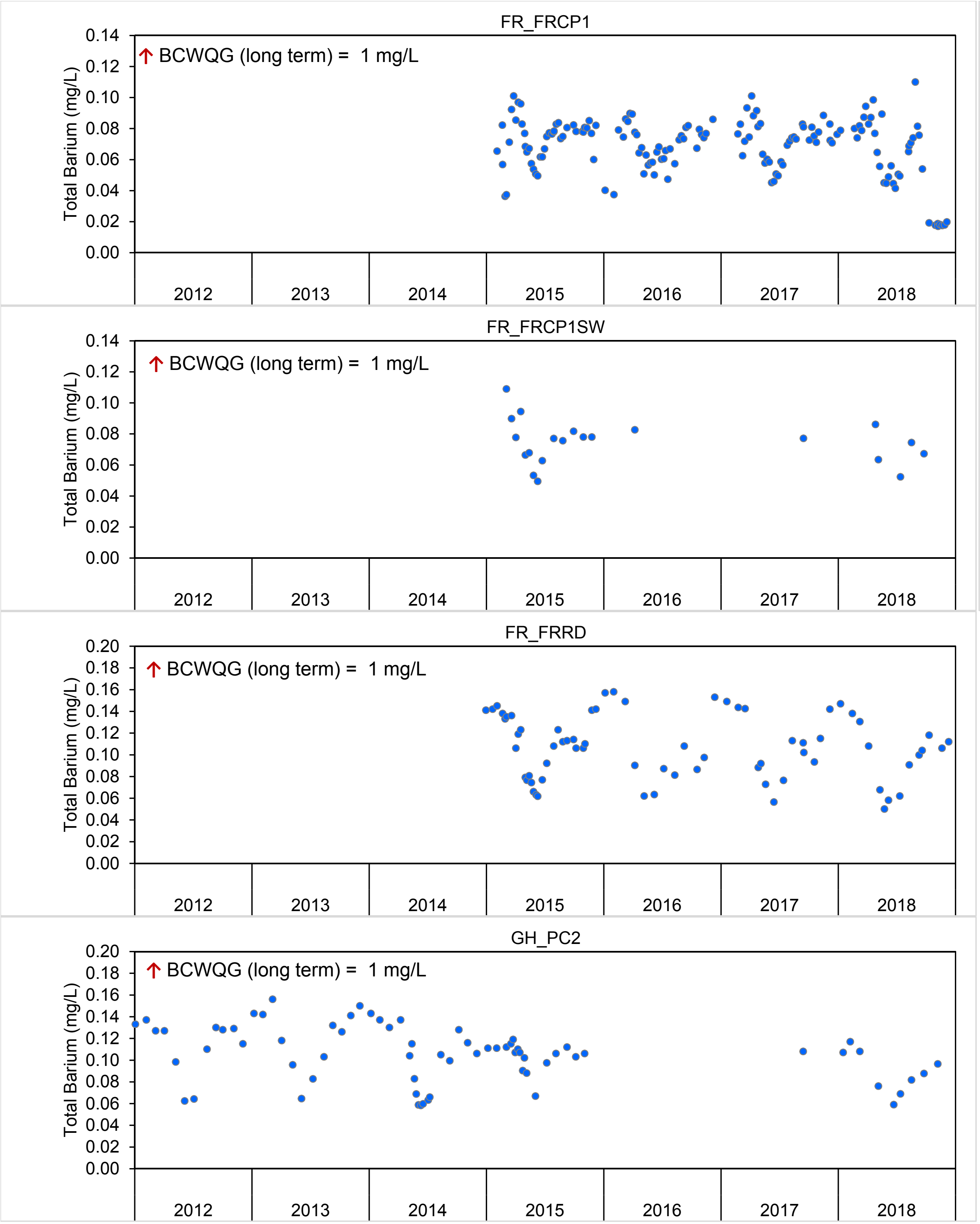


Figure C.5: Time Series Plots for Aqueous Total Barium Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

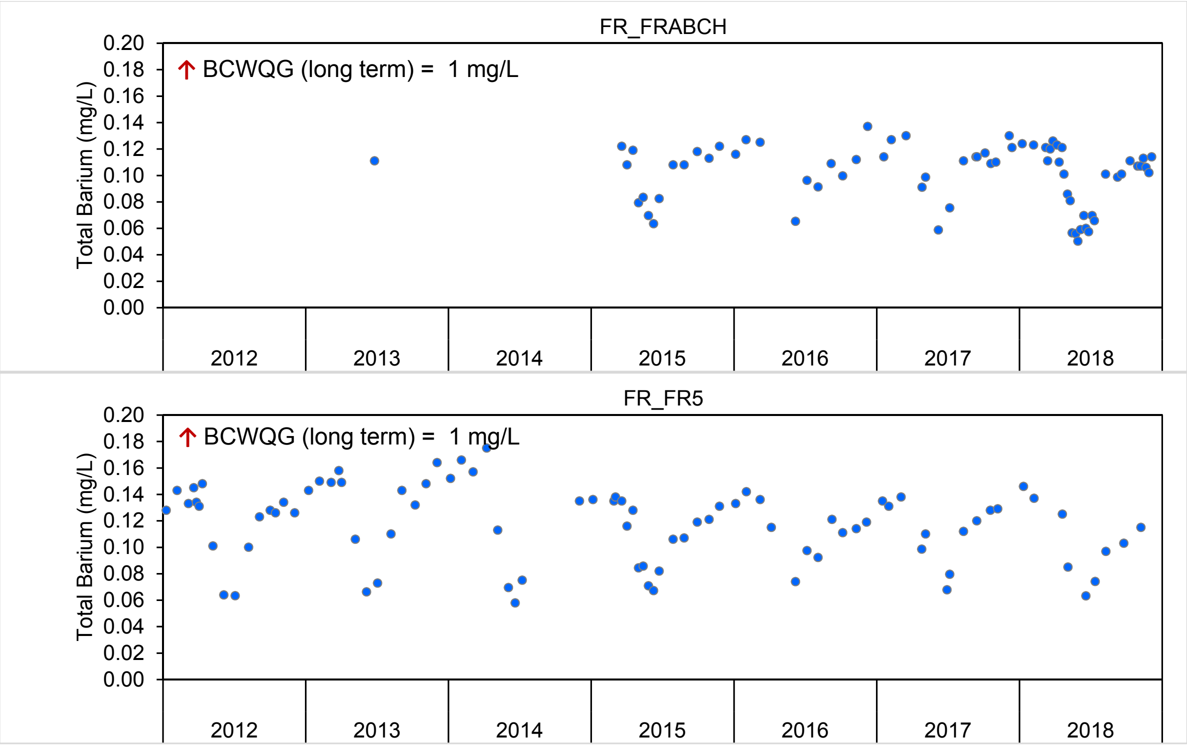


Figure C.5: **Time Series Plots for Aqueous Total Barium Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018**

– – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

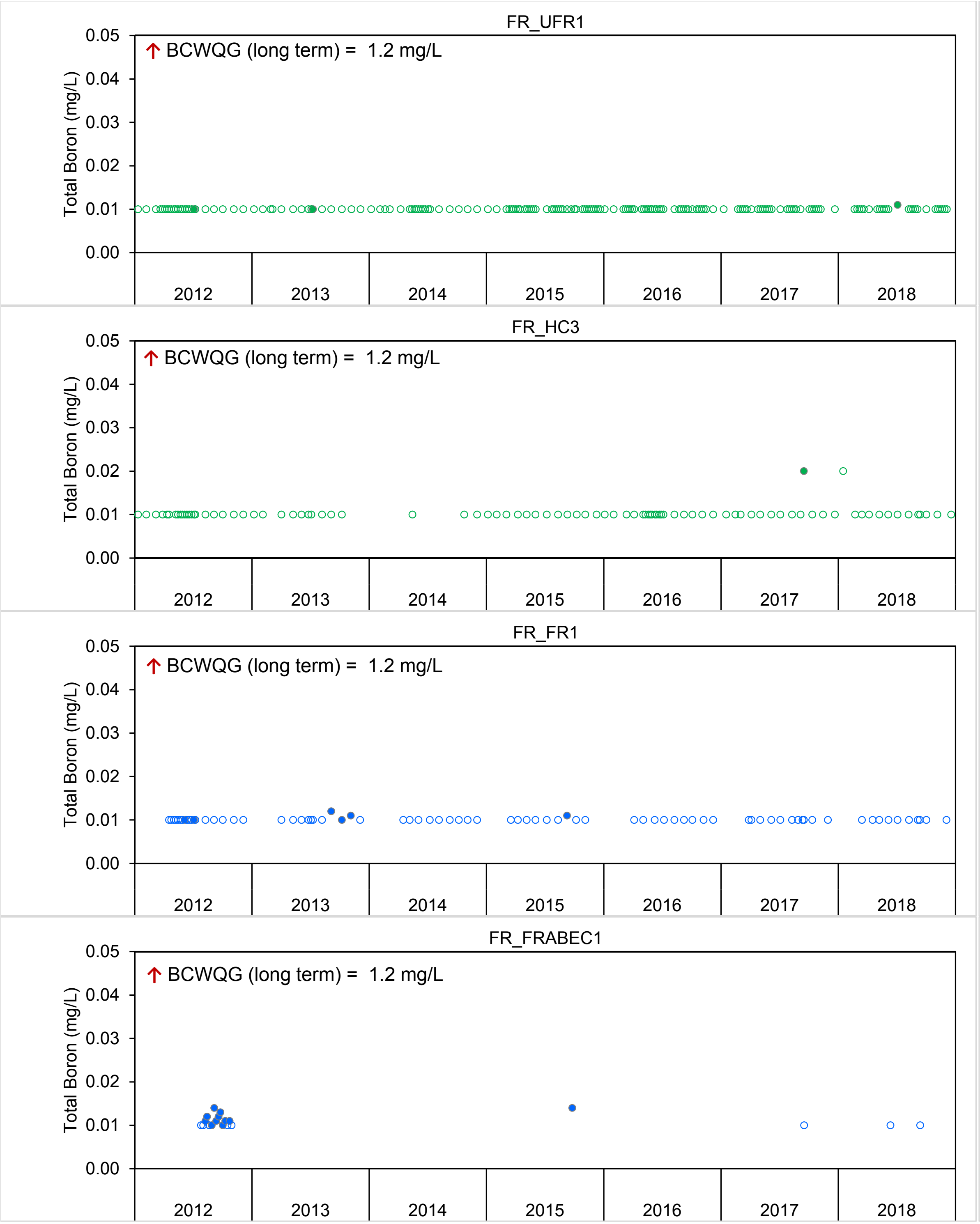


Figure C.6: Time Series Plots for Total Boron Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term)

● = Mine -exposed; ● = Reference.

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

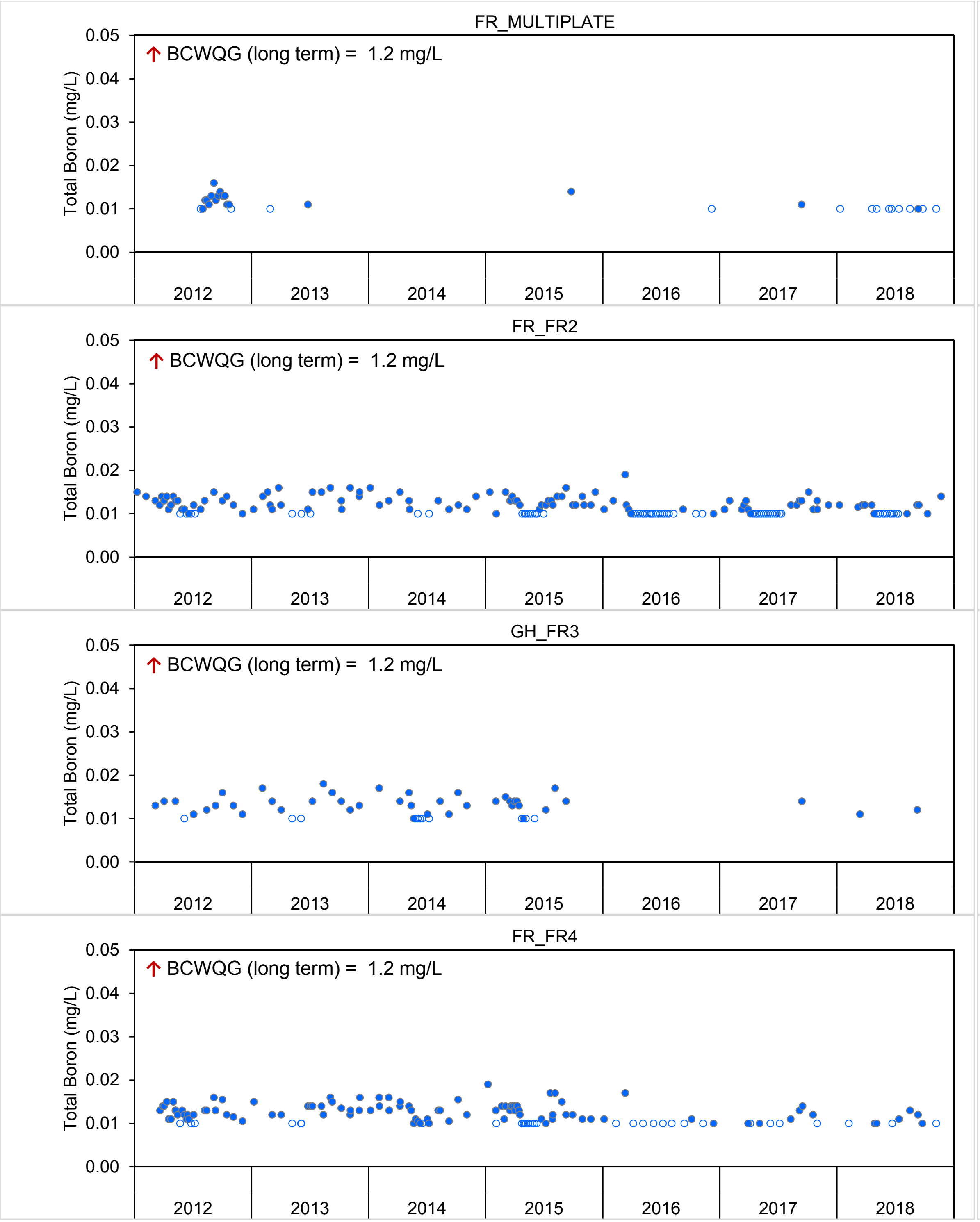


Figure C.6: Time Series Plots for Total Boron Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term)

● = Mine -exposed; ● = Reference.

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

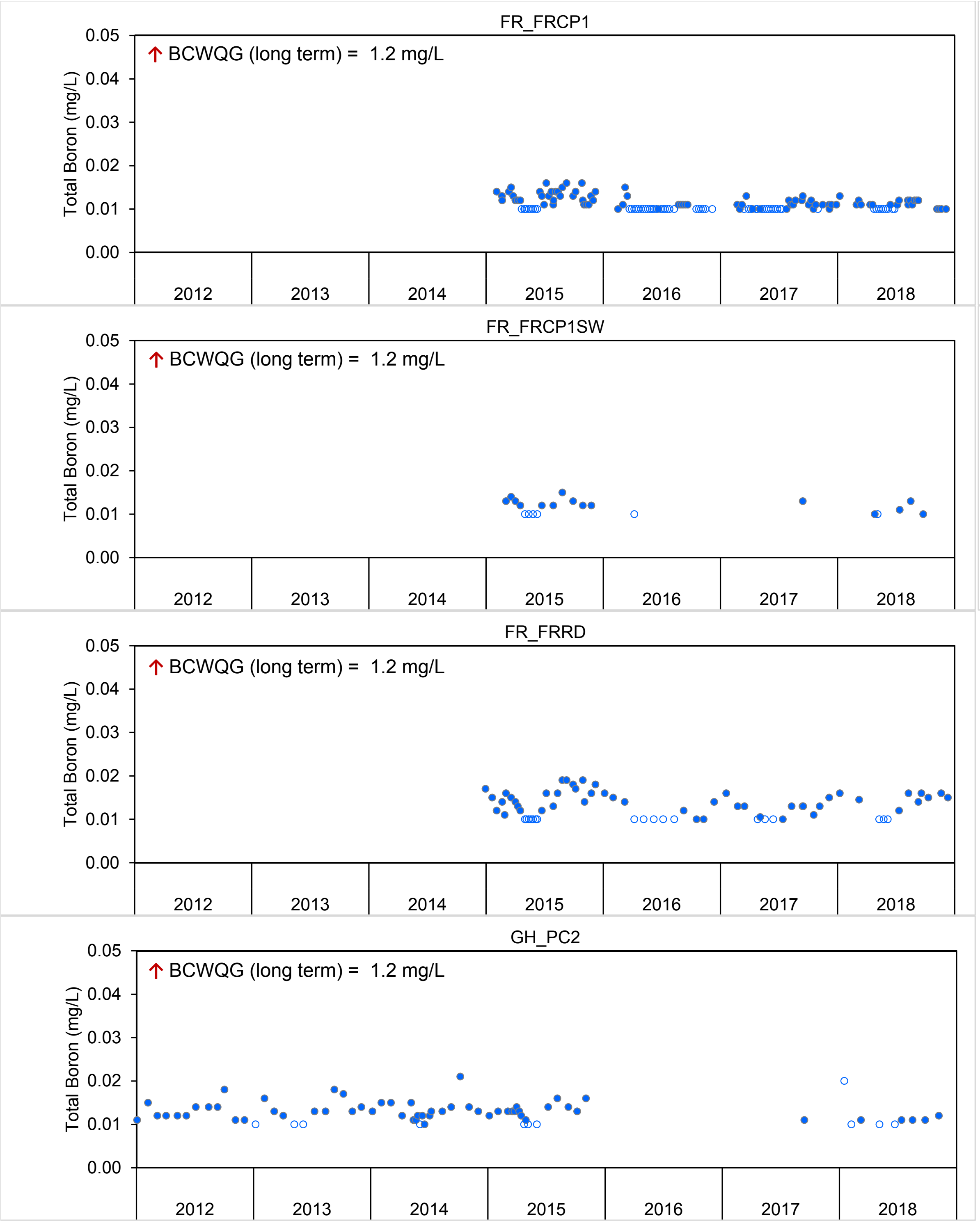


Figure C.6: Time Series Plots for Total Boron Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term)

● = Mine -exposed; ● = Reference.

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

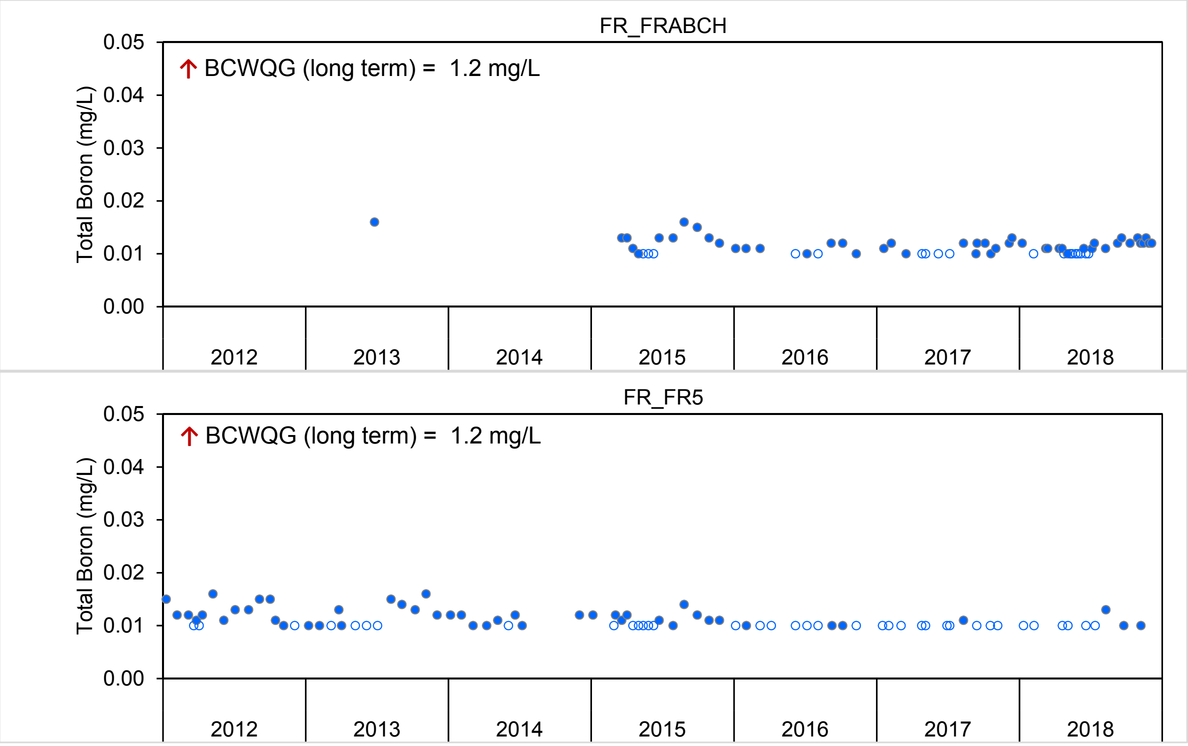


Figure C.6: Time Series Plots for Total Boron Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term)

● = Mine -exposed; ● = Reference.

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

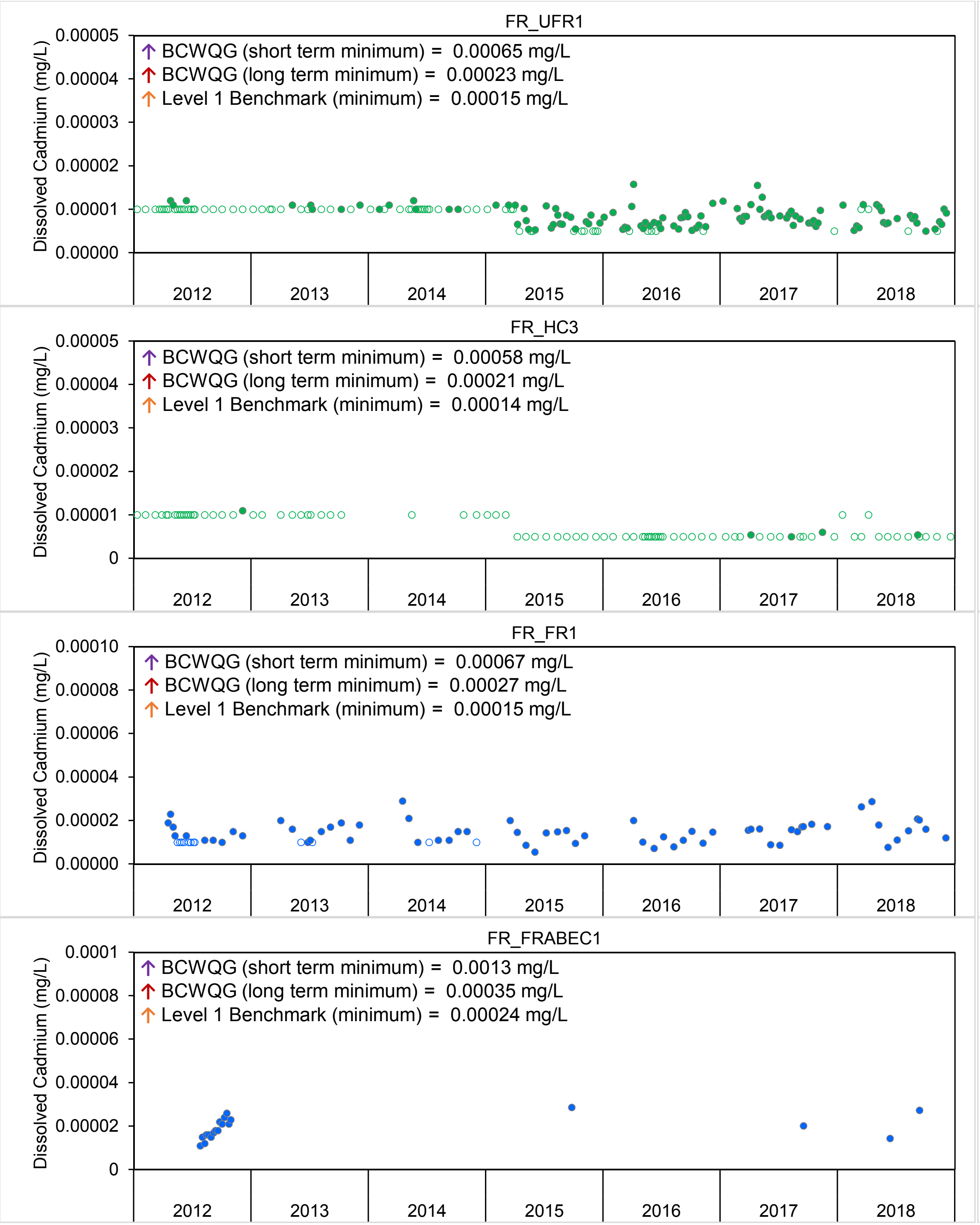


Figure C.7: Time Series Plots for Aqueous Dissolved Cadmium Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term); – – = Level 1 Benchmark

● = Mine -exposed; ● = Reference.

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

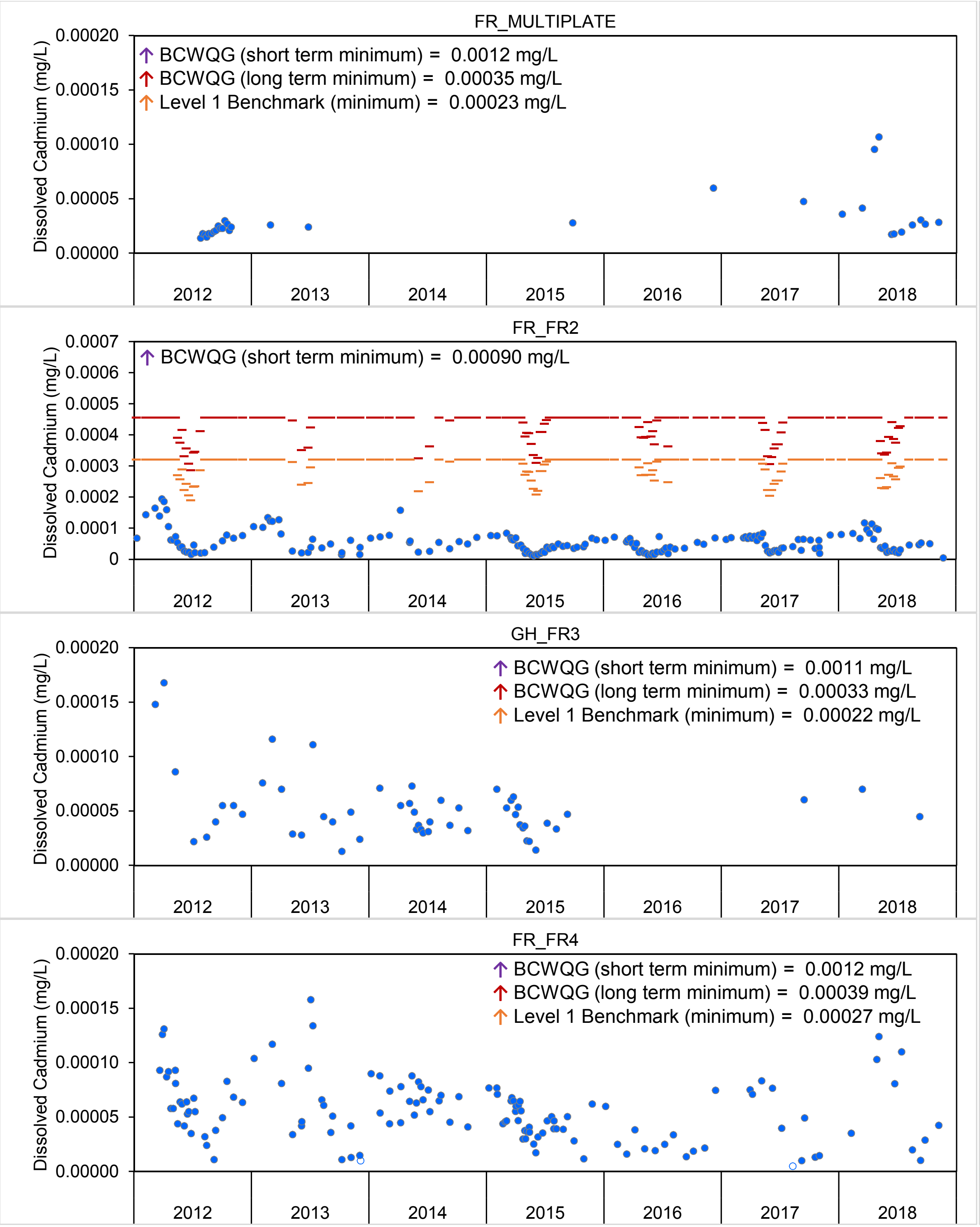


Figure C.7: Time Series Plots for Aqueous Dissolved Cadmium Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term); – – = Level 1 Benchmark

● = Mine -exposed; ● = Reference.

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

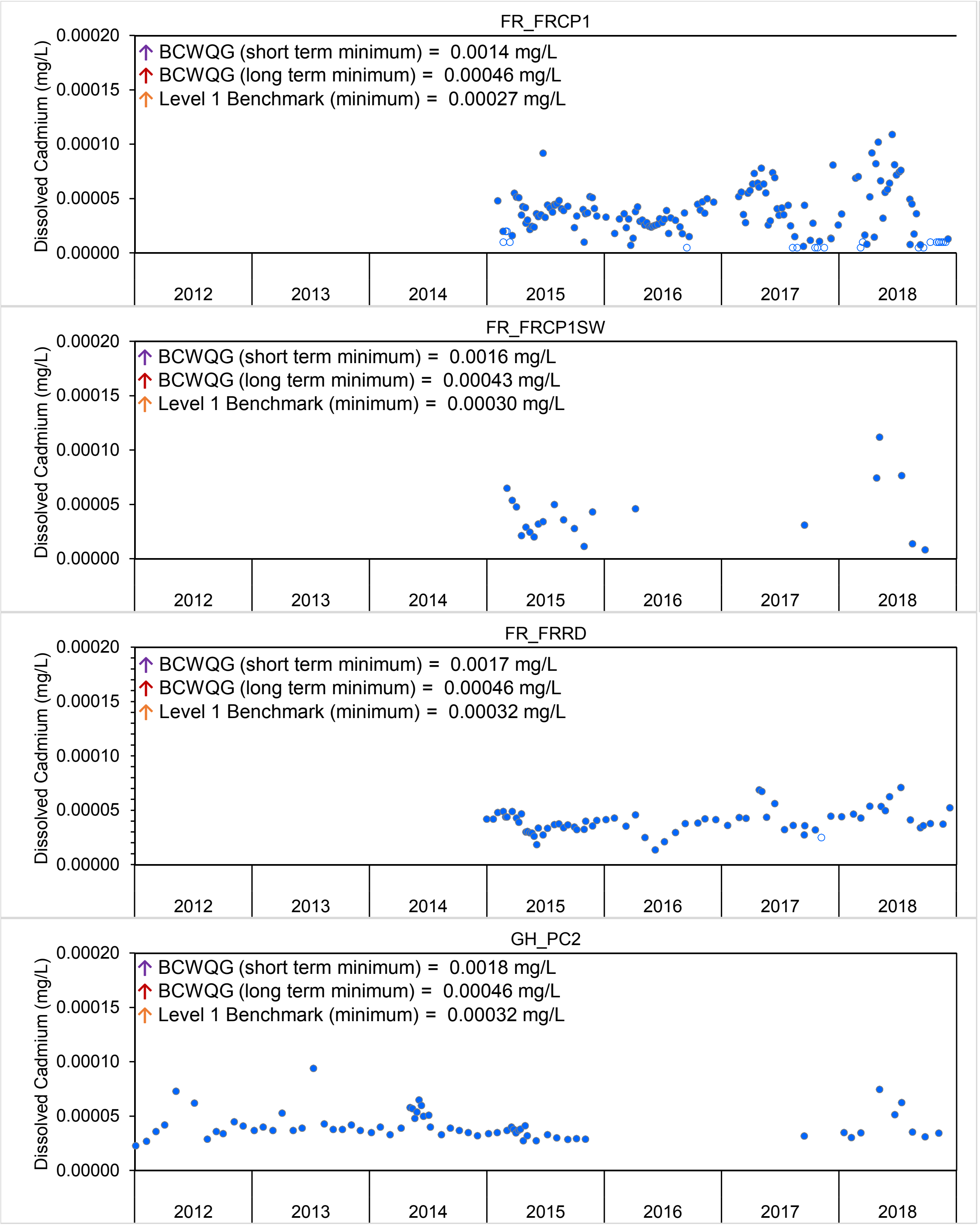


Figure C.7: Time Series Plots for Aqueous Dissolved Cadmium Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term); – – = Level 1 Benchmark

● = Mine -exposed; ● = Reference.

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

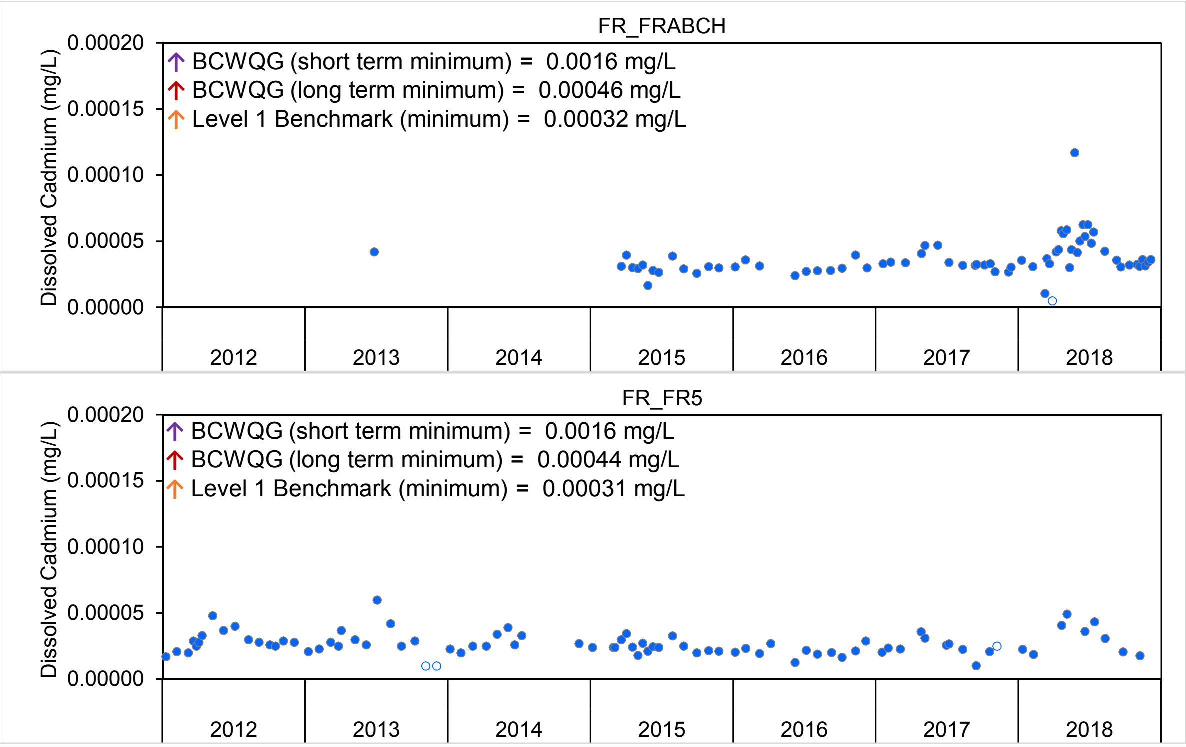


Figure C.7: Time Series Plots for Aqueous Dissolved Cadmium Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term); – – = Level 1 Benchmark

● = Mine -exposed; ● = Reference.

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

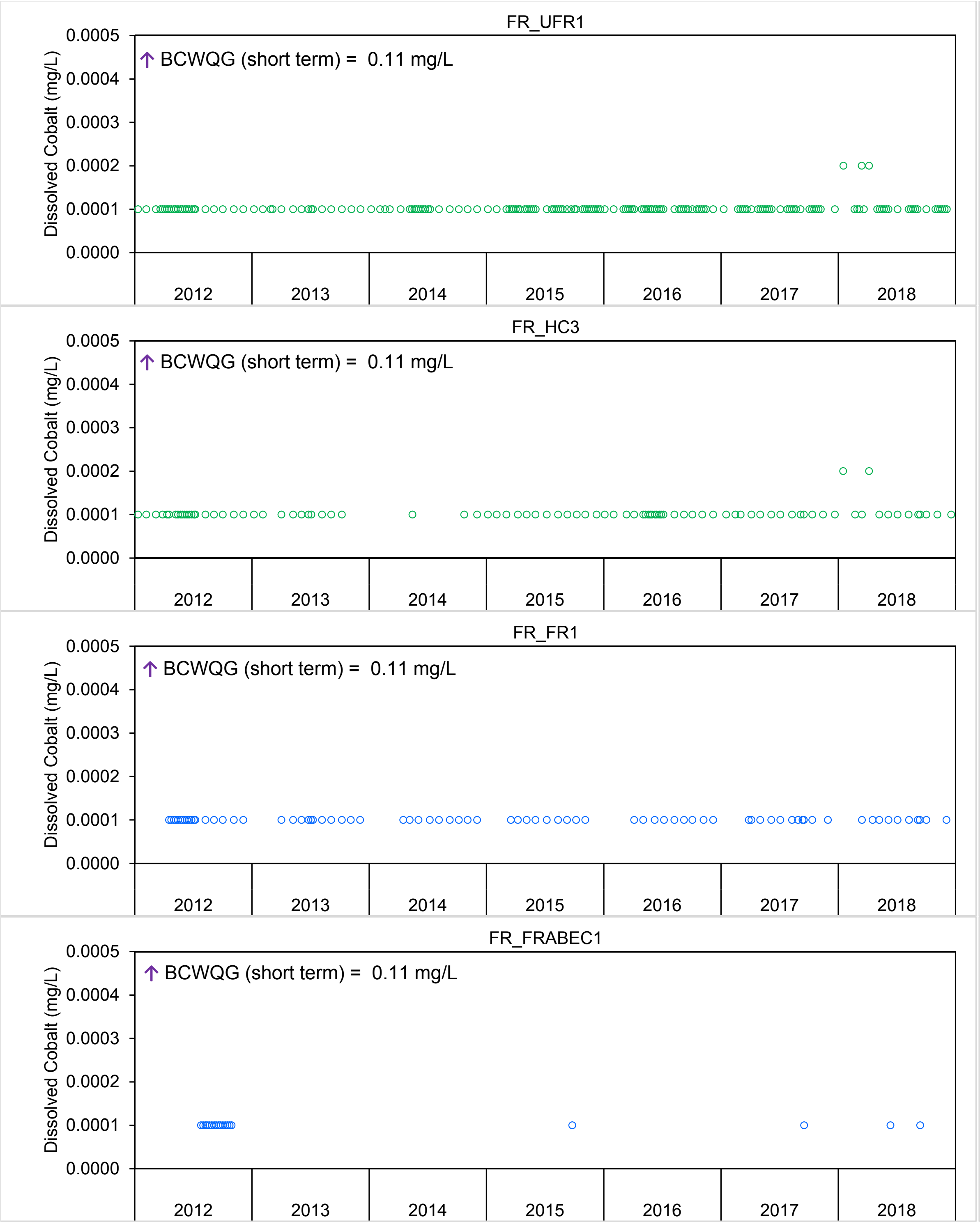


Figure C.8: Time Series Plots for Aqueous Dissolved Cobalt Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

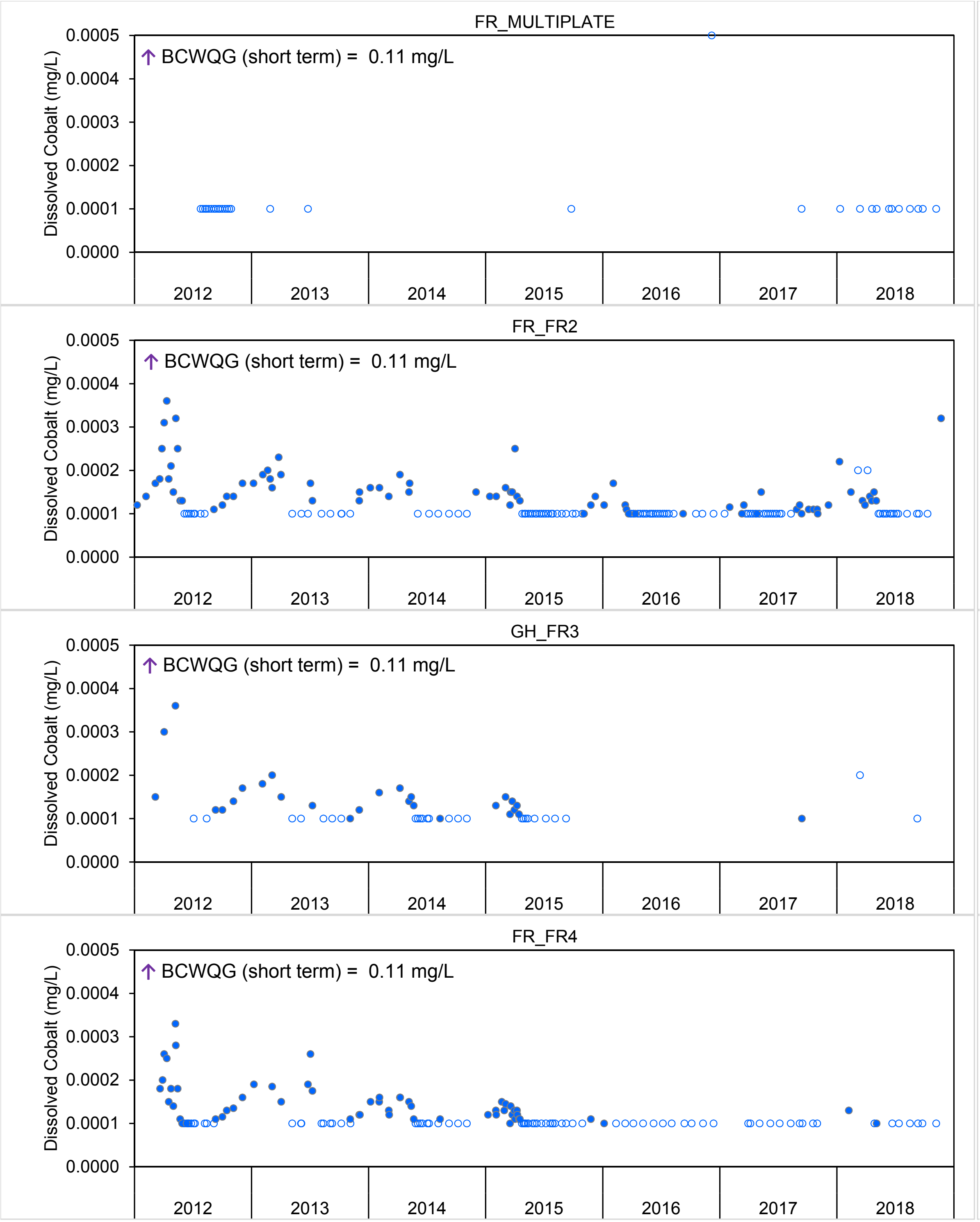


Figure C.8: Time Series Plots for Aqueous Dissolved Cobalt Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

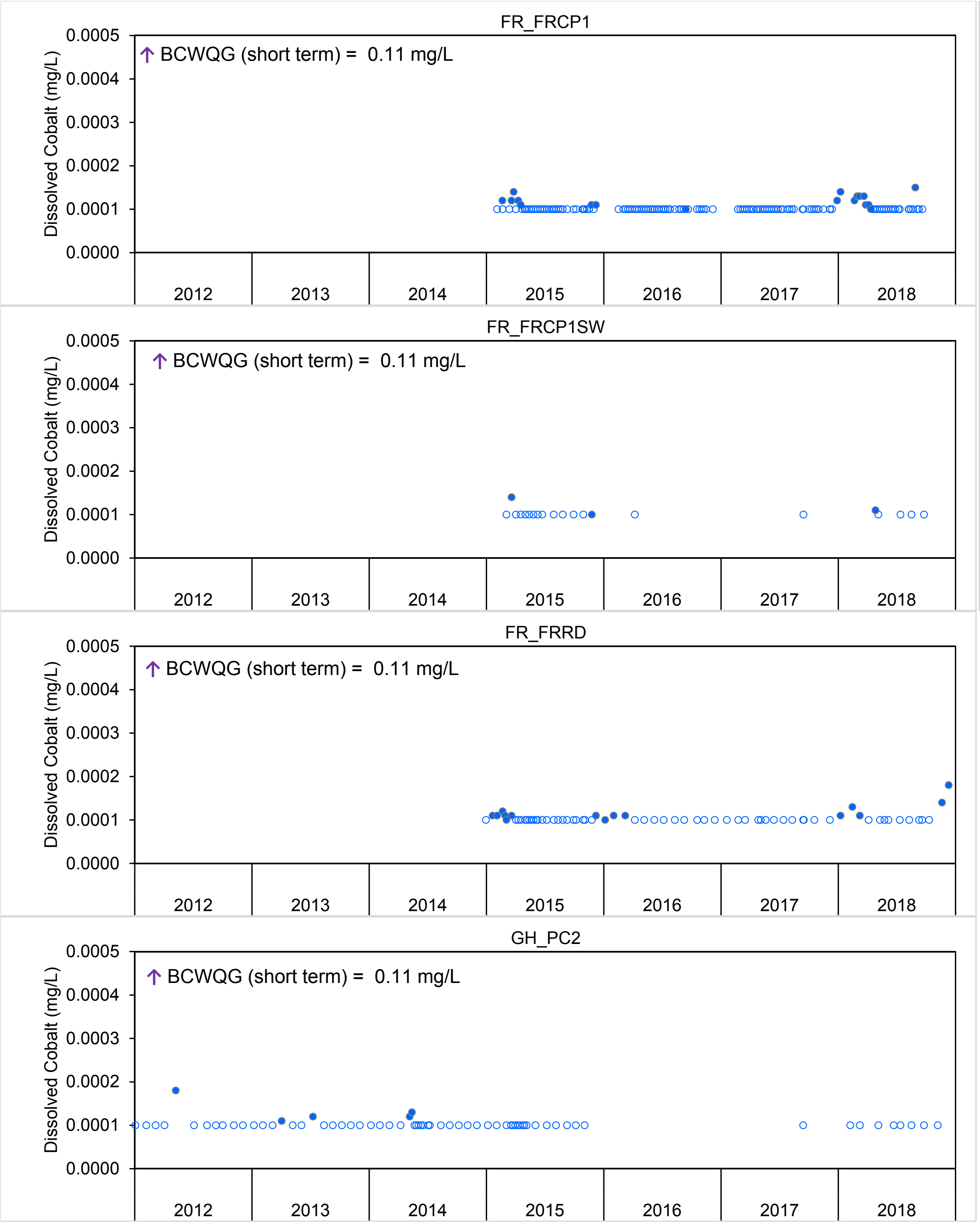


Figure C.8: Time Series Plots for Aqueous Dissolved Cobalt Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

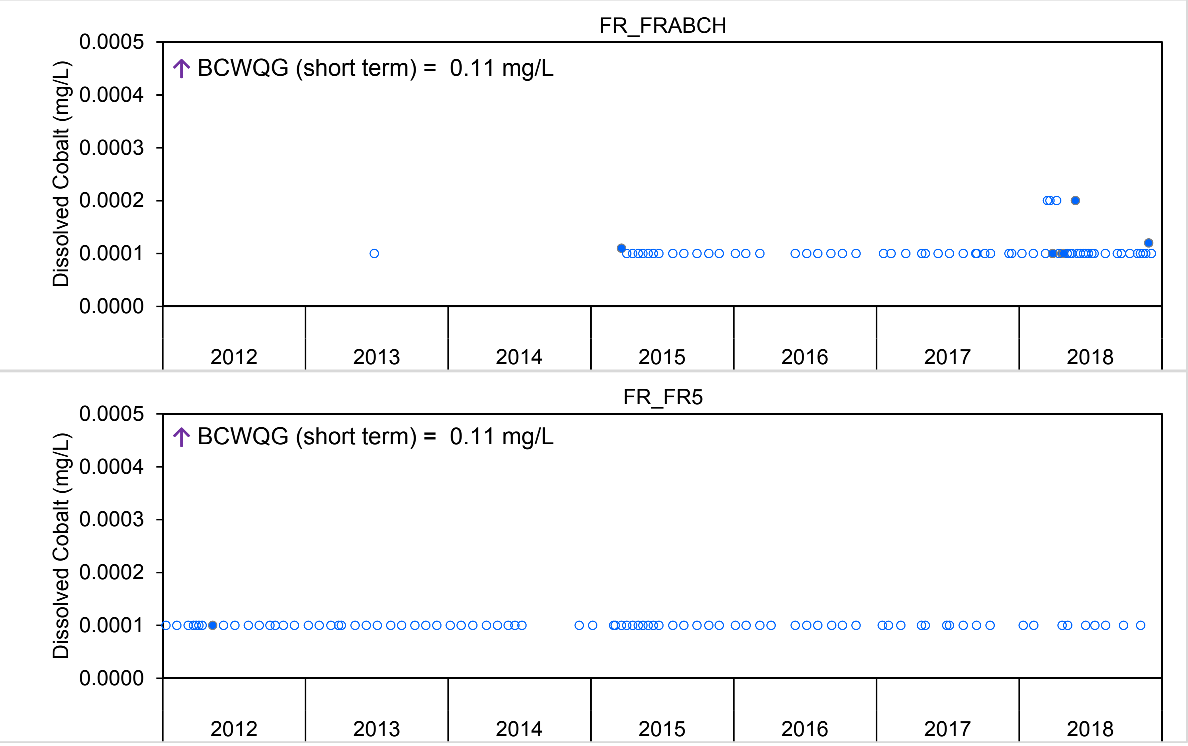


Figure C.8: Time Series Plots for Aqueous Dissolved Cobalt Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

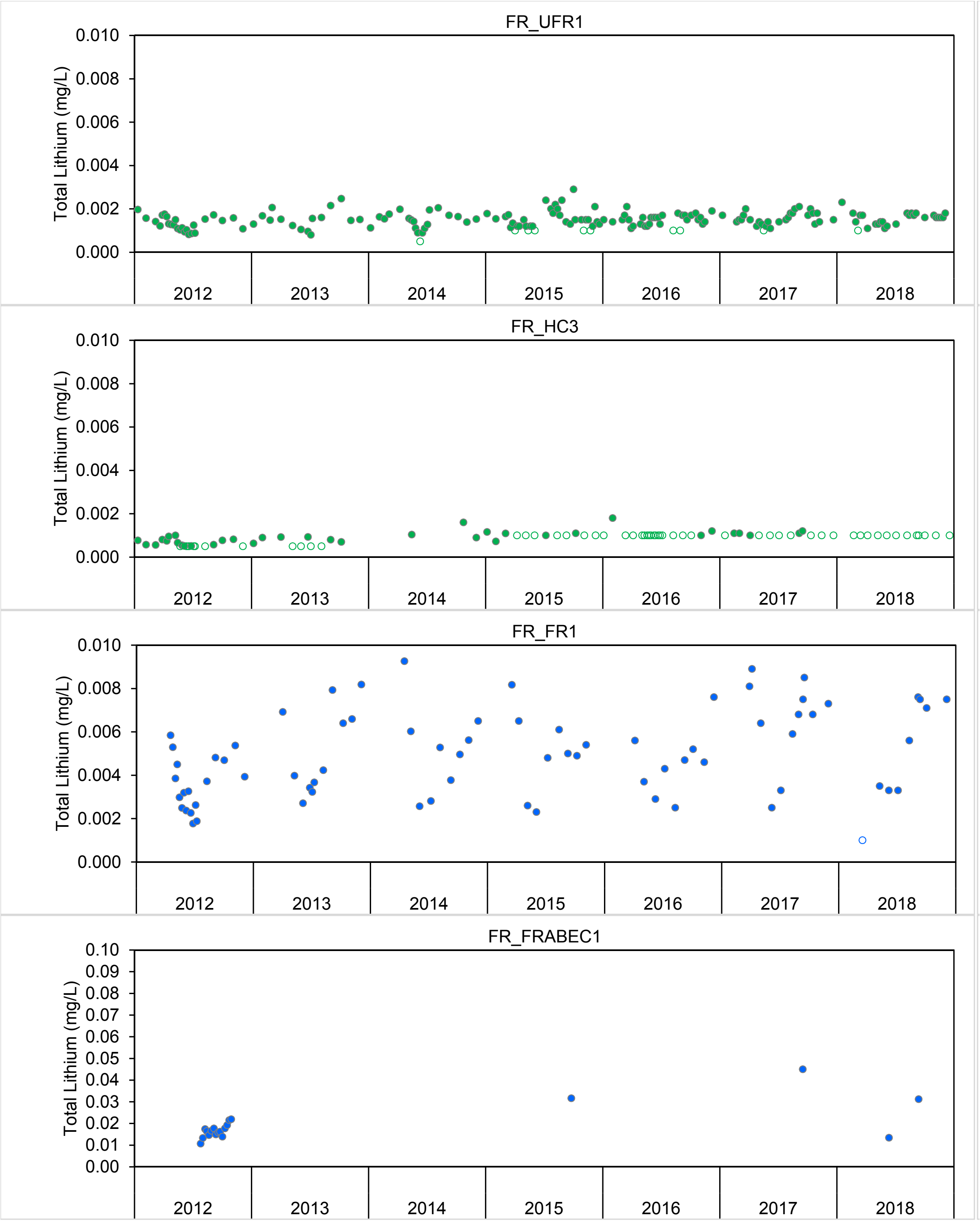


Figure C.9: Time Series Plots for Aqueous Total Lithium Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

● = Mine -exposed; ● = Reference.

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

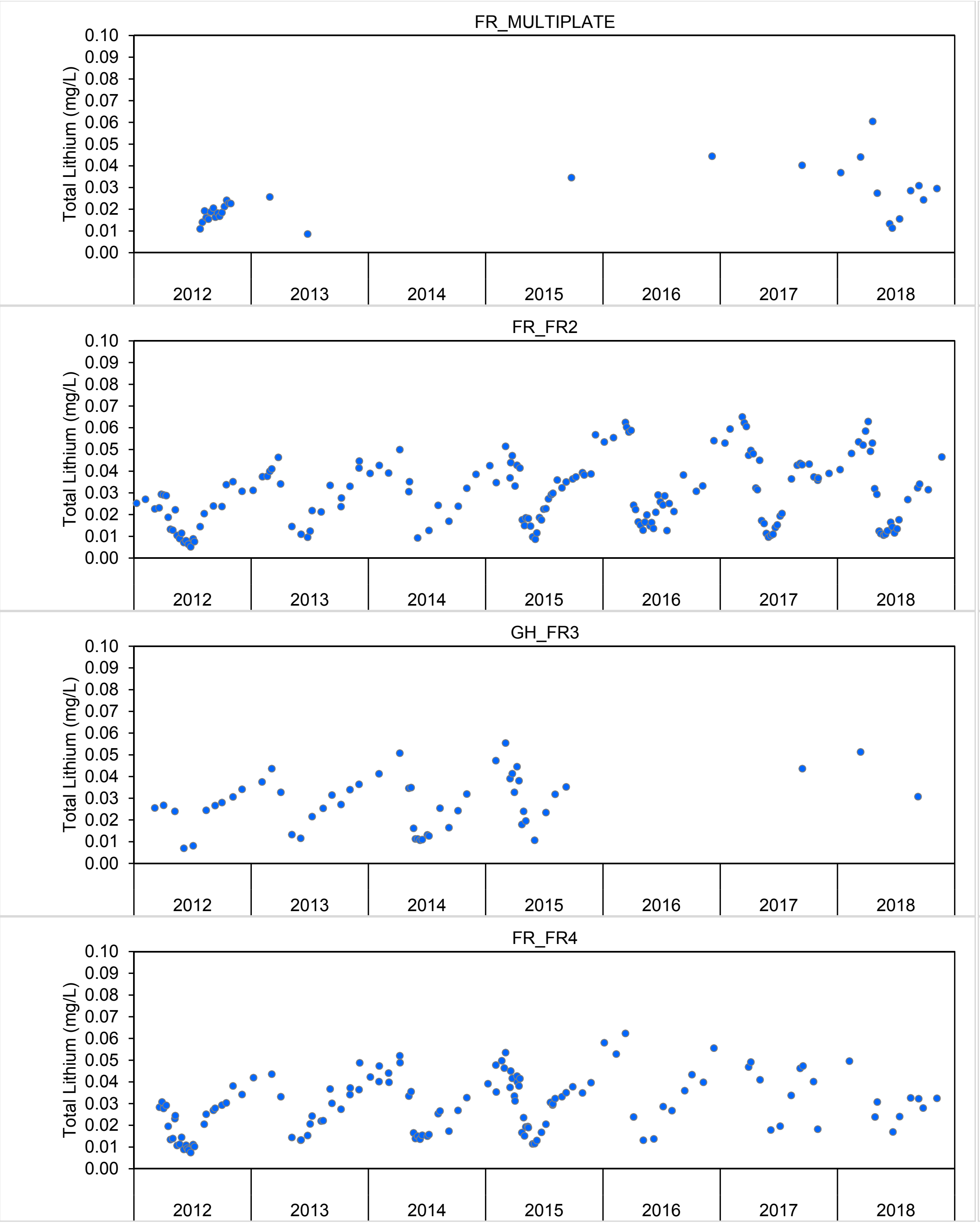


Figure C.9: Time Series Plots for Aqueous Total Lithium Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

● = Mine -exposed; ● = Reference.

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

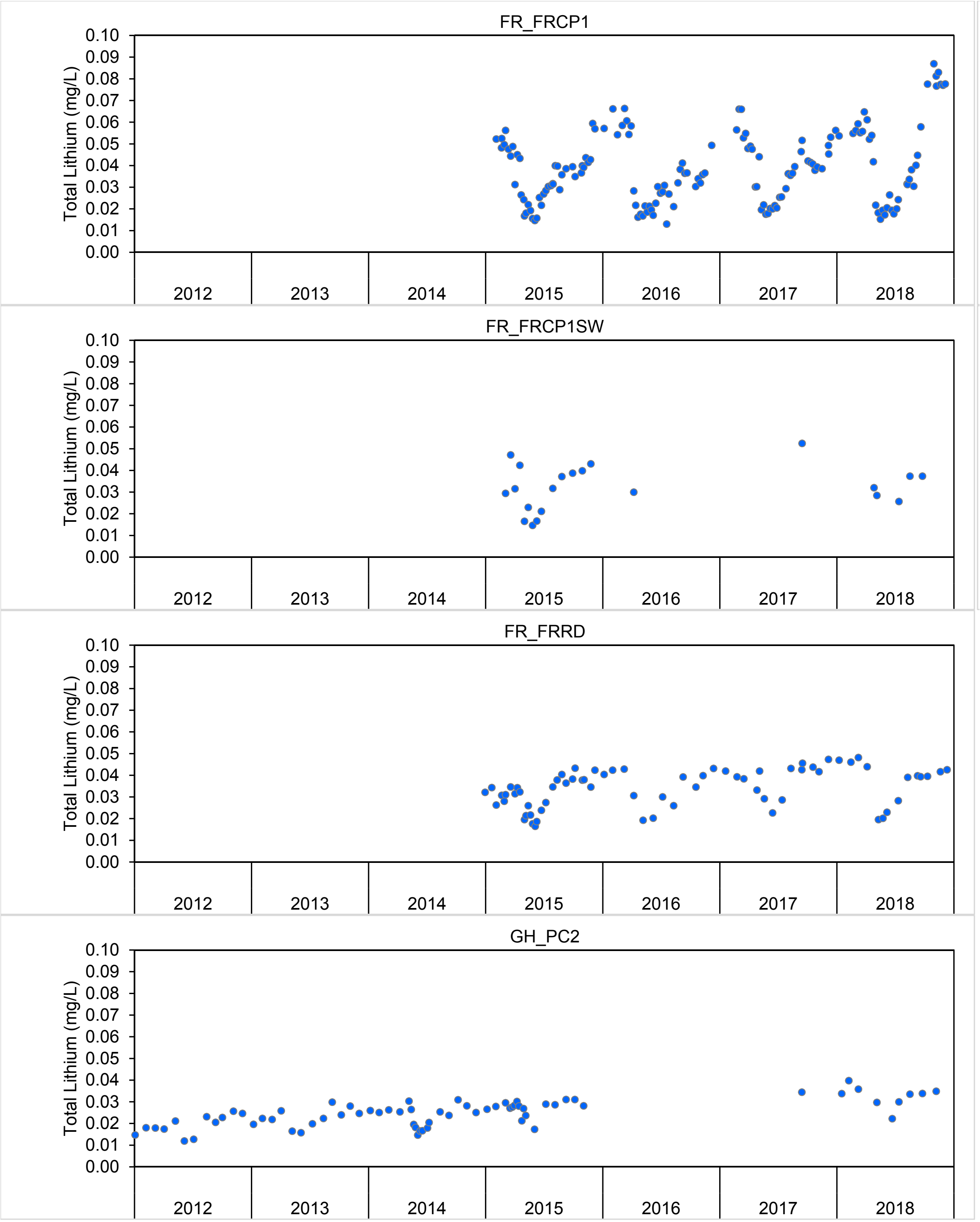


Figure C.9: Time Series Plots for Aqueous Total Lithium Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

● = Mine -exposed; ● = Reference.

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

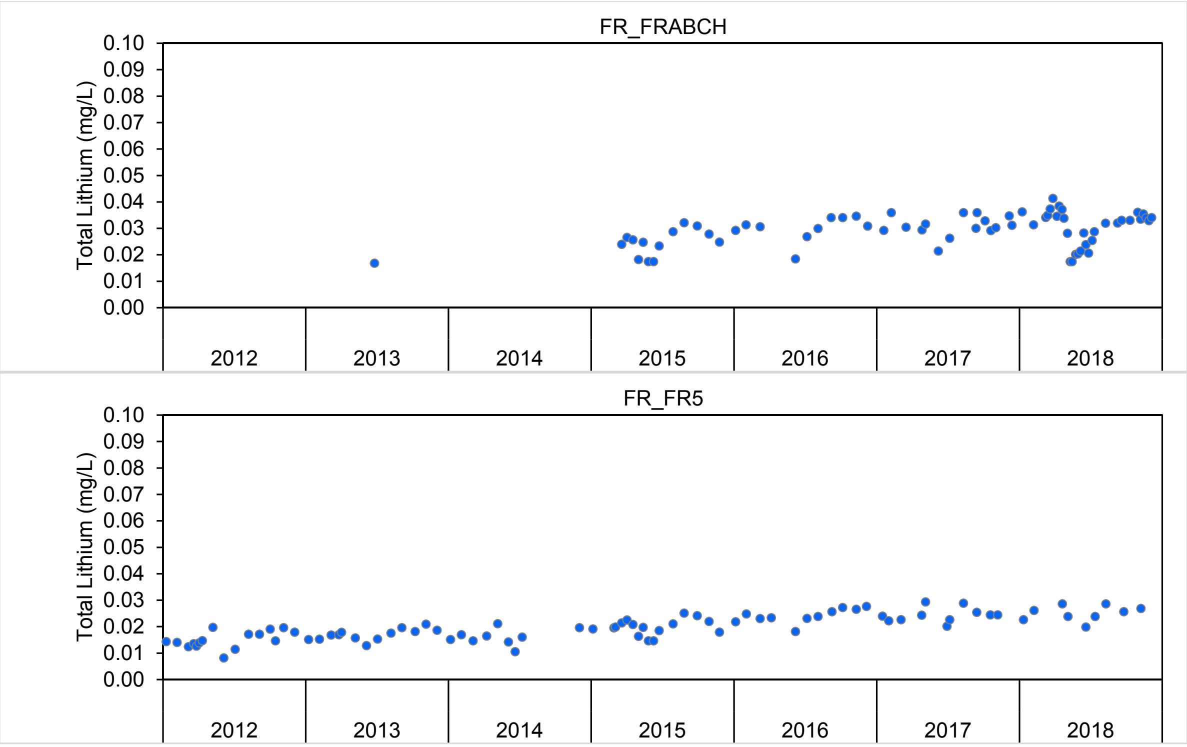


Figure C.9: Time Series Plots for Aqueous Total Lithium Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

● = Mine -exposed; ● = Reference.

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

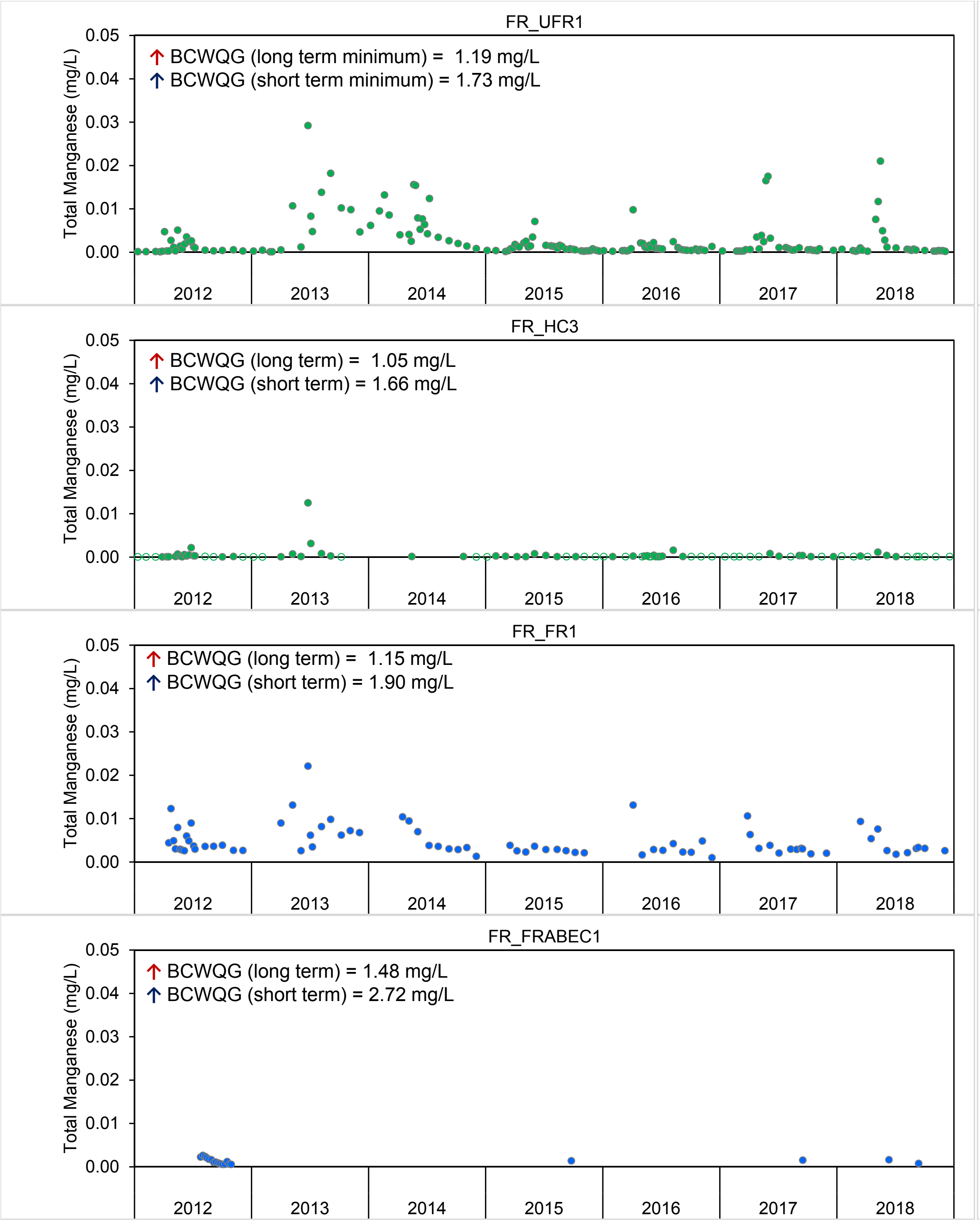


Figure C.10: Time Series Plots for Aqueous Total Manganese Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

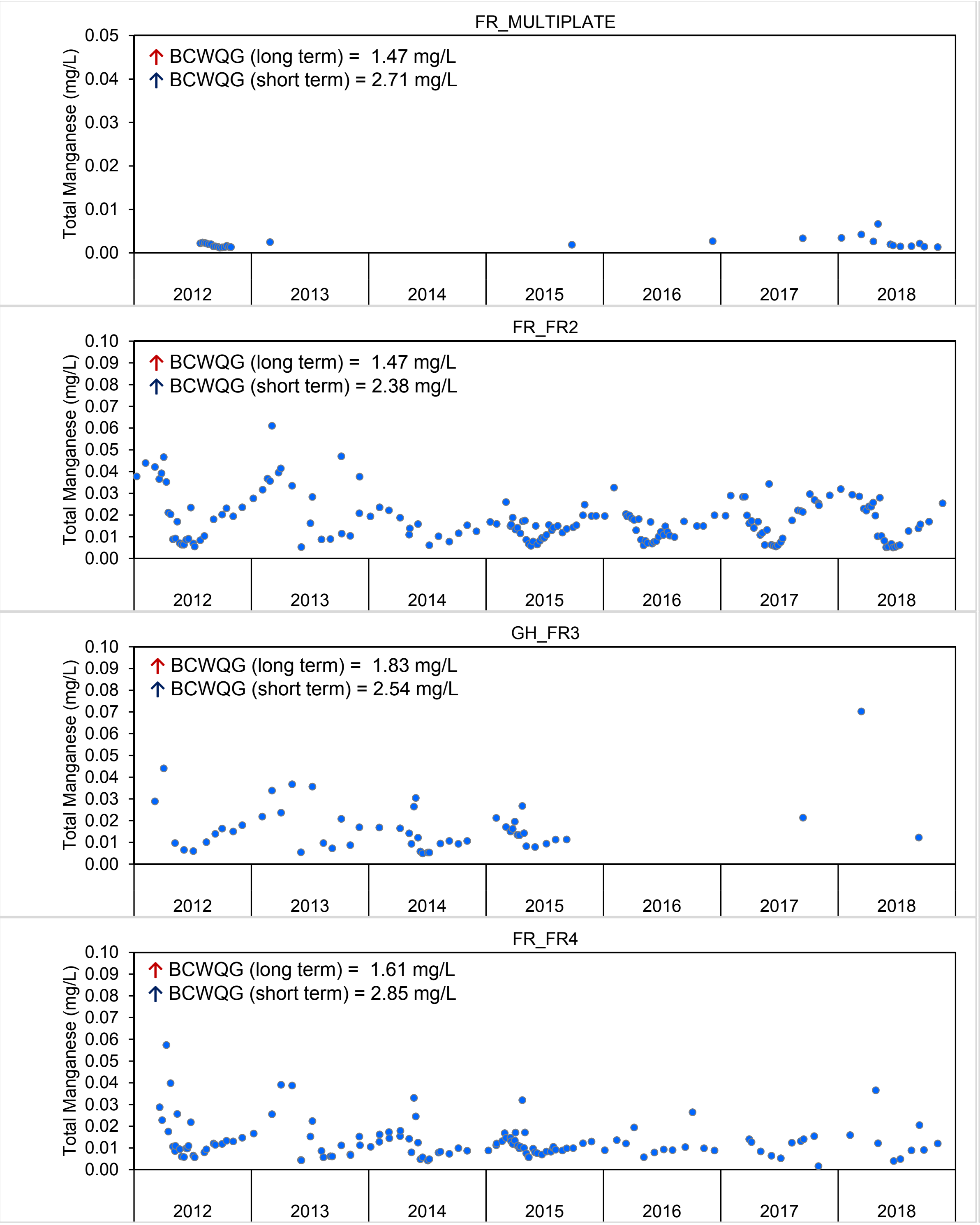


Figure C.10: Time Series Plots for Aqueous Total Manganese Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

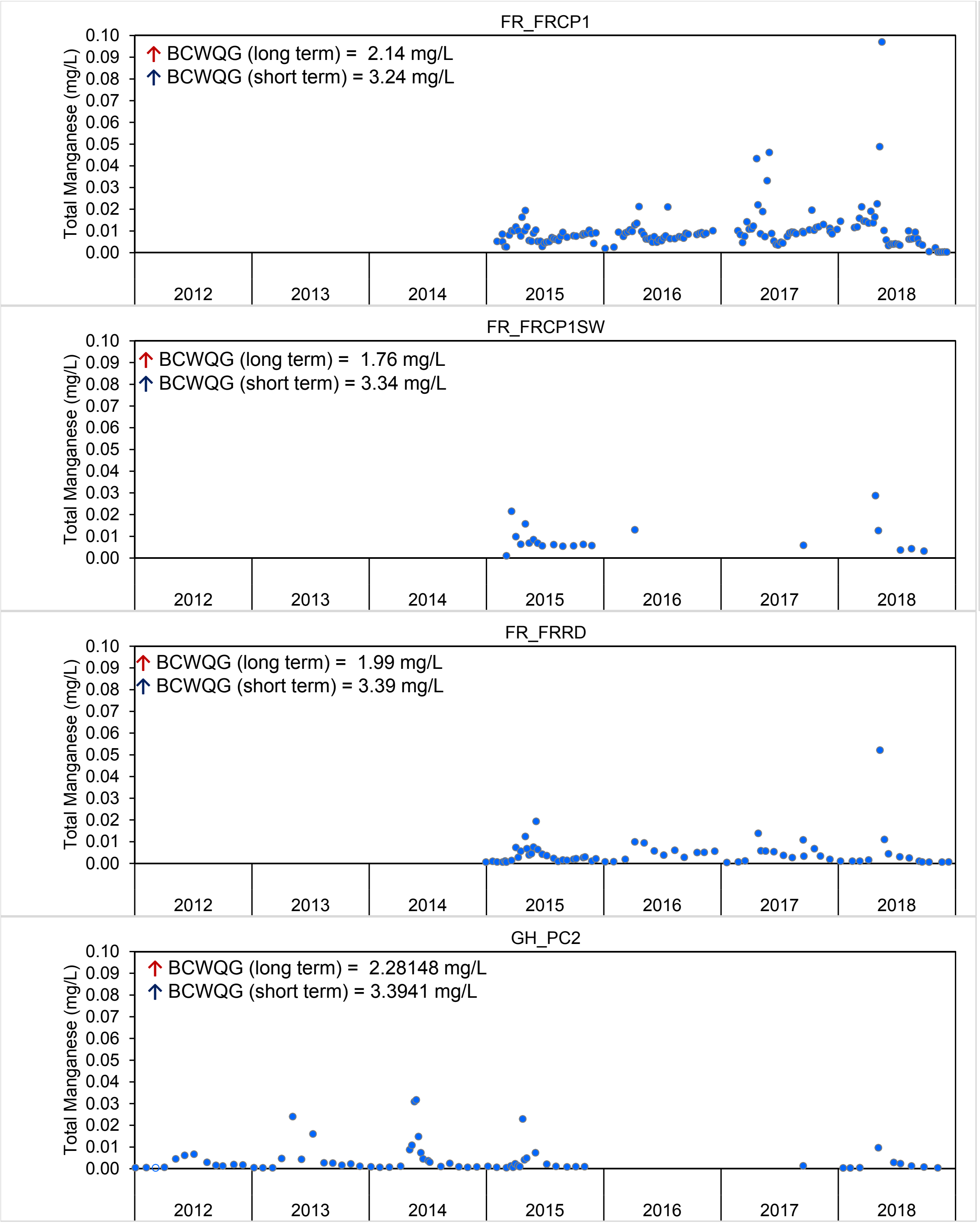


Figure C.10: Time Series Plots for Aqueous Total Manganese Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

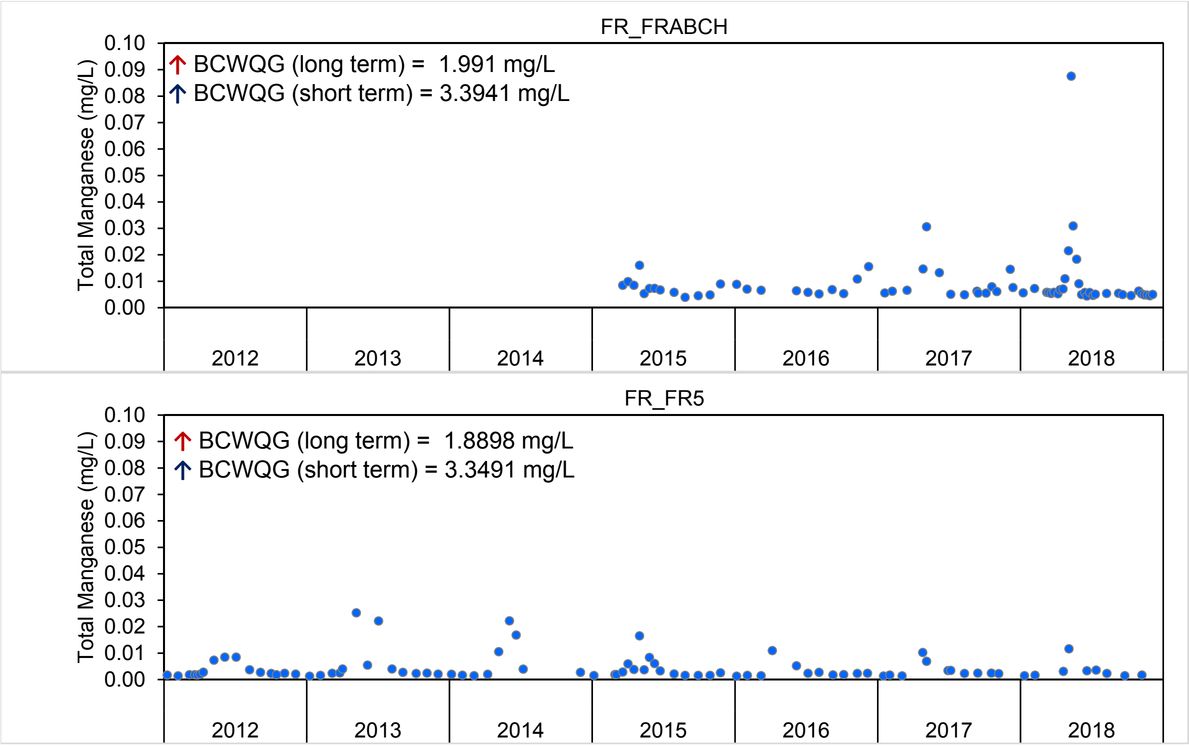


Figure C.10: **Time Series Plots for Aqueous Total Manganese Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018**

– – = BCWQG (long term); – – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

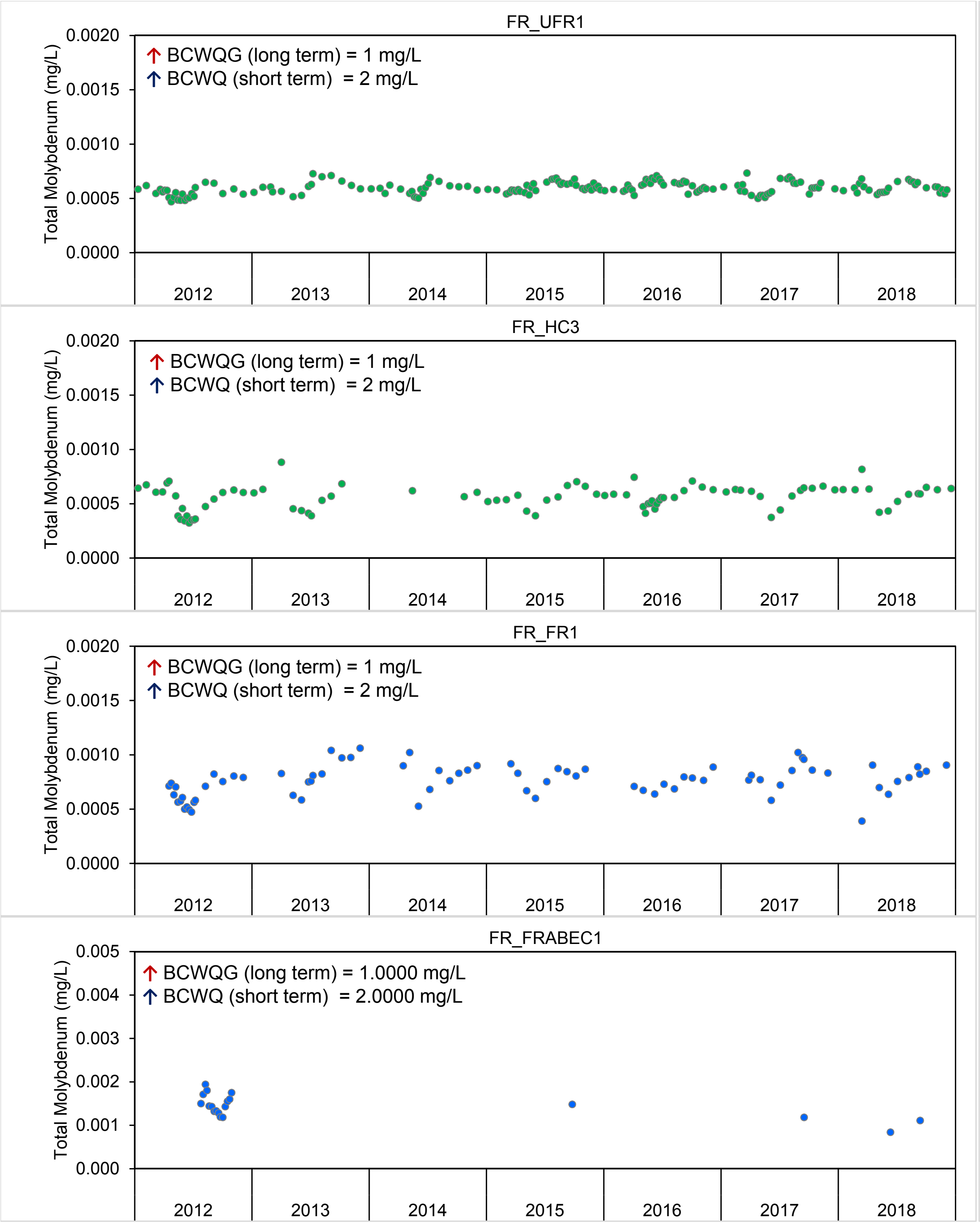


Figure C.11: Time Series Plots for Aqueous Total Molybdenum Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

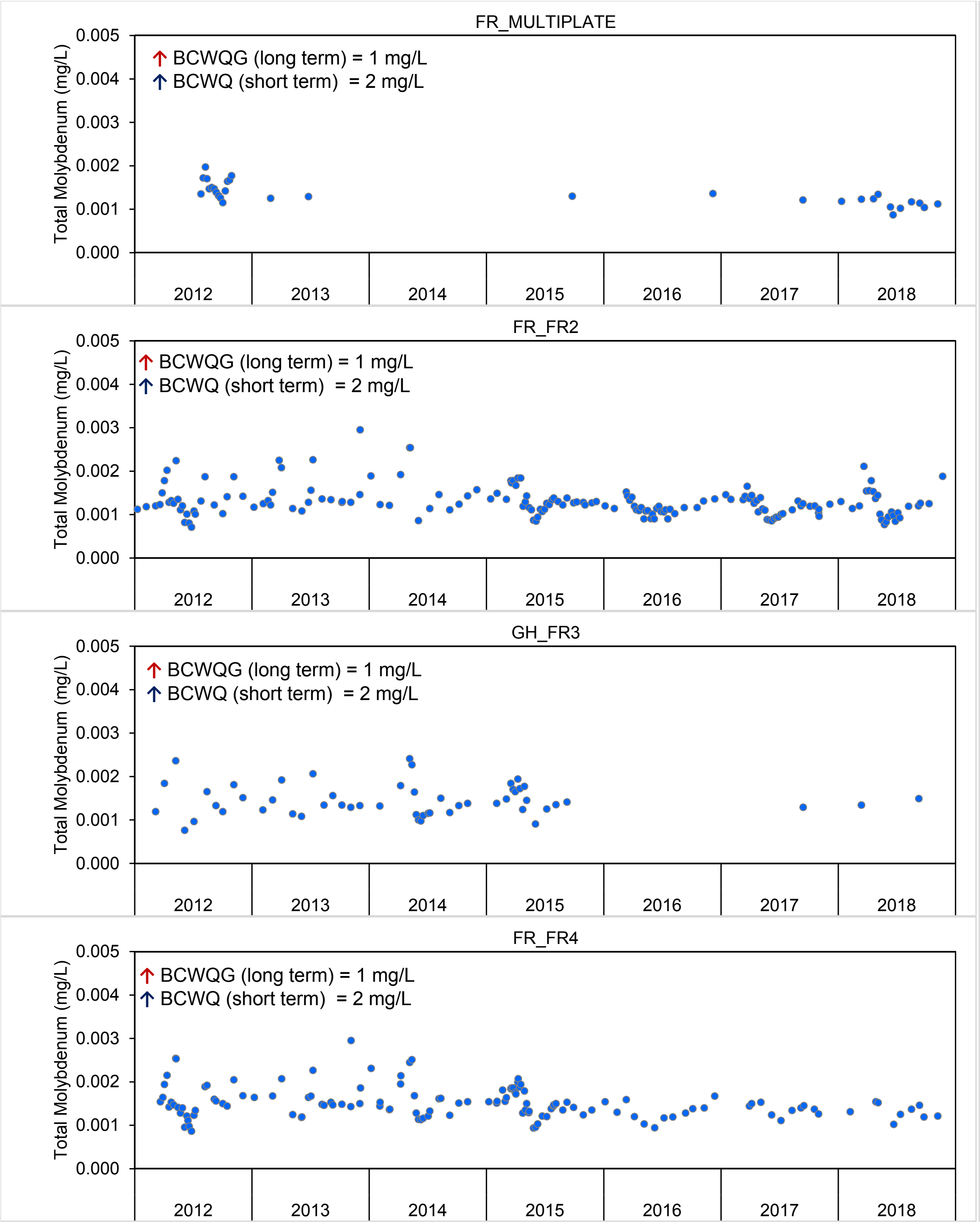


Figure C.11: Time Series Plots for Aqueous Total Molybdenum Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

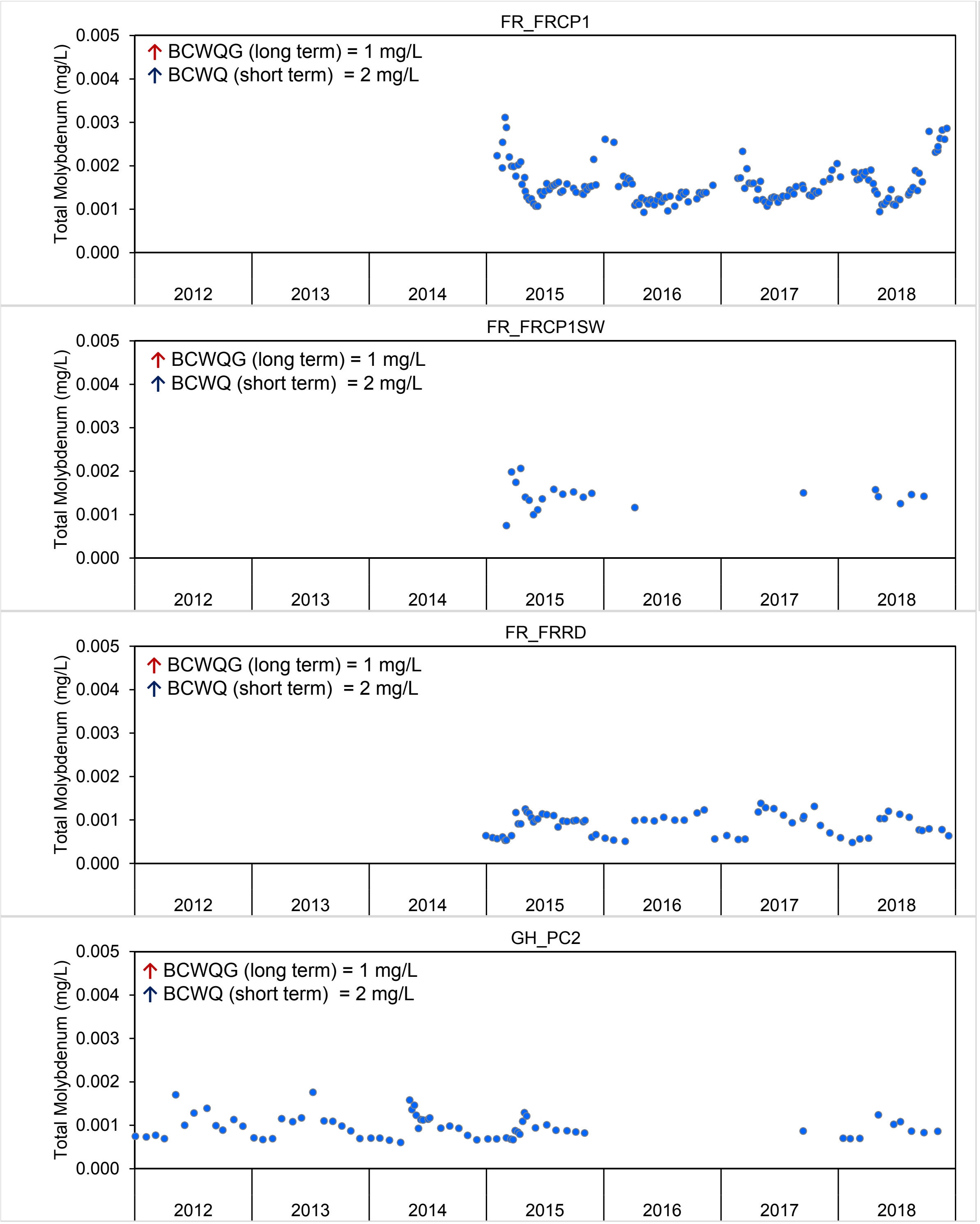


Figure C.11: **Time Series Plots for Aqueous Total Molybdenum Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018**

– – = BCWQG (long term); – – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

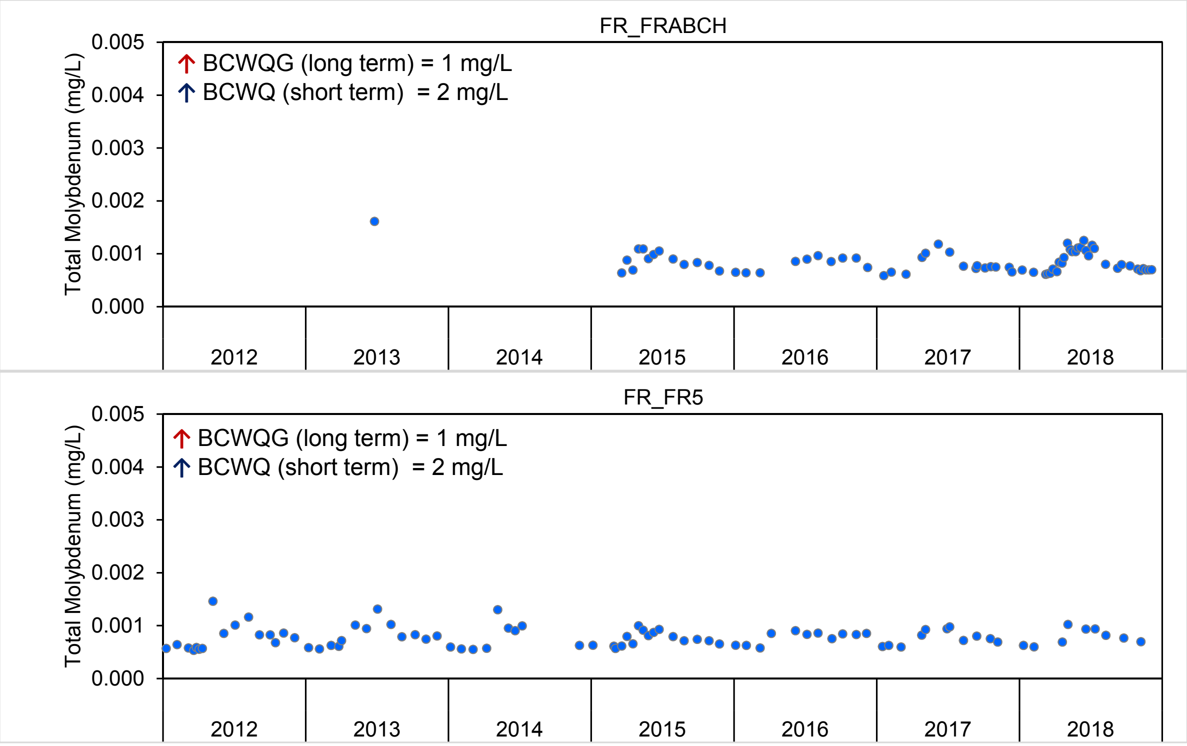


Figure C.11: Time Series Plots for Aqueous Total Molybdenum Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

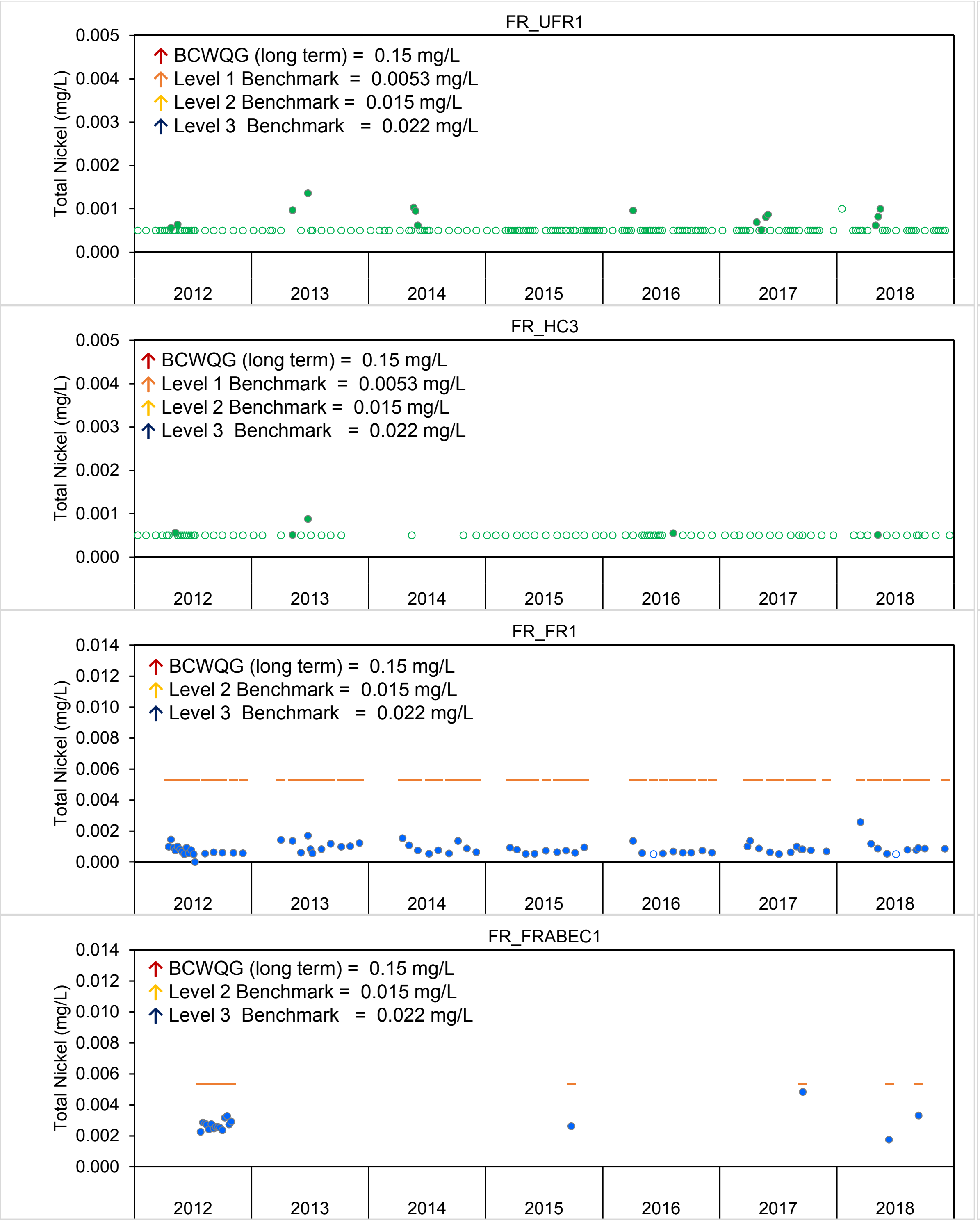


Figure C.12: Time Series Plots for AqueousTotal Nickel Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = Level 1 Benchmark; – – = Level 2 Benchmark; – – = Level 3 Benchmark

● = Mine -exposed; ● = Reference.

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

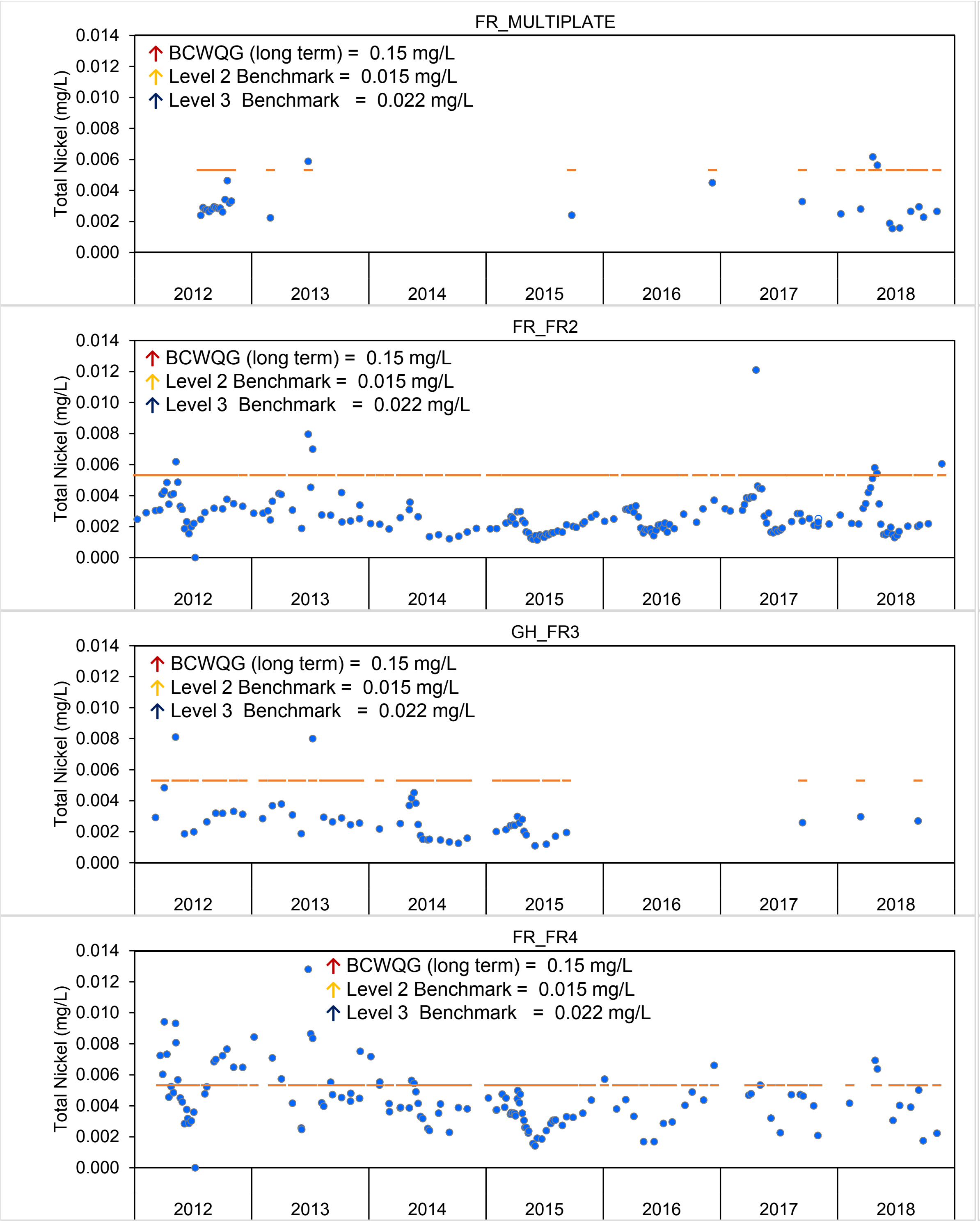


Figure C.12: Time Series Plots for AqueousTotal Nickel Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = Level 1 Benchmark; – – = Level 2 Benchmark; – – = Level 3 Benchmark

● = Mine -exposed; ● = Reference.

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

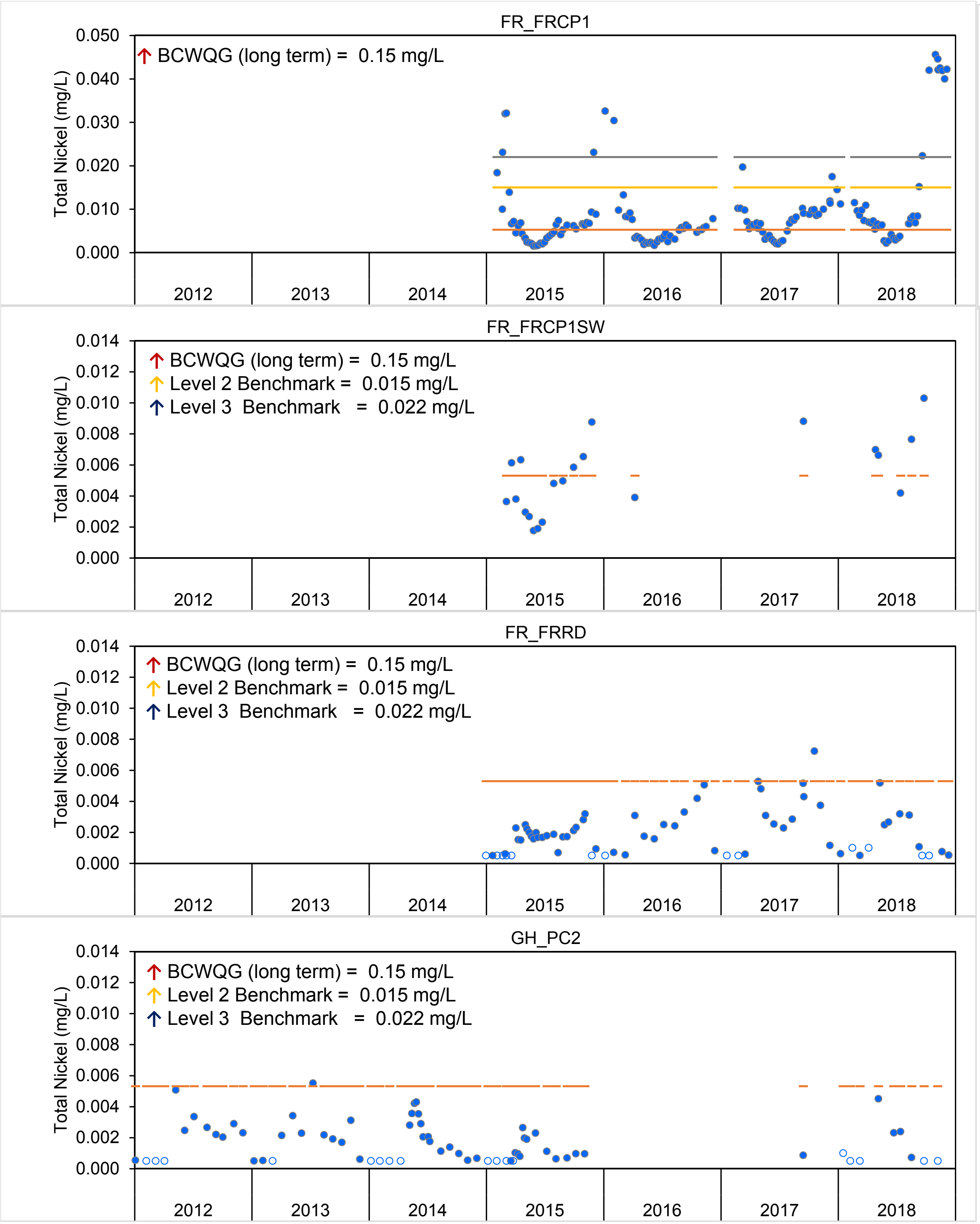


Figure C.12: Time Series Plots for AqueousTotal Nickel Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = Level 1 Benchmark; – – = Level 2 Benchmark; – – = Level 3 Benchmark

● = Mine -exposed; ● = Reference.

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

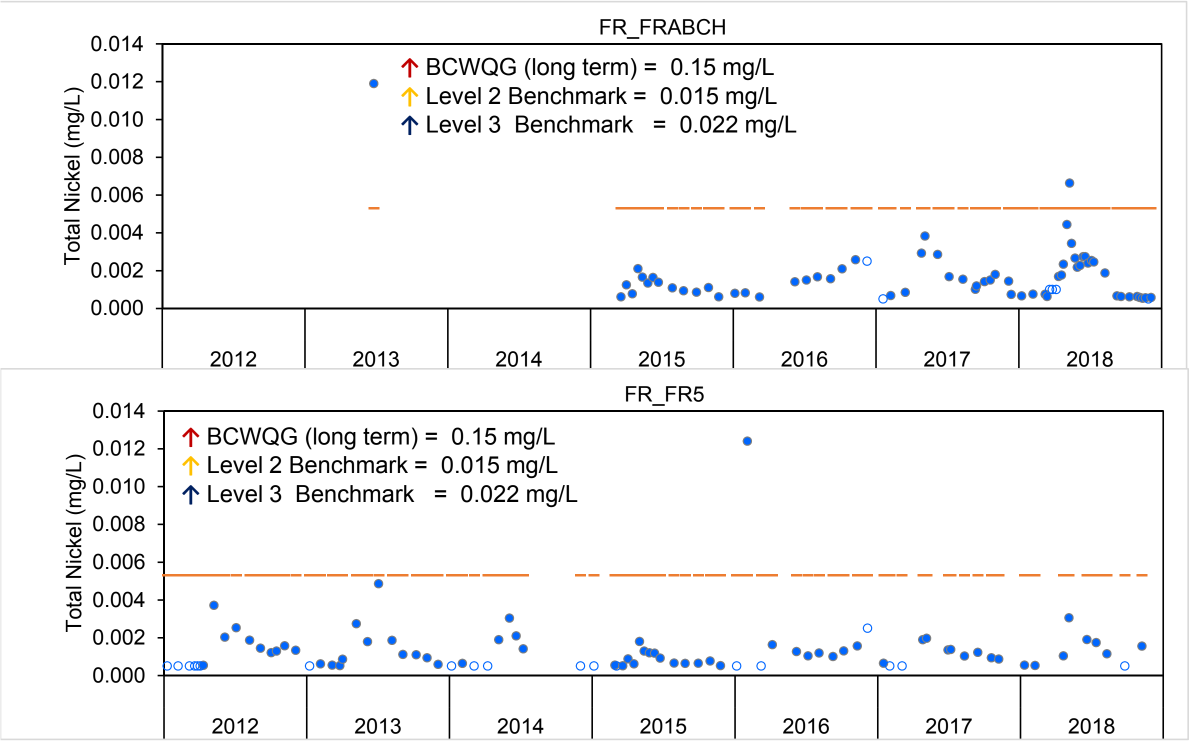


Figure C.12: Time Series Plots for AqueousTotal Nickel Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term); – – = Level 1 Benchmark; – – = Level 2 Benchmark

● = Mine -exposed; ● = Reference.

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

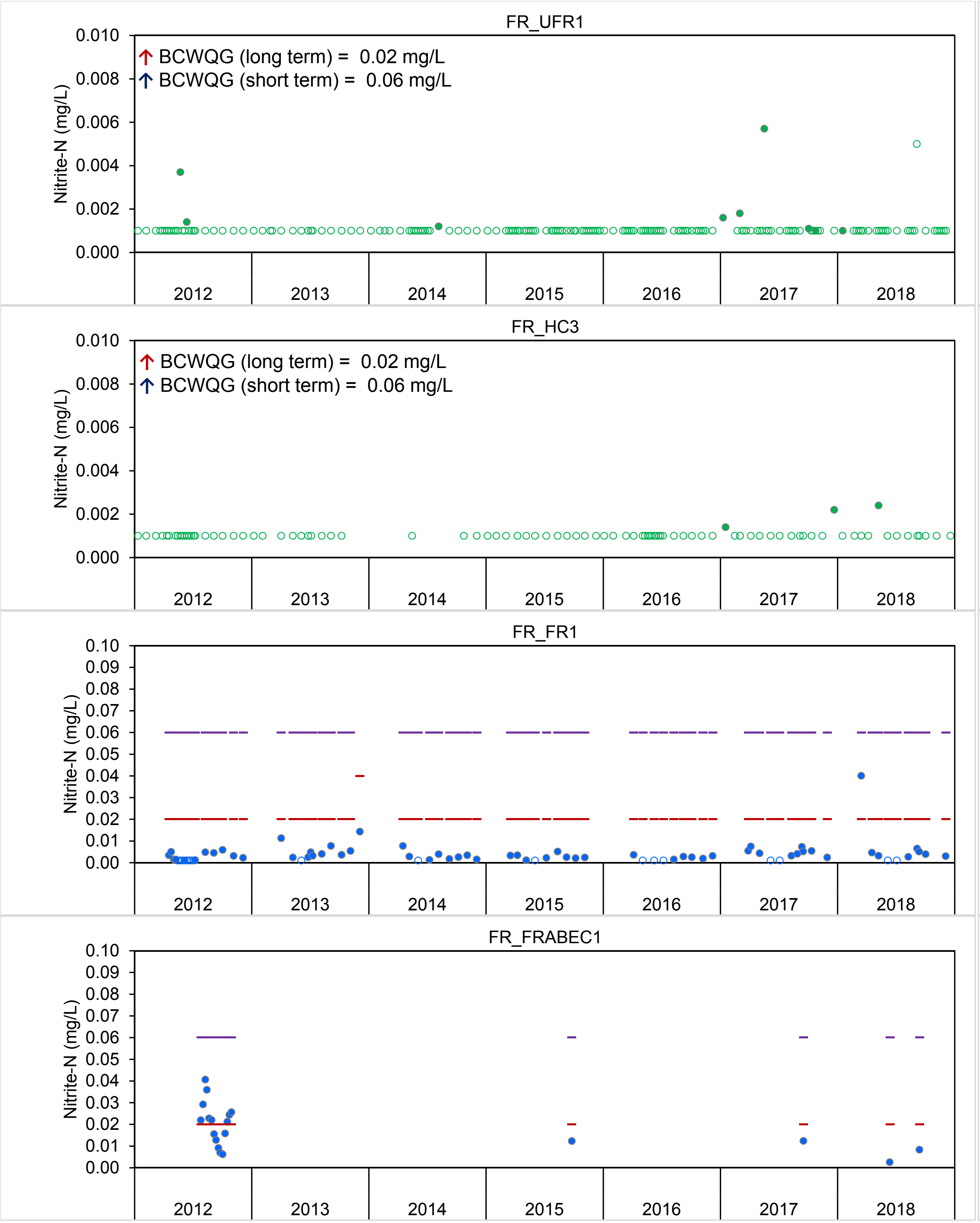


Figure C.13: Time Series Plots for Aqueous Nitrite-N Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

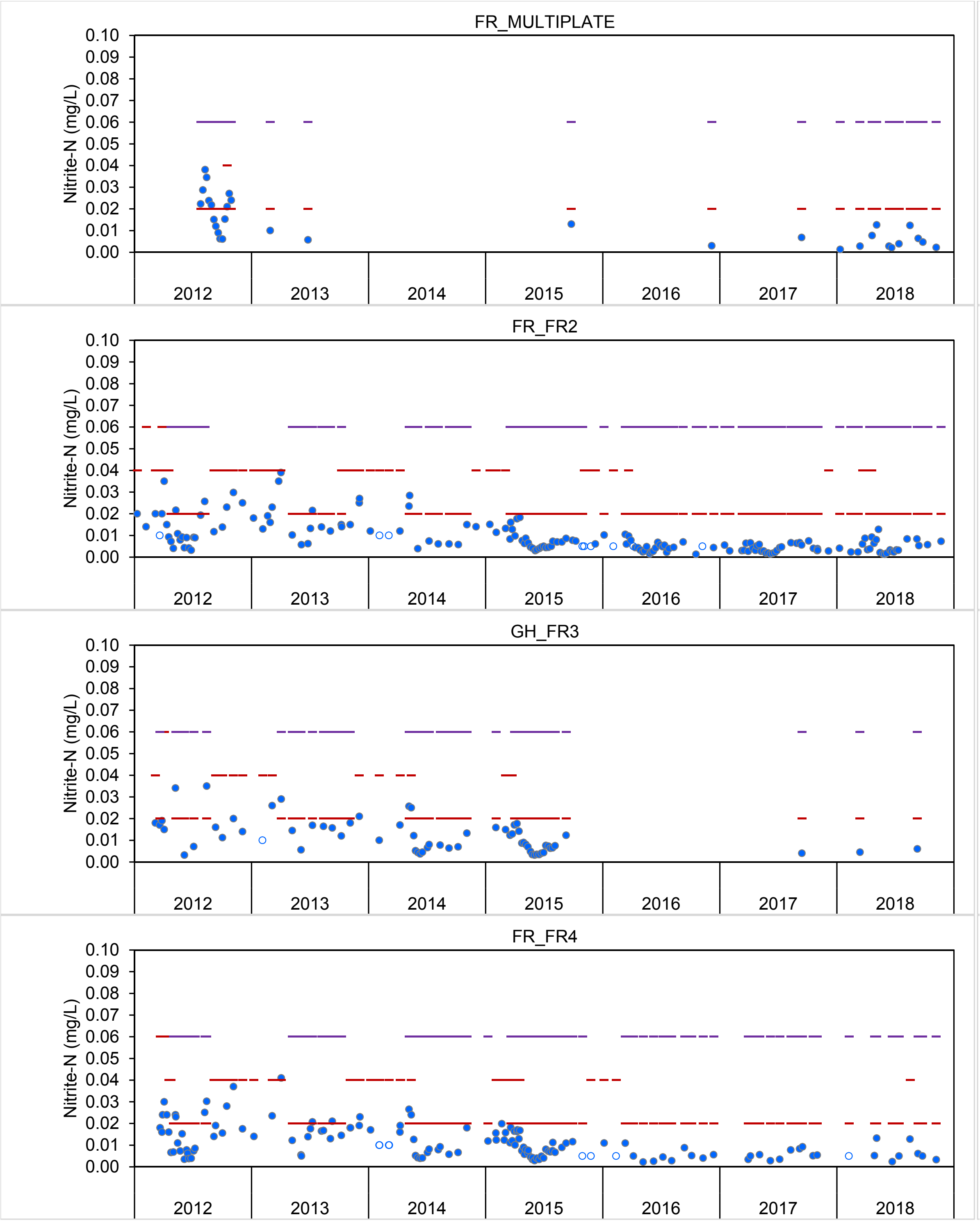


Figure C.13: Time Series Plots for Aqueous Nitrite-N Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

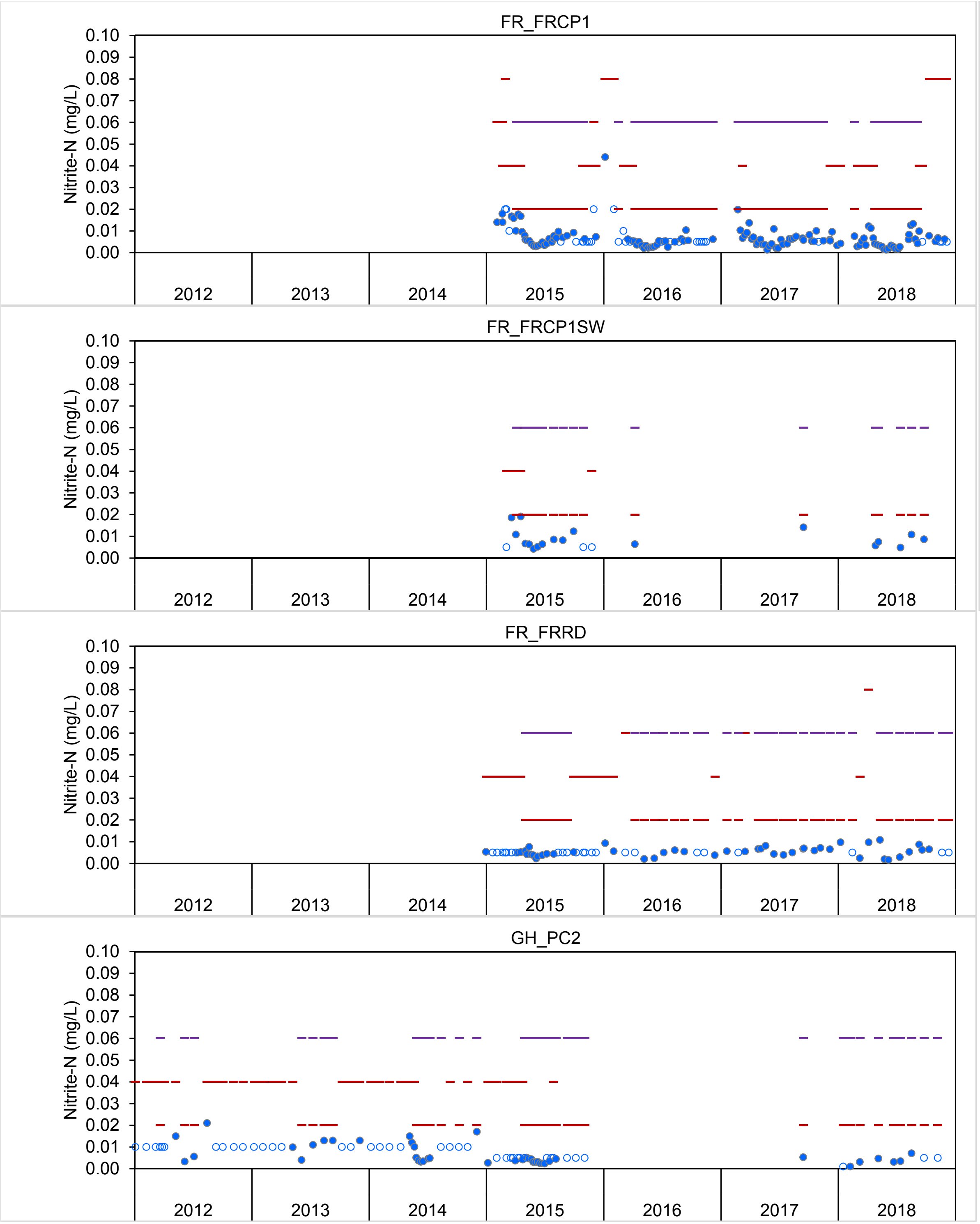


Figure C.13: **Time Series Plots for Aqueous Nitrite-N Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018**

– – = BCWQG (long term); – – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

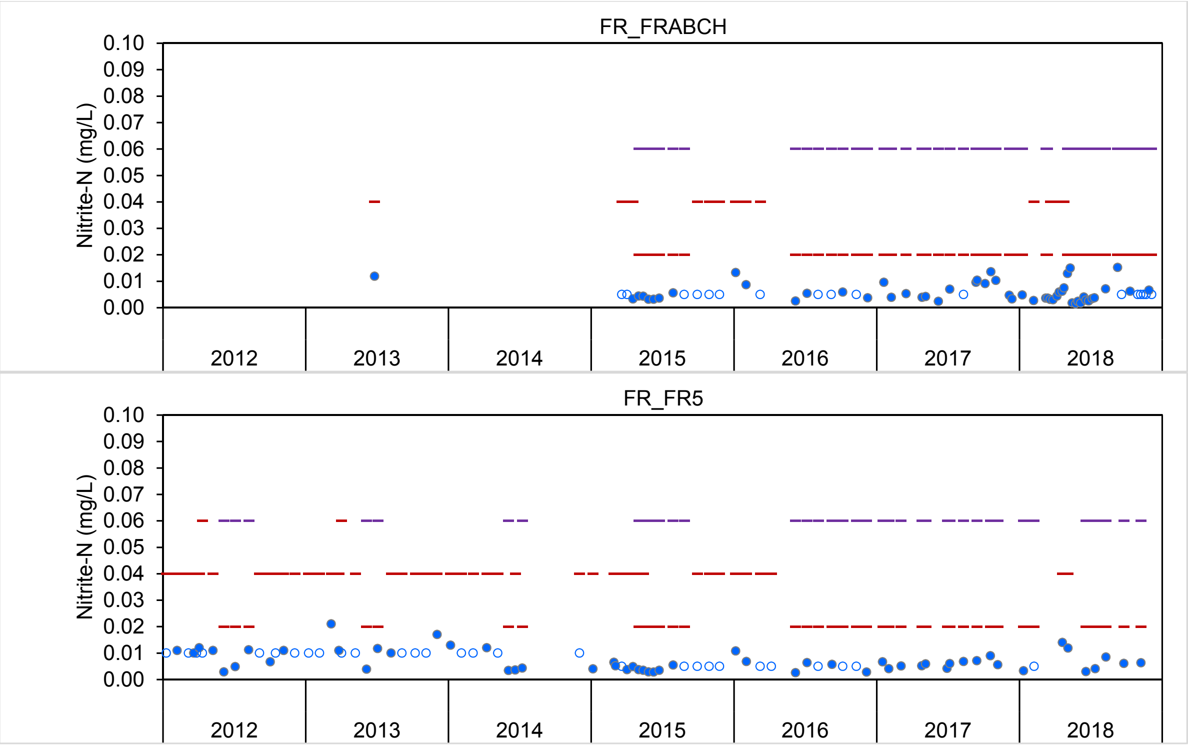


Figure C.13: Time Series Plots for Aqueous Nitrite-N Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

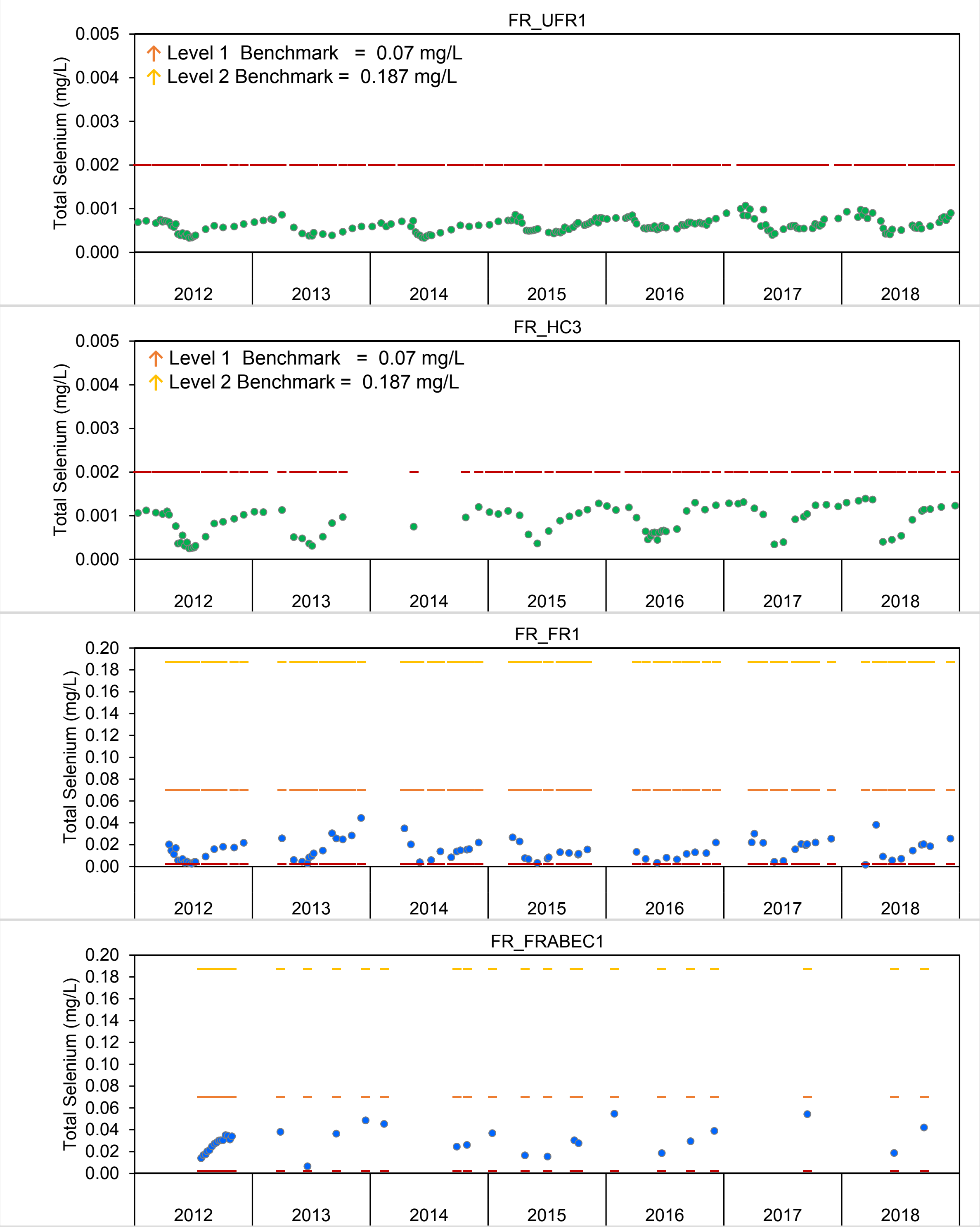


Figure C.14: Time Series Plots for Aqueous Total Selenium Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = Level 1 Benchmark; – – = Level 2 Benchmark

● = Mine -exposed; ● = Reference.

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

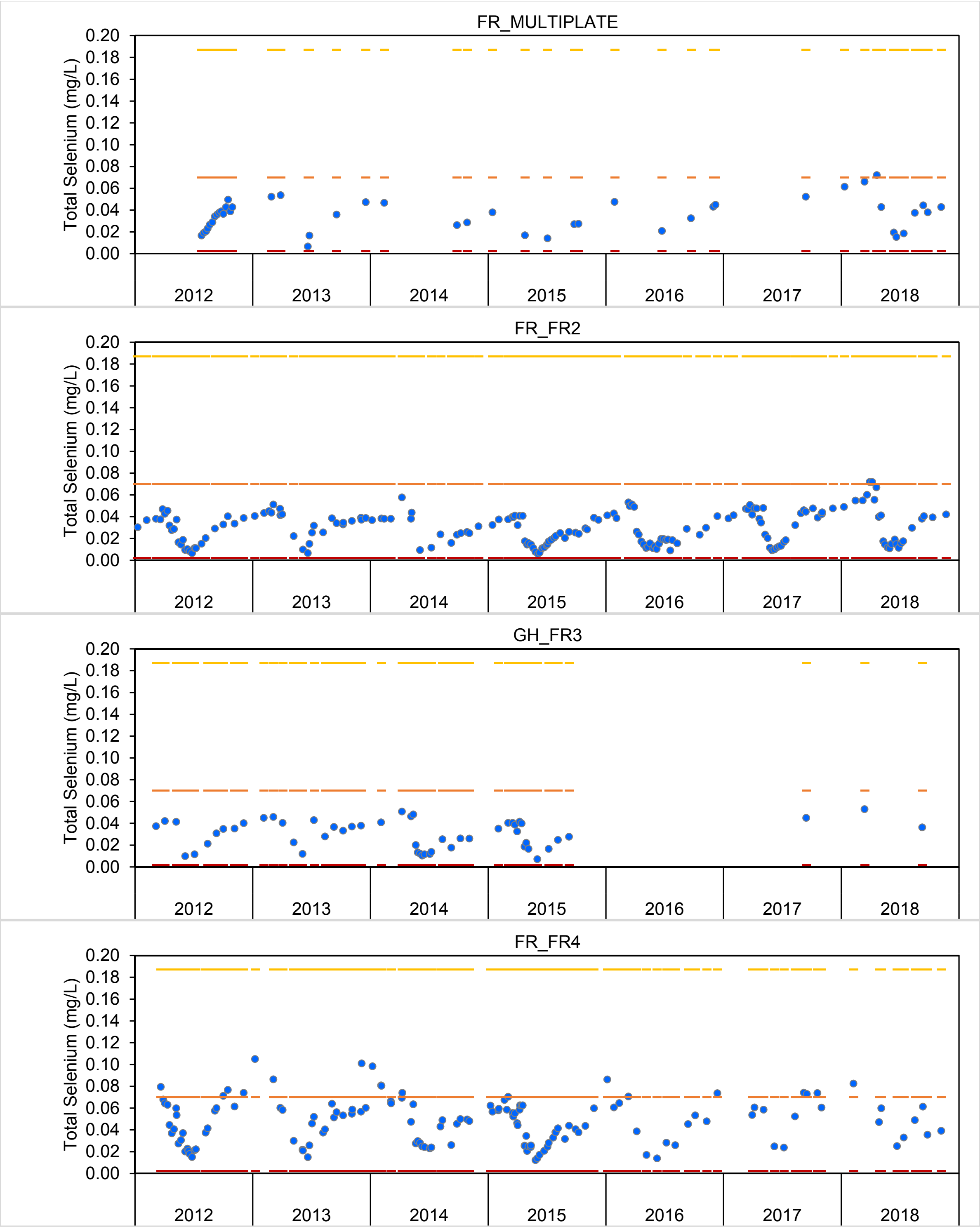


Figure C.14: Time Series Plots for Aqueous Total Selenium Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = Level 1 Benchmark; – – = Level 2 Benchmark

● = Mine -exposed; ● = Reference.

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

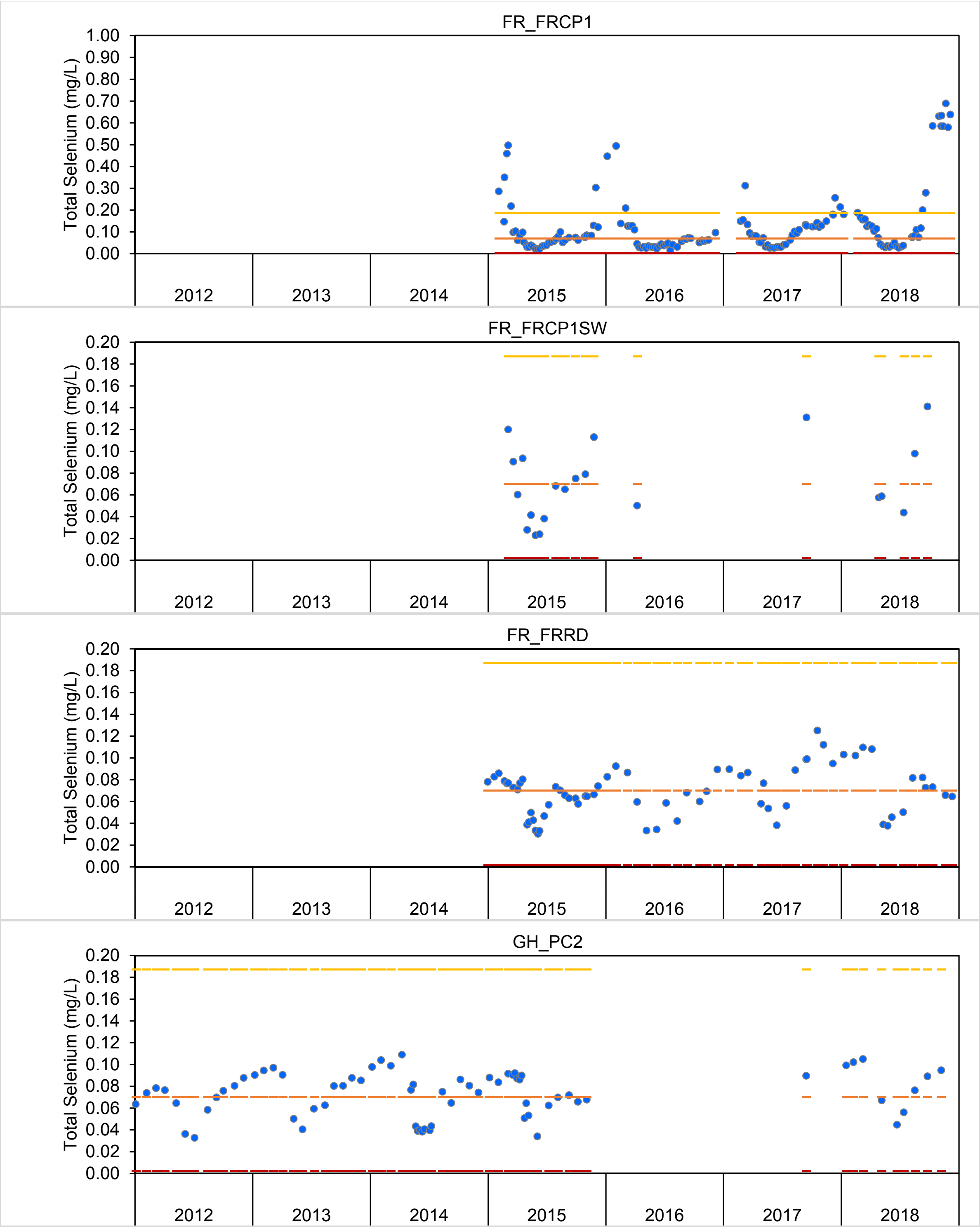


Figure C.14: Time Series Plots for Aqueous Total Selenium Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = Level 1 Benchmark; – – = Level 2 Benchmark

● = Mine -exposed; ● = Reference.

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

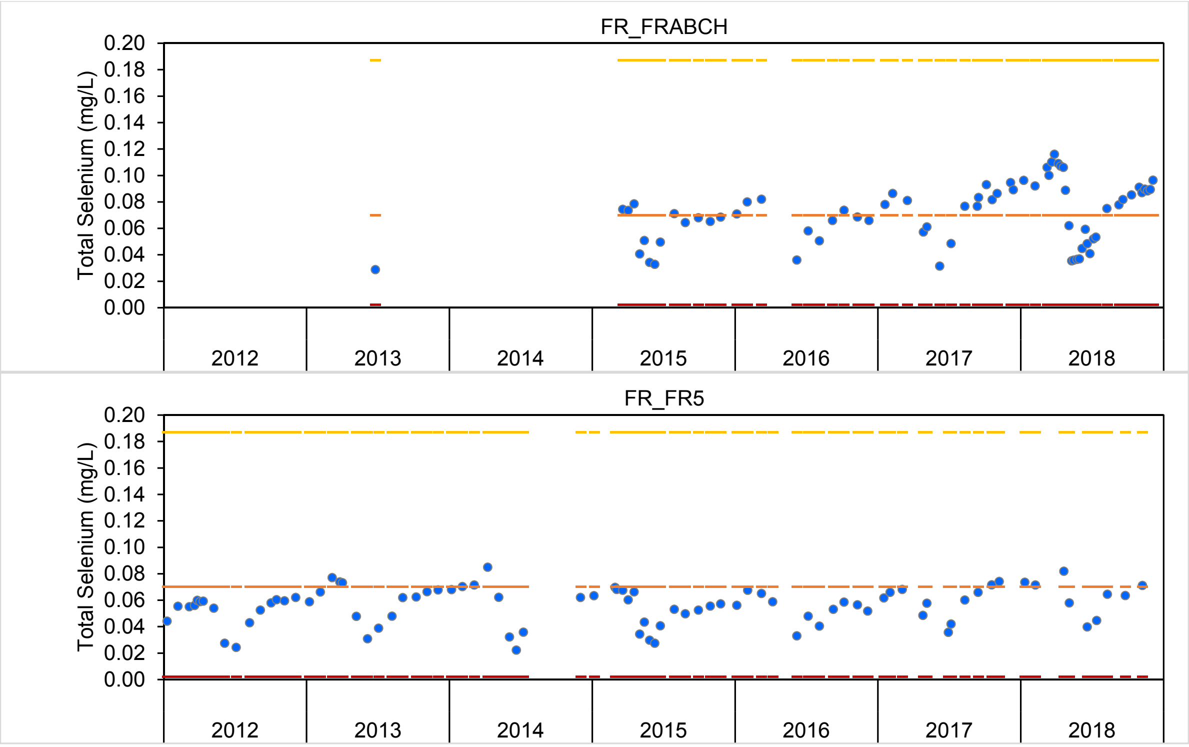


Figure C.14: Time Series Plots for Aqueous Total Selenium Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = Level 1 Benchmark; – – = Level 2 Benchmark

● = Mine -exposed; ● = Reference.

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

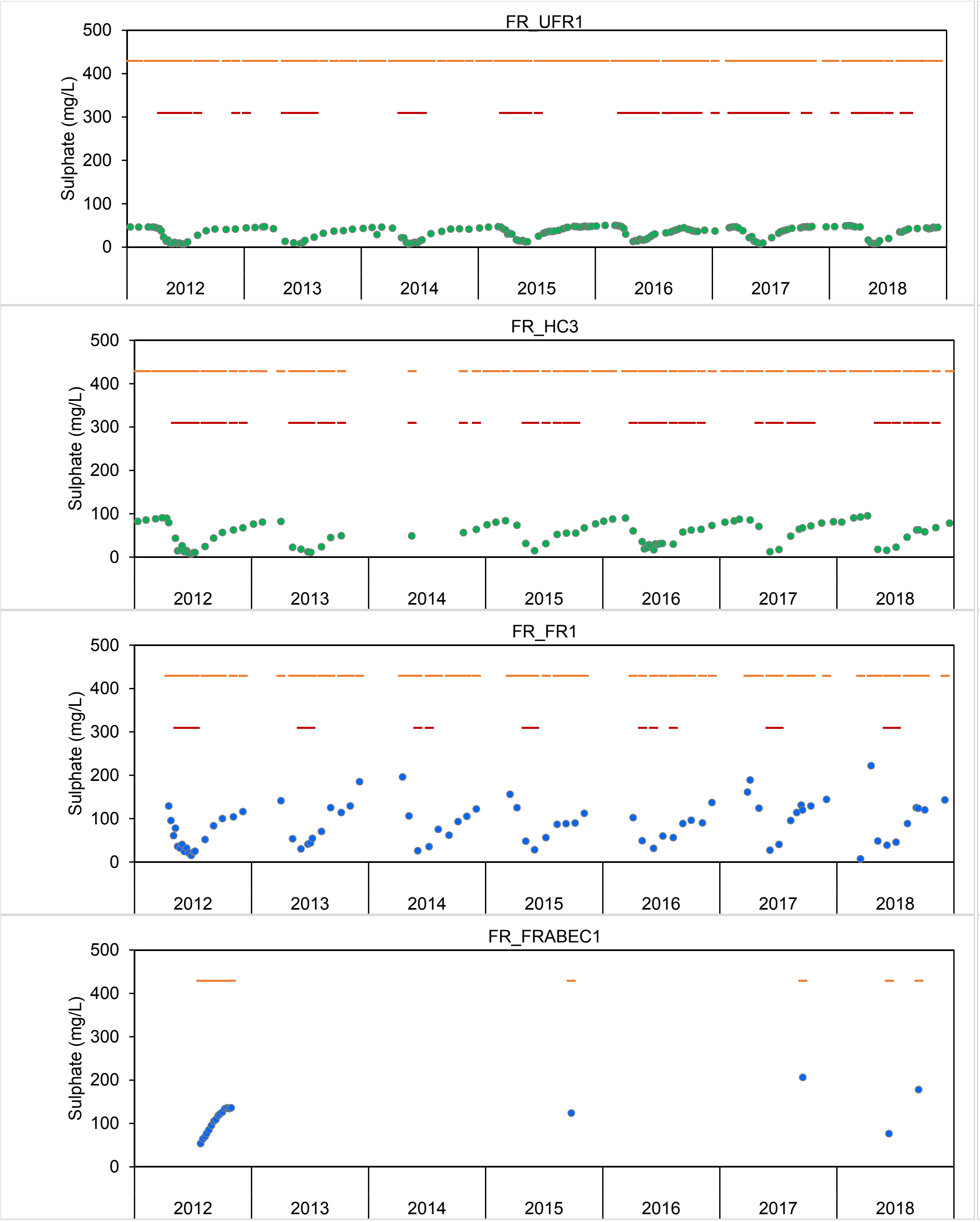


Figure C.15: Time Series Plots for Aqueous Sulphate Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (short term); – – = Level 1 Benchmark

● = Mine -exposed; ● = Reference.

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When guidelines overlap only one is visilble.

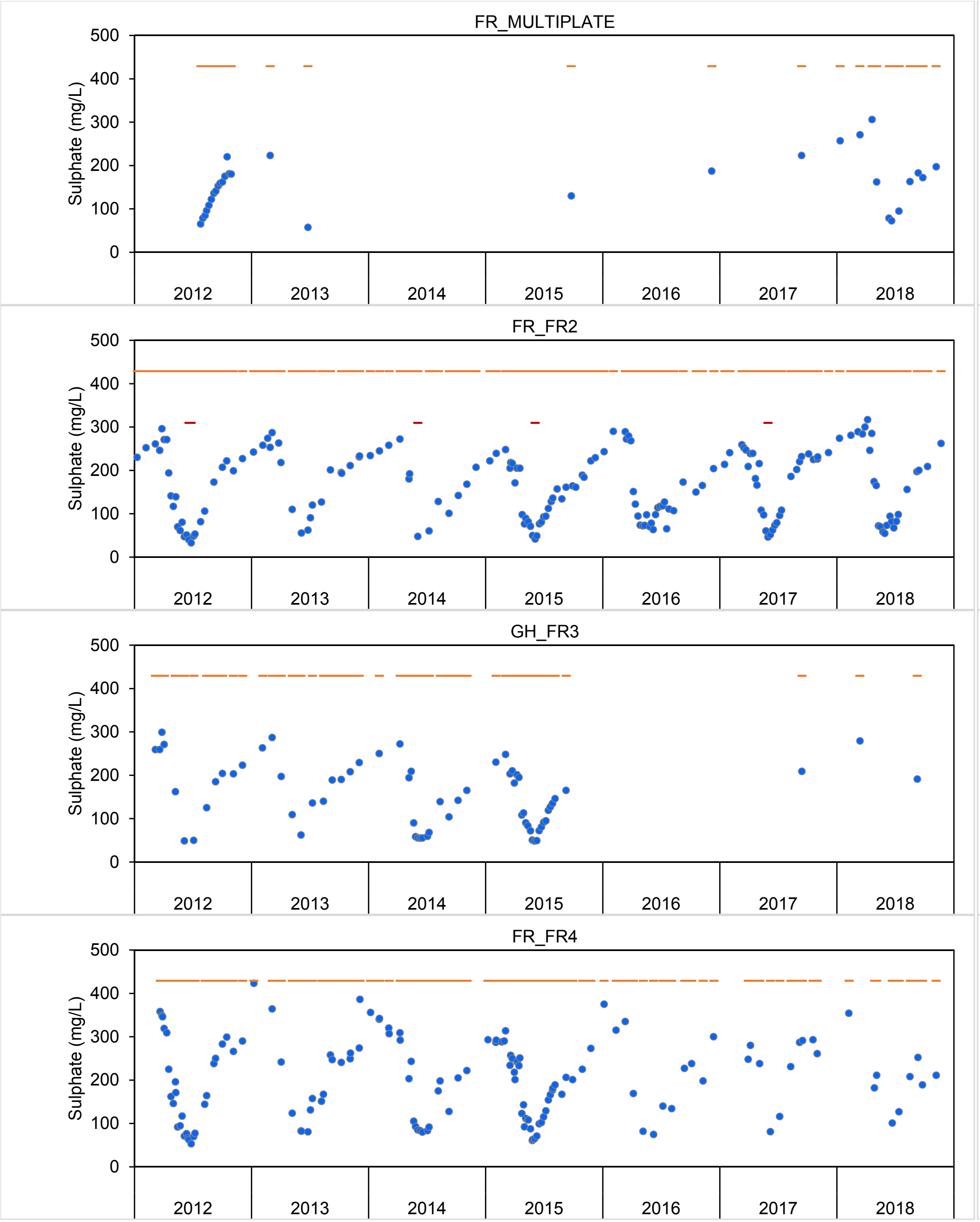


Figure C.15: Time Series Plots for Aqueous Sulphate Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (short term); – – = Level 1 Benchmark

● = Mine -exposed; ● = Reference.

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When guidelines overlap only one is visilble.

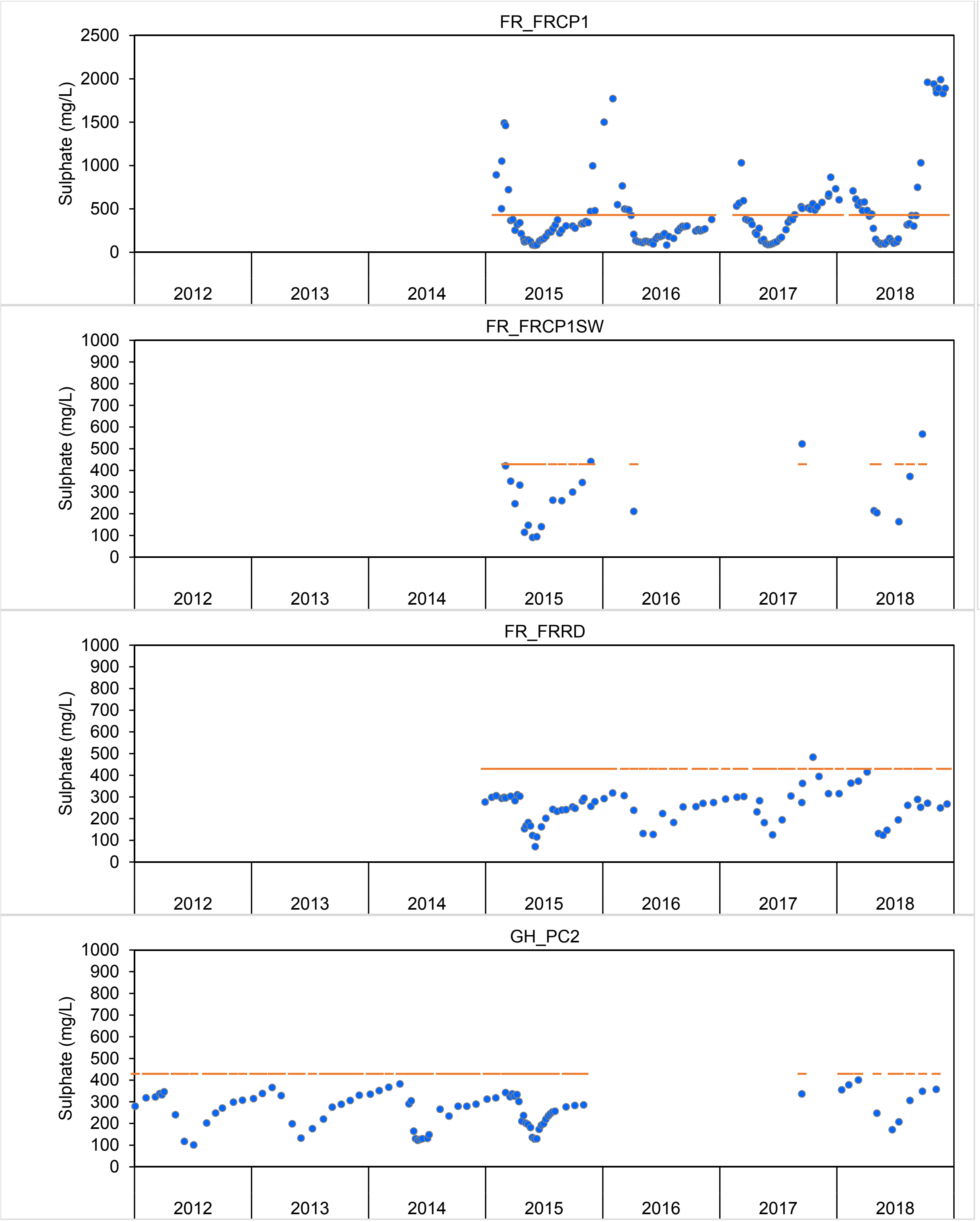


Figure C.15: Time Series Plots for Aqueous Sulphate Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (short term); – – = Level 1 Benchmark

● = Mine -exposed; ● = Reference.

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When guidelines overlap only one is visilble.

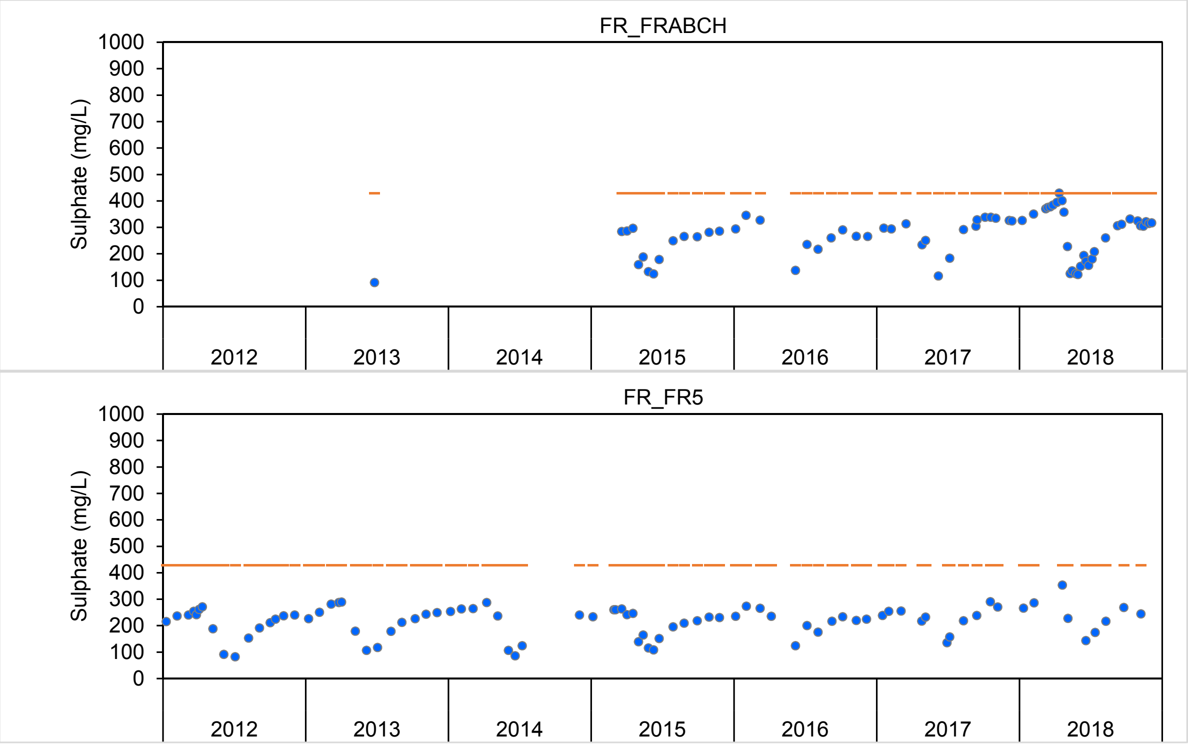


Figure C.15: **Time Series Plots for Aqueous Sulphate Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018**

– – = BCWQG (short term); – – = Level 1 Benchmark

● = Mine -exposed; ● = Reference.

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When guidelines overlap only one is visilble.

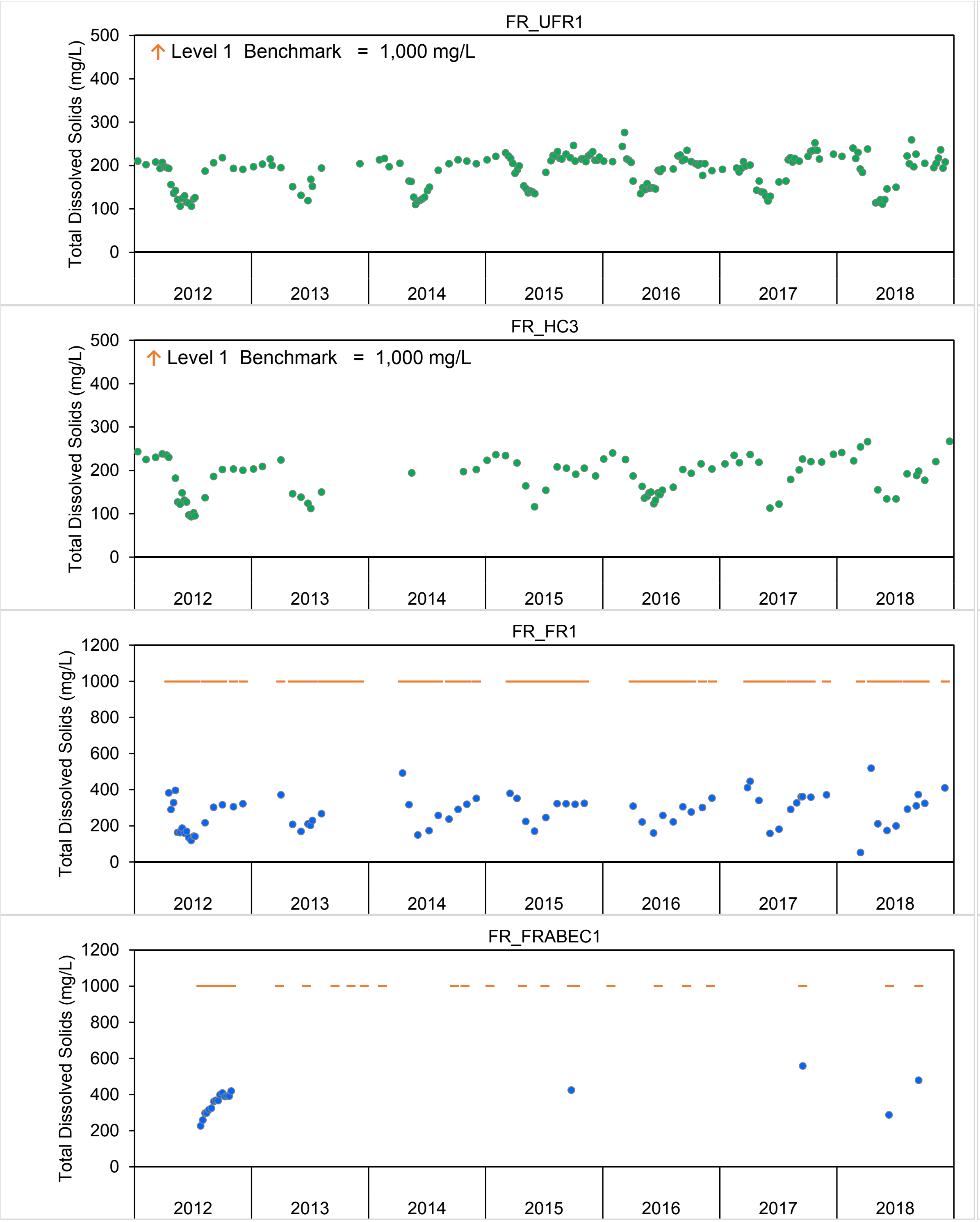


Figure C.16: Time Series Plots for Aqueous Total Dissolved Soilds Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = Level 1 Benchmark

● = Mine -exposed; ● = Reference.

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

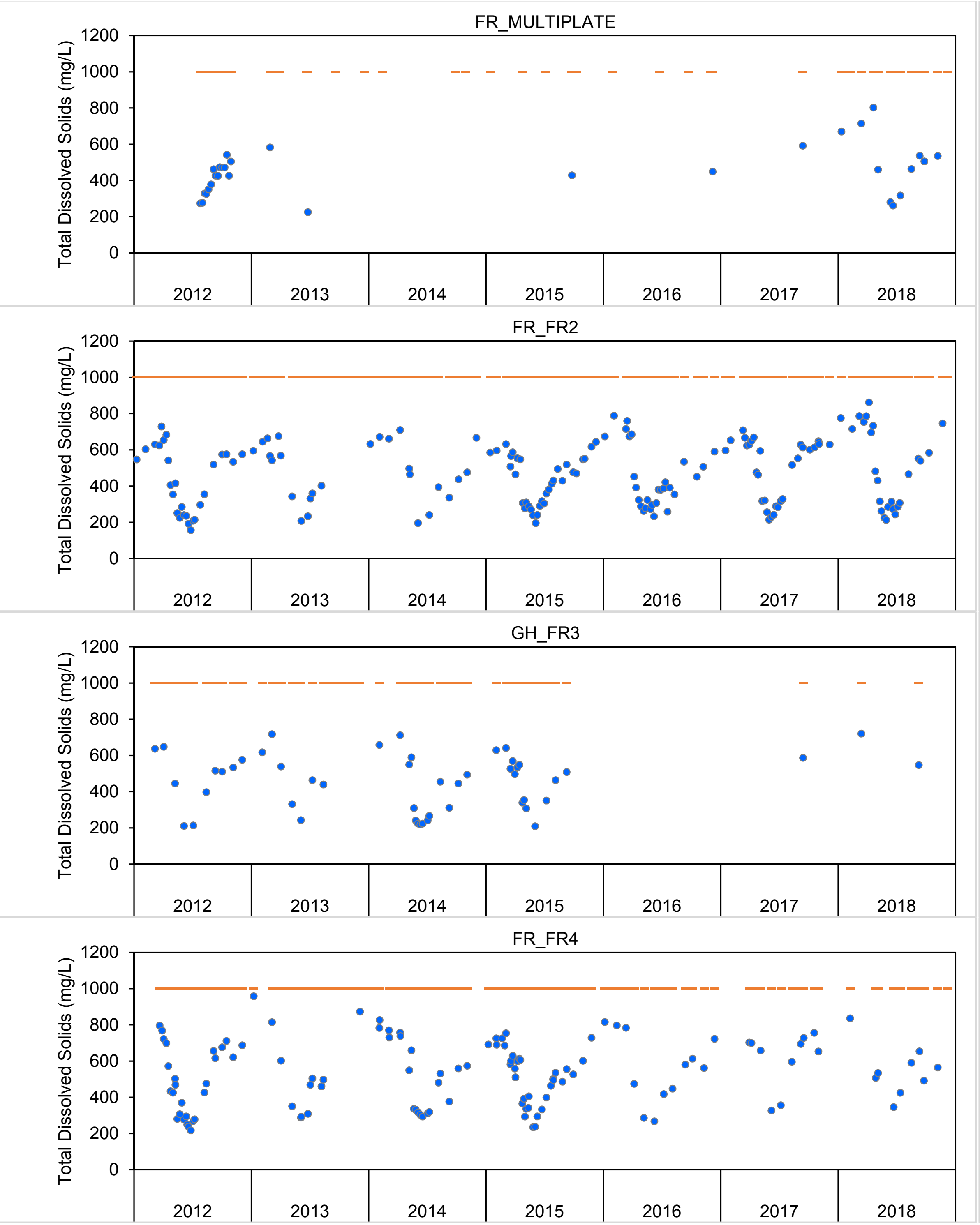


Figure C.16: Time Series Plots for Aqueous Total Dissolved Soilds Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = Level 1 Benchmark

● = Mine -exposed; ● = Reference.

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

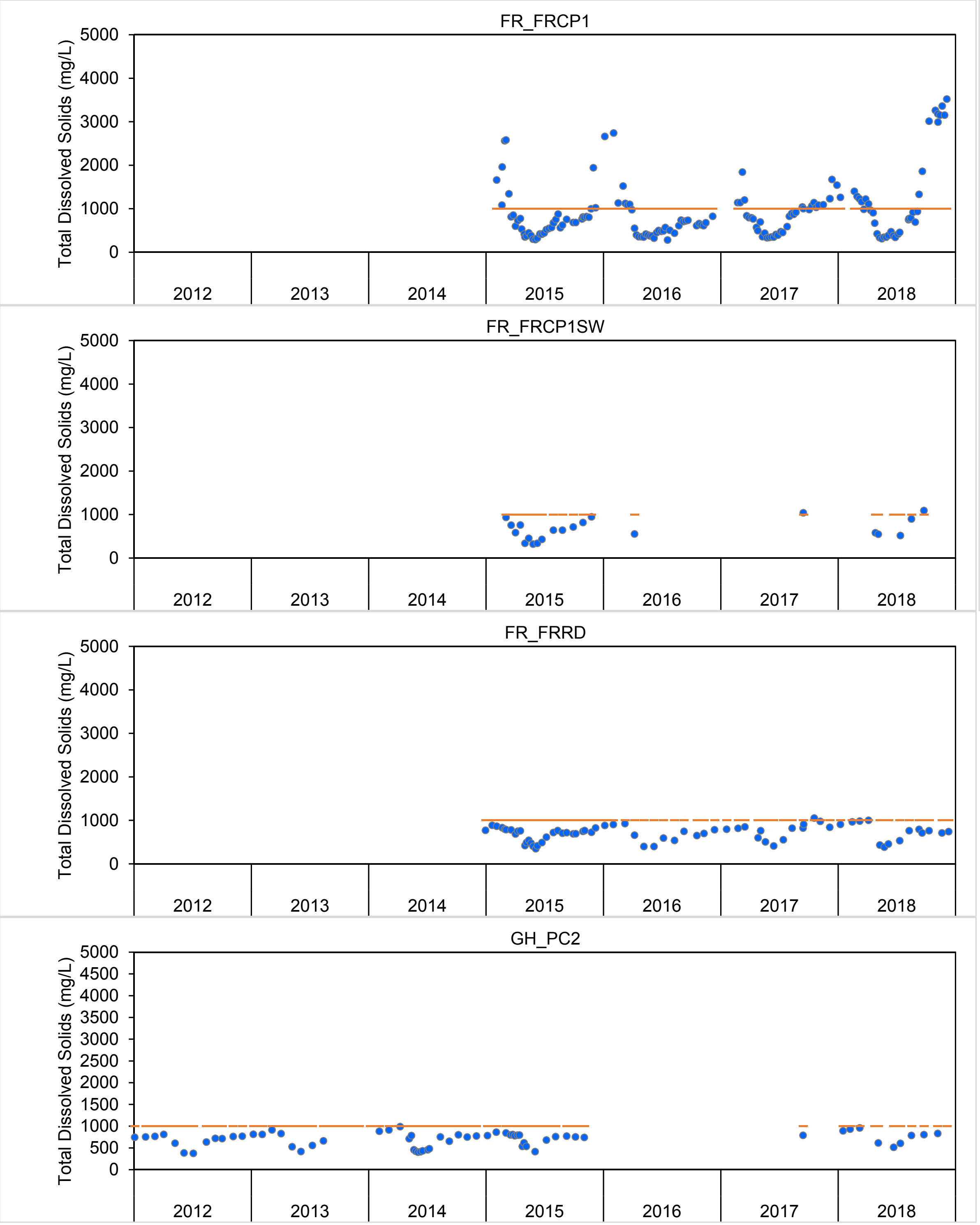


Figure C.16: **Time Series Plots for Aqueous Total Dissolved Soilds Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018**

– – = Level 1 Benchmark

● = Mine -exposed; ● = Reference.

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

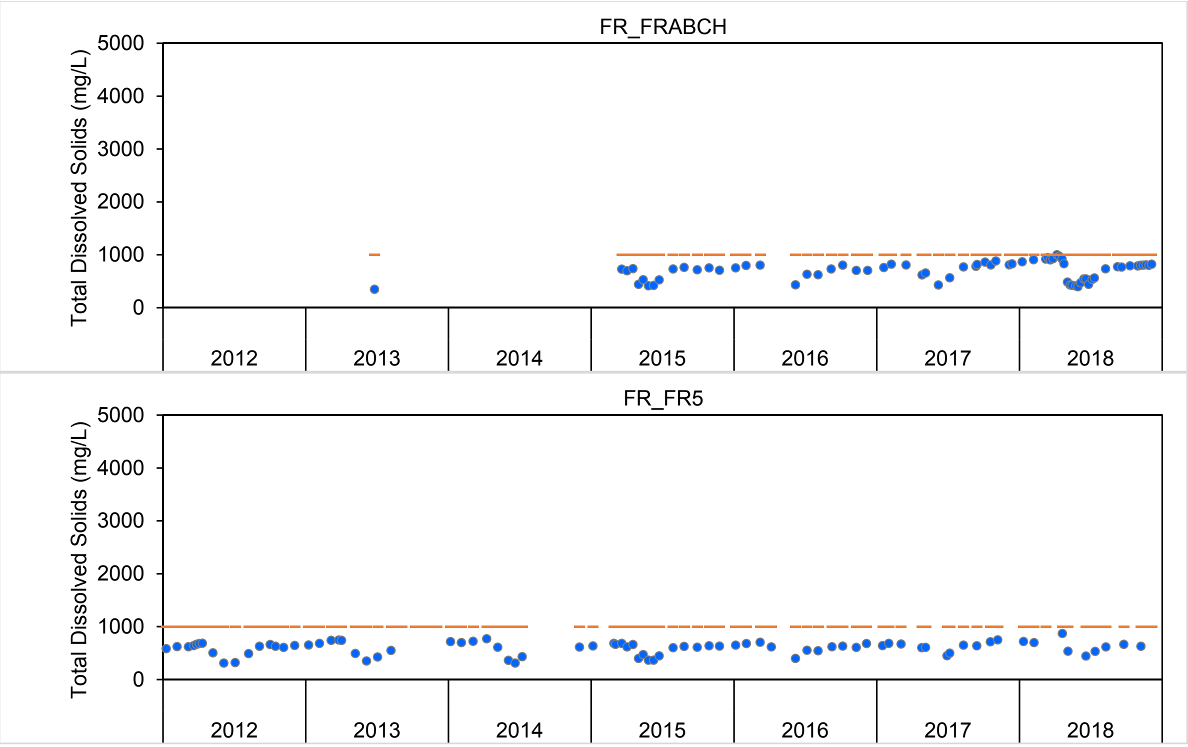


Figure C.16: Time Series Plots for Aqueous Total Dissolved Soilds Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = Level 1 Benchmark

● = Mine -exposed; ● = Reference.

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

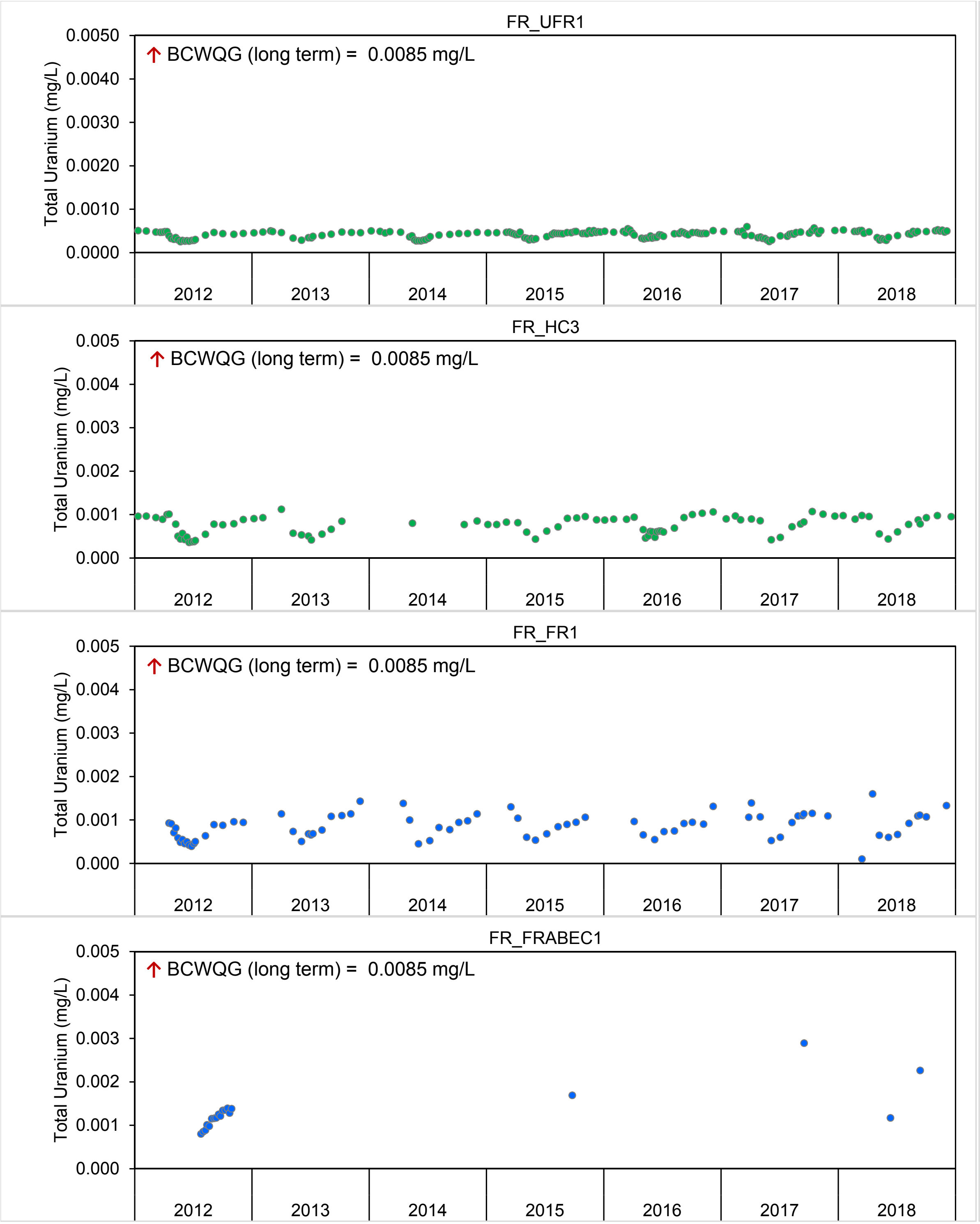


Figure C.17: Time Series Plots for Aqueous Total Uranium Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term)

● = Mine -exposed; ● = Reference.

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

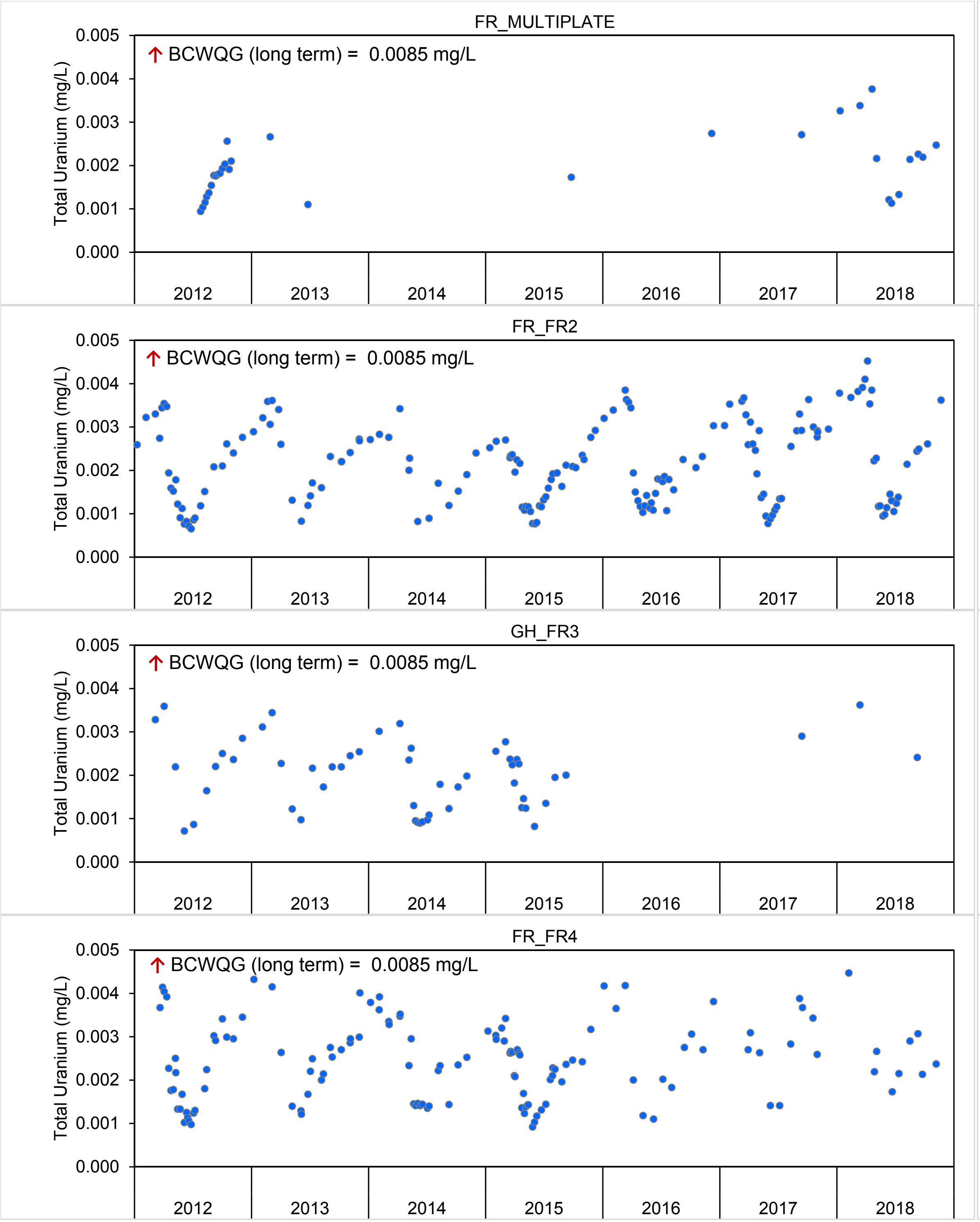


Figure C.17: Time Series Plots for Aqueous Total Uranium Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

-- = BCWQG (long term)

● = Mine -exposed; ● = Reference.

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

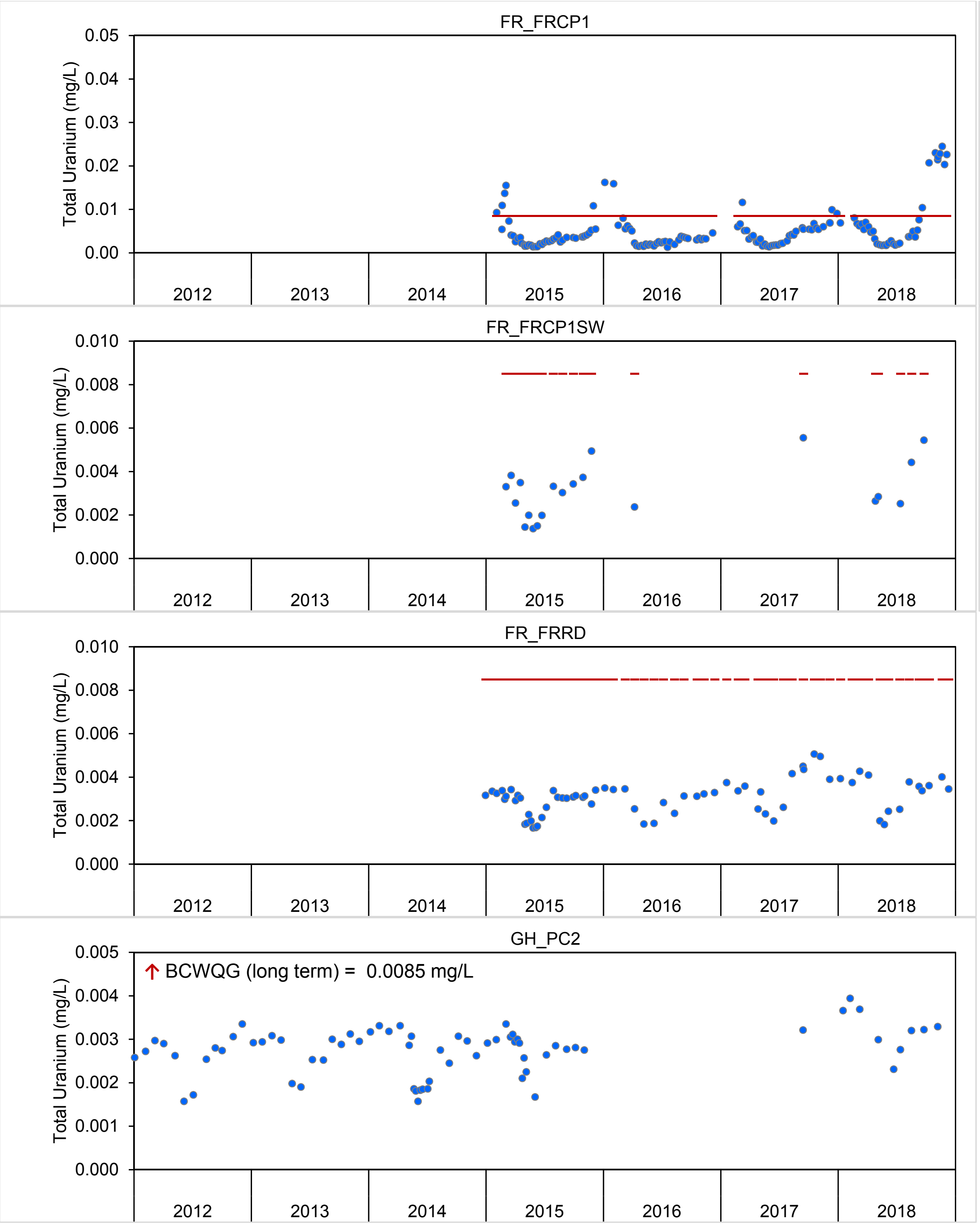


Figure C.17: **Time Series Plots for Aqueous Total Uranium Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018**

- - = BCWQG (long term)

● = Mine -exposed; ● = Reference.

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

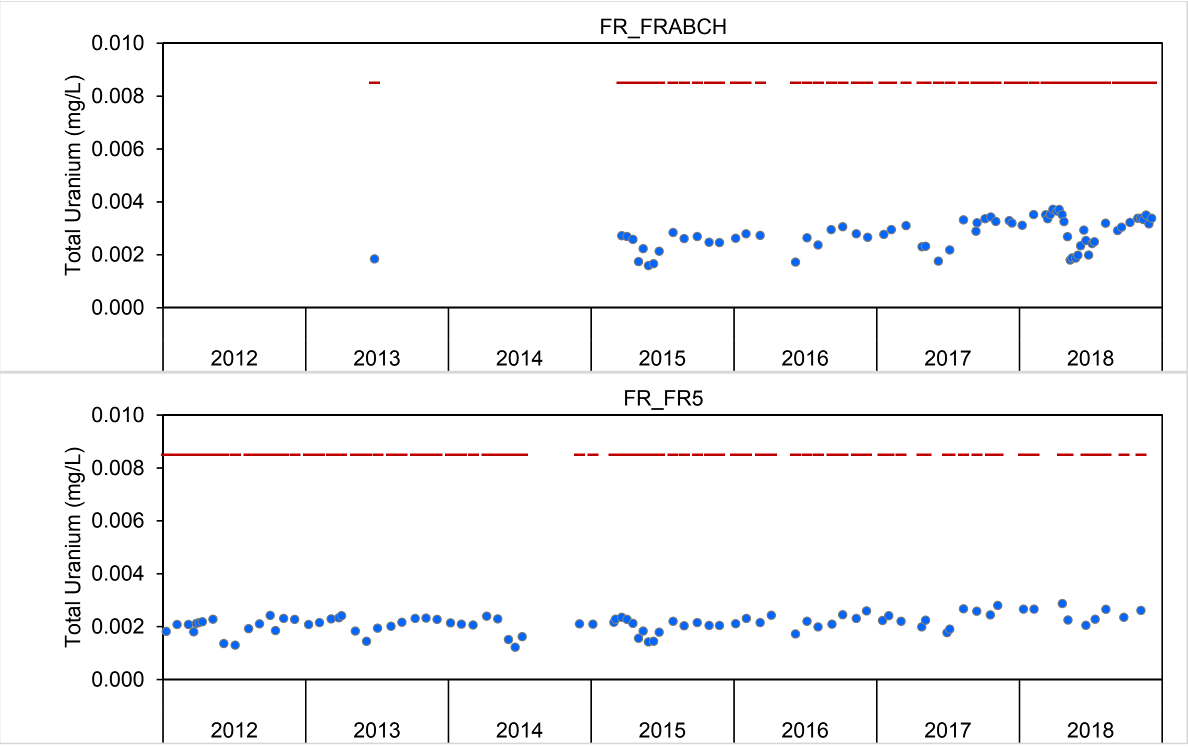


Figure C.17: Time Series Plots for Aqueous Total Uranium Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term)

● = Mine -exposed; ● = Reference.

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

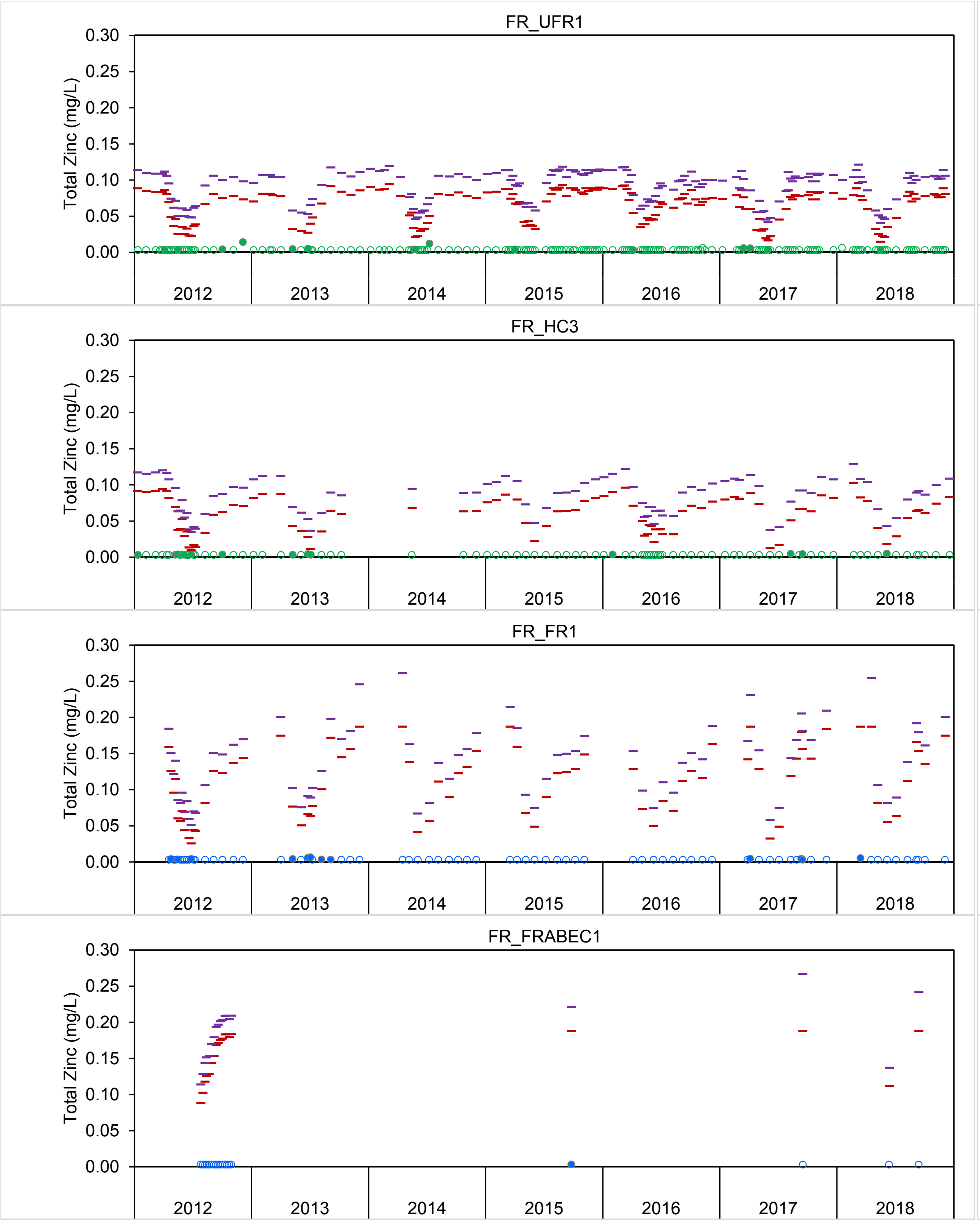


Figure C.18: Time Series Plots for Aqueous Total Zinc Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

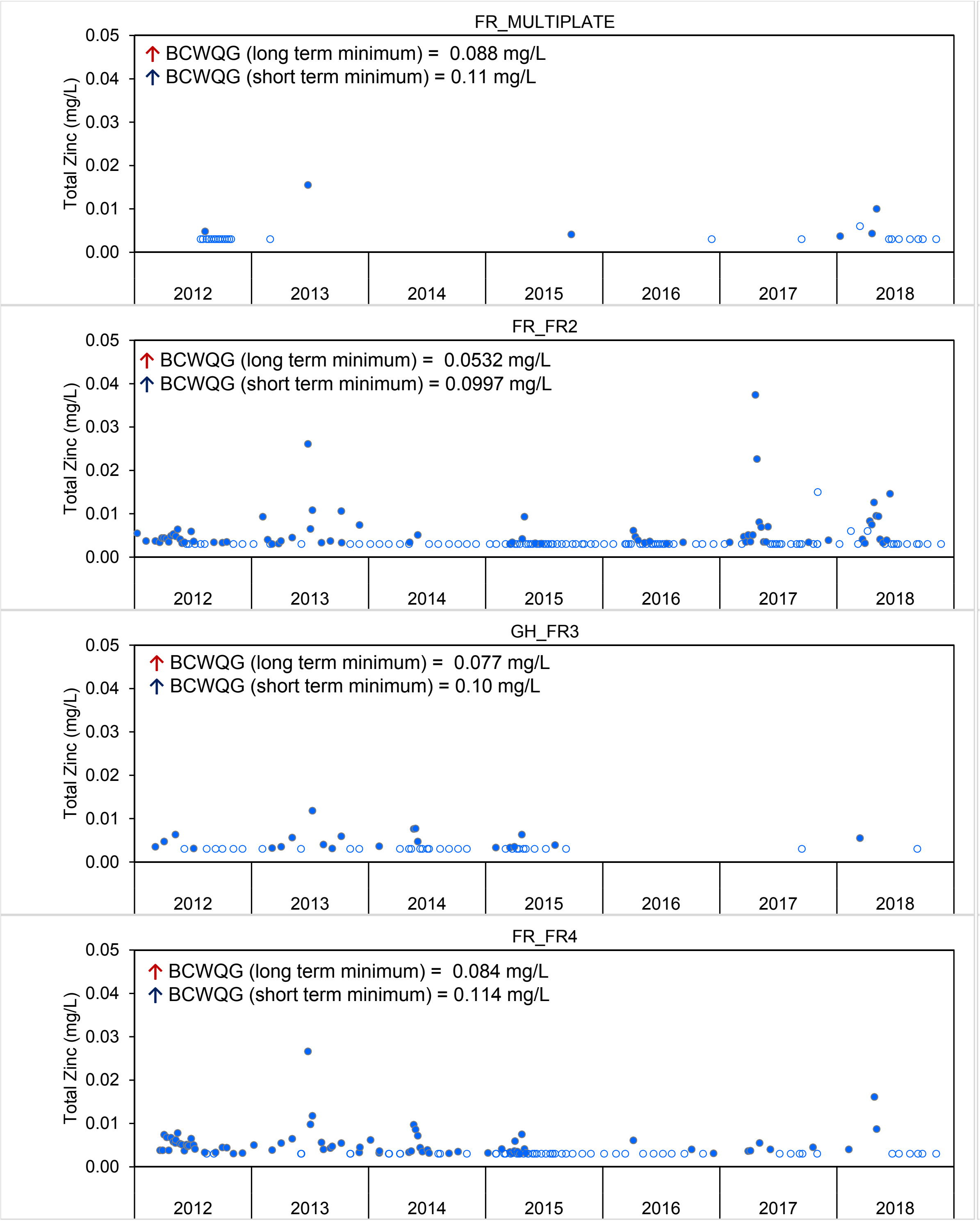


Figure C.18: **Time Series Plots for Aqueous Total Zinc Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018**

– – = BCWQG (long term); – – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

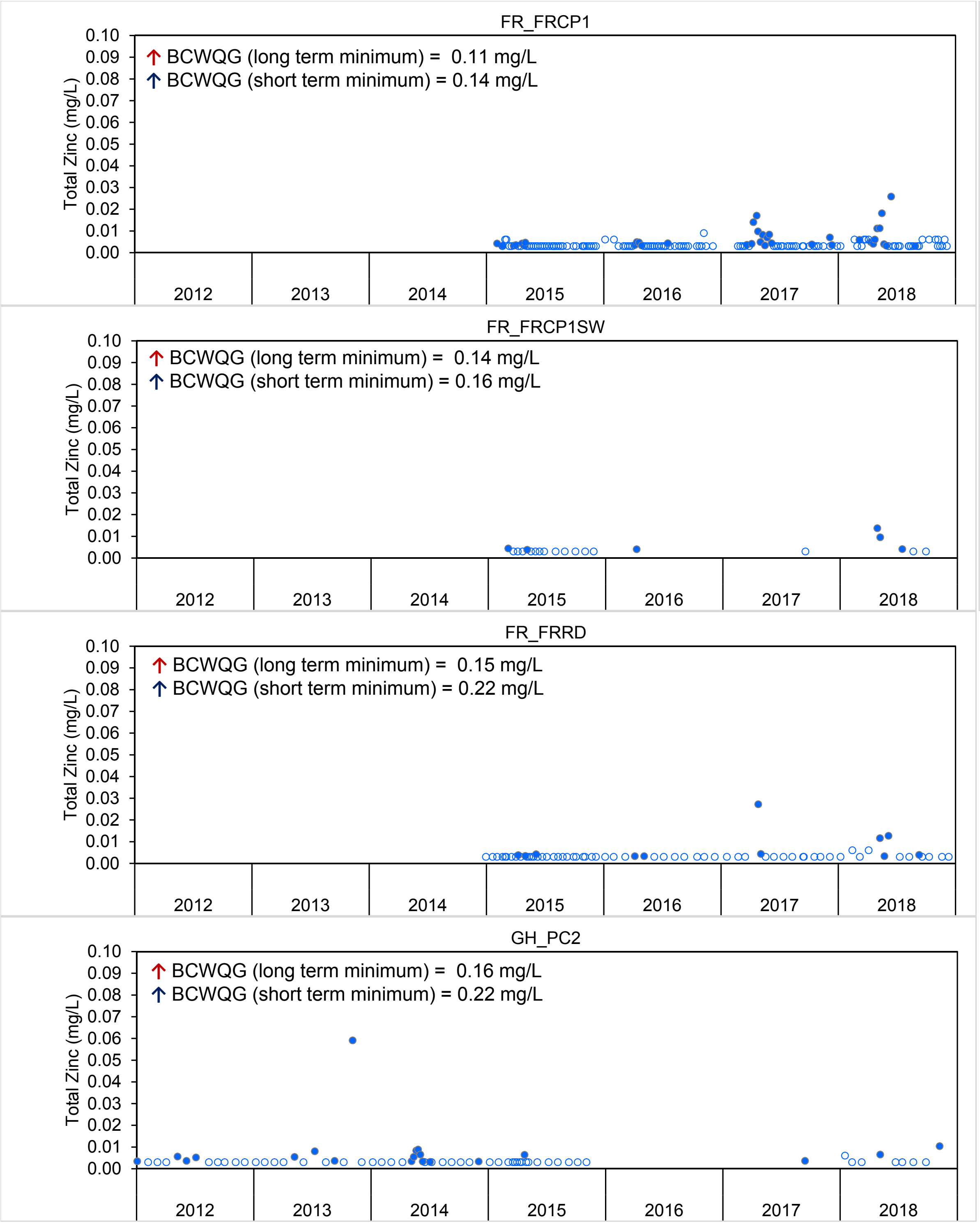


Figure C.18: **Time Series Plots for Aqueous Total Zinc Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018**

– – = BCWQG (long term); – – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

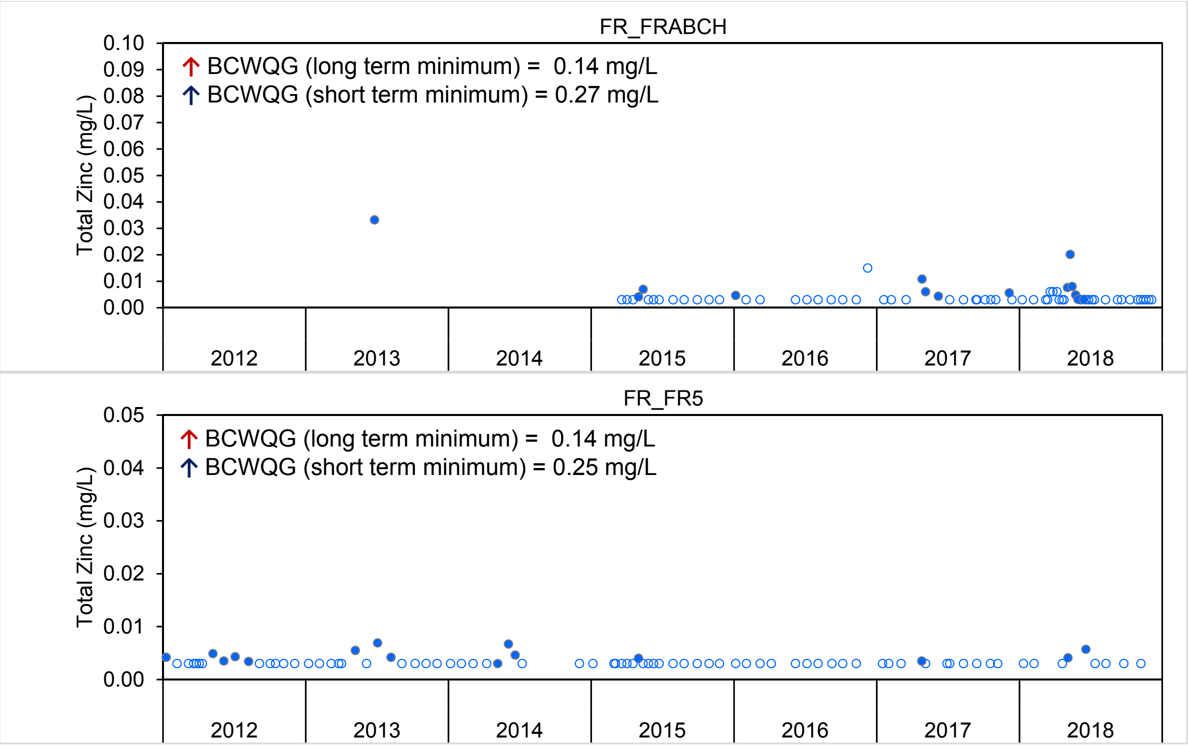


Figure C.18: Time Series Plots for Aqueous Total Zinc Concentrations from Fording River LAEMP Sampling Stations, 2012 to 2018

– – = BCWQG (long term); – – = BCWQG (short term)

● = Mine -exposed; ● = Reference.

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

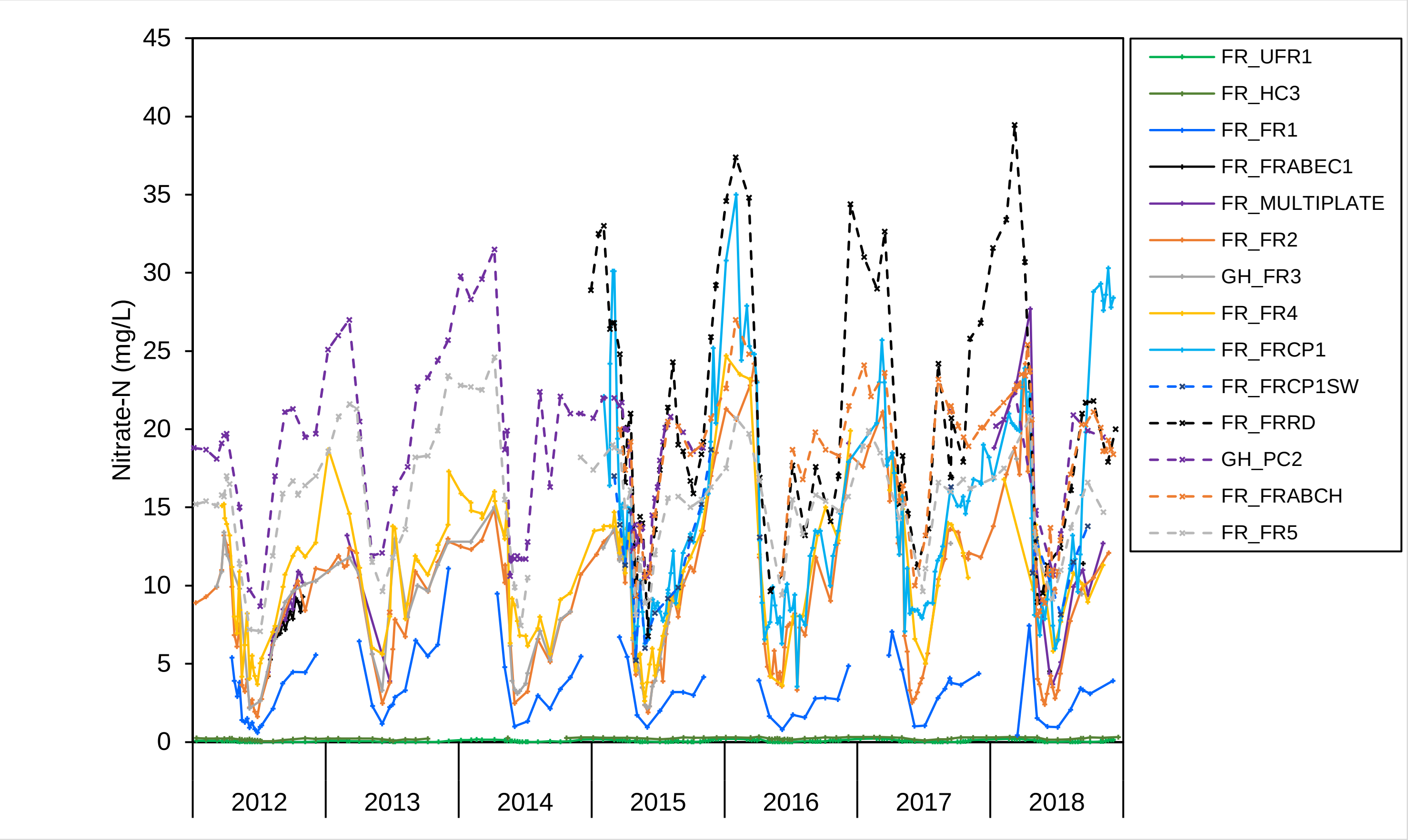


Figure C.19: **Times Series Plots for Aqueous Nitrate-N from Fording River LAEMP Sampling Stations, 2012 to 2018**

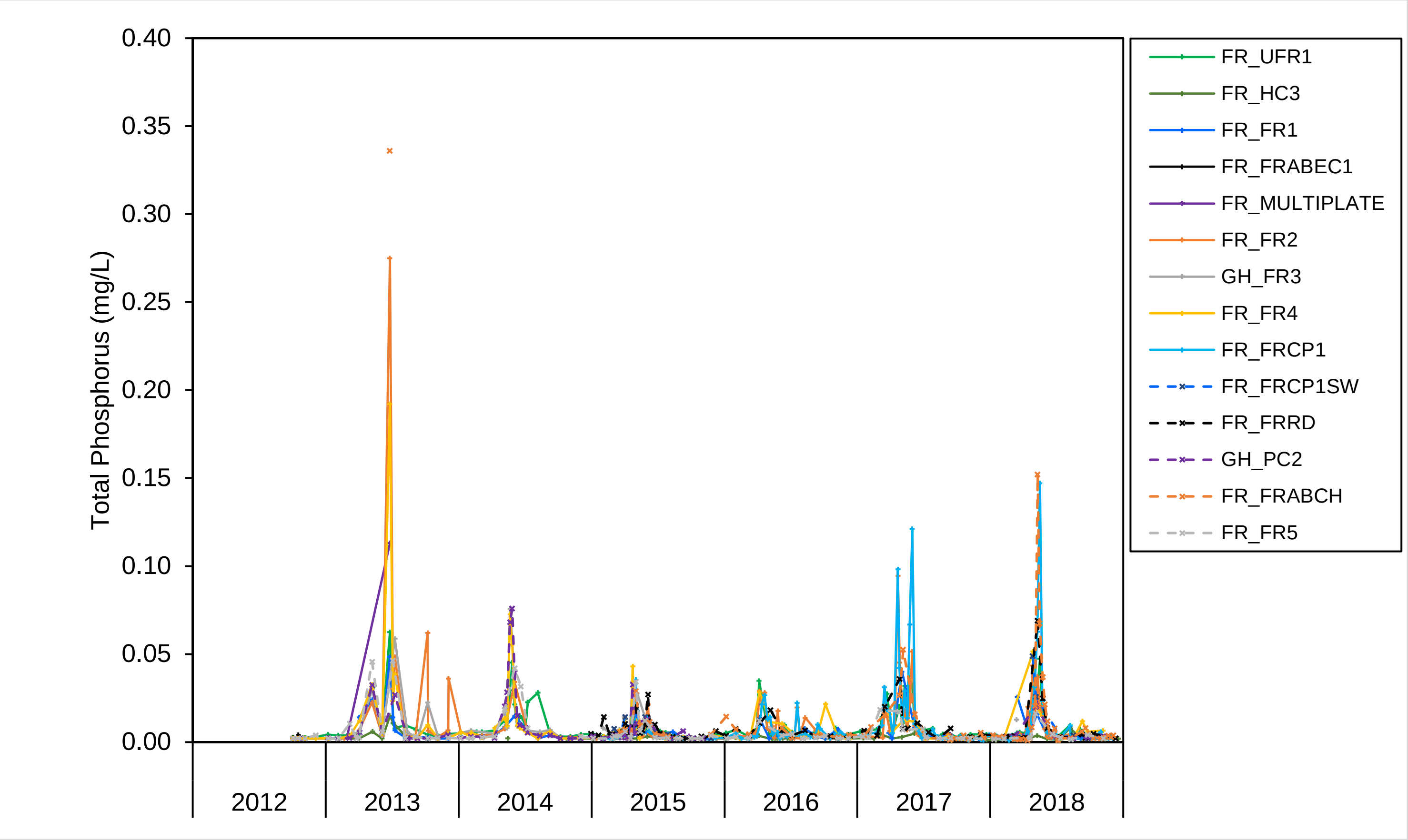


Figure C.20: **Times Series Plots for Aqueous Total Phosphorus from Fording River LAEMP Sampling Stations, 2012 to 2018**

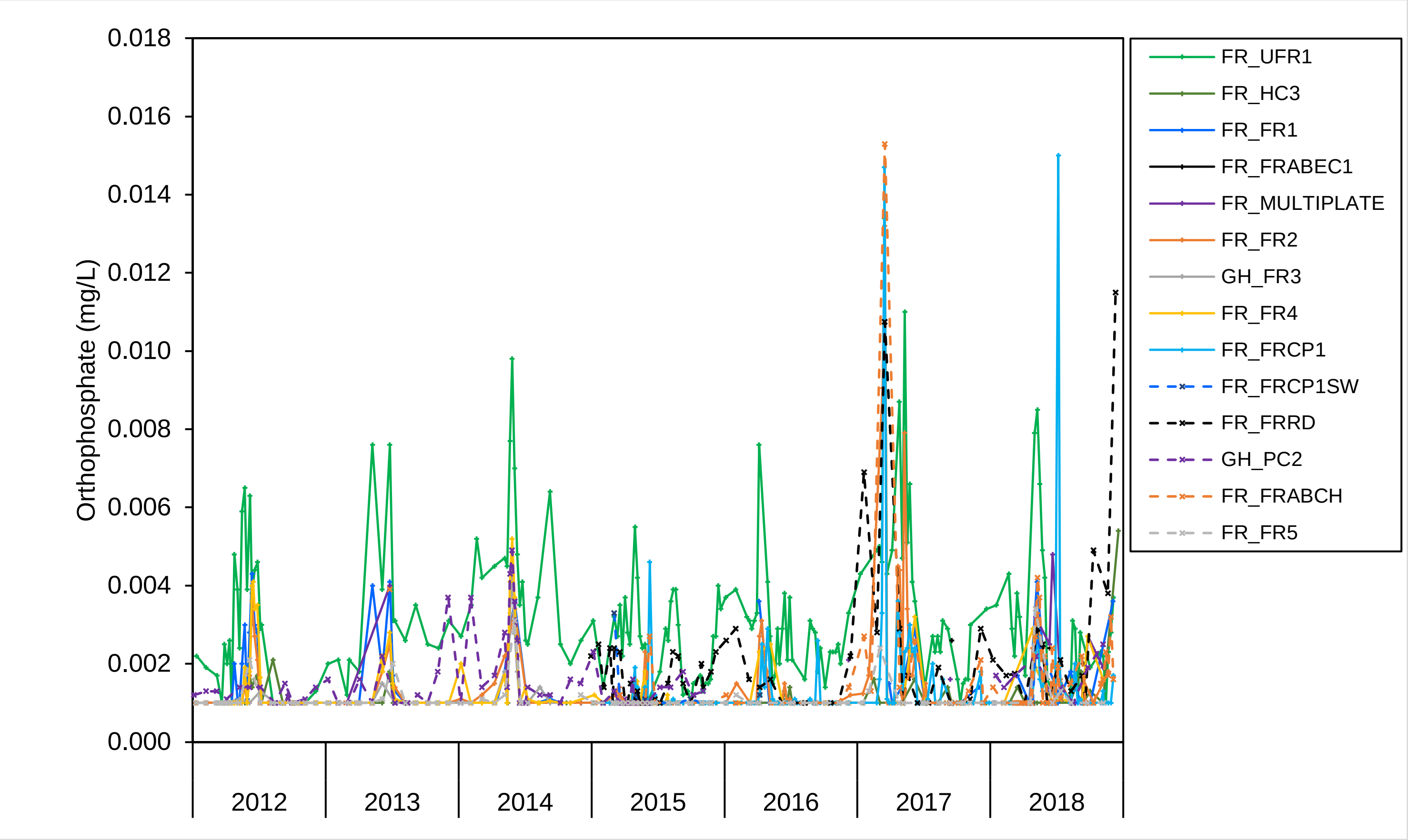


Figure C.21: **Times Series Plots for Aqueous Orthophosphate from Fording River LAEMP Sampling Stations, 2012 to 2018**

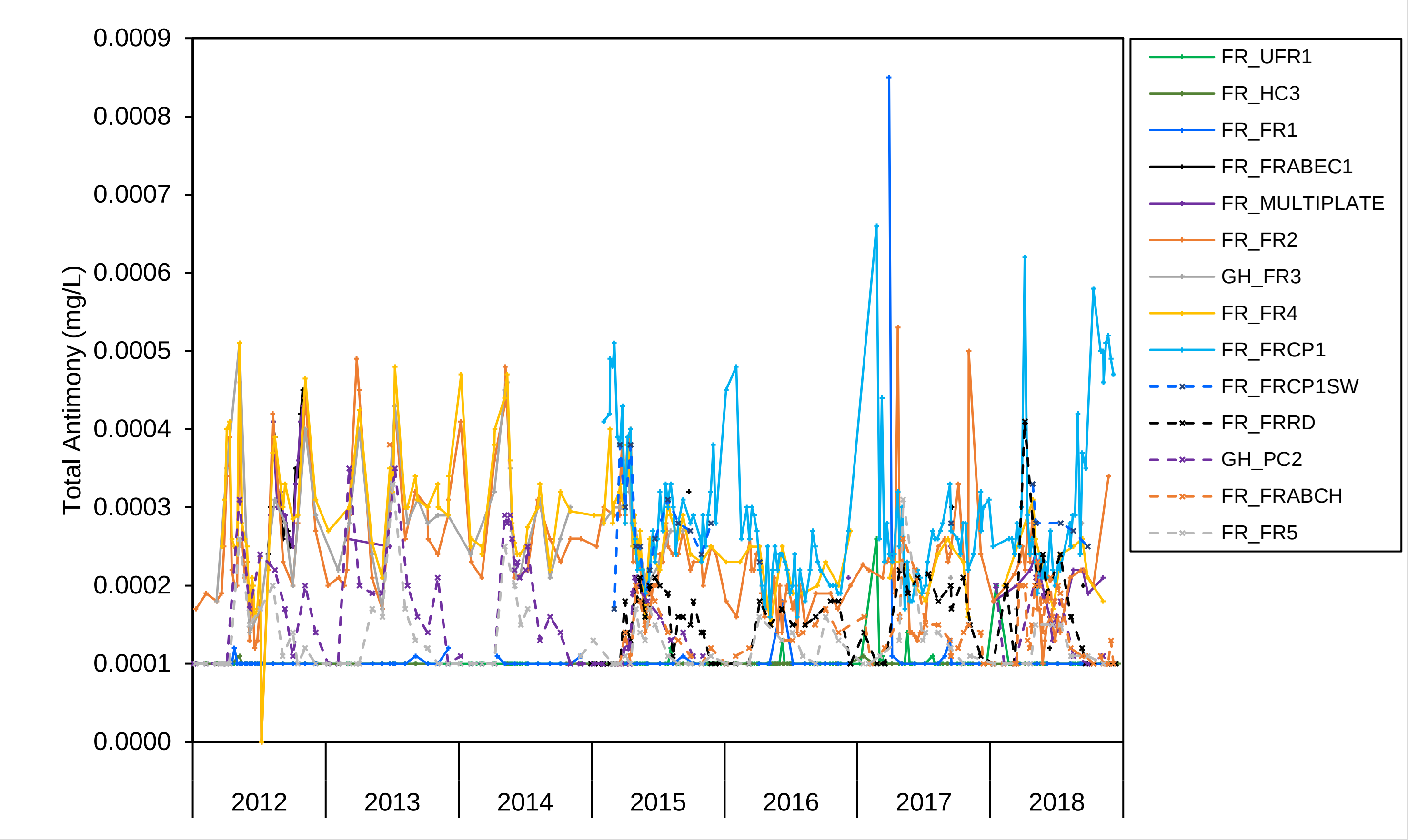


Figure C.22: **Times Series Plots for Aqueous Total Antimony from Fording River LAEMP Sampling Stations, 2012 to 2018**

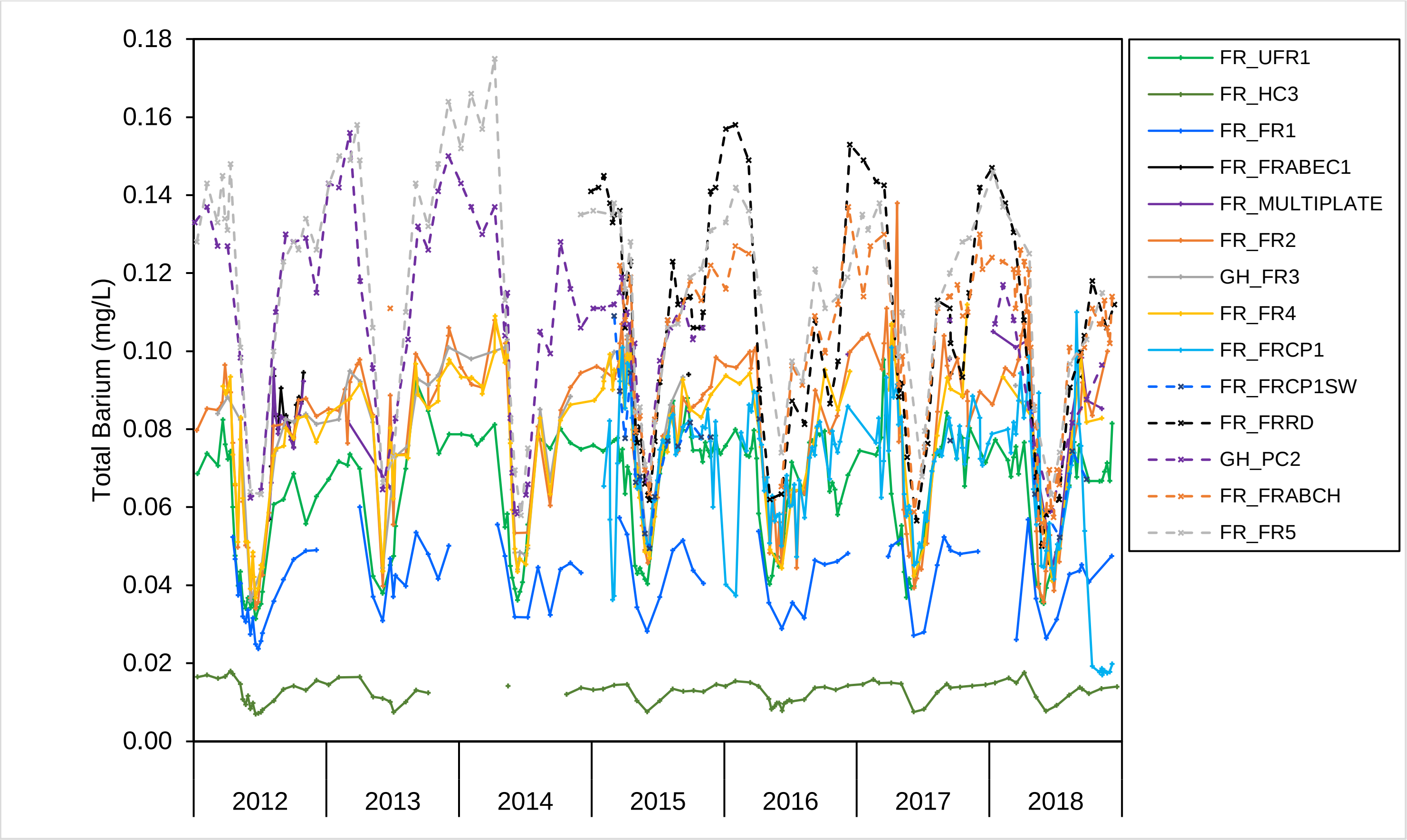


Figure C.23: **Times Series Plots for Aqueous Total Barium from Fording River LAEMP Sampling Stations, 2012 to 2018**

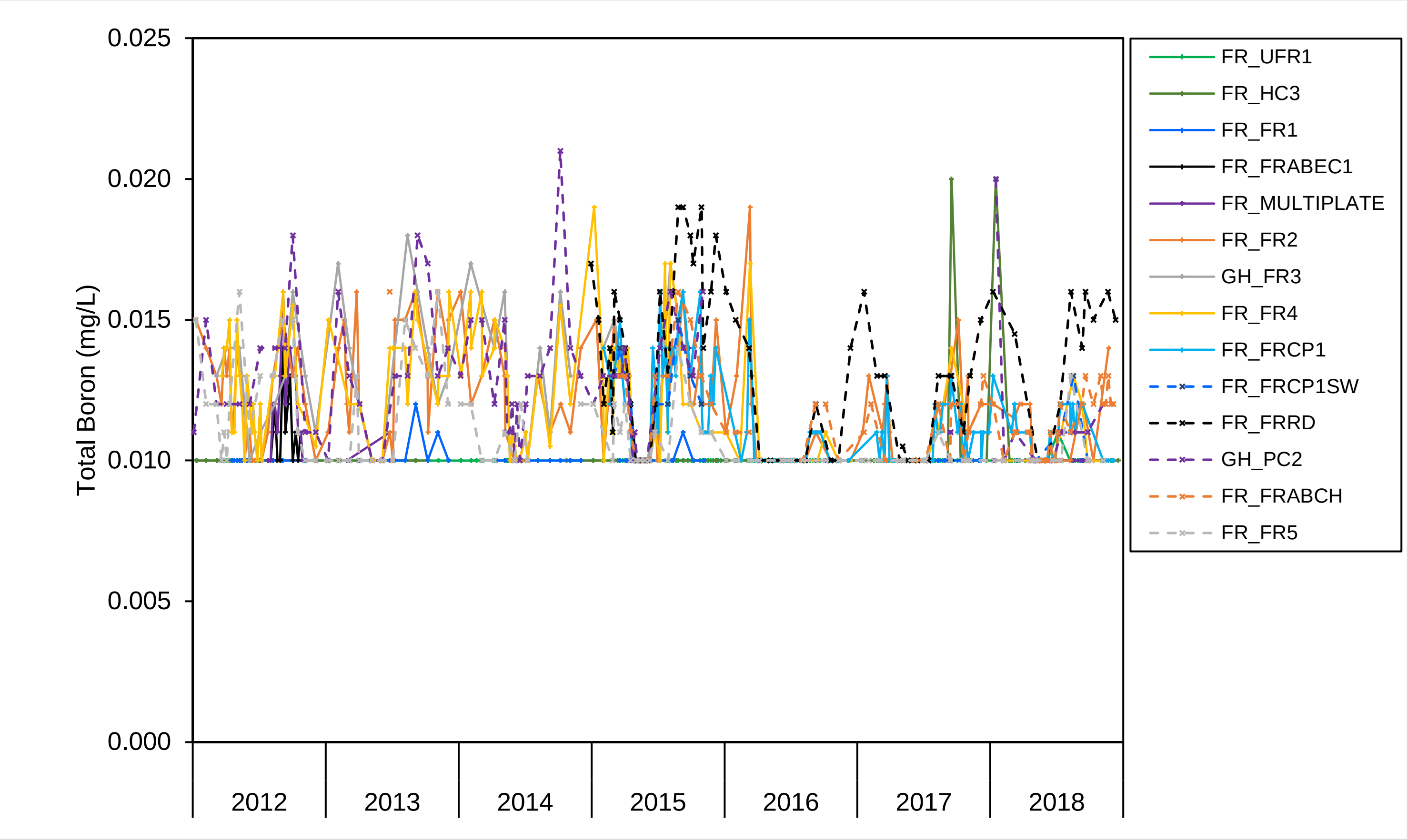


Figure C.24: **Times Series Plots for Aqueous Total Boron from Fording River LAEMP Sampling Stations, 2012 to 2018**

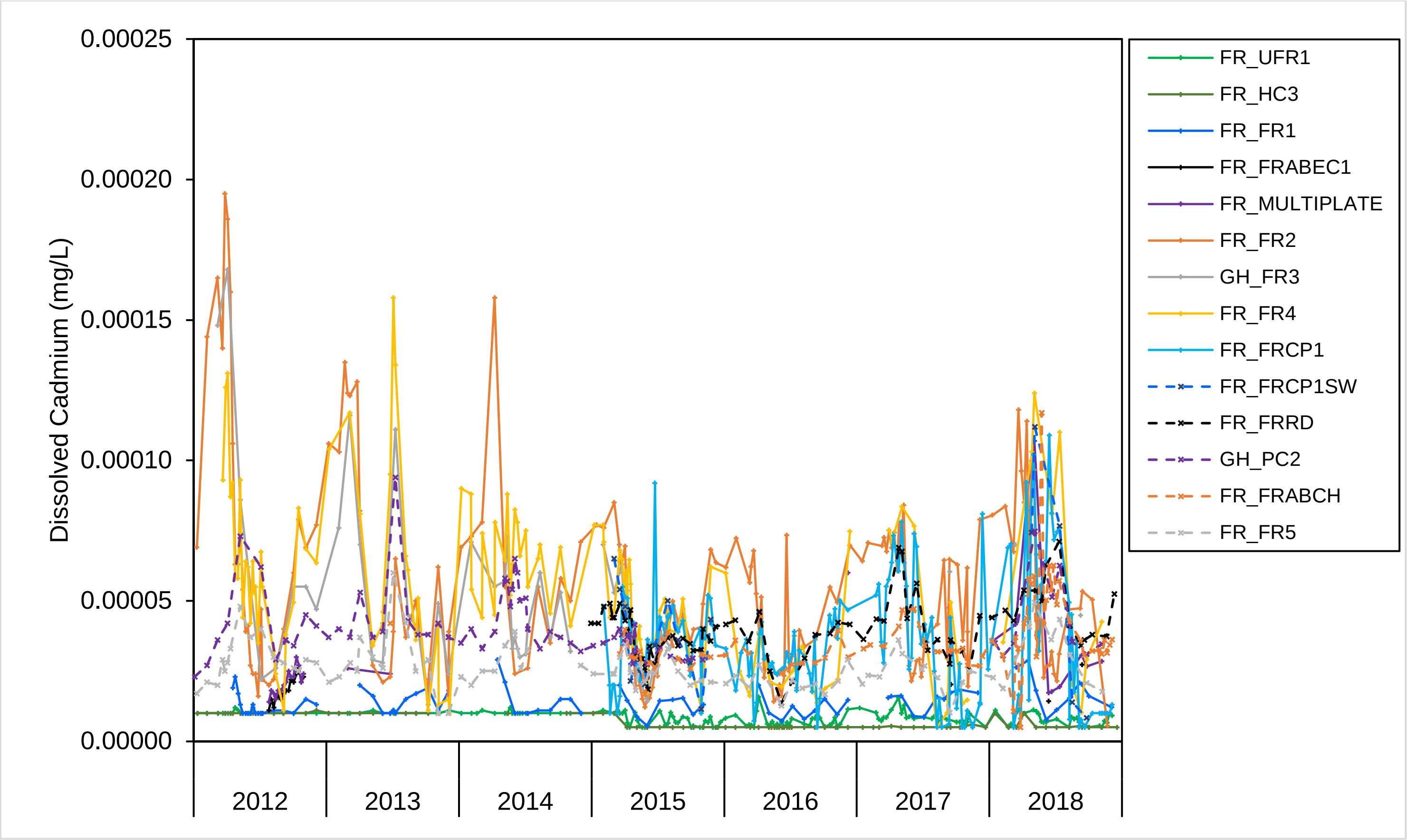


Figure C.25: Times Series Plots for Aqueous Dissolved Cadmium from Fording River LAEMP Sampling Stations, 2012 to 2018

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted at the LRL (minimum LRL = 0.000005 mg/L).

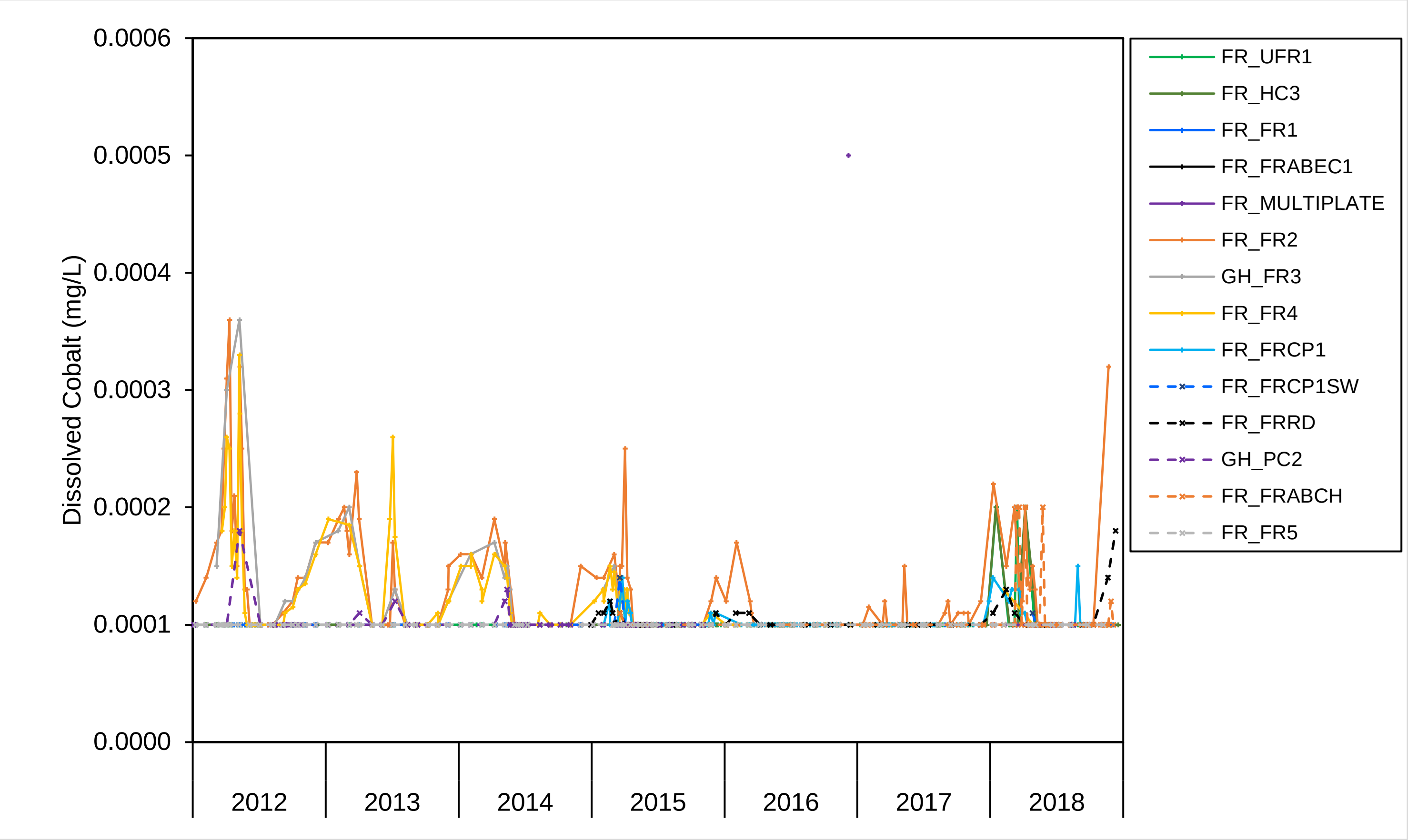


Figure C.26: **Times Series Plots for Aqueous Dissolved Cobalt from Fording River LAEMP Sampling Stations, 2012 to 2018**

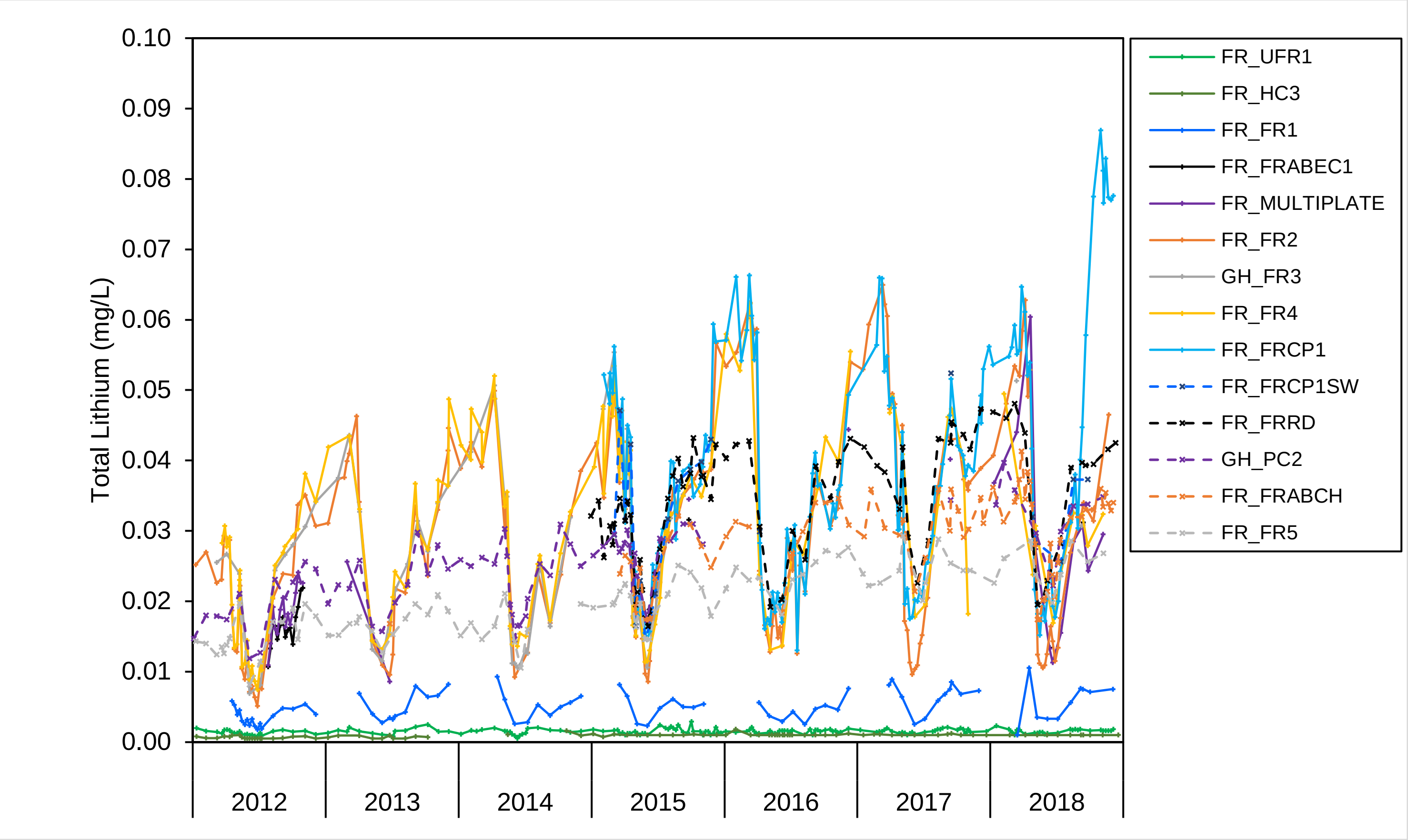


Figure C.27: **Times Series Plots for Aqueous Total Lithium from Fording River LAEMP Sampling Stations, 2012 to 2018**

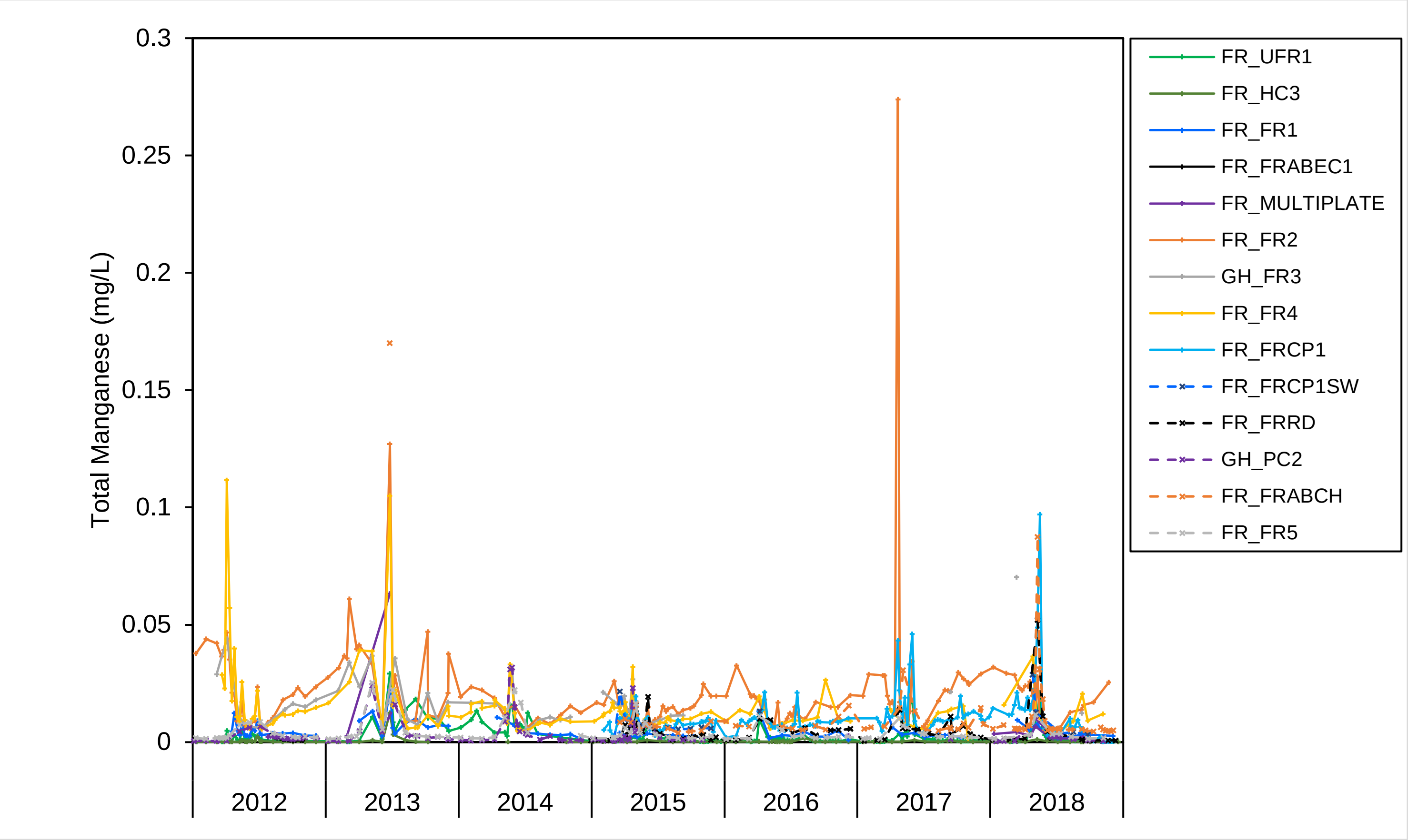


Figure C.28: Times Series Plots for Aqueous Total Manganese from Fording River LAEMP Sampling Stations, 2012 to 2018

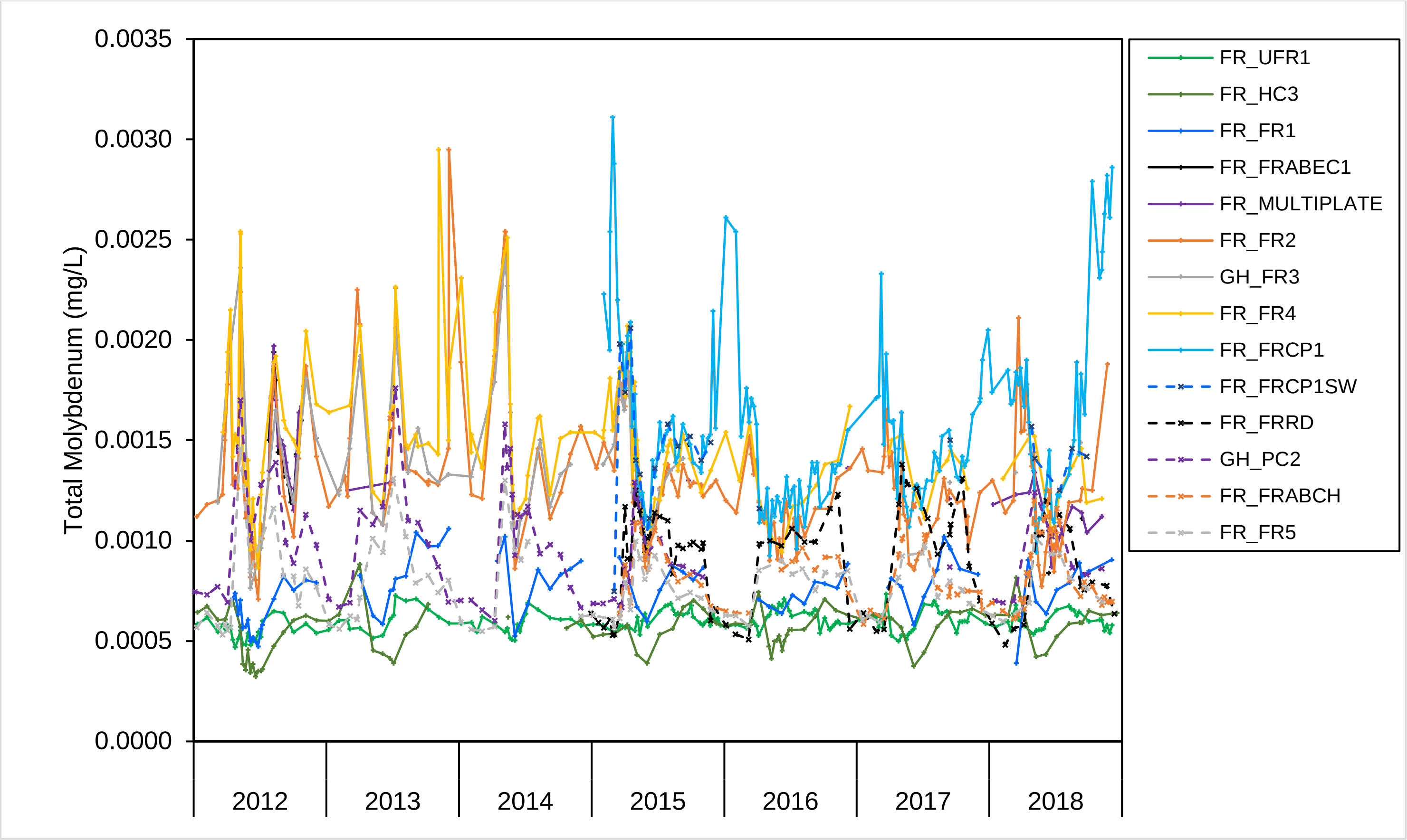


Figure C.29: Times Series Plots for Aqueous Total Molybdenum from Fording River LAEMP Sampling Stations, 2012 to 2018

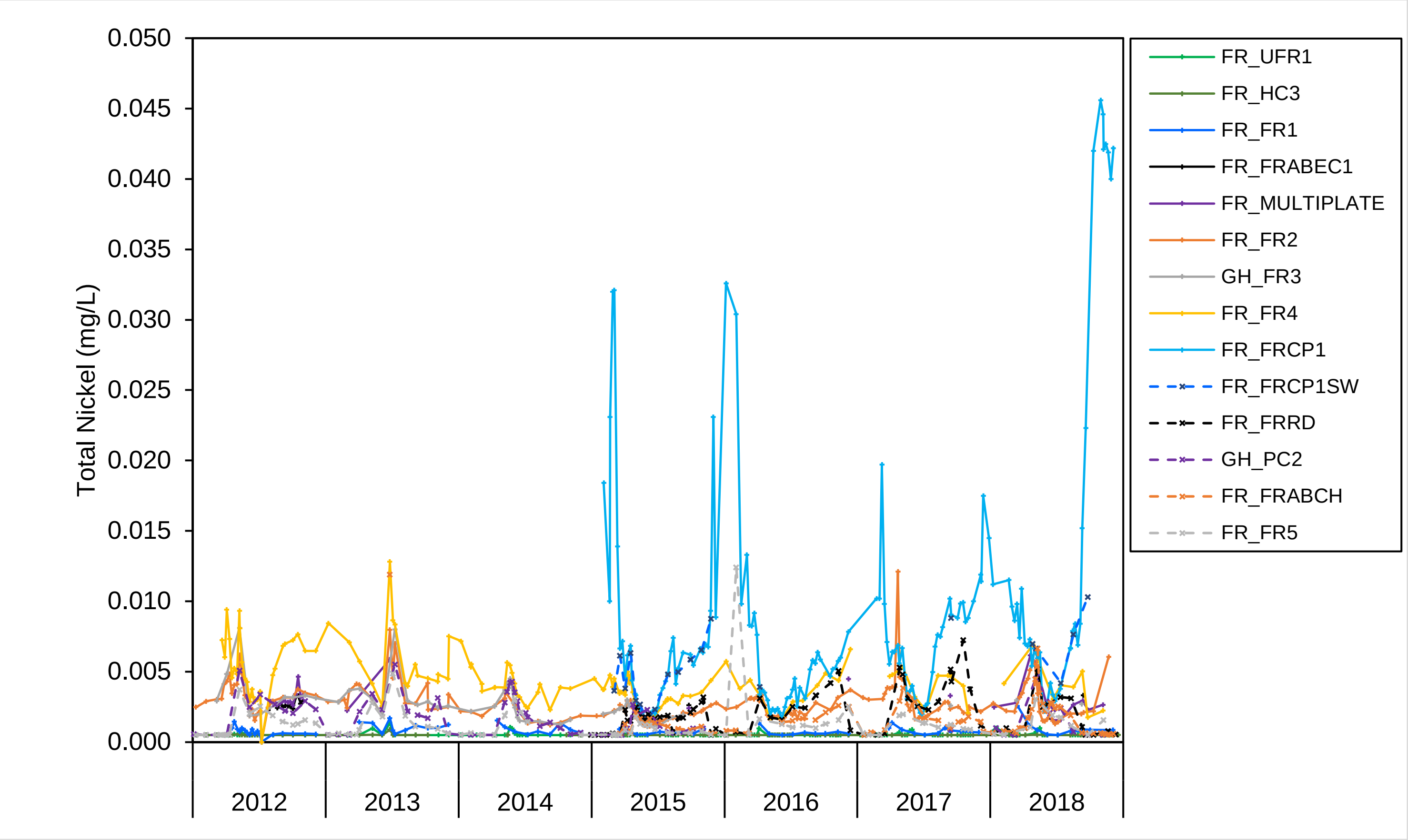


Figure C.30: **Times Series Plots for Aqueous Total Nickel from Fording River LAEMP Sampling Stations, 2012 to 2018**

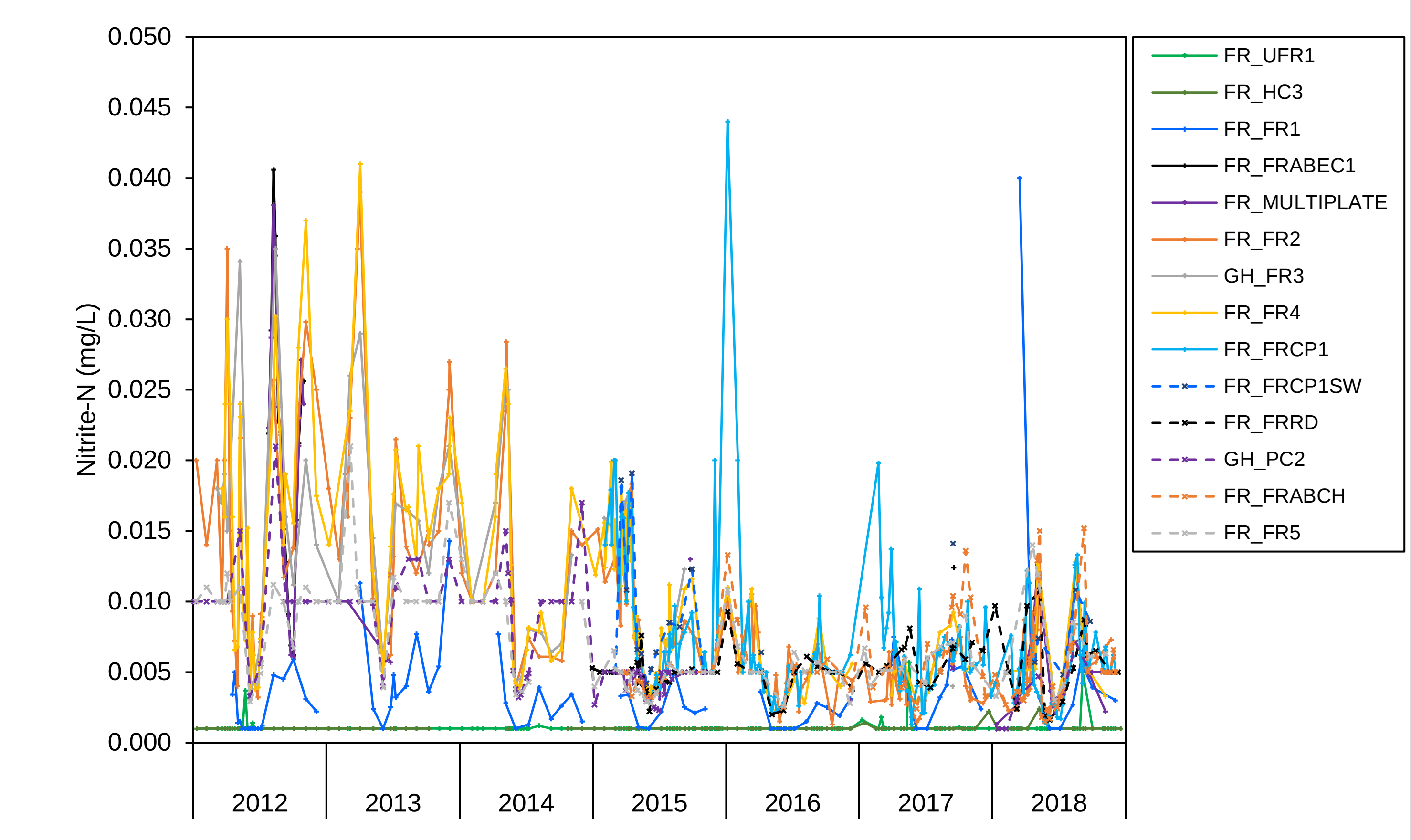


Figure C.31: Times Series Plots for Aqueous Nitrite-N from Fording River LAEMP Sampling Stations, 2012 to 2018

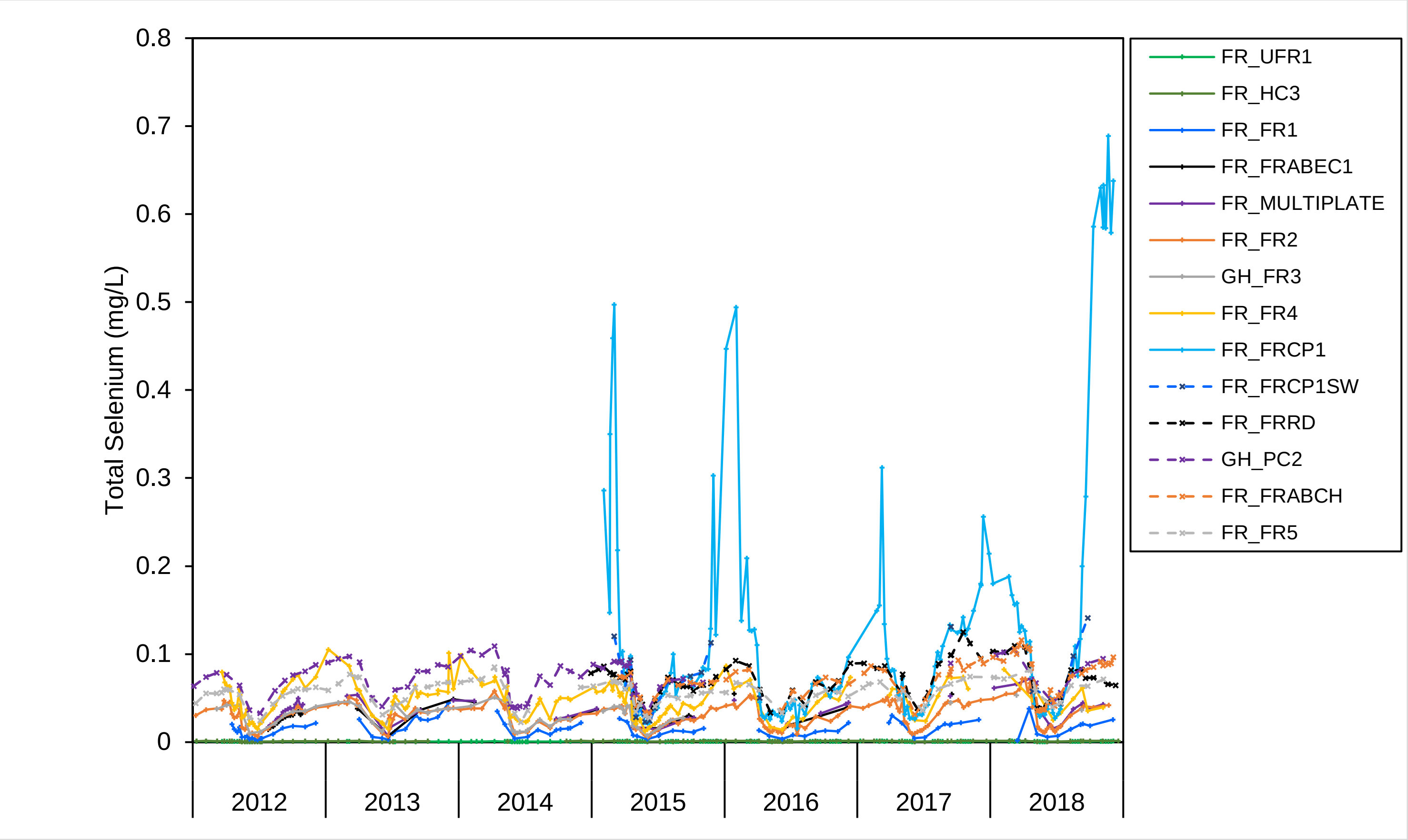


Figure C.32: **Times Series Plots for Aqueous Total Selenium from Fording River LAEMP Sampling Stations, 2012 to 2018**

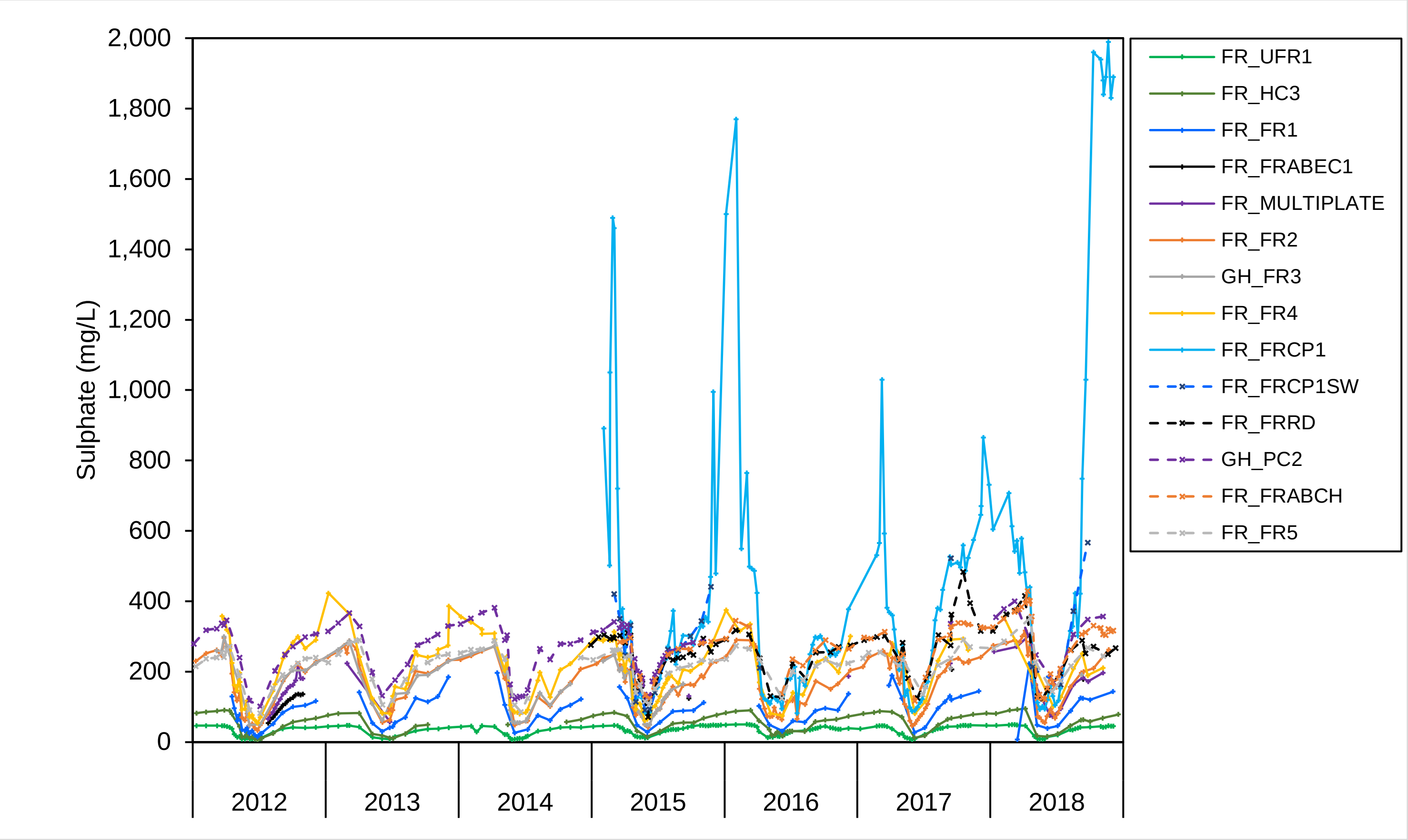


Figure C.33: **Times Series Plots for Aqueous Sulphate from Fording River LAEMP Sampling Stations, 2012 to 2018**

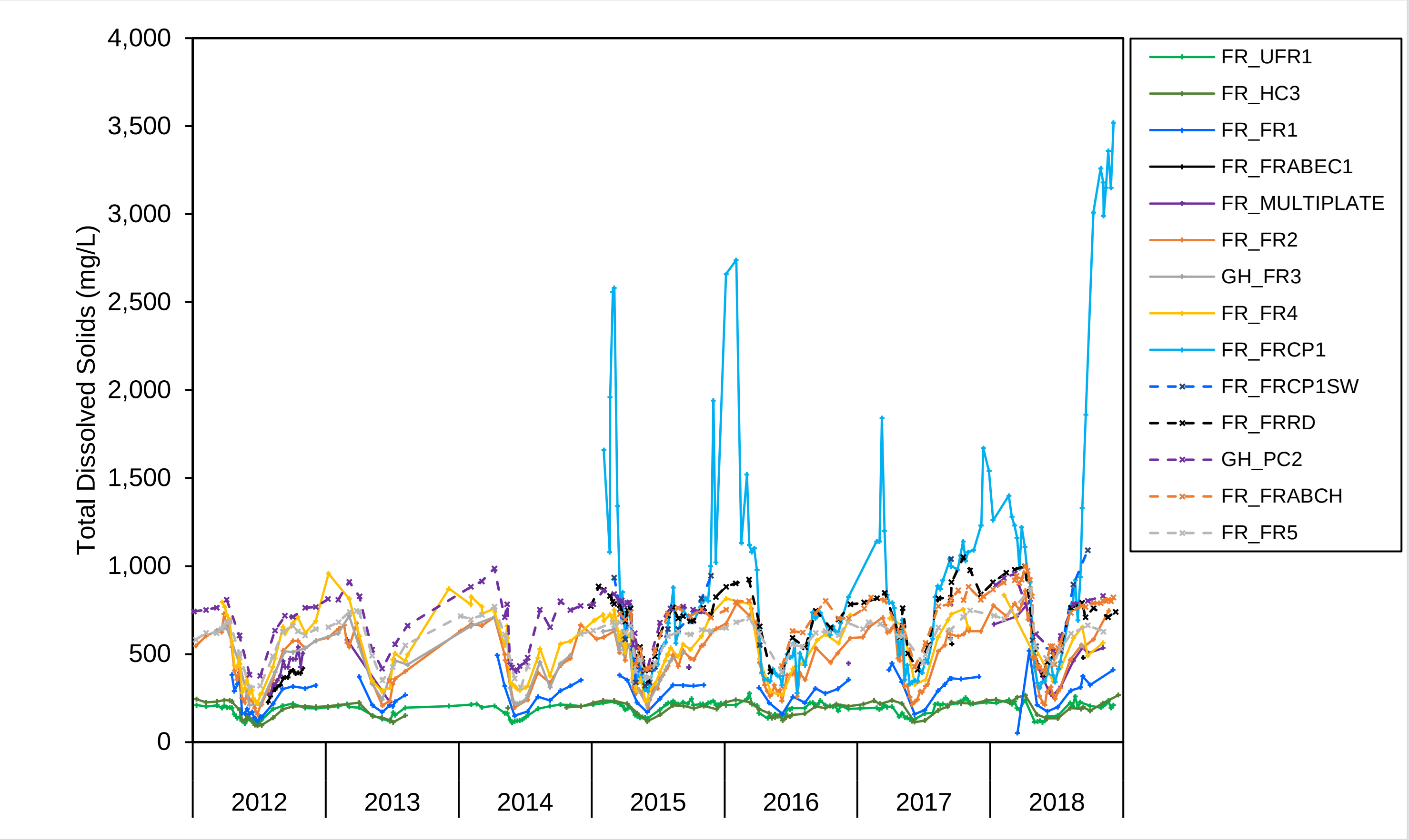


Figure C.34: **Times Series Plots for Aqueous Total Dissolved Soilds from Fording River LAEMP Sampling Stations, 2012 to 2018**

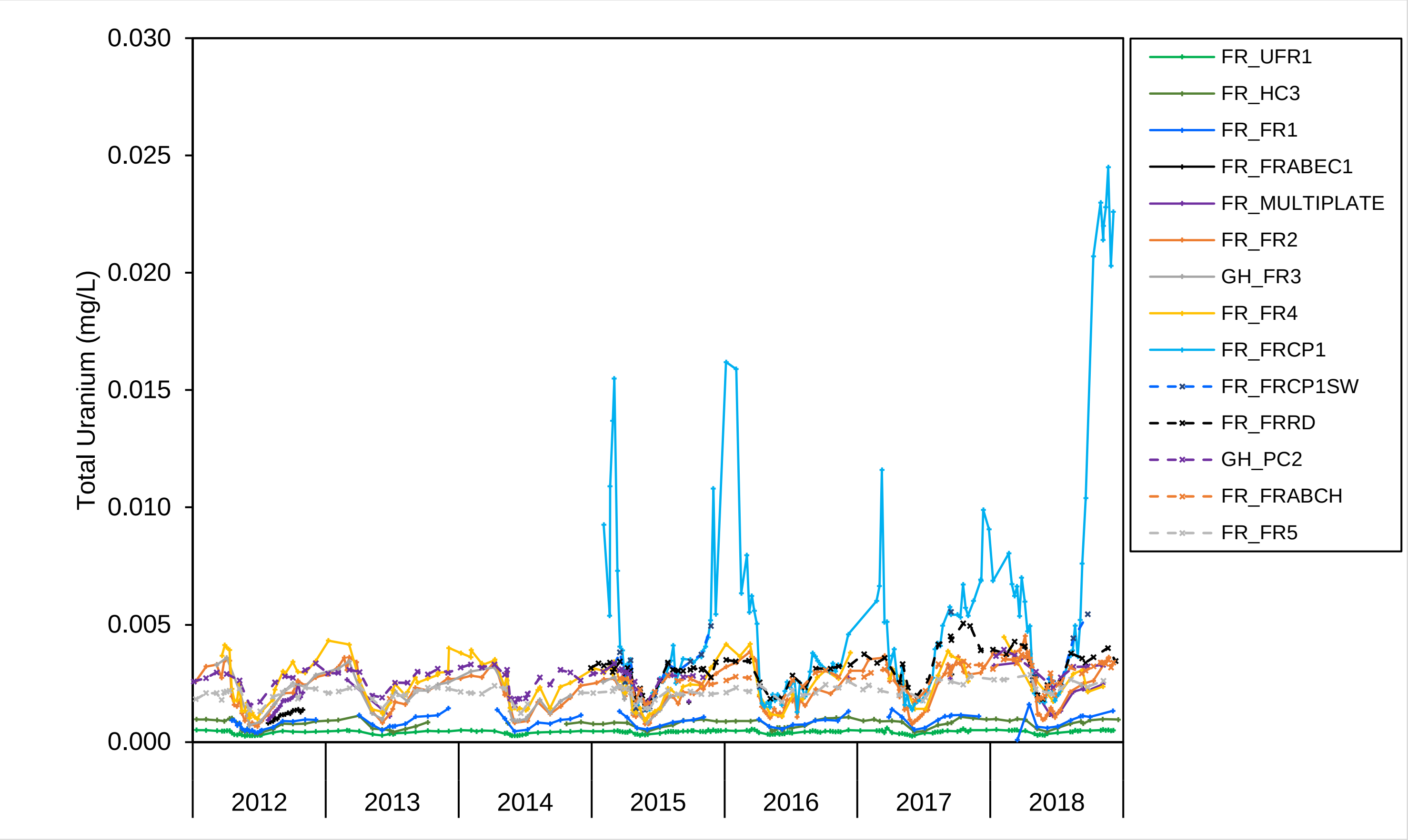


Figure C.35: **Times Series Plots for Aqueous Total Uranium from Fording River LAEMP Sampling Stations, 2012 to 2018**

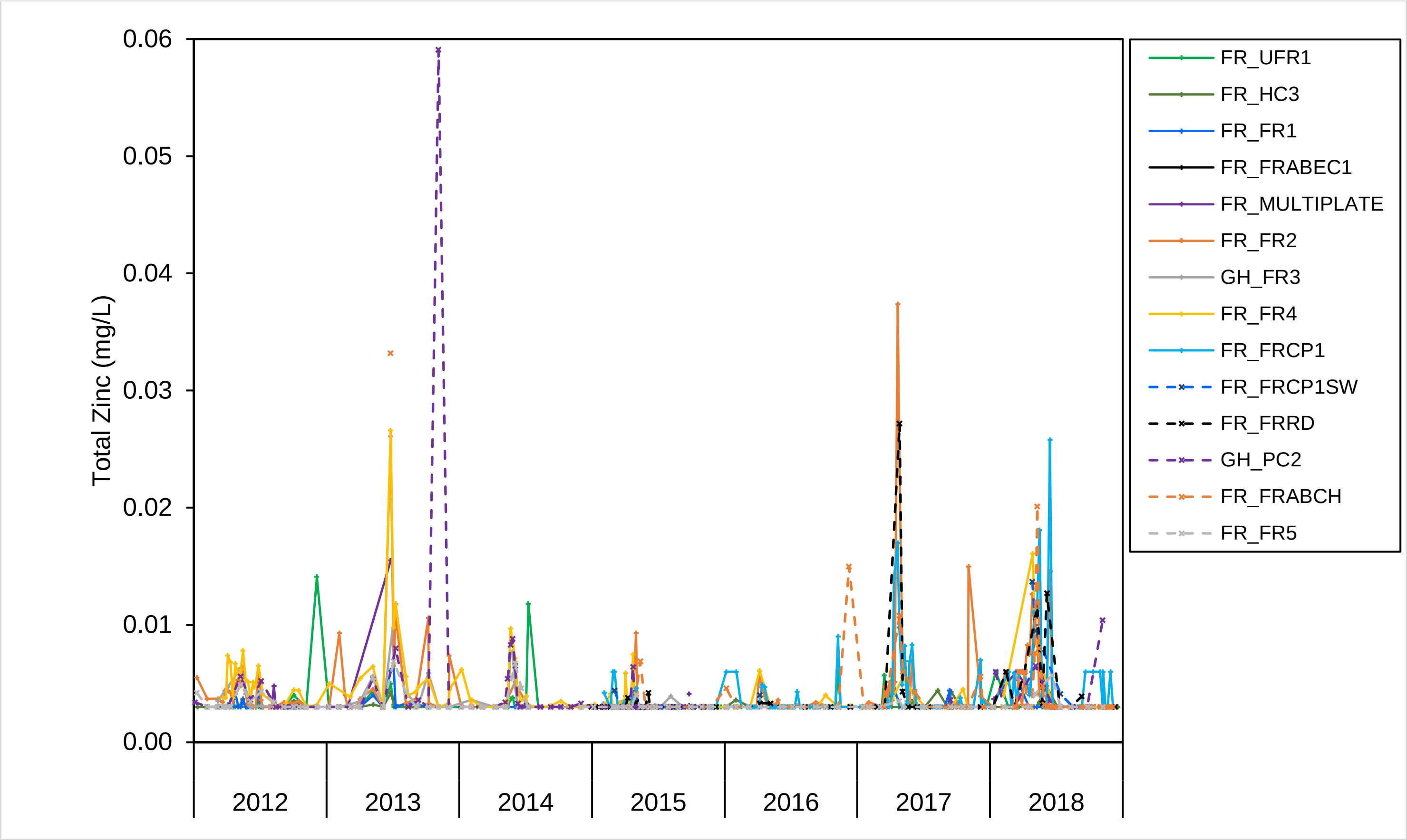


Figure C.36: Times Series Plots for Aqueous Total Zinc from Fording River LAEMP Sampling Stations, 2012 to 2018

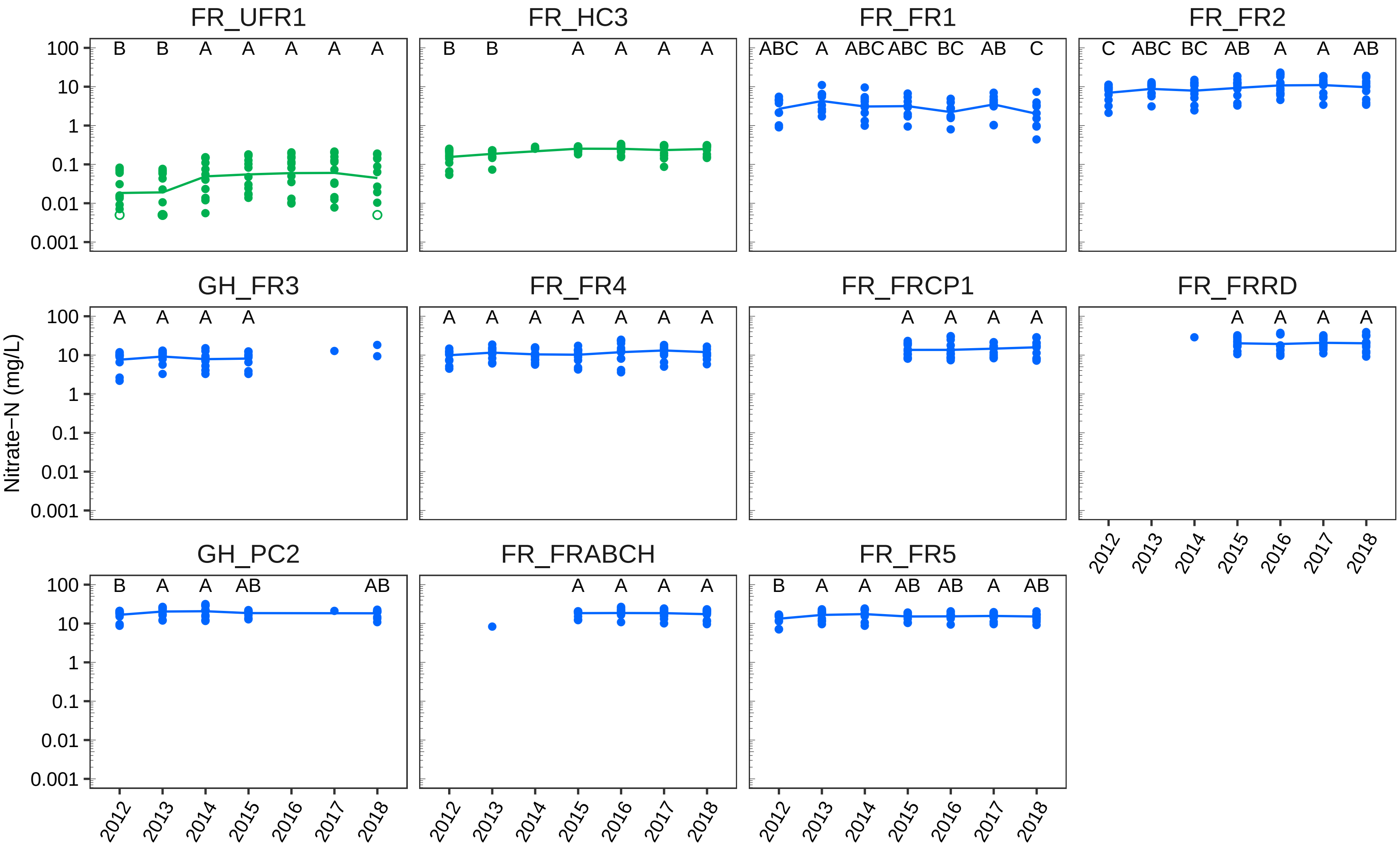


Figure C.37: **Monthly Mean Nitrate Concentrations for Reference and Mine-exposed Areas in the Fording River LAEMP, 2012 to 2018**

Notes: Values below the Laboratory Reporting Limit (LRL) are plotted with an open symbol. Years that do not share a letter symbol were significantly different in a post−hoc analysis with an alpha of 0.1 and bonferroni correction.

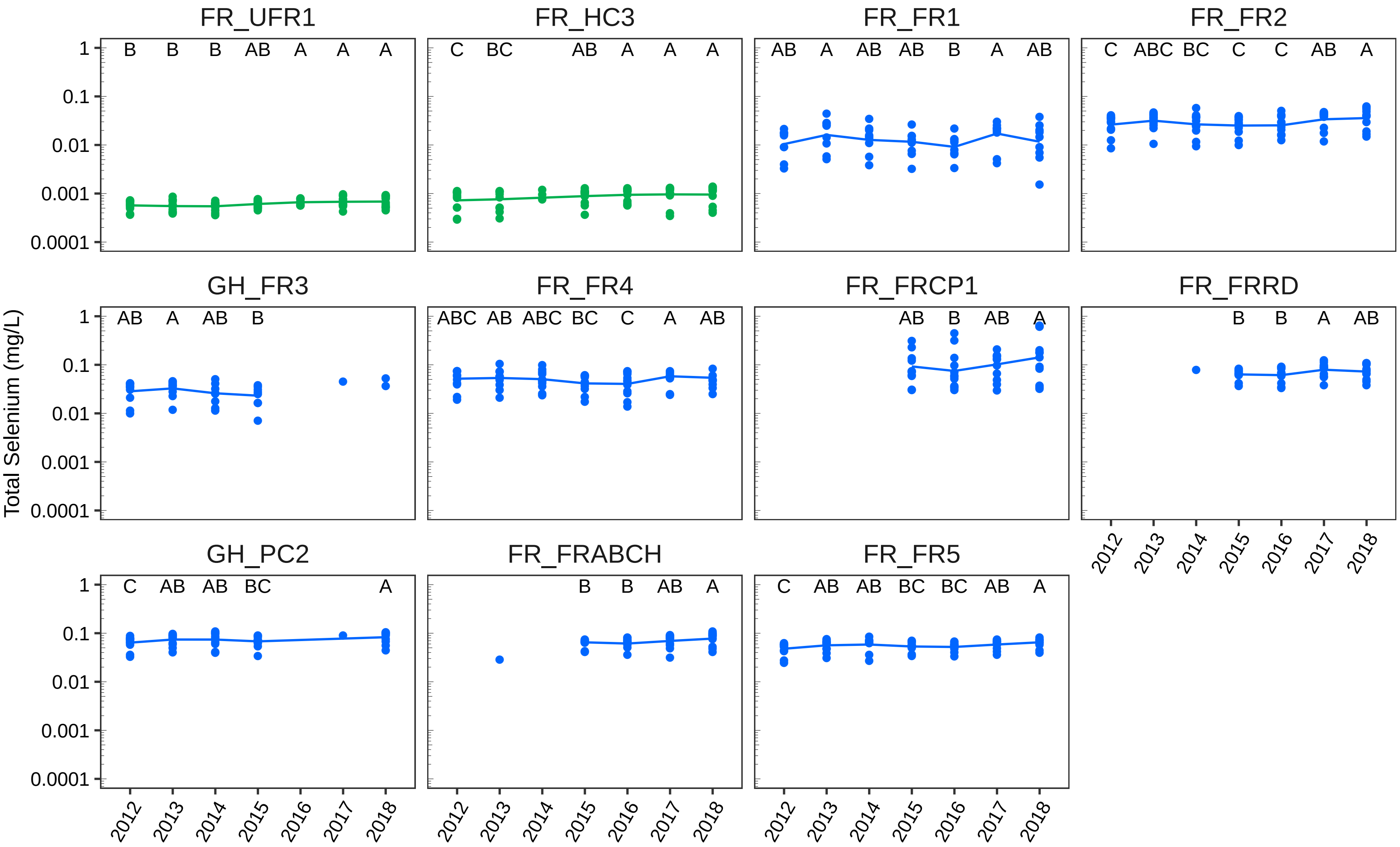


Figure C.38: **Monthly Mean Total Selenium Concentrations for Reference and Mine-exposed Areas in the Fording River LAEMP, 2012 to 2018**

Notes: Values below the Laboratory Reporting Limit (LRL) are plotted with an open symbol. Years that do not share a letter symbol were significantly different in a post−hoc analysis with an alpha of 0.1 and bonferroni correction.

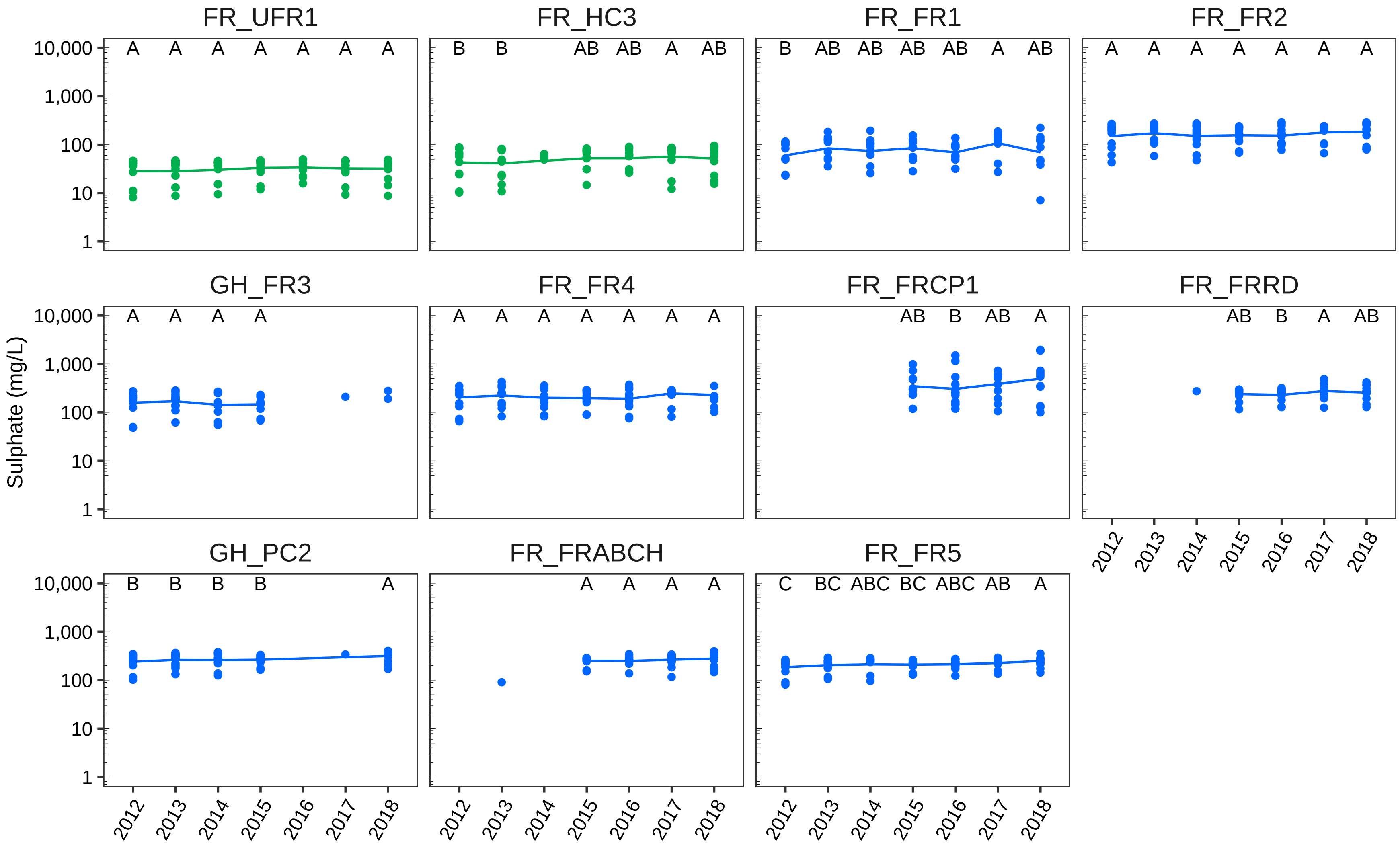


Figure C.39: **Monthly Mean Sulphate Concentrations for Reference and Mine-exposed Areas in the Fording River LAEMP, 2012 to 2018**

Notes: Values below the Laboratory Reporting Limit (LRL) are plotted with an open symbol. Years that do not share a letter symbol were significantly different in a post−hoc analysis with an alpha of 0.1 and bonferroni correction.

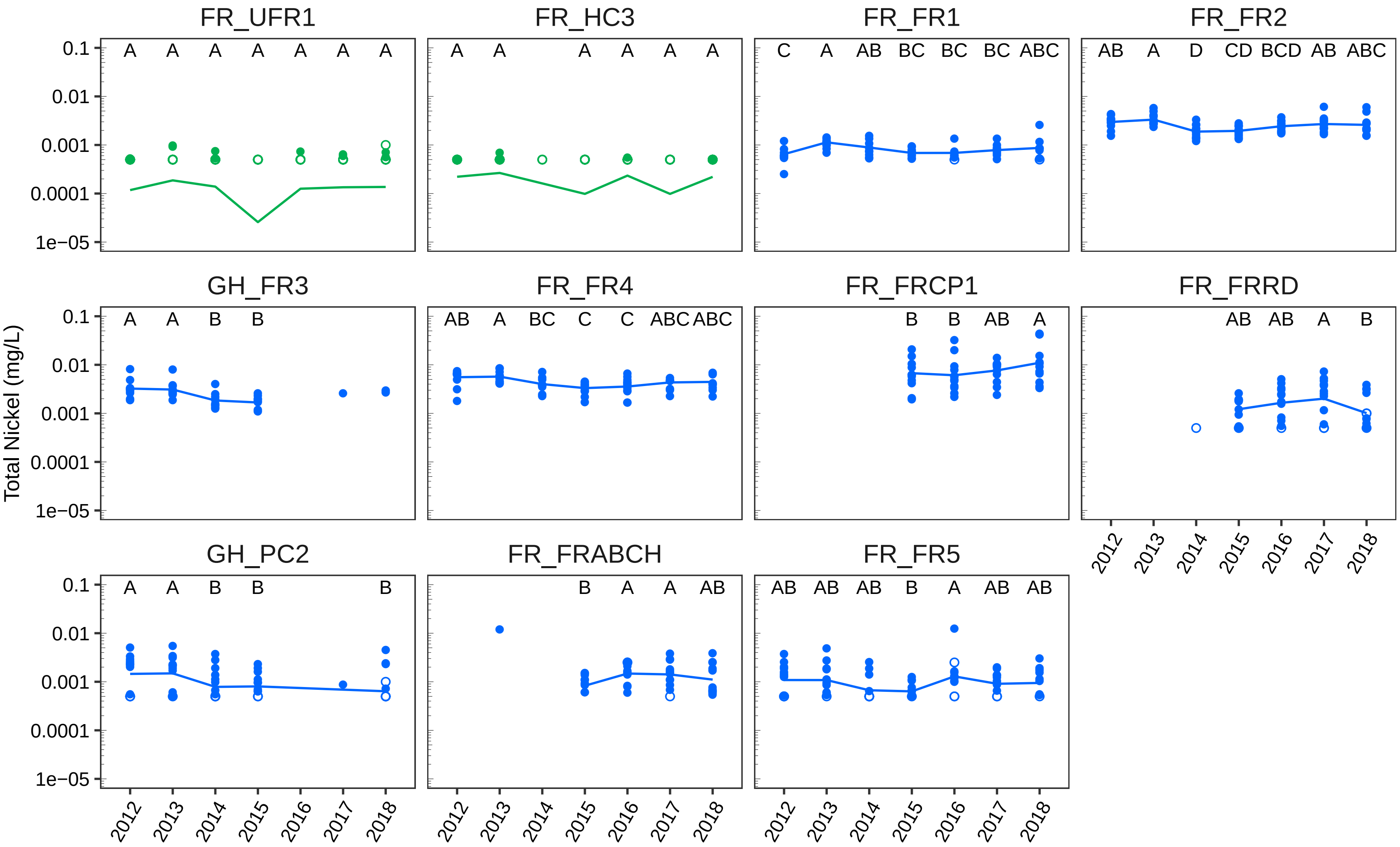


Figure C.40: **Monthly Mean Total Nickel Concentrations for Reference and Mine-exposed Areas in the Fording River LAEMP, 2012 to 2018**

Notes: Values below the Laboratory Reporting Limit (LRL) are plotted with an open symbol. Years that do not share a letter symbol were significantly different in a post−hoc analysis with an alpha of 0.1 and bonferroni correction.

Table C.1: Summary of Water Chemistry Data for Key Parameters for the Fording River LAEMP Monitoring Stations, 2018

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)
FR_UFR1	**n**	26	26	34	34	26	26	26	26
	Annual Minimum	111	7.97	7.95	8.48	93.6	<0.00500	<0.00100	<0.00500
	Annual Maximum	259	8.49	8.45	13.1	172	0.197	<0.00500	0.162
	Annual Mean	191	8.33	8.21	11.3	138	0.0877	0.00100	0.0209
	Annual Median	204	8.36	8.20	11.4	144	0.0764	<0.00100	0.0106
	% < LRL	0%	0%	0%	0%	0%	15%	96%	19%
	% > Chronic BCWQG[a]	-	0%	0%	0%	0%	0%	0%	0%
	% > Acute BCWQG[b]	-	-	-	0%	-	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_HC3	**n**	13	13	25	25	13	13	13	13
	Annual Minimum	134	7.70	7.90	9.51	86.5	0.148	<0.00100	<0.00500
	Annual Maximum	267	8.37	8.29	12.4	129	0.314	0.00240	0.0224
	Annual Mean	204	8.20	8.11	11.1	107	0.255	0.00111	0.00781
	Annual Median	198	8.25	8.12	11.2	108	0.284	<0.00100	0.00560
	% < LRL	0%	0%	0%	0%	0%	0%	92%	23%
	% > Chronic BCWQG[a]	-	0%	0%	0%	0%	0%	0%	0%
	% > Acute BCWQG[b]	-	-	-	0%	-	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FR1	**n**	10	10	18	18	10	10	10	10
	Annual Minimum	52.0	7.58	7.60	8.45	26.2	0.437	<0.00100	0.00710
	Annual Maximum	519	8.44	8.48	12.2	186	7.44	0.0400	0.459
	Annual Mean	286	8.23	8.17	10.7	131	2.71	0.00710	0.0651
	Annual Median	301	8.30	8.22	10.9	142	2.58	0.00355	0.0177
	% < LRL	0%	0%	0%	0%	0%	0.0%	20%	0%
	% > Chronic BCWQG[a]	-	0%	0%	0%	0%	50%	10%	10%
	% > Acute BCWQG[b]	-	-	-	0%	-	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-	-	-	0%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FRABEC1	**n**	2	2	0	0	2	2	2	2
	Annual Minimum	287	8.37	-	-	133	4.51	0.00260	0.00710
	Annual Maximum	479	8.37	-	-	166	11.4	0.00830	0.00950
	Annual Mean	383	8.37	-	-	150	7.96	0.00545	0.00830
	Annual Median	383	8.37	-	-	150	7.96	0.00545	0.00830
	% < LRL	0%	0%	-	-	0%	0.0%	0%	0%
	% > Chronic BCWQG[a]	-	0%	-	-	0%	100%	0%	0%
	% > Acute BCWQG[b]	-	-	-	-	-	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-	-	-	50%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_MULTIPLATE	**n**	11	11	11	11	11	11	11	11
	Annual Minimum	261	8.22	7.67	8.89	137	3.69	0.00130	<0.00500
	Annual Maximum	802	8.49	8.18	12.0	247	27.7	0.0126	0.0299
	Annual Mean	504	8.38	8.01	10.8	173	12.5	0.00535	0.0119
	Annual Median	505	8.40	8.01	10.8	174	11.0	0.00390	0.00820
	% < LRL	0%	0%	0%	0%	0%	0%	0%	18%
	% > Chronic BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%
	% > Acute BCWQG[b]	-	-	-	0%	-	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-	-	-	36%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	18%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FR2	**n**	25	25	25	25	25	25	25	25
	Annual Minimum	212	8.00	7.70	8.65	127	2.39	0.00130	<0.00500
	Annual Maximum	861	8.61	8.47	12.5	321	24.2	0.0128	0.0254
	Annual Mean	505	8.33	8.15	11.0	181	10.2	0.00494	0.0112
	Annual Median	481	8.31	8.18	11.3	167	9.94	0.00380	0.0102
	% < LRL	0%	0%	0%	0%	0%	0.0%	0%	4%
	% > Chronic BCWQG[a]	-	0%	0%	0%	0%	88%	0%	0%
	% > Acute BCWQG[b]	-	-	-	0%	-	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-	-	-	28%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	8%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
GH_FR3	**n**	2	2	0	0	2	2	2	2
	Annual Minimum	546	8.21	-	-	191	9.45	0.00450	0.00530
	Annual Maximum	720	8.47	-	-	192	18.1	0.00600	0.0119
	Annual Mean	633	8.34	-	-	192	13.8	0.00525	0.00860
	Annual Median	633	8.34	-	-	192	13.8	0.00525	0.00860
	% < LRL	0%	0%	-	-	0%	0.0%	0%	0%
	% > Chronic BCWQG[a]	-	0%	-	-	0%	100%	0%	0%
	% > Acute BCWQG[b]	-	-	-	-	-	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-	-	-	50%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FR4	**n**	9	9	9	9	9	9	9	9
	Annual Minimum	345	8.13	7.96	9.06	151	5.80	0.00240	0.00570
	Annual Maximum	835	8.51	8.63	12.2	210	16.8	0.0132	0.0777
	Annual Mean	549	8.34	8.23	10.5	182	10.6	0.00621	0.0176
	Annual Median	533	8.33	8.20	10.5	184	10.1	0.00500	0.00980
	% < LRL	0%	0%	0%	0%	0%	0.0%	11%	0%
	% > Chronic BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%
	% > Acute BCWQG[b]	-	-	-	0%	-	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-	-	-	22%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-

Table C.1: Summary of Water Chemistry Data for Key Parameters for the Fording River LAEMP Monitoring Stations, 2018

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)
FR_FRCP1	n	38	38	37	37	38	38	38	38
	Annual Minimum	309	7.73	7.86	2.69	142	5.97	0.00130	<0.00500
	Annual Maximum	3,520	8.54	8.42	1,060	391	30.3	0.0133	0.140
	Annual Mean	1,320	8.22	8.14	39.2	231	16.9	0.00523	0.0161
	Annual Median	948	8.27	8.12	11.2	216	16.3	0.00420	0.0110
	% < LRL	0%	0%	0%	0%	0%	0.0%	11%	18%
	% > Chronic BCWQG[a]	-	0%	0%	3%	0%	100%	0%	5%
	% > Acute BCWQG[b]	-	-	-	3%	-	0%	0%	5%
	% > Level 1 Benchmark	45%	-	-	-	-	55%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	34%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FRCP1SW	n	5	5	6	6	5	5	5	5
	Annual Minimum	516	8.24	7.93	9.32	161	8.14	0.00480	<0.00500
	Annual Maximum	1,090	8.50	8.27	10.8	228	13.8	0.0108	0.0183
	Annual Mean	725	8.38	8.10	10.1	193	11.4	0.00746	0.0104
	Annual Median	580	8.43	8.12	10.2	191	11.5	0.00740	0.0101
	% < LRL	0%	0%	0%	0%	0%	0.0%	0%	20%
	% > Chronic BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%
	% > Acute BCWQG[b]	-	-	-	0%	-	0%	0%	0%
	% > Level 1 Benchmark	20%	-	-	-	-	20%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FRRD	n	14	14	13	13	14	14	14	14
	Annual Minimum	382	8.00	7.60	8.63	152	8.95	0.00160	<0.00500
	Annual Maximum	1,000	8.45	7.95	11.8	302	39.4	0.0108	0.177
	Annual Mean	723	8.30	7.79	10.1	228	21.1	0.00516	0.0225
	Annual Median	750	8.33	7.82	10.0	244	20.5	0.00410	0.00840
	% < LRL	0%	0%	0%	0%	0%	0.0%	21%	14%
	% > Chronic BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%
	% > Acute BCWQG[b]	-	-	-	0%	-	14%	0%	0%
	% > Level 1 Benchmark	0%	-	-	-	-	86%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	50%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
GH_PC2	n	9	9	10	10	9	9	9	9
	Annual Minimum	514	8.10	7.33	8.48	181	10.7	<0.00100	<0.00500
	Annual Maximum	957	8.52	8.17	12.5	244	22.4	0.00710	0.0492
	Annual Mean	770	8.29	7.76	10.1	217	18.0	0.00322	0.0177
	Annual Median	803	8.28	7.75	10.2	227	19.9	0.00310	0.0110
	% < LRL	0%	0%	0%	0%	0%	0.0%	33%	22%
	% > Chronic BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%
	% > Acute BCWQG[b]	-	-	-	0%	-	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-	-	-	78%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	22%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FRABCH	n	31	31	29	29	31	31	31	31
	Annual Minimum	394	8.10	7.59	8.78	143	8.08	0.00150	<0.00500
	Annual Maximum	1,000	8.57	8.16	11.8	252	25.4	0.0152	0.0265
	Annual Mean	719	8.32	7.96	10.1	213	17.3	0.00484	0.0128
	Annual Median	790	8.30	7.99	10.1	226	18.7	0.00360	0.0121
	% < LRL	0%	0%	0%	0%	0%	0.0%	19%	10%
	% > Chronic BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%
	% > Acute BCWQG[b]	-	-	-	0%	-	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-	-	-	65%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	32%	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FR5	n	9	9	11	11	9	9	9	9
	Annual Minimum	443	8.16	7.81	9.77	174	9.15	0.00300	<0.00500
	Annual Maximum	870	8.48	8.34	12.6	220	20.8	0.0140	0.0315
	Annual Mean	633	8.34	8.05	11.0	201	14.8	0.00674	0.0144
	Annual Median	627	8.37	8.09	11.1	209	14.7	0.00610	0.0112
	% < LRL	0%	0%	0%	0%	0%	0.0%	11%	11%
	% > Chronic BCWQG[a]	-	0%	0%	0%	0%	100%	0%	0%
	% > Acute BCWQG[b]	-	-	-	0%	-	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-	-	-	44%	-	-
	% > Level 2 Benchmark	-	-	-	-	-	0%	-	-
	% > 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.1: Summary of Water Chemistry Data for Key Parameters for the Fording River LAEMP Monitoring Stations, 2018

Station	Summary Statistic	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)
FR_UFR1	n	26	25	26	26	26	26	25	25
	Annual Minimum	8.19	0.120	0.102	<0.000100	<0.000100	0.0353	<0.0000200	<0.0100
	Annual Maximum	49.4	<0.500	0.179	<0.000200	0.000310	0.0815	0.0000260	0.0110
	Annual Mean	35.2	0.120	0.139	<0.000100	0.000135	0.0632	0.0000202	0.0100
	Annual Median	42.4	0.120	0.148	<0.000100	0.000120	0.0678	<0.0000200	<0.0100
	% < LRL	0%	92%	0%	100%	27%	0%	96%	96%
	% > Chronic BCWQG[a]	0%	0%	-	0%	-	0%	0%	0%
	% > Acute BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	0%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_HC3	n	13	13	13	12	13	13	13	13
	Annual Minimum	15.5	<0.500	0.215	<0.000100	<0.000100	0.00771	<0.0000200	<0.0100
	Annual Maximum	95.0	<0.500	0.407	<0.000100	0.000210	0.0176	<0.0000400	<0.0200
	Annual Mean	60.7	<0.500	0.341	<0.000100	0.000117	0.0131	<0.0000200	<0.0100
	Annual Median	62.9	<0.500	0.366	<0.000100	0.000110	0.0135	<0.0000200	<0.0100
	% < LRL	0%	100%	0%	100%	23%	0%	100%	100%
	% > Chronic BCWQG[a]	0%	0%	-	0%	-	0%	0%	0%
	% > Acute BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	0%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FR1	n	10	10	10	10	10	10	10	10
	Annual Minimum	7.13	<0.500	0.0220	<0.000100	<0.000100	0.0261	<0.0000200	<0.0100
	Annual Maximum	222	<0.500	0.252	0.000100	0.000260	0.0568	<0.0000200	<0.0100
	Annual Mean	96.2	<0.500	0.212	0.000100	0.000142	0.0397	<0.0000200	<0.0100
	Annual Median	104	<0.500	0.238	<0.000100	0.000120	0.0418	<0.0000200	<0.0100
	% < LRL	0%	100%	0%	90%	10%	0%	100%	100%
	% > Chronic BCWQG[a]	-	0%	-	0%	-	0%	0%	0%
	% > Acute BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	0%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FRABEC1	n	2	2	2	2	2	2	2	2
	Annual Minimum	76.4	<0.500	0.163	0.000120	0.000120	0.0458	<0.0000200	<0.0100
	Annual Maximum	178	<0.500	0.202	0.000200	0.000150	0.0935	<0.0000200	<0.0100
	Annual Mean	127	<0.500	0.182	0.000160	0.000135	0.0696	<0.0000200	<0.0100
	Annual Median	127	<0.500	0.182	0.000160	0.000135	0.0696	<0.0000200	<0.0100
	% < LRL	0%	100%	0%	0%	0%	0%	100%	100%
	% > Chronic BCWQG[a]	0%	0%	-	0%	-	0%	0%	0%
	% > Acute BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	0%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_MULTIPLATE	n	11	10	11	11	11	11	11	10
	Annual Minimum	72.3	<0.500	0.121	0.000130	<0.000100	0.0440	<0.0000200	<0.0100
	Annual Maximum	306	1.13	0.214	0.000240	0.000210	0.105	<0.0000400	0.0100
	Annual Mean	178	0.639	0.181	0.000189	0.000120	0.0806	<0.0000200	0.0100
	Annual Median	172	0.545	0.195	0.000190	<0.000100	0.0853	<0.0000200	<0.0100
	% < LRL	0%	40%	0%	9%	55%	0%	100%	90%
	% > Chronic BCWQG[a]	0%	0%	-	0%	-	0%	0%	0%
	% > Acute BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	0%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FR2	n	25	25	25	25	25	25	25	22
	Annual Minimum	54.5	<0.500	0.122	<0.000100	<0.000100	0.0357	<0.0000200	<0.0100
	Annual Maximum	317	<2.50	0.235	0.000340	0.000370	0.110	0.0000420	0.0140
	Annual Mean	176	1.13	0.189	0.000198	0.000160	0.0730	0.0000218	0.0108
	Annual Median	174	0.900	0.191	0.000200	0.000130	0.0835	<0.0000200	0.0100
	% < LRL	0%	40%	0%	8%	16%	0%	92%	50%
	% > Chronic BCWQG[a]	0%	0%	-	0%	-	0%	0%	0%
	% > Acute BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	0%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
GH_FR3	n	2	2	2	2	2	2	2	2
	Annual Minimum	191	0.940	0.137	0.000170	0.000170	0.0912	<0.0000200	0.0110
	Annual Maximum	279	1.68	0.221	0.000280	0.000180	0.100	<0.0000200	0.0120
	Annual Mean	235	1.31	0.179	0.000225	0.000175	0.0956	<0.0000200	0.0115
	Annual Median	235	1.31	0.179	0.000225	0.000175	0.0956	<0.0000200	0.0115
	% < LRL	0%	0%	0%	0%	0%	0%	100%	0%
	% > Chronic BCWQG[a]	0%	0%	-	0%	-	0%	0%	0%
	% > Acute BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	0%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FR4	n	9	9	9	9	9	9	9	9
	Annual Minimum	101	<0.500	<0.100	0.000170	<0.000100	0.0412	<0.0000200	<0.0100
	Annual Maximum	354	<2.50	0.221	0.000310	0.000450	0.0991	0.0000650	0.0130
	Annual Mean	204	1.01	0.183	0.000231	0.000172	0.0760	0.0000250	0.0107
	Annual Median	208	0.865	0.199	0.000240	0.000130	0.0818	<0.0000200	0.0100
	% < LRL	0%	22%	11%	0%	11%	0%	89%	33%
	% > Chronic BCWQG[a]	0%	0%	-	0%	-	0%	0%	0%
	% > Acute BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	0%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-

Table C.1: Summary of Water Chemistry Data for Key Parameters for the Fording River LAEMP Monitoring Stations, 2018

Station	Summary Statistic	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)
FR_FRCP1	n	38	38	38	38	38	38	38	29
	Annual Minimum	93.1	<0.500	<0.100	0.000190	<0.000100	0.0170	<0.0000200	<0.0100
	Annual Maximum	1,990	6.90	0.230	0.000620	0.000840	0.110	0.000106	0.0130
	Annual Mean	688	2.59	0.165	0.000322	0.000182	0.0594	0.0000227	0.0109
	Annual Median	432	2.12	0.178	0.000265	0.000150	0.0648	<0.0000200	0.0110
	% < LRL	0%	24%	5%	0%	26%	0%	92%	31%
	% > Chronic BCWQG[a]	50%	0%	-	0%	-	0%	0%	0%
	% > Acute BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	50%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FRCP1SW	n	5	5	5	5	5	5	5	5
	Annual Minimum	163	0.670	0.164	0.000250	0.000100	0.0523	<0.0000200	<0.0100
	Annual Maximum	567	<2.50	0.214	0.000330	0.000470	0.0861	0.0000510	0.0130
	Annual Mean	304	1.04	0.188	0.000282	0.000214	0.0687	0.0000270	0.0108
	Annual Median	214	0.875	0.195	0.000280	0.000120	0.0672	<0.0000200	0.0100
	% < LRL	0%	20%	0%	0%	0%	0%	60%	20%
	% > Chronic BCWQG[a]	20%	0%	-	0%	-	0%	0%	0%
	% > Acute BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	20%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FRRD	n	14	14	14	14	14	14	12	12
	Annual Minimum	123	0.630	<0.100	<0.000100	<0.000100	0.0500	<0.0000200	<0.0100
	Annual Maximum	415	7.70	0.210	0.000410	0.000470	0.147	0.0000330	0.0160
	Annual Mean	261	1.52	0.170	0.000163	0.000150	0.0994	0.0000211	0.0137
	Annual Median	264	0.820	0.180	0.000120	0.000120	0.105	<0.0000200	0.0148
	% < LRL	0%	50%	7%	43%	29%	0%	92%	25%
	% > Chronic BCWQG[a]	0%	0%	-	0%	-	0%	0%	0%
	% > Acute BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	0%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
GH_PC2	n	9	9	9	9	9	9	9	9
	Annual Minimum	171	0.690	0.100	<0.000100	<0.000100	0.0590	<0.0000200	<0.0100
	Annual Maximum	400	<2.50	0.250	0.000210	0.000260	0.117	<0.0000400	<0.0200
	Annual Mean	308	1.43	0.162	0.000131	0.000128	0.0891	<0.0000200	0.0107
	Annual Median	348	1.54	0.160	0.000110	0.000110	0.0876	<0.0000200	0.0110
	% < LRL	0%	33%	0%	44%	44%	0%	100%	44%
	% > Chronic BCWQG[a]	0%	0%	-	0%	-	0%	0%	0%
	% > Acute BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	0%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FRABCH	n	31	31	31	31	31	31	31	28
	Annual Minimum	121	<0.500	0.0890	<0.000100	<0.000100	0.0503	<0.0000200	<0.0100
	Annual Maximum	429	3.60	0.228	0.000230	0.000830	0.126	0.0000710	0.0130
	Annual Mean	279	1.52	0.159	0.000140	0.000168	0.0952	0.0000223	0.0111
	Annual Median	311	1.47	0.160	0.000120	0.000120	0.102	<0.0000200	0.0110
	% < LRL	0%	32%	0%	32%	26%	0%	90%	32%
	% > Chronic BCWQG[a]	0%	0%	-	0%	-	0%	0%	0%
	% > Acute BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	0%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FR5	n	9	9	9	9	9	9	9	9
	Annual Minimum	143	0.860	<0.100	<0.000100	<0.000100	0.0632	<0.0000200	<0.0100
	Annual Maximum	353	3.80	0.200	0.000150	0.000170	0.146	<0.0000200	0.0130
	Annual Mean	242	1.88	0.159	0.000119	0.000117	0.105	<0.0000200	0.0103
	Annual Median	244	1.50	0.160	0.000110	<0.000100	0.103	<0.0000200	<0.0100
	% < LRL	0%	33%	11%	33%	67%	0%	100%	67%
	% > Chronic BCWQG[a]	0%	0%	-	0%	-	0%	0%	0%
	% > Acute BCWQG[b]	-	0%	0%	-	0%	-	-	-
	% > Level 1 Benchmark	0%	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > 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.1: Summary of Water Chemistry Data for Key Parameters for the Fording River LAEMP Monitoring Stations, 2018

Station	Summary Statistic	Total Chromium (mg/L)	Total Cobalt (mg/L)	Total Copper (mg/L)	Total Iron (mg/L)	Total Lead (mg/L)	Total Lithium (mg/L)	Total Manganese (mg/L)	Total Mercury (mg/L)
FR_UFR1	**n**	26	26	26	26	26	26	26	26
	Annual Minimum	<0.000100	<0.000100	<0.000500	<0.0100	<0.0000500	<0.00100	0.000200	<0.000000500
	Annual Maximum	0.000740	0.000250	0.00333	0.509	0.000367	0.00230	0.0210	0.00000316
	Annual Mean	0.000212	0.000107	0.000625	0.0515	0.0000708	0.00155	0.00226	0.000000885
	Annual Median	0.000140	<0.000100	<0.000500	<0.0100	<0.0000500	0.00160	0.000490	<0.000000500
	% < LRL	15%	92%	88%	62%	81%	4%	0%	69%
	% > Chronic BCWQG[a]	0%	0%	0%	-	0%	-	0%	19%
	% > Acute BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_HC3	**n**	13	12	12	13	13	12	13	13
	Annual Minimum	0.000110	<0.000100	<0.000500	<0.0100	<0.0000500	<0.00100	<0.000100	<0.000000500
	Annual Maximum	0.000390	<0.000100	<0.000500	0.0200	<0.000100	<0.00100	0.00114	<0.000000500
	Annual Mean	0.000199	<0.000100	<0.000500	0.0108	<0.0000500	<0.00100	0.000212	<0.000000500
	Annual Median	0.000170	<0.000100	<0.000500	<0.0100	<0.0000500	<0.00100	<0.000100	<0.000000500
	% < LRL	8%	100%	100%	92%	100%	100%	69%	100%
	% > Chronic BCWQG[a]	0%	0%	0%	-	0%	-	0%	0%
	% > Acute BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FR1	**n**	10	10	10	10	10	10	10	10
	Annual Minimum	0.000110	<0.000100	<0.000500	<0.0100	<0.0000500	<0.00100	0.00177	<0.000000500
	Annual Maximum	<0.000500	0.000250	0.00278	0.124	0.000187	0.0105	0.00932	0.00000304
	Annual Mean	0.000226	0.000115	0.000783	0.0328	0.0000688	0.00569	0.00409	0.000000874
	Annual Median	0.000195	<0.000100	<0.000500	0.0125	<0.0000500	0.00635	0.00310	<0.000000500
	% < LRL	20%	90%	70%	30%	80%	10%	0%	70%
	% > Chronic BCWQG[a]	0%	0%	0%	-	0%	-	0%	20%
	% > Acute BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FRABEC1	**n**	2	2	2	2	2	2	2	2
	Annual Minimum	0.000140	<0.000100	<0.000500	<0.0100	<0.0000500	0.0134	0.000770	<0.000000500
	Annual Maximum	0.000270	<0.000100	<0.000500	0.0120	<0.0000500	0.0312	0.00162	0.000000570
	Annual Mean	0.000205	<0.000100	<0.000500	0.0110	<0.0000500	0.0223	0.00119	0.000000535
	Annual Median	0.000205	<0.000100	<0.000500	0.0110	<0.0000500	0.0223	0.00119	0.000000535
	% < LRL	0%	100%	100%	50%	100%	0%	0%	50%
	% > Chronic BCWQG[a]	0%	0%	0%	-	0%	-	0%	0%
	% > Acute BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_MULTIPLATE	**n**	11	11	11	11	11	11	11	11
	Annual Minimum	0.000110	<0.000100	<0.000500	<0.0100	<0.0000500	0.0113	0.00133	<0.000000500
	Annual Maximum	0.000590	0.000230	<0.00100	0.308	0.000220	0.0604	0.00665	0.00000268
	Annual Mean	0.000179	0.000112	0.000529	0.0403	0.0000655	0.0293	0.00259	0.000000714
	Annual Median	0.000130	<0.000100	<0.000500	0.0130	<0.0000500	0.0285	0.00194	<0.000000500
	% < LRL	18%	91%	91%	27%	91%	0%	0%	73%
	% > Chronic BCWQG[a]	0%	0%	0%	-	0%	-	0%	9%
	% > Acute BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FR2	**n**	25	25	25	25	25	25	25	25
	Annual Minimum	0.000100	<0.000100	<0.000500	0.0120	<0.0000500	0.0105	0.00507	<0.000000500
	Annual Maximum	0.00142	0.000400	0.00808	0.559	0.000436	0.0628	0.0319	0.00000457
	Annual Mean	0.000360	0.000163	0.000881	0.116	0.000114	0.0312	0.0163	0.00000102
	Annual Median	0.000185	0.000120	<0.000500	0.0545	<0.0000500	0.0314	0.0157	<0.000000500
	% < LRL	8%	52%	76%	0%	64%	0%	0%	56%
	% > Chronic BCWQG[a]	12%	0%	0%	-	0%	-	0%	24%
	% > Acute BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
GH_FR3	**n**	2	2	2	2	2	2	2	2
	Annual Minimum	0.000110	0.000130	<0.000500	0.0480	0.0000570	0.0307	0.0122	0.000000525
	Annual Maximum	0.000300	0.000270	<0.000500	0.330	0.000157	0.0513	0.0702	0.00000134
	Annual Mean	0.000205	0.000200	<0.000500	0.189	0.000107	0.0410	0.0412	0.000000933
	Annual Median	0.000205	0.000200	<0.000500	0.189	0.000107	0.0410	0.0412	0.000000933
	% < LRL	0%	0%	100%	0%	0%	0%	0%	0%
	% > Chronic BCWQG[a]	0%	0%	0%	-	0%	-	0%	50%
	% > Acute BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FR4	**n**	9	9	9	9	9	9	9	9
	Annual Minimum	0.000110	<0.000100	<0.000500	0.0170	<0.0000500	0.0169	0.00395	<0.000000500
	Annual Maximum	0.00293	0.000510	0.00159	0.817	0.000519	0.0495	0.0365	0.00000497
	Annual Mean	0.000521	0.000176	0.000644	0.158	0.000129	0.0300	0.0138	0.00000125
	Annual Median	0.000150	0.000100	<0.000500	0.0300	<0.0000500	0.0307	0.0120	0.000000540
	% < LRL	11%	44%	78%	0%	67%	0%	0%	44%
	% > Chronic BCWQG[a]	11%	0%	0%	-	0%	-	0%	22%
	% > Acute BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-

Table C.1: Summary of Water Chemistry Data for Key Parameters for the Fording River LAEMP Monitoring Stations, 2018

Station	Summary Statistic	Total Chromium (mg/L)	Total Cobalt (mg/L)	Total Copper (mg/L)	Total Iron (mg/L)	Total Lead (mg/L)	Total Lithium (mg/L)	Total Manganese (mg/L)	Total Mercury (mg/L)
FR_FRCP1	n	38	38	38	38	38	38	38	38
	Annual Minimum	<0.000100	<0.000100	<0.000500	<0.0100	<0.0000500	0.0152	0.000200	<0.000000500
	Annual Maximum	0.00199	0.00103	0.00299	2.00	0.00146	0.0869	0.0970	0.00000712
	Annual Mean	0.000249	0.000158	0.000605	0.118	0.000112	0.0466	0.0113	0.000000932
	Annual Median	0.000130	<0.000100	<0.000500	0.0240	<0.0000500	0.0484	0.00632	<0.000000500
	% < LRL	29%	68%	89%	21%	82%	0%	0%	76%
	% > Chronic BCWQG[a]	3%	0%	0%	-	0%	-	0%	13%
	% > Acute BCWQG[b]	-	0%	0%	3%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FRCP1SW	n	5	5	5	5	5	5	5	5
	Annual Minimum	0.000140	<0.000100	<0.000500	0.0170	<0.0000500	0.0256	0.00317	<0.000000500
	Annual Maximum	0.00149	0.000480	0.00158	0.743	0.000556	0.0373	0.0287	0.00000588
	Annual Mean	0.000582	0.000202	0.000804	0.230	0.000189	0.0321	0.0105	0.00000200
	Annual Median	0.000300	<0.000100	<0.000500	0.0230	<0.0000500	0.0320	0.00424	<0.000000500
	% < LRL	0%	60%	60%	0%	60%	0%	0%	60%
	% > Chronic BCWQG[a]	20%	0%	0%	-	0%	-	0%	40%
	% > Acute BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FRRD	n	14	14	14	14	14	14	14	14
	Annual Minimum	0.000120	<0.000100	<0.000500	<0.0100	<0.0000500	0.0195	0.000590	<0.000000500
	Annual Maximum	0.00117	0.000540	0.00153	1.00	0.000635	0.0481	0.0521	0.00000407
	Annual Mean	0.000332	0.000148	0.000574	0.0948	0.000100	0.0369	0.00578	0.000000854
	Annual Median	0.000200	<0.000100	<0.000500	<0.0100	<0.0000500	0.0396	0.00102	<0.000000500
	% < LRL	7%	57%	93%	57%	86%	0%	0%	79%
	% > Chronic BCWQG[a]	14%	0%	0%	-	0%	-	0%	14%
	% > Acute BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
GH_PC2	n	9	9	9	9	9	9	9	9
	Annual Minimum	0.000120	<0.000100	<0.000500	<0.0100	<0.0000500	0.0222	0.000330	<0.000000500
	Annual Maximum	0.000450	0.000200	0.0159	0.208	0.000741	0.0397	0.00967	0.00000218
	Annual Mean	0.000185	0.000111	0.00224	0.0342	0.000140	0.0326	0.00205	0.000000698
	Annual Median	0.000160	<0.000100	<0.000500	<0.0100	<0.0000500	0.0337	0.000760	<0.000000500
	% < LRL	22%	78%	78%	67%	78%	0%	0%	78%
	% > Chronic BCWQG[a]	0%	0%	11%	-	0%	-	0%	11%
	% > Acute BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FRABCH	n	31	31	31	31	31	31	31	31
	Annual Minimum	0.000110	<0.000100	<0.000500	0.0110	<0.0000500	0.0174	0.00439	<0.000000500
	Annual Maximum	0.00185	0.000900	0.00265	1.89	0.00121	0.0413	0.0875	0.00000718
	Annual Mean	0.000297	0.000147	0.000613	0.141	0.000121	0.0305	0.0101	0.000000997
	Annual Median	0.000190	<0.000100	<0.000500	0.0260	<0.0000500	0.0330	0.00558	<0.000000500
	% < LRL	6%	58%	84%	3%	81%	0%	0%	71%
	% > Chronic BCWQG[a]	6%	0%	0%	-	0%	-	0%	16%
	% > Acute BCWQG[b]	-	0%	0%	3%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark	-	-	-	-	-	-	-	-
FR_FR5	n	9	9	9	9	9	9	9	9
	Annual Minimum	0.000120	<0.000100	<0.000500	<0.0100	<0.0000500	0.0198	0.00141	<0.000000500
	Annual Maximum	0.00245	0.000160	0.000970	0.215	0.000146	0.0286	0.0116	0.00000151
	Annual Mean	0.000458	0.000107	0.000562	0.0387	0.0000607	0.0251	0.00332	0.000000612
	Annual Median	0.000170	<0.000100	<0.000500	0.0160	<0.0000500	0.0256	0.00226	<0.000000500
	% < LRL	11%	89%	78%	11%	89%	0%	0%	89%
	% > Chronic BCWQG[a]	11%	0%	0%	-	0%	-	0%	11%
	% > Acute BCWQG[b]	-	0%	0%	0%	0%	-	0%	-
	% > Level 1 Benchmark	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark	-	-	-	-	-	-	-	-
	% > 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.1: Summary of Water Chemistry Data for Key Parameters for the Fording River LAEMP Monitoring Stations, 2018

Station	Summary Statistic	Total Molybdenum (mg/L)	Total Nickel (mg/L)	Total Selenium (mg/L)	Total Sliver (mg/L)	Total Thallium (mg/L)	Total Uranium (mg/L)	Total Zinc (mg/L)	Dissolved Aluminum (mg/L)
FR_UFR1	n	26	26	26	26	26	26	26	26
	Annual Minimum	0.000534	<0.000500	0.000410	<0.0000100	<0.0000100	0.000284	<0.00300	<0.00300
	Annual Maximum	0.000679	0.00100	0.000976	0.0000350	<0.0000200	0.000526	<0.00600	0.0219
	Annual Mean	0.000597	0.000537	0.000693	0.0000110	0.0000103	0.000443	0.00302	0.00515
	Annual Median	0.000594	<0.000500	0.000702	<0.0000100	<0.0000100	0.000480	<0.00300	<0.00300
	% < LRL	0%	88%	0%	92%	96%	0%	96%	69%
	% > Chronic BCWQG[a]	0%	0%	0%	0%	0%	0%	0%	0%
	% > Acute BCWQG[b]	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 2 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-
FR_HC3	n	13	12	13	13	13	13	12	13
	Annual Minimum	0.000421	<0.000500	0.000401	<0.0000100	<0.0000100	0.000437	<0.00300	<0.00300
	Annual Maximum	0.000816	0.000510	0.00139	<0.0000200	<0.0000200	0.000979	0.00480	0.00330
	Annual Mean	0.000598	0.000501	0.00104	<0.0000100	<0.0000100	0.000822	0.00315	0.00302
	Annual Median	0.000628	<0.000500	0.00115	<0.0000100	<0.0000100	0.000894	<0.00300	<0.00300
	% < LRL	0%	92%	0%	100%	100%	0%	92%	92%
	% > Chronic BCWQG[a]	0%	0%	0%	-	0%	0%	0%	0%
	% > Acute BCWQG[b]	0%	-	-	-	-	-	0%	0%
	% > Level 1 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 2 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-
FR_FR1	n	10	10	10	10	10	10	10	10
	Annual Minimum	0.000389	<0.000500	0.00153	<0.0000100	<0.0000100	0.0000980	<0.00300	<0.00300
	Annual Maximum	0.000905	0.00257	0.0380	<0.0000100	0.0000130	0.00160	0.00540	0.0403
	Annual Mean	0.000763	0.000978	0.0160	<0.0000100	0.0000103	0.000912	0.00324	0.00710
	Annual Median	0.000806	0.000855	0.0165	<0.0000100	<0.0000100	0.000996	<0.00300	<0.00300
	% < LRL	0%	10%	0%	100%	90%	0%	90%	70%
	% > Chronic BCWQG[a]	0%	0%	90%	0%	0%	0%	0%	0%
	% > Acute BCWQG[b]	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 2 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-
FR_FRABEC1	n	2	2	2	2	2	2	2	2
	Annual Minimum	0.000839	0.00175	0.0187	<0.0000100	<0.0000100	0.00117	<0.00300	<0.00300
	Annual Maximum	0.00111	0.00331	0.0420	<0.0000100	<0.0000100	0.00226	<0.00300	<0.00300
	Annual Mean	0.000974	0.00253	0.0304	<0.0000100	<0.0000100	0.00172	<0.00300	<0.00300
	Annual Median	0.000974	0.00253	0.0304	<0.0000100	<0.0000100	0.00172	<0.00300	<0.00300
	% < LRL	0%	0%	0%	100%	100%	0%	100%	100%
	% > Chronic BCWQG[a]	0%	0%	100%	0%	0%	0%	0%	0%
	% > Acute BCWQG[b]	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 2 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-
FR_MULTIPLATE	n	11	11	11	11	11	11	11	11
	Annual Minimum	0.000869	0.00154	0.0153	<0.0000100	<0.0000100	0.00113	<0.00300	<0.00300
	Annual Maximum	0.00134	0.00616	0.0721	<0.0000200	0.0000260	0.00376	0.0100	0.00860
	Annual Mean	0.00113	0.00296	0.0416	0.0000102	0.0000115	0.00230	0.00384	0.00351
	Annual Median	0.00114	0.00265	0.0428	<0.0000100	<0.0000100	0.00219	<0.00300	<0.00300
	% < LRL	0%	0%	0%	91%	91%	0%	73%	91%
	% > Chronic BCWQG[a]	0%	0%	100%	0%	0%	0%	0%	0%
	% > Acute BCWQG[b]	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	18%	9%	-	-	-	-	-
	% > Level 2 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-
FR_FR2	n	25	25	25	25	25	25	25	25
	Annual Minimum	0.000771	0.00128	0.0109	<0.0000100	<0.0000100	0.000945	<0.00300	<0.00300
	Annual Maximum	0.00211	0.00604	0.0718	0.0000250	0.0000390	0.00452	0.0146	0.111
	Annual Mean	0.00124	0.00285	0.0361	0.0000108	0.0000128	0.00243	0.00492	0.00905
	Annual Median	0.00120	0.00217	0.0394	<0.0000100	<0.0000100	0.00228	<0.00300	<0.00300
	% < LRL	0%	0%	0%	88%	80%	0%	56%	68%
	% > Chronic BCWQG[a]	0%	0%	100%	0%	0%	0%	0%	4%
	% > Acute BCWQG[b]	0%	-	-	0%	-	-	0%	4%
	% > Level 1 Benchmark	-	12%	8%	-	-	-	-	-
	% > Level 2 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-
GH_FR3	n	2	2	2	2	2	2	2	2
	Annual Minimum	0.00134	0.00269	0.0362	<0.0000100	<0.0000100	0.00241	<0.00300	<0.00300
	Annual Maximum	0.00149	0.00296	0.0529	<0.0000100	0.0000120	0.00362	0.00550	<0.00300
	Annual Mean	0.00142	0.00282	0.0446	<0.0000100	0.0000110	0.00302	0.00425	<0.00300
	Annual Median	0.00142	0.00282	0.0446	<0.0000100	0.0000110	0.00302	0.00425	<0.00300
	% < LRL	0%	0%	0%	100%	50%	0%	50%	100%
	% > Chronic BCWQG[a]	0%	0%	100%	0%	0%	0%	0%	0%
	% > Acute BCWQG[b]	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 2 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-
FR_FR4	n	9	9	9	9	9	9	9	9
	Annual Minimum	0.00102	0.00174	0.0251	<0.0000100	<0.0000100	0.00173	<0.00300	<0.00300
	Annual Maximum	0.00154	0.00692	0.0824	0.0000260	0.0000500	0.00447	0.0161	0.0103
	Annual Mean	0.00132	0.00416	0.0480	0.0000118	0.0000161	0.00263	0.00520	0.00440
	Annual Median	0.00131	0.00402	0.0471	<0.0000100	<0.0000100	0.00237	<0.00300	<0.00300
	% < LRL	0%	0%	0%	89%	67%	0%	67%	78%
	% > Chronic BCWQG[a]	0%	0%	100%	0%	0%	0%	0%	0%
	% > Acute BCWQG[b]	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	22%	11%	-	-	-	-	-
	% > Level 2 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-

Table C.1: Summary of Water Chemistry Data for Key Parameters for the Fording River LAEMP Monitoring Stations, 2018

Station	Summary Statistic	Total Molybdenum (mg/L)	Total Nickel (mg/L)	Total Selenium (mg/L)	Total Sliver (mg/L)	Total Thallium (mg/L)	Total Uranium (mg/L)	Total Zinc (mg/L)	Dissolved Aluminum (mg/L)
FR_FRCP1	n	38	38	38	38	38	38	38	38
	Annual Minimum	0.000943	0.00219	0.0271	<0.0000100	<0.0000100	0.00170	<0.00300	<0.00300
	Annual Maximum	0.00286	0.0456	0.689	0.0000390	0.0000560	0.0245	0.0258	0.00650
	Annual Mean	0.00172	0.0148	0.207	0.0000109	0.0000210	0.00811	0.00475	0.00325
	Annual Median	0.00165	0.00764	0.115	<0.0000100	0.0000120	0.00508	<0.00300	<0.00300
	% < LRL	0%	0%	0%	92%	37%	0%	71%	82%
	% > Chronic BCWQG^{a}	0%	0%	100%	0%	0%	24%	0%	0%
	% > Acute BCWQG^{b}	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	79%	71%	-	-	-	-	-
	% > Level 2 Benchmark	-	26%	29%	-	-	-	-	-
	% > Level 3 Benchmark	-	24%	-	-	-	-	-	-
FR_FRCP1SW	n	5	5	5	5	5	5	5	5
	Annual Minimum	0.00125	0.00419	0.0437	<0.0000100	0.0000120	0.00252	<0.00300	<0.00300
	Annual Maximum	0.00157	0.0103	0.141	0.0000270	0.0000480	0.00544	0.0137	0.00940
	Annual Mean	0.00142	0.00715	0.0798	0.0000134	0.0000218	0.00357	0.00666	0.00510
	Annual Median	0.00142	0.00698	0.0588	<0.0000100	0.0000130	0.00284	0.00410	<0.00300
	% < LRL	0%	0%	0%	60%	0%	0%	40%	60%
	% > Chronic BCWQG^{a}	0%	0%	100%	0%	0%	0%	0%	0%
	% > Acute BCWQG^{b}	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	80%	40%	-	-	-	-	-
	% > Level 2 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-
FR_FRRD	n	14	14	14	14	14	14	14	14
	Annual Minimum	0.000480	<0.000500	0.0377	<0.0000100	<0.0000100	0.00182	<0.00300	<0.00300
	Annual Maximum	0.00120	0.00519	0.110	<0.0000200	0.0000290	0.00427	0.0127	0.00330
	Annual Mean	0.000814	0.00159	0.0739	0.0000108	0.0000114	0.00333	0.00441	0.00302
	Annual Median	0.000773	0.000760	0.0729	<0.0000100	<0.0000100	0.00359	<0.00300	<0.00300
	% < LRL	0%	29%	0%	93%	93%	0%	71%	93%
	% > Chronic BCWQG^{a}	0%	0%	100%	0%	0%	0%	0%	0%
	% > Acute BCWQG^{b}	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	0%	57%	-	-	-	-	-
	% > Level 2 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-
GH_PC2	n	9	9	9	9	9	9	9	9
	Annual Minimum	0.000690	<0.000500	0.0447	<0.0000100	<0.0000100	0.00231	<0.00300	<0.00300
	Annual Maximum	0.00124	0.00451	0.105	<0.0000200	<0.0000200	0.00394	0.0104	0.00500
	Annual Mean	0.000887	0.00139	0.0816	<0.0000100	0.0000107	0.00323	0.00421	0.00322
	Annual Median	0.000861	<0.000500	0.0891	<0.0000100	<0.0000100	0.00322	<0.00300	<0.00300
	% < LRL	0%	56%	0%	100%	89%	0%	78%	89%
	% > Chronic BCWQG^{a}	0%	0%	100%	0%	0%	0%	0%	0%
	% > Acute BCWQG^{b}	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	0%	67%	-	-	-	-	-
	% > Level 2 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-
FR_FRABCH	n	31	31	31	31	31	31	31	31
	Annual Minimum	0.000610	<0.000500	0.0354	<0.0000100	<0.0000100	0.00180	<0.00300	<0.00300
	Annual Maximum	0.00125	0.00663	0.116	0.0000380	0.0000540	0.00372	0.0201	0.162
	Annual Mean	0.000857	0.00168	0.0773	0.0000110	0.0000122	0.00298	0.00394	0.00868
	Annual Median	0.000794	0.000760	0.0869	<0.0000100	<0.0000100	0.00319	<0.00300	<0.00300
	% < LRL	0%	13%	0%	90%	90%	0%	81%	81%
	% > Chronic BCWQG^{a}	0%	0%	100%	0%	0%	0%	0%	3%
	% > Acute BCWQG^{b}	0%	-	-	0%	-	-	0%	3%
	% > Level 1 Benchmark	-	3%	65%	-	-	-	-	-
	% > Level 2 Benchmark	-	0%	0%	-	-	-	-	-
	% > Level 3 Benchmark	-	0%	-	-	-	-	-	-
FR_FR5	n	9	9	9	9	9	9	9	9
	Annual Minimum	0.000598	<0.000500	0.0398	<0.0000100	<0.0000100	0.00205	<0.00300	<0.00300
	Annual Maximum	0.00102	0.00305	0.0818	<0.0000200	<0.0000100	0.00287	0.00570	0.00310
	Annual Mean	0.000786	0.00133	0.0631	<0.0000100	<0.0000100	0.00249	0.00342	0.00301
	Annual Median	0.000764	0.00115	0.0644	<0.0000100	<0.0000100	0.00261	<0.00300	<0.00300
	% < LRL	0%	11%	0%	100%	100%	0%	78%	89%
	% > Chronic BCWQG^{a}	0%	0%	100%	0%	0%	0%	0%	0%
	% > Acute BCWQG^{b}	0%	-	-	0%	-	-	0%	0%
	% > Level 1 Benchmark	-	0%	44%	-	-	-	-	-
	% > 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.1: Summary of Water Chemistry Data for Key Parameters for the Fording River LAEMP Monitoring Stations, 2018

Station	Summary Statistic	Dissolved Cadmium (mg/L)	Dissolved Cobalt (mg/L)	Dissolved Iron (mg/L)
FR_UFR1	n	26	26	26
	Annual Minimum	<0.00000500	<0.000100	<0.0100
	Annual Maximum	0.0000111	<0.000200	<0.0200
	Annual Mean	0.00000762	<0.000100	0.0102
	Annual Median	0.00000700	<0.000100	<0.0100
	% < LRL	15%	100%	96%
	% > Chronic BCWQG[a]	0%	-	-
	% > Acute BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-
FR_HC3	n	13	13	11
	Annual Minimum	<0.00000500	<0.000100	<0.0100
	Annual Maximum	<0.0000100	<0.000200	<0.0100
	Annual Mean	0.00000504	<0.000100	<0.0100
	Annual Median	<0.00000500	<0.000100	<0.0100
	% < LRL	92%	100%	100%
	% > Chronic BCWQG[a]	0%	-	-
	% > Acute BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-
FR_FR1	n	10	10	10
	Annual Minimum	0.00000770	<0.000100	<0.0100
	Annual Maximum	0.0000288	<0.000100	<0.0100
	Annual Mean	0.0000176	<0.000100	<0.0100
	Annual Median	0.0000170	<0.000100	<0.0100
	% < LRL	0%	100%	100%
	% > Chronic BCWQG[a]	0%	-	-
	% > Acute BCWQG[b]	-	0%	0%
	% > Level 1 Benchmark	0%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-
FR_FRABEC1	n	2	2	2
	Annual Minimum	0.0000143	<0.000100	<0.0100
	Annual Maximum	0.0000273	<0.000100	<0.0100
	Annual Mean	0.0000208	<0.000100	<0.0100
	Annual Median	0.0000208	<0.000100	<0.0100
	% < LRL	0%	100%	100%
	% > Chronic BCWQG[a]	0%	-	-
	% > Acute BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-
FR_MULTIPLATE	n	11	11	11
	Annual Minimum	0.0000172	<0.000100	<0.0100
	Annual Maximum	0.000107	<0.000100	<0.0100
	Annual Mean	0.0000406	<0.000100	<0.0100
	Annual Median	0.0000285	<0.000100	<0.0100
	% < LRL	0%	100%	100%
	% > Chronic BCWQG[a]	0%	-	-
	% > Acute BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-
FR_FR2	n	25	25	25
	Annual Minimum	0.00000550	<0.000100	<0.0100
	Annual Maximum	0.000118	0.000320	0.127
	Annual Mean	0.0000565	0.000125	0.0150
	Annual Median	0.0000473	<0.000100	<0.0100
	% < LRL	0%	64%	84%
	% > Chronic BCWQG[a]	0%	-	-
	% > Acute BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-
GH_FR3	n	2	2	2
	Annual Minimum	0.0000449	<0.000100	<0.0100
	Annual Maximum	0.0000700	<0.000200	<0.0200
	Annual Mean	0.0000574	<0.000100	<0.0100
	Annual Median	0.0000574	<0.000200	<0.0200
	% < LRL	0%	100%	100%
	% > Chronic BCWQG[a]	0%	-	-
	% > Acute BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-
FR_FR4	n	9	9	9
	Annual Minimum	0.0000102	<0.000100	<0.0100
	Annual Maximum	0.000124	0.000130	0.0110
	Annual Mean	0.0000616	0.000103	0.0101
	Annual Median	0.0000425	<0.000100	<0.0100
	% < LRL	0%	78%	89%
	% > Chronic BCWQG[a]	0%	-	-
	% > Acute BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-

Table C.1: Summary of Water Chemistry Data for Key Parameters for the Fording River LAEMP Monitoring Stations, 2018

Station	Summary Statistic	Dissolved Cadmium (mg/L)	Dissolved Cobalt (mg/L)	Dissolved Iron (mg/L)
FR_FRCP1	n	38	29	38
	Annual Minimum	<0.00000500	<0.000100	<0.0100
	Annual Maximum	0.000109	0.000150	0.0200
	Annual Mean	0.0000388	0.000108	0.0103
	Annual Median	0.0000341	<0.000100	<0.0100
	% < LRL	29%	69%	97%
	% > Chronic BCWQG[a]	0%	-	-
	% > Acute BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-
FR_FRCP1SW	n	5	5	5
	Annual Minimum	0.00000830	<0.000100	<0.0100
	Annual Maximum	0.000112	0.000110	<0.0100
	Annual Mean	0.0000571	0.000102	<0.0100
	Annual Median	0.0000744	<0.000100	<0.0100
	% < LRL	0%	80%	100%
	% > Chronic BCWQG[a]	0%	-	-
	% > Acute BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-
FR_FRRD	n	14	14	14
	Annual Minimum	0.0000340	<0.000100	<0.0100
	Annual Maximum	0.0000711	0.000180	<0.0100
	Annual Mean	0.0000474	0.000112	<0.0100
	Annual Median	0.0000454	<0.000100	<0.0100
	% < LRL	0%	64%	100%
	% > Chronic BCWQG[a]	0%	-	-
	% > Acute BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-
GH_PC2	n	9	8	9
	Annual Minimum	0.0000305	<0.000100	<0.0100
	Annual Maximum	0.0000747	<0.000100	<0.0200
	Annual Mean	0.0000433	<0.000100	<0.0100
	Annual Median	0.0000350	<0.000100	<0.0100
	% < LRL	0%	100%	100%
	% > Chronic BCWQG[a]	0%	-	-
	% > Acute BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-
FR_FRABCH	n	31	31	31
	Annual Minimum	<0.00000500	<0.000100	<0.0100
	Annual Maximum	0.000117	0.000200	0.255
	Annual Mean	0.0000426	0.000104	0.0185
	Annual Median	0.0000370	<0.000100	<0.0100
	% < LRL	3%	84%	94%
	% > Chronic BCWQG[a]	0%	-	-
	% > Acute BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-
	% > Level 2 Benchmark	-	-	-
	% > Level 3 Benchmark	-	-	-
FR_FR5	n	9	9	9
	Annual Minimum	0.0000177	<0.000100	<0.0100
	Annual Maximum	0.0000494	<0.000100	<0.0100
	Annual Mean	0.0000312	<0.000100	<0.0100
	Annual Median	0.0000308	<0.000100	<0.0100
	% < LRL	0%	100%	100%
	% > Chronic BCWQG[a]	0%	-	-
	% > Acute BCWQG[b]	0%	0%	0%
	% > Level 1 Benchmark	0%	-	-
	% > Level 2 Benchmark	-	-	-
	% > 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: Temporal Changes in Water Chemistry Parameters at Stations in the Fording River LAEMP, 2012 to 2018

Parameter	Status	Station	Year P-value^{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 2018 annual mean greater or less than all annual historical means (2012 to 2017) and the previous year (2017)?c								
				2012	2013	2014	2015	2016	2017	2018	2012	2013	2014	2015	2016	2017	2018	2018 vs. 2012-2017	2018 vs. 2017
Nitrate-N	Reference	FR_UFR1	<0.001	b	3.7	**168**	**201**	**225**	**228**	**143**	B	B	A	A	A	A	A	ns	ns
		FR_HC3	<0.001	b	20	-	**64**	**63**	**50**	**60**	B	B	-	A	A	A	A	ns	ns
	Mine-exposed	FR_FR1	<0.001	b	59	15	17	-17	30	-25	ABC	A	ABC	ABC	BC	AB	C	ns	↓
		FR_FRABEC1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FR_MULTIPLATE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FR_FR2	<0.001	b	26	14	**34**	**55**	**58**	**40**	C	ABC	BC	AB	A	A	AB	ns	ns
		GH_FR3	0.383	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-
		FR_FR4	0.165	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	ns	ns
		FR_FRCP1	0.142	-	-	-	ns	ns	ns	ns	-	-	-	-	-	-	-	ns	ns
		FR_FRCP1SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FR_FRRD	0.783	-	-	-	ns	ns	ns	ns	-	-	-	-	-	-	-	ns	ns
		GH_PC2	0.002	b	**21**	**24**	11	-	-	9.2	B	A	A	AB	-	-	AB	ns	-
		FR_FRABCH	0.539	-	-	-	ns	ns	ns	ns	-	-	-	-	-	-	-	ns	ns
		FR_FR5	<0.001	b	**25**	**31**	14	15	**18**	14	B	A	A	AB	AB	A	AB	ns	ns
Total Selenium	Reference	FR_UFR1	<0.001	b	-3.3	-4.2	7.0	**16**	**19**	**20**	B	B	B	AB	A	A	A	ns	ns
		FR_HC3	<0.001	b	5.1	-	**22**	**30**	**33**	**32**	C	BC	-	AB	A	A	A	ns	ns
	Mine-exposed	FR_FR1	0.010	b	54	22	12	-12	65	12	AB	A	AB	AB	B	A	AB	ns	ns
		FR_FRABEC1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FR_MULTIPLATE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FR_FR2	<0.001	b	21	1.4	-4.4	-3.2	**29**	**37**	C	ABC	BC	C	C	AB	A	ns	ns
		GH_FR3	0.015	b	15	-9.0	-19	-	-	-	AB	A	AB	B	-	-	-	-	-
		FR_FR4	<0.001	b	3.5	-2.1	-20	-22	12	4.5	ABC	AB	ABC	BC	C	A	AB	ns	ns
		FR_FRCP1	0.007	-	-	-	b	-19	10	54	-	-	-	AB	B	AB	A	ns	ns
		FR_FRCP1SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FR_FRRD	0.001	-	-	-	b	-3.4	**25**	14	-	-	-	B	B	A	AB	ns	ns
		GH_PC2	<0.001	b	**16**	**16**	6.2	-	-	**29**	C	AB	AB	BC	-	-	A	ns	-
		FR_FRABCH	<0.001	-	-	-	b	-5.6	6.8	**19**	-	-	-	B	B	AB	A	ns	ns
		FR_FR5	<0.001	b	**18**	**22**	11	8.9	**22**	**36**	C	AB	AB	BC	BC	AB	A	ns	ns
Sulphate	Reference	FR_UFR1	0.065	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	ns	ns
		FR_HC3	0.003	b	-4.2	-	23	23	**32**	21	B	B	-	AB	AB	A	AB	ns	ns
	Mine-exposed	FR_FR1	0.043	b	40	24	41	15	**79**	15	B	AB	AB	AB	AB	A	AB	ns	ns
		FR_FRABEC1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FR_MULTIPLATE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FR_FR2	0.029	b	14	0.78	4.0	2.2	19	23	A	A	A	A	A	A	A	ns	ns
		GH_FR3	0.277	ns	ns	ns	ns	-	-	-	-	-	-	-	-	-	-	-	-
		FR_FR4	0.053	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	ns	ns
		FR_FRCP1	0.028	-	-	-	b	-12	11	43	-	-	-	AB	B	AB	A	ns	ns
		FR_FRCP1SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FR_FRRD	0.012	-	-	-	b	-3.5	16	7.6	-	-	-	AB	B	A	AB	ns	ns
		GH_PC2	<0.001	b	9.2	8.0	10	-	-	**32**	B	B	B	B	-	-	A	↑	-
		FR_FRABCH	0.136	-	-	-	ns	ns	ns	ns	-	-	-	-	-	-	-	ns	ns
		FR_FR5	<0.001	b	10	14	13	14	**22**	**34**	C	BC	ABC	BC	ABC	AB	A	ns	ns

Table C.2: Temporal Changes in Water Chemistry Parameters at Stations in the Fording River LAEMP, 2012 to 2018

Parameter	Status	Station	Year P-value[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 2018 annual mean greater or less than all annual historical means (2012 to 2017) and the previous year (2017)?c								
				2012	2013	2014	2015	2016	2017	2018	2012	2013	2014	2015	2016	2017	2018	2018 vs. 2012-2017	2018 vs. 2017
Total Nickel	Reference	FR_UFR1	0.103	ns	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-	ns	ns
		FR_HC3	0.212	ns	ns	-	ns	ns	ns	ns	-	-	-	-	-	-	-	ns	ns
	Mine-exposed	FR_FR1	<0.001	b	**75**	**37**	5.9	6.2	21	35	C	A	AB	BC	BC	BC	ABC	ns	ns
		FR_FRABEC1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FR_MULTIPLATE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FR_FR2	<0.001	b	12	**-37**	**-34**	-18	-9.2	-13	AB	A	D	CD	BCD	AB	ABC	ns	ns
		GH_FR3	<0.001	b	-4.4	**-43**	**-48**	-	-	-	A	A	B	B	-	-	-	-	-
		FR_FR4	<0.001	b	2.7	-28	**-40**	**-36**	-22	-20	AB	A	BC	C	C	ABC	ABC	ns	ns
		FR_FRCP1	0.005	-	-	-	b	-9.3	14	**64**	-	-	-	B	B	AB	A	ns	ns
		FR_FRCP1SW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FR_FRRD	0.006	-	-	-	b	36	65	-17	-	-	-	AB	AB	A	B	ns	↓
		GH_PC2	<0.001	b	2.5	**-46**	**-45**	-	-	**-56**	A	A	B	B	-	-	B	ns	-
		FR_FRABCH	<0.001	-	-	-	b	**78**	**71**	34	-	-	-	B	A	A	AB	ns	ns
		FR_FR5	0.041	b	-0.20	-38	-42	19	-16	-13	AB	AB	AB	B	A	AB	AB	ns	ns

▨	P-value < 0.05
🟩	> 20% Decrease in concentration
🟩	> 33% Decrease in concentration
🟩	> 43% Decrease in concentration
🟩	> 50% Decrease in concentration
🟦	> 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 < than all historical years (or 2017)
🟦	Significantly > than all historical years (or 2017)

Notes: "ns" = not significant; "-" insufficient data for comparison

[a] *Year* p-value from an ANOVA with factors *Year* and *Month.*

[b] Magnitude of Difference (MOD) = $[\text{Mean}_{\text{given year}} - \text{Mean}_{\text{year b}}] / \text{Mean}_{\text{year b}} \times 100\%$.

c Significance among year determined using all pairwise comparisons using Tukey's honestly signifciant differences method. Years that share a letter are not significantly different. Letters assigned such that the mean with with highest magnitude is assigned "A".

Table C.3: **Results of the Seasonal Kendall Test for Discharge and Water Temperature at Station FR_FRNTP, 2010 to 2018**

Parameter	Units	Years	n (Total # Months with Data)	Slope (Magnitude Change / Year)	P-value
Discharge	(m^3/s)	2010-2018	72	-0.08394	0.001
Temperature	(°C)	2010-2018	89	-0.06804	0.099

APPENDIX D
SEDIMENT

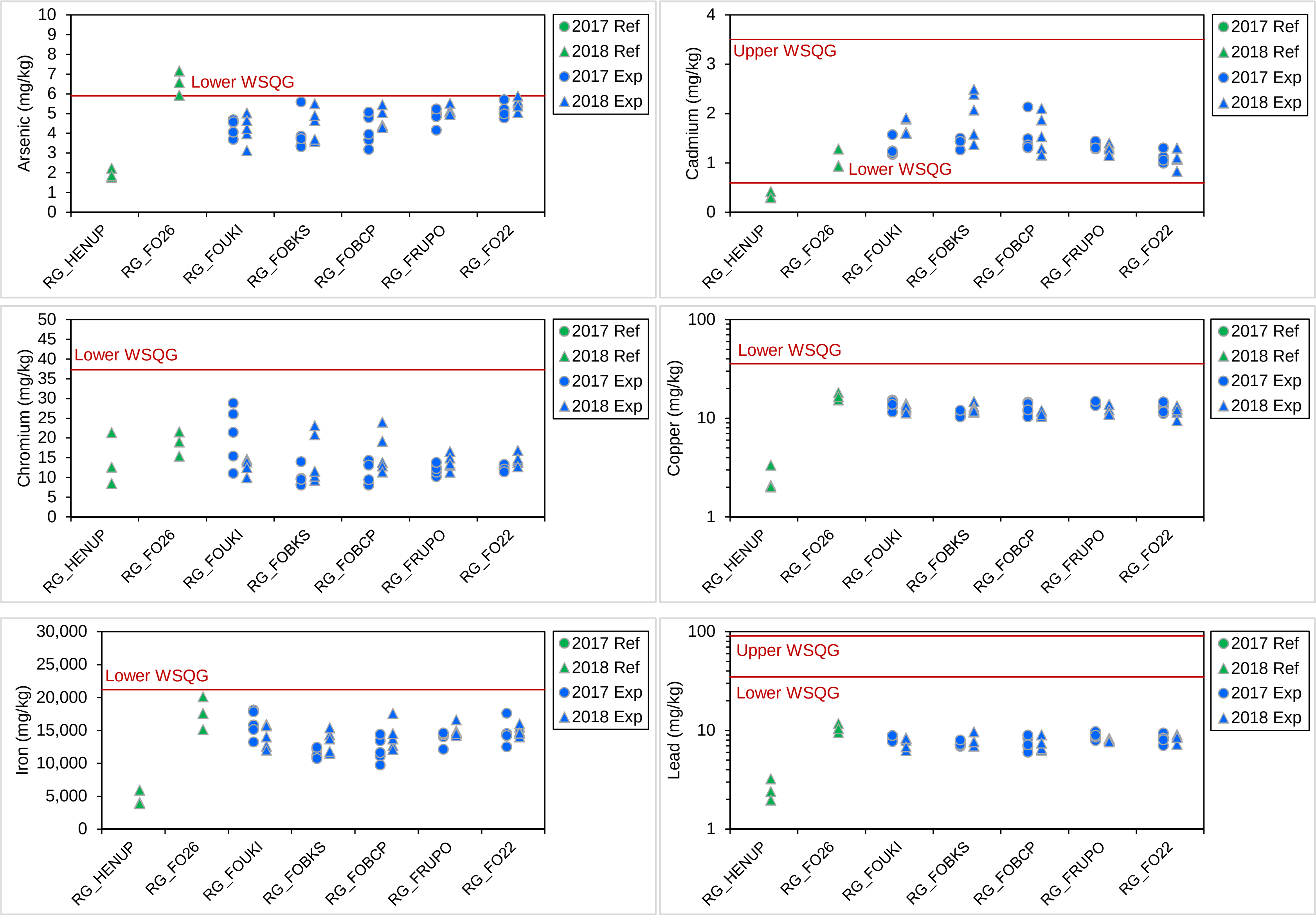


Figure D.1: **Sediment Metal Concentrations Relative to BC Working Sediment Quality Guidelines (WSQG), 2017-2018**

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

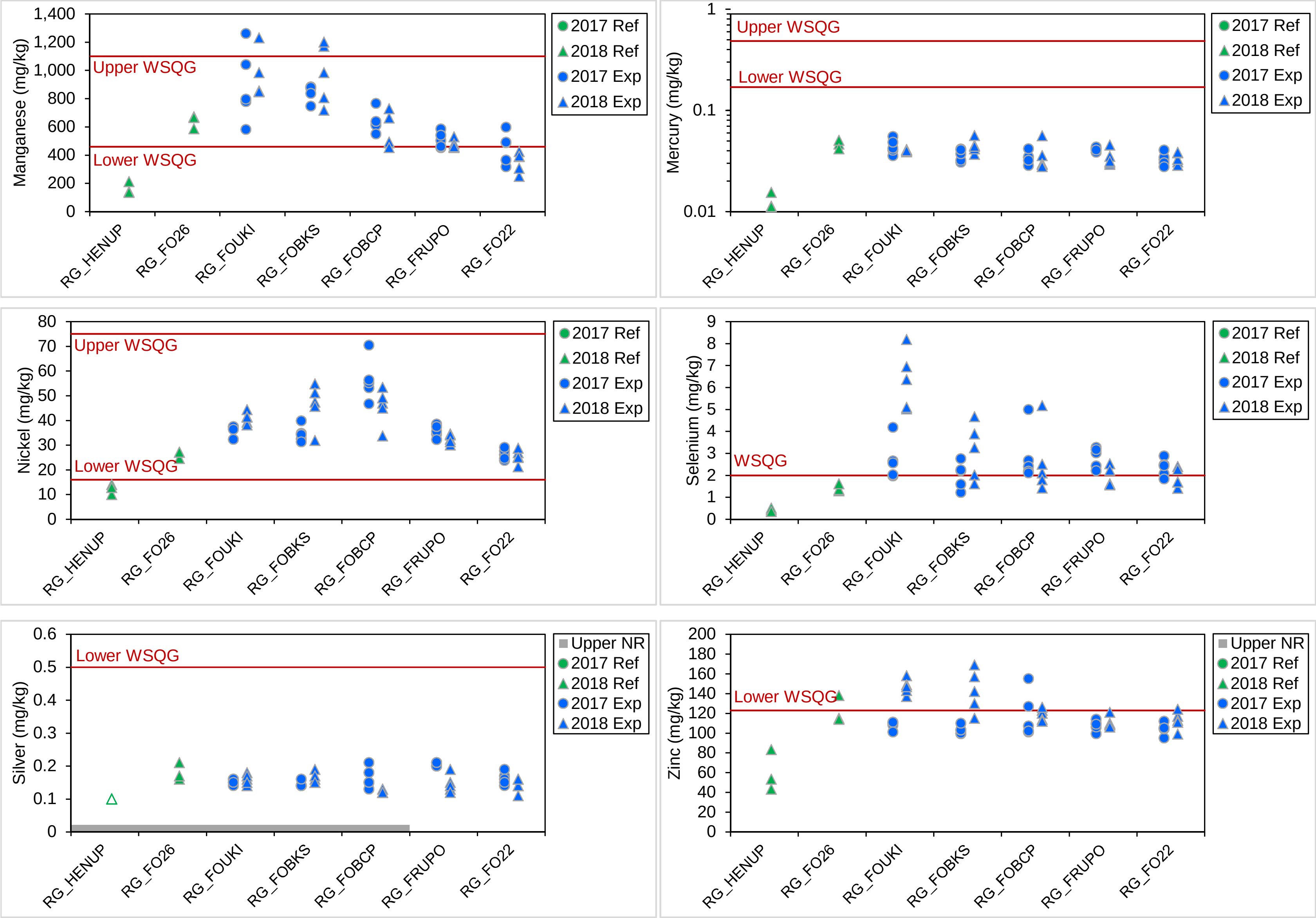


Figure D.1: Sediment Metal Concentrations Relative to BC Working Sediment Quality Guidelines (WSQG), 2017-2018

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

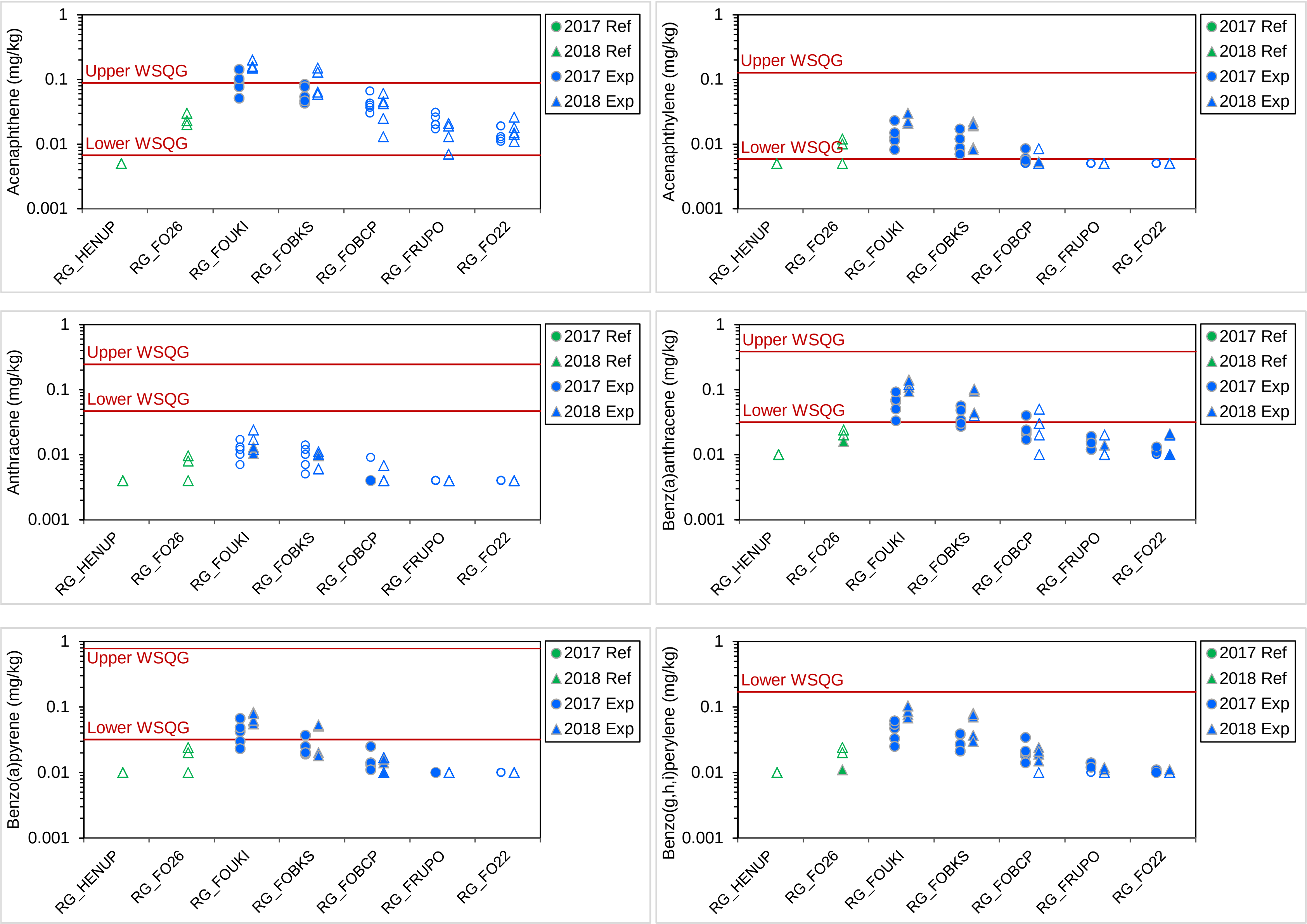


Figure D.2: Sediment Polycyclic Aromatic Hydrocarbons Concentrations Relative to BC Working Sediment Quality Guidelines (WSQG), 2017-2018

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

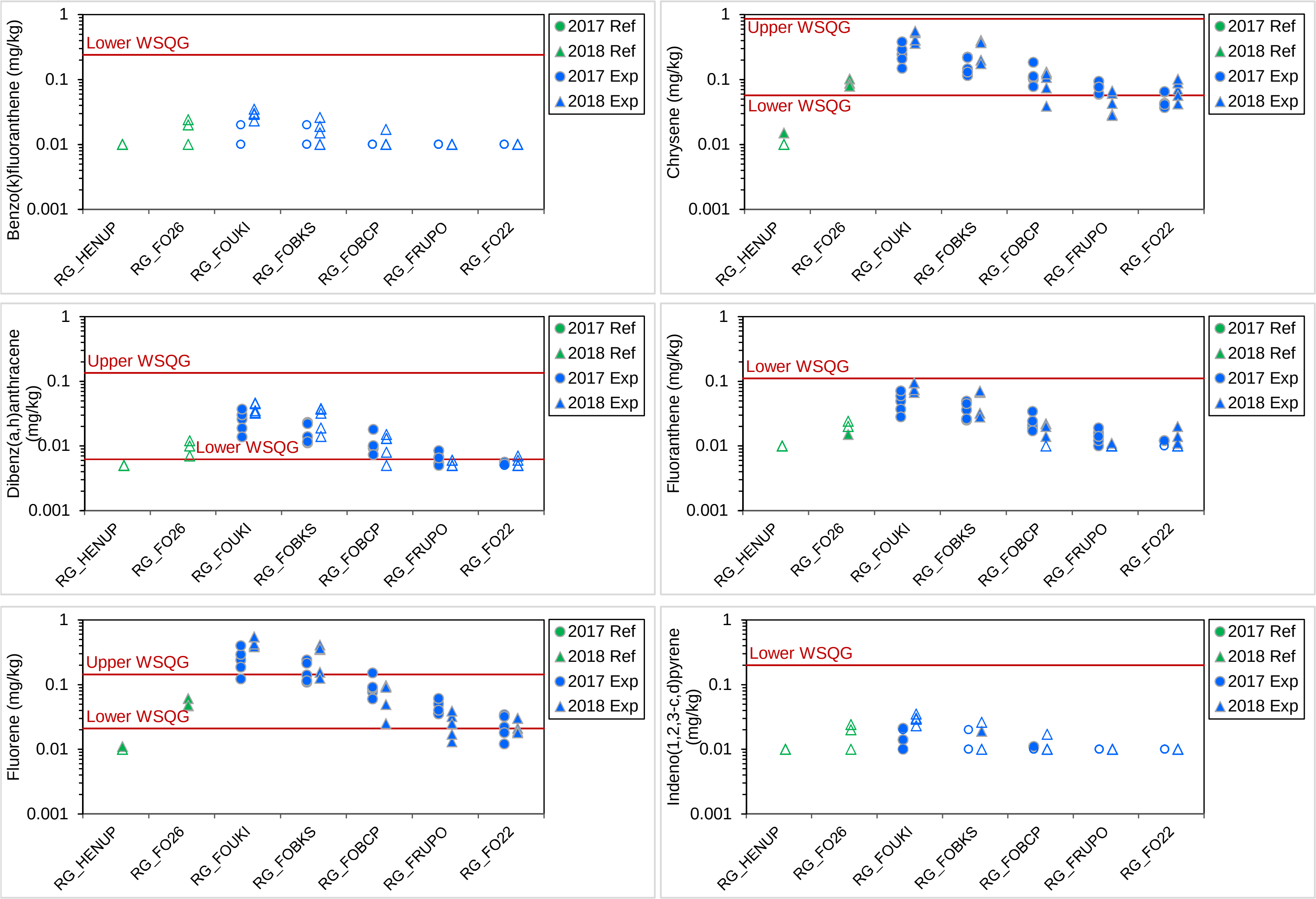


Figure D.2: Sediment Polycyclic Aromatic Hydrocarbons Concentrations Relative to BC Working Sediment Quality Guidelines (WSQG), 2017-2018

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

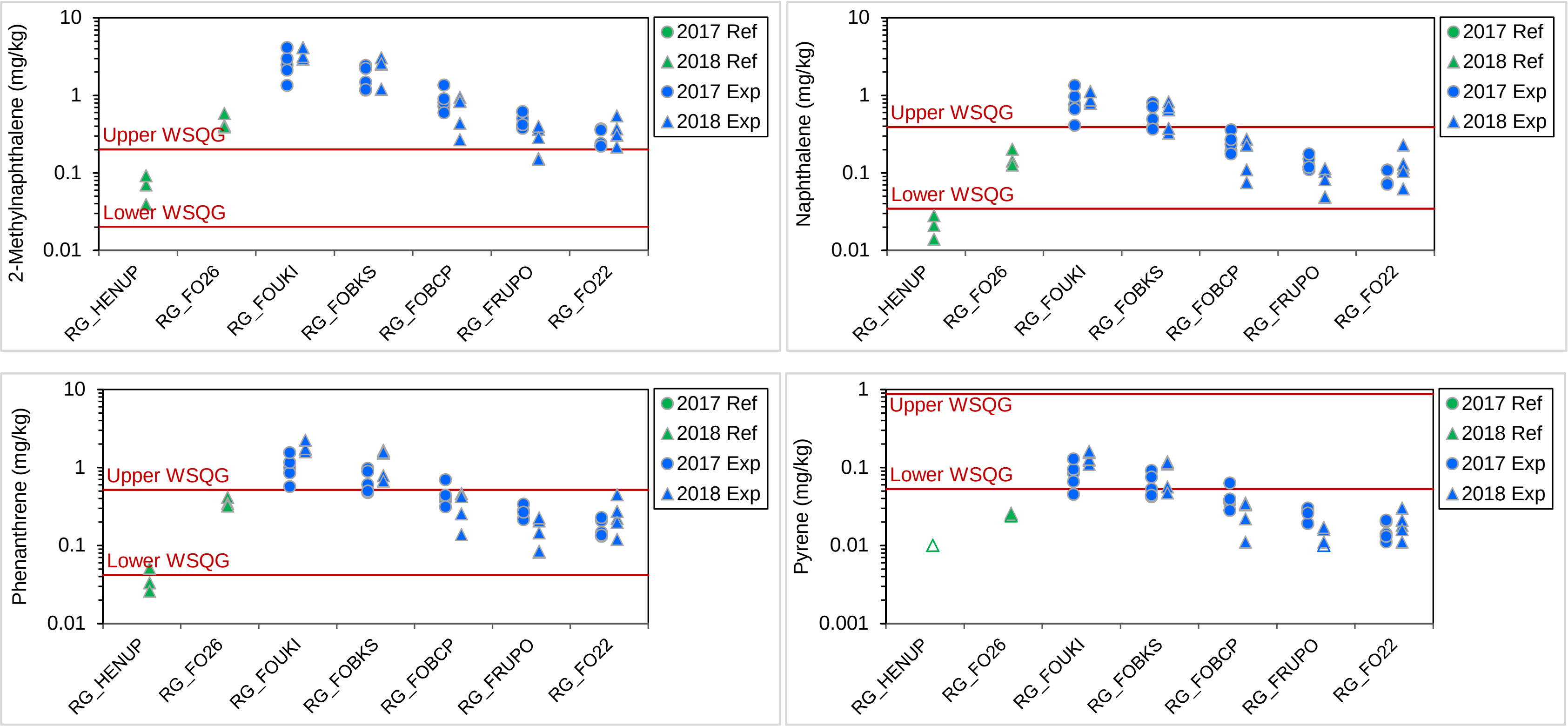


Figure D.2: **Sediment Polycyclic Aromatic Hydrocarbons Concentrations Relative to BC Working Sediment Quality Guidelines (WSQG), 2017-2018**

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

Table D.1: Sediment Quality Samples and Summary Statistics for Lotic Reference and Mine-Exposed Areas, FRO LAEMP, 2018

Parameter		Units	Detection Limit	Lower WSQG	Upper WSQG	RG_HENUP-Rep1	RG_HENUP-Rep2	RG_HENUP-Rep3	Min	Median	Max	Mean	Standard Deviation	RG_FO26-Rep1	RG_FO26-Rep2	RG_FO26-Rep3	Min	Median	Max	Mean	Standard Deviation
						6-Sep-18	6-Sep-18	6-Sep-18						7-Sep-18	7-Sep-18	7-Sep-18					
Physical Tests	Moisture	%	0.25	-	-	35.1	38.7	31.6	31.6	35.1	38.7	35.1	3.55	78.3	60.1	79.4	60.1	78.3	79.4	72.6	10.8
	pH (1:2 soil:water)	pH units	0.1	-	-	8.28	8.09	8.78	8.09	8.28	8.78	8.38	0.356	7.74	7.97	7.51	7.51	7.74	7.97	7.74	0.230
Particle Size	% Gravel (>2mm)	%	1	-	-	2.5	33.0	46.2	2.50	33.0	46.2	27.2	22.4	55.5	14.9	51.5	14.9	51.5	55.5	40.6	22.4
	% Sand (2.0mm - 0.063mm)	%	5	-	-	74.9	36.7	43	36.7	43.0	74.9	51.5	20.5	30.3	35.6	25	25.0	30.3	35.6	30.3	5.30
	% Sand (2.00mm - 1.00mm)	%	1	-	-	1.5	2.2	2.1	1.50	2.10	2.20	1.93	0.379	8.8	1.5	8.0	1.50	8.00	8.80	6.10	4.00
	% Sand (1.00mm - 0.50mm)	%	1	-	-	6.6	4.5	5.2	4.50	5.20	6.60	5.43	1.07	3.6	2.8	4.7	2.80	3.60	4.70	3.70	0.954
	% Sand (0.50mm - 0.25mm)	%	1	-	-	27.8	8.0	17.1	8.00	17.1	27.8	17.6	9.91	5.6	6.6	4.0	4.00	5.60	6.60	5.40	1.31
	% Sand (0.25mm - 0.125mm)	%	1	-	-	26.9	10.1	13.1	10.1	13.1	26.9	16.7	8.96	7.2	11.9	4.3	4.30	7.20	11.9	7.80	3.84
	% Sand (0.125mm - 0.063mm)	%	1	-	-	12.1	11.9	5.5	5.50	11.9	12.1	9.83	3.75	5.1	12.8	4.0	4.00	5.10	12.8	7.30	4.79
	% Silt (0.063mm - 0.004mm)	%	2	-	-	20.2	27.5	9.5	9.50	20.2	27.5	19.1	9.05	12.8	45	20.7	12.8	20.7	45.0	26.2	16.8
	% Silt (0.063mm - 0.0312mm)	%	1	-	-	9.6	12.7	4.6	4.60	9.60	12.7	8.97	4.09	6.1	20.8	9.5	6.10	9.50	20.8	12.1	7.70
	% Silt (0.0312mm - 0.004mm)	%	1	-	-	10.6	14.8	4.9	4.90	10.6	14.8	10.1	4.97	6.7	24.2	11.2	6.70	11.2	24.2	14.0	9.09
	% Clay (<4µm)	%	1	-	-	2.4	2.8	1.3	1.30	2.40	2.80	2.17	0.777	1.4	4.6	2.7	1.40	2.70	4.60	2.90	1.61
	Texture	-	-	-	-	Loamy sand	Sandy loam	Loamy sand	-	-	-	-	-	Sandy loam	Silt loam	Sandy loam	-	-	-	-	-
Organic Carbon	Total Organic Carbon	%	0.1	-	-	5.2	6.0	4.7	4.70	5.20	6.00	5.30	0.656	4.34	5.88	6.73	4.34	5.88	6.73	5.65	1.21
Metals (1 mm fraction)	Aluminum (Al)	mg/kg	50	-	-	2,700	4,780	2,300	2,300	2,700	4,780	3,260	1,330	7,560	9,530	7,390	7,390	7,560	9,530	8,160	1,190
	Antimony (Sb)	mg/kg	0.1	-	-	0.11	0.12	0.11	0.110	0.110	0.120	0.113	0.00577	0.62	0.62	0.63	0.620	0.620	0.630	0.623	0.00577
	Arsenic (As)	mg/kg	0.1	5.9	17	1.77	2.22	1.85	1.77	1.85	2.22	1.95	0.240	6.57	7.15	5.92	5.92	6.57	7.15	6.55	0.615
	Barium (Ba)	mg/kg	0.5	-	-	24.4	37.2	18.2	18.2	24.4	37.2	26.6	9.69	200	209	218	200	209	218	209	9.00
	Beryllium (Be)	mg/kg	0.1	-	-	0.15	0.23	0.14	0.140	0.150	0.230	0.173	0.0493	0.59	0.67	0.67	0.590	0.670	0.670	0.643	0.0462
	Bismuth (Bi)	mg/kg	0.2	-	-	<0.20	<0.20	<0.20	<0.200	<0.200	<0.200	<0.200	-	<0.20	<0.20	<0.20	<0.200	<0.200	<0.200	<0.200	-
	Boron (B)	mg/kg	5	-	-	<5.0	<5.0	<5.0	<5.00	<5.00	<5.00	<5.00	-	7.0	8.5	8.4	7.00	8.40	8.50	7.97	0.839
	Cadmium (Cd)	mg/kg	0.02	0.6	3.5	0.317	0.420	0.294	0.294	0.317	0.420	0.344	0.0671	0.943	1.28	0.933	0.933	0.943	1.28	1.05	0.198
	Calcium (Ca)	mg/kg	50	-	-	293,000	211,000	322,000	211,000	293,000	322,000	275,000	57,600	50,200	37,200	48,800	37,200	48,800	50,200	45,400	7,140
	Chromium (Cr)	mg/kg	0.5	37.3	90	8.45	12.6	21.3	8.45	12.6	21.3	14.1	6.56	15.4	19.0	21.5	15.4	19.0	21.5	18.6	3.07
	Cobalt (Co)	mg/kg	0.1	-	-	1.57	2.24	1.39	1.39	1.57	2.24	1.73	0.448	7.37	8.02	6.63	6.63	7.37	8.02	7.34	0.695
	Copper (Cu)	mg/kg	0.5	35.7	197	2.08	3.33	2.01	2.01	2.08	3.33	2.47	0.743	15.3	18.1	16.5	15.3	16.5	18.1	16.6	1.40
	Iron (Fe)	mg/kg	50	21,200	43,766	4,010	5,900	3,850	3,850	4,010	5,900	4,590	1,140	17,600	20,100	15,100	15,100	17,600	20,100	17,600	2,500
	Lead (Pb)	mg/kg	0.5	35	91	2.39	3.23	1.96	1.96	2.39	3.23	2.53	0.646	9.50	11.7	10.4	9.50	10.4	11.7	10.5	1.11
	Lithium (Li)	mg/kg	2	-	-	9.0	12.5	8.4	8.40	9.00	12.5	9.97	2.21	8.3	10.3	8.1	8.10	8.30	10.3	8.90	1.22
	Magnesium (Mg)	mg/kg	20	-	-	52,500	57,200	47,300	47,300	52,500	57,200	52,300	4,950	12,100	11,200	9,260	9,260	11,200	12,100	10,900	1,450
	Manganese (Mn)	mg/kg	1	460	1100	141	213	136	136	141	213	163	43.1	672	667	587	587	667	672	642	47.7
	Mercury (Hg)	mg/kg	0.005	0.17	0.486	0.0113	0.0155	0.0112	0.0112	0.0113	0.0155	0.0127	0.00245	0.0465	0.0505	0.0418	0.0418	0.0465	0.0505	0.0463	0.00435
	Molybdenum (Mo)	mg/kg	0.1	-	-	0.44	0.48	0.66	0.440	0.480	0.660	0.527	0.117	1.64	1.73	1.91	1.64	1.73	1.91	1.76	0.137
	Nickel (Ni)	mg/kg	0.5	16	75	10.0	14.1	12.8	10.0	12.8	14.1	12.3	2.10	24.6	27.1	27.1	24.6	27.1	27.1	26.3	1.44
	Phosphorus (P)	mg/kg	50	-	-	479	676	454	454	479	676	536	122	1,630	1,670	1,470	1,470	1,630	1,670	1,590	106
	Potassium (K)	mg/kg	100	-	-	690	930	690	690	690	930	770	139	1,950	2,300	2,080	1,950	2,080	2,300	2,110	177
	Selenium (Se)	mg/kg	0.2	2		0.43	0.51	0.35	0.350	0.430	0.510	0.430	0.0800	1.29	1.35	1.61	1.29	1.35	1.61	1.42	0.170
	Silver (Ag)	mg/kg	0.1	0.5	-	<0.10	<0.10	<0.10	<0.100	<0.100	<0.100	<0.100	-	0.16	0.21	0.17	0.160	0.170	0.210	0.180	0.0265
	Sodium (Na)	mg/kg	50	-	-	197	181	199	181	197	199	192	9.87	96	88	95	88.0	95.0	96.0	93.0	4.36
	Strontium (Sr)	mg/kg	0.5	-	-	121	91.3	136	91.3	121	136	116	22.7	66.3	62.5	77.4	62.5	66.3	77.4	68.7	7.74
	Sulfur (S)	mg/kg	1,000	-	-	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	-	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	-
	Thallium (Tl)	mg/kg	0.05	-	-	0.060	0.081	0.051	0.0510	0.0600	0.0810	0.0640	0.0154	0.230	0.272	0.242	0.230	0.242	0.272	0.248	0.0216
	Tin (Sn)	mg/kg	2	-	-	<2.0	<2.0	<2.0	<2.00	<2.00	<2.00	<2.00	-	<2.0	<2.0	<2.0	<2.00	<2.00	<2.00	<2.00	-
	Titanium (Ti)	mg/kg	1	-	-	26.6	45.7	20.2	20.2	26.6	45.7	30.8	13.3	11.0	12.4	11.6	11.0	11.6	12.4	11.7	0.702
	Tungsten (W)	mg/kg	0.5	-	-	<0.50	<0.50	<0.50	<0.500	<0.500	<0.500	<0.500	-	<0.50	<0.50	<0.50	<0.500	<0.500	<0.500	<0.500	-
	Uranium (U)	mg/kg	0.05	-	-	0.520	0.622	0.499	0.499	0.520	0.622	0.547	0.0658	0.999	0.958	1.16	0.958	0.999	1.16	1.04	0.107
	Vanadium (V)	mg/kg	0.2	-	-	8.60	12.6	8.42	8.42	8.60	12.6	9.87	2.36	29.7	33.4	29.9	29.7	29.9	33.4	31.0	2.08
	Zinc (Zn)	mg/kg	2	123	315	53.5	83.2	43.2	43.2	53.5	83.2	60.0	20.8	115	138	114	114	115	138	122	13.6
	Zirconium (Zr)	mg/kg	1	-	-	<1.0	<1.0	<1.0	<1.00	<1.00	<1.00	<1.00	-	<1.0	<1.0	<1.0	<1.00	<1.00	<1.00	<1.00	-

Table D.1: Sediment Quality Samples and Summary Statistics for Lotic Reference and Mine-Exposed Areas, FRO LAEMP, 2018

Parameter		Units	Detection Limit	Lower WSQG	Upper WSQG	RG_HENUP-Rep1	RG_HENUP-Rep2	RG_HENUP-Rep3	Min	Median	Max	Mean	Standard Deviation	RG_FO26-Rep1	RG_FO26-Rep2	RG_FO26-Rep3	Min	Median	Max	Mean	Standard Deviation
						6-Sep-18	6-Sep-18	6-Sep-18						7-Sep-18	7-Sep-18	7-Sep-18					
PAHs (1 mm fraction)	Acenaphthene	mg/kg	0.005 - 0.2	0.00671	0.0889	<0.0050	<0.0050	<0.0050	<0.00500	<0.00500	<0.00500	<0.00500	-	<0.030	<0.023	<0.020	<0.0200	<0.0230	<0.0300	<0.0200	-
	Acenaphthylene	mg/kg	0.005 - 0.018	0.00587	0.128	<0.0050	<0.0050	<0.0050	<0.00500	<0.00500	<0.00500	<0.00500	-	<0.010	<0.0050	<0.012	<0.00500	<0.0100	<0.0120	<0.00500	-
	Acridine	mg/kg	0.01 - 0.035	-	-	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-	<0.020	<0.010	<0.024	<0.0100	<0.0200	<0.0240	<0.0100	-
	Anthracene	mg/kg	0.004 - 0.024	0.0469	0.245	<0.0040	<0.0040	<0.0040	<0.00400	<0.00400	<0.00400	<0.00400	-	<0.0080	<0.0040	<0.0096	<0.00400	<0.00800	<0.00960	<0.00400	-
	Benz(a)anthracene	mg/kg	0.01 - 0.12	0.0317	0.385	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-	<0.020	0.016	<0.024	0.0160	0.0160	<0.0240	0.0160	-
	Benzo(a)pyrene	mg/kg	0.01 - 0.035	0.0319	0.782	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-	<0.020	<0.010	<0.024	<0.0100	<0.0200	<0.0240	<0.0100	-
	Benzo(b&j)fluoranthene	mg/kg	0.01 - 0.035	-	-	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-	0.034	0.033	0.032	0.0320	0.0330	0.0340	0.0330	0.00100
	Benzo(e)pyrene	mg/kg	0.01 - 0.035	-	-	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-	0.035	0.033	0.032	0.0320	0.0330	0.0350	0.0333	0.00153
	Benzo(g,h,i)perylene	mg/kg	0.01 - 0.035	0.17	3.2	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-	<0.020	0.011	<0.024	0.0110	0.0110	<0.0240	0.0110	-
	Benzo(k)fluoranthene	mg/kg	0.01 - 0.035	0.24	13.4	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-	<0.020	<0.010	<0.024	<0.0100	<0.0200	<0.0240	<0.0100	-
	Chrysene	mg/kg	0.01 - 0.035	0.0571	0.862	<0.010	<0.010	0.015	<0.0100	<0.0100	0.0150	0.0117	-	0.102	0.088	0.079	0.0790	0.0880	0.102	0.0897	0.0116
	Dibenz(a,h)anthracene	mg/kg	0.005 - 0.046	0.00622	0.135	<0.0050	<0.0050	<0.0050	<0.00500	<0.00500	<0.00500	<0.00500	-	<0.010	<0.0070	<0.012	<0.00700	<0.0100	<0.0120	<0.00700	-
	Fluoranthene	mg/kg	0.01 - 0.035	0.111	2.355	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-	<0.020	0.015	<0.024	0.0150	0.0150	<0.0240	0.0150	-
	Fluorene	mg/kg	0.01 - 0.035	0.021	0.144	<0.010	<0.010	0.011	<0.0100	<0.0100	0.0110	0.0103	-	0.061	0.047	0.048	0.0470	0.0480	0.0610	0.0520	0.00781
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.01 - 0.035	0.2	3.2	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-	<0.020	<0.010	<0.024	<0.0100	<0.0200	<0.0240	<0.0100	-
	1-Methylnaphthalene	mg/kg	0.01 - 0.035	-	-	0.043	0.025	0.060	0.0250	0.0430	0.0600	0.0427	0.0175	0.351	0.258	0.236	0.236	0.258	0.351	0.282	0.0610
	2-Methylnaphthalene	mg/kg	0.01 - 0.035	0.0202	0.201	0.070	0.039	0.092	0.0390	0.0700	0.0920	0.0670	0.0266	0.585	0.411	0.391	0.391	0.411	0.585	0.462	0.107
	Naphthalene	mg/kg	0.01 - 0.035	0.0346	0.391	0.021	0.014	0.028	0.0140	0.0210	0.0280	0.0210	0.00700	0.201	0.142	0.126	0.126	0.142	0.201	0.156	0.0395
	Perylene	mg/kg	0.01 - 0.035	-	-	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-	<0.020	<0.010	<0.024	<0.0100	<0.0200	<0.0240	<0.0100	-
	Phenanthrene	mg/kg	0.01 - 0.035	0.0419	0.515	0.033	0.026	0.051	0.0260	0.0330	0.0510	0.0367	0.0129	0.412	0.346	0.321	0.321	0.346	0.412	0.360	0.0470
	Pyrene	mg/kg	0.01 - 0.035	0.053	0.875	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-	0.026	0.025	<0.024	<0.0240	0.0250	0.0260	0.0250	0.000667
	Quinoline	mg/kg	0.01 - 0.035	-	-	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-	<0.020	<0.010	<0.024	<0.0100	<0.0200	<0.0240	<0.0100	-
	Acenaphthene d10	%		-	-	83.3	75.6	78.8	75.6	78.8	83.3	79.2	3.87	74.5	65.2	62.5	62.5	65.2	74.5	67.4	6.30
	Chrysene d12	%		-	-	90.8	92.9	97.8	90.8	92.9	97.8	93.8	3.59	82.0	81.3	81.8	81.3	81.8	82.0	81.7	0.361
	Naphthalene d8	%		-	-	81.7	70.9	76.0	70.9	76.0	81.7	76.2	5.40	72.6	59.2	54.0	54.0	59.2	72.6	61.9	9.60
	Phenanthrene d10	%		-	-	84.7	85.9	87.9	84.7	85.9	87.9	86.2	1.62	81.8	79.5	77.3	77.3	79.5	81.8	79.5	2.25
	B(a)P Total Potency Equivalent	mg/kg	0.02 - 0.048	-	-	<0.020	<0.020	<0.020	<0.0200	<0.0200	<0.0200	<0.0200	-	0.023	<0.020	0.026	<0.0200	0.0230	0.0260	0.0230	0.00200
	IACR (CCME)	mg/kg	0.15 - 0.49	-	-	<0.15	<0.15	<0.15	<0.150	<0.150	<0.150	<0.150	-	0.41	0.36	0.42	0.360	0.410	0.420	0.397	0.0321

🟦	Value > lower Working Sediment Quality Guideline (WSQG)
▭	Value < LRL and LRL > lower Working Sediment Quality Guideline (WSQG)
⬛	Value > upper Working Sediment Quality Guideline (WSQG, or only guideline for Selenium)
⬜	Value < LRL and LRL > upper Working Sediment Quality Guideline (WSQG, or only guideline in the case of Selenium)

Notes: All observed data are reported to the number of significant digits reported by the laboratory and summary statistics are reported to 3 significant digits for display purposes.

Table D.1: Sediment Quality Samples and Summary Statistics for Lotic Reference and Mine-Exposed Areas, FRO LAEMP, 2018

Parameter		Units	Detection Limit	Lower WSQG	Upper WSQG	RG_FOUKI-Rep1	RG_FOUKI-Rep2	RG_FOUKI-Rep3	RG_FOUKI-Rep4	RG_FOUKI-Rep5	Min	Median	Max	Mean	Standard Deviation
						7-Sep-18	7-Sep-18	7-Sep-18	7-Sep-18	7-Sep-18					
Physical Tests	Moisture	%	0.25	-	-	84.8	80.0	84.1	86.7	85.0	80.0	84.8	86.7	84.1	2.49
	pH (1:2 soil:water)	pH units	0.1	-	-	7.87	7.90	7.80	7.84	7.77	7.77	7.84	7.90	7.84	0.0522
Particle Size	% Gravel (>2mm)	%	1	-	-	23.9	26.2	4.4	21.5	6.1	4.40	21.5	26.2	16.4	10.3
	% Sand (2.0mm - 0.063mm)	%	5	-	-	14.4	26.6	25.9	35.2	13.2	13.2	25.9	35.2	23.1	9.22
	% Sand (2.00mm - 1.00mm)	%	1	-	-	<1.0	4.2	4.4	11.6	1.4	<1.00	4.20	11.6	4.52	4.31
	% Sand (1.00mm - 0.50mm)	%	1	-	-	<1.0	4.0	4.1	8.4	<1.0	<1.00	4.00	8.40	3.70	2.14
	% Sand (0.50mm - 0.25mm)	%	1	-	-	1.2	5.3	4.6	4.9	1.0	1.00	4.60	5.30	3.40	2.12
	% Sand (0.25mm - 0.125mm)	%	1	-	-	4.2	6.5	5.9	5.2	3.4	3.40	5.20	6.50	5.04	1.25
	% Sand (0.125mm - 0.063mm)	%	1	-	-	7.0	6.6	6.9	5.1	6.4	5.10	6.60	7.00	6.40	0.765
	% Silt (0.063mm - 0.004mm)	%	2	-	-	56.6	41.7	58.9	38.4	71.5	38.4	56.6	71.5	53.4	13.5
	% Silt (0.063mm - 0.0312mm)	%	1	-	-	25.9	18.6	25.5	17.5	32.4	17.5	25.5	32.4	24.0	6.08
	% Silt (0.0312mm - 0.004mm)	%	1	-	-	30.7	23.1	33.4	20.9	39.1	20.9	30.7	39.1	29.4	7.48
	% Clay (<4μm)	%	1	-	-	5.8	5.6	10.9	5.0	9.7	5.00	5.80	10.9	7.40	2.70
	Texture	-	-	-	-	Silt loam	Silt loam	Silt loam	Silt loam	Silt loam	-	-	-	-	-
Organic Carbon	Total Organic Carbon	%	0.1	-	-	14.3	11.6	13.6	10.1	16.6	10.1	13.6	16.6	13.2	2.50
Metals (1 mm fraction)	Aluminum (Al)	mg/kg	50	-	-	5,300	5,780	4,260	5,370	4,040	4,040	5,300	5,780	4,950	757
	Antimony (Sb)	mg/kg	0.1	-	-	0.45	0.58	0.54	0.56	0.47	0.450	0.540	0.580	0.520	0.0570
	Arsenic (As)	mg/kg	0.1	5.9	17	3.98	5.03	4.24	4.65	3.13	3.13	4.24	5.03	4.21	0.722
	Barium (Ba)	mg/kg	0.5	-	-	211	217	226	214	227	211	217	227	219	7.18
	Beryllium (Be)	mg/kg	0.1	-	-	0.36	0.49	0.41	0.51	0.35	0.350	0.410	0.510	0.424	0.0733
	Bismuth (Bi)	mg/kg	0.2	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.200	<0.200	<0.200	<0.200	-
	Boron (B)	mg/kg	5	-	-	6.8	7.5	6.5	6.5	8.3	6.50	6.80	8.30	7.12	0.776
	Cadmium (Cd)	mg/kg	0.02	0.6	3.5	1.62	1.61	1.89	1.60	1.91	1.60	1.62	1.91	1.73	0.159
	Calcium (Ca)	mg/kg	50	-	-	77,700	83,500	86,500	79,000	97,100	77,700	83,500	97,100	84,800	7,740
	Chromium (Cr)	mg/kg	0.5	37.3	90	14.6	13.9	10.0	12.5	9.90	9.90	12.5	14.6	12.2	2.17
	Cobalt (Co)	mg/kg	0.1	-	-	6.31	6.34	6.56	6.51	6.32	6.31	6.34	6.56	6.41	0.118
	Copper (Cu)	mg/kg	0.5	35.7	197	12.1	14.0	12.7	13.2	11.3	11.3	12.7	14.0	12.7	1.03
	Iron (Fe)	mg/kg	50	21,200	43,766	12,600	15,900	14,000	15,700	12,000	12,000	14,000	15,900	14,000	1,760
	Lead (Pb)	mg/kg	0.5	35	91	6.24	8.42	7.95	8.28	6.79	6.24	7.95	8.42	7.54	0.967
	Lithium (Li)	mg/kg	2	-	-	6.6	8.8	6.6	9.0	5.8	5.80	6.60	9.00	7.36	1.44
	Magnesium (Mg)	mg/kg	20	-	-	13,800	12,800	11,400	12,400	11,700	11,400	12,400	13,800	12,400	950
	Manganese (Mn)	mg/kg	1	460	1100	984	850	854	850	1230	850	854	1,230	954	165
	Mercury (Hg)	mg/kg	0.005	0.17	0.486	0.0410	0.0407	0.0402	0.0389	0.0398	0.0389	0.0402	0.0410	0.0401	0.000823
	Molybdenum (Mo)	mg/kg	0.1	-	-	1.23	1.72	1.65	1.53	1.33	1.23	1.53	1.72	1.49	0.208
	Nickel (Ni)	mg/kg	0.5	16	75	44.4	39.3	41.5	38.2	41.3	38.2	41.3	44.4	40.9	2.38
	Phosphorus (P)	mg/kg	50	-	-	1,170	1,160	1,070	1,230	1,050	1,050	1,160	1,230	1,140	74.7
	Potassium (K)	mg/kg	100	-	-	1,300	1,340	970	1,150	1,030	970	1,150	1,340	1,160	162
	Selenium (Se)	mg/kg	0.2	2		6.36	5.03	8.19	6.94	5.09	5.03	6.36	8.19	6.32	1.33
	Silver (Ag)	mg/kg	0.1	0.5	-	0.14	0.16	0.18	0.17	0.15	0.140	0.160	0.180	0.160	0.0158
	Sodium (Na)	mg/kg	50	-	-	83	78	74	75	88	74.0	78.0	88.0	79.6	5.86
	Strontium (Sr)	mg/kg	0.5	-	-	66.0	81.1	76.5	76.8	78.3	66.0	76.8	81.1	75.7	5.74
	Sulfur (S)	mg/kg	1,000	-	-	1,400	1,300	1,500	1,400	1,500	1,300	1,400	1,500	1,420	83.7
	Thallium (Tl)	mg/kg	0.05	-	-	0.147	0.164	0.141	0.162	0.115	0.115	0.147	0.164	0.146	0.0198
	Tin (Sn)	mg/kg	2	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.00	<2.00	<2.00	<2.00	-
	Titanium (Ti)	mg/kg	1	-	-	15.7	10.8	9.0	7.9	12.9	7.90	10.8	15.7	11.3	3.12
	Tungsten (W)	mg/kg	0.5	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.500	<0.500	<0.500	<0.500	-
	Uranium (U)	mg/kg	0.05	-	-	0.845	1.03	0.951	1.05	0.942	0.845	0.951	1.05	0.964	0.0815
	Vanadium (V)	mg/kg	0.2	-	-	24.1	25.9	22.3	24.4	20.9	20.9	24.1	25.9	23.5	1.94
	Zinc (Zn)	mg/kg	2	123	315	137	143	158	149	147	137	147	158	147	7.76
	Zirconium (Zr)	mg/kg	1	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.00	<1.00	<1.00	<1.00	-

Table D.1: Sediment Quality Samples and Summary Statistics for Lotic Reference and Mine-Exposed Areas, FRO LAEMP, 2018

Parameter		Units	Detection Limit	Lower WSQG	Upper WSQG	RG_FOUKI-Rep1	RG_FOUKI-Rep2	RG_FOUKI-Rep3	RG_FOUKI-Rep4	RG_FOUKI-Rep5	Min	Median	Max	Mean	Standard Deviation
						7-Sep-18	7-Sep-18	7-Sep-18	7-Sep-18	7-Sep-18					
PAHs (1 mm fraction)	Acenaphthene	mg/kg	0.005 - 0.2	0.00671	0.0889	<0.15	<0.15	<0.16	<0.20	<0.20	<0.150	<0.160	<0.200	<0.150	-
	Acenaphthylene	mg/kg	0.005 - 0.018	0.00587	0.128	0.022	0.021	0.022	0.030	0.030	0.0210	0.0220	0.0300	0.0250	0.00458
	Acridine	mg/kg	0.01 - 0.035	-	-	<0.030	<0.023	<0.029	<0.035	<0.030	<0.0230	<0.0300	<0.0350	<0.0230	-
	Anthracene	mg/kg	0.004 - 0.024	0.0469	0.245	<0.012	0.0104	<0.024	<0.017	0.013	0.0104	0.0104	<0.0240	0.0113	0.00224
	Benz(a)anthracene	mg/kg	0.01 - 0.12	0.0317	0.385	0.108	0.093	<0.12	0.141	0.137	0.0930	0.108	0.141	0.116	0.0233
	Benzo(a)pyrene	mg/kg	0.01 - 0.035	0.0319	0.782	0.061	0.055	0.063	0.083	0.079	0.0550	0.0630	0.0830	0.0682	0.0121
	Benzo(b&j)fluoranthene	mg/kg	0.01 - 0.035	-	-	0.160	0.145	0.166	0.213	0.215	0.145	0.166	0.215	0.180	0.0322
	Benzo(e)pyrene	mg/kg	0.01 - 0.035	-	-	0.172	0.153	0.178	0.223	0.228	0.153	0.178	0.228	0.191	0.0330
	Benzo(g,h,i)perylene	mg/kg	0.01 - 0.035	0.17	3.2	0.076	0.068	0.086	0.104	0.103	0.0680	0.0860	0.104	0.0874	0.0160
	Benzo(k)fluoranthene	mg/kg	0.01 - 0.035	0.24	13.4	<0.030	<0.023	<0.029	<0.035	<0.030	<0.0230	<0.0300	<0.0350	<0.0230	-
	Chrysene	mg/kg	0.01 - 0.035	0.0571	0.862	0.406	0.359	0.408	0.529	0.557	0.359	0.408	0.557	0.452	0.0861
	Dibenz(a,h)anthracene	mg/kg	0.005 - 0.046	0.00622	0.135	<0.033	<0.032	<0.035	<0.046	<0.045	<0.0320	<0.0350	<0.0460	<0.0320	-
	Fluoranthene	mg/kg	0.01 - 0.035	0.111	2.355	0.075	0.067	0.074	0.094	0.095	0.0670	0.0750	0.0950	0.0810	0.0127
	Fluorene	mg/kg	0.01 - 0.035	0.021	0.144	0.403	0.386	0.424	0.545	0.550	0.386	0.424	0.550	0.462	0.0796
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.01 - 0.035	0.2	3.2	<0.030	<0.023	<0.029	<0.035	<0.030	<0.0230	<0.0300	<0.0350	<0.0230	-
	1-Methylnaphthalene	mg/kg	0.01 - 0.035	-	-	1.69	1.70	1.82	2.37	2.36	1.69	1.82	2.37	1.99	0.348
	2-Methylnaphthalene	mg/kg	0.01 - 0.035	0.0202	0.201	2.93	2.95	3.17	4.13	4.14	2.93	3.17	4.14	3.46	0.620
	Naphthalene	mg/kg	0.01 - 0.035	0.0346	0.391	0.790	0.789	0.868	1.12	1.11	0.789	0.868	1.12	0.935	0.167
	Perylene	mg/kg	0.01 - 0.035	-	-	<0.030	<0.023	<0.029	<0.035	<0.030	<0.0230	<0.0300	<0.0350	<0.0230	-
	Phenanthrene	mg/kg	0.01 - 0.035	0.0419	0.515	1.72	1.58	1.74	2.22	2.24	1.58	1.74	2.24	1.90	0.308
	Pyrene	mg/kg	0.01 - 0.035	0.053	0.875	0.124	0.109	0.127	0.154	0.161	0.109	0.127	0.161	0.135	0.0218
	Quinoline	mg/kg	0.01 - 0.035	-	-	<0.030	<0.023	<0.029	<0.035	<0.030	<0.0230	<0.0300	<0.0350	<0.0230	-
	Acenaphthene d10	%		-	-	65.9	68.7	65.4	73.6	71.4	65.4	68.7	73.6	69.0	3.52
	Chrysene d12	%		-	-	83.6	79.2	79.1	87.4	85.1	79.1	83.6	87.4	82.9	3.66
	Naphthalene d8	%		-	-	59.5	62.8	58.5	67.3	63.3	58.5	62.8	67.3	62.3	3.48
	Phenanthrene d10	%		-	-	78.8	77.6	76.1	84.4	81.8	76.1	78.8	84.4	79.7	3.34
	B(a)P Total Potency Equivalent	mg/kg	0.02 - 0.048	-	-	0.112	0.101	0.111	0.152	0.146	0.101	0.112	0.152	0.124	0.0230
	IACR (CCME)	mg/kg	0.15 - 0.49	-	-	1.87	1.66	1.77	2.47	2.45	1.66	1.87	2.47	2.04	0.387

🟦 Value > lower Working Sediment Quality Guideline (WSQG)

▢ Value < LRL and LRL > lower Working Sediment Quality Guideline (WSQG)

■ Value > upper Working Sediment Quality Guideline (WSQG, or only guideline for Selenium)

□ Value < LRL and LRL > upper Working Sediment Quality Guideline (WSQG, or only guideline in the case of Selenium)

Notes: All observed data are reported to the number of significant digits reported by the laboratory and summary statistics are reported to 3 significant digits for display purposes.

Table D.1: **Sediment Quality Samples and Summary Statistics for Lotic Reference and Mine-Exposed Areas, FRO LAEMP, 2018**

Parameter		Units	Detection Limit	Lower WSQG	Upper WSQG	RG_FOBKS-Rep1	RG_FOBKS-Rep2	RG_FOBKS-Rep3	RG_FOBKS-Rep4	RG_FOBKS-Rep5	Min	Median	Max	Mean	Standard Deviation
						8-Sep-18	8-Sep-18	8-Sep-18	8-Sep-18	8-Sep-18					
Physical Tests	Moisture	%	0.25	-	-	69.0	75.0	52.0	81.8	50.3	50.3	69.0	81.8	65.6	14.0
	pH (1:2 soil:water)	pH units	0.1	-	-	7.93	7.79	8.18	7.81	8.15	7.79	7.93	8.18	7.97	0.184
Particle Size	% Gravel (>2mm)	%	1	-	-	4.7	1.5	4.1	1.8	<1.0	<1.00	1.80	4.70	2.62	1.60
	% Sand (2.0mm - 0.063mm)	%	5	-	-	19.5	12	39	19.2	49.5	12.0	19.5	49.5	27.8	15.7
	% Sand (2.00mm - 1.00mm)	%	1	-	-	<1.0	<1.0	1.5	<1.0	<1.0	<1.00	<1.00	1.50	1.10	-
	% Sand (1.00mm - 0.50mm)	%	1	-	-	<1.0	<1.0	1.7	<1.0	<1.0	<1.00	<1.00	1.70	1.14	-
	% Sand (0.50mm - 0.25mm)	%	1	-	-	1.6	<1.0	7.6	1.8	9.1	<1.00	1.80	9.10	4.22	3.82
	% Sand (0.25mm - 0.125mm)	%	1	-	-	4.9	1.9	14.9	5.7	15.0	1.90	5.70	15.0	8.48	6.07
	% Sand (0.125mm - 0.063mm)	%	1	-	-	11.0	7.1	13.3	9.7	23.4	7.10	11.0	23.4	12.9	6.28
	% Silt (0.063mm - 0.004mm)	%	2	-	-	67.3	77.5	51.7	69.9	46.2	46.2	67.3	77.5	62.5	13.1
	% Silt (0.063mm - 0.0312mm)	%	1	-	-	30.6	35.3	23.8	31.0	23.0	23.0	30.6	35.3	28.7	5.22
	% Silt (0.0312mm - 0.004mm)	%	1	-	-	36.7	42.2	27.9	38.9	23.2	23.2	36.7	42.2	33.8	7.94
	% Clay (<4µm)	%	1	-	-	9.7	10.6	5.3	10.9	4.8	4.80	9.70	10.9	8.26	2.97
	Texture	-	-	-	-	Silt loam	Silt loam	Silt loam	Silt loam	Sandy loam	-	-	-	-	-
Organic Carbon	Total Organic Carbon	%	0.1	-	-	12.6	14.0	8.07	13.5	5.90	5.90	12.6	14.0	10.8	3.61
Metals (1 mm fraction)	Aluminum (Al)	mg/kg	50	-	-	6,620	4,390	6,500	4,350	5,690	4,350	5,690	6,620	5,510	1,100
	Antimony (Sb)	mg/kg	0.1	-	-	0.52	<0.10	0.65	0.48	0.59	<0.100	0.520	0.650	0.468	0.0768
	Arsenic (As)	mg/kg	0.1	5.9	17	4.64	3.57	5.50	3.69	4.90	3.57	4.64	5.50	4.46	0.820
	Barium (Ba)	mg/kg	0.5	-	-	239	207	206	188	177	177	206	239	203	23.6
	Beryllium (Be)	mg/kg	0.1	-	-	0.46	0.44	0.57	0.40	0.49	0.400	0.460	0.570	0.472	0.0638
	Bismuth (Bi)	mg/kg	0.2	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.200	<0.200	<0.200	<0.200	-
	Boron (B)	mg/kg	5	-	-	8.4	5.5	7.4	6.3	<5.0	<5.00	6.30	8.40	6.52	1.31
	Cadmium (Cd)	mg/kg	0.02	0.6	3.5	2.39	2.49	1.58	2.07	1.37	1.37	2.07	2.49	1.98	0.492
	Calcium (Ca)	mg/kg	50	-	-	64,100	120,000	81,800	63,600	59,900	59,900	64,100	120,000	77,900	25,000
	Chromium (Cr)	mg/kg	0.5	37.3	90	20.8	9.29	23.1	10.3	11.6	9.29	11.6	23.1	15.0	6.43
	Cobalt (Co)	mg/kg	0.1	-	-	7.12	6.38	6.61	5.90	5.69	5.69	6.38	7.12	6.34	0.570
	Copper (Cu)	mg/kg	0.5	35.7	197	14.8	11.5	13.0	12.3	11.8	11.5	12.3	14.8	12.7	1.31
	Iron (Fe)	mg/kg	50	21,200	43,766	14,300	11,500	15,400	11,800	13,700	11,500	13,700	15,400	13,300	1,660
	Lead (Pb)	mg/kg	0.5	35	91	7.68	6.97	9.68	6.92	7.65	6.92	7.65	9.68	7.78	1.12
	Lithium (Li)	mg/kg	2	-	-	7.7	7.1	9.5	6.3	8.7	6.30	7.70	9.50	7.86	1.27
	Magnesium (Mg)	mg/kg	20	-	-	13,900	13,900	30,000	12,000	15,500	12,000	13,900	30,000	17,100	7,340
	Manganese (Mn)	mg/kg	1	460	1100	1170	1200	807	984	717	717	984	1,200	976	214
	Mercury (Hg)	mg/kg	0.005	0.17	0.486	0.0565	0.0367	0.0417	0.0452	0.0442	0.0367	0.0442	0.0565	0.0449	0.00729
	Molybdenum (Mo)	mg/kg	0.1	-	-	1.49	1.08	2.29	1.21	1.32	1.08	1.32	2.29	1.48	0.478
	Nickel (Ni)	mg/kg	0.5	16	75	54.8	51.2	47.4	45.7	31.9	31.9	47.4	54.8	46.2	8.73
	Phosphorus (P)	mg/kg	50	-	-	1,350	1,200	1,350	1,120	1,280	1,120	1,280	1,350	1,260	99.7
	Potassium (K)	mg/kg	100	-	-	1,620	930	1,490	1,040	1,210	930	1,210	1,620	1,260	293
	Selenium (Se)	mg/kg	0.2	2		3.89	4.67	2.01	3.26	1.62	1.62	3.26	4.67	3.09	1.27
	Silver (Ag)	mg/kg	0.1	0.5	-	0.19	0.15	0.16	0.17	0.15	0.150	0.160	0.190	0.164	0.0167
	Sodium (Na)	mg/kg	50	-	-	88	88	100	69	91	69.0	88.0	100	87.2	11.3
	Strontium (Sr)	mg/kg	0.5	-	-	67.9	79.8	86.3	62.5	63.2	62.5	67.9	86.3	71.9	10.6
	Sulfur (S)	mg/kg	1,000	-	-	1,200	1,400	1,100	<1,000	<1,000	<1,000	1,100	1,400	1,140	143
	Thallium (Tl)	mg/kg	0.05	-	-	0.177	0.129	0.306	0.149	0.179	0.129	0.177	0.306	0.188	0.0692
	Tin (Sn)	mg/kg	2	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.00	<2.00	<2.00	<2.00	-
	Titanium (Ti)	mg/kg	1	-	-	14.2	4.8	13.2	8.9	8.9	4.80	8.90	14.2	10.0	3.79
	Tungsten (W)	mg/kg	0.5	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.500	<0.500	<0.500	<0.500	-
	Uranium (U)	mg/kg	0.05	-	-	1.01	0.829	1.18	0.936	0.948	0.829	0.948	1.18	0.981	0.129
	Vanadium (V)	mg/kg	0.2	-	-	30.1	19.8	29.3	21.2	26.2	19.8	26.2	30.1	25.3	4.66
	Zinc (Zn)	mg/kg	2	123	315	169	157	130	142	115	115	142	169	143	21.4
	Zirconium (Zr)	mg/kg	1	-	-	<1.0	2.8	<1.0	<1.0	<1.0	<1.00	<1.00	2.80	1.36	-

Table D.1: Sediment Quality Samples and Summary Statistics for Lotic Reference and Mine-Exposed Areas, FRO LAEMP, 2018

Parameter		Units	Detection Limit	Lower WSQG	Upper WSQG	RG_FOBKS-Rep1	RG_FOBKS-Rep2	RG_FOBKS-Rep3	RG_FOBKS-Rep4	RG_FOBKS-Rep5	Min	Median	Max	Mean	Standard Deviation
						8-Sep-18	8-Sep-18	8-Sep-18	8-Sep-18	8-Sep-18					
PAHs (1 mm fraction)	Acenaphthene	mg/kg	0.005 - 0.2	0.00671	0.0889	<0.13	<0.15	<0.064	<0.13	<0.059	<0.0590	<0.130	<0.150	<0.0590	-
	Acenaphthylene	mg/kg	0.005 - 0.018	0.00587	0.128	0.0191	0.022	0.0088	0.020	0.0082	0.00820	0.0191	0.0220	0.0156	0.00659
	Acridine	mg/kg	0.01 - 0.035	-	-	<0.015	<0.019	<0.010	<0.026	<0.020	<0.0100	<0.0190	<0.0260	<0.0100	-
	Anthracene	mg/kg	0.004 - 0.024	0.0469	0.245	<0.011	0.0096	<0.0060	<0.010	<0.0060	<0.00600	<0.00600	<0.0110	0.00720	-
	Benz(a)anthracene	mg/kg	0.01 - 0.12	0.0317	0.385	0.094	0.100	0.044	0.102	<0.040	<0.0400	0.0940	0.102	0.0760	0.0311
	Benzo(a)pyrene	mg/kg	0.01 - 0.035	0.0319	0.782	0.051	0.052	0.020	0.053	0.018	0.0180	0.0510	0.0530	0.0388	0.0181
	Benzo(b&j)fluoranthene	mg/kg	0.01 - 0.035	-	-	0.149	0.151	0.076	0.147	0.065	0.0650	0.147	0.151	0.118	0.0432
	Benzo(e)pyrene	mg/kg	0.01 - 0.035	-	-	0.157	0.161	0.080	0.160	0.068	0.0680	0.157	0.161	0.125	0.0470
	Benzo(g,h,i)perylene	mg/kg	0.01 - 0.035	0.17	3.2	0.070	0.080	0.037	0.076	0.030	0.0300	0.0700	0.0800	0.0586	0.0233
	Benzo(k)fluoranthene	mg/kg	0.01 - 0.035	0.24	13.4	<0.015	<0.019	<0.010	<0.026	<0.010	<0.0100	<0.0150	<0.0260	<0.0100	-
	Chrysene	mg/kg	0.01 - 0.035	0.0571	0.862	0.372	0.401	0.198	0.369	0.175	0.175	0.369	0.401	0.303	0.107
	Dibenz(a,h)anthracene	mg/kg	0.005 - 0.046	0.00622	0.135	<0.032	<0.037	<0.019	<0.038	<0.014	<0.0140	<0.0320	<0.0380	<0.0140	-
	Fluoranthene	mg/kg	0.01 - 0.035	0.111	2.355	0.067	0.069	0.032	0.071	0.028	0.0280	0.0670	0.0710	0.0534	0.0215
	Fluorene	mg/kg	0.01 - 0.035	0.021	0.144	0.347	0.410	0.155	0.360	0.125	0.125	0.347	0.410	0.279	0.130
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.01 - 0.035	0.2	3.2	0.019	0.019	<0.010	<0.026	<0.010	<0.0100	0.0145	<0.0260	0.0145	-
	1-Methylnaphthalene	mg/kg	0.01 - 0.035	-	-	1.46	1.75	0.727	1.49	0.730	0.727	1.46	1.75	1.23	0.473
	2-Methylnaphthalene	mg/kg	0.01 - 0.035	0.0202	0.201	2.52	3.05	1.20	2.58	1.21	1.20	2.52	3.05	2.11	0.853
	Naphthalene	mg/kg	0.01 - 0.035	0.0346	0.391	0.648	0.822	0.325	0.707	0.374	0.325	0.648	0.822	0.575	0.216
	Perylene	mg/kg	0.01 - 0.035	-	-	<0.015	<0.019	<0.010	<0.026	<0.010	<0.0100	<0.0150	<0.0260	<0.0100	-
	Phenanthrene	mg/kg	0.01 - 0.035	0.0419	0.515	1.50	1.66	0.784	1.57	0.669	0.669	1.50	1.66	1.24	0.471
	Pyrene	mg/kg	0.01 - 0.035	0.053	0.875	0.110	0.119	0.056	0.115	0.047	0.0470	0.110	0.119	0.0894	0.0349
	Quinoline	mg/kg	0.01 - 0.035	-	-	<0.015	<0.019	<0.010	<0.026	<0.010	<0.0100	<0.0150	<0.0260	<0.0100	-
	Acenaphthene d10	%		-	-	67.0	66.9	66.2	61.8	83.9	61.8	66.9	83.9	69.2	8.51
	Chrysene d12	%		-	-	78.1	72.6	74.6	74.0	86.9	72.6	74.6	86.9	77.2	5.77
	Naphthalene d8	%		-	-	52.9	57.2	57.0	54.3	77.6	52.9	57.0	77.6	59.8	10.1
	Phenanthrene d10	%		-	-	75.9	73.8	75.4	74.0	83.1	73.8	75.4	83.1	76.4	3.83
	B(a)P Total Potency Equivalent	mg/kg	0.02 - 0.048	-	-	0.098	0.103	0.044	0.104	0.037	0.0370	0.0980	0.104	0.0772	0.0337
	IACR (CCME)	mg/kg	0.15 - 0.49	-	-	1.66	1.74	0.83	1.72	0.67	0.670	1.66	1.74	1.32	0.528

🟦	Value > lower Working Sediment Quality Guideline (WSQG)
▧	Value < LRL and LRL > lower Working Sediment Quality Guideline (WSQG)
⬛	Value > upper Working Sediment Quality Guideline (WSQG, or only guideline for Selenium)
⬜	Value < LRL and LRL > upper Working Sediment Quality Guideline (WSQG, or only guideline in the case of Selenium)

Notes: All observed data are reported to the number of significant digits reported by the laboratory and summary statistics are reported to 3 significant digits for display purposes.

Table D.1: **Sediment Quality Samples and Summary Statistics for Lotic Reference and Mine-Exposed Areas, FRO LAEMP, 2018**

Parameter		Units	Detection Limit	Lower WSQG	Upper WSQG	RG_FOBCP-Rep1	RG_FOBCP-Rep2	RG_FOBCP-Rep3	RG_FOBCP-Rep4	RG_FOBCP-Rep5	Min	Median	Max	Mean	Standard Deviation
						9-Sep-18	9-Sep-18	9-Sep-18	9-Sep-18	9-Sep-18					
Physical Tests	Moisture	%	0.25	-	-	73.2	51.4	42.8	50.2	42.9	42.8	50.2	73.2	52.1	12.5
	pH (1:2 soil:water)	pH units	0.1	-	-	8.13	8.22	8.24	8.24	8.26	8.13	8.24	8.26	8.22	0.0512
Particle Size	% Gravel (>2mm)	%	1	-	-	10.6	5.6	<1.0	1.9	<1.0	<1.00	1.90	10.6	4.02	4.19
	% Sand (2.0mm - 0.063mm)	%	5	-	-	42.5	47.6	61.1	54.3	77	42.5	54.3	77.0	56.5	13.4
	% Sand (2.00mm - 1.00mm)	%	1	-	-	21.9	2.0	<1.0	1.5	4.0	<1.00	2.00	21.9	6.08	9.14
	% Sand (1.00mm - 0.50mm)	%	1	-	-	7.0	2.3	3.8	4.3	3.4	2.30	3.80	7.00	4.16	1.75
	% Sand (0.50mm - 0.25mm)	%	1	-	-	3.0	8.5	14.6	12.6	16.6	3.00	12.6	16.6	11.1	5.41
	% Sand (0.25mm - 0.125mm)	%	1	-	-	4.5	18.5	24.2	19.7	32.3	4.50	19.7	32.3	19.8	10.1
	% Sand (0.125mm - 0.063mm)	%	1	-	-	6.1	16.3	17.5	16.2	20.7	6.10	16.3	20.7	15.4	5.49
	% Silt (0.063mm - 0.004mm)	%	2	-	-	43.2	42.7	35	40.1	21.2	21.2	40.1	43.2	36.4	9.12
	% Silt (0.063mm - 0.0312mm)	%	1	-	-	20.0	19.6	16.3	18.8	11.7	11.7	18.8	20.0	17.3	3.43
	% Silt (0.0312mm - 0.004mm)	%	1	-	-	23.2	23.1	18.7	21.3	9.5	9.50	21.3	23.2	19.2	5.70
	% Clay (<4μm)	%	1	-	-	3.7	4.2	4.0	3.7	1.6	1.60	3.70	4.20	3.44	1.05
	Texture	-	-	-	-	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Loamy sand	-	-	-	-	-
Organic Carbon	Total Organic Carbon	%	0.1	-	-	6.80	6.71	5.60	5.6	3.82	3.82	5.60	6.80	5.71	1.20
Metals (1 mm fraction)	Aluminum (Al)	mg/kg	50	-	-	3,460	5,830	6,040	5,620	5,320	3,460	5,620	6,040	5,250	1,040
	Antimony (Sb)	mg/kg	0.1	-	-	0.49	0.47	0.62	0.53	0.65	0.470	0.530	0.650	0.552	0.0795
	Arsenic (As)	mg/kg	0.1	5.9	17	4.40	4.41	5.05	4.29	5.44	4.29	4.41	5.44	4.72	0.503
	Barium (Ba)	mg/kg	0.5	-	-	173	199	231	228	144	144	199	231	195	37.0
	Beryllium (Be)	mg/kg	0.1	-	-	0.39	0.40	0.48	0.48	0.51	0.390	0.480	0.510	0.452	0.0536
	Bismuth (Bi)	mg/kg	0.2	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.200	<0.200	<0.200	<0.200	-
	Boron (B)	mg/kg	5	-	-	5.7	5.5	6.5	6.9	<5.0	<5.00	5.70	6.90	5.92	0.663
	Cadmium (Cd)	mg/kg	0.02	0.6	3.5	2.10	1.53	1.29	1.87	1.16	1.16	1.53	2.10	1.59	0.393
	Calcium (Ca)	mg/kg	50	-	-	92,800	55,600	77,100	114,000	54,900	54,900	77,100	114,000	78,900	25,200
	Chromium (Cr)	mg/kg	0.5	37.3	90	19.2	13.8	24.0	12.9	11.4	11.4	13.8	24.0	16.3	5.23
	Cobalt (Co)	mg/kg	0.1	-	-	4.55	5.41	5.47	5.40	5.42	4.55	5.41	5.47	5.25	0.392
	Copper (Cu)	mg/kg	0.5	35.7	197	10.4	11.7	12.0	10.4	10.9	10.4	10.9	12.0	11.1	0.740
	Iron (Fe)	mg/kg	50	21,200	43,766	17,600	12,700	13,700	12,100	14,500	12,100	13,700	17,600	14,100	2,150
	Lead (Pb)	mg/kg	0.5	35	91	6.32	6.32	8.98	6.55	7.42	6.32	6.55	8.98	7.12	1.14
	Lithium (Li)	mg/kg	2	-	-	4.9	6.3	7.6	7.3	6.8	4.90	6.80	7.60	6.58	1.06
	Magnesium (Mg)	mg/kg	20	-	-	9,670	11,900	16,100	11,700	14,100	9,670	11,900	16,100	12,700	2,470
	Manganese (Mn)	mg/kg	1	460	1100	662	487	493	728	453	453	493	728	565	122
	Mercury (Hg)	mg/kg	0.005	0.17	0.486	0.0560	0.0357	0.0298	0.0291	0.0279	0.0279	0.0298	0.0560	0.0357	0.0117
	Molybdenum (Mo)	mg/kg	0.1	-	-	1.48	1.15	1.66	1.28	1.76	1.15	1.48	1.76	1.47	0.254
	Nickel (Ni)	mg/kg	0.5	16	75	47.0	49.1	45.0	53.4	33.7	33.7	47.0	53.4	45.6	7.37
	Phosphorus (P)	mg/kg	50	-	-	1,230	1,220	1,250	1,170	1,550	1,170	1,230	1,550	1,280	152
	Potassium (K)	mg/kg	100	-	-	760	1,360	1,380	1,340	1,160	760	1,340	1,380	1,200	261
	Selenium (Se)	mg/kg	0.2	2		2.10	2.51	1.80	5.17	1.42	1.42	2.10	5.17	2.60	1.49
	Silver (Ag)	mg/kg	0.1	0.5	-	0.13	0.12	0.13	0.12	0.12	0.120	0.120	0.130	0.124	0.00548
	Sodium (Na)	mg/kg	50	-	-	62	74	129	75	77	62.0	75.0	129	83.4	26.2
	Strontium (Sr)	mg/kg	0.5	-	-	73.2	55.9	68.9	77.1	60.0	55.9	68.9	77.1	67.0	8.89
	Sulfur (S)	mg/kg	1,000	-	-	1,200	<1,000	<1,000	1,300	<1,000	<1,000	<1,000	1,300	1,100	56.6
	Thallium (Tl)	mg/kg	0.05	-	-	0.136	0.174	0.226	0.251	0.204	0.136	0.204	0.251	0.198	0.0449
	Tin (Sn)	mg/kg	2	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.00	<2.00	<2.00	<2.00	-
	Titanium (Ti)	mg/kg	1	-	-	8.0	15.2	19.6	16.0	10.0	8.00	15.2	19.6	13.8	4.70
	Tungsten (W)	mg/kg	0.5	-	-	<0.50	<0.50	0.55	<0.50	<0.50	<0.500	<0.500	0.550	0.510	-
	Uranium (U)	mg/kg	0.05	-	-	1.02	0.846	0.965	1.09	1.09	0.846	1.02	1.09	1.00	0.102
	Vanadium (V)	mg/kg	0.2	-	-	24.4	25.1	26.7	26.2	30.3	24.4	26.2	30.3	26.5	2.29
	Zinc (Zn)	mg/kg	2	123	315	123	120	114	126	112	112	120	126	119	5.92
	Zirconium (Zr)	mg/kg	1	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.00	<1.00	<1.00	<1.00	-

Table D.1: Sediment Quality Samples and Summary Statistics for Lotic Reference and Mine-Exposed Areas, FRO LAEMP, 2018

Parameter		Units	Detection Limit	Lower WSQG	Upper WSQG	RG_FOBCP-Rep1	RG_FOBCP-Rep2	RG_FOBCP-Rep3	RG_FOBCP-Rep4	RG_FOBCP-Rep5	Min	Median	Max	Mean	Standard Deviation
						9-Sep-18	9-Sep-18	9-Sep-18	9-Sep-18	9-Sep-18					
PAHs (1 mm fraction)	Acenaphthene	mg/kg	0.005 - 0.2	0.00671	0.0889	<0.061	<0.045	<0.025	<0.042	<0.013	<0.0130	<0.0420	<0.0610	<0.0130	-
	Acenaphthylene	mg/kg	0.005 - 0.018	0.00587	0.128	<0.0085	0.0053	<0.0050	<0.0050	<0.0050	<0.00500	<0.00500	<0.00850	0.00507	-
	Acridine	mg/kg	0.01 - 0.035	-	-	<0.017	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0170	<0.0100	-
	Anthracene	mg/kg	0.004 - 0.024	0.0469	0.245	<0.0068	<0.0040	<0.0040	<0.0040	<0.0040	<0.00400	<0.00400	<0.00680	<0.00400	-
	Benz(a)anthracene	mg/kg	0.01 - 0.12	0.0317	0.385	<0.050	<0.030	<0.020	<0.030	<0.010	<0.0100	<0.0300	<0.0500	<0.0100	-
	Benzo(a)pyrene	mg/kg	0.01 - 0.035	0.0319	0.782	<0.017	0.014	0.010	0.016	<0.010	<0.0100	0.0120	<0.0170	0.0125	0.00356
	Benzo(b&j)fluoranthene	mg/kg	0.01 - 0.035	-	-	0.048	0.054	0.035	0.051	0.017	0.0170	0.0480	0.0540	0.0410	0.0152
	Benzo(e)pyrene	mg/kg	0.01 - 0.035	-	-	0.051	0.057	0.035	0.055	0.018	0.0180	0.0510	0.0570	0.0432	0.0165
	Benzo(g,h,i)perylene	mg/kg	0.01 - 0.035	0.17	3.2	0.019	0.024	0.015	0.021	<0.010	<0.0100	0.0190	0.0240	0.0178	0.00403
	Benzo(k)fluoranthene	mg/kg	0.01 - 0.035	0.24	13.4	<0.017	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0170	<0.0100	-
	Chrysene	mg/kg	0.01 - 0.035	0.0571	0.862	0.108	0.131	0.074	0.122	0.039	0.0390	0.108	0.131	0.0948	0.0380
	Dibenz(a,h)anthracene	mg/kg	0.005 - 0.046	0.00622	0.135	<0.015	<0.013	<0.0080	<0.013	<0.0050	<0.00500	<0.0130	<0.0150	<0.00500	-
	Fluoranthene	mg/kg	0.01 - 0.035	0.111	2.355	0.022	0.022	0.014	0.020	<0.010	<0.0100	0.0200	0.0220	0.0176	0.00423
	Fluorene	mg/kg	0.01 - 0.035	0.021	0.144	0.097	0.095	0.049	0.091	0.025	0.0250	0.0910	0.0970	0.0714	0.0326
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.01 - 0.035	0.2	3.2	<0.017	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0170	<0.0100	-
	1-Methylnaphthalene	mg/kg	0.01 - 0.035	-	-	0.562	0.514	0.269	0.497	0.165	0.165	0.497	0.562	0.401	0.174
	2-Methylnaphthalene	mg/kg	0.01 - 0.035	0.0202	0.201	0.942	0.849	0.435	0.831	0.269	0.269	0.831	0.942	0.665	0.295
	Naphthalene	mg/kg	0.01 - 0.035	0.0346	0.391	0.273	0.230	0.110	0.227	0.075	0.0750	0.227	0.273	0.183	0.0855
	Perylene	mg/kg	0.01 - 0.035	-	-	<0.017	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0170	<0.0100	-
	Phenanthrene	mg/kg	0.01 - 0.035	0.0419	0.515	0.428	0.463	0.255	0.425	0.138	0.138	0.425	0.463	0.342	0.140
	Pyrene	mg/kg	0.01 - 0.035	0.053	0.875	0.033	0.035	0.022	0.034	0.011	0.0110	0.0330	0.0350	0.0270	0.0104
	Quinoline	mg/kg	0.01 - 0.035	-	-	<0.017	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0170	<0.0100	-
	Acenaphthene d10	%		-	-	81.6	67.5	70.5	75.3	81.8	67.5	75.3	81.8	75.3	6.44
	Chrysene d12	%		-	-	92.3	82.2	92.3	92.7	97.7	82.2	92.3	97.7	91.4	5.65
	Naphthalene d8	%		-	-	79.4	63.1	64.7	67.1	74.2	63.1	67.1	79.4	69.7	6.89
	Phenanthrene d10	%		-	-	83.1	75.1	85.1	84.2	85.6	75.1	84.2	85.6	82.6	4.31
	B(a)P Total Potency Equivalent	mg/kg	0.02 - 0.048	-	-	0.026	0.030	0.020	0.031	<0.020	<0.0200	0.0260	0.0310	0.0254	0.00545
	IACR (CCME)	mg/kg	0.15 - 0.49	-	-	0.54	0.55	0.36	0.53	0.20	0.200	0.530	0.550	0.436	0.153

▨ Value > lower Working Sediment Quality Guideline (WSQG)

▧ Value < LRL and LRL > lower Working Sediment Quality Guideline (WSQG)

■ Value > upper Working Sediment Quality Guideline (WSQG, or only guideline for Selenium)

□ Value < LRL and LRL > upper Working Sediment Quality Guideline (WSQG, or only guideline in the case of Selenium)

Notes: All observed data are reported to the number of significant digits reported by the laboratory and summary statistics are reported to 3 significant digits for display purposes.

Table D.1: Sediment Quality Samples and Summary Statistics for Lotic Reference and Mine-Exposed Areas, FRO LAEMP, 2018

Parameter		Units	Detection Limit	Lower WSQG	Upper WSQG	RG_FRUPO-Rep1	RG_FRUPO-Rep2	RG_FRUPO-Rep3	RG_FRUPO-Rep4	RG_FRUPO-Rep5	Min	Median	Max	Mean	Standard Deviation
						9-Sep-18	9-Sep-18	9-Sep-18	9-Sep-18	9-Sep-18					
Physical Tests	Moisture	%	0.25	-	-	53.0	48.7	58.8	46.9	48.0	46.9	48.7	58.8	51.1	4.90
	pH (1:2 soil:water)	pH units	0.1	-	-	8.02	8.15	8.17	8.21	8.16	8.02	8.16	8.21	8.14	0.0719
Particle Size	% Gravel (>2mm)	%	1	-	-	<1.0	<1.0	9.2	<1.0	6.6	<1.00	<1.00	9.20	3.76	1.47
	% Sand (2.0mm - 0.063mm)	%	5	-	-	39.4	67.3	56.4	64.3	63.8	39.4	63.8	67.3	58.2	11.3
	% Sand (2.00mm - 1.00mm)	%	1	-	-	<1.0	2.0	9.0	<1.0	<1.0	<1.00	<1.00	9.00	2.80	3.96
	% Sand (1.00mm - 0.50mm)	%	1	-	-	<1.0	2.5	5.1	2.2	2.5	<1.00	2.50	5.10	2.66	1.28
	% Sand (0.50mm - 0.25mm)	%	1	-	-	<1.0	13.5	15.9	13.7	12.8	<1.00	13.5	15.9	11.4	1.32
	% Sand (0.25mm - 0.125mm)	%	1	-	-	8.3	28.7	12.4	23.7	26.8	8.30	23.7	28.7	20.0	9.09
	% Sand (0.125mm - 0.063mm)	%	1	-	-	28.1	20.6	14.0	23.7	20.7	14.0	20.7	28.1	21.4	5.15
	% Silt (0.063mm - 0.004mm)	%	2	-	-	59.4	28.8	31.5	32.1	27.9	27.9	31.5	59.4	35.9	13.2
	% Silt (0.063mm - 0.0312mm)	%	1	-	-	30.2	14.9	15.2	16.5	14.7	14.7	15.2	30.2	18.3	6.69
	% Silt (0.0312mm - 0.004mm)	%	1	-	-	29.2	13.9	16.3	15.6	13.2	13.2	15.6	29.2	17.6	6.58
	% Clay (<4µm)	%	1	-	-	3.8	3.0	3.0	3.1	2.3	2.30	3.00	3.80	3.04	0.532
	Texture	-	-	-	-	Silt loam	Sandy loam	Sandy loam	Sandy loam	Loamy sand	-	-	-	-	-
Organic Carbon	Total Organic Carbon	%	0.1	-	-	7.88	3.73	4.70	4.44	3.67	3.67	4.44	7.88	4.88	1.73
Metals (1 mm fraction)	Aluminum (Al)	mg/kg	50	-	-	5,000	6,600	6,710	7,270	7,110	5,000	6,710	7,270	6,540	903
	Antimony (Sb)	mg/kg	0.1	-	-	0.61	0.63	0.69	0.62	0.60	0.600	0.620	0.690	0.630	0.0354
	Arsenic (As)	mg/kg	0.1	5.9	17	5.15	5.07	5.52	5.10	4.95	4.95	5.10	5.52	5.16	0.215
	Barium (Ba)	mg/kg	0.5	-	-	169	188	185	197	189	169	188	197	186	10.3
	Beryllium (Be)	mg/kg	0.1	-	-	0.49	0.56	0.58	0.55	0.54	0.490	0.550	0.580	0.544	0.0336
	Bismuth (Bi)	mg/kg	0.2	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.200	<0.200	<0.200	<0.200	-
	Boron (B)	mg/kg	5	-	-	<5.0	7.3	8.1	8.9	7.5	<5.00	7.50	8.90	7.36	0.710
	Cadmium (Cd)	mg/kg	0.02	0.6	3.5	1.40	1.18	1.32	1.28	1.15	1.15	1.28	1.40	1.27	0.102
	Calcium (Ca)	mg/kg	50	-	-	50,400	50,100	49,900	57,200	44,700	44,700	50,100	57,200	50,500	4,450
	Chromium (Cr)	mg/kg	0.5	37.3	90	11.3	13.1	16.6	14.9	13.4	11.3	13.4	16.6	13.9	2.00
	Cobalt (Co)	mg/kg	0.1	-	-	5.76	5.25	5.33	5.39	5.25	5.25	5.33	5.76	5.40	0.212
	Copper (Cu)	mg/kg	0.5	35.7	197	13.8	11.0	12.1	11.2	10.9	10.9	11.2	13.8	11.8	1.21
	Iron (Fe)	mg/kg	50	21,200	43,766	14,200	14,900	16,600	14,700	14,500	14,200	14,700	16,600	15,000	942
	Lead (Pb)	mg/kg	0.5	35	91	8.11	7.82	8.28	7.95	7.67	7.67	7.95	8.28	7.97	0.239
	Lithium (Li)	mg/kg	2	-	-	7.2	8.0	7.3	7.9	7.6	7.20	7.60	8.00	7.60	0.354
	Magnesium (Mg)	mg/kg	20	-	-	14,700	13,000	11,100	14,100	12,000	11,100	13,000	14,700	13,000	1,480
	Manganese (Mn)	mg/kg	1	460	1100	530	462	454	480	458	454	462	530	477	31.4
	Mercury (Hg)	mg/kg	0.005	0.17	0.486	0.0454	0.0293	0.0303	0.0351	0.0314	0.0293	0.0314	0.0454	0.0343	0.00658
	Molybdenum (Mo)	mg/kg	0.1	-	-	1.36	1.40	2.14	1.41	1.40	1.36	1.40	2.14	1.54	0.335
	Nickel (Ni)	mg/kg	0.5	16	75	32.4	30.1	34.5	34.1	31.4	30.1	32.4	34.5	32.5	1.84
	Phosphorus (P)	mg/kg	50	-	-	1,450	1,640	1,610	1,690	1,560	1,450	1,610	1,690	1,590	91.4
	Potassium (K)	mg/kg	100	-	-	950	1,560	1,710	1,820	1,720	950	1,710	1,820	1,550	349
	Selenium (Se)	mg/kg	0.2	2		2.53	1.62	2.23	1.57	1.57	1.57	1.62	2.53	1.90	0.448
	Silver (Ag)	mg/kg	0.1	0.5	-	0.19	0.13	0.15	0.14	0.12	0.120	0.140	0.190	0.146	0.0270
	Sodium (Na)	mg/kg	50	-	-	75	78	79	86	77	75.0	78.0	86.0	79.0	4.18
	Strontium (Sr)	mg/kg	0.5	-	-	52.3	67.2	70.0	70.0	62.3	52.3	67.2	70.0	64.4	7.44
	Sulfur (S)	mg/kg	1,000	-	-	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	-
	Thallium (Tl)	mg/kg	0.05	-	-	0.171	0.199	0.208	0.220	0.208	0.171	0.208	0.220	0.201	0.0185
	Tin (Sn)	mg/kg	2	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.00	<2.00	<2.00	<2.00	-
	Titanium (Ti)	mg/kg	1	-	-	15.8	11.2	15.1	14.5	12.7	11.2	14.5	15.8	13.9	1.88
	Tungsten (W)	mg/kg	0.5	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.500	<0.500	<0.500	<0.500	-
	Uranium (U)	mg/kg	0.05	-	-	1.02	1.12	1.21	1.20	1.08	1.02	1.12	1.21	1.13	0.0805
	Vanadium (V)	mg/kg	0.2	-	-	24.0	29.1	33.2	32.4	30.7	24.0	30.7	33.2	29.9	3.65
	Zinc (Zn)	mg/kg	2	123	315	110	108	121	109	106	106	109	121	111	5.89
	Zirconium (Zr)	mg/kg	1	-	-	1.3	<1.0	<1.0	<1.0	<1.0	<1.00	<1.00	1.30	1.06	-

Table D.1: Sediment Quality Samples and Summary Statistics for Lotic Reference and Mine-Exposed Areas, FRO LAEMP, 2018

Parameter		Units	Detection Limit	Lower WSQG	Upper WSQG	RG_FRUPO-Rep1	RG_FRUPO-Rep2	RG_FRUPO-Rep3	RG_FRUPO-Rep4	RG_FRUPO-Rep5	Min	Median	Max	Mean	Standard Deviation
						9-Sep-18	9-Sep-18	9-Sep-18	9-Sep-18	9-Sep-18					
PAHs (1 mm fraction)	Acenaphthene	mg/kg	0.005 - 0.2	0.00671	0.0889	<0.019	<0.0070	<0.021	<0.0070	<0.013	<0.00700	<0.0130	<0.0210	<0.00700	-
	Acenaphthylene	mg/kg	0.005 - 0.018	0.00587	0.128	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.00500	<0.00500	<0.00500	<0.00500	-
	Acridine	mg/kg	0.01 - 0.035	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-
	Anthracene	mg/kg	0.004 - 0.024	0.0469	0.245	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.00400	<0.00400	<0.00400	<0.00400	-
	Benz(a)anthracene	mg/kg	0.01 - 0.12	0.0317	0.385	<0.020	<0.010	0.014	<0.010	<0.010	<0.0100	<0.0100	<0.0200	0.0110	-
	Benzo(a)pyrene	mg/kg	0.01 - 0.035	0.0319	0.782	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-
	Benzo(b&j)fluoranthene	mg/kg	0.01 - 0.035	-	-	0.027	0.014	0.028	<0.010	0.019	<0.0100	0.0190	0.0280	0.0196	0.00703
	Benzo(e)pyrene	mg/kg	0.01 - 0.035	-	-	0.027	0.013	0.028	0.012	0.019	0.0120	0.0190	0.0280	0.0198	0.00753
	Benzo(g,h,i)perylene	mg/kg	0.01 - 0.035	0.17	3.2	0.011	<0.010	0.012	<0.010	<0.010	<0.0100	<0.0100	0.0120	0.0106	0.000566
	Benzo(k)fluoranthene	mg/kg	0.01 - 0.035	0.24	13.4	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-
	Chrysene	mg/kg	0.01 - 0.035	0.0571	0.862	0.061	0.029	0.067	0.028	0.043	0.0280	0.0430	0.0670	0.0456	0.0179
	Dibenz(a,h)anthracene	mg/kg	0.005 - 0.046	0.00622	0.135	<0.0060	<0.0050	<0.0060	<0.0050	<0.0050	<0.00500	<0.00500	<0.00600	<0.00500	-
	Fluoranthene	mg/kg	0.01 - 0.035	0.111	2.355	<0.010	<0.010	0.011	<0.010	<0.010	<0.0100	<0.0100	0.0110	0.0102	-
	Fluorene	mg/kg	0.01 - 0.035	0.021	0.144	0.032	0.013	0.039	0.017	0.025	0.0130	0.0250	0.0390	0.0252	0.0106
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.01 - 0.035	0.2	3.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-
	1-Methylnaphthalene	mg/kg	0.01 - 0.035	-	-	0.225	0.094	0.248	0.095	0.177	0.0940	0.177	0.248	0.168	0.0716
	2-Methylnaphthalene	mg/kg	0.01 - 0.035	0.0202	0.201	0.366	0.154	0.398	0.150	0.286	0.150	0.286	0.398	0.271	0.116
	Naphthalene	mg/kg	0.01 - 0.035	0.0346	0.391	0.104	0.048	0.114	0.049	0.082	0.0480	0.0820	0.114	0.0794	0.0305
	Perylene	mg/kg	0.01 - 0.035	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-
	Phenanthrene	mg/kg	0.01 - 0.035	0.0419	0.515	0.206	0.082	0.226	0.084	0.145	0.0820	0.145	0.226	0.149	0.0669
	Pyrene	mg/kg	0.01 - 0.035	0.053	0.875	0.016	<0.010	0.017	<0.010	0.011	<0.0100	0.0110	0.0170	0.0128	0.00332
	Quinoline	mg/kg	0.01 - 0.035	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-
	Acenaphthene d10	%		-	-	78.6	74.9	73.1	74.7	74.0	73.1	74.7	78.6	75.1	2.10
	Chrysene d12	%		-	-	96.2	91.1	87.1	87.8	89.4	87.1	89.4	96.2	90.3	3.63
	Naphthalene d8	%		-	-	74.3	73.3	66.5	71.6	69.1	66.5	71.6	74.3	71.0	3.18
	Phenanthrene d10	%		-	-	85.3	78.8	78.8	79.1	77.1	77.1	78.8	85.3	79.8	3.16
	B(a)P Total Potency Equivalent	mg/kg	0.02 - 0.048	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.0200	<0.0200	<0.0200	<0.0200	-
	IACR (CCME)	mg/kg	0.15 - 0.49	-	-	0.29	0.17	0.31	<0.15	0.21	<0.150	0.210	0.310	0.226	0.0685

🟦 Value > lower Working Sediment Quality Guideline (WSQG)

🟦 Value < LRL and LRL > lower Working Sediment Quality Guideline (WSQG)

⬛ Value > upper Working Sediment Quality Guideline (WSQG, or only guideline for Selenium)

⬜ Value < LRL and LRL > upper Working Sediment Quality Guideline (WSQG, or only guideline in the case of Selenium)

Notes: All observed data are reported to the number of significant digits reported by the laboratory and summary statistics are reported to 3 significant digits for display purposes.

Table D.1: **Sediment Quality Samples and Summary Statistics for Lotic Reference and Mine-Exposed Areas, FRO LAEMP, 2018**

Parameter		Units	Detection Limit	Lower WSQG	Upper WSQG	RG_FO22-Rep1	RG_FO22-Rep2	RG_FO22-Rep3	RG_FO22-Rep4	RG_FO22-Rep5	Min	Median	Max	Mean	Standard Deviation
						8-Sep-18	8-Sep-18	8-Sep-18	8-Sep-18	8-Sep-18					
Physical Tests	Moisture	%	0.25	-	-	42.1	37.1	48.5	51.0	47.1	37.1	47.1	51.0	45.2	5.55
	pH (1:2 soil:water)	pH units	0.1	-	-	8.21	8.30	8.11	8.04	8.07	8.04	8.11	8.30	8.15	0.107
Particle Size	% Gravel (>2mm)	%	1	-	-	2.1	20.0	<1.0	<1.0	<1.0	<1.00	<1.00	20.0	5.02	10.1
	% Sand (2.0mm - 0.063mm)	%	5	-	-	80	65.1	76.9	67.6	63.9	63.9	67.6	80.0	70.7	7.28
	% Sand (2.00mm - 1.00mm)	%	1	-	-	<1.0	3.9	<1.0	<1.0	<1.0	<1.00	<1.00	3.90	1.58	-
	% Sand (1.00mm - 0.50mm)	%	1	-	-	2.3	7.9	1.7	1.6	2.2	1.60	2.20	7.90	3.14	2.68
	% Sand (0.50mm - 0.25mm)	%	1	-	-	28.8	14.3	15.3	15.1	8.5	8.50	15.1	28.8	16.4	7.47
	% Sand (0.25mm - 0.125mm)	%	1	-	-	33.9	28.1	39.3	30.1	29.9	28.1	30.1	39.3	32.3	4.47
	% Sand (0.125mm - 0.063mm)	%	1	-	-	14.0	10.9	19.6	19.8	22.3	10.9	19.6	22.3	17.3	4.70
	% Silt (0.063mm - 0.004mm)	%	2	-	-	16.2	13.1	21.8	30.7	33.9	13.1	21.8	33.9	23.1	9.00
	% Silt (0.063mm - 0.0312mm)	%	1	-	-	8.2	6.9	12.0	15.8	17.7	6.90	12.0	17.7	12.1	4.67
	% Silt (0.0312mm - 0.004mm)	%	1	-	-	8.0	6.2	9.8	14.9	16.2	6.20	9.80	16.2	11.0	4.35
	% Clay (<4µm)	%	1	-	-	2.5	1.7	2.2	2.7	2.8	1.70	2.50	2.80	2.38	0.444
	Texture	-	-	-	-	Loamy sand	Loamy sand	Loamy sand	Sandy loam	Sandy loam	-	-	-	-	-
Organic Carbon	Total Organic Carbon	%	0.1	-	-	3.35	3.12	5.55	6.15	4.75	3.12	4.75	6.15	4.58	1.33
Metals (1 mm fraction)	Aluminum (Al)	mg/kg	50	-	-	7,410	6,870	7,650	7,880	6,620	6,620	7,410	7,880	7,290	529
	Antimony (Sb)	mg/kg	0.1	-	-	0.61	0.55	0.63	0.65	0.60	0.550	0.610	0.650	0.608	0.0377
	Arsenic (As)	mg/kg	0.1	5.9	17	5.53	5.05	5.64	5.89	5.38	5.05	5.53	5.89	5.50	0.312
	Barium (Ba)	mg/kg	0.5	-	-	199	179	196	204	178	178	196	204	191	11.9
	Beryllium (Be)	mg/kg	0.1	-	-	0.64	0.50	0.62	0.64	0.58	0.500	0.620	0.640	0.596	0.0590
	Bismuth (Bi)	mg/kg	0.2	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.200	<0.200	<0.200	<0.200	-
	Boron (B)	mg/kg	5	-	-	7.4	6.9	7.8	8.4	6.6	6.60	7.40	8.40	7.42	0.716
	Cadmium (Cd)	mg/kg	0.02	0.6	3.5	1.07	0.828	1.09	1.30	1.10	0.828	1.09	1.30	1.08	0.168
	Calcium (Ca)	mg/kg	50	-	-	39,000	41,300	36,500	41,200	40,200	36,500	40,200	41,300	39,600	1,990
	Chromium (Cr)	mg/kg	0.5	37.3	90	13.7	16.8	14.2	14.7	12.7	12.7	14.2	16.8	14.4	1.52
	Cobalt (Co)	mg/kg	0.1	-	-	5.78	4.40	5.63	5.96	5.26	4.40	5.63	5.96	5.41	0.619
	Copper (Cu)	mg/kg	0.5	35.7	197	11.5	9.44	12.5	13.3	12.1	9.44	12.1	13.3	11.8	1.46
	Iron (Fe)	mg/kg	50	21,200	43,766	15,500	14,000	14,900	16,000	14,600	14,000	14,900	16,000	15,000	778
	Lead (Pb)	mg/kg	0.5	35	91	8.63	7.23	8.58	9.08	8.49	7.23	8.58	9.08	8.40	0.694
	Lithium (Li)	mg/kg	2	-	-	8.5	6.9	8.0	8.7	8.2	6.90	8.20	8.70	8.06	0.702
	Magnesium (Mg)	mg/kg	20	-	-	11,100	11,000	11,100	11,900	11,800	11,000	11,100	11,900	11,400	432
	Manganese (Mn)	mg/kg	1	460	1100	425	250	390	394	307	250	390	425	353	72.4
	Mercury (Hg)	mg/kg	0.005	0.17	0.486	0.0311	0.0286	0.0328	0.0380	0.0385	0.0286	0.0328	0.0385	0.0338	0.00433
	Molybdenum (Mo)	mg/kg	0.1	-	-	1.32	1.39	1.32	1.38	1.25	1.25	1.32	1.39	1.33	0.0563
	Nickel (Ni)	mg/kg	0.5	16	75	26.9	21.2	25.3	28.8	25.0	21.2	25.3	28.8	25.4	2.81
	Phosphorus (P)	mg/kg	50	-	-	1,690	1,840	1,540	1,650	1,570	1,540	1,650	1,840	1,660	118
	Potassium (K)	mg/kg	100	-	-	1,790	1,710	1,860	1,910	1,500	1,500	1,790	1,910	1,750	161
	Selenium (Se)	mg/kg	0.2	2		1.41	1.69	1.69	2.40	2.26	1.41	1.69	2.40	1.89	0.421
	Silver (Ag)	mg/kg	0.1	0.5	-	0.14	0.11	0.14	0.16	0.16	0.110	0.140	0.160	0.142	0.0205
	Sodium (Na)	mg/kg	50	-	-	78	78	77	82	71	71.0	78.0	82.0	77.2	3.96
	Strontium (Sr)	mg/kg	0.5	-	-	66.9	66.2	68.1	70.0	64.2	64.2	66.9	70.0	67.1	2.16
	Sulfur (S)	mg/kg	1,000	-	-	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	-
	Thallium (Tl)	mg/kg	0.05	-	-	0.205	0.175	0.211	0.229	0.205	0.175	0.205	0.229	0.205	0.0194
	Tin (Sn)	mg/kg	2	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.00	<2.00	<2.00	<2.00	-
	Titanium (Ti)	mg/kg	1	-	-	10.4	12.4	13.7	15.4	11.3	10.4	12.4	15.4	12.6	1.98
	Tungsten (W)	mg/kg	0.5	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.500	<0.500	<0.500	<0.500	-
	Uranium (U)	mg/kg	0.05	-	-	1.15	1.14	1.07	1.16	1.10	1.07	1.14	1.16	1.12	0.0378
	Vanadium (V)	mg/kg	0.2	-	-	33.4	30.9	34.1	35.5	29.3	29.3	33.4	35.5	32.6	2.50
	Zinc (Zn)	mg/kg	2	123	315	117	98.9	113	124	111	98.9	113	124	113	9.21
	Zirconium (Zr)	mg/kg	1	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.00	<1.00	<1.00	<1.00	-

Table D.1: Sediment Quality Samples and Summary Statistics for Lotic Reference and Mine-Exposed Areas, FRO LAEMP, 2018

Parameter		Units	Detection Limit	Lower WSQG	Upper WSQG	RG_FO22-Rep1	RG_FO22-Rep2	RG_FO22-Rep3	RG_FO22-Rep4	RG_FO22-Rep5	Min	Median	Max	Mean	Standard Deviation
						8-Sep-18	8-Sep-18	8-Sep-18	8-Sep-18	8-Sep-18					
PAHs (1 mm fraction)	Acenaphthene	mg/kg	0.005 - 0.2	0.00671	0.0889	<0.014	<0.018	<0.015	<0.026	<0.011	<0.0110	<0.0150	<0.0260	<0.0110	-
	Acenaphthylene	mg/kg	0.005 - 0.018	0.00587	0.128	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.00500	<0.00500	<0.00500	<0.00500	-
	Acridine	mg/kg	0.01 - 0.035	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-
	Anthracene	mg/kg	0.004 - 0.024	0.0469	0.245	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.00400	<0.00400	<0.00400	<0.00400	-
	Benz(a)anthracene	mg/kg	0.01 - 0.12	0.0317	0.385	<0.020	<0.020	0.010	0.021	<0.010	<0.0100	0.0100	0.0210	0.0122	0.00622
	Benzo(a)pyrene	mg/kg	0.01 - 0.035	0.0319	0.782	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-
	Benzo(b&j)fluoranthene	mg/kg	0.01 - 0.035	-	-	0.024	0.031	0.024	0.037	0.018	0.0180	0.0240	0.0370	0.0268	0.00733
	Benzo(e)pyrene	mg/kg	0.01 - 0.035	-	-	0.023	0.031	0.022	0.032	0.017	0.0170	0.0230	0.0320	0.0250	0.00636
	Benzo(g,h,i)perylene	mg/kg	0.01 - 0.035	0.17	3.2	<0.010	0.011	<0.010	<0.010	<0.010	<0.0100	<0.0100	0.0110	0.0102	-
	Benzo(k)fluoranthene	mg/kg	0.01 - 0.035	0.24	13.4	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-
	Chrysene	mg/kg	0.01 - 0.035	0.0571	0.862	0.070	0.089	0.057	0.101	0.042	0.0420	0.0700	0.101	0.0718	0.0238
	Dibenz(a,h)anthracene	mg/kg	0.005 - 0.046	0.00622	0.135	<0.0050	<0.0060	<0.0050	<0.0070	<0.0050	<0.00500	<0.00500	<0.00700	<0.00500	-
	Fluoranthene	mg/kg	0.01 - 0.035	0.111	2.355	0.011	0.014	<0.010	0.020	<0.010	<0.0100	0.0110	0.0200	0.0130	0.00428
	Fluorene	mg/kg	0.01 - 0.035	0.021	0.144	0.021	0.030	0.019	0.030	0.018	0.0180	0.0210	0.0300	0.0236	0.00594
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.01 - 0.035	0.2	3.2	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	-
	1-Methylnaphthalene	mg/kg	0.01 - 0.035	-	-	0.194	0.235	0.201	0.373	0.134	0.134	0.201	0.373	0.227	0.0892
	2-Methylnaphthalene	mg/kg	0.01 - 0.035	0.0202	0.201	0.306	0.369	0.309	0.545	0.214	0.214	0.309	0.545	0.349	0.123
	Naphthalene	mg/kg	0.01 - 0.035	0.0346	0.391	0.116	0.130	0.104	0.228	0.062	0.0620	0.116	0.228	0.128	0.0614
	Perylene	mg/kg	0.01 - 0.035	-	-	0.017	0.019	0.021	0.028	0.015	0.0150	0.0190	0.0280	0.0200	0.00500
	Phenanthrene	mg/kg	0.01 - 0.035	0.0419	0.515	0.221	0.273	0.198	0.446	0.119	0.119	0.221	0.446	0.251	0.122
	Pyrene	mg/kg	0.01 - 0.035	0.053	0.875	0.018	0.021	0.016	0.030	0.011	0.0110	0.0180	0.0300	0.0192	0.00705
	Quinoline	mg/kg	0.01 - 0.035	-	-	<0.010	<0.010	<0.010	0.010	<0.010	<0.0100	<0.0100	0.0100	0.0100	-
	Acenaphthene d10	%		-	-	79.3	80.3	80.0	85.1	87.9	79.3	80.3	87.9	82.5	3.78
	Chrysene d12	%		-	-	95.2	96.1	98.7	102.0	105.8	95.2	98.7	106	99.6	4.38
	Naphthalene d8	%		-	-	78.1	77.5	78.8	83.5	85.8	77.5	78.8	85.8	80.7	3.69
	Phenanthrene d10	%		-	-	84.2	87.5	84.6	89.0	91.4	84.2	87.5	91.4	87.3	3.03
	B(a)P Total Potency Equivalent	mg/kg	0.02 - 0.048	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.0200	<0.0200	<0.0200	<0.0200	-
	IACR (CCME)	mg/kg	0.15 - 0.49	-	-	0.27	0.33	0.27	0.41	0.20	0.200	0.270	0.410	0.296	0.0786

🟦 Value > lower Working Sediment Quality Guideline (WSQG)

▢ Value < LRL and LRL > lower Working Sediment Quality Guideline (WSQG)

■ Value > upper Working Sediment Quality Guideline (WSQG, or only guideline for Selenium)

□ Value < LRL and LRL > upper Working Sediment Quality Guideline (WSQG, or only guideline in the case of Selenium)

Notes: All observed data are reported to the number of significant digits reported by the laboratory and summary statistics are reported to 3 significant digits for display purposes.

APPENDIX E
HYDROLOGY

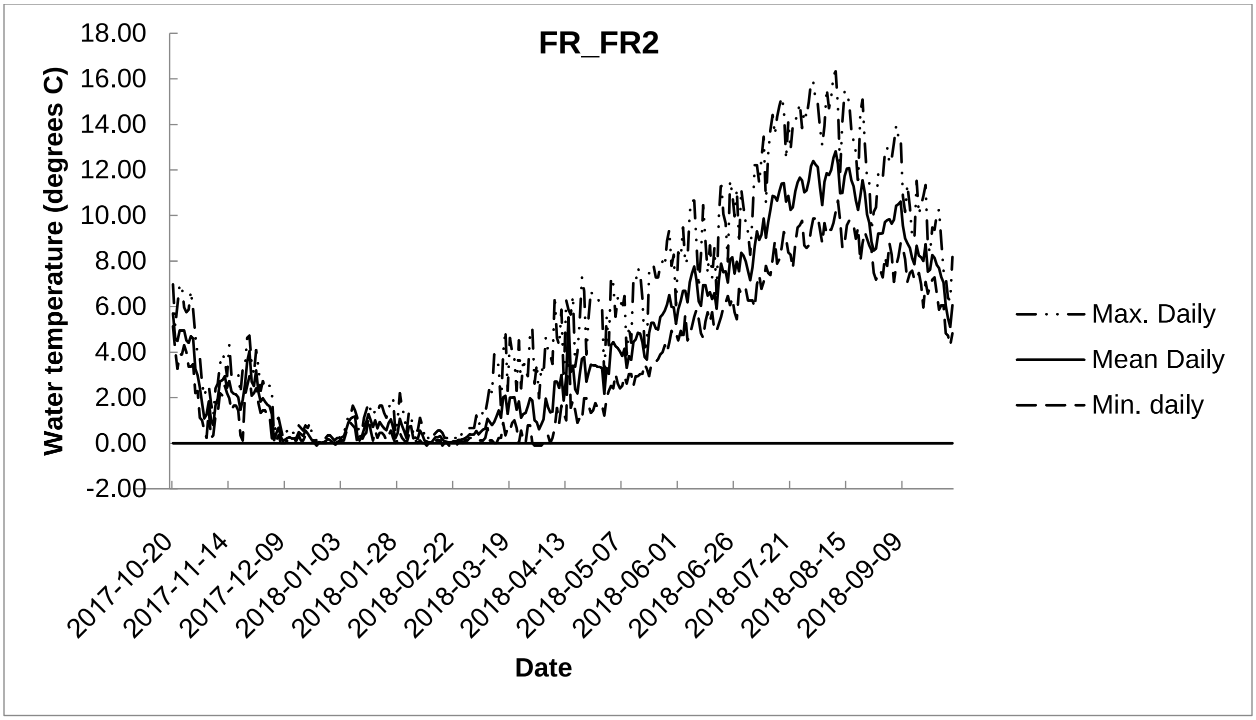


Figure E.1: Continuous Water Temperature Plot for FR_FR2

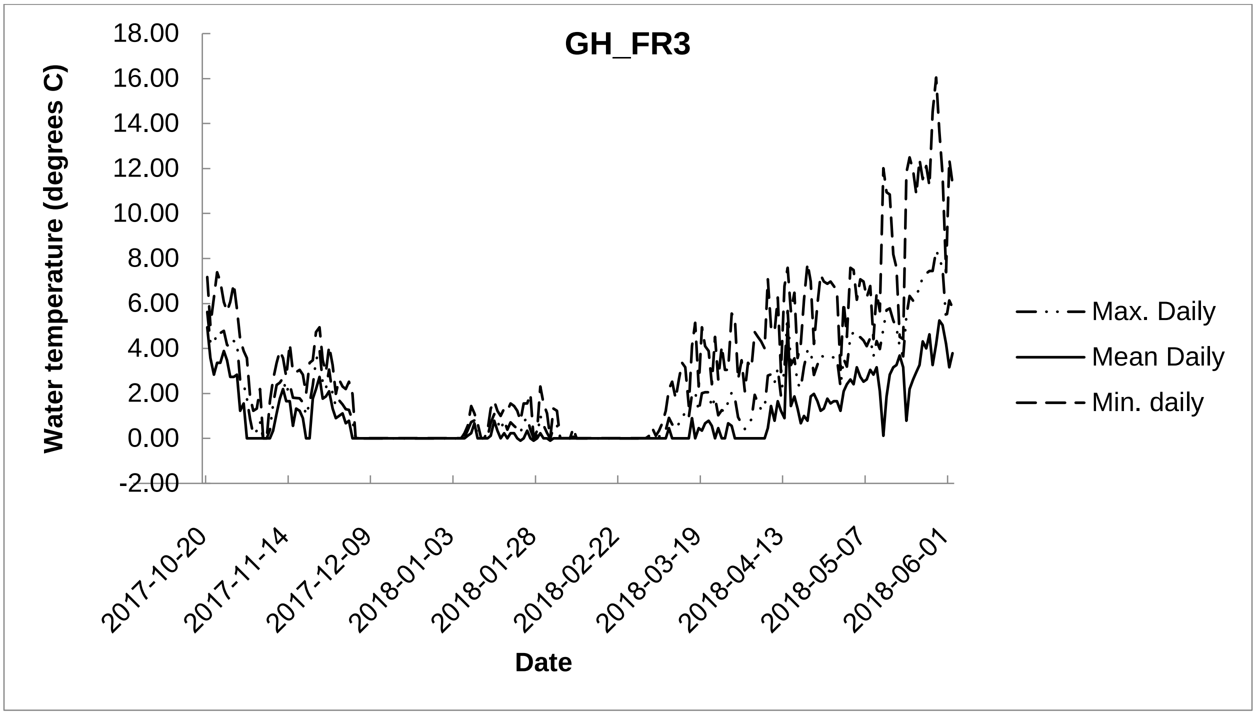


Figure E.2: Continuous Water Temperature Plot for GH_FR3

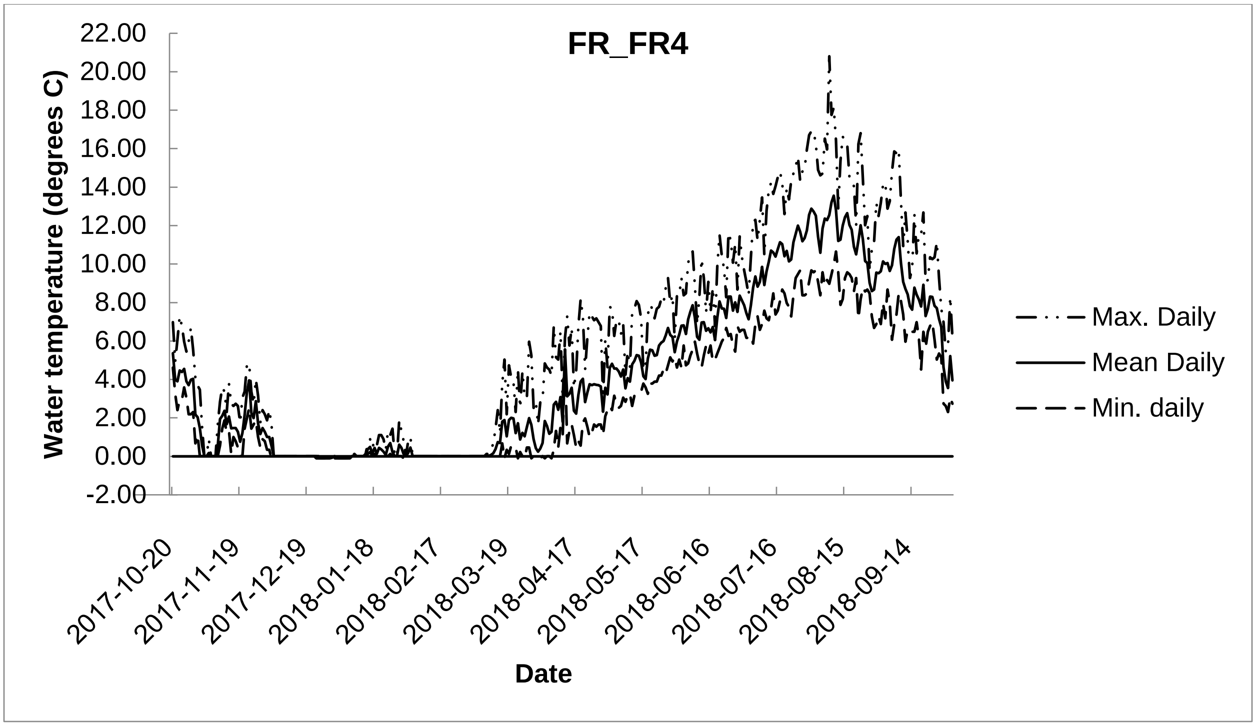


Figure E.3: Continuous Water Temperature Plot for FR_FR4

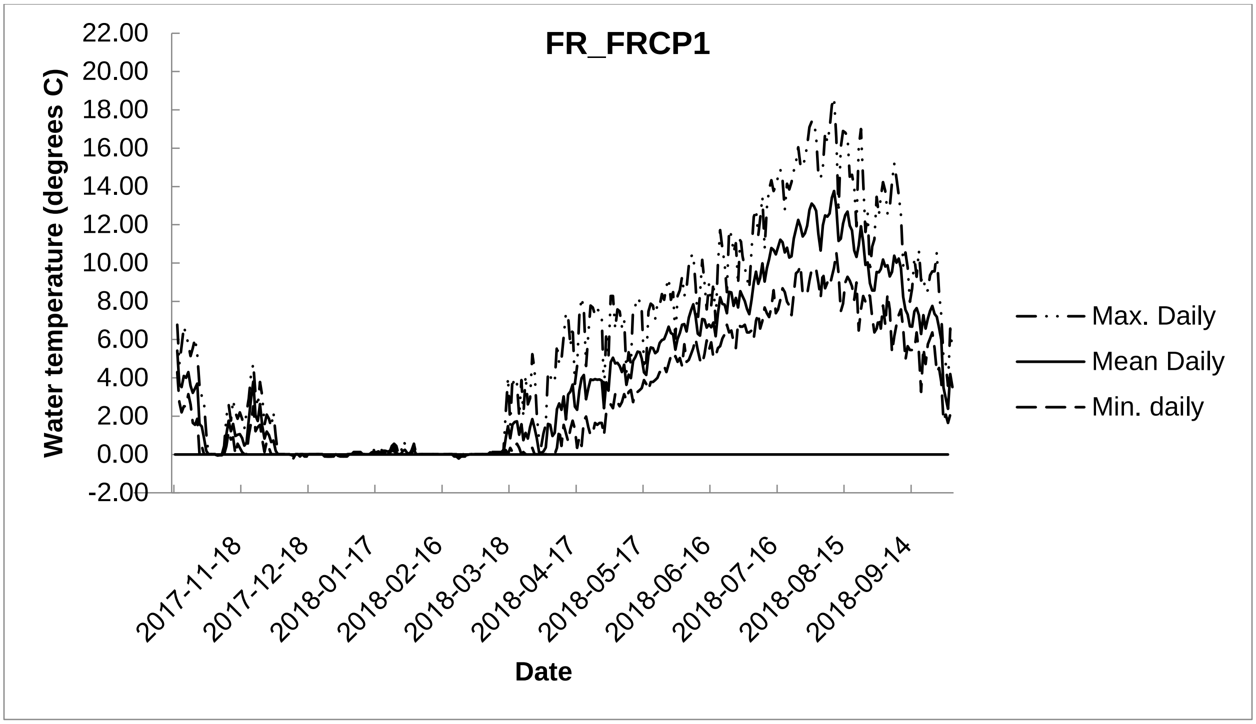


Figure E.4: Continuous Water Temperature Plot for FR_FRCP1

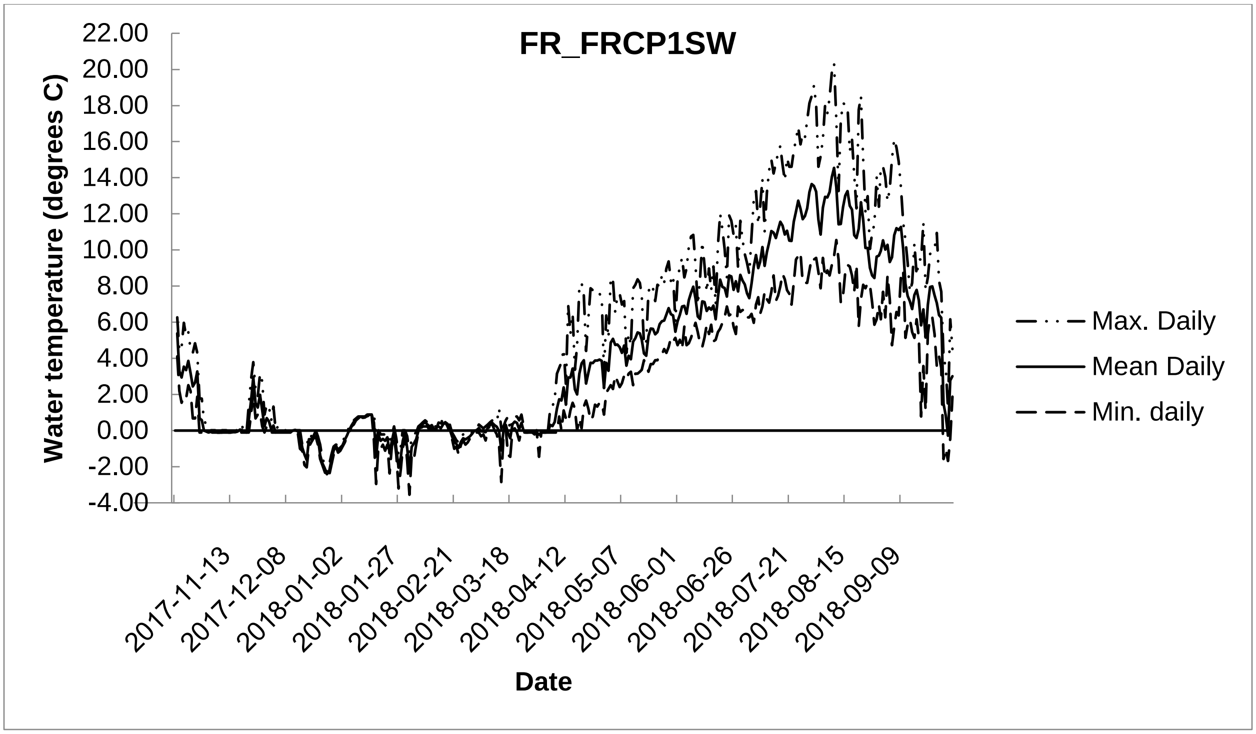


Figure E.5: Continuous Water Temperature Plot for FR_FRCP1SW

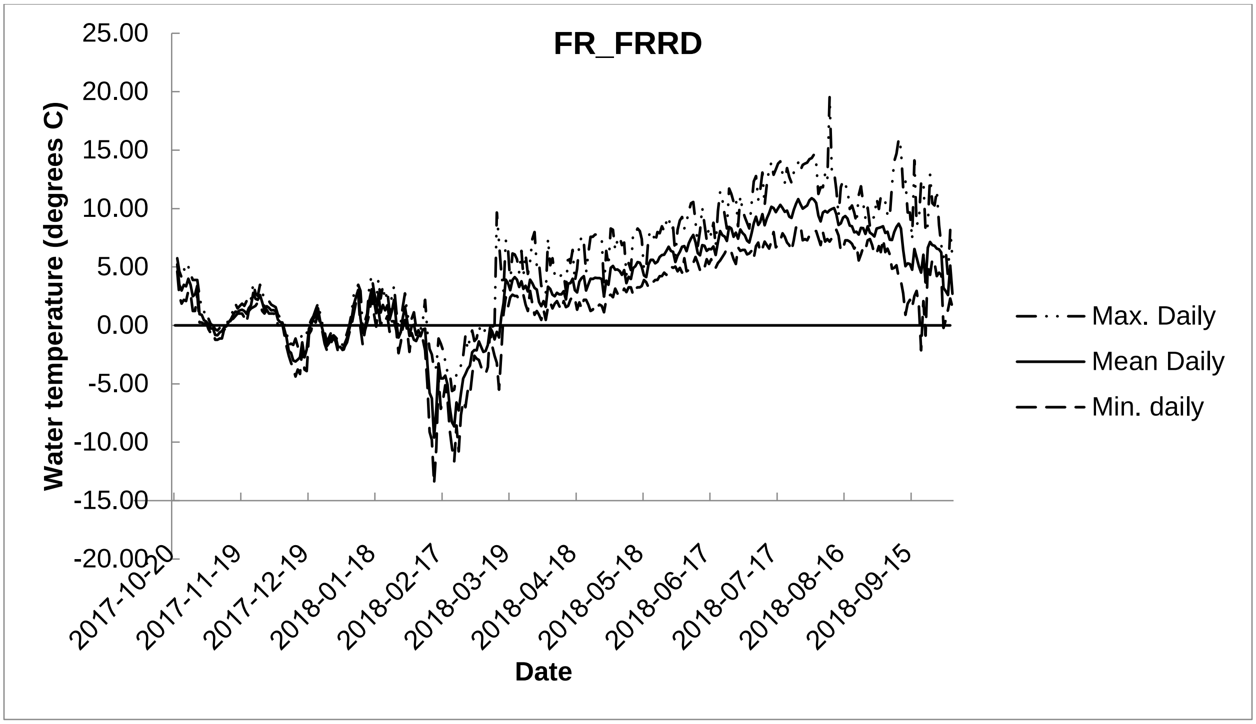


Figure E.6: Continuous Water Temperature Plot for FR_FRRD

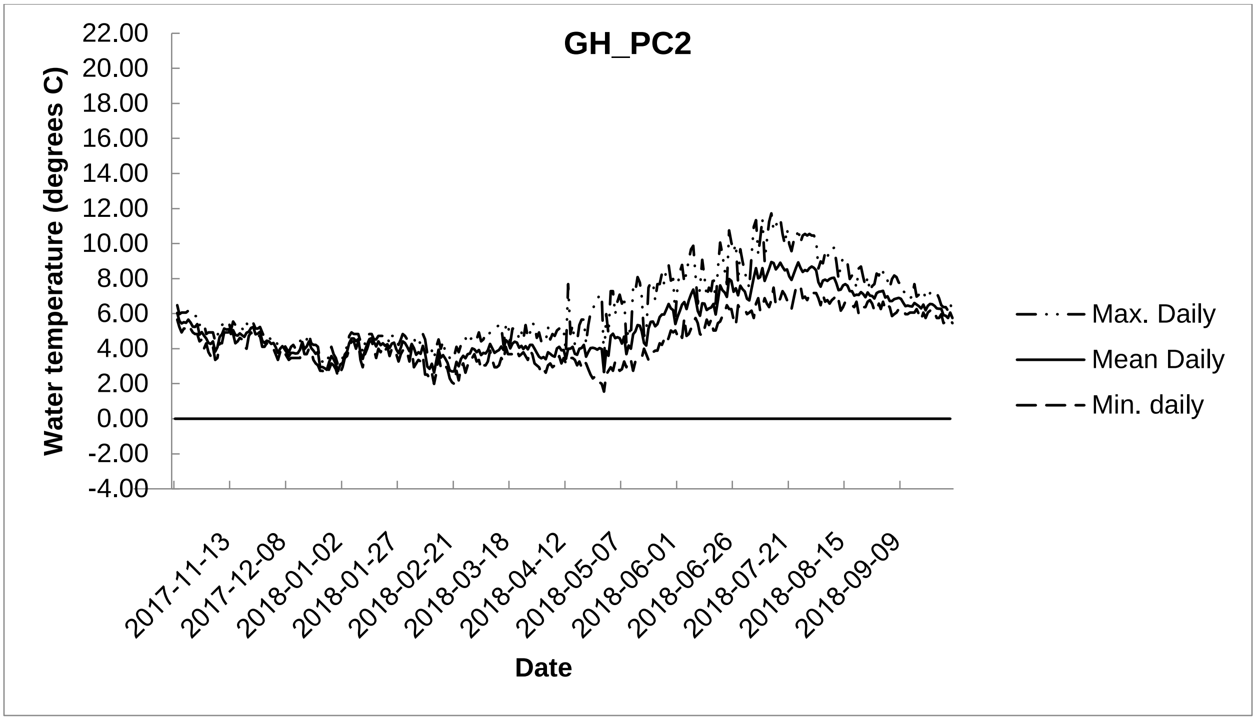


Figure E.7: **Continuous Water Temperature Plot for GH_PC2**

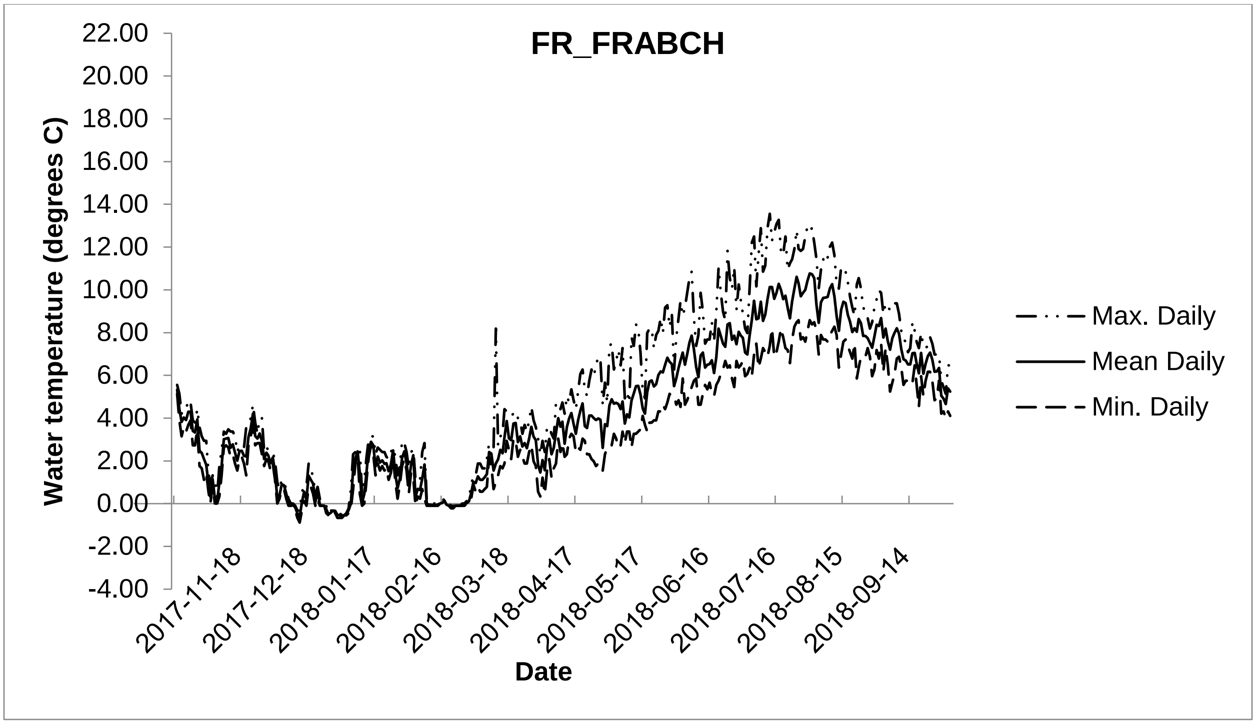


Figure E.8: **Continuous Water Temperature Plot for FR_FRABCH**

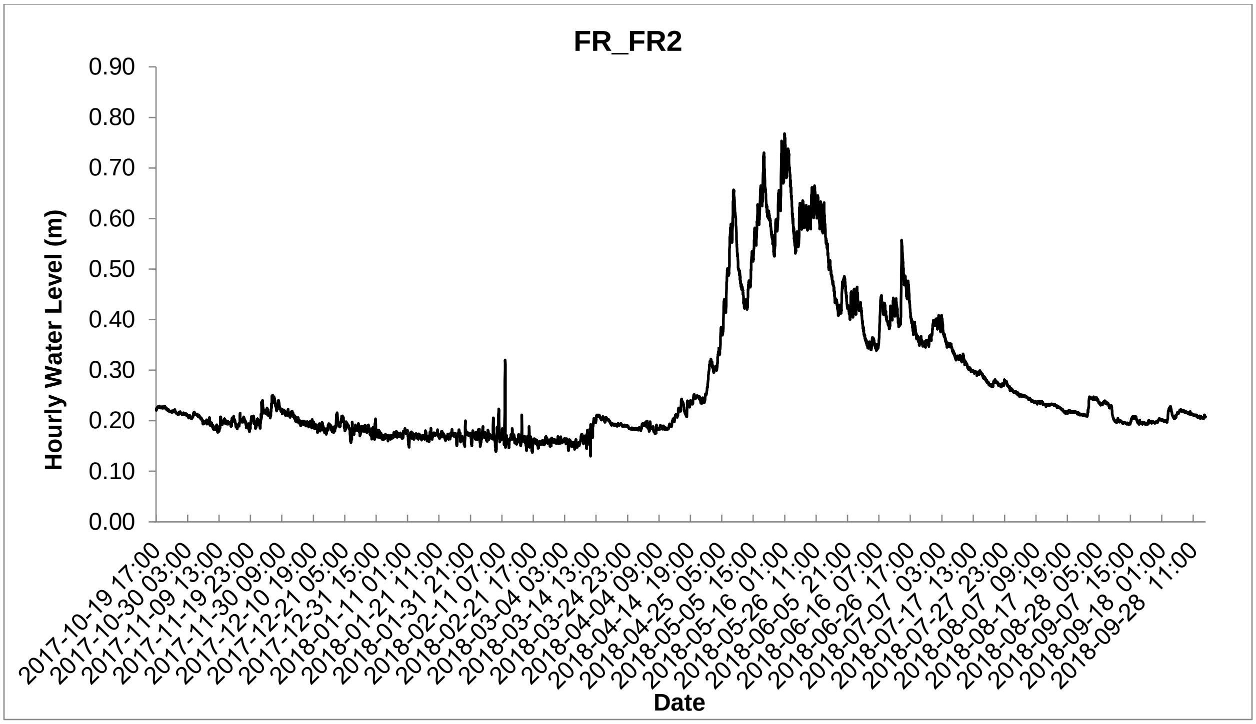


Figure E.9: Continuous Water Level for FR_FR2

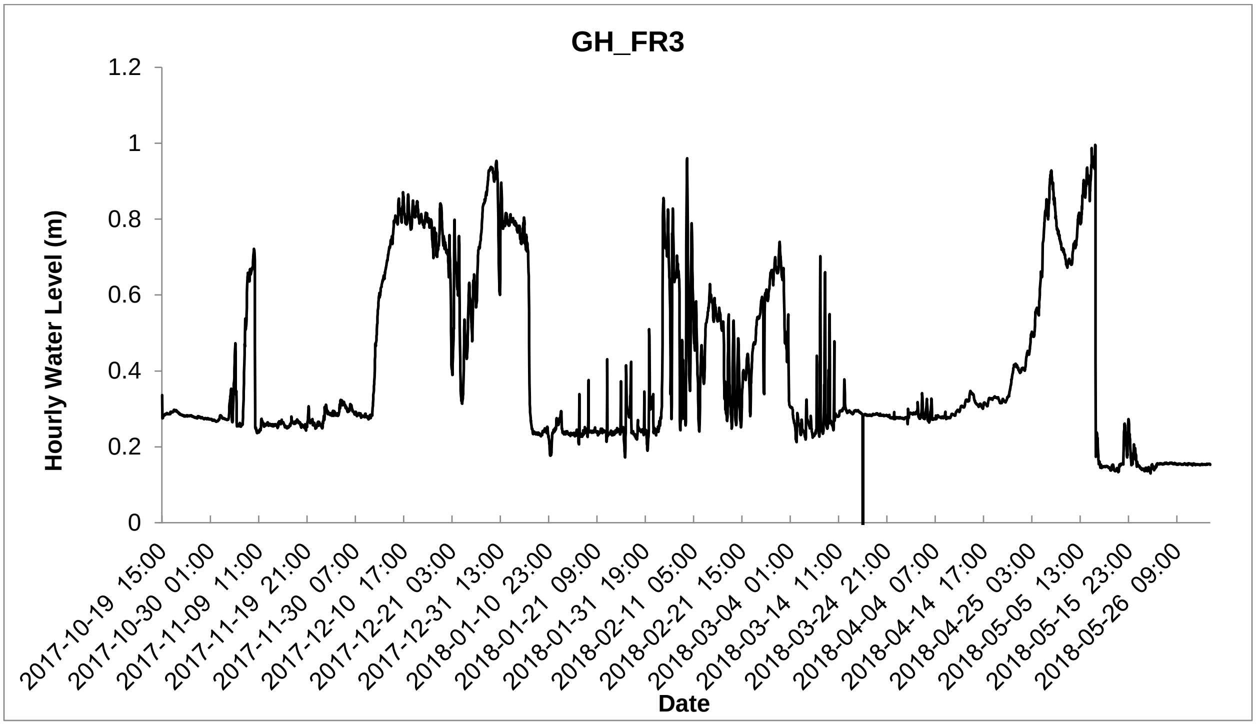


Figure E.10: Continuous Water Level for GH_GH3

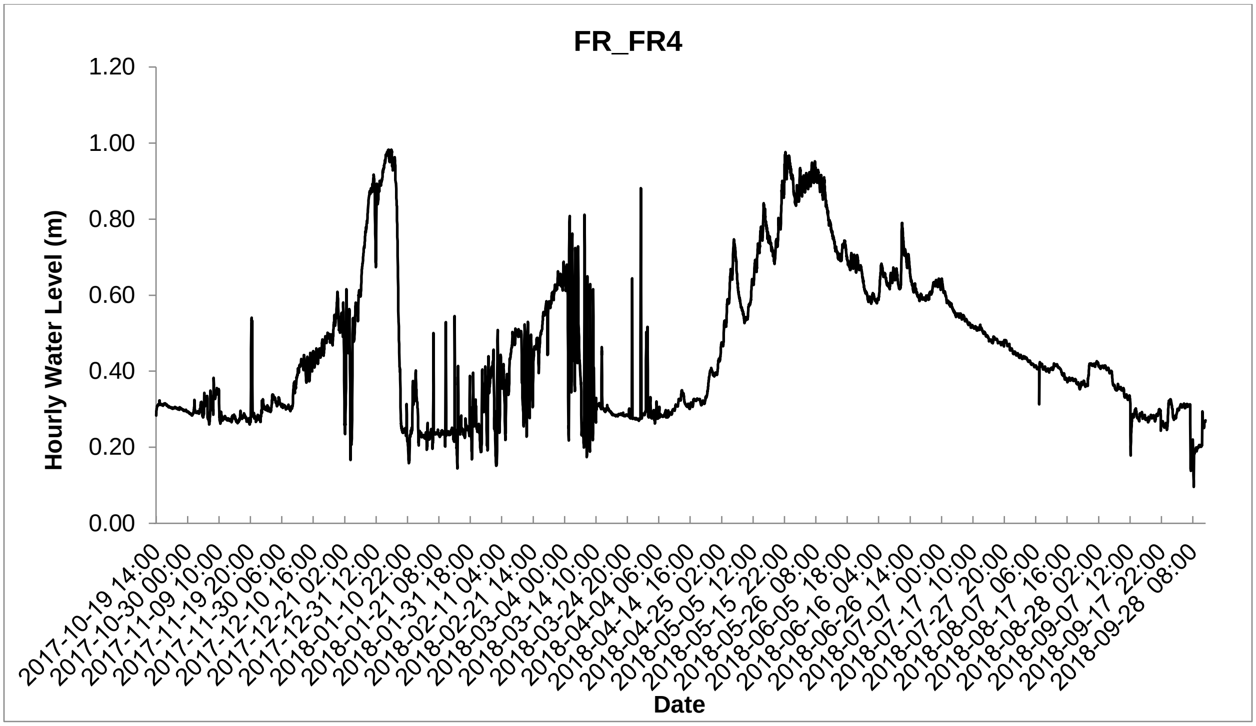


Figure E.11: Continuous Water Level for FR_FR4

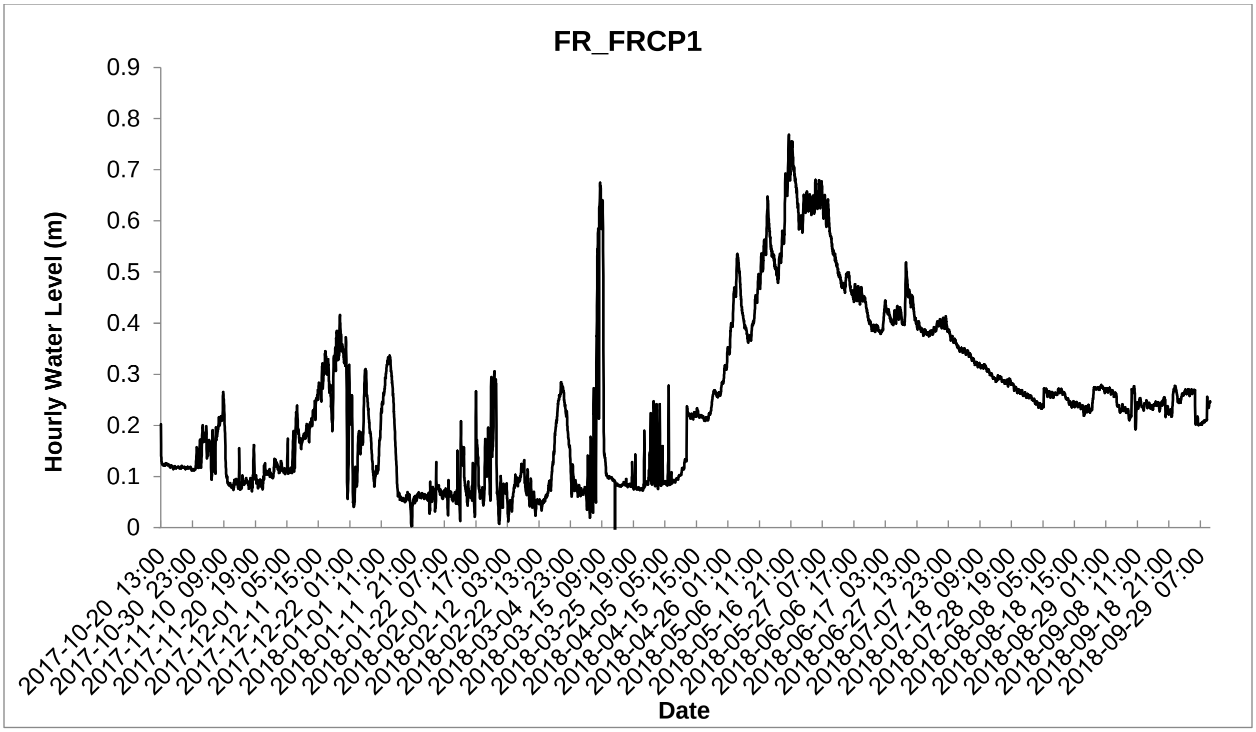


Figure E.12: Continuous Water Level for FR_FRCP1

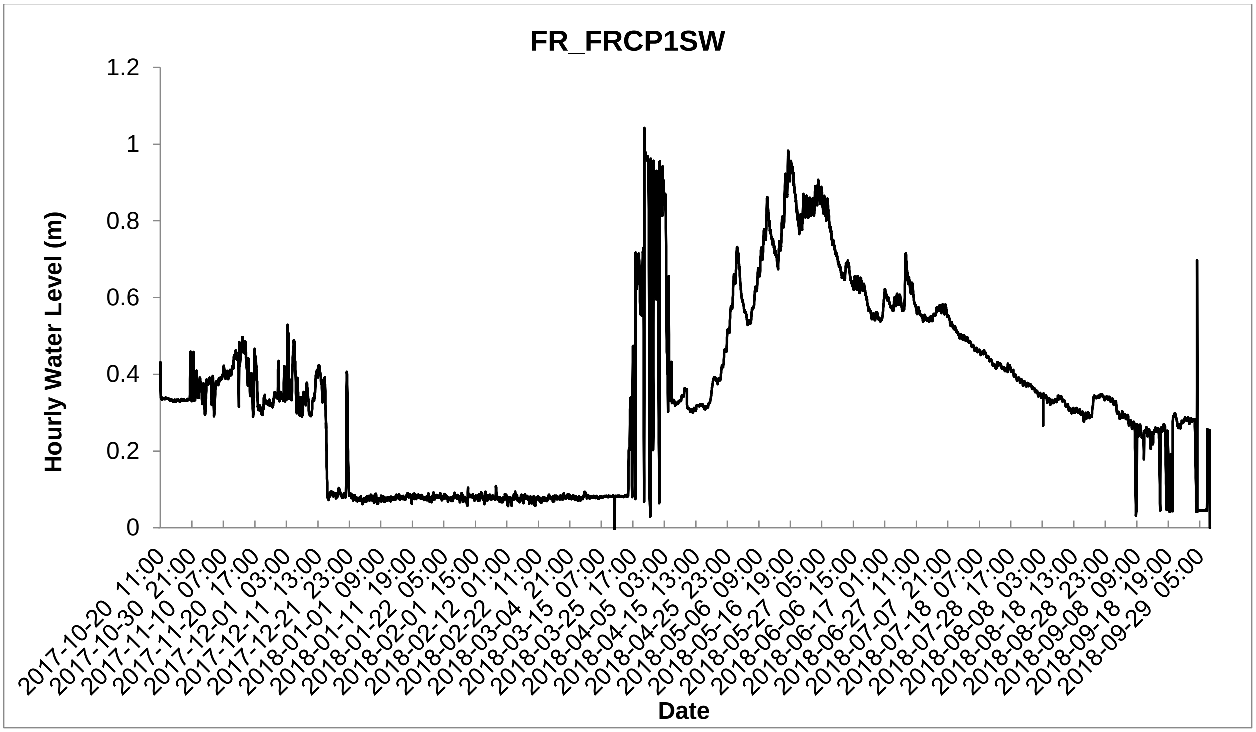


Figure E.13: **Continuous Water Level for FR_FRCP1SW**

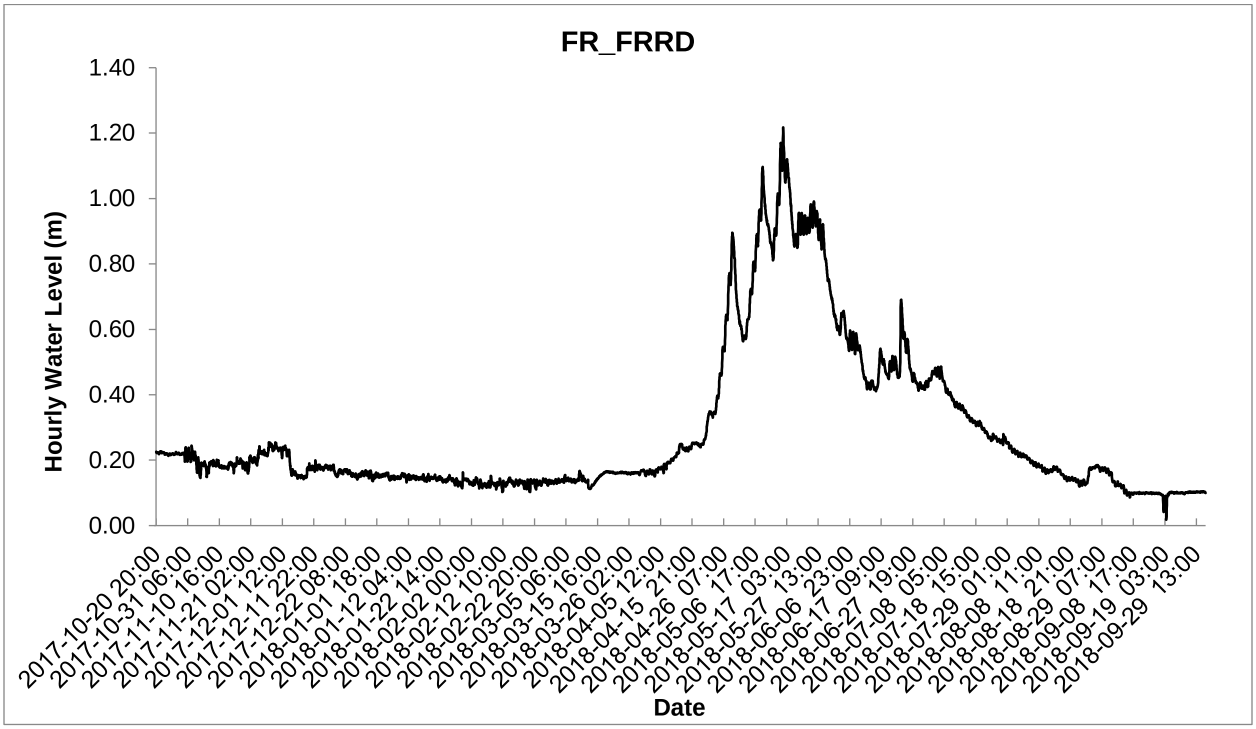


Figure E.14: **Continuous Water Level for FR_FRRD**

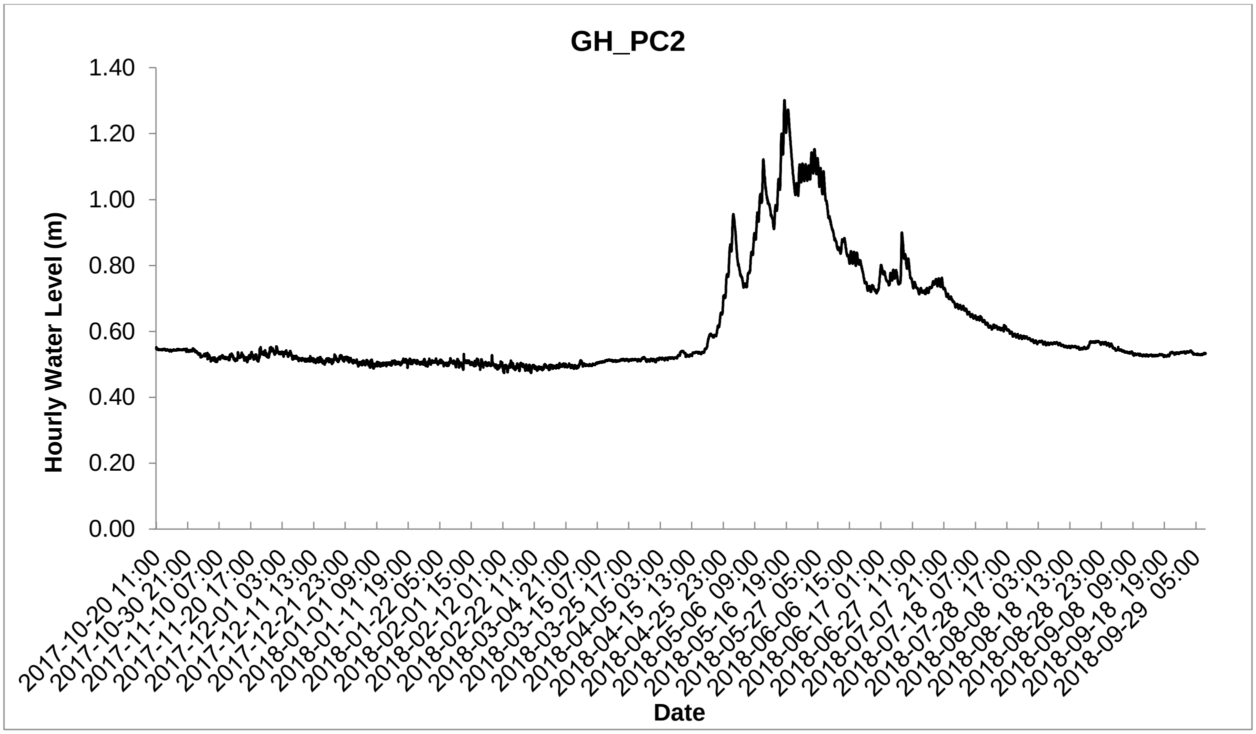


Figure E.15: Continuous Water Level for GH_PC2

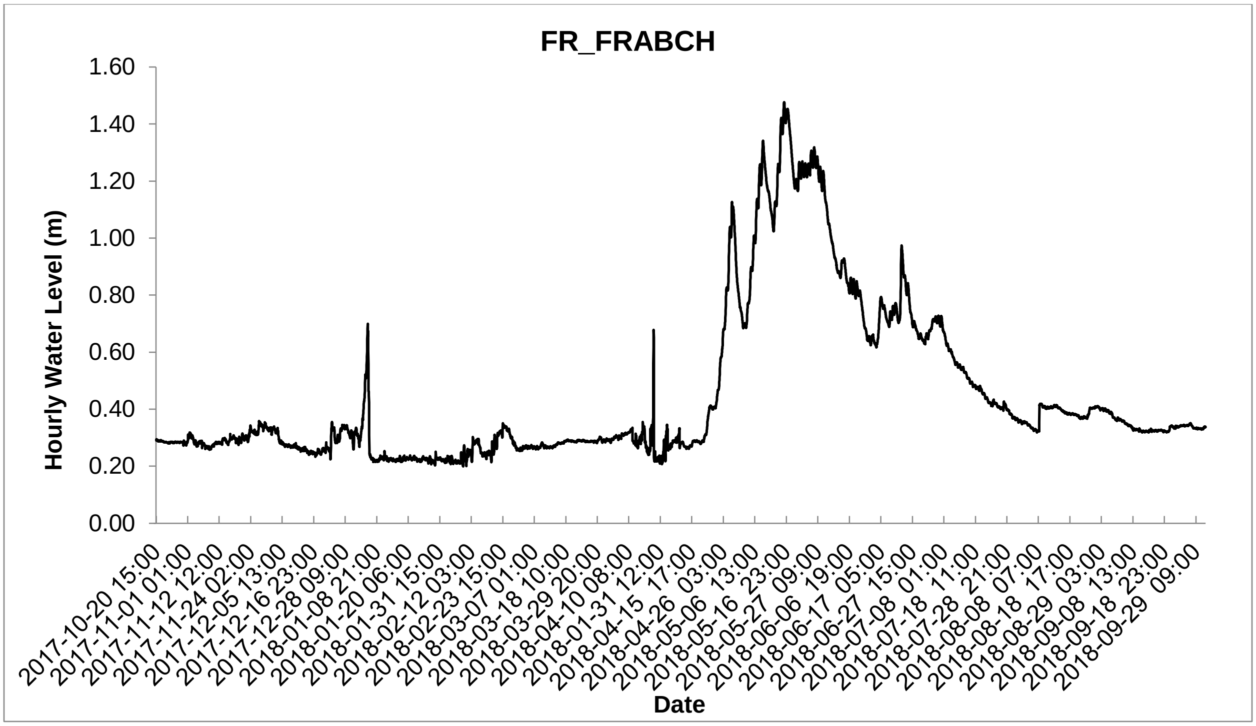


Figure E.16: Continuous Water Level for FR_FRABCH

APPENDIX F
HABITAT

Table F.1 Habitat Information at Reference and Mine-exposed Areas, FRO LAEMP, June 2018

Station ID	Reference		Mine-exposed			
	RG_HENUP	**RG_FO26**	**RG_FODHE**	**RG_FOUNGD**	**RG_FODNGD**	**RG_MP1**
Waterbody	Henretta Creek	Fording River	Fording River	Fording River	Fording River	Fording River
Date Sampled	12-Jun-18	13-Jun-18	12-Jun-18	11-Jun-18	11-Jun-18	11-Jun-18
Zone 11 UTMs - E	655778	653050	651320	650864	650918	651152
Zone 11 UTMs - N	5567706	5569601	5565422	5563525	5563163	5562441
Elevation	1,798	1,801	1,687	1,659	1,659	1,640
Samplers' Initials	KM, AL	KM, AL	KM, AL	KM, AL	KM, AL	KM, AL
Habitat Characteristics						
Site Access Description	-	-	-	-	hike down from equipment storage area, 100m	road beside river
Surrounding Land Use	forest	forest	forest, mining	forest, logging, mining	forest, mining	mining
Anthropogenic Influences	-	-	-	-	-	-
Length of Reach Assessed (m)	100	50	100	50	50	50
Bank Stability	moderate	stable, no erosion	stable, no erosion	stable, no erosion	stable, no erosion	stable, no erosion
Water Colour & Clarity	none, clear	none, clear	none, clear	none, clear	none, clear	none, clear
CABIN						
Samplers' Initials	AL	AL	AL	KM	AL	AL
Sampling Time (min)	3	3	3	3	3	3
Total Kick Distance (m)	7	10	9	21	10	10
Number of Jars	1	1	1	1	1	1
Number of transects	1	2	1	3	1	-
Distance from shore (m)	-	-	-	-	-	-

Table F.1 Habitat Information at Reference and Mine-exposed Areas, FRO LAEMP, June 2018

Station ID	Mine-exposed					
	RG_FOUSH	**RG_FOUKI**	**RG_FOBKS**	**RG_FOBSC**	**RG_FOBCP**	**RG_FRCP1SW**
Waterbody	Fording River	Fording River	Fording River	Fording River	Fording River	Fording River
Date Sampled	11-Jun-18	11-Jun-18	12-Jun-18	12-Jun-18	14-Jun-18	13-Jun-18
Zone 11 UTMs - E	650878	651844	652082	652337	652859	653327
Zone 11 UTMs - N	5560972	5559851	5558646	5558206	5557154	5556203
Elevation	1,624	1,605	1,597	1,592	1,579	1,567
Samplers' Initials	KM, AL	KM, AL	KM, AL	KM, AL	KM, AL	KM, AL
Habitat Characteristics						
Site Access Description	road along river, beside explosives plant road	road along south end of tailings berm	-	swift creek bridge	from greenhouse	forest road to west
Surrounding Land Use	forest, logging, mining	forest, logging, mining	forest, mining	forest, mining	forest, mining	-
Anthropogenic Influences	-	-	-	-	-	-
Length of Reach Assessed (m)	100	100	100	100	-	50
Bank Stability	stable, no erosion	-	stable, no erosion	stable, no erosion	stable, no erosion	moderate
Water Colour & Clarity	none, clear	none, clear	none, clear	none, clear	none, clear	none, clear
CABIN						
Samplers' Initials	AL	AL	AL	AL	AL	AL
Sampling Time (min)	3	3	3	3	3	3
Total Kick Distance (m)	12	10	10	10	15	10
Number of Jars	1	-	-	1	1	1
Number of transects	5	5	1	-	-	-
Distance from shore (m)	3	2	10	-		-

Table F.1 **Habitat Information at Reference and Mine-exposed Areas, FRO LAEMP, June 2018**

Station ID	Mine-exposed			
	RG_FRUPO	**RG_FODPO**	**RG_FO22**	**RG_FOUEW**
Waterbody	Fording River	Fording River	Fording River	Fording River
Date Sampled	13-Jun-18	19-Jun-18	13-Jun-18	13-Jun-18
Zone 11 UTMs - E	653893	-	654821	656355
Zone 11 UTMs - N	5555958	-	5553552	5551880
Elevation	1,568	-	1,553	1,551
Samplers' Initials	KM, AL	SW, HC	KM, AL	KM, AL
Habitat Characteristics				
Site Access Description	-	-	logging road to west, tree over road, 750m hike	hike from gen club gate
Surrounding Land Use	forest	-	forest	forest
Anthropogenic Influences	-	-	-	-
Length of Reach Assessed (m)	100	-	100	100
Bank Stability	moderate	-	moderate	moderate
Water Colour & Clarity	none, clear	-	none, slightly turbid	none, clear
CABIN				
Samplers' Initials	AL	-	AL	AL
Sampling Time (min)	3	3	3	3
Total Kick Distance (m)	10	-	10	10
Number of Jars	2	2	2	1
Number of transects	-	-	-	-
Distance from shore (m)	-	-	-	-

Table F.2: Pebble Count and Calcite at Reference and Mine-exposed Areas, FRO LAEMP, June 2018

RG_HENUP					RG_FO26				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**	**Rock**	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	0	9.2	-	1	0	0	8.3	-
2	0	0	5.0	-	2	0	0	2.8	-
3	0	0	4.9	-	3	0	0	3.8	-
4	0	0	9.9	-	4	0	0	6.8	-
5	0	0	7.1	-	5	0	0	7.1	-
6	0	0	9.2	-	6	0	0	BOULDER	-
7	0	0	5.0	-	7	0	0	9.1	-
8	0	0	19.0	-	8	0	0	1.3	-
9	0	0	6.8	-	9	0	0	7.5	-
10	0	0	5.1	0	10	0	0	18.5	0.75
11	0	0	5.5	-	11	0	0	7.5	-
12	0	0	2.7	-	12	0	0	3.6	-
13	0	0	2.8	-	13	0	0	11.4	-
14	0	0	5.4	-	14	0	0	9.0	-
15	0	0	3.0	-	15	0	0	3.0	-
16	0	0	15.7	-	16	0	0	16.8	-
17	0	0	4.7	-	17	0	1	7.2	-
18	0	0	4.1	-	18	0	0	8.0	-
19	0	0	5.6	-	19	0	1	15.0	-
20	0	0	5.7	0	20	0	0	4.0	0.25
21	0	0	8.6	-	21	0	0	5.4	-
22	0	0	5.6	-	22	0	0	6.5	-
23	0	0	BOULDER	-	23	0	0	8.0	-
24	0	0	1.5	-	24	0	1	13.4	-
25	0	0	4.1	-	25	0	0	3.0	-
26	0	0	7.2	-	26	0	0	4.2	-
27	0	0	4.5	-	27	0	0	5.8	-
28	0	0	3.9	-	28	0	1	9.7	-
29	0	0	7.4	-	29	0	0	10.8	-
30	0	0	10.6	0	30	0	0	8.9	0.5
31	0	0	8.3	-	31	0	0	4.0	-
32	0	0	22.5	-	32	0	1	19.0	-
33	0	0	10.0	-	33	0	1	5.0	-
34	0	0	3.2	-	34	0	1	8.0	-
35	0	0	9.7	-	35	0	1	8.9	-
36	0	0	16.2	-	36	0	1	9.7	-
37	0	0	6.2	-	37	0	0	5.0	-
38	0	0	10.2	-	38	0	1	5.5	-
39	0	0	4.8	-	39	0	1	14.1	-
40	0	0	6.5	0	40	0	0	4.3	0.5
41	0	0	7.4	-	41	0	1	6.8	-
42	0	0	12.5	-	42	0	1	10.2	-
43	0	0	5.6	-	43	0	1	3.7	-
44	0	0	5.0	-	44	0	1	4.1	-
45	0	0	9.5	-	45	0	1	4.5	-
46	0	0	7.8	-	46	0	0	5.1	-
47	0	0	9.2	-	47	0	0	3.2	-
48	0	0	8.4	-	48	0	0	6.0	-
49	0	0	11.3	-	49	0	1	10.5	-
50	0	0	12.7	0.5	50	0	0	2.2	0.25
51	0	0	10.5	-	51	0	0	5.6	-
52	0	0	4.2	-	52	0	1	5.9	-
53	0	0	8.1	-	53	0	0	4.8	-
54	0	0	8.4	-	54	0	1	11.0	-
55	0	0	4.3	-	55	0	1	10.7	-
56	0	0	7.4	-	56	0	1	4.6	-
57	0	0	11.5	-	57	0	1	13.2	-
58	0	0	7.5	-	58	0	0	6.3	-
59	0	0	3.6	-	59	0	0	5.2	-
60	0	0	8.7	0.5	60	0	1	5.2	0.25
61	0	0	9.7	-	61	0	1	15.9	-
62	0	0	4.9	-	62	0	0	3.5	-
63	0	0	5.2	-	63	0	0	9.0	-
64	0	0	14.0	-	64	0	1	10.5	-
65	0	0	4.8	-	65	0	0	4.1	-
66	0	0	19.6	-	66	0	0	8.0	-
67	0	0	10.8	-	67	0	1	9.0	-
68	0	0	13.4	-	68	0	0	5.8	-
69	0	0	8.2	-	69	0	0	7.5	-
70	0	0	8.3	0	70	0	0	4.8	0.25
71	0	0	14.6	-	71	0	1	15.0	-
72	0	0	6.8	-	72	0	1	5.8	-
73	0	0	7.8	-	73	0	0	9.4	-
74	0	0	6.4	-	74	0	1	12.6	-
75	0	0	7.1	-	75	0	1	5.8	-
76	0	0	7.8	-	76	0	1	15.2	-
77	0	0	5.1	-	77	0	0	2.3	-
78	0	0	BOULDER	-	78	0	0	2.0	-
79	0	0	10.5	-	79	0	1	12.2	-
80	0	0	12.8	0	80	0	1	11.0	0.25
81	0	0	6.5	-	81	0	0	4.6	-
82	0	0	5.2	-	82	0	1	3.3	-
83	0	0	2.8	-	83	0	1	11.6	-
84	0	0	4.6	-	84	0	1	4.8	-
85	0	0	12.7	-	85	0	0	3.2	-
86	0	0	9.8	-	86	0	0	4.1	-
87	0	0	8.1	-	87	0	1	11.1	-
88	0	0	4.9	-	88	0	0	6.2	-
89	0	0	6.5	-	89	0	0	6.3	-
90	0	0	2.7	0	90	0	0	8.1	0.5
91	0	0	11.2	-	91	0	0	5.4	-
92	0	0	7.2	-	92	0	0	4.1	-
93	0	0	8.1	-	93	0	1	10.4	-
94	0	0	5.4	-	94	0	0	9.0	-
95	0	0	2.9	-	95	0	1	7.8	-
96	0	0	10.3	-	96	0	1	5.0	-
97	0	0	3.1	-	97	0	0	4.2	-
98	0	0	11.4	-	98	0	0	2.0	-
99	0	0	12.6	-	99	0	1	9.7	-
100	0	0	9.3	0.25	100	0	1	7.5	0.5
Minimum	**0.0**	**0.0**	**1.5**	**0.0**	**Minimum**	**0.0**	**0.0**	**1.3**	**0.25**
Maximum	**0.0**	**0.0**	**22.5**	**0.5**	**Maximum**	**0.0**	**1**	**19**	**0.75**
Mean	**0.0**	**0.0**	**7.9**	**0.125**	**Mean**	**0.0**	**0.42**	**7.44**	**0.4**
Standard Dev.	**0.0**	**0.0**	**3.89**	**0.212**	**Standard Dev.**	**0.0**	**0.496**	**3.86**	**0.175**
Geometric mean	**-**	**-**	**7.02**	**-**	**Geometric mean**	**-**	**-**	**6.49**	**-**
Median	**0.0**	**0.0**	**7.4**	**0.0**	**Median**	**0.0**	**0.0**	**6.5**	**0.375**
Calcite Index	**0.0**		**-**	**-**	**Calcite Index**	**0.4**		**-**	**-**

Table F.2: Pebble Count and Calcite at Reference and Mine-exposed Areas, FRO LAEMP, June 2018

RG_FODHE					RG_FOUNGD				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	3.0	-	1	0	0	5.0	-
2	0	0	4.3	-	2	0	0	3.4	-
3	0	0	4.7	-	3	0	0	4.7	-
4	0	0	7.5	-	4	0	0	6.0	-
5	0	0	9.6	-	5	0	0	4.9	-
6	0	0	7.3	-	6	0	1	6.9	-
7	0	0	15.2	-	7	0	1	10.1	-
8	0	1	4.3	-	8	0	0	6.7	-
9	0	0	8.1	-	9	0	1	4.4	-
10	0	0	16.8	0.25	10	0	1	9.8	0.5
11	0	0	3.2	-	11	0	0	1.4	-
12	0	0	15.5	-	12	0	0	2.4	-
13	0	0	11.3	-	13	0	1	17.4	-
14	0	0	15.8	-	14	0	1	10.2	-
15	0	0	5.1	-	15	0	0	7.0	-
16	0	0	9.4	-	16	0	0	SAND	-
17	0	0	3.2	-	17	0	1	15.4	-
18	0	0	7.0	-	18	0	1	8.2	-
19	0	0	5.1	-	19	0	0	1.6	-
20	0	0	5.9	0.25	20	0	1	11.0	0.25
21	0	0	5.1	-	21	0	1	2.0	-
22	0	0	9.3	-	22	0	1	9.6	-
23	0	0	7.0	-	23	0	0	6.2	-
24	0	0	13.9	-	24	0	0	6.5	-
25	0	0	11.2	-	25	0	1	4.8	-
26	0	0	5.5	-	26	0	0	9.0	-
27	0	0	4.7	-	27	0	0	3.8	-
28	0	0	4.6	-	28	0	0	6.1	-
29	0	0	6.2	-	29	0	0	3.6	-
30	0	0	8.5	0.25	30	0	0	6.0	0.25
31	0	0	5.1	-	31	0	0	10.4	-
32	0	0	9.2	-	32	0	1	6.0	-
33	0	0	8.6	-	33	0	1	9.8	-
34	0	0	8.4	-	34	0	0	3.6	-
35	0	0	5.9	-	35	0	1	7.0	-
36	0	0	4.4	-	36	0	1	8.1	-
37	0	0	4.5	-	37	0	1	12.5	-
38	0	0	9.6	-	38	0	1	10.9	-
39	0	0	6.0	-	39	0	1	5.9	-
40	0	0	5.5	0.5	40	0	1	15.0	0.5
41	0	0	9.4	-	41	0	0	15.5	-
42	0	0	4.8	-	42	0	0	6.0	-
43	0	0	6.0	-	43	0	0	16.5	-
44	0	0	12.1	-	44	0	0	8.8	-
45	0	0	7.2	-	45	0	1	12.1	-
46	0	0	6.3	-	46	0	0	BOULDER	-
47	0	0	4.9	-	47	0	1	9.8	-
48	0	0	14.2	-	48	0	1	11.2	-
49	0	0	3.5	-	49	0	1	6.5	-
50	0	0	10.3	0.25	50	0	1	2.9	0.75
51	0	0	14.1	-	51	0	1	6.9	-
52	0	0	9.1	-	52	0	0	9.7	-
53	0	0	6.5	-	53	0	0	5.0	-
54	0	0	12.1	-	54	0	0	4.5	-
55	0	0	8.3	-	55	0	0	6.3	-
56	0	0	8.1	-	56	0	0	3.1	-
57	0	0	4.2	-	57	0	1	10.6	-
58	0	0	10.1	-	58	0	1	5.5	-
59	0	0	9.7	-	59	0	1	5.6	-
60	0	0	6.5	0.25	60	0	1	6.4	0.5
61	0	0	5.8	-	61	0	0	5.5	-
62	0	0	12.2	-	62	0	1	3.0	-
63	0	0	11.2	-	63	0	0	9.9	-
64	0	0	7.3	-	64	0	0	4.6	-
65	0	0	6.2	-	65	0	1	9.4	-
66	0	0	5.5	-	66	0	0	6.5	-
67	0	0	15.2	-	67	0	1	11.7	-
68	0	0	7.2	-	68	0	1	6.5	-
69	0	0	13.2	-	69	0	1	8.8	-
70	0	0	8.1	0.75	70	0	1	5.7	0.5
71	0	0	4.2	-	71	0	1	7.9	-
72	0	0	11.1	-	72	0	1	2.1	-
73	0	0	11.2	-	73	0	1	5.4	-
74	0	0	5.2	-	74	0	1	3.6	-
75	0	0	5.6	-	75	0	1	4.0	-
76	0	0	4.5	-	76	0	0	7.2	-
77	0	0	10.0	-	77	0	0	3.6	-
78	0	0	9.1	-	78	0	1	4.7	-
79	0	0	6.1	-	79	0	0	8.9	-
80	0	0	8.2	0.5	80	0	1	8.2	0.25
81	0	0	6.9	-	81	0	1	8.0	-
82	0	0	6.8	-	82	0	1	12.0	-
83	0	0	4.6	-	83	0	1	10.1	-
84	0	0	8.3	-	84	0	1	6.0	-
85	0	0	3.6	-	85	0	1	4.4	-
86	0	0	13.1	-	86	0	1	5.4	-
87	0	0	9.0	-	87	0	1	10.3	-
88	0	0	4.3	-	88	0	1	5.2	-
89	0	0	5.2	-	89	0	1	3.5	-
90	0	0	8.8	0.25	90	0	1	4.7	0.25
91	0	0	11.0	-	91	0	1	2.9	-
92	0	0	7.9	-	92	0	1	3.6	-
93	0	0	6.4	-	93	0	1	7.0	-
94	0	0	2.9	-	94	0	1	5.8	-
95	0	0	14.2	-	95	0	1	11.2	-
96	0	0	5.4	-	96	0	1	9.4	-
97	0	0	11.8	-	97	0	1	7.6	-
98	0	0	7.6	-	98	0	1	4.5	-
99	0	0	7.5	-	99	0	1	4.7	-
100	0	0	6.1	0.5	100	0	1	7.0	0.5
Minimum	**0.0**	**0.0**	**2.9**	**0.25**	**Minimum**	**0.0**	**0.0**	**1.4**	**0.25**
Maximum	**0.0**	**1**	**16.8**	**0.75**	**Maximum**	**0.0**	**1**	**17.4**	**0.75**
Mean	**0.0**	**0.01**	**7.91**	**0.375**	**Mean**	**0.0**	**0.63**	**7.11**	**0.425**
Standard Dev.	**0.0**	**0.1**	**3.34**	**0.177**	**Standard Dev.**	**0.0**	**0.485**	**3.39**	**0.169**
Geometric mean	**-**	**-**	**7.26**	**-**	**Geometric mean**	**-**	**-**	**6.32**	**-**
Median	**0.0**	**0.0**	**7.25**	**0.25**	**Median**	**0.0**	**1**	**6.45**	**0.5**
Calcite Index	**0.0**		**-**	**-**	**Calcite Index**	**0.6**		**-**	**-**

Table F.2: Pebble Count and Calcite at Reference and Mine-exposed Areas, FRO LAEMP, June 2018

RG_FODNGD					RG_MP1				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	4.1	-	1	0	0	1.8	-
2	0	0	2.7	-	2	0	0	10.0	-
3	0	0	2.9	-	3	0	0	6.4	-
4	0	0	3.6	-	4	0	0	7.5	-
5	0	0	7.0	-	5	0	0	8.1	-
6	0	0	5.0	-	6	0	0	7.5	-
7	0	0	6.6	-	7	0	0	6.9	-
8	0	0	4.5	-	8	0	1	6.5	-
9	0	0	6.8	-	9	0	0	5.5	-
10	0	0	4.2	0.5	10	0	0	5.6	0.5
11	0	0	6.0	-	11	0	0	8.9	-
12	0	0	8.9	-	12	0	0	4.0	-
13	0	0	4.8	-	13	0	0	5.9	-
14	0	0	3.2	-	14	0	0	7.0	-
15	0	0	4.2	-	15	0	0	11.1	-
16	0	0	6.5	-	16	0	0	8.1	-
17	0	0	5.5	-	17	0	0	7.1	-
18	0	0	8.7	-	18	0	0	3.9	-
19	0	0	3.9	-	19	0	0	4.0	-
20	0	0	6.0	0.5	20	0	0	4.5	0.5
21	0	0	10.5	-	21	0	0	3.1	-
22	0	0	9.7	-	22	0	0	5.4	-
23	0	0	9.5	-	23	0	0	7.6	-
24	0	0	6.5	-	24	0	0	15.2	-
25	0	0	6.5	-	25	0	0	10.3	-
26	0	0	5.5	-	26	0	0	3.2	-
27	0	0	4.0	-	27	0	0	7.3	-
28	0	0	8.4	-	28	0	0	6.9	-
29	0	0	BOULDER	-	29	0	0	5.3	-
30	0	0	5.5	0.25	30	0	0	6.9	0
31	0	0	3.3	-	31	0	0	6.7	-
32	0	0	5.0	-	32	0	0	16.5	-
33	0	0	13.4	-	33	0	0	6.8	-
34	0	0	4.2	-	34	0	0	11.8	-
35	0	0	5.3	-	35	0	0	5.0	-
36	0	0	2.5	-	36	0	0	4.1	-
37	0	0	5.2	-	37	0	0	4.1	-
38	0	0	6.1	-	38	0	0	10.3	-
39	0	0	4.5	-	39	0	0	9.6	-
40	0	0	6.2	0.5	40	0	0	3.2	0.25
41	0	0	7.2	-	41	0	0	6.0	-
42	0	0	11.2	-	42	0	0	10.5	-
43	0	0	11.2	-	43	0	0	2.4	-
44	0	1	5.1	-	44	0	0	5.5	-
45	0	1	20.0	-	45	0	0	2.4	-
46	0	0	5.2	-	46	0	0	2.3	-
47	0	1	5.8	-	47	0	0	7.1	-
48	0	0	8.1	-	48	0	0	2.4	-
49	0	0	6.1	-	49	0	0	3.1	-
50	0	0	4.9	0.25	50	0	0	4.2	0.75
51	0	0	6.8	-	51	0	0	6.0	-
52	0	0	5.1	-	52	0	0	3.9	-
53	0	0	11.0	-	53	0	0	5.1	-
54	0	0	5.5	-	54	0	0	7.0	-
55	0	0	5.3	-	55	0	0	3.5	-
56	0	0	9.5	-	56	0	0	3.5	-
57	0	0	3.1	-	57	0	0	5.5	-
58	0	0	7.2	-	58	0	0	4.8	-
59	0	0	4.0	-	59	0	0	4.6	-
60	0	1	9.8	0.25	60	0	0	2.2	0
61	0	0	11.2	-	61	0	0	3.1	-
62	0	0	7.3	-	62	0	0	9.4	-
63	0	1	9.2	-	63	0	0	3.2	-
64	0	0	4.8	-	64	0	0	6.4	-
65	0	0	7.4	-	65	0	0	3.0	-
66	0	0	11.8	-	66	0	0	9.0	-
67	0	1	5.3	-	67	0	0	BOULDER	-
68	0	0	4.6	-	68	0	0	5.8	-
69	0	0	3.6	-	69	0	0	4.4	-
70	0	1	8.4	0.5	70	0	0	8.0	0.25
71	0	0	6.0	-	71	0	0	3.1	-
72	0	0	7.1	-	72	0	0	18.0	-
73	0	0	5.6	-	73	0	0	9.0	-
74	0	1	21.0	-	74	0	0	3.4	-
75	0	0	3.5	-	75	0	0	15.2	-
76	0	0	3.5	-	76	0	0	9.1	-
77	0	0	8.0	-	77	0	0	5.5	-
78	0	0	4.3	-	78	0	0	9.2	-
79	0	0	10.6	-	79	0	0	10.5	-
80	0	0	5.4	0.25	80	0	0	4.5	0.25
81	0	0	9.6	-	81	0	0	5.5	-
82	0	1	9.8	-	82	0	0	7.4	-
83	0	0	3.9	-	83	0	0	2.0	-
84	0	0	7.6	-	84	0	0	5.8	-
85	0	0	11.1	-	85	0	0	7.8	-
86	0	0	9.1	-	86	0	0	6.3	-
87	0	0	3.7	-	87	0	0	4.5	-
88	0	0	7.6	-	88	0	0	8.6	-
89	0	0	4.5	-	89	0	0	2.3	-
90	0	0	8.0	0.5	90	0	0	6.2	0.75
91	0	0	8.7	-	91	0	0	7.5	-
92	0	0	5.2	-	92	0	0	11.2	-
93	0	0	7.0	-	93	0	0	1.3	-
94	0	0	5.5	-	94	0	0	7.0	-
95	0	0	3.9	-	95	0	0	17.0	-
96	0	0	11.2	-	96	0	0	13.3	-
97	0	0	3.4	-	97	0	0	6.6	-
98	0	0	5.7	-	98	0	0	3.2	-
99	0	0	9.4	-	99	0	0	3.7	-
100	0	0	4.0	0.5	100	0	0	6.4	0.25
Minimum	**0.0**	**0.0**	**2.5**	**0.25**	**Minimum**	**0.0**	**0.0**	**1.3**	**0.0**
Maximum	**0.0**	**1**	**21**	**0.5**	**Maximum**	**0.0**	**1**	**18**	**0.75**
Mean	**0.0**	**0.09**	**6.73**	**0.4**	**Mean**	**0.0**	**0.01**	**6.52**	**0.35**
Standard Dev.	**0.0**	**0.288**	**3.18**	**0.129**	**Standard Dev.**	**0.0**	**0.1**	**3.42**	**0.269**
Geometric mean	**-**	**-**	**6.14**	**-**	**Geometric mean**	**-**	**-**	**5.71**	**-**
Median	**0.0**	**0.0**	**6**	**0.5**	**Median**	**0.0**	**0.0**	**6**	**0.25**
Calcite Index	**0.1**		**-**	**-**	**Calcite Index**	**0.0**		**-**	**-**

Table F.2: Pebble Count and Calcite at Reference and Mine-exposed Areas, FRO LAEMP, June 2018

RG_FOUSH					RG_FOUKI				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	6.5	-	1	0	1	7.2	-
2	0	0	7.4	-	2	0	0	6.2	-
3	0	1	8.5	-	3	0	0	4.3	-
4	0	1	10.1	-	4	0	1	9.6	-
5	0	0	4.6	-	5	0	1	6.6	-
6	0	0	5.2	-	6	0	1	9.8	-
7	0	0	7.5	-	7	0	1	8.2	-
8	0	1	11.5	-	8	0	0	7.3	-
9	0	1	11.0	-	9	0	0	3.8	-
10	0	1	3.8	0	10	0	0	5.3	0.25
11	0	1	7.0	-	11	0	1	6.8	-
12	0	0	6.2	-	12	0	0	2.2	-
13	0	0	2.1	-	13	0	1	9.3	-
14	0	1	11.5	-	14	0	0	6.4	-
15	0	0	9.8	-	15	0	0	5.6	-
16	0	1	7.0	-	16	0	0	BOULDER	-
17	0	0	6.5	-	17	0	0	7.6	-
18	0	0	4.0	-	18	0	0	8.9	-
19	0	0	5.6	-	19	0	0	17.8	-
20	0	0	5.1	0.25	20	0	0	5.0	0.25
21	0	1	11.7	-	21	0	0	8.2	-
22	0	0	5.0	-	22	0	0	7.0	-
23	0	1	11.4	-	23	0	0	5.5	-
24	0	1	11.9	-	24	0	0	4.3	-
25	0	1	8.8	-	25	0	0	8.8	-
26	0	0	4.9	-	26	0	0	5.7	-
27	0	1	11.2	-	27	0	0	4.8	-
28	0	1	7.6	-	28	0	0	6.2	-
29	0	1	9.2	-	29	0	0	5.2	-
30	0	0	7.8	0.5	30	0	0	5.2	0.5
31	0	0	8.9	-	31	0	0	7.2	-
32	0	0	6.8	-	32	0	0	6.9	-
33	0	0	8.1	-	33	0	0	3.2	-
34	0	1	10.2	-	34	0	0	6.0	-
35	0	0	4.6	-	35	0	0	5.2	-
36	0	1	7.2	-	36	0	0	7.8	-
37	0	1	10.6	-	37	0	1	8.0	-
38	0	1	10.4	-	38	0	1	8.4	-
39	0	1	2.6	-	39	0	0	3.0	-
40	0	1	5.8	0.25	40	0	0	3.8	0.25
41	0	1	12.7	-	41	0	1	9.0	-
42	0	0	5.9	-	42	0	1	5.8	-
43	0	1	6.4	-	43	0	0	3.7	-
44	0	1	11.5	-	44	0	0	6.5	-
45	0	0	9.0	-	45	0	0	3.5	-
46	0	1	10.6	-	46	0	0	7.6	-
47	0	1	5.1	-	47	0	1	3.0	-
48	0	1	12.1	-	48	0	1	5.5	-
49	0	1	7.8	-	49	0	0	8.9	-
50	0	1	9.8	0.25	50	0	1	9.0	0.75
51	0	0	11.2	-	51	0	0	6.2	-
52	0	1	17.0	-	52	0	1	4.0	-
53	0	0	4.2	-	53	0	1	10.5	-
54	0	1	4.5	-	54	0	0	5.2	-
55	0	0	4.6	-	55	0	0	4.0	-
56	0	0	4.5	-	56	0	0	4.2	-
57	0	1	5.1	-	57	0	1	158.2	-
58	0	1	6.0	-	58	0	1	11.5	-
59	0	0	5.2	-	59	0	0	11.8	-
60	0	1	7.0	0.5	60	0	1	11.2	0.5
61	0	1	10.9	-	61	0	0	8.1	-
62	0	1	11.4	-	62	0	0	4.5	-
63	0	1	9.7	-	63	0	0	5.6	-
64	0	0	8.0	-	64	0	0	5.5	-
65	0	1	10.4	-	65	0	0	5.4	-
66	0	1	9.6	-	66	0	1	10.0	-
67	0	1	6.5	-	67	0	1	18.2	-
68	0	0	3.4	-	68	0	0	4.2	-
69	0	1	11.0	-	69	0	0	4.6	-
70	0	1	7.6	0.5	70	0	0	4.2	0.5
71	0	0	5.5	-	71	0	1	12.8	-
72	0	0	5.6	-	72	0	0	7.9	-
73	0	1	8.7	-	73	0	0	9.8	-
74	0	1	9.2	-	74	0	1	14.0	-
75	0	1	14.1	-	75	0	1	12.4	-
76	0	1	6.9	-	76	0	1	5.1	-
77	0	0	2.9	-	77	0	0	5.0	-
78	0	1	12.8	-	78	0	1	9.5	-
79	0	1	16.5	-	79	0	1	7.1	-
80	0	1	10.6	0.25	80	0	0	5.8	0.25
81	0	1	9.8	-	81	0	1	9.8	-
82	0	1	14.0	-	82	0	1	8.6	-
83	0	1	11.4	-	83	0	1	4.6	-
84	0	1	7.1	-	84	0	0	9.2	-
85	0	1	9.0	-	85	0	0	8.5	-
86	0	1	5.2	-	86	0	0	8.4	-
87	0	1	6.5	-	87	0	0	9.7	-
88	0	0	5.0	-	88	0	0	3.4	-
89	0	1	5.2	-	89	0	0	7.6	-
90	0	1	9.4	0.5	90	0	0	5.2	0.5
91	0	0	5.5	-	91	0	1	18.0	-
92	0	1	7.7	-	92	0	1	9.8	-
93	0	1	5.0	-	93	0	0	11.0	-
94	0	1	6.8	-	94	0	1	9.0	-
95	0	1	10.4	-	95	0	0	4.2	-
96	0	1	13.5	-	96	0	0	7.7	-
97	0	1	5.2	-	97	0	0	3.5	-
98	0	1	6.8	-	98	0	1	9.1	-
99	0	1	10.4	-	99	0	0	5.1	-
100	0	1	8.0	0.5	100	0	0	4.8	0.5
Minimum	**0.0**	**0.0**	**2.1**	**0.0**	**Minimum**	**0.0**	**0.0**	**2.2**	**0.25**
Maximum	**0.0**	**1.0**	**17**	**0.5**	**Maximum**	**0.0**	**1**	**158**	**0.75**
Mean	**0.0**	**0.67**	**8.09**	**0.35**	**Mean**	**0.0**	**0.34**	**8.73**	**0.425**
Standard Dev.	**0.0**	**0.473**	**3.06**	**0.175**	**Standard Dev.**	**0.0**	**0.476**	**15.5**	**0.169**
Geometric mean	**-**	**-**	**7.5**	**-**	**Geometric mean**	**-**	**-**	**6.83**	**-**
Median	**0.0**	**1**	**7.65**	**0.375**	**Median**	**0.0**	**0.0**	**6.8**	**0.5**
Calcite Index	**0.7**		**-**	**-**	**Calcite Index**	**0.3**		**-**	**-**

Table F.2: Pebble Count and Calcite at Reference and Mine-exposed Areas, FRO LAEMP, June 2018

RG_FOBKS					RG_FOBSC				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	7.9	-	1	0	1	5.6	-
2	0	0	2.4	-	2	0	1	3.1	-
3	0	0	7.8	-	3	0	1	5.8	-
4	0	0	5.8	-	4	0	1	3.6	-
5	0	1	3.2	-	5	0	1	3.8	-
6	0	0	4.6	-	6	0	1	19.0	-
7	0	0	4.0	-	7	0	1	5.5	-
8	0	0	2.1	-	8	0	1	3.2	-
9	0	1	5.0	-	9	0	1	5.2	-
10	0	0	4.0	0.25	10	0	1	7.3	0.5
11	0	1	7.9	-	11	0	1	3.2	-
12	0	0	7.0	-	12	0	1	4.2	-
13	0	0	4.9	-	13	0	1	4.6	-
14	0	0	5.8	-	14	0	1	6.5	-
15	0	1	11.6	-	15	0	1	4.0	-
16	0	0	4.2	-	16	0	1	5.2	-
17	0	1	8.2	-	17	0	1	5.5	-
18	0	1	8.8	-	18	0	1	6.2	-
19	0	0	4.2	-	19	0	1	8.0	-
20	0	0	3.5	0	20	0	0	4.5	0.25
21	0	1	10.3	-	21	0	1	7.8	-
22	0	1	10.6	-	22	0	1	6.5	-
23	0	0	6.0	-	23	0	1	4.9	-
24	0	0	7.1	-	24	0	1	4.7	-
25	0	0	5.4	-	25	0	1	4.9	-
26	0	0	8.5	-	26	0	0	4.8	-
27	0	0	5.8	-	27	0	1	5.6	-
28	0	0	11.6	-	28	0	0	2.2	-
29	0	0	8.1	-	29	0	0	3.9	-
30	0	1	10.0	0.5	30	0	1	10.0	0.25
31	0	0	6.6	-	31	0	0	4.8	-
32	0	1	9.0	-	32	0	1	5.8	-
33	0	0	8.0	-	33	0	0	5.1	-
34	0	1	11.3	-	34	0	1	8.6	-
35	0	0	6.5	-	35	0	1	9.3	-
36	0	0	5.5	-	36	0	0	3.4	-
37	0	1	7.4	-	37	0	0	5.2	-
38	0	0	7.4	-	38	0	1	4.3	-
39	0	0	4.8	-	39	0	0	4.2	-
40	0	1	11.5	0.25	40	0	0	4.6	0
41	0	0	3.4	-	41	0	1	3.4	-
42	0	0	4.7	-	42	0	0	4.1	-
43	0	1	8.5	-	43	0	0	10.2	-
44	0	0	4.4	-	44	0	1	6.9	-
45	0	0	3.2	-	45	0	0	3.7	-
46	0	0	9.2	-	46	0	0	12.1	-
47	0	0	7.5	-	47	0	0	6.8	-
48	0	0	8.4	-	48	0	0	3.1	-
49	0	0	5.3	-	49	0	0	7.2	-
50	0	1	5.2	0.25	50	0	1	7.8	0.5
51	0	1	7.4	-	51	0	0	4.2	-
52	0	0	9.2	-	52	0	0	6.0	-
53	0	0	10.2	-	53	0	0	4.5	-
54	0	0	9.7	-	54	0	0	9.1	-
55	0	0	5.8	-	55	0	0	4.6	-
56	0	0	7.7	-	56	0	0	4.1	-
57	0	1	9.8	-	57	0	0	3.2	-
58	0	0	9.2	-	58	0	0	4.5	-
59	0	1	8.2	-	59	0	0	6.0	-
60	0	1	11.2	0.75	60	0	0	7.1	0.25
61	0	0	4.2	-	61	0	0	5.2	-
62	0	0	7.1	-	62	0	0	4.0	-
63	0	1	10.5	-	63	0	0	7.4	-
64	0	1	13.0	-	64	0	0	7.2	-
65	0	1	9.0	-	65	0	0	2.7	-
66	0	1	8.5	-	66	0	0	3.9	-
67	0	0	9.8	-	67	0	0	4.9	-
68	0	1	7.8	-	68	0	0	5.1	-
69	0	1	12.5	-	69	0	0	6.6	-
70	0	1	10.5	0.5	70	0	0	7.4	0.25
71	0	1	11.4	-	71	0	0	6.9	-
72	0	1	9.5	-	72	0	0	5.9	-
73	0	0	4.1	-	73	0	0	6.4	-
74	0	0	8.2	-	74	0	0	5.4	-
75	0	0	8.7	-	75	0	1	6.6	-
76	0	1	10.4	-	76	0	0	8.4	-
77	0	0	5.4	-	77	0	1	5.1	-
78	0	0	7.2	-	78	0	0	5.2	-
79	0	0	13.2	-	79	0	1	8.2	-
80	0	1	8.6	0.5	80	0	1	9.1	0.25
81	0	1	9.6	-	81	0	0	3.1	-
82	0	0	10.2	-	82	0	0	4.2	-
83	0	0	4.3	-	83	0	1	6.4	-
84	0	0	7.5	-	84	0	1	3.9	-
85	0	1	17.0	-	85	0	1	6.0	-
86	0	0	7.5	-	86	0	1	4.9	-
87	0	0	11.5	-	87	0	1	6.2	-
88	0	0	5.8	-	88	0	1	4.2	-
89	0	0	7.1	-	89	0	1	4.5	-
90	0	1	7.2	0.5	90	0	1	7.8	0.25
91	0	1	8.5	-	91	1	1	6.3	-
92	0	0	5.9	-	92	1	1	5.8	-
93	0	0	4.6	-	93	1	1	4.2	-
94	0	0	4.2	-	94	0	1	3.6	-
95	0	0	4.9	-	95	1	1	3.5	-
96	0	0	10.8	-	96	0	1	4.5	-
97	0	0	3.8	-	97	0	0	3.6	-
98	0	0	11.8	-	98	0	1	5.8	-
99	0	0	BOULDER	-	99	0	1	3.6	-
100	0	1	9.2	0.5	100	1	1	4.2	0.5
Minimum	**0.0**	**0.0**	**2.1**	**0.0**	**Minimum**	**0.0**	**0.0**	**2.2**	**0.0**
Maximum	**0.0**	**1**	**17**	**0.75**	**Maximum**	**1**	**1**	**19**	**0.5**
Mean	**0.0**	**0.35**	**7.61**	**0.4**	**Mean**	**0.05**	**0.54**	**5.61**	**0.3**
Standard Dev.	**0.0**	**0.479**	**2.8**	**0.211**	**Standard Dev.**	**0.219**	**0.501**	**2.28**	**0.158**
Geometric mean	**-**	**-**	**7.07**	**-**	**Geometric mean**	**-**	**-**	**5.26**	**-**
Median	**0.0**	**0.0**	**7.7**	**0.5**	**Median**	**0.0**	**1**	**5.15**	**0.25**
Calcite Index	**0.4**		**-**	**-**	**Calcite Index**	**0.6**		**-**	**-**

Table F.2: Pebble Count and Calcite at Reference and Mine-exposed Areas, FRO LAEMP, June 2018

RG_FOBCP					RG_FRCP1SW				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	6.2	-	1	0	1	6.2	-
2	0	0	7.5	-	2	0	0	7.3	-
3	0	0	4.4	-	3	0	0	3.6	-
4	0	0	2.3	-	4	0	0	4.7	-
5	0	1	6.5	-	5	0	0	2.6	-
6	0	1	7.2	-	6	0	0	12.1	-
7	0	1	5.4	-	7	0	0	4.5	-
8	0	0	6.2	-	8	0	0	7.9	-
9	0	1	2.0	-	9	0	0	6.8	-
10	0	0	6.5	0.25	10	0	0	4.2	0.5
11	0	1	7.3	-	11	0	0	6.5	-
12	0	1	7.5	-	12	0	0	4.7	-
13	0	1	7.4	-	13	0	0	5.5	-
14	0	1	5.1	-	14	0	0	3.3	-
15	0	0	6.8	-	15	0	0	3.1	-
16	0	0	4.6	-	16	0	0	6.3	-
17	0	0	6.6	-	17	0	0	7.4	-
18	0	0	2.8	-	18	0	0	5.2	-
19	0	1	4.4	-	19	0	0	4.0	-
20	0	0	2.3	0.25	20	0	0	7.5	0.5
21	0	0	3.5	-	21	0	1	6.3	-
22	0	0	7.0	-	22	0	0	4.8	-
23	0	0	2.7	-	23	0	0	8.5	-
24	0	1	13.0	-	24	0	0	7.6	-
25	0	0	6.9	-	25	0	0	10.3	-
26	0	0	3.6	-	26	0	0	6.1	-
27	0	0	3.9	-	27	0	0	3.5	-
28	0	1	3.7	-	28	0	0	6.4	-
29	0	0	3.8	-	29	0	0	4.3	-
30	0	0	3.5	0	30	0	0	5.8	0.5
31	0	1	6.4	-	31	0	0	2.9	-
32	0	0	3.7	-	32	0	0	4.5	-
33	0	0	3.6	-	33	0	0	7.6	-
34	0	0	6.7	-	34	0	0	4.1	-
35	0	0	3.9	-	35	0	0	6.9	-
36	0	0	3.1	-	36	0	0	3.0	-
37	0	0	2.7	-	37	0	0	4.6	-
38	0	0	4.0	-	38	0	0	5.5	-
39	0	1	4.3	-	39	0	0	3.2	-
40	0	0	2.7	0.5	40	0	0	7.5	0.25
41	0	0	2.5	-	41	0	0	5.0	-
42	0	0	5.5	-	42	0	0	3.2	-
43	0	0	4.1	-	43	0	0	9.6	-
44	0	0	5.0	-	44	0	0	7.4	-
45	0	0	3.9	-	45	0	0	2.1	-
46	0	0	6.6	-	46	0	0	5.2	-
47	0	0	4.5	-	47	0	0	4.6	-
48	0	1	7.0	-	48	0	0	2.8	-
49	0	0	5.3	-	49	0	0	4.7	-
50	0	0	4.3	0.25	50	0	0	5.7	0.5
51	0	0	3.5	-	51	0	0	2.3	-
52	0	0	5.0	-	52	0	1	5.0	-
53	0	0	BOULDER	-	53	0	0	4.6	-
54	0	1	4.2	-	54	0	0	5.4	-
55	0	1	5.7	-	55	0	0	15.2	-
56	0	0	5.0	-	56	0	0	3.8	-
57	0	0	3.9	-	57	0	0	5.1	-
58	0	0	7.2	-	58	0	0	6.9	-
59	0	1	4.7	-	59	0	0	5.2	-
60	0	0	8.5	0	60	0	0	4.6	0.5
61	0	1	5.3	-	61	0	0	3.9	-
62	0	1	5.0	-	62	0	0	8.5	-
63	0	0	5.4	-	63	0	0	2.8	-
64	0	0	4.3	-	64	0	0	5.2	-
65	0	0	2.8	-	65	0	0	2.0	-
66	0	0	4.6	-	66	0	0	5.2	-
67	0	0	6.9	-	67	0	0	6.1	-
68	0	0	4.0	-	68	0	0	3.1	-
69	0	0	3.8	-	69	0	0	8.1	-
70	0	0	3.9	0	70	0	0	8.3	0.25
71	0	0	2.8	-	71	0	0	2.1	-
72	0	0	4.0	-	72	0	0	10.3	-
73	0	0	6.1	-	73	0	0	6.2	-
74	0	0	4.0	-	74	0	0	2.8	-
75	0	0	3.5	-	75	0	0	6.4	-
76	0	0	3.2	-	76	0	0	12.3	-
77	0	0	5.5	-	77	0	0	6.6	-
78	0	0	5.8	-	78	0	0	6.7	-
79	0	0	3.5	-	79	0	0	4.7	-
80	0	0	3.8	0.5	80	0	0	6.1	0.5
81	0	0	3.3	-	81	0	0	3.8	-
82	0	0	7.2	-	82	0	0	6.9	-
83	0	0	4.2	-	83	0	0	5.0	-
84	0	0	6.1	-	84	0	0	12.1	-
85	0	0	6.0	-	85	0	0	7.6	-
86	0	0	6.5	-	86	0	0	8.7	-
87	0	0	5.1	-	87	0	0	5.4	-
88	0	0	5.0	-	88	0	0	8.9	-
89	0	0	3.2	-	89	0	0	3.2	-
90	0	1	3.0	0.5	90	0	0	5.0	0
91	0	0	3.1	-	91	0	0	4.7	-
92	0	0	4.9	-	92	0	0	5.4	-
93	0	0	4.5	-	93	0	0	5.0	-
94	0	1	8.0	-	94	0	0	3.6	-
95	0	0	5.2	-	95	0	0	7.3	-
96	0	1	8.5	-	96	0	0	3.2	-
97	0	0	4.9	-	97	0	0	6.0	-
98	0	1	10.6	-	98	0	0	5.3	-
99	0	1	3.6	-	99	0	0	6.1	-
100	0	1	6.0	0.25	100	0	0	4.2	0
Minimum	**0.0**	**0.0**	**2**	**0.0**	**Minimum**	**0.0**	**0.0**	**2**	**0.0**
Maximum	**0.0**	**1**	**13**	**0.5**	**Maximum**	**0.0**	**1**	**15.2**	**0.5**
Mean	**0.0**	**0.25**	**5**	**0.25**	**Mean**	**0.0**	**0.03**	**5.7**	**0.35**
Standard Dev.	**0.0**	**0.435**	**1.84**	**0.204**	**Standard Dev.**	**0.0**	**0.171**	**2.39**	**0.211**
Geometric mean	**-**	**-**	**4.7**	**-**	**Geometric mean**	**-**	**-**	**5.25**	**-**
Median	**0.0**	**0.0**	**4.6**	**0.25**	**Median**	**0.0**	**0.0**	**5.2**	**0.5**
Calcite Index	**0.3**		**-**	**-**	**Calcite Index**	**0.0**		**-**	**-**

Table F.2: Pebble Count and Calcite at Reference and Mine-exposed Areas, FRO LAEMP, June 2018

RG_FRUPO					RG_FODPO				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	5.5	-	1	0	0	1.5	-
2	0	0	4.1	-	2	0	0	2.3	-
3	0	0	1.8	-	3	0	0	1.8	-
4	0	0	9.6	-	4	0	0	1.3	-
5	0	0	3.9	-	5	0	0	2.3	-
6	0	0	6.5	-	6	0	1	2.3	-
7	0	0	2.1	-	7	0	0	2.2	-
8	0	0	6.6	-	8	0	0	1.3	-
9	0	0	3.2	-	9	0	1	2.2	-
10	0	0	5.5	0	10	0	0	1.5	0.5
11	0	0	3.6	-	11	0	0	2.5	-
12	0	0	4.1	-	12	0	0	1.5	-
13	0	0	2.6	-	13	0	0	2.0	-
14	0	0	5.7	-	14	0	0	3.2	-
15	0	0	5.1	-	15	0	0	2.3	-
16	0	0	4.2	-	16	0	0	1.9	-
17	0	0	3.0	-	17	0	0	3.5	-
18	0	0	4.4	-	18	0	1	2.0	-
19	0	0	4.1	-	19	0	0	1.8	-
20	0	0	2.4	0.25	20	0	0	2.8	0.75
21	0	0	2.9	-	21	0	0	2.5	-
22	0	0	4.9	-	22	0	0	2.0	-
23	0	0	4.6	-	23	0	0	1.7	-
24	0	0	5.3	-	24	0	0	2.5	-
25	0	0	6.1	-	25	0	0	2.5	-
26	0	0	2.1	-	26	0	0	2.2	-
27	0	0	5.3	-	27	0	0	2.4	-
28	0	0	5.0	-	28	0	0	2.7	-
29	0	0	3.9	-	29	0	0	2.3	-
30	0	0	3.0	0.25	30	0	0	2.3	0.5
31	0	0	6.8	-	31	0	0	1.3	-
32	0	0	4.2	-	32	0	0	1.5	-
33	0	0	4.3	-	33	0	0	1.5	-
34	0	0	3.4	-	34	0	0	2.7	-
35	0	0	3.1	-	35	0	0	2.4	-
36	0	0	4.0	-	36	0	1	2.2	-
37	0	0	3.6	-	37	0	1	2.2	-
38	0	0	5.4	-	38	0	0	1.7	-
39	0	0	4.7	-	39	0	0	1.3	-
40	0	0	3.4	0	40	0	0	2.3	0.75
41	0	0	4.6	-	41	0	0	2.2	-
42	0	0	8.0	-	42	0	0	3.0	-
43	0	0	4.1	-	43	0	0	2.7	-
44	0	0	3.9	-	44	0	0	2.5	-
45	0	0	4.9	-	45	0	0	2.3	-
46	0	0	4.4	-	46	0	0	1.9	-
47	0	0	3.8	-	47	0	0	3.2	-
48	0	0	3.9	-	48	0	0	2.6	-
49	0	0	5.0	-	49	0	0	1.8	-
50	0	0	4.6	0.25	50	0	0	1.5	0.5
51	0	0	2.0	-	51	0	0	1.5	-
52	0	0	4.0	-	52	0	0	2.2	-
53	0	0	5.0	-	53	0	0	1.2	-
54	0	0	4.5	-	54	0	0	2.5	-
55	0	0	3.9	-	55	0	0	1.5	-
56	0	0	5.8	-	56	0	0	2.2	-
57	0	0	4.4	-	57	0	0	1.9	-
58	0	0	1.8	-	58	0	0	1.7	-
59	0	0	5.0	-	59	0	0	2.0	-
60	0	0	6.8	0.5	60	0	0	3.0	0.5
61	0	0	8.2	-	61	0	0	2.3	-
62	0	0	5.4	-	62	0	0	2.3	-
63	0	0	4.7	-	63	0	0	1.8	-
64	0	0	2.8	-	64	0	0	2.3	-
65	0	0	6.3	-	65	0	0	1.5	-
66	0	0	4.9	-	66	0	0	1.6	-
67	0	0	4.6	-	67	0	0	2.2	-
68	0	0	3.8	-	68	0	0	2.3	-
69	0	0	4.7	-	69	0	0	2.5	-
70	0	0	3.9	0.25	70	0	0	2.7	0.5
71	0	0	2.8	-	71	0	0	1.9	-
72	0	0	3.4	-	72	0	0	2.5	-
73	0	0	4.0	-	73	0	0	1.3	-
74	0	0	3.6	-	74	0	0	2.2	-
75	0	0	4.2	-	75	0	0	2.2	-
76	0	0	3.0	-	76	0	0	2.4	-
77	0	0	3.1	-	77	0	0	2.3	-
78	0	1	6.8	-	78	0	0	1.9	-
79	0	0	4.4	-	79	0	0	2.3	-
80	0	1	5.2	0.5	80	0	0	2.5	0.25
81	0	1	5.0	-	81	0	0	1.8	-
82	0	0	4.8	-	82	0	0	2.7	-
83	0	0	2.8	-	83	0	0	3.2	-
84	0	0	4.2	-	84	0	0	3.3	-
85	0	1	7.9	-	85	0	0	1.5	-
86	0	0	6.5	-	86	0	0	2.5	-
87	0	0	10.6	-	87	0	0	2.2	-
88	0	0	4.0	-	88	0	0	2.3	-
89	0	0	3.5	-	89	0	0	2.7	-
90	0	0	5.6	0.5	90	0	0	1.3	0.5
91	0	1	6.0	-	91	0	0	4.0	-
92	0	0	4.2	-	92	0	0	1.4	-
93	0	1	5.0	-	93	0	0	3.0	-
94	0	1	4.0	-	94	0	0	2.2	-
95	0	0	4.4	-	95	0	0	1.5	-
96	0	1	4.3	-	96	0	0	2.5	-
97	0	1	5.2	-	97	0	0	2.2	-
98	0	1	3.8	-	98	0	0	1.3	-
99	0	1	3.6	-	99	0	0	2.8	-
100	0	0	1.6	0	100	0	0	2.3	0.25
Minimum	**0.0**	**0.0**	**1.6**	**0.0**	**Minimum**	**0.0**	**0.0**	**1.15**	**0.25**
Maximum	**0.0**	**1**	**10.6**	**0.5**	**Maximum**	**0.0**	**1**	**4**	**0.75**
Mean	**0.0**	**0.11**	**4.51**	**0.25**	**Mean**	**0.0**	**0.05**	**2.15**	**0.5**
Standard Dev.	**0.0**	**0.314**	**1.54**	**0.204**	**Standard Dev.**	**0.0**	**0.219**	**0.551**	**0.167**
Geometric mean	**-**	**-**	**4.26**	**-**	**Geometric mean**	**-**	**-**	**2.07**	**-**
Median	**0.0**	**0.0**	**4.3**	**0.25**	**Median**	**0.0**	**0.0**	**2.2**	**0.5**
Calcite Index	**0.1**		**-**	**-**	**Calcite Index**	**0.1**		**-**	**-**

Table F.2: Pebble Count and Calcite at Reference and Mine-exposed Areas, FRO LAEMP, June 2018

RG_FO22					RG_FOUEW				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	3.2	-	1	0	1	7.8	-
2	0	1	3.1	-	2	0	1	5.8	-
3	0	0	1.5	-	3	0	1	4.2	-
4	0	1	2.2	-	4	0	1	6.9	-
5	0	0	2.0	-	5	0	1	7.2	-
6	0	1	2.3	-	6	0	1	6.2	-
7	0	1	3.0	-	7	0	1	5.4	-
8	0	1	5.5	-	8	0	1	6.8	-
9	0	0	2.2	-	9	0	1	5.8	-
10	0	1	3.0	0	10	0	1	4.7	0.25
11	0	1	4.2	-	11	0	0	8.2	-
12	0	1	1.2	-	12	0	0	3.9	-
13	0	1	3.1	-	13	0	0	4.5	-
14	0	1	1.4	-	14	0	1	11.6	-
15	0	1	3.4	-	15	0	0	4.0	-
16	0	1	2.2	-	16	0	0	6.5	-
17	0	1	2.6	-	17	0	1	8.4	-
18	0	1	2.7	-	18	0	1	9.7	-
19	0	0	SAND	-	19	0	1	10.4	-
20	0	1	2.0	0.25	20	0	0	4.1	0
21	0	0	1.4	-	21	0	0	4.9	-
22	0	1	2.0	-	22	0	1	6.5	-
23	0	1	2.0	-	23	0	0	5.8	-
24	0	1	1.9	-	24	0	1	3.6	-
25	0	1	1.7	-	25	0	1	3.9	-
26	0	1	1.9	-	26	0	1	2.7	-
27	0	1	3.4	-	27	0	1	6.0	-
28	0	0	3.7	-	28	0	1	5.9	-
29	0	1	4.6	-	29	0	0	6.5	-
30	0	1	2.0	0.25	30	0	1	9.4	0.5
31	0	0	1.8	-	31	0	0	4.6	-
32	0	1	2.9	-	32	0	1	4.9	-
33	0	1	2.4	-	33	0	0	1.7	-
34	0	1	2.0	-	34	0	1	14.5	-
35	0	1	2.7	-	35	0	0	4.0	-
36	0	1	4.0	-	36	0	0	2.9	-
37	0	0	2.1	-	37	0	0	3.2	-
38	0	0	1.3	-	38	0	0	4.4	-
39	0	1	2.9	-	39	0	0	4.9	-
40	0	1	2.1	0.5	40	0	1	12.6	0.25
41	0	1	2.6	-	41	0	1	12.5	-
42	0	0	3.1	-	42	0	1	7.9	-
43	0	1	2.3	-	43	0	1	7.5	-
44	0	1	2.9	-	44	0	0	5.6	-
45	0	1	3.1	-	45	0	0	5.2	-
46	0	1	4.6	-	46	0	1	9.5	-
47	0	0	SAND	-	47	0	1	10.4	-
48	0	0	2.0	-	48	0	0	4.8	-
49	0	1	3.1	-	49	0	0	2.9	-
50	0	0	2.5	0.5	50	0	1	4.2	0.25
51	0	1	2.0	-	51	0	0	3.7	-
52	0	1	4.6	-	52	0	1	13.0	-
53	0	1	2.9	-	53	0	1	2.4	-
54	0	1	2.5	-	54	0	1	4.9	-
55	0	0	2.6	-	55	0	0	6.9	-
56	0	0	2.6	-	56	0	1	8.0	-
57	0	1	4.7	-	57	0	1	9.6	-
58	0	0	SAND	-	58	0	0	4.2	-
59	0	1	1.8	-	59	0	1	6.8	-
60	0	1	3.8	0.25	60	0	1	9.2	0.25
61	0	1	1.4	-	61	0	0	3.9	-
62	0	0	1.3	-	62	0	1	6.1	-
63	0	1	2.3	-	63	0	0	5.0	-
64	0	1	3.1	-	64	0	1	4.4	-
65	0	1	1.4	-	65	0	0	6.4	-
66	0	1	1.3	-	66	0	1	7.0	-
67	0	1	1.6	-	67	0	0	6.8	-
68	0	1	2.8	-	68	0	0	3.8	-
69	0	1	2.6	-	69	0	1	5.0	-
70	0	0	2.5	0.25	70	0	0	3.8	0.5
71	0	0	3.2	-	71	0	1	7.0	-
72	0	1	5.0	-	72	0	1	4.8	-
73	0	0	2.9	-	73	0	1	5.5	-
74	0	0	2.8	-	74	0	0	5.9	-
75	0	1	3.2	-	75	0	0	6.4	-
76	0	0	4.6	-	76	0	0	5.4	-
77	0	1	3.1	-	77	0	0	6.2	-
78	0	0	3.1	-	78	0	0	5.4	-
79	0	1	4.2	-	79	0	0	4.1	-
80	0	0	2.3	0	80	0	0	6.0	0.25
81	0	1	2.9	-	81	0	0	3.4	-
82	0	1	4.2	-	82	0	0	2.5	-
83	0	0	2.0	-	83	0	0	4.5	-
84	0	1	3.2	-	84	0	1	3.8	-
85	0	1	2.2	-	85	0	0	5.2	-
86	0	0	1.2	-	86	0	1	8.9	-
87	0	1	2.5	-	87	0	1	7.4	-
88	0	0	1.1	-	88	0	0	4.0	-
89	0	0	2.9	-	89	0	1	8.5	-
90	0	1	3.5	0.5	90	0	1	7.8	0.25
91	0	1	3.0	-	91	0	0	4.8	-
92	0	1	4.9	-	92	0	0	6.7	-
93	0	1	3.4	-	93	0	1	5.2	-
94	0	0	3.2	-	94	0	0	3.2	-
95	0	1	2.8	-	95	0	0	3.7	-
96	0	1	2.0	-	96	0	1	5.8	-
97	0	0	3.9	-	97	0	1	5.0	-
98	0	0	2.8	-	98	0	0	5.2	-
99	0	0	3.2	-	99	0	1	4.2	-
100	0	1	2.5	0.25	100	0	0	6.2	0.25
Minimum	**0.0**	**0.0**	**1.1**	**0.0**	**Minimum**	**0.0**	**0.0**	**1.7**	**0.0**
Maximum	**0.0**	**1**	**5.5**	**0.5**	**Maximum**	**0.0**	**1**	**14.5**	**0.5**
Mean	**0.0**	**0.68**	**2.74**	**0.275**	**Mean**	**0.0**	**0.53**	**5.99**	**0.275**
Standard Dev.	**0.0**	**0.469**	**0.96**	**0.184**	**Standard Dev.**	**0.0**	**0.502**	**2.45**	**0.142**
Geometric mean	**-**	**-**	**2.57**	**-**	**Geometric mean**	**-**	**-**	**5.55**	**-**
Median	**0.0**	**1**	**2.7**	**0.25**	**Median**	**0.0**	**1**	**5.45**	**0.25**
Calcite Index	**0.7**		**-**	**-**	**Calcite Index**	**0.5**		**-**	**-**

Table F.3: *In Situ* Water Quality Reference and Mine-exposed Areas, FRO LAEMP, June 2018

Field Parameters	**Reference**		**Mine-exposed**													
	RG_HENUP	**RG_FO26**	**RG_FODHE**	**RG_FOUNGD**	**RG_FODNGD**	**RG_MP1**	**RG_FOUSH**	**RG_FOUKI**	**RG_FOBKS**	**RG_FOBSC**	**RG_FOBCP**	**RG_FRCP1SW**	**RG_FRUPO**	**RG_FODPO**	**RG_FO22**	**RG_FOUEW**
Date	12-Jun-18	13-Jun-18	12-Jun-18	11-Jun-18	11-Jun-18	11-Jun-18	11-Jun-18	11-Jun-18	12-Jun-18	12-Jun-18	14-Jun-18	13-Jun-18	13-Jun-18	19-Jun-18	13-Jun-18	13-Jun-18
Temperature (°C)	3.2	7.1	5.5	4.7	5.4	6.4	7.4	8.4	9.6	10.4	6.0	7.3	8.2	7.4	5.2	8.6
Dissolved Oxygen (mg/L)	11.2	11.8	11.4	10.8	10.9	10.6	10.4	10.2	10.2	10.2	9.8	11.6	12.3	12.5	10.9	12.9
Dissolved Oxygen (%)	84	98	91	84	86	86	87	88	89	91	79	97	105	105	86	112
Specific Conductivity (mS/cm)	235	262	330	266	439	445	451	493	624	662	736	762	8	742	837	774
Conductivity (µS/cm)	138	172	207	433	274	287	299	337	441	464	468	504	562	493	531	530
pH	8.3	8.4	8.3	8.4	8.2	8.1	8.1	8.0	8.3	8.3	8.0	8.2	8.2	8.8	8.1	8.0

Table F.4: Channel Depth and Velocity at Kick and Sweep Sampling Locations in Reference and Mine-exposed Areas, FRO LAEMP, June 2018

Replicate		1	2	3	4	5	6	7	8	Mean
Reference	**RG_HENUP**									
	Distance from shore (m)	0.4	1.7	2.6	3.5	4.4	5.3	6.2	7.1	**-**
	Depth (cm)	13	24	19	14	18	28	29	25	**21.2**
	Velocity (m/s)	0.050	0.27	0.81	0.43	0.67	0.72	0.41	0.60	**0.495**
	RG_FO26									
	Distance from shore (m)	0.3	1.0	1.8	2.5	3.3	4.0	5.3	-	**-**
	Depth (cm)	5	17	13	22	20	14	20	-	**15.9**
	Velocity (m/s)	0.13	0.63	0.77	0.74	0.65	1.24	1.17	-	**0.761**
Mine-exposed	**RG_FODHE**									
	Distance from shore (m)	0.5	1.8	3.0	4.3	5.5	6.8	8.0	9.3	**-**
	Depth (cm)	17	32	28	32	20	30	30	23	**26.5**
	Velocity (m/s)	0.36	0.32	0.80	0.47	1.17	0.58	1.00	0.20	**0.613**
	RG_FOUNGD									
	Distance from shore (m)	0.3	1.3	2.3	3.3	4.3	5.3	6.3	7.3	**-**
	Depth (cm)	4	13	27	35	35	38	41	11	**25.4**
	Velocity (m/s)	0.030	0.13	0.32	0.34	0.22	0.23	0.17	0.030	**0.184**
	RG_FODNGD									
	Distance from shore (m)	0.5	1.8	3.0	4.3	5.5	6.8	8.0	9.3	**-**
	Depth (cm)	22	35	35	38	50	45	40	45	**38.8**
	Velocity (m/s)	0.23	0.67	0.76	0.51	0.55	0.55	0.56	0.30	**0.516**
	RG_MP1									
	Distance from shore (m)	0.4	1.5	2.0	2.4	-	-	-	-	**-**
	Depth (cm)	17	30	35	40	1	-	-	-	**24.6**
	Velocity (m/s)	0.30	0.92	0.27	0.19	0.75	-	-	-	**0.486**
	RG_FOUSH									
	Distance from shore (m)	0.5	1.8	3.0	4.3	5.5	6.8	8.0	9.3	**-**
	Depth (cm)	10	35	40	40	50	50	35	20	**35.0**
	Velocity (m/s)	0.13	0.88	0.60	0.94	0.80	0.57	0.59	0.52	**0.629**
	RG_FOUKI									
	Distance from shore (m)	0.8	2.0	3.3	4.5	5.8	7.0	8.3	9.5	**-**
	Depth (cm)	8	30	40	45	45	55	30	25	**34.8**
	Velocity (m/s)	0.50	0.75	0.92	0.87	0.95	1.00	0.43	0.22	**0.705**
	RG_FOBKS									
	Distance from shore (m)	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	**-**
	Depth (cm)	50	29	10	20	25	27	30	21	**26.5**
	Velocity (m/s)	0.60	0.47	0.35	0.74	0.54	0.60	0.59	0.33	**0.528**
	RG_FOBSC									
	Distance from shore (m)	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	**-**
	Depth (cm)	33	24	22	27	25	21	22	35	**26.1**
	Velocity (m/s)	0.52	0.63	0.70	0.73	0.59	0.48	0.52	0.49	**0.583**
	RG_FOBCP									
	Distance from shore (m)	1.0	3.0	5.0	7.0	9.0	11.0	13.0	15.0	**-**
	Depth (cm)	10	18	35	35	40	45	40	18	**30.1**
	Velocity (m/s)	0.39	0.63	0.57	0.59	0.61	0.56	0.42	0.15	**0.490**
	RG_FRCP1SW									
	Distance from shore (m)	0.5	2.0	3.5	5.0	6.5	8.0	9.5	11.0	**-**
	Depth (cm)	11	16	21	19	21	19	28	80	**26.9**
	Velocity (m/s)	0.23	0.53	0.52	0.58	0.53	0.76	0.97	0.89	**0.626**
	RG_FRUPO									
	Distance from shore (m)	1.0	3.0	5.0	7.0	9.0	11.0	13.0	15.0	**-**
	Depth (cm)	40	8	8	9	40	55	30	45	**29.4**
	Velocity (m/s)	0.65	0.36	0.36	0.58	0.80	0.97	0.95	0.97	**0.705**
	RG_FODPO									
	Distance from shore (m)	-	-	-	-	-	-	-	-	**-**
	Depth (cm)	-	-	-	-	-	-	-	-	**-**
	Velocity (m/s)	-	-	-	-	-	-	-	-	**-**
	RG_FO22									
	Distance from shore (m)	0.5	1.5	2.5	3.5	4.5	-	-	-	**-**
	Depth (cm)	28	35	40	45	65	-	-	-	**42.6**
	Velocity (m/s)	0.50	0.58	0.60	0.58	0.59	-	-	-	**0.570**
	RG_FOUEW									
	Distance from shore (m)	0.8	2.3	3.8	5.3	6.8	9.3	10.8	12.3	**-**
	Depth (cm)	15	40	55	55	55	60	45	25	**43.8**
	Velocity (m/s)	0.60	0.97	0.79	0.83	0.72	0.92	0.91	0.59	**0.791**

Table F.5: **Habitat Information at Reference and Mine-exposed Areas, FRO LAEMP, August 2018**

Station ID	Reference	Mine-exposed				
	RG_HENUP	**RG_FODHE**	**RG_FOUNGD**	**RG_FODNGD**	**RG_MP1**	**RG_FOUSH**
Waterbody	Henretta Creek	Fording River	Fording River	Fording River	Fording River	Fording River
Date Sampled	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18
Zone 11 UTMs - E	655796	651320	651007	650882	651154	650873
Zone 11 UTMs - N	5567705	5565422	5563473	5563195	5562441	5560964
Elevation	1,804	1,687	1,658	1,662	1,645	1,628
Samplers' Initials	TN, TW	TN, TW	TN, TW	TN, TW	TN, TW	TN, TW
Habitat Characteristics						
Site Access Description	-	-	-	-	-	-
Surrounding Land Use	forest	forest, mining	mining	mining	mining	mining
Anthropogenic Influences	none	-	-	-	FRO	-
Length of Reach Assessed (m)	50	100	50	-	50	50
Bank Stability	unstable, substantial erosion	stable, no erosion	stable, no erosion / moderate	stable, no erosion	stable, no erosion	stable, no erosion
Water Colour & Clarity	colourless, clear	colourless, clear	colourless, clear	colourless, clear	-	colourless, clear
Channel Measurements						
Bankfull Width (m)	9	68	26	14	16	18
Wetted Width (m)	7	8	8	12	9	11
Bankfull-Wetted Depth (cm)	75	100	-	75	100	75
Gradient (%)	>1	>1	-	1	~1	>1
CABIN						
Samplers' Initials	TW	-	-	-	-	-
Sampling Time (min)	3	-	-	-	-	-
Total Kick Distance (m)	20	-	-	-	-	-
Number of Jars	1	-	-	-	-	-
Number of transects	3	-	-	-	-	-
Distance from shore (m)	-	-	-	-	-	-

Table F.5: Habitat Information at Reference and Mine-exposed Areas, FRO LAEMP, August 2018

Station ID	Mine-exposed					
	RG_FOUKI	**RG_FOBKS**	**RG_FOBSC**	**RG_FOBCP**	**RG_FRCP1SW**	**RG_FRUPO**
Waterbody	Fording River	Fording River	Fording River	Fording River	Fording River	Fording River
Date Sampled	3-Aug-18	3-Aug-15	3-Aug-18	3-Aug-18	1-Aug-18	1-Aug-18
Zone 11 UTMs - E	651843	652076	652339	652867	653389	653895
Zone 11 UTMs - N	5559849	5558651	5558200	5557134	5556195	5555949
Elevation	1,606	1,596	1,591	1,576	1,574	1,866
Samplers' Initials	TN, TW	TN, TW	TN, TW	TN, TW	TN, TW	TN, TW
Habitat Characteristics						
Site Access Description	-	-	-	-	-	-
Surrounding Land Use	mining	mining	mining	forest, mining	forest, logging, mining	forest, logging, mining
Anthropogenic Influences	FRO	-	-	-	-	FRO upstream
Length of Reach Assessed (m)	50	50	50	50	50	50
Bank Stability	stable, no erosion / moderate	stable, no erosion	stable, no erosion	stable, no erosion / moderate	stable, no erosion / moderate	moderate
Water Colour & Clarity	colourless, clear	colourless, clear	colourless, clear	-	colourless, clear	colourless, clear
Channel Measurements						
Bankfull Width (m)	14	23	30	20	18	18
Wetted Width (m)	10	12	23	12	8	9
Bankfull-Wetted Depth (cm)	50	~75	50	50	100	75
Gradient (%)	~1	1	1	1.5	~1	1
CABIN						
Samplers' Initials	TW	TW	-	-	TW	TW
Sampling Time (min)	3	3	-	-	3	3
Total Kick Distance (m)	24	30	-	-	-	25
Number of Jars	1	1	-	-	1	2
Number of transects	2	3	-	-	-	-
Distance from shore (m)	-	-	-	-	-	-

Table F.5: **Habitat Information at Reference and Mine-exposed Areas, FRO LAEMP, August 2018**

Station ID	Mine-exposed		
	RG_FODPO	**RG_FO22**	**RG_FOUEW**
Waterbody	Fording River	Fording River	Fording River
Date Sampled	1-Aug-18	1-Aug-18	1-Aug-18
Zone 11 UTMs - E	653862	654793	656355
Zone 11 UTMs - N	5555055	5553609	5551887
Elevation	1,559	1,553	1,552
Samplers' Initials	TN, TW	TN, TW	TN, TW
Habitat Characteristics			
Site Access Description	-	-	parked near gun range gate ~200m walking
Surrounding Land Use	forest, logging, mining	forest	forest, logging, mining
Anthropogenic Influences	downstream of FRO at GHO	downstream of FRO at GHO	FRO and GHO upstream
Length of Reach Assessed (m)	50	50	50
Bank Stability	stable, no erosion / moderate	moderate	moderate / unstable, substantial erosion
Water Colour & Clarity	colourless, clear	colourless, clear	colourless, clear
Channel Measurements			
Bankfull Width (m)	23	20	25
Wetted Width (m)	9	14	13
Bankfull-Wetted Depth (cm)	75	~ 100	150
Gradient (%)	~1	~ 1	~1
CABIN			
Samplers' Initials	TW	TW	TW
Sampling Time (min)	3	3	3
Total Kick Distance (m)	20	20	30
Number of Jars	1	1	1
Number of transects	3	4	-
Distance from shore (m)	-	-	-

Table F.6: Pebble Count and Calcite at Reference and Mine-exposed Areas, FRO LAEMP, August 2018

RG_HENUP					RG_FODHE				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	8.2	-	1	0	0	3.8	-
2	0	0	4.4	-	2	0	0	7.3	-
3	0	0	16.0	-	3	0	0	4.8	-
4	0	0	6.8	-	4	0	0	8.7	-
5	0	0	11.5	-	5	0	0	10.0	-
6	0	0	6.5	-	6	0	0	7.5	-
7	0	0	4.4	-	7	0	0	9.6	-
8	0	0	6.4	-	8	0	0	9.2	-
9	0	0	5.7	-	9	0	0	5.6	-
10	0	0	10.0	0	10	0	0	5.7	0
11	0	0	2.8	-	11	0	0	15.3	-
12	0	0	7.0	-	12	0	0	5.3	-
13	0	0	11.4	-	13	0	0	7.5	-
14	0	0	5.7	-	14	0	0	11.8	-
15	0	0	15.5	-	15	0	0	10.6	-
16	0	0	5.0	-	16	0	0	1.5	-
17	0	0	3.6	-	17	0	0	3.4	-
18	0	0	21.1	-	18	0	0	8.3	-
19	0	0	8.0	-	19	0	0	6.1	-
20	0	0	5.5	0	20	0	0	6.5	0.50
21	0	0	1.8	-	21	0	0	6.9	-
22	0	0	1.3	-	22	0	0	4.7	-
23	0	0	12.8	-	23	0	0	7.3	-
24	0	0	10.5	-	24	0	0	2.0	-
25	0	0	4.7	-	25	0	0	6.7	-
26	0	0	9.6	-	26	0	0	6.9	-
27	0	0	11.0	-	27	0	0	9.3	-
28	0	0	6.0	-	28	0	0	7.0	-
29	0	0	7.2	-	29	0	0	9.4	-
30	0	0	8.0	0.25	30	0	0	6.5	0.25
31	0	0	6.0	-	31	0	0	13.5	-
32	0	0	6.0	-	32	0	0	10.5	-
33	0	0	7.0	-	33	0	0	6.3	-
34	0	0	4.5	-	34	0	0	8.8	-
35	0	0	4.6	-	35	0	0	10.5	-
36	0	0	4.8	-	36	0	0	6.0	-
37	0	0	19.2	-	37	0	0	5.6	-
38	0	0	6.5	-	38	0	0	7.6	-
39	0	0	9.5	-	39	0	0	9.7	-
40	0	0	4.9	0	40	0	0	7.1	0.75
41	0	0	6.5	-	41	0	0	5.0	-
42	0	0	9.1	-	42	0	0	10.1	-
43	0	0	5.2	-	43	0	0	4.5	-
44	0	0	5.3	-	44	0	0	4.7	-
45	0	0	7.7	-	45	0	0	5.7	-
46	0	0	9.8	-	46	0	0	5.6	-
47	0	0	8.3	-	47	0	0	3.9	-
48	0	0	25.0	-	48	0	0	11.0	-
49	0	0	9.5	-	49	0	0	6.8	-
50	0	0	12.0	0	50	0	0	5.1	0
51	0	0	7.5	-	51	0	0	11.7	-
52	0	0	6.0	-	52	0	0	5.1	-
53	0	0	12.8	-	53	0	0	5.4	-
54	0	0	10.4	-	54	0	0	11.0	-
55	0	0	11.0	-	55	0	0	12.4	-
56	0	0	15.1	-	56	0	0	4.7	-
57	0	0	8.5	-	57	0	0	6.9	-
58	0	0	16.8	-	58	0	0	6.8	-
59	0	0	3.8	-	59	0	0	6.4	-
60	0	0	14.5	0.25	60	0	0	19.2	0.75
61	0	0	3.0	-	61	0	0	5.8	-
62	0	0	4.7	-	62	0	0	9.9	-
63	0	0	7.9	-	63	0	0	7.1	-
64	0	0	16.5	-	64	0	0	2.4	-
65	0	0	12.5	-	65	0	0	10.2	-
66	0	0	6.4	-	66	0	0	2.9	-
67	0	0	4.6	-	67	0	0	0.8	-
68	0	0	7.9	-	68	0	0	4.0	-
69	0	0	3.6	-	69	0	0	8.4	-
70	0	0	15.7	0	70	0	0	5.4	0
71	0	0	8.5	-	71	0	0	9.6	-
72	0	0	9.2	-	72	0	0	4.0	-
73	0	0	8.3	-	73	0	0	6.1	-
74	0	0	6.2	-	74	0	0	5.9	-
75	0	0	8.6	-	75	0	0	3.9	-
76	0	0	3.6	-	76	0	0	3.3	-
77	0	0	1.6	-	77	0	0	4.7	-
78	0	0	5.7	-	78	0	0	7.5	-
79	0	0	11.8	-	79	0	0	6.6	-
80	0	0	4.9	0	80	0	0	7.3	0.50
81	0	0	7.4	-	81	0	0	4.4	-
82	0	0	10.0	-	82	0	0	7.8	-
83	0	0	9.9	-	83	0	0	2.8	-
84	0	0	13.5	-	84	0	0	3.9	-
85	0	0	2.9	-	85	0	0	11.9	-
86	0	0	8.5	-	86	0	0	4.6	-
87	0	0	9.0	-	87	0	0	15.6	-
88	0	0	15.5	-	88	0	0	10.8	-
89	0	0	10.1	-	89	0	0	7.3	-
90	0	0	8.0	0	90	0	0	3.7	0
91	0	0	10.6	-	91	0	0	6.5	-
92	0	0	7.7	-	92	0	0	9.2	-
93	0	0	4.0	-	93	0	0	6.8	-
94	0	0	15.1	-	94	0	0	2.5	-
95	0	0	11.5	-	95	0	0	2.6	-
96	0	0	5.8	-	96	0	0	8.6	-
97	0	0	1.8	-	97	0	0	6.1	-
98	0	0	11.4	-	98	0	0	4.9	-
99	0	0	14.9	-	99	0	0	4.3	-
100	0	0	10.1	0.25	100	0	0	11.0	0.25
Minimum	**0.0**	**0.0**	**1.3**	**0.0**	**Minimum**	**0.0**	**0.0**	**0.8**	**0.0**
Maximum	**0.0**	**0.0**	**25**	**0.25**	**Maximum**	**0.0**	**0.0**	**19.2**	**0.75**
Mean	**0.0**	**0.0**	**8.55**	**0.075**	**Mean**	**0.0**	**0.0**	**7.04**	**0.3**
Standard Dev.	**0.0**	**0.0**	**4.39**	**0.121**	**Standard Dev.**	**0.0**	**0.0**	**3.18**	**0.307**
Geometric mean	**-**	**-**	**7.45**	**-**	**Geometric mean**	**-**	**-**	**6.30**	**-**
Median	**0.0**	**0.0**	**7.95**	**0.0**	**Median**	**0.0**	**0.0**	**6.65**	**0.3**
Calcite Index	**0.0**		**-**	**-**	**Calcite Index**	**0.0**		**-**	**-**

Table F.6: Pebble Count and Calcite at Reference and Mine-exposed Areas, FRO LAEMP, August 2018

RG_FOUNGD					RG_FODNGD				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	5.3	-	1	0	0	6.5	-
2	0	0	7.6	-	2	0	0	16.5	-
3	0	0	2.5	-	3	0	0	3.4	-
4	0	0	10.0	-	4	0	0	10.0	-
5	0	0	3.0	-	5	0	0	5.5	-
6	0	0	5.7	-	6	0	0	8.3	-
7	0	0	4.8	-	7	0	0	2.3	-
8	0	0	7.1	-	8	0	0	8.8	-
9	0	0	7.2	-	9	0	0	6.5	-
10	0	0	1.9	0	10	0	0	5.1	0
11	0	0	9.5	-	11	0	0	3.3	-
12	0	0	6.7	-	12	0	0	13.5	-
13	0	0	6.3	-	13	0	0	8.5	-
14	0	0	6.8	-	14	0	0	5.9	-
15	0	0	5.4	-	15	0	0	3.3	-
16	0	0	2.5	-	16	0	0	6.2	-
17	0	0	4.4	-	17	0	0	5.7	-
18	0	0	5.3	-	18	0	0	4.2	-
19	0	0	3.2	-	19	0	0	12.5	-
20	0	0	7.4	0	20	0	0	15.7	0.75
21	0	0	3.7	-	21	0	0	10.1	-
22	0	0	2.3	-	22	0	1	9.3	-
23	0	0	2.8	-	23	0	0	9.4	-
24	0	0	5.7	-	24	0	0	8.2	-
25	0	0	1.6	-	25	0	0	9.7	-
26	0	0	2.9	-	26	0	0	7.9	-
27	0	0	4.6	-	27	0	0	9.8	-
28	0	0	4.8	-	28	0	0	5.1	-
29	0	0	3.2	-	29	0	0	2.2	-
30	0	0	2.4	0.25	30	0	0	6.3	0
31	0	0	5.5	-	31	0	0	5.4	-
32	0	0	3.5	-	32	0	0	1.8	-
33	0	0	8.9	-	33	0	0	14.5	-
34	0	0	10.0	-	34	0	0	3.4	-
35	0	0	5.9	-	35	0	0	3.0	-
36	0	0	10.3	-	36	0	0	5.8	-
37	0	0	11.1	-	37	0	0	3.8	-
38	0	0	6.0	-	38	0	0	9.3	-
39	0	0	9.1	-	39	0	1	9.2	-
40	0	0	12.8	0.50	40	0	1	3.9	0
41	0	0	5.4	-	41	0	0	5.1	-
42	0	0	6.2	-	42	0	0	3.2	-
43	0	0	12.7	-	43	0	0	41.0	-
44	0	0	7.5	-	44	0	0	5.6	-
45	0	0	5.9	-	45	0	0	5.3	-
46	0	0	6.2	-	46	0	0	10.4	-
47	0	0	5.5	-	47	0	0	8.9	-
48	0	0	8.2	-	48	0	0	4.5	-
49	0	0	4.4	-	49	0	0	23.1	-
50	0	0	2.8	0	50	0	0	6.0	0.25
51	0	0	3.3	-	51	0	0	8.0	-
52	0	0	9.5	-	52	0	0	4.2	-
53	0	0	6.4	-	53	0	0	5.6	-
54	0	0	3.6	-	54	0	0	12.2	-
55	0	0	5.6	-	55	0	0	3.5	-
56	0	0	6.4	-	56	0	0	4.1	-
57	0	0	5.2	-	57	0	0	4.2	-
58	0	0	6.0	-	58	0	0	4.6	-
59	0	0	6.6	-	59	0	0	4.6	-
60	0	0	4.0	0	60	0	0	3.9	0
61	0	0	10.5	-	61	0	0	13.8	-
62	0	0	9.1	-	62	0	0	2.1	-
63	0	0	10.1	-	63	0	1	19.1	-
64	0	0	3.2	-	64	0	0	10.1	-
65	0	0	7.1	-	65	0	0	4.4	-
66	0	0	4.4	-	66	0	0	5.2	-
67	0	0	9.6	-	67	0	0	6.9	-
68	0	0	10.6	-	68	0	0	5.2	-
69	0	0	5.7	-	69	0	0	6.1	-
70	0	0	4.5	0	70	0	0	8.6	0.25
71	0	0	9.9	-	71	0	1	10.9	-
72	0	0	5.9	-	72	0	0	2.8	-
73	0	0	4.7	-	73	0	0	3.5	-
74	0	0	4.7	-	74	0	0	5.5	-
75	0	0	6.2	-	75	0	0	5.4	-
76	0	0	5.9	-	76	0	0	7.6	-
77	0	0	5.4	-	77	0	0	10.6	-
78	0	0	4.1	-	78	0	0	3.9	-
79	0	0	4.7	-	79	0	0	3.0	-
80	0	0	6.1	0	80	0	0	6.6	0
81	0	0	5.6	-	81	0	0	20.1	-
82	0	0	10.8	-	82	0	0	2.5	-
83	0	0	4.7	-	83	0	0	3.7	-
84	0	0	4.2	-	84	0	0	5.5	-
85	0	0	16.5	-	85	0	0	2.9	-
86	0	0	6.9	-	86	0	0	3.8	-
87	0	0	11.5	-	87	0	0	3.0	-
88	0	0	13.5	-	88	0	0	8.4	-
89	0	0	4.0	-	89	0	0	3.5	-
90	0	0	6.6	0	90	0	0	5.7	0.75
91	0	0	6.4	-	91	0	0	8.4	-
92	0	0	4.5	-	92	0	0	5.5	-
93	0	0	7.5	-	93	0	0	7.9	-
94	0	0	5.1	-	94	0	1	12.1	-
95	0	0	3.2	-	95	0	0	7.4	-
96	0	0	6.4	-	96	0	0	6.9	-
97	0	0	3.1	-	97	0	0	9.6	-
98	0	0	3.9	-	98	0	0	12.2	-
99	0	0	5.2	-	99	0	1	9.4	-
100	0	0	11.5	0	100	0	1	8.2	0
Minimum	**0.0**	**0.0**	**1.6**	**0.0**	**Minimum**	**0.0**	**0.0**	**1.8**	**0.0**
Maximum	**0.0**	**0.0**	**16.5**	**0.5**	**Maximum**	**0.0**	**1**	**41**	**0.75**
Mean	**0.0**	**0.0**	**6.25**	**0.075**	**Mean**	**0.0**	**0.08**	**7.46**	**0.2**
Standard Dev.	**0.0**	**0.0**	**2.86**	**0.169**	**Standard Dev.**	**0.0**	**0.273**	**5.26**	**0.307**
Geometric mean	**-**	**-**	**5.64**	**-**	**Geometric mean**	**-**	**-**	**6.29**	**-**
Median	**0.0**	**0.0**	**5.7**	**0.0**	**Median**	**0.0**	**0.0**	**5.95**	**0.0**
Calcite Index	**0.0**		**-**	**-**	**Calcite Index**	**0.1**		**-**	**-**

Table F.6: Pebble Count and Calcite at Reference and Mine-exposed Areas, FRO LAEMP, August 2018

RG_MP1					RG_FOUSH				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	7.9	-	1	0	0	8.0	-
2	0	0	9.5	-	2	0	0	9.6	-
3	0	0	12.5	-	3	0	0	6.4	-
4	0	1	7.4	-	4	0	0	4.4	-
5	0	1	4.4	-	5	0	1	22.0	-
6	0	0	7.4	-	6	0	0	4.5	-
7	0	0	10.1	-	7	0	1	9.0	-
8	0	0	4.5	-	8	0	0	5.0	-
9	0	0	24.5	-	9	0	1	7.4	-
10	0	1	9.5	0	10	0	1	18.0	0.75
11	0	0	8.9	-	11	0	0	5.5	-
12	0	0	15.1	-	12	0	1	18.0	-
13	0	1	12.6	-	13	0	1	11.5	-
14	0	1	4.9	-	14	0	1	9.5	-
15	0	0	7.9	-	15	0	1	7.5	-
16	0	1	8.3	-	16	0	1	13.4	-
17	0	0	8.1	-	17	0	1	5.0	-
18	0	0	5.5	-	18	0	0	7.5	-
19	0	0	4.1	-	19	0	1	21.6	-
20	0	0	24.5	0	20	0	1	10.5	0.50
21	0	1	4.1	-	21	0	1	9.0	-
22	0	1	6.1	-	22	0	0	6.8	-
23	0	0	2.6	-	23	0	0	7.8	-
24	0	1	9.9	-	24	0	0	5.0	-
25	0	1	34.0	-	25	0	0	5.4	-
26	0	0	7.8	-	26	0	0	7.1	-
27	0	0	2.8	-	27	0	1	10.5	-
28	0	0	0.9	-	28	0	0	11.0	-
29	0	0	4.5	-	29	0	0	9.6	-
30	0	0	2.0	0	30	0	0	7.4	0
31	0	1	6.2	-	31	0	0	11.2	-
32	0	1	5.9	-	32	0	0	4.7	-
33	0	0	3.6	-	33	0	0	5.4	-
34	0	0	6.1	-	34	0	0	6.6	-
35	0	0	4.5	-	35	0	1	18.0	-
36	0	0	2.1	-	36	0	1	6.0	-
37	0	1	6.4	-	37	0	1	8.9	-
38	0	0	2.5	-	38	0	1	11.2	-
39	0	0	4.4	-	39	0	1	21.2	-
40	0	0	6.8	0.25	40	0	0	6.9	0
41	0	1	5.6	-	41	0	1	10.1	-
42	0	1	5.0	-	42	0	1	12.9	-
43	0	0	10.9	-	43	0	0	6.9	-
44	0	0	11.7	-	44	0	0	7.0	-
45	0	0	4.2	-	45	0	0	8.9	-
46	0	0	6.4	-	46	0	0	2.9	-
47	0	1	7.1	-	47	0	0	7.2	-
48	0	1	6.5	-	48	0	1	19.7	-
49	0	0	12.9	-	49	0	1	17.8	-
50	0	0	15.6	0.75	50	0	1	6.5	0
51	0	1	4.4	-	51	0	1	11.0	-
52	0	0	5.1	-	52	0	1	12.5	-
53	0	0	8.1	-	53	0	1	7.7	-
54	0	1	7.8	-	54	0	1	9.9	-
55	0	0	3.5	-	55	0	1	5.5	-
56	0	0	5.2	-	56	0	1	9.5	-
57	0	0	5.8	-	57	0	1	7.4	-
58	0	0	5.0	-	58	0	1	10.1	-
59	0	0	3.5	-	59	0	0	5.6	-
60	0	0	5.4	0.75	60	0	1	10.7	0
61	0	0	1.6	-	61	0	0	7.6	-
62	0	0	6.0	-	62	0	1	11.1	-
63	0	0	3.1	-	63	0	1	11.5	-
64	0	0	2.0	-	64	0	1	10.6	-
65	0	0	3.9	-	65	0	0	6.6	-
66	0	0	5.1	-	66	0	0	6.5	-
67	0	0	8.4	-	67	0	0	6.0	-
68	0	0	8.2	-	68	0	1	11.9	-
69	0	0	2.4	-	69	0	0	6.9	-
70	0	0	3.4	0	70	0	0	7.4	0.25
71	0	1	13.7	-	71	0	1	12.4	-
72	0	1	8.1	-	72	0	0	4.1	-
73	0	0	8.6	-	73	0	0	2.4	-
74	0	0	7.5	-	74	0	1	9.6	-
75	0	1	5.9	-	75	0	1	11.8	-
76	0	1	17.9	-	76	0	0	7.5	-
77	0	0	12.9	-	77	0	0	5.3	-
78	0	0	6.5	-	78	0	1	12.1	-
79	0	0	4.9	-	79	0	1	8.1	-
80	0	1	11.1	0	80	0	1	10.9	0
81	0	0	9.0	-	81	0	1	8.8	-
82	0	0	9.4	-	82	0	1	10.9	-
83	0	1	17.0	-	83	0	0	7.7	-
84	0	1	6.9	-	84	0	0	7.2	-
85	0	0	4.3	-	85	0	1	10.7	-
86	0	1	7.9	-	86	0	0	6.4	-
87	0	1	4.4	-	87	0	0	7.5	-
88	0	1	9.8	-	88	0	1	17.5	-
89	0	1	6.4	-	89	0	1	8.6	-
90	0	0	3.7	0.50	90	0	1	15.5	0.50
91	0	1	5.3	-	91	0	1	9.9	-
92	0	1	5.4	-	92	0	1	6.6	-
93	0	0	4.3	-	93	0	1	9.0	-
94	0	0	9.3	-	94	0	1	10.9	-
95	0	0	2.9	-	95	0	1	14.6	-
96	0	0	5.5	-	96	0	0	5.4	-
97	0	0	6.5	-	97	0	1	10.9	-
98	0	0	7.4	-	98	0	1	9.5	-
99	0	1	5.9	-	99	0	0	5.9	-
100	0	0	5.5	0.75	100	0	0	10.8	0
Minimum	**0.0**	**0.0**	**0.9**	**0.0**	**Minimum**	**0.0**	**0.0**	**2.4**	**0**
Maximum	**0.0**	**1**	**34**	**0.75**	**Maximum**	**0.0**	**1**	**22**	**0.75**
Mean	**0.0**	**0.33**	**7.39**	**0.3**	**Mean**	**0.0**	**0.56**	**9.38**	**0.2**
Standard Dev.	**0.0**	**0.473**	**4.97**	**0.35**	**Standard Dev.**	**0.0**	**0.499**	**4.06**	**0.284**
Geometric mean	**-**	**-**	**6.22**	**-**	**Geometric mean**	**-**	**-**	**8.62**	**-**
Median	**0.0**	**0.0**	**6.15**	**0.1**	**Median**	**0.0**	**1**	**8.85**	**0**
Calcite Index	**0.3**		**-**	**-**	**Calcite Index**	**0.6**		**-**	**-**

Table F.6: Pebble Count and Calcite at Reference and Mine-exposed Areas, FRO LAEMP, August 2018

RG_FOUKI					RG_FOBKS				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	7.0	-	1	0	1	8.9	-
2	0	0	5.1	-	2	0	1	5.6	-
3	0	1	7.2	-	3	0	1	8.2	-
4	0	0	11.4	-	4	0	1	9.2	-
5	0	0	14.5	-	5	0	1	12.1	-
6	0	0	5.7	-	6	0	1	5.8	-
7	0	0	2.8	-	7	0	0	3.4	-
8	0	0	6.6	-	8	0	1	8.8	-
9	0	0	3.2	-	9	0	0	6.5	-
10	0	0	8.9	0.25	10	0	1	13.1	0
11	0	0	8.9	-	11	0	1	8.0	-
12	0	1	23.0	-	12	0	1	6.8	-
13	0	1	21.0	-	13	0	0	9.5	-
14	0	0	10.9	-	14	0	1	5.8	-
15	0	0	7.9	-	15	0	1	9.6	-
16	0	1	7.5	-	16	0	1	6.6	-
17	0	1	9.6	-	17	0	0	5.4	-
18	0	1	28.5	-	18	0	1	9.8	-
19	0	0	9.7	-	19	0	1	6.4	-
20	0	0	12.5	0	20	0	1	10.0	0
21	0	1	7.5	-	21	0	1	12.8	-
22	0	0	7.5	-	22	0	0	5.5	-
23	0	0	6.5	-	23	0	1	7.3	-
24	0	0	11.1	-	24	0	0	7.1	-
25	0	0	9.9	-	25	0	0	8.0	-
26	0	0	7.8	-	26	0	0	7.1	-
27	0	0	6.4	-	27	0	1	6.4	-
28	0	0	9.4	-	28	0	1	9.0	-
29	0	0	4.4	-	29	0	0	6.3	-
30	0	0	6.2	0	30	0	1	4.1	0
31	0	0	6.4	-	31	0	0	6.5	-
32	0	0	5.4	-	32	0	0	4.9	-
33	0	0	9.9	-	33	0	0	2.9	-
34	0	1	9.9	-	34	0	0	7.4	-
35	0	1	10.6	-	35	0	0	2.5	-
36	0	0	2.3	-	36	0	1	4.0	-
37	0	0	3.5	-	37	0	1	12.0	-
38	0	0	6.8	-	38	0	0	5.6	-
39	0	0	4.4	-	39	0	0	3.7	-
40	0	0	7.2	0	40	0	1	8.6	0.25
41	0	1	9.4	-	41	0	0	6.4	-
42	0	0	2.8	-	42	0	1	6.6	-
43	0	1	8.5	-	43	0	0	3.9	-
44	0	1	35.5	-	44	0	0	5.7	-
45	0	1	6.5	-	45	0	0	4.1	-
46	0	0	5.4	-	46	0	0	4.4	-
47	0	0	5.4	-	47	0	1	7.8	-
48	0	0	4.6	-	48	0	0	8.9	-
49	0	0	8.2	-	49	0	1	7.5	-
50	0	0	10.1	0.50	50	0	1	7.8	0
51	0	0	8.2	-	51	0	1	9.1	-
52	0	0	10.1	-	52	0	1	8.8	-
53	0	0	89.4	-	53	0	1	15.2	-
54	0	1	9.5	-	54	0	1	8.6	-
55	0	1	11.0	-	55	0	1	9.1	-
56	0	0	2.5	-	56	0	0	5.1	-
57	0	1	9.4	-	57	0	0	6.1	-
58	0	1	18.5	-	58	0	1	8.9	-
59	0	0	2.0	-	59	0	0	8.9	-
60	0	1	11.6	0.75	60	0	1	13.6	0
61	0	0	3.1	-	61	0	1	9.1	-
62	0	0	4.2	-	62	0	1	8.9	-
63	0	0	8.9	-	63	0	1	9.4	-
64	0	1	8.5	-	64	0	1	9.0	-
65	0	0	4.1	-	65	0	0	6.5	-
66	0	0	8.0	-	66	0	0	6.2	-
67	0	0	5.5	-	67	0	1	11.3	-
68	0	1	17.6	-	68	0	1	17.1	-
69	0	0	9.5	-	69	0	0	5.8	-
70	0	0	8.6	0	70	0	0	5.6	0.25
71	0	1	9.8	-	71	0	1	7.3	-
72	0	0	3.6	-	72	0	1	7.5	-
73	0	0	9.5	-	73	0	1	4.5	-
74	0	0	8.0	-	74	0	0	4.4	-
75	0	0	12.5	-	75	0	0	5.9	-
76	0	0	8.9	-	76	0	1	6.5	-
77	0	0	9.1	-	77	0	0	5.7	-
78	0	0	15.7	-	78	0	0	4.3	-
79	0	0	3.9	-	79	0	0	5.1	-
80	0	1	10.3	0	80	0	1	6.2	0
81	0	0	5.7	-	81	0	1	6.1	-
82	0	1	5.8	-	82	0	0	7.0	-
83	0	1	9.9	-	83	0	1	5.5	-
84	0	1	4.5	-	84	0	0	7.1	-
85	0	1	12.4	-	85	0	0	4.4	-
86	0	1	11.2	-	86	0	0	3.1	-
87	0	1	4.7	-	87	0	0	5.2	-
88	0	0	9.0	-	88	0	0	5.8	-
89	0	0	5.6	-	89	0	0	3.4	-
90	0	0	5.6	0	90	0	1	9.6	0.25
91	0	0	5.9	-	91	0	0	5.6	-
92	0	0	6.5	-	92	0	0	4.7	-
93	0	0	5.5	-	93	0	0	3.2	-
94	0	0	8.4	-	94	0	0	5.6	-
95	0	0	2.8	-	95	0	0	4.9	-
96	0	0	4.4	-	96	0	1	11.8	-
97	0	0	7.9	-	97	0	0	4.4	-
98	0	0	6.0	-	98	0	0	4.0	-
99	0	0	5.4	-	99	0	0	3.7	-
100	0	0	6.5	0	100	0	0	2.6	0
Minimum	**0.0**	**0.0**	**2**	**0**	**Minimum**	**0.0**	**0.0**	**2.5**	**0.0**
Maximum	**0.0**	**1**	**89.4**	**0.75**	**Maximum**	**0.0**	**1**	**17.1**	**0.25**
Mean	**0.0**	**0.29**	**9.27**	**0.15**	**Mean**	**0.0**	**0.5**	**7.02**	**0.075**
Standard Dev.	**0.0**	**0.456**	**9.54**	**0.269**	**Standard Dev.**	**0.0**	**0.503**	**2.76**	**0.121**
Geometric mean	**-**	**-**	**7.56**	**-**	**Geometric mean**	**-**	**-**	**6.52**	**-**
Median	**0.0**	**0.0**	**7.9**	**0**	**Median**	**0.0**	**0.5**	**6.5**	**0.0**
Calcite Index	**0.3**		**-**	**-**	**Calcite Index**	**0.5**		**-**	**-**

Table F.6: Pebble Count and Calcite at Reference and Mine-exposed Areas, FRO LAEMP, August 2018

RG_FOBSC					RG_FOBCP				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	7.4	-	1	0	1	6.9	-
2	0	1	10.0	-	2	0	1	8.7	-
3	0	1	9.7	-	3	0	0	5.5	-
4	0	1	6.0	-	4	0	1	9.6	-
5	0	1	11.4	-	5	0	0	4.3	-
6	0	1	6.6	-	6	0	1	14.2	-
7	0	1	4.7	-	7	0	0	8.9	-
8	0	0	10.2	-	8	0	1	12.4	-
9	0	0	10.5	-	9	0	0	8.3	-
10	0	0	2.5	0.25	10	0	0	11.1	0.25
11	0	1	8.6	-	11	0	0	6.8	-
12	0	1	8.8	-	12	0	0	6.8	-
13	0	1	4.4	-	13	0	0	8.2	-
14	0	1	6.0	-	14	0	0	10.5	-
15	0	1	4.0	-	15	0	0	9.6	-
16	0	0	5.9	-	16	0	1	14.5	-
17	0	0	9.6	-	17	0	0	10.7	-
18	0	0	7.1	-	18	0	0	14.6	-
19	0	0	7.7	-	19	0	1	9.1	-
20	0	0	11.1	0.25	20	0	1	10.4	0.25
21	0	0	7.8	-	21	0	0	3.0	-
22	0	0	6.2	-	22	0	1	10.4	-
23	0	0	4.5	-	23	0	1	5.6	-
24	0	0	8.5	-	24	0	0	5.0	-
25	0	1	9.1	-	25	0	1	5.8	-
26	0	0	4.4	-	26	0	1	8.5	-
27	0	1	5.6	-	27	0	1	9.1	-
28	0	1	9.7	-	28	0	0	5.3	-
29	0	1	11.5	-	29	0	0	9.0	-
30	0	1	27.0	0	30	0	0	9.5	0
31	0	1	9.6	-	31	0	0	11.6	-
32	0	1	9.1	-	32	0	0	11.1	-
33	0	1	7.2	-	33	0	0	8.0	-
34	0	1	6.0	-	34	0	0	4.5	-
35	0	1	13.4	-	35	0	0	3.4	-
36	0	1	14.5	-	36	0	1	10.3	-
37	0	1	9.3	-	37	0	0	11.0	-
38	0	0	4.1	-	38	0	0	7.1	-
39	0	1	7.4	-	39	0	0	8.2	-
40	0	1	10.1	0.50	40	0	0	8.5	0.25
41	0	0	5.4	-	41	0	1	6.4	-
42	0	1	10.1	-	42	0	0	6.5	-
43	0	0	5.1	-	43	0	0	13.2	-
44	0	0	3.5	-	44	0	0	7.5	-
45	0	0	8.3	-	45	0	0	9.9	-
46	0	1	6.1	-	46	0	0	10.5	-
47	0	1	8.2	-	47	0	0	2.6	-
48	0	1	11.2	-	48	0	1	9.9	-
49	0	0	8.2	-	49	0	1	7.5	-
50	0	0	11.0	0	50	0	1	11.9	0.50
51	0	0	6.5	-	51	0	0	6.8	-
52	0	0	11.9	-	52	0	1	15.5	-
53	0	0	8.5	-	53	0	0	6.2	-
54	0	0	9.1	-	54	0	1	10.5	-
55	0	0	3.5	-	55	0	1	6.4	-
56	0	0	6.6	-	56	0	1	12.3	-
57	0	1	11.1	-	57	0	1	13.0	-
58	0	0	7.4	-	58	0	1	6.5	-
59	0	0	13.1	-	59	0	0	15.2	-
60	0	0	4.2	0	60	0	0	7.5	0.50
61	0	0	9.9	-	61	0	1	13.0	-
62	0	1	8.5	-	62	0	0	12.4	-
63	0	0	5.6	-	63	0	0	7.5	-
64	0	1	15.5	-	64	0	0	9.9	-
65	0	1	-	-	65	0	0	7.0	-
66	0	0	8.7	-	66	0	1	3.1	-
67	0	1	7.4	-	67	0	1	15.4	-
68	0	1	15.9	-	68	0	0	10.4	-
69	0	1	9.7	-	69	0	0	11.6	-
70	0	1	6.4	0.25	70	0	1	13.9	0
71	0	1	11.0	-	71	0	1	8.6	-
72	0	1	5.5	-	72	0	0	4.4	-
73	0	1	10.1	-	73	0	1	10.5	-
74	0	1	8.5	-	74	0	1	6.4	-
75	0	1	8.8	-	75	0	1	20.6	-
76	0	1	7.0	-	76	0	0	10.0	-
77	0	1	15.5	-	77	0	0	6.4	-
78	0	1	9.5	-	78	0	1	18.8	-
79	0	1	6.9	-	79	0	1	14.0	-
80	0	1	7.4	0	80	0	1	5.9	0.50
81	0	0	2.6	-	81	0	1	8.1	-
82	0	1	11.7	-	82	0	1	5.8	-
83	0	0	9.8	-	83	0	1	5.4	-
84	0	1	12.1	-	84	0	1	13.9	-
85	0	0	4.7	-	85	0	1	7.2	-
86	0	0	6.8	-	86	0	1	5.1	-
87	0	0	8.5	-	87	0	1	15.4	-
88	0	0	20.8	-	88	0	0	2.2	-
89	0	1	10.6	-	89	0	1	7.3	-
90	0	1	8.9	0.50	90	0	1	7.9	0
91	0	0	6.9	-	91	0	0	10.6	-
92	0	1	10.9	-	92	0	1	7.9	-
93	0	0	2.5	-	93	0	1	8.2	-
94	0	1	11.6	-	94	0	0	4.5	-
95	0	0	4.5	-	95	0	1	13.2	-
96	0	0	6.5	-	96	0	0	9.1	-
97	0	0	3.9	-	97	0	0	6.7	-
98	0	0	4.9	-	98	0	1	8.8	-
99	0	0	8.7	-	99	0	0	8.4	-
100	0	1	20.9	0.50	100	0	0	8.9	0
Minimum	**0.0**	**0.0**	**2.5**	**0.0**	**Minimum**	**0.0**	**0.0**	**2.2**	**0.0**
Maximum	**0.0**	**1**	**27**	**0.5**	**Maximum**	**0.0**	**1**	**20.6**	**0.5**
Mean	**0.0**	**0.55**	**8.6**	**0.225**	**Mean**	**0.0**	**0.48**	**9.06**	**0.225**
Standard Dev.	**0.0**	**0.5**	**3.89**	**0.219**	**Standard Dev.**	**0.0**	**0.502**	**3.49**	**0.219**
Geometric mean	**-**	**-**	**7.84**	**-**	**Geometric mean**	**-**	**-**	**8.37**	**-**
Median	**0.0**	**1.00**	**8.5**	**0.25**	**Median**	**0.0**	**0.0**	**8.65**	**0.3**
Calcite Index	**0.6**		**-**	**-**	**Calcite Index**	**0.5**		**-**	**-**

Table F.6: Pebble Count and Calcite at Reference and Mine-exposed Areas, FRO LAEMP, August 2018

RG_FRCP1SW					RG_FRUPO				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	0	10.4	-	1	0	0	5.4	-
2	0	0	5.0	-	2	0	0	4.3	-
3	0	0	5.2	-	3	0	0	4.8	-
4	0	0	10.7	-	4	0	0	4.5	-
5	0	0	6.0	-	5	0	0	5.2	-
6	0	0	3.7	-	6	0	0	3.9	-
7	0	0	10.4	-	7	0	0	5.8	-
8	0	0	7.0	-	8	0	0	4.9	-
9	0	0	6.4	-	9	0	0	1.9	-
10	0	0	6.0	0.25	10	0	0	7.9	0
11	0	0	15.2	-	11	0	0	3.3	-
12	0	0	11.5	-	12	0	0	6.0	-
13	0	0	4.3	-	13	0	0	6.0	-
14	0	0	3.9	-	14	0	0	5.9	-
15	0	1	4.1	-	15	0	0	2.5	-
16	0	1	8.2	-	16	0	0	5.1	-
17	0	0	7.1	-	17	0	0	11.2	-
18	0	0	7.5	-	18	0	0	5.9	-
19	0	0	3.4	-	19	0	0	4.5	-
20	0	1	5.0	0.25	20	0	0	4.4	0
21	0	0	4.9	-	21	0	0	3.2	-
22	0	0	6.4	-	22	0	0	4.4	-
23	0	0	5.4	-	23	0	0	4.4	-
24	0	0	5.2	-	24	1	0	5.8	-
25	0	0	12.1	-	25	0	0	5.4	-
26	0	0	7.1	-	26	0	0	6.5	-
27	0	0	5.5	-	27	0	0	5.2	-
28	0	0	11.0	-	28	0	0	5.5	-
29	0	0	5.4	-	29	0	0	3.7	-
30	0	0	10.7	0	30	0	0	6.5	0
31	0	0	5.0	-	31	0	0	5.7	-
32	0	0	8.0	-	32	0	0	3.5	-
33	0	0	5.8	-	33	0	0	6.8	-
34	0	0	6.4	-	34	0	0	5.5	-
35	0	0	4.0	-	35	0	0	7.0	-
36	0	0	13.0	-	36	0	0	5.1	-
37	0	0	6.5	-	37	0	0	4.5	-
38	0	0	4.6	-	38	0	0	4.7	-
39	0	0	5.6	-	39	0	0	10.0	-
40	0	0	3.1	0	40	0	0	5.4	0
41	0	0	6.5	-	41	0	0	5.5	-
42	0	0	2.4	-	42	0	0	5.8	-
43	0	0	6.8	-	43	0	0	4.0	-
44	0	0	5.4	-	44	0	0	5.5	-
45	0	1	6.9	-	45	0	0	8.6	-
46	0	0	3.0	-	46	0	0	5.3	-
47	0	0	6.4	-	47	0	0	2.7	-
48	0	0	11.4	-	48	0	0	3.4	-
49	0	0	8.1	-	49	0	0	5.4	-
50	0	0	9.0	0.50	50	0	0	4.6	0
51	0	0	5.1	-	51	0	0	6.4	-
52	0	0	6.1	-	52	0	0	8.2	-
53	0	0	7.0	-	53	0	0	7.6	-
54	0	0	9.5	-	54	0	0	3.3	-
55	0	0	4.1	-	55	0	0	7.8	-
56	0	0	8.0	-	56	0	0	3.6	-
57	0	0	6.3	-	57	0	0	6.6	-
58	0	0	4.5	-	58	0	0	8.4	-
59	0	0	7.0	-	59	0	0	4.2	-
60	0	0	4.2	0	60	0	0	5.3	0
61	0	0	5.6	-	61	0	0	3.9	-
62	0	0	7.4	-	62	0	0	6.2	-
63	0	0	7.6	-	63	0	0	7.4	-
64	0	0	6.4	-	64	0	0	4.3	-
65	0	0	4.7	-	65	0	0	6.5	-
66	0	0	6.4	-	66	0	0	5.6	-
67	0	0	5.3	-	67	0	0	6.6	-
68	0	0	9.2	-	68	0	0	5.7	-
69	0	0	5.2	-	69	0	0	8.2	-
70	0	0	7.5	0	70	0	0	7.9	0.25
71	0	0	6.5	-	71	0	0	5.0	-
72	0	0	11.4	-	72	0	0	4.9	-
73	0	0	16.0	-	73	0	0	4.4	-
74	0	0	7.5	-	74	0	0	3.5	-
75	0	0	9.1	-	75	0	1	6.5	-
76	0	0	7.2	-	76	0	1	7.0	-
77	0	0	9.4	-	77	0	1	5.9	-
78	0	0	6.6	-	78	0	0	3.2	-
79	0	0	3.9	-	79	0	1	5.2	-
80	0	0	2.5	0	80	0	1	3.6	0
81	0	0	12.2	-	81	0	0	2.6	-
82	0	0	6.4	-	82	0	0	5.3	-
83	0	0	5.9	-	83	0	0	2.8	-
84	0	0	6.0	-	84	0	0	4.0	-
85	0	0	11.0	-	85	0	0	3.8	-
86	0	0	9.9	-	86	0	1	7.8	-
87	0	0	6.8	-	87	0	0	6.8	-
88	0	0	6.1	-	88	0	0	3.0	-
89	0	0	8.5	-	89	0	1	11.2	-
90	0	0	8.0	0.25	90	0	0	6.5	0
91	0	0	6.5	-	91	0	1	4.0	-
92	0	0	5.4	-	92	0	0	5.5	-
93	0	0	6.4	-	93	0	0	5.3	-
94	0	0	6.2	-	94	0	1	11.0	-
95	0	0	4.1	-	95	0	1	5.7	-
96	0	0	8.9	-	96	0	0	5.7	-
97	0	0	2.4	-	97	0	0	5.5	-
98	0	0	5.2	-	98	0	0	4.4	-
99	0	0	4.5	-	99	0	0	2.5	-
100	0	0	5.9	0	100	0	0	6.7	0
Minimum	**0.0**	**0.0**	**2.4**	**0.0**	**Minimum**	**0.0**	**0.0**	**1.9**	**0.0**
Maximum	**0.0**	**1**	**16**	**0.5**	**Maximum**	**1**	**1**	**11.2**	**0.25**
Mean	**0.0**	**0.04**	**6.86**	**0.125**	**Mean**	**0.01**	**0.1**	**5.46**	**0.025**
Standard Dev.	**0.0**	**0.197**	**2.66**	**0.177**	**Standard Dev.**	**0.1**	**0.302**	**1.84**	**0.079**
Geometric mean	**-**	**-**	**6.39**	**-**	**Geometric mean**	**-**	**-**	**5.17**	**-**
Median	**0.0**	**0.0**	**6.4**	**0.0**	**Median**	**0.0**	**0.0**	**5.4**	**0.0**
Calcite Index	**0.0**		**-**	**-**	**Calcite Index**	**0.1**		**-**	**-**

Table F.6: Pebble Count and Calcite at Reference and Mine-exposed Areas, FRO LAEMP, August 2018

RG_FODPO					RG_FO22				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	4.0	-	1	0	0	3.8	-
2	0	1	5.4	-	2	0	0	1.1	-
3	0	1	7.5	-	3	0	0	3.0	-
4	0	1	5.4	-	4	0	0	2.9	-
5	0	1	5.5	-	5	0	1	3.4	-
6	0	0	2.6	-	6	0	1	4.5	-
7	0	1	3.4	-	7	0	1	1.5	-
8	0	1	3.1	-	8	0	0	0.9	-
9	0	0	2.9	-	9	0	0	3.7	-
10	0	1	5.4	0	10	0	1	3.8	0
11	0	0	2.9	-	11	0	1	3.4	-
12	0	1	5.0	-	12	0	0	1.2	-
13	0	1	5.9	-	13	0	1	3.2	-
14	0	1	5.1	-	14	0	0	4.0	-
15	0	1	5.5	-	15	0	0	2.8	-
16	0	0	5.4	-	16	0	1	4.4	-
17	0	1	4.5	-	17	0	0	3.0	-
18	0	1	3.0	-	18	0	1	3.7	-
19	0	1	5.0	-	19	0	0	2.9	-
20	0	1	6.0	0	20	0	1	1.8	0
21	0	1	3.7	-	21	0	0	3.2	-
22	0	1	3.7	-	22	0	1	5.1	-
23	0	1	3.0	-	23	0	1	6.2	-
24	0	1	4.1	-	24	0	0	2.4	-
25	0	0	0.8	-	25	0	1	2.7	-
26	0	1	3.6	-	26	0	0	2.0	-
27	0	1	1.6	-	27	0	1	3.3	-
28	0	0	0.9	-	28	0	1	4.7	-
29	0	1	6.0	-	29	0	1	4.0	-
30	0	1	7.0	0	30	0	1	3.5	0
31	0	1	7.9	-	31	0	1	3.1	-
32	0	1	7.2	-	32	0	1	7.4	-
33	0	1	4.5	-	33	0	1	2.1	-
34	0	0	2.6	-	34	0	1	3.2	-
35	0	1	5.4	-	35	0	0	1.1	-
36	0	1	5.5	-	36	0	1	2.9	-
37	0	1	5.7	-	37	0	1	2.5	-
38	0	0	4.5	-	38	0	0	2.5	-
39	0	1	4.2	-	39	0	1	2.8	-
40	0	1	7.4	0	40	0	1	4.4	0
41	0	1	6.9	-	41	0	1	2.2	-
42	0	1	4.9	-	42	0	1	3.7	-
43	0	1	6.3	-	43	0	1	3.8	-
44	0	1	4.0	-	44	0	1	4.4	-
45	0	0	5.5	-	45	0	0	0.8	-
46	0	1	3.3	-	46	0	0	1.5	-
47	0	0	3.2	-	47	0	0	2.1	-
48	0	1	2.5	-	48	0	0	3.5	-
49	0	0	4.2	-	49	0	1	3.1	-
50	0	1	5.5	0.50	50	0	1	4.4	0
51	0	0	5.5	-	51	0	1	3.3	-
52	0	1	5.2	-	52	0	1	3.4	-
53	0	1	5.3	-	53	0	1	3.2	-
54	0	0	3.2	-	54	0	1	2.1	-
55	0	1	4.5	-	55	0	0	1.4	-
56	0	1	11.1	-	56	0	0	2.6	-
57	0	1	4.2	-	57	0	0	3.5	-
58	0	1	5.5	-	58	0	0	2.1	-
59	0	0	3.0	-	59	0	0	5.5	-
60	0	1	5.9	0	60	0	0	1.2	0
61	0	1	5.1	-	61	0	1	2.6	-
62	0	1	5.0	-	62	0	1	3.5	-
63	0	1	6.2	-	63	0	1	4.4	-
64	0	1	7.6	-	64	0	1	2.9	-
65	0	1	9.0	-	65	0	1	2.5	-
66	0	1	4.6	-	66	0	0	1.6	-
67	0	1	3.6	-	67	0	1	3.9	-
68	0	1	5.7	-	68	0	0	0.7	-
69	0	0	3.0	-	69	0	1	1.8	-
70	0	0	3.5	0	70	0	1	2.2	0
71	0	1	6.4	-	71	0	1	3.9	-
72	0	0	7.6	-	72	0	0	3.1	-
73	0	1	5.8	-	73	0	0	1.7	-
74	0	1	6.9	-	74	0	0	1.2	-
75	0	1	4.0	-	75	0	0	2.0	-
76	0	1	6.0	-	76	0	1	3.6	-
77	0	0	4.8	-	77	0	1	4.9	-
78	0	1	4.2	-	78	0	1	6.5	-
79	0	1	5.5	-	79	0	1	3.9	-
80	0	0	3.0	0	80	0	1	4.0	0
81	0	1	7.7	-	81	0	1	4.6	-
82	0	1	8.5	-	82	0	1	3.5	-
83	0	1	7.1	-	83	0	1	3.4	-
84	0	1	6.6	-	84	0	1	7.1	-
85	0	1	2.9	-	85	0	1	4.9	-
86	0	1	3.1	-	86	0	0	3.8	-
87	0	1	3.8	-	87	0	0	6.4	-
88	0	1	6.2	-	88	0	1	3.2	-
89	0	1	5.2	-	89	0	0	2.9	-
90	0	1	8.6	0.25	90	0	1	1.9	0
91	0	1	5.6	-	91	0	1	3.9	-
92	0	1	5.2	-	92	0	1	3.6	-
93	0	1	6.4	-	93	0	0	2.1	-
94	0	1	5.4	-	94	0	1	7.4	-
95	0	0	3.0	-	95	0	1	4.6	-
96	0	1	7.3	-	96	0	1	2.8	-
97	0	1	5.7	-	97	0	1	3.7	-
98	0	0	1.6	-	98	0	1	2.5	-
99	0	1	5.5	-	99	0	1	3.4	-
100	0	1	5.9	0	100	0	1	3.6	0
Minimum	**0.0**	**0.0**	**0.8**	**0.0**	**Minimum**	**0.0**	**0.0**	**0.7**	**0.0**
Maximum	**0.0**	**1**	**11.1**	**0.5**	**Maximum**	**0.0**	**1**	**7.4**	**0.0**
Mean	**0.0**	**0.79**	**5.01**	**0.075**	**Mean**	**0.0**	**0.64**	**3.26**	**0.0**
Standard Dev.	**0.0**	**0.409**	**1.79**	**0.169**	**Standard Dev.**	**0.0**	**0.482**	**1.39**	**0.0**
Geometric mean	**-**	**-**	**4.64**	**-**	**Geometric mean**	**-**	**-**	**2.95**	**-**
Median	**0.0**	**1**	**5.2**	**0.0**	**Median**	**0.0**	**1**	**3.2**	**0.0**
Calcite Index	**0.8**		**-**	**-**	**Calcite Index**	**0.6**		**-**	**-**

Table F.6: Pebble Count and Calcite at Reference and Mine-exposed Areas, FRO LAEMP, August 2018

RG_FOUEW				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	0	5.4	-
2	0	0	4.2	-
3	0	0	6.3	-
4	0	0	9.1	-
5	0	0	6.5	-
6	0	0	6.0	-
7	0	0	5.3	-
8	0	0	9.9	-
9	0	0	6.5	-
10	0	1	7.4	0.25
11	0	0	7.2	-
12	0	0	2.9	-
13	0	0	9.8	-
14	0	0	7.0	-
15	0	0	6.6	-
16	0	0	28.0	-
17	0	1	15.4	-
18	0	1	15.4	-
19	0	1	8.4	-
20	0	0	7.9	0
21	0	1	8.3	-
22	0	1	22.3	-
23	0	1	13.0	-
24	0	1	8.8	-
25	0	0	7.0	-
26	0	1	7.0	-
27	0	0	9.2	-
28	0	1	14.6	-
29	0	0	2.8	-
30	0	1	11.1	0
31	0	0	10.8	-
32	0	0	7.9	-
33	0	1	7.9	-
34	0	1	6.0	-
35	0	0	5.0	-
36	0	0	4.6	-
37	0	1	10.2	-
38	0	0	4.3	-
39	0	1	16.2	-
40	0	1	10.1	0
41	0	1	9.9	-
42	0	1	11.4	-
43	0	1	8.3	-
44	0	0	4.7	-
45	0	1	16.8	-
46	0	0	5.8	-
47	0	0	10.2	-
48	0	0	8.9	-
49	0	1	11.4	-
50	0	1	7.9	0
51	0	1	8.9	-
52	0	1	4.9	-
53	0	1	4.2	-
54	0	0	1.3	-
55	0	1	6.5	-
56	0	1	5.8	-
57	0	0	3.3	-
58	0	0	3.8	-
59	0	0	6.0	-
60	0	1	7.0	0.25
61	0	1	5.2	-
62	0	0	2.7	-
63	0	0	5.8	-
64	0	0	10.7	-
65	0	1	13.3	-
66	0	1	14.6	-
67	0	1	17.8	-
68	0	0	4.9	-
69	0	1	7.0	-
70	0	1	12.5	0
71	0	1	7.4	-
72	0	1	8.9	-
73	0	1	11.3	-
74	0	0	7.9	-
75	0	0	4.5	-
76	0	0	6.8	-
77	0	1	13.0	-
78	0	1	7.9	-
79	0	1	7.8	-
80	0	1	12.9	0.50
81	0	1	15.5	-
82	0	1	5.2	-
83	0	0	6.4	-
84	0	1	10.8	-
85	0	1	11.0	-
86	0	1	12.0	-
87	0	0	3.7	-
88	0	1	8.4	-
89	0	1	6.5	-
90	0	1	7.4	0
91	0	1	5.9	-
92	0	0	5.3	-
93	0	1	6.2	-
94	0	1	6.4	-
95	0	0	4.2	-
96	0	1	9.5	-
97	0	1	4.4	-
98	0	1	5.6	-
99	0	0	4.2	-
100	0	1	7.3	0
Minimum	**0.0**	**0.0**	**1.3**	**0.0**
Maximum	**0.0**	**1**	**28**	**0.5**
Mean	**0.0**	**0.56**	**8.38**	**0.1**
Standard Dev.	**0.0**	**0.499**	**4.22**	**0.175**
Geometric mean	**-**	**-**	**7.48**	**-**
Median	**0.0**	**1**	**7.4**	**0.0**
Calcite Index	**0.6**		**-**	**-**

Table F.7: ***In Situ*** **Water Quality at Reference and Mine-exposed Areas, FRO LAEMP, August 2018**

Field Parameters	**Reference**	**Mine-exposed**													
	RG_HENUP	**RG_FODHE**	**RG_FOUNGD**	**RG_FODNGD**	**RG_MP1**	**RG_FOUSH**	**RG_FOUKI**	**RG_FOBKS**	**RG_FOBSC**	**RG_FOBCP**	**RG_FRCP1SW**	**RG_FRUPO**	**RG_FODPO**	**RG_FO22**	**RG_FOUEW**
Date	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	2-Aug-18	3-Aug-18	3-Aug-18	3-Aug-18	3-Aug-18	1-Aug-18	1-Aug-18	1-Aug-18	1-Aug-18	1-Aug-18
Temperature (°C)	7.85	12.10	13.80	13.87	13.62	13.80	10.48	11.94	13.82	13.81	17.54	14.38	10.49	9.20	8.87
Dissolved Oxygen (mg/L)	11.86	11.26	9.99	10.49	9.89	9.48	10.92	10.54	10.12	10.37	9.57	10.77	11.57	12.06	12.08
Dissolved Oxygen (%)	99.9	105.0	96.7	101.8	95.4	91.7	98.0	98.0	98.0	100.5	100.3	105.7	103.8	105.3	104.4
Specific Conductivity (mS/cm)	255	390	528	559	569	575	602	665	681	861	844	868	921	900	830
Conductivity (µS/cm)	171	294	415	440	445	452	435	499	535	677	724	692	665	628	575
pH	8.70	8.70	8.37	8.26	8.12	8.22	8.12	8.44	8.61	8.6	8.24	8.29	8.05	8.04	7.82

Table F.8: **Channel Depth and Velocity at Reference and Mine-exposed Areas, FRO LAEMP, August 2018**

	Replicate	1	2	3	4	5	Mean
Reference	**RG_HENUP**						
	Distance from shore (m)	1.0	2.0	3.0	5.0	6.0	**-**
	Depth (cm)	29	27	27	31	11	**25.0**
	Velocity (m/s)	0.20	0.39	0.43	0.22	0.17	**0.282**
Mine-exposed	**RG_FODHE**						
	Distance from shore (m)	1.0	3.0	4.0	5.0	7.0	**-**
	Depth (cm)	23	26	32	35	36	**30.4**
	Velocity (m/s)	0.06	0.64	0.55	0.18	0.11	**0.308**
	RG_FOUNGD						
	Distance from shore (m)	1.0	2.0	4.0	6.0	7.0	**-**
	Depth (cm)	14	28	40	26	26	**26.8**
	Velocity (m/s)	0.38	0.50	0.58	0.59	0.44	**0.498**
	RG_FODNGD						
	Distance from shore (m)	2.0	4.0	6.0	8.0	10.0	**-**
	Depth (cm)	24	27	25	35	13	**24.7**
	Velocity (m/s)	0.21	0.21	0.34	0.26	0.34	**0.272**
	RG_MP1						
	Distance from shore (m)	2.0	3.0	5.0	7.0	8.0	**-**
	Depth (cm)	21	51	74	44	50	**48.0**
	Velocity (m/s)	0.16	0.15	0.27	0.54	0.44	**0.312**
	RG_FOUSH						
	Distance from shore (m)	1.0	3.0	5.0	8.0	10.0	**-**
	Depth (cm)	22	28	30	37	31	**29.6**
	Velocity (m/s)	0.40	0.39	0.32	0.03	0.24	**0.276**
	RG_FOUKI						
	Distance from shore (m)	1.0	3.0	5.0	7.0	9.0	**-**
	Depth (cm)	16	15	25	46	33	**27.0**
	Velocity (m/s)	0.60	0.69	0.45	0.46	0.32	**0.504**
	RG_FOBKS						
	Distance from shore (m)	1.0	4.0	6.0	8.0	11.0	**-**
	Depth (cm)	13	20	29	24	18	**20.8**
	Velocity (m/s)	0.49	0.13	0.44	0.46	0.18	**0.340**
	RG_FOBSC						
	Distance from shore (m)	3.0	7.0	11.0	15.0	19.0	**-**
	Depth (cm)	10	12	18	21	25	**17.2**
	Velocity (m/s)	0.39	0.08	0.59	0.61	0.28	**0.390**
	RG_FOBCP						
	Distance from shore (m)	1.0	3.0	6.0	9.0	11.0	**-**
	Depth (cm)	9.0	19	22	19	24	**18.6**
	Velocity (m/s)	0.44	0.43	0.47	0.52	0.66	**0.504**
	RG_FRCP1SW						
	Distance from shore (m)	-	-	-	-	-	**-**
	Depth (cm)	15	28	39	51	57	**38.0**
	Velocity (m/s)	0.07	0.27	0.27	0.39	0.17	**0.234**
	RG_FRUPO						
	Distance from shore (m)	1.0	3.0	5.0	7.0	8.0	**-**
	Depth (cm)	15	20	25	30	42	**26.3**
	Velocity (m/s)	0.47	0.64	0.68	0.35	0.64	**0.556**
	RG_FODPO						
	Distance from shore (m)	1.0	2.0	4.0	7.0	8.0	**-**
	Depth (cm)	12	19	37	52	54	**34.8**
	Velocity (m/s)	0.01	0.24	0.46	0.24	0.33	**0.256**
	RG_FO22						
	Distance from shore (m)	1.0	4.0	7.0	10.0	13.0	**-**
	Depth (cm)	20	23	23	32	51	**29.8**
	Velocity (m/s)	0.54	0.69	0.55	0.53	0.54	**0.570**
	RG_FOUEW						
	Distance from shore (m)	1.0	3.0	5.0	7.0	9.0	**-**
	Depth (cm)	21	22	33	43	37	**31.2**
	Velocity (m/s)	0.52	0.39	0.68	0.44	0.33	**0.472**

Table F.9: Habitat Information Associated with Mine-exposed and Reference Areas Sampled during the Benthic Invertebrate Survey, September 2018

Station ID		Reference		Mine-exposed			
		RG_HENUP	**RG_FO26**	**RG_FODHE**	**RG_FOUNGD**	**RG_FODNGD**	**RG_MP1**
Waterbody		Henretta Creek	Fording	Fording	Fording	Fording	Fording
Date Sampled		6/Sep/18	7/Sep/18	5/Sep/18	13/Sep/18	12/Sep/18	11/Sep/18
Zone 11 UTMs - E		655771	653044	651320	650870	650972	651143
Zone 11 UTMs - N		5567710	5569552	5565422	5563476	5563162	5562400
Elevation (m)		1,779	1,807	-	1,655	1,664	1,640
Samplers' Initials		JI, TN, MW	JI, TN, MW	JI. TN, MW	DH, JC	DH, JC	DH, JC
Habitat Characteristics							
Site Access Description		access through mine, stay to right up through series of switch backs and along a rough forest road.	rough road right beside henretta pit, forest road, down steep embankment ~300m through forest	mine access	Upstream of main haul road on FRO site, below bucket repair	Fording site, off main haul road, past bucket repair, just upstream of main haul road	-
Surrounding Land Use		Forest	Forest	Mining	Mining	Mining	Mining
Anthropogenic Influences		None	None	-	large tailings pile to NE	mine development	Diverted watercourse
Length of Reach Assessed (m)		100	100	100	50	100	150
Substrate	% Bedrock	0	0	0	0	0	0
	% Boulder	20	2	5	10	6	35
	% Cobble	75	7.3	90	45	65	35
	% Gravel	5	25	5	20	20	10
	% Sand	>1	<1	<1	20	5	10
	% Finers	>1	<1	<1	5	5	10
Bank Stability		moderate	stable, no erosion	-	stable, no erosion	stable, no erosion	moderate
Water Colour & Clarity		colourless, clear	colourless, clear	colourless, clear	clear, clear	clear, clear	clear, clear
Channel Measurements							
Bankfull Width (m)		18	17	12	9	12	18
Wetted Width (m)		7	4.5	10	7	13	10
Bankfull-Wetted Depth (m)		0.2	0.5	0.5	0.25	0.5	0.2
Gradient (%)		-	-	-	-	-	-

Table F.9: **Habitat Information Associated with Mine-exposed and Reference Areas Sampled during the Benthic Invertebrate Survey, September 2018**

Station ID		Mine-exposed					
		RG_FOUSH	**RG_FOUKI**	**RG_FOBKS**	**RG_FOBSC**	**RG_FOBCP**	**RG_FRUPO**
Waterbody		Fording	Fording	Fording	Fording	Fording	Fording
Date Sampled		11/Sep/18	7/Sep/18	8/Sep/18	10/Sep/18	9/Sep/18	9/Sep/18
Zone 11 UTMs - E		650876	651859	652074	652407	652920	653894
Zone 11 UTMs - N		5560957	5559804	5558652	5558109	5556982	5555975
Elevation (m)		1,625	1,601	-	1,584	-	-
Samplers' Initials		DH, JC	JI, TN, MW	JI, MW, TN	JI, MW, TN	JI, MW, TN	MW, JI, TN
Habitat Characteristics							
Site Access Description		Off main haul road, park at gate to Maxam (explosives) plant	Kilmarnock gate, keep to the right, close access beside ponds	Kilmarnock gate, before steel bridge	Kilmarnock gate, around settling pond, quick walk to river. Park at the end of the road on the settling pond berm	through greenhouse gate (key from gatehouse), drive down the hill to the right until parallel to site, hike in 300 m	off fording Rd, take a spur to the right.
Surrounding Land Use		Mining	Mining	Forest, Mining	Forest, Mining	Forest	Forest
Anthropogenic Influences		Mine	Mining, FRO	Mining, FRO	Mining, FRO	Mining, FRO	Mining
Length of Reach Assessed (m)		150	100	100	100	200	100
Substrate	% Bedrock	0	-	0	0	0	0
	% Boulder	10	2	5	10	2	0
	% Cobble	60	70	45	70	45	70
	% Gravel	5	25	45	10	45	20
	% Sand	10	2	0	8	6	7
	% Finers	15	1	5	2	2	3
Bank Stability		stable, no erosion	stable, no erosion	stable, no erosion	stable, no erosion	moderate	moderate
Water Colour & Clarity		clear, clear	colourless, clear	colourless, clear	colourless, clear	colourless, clear	no colour, 100%
Channel Measurements							
Bankfull Width (m)		12	22	17	15	11	17
Wetted Width (m)		8	12	8	8	8	15
Bankfull-Wetted Depth (m)		0.3	1	0.7	1	0.7	0.3
Gradient (%)		-	-	-	-	-	-

Table F.9: Habitat Information Associated with Mine-exposed and Reference Areas Sampled during the Benthic Invertebrate Survey, September 2018

Station ID		Mine-exposed		
		RG_FODPO	RG_FO22	RG_FOUEW
Waterbody		Fording	Fording	Fording
Date Sampled		13/Sep/18	8/Sep/18	6/Sep/18
Zone 11 UTMs - E		653935	654778	656365
Zone 11 UTMs - N		5555085	5553692	5551890
Elevation (m)		1,563	-	1,551
Samplers' Initials		DH, JC	JI, MW, TN	JI, TN, MW
Habitat Characteristics				
Site Access Description		-	down a side road, right along the pipeline. GPS walk across field to site.	gun range off fording rd. 150m south through bush
Surrounding Land Use		Forest, mining	Forest	Forest, Commercial
Anthropogenic Influences		Mine upstream (FRO)	Mining, FRO	Mining
Length of Reach Assessed (m)		100	200	100
Substrate	% Bedrock	0	0	0
	% Boulder	55	0	10
	% Cobble	0	10	75
	% Gravel	15	40	5
	% Sand	15	40	5
	% Finers	15	10	5
Bank Stability		stable, no erosion	unstable, substantial erosion	moderate
Water Colour & Clarity			colourless, clear	colourless, clear
Channel Measurements				
Bankfull Width (m)		15	18	17
Wetted Width (m)		9	12	12
Bankfull-Wetted Depth (m)		0.28	1.5	-
Gradient (%)			-	-

Table F.10: Kick and Sweep at Reference and Mine-exposed Areas, FRO LAEMP, September 2018

		RG_FO26	RG_HENUP	RG_FODHE	RG_FOUNGD	RG_FODNGD	RG_MP1	RG_FOUSH	RG_FOUKI	RG_FOBKS	RG_FOBSC
Station 1	Easting	653044	655826	651412	650870	650972	651143	650876	651859	652044	652320
	Northing	5569636	5567703	5565509	5563476	5563162	5562400	5560957	5559804	5558705	5558204
	Date	7-Sep-18	6-Sep-18	5-Sep-18	13-Sep-18	12-Sep-18	11-Sep-18	11-Sep-18	7-Sep-18	8-Sep-18	10-Sep-18
	Samplers' Initials	MW	MW	MW	DH	DH	DH	DH	MW	TN	JI
	Number of Jars	1	1	1	1	1	1	1	1	1	1
	Total Kick Distance (m)	10	10	15	15	25	15	10	12	15	12
	Full Transect (Yes / No)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Number of Transects	2.5	2.0	3.0	2.0	2.0	2.0	2.0	2.0	3.0	2.0
Station 2	Easting	653050	655763	651410	650856	509072	651194	650850	651838	652058	652363
	Northing	5569597	5567708	5565490	5563520	5563162	5562470	5561054	5559846	5558668	5558164
	Date	7-Sep-18	6-Sep-18	5-Sep-18	13-Sep-18	12-Sep-18	11-Sep-18	11-Sep-18	7-Sep-18	8-Sep-18	10-Sep-18
	Samplers' Initials	MW	MW	MW	DH	DH	DH	DH	MW	TN	MW
	Number of Jars	1	1	1	1	1	1	1	1	1	1
	Total Kick Distance (m)	12	10	10	15	25	10	15	10	10	15
	Full Transect (Yes / No)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
	Number of Transects	2.0	2.0	4.0	1.0	2.5	0.5	2.5	1.0	3.0	2.0
Station 3	Easting	653044	655722	651320	650869	650870	651274	650850	651835	652074	652411
	Northing	5569552	5567662	5565422	5563573	5563210	5562504	5561112	5559907	5558652	5558116
	Date	7-Sep-18	6-Sep-18	5-Sep-18	13-Sep-18	12-Sep-18	11-Sep-18	11-Sep-18	7-Sep-18	8-Sep-18	10-Sep-18
	Samplers' Initials	MW	MW	MW	DH	DH	DH	DH	JI	TN	MW
	Number of Jars	1	1	1	1	1	1	1	1	1	1
	Total Kick Distance (m)	9	12	10	15	20	20	15	15	12	10
	Full Transect (Yes / No)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Number of Transects	2.0	3.0	2.0	1.0	2.0	1.5	2.5	1.5	3.0	1.5
Station 4	Easting	-	-	-	-	-	-	-	-	-	-
	Northing	-	-	-	-	-	-	-	-	-	-
	Date	-	-	-	-	-	-	-	-	-	-
	Samplers' Initials	-	-	-	-	-	-	-	-	-	-
	Number of Jars	-	-	-	-	-	-	-	-	-	-
	Total Kick Distance (m)	-	-	-	-	-	-	-	-	-	-
	Full Transect (Yes / No)	-	-	-	-	-	-	-	-	-	-
	Number of Transects	-	-	-	-	-	-	-	-	-	-
Station 5	Easting	-	-	-	-	-	-	-	-	-	-
	Northing	-	-	-	-	-	-	-	-	-	-
	Date	-	-	-	-	-	-	-	-	-	-
	Samplers' Initials	-	-	-	-	-	-	-	-	-	-
	Number of Jars	-	-	-	-	-	-	-	-	-	-
	Total Kick Distance (m)	-	-	-	-	-	-	-	-	-	-
	Full Transect (Yes / No)	-	-	-	-	-	-	-	-	-	-
	Number of Transects	-	-	-	-	-	-	-	-	-	-

Table F.10: **Kick and Sweep at Reference and Mine-exposed Areas, FRO LAEMP, September 2018**

		RG_FOBCP	RG_FRUPO	RG_FODPO	RG_FO22	RG_FOUEW
Station 1	Easting	652886	653894	653935	654778	-
	Northing	5557142	5555975	5555085	5553692	-
	Date	9-Sep-18	9-Sep-18	13-Sep-18	8-Sep-18	6-Sep-18
	Samplers' Initials	JI	MW	DH	JI	MW
	Number of Jars	1	1	1	1	1
	Total Kick Distance (m)	10	12	30	17	10
	Full Transect (Yes / No)	Yes	Yes	Yes	Yes	Yes
	Number of Transects	2.0	3.0	3.5	2.0	2.0
Station 2	Easting	652899	653894	653866	654760	-
	Northing	5557117	5555879	5555058	5553637	-
	Date	9-Sep-18	9-Sep-18	13-Sep-18	8-Sep-18	6-Sep-18
	Samplers' Initials	JI	TN	DH	JI	MW
	Number of Jars	1	1	1	1	1
	Total Kick Distance (m)	12	12	30	15	10
	Full Transect (Yes / No)	Yes	Yes	Yes	Yes	Yes
	Number of Transects	2.0	2.0	2.0	4.0	2.0
Station 3	Easting	652916	653864	653842	654810	656366
	Northing	5557093	5555860	5555044	5553612	5551887
	Date	9-Sep-18	9-Sep-18	13-Sep-18	8-Sep-18	6-Sep-18
	Samplers' Initials	JI	TN	DH	JI	MW
	Number of Jars	1	1	2	1	1
	Total Kick Distance (m)	12	14	20	15	14
	Full Transect (Yes / No)	Yes	Yes	Yes	Yes	Yes
	Number of Transects	1.5	2.0	2.0	2.0	2.0
Station 4	Easting	652920	-	-	654836	-
	Northing	5557044	-	-	5553585	-
	Date	9-Sep-18	-	-	8-Sep-18	-
	Samplers' Initials	JI	-	-	JI	-
	Number of Jars	1	-	-	1	-
	Total Kick Distance (m)	10	-	-	20	-
	Full Transect (Yes / No)	Yes	-	-	Yes	-
	Number of Transects	2.0	-	-	2.00	-
Station 5	Easting	652928	-	-	654836	-
	Northing	5556981	-	-	5553547	-
	Date	9-Sep-18	-	-	8-Sep-18	-
	Samplers' Initials	JI	-	-	JI	-
	Number of Jars	1	-	-	1	-
	Total Kick Distance (m)	8	-	-	15	-
	Full Transect (Yes / No)	Yes	-	-	Yes	-
	Number of Transects	1.0	-	-	1.50	-

Table F.11: **Hess Sample Collection, September 2018**

Area	Replicate	Sample ID	Easting	Northing	Depth (unit)	Flow (unit)
FO22	10	RG_FO22_10_Hess	654837	5553540	19	0.325
	9	RG_FO22_9_Hess	654832	5553546	27	0.509
	8	RG_FO22_8_Hess	654836	5553585	29	0.588
	7	RG_FO22_7_Hess	654833	5553594	34	0.367
	6	RG_FO22_6_Hess	654805	5553604	35	0.381
	5	RG_FO22_5_Hess	654613	5553610	32	0.59
	4	RG_FO22_4_Hess	654760	5553637	26	0.378
	3	RG_FO22_3_Hess	654768	5553646	26	0.285
	2	RG_FO22_2_Hess	654783	5553686	23	0.548
	1	RG_FO22_1_Hess	654781	5553698	19	0.533
FO26	10	RG_FO26_10_Hess	653040	5569542	22	0.29
	9	RG_FO26_9_Hess	653039	5569552	23	0.145
	8	RG_FO26_8_Hess	653039	5569559	21	0.548
	7	RG_FO26_7_Hess	653035	5569568	19	0.039
	6	RG_FO26_6_Hess	653040	5569587	20	0.079
	5	RG_FO26_5_Hess	653046	5569601	19.5	0.513
	4	RG_FO26_4_Hess	653045	5569618	14	0.378
	3	RG_FO26_3_Hess	653044	5569629	13	0.229
	2	RG_FO26_2_Hess	653044	5569636	18.5	0.253
	1	RG_FO26_1_Hess	653040	5569653	15.5	0.477
FOBCP	10	RG_FOBCP_10_Hess	652926	5556968	12	0.214
	9	RG_FOBCP_9_Hess	652928	5556981	19	0.163
	8	RG_FOBCP_8_Hess	652925	5557021	19.5	0.237
	7	RG_FOBCP_7_Hess	652920	5557044	25	0.228
	6	RG_FOBCP_6_Hess	652922	5557082	17	0.32
	5	RG_FOBCP_5_Hess	652916	5557093	15	0.25
	4	RG_FOBCP_4_Hess	652901	5557109	22	0.075
	3	RG_FOBCP_3_Hess	652899	5557117	20	0.207
	2	RG_FOBCP_2_Hess	652886	5557142	22	0.478
	1	RG_FOBCP_1_Hess	652870	5557147	-	-
FOBKS	10	RG_FOBKS_10_Hess	652085	5558669	16.5	0.777
	9	RG_FOBKS_9_Hess	652082	5558642	19	0.389
	8	RG_FOBKS_8_Hess	652074	5558652	31	0.258
	7	RG_FOBKS_7_Hess	652070	5558656	23	0.325
	6	RG_FOBKS_6_Hess	652069	5558671	21	0.444
	5	RG_FOBKS_5_Hess	652065	5558680	28.5	0.351
	4	RG_FOBKS_4_Hess	652044	5558697	29	0.254
	3	RG_FOBKS_3_Hess	652043	5558698	20	0.423
	2	RG_FOBKS_2_Hess	652043	5558715	20	0.195
	1	RG_FOBKS_1_Hess	652042	5558720	25	0.658
FOBSC	10	RG_FOBSC_10_Hess	652416	5558102	20	0.119
	9	RG_FOBSC_9_Hess	652411	5558116	20	0.109
	8	RG_FOBSC_8_Hess	652409	5558124	14.5	0.532
	7	RG_FOBSC_7_Hess	652376	5558153	14.5	0.288
	6	RG_FOBSC_6_Hess	652363	5558164	21	0.568
	5	RG_FOBSC_5_Hess	652355	5558166	26	0.268
	4	RG_FOBSC_4_Hess	652338	5558180	20	0.28
	3	RG_FOBSC_3_Hess	652332	5558190	18	0.374
	2	RG_FOBSC_2_Hess	652320	5558204	17	0.099
	1	RG_FOBSC_1_Hess	652317	5558214	25	0.129
FOUKI	10	RG_FOUKI_10_Hess	651856	5559808	34	0.326
	9	RG_FOUKI_9_Hess	651853	5559816	29	0.36
	8	RG_FOUKI_8_Hess	651850	5559823	25	0.261
	7	RG_FOUKI_7_Hess	651846	5559834	32	0.3
	6	RG_FOUKI_6_Hess	651838	5559846	24	0.627
	5	RG_FOUKI_5_Hess	651835	5559852	15	0.516
	4	RG_FOUKI_4_Hess	651835	5559860	25	0.308
	3	RG_FOUKI_3_Hess	651827	5559869	19.5	0.427
	2	RG_FOUKI_2_Hess	651829	5559886	19	0.854
	1	RG_FOUKI_1_Hess	651828	5559908	37	0.39
FRUPO	10	RG_FRUPO_10_Hess	653864	5555860	20	0.287
	9	RG_FRUPO_9_Hess	653870	5555858	28	0.589
	8	RG_FRUPO_8_Hess	653872	5555860	25	0.187
	7	RG_FRUPO_7_Hess	653886	5555868	20	0.109
	6	RG_FRUPO_6_Hess	653888	5555874	24	0.08
	5	RG_FRUPO_5_Hess	653894	5555879	25	0.172
	4	RG_FRUPO_4_Hess	653893	5555939	21	0.234
	3	RG_FRUPO_3_Hess	653890	5555946	25	0.251
	2	RG_FRUPO_2_Hess	653890	5555957	22	0.355
	1	RG_FRUPO_1_Hess	653894	5555975	15	0.392
HENUP	10	RG_HENUP_10_Hess	655794	5567709	24	0.219
	9	RG_HENUP_9_Hess	655786	5567707	24	0.348
	8	RG_HENUP_8_Hess	655775	5567708	25	0.722
	7	RG_HENUP_7_Hess	655765	5567704	27	0.182
	6	RG_HENUP_6_Hess	655759	5567698	19.2	0.21
	5	RG_HENUP_5_Hess	655749	5567693	24.3	0.409
	4	RG_HENUP_4_Hess	655740	5567693	29	0.199
	3	RG_HENUP_3_Hess	655734	5567686	23.5	0.283
	2	RG_HENUP_2_Hess	655728	5567681	23	0.411
	1	RG_HENUP_1_Hess	655722	5567676	27	0.211

Table F.12: Calcite and Pebble Count at RG_HENUP, FRO LAEMP, September 2018

RG_HENUP 1					RG_HENUP 2				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**	**Rock**	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	0	11.1	-	1	0	0	10.0	-
2	0	0	9.5	-	2	0	0	15.7	-
3	0	0	20.1	-	3	0	0	8.5	-
4	0	0	9.1	-	4	0	0	5.3	-
5	0	0	33.5	-	5	0	0	4.2	-
6	0	0	6.0	-	6	0	0	6.9	-
7	0	0	11.9	-	7	0	0	6.7	-
8	0	0	12.2	-	8	0	0	17.1	-
9	0	0	6.4	-	9	0	0	6.7	-
10	0	0	15.4	0.5	10	0	0	9.2	0.5
11	0	0	6.2	-	11	0	0	11.9	-
12	0	0	4.8	-	12	0	0	10.5	-
13	0	0	17.5	-	13	0	0	7.4	-
14	0	0	17.5	-	14	0	1	7.2	-
15	0	0	12.6	-	15	0	0	8.6	-
16	0	0	10.4	-	16	0	0	15.7	-
17	0	0	10.5	-	17	0	0	3.1	-
18	0	0	4.1	-	18	0	0	12.9	-
19	0	0	11.7	-	19	0	0	3.6	-
20	0	0	14.5	0	20	0	0	11.6	0.25
21	0	0	8.2	-	21	0	0	4.9	-
22	0	0	14.4	-	22	0	0	7.1	-
23	0	0	5.5	-	23	0	0	8.6	-
24	0	0	11.3	-	24	0	0	8.6	-
25	0	0	4.9	-	25	0	1	19.0	-
26	0	0	7.2	-	26	0	0	13.9	-
27	0	0	8.6	-	27	0	0	7.5	-
28	0	0	7.2	-	28	0	0	7.4	-
29	0	0	4.5	-	29	0	0	1.1	-
30	0	0	7.7	0.25	30	0	0	7.6	0.25
31	0	0	13.1	-	31	0	0	17.5	-
32	0	0	5.9	-	32	0	0	7.0	-
33	0	0	6.0	-	33	0	0	23.5	-
34	0	0	11.2	-	34	0	0	15.1	-
35	0	0	8.4	-	35	0	0	14.0	-
36	0	0	3.2	-	36	0	0	26.5	-
37	0	0	8.5	-	37	0	0	10.2	-
38	0	0	14.0	-	38	0	0	2.1	-
39	0	0	6.4	-	39	0	0	4.4	-
40	0	0	16.2	0.25	40	0	0	8.8	0
41	0	0	5.1	-	41	0	0	14.6	-
42	0	0	11.0	-	42	0	0	15.2	-
43	0	0	8.0	-	43	0	0	6.5	-
44	0	0	8.1	-	44	0	0	2.3	-
45	0	0	8.6	-	45	0	0	13.9	-
46	0	0	3.3	-	46	0	0	8.9	-
47	0	0	7.1	-	47	0	0	6.2	-
48	0	0	9.2	-	48	0	0	4.5	-
49	0	0	6.9	-	49	0	0	7.0	-
50	0	0	12.1	0.25	50	0	0	4.2	0.25
51	0	0	6.1	-	51	0	0	13.3	-
52	0	0	9.4	-	52	0	0	5.7	-
53	0	0	24.5	-	53	0	0	4.3	-
54	0	0	5.7	-	54	0	0	6.8	-
55	0	0	5.1	-	55	0	0	12.2	-
56	0	0	4.5	-	56	0	0	3.1	-
57	0	0	2.7	-	57	0	0	8.6	-
58	0	0	12.6	-	58	0	0	8.7	-
59	0	0	10.2	-	59	0	0	11.5	-
60	0	0	8.5	0	60	0	0	6.3	0.25
61	0	0	14.5	-	61	0	0	12.0	-
62	0	0	10.5	-	62	0	0	30.0	-
63	0	0	7.2	-	63	0	0	4.1	-
64	0	0	11.9	-	64	0	0	12.9	-
65	0	0	3.3	-	65	0	0	3.9	-
66	0	0	14.0	-	66	0	0	11.1	-
67	0	0	6.8	-	67	0	0	4.6	-
68	0	0	5.5	-	68	0	0	16.9	-
69	0	0	6.7	-	69	0	1	11.5	-
70	0	0	8.5	0.25	70	0	0	9.2	0.5
71	0	0	2.1	-	71	0	0	6.3	-
72	0	0	19.3	-	72	0	0	2.1	-
73	0	0	11.5	-	73	0	0	18.8	-
74	0	0	10.2	-	74	0	0	11.8	-
75	0	0	7.7	-	75	0	0	9.5	-
76	0	0	6.9	-	76	0	0	6.6	-
77	0	0	10.4	-	77	0	0	23.0	-
78	0	0	9.0	-	78	0	0	2.1	-
79	0	0	9.5	-	79	0	0	6.5	-
80	0	0	8.2	0	80	0	0	7.1	0.5
81	0	0	18.1	-	81	0	0	10.5	-
82	0	0	15.3	-	82	0	0	2.7	-
83	0	0	6.9	-	83	0	0	19.9	-
84	0	0	7.9	-	84	0	0	3.8	-
85	0	0	9.5	-	85	0	0	9.1	-
86	0	0	8.0	-	86	0	0	35.5	-
87	0	0	6.5	-	87	0	0	4.2	-
88	0	0	8.2	-	88	0	0	6.1	-
89	0	0	6.2	-	89	0	0	11.5	-
90	0	0	7.8	0	90	0	0	5.7	0.5
91	0	0	15.3	-	91	0	0	11.5	-
92	0	0	12.5	-	92	0	0	2.2	-
93	0	0	10.9	-	93	0	0	14.0	-
94	0	0	18.0	-	94	0	0	18.1	-
95	0	0	8.8	-	95	0	0	8.3	-
96	0	0	4.1	-	96	0	0	4.5	-
97	0	0	3.0	-	97	0	0	11.8	-
98	0	0	6.2	-	98	0	0	11.1	-
99	0	0	6.0	-	99	0	0	11.4	-
100	0	0	4.6	0	100	0	0	16.2	0.25
Minimum	**0.0**	**0.0**	**2.1**	**0**	**Minimum**	**0.0**	**0.0**	**1.1**	**0**
Maximum	**0.0**	**0.0**	**33.5**	**0.5**	**Maximum**	**0.0**	**1.0**	**35.5**	**0.5**
Mean	**0.0**	**0.0**	**9.5**	**0.2**	**Mean**	**0.0**	**0.0**	**9.9**	**0.3**
Standard Dev.	**0.0**	**0.0**	**4.9**	**0.2**	**Standard Dev.**	**0.0**	**0.2**	**6.1**	**0.2**
Geometric mean	**-**	**-**	**8.5**	**-**	**Geometric mean**	**-**	**-**	**8.2**	**-**
Median	**0.0**	**0.0**	**8.5**	**0**	**Median**	**0.0**	**0.0**	**8.6**	**0**
Calcite Index	**0.0**		**-**	**-**	**Calcite Index**	**0.0**		**-**	**-**

Table F.12: Calcite and Pebble Count at RG_HENUP, FRO LAEMP, September 2018

RG_HENUP 3				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	0	4.9	-
2	0	0	12.0	-
3	0	0	8.4	-
4	0	0	6.9	-
5	0	0	5.2	-
6	0	0	15.7	-
7	0	0	9.5	-
8	0	0	13.2	-
9	0	0	8.1	-
10	0	0	12.3	0.25
11	0	0	9.4	-
12	0	0	7.5	-
13	0	0	4.5	-
14	0	0	8.1	-
15	0	0	15.4	-
16	0	0	8.2	-
17	0	0	4.9	-
18	0	0	6.2	-
19	0	0	7.8	-
20	0	0	6.2	0
21	0	0	5.6	-
22	0	0	11.2	-
23	0	0	4.3	-
24	0	0	10.7	-
25	0	0	6.1	-
26	0	0	3.9	-
27	0	0	12.2	-
28	0	0	5.5	-
29	0	1	10.0	-
30	0	0	7.8	0.5
31	0	0	9.5	-
32	0	0	8.9	-
33	0	0	9.5	-
34	0	0	8.1	-
35	0	0	4.1	-
36	0	0	3.9	-
37	0	0	14.8	-
38	0	0	11.4	-
39	0	0	14.8	-
40	0	0	8.6	0.25
41	0	0	4.2	-
42	0	0	12.9	-
43	0	0	3.2	-
44	0	0	2.7	-
45	0	0	8.2	-
46	0	0	18.5	-
47	0	0	6.1	-
48	0	0	9.1	-
49	0	0	4.4	-
50	0	0	8.7	0.5
51	0	0	7.7	-
52	0	0	11.5	-
53	0	0	8.1	-
54	0	0	3.6	-
55	0	0	12.2	-
56	0	0	4.3	-
57	0	0	8.4	-
58	0	0	5.5	-
59	0	0	8.9	-
60	0	0	5.6	0.25
61	0	0	3.2	-
62	0	0	12.1	-
63	0	0	9.5	-
64	0	0	11.4	-
65	0	0	4.7	-
66	0	0	16.0	-
67	0	0	9.7	-
68	0	0	6.3	-
69	0	0	9.7	-
70	0	0	8.8	0.5
71	0	0	3.9	-
72	0	0	10.0	-
73	0	0	5.6	-
74	0	0	8.2	-
75	0	0	4.6	-
76	0	0	24.0	-
77	0	0	5.1	-
78	0	0	5.5	-
79	0	0	3.8	-
80	0	0	8.3	0
81	0	0	6.0	-
82	0	0	5.8	-
83	0	0	7.8	-
84	0	0	8.1	-
85	0	0	2.9	-
86	0	0	13.9	-
87	0	0	7.8	-
88	0	0	5.4	-
89	0	0	6.7	-
90	0	0	12.1	0
91	0	0	3.8	-
92	0	0	2.5	-
93	0	0	6.5	-
94	0	0	11.5	-
95	0	0	5.9	-
96	0	0	7.5	-
97	0	0	9.9	-
98	0	0	6.6	-
99	0	0	10.2	-
100	0	0	7.9	0
Minimum	**0.0**	**0.0**	**2.5**	**0**
Maximum	**0.0**	**1.0**	**24.0**	**0.5**
Mean	**0.0**	**0.0**	**8.2**	**0.2**
Standard Dev.	**0.0**	**0.1**	**3.7**	**0.2**
Geometric mean	**-**	**-**	**7.4**	**-**
Median	**0.0**	**0.0**	**8.0**	**0**
Calcite Index	**0.0**		**-**	**-**

Table F.13: Calcite and Pebble Count at RG_FO26, FRO LAEMP, September 2018

RG_FO26 1					RG_FO26 2				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**	**Rock**	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	1	8.5	-	1	0	1	9.1	-
2	0	1	3.4	-	2	0	1	6.9	-
3	0	1	7.9	-	3	0	1	6.1	-
4	0	1	10.1	-	4	0	1	4.0	-
5	0	1	12.0	-	5	0	1	9.3	-
6	0	0	4.1	-	6	0	1	12.4	-
7	0	1	6.3	-	7	0	1	6.7	-
8	0	1	6.0	-	8	0	1	8.3	-
9	0	1	13.4	-	9	0	1	4.4	-
10	0	1	8.2	0.5	10	0	1	10.2	0
11	0	1	4.5	-	11	0	1	6.5	-
12	0	1	4.5	-	12	0	1	6.8	-
13	0	1	8.7	-	13	0	1	13.0	-
14	0	0	3.0	-	14	0	1	5.6	-
15	0	1	7.7	-	15	0	1	5.1	-
16	0	1	4.8	-	16	0	1	6.9	-
17	0	1	7.7	-	17	0	1	18.2	-
18	0	1	5.4	-	18	0	1	5.3	-
19	0	1	14.7	-	19	0	1	8.2	-
20	0	0	3.4	0	20	0	1	5.2	0
21	0	1	7.5	-	21	0	1	17.2	-
22	0	1	21.1	-	22	0	1	6.8	-
23	0	1	8.4	-	23	0	1	10.9	-
24	0	1	6.2	-	24	0	1	4.2	-
25	0	1	8.0	-	25	0	1	12.2	-
26	0	1	6.5	-	26	0	1	7.6	-
27	0	1	7.2	-	27	0	1	9.0	-
28	0	1	9.0	-	28	0	1	13.2	-
29	0	1	6.1	-	29	0	1	7.7	-
30	0	1	5.3	0.25	30	0	1	11.5	0
31	0	1	7.4	-	31	0	1	11.0	-
32	0	1	5.6	-	32	0	1	16.0	-
33	0	1	6.7	-	33	0	1	6.0	-
34	0	1	14.2	-	34	0	1	6.7	-
35	0	1	5.7	-	35	0	1	4.2	-
36	0	0	4.6	-	36	0	1	8.6	-
37	0	0	6.2	-	37	0	1	14.9	-
38	0	0	5.0	-	38	0	1	5.0	-
39	0	0	10.6	-	39	0	1	11.1	-
40	0	1	13.2	0.5	40	0	1	10.2	0.25
41	0	1	11.2	-	41	0	1	5.6	-
42	0	0	10.1	-	42	0	1	10.0	-
43	0	1	4.6	-	43	0	1	7.1	-
44	0	1	3.4	-	44	0	1	12.0	-
45	0	1	5.9	-	45	0	0	4.5	-
46	0	1	5.0	-	46	0	1	7.6	-
47	0	1	9.6	-	47	0	1	10.1	-
48	0	1	8.0	-	48	0	1	8.2	-
49	0	1	5.5	-	49	0	0	4.5	-
50	0	1	6.0	0	50	0	1	7.2	0.25
51	0	1	7.9	-	51	0	1	8.4	-
52	0	0	2.3	-	52	0	1	3.1	-
53	0	1	4.9	-	53	0	1	5.2	-
54	0	1	9.5	-	54	0	1	3.4	-
55	0	1	9.8	-	55	0	1	7.0	-
56	0	1	4.9	-	56	0	1	14.2	-
57	0	1	6.0	-	57	0	1	2.4	-
58	0	1	13.9	-	58	0	1	3.5	-
59	0	1	7.2	-	59	0	0	4.7	-
60	0	1	17.2	0.5	60	0	1	11.7	0.75
61	0	1	3.5	-	61	0	1	2.4	-
62	0	1	2.0	-	62	0	1	7.0	-
63	0	1	7.5	-	63	0	1	3.4	-
64	0	1	8.3	-	64	0	1	5.5	-
65	0	1	5.0	-	65	0	1	19.0	-
66	0	1	13.2	-	66	0	1	8.2	-
67	0	1	6.7	-	67	0	1	4.8	-
68	0	1	5.8	-	68	0	1	14.2	-
69	0	1	8.2	-	69	0	1	11.9	-
70	0	1	7.6	0	70	0	1	15.2	0
71	0	1	6.0	-	71	0	1	8.5	-
72	0	1	4.8	-	72	0	1	16.2	-
73	0	1	11.2	-	73	0	1	7.4	-
74	0	1	8.0	-	74	0	1	6.1	-
75	0	1	3.4	-	75	0	1	7.7	-
76	0	1	9.2	-	76	0	1	9.4	-
77	0	1	4.7	-	77	0	1	11.0	-
78	0	1	4.7	-	78	0	1	11.4	-
79	0	0	3.4	-	79	0	1	9.1	-
80	0	1	6.8	0.25	80	0	1	12.4	0.25
81	0	0	2.7	-	81	0	1	8.1	-
82	0	1	11.2	-	82	0	1	6.9	-
83	0	1	9.1	-	83	0	1	11.6	-
84	0	1	6.6	-	84	0	1	9.6	-
85	0	1	8.4	-	85	0	1	10.2	-
86	0	1	5.3	-	86	0	1	8.0	-
87	0	1	7.7	-	87	0	1	3.2	-
88	0	1	6.4	-	88	0	1	2.8	-
89	0	1	16.1	-	89	0	1	6.3	-
90	0	1	7.2	1	90	0	1	11.4	0.25
91	0	1	8.4	-	91	0	1	10.1	-
92	0	1	4.4	-	92	0	1	8.9	-
93	0	1	7.6	-	93	0	1	6.5	-
94	0	1	13.1	-	94	0	1	11.0	-
95	0	0	3.2	-	95	0	1	9.8	-
96	0	1	6.6	-	96	0	0	3.4	-
97	0	1	8.4	-	97	0	1	6.4	-
98	0	1	6.4	-	98	0	1	16.0	-
99	0	1	14.9	-	99	0	1	9.3	-
100	0	1	5.4	0	100	0	1	10.2	0.5
Minimum	**0.0**	**0.0**	**2.0**	**0.0**	**Minimum**	**0.0**	**0.0**	**2.4**	**0.0**
Maximum	**0.0**	**1.0**	**21.1**	**1.0**	**Maximum**	**0.0**	**1.0**	**19.0**	**0.75**
Mean	**0.0**	**0.88**	**7.51**	**0.3**	**Mean**	**0.0**	**0.96**	**8.53**	**0.225**
Sandard Dev.	**0.0**	**0.327**	**3.46**	**0.329**	**Standard Dev.**	**0.0**	**0.197**	**3.71**	**0.249**
Geometric mean	**-**	**-**	**6.8**	**-**	**Geometric mean**	**-**	**-**	**7.72**	**-**
Median	**0.0**	**1.0**	**6.75**	**0.25**	**Median**	**0.0**	**1.0**	**8.15**	**0.25**
Calcite Index	**0.9**		**-**	**-**	**Calcite Index**	**1.0**		**-**	**-**

Table F.13: Calcite and Pebble Count at RG_FO26, FRO LAEMP, September 2018

RG_FO26 3				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	0	4.2	-
2	0	0	4.6	-
3	0	1	8.2	-
4	0	1	6.5	-
5	0	1	3.5	-
6	0	1	4.0	-
7	0	1	6.8	-
8	0	1	5.9	-
9	0	1	7.4	-
10	0	1	7.3	0
11	0	1	6.9	-
12	0	1	8.1	-
13	0	1	5.0	-
14	0	1	4.8	-
15	0	0	6.7	-
16	0	0	4.0	-
17	0	0	4.3	-
18	0	1	14.9	-
19	0	0	4.5	-
20	0	1	5.1	0.25
21	0	1	8.4	-
22	0	0	4.4	-
23	0	1	6.5	-
24	0	0	6.2	-
25	0	1	4.0	-
26	0	0	3.2	-
27	0	1	14.1	-
28	0	1	6.9	-
29	0	1	9.2	-
30	0	1	8.2	0.5
31	0	0	8.9	-
32	0	1	6.5	-
33	0	0	4.2	-
34	0	1	6.6	-
35	0	1	6.7	-
36	0	1	6.2	-
37	0	1	15.1	-
38	0	0	6.2	-
39	0	0	3.5	-
40	0	1	5.9	0
41	0	1	9.3	-
42	0	0	4.9	-
43	0	1	6.5	-
44	0	1	4.8	-
45	0	0	8.1	-
46	0	1	5.9	-
47	0	1	11.2	-
48	0	0	6.1	-
49	0	0	7.9	-
50	0	1	4.4	0.25
51	0	1	5.4	-
52	0	0	7.0	-
53	0	1	19.5	-
54	0	1	5.2	-
55	0	1	12.9	-
56	0	1	9.5	-
57	0	1	10.8	-
58	0	1	22.3	-
59	0	1	4.1	-
60	0	1	7.6	0.25
61	0	1	7.1	-
62	0	1	6.4	-
63	0	1	3.7	-
64	0	0	2.9	-
65	0	0	4.3	-
66	0	1	5.4	-
67	0	0	5.6	-
68	0	0	9.9	-
69	0	0	5.2	-
70	0	0	12.7	0.25
71	0	1	7.5	-
72	0	1	6.2	-
73	0	1	5.3	-
74	0	1	5.1	-
75	0	1	10.2	-
76	0	0	4.5	-
77	0	1	10.9	-
78	0	1	7.5	-
79	0	1	7.8	-
80	0	1	7.5	0
81	0	1	6.2	-
82	0	1	8.8	-
83	0	1	7.7	-
84	0	0	3.4	-
85	0	1	7.4	-
86	0	0	4.1	-
87	0	1	11.4	-
88	0	1	17.2	-
89	0	1	6.6	-
90	0	1	8.9	0.5
91	0	1	9.4	-
92	0	1	8.2	-
93	0	1	7.5	-
94	0	1	10.5	-
95	0	1	4.6	-
96	0	1	9.8	-
97	0	1	12.3	-
98	0	1	13.9	-
99	0	1	6.7	-
100	0	0	7.7	0.25
Minimum	**0.0**	**0.0**	**2.9**	**0.0**
Maximum	**0.0**	**1.0**	**22.3**	**0.5**
Mean	**0.0**	**0.72**	**7.45**	**0.225**
Standard Dev.	**0.0**	**0.451**	**3.466**	**0.184**
Geometric mean	**-**	**-**	**6.818**	**-**
Median	**0.0**	**1.0**	**6.7**	**0.25**
Calcite Index	**0.7**		**-**	**-**

Table F.14 Calcite and Pebble Count at RG_FODHE, FRO LAEMP, September 2018

RG_FODHE 1					RG_FODHE 2				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	6.3	-	1	0	1	7.9	-
2	0	0	4.5	-	2	0	0	5.5	-
3	0	1	10.9	-	3	0	0	5.6	-
4	0	0	6.6	-	4	0	0	5.5	-
5	0	0	5.2	-	5	0	1	16.5	-
6	0	1	10.2	-	6	0	0	16.8	-
7	0	1	10.8	-	7	0	0	13.2	-
8	0	0	4.4	-	8	0	0	2.7	-
9	0	1	11.6	-	9	0	1	8.9	-
10	0	1	9.4	0.75	10	0	1	10.5	0.25
11	0	1	8.5	-	11	0	0	2.3	-
12	0	1	5.9	-	12	0	0	4.7	-
13	0	0	4.0	-	13	0	1	4.8	-
14	0	1	16.4	-	14	0	0	5.2	-
15	0	0	3.8	-	15	0	0	3.4	-
16	0	1	9.9	-	16	0	1	4.9	-
17	0	1	8.5	-	17	0	1	9.2	-
18	0	1	5.6	-	18	0	0	6.8	-
19	0	0	6.0	-	19	0	1	8.8	-
20	0	1	11.5	0.75	20	0	0	10.5	0.5
21	0	0	9.3	-	21	0	1	17.0	-
22	0	0	4.0	-	22	0	1	19.5	-
23	0	1	7.4	-	23	0	0	7.9	-
24	0	1	5.7	-	24	0	0	9.1	-
25	0	1	8.1	-	25	0	1	12.4	-
26	0	1	15.1	-	26	0	0	9.0	-
27	0	0	5.9	-	27	0	1	7.6	-
28	0	1	19.0	-	28	0	0	12.7	-
29	0	0	7.0	-	29	0	0	5.1	-
30	0	1	10.9	0.25	30	0	1	9.4	0.25
31	0	1	9.2	-	31	0	0	5.5	-
32	0	0	1.7	-	32	0	1	10.5	-
33	0	1	9.4	-	33	0	0	9.8	-
34	0	0	3.9	-	34	0	0	6.5	-
35	0	0	7.9	-	35	0	1	9.9	-
36	0	0	7.5	-	36	0	0	2.1	-
37	0	1	6.1	-	37	0	1	4.5	-
38	0	1	6.3	-	38	0	0	7.1	-
39	0	0	7.9	-	39	0	0	4.8	-
40	0	1	7.0	0	40	0	0	4.2	0
41	0	1	13.5	-	41	0	0	2.9	-
42	0	0	5.4	-	42	0	0	4.3	-
43	0	1	9.4	-	43	0	1	6.1	-
44	0	1	5.2	-	44	0	0	4.1	-
45	0	1	7.2	-	45	0	0	7.8	-
46	0	1	12.6	-	46	0	0	2.8	-
47	0	1	10.1	-	47	0	1	12.5	-
48	0	0	4.6	-	48	0	0	5.0	-
49	0	1	7.1	-	49	0	1	11.6	-
50	0	1	11.2	0.5	50	0	0	5.4	0.5
51	0	1	10.6	-	51	0	1	8.2	-
52	0	0	4.7	-	52	0	0	5.5	-
53	0	1	5.9	-	53	0	0	10.1	-
54	0	0	3.5	-	54	0	0	4.8	-
55	0	0	3.6	-	55	0	0	5.4	-
56	0	0	3.0	-	56	0	0	5.1	-
57	0	0	10.4	-	57	0	0	6.7	-
58	0	1	4.7	-	58	0	0	6.5	-
59	0	1	15.7	-	59	0	1	6.0	-
60	0	1	8.7	0.25	60	0	0	5.1	0.25
61	0	0	7.4	-	61	0	0	6.4	-
62	0	1	15.0	-	62	0	1	13.7	-
63	0	1	11.6	-	63	0	0	6.6	-
64	0	0	5.1	-	64	0	1	9.1	-
65	0	0	5.5	-	65	0	0	6.7	-
66	0	0	5.2	-	66	0	0	7.8	-
67	0	1	9.5	-	67	0	1	4.2	-
68	0	1	6.9	-	68	0	0	6.2	-
69	0	0	2.5	-	69	0	0	9.2	-
70	0	0	2.6	0.25	70	0	1	11.1	0.75
71	0	1	8.8	-	71	0	1	14.8	-
72	0	1	8.5	-	72	0	1	8.1	-
73	0	0	4.4	-	73	0	1	12.8	-
74	0	0	3.5	-	74	0	0	9.5	-
75	0	1	8.5	-	75	0	1	6.4	-
76	0	1	8.5	-	76	0	0	2.9	-
77	0	1	11.1	-	77	0	0	12.2	-
78	0	0	1.1	-	78	0	0	9.6	-
79	0	1	7.9	-	79	0	0	3.4	-
80	0	1	9.1	0.5	80	0	1	10.4	0
81	0	0	8.7	-	81	0	0	6.5	-
82	0	0	3.5	-	82	0	0	5.8	-
83	0	0	4.1	-	83	0	0	4.2	-
84	0	1	6.6	-	84	0	0	8.9	-
85	0	1	10.0	-	85	0	0	5.7	-
86	0	0	4.2	-	86	0	0	7.6	-
87	0	1	8.5	-	87	0	0	5.2	-
88	0	0	4.9	-	88	0	1	7.0	-
89	0	0	7.1	-	89	0	1	12.2	-
90	0	0	6.7	0.25	90	0	0	8.3	0
91	0	0	3.9	-	91	0	0	7.7	-
92	0	0	7.0	-	92	0	0	8.6	-
93	0	1	10.5	-	93	0	1	13.1	-
94	0	0	10.6	-	94	0	0	5.9	-
95	0	0	5.9	-	95	0	0	8.9	-
96	0	1	3.7	-	96	0	1	7.8	-
97	0	1	4.4	-	97	0	0	4.9	-
98	0	0	5.5	-	98	0	1	9.2	-
99	0	1	9.7	-	99	0	1	6.1	-
100	0	0	5.2	0.25	100	0	0	4.1	0.25
Minimum	**0.0**	**0.0**	**1.1**	**0**	**Minimum**	**0.0**	**0.0**	**2.1**	**0**
Maximum	**0.0**	**1.0**	**19.0**	**0.75**	**Maximum**	**0.0**	**1.0**	**19.5**	**0.75**
Mean	**0.0**	**0.6**	**7.5**	**0.4**	**Mean**	**0.0**	**0.4**	**7.7**	**0.3**
Standard Dev.	**0.0**	**0.5**	**3.4**	**0.2**	**Standard Dev.**	**0.0**	**0.5**	**3.5**	**0.2**
Geometric mean	**-**	**-**	**6.7**	**-**	**Geometric mean**	**-**	**-**	**7.0**	**-**
Median	**0.0**	**1.0**	**7.1**	**0**	**Median**	**0.0**	**0.0**	**6.9**	**0**
Calcite Index	**0.6**		**-**	**-**	**Calcite Index**	**0.4**		**-**	**-**

Table F.14 Calcite and Pebble Count at RG_FODHE, FRO LAEMP, September 2018

RG_FODHE 3				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	5.4	-
2	0	1	10.9	-
3	0	0	1.6	-
4	0	0	2.5	-
5	0	1	3.9	-
6	0	1	8.8	-
7	0	0	4.6	-
8	0	0	4.2	-
9	0	1	10.4	-
10	0	1	11.0	0.25
11	0	1	5.1	-
12	0	1	11.7	-
13	0	1	5.9	-
14	0	1	7.3	-
15	0	1	10.5	-
16	0	1	2.4	-
17	0	1	10.4	-
18	0	1	4.4	-
19	0	1	10.7	-
20	0	1	10.8	0.75
21	0	0	4.7	-
22	0	0	3.3	-
23	0	1	7.2	-
24	0	0	3.3	-
25	0	1	4.9	-
26	0	1	8.5	-
27	0	1	10.3	-
28	0	1	5.6	-
29	0	0	7.1	-
30	0	1	8.6	0.25
31	0	0	3.2	-
32	0	1	6.1	-
33	0	0	3.5	-
34	0	1	8.9	-
35	0	1	9.4	-
36	0	1	3.7	-
37	0	1	8.9	-
38	0	1	6.5	-
39	0	1	9.2	-
40	0	1	6.8	0
41	0	1	4.9	-
42	0	1	2.9	-
43	0	1	10.5	-
44	0	1	4.8	-
45	0	1	4.2	-
46	0	1	4.3	-
47	0	1	5.9	-
48	0	1	9.7	-
49	0	1	7.4	-
50	0	1	12.6	0
51	0	1	8.2	-
52	0	1	9.2	-
53	0	1	8.0	-
54	0	1	9.2	-
55	0	0	2.1	-
56	0	0	4.5	-
57	0	0	3.2	-
58	0	1	12.5	-
59	0	1	10.4	-
60	0	1	7.2	0.5
61	0	1	10.1	-
62	0	1	7.4	-
63	0	0	5.2	-
64	0	1	15.5	-
65	0	1	4.5	-
66	0	1	4.7	-
67	0	1	9.4	-
68	0	0	2.9	-
69	0	1	14.1	-
70	0	1	5.3	0.25
71	0	0	6.0	-
72	0	1	5.6	-
73	0	1	7.9	-
74	0	1	12.2	-
75	0	1	5.3	-
76	0	1	3.4	-
77	0	1	8.8	-
78	0	1	10.2	-
79	0	1	7.6	-
80	0	1	13.3	0.25
81	0	1	5.5	-
82	0	1	5.4	-
83	0	1	14.0	-
84	0	1	6.0	-
85	0	1	10.8	-
86	0	1	8.5	-
87	0	1	4.7	-
88	0	1	9.2	-
89	0	1	5.3	-
90	0	1	9.7	0.25
91	0	1	5.9	-
92	0	1	7.7	-
93	0	0	2.3	-
94	0	1	9.3	-
95	0	1	12.7	-
96	0	1	8.5	-
97	0	0	3.3	-
98	0	1	6.6	-
99	0	1	7.5	-
100	0	1	7.8	0.25
Minimum	**0.0**	**0.0**	**1.6**	**0**
Maximum	**0.0**	**1.0**	**15.5**	**0.75**
Mean	**0.0**	**0.8**	**7.2**	**0.3**
Standard Dev.	**0.0**	**0.4**	**3.1**	**0.2**
Geometric mean	**-**	**-**	**6.5**	**-**
Median	**0.0**	**1.0**	**7.2**	**0**
Calcite Index	**0.8**		**-**	**-**

Table F.15: Calcite and Pebble Count at RG_FOUNGD, FRO LAEMP, September 2018

RG_FOUNGD 1					RG_FOUNGD 2				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	9.0	-	1	0	1	5.5	-
2	0	1	7.0	-	2	0	1	9.0	-
3	b	1	34.0	-	3	0	1	3.0	-
4	0	1	4.5	-	4	0	1	5.0	-
5	0	1	4.5	-	5	0	1	8.0	-
6	1	1	8.0	-	6	0	1	8.0	-
7	0	1	5.5	-	7	0	1	8.0	-
8	0	1	4.0	-	8	0	1	2.5	-
9	0	1	2.0	-	9	0	1	7.5	-
10	0	1	4.0	0.25	10	0	1	3.5	0
11	0	1	6.0	-	11	0	1	2.5	-
12	0	1	3.0	-	12	0	1	4.0	-
13	0	1	8.0	-	13	0	1	9.0	-
14	0	1	23.0	-	14	0	1	2.5	-
15	0	1	5.5	-	15	0	1	3.0	-
16	0	1	2.5	-	16	0	1	4.0	-
17	0	1	2.0	-	17	0	1	4.0	-
18	0	1	5.0	-	18	0	1	5.5	-
19	0	1	12.0	-	19	0	1	5.0	-
20	0	1	7.5	0.25	20	0	1	3.0	0
21	0	1	8.0	-	21	0	1	7.0	-
22	0	1	8.0	-	22	0	1	5.5	-
23	0	1	5.0	-	23	0	1	10.5	-
24	0	1	2.5	-	24	0	1	7.0	-
25	0	1	9.5	-	25	0	1	7.5	-
26	1	1	8.5	-	26	0	1	8.0	-
27	0	1	8.5	-	27	0	1	6.5	-
28	0	1	4.0	-	28	0	1	12.0	-
29	0	1	47.0	-	29	0	1	14.0	-
30	0	1	6.5	0	30	0	1	6.5	0
31	0	1	5.0	-	31	0	1	10.5	-
32	0	1	8.5	-	32	0	1	2.0	-
33	0	1	39.0	-	33	0	1	8.0	-
34	0	1	4.5	-	34	0	1	4.0	-
35	1	1	12.0	-	35	0	1	7.5	-
36	0	1	47.0	-	36	1	1	6.5	-
37	0	1	6.0	-	37	0	1	3.5	-
38	0	1	6.0	-	38	0	1	4.0	-
39	0	1	10.0	-	39	0	1	2.5	-
40	0	1	10.5	0.75	40	0	1	3.5	0.25
41	0	1	4.0	-	41	0	1	4.0	-
42	0	1	31.0	-	42	0	1	5.0	-
43	0	1	3.0	-	43	1	1	5.5	-
44	0	1	3.0	-	44	0	1	5.0	-
45	0	1	3.0	-	45	0	1	6.0	-
46	0	1	19.0	-	46	1	1	4.0	-
47	0	1	12.5	-	47	0	1	6.0	-
48	0	1	6.0	-	48	0	1	3.0	-
49	0	1	4.0	-	49	0	1	6.5	-
50	0	0	3.5	0	50	0	1	5.0	0.5
51	0	1	3.0	-	51	0	1	4.5	-
52	0	1	5.0	-	52	0	1	3.5	-
53	0	1	4.0	-	53	0	1	5.0	-
54	0	1	3.5	-	54	1	1	7.0	-
55	0	1	7.5	-	55	0	1	7.0	-
56	0	1	5.5	-	56	0	1	4.5	-
57	0	1	2.5	-	57	0	1	5.0	-
58	0	1	3.0	-	58	0	1	4.0	-
59	0	1	2.0	-	59	0	1	5.0	-
60	0	1	4.5	0.75	60	0	1	3.0	0
61	0	1	8.5	-	61	0	1	3.5	-
62	0	1	29.0	-	62	0	1	4.0	-
63	0	1	4.0	-	63	0	1	4.5	-
64	0	1	11.0	-	64	0	1	3.0	-
65	0	1	4.0	-	65	0	1	12.5	-
66	0	1	3.5	-	66	0	1	8.0	-
67	0	1	8.0	-	67	0	1	4.0	-
68	0	1	3.0	-	68	0	1	5.5	-
69	0	1	18.0	-	69	0	1	4.5	-
70	0	1	5.0	0.25	70	0	1	2.5	0
71	0	1	4.5	-	71	0	1	5.5	-
72	0	1	5.0	-	72	0	1	6.0	-
73	0	1	3.0	-	73	0	1	8.5	-
74	0	1	8.0	-	74	0	1	7.0	-
75	0	1	4.5	-	75	0	1	5.0	-
76	0	1	5.5	-	76	0	1	10.5	-
77	0	1	5.5	-	77	0	1	12.0	-
78	0	1	7.5	-	78	0	1	4.5	-
79	0	1	1.0	-	79	0	1	6.0	-
80	0	1	9.5	0.75	80	0	1	5.5	0.5
81	0	1	24.0	-	81	0	1	14.0	-
82	0	1	11.0	-	82	1	1	10.0	-
83	0	1	8.5	-	83	0	1	10.0	-
84	0	1	6.5	-	84	1	1	7.5	-
85	0	1	4.0	-	85	1	1	7.5	-
86	0	1	7.0	-	86	1	1	9.0	-
87	0	1	10.0	-	87	0	1	6.5	-
88	0	1	5.0	-	88	0	1	5.0	-
89	0	1	8.0	-	89	0	1	8.0	-
90	0	1	16.0	0	90	0	1	3.0	0.5
91	0	1	10.0	-	91	0	1	4.5	-
92	0	1	15.0	-	92	0	1	5.0	-
93	0	1	7.0	-	93	0	1	6.5	-
94	1	1	11.0	-	94	0	1	4.5	-
95	0	0	5.0	-	95	0	1	8.5	-
96	0	1	4.5	-	96	0	1	5.5	-
97	0	1	3.0	-	97	0	1	4.5	-
98	0	1	5.0	-	98	0	1	6.0	-
99	0	1	9.0	-	99	0	1	3.5	-
100	0	1	36.0	1	100	0	1	6.5	0.5
Minimum	**0.0**	**0.0**	**1.0**	**0**	**Minimum**	**0.0**	**1.0**	**2.0**	**0**
Maximum	**1.0**	**1.0**	**47.0**	**1**	**Maximum**	**1.0**	**1.0**	**14.0**	**0.5**
Mean	**0.0**	**1.0**	**9.0**	**0.4**	**Mean**	**0.1**	**1.0**	**6.0**	**0.2**
Standard Dev.	**0.2**	**0.1**	**9.1**	**0.4**	**Standard Dev.**	**0.3**	**0.0**	**2.6**	**0.2**
Geometric mean	**-**	**-**	**6.6**	**-**	**Geometric mean**	**-**	**-**	**5.4**	**-**
Median	**0.0**	**1.0**	**6.0**	**0**	**Median**	**0.0**	**1.0**	**5.5**	**0**
Calcite Index	**1.0**		**-**	**-**	**Calcite Index**	**1.1**		**-**	**-**

Table F.15: Calcite and Pebble Count at RG_FOUNGD, FRO LAEMP, September 2018

RG_FOUNGD 3				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	1	5.0	-
2	0	1	8.5	-
3	0	1	3.5	-
4	0	1	5.0	-
5	0	1	6.0	-
6	0	1	7.0	-
7	0	0	3.0	-
8	0	1	5.0	-
9	0	1	7.0	-
10	0	1	9.0	0.25
11	0	1	3.5	-
12	0	1	4.5	-
13	0	1	7.0	-
14	0	1	11.0	-
15	0	1	10.0	-
16	0	1	7.0	-
17	0	1	7.0	-
18	0	1	6.0	-
19	0	1	7.0	-
20	0	1	3.0	0
21	0	1	6.0	-
22	0	1	3.0	-
23	0	1	5.0	-
24	0	1	7.0	-
25	0	1	6.0	-
26	0	1	7.0	-
27	0	1	7.0	-
28	0	1	14.0	-
29	0	1	7.0	-
30	0	1	1.0	0.5
31	0	0	4.0	-
32	0	1	4.0	-
33	0	1	5.5	-
34	0	1	5.5	-
35	0	1	3.0	-
36	0	1	4.0	-
37	0	1	6.0	-
38	0	1	5.0	-
39	0	1	7.0	-
40	0	0	8.0	0.25
41	0	1	5.0	-
42	0	1	3.5	-
43	0	1	3.5	-
44	0	1	6.0	-
45	0	1	6.0	-
46	0	1	7.0	-
47	0	1	2.0	-
48	0	1	8.0	-
49	0	0	4.0	-
50	0	1	9.0	0.5
51	0	1	7.0	-
52	0	1	8.0	-
53	0	1	8.0	-
54	0	1	3.0	-
55	0	1	10.0	-
56	0	1	5.0	-
57	0	1	Gravel	-
58	0	1	3.0	-
59	0	1	7.5	-
60	0	1	5.5	0.25
61	0	1	5.0	-
62	0	0	7.0	-
63	0	0	6.0	-
64	0	1	7.0	-
65	0	1	6.0	-
66	0	1	3.5	-
67	0	1	4.0	-
68	0	1	4.5	-
69	0	1	3.0	-
70	0	1	8.0	0.5
71	0	1	5.0	-
72	0	1	7.0	-
73	0	1	6.0	-
74	0	1	9.0	-
75	0	1	5.0	-
76	0	1	9.0	-
77	0	1	7.0	-
78	0	1	8.0	-
79	0	1	2.0	-
80	0	1	6.0	0
81	0	1	4.0	-
82	0	1	8.0	-
83	0	1	6.5	-
84	0	1	9.0	-
85	0	1	4.0	-
86	0	1	4.0	-
87	0	1	5.5	-
88	0	1	5.0	-
89	0	1	5.0	-
90	0	1	5.0	0
91	0	1	5.0	-
92	0	1	8.0	-
93	0	1	10.0	-
94	0	1	4.0	-
95	0	1	6.0	-
96	0	1	8.5	-
97	0	1	3.0	-
98	0	1	4.0	-
99	0	1	10.0	-
100	0	1	10.0	0
Minimum	**0.0**	**0.0**	**1.0**	**0**
Maximum	**0.0**	**1.0**	**14.0**	**0.5**
Mean	**0.0**	**0.9**	**6.0**	**0.2**
Standard Dev.	**0.0**	**0.2**	**2.3**	**0.2**
Geometric mean	**-**	**-**	**5.5**	**-**
Median	**0.0**	**1.0**	**6.0**	**0**
Calcite Index	**0.9**		**-**	**-**

Table F.16: Calcite and Pebble Count at RG_FODNGD, FRO LAEMP, September 2018

RG_FODNGD 1					RG_FODNGD 2				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**	**Rock**	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	1	3.5	-	1	0	1	13.0	-
2	0	1	8.0	-	2	0	1	9.0	-
3	0	1	2.5	-	3	0	1	6.5	-
4	2	1	8.0	-	4	0	1	5.5	-
5	0	1	12.5	-	5	0	1	7.0	-
6	0	1	7.0	-	6	0	1	14.5	-
7	0	1	4.5	-	7	0	1	9.5	-
8	0	1	6.5	-	8	0	1	10.0	-
9	0	1	8.0	-	9	0	1	7.0	-
10	0	1	4.0	0	10	0	1	6.0	0
11	0	1	5.0	-	11	0	1	6.5	-
12	0	1	7.0	-	12	0	1	12.0	-
13	1	1	11.0	-	13	0	1	12.0	-
14	0	1	11.0	-	14	0	1	23.0	-
15	0	1	9.0	-	15	0	1	6.0	-
16	0	1	6.0	-	16	0	0	5.0	-
17	0	1	9.0	-	17	0	0	3.0	-
18	0	1	7.0	-	18	0	1	8.0	-
19	0	1	8.0	-	19	0	1	10.0	-
20	0	1	7.0	0	20	0	1	8.0	1
21	0	1	10.0	-	21	0	1	10.0	-
22	0	1	10.0	-	22	0	1	7.0	-
23	0	1	12.5	-	23	0	1	5.0	-
24	0	1	8.0	-	24	0	1	15.0	-
25	0	1	10.5	-	25	0	1	3.0	-
26	0	1	7.5	-	26	0	1	7.5	-
27	0	1	14.0	-	27	0	1	3.5	-
28	0	1	4.5	-	28	0	1	20.0	-
29	0	1	5.0	-	29	0	1	17.0	-
30	0	1	8.0	0.25	30	0	1	9.0	1
31	0	1	9.0	-	31	0	1	8.0	-
32	0	1	12.0	-	32	0	1	5.5	-
33	0	0	3.5	-	33	0	1	10.5	-
34	0	1	13.5	-	34	0	1	5.0	-
35	0	1	19.0	-	35	0	1	5.0	-
36	0	1	3.0	-	36	0	1	6.5	-
37	0	1	2.0	-	37	0	1	4.5	-
38	0	1	Gravel	-	38	0	1	5.5	-
39	0	1	14.0	-	39	0	1	22.0	-
40	0	1	3.0	0	40	0	1	6.0	0
41	0	1	12.0	-	41	0	1	4.5	-
42	0	1	7.0	-	42	0	1	7.0	-
43	0	1	4.0	-	43	0	1	6.0	-
44	0	1	6.0	-	44	0	1	19.0	-
45	0	1	1.5	-	45	0	1	10.0	-
46	0	1	2.5	-	46	0	1	16.0	-
47	0	1	7.5	-	47	0	1	12.0	-
48	0	1	8.0	-	48	0	1	15.0	-
49	0	1	4.5	-	49	0	1	11.0	-
50	0	1	11.0	0.5	50	0	1	10.0	0.25
51	0	1	10.0	-	51	0	1	8.5	-
52	0	0	2.0	-	52	0	1	10.0	-
53	0	1	11.0	-	53	0	1	9.0	-
54	0	1	10.5	-	54	0	1	18.0	-
55	0	1	8.0	-	55	0	1	13.0	-
56	0	1	7.5	-	56	0	1	20.0	-
57	0	1	10.0	-	57	0	1	6.5	-
58	0	1	Gravel	-	58	0	1	13.0	-
59	0	1	9.0	-	59	0	1	6.0	-
60	0	1	8.0	0.75	60	0	1	13.0	0.25
61	0	1	8.0	-	61	0	1	23.0	-
62	0	1	5.0	-	62	0	1	11.0	-
63	0	0	7.0	-	63	0	1	6.0	-
64	0	0	9.0	-	64	0	1	7.0	-
65	0	0	10.0	-	65	0	1	6.0	-
66	0	0	Gravel	-	66	0	1	7.0	-
67	0	1	10.0	-	67	0	1	14.0	-
68	0	0	6.0	-	68	0	1	6.0	-
69	0	0	9.0	-	69	0	1	11.0	-
70	0	0	7.0	0.5	70	0	1	7.0	1
71	0	1	10.0	-	71	0	1	9.0	-
72	0	1	6.5	-	72	0	0	7.0	-
73	0	1	4.0	-	73	0	0	5.5	-
74	0	1	7.0	-	74	0	0	6.0	-
75	0	1	2.0	-	75	0	1	12.0	-
76	0	1	6.0	-	76	0	0	7.0	-
77	0	1	7.0	-	77	0	1	8.0	-
78	0	0	8.0	-	78	0	1	16.0	-
79	0	1	4.0	-	79	0	1	8.0	-
80	0	1	6.0	0.75	80	0	1	4.5	0
81	0	1	7.0	-	81	0	1	10.0	-
82	0	1	9.5	-	82	0	0	7.0	-
83	0	1	7.0	-	83	0	1	9.5	-
84	0	1	7.0	-	84	0	1	12.0	-
85	0	1	7.0	-	85	0	1	8.5	-
86	0	1	7.0	-	86	0	1	5.0	-
87	0	1	4.0	-	87	0	1	8.5	-
88	0	1	9.0	-	88	0	1	11.0	-
89	0	1	10.0	-	89	0	1	6.0	-
90	0	1	9.5	0.5	90	0	1	11.0	0.25
91	0	1	6.5	-	91	0	1	11.0	-
92	0	1	9.0	-	92	0	1	9.0	-
93	0	1	6.0	-	93	0	1	6.0	-
94	0	1	8.0	-	94	0	1	7.0	-
95	0	0	5.0	-	95	0	1	18.0	-
96	0	1	7.0	-	96	0	1	9.0	-
97	0	1	8.5	-	97	0	1	12.0	-
98	0	1	8.5	-	98	0	1	11.5	-
99	0	1	17.0	-	99	0	1	7.0	-
100	0	1	16.0	0.75	100	0	1	12.0	0.25
Minimum	**0.0**	**0.0**	**1.5**	**0**	**Minimum**	**0.0**	**0.0**	**3.0**	**0**
Maximum	**2.0**	**1.0**	**19.0**	**0.75**	**Maximum**	**0.0**	**1.0**	**23.0**	**1**
Mean	**0.0**	**0.9**	**7.8**	**0.4**	**Mean**	**0.0**	**0.9**	**9.6**	**0.4**
Standard Dev.	**0.2**	**0.3**	**3.3**	**0.3**	**Standard Dev.**	**0.0**	**0.3**	**4.5**	**0.4**
Geometric mean	**-**	**-**	**7.0**	**-**	**Geometric mean**	**-**	**-**	**8.7**	**-**
Median	**0.0**	**1.0**	**7.5**	**1**	**Median**	**0.0**	**1.0**	**8.5**	**0**
Calcite Index	**0.9**		**-**	**-**	**Calcite Index**	**0.9**		**-**	**-**

Table F.16: Calcite and Pebble Count at RG_FODNGD, FRO LAEMP, September 2018

RG_FODNGD 3				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	1	8.0	-
2	0	1	4.5	-
3	0	1	4.5	-
4	0	1	7.0	-
5	0	1	8.0	-
6	0	1	4.5	-
7	0	1	12.0	-
8	0	0	6.0	-
9	0	0	9.0	-
10	0	1	8.0	0.5
11	0	1	4.0	-
12	0	1	19.0	-
13	0	1	7.0	-
14	0	1	7.0	-
15	0	1	4.0	-
16	0	1	7.0	-
17	0	1	7.0	-
18	0	1	4.0	-
19	0	1	9.0	-
20	0	1	13.0	0.25
21	0	1	10.0	-
22	0	1	6.5	-
23	0	1	6.0	-
24	0	1	9.0	-
25	0	1	7.0	-
26	0	1	14.0	-
27	0	1	6.0	-
28	2	1	11.0	-
29	1	1	9.0	-
30	0	1	9.0	0
31	0	1	7.0	-
32	0	1	2.0	-
33	0	1	4.0	-
34	0	1	16.0	-
35	0	1	5.0	-
36	0	1	12.0	-
37	0	1	14.0	-
38	0	1	5.0	-
39	0	1	3.5	-
40	0	1	21.0	1
41	0	1	3.0	-
42	0	1	7.0	-
43	0	1	6.0	-
44	0	1	3.0	-
45	0	1	4.0	-
46	0	1	4.0	-
47	0	1	4.0	-
48	0	1	3.0	-
49	0	1	6.0	-
50	0	0	3.0	0
51	0	1	5.0	-
52	0	1	6.0	-
53	0	1	11.0	-
54	0	1	18.0	-
55	0	1	6.0	-
56	0	0	3.0	-
57	0	1	9.0	-
58	0	1	9.0	-
59	0	1	11.0	-
60	0	1	5.5	0
61	0	1	14.0	-
62	1	1	5.0	-
63	0	1	7.0	-
64	0	1	10.0	-
65	2	1	7.0	-
66	0	0	7.0	-
67	0	0	7.0	-
68	0	1	8.0	-
69	0	1	10.0	-
70	0	1	7.5	0.5
71	0	1	23.0	-
72	0	0	5.0	-
73	0	1	11.0	-
74	0	0	5.0	-
75	0	1	6.0	-
76	0	1	3.0	-
77	0	1	4.0	-
78	0	1	5.0	-
79	0	1	4.0	-
80	0	1	15.0	1
81	0	1	6.0	-
82	0	1	5.0	-
83	0	1	5.5	-
84	0	1	7.5	-
85	0	1	3.0	-
86	0	1	2.0	-
87	0	1	3.0	-
88	0	0	3.0	-
89	0	1	4.0	-
90	0	1	7.0	1
91	0	1	7.0	-
92	0	1	3.0	-
93	0	1	5.5	-
94	0	1	4.5	-
95	0	1	5.0	-
96	0	1	3.5	-
97	0	1	5.0	-
98	0	1	3.0	-
99	0	1	9.0	-
100	0	0	4.0	0.75
Minimum	**0.0**	**0.0**	**2.0**	**0**
Maximum	**2.0**	**1.0**	**23.0**	**1**
Mean	**0.1**	**0.9**	**7.2**	**0.5**
Standard Dev.	**0.3**	**0.3**	**4.1**	**0.4**
Geometric mean	**-**	**-**	**6.2**	**-**
Median	**0.0**	**1.0**	**6.0**	**1**
Calcite Index	**1.0**		**-**	**-**

Table F.17: Calcite and Pebble Count at RG_MP1, FRO LAEMP, September 2018

RG_MP1 1					**RG_MP1 2**				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**	**Rock**	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	1	6.0	-	1	0	1	5.0	-
2	0	1	18.0	-	2	0	1	7.0	-
3	0	1	8.0	-	3	0	1	9.5	-
4	1	1	11.0	-	4	0	1	7.0	-
5	0	1	4.5	-	5	0	1	120.0	-
6	2	1	30.0	-	6	0	0	5.0	-
7	0	1	15.0	-	7	0	1	8.0	-
8	0	0	Gravel	-	8	0	0	6.0	-
9	2	1	5.0	-	9	0	1	4.0	-
10	1	1	58.0	0.5	10	0	1	17.5	0
11	0	1	2.0	-	11	0	0	4.0	-
12	2	1	41.0	-	12	0	1	41.0	-
13	2	1	21.0	-	13	0	1	10.0	-
14	0	1	5.0	-	14	0	1	6.0	-
15	0	1	8.0	-	15	0	1	5.0	-
16	0	1	6.0	-	16	0	1	5.0	-
17	2	1	31.0	-	17	0	0	6.0	-
18	0	0	Gravel	-	18	0	1	5.0	-
19	2	1	30.0	-	19	0	1	7.0	-
20	0	1	5.0	0.25	20	0	1	3.5	0.5
21	0	1	13.5	-	21	0	0	4.0	-
22	0	1	6.0	-	22	0	1	67.0	-
23	0	1	12.0	-	23	0	1	11.0	-
24	0	1	7.5	-	24	0	1	8.0	-
25	0	1	3.0	-	25	0	1	3.0	-
26	0	1	14.0	-	26	0	1	6.5	-
27	0	1	5.5	-	27	0	1	92.0	-
28	0	1	7.0	-	28	0	1	6.5	-
29	2	1	17.0	-	29	0	1	9.0	-
30	0	1	10.0	0	30	0	1	5.0	0.75
31	1	1	3.5	-	31	0	1	6.0	-
32	2	1	28.0	-	32	0	1	4.0	-
33	0	1	5.0	-	33	0	1	6.0	-
34	2	1	29.0	-	34	0	0	3.5	-
35	0	1	9.0	-	35	0	1	4.5	-
36	2	1	81.0	-	36	0	1	21.0	-
37	2	1	36.0	-	37	0	1	25.0	-
38	1	1	18.0	-	38	0	0	6.5	-
39	0	1	7.0	-	39	0	1	4.0	-
40	0	1	9.0	0	40	0	1	5.0	0.25
41	0	1	7.0	-	41	1	1	2.0	-
42	2	1	58.0	-	42	0	1	2.5	-
43	0	1	7.0	-	43	2	1	10.0	-
44	2	1	18.0	-	44	0	1	3.0	-
45	0	0	Gravel	-	45	0	1	16.5	-
46	0	1	5.0	-	46	0	1	7.0	-
47	0	1	6.0	-	47	0	1	6.0	-
48	1	1	6.0	-	48	0	0	Gravel	-
49	0	1	11.0	-	49	2	1	22.0	-
50	1	1	14.0	0.25	50	0	1	8.0	0.5
51	0	1	8.0	-	51	0	1	12.0	-
52	2	1	8.0	-	52	0	1	8.0	-
53	2	1	18.0	-	53	0	0	Gravel	-
54	2	1	30.0	-	54	0	1	4.0	-
55	0	0	Gravel	-	55	0	1	5.0	-
56	0	1	13.0	-	56	0	1	6.0	-
57	1	1	59.0	-	57	0	1	8.0	-
58	0	1	12.0	-	58	0	1	5.0	-
59	0	0	1.0	-	59	0	0	Gravel	-
60	0	0	Gravel	0	60	0	1	1.0	0
61	1	1	35.0	-	61	2	1	3.0	-
62	1	1	40.0	-	62	0	1	6.0	-
63	2	1	21.0	-	63	2	1	7.0	-
64	0	0	1.5	-	64	0	1	5.0	-
65	2	1	50.0	-	65	0	1	3.0	-
66	2	1	77.0	-	66	0	1	5.0	-
67	0	1	5.0	-	67	0	1	4.0	-
68	1	1	9.0	-	68	0	1	7.0	-
69	1	1	50.0	-	69	0	1	4.0	-
70	1	1	41.0	1	70	0	1	2.0	0
71	0	1	8.0	-	71	0	1	5.0	-
72	0	1	6.0	-	72	0	1	6.0	-
73	1	1	37.0	-	73	0	1	4.5	-
74	0	1	6.0	-	74	0	1	3.5	-
75	1	1	49.0	-	75	0	1	3.5	-
76	0	1	4.5	-	76	0	1	5.0	-
77	0	0	5.0	-	77	0	1	2.0	-
78	1	1	32.0	-	78	0	1	4.5	-
79	0	1	9.0	-	79	0	1	7.0	-
80	0	1	3.5	0.5	80	0	1	4.0	0
81	0	1	4.5	-	81	0	1	8.0	-
82	0	1	7.0	-	82	2	1	7.0	-
83	0	1	17.0	-	83	2	1	9.0	-
84	0	1	10.5	-	84	0	1	6.0	-
85	0	1	7.5	-	85	2	1	6.0	-
86	0	1	71.0	-	86	0	0	1.0	-
87	1	1	11.5	-	87	0	1	10.0	-
88	0	1	47.0	-	88	0	1	5.0	-
89	0	1	5.5	-	89	2	1	11.0	-
90	0	0	5.0	0	90	2	1	8.0	0.75
91	0	0	3.5	-	91	2	1	4.0	-
92	0	1	42.0	-	92	2	1	13.0	-
93	0	0	2.5	-	93	0	1	7.0	-
94	0	0	Gravel	-	94	1	1	5.0	-
95	0	1	4.5	-	95	0	1	5.5	-
96	0	1	3.0	-	96	0	1	5.0	-
97	0	1	47.0	-	97	0	1	80.0	-
98	0	1	51.0	-	98	0	1	5.0	-
99	1	1	8.0	-	99	0	1	3.5	-
100	0	1	15.5	0	100	0	1	52.0	0.5
Minimum	**0.0**	**0.0**	**1.0**	**0**	**Minimum**	**0.0**	**0.0**	**1.0**	**0**
Maximum	**2.0**	**1.0**	**81.0**	**1**	**Maximum**	**2.0**	**1.0**	**120.0**	**0.75**
Mean	**0.6**	**0.9**	**18.7**	**0.3**	**Mean**	**0.2**	**0.9**	**10.8**	**0.3**
Standard Dev.	**0.8**	**0.3**	**18.8**	**0.3**	**Standard Dev.**	**0.6**	**0.3**	**18.3**	**0.3**
Geometric mean	**-**	**-**	**11.8**	**-**	**Geometric mean**	**-**	**-**	**6.6**	**-**
Median	**0.0**	**1.0**	**9.5**	**0**	**Median**	**0.0**	**1.0**	**6.0**	**0**
Calcite Index	**1.4**		**-**	**-**	**Calcite Index**	**1.1**		**-**	**-**

Table F.17: Calcite and Pebble Count at RG_MP1, FRO LAEMP, September 2018

RG_MP1 3				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	0	10.0	-
2	2	1	12.0	-
3	0	1	9.0	-
4	2	1	11.0	-
5	1	1	29.0	-
6	1	1	15.0	-
7	0	1	16.0	-
8	1	1	15.0	-
9	0	0	6.0	-
10	0	1	20.0	0
11	0	1	8.0	-
12	0	1	7.0	-
13	0	1	23.0	-
14	0	1	6.0	-
15	0	1	6.5	-
16	0	1	14.0	-
17	0	1	4.0	-
18	0	1	8.0	-
19	0	1	14.5	-
20	0	1	12.0	0
21	0	0	7.5	-
22	0	0	2.0	-
23	1	1	19.0	-
24	0	1	16.0	-
25	0	1	11.0	-
26	0	1	9.0	-
27	0	1	28.0	-
28	0	0	4.0	-
29	0	1	39.0	-
30	0	1	29.0	0.75
31	1	1	16.0	-
32	1	1	76.0	-
33	0	0	15.0	-
34	0	1	9.0	-
35	0	0	6.5	-
36	0	1	11.5	-
37	0	1	13.0	-
38	2	1	8.0	-
39	2	1	12.0	-
40	1	1	11.0	0.5
41	0	1	18.0	-
42	0	1	7.0	-
43	0	1	15.0	-
44	0	0	9.5	-
45	0	1	6.0	-
46	0	1	8.0	-
47	0	1	28.0	-
48	0	1	31.0	-
49	0	1	10.0	-
50	0	1	15.0	0.75
51	2	1	15.0	-
52	0	0	4.5	-
53	0	1	13.5	-
54	0	1	Gravel	-
55	0	1	8.0	-
56	0	1	10.0	-
57	2	1	8.0	-
58	2	1	18.0	-
59	2	1	16.0	-
60	0	1	8.0	0.75
61	0	0	Gravel	-
62	0	1	4.5	-
63	0	1	5.5	-
64	1	1	14.0	-
65	0	0	1.5	-
66	0	0	7.0	-
67	0	1	9.5	-
68	0	1	15.0	-
69	0	1	4.0	-
70	0	1	5.5	0.5
71	0	0	3.0	-
72	0	1	8.0	-
73	0	0	7.5	-
74	0	1	6.0	-
75	0	1	7.5	-
76	0	1	6.0	-
77	0	1	73.0	-
78	0	1	38.0	-
79	2	1	11.0	-
80	0	1	8.0	1
81	0	1	7.5	-
82	0	1	9.0	-
83	0	1	12.0	-
84	0	0	4.0	-
85	0	1	12.0	-
86	0	1	17.0	-
87	0	1	4.0	-
88	0	1	16.0	-
89	2	1	21.0	-
90	0	1	2.0	0.25
91	0	0	Gravel	-
92	0	1	5.0	-
93	0	1	10.0	-
94	0	1	10.5	-
95	0	1	13.0	-
96	0	1	16.0	-
97	0	1	8.0	-
98	0	1	12.0	-
99	0	0	2.0	-
100	0	1	5.0	1
Minimum	**0.0**	**0.0**	**1.5**	**0**
Maximum	**2.0**	**1.0**	**76.0**	**1**
Mean	**0.3**	**0.8**	**13.0**	**0.6**
Standard Dev.	**0.6**	**0.4**	**11.6**	**0.4**
Geometric mean	**-**	**-**	**10.1**	**-**
Median	**0.0**	**1.0**	**10.0**	**1**
Calcite Index	**1.1**		**-**	**-**

Table F.18: Calcite and Pebble Count at RG_FOUSH, FRO LAEMP, September 2018

RG_FOUSH 1					RG_FOUSH 2				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**	**Rock**	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	1	15.0	-	1	0	1	6.5	-
2	0	1	5.0	-	2	0	1	12.0	-
3	0	1	22.0	-	3	0	1	8.0	-
4	0	1	13.0	-	4	0	1	3.5	-
5	0	1	14.0	-	5	0	1	11.0	-
6	0	1	6.0	-	6	0	1	11.0	-
7	0	1	6.0	-	7	0	1	7.0	-
8	0	1	11.0	-	8	0	1	4.5	-
9	0	1	3.0	-	9	0	1	8.5	-
10	0	1	27.0	0.25	10	0	1	4.0	0.5
11	0	1	9.0	-	11	0	1	5.0	-
12	0	1	7.0	-	12	0	1	27.0	-
13	0	1	9.0	-	13	0	1	4.0	-
14	0	1	6.5	-	14	0	1	12.0	-
15	0	1	8.0	-	15	0	1	4.0	-
16	0	1	3.0	-	16	0	1	17.0	-
17	0	1	6.0	-	17	0	1	11.0	-
18	0	1	12.0	-	18	0	1	6.5	-
19	0	1	8.0	-	19	0	1	7.0	-
20	0	1	11.0	0	20	0	1	7.5	0.5
21	0	1	7.0	-	21	0	1	5.0	-
22	0	1	21.0	-	22	0	1	9.0	-
23	0	1	9.0	-	23	0	1	4.5	-
24	0	1	6.0	-	24	0	1	18.0	-
25	0	1	11.0	-	25	0	1	8.5	-
26	0	0	Gravel	-	26	0	1	25.0	-
27	0	1	10.0	-	27	0	1	11.0	-
28	0	1	10.0	-	28	0	1	12.0	-
29	0	1	5.5	-	29	0	1	15.0	-
30	0	1	14.0	0.25	30	0	1	5.5	0
31	0	1	7.0	-	31	0	1	5.0	-
32	0	1	6.0	-	32	0	1	5.0	-
33	0	1	9.5	-	33	0	1	6.0	-
34	0	1	5.5	-	34	0	1	12.0	-
35	0	1	10.0	-	35	0	1	5.5	-
36	0	1	7.0	-	36	0	1	9.5	-
37	0	1	2.5	-	37	0	1	11.5	-
38	0	1	13.0	-	38	0	1	10.0	-
39	0	1	8.0	-	39	0	1	7.5	-
40	0	1	9.0	0.75	40	0	1	10.0	0.25
41	0	1	9.0	-	41	0	1	20.0	-
42	0	1	7.5	-	42	0	1	5.0	-
43	0	1	8.0	-	43	0	1	8.0	-
44	0	1	11.0	-	44	0	1	7.0	-
45	0	1	15.0	-	45	0	1	7.0	-
46	0	1	12.0	-	46	0	1	24.0	-
47	0	1	7.0	-	47	0	1	9.0	-
48	0	1	3.5	-	48	0	1	10.0	-
49	0	1	7.0	-	49	0	0	7.0	-
50	0	1	12.0	0.25	50	0	1	-	0.5
51	0	1	19.0	-	51	0	1	13.5	-
52	0	1	16.0	-	52	0	1	4.5	-
53	0	1	13.0	-	53	0	1	10.0	-
54	0	1	6.0	-	54	0	1	Gravel	-
55	0	1	12.0	-	55	0	1	10.5	-
56	0	1	11.0	-	56	0	1	8.0	-
57	0	1	11.0	-	57	0	1	9.0	-
58	0	1	12.0	-	58	0	1	5.0	-
59	0	1	9.0	-	59	0	1	8.5	-
60	0	1	13.0	0	60	0	1	9.0	0
61	0	1	17.0	-	61	0	1	5.5	-
62	0	1	5.5	-	62	0	1	6.0	-
63	0	1	9.0	-	63	0	1	5.0	-
64	0	1	18.0	-	64	0	1	7.0	-
65	0	1	11.0	-	65	0	0	6.5	-
66	0	1	13.0	-	66	0	1	3.0	-
67	0	1	9.0	-	67	0	1	11.0	-
68	0	1	12.0	-	68	0	1	5.0	-
69	0	1	9.0	-	69	0	0	8.0	-
70	0	1	14.0	1	70	0	1	9.0	0
71	0	1	14.0	-	71	0	1	8.0	-
72	0	1	10.0	-	72	0	1	7.5	-
73	0	1	2.0	-	73	0	1	13.0	-
74	0	1	15.0	-	74	0	1	9.0	-
75	0	1	12.0	-	75	0	1	21.0	-
76	0	1	8.0	-	76	0	0	5.0	-
77	0	1	8.0	-	77	0	1	6.5	-
78	0	1	9.0	-	78	0	1	10.5	-
79	0	1	5.0	-	79	0	1	7.0	-
80	0	1	6.0	0.25	80	0	1	5.0	1
81	0	1	10.5	-	81	0	1	6.0	-
82	0	1	10.0	-	82	0	1	21.0	-
83	0	1	3.5	-	83	0	1	5.5	-
84	0	1	7.0	-	84	0	1	6.0	-
85	0	1	6.0	-	85	0	1	12.0	-
86	0	1	3.0	-	86	0	1	10.0	-
87	0	1	9.0	-	87	0	1	10.0	-
88	0	1	5.5	-	88	0	1	10.0	-
89	0	1	12.0	-	89	0	1	16.5	-
90	0	1	13.0	0.5	90	0	1	15.0	0
91	0	0	Gravel	-	91	0	1	14.0	-
92	0	1	5.0	-	92	0	1	7.5	-
93	0	1	7.0	-	93	0	1	9.5	-
94	0	1	6.0	-	94	0	1	8.0	-
95	0	1	8.0	-	95	0	1	8.0	-
96	0	1	7.0	-	96	0	1	17.0	-
97	0	1	6.0	-	97	0	1	11.0	-
98	0	1	12.0	-	98	0	1	12.0	-
99	0	1	6.0	-	99	0	1	7.0	-
100	0	0	Gravel	0	100	0	1	9.0	0.5
Minimum	**0.0**	**0.0**	**2.0**	**0**	**Minimum**	**0.0**	**0.0**	**3.0**	**0**
Maximum	**0.0**	**1.0**	**27.0**	**1**	**Maximum**	**0.0**	**1.0**	**27.0**	**1**
Mean	**0.0**	**1.0**	**9.6**	**0.3**	**Mean**	**0.0**	**1.0**	**9.4**	**0.3**
Standard Dev.	**0.0**	**0.2**	**4.4**	**0.3**	**Standard Dev.**	**0.0**	**0.2**	**4.8**	**0.3**
Geometric mean	**-**	**-**	**8.6**	**-**	**Geometric mean**	**-**	**-**	**8.4**	**-**
Median	**0.0**	**1.0**	**9.0**	**0**	**Median**	**0.0**	**1.0**	**8.3**	**0**
Calcite Index	**1.0**		**-**	**-**	**Calcite Index**	**1.0**		**-**	**-**

Table F.18: Calcite and Pebble Count at RG_FOUSH, FRO LAEMP, September 2018

RG_FOUSH 3				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	1	12.0	-
2	0	1	10.0	-
3	0	0	7.0	-
4	0	0	5.0	-
5	0	1	10.5	-
6	0	1	9.0	-
7	0	1	9.0	-
8	0	1	9.0	-
9	0	1	15.0	-
10	0	1	8.5	0
11	0	1	10.0	-
12	0	1	6.0	-
13	0	1	10.0	-
14	0	1	18.0	-
15	0	1	9.5	-
16	0	1	16.0	-
17	0	1	3.0	-
18	0	0	4.0	-
19	0	0	4.5	-
20	0	0	4.0	-
21	0	1	19.0	-
22	0	1	8.0	-
23	0	1	9.0	-
24	0	1	4.0	-
25	0	1	3.0	-
26	0	1	19.0	-
27	0	1	9.5	-
28	0	1	12.0	-
29	0	1	6.0	-
30	0	1	5.0	0.75
31	0	1	11.5	-
32	0	1	9.0	-
33	0	1	6.0	-
34	0	1	18.0	-
35	0	1	8.0	-
36	0	0	5.0	-
37	0	0	7.5	-
38	0	1	10.0	-
39	0	1	37.0	-
40	0	1	19.0	0.25
41	0	1	5.0	-
42	0	1	14.0	-
43	0	1	12.0	-
44	0	1	11.0	-
45	0	1	19.0	-
46	0	1	9.5	-
47	0	1	13.0	-
48	0	1	8.0	-
49	0	0	3.0	-
50	0	1	7.0	0.5
51	0	1	4.5	-
52	0	1	15.0	-
53	0	1	11.0	-
54	0	1	17.0	-
55	0	1	8.0	-
56	0	1	16.0	-
57	0	1	11.0	-
58	0	1	7.5	-
59	0	1	6.0	-
60	0	1	8.0	0.5
61	0	1	13.0	-
62	0	1	12.0	-
63	0	1	2.5	-
64	0	1	7.0	-
65	0	1	14.0	-
66	0	1	9.0	-
67	0	1	24.0	-
68	2	1	8.0	-
69	0	1	9.0	-
70	0	1	13.0	1
71	0	1	12.0	-
72	0	1	8.5	-
73	0	1	12.0	-
74	0	1	11.0	-
75	0	1	10.0	-
76	0	1	6.0	-
77	0	1	10.0	-
78	0	1	9.5	-
79	0	1	13.0	-
80	0	0	9.5	0.5
81	0	1	10.5	-
82	0	1	5.0	-
83	0	1	10.0	-
84	0	1	12.5	-
85	0	1	5.0	-
86	0	1	9.5	-
87	0	1	28.0	-
88	0	1	16.0	-
89	0	1	10.0	-
90	0	1	13.0	0
91	0	1	9.0	-
92	0	1	14.0	-
93	0	1	7.0	-
94	0	1	10.0	-
95	0	1	8.5	-
96	0	0	8.0	-
97	0	1	12.0	-
98	0	1	14.0	-
99	0	1	6.0	-
100	0	1	10.0	0
Minimum	**0.0**	**0.0**	**2.5**	**0**
Maximum	**2.0**	**1.0**	**37.0**	**1**
Mean	**0.0**	**0.9**	**10.4**	**0.4**
Standard Dev.	**0.2**	**0.3**	**5.3**	**0.4**
Geometric mean	**-**	**-**	**9.3**	**-**
Median	**0.0**	**1.0**	**9.5**	**1**
Calcite Index	**0.9**		**-**	**-**

Table F.19: Calcite and Pebble Count at RG_FOUKI, FRO LAEMP, September 2018

RG_FOUKI 1					RG_FOUKI 2				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	11.2	-	1	0	1	7.2	-
2	0	0	4.3	-	2	0	1	16.0	-
3	0	1	19.5	-	3	0	0	9.8	-
4	0	1	10.2	-	4	0	0	7.3	-
5	0	1	13.4	-	5	0	0	7.4	-
6	0	1	5.8	-	6	0	0	7.6	-
7	0	1	10.1	-	7	0	1	15.3	-
8	0	1	17.0	-	8	0	0	6.0	-
9	0	1	11.4	-	9	0	0	9.2	-
10	0	1	4.5	0	10	0	0	10.5	0.25
11	0	0	11.7	-	11	0	0	14.6	-
12	0	1	10.2	-	12	0	1	13.0	-
13	0	0	5.6	-	13	0	1	14.6	-
14	0	0	8.7	-	14	0	1	11.2	-
15	0	1	13.9	-	15	0	0	7.0	-
16	0	0	7.2	-	16	0	1	21.4	-
17	0	0	7.5	-	17	0	1	9.8	-
18	0	0	8.6	-	18	0	1	7.0	-
19	0	0	3.9	-	19	0	1	7.9	-
20	0	1	14.4	0.5	20	0	1	15.9	0.75
21	0	0	13.8	-	21	0	0	6.2	-
22	0	1	10.2	-	22	0	0	5.9	-
23	0	0	8.5	-	23	0	0	10.1	-
24	0	0	4.7	-	24	0	1	6.6	-
25	0	0	8.3	-	25	0	1	9.6	-
26	0	0	8.1	-	26	0	0	5.2	-
27	0	1	8.2	-	27	0	0	6.9	-
28	0	1	5.0	-	28	0	0	6.6	-
29	0	0	9.9	-	29	0	1	9.9	-
30	0	1	7.4	0.25	30	0	0	14.0	0.5
31	0	0	7.5	-	31	0	1	15.6	-
32	0	1	4.6	-	32	0	1	16.2	-
33	0	1	5.2	-	33	0	1	9.4	-
34	0	0	5.5	-	34	0	1	7.2	-
35	0	1	6.1	-	35	0	1	10.8	-
36	0	1	33.0	-	36	0	1	6.8	-
37	0	0	4.4	-	37	0	1	5.9	-
38	0	1	14.5	-	38	0	1	8.6	-
39	0	1	10.2	-	39	0	1	9.0	-
40	0	1	15.4	0.25	40	0	1	8.0	0
41	0	0	4.9	-	41	0	1	16.1	-
42	0	1	41.2	-	42	0	1	12.0	-
43	0	0	4.3	-	43	0	1	10.5	-
44	0	0	6.4	-	44	0	1	34.1	-
45	0	1	11.3	-	45	0	1	6.1	-
46	0	1	9.8	-	46	0	1	11.2	-
47	0	0	9.1	-	47	0	1	6.2	-
48	0	1	10.9	-	48	0	1	4.0	-
49	0	0	8.2	-	49	0	0	5.5	-
50	0	0	11.3	0.5	50	0	1	9.6	0
51	0	0	12.6	-	51	0	1	4.5	-
52	0	1	12.7	-	52	0	1	17.2	-
53	0	1	10.2	-	53	0	1	16.6	-
54	0	0	7.3	-	54	0	1	6.2	-
55	0	1	14.0	-	55	0	1	11.2	-
56	0	0	8.1	-	56	0	1	9.4	-
57	0	1	8.1	-	57	0	1	10.8	-
58	0	1	7.7	-	58	0	1	17.1	-
59	0	1	7.5	-	59	0	0	4.6	-
60	0	1	7.1	0.25	60	0	1	16.4	0
61	0	0	7.5	-	61	0	1	9.5	-
62	0	1	6.9	-	62	0	1	5.6	-
63	0	1	10.4	-	63	0	1	9.1	-
64	0	1	6.3	-	64	0	1	8.6	-
65	0	1	6.8	-	65	0	1	7.2	-
66	0	1	11.5	-	66	0	1	14.0	-
67	0	1	12.2	-	67	0	1	7.0	-
68	0	1	8.4	-	68	0	1	11.2	-
69	0	1	6.0	-	69	0	1	13.0	-
70	0	1	10.0	0	70	0	1	10.4	0.25
71	0	1	8.1	-	71	0	1	13.7	-
72	0	0	3.9	-	72	0	1	8.0	-
73	0	1	13.3	-	73	0	1	18.3	-
74	0	0	9.5	-	74	0	1	9.7	-
75	0	0	3.5	-	75	0	1	10.4	-
76	0	0	4.8	-	76	0	1	19.2	-
77	0	0	4.5	-	77	0	1	12.0	-
78	0	1	16.7	-	78	0	1	7.4	-
79	0	1	13.0	-	79	0	1	9.4	-
80	0	1	13.4	0.25	80	0	1	22.1	0.5
81	0	1	12.7	-	81	0	1	4.2	-
82	0	0	10.5	-	82	0	1	10.6	-
83	0	1	12.0	-	83	0	1	14.3	-
84	0	0	8.2	-	84	0	1	17.2	-
85	0	1	9.8	-	85	0	1	3.4	-
86	0	0	5.4	-	86	0	1	14.1	-
87	0	0	5.9	-	87	0	1	12.1	-
88	0	1	6.8	-	88	0	1	17.4	-
89	0	1	10.9	-	89	0	0	5.0	-
90	0	1	12.5	0	90	0	1	6.1	0.5
91	0	0	5.6	-	91	0	1	15.6	-
92	0	1	12.2	-	92	0	1	3.4	-
93	0	0	7.7	-	93	0	1	5.9	-
94	0	1	6.5	-	94	0	1	7.2	-
95	0	0	3.3	-	95	0	1	4.0	-
96	0	1	12.4	-	96	0	1	4.2	-
97	0	1	8.5	-	97	0	1	9.6	-
98	0	1	5.2	-	98	0	1	6.4	-
99	0	1	9.5	-	99	0	1	11.0	-
100	0	1	11.6	0.25	100	0	1	8.1	0
Minimum	**0.0**	**0.0**	**3.3**	**0**	**Minimum**	**0.0**	**0.0**	**3.4**	**0**
Maximum	**0.0**	**1.0**	**41.2**	**0.5**	**Maximum**	**0.0**	**1.0**	**34.1**	**0.75**
Mean	**0.0**	**0.6**	**9.6**	**0.2**	**Mean**	**0.0**	**0.8**	**10.3**	**0.3**
Standard Dev.	**0.0**	**0.5**	**5.2**	**0.2**	**Standard Dev.**	**0.0**	**0.4**	**4.9**	**0.3**
Geometric mean	**-**	**-**	**8.6**	**-**	**Geometric mean**	**-**	**-**	**9.3**	**-**
Median	**0.0**	**1.0**	**8.5**	**0**	**Median**	**0.0**	**1.0**	**9.6**	**0**
Calcite Index	**0.6**		**-**	**-**	**Calcite Index**	**0.8**		**-**	**-**

Table F.19: Calcite and Pebble Count at RG_FOUKI, FRO LAEMP, September 2018

RG_FOUKI 3				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	1	13.2	-
2	0	1	9.3	-
3	0	1	10.4	-
4	0	1	8.3	-
5	0	0	7.0	-
6	0	0	6.5	-
7	0	0	4.0	-
8	0	0	5.9	-
9	0	0	7.3	-
10	0	0	8.5	0
11	0	0	9.2	-
12	0	1	16.0	-
13	0	1	14.5	-
14	0	0	5.2	-
15	0	0	8.8	-
16	0	0	10.3	-
17	0	1	14.2	-
18	0	0	8.2	-
19	0	0	7.5	-
20	0	0	8.1	0
21	0	1	15.5	-
22	0	0	6.2	-
23	0	0	10.5	-
24	0	0	8.0	-
25	0	0	6.9	-
26	0	0	3.4	-
27	0	0	9.7	-
28	0	1	7.9	-
29	0	1	6.7	-
30	0	1	13.0	0.25
31	0	0	8.5	-
32	0	1	14.2	-
33	0	1	11.8	-
34	0	0	8.2	-
35	0	1	14.7	-
36	0	0	3.6	-
37	0	1	15.2	-
38	0	1	6.6	-
39	0	1	4.9	-
40	0	1	8.8	0
41	0	1	6.4	-
42	0	1	9.1	-
43	0	1	8.1	-
44	0	1	12.6	-
45	0	1	11.2	-
46	0	1	6.6	-
47	0	1	4.8	-
48	0	1	12.7	-
49	0	1	6.3	-
50	0	0	3.7	0.5
51	0	1	12.2	-
52	0	1	10.6	-
53	0	1	7.9	-
54	0	0	3.6	-
55	0	1	14.0	-
56	0	0	7.5	-
57	0	0	4.3	-
58	0	1	8.9	-
59	0	1	7.3	-
60	0	1	7.7	0.25
61	0	0	6.2	-
62	0	1	8.9	-
63	0	1	12.6	-
64	0	1	13.3	-
65	0	1	9.3	-
66	0	1	12.1	-
67	0	1	23.0	-
68	0	0	4.1	-
69	0	0	7.4	-
70	0	0	3.7	0
71	0	1	9.5	-
72	0	0	7.8	-
73	0	1	12.9	-
74	0	1	12.0	-
75	0	0	7.7	-
76	0	1	10.9	-
77	0	1	12.3	-
78	0	1	6.5	-
79	0	0	4.9	-
80	0	1	9.7	0
81	0	1	12.4	-
82	0	0	6.7	-
83	0	0	9.2	-
84	0	0	8.0	-
85	0	1	7.1	-
86	0	1	19.5	-
87	0	1	9.5	-
88	0	0	8.1	-
89	0	0	7.3	-
90	0	1	13.2	0.75
91	0	1	11.3	-
92	0	1	5.5	-
93	0	0	7.9	-
94	0	1	6.1	-
95	0	0	10.3	-
96	0	1	6.5	-
97	0	0	4.7	-
98	0	1	7.1	-
99	0	1	6.9	-
100	0	0	3.5	0
Minimum	**0.0**	**0.0**	**3.4**	**0**
Maximum	**0.0**	**1.0**	**23.0**	**0.75**
Mean	**0.0**	**0.6**	**9.0**	**0.2**
Standard Dev.	**0.0**	**0.5**	**3.6**	**0.3**
Geometric mean	**-**	**-**	**8.3**	**-**
Median	**0.0**	**1.0**	**8.2**	**0**
Calcite Index	**0.6**		**-**	**-**

Table F.20: Calcite and Pebble Count at RG_FOBKS, FRO LAEMP, September 2018

RG_FOBKS 1					RG_FOBKS 2				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**	**Rock**	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	0	6.7	-	1	0	1	6.5	-
2	0	0	7.2	-	2	0	0	10.2	-
3	0	0	10.1	-	3	0	0	8.4	-
4	0	1	11.7	-	4	0	1	9.7	-
5	0	0	3.4	-	5	0	0	8.0	-
6	0	0	2.9	-	6	0	0	3.6	-
7	0	1	9.8	-	7	0	1	7.9	-
8	0	1	14.0	-	8	0	0	7.8	-
9	0	1	6.2	-	9	0	1	13.9	-
10	0	1	18.1	0.5	10	0	0	8.1	0.75
11	0	0	17.4	-	11	0	0	6.7	-
12	0	1	17.0	-	12	0	0	5.9	-
13	0	1	13.2	-	13	0	1	8.2	-
14	0	1	17.8	-	14	0	0	6.3	-
15	0	1	22.0	-	15	0	1	5.4	-
16	0	1	6.4	-	16	0	1	6.1	-
17	0	0	8.1	-	17	0	0	3.4	-
18	0	1	11.2	-	18	0	0	5.3	-
19	0	1	7.4	-	19	0	1	7.0	-
20	0	1	5.6	0.25	20	0	0	2.4	-
21	0	1	32.0	-	21	0	0	8.1	0
22	0	0	18.2	-	22	0	1	9.5	-
23	0	0	6.1	-	23	0	0	6.3	-
24	0	0	4.3	-	24	0	1	11.1	-
25	0	1	4.2	-	25	0	1	18.1	-
26	0	1	22.0	-	26	0	0	3.6	-
27	0	1	15.1	-	27	0	0	7.4	-
28	0	1	9.4	-	28	0	0	5.5	-
29	0	1	13.1	-	29	0	0	10.4	-
30	0	1	17.9	0.5	30	0	1	5.8	0
31	0	0	3.7	-	31	0	1	16.5	-
32	0	1	12.6	-	32	0	1	10.7	-
33	0	1	16.3	-	33	0	1	7.2	-
34	0	0	7.5	-	34	0	1	11.7	-
35	0	1	4.8	-	35	0	1	9.1	-
36	0	1	12.6	-	36	0	0	4.2	-
37	0	1	3.9	-	37	0	1	7.5	-
38	0	0	4.8	-	38	0	0	5.5	-
39	0	1	13.1	-	39	0	0	11.7	-
40	0	1	10.1	0	40	0	0	10.2	0
41	0	1	13.4	-	41	0	1	9.6	-
42	0	0	13.3	-	42	0	0	5.2	-
43	0	1	7.0	-	43	0	1	11.9	-
44	0	0	8.9	-	44	0	1	10.3	-
45	0	1	4.6	-	45	0	1	8.0	-
46	0	1	14.9	-	46	0	1	8.9	-
47	0	1	13.1	-	47	0	1	9.0	-
48	0	1	7.5	-	48	0	0	4.6	-
49	0	0	4.4	-	49	0	0	6.8	-
50	0	1	14.0	-	50	0	1	12.1	0.5
51	0	1	3.6	-	51	0	0	11.4	-
52	0	0	14.4	-	52	0	1	6.4	-
53	0	1	16.8	-	53	0	1	9.8	-
54	0	1	15.1	-	54	0	1	11.1	-
55	0	1	11.4	-	55	0	0	8.5	-
56	0	1	16.2	-	56	0	0	7.6	-
57	0	1	18.2	-	57	0	1	4.1	-
58	0	1	11.7	-	58	0	1	14.1	-
59	0	1	17.0	-	59	0	1	9.0	-
60	0	1	9.9	0.25	60	0	0	9.4	0.5
61	0	1	14.2	-	61	0	1	8.7	-
62	0	1	4.0	-	62	0	1	6.6	-
63	0	1	12.1	-	63	0	0	4.2	-
64	0	1	8.9	-	64	0	1	8.1	-
65	0	1	4.0	-	65	0	0	3.7	-
66	0	1	8.0	-	66	0	0	5.4	-
67	0	1	5.5	-	67	0	1	8.5	-
68	0	1	9.4	-	68	0	1	5.9	-
69	0	1	13.0	-	69	0	1	7.8	-
70	0	1	13.9	0.75	70	0	1	7.1	0.25
71	0	1	9.5	-	71	0	0	7.9	-
72	0	1	12.4	-	72	0	0	3.9	-
73	0	1	5.3	-	73	0	1	13.0	-
74	0	1	7.4	-	74	0	0	7.6	-
75	0	0	7.5	-	75	0	0	7.4	-
76	0	1	23.4	-	76	0	0	11.1	-
77	0	1	8.9	-	77	0	1	8.8	-
78	0	1	15.0	-	78	0	0	3.2	-
79	0	1	15.0	-	79	0	0	6.5	-
80	0	0	9.0	0	80	0	1	8.1	0.25
81	0	1	19.1	-	81	0	0	4.6	-
82	0	1	16.2	-	82	0	0	4.4	-
83	0	1	7.8	-	83	0	0	2.8	-
84	0	1	6.6	-	84	0	0	6.5	-
85	0	1	4.0	-	85	0	1	10.7	-
86	0	0	8.5	-	86	0	0	10.2	-
87	0	1	18.4	-	87	0	0	9.3	-
88	0	1	6.2	-	88	0	0	8.0	-
89	0	1	22..4	-	89	0	0	6.2	-
90	0	1	14.0	0.75	90	0	1	9.4	0.25
91	0	1	7.6	-	91	0	0	8.9	-
92	0	1	16.0	-	92	0	0	6.2	-
93	0	1	18.0	-	93	0	1	3.1	-
94	1	1	8.6	-	94	0	0	4.3	-
95	1	1	6.0	-	95	0	0	6.0	-
96	1	1	7.0	-	96	0	1	6.1	-
97	0	1	10.5	-	97	0	1	6.3	-
98	0	0	7.4	-	98	0	0	8.5	-
99	0	1	8.6	-	99	0	1	7.4	-
100	0	1	12.0	0	100	0	1	7.1	0
Minimum	**0.0**	**0.0**	**2.9**	**0**	**Minimum**	**0.0**	**0.0**	**2.4**	**0**
Maximum	**1.0**	**1.0**	**32.0**	**0.75**	**Maximum**	**0.0**	**1.0**	**18.1**	**0.75**
Mean	**0.0**	**0.8**	**11.0**	**0.3**	**Mean**	**0.0**	**0.5**	**7.8**	**0.3**
Standard Dev.	**0.2**	**0.4**	**5.4**	**0.3**	**Standard Dev.**	**0.0**	**0.5**	**2.9**	**0.3**
Geometric mean	**-**	**-**	**9.7**	**-**	**Geometric mean**	**-**	**-**	**7.2**	**-**
Median	**0.0**	**1.0**	**10.1**	**0**	**Median**	**0.0**	**0.0**	**7.7**	**0**
Calcite Index	**0.8**		**-**	**-**	**Calcite Index**	**0.5**		**-**	**-**

Table F.20: Calcite and Pebble Count at RG_FOBKS, FRO LAEMP, September 2018

RG_FOBKS 3				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	6.1	-
2	0	0	7.5	-
3	0	1	10.6	-
4	0	1	7.3	-
5	0	1	9.6	-
6	0	1	7.8	-
7	0	1	3.6	-
8	0	1	10.1	-
9	0	0	4.6	-
10	0	1	9.1	0
11	0	1	9.6	-
12	0	0	6.9	-
13	0	0	5.9	-
14	0	0	14.7	-
15	0	0	4.2	-
16	0	1	3.9	-
17	0	1	12.2	-
18	0	1	12.0	-
19	0	1	8.3	-
20	0	1	6.1	0
21	0	1	8.9	-
22	0	1	4.2	-
23	0	1	6.9	-
24	0	1	6.1	-
25	0	1	7.2	-
26	0	1	8.4	-
27	0	0	4.5	-
28	0	0	4.7	-
29	0	1	8.3	-
30	0	0	8.5	0
31	0	1	6.2	-
32	0	1	7.4	-
33	0	1	9.8	-
34	0	0	6.0	-
35	0	1	7.4	-
36	0	0	3.1	-
37	0	0	3.6	-
38	0	1	4.6	-
39	0	1	6.4	-
40	0	1	6.9	0.5
41	0	1	8.6	-
42	0	1	10.2	-
43	0	0	6.7	-
44	0	1	8.9	-
45	0	0	8.1	-
46	0	0	6.4	-
47	0	1	16.9	-
48	0	1	8.6	-
49	0	0	6.8	-
50	0	1	5.1	0
51	0	0	5.0	-
52	0	1	4.9	-
53	0	1	8.2	-
54	0	1	16.0	-
55	0	0	3.9	-
56	0	1	7.7	-
57	0	0	5.1	-
58	0	0	8.8	-
59	0	1	9.0	-
60	0	1	4.3	0.25
61	0	1	5.9	-
62	0	0	2.7	-
63	0	1	15.3	-
64	0	0	5.2	-
65	0	0	7.0	-
66	0	1	12.8	-
67	0	0	4.9	-
68	0	1	7.2	-
69	0	1	7.0	-
70	0	1	6.1	0
71	0	1	5.2	-
72	0	1	7.5	-
73	0	0	3.6	-
74	0	0	3.1	-
75	0	1	17.3	-
76	0	1	6.7	-
77	0	1	6.8	-
78	0	0	7.4	-
79	0	1	13.1	-
80	0	1	10.6	0.25
81	0	1	11.2	-
82	0	1	16.4	-
83	0	0	3.0	-
84	0	1	11.0	-
85	0	1	8.1	-
86	0	0	6.9	-
87	0	1	11.4	-
88	0	0	5.7	-
89	0	0	7.5	-
90	0	0	4.9	0.5
91	0	0	7.4	-
92	0	1	7.6	-
93	0	0	3.9	-
94	0	1	18.1	-
95	0	1	8.1	-
96	0	1	6.6	-
97	0	1	11.4	-
98	0	1	11.3	-
99	0	1	9.9	-
100	0	1	7.5	0.25
Minimum	**0.0**	**0.0**	**2.7**	**0**
Maximum	**0.0**	**1.0**	**18.1**	**0.5**
Mean	**0.0**	**0.7**	**7.8**	**0.2**
Standard Dev.	**0.0**	**0.5**	**3.3**	**0.2**
Geometric mean	**-**	**-**	**7.2**	**-**
Median	**0.0**	**1.0**	**7.4**	**0**
Calcite Index	**0.7**		**-**	**-**

Table F.21: Calcite and Pebble Count at RG_FOBSC, FRO LAEMP, September 2018

RG_FOBSC 1					RG_FOBSC 2				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**	**Rock**	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	1	13.1	-	1	0	1	8.9	-
2	0	1	8.9	-	2	0	1	9.8	-
3	0	1	26.2	-	3	0	1	8.1	-
4	0	1	8.7	-	4	0	1	4.0	-
5	0	1	8.6	-	5	0	1	5.1	-
6	0	1	8.7	-	6	0	1	7.9	-
7	0	1	7.1	-	7	0	1	21.0	-
8	0	1	6.0	-	8	0	1	32.0	-
9	0	1	9.3	-	9	0	1	10.7	-
10	0	1	10.2	0	10	0	1	7.7	0.5
11	0	1	5.1	-	11	0	1	6.2	-
12	0	1	7.6	-	12	0	1	9.6	-
13	0	1	4.1	-	13	0	1	6.5	-
14	0	1	11.0	-	14	0	1	8.4	-
15	0	1	9.0	-	15	0	1	4.7	-
16	0	1	4.0	-	16	0	1	7.7	-
17	0	1	7.4	-	17	0	1	8.1	-
18	0	1	4.7	-	18	0	1	10.5	-
19	0	1	2.6	-	19	0	1	4.5	-
20	0	1	7.1	1	20	0	1	14.2	0.5
21	0	1	6.2	-	21	0	1	9.1	-
22	0	1	7.0	-	22	0	1	18.8	-
23	0	1	10.1	-	23	0	1	9.2	-
24	0	1	9.6	-	24	0	1	6.5	-
25	0	1	6.1	-	25	0	1	10.5	-
26	0	1	15.2	-	26	0	1	5.8	-
27	0	1	5.0	-	27	0	1	6.0	-
28	0	1	10.1	-	28	0	1	8.1	-
29	0	1	7.4	-	29	0	1	10.3	-
30	0	1	7.1	0	30	0	1	5.7	0
31	0	1	4.8	-	31	0	1	4.7	-
32	0	1	12.6	-	32	0	1	21.2	-
33	0	1	6.8	-	33	0	1	16.7	-
34	0	1	4.3	-	34	0	1	9.5	-
35	0	1	8.5	-	35	0	1	5.6	-
36	0	1	6.6	-	36	0	1	12.9	-
37	0	1	7.9	-	37	0	1	7.2	-
38	0	1	4.4	-	38	0	1	4.5	-
39	0	1	7.4	-	39	0	1	18.3	-
40	0	1	9.0	0.75	40	0	1	9.1	0
41	0	0	4.6	-	41	0	1	6.7	-
42	0	1	9.6	-	42	0	1	6.4	-
43	0	1	5.4	-	43	0	1	16.4	-
44	0	1	7.9	-	44	0	1	17.1	-
45	0	1	8.2	-	45	0	1	5.5	-
46	0	1	5.0	-	46	0	1	10.4	-
47	0	1	14.3	-	47	0	1	4.9	-
48	0	1	7.5	-	48	0	1	10.2	-
49	0	1	7.0	-	49	0	1	12.8	-
50	0	1	5.7	0	50	0	1	6.4	0.25
51	0	1	4.0	-	51	0	1	9.1	-
52	0	1	8.6	-	52	0	1	6.9	-
53	0	1	7.6	-	53	0	1	10.2	-
54	0	1	6.0	-	54	0	1	4.3	-
55	0	1	9.0	-	55	0	1	7.5	-
56	0	1	6.9	-	56	0	1	12.1	-
57	0	1	4.4	-	57	0	1	10.4	-
58	0	1	8.7	-	58	0	1	13.2	-
59	0	1	4.9	-	59	0	1	6.8	-
60	0	1	2.0	0.25	60	0	1	11.7	0.75
61	0	1	13.0	-	61	0	1	8.5	-
62	0	1	2.6	-	62	0	1	8.2	-
63	0	1	12.1	-	63	0	1	11.3	-
64	0	1	4.2	-	64	0	1	10.8	-
65	0	1	9.0	-	65	0	1	11.6	-
66	0	1	3.0	-	66	0	1	7.1	-
67	0	1	7.6	-	67	0	1	10.1	-
68	0	1	8.2	-	68	0	1	9.5	-
69	0	1	11.1	-	69	1	1	3.3	-
70	0	1	5.0	0.25	70	0	1	6.4	0
71	0	1	5.0	-	71	0	1	7.7	-
72	0	1	9.2	-	72	0	1	12.3	-
73	0	1	4.6	-	73	0	1	5.4	-
74	0	1	3.7	-	74	0	1	6.0	-
75	0	1	6.7	-	75	0	1	11.2	-
76	0	1	10.0	-	76	0	1	10.4	-
77	0	1	6.5	-	77	0	1	12.5	-
78	0	1	4.4	-	78	0	1	12.4	-
79	0	1	7.3	-	79	0	1	8.6	-
80	0	1	6.4	0	80	0	1	7.6	1
81	0	1	7.5	-	81	0	1	7.8	-
82	0	1	4.0	-	82	0	1	10.2	-
83	0	1	4.6	-	83	0	1	6.5	-
84	0	1	5.1	-	84	0	1	6.4	-
85	0	1	5.2	-	85	0	1	9.2	-
86	0	1	7.7	-	86	0	1	11.7	-
87	0	1	3.7	-	87	0	1	5.5	-
88	0	1	6.6	-	88	0	1	6.1	-
89	0	1	6.8	-	89	0	1	17.0	-
90	0	1	6.5	0.25	90	0	1	7.4	0.25
91	0	1	2.2	-	91	0	1	9.3	-
92	0	1	9.5	-	92	0	1	8.0	-
93	0	1	4.2	-	93	0	1	21.0	-
94	0	1	8.0	-	94	0	1	12.6	-
95	0	1	2.7	-	95	0	1	10.0	-
96	0	1	4.9	-	96	0	1	12.9	-
97	0	1	5.1	-	97	0	1	8.4	-
98	0	1	5.1	-	98	0	1	8.3	-
99	0	1	3.5	-	99	0	1	5.8	-
100	0	1	13.0	0	100	0	1	11.5	0.5
Minimum	**0.0**	**0.0**	**2.0**	**0**	**Minimum**	**0.0**	**1.0**	**3.3**	**0**
Maximum	**0.0**	**1.0**	**26.2**	**1**	**Maximum**	**1.0**	**1.0**	**32.0**	**1**
Mean	**0.0**	**1.0**	**7.2**	**0.3**	**Mean**	**0.0**	**1.0**	**9.6**	**0.4**
Standard Dev.	**0.0**	**0.1**	**3.3**	**0.4**	**Standard Dev.**	**0.1**	**0.0**	**4.4**	**0.3**
Geometric mean	**-**	**-**	**6.5**	**-**	**Geometric mean**	**-**	**-**	**8.8**	**-**
Median	**0.0**	**1.0**	**7.0**	**0**	**Median**	**0.0**	**1.0**	**8.8**	**0**
Calcite Index	**1.0**		**-**	**-**	**Calcite Index**	**1.0**		**-**	**-**

Table F.21: Calcite and Pebble Count at RG_FOBSC, FRO LAEMP, September 2018

RG_FOBSC 3				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	1	6.1	-
2	0	1	4.9	-
3	0	1	7.4	-
4	0	1	7.2	-
5	0	1	12.9	-
6	0	1	6.4	-
7	0	0	7.4	-
8	0	1	14.5	-
9	0	1	10.1	-
10	0	1	13.2	0.5
11	0	1	8.7	-
12	0	1	6.9	-
13	0	1	10.4	-
14	0	0	7.6	-
15	0	1	13.6	-
16	0	0	5.3	-
17	0	1	12.0	-
18	0	1	6.0	-
19	0	0	8.1	-
20	0	1	10.9	0.25
21	0	1	11.7	-
22	0	1	7.3	-
23	0	1	9.9	-
24	0	1	9.4	-
25	0	0	7.2	-
26	0	1	5.5	-
27	0	0	7.5	-
28	0	1	12.3	-
29	0	1	9.8	-
30	0	1	11.9	0.5
31	2	1	9.5	-
32	2	1	6.9	-
33	1	1	14.1	-
34	1	1	6.4	-
35	0	1	9.4	-
36	0	1	6.7	-
37	0	0	13.0	-
38	0	1	15.9	-
39	0	1	9.4	-
40	0	1	9.1	0.25
41	0	1	11.7	-
42	0	0	5.9	-
43	0	1	7.3	-
44	0	1	4.2	-
45	0	1	7.7	-
46	0	1	6.7	-
47	0	1	8.8	-
48	0	1	12.4	-
49	0	1	7.1	-
50	0	1	11.2	0.5
51	0	0	4.5	-
52	0	0	5.3	-
53	0	1	6.0	-
54	0	1	6.4	-
55	0	1	10.2	-
56	0	1	8.9	-
57	0	1	8.1	-
58	0	1	8.3	-
59	0	1	6.6	-
60	0	1	7.5	0.25
61	0	1	13.8	-
62	0	1	14.6	-
63	0	1	12.0	-
64	0	1	11.5	-
65	0	1	8.3	-
66	0	1	7.2	-
67	0	1	6.2	-
68	0	1	12.8	-
69	0	1	5.6	-
70	0	1	14.9	0.25
71	0	1	9.7	-
72	0	1	4.9	-
73	0	1	5.6	-
74	0	1	4.7	-
75	0	1	11.9	-
76	0	1	11.1	-
77	0	1	8.2	-
78	0	1	11.6	-
79	0	1	13.8	-
80	0	1	6.9	0.25
81	0	1	6.8	-
82	0	1	4.8	-
83	0	1	7.6	-
84	0	1	11.2	-
85	0	1	10.2	-
86	0	1	9.0	-
87	0	1	8.4	-
88	0	1	5.9	-
89	0	1	8.9	-
90	0	1	7.7	0.25
91	0	1	3.7	-
92	0	1	7.5	-
93	0	1	4.2	-
94	0	1	9.6	-
95	0	1	5.9	-
96	0	1	10.5	-
97	0	1	6.6	-
98	0	1	8.4	-
99	0	1	5.4	-
100	0	0	6.4	0
Minimum	**0.0**	**0.0**	**3.7**	**0**
Maximum	**2.0**	**1.0**	**15.9**	**0.5**
Mean	**0.1**	**0.9**	**8.7**	**0.3**
Standard Dev.	**0.3**	**0.3**	**2.9**	**0.2**
Geometric mean	**-**	**-**	**8.3**	**-**
Median	**0.0**	**1.0**	**8.2**	**0**
Calcite Index	**1.0**		**-**	**-**

Table F.22: Calcite and Pebble Count at RG_FOBCP, FRO LAEMP, September 2018

RG_FOBCP 1					RG_FOBCP 2				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	7.9	-	1	0	1	4.5	-
2	0	1	10.7	-	2	0	1	8.7	-
3	0	1	7.0	-	3	0	1	6.3	-
4	0	1	6.4	-	4	1	1	8.2	-
5	0	0	11.5	-	5	2	1	9.0	-
6	0	1	7.3	-	6	2	1	7.0	-
7	0	1	13.9	-	7	0	1	12.2	-
8	0	1	5.2	-	8	0	1	7.6	-
9	0	1	8.4	-	9	0	1	11.1	-
10	0	1	14.2	0.5	10	0	1	8.5	0.25
11	0	1	5.9	-	11	1	1	15.0	-
12	0	1	11.0	-	12	0	1	12.3	-
13	0	1	10.4	-	13	0	1	9.2	-
14	1	1	9.5	-	14	0	1	2.3	-
15	0	1	13.7	-	15	0	1	6.0	-
16	0	1	11.2	-	16	0	1	13.0	-
17	0	1	7.9	-	17	0	1	7.2	-
18	0	1	8.1	-	18	1	1	4.1	-
19	0	1	12.5	-	19	0	1	7.6	-
20	1	1	13.7	0.5	20	2	1	21.3	0.5
21	0	1	5.6	-	21	2	1	5.5	-
22	0	1	8.4	-	22	1	1	7.0	-
23	0	0	6.5	-	23	0	1	7.0	-
24	0	1	6.0	-	24	1	1	11.7	-
25	0	0	1.9	-	25	0	1	4.5	-
26	0	0	8.2	-	26	0	1	7.1	-
27	0	1	10.8	-	27	0	1	3.6	-
28	0	0	6.7	-	28	0	1	6.1	-
29	0	1	14.1	-	29	0	0	5.0	-
30	0	1	12.3	0	30	0	1	8.2	0
31	0	0	7.7	-	31	0	1	10.1	-
32	0	1	10.1	-	32	0	1	3.3	-
33	0	1	11.5	-	33	0	1	3.6	-
34	0	0	6.7	-	34	0	1	4.5	-
35	0	1	9.1	-	35	0	1	7.4	-
36	0	1	8.0	-	36	0	1	5.9	-
37	0	0	10.4	-	37	0	1	10.2	-
38	0	1	8.5	-	38	0	0	3.5	-
39	0	1	6.6	-	39	1	1	3.3	-
40	0	0	9.1	0	40	0	1	7.0	0.5
41	0	1	10.9	-	41	1	1	2.9	-
42	0	1	9.5	-	42	0	1	8.5	-
43	0	0	4.4	-	43	0	1	3.5	-
44	0	1	7.3	-	44	0	0	5.2	-
45	0	1	10.2	-	45	0	1	6.7	-
46	0	0	5.5	-	46	0	1	4.7	-
47	0	1	7.9	-	47	0	1	6.4	-
48	0	1	9.0	-	48	0	1	9.5	-
49	0	1	8.9	-	49	1	1	6.7	-
50	0	1	11.2	0	50	0	1	11.8	0
51	0	0	11.4	-	51	1	1	9.3	-
52	0	1	12.0	-	52	0	1	5.5	-
53	0	1	10.5	-	53	0	1	5.2	-
54	0	0	9.9	-	54	0	1	5.8	-
55	0	1	10.1	-	55	0	1	4.6	-
56	0	0	6.9	-	56	0	1	5.2	-
57	0	1	7.7	-	57	0	1	8.5	-
58	0	0	8.6	-	58	0	0	3.4	-
59	0	0	6.7	-	59	0	1	3.7	-
60	0	1	10.8	0.25	60	0	1	4.9	0.25
61	0	1	16.2	-	61	1	1	6.5	-
62	0	0	6.5	-	62	0	1	5.7	-
63	0	1	6.4	-	63	0	1	4.3	-
64	0	0	4.8	-	64	0	1	7.6	-
65	0	1	11.0	-	65	1	1	16.2	-
66	0	1	9.1	-	66	0	1	5.7	-
67	0	1	10.7	-	67	0	1	7.8	-
68	0	1	8.9	-	68	0	1	4.1	-
69	0	1	5.0	-	69	1	1	4.6	-
70	0	1	6.4	0.25	70	0	1	9.4	0.5
71	1	1	12.0	-	71	0	1	5.3	-
72	0	1	9.1	-	72	0	1	5.1	-
73	0	1	6.4	-	73	0	1	5.9	-
74	0	1	7.9	-	74	0	1	12.0	-
75	0	1	13.7	-	75	0	1	13.4	-
76	0	1	11.9	-	76	1	1	11.3	-
77	0	1	3.4	-	77	0	1	3.1	-
78	0	1	6.8	-	78	1	1	13.1	-
79	0	1	4.4	-	79	0	1	8.5	-
80	1	1	9.8	0.5	80	0	1	5.4	0
81	0	1	7.6	-	81	0	1	5.6	-
82	0	1	10.5	-	82	0	1	4.5	-
83	0	1	8.5	-	83	0	1	4.7	-
84	0	1	4.1	-	84	0	1	6.9	-
85	0	1	7.4	-	85	0	1	5.1	-
86	0	1	13.6	-	86	0	1	7.8	-
87	0	1	6.3	-	87	0	1	8.0	-
88	0	0	11.5	-	88	0	1	8.0	-
89	0	1	7.6	-	89	0	1	4.3	-
90	0	1	8.2	0.5	90	0	1	9.5	0.25
91	0	1	9.9	-	91	0	0	5.4	-
92	0	1	3.9	-	92	0	1	6.9	-
93	0	1	12.4	-	93	0	0	4.7	-
94	0	1	9.5	-	94	0	1	4.2	-
95	0	1	11.1	-	95	0	1	12.0	-
96	0	1	5.5	-	96	1	1	2.6	-
97	0	1	6.6	-	97	0	1	6.1	-
98	1	1	9.4	-	98	0	1	9.0	-
99	1	1	3.7	-	99	0	1	8.6	-
100	1	1	10.2	0.5	100	1	1	5.7	0
Minimum	**0.0**	**0.0**	**1.9**	**0**	**Minimum**	**0.0**	**0.0**	**2.3**	**0**
Maximum	**1.0**	**1.0**	**16.2**	**0.5**	**Maximum**	**2.0**	**1.0**	**21.3**	**0.5**
Mean	**0.1**	**0.8**	**8.8**	**0.3**	**Mean**	**0.2**	**0.9**	**7.1**	**0.2**
Standard Dev.	**0.3**	**0.4**	**2.8**	**0.2**	**Standard Dev.**	**0.5**	**0.2**	**3.3**	**0.2**
Geometric mean	**-**	**-**	**8.3**	**-**	**Geometric mean**	**-**	**-**	**6.5**	**-**
Median	**0.0**	**1.0**	**8.8**	**0**	**Median**	**0.0**	**1.0**	**6.5**	**0**
Calcite Index	0.9		-	-	**Calcite Index**	1.2		-	-

Table F.22: Calcite and Pebble Count at RG_FOBCP, FRO LAEMP, September 2018

RG_FOBCP 3					RG_FOBCP 4				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	7.4	-	1	0	1	12.1	-
2	0	1	12.5	-	2	0	1	4.6	-
3	0	1	6.9	-	3	0	1	5.4	-
4	0	1	8.9	-	4	0	1	14.1	-
5	0	1	4.5	-	5	0	1	5.0	-
6	0	1	6.4	-	6	0	1	3.7	-
7	0	1	3.2	-	7	0	1	6.0	-
8	0	1	9.6	-	8	0	1	10.1	-
9	0	1	4.0	-	9	0	1	8.4	-
10	0	1	9.8	0.5	10	0	1	7.9	0
11	0	1	5.4	-	11	0	1	8.2	-
12	0	1	3.2	-	12	0	1	8.1	-
13	0	1	9.6	-	13	0	1	11.7	-
14	0	1	4.2	-	14	0	1	4.0	-
15	0	1	7.3	-	15	0	1	15.0	-
16	0	1	12.3	-	16	0	1	14.2	-
17	0	1	5.2	-	17	0	1	7.9	-
18	0	1	13.7	-	18	0	1	4.6	-
19	0	0	5.5	-	19	0	1	5.7	-
20	0	0	11.5	0	20	0	1	5.6	0.25
21	0	0	4.6	-	21	1	1	10.0	-
22	0	1	7.6	-	22	1	1	5.1	-
23	0	1	4.2	-	23	1	1	6.3	-
24	1	1	11.8	-	24	1	1	7.2	-
25	0	0	6.9	-	25	0	1	4.9	-
26	0	1	9.1	-	26	0	1	6.6	-
27	0	1	8.1	-	27	0	1	10.3	-
28	0	1	6.3	-	28	1	1	6.0	-
29	0	1	8.4	-	29	0	1	17.8	-
30	0	0	5.6	0.25	30	1	1	7.2	0.25
31	0	1	14.3	-	31	0	1	8.4	-
32	0	1	3.7	-	32	0	1	7.3	-
33	0	1	11.1	-	33	0	1	7.1	-
34	0	1	4.7	-	34	0	1	8.6	-
35	0	1	9.2	-	35	0	1	8.0	-
36	0	1	8.3	-	36	0	1	10.0	-
37	0	1	4.2	-	37	0	1	8.6	-
38	0	1	6.4	-	38	0	1	7.1	-
39	0	1	2.9	-	39	0	1	13.4	-
40	0	0	5.3	0	40	0	1	14.0	0
41	0	1	8.5	-	41	1	1	15.8	-
42	0	1	7.7	-	42	0	1	6.8	-
43	0	1	15.0	-	43	2	1	15.0	-
44	0	1	7.9	-	44	1	1	18.2	-
45	0	0	10.2	-	45	1	1	8.0	-
46	0	1	8.2	-	46	0	1	10.9	-
47	0	1	7.3	-	47	0	1	9.7	-
48	0	1	4.6	-	48	0	1	12.9	-
49	0	1	10.8	-	49	2	1	13.0	-
50	0	1	10.3	0.5	50	0	1	15.4	0
51	0	1	6.5	-	51	0	1	5.9	-
52	0	1	8.1	-	52	1	1	10.3	-
53	0	1	15.5	-	53	0	1	5.6	-
54	0	1	7.0	-	54	0	1	10.6	-
55	0	1	9.6	-	55	0	1	7.6	-
56	0	1	11.1	-	56	1	1	8.9	-
57	0	1	7.6	-	57	0	1	10.0	-
58	0	1	10.4	-	58	0	1	11.3	-
59	0	1	8.4	-	59	0	1	10.4	-
60	1	1	14.4	0.25	60	0	1	5.7	0.5
61	0	1	13.5	-	61	0	1	6.7	-
62	0	1	11.2	-	62	0	1	4.3	-
63	0	1	9.4	-	63	0	1	3.7	-
64	2	1	8.0	-	64	0	1	2.4	-
65	1	1	8.3	-	65	1	1	5.8	-
66	0	1	5.5	-	66	2	1	14.3	-
67	0	1	6.3	-	67	2	1	3.3	-
68	0	1	7.5	-	68	1	1	9.6	-
69	0	1	5.1	-	69	2	1	18.6	-
70	0	1	5.6	0.5	70	1	1	10.9	0
71	0	1	7.8	-	71	0	1	5.5	-
72	0	1	6.6	-	72	2	1	5.4	-
73	1	1	4.4	-	73	1	1	3.4	-
74	0	1	8.1	-	74	0	1	5.0	-
75	0	1	10.1	-	75	2	1	8.5	-
76	0	1	10.7	-	76	1	1	9.1	-
77	1	1	2.6	-	77	1	1	4.3	-
78	1	1	5.5	-	78	1	1	7.7	-
79	2	1	5.3	-	79	1	1	7.0	-
80	2	1	7.1	0.25	80	0	1	8.0	0
81	0	1	11.9	-	81	1	1	4.6	-
82	0	1	10.9	-	82	1	1	6.2	-
83	0	1	7.0	-	83	0	1	9.0	-
84	0	1	9.2	-	84	0	1	13.2	-
85	0	1	8.7	-	85	0	1	11.4	-
86	0	1	4.3	-	86	0	1	6.4	-
87	0	1	3.3	-	87	0	1	6.9	-
88	0	1	10.5	-	88	0	1	5.9	-
89	1	1	7.1	-	89	0	1	7.0	-
90	0	1	13.0	0	90	0	1	8.8	0.25
91	0	1	13.0	-	91	1	1	13.1	-
92	0	1	5.5	-	92	0	1	4.0	-
93	0	1	8.9	-	93	0	1	7.2	-
94	0	1	6.4	-	94	0	1	5.6	-
95	1	1	9.6	-	95	2	1	12.7	-
96	0	1	5.9	-	96	1	1	11.0	-
97	0	1	10.4	-	97	0	1	3.4	-
98	0	1	6.3	-	98	0	1	2.7	-
99	0	1	5.7	-	99	0	1	9.6	-
100	0	0	5.7	0	100	0	1	3.5	0
Minimum	**0.0**	**0.0**	**2.6**	**0**	**Minimum**	**0.0**	**1.0**	**2.4**	**0**
Maximum	**2.0**	**1.0**	**15.5**	**0.5**	**Maximum**	**2.0**	**1.0**	**18.6**	**0.5**
Mean	**0.1**	**0.9**	**7.9**	**0.2**	**Mean**	**0.4**	**1.0**	**8.4**	**0.1**
Standard Dev.	**0.4**	**0.3**	**3.0**	**0.2**	**Standard Dev.**	**0.6**	**0.0**	**3.7**	**0.2**
Geometric mean	**-**	**-**	**7.4**	**-**	**Geometric mean**	**-**	**-**	**7.7**	**-**
Median	**0.0**	**1.0**	**7.7**	**0**	**Median**	**0.0**	**1.0**	**7.9**	**0**
Calcite Index	1.1		-	-	**Calcite Index**	1.4		-	-

Table F.22: Calcite and Pebble Count at RG_FOBCP, FRO LAEMP, September 2018

RG_FOBCP 5				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	13.3	-
2	0	1	13.4	-
3	0	1	8.9	-
4	0	1	6.5	-
5	0	1	2.9	-
6	0	1	3.6	-
7	0	1	5.0	-
8	0	1	4.1	-
9	0	1	3.3	-
10	1	1	7.5	0.75
11	1	1	5.2	-
12	1	1	6.1	-
13	1	1	3.0	-
14	1	1	4.1	-
15	1	1	5.9	-
16	0	1	8.0	-
17	0	1	5.7	-
18	0	1	3.5	-
19	0	1	9.6	-
20	1	1	9.7	0.25
21	1	1	11.1	-
22	0	1	5.8	-
23	0	1	3.6	-
24	0	1	7.2	-
25	1	1	2.4	-
26	0	1	3.9	-
27	1	1	7.3	-
28	0	1	4.2	-
29	1	1	6.0	-
30	1	1	7.1	0.25
31	1	1	7.2	-
32	1	1	8.9	-
33	1	1	3.6	-
34	1	1	2.1	-
35	0	1	2.0	-
36	0	1	4.7	-
37	0	1	8.9	-
38	0	1	4.0	-
39	1	1	3.3	-
40	1	1	7.0	0.25
41	0	1	5.6	-
42	1	1	9.5	-
43	0	1	7.2	-
44	1	1	2.5	-
45	1	1	4.2	-
46	0	1	7.2	-
47	1	0	3.9	-
48	0	1	8.8	-
49	0	1	12.5	-
50	0	1	7.9	0
51	0	1	6.8	-
52	0	1	9.1	-
53	0	1	11.5	-
54	0	1	6.9	-
55	0	1	9.4	-
56	0	1	6.5	-
57	1	1	4.1	-
58	0	1	5.4	-
59	1	1	6.2	-
60	1	1	5.6	0.5
61	1	1	6.1	-
62	1	1	4.5	-
63	1	1	5.2	-
64	0	1	6.4	-
65	2	1	5.1	-
66	2	1	3.5	-
67	1	1	8.7	-
68	0	1	7.2	-
69	1	1	4.1	-
70	0	1	8.8	-
71	0	1	6.4	-
72	0	1	4.3	-
73	2	1	5.4	0.5
74	0	1	4.0	-
75	0	1	6.6	-
76	2	1	8.0	-
77	1	1	10.1	-
78	0	1	3.3	-
79	0	1	6.9	-
80	0	1	6.8	0
81	0	1	9.5	-
82	0	1	8.2	-
83	0	1	8.4	-
84	1	1	9.3	-
85	0	1	5.6	-
86	0	1	11.5	-
87	0	1	6.5	-
88	1	1	6.2	-
89	0	1	7.5	-
90	0	0	8.3	0.5
91	0	1	7.0	-
92	0	0	9.5	-
93	0	1	10.5	-
94	0	1	5.1	-
95	0	1	8.2	-
96	0	1	5.8	-
97	0	1	4.9	-
98	2	1	12.0	-
99	2	1	7.3	-
100	1	1	12.1	0.5
Minimum	**0.0**	**0.0**	**2.0**	**0**
Maximum	**2.0**	**1.0**	**13.4**	**0.75**
Mean	**0.5**	**1.0**	**6.7**	**0.4**
Standard Dev.	**0.6**	**0.2**	**2.6**	**0.2**
Geometric mean	**-**	**-**	**6.1**	**-**
Median	**0.0**	**1.0**	**6.5**	**0**
Calcite Index	1.4		-	-

Table F.23 Calcite and Pebble Count at RG_FRUPO, FRO LAEMP, September 2018

RG_FRUPO 1					RG_FRUPO 2				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	5.1	-	1	0	1	5.5	-
2	0	1	5.9	-	2	0	1	11.0	-
3	0	1	3.4	-	3	0	1	6.9	-
4	0	1	3.6	-	4	0	1	7.3	-
5	0	0	3.7	-	5	0	1	4.2	-
6	0	1	6.0	-	6	0	0	3.7	-
7	0	1	6.5	-	7	0	0	5.0	-
8	0	1	3.9	-	8	0	1	6.1	-
9	0	1	4.0	-	9	0	1	3.9	-
10	0	1	4.4	0	10	0	1	14.6	0
11	0	0	3.7	-	11	0	1	7.2	-
12	0	1	4.6	-	12	1	1	10.9	-
13	0	1	3.9	-	13	0	1	11.0	-
14	0	1	5.8	-	14	0	1	15.2	-
15	0	1	6.2	-	15	0	1	12.1	-
16	0	1	3.7	-	16	0	1	6.5	-
17	0	1	6.1	-	17	0	1	5.5	-
18	0	1	5.0	-	18	1	1	10.8	-
19	0	1	6.5	-	19	0	1	6.0	-
20	0	1	5.3	0.5	20	0	1	6.0	0
21	0	1	5.5	-	21	0	1	8.1	-
22	0	1	3.4	-	22	0	1	7.3	-
23	0	1	6.9	-	23	0	1	10.6	-
24	0	1	7.5	-	24	0	1	12.2	-
25	0	1	5.0	-	25	1	1	13.3	-
26	0	1	4.6	-	26	0	1	12.0	-
27	0	1	5.7	-	27	0	1	11.6	-
28	0	1	4.4	-	28	0	1	15.3	-
29	0	1	8.0	-	29	0	1	5.5	-
30	0	1	9.4	0	30	0	1	8.0	0
31	0	1	7.5	-	31	0	1	7.5	-
32	0	1	6.2	-	32	0	1	8.1	-
33	0	1	3.6	-	33	0	1	10.2	-
34	0	1	4.1	-	34	0	1	11.1	-
35	0	1	5.1	-	35	0	1	8.4	-
36	0	1	11.6	-	36	0	1	10.7	-
37	0	0	3.2	-	37	0	1	7.2	-
38	0	1	4.5	-	38	0	1	11.2	-
39	0	1	6.3	-	39	0	1	5.0	-
40	0	1	6.8	0	40	0	1	9.1	0.25
41	0	1	6.3	-	41	0	1	6.1	-
42	0	1	6.7	-	42	0	1	7.6	-
43	0	1	4.5	-	43	0	1	12.3	-
44	0	1	3.9	-	44	0	1	11.0	-
45	0	1	6.8	-	45	0	1	7.4	-
46	0	1	4.4	-	46	0	1	6.9	-
47	0	1	6.4	-	47	0	1	9.6	-
48	0	1	3.2	-	48	0	1	8.9	-
49	0	1	4.7	-	49	0	1	8.7	-
50	0	1	6.9	0	50	0	1	11.2	0
51	0	1	5.7	-	51	0	1	11.2	-
52	0	1	6.5	-	52	0	1	7.5	-
53	0	1	8.0	-	53	0	1	6.4	-
54	0	1	5.2	-	54	0	1	8.9	-
55	0	0	4.3	-	55	0	1	7.9	-
56	0	1	5.8	-	56	0	1	7.6	-
57	0	1	4.6	-	57	0	1	6.1	-
58	0	1	4.4	-	58	0	1	8.4	-
59	0	1	10.1	-	59	0	1	10.1	-
60	0	1	4.5	0	60	0	1	11.6	0.25
61	0	1	5.7	-	61	0	1	9.3	-
62	0	1	6.0	-	62	0	1	17.1	-
63	0	1	5.1	-	63	0	1	19.2	-
64	0	1	3.5	-	64	0	1	10.3	-
65	0	1	3.8	-	65	0	1	8.7	-
66	0	1	3.1	-	66	0	1	20.1	-
67	0	1	7.9	-	67	0	1	6.4	-
68	0	1	8.4	-	68	0	1	3.3	-
69	0	1	6.2	-	69	0	1	8.5	-
70	0	1	8.8	0.25	70	0	1	5.4	0.25
71	0	1	4.7	-	71	0	1	16.6	-
72	0	1	5.5	-	72	0	1	4.0	-
73	0	1	5.2	-	73	0	1	9.9	-
74	0	1	4.6	-	74	0	1	14.2	-
75	0	1	6.8	-	75	0	1	12.3	-
76	0	1	5.6	-	76	0	1	5.1	-
77	0	1	4.3	-	77	1	1	7.3	-
78	0	1	5.3	-	78	0	1	12.6	-
79	0	1	6.1	-	79	0	1	5.6	-
80	0	1	3.2	0.5	80	0	1	11.0	0
81	0	1	5.0	-	81	0	1	4.6	-
82	0	1	6.1	-	82	0	1	6.6	-
83	0	1	4.9	-	83	0	1	13.6	-
84	0	1	3.7	-	84	0	1	4.6	-
85	0	1	6.2	-	85	0	1	7.2	-
86	0	1	5.1	-	86	0	1	8.4	-
87	0	1	5.7	-	87	0	1	15.1	-
88	0	1	3.5	-	88	0	1	9.3	-
89	0	1	3.6	-	89	0	1	8.6	-
90	0	1	6.4	0.25	90	0	1	6.6	0
91	0	0	6.1	-	91	0	1	11.9	-
92	0	1	5.8	-	92	0	1	17.6	-
93	0	1	8.5	-	93	0	1	7.3	-
94	0	1	6.1	-	94	0	1	11.8	-
95	0	1	3.2	-	95	0	1	17.7	-
96	0	1	6.7	-	96	1	1	7.5	-
97	0	1	4.4	-	97	1	1	11.6	-
98	0	1	4.6	-	98	0	1	3.4	-
99	0	1	6.3	-	99	0	1	12.0	-
100	0	1	5.5	0.5	100	0	1	11.3	0.5
Minimum	**0.0**	**0.0**	**3.1**	**0**	**Minimum**	**0.0**	**0.0**	**3.3**	**0**
Maximum	**0.0**	**1.0**	**11.6**	**0.5**	**Maximum**	**1.0**	**1.0**	**20.1**	**0.5**
Mean	**0.0**	**1.0**	**5.5**	**0.2**	**Mean**	**0.1**	**1.0**	**9.3**	**0.1**
Standard Dev.	**0.0**	**0.2**	**1.6**	**0.2**	**Standard Dev.**	**0.2**	**0.1**	**3.6**	**0.2**
Geometric mean	**-**	**-**	**5.3**	**-**	**Geometric mean**	**-**	**-**	**8.6**	**-**
Median	**0.0**	**1.0**	**5.3**	**0**	**Median**	**0.0**	**1.0**	**8.7**	**0**
Calcite Index	**1.0**		**-**	**-**	**Calcite Index**	**1.0**		**-**	**-**

Table F.23 Calcite and Pebble Count at RG_FRUPO, FRO LAEMP, September 2018

RG_FRUPO 3				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	1	10.0	-
2	0	1	5.6	-
3	0	1	3.1	-
4	0	1	6.1	-
5	0	1	9.7	-
6	0	1	7.7	-
7	0	1	7.0	-
8	0	1	7.4	-
9	0	1	5.6	-
10	0	1	6.1	0
11	0	1	7.5	-
12	0	1	7.5	-
13	0	1	6.9	-
14	0	1	6.4	-
15	0	1	8.2	-
16	0	1	4.7	-
17	0	1	6.9	-
18	0	1	5.9	-
19	0	1	6.6	-
20	0	1	6.0	0
21	0	1	4.6	-
22	0	1	6.7	-
23	0	1	3.4	-
24	0	1	8.4	-
25	0	1	8.0	-
26	0	1	3.9	-
27	0	1	5.3	-
28	0	1	9.2	-
29	0	1	5.8	-
30	0	1	4.4	0.75
31	0	1	6.6	-
32	0	1	6.0	-
33	0	1	2.3	-
34	0	1	12.1	-
35	0	1	7.3	-
36	0	1	8.4	-
37	0	1	3.0	-
38	0	1	6.3	-
39	0	1	5.3	-
40	0	1	5.6	0
41	0	1	6.7	-
42	0	1	5.1	-
43	0	1	8.2	-
44	0	1	6.3	-
45	0	1	5.6	-
46	0	1	8.6	-
47	0	1	6.7	-
48	0	1	5.1	-
49	0	1	5.2	-
50	0	1	5.9	0
51	0	1	6.9	-
52	0	1	7.0	-
53	0	1	7.5	-
54	0	1	2.6	-
55	0	1	10.1	-
56	0	1	6.4	-
57	0	1	8.2	-
58	0	1	4.6	-
59	0	1	9.1	-
60	0	1	10.3	0
61	0	1	5.3	-
62	0	1	4.8	-
63	0	1	6.4	-
64	0	1	4.7	-
65	0	1	6.5	-
66	0	1	7.1	-
67	0	1	7.1	-
68	0	1	5.5	-
69	0	1	3.0	-
70	0	1	6.3	0.25
71	0	1	7.6	-
72	0	1	5.4	-
73	0	1	3.1	-
74	0	1	8.4	-
75	0	1	2.6	-
76	0	1	4.2	-
77	0	1	9.0	-
78	0	1	3.6	-
79	0	1	5.5	-
80	0	1	6.0	0
81	0	1	7.0	-
82	0	1	7.5	-
83	0	1	4.6	-
84	0	1	7.9	-
85	0	1	6.9	-
86	0	1	8.1	-
87	0	1	3.6	-
88	0	1	3.1	-
89	0	1	6.5	-
90	0	1	5.6	0.25
91	0	1	4.4	-
92	0	1	9.7	-
93	0	1	4.6	-
94	0	1	5.9	-
95	0	1	3.3	-
96	0	1	4.4	-
97	0	1	8.3	-
98	0	1	4.4	-
99	0	1	4.6	-
100	0	1	5.6	0
Minimum	**0.0**	**1.0**	**2.3**	**0**
Maximum	**0.0**	**1.0**	**12.1**	**0.75**
Mean	**0.0**	**1.0**	**6.2**	**0.1**
Standard Dev.	**0.0**	**0.0**	**1.9**	**0.2**
Geometric mean	**-**	**-**	**5.9**	**-**
Median	**0.0**	**1.0**	**6.2**	**0**
Calcite Index	**1.0**		**-**	**-**

Table F.24: Calcite and Pebble Count at RG_FODPO, FRO LAEMP, September 2018

RG_FODPO 1					RG_FODPO 2				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	3.0	-	1	0	1	3.0	-
2	0	0	Gravel	-	2	0	1	4.0	-
3	0	1	3.0	-	3	0	1	3.0	-
4	0	1	2.5	-	4	0	1	2.5	-
5	0	1	2.0	-	5	0	1	3.5	-
6	0	1	2.0	-	6	0	1	4.0	-
7	0	1	3.5	-	7	0	1	4.0	-
8	0	0	1.5	-	8	0	1	3.5	-
9	0	1	2.5	-	9	0	1	3.5	-
10	0	1	2.0	0	10	0	1	3.0	0.5
11	0	1	2.0	-	11	0	1	4.5	-
12	0	1	3.0	-	12	0	1	1.0	-
13	0	1	2.5	-	13	0	1	5.0	-
14	0	1	2.0	-	14	0	1	3.0	-
15	0	1	2.5	-	15	0	1	3.5	-
16	0	1	3.5	-	16	0	1	4.0	-
17	0	1	2.5	-	17	0	1	3.5	-
18	0	1	2.0	-	18	0	1	5.0	-
19	0	1	3.0	-	19	0	1	3.5	-
20	0	1	2.0	0	20	0	1	2.0	0.5
21	0	1	3.0	-	21	0	1	4.0	-
22	0	1	4.0	-	22	0	1	3.5	-
23	0	1	2.5	-	23	0	1	4.0	-
24	0	1	2.5	-	24	0	1	2.0	-
25	0	1	3.5	-	25	0	0	Gravel	-
26	0	1	2.5	-	26	0	1	3.0	-
27	0	1	2.0	-	27	0	1	4.5	-
28	0	1	3.5	-	28	0	1	3.0	-
29	0	1	2.5	-	29	0	1	3.0	-
30	0	1	4.5	0.5	30	0	1	5.0	0.75
31	0	1	3.5	-	31	0	1	4.0	-
32	0	1	3.5	-	32	0	1	3.5	-
33	0	1	2.5	-	33	0	1	3.0	-
34	0	1	3.5	-	34	0	1	2.0	-
35	0	1	4.5	-	35	0	1	5.0	-
36	0	1	Gravel	-	36	0	1	4.0	-
37	0	1	2.5	-	37	0	1	6.0	-
38	0	1	2.0	-	38	0	1	3.0	-
39	0	1	3.0	-	39	0	1	4.5	-
40	0	1	1.5	0.5	40	0	0	Gravel	-
41	0	1	2.5	-	41	0	1	2.5	-
42	0	1	3.0	-	42	0	1	5.5	-
43	0	1	2.0	-	43	0	1	3.0	-
44	0	1	4.5	-	44	0	1	4.5	-
45	0	1	2.0	-	45	0	0	Gravel	-
46	0	1	2.0	-	46	0	0	Gravel	-
47	0	1	3.5	-	47	0	0	Gravel	-
48	0	1	2.0	-	48	0	1	4.0	-
49	0	1	2.0	-	49	0	1	5.0	-
50	0	1	2.0	0	50	0	1	3.5	0
51	0	1	2.0	-	51	0	1	3.0	-
52	0	1	2.5	-	52	0	1	4.0	-
53	0	1	3.0	-	53	0	1	2.0	-
54	0	1	2.0	-	54	0	1	6.0	-
55	0	1	3.5	-	55	0	1	2.5	-
56	0	1	2.5	-	56	0	1	3.5	-
57	0	1	4.5	-	57	0	1	4.0	-
58	0	1	1.0	-	58	0	1	5.0	-
59	0	1	2.5	-	59	0	1	3.5	-
60	0	1	1.0	0	60	0	1	4.0	0.75
61	0	1	3.5	-	61	0	1	2.5	-
62	0	1	4.5	-	62	0	1	4.0	-
63	0	0	2.0	-	63	0	1	4.0	-
64	0	1	1.0	-	64	0	1	3.0	-
65	0	1	2.0	-	65	0	1	5.5	-
66	0	1	4.5	-	66	0	1	4.0	-
67	0	1	1.0	-	67	0	1	2.5	-
68	0	1	3.5	-	68	0	1	3.5	-
69	0	1	2.5	-	69	0	1	2.5	-
70	0	1	1.0	0.5	70	0	0	Gravel	-
71	0	1	1.5	-	71	0	1	5.5	-
72	0	1	2.0	-	72	0	1	4.5	-
73	0	1	2.0	-	73	0	1	5.0	-
74	0	1	2.5	-	74	0	1	2.5	-
75	0	1	4.5	-	75	0	1	3.5	-
76	0	1	3.0	-	76	0	1	5.0	-
77	0	1	2.5	-	77	0	1	4.0	-
78	0	1	4.0	-	78	0	1	5.0	-
79	0	1	2.0	-	79	0	1	3.0	-
80	0	1	2.0	0	80	0	1	6.0	0
81	0	1	3.5	-	81	0	1	3.0	-
82	0	1	1.0	-	82	0	1	4.5	-
83	0	1	2.0	-	83	0	1	6.0	-
84	0	1	2.5	-	84	0	1	5.0	-
85	0	0	1.0	-	85	0	1	4.5	-
86	0	0	2.5	-	86	0	1	6.0	-
87	0	1	3.0	-	87	0	1	5.0	-
88	0	1	2.5	-	88	0	1	5.0	-
89	0	1	4.5	-	89	0	1	3.0	-
90	0	1	2.0	0	90	0	1	4.5	0.5
91	0	1	2.5	-	91	0	1	4.0	-
92	0	1	2.0	-	92	0	1	5.0	-
93	0	1	3.5	-	93	0	1	4.0	-
94	0	0	2.5	-	94	0	1	5.5	-
95	0	0	2.5	-	95	0	1	3.0	-
96	0	1	3.5	-	96	0	1	5.0	-
97	0	1	2.0	-	97	0	1	3.5	-
98	0	1	3.5	-	98	0	1	4.0	-
99	0	1	2.5	-	99	0	1	5.0	-
100	0	1	4.0	0.5	100	0	1	3.5	0
Minimum	**0.0**	**0.0**	**1.0**	**0.0**	**Minimum**	**0.0**	**0.0**	**1.0**	**0.0**
Maximum	**0.0**	**1.0**	**4.5**	**0.5**	**Maximum**	**0.0**	**1.0**	**6.0**	**0.75**
Mean	**0.0**	**0.93**	**2.64**	**0.2**	**Mean**	**0.0**	**0.94**	**3.89**	**0.375**
Standard Dev.	**0.0**	**0.256**	**0.908**	**0.258**	**Standard Dev.**	**0.0**	**0.239**	**1.06**	**0.327**
Geometric mean	**-**	**-**	**2.47**	**-**	**Geometric mean**	**-**	**-**	**3.73**	**-**
Median	**0.0**	**1.0**	**2.5**	**0.0**	**Median**	**0.0**	**1.0**	**4.0**	**0.5**
Calcite Index	**0.9**		**-**	**-**	**Calcite Index**	**0.9**		**-**	**-**

Table F.24: Calcite and Pebble Count at RG_FODPO, FRO LAEMP, September 2018

RG_FODPO 3				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	1	7.0	-
2	0	1	4.0	-
3	0	1	9.0	-
4	0	1	6.0	-
5	0	1	12.0	-
6	0	1	4.0	-
7	0	1	5.0	-
8	0	1	4.0	-
9	0	1	5.0	-
10	0	1	5.0	0
11	0	1	6.0	-
12	0	1	7.0	-
13	0	1	9.0	-
14	0	1	7.0	-
15	0	1	5.0	-
16	0	1	3.0	-
17	0	1	4.0	-
18	0	1	5.0	-
19	0	1	3.0	-
20	0	1	5.0	0.25
21	0	1	3.0	-
22	0	1	8.0	-
23	0	1	7.0	-
24	0	1	4.0	-
25	0	1	5.0	-
26	0	1	4.0	-
27	0	1	6.0	-
28	0	1	5.0	-
29	0	1	8.0	-
30	0	1	2.5	0
31	0	1	6.0	-
32	0	1	3.0	-
33	0	1	5.0	-
34	0	1	9.0	-
35	0	1	7.0	-
36	0	1	7.5	-
37	0	1	6.0	-
38	0	1	5.5	-
39	0	1	5.0	-
40	0	1	6.0	0
41	0	1	7.0	-
42	0	1	9.0	-
43	0	1	5.0	-
44	0	1	10.0	-
45	0	1	9.0	-
46	0	1	6.0	-
47	0	1	7.0	-
48	0	1	9.0	-
49	0	1	8.0	-
50	0	1	5.0	0.5
51	0	1	9.0	-
52	0	1	4.0	-
53	0	1	6.0	-
54	0	1	7.0	-
55	0	1	4.0	-
56	0	1	5.0	-
57	0	1	6.0	-
58	0	1	6.0	-
59	0	1	7.0	-
60	0	1	9.0	0.5
61	0	1	5.5	-
62	0	1	3.0	-
63	0	1	4.5	-
64	0	1	7.0	-
65	0	1	4.0	-
66	0	1	6.0	-
67	0	1	9.0	-
68	0	1	7.0	-
69	0	1	6.0	-
70	0	1	6.0	0.25
71	0	1	7.0	-
72	0	1	5.0	-
73	0	1	9.0	-
74	0	1	5.0	-
75	0	1	6.0	-
76	0	1	7.0	-
77	0	1	8.0	-
78	0	1	6.0	-
79	0	1	6.0	-
80	0	1	6.0	0.25
81	0	1	8.0	-
82	0	1	4.0	-
83	0	1	5.0	-
84	0	1	7.0	-
85	0	1	5.0	-
86	0	1	8.0	-
87	0	1	4.0	-
88	0	1	9.0	-
89	1	1	6.0	-
90	0	1	4.5	0.5
91	0	0	3.0	-
92	0	1	5.0	-
93	0	1	5.5	-
94	0	1	5.0	-
95	0	1	6.0	-
96	0	1	7.0	-
97	0	1	4.5	-
98	0	1	9.0	-
99	0	1	6.0	-
100	0	1	6.0	0.25
Minimum	**0.0**	**0.0**	**2.5**	**0.0**
Maximum	**1.0**	**1.0**	**12.0**	**0.5**
Mean	**0.01**	**0.99**	**6.06**	**0.25**
Standard Dev.	**0.1**	**0.1**	**1.85**	**0.204**
Geometric mean	**-**	**-**	**5.78**	**-**
Median	**0.0**	**1.0**	**6.0**	**0.25**
Calcite Index	**1.0**		**-**	**-**

Table F.25: Calcite and Pebble Count at RG_FO22, FRO LAEMP, September 2018

RG_FO22 1					RG_FO22 2				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**	**Rock**	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	1	8.1	-	1	0	1	4	-
2	0	1	7.5	-	2	0	1	4.1	-
3	0	1	2.6	-	3	0	1	2.8	-
4	0	1	4.9	-	4	0	1	3.9	-
5	0	1	3.8	-	5	0	1	5.1	-
6	0	1	3	-	6	0	1	3.8	-
7	0	1	4.4	-	7	0	1	4.7	-
8	0	1	3.2	-	8	0	1	4.7	-
9	0	1	5.9	-	9	0	1	3.3	-
10	0	1	3.9	0	10	0	1	2.5	0
11	0	1	3.7	-	11	0	1	2.9	-
12	0	1	5.1	-	12	0	1	2.4	-
13	0	1	4.2	-	13	0	1	2.6	-
14	0	1	5	-	14	0	1	3.7	-
15	0	1	3.1	-	15	0	1	3	-
16	0	1	4.3	-	16	0	1	3.6	-
17	0	1	3.5	-	17	0	1	3.4	-
18	0	1	3.3	-	18	0	1	4.5	-
19	0	1	4.3	-	19	0	1	3.2	-
20	0	1	4.6	0	20	0	1	5	0
21	0	1	2.6	-	21	0	0	2.5	-
22	0	1	3.2	-	22	0	1	2.9	-
23	0	1	6.1	-	23	0	1	3.1	-
24	0	1	2	-	24	0	1	2.5	-
25	0	1	3	-	25	0	1	4.3	-
26	0	1	5.5	-	26	0	1	4.9	-
27	0	1	4	-	27	0	0	3.5	-
28	0	1	3.9	-	28	0	1	3.6	-
29	0	1	3.1	-	29	0	1	2.8	-
30	0	1	3.7	0.25	30	0	1	4.2	0
31	0	1	2.8	-	31	0	1	4.1	-
32	0	1	5.6	-	32	0	1	3.1	-
33	0	1	2.8	-	33	0	1	1.2	-
34	0	1	3.9	-	34	0	1	2.7	-
35	0	1	2.5	-	35	0	1	2.7	-
36	0	1	7.1	-	36	0	1	2.4	-
37	0	1	6.4	-	37	0	1	2.1	-
38	0	1	4.7	-	38	0	0	1.3	-
39	0	1	3.8	-	39	0	1	3.5	-
40	0	1	5.2	0	40	0	0	1.2	0
41	0	1	5.5	-	41	0	0	3.6	-
42	0	1	6.7	-	42	0	0	1	-
43	0	1	4.1	-	43	0	1	2.3	-
44	0	1	2.2	-	44	0	1	3.7	-
45	0	1	3.4	-	45	0	1	4.9	-
46	0	1	4.6	-	46	0	1	1.5	-
47	0	1	3.3	-	47	0	1	3.1	-
48	0	1	3.5	-	48	0	1	3.2	-
49	0	1	4.3	-	49	0	1	5.1	-
50	0	1	2.4	0	50	0	1	3.5	0.25
51	0	1	4.3	-	51	0	1	4.3	-
52	0	1	2	-	52	0	0	2	-
53	0	1	2.7	-	53	0	1	2.7	-
54	0	1	3	-	54	0	1	3	-
55	0	1	3	-	55	0	0	3	-
56	0	1	2.6	-	56	0	1	2.6	-
57	0	1	1.9	-	57	0	0	1.9	-
58	0	1	3	-	58	0	1	3	-
59	0	1	3.5	-	59	0	1	3.5	-
60	0	1	3.6	0.25	60	0	1	3.6	0
61	0	1	4.4	-	61	0	1	4.4	-
62	0	1	2	-	62	0	0	2	-
63	0	1	2.2	-	63	0	1	2.2	-
64	0	1	1.9	-	64	0	1	1.9	-
65	0	1	3.4	-	65	0	1	3.4	-
66	0	1	3.4	-	66	0	1	3.4	-
67	0	1	4.2	-	67	0	1	4.2	-
68	0	1	2.8	-	68	0	1	2.8	-
69	0	1	3.4	-	69	0	0	3.4	-
70	0	1	3.1	0	70	0	0	3.1	0
71	0	1	2.9	-	71	0	1	2.9	-
72	0	1	2.8	-	72	0	1	2.8	-
73	0	1	3.6	-	73	0	1	3.6	-
74	0	1	7.4	-	74	0	1	7.4	-
75	0	1	3.3	-	75	0	1	3.3	-
76	0	1	2.2	-	76	0	0	2.2	-
77	0	1	3.2	-	77	0	1	3.2	-
78	0	1	1.9	-	78	0	0	1.9	-
79	0	1	4.2	-	79	0	1	4.2	-
80	0	1	3.4	0	80	0	1	3.4	0.25
81	0	1	4.2	-	81	0	1	4.2	-
82	0	1	2.3	-	82	0	1	2.3	-
83	0	1	2.6	-	83	0	1	2.6	-
84	0	1	2.7	-	84	0	0	2.7	-
85	0	1	4	-	85	0	1	4	-
86	0	1	5.3	-	86	0	1	5.3	-
87	0	1	3.2	-	87	0	1	3.2	-
88	0	1	3.6	-	88	0	0	3.6	-
89	0	1	2.7	-	89	0	1	2.7	-
90	0	1	3.9	0.25	90	0	1	3.9	0
91	0	1	2.5	-	91	0	1	2.5	-
92	0	1	2.6	-	92	0	1	2.6	-
93	0	1	2.9	-	93	0	1	2.9	-
94	0	1	3.1	-	94	0	0	3.1	-
95	0	1	4	-	95	0	1	4	-
96	0	1	1.8	-	96	0	0	1.8	-
97	0	1	3.3	-	97	0	1	3.3	-
98	0	1	2.7	-	98	0	1	2.7	-
99	0	1	3.2	-	99	0	1	3.2	-
100	0	1	3.9	0	100	0	1	3.9	0.25
Minimum	**0.0**	**1.0**	**1.8**	**0.0**	**Minimum**	**0.0**	**0.0**	**1.0**	**0.0**
Maximum	**0.0**	**1.0**	**8.1**	**0.25**	**Maximum**	**0.0**	**1.0**	**7.4**	**0.25**
Mean	**0.0**	**1.0**	**3.7**	**0.075**	**Mean**	**0.0**	**0.82**	**3.24**	**0.075**
Standard Dev.	**0.0**	**0.0**	**1.31**	**0.121**	**Standard Dev.**	**0.0**	**0.386**	**1.01**	**0.121**
Geometric mean	**-**	**-**	**3.5**	**-**	**Geometric mean**	**-**	**-**	**3.07**	**-**
Median	**0.0**	**1.0**	**3.4**	**0.0**	**Median**	**0.0**	**1.0**	**3.2**	**0.0**
Calcite Index	**1.0**		**-**	**-**	**Calcite Index**	**0.8**		**-**	**-**

Table F.25: Calcite and Pebble Count at RG_FO22, FRO LAEMP, September 2018

RG_FO22 3					RG_FO22 4				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**	**Rock**	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	1	4.9	-	1	0	1	3.6	-
2	0	1	3.4	-	2	0	1	2.5	-
3	0	1	3.0	-	3	0	1	3.9	-
4	0	1	4.5	-	4	0	1	4.0	-
5	0	1	3.1	-	5	0	0	3.1	-
6	0	1	2.9	-	6	0	1	4.3	-
7	0	1	1.9	-	7	0	1	1.9	-
8	0	1	4.4	-	8	0	1	5.5	-
9	0	1	3.5	-	9	0	1	6.1	-
10	0	1	3.4	0.5	10	0	1	6.7	0.25
11	0	1	2.1	-	11	0	1	3.4	-
12	0	1	2.7	-	12	0	0	2.2	-
13	0	1	1.6	-	13	0	0	3.0	-
14	0	1	2.3	-	14	0	1	3.8	-
15	0	1	4.1	-	15	0	1	4.6	-
16	0	1	3.8	-	16	0	1	3.3	-
17	0	1	5.7	-	17	0	1	4.5	-
18	0	1	2.5	-	18	0	1	4.6	-
19	0	1	2.1	-	19	0	0	2.2	-
20	0	0	3.0	0	20	0	1	6.2	0
21	0	1	3.6	-	21	0	1	4.1	-
22	0	1	2.4	-	22	0	1	4.4	-
23	0	1	1.2	-	23	0	1	4.3	-
24	0	1	2.4	-	24	0	1	4.3	-
25	0	1	1.7	-	25	0	1	6.9	-
26	0	1	5.5	-	26	0	0	1.2	-
27	0	1	3.6	-	27	0	1	3.1	-
28	0	1	4.9	-	28	0	1	3.0	-
29	0	1	2.2	-	29	0	1	3.7	-
30	0	1	1.6	0	30	0	1	5.1	-
31	0	1	5.6	-	31	0	1	2.9	0
32	0	1	1.4	-	32	0	1	2.9	-
33	0	1	1.5	-	33	0	1	4.0	-
34	0	1	2.0	-	34	0	1	3.8	-
35	0	1	5.5	-	35	0	1	4.2	-
36	0	1	5.2	-	36	0	0	3.4	-
37	0	1	3.4	-	37	0	1	2.4	-
38	0	1	6.1	-	38	0	1	2.7	-
39	0	0	1.9	-	39	0	1	3.0	-
40	0	1	6.4	0	40	0	1	5.0	0
41	0	1	4.2	-	41	0	1	6.9	-
42	0	1	4.6	-	42	0	1	3.6	-
43	0	1	3.1	-	43	0	1	4.3	-
44	0	1	2.1	-	44	0	1	3.9	-
45	0	1	6.1	-	45	0	1	1.9	-
46	0	1	1.2	-	46	0	1	1.6	-
47	0	1	1.4	-	47	0	1	5.9	-
48	0	1	3.7	-	48	0	1	2.4	-
49	0	1	4.9	-	49	0	1	2.1	-
50	0	1	5.6	0.25	50	0	1	2.1	0
51	0	1	3.4	-	51	0	0	2.5	-
52	0	1	2.7	-	52	0	1	2.9	-
53	0	1	3.0	-	53	0	1	2.6	-
54	0	1	2.5	-	54	0	1	4.6	-
55	0	1	2.4	-	55	0	1	2.2	-
56	0	1	4.6	-	56	0	1	5.1	-
57	0	1	2.9	-	57	0	1	4.2	-
58	0	0	3.1	-	58	0	1	2.6	-
59	0	1	0.6	-	59	0	1	2.7	-
60	0	1	3.7	0	60	0	1	2.8	0.25
61	0	0	0.9	-	61	0	1	3.4	-
62	0	1	5.2	-	62	0	1	5.1	-
63	0	1	3.7	-	63	0	1	6.3	-
64	0	1	4.0	-	64	0	1	4.5	-
65	0	1	2.6	-	65	0	1	5.6	-
66	0	1	4.0	-	66	0	1	3.7	-
67	0	1	3.9	-	67	0	1	4.4	-
68	0	1	3.3	-	68	0	1	2.9	-
69	0	1	2.7	-	69	0	1	5.9	-
70	0	1	3.2	0	70	0	1	3.3	0
71	0	1	4.1	-	71	0	1	1.9	-
72	0	1	4.1	-	72	0	1	6.6	-
73	0	1	3.9	-	73	0	1	3.2	-
74	0	1	2.5	-	74	0	1	3.1	-
75	0	1	3.0	-	75	0	1	3.4	-
76	0	1	2.8	-	76	0	1	4.9	-
77	0	1	4.4	-	77	0	1	1.0	-
78	0	1	4.0	-	78	0	0	4.7	-
79	0	1	3.2	-	79	0	1	5.5	-
80	0	1	3.0	0.25	80	0	1	2.8	0
81	0	1	2.6	-	81	0	0	3.7	-
82	0	1	2.3	-	82	0	1	4.1	-
83	0	1	1.6	-	83	0	1	3.0	-
84	0	1	4.3	-	84	0	1	3.1	-
85	0	1	2.0	-	85	0	1	4.7	-
86	0	1	3.7	-	86	0	1	2.3	-
87	0	1	5.4	-	87	0	1	2.1	-
88	0	1	5.0	-	88	0	1	3.6	-
89	0	1	3.4	-	89	0	1	4.1	-
90	0	1	2.7	0	90	0	1	4.2	0
91	0	1	4.8	-	91	0	0	1.7	-
92	0	1	3.4	-	92	0	1	2.9	-
93	0	1	2.1	-	93	0	1	2.5	-
94	0	1	2.2	-	94	0	1	2.8	-
95	0	1	4.0	-	95	0	1	3.3	-
96	0	1	4.4	-	96	0	1	2.9	-
97	0	1	4.9	-	97	0	1	2.8	-
98	0	1	3.2	-	98	0	1	3.0	-
99	0	1	2.5	-	99	0	1	4.6	-
100	0	1	2.1	0	100	0	1	5.0	0
Minimum	**0.0**	**0.0**	**0.6**	**0.0**	**Minimum**	**0.0**	**0.0**	**1.0**	**0.0**
Maximum	**0.0**	**1.0**	**6.4**	**0.5**	**Maximum**	**0.0**	**1.0**	**6.9**	**0.25**
Mean	**0.0**	**0.96**	**3.34**	**0.1**	**Mean**	**0.0**	**0.9**	**3.69**	**0.05**
Standard Dev.	**0.0**	**0.197**	**1.29**	**0.175**	**Standard Dev.**	**0.0**	**0.302**	**1.31**	**0.105**
Geometric mean	**-**	**-**	**3.06**	**-**	**Geometric mean**	**-**	**-**	**3.46**	**-**
Median	**0.0**	**1.0**	**3.2**	**0.0**	**Median**	**0.0**	**1.0**	**3.5**	**0.0**
Calcite Index	**1.0**		**-**	**-**	**Calcite Index**	**0.9**		**-**	**-**

Table F.25: Calcite and Pebble Count at RG_FO22, FRO LAEMP, September 2018

RG_FO22 5				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	2.7	-
2	0	1	3.2	-
3	0	1	4.6	-
4	0	1	2.6	-
5	0	1	3.4	-
6	0	1	5.0	-
7	0	1	2.9	-
8	0	1	3.8	-
9	0	1	2.8	-
10	0	1	3.5	0
11	0	1	4.6	-
12	0	1	4.6	-
13	0	1	3.1	-
14	0	1	6.2	-
15	0	1	4.1	-
16	0	1	4.8	-
17	0	1	3.8	-
18	0	1	3.5	-
19	0	1	3.1	-
20	0	1	2.4	0
21	0	1	2.1	-
22	0	1	2.7	-
23	0	1	2.6	-
24	0	1	2.3	-
25	0	1	2.5	-
26	0	1	4.1	-
27	0	1	2.8	-
28	0	1	4.7	-
29	0	1	2.1	-
30	0	1	3.6	0
31	0	1	3.2	-
32	0	1	2.5	-
33	0	1	3.8	-
34	0	1	5.0	-
35	0	1	3.1	-
36	0	0	2.2	-
37	0	1	3.1	-
38	0	1	2.9	-
39	0	1	4.6	-
40	0	1	4.7	0
41	0	1	3.2	-
42	0	1	2.3	-
43	0	1	2.4	-
44	0	1	4.4	-
45	0	1	5.5	-
46	0	1	3.7	-
47	0	0	1.1	-
48	0	1	4.1	-
49	0	1	1.8	-
50	0	1	3.0	0
51	0	1	2.7	-
52	0	1	2.2	-
53	0	1	3.1	-
54	0	1	6.5	-
55	0	1	3.8	-
56	0	1	2.8	-
57	0	0	3.6	-
58	0	1	4.3	-
59	0	1	3.2	-
60	0	1	3.4	0
61	0	1	1.9	-
62	0	1	2.3	-
63	0	1	5.5	-
64	0	1	3.3	-
65	0	1	2.9	-
66	0	1	4.2	-
67	0	1	3.1	-
68	0	1	3.6	-
69	0	1	6.2	-
70	0	1	3.3	0.25
71	0	1	5.6	-
72	0	1	4.1	-
73	0	1	4.1	-
74	0	1	2.4	-
75	0	1	3.5	-
76	0	1	2.5	-
77	0	1	3.0	-
78	0	1	3.9	-
79	0	1	3.6	-
80	0	1	4.3	0.25
81	0	1	4.3	-
82	0	1	5.1	-
83	0	1	4.5	-
84	0	0	2.1	-
85	0	1	4.2	-
86	0	1	3.8	-
87	0	1	3.5	-
88	0	1	3.1	-
89	0	1	5.6	-
90	0	1	2.4	0
91	0	1	3.2	-
92	0	1	3.2	-
93	0	1	4.5	-
94	0	1	2.5	-
95	0	1	4.9	-
96	0	1	4.1	-
97	0	1	3.9	-
98	0	1	3.2	-
99	0	0	1.2	-
100	0	1	3.3	0
Minimum	**0.0**	**0.0**	**1.1**	**0.0**
Maximum	**0.0**	**1.0**	**6.5**	**0.25**
Mean	**0.0**	**0.95**	**3.52**	**0.05**
Standard Dev.	**0.0**	**0.219**	**1.08**	**0.105**
Geometric mean	**-**	**-**	**3.36**	**-**
Median	**0.0**	**1.0**	**3.35**	**0.0**
Calcite Index	**1.0**		**-**	**-**

Table F.26: Calcite and Pebble Count at RG_FOUEW, FRO LAEMP, September 2018

RG_FOUEW 1					RG_FOUEW 2				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	11.9	-	1	0	1	7.5	-
2	0	1	13.2	-	2	0	1	9.6	-
3	0	1	6.2	-	3	0	1	11.2	-
4	0	1	9.6	-	4	0	1	7.8	-
5	1	1	10.1	-	5	0	1	11.3	-
6	0	1	7.6	-	6	0	1	8.5	-
7	0	1	8.9	-	7	0	1	12.7	-
8	0	1	8.2	-	8	0	1	10.5	-
9	1	1	6.1	-	9	0	1	8.1	-
10	0	1	6.5	0.25	10	0	1	9.3	0.25
11	1	1	6.2	-	11	0	1	10.8	-
12	0	1	7.5	-	12	0	1	9.1	-
13	0	1	9.8	-	13	0	1	12.9	-
14	0	1	6.0	-	14	0	1	4.1	-
15	0	1	7.5	-	15	0	1	10.0	-
16	1	1	5.1	-	16	0	1	5.4	-
17	1	1	7.0	-	17	0	1	8.1	-
18	0	1	7.3	-	18	0	1	10.3	-
19	0	1	5.0	-	19	0	1	7.5	-
20	0	1	5.2	0	20	0	1	6.1	0
21	0	1	4.9	-	21	0	1	7.2	-
22	0	1	7.8	-	22	0	1	11.3	-
23	0	1	8.9	-	23	0	1	7.0	-
24	0	1	9.0	-	24	0	1	14.8	-
25	0	1	8.1	-	25	0	1	4.5	-
26	0	1	8.2	-	26	0	1	5.8	-
27	0	1	7.3	-	27	0	1	11.1	-
28	1	1	8.2	-	28	0	1	3.7	-
29	0	1	9.9	-	29	0	1	8.1	-
30	0	1	7.9	0.25	30	0	1	6.5	0.25
31	0	1	9.4	-	31	0	1	7.4	-
32	0	1	7.1	-	32	0	1	6.9	-
33	0	1	8.0	-	33	0	1	6.1	-
34	0	1	5.5	-	34	0	1	15.5	-
35	0	1	5.4	-	35	0	1	8.8	-
36	0	1	11.7	-	36	0	1	6.2	-
37	0	1	4.5	-	37	0	1	4.2	-
38	0	1	7.1	-	38	0	1	9.9	-
39	0	1	12.7	-	39	0	1	5.6	-
40	0	1	6.4	0.25	40	0	1	8.5	0.25
41	0	1	10.5	-	41	0	1	12.0	-
42	0	1	7.9	-	42	0	1	10.5	-
43	0	1	5.8	-	43	0	1	9.8	-
44	0	1	9.5	-	44	0	1	11.0	-
45	0	1	10.5	-	45	0	1	13.4	-
46	0	1	11.0	-	46	0	1	9.5	-
47	0	1	9.1	-	47	0	1	11.5	-
48	0	1	7.6	-	48	0	1	7.5	-
49	0	1	7.9	-	49	0	1	11.6	-
50	0	1	6.5	0.75	50	0	1	9.4	0.25
51	0	1	8.5	-	51	0	1	9.3	-
52	0	1	7.3	-	52	0	1	10.1	-
53	0	1	6.2	-	53	0	1	10.9	-
54	0	1	8.6	-	54	0	1	9.5	-
55	0	1	6.3	-	55	0	1	8.3	-
56	0	1	10.1	-	56	0	1	4.4	-
57	0	1	6.4	-	57	0	1	4.9	-
58	0	1	8.5	-	58	0	1	5.7	-
59	0	1	7.2	-	59	0	1	8.2	-
60	0	1	9.5	0	60	0	1	8.0	0.25
61	0	1	6.9	-	61	0	1	6.9	-
62	0	1	6.3	-	62	0	1	7.5	-
63	0	1	9.4	-	63	0	1	8.4	-
64	0	1	8.5	-	64	0	1	7.1	-
65	0	1	8.6	-	65	0	1	8.2	-
66	0	1	8.7	-	66	0	1	7.5	-
67	0	1	11.9	-	67	0	1	6.8	-
68	0	1	11.5	-	68	0	1	12.1	-
69	0	1	8.4	-	69	0	1	5.2	-
70	0	1	12.1	0.25	70	0	1	9.9	0.5
71	0	1	9.1	-	71	0	1	8.8	-
72	0	1	7.2	-	72	0	1	8.7	-
73	0	1	9.5	-	73	0	1	6.4	-
74	0	1	7.8	-	74	0	1	12.6	-
75	0	1	4.8	-	75	0	1	7.9	-
76	0	1	8.6	-	76	0	1	12.1	-
77	0	1	9.3	-	77	0	1	7.1	-
78	0	1	9.2	-	78	0	1	8.8	-
79	0	1	6.9	-	79	0	1	11.2	-
80	0	1	5.8	0	80	0	1	8.3	0.5
81	0	1	11.0	-	81	0	1	7.4	-
82	0	1	6.0	-	82	0	1	9.5	-
83	0	1	7.5	-	83	0	1	6.1	-
84	0	1	10.5	-	84	0	1	8.8	-
85	0	1	10.8	-	85	0	1	5.9	-
86	0	1	10.4	-	86	0	1	5.1	-
87	0	1	5.5	-	87	0	1	4.8	-
88	0	1	10.4	-	88	0	1	12.3	-
89	0	1	7.3	-	89	0	1	10.5	-
90	0	1	9.5	0.25	90	0	1	4.5	0.25
91	0	1	11.6	-	91	0	1	7.2	-
92	0	1	7.2	-	92	0	1	6.2	-
93	0	1	7.3	-	93	0	1	9.4	-
94	0	1	6.9	-	94	0	1	5.2	-
95	0	1	9.4	-	95	0	1	10.1	-
96	0	1	7.6	-	96	0	1	5.5	-
97	0	1	13.9	-	97	0	1	5.4	-
98	0	1	14.4	-	98	0	1	11.1	-
99	0	1	6.1	-	99	0	1	8.4	-
100	0	1	12.6	0.5	100	0	1	6.2	0.25
Minimum	**0.0**	**1.0**	**4.5**	**0**	**Minimum**	**0.0**	**1.0**	**3.7**	**0**
Maximum	**1.0**	**1.0**	**14.4**	**0.75**	**Maximum**	**0.0**	**1.0**	**15.5**	**0.5**
Mean	**0.1**	**1.0**	**8.3**	**0.3**	**Mean**	**0.0**	**1.0**	**8.5**	**0.3**
Standard Dev.	**0.2**	**0.0**	**2.2**	**0.2**	**Standard Dev.**	**0.0**	**0.0**	**2.5**	**0.1**
Geometric mean	**-**	**-**	**8.1**	**-**	**Geometric mean**	**-**	**-**	**8.1**	**-**
Median	**0.0**	**1.0**	**8.1**	**0**	**Median**	**0.0**	**1.0**	**8.3**	**0**
Calcite Index	**1.1**		**-**	**-**	**Calcite Index**	**1.0**		**-**	**-**

Table F.26: Calcite and Pebble Count at RG_FOUEW, FRO LAEMP, September 2018

RG_FOUEW 3				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	1	6.5	-
2	0	1	10.7	-
3	0	1	11.1	-
4	0	1	5.5	-
5	0	1	6.0	-
6	0	1	5.1	-
7	0	1	9.3	-
8	0	1	7.0	-
9	0	1	10.1	-
10	0	1	7.1	0.58
11	0	1	8.0	-
12	0	1	4.9	-
13	0	1	3.2	-
14	0	1	9.7	-
15	0	1	8.1	-
16	0	1	8.8	-
17	0	1	12.8	-
18	0	1	11.5	-
19	0	1	12.5	-
20	0	1	9.7	0
21	0	1	4.6	-
22	0	1	7.2	-
23	0	1	8.9	-
24	0	1	14.3	-
25	0	1	9.9	-
26	0	1	12.5	-
27	0	1	8.8	-
28	0	1	9.6	-
29	0	1	11.5	-
30	0	1	9.4	0.25
31	0	1	18.5	-
32	0	1	14.4	-
33	0	1	18.2	-
34	0	1	15.6	-
35	0	1	10.0	-
36	0	1	10.5	-
37	0	1	8.0	-
38	0	1	16.3	-
39	0	1	10.3	-
40	0	1	9.1	0
41	0	1	12.1	-
42	0	1	10.2	-
43	0	1	6.4	-
44	0	1	9.6	-
45	0	1	10.9	-
46	0	1	11.9	-
47	0	1	5.0	-
48	0	1	10.8	-
49	0	1	8.1	-
50	0	1	5.6	0
51	0	1	12.0	-
52	0	1	6.1	-
53	0	1	12.1	-
54	0	1	6.5	-
55	0	1	9.5	-
56	0	1	7.7	-
57	0	1	8.5	-
58	0	1	8.9	-
59	0	1	8.2	-
60	0	1	11.5	0.5
61	0	1	7.5	-
62	0	1	11.2	-
63	0	1	18.5	-
64	0	1	22.7	-
65	0	1	11.0	-
66	0	1	9.4	-
67	0	1	10.7	-
68	0	1	3.6	-
69	0	1	8.9	-
70	0	1	4.1	0.5
71	0	1	9.3	-
72	0	1	5.9	-
73	0	1	11.8	-
74	0	1	7.9	-
75	0	1	4.1	-
76	0	1	21.2	-
77	0	1	5.0	-
78	0	1	7.4	-
79	0	1	9.1	-
80	0	1	6.3	0.25
81	0	1	8.4	-
82	0	1	5.5	-
83	0	1	7.5	-
84	0	1	18.9	-
85	0	1	6.5	-
86	0	1	7.0	-
87	0	1	10.1	-
88	0	1	3.9	-
89	0	1	5.1	-
90	0	1	6.6	-
91	0	1	4.6	0.25
92	0	1	6.0	-
93	0	1	9.5	-
94	0	1	7.6	-
95	0	1	4.2	-
96	0	1	7.7	-
97	0	1	19.4	-
98	0	1	8.3	-
99	0	1	5.7	-
100	0	1	5.1	0.25
Minimum	**0.0**	**1.0**	**3.2**	**0**
Maximum	**0.0**	**1.0**	**22.7**	**0.58**
Mean	**0.0**	**1.0**	**9.3**	**0.3**
Standard Dev.	**0.0**	**0.0**	**3.9**	**0.2**
Geometric mean	**-**	**-**	**8.6**	**-**
Median	**0.0**	**1.0**	**8.9**	**0**
Calcite Index	**1.0**		**-**	**-**

Table F.27: ***In Situ*** **Water Quality Taken at Biological Monitoring Areas, September 2018**

Field Parameters		Reference		Mine-Exposed													
		RG_FO26	RG_HENUP	RG_FODHE	RG_FOUNGD	RG_FODNGD	RG_MP1	RG_FOUSH	RG_FOUKI	RG_FOBKS	RG_FOBSC	RG_FOBCP	FRCP1SW	RG_FRUPO	RG_FODPO	RG_FO22	RG_FOUEW
Date		7-Sep-18	6-Sep-18	5-Sep-18	13-Sep-18	12-Sep-18	11-Sep-18	11-Sep-18	7-Sep-18	8-Sep-18	10-Sep-18	9-Sep-18	-	9-Sep-18	13-Sep-18	8-Sep-18	6-Sep-18
Station 1	Temperature (°C)	8.42	6.90	11.47	7.97	8.6	10.32	8.74	13.40	10.89	9.87	11.03	-	8.10	7.00	8.95	8.10
	Dissolved Oxygen (mg/L)	9.62	11.45	10.11	13.48	13.54	12.04	13.49	8.43	9.07	11.17	13.01	-	12.15	12.94	9.86	10.24
	Dissolved Oxygen (%)	82.1	94.3	92.8	114	116.3	107.7	116.3	80.5	82.6	99.0	118.7	-	103.7	106.9	85.4	86.9
	Conductivity (µS/cm)	276	209	387	480	500	536	520	689	546	597	1,177	-	674	722	710	657
	Specific Conductivity (µS/cm)	405	320	521	711	728	745	754	891	747	840	1,604	-	995	1,100	1,024	970
	pH	8.03	8.89	8.61	8.02	8.26	8.24	8.23	8.18	8.15	8.21	8.29	-	7.82	7.84	7.87	7.23
	ORP (mV)		209.70	182.10	-	-	-	-	193.60	198.60	220.70	221.30	-	219.80	-	242.20	188.60
Station 2	Temperature (°C)	7.39	4.48	11.95	8.26	8.83	10.08	9.35	13.35	9.79	9.49	9.64	-	8.21	6.89	8.84	7.99
	Dissolved Oxygen (mg/L)	9.78	12.54	10.11	12.79	13.29	12.52	13.5	8.68	9.12	10.78	13.78	-	13.41	13.93	9.60	9.23
	Dissolved Oxygen (%)	81.5	97.0	93.7	108.9	114.7	111.4	118.0	83.2	80.6	94.6	121.8	-	114.2	114.9	83.4	78.2
	Conductivity (µS/cm)	271	199	522	484	502	534	526	699	532	345	1,137	-	689	719	706	606
	Specific Conductivity (µS/cm)	409	326	392	711	727	747	750	892	750	595	1,608	-	1,014	1099	1,021	897
	pH	8.02	8.88	7.38	8.06	8.24	8.24	8.29	7.84	8.25	8.15	8.37	-	7.77	7.82	7.89	7.50
	ORP (mV)	308.10	200.20	195.10	-	-	-	-	148.90	221.50	232.00	242.90	-	218.70	-	242.50	182.30
Station 3	Temperature (°C)	5.94	4.75	11.95	8.77	9.26	9.5	9.76	12.70	8.68	8.81	8.81	-	8.59	6.88	8.60	6.35
	Dissolved Oxygen (mg/L)	11.31	12.29	9.85	11.91	12.47	11.9	13.24	8.53	10.28	10.39	13.64	-	13.51	12.86	9.72	8.94
	Dissolved Oxygen (%)	90.8	95.6	91.6	102.8	108.8	104.5	116.8	180.6	88.8	89.6	118.2	-	116.1	106.3	83.5	72.4
	Conductivity (µS/cm)	261	198	392	491	508	523	533	679	514	586	1,115	-	705	718	702	462
	Specific Conductivity (µS/cm)	410	321	522	712	729	743	751	887	747	849	1,613	-	1,027	1098.0	1,023	714
	pH	8.02	9.07	9.16	8.08	8.20	8.14	8.32	8.06	8.10	8.20	8.36	-	7.79	7.8	7.88	7.84
	ORP (mV)	310.20	220.70	164.90	-	-	-	-	157.20	243.90	226.80	234.00	-	179.30	-	230.50	192.30
Station 4	Temperature (°C)	-	-	-	-	-	-	-	-	-	-	7.56	-	-	-	8.42	-
	Dissolved Oxygen (mg/L)	-	-	-	-	-	-	-	-	-	-	14.44	-	-	-	9.82	-
	Dissolved Oxygen (%)	-	-	-	-	-	-	-	-	-	-	121.1	-	-	-	84.1	-
	Conductivity (µS/cm)	-	-	-	-	-	-	-	-	-	-	1,083	-	-	-	699	-
	Specific Conductivity (µS/cm)	-	-	-	-	-	-	-	-	-	-	1,624	-	-	-	1,023	-
	pH	-	-	-	-	-	-	-	-	-	-	8.36	-	-	-	7.80	-
	ORP (mV)	-	-	-	-	-	-	-	-	-	-	254.30	-	-	-	231.70	-
Station 5	Temperature (°C)	-	-	-	-	-	-	-	-	-	-	7.34	-	-	-	8.50	-
	Dissolved Oxygen (mg/L)	-	-	-	-	-	-	-	-	-	-	13.31	-	-	-	9.72	-
	Dissolved Oxygen (%)	-	-	-	-	-	-	-	-	-	-	111.1	-	-	-	83.4	-
	Conductivity (µS/cm)	-	-	-	-	-	-	-	-	-	-	1,074	-	-	-	700	-
	Specific Conductivity (µS/cm)	-	-	-	-	-	-	-	-	-	-	1,620	-	-	-	1,022	-
	pH	-	-	-	-	-	-	-	-	-	-	8.34	-	-	-	7.70	-
	ORP (mV)	-	-	-	-	-	-	-	-	-	-	247.60	-	-	-	203.50	-

Table F.28: Channel Depth and Velocity at Kick and Sweep Sampling Locations in Reference and Mine-exposed areas, FRO LAEMP, September 2018

Replicate			1	2	3	4	5	Mean
Reference	**RG_HENUP**							
	1	Depth (cm)	10	14.5	24.7	23	31	**20.6**
		Velocity (m/s)	0.446	-0.029	0.405	0.604	0.351	**0.355**
	2	Depth (cm)	21	22	26	25	24	**23.6**
		Velocity (m/s)	0.531	0.142	0.416	0.354	0.343	**0.357**
	3	Depth (cm)	10	17	22	16	19	**16.8**
		Velocity (m/s)	0.209	0.195	0.186	0.184	0.374	**0.230**
	RG_FO26							
	1	Depth (cm)	11.5	16	12	9	10	**11.7**
		Velocity (m/s)	0.275	0.322	0.496	0.386	0.417	**0.379**
	2	Depth (cm)	13	14.5	11	13	19.5	**14.2**
		Velocity (m/s)	0.325	0.461	0.514	0.472	0.513	**0.457**
	3	Depth (cm)	22	23	21	13	11	**18.0**
		Velocity (m/s)	0.290	0.145	0.548	0.323	0.363	**0.334**
Mine-exposed	**RG_FODHE**							
	1	Depth (cm)	14	18	24	25	12	**18.6**
		Velocity (m/s)	0.626	0.532	0.356	0.512	0.382	**0.482**
	2	Depth (cm)	34	55	24	21	27	**32.2**
		Velocity (m/s)	0.072	0.125	-0.020	0.110	0.406	**0.139**
	3	Depth (cm)	12.5	15	20.5	17	15.5	**16.1**
		Velocity (m/s)	0.088	0.128	0.296	0.249	0.147	**0.182**
	RG_FOUNGD							
	1	Depth (cm)	19	15	20	20	19	**18.6**
		Velocity (m/s)	0.207	0.497	0.484	0.358	0.366	**0.382**
	2	Depth (cm)	25	17	14	7	9	**14.4**
		Velocity (m/s)	0.395	0.523	0.652	0.552	0.471	**0.519**
	3	Depth (cm)	11	8	13	10	12	**10.8**
		Velocity (m/s)	0.611	0.675	0.306	0.309	0.878	**0.556**
	RG_FODNGD							
	1	Depth (cm)	12	8	7	8	33	**13.6**
		Velocity (m/s)	0.327	0.107	0.332	0.490	0.895	**0.4302**
	2	Depth (cm)	11	12	13	21	34	**18.2**
		Velocity (m/s)	0.197	0.100	0.318	0.653	0.451	**0.344**
	3	Depth (cm)	23	15	20	21	15	**18.8**
		Velocity (m/s)	0.314	0.274	0.506	0.282	0.556	**0.386**
	RG_MP1							
	1	Depth (cm)	20	29	20	19	20	**21.6**
		Velocity (m/s)	0.658	0.054	0.619	0.722	0.371	**0.485**
	2	Depth (cm)	12	18	15	17	10	**14.4**
		Velocity (m/s)	0.663	0.427	0.603	0.463	0.037	**0.439**
	3	Depth (cm)	19	19	22	22	13	**19**
		Velocity (m/s)	0.355	0.096	0.242	0.183	0.545	**0.284**
	RG_FOUSH							
	1	Depth (cm)	20	26	25	22	10	**20.6**
		Velocity (m/s)	0.047	0.150	0.711	0.582	0.466	**0.391**
	2	Depth (cm)	13	22	22	25	22	**20.8**
		Velocity (m/s)	0.213	0.696	0.604	0.441	0.503	**0.491**
	3	Depth (cm)	22	29	25	22	17	**23**
		Velocity (m/s)	0.405	0.840	0.104	0.530	0.502	**0.476**

Table F.28: Channel Depth and Velocity at Kick and Sweep Sampling Locations in Reference and Mine-exposed areas, FRO LAEMP, September 2018

Replicate			**1**	**2**	**3**	**4**	**5**	**Mean**
Mine-exposed	**RG_FOUKI**							
	1	Depth (cm)	29	31	26	20	12	**23.6**
		Velocity (m/s)	0.246	0.555	0.456	0.212	0.382	**0.370**
	2	Depth (cm)	17	15	24	32	51	**27.8**
		Velocity (m/s)	0.173	0.717	0.252	0.458	0.609	**0.442**
	3	Depth (cm)	23.5	36	27	21	24	**26.3**
		Velocity (m/s)	0.108	0.280	0.449	0.233	0.087	**0.231**
	RG_FOBKS							
	1	Depth (cm)	15	30	27	13	20	**21.0**
		Velocity (m/s)	0.150	0.310	0.297	0.223	0.195	**0.235**
	2	Depth (cm)	14.5	13	24	18	24	**18.7**
		Velocity (m/s)	0.129	0.314	0.447	0.408	0.249	**0.309**
	3	Depth (cm)	19	9	12	17	16	**14.6**
		Velocity (m/s)	0.389	0.249	0.325	0.199	0.366	**0.306**
	RG_FOBSC							
	1	Depth (cm)	18	13	11	8	13	**12.6**
		Velocity (m/s)	0.374	0.442	0.183	0.267	0.443	**0.342**
	2	Depth (cm)	16	21	12	11.5	11.5	**14.4**
		Velocity (m/s)	0.211	0.401	0.359	0.127	0.149	**0.249**
	3	Depth (cm)	20	21	14.5	16.5	15	**17.4**
		Velocity (m/s)	0.119	0.185	0.187	0.135	**0.317**	**0.189**
	RG_FOBCP							
	1	Depth (cm)	22	15	17	15	12	**16.2**
		Velocity (m/s)	0.478	0.320	0.419	0.324	0.201	**0.348**
	2	Depth (cm)	22	15	21	22	17	**19.4**
		Velocity (m/s)	0.075	0.181	0.196	0.243	0.223	**0.184**
	3	Depth (cm)	17	12	16	18	15	**15.6**
		Velocity (m/s)	0.320	0.252	0.373	0.409	0.245	**0.320**
	4	Depth (cm)	15	18	15	14	11	**14.6**
		Velocity (m/s)	0.365	0.054	0.276	0.377	0.110	**0.236**
	5	Depth (cm)	13	15.5	16.5	11.5	12	**13.7**
		Velocity (m/s)	0.417	0.248	0.231	0.183	0.371	**0.290**
	RG_FRUPO							
	1	Depth (cm)	13	11	25	18	15	**16.4**
		Velocity (m/s)	0.335	0.175	0.342	0.107	0.699	**0.332**
	2	Depth (cm)	24	20	18	26	24	**22.4**
		Velocity (m/s)	0.080	0.132	0.176	0.227	0.240	**0.171**
	3	Depth (cm)	28	17	14	9	20	**17.6**
		Velocity (m/s)	0.589	0.288	0.279	0.211	0.381	**0.350**
	RG_FODPO							
	1	Depth (cm)	7	9	17	26	33	**18.4**
		Velocity (m/s)	0.181	0.452	0.378	0.374	0.395	**0.356**
	2	Depth (cm)	10	12	14	12	13	**12.2**
		Velocity (m/s)	0.315	0.324	0.253	0.595	0.198	**0.337**
	3	Depth (cm)	10	16	19	15	16	**15.2**
		Velocity (m/s)	0.290	0.450	0.181	0.303	0.179	**0.281**

Table F.28: Channel Depth and Velocity at Kick and Sweep Sampling Locations in Reference and Mine-exposed areas, FRO LAEMP, September 2018

Replicate			1	2	3	4	5	Mean
Mine-exposed	**RG_FO22**							
	1	Depth (cm)	10	26	30.5	22	24	**22.5**
		Velocity (m/s)	0.401	0.775	0.761	0.578	0.690	**0.641**
	2	Depth (cm)	24	35	28	29	33	**29.8**
		Velocity (m/s)	0.440	0.352	0.214	0.290	0.287	**0.317**
	3	Depth (cm)	18	12	23	34	43	**26.0**
		Velocity (m/s)	0.363	0.250	0.298	0.382	0.294	**0.317**
	4	Depth (cm)	32	33	35	27	24	**30.2**
		Velocity (m/s)	0.521	0.440	0.350	0.549	0.524	**0.477**
	5	Depth (cm)	9.5	19	22	31	31	**22.5**
		Velocity (m/s)	0.289	0.336	0.224	0.464	0.388	**0.340**
	RG_FOUEW							
	1	Depth (cm)	38	31	35	36	29	**33.8**
		Velocity (m/s)	0.650	0.485	0.751	0.450	0.099	**0.487**
	2	Depth (cm)	20.5	17	18.5	31	29	**23.2**
		Velocity (m/s)	0.182	0.536	0.646	0.493	0.556	**0.483**
	3	Depth (cm)	16.5	22	24	36	37	**27.1**
		Velocity (m/s)	0.123	0.225	0.254	0.709	0.770	**0.416**

Notes: Velocity measurements were taken at five randomly chosen locations throughout the kick sample area.
Velocity was measured at the bottom of the water column.

Table F.29: **Habitat Information at Reference and Mine-exposed Areas, FRO LAEMP, December 2018**

Station ID	**Reference**	**Mine-exposed**				
	RG_UFR1	**RG_FODHE**	**RG_FOUNGD**	**RG_FODNGD**	**RG_MP1**	**RG_FOUSH**
Waterbody	Fording River	Fording River	Fording River	Fording River	Fording River	Fording River
Date Sampled	5-Dec-18	5-Dec-18	5-Dec-18	5-Dec-18	6-Dec-18	6-Dec-18
Zone 11 UTMs - E	651390	651337	680855	650973	651157	650862
Zone 11 UTMs - N	5566745	5565428	5563521	5563162	5562443	5580971
Elevation	1,735	1,685	1,664	1,657	-	-
Samplers' Initials	TN, MG	TN, MG	TN	TN, MG	NW, TW	NW, TW
Habitat Characteristics						
Site Access Description	reference, forest	-	park at discharge, walk in	park off haul road by discharge	-	from mine access road, 30m
Surrounding Land Use	forest, mining	mining	mining	mining	mining	mining
Anthropogenic Influences	mining downstream	-	-	-	mine activity	FRO operation surrounding on all sides
Length of Reach Assessed (m)	100	100	100	100	100	50
Bank Stability	moderate	stable, no erosion	stable, no erosion	moderate	moderate	stable, no erosion
Water Colour & Clarity	colourless, clear	colourless, clear	colourless, clear	colourless, clear	colourless, clear	colourless, clear
Substrate Coverage						
% Bedrock		-	-	-	-	-
% Boulder	10	-	-	5	-	-
% Cobble	70	-	10	40	-	-
% Gravel	20	-	90	55	-	-
% Sand		-	-	-	-	-
% Fines		-	-	-	-	-

Table F.29: **Habitat Information at Reference and Mine-exposed Areas, FRO LAEMP, December 2018**

Station ID	Mine-exposed				
	RG_FOUKI	**RG_FOBKS**	**RG_FOBSC**	**RG_FOBCP**	**RG_FRUPO**
Waterbody	Fording River	Fording River	Fording River	Fording River	Fording River
Date Sampled	4-Dec-18	4-Dec-18	4-Dec-18	3-Dec-18	4-Dec-18
Zone 11 UTMs - E	641858	652085	652371	652921	653892
Zone 11 UTMs - N	5559805	5558650	5558151	5556990	5555951
Elevation	-	1,595	1,590	-	-
Samplers' Initials	TN, MG	TN, MG	TN, MG	TN, NW, TW, MG	TW
Habitat Characteristics					
Site Access Description	park at base of tailing pond, need swift gate key	-	park on berm	-	fording river road
Surrounding Land Use	forest, mining	forest, mining	forest, mining	forest, mining	forest, mining
Anthropogenic Influences	mining	-	-	mining upstream	FRO upstream
Length of Reach Assessed (m)	100	100	100	100	100
Bank Stability	stable, no erosion	stable, no erosion	moderate	stable, no erosion	moderate
Water Colour & Clarity	slightly coloured, clear	colourless, clear	tea, clear	frozen, no water	colourless, clear
Substrate Coverage					
% Bedrock	-	-	-	-	-
% Boulder	5	5	5	-	-
% Cobble	5	10	15	-	-
% Gravel	80	80	80	-	-
% Sand	10	5	-	-	-
% Fines	-	-	-	-	-

Table F.29: Habitat Information at Reference and Mine-exposed Areas, FRO LAEMP, December 2018

Station ID	Mine-exposed		
	RG_FODPO	**RG_FO22**	**RG_FOUEW**
Waterbody	Fording River	Fording River	Fording River
Date Sampled	4-Dec-18	5-Dec-18	5-Dec-18
Zone 11 UTMs - E	653887	654828	656362
Zone 11 UTMs - N	5555078	5553606	5551885
Elevation	-	1,569	-
Samplers' Initials	NW, TW	NW, TW	NW, TW
Habitat Characteristics			
Site Access Description	-	access trail off Fording River highway	-
Surrounding Land Use	forest, mining	forest, mining	forest, mining, gun range u/s
Anthropogenic Influences	-	mining upstream	FRO upstream
Length of Reach Assessed (m)	100	50	100
Bank Stability	moderate	unstable, substantial erosion	moderate
Water Colour & Clarity	colurless, clear	colourless, clear	colurless, clear
Substrate Coverage			
% Bedrock	-	-	-
% Boulder	-	-	-
% Cobble	-	-	-
% Gravel	-	-	-
% Sand	-	-	-
% Fines	-	-	-

Table F.30: Kick and Sweep at Reference and Mine-exposed Areas, FRO LAEMP, December 2018

		RG_UFR1	RG_FOUKI	RG_FOBSC	RG_FRUPO	RG_FODPO	RG_FOUEW
Station 1	Easting	651390	651858	652385	653880	653848	656266
	Northing	5566745	5559805	5558151	5556001	5555044	5551878
	Date	5-Dec-18	4-Dec-18	4-Dec-18	4-Dec-18	4-Dec-18	5-Dec-18
	Samplers' Initials	TN, MG	TN, MG	TN, MG	TW, NW	TW, NW	NW, TW
	Number of Jars	1	1	1	1	1	1
	Total Kick Distance (m)	10	15	10	20	20	20
	Full Transect (Yes / No)	No	No	-	Yes	Yes	Yes
	Number of Transects	10.0	4.0	10.0	2.5	2.5	2.5
Station 2	Easting	651376	651837	652371	653893	653887	656322
	Northing	5566758	5559840	5558158	5555950	5555078	5551867
	Date	5-Dec-18	4-Dec-18	4-Dec-18	4-Dec-18	4-Dec-18	5-Dec-18
	Samplers' Initials	TN, MG	TN, MG	TN, MG	TW, NW	TW, NW	NW, TW
	Number of Jars	1	1	1	1	1	1
	Total Kick Distance (m)	10	15	10	20	20	20
	Full Transect (Yes / No)	No	Yes	No	Yes	Yes	Yes
	Number of Transects	10.0	3.0	8.0	2.5	2.5	2.5
Station 3	Easting	651350	651834	652345	653892	653942	656362
	Northing	5566774	5559908	5558184	5555880	5555079	5551885
	Date	5-Dec-18	4-Dec-18	4-Dec-18	4-Dec-18	4-Dec-18	5-Dec-18
	Samplers' Initials	TN, MG	TN, MG	TN, MG	TW, NW	TW, NW	NW, TW
	Number of Jars	1	1	1	1	1	1
	Total Kick Distance (m)	10	15	8	20	20	20
	Full Transect (Yes / No)	No	Yes	No	Yes	Yes	Yes
	Number of Transects	7.0	3.0	20.0	2.5	2.5	2.5

Table F.31: Pebble Count and Calcite at Reference and Mine-exposed Areas, FRO LAEMP, December 2018

RG_UFR1					RG_FOUKI				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**	**Rock**	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	0	9.7	-	1	0	0	7.5	-
2	0	0	9.4	-	2	0	0	7.3	-
3	0	0	8.1	-	3	0	0	9.1	-
4	0	0	5.8	-	4	0	1	9.1	-
5	0	1	4.4	-	5	0	0	4.2	-
6	0	0	5.7	-	6	0	0	5.9	-
7	0	0	2.3	-	7	0	0	5.0	-
8	0	0	4.1	-	8	0	0	5.2	-
9	0	0	4.5	-	9	0	0	7.3	-
10	0	0	15.5	0.50	10	0	0	6.9	0.25
11	0	0	4.5	-	11	0	0	9.8	-
12	0	0	2.4	-	12	0	0	5.8	-
13	0	0	9.6	-	13	0	0	5.2	-
14	0	0	3.7	-	14	0	0	6.6	-
15	0	0	15.5	-	15	0	0	21.0	-
16	0	0	5.1	-	16	0	0	7.4	-
17	0	0	4.6	-	17	0	0	7.1	-
18	0	0	2.7	-	18	0	0	22.5	-
19	0	0	5.1	-	19	0	0	8.1	-
20	0	0	1.6	0.50	20	0	0	8.2	0.50
21	0	0	3.7	-	21	0	0	10.3	-
22	0	0	3.6	-	22	0	0	6.8	-
23	0	0	7.1	-	23	0	0	18.5	-
24	0	0	5.7	-	24	0	0	6.1	-
25	0	0	4.7	-	25	0	0	6.7	-
26	0	0	4.3	-	26	0	0	7.3	-
27	0	0	4.5	-	27	0	0	26.0	-
28	0	0	5.5	-	28	0	0	8.8	-
29	0	0	6.5	-	29	0	0	6.1	-
30	0	0	4.1	0	30	0	0	6.0	0.50
31	0	0	9.9	-	31	0	0	17.0	-
32	0	0	6.1	-	32	0	0	12.1	-
33	0	0	9.5	-	33	0	0	8.1	-
34	0	0	9.0	-	34	0	0	9.2	-
35	0	0	5.5	-	35	0	0	7.5	-
36	0	0	4.4	-	36	0	0	21.2	-
37	0	1	8.0	-	37	0	0	4.5	-
38	0	0	7.8	-	38	0	0	6.6	-
39	0	0	2.7	-	39	0	0	9.5	-
40	0	0	8.6	0	40	0	0	10.9	0
41	0	0	5.0	-	41	0	0	8.4	-
42	0	0	3.6	-	42	0	0	5.0	-
43	0	0	10.1	-	43	0	0	5.8	-
44	0	0	12.5	-	44	0	0	5.7	-
45	0	0	4.7	-	45	0	0	9.2	-
46	0	0	8.6	-	46	0	0	8.1	-
47	0	0	4.3	-	47	0	0	6.3	-
48	0	0	21.0	-	48	0	0	11.0	-
49	0	0	6.1	-	49	0	0	7.9	-
50	0	0	4.6	0.50	50	0	0	8.4	0.25
51	0	0	10.1	-	51	0	0	6.9	-
52	0	0	4.5	-	52	0	0	8.7	-
53	0	0	5.3	-	53	0	0	12.3	-
54	0	0	9.1	-	54	0	0	25.1	-
55	0	0	5.7	-	55	0	0	10.5	-
56	0	0	6.7	-	56	0	0	5.9	-
57	0	0	3.2	-	57	0	0	5.5	-
58	0	0	3.6	-	58	0	0	13.5	-
59	0	0	4.3	-	59	0	0	6.3	-
60	0	0	12.0	0.25	60	0	0	7.9	0.25
61	0	0	3.4	-	61	0	0	5.8	-
62	0	0	5.1	-	62	0	0	11.0	-
63	0	0	16.2	-	63	0	0	10.7	-
64	0	0	23.1	-	64	0	0	2.1	-
65	0	0	15.5	-	65	0	0	5.6	-
66	0	0	6.3	-	66	0	0	18.2	-
67	0	0	3.2	-	67	0	0	5.7	-
68	0	0	4.2	-	68	0	0	5.9	-
69	0	0	9.5	-	69	0	0	10.6	-
70	0	0	5.6	0..25	70	0	0	8.7	0
71	0	0	5.0	-	71	0	0	7.7	-
72	0	0	3.2	-	72	0	0	16.5	-
73	0	0	4.2	-	73	0	0	12.3	-
74	0	0	5.1	-	74	0	0	8.3	-
75	0	0	8.7	-	75	0	0	11.7	-
76	0	0	9.8	-	76	0	0	8.4	-
77	0	0	2.8	-	77	0	0	9.5	-
78	0	0	7.0	-	78	0	0	6.5	-
79	0	0	8.9	-	79	0	0	8.6	-
80	0	0	6.1	0	80	0	0	5.5	0.25
81	0	0	8.9	-	81	0	0	7.8	-
82	0	0	4.7	-	82	0	0	8.5	-
83	0	1	6.6	-	83	0	0	8.1	-
84	0	0	11.5	-	84	0	0	8.5	-
85	0	0	6.8	-	85	0	0	8.6	-
86	0	0	6.7	-	86	0	0	9.4	-
87	0	0	8.0	-	87	0	0	5.7	-
88	0	0	26.2	-	88	0	0	8.8	-
89	0	0	7.3	-	89	0	0	5.9	-
90	0	0	9.1	0	90	0	0	6.1	0
91	0	0	2.6	-	91	0	0	16.9	-
92	0	0	8.0	-	92	0	0	11.0	-
93	0	0	8.3	-	93	0	0	6.0	-
94	0	0	5.5	-	94	0	0	6.2	-
95	0	0	5.2	-	95	0	0	5.1	-
96	0	0	15.5	-	96	0	0	26.5	-
97	0	0	5.3	-	97	0	0	5.7	-
98	0	0	4.0	-	98	0	0	6.5	-
99	0	0	11.1	-	99	0	0	8.0	-
100	0	0	10.3	0.25	100	0	0	9.1	0.50
Minimum	**0.0**	**0.0**	**1.6**	**0.0**	**Minimum**	**0.0**	**0.0**	**2.1**	**0.0**
Maximum	**0.0**	**1**	**26.2**	**0.5**	**Maximum**	**0.0**	**1**	**26.5**	**0.5**
Mean	**0.0**	**0.03**	**7.15**	**0.222**	**Mean**	**0.0**	**0.01**	**9.15**	**0.25**
Standard Dev.	**0.0**	**0.171**	**4.31**	**0.232**	**Standard Dev.**	**0.0**	**0.1**	**4.74**	**0.204**
Geometric mean	**-**	**-**	**6.2**	**-**	**Geometric mean**	**-**	**-**	**8.28**	**-**
Median	**0.0**	**0.0**	**5.7**	**0.25**	**Median**	**0.0**	**0.0**	**8.05**	**0.25**
Calcite Index	**0.0**		**-**	**-**	**Calcite Index**	**0.0**		**-**	**-**

Table F.31: Pebble Count and Calcite at Reference and Mine-exposed Areas, FRO LAEMP, December 2018

RG_FOBSC					RG_FOBCP-1				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**	**Rock**	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	0	5.5	-	1	0	1	6.8	-
2	0	1	9.3	-	2	1	1	6.1	-
3	0	1	9.2	-	3	2	1	8.5	-
4	0	0	4.1	-	4	0	1	6.1	-
5	0	1	5.5	-	5	0	1	10.5	-
6	0	1	6.6	-	6	0	1	8.0	-
7	0	1	4.1	-	7	0	1	10.2	-
8	0	1	5.7	-	8	0	1	7.3	-
9	0	1	3.6	-	9	0	1	7.3	-
10	0	0	2.0	0	10	0	1	3.5	0
11	0	1	10.5	-	11	0	1	6.3	-
12	0	1	3.5	-	12	1	1	6.7	-
13	0	1	10.1	-	13	0	1	8.5	-
14	0	0	4.6	-	14	0	1	6.9	-
15	0	1	6.7	-	15	0	1	4.8	-
16	0	0	4.1	-	16	0	1	9.4	-
17	0	1	6.2	-	17	0	1	10.3	-
18	0	1	4.1	-	18	0	1	9.8	-
19	0	1	5.2	-	19	0	1	8.9	-
20	0	1	4.2	0	20	1	1	7.2	0.50
21	0	1	6.6	-	21	0	1	7.1	-
22	0	1	6.7	-	22	1	1	7.0	-
23	0	1	14.3	-	23	0	1	4.5	-
24	0	1	6.6	-	24	0	1	9.7	-
25	0	1	15.5	-	25	1	1	6.5	-
26	0	0	6.8	-	26	0	1	3.3	-
27	0	1	9.8	-	27	0	1	10.6	-
28	0	1	2.7	-	28	0	1	5.0	-
29	0	1	7.9	-	29	0	1	6.5	-
30	0	1	3.6	0.50	30	0	1	7.0	0.25
31	0	1	2.6	-	31	0	1	11.5	-
32	0	1	7.9	-	32	0	1	10.9	-
33	0	1	5.7	-	33	0	1	5.2	-
34	0	1	4.6	-	34	0	1	3.5	-
35	0	1	8.4	-	35	0	0	3.6	-
36	0	0	4.4	-	36	0	1	4.4	-
37	0	1	2.9	-	37	0	1	6.1	-
38	0	1	10.2	-	38	0	1	3.6	-
39	0	1	3.8	-	39	0	1	11.6	-
40	0	1	7.5	0	40	0	1	4.1	0
41	0	1	5.5	-	41	0	1	8.1	-
42	0	1	3.6	-	42	1	1	6.4	-
43	0	0	4.6	-	43	0	1	3.4	-
44	0	1	7.2	-	44	0	1	2.6	-
45	0	1	6.3	-	45	0	1	3.2	-
46	0	1	4.6	-	46	0	1	6.6	-
47	0	1	2.2	-	47	0	1	6.7	-
48	0	1	17.5	-	48	1	1	6.1	-
49	0	1	15.5	-	49	0	1	3.4	-
50	0	1	4.5	0	50	0	1	4.8	0
51	0	1	7.0	-	51	0	0	5.6	-
52	0	1	10.9	-	52	0	1	3.5	-
53	0	1	7.1	-	53	0	1	5.1	-
54	0	1	3.6	-	54	0	1	8.6	-
55	0	1	8.0	-	55	0	1	8.9	-
56	0	1	14.0	-	56	0	1	7.0	-
57	0	1	7.9	-	57	0	1	8.9	-
58	0	1	12.5	-	58	0	1	6.9	-
59	0	1	3.0	-	59	1	1	4.9	-
60	0	1	13.0	0.25	60	0	1	9.2	0.75
61	0	1	2.4	-	61	0	1	7.3	-
62	0	1	10.2	-	62	0	1	9.2	-
63	0	1	6.1	-	63	0	1	5.0	-
64	0	1	4.6	-	64	0	1	5.1	-
65	0	1	4.1	-	65	0	1	7.1	-
66	0	0	4.0	-	66	0	1	7.8	-
67	0	1	5.3	-	67	1	1	6.5	-
68	0	1	11.0	-	68	0	1	4.4	-
69	0	1	8.1	-	69	0	1	4.8	-
70	0	1	7.8	0.25	70	0	1	2.7	0.25
71	0	1	8.8	-	71	0	1	4.0	-
72	0	1	4.0	-	72	0	1	11.4	-
73	0	1	7.3	-	73	0	1	4.9	-
74	0	1	5.6	-	74	0	1	6.0	-
75	0	0	5.8	-	75	0	1	4.7	-
76	0	0	4.5	-	76	0	1	5.8	-
77	0	1	3.6	-	77	0	1	5.5	-
78	0	1	6.3	-	78	0	1	2.8	-
79	0	1	7.8	-	79	0	1	3.8	-
80	0	1	9.1	0.50	80	0	1	3.2	0
81	0	1	6.9	-	81	0	1	7.8	-
82	0	1	7.6	-	82	0	1	8.2	-
83	0	1	7.6	-	83	0	1	8.2	-
84	0	1	9.7	-	84	0	1	4.0	-
85	0	1	7.7	-	85	0	1	6.4	-
86	0	1	8.1	-	86	0	1	5.5	-
87	0	1	3.5	-	87	0	1	6.5	-
88	0	1	4.9	-	88	0	1	5.7	-
89	0	1	2.9	-	89	0	1	3.5	-
90	0	0	7.4	0	90	0	1	7.6	0.25
91	0	1	3.0	-	91	0	1	2.5	-
92	0	1	12.1	-	92	0	1	4.5	-
93	0	1	6.0	-	93	0	1	9.4	-
94	0	1	7.6	-	94	0	1	7.4	-
95	0	1	4.4	-	95	0	1	4.6	-
96	0	1	4.9	-	96	0	1	4.8	-
97	0	1	5.7	-	97	0	1	4.5	-
98	0	1	2.0	-	98	0	1	4.7	-
99	0	0	3.4	-	99	0	1	4.8	-
100	0	1	4.9	0	100	0	1	5.2	0
Minimum	**0.0**	**0.0**	**2**	**0.0**	**Minimum**	**0.0**	**0.0**	**2.5**	**0.0**
Maximum	**0.0**	**1**	**17.5**	**0.5**	**Maximum**	**2**	**1**	**11.6**	**0.75**
Mean	**0.0**	**0.87**	**6.59**	**0.15**	**Mean**	**0.11**	**0.98**	**6.33**	**0.2**
Standard Dev.	**0.0**	**0.338**	**3.2**	**0.211**	**Standard Dev.**	**0.345**	**0.141**	**2.27**	**0.258**
Geometric mean	**-**	**-**	**5.89**	**-**	**Geometric mean**	**-**	**-**	**5.92**	**-**
Median	**0.0**	**1**	**6.05**	**0.0**	**Median**	**0.0**	**1**	**6.2**	**0.125**
Calcite Index	**0.9**		**-**	**-**	**Calcite Index**	**1.1**		**-**	**-**

Table F.31: Pebble Count and Calcite at Reference and Mine-exposed Areas, FRO LAEMP, December 2018

RG_FOBCP-2					RG_FOBCP-3				
Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness	Rock	Concreted Status	Calcite Presence	Intermediate Axis (cm)	Embeddedness
1	0	1	3.4	-	1	0	1	8.6	-
2	0	1	6.7	-	2	0	1	8.2	-
3	0	0	3.4	-	3	0	1	6.9	-
4	0	1	6.0	-	4	0	0	5.5	-
5	0	1	7.5	-	5	0	1	5.4	-
6	0	0	4.0	-	6	0	0	4.4	-
7	0	1	8.0	-	7	0	1	9.6	-
8	0	1	6.6	-	8	0	1	14.1	-
9	0	1	5.5	-	9	0	1	3.2	-
10	0	1	1.0	0	10	0	1	4.1	0
11	0	1	5.0	-	11	0	1	5.9	-
12	0	1	5.7	-	12	0	1	14.7	-
13	0	1	4.4	-	13	0	1	6.9	-
14	0	1	5.4	-	14	0	0	2.2	-
15	0	0	5.5	-	15	0	1	4.9	-
16	0	0	5.2	-	16	0	1	7.5	-
17	0	0	6.0	-	17	0	1	6.1	-
18	0	1	6.1	-	18	0	1	12.9	-
19	0	1	6.2	-	19	0	0	1.7	-
20	0	1	3.2	0	20	0	1	3.4	0
21	0	1	3.5	-	21	0	0	4.9	-
22	0	1	6.7	-	22	0	0	5.7	-
23	0	1	6.8	-	23	0	1	7.1	-
24	1	1	7.1	-	24	0	1	3.6	-
25	0	1	5.6	-	25	0	1	4.6	-
26	0	1	3.7	-	26	0	0	3.9	-
27	0	1	6.1	-	27	0	1	7.3	-
28	0	1	3.1	-	28	0	0	4.7	-
29	0	0	6.3	-	29	0	1	7.0	-
30	0	1	8.0	0	30	0	0	5.7	0.25
31	0	1	6.3	-	31	0	1	5.4	-
32	0	1	5.6	-	32	0	1	5.2	-
33	1	1	8.2	-	33	0	0	2.6	-
34	0	1	8.9	-	34	0	0	3.1	-
35	0	1	8.0	-	35	0	1	5.5	-
36	0	1	4.4	-	36	0	0	5.7	-
37	0	1	4.7	-	37	0	1	9.3	-
38	0	1	5.5	-	38	0	1	7.2	-
39	0	1	3.5	-	39	0	1	5.2	-
40	0	1	3.2	0	40	0	1	3.9	0.50
41	0	1	6.2	-	41	0	1	3.4	-
42	0	1	4.1	-	42	0	1	3.6	-
43	0	1	6.2	-	43	0	1	4.0	-
44	0	1	5.3	-	44	0	0	3.7	-
45	0	1	6.0	-	45	0	1	6.2	-
46	0	1	6.0	-	46	0	1	5.6	-
47	0	1	3.1	-	47	0	1	3.6	-
48	0	1	5.1	-	48	0	1	5.7	-
49	0	1	4.1	-	49	0	1	3.6	-
50	0	1	4.5	0	50	0	0	5.9	0
51	0	1	9.4	-	51	0	0	5.0	-
52	0	1	5.0	-	52	0	1	5.6	-
53	0	1	15.5	-	53	0	1	6.6	-
54	0	1	5.1	-	54	0	1	5.7	-
55	0	1	9.0	-	55	0	1	6.6	-
56	0	1	7.0	-	56	0	0	4.7	-
57	0	1	8.0	-	57	0	0	4.3	-
58	0	1	6.7	-	58	0	0	3.3	-
59	0	1	4.0	-	59	0	1	4.4	-
60	0	1	5.1	0	60	0	1	5.5	0
61	0	0	4.0	-	61	0	1	8.5	-
62	0	1	5.7	-	62	0	1	3.7	-
63	0	1	6.6	-	63	0	1	8.5	-
64	0	1	6.8	-	64	0	0	4.0	-
65	0	1	5.0	-	65	0	1	4.7	-
66	0	1	6.8	-	66	0	1	4.7	-
67	0	1	6.0	-	67	0	1	7.6	-
68	0	1	4.0	-	68	0	0	6.0	-
69	0	1	3.7	-	69	0	1	5.1	-
70	0	1	2.5	0	70	0	1	11.5	0.75
71	0	1	4.5	-	71	0	1	3.5	-
72	0	1	7.5	-	72	0	1	3.6	-
73	0	1	6.5	-	73	0	1	8.1	-
74	0	1	4.7	-	74	0	0	4.3	-
75	0	1	8.0	-	75	0	1	12.4	-
76	0	1	3.0	-	76	0	1	7.2	-
77	0	1	5.2	-	77	0	1	7.7	-
78	0	1	3.5	-	78	0	1	4.9	-
79	0	1	3.4	-	79	0	1	11.9	-
80	0	1	5.1	0.50	80	0	0	8.5	0.25
81	0	1	11.3	-	81	0	0	3.8	-
82	0	1	5.0	-	82	0	1	5.4	-
83	0	1	5.4	-	83	0	1	5.9	-
84	0	1	6.2	-	84	0	1	4.4	-
85	0	1	4.3	-	85	0	1	5.5	-
86	0	1	6.7	-	86	0	0	4.8	-
87	0	1	4.0	-	87	0	1	16.2	-
88	0	1	7.1	-	88	0	1	7.5	-
89	0	1	6.7	-	89	0	1	7.1	-
90	0	1	3.9	0.25	90	0	0	4.2	0
91	0	1	6.8	-	91	0	1	5.5	-
92	0	1	4.7	-	92	0	1	4.1	-
93	0	1	4.8	-	93	0	1	5.9	-
94	0	1	9.0	-	94	0	1	6.5	-
95	0	1	4.9	-	95	0	1	8.9	-
96	0	1	4.1	-	96	0	1	7.3	-
97	0	1	5.8	-	97	0	1	7.5	-
98	0	1	8.6	-	98	0	0	2.2	-
99	0	1	5.0	-	99	0	0	5.2	-
100	0	1	4.1	0.25	100	0	1	6.6	0
Minimum	**0.0**	**0.0**	**1**	**0.0**	**Minimum**	**0.0**	**0.0**	**1.7**	**0.0**
Maximum	**1**	**1**	**15.5**	**0.5**	**Maximum**	**0.0**	**1**	**16.2**	**0.75**
Mean	**0.02**	**0.93**	**5.66**	**0.1**	**Mean**	**0.0**	**0.73**	**6.02**	**0.175**
Standard Dev.	**0.141**	**0.256**	**1.99**	**0.175**	**Standard Dev.**	**0.0**	**0.446**	**2.66**	**0.265**
Geometric mean	**-**	**-**	**5.34**	**-**	**Geometric mean**	**-**	**-**	**5.53**	**-**
Median	**0.0**	**1**	**5.5**	**0.0**	**Median**	**0.0**	**1**	**5.5**	**0.0**
Calcite Index	**1.0**		**-**	**-**	**Calcite Index**	**0.7**		**-**	**-**

Table F.31: Pebble Count and Calcite at Reference and Mine-exposed Areas, FRO LAEMP, December 2018

RG_FRUPO					RG_FODPO				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**	**Rock**	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	0	5.3	-	1	0	1	3.9	-
2	0	0	3.3	-	2	0	1	3.4	-
3	0	0	5.5	-	3	0	1	1.9	-
4	0	0	2.0	-	4	0	1	3.7	-
5	0	0	2.2	-	5	0	1	2.8	-
6	0	0	6.4	-	6	0	1	6.0	-
7	0	0	4.4	-	7	0	1	4.5	-
8	0	0	3.2	-	8	0	1	5.4	-
9	0	0	6.5	-	9	0	1	3.9	-
10	0	0	4.3	0	10	0	1	2.8	0
11	0	0	7.1	-	11	0	1	5.2	-
12	0	0	5.5	-	12	0	1	4.3	-
13	0	0	7.5	-	13	0	1	5.0	-
14	0	0	7.2	-	14	0	1	3.8	-
15	0	0	6.3	-	15	0	1	2.8	-
16	0	0	5.5	-	16	0	1	3.6	-
17	0	0	5.0	-	17	0	1	4.9	-
18	0	1	5.9	-	18	0	1	2.8	-
19	0	0	4.4	-	19	0	1	5.4	-
20	0	0	4.5	0	20	0	1	4.5	0
21	0	0	3.0	-	21	0	1	4.0	-
22	0	0	5.5	-	22	0	1	5.9	-
23	0	0	4.1	-	23	0	1	6.0	-
24	0	0	6.4	-	24	0	1	5.4	-
25	0	1	11.0	-	25	0	1	6.8	-
26	0	0	3.1	-	26	0	1	1.9	-
27	0	0	5.6	-	27	0	1	7.2	-
28	0	0	6.1	-	28	0	1	6.1	-
29	0	0	2.9	-	29	0	1	4.5	-
30	0	0	4.8	0	30	0	1	6.5	0.25
31	0	0	3.5	-	31	0	1	3.0	-
32	0	0	7.2	-	32	0	1	6.8	-
33	0	0	2.8	-	33	0	1	3.8	-
34	0	0	2.3	-	34	0	1	5.6	-
35	0	0	5.8	-	35	0	1	3.4	-
36	0	0	2.1	-	36	0	1	4.8	-
37	0	0	6.2	-	37	0	1	2.6	-
38	0	0	4.1	-	38	0	1	2.8	-
39	0	0	5.4	-	39	0	1	3.6	-
40	0	0	4.6	0	40	0	1	5.0	0
41	0	0	5.4	-	41	0	1	5.0	-
42	0	1	5.4	-	42	0	1	3.3	-
43	0	1	5.7	-	43	0	1	3.6	-
44	0	1	7.4	-	44	0	1	5.0	-
45	0	0	2.4	-	45	0	1	2.5	-
46	0	1	4.3	-	46	0	1	7.1	-
47	0	0	8.2	-	47	0	1	5.0	-
48	0	1	5.2	-	48	0	1	3.8	-
49	0	0	5.5	-	49	0	1	3.6	-
50	0	1	4.5	0	50	0	1	5.5	0
51	0	0	5.8	-	51	0	1	4.1	-
52	0	0	4.4	-	52	0	1	5.0	-
53	0	0	5.5	-	53	0	1	4.4	-
54	0	0	3.4	-	54	0	1	4.2	-
55	0	1	4.7	-	55	0	1	3.3	-
56	0	0	52.2	-	56	0	1	3.1	-
57	0	0	2.3	-	57	0	1	2..1	-
58	0	0	6.5	-	58	0	1	2.4	-
59	0	1	2.9	-	59	0	1	5.9	-
60	0	0	4.7	0	60	0	1	5.5	0
61	0	1	4.1	-	61	0	1	2.8	-
62	0	0	6.0	-	62	0	1	3.5	-
63	0	1	4.9	-	63	0	1	3.7	-
64	0	1	4.9	-	64	0	1	3.2	-
65	0	1	6.9	-	65	0	1	2.4	-
66	0	1	11.6	-	66	0	1	3.9	-
67	0	1	6.7	-	67	0	1	2.9	-
68	0	0	5.0	-	68	0	1	4.1	-
69	0	1	6.2	-	69	0	1	3.8	-
70	0	1	2.2	0	70	0	1	2.4	0
71	0	0	6.7	-	71	0	1	3.5	-
72	0	0	3.3	-	72	0	1	4.9	-
73	0	0	2.1	-	73	0	1	4.2	-
74	0	0	1.9	-	74	0	1	2.8	-
75	0	0	4.9	-	75	0	1	6.0	-
76	0	0	4.4	-	76	0	1	4.8	-
77	0	0	6.0	-	77	0	1	5.2	-
78	0	0	5.2	-	78	0	1	3.5	-
79	0	0	7.5	-	79	0	1	4.9	-
80	0	0	5.7	0	80	0	1	6.5	0
81	0	0	5.9	-	81	0	1	4.6	-
82	0	0	6.1	-	82	0	1	1.1	-
83	0	0	3.4	-	83	0	1	0.8	-
84	0	0	3.9	-	84	0	1	4.1	-
85	0	0	3.6	-	85	0	1	2.5	-
86	0	0	5.6	-	86	0	1	3.0	-
87	0	0	7.5	-	87	0	1	2.9	-
88	0	0	5.7	-	88	0	1	3.9	-
89	0	1	4.1	-	89	0	1	5.8	-
90	0	0	2.9	0	90	0	1	5.4	0
91	0	0	2.5	-	91	0	1	4.4	-
92	0	0	4.5	-	92	0	1	4.4	-
93	0	0	5.9	-	93	0	1	3.5	-
94	0	0	4.8.	-	94	0	1	2.1	-
95	0	0	2.8	-	95	0	1	3.0	-
96	0	0	4.2	-	96	0	1	6.5	-
97	0	0	5.2	-	97	0	1	4.5	-
98	0	0	6.6	-	98	0	1	4.0	-
99	0	0	5.4	-	99	0	1	3.1	-
100	0	0	4.4	0	100	0	1	5.4	0
Minimum	**0.0**	**0.0**	**1.9**	**0.0**	**Minimum**		**1**	**0.8**	**0.0**
Maximum	**0.0**	**1**	**52.2**	**0.0**	**Maximum**	**0.0**	**1**	**7.2**	**0.25**
Mean	**0.0**	**0.19**	**5.47**	**0.0**	**Mean**	**0.0**	**1**	**4.17**	**0.025**
Standard Dev.	**0.0**	**0.394**	**5.06**	**0.0**	**Standard Dev.**	**0.0**	**0.0**	**1.34**	**0.0791**
Geometric mean	**-**	**-**	**4.79**	**-**	**Geometric mean**	**-**	**-**	**3.92**	**-**
Median	**0.0**	**0.0**	**5.2**	**0.0**	**Median**	**0.0**	**1**	**4**	**0.0**
Calcite Index	**0.2**		**-**	**-**	**Calcite Index**	**1.0**		**-**	**-**

Table F.31: Pebble Count and Calcite at Reference and Mine-exposed Areas, FRO LAEMP, December 2018

RG_FOUEW				
Rock	**Concreted Status**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness**
1	0	1	7.9	-
2	0	1	7.4	-
3	0	1	6.6	-
4	0	1	12.4	-
5	0	1	6.4	-
6	0	1	12.7	-
7	0	1	8.6	-
8	0	1	7.5	-
9	0	1	11.0	-
10	0	1	6.9	0
11	0	1	6.9	-
12	0	1	12.8	-
13	0	1	8.4	-
14	0	1	8.5	-
15	0	1	14.2	-
16	0	1	6.9	-
17	0	1	8.6	-
18	0	1	5.6	-
19	0	1	12.8	-
20	0	1	14.9	0
21	0	1	7.2	-
22	0	1	14.0	-
23	0	1	6.2	-
24	0	1	5.9	-
25	0	1	16.0	-
26	0	1	10.9	-
27	0	1	8.9	-
28	0	1	5.6	-
29	0	1	19.4	-
30	0	1	6.8	0.75
31	0	1	11.4	-
32	0	1	1.0	-
33	0	1	9.4	-
34	0	1	4.1	-
35	0	1	11.9	-
36	0	0	5.0	-
37	0	1	7.4	-
38	0	1	3.1	-
39	0	1	6.4	-
40	0	1	8.8	0.25
41	0	1	6.4	-
42	0	1	7.0	-
43	0	1	17.5	-
44	0	1	16.0	-
45	0	1	11.4	-
46	0	1	6.4	-
47	0	1	9.2	-
48	0	1	14.8	-
49	0	1	7.7	-
50	0	1	5.1	0.50
51	0	1	15.2	-
52	0	1	12.6	-
53	0	1	11.4	-
54	0	1	7.7	-
55	0	1	14.5	-
56	0	1	6.8	-
57	0	1	9.8	-
58	0	1	7.8	-
59	0	1	10.0	-
60	0	1	8.4	0
61	0	1	5.9	-
62	0	1	7.0	-
63	0	1	12.1	-
64	0	1	11.5	-
65	0	1	3.9	-
66	0	1	8.0	-
67	0	1	6.7	-
68	0	1	13.4	-
69	0	1	7.9	-
70	0	1	6.3	0
71	0	1	7.2	-
72	0	1	3.9	-
73	0	1	4.9	-
74	0	1	5.8	-
75	0	1	17.7	-
76	0	1	4.5	-
77	0	1	4.4	-
78	0	1	9.2	-
79	0	1	6.3	-
80	0	1	8.5	0
81	0	1	11.8	-
82	0	1	12.0	-
83	0	1	10.0	-
84	0	1	6.5	-
85	0	1	14.5	-
86	0	1	4.1	-
87	0	1	10.4	-
88	0	1	10.6	-
89	0	1	5.9	-
90	0	1	9.5	0
91	0	1	3.5	-
92	0	1	10.6	-
93	0	1	15.8	-
94	0	1	7.1	-
95	0	1	7.9	-
96	0	1	7.2	-
97	0	1	15.5	-
98	0	1	7.3	-
99	0	1	10.6	-
100	0	1	11.6	0
Minimum	**0.0**	**0.0**	**1**	**0.0**
Maximum	**0.0**	**1**	**19.4**	**0.75**
Mean	**0.0**	**0.99**	**9.1**	**0.15**
Standard Dev.	**0.0**	**0.1**	**3.69**	**0.269**
Geometric mean	**-**	**-**	**8.32**	**-**
Median	**0.0**	**1**	**8.2**	**0.0**
Calcite Index	**1.0**		**-**	**-**

Table F.32: ***In Situ*** **Water Quality at Reference and Mine-exposed Areas, FRO LAEMP, December 2018**

Field Parameters		Reference	Mine-Exposed												
		RG_UFR1	RG_FODHE	RG_FOUNGD	RG_FODNGD	RG_MP1	RG_FOUSH	RG_FOUKI	RG_FOBKS	RG_FOBSC	RG_FOBCP	RG_FRUPO	RG_FODPO	RG_FO22	RG_FOUEW
Date		5-Dec-18	5-Dec-18	5-Dec-18	5-Dec-18	6-Dec-18	6-Dec-18	4-Dec-18	4-Dec-18	4-Dec-18	3-Dec-18	4-Dec-18	4-Dec-18	5-Dec-18	5-Dec-18
Station 1	Temperature (°C)	0	-0.10	1.60	1.10	-0.022	0.050	0.20	-0.025	-0.10	-0.10	4.64	3.86	2.07	0.34
	Dissolved Oxygen (mg/L)	11.89	11.66	11.39	11.99	12.17	12.08	12.24	12.53	12.41	11.94	10.21	9.88	11.44	11.78
	Dissolved Oxygen (%)	81.3	79.8	81.6	84.9	83.4	83.0	84.4	85.9	85.0	-	79.5	75.6	83.2	81.7
	Conductivity (µS/cm)	186.3	271.0	461.3	470.6	392.0	493.1	489.0	440.2	480.4	1762.0	628.0	700.0	623.0	574.0
	Specific Conductivity (µS/cm)	356.9	531.0	835.0	865.0	751.0	942.0	931.0	844.0	925.0	-	1,028.0	1,172.0	1,109.0	1,084.0
	pH	7.93	8.04	7.95	8.11	8.71	8.13	8.17	8.51	8.12	7.68	7.79	7.70	8.02	7.90
	ORP (mV)	-	-	-	-	-	-	-	-	79.20	-	-	-	-	-
Station 2	Temperature (°C)	0	-	-	-	-	-	0.10	-	-0.10	-	4.46	3.82	-	0.47
	Dissolved Oxygen (mg/L)	11.96	-	-	-	-	-	12.19	-	12.39	-	10.34	9.81	-	11.67
	Dissolved Oxygen (%)	81.8	-	-	-	-	-	83.0	-	84.9	-	80.1	74.8	-	81.3
	Conductivity (µS/cm)	186.0	-	-	-	-	-	489.6	-	506.0	-	625.0	698.0	-	561.0
	Specific Conductivity (µS/cm)	356.3	-	-	-	-	-	934.0	-	971.0	-	1,028.0	1,173.0	-	1,054.0
	pH	7.97	-	-	-	-	-	8.11	-	8.12	-	7.77	7.55	-	7.85
	ORP (mV)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Station 3	Temperature (°C)	0	-	-	-	-	-	0.10	-	0	-	4.35	3.60	-	0.49
	Dissolved Oxygen (mg/L)	12.11	-	-	-	-	-	12.17	-	12.45	-	10.47	9.95	-	11.56
	Dissolved Oxygen (%)	83.4	-	-	-	-	-	83.8	-	85.4	-	80.9	75.2	-	80.3
	Conductivity (µS/cm)	185.9	-	-	-	-	-	491.8	-	481.5	-	621.0	689.0	-	565.0
	Specific Conductivity (µS/cm)	356.2	-	-	-	-	-	937.0	-	930.0	-	1,025.0	1,167.0	-	1,065.0
	pH	7.97	-	-	-	-	-	8.09	-	8.14	-	7.82	7.67	-	7.84
	ORP (mV)	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table F.33: Channel Depth and Velocity at Kick and Sweep Sampling Locations in Mine-exposed Areas, FRO LAEMP, December 2018

Replicate	1	2	3	4	5	Mean
RG_FOUKI_1						
Depth (cm)	30	31	32	24	23	**28.0**
Velocity (m/s)	1.15	1.29	0.73	0.80	0.71	**0.936**
RG_FOUKI_2						
Depth (cm)	30	31	32	24	23	**28.0**
Velocity (m/s)	–	–	–	–	–	**–**
RG_FOBSC_1						
Depth (cm)	12	9	17	14	14	**13.2**
Velocity (m/s)	0.02	0.02	0.01	0.00	0.05	**0.020**
RG_FOBSC_2						
Depth (cm)	16	17	16	20	13	**16.3**
Velocity (m/s)	0.02	0.02	0.05	0.10	0.12	**0.062**
RG_FOBSC_3						
Depth (cm)	28	29	24	10	12	**20.6**
Velocity (m/s)	0.16	0.20	0.09	0.24	0.19	**0.176**

APPENDIX G

QAQC REPORTS

Methods and QC Report 2018

Project ID: Teck FROLAEMP Batch 2

Client: Minnow Environmental

Prepared by:
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Sample Reception

On August 15, 2018, Cordillera Consulting received 15 CABIN samples from Minnow Environmental. When samples arrived at Cordillera Consulting, exterior packaging was initially inspected for damage or wet spots that would have indicated damage to the interior containers.

Samples were logged into a proprietary software database (INSTAR1) where the clients assigned sample name was recorded along with a Cordillera Consulting (CC) number for cross-reference. Each sample was checked to ensure that all sites and replicates recorded on field sheets or packing lists were delivered intact and with adequate preservative. Any missing, mislabelled or extra samples were reported to the client immediately to confirm the total numbers and correct names on the sample jars. The client representative was notified of the arrival of the shipment and provided a sample inventory once intake was completed.
See table below for sample inventory:

Table 1: Summary of sample information including Cordillera Consulting (CC) number

Site	Sample	Site Code	CC#	Date	Size	# of Jars
Batch 2 2018	RG_FRCP1SW-BIC	RG_FRCP1SW-BIC	CC190124	8/1/2018	400μM	1
Batch 2 2018	RG_FO22-BIC	RG_FO22-BIC	CC190125	8/1/2018	400μM	1
Batch 2 2018	RG_FRUPO-BIC	RG_FRUPO-BIC	CC190126	8/1/2018	400μM	2
Batch 2 2018	RG_FOUEW-BIC	RG_FOUEW-BIC	CC190127	8/1/2018	400μM	1
Batch 2 2018	RG_FODPO-BIC	RG_FODPO-BIC	CC190128	8/1/2018	400μM	1

Batch 2 2018	RG_FOUSH-BIC	RG_FOUSH-BIC	CC190129	8/2/2018	400μM	1
Batch 2 2018	RG_MP1-BIC	RG_MP1-BIC	CC190130	8/2/2018	400μM	1
Batch 2 2018	RG_FODNGD-BIC	RG_FODNGD-BIC	CC190131	8/2/2018	400μM	1
Batch 2 2018	RG_FOUNGD-BIC	RG_FOUNGD-BIC	CC190132	8/2/2018	400μM	1
Batch 2 2018	RG_HENUP-BIC	RG_HENUP-BIC	CC190133	8/2/2018	400μM	1
Batch 2 2018	RG_FODHE-BIC	RG_FODHE-BIC	CC190134	8/2/2018	400μM	1
Batch 2 2018	RG_FOUKI-BIC	RG_FOUKI-BI	CC190135	8/3/2018	400μM	1
Batch 2 2018	RG_FOBKS-BIC	RG_FOBKS-BIC	CC190136	8/3/2018	400μM	1
Batch 2 2018	RG_FOBSC-BIC	RG_FOBSC-BIC	CC190137	8/3/2018	400μM	1
Batch 2 2018	RG_FOBCP-BIC	RG_FOBCP-BIC	CC190138	8/3/2018	400μM	1

Sample Sorting

- Using a gridded Petri dish, fine forceps and a low power stereo-microscope (Olympus, Nikon, Leica) the sorting technicians removed the invertebrates and sorted them into family/orders.
- The sorting technician kept a running tally of total numbers excluding organisms from Porifera, Nemata, Platyhelminthes, Ostracoda, Copepoda, Cladocera and terrestrial drop-ins such as aphids. These organisms were marked for their presence (given a value of 1) only and left in the sample. They were not included towards the 300-organism subsample count.
- Where specimens are broken or damaged, only heads were counted.
- Subsampling was conducted with the use of a Marchant Box.
- When using the Marchant box, cells were extracted at the same time in the order indicated by a random number table. If the 300th organism was found part way into sorting a cell then the balance of that cell was sorted. If the organism count had not reached 300 by the 50th cell then the entire sample was sorted.
- The total number of cells sorted and the number of organisms removed were recorded manually on a bench sheet and then recorded into INSTAR1
- Organisms were stored in vials containing 80% ethanol and an interior label indicating the site names, date of sampling, site code numbers and portion subsampled. This information was also recorded on the laboratory bench sheet and on INSTAR1.
- The sorted portion of the debris was preserved and labeled separately from the unsorted portion and was tested for sorting efficiency (Sorting Quality Control – Sorting Efficiency). The unsorted portion was also labeled and preserved in separate jars.

Percent sub-sampled and total countable invertebrates pulled from the samples were summarized in the table below.

Table 2: Percent sub-sample and invertebrate count for each sample

Sample	Date	CC#	400 micron fraction	
			% Sampled	# Invertebrates
RG_FRCP1SW-BIC	01-Aug-18	CC190124	5%	594

RG_FO22-BIC	01-Aug-18	CC190125	5%	331
RG_FRUPO-BIC	01-Aug-18	CC190126	5%	941
RG_FOUEW-BIC	01-Aug-18	CC190127	5%	491
RG_FODPO-BIC	01-Aug-18	CC190128	6%	382
RG_FOUSH-BIC	02-Aug-18	CC190129	10%	466
RG_MP1-BIC	02-Aug-18	CC190130	5%	371
RG_FODNGD-BIC	02-Aug-18	CC190131	5%	467
RG_FOUNGD-BIC	02-Aug-18	CC190132	5%	1018
RG_HENUP-BIC	02-Aug-18	CC190133	7%	325
RG_FODHE-BIC	02-Aug-18	CC190134	5%	474
RG_FOUKI-BIC	03-Aug-18	CC190135	5%	308
RG_FOBKS-BIC	03-Aug-18	CC190136	5%	466
RG_FOBSC-BIC	03-Aug-18	CC190137	5%	426
RG_FOBCP-BIC	03-Aug-18	CC190138	5%	1154

Sorting Quality Control - Sorting Efficiency

As a part of Cordillera’s laboratory policy, all projects undergo sorting efficiency checks.

- As sorting progresses, 10% of samples were randomly chosen by senior members of the sorting team for resorting.
- All sorters working on a project had at least 1 sample resorted by another sorter.
- An efficiency of 90 % was expected (95% for CABIN samples).
- If 90/95% efficiency was not met, samples from that sorter were resorted.
- To calculated sorting efficiency the following formula was used:

$$\frac{\#OrganismsMissed}{TotalOrganismsFound}*100=\%OM$$

Table 3: Summary of sorting efficiency

CC #	Number of Organisms Recovered (initial sort)	Number of Organisms in Re-sort	Percent Recovery
CC190132	1018	0	100%
CC190134	474	0	100%
		Average Recovery	100%

Sorting Quality Control - Sub-Sampling QC

Certain Provincial and Mining projects require additional sorting checks in the form of sub-sampling QC, (Environmental Effects Monitoring (EEM) protocol). This ensured that any fraction of the total sample that was examined was actually an accurate representation of the number of total organisms. Organisms from the additional sub-samples were not identified; rather total organism count only was compared.

Sub-Sampling efficiency was measured on 10% of the number of sub-sampled samples in the project. Ex. In a project where 50 of 100 total samples were processed through subsampling using a Marchant box, then 10% of 50; or 5 samples were used for sub sampling efficiency.

Sub-Sampling efficiency was performed by fractioning the entire sample into sub-sample percentages. On each sub-sampled portion, a total organism count was recorded and compared to the rest of the sub-samples. In order to pass, all fractions were required to be within 20% of total organism count.

Example: If 300 organisms are found in 10% of the sample, the sorter will continue to sample in 10% fractions until the entire sample is separated. They will then count the total number of organisms in each of the 10 fractions of 10% and compare the organism count.

When divergence is >20% the sorting manager examines for the source of the problem and takes steps to correct it. With the Marchant box, the problem typically rested with how the box is flipped back to the upright position. For this reason subsampling was performed by experienced employees only. Another common source of area would be the type of debris in the sample. Samples with algae or heavy with periphyton have a higher incident of failure due to clumping than clear samples.

Table 4: Summary of Sub Sample efficiency

Station ID		Organisms in Subsample																				Actual Total	Precision Error		Accuracy Error	
CC#	Sample Name																						Min (%)	Max (%)	Min (%)	Max (%)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20					
190125	RG_FO22-BIC	329	318	319	336	345	340	325	331	336	338	342	353	329	311	360	324	358	313	342	310	6659	0	13.889	0.586	8.124
190129	RG_FOUSH-BIC	464	478	467	478	509	515	510	511	457	446											4835	0	13.398	1.138	7.756

Taxonomic Effort

The next procedure was the identification to genus-species level where possible of all the organisms in the sample.

- Identifications were made at the genus/species level for all insect organisms found including Chironomidae (Based on CABIN protocol).
- Non-insect organisms (except those not included in CABIN count) were identified to genus/species where possible and to a minimum of family level with intact and mature specimens.
- The Standard Taxonomic Effort lists compiled by the CABIN manual[1], SAFIT[2] , and PNAMP[3] were used as a guide line for what level of identification to achieve where the condition and maturity of the organism enabled.
- Organisms from the same families/order were kept in separate vials with 80% ethanol and an interior label of printed laser paper.
- Chironomidae was identified to genus/species level where possible and was aided by slide mounts. CMC-10 was used to clear and mount the slide.
- Oligochaetes was identified to family/genus level with the aid of slide mounts. CMC-10 was used to clear and mount the slide.
- Other Annelida (leeches, polychaetes) were identified to the family/genus/species level with undamaged, mature specimens.
- Mollusca was identified to family and genus/species where possible
- Decapoda, Amphipoda and Isopoda were identified at family/genus/species level where possible.
- Bryozoans and Nemata remained at the phylum level
- Hydrachnidae and Cnidaria were identified at the family/genus level where possible.
- When requested, reference collections were made containing at least one individual from each taxa listed. Organisms represented will have been identified to the lowest practical level.
- Reference collection specimens were stored in 55 mm glass vials with screw-cap lids with polyseal inserts (museum quality). They were labeled with taxa name, site code, date identified and taxonomist name. The same information was applied to labels on the slide mounts.

Taxonomic QC

The taxonomists for this project were certified by the Society of Freshwater Science (SFS) Taxonomic Certification Program at level 2 which is the required certification for CABIN projects:

Sue Salter: Group 1 General Arthropods (West); Group 2 EPT (East/West); Group 3 Chironomidae (East/West); Group 4 Oligochaeta

Scott Finlayson: Group 1 General Arthropods (East/West); Group 2 EPT (East/West); Group 3 Chironomidae (East/West); Group 4 Oligochaeta

Adam Bliss: Group 1 General Arthropods (East/West); Group 2 EPT (East/West);
Group 3 Chironomidae
Rita Avery: Group 1 General Arthropods (East/West); Group 2 EPT (East/West)

Taxonomic QC was performed in house by someone other than the original taxonomist.

- Quality control protocol involved complete, blind re-identification and re-enumeration of at least 10% of samples by a second SFS-certified taxonomist.
- Samples for taxonomic quality control were randomly selected and quality control procedures were conducted as the project progresses through the laboratories.

- The second (QC) taxonomist will calculate and record four types of errors:
    1. Misidentification error
    2. Enumeration error
    3. Questionable taxonomic resolution error
    4. Insufficient taxonomic resolution error

The QC coordinator then calculates the following estimates of taxonomic precision.

1. The percent total identification error rate is calculated as:

$$\frac{Sum\ of\ incorrect\ identifications}{total\ organisms\ counted\ in\ audit} * (100)$$

The average total identification error rate of audited samples did not exceed 5%. All samples that exceed a 5% error rate were re-evaluated to determine whether repeated errors or patterns in error contributed.

2. The percent difference in enumeration (PDE) to quantify the consistency of specimen counts.

$$PDE = \frac{|n_1 - n_2|}{n_1 + n_2} x100$$

3. The percent taxonomic disagreement (PTD) to quantify the shared precision between two sets of identifications.

$$PTD = \left(1 - \left[\frac{a}{N}\right]\right) x100$$

4. Bray Curtis dissimilarity Index to quantify the differences in identifications.

$$BC_{ij} = 1 - \frac{2C_{ij}}{S_j + S_i}$$

Error Summary

All samples report errors within the acceptable limits for CABIN Laboratory methods (less than 5% error).

Table 4: Summary of taxonomic error following QC

Site	Taxa Identified	% Error	PDE	PTD	Bray - Curtis Dissimilarity index
Site - Batch 2 2018, Sample - RG_FOBCP-BIC, CC# - CC190138, Percent sampled = 5%, Sieve size = 400	1154	0.00	0.087	0.952	0.009
Site - Batch 2 2018, Sample - RG_FO22-BIC, CC# - CC190125, Percent sampled = 5%, Sieve size = 400	331	0.00	0.151	0.604	0.005

There will always be disagreements between taxonomists regarding the degree of taxonomic resolution in immature specimens and when laboratories make use of different keys for certain groups (Mollusks is an especially disputed group). It is always possible that some taxa found by the original taxonomist were overlooked in QC.

All of the Taxonomic QC samples that were observed passed testing according to the CABIN misidentification protocols. See the tables below for results from taxonomic QC audit.

Error Rationale

Site - Batch 2 2018, Sample - RG_FOBCP-BIC, CC# - CC190138, Percent sampled = 5%, Sieve size = 400	Laboratory Count	QC Audit Count	Agreement	Misidentification	Questionable Taxonomic Resolution	Enumeration	Insufficent Taxonomic Resolution	Comments
Acentrella	2	2						
Ameletus	1	1						
Apatania	1	1						
Aturus	1	1						
Baetidae	22	22						
Baetis	28	28						
Baetis rhodani group	45	45						
Capniidae	1	1						
Chironomidae	1	1						
Chironomidae	46	46						
Corynoneura	4	4						
Diamesa	1	1						
Drunella doddsii	9	9						
Epeorus	11	11						
Ephemerellidae	11	11						
Eukiefferiella	35	35						
Heleniella	4	4						
Heptageniidae	121	118	No			X		
Hesperoperla	1	1						
Hydropsychidae	2	2						
Kogotus	3	3						
Lebertia	4	4						
Mallochohelea	4	4						
Megarcys	3	3						
Micropsectra	6	6						
Enchytraeus	3	3						
Orthocladiinae	7	0	No			X		
Orthocladius complex	219	226	No			X		
Pagastia	2	2						

Pericoma/Telmatoscopus	22	22						
Perlidae	5	5						
Perlodidae	14	14						
Rheocricotopus	4	4						
Rhithrogena	1	1						
Rhyacophila	1	1						
Rhyacophila alberta group	1	1						
Rhyacophila angelita group	1	1						
Rhyacophila narvae	1	1						
Serratella	6	6						
Simuliidae	3	3						
Simuliidae	7	7						
Simulium	246	245	No			X		
Sperchon	1	1						
Stempellinella	1	1						
Taeniopterygidae	1	1						
Thienemanniella	4	4						
Tipula	1	1						
Tvetenia	169	171	No			X		
Zapada	65	65						
Zapada columbiana	1	1						
Zapada oregonensis group	3	3						
Total:	**1156**	**1154**						
					0	**5**	**0**	
% Total Misidentification Rate =	misidentifications		x100 =	0.00	**Pass**			
	total number							
0								
5								
0								

Site - Batch 2 2018, Sample - RG_FO22-BIC, CC# - CC190125, Percent sampled = 5%, Sieve size = 400	**Laboratory Count**	**QC Audit Count**	**Agreement**	**Misidentification**	**Questionable Taxonomic Resolution**	**Enumeration**	**Insufficent Taxonomic Resolution**	**Comments**
Apatania	1	1						
Aturus	5	5						

Baetidae	3	3						
Capniidae	3	3						
Chelifera/ Metachela	1	1						
Chironomidae	11	11						
Drunella doddsii	1	1						
Drunella grandis group	2	2						
Elmidae	87	87						
Empididae	1	1						
Ephemerellidae	4	4						
Eukiefferiella	3	3						
Feltria	2	2						
Heleniella	1	1						
Heterlimnius	69	69						
Kogotus	7	7						
Lebertia	27	27						
Limnephilidae	2	2						
Limnophila	1	1						
Limnophyes	2	2						
Micropsectra	2	2						
Neoplasta	2	2						
Orthocladiinae	1	0	No			X		
Orthocladius complex	41	42	No			X		
Pagastia	4	4						
Pedomoecus sierra	1	1						
Perlodidae	11	12	No			X		
Pisidium	2	2						
Rheocricotopus	4	4						
Rhyacophila	2	2						
Rhyacophila brunnea/vemna group	3	3						
Serratella	2	2						
Simulium	6	6						
Taeniopterygidae	1	1						
Tipula	1	1						
Tvetenia	5	5						
Zapada	4	4						
Zapada cinctipes	1	1						
Zapada oregonensis group	3	3						
Enchytraeus	1	1						
Total:	**330**	**331**						

					0	**0**	**0**	
% Total Misidentification Rate =	misidentifications			x100 =	0.00	**Pass**		
	total number							

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[3] Pacific Northwest Aquatic Monitoring Partnership (Accessed 2015). www.pnamp.org

Taxonomic Keys

Below is a reference list of taxonomic keys utilized by taxonomists at Cordillera Consulting. Cordillera taxonomists routinely seek out new literature to ensure the most accurate identification keys are being utilized. This is not reflective of the exhaustive list of resources that we use for identification. A more complete list of taxonomic resources can be found at Southwest Association of Freshwater Invertebrate Taxonomists. (2015).
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Methods and QC Report 2018

Project ID: Teck FROLAEMP Batch 3

Client: Minnow Environmental

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Sample Reception

On September 20, 2018, Cordillera Consulting received 49 CABIN samples from Minnow Environmental. When samples arrived at Cordillera Consulting, exterior packaging was initially inspected for damage or wet spots that would have indicated damage to the interior containers.

Samples were logged into a proprietary software database (INSTAR1) where the clients assigned sample name was recorded along with a Cordillera Consulting (CC) number for cross-reference. Each sample was checked to ensure that all sites and replicates recorded on field sheets or packing lists were delivered intact and with adequate preservative. Any missing, mislabelled or extra samples were reported to the client immediately to confirm the total numbers and correct names on the sample jars. The client representative was notified of the arrival of the shipment and provided a sample inventory once intake was completed.
See table below for sample inventory:

Table 1: Summary of sample information including Cordillera Consulting (CC) number

Batch 3 2018	RG_FODHE1_BIC	RG_FODHE1_BIC	CC191003	9/5/2018	400µM	1
Batch 3 2018	RG_FODHE2_BIC	RG_FODHE2_BIC	CC191004	9/5/2018	400µM	1
Batch 3 2018	RG_FODHE3_BIC	RG_FODHE3_BIC	CC191005	9/5/2018	400µM	1
Batch 3 2018	RG_FOUEW1_BIC	RG_FOUEW1_BIC	CC191006	9/6/2018	400µM	1
Batch 3 2018	RG_FOUEW2_BIC	RG_FOUEW2_BIC	CC191007	9/6/2018	400µM	1
Batch 3 2018	RG_FOUEW3_BIC	RG_FOUEW3_BIC	CC191008	9/6/2018	400µM	1
Batch 3 2018	RG_HENUP1_BIC	RG_HENUP1_BIC	CC191009	9/6/2018	400µM	1

Batch 3 2018	RG_HENUP2_BIC	RG_HENUP2_BIC	CC191010	9/6/2018	400µM	1
Batch 3 2018	RG_HENUP3_BIC	RG_HENUP3_BIC	CC191011	9/6/2018	400µM	1
Batch 3 2018	RG_FOUKI1_BIC	RG_FOUKI1_BIC	CC191012	9/7/2018	400µM	1
Batch 3 2018	RG_FOUKI2_BIC	RG_FOUKI2_BIC	CC191013	9/7/2018	400µM	1
Batch 3 2018	RG_FOUKI3_BIC	RG_FOUKI3_BIC	CC191014	9/7/2018	400µM	1
Batch 3 2018	RG_FO26-1_BIC	RG_FO26-1_BIC	CC191015	9/7/2018	400µM	1
Batch 3 2018	RG_FO26-2_BIC	RG_FO26-2_BIC	CC191016	9/7/2018	400µM	1
Batch 3 2018	RG_FO26-3_BIC	RG_FO26-3_BIC	CC191017	9/7/2018	400µM	1
Batch 3 2018	RG_FO22-1_BIC	RG_FO22-1_BIC	CC191018	9/8/2018	400µM	1
Batch 3 2018	RG_FO22-2_BIC	RG_FO22-2_BIC	CC191019	9/8/2018	400µM	1
Batch 3 2018	RG_FO22-3_BIC	RG_FO22-3_BIC	CC191020	9/8/2018	400µM	1
Batch 3 2018	RG_FO22-4_BIC	RG_FO22-4_BIC	CC191021	9/8/2018	400µM	1
Batch 3 2018	RG_FO22-5_BIC	RG_FO22-5_BIC	CC191022	9/8/2018	400µM	1
Batch 3 2018	RG_FOBKS1_BIC	RG_FOBKS1_BIC	CC191023	9/8/2018	400µM	1
Batch 3 2018	RG_FOBKS2_BIC	RG_FOBKS2_BIC	CC191024	9/8/2018	400µM	1
Batch 3 2018	RG_FOBKS3_BIC	RG_FOBKS3_BIC	CC191025	9/8/2018	400µM	1
Batch 3 2018	RG_FRUPO1_BIC	RG_FRUPO1_BIC	CC191026	9/9/2018	400µM	1
Batch 3 2018	RG_FRUPO2_BIC	RG_FRUPO2_BIC	CC191027	9/9/2018	400µM	1
Batch 3 2018	RG_FRUPO3_BIC	RG_FRUPO3_BIC	CC191028	9/9/2018	400µM	1
Batch 3 2018	RG_FOBCP1_BIC	RG_FOBCP1_BIC	CC191029	9/9/2018	400µM	1
Batch 3 2018	RG_FOBCP2_BIC	RG_FOBCP2_BIC	CC191030	9/9/2018	400µM	1
Batch 3 2018	RG_FOBCP3_BIC	RG_FOBCP3_BIC	CC191031	9/9/2018	400µM	1
Batch 3 2018	RG_FOBCP4_BIC	RG_FOBCP4_BIC	CC191032	9/9/2018	400µM	1
Batch 3 2018	RG_FOBCP5_BIC	RG_FOBCP5_BIC	CC191033	9/9/2018	400µM	1
Batch 3 2018	RG_FOBSC1_BIC	RG_FOBSC1_BIC	CC191034	9/10/2018	400µM	1
Batch 3 2018	RG_FOBSC2_BIC	RG_FOBSC2_BIC	CC191035	9/10/2018	400µM	1
Batch 3 2018	RG_FOBSC3_BIC	RG_FOBSC3_BIC	CC191036	9/10/2018	400µM	1
Batch 3 2018	RG_FOUSH1_BIC	RG_FOUSH1_BIC	CC191037	9/11/2018	400µM	1
Batch 3 2018	RG_FOUSH2_BIC	RG_FOUSH2_BIC	CC191038	9/11/2018	400µM	1
Batch 3 2018	RG_FOUSH3_BIC	RG_FOUSH3_BIC	CC191039	9/11/2018	400µM	1
Batch 3 2018	RG_MP1-1_BIC	RG_MP1-1_BIC	CC191040	9/11/2018	400µM	1
Batch 3 2018	RG_MP1-2_BIC	RG_MP1-2_BIC	CC191041	9/11/2018	400µM	1
Batch 3 2018	RG_MP1-3_BIC	RG_MP1-3_BIC	CC191042	9/11/2018	400µM	1
Batch 3 2018	RG_FODNGD1_BIC	RG_FODNGD1_BIC	CC191043	9/12/2018	400µM	1
Batch 3 2018	RG_FODNGD2_BIC	RG_FODNGD2_BIC	CC191044	9/12/2018	400µM	1
Batch 3 2018	RG_FODNGD3_BIC	RG_FODNGD3_BIC	CC191045	9/12/2018	400µM	1
Batch 3 2018	RG_FOUNGD1_BIC	RG_FOUNGD1_BIC	CC191046	9/13/2018	400µM	1
Batch 3 2018	RG_FOUNGD2_BIC	RG_FOUNGD2_BIC	CC191047	9/13/2018	400µM	1
Batch 3 2018	RG_FOUNGD3_BIC	RG_FOUNGD3_BIC	CC191048	9/13/2018	400µM	1
Batch 3 2018	RG_FODPO1_BIC	RG_FODPO1_BIC	CC191049	9/13/2018	400µM	1
Batch 3 2018	RG_FODPO2_BIC	RG_FODPO2_BIC	CC191050	9/13/2018	400µM	1
Batch 3 2018	RG_FODPO3_BIC	RG_FODPO3_BIC	CC191051	9/13/2018	400µM	2

Sample Sorting

- Using a gridded Petri dish, fine forceps and a low power stereo-microscope (Olympus, Nikon, Leica) the sorting technicians removed the invertebrates and sorted them into family/orders.
- The sorting technician kept a running tally of total numbers excluding organisms from Porifera, Nemata, Platyhelminthes, Ostracoda, Copepoda, Cladocera and terrestrial drop-ins such as aphids. These organisms were marked for their presence (given a value of 1) only and left in the sample. They were not included towards the 300-organism subsample count.
- Where specimens are broken or damaged, only heads were counted.
- Subsampling was conducted with the use of a Marchant Box.
- When using the Marchant box, cells were extracted at the same time in the order indicated by a random number table. If the 300th organism was found part way into sorting a cell then the balance of that cell was sorted. If the organism count had not reached 300 by the 50th cell then the entire sample was sorted.
- The total number of cells sorted and the number of organisms removed were recorded manually on a bench sheet and then recorded into INSTAR1
- Organisms were stored in vials containing 80% ethanol and an interior label indicating the site names, date of sampling, site code numbers and portion subsampled. This information was also recorded on the laboratory bench sheet and on INSTAR1.
- The sorted portion of the debris was preserved and labeled separately from the unsorted portion and was tested for sorting efficiency (Sorting Quality Control – Sorting Efficiency). The unsorted portion was also labeled and preserved in separate jars.

Percent sub-sampled and total countable invertebrates pulled from the samples were summarized in the table below.

Table 2: Percent sub-sample and invertebrate count for each sample

Batch 3 2018	RG_FODHE1_BIC	05-Sep-18	CC191003	5%	640
Batch 3 2018	RG_FODHE2_BIC	05-Sep-18	CC191004	5%	869
Batch 3 2018	RG_FODHE3_BIC	05-Sep-18	CC191005	5%	898
Batch 3 2018	RG_FOUEW1_BIC	06-Sep-18	CC191006	5%	318
Batch 3 2018	RG_FOUEW2_BIC	06-Sep-18	CC191007	5%	458
Batch 3 2018	RG_FOUEW3_BIC	06-Sep-18	CC191008	5%	335
Batch 3 2018	RG_HENUP1_BIC	06-Sep-18	CC191009	7%	358
Batch 3 2018	RG_HENUP2_BIC	06-Sep-18	CC191010	6%	436
Batch 3 2018	RG_HENUP3_BIC	06-Sep-18	CC191011	5%	643
Batch 3 2018	RG_FOUKI1_BIC	07-Sep-18	CC191012	6%	330
Batch 3 2018	RG_FOUKI2_BIC	07-Sep-18	CC191013	10%	490
Batch 3 2018	RG_FOUKI3_BIC	07-Sep-18	CC191014	7%	363
Batch 3 2018	RG_FO26-1_BIC	07-Sep-18	CC191015	5%	1228
Batch 3 2018	RG_FO26-2_BIC	07-Sep-18	CC191016	5%	1826
Batch 3 2018	RG_FO26-3_BIC	07-Sep-18	CC191017	5%	1180
Batch 3 2018	RG_FO22-1_BIC	08-Sep-18	CC191018	5%	756
Batch 3 2018	RG_FO22-2_BIC	08-Sep-18	CC191019	5%	843

Batch 3 2018	RG_FO22-3_BIC	08-Sep-18	CC191020	5%	736
Batch 3 2018	RG_FO22-4_BIC	08-Sep-18	CC191021	5%	423
Batch 3 2018	RG_FO22-5_BIC	08-Sep-18	CC191022	5%	549
Batch 3 2018	RG_FOBKS1_BIC	08-Sep-18	CC191023	5%	395
Batch 3 2018	RG_FOBKS2_BIC	08-Sep-18	CC191024	6%	337
Batch 3 2018	RG_FOBKS3_BIC	08-Sep-18	CC191025	5%	629
Batch 3 2018	RG_FRUPO1_BIC	09-Sep-18	CC191026	5%	1027
Batch 3 2018	RG_FRUPO2_BIC	09-Sep-18	CC191027	8%	357
Batch 3 2018	RG_FRUPO3_BIC	09-Sep-18	CC191028	5%	521
Batch 3 2018	RG_FOBCP1_BIC	09-Sep-18	CC191029	6%	364
Batch 3 2018	RG_FOBCP2_BIC	09-Sep-18	CC191030	20%	415
Batch 3 2018	RG_FOBCP3_BIC	09-Sep-18	CC191031	5%	315
Batch 3 2018	RG_FOBCP4_BIC	09-Sep-18	CC191032	10%	350
Batch 3 2018	RG_FOBCP5_BIC	09-Sep-18	CC191033	6%	336
Batch 3 2018	RG_FOBSC1_BIC	10-Sep-18	CC191034	5%	351
Batch 3 2018	RG_FOBSC2_BIC	10-Sep-18	CC191035	20%	741
Batch 3 2018	RG_FOBSC3_BIC	10-Sep-18	CC191036	10%	336
Batch 3 2018	RG_FOUSH1_BIC	11-Sep-18	CC191037	5%	431
Batch 3 2018	RG_FOUSH2_BIC	11-Sep-18	CC191038	5%	478
Batch 3 2018	RG_FOUSH3_BIC	11-Sep-18	CC191039	10%	668
Batch 3 2018	RG_MP1-1_BIC	11-Sep-18	CC191040	5%	645
Batch 3 2018	RG_MP1-2_BIC	11-Sep-18	CC191041	5%	642
Batch 3 2018	RG_MP1-3_BIC	11-Sep-18	CC191042	5%	517
Batch 3 2018	RG_FODNGD1_BIC	12-Sep-18	CC191043	5%	714
Batch 3 2018	RG_FODNGD2_BIC	12-Sep-18	CC191044	5%	593
Batch 3 2018	RG_FODNGD3_BIC	12-Sep-18	CC191045	5%	722
Batch 3 2018	RG_FOUNGD1_BIC	13-Sep-18	CC191046	5%	1134
Batch 3 2018	RG_FOUNGD2_BIC	13-Sep-18	CC191047	5%	1110
Batch 3 2018	RG_FOUNGD3_BIC	13-Sep-18	CC191048	5%	1190
Batch 3 2018	RG_FODPO1_BIC	13-Sep-18	CC191049	5%	1406
Batch 3 2018	RG_FODPO2_BIC	13-Sep-18	CC191050	5%	2216
Batch 3 2018	RG_FODPO3_BIC	13-Sep-18	CC191051	5%	3337

Sorting Quality Control - Sorting Efficiency

As a part of Cordillera’s laboratory policy, all projects undergo sorting efficiency checks.

- As sorting progresses, 10% of samples were randomly chosen by senior members of the sorting team for resorting.
- All sorters working on a project had at least 1 sample resorted by another sorter.
- An efficiency of 90 % was expected (95% for CABIN samples).
- If 90/95% efficiency was not met, samples from that sorter were resorted.
- To calculated sorting efficiency the following formula was used:

$$\frac{\#OrganismsMissed}{TotalOrganismsFound}*100=\%OM$$

Table 3: Summary of sorting efficiency

CC #	Number of Organisms Recovered (initial sort)	Number of Organisms in Re-sort	Percent Recovery
CC191007	458	7	98%
CC191010	436	1	99%
CC191019	843	23	97%
CC191024	337	0	100%
		Average Recovery	98.5%

Sorting Quality Control - Sub-Sampling QC

Certain Provincial and Mining projects require additional sorting checks in the form of sub-sampling QC, (Environmental Effects Monitoring (EEM) protocol). This ensured that any fraction of the total sample that was examined was actually an accurate representation of the number of total organisms. Organisms from the additional sub-samples were not identified; rather total organism count only was compared.

Sub-Sampling efficiency was measured on 10% of the number of sub-sampled samples in the project. Ex. In a project where 50 of 100 total samples were processed through subsampling using a Marchant box, then 10% of 50; or 5 samples were used for sub sampling efficiency.

Sub-Sampling efficiency was performed by fractioning the entire sample into sub-sample percentages. On each sub-sampled portion, a total organism count was recorded and compared to the rest of the sub-samples. In order to pass, all fractions were required to be within 20% of total organism count.

Example: If 300 organisms are found in 10% of the sample, the sorter will continue to sample in 10% fractions until the entire sample is separated. They will then count the total number of organisms in each of the 10 fractions of 10% and compare the organism count.

When divergence is >20% the sorting manager examines for the source of the problem and takes steps to correct it. With the Marchant box, the problem typically rested with how the box is flipped back to the upright position. For this reason, subsampling was performed by experienced employees only. Another common source of area would be the type of debris in the sample. Samples with algae or heavy with periphyton have a higher incident of failure due to clumping than clear samples.

Table 4: Summary of Sub Sample efficiency

Station ID		Organisms in Subsample																				Actual Total	Precision Error		Accuracy Error	
CC#	Sample Name																						Min (%)	Max (%)	Min (%)	Max (%)

This data to come at a later date.

Taxonomic Effort

The next procedure was the identification to genus-species level where possible of all the organisms in the sample.

- Identifications were made at the genus/species level for all insect organisms found including Chironomidae (Based on CABIN protocol).
- Non-insect organisms (except those not included in CABIN count) were identified to genus/species where possible and to a minimum of family level with intact and mature specimens.
- The Standard Taxonomic Effort lists compiled by the CABIN manual[1], SAFIT[2] , and PNAMP[3] were used as a guide line for what level of identification to achieve where the condition and maturity of the organism enabled.
- Organisms from the same families/order were kept in separate vials with 80% ethanol and an interior label of printed laser paper.
- Chironomidae was identified to genus/species level where possible and was aided by slide mounts. CMC-10 was used to clear and mount the slide.
- Oligochaetes was identified to family/genus level with the aid of slide mounts. CMC-10 was used to clear and mount the slide.
- Other Annelida (leeches, polychaetes) were identified to the family/genus/species level with undamaged, mature specimens.
- Mollusca was identified to family and genus/species where possible
- Decapoda, Amphipoda and Isopoda were identified at family/genus/species level where possible.
- Bryozoans and Nemata remained at the phylum level
- Hydrachnidae and Cnidaria were identified at the family/genus level where possible.
- When requested, reference collections were made containing at least one individual from each taxa listed. Organisms represented will have been identified to the lowest practical level.
- Reference collection specimens were stored in 55 mm glass vials with screw-cap lids with polyseal inserts (museum quality). They were labeled with taxa name, site code, date identified and taxonomist name. The same information was applied to labels on the slide mounts.

Taxonomic QC

The taxonomists for this project were certified by the Society of Freshwater Science (SFS) Taxonomic Certification Program at level 2 which is the required certification for CABIN projects:

Scott Finlayson: Group 1 General Arthropods (East/West); Group 2 EPT (East/West); Group 3 Chironomidae (East/West); Group 4 Oligochaeta

Adam Bliss: Group 1 General Arthropods (East/West); Group 2 EPT (East/West); Group 3 Chironomidae

Rita Avery: Group 1 General Arthropods (East/West); Group 2 EPT (East/West)

Taxonomic QC was performed in house by someone other than the original taxonomist.

- Quality control protocol involved complete, blind re-identification and re-enumeration of at least 10% of samples by a second SFS-certified taxonomist.
- Samples for taxonomic quality control were randomly selected and quality control procedures were conducted as the project progresses through the laboratories.

- The second (QC) taxonomist will calculate and record four types of errors:
    1. Misidentification error
    2. Enumeration error
    3. Questionable taxonomic resolution error
    4. Insufficient taxonomic resolution error

The QC coordinator then calculates the following estimates of taxonomic precision.

1. The percent total identification error rate is calculated as:

$$\frac{Sum\ of\ incorrect\ identifications}{total\ organisms\ counted\ in\ audit} * (100)$$

The average total identification error rate of audited samples did not exceed 5%. All samples that exceed a 5% error rate were re-evaluated to determine whether repeated errors or patterns in error contributed.

2. The percent difference in enumeration (PDE) to quantify the consistency of specimen counts.

$$PDE = \frac{|n_1 - n_2|}{n_1 + n_2} x100$$

3. The percent taxonomic disagreement (PTD) to quantify the shared precision between two sets of identifications.

$$PTD = \left(1 - \left[\frac{a}{N}\right]\right) x100$$

4. Bray Curtis dissimilarity Index to quantify the differences in identifications.

$$BC_{ij} = 1 - \frac{2C_{ij}}{S_j + S_i}$$

Error Summary

All samples report errors within the acceptable limits for CABIN Laboratory methods (less than 5% error).

Table 4: Summary of taxonomic error following QC

Site	Taxa Identified	% Error	PDE	PTD	Bray - Curtis Dissimilarity index
Site - Batch 3 2018, Sample - RG_FRUPO3_BIC, CC# - CC191028, Percent sampled = 5%, Sieve size = 400	521	0.00	0	1.15163148	0.01151631
Site - Batch 3 2018, Sample - RG_FOBCP3_BIC, CC# - CC191031, Percent sampled = 5%, Sieve size = 400	315	0.00	0	0.63492063	0.00634921
Site - Batch 3 2018, Sample - RG_FODNGD1_BIC, CC# - CC191043, Percent sampled = 5%, Sieve size = 400	715	0.00	0.06997901	0.6993007	0.00629811
Site - Batch 3 2018, Sample - RG_FOUSH2_BIC, CC# - CC191038, Percent sampled = 5%, Sieve size = 400	478	0.00	0	0.62761506	0.00627615
Site - Batch 3 2018, Sample - RG_FODNGD3_BIC, CC# - CC191045, Percent sampled = 5%, Sieve size = 400	714	0.00	0.55710306	1.38504155	0.00835655

There will always be disagreements between taxonomists regarding the degree of taxonomic resolution in immature specimens and when laboratories make use of different keys for certain groups (Mollusks is an especially disputed group). It is always possible that some taxa found by the original taxonomist were overlooked in QC.

All of the Taxonomic QC samples that were observed passed testing according to the CABIN misidentification protocols. See the tables below for results from taxonomic QC audit.

Error Rationale

Site - Batch 3 2018, Sample - RG_FRUPO3_BIC, CC# - CC191028, Percent sampled = 5%, Sieve size = 400	Laboratory Count	QC Audit Count	Agreement	Misidentification	Questionable Taxonomic Resolution	Enumeration	Insufficent Taxonomic Resolution	Comments
Apatania	6	6						
Baetis	1	2	No			X		
Baetis rhodani group	10	9	No			X		
Capniidae	6	6						
Chelifera/ Metachela	3	3						
Chironomidae	7	7						
Clinocera	1	1						
Dicranota	1	1						
Drunella spinifera	3	3						
Empididae	2	2						
Epeorus	1	1						
Ephemerellidae	25	25						
Eukiefferiella	1	1						
Feltria	2	2						
Heptageniidae	34	34						
Heterlimnius	1	1						
Isoperla	80	75	No			X		
Kogotus	22	22						
Lebertia	30	30						
Mallochohelea	8	8						
Megarcys	6	6						
Micrasema	2	2						
Nemouridae	9	9						
Neoplasta	1	1						
Oligophlebodes	1	1						
Orthocladius complex	30	35	No			X		
Pagastia	8	8						
Perlodidae	33	33						
Rheocricotopus	4	4						
Rhyacophila	2	2						
Rhyacophila	3	3						
Rhyacophila atrata complex	6	6						

Rhyacophila hyalinata group	1	1						
Simuliidae	23	23						
Simulium	6	6						
Sperchon	2	2						
Sweltsa	2	2						
Taeniopterygidae	15	15						
Testudacarus	1	1						
Thienemannimyia group	1	1						
Tipula	1	1						
Trichoptera	1	1						
Tvetenia	3	3						
Zapada	73	73	72					
Zapada cinctipes	38	38	37					
Zapada oregonensis group	5	5						
Total:	**521**	**521**						
					0	**4**	**0**	
% Total Misidentification Rate =	misidentifications			x100 =	0.00	**Pass**		
	total number							

Site - Batch 3 2018, Sample - RG_FOBCP3_BIC, CC# - CC191031, Percent sampled = 5%, Sieve size = 400	**Laboratory Count**	**QC Audit Count**	**Agreement**	**Misidentification**	**Questionable Taxonomic Resolution**	**Enumeration**	**Insufficent Taxonomic Resolution**	**Comments**
Ameletus	2	2						
Arctopsyche	4	4						
Chironomidae	1	1						
Chloroperlidae	2	2						
Drunella doddsii	1	1						
Heptageniidae	112	110	No			X		
Isoperla	7	7						
Kogotus	10	10						
Lebertia	41	41						
Liodessus	1	1						
Mallochohelea	1	1						
Megarcys	3	3						
Orthocladiinae	1	1						
Pagastia	3	3						

Parapsyche	1	1						
Pericoma/Telmatoscopus	51	52	No			X		
Perlidae	4	4						
Perlodidae	3	3						
Rhithrogena	1	1						
Rhyacophila	6	6						
Rhyacophila atrata complex	2	2						
Rhyacophila brunnea/vemna group	2	2						
Rhyacophila hyalinata group	1	1						
Roederiodes	2	2						
Simulium	1	1						
Taeniopterygidae	6	6						
Tanytarsini	1	1						
Testudacarus	1	1						
Thienemannimyia group	1	1						
Trichoptera	1	1						
Tvetenia	2	2						
Zapada	8	8						
Zapada cinctipes	32	33	No			X		
Total:	**315**	**315**						
					0	**3**	**0**	
% Total Misidentification Rate =	misidentifications			x100 =	0.00	**Pass**		
	total number							

Site - Batch 3 2018, Sample - RG_FOUSH2_BIC, CC# - CC191038, Percent sampled = 5%, Sieve size = 400	**Laboratory Count**	**QC Audit Count**	**Agreement**	**Misidentification**	**Questionable Taxonomic Resolution**	**Enumeration**	**Insufficent Taxonomic Resolution**	**Comments**
Ameletus	2	2						
Antocha	1	1						
Arctopsyche	1	1						
Aturus	1	1						
Baetidae	6	6						
Baetis	3	4	No			X		
Baetis rhodani group	23	22	No			X		

Brachycentrus	4	4						
Chironomidae	13	13						
Cinygmula	1	1						
Diamesa	1	1						
Drunella doddsii	1	1						
Drunella spinifera	1	1						
Epeorus	5	6	No			X		
Ephemerellidae	20	20						
Eukiefferiella	12	12						
Feltria	1	1						
Heptageniidae	147	145	No			X		
Hesperoperla	1	1						
Hexatoma	1	1						
Hydropsychidae	2	2						
Isoperla	3	3						
Kogotus	5	5						
Lebertia	8	8						
Mallochohelea	4	4						
Megarcys	5	5						
Micropsectra	3	3						
Nemouridae	3	3						
Oligophlebodes	2	2						
Orthocladius complex	43	43						
Pagastia	5	5						
Parapsyche	3	3						
Parapsyche elsis	1	1						
Pericoma/Telmatoscopus	27	28	No			X		
Perlidae	5	5						
Perlodidae	2	2						
Rheocricotopus	1	1						
Rhithrogena	2	2						
Rhyacophila	7	7						
Rhyacophila betteni group	1	1						
Rhyacophila brunnea/vemna group	1	1						
Rhyacophila hyalinata group	5	5						
Roederiodes	3	3						
Serratella	1	1						
Simulium	4	4						
Sperchon	1	1						
Sweltsa	1	1						
Taeniopterygidae	1	1						
Testudacarus	1	1						

Thienemannimyia group	1	1						
Tipulidae	1	1						
Tvetenia	24	24						
Zapada	5	5						
Zapada cinctipes	47	47						
Zapada columbiana	2	2						
Zapada oregonensis group	3	3						
Total:	**478**	**478**						
					0	**5**	**0**	
% Total Misidentification Rate =	misidentifications			x100 =	0.00	**Pass**		
	total number							

Site - Batch 3 2018, Sample - RG_FODNGD1_BIC, CC# - CC191043, Percent sampled = 5%, Sieve size = 400	**Laboratory Count**	**QC Audit Count**	**Agreement**	**Misidentification**	**Questionable Taxonomic Resolution**	**Enumeration**	**Insufficent Taxonomic Resolution**	**Comments**
Ameletus	3	3						
Antocha	3	3						
Baetidae	13	13						
Baetis	3	3						
Baetis rhodani group	29	29						
Brachycentrus	2	2						
Chelifera/ Metachela	1	1						
Chironomidae	6	6						
Dicranota	1	1						
Drunella doddsii	9	9						
Epeorus	5	5						
Ephemerellidae	69	68	No			X		
Eukiefferiella	3	3						
Feltria	3	3						
Heptageniidae	247	250	No			X		
Hexatoma	2	2						
Isoperla	3	3						
Kogotus	5	5						
Lebertia	7	7						
Limnephilidae	1	1						
Mallochohelea	3	3						
Megarcys	16	16						

Micropsectra	3	3						
Nemouridae	3	3						
Neoplasta	1	1						
Oligophlebodes	1	1						
Orthocladius complex	6	6						
Pagastia	11	11						
Parapsyche	2	2						
Pericoma/Telmatoscopus	93	92	No			X		
Perlodidae	2	2						
Rheocricotopus	1	1						
Rhyacophila	1	1						
Rhyacophila	34	33	No			X		
Rhyacophila brunnea/vemna group	6	6						
Rhyacophila hyalinata group	1	1						
Serratella	1	1						
Simuliidae	1	1						
Simulium	1	1						
Sperchon	7	7						
Sweltsa	5	5						
Taeniopterygidae	24	23	No			X		
Thienemanniella	1	1						
Thienemannimyia group	1	1						
Trichoptera	1	1						
Trichoptera	2	2						
Tvetenia	4	4						
Zapada	11	11						
Zapada cinctipes	44	46	No			X		
Zapada columbiana	1	1						
Zapada oregonensis group	11	11						
Total:	**714**	**715**						
					0	**6**	**0**	
% Total Misidentification Rate =	misidentifications			x100 =	0.00	**Pass**		
	total number							

Site - Batch 3 2018, Sample - RG_FODNGD3_BIC, CC# - CC191045, Percent sampled = 5%, Sieve size = 400	Laboratory Count	QC Audit Count	Agreement	Misidentification	Questionable Taxonomic Resolution	Enumeration	Insuffcent Taxonomic Resolution	Comments
Ameletus	1	1						
Apatania	3	3						
Baetidae	3	3						
Baetis	3	3						
Baetis rhodani group	25	25						
Brachycentrus	1	1						
Chelifera/ Metachela	1	1						
Chironomidae	1	1						
Cinygmula	1	1						
Dicranota	2	2						
Drunella doddsii	6	6						
Epeorus	5	5						
Ephemerellidae	136	130	No			X		
Eukiefferiella	7	7						
Feltria	3	3						
Glossosoma	5	5						
Heptageniidae	225	221	No			X		
Hydroptila	1	1						
Isoperla	1	1						
Kogotus	14	14						
Lebertia	18	18						
Limnephilidae	1	1						
Mallochohelea	4	4						
Megarcys	12	12						
Nemouridae	3	3						
Neoplasta	2	2						
Oligophlebodes	13	13						
Orthocladius complex	2	2						
Pagastia	9	9						
Parapsyche	1	1						
Pericoma/Telmatoscopus	105	107	No			X		
Perlodidae	1	1						
Rhyacophila	43	43						
Rhyacophila atrata complex	9	9						
Rhyacophila betteni group	1	1						

Rhyacophila brunnea/vemna group	1	1						
Rhyacophila narvae	1	1						
Serratella	1	1						
Sperchon	8	8						
Sweltsa	6	6						
Taeniopterygidae	7	7						
Tanytarsini	4	4						
Thienemannimyia group	1	1						
Trichoptera	4	4						
Trombidiformes	1	1						
Tvetenia	2	2						
Zapada	2	2						
Zapada cinctipes	11	11						
Zapada columbiana	1	1						
Zapada oregonensis group	4	4						
Total:	**722**	**714**						
					0	**3**	**0**	
% Total Misidentification Rate =	misidentifications			x100 =	0.00	**Pass**		
	total number							

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Taxonomic Keys

Below is a reference list of taxonomic keys utilized by taxonomists at Cordillera Consulting. Cordillera taxonomists routinely seek out new literature to ensure the most accurate identification keys are being utilized. This is not reflective of the exhaustive list of resources that we use for identification. A more complete list of taxonomic resources can be found at Southwest Association of Freshwater Invertebrate Taxonomists. (2015). http://www.safit.org/Docs/SAFIT_Taxonomic_Literature_Database_1_March_2011.enl

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Oct 05, 2018

This report was generated for samples included in SRC Group # 2018-11603

Quality Control Report

Jennifer Ings
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Reference Materials and Standards:

A reference material of known concentration is used whenever possible as either a control sample or control standard and analyzed with each batch of samples. These "QC" results are used to assess the performance of the method and must be within clearly defined limits; otherwise corrective action is required.

QC Analysis	Units	Target Value	Obtained Value	
Aluminum	ug/g	1280	1400	
Aluminum	ug/g	1280	1400	
Aluminum	ug/g	1280	1410	
Aluminum	ug/g	1280	1420	
Arsenic	ug/g	6.87	7.30	
Arsenic	ug/g	6.87	6.86	
Cadmium	ug/g	0.299	0.295	
Cadmium	ug/g	0.299	0.295	
Chromium	ug/g	1.57	2.30	*(1)
Chromium	ug/g	1.57	1.65	
Copper	ug/g	13.8	14.2	
Copper	ug/g	13.8	13.9	
Iron	ug/g	312	329	
Iron	ug/g	312	341	
Iron	ug/g	312	317	
Lead	ug/g	0.404	0.754	*(2)
Lead	ug/g	0.404	0.424	
Manganese	ug/g	2.70	2.85	
Manganese	ug/g	2.70	2.56	
Mercury	ug/g	0.364	0.337	
Mercury	ug/g	0.364	0.372	
Nickel	ug/g	1.20	1.89	*(3)
Nickel	ug/g	1.20	1.18	
Selenium	ug/g	3.74	3.78	
Selenium	ug/g	3.74	3.74	
Silver	ug/g	0.0215	0.0212	
Silver	ug/g	0.0215	0.0212	
Zinc	ug/g	47.8	48.4	
Zinc	ug/g	47.8	47.0	

Oct 05, 2018

This report was generated for samples included in SRC Group # 2018-11603

Duplicates:

Duplicates are used to assess problems with precision and help ensure that samples within a given batch were processed appropriately. The difference between duplicates must be within strict limits, otherwise corrective action is required. Please note, the duplicate(s) in this report are duplicates analyzed within a given batch of test samples and may not be from this specific group of samples.

Duplicate Analysis	**Units**	**Sample ID**	**First Result**	**Second Result**
Moisture	%	37107	81.20	79.69
Moisture	%	37112	82.01	78.96
Moisture	%	37124	86.63	90.04

Please note, duplicates could not be analyzed for ICP due to insufficient sample available.

*(1) (2) (3) The Chromium, Lead and Nickel resuls for the quality control sample were just outside the specified limits. The data was reviewed and additional quality control measures in the same batch were within specified limits.

Overall, there were no other indications of problems with the analysis and the results were considered acceptable.

Roxane Ortmann - Quality Assurance Supervisor

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Jan 04, 2019

This report was generated for samples included in SRC Group # 2018-15385

Quality Control Report

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Reference Materials and Standards:

A reference material of known concentration is used whenever possible as either a control sample or control standard and analyzed with each batch of samples. These "QC" results are used to assess the performance of the method and must be within clearly defined limits; otherwise corrective action is required.

QC Analysis	Units	Target Value	Obtained Value
Aluminum	ug/g	1280	1330
Arsenic	ug/g	6.87	7.19
Cadmium	ug/g	0.299	0.310
Chromium	ug/g	1.57	1.62
Copper	ug/g	13.8	15.9
Iron	ug/g	312	296
Lead	ug/g	0.404	0.483
Manganese	ug/g	2.70	2.74
Mercury	ug/g	0.364	0.405
Nickel	ug/g	1.20	1.24
Selenium	ug/g	3.74	3.77
Silver	ug/g	0.0215	0.0183
Zinc	ug/g	47.8	46.8

Duplicates:

Duplicates are used to assess problems with precision and help ensure that samples within a given batch were processed appropriately. The difference between duplicates must be within strict limits, otherwise corrective action is required. Please note, the duplicate(s) in this report are duplicates analyzed within a given batch of test samples and may not be from this specific group of samples.

Duplicate Analysis	Units	Sample ID	First Result	Second Result
Moisture	%	51767	75.09	78.70

Please note, duplicates could not be analyzed for ICP due to insufficient sample available.

All quality control results were within the specified limits and considered acceptable.

Roxane Ortmann - Quality Assurance Supervisor

Table G.1: Field Duplicate (Split Sample) Results for Sediment Chemistry Samples

Analyte		Units	RG_HENUP			RG_FOUKI		
			L2162034			L2162034		
			RG_HENUP2_SE_20180906-1120	RG_DUP_SE_20180906-1120	RPD	RG_FOUKI1_SE_20180907-1515	RG_DUP_SE_20180907-1515	RPD
			6-Sep-18	6-Sep-18	-	7-Sep-18	7-Sep-18	-
Physical Tests	Moisture	%	38.7	44.1	13%	84.8	83.2	2%
Particle Size	% Gravel (>2 mm)	%	33	11.9	94%	23.9	<1.0	184%
	% Sand (2.00 mm - 1.00 mm)	%	2.2	2.8	24%	<1.0	<1.0	0%
	% Sand (1.00 mm - 0.50 mm)	%	4.5	5.9	27%	<1.0	<1.0	0%
	% Sand (0.50 mm - 0.25 mm)	%	8.0	10.6	28%	1.2	<1.0	18%
	% Sand (0.25 mm - 0.125 mm)	%	10.1	13.5	29%	4.2	4.2	0%
	% Sand (0.125 mm - 0.063 mm)	%	11.9	14.8	22%	7.0	7.5	7%
	% Silt (0.063 mm - 0.0312 mm)	%	12.7	17.9	34%	25.9	34.1	27%
	% Silt (0.0312 mm - 0.004 mm)	%	14.8	19.6	28%	30.7	42.4	32%
	% Clay (<4 µm)	%	2.8	3.0	7%	5.8	9.8	51%
	Texture	-	Sandy loam	Sandy loam	-	Silt loam	Silt loam	-
Organic Carbon	Total Organic Carbon	%	6	6.3	5%	14.3	14.7	3%
Total Metals	Aluminum (Al)	mg/kg	4,780	6,110	24%	5,300	4,960	7%
	Antimony (Sb)	mg/kg	0.12	0.16	29%	0.45	0.41	9%
	Arsenic (As)	mg/kg	2.22	2.67	18%	3.98	3.61	10%
	Barium (Ba)	mg/kg	37	44	16%	211	235	11%
	Beryllium (Be)	mg/kg	0.23	0.31	30%	0.36	0.42	15%
	Bismuth (Bi)	mg/kg	<0.20	<0.20	0%	<0.20	<0.20	0%
	Boron (B)	mg/kg	<5.0	6.8	31%	6.8	7.9	15%
	Cadmium (Cd)	mg/kg	0.42	0.51	19%	1.62	1.67	3%
	Calcium (Ca)	mg/kg	211,000	261,000	21%	77,700	91,000	16%
	Chromium (Cr)	mg/kg	12.6	15.6	21%	14.6	11.3	25%
	Cobalt (Co)	mg/kg	2.24	2.62	16%	6.31	6.11	3%
	Copper (Cu)	mg/kg	3.3	3.8	14%	12.1	11.6	4%
	Iron (Fe)	mg/kg	5,900	6,810	14%	12,600	12,200	3%
	Lead (Pb)	mg/kg	3.2	3.9	19%	6.2	6.9	10%
	Lithium (Li)	mg/kg	12.5	18.0	36%	6.6	7.2	9%
	Magnesium (Mg)	mg/kg	57,200	61,200	7%	13,800	13,700	1%
	Manganese (Mn)	mg/kg	213	248	15%	984	1030	5%
	Mercury (Hg)	mg/kg	0.0155	0.0193	22%	0.0410	0.0413	1%
	Molybdenum (Mo)	mg/kg	0.48	0.66	32%	1.23	1.21	2%
	Nickel (Ni)	mg/kg	14.1	16.0	13%	44.4	43.9	1%
	Phosphorus (P)	mg/kg	676	844	22%	1,170	1,200	3%
	Potassium (K)	mg/kg	930	1,290	32%	1,300	1,210	7%
	Selenium (Se)	mg/kg	0.51	0.61	18%	6.36	5.68	11%
	Silver (Ag)	mg/kg	<0.10	<0.10	0%	0.14	0.15	7%
	Sodium (Na)	mg/kg	181	202	11%	83	80	4%
	Strontium (Sr)	mg/kg	91.3	113	21%	66.0	95	36%
	Sulfur (S)	mg/kg	<1000	<1000	0%	1400	1300	7%
	Thallium (Tl)	mg/kg	0.081	0.113	33%	0.147	0.144	2%
	Tin (Sn)	mg/kg	<2.0	<2.0	0%	<2.0	<2.0	0%
	Titanium (Ti)	mg/kg	45.7	56.5	21%	15.7	12.9	20%
	Tungsten (W)	mg/kg	<0.50	<0.50	0%	<0.50	<0.50	0%
	Uranium (U)	mg/kg	0.62	0.79	24%	0.85	0.96	12%
	Vanadium (V)	mg/kg	12.6	15.9	23%	24.1	21.7	10%
	Zinc (Zn)	mg/kg	83.2	97	15%	137.0	139	1%
	Zirconium (Zr)	mg/kg	<1.0	1.1	10%	<1.0	<1.0	0%
Polycyclic Aromatic Hydrocarbons	Acenaphthene	mg/kg	<0.0050	<0.0050	0%	<0.15	<0.14	7%
	Acenaphthylene	mg/kg	<0.0050	<0.0050	0%	0.022	0.019	15%
	Acridine	mg/kg	<0.010	<0.010	0%	<0.030	<0.027	11%
	Anthracene	mg/kg	<0.0040	<0.0040	0%	<0.012	<0.011	9%
	Benz(a)anthracene	mg/kg	<0.010	<0.010	0%	0.108	0.090	18%
	Benzo(a)pyrene	mg/kg	<0.010	<0.010	0%	0.061	0.051	18%
	Benzo(b&j)fluoranthene	mg/kg	<0.010	<0.010	0%	0.160	0.135	17%
	Benzo(e)pyrene	mg/kg	<0.010	<0.010	0%	0.172	0.145	17%
	Benzo(g,h,i)perylene	mg/kg	<0.010	<0.010	0%	0.076	0.068	11%
	Benzo(k)fluoranthene	mg/kg	<0.010	<0.010	0%	<0.030	<0.027	11%
	Chrysene	mg/kg	<0.010	<0.010	0%	0.406	0.347	16%
	Dibenz(a,h)anthracene	mg/kg	<0.0050	<0.0050	0%	<0.033	<0.032	3%
	Fluoranthene	mg/kg	<0.010	<0.010	0%	0.075	0.058	26%
	Fluorene	mg/kg	<0.010	<0.010	0%	0.403	0.365	10%
	Indeno(1,2,3-c,d)pyrene	mg/kg	<0.010	<0.010	0%	<0.030	<0.027	11%
	1-Methylnaphthalene	mg/kg	0.025	0.028	11%	1.690	1.510	11%
	2-Methylnaphthalene	mg/kg	0.039	0.044	12%	2.930	2.590	12%
	Naphthalene	mg/kg	0.014	0.016	13%	0.790	0.696	13%
	Perylene	mg/kg	<0.010	<0.010	0%	<0.030	<0.027	11%
	Phenanthrene	mg/kg	0.026	0.029	11%	1.720	1.520	12%
	Pyrene	mg/kg	<0.010	<0.010	0%	0.124	0.103	19%
	Quinoline	mg/kg	<0.010	<0.010	0%	<0.030	<0.027	11%
	d10-Acenaphthene	%	75.6	70.6	7%	65.9	60.4	9%
	d12-Chrysene	%	92.9	91.5	2%	83.6	72.2	15%
	d8-Naphthalene	%	70.9	67.2	5%	59.5	54.4	9%
	d10-Phenanthrene	%	85.9	83.8	2%	78.8	71.8	9%
	B(a)P Total Potency Equivalent	mg/kg	<0.020	<0.020	0%	0.112	0.096	15%
	IACR (CCME)	mg/kg	<0.15	<0.15	0%	1.87	1.59	16%

▨ Relative Percent Difference greater than 40%.

Note: For calculation of the RPD, laboratory reporting limit (LRL) values were used in cases where the reported value was below the LRL.