# ELK RIVER ALLIANCE

# COMMUNITY-BASED WATER MONITORING

2020 MONITORING REPORT





PREPARED BY: THE ELK RIVER ALLIANCE, FERNIE BC

WITH FINANCIAL SUPPORT FROM: THE BC COMMUNITY GAMING GRANT, THE REAL ESTATE FOUNDATION OF BC HEALTHY WATERSHED INITIATIVE, COLUMBIA BASIN TRUST, AND PUBLIC STAKEHOLDERS

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# Land Acknowledgment

#### ERA operates within the ?amak̈́?is Ktunaxa, the Traditional Territory of the Ktunaxa Nation.

For more than 10,000 years, the Ktunaxa people have occupied their traditional territory, the ?amaḱ?is Ktunaxa, which spans from southwestern Canada into parts of the United States. (Ktunaxa Nation Council 2022) The Elk River flows through part of this traditional territoty, the Qukin ?amaḱ?is, or the land of the raven. Prior to European settlement, the Ktunaxa people seasonally migrated throughout this land, following vegetation and hunting cycles. The introduction of European settlers in the late 1800s and the creation of Indian reservations marked and the beginning of large land-use changes and a long history of resource development.



# **Executive Summary**

The Elk River Alliance's (ERA) Community-based Monitoring program (CBWM) was established in 2012 as a response to rising community concern over the health of the Elk River Watershed. The primary purpose of the program is to fill in gaps in currently available watershed data and to make these data accessible to the wider community. In 2020, ERA's CBWM program transitioned into a fully CABIN (Canadian Aquatic Biomonitoring Network) based program, adopting these nationally recognized protocols to assess 10 sites across 5 tributaries of the Elk River, all affected by different types of land-use and development.

The Elk Valley has a long history of resource development following European arrival more than 100 years ago. Currently the valley is home to 4 active steelmaking coal mines, with two additional mines and a mine extension currently submitted for regulatory review. Following a long period of moderate timber extraction over the past century, the valley is experiencing a rapid increase in the rate and volume of clearcut timber harvesting by a private logging operation. Growing urban centers and linear development such as road, rail, power and natural gas also have their impacts on the Elk River and its tributaries. Since extensive government and industry water monitoring programs focus on the effects of mining operations, the Elk River Alliance's CBWM program to date has examined the impacts of other land uses on five tributaries which are not affected by current mining operations.

Analysis of 2020 sampling data indicates most sites were in relatively good condition when compared to reference sites with little or no human disturbance. Exceptions to this were the the lower Coal Creek and Morrissey Creek sites (COL001, MOR001), which contained benthic macroinvertebrate communities that differ from what would be expected if the site was unaffected by disturbance. All water chemistry parameters measured were below the water quality guidelines designated by the BC government; however, both sites are downstream of moderate to high current and historical land use activities, particularly logging. Each of these two streams are new to the program, with Coal Creek added in 2019 and Morrissey in 2020. Other sites with a longer history in the CBWM program show fluctuating conditions over time. Long-term data will allow for a greater understanding of the relative role of natural and human-influenced processes in these areas. CBWM assessments continued in 2021, with plans for program expansion in 2022.



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- Stella Swanson, ERA Board of Directors (Program Advisor)
- Ashlee Jollymore, ERA Board of Directors (Program Advisor)
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BRITISH COLUMBIA





The **Healthy Watersheds Initiative** is a \$27-million program, supported by the Province of BC, to stimulate British Columbia's economic recovery through investments in community-driven watershed conservation and restoration projects. Through this program, the Real Estate Foundation of BC, in partnership with Watersheds BC, is administering grants for more than 60 watershed security projects in communities across the province.

#### https://refbc.com/healthy-watersheds-initiative

The **Real Estate Foundation of BC** is a philanthropic organization that works to advance sustainable land use and real estate practices in British Columbia. Since 1988, the REFBC has granted more than \$90 million for research, education, and policy projects that strengthen BC communities and protect our land and water.

#### https://refbc.com

**Watersheds BC** was launched in 2020 to support water leaders to improve decision-making for their home waters by equipping them with the knowledge, skills, and connections they need to engage effectively in their watershed. WBC supports water leaders across many organizations including First Nation communities and governments, local government staff, watershed boards and roundtables, provincial government staff, and other community champions.

#### https://www.watershedsbc.ca

The **Province of BC** has invested \$37 million (including \$27 million through the Healthy Watersheds Initiative) for projects that support healthy watersheds, species, and ecosystems, and create new jobs in areas that are critical to help communities adapt to the effects of climate change. This funding is part of the Province's \$10-billion COVID-19 response to help people in hard-hit industries.

https://strongerbc.gov.bc.ca



# Introduction

# The Elk River Alliance

Operating since 2010, the Elk River Alliance (ERA) is a community-based water group that aims to connect people to the Elk River ensuring it is drinkable, fishable, and swimmable for future generations. ERA aims to improve and preserve watershed health through projects that raise watershed literacy, inform sustainable water decision-making, collect scientific data to prioritize restoration opportunities, and promote safe and sustainable river recreation. ERA is a registered charity that is governed by a volunteer board consisting of board members from various backgrounds.

ERA has four guiding principles: (1) Stimulate conversation, share information, and facilitate community input to encourage sustainable water decision-making in the Elk Valley; (2) Promote a new era in watershed thinking by coordinating a community voice to contribute to watershed planning and management activities, regulatory processes, and other regional water initiatives; (3) Bring together diverse points of view and offer a safe place to dialogue about the Elk River, and; (4) Unite not divide.

## Advisor Credentials

Stella Swanson, Ph.D. Limnology (Director, Chair of the Program & Technical Working Group)

Stella's 42 year-career has included management of the Aquatic Biology Group at the Saskatchewa Research Council and consulting with SENTAR Consultants and Golder Associates, Ltd. She has owned and operated Swanson Environmental Strategies since 2007, where she focuses on environmental risk management, indigenous and community engagement, and sustainability. Stella has contributed to dozens of environmental impact assessments and provides strategic advice regarding the regulatory requirements for specific projects as well as guidance in support of the requirement to demonstrate sustainability under the Impact Assessment Act. She led the development of a new generation of monitoring design approaches for Terrestrial Biological Monitoring, focused on monitoring for cumulative effects within the Oil Sands Monitoring Program and was recently appointed to the Nuclear Waste Management Advisory Council to provide advice on siting a high-level nuclear waste facility. More locally, she led the original development of the Elk Valley Cumulative Effects Management Framework, and was the chair of the Strategic Advisory Panel for Selenium Management.

Ashlee Jollymore, Ph.D. Resource Management Studies (Director, Vice Chair)

Ashlee is a hydrologist for the provincial government in the River Forecast Centre and has experience in forestry, land management and sustainable development.

## Staff Credentials

Chad Hughes, Executive Director, B.Sc. Environmental Science

Beth Millions, Ecologist, M.Sc. Environmental Science

Kaileigh McCallum, Junior Ecologist, M.Sc. Biodiversity & Conservation

Chad Hughes and Beth Millions were trained and received CABIN Field Technician level certification



through the Canadian Rivers Institute and Living Lakes Canada (LLC). LLC also provided training on the new STREAM e-DNA program.

Kaileigh McCallum joined ERA in March 2021. Following the completion of Project Manager level CABIN certification, she was responsible for the 2020 CBWM analysis and reporting,

# Community-based Water Monitoring (CBWM)

The Elk River Alliance's Community Based Water Monitoring (CBWM) program collects baseline data on aquatic habitat health and increases community water literacy in the Elk River Watershed, located in the East Kootenay Region of the Province. The program was created to fill gaps in watershed data, with findings creating an opportunity for community and industry discussion on watershed health and providing contextual information to decision makers. The program involves trained staff and volunteers conducting monitoring and research on targeted Elk River tributaries and sharing relevant findings with the community.

The valley's long-standing relationship with coal mining has resulted in the formation of extensive government and industry water monitoring programs covering a large extent of mine-affected areas. However, aquatic health of non-mine affected tributaries is not monitored despite impacts from other forms of land use. The Elk River alliance's Community Based Water Monitoring program began monitoring the effects of land use on non-mine affected Elk River tributaries to allow for a more well-rounded assessment of the state of the watershed. This program has expanded to now include five Elk River tributaries.

## Study Area

The focus of ERA's CBWM program covers the spatial extent of the Elk River Watershed, located within the East Kootenay region of British Columbia. This watershed begins at the Elk Lakes in the North and extends to Lake Koocanusa in the South. The Elk River serves the communities of the Elk Valley, from Elkford to Tobacco Plains and the CBWM program incorporates these areas/communities and their interests.

In 2020, the CBWM program assessed a total 10 sites across 5 major tributaries – Lizard Creek, Alexander Creek, Coal Creek, Boivin Creek and Morrissey Creek (Figure 1). All of these sites were chosen because they are areas of community concern or contain good aquatic habitat that ERA would like to monitor, preserve, or restore.



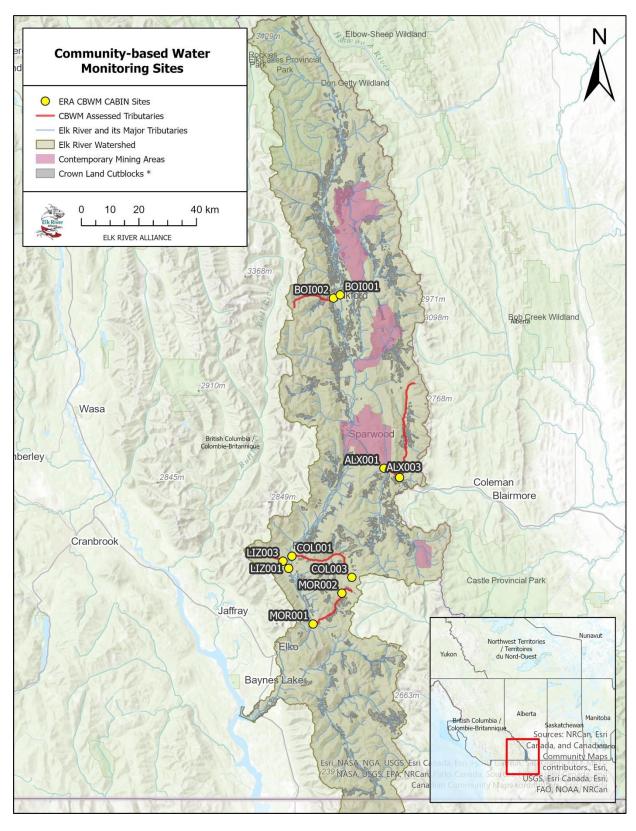


Figure 1. Elk River watershed (British Columbia) and CBWM site locations. ERA sites are chosen based on community concern and focus largely non-mine affected tributaries. 2020 study locations include Boivin Creek, Alexander Creek, Lizard Creek, Coal Creek and Morrissey Creek.



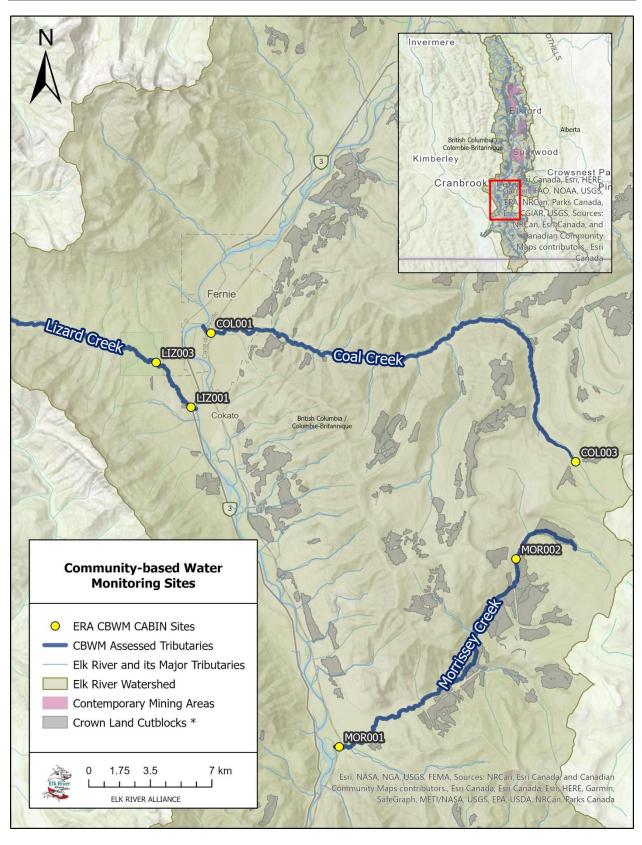


Figure 2. Close-up of Lizard Creek (LIZ001, LIZ003), Coal Creek (COL001, COL003) and Morrissey Creek (MOR001, MOR002), the southern-most study sites in the CBWM program.

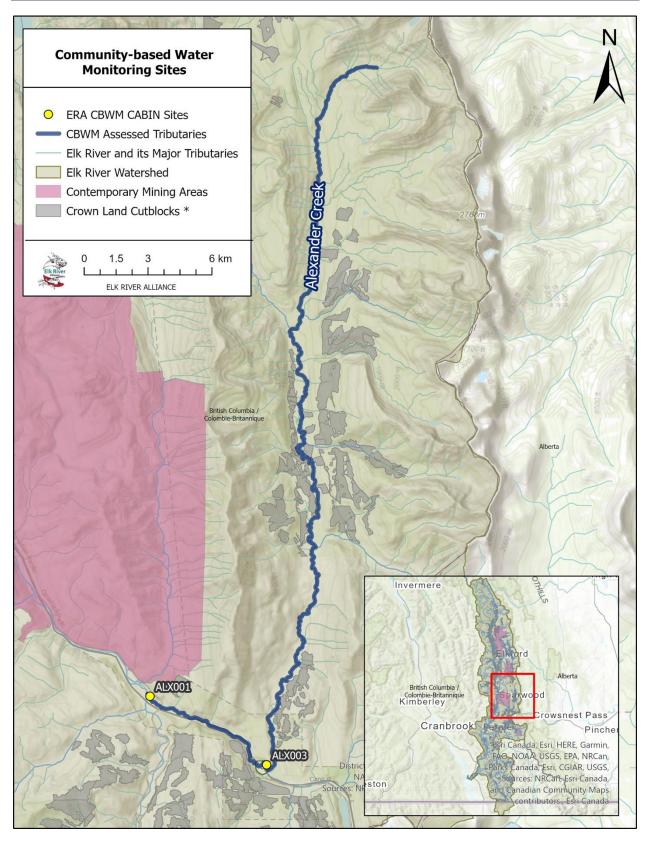


Figure 3. Alexander Creek site locations (ALX001, ALX003), just East of Sparwood, BC.

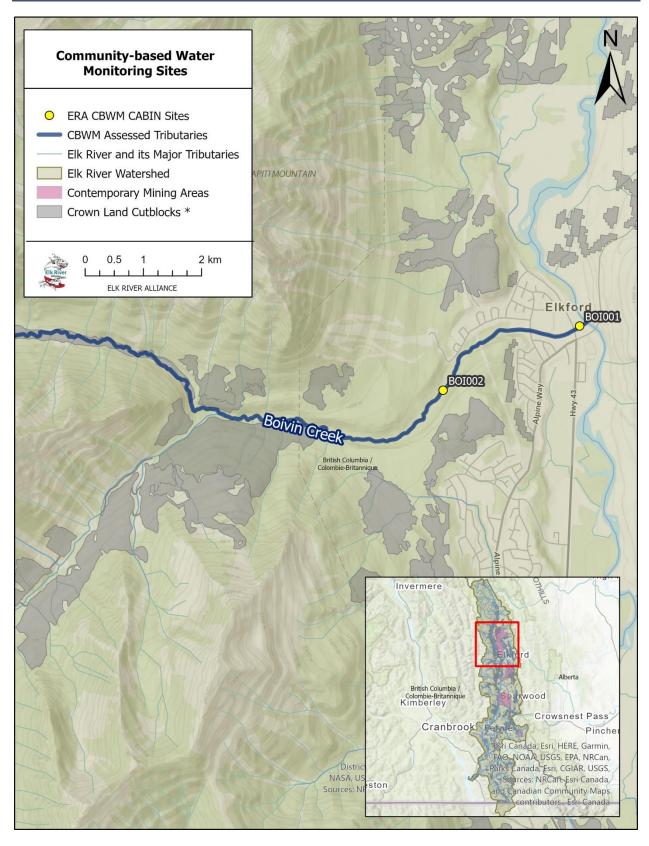


Figure 4. CBWM sites (BOI001, BOI002) on Boivin Creek in Elkford.



# Lizard Creek

Lizard Creek, located approximately 5km south of Fernie, was the first Elk RIver tributary for ERA's CBWM program. It was initially created as a 'reference site' in 2011 since at the time, the creek and its catchment had relatively little development or industrial activity. A large amount of the lower portion of this creek falls within Mount Fernie Provincial Park and is protected. Upstream of the Provincial Park is Island Lake, a hotel and cat skiing area with access roads. Residential development in close proximity to the creek began in 2018. Lizard Creek has continued to be monitored as it contains important spawning grounds for Westslope Cutthroat Trout (Elk River Alliance 2020).

Since 2018, the Lizard Creek catchment downstream of the provincial park has seen increasing urban and road development. ERA will continue to pay special attention to these sites as the surrounding land-use changes.

LIZ001



Figure 5. Images of LIZ001: upstream across the stream and down stream.

#### LIZ003



Figure 6. Images of LIZ003: upstream, across the stream and downstream.



## Alexander Creek

In 2012, sites were established along Alexander Creek. This creek was identified as important due to its role as a significant tributary into Michel Creek, as well as the absence of effects from mining and urban development. The placement of sites along Alexander Creek allowed ERA to expand monitoring efforts into the Sparwood area. Sites along the creek were established to monitor effects related to stream proximity to the Crowsnest Highway, local logging and cattle grazing leases in the area.

The proposed Crown Mountain coal mine in the upper reaches of Alexander Creek poses an additional source of stressors, and continued monitoring here will provide baseline data for pre-mining conditions (NWP Coal Canada Ltd. 2014).

#### ALX001



Figure 7. Images of ALX001: upstream, across the stream and downstream.

#### ALX003



Figure 8. Images of ALX003: upstream, across the stream and downstream.



#### Boivin Creek

In 2018, Boivin Creek was selected in order to include Elkford in CBWM activities, and to contribute to a greater understanding of tributaries further upstream in the watershed. Boivin Creek was chosen for its undeveloped upstream catchment and to understand the effects of urban development and extensive rip-rap in its lower reaches.

#### BOI001



Figure 9. BOI001: upstream, across the stream and downstream.

#### BO1002



Figure 10. BOI002: upstream, across the stream and downstream.



# Coal Creek

Coal Creek was added to the CBWM program in 2019. Previously, this creek purportedly contained good quality habitat for Westslope Cutthroat Trout; however, few spawning sites were identified by ERA in a 2019 redd survey (Elk River Alliance 2020). Historical mining, logging, forestry, access roads, recreational trails/activities, and the old Fernie landfill are all likely stressors on this catchment. In recent years, increased clearcut logging activity and associated road development along Coal Creek continues to alter the waterways in this catchment area.

#### COL001



Figure 11. COL001: upstream, across the stream and downstream.

#### COL003



Figure 12. COL003: upstream, across the stream and downstream.



## Morrissey Creek

The Morrissey Creek sites are the newest additions to ERA's CBWM monitoring locations, added in 2020 due to the presence of good quality trout spawning habitat coupled with logging, resource road use and and cattle grazing activities in the catchment. Monitoring this creek is essential in understanding and potentially mitigating the effects of logging, linear development (forestry roads, gas lines), recreational use (vehicle and ATV access), agriculture, and natural erosion that may degrade Morrissey Creek.

#### *MOR001*



Figure 13. MOR001: upstream, across the stream and downstream.

#### MOR002



Figure 14. MOR002: upstream, across the stream and downstream.



# **Background Information**

# CABIN

2020 marked the completion of the CBWM program's transition from Streamkeepers-based stream assessment protocols to CABIN (Canadian Aquatic Biomonitoring Network) protocols for the assessment of aquatic health. CABIN is a nationally recognized program that uses a "reference system approach" to assess aquatic ecosystem condition and was designed with community-based water monitoring in mind.

The reference system approach to assessment means study sites or "test sites" are compared to 'reference sites', or sites considered to be in pristine condition. CABIN uses a combination of physical, chemical and biological parameters, to statistically categorize a test site and analyze it in comparison to reference sites with similar hydrologic (amounts and quality of water), geomorphic (stream bed, channel features and bank forms) and geographic (topography, geology, climate, vegetation, and human setting) characteristics. The assumption is a test site in good condition will have similar assessed values to the associated reference sites, and the more polluted or poor quality the site is, the farther it will diverge from reference site conditions.

The use of CABIN protocols has greatly improved ERA's ability to produce data comparable to monitoring data collected by other organizations, government, and industry, increasing the validity of ERA's work and facilitating better data sharing.

## Habitat Variables

Physical habitat variables play a critical role in stream health. Underlying geology, substrate, local vegetation, surrounding land-use and specific channel characteristics all contribute to the ambient state of flowing water. CABIN uses these characteristics, depending on the specific model, to categorize and analyze test sites. The physical characteristics of a study site are used to assign the site to a reference group for comparison.

These physical characteristics are important because the natural "pristine" state of a site is dependant these traits. For example, a creek with limestone (alkaline/basic) as the primary underlying rock, will naturally have a higher pH than a stream with sandstone (more acidic) as the base. If the CABIN test site was not categorized to a suitable reference site, results would not accurately assess the health of an area, and high pH could be seen as the result of a pollutant rather than a natural occurrence.



# **Physical Properties**

The physical properties of water – colour, temperature, turbidity, taste and odour - are also useful indicators of what is occurring within a stream. CBWM assesses both temperature and turbidity to better understand the condition of studied sites.

The *temperature* of a stream needs to remain within certain limits for healthy aquatic life, and many species take their life stage cues from temperature changes in the water. For example, Westslope Cutthroat Trout (WCT) begin migration to spawning grounds when the temperature is between 7-10 degrees Celsius (Bear, McMahon, and Zale 2007). Figure 15 includes a visual representation of temperature limits for the survival of adult WCT. In green is the optimal temperature range for this species, with the orange-red showing the sub-optimal, or increased stress range. The bright red colour signifies the range at which the temperature increase becomes lethal for WCT. Outside of these temperatures, WCT do not survive.

Temperature is closely correlated with dissolved oxygen levels. Colder water contains higher oxygen levels, which are critical for the majority of stream life in the Rockies. Elevated water temperatures during WCT life stages such as embryo development (when oxygen requirements are particularly high) may result in embryo death or high mortality of alevins (a very young life stage, just after emergence from the egg). For example, if an early spring heat wave occurs and water temperature rises above 12°C, oxygen levels will fall below the guideline for protection of embryos and alevins (British Columbia Ministry of Environment and Climate Change Strategy 2021).

# Temperature

Temperature affects many physiological aspects of an animal's life, especially their metabolism. Elk River Alliance monitors the water temperature in the Elk River watershed to measure annual and seasonal temperature variation.

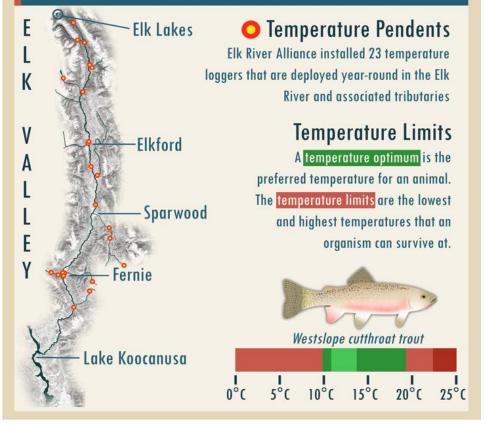


Figure 15. ERA Infographic outlining the importance of temperature to aquatic systems.





Turbidity is a measure of the ability of light to pass through water and is usually a reflection of the amount of sediment ((B.C. Ministry of Environment and Climate Change Strategy 2021c). Excess sediment can negatively effect aquatic life - reduces the amount of sunlight reaching aquatic plants and organisms, settles on the bottom of the stream reducing habitat for benthic invertebrates and smothering fish eggs (Figure 16)

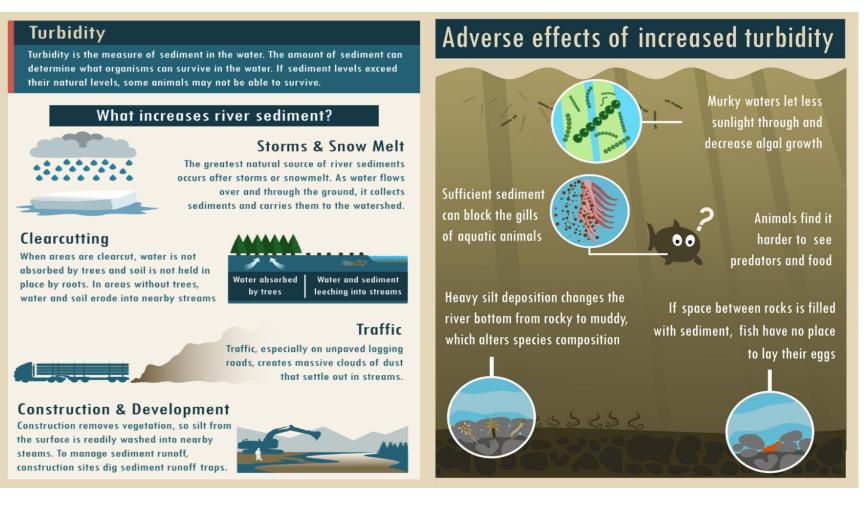


Figure 16. ERA CBWM inforgraphic explaining turbidity and its importance.



# Water Chemistry

Water chemistry parameters are important indicators of water quality. These parameters provide insight into the processes happening within a stream and the health of aquatic systems. Changes in water chemistry variables can signify landscape level changes or the introduction of new pollutants.

PH, dissolved oxygen and conductivity are all basic parameters measured as part of CABIN protocols. Aquatic life can only survive in water that falls within a specific range of water quality parameters. Unusually high or low measurements for any of these variables may suggest a problem in the stream.

Aquatic life requires water to be saturated with enough oxygen for them to breathe easily. The amount of *dissolved oxygen* in water affects the types of aquatic life present and its health. The lower the oxygen content, the less life that is able to persist in the water.

Significant changes in pH can also negatively affect aquatic life. Pure distilled water has neutral pH of 7. The local geology of an area can result in water that is alkaline or acidic. In the Elk River watershed, rivers are more alkaline due to a limestonebased geology, and aquatic organisms have adapted to these conditions. When pH levels deviate from the original, natural ambient conditions, there may be effects on the health of

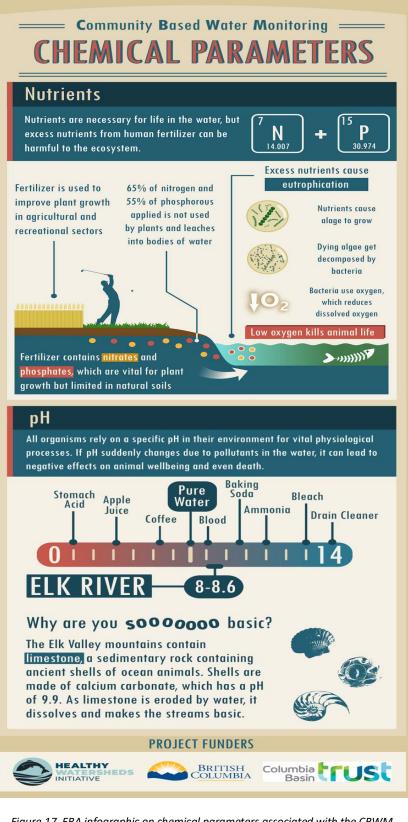


Figure 17. ERA infographic on chemical parameters associated with the CBWM program.



aquatic organisms and partial or complete changes in species composition. For example, decreases in pH can damage fish gills and cause difficulties in their ability to uptake oxygen and transport it to their bloodstream. On the other extreme, increases in pH can increase the concentration of the more toxic forms of ammonia in the water, killing fish quickly. (B.C. Ministry of Environment and Climate Change Strategy 2021b). Significant changes in pH are often a result of metals, nutrients and other pollutants discharged into the waterbody.

Conductivity is another measure that can indicate changes in aquatic health. It is a measure of the ability of water to pass an electrical current. Conductivity increases when there are more dissolved mineral salts (Chapman 1996). Significant changes in conductivity can be indicative of increased or decreased mineral salts dissolved in the water. In the Elk Valley, high conductivity in stream water is often associated with groundwater influence (because groundwater naturally has higher concentrations of salts); however, an increase in conductivity may point to increased human disturbance. Mining commonly causes increased sulphate concentrations in surface waters. Sodium, calcium, or potassium chloride runoff due to road salting is another common source of increased conductivity.

Changes in physical and chemical parameters which fall outside of the range of natural variability can cause a cascade of effects on the diversity and productivity of aquatic life. If such changes are observed, further monitoring should be initiated to explore different local stressors as potential causes. From here, additional required mitigation and management measures can be identified. For example, if elevated water temperatures in areas known to be important for WCT spawning are shown to be connected to less vegetation along the streambanks providing shade, mitigation may include planting of fast-growing riparian species such as willow. For example, if elevated to less vegetation along the streambanks providing of fast-growing riparian species such as willow. For example, if elevated to less vegetation along the streambanks providing of fast-growing riparian species such as willow. For example, if elevated to less vegetation along the streambanks providing shade, mitigation may include planting of fast-growing riparian species such as willow. If CABIN analyses show a test site in poor condition, water chemistry results can provide vital insight into what is occurring in the system. Often, long term monitoring is needed to detect unusual changes in parameters such as conductivity, and then identify unnatural changes to stream chemistry.

# Benthic Invertebrates

A "biological indicator" is an organism that can be used to monitor the health of an ecosystem. CABIN uses benthic macroinvertebrates (small aquatic insects and other species such as aquatic worms) as biological indicators of stream health. While water chemistry variables can provide a "snapshot" of what is happening at a distinct moment in time within an aquatic system, benthic organisms experience the cumulative effects of all the physical and chemical stressors interacting within this system over time. Benthic organisms tend to remain in one general location and can be an indicator of the effects of activities associated with land uses in that area. Changes in the health of an aquatic systems are reflected in the structure of the communities of these organisms within it.

In general, aquatic communities consist of groups (taxa) that are tolerant to pollution and those that are sensitive to it. By comparing the amount of tolerant versus intolerant groups in a community, assumptions can be made about the overall health of a system. For example, mayflies (*Ephemeroptera*), stoneflies (*Plectoptera*) and caddisflies (*Trichoptera*) are all, generally, considered to be sensitive to pollution, while groups like midges (*Chironomidae*), leeches (*Hirudinea*) and worms (*Naididae*) are considered to be more tolerant to pollutants. A high number of midges, leeches and worms and little of anything else is a likely indication of a stream in poor condition (Figure 18).



CABIN assessments use the composition of the benthic macroinvertebrate community (at the taxonomic level of family) within the stream, and their sensitivities, to make assumptions about the health of the system.

# STREAM e-DNA

In 2020, the CBWM program was further expanded to include participating in STREAM e-DNA sampling; a trial for a future phase of CABIN monitoring, where additional benthic invertebrate samples are collected and analyzed to a finer taxonomic resolution using DNA analysis (Wright, Robinson, and Hajibabaei 2020). This means benthic organisms can be identified to the species level. STREAM e-DNA is not currently part of the CABIN analysis process, and the aim of these trials is to potentially incorporate this feature in future monitoring efforts.

Although DNA analysis only produces data on presence versus absence of benthic species, it may prove helpful for the early identification of pathogenic species. For example, the *Tubifex tubifex* species of worm can host whirling disease (*Myxobolus cerebralis*), and the presence of *T. tubifex* may indicate a reach is vulnerable to whirling disease infection.

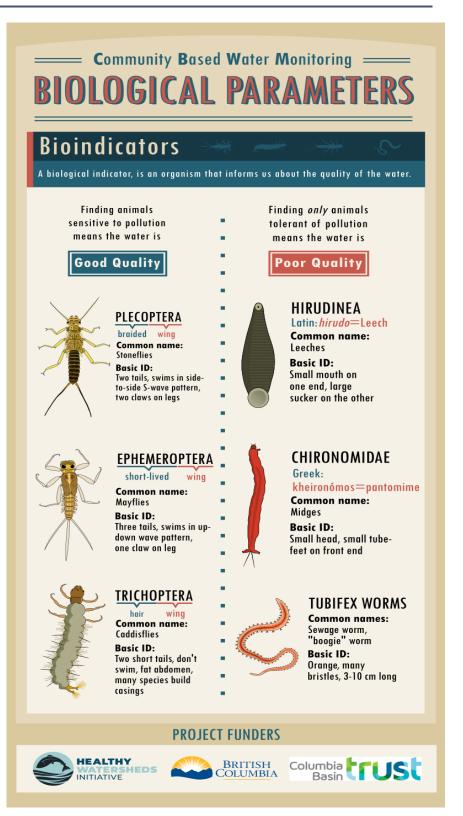


Figure 18. ERA infographic outlining the biological parameters associated with the CBWM program.

**Flk River Alliance** 



# Methods

# Site Selection

The Elk River Alliance's CBWM sites are chosen based on community input or the presence of important habitat that warrants monitoring. Areas of interest are identified using a combination of GIS (Geographic Information System) and in-person assessments. Representative sites along a creek are chosen to capture the effects of different types of land-use or disturbance. Typically, sites are placed upstream and downstream of suspected impacts or stressor source point. Sites may also be placed just above the confluence of tributaries to gain an overall idea of water quality and stream habitat health within a catchment.

# Stream Assessment

Study sites were assessed using the techniques outlined in the Canadian Aquatic Biomonitoring Network (CABIN) Field Manual for Wadeable Streams (Carter 2012).

At each site, a detailed site description is recorded, including GPS location, surrounding land-use, site drawing, and photographs. Reach (the length of the creek included in the "study site") characteristics are then recorded. This includes information on habitat types, canopy coverage, streamside vegetation and the amount of macrophyte (aquatic plants) and periphyton (organisms growing on submerged surfaces – ie. algae, cyanobacteria, etc.) coverage.

Water chemistry measurements and samples are taken at the lower end of the reach to avoid disturbing benthic macroinvertebrate communities. This includes the collection of on-site water quality parameters (temperature, dissolved oxygen, pH, conductivity, ORP, turbidity), and any samples that need to be taken for laboratory analysis (metals, nutrients, ions).

Next, the benthic macroinvertebrates are collected using the "kick-net" method, which includes 3 minutes of travelling backwards upstream, with a large net placed on the bottom of the stream, and aggressively kicking rocks to send any insects hanging on into the kick-net. Organisms and material collected in the net during these 3 minutes is moved into a sample jar and preserved with the appropriate chemicals.

When STREAM protocols are included, 3 additional 'kick-net' samples are collected, prior to the standard CABIN "kick-net" sampling, using the same protocol but with full decontaminations of the equipment and sampler before each round (Wright, Robinson, and Hajibabaei 2020). Since STREAM focuses on taxonomic identification through DNA, proper decontamination is necessary to avoid tainting the samples. Benthic invertebrate sampling is always performed beginning downstream and moving upwards. STREAM samples are again collected in sampling jars and preserved according to STREAM protocols. In 2020, only the lower sites on each creek were included in the STREAM program (i.e., COL001, MOR001 etc.).

CABIN requires the sampler to collect information on substrate characteristics. This includes following the kick-net path while counting and measuring 100 pebbles from the bottom of the stream and assessing every 10<sup>th</sup> pebble for embeddedness. The surrounding substrate, or streambed, material is also assessed based on size and consistency.



Finally, the study site channel characteristics are measured. The width of the stream during high flow (estimated based on bank structure and changes in vegetation) and current flow is measured, as well as the slope, depth, velocity and overall discharge of the stream.

For more details on CABIN and STREAM protocols, please see the *Canadian Aquatic Biomonitoring Network (CABIN) Field Manual for Wadeable Streams*, and *STREAM: Procedure for collecting benthic macroinvertebrate DNA samples in wadeable streams* (Carter 2012; Wright, Robinson, and Hajibabaei 2020)

# Laboratory Analysis

Basic water quality parameters – temperature, pH, conductivity, oxidation-reduction potential (ORP) and dissolved oxygen – were tested on site by trained ERA staff and volunteers. Samples acquired during site assessments were preserved appropriately and shipped to independent laboratories for further analysis.

## Water Chemistry

CARO Analytical Services in Kelowna, BC was responsible for 2020 water chemistry analyses. Typically, ERA CBWM sites are assessed for total and dissolved metals, nutrients, and anions (e.g. chloride, sulphate, carbonate) (Appendix C: CARO Reports).

## Benthic Invertebrate Taxonomy

ERA contracted Surrey-based, CABIN-approved, aquatic invertebrate taxonomist, Pina Viola (B.Sc. Biology, SFS, SAFIT) to assess benthic macroinvertebrate samples for the CBWM program. She sorted, identified, and performed data entry for benthic invertebrate samples, following CABIN laboratory protocols (Environment and Climate Change Canada 2020).

# Data Analysis

As per CABIN Wadable Streams Protocols, all data collected was input into the Environment and Climate Change Canada (ECCC) national CABIN database, under "CBWQ – Elk study".

Sites were assessed based on the Okanagan-Columbia 2010 Preliminary model.

To prepare sites for CABIN analysis, characteristics based on GIS data was collected. Catchments for each site were delineated using GIS software and analysed for model requirements – % ice coverage and the % area with >= 30% slope.

From here the CABIN database sorts sites into smaller groups based on similarities in characteristics to designated groups of reference sites, then performs a BEAST (Benthic Assessment of Sediment) analysis to assess the health of a site, in comparison to similar reference sites, based on the benthic community structure, the functional responses of these invertebrates, and selected habitat variables. These analyses produce a "community ellipses" for each site, which is an ordination plot that visually represents how similar reference sites are, and where a test site fits in to the comparison. The center of the ellipses represents reference condition, and the further out from the center a test site appears, the more it has diverged from this condition and the most likely it is to be in poor condition.



Where sites appeared to be diverging from reference condition, data was further explored to investigate pattens associated with these sites. Specific water chemistry results were assessed for any drastic measurements or changes. RIVPACS and Bray-Curtis dissimilarities were used to assess issues with benthic community structure.

RIVPACS (River Invertebrate Prediction and Classification System) is an aquatic biomonitoring system used to assess water quality. It measures taxa richness (presence/absence but not abundance), based on expected taxa according to reference sites versus what is observed at a test site. A value of 1, indicates the test site is similar to the reference sites, while values above 1 indicate increasing differences from the reference sites (and more taxa), and values below 1 indicate increasing differences but less taxa, and likely poorer conditions.

Bray-Curtis dissimilarity is a statistical assessment to measure the dissimilarity between sites based on numbers within groups at each site. In CABIN, the Bray-Curtis dissimilarity is used to measure both richness and abundance of test sites compared to the mean values of the reference sites. A value of 0 means that the sites are in good condition, similar to the mean values of the reference sites, while a value of 1 indicates complete dissimilarity.



# **Results & Discussion**

In 2020, 10 sites were assessed across 5 tributaries – Lizard Creek, Alexander Creek, Boivin Creek, Coal Creek and Morrissey Creek. CABIN assessments indicate most sites to be in relatively good condition (similar benthic community structure to similar reference sites), with the exception of the lower Coal Creek (COL001) and Morrissey Creek (MOR001) sites. According to the CABIN assessment model, both of these sites are stressed and are diverging from the designated "reference condition".



# Lizard Creek

Lizard Creek sites – LIZ001, LIZ003 – were "mildly divergent" in 2020 (Figure 19). LIZ001, the downstream site, fluctuated between being reference condition and divergent between 2012 and 2020. Although not new to the CBWM program, 2020 was the first year LIZ003 was incorporated into the CABIN program, so overall patterns cannot be assessed yet. The "mildly divergent" assessment of these sites is not considered cause for concern as this site has historically fluctuated in divergence, and CABIN-designated reference sites also occasionally shift into the "mildly divergent" category (Figure 23).

Both sites differ from reference sites according to the Bray-Curtis dissimilarity (LIZ001: 0.76, LIZ003: 075), however RIVPACS shows this difference may be in part due to a larger number of taxa present (Table 1). %EPT for both sites (40.43 and 63.10, respectively) is lower than what would be expected based on the reference site mean (84.05 ±11.54). All measured water quality variables met BC guidelines for the protection of aquatic life.

LIZ003 is unlikely to be in poor health. Although downstream from Island Lake Lodge, the site is within a protected provincial park and aside from a resource road, the creek has minimal land use impacts.

LIZ001 is closer to the Lizard Creek confluence into the Elk River (Figure 20). Although this site borders the provincial park, it has a greater potential to be affected by human disturbance from residential development adjacent to the stream and provincial park. Proposed future development and roadways adjacent to Lizard Creek may contribute additional impacts and ERA will continue to monitor conditions as these developments progress.

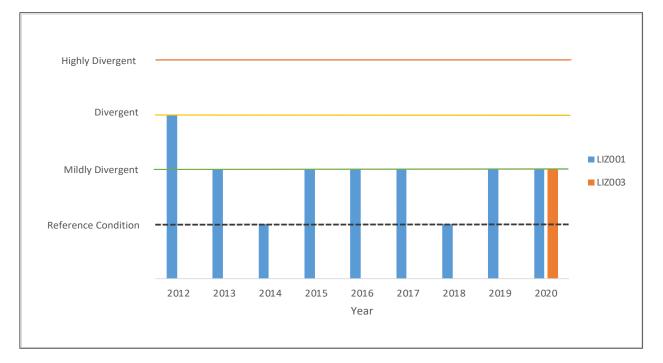


Figure 19. CABIN analysis results for Lizard Creek sites from 2012 – 2020.



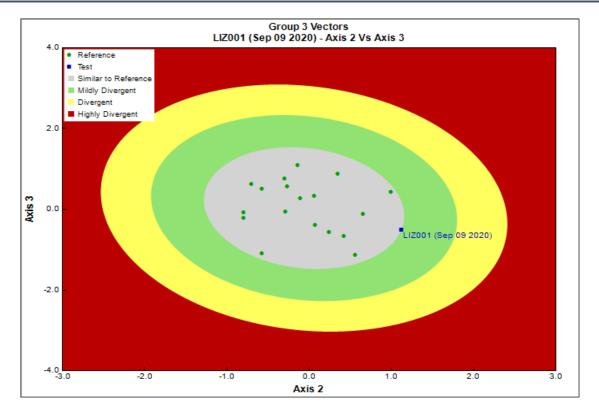


Figure 20. CABIN community ellipses for LIZ001 in 2020.

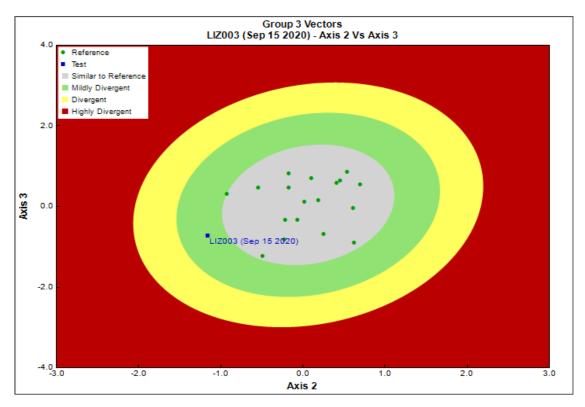


Figure 21. CABIN community ellipses for LIZ003 in 2020.



## Alexander Creek

In 2020, both the upstream (ALX003) and downstream (ALX001) sites were in good condition, according to CABIN analysis (Figure 22). Water chemistry variables echo this, with all measurements for both sites meeting the BC guidelines for the protection of aquatic life. Alexander Creek sites have fluctuated over time, from reference conditions to mildly divergent. Further statistical testing (Bray-Curtis, RIVPACS) indicates that sites on Alexander Creek were similar to reference sites in taxa diversity and %EPT. Alexander Creek runs alongside the Crowsnest highway and past a gun range and local logging roads. Fluctuations in divergence may result from intermittent disturbances caused by the use of these areas. Proposed mining development in the upper catchment may increase stressors on Alexander Creek. If mining development goes forward, ongoing monitoring of Alexander Creek will become increasingly important to track changes in stream health.

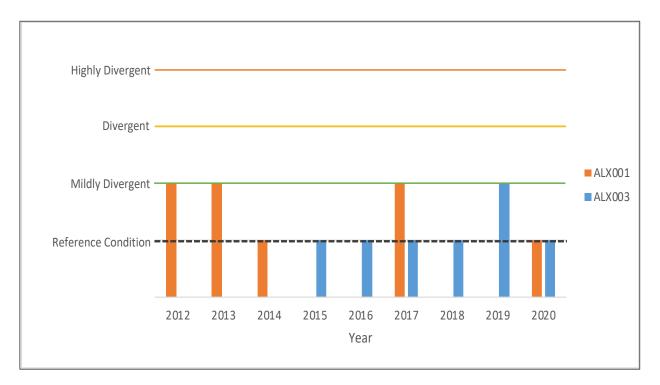


Figure 22. CABIN analysis results for Alexander Creek sites from 2012 - 2020.



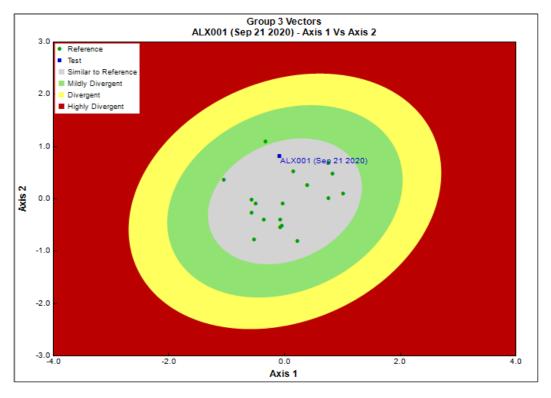


Figure 23. CABIN community ellipses for Alexander Creek's downstream site, ALX001 in 2020.

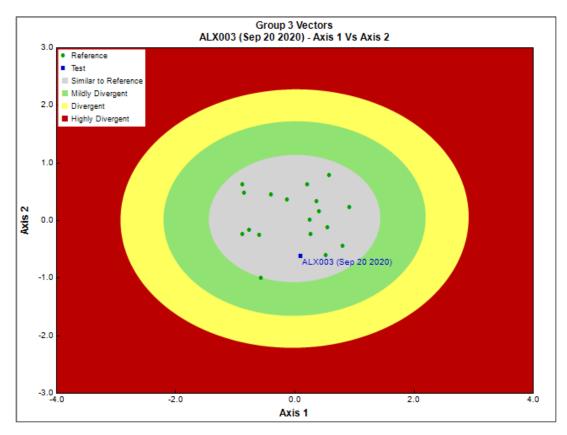


Figure 24. CABIN community ellipses for Alexander Creek's upstream site, ALX003 in 2020.



## Boivin Creek

In the two years (2019 and 2020) of monitoring on Boivin Creek, sites were in good condition (Figure 25). CABIN analysis showed Boivin Creek sites similar to reference condition, with further statistical testing confirming these results (Table 1).

ERA began monitoring this site to assess the impacts of artificial rip-rap that stretches along large sections of the creek as it passes through Elkford. However, CABIN results show that the creek remains in relatively good condition. Continued monitoring efforts will allow for more long-term assessments of the creek and potential impacts of local urban developments. All measured water quality variables met BC guidelines for the protection of aquatic life.

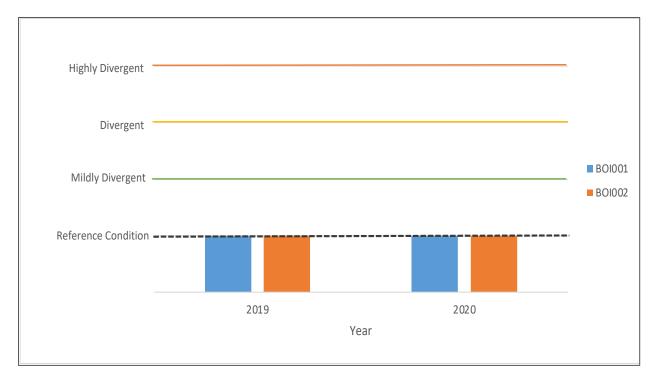
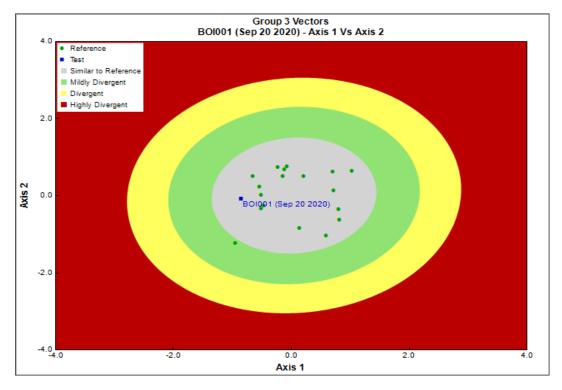


Figure 25. CABIN results for Boivin Creek sites in 2019 and 2020. Both the upstream (BOI002) and the downstream (BOI001) sites have remained in a similar state to reference condition, despite any potential for habitat degradation.





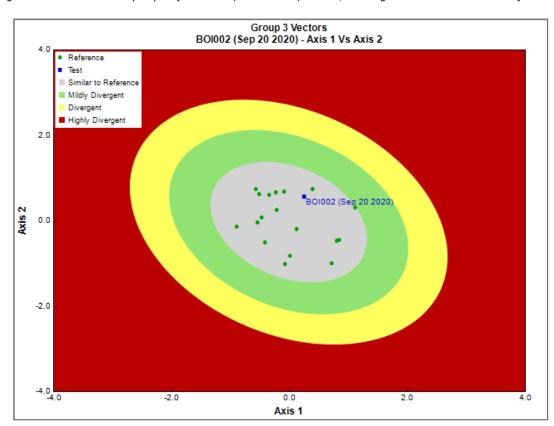


Figure 26. CABIN community ellipses for BOI001 (downstream) in 2020, showing the site to be "similar to reference".

Figure 27. CABIN community ellipses for BOI002 (upstream) in 2020, showing the site to be "similar to reference".



# Coal Creek

Coal Creek was added to the CBWM CABIN assessments in 2019. Results indicate the creek may be diverging from reference sites (Figure 28). However, further investigation will be needed to comment on this trend. Divergent results at COL001, the downstream site, are not unexpected, as this site is downstream of historic mining sites, a decommissioned landfill, cattle grazing, recreational ATV trails, current clear-cut logging practices, and the creek meanders through a portion of the town of Fernie before arriving at the site.

According to additional analyses, both sites along Coal Creek have a species diversity that differs from what was expected according to the "pristine" reference sites, have a slightly lower taxa richness than reference sites, and the %EPT is significantly lower than expected (Table 1).

The CBWM program focuses on long-term trends in stream health. Stable fluctuations observed at other sites with more extended datasets make a case for these sites fluctuating over time. Currently, data at Coal Creek is not sufficient to establish distinct patterns or definitive conclusions. ERA will continue to monitor COL001 and COL003 to accumulate data and the development of trends. If the COL003 site continues to diverge from reference sites, ERA will seek to investigate further, as this site is within the headwaters, and poor conditions are not expected at this location. All measured water quality variables met BC guidelines for the protection of aquatic life.

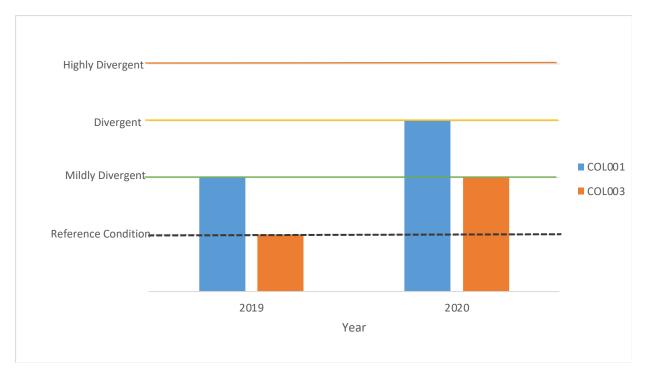


Figure 28. CABIN results for Coal Creek sites in 2019 and 2020.



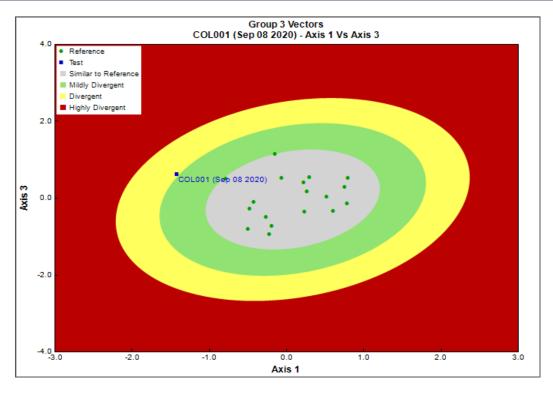


Figure 29. 2020 CABIN analysis community ellipses for the Coal Creek downstream site, COL001, showing the site has diverged from reference condition.

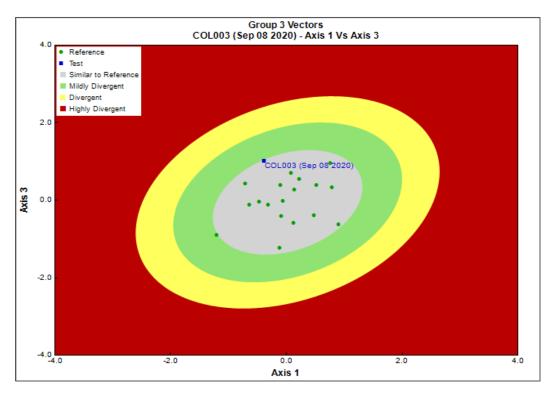


Figure 30. 2020 CABIN analysis community ellipses for the Coal Creek upstream site, COL003, showing the site is just at the edge of mild divergence from reference condition.



# Morrissey Creek

2020 was the first year of CBWM assessments for Morrissey Creek. The upstream site, MOR002, was in a condition similar to that of the associated reference sites, while the downstream site, MOR001, was divergent (Figure 31). Morrissey Creek originates from a geographically similar location to Coal Creek, with similar historical logging in the upstream reaches. While MOR002 lies above most potential disturbance, MOR001 is downstream of active logging roads, ATV trails, cattle grazing, and an active farming area.

MOR001 was on the higher end of B-C values (0.76733738), indicating taxa diversity at the site was lower than expected. Still, EPT values and the number of taxa present were similar to what would be expected from a site in good condition (Table 1). The downstream sites on both streams were predicted to experience the most disturbance, compared to other CBWM sites, and therefore divergence from reference condition.

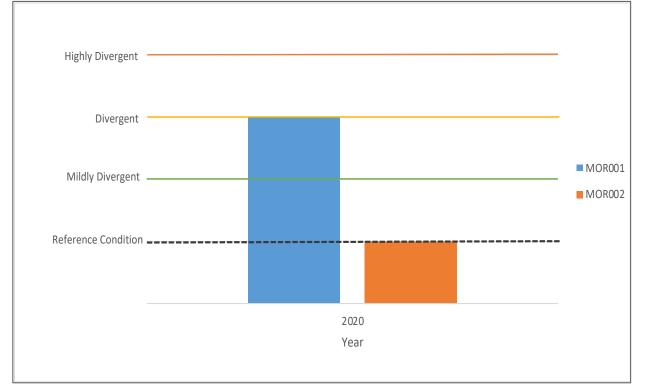


Figure 31. Results of CABIN assessment for Morrissey Creek sites in 2020. MOR002 is in "reference condition" while MOR001 was classified as. "divergent".



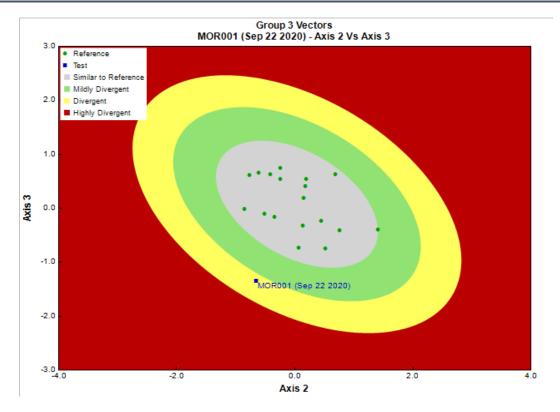


Figure 32. CABIN analysis community ellipses for the Morrissey Creek downstream site, MOR001, showing the site diverging from reference condition.

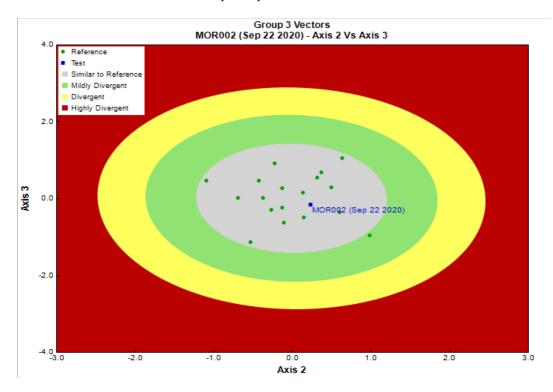


Figure 33. CABIN analysis community ellipses for the Morrissey Creek upstream site, MOR002, showing the site is similar to reference condition.



# Benthic Macroinvertebrate Communities

CABIN assessments assign test sites a condition based on the structure of the benthic macroinvertebrate community. Figure 34 acts as a visual representation of the overall species diversity and abundance in each CBWM test stream. It displays the proportion of individuals belonging to each taxonomic order, with typically pollutant-sensitive orders on the left (EPT) and more tolerant orders on the right. In grey, the total number of individuals collected in each stream are represented. Streams with higher amounts of EPT individuals coincide with those deemed less divergent from reference condition through CABIN assessments. The exception to this is the lower Morrissey site (MOR001) which was assessed as "Divergent" yet over 80% of the taxa present belong are part of the typically pollution sensitive group (EPT). Taking a closer look, nearly all of this 80% belongs to one order – *Trichoptera*. These results speak to the importance of biodiversity in a healthy stream. A healthy ecosystem requires many different species with their own distinct roles to function properly. In areas where one particular taxon begins to take over, there is likely an issue that will eventually take a toll on the entire system. Further, although the EPT taxa are often associated with pollution sensitivity, these sensitivities may vary at finer taxonomic resolutions. Trichoptera (caddisflies) are regularly used as indicators of stream health and generally decreased numbers are associated with poor health, but there are certain species that exhibit a higher tolerance to pollution and have been found to thrive in these envrionments (Houghtona 2004).

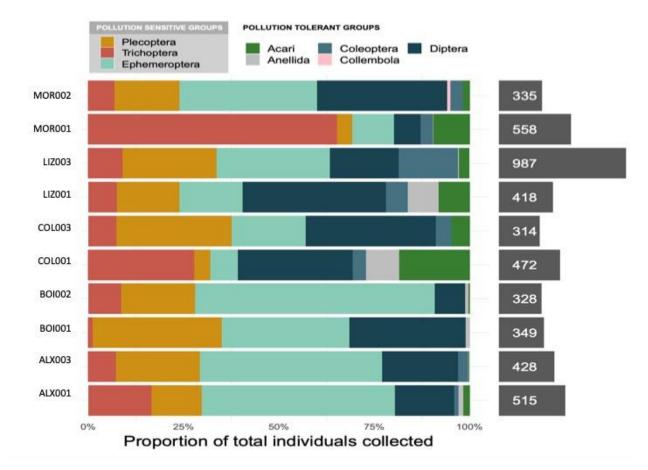


Figure 34. Graph representing the proportions of different benthic macroinvertebrates at each CBWM stream. The three leftmost bars represent pollution-sensitive taxa (Ephemeroptera, Plecoptera, Trichoptera), while the taxa on the right are more pollution-tolerant. Higher % EPT is generally considered to equate to healthier streams. The figures in grey represent the total number of individuals found in each stream.



Table 1 takes a closer look at these results within benthic communities at each CBWM site using RIVPACS, Bray-Curtis Dissimilarity and %EPT. The highlighted cells indicate values that differ from what is expected from a site in "reference condition". Sites with highlighted cells all experience deviations from reference condition according to CABIN analyses.

 Table 1. A comparison of CBWM sites, their classification according to 2020 CABIN assessments, and additional statistical

 measures that address the classification – RIVPACS, Bray-Curtis dissimilarity, and the percent EPT (Ephemeroptera, Plecoptera,

 Trichoptera). Highlighted cells indicate values that differ from what is expected for a site in reference condition.

Stream Name	Site ID	CABIN Analysis	RIVPACS O:E (p>0.7)	Bray-Curtis Dissimilarity	% EPT
Alexander Creek	ALX001	Reference	1.047024074	0.624722059	80.66
	ALX003	Reference	1.047843071	0.474854415	77.1
Boivin Creek	BOI001	Reference	0.867716227	0.459945921	68.48
	BO1002	Reference	0.869820956	0.311182669	90.85
Coal Creek	COL001	Divergent	0.954562374	0.811380344	39.45
	COL003	Mildly Divergent	0.769140538	0.744732558	56.77
Lizard Creek	LIZ001	Mildly Divergent	1.052912678	0.761580405	40.43
	LIZ003	Mildly Divergent	1.054728842	0.754085228	63.1
Morrissey Creek	MOR001	Divergent	0.954737831	0.76733738	80.07
	MOR002	Reference	0.959451387	0.694461696	60.67
	Reference Mean			0.42585847 ±0.15994129*	84.05 ±11.54

\* the average dissimilarity value between individual reference sites and the "Reference Mean" that all test sites were measured against.



# STREAM e-DNA

STREAM e-DNA analysis presents a list of species present at each sampled site, including general information on the species' ability to tolerate stressors and some general information regarding species richness at each site.

The report also identifies the presence of *Tubifex tubifex*, one of the two host species necessary for the presence of whirling disease, caused by the *Myxobolus cerebralis* parasite. *Tubifex tubifex* was identified at BOI001. There are no known cases of whirling disease in British Columbia to date, but it is widespread in the neighbouring parts of Alberta, including the Oldman watershed bordering the Elk River watershed(Veillard and James 2020). If whirling disease were to enter BC, Boivin Creek could be a high-risk area for an outbreak.

This discovery has led to the development of the 'Elk Valley Whirling Disease Project', an ERA outreach and monitoring initiative within the Elk Valley to identify other potentially high-risk locations and educate to prevent the introduction of this disease.

The detailed STREAM report is available in (Appendix E: Stream Report).



# Water Quality Trends

ERA's CBWM program monitors water quality parameters over time to assess long-term trends. Data on pH, temperature, turbidity, dissolved oxygen concentration, and discharge are available as far back as 2012.

# рН

PH levels at all sites have been consistent over time (Figure 35). All areas assessed remained within the 6.5 to 9 pH BC Water Quality Guideline limits for freshwater aquatic life (British Columbia Ministry of Environment and Climate Change Strategy 2021). Stream pH is primarily a function of surrounding geology, so the Elk Valley's predominantly limestone formations result in high pH values. Aquatic life in these areas has adapted to high pH conditions. If values deviate outside of these limits, damage to current aquatic communities and a complete change to the species composition of the stream can occur (B.C. Ministry of Environment and Climate Change Strategy 2021b).

Both Morrissey and Coal sites show lower pH than other sites. Both of these sites are located higher in the landscape than other sites and are from neighbouring catchments. It is likely these two sites have lower groundwater influence than other sites, resulting in lower pH.

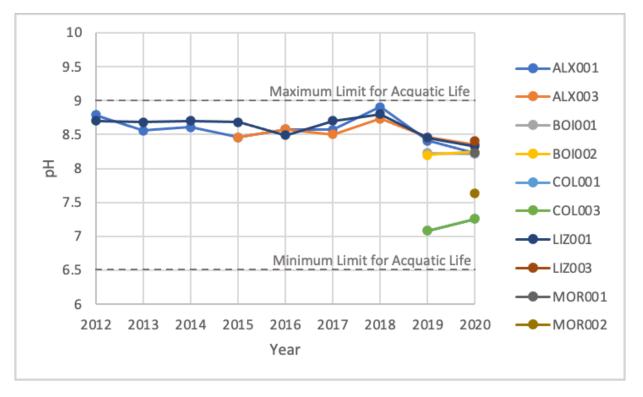


Figure 35. pH values for CBWM sites from 2012-2020. All sites remain within the range of limits outlined within the BC Water Quality Guidelines.



# Temperature

In light of the potential effects of climate change on the Elk River system, understanding long-term temperature trends is a priority for ERA. Outside of the CBWM program, ERA collects consistent data from in-stream temperature loggers throughout the Elk Valley. Typically, aquatic life can only survive within specific ranges of temperatures. For example, WCT can only survive in waters between  $0 - 25^{\circ}$ C (Bear, McMahon, and Zale 2007).

Temperatures fluctuated on all sites (Figure 36). However, this can be attributed to natural climatic fluctuations and sampling dates. Although all sites in CABIN are monitored during low flow conditions between the end of August and the beginning of November, relatively large fluctuations are expected during this period. Overall, temperatures appear normal and remain within the critical limit for important local species like the WCT and bull trout (DFO 2017).

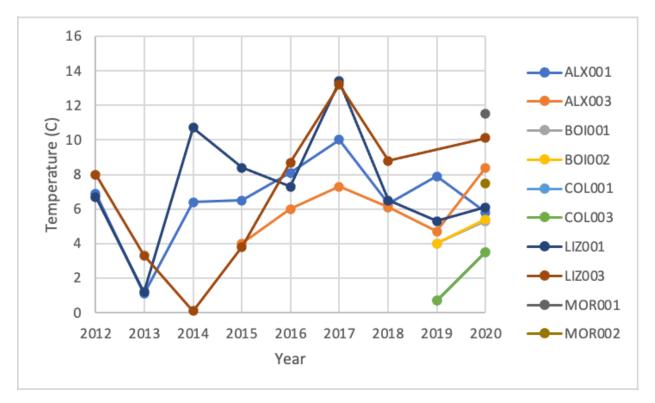


Figure 36. Temperature values for CBWM sites from 2012-2020.



# Dissolved Oxygen

Dissolved oxygen is tracked by CBWM programming. The concentration of dissolved oxygen (DO) at all CBWM sites has remained stable over time and has been consistently above the BC Water Quality Guideline long-term minimum level of 8mg/L (Figure 37)(British Columbia Ministry of Environment and Climate Change Strategy 2021). Data is unavailable for some sites in 2020 due to equipment condition. DO measurements were recorded; however, values deemed unreliable were omitted from the final results.

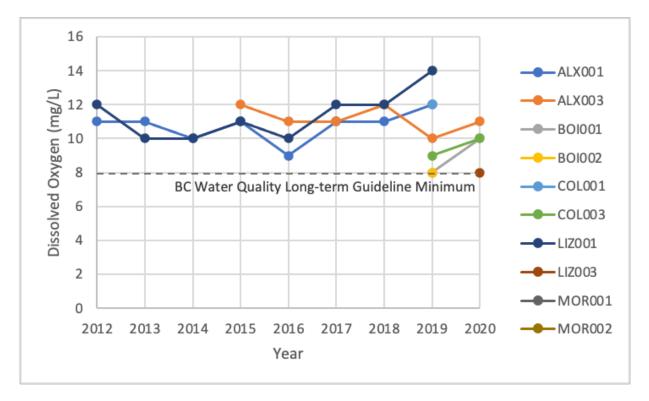


Figure 37. The amount of dissolved oxygen at CBWM sites in mg/L from 2012-2020. Site values do not fall below the BC water Quality Long-term Guideline minimum for Freshwater Aquatic Life (8mg/L).



# Turbidity

Canadian Water Quality guidelines suggest that environmental samples vary within the normal range of 1 to 1000 NTU but that turbidity as low as 25 NTU can begin to have a negative effect on fish growth (Canadian Council of Ministers of the Environment 1999). Since 2012, CBWM site turbidity readings have remained below 4 NTU, with most readings below 2 NTU.

Anecdotal observations indicate all tributaries in the Elk River watershed experience significant turbidity spikes during rainfall events. However, all monitored creeks tend to have low turbidity readings during low-flow conditions, with turbidity spikes being indicative of upstream disturbance.

According to the BC Water Quality Guidelines, turbidity is only a concern when the value changes by 8 or more NTU for 24 hours from the ambient turbidity level, or 2 NTU for 30 days (British Columbia Ministry of Environment and Climate Change Strategy 2021).

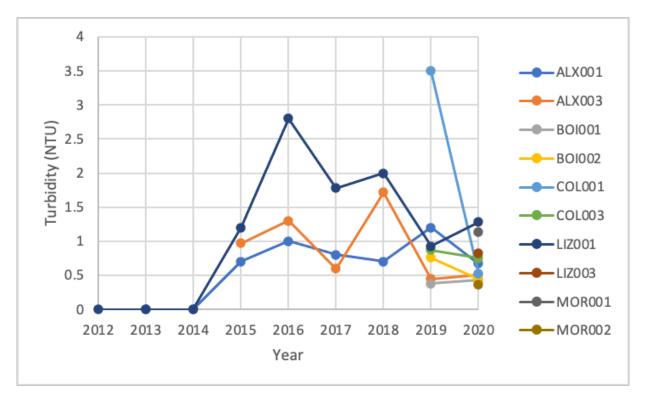


Figure 32. The turbidity (NTU) measured at CBWM sites from 2012-2020.



# Discharge

Discharge, referring to the volume of water flowing through a section of stream at a given time, was assessed during low flow conditions for each site over time (Figure 38). Discharge measurements at all sites remained relatively stable between years, except COL001, which appeared to decrease by 1.76 m3/s between 2019 and 2020. This is not considered abnormal as Coal Creek has a high gradient and frequently experiences fluctuating flow and regular flood events.

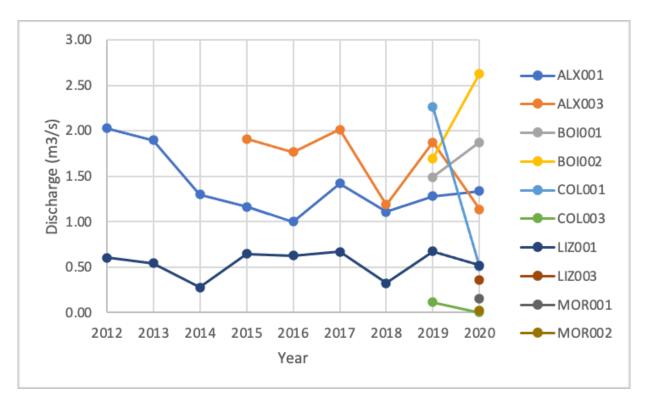


Figure 38. Discharge measurements calculated for CBWM sites from 2012-2020.



# Metals & Nutrients

Water chemistry data collected during the 2020 sampling period indicates there were no exceedances in metals or nutrients based on BC Water Quality Guidelines.

In 2019, Coal Creek site COL003 showed elevated Aluminimum concentrations of 0.0724 mg/L, exceeding the BC water quality guideline limit for freshwater aquatic life by 0.0224 mg/L, but returned to an acceptable level in 2020 (Figure 39)(British Columbia Ministry of Environment and Climate Change Strategy 2021).

Although naturally occurring in large quantities within the earth's crust, aluminum does not play a role in the biological function of living things (B.C. Ministry of Environment and Climate Change Strategy 2021a). It can enter aquatic environments through both natural and anthropogenic means. For example, weathering, erosion, mining and the burning fossil fuels can all introduce aluminum to waterways. Elevated levels of aluminum are toxic to aquatic life, and can interrupt the ability of aquatic organisms to grow, reproduce and survive. In fish, excess aluminum can damage their gills and decrease their ability to respirate and osmoregulate (U.S. Environmental Protection Agency 2018).

These results at Coal Creek in may indicate an upstream Aluminum source but could have been related to a sampling error. Data on dissolved Aluminum is unavailable before 2019. ERA will continue to assess patterns in aluminum concentrations at Coal Creek sites.

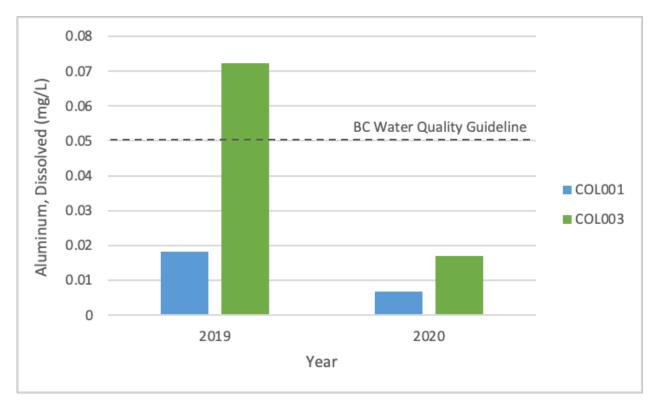


Figure 39. Dissolved aluminum concentrations for Coal Creek sites in 2019 and 2020.



# Selenium and Calcite

The Elk Valley has a long history of mining, and its residents are very aware of the associated environmental issues with this industry. Selenium and calcite are two constituants of serious concern in this region.

Selenium (Se) is a naturally occurring element and low levels are essential for the health of both humans and animals (Janz et al. 2010). Unfortunately, selenium actively bioaccumulates in tissues, and in higher concentrations, begins to become toxic, eventually causing reproductive issues and deformities (Teck Resources Ltd. 2015). Waste rock, resulting from coal mining operations, contains selenium. During the mining process, this rock is broken into smaller pieces, creating more opportunity for air and water to interact with the rock. This results in the conversion of selenium into its soluble form, which is then released in water seeping through these waste rock piles into local waterways (Teck Resources Ltd. 2015). The BC water quality guideline for the protection of aquatic life is  $2 \mu g/L$  (micrograms/litre). The BC human drinking water consumption guideline is  $10 \mu g/L$  (British Columbia Ministry of Environment and Climate Change Strategy 2021)

Calcite (CaCO3) is also naturally occurring and is formed when calcium (Ca) and carbonate (CO3) ions react under saturated conditions (Janz et al. 2010). Calcite concretion in streambeds, specifically downstream of local coal mining operations, has become an increasing concern in the Elk Valley. Although calcite precipitates occur naturally, the waste rock produced from mining has high concentrations of both calcium and carbonate which can solidify on large stretches of stream. Supersaturated conditions cause concretion of the streambed which can negatively affect aquatic life by actively eliminating benthic invertebrate habitat (Barrett, Weech, and Orr 2016). High amounts of calcite precipitate correlate with decreased %EPT and *%Ephemeroptera* (Golder Associates Ltd. 2014). There are no water quality guidelines associated with calcite in rivers, and as the Elk River watershed is primarily calcite-rich limestone, local rivers are naturally high in this substance (Golder Associates Ltd. 2014). Assessments of calcite usually measure the amount of solidified deposits within a stream through pebble counts (Barrett, Weech, and Orr 2016). CBWM monitoring includes a pebble count which should allow ERA to see any major deposits if present. To date, no major calcite deposits have been seen during monitoring.

The tributaries included in the CBWM program are not mining-influenced and should not experience the same issues as those within the mining areas. Selenium concentrations at the CBWM sites do not exceed reference levels and always remain below thewater quality guideline for freshwater aquatic life (Figure 40)(British Columbia Ministry of Environment and Climate Change Strategy 2021). For comparison, Figure 41 displays selenium concentrations in the Elk River mainstem near the outflow to Lake Koocanusa, (the Elk receives selenium loadings from upstream mines), and compares the levels found in ERA's CBWM assessed tributaries. The concentrations at these tributaries are well below what is now observed in the Elk River mainstem and are similar to those in the Elk River in the 1990s.

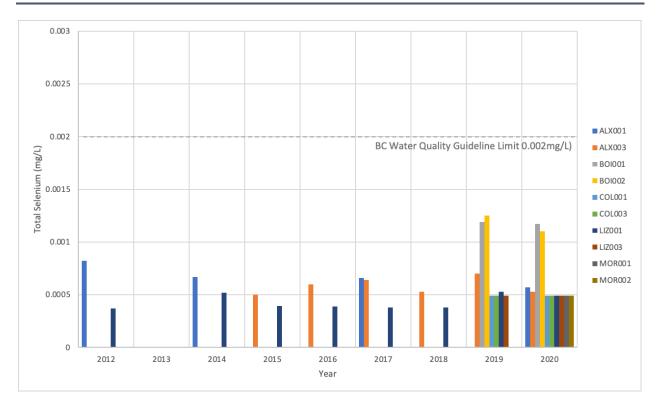


Figure 40. Total selenium concentrations at CBWM sites from 2012 to 2020. All concentrations are well below the BC water quality guideline of 0.002 mg/L ( $2\mu$ g/L).

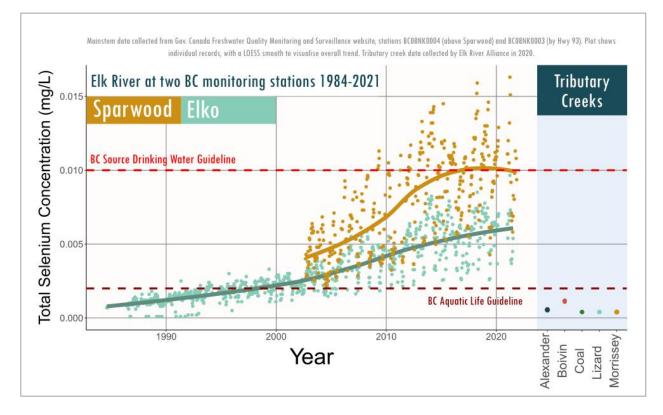


Figure 41. Total selenium in the Elk River mainstem at the outflow to Lake Koocanusa. Approximate concentrations at CBWM tributaries is included to the right and coincides with Elk River concentrations in the 1990s..



# **Study Limitations**

A breakdown of some of the potential limitations for the 2020 CBWM sampling season.

Aspect	Constraint	Comments on Limitations
Team competency/ experience	No	Teams performing site assessments are trained in CABIN protocols through either the Canadian Government or Living Lakes Canada, but many were inexperienced in applying them to new ERA sites. STREAM e-DNA sampling was new to the program in 2020, and although field teams received training, it was a new component of ERA's CBWM program. As the team continues to use CABIN/STREAM and adjust to the new protocols,
		team members gain experience, improving confidence in data collection and assessment.
Timing / weather / seasonality	No	All monitoring is completed during low flow conditions, typically between August and November. This relatively large time window likely allows for fluctuations in some parameters, like temperature, may occur naturally rather than signify any important changes to the study site.
CABIN Model	Likely	In 2020 a new CABIN model was produced for the Columbia Basin. Prior to 2020, an Okanagan-Columbia Basin model was used. ERA completed initial assessments using this model. However, there were issues regarding the model's ability to correctly sort ERA's test sites, and the assessment appeared skewed. While these issues are under investigation, ERA has continued to use the original model for site assessments. The new model will be reassessed for 2021 data.
Scope	No	The scope was clearly defined and realistically achievable within the designated timeframe.
Proportion of task achieved, and further work which might be needed	Maybe	All sites currently part of the program were successfully sampled and assessed, but there is room for improvement and expansion. The CBWM program aims to create a better understanding of watershed health. Increasing the number of sites across different watershed areas and incorporating a greater variety of habitats may be necessary to better understand overall ecosystem health.
Resources	No	Through the ERA board of directors and local partnerships, ERA staff have access to a diverse group of experts in various scientific fields.
		Currently, ERA has limited access to industry-standard equipment. Although CABIN data collection only requires a "head tube" for velocity measurements, ERA seeks to align data with BC RISC standards. In 2020, discharge was calculated using velocity measurements taken by a Global Water Flow Probe.
		Although results are considered accurate and are comparable to more technical instruments (like Sontec's FlowProbe), velocity measurements are only



Aspect	Constraint	Comments on Limitations
		available to the nearest 0.1 m/s and results do not adhere to BC RISC requirements.
Access	No	All sites were accessible. Initial CBWM site selection includes evaluating the accessibility of a site prior to inclusion in the program.



# Conclusion

ERA's CBWM program is an ongoing program used to assess streams of concern identified through research and community input. 2020 saw a shift to CABIN-based assessments, the inclusion of STREAM e-DNA, and the addition of a new tributary and two new sites (Morrissey Creek: MOR001, MOR002).

Most study sites were in relatively healthy condition, with the potential exception of the Coal Creek site COL001 and the Morrisey Creek site MOR001. Both COL001 and MOR001 have large amounts of upstream development, and both are new sites. It will take additional sampling years to establish site norms and differentiate between stable fluctuations in their state and an ongoing trend in aquatic habitat. Analysis of water quality parameters associated with these sites does not indicate any obvious or specific red flags due to exceedances of water quality guidelines, pointing to causes for divergence. Continuing to monitor these sites is a priority going forward.

Data assessment will utilize the newly established 'Columbia 2020' CABIN model. The new model uses a new group of parameters to categorize sites and is better suited to the area than the previous model. However an adjustment period is expected. The new model can be applied to historical data, and a reassessment may result in altered historical results.

ERA is working to establish the Elk River Watershed Collaborative Monitoring Program. With the growth of new partnerships, the development of new research questions and access to previously unaccessable data, ERA hopes to continue to expand the CBWM program in the coming years and integrate ERA CABIN sites with the monitoring collaborative's recommendations and increase the areas of the watershed included in assessments. The primary focus will continue to be filling in current data gaps and finding answers to the local community's environmental concerns.



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Appendix A: CABIN Reports

### **Site Description**

Study Name	CBWQ-Elk
Site	ALX001
Sampling Date	Sep 21 2020
Know Your Watershed Basin	Central Kootenay
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera EcoZone
	Northern Continental Divide EcoRegion
Coordinates (decimal degrees)	49.67394 N, 114.77990 W
Altitude	1218
Local Basin Name	Alexander Creek
	Elk River
Stream Order	4



Figure 1. Location Map

Across Reach (No image found) Down Stream (No image found) Field Sheet (No image found) Substrate (No image found) Up Stream (No image found)

#### **Cabin Assessment Results**

Reference Model Summary						
Model	Columbia-Okana	Columbia-Okanagan Preliminary March 2010				
Analysis Date	January 07, 202	2				
Taxonomic Level	Family					
Predictive Model Variables	Depth-Avg Latitude Longitude Reg-Ice Reg-SlopeLT30%					
Reference Groups	1 2 3 4 5					
Number of Reference Sites	9	43	17	12	33	
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%	
Overall Model Error Rate	26.4%					
Probability of Group Membership	0.0% 0.8% 93.6% 5.0% 0.6%					
CABIN Assessment of ALX001 on Sep 21, 2020	Similar to Reference					

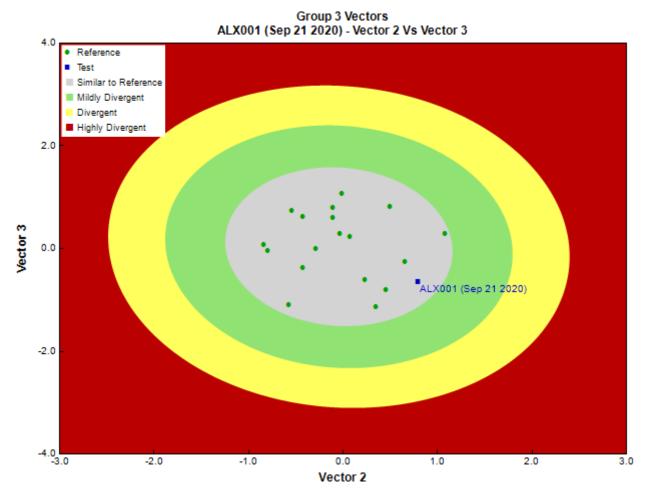


Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

### Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Pina Viola, Consultant
	Marchant Box
Sub-Sample Proportion	5/100

# **Community Structure**

Phylum	Class	Order	Family	Raw Count	Total Count
Annelida	Clitellata			2	40.0
		Lumbriculida	Lumbriculidae	3	60.0
		Tubificida	Naididae	1	20.0
Arthropoda	Arachnida	Trombidiformes	Hygrobatidae	2	40.0
			Lebertiidae	5	100.0
			Sperchontidae	1	20.0
			Torrenticolidae	1	20.0
	Insecta	Coleoptera	Elmidae	6	120.0
		Diptera	Ceratopogonidae	7	140.0
			Chironomidae	24	480.0
			Empididae	2	40.0
			Psychodidae	44	880.0
			Simuliidae	2	40.0
			Tipulidae	1	20.0
		Ephemeroptera	Ameletidae	1	20.0
			Baetidae	103	2,060.0

## **Community Structure**

Phylum	Ephemerellidae		Family	Raw Count	Total Count
			Ephemerellidae	100	2,000.0
			Heptageniidae	56	1,120.0
			Leptophlebiidae	1	20.0
		Plecoptera	Chloroperlidae	2	40.0
			Leuctridae	5	100.0
			Nemouridae	51	1,020.0
			Perlidae	1	20.0
			Perlodidae	4	80.0
			Taeniopterygidae	5	100.0
		Trichoptera		1	20.0
			Apataniidae	13	260.0
			Brachycentridae	5	100.0
			Glossosomatidae	39	780.0
			Hydropsychidae	3	60.0
			Rhyacophilidae	21	420.0
			Uenoidae	3	60.0
			Total	515	10,300.0

### Metrics

Name	ALX001	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.62	$0.4 \pm 0.2$
Biotic	Indices	
Intolerant taxa		1.0
Tolerant individuals (%)		$0.6 \pm 0.4$
Number Of	Individuals	
% Chironomidae	4.7	7.3 ± 10.2
% Coleoptera	1.2	2.9 ± 5.0
% Diptera + Non-insects	18.2	$13.0 \pm 11.1$
% Ephemeroptera	51.0	48.4 ± 15.8
% Ephemeroptera that are Baetidae	39.5	41.9 ± 25.2
% EPT Individuals	80.7	84.1 ± 11.5
% Odonata		$0.0 \pm 0.0$
% of 2 dominant taxa	39.6	54.3 ± 12.1
% of dominant taxa	20.1	35.5 ± 11.8
% Plecoptera	13.3	28.1 ± 15.3
% Tribe Tanyatarisini		
% Trichoptera that are Hydropsychida	3.6	25.4 ± 24.5
% Tricoptera	16.4	7.5 ± 7.7
No. EPT individuals/Chironomids+EPT Individuals	0.9	$0.9 \pm 0.1$
Total Abundance	10300.0	4086.0 ± 3834.6
-	ness	
Chironomidae taxa (genus level only)	1.0	$1.0 \pm 0.0$
Coleoptera taxa	1.0	0.6 ± 0.6
Diptera taxa	6.0	3.5 ± 1.1
Ephemeroptera taxa	5.0	3.8 ± 0.7
EPT Individuals (Sum)	8260.0	3252.2 ± 2587.2
EPT taxa (no)	17.0	12.7 ± 2.6
Odonata taxa		$0.0 \pm 0.0$
Pielou's Evenness	0.7	0.7 ± 0.1
Plecoptera taxa	6.0	5.4 ± 1.3
Shannon-Wiener Diversity	2.5	2.0 ± 0.3
Simpson's Diversity	0.9	$0.8 \pm 0.1$
Simpson's Evenness	0.3	$0.3 \pm 0.1$
Total No. of Taxa	30.0	19.4 ± 4.2
Trichoptera taxa	6.0	3.6 ± 1.5

# Frequency and Probability of Taxa Occurrence

Reference Model Taxa	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at
	Group 1	Group 2	Group 3	Group 4	Group 5	ALX001
Ameletidae	56%	53%	22%	50%	68%	0.24

#### Frequency of Occurrence in Reference Sites **Probability Of Occurrence at Reference Model Taxa** ALX001 Group 1 Group 2 Group 5 Group 3 Group 4 24% Apataniidae 28% 0.27 22% 25% 3% 0% Athericidae 0% 2% 17% 0% 0.01 Aturidae 0% 8% 0% 0% 0% 0.00 Baetidae 100% 100% 100% 100% 97% 1.00 Blephariceridae 0% 0% 5% 0.00 0% 0% Brachycentridae 11% 69% 0% 42% 3% 0.03 Capniidae 78% 55% 50% 92% 68% 0.52 42% 0% 55% 28% 0.29 Ceratopogonidae 5% Chironomidae 100% 100% 100% 100% 95% 1.00 Chloroperlidae 78% 88% 94% 100% 100% 0.95 Corixidae 11% 0% 0% 0% 0% 0.00 Curculionidae 0% 4% 0% 0% 0% 0.00 Deuterophlebiidae 0% 0% 0% 0% 3% 0.00 Dixidae 0% 10% 0% 0% 0% 0.00 Dytiscidae 0% 8% 6% 0% 0% 0.05 50% 0% 86% 50% 5% 0.50 Elmidae Empididae 67% 55% 50% 67% 57% 0.51 11% 14% 0% 8% 0% 0.01 Enchytraeidae Ephemerellidae 78% 100% 100% 100% 100% 1.00 Ephydridae 0% 2% 0% 0% 0% 0.00 Glossosomatidae 11% 49% 39% 42% 35% 0.39 100% Heptageniidae 100% 100% 100% 100% 1.00 Hydraenidae 0% 4% 0% 0% 0% 0.00 2% Hydrophilidae 11% 0% 0% 0% 0.00 92% 78% Hydropsychidae 11% 92% 86% 0.79 Hydroptilidae 11% 8% 0% 0% 0% 0.00 17% Hydrozetidae 0% 10% 8% 16% 0.16 Hydryphantidae 11%31% 11% 8% 8% 0.11 0% 29% 0% 0% 11%0.00 Hygrobatidae Lebertiidae 78% 65% 39% 58% 5% 0.40 Lepidostomatidae 0% 53% 6% 17% 8% 0.07 0% Leptohyphidae 2% 0% 0% 0% 0.00 11% 90% Leptophlebiidae 0% 33% 3% 0.13 22% 43% 56% 67% 54% 0.56 Leuctridae Limnephilidae 22% 31% 6% 25% 41% 0.07 2% 0% 0.00 Limnesiidae 0% 0% 0% Lumbriculidae 0% 20% 17% 25% 3% 0.17 Mideopsidae 0% 2% 0% 0% 0% 0.00 39% Naididae 0% 8% 0% 3% 0.36 100% 100% 100% 100% Nemouridae 100% 1.00 0% 0% 22% 0.05 Pelecorhynchidae 6% 0% Peltoperlidae 22% 12% 6% 8% 41% 0.06 100% Perlidae 11% 84% 33% 3% 0.37 78% 89% 92% 81% 0.89 Perlodidae 78% Philopotamidae 0% 31% 0% 0% 3% 0.00 Pisidiidae 0% 6% 0% 8% 0% 0.00 0% Planariidae 8% 67% 17% 3% 0.63 0% 0% 0% 0% 3% 0.00 Planorbidae 22% 65% 94% 8% 11% 0.89 Psychodidae Pteronarcyidae 0% 12% 6% 0% 3% 0.05 92% 95% Rhyacophilidae 100% 100% 100% 1.00 Simuliidae 33% 49% 39% 33% 16% 0.39 Sperchontidae 78% 63% 50% 42% 65% 0.50 Stygothrombiidae 0% 4% 0% 17% 0% 0.01 100% 97% 89% 49% 92% 0.99 Taeniopterygidae Thaumaleidae 4% 0% 0% 0.00 11% 0% 28% 43% Tipulidae 56% 55% 67% 0.30 Torrenticolidae 11% 86% 11% 17% 11% 0.12 Uenoidae 22% 37% 17% 25% 46% 0.17

#### Frequency and Probability of Taxa Occurrence

0%

2%

6%

0%

0%

0.05

Valvatidae

# **RIVPACS** Ratios

RIVPACS : Expected taxa P>0.50	13.23
RIVPACS : Observed taxa P>0.50	14.00
RIVPACS : 0:E (p > 0.5)	1.06
RIVPACS : Expected taxa P>0.70	10.51
RIVPACS : Observed taxa P>0.70	11.00
RIVPACS : 0:E (p > 0.7)	1.05

# **Habitat Description**

Variable	ALX001	Predicted Group Reference Mean ±SD
	ck Geology	
Sedimentary (%)	100.00000	92.18813 ± 22.65908
	nannel	
Depth-Avg (cm)	22.4	22.5 ± 10.5
Depth-BankfullMinusWetted (cm)	29.00	67.33 ± 71.65
Depth-Max (cm)	42.5	32.9 ± 17.9
Macrophyte (PercentRange)	0	0 ± 0
Reach-%CanopyCoverage (PercentRange)	1.00	$0.94 \pm 0.80$
Reach-DomStreamsideVeg (Category(1-4))	2	3 ± 1
Reach-Pools (Binary)	0	0 ± 1
Reach-Rapids (Binary)	0	0 ± 1
Reach-Riffles (Binary)	1	$\frac{1\pm0}{1+2}$
Reach-StraightRun (Binary)	0	1 ± 0
Slope (m/m)	0.0070000	0.0235102 ± 0.0284557
Veg-Coniferous (Binary)	1	$\frac{1\pm0}{1+2}$
Veg-Deciduous (Binary)	1	$1 \pm 0$
Veg-GrassesFerns (Binary) Veg-Shrubs (Binary)	1	$1 \pm 0$ 1 ± 0
Velocity-Avg (m/s)	0.58	$1 \pm 0$ 0.50 ± 0.25
Velocity-Avg (m/s)	1.33	
Width-Bankfull (m)	1.55	0.75 ± 0.28 15.6 ± 12.8
Width-Wetted (m)	14.1	15.0 ± 12.8 10.2 ± 7.0
XSEC-VelMethod (Category(1-3))	10.5	$10.2 \pm 7.0$ 2 ± 1
	imate	2 ± 1
Precip10_OCT (mm)	48.36767	52.92857 ± 22.22704
Temp12_DECmin (Degrees Celsius)	-13.00498	$-12.82063 \pm 22.22704$
	drology	12.02003 ± 2.01422
Drainage-Area (km^2)	544.36405	166.32560 ± 185.60049
	ndcover	
Natl-Grassland (%)	3.20140	4.92979 ± 5.99508
Natl-ShrubLow (%)	1.04732	$1.89085 \pm 1.59075$
Natl-Water (%)	0.06415	$0.22269 \pm 0.34683$
Reg-Ice (%)	0.00000	$0.46949 \pm 1.15785$
	rate Data	
%Bedrock (%)	0	0 ± 0
%Boulder (%)	7	6 ± 7
%Cobble (%)	60	61 ± 27
%Gravel (%)	1	1 ± 2
%Pebble (%)	32	31 ± 28
%Sand (%)	0	0 ± 0
%Silt+Clay (%)	0	0 ± 1
D50 (cm)	9.35	79.45 ± 47.98
Dg (cm)	8.9	73.9 ± 48.0
Dominant-1st (Category(0-9))	6	6 ± 1
Dominant-2nd (Category(0-9))	7	6 ± 2
Embeddedness (Category(1-5))	4	4 ± 1
PeriphytonCoverage (Category(1-5))	2	2 ± 1
SurroundingMaterial (Category(0-9))	2	3 ± 1
	ography	
Reg-SlopeLT30% (%)	54.53046	27.92073 ± 14.83033
SlopeLT30% (%)	54.53046	29.33739 ± 12.62448
SlopeMax (%)	318.46573	$616.97887 \pm 680.88955$

# Habitat Description

Habitat Description		Duadiated Charme Defense
Variable	ALX001	Predicted Group Reference Mean ±SD
Ag (mg/L)	0.0000250	$0.0000004 \pm 0.0000014$
AI (mg/L)	0.0058000	$0.0059500 \pm 0.0039700$
As (mg/L)	0.0002500	$0.0002175 \pm 0.0001795$
B (mg/L)	0.0250000	0.0500000
Ba (mg/L)	0.0787000	$0.0639025 \pm 0.0450861$
Be (mg/L)	0.0000500	$0.0000025 \pm 0.0000062$
Bi (mg/L)	0.0000500	$0.0000004 \pm 0.0000014$
Ca (mg/L)	48.8000000	38.6142857 ± 14.8464843
Cd (mg/L)	0.0000110	$0.0000059 \pm 0.000067$
Co (mg/L)	0.0000500	$0.0000043 \pm 0.0000057$
CO3 (mg/L)	169.000000	$0.0000000 \pm 0.0000000$
Cr (mg/L)	0.0002500	$0.0000833 \pm 0.0001403$
Cu (mg/L)	0.0005900	$0.0001875 \pm 0.0001434$
Fe (mg/L)	0.0150000	0.0090000
General-Alkalinity (mg/L)	169.0000000	121.5944444 ± 36.7225924
General-Hardness (mg/L)	169.000000	$146.8222222 \pm 41.6699011$
General-pH (pH)	8.2	8.0 ± 0.6
General-SolidsTSS (mg/L)	1.000000	$0.5604289 \pm 1.4627232$
General-SpCond (µS/cm)	208.4000000	214.2437500 ± 77.1891440
General-TempAir (Degrees Celsius)	2.0	$10.5 \pm 4.2$
General-TempWater (Degrees Celsius)	5.800000	$6.6716667 \pm 2.0277755$
General-Turbidity (NTU)	0.6700000	$0.0000000 \pm 0.0000000$
Hg (ng/L)	0.0050000	$0.0000000 \pm 0.0000000$
K (mg/L)	0.4600000	$0.6471429 \pm 0.7154652$
Li (mg/L)	0.0046400	$0.0011817 \pm 0.0004768$
Mg (mg/L)	13.800000	9.8814286 ± 6.1601202
Mn (mg/L)	0.0010400	$0.0011426 \pm 0.0016097$
Mo (mg/L)	0.0008500	$0.0024883 \pm 0.0065339$
Na (mg/L)	1.8300000	$2.6357143 \pm 3.7712414$
Ni (mg/L)	0.0004200	$0.0000808 \pm 0.0000811$
Nitrogen-NH3 (mg/L)	0.0050000	$0.0019286 \pm 0.0059286$
Nitrogen-NH4+ (mg/L)	0.0050000	$0.0000000 \pm 0.0000000$
Nitrogen-NO2 (mg/L)	0.0050000	$0.0023889 \pm 0.0063351$
Nitrogen-NO2+NO3 (mg/L)	0.0050000	$0.0130000 \pm 0.0088111$
Nitrogen-NO3 (mg/L)	0.0050000	$0.0245003 \pm 0.0229452$
Nitrogen-TKN (mg/L)	0.0660000	$0.0233333 \pm 0.0161433$
Nitrogen-TN (mg/L)	0.0660000	$0.0688889 \pm 0.0759171$
Pb (mg/L)	0.0001000	$0.0000224 \pm 0.0000176$
Phosphorus-TP (mg/L)	0.0056000	$0.0032778 \pm 0.0061816$
S (mg/L)	7.9000000	5.000000
Sb (mg/L)	0.0001000	$0.0000361 \pm 0.0000135$
Se (mg/L)	0.0005700	$0.0004382 \pm 0.0004486$
Si (mg/L)	2.5000000	$3.0657143 \pm 1.4070046$
Sn (mg/L)	0.0001000	$0.0000167 \pm 0.0000078$
Sr (mg/L)	0.1350000	$0.1159167 \pm 0.0982749$
Te (mg/L)	0.0002500	$0.0000000 \pm 0.0000000$
Th (mg/L)	0.0000500	$0.0000000 \pm 0.0000000$
Ti (mg/L)	0.0025000	0.0009000
TI (mg/L)	0.0000050	$0.0000038 \pm 0.0000064$
U (mg/L)	0.0006530	$0.0005298 \pm 0.0003220$
V (mg/L)	0.0005000	$0.0001642 \pm 0.0001203$
Zn (mg/L)	0.0020000	$0.0004083 \pm 0.0008361$
Zr (mg/L)	0.0000500	$0.0000000 \pm 0.0000000$
(	0.0000000	0.000000 ± 0.0000000

### **Site Description**

Study Name	CBWQ-Elk	
Site	ALX003	
Sampling Date	Sep 20 2020	
Know Your Watershed Basin	Central Kootenay	
Province / Territory	British Columbia	
Terrestrial Ecological Classification	Montane Cordillera EcoZone	
	Northern Continental Divide EcoRegion	
Coordinates (decimal degrees)	49.65521 N, 114.73074 W	
Altitude	0	
Local Basin Name	Alexander Creek	
	Elk River Watershed	
Stream Order	4	

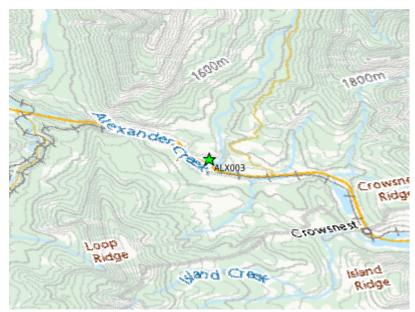


Figure 1. Location Map

Across Reach (No image found) Down Stream (No image found) Field Sheet (No image found) Substrate (No image found) Up Stream (No image found)

#### **Cabin Assessment Results**

Reference Model Summary						
Model	Columbia-Okana	Columbia-Okanagan Preliminary March 2010				
Analysis Date	January 07, 202	2				
Taxonomic Level	Family					
Predictive Model Variables	Depth-Avg Latitude Longitude Reg-Ice Reg-SlopeLT30%					
Reference Groups	1	2	3	4	5	
Number of Reference Sites	9	43	17	12	33	
Group Error Rate	22.2% 24.5% 22.2% 25.0% 32.4%					
Overall Model Error Rate	26.4%					
Probability of Group Membership	0.1% 0.5% 92.5% 6.3% 0.7%					
CABIN Assessment of ALX003 on Sep 20, 2020	Similar to Reference					

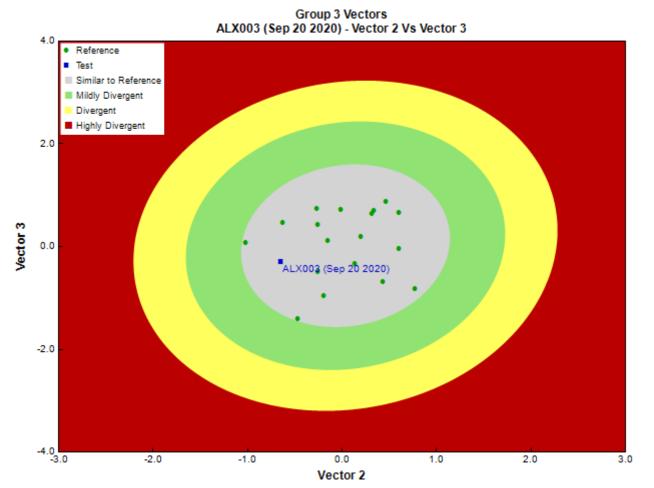


Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

### Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Pina Viola, Consultant
	Marchant Box
Sub-Sample Proportion	5/100

### **Community Structure**

Phylum	Class	Order	Family	Raw Count	Total Count
Annelida	Clitellata	Lumbriculida	Lumbriculidae	1	20.0
Arthropoda	Arachnida	Trombidiformes	Torrenticolidae	1	20.0
	Insecta	Coleoptera	Elmidae	11	220.0
		Diptera	Ceratopogonidae	3	60.0
			Chironomidae	22	440.0
			Empididae	2	40.0
			Psychodidae	33	660.0
			Simuliidae	24	480.0
			Tipulidae	1	20.0
		Ephemeroptera	Ameletidae	1	20.0
			Baetidae	38	760.0
			Ephemerellidae	92	1,840.0
			Heptageniidae	74	1,480.0
		Plecoptera	Chloroperlidae	7	140.0
			Leuctridae	4	80.0
			Nemouridae	41	820.0

# **Community Structure**

Phylum	Class	Order	Family	Raw Count	Total Count
			Perlodidae	4	80.0
			Taeniopterygidae	38	760.0
		Trichoptera	Apataniidae	4	80.0
			Brachycentridae	2	40.0
			Glossosomatidae	5	100.0
			Hydropsychidae	9	180.0
			Rhyacophilidae	10	200.0
			Uenoidae	1	20.0
			Total	428	8,560.0

#### Metrics

Name	ALX003	Predicted Group Reference Mean ±SD					
Bray-Curtis Distance	0.47	0.4 ± 0.2					
Biotic Indices							
Intolerant taxa		1.0					
Tolerant individuals (%)		0.6 ± 0.4					
Number Of	Individuals						
% Chironomidae	5.1	7.3 ± 10.2					
% Coleoptera	2.6	2.9 ± 5.0					
% Diptera + Non-insects	20.3	13.0 ± 11.1					
% Ephemeroptera	47.9	48.4 ± 15.8					
% Ephemeroptera that are Baetidae	18.5	41.9 ± 25.2					
% EPT Individuals	77.1	84.1 ± 11.5					
% Odonata		$0.0 \pm 0.0$					
% of 2 dominant taxa	38.8	54.3 ± 12.1					
% of dominant taxa	21.5	35.5 ± 11.8					
% Plecoptera	22.0	28.1 ± 15.3					
% Tribe Tanyatarisini							
% Trichoptera that are Hydropsychida	29.0	25.4 ± 24.5					
% Tricoptera	7.2	7.5 ± 7.7					
No. EPT individuals/Chironomids+EPT Individuals	0.9	0.9 ± 0.1					
Total Abundance	8560.0	4086.0 ± 3834.6					
Richness							
Chironomidae taxa (genus level only)	1.0	1.0 ± 0.0					
Coleoptera taxa	1.0	0.6 ± 0.6					
Diptera taxa	6.0	3.5 ± 1.1					
Ephemeroptera taxa	4.0	3.8 ± 0.7					
EPT Individuals (Sum)	6600.0	3252.2 ± 2587.2					
EPT taxa (no)	15.0	12.7 ± 2.6					
Odonata taxa		0.0 ± 0.0					
Pielou's Evenness	0.8	0.7 ± 0.1					
Plecoptera taxa	5.0	5.4 ± 1.3					
Shannon-Wiener Diversity	2.5	2.0 ± 0.3					
Simpson's Diversity	0.9	0.8 ± 0.1					
Simpson's Evenness	0.4	0.3 ± 0.1					
Total No. of Taxa	24.0	19.4 ± 4.2					
Trichoptera taxa	6.0	3.6 ± 1.5					

# Frequency and Probability of Taxa Occurrence

Reference Model Taxa	Frequ	lency of Oc	currence in	Probability Of Occurrence at		
	Group 1	Group 2	Group 3	Group 4	Group 5	ALX003
Ameletidae	56%	53%	22%	50%	68%	0.24
Apataniidae	22%	24%	28%	25%	3%	0.27
Athericidae	0%	2%	0%	17%	0%	0.01
Aturidae	0%	8%	0%	0%	0%	0.00
Baetidae	100%	100%	100%	100%	97%	1.00
Blephariceridae	0%	0%	0%	0%	5%	0.00
Brachycentridae	11%	69%	0%	42%	3%	0.03
Capniidae	78%	55%	50%	92%	68%	0.53
Ceratopogonidae	0%	55%	28%	42%	5%	0.29

#### Frequency of Occurrence in Reference Sites **Probability Of Occurrence at Reference Model Taxa** ALX003 Group 1 Group 2 Group 5 Group 3 Group 4 Chironomidae 100% 100% 1.00 100% 100% 95% Chloroperlidae 78% 88% 94% 100% 100% 0.95 Corixidae 11% 0% 0% 0% 0% 0.00 Curculionidae 0% 4% 0% 0% 0% 0.00 Deuterophlebiidae 0% 0% 0% 0% 3% 0.00 Dixidae 0% 10% 0% 0% 0% 0.00 Dytiscidae 0% 8% 6% 0% 0% 0.05 50% Elmidae 0% 86% 50% 5% 0.50 Empididae 67% 55% 50% 67% 57% 0.51 Enchytraeidae 11% 14% 0% 8% 0% 0.01 Ephemerellidae 78% 100% 100% 100% 100% 1.00 Ephydridae 0% 2% 0% 0% 0% 0.00 Glossosomatidae 11% 49% 39% 42% 35% 0.39 Heptageniidae 100% 100% 100% 100% 100% 1.00 Hydraenidae 0% 4% 0% 0% 0% 0.00 2% 0% 0% 0.00 Hydrophilidae 11%0% 92% Hydropsychidae 11%92% 78% 86% 0.79 11% 8% 0% 0% 0% 0.00 Hydroptilidae 0% 10% 17% 8% 16% 0.16 Hydrozetidae 11% 31% 11% Hydryphantidae 8% 8% 0.11 Hygrobatidae 0% 29% 0% 0% 11%0.00 Lebertiidae 78% 65% 39% 58% 5% 0.40 17% Lepidostomatidae 0% 53% 6% 8% 0.07 0% 2% Leptohyphidae 0% 0% 0% 0.00 11% 0% 90% Leptophlebiidae 33% 3% 0.13 Leuctridae 22% 43% 56% 67% 54% 0.56 Limnephilidae 22% 31% 6% 25% 41% 0.07 Limnesiidae 0% 2% 0% 0% 0% 0.00 Lumbriculidae 0% 20% 17% 25% 3% 0.17 Mideopsidae 0% 2% 0% 0% 0% 0.00 Naididae 0% 8% 39% 0% 3% 0.36 100% Nemouridae 100% 100% 100% 100% 1.00 Pelecorhynchidae 0% 22% 6% 0% 0% 0.05 22% 12% 41% 8% 0.06 Peltoperlidae 6% Perlidae 11% 84% 33% 100% 3% 0.38 Perlodidae 78% 78% 89% 92% 81% 0.89 Philopotamidae 0% 31% 0% 0% 3% 0.00 Pisidiidae 0% 6% 0% 8% 0% 0.01 Planariidae 67% 0% 8% 17% 3% 0.63 Planorbidae 0% 0% 0% 0% 3% 0.00 Psychodidae 22% 65% 94% 8% 11% 0.88 Pteronarcyidae 0% 12% 6% 0% 3% 0.05 92% 100% 100% 95% Rhyacophilidae 100% 1.00 Simuliidae 33% 49% 39% 33% 0.38 16% Sperchontidae 78% 63% 50% 42% 65% 0.50 Stygothrombiidae 0% 4% 0% 17% 0% 0.01 Taeniopterygidae 89% 49% 100% 92% 97% 0.99 0% 0% 0% 0.00 11% 4% Thaumaleidae Tipulidae 56% 55% 28% 67% 43% 0.30 Torrenticolidae 11%86% 11% 17% 11%0.12 22% 37% 17% 25% Uenoidae 46% 0.17 Valvatidae 0% 2% 6% 0% 0% 0.05

### Frequency and Probability of Taxa Occurrence

RIVPACS Ratios	
RIVPACS : Expected taxa P>0.50	12.73
RIVPACS : Observed taxa P>0.50	13.00
RIVPACS : 0:E (p > 0.5)	1.02
RIVPACS : Expected taxa P>0.70	10.50
RIVPACS : Observed taxa P>0.70	11.00
RIVPACS : 0:E (p > 0.7)	1.05
RIVPACS: O:E(p > 0.7)	

### Habitat Description

Variable	ALX003	Predicted Group Reference Mean ±SD
	ock Geology	
Sedimentary (%)	100.00000	92.18813 ± 22.65908
	Channel	22 5 4 10 5
Depth-Avg (cm) Depth-BankfullMinusWetted (cm)	33.6	22.5 ± 10.5 67.33 ± 71.65
Depth-Max (cm)	46.5	$32.9 \pm 17.9$
Macrophyte (PercentRange)	0	$0 \pm 0$
Reach-%CanopyCoverage (PercentRange)	1.00	$0.94 \pm 0.80$
Reach-DomStreamsideVeg (Category(1-4))	2	3 ± 1
Reach-Pools (Binary)	0	0 ± 1
Reach-Rapids (Binary)	0	0 ± 1
Reach-Riffles (Binary)	1	1 ± 0
Reach-StraightRun (Binary)	1	$1 \pm 0$
Slope (m/m)	0.0095000	$0.0235102 \pm 0.0284557$
Veg-Coniferous (Binary)	1	<u>1 ± 0</u>
Veg-Deciduous (Binary)	1	<u>1 ± 0</u>
Veg-GrassesFerns (Binary)	1	1 ± 0 1 ± 0
Veg-Shrubs (Binary)	0.37	$1 \pm 0$ 0.50 ± 0.25
Velocity-Avg (m/s) Velocity-Max (m/s)	0.37	$0.50 \pm 0.25$ $0.75 \pm 0.28$
Width-Bankfull (m)	10.1	$0.75 \pm 0.28$ 15.6 ± 12.8
Width-Wetted (m)	9.1	$10.2 \pm 7.0$
XSEC-VelMethod (Category(1-3))	1	$2 \pm 1$
	Climate	
Precip10_OCT (mm)	43.56508	52.92857 ± 22.22704
Temp12_DECmin (Degrees Celsius)	-13.47046	$-12.82063 \pm 2.01422$
	ydrology	
Drainage-Area (km^2)	145.66793	166.32560 ± 185.60049
La	andcover	
Natl-Grassland (%)	2.54651	4.92979 ± 5.99508
Natl-ShrubLow (%)	0.10049	$1.89085 \pm 1.59075$
Natl-Water (%)	0.00000	$0.22269 \pm 0.34683$
Reg-Ice (%)	0.00000	0.46949 ± 1.15785
	strate Data	0 ± 0
%Bedrock (%) %Boulder (%)	0	<u> </u>
%Cobble (%)	66	61 ± 27
%Gravel (%)	4	1 ± 2
%Pebble (%)	20	31 ± 28
%Sand (%)	0	$\frac{31-20}{0\pm0}$
%Silt+Clay (%)	2	0 ± 1
D50 (cm)	10.50	79.45 ± 47.98
Dg (cm)	8.7	73.9 ± 48.0
Dominant-1st (Category(0-9))	6	6 ± 1
Dominant-2nd (Category(0-9))	7	6 ± 2
Embeddedness (Category(1-5))	3	4 ± 1
PeriphytonCoverage (Category(1-5))	2	<u>2 ± 1</u>
SurroundingMaterial (Category(0-9))	2	3 ± 1
	pography E1.07020	
Reg-SlopeLT30% (%)	51.07930	$27.92073 \pm 14.83033$
SlopeMax (%)	318.46573	616.97887 ± 680.88955
Ag (mg/L)	0.0000250	$0.0000004 \pm 0.0000014$
Al (mg/L)	0.0089000	$0.0059500 \pm 0.0039700$
As (mg/L)	0.0002500	$0.0002175 \pm 0.0001795$
B (mg/L)	0.0250000	0.0500000
Ba (mg/L)	0.0741000	$0.0639025 \pm 0.0450861$
Be (mg/L)	0.0000500	$0.0000025 \pm 0.0000062$
Bi (mg/L)	0.0000500	$0.0000004 \pm 0.0000014$
Ca (mg/L)	46.8000000	38.6142857 ± 14.8464843
Cd (mg/L)	0.0000120	$0.0000059 \pm 0.0000067$
Co (mg/L)	0.0000500	0.0000043 ± 0.0000057

Date: February 2, 2022 6:06 PM

## Habitat Description

Habitat Description		Duadiated Cusum Deferrers
Variable	ALX003	Predicted Group Reference Mean ±SD
Cr (mg/L)	0.0006800	$0.0000833 \pm 0.0001403$
Cu (mg/L)	0.0002000	$0.0001875 \pm 0.0001434$
Fe (mg/L)	0.0190000	0.0090000
General-Alkalinity (mg/L)	165.000000	$121.5944444 \pm 36.7225924$
General-Conductivity (µS/cm)	143.2800000	$186.8500000 \pm 84.0864011$
General-DO (mg/L)	11.0000000	$10.4922222 \pm 0.8833463$
General-Hardness (mg/L)	160.000000	$146.8222222 \pm 41.6699011$
General-pH (pH)	8.4	8.0 ± 0.6
General-SolidsTSS (mg/L)	1.000000	$0.5604289 \pm 1.4627232$
General-SpCond (µS/cm)	214.5000000	214.2437500 ± 77.1891440
General-TempAir (Degrees Celsius)	14.5	10.5 ± 4.2
General-TempWater (Degrees Celsius)	8.400000	6.6716667 ± 2.0277755
General-Turbidity (NTU)	0.5100000	$0.0000000 \pm 0.0000000$
Hg (ng/L)	0.0000200	$0.0000000 \pm 0.0000000$
K (mg/L)	0.4300000	$0.6471429 \pm 0.7154652$
Li (mg/L)	0.0040600	$0.0011817 \pm 0.0004768$
Mg (mg/L)	13.000000	9.8814286 ± 6.1601202
Mn (mg/L)	0.0015400	$0.0011426 \pm 0.0016097$
Mo (mg/L)	0.0006900	0.0024883 ± 0.0065339
Na (mg/L)	1.5700000	2.6357143 ± 3.7712414
Ni (mg/L)	0.0002000	$0.0000808 \pm 0.0000811$
Nitrogen-NH3 (mg/L)	0.0250000	$0.0019286 \pm 0.0059286$
Nitrogen-NO2 (mg/L)	0.0050000	$0.0023889 \pm 0.0063351$
Nitrogen-NO2+NO3 (mg/L)	0.0050000	$0.0130000 \pm 0.0088111$
Nitrogen-NO3 (mg/L)	0.0050000	$0.0245003 \pm 0.0229452$
Nitrogen-TKN (mg/L)	0.0250000	$0.0233333 \pm 0.0161433$
Nitrogen-TN (mg/L)	0.0250000	$0.0688889 \pm 0.0759171$
Pb (mg/L)	0.0001000	$0.0000224 \pm 0.0000176$
Phosphorus-TP (mg/L)	0.0051000	0.0032778 ± 0.0061816
S (mg/L)	6.700000	5.000000
Sb (mg/L)	0.0001000	$0.0000361 \pm 0.0000135$
Se (mg/L)	0.0005300	$0.0004382 \pm 0.0004486$
Si (mg/L)	2.300000	3.0657143 ± 1.4070046
Sn (mg/L)	0.0001000	0.0000167 ± 0.0000078
Sr (mg/L)	0.1220000	$0.1159167 \pm 0.0982749$
Te (mg/L)	0.0002500	$0.0000000 \pm 0.0000000$
Th (mg/L)	0.0000500	$0.0000000 \pm 0.0000000$
Ti (mg/L)	0.0025000	0.0009000
TI (mg/L)	0.0000100	$0.0000038 \pm 0.0000064$
U (mg/L)	0.0005660	$0.0005298 \pm 0.0003220$
V (mg/L)	0.0005000	$0.0001642 \pm 0.0001203$
Zn (mg/L)	0.0020000	$0.0004083 \pm 0.0008361$
Zr (mg/L)	0.0000500	$0.0000000 \pm 0.0000000$

### **Site Description**

Study Name	CBWQ-Elk			
Site	BOI001			
Sampling Date	Sep 20 2020			
Know Your Watershed Basin	Central Kootenay			
Province / Territory	British Columbia			
Terrestrial Ecological Classification	Montane Cordillera EcoZone			
	Northern Continental Divide EcoRegion			
Coordinates (decimal degrees)	50.02315 N, 114.91624 W			
Altitude	1250			
Local Basin Name	Elk River			
	Boivin Creek			
Church and Audion				

#### Stream Order

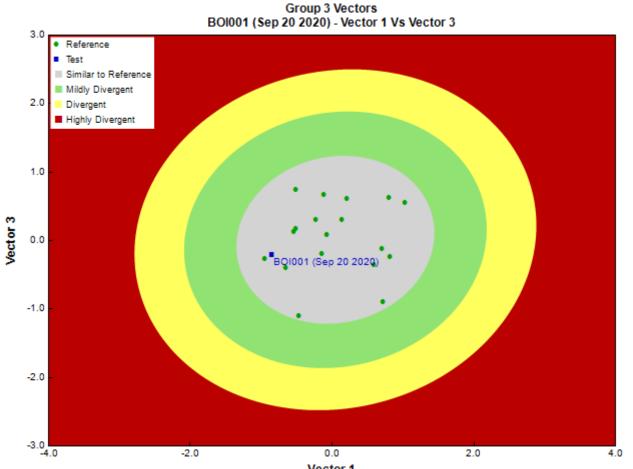


Figure 1. Location Map

Across Reach (No image found) Down Stream (No image found) Field Sheet (No image found) Substrate (No image found) Up Stream (No image found)

#### **Cabin Assessment Results**

Reference Model Summary							
Model	Columbia-Okana	Columbia-Okanagan Preliminary March 2010					
Analysis Date	January 07, 2022	2					
Taxonomic Level	Family						
Predictive Model Variables	Depth-Avg Latitude Longitude Reg-Ice Reg-SlopeLT30%						
Reference Groups	1 2 3 4 5						
Number of Reference Sites	9	43	17	12	33		
Group Error Rate	22.2% 24.5% 22.2% 25.0% 32.4%						
Overall Model Error Rate	26.4%						
Probability of Group Membership	0.1% 0.1% 76.5% 17.2% 6.1%						
CABIN Assessment of BOI001 on Sep 20, 2020	Similar to Reference						



Vector 1

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

#### **Sample Information**

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Pina Viola, Consultant
	Marchant Box
Sub-Sample Proportion	5/100

### **Community Structure**

Phylum	Class	Order	Order Family		Order Family Raw Count		Total Count	
Annelida	Clitellata	Lumbriculida	Lumbriculida Lumbriculidae		80.0			
Arthropoda	Insecta	Diptera	Chironomidae	102	2,040.0			
			Simuliidae	2	40.0			
			Tipulidae	2	40.0			
		Ephemeroptera	Baetidae	19	380.0			
			Ephemerellidae	11	220.0			
			Heptageniidae	87	1,740.0			
		Plecoptera			20.0			
			Chloroperlidae	3	60.0			
			Leuctridae	1	20.0			
			Nemouridae	23	460.0			
			Perlodidae	1	20.0			
			Taeniopterygidae	89	1,780.0			
		Trichoptera	Glossosomatidae	2	40.0			
			Rhyacophilidae	1	20.0			
			Uenoidae	1	20.0			

# Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
			Total	349	6,980.0

# Metrics

Name	BOI001	Predicted Group Reference Mean ±SD						
Bray-Curtis Distance	0.46	0.4 ± 0.2						
Biotic Indices								
Intolerant taxa		1.0						
Tolerant individuals (%)		0.6 ± 0.4						
Number Of Individuals								
% Chironomidae	29.2	7.3 ± 10.2						
% Coleoptera	0.0	2.9 ± 5.0						
% Diptera + Non-insects	31.5	13.0 ± 11.1						
% Ephemeroptera	33.5	48.4 ± 15.8						
% Ephemeroptera that are Baetidae	16.2	41.9 ± 25.2						
% EPT Individuals	68.5	84.1 ± 11.5						
% Odonata		$0.0 \pm 0.0$						
% of 2 dominant taxa	54.7	54.3 ± 12.1						
% of dominant taxa	29.2	35.5 ± 11.8						
% Plecoptera	33.8	28.1 ± 15.3						
% Tribe Tanyatarisini								
% Trichoptera that are Hydropsychida	0.0	25.4 ± 24.5						
% Tricoptera	1.1	7.5 ± 7.7						
No. EPT individuals/Chironomids+EPT Individuals	0.7	0.9 ± 0.1						
Total Abundance	6980.0	4086.0 ± 3834.6						
-	ness							
Chironomidae taxa (genus level only)	1.0	$1.0 \pm 0.0$						
Coleoptera taxa	0.0	0.6 ± 0.6						
Diptera taxa	3.0	3.5 ± 1.1						
Ephemeroptera taxa	3.0	3.8 ± 0.7						
EPT Individuals (Sum)	4780.0	3252.2 ± 2587.2						
EPT taxa (no)	12.0	12.7 ± 2.6						
Odonata taxa		$0.0 \pm 0.0$						
Pielou's Evenness	0.6	0.7 ± 0.1						
Plecoptera taxa	6.0	5.4 ± 1.3						
Shannon-Wiener Diversity	1.8	2.0 ± 0.3						
Simpson's Diversity	0.8	$0.8 \pm 0.1$						
Simpson's Evenness	0.3	0.3 ± 0.1						
Total No. of Taxa	16.0	19.4 ± 4.2						
Trichoptera taxa	3.0	3.6 ± 1.5						

# Frequency and Probability of Taxa Occurrence

<b>Reference Model Taxa</b>	Frequ	Frequency of Occurrence in Reference Sites			Probability Of Occurrence at	
	Group 1	Group 2	Group 3	Group 4	Group 5	BOI001
Ameletidae	56%	53%	22%	50%	68%	0.30
Apataniidae	22%	24%	28%	25%	3%	0.26
Athericidae	0%	2%	0%	17%	0%	0.03
Aturidae	0%	8%	0%	0%	0%	0.00
Baetidae	100%	100%	100%	100%	97%	1.00
Blephariceridae	0%	0%	0%	0%	5%	0.00
Brachycentridae	11%	69%	0%	42%	3%	0.07
Capniidae	78%	55%	50%	92%	68%	0.58
Ceratopogonidae	0%	55%	28%	42%	5%	0.29
Chironomidae	100%	100%	100%	100%	95%	1.00
Chloroperlidae	78%	88%	94%	100%	100%	0.96
Corixidae	11%	0%	0%	0%	0%	0.00
Curculionidae	0%	4%	0%	0%	0%	0.00
Deuterophlebiidae	0%	0%	0%	0%	3%	0.00
Dixidae	0%	10%	0%	0%	0%	0.00
Dytiscidae	0%	8%	6%	0%	0%	0.04
Elmidae	0%	86%	50%	50%	5%	0.47

<b>Reference Model Taxa</b>	Frequ	uency of Oc	Probability Of Occurrence at			
	Group 1	Group 2	Group 3	Group 4	Group 5	BOI001
Empididae	67%	55%	50%	67%	57%	0.53
Enchytraeidae	11%	14%	0%	8%	0%	0.01
Ephemerellidae	78%	100%	100%	100%	100%	1.00
Ephydridae	0%	2%	0%	0%	0%	0.00
Glossosomatidae	11%	49%	39%	42%	35%	0.39
Heptageniidae	100%	100%	100%	100%	100%	1.00
Hydraenidae	0%	4%	0%	0%	0%	0.00
Hydrophilidae	11%	2%	0%	0%	0%	0.00
Hydropsychidae	11%	92%	78%	92%	86%	0.81
Hydroptilidae	11%	8%	0%	0%	0%	0.00
Hydrozetidae	0%	10%	17%	8%	16%	0.15
Hydryphantidae	11%	31%	11%	8%	8%	0.10
Hygrobatidae	0%	29%	0%	0%	11%	0.01
Lebertiidae	78%	65%	39%	58%	5%	0.40
Lepidostomatidae	0%	53%	6%	17%	8%	0.08
Leptohyphidae	0%	2%	0%	0%	0%	0.00
Leptophlebiidae	0%	90%	11%	33%	3%	0.14
Leuctridae	22%	43%	56%	67%	54%	0.57
Limnephilidae	22%	31%	6%	25%	41%	0.11
Limnesiidae	0%	2%	0%	0%	0%	0.00
Lumbriculidae	0%	20%	17%	25%	3%	0.17
Mideopsidae	0%	20%	0%	0%	0%	0.00
Naididae	0%	8%	39%	0%	3%	0.30
Nemouridae	100%	100%	100%	100%	100%	1.00
Pelecorhynchidae	0%	22%	6%	0%	0%	0.04
Peltoperlidae	22%	12%	6%	8%	41%	0.04
Perlidae	11%	84%	33%	100%	3%	0.08
Perlodidae	78%	78%	89%	92%	81%	0.43
Philopotamidae	0%	31%	0%	0%	3%	0.00
	0%	6%	0%	8%	0%	0.00
Pisidiidae	0%	8%	67%	17%	3%	
Planariidae	0%	0%	0%	0%	3%	0.54
Planorbidae		65%	94%	8%		0.00 0.74
Psychodidae	22%				11%	
Pteronarcyidae	0%	12%	6%	0%	3%	0.04
Rhyacophilidae	100%	92%	100%	100%	95%	1.00
Simuliidae	33%	49%	39%	33%	16%	0.37
Sperchontidae	78%	63%	50%	42%	65%	0.49
Stygothrombiidae	0%	4%	0%	17%	0%	0.03
Taeniopterygidae	89%	49%	100%	92%	97%	0.98
Thaumaleidae	11%	4%	0%	0%	0%	0.00
Tipulidae	56%	55%	28%	67%	43%	0.35
Torrenticolidae	11%	86%	11%	17%	11%	0.12
Uenoidae	22%	37%	17%	25%	46%	0.20
Valvatidae	0%	2%	6%	0%	0%	0.04

# Frequency and Probability of Taxa Occurrence

RIVPACS Ratios	
RIVPACS : Expected taxa P>0.50	12.60
RIVPACS : Observed taxa P>0.50	11.00
RIVPACS : 0:E (p > 0.5)	0.87
RIVPACS : Expected taxa P>0.70	10.37
RIVPACS : Observed taxa P>0.70	9.00
RIVPACS : 0:E (p > 0.7)	0.87

Variable	B0I001	Predicted Group Reference Mean ±SD	
Bedrock	Geology		
Sedimentary (%)	100.00000	92.18813 ± 22.65908	
Cha	nnel		
Depth-Avg (cm)	24.3	22.5 ± 10.5	

Habitat Description Variable	B0I001	Predicted Group Reference
		Mean ±SD
Depth-BankfullMinusWetted (cm)	23.00	67.33 ± 71.65
Depth-Max (cm)	38.2	32.9 ± 17.9
Macrophyte (PercentRange) Reach-%CanopyCoverage (PercentRange)	0.00	0 ± 0 0.94 ± 0.80
Reach-DomStreamsideVeg (Category(1-4))	1	$0.94 \pm 0.80$ $3 \pm 1$
Reach-Pools (Binary)	0	$3 \pm 1$ 0 ± 1
Reach-Rapids (Binary)	0	0 ± 1
Reach-Riffles (Binary)		0 ± 1 1 ± 0
Reach-StraightRun (Binary)	0	1 = 0 1 ± 0
Slope (m/m)	0.0260000	$0.0235102 \pm 0.0284557$
Veg-Coniferous (Binary)	1	1 ± 0
Veg-Deciduous (Binary)	0	1 ± 0
Veg-GrassesFerns (Binary)	1	1 ± 0
Veg-Shrubs (Binary)	1	1 ± 0
Velocity-Avg (m/s)	1.10	0.50 ± 0.25
Velocity-Max (m/s)	1.50	0.75 ± 0.28
Width-Bankfull (m)	7.4	15.6 ± 12.8
Width-Wetted (m)	7.1	10.2 ± 7.0
XSEC-VelMethod (Category(1-3))	1	2 ± 1
	Climate	
Precip10_OCT (mm)	45.44750	52.92857 ± 22.22704
Temp12_DECmin (Degrees Celsius)	-14.26821	-12.82063 ± 2.01422
	Hydrology	
Drainage-Area (km^2)	63.55192	$166.32560 \pm 185.60049$
	Landcover	4 02070 + 5 00500
Nati-Grassland (%)	0.70842	4.92979 ± 5.99508
Nati-ShrubLow (%)	0.53944	1.89085 ± 1.59075
Natl-Water (%)	0.00000	0.22269 ± 0.34683
Reg-Ice (%)	ubstrate Data	0.46949 ± 1.15785
%Bedrock (%)		0 ± 0
%Boulder (%)	2	0 ± 0 6 ± 7
%Cobble (%)	50	61 ± 27
%Gravel (%)	4	
%Pebble (%)	42	31 ± 28
%Sand (%)	0	0 ± 0
%Silt+Clay (%)	2	0 ± 1
D50 (cm)	6.50	79.45 ± 47.98
Dg (cm)	5.8	73.9 ± 48.0
Dominant-1st (Category(0-9))	6	6 ± 1
Dominant-2nd (Category(0-9))	5	6 ± 2
Embeddedness (Category(1-5))	3	4 ± 1
PeriphytonCoverage (Category(1-5))	2	2 ± 1
SurroundingMaterial (Category(0-9))	2	3 ± 1
	Topography	
Reg-SlopeLT30% (%)	26.07481	27.92073 ± 14.83033
SlopeMax (%)	298.23184	616.97887 ± 680.88955
	ater Chemistry	
Ag (mg/L)	0.0000250	$0.0000004 \pm 0.0000014$
Al (mg/L)	0.0059000	0.0059500 ± 0.0039700
As (mg/L)	0.0005200	0.0002175 ± 0.0001795
B (mg/L)	0.0250000	0.0500000
Ba (mg/L)	0.0293000	0.0639025 ± 0.0450861
Be (mg/L)	0.0000500	$0.0000025 \pm 0.0000062$
Bi (mg/L)	0.0000500	$0.000004 \pm 0.000014$
Ca (mg/L)	49.900000	$38.6142857 \pm 14.8464843$
Cd (mg/L)	0.0000350	$0.0000059 \pm 0.0000067$
Co (mg/L)	0.0000500	0.0000043 ± 0.0000057
Cr (mg/L)	0.0007200	$0.0000833 \pm 0.0001403$
	0.0002000	$0.0001875 \pm 0.0001434$
Cu (mg/L)		0.000000
Fe (mg/L) General-Alkalinity (mg/L)	0.0240000	0.0090000 121.5944444 ± 36.7225924

#### Date: February 2, 2022 6:07 PM

Variable	B0I001	Predicted Group Reference
Variable	BOIUUI	Mean ±SD
General-Conductivity (µS/cm)	128.9000000	$186.8500000 \pm 84.0864011$
General-DO (mg/L)	10.000000	$10.4922222 \pm 0.8833463$
General-Hardness (mg/L)	171.0000000	$146.8222222 \pm 41.6699011$
General-pH (pH)	8.2	$8.0 \pm 0.6$
General-SolidsTSS (mg/L)	1.000000	0.5604289 ± 1.4627232
General-SpCond (µS/cm)	212.7000000	214.2437500 ± 77.1891440
General-TempAir (Degrees Celsius)	9.5	10.5 ± 4.2
General-TempWater (Degrees Celsius)	5.300000	6.6716667 ± 2.0277755
General-Turbidity (NTU)	0.4300000	$0.0000000 \pm 0.0000000$
Hg (ng/L)	0.0000200	$0.0000000 \pm 0.0000000$
K (mg/L)	0.3200000	0.6471429 ± 0.7154652
Li (mg/L)	0.0016400	$0.0011817 \pm 0.0004768$
Mg (mg/L)	13.900000	9.8814286 ± 6.1601202
Mn (mg/L)	0.0003700	$0.0011426 \pm 0.0016097$
Mo (mg/L)	0.0014500	$0.0024883 \pm 0.0065339$
Na (mg/L)	0.5900000	2.6357143 ± 3.7712414
Ni (mg/L)	0.0002000	$0.0000808 \pm 0.0000811$
Nitrogen-NH3 (mg/L)	0.0250000	0.0019286 ± 0.0059286
Nitrogen-NO2 (mg/L)	0.0050000	0.0023889 ± 0.0063351
Nitrogen-NO2+NO3 (mg/L)	0.0613000	$0.0130000 \pm 0.0088111$
Nitrogen-NO3 (mg/L)	0.0610000	$0.0245003 \pm 0.0229452$
Nitrogen-TKN (mg/L)	0.0250000	$0.0233333 \pm 0.0161433$
Nitrogen-TN (mg/L)	0.0613000	$0.0688889 \pm 0.0759171$
Pb (mg/L)	0.0001000	$0.0000224 \pm 0.0000176$
Phosphorus-OrthoP (mg/L)	0.0025000	$0.0035000 \pm 0.0018292$
Phosphorus-TP (mg/L)	0.0061000	$0.0032778 \pm 0.0061816$
S (mg/L)	23.1000000	5.000000
Sb (mg/L)	0.0001000	$0.0000361 \pm 0.0000135$
Se (mg/L)	0.0011700	$0.0004382 \pm 0.0004486$
Si (mg/L)	2.200000	$3.0657143 \pm 1.4070046$
Sn (mg/L)	0.0001000	$0.0000167 \pm 0.0000078$
Sr (mg/L)	0.5900000	$0.1159167 \pm 0.0982749$
Te (mg/L)	0.0002500	$0.0000000 \pm 0.0000000$
Th (mg/L)	0.0000500	$0.0000000 \pm 0.0000000$
Ti (mg/L)	0.0025000	0.0009000
TI (mg/L)	0.0000100	$0.0000038 \pm 0.0000064$
U (mg/L)	0.0009950	0.0005298 ± 0.0003220
V (mg/L)	0.0005000	0.0001642 ± 0.0001203
Zn (mg/L)	0.0020000	$0.0004083 \pm 0.0008361$
Zr (mg/L)	0.0000500	$0.0000000 \pm 0.0000000$

# **Site Description**

Study Name	CBWQ-Elk			
Site	BOI002			
Sampling Date	Sep 20 2020			
Know Your Watershed Basin	Central Kootenay			
Province / Territory	British Columbia			
Terrestrial Ecological Classification	Montane Cordillera EcoZone			
	Northern Continental Divide EcoRegion			
Coordinates (decimal degrees)	50.01678 N, 114.93732 W			
Altitude	1298			
Local Basin Name	Elk River			
	Boivin Creek			
Church and Audion				

# Stream Order

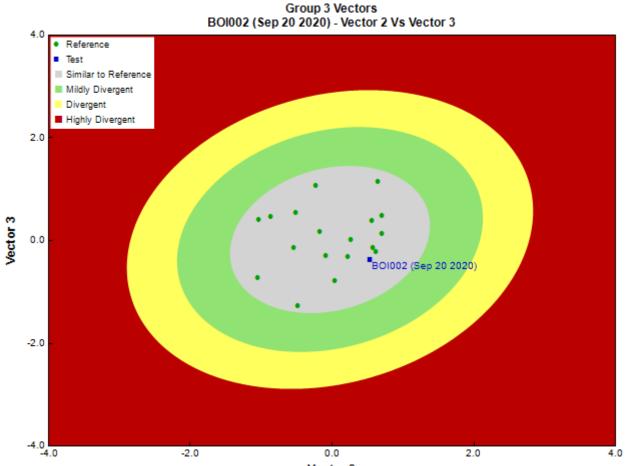


Figure 1. Location Map

Across Reach (No image found) Down Stream (No image found) Field Sheet (No image found) Substrate (No image found) Up Stream (No image found)

### **Cabin Assessment Results**

Reference Model Summary							
Model	Columbia-Okana	Columbia-Okanagan Preliminary March 2010					
Analysis Date	January 07, 2022	2	•				
Taxonomic Level	Family						
Predictive Model Variables	Depth-Avg Latitude Longitude Reg-Ice Reg-SlopeLT30%						
Reference Groups	1	2	3	4	5		
Number of Reference Sites	9	43	17	12	33		
Group Error Rate	22.2% 24.5% 22.2% 25.0% 32.4%						
Overall Model Error Rate	26.4%						
Probability of Group Membership	0.1% 0.1% 73.3% 19.7% 6.8%						
CABIN Assessment of BOI002 on Sep 20, 2020	Similar to Reference						



Vector 2

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

# **Sample Information**

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Pina Viola, Consultant
	Marchant Box
Sub-Sample Proportion	6/100

# **Community Structure**

Phylum	Class	Order	Family	Raw Count	Total Count
Annelida	Clitellata	Lumbriculida	Lumbriculida Lumbriculidae		50.0
Arthropoda	Arachnida	Trombidiformes	Hydryphantidae	1	16.7
	Insecta	Diptera	Chironomidae	16	266.7
			Empididae	1	16.7
			Simuliidae	5	83.3
			Tipulidae	4	66.7
		Ephemeroptera	Ameletidae	3	50.0
			Baetidae	25	416.7
			Ephemerellidae	94	1,566.6
			Heptageniidae	83	1,383.4
			Leptophlebiidae	1	16.7
		Plecoptera	Capniidae	1	16.7
			Chloroperlidae	9	150.0
			Leuctridae	2	33.3
			Nemouridae	19	316.7
			Peltoperlidae	1	16.7

# **Community Structure**

Phylum	Class	Order	Order Family		Total Count
			Perlodidae	6	100.0
			Taeniopterygidae	26	433.3
		Trichoptera	Glossosomatidae	15	250.0
			Rhyacophilidae	13	216.7
			Total	328	5,466.9

### **Metrics**

Name	B01002	Predicted Group Reference Mean ±SD						
Bray-Curtis Distance	0.31	$0.4 \pm 0.2$						
Biotic Indices								
Intolerant taxa		1.0						
Tolerant individuals (%)		0.6 ± 0.4						
Number Of	Individuals							
% Chironomidae	4.9	7.3 ± 10.2						
% Coleoptera	0.0	2.9 ± 5.0						
% Diptera + Non-insects	9.1	$13.0 \pm 11.1$						
% Ephemeroptera	62.8	48.4 ± 15.8						
% Ephemeroptera that are Baetidae	12.1	41.9 ± 25.2						
% EPT Individuals	90.9	84.1 ± 11.5						
% Odonata		0.0 ± 0.0						
% of 2 dominant taxa	54.0	54.3 ± 12.1						
% of dominant taxa	28.7	35.5 ± 11.8						
% Plecoptera	19.5	28.1 ± 15.3						
% Tribe Tanyatarisini								
% Trichoptera that are Hydropsychida	0.0	25.4 ± 24.5						
% Tricoptera	8.5	7.5 ± 7.7						
No. EPT individuals/Chironomids+EPT Individuals	0.9	0.9 ± 0.1						
Total Abundance	5466.7	4086.0 ± 3834.6						
-	ness							
Chironomidae taxa (genus level only)	1.0	$1.0 \pm 0.0$						
Coleoptera taxa	0.0	0.6 ± 0.6						
Diptera taxa	4.0	3.5 ± 1.1						
Ephemeroptera taxa	5.0	3.8 ± 0.7						
EPT Individuals (Sum)	4966.7	3252.2 ± 2587.2						
EPT taxa (no)	14.0	12.7 ± 2.6						
Odonata taxa		0.0 ± 0.0						
Pielou's Evenness	0.7	0.7 ± 0.1						
Plecoptera taxa	7.0	5.4 ± 1.3						
Shannon-Wiener Diversity	2.2	2.0 ± 0.3						
Simpson's Diversity	0.8	$0.8 \pm 0.1$						
Simpson's Evenness	0.3	0.3 ± 0.1						
Total No. of Taxa	20.0	19.4 ± 4.2						
Trichoptera taxa	2.0	3.6 ± 1.5						

Reference Model Taxa	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at
	Group 1	Group 2	Group 3	Group 4	Group 5	BO1002
Ameletidae	56%	53%	22%	50%	68%	0.31
Apataniidae	22%	24%	28%	25%	3%	0.26
Athericidae	0%	2%	0%	17%	0%	0.03
Aturidae	0%	8%	0%	0%	0%	0.00
Baetidae	100%	100%	100%	100%	97%	1.00
Blephariceridae	0%	0%	0%	0%	5%	0.00
Brachycentridae	11%	69%	0%	42%	3%	0.08
Capniidae	78%	55%	50%	92%	68%	0.59
Ceratopogonidae	0%	55%	28%	42%	5%	0.29
Chironomidae	100%	100%	100%	100%	95%	1.00
Chloroperlidae	78%	88%	94%	100%	100%	0.96
Corixidae	11%	0%	0%	0%	0%	0.00
Curculionidae	0%	4%	0%	0%	0%	0.00

Frequency and Probal Reference Model Taxa		uency of Oc	Probability Of Occurrence at			
	Group 1	Group 2	Group 3	Group 4	Group 5	BOI002
Deuterophlebiidae	0%	0%	0%	0%	3%	0.00
Dixidae	0%	10%	0%	0%	0%	0.00
Dytiscidae	0%	8%	6%	0%	0%	0.04
Elmidae	0%	86%	50%	50%	5%	0.47
Empididae	67%	55%	50%	67%	57%	0.54
Enchytraeidae	11%	14%	0%	8%	0%	0.02
Ephemerellidae	78%	100%	100%	100%	100%	1.00
Ephydridae	0%	2%	0%	0%	0%	0.00
Glossosomatidae	11%	49%	39%	42%	35%	0.39
Heptageniidae	100%	100%	100%	100%	100%	1.00
Hydraenidae	0%	4%	0%	0%	0%	0.00
Hydrophilidae	11%	2%	0%	0%	0%	0.00
Hydropsychidae	11%	92%	78%	92%	86%	0.81
Hydroptilidae	11%	8%	0%	0%	0%	0.00
Hydrozetidae	0%	10%	17%	8%	16%	0.15
Hydryphantidae	11%	31%	11%	8%	8%	0.10
Hygrobatidae	0%	29%	0%	0%	11%	0.10
Lebertiidae	78%	65%	39%	58%	5%	0.40
Lepidostomatidae	0%	53%	6%	17%	8%	0.08
Leptohyphidae	0%	2%	0%	0%	0%	0.00
Leptophlebiidae	0%	90%	11%	33%	3%	0.15
Leuctridae	22%	43%	56%	67%	54%	0.13
Limnephilidae	22%	31%	6%	25%	41%	0.12
Limnesiidae	0%	2%	0%	0%	0%	0.12
Lumbriculidae	0%	2%	17%	25%	3%	0.17
Mideopsidae	0%	20%	0%	0%	0%	0.00
						0.00
Naididae	0%	8% 100%	39%	0%	3%	
Nemouridae	100%		100%	100%	100%	1.00
Pelecorhynchidae	0%	22%	6%	0%	0%	0.04
Peltoperlidae	22%	12%	6%	8%	41%	0.09
Perlidae	11%	84%	33%	100%	3%	0.44
Perlodidae	78%	78%	89%	92%	81%	0.89
Philopotamidae	0%	31%	0%	0%	3%	0.00
Pisidiidae	0%	6%	0%	8%	0%	0.02
Planariidae	0%	8%	67%	17%	3%	0.52
Planorbidae	0%	0%	0%	0%	3%	0.00
Psychodidae	22%	65%	94%	8%	11%	0.72
Pteronarcyidae	0%	12%	6%	0%	3%	0.04
Rhyacophilidae	100%	92%	100%	100%	95%	1.00
Simuliidae	33%	49%	39%	33%	16%	0.36
Sperchontidae	78%	63%	50%	42%	65%	0.49
Stygothrombiidae	0%	4%	0%	17%	0%	0.03
Taeniopterygidae	89%	49%	100%	92%	97%	0.98
Thaumaleidae	11%	4%	0%	0%	0%	0.00
Tipulidae	56%	55%	28%	67%	43%	0.37
Torrenticolidae	11%	86%	11%	17%	11%	0.12
Uenoidae	22%	37%	17%	25%	46%	0.20
Valvatidae	0%	2%	6%	0%	0%	0.04

# Frequency and Probability of Taxa Occurrence

# **RIVPACS** Ratios

RIVPACS : Expected taxa P>0.50	12.58
RIVPACS : Observed taxa P>0.50	12.00
RIVPACS : 0:E (p > 0.5)	0.95
RIVPACS : Expected taxa P>0.70	10.35
RIVPACS : Observed taxa P>0.70	9.00
RIVPACS : 0:E (p > 0.7)	0.87

Variable	B0I002	Predicted Group Reference Mean ±SD	
	ock Geology		
Sedimentary (%)	100.00000	92.18813 ± 22.65908	
	Channel		
Depth-Avg (cm) Depth-BankfullMinusWetted (cm)	26.4		
Depth-Max (cm)	32.5		
Macrophyte (PercentRange)	0		
Reach-%CanopyCoverage (PercentRange)	1.00		
Reach-DomStreamsideVeg (Category(1-4))	2		
Reach-Pools (Binary)	0	0 ± 1	
Reach-Rapids (Binary)	0	0 ± 1	
Reach-Riffles (Binary)	1	1 ± 0	
Reach-StraightRun (Binary)	0	1 ± 0	
Slope (m/m)	0.0294500		
Veg-Coniferous (Binary)	1	-	
Veg-Deciduous (Binary)	1	-	
Veg-GrassesFerns (Binary)	1		
Veg-Shrubs (Binary)	1	-	
Velocity-Avg (m/s)	0.89		
Velocity-Max (m/s) Width-Bankfull (m)	1.33		
Width-Wetted (m)	11.0		
XSEC-VelMethod (Category(1-3))	11.2		
	Climate	2 - 1	
Precip10_OCT (mm)	45.58192	52.92857 ± 22.22704	
Temp12_DECmin (Degrees Celsius)	-14.29423		
	lydrology		
Drainage-Area (km^2)	59.44236	166.32560 ± 185.60049	
L	andcover		
Natl-Grassland (%)	0.53139		
Natl-ShrubLow (%)	0.52935		
Natl-Water (%)	0.00000		
Reg-Ice (%)	0.00000	0.46949 ± 1.15785	
	ostrate Data	0.1.0	
%Bedrock (%) %Boulder (%)	0		
%Cobble (%)	52	-	
%Gravel (%)	11		
%Pebble (%)	31		
%Sand (%)	0		
%Silt+Clay (%)	1		
D50 (cm)	8.25	79.45 ± 47.98	
Dg (cm)	6.0		
Dominant-1st (Category(0-9))	6		
Dominant-2nd (Category(0-9))	5		
Embeddedness (Category(1-5))	4		
PeriphytonCoverage (Category(1-5))	2		
SurroundingMaterial (Category(0-9))	3	3 ± 1	
	pography		
Reg-SlopeLT30% (%) SlopeMax (%)	23.73108 298.23184		
	er Chemistry	010.37007 ± 000.00322	
Ag (mg/L)	0.0000250	$0.0000004 \pm 0.0000014$	
Al (mg/L)	0.0062000		
As (mg/L)	0.0005200		
B (mg/L)	0.0250000	0.0500000	
Ba (mg/L)	0.0292000		
Be (mg/L)	0.0000500	$0.0000025 \pm 0.0000062$	
Bi (mg/L)	0.0000500		
Ca (mg/L)	48.500000		
Cd (mg/L)	0.0000200		
Co (mg/L)	0.0000500	0.0000043 ± 0.0000057	

Habitat Description	DOT003	Duadiated Cusum Deferrers
Variable	B01002	Predicted Group Reference Mean ±SD
Cr (mg/L)	0.0007800	$0.0000833 \pm 0.0001403$
Cu (mg/L)	0.0002000	$0.0001875 \pm 0.0001434$
Fe (mg/L)	0.0050000	0.0090000
General-Alkalinity (mg/L)	130.000000	121.5944444 ± 36.7225924
General-Conductivity (µS/cm)	133.000000	$186.8500000 \pm 84.0864011$
General-Hardness (mg/L)	172.000000	$146.8222222 \pm 41.6699011$
General-pH (pH)	8.3	8.0 ± 0.6
General-SolidsTSS (mg/L)	1.000000	$0.5604289 \pm 1.4627232$
General-SpCond (µS/cm)	213.000000	$214.2437500 \pm 77.1891440$
General-TempAir (Degrees Celsius)	11.5	10.5 ± 4.2
General-TempWater (Degrees Celsius)	5.400000	6.6716667 ± 2.0277755
General-Turbidity (NTU)	0.4400000	$0.0000000 \pm 0.0000000$
Hg (ng/L)	0.0000200	$0.0000000 \pm 0.0000000$
K (mg/L)	0.3200000	$0.6471429 \pm 0.7154652$
Li (mg/L)	0.0015100	$0.0011817 \pm 0.0004768$
Mg (mg/L)	13.700000	$9.8814286 \pm 6.1601202$
Mn (mg/L)	0.0001000	$0.0011426 \pm 0.0016097$
Mo (mg/L)	0.0014600	$0.0024883 \pm 0.0065339$
Na (mg/L)	0.5800000	2.6357143 ± 3.7712414
Ni (mg/L)	0.0002000	$0.0000808 \pm 0.0000811$
Nitrogen-NH3 (mg/L)	0.0250000	$0.0019286 \pm 0.0059286$
Nitrogen-NO2 (mg/L)	0.0050000	$0.0023889 \pm 0.0063351$
Nitrogen-NO2+NO3 (mg/L)	0.0506000	$0.0130000 \pm 0.0088111$
Nitrogen-NO3 (mg/L)	0.0510000	0.0245003 ± 0.0229452
Nitrogen-TKN (mg/L)	0.0610000	$0.0233333 \pm 0.0161433$
Nitrogen-TN (mg/L)	0.1120000	$0.0688889 \pm 0.0759171$
Pb (mg/L)	0.0001000	$0.0000224 \pm 0.0000176$
Phosphorus-TP (mg/L)	0.0050000	$0.0032778 \pm 0.0061816$
S (mg/L)	19.900000	5.000000
Sb (mg/L)	0.0001000	$0.0000361 \pm 0.0000135$
Se (mg/L)	0.0011000	$0.0004382 \pm 0.0004486$
Si (mg/L)	2.100000	$3.0657143 \pm 1.4070046$
Sn (mg/L)	0.0001000	$0.0000167 \pm 0.0000078$
Sr (mg/L)	0.5800000	$0.1159167 \pm 0.0982749$
Te (mg/L)	0.0002500	$0.0000000 \pm 0.0000000$
Th (mg/L)	0.0000500	$0.0000000 \pm 0.0000000$
Ti (mg/L)	0.0025000	0.0009000
TI (mg/L)	0.0000100	$0.0000038 \pm 0.0000064$
U (mg/L)	0.0009890	0.0005298 ± 0.0003220
V (mg/L)	0.0011000	$0.0001642 \pm 0.0001203$
Zn (mg/L)	0.0020000	$0.0004083 \pm 0.0008361$
Zr (mg/L)	0.0000500	$0.0000000 \pm 0.0000000$

# **Site Description**

Study Name	CBWQ-Elk		
Site	COL001		
Sampling Date	Sep 08 2020		
Know Your Watershed Basin	Central Kootenay		
Province / Territory	British Columbia		
Terrestrial Ecological Classification	Montane Cordillera EcoZone		
	Northern Continental Divide EcoRegion		
Coordinates (decimal degrees)	49.49556 N, 115.06644 W		
Altitude	999		
Local Basin Name	Elk River		
	Coal Creek		
Stream Order			

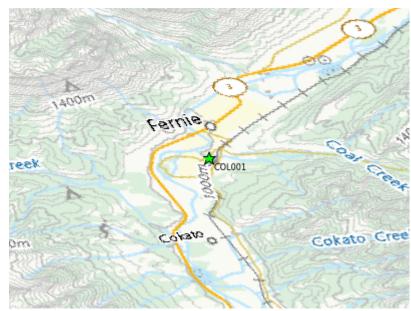


Figure 1. Location Map

Across Reach (No image found) Down Stream (No image found) Field Sheet (No image found) Substrate (No image found) Up Stream (No image found)

### **Cabin Assessment Results**

Reference Model Summary						
Model	Columbia-Okana	Columbia-Okanagan Preliminary March 2010				
Analysis Date	January 07, 202	2				
Taxonomic Level	Family					
Predictive Model Variables	Depth-Avg Latitude Longitude Reg-Ice Reg-SlopeLT30%					
Reference Groups				5		
Number of Reference Sites	9	43	17	12	33	
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%	
Overall Model Error Rate	26.4%					
Probability of Group Membership	0.0% 2.8% 89.9% 6.8% 0.6%					
CABIN Assessment of COL001 on Sep 08, 2020	Divergent					

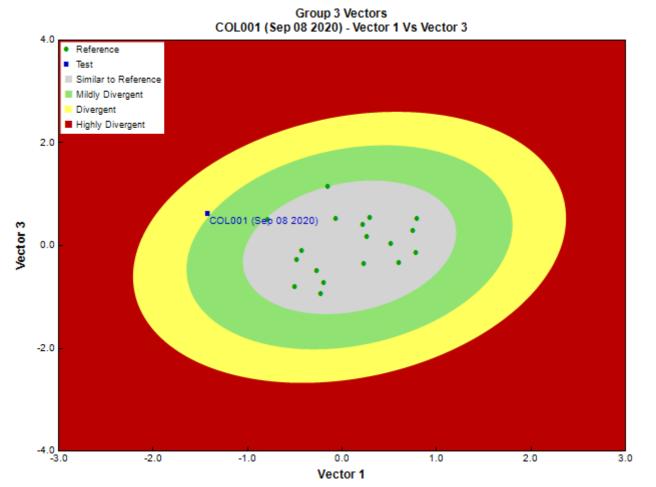


Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

# Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Pina Viola, Consultant
	Marchant Box
Sub-Sample Proportion	5/100

# **Community Structure**

Phylum	Class	Order	Family	Raw Count	Total Count
Annelida	Clitellata	Tubificida	Naididae	41	820.0
Arthropoda	Arachnida	Trombidiformes		3	60.0
			Aturidae	1	20.0
			Lebertiidae	9	180.0
			Sperchontidae	5	100.0
			Torrenticolidae	69	1,380.0
	Insecta	Coleoptera	Elmidae	17	340.0
		Diptera	Athericidae	1	20.0
			Chironomidae	120	2,400.0
			Empididae	2	40.0
			Psychodidae	4	80.0
			Tipulidae	15	300.0
		Ephemeroptera	Baetidae	17	340.0
			Ephemerellidae	9	180.0
			Heptageniidae	8	160.0
		Plecoptera	Capniidae	8	160.0

# **Community Structure**

Phylum	Class	Order	Family	Raw Count	Total Count
			Chloroperlidae	4	80.0
			Nemouridae	5	100.0
			Perlidae	1	20.0
			Perlodidae	2	40.0
		Trichoptera	Apataniidae	10	200.0
			Brachycentridae	4	80.0
			Hydropsychidae	7	140.0
			Hydroptilidae	1	20.0
			Lepidostomatidae	102	2,040.0
			Rhyacophilidae	7	140.0
			Total	472	9,440.0

#### **Metrics**

Name	COL001	Predicted Group Reference Mean ±SD					
Bray-Curtis Distance	0.81	$0.4 \pm 0.2$					
Biotic Indices							
Intolerant taxa		1.0					
Tolerant individuals (%)	0.2	0.6 ± 0.4					
Number Of	Individuals						
% Chironomidae	25.6	7.3 ± 10.2					
% Coleoptera	3.6	2.9 ± 5.0					
% Diptera + Non-insects	56.9	$13.0 \pm 11.1$					
% Ephemeroptera	7.2	48.4 ± 15.8					
% Ephemeroptera that are Baetidae	50.0	41.9 ± 25.2					
% EPT Individuals	39.4	84.1 ± 11.5					
% Odonata		$0.0 \pm 0.0$					
% of 2 dominant taxa	47.3	54.3 ± 12.1					
% of dominant taxa	25.6	35.5 ± 11.8					
% Plecoptera	4.3	28.1 ± 15.3					
% Tribe Tanyatarisini							
% Trichoptera that are Hydropsychida	5.3	25.4 ± 24.5					
% Tricoptera	27.9	7.5 ± 7.7					
No. EPT individuals/Chironomids+EPT Individuals	0.6	$0.9 \pm 0.1$					
Total Abundance	9440.0	4086.0 ± 3834.6					
Rich	ness						
Chironomidae taxa (genus level only)	1.0	$1.0 \pm 0.0$					
Coleoptera taxa	1.0	0.6 ± 0.6					
Diptera taxa	5.0	3.5 ± 1.1					
Ephemeroptera taxa	3.0	3.8 ± 0.7					
EPT Individuals (Sum)	3700.0	3252.2 ± 2587.2					
EPT taxa (no)	14.0	12.7 ± 2.6					
Odonata taxa		$0.0 \pm 0.0$					
Pielou's Evenness	0.7	0.7 ± 0.1					
Plecoptera taxa	5.0	5.4 ± 1.3					
Shannon-Wiener Diversity	2.3	2.0 ± 0.3					
Simpson's Diversity	0.9	$0.8 \pm 0.1$					
Simpson's Evenness	0.3	0.3 ± 0.1					
Total No. of Taxa	25.0	19.4 ± 4.2					
Trichoptera taxa	6.0	3.6 ± 1.5					

<b>Reference Model Taxa</b>	Frequ	lency of Oc	Probability Of Occurrence at			
	Group 1	Group 2	Group 3	Group 4	Group 5	COL001
Ameletidae	56%	53%	22%	50%	68%	0.25
Apataniidae	22%	24%	28%	25%	3%	0.27
Athericidae	0%	2%	0%	17%	0%	0.01
Aturidae	0%	8%	0%	0%	0%	0.00
Baetidae	100%	100%	100%	100%	97%	1.00
Blephariceridae	0%	0%	0%	0%	5%	0.00
Brachycentridae	11%	69%	0%	42%	3%	0.05

#### **Probability Of Occurrence at Reference Model Taxa** Frequency of Occurrence in Reference Sites COL001 Group 1 Group 2 Group 5 Group 3 Group 4 78% 50% 0.53 Capniidae 55% 92% 68% 5% Ceratopogonidae 0% 55% 28% 42% 0.29 Chironomidae 100% 100% 100% 100% 95% 1.00 0.95 Chloroperlidae 78% 88% 94% 100% 100% Corixidae 11% 0% 0% 0.00 0% 0% Curculionidae 0% 4% 0% 0% 0% 0.00 Deuterophlebiidae 0% 0% 0% 0% 3% 0.00 0% 10% 0% 0% 0.00 Dixidae 0% Dytiscidae 0% 8% 6% 0% 0% 0.05 Elmidae 0% 86% 50% 50% 5% 0.51 Empididae 67% 55% 50% 67% 57% 0.51 14% Enchytraeidae 11% 0% 8% 0% 0.01 Ephemerellidae 78% 100% 100% 100% 100% 1.00 Ephydridae 0% 2% 0% 0% 0% 0.00 49% 39% Glossosomatidae 11%42% 35% 0.39 100% 100% 100% 100% 100% 1.00 Heptageniidae Hydraenidae 0% 4% 0% 0% 0% 0.00 11% 2% 0% 0% 0% 0.00 Hydrophilidae Hydropsychidae 11% 92% 78% 92% 86% 0.79 11% 8% 0% Hydroptilidae 0% 0% 0.00 Hydrozetidae 0% 10% 17% 8% 16% 0.16 Hydryphantidae 11% 31% 11% 8% 8% 0.11 11%Hygrobatidae 0% 29% 0% 0% 0.01 78% 65% 39% 58% 5% 0.41 Lebertiidae 53% 6% 17% Lepidostomatidae 0% 8% 0.08 0% 2% 0% 0% 0% 0.00 Leptohyphidae 90% Leptophlebiidae 0% 11% 33% 3% 0.15 Leuctridae 22% 43% 56% 67% 54% 0.56 Limnephilidae 22% 31% 6% 25% 41% 0.08 Limnesiidae 0% 2% 0% 0% 0% 0.00 Lumbriculidae 0% 20% 17% 25% 3% 0.17 0% 0% Mideopsidae 2% 0% 0% 0.00 39% 0.35 Naididae 0% 8% 0% 3% 100% 100% 100% 100% 1.00 Nemouridae 100% Pelecorhynchidae 0% 22% 6% 0% 0% 0.06 22% 12% 41% 0.06 Peltoperlidae 6% 8% Perlidae 11% 84% 33% 100% 3% 0.39 Perlodidae 78% 78% 89% 92% 81% 0.89 Philopotamidae 31% 0% 0% 0% 3% 0.01 0% Pisidiidae 0% 6% 8% 0% 0.01 Planariidae 0% 8% 67% 17% 3% 0.61 Planorbidae 0% 0% 0% 0% 3% 0.00 65% 94% Psychodidae 22% 8% 11% 0.87 0% 12% 6% 0% 0.05 Pteronarcyidae 3% Rhyacophilidae 100% 92% 100% 100% 95% 1.00 Simuliidae 33% 49% 39% 33% 16% 0.39 78% 42% Sperchontidae 63% 50% 65% 0.50 4% 0% 17% Stygothrombiidae 0% 0% 0.01 89% 49% 100% 92% 97% 0.98 Taeniopterygidae 4% Thaumaleidae 11% 0% 0% 0% 0.00 55% 28% 67% 43% Tipulidae 56% 0.31 Torrenticolidae 11%86% 11% 17% 11%0.14 Uenoidae 22% 37% 17% 25% 46% 0.18 Valvatidae 0% 2% 6% 0% 0% 0.05

RIVPACS Ratios	
RIVPACS : Expected taxa P>0.50	13.20
RIVPACS : Observed taxa P>0.50	13.00
RIVPACS : 0:E (p > 0.5)	0.98
RIVPACS : Expected taxa P>0.70	10.48

**RIVPACS** Ratios

RIVPACS : Observed taxa P>0.70	10.00
RIVPACS : 0:E (p > 0.7)	0.95

Variable	COL001	Predicted Group Reference
	k Caalaani	Mean ±SD
	k Geology 100.00000	92.18813 ± 22.65908
Sedimentary (%)	annel	92.18813 ± 22.03908
Depth-Avg (cm)	11.5	22.5 ± 10.5
Depth-BankfullMinusWetted (cm)	29.00	$67.33 \pm 71.65$
Depth-Max (cm)	36.5	32.9 ± 17.9
Macrophyte (PercentRange)	0	0 ± 0
Reach-%CanopyCoverage (PercentRange)	1.00	$0.94 \pm 0.80$
Reach-DomStreamsideVeg (Category(1-4))	2	3 ± 1
Reach-Pools (Binary)	0	0 ± 1
Reach-Rapids (Binary)	0	0 ± 1
Reach-Riffles (Binary)	1	1 ± 0
Reach-StraightRun (Binary)	1	1 ± 0
Slope (m/m)	0.0100000	0.0235102 ± 0.0284557
Veg-Coniferous (Binary)	0	1 ± 0
Veg-Deciduous (Binary)	1	1 ± 0
Veg-GrassesFerns (Binary)	1	1 ± 0
Veg-Shrubs (Binary)	1	1 ± 0
Velocity-Avg (m/s)	0.05	0.50 ± 0.25
Velocity-Max (m/s)	0.31	0.75 ± 0.28
Width-Bankfull (m)	19.4	15.6 ± 12.8
Width-Wetted (m)	8.4	10.2 ± 7.0
XSEC-VelMethod (Category(1-3))	1	2 ± 1
	mate	
Precip10_OCT (mm)	52.84964	52.92857 ± 22.22704
Temp12_DECmin (Degrees Celsius)	-12.55455	-12.82063 ± 2.01422
	rology	
Drainage-Area (km^2)	117.65191	166.32560 ± 185.60049
	dcover	4 02070 ± E 00E08
Nati-Grassland (%)	0.00000	$\frac{4.92979 \pm 5.99508}{1.89085 \pm 1.59075}$
Natl-ShrubLow (%) Natl-Water (%)	0.00000	$\frac{1.89085 \pm 1.39075}{0.22269 \pm 0.34683}$
Reg-Ice (%)	0.00000	$0.22209 \pm 0.34003$ $0.46949 \pm 1.15785$
	rate Data	0.40949 ± 1.13703
%Bedrock (%)		0 ± 0
%Boulder (%)	4	0 ± 0
%Cobble (%)	44	61 ± 27
%Gravel (%)	16	1 ± 2
%Pebble (%)	32	31 ± 28
%Sand (%)	2	0 ± 0
%Silt+Clay (%)	1	0 ± 1
D50 (cm)	5.95	79.45 ± 47.98
Dg (cm)	3.9	73.9 ± 48.0
Dominant-1st (Category(0-9))	6	6 ± 1
Dominant-2nd (Category(0-9))	5	6 ± 2
Embeddedness (Category(1-5))	4	4 ± 1
PeriphytonCoverage (Category(1-5))	4	2 ± 1
SurroundingMaterial (Category(0-9))	2	3 ± 1
	ography	
Reg-SlopeLT30% (%)	55.71333	27.92073 ± 14.83033
SlopeMax (%)	160.96903	616.97887 ± 680.88955
	Chemistry	
Ag (mg/L)	0.0000250	$0.0000004 \pm 0.0000014$
Al (mg/L)	0.0131000	$0.0059500 \pm 0.0039700$
As (mg/L)	0.0002500	$0.0002175 \pm 0.0001795$
B (mg/L)	0.0250000	0.0500000
Ba (mg/L)	0.3050000	$0.0639025 \pm 0.0450861$

Variable	COL001	Predicted Group Reference
Variable	00001	Mean ±SD
Be (mg/L)	0.0000500	$0.0000025 \pm 0.0000062$
Bi (mg/L)	0.0000500	$0.0000004 \pm 0.0000014$
Ca (mg/L)	39.300000	38.6142857 ± 14.8464843
Cd (mg/L)	0.0000310	$0.0000059 \pm 0.000067$
Chloride-Total (mg/L)	0.4200000	$0.0000000 \pm 0.0000000$
Co (mg/L)	0.0000500	0.0000043 ± 0.0000057
Cr (mg/L)	0.0002500	$0.0000833 \pm 0.0001403$
Cu (mg/L)	0.0006200	$0.0001875 \pm 0.0001434$
Fe (mg/L)	0.0050000	0.0090000
General-Alkalinity (mg/L)	117.0000000	121.5944444 ± 36.7225924
General-Conductivity (µS/cm)	156.1000000	$186.8500000 \pm 84.0864011$
General-Hardness (mg/L)	131.000000	$146.8222222 \pm 41.6699011$
General-pH (pH)	8.3	8.0 ± 0.6
General-SolidsTSS (mg/L)	1.0000000	$0.5604289 \pm 1.4627232$
General-SpCond (µS/cm)	249.5000000	214.2437500 ± 77.1891440
General-TempAir (Degrees Celsius)	14.0	$10.5 \pm 4.2$
General-TempWater (Degrees Celsius)	12.200000	6.6716667 ± 2.0277755
General-Turbidity (NTU)	0.5200000	0.00000000000000000000000000000000000
Hg (ng/L)	0.0000200	$0.0000000 \pm 0.0000000000000000000000000$
K (mg/L)	0.7700000	$0.6471429 \pm 0.7154652$
Li (mg/L)	0.0097900	$0.0011817 \pm 0.0004768$
Mg (mg/L)	8.300000	9.8814286 ± 6.1601202
Mn (mg/L)	0.0055100	0.0011426 ± 0.0016097
Mo (mg/L)	0.0007600	$0.0024883 \pm 0.0065339$
Na (mg/L)	3.300000	$2.6357143 \pm 3.7712414$
Ni (mg/L)	0.0005700	$\frac{2.0537143 \pm 5.7712414}{0.0000808 \pm 0.0000811}$
Nitrogen-NO2 (mg/L)	0.0050000	$0.0023889 \pm 0.0063351$
Nitrogen-NO2+NO3 (mg/L)	0.0050000	$0.0130000 \pm 0.0083111$
Nitrogen-NO3 (mg/L)		$\frac{0.0130000 \pm 0.0088111}{0.0245003 \pm 0.0229452}$
	0.0050000	
Nitrogen-TKN (mg/L)	0.0530000	$\begin{array}{r} 0.0233333 \pm 0.0161433 \\ 0.0688889 \pm 0.0759171 \end{array}$
Nitrogen-TN (mg/L)		
Pb (mg/L)	0.0001000	$0.0000224 \pm 0.0000176$
Phosphorus-TP (mg/L)	0.0136000	0.0032778 ± 0.0061816 5.0000000
S (mg/L)		$0.0000361 \pm 0.0000135$
Sb (mg/L)	0.0001000	
Se (mg/L)	0.0002500	$0.0004382 \pm 0.0004486$
Si (mg/L)	2.0000000	$3.0657143 \pm 1.4070046$
Sn (mg/L)	0.0001000	$0.0000167 \pm 0.0000078$
SO4 (mg/L)	5.400000	$14.9647059 \pm 10.8432549$
Sr (mg/L)	0.1400000	0.1159167 ± 0.0982749
Te (mg/L)	0.0002500	$0.000000 \pm 0.000000$
Th (mg/L)	0.0000500	$0.0000000 \pm 0.0000000$
Ti (mg/L)	0.0025000	0.0009000
TI (mg/L)	0.0000100	0.0000038 ± 0.0000064
U (mg/L)	0.0004490	0.0005298 ± 0.0003220
V (mg/L)	0.0005000	$0.0001642 \pm 0.0001203$
Zn (mg/L)	0.0020000	$0.0004083 \pm 0.0008361$
Zr (mg/L)	0.0000500	$0.0000000 \pm 0.0000000$

# **Site Description**

Study Name	CBWQ-Elk
Site	COL003
Sampling Date	Sep 08 2020
Know Your Watershed Basin	Central Kootenay
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera EcoZone
	Northern Continental Divide EcoRegion
Coordinates (decimal degrees)	49.45387 N, 114.88066 W
Altitude	1728
Local Basin Name	Elk River
	Coal Creek
Chusana Ouden	

#### Stream Order

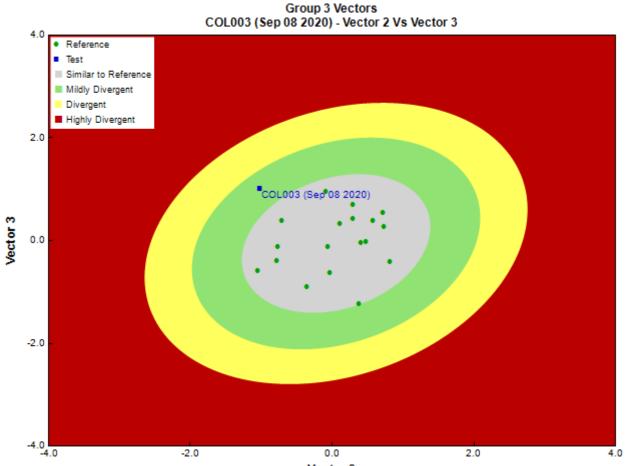


Figure 1. Location Map

Across Reach (No image found) Down Stream (No image found) Field Sheet (No image found) Substrate (No image found) Up Stream (No image found)

### **Cabin Assessment Results**

Reference Model Summary						
Model	Columbia-Okana	gan Preliminar	y March 2010			
Analysis Date	January 07, 2022	2				
Taxonomic Level	Family					
Predictive Model Variables	Depth-Avg Latitude Longitude Reg-Ice Reg-SlopeLT30%					
Reference Groups	1	2	3	4	5	
Number of Reference Sites	9	43	17	12	33	
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%	
Overall Model Error Rate	26.4%					
Probability of Group Membership	0.0% 16.1% 83.1% 0.8% 0.1%					
CABIN Assessment of COL003 on Sep 08, 2020	Mildly Divergent					



Vector 2

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

# **Sample Information**

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Pina Viola, Consultant
	Marchant Box
Sub-Sample Proportion	17/100

# **Community Structure**

Phylum	Class	Order	Family	Raw Count	Total Count
Arthropoda	Arachnida	Sarcoptiformes		1	5.9
		Trombidiformes	Aturidae	1	5.9
			Hydryphantidae	4	23.5
			Hygrobatidae	1	5.9
			Lebertiidae	4	23.5
			Sperchontidae	3	17.6
			Torrenticolidae	1	5.9
	Insecta	Coleoptera	Dytiscidae	1	5.9
			Elmidae	12	70.6
		Diptera	Ceratopogonidae	2	11.8
			Chironomidae	105	617.6
		Ephemeroptera	Ameletidae	29	170.6
			Baetidae	8	47.0
			Ephemerellidae	11	64.7
			Heptageniidae	11	64.7
			Leptophlebiidae	2	11.8

# **Community Structure**

Phylum	Class	Order	Order Family		Total Count
		Plecoptera	Capniidae	13	76.5
			Chloroperlidae	35	205.8
			Leuctridae	2	11.8
			Nemouridae	24	141.1
			Peltoperlidae	1	5.9
		Perlidae		14	82.3
		Perlodidae		6	35.3
		Trichoptera		3	17.6
			Brachycentridae	5	29.4
		Limnephilidae		2	11.8
			Rhyacophilidae	13	76.5
			Total	314	1,846.9

### **Metrics**

Name	COL003	Predicted Group Reference Mean ±SD						
Bray-Curtis Distance	0.74	$0.4 \pm 0.2$						
Biotic Indices								
Intolerant taxa								
Tolerant individuals (%)	0.3	$0.6 \pm 0.4$						
Number Of Individuals								
% Chironomidae	33.9	7.3 ± 10.2						
% Coleoptera	4.2	2.9 ± 5.0						
% Diptera + Non-insects	39.0	$13.0 \pm 11.1$						
% Ephemeroptera	19.7	48.4 ± 15.8						
% Ephemeroptera that are Baetidae	13.1	41.9 ± 25.2						
% EPT Individuals	56.8	84.1 ± 11.5						
% Odonata		$0.0 \pm 0.0$						
% of 2 dominant taxa	45.2	54.3 ± 12.1						
% of dominant taxa	33.9	35.5 ± 11.8						
% Plecoptera	30.6	28.1 ± 15.3						
% Tribe Tanyatarisini								
% Trichoptera that are Hydropsychida	0.0	25.4 ± 24.5						
% Tricoptera	6.5	7.5 ± 7.7						
No. EPT individuals/Chironomids+EPT Individuals	0.6	$0.9 \pm 0.1$						
Total Abundance	1847.1	$4086.0 \pm 3834.6$						
Rich	ness							
Chironomidae taxa (genus level only)	1.0	$1.0 \pm 0.0$						
Coleoptera taxa	2.0	$0.6 \pm 0.6$						
Diptera taxa	2.0	3.5 ± 1.1						
Ephemeroptera taxa	5.0	3.8 ± 0.7						
EPT Individuals (Sum)	1035.3	3252.2 ± 2587.2						
EPT taxa (no)	15.0	12.7 ± 2.6						
Odonata taxa		$0.0 \pm 0.0$						
Pielou's Evenness	0.8	$0.7 \pm 0.1$						
Plecoptera taxa	7.0	5.4 ± 1.3						
Shannon-Wiener Diversity	2.4	2.0 ± 0.3						
Simpson's Diversity	0.8	$0.8 \pm 0.1$						
Simpson's Evenness	0.3	$0.3 \pm 0.1$						
Total No. of Taxa	25.0	19.4 ± 4.2						
Trichoptera taxa	3.0	3.6 ± 1.5						

<b>Reference Model Taxa</b>	Frequ	ency of Oc	Probability Of Occurrence at			
	Group 1	Group 2	Group 3	Group 4	Group 5	COL003
Ameletidae	56%	53%	22%	50%	68%	0.27
Apataniidae	22%	24%	28%	25%	3%	0.27
Athericidae	0%	2%	0%	17%	0%	0.00
Aturidae	0%	8%	0%	0%	0%	0.01
Baetidae	100%	100%	100%	100%	97%	1.00
Blephariceridae	0%	0%	0%	0%	5%	0.00

#### Frequency of Occurrence in Reference Sites **Reference Model Taxa Probability Of Occurrence at** COL003 Group 1 Group 2 Group 5 Group 3 Group 4 0.11 Brachycentridae 11% 69% 0% 42% 3% Capniidae 78% 55% 50% 92% 68% 0.51 Ceratopogonidae 0% 55% 28% 42% 5% 0.32 95% Chironomidae 100% 100% 100% 100% 1.00 Chloroperlidae 78% 88% 94% 100% 100% 0.93 Corixidae 11% 0% 0% 0% 0% 0.00 Curculionidae 0% 4% 0% 0% 0% 0.01 0% 0% 0% 0.00 Deuterophlebiidae 0% 3% 0% 10% 0% 0% 0.02 Dixidae 0% Dytiscidae 0% 8% 6% 0% 0% 0.06 Elmidae 0% 86% 50% 50% 5% 0.56 55% 50% 57% Empididae 67% 67% 0.51 Enchytraeidae 11% 14% 0% 8% 0% 0.02 Ephemerellidae 78% 100% 100% 100% 100% 1.00 Ephydridae 0% 2% 0% 0% 0% 0.00 49% 42% 39% 35% 0.41 Glossosomatidae 11% Heptageniidae 100% 100% 100% 100% 100% 1.00 0% 4% 0% 0% 0% 0.01 Hydraenidae 11% 2% 0% 0% 0% 0.00 Hydrophilidae 11% 92% 78% 92% Hydropsychidae 86% 0.80 Hydroptilidae 11% 8% 0% 0% 0% 0.01 Hydrozetidae 0% 10% 17% 8% 16% 0.16 11% Hydryphantidae 11%31% 8% 8% 0.14 0% 29% 0% 0% 11% 0.05 Hygrobatidae 39% Lebertiidae 78% 65% 58% 5% 0.43 Lepidostomatidae 0% 53% 6% 17% 8% 0.13 Leptohyphidae 0% 2% 0% 0% 0% 0.00 Leptophlebiidae 0% 90% 11% 33% 3% 0.24 22% 43% 56% 67% 54% 0.54 Leuctridae Limnephilidae 22% 31% 6% 25% 41% 0.10 Limnesiidae 0% 2% 0% 0% 0% 0.00 25% 20% Lumbriculidae 0% 17% 3% 0.17 0% 0.00 0% 2% 0% 0% Mideopsidae 8% 39% 0.34 Naididae 0% 0% 3% Nemouridae 100% 100% 100% 100% 100% 1.00 22% 0.08 Pelecorhynchidae 0% 6% 0% 0% Peltoperlidae 22% 12% 6% 8% 41% 0.07 Perlidae 11% 84% 33% 100% 3% 0.42 Perlodidae 89% 81% 0.87 78% 78% 92% 0% 31% 0% 0% 0.05 Philopotamidae 3% 8% Pisidiidae 0% 6% 0% 0% 0.01 Planariidae 0% 8% 67% 17% 3% 0.57 Planorbidae 0% 0% 0% 0% 3% 0.00 Psychodidae 22% 65% 94% 8% 11% 0.89 Pteronarcyidae 0% 12% 6% 0% 3% 0.07 Rhyacophilidae 100% 92% 100% 100% 95% 0.99 Simuliidae 33% 49% 39% 33% 16% 0.40 78% 63% 50% 42% 65% 0.52 Sperchontidae 4% 0% 17% 0% 0.01 Stygothrombiidae 0% Taeniopterygidae 89% 49% 100% 92% 97% 0.92 4% Thaumaleidae 11% 0% 0% 0% 0.01 Tipulidae 56% 55% 28% 67% 43% 0.32 Torrenticolidae 11%86% 11% 17% 11%0.23 Uenoidae 22% 37% 17% 25% 46% 0.20 Valvatidae 0% 2% 6% 0% 0% 0.05

RIVPACS Ratios	
RIVPACS : Expected taxa P>0.50	13.60
RIVPACS : Observed taxa P>0.50	12.00
RIVPACS : O:E (p > 0.5)	0.88

# **RIVPACS** Ratios

RIVPACS : Expected taxa P>0.70	10.40
RIVPACS : Observed taxa P>0.70	8.00
RIVPACS : 0:E (p > 0.7)	0.77

Habitat Description						
Variable	COL003	Predicted Group Reference Mean ±SD				
Bedrock						
Sedimentary (%)	100.00000	92.18813 ± 22.65908				
Char	nnel					
Depth-Avg (cm)	2.4	22.5 ± 10.5				
Depth-BankfullMinusWetted (cm)	17.00	67.33 ± 71.65				
Depth-Max (cm)	4.0	32.9 ± 17.9				
Macrophyte (PercentRange)	0	0 ± 0				
Reach-%CanopyCoverage (PercentRange)	1.00	$0.94 \pm 0.80$				
Reach-DomStreamsideVeg (Category(1-4))	2	3 ± 1				
Reach-Pools (Binary)	1	0 ± 1				
Reach-Rapids (Binary)	0	0 ± 1				
Reach-Riffles (Binary)	1	1 ± 0				
Reach-StraightRun (Binary)	0	1 ± 0				
Slope (m/m)	0.0480000	0.0235102 ± 0.0284557				
Veg-Coniferous (Binary)	1	1 ± 0				
Veg-Deciduous (Binary)	0	1 ± 0				
Veg-GrassesFerns (Binary)	1	1 ± 0				
Veg-Shrubs (Binary)	1	1 ± 0				
Velocity-Avg (m/s)	0.00	0.50 ± 0.25				
Velocity-Max (m/s)	0.00	0.75 ± 0.28				
Width-Bankfull (m)	3.3	15.6 ± 12.8				
Width-Wetted (m)	2.4	$10.2 \pm 7.0$				
XSEC-VelMethod (Category(1-3))	1	2 ± 1				
Clim						
Precip10_OCT (mm)	52.73000	52.92857 ± 22.22704				
Temp12_DECmin (Degrees Celsius)	-12.89667	$-12.82063 \pm 2.01422$				
Hydro						
Drainage-Area (km^2)	5.65738	$166.32560 \pm 185.60049$				
Lando						
Natl-Grassland (%)	0.00000	4.92979 ± 5.99508				
Natl-ShrubLow (%)	0.20735	$1.89085 \pm 1.59075$				
Natl-Water (%)	0.00000	$0.22269 \pm 0.34683$				
Reg-Ice (%)	0.00000	$0.46949 \pm 1.15785$				
Substra						
%Bedrock (%)	1	0 ± 0				
%Boulder (%)	4	6 ± 7				
%Cobble (%)	46	61 ± 27				
%Gravel (%)	10	1 ± 2				
%Pebble (%)	39	31 ± 28				
%Sand (%)	0	0 ± 0				
%Silt+Clay (%)	0	0 ± 1				
D50 (cm)	6.50	79.45 ± 47.98				
Dg (cm)	6.1	$73.9 \pm 48.0$				
Dominant-1st (Category(0-9))	6	6 ± 1				
Dominant-2nd (Category(0-9))	5	6 ± 2				
Embeddedness (Category(1-5))	4	$\frac{0}{4 \pm 1}$				
		·				
		2 + 1				
PeriphytonCoverage (Category(1-5))	2	2 ± 1 3 + 1				
PeriphytonCoverage (Category(1-5)) SurroundingMaterial (Category(0-9))	2	2 ± 1 3 ± 1				
PeriphytonCoverage (Category(1-5)) SurroundingMaterial (Category(0-9)) Topog	2 3 raphy	3 ± 1				
PeriphytonCoverage (Category(1-5)) SurroundingMaterial (Category(0-9)) Topog Reg-SlopeLT30% (%)	2 3 raphy 88.18473	3 ± 1 27.92073 ± 14.83033				
PeriphytonCoverage (Category(1-5)) SurroundingMaterial (Category(0-9)) Topog Reg-SlopeLT30% (%) SlopeMax (%)	2 3 raphy 88.18473 100.83002	3 ± 1				
PeriphytonCoverage (Category(1-5)) SurroundingMaterial (Category(0-9)) Topog Reg-SlopeLT30% (%) SlopeMax (%) Water Ch	2 3 raphy 88.18473 100.83002 memistry	3 ± 1 27.92073 ± 14.83033 616.97887 ± 680.88955				
PeriphytonCoverage (Category(1-5)) SurroundingMaterial (Category(0-9)) Topog Reg-SlopeLT30% (%) SlopeMax (%) Water Ch Ag (mg/L)	2 3 raphy 88.18473 100.83002 nemistry 0.0000250	3 ± 1 27.92073 ± 14.83033 616.97887 ± 680.88955 0.0000004 ± 0.0000014				
PeriphytonCoverage (Category(1-5)) SurroundingMaterial (Category(0-9)) Topog Reg-SlopeLT30% (%) SlopeMax (%) Water Ch Ag (mg/L) Al (mg/L)	2 3 raphy 88.18473 100.83002 nemistry 0.0000250 0.0253000	$3 \pm 1$ 27.92073 ± 14.83033 616.97887 ± 680.88955 0.0000004 ± 0.0000014 0.0059500 ± 0.0039700				
PeriphytonCoverage (Category(1-5)) SurroundingMaterial (Category(0-9)) Topog Reg-SlopeLT30% (%) SlopeMax (%) Water Ch Ag (mg/L)	2 3 raphy 88.18473 100.83002 nemistry 0.0000250	$3 \pm 1$ 27.92073 ± 14.83033 616.97887 ± 680.88955 0.0000004 ± 0.0000014				

Habitat Description	COL 000	Duadiated Charge Defense
Variable	COL003	Predicted Group Reference Mean ±SD
Ba (mg/L)	0.0876000	$0.0639025 \pm 0.0450861$
Be (mg/L)	0.0000500	$0.0000025 \pm 0.0000062$
Bi (mg/L)	0.0000500	$0.0000004 \pm 0.0000014$
Ca (mg/L)	15.700000	38.6142857 ± 14.8464843
Cd (mg/L)	0.0000600	$0.0000059 \pm 0.0000067$
Chloride-Total (mg/L)	0.0500000	$0.0000000 \pm 0.0000000$
Co (mg/L)	0.0000500	$0.0000043 \pm 0.0000057$
Cr (mg/L)	0.0002500	$0.0000833 \pm 0.0001403$
Cu (mg/L)	0.0006000	$0.0001875 \pm 0.0001434$
Fe (mg/L)	0.0050000	0.0090000
General-Alkalinity (mg/L)	40.300000	121.5944444 ± 36.7225924
General-Conductivity (µS/cm)	65.1000000	$186.8500000 \pm 84.0864011$
General-DO (mg/L)	10.000000	$10.4922222 \pm 0.8833463$
General-Hardness (mg/L)	51.1000000	146.8222222 ± 41.6699011
General-pH (pH)	7.3	8.0 ± 0.6
General-SolidsTSS (mg/L)	1.000000	0.5604289 ± 1.4627232
General-SpCond (µS/cm)	104.000000	214.2437500 ± 77.1891440
General-TempAir (Degrees Celsius)	4.8	10.5 ± 4.2
General-TempWater (Degrees Celsius)	3.500000	6.6716667 ± 2.0277755
General-Turbidity (NTU)	0.7400000	$0.0000000 \pm 0.0000000$
Hg (ng/L)	0.0000200	$0.0000000 \pm 0.0000000$
K (mg/L)	0.2300000	$0.6471429 \pm 0.7154652$
Li (mg/L)	0.0003000	$0.0011817 \pm 0.0004768$
Mg (mg/L)	3.2600000	9.8814286 ± 6.1601202
Mn (mg/L)	0.0003100	$0.0011426 \pm 0.0016097$
Mo (mg/L)	0.0005300	$0.0024883 \pm 0.0065339$
Na (mg/L)	0.2100000	2.6357143 ± 3.7712414
Ni (mg/L)	0.0006100	$0.0000808 \pm 0.0000811$
Nitrogen-NO2 (mg/L)	0.0050000	$0.0023889 \pm 0.0063351$
Nitrogen-NO2+NO3 (mg/L)	0.0050000	$0.0130000 \pm 0.0088111$
Nitrogen-NO3 (mg/L)	0.0050000	0.0245003 ± 0.0229452
Nitrogen-TKN (mg/L)	0.0840000	$0.0233333 \pm 0.0161433$
Nitrogen-TN (mg/L)	0.0840000	0.0688889 ± 0.0759171
Pb (mg/L)	0.0001000	$0.0000224 \pm 0.0000176$
Phosphorus-TP (mg/L)	0.0168000	0.0032778 ± 0.0061816
S (mg/L)	3.1000000	5.000000
Sb (mg/L)	0.0001000	$0.0000361 \pm 0.0000135$
Se (mg/L)	0.0002500	0.0004382 ± 0.0004486
Si (mg/L)	1.1000000	3.0657143 ± 1.4070046
Sn (mg/L)	0.0001000	0.0000167 ± 0.0000078
SO4 (mg/L)	6.900000	14.9647059 ± 10.8432549
Sr (mg/L)	0.0214000	0.1159167 ± 0.0982749
Te (mg/L)	0.0002500	$0.0000000 \pm 0.0000000$
Th (mg/L)	0.0000500	$0.0000000 \pm 0.0000000$
Ti (mg/L)	0.0025000	0.0009000
TI (mg/L)	0.0000100	$0.0000038 \pm 0.0000064$
U (mg/L)	0.0001070	0.0005298 ± 0.0003220
V (mg/L)	0.0005000	$0.0001642 \pm 0.0001203$
Zn (mg/L)	0.0040000	$0.0004083 \pm 0.0008361$
Zr (mg/L)	0.0001000	$0.0000000 \pm 0.0000000$
	0.0001000	0.000000 ± 0.000000

# **Site Description**

Study Name	CBWQ-Elk	
Site	LIZ001	
Sampling Date	Sep 09 2020	
Know Your Watershed Basin	Central Kootenay	
Province / Territory	British Columbia	
Terrestrial Ecological Classification Montane Cordillera EcoZone		
	Northern Continental Divide EcoRegion	
Coordinates (decimal degrees)	49.47094 N, 115.07660 W	
Altitude	989	
Local Basin Name	Lizard Creek	
	Elk River	
Stream Order	3	



Figure 1. Location Map

Across Reach (No image found) Down Stream (No image found) Field Sheet (No image found) Substrate (No image found) Up Stream (No image found)

### **Cabin Assessment Results**

Reference Model Summary						
Model	Columbia-Okana	gan Prelimina	ry March 2010			
Analysis Date	January 07, 202	2	-			
Taxonomic Level	Family					
Predictive Model Variables	Depth-Avg Latitude Longitude Reg-Ice Reg-SlopeLT30%					
Reference Groups	1	2	3	4	5	
Number of Reference Sites	9	43	17	12	33	
Group Error Rate	22.2% 24.5% 22.2% 25.0% 32.4%					
Overall Model Error Rate	26.4%					
Probability of Group Membership	0.0% 1.4% 85.7% 12.0% 1.0%					
CABIN Assessment of LIZ001 on Sep 09, 2020	Mildly Divergent					

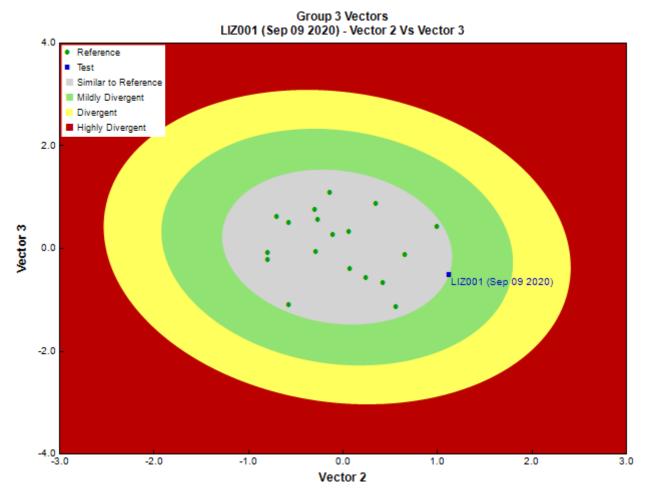


Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

# Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Pina Viola, Consultant
	Marchant Box
Sub-Sample Proportion	5/100

# **Community Structure**

Phylum	Class	Order	Family	Raw Count	Total Count
Annelida	Clitellata		Enchytraeidae	1	20.0
		Tubificida	Naididae	33	660.0
Arthropoda	Arachnida	Trombidiformes	Lebertiidae	30	600.0
			Torrenticolidae	4	80.0
	Insecta	Coleoptera	Elmidae	24	480.0
		Diptera	Chironomidae	109	2,180.0
			Empididae	4	80.0
			Psychodidae	39	780.0
			Simuliidae	2	40.0
			Tipulidae	3	60.0
		Ephemeroptera	Ameletidae	1	20.0
			Baetidae	51	1,020.0
			Ephemerellidae	9	180.0
			Heptageniidae	8	160.0
		Plecoptera	Capniidae	4	80.0
			Chloroperlidae	2	40.0

# **Community Structure**

Phylum	Class	Order	Family	Raw Count	Total Count
			Nemouridae	47	940.0
			Perlidae	6	120.0
			Perlodidae	4	80.0
			Taeniopterygidae	6	120.0
		Trichoptera	Apataniidae	1	20.0
			Brachycentridae	2	40.0
			Glossosomatidae	2	40.0
			Hydropsychidae	14	280.0
			Hydroptilidae	1	20.0
			Lepidostomatidae	1	20.0
			Rhyacophilidae	1	20.0
			Uenoidae	9	180.0
			Total	418	8,360.0

#### **Metrics**

Name	LIZ001	Predicted Group Reference Mean ±SD						
Bray-Curtis Distance	0.76	0.4 ± 0.2						
Biotic Indices								
Intolerant taxa		1.0						
Tolerant individuals (%)		0.6 ± 0.4						
Number Of Individuals								
% Chironomidae	26.1	7.3 ± 10.2						
% Coleoptera	5.7	2.9 ± 5.0						
% Diptera + Non-insects	53.6	$13.0 \pm 11.1$						
% Ephemeroptera	16.5	$48.4 \pm 15.8$						
% Ephemeroptera that are Baetidae	73.9	41.9 ± 25.2						
% EPT Individuals	40.4	84.1 ± 11.5						
% Odonata		$0.0 \pm 0.0$						
% of 2 dominant taxa	38.3	54.3 ± 12.1						
% of dominant taxa	26.1	35.5 ± 11.8						
% Plecoptera	16.5	28.1 ± 15.3						
% Tribe Tanyatarisini								
% Trichoptera that are Hydropsychida	45.2	25.4 ± 24.5						
% Tricoptera	7.4	7.5 ± 7.7						
No. EPT individuals/Chironomids+EPT Individuals	0.6	0.9 ± 0.1						
Total Abundance	8360.0	4086.0 ± 3834.6						
Rich	ness							
Chironomidae taxa (genus level only)	1.0	$1.0 \pm 0.0$						
Coleoptera taxa	1.0	0.6 ± 0.6						
Diptera taxa	5.0	3.5 ± 1.1						
Ephemeroptera taxa	4.0	3.8 ± 0.7						
EPT Individuals (Sum)	3380.0	3252.2 ± 2587.2						
EPT taxa (no)	18.0	12.7 ± 2.6						
Odonata taxa		0.0 ± 0.0						
Pielou's Evenness	0.8	0.7 ± 0.1						
Plecoptera taxa	6.0	5.4 ± 1.3						
Shannon-Wiener Diversity	2.5	2.0 ± 0.3						
Simpson's Diversity	0.9	$0.8 \pm 0.1$						
Simpson's Evenness	0.3	$0.3 \pm 0.1$						
Total No. of Taxa	28.0	19.4 ± 4.2						
Trichoptera taxa	8.0	3.6 ± 1.5						

<b>Reference Model Taxa</b>	Frequ	iency of Oc	Probability Of Occurrence at			
	Group 1	Group 2	Group 3	Group 4	Group 5	LIZ001
Ameletidae	56%	53%	22%	50%	68%	0.26
Apataniidae	22%	24%	28%	25%	3%	0.27
Athericidae	0%	2%	0%	17%	0%	0.02
Aturidae	0%	8%	0%	0%	0%	0.00
Baetidae	100%	100%	100%	100%	97%	1.00

#### Frequency of Occurrence in Reference Sites **Reference Model Taxa Probability Of Occurrence at** LIZ001 Group 1 Group 2 Group 5 Group 3 Group 4 Blephariceridae 0% 0.00 0% 0% 0% 5% Brachycentridae 11% 69% 0% 42% 3% 0.06 Capniidae 78% 55% 50% 92% 68% 0.55 Ceratopogonidae 0% 55% 28% 42% 5% 0.30 100% 100% 100% 100% 95% 1.00 Chironomidae Chloroperlidae 78% 88% 94% 100% 100% 0.95 Corixidae 11% 0% 0% 0% 0% 0.00 4% 0% 0.00 Curculionidae 0% 0% 0% Deuterophlebiidae 0% 0% 0% 0.00 0% 3% Dixidae 0% 10% 0% 0% 0% 0.00 Dytiscidae 0% 8% 6% 0% 0% 0.05 86% 50% Elmidae 0% 50% 5% 0.50 67% 55% 50% 67% 57% 0.52 Empididae Enchytraeidae 11% 14% 0% 8% 0% 0.01 Ephemerellidae 78% 100% 100% 100% 100% 1.00 0% 2% 0% 0.00 Ephydridae 0% 0% 11% Glossosomatidae 49% 39% 42% 35% 0.39 100% 100% 100% 100% 100% 1.00 Heptageniidae 0% 4% 0% 0% 0% 0.00 Hydraenidae 11% 2% Hydrophilidae 0% 0% 0% 0.00 Hydropsychidae 11% 92% 78% 92% 86% 0.80 Hydroptilidae 11% 8% 0% 0% 0% 0.00 17% Hydrozetidae 0% 10% 8% 16% 0.16 11% 31% 11% 8% 8% Hydryphantidae 0.11 0% 0% 11% Hygrobatidae 0% 29% 0.01 78% 65% 39% 58% 5% 0.41 Lebertiidae Lepidostomatidae 0% 53% 6% 17% 8% 0.08 Leptohyphidae 0% 2% 0% 0% 0% 0.00 0% 90% 11% 33% 3% 0.15 Leptophlebiidae Leuctridae 22% 43% 56% 67% 54% 0.57 Limnephilidae 22% 31% 6% 25% 41% 0.09 Limnesiidae 0% 2% 0% 0% 0% 0.00 20% 17% 0% 25% 3% 0.18 Lumbriculidae 0% 2% 0% 0% 0.00 Mideopsidae 0% Naididae 0% 8% 39% 0% 3% 0.33 100% 100% 100% 100% 100% Nemouridae 1.00 Pelecorhynchidae 0% 22% 6% 0% 0% 0.05 Peltoperlidae 22% 12% 6% 8% 41% 0.06 Perlidae 33% 11% 84% 100% 3% 0.42 89% 81% Perlodidae 78% 92% 0.89 78% Philopotamidae 0% 31% 0% 0% 0.00 3% Pisidiidae 0% 6% 0% 8% 0% 0.01 67% Planariidae 0% 8% 17% 3% 0.59 Planorbidae 0% 0% 0% 0% 3% 0.00 Psychodidae 22% 65% 94% 8% 11% 0.83 Pteronarcyidae 0% 12% 6% 0% 3% 0.05 95% Rhyacophilidae 100% 92% 100% 100% 1.00 49% 33% 39% 33% 16% 0.38 Simuliidae 78% 63% 50% 42% 65% 0.49 Sperchontidae 4% Stygothrombiidae 0% 0% 17% 0% 0.02 49% 100% 92% 97% Taeniopterygidae 89% 0.98 Thaumaleidae 11%4% 0% 0% 0% 0.00 Tipulidae 56% 55% 28% 67% 43% 0.33 Torrenticolidae 11%86% 11% 17% 11%0.13 22% 37% 17% 25% Uenoidae 46% 0.18 Valvatidae 0% 2% 6% 0% 0% 0.05

RIVPACS Ratios	
RIVPACS : Expected taxa P>0.50	13.18
RIVPACS : Observed taxa P>0.50	14.00

# **RIVPACS** Ratios

1.06
10.45
11.00
1.05

# Habitat Description

Variable	LIZ001	Predicted Group Reference Mean ±SD						
Bedroc	Bedrock Geology							
Sedimentary (%)	100.00000	92.18813 ± 22.65908						
-	annel							
Depth-Avg (cm)	15.3	22.5 ± 10.5						
Depth-BankfullMinusWetted (cm)	14.00	67.33 ± 71.65						
Depth-Max (cm)	24.0	32.9 ± 17.9						
Macrophyte (PercentRange)	0	0 ± 0						
Reach-%CanopyCoverage (PercentRange)	1.00	0.94 ± 0.80						
Reach-DomStreamsideVeg (Category(1-4))	1	<u>3 ± 1</u>						
Reach-Pools (Binary)	0	$0 \pm 1$ 0 ± 1						
Reach-Rapids (Binary)								
Reach-Riffles (Binary)	1	$\frac{1 \pm 0}{1 \pm 0}$						
Reach-StraightRun (Binary) Slope (m/m)	0.0160000	$1 \pm 0$ 0.0235102 ± 0.0284557						
Veg-Coniferous (Binary)	1	$\frac{0.0233102 \pm 0.0284337}{1 \pm 0}$						
Veg-Deciduous (Binary)	1	$\frac{1\pm 0}{1\pm 0}$						
Veg-GrassesFerns (Binary)	1	$1 \pm 0$						
Veg-Shrubs (Binary)	1	$1 \pm 0$						
Velocity-Avg (m/s)	0.49	$0.50 \pm 0.25$						
Velocity-Max (m/s)	0.89	$0.75 \pm 0.28$						
Width-Bankfull (m)	9.0	$15.6 \pm 12.8$						
Width-Wetted (m)	6.9	$10.2 \pm 7.0$						
XSEC-VelMethod (Category(1-3))	1	2 ± 1						
	mate							
Precip10_OCT (mm)	48.29762	52.92857 ± 22.22704						
Temp12_DECmin (Degrees Celsius)	-12.00143	-12.82063 ± 2.01422						
Hyd	rology							
Drainage-Area (km^2)	45.25496	$166.32560 \pm 185.60049$						
Lan	dcover							
Natl-Grassland (%)	3.20862	4.92979 ± 5.99508						
Natl-ShrubLow (%)	6.93880	$1.89085 \pm 1.59075$						
Natl-Water (%)	0.15275	0.22269 ± 0.34683						
Reg-Ice (%)	0.00000	0.46949 ± 1.15785						
	rate Data							
%Bedrock (%)	0	0 ± 0						
%Boulder (%)	13	<u>6 ± 7</u>						
%Cobble (%)	60	61 ± 27						
%Gravel (%) %Pebble (%)	5 21	<u>1 ± 2</u> 31 ± 28						
%Pebble (%) %Sand (%)	1	$51 \pm 28$ 0 ± 0						
%Silt+Clay (%)	0	$0 \pm 0$ 0 ± 1						
D50 (cm)	11.45	79.45 ± 47.98						
Dg (cm)	7.9	$73.9 \pm 48.0$						
Dominant-1st (Category(0-9))	6	6 ± 1						
Dominant-2nd (Category(0-9))	7	6 ± 2						
Embeddedness (Category(1-5))	4	4 ± 1						
PeriphytonCoverage (Category(1-5))	4	2 ± 1						
SurroundingMaterial (Category(0-9))	3							
	graphy							
Reg-SlopeLT30% (%)	45.90545	27.92073 ± 14.83033						
SlopeMax (%)	204.47122	616.97887 ± 680.88955						
	Chemistry							
Ag (mg/L)	0.0000250	$0.0000004 \pm 0.0000014$						
Al (mg/L)	0.0110000	$0.0059500 \pm 0.0039700$						
As (mg/L)	0.0002500	$0.0002175 \pm 0.0001795$						

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Heam :5D           B (mg/L)         0.025000         0.050000           Ba (mg/L)         0.00761000         0.0639025 ± 0.045086           Bi (mg/L)         0.000000         0.0000025 ± 0.000062           Bi (mg/L)         0.000000         0.0000025 ± 0.000062           Ca (mg/L)         0.000000         0.0000025 ± 0.000006           Ca (mg/L)         0.000000         0.0000000 ± 0.00000043 ± 0.000000           Ca (mg/L)         0.000000         0.0000000 ± 0.0000000           Ca (mg/L)         0.0002500         0.00000033 ± 0.0000037 ± 0.000000           Ca (mg/L)         0.0000000         0.000000137 ± 0.000000           Ca (mg/L)         0.0000000         0.0000037 ± 0.0000137 ± 0.000137 ± 0.000137 ± 0.000137 ± 0.000143           General-Makalinity (mg/L)         129.0000000         112.594444 ± 36.722592           General-Makalinity (mg/L)         0.0200000         146.822020 ± 84.066011           General-Makalinity (mg/L)         2.0000000         146.82222 ± 44.669901           General-Makalinity (mg/L)         2.0000000         146.82222 ± 44.629703           General-SpCond (µS/cm)         610.000000         214.2437500 ± 77.189144           General-SpCond (µS/cm)         610.000000         0.000000 ± 0.000000           General-SpEcond (µS/cm)         610	Habitat Description	177004	Due dista d'Oue D'O
Ba (mg/L)         0.0751000         0.0639025 ± 0.045086           Be (mg/L)         0.0000050         0.0000025 ± 0.000062           Bl (mg/L)         98.300000         38.6142857 ± 14.845484           Ca (mg/L)         0.0000050         0.0000043 ± 0.000005           Cornde-Total (mg/L)         0.0000000         0.0000043 ± 0.000005           Corndg/L)         0.0002500         0.0000043 ± 0.000005           Ca (mg/L)         0.0002000         0.0000043 ± 0.000005           Ca (mg/L)         0.0002000         0.0000037 ± 0.0001875 ± 0.000137           Ca (mg/L)         0.0020000         0.0000037 ± 0.0001875 ± 0.000137           General-Makalinity (mg/L)         112.5000000         114.594444 ± 36.722592           General-Markess (mg/L)         362.0000000         146.850000 ± 84.06601           General-Markess (mg/L)         20.000000         0.5564289 ± 1.462733           General-SpCond (µS/cm)         610.000000         214.2437500 ± 77.1891444           General-Turphir (Degrees Celsius)         610.000000         0.000000 ± 0.000000           General-Turphity (NTU)         1.280000         0.6716667 ± 2.027757           General-SpCond (µS/cm)         610.000000         0.6716667 ± 2.027757           General-SpCond (µS/cm)         610.000000         0.6716667 ± 2.027757	Variable	LIZ001	Predicted Group Reference Mean ±SD
Ba (mg/L)         0.0751000         0.0639025 ± 0.045086           Bi (mg/L)         0.0000500         0.0000025 ± 0.000062           Bi (mg/L)         0.000010         0.0000025 ± 0.000062           Ca (mg/L)         0.000010         0.0000025 ± 0.000062           Ca (mg/L)         0.000010         0.000002 ± 0.000000           Ca (mg/L)         0.000010         0.000000 ± 0.000000           Co (mg/L)         0.0000250         0.000003 ± 0.000000           Ca (mg/L)         0.0002500         0.000003 ± 0.000000           Ca (mg/L)         0.000000         0.0001875 ± 0.00143           General-Mkalinity (mg/L)         129.0000000         112.15944444 ± 36.722592           General-Mathinity (mg/L)         389.800000         1165.8500000 ± 84.086401           General-SpCond (uS/cm)         610.000000         214.2437500 ± 77.189144           General-SpCond (uS/cm)         610.000000         0.5604289 ± 1.462723           General-TempWater (Degrees Celsius)         6.1000000         6.6716667 ± 2.02775           General-TempWater (Degrees Celsius)         6.1000000         6.6716667 ± 0.00070           General-TempWater (Degrees Celsius)         6.1000000         0.6471429 ± 0.714525           General-TempWater (Degrees Celsius)         6.10000000         0.0001426 ± 0.000100	B (mg/L)	0.0250000	0.0500000
Bl (mg/L)         0.00000500         0.0000004 ± 0.0000004           Ca (mg/L)         98.300000         38.42857 ± 14.846484           Cd (mg/L)         0.0000160         0.0000005 ± 0.000000           Co (mg/L)         0.0000500         0.0000004 ± 0.000005           Co (mg/L)         0.0002500         0.000003 ± 0.000003           Cu (mg/L)         0.0002500         0.0000187 ± 0.000183           Cu (mg/L)         0.002000         0.00187 ± 0.000183           General-Alkalinity (mg/L)         129.000000         121.594444 ± 36.722592           General-Mikalinity (mg/L)         389.800000         186.8500000 ± 84.086401           General-SolidsTSS (mg/L)         2.000000         0.5604289 ± 1.462723           General-TempAir (Degrees Celsius)         6.10.00000         6.214.247500 ± 77.189144           General-TempAir (Degrees Celsius)         6.10.00000         6.214.247500 ± 77.189144           General-TempMatr (Degrees Celsius)         6.1000000         6.0000000 ± 0.0000000 ± 0.0000000 ± 0.0000000 ± 0.0000000 ± 0.0000000 ± 0.0000000		0.0761000	$0.0639025 \pm 0.0450861$
Ca (mg/L)         98.300000         38.6142857 ± 14.846494           Chioride-Total (mg/L)         0.0000160         0.000005 ± 0.000005           Co (mg/L)         0.1800000         0.000005 ± 0.000005           Co (mg/L)         0.0002500         0.000003 ± 0.000005           Cu (mg/L)         0.0002000         0.000013 ± 0.000103           Cu (mg/L)         0.0002000         0.000103 ± 0.000100           General-Matalinity (mg/L)         0.020000         0.0001003 ± 0.000000           General-Matchixity (µS/cm)         389.800000         186.850000 ± 84.086401           General-Hardness (mg/L)         20.000000         0.5604289 ± 1.4627232           General-SpCond (µS/cm)         610.000000         214.2437500 ± 77.189144           General-TempAir (Degrees Celsius)         8.0         10.5 ± 4.           General-TempAir (Degrees Celsius)         8.1000000         0.000000 ± 0.000000           General-TempAir (Degrees Celsius)         8.0         10.5 ± 4.           General-TempAir (Degrees Celsius)         8.100000         0.6716667 ± 2.027775           General-TempAir (Degrees Celsius)         8.0         10.5 ± 4.           General-TempAir (Degrees Celsius)         8.1000000         0.0000000 ± 0.0000000           General-TempAir (Degrees Celsius)         8.1000000         0	Be (mg/L)	0.0000500	$0.0000025 \pm 0.0000062$
Cd (mg/L)         0.000160         0.0000059         ± 0.0000050           Choride-Total (mg/L)         0.1800000         0.00000050         0.00000043         ± 0.0000140           Cu (mg/L)         0.0002500         0.0000833         ± 0.000140           Cu (mg/L)         0.0002000         0.0000833         ± 0.000143           General-Alkalinity (mg/L)         120.000000         121.5944444         ± 57.22522           General-Alkalinity (mg/L)         139.8000000         146.822222         ± 41.659901           General-Alkalinity (mg/L)         8.0         146.822222         ± 41.659901           General-SolidsTSS (mg/L)         2.0000000         1.504444         ± 62222           General-TempAir (Degrees Celsius)         6.1000000         1.504289         ± 1.462723           General-TempAir (Degrees Celsius)         8.0         10.5 ± 4.3         General-TempAir (Degrees Celsius)         6.1000000         5.7166767         2.027757           General-TempAir (Degrees Celsius)         6.1000000         0.5404289 ± 0.0751457         Li (mg/L)         0.000200         0.0001000         ± 0.000700           Kg (ng/L)         0.000200         0.00011426         ± 0.001697         UL         0.000000         ± 0.0005357           Kg (ng/L)         0.0024000	Bi (mg/L)	0.0000500	$0.0000004 \pm 0.0000014$
Chioride-Total (mg/L)         0.1800000         0.0000000         0.0000000           Co (mg/L)         0.0000500         0.0000033 ± 0.000004           Cu (mg/L)         0.0002500         0.0000833 ± 0.000143           Cu (mg/L)         0.0002000         0.0000833 ± 0.000143           General-Conductivity (µ5/cm)         129.000000         111.5944444 ± 35.722592           General-Anductsivity (µ5/cm)         389.800000         146.822222 ± 41.669901           General-SolidSTSS (mg/L)         2.0000000         0.5604289 ± 1.462723           General-SolidSTSS (mg/L)         2.0000000         0.5604289 ± 1.462723           General-TempAir (Degrees Celsius)         8.0         10.5 ± 4.3           General-TempAir (Degrees Celsius)         6.10000000         0.6716667 ± 2.027755           General-TempAir (Degrees Celsius)         0.0000200         0.0000000 ± 0.000000           Hg (ng/L)         0.000200         0.0000000 ± 0.000000           Hg (ng/L)         0.0002000         0.0011437 ± 0.004760           Mn (mg/L)         0.0024000         0.0471249 ± 0.7154652           H (mg/L)         0.0024000         0.0018143 ± 0.712441           Mn (mg/L)         0.0024000         0.0024883 ± 0.0065333           Na (mg/L)         0.0024000         0.0024883 ± 0.0065335 </th <th>Ca (mg/L)</th> <th>98.300000</th> <th>38.6142857 ± 14.8464843</th>	Ca (mg/L)	98.300000	38.6142857 ± 14.8464843
Co (mg/L)         0.0005200         0.0000043 ± 0.0000053           Cr (mg/L)         0.0002500         0.0000833 ± 0.0001403           Cu (mg/L)         0.0002000         0.000183 ± 0.0001403           Fe (mg/L)         0.000000         121.5944444 ± 36.722525           General-Alkalinity (mg/L)         129.000000         146.822222 ± 41.669901           General-BildsTSS (mg/L)         610.00000         146.822222 ± 41.669901           General-SolidsTSS (mg/L)         2.0000000         146.42723           General-TempWater (Degrees Celsius)         8.0         10.5 ± 4.3           General-TempWater (Degrees Celsius)         8.0         10.5 ± 4.3           General-Turbidity (NTU)         1.280000         0.0000000 ± 0.000000           Mg (mg/L)         0.0002000         0.0000000 ± 0.000000           Mg (mg/L)         0.0024000         0.66714567 ± 0.277753           General-Turbidity (NTU)         1.280000         0.0000000 ± 0.000000           Mg (mg/L)         0.002000         0.0000000           Mg (mg/L)         0.0040500         0.0011426 ± 0.001609           Mg (mg/L)         0.0024000         0.0014483 ± 0.006533           Mg (mg/L)         0.0022000         0.002483 ± 0.0065335           Nitrogen-NO2 (mg/L)         0.0002000	Cd (mg/L)	0.0000160	$0.0000059 \pm 0.000067$
Cr (mg/L)         0.000230         0.000033 ± 0.0001433         0.0001433           Cu (mg/L)         0.000000         0.0001875 ± 0.0001430         0.0001875 ± 0.0001430           Fe (mg/L)         0.0200000         121.5944444 ± 36.722592         0.000000         186.8500000         186.8500000         186.8500000         186.8500000         186.8500000         186.8500000         186.8500000         84.06401           General-Hardness (mg/L)         362.000000         0.5504289 ± 1.4627333         8.0 ± 0.0           General-SpCond (µS/cm)         610.000000         2.5504289 ± 1.4627333         General-TempAir (Degrees Celsius)         8.0         1.0.5 ± 4.1           General-TempAir (Degrees Celsius)         6.1000000         6.6716667 ± 2.0277751         General-TempAir (Degrees Celsius)         0.0000000         0.000000 ± 0.000000           K (mg/L)         0.004000         0.0010000 ± 0.000000         0.000000 ± 0.000000         Con00000         K (mg/L)         0.0040500         0.0011817 ± 0.004763         Mg (mg/L)         0.0024000         0.0011817 ± 0.004763         Mg (mg/L)         0.0	Chloride-Total (mg/L)	0.1800000	$0.0000000 \pm 0.0000000$
Cu (mg/L)         0.0001875 ± 0.000000 ± 0.0000000 ± 0.0	Co (mg/L)	0.0000500	$0.0000043 \pm 0.0000057$
Fe (mg/L)         0.020000         0.090000           General-Canductivity (µS/cm)         129,000000         121,5944444 ± 36,722592           General-Conductivity (µS/cm)         386,800000         186,8500000         186,822222 ± 1.669901           General-Mardness (mg/L)         2.000000         0.5604289 ± 1.462723           General-SpCond (µS/cm)         610.000000         214,243750 ± 77,189144           General-TempAir (Degrees Celsius)         8.0         10.5 ± 4.3           General-TempAir (Degrees Celsius)         6.1000000         6.6716667 ± 2.027757           General-TempAir (Degrees Celsius)         6.1000000         0.0000000 ± 0.000000           General-Turbidity (NTU)         1.280000         0.0000000 ± 0.000000           Mg (mg/L)         0.040500         0.061412 ± 0.07575           Mg (mg/L)         0.002000         9.881426 ± 6.160120           Mn (mg/L)         0.002000         0.001426 ± 0.006533           Mn (mg/L)         0.002000         0.002389 ± 0.065337           Na (mg/L)         0.002000         0.002388 ± 0.006533           Na (mg/L)         0.005000         0.023889 ± 0.075317           Mn (mg/L)         0.005000         0.023889 ± 0.075317           Nitrogen-NO2 (mg/L)         0.0050000         0.023889 ± 0.006331	Cr (mg/L)	0.0002500	$0.0000833 \pm 0.0001403$
General-Aikalinity (mg/L)         129.000000         121.5944444 ± 36.722592           General-Conductivity (µS/cm)         389.800000         186.850000 ± 84.086401           General-Hardness (mg/L)         362.000000         146.822222 ± 41.669901           General-SpCind (µS/cm)         2.0000000         0.5604289 ± 1.462723           General-SpCind (µS/cm)         610.000000         214.2437500 ± 77.1891444           General-TempWater (Degrees Celsius)         6.1000000         6.6716667 ± 2.027775           General-TempWater (Degrees Celsius)         6.1000000         0.000000 ± 0.000000           Mg (ng/L)         0.0000200         0.0000000 ± 0.000000           Mg (ng/L)         0.0000200         0.0000000 ± 0.000000           K (mg/L)         0.0000200         0.0000000 ± 0.000000           Mg (ng/L)         0.0002000         0.0001000         0.000000           Mg (ng/L)         0.002300         0.024833 ± 0.006333         Na (mg/L)         0.002300         0.002483 ± 0.006335           Mitrogen-NO2 (mg/L)         0.005000         0.002388 ± 0.006335         Nitrogen-NO2 (mg/L)         0.005000         0.002388 ± 0.006335           Nitrogen-NO2 (mg/L)         0.005000         0.023889 ± 0.07517         Nitrogen-NO3 (mg/L)         0.005000         0.024803 ± 0.0006335           Nitrogen-N	Cu (mg/L)	0.0002000	$0.0001875 \pm 0.0001434$
General-Conductivity (µS/cm)         389.800000         186.8500000         84.086401           General-Hardness (mg/L)         362.000000         146.822222 ± 41.669901           General-SolidsTSS (mg/L)         2.0000000         0.5604289 ± 1.462723           General-TempAir (Degrees Celsius)         610.000000         214.2437500 ± 77.189144           General-TempAir (Degrees Celsius)         6.1000000         6.6716667 ± 2.027775           General-TempAir (Degrees Celsius)         6.1000000         0.000000 ± 0.000000           General-Turbidity (NTU)         1.2800000         0.000000 ± 0.000000           M(mg/L)         0.0040500         0.0011817 ± 0.004760           M(mg/L)         0.0040500         0.0011817 ± 0.004760           M(mg/L)         0.0024000         0.0011426 ± 0.7154653           M(mg/L)         0.0024000         0.0011426 ± 0.01609           M(mg/L)         0.0024000         0.001426 ± 0.001699           M(mg/L)         0.002000         0.0024883 ± 0.0065333           Na (mg/L)         0.002000         0.002388 ± 0.006333           Nitrogen-NO2 (mg/L)         0.005000         0.023883 ± 0.006333           Nitrogen-NO2 (mg/L)         0.005000         0.023333 ± 0.016143           Nitrogen-NO2 (mg/L)         0.005000         0.023888 ± 0.000631		0.0200000	0.0090000
General-Hardness (mg/L)         362.000000         146.822222 ± 41.669901           General-SolidSTSS (mg/L)         2.000000         0.5604289 ± 1.462723           General-SpCond (µS/cm)         610.000000         214.2437500 ± 77.189144           General-TempWater (Degrees Celsius)         8.0         10.5 ± 4.3           General-TempWater (Degrees Celsius)         6.1000000         6.6716667 ± 2.027775           General-Turbidity (NTU)         1.2800000         0.0000000 ± 0.000000           Mg (ng/L)         0.0470000         0.6471429 ± 0.715465           Li (mg/L)         0.0440500         0.0011817 ± 0.000476           Mg (ng/L)         25.300000         9.8814286 ± 6.160120           Mn (mg/L)         0.0024000         0.001426 ± 0.001693           Ma (mg/L)         0.0024000         0.0024883 ± 0.006533           Ma (mg/L)         0.002000         0.0024883 ± 0.006335           Nitrogen-NO2 (mg/L)         0.0050000         0.023889 ± 0.066335           Nitrogen-NO2 (mg/L)         0.0050000         0.023833 ± 0.006335           Nitrogen-NO3 (mg/L)         0.0050000         0.023333 ± 0.006335           Nitrogen-NO3 (mg/L)         0.0050000         0.023333 ± 0.006335           Nitrogen-NO3 (mg/L)         0.0055000         0.023333 ± 0.006335	General-Alkalinity (mg/L)	129.000000	121.5944444 ± 36.7225924
General-pH (pH)         8.3         8.0 ± 0.0           General-SolidsTSS (mg/L)         2.000000         0.5604289 ± 1.462723           General-SpCond (µS/cm)         610.000000         214.2437500 ± 7.189144           General-TempMir (Degrees Celsius)         8.0         10.5 ± 4.3           General-TempWater (Degrees Celsius)         6.1000000         6.6716667 ± 2.027755           General-Turbidity (NTU)         1.280000         0.0000000 ± 0.0000000           Hg (mg/L)         0.4700000         0.6471429 ± 0.154652           K (mg/L)         0.0049500         0.00111817 ± 0.0004766           Mg (mg/L)         0.002400         0.0011426 ± 0.001609           Mn (mg/L)         0.0024000         0.0011426 ± 0.001609           Mg (mg/L)         0.002000         0.000818 ± 0.006533           Na (mg/L)         0.000200         0.002300         0.0024883 ± 0.006533           Na (mg/L)         0.0050000         0.0133008 ± 0.000813         0.016000           Nitrogen-NO2 (mg/L)         0.0050000         0.023333 ± 0.0224945         0.016400           Nitrogen-NO3 (mg/L)         0.0050000         0.023333 ± 0.0224945         0.0000177           Phosphorus-TP (mg/L)         0.0001000         0.0003278 ± 0.000174         0.0000100         0.0000101		389.8000000	$186.8500000 \pm 84.0864011$
General-SolidsTSS (mg/L)         2.0000000         0.5604289 ± 1.462723           General-EmpAir (Degrees Celsius)         610.000000         214.2437500 ± 77.189144           General-TempMater (Degrees Celsius)         6.1000000         6.6716667 ± 2.027755           General-TempWater (Degrees Celsius)         6.1000000         6.6716667 ± 2.027755           General-Turbidity (NTU)         1.280000         0.0000000 ± 0.0000000           Mg (mg/L)         0.000200         0.0000000 ± 0.0000000           K (mg/L)         0.0405500         0.011817 ± 0.0047650           Li (mg/L)         0.0024000         0.0611827 ± 0.01754655           Mg (mg/L)         0.0024000         0.001817 ± 0.004768           Mg (mg/L)         0.0024000         0.0011817 ± 0.004768           Mg (mg/L)         0.0024000         0.001483 ± 0.006335           M (mg/L)         0.0024000         0.001483 ± 0.006335           Nitrogen-NO2 (mg/L)         0.000200         0.0023898 ± 0.0063355           Nitrogen-NO2 (mg/L)         0.005000         0.023333 ± 0.016143           Nitrogen-TN( (mg/L)         0.025000         0.023333 ± 0.016143           Nitrogen-TN (mg/L)         0.005000         0.003278 ± 0.006315           Nitrogen-TN (mg/L)         0.001600         0.000233 ± 0.000135	General-Hardness (mg/L)	362.000000	$146.8222222 \pm 41.6699011$
General-SpCond (µ\$/cm)         610.000000         214.2437500 ± 77.1891444           General-TempMir (Degrees Celsius)         8.0         10.5 ± 4.3.           General-TempWater (Degrees Celsius)         6.1000000         6.6716667 ± 2.027775           General-Turbidity (NTU)         1.2800000         0.0000000 ± 0.000000           Hg (ng/L)         0.000000         0.0000000         ± 0.000000           K (mg/L)         0.0470000         0.6471429 ± 0.7154655           Li (mg/L)         0.0024000         0.0011817 ± 0.004766           Mg (mg/L)         0.0024000         0.0011426 ± 0.01609           Mo (mg/L)         0.0024000         0.0011426 ± 0.01609           Mo (mg/L)         0.0020300         0.002483 ± 0.006533           Na (mg/L)         0.002000         0.0002488 ± 0.006813           Nitrogen-NO2 (mg/L)         0.0050000         0.002389 ± 0.008811           Nitrogen-NO3 (mg/L)         0.0050000         0.023333 ± 0.016143           Nitrogen-TKN (mg/L)         0.0050000         0.0023333 ± 0.016143           Nitrogen-TKN (mg/L)         0.0050000         0.0023333 ± 0.006174           Phosphorus-TP (mg/L)         0.001000         0.0000224 ± 0.000174           S (mg/L)         0.000100         0.0000124 ± 0.0000131           S (mg/L) </th <th>General-pH (pH)</th> <th>8.3</th> <th>8.0 ± 0.6</th>	General-pH (pH)	8.3	8.0 ± 0.6
General-TempAir (Degrees Celsius)         8.0         10.5 ± 4.3           General-TempWater (Degrees Celsius)         6.100000         6.6716667 ± 2.027775           General-Turbidity (NTU)         1.280000         0.0000000 ± 0.000000           Hg (ng/L)         0.0000200         0.0000000 ± 0.000000           K (mg/L)         0.0404000         0.6471429 ± 0.715465           Li (mg/L)         0.0404500         0.0011425 ± 0.004763           Mg (mg/L)         0.0024000         0.001426 ± 0.001693           Mg (mg/L)         0.0024000         0.001426 ± 0.001693           Ma (mg/L)         0.002000         0.002483 ± 0.006533           Ma (mg/L)         0.002000         0.0023889 ± 0.006335           Nitrogen-NO2 (mg/L)         0.0050000         0.023333 ± 0.006335           Nitrogen-NO3 (mg/L)         0.0050000         0.023333 ± 0.016433           Nitrogen-NO3 (mg/L)         0.0250000         0.023333 ± 0.016433           Nitrogen-TN (mg/L)         0.0250000         0.0224503 ± 0.022945           Nitrogen-TN (mg/L)         0.0250000         0.00032778 ± 0.000137           Pb (mg/L)         0.001000         0.00032778 ± 0.000137           Se (mg/L)         0.0001000         0.000361 ± 0.0000133           Se (mg/L)         0.0001000	General-SolidsTSS (mg/L)	2.000000	0.5604289 ± 1.4627232
General-TempWater (Degrees Celsius)         6.100000         6.6716667 ± 2.027775           General-Turbidity (NTU)         1.2800000         0.000000 ± 0.000000           Hg (ng/L)         0.0040520         0.000000 ± 0.000000           K (mg/L)         0.0470000         0.6471429 ± 0.715465           Li (mg/L)         0.0440500         0.011817 ± 0.004766           Mg (mg/L)         25.300000         9.8814286 ± 6.160120           Mn (mg/L)         0.0024000         0.0011426 ± 0.001697           Mo (mg/L)         0.002000         0.0024883 ± 0.006335           Ni (mg/L)         0.002000         0.0023889 ± 0.006335           Ni (mg/L)         0.0050000         0.0123898 ± 0.006335           Nitrogen-NO2 (mg/L)         0.0050000         0.023333 ± 0.016143           Nitrogen-NO3 (mg/L)         0.0025000         0.023333 ± 0.016143           Nitrogen-TK (mg/L)         0.0025000         0.032778 ± 0.006131           S (mg/L)         0.001000         0.0003274 ± 0.000133           Se (mg/L)         0.001000         0.0003274 ± 0.000133           Se (mg/L)         0.001000         0.000361 ± 0.000133           Se (mg/L)         0.0001000         0.000361 ± 0.000133           Se (mg/L)         0.0001000         0.0001033	General-SpCond (µS/cm)	610.0000000	214.2437500 ± 77.1891440
General-Turbidity (NTU)         1.2800000         0.000000 ± 0.000000           Hg (ng/L)         0.0000200         0.000000         ± 0.000000           K (mg/L)         0.00040500         0.0011817 ± 0.0004760           Mg (mg/L)         0.0040500         0.0011817 ± 0.0004760           Mg (mg/L)         0.0024000         0.0011426 ± 0.001609           Mo (mg/L)         0.002300         0.0024883 ± 0.006333           Nitrogen-NO2 (mg/L)         0.0050000         0.0023889 ± 0.006335           Nitrogen-NO3 (mg/L)         0.0050000         0.0130000 ± 0.008811           Nitrogen-NO3 (mg/L)         0.0050000         0.023889 ± 0.075917           Mitrogen-TKN (mg/L)         0.0250000         0.003278 ± 0.006181           Nitrogen-TKM (mg/L)         0.0149000         0.0032778 ± 0.006181           S (mg/L)         0.001000         0.000224 ± 0.000170           S (mg/L)         0.001000         0.0002778 ± 0.006181           S (mg/L)         0.00149000         0.0032778 ± 0.006181           S (mg/L)         0.001000         0.000250	General-TempAir (Degrees Celsius)	8.0	10.5 ± 4.2
Hg (ng/L)         0.0000200         0.0000000 ± 0.000000           K (mg/L)         0.4710000         0.6471429 ± 0.715465           Li (mg/L)         0.0040500         0.0011817 ± 0.004766           Mg (mg/L)         25.300000         9.8814286 ± 6.160120           Mn (mg/L)         0.0024000         0.0011817 ± 0.004765           Mo (mg/L)         0.0024000         0.001426 ± 0.001609           Mo (mg/L)         0.002000         0.0024883 ± 0.0065335           Na (mg/L)         0.0002000         0.0002888 ± 0.000813           Nitrogen-NO2 (mg/L)         0.0050000         0.0223033 ± 0.022845           Nitrogen-NO3 (mg/L)         0.0050000         0.0223033 ± 0.0229453           Nitrogen-NMK (mg/L)         0.0050000         0.0223033 ± 0.0229453           Nitrogen-TN (mg/L)         0.0050000         0.0223333 ± 0.0161433           Nitrogen-TN (mg/L)         0.0250000         0.0223333 ± 0.0161433           Nitrogen-TN (mg/L)         0.001000         0.0003278 ± 0.00618103           Se (mg/L)         0.00149000         0.0032778 ± 0.00618103           Se (mg/L)         0.0001000         0.000331 ± 0.0000133           Se (mg/L)         0.0001000         0.000331 ± 0.0000133           Se (mg/L)         0.0001000         0.000331 ± 0.00000	General-TempWater (Degrees Celsius)	6.1000000	6.6716667 ± 2.0277755
K (mg/L)         0.4700000         0.6471429 ± 0.715465           Li (mg/L)         0.0040500         0.0011817 ± 0.004766           Mg (mg/L)         25.300000         9.8814286 ± 6.160120           Mn (mg/L)         0.0024000         0.0011426 ± 0.001609           Mo (mg/L)         0.0024000         0.001426 ± 0.001609           Mo (mg/L)         0.002300         0.002483 ± 0.006533           Na (mg/L)         0.0002000         0.00088 ± 0.000811           Nitrogen-NO2 (mg/L)         0.005000         0.0123889 ± 0.006335           Nitrogen-NO3 (mg/L)         0.005000         0.01245003 ± 0.0224503           Nitrogen-NO3 (mg/L)         0.005000         0.02245003 ± 0.0224550           Nitrogen-TKN (mg/L)         0.025000         0.023333 ± 0.0161433           Nitrogen-TR (mg/L)         0.025000         0.032278 ± 0.0063811           Nitrogen-TR (mg/L)         0.0149000         0.0032274 ± 0.000176           Pb (mg/L)         0.001000         0.0003224 ± 0.000177           Pb (mg/L)         0.001000         0.0003274 ± 0.000183           Si (mg/L)         0.001000         0.0003274 ± 0.000137           Se (mg/L)         0.0001000         0.000361 ± 0.0000133           Se (mg/L)         0.0001000         0.0000361 ± 0.0000133 </th <th></th> <th></th> <th><math>0.0000000 \pm 0.0000000</math></th>			$0.0000000 \pm 0.0000000$
K (mg/L)         0.470000         0.6471429 ± 0.715455           Li (mg/L)         0.0040500         0.0011817 ± 0.004760           Mg (mg/L)         25.300000         9.8814286 ± 6.601200           Mn (mg/L)         0.0024000         0.0011426 ± 0.001609           Mo (mg/L)         0.002300         0.0024833 ± 0.0065333           Na (mg/L)         0.002000         0.002883 ± 0.006835           Na (mg/L)         0.0002000         0.0002889 ± 0.006835           Nitrogen-NO2 (mg/L)         0.0050000         0.013000 ± 0.008811           Nitrogen-NO3 (mg/L)         0.0050000         0.02245033 ± 0.0161433           Nitrogen-TN3 (mg/L)         0.0050000         0.0224503 ± 0.008811           Nitrogen-TN (mg/L)         0.0250000         0.023333 ± 0.0161433           Nitrogen-TN (mg/L)         0.0250000         0.023333 ± 0.0161433           Nitrogen-TN (mg/L)         0.0050000         0.0032778 ± 0.006181           Si (mg/L)         0.0001000         0.0032778 ± 0.006184           S (mg/L)         0.0001000         0.000361 ± 0.0000133           S (mg/L)         0.0001000         0.000361 ± 0.0000133           S (mg/L)         0.0001000         0.000361 ± 0.0000133           S (mg/L)         0.0001000         0.0000167 ± 0.000073     <		0.0000200	$0.0000000 \pm 0.0000000$
Li (mg/L)         0.0040500         0.0011817 ± 0.000466           Mg (mg/L)         25.300000         9.8814286 ± 6.160120           Mn (mg/L)         0.0024000         0.0011426 ± 0.001699           Mo (mg/L)         0.0020300         0.002483 ± 0.0065335           Na (mg/L)         0.002000         0.0002889 ± 0.0006335           Na (mg/L)         0.0050000         0.002389 ± 0.006335           Nitrogen-NO2 (mg/L)         0.0050000         0.013000 ± 0.008811           Nitrogen-NO3 (mg/L)         0.0050000         0.0245003 ± 0.0229455           Nitrogen-TKN (mg/L)         0.0050000         0.0245003 ± 0.0229455           Nitrogen-TKN (mg/L)         0.0050000         0.0032778 ± 0.006181           Nitrogen-TKN (mg/L)         0.001000         0.00032778 ± 0.00138           S (mg/L)         0.001000         0.00032778 ± 0.00138           S (mg/L)         0.0001000         0.000161 ± 0.000013           Se (mg/L)         0.0001000         0.0001631 ± 0.000013           Se (mg/L)         0.0001000         0.0000167 ± 0.000074           Sh (mg/L)         0.0002500         0.000167 ± 0.000074           Sh (mg/L)         0.0002500         0.0000167 ± 0.000074           Se (mg/L)         0.0002500         0.0000167 ± 0.000074		0.4700000	0.6471429 ± 0.7154652
Mg (mg/L)         25.300000         9.8814286 ± 6.160120           Mn (mg/L)         0.002400         0.0011426 ± 0.001603           Mo (mg/L)         0.002030         0.002483 ± 0.006533           Ma (mg/L)         1.730000         2.6357143 ± 3.7712414           Ni (mg/L)         0.0002000         0.000088 ± 0.00081           Nitrogen-NO2 (mg/L)         0.0050000         0.002389 ± 0.006335           Nitrogen-NO2 (mg/L)         0.0050000         0.0123889 ± 0.006381           Nitrogen-NO3 (mg/L)         0.0050000         0.023333 ± 0.016143           Nitrogen-TKN (mg/L)         0.0250000         0.023333 ± 0.016143           Nitrogen-TKN (mg/L)         0.002000         0.0032778 ± 0.006181           Nitrogen-TKN (mg/L)         0.001000         0.000224 ± 0.000177           Pb (mg/L)         0.001000         0.0032778 ± 0.006181           S (mg/L)         0.001000         0.000361 ± 0.000133           Se (mg/L)         0.001000         0.00032778 ± 0.006181           Se (mg/L)         0.001000         0.000361 ± 0.000013           Se (mg/L)         0.001000         0.000361 ± 0.000013           Se (mg/L)         0.000100         0.000167 ± 0.000074           So (mg/L)         0.000100         0.0000167 ± 0.000074		0.0040500	$0.0011817 \pm 0.0004768$
Mn (mg/L)         0.0024000         0.0011426 ± 0.001699           Mo (mg/L)         0.0020300         0.0024883 ± 0.006533           Na (mg/L)         1.7300000         2.6357143 ± 3.771241           Ni (mg/L)         0.002000         0.000088 ± 0.000881           Nitrogen-NO2 (mg/L)         0.0050000         0.0023899 ± 0.006335           Nitrogen-NO3 (mg/L)         0.0050000         0.0130000 ± 0.00881           Nitrogen-NO3 (mg/L)         0.0050000         0.0245033 ± 0.0229455           Nitrogen-TKN (mg/L)         0.0050000         0.0245033 ± 0.0229455           Nitrogen-TKN (mg/L)         0.0050000         0.0245033 ± 0.029455           Nitrogen-TKN (mg/L)         0.0050000         0.0245003 ± 0.0229455           Nitrogen-TKN (mg/L)         0.0250000         0.00245003 ± 0.0229455           Nitrogen-TKN (mg/L)         0.0250000         0.0000224 ± 0.000176           Pb (mg/L)         0.001000         0.000224 ± 0.000176           Phosphorus-TP (mg/L)         0.0149000         0.0032778 ± 0.006181           S( mg/L)         0.001000         0.0003241 ± 0.000133           Se (mg/L)         0.0001000         0.0004382 ± 0.0004384           Si (mg/L)         0.0001000         0.0000007           Sof (mg/L)         0.0002500         0.			9.8814286 ± 6.1601202
Mo (mg/L)         0.0020300         0.0024883 ± 0.006533           Na (mg/L)         1.7300000         2.6357143 ± 3.7712414           Ni (mg/L)         0.0002000         0.000888 ± 0.000813           Nitrogen-NO2 (mg/L)         0.0050000         0.002389 ± 0.006335           Nitrogen-NO2 (mg/L)         0.0050000         0.0130000 ± 0.00881           Nitrogen-NO3 (mg/L)         0.0050000         0.0245003 ± 0.022945           Nitrogen-TKN (mg/L)         0.0050000         0.023333 ± 0.016143           Nitrogen-TN (mg/L)         0.00250000         0.008888 ± 0.075917           Pb (mg/L)         0.0001000         0.0000224 ± 0.000174           Phosphorus-TP (mg/L)         0.001000         0.00032778 ± 0.0061816           S (mg/L)         0.001000         0.00032778 ± 0.006181           S (mg/L)         0.0001000         0.0000361 ± 0.000103           Se (mg/L)         0.0001000         0.0004382 ± 0.000173           Se (mg/L)         0.0001000         0.0000361 ± 0.000073           So (mg/L)         0.0001000         0.0000361 ± 0.000073           Se (mg/L)         0.0001000         0.0000075           So (mg/L)         0.0001000         0.00007578 ± 0.082743           Sr (mg/L)         0.0000000         0.0000000			$0.0011426 \pm 0.0016097$
Na (mg/L)         1.7300000         2.6357143 ± 3.7712414           Ni (mg/L)         0.0002000         0.000808 ± 0.000801           Nitrogen-NO2 (mg/L)         0.0050000         0.0023889 ± 0.006315           Nitrogen-NO3 (mg/L)         0.0050000         0.0130000 ± 0.008811           Nitrogen-NO3 (mg/L)         0.0050000         0.0245003 ± 0.0229453           Nitrogen-TKN (mg/L)         0.0250000         0.0233333 ± 0.0161433           Nitrogen-TKN (mg/L)         0.0250000         0.0233333 ± 0.0161433           Nitrogen-TK (mg/L)         0.0050000         0.000224 ± 0.000176           Phosphorus-TP (mg/L)         0.0149000         0.0032778 ± 0.0061810           S (mg/L)         0.001000         0.0003278 ± 0.000183           S (mg/L)         0.001000         0.00033718 ± 0.000183           S (mg/L)         0.0001000         0.0003361 ± 0.000193           Se (mg/L)         0.0001000         0.000361 ± 0.000193           Son (mg/L)         0.0001000         0.000167 ± 0.000743           Sr (mg/L)         0.0001000         0.1159167 ± 0.0982743           Sr (mg/L)         0.0002500         0.0000000 ± 0.0000074           Sr (mg/L)         0.0002500         0.0000000 ± 0.0000074           Sr (mg/L)         0.0002500         0.0000000		0.0020300	0.0024883 ± 0.0065339
Ni (mg/L)         0.0002000         0.000808 ± 0.00081           Nitrogen-NO2 (mg/L)         0.0050000         0.0023889 ± 0.006335           Nitrogen-NO3 (mg/L)         0.0050000         0.0130000 ± 0.008811           Nitrogen-NO3 (mg/L)         0.0050000         0.0245003 ± 0.022945           Nitrogen-TK (mg/L)         0.0250000         0.023333 ± 0.016433           Nitrogen-TK (mg/L)         0.0250000         0.023333 ± 0.016433           Nitrogen-TN (mg/L)         0.0250000         0.000224 ± 0.000176           Pb (mg/L)         0.0149000         0.0002278 ± 0.0061816           S (mg/L)         0.0001000         0.00032778 ± 0.0061816           S (mg/L)         0.0001000         0.00032778 ± 0.0061816           S (mg/L)         0.0001000         0.0000361 ± 0.0000136           S (mg/L)         0.0001000         0.000361 ± 0.0000136           S (mg/L)         0.0001000         0.0004382 ± 0.000438           S (mg/L)         0.0001000         0.000167 ± 0.000074           S (mg/L)         0.0001000         0.000167 ± 0.000074           S (mg/L)         0.0002500         0.0000000 ± 0.000004           S (mg/L)         0.0002500         0.0000000 ± 0.000004           S (mg/L)         0.0002500         0.00000000      S			2.6357143 ± 3.7712414
Nitrogen-NO2 (mg/L)         0.0050000         0.0023889 ± 0.006335           Nitrogen-NO2+NO3 (mg/L)         0.0050000         0.0130000 ± 0.008811           Nitrogen-NO3 (mg/L)         0.0050000         0.0245003 ± 0.022945           Nitrogen-TKN (mg/L)         0.0050000         0.023333 ± 0.016143           Nitrogen-TN (mg/L)         0.0050000         0.0032778 ± 0.000174           Pb (mg/L)         0.00149000         0.0032778 ± 0.0061816           S (mg/L)         72.6000000         5.0000006           Sb (mg/L)         0.0001000         0.000361 ± 0.000133           Se (mg/L)         2.6000000         3.0657143 ± 1.4070446           Si (mg/L)         0.0001000         0.000167 ± 0.000074           So4 (mg/L)         192.0000000         14.9647059 ± 10.8432544           Sr (mg/L)         0.0002500         0.0000000 ± 0.000004           So4 (mg/L)         0.0002500         0.0000000 ± 0.000000           Te (mg/L)         0.0002500         0.0000000 ± 0.000000           Ti (mg/L)         0.0002500         0.0000000 ± 0.000000           Nitrogen-Ti (mg/L)         0.0000500         0.0000000 ± 0.000000           Ti (mg/L)         0.0000500         0.0000000 ± 0.000000           Ti (mg/L)         0.0005000         0.0005298 ± 0.0003220 <th></th> <th>0.0002000</th> <th><math>0.0000808 \pm 0.0000811</math></th>		0.0002000	$0.0000808 \pm 0.0000811$
Nitrogen-NO3 (mg/L)         0.0050000         0.0245003 ± 0.0229457           Nitrogen-TKN (mg/L)         0.0250000         0.0233333 ± 0.0161433           Nitrogen-TN (mg/L)         0.0250000         0.0688889 ± 0.075917           Pb (mg/L)         0.0001000         0.0000224 ± 0.000176           Phosphorus-TP (mg/L)         0.0149000         0.0032778 ± 0.0061816           S (mg/L)         0.0001000         0.00032778 ± 0.000181           S (mg/L)         0.0001000         0.000361 ± 0.0000131           Se (mg/L)         0.0002500         0.0004382 ± 0.0004488           Si (mg/L)         0.0001000         0.000167 ± 0.000078           Sof (mg/L)         0.0001000         0.0000167 ± 0.000078           Sof (mg/L)         0.0001000         0.0000167 ± 0.000078           Sof (mg/L)         0.0001000         0.0000167 ± 0.000078           Sof (mg/L)         0.0001000         0.00000078           Sof (mg/L)         0.0001000         0.0000078           Sof (mg/L)         0.0001000         0.0000000           Te (mg/L)         0.0002500         0.0000000           Th (mg/L)         0.0002500         0.0000000           Th (mg/L)         0.0003940         0.0005288 ± 0.0003220           V (mg/L)         0.00		0.0050000	$0.0023889 \pm 0.0063351$
Nitrogen-TKN (mg/L)         0.0250000         0.0233333 ± 0.0161433           Nitrogen-TN (mg/L)         0.0250000         0.0688889 ± 0.0759173           Pb (mg/L)         0.0001000         0.0000224 ± 0.000176           Phosphorus-TP (mg/L)         0.0149000         0.0032778 ± 0.0061816           S (mg/L)         0.0001000         0.0000361 ± 0.000133           Sb (mg/L)         0.0001000         0.0000361 ± 0.000133           Se (mg/L)         0.0001000         0.0000361 ± 0.000482           Si (mg/L)         0.0001000         0.0000167 ± 0.000476           Sn (mg/L)         0.0001000         0.0000167 ± 0.000076           So4 (mg/L)         1.6300000         3.0557143 ± 1.4070046           Sr (mg/L)         0.0001000         0.0000006 ± 0.0000076           So4 (mg/L)         1.6300000         0.1159167 ± 0.0982749           Te (mg/L)         0.0002500         0.0000000 ± 0.0000000           Th (mg/L)         0.0000500         0.0000000 ± 0.0000000           Ti (mg/L)         0.0002500         0.0009000           Ti (mg/L)         0.0003940         0.0005298 ± 0.0003224           V (mg/L)         0.0005000         0.0001642 ± 0.0001200           Zn (mg/L)         0.00025000         0.00004083 ± 0.000836			$0.0130000 \pm 0.0088111$
Nitrogen-TKN (mg/L)         0.0250000         0.023333 ± 0.0161433           Nitrogen-TN (mg/L)         0.0250000         0.0688889 ± 0.0759173           Pb (mg/L)         0.0001000         0.0000224 ± 0.000176           Phosphorus-TP (mg/L)         0.0149000         0.0032778 ± 0.0061816           S (mg/L)         72.600000         5.000000           Sb (mg/L)         0.0001000         0.0000361 ± 0.000131           Se (mg/L)         0.0002500         0.0004382 ± 0.004488           Si (mg/L)         0.0001000         0.0000167 ± 0.00076           Sh (mg/L)         0.0001000         0.0000167 ± 0.00076           Sof (mg/L)         1.6300000         14.9647059 ± 10.8432549           Sr (mg/L)         1.6300000         0.1159167 ± 0.0982749           Te (mg/L)         0.0002500         0.0000000 ± 0.000000           Ti (mg/L)         0.0002500         0.0000000 ± 0.000000           Ti (mg/L)         0.0002500         0.0000000           U (mg/L)         0.0003940         0.0005298 ± 0.0003224           V (mg/L)         0.0005000         0.0001642 ± 0.0001200	Nitrogen-NO3 (mg/L)	0.0050000	0.0245003 ± 0.0229452
Pb (mg/L)         0.0001000         0.0000224 ± 0.000176           Phosphorus-TP (mg/L)         0.0149000         0.0032778 ± 0.0061816           S (mg/L)         72.600000         5.000000           Sb (mg/L)         0.0001000         0.000361 ± 0.000131           Se (mg/L)         0.0002500         0.0004382 ± 0.0004486           Si (mg/L)         0.0001000         0.000167 ± 0.000076           Se (mg/L)         0.0001000         0.0000167 ± 0.0000767           Sn (mg/L)         0.0001000         0.0000167 ± 0.0000767           Sr (mg/L)         1.6300000         0.1159167 ± 0.0982747           Sr (mg/L)         0.0002500         0.0000000 ± 0.0000007           Te (mg/L)         0.0002500         0.0000000 ± 0.000000           Ti (mg/L)         0.0002500         0.0000000 ± 0.000000           U (mg/L)         0.0003940         0.0005298 ± 0.003220           V (mg/L)         0.0002500         0.0001642 ± 0.00120	Nitrogen-TKN (mg/L)	0.0250000	0.0233333 ± 0.0161433
Pb (mg/L)         0.0001000         0.0000224 ± 0.000176           Phosphorus-TP (mg/L)         0.0149000         0.0032778 ± 0.0061816           S (mg/L)         72.600000         5.000000           Sb (mg/L)         0.0001000         0.000361 ± 0.000131           Se (mg/L)         0.0002500         0.0004382 ± 0.0004486           Si (mg/L)         0.0001000         0.000167 ± 0.000076           Se (mg/L)         0.0001000         0.0000167 ± 0.0000767           Sn (mg/L)         0.0001000         0.0000167 ± 0.0000767           Sr (mg/L)         1.6300000         0.1159167 ± 0.0982747           Sr (mg/L)         0.0002500         0.0000000 ± 0.0000007           Te (mg/L)         0.0002500         0.0000000 ± 0.000000           Ti (mg/L)         0.0002500         0.0000000 ± 0.000000           U (mg/L)         0.0003940         0.0005298 ± 0.003220           V (mg/L)         0.0002500         0.0001642 ± 0.00120	Nitrogen-TN (mg/L)	0.0250000	$0.0688889 \pm 0.0759171$
S (mg/L)         72.600000         5.000000           Sb (mg/L)         0.0001000         0.000361 ± 0.000133           Se (mg/L)         0.0002500         0.0004382 ± 0.0004486           Si (mg/L)         2.600000         3.0657143 ± 1.4070046           Sn (mg/L)         0.0001000         0.0000167 ± 0.000073           SO4 (mg/L)         192.000000         14.9647059 ± 10.8432549           Sr (mg/L)         0.0002500         0.01159167 ± 0.0982749           Te (mg/L)         0.0002500         0.0000000 ± 0.000000           Th (mg/L)         0.0002500         0.0000000 ± 0.000000           Ti (mg/L)         0.0002500         0.0000000           Ti (mg/L)         0.0003940         0.0005298 ± 0.000322           V (mg/L)         0.0005000         0.0001642 ± 0.000120		0.0001000	$0.0000224 \pm 0.0000176$
S (mg/L)         72.600000         5.000000           Sb (mg/L)         0.0001000         0.000361 ± 0.000133           Se (mg/L)         0.0002500         0.0004382 ± 0.0004486           Si (mg/L)         2.600000         3.0657143 ± 1.4070046           Sn (mg/L)         0.0001000         0.0000167 ± 0.000073           SO4 (mg/L)         192.000000         14.9647059 ± 10.8432549           Sr (mg/L)         0.0002500         0.01159167 ± 0.0982749           Te (mg/L)         0.0002500         0.0000000 ± 0.000000           Th (mg/L)         0.0002500         0.0000000 ± 0.000000           Ti (mg/L)         0.0002500         0.0000000           Ti (mg/L)         0.0003940         0.0005298 ± 0.000322           V (mg/L)         0.0005000         0.0001642 ± 0.000120	Phosphorus-TP (mg/L)	0.0149000	$0.0032778 \pm 0.0061816$
Se (mg/L)         0.0002500         0.0004382 ± 0.0004486           Si (mg/L)         2.600000         3.0657143 ± 1.407046           Sn (mg/L)         0.0001000         0.0000167 ± 0.000078           SO4 (mg/L)         192.000000         14.9647059 ± 10.8432549           Sr (mg/L)         1.630000         0.1159167 ± 0.0982749           Te (mg/L)         0.0002500         0.000000 ± 0.000000           Th (mg/L)         0.0002500         0.0000000           Ti (mg/L)         0.0002500         0.0009000           Ti (mg/L)         0.0002500         0.0009000           Ti (mg/L)         0.0003940         0.0005298 ± 0.0003220           V (mg/L)         0.0005000         0.0001642 ± 0.0001200           Zn (mg/L)         0.0020000         0.0004083 ± 0.0008365		72.600000	5.000000
Si (mg/L)         2.600000         3.0657143 ± 1.407044           Sn (mg/L)         0.000100         0.0000167 ± 0.000073           SO4 (mg/L)         192.000000         14.9647059 ± 10.8432543           Sr (mg/L)         1.630000         0.1159167 ± 0.0982743           Te (mg/L)         0.0002500         0.000000 ± 0.000000           Th (mg/L)         0.0002500         0.0000000 ± 0.000000           Ti (mg/L)         0.0002500         0.0000000           Ti (mg/L)         0.0002500         0.0000000           Ti (mg/L)         0.0000100         0.0000000           Ti (mg/L)         0.0000000         0	Sb (mg/L)	0.0001000	$0.0000361 \pm 0.0000135$
Sn (mg/L)         0.0001000         0.000167 ± 0.000073           SO4 (mg/L)         192.000000         14.9647059 ± 10.8432543           Sr (mg/L)         1.630000         0.1159167 ± 0.0982743           Te (mg/L)         0.0002500         0.000000 ± 0.000000           Th (mg/L)         0.000500         0.0000000 ± 0.000000           Ti (mg/L)         0.0025000         0.0000000           Ti (mg/L)         0.00025000         0.0000000           Ti (mg/L)         0.0000100         0.0009000           Ti (mg/L)         0.0003940         0.0005298 ± 0.0003220           V (mg/L)         0.0005000         0.0001642 ± 0.0001200           Zn (mg/L)         0.0020000         0.0004083 ± 0.0008363		0.0002500	$0.0004382 \pm 0.0004486$
Sn (mg/L)         0.0001000         0.000167 ± 0.000073           SO4 (mg/L)         192.000000         14.9647059 ± 10.8432543           Sr (mg/L)         1.630000         0.1159167 ± 0.0982743           Te (mg/L)         0.0002500         0.000000 ± 0.000000           Th (mg/L)         0.000500         0.0000000 ± 0.000000           Ti (mg/L)         0.0025000         0.0000000           Ti (mg/L)         0.00025000         0.0000000           Ti (mg/L)         0.0000100         0.0009000           Ti (mg/L)         0.0003940         0.0005298 ± 0.0003220           V (mg/L)         0.0005000         0.0001642 ± 0.0001200           Zn (mg/L)         0.0020000         0.0004083 ± 0.0008363	Si (mg/L)	2.600000	3.0657143 ± 1.4070046
SO4 (mg/L)         192.000000         14.9647059 ± 10.8432549           Sr (mg/L)         1.630000         0.1159167 ± 0.0982749           Te (mg/L)         0.0002500         0.000000 ± 0.000000           Th (mg/L)         0.000500         0.000000 ± 0.000000           Ti (mg/L)         0.0025000         0.000000 ± 0.000000           Ti (mg/L)         0.00025000         0.0000000           Ti (mg/L)         0.0000100         0.0000038 ± 0.000064           U (mg/L)         0.0003940         0.0005298 ± 0.003220           V (mg/L)         0.0005000         0.0001642 ± 0.0001200		0.0001000	$0.0000167 \pm 0.0000078$
Sr (mg/L)         1.630000         0.1159167 ± 0.0982749           Te (mg/L)         0.0002500         0.000000 ± 0.000000           Th (mg/L)         0.000500         0.000000 ± 0.000000           Ti (mg/L)         0.0025000         0.0009000           Ti (mg/L)         0.0000100         0.0000038 ± 0.000064           U (mg/L)         0.0003940         0.0005298 ± 0.003220           V (mg/L)         0.0005000         0.0001642 ± 0.0001200           Zn (mg/L)         0.0020000         0.0004083 ± 0.0008365	SO4 (mg/L)	192.000000	$14.9647059 \pm 10.8432549$
Te (mg/L)         0.0002500         0.000000 ± 0.000000           Th (mg/L)         0.000500         0.0000000 ± 0.000000           Ti (mg/L)         0.0025000         0.0009000           Ti (mg/L)         0.0000100         0.0000038 ± 0.000064           U (mg/L)         0.0003940         0.0005298 ± 0.0003220           V (mg/L)         0.0005000         0.0001642 ± 0.0001200           Zn (mg/L)         0.0020000         0.0004083 ± 0.0008365		1.6300000	0.1159167 ± 0.0982749
Th (mg/L)         0.0000500         0.000000 ± 0.000000           Ti (mg/L)         0.0025000         0.0009000           Tl (mg/L)         0.0000100         0.0000038 ± 0.000064           U (mg/L)         0.0003940         0.0005298 ± 0.0003220           V (mg/L)         0.0005000         0.0001642 ± 0.0001200           Zn (mg/L)         0.0020000         0.0004083 ± 0.0008365			$0.0000000 \pm 0.0000000$
Ti (mg/L)         0.0025000         0.000900           Tl (mg/L)         0.0000100         0.0000038 ± 0.000064           U (mg/L)         0.0003940         0.0005298 ± 0.0003220           V (mg/L)         0.0005000         0.0001642 ± 0.0001200           Zn (mg/L)         0.0020000         0.0004083 ± 0.0008365			$0.0000000 \pm 0.0000000$
TI (mg/L)         0.0000100         0.000038 ± 0.000064           U (mg/L)         0.0003940         0.0005298 ± 0.003220           V (mg/L)         0.0005000         0.0001642 ± 0.0001203           Zn (mg/L)         0.0020000         0.0004083 ± 0.0008363			0.0009000
U (mg/L)         0.0003940         0.0005298 ± 0.0003220           V (mg/L)         0.0005000         0.0001642 ± 0.0001200           Zn (mg/L)         0.0020000         0.0004083 ± 0.0008365			$0.0000038 \pm 0.0000064$
V (mg/L)         0.0005000         0.0001642 ± 0.0001203           Zn (mg/L)         0.0020000         0.0004083 ± 0.0008363			0.0005298 ± 0.0003220
<b>Zn (mg/L)</b> 0.0020000 0.0004083 ± 0.0008365			$0.0001642 \pm 0.0001203$
			$0.0004083 \pm 0.0008361$
Zr (mg/L) 0.0000500 0.0000000 ± 0.000000	Zr (mg/L)	0.0000500	$0.0000000 \pm 0.0000000$

# **Site Description**

Sile Description	
Study Name	CBWQ-Elk
Site	LIZ003
Sampling Date	Sep 15 2020
Know Your Watershed Basin	Central Kootenay
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera EcoZone
	Northern Continental Divide EcoRegion
Coordinates (decimal degrees)	49.48584 N, 115.09455 W
Altitude	1022
Local Basin Name	Lizard Creek
	Central Kootenay
Stream Order	3

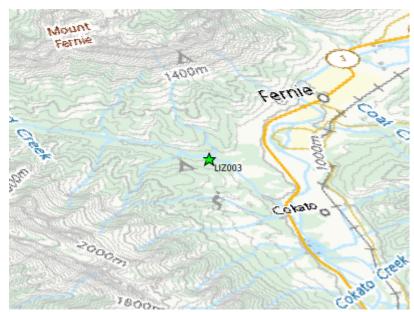


Figure 1. Location Map

Across Reach (No image found) Down Stream (No image found) Field Sheet (No image found) Substrate (No image found) Up Stream (No image found)

### **Cabin Assessment Results**

R	Reference Model	Summary			
Model	Columbia-Okana	Columbia-Okanagan Preliminary March 2010			
Analysis Date	January 07, 202	2			
Taxonomic Level	Family				
Predictive Model Variables	Depth-Avg Latitude Longitude Reg-Ice Reg-SlopeLT30%				
Reference Groups	1 2 3 4 5				
Number of Reference Sites	9	43	17	12	33
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%
Overall Model Error Rate	26.4%				
Probability of Group Membership	0.0%	1.1%	83.2%	14.5%	1.3%
CABIN Assessment of LIZ003 on Sep 15, 2020	Mildly Divergent				

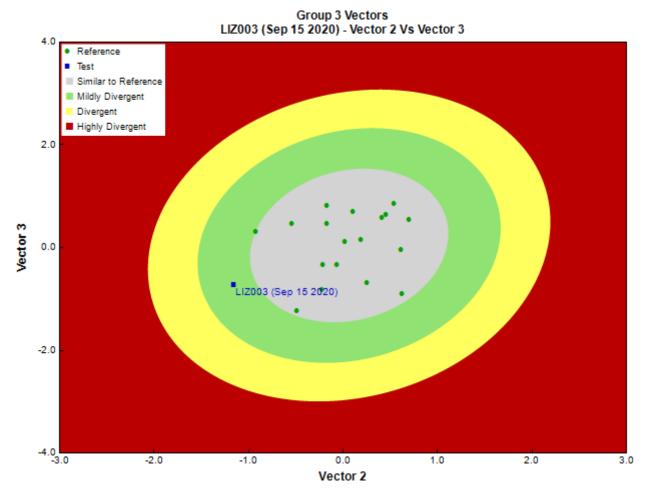


Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

# Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Pina Viola, Consultant
	Marchant Box
Sub-Sample Proportion	5/100

# **Community Structure**

Phylum	Class	Order	Family	Raw Count	Total Count
Annelida	Clitellata		Enchytraeidae	1	20.0
		Tubificida	Naididae	1	20.0
Arthropoda	Arachnida	Trombidiformes	Lebertiidae	20	400.0
			Torrenticolidae	8	160.0
	Insecta	Coleoptera	Elmidae	154	3,080.0
		Diptera	Chironomidae	59	1,180.0
			Empididae	1	20.0
			Pelecorhynchidae	3	60.0
			Psychodidae	94	1,880.0
			Simuliidae	2	40.0
			Tipulidae	19	380.0
		Ephemeroptera	Baetidae	125	2,500.0
			Ephemerellidae	116	2,320.0
			Heptageniidae	53	1,060.0
		Plecoptera		6	120.0
			Capniidae	4	80.0

# **Community Structure**

Phylum	Class	Order	Family	Raw Count	Total Count
			Chloroperlidae	14	280.0
			Nemouridae	164	3,280.0
			Perlidae	19	380.0
			Perlodidae	4	80.0
			Taeniopterygidae	31	620.0
		Trichoptera	Apataniidae	10	200.0
			Brachycentridae	3	60.0
			Glossosomatidae	7	140.0
			Hydropsychidae	1	20.0
			Rhyacophilidae	24	480.0
			Uenoidae	44	880.0
			Total	987	19,740.0

### **Metrics**

Name	LIZ003	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.75	$0.4 \pm 0.2$
Biotic	Indices	
Intolerant taxa		1.0
Tolerant individuals (%)		$0.6 \pm 0.4$
Number Of	Individuals	
% Chironomidae	6.0	7.3 ± 10.2
% Coleoptera	15.7	2.9 ± 5.0
% Diptera + Non-insects	21.1	$13.0 \pm 11.1$
% Ephemeroptera	30.0	48.4 ± 15.8
% Ephemeroptera that are Baetidae	42.5	41.9 ± 25.2
% EPT Individuals	63.1	84.1 ± 11.5
% Odonata		$0.0 \pm 0.0$
% of 2 dominant taxa	32.4	54.3 ± 12.1
% of dominant taxa	16.7	35.5 ± 11.8
% Plecoptera	24.1	28.1 ± 15.3
% Tribe Tanyatarisini		
% Trichoptera that are Hydropsychida	1.1	25.4 ± 24.5
% Tricoptera	9.1	7.5 ± 7.7
No. EPT individuals/Chironomids+EPT Individuals	0.9	$0.9 \pm 0.1$
Total Abundance	19740.0	4086.0 ± 3834.6
Rich	ness	
Chironomidae taxa (genus level only)	1.0	$1.0 \pm 0.0$
Coleoptera taxa	1.0	$0.6 \pm 0.6$
Diptera taxa	6.0	$3.5 \pm 1.1$
Ephemeroptera taxa	3.0	3.8 ± 0.7
EPT Individuals (Sum)	12380.0	3252.2 ± 2587.2
EPT taxa (no)	15.0	12.7 ± 2.6
Odonata taxa		$0.0 \pm 0.0$
Pielou's Evenness	0.8	$0.7 \pm 0.1$
Plecoptera taxa	6.0	5.4 ± 1.3
Shannon-Wiener Diversity	2.5	2.0 ± 0.3
Simpson's Diversity	0.9	$0.8 \pm 0.1$
Simpson's Evenness	0.4	$0.3 \pm 0.1$
Total No. of Taxa	26.0	19.4 ± 4.2
Trichoptera taxa	6.0	3.6 ± 1.5

<b>Reference Model Taxa</b>	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at
	Group 1	Group 2	Group 3	Group 4	Group 5	LIZ003
Ameletidae	56%	53%	22%	50%	68%	0.27
Apataniidae	22%	24%	28%	25%	3%	0.27
Athericidae	0%	2%	0%	17%	0%	0.02
Aturidae	0%	8%	0%	0%	0%	0.00
Baetidae	100%	100%	100%	100%	97%	1.00
Blephariceridae	0%	0%	0%	0%	5%	0.00

#### Frequency of Occurrence in Reference Sites **Probability Of Occurrence at Reference Model Taxa** LIZ003 Group 1 Group 2 Group 5 Group 3 Group 4 11% 0% 0.07 Brachycentridae 69% 42% 3% Capniidae 78% 55% 50% 92% 68% 0.56 Ceratopogonidae 0% 55% 28% 42% 5% 0.30 95% Chironomidae 100% 100% 100% 100% 1.00 Chloroperlidae 78% 88% 94% 100% 100% 0.95 Corixidae 11% 0% 0% 0% 0% 0.00 Curculionidae 0% 4% 0% 0% 0% 0.00 0% Deuterophlebiidae 0% 0% 0.00 0% 3% 0% 10% 0% 0% 0% 0.00 Dixidae Dytiscidae 0% 8% 6% 0% 0% 0.05 Elmidae 0% 86% 50% 50% 5% 0.50 55% 50% 57% Empididae 67% 67% 0.53 Enchytraeidae 11% 14% 0% 8% 0% 0.01 Ephemerellidae 78% 100% 100% 100% 100% 1.00 Ephydridae 0% 2% 0% 0% 0% 0.00 49% 39% 42% 11% 35% 0.39 Glossosomatidae Heptageniidae 100% 100% 100% 100% 100% 1.00 0% 4% 0% 0% 0% 0.00 Hydraenidae Hydrophilidae 11% 2% 0% 0% 0% 0.00 11% 92% 78% 92% Hydropsychidae 86% 0.80 Hydroptilidae 11% 8% 0% 0% 0% 0.00 Hydrozetidae 0% 10% 17% 8% 16% 0.15 11% Hydryphantidae 11%31% 8% 8% 0.11 0% 0% 29% 0% 11% 0.00 Hygrobatidae 78% 65% 39% Lebertiidae 58% 5% 0.42 Lepidostomatidae 0% 53% 6% 17% 8% 0.08 Leptohyphidae 0% 2% 0% 0% 0% 0.00 Leptophlebiidae 0% 90% 11% 33% 3% 0.15 Leuctridae 22% 43% 56% 67% 54% 0.57 Limnephilidae 22% 31% 6% 25% 41% 0.09 Limnesiidae 0% 2% 0% 0% 0% 0.00 17% 25% 0% 20% Lumbriculidae 3% 0.18 0% 0% 0.00 0% 2% 0% Mideopsidae Naididae 0% 8% 39% 0.32 0% 3% Nemouridae 100% 100% 100% 100% 100% 1.00 22% 0.05 Pelecorhynchidae 0% 6% 0% 0% Peltoperlidae 22% 12% 6% 8% 41% 0.06 Perlidae 11% 84% 33% 100% 3% 0.43 Perlodidae 89% 81% 0.89 78% 78% 92% Philopotamidae 0% 0% 31% 0% 0.00 3% Pisidiidae 0% 6% 0% 8% 0% 0.01 Planariidae 0% 8% 67% 17% 3% 0.58 Planorbidae 0% 0% 0% 0% 3% 0.00 Psychodidae 22% 65% 94% 8% 11% 0.81 Pteronarcyidae 0% 12% 6% 0% 3% 0.05 Rhyacophilidae 100% 92% 100% 100% 95% 1.00 Simuliidae 33% 49% 39% 33% 16% 0.38 63% 42% 50% 78% 65% 0.49 Sperchontidae 4% 0% 17% 0% 0.02 Stygothrombiidae 0% Taeniopterygidae 89% 49% 100% 92% 97% 0.98 4% Thaumaleidae 11% 0% 0% 0% 0.00 Tipulidae 56% 55% 28% 67% 43% 0.34 Torrenticolidae 11%86% 11% 17% 11%0.13 Uenoidae 22% 37% 17% 25% 46% 0.18 Valvatidae 0% 2% 6% 0% 0% 0.05

RIVPACS Ratios	
RIVPACS : Expected taxa P>0.50	12.67
RIVPACS : Observed taxa P>0.50	13.00
RIVPACS : 0:E (p > 0.5)	1.03

# **RIVPACS** Ratios

RIVPACS : Expected taxa P>0.70	10.43
RIVPACS : Observed taxa P>0.70	11.00
RIVPACS : 0:E (p > 0.7)	1.05

Habitat Description	179000	
Variable	LIZ003	Predicted Group Reference Mean ±SD
Bedrock	Geology	
Sedimentary (%)	100.00000	92.18813 ± 22.65908
Chai		
Depth-Avg (cm)	14.3	22.5 ± 10.5
Depth-BankfullMinusWetted (cm)	27.10	67.33 ± 71.65
Depth-Max (cm)	24.3	32.9 ± 17.9
Macrophyte (PercentRange)	1	0 ± 0
Reach-%CanopyCoverage (PercentRange)	1.00	0.94 ± 0.80
Reach-DomStreamsideVeg (Category(1-4))	2	3 ± 1
Reach-Pools (Binary)	0	0 ± 1
Reach-Rapids (Binary)	0	0 ± 1
Reach-Riffles (Binary)	1	1 ± 0
Reach-StraightRun (Binary)	0	1 ± 0
Slope (m/m)	0.0078000	0.0235102 ± 0.0284557
Veg-Coniferous (Binary)	1	<u>1 ± 0</u>
Veg-Deciduous (Binary)	1	1 ± 0
Veg-GrassesFerns (Binary)	1	1 ± 0
Veg-Shrubs (Binary)	1	<u>1±0</u>
Velocity-Avg (m/s)	0.29	0.50 ± 0.25
Velocity-Max (m/s)	0.51	0.75 ± 0.28
Width-Bankfull (m)	8.2	15.6 ± 12.8
Width-Wetted (m)	8.5	10.2 ± 7.0
XSEC-VelMethod (Category(1-3))	1	2 ± 1
Clim		
Precip10_OCT (mm)	50.00611	52.92857 ± 22.22704
Temp12_DECmin (Degrees Celsius)	-12.16556	-12.82063 ± 2.01422
Hydro		100 22500 1 105 00040
Drainage-Area (km^2)	41.12742	166.32560 ± 185.60049
Lando		4 02030 + 5 00500
Natl-Grassland (%)	3.33891	4.92979 ± 5.99508
Natl-ShrubLow (%)	6.54440	1.89085 ± 1.59075
Nati-Water (%)	0.16808	0.22269 ± 0.34683
Reg-Ice (%)	0.00000	0.46949 ± 1.15785
Substra		0 ± 0
%Bedrock (%) %Boulder (%)	0	
%Boulder (%) %Cobble (%)	0 40	<u> </u>
	40	$1 \pm 2$
%Gravel (%) %Pebble (%)	53	$1 \pm 2$ 31 ± 28
%Pebble (%) %Sand (%)	0	$\frac{31 \pm 28}{0 \pm 0}$
%Sand (%) %Silt+Clay (%)	0	$\begin{array}{c} 0 \pm 0 \\ 0 \pm 1 \end{array}$
D50 (cm)	5.55	$0 \pm 1$ 79.45 ± 47.98
Dg (cm)	4.5	73.9 ± 48.0
Dominant-1st (Category(0-9))	5	6 ± 1
Dominant-2nd (Category(0-9))	6	6 ± 2
Embeddedness (Category(1-5))	5	$\frac{0 \pm 2}{4 \pm 1}$
PeriphytonCoverage (Category(1-5))	3	2 ± 1
SurroundingMaterial (Category(1-5))	2	$3 \pm 1$
Topog		5 ± 1
Reg-SlopeLT30% (%)	41.98937	27.92073 ± 14.83033
SlopeMax (%)	204.47122	$616.97887 \pm 680.88955$
Water Ch		010.37007 ± 000.00333
Ag (mg/L)	0.0000250	$0.0000004 \pm 0.0000014$
Ag (mg/L) Al (mg/L)	0.0000230	$0.0059500 \pm 0.0039700$
As (mg/L)	0.0091000	$0.0002175 \pm 0.0001795$
B (mg/L)	0.0002300	0.0500000
B (IIIg/L)	0.0250000	0.0500000

VariableBa (mg/L)Be (mg/L)Bi (mg/L)Ca (mg/L)Cd (mg/L)Chloride-Total (mg/L)Co (mg/L)Cr (mg/L)Cu (mg/L)	LIZ003 0.0668000 0.0000500 95.1000000 0.0000130 0.1900000 0.0000500 0.0002500	Predicted Group Reference Mean ±SD 0.0639025 ± 0.0450861 0.0000025 ± 0.0000062 0.0000004 ± 0.0000014 38.6142857 ± 14.8464843 0.0000059 ± 0.0000067 0.0000000 ± 0.0000000
Be (mg/L)         Bi (mg/L)           Ca (mg/L)         Cd (mg/L)           Chloride-Total (mg/L)         Co (mg/L)           Cr (mg/L)         Cr (mg/L)	0.0000500 0.0000500 95.1000000 0.0000130 0.1900000 0.0000500 0.0002500	$\begin{array}{c} 0.0000025 \pm 0.0000062 \\ 0.0000004 \pm 0.0000014 \\ 38.6142857 \pm 14.8464843 \\ 0.0000059 \pm 0.0000067 \end{array}$
Bi (mg/L)         Ca (mg/L)           Cd (mg/L)         Chloride-Total (mg/L)           Co (mg/L)         Cr (mg/L)	0.0000500 95.1000000 0.0000130 0.1900000 0.0000500 0.0002500	$\begin{array}{r} 0.0000004 \pm 0.0000014 \\ 38.6142857 \pm 14.8464843 \\ 0.0000059 \pm 0.0000067 \end{array}$
Ca (mg/L) Cd (mg/L) Chloride-Total (mg/L) Co (mg/L) Cr (mg/L)	95.1000000 0.0000130 0.1900000 0.0000500 0.0002500	38.6142857 ± 14.8464843 0.0000059 ± 0.0000067
Cd (mg/L) Chloride-Total (mg/L) Co (mg/L) Cr (mg/L)	0.0000130 0.1900000 0.0000500 0.0002500	$0.0000059 \pm 0.0000067$
Chloride-Total (mg/L) Co (mg/L) Cr (mg/L)	0.1900000 0.0000500 0.0002500	
Co (mg/L) Cr (mg/L)	0.0000500 0.0002500	$0.000000 \pm 0.000000$
Cr (mg/L)	0.0002500	
		$0.0000043 \pm 0.0000057$
Cu (ma/L)		$0.0000833 \pm 0.0001403$
(	0.0002000	$0.0001875 \pm 0.0001434$
Fe (mg/L)	0.0140000	0.0090000
General-Alkalinity (mg/L)	142.0000000	121.5944444 ± 36.7225924
General-Conductivity (µS/cm)	427.8000000	$186.8500000 \pm 84.0864011$
General-Hardness (mg/L)	329.0000000	$146.8222222 \pm 41.6699011$
General-pH (pH)	8.4	8.0 ± 0.6
General-SolidsTSS (mg/L)	1.0000000	$0.5604289 \pm 1.4627232$
General-SpCond (µS/cm)	598.0000000	214.2437500 ± 77.1891440
General-TempAir (Degrees Celsius)	21.5	10.5 ± 4.2
General-TempWater (Degrees Celsius)	10.1000000	6.6716667 ± 2.0277755
General-Turbidity (NTU)	0.8300000	$0.0000000 \pm 0.0000000$
Hg (ng/L)	0.0000200	$0.0000000 \pm 0.0000000$
K (mg/L)	0.4100000	$0.6471429 \pm 0.7154652$
Li (mg/L)	0.0042600	$0.0011817 \pm 0.0004768$
Mg (mg/L)	23.5000000	9.8814286 ± 6.1601202
Mn (mg/L)	0.0035700	$0.0011426 \pm 0.0016097$
Mo (mg/L)	0.0019200	$0.0024883 \pm 0.0065339$
Na (mg/L)	1.6800000	$2.6357143 \pm 3.7712414$
Ni (mg/L)	0.0002000	$0.0000808 \pm 0.0000811$
Nitrogen-NH3 (mg/L)	0.0250000	$0.0019286 \pm 0.0059286$
Nitrogen-NO2 (mg/L)	0.0050000	$0.0023889 \pm 0.0063351$
Nitrogen-NO2+NO3 (mg/L)	0.0120000	$0.0130000 \pm 0.0088111$
Nitrogen-NO3 (mg/L)	0.0120000	$0.0245003 \pm 0.0229452$
Nitrogen-TKN (mg/L)	0.0250000	$0.0233333 \pm 0.0161433$
Nitrogen-TN (mg/L)	0.0250000	$0.0688889 \pm 0.0759171$
Pb (mg/L)	0.0001000	$0.0000224 \pm 0.0000176$
Phosphorus-TP (mg/L)	0.0179000	0.0032778 ± 0.0061816
S (mg/L)	68.9000000	5.000000
Sb (mg/L)	0.0001000	$0.0000361 \pm 0.0000135$
Se (mg/L)	0.0002500	$0.0004382 \pm 0.0004486$
Si (mg/L)	2.5000000	$3.0657143 \pm 1.4070046$
Sn (mg/L)	0.0001000	$0.0000167 \pm 0.0000078$
SO4 (mg/L)	192.0000000	$14.9647059 \pm 10.8432549$
Sr (mg/L)	1.5700000	$0.1159167 \pm 0.0982749$
Te (mg/L)	0.0002500	$0.0000000 \pm 0.0000000$
Th (mg/L)	0.0000500	$0.0000000 \pm 0.0000000$
Ti (mg/L)	0.0025000	0.0009000
TI (mg/L)	0.0000100	$0.0000038 \pm 0.0000064$
U (mg/L)	0.0004070	$0.0005298 \pm 0.0003220$
V (mg/L)	0.0005000	$0.0001642 \pm 0.0001203$
Zn (mg/L)	0.0020000	$0.0004083 \pm 0.0001203$
Zr (mg/L)	0.0000500	0.00000000000000000000000000000000000

# **Site Description**

Study Name	CBWQ-Elk
Site	MOR001
Sampling Date	Sep 22 2020
Know Your Watershed Basin	Central Kootenay
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera EcoZone
	Northern Continental Divide EcoRegion
Coordinates (decimal degrees)	49.35806 N, 115.00088 W
Altitude	941
Local Basin Name	Morrissey Creek
	Central Kootenay
Stream Order	3



Figure 1. Location Map

Across Reach (No image found) Down Stream (No image found) Field Sheet (No image found) Substrate (No image found) Up Stream (No image found)

### **Cabin Assessment Results**

Reference Model Summary						
Model	Columbia-Okana	igan Prelimina	ry March 2010			
Analysis Date	January 07, 202	2				
Taxonomic Level	Family					
Predictive Model Variables	Depth-Avg					
	Latitude					
	Longitude					
	Reg-Ice					
	Reg-SlopeLT30%					
Reference Groups	1 2 3 4 5					
Number of Reference Sites	9	43	17	12	33	
Group Error Rate	22.2% 24.5% 22.2% 25.0% 32.4%					
Overall Model Error Rate	26.4%					
Probability of Group Membership	0.0% 5.1% 90.2% 4.4% 0.2%					
CABIN Assessment of MOR001 on Sep 22,	2, Divergent					
2020						

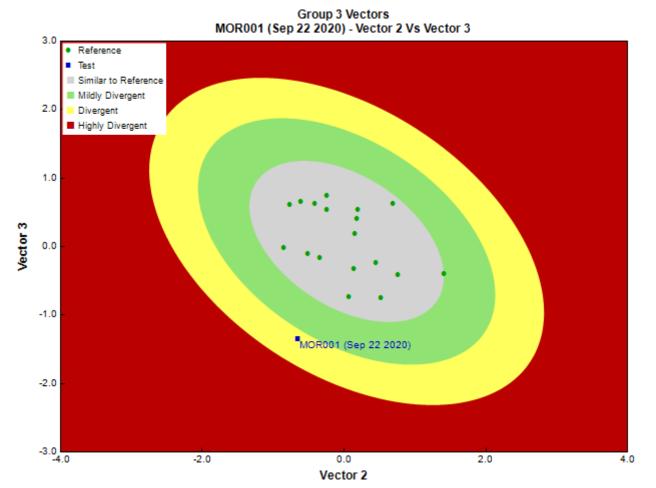


Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

### **Sample Information**

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Pina Viola, Consultant
	Marchant Box
Sub-Sample Proportion	5/100

# **Community Structure**

Phylum	Class Order		Order Family		Total Count	
Annelida	Clitellata	Tubificida	Naididae	1	20.0	
Arthropoda	Arachnida	Trombidiformes	Hydryphantidae	1	20.0	
			Lebertiidae	34	680.0	
			Sperchontidae	5	100.0	
			Torrenticolidae	13	260.0	
	Insecta	Coleoptera	Elmidae	18	360.0	
		Diptera	Athericidae	3	60.0	
			Chironomidae	20	400.0	
			Empididae	3	60.0	
			Psychodidae	3	60.0	
			Tipulidae	10	200.0	
		Ephemeroptera	Baetidae	3	60.0	
			Ephemerellidae	13	260.0	
			Heptageniidae	41	820.0	
			Leptophlebiidae	4	80.0	
		Plecoptera		1	20.0	

# **Community Structure**

Phylum	Class	Order	Family	Raw Count	Total Count
			Chloroperlidae	1	20.0
			Nemouridae	13	260.0
			Perlidae	1	20.0
			Perlodidae	6	120.0
		Trichoptera	Brachycentridae	21	420.0
			Hydropsychidae	49	980.0
			Hydroptilidae	2	40.0
			Lepidostomatidae	290	5,800.0
			Rhyacophilidae	2	40.0
			Total	558	11,160.0

#### **Metrics**

Biotic Indices           Intolerant taxa          1.0           Tolerant individuals (%)         0.5         0.6 ± 0.4           Number Of Individuals          1.0           % Coleoptera         3.6         7.3 ± 10.2           % Coleoptera         3.2         2.9 ± 5.0           % Diptera + Non-insects         16.7         13.0 ± 11.1           % Ephemeroptera         4.1.9         41.9 ± 25.2           % EPT Individuals         80.1         84.1 ± 11.5           % Odonata          0.0 ± 0.0           % of 2 dominant taxa         60.9         9.4.3 ± 12.1           % of dominant taxa         60.9         9.4.3 ± 12.1           % of dominant taxa         65.9         7.5 ± 7.7           % Of Individuals/Chironomids+EPT Individuals         1.0         0.9 ± 0.1           % Trichoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Trichoptera taxa         1.0         0.9 ± 0.1           Total Abundance         11160.0         4086.0 ± 3834.6           Diptera taxa         5.0         3.5 ± 1.1           % Plecoptera taxa         5.0         3.5 ± 1.2           % Trichoptera taxa         5.0         3.25.2.2 ± 2587.2 <th>Name</th> <th>MOR001</th> <th>Predicted Group Reference Mean ±SD</th>	Name	MOR001	Predicted Group Reference Mean ±SD					
Intolerant taxa          1.0           Tolerant individuals (%)         0.5         0.6 ± 0.4           Number Of Individuals         3.6         7.3 ± 10.2           % Chironomidae         3.2         2.9 ± 5.0           % Diptera + Non-insects         16.7         13.0 ± 11.1           % Ephemeroptera         11.0         48.4 ± 15.8           % Ephemeroptera         80.1         84.1 ± 11.5           % Godonata         80.1         84.1 ± 11.5           % Odonata         60.9         54.3 ± 12.1           % of dominant taxa         60.9         54.3 ± 12.1           % Oftoptera         3.8         28.1 ± 15.3           % Tricoptera         3.8         28.1 ± 15.3           % Tricoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Tricoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Tricoptera taxa         1.0         0.9 ± 0.0           Coleoptera taxa         1.0         0.0 ± 0.0           Coleoptera taxa         1.0         0.9 ± 0.1           Total Abundance         1.10         0.0 ± 0.0           Coleoptera taxa         4.0         3.8 ± 0.7           Ephemeroptera taxa         5.0	Bray-Curtis Distance	0.77	$0.4 \pm 0.2$					
Tolerant individuals (%)         0.6 ± 0.4           Number Of Individuals           % Chironomidae         3.6         7.3 ± 10.2           % Coleoptera         3.2         2.9 ± 5.0           % Diptera + Non-insects         11.0         48.4 ± 15.8           % Ephemeroptera         11.0         48.4 ± 15.8           % Ephemeroptera that are Baetidae         4.9         41.9 ± 25.2           % Of Colonata          0.0 ± 0.0           % of 2 dominant taxa         60.9         54.3 ± 12.1           % Of dominant taxa         65.1         3.8         28.1 ± 15.3           % Trichoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Trichoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Tricoptera         65.4         7.5 ± 7.7           No. EPT individuals/Chironomids+EPT Individuals         1.0         0.0 ± 0.0           Chironomidae taxa (genus level only)         1.0         1.0 ± 0.0           Coloptera taxa         5.0         3.5 ± 11.8           Ø         Eventes         7.5 ± 7.7           Chironomidae taxa (genus level only)         1.0         1.0 ± 0.0           Coloptera taxa         5.0         3.5 ± 1.1           Ephe	Biotic Indices							
Number Of Individuals           % Chironomidae         3.6         7.3 ± 10.2           % Coleoptera         3.2         2.9 ± 5.0           % Diptera + Non-insects         16.7         13.0 ± 11.1           % Ephemeroptera         11.0         48.4 ± 15.8           % Ephemeroptera that are Baetidae         4.9         41.9 ± 25.2           % EPT Individuals         80.1         84.1 ± 11.5           % Odonata          0.0 ± 0.0           % of 2 dominant taxa         60.9         54.3 ± 12.1           % of dominant taxa         3.8         28.1 ± 15.3           % Trichoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Tricoptera         65.4         7.5 ± 7.7           No. EPT individuals/Chironomids+EPT Individuals         1.0         0.9 ± 0.1           Total Abundance         1100         4086.0 ± 3834.6           Ehrenoptera taxa         1.0         0.6 ± 0.6           Diptera taxa         1.0         0.6 ± 0.6           Diptera taxa         5.0         3.25 ± 1.1           EPT taxia (genus level only)         1.0         1.0 ± 0.0           Coloptera taxa         0.0         3.8 ± 0.7           EPT taxia (gon)         3.8 ± 0.7	Intolerant taxa							
% Chironomidae         3.6         7.3 ± 10.2           % Coleoptera         3.2         2.9 ± 5.0           % Diptera + Non-insects         16.7         13.0 ± 11.1           % Ephemeroptera         11.0         48.4 ± 15.8           % Eph meroptera that are Baetidae         4.9         41.9 ± 25.2           % EPT Individuals         80.1         84.1 ± 11.5           % Odonata          0.0 0. ± 0.0           % of 2 dominant taxa         60.9         54.3 ± 12.1           % of dominant taxa         52.1         35.5 ± 11.8           % Piecoptera         3.8         28.1 ± 15.3           % of dominant taxa         52.1         35.5 ± 12.1           % Of contract taxa         52.1         35.5 ± 12.4           % Piecoptera         3.8         28.1 ± 15.3           % Trichoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Trichoptera         11.0         0.9 ± 0.1           Total Abundance         11160.0         4086.0 ± 3834.6           Chironomidae taxa (genus level only)         1.0         1.0 ± 0.0           Coleoptera taxa         5.0         3.5 ± 1.1           Eph meroptera taxa         4.0         3.8 ± 0.7           EPT Indivi	Tolerant individuals (%)	0.5	$0.6 \pm 0.4$					
% Coleoptera         3.2         2.9 ± 5.0           % Diptera + Non-insects         16.7         13.0 ± 11.1           % Ephemeroptera         11.0         48.4 ± 15.8           % Ephemeroptera that are Baetidae         4.9         41.9 ± 25.2           % EPT Individuals         80.1         84.1 ± 11.5           % Odonata          0.0 ± 0.0           % of 2 dominant taxa         60.9         954.3 ± 12.1           % of dominant taxa         52.1         35.5 ± 11.8           % Plecoptera         3.8         28.1 ± 15.3           % Tricoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Tricoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Tricoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Tricoptera taxa         65.4         7.5 ± 7.7           No. EPT individuals/Chironomids+EPT Individuals         1.0         0.9 ± 0.1           Total Abundance         11160.0         4086.0 ± 3834.6           Chironomidae taxa (genus level only)         1.0         1.0 ± 0.0           Coleoptera taxa         5.0         3.5 ± 1.1           Ephemeroptera taxa         4.0         3.8 ± 0.7           EPT Individuals (Sum)         892	Number O	f Individuals						
% Diptera + Non-insects         16.7         13.0 ± 11.1           % Ephemeroptera         11.0         48.4 ± 15.8           % Ephemeroptera that are Baetidae         4.9         41.9 ± 25.2           % EPT Individuals         80.1         84.1 ± 11.5           % Odonata          0.0 ± 0.0           % of 2 dominant taxa         60.9         54.3 ± 12.1           % of dominant taxa         52.1         35.5 ± 11.8           % Piceptera         3.8         28.1 ± 15.3           % Trichoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Trichoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Trichoptera that are Hydropsychida         1.0         0.9 ± 0.1           Total Abundance         11160.0         4086.0 ± 3834.6           Chironomidae taxa (genus level only)         1.0         1.0 ± 0.0           Coleoptera taxa         4.0         3.8 ± 0.7           EPT Individuals (Sum)         8920.0         3252.2 ± 2587.2           EPT taxa (no)         12.7 ± 2.6         0.4 ± 0.0           Odonata taxa          0.0 ± 0.0           Pielou's Evenness         0.6         0.7 ± 0.1           Pielou's Evenness         0.6         0.7	% Chironomidae		7.3 ± 10.2					
% Ephemeroptera         11.0         48.4 ± 15.8           % Ephemeroptera that are Baetidae         4.9         41.9 ± 25.2           % EPT Individuals         80.1         84.1 ± 11.5           % Odonata         -         0.0 ± 0.0           % of 2 dominant taxa         60.9         54.3 ± 12.1           % of dominant taxa         3.8         28.1 ± 15.3           % Plecoptera         3.8         28.1 ± 15.3           % Trichoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Trichoptera         65.4         7.5 ± 7.7           % Trichoptera that are Hydropsychida         11160.0         4086.0 ± 3834.6           Trichoptera         11160.0         4086.0 ± 3834.6           Methemeroptera taxa         1.0         0.0 ± 0.0           Coleoptera taxa         1.0         0.6 ± 0.6           Diptera taxa         5.0         3.5 ± 1.1           Ephemeroptera taxa         4.0         3.8 ± 0.7           EPT Individuals (Sum)         8920.0         3252.2 ± 2587.2           EPT taxa (no)         13.0         12.7 ± 2.6           Odonata taxa          0.0 ± 0.0           Pielou's Evenness         0.6         0.7 ± 0.1           Pielou's Even	% Coleoptera	3.2	2.9 ± 5.0					
% Ephemeroptera that are Baetidae         4.9         41.9 ± 25.2           % EPT Individuals         80.1         84.1 ± 11.5           % Odonata          0.0 ± 0.0           % of 2 dominant taxa         60.9         54.3 ± 12.1           % of dominant taxa         60.9         54.3 ± 12.1           % of dominant taxa         52.1         35.5 ± 11.8           % Plecoptera         3.8         28.1 ± 15.3           % Tribe Tanyatarisini             % Tricoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Tricoptera         65.4         7.5 ± 7.7           No. EPT individuals/Chironomids+EPT Individuals         1.0         0.9 ± 0.1           Total Abundance         11160.0         4086.0 ± 3834.6           Chironomidae taxa (genus level only)         1.0         1.0 ± 0.0           Coleoptera taxa         5.0         3.5 ± 1.1           Bphemeroptera taxa         4.0         3.8 ± 0.7           EPT Individuals (Sum)         8920.0         3252.2 ± 2587.2           EPT Individuals (Sum)         8920.0         3252.2 ± 2587.2           EPT Individuals (Sum)         8920.0         3252.2 ± 2587.2           EPT taxa (no)         12.7 ± 2.6	% Diptera + Non-insects	16.7	$13.0 \pm 11.1$					
% EPT Individuals         80.1         84.1 ± 11.5           % Odonata          0.0 ± 0.0           % of 2 dominant taxa         60.9         54.3 ± 12.1           % of dominant taxa         52.1         35.5 ± 11.8           % Plecoptera         3.8         28.1 ± 15.3           % Tribe Tanyatarisini             % Tricoptera that are Hydropsychida         11.5         25.4 ± 24.5           % Tricoptera         65.4         7.5 ± 7.7           No. EPT Individuals/Chironomids+EPT Individuals         1.0         0.9 ± 0.1           Total Abundance         11160.0         4086.0 ± 3834.6           Entimistion           Chironomidae taxa (genus level only)         1.0         1.0 ± 0.0           Coleoptera taxa         1.0         0.6 ± 0.6         0.6 ± 0.6           Diptera taxa         4.0         3.8 ± 0.7         257.2 ± 258.7.2           EPT Individuals (Sum)         8920.0         3252.2 ± 258.7.2         257.2 ± 258.7.2           EPT taxa (no)         1.2,7 ± 2.6         0.6         0.7 ± 0.1           Odonata taxa          0.0 ± 0.0         0.6           Pielou's Evenness         0.6         0.7 ± 0.1           Oh		11.0	48.4 ± 15.8					
% Odonata          0.0 ± 0.0           % of 2 dominant taxa         60.9         54.3 ± 12.1           % of dominant taxa         52.1         35.5 ± 11.8           % Plecoptera         3.8         28.1 ± 15.3           % Tribe Tanyatarisini            % Tricoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Tricoptera         65.4         7.5 ± 7.7           No. EPT individuals/Chironomids+EPT Individuals         1.0         0.9 ± 0.1           Total Abundance         11160.0         4086.0 ± 3834.6           Chironomidae taxa (genus level only)         1.0         1.0 ± 0.0           Coleoptera taxa         5.0         3.5 ± 1.1           Ephemeroptera taxa         4.0         3.8 ± 0.7           EPT Individuals (Sum)         8920.0         3252.2 ± 2587.2           EPT taxa (no)         1.3.0         12.7 ± 2.6           Odonata taxa          0.0.6           0.6         0.7 ± 0.1         1.9           Plecoptera taxa         4.0         5.4 ± 1.3           Shannon-Wiener Diversity         0.7         0.8 ± 0.1           Simpson's Evenness         0.1         0.3 ± 0.1           Simpson's Evenness         0.1 </th <th>% Ephemeroptera that are Baetidae</th> <th>4.9</th> <th>41.9 ± 25.2</th>	% Ephemeroptera that are Baetidae	4.9	41.9 ± 25.2					
% of 2 dominant taxa         60.9         54.3 ± 12.1           % of dominant taxa         52.1         35.5 ± 11.8           % Plecoptera         3.8         28.1 ± 15.3           % Tribe Tanyatarisini             % Trichoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Trichoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Trichoptera that are Hydropsychida         10.0         0.9 ± 0.1           Total Abundance         11160.0         4086.0 ± 3834.6           Richness         11160.0         4086.0 ± 3834.6           Chironomidae taxa (genus level only)         1.0         1.0 ± 0.0           Coleoptera taxa         1.0         0.6 ± 0.6           Diptera taxa         5.0         3.5 ± 1.1           Ephemeroptera taxa         4.0         3.8 ± 0.7           EPT Individuals (Sum)         8920.0         3252.2 ± 2587.2           EPT taxa (no)         12.7 ± 2.6         0.6         0.7 ± 0.1           Plecoptera taxa         0.6         0.7 ± 0.1         1.2.7 ± 2.6           Odonata taxa          0.0 ± 0.0         1.2.7 ± 2.6           Odonata taxa         0.6         0.7 ± 0.1         1.9	% EPT Individuals	80.1	84.1 ± 11.5					
% of dominant taxa         52.1         35.5 ± 11.8           % Plecoptera         3.8         28.1 ± 15.3           % Tribe Tanyatarisini            % Tricoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Tricoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Tricoptera         65.4         7.5 ± 7.7           No. EPT individuals/Chironomids+EPT Individuals         1.0         0.9 ± 0.1           Total Abundance         11160.0         4086.0 ± 3834.6           Richness           Chironomidae taxa (genus level only)         1.0         1.0 ± 0.0           Coleoptera taxa         1.0         0.6 ± 0.6           Diptera taxa         4.0         3.8 ± 0.7           EPT Individuals (Sum)         8920.0         3252.2 ± 2587.2           EPT taxa (no)         1.2.7 ± 2.6         0.4           Odonata taxa          0.0 ± 0.0           Oleoptera taxa         4.0         5.4 ± 1.3           Shannon-Wiener Diversity         0.6         0.7 ± 0.1           Plecoptera taxa         4.0         5.4 ± 1.3           Simpson's Diversity         0.7         0.8 ± 0.1           Simpson's Diversity         0.1	% Odonata		$0.0 \pm 0.0$					
% Plecoptera         3.8         28.1 ± 15.3           % Tribe Tanyatarisini             % Trichoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Tricoptera         65.4         7.5 ± 7.7           No. EPT individuals/Chironomids+EPT Individuals         1.0         0.9 ± 0.1           Total Abundance         11160.0         4086.0 ± 3834.6           Richness         1.0         0.6 ± 0.6           Diptera taxa         1.0         0.6 ± 0.6           Diptera taxa         5.0         3.5 ± 1.1           Ephemeroptera taxa         4.0         3.8 ± 0.7           EPT Individuals (Sum)         8920.0         3252.2 ± 2587.2           EPT taxa (no)         1.2.7 ± 2.6         0.0 ± 0.0           Odonata taxa          0.0 ± 0.0           Pielou's Evenness         0.6         0.7 ± 0.1           Plecoptera taxa         4.0         5.4 ± 1.3           Shannon-Wiener Diversity         0.7         0.8 ± 0.1           Simpson's Diversity         0.7         0.8 ± 0.1           Simpson's Evenness         0.1         0.3 ± 0.1           Total No. of Taxa         24.0         19.4 ± 4.2	% of 2 dominant taxa	60.9	54.3 ± 12.1					
% Tribe Tanyatarisini            % Trichoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Tricoptera         65.4         7.5 ± 7.7           No. EPT individuals/Chironomids+EPT Individuals         1.0         0.9 ± 0.1           Total Abundance         11160.0         4086.0 ± 3834.6           Richness           Chironomidae taxa (genus level only)         1.0         1.0 ± 0.0           Coleoptera taxa         1.0         0.6 ± 0.6         0.5.0           Diptera taxa         5.0         3.5 ± 1.1         1.0           Ephemeroptera taxa         4.0         3.8 ± 0.7         25.7.2           EPT Individuals (Sum)         8920.0         3252.2 ± 2587.2         2587.2           EPT taxa (no)         1.2.7 ± 2.6         0donata taxa          0.0 ± 0.0           Odonata taxa          0.0 ± 0.0         1.2.7 ± 2.6         0.1         0.1 ± 0.3           Shannon-Wiener Diversity         1.9         2.0 ± 0.3         5.4 ± 1.3         5.4 ± 1.3         5.4 ± 0.1         5.4 ± 1.3         5.4 ± 0.1         5.4 ± 1.3         5.4 ± 0.1         5.4 ± 0.3         5.4 ± 0.3         5.4 ± 0.3         5.4 ± 0.3         5.1 ± 0.1         0.1 ± 0.3 ± 0.1         0.3 ±	% of dominant taxa	52.1	35.5 ± 11.8					
% Trichoptera that are Hydropsychida         13.5         25.4 ± 24.5           % Tricoptera         65.4         7.5 ± 7.7           No. EPT individuals/Chironomids+EPT Individuals         1.0         0.9 ± 0.1           Total Abundance         11160.0         4086.0 ± 3834.6           Richness           Chironomida taxa (genus level only)         1.0         1.0 ± 0.0           Coleoptera taxa         1.0         0.6 ± 0.6         0.6 ± 0.6           Diptera taxa         5.0         3.5 ± 1.1         3.8 ± 0.7           EPT Individuals (Sum)         8920.0         3252.2 ± 2587.2           EPT taxa (no)         1.2.7 ± 2.6         0donata taxa          0.0 ± 0.0           Piecoptera taxa          0.0 ± 0.0           0.0 ± 0.0           0.0 ± 0.0           0.0 ± 0.0           0.0 ± 0.0           0.0 ± 0.0           0.0 ± 0.0           0.0 ± 0.0           0.0 ± 0.0           0.0 ± 0.0           0.0 ± 0.0           0.0 ± 0.1 <th>% Plecoptera</th> <th>3.8</th> <th>28.1 ± 15.3</th>	% Plecoptera	3.8	28.1 ± 15.3					
% Tricoptera         65.4         7.5 ± 7.7           No. EPT individuals/Chironomids+EPT Individuals         1.0         0.9 ± 0.1           Total Abundance         11160.0         4086.0 ± 3834.6           Richness           Chironomidae taxa (genus level only)         1.0         1.0 ± 0.0           Coleoptera taxa         1.0         0.6 ± 0.6           Diptera taxa         5.0         3.5 ± 1.1           Ephemeroptera taxa         4.0         3.8 ± 0.7           EPT Individuals (Sum)         8920.0         3252.2 ± 2587.2           EPT taxa (no)         13.0         12.7 ± 2.6           Odonata taxa          0.0 ± 0.0           Pielou's Evenness         0.6         0.7 ± 0.1           Plecoptera taxa         4.0         5.4 ± 1.3           Shannon-Wiener Diversity         1.9         2.0 ± 0.3           Simpson's Diversity         0.7         0.8 ± 0.1           Simpson's Evenness         0.1         0.3 ± 0.1           Total No. of Taxa         24.0         19.4 ± 4.2	% Tribe Tanyatarisini							
No. EPT individuals/Chironomids+EPT Individuals         1.0         0.9 ± 0.1           Total Abundance         11160.0         4086.0 ± 3834.6           Richmess           Chironomidae taxa (genus level only)         1.0         1.0 ± 0.0           Coleoptera taxa         1.0         0.6 ± 0.6           Diptera taxa         5.0         3.5 ± 1.1           Ephemeroptera taxa         4.0         3.8 ± 0.7           EPT Individuals (Sum)         3252.2 ± 2587.2         EPT taxa (no)           Odonata taxa          0.0 ± 2.0           Pielou's Evenness         0.6         0.7 ± 0.1           Plecoptera taxa         4.0         5.4 ± 1.3           Shannon-Wiener Diversity         1.9         2.0 ± 0.3           Simpson's Diversity         0.7         0.8 ± 0.1           Simpson's Evenness         0.1         0.3 ± 0.1           Total No. of Taxa         24.0         19.4 ± 4.2	% Trichoptera that are Hydropsychida	13.5	25.4 ± 24.5					
Total Abundance         11160.0         4086.0 ± 3834.6           Richness           Chironomidae taxa (genus level only)         1.0         1.0         0.0           Coleoptera taxa         1.0         0.0.6 ± 0.6         0.6         0.6         0.6         0.6         0.6         0.6         0.6         0.0         3.5 ± 1.1         1.0         0.0.2         3.5 ± 1.1         1.0         0.0.2         3.5 ± 1.1         1.0         0.0.2         3.5 ± 1.1         1.0         0.0         3.8 ± 0.7         3.5 ± 1.1         1.0         1.0         3.8 ± 0.7         3.5 ± 1.1         1.0         3.8 ± 0.7         3.5 ± 1.1         2.0         3.5 ± 1.1         2.0         3.5 ± 1.1         2.0         3.0         3.252.2 ± 2587.2         2.0<		65.4	7.5 ± 7.7					
Richness           Chironomidae taxa (genus level only)         1.0         1.0 ± 0.0           Coleoptera taxa         1.0         0.6 ± 0.6           Diptera taxa         5.0         3.5 ± 1.1           Ephemeroptera taxa         4.0         3.8 ± 0.7           EPT Individuals (Sum)         8920.0         3252.2 ± 2587.2           EPT taxa (no)         13.0         12.7 ± 2.6           Odonata taxa          0.0 ± 0.0           Pielou's Evenness         0.6         0.7 ± 0.1           Plecoptera taxa         4.0         5.4 ± 1.3           Shannon-Wiener Diversity         1.9         2.0 ± 0.3           Simpson's Diversity         0.7         0.8 ± 0.1           Simpson's Evenness         0.1         0.3 ± 0.1           Total No. of Taxa         24.0         19.4 ± 4.2	No. EPT individuals/Chironomids+EPT Individuals	1.0	0.9 ± 0.1					
Chironomidae taxa (genus level only)         1.0         1.0 ± 0.0           Coleoptera taxa         1.0         0.6 ± 0.6           Diptera taxa         5.0         3.5 ± 1.1           Ephemeroptera taxa         4.0         3.8 ± 0.7           EPT Individuals (Sum)         8920.0         3252.2 ± 2587.2           EPT taxa (no)         13.0         12.7 ± 2.6           Odonata taxa          0.0 ± 0.0           Pielou's Evenness         0.6         0.7 ± 0.1           Plecoptera taxa         4.0         5.4 ± 1.3           Shannon-Wiener Diversity         1.9         2.0 ± 0.3           Simpson's Diversity         0.7         0.8 ± 0.1           Simpson's Evenness         0.1         0.3 ± 0.1           Total No. of Taxa         24.0         19.4 ± 4.2	Total Abundance	11160.0	4086.0 ± 3834.6					
Coleoptera taxa         1.0         0.6 ± 0.6           Diptera taxa         5.0         3.5 ± 1.1           Ephemeroptera taxa         4.0         3.8 ± 0.7           EPT Individuals (Sum)         8920.0         3252.2 ± 2587.2           EPT taxa (no)         13.0         12.7 ± 2.6           Odonata taxa          0.0 ± 0.0           Pielou's Evenness         0.6         0.7 ± 0.1           Plecoptera taxa         4.0         5.4 ± 1.3           Shannon-Wiener Diversity         1.9         2.0 ± 0.3           Simpson's Diversity         0.7         0.8 ± 0.1           Simpson's Evenness         0.1         0.3 ± 0.1           Total No. of Taxa         24.0         19.4 ± 4.2		hness						
Diptera taxa         5.0         3.5 ± 1.1           Ephemeroptera taxa         4.0         3.8 ± 0.7           EPT Individuals (Sum)         8920.0         3252.2 ± 2587.2           EPT taxa (no)         13.0         12.7 ± 2.6           Odonata taxa          0.0 ± 0.0           Pielou's Evenness         0.6         0.7 ± 0.1           Plecoptera taxa         4.0         5.4 ± 1.3           Shannon-Wiener Diversity         1.9         2.0 ± 0.3           Simpson's Diversity         0.7         0.8 ± 0.1           Simpson's Evenness         0.1         0.3 ± 0.1           Total No. of Taxa         24.0         19.4 ± 4.2		1.0	$1.0 \pm 0.0$					
Ephemeroptera taxa         4.0         3.8 ± 0.7           EPT Individuals (Sum)         8920.0         3252.2 ± 2587.2           EPT taxa (no)         13.0         12.7 ± 2.6           Odonata taxa          0.0 ± 0.0           Pielou's Evenness         0.6         0.7 ± 0.1           Plecoptera taxa         4.0         5.4 ± 1.3           Shannon-Wiener Diversity         1.9         2.0 ± 0.3           Simpson's Diversity         0.7         0.8 ± 0.1           Simpson's Evenness         0.1         0.3 ± 0.1           Total No. of Taxa         24.0         19.4 ± 4.2	Coleoptera taxa	-	0.6 ± 0.6					
EPT Individuals (Sum)         8920.0         3252.2 ± 2587.2           EPT taxa (no)         13.0         12.7 ± 2.6           Odonata taxa          0.0 ± 0.0           Pielou's Evenness         0.6         0.7 ± 0.1           Plecoptera taxa         4.0         5.4 ± 1.3           Shannon-Wiener Diversity         1.9         2.0 ± 0.3           Simpson's Diversity         0.7         0.8 ± 0.1           Simpson's Evenness         0.1         0.3 ± 0.1           Total No. of Taxa         24.0         19.4 ± 4.2		5.0	3.5 ± 1.1					
EPT taxa (no)         13.0         12.7 ± 2.6           Odonata taxa          0.0 ± 0.0           Pielou's Evenness         0.6         0.7 ± 0.1           Plecoptera taxa         4.0         5.4 ± 1.3           Shannon-Wiener Diversity         1.9         2.0 ± 0.3           Simpson's Diversity         0.7         0.8 ± 0.1           Simpson's Evenness         0.1         0.3 ± 0.1           Total No. of Taxa         24.0         19.4 ± 4.2		4.0	3.8 ± 0.7					
Odonata taxa          0.0 ± 0.0           Pielou's Evenness         0.6         0.7 ± 0.1           Plecoptera taxa         4.0         5.4 ± 1.3           Shannon-Wiener Diversity         1.9         2.0 ± 0.3           Simpson's Diversity         0.7         0.8 ± 0.1           Simpson's Evenness         0.1         0.3 ± 0.1           Total No. of Taxa         24.0         19.4 ± 4.2								
Pielou's Evenness         0.6         0.7 ± 0.1           Plecoptera taxa         4.0         5.4 ± 1.3           Shannon-Wiener Diversity         1.9         2.0 ± 0.3           Simpson's Diversity         0.7         0.8 ± 0.1           Simpson's Evenness         0.1         0.3 ± 0.1           Total No. of Taxa         24.0         19.4 ± 4.2	EPT taxa (no)	13.0	12.7 ± 2.6					
Plecoptera taxa         4.0         5.4 ± 1.3           Shannon-Wiener Diversity         1.9         2.0 ± 0.3           Simpson's Diversity         0.7         0.8 ± 0.1           Simpson's Evenness         0.1         0.3 ± 0.1           Total No. of Taxa         24.0         19.4 ± 4.2	Odonata taxa		0.0 ± 0.0					
Shannon-Wiener Diversity         1.9         2.0 ± 0.3           Simpson's Diversity         0.7         0.8 ± 0.1           Simpson's Evenness         0.1         0.3 ± 0.1           Total No. of Taxa         24.0         19.4 ± 4.2	Pielou's Evenness	0.6	0.7 ± 0.1					
Simpson's Diversity         0.7         0.8 ± 0.1           Simpson's Evenness         0.1         0.3 ± 0.1           Total No. of Taxa         24.0         19.4 ± 4.2	Plecoptera taxa	4.0	5.4 ± 1.3					
Simpson's Evenness         0.1         0.3 ± 0.1           Total No. of Taxa         24.0         19.4 ± 4.2			2.0 ± 0.3					
Total No. of Taxa         24.0         19.4 ± 4.2	Simpson's Diversity	0.7	$0.8 \pm 0.1$					
	Simpson's Evenness	0.1	$0.3 \pm 0.1$					
Trichoptera taxa         5.0         3.6 ± 1.5		-	19.4 ± 4.2					
	Trichoptera taxa	5.0	3.6 ± 1.5					

Reference Model Taxa	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at
	Group 1	Group 2	Group 3	Group 4	Group 5	MOR001
Ameletidae	56%	53%	22%	50%	68%	0.25
Apataniidae	22%	24%	28%	25%	3%	0.27
Athericidae	0%	2%	0%	17%	0%	0.01
Aturidae	0%	8%	0%	0%	0%	0.00
Baetidae	100%	100%	100%	100%	97%	1.00
Blephariceridae	0%	0%	0%	0%	5%	0.00
Brachycentridae	11%	69%	0%	42%	3%	0.05
Capniidae	78%	55%	50%	92%	68%	0.52

#### Frequency of Occurrence in Reference Sites **Probability Of Occurrence at Reference Model Taxa** MOR001 Group 1 Group 2 Group 5 Group 3 Group 4 42% 28% 0.30 Ceratopogonidae 0% 55% 5% Chironomidae 100% 100% 100% 100% 95% 1.00 Chloroperlidae 78% 88% 94% 100% 100% 0.94 Corixidae 11% 0% 0% 0% 0% 0.00 Curculionidae 0% 4% 0% 0% 0% 0.00 Deuterophlebiidae 0% 0% 0% 0% 3% 0.00 Dixidae 0% 10% 0% 0% 0% 0.01 0% 6% 0% 0.05 Dytiscidae 8% 0% Elmidae 0% 86% 50% 50% 5% 0.52 Empididae 67% 55% 50% 67% 57% 0.51 Enchytraeidae 11% 14% 0% 8% 0% 0.01 100% 100% 100% Ephemerellidae 78% 100% 1.00 Ephydridae 0% 2% 0% 0% 0% 0.00 Glossosomatidae 11% 49% 39% 42% 35% 0.40 100% Heptageniidae 100% 100% 100% 100% 1.00 0% 0% 4% 0% 0% 0.00 Hydraenidae 2% Hydrophilidae 11% 0% 0% 0% 0.00 11%92% 78% 92% 86% 0.79 Hydropsychidae Hydroptilidae 11% 8% 0% 0% 0% 0.00 10% 17% Hydrozetidae 0% 8% 16% 0.16 Hydryphantidae 11% 31% 11% 8% 8% 0.12 Hygrobatidae 0% 29% 0% 0% 11%0.01 39% Lebertiidae 78% 65% 58% 5% 0.41 Lepidostomatidae 0% 53% 6% 17% 8% 0.08 0% 0% 0% Leptohyphidae 2% 0% 0.00 Leptophlebiidae 0% 90% 11% 33% 3% 0.16 67% 54% Leuctridae 22% 43% 56% 0.55 Limnephilidae 22% 31% 6% 25% 41% 0.08 Limnesiidae 0% 2% 0% 0% 0% 0.00 Lumbriculidae 0% 20% 17% 25% 3% 0.17 Mideopsidae 0% 2% 0% 0% 0% 0.00 Naididae 0% 8% 39% 0% 3% 0.36 100% 100% 100% 100% Nemouridae 100% 1.00 22% 6% 0% 0% 0.06 Pelecorhynchidae 0% Peltoperlidae 22% 12% 6% 8% 41% 0.06 Perlidae 11% 84% 33% 100% 0.39 3% Perlodidae 78% 78% 89% 92% 81% 0.88 Philopotamidae 0% 31% 0% 0% 3% 0.02 Pisidiidae 0% 0% 6% 8% 0% 0.01 17% 67% Planariidae 0% 8% 3% 0.61 Planorbidae 0% 0% 0% 0% 3% 0.00 Psychodidae 22% 65% 94% 8% 11% 0.89 Pteronarcyidae 0% 12% 6% 0% 3% 0.06 Rhyacophilidae 100% 92% 100% 100% 95% 1.00 Simuliidae 33% 49% 39% 33% 16% 0.39 Sperchontidae 78% 63% 50% 42% 65% 0.50 17% 0% Stygothrombiidae 0% 4% 0% 0.01 49% 97% 100% 92% 89% 0.97 Taeniopterygidae 11% 4% 0% 0% 0% 0.00 Thaumaleidae Tipulidae 56% 55% 28% 67% 43% 0.31 86% 11% 17% 11% Torrenticolidae 11% 0.15 Uenoidae 22% 37% 17% 25% 46% 0.18 Valvatidae 0% 2% 6% 0% 0% 0.05

#### Frequency and Probability of Taxa Occurrence

RIVPACS Ratios	
RIVPACS : Expected taxa P>0.50	13.69
RIVPACS : Observed taxa P>0.50	13.00
RIVPACS : 0:E (p > 0.5)	0.95
RIVPACS : Expected taxa P>0.70	10.47
RIVPACS : Observed taxa P>0.70	10.00

# RIVPACS Ratios

**RIVPACS : 0:E (p > 0.7)** 

# Habitat Description

Variable	MOR001	Predicted Group Reference Mean ±SD
Bedro	ck Geology	
Sedimentary (%)	100.00000	92.18813 ± 22.65908
C	hannel	
Depth-Avg (cm)	12.0	22.5 ± 10.5
Depth-BankfullMinusWetted (cm)	67.00	67.33 ± 71.65
Depth-Max (cm)	16.3	32.9 ± 17.9
Macrophyte (PercentRange)	1	0 ± 0
Reach-%CanopyCoverage (PercentRange)	1.00	$0.94 \pm 0.80$
Reach-DomStreamsideVeg (Category(1-4))	3	3 ± 1
Reach-Pools (Binary)	0	0 ± 1
Reach-Rapids (Binary)	0	0 ± 1
Reach-Riffles (Binary)	1	<u>1 ± 0</u>
Reach-StraightRun (Binary)	0	1 ± 0
Slope (m/m)	0.0175000	0.0235102 ± 0.0284557
Veg-Coniferous (Binary)	1	<u>1 ± 0</u>
Veg-Deciduous (Binary) Veg-GrassesFerns (Binary)	1	$1 \pm 0$ 1 ± 0
Veg-Shrubs (Binary)	1	$\frac{1 \pm 0}{1 \pm 0}$
Velocity-Avg (m/s)	0.23	$0.50 \pm 0.25$
Velocity-Avg (m/s)	0.23	$0.30 \pm 0.23$ $0.75 \pm 0.28$
Width-Bankfull (m)	11.9	15.6 ± 12.8
Width-Wetted (m)	5.7	$10.2 \pm 7.0$
XSEC-VelMethod (Category(1-3))	1	$2 \pm 1$
	limate	2 ± 1
Precip10_OCT (mm)	51.59276	52.92857 ± 22.22704
Temp12_DECmin (Degrees Celsius)	-12.07931	-12.82063 ± 2.01422
Hy	drology	
Drainage-Area (km^2)	70.83074	166.32560 ± 185.60049
La	ndcover	
Natl-Grassland (%)	0.00000	4.92979 ± 5.99508
Natl-ShrubLow (%)	4.94777	$1.89085 \pm 1.59075$
Natl-Water (%)	0.00000	0.22269 ± 0.34683
Reg-Ice (%)	0.00000	0.46949 ± 1.15785
	trate Data	
%Bedrock (%)	0	0 ± 0
%Boulder (%)	6	<u>6 ± 7</u>
%Cobble (%)	55	61 ± 27
%Gravel (%)	8	1 ± 2
%Pebble (%) %Sand (%)	30	<u>31 ± 28</u> 0 ± 0
%Sand (%) %Silt+Clay (%)	1	$0 \pm 0$ $0 \pm 1$
D50 (cm)	9.35	$79.45 \pm 47.98$
Dg (cm)	7.0	73.9 ± 48.0
Dominant-1st (Category(0-9))	6	$73.9 \pm 48.0$ 6 ± 1
Dominant-Int (Category(0-9))	7	6 ± 2
Embeddedness (Category(1-5))	4	$\frac{0 \pm 2}{4 \pm 1}$
PeriphytonCoverage (Category(1-5))	2	2 ± 1
SurroundingMaterial (Category(0-9))	2	3 ± 1
	ography	5 - 1
Reg-SlopeLT30% (%)	64.31823	27.92073 ± 14.83033
SlopeMax (%)	149.28961	616.97887 ± 680.88955
	Chemistry	
Ag (mg/L)	0.0000250	0.0000004 ± 0.0000014
Al (mg/L)	0.0128000	0.0059500 ± 0.0039700
As (mg/L)	0.0002500	$0.0002175 \pm 0.0001795$
B (mg/L)	0.0250000	0.0500000
Ba (mg/L)	0.1630000	$0.0639025 \pm 0.0450861$
Be (mg/L)	0.0000500	$0.000025 \pm 0.000062$

0.95

#### Habitat Description

Habitat Description	MORAA	Buedlated Cost D (
Variable	MOR001	Predicted Group Reference Mean ±SD
Bi (mg/L)	0.0000500	$0.0000004 \pm 0.0000014$
Ca (mg/L)	41.2000000	38.6142857 ± 14.8464843
Cd (mg/L)	0.0000330	$0.0000059 \pm 0.000067$
Co (mg/L)	0.0000500	$0.0000043 \pm 0.0000057$
Cr (mg/L)	0.0002500	$0.0000833 \pm 0.0001403$
Cu (mg/L)	0.0007400	$0.0001875 \pm 0.0001434$
Fe (mg/L)	0.0130000	0.0090000
General-Alkalinity (mg/L)	141.000000	$121.5944444 \pm 36.7225924$
General-Conductivity (µS/cm)	146.2700000	$186.8500000 \pm 84.0864011$
General-Hardness (mg/L)	136.000000	$146.8222222 \pm 41.6699011$
General-pH (pH)	8.2	8.0 ± 0.6
General-SolidsTSS (mg/L)	1.000000	0.5604289 ± 1.4627232
General-SpCond (µS/cm)	197.1000000	214.2437500 ± 77.1891440
General-TempAir (Degrees Celsius)	11.5	10.5 ± 4.2
General-TempWater (Degrees Celsius)	11.500000	6.6716667 ± 2.0277755
General-Turbidity (NTU)	1.1400000	$0.0000000 \pm 0.0000000$
Hg (ng/L)	0.0000200	$0.0000000 \pm 0.0000000$
K (mg/L)	0.5300000	0.6471429 ± 0.7154652
Li (mg/L)	0.0042100	$0.0011817 \pm 0.0004768$
Mg (mg/L)	9.0400000	9.8814286 ± 6.1601202
Mn (mg/L)	0.0038700	$0.0011426 \pm 0.0016097$
Mo (mg/L)	0.0006500	$0.0024883 \pm 0.0065339$
Na (mg/L)	2.0800000	2.6357143 ± 3.7712414
Ni (mg/L)	0.0002000	$0.0000808 \pm 0.0000811$
Nitrogen-NH3 (mg/L)	0.0250000	$0.0019286 \pm 0.0059286$
Nitrogen-NO2 (mg/L)	0.0050000	$0.0023889 \pm 0.0063351$
Nitrogen-NO2+NO3 (mg/L)	0.0050000	$0.0130000 \pm 0.0088111$
Nitrogen-NO3 (mg/L)	0.0050000	$0.0245003 \pm 0.0229452$
Nitrogen-TKN (mg/L)	0.0250000	$0.0233333 \pm 0.0161433$
Nitrogen-TN (mg/L)	0.0250000	$0.0688889 \pm 0.0759171$
Pb (mg/L)	0.0001000	$0.0000224 \pm 0.0000176$
Phosphorus-TP (mg/L)	0.0104000	$0.0032778 \pm 0.0061816$
S (mg/L)	5.000000	5.000000
Sb (mg/L)	0.0001000	$0.0000361 \pm 0.0000135$
Se (mg/L)	0.0002500	$0.0004382 \pm 0.0004486$
Si (mg/L)	2.3000000	3.0657143 ± 1.4070046
Sn (mg/L)	0.0001000	$0.0000167 \pm 0.0000078$
Sr (mg/L)	0.1510000	$0.1159167 \pm 0.0982749$
Te (mg/L)	0.0002500	$0.000000 \pm 0.000000$
Th (mg/L)	0.0000500	$0.0000000 \pm 0.0000000$
Ti (mg/L)	0.0025000	0.0009000
TI (mg/L)	0.0000100	0.0000038 ± 0.0000064
U (mg/L)	0.0003340	$0.0005298 \pm 0.0003220$
V (mg/L)	0.0005000	$0.0001642 \pm 0.0001203$
Zn (mg/L)	0.0020000	$0.0004083 \pm 0.000361$
Zr (mg/L)	0.0000500	0.00000000000000000000000000000000000
Li (iiig/L)	0.0000300	0.000000 ± 0.000000

#### **Site Description**

Study Name	CBWQ-Elk
Site	MOR002
Sampling Date	Sep 22 2020
Know Your Watershed Basin	Central Kootenay
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera EcoZone
	Northern Continental Divide EcoRegion
Coordinates (decimal degrees)	49.42076 N, 114.91049 W
Altitude	1529
Local Basin Name	Morrissey Creek
	Central Kootenay
Stream Order	3

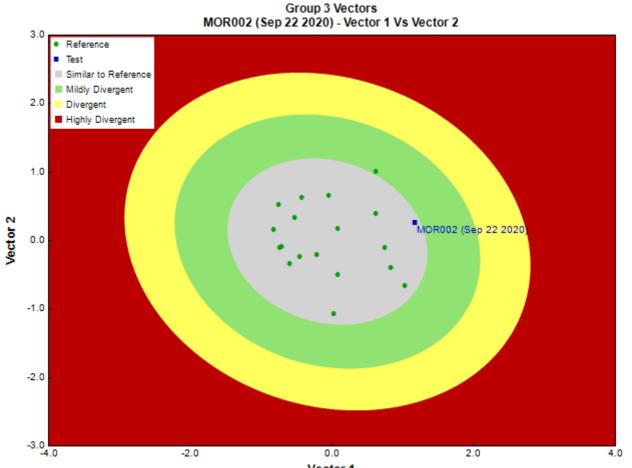


Figure 1. Location Map

Across Reach (No image found) Down Stream (No image found) Field Sheet (No image found) Substrate (No image found) Up Stream (No image found)

#### **Cabin Assessment Results**

Reference Model Summary						
Model	Columbia-Okana	Columbia-Okanagan Preliminary March 2010				
Analysis Date	January 07, 2022	2				
Taxonomic Level	Family					
Predictive Model Variables	Depth-Avg Latitude Longitude Reg-Ice Reg-SlopeLT30%					
Reference Groups	1	2	3	4	5	
Number of Reference Sites	9	43	17	12	33	
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%	
Overall Model Error Rate	26.4%					
Probability of Group Membership	0.0% 13.4% 85.3% 1.1% 0.1%					
CABIN Assessment of MOR002 on Sep 22, 2020	Similar to Reference					



Vector 1

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

#### **Sample Information**

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Pina Viola, Consultant
	Marchant Box
Sub-Sample Proportion	6/100

#### **Community Structure**

Phylum	Class	Order	Family	Raw Count	Total Count
Arthropoda	Arachnida	Trombidiformes		2	33.3
			Hydryphantidae	2	33.3
			Torrenticolidae	2	33.3
	Collembola	Collembola		3	50.0
	Insecta	Coleoptera	Elmidae	11	183.3
		Diptera	Ceratopogonidae	1	16.7
			Chironomidae	109	1,816.7
			Empididae	1	16.7
			Psychodidae	1	16.7
			Tipulidae	2	33.4
		Ephemeroptera	Ameletidae	7	116.7
			Baetidae	86	1,433.3
			Ephemerellidae	3	50.0
			Heptageniidae	20	333.4
			Leptophlebiidae	5	83.3
		Plecoptera	Capniidae	15	250.0

#### **Community Structure**

Phylum	Class	Order	Family	Raw Count	Total Count
			Chloroperlidae	12	200.0
			Leuctridae	1	16.7
			Nemouridae	22	366.7
			Perlidae	5	83.4
			Perlodidae	2	33.4
		Trichoptera		2	33.3
			Brachycentridae	5	83.3
			Glossosomatidae	2	33.3
			Hydropsychidae	1	16.7
			Rhyacophilidae	8	133.4
			Uenoidae		83.3
			Total	335	5,583.6

#### **Metrics**

Name	MOR002	Predicted Group Reference Mean ±SD						
Bray-Curtis Distance	0.69	$0.4 \pm 0.2$						
Biotic	Biotic Indices							
Intolerant taxa		1.0						
Tolerant individuals (%)		$0.6 \pm 0.4$						
Number Of Individuals								
% Chironomidae	33.2	7.3 ± 10.2						
% Coleoptera	3.4	2.9 ± 5.0						
% Diptera + Non-insects	36.0	$13.0 \pm 11.1$						
% Ephemeroptera	36.9	48.4 ± 15.8						
% Ephemeroptera that are Baetidae	71.1	41.9 ± 25.2						
% EPT Individuals	60.7	84.1 ± 11.5						
% Odonata		$0.0 \pm 0.0$						
% of 2 dominant taxa	59.5	54.3 ± 12.1						
% of dominant taxa	33.2	35.5 ± 11.8						
% Plecoptera	17.4	28.1 ± 15.3						
% Tribe Tanyatarisini								
% Trichoptera that are Hydropsychida	4.8	25.4 ± 24.5						
% Tricoptera	6.4	7.5 ± 7.7						
No. EPT individuals/Chironomids+EPT Individuals	0.6	$0.9 \pm 0.1$						
Total Abundance	5583.3	4086.0 ± 3834.6						
Richness								
Chironomidae taxa (genus level only)	1.0	$1.0 \pm 0.0$						
Coleoptera taxa	1.0	0.6 ± 0.6						
Diptera taxa	5.0	3.5 ± 1.1						
Ephemeroptera taxa	5.0	3.8 ± 0.7						
EPT Individuals (Sum)	3316.7	3252.2 ± 2587.2						
EPT taxa (no)	16.0	12.7 ± 2.6						
Odonata taxa		0.0 ± 0.0						
Pielou's Evenness	0.7	0.7 ± 0.1						
Plecoptera taxa	6.0	5.4 ± 1.3						
Shannon-Wiener Diversity	2.2	2.0 ± 0.3						
Simpson's Diversity	0.8	$0.8 \pm 0.1$						
Simpson's Evenness	0.2	0.3 ± 0.1						
Total No. of Taxa	24.0	19.4 ± 4.2						
Trichoptera taxa	5.0	3.6 ± 1.5						

#### Frequency and Probability of Taxa Occurrence

Reference Model Taxa	Frequ	iency of Oc	Probability Of Occurrence at			
	Group 1	Group 2	Group 3	Group 4	Group 5	MOR002
Ameletidae	56%	53%	22%	50%	68%	0.27
Apataniidae	22%	24%	28%	25%	3%	0.27
Athericidae	0%	2%	0%	17%	0%	0.00
Aturidae	0%	8%	0%	0%	0%	0.01
Baetidae	100%	100%	100%	100%	97%	1.00
Blephariceridae	0%	0%	0%	0%	5%	0.00

#### Frequency of Occurrence in Reference Sites **Reference Model Taxa Probability Of Occurrence at** MOR002 Group 1 Group 2 Group 5 Group 3 Group 4 11% 0% 0.10 Brachycentridae 69% 42% 3% Capniidae 78% 55% 50% 92% 68% 0.51 Ceratopogonidae 0% 55% 28% 42% 5% 0.32 95% Chironomidae 100% 100% 100% 100% 1.00 Chloroperlidae 78% 88% 94% 100% 100% 0.94 Corixidae 11% 0% 0% 0% 0% 0.00 Curculionidae 0% 4% 0% 0% 0% 0.01 0% Deuterophlebiidae 0% 0% 0.00 0% 3% 0% 10% 0% 0% 0% 0.01 Dixidae Dytiscidae 0% 8% 6% 0% 0% 0.06 Elmidae 0% 86% 50% 50% 5% 0.55 55% 50% 57% Empididae 67% 67% 0.51 Enchytraeidae 11% 14% 0% 8% 0% 0.02 Ephemerellidae 78% 100% 100% 100% 100% 1.00 Ephydridae 0% 2% 0% 0% 0% 0.00 49% 39% 42% 11% 35% 0.40 Glossosomatidae Heptageniidae 100% 100% 100% 100% 100% 1.00 0% 4% 0% 0% 0% 0.01 Hydraenidae Hydrophilidae 11% 2% 0% 0% 0% 0.00 11% 92% 78% 92% Hydropsychidae 86% 0.80 Hydroptilidae 11% 8% 0% 0% 0% 0.01 Hydrozetidae 0% 10% 17% 8% 16% 0.16 11% Hydryphantidae 11%31% 8% 8% 0.14 0% Hygrobatidae 0% 29% 0% 11% 0.04 78% 65% 39% Lebertiidae 58% 5% 0.43 Lepidostomatidae 0% 53% 6% 17% 8% 0.12 Leptohyphidae 0% 2% 0% 0% 0% 0.00 Leptophlebiidae 0% 90% 11% 33% 3% 0.22 Leuctridae 22% 43% 56% 67% 54% 0.54 Limnephilidae 22% 31% 6% 25% 41% 0.09 Limnesiidae 0% 2% 0% 0% 0% 0.00 17% 25% 0% 20% Lumbriculidae 3% 0.17 0% 0% 0.00 0% 2% 0% Mideopsidae Naididae 0% 8% 39% 0.34 0% 3% Nemouridae 100% 100% 100% 100% 100% 1.00 22% 0.08 Pelecorhynchidae 0% 6% 0% 0% Peltoperlidae 22% 12% 6% 8% 41% 0.07 Perlidae 11% 84% 33% 100% 3% 0.41 Perlodidae 89% 81% 78% 78% 92% 0.87 Philopotamidae 0% 0% 31% 0% 0.04 3% Pisidiidae 0% 6% 0% 8% 0% 0.01 Planariidae 0% 8% 67% 17% 3% 0.58 Planorbidae 0% 0% 0% 0% 3% 0.00 Psychodidae 22% 65% 94% 8% 11% 0.89 Pteronarcyidae 0% 12% 6% 0% 3% 0.06 Rhyacophilidae 100% 92% 100% 100% 95% 0.99 Simuliidae 33% 49% 39% 33% 16% 0.40 63% 42% 50% 78% 65% 0.52 Sperchontidae 4% 0% 17% 0% 0.01 Stygothrombiidae 0% Taeniopterygidae 89% 49% 100% 92% 97% 0.93 4% Thaumaleidae 11% 0% 0% 0% 0.01 Tipulidae 56% 55% 28% 67% 43% 0.32 Torrenticolidae 11%86% 11% 17% 11%0.21 Uenoidae 22% 37% 17% 25% 46% 0.19 Valvatidae 0% 2% 6% 0% 0% 0.05

#### Frequency and Probability of Taxa Occurrence

RIVPACS Ratios	
RIVPACS : Expected taxa P>0.50	13.63
RIVPACS : Observed taxa P>0.50	14.00
RIVPACS : 0:E (p > 0.5)	1.03

#### **RIVPACS** Ratios

RIVPACS : Expected taxa P>0.70	10.42
RIVPACS : Observed taxa P>0.70	10.00
RIVPACS : 0:E (p > 0.7)	0.96

#### Habitat Description

Habitat Description									
Variable	MOR002	Predicted Group Reference Mean ±SD							
Bedrock Geology									
Sedimentary (%)	100.00000	92.18813 ± 22.65908							
Chan	nel								
Depth-Avg (cm)	4.1	22.5 ± 10.5							
Depth-BankfullMinusWetted (cm)	58.00	67.33 ± 71.65							
Depth-Max (cm)	8.9	32.9 ± 17.9							
Macrophyte (PercentRange)	1	0 ± 0							
Reach-%CanopyCoverage (PercentRange)	1.00	0.94 ± 0.80							
Reach-DomStreamsideVeg (Category(1-4))	2	3 ± 1							
Reach-Pools (Binary)	1	0 ± 1							
Reach-Rapids (Binary)	0	0 ± 1							
Reach-Riffles (Binary)	1	1 ± 0							
Reach-StraightRun (Binary)	1	1 ± 0							
Slope (m/m)	0.0160000	$0.0235102 \pm 0.0284557$							
Veg-Coniferous (Binary)	1	1 ± 0							
Veg-Deciduous (Binary)	1	1 ± 0							
Veg-GrassesFerns (Binary)	1	1 ± 0							
Veg-Shrubs (Binary)	1	1 ± 0							
Velocity-Avg (m/s)	0.09	0.50 ± 0.25							
Velocity-Max (m/s)	0.40	0.75 ± 0.28							
Width-Bankfull (m)	10.6	15.6 ± 12.8							
Width-Wetted (m)	4.6	$10.2 \pm 7.0$							
XSEC-VelMethod (Category(1-3))	1	2 ± 1							
Clim	-								
Precip10_OCT (mm)	54.48857	52.92857 ± 22.22704							
Temp12_DECmin (Degrees Celsius)	-12.63857	-12.82063 ± 2.01422							
Hydro	I								
Drainage-Area (km^2)	16.01314	166.32560 ± 185.60049							
Lando									
Natl-Grassland (%)	0.00000	4.92979 ± 5.99508							
Natl-ShrubLow (%)	2.55232	$1.89085 \pm 1.59075$							
Natl-Water (%)	0.00000	$0.22269 \pm 0.34683$							
Reg-Ice (%)	0.00000	$0.46949 \pm 1.15785$							
Substrat		0.10515 = 1.15705							
%Bedrock (%)	0	0 ± 0							
%Boulder (%)	14	6 ± 7							
%Cobble (%)	53	61 ± 27							
%Gravel (%)	7	1 ± 2							
%Pebble (%)	25	31 ± 28							
%Sand (%)	0	0 ± 0							
%Silt+Clay (%)	1	$\begin{array}{c} 0 \pm 0 \\ 0 \pm 1 \end{array}$							
D50 (cm)	9.50	79.45 ± 47.98							
Dg (cm)	8.0	73.9 ± 48.0							
Dominant-1st (Category(0-9))	6	6 ± 1							
Dominant-Ist (Category(0-9)) Dominant-2nd (Category(0-9))	7	6 ± 2							
Embeddedness (Category(1-5))	2	$\frac{0 \pm 2}{4 \pm 1}$							
	4	2 ± 1							
PeriphytonCoverage (Category(1-5)) SurroundingMaterial (Category(0-9))									
	3	3 ± 1							
Topogi Reg-SlopeLT30% (%)		27.92073 ± 14.83033							
	83.40667	$27.92073 \pm 14.83033$ 616.97887 ± 680.88955							
		$(22886.080 \pm 1867.97010)$							
SlopeMax (%)	83.89085	01000,000,00000000							
Water Ch	emistry								
Water Ch Ag (mg/L)	emistry 0.0000250	$0.0000004 \pm 0.0000014$							
Water Ch Ag (mg/L) Al (mg/L)	emistry 0.0000250 0.0108000	0.0000004 ± 0.0000014 0.0059500 ± 0.0039700							
Water Ch Ag (mg/L)	emistry 0.0000250	$0.0000004 \pm 0.0000014$							

#### Habitat Description

Habitat Description	MODOOD	Duadiated Charmen Defenser
Variable	MOR002	Predicted Group Reference Mean ±SD
Ba (mg/L)	0.2070000	$0.0639025 \pm 0.0450861$
Be (mg/L)	0.0000500	$0.0000025 \pm 0.0000062$
Bi (mg/L)	0.0000500	$0.0000004 \pm 0.0000014$
Ca (mg/L)	20.300000	38.6142857 ± 14.8464843
Cd (mg/L)	0.0000380	$0.0000059 \pm 0.000067$
Co (mg/L)	0.0000500	$0.0000043 \pm 0.0000057$
Cr (mg/L)	0.0002500	$0.0000833 \pm 0.0001403$
Cu (mg/L)	0.0055600	$0.0001875 \pm 0.0001434$
Fe (mg/L)	0.0120000	0.0090000
General-Alkalinity (mg/L)	66.7000000	$121.5944444 \pm 36.7225924$
General-Conductivity (µS/cm)	46.5000000	$186.8500000 \pm 84.0864011$
General-Hardness (mg/L)	64.4000000	$146.8222222 \pm 41.6699011$
General-pH (pH)	7.6	8.0 ± 0.6
General-SolidsTSS (mg/L)	1.0000000	0.5604289 ± 1.4627232
General-SpCond (µS/cm)	69.9000000	214.2437500 ± 77.1891440
General-TempAir (Degrees Celsius)	6.5	$10.5 \pm 4.2$
General-TempWater (Degrees Celsius)	7.500000	$6.6716667 \pm 2.0277755$
General-Turbidity (NTU)	0.3600000	0.00000000000000000000000000000000000
Hg (ng/L)	0.0000200	$\frac{0.0000000 \pm 0.0000000}{0.00000000000000000000000000$
K (mg/L)	0.4600000	$0.6471429 \pm 0.7154652$
Li (mg/L)	0.0022900	$0.0011817 \pm 0.0004768$
Mg (mg/L)	4.3100000	9.8814286 ± 6.1601202
Mn (mg/L)	0.0019000	$0.0011426 \pm 0.0016097$
Mo (mg/L)	0.0005900	$0.0024883 \pm 0.0065339$
Na (mg/L)	1.4500000	$2.6357143 \pm 3.7712414$
	0.0012700	
Ni (mg/L) Nitrogen-NH3 (mg/L)	0.0250000	$0.0000808 \pm 0.0000811$
	0.0230000	$\begin{array}{c} 0.0019286 \pm 0.0059286 \\ 0.0023889 \pm 0.0063351 \end{array}$
Nitrogen-NO2 (mg/L) Nitrogen-NO2+NO3 (mg/L)		
	0.0050000	$0.0130000 \pm 0.0088111$
Nitrogen-NO3 (mg/L)	0.0050000	0.0245003 ± 0.0229452
Nitrogen-TKN (mg/L)	0.0250000	$\begin{array}{r} 0.0233333 \pm 0.0161433 \\ 0.0688889 \pm 0.0759171 \end{array}$
Nitrogen-TN (mg/L)	0.0250000	
Pb (mg/L) Phosphorus-TP (mg/L)	0.0001000	0.0000224 ± 0.0000176
	0.0025000	0.0032778 ± 0.0061816 5.0000000
S (mg/L)	3.1000000	
Sb (mg/L)	0.0001000	$0.0000361 \pm 0.0000135$
Se (mg/L)	0.0002500	$0.0004382 \pm 0.0004486$
Si (mg/L)	0.5000000	$3.0657143 \pm 1.4070046$
Sn (mg/L)	0.0001000	0.0000167 ± 0.0000078
Sr (mg/L)	0.1170000	0.1159167 ± 0.0982749
Te (mg/L)	0.0002500	$0.000000 \pm 0.000000$
Th (mg/L)	0.0000500	$0.0000000 \pm 0.0000000$
Ti (mg/L)	0.0025000	0.0009000
TI (mg/L)	0.0000100	0.0000038 ± 0.0000064
U (mg/L)	0.0002030	0.0005298 ± 0.0003220
V (mg/L)	0.0005000	$0.0001642 \pm 0.0001203$
Zn (mg/L)	0.0020000	$0.0004083 \pm 0.0008361$
Zr (mg/L)	0.0000500	$0.0000000 \pm 0.0000000$



Appendix B: Raw Data/Datasheets

Occupational Health & Safety: Site Inspection Sheet completed      PRIMARY SITE DATA      AABIN Study Name:	-Chad C CABIN	SITE
Sampling Date: (DD/MM/YYYY)		
Sampling Date: (DD/MM/YYYY)	Field Crew: Ched Hughes + Both Millions Site Code: ALXOI	
PRIMARY SITE DATA         CABIN Study Name:	Sampling Date: (DD/MM/YYYY)	
PRIMARY SITE DATA         CABIN Study Name:		
PRIMARY SITE DATA         CABIN Study Name:	Occupational Health & Safety: Site Inspection Sheet completed	
River/Stream Name: Academ Concel	PRIMARY SITE DATA	
River/Stream Name: Academ Concel	CABIN Study Name:CBUMLocal Basin Name:FIL Reserved	
Select one: Test Site   Potential Reference Site		
Geographical Description/Notes:       Residential/Undescription/Notes:         With disk and water, disk data and disk and dis		
urrounding Land Use: (check those present) Information Source: <a href="https://www.internationstation.com">https://www.internationstation.com</a> Porest Pield/Pasture Agriculture Residential/Urban   ominant Surrounding Land Use: (check one) Information Source: <a href="https://www.internationstation.com">https://www.internationstation.com</a> Porest Pield/Pasture Agriculture Residential/Urban   I togging Mining Commercial/Industrial Other   Porest Pield/Pasture Agriculture Residential/Urban   Logging Mining Commercial/Industrial Other   Logging Mining GPS Datum: GRS80 (NADB3WGS84) Other:		
urrounding Land Use: (check those present) Information Source: <a href="https://www.internationstation.com">https://www.internationstation.com</a> Porest Pield/Pasture Agriculture Residential/Urban   ominant Surrounding Land Use: (check one) Information Source: <a href="https://www.internationstation.com">https://www.internationstation.com</a> Porest Pield/Pasture Agriculture Residential/Urban   I togging Mining Commercial/Industrial Other   Porest Pield/Pasture Agriculture Residential/Urban   Logging Mining Commercial/Industrial Other   Logging Mining GPS Datum: GRS80 (NADB3WGS84) Other:	walk dista confluence with highway by broke over	Michel Cr.
Forest Field/Pasture   Logging Mining     commercial/Industrial     ominant Surrounding Land Use: (check one)   Information Source:   Forest   Field/Pasture   Agriculture   Residential/Urban   Logging   Mining   Commercial/Industrial   Other   Logging   Mining   Commercial/Industrial   Other     Commercial/Industrial     Other     Logging     Mining     Commercial/Industrial     Other     Information Source:   Nining     Commercial/Industrial     Other     Information Source:     Procestion Data     Ititude:     N Longitude:     W (DMS or DD)     evation:     (fasl or masl)     GPS Datum:     Gesso     Madel     Madel     Model     Model <td>on abor. Os mer for a rom. She</td> <td>has by</td>	on abor. Os mer for a rom. She	has by
Logging Mining     Commercial/Industrial     ominant Surrounding Land Use: (check one)   Information Source: Visual      Forest   Field/Pasture   Agriculture   Residential/Urban   Logging   Mining   Commercial/Industrial   Other     Commercial/Industrial     Information Source: Visual     Residential/Urban   Logging   Mining     Commercial/Industrial     Other     Information Source: Visual     Residential/Urban     Information Source: Visual     Information Source: Notation Map Drawing     Information Source: Notation Map Drawing     Information Source: Notation Source: Notation Source: Notation Source: Notation Source: Notation Source: Notation S	Surrounding Land Use: (check those present) Information Source:	
ominant Surrounding Land Use: (check one) Information Source: Vised   Forest Field/Pasture Agriculture   Logging Mining Commercial/Industrial   Decation Data titude:W (DMS or DD) evation:(fasl or masl) GPS Datum:GRS80 (NADB3/NGS84) Other: te Location Map Drawing Midde	Forest L Field/Pasture Agriculture Residential/Urban	
Forest       Field/Pasture       Agriculture       Residential/Urban         Logging       Mining       Commercial/Industrial       Other         cocation Data       N Longitude:W (DMS or DD)         evation:      (fasl or masl)       GPS Datum:       GRS80 (NAD83/WGS84)       Other:         tet Location Map Drawing       Greeford		
I Logging Mining    Commercial/Industrial     Detation Data  Titude:     The Location Map Drawing  The Locating  The Location Map Drawing  The Location	Forest Field/Pasture Agriculture Residential/Urban	•
titude:N Longitude:W (DMS or DD) evation:(fasl or masl) GPS Datum: GRS80 (NAD83WGS84) Other: te Location Map Drawing	Logging Mining Commercial/Industrial Other	
evation:(fasl or masl) GPS Datum: GRS80 (NADB3/WGS84) Other:	ocation Data	
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	Aow Parking @ Lighway 3 1	

CABIN Field Sheet June 2012

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Sampling Date: (DD/MM/YYYY)       21/09/2020         Photos       Image: State in the	
REACH DATA (represents 6 times bankfull width)	
. Habitat Types: (check those present)	
. Canopy Coverage: (stand in middle of stream and look up, check one)	
Macrophyte Coverage: (not algae or moss, check one)	
Streamside Vegetation: ( <i>check those present</i> ) ferns/grasses shrubs deciduous trees coniferous trees	
Dominant Streamside Vegetation: (check one)	
Periphyton Coverage on Substrate: (benthic algae, not moss, check one)	
<ul> <li>1 - Rocks are not slippery, no obvious colour (thin layer &lt; 0.5 mm thick)</li> <li>2 - Rocks are slightly slippery, yellow-brown to light green colour (0.5-1 mm thick)</li> <li>3 - Rocks have a noticeable slippery feel (footing is slippery), with patches of thicker green to brown algae (1-5 mm thick)</li> </ul>	
4 - Rocks are very slippery (algae can be removed with thumbnail), numerous large clumps of green to dark brown algae (5 mm -20 mm thick)	
5 - Rocks are mostly obscured by algal mat, extensive green, brown to black algal mass may have long strands (> 20 mm thick)	

# BENTHIC MACROINVERTEBRATE DATA

Habitat sampled: (check one) Triffle rapids straight run

400 μm mesh Kick Net	
Person sampling	Chad Highes
Sampling time (i.e. 3 min.)	3
No. of sample jars	1
Typical depth in kick area (cm)	20

Preservative used: 991. 100

Sampled sieved on site using "Bucket Swirling Method": YES INO If YES, debris collected for QAQC

Note: Indicate if a sampling method other than the recommended 400  $\mu m$  mesh kick net is used.

CABIN Field Sheet June 2012



ampling Date: (DD/MM/YYY) 21/09/7020	
VATER CHEMISTRY DATA Time: 09:30 (24 hr clock)	Time zone: MT
ir Temp:(°C) Water Temp:(°C)	pH:
specific Conductance: 20%.4 (µs/cm) DO:(mg/	
Check if water samples were collected for the following analyses:	
TSS (Total Suspended Solids)	
Nitrogen (i.e. Total, Nitrate, Nitrite, Dissolved, and/or Ammonia)	
Phosphorus (Total, Ortho, and/or Dissolved)	
Major Ions (i.e. Alkalinity, Hardness, Chloride, and/or Sulphate)	Other
lote: Determining alkalinity is recommended, as are other analyses, but not r	required for CARIN assessments

# **CHANNEL DATA**

Slope - Indicate how slope was measured: (check one)

#### □ Calculated from map

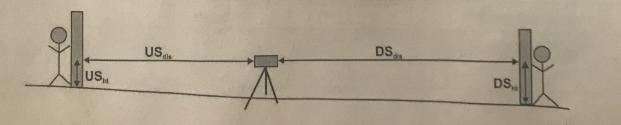
Scale:	(Note: small scale map recommended if field	d measurement is not possible - i.e. 1:20,000).
contour interval (vertica	l distance) (m),	
distance between conto	ur intervals (horizontal distance)	(m)
slope = vertical distance	e/horizontal distance =	

OR

#### Measured in field

- Circle device used and fill out table according to device: a. Survey Equipment b. Hand Level & Measuring Tape

Measurements	Upstream (U/S)	Downstream(D/S)	Calculation
<sup>a</sup> Top Hairline (T)	and the second states in	1	
<sup>a</sup> Mid Hairline (ht) OR			
<sup>b</sup> Height of rod	a second and		
<sup>a</sup> Bottom Hairline (B)			
<sup>b</sup> Distance (dis) OR			US <sub>dis</sub> +DS <sub>dis</sub> =
<sup>a</sup> T-B x 100	<sup>a</sup> US <sub>dis</sub> =T-B	<sup>a</sup> DS <sub>dis</sub> =T-B	
Change in height (∆ht)			DS <sub>ht</sub> -US <sub>ht</sub> =
Slope (Δht/total dis)			0.007



**CABIN Field Sheet June 2012** 

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· · · · ·	14
Field Crew: Ched Higher - Beth Millions Site Code: Micol	1.
Sampling Date: (DD/MM/YYYY) 21/09/ 2020	
Widths and Depth	
Location at site: USE kickolea (Indicate where in sample reach, ex. d/s of kick area)	
A - Bankfull Width: 14.17 (m) B - Wetted Stream Width: 10.30 (m)	
C - Bankfull-Wetted Depth (height from water surface to Bankfull): 29 (cm)	
1c	
V1 V2 V3 V4 V5 D1 D2 D3 D4 D5	
$D_1$ $D_2$ $D_3$ $D_4$ $D_5$	
Note:	
Wetted widths > 5 m, measure a minimum of 5-6 equidistant locations; Wetted widths < 5 m, measure 3-4 equidistant locations.	
Wetted widths < 5 m, measure 5-4 equidistant locations.	

#### **Velocity and Depth**

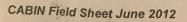
Check appropriate velocity measuring device and fill out the appropriate section in chart below. Distance from shore and depth are required regardless of method:

**Velocity Head Rod (or ruler)**: Velocity Equation (m/s) =  $\sqrt{[2(\Delta D/100) * 9.81]}$ 

Rotary meters: Gurley/Price/Mini-Price/Propeller (Refer to specific meter conversion chart for calculation)

Direct velocity measurements: 
Marsh-McBirney 
Sontek or 
Other

	1	2	3	4	5	6	AVG
Distance from Shore (m)	1.5	3	45	6	7.5	q	
Depth ( <b>D</b> ) (cm)				4			
Velocity Head Rod (ruler)	R Same						
Flowing water Depth (D1) (cm)	42.5	29.2	16.7	17.6	16.0	12.2	
Depth of Stagnation (D <sub>2</sub> ) (cm)	51.5	33	17.7	18.4	17.0	12.2	
Change in depth (ΔD=D <sub>2</sub> -D <sub>1</sub> ) (cm)	9	13,8	1	0.8		0	
Rotary meter							
Revolutions							
Time (minimum 40 seconds)							
Direct Measurement or calculation			1.74				
Velocity (V) (m/s)		n		e l			





es Beth Millions Site Code: ALADI Field Crew:

Sampling Date: (DD/MM/YYYY) \_\_\_\_\_\_ 21/09/2020

#### SUBSTRATE DATA

#### Surrounding/Interstitial Material

Circle the substrate size category for the surrounding material.

Substrate Size Class	Category
Organic Cover	0
< 0.1 cm (fine sand, silt or clay)	(1)
0.1-0.2 cm (coarse sand)	(2)
0.2-1.6 cm (gravel)	3
1.6-3.2 cm (small pebble)	4
3.2-6.4 cm (large pebble)	5
6.4-12.8 cm (small cobble)	6
12.8-25.6 cm (cobble)	7
> 25.6 cm (boulder)	8
Bedrock	9

#### **100 Pebble Count & Substrate Embeddedness**

Measure the intermediate axis (100 rocks) and embeddedness (10 rocks) of substrate in the stream bed.

Indicate B for bedrock, S for sand/sill/clay (particles < 0.2 cm) and O for organic material.</li>
 Embeddedness categories (E): Completely embedded = 1, 3/4 embedded, 1/2 embedded, 1/4 embedded, unembedded = 0

	Diameter (cm)	E		Diameter (cm)	E	and a start of the start of the	Diameter (cm)	E		Diameter (cm)	E
1	4.4		26	a.2		51	5.5		76	16.5	
2	10.2		27	13		52	5.7		77	27	
3	8.6		28	11.4		53	9.2		78	145	
4	2.0		29	3.6		54	3		79	7.5	
5	10.2	1	30)	11.2	1/21	55	10.5	(	80)	18.5	3/4
6	35.0		31	10	17	56	3.9		81	9.5	
7	14.0		32	8.5		57	25		82	4.7	
8	35		33	10.6		58	1.5		83	7	
9	135		34	10.4		59	21		84	7.5	
10	10	1	35	5.1	(	60)	8.5	Ø	85	.4	
11	17		36	5,4		61	5.4	18	86	16.7	
12	2		37	2.9	-	62	5.5		87	7.9	
13	38		38	11.3	1	63	7.3		88	10	
14	7.4		39	11.5	-	64	8.8		89	2.7	
15	22		(40)	25	1/4	65	22.5	- (	90)	3.7	1/4
16	Ц		41	4,6		66	2.0		91	6.9	
17	5.5		42	13.1		67	7.6	1	92	2.9	
18	6		43	4.3		68	25		93	6.7	
19	11		44	5.2	1	69	19.5	-	94	31	
(20	14.5	14	45	11.	1	70)	24.5	74	95	3.6	
21	27	1	46	5		71	18.5		96	7.7	
22	3		47	15.4		72	35.5		97	5.3	
23	)		48	13		73	8.9	-	98.	11.5	
24	3		49	24		74	16.5		-99	12	
25	4.5		(50)	18	44	75	29	1	(100)	12	0

Note: The Wolman D50 (i.e. median diameter), Wolman Dg (i.e. geometric mean diameter) and the % composition of the substrate classes will be calculated automatically in the CABIN database using the 100 pebble data. All 100 pebbles must be measured in order for the CABIN database tool to perform substrate calculations.

**CABIN Field Sheet June 2012** 

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Ci	ald	C	rew
TI	GIG		CVI

Site Code: ALXOI

SITE INSPECTION

Site Inspected by: Beth Unlight

#### **Communication Information**

I Itinerary left with contact person (include contact numbers)

Hinling to

Sampling Date; (DD/MM/YYYY) 21/04/9020

Contact Person: kain Wating	Time checked-in: 10 :00
Form of communication:  radio  cell satellite	hotel/pay phone SPOT
Phone number: (403) 702 -4868	

151

#### **Vehicle Safety**

Safety equipment (first aid, fire extinguisher, blanket, emergency kit in vehicle)
 Equipment and chemicals safely secured for transport
 Vehicle parked in safe location; pylons, hazard light, reflective vests if necessary
 Notes:

Shore & Wading Safety

Wading Task Hazard Analysis read by all field staff
Wading Safe Work Procedures read by all field staff
Instream hazards identified (i.e. log jams, deep pools, slippery rocks)
PFD worn
Appropriate footwear, waders, wading belt
Belay used

Notes:

CABIN Field Sheet June 2012

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PRIMARY S	tional Health & Safety: Site Inspection Sheet completed
	Name: <u>CBIDM</u> Local Basin Name: <u>Elk River</u>
	Name: Alexander Creek Stream Order: (map scale 1:50,000)
Select one:	Test Site D Potential Reference Site
Geographic Park of oscor po	cal Description/Notes: pullost on high way us of gunrange. Prive to illegal camping sk. walk to stream (~ 20 m)
Surrounding L	and Use: (check those present) Information Source:
Dominant Sur	rounding Land Use: (check one)       Information Source:
Location D	
	.654919N Longitude: - 114.3.20.206 W (DMS or D) (fasl or masl) GPS Datum: □ GRS80 (NAD83/WGS84) □ Other:
	on Map Drawing Gun Range A Streambert
4	Kon narge -

CABIN Field Sheet June 2012

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.



Field Crew: Chad Highes - Both Millions Site Code: ALLO3
Sampling Date: (DD/MM/YYYY) 20/09/2020
Photos     Downstream     Across Site     Aerial View       Field Sheet     Upstream     Substrate (aquatic)     Other
REACH DATA (represents 6 times bankfull width)
1. Habitat Types: <i>(check those present)</i> Riffle Rapids Straight run Pool/Back Eddy
2. Canopy Coverage: (stand in middle of stream and look up, check one)
3. Macrophyte Coverage: (not algae or moss, check one)
4. Streamside Vegetation: ( <i>check those present</i> )
5. Dominant Streamside Vegetation: (check one)
6. Periphyton Coverage on Substrate: (benthic algae, not moss, check one)
1 - Rocks are not slippery, no obvious colour (this t
algae (1-5 mm thick)
to dark brown algae (5 mer 20
<ul> <li>5 - Rocks are mostly obscured by algal mat, extensive green, brown to black algal mass may have</li> </ul>
Note: 1 through 5 represent categories entered into the CABIN database.
BENTHIC MACROINVERTEBRATE DATA
Habitat sampled: ( <i>check one</i> ) □ riffle □ rapids ⊠ straight run 400 μm mesh Kick Net
Person sampling
Sampling time (i.e. 2
No. of sample jars
Typical depth in kick area (cm) 20
Note: Indicate if a sampling method other than the recommended 400 µm mesh kick net is used.

CABIN Field Sheet June 2012

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A STATE OF THE OWNER OF THE OWNER

reid Grew.	ad Highes + Bell	M. M. Ons	Site Code: ALX03
ampling Date: (DD	/MM/YYYY) 20 691	2870	
WATER CHEMIS	TRY DATA Time:	6:00 (24 hr	clock) Time zone: MT
Air Temp: <u>14.5</u>	(°C) Water Te	mp: <u>8.4</u>	_(°C) pH:
Specific Conductanc	e: <u>214.5 (µs/cm)</u> 1	DO: <u>11</u>	_(mg/L) Turbidity:
Check if water samp	es were collected for the	following analyses	5 <b>2</b>
TSS (Total Susp	ended Solids)		
Nitrogen (i.e. Tot	al, Nitrate, Nitrite, Dissolv	ed, and/or Ammon	nia)
	1011 11 -1 1	4)	
Phosphorus (Tot	al, Ortho, and/or Dissolve	u)	

CHANNEL DATA

Slope - Indicate how slope was measured: (check one)

Calculated from map

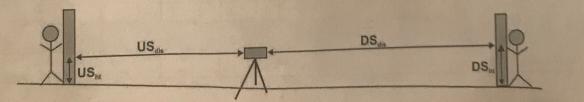
Scale: \_\_\_\_\_\_(Note: small scale map recommended if field measurement is not possible - i.e. 1:20,000). contour interval (vertical distance) \_\_\_\_\_\_(m), distance between contour intervals (horizontal distance) \_\_\_\_\_\_(m) slope = vertical distance/horizontal distance =\_\_\_\_\_

OR

#### Measured in field

Circle device used and fill out table according to device: a. Survey Equipment b. Hand Level & Measuring Tape

Measurements	Upstream (U/S)	Downstream(D/S)	Calculation
<sup>a</sup> Top Hairline (T)		and the second second	
<sup>a</sup> Mid Hairline (ht) OR			
<sup>b</sup> Height of rod	1.43~	200,0	
<sup>a</sup> Bottom Hairline (B)			
Distance (dis) OR	30 m	30 m	US <sub>dis</sub> +DS <sub>dis</sub> ≃
<sup>a</sup> T-B x 100	<sup>a</sup> US <sub>dis</sub> =T-B	<sup>a</sup> DS <sub>dis</sub> =T-B	0 m
Change in height (∆ht)			0 DShr-USht= 2-1.43 0.57
Slope (Δht/total dis)			0.95%



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	and the second s		0.11		1				
1	Field Crew:	-				Site Code:	ALXO	3	-
-	Widths and Depth	-							
	Location at site: <u>115 of</u> A - Bankfull Width: <u>10 .1</u>	_(m)	site	(Indicat B - Wet	e where in ted Stream	sample re	ach, ex. d	/s of kick a	irea)
	C - Bankfull–Wetted Depth (he	eight from wa	ter surface i	o Bankfull	):14(		1.00		
	X			<u>+</u>		A			
Not	ha:	DI			V5 D5				
Wei	tted widths > 5 m, measure a min tted widths < 5 m, measure 3-4 e	nimum of 5-6 equidistant loc	equidistant lo ations.	cations;			ĩ		
Vel Che shor	locity and Depth ck appropriate velocity meas e and depth are required reg.	uring device	and fill out t	bo onne					
	(or ruler)	: Velocity Fr	Illation (m. ).						-
				$- \sqrt{2(\Delta L)}$	D/1001 * 0	R11			
	Concyrrice/	VIINI-Price/Pr	onellar (D				rt for calcula	ition)	
	irect velocity measurement	VIINI-Price/Pr	opeller (Ref	er to specifi	c meter con r □ Other_	version cha			
Distanc Depth (I	irect velocity measurement ce from Shore (m) D) (cm)	ts: □ Marsh	opeller (Refi McBirney E	er to specifi ] Sontek o 3			rt for calcula	ation)	
Distanc Depth (I Velocity	irect velocity measurement ce from Shore (m) D) (cm) V Head Rod (ruler)	ts: □ Marsh	opeller (Refines Decision of the second s	er to specifi ] Sontek o 3	c meter con r □ Other_ 4	version cha	6		
Distanc Depth (I Velocity Flowi	irect velocity measurement ce from Shore (m) D) (cm) V Head Rod (ruler) ing water Depth (D1) (cm)	ts:   Marsh	opeller (Refi	er to specifi Sontek o 3 4	c meter con r □ Other_ 4 5.5	s	6		
Distanc Depth (I Velocity Flowi Depth	irect velocity measurement ce from Shore (m) D) (cm) V Head Rod (ruler) ing water Depth (D <sub>1</sub> ) (cm)	ts: D Marsh	Opeller (Refi	er to specifi I Sontek o 3 4 4 - 3 9 - 3 9 - 3 9 - 3	c meter con $T \Box Other_$ 4 5.5 4 4 4 4 4 5.5	version cha	6 8.5 24.5		
Distanc Depth (I Velocity Flowi Depth Chang	irect velocity measurement is from Shore (m) D) (cm) V Head Rod (ruler) ing water Depth (D <sub>1</sub> ) (cm) h of Stagnation (D <sub>2</sub> ) (cm) ge in depth ( $\Delta D=D_2-D_1$ ) (cm)	ts: D Marsh	Propeller (Ref.           •McBirney E           2           2           34.3           36.8	er to specifi I Sontek o 3 4 4 - - - - - - - - - - - - - - - - -	c meter con 1 □ Other_ 4 5.5 4 46.5 47.3	version cha 5 7 37.7 38.4	6 8.5 24.5 24.5		
Distanc Depth (I Velocity Flowi Depth Chang Rotary m	irect velocity measurement ce from Shore (m) D) (cm) V Head Rod (ruler) ing water Depth ( $D_1$ ) (cm) n of Stagnation ( $D_2$ ) (cm) ge in depth ( $\Delta D=D_2-D_1$ ) (cm) neter	ts: D Marsh	Opeller (Refi	er to specifi I Sontek o 3 4 4 - 3 9 - 3 9 - 3 9 - 3	c meter con $T \Box Other_$ 4 5.5 4 4 4 4 4 5.5	version cha	6 8.5 24.5		
Distanc Depth (I Velocity Flowi Depth Chang Rotary m Revolu	irect velocity measurement is from Shore (m) D) (cm) V Head Rod (ruler) ing water Depth ( $D_1$ ) (cm) n of Stagnation ( $D_2$ ) (cm) ge in depth ( $\Delta D=D_2-D_1$ ) (cm) meter utions	ts: D Marsh	Propeller (Ref.           •McBirney E           2           2           34.3           36.8	er to specifi I Sontek o 3 4 4 - - - - - - - - - - - - - - - - -	c meter con 1 □ Other_ 4 5.5 4 46.5 47.3	version cha 5 7 37.7 38.4	6 8.5 24.5 24.5		
Distanc Depth (I Velocity Flowi Depth Chang Rotary m Revolu Time (r	irect velocity measurement is from Shore (m) D) (cm) V Head Rod (ruler) ing water Depth (D <sub>1</sub> ) (cm) n of Stagnation (D <sub>2</sub> ) (cm) ge in depth ( $\Delta D=D_2-D_1$ ) (cm) meter utions minimum 40 seconds)	ts: D Marsh	Propeller (Ref.           •McBirney E           2           2           34.3           36.8	er to specifi I Sontek o 3 4 4 - - - - - - - - - - - - - - - - -	c meter con 1 □ Other_ 4 5.5 4 46.5 47.3	version cha 5 7 37.7 38.4	6 8.5 24.5 24.5		
Distanc Depth (I Velocity Flowi Depth Chang Rotary m Revolu Time (r	irect velocity measurement is from Shore (m) D) (cm) V Head Rod (ruler) ing water Depth ( $D_1$ ) (cm) n of Stagnation ( $D_2$ ) (cm) ge in depth ( $\Delta D=D_2-D_1$ ) (cm) meter utions	ts: D Marsh	Propeller (Ref.           •McBirney E           2           2           34.3           36.8	er to specifi I Sontek o 3 4 4 - - - - - - - - - - - - - - - - -	c meter con 1 □ Other_ 4 5.5 4 46.5 47.3	version cha 5 7 37.7 38.4	6 8.5 24.5 24.5		

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CABIN Field Sheet June 2012

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Millions + Chod Hip Field Crew:

Site Code: ALLO3

Sampling Date: (DD/MM/YYYY) \_ 25/09 / 2020

#### SUBSTRATE DATA

#### Surrounding/Interstitial Material

Circle the substrate size category for the surrounding material.

Substrate Size Class	Category
Organic Cover	0
< 0.1 cm (fine sand, silt or clay)	1
0.1-0.2 cm (coarse sand)	(2)
0.2-1.6 cm (gravel)	3
1.6-3.2 cm (small pebble)	4
3.2-6.4 cm (large pebble)	5
6.4-12.8 cm (small cobble)	6
12.8-25.6 cm (cobble)	7
> 25.6 cm (boulder)	8
Bedrock	9

#### **100 Pebble Count & Substrate Embeddedness**

Measure the intermediate axis (100 rocks) and embeddedness (10 rocks) of substrate in the stream bed.

Indicate B for bedrock, S for sand/silt/clay (particles < 0.2 cm) and O for organic material.</li>
 Embeddedness categories (E): Completely embedded = 1, 3/4 embedded, 1/2 embedded

			the second s	and the second second	and the second second	and the second se		Contraction of the local division of the loc	and a second	
iameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E
9.8		26	12.7		51	5.2		76	40.0	
240		27	10.2		52	12.4		77	16.0	
19.5		28	4.9		53	9.6		78	6:5	1 all a
33.0		29	7.5		54	18.0		79	16.5	
140		30	15.0	1/4	55	13.6		80)	19.0	1/2
22.5		31	Sad		56	18.5		81	1.4	
11.3		32	4.8		57	6.0		82		
28		33	3.7	disease of	58	17.0		83	8.2	
23		34	B.7		59	12.5		84	4.4	
6.5	1/2	35	"Sand			1.5	1. ¢.	85	3.9	
37.5	1.75	36	14:5		61	11.4	314	86	17.5	
22		37	14.5.		62	17.0		87	9.0	
13		38	3.8		63	7.4		88	9.9	
8:5		39	14.8		64	13.0		89	16.0	
110		(40)	36.0	3/4	65	10.0		90)	11.5	1/4
0.9		41	11.1		66	14.8		91	12.5	
Contraction of the American States		42	21.1		67	2.2		92	10.6	
4		43	79.4		68	6.5		93	5.4	
9.5		44	10.5		69	9.7		94	0.9	
7.0	0	45	5.3		fo)	24.5	1/2	95	19.0	
81.0		46	8.0	and so	71	8.5		96	52.5	
93		47	7.7_		72	6.0	1	97	9.5	
145		48			73	10.5		98	9.5	
1.8		49	AND DESCRIPTION OF THE OWNER		74	10.0		99		
		(50)	Colligible in the second second	0	75			(100)	Construction of the local division of the lo	171
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mbedded = 1 3/4 embedded 1/2 embedded, 1/4 embedded, unembedded = 0

00

Note: The Wolman D50 (i.e. median diameter), Wolman Dg (i.e. geometric mean diameter) and the % composition of the substrate classes will be calculated automatically in the CABIN database using the 100 pebble data. All 100 pebbles must be measured in order for the CABIN database tool to perform substrate calculations.

**CABIN Field Sheet June 2012** 

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Sampling Date: (DD/MM/YYYY) 20109 /2	Sampling	Date:	(DD/MN	A/YYYY)	2010	9/20

# SITE INSPECTION

Site Code: ALXO

Field Crew:

#### **Communication Information**

Itinerary left with contact person (include contact numbers)

Contact Person: kavin Whiting	Time checked-in: 16:3
Form of communication:  radio  cell satellite	hotel/pay phone SPOT
Phone number: ( 403) 702-4968	

#### Vehicle Safety

Safety equipment (first aid, fire extinguisher, blanket, emergency kit in vehicle)

Equipment and chemicals safely secured for transport

Vehicle parked in safe location; pylons, hazard light, reflective vests if necessary

Notes:

#### Shore & Wading Safety

Wading Task Hazard Analysis read by all field staff

Wading Safe Work Procedures read by all field staff

□ Instream hazards identified (i.e. log jams, deep pools, slippery rocks)

□ PFD worn

Appropriate footwear, waders, wading belt

D Belay used

Notes:

**CABIN Field Sheet June 2012** 

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titine Code: Davoi
Field Crew: Beth Millions + Chad Highes Site Code: Bovor
Field Crew: Beth Millions
Field Crew:
Across Site Aerial View
Mining Sheet
Substrate (exposed)
REACH DATA (represents 6 times bankfull width)
1. Habitat Types: (check those present)
2. Canopy Coverage: (stand in middle of stream and look up, check one)
3. Macrophyte Coverage: (not algae or moss, check one)
4. Streamside Vegetation: ( <i>check those present</i> )
5. Dominant Streamside Vegetation: <i>(check one)</i>
6. Periphyton Coverage on Substrate: (benthic algae, not moss, check one)
$\Box$ 1 - Rocks are not slippery, no obvious colour (thin layer < 0.5 mm thick)
2 - Rocks are slightly slippery, yellow-brown to light green colour (0.5-1 mm thick)
3 - Rocks have a noticeable slippery feel (footing is slippery), with patches of thicker green to brown algae (1-5 mm thick)
4 - Rocks are very slippery (algae can be removed with thumbnail) numerous large changes of
5 - Rocks are mostly obscured by algal mat, extensive green, brown to block algal, algal
Note: 1 through 5 represent categories entered into the CABIN database.
BENTHIC MACROINVERTEBRATE DATA
Habitat sampled: (check one) Triffle rapids straight run
400 µm mosh Kish N K
Person sampling
Sampling time (i.e. 3 min.) 3 0 Sampled sieved on site using "Bucket Swirling Method":
No. of sample jars
Typical depth in kick area (cm)
Note: Indicate if a sampling method other the still

Note: Indicate if a sampling method other than the recommended 400 µm mesh kick net is used.

CABIN Field Sheet June 2012

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WATER CHEMISTRY	DATA Time: 09:15	_ (24 hr clock) Time zone:	MT
		3_(°C) pH:	
		(mg/L) Turbidity:	
Check if water samples wer TSS (Total Suspended S Nitrogen (i.e. Total, Nitra Phosphorus (Total, Orth Major Ions (i.e. Alkalinity	Solids) ate, Nitrite, Dissolved, and/o o, and/or Dissolved)	r Ammonia)	
Note: Determining alkalinity is r	ecommended, as are other an	alyses, but not required for CABIN	Vassessments.
CHANNEL DATA		and the spectrum of the second	
Slope - Indicate how slope	e was measured: (check on	a)	
Calculated from map			
Scale: contour interval (vertica distance between conto slope = vertical distance OR Measured in field Circle device used and f	(Note: small scale map reco l distance) (i ur intervals (horizontal dista e/horizontal distance = ill out table according to dev b. Hand Level & Measuring	vice: , )	possible - i.e. 1:20,000).
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Scale:	I distance)(i ur intervals (horizontal dista e/horizontal distance = ill out table according to dev b. Hand Level & Measuring	m), ince)(m) vice: Tape Lost year	
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Scale: contour interval (vertica distance between conto slope = vertical distance OR Measured in field Circle device used and f a. Survey Equipment Measurements *Top Hairline (T) *Mid Hairline (ht) OR	I distance)(i ur intervals (horizontal dista e/horizontal distance = ill out table according to dev b. Hand Level & Measuring	m), ince)(m) vice: Tape Lost year	
Scale:	I distance)(i ur intervals (horizontal dista e/horizontal distance = ill out table according to dev b. Hand Level & Measuring	m), ince)(m) vice: Tape Lost year	Calculation
Scale:	I distance)( ur intervals (horizontal dista e/horizontal distance = ill out table according to dev b. Hand Level & Measuring Upstream (U/S)	m), ince) (m) //ice: Tape Lost year Downstream(D/S)	
Scale: contour interval (vertica distance between conto slope = vertical distance OR Measured in field Circle device used and f a. Survey Equipment Measurements <sup>a</sup> Top Hairline (T) <sup>a</sup> Mid Hairline (ht) OR <sup>b</sup> Height of rod <sup>a</sup> Bottom Hairline (B) <sup>b</sup> Distance (dis) OR <sup>b</sup> T-B x 100	I distance)(i ur intervals (horizontal dista e/horizontal distance = ill out table according to dev b. Hand Level & Measuring	m), ince)(m) vice: Tape Lost year	Calculation
Scale: contour interval (vertica distance between conto slope = vertical distance OR Measured in field Circle device used and f a. Survey Equipment Measurements <sup>a</sup> Top Hairline (T) <sup>a</sup> Mid Hairline (ht) OR <sup>b</sup> Height of rod <sup>a</sup> Bottom Hairline (B) <sup>b</sup> Distance (dis) OR <sup>b</sup> T-B x 100 Change in height (Δht)	I distance)( ur intervals (horizontal dista e/horizontal distance = ill out table according to dev b. Hand Level & Measuring Upstream (U/S)	m), ince) (m) //ice: Tape Lost year Downstream(D/S)	Calculation US <sub>dis</sub> +DS <sub>dis</sub> = DS <sub>ht</sub> -US <sub>ht</sub> =
Scale: contour interval (vertica distance between conto slope = vertical distance OR Measured in field Circle device used and f a. Survey Equipment Measurements <sup>a</sup> Top Hairline (T) <sup>a</sup> Mid Hairline (ht) OR <sup>b</sup> Height of rod <sup>a</sup> Bottom Hairline (B) <sup>b</sup> Distance (dis) OR <sup>b</sup> T-B x 100	I distance)( ur intervals (horizontal dista e/horizontal distance = ill out table according to dev b. Hand Level & Measuring Upstream (U/S)	m), ince) (m) //ice: Tape Lost year Downstream(D/S)	Calculation US <sub>dis</sub> +DS <sub>dis</sub> =

Field Crew: Ched Hughes + Beth Millions Site Code: poro	Fier
Sampling Date: (DD/MM/YYYY) 30/09/ 2010	1/1
Widths and Depth	]
Location at site:       at exacted slope disktick (Indicate where in sample reach, ex. d/s of kick area)         A - Bankfull Width:       7.40 (m)         B - Wetted Stream Width:       7.05 (m)	
C - Bankfull-Wetted Depth (height from water surface to Bankfull): 23 (cm)	
$V_1 V_2 V_3 V_4 V_5 D_1 D_2 D_3 D_4 D_5 V_4 V_5 D_5 V_6 V_6 V_6 V_6 V_6 V_6 V_6 V_6 V_6 V_6$	
Note: Wetted widths > 5 m, measure a minimum of 5-6 equidistant locations; Wetted widths < 5 m, measure 3-4 equidistant locations.	

# Velocity and Depth

Check appropriate velocity measuring device and fill out the appropriate section in chart below. Distance from shore and depth are required regardless of method:

Velocity Head Rod (or ruler): Velocity Equation (m/s) =  $\sqrt{[2(\Delta D/100) * 9.81]}$ 

Rotary meters: Gurley/Price/Mini-Price/Propeller (Refer to specific meter conversion chart for calculation)

Direct velocity measurements: 
Marsh-McBirney 
Sontek or 
Other\_\_\_\_

Distance from OL	1	2	3	4	5	6	AVG
Distance from Shore (m)	1	2	8	14	5	1/	
Depth (D) (cm)					12	6	
Velocity Head Rod (ruler)			No. I State				
Flowing water Depth (D1) (cm)	-		State State	- Alexander			
Depth of Stagnation (D <sub>2</sub> ) (cm)	38.2	27:1	20.8	15.5	.20.9	23	
	41.5	31	25.2	23	29	244	
Change in depth (ΔD=D <sub>2</sub> -D <sub>1</sub> ) (cm) Rotary meter	3.3	3.9	4.4	75	8.1	14.4	
					0.1	141	
Revolutions							
Time (minimum 40 seconds)							
Direct Measurement or calculation							
Velocity (V) (m/s)	A STATISTICS						

CABIN Field Sheet June 2012

or

0.5

51

0 41

2226



- Roth Millions Site Code: Boros

Sampling Date: (DD/MM/YYYY) 20/04/70 20

#### SUBSTRATE DATA

#### Surrounding/Interstitial Material

Circle the substrate size category for the surrounding material.

Substrate Size Class	Category
Organic Cover	0
< 0.1 cm (fine sand, silt or clay)	Se .
0.1-0.2 cm (coarse sand)	(2)
0.2-1.6 cm (gravel)	3
1.6-3.2 cm (small pebble)	4
3.2-6.4 cm (large pebble)	5
6.4-12.8 cm (small cobble)	6
12.8-25.6 cm (cobble)	7
> 25.6 cm (boulder)	8
Bedrock	9

### **100 Pebble Count & Substrate Embeddedness**

Measure the intermediate axis (100 rocks) and embeddedness (10 rocks) of substrate in the stream bed.

Indicate B for bedrock, S for sand/silt/clay (particles < 0.2 cm) and O for organic material.</li>

• Embeddedness categories (E): Completely embedded = 1, 3/4 embedded, 1/2 embedded, 1/4 embedded, unembedded = 0

Diameter (cm)EDiameter (cm)EDiameter (cm)EDiameter (cm)1 $4.4$ 26 $4$ 51 $4.9$ 76 $8.5$ 210277.552 $8.9$ 7720.13 $9.66$ 28 $4.4$ 53 $4.7$ 785.54 $6.5$ 29 $39.0$ 54 $21$ 79 $18.5$ 5 $6.1$ $30$ $4.5$ $1/2$ 55 $3.9$ $80$ $1.8$ 6 $17$ $31$ $2.9$ $56$ $4$ $81$ $9.7$ 7 $14.5$ $32$ $1.3$ $57$ $4.7$ $82$ $7.5$ 8 $9.7$ $34$ $9.4$ $59$ $3.2$ $84$ $1.8$ 10 $8.6$ $74$ $35$ $5.7$ $60$ $1.8$ $66$ $2.1$ 11 $11$ $36$ $2.8$ $61$ $39$ $86$ $2.1$ 12 $1.4$ $37$ $2.7$ $62$ $14.2$ $87$ $2.5$ 13 $4.9$ $38$ $3.8$ $63$ $6.5$ $88$ $7.7$	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	-
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	3/4
6 $7$ $4.3$ $51$ $7.4$ $60$ $4.2$ $82$ $7.5$ $8$ $9.2$ $33$ $33$ $30$ $58$ $41$ $83$ $3.1$ $9$ $1.5$ $34$ $9.4$ $59$ $3.2$ $84$ $1.8$ $10$ $8.6$ $7.5$ $60$ $1.8$ $0.85$ $4.4$ $10$ $8.6$ $7.5$ $60$ $1.8$ $0.85$ $4.4$ $11$ $12$ $37$ $2.7$ $62$ $14.2$ $87$ $2.5$ $12$ $11.4$ $37$ $2.7$ $62$ $14.2$ $87$ $2.5$	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	
12 4 9 38 32 63 65 88 7.7	
14 4.2 39 3.2 64 11.4 89 4.2	
15 h (40) 9.7 3/4 65 7.8 90 7.5	1/2/
16 0.6 41 3.5 66 7.2 91 9.5	
17 B.b 42 5.7 67 17.3 92 3.1	
18 6.9 43 Sand 68 15.5 93 4.4	
19 22.5 44 41 69 16.7 94 7.6	
20 117 1/2 45 5.6. 170 6.8. 0 95 10.5	
21 9.8 46 Gard M1 17.5 96 7.0.	R
22 118 47 1.7 72 11.5 97 25.	5
23 13,3 48 2 73 5.2 98 9.8	
24 6 49 6.5 74 7.7 99 1.5	
25 4.4 50 20 1 75 10 100 9	1/2

Note: The Wolman D50 (i.e. median diameter), Wolman Dg (i.e. geometric mean diameter) and the % composition of the substrate classes will be calculated automatically in the CABIN database using the 100 pebble data. All 100 pebbles must be measured in order for the CABIN database tool to perform substrate calculations.

CABIN Field Sheet June 2012

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	1. 1.		3	-	
Sampling	Date:	(DD/MM/)	(YYY)	20	109/7

SITE INSPECTION

Site Code:

RANO

Site Inspected by: Bella Millions

#### **Communication Information**

Itinerary left with contact person (include contact numbers)

Contact Person: <u>Ferritory</u> Time checked-in: <u>107.00</u> Form of communication: I radio I cell I satellite I hotel/pay phone I SPOT Phone number: (403) <u>707 - 4969</u>

#### Vehicle Safety

Field Crew

Safety equipment (first aid, fire extinguisher, blanket, emergency kit in vehicle)
 Equipment and chemicals safely secured for transport
 Vehicle parked in safe location; pylons, hazard light, reflective vests if necessary
 Notes:

Shore & Wading Safety

Wading Task Hazard Analysis read by all field staff
Wading Safe Work Procedures read by all field staff
Instream hazards identified (i.e. log jams, deep pools, slippery rocks)
PFD worn
Appropriate footwear, waders, wading belt
Belay used
Notes:

CABIN Field Sheet June 2012



	chol->Copin site - 2000 12 11
ield Crew: Chad Hugher -	Beth Million Site Code: Boyloz
Sampling Date: (DD/MM/YYYY)	2010912020
Occupational Health & S	afety: Site Inspection Sheet completed
PRIMARY SITE DATA	
	DM Local Basin Name: Elk River
River/Stream Name:	Stream Order: (map scale 1:50,000)
Select one: 🛛 Test Site 🏾 Poten	
Geographical Description/1 duad train to brid	Notes: Brt at x-country sti tails, walk abour gle, walk us to drooping spruce.
Forest Field/Pasture	se present) Information Source: <u>Visua(+Mq)s</u> ☐ Agriculture ☐ Residential/Urban ☑ Commercial/Industrial ☐ Other
Forest Field/Pasture	(check one)       Information Source:       Uisual + Maps         □ Agriculture       □ Residential/Urban         □ Commercial/Industrial       □ Other
Location Data	
Latitude:N Longitu	ude:W (DMS or DD)
	GPS Datum: GRS80 (NAD83/WGS84) Other:
Site Location Map Drawing	Bridged/s path to d/s bridg
	averbaging Asprove
Note: Indicate north	lo % Steep eroded Slope
CABIN Field Sheet June 2012	Page 1 of 6

Representation of Berniche

Photos			
1	pstream Dov Substrate (a	vnstream Across Site Aerial View quatic) Other	
REACH DATA (represe	ents 6 times bankfull w	dth)	
1. Habitat Types: <i>(check the</i> Riffle	ose present) Rapids	ht run Dool/Back Eddy	
2. Canopy Coverage: (stand	<i>in middle of stream ai</i> 1-25 % □ 26-50		
3. Macrophyte Coverage: (no 0 %	ot algae or moss, chec 1-25 % □ 26-50	k one) %	
4. Streamside Vegetation: (c/ ☑ ferns/grasses	The second s	deciduous trees	
5. Dominant Streamside Vege	etation: (check one)	deciduous trees	
6. Periphyton Coverage on Su			
<ul> <li>1 - Rocks are not</li> <li>2 - Rocks are sligh</li> <li>3 - Rocks have a r algae (1-5 mm</li> <li>4 - Rocks are very to dark brown a</li> </ul>	slippery, no obvious c htly slippery, yellow-br hoticeable slippery fee thick) slippery (algae can bo lgae (5 mm -20 mm th tly obscured by algae to	olour (thin layer < 0.5 mm thick) own to light green colour (0.5-1 mm thick) I (footing is slippery), with patches of thicker green to brown	
Note: 1 through 5 represent cate		CABIN database.	
BENTHIC MACROINVER			
Habitat sampled: (check one)	17	straight run	
00 μm mesh Kick Net		Preservative used: <u>997 iso</u>	
Person sampling	Chad Highes	Sampled sieved on site using "Bucket Swirling Method":	
ampling time (i.e. 3 min.)	3 min		
o. of sample jars	1	If YES, debris collected for QAQC	

CABIN Field Sheet June 2012

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~ ~ ~ 10



Field Crew:	
WATER CHEMISTRY DATA Time: 12.00 (24 hr clock)         Time zone:           Air Temp:(°C)         Water Temp:(°C)         pH:           Specific Conductance:	
Check if water samples were collected for the following analyses:  TSS (Total Suspended Solids)  Nitrogen (i.e. Total, Nitrate, Nitrite, Dissolved, and/or Ammonia)  Phosphorus (Total, Ortho, and/or Dissolved)  Major Ions (i.e. Alkalinity, Hardness, Chloride, and/or Sulphate)  Note: Determining alkalinity is recommended, as are other analyses, but not required for CABIN assessments.	

#### **CHANNEL DATA**

Slope - Indicate how slope was measured: (check one)

Calculated from map

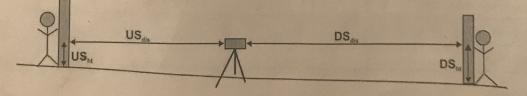
Scale: \_\_\_\_\_\_(Note: small scale map recommended if field measurement is not possible - i.e. 1:20,000). contour interval (vertical distance) \_\_\_\_\_\_(m), distance between contour intervals (horizontal distance) \_\_\_\_\_\_(m) slope = vertical distance/horizontal distance = \_\_\_\_\_\_

OR

#### Measured in field

Circle device used and fill out table according to device: a. Survey Equipment b. Hand Level & Measuring Tape

Measurements	Upstream (U/S)	Downstream(D/S)	Calculation
<sup>a</sup> Top Hairline (T)	TA		
<sup>a</sup> Mid Hairline (ht) OR			
<sup>b</sup> Height of rod	1,208	2.975	
<sup>a</sup> Bottom Hairline (B)			
<sup>b</sup> Distance (dis) OR	30	30 m	US <sub>dis</sub> +DS <sub>dis</sub> =
<sup>a</sup> T-B x 100	<sup>a</sup> US <sub>dis</sub> =T-B	aDS <sub>dis</sub> =T-B	60
Change in height (∆ht)			DSht-USht=
Slope (Δht/total dis)			2.945



CABIN Field Sheet June 2012

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Field Crew: Chad to	ghes + Beth Millions Site Code: Povor	
Sampling Date: (DD/MM/	(YYY) <u>10109/2020</u>	
Widths and Depth ocation at site: - Bankfull Width:11_6 - Bankfull–Wetted Depth (h		a)
1	$\begin{array}{c} \downarrow C \\ \hline \downarrow 1 \\ \downarrow 1 \\ \downarrow 1 \\ \downarrow 1 \\ \downarrow 2 \\ \downarrow 3 \\ \downarrow 4 \\ \downarrow 5 \\ \downarrow 4 \\ \downarrow 4 \\ \downarrow 5 \\ \downarrow 4 \\ \downarrow 4 \\ \downarrow 5 \\ \downarrow 4 \\ \downarrow 5 \\ \downarrow 4 \\ \downarrow 4 \\ \downarrow 5 \\ \downarrow 4 \\ \downarrow 4 \\ \downarrow 5 \\ \downarrow 4 \\ \downarrow 4 \\ \downarrow 5 \\ \downarrow 4 \\ \downarrow 4 \\ \downarrow 5 \\ \downarrow 4 \\ \downarrow 4 \\ \downarrow 5 \\ \downarrow 4 \\ \downarrow 4$	
te: tted widths > 5 m, measure a tted widths < 5 m, measure 3-	ninimum of 5-6 equidistant locations; 4 equidistant locations.	

## Velocity and Depth

Check appropriate velocity measuring device and fill out the appropriate section in chart below. Distance from shore and depth are required regardless of method:

Velocity Head Rod (or ruler): Velocity Equation (m/s) =  $\sqrt{[2(\Delta D/100) * 9.81]}$ 

Rotary meters: Gurley/Price/Mini-Price/Propeller (Refer to specific meter conversion chart for calculation)

Direct velocity measurements: 
Marsh-McBirney 
Sontek or 
Other

	1	2	3	4	5	6	AVG
Distance from Shore (m)	2	4	6	0	10		
Depth (D) (cm)	77	1.110			10		
Velocity Head Rod (ruler)							
Flowing water Depth (D1) (cm)	18.7	3.1	77	28.5	275		
Depth of Stagnation $(D_2)$ (cm)	209	35	21	39	311		
Change in depth ( <b>ΔD=D<sub>2</sub>-D</b> 1) (cm)	2.2	4.9	9	45	15	-	
Rotary meter					1		
Revolutions				and a	1		
Time (minimum 40 seconds)		1					
Direct Measurement or calculation							
Velocity (V) (m/s)							

CABIN Field Sheet June 2012

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Field Crew: Ched Hundre Part

Site Code: Roy 02

Sampling Date: (DD/MM/YYYY) 20/09/2020

# SUBSTRATE DATA

### Surrounding/Interstitial Material

Circle the substrate size category for the surrounding material.

Category
0
1
2
3
4
5
6
7
8
9

# **100 Pebble Count & Substrate Embeddedness**

Measure the intermediate axis (100 rocks) and embeddedness (10 rocks) of substrate in the stream bed.

 Indicate B for bedrock, S for sand/silt/clay (particles < 0.2 cm) and O for organic material.</li> • Embeddedness categories (E): Completely embedded = 1, 3/4 embedded, 1/2 embedded, 1/4 embedded, unembedded = 0

M-llease

- Lin		-	Spint in the	Diameter (cm)	E	I	Diameter (cm)	E	D	liameter (cm)	E
Statement of the statem	Diameter (cm)	E	Contraction of the			51	4.2		76	2.3	
3)	2.8		26	9.7		52	4.1		77	4.1	
2	5.2		27	6.1		53	100		78	12.2	
3	16.5		28	14.8			3.0		79	14.0	
4	11.8		29	1.8	1	54	1.0		80	26.0	114
5	K.5		30	10.1	14	55			81	2.4	
6	5.9	199	31	5.7		56	0		82	4.9	
7	0.9		32	16.1		57	10.5		83	28.0	
8	14.8		33	11.2		58	4.0			3.5	
9	5.7		34	10.2		59	23.5		84	No. 2 - Contraction of the second	.8
(10)	0.7	a	35	11.0		60	9.0		85		10.0
11	10.5		36	6.1		61	27.0		86	5.8	
12	4.7		37	5.6		62	7.0		87	8.5	
13	7.5		38	13.3		63	24.0		88	1.5	
14	8.9		39	27	1 Martin	64	9.2	1	89	10.0	
15		P	(40)	5.0	OS	65	7.0	P. S. A.	(90)	17.0	100
	5.5		41	25		66	Ora		91	16.0	
16	1.5		42	R d		67	9.0	Ø	92	9.6	
17	8.5	-	43	29.5		68	40.0		93	5.4	
18	0.3			- 1F-1		69	24.0	100	94	4.3	
19	4.9	111	44	8.8		(70)	13.0	1.00	95	ID	
20	20.5	1/21	45	1.5		71	11.2		96	2.7	
21	4.5		46	11.5	1		11.0	-	97	150	6
22	10.3		47	16.0	- All	72	11.0		98	8.0	
23	14.0		48	10.3		73	17.0		_	8.0	
24	6.5		49	14.0		74	0.3		99	1.4	1000
25	5.8		(50)	103	1/4	75	0.8	-	100	1 43	(00)
1 Martin Contraction	and the second distance of the second distanc	Concernance of the second	A CO MARK COLOR						1		

Note: The Wolman D50 (i.e. median diameter), Wolman Dg (i.e. geometric mean diameter) and the % composition of the substrate classes will be calculated automatically in the CABIN database using the 100 pebble data. All 100 pebbles must be measured in order for the CABIN database tool to perform substrate calculations.

**CABIN Field Sheet June 2012** 

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Fiel	1	no	100.00	2.	
PIP		1.1	ew	1.5	1000
4. 1. 1. 1. 1.		~ 1	~ ~ ~ ~	100	-

Site Code: Rovor

-

Sampling Date: (DD/MM/YYYY) \_\_\_\_\_\_\_\_\_

# SITE INSPECTION

Site Inspected by: \_\_\_\_\_\_ Beth Millions

#### **Communication Information**

Itinerary left with contact person (include contact numbers)

Contact Person: Kern Whiting Time checked-in: 14:30 Form of communication: Tradio Cell Satellite hotel/pay phone SPOT Phone number: (403) 707-4368

#### **Vehicle Safety**

Safety equipment (first aid, fire extinguisher, blanket, emergency kit in vehicle)

I Equipment and chemicals safely secured for transport

Vehicle parked in safe location; pylons, hazard light, reflective vests if necessary Notes:

#### Shore & Wading Safety

Wading Task Hazard Analysis read by all field staff
Wading Safe Work Procedures read by all field staff
Instream hazards identified (i.e. log jams, deep pools, slippery rocks)
PFD worn
Appropriate footwear, waders, wading belt
Belay used

**CABIN Field Sheet June 2012** 

	AND RULANIE OF AUTOAL
1	Field Crew: Both Millions, Chad Hughes, Ayla Site Code: LIZ-OI Bennett -ched Hype
	Sampling Date: (DD/MM/YYYY) DA/D9/2020 CABW Sile
	Occupational Health & Safety: Site Inspection Sheet completed
	PRIMARY SITE DATA
	CABIN Study Name: EIK River tributares Local Basin Name: Lizard Creek
	River/Stream Name: Lizard GreekStream Order: (map scale 1:50,000)
	Select one: 🗹 Test Site 🗖 Potential Reference Site
	Geographical Description/Notes: Lizard Creek site 1-u/s Hwy 3 bridge
2	
ÿ	
	Surrounding Land Use: (check those present)       Information Source:         Forest       Field/Pasture         Agriculture       Residential/Urban
	Logging     Mining     Commercial/Industrial     Other highway
	Dominant Surrounding Land Use: (check one) Information Source:
	Image: Forest       Image: Field/Pasture       Image: Agriculture       Image: Residential/Urban         Image: Logging       Image: Mining       Image: Commercial/Industrial       Image: Other
1	Latitude:N Longitude:W (DMS or DD)
リ	Latitude:
ſ	
	Site Location Map Drawing
	AN ARA
	000000000000000000000000000000000000
+	THE A A A RECOOL
	I RI I WQ I I I I I I I I I I I I I I I I I
+	bench 000000 FLOW
	A 2 Mark Kicknet
	Kicknet (4)
	Note: Indicate north
	4 1 12

CABIN Field Sheet June 2012

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			Si	ite Code:	LIZ-OL	1º
	Field Crew: BM AB, CH			10		
	Sampling Date: (DD/MM/YYYY)	39/2020	- Jan -	-		the second second
Ð	Photos	Downstream ite (aquatic)	Acros	5 0110	Aerial View	
	REACH DATA (represents 6 times bankt	ull width)				·
	1. Habitat Types: (check those present)	Straight run	Pool/	Back Eddy		
	2. Canopy Coverage: (stand in middle of stree	am and look up, cf 26-50 %        51-		76-100 %		
	3. Macrophyte Coverage: (not algae or moss,	<i>check one)</i> 26-50 %       51	-75 %	76-100 %		
	4. Streamside Vegetation: (check those prese	deciduous t	rees 🗹	coniferous	trees	
	5. Dominant Streamside Vegetation: (check of ferns/grasses Shrubs	deciduous t		coniferous t	rees	
	6. Periphyton Coverage on Substrate: (benthic	algae, not moss,	check one)			
	<ul> <li>1 - Rocks are not slippery, no obv</li> <li>2 - Rocks are slightly slippery, yell</li> <li>3 - Rocks have a noticeable slipper algae (1-5 mm thick)</li> <li>4 - Rocks are very slippery (algae to dark brown algae (5 mm -20</li> <li>5 - Rocks are mostly obscured by long strands (&gt; 20 mm thick)</li> </ul>	ow-brown to light g ry feel (footing is s can be removed w	green colour slippery), with rith thumbnai	(0.5-1 mm t h patches of	thicker green to brow	
	Note: 1 through 5 represent categories entered in	to the CABIN datab			ser mass may nave	8
E	SENTHIC MACROINVERTEBRATE DA		ase.			
	labitat sampled: (check one) 🗹 riffle 🛛 rap		n			
4	00 μm mesh Kick Net	Preserva	tive uport			
P	erson sampling Beth	Sampled	tive used:	robub	AL 997.	
Si	ampling time (i.e. 3 min.)	☐ YES		ite using "Bu	cket Swirling Method	n.
	o, of sample jars 2	If YES, de	ebris collecte	ed for QAQC		
Ту	pical depth in kick area (cm) 25.					
No	te: Indicate if a sampling method other than the rec	ommended 400 µm	mesh kick net	is used.	DNA-03	addition S
CA	ABIN Field Sheet June 2012 Page	2 of 6			CONTRACT	
	X	1	/	8	CHIGAN A RECEIPTION	

Field Crew: Gua 13	11	Site Code:	L12-01			
	(YYYY) _ <u>00/00/2020</u>					
Air Temp: 8.0	DATA Time:	(°C) pH:	3			
Check if water samples were TSS (Total Suspended S Nitrogen (i.e. Total, Nitra Phosphorus (Total, Orth Major Ions (i.e. Alkalinity	e collected for the following an Solids) ite, Nitrite, Dissolved, and/or /	nalyses: Ammonia) Sulphate)				
Calculated from map Scale: contour interval (vertical distance between contou slope = vertical distance OR Measured in field Circle device used and fi	was measured: (check one) (Note: small scale map recom distance) (m ur intervals (horizontal distance) /horizontal distance = Il out table according to devic hand Level & Measuring T	), ce) (m) 	t possible - i.e. 1:20,000).			
Measurements		Downstream(D/S)	Calculation			
<sup>a</sup> T <del>op Hairline (T)</del> <sup>a</sup> Mid Hairline (ht) OR <sup>b</sup> Height of rod	1.34 m.	2.14 m				
<sup>a</sup> Bottom Hairline (B) <sup>b</sup> Distance (dis) OR <sup>a</sup> T-B x 100 Change in height (Δht) <sup>a</sup> Bottom Hairline (B) <sup>b</sup> Distance (dis) OR <sup>a</sup> US <sub>dis</sub> =T-B <sup>a</sup> DS <sub>dis</sub> =T-B <sup>b</sup> DS <sub>dis</sub> =T-B						
Slope (Δht/total dis)			0.016 = 1.67			
	S <sub>dis</sub>	DS <sub>da</sub>				

CABIN Field Sheet June 2012

1



and the second sec	1
Field Crew: AB, BM, CH Site Code: 112-01	- Freedom -
Sampling Date: (DD/MM/YYYY) 0910912020	7
Widths and Depth         Location at site:       Denchmark (Indicate where in sample reach, ex. d/s of kick area)         A - Bankfull Width:       9.0 (m)         B - Wetted Stream Width:       6.9 (m)         C - Bankfull-Wetted Depth (height from water surface to Bankfull):       14.0 (cm)	
Note: Wetted widths > 5 m, measure a minimum of 5-6 equidistant locations; Wetted widths < 5 m, measure 3-4 equidistant locations.	

### Velocity and Depth

Check appropriate velocity measuring device and fill out the appropriate section in chart below. Distance from shore and depth are required regardless of method:

Velocity Head Rod (or ruler): Velocity Equation (m/s) =  $\sqrt{[2(\Delta D/100) * 9.81]}$ 

Rotary meters: Gurley/Price/Mini-Price/Propeller (Refer to specific meter conversion chart for calculation)

Direct velocity measurements: 
Marsh-McBirney 
Sontek or 
Other\_\_\_\_

	1	2	3	4	5	6	AVG		
Distance from Shore (m)	1.0	2.0	3.0	4.0	5.0	6.0			
Depth (D) (cm)	4	9	15.5	22.0	24.D	17.0	and the second		
Velocity Head Rod (ruler)									
Flowing water Depth (D1) (cm)	4	9	15.5	22.D	24.0	(7.0			
Depth of Stagnation $(D_2)$ (cm)	4	9	18.5	25.0	28.0	18.5			
Change in depth ( $\Delta D=D_2-D_1$ ) (cm)		0	3.0	3.0	4.0	1.5			
Rotary meter							N.		
Revolutions	A CONTRACTOR						Park		
Time (minimum 40 seconds)									
irect Measurement or calculation									
Velocity (V) (m/s)	0	0					-		

Field Crew: RU

Site Code: 17-01

Sampling Date: (DD/MM/YYYY) \_ CA109/2070

### SUBSTRATE DATA

### Surrounding/Interstitial Material

Circle the substrate size category for the surrounding material.

gravel

Substrate Size Cl	ass Category
Organic Cover	0
< 0.1 cm (fine sand, silt of	pr.clay) 1
0.1-0.2 cm (coarse sand	2
(0.2-1.6 cm (gravel)	3
1.6-3.2 cm (small pebble	4
3.2-6.4 cm (large pebble	) 5
6.4-12.8 cm (small cobb	le) 6
12.8-25.6 cm (cobble)	7
> 25.6 cm (boulder)	8
Bedrock	9

#### **100 Pebble Count & Substrate Embeddedness**

Measure the intermediate axis (100 rocks) and embeddedness (10 rocks) of substrate in the stream bed.

Indicate B for bedrock, S for sand/silt/clay (particles < 0.2 cm) and O for organic material.</li>
 Embeddedness categories (E): Completely embedded = 1, 3/4 embedded, 1/2 embedded, 1/4 embedded, unembedded = 0

• Er	nbededness categ	ories (t	=): Com	pletely embedded	and a de com	and the second second				Standard (and)	E
Sec.	Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E
1	0.3		26	K		51	11.5		76	1.9	
2	3.2		27	6.4		52	4.6		77	29.0	
3	2.8		28	9.41		53	12.2		78	5.	
4	7.5	1.4.13	29	Bra		54	17.6		79	16.1	
5	26		30)	32	1/4	55	10.0	1	80)	26.3	3/4
6	0,9		31	22	1.51	56	27.3		81	10.9	
7	15		32	4.8	de la compositione	57	10.1		82	19.8	
8	Bra		33	11.9		58	0.1		83	14.0	
9	21		34	60		59	14.5	a secolo	84	19.9	1
10)	1	1	35	5.4		60)	21.2	1	85	1.3	
11	3.9	· · ·	36	4.5	1.1	61	15.6	1 1/2	86	19.5	1
12	11.5		37	28.5		62	22.4		87	27	
13	0.5		38	7.7	1	63	28		88	8.1	
14	23.1		39	36.2	2	64	0		89	54.5	
15	7.7		40)	11.5	Ø	65	51		(90)	1.8	0
16	COLORIDA COL		41	11.1	0	66	10.9		91	8.6	× 1
17	11.4		42	and the second se	Lade	67	10.5		92	203	
18	1.8	and the second second	43	3.8		68	235		93	121	
	32		43	10		69		1000	94	18.8	
19	14.5			21		70	6.	10			
20)	- 2.1	Ø	45	12		And	5.8	10	95	8.4	
21	17.2		46	12.1		71	11.7		96	12.4	1
22	19.9		47	23.2		72	17.6		97	10.0	
23	26.5		48	5.2	and the first	73	11.2		98	7.9	
24	6.6		49	35.9	16.35-	74	39.8		99	15.2	
25	8.7	1	50)	15.5	1/2-	75	31.2		100	8.7	1/4

Note: The Wolman D50 (i.e. median diameter), Wolman Dg (i.e. geometric mean diameter) and the % composition of the substrate classes will be calculated automatically in the CABIN database using the 100 pebble data. All 100 pebbles must be measured in order for the CABIN database tool to perform substrate calculations.

**CABIN Field Sheet June 2012** 

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Field Crew: RMAD	Site Code:
Sampling Date: (DD/MM/YY)	
And the second s	
··· ··· ··· ···	SITE INSPECTION
Site Inspected by: Ala	Bennett
1	the second states in the second states in the second states and the second states and the second states and the
Communication Information	13/0/6
Itinerary left with contact pers	
contact Person: Mike Ber	
	o ☐ cell ☐ satellite ☐ hotel/pay phone ☐ SPOT
hone number: (250) 423	-824+
abiala Cafata	
ehicle Safety	
/	re extinguisher, blanket, emergency kit in vehicle)
Equipment and chemicals saf	fely secured for transport
Vehicle parked in safe locatio	on; pylons, hazard light, reflective vests if necessary
otes:	
nore & Wading Safety	
Wading Task Hazard Analysis	read by all field staff
Wading Safe Work Procedures	s read by all field staff
Instream hazards identified (i.e	e. log jams, deep pools, slippery rocks)
PFD worn	at a first a second as a second as
Appropriate footwear, waders,	wading belt

NA Belay used

Notes:

4/4



Chad Highes CAB INSITE 2070 12-11
Field Crew: Chad Viglies Site Code: 1/203
Sampling Date: (DD/MM/YYY). 15/09/2020
Occupational Health & Safety: Site Inspection Sheet completed
PRIMARY SITE DATA
CABIN Study Name:Local Basin Name:
River/Stream Name: Stream Order: (map scale 1:50,000)
Select one: Test Site D Potential Reference Site
Geographical Description/Notes: Parts at cast end of campground day use area by mordic trail. Follow trail parallel to stream to coordinates on left.
Surrounding Land Use: (check those present) Information Source: Uisual
Forest Field/Pasture Agriculture Residential/Urban
Logging Mining Commercial/Industrial Other canona
Dominant Surrounding Land Use: (check one) Information Source:
Forest       Field/Pasture       Agriculture       Residential/Urban         Logging       Mining       Commercial/Industrial       Other
Location Data
Latitude: 49485840N Longitude: - 115.094551 W (DMS or DD)
Elevation: 1021.78 (fasl or masl) GPS Datum: GRS80 (NAD83/WGS84) Other:
Site Location Map Drawing
15
a scope of the state
0.0000000000000000000000000000000000000
Co Que to to the contraction of
1000
$(\overline{\mathfrak{S}}, \overline{\mathfrak{S}}) \rightarrow (\overline{\mathfrak{S}}, \overline{\mathfrak{S}})$
Note: Indicate north
and the second se
CABIN Field Sheet June 2012 Page 1 of 6 CABIN

Rigidaliseine Bernat

Field Crew: _ Chod His	thes + Beth Millie	Site Code: 11203
Sampling Date: (DD/MM/Y	YYY) 15/08/2020	
Photos	stream 🖾 Downstr	
REACH DATA (represen	ts 6 times bankfull width)	
1. Habitat Types: (check thos	<i>e present)</i> Rapids 🛛 Straight ru	
2. Canopy Coverage: (stand i	n middle of stream and lo -25 % 🔲 26-50 %	bok up, check one)
3. Macrophyte Coverage: (not	algae or moss, check or -25 % 🔲 26-50 %	ne)
4. Streamside Vegetation: (ch		eciduous trees
5. Dominant Streamside Vege		ciduous trees
6. Periphyton Coverage on Su	bstrate: <i>(benthic algae, r</i>	
1 - Rocks are not	slippery, no obvious colo	our (thin layer < 0.5 mm thick)
2 - Rocks are slight	tly slippery, yellow-brow	n to light green colour (0.5.1 mm thigh)
		ooting is slippery), with patches of thicker green to brown
4 - Rocks are very	slippery (algae can be re Igae (5 mm -20 mm thicl	emoved with thumbnail), numerous large clumps of green
<b>5</b> - Rocks are mos	tly obscured by algal ma	t, extensive green, brown to black algal mass may have
iong counter (	20 min diloky	
Note: 1 through 5 represent cate	egories entered into the CA	BIN database.
BENTHIC MACROINVER	TEBRATE DATA	
abitat sampled: ( <i>check one</i> )	riffle I rapids I s	straight run
00 μm mesh Kick Net	The second by	Preservative used: 991. 180
erson sampling	Ched Hughes	Sampled sieved on site using "Bucket Swirling Method":
ampling time (i.e. 3 min.)	3 min	LI YES IN NO
	2	If YES, debris collected for QAQC
o. of sample jars	5	

CABIN Field Sheet June 2012

Page 2 of 6

日日の 日前 三日 一日 二日 二日



111

eld Crew: Chadden	has - Both Millions	Site Code:
ampling Date: (DD/MM/YY	YY) 15/09/2020	-
NATER CHEMISTRY DA	ATA Time: 12:50 (24 hr clock)	Time zone:
Air Temp: <u>21.5</u>	_(°C) Water Temp: _10,1(°C)	рН:
Specific Conductance:	(µs/cm) DO:(mg/L)	Turbidity: <u>0.83</u> (NTU)
Check if water samples were o	collected for the following analyses:	
TSS (Total Suspended Sol	ids)	
Nitrogen (i.e. Total, Nitrate	, Nitrite, Dissolved, and/or Ammonia)	
	and/or Dissolved)	
Phosphorus (Total, Ortho,	anu/or Dissolveu)	

### CHANNEL DATA

Slope - Indicate how slope was measured: (check one)

### □ Calculated from map

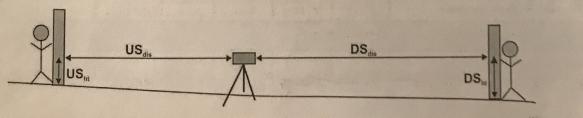
Scale: \_\_\_\_\_\_ (Note: small scale map recommended if field measurement is not possible - i.e. 1:20,000). contour interval (vertical distance) \_\_\_\_\_\_ (m), distance between contour intervals (horizontal distance) \_\_\_\_\_\_ (m) slope = vertical distance/horizontal distance =\_\_\_\_\_\_

### OR

#### Measured in field

Circle device used and fill out table according to device: a. Survey Equipment b. Hand Level & Measuring Tape

Measurements	Upstream (U/S)	Downstream(D/S)	Calculation
<sup>a</sup> Top Hairline (T)		and the second	
<sup>a</sup> Mid Hairline (ht) OR			
Height of rod	1.48 m	1.95	
<sup>a</sup> Bottom Hairline (B)			ALL STREET
<sup>b</sup> Distance (dis) <b>O</b> R	30m	30 m	US <sub>dis</sub> +DS <sub>dis</sub> =
<sup>2</sup> I-B x 100	<sup>a</sup> US <sub>dis</sub> =T-B	<sup>a</sup> DS <sub>dis</sub> =T-B	30+30=60m
Change in height ( $\Delta$ ht)			DSht-USht=
Slope (Δht/total dis)			0.47m160 m = 0.784.





KI/	1		100	/				
		1 . 1 ().		Site	Code:	1203		
Field Crew: Chad Highe	+ Bet	the Milli	ast					
Sampling Date: (DD/MM/YYYY	15/09	12020						
							Take State	
Widths and Depth					la secol	h av d/s a	f kick area	,
Location at site: at trick area							f kick area,	
A - Bankfull Width: <u>8-7</u> (n					/idth:	<u>5 (r</u>		
C - Bankfull-Wetted Depth (height	from water	surface to	Bankfull):	27.1		(C	:m)	
to					A	-		
<u></u>	<u>†</u> †	2 1/3	† V4	+ B-	/			
		2 V3 2 D3	D4	V5 D5 ↓				
Note:	*	-+		-				
Wetted widths > 5 m, measure a minim Wetted widths < 5 m, measure 3-4 equi	um of 5-6 eq distant locati	uidistant loc	ations;			in the	alex rail	
Velocity and Depth								_
Check appropriate velocity measuring shore and depth are required regard	ng device a	nd fill out th	ie appropr	iate section	in chart be	elow. Distar	Ice from	
Velocity Head Rod (or ruler): V	elocity Equ	ation (m/s)	= 1/2(10	/100) * 0 0	11		• • •	
Rotary meters: Gurley/Price/Mir	ii-Price/Pro	peller (Refe	r to specific	meter conv		· · · ·		
Direct velocity measurements:	Marsh-N	AcBirney □	Sontek or	□ Other	STOLET CHAIL	for calculation	on)	
	1	2	3	4	F	1. 1. 1.		
Distance from Shore (m)	1.2	2.4	3.6.	4-8	5	6	AVG	
Depth (D) (cm)	1.3	1.1	0	0	6	7.2		-
Velocity Head Rod (ruler)				<u> </u>	0.9	0.2		ter la la
Flowing water Depth (D <sub>1</sub> ) (cm)	18.4	15.4	0.2	11.0	11/2			
Depth of Stagnation (D <sub>2</sub> ) (cm)	19.7	16.5	0.2	11.0	16.2	24.3		
Change in depth ( $\Delta D=D_2-D_1$ ) (cm)	1.3	-1.1	0	0	0,9	25.0		
Rotary meter						0.7		
Revolutions			,					
Time (minimum 40 seconds)								
Direct Measurement or calculation								
Velocity (V) (m/s)						T		
	State State						A. M. M.	

atter

Site Code: \_\_\_\_\_

Sampling Date: (DD/MM/YYYY) \_15/09/2020

### SUBSTRATE DATA

# Surrounding/Interstitial Material

Circle the substrate size category for the surrounding material.

Substrate Size Class	Category
Organic Cover	0
< 0.1 cm (fine sand, silt or clay)	1
0.1-0.2 cm (coarse sand)	(2)
Q.2-1.6 cm (gravel)	3
1.6-3.2 cm (small pebble)	4
3.2-6.4 cm (large pebble)	5
6.4-12.8 cm (small cobble)	6
12.8-25.6 cm (cobble)	7
> 25.6 cm (boulder)	8
Bedrock	9

### 100 Pebble Count & Substrate Embeddedness

Measure the intermediate axis (100 rocks) and embeddedness (10 rocks) of substrate in the stream bed.

Indicate B for bedrock, S for sand/silt/clay (particles < 0.2 cm) and O for organic material.</li>

• Embeddedness categories (E): Completely embedded = 1, 3/4 embedded, 1/2 embedded, 1/4 embedded, unembedded = 0

	Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E	D	iameter (cm)	E
1	8.5'		26	5.5		51	9.6		76	6.5	
2	2.5		27	4.5		52	9.0		77	2.3	
3	Ora		28	4.3		53	3.0		78	6.0	
4	7.8		29	6.5		54	5.4		79	0.2	
5	8.5		30	2.5	0	55	0.3	J. S.	80	5.5	
6	4.6		31	5.2		56	7.0		81	6.5	
7	10.1		32	8.5		57	1.7		82	6.2	12
8	4.2		33	5.5		58	10.4		83	8,8	-
9	5.9		34	3.8		59	5.7		84	2.6	
10	10.5	Ø	35	4.2		60)	3.6	r	85	7.6	-
11	1.3		36	6.7		61	6.9	0	86	30	
12	9.8		37	5.8	and the	62	9.2		87	14.8	
13	1.5		38	8.3	144	63	3.2		88	9.2	
14	80	in the	39	22.8	14	64	0.5		89	3.7	
15	9.5		40	12	1	65	9.5		90	7.4	0
16	7.0		41	0.2		66	2.1		91	6.0	
17	. 5		42	2.5		67	. 4.6		92	4.4	
18	86		43	2.6		68	35	a series	93	F.1	
19	4.5	~	44	2.6		69	5.6		94	8.0	
20	0.8	Ø	45	2.9		70)	1.6	0	95	5.2	
21	5	1	46	5.4		71	2.2		96	4.9	
22	8		47	7.6		72	7.0		97	6.0	
23	2.5		48	58		73	1.9		98	6.4	
24	8.1		49	3.6		74	4.6		99	5.7	
25	10,2		50	. 4.7	0	75	4.7		(100)	11.6	184

*Note:* The Wolman D50 (i.e. median diameter), Wolman Dg (i.e. geometric mean diameter) and the % composition of the substrate classes will be calculated automatically in the CABIN database using the 100 pebble data. All 100 pebbles must be measured in order for the CABIN database tool to perform substrate calculations.

**CABIN Field Sheet June 2012** 

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Field Crew: Both Millians + Auto Bernett

Site Code: \_\_\_\_\_

Sampling Date: (DD/MM/YYYY) 215/09 /7020

# SITE INSPECTION

Site Inspected by: Ret Millions

### **Communication Information**

Itinerary left with contact person (include contact numbers)

Contact Person: <u>Kevia Whiling</u> Time checked-in: <u>13:30</u> Form of communication: I radio I cell I satellite I hotel/pay phone I SPOT Phone number: (463) <u>702</u> 4868

### **Vehicle Safety**

Safety equipment (first aid, fire extinguisher, blanket, emergency kit in vehicle)
 Equipment and chemicals safely secured for transport
 Vehicle parked in safe location; pylons, hazard light, reflective vests if necessary Notes:

### Shore & Wading Safety

Wading Task Hazard Analysis read by all field staff
 Wading Safe Work Procedures read by all field staff
 Instream hazards identified (i.e. log jams, deep pools, slippery rocks)
 PFD worn
 Appropriate footwear, waders, wading belt
 Belay used

### Notes:



	D/MM/YYYY) <u>22</u>					
Occupational	Health & Safety:	: Site Inspect	ion Sheet o	completed		
PRIMARY SITE D	ATA					
	CBWM					
River/Stream Name:	Morrissey	S	tream Order:	(map scale 1:50,00		internet in the
Select one: 🖬 Test S	ite 🛛 Potential Ref	erence Site				
and the set of the head the	scription/Notes: Rig over creating over creating					Lodgepol
Forest Field	eld/Pasture	] Agriculture		Residential/U	rban	
					Contraction of the local sector	20.20
ominant Surrounding         Forest       Fie         Logging       Mi         ocation Data         atitude: <u>49.35806</u> evation: <u>94163</u> (f	eld/Pasture ning N Longitude: - <u>\ </u>	Agriculture Commercial/Ir	dustrial / (DMS or DE	Residential/U Other		
Forest Field Logging Mi Ocation Data	eld/Pasture [ ning N Longitude: - <u>\ </u> asl <i>or</i> masl) GI	Agriculture Commercial/Ir	dustrial / (DMS or DE	Residential/U Other		1000

CABIN Field Sheet June 2012

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	Site Code: MoRol
Field Crew: Ched Hugher + Both Mil	
Field Crew: <u>Ched Hugher + Rolt Mil</u> Sampling Date: (DD/MM/YYYY) <u>22109/80</u>	20
Samping Dater,	
Photos Dystream Down	
Field Sheet Dystream Substrate (aqu	atic) Other
REACH DATA (represents 6 times bankfull widt	h)
1. Habitat Types: <i>(check those present)</i> ☑ Riffle □ Rapids □ Straight	
2. Canopy Coverage: (stand in middle of stream and	look up, check one)
0 % 🖾 1-25 % 🗆 26-50 %	6 🛛 51-75 % 🔲 76-100 %
3. Macrophyte Coverage: (not algae or moss, check □ 0 % □ 1-25 % □ 26-50 %	
4. Streamside Vegetation: (check those present)	
	deciduous trees
5. Dominant Streamside Vegetation: (check one)	
	deciduous trees
6. Periphyton Coverage on Substrate: (benthic algae,	not moss, check one)
<ul> <li>1 - Rocks are not slippery, no obvious co</li> <li>2 - Rocks are slightly slippery, yellow-bro</li> <li>2 - Rocks are slightly slippery, yellow-bro</li> </ul>	Nour (thin layer < 0.5 mm thick)
3 - Rocks have a noticeable slippery feel	(footing is slippery), with patches of thicker green to brown
	removed with thumbnail), numerous large clumps of green ick)
5 - Rocks are mostly obscured by algal n long strands (> 20 mm thick)	nat, extensive green, brown to black algal mass may have
Note: 1 through 5 represent categories entered into the	CABIN database.
BENTHIC MACROINVERTEBRATE DATA	
Habitat sampled: (check one) 🔀 riffle 🔲 rapids 🗌	straight run
400 μm mesh Kick Net	Preservative used: 99% :50
Person sampling Chad Hughes	Sampled sieved on site using "Bucket Swirling Method":
Sampling time (i.e. 3 min.)	
No. of sample jars	If YES, debris collected for QAQC
Typical depth in kick area (cm)	

Note: Indicate if a sampling method other than the recommended 400  $\mu m$  mesh kick net is used.

< U 20 .0



Field Crew: Marchander + Belly Millions Site Code: MoRoj
Sampling Date: (DD/MM/YYYY) <u>37/09/7678</u>
WATER CHEMISTRY DATA Time: 12:30 (24 hr clock) Time zone:
Air Temp:(°C) Water Temp:11.5(°C) pH:3.23
Specific Conductance: 197.1 (µs/cm) DO:(mg/L) Turbidity: 1.14 (NTU)
Check if water samples were collected for the following analyses: TSS (Total Suspended Solids) Nitrogen (i.e. Total, Nitrate, Nitrite, Dissolved, and/or Ammonia)
Phosphorus (Total, Ortho, and/or Dissolved)
Major Ions (i.e. Alkalinity, Hardness, Chloride, and/or Sulphate)
Note: Determining alkalinity is recommended, as are other analyses, but not required for CABIN assessments.

### CHANNEL DATA

Slope - Indicate how slope was measured: (check one)

□ Calculated from map

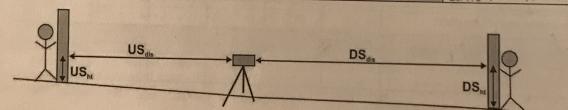
Scale: \_\_\_\_\_\_ (Note: small scale map recommended if field measurement is not possible - i.e. 1:20,000). contour interval (vertical distance) \_\_\_\_\_\_ (m), distance between contour intervals (horizontal distance) \_\_\_\_\_\_ (m) slope = vertical distance/horizontal distance = \_\_\_\_\_\_

#### OR

### Measured in field

Circle device used and fill out table according to device: a. Survey Equipment b. Hand Level & Measuring Tape

Measurements	Upstream (U/S)	Downstream(D/S)	Calculation
<sup>a</sup> Top Hairline (T)	Participal Participad Participad Participad Participad Participad		
<sup>a</sup> Mid Hairline (ht) OR	A State of the second s		
<sup>b</sup> Height of rod	1.21	2.26m	
<sup>a</sup> Bottom Hairline (B)			
<sup>b</sup> Distance (dis) OR	30m	30 m	US <sub>dis</sub> +DS <sub>dis</sub> =
<sup>a</sup> T-B x 100	30∽ ªUS <sub>dis</sub> =T-B	<sup>a</sup> DS <sub>dis</sub> =T-B	US <sub>dis</sub> +DS <sub>dis</sub> = 60 ~~
Change in height (Δht)			DSht-USht=
Slope (Δht/total dis)			1.05
			00175-21.75%



CABIN Field Sheet June 2012

Page 3 of 6



Sampling Date: (DD/MM/YYYY								
Widths and Depth								
Location at site: @kckent o	irea						of kick are	a)
A - Bankfull Width: <u>11,9</u> (n	ı)		B - Wetted	Stream V	Vidth: <u></u>	72	_(m)	
C - Bankfull-Wetted Depth (height	from water	surface to	Bankfull): _	67			_(cm)	
					A	-		2.16
10	<u>†</u> <u>†</u>	t	+	T-B-	/			7.88
		2 V3 D3	V4 1 D4 1	V5 05				
Note: Wetted widths > 5								
Wetted widths > 5 m, measure a minim Wetted widths < 5 m, measure 3-4 equi	um of 5-6 eq idistant locati	uidistant loc	ations;					Las Carlos
Check appropriate velocity measuring the second shore and depth are required regard <b>Velocity Head Rod (or ruler)</b> : Velocity Head Rod (or ruler): Velocity Head Rod (or ruler)	ng device a dless of met /elocity Equ	nd fill out th hod: ation (m/s)	= √ [ 2(∆D)	(100) * 9.8	11			
Velocity and Depth Check appropriate velocity measuri shore and depth are required regard Velocity Head Rod (or ruler): V Rotary meters: Gurley/Price/Min Direct velocity measurements:	ng device a dless of met /elocity Equ ni-Price/Pro □ Marsh-M	nd fill out th hod: ation (m/s) peller (Refe ∕IcBirney □	= $\sqrt{2(\Delta D)}$ er to specific	(100) * 9.8 meter conv	1]			
Check appropriate velocity measuring shore and depth are required regard Velocity Head Rod (or ruler): V Rotary meters: Gurley/Price/Min	ng device a dless of met /elocity Equ ni-Price/Pro	nd fill out th hod: lation (m/s) peller (Refe AcBirney 2	= $\sqrt{2(\Delta D)}$ er to specific Sontek or 3	(100) * 9.8 meter conv	1]			
Check appropriate velocity measuri shore and depth are required regard Velocity Head Rod (or ruler): V Rotary meters: Gurley/Price/Min Direct velocity measurements:	ng device a dless of met /elocity Equ ni-Price/Pro □ Marsh-M	nd fill out th hod: ation (m/s) peller (Refe ∕IcBirney □	= √ [ 2(∆D/ er to specific I Sontek or	′100) * 9.8 <sup>meter</sup> conv □ Other_	1] rersion char	t for calcula	ation)	
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100 00 0

Site Code: MoROL

Sampling Date: (DD/MM/YYYY) \_\_\_\_\_\_\_

### SUBSTRATE DATA

### Surrounding/Interstitial Material

Circle the substrate size category for the surrounding material.

Substrate Size Class	Category
Organic Cover	0
< 0.1 cm (fine sand, silt or clay)	1
0.1-0.2 cm (coarse sand)	(2)
0.2-1.6 cm (gravel)	3
1.6-3.2 cm (small pebble)	4
3.2-6.4 cm (large pebble)	5
6.4-12.8 cm (small cobble)	6
12.8-25.6 cm (cobble)	7
> 25.6 cm (boulder)	8
Bedrock	9

### **100 Pebble Count & Substrate Embeddedness**

· Measure the intermediate axis (100 rocks) and embeddedness (10 rocks) of substrate in the stream bed.

• Indicate B for bedrock, S for sand/silt/clay (particles < 0.2 cm) and O for organic material.

	Diameter (cm)	Е		Diameter (cm)	E	A Contraction	Diameter (cm)	E	and in more of	Diameter (cm)	E
1	8.0		26	1.7		51	2.7		76	29	
2	4.0		27	2.5	Service of	52	3.2		77	13.9	
3	1.5		28	18.4		53	21.0		78	20,5	
4	95		29	17.2		54	1.5		79	10.4	
5	19.0		30)	6.4	47	55	25		80	10.5	14
6	3.0		31	0.6		56	8.8		81	3.5	1
7	6.5		32	15.6		57	10.0		82	6.1	
8	11.4		33	1.7		58	4.6		83	15,4	
9	7.6	and the second	34	18.7		59	3.7		84	11.9	
(10)	23.4	1/2	35	5.0	1. 6 6	60)	2.2	0	85	12.1	
11	4.1	Sec.	36	9.8	4 5 3	61	22.0		86	11.8	
12	5.9		37	10.2		62	15.8		87	1.6	
13	0.4		38	8.2	and and	63	5.3		88	16.3	
14	4.6		39	17.3	1700	64	13.8		89	9.8	
15	7.5		40	35.4	3/4	65	16.0		90	2.6	1/4
16	15		41	28.7		66	31.6		91	8.2	
17	0.7		42	2.5		67	19.8		92	18.1	
18	13.2		43	12.7		68	27.3		93	145	
19	12.0		44	3.5		69	18.9	1	94	6.0	1000
20	3.6	1/4	45	11.7		(70)	1.9	0	95	1.1	
21	11.5		46	6.7		71	14.6	-	96	8.7	
22	17.5		47	14.3		72	Sand	2.50	97	10.8	
23	6.3	N	48	2.7		73	6.2		98	6.0	
24	18.4		49	12.6		74	26.8		99	13.4	
25	16.2		(50)	12.1	0	75	8.4		100	9.2	1/4

• Embeddedness categories (E): Completely embedded = 1, 3/4 embedded, 1/2 embedded, 1/4 embedded, unembedded = 0

Profil

*Note:* The Wolman D50 (i.e. median diameter), Wolman Dg (i.e. geometric mean diameter) and the % composition of the substrate classes will be calculated automatically in the CABIN database using the 100 pebble data. All 100 pebbles must be measured in order for the CABIN database tool to perform substrate calculations.



Field Crew: Chad Hughes + Both Millions

Site Code: MoRON

Sampling Date: (DD/MM/YYYY) 22/09/2020

## SITE INSPECTION

Site Inspected by: <u>Ball Millions</u>

#### **Communication Information**

Itinerary left with contact person (include contact numbers)

Contact Person: <u>Keyin Whiting</u> Time checked-in: <u>Keyin</u> Form of communication: I radio I cell is satellite I hotel/pay phone I SPOT Phone number: (409) 702-4869

### **Vehicle Safety**

Safety equipment (first aid, fire extinguisher, blanket, emergency kit in vehicle)

Equipment and chemicals safely secured for transport

Vehicle parked in safe location; pylons, hazard light, reflective vests if necessary

Notes: walk under train bridge

### Shore & Wading Safety

Wading Task Hazard Analysis read by all field staff
Wading Safe Work Procedures read by all field staff
Instream hazards identified (i.e. log jams, deep pools, slippery rocks)
PFD worn
Appropriate footwear, waders, wading belt
Belay used

Notes:

CABIN Field Sheet June 2012



	11 21 0606
	Field Crew: ched Hoghes Bath Millions Site Code: MOROZ
	Sampling Date: (DD/MM/YYYY) 22/09/2020
	Occupational Health & Safety: Site Inspection Sheet completed
	PRIMARY SITE DATA
	CABIN Study Name: CBWM Local Basin Name: Elk Rijer
	River/Stream Name: MarrieseyStream Order: (map scale 1:50,000)
	Select one: Test Site D Potential Reference Site
	Geographical Description/Notes: Prive on Morrissey Forest Service Road with 3rd bridge, part @ bridge, Walk d/s from bridge 50 m. * Noter want 4 what
	drive, high déarance véhicle
	Surrounding Land Use: (check those present) Information Source:
	Forest       Field/Pasture       Agriculture       Residential/Urban         Logging       Mining       Commercial/Industrial       Other
	Dominant Surrounding Land Use: (check one) Information Source:
	Forest       Field/Pasture       Agriculture       Residential/Urban         Logging       Mining       Commercial/Industrial       Other
	Location Data
	Latitude: <u>49.42376</u> N Longitude: - <u>114.91049</u> W (DMS of DD)
	Elevation: 1529.35 (fasl or mas) GPS Datum: GRS80 (NAD83/WGS84) Other:
	Site Location Map Drawing
	2 A sprice
	TN / shouts / to
	N Start skibs
	T 2 Nov [ D
Ļ	Note: Indicate north A A A A A A A



# BENTHIC MACROINVERTEBRATE DATA

Habitat sampled: (check one) I riffle rapids straight run

400 μm mesh Kick Net	
Person sampling	Chad Highes
Sampling time (i.e. 3 min.)	3 min
No. of sample jars	
Typical depth in kick area (cm)	toom

Preservative used:	99% 130
--------------------	---------

Sampled sieved on site using "Bucket Swirling Method":

If YES, debris collected for QAQC

Note: Indicate if a sampling method other than the recommended 400  $\mu$ m mesh kick net is used.



Field Crew:	and Hughes + Beth Millions - Site Code: MOROZ
Sampling Date:	(DD/MM/YYYY) _22/09/2020
WATER CHE	MISTRY DATA Time: 09:30 (24 hr clock) Time zone: MT
Air Temp:	(°C) Water Temp: <u>7.5</u> (°C) pH: <u>7.64</u>
Specific Conduct	ance: <u>69.9 (</u> µs/cm) DO: <u>"5" (</u> mg/L) Turbidity: <u>0.36 (</u> NTU)
Check if water sa	mples were collected for the following analyses:
	uspended Solids)
Nitrogen (i.e.	Total, Nitrate, Nitrite, Dissolved, and/or Ammonia)
Phosphorus (	Total, Ortho, and/or Dissolved)
Major Ions (i.e	e. Alkalinity, Hardness, Chloride, and/or Sulphate)
Note: Determining :	alkalinity is recommended, as are other analyses, but not required for CABIN assessments.

### CHANNEL DATA

Slope - Indicate how slope was measured: (check one)

□ Calculated from map

Scale: \_\_\_\_\_\_\_(Note: small scale map recommended if field measurement is not possible - i.e. 1:20,000). contour interval (vertical distance) \_\_\_\_\_\_\_(m), distance between contour intervals (horizontal distance) \_\_\_\_\_\_\_(m) slope = vertical distance/horizontal distance = \_\_\_\_\_\_

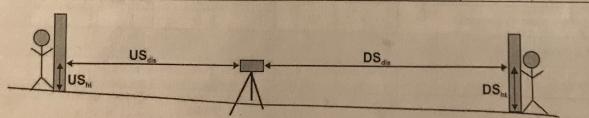
OR

### Measured in field

Circle device used and fill out table according to device:

a. Survey Equipment b. Hand Level & Measuring Tape

Measurements	Upstream (U/S)	Downstream(D/S)	Calculation
<sup>a</sup> Top Hairline (T)	the second s	Part Part	
<sup>a</sup> Mid Hairline (ht) OR			
<sup>b</sup> Height of rod	1.30	2.20	
<sup>a</sup> Bottom Hairline (B)		Company and the second second	
<sup>b</sup> Distance (dis) OR	30	30	US <sub>dis</sub> +DS <sub>dis</sub> =
<sup>a</sup> T-B x 100	<sup>a</sup> US <sub>dis</sub> =T-B	<sup>a</sup> DS <sub>dis</sub> =T-B	60
Change in height (Δht)		A state of the second stat	DS <sub>ht</sub> -US <sub>ht</sub> =
Slope (∆ht/total dis) ≻\@			1.67%



**CABIN Field Sheet June 2012** 



Field Onen al 1.1 1	6	AL MAS	200:11:	Site	Code:	hoko	1	
Field Crew: _ Chad Hugh					and fre			
Sampling Date: (DD/MM/YYYY)	221091	12070						
Widths and Depth					7 17 1	100		
Location at site: At kicknet			Indicate wh	ere in sar	nple reach	n, ex. d/s c	of kick are	a) 6.16
A - Bankfull Width: 10.56 (m			B - Wetted S					1.5
C - Bankfull-Wetted Depth (height								
to								
	† † V1 V2 D1 D2	† V3 D3	1 V4 V D4 D	55				
				/				
Note: Wetted widths > 5 m massive in the	-	+						
Wetted widths > 5 m, measure a minim Wetted widths < 5 m, measure 3-4 equi	um of 5-6 equidistant location	uidistant loca	ations;			×		
/elocity and Depth					and the	1 1 1	- 11	
heck appropriate velocity monouri	na device or	ad fill out th						
hore and donth are main	ing device al	iu illi out th	e appropria	te section	in chart be	elow Dista	nce trom	
	and of the the	nou.				elow. Dista	nce from	
Check appropriate velocity measuring shore and depth are required regard Velocity Head Rod (or ruler): V	/elocity Equ	ation (m/s)	= √ [ 2(∆D/1	00) * 9.81	]			
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Velocity Head Rod (or ruler): V Rotary meters: Gurley/Price/Min Direct velocity measurements:	/elocity Equa	ation (m/s) peller (Refe ∕IcBirney □	= $\sqrt{2} (\Delta D/1)$ or to specific n Sontek or [	00) * 9.81 neter conve ] Other 4	] ersion chart	for calculatio	on)	
Velocity Head Rod (or ruler): V Rotary meters: Gurley/Price/Min Direct velocity measurements: stance from Shore (m) epth (D) (cm)	/elocity Equa ni-Price/Proj : □ Marsh-N	ation (m/s) peller (Refe ∕IcBirney □	= $\sqrt{2} (\Delta D/1)$ or to specific n Sontek or [ 3	00) * 9.81 neter conve ] Other 4	] ersion chart	for calculatio	on)	
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Velocity Head Rod (or ruler): V Rotary meters: Gurley/Price/Min Direct velocity measurements: istance from Shore (m) epth (D) (cm) elocity Head Rod (ruler) Flowing water Depth (D <sub>1</sub> ) (cm) Depth of Stagnation (D <sub>2</sub> ) (cm)	/elocity Equa ni-Price/Proj :	ation (m/s) peller (Refe AcBirney [] 2 1.5 8.9	$= \sqrt{2(\Delta D/1)}$ or to specific n Sontek or [ 3 2.25 6.0	00) * 9.81 heter conve ] Other 4  4 	] ersion chart 5 3.75	for calculation	on)	
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Velocity Head Rod (or ruler): V Rotary meters: Gurley/Price/Min Direct velocity measurements: istance from Shore (m) epth (D) (cm) elocity Head Rod (ruler) Flowing water Depth (D <sub>1</sub> ) (cm) Depth of Stagnation (D <sub>2</sub> ) (cm) Change in depth (ΔD=D <sub>2</sub> -D <sub>1</sub> ) (cm)	/elocity Equa ni-Price/Proj :	ation (m/s) peller (Refe AcBirney [] 2 1.5 8.9	$= \sqrt{2(\Delta D/1)}$ or to specific n Sontek or [ 3 2.25 6.0	00) * 9.81 heter conve ] Other 4  4 	] ersion chart 5 3.75	for calculation	on)	
Velocity Head Rod (or ruler): V Rotary meters: Gurley/Price/Min Direct velocity measurements: istance from Shore (m) epth (D) (cm) elocity Head Rod (ruler) Flowing water Depth (D <sub>1</sub> ) (cm) Depth of Stagnation (D <sub>2</sub> ) (cm) Change in depth (ΔD=D <sub>2</sub> -D <sub>1</sub> ) (cm) tary meter Revolutions	/elocity Equa ni-Price/Proj :	ation (m/s) peller (Refe AcBirney [] 2 1.5 8.9	$= \sqrt{2(\Delta D/1)}$ or to specific n Sontek or [ 3 2.25 6.0	00) * 9.81 heter conve ] Other 4  4 	] ersion chart 5 3.75	for calculation	on)	
Velocity Head Rod (or ruler): V Rotary meters: Gurley/Price/Min Direct velocity measurements: istance from Shore (m) epth (D) (cm) elocity Head Rod (ruler) Flowing water Depth (D <sub>1</sub> ) (cm) Depth of Stagnation (D <sub>2</sub> ) (cm) Change in depth (ΔD=D <sub>2</sub> -D <sub>1</sub> ) (cm) tary meter Revolutions Time (minimum 40 seconds) ect Measurement or calculation	/elocity Equani-Price/Prop :  Marsh-W 1 0.75 1 1.2 1.2	ation (m/s) peller (Refe AcBirney [] 2 1.5 8.9 9.7	$= \sqrt{\left[ 2(\Delta D) \right]}$	00) * 9.81 heter conve Other 4	] ersion chart 1	for calculation	On)	
Velocity Head Rod (or ruler): V Rotary meters: Gurley/Price/Min Direct velocity measurements: istance from Shore (m) epth (D) (cm) elocity Head Rod (ruler) Flowing water Depth (D <sub>1</sub> ) (cm) Depth of Stagnation (D <sub>2</sub> ) (cm) Change in depth (ΔD=D <sub>2</sub> -D <sub>1</sub> ) (cm) tary meter Revolutions Time (minimum 40 seconds) ect Measurement or calculation	/elocity Equani-Price/Prop :  Marsh-W 1 0.75 1 1.2 1.2	ation (m/s) peller (Refe AcBirney [] 2 1.5 8.9 9.7	$= \sqrt{\left[ 2(\Delta D) \right]}$	00) * 9.81 heter conve Other 4	] ersion chart 1	for calculation	On)	12 9.0
Velocity Head Rod (or ruler): V Rotary meters: Gurley/Price/Min Direct velocity measurements: istance from Shore (m) epth (D) (cm) elocity Head Rod (ruler) Flowing water Depth (D <sub>1</sub> ) (cm) Depth of Stagnation (D <sub>2</sub> ) (cm) Change in depth (ΔD=D <sub>2</sub> -D <sub>1</sub> ) (cm) tary meter Revolutions Time (minimum 40 seconds) ect Measurement or calculation	<pre>/elocity Equa ni-Price/Prop : □ Marsh-M 1 0.75 1.2 1.2 1.2 9.8 4 9.8 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4</pre>	ation (m/s) peller (Refe $AcBirney \square$ 2 1.5 8.9 9.7 9.7 0 0 ( $t_2$ ) 0 0 ( $t_2$ ) 0 0 ( $t_2$ ) 0 0 ( $t_2$ ) 0 0 ( $t_2$ ) 0 0 ( $t_2$ ) 0 0 0 0 0 0 0 0 0 0 0 0 0	$= \sqrt{\left[ 2(\Delta D/1) + 1 \right]}$ The specific matrix is some k or provide the speci	00) * 9.81 heter conve Other 4	] ersion chart 1	for calculation	On)	1290

Site Code: \_\_\_\_\_\_

Sampling Date: (DD/MM/YYYY) 22109 120 20

### SUBSTRATE DATA

Field Crew:

#### Surrounding/Interstitial Material

Circle the substrate size category for the surrounding material.

Substrate Size Class	Category
	0
Organic Cover	1
< 0.1 cm (fine sand, silt or clay)	2
0.1-0.2 cm (coarse sand)	
0.2-1.6 cm (gravel)	(3)
1.6-3.2 cm (small pebble)	4
3.2-6.4 cm (large pebble)	5
6.4-12.8 cm (small cobble)	6
6.4-12.8 Cm (smail couble)	7
12.8-25.6 cm (cobble)	8
> 25.6 cm (boulder)	0
Bedrock	9
Bedrock	

### **100 Pebble Count & Substrate Embeddedness**

Measure the intermediate axis (100 rocks) and embeddedness (10 rocks) of substrate in the stream bed.

Indicate B for bedrock, S for sand/silt/clay (particles < 0.2 cm) and O for organic material.</li>

Embeddedness categories (E): Completely embedded = 1, 3/4 embedded, 1/2 embedded, 1/4 embedded, unembedded = 0

2 rolling

• Eml	bededness catego	ones (E	). Com	pletely embedded	and the second sec			E	Γ	Diameter (cm)	E
	Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)		76	2.7	
1	9.0		26	1.8		51	9.5		77		
2	1.8		27	6.8		52	4			33.5	
3	0.3		28	5.6	Reci	53	10.1		78	31.0	
4	11.6		29	14.9		54	30.0		79	5.4	3/4
5	0.7	1.21 2.2	30)	9.9	3/4	55	12.0	1	80	11.0	74
6	11.2		31	11.4		56	1.0		81	7.0	
7	13.8		32	89		57	42.4		82	8.8	
8	24.0		33	6.0		58	11.7		83	Sand	
9	2.2		34	97		59	32.5	7.00	84	16.5	
10		or	35	75		60	22.7	3/4	85	9.6	17
11	11.0	10	36	36.5		61	24.7	1	86	5.0	
12	1. 1. 1		37	69.9	1	62	15.9		87	73.5	
	74.5		38	011		63	17.0		88	1.1	
13	12.5		39	28.5	1	64	81.5		89	6.5	
14	2.3		40	2.7	1	65	and the second se		90	16.0	1/4
15	5.8			9.8	1	66	50	1	91	2.2	1
16	14.5		41	5.8	-		6.4	-	92	In the second	
17	4.9		42	7.8		67	9.5	-		11.7	
18	1.6		43	7.9		68	14.4		93	2.7	
19	11.5		44	9.0	- alter	69	4.5		94	1.3	-
(20)	7.8	3/4	45	9.5	No. Sta	70	10	1/2	95	12.6	
21	19.8		46	9.5		71	5		96	25.5	1 1
22	11.7		47	8.9		72	38.7		97	2.5	
23	21.9		48	30.0		73	27.9		98	0.9	
24	7.0		49	3.6		74	31.8		99	15.2	
25	4.9		(50)	1/2	Ø	75	6.3		100	15.2	1/2
	1 11	1	11	100-	Red	_	1			12.6	-1AC

Note: The Wolman D50 (i.e. median diameter), Wolman Dg (i.e. geometric mean diameter) and the % composition of the substrate classes will be calculated automatically in the CABIN database using the 100 pebble data. All 100 pebbles must be measured in order for the CABIN database tool to perform substrate calculations.

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Site Code: Mores

Sampling Date: (DD/MM/YYYY) 22/09/2020

# SITE INSPECTION

ant

Site Inspected by: Back Millions

Field Crew: \_\_\_\_

#### **Communication Information**

Itinerary left with contact person (include contact numbers)

Contact Person: Kein Whiting	Time checked-in: 03:30
Form of communication:	otel/pay phone SPOT
Phone number: (403) 707 - 4868	

#### **Vehicle Safety**

Safety equipment (first aid, fire extinguisher, blanket, emergency kit in vehicle)

Equipment and chemicals safely secured for transport

Vehicle parked in safe location; pylons, hazard light, reflective vests if necessary Notes:

### Shore & Wading Safety

Wading Task Hazard Analysis read by all field staff
 Wading Safe Work Procedures read by all field staff
 Instream hazards identified (i.e. log jams, deep pools, slippery rocks)
 PFD worn
 Appropriate footwear, waders, wading belt
 Belay used

Notes:

**CABIN Field Sheet June 2012** 



Field Crown (C. II)	
	Chad Hughes Agla Benet Site Code: <u>COLOL</u>
Sampling Date: (DD/MM/YYYY	) _ OR / OR / 786
Occupational Health & S	Safety: Site Inspection Sheet completed
PRIMARY SITE DATA	
CABIN Study Name: Elk Rover	
River/Stream Name:	CreekStream Order: (map scale 1:50,000)
Select one: Test Site D Poter	ntial Reference Site
Geographical Description/	Notes: COL-01 site between ParkAve+ train b
ACCESS VIA END OF ELK I	UIEW CRESENT
	Dise present) Information Source: <u>USUAL</u> Agriculture B Residential/Urban
Logging Mining	Commercial/Industrial Other <u>trail</u> train bridge
	(check one) Information Source: <u>VI SUAL</u> Agriculture Residential/Urban
□ Forest □ Field/Pasture □ Logging □ Mining	Agriculture     Agriculture       Commercial/Industrial     Other
Location Data	
	tude: - <u>IIS, @6644</u> W/ (DMS of DD)
	GPS Datum: GRS80 (NAD83/WGS84) Other:
Site Location Map Drawing	G.A. House
	benchmark kickingt
	NQ 7 7 7 7 1 1
0000	
060000	
100000	0000000
and from the me	00000
602207	stream bed Streams
628002	A STATE AND
Law Color	Solo O Shreubs



	2101
	Site Code: <u>COL-OI</u>
Field Crew: BM CH-AB	
Field Crew: <u>BM</u> CH -FIE Sampling Date: (DD/MM/YYYY) <u>08/09/20</u>	20
Sampling Date. (Define	
Photos Upstream Downstree	
Field Sheet Upstream Substrate (aquation	
REACH DATA (represents 6 times bankfull width)	
1. Habitat Types: (check those present)	
2. Canopy Coverage: (stand in middle of stream and loo □ 0 % ☑ 1-25 % □ 26-50 %	ok up, check one)
3. Macrophyte Coverage: (not algae or moss, check one ↓ 0 % ↓ 1-25 % ↓ 26-50 %	
	□ 51-75 % □ 76-100 %
4. Streamside Vegetation: ( <i>check those present</i> ) ☑ ferns/grasses ☑ shrubs ☑ deci	iduous trees
5. Dominant Streamside Vegetation: (check one)	
	iduous trees
6. Periphyton Coverage on Substrate: (benthic algae, not	
<ul> <li>1 - Rocks are not slippery, no obvious colour</li> <li>2 - Rocks are slightly slippery, usily</li> </ul>	r (thin layer < 0.5 mm thick)
HOCKS are Signily Silpperv Vellow-brown	to light
algae (1-5 mm thick)	oting is slippery), with patches of thicker green to brown
to dark brown algae (5 mm 20 mm be rem	noved with thumbnail), numerous large clumps of group
5 - Rocks are mostly obscured by algal mot	and the starge clumps of green
long strands (> 20 mm thick)	extensive green, brown to black algal mass may have
Note: 1 through 5 represent categories entered into the CABI	IN Jacob
BENTHIC MACROINVERTEBRATE DATA	N database.
Habitat sampled ( )	additional Zjars (3x)
Habitat sampled: (check one) riffle rapids str.	aightrup & 3 reps of eDNA
i milliosh kick Net	w antimeeze
Person sampling Chad Hughes s Sampling time (i.e. 3 min )	reservative used: <u>997. isoprophy</u> alcohol
Sampling time (i.e. 3 min.)	ampled sieved on site using "Bucket Swiding Mathe
no. of sample jars	
Typical depth in kick area (cm)	YES, debris collected for QAQC
Note: Indicate if a sampling method other than the recommended	400 um mesh Rick net is used
	A Martine Horis used.

CABIN Field Sheet June 2012

NEI

Page 2 of 6



Field Crew:       BM       CIL       AB       Site Code:         Sampling Date:       (DD/MM/YYYY)       08/09/2020       Site Code:	<u>COL-01</u>
WATER CHEMISTRY DATA Time: 13:30 (24 hr clock) Time zone:         Air Temp:14.0(°C) Water Temp: 12.2(°C) pH: <u>8.33</u> Specific Conductance: <u>2495 (µs/cm)</u> DO: <u>7.0 (mg/L)</u> Turbidity:         Check if water samples were collected for the following analyses:         Image: TSS (Total Suspended Solids)         Image: Nitrogen (i.e. Total, Nitrate, Nitrite, Dissolved, and/or Ammonia)	
	total + <u>dissolved</u> metals Nassessments.

### CHANNEL DATA

Slope - Indicate how slope was measured: (check one)

□ Calculated from map

Scale: \_\_\_\_\_\_(Note\_small scale map recommended if field measurement is not possible - i.e. 1:20,000). contour interval (vertical distance) \_\_\_\_\_\_ (m), distance between contour intervals (horizontal distance) \_\_\_\_\_\_ (m)

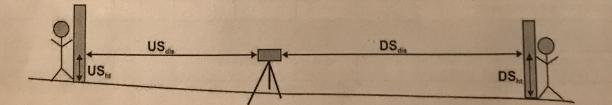
slope = vertical distance/horizontal distance =\_

### OR

### Measured in field

Circle device used and fill out table according to device: a. Survey Equipment b Hand Level & Measuring Tape

Measurements	Upstream (U/S)	Downstream(D/S)	Calculation
<sup>a</sup> Top Hairline (T)	A CARLEN AND AND A CARLEN AND A C		
<sup>a</sup> Mid Hairline (ht) OR		And a hard have	
<sup>b</sup> Height of rod	in the state		
<sup>a</sup> Bottom Hairline (B)	a state of the sta	and the armanis	
<sup>b</sup> Distance (dis) OR			US <sub>dis</sub> +DS <sub>dis</sub> =
<sup>a</sup> T-B x 100	<sup>a</sup> US <sub>dis</sub> =T-B	<sup>a</sup> DS <sub>dis</sub> =T-B	
Change in height (Δht)			DS <sub>ht</sub> -US <sub>ht</sub> =
Slope (Δht/total dis)			0.01



CABIN Field Sheet June 2012



Field Crew: BM, C Sampling Date: (DD/MM	1, AB	12020		ode: <u>COL</u>	
Widths and Depth Location at site: A - Bankfull Width: <u>19.4</u> C - Bankfull–Wetted Depth	(m)	B - W	ate where in samp etted Stream Widt ull):2Q	ble reach, ex. d/s th: <u>8-4</u>	of kick area) _(m) _(cm)
lote: Vetted widths > 5 m, measure		$ \begin{array}{c} \uparrow \\ V3 \\ D3 \\ \downarrow \\ \downarrow$	/		

### Velocity and Depth

Check appropriate velocity measuring device and fill out the appropriate section in chart below. Distance from shore and depth are required regardless of method:

Velocity Head Rod (or ruler): Velocity Equation (m/s) =  $\sqrt{[2(\Delta D/100) * 9.81]}$ 

Rotary meters: Gurley/Price/Mini-Price/Propeller (Refer to specific meter conversion chart for calculation)

Direct velocity measurements: 
Marsh-McBirney 
Sontek or 
Other\_\_\_\_

	1	2	3	4	5	6	AV
Distance from Shore (m)	1.2	24	3.6	4.8	10		AVI
Depth (D) (cm)	36.5	14	1.5	3.5	6.0	7.2	
Velocity Head Rod (ruler)	100.0	11.	1.0	0.5	7.0	6.5	
Flowing water Depth (D1) (cm)	36.5	14	1.5	25			
Depth of Stagnation $(D_2)$ (cm)	37	14	1.5	3.5	7	6.5	
Change in depth ( $\Delta D=D_2-D_1$ ) (cm)	0.5	0	1.2	3.5	7	6.5	
lotary meter		0	0	0	0	0	1
Revolutions							
Time (minimum 40 seconds)							
rect Measurement or calculation	and the second						
Velocity (V) (m/s)							



Field Crew: BM, CH, A

Site Code: COL-OL

Sampling Date: (DD/MM/YYYY) 08/09 /2020

# SUBSTRATE DATA

# Surrounding/Interstitial Material

Circle the substrate size category for the surrounding material.

coarse

Substrate Size Class	Category
Organic Cover	0
< 0.1 cm (fine sand, silt or clay)	1
0.1-0.2 cm (coarse sand)	2
0.2-1.6 cm (gravel)	3
1.6-3.2 cm (small pebble)	4
3.2-6.4 cm (large pebble)	5
6.4-12.8 cm (small cobble)	6
12.8-25.6 cm (cobble)	7
> 25.6 cm (boulder)	8
Bedrock	9

# 100 Pebble Count & Substrate Embeddedness

- Measure the intermediate axis (100 rocks) and embeddedness (10 rocks) of substrate in the stream bed.
- Indicate B for bedrock, S for sand/silt/clay (particles < 0.2 cm) and O for organic material.</li>

• Embeddedness categories (E): Completely embedded = 1, 3/4 embedded, 1/2 embedded, 1/4 embedded, unembedded = 0

1	Diameter (cm)	E	1145.201	Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E
1	9.0		26	2.0		51	4.0		76	ac	
2	11.5		27	3.5		52	95		77	1.0	
3	20		28	0.1		53	6.7		78	3.0	
4	4.5		29	5.4		54	8.0		79	3.0	
5	7.5		30	31.0 AF	3/4	55	10.0		80)	95	1/2
- 6	7.0		31	6.5		56	12.0		81	90	YE
7	11.5		32	6.7		57	0.2		82	210	
8	8.0	19.10	33	30.0	and the	58	6.0		83	25	
9	5.5		34	2.5		59	5.6		84	2:2	
10	3.5	0	35	10.0		60	11.0		85	1.9	
11	26.0	1	36	9.5		61	0.6		86	LIE -	
12	2.5		37	0.3		62	14.5		87	8.0	
13	2.3		38	7.2		63	1.2		88	220	
14	6.5		39	4.8	1000	64	22.0	1.1.1	89	32.0	
15	0.7		(40)	0.9	0	65	17		(90)	2.6	
16	1.2		41	1.5		66	1/2		91	2.2	0
17	16.0		42	5.5		67	1.8		92	13.1	
18	0.2		43	45		68	23.5		93	15.0	
19	9.5		44	0.2		69	19.0		93	3.2	
(20)	14.5	3/4	45	0.3	(	70)	14.5	3/4		12.5	
21	5.0		46	110		71	6	514	95	4.5	
22	0.1		47	8.5		72	08		96	9.5	
23	0.2		48	5.9			0.0		97	7.5	
24	5.5		49	<u> </u>		73	8.5		98	8.5	
25	Ora.		(50)	5.5	141	74	1.0		99	6.2	
	- Jug- I			10. +	74	75	5.5		(100)	0.4	0

Note: The Wolman D50 (i.e. median diameter), Wolman Dg (i.e. geometric mean diameter) and the % composition of the substrate classes will be calculated automatically in the CABIN database using the 100 pebble data. All 100 pebbles must be measured in order for the CABIN database tool to perform substrate calculations.

CABIN Field Sheet June 2012

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	the second se
Field Crew: BM CH + AB	Site Code: COL-O)
Sampling Date: (DD/MM/YYYY) 08/09/2020	<u>n ma</u> stra and an and a se
SITE INSPEC	CTION
Site Inspected by: <u>Chad</u> Hughes	
Communication Information	
Itinerary left with contact person (include contact numbers)	
Contact Person: Mike Bennett	Time checked-in: 12:00
Form of communication: Tradio Cell satellite hotel	
Phone number: (250) 423-8547	
Vehicle Safety	
Safety equipment (first aid, fire extinguisher, blanket, emer	gency kit in vehicle)
Equipment and chemicals safely secured for transport	
Vehicle parked in safe location; pylons, hazard light, reflect	tive vests if necessary
Notes:	and the second
	5.0
Shore & Wading Safety	1- Simologia a data data data data data data data
Wading Task Hazard Analysis read by all field staff	
Wading Safe Work Procedures read by all field staff	- 7
Instream hazards identified (i.e. log jams, deep pools, slippe	ery rocks)
□ PFD worn	E. Barrier
Appropriate footwear, waders, wading belt	
] Belay used	
A A A A A A A A A A A A A A A A A A A	
lotes:	

>	Ched Hybr - Cabin Site - 200 12 11 DO-10
	Field Crew: 12th Millions, Chad Hughes + Site Code: Col-03 Sampling Date: (DD/MM/YYYY) 08/09 2020
	Occupational Health & Safety: Site Inspection Sheet completed
	PRIMARY SITE DATA
	CABIN Study Name: EIK River tributaries local Basin Name: Coal Creek
	River/Stream Name: Coal CreekStream Order: (map scale 1:50,000)
	Select one: 🖾 Test Site 🗖 Potential Reference Site
	Geographical Description/Notes: Site # 3, access by Coal Cr. Rd - Paige's Draw
Ð	
	Surrounding Land Use: (check those present)       Information Source: UISUAL         Forest       Field/Pasture       Agriculture         Logging       Mining       Commercial/Industrial
	Dominant Surrounding Land Use: (check one)       Information Source: USUAL         Forest       Field/Pasture       Agriculture       Residential/Urban         Logging       Mining       Commercial/Industrial       Other
A	Location Data         Latitude: 49,45387_N Longitude: - 119,8966W (DMS or DD)         Elevation:(fast or mast)         GPS Datum: GRS80 (NAD83/WGS84)
	Site Location Map Drawing
	Site Location Map Drawing
	E PIVIE TO
	wal/1/1×
	bunchmark fallen log
	1 2 2
1 17	Note: Indicate north

CABIN Field Sheet June 2012

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Page 1 of 6



<form>         Pieta Crew:       Bite Code:       Subserved         Sampling Date:       (DO/MMNYYY)       BLDEMI2020         Pieta Sheet       Upstream       Downstream       Aerross Site       Aerrial View         Pieta Sheet       Upstream       Downstream       Aerross Site       Aerrial View         Pieta Sheet       Upstream       Downstream       Orber         State Code:       State View       Orber         Orber       Orber       Orber         State Code:       State View       Orber         Orber       Orber       Orber         Orber</form>
Photos       Aerial View         Substrate (exposed)       Substrate (aquatic)         REACH DATA (represents 6 times bankfull width)         1       Habitat Types: (check those present)         2       Riffle       Rapids         3       Substrate (aquatic)       Pool/Back Eddy         2       Canopy Coverage: (stand in middle of stream and look up, check one)       76-100 %         3       Macrophyte Coverage: (not algae or most, check one)       76-100 %         4       Streamside Vegetation: (check those present)       76-100 %         6       Remorphyte Coverage: (not algae or most, check one)       0 %         1       1-25 %       26-50 %       51-75 %         2       Streamside Vegetation: (check those present)       6eciduous trees       coniferous trees         5       Dominant Streamside Vegetation: (check one)       6eciduous trees       coniferous trees         6       Periphyton Coverage on Substrate: (benthic algae, not moss, check one)       9       9         2       Pocks are not slippery, no obvious colour (thin layer < 0.5 mm thick)
□ Frield Sheet       □ Upstream       □ Ownstream       □ Actose Succ         □ Substrate (exposed)       □ Substrate (aquatic)       □ Other         REACH DATA (represents 6 times bankfull width)         1. Habitat Types: (check those present)       □ Pool/Back Eddy         2. Canopy Coverage: (stand in middle of stream and look up, check one)       □ 76-100 %         3. Macrophyte Coverage: (not algae or mos., check one)       □ 76-100 %         3. Macrophyte Coverage: (not algae or mos., check one)       □ 76-100 %         3. Macrophyte Coverage: (not algae or mos., check one)       □ 76-100 %         4. Streamside Vegetation: (check those present)       □ 76-100 %         5. Dominant Streamside Vegetation: (check those present)       □ 76-100 %         4. Streamside Vegetation: (check those present)       □ 1-25 %         □ 1 - Rocks are not slippery, and obvious colour (thin layer < 0.5 mm thick)
1. Habitat Types: (check those present)       Straight run       Pool/Back Eddy         2. Canopy Coverage: (stand in middle of stream and look up, check one)       76-100 %         0 %       1-25 %       26-50 %       51-75 %       76-100 %         3. Macrophyte Coverage: (not algae or moss, check one)       0 %       1-25 %       26-50 %       51-75 %       76-100 %         4. Streamside Vegetation: (check those present)       0 %       1-25 %       26-50 %       51-75 %       76-100 %         5. Dominant Streamside Vegetation: (check those present)       0 coniferous trees       coniferous trees         6. Derriphyten Coverage on Substrate: (benthic algae, not moss, check one)       1 endoty algae (a multicalgae, not moss, check one)       1 endoty algae (b multicalgae, not moss, check one)         1 = 4. Rocks are not slippery, no obvious colour (thin layer < 0.5 mm thick)
Riffie       Rapids       Straight run       Pool/Back Eduy         2. Canopy Coverage: (stand in middle of stream and look up, check one)       0 %       76-100 %         0 %       1-25 %       26-50 %       51-75 %       76-100 %         3. Macrophyte Coverage: (not algae or moss, check one)       0 %       1-25 %       26-50 %       51-75 %       76-100 %         4. Streamside Vegetation: (check those present)       0 %       1-25 %       deciduous trees       coniferous trees         5. Dominant Streamside Vegetation: (check one)       1 ferms/grasses       1 shrubs       deciduous trees       coniferous trees         6. Periphyton Coverage on Substrate: (benthic algae, not moss, check one)       1 - Rocks are not slippery, no obvious colour (thin layer < 0.5 mm thick)
<ul> <li>0% 24.25% 26-50% 51-75% 76-100%</li> <li>3. Macrophyte Coverage: (not algae or moss, check one)</li> <li>20% 1.25% 26-50% 51-75% 76-100%</li> <li>4. Streamside Vegetation: (check those present)</li> <li>2 fems/grasses 3 shrubs 1 deciduous trees</li> <li>5. Dominant Streamside Vegetation; (check one)</li> <li>1 ferns/grasses 3 shrubs 1 deciduous trees</li> <li>coniferous trees</li> <li>5. Dominant Streamside Vegetation; (check one)</li> <li>1 ferns/grasses 3 shrubs 1 deciduous trees</li> <li>coniferous trees</li> <li>coniferous trees</li> <li>6. Periphyton Coverage on Substrate: (benthic algae, not moss, check one)</li> <li>4. Rocks are not slippery, no obvious colour (thin layer &lt; 0.5 mm thick)</li> <li>2. Rocks are slightly slippery, yellow-brown to light green colour (0.5-1 mm thick)</li> <li>3. Rocks have a noticeable slipper feel (tooting is slippery), with patches of thicker green to brown algae (1-5 mm thick)</li> <li>3. Rocks are nostly obscured by algal mat, extensive green, brown to black algal mass may have long strands (&gt; 20 mm thick)</li> <li>5. Rocks are mostly obscured by algal mat, extensive green, brown to black algal mass may have long strands (&gt; 20 mm thick)</li> <li>5. Rocks are mostly obscured by algal mat, extensive green, brown to black algal mass may have long strands (&gt; 20 mm thick)</li> <li>Streff eDM eDM</li> <li>Note: 1 through 5 represent categories entered into the CABIN database.</li> <li>BENTHIC MACROINVERTEBRATE DATA</li> <li>Habitat sampled: (check one) 1 riffle   rapids   straight run</li> <li>400 µm mesh Kick Net</li></ul>
Image: Constraint Streamside Vegetation: (check those present)       Image: Constraint Streamside Vegetation: (check those present)         Image: Constraint Streamside Vegetation: (check one)       Image: Constraint Streamside Vegetation: (check one)         Image: Constraint Streamside Vegetation: (check one)       Image: Constraint Streamside Vegetation: (check one)         Image: Constraint Streamside Vegetation: (check one)       Image: Constraint Streamside Vegetation: (check one)         Image: Constraint Streamside Vegetation: (check one)       Image: Constraint Streamside Vegetation: (check one)         Image: Constraint Streamside Vegetation: (check one)       Image: Check one)         Image: Constraint Streamside Vegetation: (check one)       Image: Check one)         Image: Check one on Substrate: (benthic algae, not moss, check one)       Image: Check one on Substrate: (benthic algae, not moss, check one)         Image: Check one on Substrate: (benthic algae, not moss, check one)       Image: Check one on Substrate: (benthic algae, not moss, check one)         Image: Check one on Substrate: (benthic algae, not moss, check one)       Image: Check one on Substrate: (benthic algae, not moss, check one)         Image: Check one on Substrate: (benthic algae, not moss, check one)       Image: Check one on Substrate: (benthic algae, not moss, check one)         Image: Check one on Substrate: (benthic algae, not moss, check one)       Image: Check one on Substrate: (benthic algae, not moss, check one)         Image: Check one on Substrate: (benthic algae, not moss
☐ ferms/grasses       ☐ shrubs       ☐ deciduous trees       ☐ coniferous trees         5. Dominant Streamside Vegetation: (check one)
<ul> <li>☐ ferns/grasses</li></ul>
<ul> <li>A - Rocks are not slippery, no obvious colour (thin layer &lt; 0.5 mm thick)</li> <li>A - Rocks are slightly slippery, yellow-brown to light green colour (0.5-1 mm thick)</li> <li>A - Rocks have a noticeable slippery feel (footing is slippery), with patches of thicker green to brown algae (1-5 mm thick)</li> <li>A - Rocks are very slippery (algae can be removed with thumbnail), numerous large clumps of green to dark brown algae (5 mm -20 mm thick)</li> <li>A - Rocks are mostly obscured by algal mat, extensive green, brown to black algal mass may have long strands (&gt; 20 mm thick)</li> <li>S - Rocks are mostly obscured by algal mat, extensive green, brown to black algal mass may have long strands (&gt; 20 mm thick)</li> <li>S - Rocks are mostly obscured by algal mat, extensive green, brown to black algal mass may have long strands (&gt; 20 mm thick)</li> <li>S - Rocks are mostly obscured by algal mat, extensive green, brown to black algal mass may have long strands (&gt; 20 mm thick)</li> <li>S - Rocks are mostly obscured by algal mat, extensive green, brown to black algal mass may have long strands (&gt; 20 mm thick)</li> <li>S - Rocks are mostly obscured by algal mat, extensive green, brown to black algal mass may have</li> <li>S - Rocks are mostly obscured by algal mat, extensive green, brown to black algal mass may have</li> <li>S - Rocks are mostly obscured by algal mat, extensive green, brown to black algal mass may have</li> <li>S - Rocks are mostly obscured by algal mat, extensive green, brown to black algal mass may have</li> <li>S - Rocks are mostly obscured by algal mat, extensive green, brown to black algal mass may have</li> <li>S - Rocks are mostly obscured by algal mat, extensive green, brown to black algal mass may have</li> <li>S - Rocks are mostly obscured by algal mat, extensive green, brown eDMA</li> <li>S - Rocks are extensive green, brown eDMA</li> <li>S - Rocks are extensive green, brown eDMA</li> <li>S - Rocks are exten</li></ul>
<ul> <li>2 - Rocks are slightly slippery, yellow-brown to light green colour (0.5-1 mm thick)</li> <li>3 - Rocks have a noticeable slippery feel (footing is slippery), with patches of thicker green to brown algae (1-5 mm thick)</li> <li>4 - Rocks are very slippery (algae can be removed with thumbnail), numerous large clumps of green to dark brown algae (5 mm -20 mm thick)</li> <li>5 - Rocks are mostly obscured by algal mat, extensive green, brown to black algal mass may have long strands (&gt; 20 mm thick)</li> <li>5 - Rocks are mostly obscured by algal mat, extensive green, brown to black algal mass may have long strands (&gt; 20 mm thick)</li> <li>Stream eDNA</li> <li>Stream eDNA</li></ul>
□       5 - Rocks are mostly obscured by algal mat, extensive green, brown to black algal mass may have long strands (> 20 mm thick)         Note: 1 through 5 represent categories entered into the CABIN database.       STRPAM eDMA         BENTHIC MACROINVERTEBRATE DATA       3 κ, rcps.         Habitat sampled: (check one)       I riffle         I rapids       straight run         400 μm mesh Kick Net       Preservative used: 997. isoppopul         Person sampling       Croad Hugws         Sampling time (i.e. 3 min.)       3 min.
Note: 1 through 5 represent categories entered into the CABIN database.       3x, rcps.         BENTHIC MACROINVERTEBRATE DATA       Pres: Antifrege.         Habitat sampled: (check one)       riffle       rapids       straight run         400 μm mesh Kick Net       Preservative used: 997. isoprophyl         Person sampling       Check Hughes       Sampled sieved on site using "Bucket Swirling Method":         Sampling time (i.e. 3 min.)       3 min.       YES   NO
Habitat sampled: (check one)       I riffle       rapids       straight run         400 μm mesh Kick Net       Preservative used: 997. isoprophyl         Person sampling       Croad       Hughes         Sampling time (i.e. 3 min.)       3 min.       Sampled sieved on site using "Bucket Swirling Method":
400 μm mesh Kick Net     Preservative used: 997. isoprophyl       Person sampling     Chad Hughes       Sampling time (i.e. 3 min.)     3 min.
Person sampling       Chad Hughes       Sampled sieved on site using "Bucket Swirling Method":         Sampling time (i.e. 3 min.)       3 min.       YES INO
Person sampling       Chad Hudkes       Sampled sieved on site using "Bucket Swirling Method":         Sampling time (i.e. 3 min.)       3 min.       YES INO
No. of sample jars
Typical depth in kick area (cm) 5.0 cm
Note: Indicate if a sampling method other than the recommended 400 µm mesh kick net is used.
CABIN Field Sheet June 2012 Page 2 of 6

PRI I MANE

Field Crew: BUCH AB	Site Code: <u>CoL-03</u>
Sampling Date: (DD/MM/YYYY) 08/09/2020	- * .
WATER CHEMISTRY DATA Time: 10:05 (24 hr clock)	Time zone:
Air Temp: 4.8 (°C) Water Temp: 3.5 (°C)	рн: <u>7.26</u>
Specific Conductance: 104 (µs/cm) DO: 10 (mg/L	) Turbidity: <u>0.75</u> (NTU)
Check if water samples were collected for the following analyses:	
Image: TSS (Total Suspended Solids)         Image: Nitrogen (i.e. Total, Nitrate, Nitrite, Dissolved, and/or Ammonia)	
<ul> <li>Phosphorus (Total, Ortho, and/or Dissolved)</li> <li>Major Ions (i.e. Alkalinity, Hardness, Chloride, and/or Sulphate)</li> </ul>	1 Other total + dissolver metals
Note: Determining alkalinity is recommended, as are other analyses, but not re	

CHANNEL DATA

Slope - Indicate how slope was measured: (check one)

Calculated from map

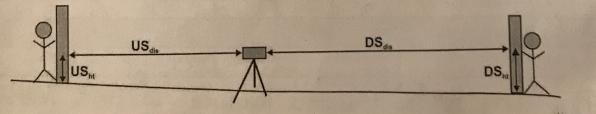
\_ (Note: small scale map recommended if field measurement is not possible - i.e. 1:20,000). Scale: contour interval (vertical distance) \_\_\_\_\_(m), distance between contour intervals (horizontal distance) \_\_\_\_\_ (m) slope = vertical distance/horizontal distance =\_\_\_\_

### OR

### Measured in field

Circle device used and fill out table according to device: a. Survey Equipment b Hand Level & Measuring Tape

Measurements	Upstream (U/S)	Downstream(D/S)	Calculation
<sup>a</sup> Top Hairline (T)		N. K. Land Land	
<sup>a</sup> Mid Hairline (ht) OR			
<sup>b</sup> Height of rod	1.3700	2.5/m	
<sup>a</sup> Bottom Hairline (B)			
Distance (dis) OR	11.2 m	12.8	US <sub>dis</sub> +DS <sub>dis</sub> =
<sup>a</sup> T-B x 100	<sup>a</sup> US <sub>dis</sub> =T-B	<sup>a</sup> DS <sub>dis</sub> =T-B	- 24.0M
Change in height (Δht)			DS <sub>ht</sub> -US <sub>ht</sub> =
Slope (Δht/total dis)			1.14/24.0 = 0.048





2.2	Site Code: CoL-03
Field Crew: BM,	H + AD
Sampling Date: (DD	MM/YYYY) 08/09/2020
Widths and Deptl	
	conchronave K(Indicate where in sample reach, ex. d/s of kick area)
	Ministration Width: 2.4 (m)
A - Bankfull Width:	
C - Bankfull-Wetted D	epth (height from water surface to Bankfull):
	A
	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
ote:	
letted widths > 5 m, mea	sure a minimum of 5-6 equidistant locations; sure 3-4 equidistant locations.
elocity and Deptl	
ore and depth are rec	sity measuring device and fill out the appropriate section in chart below. Distance from uired regardless of method:
/	(or ruler): Velocity Equation (m/s) = $\sqrt{[2(\Delta D/100) * 9.81]}$

Rotary meters: Gurley/Price/Mini-Price/Propeller (Refer to specific meter conversion chart for calculation)

Direct velocity measurements: 
Marsh-McBirney 
Sontek or 
Other

	1	2	3	4	5	6	AVG
Distance from Shore (m)	0.5	1.0	1.5	20	/	1	AVG
Depth (D) (cm)	200	2.5	4.0	1.0	1/	/	2.20
Velocity Head Rod (ruler)			1	1 (1-	P	<u> </u>	12.38
Flowing water Depth (D1) (cm)	.2.0	2.5	4.0	1.0		ł	
Depth of Stagnation (D2) (cm)	2.0	2.5	4.0	1.0	1/		
Change in depth ( <b>△D=D<sub>2</sub>-D</b> <sub>1</sub> ) (cm)	0	0	O	0	/	/	
Rotary meter					¥	<u>k</u>	
Revolutions		/	/	/	1		/
Time (minimum 40 seconds)				/	/	/ /	
Direct Measurement or calculation			4		2 (		
Velocity (V) (m/s)	.0	0	0	0			
@ velocity+ Ho For	et low	-to	10005		T Ho		1
CADINE							
CABIN Field Sheet June 2012	Page 4	of 6				and the	9
						CHE	SIN
						THE AR	15-2-0-P-

Site Code: CDL+D3

2020 Sampling Date: (DD/MM/YYYY) 08/09

### SUBSTRATE DATA

Field Crew: BM;CH

### Surrounding/Interstitial Material

Circle the substrate size category for the surrounding material.

gravel

Category
0
1
2
3)
4
5
6
7
8
9

### **100 Pebble Count & Substrate Embeddedness**

Measure the intermediate axis (100 rocks) and embeddedness (10 rocks) of substrate in the stream bed.

Indicate B for bedrock, S for sand/silt/clay (particles < 0.2 cm) and O for organic material.</li>

• Embeddedness categories (E): Completely embedded = 1, 3/4 embedded, 1/2 embedded, 1/4 embedded, unembedded = 0

	Diameter (cm)	E		Diameter (cm)	Е		Diameter (cm)	E	[	Diameter (cm)	E
1	7.5		26	3,5		51	13.0		76	48.0	
2	4.5		27	5.0		52	25.5		77	3.3	
3	49		28	11.5		53	7.7		78	1.5	1
4	2.8		29	23.0		54	4.3		79	16.0	
5	14.0		(30)	8.9	V2.	55	19.6	(	80	10.2	0
6	5.7		31	3.0		56	3.7	1.1952.1.	81	1.3	-
7	14.0		32	18.5		57	6.6		82	6.0	
8	21.0		33	3.7		58	0.4		83	21.0	
9	10.3		34	14.0		59	1.1		84	9.8	
10	10.0	V4	35	2.9		60	10.0	314	85	B	6
11	6.6		36	3.5		61	19.6		86	2.5	
12	11.5		37	6.8		62	200		87	4.2	1
13	18.5		38	5.0		63	8.0		88	5.2	
14	3.0		39	14.0		64	49.7	1.1.18	89	8.1	-
15	5.5		(40)	28.0	14	65	0.6		90	6.0	1/4
16	3.0		41	3.7		66	7.0		91	2.3	
17	b.8		42	3.7		67	0.8		92	7.5	
18	2.5		43	4.0		68	16.5		93	6.5	
19	6.6		44	18.1		69	5.1		94	4.5	
20	2.7	0	45	7.5		(70)	11.0	Y4	95	30.0	
21	22.0		46	8.0		71	11.8		96	10.2	
22	12.0		47	5.0		72	6.0		97	2.6	
23	3.9		48	8.9		73	0.6		98	6.3	
24	4.0		49	6.0		74	2.3		99	5.7	
25	12.3		(50)	7.8	3/4	75	10.4		100)	1.2.	0

Note: The Wolman D50 (i.e. median diameter), Wolman Dg (i.e. geometric mean diameter) and the % composition of the substrate classes will be calculated automatically in the CABIN database using the 100 pebble data. All 100 pebbles must be measured in order for the CABIN database tool to perform substrate calculations.

**CABIN Field Sheet June 2012** 

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Field Crew;	BN	1, CI		+A	B
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Sampling Date: (DD/MM/YYYY) 08/09/2020

# SITE INSPECTION

Site Code: COL-02

Site Inspected by: Chad Hughes

### **Communication Information**

Itinerary left with contact person (include contact numbers)

Contact Person: Mike Bennett	Time checked-in: <u>9:00</u> AM
Form of communication:  radio  cell  satellite	hotel/pay phone SPOT
Phone number: (250) 423-8547	

### **Vehicle Safety**

Safety equipment (first aid, fire extinguisher, blanket, emergency kit in vehicle)
 Equipment and chemicals safely secured for transport
 Vehicle parked in safe location; pylons, hazard light, reflective vests if necessary
 Notes:

### Shore & Wading Safety

Wading Task Hazard Analysis read by all field staff
 Wading Safe Work Procedures read by all field staff
 Instream hazards identified (i.e. log jams, deep pools, slippery rocks)
 PFD worn
 Appropriate footwear, waders, wading belt

Belay used

Notes:



CABIN Field Sheet June 2012



Appendix C: CARO Reports



# **CERTIFICATE OF ANALYSIS**

REPORTED TO	Elk River Alliance PO Box 537 - 891 2nd Ave Ferniecha, BC V0B1M0		
ATTENTION	Beth Millions	WORK ORDER	0091166
PO NUMBER PROJECT PROJECT INFO	ERA-CBWM [info]	RECEIVED / TEMP REPORTED COC NUMBER	2020-09-10 09:30 / 5°C 2020-09-17 16:55 B90358

#### Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

We've Got Chemistry

#### Big Picture Sidekicks



You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

It's simple. We figure the more you working enjoy with our fun and engaged team the more members; likely you are to give us continued opportunities to support you.

Ahead of the Curve



research, Through regulation knowledge, and instrumentation, we are your analytical centre for the knowledge you technical need, BEFORE you need it, so you can stay up to date and in the know.

If you have any questions or concerns, please contact me at teamcaro@caro.ca

#### Authorized By:

Team CARO **Client Service Representative** 

#### 1-888-311-8846 | www.caro.ca

#110 4011 Viking Way Richmond, BC V6V 2K9 | #102 3677 Highway 97N Kelowna, BC V1X 5C3 | 17225 109 Avenue Edmonton, AB T5S 1H7



# **TEST RESULTS**

<b>REPORTED TO</b> Elk River Alliance <b>PROJECT</b> ERA-CBWM				WORK ORDER REPORTED	0091166 2020-09-17 16:55	
Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
COL-03_200908_1030 (0091166-01)   Mati	rix: Water   Sampl	ed: 2020-09-08 10:	05			
Anions						
Chloride	< 0.10	AO ≤ 250	0.10	mg/L	2020-09-12	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2020-09-12	HT1
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2020-09-12	HT1
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-09-12	HT1
Sulfate	6.9	AO ≤ 500	1.0	mg/L	2020-09-12	
Calculated Parameters						
Hardness, Total (as CaCO3)	51.1	None Required	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	0.0840	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Lithium, dissolved	0.00816	N/A	0.00010	mg/L	2020-09-16	
Aluminum, dissolved	0.0171	N/A	0.0050	0	2020-09-16	
Antimony, dissolved	< 0.00020	N/A	0.00020	-	2020-09-16	
Arsenic, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-09-16	
Barium, dissolved	0.0850	N/A	0.0050		2020-09-16	
Beryllium, dissolved	< 0.00010	N/A	0.00010	-	2020-09-16	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-09-16	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2020-09-16	
Cadmium, dissolved	0.000060	N/A	0.000010	mg/L	2020-09-16	
Calcium, dissolved	15.3	N/A	0.20	mg/L	2020-09-16	
Chromium, dissolved	< 0.00050	N/A	0.00050	-	2020-09-16	
Cobalt, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-09-16	
Copper, dissolved	< 0.00040	N/A	0.00040	mg/L	2020-09-16	
Iron, dissolved	< 0.010	N/A	0.010	mg/L	2020-09-16	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-09-16	
Magnesium, dissolved	3.15	N/A	0.010	mg/L	2020-09-16	
Manganese, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-09-16	
Mercury, dissolved	< 0.000040	N/A	0.000040	mg/L	2020-09-16	CT5
Molybdenum, dissolved	0.00050	N/A	0.00010	mg/L	2020-09-16	
Nickel, dissolved	< 0.00040	N/A	0.00040	mg/L	2020-09-16	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2020-09-16	
Potassium, dissolved	0.24	N/A	0.10	mg/L	2020-09-16	
Selenium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-09-16	
Silicon, dissolved	1.0	N/A	1.0	mg/L	2020-09-16	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2020-09-16	
Sodium, dissolved	0.20	N/A		mg/L	2020-09-16	
Strontium, dissolved	0.0208	N/A	0.0010	mg/L	2020-09-16	
Sulfur, dissolved	3.2	N/A	3.0	mg/L	2020-09-16	
Tellurium, dissolved	< 0.00050	N/A	0.00050	-	2020-09-16	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2020-09-16	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-09-16	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-09-16	Page 2 of

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<b>REPORTED TO</b> Elk River Alliance <b>PROJECT</b> ERA-CBWM				WORK ORDER REPORTED	0091166 2020-09-1	7 16:55
Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
COL-03_200908_1030 (0091166-01)   Mat	rix: Water   Sampl	led: 2020-09-08 10:(	05, Continue	d		
Dissolved Metals, Continued						
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-09-16	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-09-16	
Uranium, dissolved	0.000106	N/A	0.000020	mg/L	2020-09-16	
Vanadium, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-09-16	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2020-09-16	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-09-16	
General Parameters						
Alkalinity, Total (as CaCO3)	40.3	N/A	1.0	mg/L	2020-09-15	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2020-09-15	
Alkalinity, Bicarbonate (as CaCO3)	40.3	N/A	1.0	mg/L	2020-09-15	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2020-09-15	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2020-09-15	
BOD, 5-day	< 6.5	N/A	2.0	mg/L	2020-09-17	HT1
Chemical Oxygen Demand	< 20	N/A	20	mg/L	2020-09-15	
Nitrogen, Total Kjeldahl	0.084	N/A	0.050	mg/L	2020-09-15	
Phosphorus, Total (as P)	0.0168	N/A	0.0050	mg/L	2020-09-15	
Solids, Total Suspended	< 2.0	N/A	2.0	mg/L	2020-09-14	
Total Metals						
Aluminum, total	0.0253	OG < 0.1	0.0050	mg/L	2020-09-17	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2020-09-17	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2020-09-17	
Barium, total	0.0876	MAC = 2	0.0050	mg/L	2020-09-17	
Beryllium, total	< 0.00010	N/A	0.00010	mg/L	2020-09-17	
Bismuth, total	< 0.00010	N/A	0.00010	mg/L	2020-09-17	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2020-09-17	
Cadmium, total	0.000060	MAC = 0.005	0.000010	mg/L	2020-09-17	
Calcium, total	15.7	None Required	0.20	mg/L	2020-09-17	
Chromium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2020-09-17	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2020-09-17	
Copper, total	0.00060	MAC = 2	0.00040	mg/L	2020-09-17	
Iron, total	< 0.010	AO ≤ 0.3	0.010	mg/L	2020-09-17	
Lead, total	< 0.00020	MAC = 0.005	0.00020	mg/L	2020-09-17	
Lithium, total	0.00030	N/A	0.00010	mg/L	2020-09-17	
Magnesium, total	3.26	None Required	0.010	mg/L	2020-09-17	
Manganese, total	0.00031	MAC = 0.12	0.00020	mg/L	2020-09-17	
Mercury, total	< 0.000040	MAC = 0.001	0.000040	mg/L	2020-09-17	
Molybdenum, total	0.00053	N/A	0.00010	•	2020-09-17	
Nickel, total	0.00061	N/A	0.00040	-	2020-09-17	
Phosphorus, total	< 0.050	N/A	0.050	-	2020-09-17	
Potassium, total	0.23	N/A		mg/L	2020-09-17	
Selenium, total	< 0.00050	MAC = 0.05	0.00050		2020-09-17	
Silicon, total	1.1	N/A		mg/L	2020-09-17	

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Analyte		Result	Guideline	RL	Units	Analyzed	Qualifier
REPORTED TO PROJECT	Elk River Alliance ERA-CBWM				WORK ORDER	0091166 2020-09-1	7 16:55

### COL-03\_200908\_1030 (0091166-01) | Matrix: Water | Sampled: 2020-09-08 10:05, Continued

Silver, total	< 0.000050	None Required	0.000050	mg/L	2020-09-17
Sodium, total	0.21	AO ≤ 200	0.10	mg/L	2020-09-17
Strontium, total	0.0214	7	0.0010	mg/L	2020-09-17
Sulfur, total	3.1	N/A	3.0	mg/L	2020-09-17
Tellurium, total	< 0.00050	N/A	0.00050	mg/L	2020-09-17
Thallium, total	< 0.000020	N/A	0.000020	mg/L	2020-09-17
Thorium, total	< 0.00010	N/A	0.00010	mg/L	2020-09-17
Tin, total	< 0.00020	N/A	0.00020	mg/L	2020-09-17
Titanium, total	< 0.0050	N/A	0.0050	mg/L	2020-09-17
Tungsten, total	< 0.0010	N/A	0.0010	mg/L	2020-09-17
Uranium, total	0.000107	MAC = 0.02	0.000020	mg/L	2020-09-17
Vanadium, total	< 0.0010	N/A	0.0010	mg/L	2020-09-17
Zinc, total	0.0040	AO ≤ 5	0.0040	mg/L	2020-09-17
Zirconium, total	0.00010	N/A	0.00010	mg/L	2020-09-17

### COL01\_200908\_1330 (0091166-02) | Matrix: Water | Sampled: 2020-09-08 13:30

Anions						
Chloride	0.42	AO ≤ 250	0.10	mg/L	2020-09-12	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2020-09-12	ΗT
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2020-09-12	ΗT
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-09-12	HT
Sulfate	5.4	AO ≤ 500	1.0	mg/L	2020-09-12	
Calculated Parameters						
Hardness, Total (as CaCO3)	131	None Required	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	0.0530	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Lithium, dissolved	0.0117	N/A	0.00010	mg/L	2020-09-16	
Aluminum, dissolved	0.0068	N/A	0.0050	mg/L	2020-09-16	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-09-16	
Arsenic, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-09-16	
Barium, dissolved	0.298	N/A	0.0050	mg/L	2020-09-16	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-09-16	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-09-16	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2020-09-16	
Cadmium, dissolved	0.000034	N/A	0.000010	mg/L	2020-09-16	
Calcium, dissolved	38.0	N/A	0.20	mg/L	2020-09-16	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-09-16	
Cobalt, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-09-16	
Copper, dissolved	< 0.00040	N/A	0.00040	mg/L	2020-09-16	

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REPORTED TO PROJECT	Elk River Alliance ERA-CBWM				WORK ORDER REPORTED	0091166 2020-09-1	7 16:55
Analyte		Result	Guideline	RL	Units	Analyzed	Qualifie
COL01_200908_1	330 (0091166-02)   Matr	ix: Water   Sample	d: 2020-09-08 13:3	30, Continued	I		
Dissolved Metals, (	Continued						
Iron, dissolved		< 0.010	N/A	0.010	mg/L	2020-09-16	
Lead, dissolved		< 0.00020	N/A	0.00020	mg/L	2020-09-16	
Magnesium, disso	lved	8.66	N/A	0.010	mg/L	2020-09-16	
Manganese, disso	lved	0.00451	N/A	0.00020	mg/L	2020-09-16	
Mercury, dissolved	1	< 0.000040	N/A	0.000040	mg/L	2020-09-16	CT5
Molybdenum, diss	olved	0.00079	N/A	0.00010	mg/L	2020-09-16	
Nickel, dissolved		0.00051	N/A	0.00040	mg/L	2020-09-16	
Phosphorus, disso	blved	< 0.050	N/A	0.050	mg/L	2020-09-16	
Potassium, dissolv	ved	0.79	N/A	0.10	mg/L	2020-09-16	
Selenium, dissolve	ed	< 0.00050	N/A	0.00050	mg/L	2020-09-16	
Silicon, dissolved		1.9	N/A	1.0	mg/L	2020-09-16	
Silver, dissolved		< 0.000050	N/A	0.000050	mg/L	2020-09-16	
Sodium, dissolved		3.37	N/A	0.10	mg/L	2020-09-16	
Strontium, dissolve	ed	0.136	N/A	0.0010	mg/L	2020-09-16	
Sulfur, dissolved		3.1	N/A	3.0	mg/L	2020-09-16	
Tellurium, dissolve	d	< 0.00050	N/A	0.00050	mg/L	2020-09-16	
Thallium, dissolve	d	< 0.000020	N/A	0.000020	mg/L	2020-09-16	
Thorium, dissolved	b	< 0.00010	N/A	0.00010	mg/L	2020-09-16	
Tin, dissolved		< 0.00020	N/A	0.00020	mg/L	2020-09-16	
Titanium, dissolve	d	< 0.0050	N/A	0.0050	mg/L	2020-09-16	
Tungsten, dissolve	ed	< 0.0010	N/A	0.0010	mg/L	2020-09-16	
Uranium, dissolve	d	0.000456	N/A	0.000020	mg/L	2020-09-16	
Vanadium, dissolv	ed	< 0.0010	N/A	0.0010	mg/L	2020-09-16	
Zinc, dissolved		< 0.0040	N/A	0.0040	mg/L	2020-09-16	
Zirconium, dissolv	ed	< 0.00010	N/A	0.00010	mg/L	2020-09-16	
General Parameter	s						
Alkalinity, Total (as	CaCO3)	117	N/A	1.0	mg/L	2020-09-15	
Alkalinity, Phenolp	, hthalein (as CaCO3)	< 1.0	N/A		mg/L	2020-09-15	
Alkalinity, Bicarbor		117	N/A		mg/L	2020-09-15	
Alkalinity, Carbona		< 1.0	N/A		mg/L	2020-09-15	
Alkalinity, Hydroxid		< 1.0	N/A		mg/L	2020-09-15	
BOD, 5-day		< 6.5	N/A		mg/L	2020-09-17	HT1
Chemical Oxygen	Demand	< 20	N/A		mg/L	2020-09-15	
Nitrogen, Total Kje		0.053	N/A	0.050		2020-09-15	
Phosphorus, Total		0.0136	N/A	0.0050		2020-09-15	
Solids, Total Susp	. ,	< 2.0	N/A		mg/L	2020-09-14	
Total Metals					-		
Aluminum, total		0.0131	OG < 0.1	0.0050	mg/L	2020-09-17	
Antimony, total		< 0.00020	MAC = 0.006	0.00020	-	2020-09-17	

Aluminum, total	0.0131	OG < 0.1	0.0050 mg/L	2020-09-17
Antimony, total	< 0.00020	MAC = 0.006	0.00020 mg/L	2020-09-17
Arsenic, total	< 0.00050	MAC = 0.01	0.00050 mg/L	2020-09-17
Barium, total	0.305	MAC = 2	0.0050 mg/L	2020-09-17
Beryllium, total	< 0.00010	N/A	0.00010 mg/L	2020-09-17
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Caring About Results, Obviously.



REPORTED TO PROJECT	Elk River Alliance ERA-CBWM				WORK ORDER REPORTED	0091166 2020-09-1	
Analyte		Result	Guideline	RL	Units	Analyzed	Qualifier
COL01_200908_1	330 (0091166-02)   Matr	ix: Water   Sample	ed: 2020-09-08 13:3	0, Continued	I.		
Total Metals, Conti	nued						
Bismuth, total		< 0.00010	N/A	0.00010	mg/L	2020-09-17	
Boron, total		< 0.0500	MAC = 5	0.0500	mg/L	2020-09-17	
Cadmium, total		0.000031	MAC = 0.005	0.000010	mg/L	2020-09-17	
Calcium, total		39.3	None Required	0.20	mg/L	2020-09-17	
Chromium, total		< 0.00050	MAC = 0.05	0.00050	mg/L	2020-09-17	
Cobalt, total		< 0.00010	N/A	0.00010	mg/L	2020-09-17	
Copper, total		0.00062	MAC = 2	0.00040	mg/L	2020-09-17	
Iron, total		< 0.010	AO ≤ 0.3	0.010	mg/L	2020-09-17	
Lead, total		< 0.00020	MAC = 0.005	0.00020	mg/L	2020-09-17	
Lithium, total		0.00979	N/A	0.00010	mg/L	2020-09-17	
Magnesium, total		8.30	None Required	0.010	mg/L	2020-09-17	
Manganese, total		0.00551	MAC = 0.12	0.00020	mg/L	2020-09-17	
Mercury, total		< 0.000040	MAC = 0.001	0.000040	mg/L	2020-09-17	
Molybdenum, tota	I	0.00076	N/A	0.00010	mg/L	2020-09-17	
Nickel, total		0.00057	N/A	0.00040	mg/L	2020-09-17	
Phosphorus, total		< 0.050	N/A	0.050	mg/L	2020-09-17	
Potassium, total		0.77	N/A	0.10	mg/L	2020-09-17	
Selenium, total		< 0.00050	MAC = 0.05	0.00050	mg/L	2020-09-17	
Silicon, total		2.0	N/A	1.0	mg/L	2020-09-17	
Silver, total		< 0.000050	None Required	0.000050	mg/L	2020-09-17	
Sodium, total		3.30	AO ≤ 200	0.10	mg/L	2020-09-17	
Strontium, total		0.140	7	0.0010	mg/L	2020-09-17	
Sulfur, total		< 3.0	N/A	3.0	mg/L	2020-09-17	
Tellurium, total		< 0.00050	N/A	0.00050	mg/L	2020-09-17	
Thallium, total		< 0.000020	N/A	0.000020	mg/L	2020-09-17	
Thorium, total		< 0.00010	N/A	0.00010	mg/L	2020-09-17	
Tin, total		< 0.00020	N/A	0.00020	mg/L	2020-09-17	
Titanium, total		< 0.0050	N/A	0.0050	mg/L	2020-09-17	
Tungsten, total		< 0.0010	N/A	0.0010	mg/L	2020-09-17	
Uranium, total		0.000449	MAC = 0.02	0.000020	mg/L	2020-09-17	
Vanadium, total		< 0.0010	N/A	0.0010	mg/L	2020-09-17	
Zinc, total		< 0.0040	AO ≤ 5	0.0040	mg/L	2020-09-17	
Zirconium, total		< 0.00010	N/A	0.00010	mg/L	2020-09-17	

### Sample Qualifiers:

CT5 This sample has been incorrectly preserved for Mercury analysis

HT1 The sample was prepared and/or analyzed past the recommended holding time.



## **APPENDIX 1: SUPPORTING INFORMATION**

REPORTED TO PROJECT	Elk River Allia ERA-CBWM	ance	WORK ORDER REPORTED	0091166 2020-09-1	7 16:55
Analysis Descrip	otion	Method Ref.	Technique A	ccredited	Location
Alkalinity in Water		SM 2320 B* (2017)	Titration with H2SO4	$\checkmark$	Kelowna
Anions in Water		SM 4110 B (2017)	Ion Chromatography	✓	Kelowna
Biochemical Oxyge Water	en Demand in	SM 5210 B (2017)	Dissolved Oxygen Meter	✓	Kelowna
Chemical Oxygen I Water	Demand in	SM 5220 D* (2017)	Closed Reflux, Colorimetry	✓	Kelowna
Dissolved Metals in	n Water	EPA 200.8 / EPA 6020B	0.45 µm Filtration / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond
Hardness in Water		SM 2340 B (2017)	Calculation: 2.497 [diss Ca] + 4.118 [diss Mg]	✓	N/A
Nitrogen, Total Kjel	dahl in Water	SM 4500-Norg D* (2017)	Block Digestion and Flow Injection Analysis	✓	Kelowna
Phosphorus, Total i	in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Ac	id) ✓	Kelowna
Solids, Total Suspe Water	ended in	SM 2540 D* (2017)	Gravimetry (Dried at 103-105C)	✓	Kelowna
Total Metals in Wat	er	EPA 200.2 / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

### **Glossary of Terms:**

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
AO	Aesthetic Objective
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
OG	Operational Guideline (treated water)
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

### **Guidelines Referenced in this Report:**

Guidelines for Canadian Drinking Water Quality (Health Canada, June 2019)

Note: In some cases, the values displayed on the report represent the lowest guideline and are to be verified by the end user



## **APPENDIX 1: SUPPORTING INFORMATION**

REPORTED TO	Elk River Alliance
PROJECT	ERA-CBWM

WORK ORDER 0 REPORTED 2

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#### General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing.

Results in **Bold** indicate values that are above CARO's method reporting limits. Any results that are above regulatory limits are highlighted **red**. Please note that results will only be highlighted red if the regulatory limits are included on the CARO report. Any Bold and/or highlighted results do <u>not</u> take into account method uncertainty. If you would like method uncertainty or regulatory limits to be included on your report, please contact your Account Manager:teamcaro@caro.ca

Please note any regulatory guidelines applied to this report are added as a convenience to the client, at their request, to help provide some initial context to analytical results obtained. Although CARO makes every effort to ensure accuracy of the associated regulatory guideline(s) applied, the guidelines applied cannot be assumed to be correct due to a variety of factors and as such CARO Analytical Services assumes no liability or responsibility for the use of those guidelines to make any decisions. The original source of the regulation should be verified and a review of the guideline (s) should be validated as correct in order to make any decisions arising from the comparison of the analytical data obtained to the relevant regulatory guideline for one's particular circumstances. Further, CARO Analytical Services assumes no liability or responsibility for any loss attributed from the use of these guidelines in any way.



REPORTED TO	Elk River Alliance	WORK ORDER	0091166
PROJECT	ERA-CBWM	REPORTED	2020-09-17 16:55

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- Method Blank (Blk): A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- Duplicate (Dup): An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- Blank Spike (BS): A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- Matrix Spike (MS): A second aliquot of sample is fortified with with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL Units	Spike	Source	% REC	REC	% RPD RPD	Qualifier
, many to	Hoodit		Level	Result	/0 IXE0	Limit	Limit	quanto

#### Anions, Batch B0I1063

Blank (B0I1063-BLK1)			Prepared: 202	20-09-12, Analyze	ed: 2020-09-12	
Chloride	< 0.10	0.10 mg/L				
Nitrate (as N)	< 0.010	0.010 mg/L				
Nitrite (as N)	< 0.010	0.010 mg/L				
Phosphate (as P)	< 0.0050	0.0050 mg/L				
Sulfate	< 1.0	1.0 mg/L				
Blank (B0I1063-BLK2)			Prepared: 202	20-09-13, Analyze	ed: 2020-09-13	
Chloride	< 0.10	0.10 mg/L				
Nitrate (as N)	< 0.010	0.010 mg/L				
Nitrite (as N)	< 0.010	0.010 mg/L				
Phosphate (as P)	< 0.0050	0.0050 mg/L				
Sulfate	< 1.0	1.0 mg/L				
LCS (B0I1063-BS1)			Prepared: 202	20-09-12, Analyze	ed: 2020-09-12	
Chloride	16.1	0.10 mg/L	16.0	101	90-110	
Nitrate (as N)	4.06	0.010 mg/L	4.00	101	90-110	
Nitrite (as N)	2.04	0.010 mg/L	2.00	102	85-115	
Phosphate (as P)	0.998	0.0050 mg/L	1.00	100	80-120	
Sulfate	15.9	1.0 mg/L	16.0	100	90-110	
LCS (B0I1063-BS2)			Prepared: 202	20-09-13, Analyze	ed: 2020-09-13	
Chloride	16.0	0.10 mg/L	16.0	100	90-110	
Nitrate (as N)	3.97	0.010 mg/L	4.00	99	90-110	
Nitrite (as N)	1.95	0.010 mg/L	2.00	98	85-115	
	0.965	0.0050 mg/L	1.00	96	80-120	
Phosphate (as P)	0.905	0.0000 mg/L	1.00		00-120	

### Dissolved Metals, Batch B0l1383

Blank (B0I1383-BLK1)			Prepared: 2020-09-16, Analyzed: 2020-09-16	
Lithium, dissolved	< 0.00010	0.00010 mg/L		_
Aluminum, dissolved	< 0.0050	0.0050 mg/L		_
Antimony, dissolved	< 0.00020	0.00020 mg/L		_
Arsenic, dissolved	< 0.00050	0.00050 mg/L		_
Barium, dissolved	< 0.0050	0.0050 mg/L		_
Beryllium, dissolved	< 0.00010	0.00010 mg/L		_
				· · · · · ·



REPORTED TO PROJECT	Elk River Alliance ERA-CBWM					WORK REPOR			166 -09-17	16:55
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier

### Dissolved Metals, Batch B0l1383, Continued

Blank (B0I1383-BLK1), Continued			Prepared: 2020-09-16, Analyzed: 2020-09-16
Bismuth, dissolved	< 0.00010	0.00010 mg/L	
Boron, dissolved	< 0.0500	0.0500 mg/L	
Cadmium, dissolved	< 0.000010	0.000010 mg/L	
Calcium, dissolved	< 0.20	0.20 mg/L	
Chromium, dissolved	< 0.00050	0.00050 mg/L	
Cobalt, dissolved	< 0.00010	0.00010 mg/L	
Copper, dissolved	< 0.00040	0.00040 mg/L	
Iron, dissolved	< 0.010	0.010 mg/L	
Lead, dissolved	< 0.00020	0.00020 mg/L	
Magnesium, dissolved	< 0.010	0.010 mg/L	
Manganese, dissolved	< 0.00020	0.00020 mg/L	
Mercury, dissolved	< 0.000040	0.000040 mg/L	
Molybdenum, dissolved	< 0.00010	0.00010 mg/L	
Nickel, dissolved	< 0.00040	0.00040 mg/L	
Phosphorus, dissolved	< 0.050	0.050 mg/L	
Potassium, dissolved	< 0.10	0.10 mg/L	
Selenium, dissolved	< 0.00050	0.00050 mg/L	
Silicon, dissolved	< 1.0	1.0 mg/L	
Silver, dissolved	< 0.000050	0.000050 mg/L	
Sodium, dissolved	< 0.10	0.10 mg/L	
Strontium, dissolved	< 0.0010	0.0010 mg/L	
Sulfur, dissolved	< 3.0	3.0 mg/L	
Tellurium, dissolved	< 0.00050	0.00050 mg/L	
Thallium, dissolved	< 0.000020	0.000020 mg/L	
Thorium, dissolved	< 0.00010	0.00010 mg/L	
Tin, dissolved	< 0.00020	0.00020 mg/L	
Titanium, dissolved	< 0.0050	0.0050 mg/L	
Tungsten, dissolved	< 0.0010	0.0010 mg/L	
Uranium, dissolved	< 0.000020	0.000020 mg/L	
Vanadium, dissolved	< 0.0010	0.0010 mg/L	
Zinc, dissolved	< 0.0040	0.0040 mg/L	
Zirconium, dissolved	< 0.00010	0.00010 mg/L	
LCS (B0I1383-BS1)			Prepared: 2020-09-16, Analyzed: 2020-09-16

LCS (BUI1303-BS1)			Flepaleu. 20	20-09-10, Analyze	u. 2020-09-1	10
Lithium, dissolved	0.0234	0.00010 mg/L	0.0200	117	80-120	
Aluminum, dissolved	0.0224	0.0050 mg/L	0.0199	113	80-120	
Antimony, dissolved	0.0203	0.00020 mg/L	0.0200	101	80-120	
Arsenic, dissolved	0.0193	0.00050 mg/L	0.0200	96	80-120	
Barium, dissolved	0.0198	0.0050 mg/L	0.0198	100	80-120	
Beryllium, dissolved	0.0226	0.00010 mg/L	0.0198	114	80-120	
Bismuth, dissolved	0.0212	0.00010 mg/L	0.0200	106	80-120	
Boron, dissolved	< 0.0500	0.0500 mg/L	0.0200	117	80-120	
Cadmium, dissolved	0.0204	0.000010 mg/L	0.0199	102	80-120	
Calcium, dissolved	2.34	0.20 mg/L	2.02	116	80-120	
Chromium, dissolved	0.0210	0.00050 mg/L	0.0198	106	80-120	
Cobalt, dissolved	0.0197	0.00010 mg/L	0.0199	99	80-120	
Copper, dissolved	0.0205	0.00040 mg/L	0.0200	102	80-120	
Iron, dissolved	2.04	0.010 mg/L	2.02	101	80-120	
Lead, dissolved	0.0208	0.00020 mg/L	0.0199	105	80-120	
Magnesium, dissolved	2.14	0.010 mg/L	2.02	106	80-120	
Manganese, dissolved	0.0212	0.00020 mg/L	0.0199	107	80-120	
Mercury, dissolved	0.000798	0.000040 mg/L	0.00100	80	80-120	
Molybdenum, dissolved	0.0193	0.00010 mg/L	0.0200	96	80-120	
Nickel, dissolved	0.0208	0.00040 mg/L	0.0200	104	80-120	
Phosphorus, dissolved	2.18	0.050 mg/L	2.00	109	80-120	
Potassium, dissolved	2.12	0.10 mg/L	2.02	105	80-120	

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REPORTED TO PROJECT	Elk River Alliance ERA-CBWM					WORK REPOR	ORDER TED	0091 2020	166 -09-17	16:55
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifie
Dissolved Metals, I	Batch B0l1383, Continue	ed								
LCS (B0I1383-BS1)	, Continued			Prepared	: 2020-09-1	6, Analyze	d: 2020-0	9-16		
Selenium, dissolved		0.0207	0.00050 mg/L	0.0200		103	80-120			
Silicon, dissolved		1.9	1.0 mg/L	2.00		97	80-120			
Silver, dissolved		0.0203	0.000050 mg/L	0.0200		101	80-120			
Sodium, dissolved		2.16	0.10 mg/L	2.02		107	80-120			
Strontium, dissolved		0.0195	0.0010 mg/L	0.0200		98	80-120			
Sulfur, dissolved		5.9	3.0 mg/L	5.00		119	80-120			
Tellurium, dissolved		0.0191	0.00050 mg/L	0.0200		95	80-120			
Thallium, dissolved		0.0209	0.000020 mg/L	0.0199		105	80-120			
Thorium, dissolved		0.0201	0.00010 mg/L	0.0200		100	80-120			
Tin, dissolved		0.0203	0.00020 mg/L	0.0200		101	80-120			
Titanium, dissolved		0.0206	0.0050 mg/L	0.0200		103	80-120			
Tungsten, dissolved		0.0205	0.0010 mg/L	0.0200		102	80-120			
Uranium, dissolved		0.0204	0.000020 mg/L	0.0200		102	80-120			
Vanadium, dissolved		0.0198	0.0010 mg/L	0.0200		99	80-120			
Zinc, dissolved		0.0234	0.0040 mg/L	0.0200		117	80-120			
Zirconium, dissolved		0.0198	0.00010 mg/L	0.0200		99	80-120			
Reference (B0I1383	3-SRM1)			Prepared	1: 2020-09-1	6 Analyze	d <sup>.</sup> 2020-0	9-16		
Lithium, dissolved	,	0.117	0.00010 mg/L	0.100		117	70-130			
Aluminum, dissolved		0.245	0.0050 mg/L	0.235		104	70-130			
Antimony, dissolved		0.0456	0.00020 mg/L	0.0431		106	70-130			
Arsenic, dissolved		0.425	0.00050 mg/L	0.423		100	70-130			
Barium, dissolved		2.97	0.0050 mg/L	3.30		90	70-130			
Beryllium, dissolved		0.240	0.00010 mg/L	0.209		115	70-130			
Boron, dissolved		1.88	0.0500 mg/L	1.65		114	70-130			
Cadmium, dissolved		0.223	0.000010 mg/L	0.221		101	70-130			
Calcium, dissolved		7.46	0.20 mg/L	7.72		97	70-130			
Chromium, dissolved		0.449	0.00050 mg/L	0.434		104	70-130			
Cobalt, dissolved		0.123	0.00010 mg/L	0.124		99	70-130			
Copper, dissolved		0.823	0.00040 mg/L	0.815		101	70-130			
Iron, dissolved		1.30	0.010 mg/L	1.27		102	70-130			
Lead, dissolved		0.111	0.00020 mg/L	0.110		101	70-130			
Magnesium, dissolved	1	6.91	0.010 mg/L	6.59		105	70-130			
Manganese, dissolved		0.346	0.00020 mg/L	0.342		101	70-130			
Molybdenum, dissolve		0.407	0.00010 mg/L	0.404		101	70-130			
Nickel, dissolved		0.829	0.00040 mg/L	0.835		99	70-130			
Phosphorus, dissolved	4	0.502	0.050 mg/L	0.499		101	70-130			
Potassium, dissolved	-	3.04	0.10 mg/L	2.88		101	70-130			
Selenium, dissolved		0.0348	0.00050 mg/L	0.0324		103	70-130			
Sodium, dissolved		19.3	0.10 mg/L	18.0		107	70-130			
Strontium, dissolved		0.872	0.0010 mg/L	0.935		93	70-130			
Thallium, dissolved		0.0390	0.000020 mg/L	0.0385		101	70-130			
manium, uissoiveu										
Liranium dissolved		0 251	0.000020 ma/l	0 258		97	/()_1:20			
Uranium, dissolved Vanadium, dissolved		0.251	0.000020 mg/L 0.0010 mg/L	0.258		97 94	70-130 70-130			

### General Parameters, Batch B0I1072

Blank (B0I1072-BLK1)			Prepared: 202	20-09-12, Analyze	d: 2020-09-17	
BOD, 5-day	< 2.0	2.0 mg/L				
LCS (B0I1072-BS1)			Prepared: 202	20-09-12, Analyze	d: 2020-09-17	
BOD, 5-day	177	2.0 mg/L	180	98	85-115	

General Parameters, Batch B0I1134



	k River Alliance RA-CBWM					WORK ( REPOR		0091 2020	166 -09-17	16:55
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifie
General Parameters,E	atch B0I1134, Conti	nued								
Blank (B0I1134-BLK1)				Prepared	: 2020-09-14	1, Analyzeo	d: 2020-0	9-14		
Solids, Total Suspended		< 2.0	2.0 mg/L							
Blank (B0I1134-BLK2)				Prepared	: 2020-09-14	1. Analvzeo	d: 2020-0	9-14		
Solids, Total Suspended		< 2.0	2.0 mg/L	1		, ,		-		
LCS (B0I1134-BS1)				Prenared	: 2020-09-14		4. 2020-0	9_14		
Solids, Total Suspended		104	10.0 mg/L	100	. 2020-09-12	104	85-115	9-14		
		104	10.0 mg/L							
LCS (B0I1134-BS2)				•	: 2020-09-14			9-14		
Solids, Total Suspended		110	10.0 mg/L	100		110	85-115			
General Parameters,B	atch B0l1173									
Blank (B0I1173-BLK1)				Prepared	: 2020-09-14	1, Analyzeo	d: 2020-0	9-15		
Nitrogen, Total Kjeldahl		< 0.050	0.050 mg/L							
Blank (B0I1173-BLK2)				Prepared	: 2020-09-14	1, Analyzeo	d: 2020-0	9-15		
Nitrogen, Total Kjeldahl		< 0.050	0.050 mg/L	•						
LCS (B0I1173-BS1)				Prepared	: 2020-09-14	1 Analyze	1. 2020-0	9-15		
Nitrogen, Total Kjeldahl		1.02	0.050 mg/L	1.00	. 2020 00 1	102	85-115	0 10		
			,,,		: 2020-09-14			0.15		
						+ Analyzed	1 2020-0			
LCS (B0I1173-BS2) Nitrogen, Total Kjeldahl		1.03	0.050 mg/L	1.00	. 2020-03-1-	103	85-115			
Nitrogen, Total Kjeldahl General Parameters, E		1.03	0.050 mg/L	1.00		103	85-115			
Nitrogen, Total Kjeldahl		1.03	0.050 mg/L	1.00	: 2020-09-15	103	85-115			
Nitrogen, Total Kjeldahl General Parameters, E Blank (B0I1220-BLK1) Alkalinity, Total (as CaCO3 Alkalinity, Phenolphthaleir	3) i (as CaCO3)		1.0 mg/L 1.0 mg/L	1.00		103	85-115			
Nitrogen, Total Kjeldahl General Parameters, E Blank (B0I1220-BLK1) Alkalinity, Total (as CaCO3 Alkalinity, Phenolphthaleir Alkalinity, Bicarbonate (as	3) (as CaCO3) CaCO3)	< 1.0 < 1.0 < 1.0	1.0 mg/L 1.0 mg/L 1.0 mg/L	1.00		103	85-115			
Nitrogen, Total Kjeldahl General Parameters, E Blank (B0I1220-BLK1) Alkalinity, Total (as CaCO3 Alkalinity, Phenolphthaleir Alkalinity, Bicarbonate (as Alkalinity, Carbonate (as C	3) (as CaCO3) CaCO3) CaCO3)	< 1.0 < 1.0 < 1.0 < 1.0	1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L	1.00		103	85-115			
Nitrogen, Total Kjeldahl General Parameters, E Blank (B0I1220-BLK1) Alkalinity, Total (as CaCO3 Alkalinity, Phenolphthaleir Alkalinity, Bicarbonate (as	3) (as CaCO3) CaCO3) CaCO3)	< 1.0 < 1.0 < 1.0	1.0 mg/L 1.0 mg/L 1.0 mg/L	1.00 Prepared	: 2020-09-15	103 5, Analyzed	85-115 d: 2020-0	9-15		
Nitrogen, Total Kjeldahl General Parameters, E Blank (B0I1220-BLK1) Alkalinity, Total (as CaCO3 Alkalinity, Phenolphthalein Alkalinity, Bicarbonate (as C Alkalinity, Carbonate (as C Alkalinity, Hydroxide (as C Blank (B0I1220-BLK2)	3) (as CaCO3) CaCO3) CaCO3) caCO3)	< 1.0 < 1.0 < 1.0 < 1.0 < 1.0 < 1.0	1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L	1.00 Prepared		103 5, Analyzed	85-115 d: 2020-0	9-15		
Nitrogen, Total Kjeldahl General Parameters, E Blank (B0I1220-BLK1) Alkalinity, Total (as CaCO Alkalinity, Phenolphthalein Alkalinity, Bicarbonate (as C Alkalinity, Carbonate (as C Alkalinity, Hydroxide (as C Blank (B0I1220-BLK2) Alkalinity, Total (as CaCO	3) (as CaCO3) CaCO3) CaCO3) caCO3) 3)	< 1.0 < 1.0 < 1.0 < 1.0 < 1.0 < 1.0 < 1.0	1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L	1.00 Prepared	: 2020-09-15	103 5, Analyzed	85-115 d: 2020-0	9-15		
Nitrogen, Total Kjeldahl General Parameters, E Blank (B0I1220-BLK1) Alkalinity, Total (as CaCO Alkalinity, Phenolphthaleir Alkalinity, Bicarbonate (as C Alkalinity, Carbonate (as C Alkalinity, Hydroxide (as C Blank (B0I1220-BLK2) Alkalinity, Total (as CaCO Alkalinity, Phenolphthaleir	3) (as CaCO3) CaCO3) CaCO3) caCO3) 3) (as CaCO3)	< 1.0 < 1.0 < 1.0 < 1.0 < 1.0 < 1.0 < 1.0 < 1.0	1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L	1.00 Prepared	: 2020-09-15	103 5, Analyzed	85-115 d: 2020-0	9-15		
Nitrogen, Total Kjeldahl General Parameters, E Blank (B0I1220-BLK1) Alkalinity, Total (as CaCO Alkalinity, Phenolphthalein Alkalinity, Bicarbonate (as C Alkalinity, Carbonate (as C Alkalinity, Hydroxide (as C Blank (B0I1220-BLK2) Alkalinity, Total (as CaCO Alkalinity, Phenolphthalein Alkalinity, Bicarbonate (as	3) (as CaCO3) CaCO3) CaCO3) (acO3) 3) (as CaCO3) CaCO3)	< 1.0 < 1.0 < 1.0 < 1.0 < 1.0 < 1.0 < 1.0 < 1.0 < 1.0 < 1.0	1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L	1.00 Prepared	: 2020-09-15	103 5, Analyzed	85-115 d: 2020-0	9-15		
Nitrogen, Total Kjeldahl General Parameters, E Blank (B0I1220-BLK1) Alkalinity, Total (as CaCO Alkalinity, Phenolphthaleir Alkalinity, Bicarbonate (as C Alkalinity, Hydroxide (as C Blank (B0I1220-BLK2) Alkalinity, Total (as CaCO Alkalinity, Phenolphthaleir Alkalinity, Bicarbonate (as C Alkalinity, Carbonate (as C	3) (as CaCO3) CaCO3) CaCO3) (acCO3) (acCO3) (as CaCO3) (as CaCO3) CaCO3)	< 1.0 < 1.0	1.0 mg/L 1.0 mg/L	1.00 Prepared	: 2020-09-15	103 5, Analyzed	85-115 d: 2020-0	9-15		
Nitrogen, Total Kjeldahl General Parameters, E Blank (B0I1220-BLK1) Alkalinity, Total (as CaCC) Alkalinity, Total (as CaCC) Alkalinity, Phenolphthaleir Alkalinity, Bicarbonate (as C Alkalinity, Hydroxide (as C Blank (B0I1220-BLK2) Alkalinity, Total (as CaCC) Alkalinity, Phenolphthaleir Alkalinity, Bicarbonate (as C Alkalinity, Carbonate (as C Alkalinity, Hydroxide (as C	3) (as CaCO3) CaCO3) CaCO3) (acCO3) (acCO3) (as CaCO3) (as CaCO3) CaCO3)	< 1.0 < 1.0 < 1.0 < 1.0 < 1.0 < 1.0 < 1.0 < 1.0 < 1.0 < 1.0	1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L	1.00 Prepared Prepared	: 2020-09-15 : 2020-09-15	103 5, Analyzed	85-115 d: 2020-0 d: 2020-0	9-15		
Nitrogen, Total Kjeldahl General Parameters, E Blank (B0I1220-BLK1) Alkalinity, Total (as CaCO: Alkalinity, Phenolphthaleir Alkalinity, Bicarbonate (as C Alkalinity, Carbonate (as C Alkalinity, Hydroxide (as C Blank (B0I1220-BLK2) Alkalinity, Phenolphthaleir Alkalinity, Bicarbonate (as C Alkalinity, Bicarbonate (as C Alkalinity, Hydroxide (as C Alkalinity, Hydroxide (as C Alkalinity, Hydroxide (as C	3) (as CaCO3) CaCO3) (aCO3) (aCO3) (as CaCO3) (as CaCO3) (aCO3) (aCO3) (aCO3)	< 1.0 < 1.0	1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L	1.00 Prepared Prepared Prepared	: 2020-09-15	103 5, Analyzed 5, Analyzed 5, Analyzed	85-115 d: 2020-0 d: 2020-0	9-15		
Nitrogen, Total Kjeldahl General Parameters, E Blank (B0I1220-BLK1) Alkalinity, Total (as CaCO: Alkalinity, Total (as CaCO: Alkalinity, Phenolphthaleir Alkalinity, Bicarbonate (as C Alkalinity, Hydroxide (as C Blank (B0I1220-BLK2) Alkalinity, Total (as CaCO: Alkalinity, Phenolphthaleir Alkalinity, Bicarbonate (as C Alkalinity, Carbonate (as C Alkalinity, Hydroxide (as C	3) (as CaCO3) CaCO3) (aCO3) (aCO3) (as CaCO3) (as CaCO3) (aCO3) (aCO3) (aCO3)	< 1.0 < 1.0	1.0 mg/L 1.0 mg/L	1.00 Prepared Prepared Prepared 100	: 2020-09-15 : 2020-09-15 : 2020-09-15	103 5, Analyzed 5, Analyzed 5, Analyzed 88	85-115 d: 2020-0 d: 2020-0 d: 2020-0 d: 2020-0 80-120	9-15 9-15 9-15		
Nitrogen, Total Kjeldahl General Parameters, E Blank (B0I1220-BLK1) Alkalinity, Total (as CaCO: Alkalinity, Total (as CaCO: Alkalinity, Bicarbonate (as C Alkalinity, Carbonate (as C Alkalinity, Hydroxide (as C Blank (B0I1220-BLK2) Alkalinity, Phenolphthaleir Alkalinity, Bicarbonate (as C Alkalinity, Bicarbonate (as C Alkalinity, Hydroxide (as C Alkalinity, Hydroxide (as C Alkalinity, Hydroxide (as C	3) (as CaCO3) CaCO3) (aCO3) (aCO3) (as CaCO3) (as CaCO3) (aCO3) (aCO3) (aCO3)	< 1.0 < 1.0	1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L	1.00 Prepared Prepared Prepared 100	: 2020-09-15 : 2020-09-15	103 5, Analyzed 5, Analyzed 5, Analyzed 88	85-115 d: 2020-0 d: 2020-0 d: 2020-0 d: 2020-0 80-120	9-15 9-15 9-15		
Nitrogen, Total Kjeldahl General Parameters, E Blank (B0I1220-BLK1) Alkalinity, Total (as CaCOC Alkalinity, Phenolphthaleir Alkalinity, Bicarbonate (as C Alkalinity, Carbonate (as C Alkalinity, Hydroxide (as C Blank (B0I1220-BLK2) Alkalinity, Phenolphthaleir Alkalinity, Phenolphthaleir Alkalinity, Bicarbonate (as C Alkalinity, Hydroxide (as C C LCS (B0I1220-BS1) Alkalinity, Total (as CaCOC LCS (B0I1220-BS2) Alkalinity, Total (as CaCOC	3) (as CaCO3) CaCO3) CaCO3) (acO3) (as CaCO3) CaCO3) CaCO3) CaCO3) (asCO3)	< 1.0 < 1.0	1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L 1.0 mg/L	1.00 Prepared Prepared Prepared 100	: 2020-09-15 : 2020-09-15 : 2020-09-15	103 5, Analyzed 5, Analyzed 5, Analyzed 88	85-115 d: 2020-0 d: 2020-0 d: 2020-0 d: 2020-0 80-120	9-15 9-15 9-15		
Nitrogen, Total Kjeldahl General Parameters, E Blank (B0I1220-BLK1) Alkalinity, Total (as CaCO Alkalinity, Phenolphthalein Alkalinity, Bicarbonate (as C Alkalinity, Carbonate (as C Alkalinity, Hydroxide (as C Blank (B0I1220-BLK2) Alkalinity, Total (as CaCO Alkalinity, Phenolphthalein Alkalinity, Bicarbonate (as C Alkalinity, Bicarbonate (as C Alkalinity, Bicarbonate (as C Alkalinity, Carbonate (as C Alkalinity, Hydroxide (as C LCS (B0I1220-BS1) Alkalinity, Total (as CaCO LCS (B0I1220-BS2) Alkalinity, Total (as CaCO General Parameters, E	3) (as CaCO3) CaCO3) CaCO3) (acO3) (as CaCO3) CaCO3) CaCO3) CaCO3) (asCO3)	<1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0	1.0 mg/L 1.0 mg/L	1.00 Prepared Prepared 100 Prepared 100	: 2020-09-18 : 2020-09-18 : 2020-09-18 : 2020-09-18	103 5, Analyzed 5, Analyzed 5, Analyzed 88 5, Analyzed 90	85-115 d: 2020-0 d: 2020-0 d: 2020-0 80-120 d: 2020-0 80-120	9-15 9-15 9-15 9-15		
Nitrogen, Total Kjeldahl General Parameters, E Blank (B0I1220-BLK1) Alkalinity, Total (as CaCO Alkalinity, Phenolphthaleir Alkalinity, Bicarbonate (as C Alkalinity, Carbonate (as C Alkalinity, Hydroxide (as C Blank (B0I1220-BLK2) Alkalinity, Phenolphthaleir Alkalinity, Dicarbonate (as C Alkalinity, Carbonate (as C Alkalinity, Carbonate (as C Alkalinity, Carbonate (as C Alkalinity, Bicarbonate (as C Alkalinity, Carbonate (as C Alkalinity, Hydroxide (as C LCS (B0I1220-BS1) Alkalinity, Total (as CaCO LCS (B0I1220-BS2) Alkalinity, Total (as CaCO General Parameters, E Blank (B0I1233-BLK1)	3) (as CaCO3) CaCO3) CaCO3) (acO3) (as CaCO3) CaCO3) CaCO3) (acO3) (a	<pre>&lt; 1.0 &lt; 88.1 </pre>	1.0 mg/L 1.0 mg/L	1.00 Prepared Prepared 100 Prepared 100	: 2020-09-15 : 2020-09-15 : 2020-09-15	103 5, Analyzed 5, Analyzed 5, Analyzed 88 5, Analyzed 90	85-115 d: 2020-0 d: 2020-0 d: 2020-0 80-120 d: 2020-0 80-120	9-15 9-15 9-15 9-15		
Nitrogen, Total Kjeldahl General Parameters, E Blank (B0I1220-BLK1) Alkalinity, Total (as CaCO Alkalinity, Phenolphthaleir Alkalinity, Bicarbonate (as C Alkalinity, Carbonate (as C Alkalinity, Hydroxide (as C Blank (B0I1220-BLK2) Alkalinity, Total (as CaCO Alkalinity, Phenolphthaleir Alkalinity, Bicarbonate (as C Alkalinity, Bicarbonate (as C Alkalinity, Bicarbonate (as C Alkalinity, Bicarbonate (as C Alkalinity, Hydroxide (as C LCS (B0I1220-BS1) Alkalinity, Total (as CaCO LCS (B0I1220-BS2) Alkalinity, Total (as CaCO General Parameters, E	3) (as CaCO3) CaCO3) CaCO3) (acO3) (as CaCO3) CaCO3) CaCO3) (acO3) (a	<1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0	1.0 mg/L 1.0 mg/L	1.00 Prepared Prepared 100 Prepared 100 Prepared	: 2020-09-18 : 2020-09-18 : 2020-09-18 : 2020-09-18 : 2020-09-18	103 5, Analyzed 5, Analyzed 5, Analyzed 88 5, Analyzed 90 5, Analyzed	85-115 d: 2020-0 d: 2020-0 d: 2020-0 80-120 d: 2020-0 80-120 d: 2020-0 80-120	9-15 9-15 9-15 9-15 9-15		
Nitrogen, Total Kjeldahl General Parameters, E Blank (B0I1220-BLK1) Alkalinity, Total (as CaCO Alkalinity, Phenolphthaleir Alkalinity, Bicarbonate (as C Alkalinity, Carbonate (as C Alkalinity, Hydroxide (as C Blank (B0I1220-BLK2) Alkalinity, Phenolphthaleir Alkalinity, Dicarbonate (as C Alkalinity, Carbonate (as C Alkalinity, Carbonate (as C Alkalinity, Carbonate (as C Alkalinity, Bicarbonate (as C Alkalinity, Carbonate (as C Alkalinity, Hydroxide (as C LCS (B0I1220-BS1) Alkalinity, Total (as CaCO LCS (B0I1220-BS2) Alkalinity, Total (as CaCO General Parameters, E Blank (B0I1233-BLK1)	3) (as CaCO3) CaCO3) CaCO3) (acO3) (as CaCO3) CaCO3) CaCO3) (acO3) (a	<pre>&lt; 1.0 &lt; 88.1 </pre>	1.0 mg/L 1.0 mg/L	1.00 Prepared Prepared 100 Prepared 100 Prepared	: 2020-09-18 : 2020-09-18 : 2020-09-18 : 2020-09-18	103 5, Analyzed 5, Analyzed 5, Analyzed 88 5, Analyzed 90 5, Analyzed	85-115 d: 2020-0 d: 2020-0 d: 2020-0 80-120 d: 2020-0 80-120 d: 2020-0 80-120	9-15 9-15 9-15 9-15 9-15		



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REPORTED TO PROJECT	Elk River Alliance ERA-CBWM					WORK REPOR	ORDER RTED		1166 )-09-17	16:55
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameter	rs, Batch B0l1237									
Blank (B0I1237-BL	_K1)			Prepared	1: 2020-09-1	15, Analyze	ed: 2020-0	)9-15		
Phosphorus, Total (as	s P)	< 0.0050	0.0050 mg/L							
Blank (B0I1237-BL	_K2)			Prepared	1: 2020-09-1	15, Analyze	ed: 2020-0	)9-15		
Phosphorus, Total (as	s P)	< 0.0050	0.0050 mg/L							
LCS (B0I1237-BS1	)			Prepared	1: 2020-09-1	15, Analyze	ed: 2020-0	)9-15		
Phosphorus, Total (as	s P)	0.103	0.0050 mg/L	0.100		103	85-115			
LCS (B0I1237-BS2	2)			Prepared	1: 2020-09-1	15, Analyze	ed: 2020-0	)9-15		
Phosphorus, Total (as	s P)	0.103	0.0050 mg/L	0.100		103	85-115			
Duplicate (B0I123)	7-DUP2)	Sou	urce: 0091166-02	Prepared	1: 2020-09-1	15, Analyze	ed: 2020-0	)9-15		
Phosphorus, Total (as	s P)	0.0139	0.0050 mg/L		0.0136				15	
Matrix Spike (B0I1	237-MS2)	Sou	urce: 0091166-02	Prepared	1: 2020-09-1	15, Analyze	ed: 2020-0	)9-15		
Phosphorus, Total (as	s P)	0.119	0.0050 mg/L	0.102	0.0136	103	70-125			

### Total Metals, Batch B0l1450

Blank (B0I1450-BLK1)			Prepared: 2020-09-16, Analyzed: 2020-09-17
Aluminum, total	< 0.0050	0.0050 mg/L	
Antimony, total	< 0.00020	0.00020 mg/L	
Arsenic, total	< 0.00050	0.00050 mg/L	
Barium, total	< 0.0050	0.0050 mg/L	
Beryllium, total	< 0.00010	0.00010 mg/L	
Bismuth, total	< 0.00010	0.00010 mg/L	
Boron, total	< 0.0500	0.0500 mg/L	
Cadmium, total	< 0.000010	0.000010 mg/L	
Calcium, total	< 0.20	0.20 mg/L	
Chromium, total	< 0.00050	0.00050 mg/L	
Cobalt, total	< 0.00010	0.00010 mg/L	
Copper, total	< 0.00040	0.00040 mg/L	
Iron, total	< 0.010	0.010 mg/L	
Lead, total	< 0.00020	0.00020 mg/L	
Lithium, total	< 0.00010	0.00010 mg/L	
Magnesium, total	< 0.010	0.010 mg/L	
Manganese, total	< 0.00020	0.00020 mg/L	
Mercury, total	< 0.000040	0.000040 mg/L	
Molybdenum, total	< 0.00010	0.00010 mg/L	
Nickel, total	< 0.00040	0.00040 mg/L	
Phosphorus, total	< 0.050	0.050 mg/L	
Potassium, total	< 0.10	0.10 mg/L	
Selenium, total	< 0.00050	0.00050 mg/L	
Silicon, total	< 1.0	1.0 mg/L	
Silver, total	< 0.000050	0.000050 mg/L	
Sodium, total	< 0.10	0.10 mg/L	
Strontium, total	< 0.0010	0.0010 mg/L	
Sulfur, total	< 3.0	3.0 mg/L	
Tellurium, total	< 0.00050	0.00050 mg/L	
Thallium, total	< 0.000020	0.000020 mg/L	
Thorium, total	< 0.00010	0.00010 mg/L	
Tin, total	< 0.00020	0.00020 mg/L	
Titanium, total	< 0.0050	0.0050 mg/L	
Tungsten, total	< 0.0010	0.0010 mg/L	
Uranium, total	< 0.000020	0.000020 mg/L	
Vanadium, total	< 0.0010	0.0010 mg/L	

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PROJECT	Elk River Alliance ERA-CBWM					WORK (			-09-17	16:55
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier

### Total Metals, Batch B0l1450, Continued

Blank (B0I1450-BLK1), Continued			Prepared: 2	020-09-16, Analyzed:	2020-09-17	
Zinc, total	< 0.0040	0.0040 mg/L				
Zirconium, total	< 0.00010	0.00010 mg/L				
LCS (B0I1450-BS1)			Prepared: 2	020-09-16, Analyzed:	2020-09-17	
Aluminum, total	0.0198	0.0050 mg/L	0.0199	100 8	30-120	
Antimony, total	0.0200	0.00020 mg/L	0.0200	100 8	30-120	
Arsenic, total	0.0199	0.00050 mg/L	0.0200	100 8	30-120	
Barium, total	0.0209	0.0050 mg/L	0.0198	106 8	30-120	
Beryllium, total	0.0197	0.00010 mg/L	0.0198	100 8	30-120	
Bismuth, total	0.0209	0.00010 mg/L	0.0200	104 8	30-120	
Boron, total	< 0.0500	0.0500 mg/L	0.0200	112 8	30-120	
Cadmium, total	0.0197	0.000010 mg/L	0.0199	99 8	30-120	
Calcium, total	2.01	0.20 mg/L	2.02	100 8	30-120	
Chromium, total	0.0200	0.00050 mg/L	0.0198	101 8	30-120	
Cobalt, total	0.0209	0.00010 mg/L	0.0199	105 8	30-120	
Copper, total	0.0207	0.00040 mg/L	0.0200	103 8	30-120	
Iron, total	2.03	0.010 mg/L	2.02	100 8	30-120	
Lead, total	0.0198	0.00020 mg/L	0.0199	99 8	30-120	
Lithium, total	0.0199	0.00010 mg/L	0.0200	99 8	30-120	
Magnesium, total	2.20	0.010 mg/L	2.02	109 8	30-120	
Manganese, total	0.0202	0.00020 mg/L	0.0199	102 8	30-120	
Mercury, total	0.00109	0.000040 mg/L	0.00100	109 8	30-120	
Molybdenum, total	0.0199	0.00010 mg/L	0.0200	99 8	30-120	
Nickel, total	0.0200	0.00040 mg/L	0.0200	100 8	30-120	
Phosphorus, total	2.04	0.050 mg/L	2.00	102 8	30-120	
Potassium, total	2.04	0.10 mg/L	2.02	101 8	30-120	
Selenium, total	0.0198	0.00050 mg/L	0.0200	99 8	30-120	
Silicon, total	2.0	1.0 mg/L	2.00	102 8	30-120	
Silver, total	0.0200	0.000050 mg/L	0.0200	100 8	30-120	
Sodium, total	2.22	0.10 mg/L	2.02		30-120	
Strontium, total	0.0200	0.0010 mg/L	0.0200		30-120	
Sulfur, total	5.4	3.0 mg/L	5.00		30-120	
Tellurium, total	0.0191	0.00050 mg/L	0.0200		30-120	
Thallium, total	0.0210	0.000020 mg/L	0.0199		30-120	
Thorium, total	0.0195	0.00010 mg/L	0.0200		30-120	
Tin, total	0.0202	0.00020 mg/L	0.0200		30-120	
Titanium, total	0.0186	0.0050 mg/L	0.0200		30-120	
Tungsten, total	0.0209	0.0010 mg/L	0.0200		30-120	
Uranium, total	0.0205	0.000020 mg/L	0.0200		30-120	
Vanadium, total	0.0184	0.0010 mg/L	0.0200		30-120	
Zinc, total	0.0238	0.0040 mg/L	0.0200		30-120	
Zirconium, total	0.0197	0.00010 mg/L	0.0200		30-120	
Reference (B0I1450-SRM1)			-	020-09-16, Analyzed:		
Aluminum, total	0.281	0.0050 mg/L	0.299		70-130	
Antimony, total	0.0494	0.00020 mg/L	0.0517		70-130	
Arsenic, total	0.118	0.00050 mg/L	0.119		70-130	
Barium, total	0.783	0.0050 mg/L	0.801		70-130	
Beryllium, total	0.0485	0.00010 mg/L	0.0501		70-130	
Boron, total	3.82	0.0500 mg/L	4.11		70-130	
Cadmium, total	0.0478	0.000010 mg/L	0.0503		70-130	
Calcium, total	10.8	0.20 mg/L	10.7		70-130	
Chromium, total	0.247	0.00050 mg/L	0.250		70-130	
Cobalt, total	0.0402	0.00010 mg/L	0.0384		70-130	
Copper, total	0.467	0.00040 mg/L	0.487		70-130	
Iron, total	0.541	0.010 mg/L	0.504		70-130	
Lead, total	0.269	0.00020 mg/L	0.278	97 7	70-130	Page 14 of 1



REPORTED TO PROJECT	Elk River Alliance ERA-CBWM					WORK REPOR	-		166 -09-17	16:55
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifie
Total Metals, Batc	h B0l1450, Continued									
Reference (B0I145	50-SRM1), Continued			Prepared	l: 2020-09-1	l6, Analyze	d: 2020-0	)9-17		

Reference (B0I1450-SRM1), Continued			Prepared: 20	20-09-16, Analyze	a: 2020-09-17	
Lithium, total	0.390	0.00010 mg/L	0.398	98	70-130	
Magnesium, total	4.10	0.010 mg/L	3.59	114	70-130	
Manganese, total	0.107	0.00020 mg/L	0.111	97	70-130	
Mercury, total	0.00586	0.000040 mg/L	0.00581	101	70-130	
Molybdenum, total	0.197	0.00010 mg/L	0.196	100	70-130	
Nickel, total	0.244	0.00040 mg/L	0.248	99	70-130	
Phosphorus, total	0.215	0.050 mg/L	0.213	101	70-130	
Potassium, total	6.70	0.10 mg/L	5.89	114	70-130	
Selenium, total	0.122	0.00050 mg/L	0.120	102	70-130	
Sodium, total	8.81	0.10 mg/L	8.71	101	70-130	
Strontium, total	0.391	0.0010 mg/L	0.393	99	70-130	
Thallium, total	0.0690	0.000020 mg/L	0.0787	88	70-130	
Uranium, total	0.0346	0.000020 mg/L	0.0344	101	70-130	
Vanadium, total	0.386	0.0010 mg/L	0.391	99	70-130	
Zinc, total	2.00	0.0040 mg/L	2.50	80	70-130	



## **CERTIFICATE OF ANALYSIS**

REPORTED TO	Elk River Alliance PO Box 537 - 891 2nd Ave Ferniecha, BC V0B1M0		
ATTENTION	Chad Hughes	WORK ORDER	0091213
PO NUMBER PROJECT PROJECT INFO	ERA-CBWM [info]	RECEIVED / TEMP REPORTED COC NUMBER	2020-09-11 09:35 / 9°C 2020-09-18 20:16 B90308

#### Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

We've Got Chemistry

#### Big Picture Sidekicks



You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too. It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

👗 Af

Ahead of the Curve

Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

If you have any questions or concerns, please contact me at teamcaro@caro.ca

#### Authorized By:

Team CARO Client Service Representative

### 1-888-311-8846 | www.caro.ca

#110 4011 Viking Way Richmond, BC V6V 2K9 | #102 3677 Highway 97N Kelowna, BC V1X 5C3 | 17225 109 Avenue Edmonton, AB T5S 1H7



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REPORTED TO PROJECT	Elk River Alliance ERA-CBWM				WORK ORDER REPORTED	0091213 2020-09-1	8 20:16
Analyte		Result	Guideline	RL	Units	Analyzed	Qualifier
LIZ01_200909_94	5 (0091213-01)   Matrix:	Water   Sampled	: 2020-09-09 09:45				
Anions							
Chloride		0.18	AO ≤ 250	0.10	mg/L	2020-09-13	
Nitrate (as N)		< 0.010	MAC = 10	0.010		2020-09-13	HT1
Nitrite (as N)		< 0.010	MAC = 1	0.010	mg/L	2020-09-13	HT1
Phosphate (as P)		< 0.0050	N/A	0.0050		2020-09-13	HT1
Sulfate		192	AO ≤ 500	1.0	mg/L	2020-09-13	
Calculated Parame	ters						
Hardness, Total (a	as CaCO3)	362	None Required	0.500	mg/L	N/A	
Nitrate+Nitrite (as	N)	< 0.0100	N/A	0.0100	mg/L	N/A	
Nitrogen, Total		< 0.0500	N/A	0.0500	mg/L	N/A	
Dissolved Metals							
Lithium, dissolved		0.00371	N/A	0.00010	ma/L	2020-09-18	
Aluminum, dissolv		< 0.0050	N/A	0.0050	•	2020-09-18	
Antimony, dissolve		< 0.00020	N/A	0.00020		2020-09-18	
Arsenic, dissolved		< 0.00050	N/A	0.00050	0	2020-09-18	
Barium, dissolved		0.0696	N/A	0.0050	-	2020-09-18	
Beryllium, dissolve		< 0.00010	N/A	0.00010		2020-09-18	
Bismuth, dissolve		< 0.00010	N/A	0.00010	-	2020-09-18	
Boron, dissolved		< 0.0500	N/A	0.0500	-	2020-09-18	
Cadmium, dissolv	ed	0.000022	N/A	0.000010	-	2020-09-18	
Calcium, dissolve	d	106	N/A	0.20	mg/L	2020-09-18	
Chromium, dissolv	ved	0.00058	N/A	0.00050	-	2020-09-18	
Cobalt, dissolved		< 0.00010	N/A	0.00010	mg/L	2020-09-18	
Copper, dissolved		< 0.00040	N/A	0.00040	mg/L	2020-09-18	
Iron, dissolved		< 0.010	N/A	0.010	mg/L	2020-09-18	
Lead, dissolved		< 0.00020	N/A	0.00020	mg/L	2020-09-18	
Magnesium, disso	lved	23.5	N/A	0.010	mg/L	2020-09-18	
Manganese, disso	blved	0.00149	N/A	0.00020	mg/L	2020-09-18	
Mercury, dissolved	b	< 0.000040	N/A	0.000040	mg/L	2020-09-18	
Molybdenum, diss	solved	0.00194	N/A	0.00010	mg/L	2020-09-18	
Nickel, dissolved		< 0.00040	N/A	0.00040	mg/L	2020-09-18	
Phosphorus, disso	blved	< 0.050	N/A	0.050	mg/L	2020-09-18	
Potassium, dissolv	ved	0.44	N/A	0.10	mg/L	2020-09-18	
Selenium, dissolve	ed	< 0.00050	N/A	0.00050	mg/L	2020-09-18	
Silicon, dissolved		2.4	N/A	1.0	mg/L	2020-09-18	
Silver, dissolved		< 0.000050	N/A	0.000050	mg/L	2020-09-18	
Sodium, dissolved	1	1.58	N/A		mg/L	2020-09-18	
Strontium, dissolv	ed	1.61	N/A	0.0010	mg/L	2020-09-18	
Sulfur, dissolved		71.0	N/A		mg/L	2020-09-18	
Tellurium, dissolve	ed	< 0.00050	N/A	0.00050	mg/L	2020-09-18	
Thallium, dissolve	d	< 0.000020	N/A	0.000020	mg/L	2020-09-18	
Thorium, dissolve	d	< 0.00010	N/A	0.00010	-	2020-09-18	
Tin, dissolved		< 0.00020	N/A	0.00020	mg/L	2020-09-18	Page 2 of

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REPORTED TO Elk River Alliance PROJECT ERA-CBWM				WORK ORDER REPORTED	0091213 2020-09-1	8 20:16
Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
	Water   Sampled	2020-09-09 09:45,	Continued			
Dissolved Metals, Continued						
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-09-18	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-09-18	
Uranium, dissolved	0.000382	N/A	0.000020	mg/L	2020-09-18	
Vanadium, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-09-18	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2020-09-18	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-09-18	
General Parameters						
Alkalinity, Total (as CaCO3)	129	N/A	1.0	mg/L	2020-09-15	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2020-09-15	
Alkalinity, Bicarbonate (as CaCO3)	129	N/A	1.0	mg/L	2020-09-15	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2020-09-15	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2020-09-15	
BOD, 5-day	< 6.5	N/A	2.0	mg/L	2020-09-17	
Chemical Oxygen Demand	< 20	N/A	20	mg/L	2020-09-17	
Nitrogen, Total Kjeldahl	< 0.050	N/A	0.050	mg/L	2020-09-16	
Phosphorus, Total (as P)	0.0149	N/A	0.0050	mg/L	2020-09-16	
Solids, Total Suspended	2.0	N/A	2.0	mg/L	2020-09-14	
Total Metals						
Aluminum, total	0.0110	OG < 0.1	0.0050	mg/L	2020-09-17	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2020-09-17	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2020-09-17	
Barium, total	0.0761	MAC = 2	0.0050	mg/L	2020-09-17	
Beryllium, total	< 0.00010	N/A	0.00010	mg/L	2020-09-17	
Bismuth, total	< 0.00010	N/A	0.00010	mg/L	2020-09-17	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2020-09-17	
Cadmium, total	0.000016	MAC = 0.005	0.000010	mg/L	2020-09-17	
Calcium, total	98.3	None Required	0.20	mg/L	2020-09-17	
Chromium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2020-09-17	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2020-09-17	
Copper, total	< 0.00040	MAC = 2	0.00040	mg/L	2020-09-17	
Iron, total	0.020	AO ≤ 0.3	0.010	mg/L	2020-09-17	
Lead, total	< 0.00020	MAC = 0.005	0.00020	mg/L	2020-09-17	
Lithium, total	0.00405	N/A	0.00010	mg/L	2020-09-17	
Magnesium, total	25.3	None Required	0.010	mg/L	2020-09-17	
Manganese, total	0.00240	MAC = 0.12	0.00020	mg/L	2020-09-17	
Mercury, total	< 0.000040	MAC = 0.001	0.000040	mg/L	2020-09-17	CT5
Molybdenum, total	0.00203	N/A	0.00010	mg/L	2020-09-17	
Nickel, total	< 0.00040	N/A	0.00040	mg/L	2020-09-17	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2020-09-17	
Potassium, total	0.47	N/A	0.10	mg/L	2020-09-17	
Selenium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2020-09-17	
Silicon, total	2.6	N/A	1.0	mg/L	2020-09-17	

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REPORTED TO PROJECT	Elk River Alliance ERA-CBWM				WORK ORDER REPORTED	0091213 2020-09-1	8 20:16
Analyte		Result	Guideline	RL	Units	Analyzed	Qualifie
LIZ01_200909_94	5 (0091213-01)   Matrix	Water   Sampled:	2020-09-09 09:45,	Continued			
Total Metals, Conti	nued						
Silver, total		< 0.000050	None Required	0.000050	mg/L	2020-09-17	
Sodium, total		1.73	AO ≤ 200	0.10	mg/L	2020-09-17	
Strontium, total		1.63	7	0.0010	mg/L	2020-09-17	
Sulfur, total		72.6	N/A	3.0	mg/L	2020-09-17	
Tellurium, total		< 0.00050	N/A	0.00050	mg/L	2020-09-17	
Thallium, total		< 0.000020	N/A	0.000020	mg/L	2020-09-17	
Thorium, total		< 0.00010	N/A	0.00010	mg/L	2020-09-17	
Tin, total		< 0.00020	N/A	0.00020	mg/L	2020-09-17	
Titanium, total		< 0.0050	N/A	0.0050	mg/L	2020-09-17	
Tungsten, total		< 0.0010	N/A	0.0010	mg/L	2020-09-17	
Uranium, total		0.000394	MAC = 0.02	0.000020	mg/L	2020-09-17	
Vanadium, total		< 0.0010	N/A	0.0010	mg/L	2020-09-17	
Zinc, total		< 0.0040	AO ≤ 5	0.0040	mg/L	2020-09-17	
Zirconium, total		< 0.00010	N/A	0.00010	mg/L	2020-09-17	

### Sample Qualifiers:

CT5 This sample has been incorrectly preserved for Mercury analysis

HT1 The sample was prepared and/or analyzed past the recommended holding time.



## **APPENDIX 1: SUPPORTING INFORMATION**

REPORTED TO PROJECT	Elk River Allia ERA-CBWM	ance	WORK ORDER REPORTED	0091213 2020-09-1	8 20:16
Analysis Descrip	otion	Method Ref.	Technique A	ccredited	Location
Alkalinity in Water		SM 2320 B* (2017)	Titration with H2SO4	✓	Kelowna
Anions in Water		SM 4110 B (2017)	Ion Chromatography	✓	Kelowna
Biochemical Oxyge Water	en Demand in	SM 5210 B (2017)	Dissolved Oxygen Meter	✓	Kelowna
Chemical Oxygen I Water	Demand in	SM 5220 D* (2017)	Closed Reflux, Colorimetry	✓	Kelowna
Dissolved Metals in	n Water	EPA 200.8 / EPA 6020B	0.45 µm Filtration / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond
Hardness in Water		SM 2340 B (2017)	Calculation: 2.497 [diss Ca] + 4.118 [diss Mg]	✓	N/A
Nitrogen, Total Kjel	dahl in Water	SM 4500-Norg D* (2017)	Block Digestion and Flow Injection Analysis	$\checkmark$	Kelowna
Phosphorus, Total i	n Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Ac	id) ✓	Kelowna
Solids, Total Suspe Water	nded in	SM 2540 D* (2017)	Gravimetry (Dried at 103-105C)	✓	Kelowna
Total Metals in Wat	er	EPA 200.2 / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

### **Glossary of Terms:**

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
AO	Aesthetic Objective
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
OG	Operational Guideline (treated water)
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

### **Guidelines Referenced in this Report:**

Guidelines for Canadian Drinking Water Quality (Health Canada, June 2019)

Note: In some cases, the values displayed on the report represent the lowest guideline and are to be verified by the end user



## **APPENDIX 1: SUPPORTING INFORMATION**

REPORTED TO	Elk River Alliance
PROJECT	ERA-CBWM

WORK ORDER REPORTED 0091213 2020-09-18 20:16

#### General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing.

Results in **Bold** indicate values that are above CARO's method reporting limits. Any results that are above regulatory limits are highlighted **red**. Please note that results will only be highlighted red if the regulatory limits are included on the CARO report. Any Bold and/or highlighted results do <u>not</u> take into account method uncertainty. If you would like method uncertainty or regulatory limits to be included on your report, please contact your Account Manager:teamcaro@caro.ca

Please note any regulatory guidelines applied to this report are added as a convenience to the client, at their request, to help provide some initial context to analytical results obtained. Although CARO makes every effort to ensure accuracy of the associated regulatory guideline(s) applied, the guidelines applied cannot be assumed to be correct due to a variety of factors and as such CARO Analytical Services assumes no liability or responsibility for the use of those guidelines to make any decisions. The original source of the regulation should be verified and a review of the guideline (s) should be validated as correct in order to make any decisions arising from the comparison of the analytical data obtained to the relevant regulatory guideline for one's particular circumstances. Further, CARO Analytical Services assumes no liability or responsibility for any loss attributed from the use of these guidelines in any way.



REPORTED TO	Elk River Alliance	WORK ORDER	0091213
PROJECT	ERA-CBWM	REPORTED	2020-09-18 20:16

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- Method Blank (Blk): A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- Duplicate (Dup): An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- Blank Spike (BS): A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- Matrix Spike (MS): A second aliquot of sample is fortified with with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL Units	Spike	Source	% REC	REC	% RPD RPD	Qualifier
, many to	Hoodit		Level	Result	/0 IXE0	Limit	Limit	quanto

#### Anions, Batch B0I1063

Blank (B0I1063-BLK1)			Prepared: 202	0-09-12, Analyze	ed: 2020-09-12	
Chloride	< 0.10	0.10 mg/L				
Nitrate (as N)	< 0.010	0.010 mg/L				
Nitrite (as N)	< 0.010	0.010 mg/L				
Phosphate (as P)	< 0.0050	0.0050 mg/L				
Sulfate	< 1.0	1.0 mg/L				
Blank (B0I1063-BLK2)			Prepared: 202	0-09-13, Analyze	ed: 2020-09-13	
Chloride	< 0.10	0.10 mg/L				
Nitrate (as N)	< 0.010	0.010 mg/L				
Nitrite (as N)	< 0.010	0.010 mg/L				
Phosphate (as P)	< 0.0050	0.0050 mg/L				
Sulfate	< 1.0	1.0 mg/L				
LCS (B0I1063-BS1)			Prepared: 202	0-09-12, Analyze	ed: 2020-09-12	
Chloride	16.1	0.10 mg/L	16.0	101	90-110	
Nitrate (as N)	4.06	0.010 mg/L	4.00	101	90-110	
Nitrite (as N)	2.04	0.010 mg/L	2.00	102	85-115	
	2.04 0.998	0.010 mg/L 0.0050 mg/L	2.00 1.00	102 100	85-115 80-120	
Phosphate (as P)		0				
Phosphate (as P) Sulfate	0.998	0.0050 mg/L	1.00 16.0	100	80-120 90-110	
Phosphate (as P) Sulfate LCS (B0I1063-BS2)	0.998	0.0050 mg/L	1.00 16.0	100 100	80-120 90-110	
Phosphate (as P) Sulfate LCS (B0l1063-BS2) Chloride	0.998 15.9	0.0050 mg/L 1.0 mg/L	1.00 16.0 Prepared: 202	100 100 0-09-13, Analyze	80-120 90-110 ed: 2020-09-13	
Phosphate (as P) Sulfate LCS (B0I1063-BS2) Chloride Nitrate (as N)	0.998 15.9 16.0	0.0050 mg/L 1.0 mg/L 0.10 mg/L	1.00 16.0 Prepared: 2020 16.0	100 100 0-09-13, Analyze 100	80-120 90-110 ed: 2020-09-13 90-110	
Nitrite (as N) Phosphate (as P) Sulfate LCS (B0I1063-BS2) Chloride Nitrate (as N) Nitrite (as N) Phosphate (as P)	0.998 15.9 16.0 3.97	0.0050 mg/L 1.0 mg/L 0.10 mg/L 0.010 mg/L	1.00 16.0 Prepared: 2020 16.0 4.00	100 100 0-09-13, Analyze 100 99	80-120 90-110 ed: 2020-09-13 90-110 90-110	

### Dissolved Metals, Batch B0l1528

		Prepared: 2020-09-18, Analyzed: 2020-09-18	
< 0.00010	0.00010 mg/L		
< 0.0050	0.0050 mg/L		
< 0.00020	0.00020 mg/L		
< 0.00050	0.00050 mg/L		
< 0.0050	0.0050 mg/L		
< 0.00010	0.00010 mg/L		
	< 0.0050 < 0.00020 < 0.00050 < 0.0050	<ul> <li>&lt; 0.0050</li> <li>0.0050 mg/L</li> <li>&lt; 0.00020</li> <li>&lt; 0.00050 mg/L</li> <li>&lt; 0.00050</li> <li>&lt; 0.0050</li> <li></li> <li>&lt; 0.0050</li> <li></li> <li></li></ul>	< 0.00010



REPORTED TO PROJECT	Elk River Alliance ERA-CBWM					WORK REPOR			213 -09-18	20:16
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier

### Dissolved Metals, Batch B0l1528, Continued

Blank (B0I1528-BLK1), Continued			Prepared: 2020-09-18, Analyze	ed: 2020-09-18
Bismuth, dissolved	< 0.00010	0.00010 mg/L		
Boron, dissolved	< 0.0500	0.0500 mg/L		
Cadmium, dissolved	< 0.000010	0.000010 mg/L		
Calcium, dissolved	< 0.20	0.20 mg/L		
Chromium, dissolved	< 0.00050	0.00050 mg/L		
Cobalt, dissolved	< 0.00010	0.00010 mg/L		
Copper, dissolved	< 0.00040	0.00040 mg/L		
Iron, dissolved	< 0.010	0.010 mg/L		
Lead, dissolved	< 0.00020	0.00020 mg/L		
Magnesium, dissolved	< 0.010	0.010 mg/L		
Manganese, dissolved	< 0.00020	0.00020 mg/L		
Mercury, dissolved	< 0.000040	0.000040 mg/L		
Molybdenum, dissolved	< 0.00010	0.00010 mg/L		
Nickel, dissolved	< 0.00040	0.00040 mg/L		
Phosphorus, dissolved	< 0.050	0.050 mg/L		
Potassium, dissolved	< 0.10	0.10 mg/L		
Selenium, dissolved	< 0.00050	0.00050 mg/L		
Silicon, dissolved	< 1.0	1.0 mg/L		
Silver, dissolved	< 0.000050	0.000050 mg/L		
Sodium, dissolved	< 0.10	0.10 mg/L		
Strontium, dissolved	< 0.0010	0.0010 mg/L		
Sulfur, dissolved	< 3.0	3.0 mg/L		
Tellurium, dissolved	< 0.00050	0.00050 mg/L		
Thallium, dissolved	< 0.000020	0.000020 mg/L		
Thorium, dissolved	< 0.00010	0.00010 mg/L		
Tin, dissolved	< 0.00020	0.00020 mg/L		
Titanium, dissolved	< 0.0050	0.0050 mg/L		
Tungsten, dissolved	< 0.0010	0.0010 mg/L		
Uranium, dissolved	< 0.000020	0.000020 mg/L		
Vanadium, dissolved	< 0.0010	0.0010 mg/L		
Zinc, dissolved	< 0.0040	0.0040 mg/L		
Zirconium, dissolved	< 0.00010	0.00010 mg/L		
LCS (B0I1528-BS1)			Prepared: 2020-09-18, Analyze	ed: 2020-09-18
Lithium, dissolved	0.0205	0.00010 mg/L	0.0200 102	80-120
Aluminum, dissolved	0.0227	0.0050 mg/L	0.0199 114	80-120

Lithium, dissolved	0.0205	0.00010 mg/L	0.0200	102	80-120	
Aluminum, dissolved	0.0227	0.0050 mg/L	0.0199	114	80-120	
Antimony, dissolved	0.0192	0.00020 mg/L	0.0200	96	80-120	
Arsenic, dissolved	0.0194	0.00050 mg/L	0.0200	97	80-120	
Barium, dissolved	0.0199	0.0050 mg/L	0.0198	100	80-120	
Beryllium, dissolved	0.0212	0.00010 mg/L	0.0198	107	80-120	
Bismuth, dissolved	0.0207	0.00010 mg/L	0.0200	103	80-120	
Boron, dissolved	< 0.0500	0.0500 mg/L	0.0200	104	80-120	
Cadmium, dissolved	0.0197	0.000010 mg/L	0.0199	99	80-120	
Calcium, dissolved	2.18	0.20 mg/L	2.02	108	80-120	
Chromium, dissolved	0.0209	0.00050 mg/L	0.0198	105	80-120	
Cobalt, dissolved	0.0199	0.00010 mg/L	0.0199	100	80-120	
Copper, dissolved	0.0203	0.00040 mg/L	0.0200	102	80-120	
Iron, dissolved	2.09	0.010 mg/L	2.02	104	80-120	
Lead, dissolved	0.0202	0.00020 mg/L	0.0199	101	80-120	
Magnesium, dissolved	1.94	0.010 mg/L	2.02	96	80-120	
Manganese, dissolved	0.0204	0.00020 mg/L	0.0199	103	80-120	
Mercury, dissolved	0.00103	0.000040 mg/L	0.00100	103	80-120	
Molybdenum, dissolved	0.0197	0.00010 mg/L	0.0200	99	80-120	
Nickel, dissolved	0.0201	0.00040 mg/L	0.0200	100	80-120	
Phosphorus, dissolved	2.10	0.050 mg/L	2.00	105	80-120	
Potassium, dissolved	2.09	0.10 mg/L	2.02	103	80-120	

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REPORTED TO PROJECT	Elk River Alliance ERA-CBWM					WORK REPOR	ORDER TED	0091 2020	213 -09-18	20:16
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifie
Dissolved Metals, E	Batch B0l1528, Continue	ed								
LCS (B0I1528-BS1)	, Continued			Prepared	: 2020-09-1	8, Analyze	d: 2020-0	9-18		
Selenium, dissolved		0.0198	0.00050 mg/L	0.0200		99	80-120			
Silicon, dissolved		1.9	1.0 mg/L	2.00		97	80-120			
Silver, dissolved		0.0198	0.000050 mg/L	0.0200		99	80-120			
Sodium, dissolved		1.92	0.10 mg/L	2.02		95	80-120			
Strontium, dissolved		0.0194	0.0010 mg/L	0.0200		97	80-120			
Sulfur, dissolved		4.6	3.0 mg/L	5.00		92	80-120			
Tellurium, dissolved		0.0198	0.00050 mg/L	0.0200		99	80-120			
Thallium, dissolved		0.0202	0.000020 mg/L	0.0199		102	80-120			
Thorium, dissolved		0.0205	0.00010 mg/L	0.0200		102	80-120			
Tin, dissolved		0.0203	0.00020 mg/L	0.0200		101	80-120			
Titanium, dissolved		0.0212	0.0050 mg/L	0.0200		106	80-120			
Tungsten, dissolved		0.0201	0.0010 mg/L	0.0200		100	80-120			
Uranium, dissolved		0.0205	0.000020 mg/L	0.0200		102	80-120			
Vanadium, dissolved		0.0215	0.0010 mg/L	0.0200		108	80-120			
Zinc, dissolved		0.0210	0.0040 mg/L	0.0200		105	80-120			
Zirconium, dissolved		0.0198	0.00010 mg/L	0.0200		99	80-120			
Reference (B0I1528	S-SRM1)			Prepared	: 2020-09-1	8 Analyze	d <sup>.</sup> 2020-0	9-18		
Lithium, dissolved	,	0.106	0.00010 mg/L	0.100		106	70-130			
Aluminum, dissolved		0.245	0.0050 mg/L	0.235		104	70-130			
Antimony, dissolved		0.0455	0.00020 mg/L	0.0431		105	70-130			
Arsenic, dissolved		0.426	0.00050 mg/L	0.423		101	70-130			
Barium, dissolved		3.05	0.0050 mg/L	3.30		92	70-130			
Beryllium, dissolved		0.234	0.00010 mg/L	0.209		112	70-130			
Boron, dissolved		1.92	0.0500 mg/L	1.65		116	70-130			
Cadmium, dissolved		0.217	0.000010 mg/L	0.221		98	70-130			
Calcium, dissolved		8.61	0.20 mg/L	7.72		112	70-130			
Chromium, dissolved		0.440	0.00050 mg/L	0.434		101	70-130			
Cobalt, dissolved		0.124	0.00010 mg/L	0.124		100	70-130			
Copper, dissolved		0.840	0.00040 mg/L	0.815		103	70-130			
Iron, dissolved		1.35	0.010 mg/L	1.27		106	70-130			
Lead, dissolved		0.120	0.00020 mg/L	0.110		109	70-130			
Magnesium, dissolved		6.72	0.010 mg/L	6.59		102	70-130			
Manganese, dissolved		0.349	0.00020 mg/L	0.342		102	70-130			
Molybdenum, dissolve		0.408	0.00010 mg/L	0.404		101	70-130			
Nickel, dissolved		0.849	0.00040 mg/L	0.835		101	70-130			
Phosphorus, dissolved	4	0.534	0.050 mg/L	0.499		102	70-130			
Potassium, dissolved	a	3.13	0.10 mg/L	2.88		107	70-130			
Selenium, dissolved		0.0330	0.00050 mg/L	0.0324		103	70-130			
Sodium, dissolved		18.3	0.10 mg/L	18.0		102	70-130			
Strontium, dissolved		0.920	0.0010 mg/L	0.935		98	70-130			
		0.020								
		0 0420	0.000020 mg/l	0 0385		100	/11_1 311			
Thallium, dissolved		0.0420	0.000020 mg/L	0.0385		109	70-130			
· · · · · · · · · · · · · · · · · · ·		0.0420 0.262 0.865	0.000020 mg/L 0.000020 mg/L 0.0010 mg/L	0.0385 0.258 0.873		109 102 99	70-130 70-130 70-130			

### General Parameters, Batch B0I1072

Blank (B0I1072-BLK1)			Prepared: 202	20-09-12, Analyze	d: 2020-09-17	
BOD, 5-day	< 2.0	2.0 mg/L				
LCS (B0I1072-BS1)			Prepared: 202	20-09-12, Analyze	d: 2020-09-17	
BOD, 5-day	177	2.0 mg/L	180	98	85-115	

General Parameters, Batch B0I1134



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REPORTED TO PROJECT	Elk River Alliance ERA-CBWM					WORK REPOR	ORDER TED	0091 2020	213 0-09-18	20:16
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifie
General Parameter	rs, Batch B0l1134, Cont	inued								
Blank (B0I1134-BL	_K1)			Prepared	I: 2020-09-1	4, Analyze	d: 2020-0	9-14		
Solids, Total Suspend	ded	< 2.0	2.0 mg/L							
Blank (B0I1134-BL	_K2)			Prepared	I: 2020-09-1	4, Analyze	d: 2020-0	9-14		
Solids, Total Suspend	ded	< 2.0	2.0 mg/L							
LCS (B0I1134-BS1	)			Prepared	I: 2020-09-1	4. Analvze	d: 2020-0	9-14		
Solids, Total Suspend	,	104	10.0 mg/L	100		104	85-115	-		
LCS (B0I1134-BS2	2)			Prepared	I: 2020-09-1	4 Analyze	d. 2020-0	9-14		
Solids, Total Suspend	,	110	10.0 mg/L	100		110	85-115			
General Parameter	rs, Batch B0l1305									
Blank (B0I1305-BL	_K1)			Prepared	I: 2020-09-1	5, Analyze	d: 2020-0	9-16		
Nitrogen, Total Kjelda	ahl	< 0.050	0.050 mg/L							
Blank (B0I1305-BL	_K2)			Prepared	I: 2020-09-1	5, Analyze	d: 2020-0	9-16		
Nitrogen, Total Kjelda	ahl	< 0.050	0.050 mg/L							
LCS (B0I1305-BS1	)			Prepared	I: 2020-09-1	5, Analyze	d: 2020-0	9-16		
Nitrogen, Total Kjelda	ahl	0.984	0.050 mg/L	1.00		98	85-115			
LCS (B0I1305-BS2	2)			Prepared	I: 2020-09-1	5, Analyze	d: 2020-0	9-16		
Nitrogen, Total Kjelda	ahl	1.06	0.050 mg/L	1.00		106	85-115			
General Parameter Blank (B0I1337-BL Alkalinity, Total (as C	_K1)	< 1.0	1.0 mg/L	Prepared	l: 2020-09-1	5, Analyze	d: 2020-0	9-15		
Alkalinity, Phenolphth	,	< 1.0	1.0 mg/L							
Alkalinity, Bicarbonat	· /	< 1.0	1.0 mg/L							
Alkalinity, Carbonate		< 1.0 < 1.0	1.0 mg/L							
Alkalinity, Hydroxide	· · ·	< 1.0	1.0 mg/L							
Blank (B0I1337-BL	-			Prepared	l: 2020-09-1	5, Analyze	d: 2020-0	9-15		
Alkalinity, Total (as Ca Alkalinity, Phenolphth	,	< 1.0 < 1.0	1.0 mg/L 1.0 mg/L							
Alkalinity, Phenoiphu Alkalinity, Bicarbonat	· · · · ·	< 1.0	1.0 mg/L							
Alkalinity, Carbonate	· /	< 1.0	1.0 mg/L							
Alkalinity, Hydroxide	(as CaCO3)	< 1.0	1.0 mg/L							
LCS (B011337-BS1	)			Prepared	I: 2020-09-1	5, Analyze	d: 2020-0	9-15		
Alkalinity, Total (as C	aCO3)	89.1	1.0 mg/L	100		89	80-120			
LCS (B011337-BS2	2)			Prepared	I: 2020-09-1	5, Analyze	d: 2020-0	9-15		
Alkalinity, Total (as C	•	89.2	1.0 mg/L	100		89	80-120			
General Parameter	rs, Batch B0l1366									
Blank (B0I1366-BL	_K1)			Prepared	I: 2020-09-1	6, Analyze	d: 2020-0	9-16		
Phosphorus, Total (as	s P)	< 0.0050	0.0050 mg/L							
Blank (B0I1366-BL	_K2)			Prepared	I: 2020-09-1	6, Analyze	d: 2020-0	9-16		
Phosphorus, Total (as	•	< 0.0050	0.0050 mg/L			,				
			<u> </u>							



	River Alliance A-CBWM						WORK REPOR	ORDER TED	0091 2020	213 )-09-18	20:16
Analyte		Result	RL I	Jnits	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Ba	atch B0l1366, Con	ntinued									
LCS (B0I1366-BS1)					Prepared:	2020-09-1	6. Analvze	d: 2020-0	9-16		
Phosphorus, Total (as P)		0.110	0.0050 r	ng/L	0.100		110	85-115			
				0	Bronarad:	2020-09-1	6 Analyza		0 16		
LCS (B0I1366-BS2) Phosphorus, Total (as P)		0.109	0.0050 r	ma/l	0.100	2020-09-1	0, Analyze 109	85-115	19-10		
i				-							
Duplicate (B0I1366-DUI	P2)		ource: 00912		Prepared:	2020-09-1	6, Analyze	d: 2020-0	9-16		
Phosphorus, Total (as P)		0.0141	0.0050 r	ng/L		0.0149				15	
Matrix Spike (B0I1366-	MS2)	S	ource: 00912	13-01	Prepared:	2020-09-1	6, Analyze	d: 2020-0	9-16		
Phosphorus, Total (as P)		0.124	0.0050 r	ng/L	0.102	0.0149	107	70-125			
General Parameters, Ba	atch B0l1494				Proparad	2020-09-1	7 Apolyzo	4. 2020 (	0 17		
Blank (B0I1494-BLK1) Chemical Oxygen Demand	1	< 20	20 r	ma/l	Fiepaieu.	2020-09-1	T, Analyze	u. 2020-u	19-17		
	l	< 20	20 1	ng/L							
LCS (B0I1494-BS1)						2020-09-1	7, Analyze	d: 2020-0	9-17		
Chemical Oxygen Demand		508	20 r	ng/L	500		102	89-115			
Total Metals,Batch B0l	1589										
Blank (B0I1589-BLK1)					Prepared:	2020-09-1	7, Analyze	d: 2020-0	9-17		
Aluminum, total		< 0.0050	0.0050 r 0.00020 r								
Antimony, total Arsenic, total		< 0.00020	0.00020 r								
Barium, total		< 0.0050	0.00050 r								
Beryllium, total		< 0.00010	0.00010 r								
Bismuth, total		< 0.00010	0.00010 r	ng/L							
Boron, total		< 0.0500	0.0500 r	ng/L							
Cadmium, total		< 0.000010	0.000010 r	ng/L							
Calcium, total		< 0.20	0.20 r								
Chromium, total		< 0.00050	0.00050 r								
Cobalt, total		< 0.00010	0.00010 r 0.00040 r								
Copper, total Iron, total		< 0.00040	0.00040 r								
Lead, total		< 0.00020	0.00020 r	•							
Lithium, total		< 0.00010	0.00020 r	-							
Magnesium, total		< 0.010	0.010 r								
Manganese, total		< 0.00020	0.00020 r								
Mercury, total		< 0.000040	0.000040 r								
Molybdenum, total		< 0.00010	0.00010 r	ng/L							
Nickel, total		< 0.00040	0.00040 r	ng/L							
Phosphorus, total		< 0.050	0.050 r	ng/L							
Potassium, total		< 0.10	0.10 r	<u> </u>							
Selenium, total		< 0.00050	0.00050 r	-							
		< 1.0	1.0 r								
Silicon, total		< 0.000050	0.000050 r								
Silver, total			0.10 r	-							
Silver, total Sodium, total		< 0.10									
Silver, total Sodium, total Strontium, total		< 0.0010	0.0010 r								
Silver, total Sodium, total Strontium, total Sulfur, total		< 0.0010 < 3.0	0.0010 r 3.0 r	ng/L							
Silver, total Sodium, total Strontium, total Sulfur, total Tellurium, total		< 0.0010 < 3.0 < 0.00050	0.0010 r 3.0 r 0.00050 r	ng/L ng/L							
Silver, total Sodium, total Strontium, total Sulfur, total Tellurium, total Thallium, total		< 0.0010 < 3.0 < 0.00050 < 0.000020	0.0010 r 3.0 r 0.00050 r 0.00020 r	ng/L ng/L ng/L							
Silver, total Sodium, total Strontium, total Sulfur, total Tellurium, total Thallium, total Thorium, total		< 0.0010 < 3.0 < 0.00050	0.0010 r 3.0 r 0.00050 r 0.000020 r 0.00010 r	ng/L ng/L ng/L ng/L							
Silver, total Sodium, total Strontium, total Sulfur, total Tellurium, total Thallium, total		< 0.0010 < 3.0 < 0.00050 < 0.000020 < 0.00010	0.0010 r 3.0 r 0.00050 r 0.00020 r	ng/L ng/L ng/L ng/L ng/L							



REPORTED TO PROJECT	Elk River Alliance ERA-CBWM					WORK REPOR	-		213 -09-18	20:16
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier

### Total Metals, Batch B0l1589, Continued

Blank (B0I1589-BLK1), Continued			Piepaieu. 202	0-09-17, Analyze	u. 2020-09-17
Uranium, total	< 0.000020	0.000020 mg/L			
Vanadium, total	< 0.0010	0.0010 mg/L			
Zinc, total	< 0.0040	0.0040 mg/L			
Zirconium, total	< 0.00010	0.00010 mg/L			
.CS (B0I1589-BS1)			Prepared: 202	0-09-17, Analyze	ed: 2020-09-17
Aluminum, total	0.0233	0.0050 mg/L	0.0199	117	80-120
Antimony, total	0.0232	0.00020 mg/L	0.0200	116	80-120
Arsenic, total	0.0227	0.00050 mg/L	0.0200	114	80-120
3arium, total	0.0216	0.0050 mg/L	0.0198	109	80-120
3eryllium, total	0.0235	0.00010 mg/L	0.0198	119	80-120
3ismuth, total	0.0231	0.00010 mg/L	0.0200	116	80-120
Boron, total	< 0.0500	0.0500 mg/L	0.0200	108	80-120
Cadmium, total	0.0217	0.000010 mg/L	0.0199	109	80-120
Calcium, total	2.37	0.20 mg/L	2.02	117	80-120
Chromium, total	0.0213	0.00050 mg/L	0.0198	107	80-120
Cobalt, total	0.0213	0.00010 mg/L	0.0199	107	80-120
Copper, total	0.0215	0.00040 mg/L	0.0200	107	80-120
ron, total	2.10	0.010 mg/L	2.02	104	80-120
₋ead, total	0.0239	0.00020 mg/L	0.0199	120	80-120
ithium, total	0.0219	0.00010 mg/L	0.0200	110	80-120
/lagnesium, total	2.30	0.010 mg/L	2.02	114	80-120
Manganese, total	0.0199	0.00020 mg/L	0.0199	100	80-120
Aercury, total	0.00115	0.000040 mg/L	0.00100	115	80-120
lolybdenum, total	0.0208	0.00010 mg/L	0.0200	104	80-120
lickel, total	0.0211	0.00040 mg/L	0.0200	105	80-120
hosphorus, total	2.23	0.050 mg/L	2.00	112	80-120
Potassium, total	2.43	0.10 mg/L	2.02	120	80-120
elenium, total	0.0241	0.00050 mg/L	0.0200	120	80-120
ilicon, total	2.2	1.0 mg/L	2.00	112	80-120
ilver, total	0.0211	0.000050 mg/L	0.0200	106	80-120
Sodium, total	2.22	0.10 mg/L	2.02	110	80-120
Strontium, total	0.0217	0.0010 mg/L	0.0200	108	80-120
Sulfur, total	5.5	3.0 mg/L	5.00	110	80-120
ellurium, total	0.0221	0.00050 mg/L	0.0200	111	80-120
hallium, total	0.0224	0.000020 mg/L	0.0199	113	80-120
Thorium, total	0.0216	0.00010 mg/L	0.0200	108	80-120
Fin, total	0.0217	0.00020 mg/L	0.0200	109	80-120
ītanium, total	0.0238	0.0050 mg/L	0.0200	119	80-120
ungsten, total	0.0206	0.0010 mg/L	0.0200	103	80-120
Jranium, total	0.0219	0.000020 mg/L	0.0200	109	80-120
/anadium, total	0.0221	0.0010 mg/L	0.0200	110	80-120
Zinc, total	0.0237	0.0040 mg/L	0.0200	119	80-120
Zirconium, total	0.0210	0.00010 mg/L	0.0200	105	80-120
Reference (B0I1589-SRM1)		<u> </u>		0-09-17, Analyze	
Aluminum, total	0.322	0.0050 mg/L	0.299	108	70-130
	0.522	0.0000 mg/L	0.233	115	70-130

				· · · · , <b>,</b>		
Aluminum, total	0.322	0.0050 mg/L	0.299	108	70-130	
Antimony, total	0.0595	0.00020 mg/L	0.0517	115	70-130	
Arsenic, total	0.140	0.00050 mg/L	0.119	118	70-130	
Barium, total	0.869	0.0050 mg/L	0.801	108	70-130	
Beryllium, total	0.0600	0.00010 mg/L	0.0501	120	70-130	
Boron, total	4.67	0.0500 mg/L	4.11	114	70-130	
Cadmium, total	0.0549	0.000010 mg/L	0.0503	109	70-130	
Calcium, total	12.2	0.20 mg/L	10.7	114	70-130	
Chromium, total	0.270	0.00050 mg/L	0.250	108	70-130	
Cobalt, total	0.0424	0.00010 mg/L	0.0384	111	70-130	
Copper, total	0.536	0.00040 mg/L	0.487	110	70-130	



REPORTED TO PROJECT	Elk River Alliance ERA-CBWM					WORK REPOR	ORDER TED		213 -09-18	20:16
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
	h B0l1589, Continued 39-SRM1), Continued			Prepared	1: 2020-09-1	7 Analyze	d. 2020-0	9-17		
· ·		0.505	0.010	•	. 2020 00 1			,0 II		
Iron, total		0.535	0.010 mg/L	0.504		106	70-130			
Lead, total		0.333	0.00020 mg/L	0.278		120	70-130			
Lithium, total		0.454	0.00010 mg/L	0.398		114	70-130			
Magnesium, total		4.21	0.010 mg/L	3.59		117	70-130			
Manganese, total		0.110	0.00020 mg/L	0.111		99	70-130			
Mercury, total		0.00597	0.000040 mg/L	0.00581		103	70-130			
Molybdenum, total		0.213	0.00010 mg/L	0.196		108	70-130			
Nickel, total		0.273	0.00040 mg/L	0.248		110	70-130			
Phosphorus, total		0.204	0.050 mg/L	0.213		96	70-130			
Potassium, total		7.36	0.10 mg/L	5.89		125	70-130			

Reference (B0I1589-SRM1), Continued		Prepared: 2020-09-17, Analyzed: 2020-09-17				
Iron, total	0.535	0.010 mg/L	0.504	106 70-130		
Lead, total	0.333	0.00020 mg/L	0.278	120 70-130		
Lithium, total	0.454	0.00010 mg/L	0.398	114 70-130		
Magnesium, total	4.21	0.010 mg/L	3.59	117 70-130		
Manganese, total	0.110	0.00020 mg/L	0.111	99 70-130		
Mercury, total	0.00597	0.000040 mg/L	0.00581	103 70-130		
Molybdenum, total	0.213	0.00010 mg/L	0.196	108 70-130		
Nickel, total	0.273	0.00040 mg/L	0.248	110 70-130		
Phosphorus, total	0.204	0.050 mg/L	0.213	96 70-130		
Potassium, total	7.36	0.10 mg/L	5.89	125 70-130		
Selenium, total	0.148	0.00050 mg/L	0.120	123 70-130		
Sodium, total	9.76	0.10 mg/L	8.71	112 70-130		
Strontium, total	0.435	0.0010 mg/L	0.393	111 70-130		
Thallium, total	0.0880	0.000020 mg/L	0.0787	112 70-130		
Uranium, total	0.0377	0.000020 mg/L	0.0344	110 70-130		
Vanadium, total	0.420	0.0010 mg/L	0.391	107 70-130		
Zinc, total	2.83	0.0040 mg/L	2.50	113 70-130		



## **CERTIFICATE OF ANALYSIS**

REPORTED TO	Elk River Alliance PO Box 537 - 891 2nd Ave Ferniecha, BC V0B1M0		
ATTENTION	Beth Millions	WORK ORDER	0092642
PO NUMBER PROJECT PROJECT INFO	ERA-CBWM [info]	RECEIVED / TEMP REPORTED COC NUMBER	2020-09-23 09:05 /  7°C 2020-10-05 17:04 B90468

### Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

We've Got Chemistry

#### Big Picture Sidekicks



You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

It's simple. We figure the more you working fun enjoy with and our the more engaged team members; likely you are to give us continued opportunities to support you.

Ahead of the Curve



Through research, regulation knowledge, and instrumentation, we analytical centre are your for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

If you have any questions or concerns, please contact me at teamcaro@caro.ca

Authorized By:

Team CARO **Client Service Representative** 

### 1-888-311-8846 | www.caro.ca

#110 4011 Viking Way Richmond, BC V6V 2K9 | #102 3677 Highway 97N Kelowna, BC V1X 5C3 | 17225 109 Avenue Edmonton, AB T5S 1H7



Analuta					REPORTED	2020-10-0	5 17:04
Analyte		Result	Guideline	RL	Units	Analyzed	Qualifier
BOV01_200920_09	30 (0092642-01)   Matri	x: Water   Sample	ed: 2020-09-20 09:3	30			
Anions							
Nitrate (as N)		0.061	MAC = 10	0.010	mg/L	2020-09-27	HT1
Nitrite (as N)		< 0.010	MAC = 1	0.010	mg/L	2020-09-27	HT1
Phosphate (as P)		< 0.0050	N/A	0.0050	mg/L	2020-09-27	HT1
Calculated Paramete	rs						
Hardness, Total (as	CaCO3)	171	None Required	0.500	mg/L	N/A	
Nitrate+Nitrite (as N	)	0.0613	N/A	0.0100	mg/L	N/A	
Nitrogen, Total		0.0613	N/A	0.0500	mg/L	N/A	
Dissolved Metals							
Lithium, dissolved		0.00142	N/A	0.00010	mg/L	2020-10-01	
Aluminum, dissolved	b	< 0.0050	N/A	0.0050	mg/L	2020-10-01	
Antimony, dissolved		< 0.00020	N/A	0.00020	mg/L	2020-10-01	
Arsenic, dissolved		< 0.00050	N/A	0.00050	mg/L	2020-10-01	
Barium, dissolved		0.0280	N/A	0.0050	mg/L	2020-10-01	
Beryllium, dissolved		< 0.00010	N/A	0.00010	mg/L	2020-10-01	
Bismuth, dissolved		< 0.00010	N/A	0.00010	mg/L	2020-10-01	
Boron, dissolved		< 0.0500	N/A	0.0500	mg/L	2020-10-01	
Cadmium, dissolved	l	0.000042	N/A	0.000010	mg/L	2020-10-01	
Calcium, dissolved		46.7	N/A	0.20	mg/L	2020-10-01	
Chromium, dissolve	d	0.00060	N/A	0.00050	mg/L	2020-10-01	
Cobalt, dissolved		< 0.00010	N/A	0.00010		2020-10-01	
Copper, dissolved		< 0.00040	N/A	0.00040	mg/L	2020-10-01	
Iron, dissolved		0.040	N/A	0.010		2020-10-01	
Lead, dissolved		< 0.00020	N/A	0.00020	-	2020-10-01	
Magnesium, dissolv	ed	13.1	N/A	0.010	mg/L	2020-10-01	
Manganese, dissolv	ed	0.00024	N/A	0.00020	•	2020-10-01	
Mercury, dissolved		< 0.000010	N/A	0.000010		2020-09-27	
Molybdenum, dissol	ved	0.00151	N/A	0.00010	-	2020-10-01	
Nickel, dissolved		< 0.00040	N/A	0.00040		2020-10-01	
Phosphorus, dissolv		< 0.050	N/A	0.050	-	2020-10-01	
Potassium, dissolve		0.30	N/A		mg/L	2020-10-01	
Selenium, dissolved		0.00117	N/A	0.00050		2020-10-01	
Silicon, dissolved		2.1	N/A		mg/L	2020-10-01	
Silver, dissolved		< 0.000050	N/A	0.000050	-	2020-10-01	
Sodium, dissolved	1	0.55	N/A		mg/L	2020-10-01	
Strontium, dissolved	1	0.556	N/A	0.0010	-	2020-10-01	
Sulfur, dissolved		21.8	N/A		mg/L	2020-10-01	
Tellurium, dissolved		< 0.00050	N/A	0.00050		2020-10-01	
Thallium, dissolved		< 0.000020	N/A	0.000020	-	2020-10-01	
Thorium, dissolved		< 0.00010	N/A	0.00010	-	2020-10-01	
Tin, dissolved Titanium, dissolved		< 0.00020	N/A N/A			2020-10-01 2020-10-01	
Tungsten, dissolved		< 0.0030	N/A N/A	0.0050		2020-10-01	

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<b>REPORTED TO</b> Elk River Alliance <b>PROJECT</b> ERA-CBWM				WORK ORDER REPORTED	0092642 2020-10-	05 17:04
Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
	/latrix: Water   Samp	led: 2020-09-20 09:	30, Continue	t		
Dissolved Metals, Continued						
Uranium, dissolved	0.000854	N/A	0.000020	mg/L	2020-10-01	
Vanadium, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-01	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2020-10-01	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-01	
General Parameters						
Alkalinity, Total (as CaCO3)	131	N/A	1.0	mg/L	2020-09-28	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2020-09-28	
Alkalinity, Bicarbonate (as CaCO3)	131	N/A	1.0	mg/L	2020-09-28	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2020-09-28	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2020-09-28	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2020-09-25	
BOD, 5-day	< 6.0	N/A	2.0	mg/L	2020-09-30	HT1
Chemical Oxygen Demand	< 20	N/A	20	mg/L	2020-09-28	
Nitrogen, Total Kjeldahl	< 0.050	N/A	0.050	mg/L	2020-09-29	
Phosphorus, Total (as P)	0.0061	N/A	0.0050	mg/L	2020-09-28	
Solids, Total Suspended	< 2.0	N/A	2.0	mg/L	2020-09-27	
Total Metals						
Aluminum, total	0.0059	OG < 0.1	0.0050	mg/L	2020-09-30	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2020-09-30	
Arsenic, total	0.00052	MAC = 0.01	0.00050	mg/L	2020-09-30	
Barium, total	0.0293	MAC = 2	0.0050	mg/L	2020-09-30	
Beryllium, total	< 0.00010	N/A	0.00010	mg/L	2020-09-30	
Bismuth, total	< 0.00010	N/A	0.00010	mg/L	2020-09-30	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2020-09-30	
Cadmium, total	0.000035	MAC = 0.005	0.000010	mg/L	2020-09-30	
Calcium, total	49.9	None Required	0.20	mg/L	2020-09-30	
Chromium, total	0.00072	MAC = 0.05	0.00050	mg/L	2020-09-30	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2020-09-30	
Copper, total	< 0.00040	MAC = 2	0.00040	mg/L	2020-09-30	
Iron, total	0.024	AO ≤ 0.3	0.010	mg/L	2020-09-30	
Lead, total	< 0.00020	MAC = 0.005	0.00020	mg/L	2020-09-30	
Lithium, total	0.00164	N/A	0.00010	mg/L	2020-09-30	
Magnesium, total	13.9	None Required	0.010	mg/L	2020-09-30	
Manganese, total	0.00037	MAC = 0.12	0.00020	mg/L	2020-09-30	
Mercury, total	< 0.000010	MAC = 0.001	0.000010	mg/L	2020-09-29	
Molybdenum, total	0.00145	N/A	0.00010	mg/L	2020-09-30	
Nickel, total	< 0.00040	N/A	0.00040	mg/L	2020-09-30	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2020-09-30	
Potassium, total	0.32	N/A	0.10	mg/L	2020-09-30	
Selenium, total	0.00117	MAC = 0.05	0.00050	mg/L	2020-09-30	
Silicon, total	2.2	N/A	1.0	mg/L	2020-09-30	
Silver, total	< 0.000050	None Required	0.000050	ma/L	2020-09-30	

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Zinc, total

Zirconium, total

						-	
REPORTED TO PROJECT	Elk River Alliance ERA-CBWM				WORK ORDER REPORTED	0092642 2020-10-0	5 17:04
Analyte		Result	Guideline	RL	Units	Analyzed	Qualifie
3OV01_200920_0	0930 (0092642-01)   Matr	ix: Water   Sample	ed: 2020-09-20 09:	30, Continue	d		
Total Metals, Conti	inued						
Sodium, total		0.59	AO ≤ 200	0.10	mg/L	2020-09-30	
Strontium, total		0.590	7	0.0010	mg/L	2020-09-30	
Sulfur, total		23.1	N/A	3.0	mg/L	2020-09-30	
Tellurium, total		< 0.00050	N/A	0.00050	mg/L	2020-09-30	
Thallium, total		< 0.000020	N/A	0.000020	mg/L	2020-09-30	
Thorium, total		< 0.00010	N/A	0.00010	mg/L	2020-09-30	
Tin, total		< 0.00020	N/A	0.00020	mg/L	2020-09-30	
Titanium, total		< 0.0050	N/A	0.0050	mg/L	2020-09-30	
Tungsten, total		< 0.0010	N/A	0.0010	mg/L	2020-09-30	
Uranium, total		0.000995	MAC = 0.02	0.000020	mg/L	2020-09-30	
Vanadium, total		< 0.0010	N/A	0.0010	mg/L	2020-09-30	

AO ≤ 5

N/A

0.0040 mg/L

0.00010 mg/L

2020-09-30

2020-09-30

### BOV03\_200920\_1250 (0092642-02) | Matrix: Water | Sampled: 2020-09-20 12:50

< 0.0040

< 0.00010

Anions						
Nitrate (as N)	0.051	MAC = 10	0.010	mg/L	2020-09-27	HT1
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2020-09-27	HT1
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-09-27	HT1
Calculated Parameters						
Hardness, Total (as CaCO3)	172	None Required	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	0.0506	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	0.112	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Lithium, dissolved	0.00148	N/A	0.00010	mg/L	2020-10-01	
Aluminum, dissolved	0.0055	N/A	0.0050	mg/L	2020-10-01	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-01	
Arsenic, dissolved	0.00055	N/A	0.00050	mg/L	2020-10-01	
Barium, dissolved	0.0276	N/A	0.0050	mg/L	2020-10-01	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-01	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-01	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2020-10-01	
Cadmium, dissolved	0.000058	N/A	0.000010	mg/L	2020-10-01	
Calcium, dissolved	47.5	N/A	0.20	mg/L	2020-10-01	
Chromium, dissolved	0.00065	N/A	0.00050	mg/L	2020-10-01	
Cobalt, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-01	
Copper, dissolved	< 0.00040	N/A	0.00040	mg/L	2020-10-01	
Iron, dissolved	< 0.010	N/A	0.010	mg/L	2020-10-01	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-01	
Magnesium, dissolved	12.9	N/A	0.010	mg/L	2020-10-01	



Beryllium, total

Bismuth, total

Boron, total

REPORTED TO Elk River A PROJECT ERA-CBW				WORK ORDER REPORTED	0092642 2020-10 <b>-</b> 0	5 17:04
Analyte	Result	Guideline	RL	Units	Analyzed	Qualifi
3OV03_200920_1250 (009264	42-02)   Matrix: Water   Sample	ed: 2020-09-20 12:	50, Continued	ł		
Dissolved Metals, Continued						
Manganese, dissolved	< 0.00020	N/A	0.00020	•	2020-10-01	
Mercury, dissolved	< 0.000040	N/A	0.000040		2020-10-01	
Molybdenum, dissolved	0.00140	N/A	0.00010	•	2020-10-01	
Nickel, dissolved	< 0.00040	N/A	0.00040	<u> </u>	2020-10-01	
Phosphorus, dissolved	< 0.050	N/A	0.050		2020-10-01	
Potassium, dissolved	0.31	N/A		mg/L	2020-10-01	
Selenium, dissolved	0.00106	N/A	0.00050		2020-10-01	
Silicon, dissolved	2.1	N/A	1.0	mg/L	2020-10-01	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2020-10-01	
Sodium, dissolved	0.55	N/A	0.10	mg/L	2020-10-01	
Strontium, dissolved	0.562	N/A	0.0010	mg/L	2020-10-01	
Sulfur, dissolved	21.4	N/A	3.0	mg/L	2020-10-01	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-01	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2020-10-01	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-01	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-01	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-01	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-01	
Uranium, dissolved	0.000887	N/A	0.000020	mg/L	2020-10-01	
Vanadium, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-01	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2020-10-01	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-01	
General Parameters						
Alkalinity, Total (as CaCO3)	130	N/A	1.0	mg/L	2020-09-28	
Alkalinity, Phenolphthalein (as C	CaCO3) < 1.0	N/A		mg/L	2020-09-28	
Alkalinity, Bicarbonate (as CaCo		N/A		mg/L	2020-09-28	
Alkalinity, Carbonate (as CaCO		N/A		mg/L	2020-09-28	
Alkalinity, Hydroxide (as CaCO3	,	N/A		mg/L	2020-09-28	
Ammonia, Total (as N)	< 0.050	None Required	0.050		2020-09-25	
BOD, 5-day	< 6.0	N/A		mg/L	2020-09-30	HT1
Chemical Oxygen Demand	< 20	N/A		mg/L	2020-09-28	
Nitrogen, Total Kjeldahl	0.061	N/A	0.050		2020-09-29	
Phosphorus, Total (as P)	0.0050	N/A	0.0050		2020-09-28	
Solids, Total Suspended	< 2.0	N/A		mg/L	2020-09-27	
Fotal Metals						
Aluminum, total	0.0062	OG < 0.1	0.0050	ma/L	2020-09-30	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	•	2020-09-30	
Arsenic, total	0.00052	MAC = 0.000	0.00020	-	2020-09-30	
Barium, total	0.0292	MAC = 0.01 MAC = 2	0.0050		2020-09-30	
Dendling total	0.0292	N/A	0.0050		2020-09-30	

 < 0.00010</th>
 N/A
 0.00010
 mg/L
 2020-09-30

 < 0.0500</td>
 MAC = 5
 0.0500
 mg/L
 2020-09-30

 Caring About Results, Obviously.

N/A

0.00010 mg/L

2020-09-30

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< 0.00010



REPORTED TO PROJECT	Elk River Alliance ERA-CBWM				WORK ORDER REPORTED	0092642 2020-10-0	5 17:04
Analyte		Result	Guideline	RL	Units	Analyzed	Qualifie
3OV03_200920_1	250 (0092642-02)   Matr	ix: Water   Sampl	ed: 2020-09-20 12:5	i0, Continued	t		
otal Metals, Contin	nued						
Cadmium, total		0.000020	MAC = 0.005	0.000010	mg/L	2020-09-30	
Calcium, total		48.5	None Required	0.20	mg/L	2020-09-30	
Chromium, total		0.00078	MAC = 0.05	0.00050	mg/L	2020-09-30	
Cobalt, total		< 0.00010	N/A	0.00010	mg/L	2020-09-30	
Copper, total		< 0.00040	MAC = 2	0.00040	mg/L	2020-09-30	
Iron, total		< 0.010	AO ≤ 0.3	0.010	mg/L	2020-09-30	
Lead, total		< 0.00020	MAC = 0.005	0.00020	mg/L	2020-09-30	
Lithium, total		0.00151	N/A	0.00010	mg/L	2020-09-30	
Magnesium, total		13.7	None Required	0.010	mg/L	2020-09-30	
Manganese, total		< 0.00020	MAC = 0.12	0.00020	mg/L	2020-09-30	
Mercury, total		< 0.000040	MAC = 0.001	0.000040	mg/L	2020-09-30	
Molybdenum, total		0.00146	N/A	0.00010	mg/L	2020-09-30	
Nickel, total		< 0.00040	N/A	0.00040	mg/L	2020-09-30	
Phosphorus, total		< 0.050	N/A	0.050	mg/L	2020-09-30	
Potassium, total		0.32	N/A	0.10	mg/L	2020-09-30	
Selenium, total		0.00110	MAC = 0.05	0.00050	mg/L	2020-09-30	
Silicon, total		2.1	N/A	1.0	mg/L	2020-09-30	
Silver, total		< 0.000050	None Required	0.000050	mg/L	2020-09-30	
Sodium, total		0.58	AO ≤ 200	0.10	mg/L	2020-09-30	
Strontium, total		0.580	7	0.0010	mg/L	2020-09-30	
Sulfur, total		19.9	N/A	3.0	mg/L	2020-09-30	
Tellurium, total		< 0.00050	N/A	0.00050	mg/L	2020-09-30	
Thallium, total		< 0.000020	N/A	0.000020	mg/L	2020-09-30	
Thorium, total		< 0.00010	N/A	0.00010	mg/L	2020-09-30	
Tin, total		< 0.00020	N/A	0.00020	mg/L	2020-09-30	
Titanium, total		< 0.0050	N/A	0.0050	mg/L	2020-09-30	
Tungsten, total		< 0.0010	N/A	0.0010	mg/L	2020-09-30	
Uranium, total		0.000989	MAC = 0.02	0.000020	mg/L	2020-09-30	
Vanadium, total		0.0011	N/A	0.0010	mg/L	2020-09-30	
Zinc, total		< 0.0040	AO ≤ 5	0.0040	ma/l	2020-09-30	
		+ 0.00+0	//0 = 0	0.00+0	ilig/L	2020 00 00	

### ALX01\_200921\_0930 (0092642-03) | Matrix: Water | Sampled: 2020-09-21 09:30

Anions					
Nitrate (as N)	< 0.010	MAC = 10	0.010 mg/L	2020-09-27	HT1
Nitrite (as N)	< 0.010	MAC = 1	0.010 mg/L	2020-09-27	HT1
Phosphate (as P)	< 0.0050	N/A	0.0050 mg/L	2020-09-27	HT1
Calculated Parameters					
Hardness, Total (as CaCO3)	169	None Required	0.500 mg/L	N/A	
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100 mg/L	N/A	
Nitrogen, Total	0.0660	N/A	0.0500 mg/L	N/A	
	Caring Al	pout Results, Obviou	usly.		Page 6 of



REPORTED TO PROJECT	Elk River Alliance ERA-CBWM				WORK ORDER REPORTED	0092642 2020-10-0	5 17:04
Analyte		Result	Guideline	RL	Units	Analyzed	Qualifier
ALX01_200921_0	930 (0092642-03)   Matr	ix: Water   Sampled	d: 2020-09-21 09:	30, Continuec	I		
Dissolved Metals							
Lithium, dissolved		0.00438	N/A	0.00010	mg/L	2020-10-01	
Aluminum, dissolve	ed	0.0057	N/A	0.0050	mg/L	2020-10-01	
Antimony, dissolve	d	< 0.00020	N/A	0.00020	mg/L	2020-10-01	
Arsenic, dissolved		< 0.00050	N/A	0.00050	mg/L	2020-10-01	
Barium, dissolved		0.0719	N/A	0.0050	mg/L	2020-10-01	
Beryllium, dissolve	d	< 0.00010	N/A	0.00010	mg/L	2020-10-01	
Bismuth, dissolved	l	< 0.00010	N/A	0.00010	mg/L	2020-10-01	
Boron, dissolved		< 0.0500	N/A	0.0500	mg/L	2020-10-01	
Cadmium, dissolve	ed	0.000031	N/A	0.000010	mg/L	2020-10-01	
Calcium, dissolved	I	45.9	N/A	0.20	mg/L	2020-10-01	
Chromium, dissolv	ed	< 0.00050	N/A	0.00050	mg/L	2020-10-01	
Cobalt, dissolved		< 0.00010	N/A	0.00010	mg/L	2020-10-01	
Copper, dissolved		< 0.00040	N/A	0.00040	mg/L	2020-10-01	
Iron, dissolved		< 0.010	N/A	0.010	mg/L	2020-10-01	
Lead, dissolved		< 0.00020	N/A	0.00020	mg/L	2020-10-01	
Magnesium, dissol	lved	13.2	N/A	0.010	mg/L	2020-10-01	
Manganese, disso	lved	0.00100	N/A	0.00020	mg/L	2020-10-01	
Mercury, dissolved		< 0.000010	N/A	0.000010	mg/L	2020-09-27	
Molybdenum, disse	olved	0.00085	N/A	0.00010	mg/L	2020-10-01	
Nickel, dissolved		< 0.00040	N/A	0.00040	mg/L	2020-10-01	
Phosphorus, disso	lved	< 0.050	N/A	0.050	mg/L	2020-10-01	
Potassium, dissolv	red	0.46	N/A	0.10	mg/L	2020-10-01	
Selenium, dissolve	ed	0.00058	N/A	0.00050	mg/L	2020-10-01	
Silicon, dissolved		2.4	N/A	1.0	mg/L	2020-10-01	
Silver, dissolved		< 0.000050	N/A	0.000050	mg/L	2020-10-01	
Sodium, dissolved		1.75	N/A	0.10	mg/L	2020-10-01	
Strontium, dissolve	ed	0.127	N/A	0.0010	mg/L	2020-10-01	
Sulfur, dissolved		7.7	N/A	3.0	mg/L	2020-10-01	
Tellurium, dissolve	d	< 0.00050	N/A	0.00050	mg/L	2020-10-01	
Thallium, dissolved	Ł	< 0.000020	N/A	0.000020	mg/L	2020-10-01	
Thorium, dissolved	1	< 0.00010	N/A	0.00010	mg/L	2020-10-01	
Tin, dissolved		< 0.00020	N/A	0.00020	mg/L	2020-10-01	
Titanium, dissolved	Ŀ	< 0.0050	N/A	0.0050	mg/L	2020-10-01	
Tungsten, dissolve	d	< 0.0010	N/A	0.0010	mg/L	2020-10-01	
Uranium, dissolved	Ł	0.000557	N/A	0.000020	mg/L	2020-10-01	
Vanadium, dissolve	ed	< 0.0010	N/A	0.0010	mg/L	2020-10-01	
Zinc, dissolved		< 0.0040	N/A	0.0040	mg/L	2020-10-01	
Zirconium, dissolve	ed	< 0.00010	N/A	0.00010	mg/L	2020-10-01	
General Parameters	5						
Alkalinity, Total (as	CaCO3)	169	N/A	1.0	mg/L	2020-09-28	
Alkalinity, Phenolp	hthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2020-09-28	
Alkalinity, Bicarbor	nate (as CaCO3)	169	N/A	1.0	mg/L	2020-09-28	



REPORTED TO PROJECT	Elk River Alliance ERA-CBWM				WORK ORDER REPORTED	0092642 2020-10-0	95 17:04
Analyte		Result	Guideline	RL	Units	Analyzed	Qualifie
ALX01_200921_0	0930 (0092642-03)   Matri	x: Water   Sample	ed: 2020-09-21 09:3	0, Continued	I		
General Parameter	rs, Continued						
Alkalinity, Carbona	ate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2020-09-28	
Alkalinity, Hydroxi		< 1.0	N/A		mg/L	2020-09-28	
Ammonia, Total (a	. ,	< 0.050	None Required	0.050		2020-09-25	
BOD, 5-day	,	< 6.0	N/A	2.0	mg/L	2020-09-30	HT1
Chemical Oxygen	Demand	< 20	N/A		mg/L	2020-09-28	
Nitrogen, Total Kje		0.066	N/A	0.050	-	2020-09-29	
Phosphorus, Total		0.0056	N/A	0.0050	-	2020-09-28	
Solids, Total Susp		< 2.0	N/A		mg/L	2020-09-27	
Total Metals			00 +04	0.0050			
Aluminum, total		0.0058	OG < 0.1	0.0050		2020-09-30	
Antimony, total		< 0.00020	MAC = 0.006	0.00020	-	2020-09-30	
Arsenic, total		< 0.00050	MAC = 0.01	0.00050	0	2020-09-30	
Barium, total		0.0787	MAC = 2	0.0050		2020-09-30	
Beryllium, total		< 0.00010	N/A	0.00010		2020-09-30	
Bismuth, total		< 0.00010	N/A	0.00010		2020-09-30	
Boron, total		< 0.0500	MAC = 5	0.0500		2020-09-30	
Cadmium, total		0.000011	MAC = 0.005	0.000010	-	2020-09-30	
Calcium, total		48.8	None Required	0.20	0	2020-09-30	
Chromium, total		0.00056	MAC = 0.05	0.00050		2020-09-30	
Cobalt, total		< 0.00010	N/A	0.00010		2020-09-30	
Copper, total		0.00059	MAC = 2	0.00040		2020-09-30	
Iron, total		0.015	AO ≤ 0.3	0.010	•	2020-09-30	
Lead, total		< 0.00020	MAC = 0.005	0.00020		2020-09-30	
Lithium, total		0.00464	N/A	0.00010		2020-09-30	
Magnesium, total		13.8	None Required	0.010	•	2020-09-30	
Manganese, total		0.00104	MAC = 0.12	0.00020	-	2020-09-30	
Mercury, total		< 0.000010	MAC = 0.001	0.000010		2020-09-29	
Molybdenum, tota		0.00085	N/A	0.00010	-	2020-09-30	
Nickel, total		0.00042	N/A	0.00040		2020-09-30	
Phosphorus, total		< 0.050	N/A	0.050	-	2020-09-30	
Potassium, total		0.46	N/A		mg/L	2020-09-30	
Selenium, total		0.00057	MAC = 0.05	0.00050	-	2020-09-30	
Silicon, total		2.5	N/A		mg/L	2020-09-30	
Silver, total		< 0.000050	None Required	0.000050		2020-09-30	
Sodium, total		1.83	AO ≤ 200		mg/L	2020-09-30	
Strontium, total		0.135	7	0.0010	-	2020-09-30	
Sulfur, total		7.9	N/A		mg/L	2020-09-30	
Tellurium, total		< 0.00050	N/A	0.00050	-	2020-09-30	
Thallium, total		< 0.000020	N/A	0.000020	-	2020-09-30	
Thorium, total		< 0.00010	N/A	0.00010		2020-09-30	
Tin, total		< 0.00020	N/A	0.00020		2020-09-30	
Titanium, total		< 0.0050	N/A	0.0050	mg/L	2020-09-30	



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REPORTED TO PROJECT	Elk River Alliance ERA-CBWM				WORK ORDER REPORTED	0092642 2020-10-0	5 17:04
Analyte		Result	Guideline	RL	Units	Analyzed	Qualifie
ALX01_200921_0	930 (0092642-03)   Matri	x: Water   Sample	ed: 2020-09-21 09:3	0, Continued	I		
Total Metals, Conti	inued						
Tungsten, total		< 0.0010	N/A	0.0010	mg/L	2020-09-30	
Uranium, total		0.000653	MAC = 0.02	0.000020	mg/L	2020-09-30	
Vanadium, total		< 0.0010	N/A	0.0010	mg/L	2020-09-30	
Zinc, total		< 0.0040	AO ≤ 5	0.0040	mg/L	2020-09-30	
Zirconium, total		< 0.00010	N/A	0.00010	mg/L	2020-09-30	
ALX03_200920_1	600 (0092642-04)   Matri	x: Water   Sample	ed: 2020-09-20 16:0	D			
Anions							
Nitrate (as N)		< 0.010	MAC = 10	0.010	mg/L	2020-09-27	HT1
Nitrite (as N)		< 0.010	MAC = 1	0.010		2020-09-27	HT1
Phosphate (as P)		< 0.0050	N/A	0.0050	•	2020-09-27	HT1
Calculated Parame	eters						
Hardness, Total (a	as CaCO3)	160	None Required	0.500	mg/L	N/A	
Nitrate+Nitrite (as		< 0.0100	N/A	0.0100	mg/L	N/A	
Nitrogen, Total		< 0.0500	N/A	0.0500	mg/L	N/A	
Dissolved Metals							
Lithium, dissolved	l	0.00382	N/A	0.00010	mg/L	2020-10-01	
Aluminum, dissolv	ved	< 0.0050	N/A	0.0050	mg/L	2020-10-01	
Antimony, dissolve	ed	< 0.00020	N/A	0.00020	mg/L	2020-10-01	
Arsenic, dissolved	1	< 0.00050	N/A	0.00050	mg/L	2020-10-01	
Barium, dissolved		0.0701	N/A	0.0050	mg/L	2020-10-01	
Beryllium, dissolve	ed	< 0.00010	N/A	0.00010	mg/L	2020-10-01	
Bismuth, dissolve	d	< 0.00010	N/A	0.00010	mg/L	2020-10-01	
Boron, dissolved		< 0.0500	N/A	0.0500	mg/L	2020-10-01	
Cadmium, dissolv	red	0.000022	N/A	0.000010	mg/L	2020-10-01	
Calcium, dissolve	d	43.4	N/A	0.20	mg/L	2020-10-01	
Chromium, dissol	ved	< 0.00050	N/A	0.00050	mg/L	2020-10-01	
Cobalt, dissolved		< 0.00010	N/A	0.00010	mg/L	2020-10-01	
Copper, dissolved	l	< 0.00040	N/A	0.00040	mg/L	2020-10-01	
Iron, dissolved		< 0.010	N/A	0.010	mg/L	2020-10-01	
Lead, dissolved		< 0.00020	N/A	0.00020	mg/L	2020-10-01	
Magnesium, disso	blved	12.5	N/A	0.010	•	2020-10-01	
Manganese, disso		0.00123	N/A	0.00020	mg/L	2020-10-01	
Mercury, dissolved	d	< 0.000040	N/A	0.000040	mg/L	2020-10-01	
Molybdenum, diss	solved	0.00068	N/A	0.00010	-	2020-10-01	
Nickel, dissolved		< 0.00040	N/A	0.00040	mg/L	2020-10-01	
Phosphorus, disso	olved	< 0.050	N/A	0.050	mg/L	2020-10-01	
Potassium, dissol	ved	0.42	N/A		mg/L	2020-10-01	
Selenium, dissolv	ed	0.00063	N/A	0.00050	mg/L	2020-10-01	
					mg/L		

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Chromium, total

Cobalt, total

Copper, total

Iron, total

Lead, total

Lithium, total

<b>REPORTED TO</b> Elk River Alliance <b>PROJECT</b> ERA-CBWM				WORK ORDER REPORTED	0092642 2020-10 <b>-</b> 05 17:04	
Analyte	Result	Guideline	RL	Units	Analyzed	Qualifie
ALX03_200920_1600 (0092642-04)   Matr	ix: Water   Sample	ed: 2020-09-20 16:0	0, Continued	l		
Dissolved Metals, Continued						
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2020-10-01	
Sodium, dissolved	1.49	N/A	0.10	mg/L	2020-10-01	
Strontium, dissolved	0.119	N/A	0.0010	mg/L	2020-10-01	
Sulfur, dissolved	6.4	N/A	3.0	mg/L	2020-10-01	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-01	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2020-10-01	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-01	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-01	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-01	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-01	
Uranium, dissolved	0.000501	N/A	0.000020	mg/L	2020-10-01	
Vanadium, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-01	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2020-10-01	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-01	
General Parameters						
Alkalinity, Total (as CaCO3)	165	N/A	1.0	mg/L	2020-09-28	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2020-09-28	
Alkalinity, Bicarbonate (as CaCO3)	165	N/A	1.0	mg/L	2020-09-28	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2020-09-28	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2020-09-28	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2020-09-25	
BOD, 5-day	< 6.0	N/A	2.0	mg/L	2020-09-30	HT1
Chemical Oxygen Demand	< 20	N/A	20	mg/L	2020-09-28	
Nitrogen, Total Kjeldahl	< 0.050	N/A	0.050	mg/L	2020-09-29	
Phosphorus, Total (as P)	0.0051	N/A	0.0050	mg/L	2020-09-28	
Solids, Total Suspended	< 2.0	N/A	2.0	mg/L	2020-09-27	
Fotal Metals						
Aluminum, total	0.0089	OG < 0.1	0.0050	mg/L	2020-09-30	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	-	2020-09-30	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050		2020-09-30	
Barium, total	0.0741	MAC = 2	0.0050		2020-09-30	
Beryllium, total	< 0.00010	N/A	0.00010		2020-09-30	
Bismuth, total	< 0.00010	N/A	0.00010		2020-09-30	
Boron, total	< 0.0500	MAC = 5	0.0500	-	2020-09-30	
Cadmium, total	0.000012	MAC = 0.005	0.000010		2020-09-30	
Calcium, total	46.8	None Required		mg/L	2020-09-30	
<u> </u>			0.00050		0000 00 00	

MAC = 0.05

N/A

MAC = 2

 $AO \le 0.3$ 

MAC = 0.005

N/A

0.00050 mg/L

0.00010 mg/L

0.00040 mg/L

0.00020 mg/L

0.00010 mg/L

0.010 mg/L

0.00068

< 0.00010

< 0.00040

< 0.00020

0.00406

0.019

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	River Alliance				0000040		
	A-CBWM			WORK ORDER REPORTED	0092642 2020-10-0	5 17:04	
Analyte	Result	Guideline	RL	Units	Analyzed	Qualifie	
ALX03_200920_1600	(0092642-04)   Matrix: Water   Sam	pled: 2020-09-20 16	:00, Continued	l			
Fotal Metals, Continued	,						
Magnesium, total	13.0	None Required	0.010	mg/L	2020-09-30		
Manganese, total	0.00154	MAC = 0.12	0.00020	mg/L	2020-09-30		
Mercury, total	< 0.000040	MAC = 0.001	0.000040	mg/L	2020-09-30		
Molybdenum, total	0.00069	N/A	0.00010	mg/L	2020-09-30		
Nickel, total	< 0.00040	N/A	0.00040	mg/L	2020-09-30		
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2020-09-30		
Potassium, total	0.43	N/A	0.10	mg/L	2020-09-30		
Selenium, total	0.00053	MAC = 0.05	0.00050	mg/L	2020-09-30		
Silicon, total	2.3	N/A	1.0	mg/L	2020-09-30		
Silver, total	< 0.000050	None Required	0.000050	mg/L	2020-09-30		
Sodium, total	1.57	AO ≤ 200	0.10	mg/L	2020-09-30		
Strontium, total	0.122	7	0.0010	mg/L	2020-09-30		
Sulfur, total	6.7	N/A	3.0	mg/L	2020-09-30		
Tellurium, total	< 0.00050	N/A	0.00050	mg/L	2020-09-30		
Thallium, total	< 0.000020	N/A	0.000020	mg/L	2020-09-30		
Thorium, total	< 0.00010	N/A	0.00010	mg/L	2020-09-30		
Tin, total	< 0.00020	N/A	0.00020	mg/L	2020-09-30		
Titanium, total	< 0.0050	N/A	0.0050	mg/L	2020-09-30		
Tungsten, total	< 0.0010	N/A	0.0010	mg/L	2020-09-30		
Uranium, total	0.000566	MAC = 0.02	0.000020	mg/L	2020-09-30		
Vanadium, total	< 0.0010	N/A	0.0010	mg/L	2020-09-30		
Zinc, total	< 0.0040	AO ≤ 5	0.0040	mg/L	2020-09-30		
Zirconium, total	< 0.00010	N/A	0.00010	mg/L	2020-09-30		

### Sample Qualifiers:

HT1 The sample was prepared and/or analyzed past the recommended holding time.



# **APPENDIX 1: SUPPORTING INFORMATION**

	Elk River Allia ERA-CBWM	ance	WORK ORDER REPORTED	0092642 2020-10-0	5 17:04
Analysis Descrip	tion	Method Ref.	Technique A	ccredited	Location
Alkalinity in Water		SM 2320 B* (2017)	Titration with H2SO4	✓	Kelowna
Ammonia, Total in V	Vater	SM 4500-NH3 G* (2017)	Automated Colorimetry (Phenate)	√	Kelowna
Anions in Water		SM 4110 B (2017)	Ion Chromatography	✓	Kelowna
Biochemical Oxyger Water	n Demand in	SM 5210 B (2017)	Dissolved Oxygen Meter	√	Kelowna
Chemical Oxygen D Water	Demand in	SM 5220 D* (2017)	Closed Reflux, Colorimetry	√	Kelowna
Dissolved Metals in	Water	EPA 200.8 / EPA 6020B	0.45 µm Filtration / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond
Hardness in Water		SM 2340 B (2017)	Calculation: 2.497 [diss Ca] + 4.118 [diss Mg]	✓	N/A
Mercury, dissolved i	in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	√	Richmond
Mercury, total in Wa	iter	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	√	Richmond
Nitrogen, Total Kjelo	dahl in Water	SM 4500-Norg D* (2017)	Block Digestion and Flow Injection Analysis	√	Kelowna
Phosphorus, Total ir	n Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Ad	cid) ✓	Kelowna
Solids, Total Susper Water	nded in	SM 2540 D* (2017)	Gravimetry (Dried at 103-105C)	√	Kelowna
Total Metals in Wate	ər	EPA 200.2 / EPA 6020B	HNO3+HCI Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

### **Glossary of Terms:**

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
AO	Aesthetic Objective
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
OG	Operational Guideline (treated water)
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

### **Guidelines Referenced in this Report:**

Guidelines for Canadian Drinking Water Quality (Health Canada, June 2019)

Note: In some cases, the values displayed on the report represent the lowest guideline and are to be verified by the end user



# **APPENDIX 1: SUPPORTING INFORMATION**

REPORTED TO	Elk River Alliance
PROJECT	ERA-CBWM

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### General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing.

Results in **Bold** indicate values that are above CARO's method reporting limits. Any results that are above regulatory limits are highlighted **red**. Please note that results will only be highlighted red if the regulatory limits are included on the CARO report. Any Bold and/or highlighted results do <u>not</u> take into account method uncertainty. If you would like method uncertainty or regulatory limits to be included on your report, please contact your Account Manager:teamcaro@caro.ca

Please note any regulatory guidelines applied to this report are added as a convenience to the client, at their request, to help provide some initial context to analytical results obtained. Although CARO makes every effort to ensure accuracy of the associated regulatory guideline(s) applied, the guidelines applied cannot be assumed to be correct due to a variety of factors and as such CARO Analytical Services assumes no liability or responsibility for the use of those guidelines to make any decisions. The original source of the regulation should be verified and a review of the guideline(s) should be validated as correct in order to make any decisions arising from the comparison of the analytical data obtained to the relevant regulatory guideline for one's particular circumstances. Further, CARO Analytical Services assumes no liability or responsibility for any loss attributed from the use of these guidelines in any way.



Mercury, dissolved

# **APPENDIX 2: QUALITY CONTROL RESULTS**

REPORTED TO	Elk River Alliance	WORK ORDER	0092642
PROJECT	ERA-CBWM	REPORTED	2020-10-05 17:04

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- Method Blank (Blk): A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- Duplicate (Dup): An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- Blank Spike (BS): A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- Matrix Spike (MS): A second aliquot of sample is fortified with with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B0l2281									
Blank (B0I2281-BLK1)			Prepared	: 2020-09-2	26, Analyze	d: 2020-(	09-26		
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
Phosphate (as P)	< 0.0050	0.0050 mg/L							
Blank (B0l2281-BLK2)			Prepared	: 2020-09-2	27, Analyze	d: 2020-(	09-27		
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
Phosphate (as P)	< 0.0050	0.0050 mg/L							
Blank (B0 2281-BLK3)			Prepared	: 2020-09-2	27, Analyze	d: 2020-(	09-27		
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
Phosphate (as P)	< 0.0050	0.0050 mg/L							
LCS (B0l2281-BS1)			Prepared	: 2020-09-2	26, Analyze	d: 2020-(	09-26		
Nitrate (as N)	4.05	0.010 mg/L	4.00		101	90-110			
Nitrite (as N)	2.02	0.010 mg/L	2.00		101	85-115			
Phosphate (as P)	1.03	0.0050 mg/L	1.00		103	80-120			
LCS (B0 2281-BS2)			Prepared	: 2020-09-2	27, Analyze	d: 2020-(	09-27		
Nitrate (as N)	3.98	0.010 mg/L	4.00		100	90-110			
Nitrite (as N)	2.00	0.010 mg/L	2.00		100	85-115			
Phosphate (as P)	1.00	0.0050 mg/L	1.00		100	80-120			
LCS (B0l2281-BS3)			Prepared	: 2020-09-2	27, Analyze	d: 2020-(	09-27		
Nitrate (as N)	4.03	0.010 mg/L	4.00		101	90-110			
Nitrite (as N)	1.98	0.010 mg/L	2.00		99	85-115			
Phosphate (as P)	0.992	0.0050 mg/L	1.00		99	80-120			
Dissolved Metals, Batch B0l2438 Blank (B0l2438-BLK1)			Prenared	: 2020-09-2	06 Analyza	4. 2020 (	19-27		
· ·	< 0.000010	0.000010 mg/L	riepaleu	. 2020-03-2	.o, Analyze	u. 2020-0	55-21		
Mercury, dissolved	< 0.000010	0.000010 mg/L							
Blank (B0I2438-BLK2)			Prepared	I: 2020-09-2	26, Analyze	d: 2020-(	09-27		

Caring About Results, Obviously.

0.000010 mg/L

< 0.000010



0.00649

<b>REPORTED TO</b> Elk River Alliance <b>PROJECT</b> ERA-CBWM						WORK REPOR			642 -10-05	17:04	
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier	
Dissolved Metals,	Batch B0/2438, Continue	ed									
Reference (B0l243	88-SRM1)			Prepared	: 2020-09-2	26, Analyze	d: 2020-0	09-27			
Mercury, dissolved		0.00701	0.000010 mg/L	0.00581		121	70-130				
Reference (B0I2438-SRM2) Prepa					Prepared: 2020-09-26, Analyzed: 2020-09-27						

0.00581

112

Prepared: 2020-09-30, Analyzed: 2020-09-30

70-130

0.000010 mg/L

### Dissolved Metals, Batch B0/2727

### Blank (B0I2727-BLK1)

Beryllium, dissolved

Bismuth, dissolved

Boron, dissolved

Mercury, dissolved

				e ee ee,:		
Lithium, dissolved	< 0.00010	0.00010 mg/L				
Aluminum, dissolved	< 0.0050	0.0050 mg/L				
Antimony, dissolved	< 0.00020	0.00020 mg/L				
Arsenic, dissolved	< 0.00050	0.00050 mg/L				
Barium, dissolved	< 0.0050	0.0050 mg/L				
Beryllium, dissolved	< 0.00010	0.00010 mg/L				
Bismuth, dissolved	< 0.00010	0.00010 mg/L				
Boron, dissolved	< 0.0500	0.0500 mg/L				
Cadmium, dissolved	< 0.000010	0.000010 mg/L				
Calcium, dissolved	< 0.20	0.20 mg/L				
Chromium, dissolved	< 0.00050	0.00050 mg/L				
Cobalt, dissolved	< 0.00010	0.00010 mg/L				
Copper, dissolved	< 0.00040	0.00040 mg/L				
Iron, dissolved	< 0.010	0.010 mg/L				
Lead, dissolved	< 0.00020	0.00020 mg/L				
Magnesium, dissolved	< 0.010	0.010 mg/L				
Manganese, dissolved	< 0.00020	0.00020 mg/L				
Mercury, dissolved	< 0.000040	0.000040 mg/L				
Molybdenum, dissolved	< 0.00010	0.00010 mg/L				
Nickel, dissolved	< 0.00040	0.00040 mg/L				
Phosphorus, dissolved	< 0.050	0.050 mg/L				
Potassium, dissolved	< 0.10	0.10 mg/L				
Selenium, dissolved	< 0.00050	0.00050 mg/L				
Silicon, dissolved	< 1.0	1.0 mg/L				
Silver, dissolved	< 0.000050	0.000050 mg/L				
Sodium, dissolved	< 0.10	0.10 mg/L				
Strontium, dissolved	< 0.0010	0.0010 mg/L				
Sulfur, dissolved	< 3.0	3.0 mg/L				
Tellurium, dissolved	< 0.00050	0.00050 mg/L				
Thallium, dissolved	< 0.000020	0.000020 mg/L				
Thorium, dissolved	< 0.00010	0.00010 mg/L				
Tin, dissolved	< 0.00020	0.00020 mg/L				
Titanium, dissolved	< 0.0050	0.0050 mg/L				
Tungsten, dissolved	< 0.0010	0.0010 mg/L				
Uranium, dissolved	< 0.000020	0.000020 mg/L				
Vanadium, dissolved	< 0.0010	0.0010 mg/L				
Zinc, dissolved	< 0.0040	0.0040 mg/L				
Zirconium, dissolved	< 0.00010	0.00010 mg/L				
LCS (B0I2727-BS1)			Prepared: 2020	0-09-30, Analyze	ed: 2020-09-30	
Lithium, dissolved	0.0201	0.00010 mg/L	0.0200	100	80-120	
Aluminum, dissolved	0.0230	0.0050 mg/L	0.0199	116	80-120	
Antimony, dissolved	0.0190	0.00020 mg/L	0.0200	95	80-120	
Arsenic, dissolved	0.0200	0.00050 mg/L	0.0200	100	80-120	
Barium, dissolved	0.0192	0.0050 mg/L	0.0198	97	80-120	

0.00010 mg/L

0.00010 mg/L

0.0500 mg/L

0.0199

0.0190

< 0.0500

0.0198

0.0200

0.0200

100

95

103

80-120

80-120

80-120



REPORTED TO PROJECT	Elk River Alliance ERA-CBWM						WORK REPOR	ORDER TED	0092 2020	2642 )-10-05	17:04
Analyte		Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, B	Batch B0/2727, Continu	ıed									
LCS (B012727-BS1)	, Continued				Prepared	: 2020-09-3	0, Analyze	d: 2020-0	9-30		
Cadmium, dissolved		0.0193	0.000010	mg/L	0.0199		97	80-120			
Calcium, dissolved		2.12	0.20	mg/L	2.02		105	80-120			
Chromium, dissolved		0.0198	0.00050	-	0.0198		100	80-120			
Cobalt, dissolved		0.0200	0.00010	-	0.0199		101	80-120			
Copper, dissolved		0.0205	0.00040		0.0200		102	80-120			
Iron, dissolved		1.99	0.010	· ·	2.02		98	80-120			
Lead, dissolved		0.0185	0.00020		0.0199		93	80-120			
Magnesium, dissolved		1.93 0.0199	0.010		2.02		96	80-120 80-120			
Manganese, dissolved Mercury, dissolved		0.000867	0.00020		0.00199		100 87	80-120			
Molybdenum, dissolved	d	0.000807	0.000040	-	0.0200		99	80-120			
Nickel, dissolved	u	0.0198	0.00040	-	0.0200		98	80-120			
Phosphorus, dissolved	1	2.04	0.050	-	2.00		102	80-120			
Potassium, dissolved	•	2.04		mg/L	2.02		101	80-120			
Selenium, dissolved		0.0186	0.00050		0.0200		93	80-120			
Silicon, dissolved		2.0		mg/L	2.00		100	80-120			
Silver, dissolved		0.0191	0.000050	-	0.0200		96	80-120			
Sodium, dissolved		1.88	0.10	mg/L	2.02		93	80-120			
Strontium, dissolved		0.0199	0.0010	mg/L	0.0200		100	80-120			
Sulfur, dissolved		4.7		mg/L	5.00		95	80-120			
Tellurium, dissolved		0.0185	0.00050	mg/L	0.0200		93	80-120			
Thallium, dissolved		0.0187	0.000020	mg/L	0.0199		94	80-120			
Thorium, dissolved		0.0178	0.00010	-	0.0200		89	80-120			
Tin, dissolved		0.0196	0.00020		0.0200		98	80-120			
Titanium, dissolved		0.0216	0.0050		0.0200		108	80-120			
Tungsten, dissolved		0.0181	0.0010		0.0200		91	80-120			
Uranium, dissolved		0.0180	0.000020		0.0200		90	80-120			
Vanadium, dissolved		0.0195	0.0010		0.0200		98	80-120			
Zinc, dissolved		0.0215	0.0040		0.0200		108 96	80-120			
Zirconium, dissolved		0.0192	0.00010	-	0.0200			80-120			
Duplicate (B0I2727-	-DUP1)		ource: 0092		Prepared	: 2020-10-0	1, Analyze	d: 2020-1			
Lithium, dissolved		0.00138	0.00010	<u> </u>		0.00148			8	20	
Aluminum, dissolved		< 0.0050	0.0050			0.0055				20	
Antimony, dissolved		< 0.00020	0.00020			< 0.00020				20	
Arsenic, dissolved		0.00056	0.00050	0		0.00055			< 1	20	
Barium, dissolved		0.0274	0.0050			0.0276			< 1	20 20	
Beryllium, dissolved Bismuth, dissolved		< 0.00010	0.00010			< 0.00010				20	
Boron, dissolved		< 0.00010	0.00010	-		< 0.00010				20	
Cadmium, dissolved		0.000072	0.000010	-		0.000058			21	20	RPD
Calcium, dissolved		47.9		mg/L		47.5			< 1	20	
Chromium, dissolved		0.00062	0.00050	-		0.00065				20	
Cobalt, dissolved		< 0.00010	0.00010			< 0.00010				20	
Copper, dissolved		< 0.00040	0.00040	-		< 0.00040				20	
Iron, dissolved		< 0.010	0.010			< 0.010				20	
Lead, dissolved		< 0.00020	0.00020	-		< 0.00020				20	
Magnesium, dissolved		13.0	0.010	-		12.9			< 1	20	
Manganese, dissolved		< 0.00020	0.00020			< 0.00020				20	
Mercury, dissolved		< 0.000040	0.000040			< 0.000040				20	
Molybdenum, dissolve	d	0.00153	0.00010	mg/L		0.00140			8	20	
Nickel, dissolved		< 0.00040	0.00040	mg/L		< 0.00040				20	
Phosphorus, dissolved	1	< 0.050	0.050	mg/L		< 0.050				20	
Potassium, dissolved		0.31		mg/L		0.31				20	
Selenium, dissolved		0.00098	0.00050			0.00106				20	
Silicon, dissolved		2.0	1.0	mg/L		2.1				20	

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REPORTED TO PROJECT	Elk River Alliance ERA-CBWM					WORK REPOR	ORDER	0092 2020	642 -10-05	17:04
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifie
Dissolved Metals,	Batch B0l2727, Contin	ued								
Duplicate (B0l2727	-DUP1), Continued	So	ource: 0092642-02	Prepared	1: 2020-10-0	1, Analyze	d: 2020-1	0-01		
Silver, dissolved	•	< 0.000050	0.000050 mg/L	-	< 0.000050				20	
Sodium, dissolved		0.55	0.10 mg/L		0.55			< 1	20	
Strontium, dissolved		0.557	0.0010 mg/L		0.562			< 1	20	
Sulfur, dissolved		22.5	3.0 mg/L		21.4			5	20	
Tellurium, dissolved		< 0.00050	0.00050 mg/L		< 0.00050			•	20	
Thallium, dissolved		< 0.000020	0.000020 mg/L		< 0.000020				20	
Thorium, dissolved		< 0.00010	0.00010 mg/L		< 0.00010				20	
Tin, dissolved		< 0.00020	0.00020 mg/L		< 0.00020				20	
Titanium, dissolved		< 0.0050	0.0050 mg/L		< 0.0050				20	
Tungsten, dissolved		< 0.0010	0.0010 mg/L		< 0.0000				20	
Uranium, dissolved		0.000898	0.000020 mg/L		0.000887			1	20	
Vanadium, dissolved		< 0.0010	0.00020 mg/L		< 0.0010				20	
		< 0.0010	0.0040 mg/L		< 0.0040				20	
Zinc, dissolved			0.00010 mg/L		< 0.00040				20	
Zirconium, dissolved		< 0.00010	0.00010 mg/L						20	
Reference (B0I272	7-SRM1)				1: 2020-10-0			0-01		
Lithium, dissolved		0.103	0.00010 mg/L	0.100		103	70-130			
Aluminum, dissolved		0.242	0.0050 mg/L	0.235		103	70-130			
Antimony, dissolved		0.0460	0.00020 mg/L	0.0431		107	70-130			
Arsenic, dissolved		0.444	0.00050 mg/L	0.423		105	70-130			
Barium, dissolved		3.08	0.0050 mg/L	3.30		93	70-130			
Beryllium, dissolved		0.213	0.00010 mg/L	0.209		102	70-130			
Boron, dissolved		1.57	0.0500 mg/L	1.65		95	70-130			
Cadmium, dissolved		0.214	0.000010 mg/L	0.221		97	70-130			
Calcium, dissolved		7.51	0.20 mg/L	7.72		97	70-130			
Chromium, dissolved		0.428	0.00050 mg/L	0.434		99	70-130			
Cobalt, dissolved		0.127	0.00010 mg/L	0.124		102	70-130			
Copper, dissolved		0.833	0.00040 mg/L	0.815		102	70-130			
Iron, dissolved		1.27	0.010 mg/L	1.27		100	70-130			
Lead, dissolved		0.102	0.00020 mg/L	0.110		92	70-130			
Magnesium, dissolve	d	6.55	0.010 mg/L	6.59		99	70-130			
Manganese, dissolve		0.352	0.00020 mg/L	0.342		103	70-130			
Molybdenum, dissolv		0.407	0.00010 mg/L	0.404		101	70-130			
Nickel, dissolved		0.852	0.00040 mg/L	0.835		102	70-130			
Phosphorus, dissolve	d	0.518	0.050 mg/L	0.499		104	70-130			
Potassium, dissolved		3.09	0.10 mg/L	2.88		107	70-130			
Selenium, dissolved		0.0324	0.00050 mg/L	0.0324		100	70-130			
Sodium, dissolved		17.6	0.10 mg/L	18.0		98	70-130			
Strontium, dissolved		0.906	0.0010 mg/L	0.935		97	70-130			
Thallium, dissolved		0.0362	0.000020 mg/L	0.0385		94	70-130			
Uranium, dissolved		0.221	0.000020 mg/L	0.258		85	70-130			
Vanadium, dissolved		0.848	0.000020 mg/L	0.873		97	70-130			
				0.070			10 100			

### General Parameters, Batch B0/2299

Blank (B0I2299-BLK1)			Prepared: 202	20-09-25, Analyze	d: 2020-09-30	
BOD, 5-day	< 2.0	2.0 mg/L				
LCS (B0I2299-BS1)			Prepared: 202	20-09-25, Analyze	d: 2020-09-30	
BOD, 5-day	176	49.6 ma/L	180	98	85-115	

### General Parameters, Batch B0/2345

Blank (B0l2345-BLK1)

Ammonia, Total (as N)

Prepared: 2020-09-25, Analyzed: 2020-09-25 0.050 mg/L

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< 0.050



PROJECT ERA-CBWM REPORTED 2020-10-05 17:04	REPORTED TO	Elk River Alliance				_	WORK	ORDER	0092	642	
Anaryon         Result         R. Units         Lavel         Result         ** RCD         Limit         Valuet           General Parameters, Batch B0/2345, Continued         Blank (B0/2345-BLK2)         Prepared: 2020-09-25, Analyzed: 2020-09-25         Anaronia, Total (as N)         < 0.050         mg/L         LCS (80/2345-BS1)         Prepared: 2020-09-25, Analyzed: 2020-09-25         Anaronia, Total (as N)         0.989         90-115           Anaronia, Total (as N)         0.050 mg/L         1.00         99         90-115           Anaronia, Total (as N)         0.010         90         90-115           Anaronia, Total (as N)         1.01         0.050 mg/L         1.00         101         90-115           Anaronia, Total (as N)         1.01         0.050 mg/L         1.00         101         90-115           Anaronia, Total (as N)         1.01         0.050 mg/L         1.00         101         90-115           Anaronia, Total (as N)         1.01         0.050 mg/L         1.00         101         90-115          Charnetal Darget 2020-09-28, Analyzed: 2020-09-28         Charnetal Darget 2020-09-27         Solds, Total Suspended         < 2.0         mg/L         1.05 (80/2420-BLK1)         Prepared: 2020-09-27, Analyzed: 2020-09-27 <th></th> <th>17:04</th>											17:04
Blank (B012345-BLK2)         Prepared: 2020-09-25, Analyzed: 2020-09-25           Ammonia, Total (as N)         < 0.050         0.050 mg/L         Prepared: 2020-09-25, Analyzed: 2020-09-25           Ammonia, Total (as N)         0.992         0.050 mg/L         1.00         99         90-115           LCS (8012345-BS2)         Prepared: 2020-09-25, Analyzed: 2020-09-25         Ammonia, Total (as N)         1.01         0.050 mg/L         1.00         101         90-115           General Parameters, Batch B012367         Blank (B012367-BLK1)         Prepared: 2020-09-28, Analyzed: 2020-09-28         Chemical Oxygen Demand         20         0.01         90-115         Chemical Oxygen Demand         20         00         102         88-115         Chemical Oxygen Demand         510         20 mg/L         Chemical Oxygen Demand         510         20 mg/L         Edit (as N)         100         100         90-928         Chemical Oxygen Demand         510         20 mg/L         Edit (as N)         100	Analyte		Result	RL Units	-		% REC		% RPD		Qualifier
Ammonia, Total (as N)         < 0.050	General Parameters,	Batch B0l2345, Conti	inued								
LCS (80/2345-851)         Prepared: 2020-09-25, Analyzed: 2020-09-25           Ammonia, Total (as N)         0.392         0.050 mg/L         1.00         99         90-115           LCS (80/2345-852)         Prepared: 2020-09-25, Analyzed: 2020-09-25         Ammonia, Total (as N)         1.01         0.050 mg/L         1.00         101         90-115           General Parameters, Batch B0/2367         Blank (B0/2367-BLX1)         Prepared: 2020-09-28, Analyzed: 2020-09-28         Chemical Oxygen Demand         < 20	Blank (B0l2345-BLK	2)			Prepared	I: 2020-09-2	5, Analyze	ed: 2020-0	9-25		
Ammonia, Total (as N)         0.992         0.050 mg/L         1.00         99         90-115           LCS (B012345-BS2)         Prepared: 2020-09-25, Analyzed: 2020-09-25           Ammonia, Total (as N)         1.01         0.050 mg/L         1.00         101         90-115           General Parameters, Batch B012367         Blank (B012367-BLK1)         Prepared: 2020-09-28, Analyzed: 2020-09-28         C020-09-28, Analyzed: 2020-09-28           Chemical Oxygen Demand         < 20	Ammonia, Total (as N)		< 0.050	0.050 mg/L							
LCS (B012345-BS2)         Prepared: 2020-09-25, Analyzed: 2020-09-25           Ammonia, Total (as N)         1.01         0.050 mg/L         1.00         101         90-115           General Parameters, Batch B012367         Blank (B012367-BLK1)         Prepared: 2020-09-28, Analyzed: 2020-09-28           Chemical Oxygen Demand         < 20	LCS (B012345-BS1)				Prepared	I: 2020-09-2	5, Analyze	ed: 2020-0	9-25		
Ammonia, Total (as N)         1.01         0.050 mg/L         1.00         101         90-115           General Parameters, Batch B0/2367         Blank (B0/2367-BLK1)         Prepared: 2020-09-28, Analyzed: 2020-09-28           Chemical Oxygen Demand         < 20	Ammonia, Total (as N)		0.992	0.050 mg/L	1.00		99	90-115			
Ammonia, Total (as N)         1.01         0.050 mg/L         1.00         101         90-115           General Parameters, Batch B0/2367         Blank (B0/2367-BLY1)         Prepared: 2020-09-28, Analyzed: 2020-09-28           Chemical Oxygen Demand         < 20	LCS (B012345-BS2)				Prepared	I: 2020-09-2	5, Analyze	ed: 2020-0	9-25		
Blank (B0/2367-BLK1)         Prepared: 2020-09-28, Analyzed: 2020-09-28           Chemical Oxygen Demand         < 20	•		1.01	0.050 mg/L	1.00		101	90-115			
Chemical Oxygen Demand         < 20	General Parameters,	Batch B0l2367									
Chemical Oxygen Demand         < 20	Blank (B0l2367-BLK	1)			Prepared	I: 2020-09-2	8, Analyze	ed: 2020-0	9-28		
Chemical Oxygen Demand         510         20 mg/L         500         102         89-115           General Parameters, Batch B0l2420         Blank (B0l2420-BLK1)         Prepared: 2020-09-27, Analyzed: 2020-09-27           Solids, Total Suspended         < 2.0         2.0 mg/L         Prepared: 2020-09-27, Analyzed: 2020-09-27           Blank (B0l2420-BLK2)         Prepared: 2020-09-27, Analyzed: 2020-09-27         Solids, Total Suspended         < 2.0         g/L           LCS (B0l2420-BS1)         Prepared: 2020-09-27, Analyzed: 2020-09-27         Solids, Total Suspended         94.0         10.0 mg/L         100         94         85-115           LCS (B0l2420-BS2)         Prepared: 2020-09-27, Analyzed: 2020-09-27         Solids, Total Suspended         98.0         10.0 mg/L         100         98         85-115           LCS (B0l2420-BS2)         Prepared: 2020-09-27, Analyzed: 2020-09-27         Solids, Total Suspended         98.0         10.0 mg/L         100         98         85-115           LCS (B0l249-BS2)         Prepared: 2020-09-28, Analyzed: 2020-09-28         Prepared: 2020-09-28, Analyzed: 2020-09-28         Phosphorus, Total (as P)         <0.0050         0.0050         mg/L           LCS (B0l2495-BL2)         Prepared: 2020-09-28, Analyzed: 2020-09-28         Phosphorus, Total (as P)         0.00996         0.0050         mg/L	Chemical Oxygen Dem	and	< 20	20 mg/L	· · ·		•				
Chemical Oxygen Demand         510         20 mg/L         500         102         89-115           General Parameters, Batch B0/2420         Blank (B0/2420-BLK1)         Prepared: 2020-09-27, Analyzed: 2020-09-27           Solids, Total Suspended         < 2.0         2.0 mg/L         Prepared: 2020-09-27, Analyzed: 2020-09-27           Solids, Total Suspended         < 2.0         2.0 mg/L         Prepared: 2020-09-27, Analyzed: 2020-09-27           Solids, Total Suspended         < 2.0         2.0 mg/L         Prepared: 2020-09-27, Analyzed: 2020-09-27           Solids, Total Suspended         94.0         10.0 mg/L         100         94         85-115           LCS (B0/2420-BS1)         Prepared: 2020-09-27, Analyzed: 2020-09-27         Solids, Total Suspended         94.0         10.0 mg/L         100         94         85-115           LCS (B0/2420-BS2)         Prepared: 2020-09-27, Analyzed: 2020-09-27         Solids, Total Suspended         96.0         10.0 mg/L         100         98         85-115           General Parameters, Batch B0/2495         Blank (B0/2496-BLK2)         Prepared: 2020-09-28, Analyzed: 2020-09-28         Phosphorus, Total (as P)         < 0.0050         0.0050 mg/L         Prepared: 2020-09-28, Analyzed: 2020-09-28           Phosphorus, Total (as P)         0.0996         0.0050 mg/L         Prepared: 2020-09-28, Analyzed: 2020-09-29 <td>LCS (B0 2367-BS1)</td> <td></td> <td></td> <td></td> <td>Prepared</td> <td>I: 2020-09-2</td> <td>8, Analyze</td> <td>ed: 2020-0</td> <td>9-28</td> <td></td> <td></td>	LCS (B0 2367-BS1)				Prepared	I: 2020-09-2	8, Analyze	ed: 2020-0	9-28		
Biank (8012420-BLK1)         Prepared: 2020-09-27, Analyzed: 2020-09-27           Solids, Total Suspended         < 2.0		and	510	20 mg/L							
Solids, Total Suspended         < 2.0         2.0 mg/L           Blank (B0l2420-BLK2)         Prepared: 2020-09-27, Analyzed: 2020-09-27           Solids, Total Suspended         < 2.0	General Parameters,	Batch B0l2420									
Blank (B0l2420-BLK2)         Prepared: 2020-09-27, Analyzed: 2020-09-27           Solids, Total Suspended         < 2.0	Blank (B0I2420-BLK	1)			Prepared	l: 2020-09-2	?, Analyze	ed: 2020-0	9-27		
Solids, Total Suspended         < 2.0         2.0 mg/L           LCS (B0/2420-BS1)         Prepared: 2020-09-27, Analyzed: 2020-09-27           Solids, Total Suspended         94.0         10.0 mg/L         100         94         85-115           LCS (B0/2420-BS2)         Prepared: 2020-09-27, Analyzed: 2020-09-27         Solids, Total Suspended         98.0         10.0 mg/L         100         98         85-115           General Parameters, Batch B0/2495         Blank (B0/2495-BLK2)         Prepared: 2020-09-28, Analyzed: 2020-09-28         Phosphorus, Total (as P)         < 0.0050	Solids, Total Suspended	Ŀ	< 2.0	2.0 mg/L							
LCS (B012420-BS1)         Prepared: 2020-09-27, Analyzed: 2020-09-27           Solids, Total Suspended         94.0         10.0 mg/L         100         94         85-115           LCS (B012420-BS2)         Prepared: 2020-09-27, Analyzed: 2020-09-27         Solids, Total Suspended         98.0         10.0 mg/L         100         98         85-115           Solids, Total Suspended         98.0         10.0 mg/L         100         98         85-115           General Parameters, Batch B012495         Blank (B012495-BLK2)         Prepared: 2020-09-28, Analyzed: 2020-09-28           Phosphorus, Total (as P)         < 0.0050	Blank (B0l2420-BLK	2)			Prepared	I: 2020-09-2	7, Analyze	ed: 2020-0	9-27		
Solids, Total Suspended         94.0         10.0 mg/L         100         94         85-115           LCS (B012420-BS2)         Prepared: 2020-09-27, Analyzed: 2020-09-27           Solids, Total Suspended         98.0         10.0 mg/L         100         98         85-115           General Parameters, Batch B012495         Blank (B012495-BLK2)         Prepared: 2020-09-28, Analyzed: 2020-09-28         Prepared: 2020-09-28, Analyzed: 2020-09-28           Phosphorus, Total (as P)         < 0.0050         0.0050 mg/L         Prepared: 2020-09-28, Analyzed: 2020-09-28           Phosphorus, Total (as P)         < 0.0096         0.0050 mg/L         0.100         100         85-115           General Parameters, Batch B012496         Blank (B012496-BLK1)         Prepared: 2020-09-28, Analyzed: 2020-09-28         Prepared: 2020-09-28, Analyzed: 2020-09-28           Nitrogen, Total Kjeldahl         < 0.050         0.050 mg/L         Prepared: 2020-09-28, Analyzed: 2020-09-29           Nitrogen, Total Kjeldahl         < 0.050         0.050 mg/L         Prepared: 2020-09-28, Analyzed: 2020-09-29           Nitrogen, Total Kjeldahl         < 0.050         0.050 mg/L         Prepared: 2020-09-28, Analyzed: 2020-09-29           Nitrogen, Total Kjeldahl         < 0.050         0.050 mg/L         Prepared: 2020-09-28, Analyzed: 2020-09-29           Nitrogen, Total Kjeldahl         < 0.050	Solids, Total Suspended	t	< 2.0	2.0 mg/L							
LCS (B012420-BS2)         Prepared: 2020-09-27, Analyzed: 2020-09-27           Solids, Total Suspended         98.0         10.0 mg/L         100         98         85-115           General Parameters, Batch B012495         Blank (B012495-BLK2)         Prepared: 2020-09-28, Analyzed: 2020-09-28           Phosphorus, Total (as P)         < 0.0050	LCS (B0 2420-BS1)				Prepared	I: 2020-09-2	?, Analyze	ed: 2020-0	9-27		
Solids, Total Suspended         98.0         10.0 mg/L         100         98         85-115           General Parameters, Batch B0l2495         Prepared: 2020-09-28, Analyzed: 2020-09-28           Phosphorus, Total (as P)         < 0.0050         0.0050 mg/L           LCS (B0l2495-BLX2)         Prepared: 2020-09-28, Analyzed: 2020-09-28           Phosphorus, Total (as P)         0.0996         0.0050 mg/L         0.100         100         85-115           General Parameters, Batch B0l2496         Blank (B0l2496-BLK1)         Prepared: 2020-09-28, Analyzed: 2020-09-28         Prepared: 2020-09-28, Analyzed: 2020-09-29           Nitrogen, Total Kjeldahl         < 0.050         0.050 mg/L         0.100         100         85-115           Blank (B0l2496-BLK1)         Prepared: 2020-09-28, Analyzed: 2020-09-29         Nitrogen, Total Kjeldahl         < 0.050         0.050 mg/L           Blank (B0l2496-BLK1)         Prepared: 2020-09-28, Analyzed: 2020-09-29         Prepared: 2020-09-28, Analyzed: 2020-09-29           Nitrogen, Total Kjeldahl         < 0.050         0.050 mg/L         Prepared: 2020-09-28, Analyzed: 2020-09-29           Nitrogen, Total Kjeldahl         < 0.050         0.050 mg/L         Prepared: 2020-09-28, Analyzed: 2020-09-29           Nitrogen, Total Kjeldahl         < 0.050 mg/L         Prepared: 2020-09-28, Analyzed: 2020-09-29           Nitrogen	Solids, Total Suspended	b	94.0	10.0 mg/L	100		94	85-115			
General Parameters, Batch B0l2495         Blank (B0l2495-BLK2)       Prepared: 2020-09-28, Analyzed: 2020-09-28         Phosphorus, Total (as P)       < 0.0050       mg/L         LCS (B0l2495-BS2)       Prepared: 2020-09-28, Analyzed: 2020-09-28         Phosphorus, Total (as P)       0.0996       0.0050 mg/L       0.100       100       85-115         General Parameters, Batch B0l2496       Blank (B0l2496-BLK1)       Prepared: 2020-09-28, Analyzed: 2020-09-29       Nitrogen, Total Kjeldahl       < 0.050       0.050 mg/L         Blank (B0l2496-BLK1)       Prepared: 2020-09-28, Analyzed: 2020-09-29       Nitrogen, Total Kjeldahl       < 0.050       0.050 mg/L         Blank (B0l2496-BLK2)       Prepared: 2020-09-28, Analyzed: 2020-09-29       Nitrogen, Total Kjeldahl       < 0.050       0.050 mg/L         LCS (B0l2496-BS1)       Prepared: 2020-09-28, Analyzed: 2020-09-29       Nitrogen, Total Kjeldahl       < 0.050 mg/L       Prepared: 2020-09-28, Analyzed: 2020-09-29         Nitrogen, Total Kjeldahl       < 0.050 mg/L       Prepared: 2020-09-28, Analyzed: 2020-09-29       Nitrogen, Total Kjeldahl       < 0.050 mg/L         LCS (B0l2496-BS1)       Prepared: 2020-09-28, Analyzed: 2020-09-29       Nitrogen, Total Kjeldahl       1.12       0.050 mg/L       1.00       112       85-115	LCS (B012420-BS2)				Prepared	I: 2020-09-2	7, Analyze	ed: 2020-0	9-27		
Blank (B0l2495-BLK2)       Prepared: 2020-09-28, Analyzed: 2020-09-28         Phosphorus, Total (as P)       < 0.0050 mg/L	Solids, Total Suspended	t	98.0	10.0 mg/L	100		98	85-115			
Phosphorus, Total (as P)       < 0.0050       0.0050 mg/L         LCS (B0l2495-BS2)       Prepared: 2020-09-28, Analyzed: 2020-09-28         Phosphorus, Total (as P)       0.0996       0.0050 mg/L       0.100       100       85-115         General Parameters, Batch B0l2496       Prepared: 2020-09-28, Analyzed: 2020-09-29         Nitrogen, Total Kjeldahl       < 0.050       mg/L         Blank (B0l2496-BLK2)       Prepared: 2020-09-28, Analyzed: 2020-09-29         Nitrogen, Total Kjeldahl       < 0.050       0.050 mg/L         LCS (B0l2496-BLK2)       Prepared: 2020-09-28, Analyzed: 2020-09-29         Nitrogen, Total Kjeldahl       < 0.050       0.050 mg/L         LCS (B0l2496-BS1)       Prepared: 2020-09-28, Analyzed: 2020-09-29         Nitrogen, Total Kjeldahl       < 0.050 mg/L       Prepared: 2020-09-28, Analyzed: 2020-09-29         Nitrogen, Total Kjeldahl       < 0.050 mg/L       Prepared: 2020-09-28, Analyzed: 2020-09-29         Nitrogen, Total Kjeldahl       1.12       0.050 mg/L       Interpreter	General Parameters,	Batch B0l2495									
LCS (B0I2495-BS2)       Prepared: 2020-09-28, Analyzed: 2020-09-28         Phosphorus, Total (as P)       0.0996       0.0050 mg/L       0.100       100       85-115         General Parameters, Batch B0I2496       Prepared: 2020-09-28, Analyzed: 2020-09-29         Nitrogen, Total Kjeldahl       < 0.050	Blank (B0I2495-BLK	2)			Prepared	l: 2020-09-2	8, Analyze	ed: 2020-0	9-28		
Phosphorus, Total (as P)       0.0996       0.0050 mg/L       0.100       100       85-115         General Parameters, Batch B0l2496       Prepared: 2020-09-28, Analyzed: 2020-09-29         Blank (B0l2496-BLK1)       Prepared: 2020-09-28, Analyzed: 2020-09-29         Nitrogen, Total Kjeldahl       < 0.050       mg/L         Blank (B0l2496-BLK2)       Prepared: 2020-09-28, Analyzed: 2020-09-29         Nitrogen, Total Kjeldahl       < 0.050       mg/L         LCS (B0l2496-BS1)       Prepared: 2020-09-28, Analyzed: 2020-09-29         Nitrogen, Total Kjeldahl       1.12       0.050 mg/L	Phosphorus, Total (as F	?)	< 0.0050	0.0050 mg/L							
General Parameters, Batch B0l2496         Blank (B0l2496-BLK1)       Prepared: 2020-09-28, Analyzed: 2020-09-29         Nitrogen, Total Kjeldahl       < 0.050	LCS (B012495-BS2)				Prepared	I: 2020-09-2	8, Analyze	ed: 2020-0	9-28		
Blank (B0l2496-BLK1)         Prepared: 2020-09-28, Analyzed: 2020-09-29           Nitrogen, Total Kjeldahl         < 0.050	Phosphorus, Total (as F	?)	0.0996	0.0050 mg/L	0.100		100	85-115			
Nitrogen, Total Kjeldahl         < 0.050         mg/L           Blank (B012496-BLK2)         Prepared: 2020-09-28, Analyzed: 2020-09-29           Nitrogen, Total Kjeldahl         < 0.050         mg/L           LCS (B012496-BS1)         Prepared: 2020-09-28, Analyzed: 2020-09-29           Nitrogen, Total Kjeldahl         1.12         0.050 mg/L	General Parameters,	Batch B0l2496									
Blank (B0l2496-BLK2)         Prepared: 2020-09-28, Analyzed: 2020-09-29           Nitrogen, Total Kjeldahl         < 0.050 mg/L	Blank (B012496-BLK	1)			Prepared	I: 2020-09-2	8, Analyze	ed: 2020-0	9-29		
Nitrogen, Total Kjeldahl         < 0.050         0.050         mg/L           LCS (B0I2496-BS1)         Prepared: 2020-09-28, Analyzed: 2020-09-29           Nitrogen, Total Kjeldahl         1.12         0.050         mg/L         1.00         112         85-115	Nitrogen, Total Kjeldahl		< 0.050	0.050 mg/L							
LCS (B0I2496-BS1)         Prepared: 2020-09-28, Analyzed: 2020-09-29           Nitrogen, Total Kjeldahl         1.12         0.050 mg/L         1.00         112         85-115	Blank (B0I2496-BLK	2)			Prepared	l: 2020-09-2	8, Analyze	ed: 2020-0	9-29		
Nitrogen, Total Kjeldahl         1.12         0.050 mg/L         1.00         112         85-115	Nitrogen, Total Kjeldahl		< 0.050	0.050 mg/L							
Nitrogen, Total Kjeldahl         1.12         0.050 mg/L         1.00         112         85-115	LCS (B012496-BS1)				Prepared	I: 2020-09-2	8, Analyze	ed: 2020-0	9-29		
LCS (B0l2496-BS2) Prepared: 2020-09-28, Analyzed: 2020-09-29	Nitrogen, Total Kjeldahl		1.12	0.050 mg/L							
	LCS (B012496-BS2)				Prepared	I: 2020-09-2	8, Analyze	ed: 2020-0	9-29		
Nitrogen, Total Kjeldahl 0.994 0.050 mg/L 1.00 99 85-115	•		0.994	0.050 mg/L							



REPORTED TO Elk River A PROJECT ERA-CBW					WORK ORDER REPORTED		0092642 2020-10-05		5 17:04	
Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier	
General Parameters,Batch B0l	2542, Continued									
Blank (B0l2542-BLK1)			Prepared	I: 2020-09-2	28, Analyze	d: 2020-0	9-28			
Alkalinity, Total (as CaCO3)	< 1.0	1.0 mg/L								
Alkalinity, Phenolphthalein (as CaCO	93) < 1.0	1.0 mg/L								
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0 mg/L								
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0 mg/L								
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0 mg/L								
Blank (B0l2542-BLK2)			Prepared	I: 2020-09-2	28, Analyze	d: 2020-0	9-28			
Alkalinity, Total (as CaCO3)	< 1.0	1.0 mg/L								
Alkalinity, Phenolphthalein (as CaCO	(3) < 1.0	1.0 mg/L								
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0 mg/L								
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0 mg/L								
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0 mg/L								
Blank (B0I2542-BLK3)			Prepared	I: 2020-09-2	28, Analyze	d: 2020-0	9-28			
Alkalinity, Total (as CaCO3)	< 1.0	1.0 mg/L								
Alkalinity, Phenolphthalein (as CaCO	3) < 1.0	1.0 mg/L								
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0 mg/L								
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0 mg/L								
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0 mg/L								
LCS (B0I2542-BS1)			Prepared	I: 2020-09-2	28, Analyze	d: 2020-0	9-28			
Alkalinity, Total (as CaCO3)	104	1.0 mg/L	100		104	80-120				
LCS (B0I2542-BS2)			Prepared	I: 2020-09-2	28, Analyze	d: 2020-0	9-28			
Alkalinity, Total (as CaCO3)	105	1.0 mg/L	100		105	80-120				
LCS (B0l2542-BS3)			Prepared	I: 2020-09-2	28, Analyze	d: 2020-0	9-28			
Alkalinity, Total (as CaCO3)	106	1.0 mg/L	100		106	80-120				

### Total Metals, Batch B0l2439

Blank (B0I2439-BLK1)			Prepared: 2020	-09-26, Analyze	ed: 2020-09-29	
Mercury, total	< 0.000010	0.000010 mg/L				
Blank (B0 2439-BLK2)			Prepared: 2020	-09-26, Analyze	ed: 2020-09-29	
Mercury, total	< 0.000010	0.000010 mg/L				
Reference (B0I2439-SRM1)			Prepared: 2020	-09-26, Analyze	ed: 2020-09-29	
Mercury, total	0.00625	0.000010 mg/L	0.00581	107	70-130	
Reference (B0I2439-SRM2)			Prepared: 2020	-09-26, Analyze	ed: 2020-09-29	
Mercury, total	0.00679	0.000010 mg/L	0.00581	117	70-130	

### Total Metals, Batch B0l2647

		Prepared: 2020-09-29, Analyzed: 2020-09-30
< 0.0050	0.0050 mg/L	
< 0.00020	0.00020 mg/L	
< 0.00050	0.00050 mg/L	
< 0.0050	0.0050 mg/L	
< 0.00010	0.00010 mg/L	
< 0.00010	0.00010 mg/L	
< 0.0500	0.0500 mg/L	
< 0.000010	0.000010 mg/L	
< 0.20	0.20 mg/L	
< 0.00050	0.00050 mg/L	
	< 0.00020 < 0.00050 < 0.0050 < 0.00010 < 0.00010 < 0.0500 < 0.000010 < 0.20	< 0.00020



REPORTED TO PROJECT	Elk River Alliance ERA-CBWM					WORK REPOR			2642 )-10 <b>-</b> 05	17:04
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier

### Total Metals, Batch B0l2647, Continued

Blank (B0I2647-BLK1), Continued			Prepared: 2020	0-09-29, Analyze	ed: 2020-09-30	
Cobalt, total	< 0.00010	0.00010 mg/L	-			
Copper, total	< 0.00040	0.00040 mg/L				
Iron, total	< 0.010	0.010 mg/L				
Lead, total	< 0.00020	0.00020 mg/L				
Lithium, total	< 0.00010	0.00010 mg/L				
Magnesium, total	< 0.010	0.010 mg/L				
Manganese, total	< 0.00020	0.00020 mg/L				
Mercury, total	< 0.000040	0.000040 mg/L				
Molybdenum, total	< 0.00010	0.00010 mg/L				
Nickel, total	< 0.00040	0.00040 mg/L				
Phosphorus, total	< 0.050	0.050 mg/L				
Potassium, total	< 0.10	0.10 mg/L				
Selenium, total	< 0.00050	0.00050 mg/L				
Silicon, total	< 1.0	1.0 mg/L				
Silver, total	< 0.000050	0.000050 mg/L				
Sodium, total	< 0.10	0.10 mg/L				
Strontium, total	< 0.0010	0.0010 mg/L				
Sulfur, total	< 3.0	3.0 mg/L				
Tellurium, total	< 0.00050	0.00050 mg/L				
Thallium, total	< 0.000020	0.000020 mg/L				
Thorium, total	< 0.00010	0.00010 mg/L				
Tin, total	< 0.00020	0.00020 mg/L				
Titanium, total	< 0.0050	0.0050 mg/L				
Tungsten, total	< 0.0010	0.0010 mg/L				
Uranium, total	< 0.000020	0.000020 mg/L				
Vanadium, total	< 0.0010	0.0010 mg/L				
Zinc, total	< 0.0040	0.0040 mg/L				
Zirconium, total	< 0.00010	0.00010 mg/L				
·		0,00010 mg/2	Propared: 202	0-09-29, Analyze	4. 2020 00 30	
LCS (B0l2647-BS1)			•			
Aluminum, total	0.0238	0.0050 mg/L	0.0199	120	80-120	
Antimony, total	0.0215	0.00020 mg/L	0.0200	108	80-120	
Arsenic, total	0.0213	0.00050 mg/L	0.0200	106	80-120	
Barium, total	0.0219	0.0050 mg/L	0.0198	111	80-120	
Beryllium, total	0.0216	0.00010 mg/L	0.0198	109	80-120	
Bismuth, total	0.0219	0.00010 mg/L	0.0200	110	80-120	
Boron, total	< 0.0500	0.0500 mg/L	0.0200	107	80-120	
Cadmium, total	0.0213	0.000010 mg/L	0.0199	107	80-120	
Calcium, total	2.23	0.20 mg/L	2.02	110	80-120	
Chromium, total	0.0216	0.00050 mg/L	0.0198	109	80-120	
Cobalt, total	0.0220	0.00010 mg/L	0.0199	111	80-120	
Copper, total	0.0221	0.00040 mg/L	0.0200	110	80-120	
Iron, total	2.19	0.010 mg/L	2.02	109	80-120	
Lead, total	0.0213	0.00020 mg/L	0.0199	107	80-120	
Lithium, total	0.0214	0.00010 mg/L	0.0200	107	80-120	
Magnesium, total	2.17	0.010 mg/L	2.02	108	80-120	
Manganese, total	0.0225	0.00020 mg/L	0.0199	113	80-120	
Mercury, total	0.00102	0.000040 mg/L	0.00100	102	80-120	
Molybdenum, total	0.0217	0.00010 mg/L	0.0200	108	80-120	
Nickel, total	0.0221	0.00040 mg/L	0.0200	111	80-120	
Phosphorus, total	2.05	0.050 mg/L	2.00	102	80-120	
Potassium, total	2.25	0.10 mg/L	2.02	111	80-120	
Selenium, total	0.0207	0.00050 mg/L	0.0200	104	80-120	
Silicon, total	2.1	1.0 mg/L	2.00	104	80-120	
Silver, total	0.0214	0.000050 mg/L	0.0200	107	80-120	
Sodium, total	2.11	0.10 mg/L	2.02	104	80-120	
						Deero 00 of



REPORTED TO PROJECT	Elk River Alliance ERA-CBWM			Spiles		WORK ORDER REPORTED		2020-10-05 17		17:04
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batc	h B0l2647, Continued									
LCS (B012647-BS	1), Continued			Prepared	: 2020-09-2	9, Analyze	d: 2020-0	9-30		
Strontium, total		0.0215	0.0010 mg/L	0.0200		108	80-120			
Sulfur, total		5.0	3.0 mg/L	5.00		100	80-120			
Tellurium, total		0.0203	0.00050 mg/L	0.0200		101	80-120			
Thallium, total		0.0215	0.000020 mg/L	0.0199		108	80-120			
Thorium, total		0.0208	0.00010 mg/L	0.0200		104	80-120			
Tin, total		0.0221	0.00020 mg/L	0.0200		110	80-120			
Titanium, total		0.0239	0.0050 mg/L	0.0200		120	80-120			
Tungsten, total		0.0221	0.0010 mg/L	0.0200		110	80-120			
Uranium, total		0.0210	0.000020 mg/L	0.0200		105	80-120			
Vanadium, total		0.0215	0.0010 mg/L	0.0200		108	80-120			
Zinc, total		0.0220	0.0040 mg/L	0.0200		110	80-120			
Zirconium, total		0.0219	0.00010 mg/L	0.0200		109	80-120			
Reference (B0I264	47-SRM1)			Prepared	1: 2020-09-2	9, Analyze	d: 2020-0	9-30		
Aluminum, total		0.320	0.0050 mg/L	0.299		107	70-130			
Antimony, total		0.0523	0.00020 mg/L	0.0517		101	70-130			
Arsenic, total		0.129	0.00050 mg/L	0.119		108	70-130			
Barium, total		0.855	0.0050 mg/L	0.801		107	70-130			
Beryllium, total		0.0559	0.00010 mg/L	0.0501		112	70-130			
Boron, total		4.22	0.0500 mg/L	4.11		103	70-130			
Cadmium, total		0.0529	0.000010 mg/L	0.0503		105	70-130			
Calcium, total		10.7	0.20 mg/L	10.7		100	70-130			
Chromium, total		0.267	0.00050 mg/L	0.250		107	70-130			
Cobalt, total		0.0420	0.00010 mg/L	0.0384		109	70-130			
Copper, total		0.521	0.00040 mg/L	0.487		107	70-130			
Iron, total		0.544	0.010 mg/L	0.504		108	70-130			
Lead, total		0.300	0.00020 mg/L	0.278		108	70-130			
Lithium, total		0.443	0.00010 mg/L	0.398		111	70-130			
Magnesium, total		4.01	0.010 mg/L	3.59		112	70-130			
Manganese, total		0.123	0.00020 mg/L	0.111		111	70-130			
Mercury, total		0.00578	0.000040 mg/L	0.00581		100	70-130			
Molybdenum, total		0.211	0.00010 mg/L	0.196		108	70-130			
Nickel, total		0.267	0.00040 mg/L	0.248		108	70-130			
Phosphorus, total		0.259	0.050 mg/L	0.213		122	70-130			
Potassium, total		6.75	0.10 mg/L	5.89		115	70-130			
Selenium, total		0.131	0.00050 mg/L	0.120		109	70-130			
Sodium, total		9.47	0.10 mg/L	8.71		109	70-130			
Strontium, total		0.424	0.0010 mg/L	0.393		108	70-130			
Thallium, total		0.0863	0.000020 mg/L	0.0787		110	70-130			
Uranium, total		0.0363	0.000020 mg/L	0.0344		106	70-130			
Vanadium, total		0.412	0.0010 mg/L	0.391		105	70-130			
Zinc, total		2.71	0.0040 mg/L	2.50		108	70-130			

### QC Qualifiers:

RPD Relative percent difference (RPD) of duplicate analysis are outside of control limits for unknown reason(s).



# **CERTIFICATE OF ANALYSIS**

REPORTED TO	Elk River Alliance PO Box 537 - 891 2nd Ave Ferniecha, BC V0B1M0		
ATTENTION	Beth Millions	WORK ORDER	0092807
PO NUMBER PROJECT PROJECT INFO	ERA-CBWM [info]	RECEIVED / TEMP REPORTED COC NUMBER	2020-09-25 09:30 / 11°C 2020-10-05 11:55 B90461

### Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

We've Got Chemistry

### Big Picture Sidekicks



You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

It's simple. We figure the more you working enjoy with our fun and engaged team the more members; likely you are to give us continued opportunities to support you.

Ahead of the Curve



research, Through regulation knowledge, and instrumentation, we are your analytical centre for the knowledge you technical need, BEFORE you need it, so you can stay up to date and in the know.

If you have any questions or concerns, please contact me at teamcaro@caro.ca

### Authorized By:

Team CARO **Client Service Representative** 

### 1-888-311-8846 | www.caro.ca

#110 4011 Viking Way Richmond, BC V6V 2K9 | #102 3677 Highway 97N Kelowna, BC V1X 5C3 | 17225 109 Avenue Edmonton, AB T5S 1H7



REPORTED TO PROJECT	Elk River Alliance ERA-CBWM				WORK ORDER REPORTED	0092807 2020-10-0	05 11:55
Analyte		Result	Guideline	RL	Units	Analyzed	Qualifier
MOR02_200922_	0930 (0092807-01)   Matı	rix: Water   Sampl	ed: 2020-09-22 09:	30			
Anions							
Nitrate (as N)		< 0.010	MAC = 10	0.010	mg/L	2020-09-27	HT1
Nitrite (as N)		< 0.010	MAC = 1	0.010	-	2020-09-27	HT1
Phosphate (as P)		< 0.0050	N/A	0.0050	mg/L	2020-09-27	HT1
Calculated Parame	eters						
Hardness, Total (a	as CaCO3)	64.4	None Required	0.500	mg/L	N/A	
Nitrate+Nitrite (as	N)	< 0.0100	N/A	0.0100	mg/L	N/A	
Nitrogen, Total		< 0.0500	N/A	0.0500	mg/L	N/A	
Dissolved Metals							
Lithium, dissolved		0.00197	N/A	0.00010	mg/L	2020-10-01	
Aluminum, dissolv	ved	0.0084	N/A	0.0050	mg/L	2020-10-01	
Antimony, dissolve	ed	< 0.00020	N/A	0.00020	mg/L	2020-10-01	
Arsenic, dissolved	1	< 0.00050	N/A	0.00050	mg/L	2020-10-01	
Barium, dissolved		0.192	N/A	0.0050	mg/L	2020-10-01	
Beryllium, dissolve	ed	< 0.00010	N/A	0.00010	mg/L	2020-10-01	
Bismuth, dissolve	d	< 0.00010	N/A	0.00010	mg/L	2020-10-01	
Boron, dissolved		< 0.0500	N/A	0.0500	mg/L	2020-10-01	
Cadmium, dissolv	ed	0.000024	N/A	0.000010	mg/L	2020-10-01	
Calcium, dissolve	d	19.0	N/A	0.20	mg/L	2020-10-01	
Chromium, dissolv	ved	< 0.00050	N/A	0.00050	mg/L	2020-10-01	
Cobalt, dissolved		< 0.00010	N/A	0.00010	mg/L	2020-10-01	
Copper, dissolved		< 0.00040	N/A	0.00040	mg/L	2020-10-01	
Iron, dissolved		< 0.010	N/A	0.010	mg/L	2020-10-01	
Lead, dissolved		< 0.00020	N/A	0.00020	mg/L	2020-10-01	
Magnesium, disso	blved	4.10	N/A	0.010	mg/L	2020-10-01	
Manganese, disso	blved	0.00113	N/A	0.00020	mg/L	2020-10-01	
Mercury, dissolved	d	< 0.000040	N/A	0.000040	mg/L	2020-10-01	
Molybdenum, diss	solved	0.00059	N/A	0.00010	-	2020-10-01	
Nickel, dissolved		< 0.00040	N/A	0.00040	mg/L	2020-10-01	
Phosphorus, disso	olved	< 0.050	N/A	0.050	mg/L	2020-10-01	
Potassium, dissol	ved	0.44	N/A	0.10	mg/L	2020-10-01	
Selenium, dissolv	ed	< 0.00050	N/A	0.00050	mg/L	2020-10-01	
Silicon, dissolved		< 1.0	N/A	1.0	mg/L	2020-10-01	
Silver, dissolved		< 0.000050	N/A	0.000050		2020-10-01	
Sodium, dissolved	1	1.42	N/A		mg/L	2020-10-01	
Strontium, dissolv	ed	0.114	N/A	0.0010		2020-10-01	
Sulfur, dissolved		< 3.0	N/A		mg/L	2020-10-01	
Tellurium, dissolve		< 0.00050	N/A	0.00050	-	2020-10-01	
Thallium, dissolve		< 0.000020	N/A	0.000020	-	2020-10-01	
Thorium, dissolve	d	< 0.00010	N/A	0.00010		2020-10-01	
Tin, dissolved		< 0.00020	N/A	0.00020		2020-10-01	
Titanium, dissolve		< 0.0050	N/A	0.0050		2020-10-01	
Tungsten, dissolve	ed	< 0.0010	N/A	0.0010	mg/L	2020-10-01	Page 2 of

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<b>REPORTED TO</b> Elk River Alliance <b>PROJECT</b> ERA-CBWM				WORK ORDER REPORTED	0092807 2020-10-0	05 11:55
Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
	atrix: Water   Sampl	ed: 2020-09-22 09:	30, Continue	d		
Dissolved Metals, Continued						
Uranium, dissolved	0.000183	N/A	0.000020	mg/L	2020-10-01	
Vanadium, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-01	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2020-10-01	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-01	
General Parameters						
Alkalinity, Total (as CaCO3)	66.7	N/A	1.0	mg/L	2020-09-30	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2020-09-30	
Alkalinity, Bicarbonate (as CaCO3)	66.7	N/A	1.0	mg/L	2020-09-30	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2020-09-30	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2020-09-30	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2020-09-29	
BOD, 5-day	< 6.0	N/A	2.0	mg/L	2020-10-01	HT1
Chemical Oxygen Demand	< 20	N/A	20	mg/L	2020-10-01	
Nitrogen, Total Kjeldahl	< 0.050	N/A	0.050	mg/L	2020-10-01	
Phosphorus, Total (as P)	< 0.0050	N/A	0.0050	mg/L	2020-10-01	
Solids, Total Suspended	< 2.0	N/A	2.0	mg/L	2020-09-28	
Total Metals						
Aluminum, total	0.0108	OG < 0.1	0.0050	mg/L	2020-10-03	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2020-10-03	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2020-10-03	
Barium, total	0.207	MAC = 2	0.0050	mg/L	2020-10-03	
Beryllium, total	< 0.00010	N/A	0.00010	mg/L	2020-10-03	
Bismuth, total	< 0.00010	N/A	0.00010	mg/L	2020-10-03	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2020-10-03	
Cadmium, total	0.000038	MAC = 0.005	0.000010	mg/L	2020-10-03	
Calcium, total	20.3	None Required	0.20	mg/L	2020-10-03	
Chromium, total	< 0.00050	MAC = 0.05	0.00050	-	2020-10-03	
Cobalt, total	< 0.00010	N/A	0.00010	-	2020-10-03	
Copper, total	0.00556	MAC = 2	0.00040	-	2020-10-03	
Iron, total	0.012	AO ≤ 0.3	0.010	-	2020-10-03	
Lead, total	< 0.00020	MAC = 0.005	0.00020		2020-10-03	
Lithium, total	0.00229	N/A	0.00010	-	2020-10-03	
Magnesium, total	4.31	None Required		mg/L	2020-10-03	
Manganese, total	0.00190	MAC = 0.12	0.00020		2020-10-03	
Mercury, total	< 0.000040	MAC = 0.001	0.000040	-	2020-10-03	
Molybdenum, total	0.00059	N/A	0.00010		2020-10-03	
Nickel, total	0.00127	N/A	0.00040	-	2020-10-03	
Phosphorus, total	< 0.050	N/A	0.050	-	2020-10-03	
Potassium, total	0.46	N/A		mg/L	2020-10-03	
Selenium, total	< 0.00050	MAC = 0.05	0.00050	-	2020-10-03	
Silicon, total	< 1.0	N/A		mg/L	2020-10-03	
Silver, total	< 0.000050	None Required	0.000050	-	2020-10-03	

Caring About Results, Obviously.

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REPORTED TO ROJECT	Elk River Alliance ERA-CBWM				WORK ORDER REPORTED	0092807 2020-10-0	5 11:55	
Analyte		Result	Guideline	RL	Units	Analyzed	Qualifi	
IOR02_200922_	0930 (0092807-01)   Ma	trix: Water   Sample	ed: 2020-09-22 09:	30, Continue	d			
otal Metals, Conti	nued	4.45	10 < 200	0.40		2020 40 02		
Sodium, total		1.45	AO ≤ 200		mg/L	2020-10-03		
Strontium, total		0.117	7	0.0010		2020-10-03		
Sulfur, total		3.1	N/A		mg/L	2020-10-03		
Tellurium, total		< 0.00050	N/A	0.00050	mg/L	2020-10-03		
Thallium, total		< 0.000020	N/A	0.000020	mg/L	2020-10-03		
Thorium, total		< 0.00010	N/A	0.00010	mg/L	2020-10-03		
Tin, total		< 0.00020	N/A	0.00020	mg/L	2020-10-03		
Titanium, total		< 0.0050	N/A	0.0050	mg/L	2020-10-03		
Tungsten, total		< 0.0010	N/A	0.0010	mg/L	2020-10-03		
Uranium, total		0.000203	MAC = 0.02	0.000020	mg/L	2020-10-03		
			N/A	0.0010		2020-10-03		
Vanadium, total		< 0.0010	IN/A	0.0010				
Vanadium, total Zinc, total		< 0.0010	AO ≤ 5	0.0040	-	2020-10-03		

### MOR01\_200922\_0930 (0092807-02) | Matrix: Water | Sampled: 2020-09-22 09:30

Anions						
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2020-09-27	HT1
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2020-09-27	HT
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-09-27	HT
Calculated Parameters						
Hardness, Total (as CaCO3)	136	None Required	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	< 0.0500	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Lithium, dissolved	0.00372	N/A	0.00010	mg/L	2020-10-01	
Aluminum, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-01	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-01	
Arsenic, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-01	
Barium, dissolved	0.151	N/A	0.0050	mg/L	2020-10-01	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-01	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-01	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2020-10-01	
Cadmium, dissolved	0.000014	N/A	0.000010	mg/L	2020-10-01	
Calcium, dissolved	39.6	N/A	0.20	mg/L	2020-10-01	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-01	
Cobalt, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-01	
Copper, dissolved	< 0.00040	N/A	0.00040	mg/L	2020-10-01	
Iron, dissolved	< 0.010	N/A	0.010	mg/L	2020-10-01	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-01	
Magnesium, dissolved	8.95	N/A	0.010	mg/L	2020-10-01	



<b>REPORTED TO</b> Elk River Alliance <b>PROJECT</b> ERA-CBWM				WORK ORDER REPORTED	0092807 2020-10-0	)5 11:55
Analyte	Result	Guideline	RL	Units	Analyzed	Qualifie
MOR01_200922_0930 (0092807-02)   M	atrix: Water   Sampl	ed: 2020-09-22 09::	30, Continue	d		
Dissolved Metals, Continued						
Manganese, dissolved	0.00244	N/A	0.00020	mg/L	2020-10-01	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2020-10-01	
Molybdenum, dissolved	0.00067	N/A	0.00010	mg/L	2020-10-01	
Nickel, dissolved	< 0.00040	N/A	0.00040	mg/L	2020-10-01	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2020-10-01	
Potassium, dissolved	0.50	N/A	0.10	mg/L	2020-10-01	
Selenium, dissolved	< 0.00050	N/A	0.00050	-	2020-10-01	
Silicon, dissolved	2.1	N/A		mg/L	2020-10-01	
Silver, dissolved	< 0.000050	N/A	0.000050	-	2020-10-01	
Sodium, dissolved	2.11	N/A		mg/L	2020-10-01	
Strontium, dissolved	0.148	N/A	0.0010	-	2020-10-01	
Sulfur, dissolved	6.9	N/A		mg/L	2020-10-01	
Tellurium, dissolved	< 0.00050	N/A	0.00050		2020-10-01	
Thallium, dissolved	< 0.000020	N/A	0.000020		2020-10-01	
Thorium, dissolved	< 0.00010	N/A	0.00010	0	2020-10-01	
Tin, dissolved	< 0.00020	N/A	0.00020	0	2020-10-01	
Titanium, dissolved	< 0.0050	N/A	0.0050	0	2020-10-01	
Tungsten, dissolved	< 0.0010	N/A	0.0010	-	2020-10-01	
Uranium, dissolved	0.000319	N/A	0.000020	•	2020-10-01	
Vanadium, dissolved	< 0.0010	N/A	0.0010	-	2020-10-01	
Zinc, dissolved	< 0.0040	N/A	0.0040	-	2020-10-01	
Zirconium, dissolved	< 0.00010	N/A	0.00010	-	2020-10-01	
General Parameters			0.00010		2020 10 01	
		N1/A	1.0		2020 00 20	
Alkalinity, Total (as CaCO3)	141	N/A		mg/L	2020-09-30	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A		mg/L	2020-09-30	
Alkalinity, Bicarbonate (as CaCO3)	141	N/A		mg/L	2020-09-30	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A		mg/L	2020-09-30	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A		mg/L	2020-09-30	
Ammonia, Total (as N)	< 0.050	None Required	0.050		2020-09-29	
BOD, 5-day	< 6.0	N/A		mg/L	2020-10-01	HT1
Chemical Oxygen Demand	< 20	N/A		mg/L	2020-10-01	
Nitrogen, Total Kjeldahl	< 0.050	N/A	0.050		2020-10-01	
Phosphorus, Total (as P)	0.0104	N/A	0.0050		2020-10-01	
Solids, Total Suspended	< 2.0	N/A	2.0	mg/L	2020-09-28	
Fotal Metals						
Aluminum, total	0.0128	OG < 0.1	0.0050	-	2020-10-03	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	-	2020-10-03	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	-	2020-10-03	
Barium, total	0.163	MAC = 2	0.0050	mg/L	2020-10-03	
Beryllium, total	< 0.00010	N/A	0.00010	mg/L	2020-10-03	
Bismuth, total	< 0.00010	N/A	0.00010	-	2020-10-03	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2020-10-03	Page 5 o



ROJECTERA-CBWMResultGuidelineREPORTED2020-10-0511.55AnalyteResultGuidelineR.InitsAnalyzedQualiIOR01_200922_0930 (0092807-02)   Matrix: Water   Sampled: 2020-09-22 09:30, ContinueContinueData Metals, Continued0.00003MAC = 0.050.00001mg/L2020-10-03Cadimium, total0.00003MAC = 0.050.00005mg/L2020-10-03Cobent, total<0.00010N/A0.00010mg/L2020-10-03Cobent, total<0.00011MAC = 20.00040mg/L2020-10-03Cobent, total<0.00021MAC = 0.050.00020mg/L2020-10-03Cobent, total<0.00021MAC = 0.010mg/L2020-10-03Lead, total<0.00021MAC = 0.0100.0010mg/L2020-10-03Magnesim, total<0.00021N/A0.00010mg/L2020-10-03Margenesim, total<0.00037MAC = 0.0210.00020mg/L2020-10-03Margenesim, total<0.00010N/A0.00010mg/L2020-10-03Nickei, total<0.00050N/A0.00010mg/L2020-10-03Nickei, total<0.00050N/A0.00010mg/L2020-10-03Nickei, total<0.00050N/A0.00050mg/L2020-10-03Nickei, total<0.00050N/A0.00050									
IDROP         1000000000000000000000000000000000000	REPORTED TO PROJECT							5 11:55	
otal Metals, Continued           Cadmium, total         0.000033         MAC = 0.005         0.000010         mg/L         2020-10-03           Calcium, total         41.2         None Required         0.20         mg/L         2020-10-03           Chromium, total         < 0.00050         MAC = 0.05         0.00050         mg/L         2020-10-03           Cobalt, total         < 0.00074         MAC = 2         0.00040         mg/L         2020-10-03           Iron, total          0.0013         AO ≤ 0.3         0.010         mg/L         2020-10-03           Iron, total          0.0020         MAC = 0.005         0.00020         mg/L         2020-10-03           Ithium, total          0.00421         N/A         0.00010         mg/L         2020-10-03           Magnesium, total          9.04         None Required         0.010         mg/L         2020-10-03           Magnesium, total           0.00020         mg/L         2020-10-03           Magnesium, total           0.00010         MAC = 0.12         0.00020         mg/L         2020-10-03           Nickel, total            0.00010 <th>Analyte</th> <th></th> <th>Result</th> <th>Guideline</th> <th>RL</th> <th>Units</th> <th>Analyzed</th> <th>Qualifie</th>	Analyte		Result	Guideline	RL	Units	Analyzed	Qualifie	
Cadmium, total         0.000033         MAC = 0.005         0.00010         mg/L         2020-10-03           Calcium, total         41.2         None Required         0.20         mg/L         2020-10-03           Chromium, total         < 0.00050	/IOR01_200922_	0930 (0092807-02)   Mat	rix: Water   Sampl	ed: 2020-09-22 09:3	30, Continue	d			
Calcium, total         41.2         None Required         0.20         mg/L         2020-10-03           Chromium, total         < 0.00050	otal Metals, Conti	inued							
Chromium, total         < 0.00050         MAC = 0.05         0.00050         mg/L         2020-10-03           Cobalt, total         < 0.00074	Cadmium, total		0.000033	MAC = 0.005	0.000010	mg/L	2020-10-03		
Cobalt, total         < 0.00010         N/A         0.00010         mg/L         2020-10-03           Copper, total         0.013         AO ≤ 0.3         0.010         mg/L         2020-10-03           Iron, total         0.013         AO ≤ 0.3         0.010         mg/L         2020-10-03           Lead, total         0.00020         MAC = 0.005         0.00020         mg/L         2020-10-03           Magnesium, total         0.00421         N/A         0.00010         mg/L         2020-10-03           Margnese, total         0.00337         MAC = 0.12         0.00020         mg/L         2020-10-03           Mercury, total         0.00065         N/A         0.00010         mg/L         2020-10-03           Molybdenum, total         0.00065         N/A         0.00010         mg/L         2020-10-03           Nickel, total         < 0.00040	Calcium, total		41.2	None Required	0.20	mg/L	2020-10-03		
Copper, total $0.00074$ MAC = 2 $0.0040$ $mg/L$ $2020-10-03$ Iron, total $0.013$ AC $\leq 0.3$ $0.010$ $mg/L$ $2020-10-03$ Lead, total $<0.00020$ MAC = $0.005$ $0.0020$ $mg/L$ $2020-10-03$ Lithium, total $0.00421$ N/A $0.00010$ $mg/L$ $2020-10-03$ Magnesium, total $9.04$ None Required $0.010$ $mg/L$ $2020-10-03$ Marganese, total $0.00367$ MAC = $0.12$ $0.00020$ $mg/L$ $2020-10-03$ Mercury, total $<0.00065$ N/A $0.00010$ $mg/L$ $2020-10-03$ Moldenum, total $0.00065$ N/A $0.00010$ $mg/L$ $2020-10-03$ Nickel, total $<0.00000$ N/A $0.00010$ $mg/L$ $2020-10-03$ Posphorus, total $<0.00050$ N/A $0.050$ $mg/L$ $2020-10-03$ Selenium, total $<0.00050$ MAC = $0.05$ $0.00050$ $mg/L$ $2020-10-03$ Silicon, total $2.3$ N/A $0.10$ $mg/L$ $2020-10-03$ Silicon, total $2.08$ AO $\leq 200$ $0.10$ $mg/L$ $2020-10-03$ Silicr, total $0.151$ 7 $0.0010$ $mg/L$ $2020-10-03$ Sufur, total $0.0050$ N/A $3.0$ $mg/L$ $2020-10-03$ Sufur, total $0.0050$ N/A $3.0$ $mg/L$ $2020-10-03$ Sufur, total $0.0050$ N/A $0.00050$ $mg/L$ $2020-10-03$ Thalium, total $<0.00050$ N/A	Chromium, total		< 0.00050	MAC = 0.05	0.00050	mg/L	2020-10-03		
Inn, total         0.013 $AO \le 0.3$ 0.010         mg/L         2020-10-03           Lead, total         < 0.00020	Cobalt, total		< 0.00010	N/A	0.00010	mg/L	2020-10-03		
Lead, total< 0.00020MAC = 0.0050.00020mg/L2020-10-03Lithium, total0.00421N/A0.0010mg/L2020-10-03Magnesium, total9.04None Required0.010mg/L2020-10-03Manganese, total0.00387MAC = 0.120.00020mg/L2020-10-03Mercury, total< 0.000010	Copper, total		0.00074	MAC = 2	0.00040	mg/L	2020-10-03		
Lithium, total0.00421N/A0.0010mg/L2020-10-03Magnesium, total9.04None Required0.010mg/L2020-10-03Manganese, total0.00387MAC = 0.120.00020mg/L2020-10-03Mercury, total<0.00065	Iron, total		0.013	AO ≤ 0.3	0.010	mg/L	2020-10-03		
Magnesium, total9.04None Required0.010mg/L2020-10-03Manganese, total0.00387MAC = 0.120.00020mg/L2020-10-03Mercury, total< 0.000010	Lead, total		< 0.00020	MAC = 0.005	0.00020	mg/L	2020-10-03		
Marganese, total $0.00387$ MAC = $0.12$ $0.00020$ $mg/L$ $2020-10-03$ Mercury, total $< 0.00010$ MAC = $0.001$ $0.000010$ $mg/L$ $2020-10-03$ Molybdenum, total $0.00065$ N/A $0.00040$ $mg/L$ $2020-10-03$ Nickel, total $< 0.00040$ N/A $0.00040$ $mg/L$ $2020-10-03$ Phosphorus, total $< 0.050$ N/A $0.000$ $mg/L$ $2020-10-03$ Potassium, total $0.53$ N/A $0.10$ $mg/L$ $2020-10-03$ Selenium, total $< 0.0050$ MAC = $0.05$ $0.00050$ $mg/L$ $2020-10-03$ Silicon, total $2.3$ N/A $1.0$ $mg/L$ $2020-10-03$ Silicon, total $2.3$ N/A $1.0$ $mg/L$ $2020-10-03$ Sodium, total $< 0.00050$ None Required $0.00050$ $mg/L$ $2020-10-03$ Sulfur, total $2.08$ AO $\leq 200$ $0.10$ $mg/L$ $2020-10-03$ Sulfur, total $0.151$ $7$ $0.0010$ $mg/L$ $2020-10-03$ Sulfur, total $5.0$ N/A $3.0$ $mg/L$ $2020-10-03$ Tellurium, total $< 0.00050$ N/A $0.00050$ $mg/L$ $2020-10-03$ Thallium, total $< 0.000020$ N/A $0.00050$ $mg/L$ $2020-10-03$ Tin, total $< 0.000020$ N/A $0.00050$ $mg/L$ $2020-10-03$ Tin, total $< 0.000020$ N/A $0.00000$ $mg/L$ $2020-10-03$ Tin, total $< 0.0010$ <td>Lithium, total</td> <td></td> <td>0.00421</td> <td>N/A</td> <td>0.00010</td> <td>mg/L</td> <td>2020-10-03</td> <td></td>	Lithium, total		0.00421	N/A	0.00010	mg/L	2020-10-03		
Mercury, total< 0.000010MAC = 0.0010.00010 $mg/L$ 2020-10-01Molybdenum, total0.00065N/A0.00010 $mg/L$ 2020-10-03Nickel, total< 0.00040	Magnesium, total		9.04	None Required	0.010	mg/L	2020-10-03		
Molybdenum, total0.00065N/A0.00010mg/L2020-10-03Nickel, total< 0.00040	Manganese, total		0.00387	MAC = 0.12	0.00020	mg/L	2020-10-03		
Nickel, total< 0.00040N/A0.00040mg/L2020-10-03Phosphorus, total< 0.050	Mercury, total		< 0.000010	MAC = 0.001	0.000010	mg/L	2020-10-01		
Phosphorus, total< 0.050N/A0.050mg/L2020-10-03Potassium, total0.53N/A0.10mg/L2020-10-03Selenium, total< 0.00050	Molybdenum, tota	l	0.00065	N/A	0.00010	mg/L	2020-10-03		
Potassium, total0.53N/A0.10mg/L2020-10-03Selenium, total< 0.00050	Nickel, total		< 0.00040	N/A	0.00040	mg/L	2020-10-03		
Selenium, total< 0.00050MAC = 0.050.00050mg/L2020-10-03Silicon, total2.3N/A1.0mg/L2020-10-03Silver, total< 0.00050	Phosphorus, total		< 0.050	N/A	0.050	mg/L	2020-10-03		
Silicon, total2.3N/A1.0mg/L2020-10-03Silver, total< 0.00050	Potassium, total		0.53	N/A	0.10	mg/L	2020-10-03		
Silver, total< 0.000050None Required0.000050mg/L2020-10-03Sodium, total2.08AO $\leq$ 2000.10mg/L2020-10-03Strontium, total0.15170.0010mg/L2020-10-03Sulfur, total5.0N/A3.0mg/L2020-10-03Tellurium, total< 0.00050	Selenium, total		< 0.00050	MAC = 0.05	0.00050	mg/L	2020-10-03		
Sodium, total2.08 $AO \le 200$ 0.10 $mg/L$ 2020-10-03Strontium, total0.15170.0010 $mg/L$ 2020-10-03Sulfur, total5.0N/A3.0 $mg/L$ 2020-10-03Tellurium, total< 0.00050	Silicon, total		2.3	N/A	1.0	mg/L	2020-10-03		
Strontium, total $0.151$ 7 $0.0010$ mg/L $2020-10-03$ Sulfur, total $5.0$ N/A $3.0$ mg/L $2020-10-03$ Tellurium, total $< 0.00050$ N/A $0.00050$ mg/L $2020-10-03$ Thallium, total $< 0.00020$ N/A $0.00020$ mg/L $2020-10-03$ Thorium, total $< 0.00010$ N/A $0.00010$ mg/L $2020-10-03$ Thorium, total $< 0.00010$ N/A $0.00020$ mg/L $2020-10-03$ Tin, total $< 0.00020$ N/A $0.00020$ mg/L $2020-10-03$ Titanium, total $< 0.0050$ N/A $0.00020$ mg/L $2020-10-03$ Tungsten, total $< 0.0010$ N/A $0.0010$ mg/L $2020-10-03$ Uranium, total $0.000334$ MAC = $0.02$ $0.00020$ mg/L $2020-10-03$ Vanadium, total $< 0.0010$ N/A $0.0010$ mg/L $2020-10-03$ Zinc, total $< 0.0040$ AO $\leq 5$ $0.0040$ mg/L $2020-10-03$	Silver, total		< 0.000050	None Required	0.000050	mg/L	2020-10-03		
Sulfur, total5.0N/A3.0mg/L2020-10-03Tellurium, total< 0.00050	Sodium, total		2.08	AO ≤ 200	0.10	mg/L	2020-10-03		
Tellurium, total< 0.00050N/A0.00050mg/L2020-10-03Thallium, total< 0.00020	Strontium, total		0.151	7	0.0010	mg/L	2020-10-03		
Thallium, total< 0.000020N/A0.000020mg/L2020-10-03Thorium, total< 0.00010	Sulfur, total		5.0	N/A	3.0	mg/L	2020-10-03		
Thorium, total< 0.00010N/A0.00010mg/L2020-10-03Tin, total< 0.00020	Tellurium, total		< 0.00050	N/A	0.00050	mg/L	2020-10-03		
Tin, total< 0.00020N/A0.00020mg/L2020-10-03Titanium, total< 0.0050	Thallium, total		< 0.000020	N/A	0.000020	mg/L	2020-10-03		
Titanium, total         < 0.0050         N/A         0.0050         mg/L         2020-10-03           Tungsten, total         < 0.0010	Thorium, total		< 0.00010	N/A	0.00010	mg/L	2020-10-03		
Tungsten, total         < 0.0010         N/A         0.0010         mg/L         2020-10-03           Uranium, total         0.000334         MAC = 0.02         0.000020         mg/L         2020-10-03           Vanadium, total         < 0.0010	Tin, total		< 0.00020	N/A	0.00020	mg/L	2020-10-03		
Uranium, total         0.000334         MAC = 0.02         0.000020         mg/L         2020-10-03           Vanadium, total         < 0.0010	Titanium, total		< 0.0050	N/A	0.0050	mg/L	2020-10-03		
Vanadium, total         < 0.0010         N/A         0.0010         mg/L         2020-10-03           Zinc, total         < 0.0040	Tungsten, total		< 0.0010	N/A	0.0010	mg/L	2020-10-03		
Vanadium, total         < 0.0010         N/A         0.0010         mg/L         2020-10-03           Zinc, total         < 0.0040	Uranium, total		0.000334	MAC = 0.02	0.000020	mg/L	2020-10-03		
Zinc, total < 0.0040 AO ≤ 5 0.0040 mg/L 2020-10-03	Vanadium, total		< 0.0010	N/A			2020-10-03		
Zirconium, total < 0.00010 N/A 0.00010 mg/L 2020-10-03	Zinc, total		< 0.0040	AO ≤ 5		-	2020-10-03		
	Zirconium, total		< 0.00010	N/A	0.00010	mg/L	2020-10-03		

### Sample Qualifiers:

HT1 The sample was prepared and/or analyzed past the recommended holding time.



# **APPENDIX 1: SUPPORTING INFORMATION**

REPORTED TO PROJECT	Elk River Allia ERA-CBWM	ance	WORK ORDER REPORTED	0092807 2020-10-0	5 11:55	
Analysis Descrip	otion	Method Ref.	Technique A	ccredited	Location	
Alkalinity in Water		SM 2320 B* (2017)	Titration with H2SO4	$\checkmark$	Kelowna	
Ammonia, Total in \	Water	SM 4500-NH3 G* (2017)	Automated Colorimetry (Phenate)	✓	Kelowna	
Anions in Water		SM 4110 B (2017)	Ion Chromatography	$\checkmark$	Kelowna	
Biochemical Oxyge Water	en Demand in	SM 5210 B (2017)	Dissolved Oxygen Meter	√	Kelowna	
Chemical Oxygen I Water	Demand in	SM 5220 D* (2017)	Closed Reflux, Colorimetry	✓	Kelowna	
Dissolved Metals in	n Water	EPA 200.8 / EPA 6020B	0.45 µm Filtration / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	√	Richmond	
Hardness in Water		SM 2340 B (2017)	Calculation: 2.497 [diss Ca] + 4.118 [diss Mg]	✓	N/A	
Mercury, dissolved	in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	√	Richmond	
Mercury, total in Wa	ater	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	✓	Richmond	
Nitrogen, Total Kjel	dahl in Water	SM 4500-Norg D* (2017)	Block Digestion and Flow Injection Analysis	✓	Kelowna	
Phosphorus, Total i	n Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Ad	cid) ✓	Kelowna	
Solids, Total Suspe Water	nded in	SM 2540 D* (2017)	Gravimetry (Dried at 103-105C)	✓	Kelowna	
Total Metals in Wat	er	EPA 200.2 / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond	

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

### **Glossary of Terms:**

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
AO	Aesthetic Objective
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
OG	Operational Guideline (treated water)
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

### **Guidelines Referenced in this Report:**

Guidelines for Canadian Drinking Water Quality (Health Canada, June 2019)

Note: In some cases, the values displayed on the report represent the lowest guideline and are to be verified by the end user



# **APPENDIX 1: SUPPORTING INFORMATION**

REPORTED TO	Elk River Alliance
PROJECT	ERA-CBWM

WORK ORDER REPORTED 0092807 2020-10-05 11:55

### General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing.

Results in **Bold** indicate values that are above CARO's method reporting limits. Any results that are above regulatory limits are highlighted **red**. Please note that results will only be highlighted red if the regulatory limits are included on the CARO report. Any Bold and/or highlighted results do <u>not</u> take into account method uncertainty. If you would like method uncertainty or regulatory limits to be included on your report, please contact your Account Manager:teamcaro@caro.ca

Please note any regulatory guidelines applied to this report are added as a convenience to the client, at their request, to help provide some initial context to analytical results obtained. Although CARO makes every effort to ensure accuracy of the associated regulatory guideline(s) applied, the guidelines applied cannot be assumed to be correct due to a variety of factors and as such CARO Analytical Services assumes no liability or responsibility for the use of those guidelines to make any decisions. The original source of the regulation should be verified and a review of the guideline (s) should be validated as correct in order to make any decisions arising from the comparison of the analytical data obtained to the relevant regulatory guideline for one's particular circumstances. Further, CARO Analytical Services assumes no liability or responsibility for any loss attributed from the use of these guidelines in any way.



REPORTED TO	Elk River Alliance	WORK ORDER	0092807
PROJECT	ERA-CBWM	REPORTED	2020-10-05 11:55

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- Method Blank (Blk): A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- Duplicate (Dup): An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- Blank Spike (BS): A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- Matrix Spike (MS): A second aliquot of sample is fortified with with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B0l2386									
Blank (B0I2386-BLK1)			Prepared	d: 2020-09-2	27, Analyz	ed: 2020-	09-27		
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
Phosphate (as P)	< 0.0050	0.0050 mg/L							
Blank (B0I2386-BLK2)			Prepared	d: 2020-09-2	28, Analyz	ed: 2020-	09-28		
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
Phosphate (as P)	< 0.0050	0.0050 mg/L							
LCS (B0I2386-BS1)			Prepared	d: 2020-09-2	27, Analyz	ed: 2020-	09-27		
Nitrate (as N)	4.01	0.010 mg/L	4.00		100	90-110			
Nitrite (as N)	2.00	0.010 mg/L	2.00		100	85-115			
Phosphate (as P)	1.01	0.0050 mg/L	1.00		101	80-120			
LCS (B0I2386-BS2)			Prepared	d: 2020-09-2	28, Analyz	ed: 2020-	09-28		
Nitrate (as N)	4.04	0.010 mg/L	4.00		101	90-110			
Nitrite (as N)	2.00	0.010 mg/L	2.00		100	85-115			
Phosphate (as P)	1.00	0.0050 mg/L	1.00		100	80-120			
Duplicate (B0I2386-DUP2)	Sc	ource: 0092807-02	Prepared	d: 2020-09-2	28, Analyz	ed: 2020-	09-28		
Nitrate (as N)	< 0.010	0.010 mg/L		< 0.010				10	
Nitrite (as N)	< 0.010	0.010 mg/L		< 0.010				15	
Phosphate (as P)	< 0.0050	0.0050 mg/L		< 0.0050				20	
Matrix Spike (B0I2386-MS2)	Sc	ource: 0092807-02	Prepared	d: 2020-09-2	28, Analyz	ed: 2020-	09-28		
Nitrate (as N)	3.93	0.010 mg/L	4.00	< 0.010	98	75-125			
Nitrite (as N)	1.96	0.010 mg/L	2.00	< 0.010	98	80-120			
Phosphate (as P)	0.831	0.0050 mg/L	1.00	< 0.0050	83	70-130			
Dissolved Metals, Batch B0l2734									
Blank (B0I2734-BLK1)			Prepared	d: 2020-09-3	30, Analyz	ed: 2020-	10-01		
Mercury, dissolved	< 0.000010	0.000010 mg/L							

Mercury, dissolved	< 0.000010	0.000010 mg/L				
Reference (B0I2734-SRM1)			Prepared: 2020	)-09-30, Analyze	ed: 2020-10-01	
Mercury, dissolved	0.00694	0.000010 mg/L	0.00581	119	70-130	



REPORTED TO PROJECT	Elk River Alliance ERA-CBWM					WORK REPOR			2807 )-10-05	11:55
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier

### Dissolved Metals, Batch B0J0127

Bismuth, dissolved

Cadmium, dissolved

Chromium, dissolved

Magnesium, dissolved

Calcium, dissolved

Cobalt, dissolved

Copper, dissolved

Iron, dissolved

Lead, dissolved

Boron, dissolved

Blank (B0J0127-BLK1)			Prepared: 2020-10-01, A	anaryz	Eu. 2020-10-01
Lithium, dissolved	< 0.00010	0.00010 mg/L			
Aluminum, dissolved	< 0.0050	0.0050 mg/L			
Antimony, dissolved	< 0.00020	0.00020 mg/L			
Arsenic, dissolved	< 0.00050	0.00050 mg/L			
Barium, dissolved	< 0.0050	0.0050 mg/L			
Beryllium, dissolved	< 0.00010	0.00010 mg/L			
Bismuth, dissolved	< 0.00010	0.00010 mg/L			
Boron, dissolved	< 0.0500	0.0500 mg/L			
Cadmium, dissolved	< 0.000010	0.000010 mg/L			
Calcium, dissolved	< 0.20	0.20 mg/L			
Chromium, dissolved	< 0.00050	0.00050 mg/L			
Cobalt, dissolved	< 0.00010	0.00010 mg/L			
Copper, dissolved	< 0.00040	0.00040 mg/L			
Iron, dissolved	< 0.010	0.010 mg/L			
Lead, dissolved	< 0.00020	0.00020 mg/L			
Magnesium, dissolved	< 0.010	0.010 mg/L			
Manganese, dissolved	< 0.00020	0.00020 mg/L			
Mercury, dissolved	< 0.000040	0.000040 mg/L			
Molybdenum, dissolved	< 0.00010	0.00010 mg/L			
Nickel, dissolved	< 0.00040	0.00040 mg/L			
Phosphorus, dissolved	< 0.050	0.050 mg/L			
Potassium, dissolved	< 0.10	0.10 mg/L			
Selenium, dissolved	< 0.00050	0.00050 mg/L			
Silicon, dissolved	< 1.0	1.0 mg/L			
Silver, dissolved	< 0.000050	0.000050 mg/L			
Sodium, dissolved	< 0.10	0.10 mg/L			
Strontium, dissolved	< 0.0010	0.0010 mg/L			
Sulfur, dissolved	< 3.0	3.0 mg/L			
Tellurium, dissolved	< 0.00050	0.00050 mg/L			
Thallium, dissolved	< 0.000020	0.000020 mg/L			
Thorium, dissolved	< 0.00010	0.00010 mg/L			
Tin, dissolved	< 0.00020	0.00020 mg/L			
Titanium, dissolved	< 0.0050	0.0050 mg/L			
Tungsten, dissolved	< 0.0010	0.0010 mg/L			
Uranium, dissolved	< 0.000020	0.000020 mg/L			
Vanadium, dissolved	< 0.0010	0.0010 mg/L			
Zinc, dissolved	< 0.0040	0.0040 mg/L			
Zirconium, dissolved	< 0.00010	0.00010 mg/L			
LCS (B0J0127-BS1)			Prepared: 2020-10-01, A	nalyz	ed: 2020-10-01
Lithium, dissolved	0.0199	0.00010 mg/L	0.0200	99	80-120
Aluminum, dissolved	0.0221	0.0050 mg/L	0.0199	111	80-120
Antimony, dissolved	0.0201	0.00020 mg/L		101	80-120
Arsenic, dissolved	0.0202	0.00050 mg/L	0.0200	101	80-120
Barium, dissolved	0.0225	0.0050 mg/L	0.0198	113	80-120
Beryllium, dissolved	0.0192	0.00010 mg/L	0.0198	97	80-120
Diama dia aliana kun d	0.0400	0.00010 ======	0.0000	00	00.400

0.0200

0.0200

0.0199

2.02

0.0198

0.0199

0.0200

2.02

0.0199

2.02

0.00010 mg/L

0.000010 mg/L

0.00050 mg/L

0.00010 mg/L

0.00040 mg/L

0.00020 mg/L

0.010 mg/L

0.010 mg/L

0.0500 mg/L

0.20 mg/L

0.0198

0.0199

0.0196

0.0200

0.0197

0.0201

1.97

2.03

2.17

< 0.0500

99

109

100

107

99

101

99

97

101

100

80-120

80-120

80-120

80-120

80-120

80-120

80-120

80-120

80-120

80-120



REPORTED TO PROJECT	Elk River Alliance ERA-CBWM					WORK REPOR	ORDER TED	0092 2020	807 -10-05	11:55
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals,	Batch B0J0127, Continu	ied								
LCS (B0J0127-BS	1), Continued			Prepared	: 2020-10-0	1, Analyze	d: 2020-1	0-01		
Manganese, dissolve	d	0.0196	0.00020 mg/L	0.0199		99	80-120			
Mercury, dissolved		0.00105	0.000040 mg/L	0.00100		105	80-120			
Molybdenum, dissolv	ed	0.0200	0.00010 mg/L	0.0200		100	80-120			
Nickel, dissolved		0.0205	0.00040 mg/L	0.0200		102	80-120			
Phosphorus, dissolve	ed	1.94	0.050 mg/L	2.00		97	80-120			
Potassium, dissolved	1	2.02	0.10 mg/L	2.02		100	80-120			
Selenium, dissolved		0.0215	0.00050 mg/L	0.0200		107	80-120			
Silicon, dissolved		2.2	1.0 mg/L	2.00		111	80-120			
Silver, dissolved		0.0199	0.000050 mg/L	0.0200		100	80-120			
Sodium, dissolved		2.13	0.10 mg/L	2.02		105	80-120			
Strontium, dissolved		0.0198	0.0010 mg/L	0.0200		99	80-120			
Sulfur, dissolved		4.1	3.0 mg/L	5.00		83	80-120			
Tellurium, dissolved		0.0217	0.00050 mg/L	0.0200		109	80-120			
Thallium, dissolved		0.0191	0.000020 mg/L	0.0199		96	80-120			
Thorium, dissolved		0.0183	0.00010 mg/L	0.0200		91	80-120			
Tin, dissolved		0.0204	0.00020 mg/L	0.0200		102	80-120			
Titanium, dissolved		0.0186	0.0050 mg/L	0.0200		93	80-120			
Tungsten, dissolved		0.0195	0.0010 mg/L	0.0200		97	80-120			
Uranium, dissolved		0.0185	0.000020 mg/L	0.0200		92	80-120			
Vanadium, dissolved		0.0215	0.0010 mg/L	0.0200		107	80-120			
Zinc, dissolved		0.0214	0.0040 mg/L	0.0200		107	80-120			
Zirconium, dissolved		0.0198	0.00010 mg/L	0.0200		99	80-120			
Reference (B0J012	27-SRM1)			Prepared	: 2020-10-0	1, Analyze	d: 2020-1	0-01		
Lithium, dissolved		0.103	0.00010 mg/L	0.100		103	70-130			
Aluminum, dissolved		0.234	0.0050 mg/L	0.235		100	70-130			
Antimony, dissolved		0.0469	0.00020 mg/L	0.0431		109	70-130			
Arsenic, dissolved		0.455	0.00050 mg/L	0.423		108	70-130			
Barium, dissolved		3.16	0.0050 mg/L	3.30		96	70-130			
Beryllium, dissolved		0.214	0.00010 mg/L	0.209		102	70-130			
Boron, dissolved		1.73	0.0500 mg/L	1.65		105	70-130			
Cadmium, dissolved		0.222	0.000010 mg/L	0.221		100	70-130			
Calcium, dissolved		8.72	0.20 mg/L	7.72		113	70-130			
Chromium, dissolved		0.434	0.00050 mg/L	0.434		100	70-130			
Cobalt, dissolved		0.128	0.00010 mg/L	0.124		103	70-130			
Copper, dissolved		0.840	0.00040 mg/L	0.815		103	70-130			
Iron, dissolved		1.28	0.010 mg/L	1.27		101	70-130			
Lead, dissolved		0.110	0.00020 mg/L	0.110		100	70-130			
Magnesium, dissolve		6.82	0.010 mg/L	6.59		103	70-130			
Manganese, dissolve		0.339	0.00020 mg/L	0.342		99	70-130			
Molybdenum, dissolv	ed	0.407	0.00010 mg/L	0.404		101	70-130			
Nickel, dissolved		0.860	0.00040 mg/L	0.835		103	70-130			
Phosphorus, dissolve		0.476	0.050 mg/L	0.499		95	70-130			
Potassium, dissolved		3.05	0.10 mg/L	2.88		106	70-130			
Selenium, dissolved		0.0352	0.00050 mg/L	0.0324		109	70-130			
Sodium, dissolved		20.2	0.10 mg/L	18.0		112	70-130			
Strontium, dissolved		0.917	0.0010 mg/L	0.935		98	70-130			
Thallium, dissolved		0.0376	0.000020 mg/L	0.0385		98	70-130			
Uranium, dissolved		0.238	0.000020 mg/L	0.258		92	70-130			
Vanadium, dissolved		0.855	0.0010 mg/L	0.873		98	70-130			
Zinc, dissolved		0.873	0.0040 mg/L	0.848		103	70-130			

### General Parameters, Batch B0/2422

Blank (B0I2422-BLK1)

BOD, 5-day

2.0 mg/L

Prepared: 2020-09-26, Analyzed: 2020-10-01

< 2.0



	River Alliance A-CBWM					WORK ORDER REPORTED		0092807 2020-10-05		5 11:55	
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier	
General Parameters, Ba	atch B0l2422, Conti	nued									
LCS (B0I2422-BS1)				Prepared	: 2020-09-2	26, Analyze	ed: 2020-1	0-01			
BOD, 5-day		190	50.1 mg/L	180		105	85-115				
General Parameters, Ba	atch B0l2454										
Blank (B0l2454-BLK1)				Prepared	: 2020-09-2	8, Analyze	ed: 2020-0	9-28			
Solids, Total Suspended		< 2.0	2.0 mg/L			<u> </u>					
Blank (B0I2454-BLK2)				Prenared	: 2020-09-2	98 Analyze	vd. 2020-0	10-28			
Solids, Total Suspended		< 2.0	2.0 mg/L	Перагеч	. 2020-03-2	o, Analyze	u. 2020-0	13-20			
		- 2.0	2.0 mg/L	Duananad			4.0000 0	0.00			
LCS (B0I2454-BS1)		07.0	10.0		: 2020-09-2			19-28			
Solids, Total Suspended		97.0	10.0 mg/L	100		97	85-115				
LCS (B0I2454-BS2)				-	: 2020-09-2			9-28			
Solids, Total Suspended		113	10.0 mg/L	100		113	85-115				
General Parameters,Ba	atch B0l2603										
Blank (B0I2603-BLK1)				Prepared	: 2020-09-2	9, Analyze	ed: 2020-0	9-29			
Ammonia, Total (as N)		< 0.050	0.050 mg/L								
Blank (B0I2603-BLK2)				Prepared	: 2020-09-2	9. Analvze	ed: 2020-0	9-29			
Ammonia, Total (as N)		< 0.050	0.050 mg/L		0 _ 0	, /					
Blank (B0I2603-BLK3)				Prepared	: 2020-09-2	0 Analyze	d. 2020-0	0_20			
Ammonia, Total (as N)		< 0.050	0.050 mg/L	Fiepaieu	. 2020-09-2	.9, Analyze	u. 2020-0	19-29			
		\$ 0.000	0.000 mg/L	Durana		0 A		0.00			
LCS (B0I2603-BS1)		4.07	0.050	-	: 2020-09-2			9-29			
Ammonia, Total (as N)		1.07	0.050 mg/L	1.00		107	90-115				
LCS (B0I2603-BS2)				-	: 2020-09-2			9-29			
Ammonia, Total (as N)		1.07	0.050 mg/L	1.00		107	90-115				
LCS (B0I2603-BS3)				Prepared	: 2020-09-2	9, Analyze	ed: 2020-0	9-29			
Ammonia, Total (as N)		1.01	0.050 mg/L	1.00		101	90-115				
General Parameters, Ba	atch B0l2746										
Blank (B0I2746-BLK1)				Prepared	: 2020-09-3	80, Analyze	ed: 2020-0	9-30			
Alkalinity, Total (as CaCO3	)	< 1.0	1.0 mg/L								
Alkalinity, Phenolphthalein	(as CaCO3)	< 1.0	1.0 mg/L								
Alkalinity, Bicarbonate (as C	,	< 1.0	1.0 mg/L								
Alkalinity, Carbonate (as Ca Alkalinity, Hydroxide (as Ca	,	< 1.0 < 1.0	1.0 mg/L 1.0 mg/L								
	,			Prepared	: 2020-09-3		d. 2020 0	0-30			
Blank (B0l2746-BLK2) Alkalinity, Total (as CaCO3	)	< 1.0	1.0 mg/L	гтератец	. 2020-09-3	o, Analyze	u. 2020-0	3-30			
Alkalinity, Phenolphthalein		< 1.0	1.0 mg/L								
Alkalinity, Bicarbonate (as	· /	< 1.0	1.0 mg/L								
Alkalinity, Carbonate (as C	,	< 1.0	1.0 mg/L								
Alkalinity, Hydroxide (as Ca	aCO3)	< 1.0	1.0 mg/L								
LCS (B0I2746-BS1)				Prepared	: 2020-09-3	80, Analyze	ed: 2020-0	9-30			
Alkalinity, Total (as CaCO3	)	107	1.0 mg/L	100		107	80-120				



	Elk River Alliance				-	WORK		0000	007	
REPORTED TO PROJECT	ERA-CBWM					REPOR	ORDER RTED	0092 2020	)-10-05	11:55
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifie
General Parameters	, Batch B0l2746, Cor	ntinued								
LCS (B0I2746-BS2)				Prepared	: 2020-09-3	0, Analyze	ed: 2020-0	9-30		
Alkalinity, Total (as Ca	CO3)	95.2	1.0 mg/L	100		95	80-120			
General Parameters	, Batch B0l2781									
Blank (B0I2781-BLK	(1)			Prepared	1: 2020-09-3	0, Analyze	ed: 2020-1	0-01		
Nitrogen, Total Kjeldah	I	< 0.050	0.050 mg/L							
Blank (B0l2781-BL	(2)			Prepared	: 2020-09-3	0, Analyze	ed: 2020-1	0-01		
Nitrogen, Total Kjeldah	l	< 0.050	0.050 mg/L	•						
LCS (B0I2781-BS1)				Prepared	: 2020-09-3	0, Analyze	ed: 2020-1	0-01		
Nitrogen, Total Kjeldah		1.03	0.050 mg/L	1.00		103	85-115			
LCS (B012781-BS2)				Prepared	: 2020-09-3	0, Analyze	ed: 2020-1	0-01		
Nitrogen, Total Kjeldah		1.01	0.050 mg/L	1.00		101	85-115			
General Parameters	, Batch B0J0006									
Blank (B0J0006-BL	K1)			Prepared	l: 2020-10-0	1, Analyze	ed: 2020-1	0-01		
Phosphorus, Total (as	P)	< 0.0050	0.0050 mg/L							
Blank (B0J0006-BL	K2)			Prepared	: 2020-10-0	1, Analyze	ed: 2020-1	0-01		
Phosphorus, Total (as	P)	< 0.0050	0.0050 mg/L							
Blank (B0J0006-BL	K3)			Prepared	: 2020-10-0	1, Analyze	ed: 2020-1	0-01		
Phosphorus, Total (as	P)	< 0.0050	0.0050 mg/L			-				
LCS (B0J0006-BS1)				Prepared	: 2020-10-0	1, Analyze	ed: 2020-1	0-01		
Phosphorus, Total (as		0.0979	0.0050 mg/L	0.100		98	85-115			
LCS (B0J0006-BS2)				Prepared	: 2020-10-0	1, Analyze	ed: 2020-1	0-01		
Phosphorus, Total (as	P)	0.0975	0.0050 mg/L	0.100		97	85-115			
LCS (B0J0006-BS3)				Prepared	: 2020-10-0	1, Analyze	ed: 2020-1	0-01		
Phosphorus, Total (as		0.0962	0.0050 mg/L	0.100		96	85-115			
General Parameters	, Batch B0J0086									
Blank (B0J0086-BL	K1)			Prepared	l: 2020-10-0	1, Analyze	ed: 2020-1	0-01		
Chemical Oxygen Dem	nand	< 20	20 mg/L							
LCS (B0J0086-BS1)				Prepared	: 2020-10-0	1, Analyze	ed: 2020-1	0-01		
Chemical Oxygen Dem	nand	508	20 mg/L	500		102	89-115			
Total Metals, Batch	B0J0079									
Blank (B0J0079-BL	K1)			Prepared	1: 2020-10-0	1, Analyze	ed: 2020-1	0-01		
Mercury, total		< 0.000010	0.000010 mg/L							
Duplicate (B0J0079	-DUP1)	Sc	ource: 0092807-02	Prepared	: 2020-10-0	1, Analyze	ed: 2020-1	0-01		
Mercury, total	-	< 0.000010	0.000010 mg/L	·	< 0.000010				20	
Reference (B0J0079	9-SRM1)			Prepared	1: 2020-10-0	1, Analyze	ed: 2020-1	0-01		
Mercury, total	,	0.00625	0.000010 mg/L	0.00581	-	108	70-130			



REPORTED TO PROJECT	Elk River Alliance ERA-CBWM					WORK REPOR			2807 )-10-05	11:55
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier

### Total Metals, Batch B0J0176

Blank (B0J0176-BLK1)			Prepared: 2020-10-02, Analyzed: 2020-10-02
Aluminum, total	< 0.0050	0.0050 mg/L	
Antimony, total	< 0.00020	0.00020 mg/L	
Arsenic, total	< 0.00050	0.00050 mg/L	
Barium, total	< 0.0050	0.0050 mg/L	
Beryllium, total	< 0.00010	0.00010 mg/L	
Bismuth, total	< 0.00010	0.00010 mg/L	
Boron, total	< 0.0500	0.0500 mg/L	
Cadmium, total	< 0.000010	0.000010 mg/L	
Calcium, total	< 0.20	0.20 mg/L	
Chromium, total	< 0.00050	0.00050 mg/L	
Cobalt, total	< 0.00010	0.00010 mg/L	
Copper, total	< 0.00040	0.00040 mg/L	
Iron, total	< 0.010	0.010 mg/L	
Lead, total	< 0.00020	0.00020 mg/L	
Lithium, total	< 0.00010	0.00010 mg/L	
Magnesium, total	< 0.010	0.010 mg/L	
Manganese, total	< 0.00020	0.00020 mg/L	
Mercury, total	< 0.000040	0.000040 mg/L	
Molybdenum, total	< 0.00010	0.00010 mg/L	
Nickel, total	< 0.00040	0.00040 mg/L	
Phosphorus, total	< 0.050	0.050 mg/L	
Potassium, total	< 0.10	0.10 mg/L	
Selenium, total	< 0.00050	0.00050 mg/L	
Silicon, total	< 1.0	1.0 mg/L	
Silver, total	< 0.000050	0.000050 mg/L	
Sodium, total	< 0.10	0.10 mg/L	
Strontium, total	< 0.0010	0.0010 mg/L	
Sulfur, total	< 3.0	3.0 mg/L	
Tellurium, total	< 0.00050	0.00050 mg/L	
Thallium, total	< 0.000020	0.000020 mg/L	
Thorium, total	< 0.00010	0.00010 mg/L	
Tin, total	< 0.00020	0.00020 mg/L	
Titanium, total	< 0.0050	0.0050 mg/L	
Tungsten, total	< 0.0010	0.0010 mg/L	
Uranium, total	< 0.000020	0.000020 mg/L	
Vanadium, total	< 0.0010	0.0010 mg/L	
Zinc, total	< 0.0040	0.0040 mg/L	
Zirconium, total	< 0.00010	0.00010 mg/L	

### Blank (B0J0176-BLK2)

Blank (B0J0176-BLK2)			Prepared: 2020-10-02, Analyzed: 2020-10-03
Aluminum, total	< 0.0050	0.0050 mg/L	
Antimony, total	< 0.00020	0.00020 mg/L	
Arsenic, total	< 0.00050	0.00050 mg/L	
Barium, total	< 0.0050	0.0050 mg/L	
Beryllium, total	< 0.00010	0.00010 mg/L	
Bismuth, total	< 0.00010	0.00010 mg/L	
Boron, total	< 0.0500	0.0500 mg/L	
Cadmium, total	< 0.000010	0.000010 mg/L	
Calcium, total	< 0.20	0.20 mg/L	
Chromium, total	< 0.00050	0.00050 mg/L	
Cobalt, total	< 0.00010	0.00010 mg/L	
Copper, total	< 0.00040	0.00040 mg/L	
Iron, total	< 0.010	0.010 mg/L	
Lead, total	< 0.00020	0.00020 mg/L	
Lithium, total	< 0.00010	0.00010 mg/L	
Magnesium, total	< 0.010	0.010 mg/L	



REPORTED TO PROJECT	Elk River Alliance ERA-CBWM					WORK REPOR			807 -10-05	11:55
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier

### Total Metals, Batch B0J0176, Continued

Blank (B0J0176-BLK2), Continued			Prepared: 2020	0-10-02, Analyze	ed: 2020-10-03
Manganese, total	< 0.00020	0.00020 mg/L			
Mercury, total	< 0.000040	0.000040 mg/L			
Molybdenum, total	< 0.00010	0.00010 mg/L			
Nickel, total	< 0.00040	0.00040 mg/L			
Phosphorus, total	< 0.050	0.050 mg/L			
Potassium, total	< 0.10	0.10 mg/L			
Selenium, total	< 0.00050	0.00050 mg/L			
Silicon, total	< 1.0	1.0 mg/L			
Silver, total	< 0.000050	0.000050 mg/L			
Sodium, total	< 0.10	0.10 mg/L			
Strontium, total	< 0.0010	0.0010 mg/L			
Sulfur, total	< 3.0	3.0 mg/L			
Tellurium, total	< 0.00050	0.00050 mg/L			
Thallium, total	< 0.000020	0.000020 mg/L			
Thorium, total	< 0.00010	0.00010 mg/L			
Fin, total	< 0.00020	0.00020 mg/L			
Fitanium, total	< 0.0050	0.0050 mg/L			
Fungsten, total	< 0.0010	0.0010 mg/L			
Jranium, total	< 0.000020	0.000020 mg/L			
/anadium, total	< 0.0010	0.0010 mg/L			
Zinc, total	< 0.0040	0.0040 mg/L			
Zirconium, total	< 0.00010	0.00010 mg/L			
LCS (B0J0176-BS1)			Prepared: 2020	)-10-02, Analyze	ed: 2020-10-02
Aluminum, total	0.0236	0.0050 mg/L	0.0199	119	80-120
Antimony, total	0.0209	0.00020 mg/L	0.0200	104	80-120
Arsenic, total	0.0209	0.00050 mg/L	0.0200	104	80-120
Barium, total	0.0211	0.0050 mg/L	0.0200	105	80-120
•	0.0212	0.00010 mg/L	0.0198	117	80-120
Beryllium, total	0.0231	· ·		102	80-120
Bismuth, total		0.00010 mg/L	0.0200		80-120
Boron, total	< 0.0500	0.0500 mg/L 0.000010 mg/L	0.0200	111	
Cadmium, total	0.0195		0.0199 2.02	98	80-120
Calcium, total	2.41	0.20 mg/L		119	80-120
Chromium, total	0.0208	0.00050 mg/L	0.0198	105	80-120
Cobalt, total	0.0204	0.00010 mg/L	0.0199	103	80-120
Copper, total	0.0206	0.00040 mg/L	0.0200	103	80-120
ron, total	2.10	0.010 mg/L	2.02	104	80-120
_ead, total	0.0203	0.00020 mg/L	0.0199	102	80-120
Lithium, total	0.0230	0.00010 mg/L	0.0200	115	80-120
Magnesium, total	2.05	0.010 mg/L	2.02	102	80-120
Manganese, total	0.0207	0.00020 mg/L	0.0199	104	80-120
Aercury, total	0.00102	0.000040 mg/L	0.00100	102	80-120
Molybdenum, total	0.0200	0.00010 mg/L	0.0200	100	80-120
Nickel, total	0.0204	0.00040 mg/L	0.0200	102	80-120
Phosphorus, total	2.16	0.050 mg/L	2.00	108	80-120
Potassium, total	1.97	0.10 mg/L	2.02	97	80-120
Selenium, total	0.0201	0.00050 mg/L	0.0200	101	80-120
Silicon, total	2.3	1.0 mg/L	2.00	116	80-120
Silver, total	0.0195	0.000050 mg/L	0.0200	98	80-120
Sodium, total	2.02	0.10 mg/L	2.02	100	80-120
Strontium, total	0.0199	0.0010 mg/L	0.0200	100	80-120
Sulfur, total	5.7	3.0 mg/L	5.00	114	80-120
Fellurium, total	0.0194	0.00050 mg/L	0.0200	97	80-120
Thallium, total	0.0206	0.000020 mg/L	0.0199	103	80-120
Thorium, total	0.0200	0.00010 mg/L	0.0200	100	80-120
Tin, total	0.0202	0.00020 mg/L	0.0200	101	80-120



REPORTED TO PROJECT	Elk River Alliance ERA-CBWM					WORK REPOR	ORDER TED	0092 2020	807 -10-05	11:55
Analyte		Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifie
Total Metals, Batc	h B0J0176, Continued									
LCS (B0J0176-BS	1), Continued			Prepared	: 2020-10-02	, Analyze	d: 2020-1	0-02		
Titanium, total		0.0213	0.0050 mg/L	0.0200		106	80-120			
Tungsten, total		0.0208	0.0010 mg/L	0.0200		104	80-120			
Uranium, total		0.0201	0.000020 mg/L	0.0200		101	80-120			
Vanadium, total		0.0190	0.0010 mg/L	0.0200		95	80-120			
Zinc, total		0.0209	0.0040 mg/L	0.0200		104	80-120			
Zirconium, total		0.0196	0.00010 mg/L	0.0200		98	80-120			
LCS (B0J0176-BS	2)			Prepared	: 2020-10-02	, Analyze	d: 2020-1	0-03		
Aluminum, total		0.0218	0.0050 mg/L	0.0199		109	80-120			
Antimony, total		0.0211	0.00020 mg/L	0.0200		106	80-120			
Arsenic, total		0.0202	0.00050 mg/L	0.0200		101	80-120			
Barium, total Beryllium, total		0.0209	0.0050 mg/L	0.0198		105	80-120			
Beryllium, total		0.0224	0.00010 mg/L	0.0198		113 102	80-120 80-120			
Boron, total		< 0.0500	0.00010 mg/L 0.0500 mg/L	0.0200		110	80-120			
Cadmium, total		0.0196	0.000010 mg/L	0.0200		99	80-120			
Calcium, total		2.38	0.20 mg/L	2.02		118	80-120			
Chromium, total		0.0206	0.00050 mg/L	0.0198		104	80-120			
Cobalt, total		0.0208	0.00010 mg/L	0.0199		104	80-120			
Copper, total		0.0204	0.00040 mg/L	0.0200		102	80-120			
Iron, total		2.10	0.010 mg/L	2.02		104	80-120			
Lead, total		0.0203	0.00020 mg/L	0.0199		102	80-120			
Lithium, total		0.0228	0.00010 mg/L	0.0200		114	80-120			
Magnesium, total		2.06	0.010 mg/L	2.02		102	80-120			
Manganese, total		0.0206	0.00020 mg/L	0.0199		103	80-120			
Mercury, total		0.00104	0.000040 mg/L	0.00100		104	80-120			
Molybdenum, total Nickel, total		0.0198	0.00010 mg/L 0.00040 mg/L	0.0200		99 103	80-120 80-120			
Phosphorus, total		2.24	0.050 mg/L	2.00		112	80-120			
Potassium, total		1.97	0.10 mg/L	2.00		98	80-120			
Selenium, total		0.0198	0.00050 mg/L	0.0200		99	80-120			
Silicon, total		2.3	1.0 mg/L	2.00		113	80-120			
Silver, total		0.0198	0.000050 mg/L	0.0200		99	80-120			
Sodium, total		2.05	0.10 mg/L	2.02		102	80-120			
Strontium, total		0.0198	0.0010 mg/L	0.0200		99	80-120			
Sulfur, total		5.8	3.0 mg/L	5.00		116	80-120			
Tellurium, total		0.0199	0.00050 mg/L	0.0200		100	80-120			
Thallium, total		0.0206	0.000020 mg/L	0.0199		104	80-120			
Thorium, total		0.0200	0.00010 mg/L	0.0200		100	80-120			
Tin, total		0.0203	0.00020 mg/L	0.0200		102	80-120			
Titanium, total Tungsten, total		0.0204	0.0050 mg/L 0.0010 mg/L	0.0200		102 103	80-120 80-120			
Uranium, total		0.0200	0.000020 mg/L	0.0200		103	80-120			
Vanadium, total		0.0202	0.0010 mg/L	0.0200		93	80-120			
Zinc, total		0.0230	0.0040 mg/L	0.0200		115	80-120			
Zirconium, total		0.0198	0.00010 mg/L	0.0200		99	80-120			
Reference (B0J01	76-SRM1)			Prepared	1: 2020-10-02	, Analyze	d: 2020-1	0-02		
Aluminum, total		0.315	0.0050 mg/L	0.299		, <b>,</b> 105	70-130			
Antimony, total		0.0525	0.00020 mg/L	0.0517		102	70-130			
Arsenic, total		0.127	0.00050 mg/L	0.119		106	70-130			
Barium, total		0.823	0.0050 mg/L	0.801		103	70-130			
Beryllium, total		0.0581	0.00010 mg/L	0.0501		116	70-130			
Boron, total		3.99	0.0500 mg/L	4.11		97	70-130			
Cadmium, total		0.0501	0.000010 mg/L	0.0503		100	70-130			
Calcium, total		10.9	0.20 mg/L	10.7		102	70-130			
Chromium, total		0.256	0.00050 mg/L	0.250		102	70-130			ge 16 o



REPORTED TO PROJECT	Elk River Alliance ERA-CBWM				-	K ORDER ORTED	0092 2020	807 -10-05	11:55
Analyte		Result	RL Units	Spike Level	Source % RE Result	C REC Limit	% RPD	RPD Limit	Qualifie
Total Metals, Batc	h B0J0176, Continued								
Reference (B0J01	76-SRM1), Continued			Prepared	: 2020-10-02, Analy	/zed: 2020-1	0-02		
Cobalt, total		0.0399	0.00010 mg/L	0.0384	104	70-130			
Copper, total		0.499	0.00040 mg/L	0.487	103	70-130			
Iron, total		0.525	0.010 mg/L	0.504	104	70-130			
Lead, total		0.281	0.00020 mg/L	0.278	101	70-130			
Lithium, total		0.468	0.00010 mg/L	0.398	117	70-130			
Magnesium, total		3.71	0.010 mg/L	3.59	103	70-130			
Manganese, total		0.114	0.00020 mg/L	0.111	103	70-130			
Mercury, total		0.00560	0.000040 mg/L	0.00581	96	70-130			
Molybdenum, total		0.196	0.00010 mg/L	0.196	100	70-130			
Nickel, total		0.255	0.00040 mg/L	0.248	103	70-130			
Phosphorus, total		0.248	0.050 mg/L	0.213	116	70-130			
Potassium, total		5.95	0.10 mg/L	5.89	101	70-130			
Selenium, total		0.124	0.00050 mg/L	0.120	104	70-130			
Sodium, total		8.85	0.10 mg/L	8.71	102	70-130			
Strontium, total		0.395	0.0010 mg/L	0.393	101	70-130			
Thallium, total		0.0817	0.000020 mg/L	0.0787	104	70-130			
Uranium, total		0.0346	0.000020 mg/L	0.0344	101	70-130			
Vanadium, total		0.399	0.0010 mg/L	0.391	102	70-130			
Zinc, total		2.55	0.0040 mg/L	2.50	102	70-130			
Reference (B0J01	76-SRM2)			Prepared	: 2020-10-02, Analy	/zed: 2020-1	0-03		
Aluminum, total		0.310	0.0050 mg/L	0.299	104	70-130			
Antimony, total		0.0509	0.00020 mg/L	0.0517	98	70-130			
Arsenic, total		0.122	0.00050 mg/L	0.119	102	70-130			
Barium, total		0.798	0.0050 mg/L	0.801	100	70-130			
Beryllium, total		0.0540	0.00010 mg/L	0.0501	108	70-130			
Boron, total		3.70	0.0500 mg/L	4.11	90	70-130			
Cadmium, total		0.0485	0.000010 mg/L	0.0503	96	70-130			
Calcium, total		10.6	0.20 mg/L	10.7	99	70-130			
Chromium, total		0.251	0.00050 mg/L	0.250	100	70-130			
Cobalt, total		0.0387	0.00010 mg/L	0.0384	101	70-130			
Copper, total									
Iron, total						70-130			
		0.491	0.00040 mg/L	0.487	101	70-130 70-130			
Lead, total		0.491 0.511	0.00040 mg/L 0.010 mg/L	0.487 0.504	101 101	70-130			
Lead, total Lithium, total		0.491 0.511 0.274	0.00040 mg/L 0.010 mg/L 0.00020 mg/L	0.487 0.504 0.278	101 101 99	70-130 70-130			
Lithium, total		0.491 0.511 0.274 0.442	0.00040 mg/L 0.010 mg/L 0.00020 mg/L 0.00010 mg/L	0.487 0.504 0.278 0.398	101 101 99 111	70-130 70-130 70-130			
Lithium, total Magnesium, total		0.491 0.511 0.274 0.442 3.68	0.00040 mg/L 0.010 mg/L 0.00020 mg/L 0.00010 mg/L 0.010 mg/L	0.487 0.504 0.278 0.398 3.59	101 101 99 111 103	70-130 70-130 70-130 70-130			
Lithium, total Magnesium, total Manganese, total		0.491 0.511 0.274 0.442 3.68 0.112	0.00040 mg/L 0.010 mg/L 0.00020 mg/L 0.00010 mg/L 0.0010 mg/L 0.00020 mg/L	0.487 0.504 0.278 0.398 3.59 0.111	101 101 99 111 103 101	70-130 70-130 70-130 70-130 70-130			
Lithium, total Magnesium, total Manganese, total Mercury, total		0.491 0.511 0.274 0.442 3.68 0.112 0.00545	0.00040 mg/L 0.010 mg/L 0.00020 mg/L 0.00010 mg/L 0.0010 mg/L 0.00020 mg/L 0.000040 mg/L	0.487 0.504 0.278 0.398 3.59 0.111 0.00581	101 101 99 111 103 101 94	70-130 70-130 70-130 70-130 70-130 70-130			
Lithium, total Magnesium, total Manganese, total Mercury, total Molybdenum, total		0.491 0.511 0.274 0.442 3.68 0.112 0.00545 0.196	0.00040 mg/L 0.010 mg/L 0.00020 mg/L 0.0010 mg/L 0.00020 mg/L 0.00020 mg/L 0.000040 mg/L	0.487 0.504 0.278 0.398 3.59 0.111 0.00581 0.196	101 101 99 111 103 101 94 100	70-130 70-130 70-130 70-130 70-130 70-130 70-130			
Lithium, total Magnesium, total Manganese, total Mercury, total Molybdenum, total Nickel, total		0.491 0.511 0.274 0.442 3.68 0.112 0.00545 0.196 0.251	0.00040 mg/L 0.010 mg/L 0.00020 mg/L 0.0010 mg/L 0.00020 mg/L 0.000040 mg/L 0.00010 mg/L 0.00040 mg/L	0.487 0.504 0.278 0.398 3.59 0.111 0.00581 0.196 0.248	101 101 99 111 103 101 94 100 101	70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130			
Lithium, total Magnesium, total Manganese, total Mercury, total Molybdenum, total Nickel, total Phosphorus, total		0.491 0.511 0.274 0.442 3.68 0.112 0.00545 0.196 0.251 0.200	0.00040 mg/L 0.010 mg/L 0.00020 mg/L 0.0010 mg/L 0.00020 mg/L 0.000040 mg/L 0.00010 mg/L 0.00040 mg/L 0.00040 mg/L	0.487 0.504 0.278 0.398 3.59 0.111 0.00581 0.196 0.248 0.213	101 101 99 111 103 101 94 100 101 94	70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130			
Lithium, total Magnesium, total Manganese, total Mercury, total Molybdenum, total Nickel, total Phosphorus, total Potassium, total		0.491 0.511 0.274 0.442 3.68 0.112 0.00545 0.196 0.251 0.200 5.90	0.00040 mg/L 0.010 mg/L 0.00020 mg/L 0.0010 mg/L 0.00020 mg/L 0.000040 mg/L 0.00010 mg/L 0.00040 mg/L 0.0050 mg/L 0.10 mg/L	0.487 0.504 0.278 0.398 3.59 0.111 0.00581 0.196 0.248 0.213 5.89	101 101 99 111 103 101 94 100 101 94 100	70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130			
Lithium, total Magnesium, total Manganese, total Mercury, total Molybdenum, total Nickel, total Phosphorus, total Potassium, total Selenium, total		0.491 0.511 0.274 0.442 3.68 0.112 0.00545 0.196 0.251 0.200 5.90 0.119	0.00040 mg/L 0.0010 mg/L 0.00020 mg/L 0.0010 mg/L 0.00020 mg/L 0.000040 mg/L 0.00010 mg/L 0.00040 mg/L 0.0050 mg/L 0.10 mg/L	0.487 0.504 0.278 0.398 3.59 0.111 0.00581 0.196 0.248 0.213 5.89 0.120	101 101 99 111 103 101 94 100 101 94 100 99	70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130			
Lithium, total Magnesium, total Manganese, total Mercury, total Molybdenum, total Nickel, total Phosphorus, total Potassium, total Selenium, total Sodium, total		0.491 0.511 0.274 0.442 3.68 0.112 0.00545 0.196 0.251 0.200 5.90 0.119 8.70	0.00040 mg/L 0.010 mg/L 0.00020 mg/L 0.0010 mg/L 0.00020 mg/L 0.000040 mg/L 0.00010 mg/L 0.00040 mg/L 0.0050 mg/L 0.10 mg/L 0.10 mg/L	0.487 0.504 0.278 0.398 3.59 0.111 0.00581 0.196 0.248 0.213 5.89 0.120 8.71	101 101 99 111 103 101 94 100 101 94 100 99 100	70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130			
Lithium, total Magnesium, total Manganese, total Mercury, total Molybdenum, total Nickel, total Phosphorus, total Potassium, total Selenium, total Strontium, total		0.491 0.511 0.274 0.442 3.68 0.112 0.00545 0.196 0.251 0.200 5.90 0.119 8.70 0.382	0.00040 mg/L 0.010 mg/L 0.00020 mg/L 0.0010 mg/L 0.00020 mg/L 0.000040 mg/L 0.00010 mg/L 0.00040 mg/L 0.0050 mg/L 0.10 mg/L 0.0010 mg/L	0.487 0.504 0.278 0.398 3.59 0.111 0.00581 0.196 0.248 0.213 5.89 0.120 8.71 0.393	101 101 99 111 103 101 94 100 101 94 100 99 100 97	70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130			
Lithium, total Magnesium, total Manganese, total Mercury, total Molybdenum, total Nickel, total Phosphorus, total Potassium, total Selenium, total Strontium, total Thallium, total		0.491 0.511 0.274 0.442 3.68 0.112 0.00545 0.196 0.251 0.200 5.90 0.119 8.70 0.382 0.0794	0.00040 mg/L 0.010 mg/L 0.00020 mg/L 0.0010 mg/L 0.00020 mg/L 0.000040 mg/L 0.00010 mg/L 0.00040 mg/L 0.0050 mg/L 0.10 mg/L 0.0010 mg/L 0.0010 mg/L 0.00010 mg/L	0.487 0.504 0.278 0.398 3.59 0.111 0.00581 0.196 0.248 0.213 5.89 0.120 8.71 0.393 0.0787	101 101 99 111 103 101 94 100 101 94 100 99 100 97	70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130			
Lithium, total Magnesium, total Manganese, total Mercury, total Molybdenum, total Nickel, total Phosphorus, total Potassium, total Selenium, total Strontium, total Thallium, total Uranium, total		0.491 0.511 0.274 0.442 3.68 0.112 0.00545 0.196 0.251 0.200 5.90 0.119 8.70 0.382 0.0794 0.0337	0.00040 mg/L 0.010 mg/L 0.00020 mg/L 0.0010 mg/L 0.00020 mg/L 0.000040 mg/L 0.00040 mg/L 0.00040 mg/L 0.0050 mg/L 0.10 mg/L 0.00050 mg/L 0.0010 mg/L 0.0010 mg/L 0.00000 mg/L 0.000020 mg/L	0.487 0.504 0.278 0.398 3.59 0.111 0.00581 0.196 0.248 0.213 5.89 0.120 8.71 0.393 0.0787 0.0344	101 101 99 111 103 101 94 100 101 94 100 99 100 97 101 98	70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130			
Lithium, total Magnesium, total Marganese, total Molybdenum, total Nickel, total Phosphorus, total Potassium, total Selenium, total Strontium, total Thallium, total		0.491 0.511 0.274 0.442 3.68 0.112 0.00545 0.196 0.251 0.200 5.90 0.119 8.70 0.382 0.0794	0.00040 mg/L 0.010 mg/L 0.00020 mg/L 0.0010 mg/L 0.00020 mg/L 0.000040 mg/L 0.00010 mg/L 0.00040 mg/L 0.0050 mg/L 0.10 mg/L 0.0010 mg/L 0.0010 mg/L 0.00010 mg/L	0.487 0.504 0.278 0.398 3.59 0.111 0.00581 0.196 0.248 0.213 5.89 0.120 8.71 0.393 0.0787	101 101 99 111 103 101 94 100 101 94 100 99 100 97	70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130			



Appendix D: Benthic Macroinvertebrate Taxonomy Report

ELK River Alliance			Site	ALX001	ALX003	BOV001	BOV002	COL001	COL003	LIZ001	LIZ003	MOR001	MOR002	
2020 CABIN Benth	os		Stre am	Alexander Creek	Alexander Creek	Boivin Creek	Boivin Creek	<b>Coal Creek</b>	Coal Creek	Lizard Creek	Lizard Creek	Morrissey Creek	Morrissey Creek	
Taxonomist: Pina V	iola		CABIN study	CBWQ-Elk	CBWQ-Elk	CBWQ-Elk	CBWQ-Elk	CBWQ-Elk	CBWQ-Elk	CBWQ-Elk	CBWQ-Elk	CBWQ-Elk	CBWQ-Elk	
Date: May 6/2021			Sampling date	9/21/2020	9/20/2020	9/20/2020	9/20/2020	9/08/2021	9/08/2022	9/09/2023	9/15/2020	9/22/2020	9/22/2020	
			Device	kicknet	kicknet	kicknet	kicknet	kicknet	kicknet	kicknet	kicknet	kicknet	kicknet	
			Habitat	riffle	riffle	riffle	riffle	riffle	riffle	riffle	riffle	riffle	riffle	
			% sorted	5/100	5/100	5/100	6/101	5/102	17/100	5/100	5/100	5/100	6/101	
Order	Family	Genus	Species	1										_
Ephemeroptera	Ameletidae	Ameletus		1	1	C	) 3	3 (	29	:	1 0	1	0 7	·
	Baetidae			0	0	C	) (	D 2	3		2 2		0 0	I
		Acentrella		0	0	C	) (	o 3	0		D (	1	0 0	i
		Baetis		103	38	19	25	5 12	5	49	9 123		3 80	I.
		Diphetor		0	0	C	) (	) (	0 0		D C	1	0 6	i
	Ephemerellidae			81	75	2	: 2	2 9	10	9	9 72	1	3 3	
			Caudatella	1	4	C	) (	0 0	0 0		D C	1	0 0	i
			Drunella coloradensis	1	0	C	) 2	2 0	0 0		0 1		0 0	ł
			Drunella doddsi	17	12	g	90	0 0	) 1	. (	0 43		0 0	į
			Drunella grandis/spinifera	0	1	C	) (	D (	0 0		D 0	1	0 0	į
	Heptageniidae			28	30	29	25	5 2	2		3 18		3 7	
		Cinygmula		11	14	10	) (	6 6	9		5 35	3	8 12	
		Epeorus		5		10					0 0		0 0	J
		Rhithrogena		12		38					D C		0 1	
	Leptophlebiidae			1							D C		4 4	
		Neoleptophlebi	a	0							0 0		0 1	
Plecoptera				0							0 6		1 0	
	Capniidae			0							-		0 15	
	Chloroperlidae			0							2 6		0 1	
		Sweltza		2							3 C		1 11	
	Leuctridae			5							D C		0 1	
	Nemouridae	Visoka		0							D C		0 0	
		Zapada		10							3 21		0 5	
			Zapada cinctipes	31		C								
			Zapada columbiana	1									3 10	
			Zapada oregonensis/haisi	9									0 4	
	Peltoperlidae			0	0	C	) (	) (	) 1	. (	D C	1	0 0	)

		Yoraperla		0	0	0	1	0	0	0	0	0	0
	Perlidae	тотарена		1	0	0	0	0	9	2	7	0	4
	i cinduc	Doroneuria		0	0	0	0	1	5	4	12	1	1
	Perlodidae	Doronicana		4	3	0	1	- 0	5	1	1	- 0	1
		Megarcys		0	1	1	5	0	1	2	3	0	1
		Skwala		0	0	0	0	2	0	1	0	6	0
	Taeniopterygidae			5	38	89	26	0	0	6	31	0	0
Trichoptera				1	0	0	0	0	3	0	0	0	2
	Apatanidae	Apatania		13	4	0	0	10	0	1	10	0	0
	Brachycentridae	Brachycentrus		5	1	0	0	0	0	0	0	1	0
		Micrasema		0	1	0	0	4	5	2	3	20	5
	Glossosomatidae	Glossosoma		39	5	2	15	0	0	2	7	0	2
	Hydropsychidae			2	8	0	0	5	0	13	1	8	0
		Artopsyche		0	0	0	0	0	0	0	0	1	0
		Hydropsyche		0	0	0	0	2	0	1	0	40	0
		Parapsyche		1	1	0	0	0	0	0	0	0	1
	Hydroptilidae	Hydroptila		0	0	0	0	1	0	1	0	0	0
		Ochrotrichia		0	0	0	0	0	0	0	0	2	0
	Lepidostomatida	e Lepidostoma		0	0	0	0	102	0	1	0	290	0
	Limnephilidae			0	0	0	0	0	2	0	0	0	0
	Rhyacophilidae	Rhyacophila		14	4	0	4	6	2	0	15	0	2
			Rhyacophila betteni gr.A	1	3	0	0	0	5	0	1	1	2
			Rhyacophila hyalinata	1	0	0	0	0	0	0	0	0	0
			Rhyacophila narvae	0	0	0	0	0	0	0	1	0	4
			Rhyacophila vemna/brunnea	5	3	1	6	1	6	1	7	1	0
	Uenoidae	Neothremma	Rhyacophila vetina complex	0	0 1	0 1	3 0	0 0	0 0	0	0 0	0	0
	Denotuae	Oligophlebode	c	3	0	0	0	0	0	9	44	0	0
Coleoptera	Dytiscidae	ongophicbouc	3	0	0	0	0	0	1	0	0	0	0
	Elmidae			0	1	0	0	0	0	4	9	9	0
		Heterlimnius		6	10	0	0	0	12	18	142	4	11
		Narpus		0	0	0	0	0	0	2	3	0	0
		Optioservus		0	0	0	0	0	0	0	0	2	0
		Zaitzevia		0	0	0	0	17	0	0	0	3	0
Diptera	Athericidae	Atherix		0	0	0	0	1	0	0	0	3	0
			-										

	Ceratopogonidae		7	3	0	0	0	2	0	0	0	1
	Chironomidae		24	22	102	16	120	105	109	59	20	109
	Empididae		0	0	0	0	0	0	2	0	0	0
		Chelifera	2	2	0	0	0	0	0	1	1	0
		Oreogeton	0	0	0	1	0	0	0	0	0	0
		Wiedemannia	0	0	0	0	2	0	2	0	2	1
	Pelecorhynchida	e Glutops	0	0	0	0	0	0	0	3	0	0
	Psychodidae	Pericoma/Telmatoscopus	44	33	0	0	4	0	39	94	3	1
	Simuliidae		1	0	0	5	0	0	0	2	0	0
		Helodon	0	0	2	0	0	0	0	0	0	0
		Simulium	1	24	0	0	0	0	2	0	0	0
	Tipulidae		0	0	0	0	12	0	0	0	4	0
		Antocha	0	0	0	0	3	0	3	15	3	1
		Dicranota	1	0	2	3	0	0	0	3	1	1
		Hexatoma	0	0	0	0	0	0	0	1	2	0
		Limnophila	0	1	0	0	0	0	0	0	0	0
		Pedicia	0	0	0	1	0	0	0	0	0	0
Collembola			0	0	0	0	0	0	0	0	0	3
Acari-Sarcoptiformes			0	0	0	0	0	1	0	0	0	0
Acari-Trombidiforme	5		0	0	0	0	3	0	0	0	0	2
	Aturidae	Aturus	0	0	0	0	1	1	0	0	0	0
	Hydryphantidae		0	0	0	1	0	1	0	0	0	0
		Protzia	0	0	0	0	0	3	0	0	1	2
	Hygrobatidae		1	0	0	0	0	0	0	0	0	0
		Atractides	1	0	0	0	0	0	0	0	0	0
		Hygro bates	0	0	0	0	0	1	0	0	0	0
	Lebertiidae	Lebertia	5	0	0	0	9	4	30	20	34	0
	Sperchontidae	Sperchon	1	0	0	0	5	3	0	0	4	0
		Sperchonopsis	0	0	0	0	0	0	0	0	1	0
	Torrenticolidae	Testudacarus	0	0	0	0	2	0	2	7	0	0
		Torrenticola	1	1	0	0	67	1	2	1	13	2
Anellida-Oligochaeta			2	0	0	0	0	0	0	0	0	0
Anellida-Oligochaeta	Enchytraeidae		0	0	0	0	0	0	1	1	0	0
	Lumbriculidae		3	1	4	3	0	0	0	0	0	0
	Naididae (Tubific	idae)	1	0	0	0	41	0	33	1	1	0

515 428 349 328 472 314 418 987 558 335	515	428	349	328	472	314	418	987	558	335
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Appendix E: Stream Report

# **Preliminary DNA Data**

Elk River, BC Elk River Alliance - Community Based Water Monitoring *March 2021* 

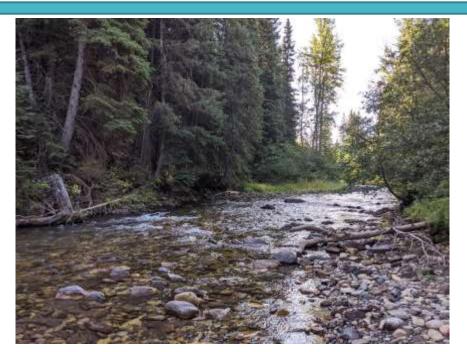


Photo: Alexander Creek. Credit: Elk River Alliance.

## www.STREAM-DNA.com

Hajibabaei Lab, Centre for Biodiversity Genomics, University of Guelph

# **EXAMPLE A REAM**

Environment and Climate Change Canada Living Lakes Canada

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DISCLAIMER: This report is a preliminary report based on the samples and information provided by the corresponding organisation. Identifications of taxa are based on best available information at time of analysis and reporting.

PRELIMINARY DNA DATA

#### 1. INTRODUCTION

1.1.Benthic Macroinvertebrates

Freshwater benthic macroinvertebrates are typically insect orders, as well as crustaceans (e.g. crayfish), gastropods (e.g. snails), bivalves (e.g. freshwater mussels) and oligochaetes (e.g. worms), which are located on or within the benthic substrate of freshwater systems (i.e. streams, rivers, lakes; (Covich et al., 1999; Schmera et al., 2017). Benthic macroinvertebrates occupy important roles in the functioning of freshwater ecosystems, namely nutrient cycling within aquatic food webs and also influence numerous processes including microbial production and release of greenhouse gases (Covich et al., 1999; Schmera et al., 2017).

Biological monitoring (biomonitoring), referring to the collection and identification of particular aquatic species is an effective method for measuring the health status of freshwater systems. Currently, macroinvertebrates are routinely used for biomonitoring studies in freshwater habitats because they are relatively sedentary, have high species richness and a range of responses to different environmental stressors and contaminants, including temperature (Curry et al., 2018; Geest et al., 2010; Rosenberg and Resh, 1993; Sidney et al., 2016). Some groups of macroinvertebrates (mayflies, Ephemeroptera; stoneflies, Plecoptera and caddisflies, Trichoptera), commonly referred to as EPT groups, are more sensitive to change in the aquatic environment and are deemed important bioindicator taxa for assessing freshwater quality (Curry et al., 2018; Hajibabaei et al., 2012, 2011).

Traditionally, macroinvertebrates are identified to family level (**Figure 1**) through morphological identification using microscopy, however there has been a shift from this labour-intensive methodology to a DNA-based approach (Curry et al., 2018; Hajibabaei et al., 2012, 2011). 'Biomonitoring 2.0' combines bulk-tissue DNA collection (i.e. benthos) with next-generation sequencing (NGS), to produce highquality data in large quantities and allows identification to a finer resolution than traditional methods (Baird and Hajibabaei, 2012; Hajibabaei et al., 2012).

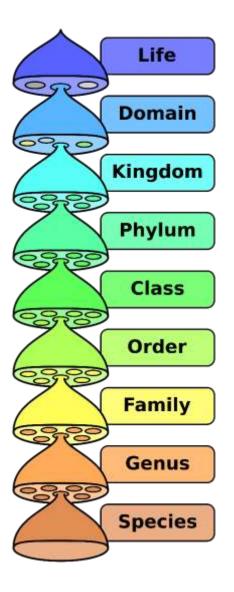


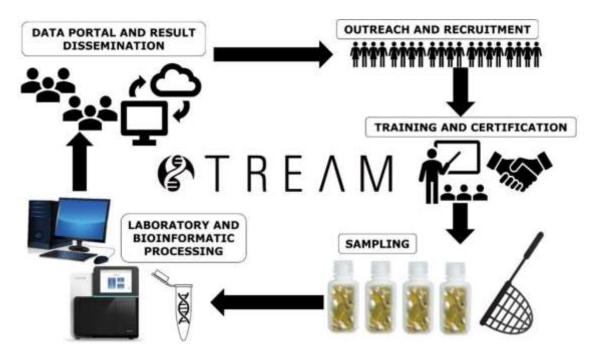
Figure 1. Graphical representation the classification of organisms.

### 1.2. Background of STREAM

STREAM (Sequencing The Rivers for Environmental Assessment and Monitoring), is a biomonitoring project, which involves the combination of community based monitoring and DNA metabarcoding technologies to assess the benthic macroinvertebrate communities in watersheds across Canada (**Figure 2**). STREAM is a collaboration between World Wildlife Fund (WWF) Canada, Living Lakes Canada

(LLC) and Environmental and Climate Change Canada (ECCC), led by the Hajibabaei Lab at Centre for Biodiversity Genomics (University of Guelph, Canada). STREAM is integrated with the Canadian Aquatic Biomonitoring Network (CABIN) programme, through the implementation of existing nationally standardized protocols for freshwater monitoring. The aquatic biodiversity data generated in STREAM will be added to the existing CABIN database, to improve our understanding of the health of Canadian watersheds.

The main objective of STREAM is to generate baseline benthic macroinvertebrate DNA data from across Canada. To understand the health status of freshwater systems, we first need to understand the natural fluctuations and trends of benthic macroinvertebrates, especially in locations which are data deficient. By building this baseline, in years to come we can investigate the longer-term trends and begin to understand the impact of issues, such as climate change, on freshwater systems. STREAM was established with the main premise of fast-tracking the generation of benthic macroinvertebrate data from 12-18 months to ~2 months, while increasing the taxonomic resolution of the data produced.



**Figure 2.** Graphical representation of the STREAM collaborative workflow for DNA biomonitoring of benthic invertebrates.

PRELIMINARY DNA DATA

### 1.3. Objective of Report

Data and information included in this report is a preliminary examination of results from the Elk River (BC), which consists of a list of the macroinvertebrate taxa detected within the samples submitted. This report aims to highlight the different macroinvertebrate EPTO taxa and provide basic richness metrics as a useful contribution for community groups to assess river health

#### 1.4. Study Objective

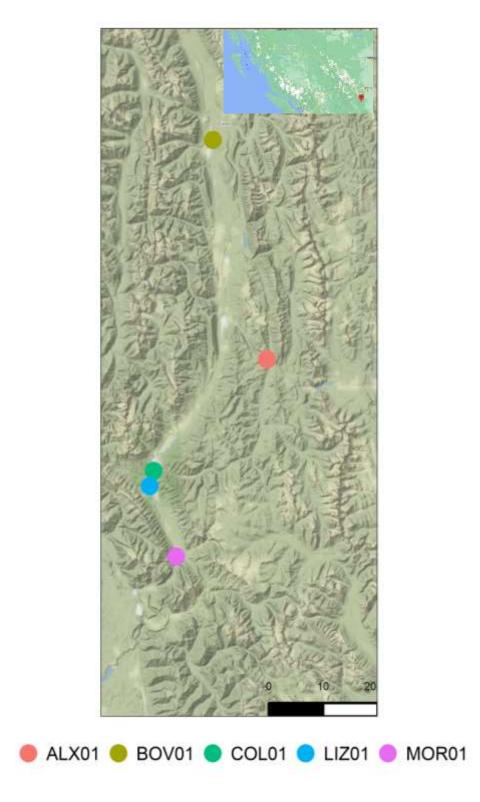
Community-based water monitoring (CBWM) groups collected baseline Elk River tributary habitat data to increase community water literacy and understanding of the Elk River Watershed. Monitoring and research is conducted by trained staff and volunteers and presented in easily understood terminology to the community, including updates on the current status of aquatic health and concerns regarding future trends. Community members are educated through the sharing of data to the public at annual workshops, summer markets (suspended in 2020 due to COVID-19), direct participation with the program, and mixed media reporting. This increases water literacy and opens a two-way dialogue with residents to discuss community concerns regarding watershed health.

# 2. METHODOLOGY

2.1. Study Area

In September 2020, this study was conducted across 5 pre-determined sampling locations within Elk River (BC; Figure 3). Sampling was conducted by Elk River Watershed Alliance for benthic macroinvertebrate monitoring with STREAM.

Additional site information, including coordinates, and number of samples collected is provided in Appendix A



**Figure 3. Map of sampling locations within the Elk River (BC).** Inset map (top right) shows location of sampling area with respect to BC. Scale bar shown in kilometres.

# 2.2. DNA Sampling and Processing Methods

### 2.2.1. Measures to Avoid DNA Contamination

Prior to sampling, kick-nets were sanitized in bleach for 45 minutes and kept in clean garbage bags until they were used in the field. Gloves were used when handling all sampling materials to avoid contamination. During the kick-netting, the surveyor in the water wore two pairs of gloves while handling the kick-net. The outer pair of gloves was removed prior to transferring the contents into sampling containers so that the gloves used when contacting the sample were guaranteed to be clean. Each sampling container was individually sealed in a Ziploc bag prior to placing them in the cooler.

## 2.2.2. Benthic Macroinvertebrate Field Sampling Protocol

Benthic macroinvertebrate DNA samples were collected following the STREAM Procedure for collecting benthic macroinvertebrate <u>DNA samples in wadeable</u> <u>streams (v1.0 June 2019)</u> and the CABIN Field Manual for Wadeable Streams (2012). The STREAM procedure outlines steps to minimize DNA contamination and preserve DNA samples and was employed in conjunction with sampling steps outlined in the CABIN manual. All samples collected were transported to the University of Guelph Centre for Biodiversity Genomics.

# 2.2.3. Laboratory Methods

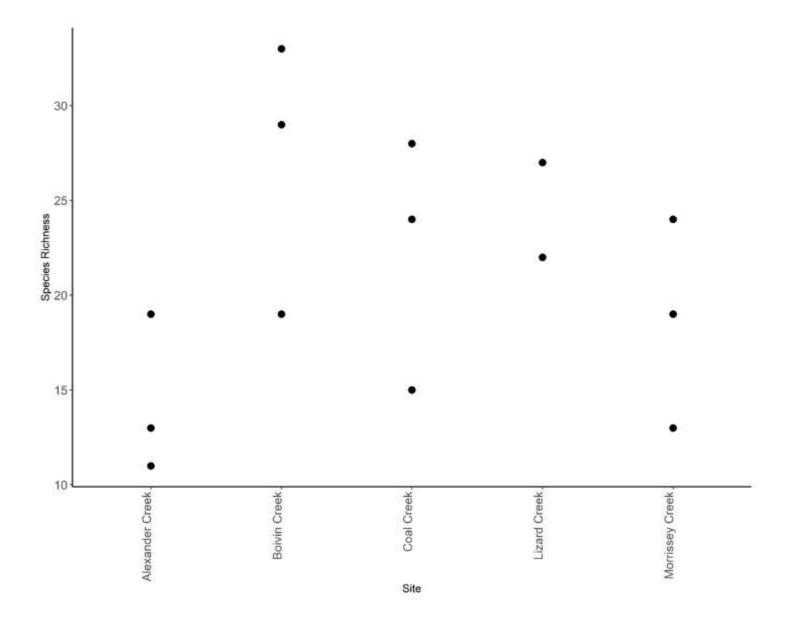
Benthic samples were preserved in alcohol and stored at -20°C until processing. Benthic samples were coarsely homogenized in a sterile blender and DNA was extracted using a DNeasy® PowerSoil® kit (Qiagen, CA) kit. Extracted DNA was then processed following the standard Hajibabaei Lab protocol for Next-Generation Sequencing (NGS). Sequences were then processed through the MetaWorks (v1.3.4) pipeline: <u>https://github.com/terrimporter/MetaWorks</u>.

### 3. RESULTS

3.1. Overview

The raw data output from NGS produced sequences for a range of taxa. This taxa list was reduced to only sequences that identified macroinvertebrates

associated with freshwater and riparian ecosystems, and that were of high enough quality to match reference sequences. These results consisted of **74 Orders**, **71 Families**, **100 Genera**, **and 112 species of macroinvertebrates**. After normalizing, species richness (number of species present) ranged from an average of 14 in Alexander Creek to an average of 27 in Boivin Creek (**Figure 4**). A full taxonomic list identified to the raw genus and species level for macroinvertebrates is included as a separate Excel spreadsheet (RP45\_Taxonomy).



**Figure 4. Species richness of each site sampled.** Each replicate plotted separately. Only species taxonomically assigned with high confidence (bootstrap support >= 0.70) are included. Based on normalized data.

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PRELIMINARY DNA DATA
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### 3.2. Taxonomic Coverage

A range of macroinvertebrate species were detected. Traditional bioindicator EPTO species were detected across the sampling sites, including Ephemeroptera (mayflies), Plecoptera (stoneflies), Trichoptera (caddisflies) and Odonata (dragonflies and damselflies; **Table 1**). Some families of these EPTO groups are typically sensitive to many pollutants in the stream environment and are therefore associated with clean water (Gresens et al., 2009; Laini et al., 2019; Loeb and Spacie, 1994).

Please refer to the 'Macroinvertebrate Bioindicator Families Guide v1.2' attached with your data or visit the corresponding website <u>here</u> for more information on approximate tolerances for the species detected in your sites.

Note: The benthic macroinvertebrate kick-net sample procedure often results in collection of both aquatic and terrestrial taxa, however terrestrial taxa are not identified using the traditional taxonomic identification methods. Due to the nature of DNA metabarcoding, both terrestrial and aquatic macroinvertebrates are identified and described using the DNA approach in this report.

Table 1. List of macroinvertebrates identified to the species level. P = present; (T) = terrestrial. Grey cells indicate absence. Highlighted in blue are the traditional EPT bioindicator orders present and highlighted in orange is the species *Tubifex tubifex*, a known Whirling Disease host. Site names for each column refer to site code (see Appendix A). Only species taxonomically assigned with high confidence (bootstrap support >= 0.70) are included. Replicates are pooled.

Order	Family	Family Description	Species	ALX01	BOV01	COL01	LIZ01	MOR01
Anthoathecata	Hydridae	Freshwater hydra	Hydra utahensis				Р	
Araneae	Linyphiidae	Sheetweb and dwarf spiders (T)	Aphileta microtarsa			Р		
Coleoptera	Chrysomelidae	Leaf beetles (T)	Donacia clavipes			Р	Р	
Coleoptera	Curculionidae	True weevils (T)	Polygraphus rufipennis		Р			
Diptera	Chironomidae	Non-biting midges	Conchapelopia pallens			Р		
Diptera	Chironomidae	Non-biting midges	Eukiefferiella claripennis					Р
Diptera	Chironomidae	Non-biting midges	Micropsectra polita	Р				
Diptera	Chironomidae	Non-biting midges	Micropsectra subletteorum					Р
Diptera	Chironomidae	Non-biting midges	Pagastia orthogonia					Р
Diptera	Chironomidae	Non-biting midges	Polypedilum albicorne				Р	
Diptera	Chironomidae	Non-biting midges	Polypedilum tuberculum		Р			
Diptera	Limoniidae	Limoniid crane flies	Limonia nubeculosa	Р				
Diptera	Simuliidae	Black flies	Prosimulium travisi					Р
Diptera	Simuliidae	Black flies	Simulium apricarium			Р		
Diptera	Simuliidae	Black flies	Simulium arcticum		Р	Р		
Diptera	Simuliidae	Black flies	Simulium chromatinum			Р		
Diptera	Simuliidae	Black flies	Simulium defoliarti		Р			
Diptera	Simuliidae	Black flies	Simulium negativum		Р	Р		
Diptera	Simuliidae	Black flies	Simulium saxosum			Р		
Diptera	Simuliidae	Black flies	Simulium tuberosum		Р	Р		Р
Diptera	Tipulidae	Craneflies	Tipula abdominalis	Р				
Enchytraeida	Enchytraeidae	Potworms (T)	Enchytraeus buchholzi		Р			
Ephemeroptera	Ameletidae	Combmouthed minnow mayflies	Ameletus celer				Р	
Ephemeroptera	Ameletidae	Combmouthed minnow mayflies	Ameletus cooki					Р
Ephemeroptera	Baetidae	Small minnow mayflies	Acentrella turbida				Р	Р
Ephemeroptera	Baetidae	Small minnow mayflies	Baetis bicaudatus	Р	Р	Р	Р	
Ephemeroptera	Baetidae	Small minnow mayflies	Baetis phoebus		Р	Р		Р

		Small minnow						
Ephemeroptera	Baetidae	mayflies	Baetis tricaudatus		Р	Р	Р	Р
		Spiny crawler						
Ephemeroptera	Ephemerellidae	mayflies	Drunella coloradensis	Р	Р	Р	Р	
Enhomorontora	Enhomorollidae	Spiny crawler	Drunella doddsii	Р	Р	Р	Р	Р
Ephemeroptera	Ephemerellidae	mayflies Spiny crawler		F	F	Г	Г	Г
Ephemeroptera	Ephemerellidae	mayflies	Drunella flavilinea		Р	Р	Р	Р
		Spiny crawler						
Ephemeroptera	Ephemerellidae	mayflies	Drunella grandis		Р	Р		Р
		Spiny crawler			_			
Ephemeroptera	Ephemerellidae	mayflies	Drunella spinifera		Р			
Ephemeroptera	Ephemerellidae	Spiny crawler mayflies	Ephemerella subvaria				Р	
Ephemeroptera	Lphemereindae	Spiny crawler						
Ephemeroptera	Ephemerellidae	mayflies	Ephemerella tibialis		Р	Р		Р
	•	Flat-headed						
Ephemeroptera	Heptageniidae	mayflies	Cinygmula spJMW3	Р	Р	Р	Р	
		Flat-headed		_	_	_	_	
Ephemeroptera	Heptageniidae	mayflies	Epeorus deceptivus	Р	Р	Р	Р	
Ephemeroptera	Heptageniidae	Flat-headed mayflies	Epeorus grandis	Р	Р		Р	
Ephemeroptera	Tieptagemidae	Flat-headed	Epeorus grunuis	r	r		-	
Ephemeroptera	Heptageniidae	mayflies	Epeorus longimanus				Р	
· ·		Flat-headed						
Ephemeroptera	Heptageniidae	mayflies	Maccaffertium vicarium		Р			
		Flat-headed		_	_		_	_
Ephemeroptera	Heptageniidae	mayflies	Rhithrogena robusta	Р	Р		Р	Р
Ephemeroptera	Leptophlebiidae	Prong-gilled mayflies	Paraleptophlebia heteronea		Р	Р		Р
Ephemeroptera	Leptophiebhuae	Prong-gilled	Paraleptophlebia			•		1
Ephemeroptera	Leptophlebiidae	mayflies	memorialis			Р	Р	
- · ·		Primitive minnow						
Ephemeroptera	Siphlonuridae	mayflies	Siphlonurus occidentalis				Р	
Haplotaxida	Lumbricidae	Earthworms (T)	Dendrodrilus rubidus				Р	
Haplotaxida	Lumbricidae	Earthworms (T)	Eiseniella tetraedra				Р	
Haplotaxida	Naididae	Oligochaete worms	Nais bretscheri		Р			Р
Haplotaxida	Naididae	Oligochaete worms	Nais communis					Р
Haplotaxida	Naididae	Oligochaete worms	Tubifex tubifex		Р			
Hemiptera	Aphididae	Aphids (T)	Euceraphis papyrifericola				Р	
			Camponotus					
Hymenoptera	Formicidae	Ants (T)	novaeboracensis				Р	
Hymenoptera	Formicidae	Ants (T)	Lasius flavus		Р			
Hymenoptera	Formicidae	Ants (T)	Lasius niger		Р			
Hymenoptera	Formicidae	Ants (T)	Lasius pallitarsis				Р	
Lepidoptera	Noctuidae	Owlet moths (T)	Raphia frater					Р
		Prominent moths						
Lepidoptera	Notodontidae	(T)	Schizura unicornis					Р
Lepidoptera	Pyralidae	Snout moths (T)	Oreana unicolorella				Р	
Opiliones	Phalangiidae	Harvestmen (T)	Oligolophus tridens				Р	
<b>a</b>		Parasitic						
Plagiorchiida	Plagiorchiidae	trematodes	Plagiorchis maculosus	Р				

		Small winter						
Plecoptera	Capniidae	stoneflies	Capnia coloradensis				Р	
		Small winter						
Plecoptera	Capniidae	stoneflies	Capnia gracilaria				Р	
		Small winter						
Plecoptera	Capniidae	stoneflies	Eucapnopsis brevicauda		Р	Р	Р	Р
		Small winter					Р	
Plecoptera	Capniidae	stoneflies Small winter	Utacapnia columbiana				r	
Plecoptera	Capniidae	stoneflies	Utacapnia logana					Р
Plecoptera	Chloroperlidae	Green stoneflies	Alloperla serrata	Р				
Plecoptera	Chloroperlidae	Green stoneflies	Paraperla frontalis		Р	Р		
Plecoptera	Chloroperlidae	Green stoneflies	Plumiperla diversa		Р		Р	
Plecoptera	Chloroperlidae	Green stoneflies	Sweltsa borealis		P		P	
Plecoptera	Chloroperlidae	Green stoneflies	Sweltsa coloradensis					Р
Plecoptera	Chloroperlidae	Green stoneflies	Sweltsa urticae	Р				
Fiecoptera	Chloropenidae	Rolled-winged	Sweitsa articae					
Plecoptera	Leuctridae	stoneflies	Paraleuctra occidentalis	Р	Р	Р	Р	
Plecoptera	Nemouridae	Spring stoneflies	Prostoia besametsa		Р	Р	Р	
Plecoptera	Nemouridae	Spring stoneflies	Visoka cataractae				Р	
Plecoptera	Nemouridae	Spring stoneflies	Zapada cinctipes	Р	Р	Р	Р	Р
Plecoptera	Nemouridae	Spring stoneflies	Zapada columbiana	Р	Р	Р	Р	Р
Plecoptera	Nemouridae	Spring stoneflies	Zapada haysi	Р	Р	Р	Р	
Plecoptera	Nemouridae	Spring stoneflies	Zapada oregonensis	P	P	P		
Plecoptera	Perlidae	Common stoneflies	Doroneuria theodora	P	P	P	Р	Р
Plecoptera	Perlidae	Common stoneflies	Hesperoperla pacifica	<u> </u>	•	•	P	P
Plecoptera	Perlodidae	Springflies	Isoperla petersoni		Р		P	
Plecoptera	Perlodidae	Springflies	Kogotus modestus		P	Р	P	
Plecoptera	Periodidae	Springflies	Megarcys signata	Р	-	•	P	
Plecoptera	Periodidae	Springflies	Megarcys watertoni	P	Р	Р	P	
· · · ·				P	-	1	P	
Plecoptera	Perlodidae	Springflies	Setvena bradleyi	F			r -	Р
Plecoptera	Pteronarcyidae Taeniopterygida	Giant stoneflies	Pteronarcys princeps					P
Plecoptera	e	Winter stoneflies	Doddsia occidentalis	Р	Р	Р	Р	
	Taeniopterygida							
Plecoptera	е	Winter stoneflies	Taenionema pallidum				Р	
Plectida	Plectidae	Worms	Plectus aquatilis		Р		Р	Р
Psocoptera	Peripsocidae	Stout barklice (T)	Peripsocus subfasciatus				Р	
		Early smoky wing						
Trichoptera	Apataniidae	sedges	Apatania comosa		Р	Р		Р
Trichentera	Anataniidaa	Early smoky wing	Anatania corov		Р	Р		Р
Trichoptera	Apataniidae	sedges Humpless	Apatania sorex		F	г		
		casemaker	Brachycentrus					
Trichoptera	Brachycentridae	caddisflies	americanus					Р
		Humpless						
<b>-</b> · · · ·		casemaker				-		
Trichoptera	Brachycentridae	caddisflies Saddle casemaker	Micrasema bactro			Р		Р
Trichoptera	Glossosomatidae	caddisflies	Glossosoma alascense				Р	
menopicia	Siossosoniatidae	ouddistiles	clossesenta alasterise					

ossosomatidae	caddisflies	-					
	caudistiles	Glossosoma pyroxum		Р	Р		
	Saddle casemaker						
ossosomatidae	caddisflies	Glossosoma verdonum	Р				
	Net-spinning						
dropsychidae	caddisflies	Arctopsyche grandis		Р	Р	Р	Р
	Net-spinning						
dropsychidae	caddisflies	Ceratopsyche oslari		Р	Р	Р	Р
	Net-spinning			_	_	_	
	caddisflies	Parapsyche elsis	Р	Р	Р	Р	
pidostomatida					_		
	Bizarre caddisflies	Lepidostoma pluviale			Р		Р
pidostomatida					-		
		Lepidostoma rayneri			Р		Р
	-						
otoceridae		Oecetis inconspicua	Р				
					-		
nnephilidae		Onocosmoecus unicolor			Р		
:	•	Delevelitedes energie				<b>_</b>	
liopotamidae		Dolophilodes dequalis				Р	
u a a sa la ili al a a	U	Dhursenhile encelite					Р
yacoprinidae							
vacanhilidaa	-	Physicaphila bruppag		D			Р
yacopinnuae				ſ			
vaconhilidae	0	Rhvaconhila nellisa		Р			
yacopinidae							
vacophilidae	-	Rhvaconhila vaccua		Р			
7.0000							
yacophilidae	caddisflies	Rhyacophila vao				Р	
· ·							Р
	dropsychidae dropsychidae dropsychidae oidostomatida oidostomatida otoceridae nephilidae yacophilidae yacophilidae yacophilidae	Net-spinning caddisfliesdropsychidaecaddisflieshet-spinning caddisfliesNet-spinning caddisfliesdropsychidaecaddisfliesbidostomatidaBizarre caddisfliesbidostomatidaBizarre caddisfliesbidostomatidaBizarre caddisfliesbidostomatidaBizarre caddisfliesbidostomatidaBizarre caddisfliesbidostomatidaBizarre 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### 3.2. Whirling Disease Host Detection

Whirling Disease is a disease caused by *Myxobolus cerebralis*, a microscopic parasite that affects salmonid fish such as trout, salmon and whitefish (Gilbert and Granath, 2003). *M. cerebralis* requires a specific aquatic oligochaete (worm) intermediate host, *Tubifex tubifex* (sludge worm). This species is most commonly associated with poor-quality, eutrophic conditions (Gilbert and Granath, 2003).

While there are still <u>no documented cases of Whirling disease in BC</u>, it has been confirmed in several locations in Alberta near the BC border. Across the five sites sampled, *T. tubifex* was detected exclusively at BOV01 (Boivin Creek; **Table 1**). If the whirling disease causal agent was to spread into BC, this would be a high-risk site for a whirling disease outbreak.

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#### 5. APPENDICES

**Appendix A.** Summary table of sample sites, including site name, date of collection and site coordinates.

Site	Site name	Sample collection	Number of replicates	Latitude	Longitude
ALX01	Alexander Creek	September 2020	3	49.67394	-114.78
BOV01	Boivin Creek	September 2020	3	50.02315	-114.916
COL01	Coal Creek	September 2020	3	49.49556	-115.066
LIZ01	Lizard Creek	September 2020	3	49.47094	-115.077
MOR01	Morrissey Creek	September 2020	3	49.35806	-115.009

# 6. GLOSSARY

Term	Meaning
Benthic/benthos	The ecological region at the lowest level of a body of
	water such as an ocean, lake, or stream, including the
	sediment surface and some sub-surface layers.
Biomonitoring	The science of inferring the ecological condition of an
	ecosystem (i.e. rivers, lakes, streams, and wetlands) by
	examining the organisms that live there.
Bootstrap support	Statistical methods used to evaluate and distinguish the
	confidence of results produced.
Bulk-tissue DNA	This refers to the collection and removal of a reasonable
sample	quantity of representative material (including organisms
	such as river bugs) from a location (i.e. river bed).
DNA extraction	Isolation of DNA from either the target organism (i.e. DNA
	from an insect leg) or from an environmental sample (i.e.
	DNA from a water or benthos sample).
DNA Metabarcoding	Amplification of DNA using universal barcode primers (e.g.
	universal for invertebrates) to allow sequencing of DNA
	from target organisms (e.g. invertebrates) from
	environmental samples (e.g. river water or benthos).
Environmental DNA	The DNA released into the environment through faeces,
(eDNA)	urine, gametes, mucus, etc. eDNA can result from the
	decomposition of dead organisms. eDNA is characterized by
	a complex mixture of nuclear, mitochondrial or chloroplast
	DNA, and can be intracellular (from living cells) or
	extracellular. Environmental DNA: DNA that can be
	extracted from environmental samples (such as soil, water,

	or air), without first isolating any target organisms.
EPT groups	The three orders of aquatic insects that are common in
	the benthic macroinvertebrate community:
	Ephemeroptera (mayflies), Plecoptera (stoneflies), and
	Trichoptera (caddisflies).
Macroinvertebrate	Organisms that lack a spine and are large enough to be
	seen with the naked eye. Examples of macro-
	invertebrates include flatworms, crayfish, snails, clams
	and insects, such as dragonflies.
Metrics	The method of measuring something, or the results
	obtained from this.
Next-generation	Use of next-generation sequencers (i.e. Illumina) to
sequencing (NGS)	millions or billions of DNA strands in parallel.
Normalizing	The process of rarefying samples down to the smallest
	library size - a common practice in DNA metabarcoding
	methods.
Richness	The number of species represented in an ecological
	community, landscape or region. Species richness is
	simply a count of species, and it does not take into
	account the abundances of the species or their relative
	abundance distributions.
Riparian	Relating to or situated on the banks of a river.
Sample	The process of making an environmental sample (i.e.
homogenization	benthos) uniform. For liquid/benthos samples, this often
	involves mixing using a blender so that DNA is evenly
	distributed within the sample.
Таха	Unit used in the science of biological classification, or
	taxonomy.