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 ʔamakʔis Ktunaxa, the Traditional Territory of the Ktunaxa Nation.

For more than 10,000 years, the Ktunaxa people have occupied their traditional territory, the ʔamakʔis 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 ʔamakʔis, 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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Acknowledgements - 2020

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

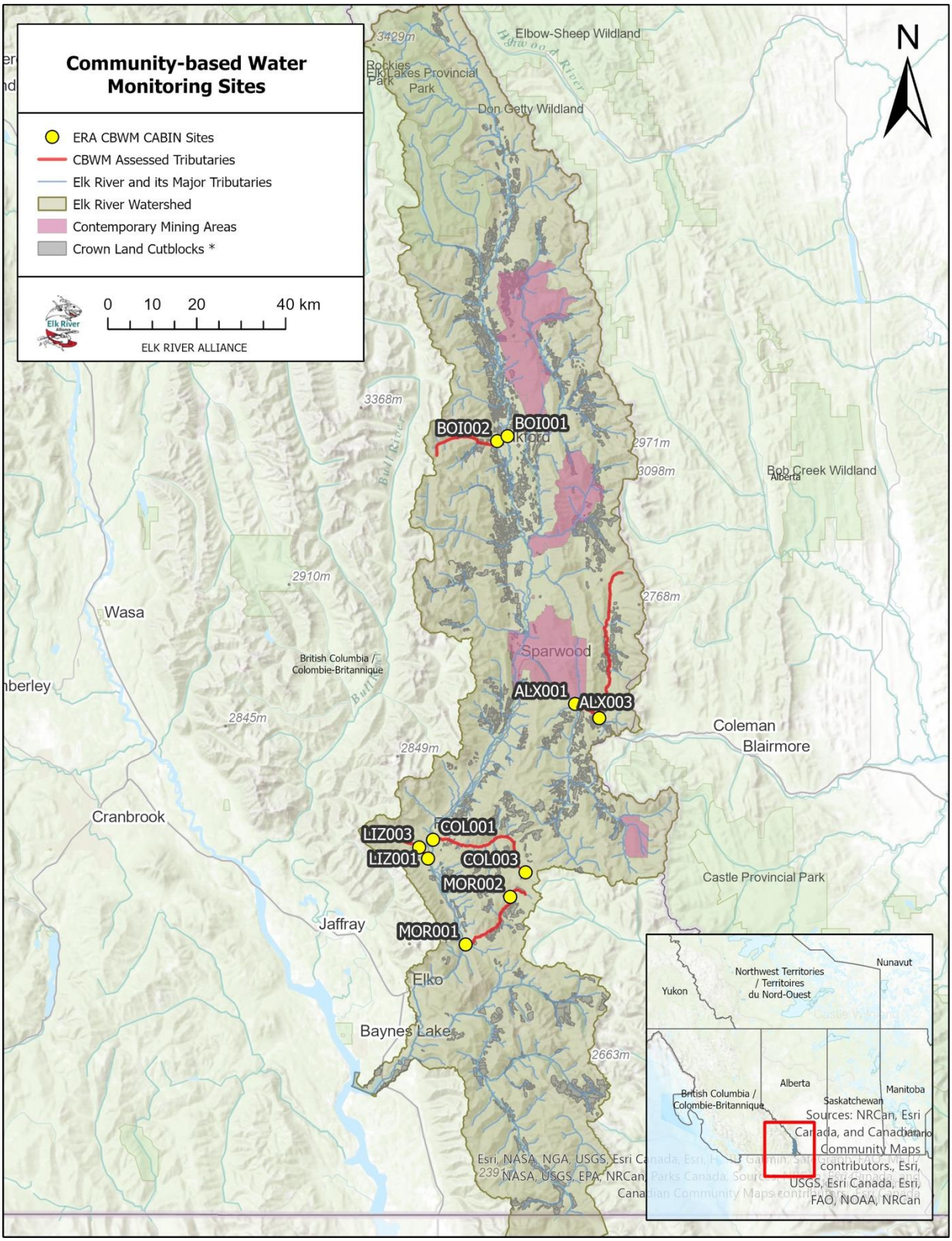

Figure 1. Elk River watershed (British Columbia) and CBWM site locations. ERA sites are chosen based on community concern and focus largely non-mine affected tributaries. 2020 study locations include Boivin Creek, Alexander Creek, Lizard Creek, Coal Creek and Morrissey Creek.

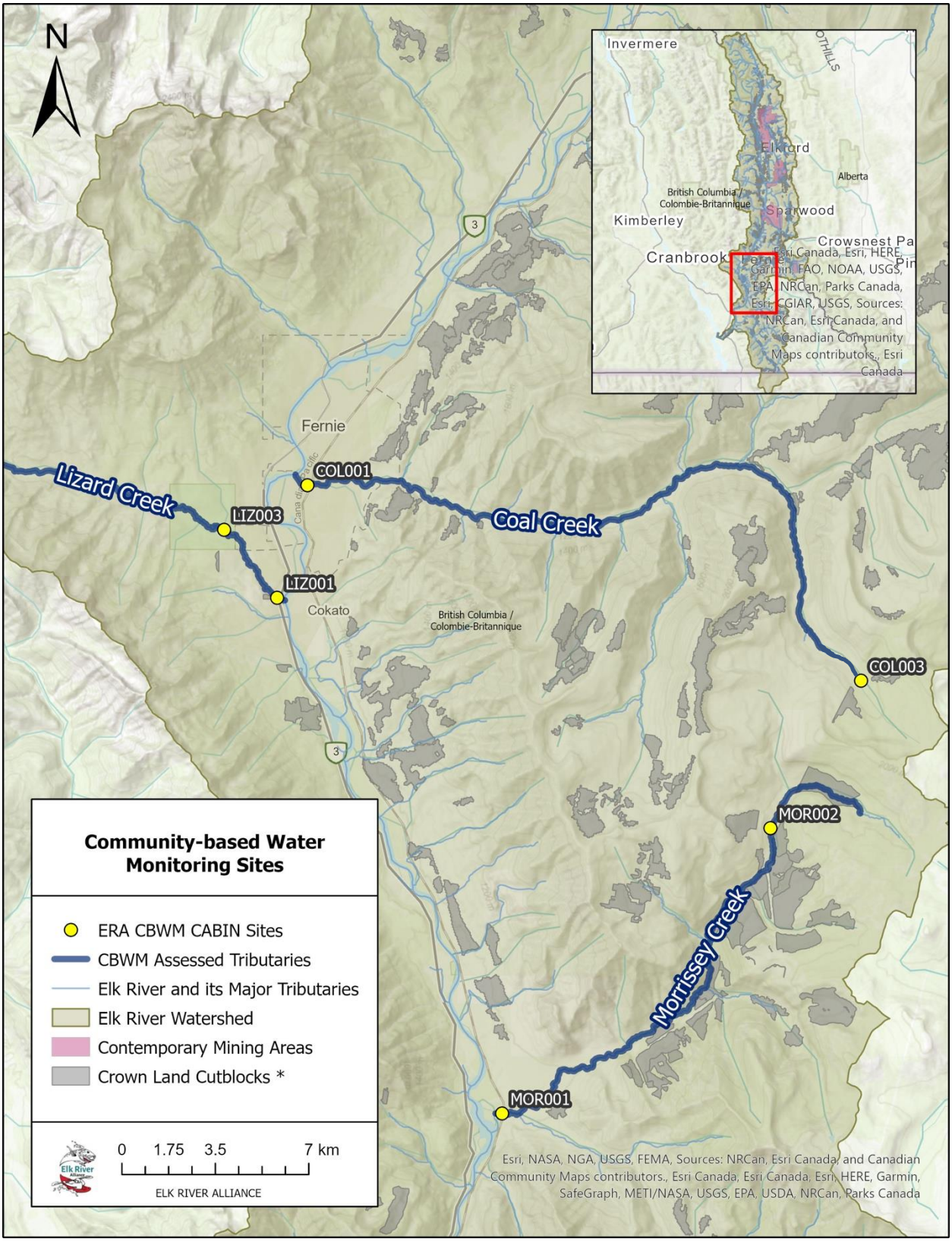

Figure 2. Close-up of Lizard Creek (LIZ001, LIZ003), Coal Creek (COL001, COL003) and Morrissey Creek (MOR001, MOR002), the southern-most study sites in the CBWM program.

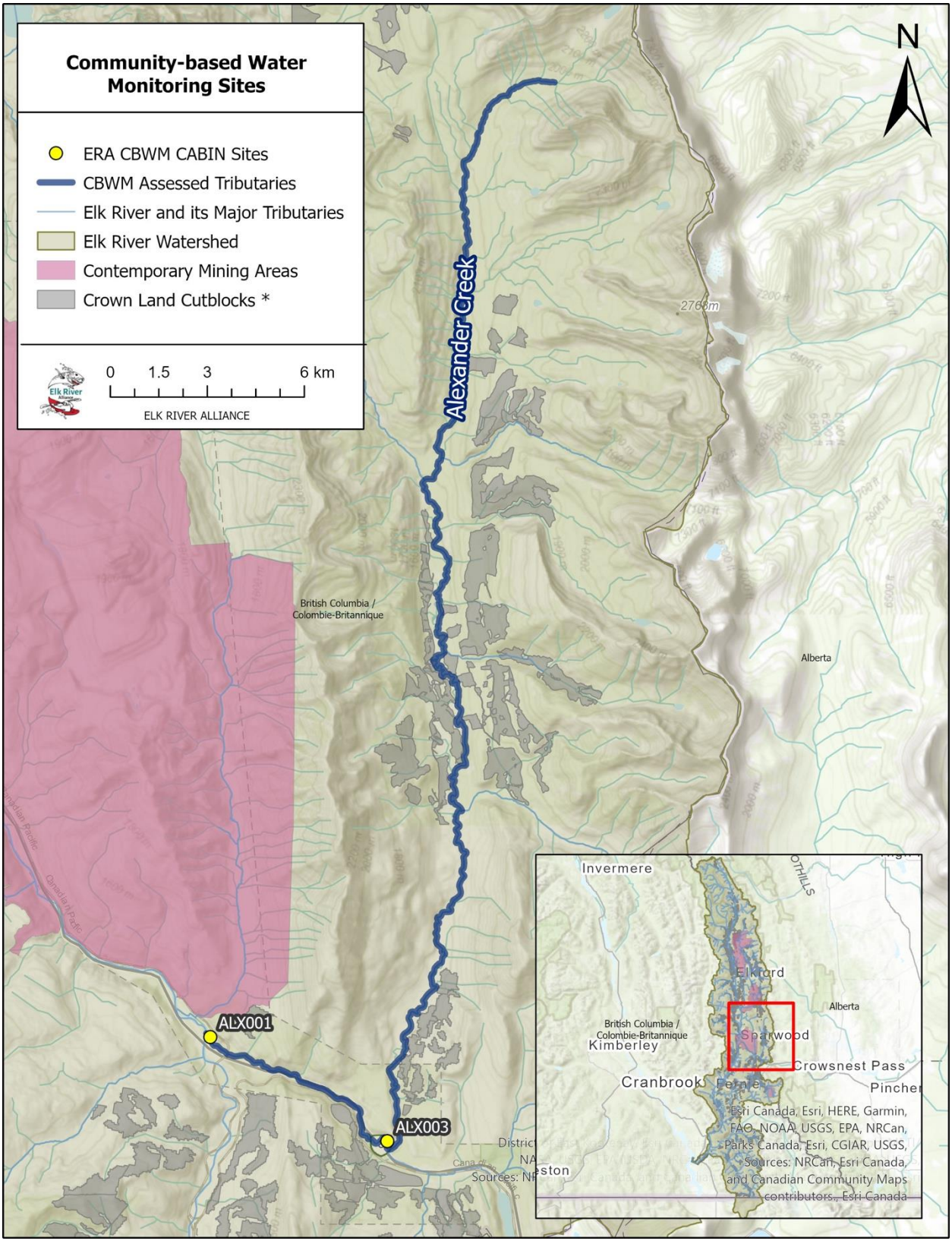

Figure 3. Alexander Creek site locations (ALX001, ALX003), just East of Sparwood, BC.

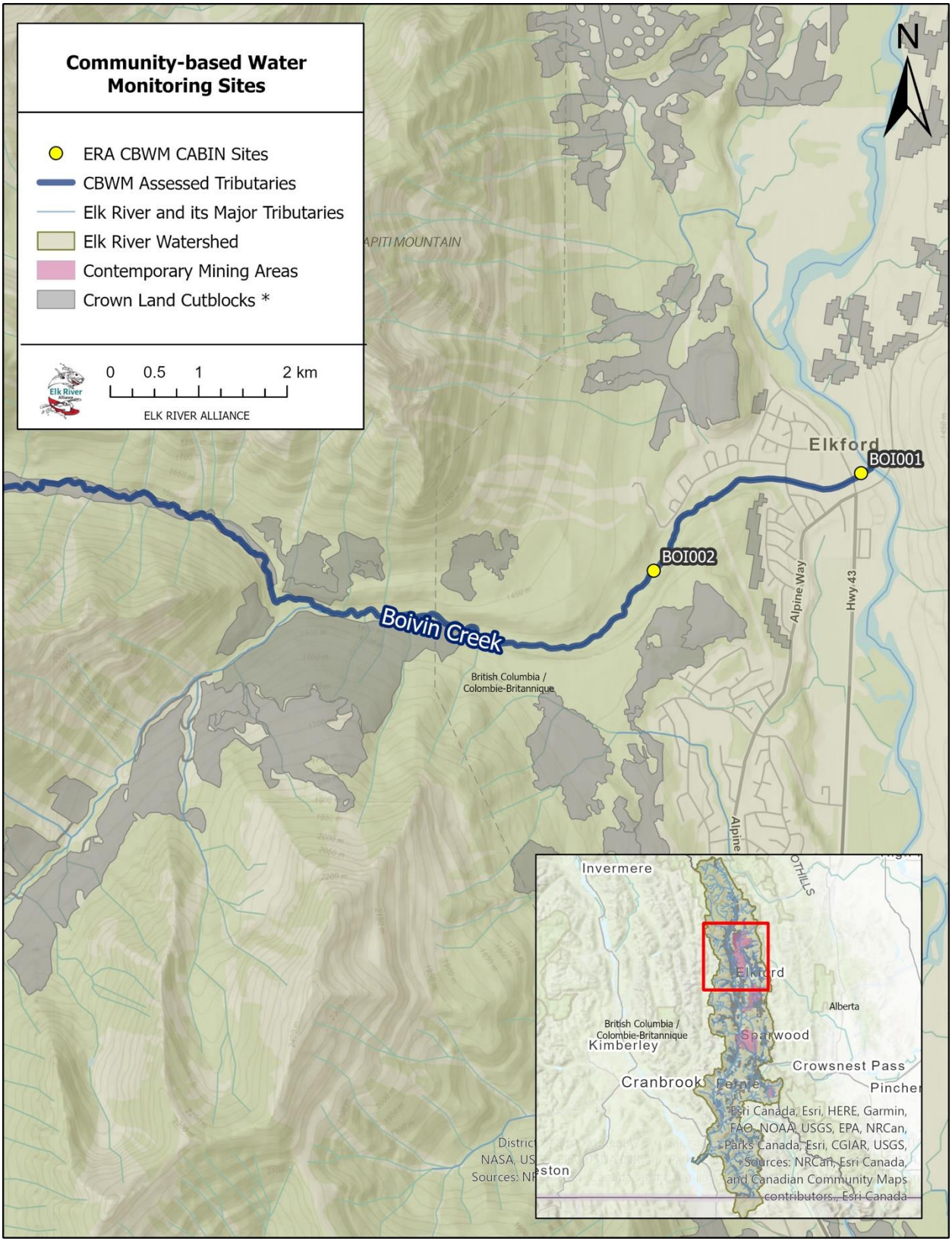

Figure 4. CBWM sites (BOI001, BOI002) on Boivin Creek in Elkford.

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.

BOI002

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).

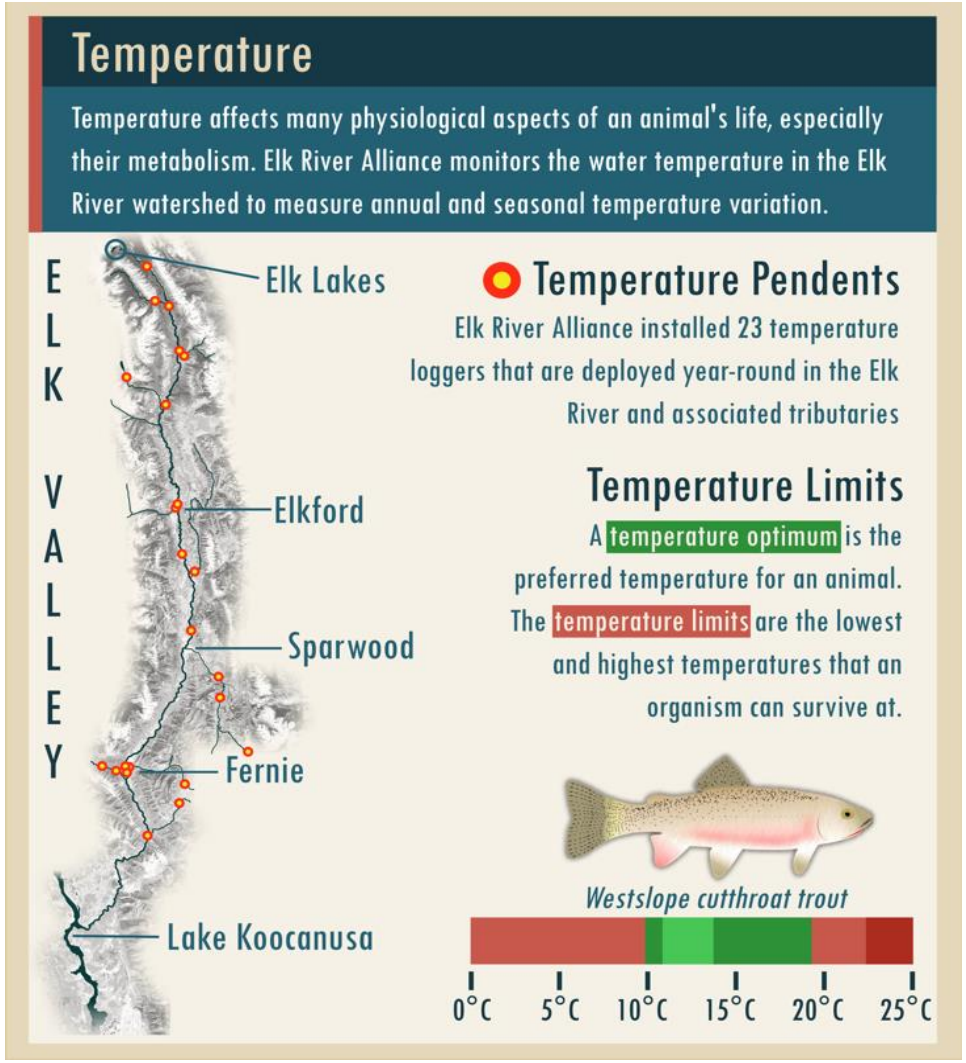

Figure 15. ERA Infographic outlining the importance of temperature to aquatic systems.

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)

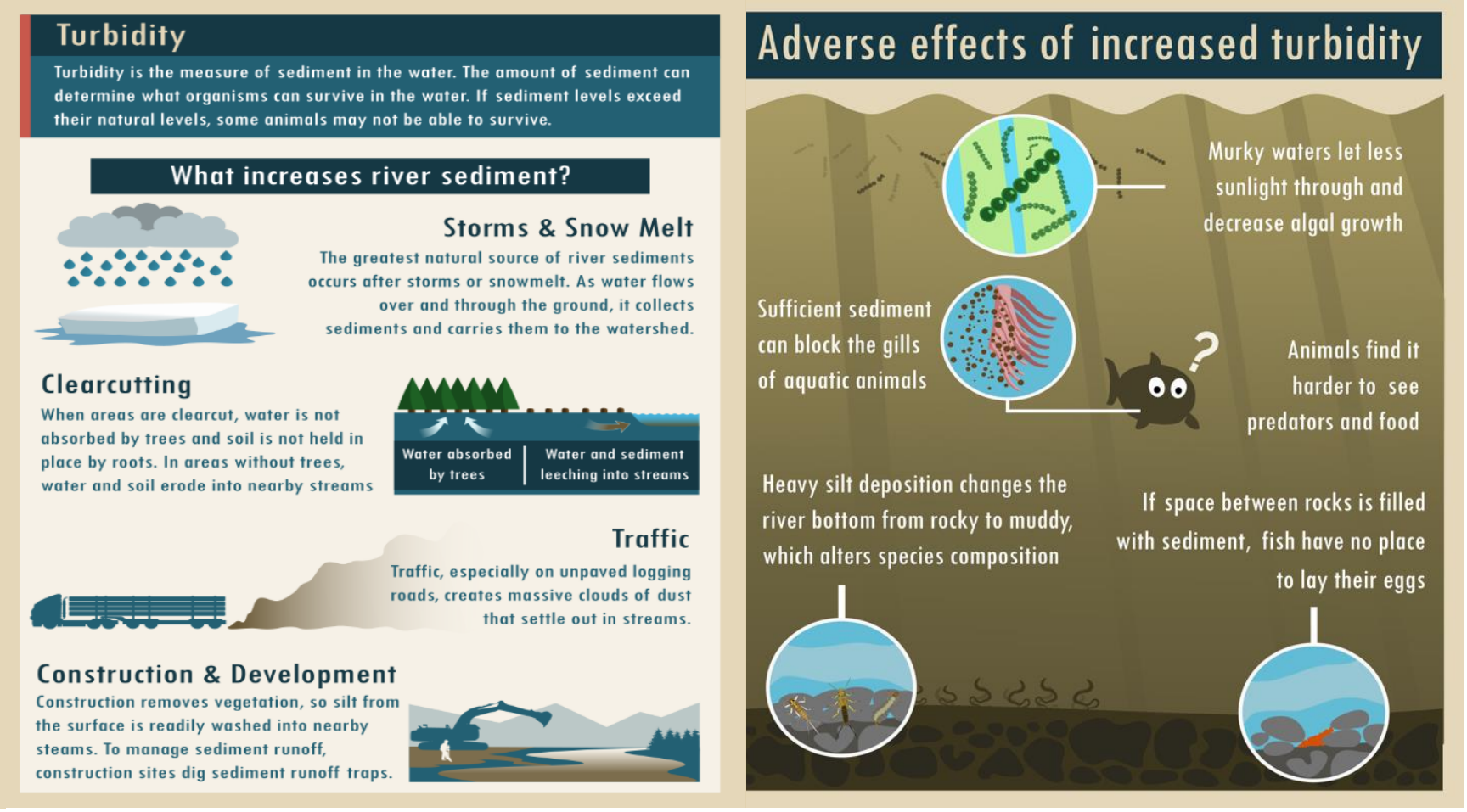

Figure 16. ERA CBWM inforgraphic explaining turbidity and its importance.

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 limestone-based 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

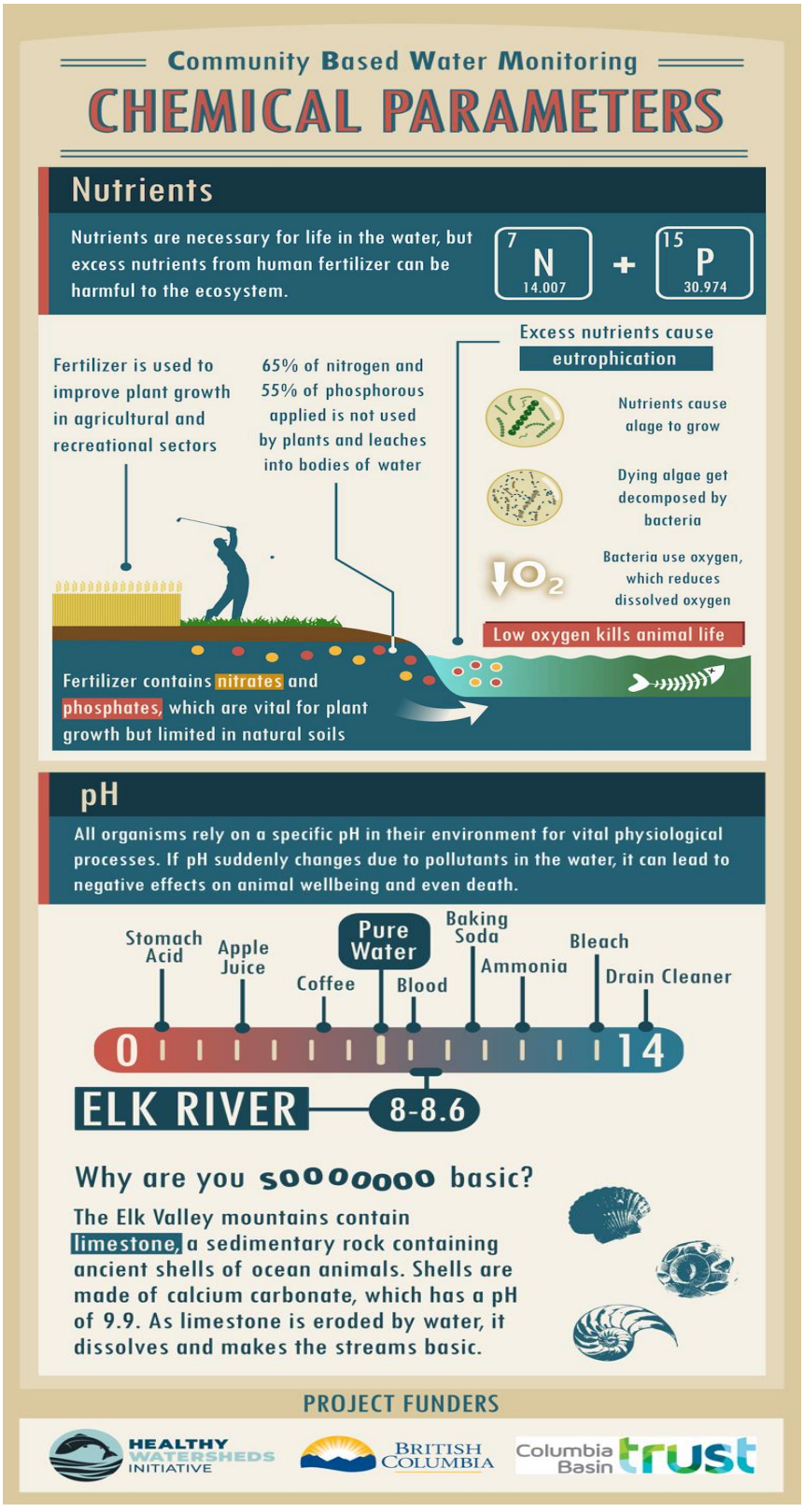

Figure 17. ERA infographic on chemical parameters associated with the CBWM program.

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 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. 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 (*Hirudin*ea) 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.

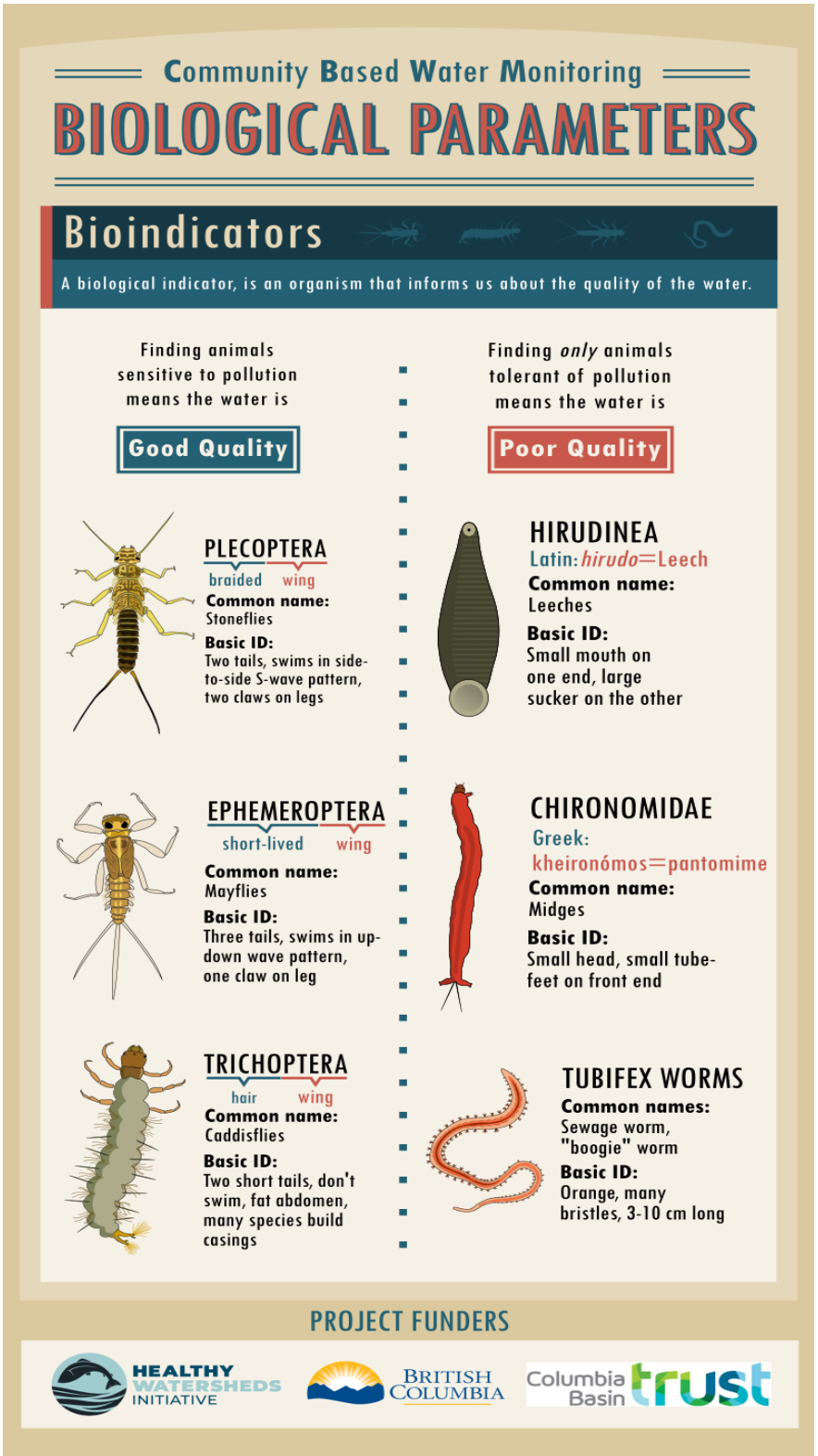

Figure 18. ERA infographic outlining the biological parameters associated with the CBWM program.

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 10th 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.

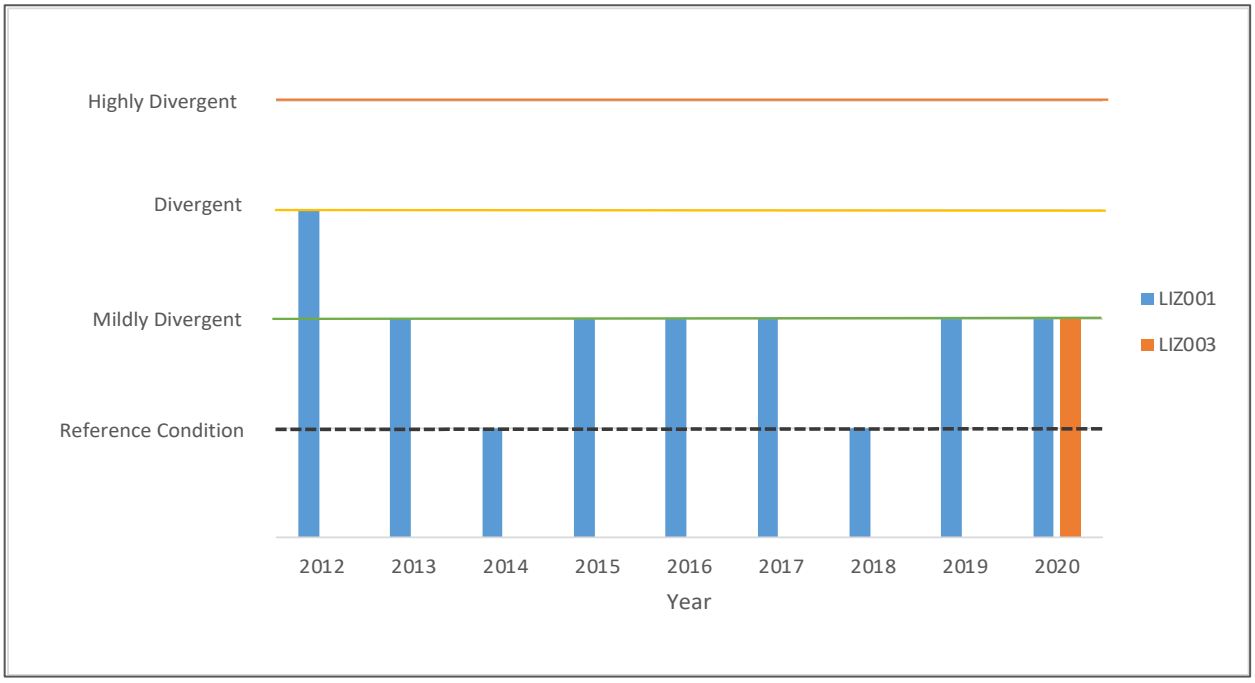

Figure 19. CABIN analysis results for Lizard Creek sites from 2012 – 2020.

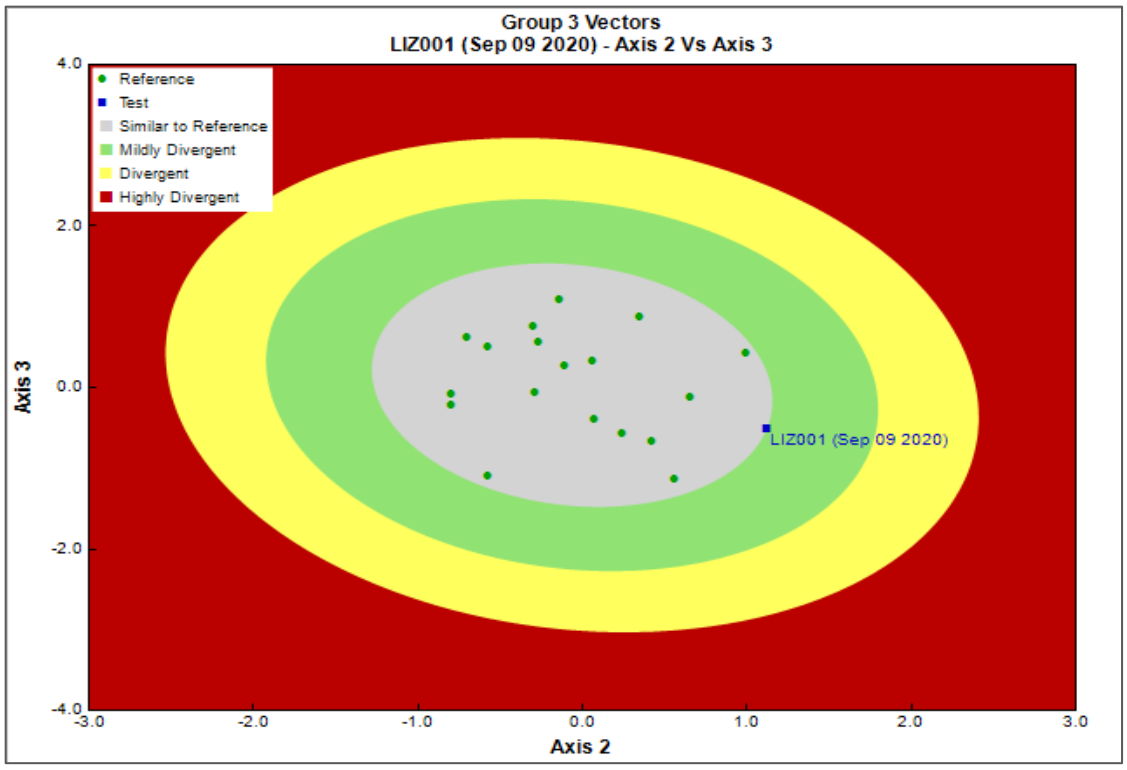

Figure 20. CABIN community ellipses for LIZ001 in 2020.

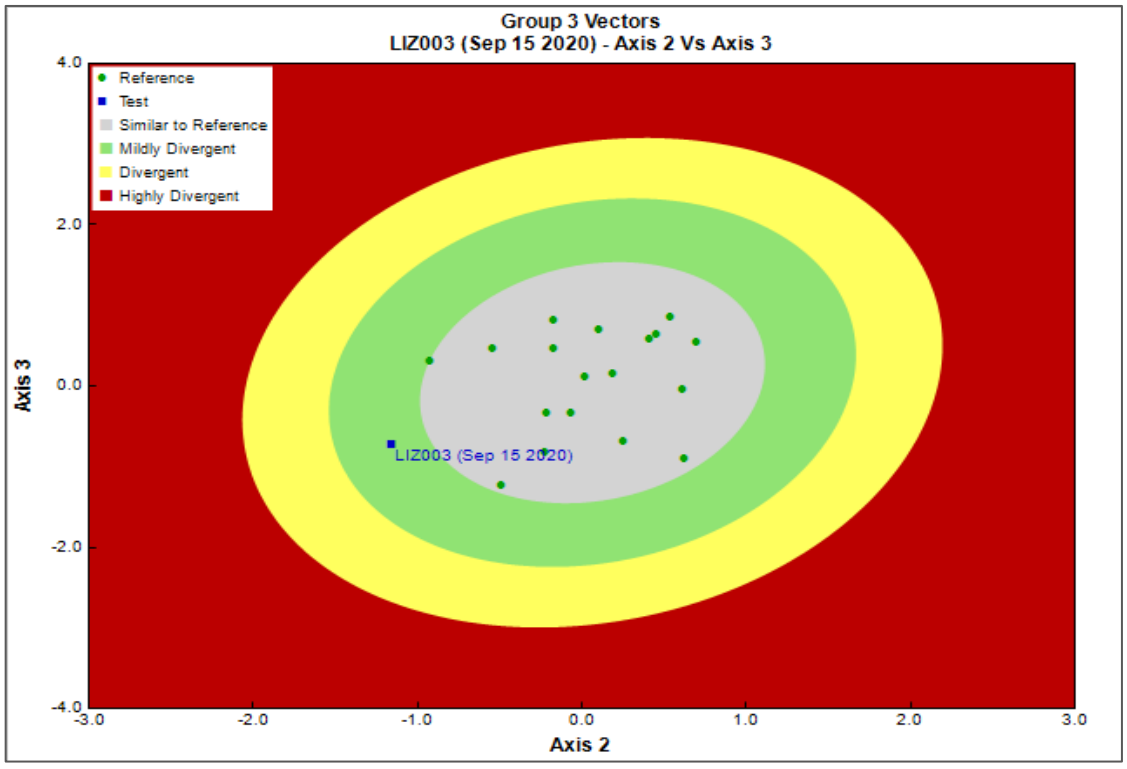

Figure 21. CABIN community ellipses for LIZ003 in 2020.

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.

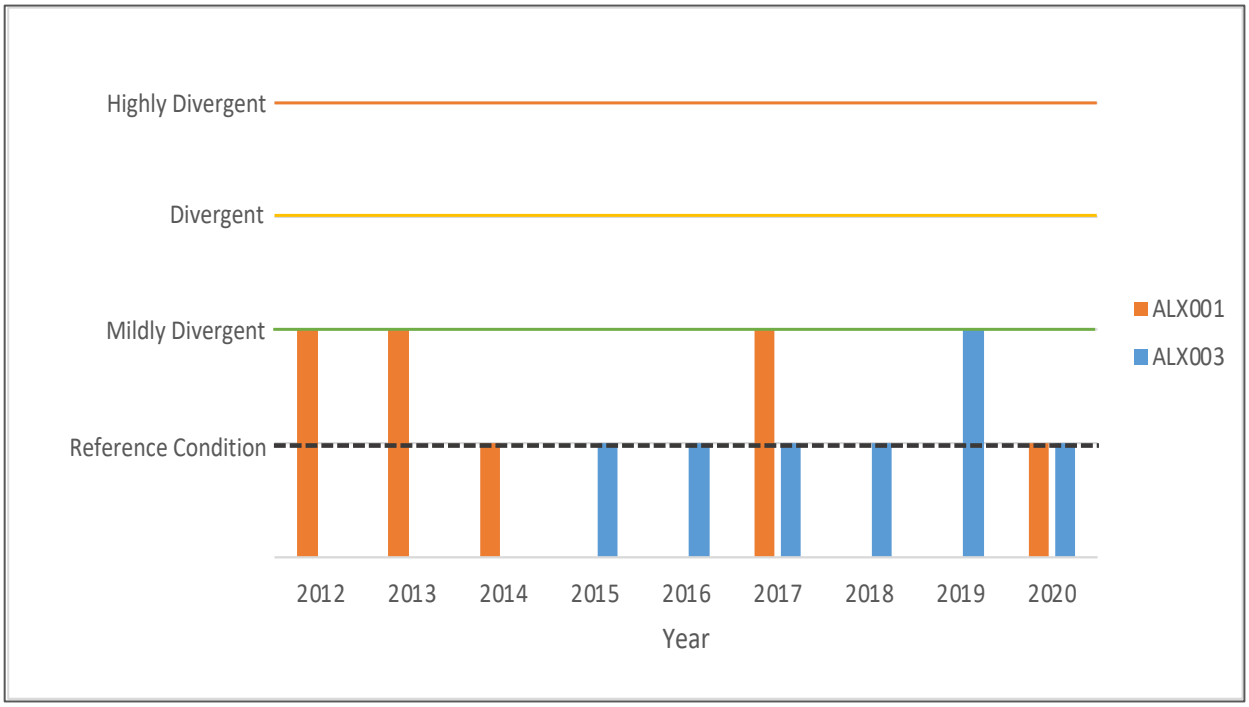

Figure 22. CABIN analysis results for Alexander Creek sites from 2012 - 2020.

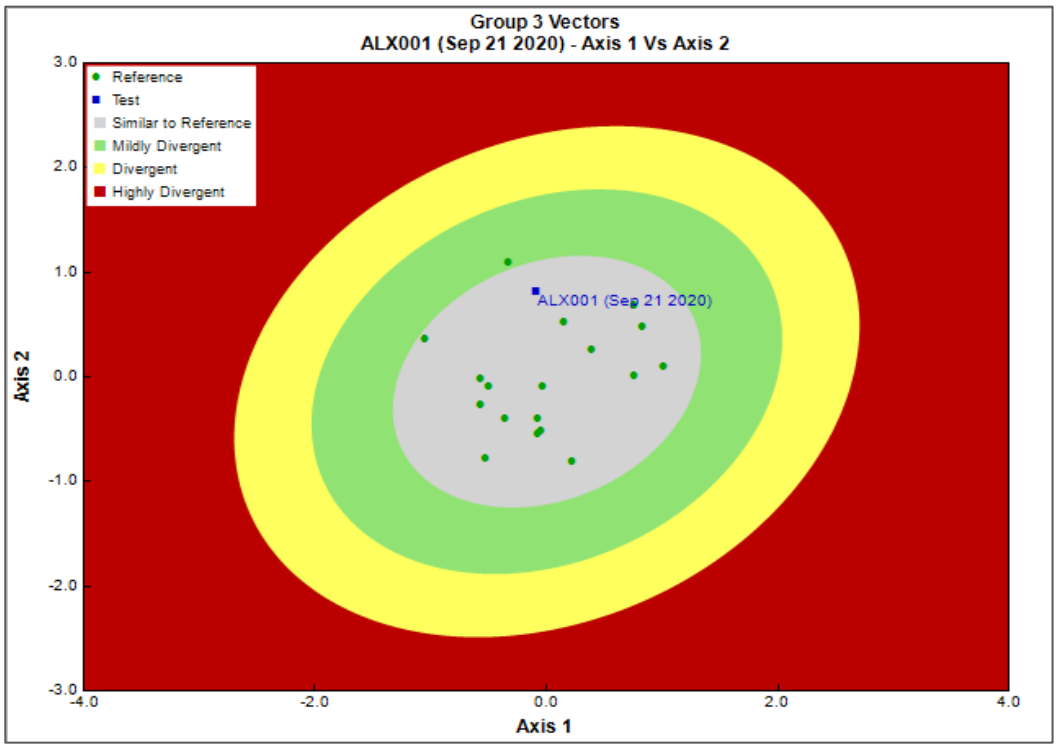

Figure 23. CABIN community ellipses for Alexander Creek's downstream site, ALX001 in 2020.

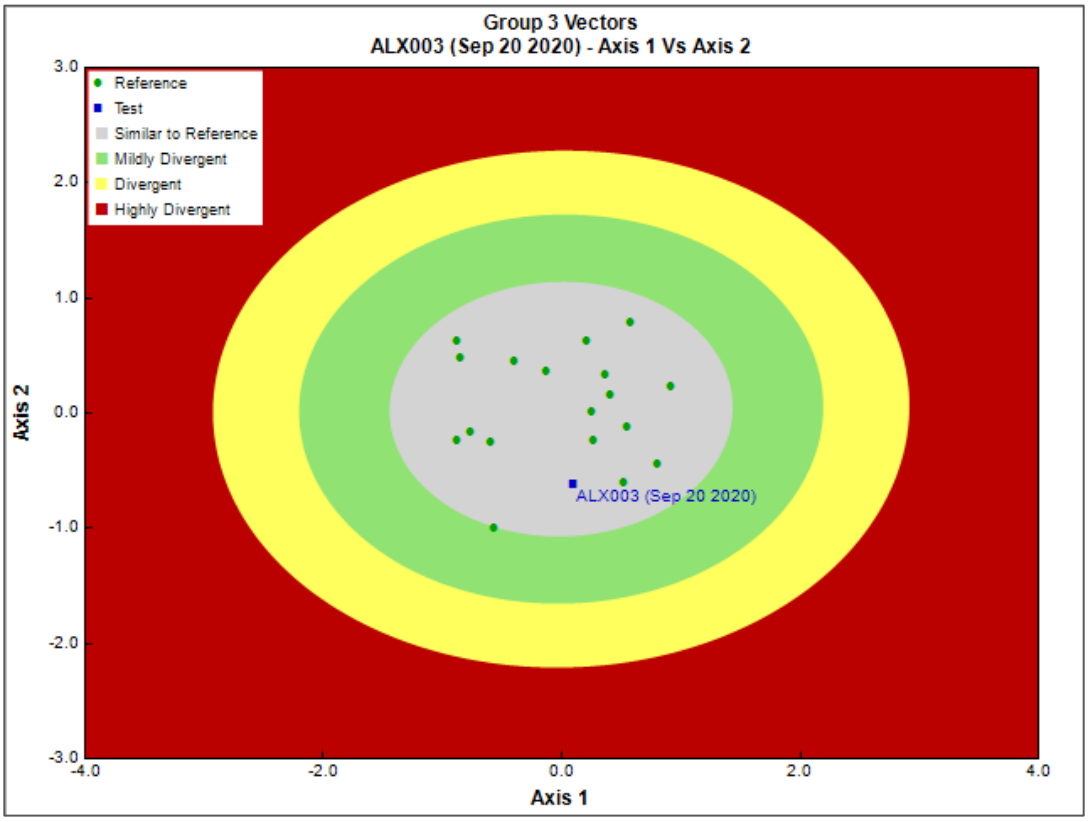

Figure 24. CABIN community ellipses for Alexander Creek's upstream site, ALX003 in 2020.

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.

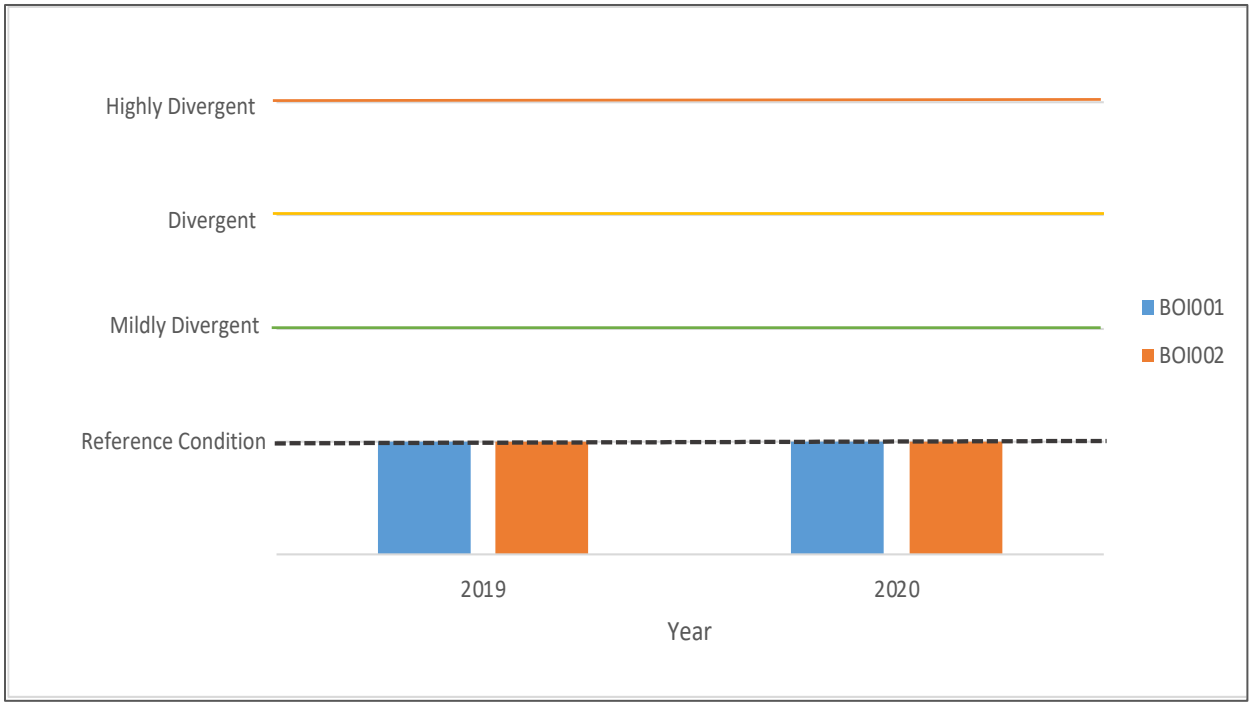

Figure 25. CABIN results for Boivin Creek sites in 2019 and 2020. Both the upstream (BOI002) and the downstream (BOI001) sites have remained in a similar state to reference condition, despite any potential for habitat degradation.

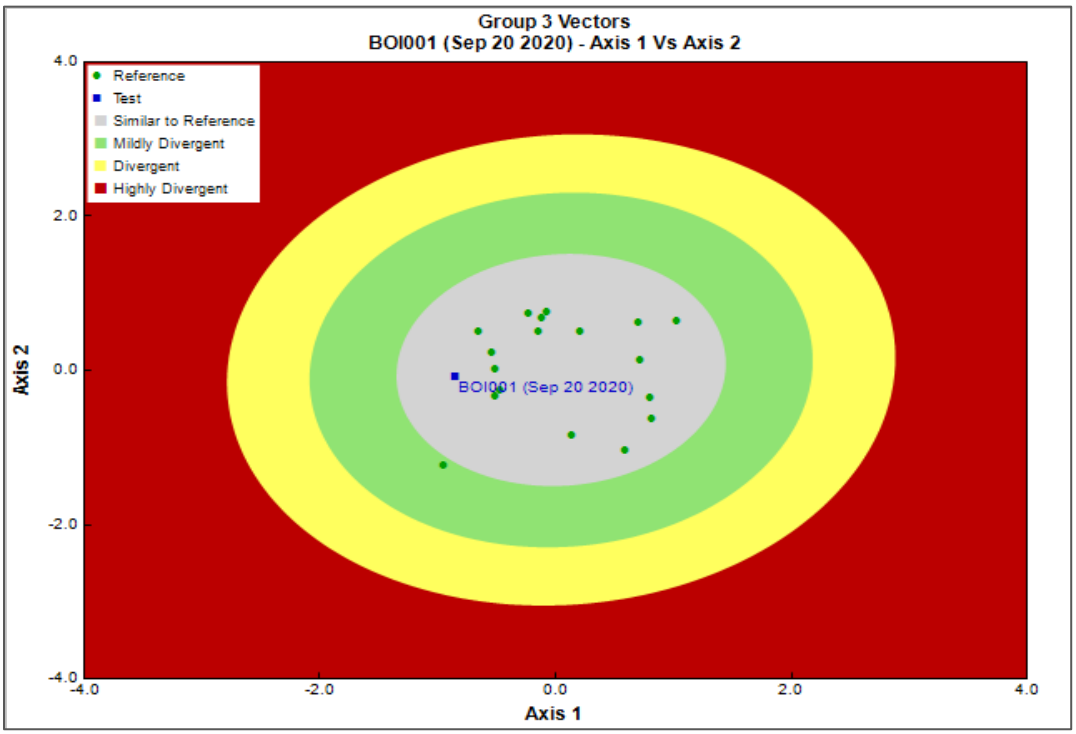

Figure 26. CABIN community ellipses for BOI001 (downstream) in 2020, showing the site to be "similar to reference".

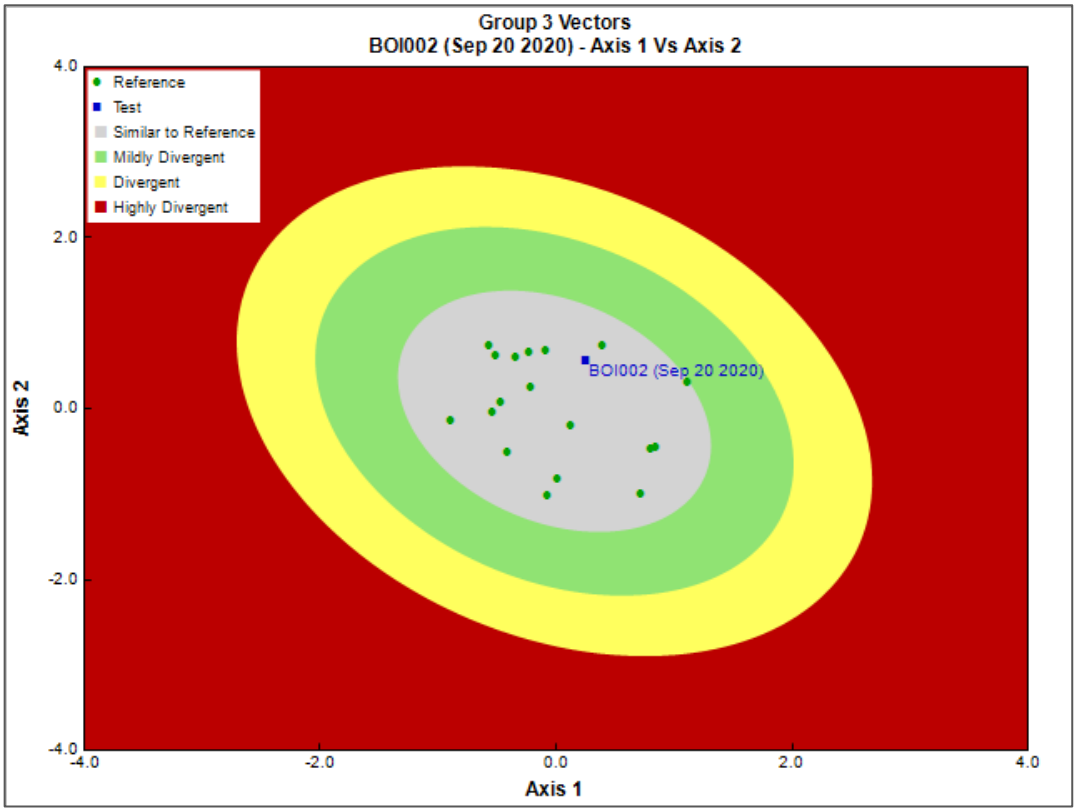

Figure 27. CABIN community ellipses for BOI002 (upstream) in 2020, showing the site to be "similar to reference".

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.

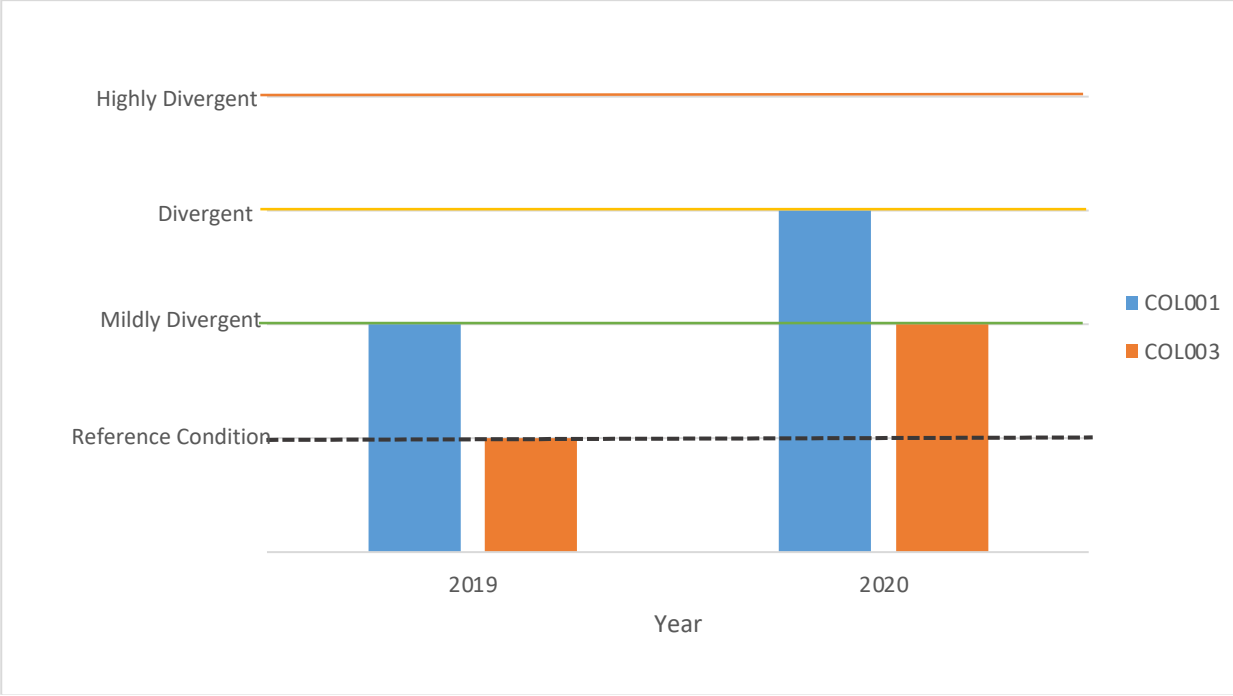

Figure 28. CABIN results for Coal Creek sites in 2019 and 2020.

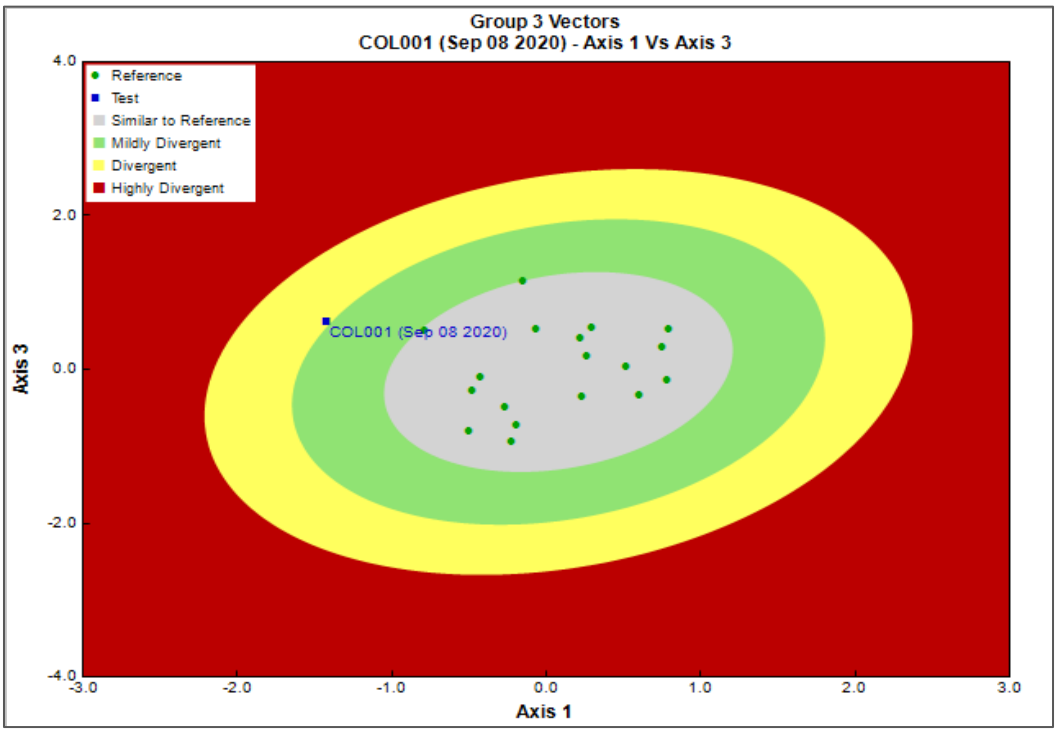

Figure 29. 2020 CABIN analysis community ellipses for the Coal Creek downstream site, COL001, showing the site has diverged from reference condition.

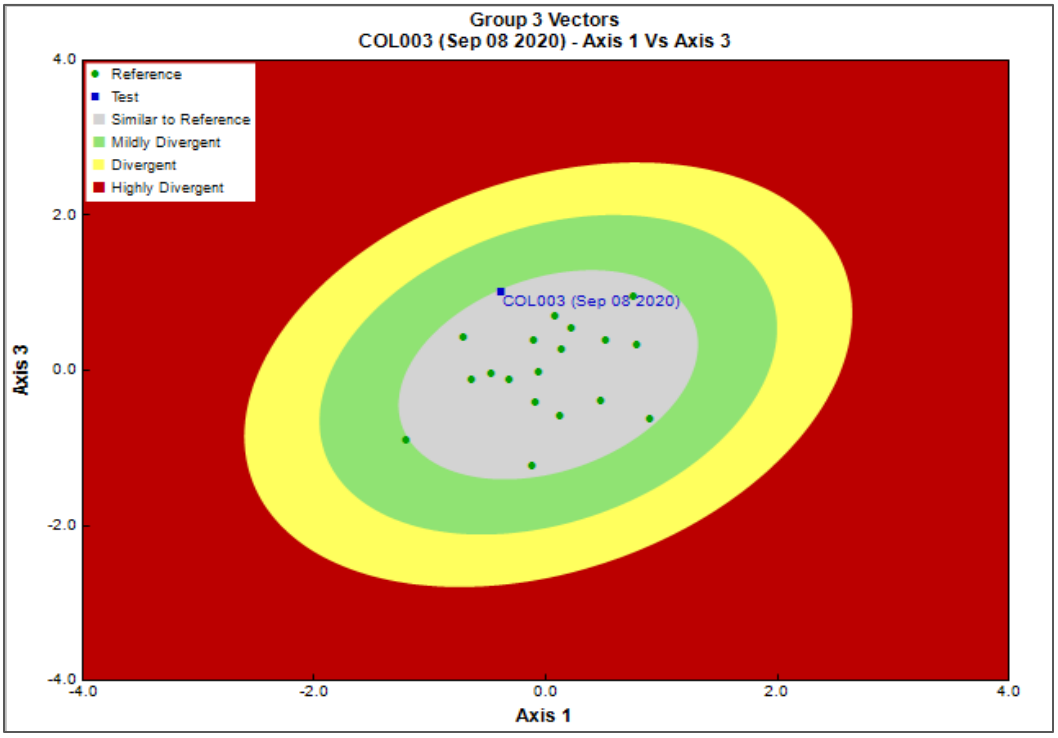

Figure 30. 2020 CABIN analysis community ellipses for the Coal Creek upstream site, COL003, showing the site is just at the edge of mild divergence from reference condition.

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.

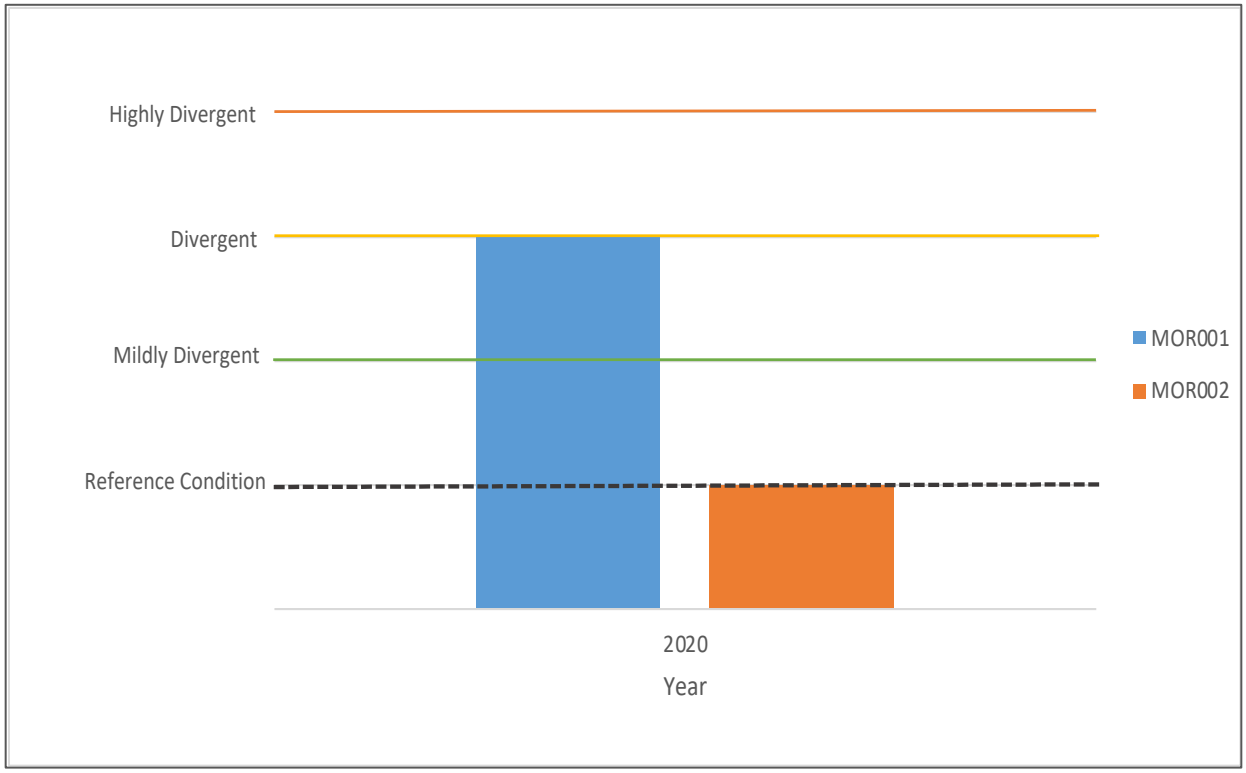

Figure 31. Results of CABIN assessment for Morrissey Creek sites in 2020. MOR002 is in "reference condition" while MOR001 was classified as. "divergent".

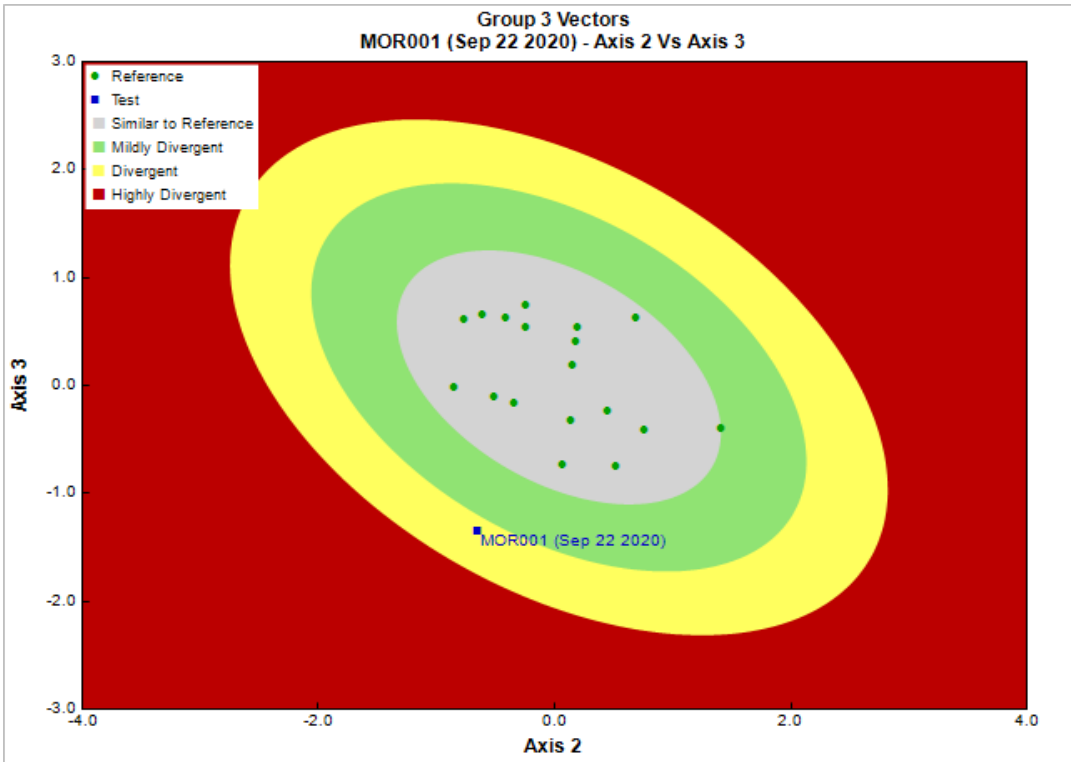

Figure 32. CABIN analysis community ellipses for the Morrissey Creek downstream site, MOR001, showing the site diverging from reference condition.

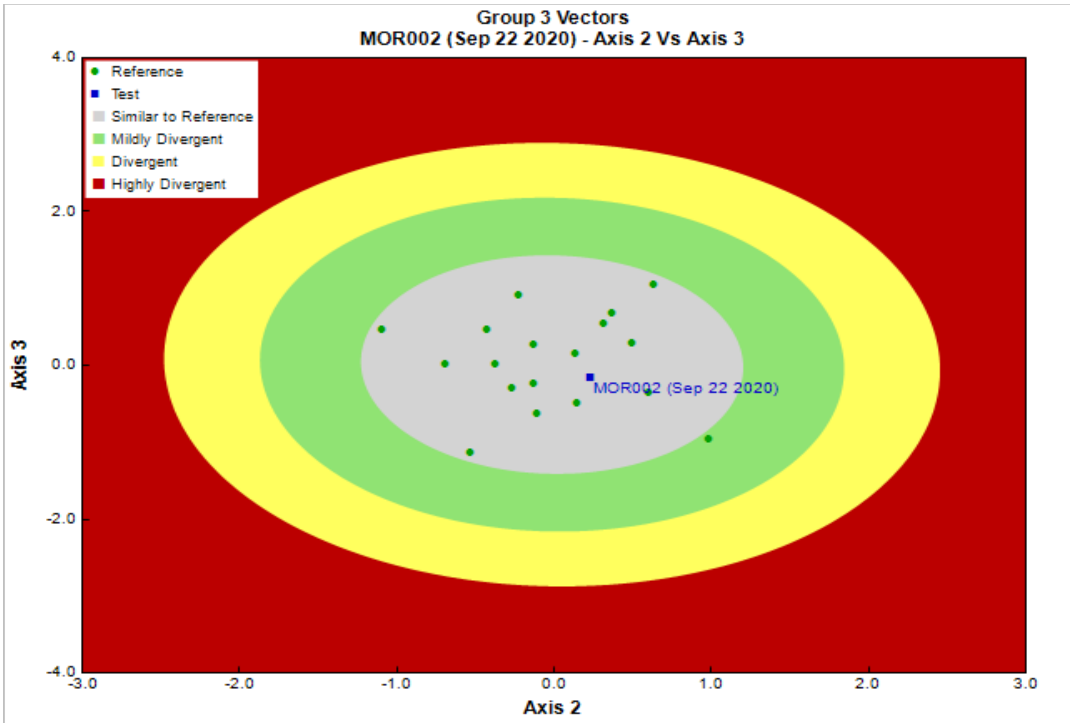

Figure 33. CABIN analysis community ellipses for the Morrissey Creek upstream site, MOR002, showing the site is similar to reference condition.

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).

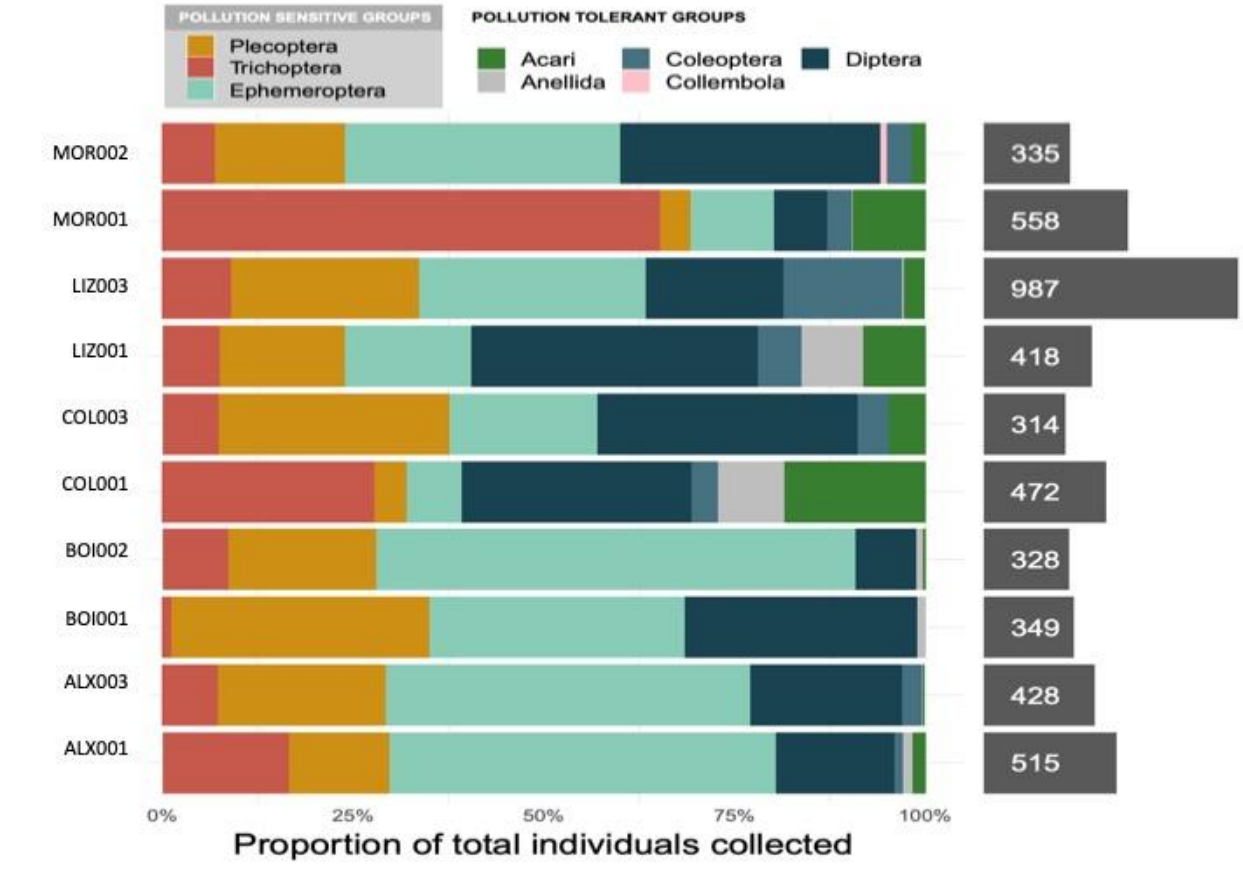

Figure 34. Graph representing the proportions of different benthic macroinvertebrates at each CBWM stream.The three left-most bars represent pollution-sensitive taxa (Ephemeroptera, Plecoptera, Trichoptera), while the taxa on the right are more pollution-tolerant. Higher % EPT is generally considered 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
	BOI002	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.

pH

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.

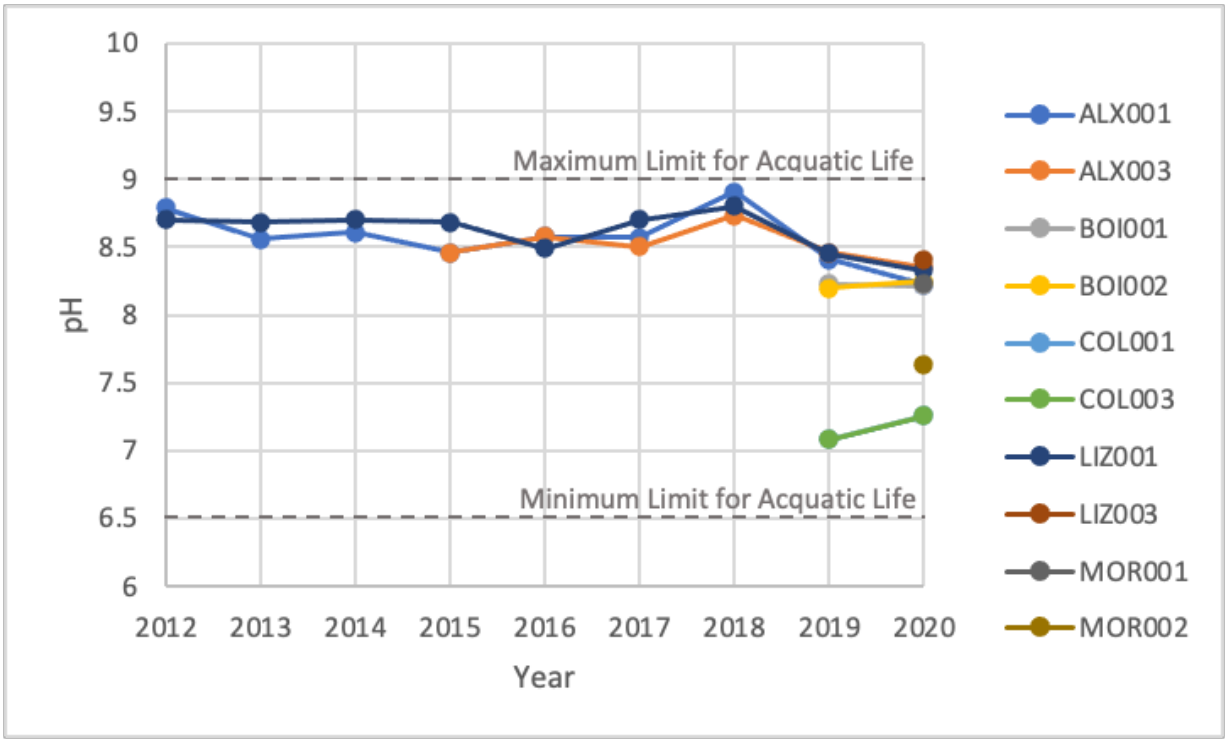

Figure 35. pH values for CBWM sites from 2012-2020. All sites remain within the range of limits outlined within the BC Water Quality Guidelines.

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°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).

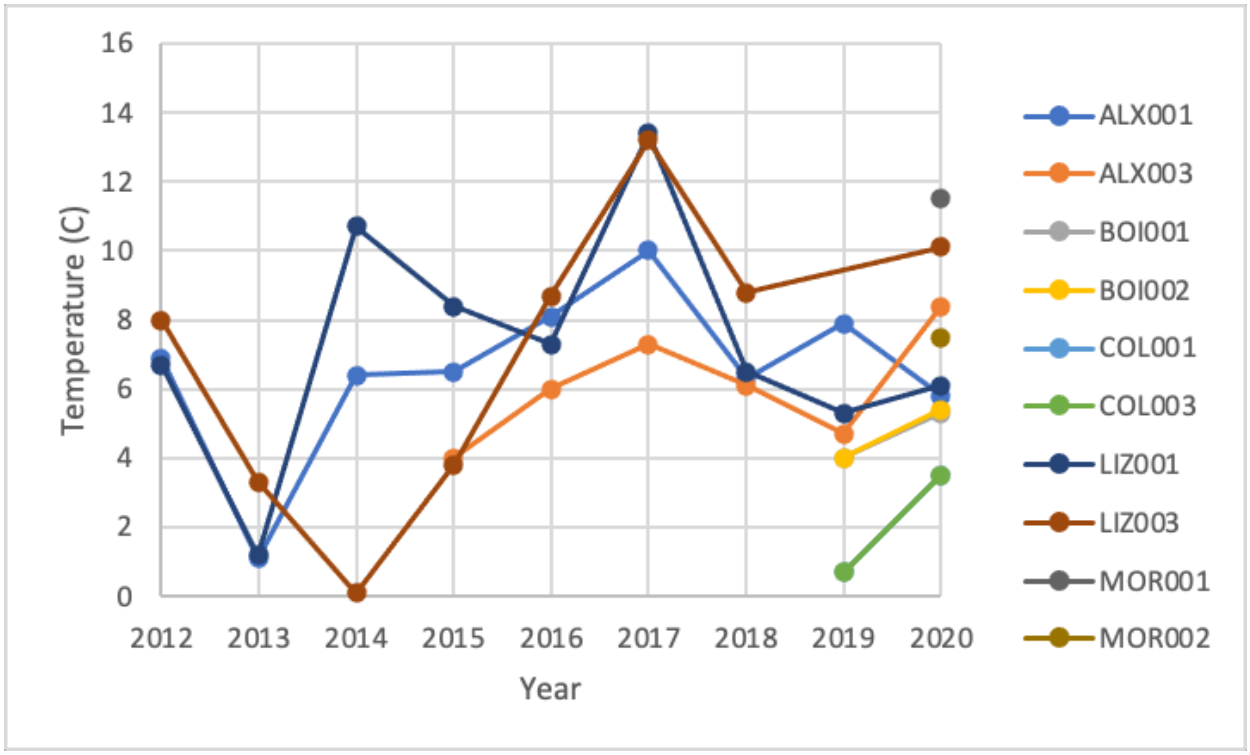

Figure 36. Temperature values for CBWM sites from 2012-2020.

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.

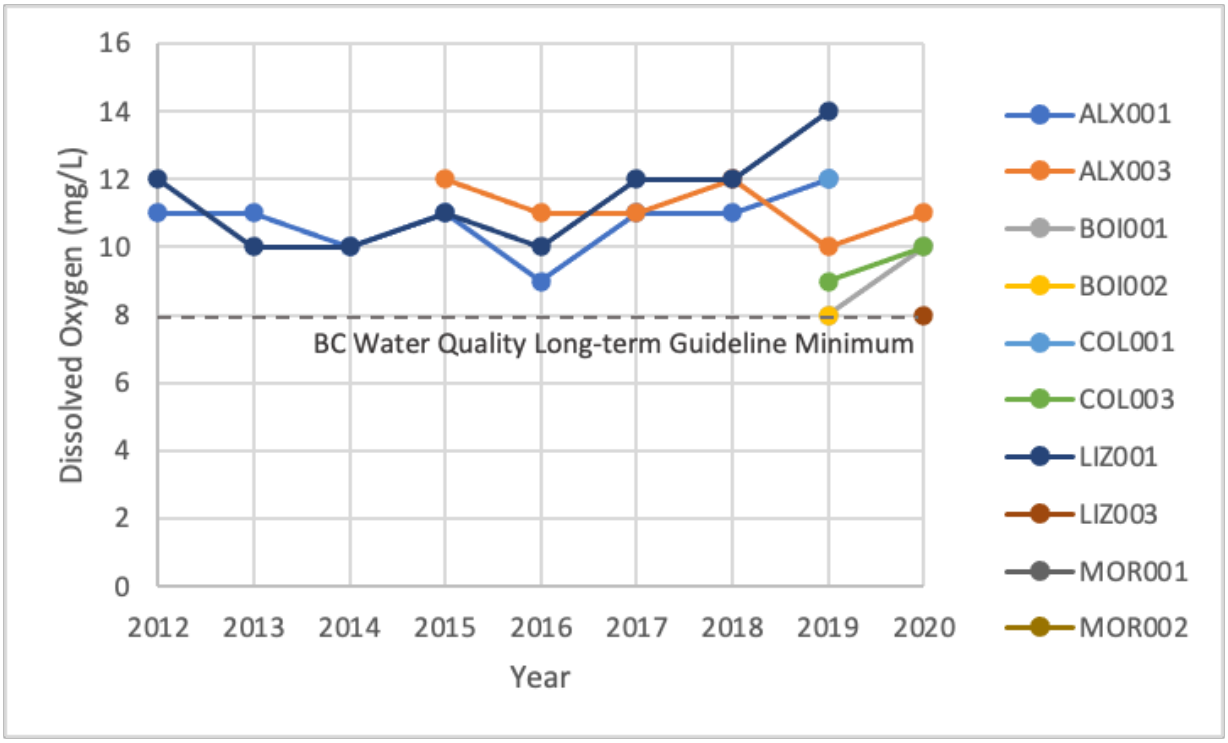

Figure 37. The amount of dissolved oxygen at CBWM sites in mg/L from 2012-2020. Site values do not fall below the BC water Quality Long-term Guideline minimum for Freshwater Aquatic Life (8mg/L).

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).

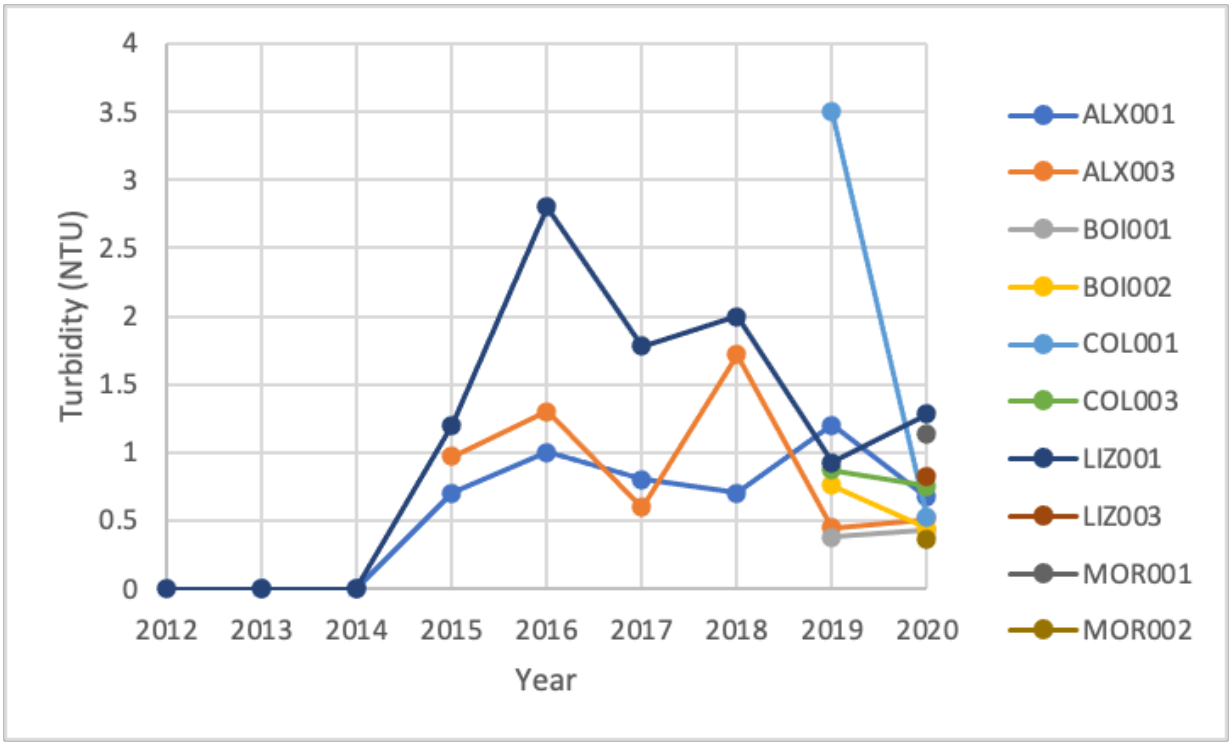

Figure 32. The turbidity (NTU) measured at CBWM sites from 2012-2020.

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.

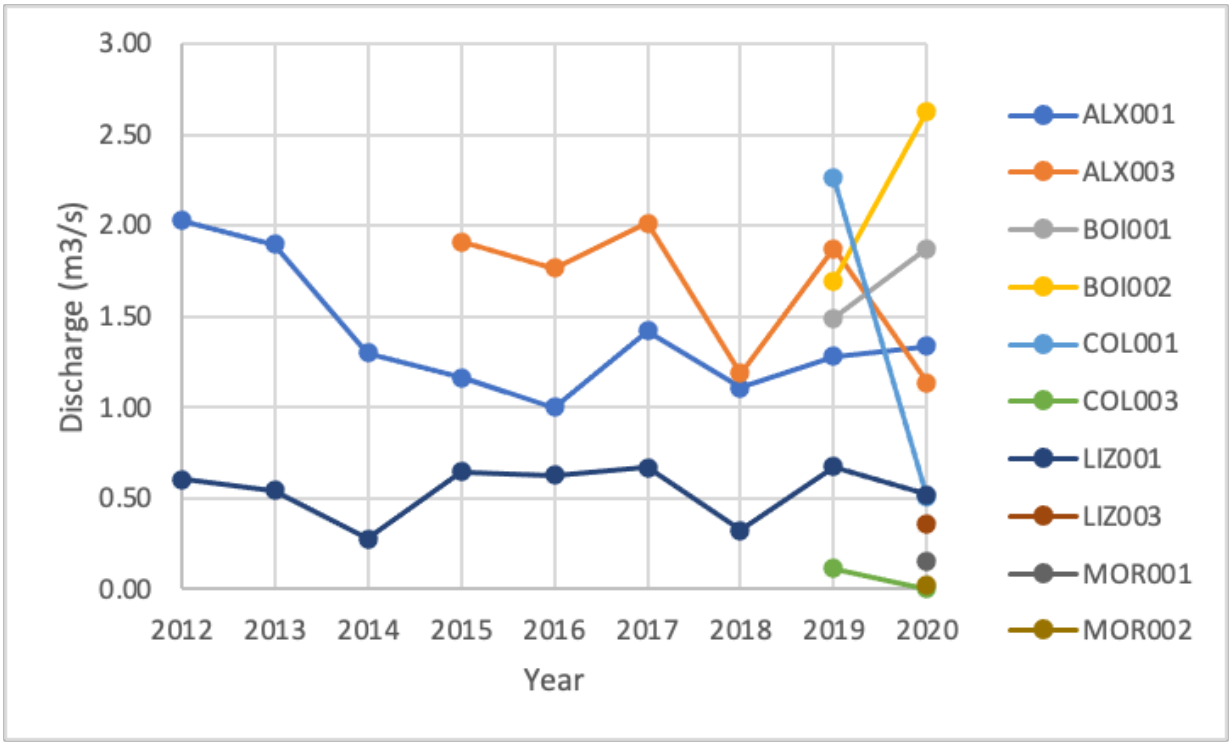

Figure 38. Discharge measurements calculated for CBWM sites from 2012- 2020.

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.

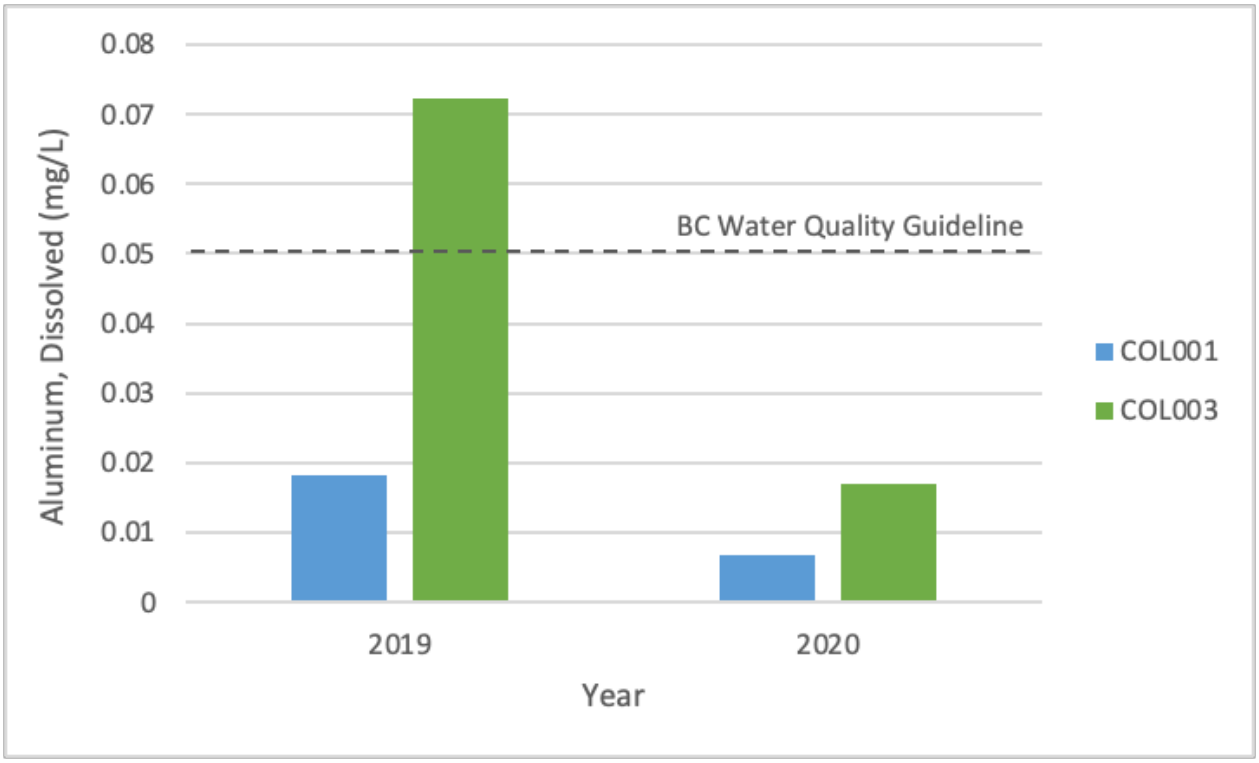

Figure 39. Dissolved aluminum concentrations for Coal Creek sites in 2019 and 2020.

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 µg/L (micrograms/litre). The BC human drinking water consumption guideline is 10 µg/L (British Columbia Ministry of Environment and Climate Change Strategy 2021)

Calcite ($CaCO_3$) is also naturally occurring and is formed when calcium (Ca) and carbonate (CO_3) 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.

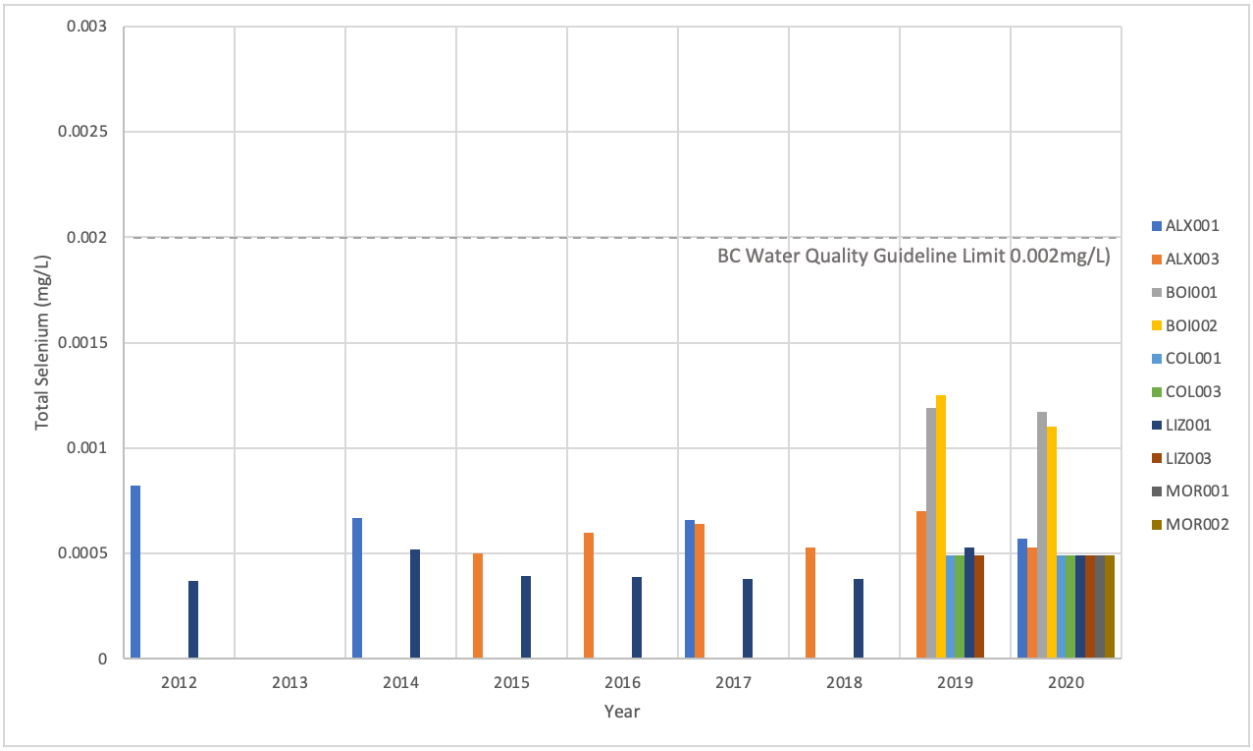

Figure 40. Total selenium concentrations at CBWM sites from 2012 to 2020. All concentrations are well below the BC water quality guideline of 0.002 mg/L (2µg/L).

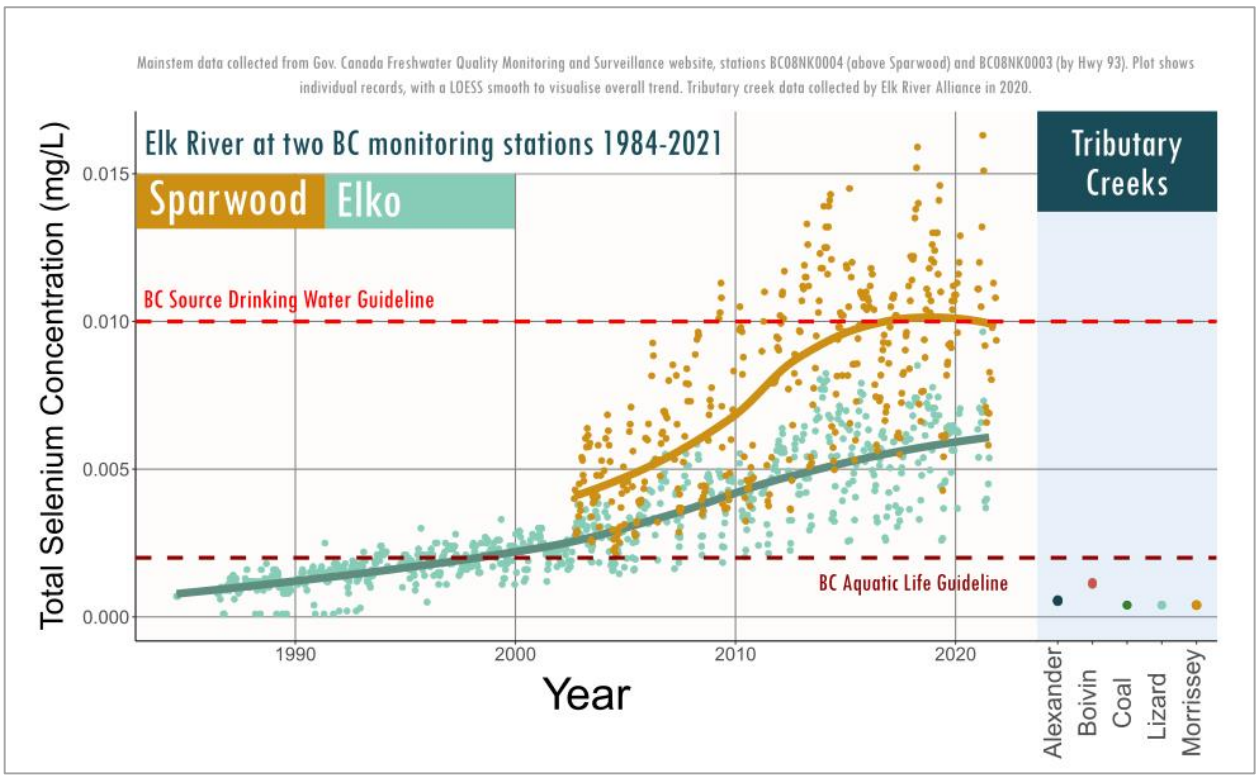

Figure 41. Total selenium in the Elk River mainstem at the outflow to Lake Koocanusa. Approximate concentrations at CBWM tributaries is included to the right and coincides with Elk River concentrations in the 1990s..

Study Limitations

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

Table 2. Outline of the potential limitations of ERA's Community-based Water Monitoring program

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

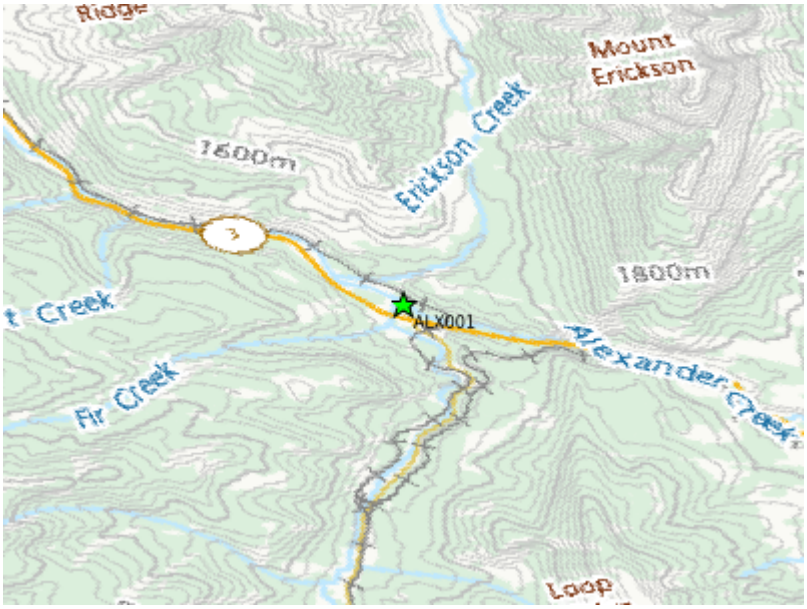

Figure 1. Location Map

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-Okanagan Preliminary March 2010
Analysis Date	January 07, 2022
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				

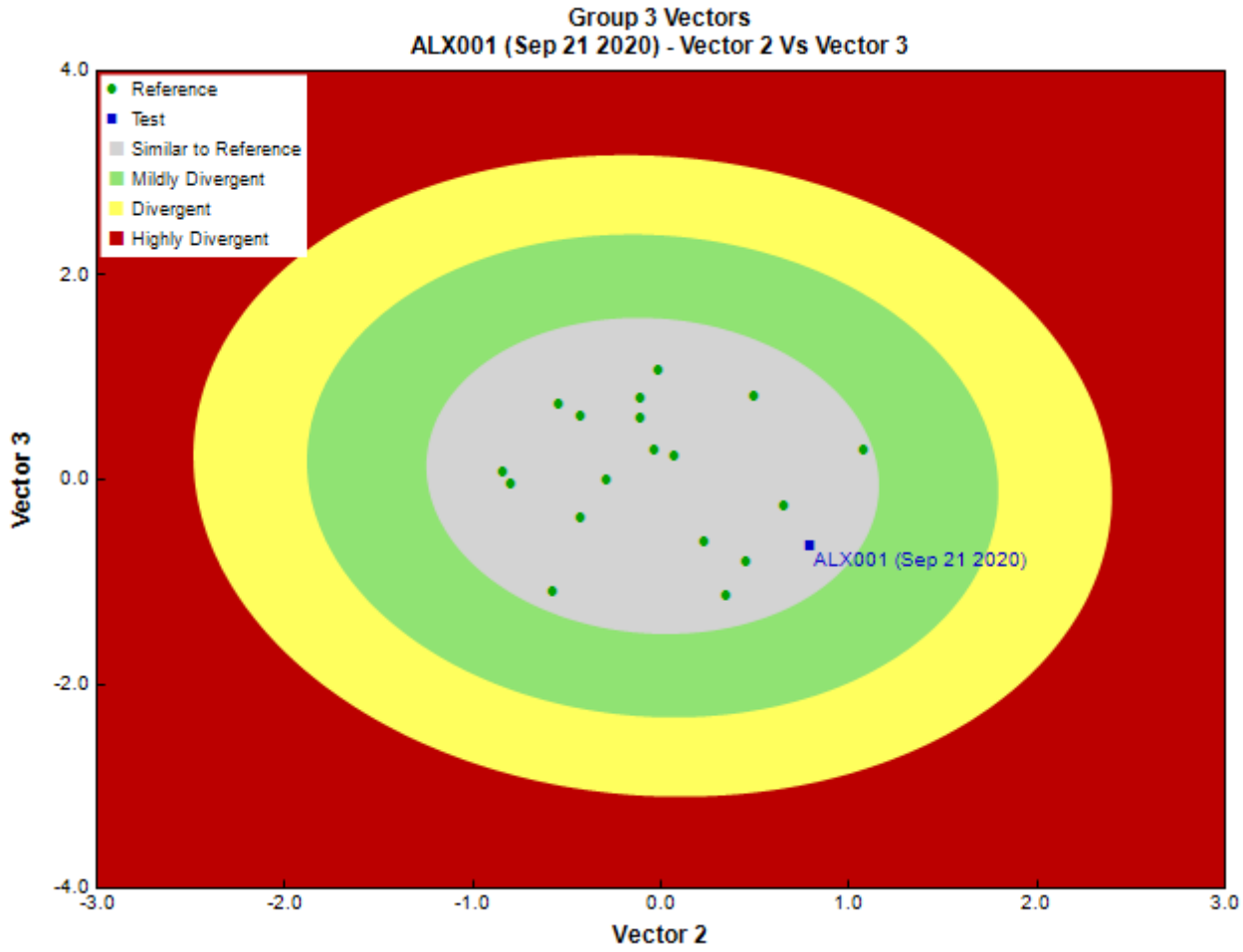

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

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	Class	Order	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 ± 0.2
Biotic Indices		
Intolerant taxa	--	1.0
Tolerant individuals (%)	--	0.6 ± 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 ± 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 ± 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 ± 0.1
Total Abundance	10300.0	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	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 ± 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 ± 0.1
Simpson's Evenness	0.3	0.3 ± 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 ALX001
	Group 1	Group 2	Group 3	Group 4	Group 5	
Ameletidae	56%	53%	22%	50%	68%	0.24

Frequency and Probability of Taxa Occurrence

Reference Model Taxa	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at ALX001
	Group 1	Group 2	Group 3	Group 4	Group 5	
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%	0.52
Ceratopogonidae	0%	55%	28%	42%	5%	0.29
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
Elmidae	0%	86%	50%	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
Hydrophilidae	11%	2%	0%	0%	0%	0.00
Hydropsychidae	11%	92%	78%	92%	86%	0.79
Hydroptilidae	11%	8%	0%	0%	0%	0.00
Hydrozetidae	0%	10%	17%	8%	16%	0.16
Hydryphantidae	11%	31%	11%	8%	8%	0.11
Hygrobatidae	0%	29%	0%	0%	11%	0.00
Lebertiidae	78%	65%	39%	58%	5%	0.40
Lepidostomatidae	0%	53%	6%	17%	8%	0.07
Leptohyphidae	0%	2%	0%	0%	0%	0.00
Leptophlebiidae	0%	90%	11%	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
Nemouridae	100%	100%	100%	100%	100%	1.00
Pelecorhynchidae	0%	22%	6%	0%	0%	0.05
Peltoperlidae	22%	12%	6%	8%	41%	0.06
Perlidae	11%	84%	33%	100%	3%	0.37
Perlodidae	78%	78%	89%	92%	81%	0.89
Philopotamidae	0%	31%	0%	0%	3%	0.00
Pisidiidae	0%	6%	0%	8%	0%	0.00
Planariidae	0%	8%	67%	17%	3%	0.63
Planorbidae	0%	0%	0%	0%	3%	0.00
Psychodidae	22%	65%	94%	8%	11%	0.89
Pteronarcyidae	0%	12%	6%	0%	3%	0.05
Rhyacophilidae	100%	92%	100%	100%	95%	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
Taeniopterygidae	89%	49%	100%	92%	97%	0.99
Thaumaleidae	11%	4%	0%	0%	0%	0.00
Tipulidae	56%	55%	28%	67%	43%	0.30
Torrenticolidae	11%	86%	11%	17%	11%	0.12
Uenoidae	22%	37%	17%	25%	46%	0.17
Valvatidae	0%	2%	6%	0%	0%	0.05

RIVPACS Ratios

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

Habitat Description

Variable	ALX001	Predicted Group Reference Mean ±SD
Bedrock Geology		
Sedimentary (%)	100.00000	92.18813 ± 22.65908
Channel		
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 ± 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)	0.0070000	0.0235102 ± 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)	0.58	0.50 ± 0.25
Velocity-Max (m/s)	1.33	0.75 ± 0.28
Width-Bankfull (m)	14.1	15.6 ± 12.8
Width-Wetted (m)	10.3	10.2 ± 7.0
XSEC-VelMethod (Category(1-3))	1	2 ± 1
Climate		
Precip10_OCT (mm)	48.36767	52.92857 ± 22.22704
Temp12_DECmin (Degrees Celsius)	-13.00498	-12.82063 ± 2.01422
Hydrology		
Drainage-Area (km^2)	544.36405	166.32560 ± 185.60049
Landcover		
Natl-Grassland (%)	3.20140	4.92979 ± 5.99508
Natl-ShrubLow (%)	1.04732	1.89085 ± 1.59075
Natl-Water (%)	0.06415	0.22269 ± 0.34683
Reg-Ice (%)	0.00000	0.46949 ± 1.15785
Substrate 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
Topography		
Reg-SlopeLT30% (%)	54.53046	27.92073 ± 14.83033
SlopeLT30% (%)	54.53046	29.33739 ± 12.62448
SlopeMax (%)	318.46573	616.97887 ± 680.88955
Water Chemistry		

Habitat Description

Variable	ALX001	Predicted Group Reference Mean ±SD
Ag (mg/L)	0.0000250	0.0000004 ± 0.0000014
Al (mg/L)	0.0058000	0.0059500 ± 0.0039700
As (mg/L)	0.0002500	0.0002175 ± 0.0001795
B (mg/L)	0.0250000	0.0500000
Ba (mg/L)	0.0787000	0.0639025 ± 0.0450861
Be (mg/L)	0.0000500	0.0000025 ± 0.0000062
Bi (mg/L)	0.0000500	0.0000004 ± 0.0000014
Ca (mg/L)	48.8000000	38.6142857 ± 14.8464843
Cd (mg/L)	0.0000110	0.0000059 ± 0.0000067
Co (mg/L)	0.0000500	0.0000043 ± 0.0000057
CO3 (mg/L)	169.0000000	0.0000000 ± 0.0000000
Cr (mg/L)	0.0002500	0.0000833 ± 0.0001403
Cu (mg/L)	0.0005900	0.0001875 ± 0.0001434
Fe (mg/L)	0.0150000	0.0090000
General-Alkalinity (mg/L)	169.0000000	121.5944444 ± 36.7225924
General-Hardness (mg/L)	169.0000000	146.8222222 ± 41.6699011
General-pH (pH)	8.2	8.0 ± 0.6
General-SolidsTSS (mg/L)	1.0000000	0.5604289 ± 1.4627232
General-SpCond (µS/cm)	208.4000000	214.2437500 ± 77.1891440
General-TempAir (Degrees Celsius)	2.0	10.5 ± 4.2
General-TempWater (Degrees Celsius)	5.8000000	6.6716667 ± 2.0277755
General-Turbidity (NTU)	0.6700000	0.0000000 ± 0.0000000
Hg (ng/L)	0.0050000	0.0000000 ± 0.0000000
K (mg/L)	0.4600000	0.6471429 ± 0.7154652
Li (mg/L)	0.0046400	0.0011817 ± 0.0004768
Mg (mg/L)	13.8000000	9.8814286 ± 6.1601202
Mn (mg/L)	0.0010400	0.0011426 ± 0.0016097
Mo (mg/L)	0.0008500	0.0024883 ± 0.0065339
Na (mg/L)	1.8300000	2.6357143 ± 3.7712414
Ni (mg/L)	0.0004200	0.0000808 ± 0.0000811
Nitrogen-NH3 (mg/L)	0.0050000	0.0019286 ± 0.0059286
Nitrogen-NH4+ (mg/L)	0.0050000	0.0000000 ± 0.0000000
Nitrogen-NO2 (mg/L)	0.0050000	0.0023889 ± 0.0063351
Nitrogen-NO2+NO3 (mg/L)	0.0050000	0.0130000 ± 0.0088111
Nitrogen-NO3 (mg/L)	0.0050000	0.0245003 ± 0.0229452
Nitrogen-TKN (mg/L)	0.0660000	0.0233333 ± 0.0161433
Nitrogen-TN (mg/L)	0.0660000	0.0688889 ± 0.0759171
Pb (mg/L)	0.0001000	0.0000224 ± 0.0000176
Phosphorus-TP (mg/L)	0.0056000	0.0032778 ± 0.0061816
S (mg/L)	7.9000000	5.0000000
Sb (mg/L)	0.0001000	0.0000361 ± 0.0000135
Se (mg/L)	0.0005700	0.0004382 ± 0.0004486
Si (mg/L)	2.5000000	3.0657143 ± 1.4070046
Sn (mg/L)	0.0001000	0.0000167 ± 0.0000078
Sr (mg/L)	0.1350000	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)	0.0025000	0.0009000
Tl (mg/L)	0.0000050	0.0000038 ± 0.0000064
U (mg/L)	0.0006530	0.0005298 ± 0.0003220
V (mg/L)	0.0005000	0.0001642 ± 0.0001203
Zn (mg/L)	0.0020000	0.0004083 ± 0.0008361
Zr (mg/L)	0.0000500	0.0000000 ± 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

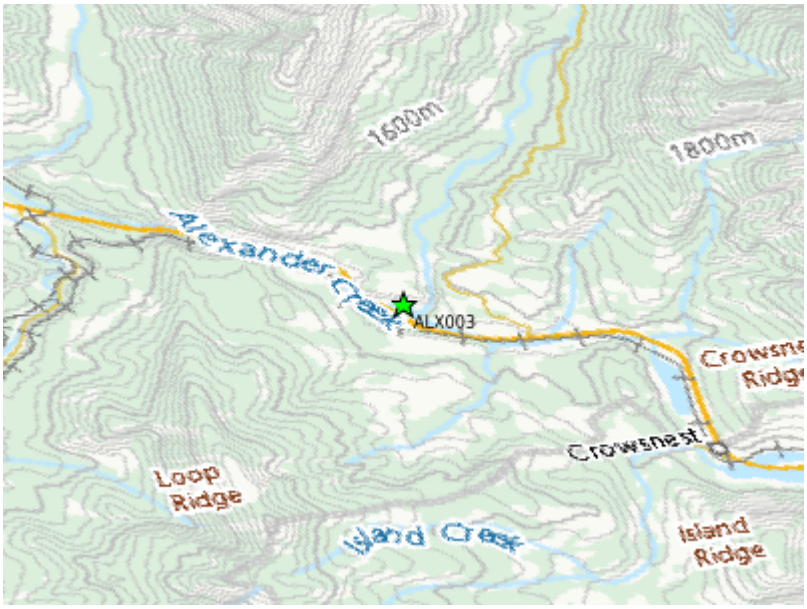

Figure 1. Location Map

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-Okanagan Preliminary March 2010
Analysis Date	January 07, 2022
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				

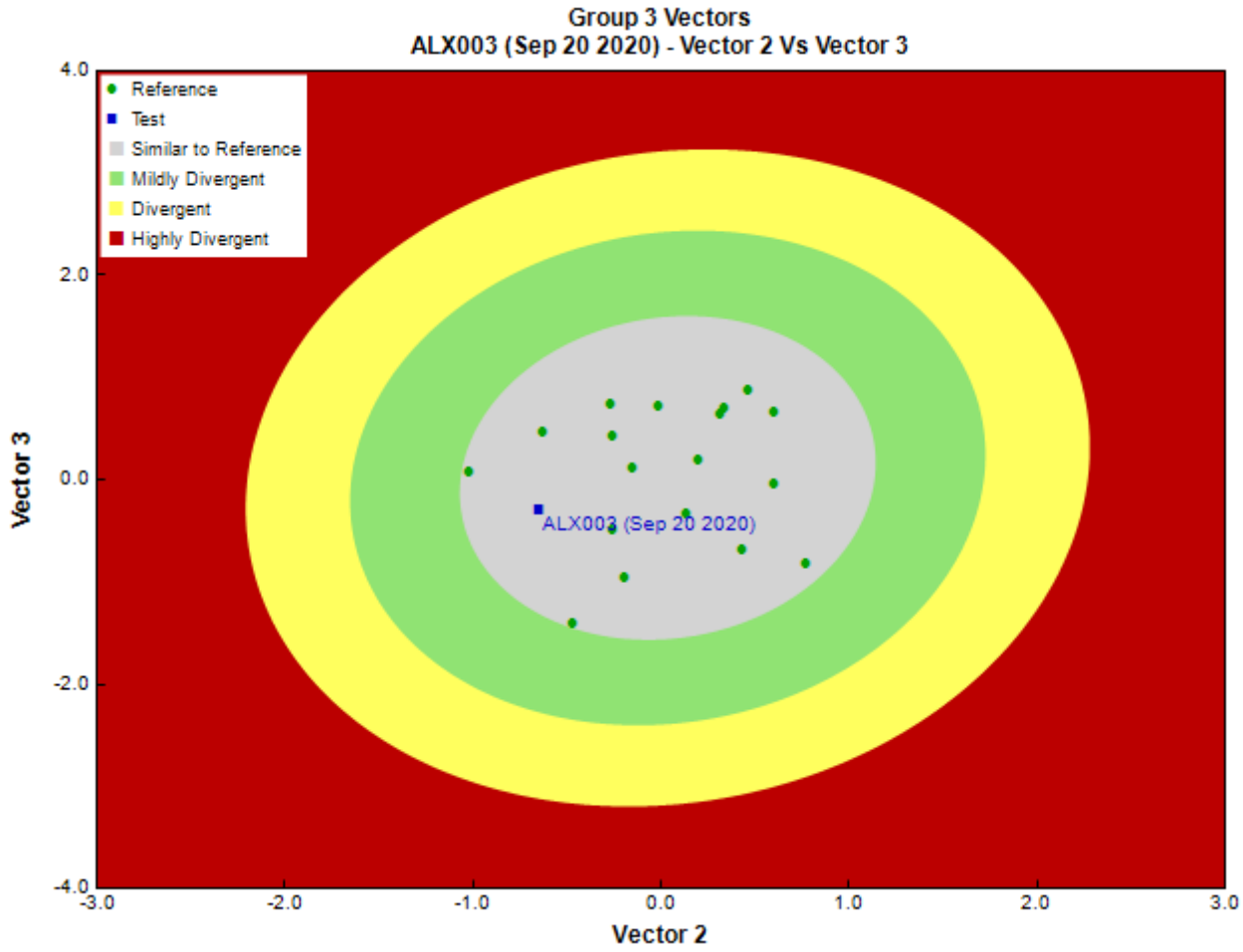

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

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 ± 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	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at ALX003
	Group 1	Group 2	Group 3	Group 4	Group 5	
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 and Probability of Taxa Occurrence

Reference Model Taxa	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at ALX003
	Group 1	Group 2	Group 3	Group 4	Group 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
Elmidae	0%	86%	50%	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
Hydrophilidae	11%	2%	0%	0%	0%	0.00
Hydropsychidae	11%	92%	78%	92%	86%	0.79
Hydroptilidae	11%	8%	0%	0%	0%	0.00
Hydrozetidae	0%	10%	17%	8%	16%	0.16
Hydryphantidae	11%	31%	11%	8%	8%	0.11
Hygrobatidae	0%	29%	0%	0%	11%	0.00
Lebertiidae	78%	65%	39%	58%	5%	0.40
Lepidostomatidae	0%	53%	6%	17%	8%	0.07
Leptohyphidae	0%	2%	0%	0%	0%	0.00
Leptophlebiidae	0%	90%	11%	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
Nemouridae	100%	100%	100%	100%	100%	1.00
Pelecorhynchidae	0%	22%	6%	0%	0%	0.05
Peltoperlidae	22%	12%	6%	8%	41%	0.06
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	0%	8%	67%	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
Rhyacophilidae	100%	92%	100%	100%	95%	1.00
Simuliidae	33%	49%	39%	33%	16%	0.38
Sperchontidae	78%	63%	50%	42%	65%	0.50
Stygothrombiidae	0%	4%	0%	17%	0%	0.01
Taeniopterygidae	89%	49%	100%	92%	97%	0.99
Thaumaleidae	11%	4%	0%	0%	0%	0.00
Tipulidae	56%	55%	28%	67%	43%	0.30
Torrenticolidae	11%	86%	11%	17%	11%	0.12
Uenoidae	22%	37%	17%	25%	46%	0.17
Valvatidae	0%	2%	6%	0%	0%	0.05

RIVPACS Ratios

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

Habitat Description

Variable	ALX003	Predicted Group Reference Mean ±SD
Bedrock Geology		
Sedimentary (%)	100.00000	92.18813 ± 22.65908
Channel		
Depth-Avg (cm)	33.6	22.5 ± 10.5
Depth-BankfullMinusWetted (cm)	14.00	67.33 ± 71.65
Depth-Max (cm)	46.5	32.9 ± 17.9
Macrophyte (PercentRange)	0	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)	1	1 ± 0
Slope (m/m)	0.0095000	0.0235102 ± 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)	0.37	0.50 ± 0.25
Velocity-Max (m/s)	0.70	0.75 ± 0.28
Width-Bankfull (m)	10.1	15.6 ± 12.8
Width-Wetted (m)	9.1	10.2 ± 7.0
XSEC-VelMethod (Category(1-3))	1	2 ± 1
Climate		
Precip10_OCT (mm)	43.56508	52.92857 ± 22.22704
Temp12_DECmin (Degrees Celsius)	-13.47046	-12.82063 ± 2.01422
Hydrology		
Drainage-Area (km^2)	145.66793	166.32560 ± 185.60049
Landcover		
Natl-Grassland (%)	2.54651	4.92979 ± 5.99508
Natl-ShrubLow (%)	0.10049	1.89085 ± 1.59075
Natl-Water (%)	0.00000	0.22269 ± 0.34683
Reg-Ice (%)	0.00000	0.46949 ± 1.15785
Substrate Data		
%Bedrock (%)	0	0 ± 0
%Boulder (%)	8	6 ± 7
%Cobble (%)	66	61 ± 27
%Gravel (%)	4	1 ± 2
%Pebble (%)	20	31 ± 28
%Sand (%)	0	0 ± 0
%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	2 ± 1
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Reg-SlopeLT30% (%)	51.07930	27.92073 ± 14.83033
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Ca (mg/L)	46.8000000	38.6142857 ± 14.8464843
Cd (mg/L)	0.0000120	0.0000059 ± 0.0000067
Co (mg/L)	0.0000500	0.0000043 ± 0.0000057

Habitat Description

Variable	ALX003	Predicted Group Reference Mean ±SD
Cr (mg/L)	0.0006800	0.0000833 ± 0.0001403
Cu (mg/L)	0.0002000	0.0001875 ± 0.0001434
Fe (mg/L)	0.0190000	0.0090000
General-Alkalinity (mg/L)	165.0000000	121.5944444 ± 36.7225924
General-Conductivity (µS/cm)	143.2800000	186.8500000 ± 84.0864011
General-DO (mg/L)	11.0000000	10.4922222 ± 0.8833463
General-Hardness (mg/L)	160.0000000	146.8222222 ± 41.6699011
General-pH (pH)	8.4	8.0 ± 0.6
General-SolidsTSS (mg/L)	1.0000000	0.5604289 ± 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)	8.4000000	6.6716667 ± 2.0277755
General-Turbidity (NTU)	0.5100000	0.0000000 ± 0.0000000
Hg (ng/L)	0.0000200	0.0000000 ± 0.0000000
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Phosphorus-TP (mg/L)	0.0051000	0.0032778 ± 0.0061816
S (mg/L)	6.7000000	5.0000000
Sb (mg/L)	0.0001000	0.0000361 ± 0.0000135
Se (mg/L)	0.0005300	0.0004382 ± 0.0004486
Si (mg/L)	2.3000000	3.0657143 ± 1.4070046
Sn (mg/L)	0.0001000	0.0000167 ± 0.0000078
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Tl (mg/L)	0.0000100	0.0000038 ± 0.0000064
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V (mg/L)	0.0005000	0.0001642 ± 0.0001203
Zn (mg/L)	0.0020000	0.0004083 ± 0.0008361
Zr (mg/L)	0.0000500	0.0000000 ± 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
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	
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Taxonomic Level	Family
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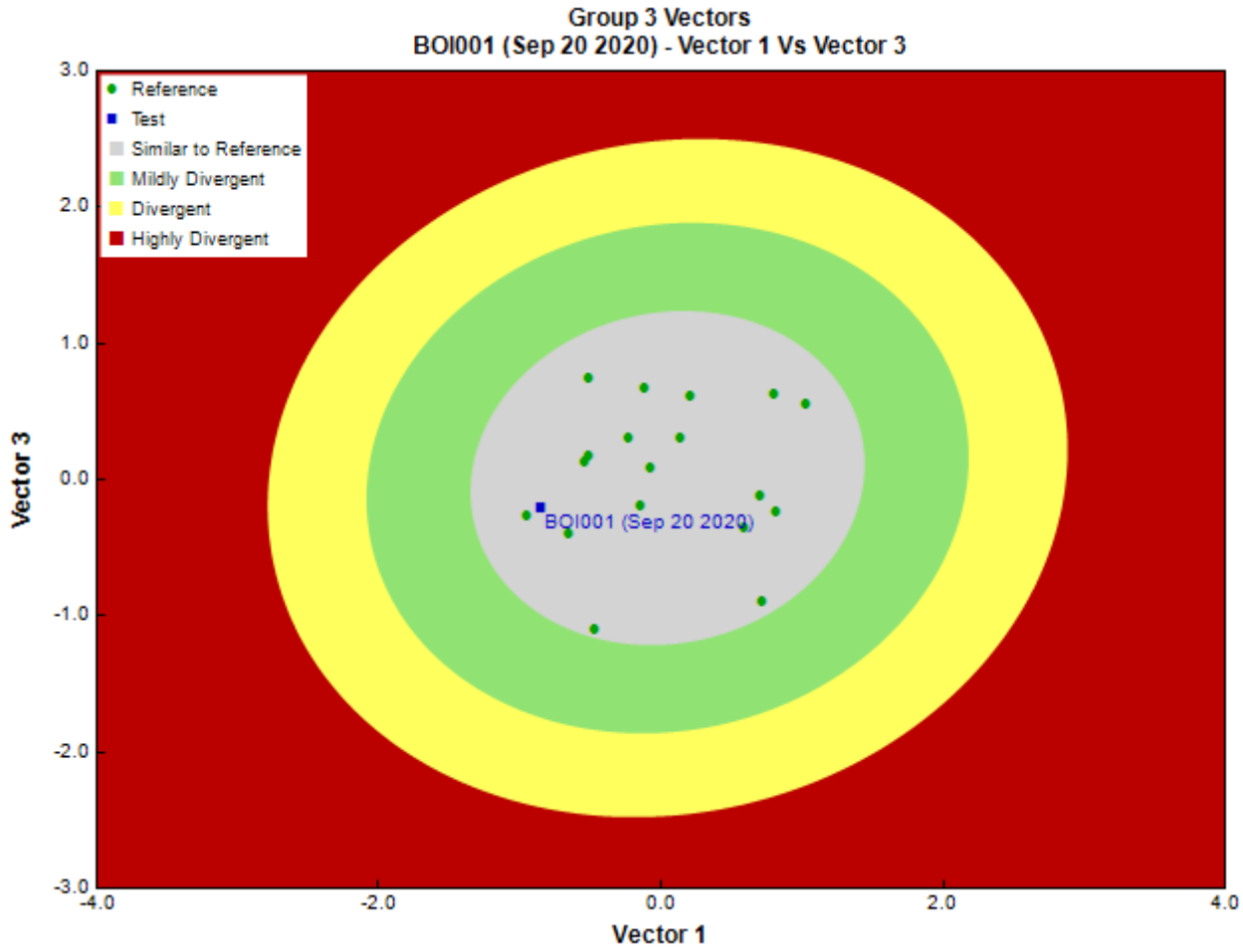
Overall Model Error Rate	26.4%				
Probability of Group Membership	0.1%	0.1%	76.5%	17.2%	6.1%
CABIN Assessment of BOI001 on Sep 20, 2020	Similar to Reference				



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	Marchant Box
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Community Structure

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			Simuliidae	2	40.0
			Tipulidae	2	40.0
		Ephemeroptera	Baetidae	19	380.0
			Ephemerellidae	11	220.0
			Heptageniidae	87	1,740.0
		Plecoptera	Capniidae	1	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 ± 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
Richness		
Chironomidae taxa (genus level only)	1.0	1.0 ± 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 ± 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 ± 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

Reference Model Taxa	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at BOI001
	Group 1	Group 2	Group 3	Group 4	Group 5	
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

Frequency and Probability of Taxa Occurrence

Reference Model Taxa	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at BOI001
	Group 1	Group 2	Group 3	Group 4	Group 5	
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%	2%	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%	0.08
Perlidae	11%	84%	33%	100%	3%	0.43
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	0%	8%	67%	17%	3%	0.54
Planorbidae	0%	0%	0%	0%	3%	0.00
Psychodidae	22%	65%	94%	8%	11%	0.74
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

RIVPACS Ratios

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

Habitat Description

Variable	BOI001	Predicted Group Reference Mean ±SD
Bedrock Geology		
Sedimentary (%)	100.00000	92.18813 ± 22.65908
Channel		
Depth-Avg (cm)	24.3	22.5 ± 10.5

Habitat Description

Variable	BOI001	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)	0	0 ± 0
Reach-%CanopyCoverage (PercentRange)	0.00	0.94 ± 0.80
Reach-DomStreamsideVeg (Category(1-4))	1	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)	0.0260000	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)	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 ± 185.60049
Landcover		
Natl-Grassland (%)	0.70842	4.92979 ± 5.99508
Natl-ShrubLow (%)	0.53944	1.89085 ± 1.59075
Natl-Water (%)	0.00000	0.22269 ± 0.34683
Reg-Ice (%)	0.00000	0.46949 ± 1.15785
Substrate Data		
%Bedrock (%)	0	0 ± 0
%Boulder (%)	2	6 ± 7
%Cobble (%)	50	61 ± 27
%Gravel (%)	4	1 ± 2
%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
Water Chemistry		
Ag (mg/L)	0.0000250	0.0000004 ± 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 ± 0.0000062
Bi (mg/L)	0.0000500	0.0000004 ± 0.0000014
Ca (mg/L)	49.9000000	38.6142857 ± 14.8464843
Cd (mg/L)	0.0000350	0.0000059 ± 0.0000067
Co (mg/L)	0.0000500	0.0000043 ± 0.0000057
Cr (mg/L)	0.0007200	0.0000833 ± 0.0001403
Cu (mg/L)	0.0002000	0.0001875 ± 0.0001434
Fe (mg/L)	0.0240000	0.0090000
General-Alkalinity (mg/L)	131.0000000	121.5944444 ± 36.7225924

Habitat Description

Variable	BOI001	Predicted Group Reference Mean ±SD
General-Conductivity (µS/cm)	128.9000000	186.8500000 ± 84.0864011
General-DO (mg/L)	10.0000000	10.4922222 ± 0.8833463
General-Hardness (mg/L)	171.0000000	146.8222222 ± 41.6699011
General-pH (pH)	8.2	8.0 ± 0.6
General-SolidsTSS (mg/L)	1.0000000	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)	5.3000000	6.6716667 ± 2.0277755
General-Turbidity (NTU)	0.4300000	0.0000000 ± 0.0000000
Hg (ng/L)	0.0000200	0.0000000 ± 0.0000000
K (mg/L)	0.3200000	0.6471429 ± 0.7154652
Li (mg/L)	0.0016400	0.0011817 ± 0.0004768
Mg (mg/L)	13.9000000	9.8814286 ± 6.1601202
Mn (mg/L)	0.0003700	0.0011426 ± 0.0016097
Mo (mg/L)	0.0014500	0.0024883 ± 0.0065339
Na (mg/L)	0.5900000	2.6357143 ± 3.7712414
Ni (mg/L)	0.0002000	0.0000808 ± 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 ± 0.0088111
Nitrogen-NO3 (mg/L)	0.0610000	0.0245003 ± 0.0229452
Nitrogen-TKN (mg/L)	0.0250000	0.0233333 ± 0.0161433
Nitrogen-TN (mg/L)	0.0613000	0.0688889 ± 0.0759171
Pb (mg/L)	0.0001000	0.0000224 ± 0.0000176
Phosphorus-OrthoP (mg/L)	0.0025000	0.0035000 ± 0.0018292
Phosphorus-TP (mg/L)	0.0061000	0.0032778 ± 0.0061816
S (mg/L)	23.1000000	5.0000000
Sb (mg/L)	0.0001000	0.0000361 ± 0.0000135
Se (mg/L)	0.0011700	0.0004382 ± 0.0004486
Si (mg/L)	2.2000000	3.0657143 ± 1.4070046
Sn (mg/L)	0.0001000	0.0000167 ± 0.0000078
Sr (mg/L)	0.5900000	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)	0.0025000	0.0009000
Tl (mg/L)	0.0000100	0.0000038 ± 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 ± 0.0008361
Zr (mg/L)	0.0000500	0.0000000 ± 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
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-Okanagan Preliminary March 2010
Analysis Date	January 07, 2022
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				

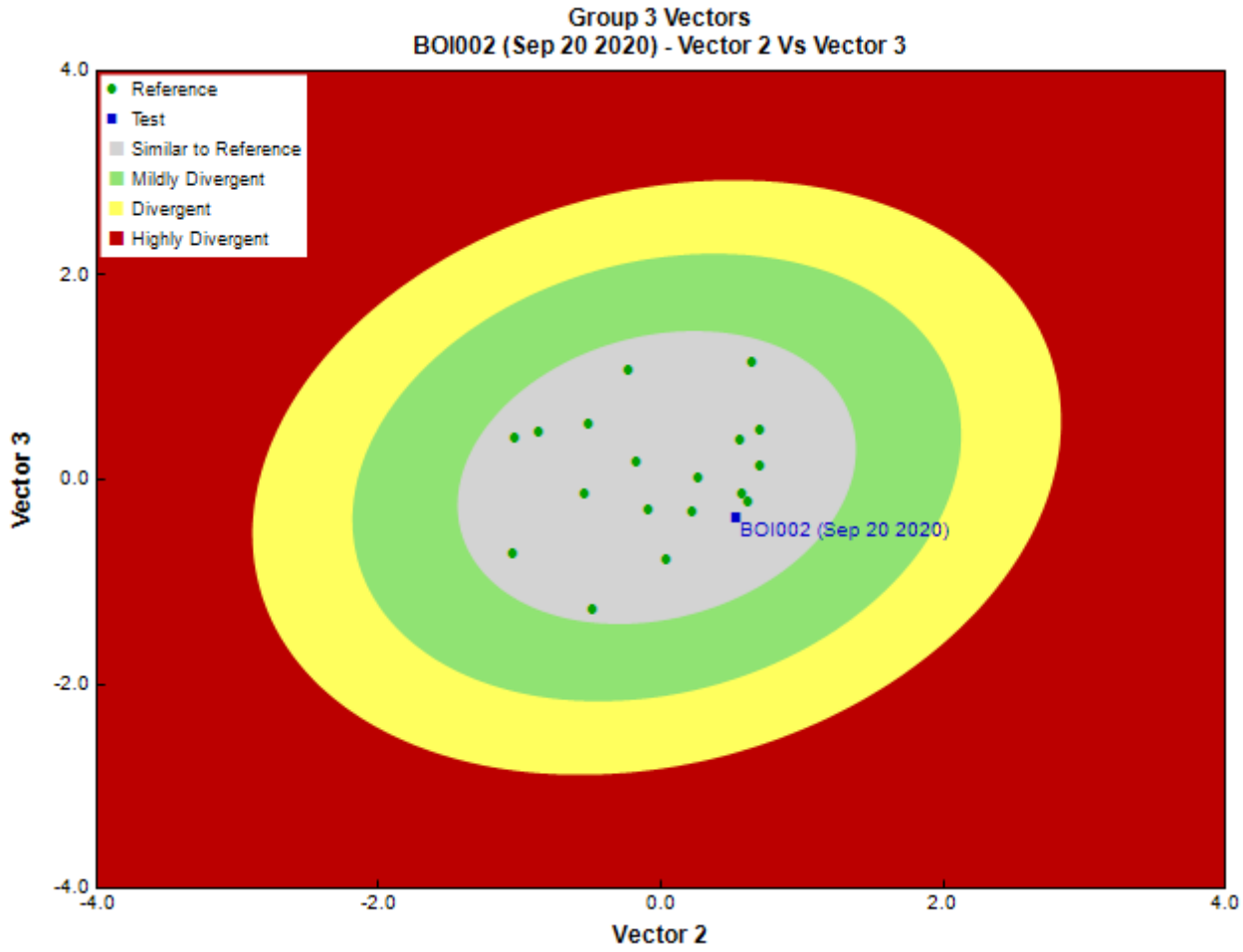

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

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	Lumbriculidae	3	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	Family	Raw Count	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	BOI002	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.31	0.4 ± 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 ± 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
Richness		
Chironomidae taxa (genus level only)	1.0	1.0 ± 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 ± 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

Frequency and Probability of Taxa Occurrence

Reference Model Taxa	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at BOI002
	Group 1	Group 2	Group 3	Group 4	Group 5	
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 Probability of Taxa Occurrence

Reference Model Taxa	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at BOI002
	Group 1	Group 2	Group 3	Group 4	Group 5	
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%	0.01
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%	0.15
Leuctridae	22%	43%	56%	67%	54%	0.58
Limnephilidae	22%	31%	6%	25%	41%	0.12
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%	0.29
Nemouridae	100%	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

RIVPACS Ratios

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

Habitat Description

Variable	BOI002	Predicted Group Reference Mean ±SD
Bedrock Geology		
Sedimentary (%)	100.00000	92.18813 ± 22.65908
Channel		
Depth-Avg (cm)	26.4	22.5 ± 10.5
Depth-BankfullMinusWetted (cm)	28.00	67.33 ± 71.65
Depth-Max (cm)	32.5	32.9 ± 17.9
Macrophyte (PercentRange)	0	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)	0.0294500	0.0235102 ± 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)	0.89	0.50 ± 0.25
Velocity-Max (m/s)	1.33	0.75 ± 0.28
Width-Bankfull (m)	11.6	15.6 ± 12.8
Width-Wetted (m)	11.2	10.2 ± 7.0
XSEC-VelMethod (Category(1-3))	1	2 ± 1
Climate		
Precip10_OCT (mm)	45.58192	52.92857 ± 22.22704
Temp12_DECmin (Degrees Celsius)	-14.29423	-12.82063 ± 2.01422
Hydrology		
Drainage-Area (km^2)	59.44236	166.32560 ± 185.60049
Landcover		
Natl-Grassland (%)	0.53139	4.92979 ± 5.99508
Natl-ShrubLow (%)	0.52935	1.89085 ± 1.59075
Natl-Water (%)	0.00000	0.22269 ± 0.34683
Reg-Ice (%)	0.00000	0.46949 ± 1.15785
Substrate Data		
%Bedrock (%)	0	0 ± 0
%Boulder (%)	5	6 ± 7
%Cobble (%)	52	61 ± 27
%Gravel (%)	11	1 ± 2
%Pebble (%)	31	31 ± 28
%Sand (%)	0	0 ± 0
%Silt+Clay (%)	1	0 ± 1
D50 (cm)	8.25	79.45 ± 47.98
Dg (cm)	6.0	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))	2	2 ± 1
SurroundingMaterial (Category(0-9))	3	3 ± 1
Topography		
Reg-SlopeLT30% (%)	23.73108	27.92073 ± 14.83033
SlopeMax (%)	298.23184	616.97887 ± 680.88955
Water Chemistry		
Ag (mg/L)	0.0000250	0.0000004 ± 0.0000014
Al (mg/L)	0.0062000	0.0059500 ± 0.0039700
As (mg/L)	0.0005200	0.0002175 ± 0.0001795
B (mg/L)	0.0250000	0.0500000
Ba (mg/L)	0.0292000	0.0639025 ± 0.0450861
Be (mg/L)	0.0000500	0.0000025 ± 0.0000062
Bi (mg/L)	0.0000500	0.0000004 ± 0.0000014
Ca (mg/L)	48.5000000	38.6142857 ± 14.8464843
Cd (mg/L)	0.0000200	0.0000059 ± 0.0000067
Co (mg/L)	0.0000500	0.0000043 ± 0.0000057

Habitat Description

Variable	BOI002	Predicted Group Reference Mean ±SD
Cr (mg/L)	0.0007800	0.0000833 ± 0.0001403
Cu (mg/L)	0.0002000	0.0001875 ± 0.0001434
Fe (mg/L)	0.0050000	0.0090000
General-Alkalinity (mg/L)	130.0000000	121.5944444 ± 36.7225924
General-Conductivity (µS/cm)	133.0000000	186.8500000 ± 84.0864011
General-Hardness (mg/L)	172.0000000	146.8222222 ± 41.6699011
General-pH (pH)	8.3	8.0 ± 0.6
General-SolidsTSS (mg/L)	1.0000000	0.5604289 ± 1.4627232
General-SpCond (µS/cm)	213.0000000	214.2437500 ± 77.1891440
General-TempAir (Degrees Celsius)	11.5	10.5 ± 4.2
General-TempWater (Degrees Celsius)	5.4000000	6.6716667 ± 2.0277755
General-Turbidity (NTU)	0.4400000	0.0000000 ± 0.0000000
Hg (ng/L)	0.0000200	0.0000000 ± 0.0000000
K (mg/L)	0.3200000	0.6471429 ± 0.7154652
Li (mg/L)	0.0015100	0.0011817 ± 0.0004768
Mg (mg/L)	13.7000000	9.8814286 ± 6.1601202
Mn (mg/L)	0.0001000	0.0011426 ± 0.0016097
Mo (mg/L)	0.0014600	0.0024883 ± 0.0065339
Na (mg/L)	0.5800000	2.6357143 ± 3.7712414
Ni (mg/L)	0.0002000	0.0000808 ± 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)	0.0506000	0.0130000 ± 0.0088111
Nitrogen-NO3 (mg/L)	0.0510000	0.0245003 ± 0.0229452
Nitrogen-TKN (mg/L)	0.0610000	0.0233333 ± 0.0161433
Nitrogen-TN (mg/L)	0.1120000	0.0688889 ± 0.0759171
Pb (mg/L)	0.0001000	0.0000224 ± 0.0000176
Phosphorus-TP (mg/L)	0.0050000	0.0032778 ± 0.0061816
S (mg/L)	19.9000000	5.0000000
Sb (mg/L)	0.0001000	0.0000361 ± 0.0000135
Se (mg/L)	0.0011000	0.0004382 ± 0.0004486
Si (mg/L)	2.1000000	3.0657143 ± 1.4070046
Sn (mg/L)	0.0001000	0.0000167 ± 0.0000078
Sr (mg/L)	0.5800000	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)	0.0025000	0.0009000
Tl (mg/L)	0.0000100	0.0000038 ± 0.0000064
U (mg/L)	0.0009890	0.0005298 ± 0.0003220
V (mg/L)	0.0011000	0.0001642 ± 0.0001203
Zn (mg/L)	0.0020000	0.0004083 ± 0.0008361
Zr (mg/L)	0.0000500	0.0000000 ± 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-Okanagan Preliminary March 2010
Analysis Date	January 07, 2022
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%	2.8%	89.9%	6.8%	0.6%
CABIN Assessment of COL001 on Sep 08, 2020	Divergent				

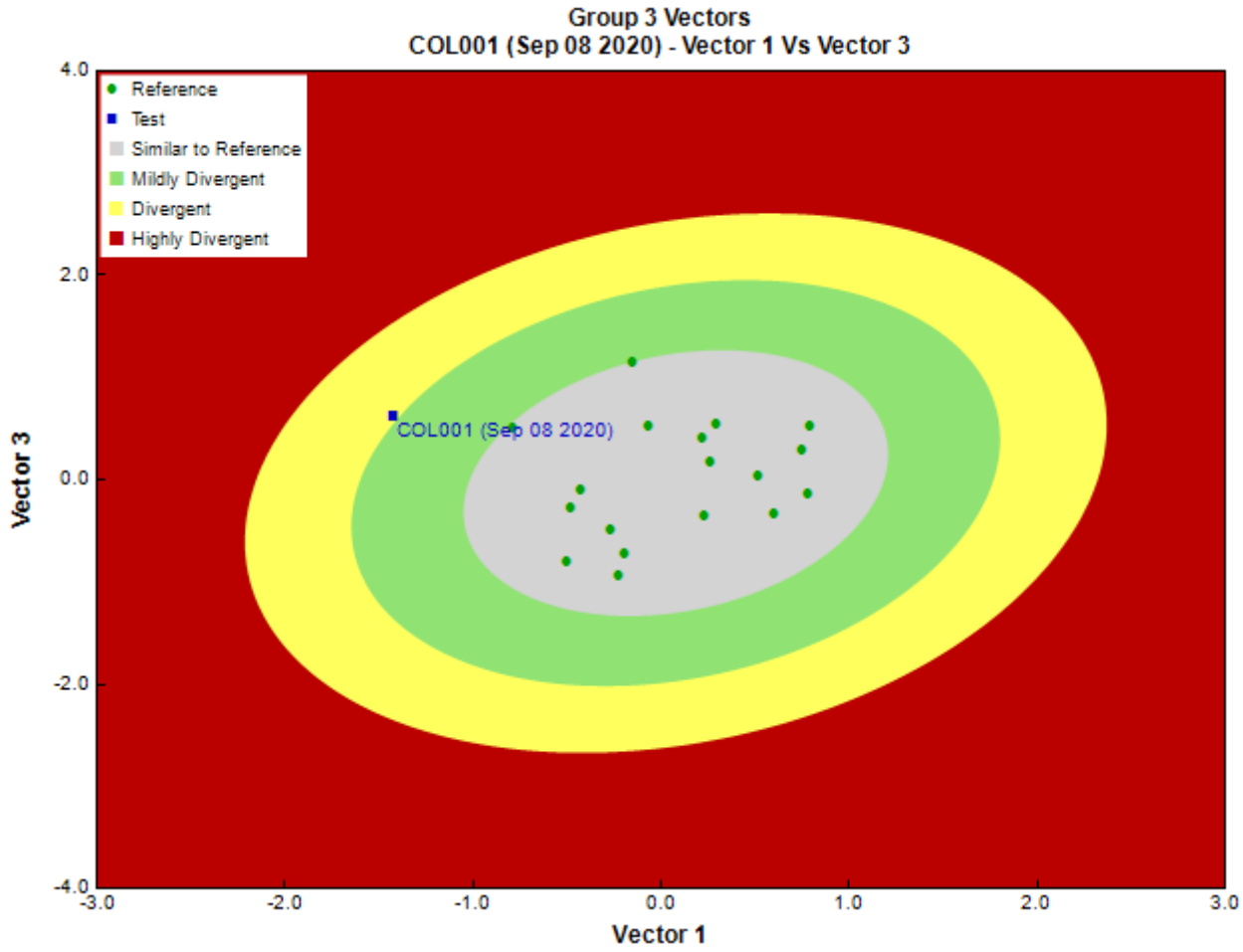

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

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 ± 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 ± 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 ± 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 ± 0.1
Total Abundance	9440.0	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	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 ± 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 ± 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

Frequency and Probability of Taxa Occurrence

Reference Model Taxa	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at COL001
	Group 1	Group 2	Group 3	Group 4	Group 5	
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

Frequency and Probability of Taxa Occurrence

Reference Model Taxa	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at COL001
	Group 1	Group 2	Group 3	Group 4	Group 5	
Capniidae	78%	55%	50%	92%	68%	0.53
Ceratopogonidae	0%	55%	28%	42%	5%	0.29
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
Elmidae	0%	86%	50%	50%	5%	0.51
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
Hydrophilidae	11%	2%	0%	0%	0%	0.00
Hydropsychidae	11%	92%	78%	92%	86%	0.79
Hydroptilidae	11%	8%	0%	0%	0%	0.00
Hydrozetidae	0%	10%	17%	8%	16%	0.16
Hydryphantidae	11%	31%	11%	8%	8%	0.11
Hygrobatidae	0%	29%	0%	0%	11%	0.01
Lebertiidae	78%	65%	39%	58%	5%	0.41
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%	0.56
Limnephilidae	22%	31%	6%	25%	41%	0.08
Limnesiidae	0%	2%	0%	0%	0%	0.00
Lumbriculidae	0%	20%	17%	25%	3%	0.17
Mideopsidae	0%	2%	0%	0%	0%	0.00
Naididae	0%	8%	39%	0%	3%	0.35
Nemouridae	100%	100%	100%	100%	100%	1.00
Pelecorhynchidae	0%	22%	6%	0%	0%	0.06
Peltoperlidae	22%	12%	6%	8%	41%	0.06
Perlidae	11%	84%	33%	100%	3%	0.39
Perlodidae	78%	78%	89%	92%	81%	0.89
Philopotamidae	0%	31%	0%	0%	3%	0.01
Pisidiidae	0%	6%	0%	8%	0%	0.01
Planariidae	0%	8%	67%	17%	3%	0.61
Planorbidae	0%	0%	0%	0%	3%	0.00
Psychodidae	22%	65%	94%	8%	11%	0.87
Pteronarcyidae	0%	12%	6%	0%	3%	0.05
Rhyacophilidae	100%	92%	100%	100%	95%	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
Taeniopterygidae	89%	49%	100%	92%	97%	0.98
Thaumaleidae	11%	4%	0%	0%	0%	0.00
Tipulidae	56%	55%	28%	67%	43%	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 : O: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 : O:E (p > 0.7)	0.95

Habitat Description

Variable	COL001	Predicted Group Reference Mean ±SD
Bedrock Geology		
Sedimentary (%)	100.00000	92.18813 ± 22.65908
Channel		
Depth-Avg (cm)	11.5	22.5 ± 10.5
Depth-BankfullMinusWetted (cm)	29.00	67.33 ± 71.65
Depth-Max (cm)	36.5	32.9 ± 17.9
Macrophyte (PercentRange)	0	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)	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
Climate		
Precip10_OCT (mm)	52.84964	52.92857 ± 22.22704
Temp12_DECmin (Degrees Celsius)	-12.55455	-12.82063 ± 2.01422
Hydrology		
Drainage-Area (km^2)	117.65191	166.32560 ± 185.60049
Landcover		
Natl-Grassland (%)	0.00000	4.92979 ± 5.99508
Natl-ShrubLow (%)	2.06574	1.89085 ± 1.59075
Natl-Water (%)	0.00000	0.22269 ± 0.34683
Reg-Ice (%)	0.00000	0.46949 ± 1.15785
Substrate Data		
%Bedrock (%)	0	0 ± 0
%Boulder (%)	4	6 ± 7
%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
Topography		
Reg-SlopeLT30% (%)	55.71333	27.92073 ± 14.83033
SlopeMax (%)	160.96903	616.97887 ± 680.88955
Water Chemistry		
Ag (mg/L)	0.0000250	0.0000004 ± 0.0000014
Al (mg/L)	0.0131000	0.0059500 ± 0.0039700
As (mg/L)	0.0002500	0.0002175 ± 0.0001795
B (mg/L)	0.0250000	0.0500000
Ba (mg/L)	0.3050000	0.0639025 ± 0.0450861

Habitat Description

Variable	COL001	Predicted Group Reference Mean ±SD
Be (mg/L)	0.0000500	0.0000025 ± 0.0000062
Bi (mg/L)	0.0000500	0.0000004 ± 0.0000014
Ca (mg/L)	39.3000000	38.6142857 ± 14.8464843
Cd (mg/L)	0.0000310	0.0000059 ± 0.0000067
Chloride-Total (mg/L)	0.4200000	0.0000000 ± 0.0000000
Co (mg/L)	0.0000500	0.0000043 ± 0.0000057
Cr (mg/L)	0.0002500	0.0000833 ± 0.0001403
Cu (mg/L)	0.0006200	0.0001875 ± 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 ± 84.0864011
General-Hardness (mg/L)	131.0000000	146.8222222 ± 41.6699011
General-pH (pH)	8.3	8.0 ± 0.6
General-SolidsTSS (mg/L)	1.0000000	0.5604289 ± 1.4627232
General-SpCond (µS/cm)	249.5000000	214.2437500 ± 77.1891440
General-TempAir (Degrees Celsius)	14.0	10.5 ± 4.2
General-TempWater (Degrees Celsius)	12.2000000	6.6716667 ± 2.0277755
General-Turbidity (NTU)	0.5200000	0.0000000 ± 0.0000000
Hg (ng/L)	0.0000200	0.0000000 ± 0.0000000
K (mg/L)	0.7700000	0.6471429 ± 0.7154652
Li (mg/L)	0.0097900	0.0011817 ± 0.0004768
Mg (mg/L)	8.3000000	9.8814286 ± 6.1601202
Mn (mg/L)	0.0055100	0.0011426 ± 0.0016097
Mo (mg/L)	0.0007600	0.0024883 ± 0.0065339
Na (mg/L)	3.3000000	2.6357143 ± 3.7712414
Ni (mg/L)	0.0005700	0.0000808 ± 0.0000811
Nitrogen-NO2 (mg/L)	0.0050000	0.0023889 ± 0.0063351
Nitrogen-NO2+NO3 (mg/L)	0.0050000	0.0130000 ± 0.0088111
Nitrogen-NO3 (mg/L)	0.0050000	0.0245003 ± 0.0229452
Nitrogen-TKN (mg/L)	0.0530000	0.0233333 ± 0.0161433
Nitrogen-TN (mg/L)	0.0530000	0.0688889 ± 0.0759171
Pb (mg/L)	0.0001000	0.0000224 ± 0.0000176
Phosphorus-TP (mg/L)	0.0136000	0.0032778 ± 0.0061816
S (mg/L)	1.5000000	5.0000000
Sb (mg/L)	0.0001000	0.0000361 ± 0.0000135
Se (mg/L)	0.0002500	0.0004382 ± 0.0004486
Si (mg/L)	2.0000000	3.0657143 ± 1.4070046
Sn (mg/L)	0.0001000	0.0000167 ± 0.0000078
SO4 (mg/L)	5.4000000	14.9647059 ± 10.8432549
Sr (mg/L)	0.1400000	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)	0.0025000	0.0009000
Tl (mg/L)	0.0000100	0.0000038 ± 0.0000064
U (mg/L)	0.0004490	0.0005298 ± 0.0003220
V (mg/L)	0.0005000	0.0001642 ± 0.0001203
Zn (mg/L)	0.0020000	0.0004083 ± 0.0008361
Zr (mg/L)	0.0000500	0.0000000 ± 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
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-Okanagan Preliminary March 2010
Analysis Date	January 07, 2022
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				

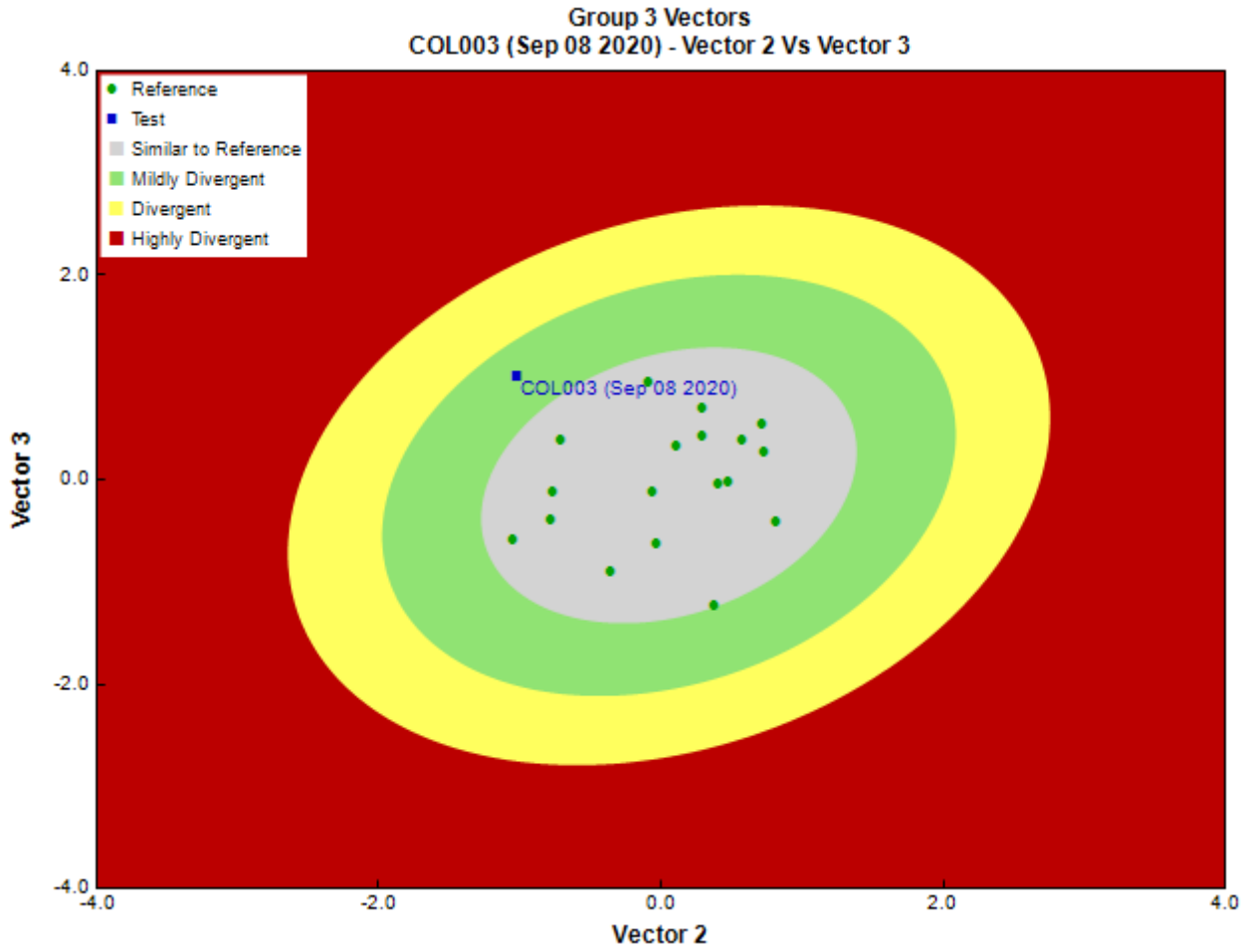

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

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	Family	Raw Count	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 ± 0.2
Biotic Indices		
Intolerant taxa	--	1.0
Tolerant individuals (%)	0.3	0.6 ± 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 ± 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 ± 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 ± 0.1
Total Abundance	1847.1	4086.0 ± 3834.6
Richness		
Chironomidae taxa (genus level only)	1.0	1.0 ± 0.0
Coleoptera taxa	2.0	0.6 ± 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 ± 0.0
Pielou's Evenness	0.8	0.7 ± 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 ± 0.1
Simpson's Evenness	0.3	0.3 ± 0.1
Total No. of Taxa	25.0	19.4 ± 4.2
Trichoptera taxa	3.0	3.6 ± 1.5

Frequency and Probability of Taxa Occurrence

Reference Model Taxa	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at COL003
	Group 1	Group 2	Group 3	Group 4	Group 5	
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 and Probability of Taxa Occurrence

Reference Model Taxa	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at COL003
	Group 1	Group 2	Group 3	Group 4	Group 5	
Brachycentridae	11%	69%	0%	42%	3%	0.11
Capniidae	78%	55%	50%	92%	68%	0.51
Ceratopogonidae	0%	55%	28%	42%	5%	0.32
Chironomidae	100%	100%	100%	100%	95%	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
Deuterophlebiidae	0%	0%	0%	0%	3%	0.00
Dixidae	0%	10%	0%	0%	0%	0.02
Dytiscidae	0%	8%	6%	0%	0%	0.06
Elmidae	0%	86%	50%	50%	5%	0.56
Empididae	67%	55%	50%	67%	57%	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
Glossosomatidae	11%	49%	39%	42%	35%	0.41
Heptageniidae	100%	100%	100%	100%	100%	1.00
Hydraenidae	0%	4%	0%	0%	0%	0.01
Hydrophilidae	11%	2%	0%	0%	0%	0.00
Hydropsychidae	11%	92%	78%	92%	86%	0.80
Hydroptilidae	11%	8%	0%	0%	0%	0.01
Hydrozetidae	0%	10%	17%	8%	16%	0.16
Hydryphantidae	11%	31%	11%	8%	8%	0.14
Hygrobatidae	0%	29%	0%	0%	11%	0.05
Lebertiidae	78%	65%	39%	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
Leuctridae	22%	43%	56%	67%	54%	0.54
Limnephilidae	22%	31%	6%	25%	41%	0.10
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%	0.34
Nemouridae	100%	100%	100%	100%	100%	1.00
Pelecorhynchidae	0%	22%	6%	0%	0%	0.08
Peltoperlidae	22%	12%	6%	8%	41%	0.07
Perlidae	11%	84%	33%	100%	3%	0.42
Perlodidae	78%	78%	89%	92%	81%	0.87
Philopotamidae	0%	31%	0%	0%	3%	0.05
Pisidiidae	0%	6%	0%	8%	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
Sperchontidae	78%	63%	50%	42%	65%	0.52
Stygothrombiidae	0%	4%	0%	17%	0%	0.01
Taeniopterygidae	89%	49%	100%	92%	97%	0.92
Thaumaleidae	11%	4%	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 : O:E (p > 0.7)	0.77

Habitat Description

Variable	COL003	Predicted Group Reference Mean ±SD
Bedrock Geology		
Sedimentary (%)	100.00000	92.18813 ± 22.65908
Channel		
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 ± 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 ± 7.0
XSEC-VelMethod (Category(1-3))	1	2 ± 1
Climate		
Precip10_OCT (mm)	52.73000	52.92857 ± 22.22704
Temp12_DECmin (Degrees Celsius)	-12.89667	-12.82063 ± 2.01422
Hydrology		
Drainage-Area (km^2)	5.65738	166.32560 ± 185.60049
Landcover		
Natl-Grassland (%)	0.00000	4.92979 ± 5.99508
Natl-ShrubLow (%)	0.20735	1.89085 ± 1.59075
Natl-Water (%)	0.00000	0.22269 ± 0.34683
Reg-Ice (%)	0.00000	0.46949 ± 1.15785
Substrate Data		
%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 ± 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))	2	2 ± 1
SurroundingMaterial (Category(0-9))	3	3 ± 1
Topography		
Reg-SlopeLT30% (%)	88.18473	27.92073 ± 14.83033
SlopeMax (%)	100.83002	616.97887 ± 680.88955
Water Chemistry		
Ag (mg/L)	0.0000250	0.0000004 ± 0.0000014
Al (mg/L)	0.0253000	0.0059500 ± 0.0039700
As (mg/L)	0.0002500	0.0002175 ± 0.0001795
B (mg/L)	0.0250000	0.0500000

Habitat Description

Variable	COL003	Predicted Group Reference Mean ±SD
Ba (mg/L)	0.0876000	0.0639025 ± 0.0450861
Be (mg/L)	0.0000500	0.0000025 ± 0.0000062
Bi (mg/L)	0.0000500	0.0000004 ± 0.0000014
Ca (mg/L)	15.7000000	38.6142857 ± 14.8464843
Cd (mg/L)	0.0000600	0.0000059 ± 0.0000067
Chloride-Total (mg/L)	0.0500000	0.0000000 ± 0.0000000
Co (mg/L)	0.0000500	0.0000043 ± 0.0000057
Cr (mg/L)	0.0002500	0.0000833 ± 0.0001403
Cu (mg/L)	0.0006000	0.0001875 ± 0.0001434
Fe (mg/L)	0.0050000	0.0090000
General-Alkalinity (mg/L)	40.3000000	121.5944444 ± 36.7225924
General-Conductivity (µS/cm)	65.1000000	186.8500000 ± 84.0864011
General-DO (mg/L)	10.0000000	10.4922222 ± 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)	1.0000000	0.5604289 ± 1.4627232
General-SpCond (µS/cm)	104.0000000	214.2437500 ± 77.1891440
General-TempAir (Degrees Celsius)	4.8	10.5 ± 4.2
General-TempWater (Degrees Celsius)	3.5000000	6.6716667 ± 2.0277755
General-Turbidity (NTU)	0.7400000	0.0000000 ± 0.0000000
Hg (ng/L)	0.0000200	0.0000000 ± 0.0000000
K (mg/L)	0.2300000	0.6471429 ± 0.7154652
Li (mg/L)	0.0003000	0.0011817 ± 0.0004768
Mg (mg/L)	3.2600000	9.8814286 ± 6.1601202
Mn (mg/L)	0.0003100	0.0011426 ± 0.0016097
Mo (mg/L)	0.0005300	0.0024883 ± 0.0065339
Na (mg/L)	0.2100000	2.6357143 ± 3.7712414
Ni (mg/L)	0.0006100	0.0000808 ± 0.0000811
Nitrogen-NO2 (mg/L)	0.0050000	0.0023889 ± 0.0063351
Nitrogen-NO2+NO3 (mg/L)	0.0050000	0.0130000 ± 0.0088111
Nitrogen-NO3 (mg/L)	0.0050000	0.0245003 ± 0.0229452
Nitrogen-TKN (mg/L)	0.0840000	0.0233333 ± 0.0161433
Nitrogen-TN (mg/L)	0.0840000	0.0688889 ± 0.0759171
Pb (mg/L)	0.0001000	0.0000224 ± 0.0000176
Phosphorus-TP (mg/L)	0.0168000	0.0032778 ± 0.0061816
S (mg/L)	3.1000000	5.0000000
Sb (mg/L)	0.0001000	0.0000361 ± 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)	6.9000000	14.9647059 ± 10.8432549
Sr (mg/L)	0.0214000	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)	0.0025000	0.0009000
Tl (mg/L)	0.0000100	0.0000038 ± 0.0000064
U (mg/L)	0.0001070	0.0005298 ± 0.0003220
V (mg/L)	0.0005000	0.0001642 ± 0.0001203
Zn (mg/L)	0.0040000	0.0004083 ± 0.0008361
Zr (mg/L)	0.0001000	0.0000000 ± 0.0000000

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-Okanagan Preliminary March 2010
Analysis Date	January 07, 2022
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				

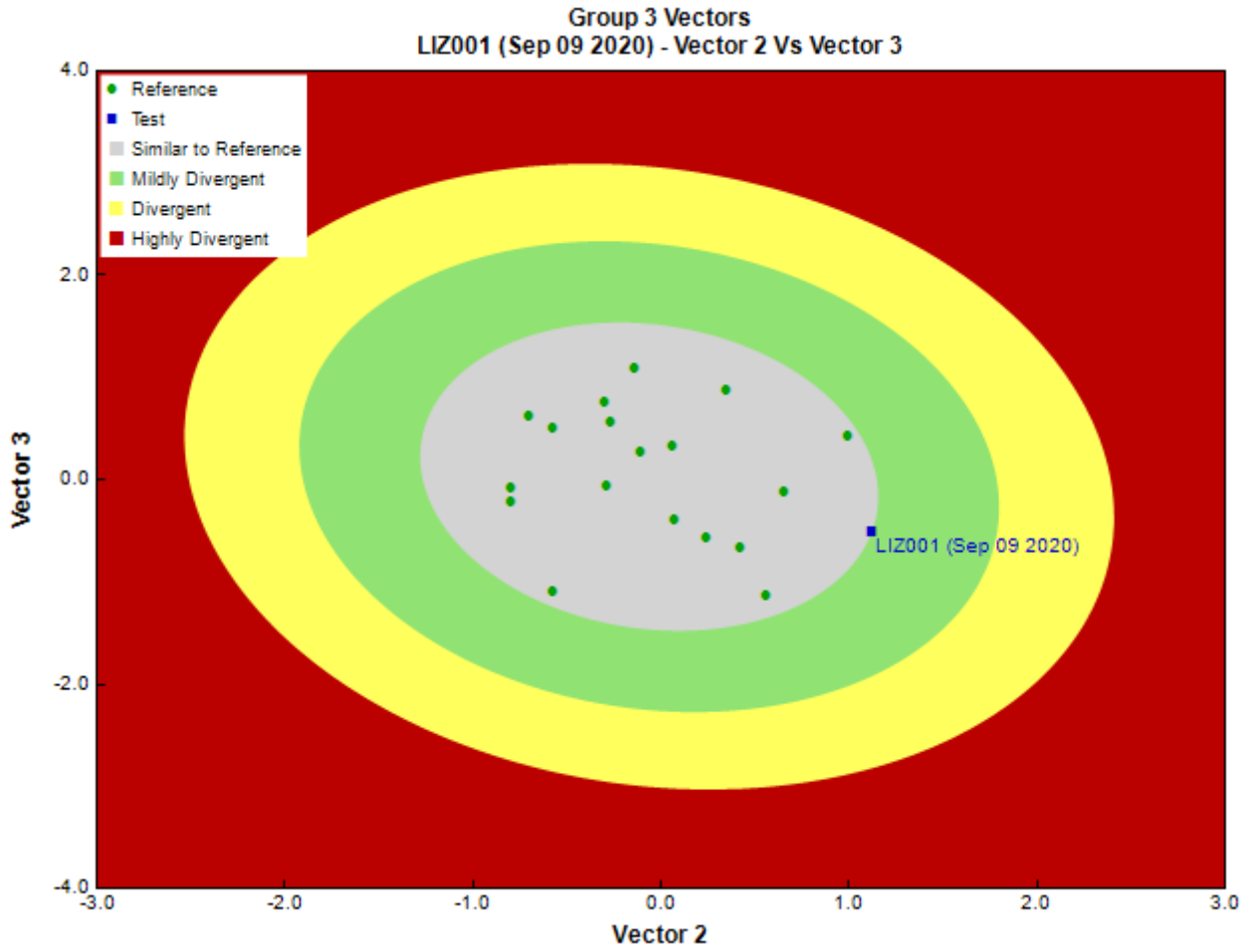

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

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 ± 11.1
% Ephemeroptera	16.5	48.4 ± 15.8
% Ephemeroptera that are Baetidae	73.9	41.9 ± 25.2
% EPT Individuals	40.4	84.1 ± 11.5
% Odonata	--	0.0 ± 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
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)	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 ± 0.1
Simpson's Evenness	0.3	0.3 ± 0.1
Total No. of Taxa	28.0	19.4 ± 4.2
Trichoptera taxa	8.0	3.6 ± 1.5

Frequency and Probability of Taxa Occurrence

Reference Model Taxa	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at LIZ001
	Group 1	Group 2	Group 3	Group 4	Group 5	
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 and Probability of Taxa Occurrence

Reference Model Taxa	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at LIZ001
	Group 1	Group 2	Group 3	Group 4	Group 5	
Blephariceridae	0%	0%	0%	0%	5%	0.00
Brachycentridae	11%	69%	0%	42%	3%	0.06
Capniidae	78%	55%	50%	92%	68%	0.55
Ceratopogonidae	0%	55%	28%	42%	5%	0.30
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
Elmidae	0%	86%	50%	50%	5%	0.50
Empididae	67%	55%	50%	67%	57%	0.52
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%	0.80
Hydroptilidae	11%	8%	0%	0%	0%	0.00
Hydrozetidae	0%	10%	17%	8%	16%	0.16
Hydryphantidae	11%	31%	11%	8%	8%	0.11
Hygrobatidae	0%	29%	0%	0%	11%	0.01
Lebertiidae	78%	65%	39%	58%	5%	0.41
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
Lumbriculidae	0%	20%	17%	25%	3%	0.18
Mideopsidae	0%	2%	0%	0%	0%	0.00
Naididae	0%	8%	39%	0%	3%	0.33
Nemouridae	100%	100%	100%	100%	100%	1.00
Pelecorhynchidae	0%	22%	6%	0%	0%	0.05
Peltoperlidae	22%	12%	6%	8%	41%	0.06
Perlidae	11%	84%	33%	100%	3%	0.42
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	0%	8%	67%	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
Rhyacophilidae	100%	92%	100%	100%	95%	1.00
Simuliidae	33%	49%	39%	33%	16%	0.38
Sperchontidae	78%	63%	50%	42%	65%	0.49
Stygothrombiidae	0%	4%	0%	17%	0%	0.02
Taeniopterygidae	89%	49%	100%	92%	97%	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
Uenoidae	22%	37%	17%	25%	46%	0.18
Valvatidae	0%	2%	6%	0%	0%	0.05

RIVPACS Ratios

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

RIVPACS Ratios

RIVPACS : O:E (p > 0.5)	1.06
RIVPACS : Expected taxa P>0.70	10.45
RIVPACS : Observed taxa P>0.70	11.00
RIVPACS : O:E (p > 0.7)	1.05

Habitat Description

Variable	LIZ001	Predicted Group Reference Mean ±SD
Bedrock Geology		
Sedimentary (%)	100.00000	92.18813 ± 22.65908
Channel		
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	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)	0.0160000	0.0235102 ± 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)	0.49	0.50 ± 0.25
Velocity-Max (m/s)	0.89	0.75 ± 0.28
Width-Bankfull (m)	9.0	15.6 ± 12.8
Width-Wetted (m)	6.9	10.2 ± 7.0
XSEC-VelMethod (Category(1-3))	1	2 ± 1
Climate		
Precip10_OCT (mm)	48.29762	52.92857 ± 22.22704
Temp12_DECmin (Degrees Celsius)	-12.00143	-12.82063 ± 2.01422
Hydrology		
Drainage-Area (km^2)	45.25496	166.32560 ± 185.60049
Landcover		
Natl-Grassland (%)	3.20862	4.92979 ± 5.99508
Natl-ShrubLow (%)	6.93880	1.89085 ± 1.59075
Natl-Water (%)	0.15275	0.22269 ± 0.34683
Reg-Ice (%)	0.00000	0.46949 ± 1.15785
Substrate Data		
%Bedrock (%)	0	0 ± 0
%Boulder (%)	13	6 ± 7
%Cobble (%)	60	61 ± 27
%Gravel (%)	5	1 ± 2
%Pebble (%)	21	31 ± 28
%Sand (%)	1	0 ± 0
%Silt+Clay (%)	0	0 ± 1
D50 (cm)	11.45	79.45 ± 47.98
Dg (cm)	7.9	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))	4	2 ± 1
SurroundingMaterial (Category(0-9))	3	3 ± 1
Topography		
Reg-SlopeLT30% (%)	45.90545	27.92073 ± 14.83033
SlopeMax (%)	204.47122	616.97887 ± 680.88955
Water Chemistry		
Ag (mg/L)	0.0000250	0.0000004 ± 0.0000014
Al (mg/L)	0.0110000	0.0059500 ± 0.0039700
As (mg/L)	0.0002500	0.0002175 ± 0.0001795

Habitat Description

Variable	LIZ001	Predicted Group Reference Mean ±SD
B (mg/L)	0.0250000	0.0500000
Ba (mg/L)	0.0761000	0.0639025 ± 0.0450861
Be (mg/L)	0.0000500	0.0000025 ± 0.0000062
Bi (mg/L)	0.0000500	0.0000004 ± 0.0000014
Ca (mg/L)	98.3000000	38.6142857 ± 14.8464843
Cd (mg/L)	0.0000160	0.0000059 ± 0.0000067
Chloride-Total (mg/L)	0.1800000	0.0000000 ± 0.0000000
Co (mg/L)	0.0000500	0.0000043 ± 0.0000057
Cr (mg/L)	0.0002500	0.0000833 ± 0.0001403
Cu (mg/L)	0.0002000	0.0001875 ± 0.0001434
Fe (mg/L)	0.0200000	0.0090000
General-Alkalinity (mg/L)	129.0000000	121.5944444 ± 36.7225924
General-Conductivity (µS/cm)	389.8000000	186.8500000 ± 84.0864011
General-Hardness (mg/L)	362.0000000	146.8222222 ± 41.6699011
General-pH (pH)	8.3	8.0 ± 0.6
General-SolidsTSS (mg/L)	2.0000000	0.5604289 ± 1.4627232
General-SpCond (µS/cm)	610.0000000	214.2437500 ± 77.1891440
General-TempAir (Degrees Celsius)	8.0	10.5 ± 4.2
General-TempWater (Degrees Celsius)	6.1000000	6.6716667 ± 2.0277755
General-Turbidity (NTU)	1.2800000	0.0000000 ± 0.0000000
Hg (ng/L)	0.0000200	0.0000000 ± 0.0000000
K (mg/L)	0.4700000	0.6471429 ± 0.7154652
Li (mg/L)	0.0040500	0.0011817 ± 0.0004768
Mg (mg/L)	25.3000000	9.8814286 ± 6.1601202
Mn (mg/L)	0.0024000	0.0011426 ± 0.0016097
Mo (mg/L)	0.0020300	0.0024883 ± 0.0065339
Na (mg/L)	1.7300000	2.6357143 ± 3.7712414
Ni (mg/L)	0.0002000	0.0000808 ± 0.0000811
Nitrogen-NO2 (mg/L)	0.0050000	0.0023889 ± 0.0063351
Nitrogen-NO2+NO3 (mg/L)	0.0050000	0.0130000 ± 0.0088111
Nitrogen-NO3 (mg/L)	0.0050000	0.0245003 ± 0.0229452
Nitrogen-TKN (mg/L)	0.0250000	0.0233333 ± 0.0161433
Nitrogen-TN (mg/L)	0.0250000	0.0688889 ± 0.0759171
Pb (mg/L)	0.0001000	0.0000224 ± 0.0000176
Phosphorus-TP (mg/L)	0.0149000	0.0032778 ± 0.0061816
S (mg/L)	72.6000000	5.0000000
Sb (mg/L)	0.0001000	0.0000361 ± 0.0000135
Se (mg/L)	0.0002500	0.0004382 ± 0.0004486
Si (mg/L)	2.6000000	3.0657143 ± 1.4070046
Sn (mg/L)	0.0001000	0.0000167 ± 0.0000078
SO4 (mg/L)	192.0000000	14.9647059 ± 10.8432549
Sr (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)	0.0025000	0.0009000
Tl (mg/L)	0.0000100	0.0000038 ± 0.0000064
U (mg/L)	0.0003940	0.0005298 ± 0.0003220
V (mg/L)	0.0005000	0.0001642 ± 0.0001203
Zn (mg/L)	0.0020000	0.0004083 ± 0.0008361
Zr (mg/L)	0.0000500	0.0000000 ± 0.0000000

Site 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

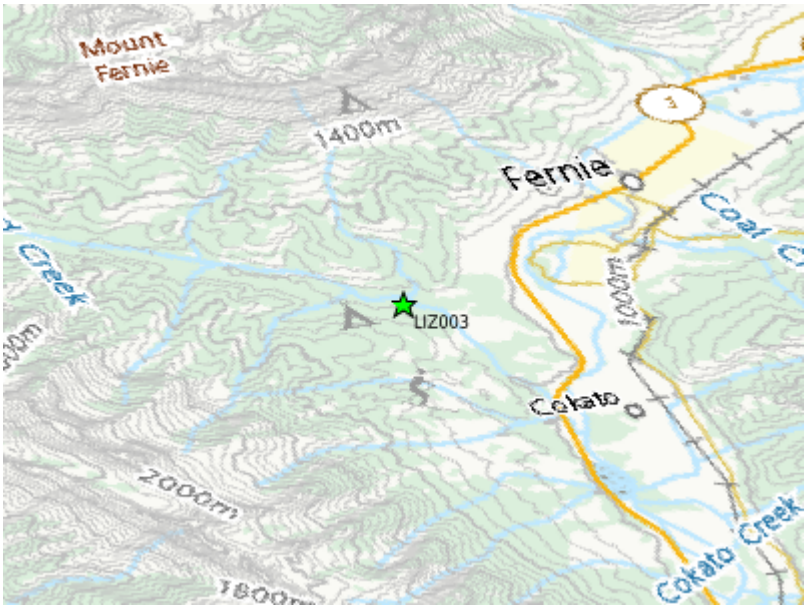

Figure 1. Location Map

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

Reference Model Summary	
Model	Columbia-Okanagan Preliminary March 2010
Analysis Date	January 07, 2022
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				

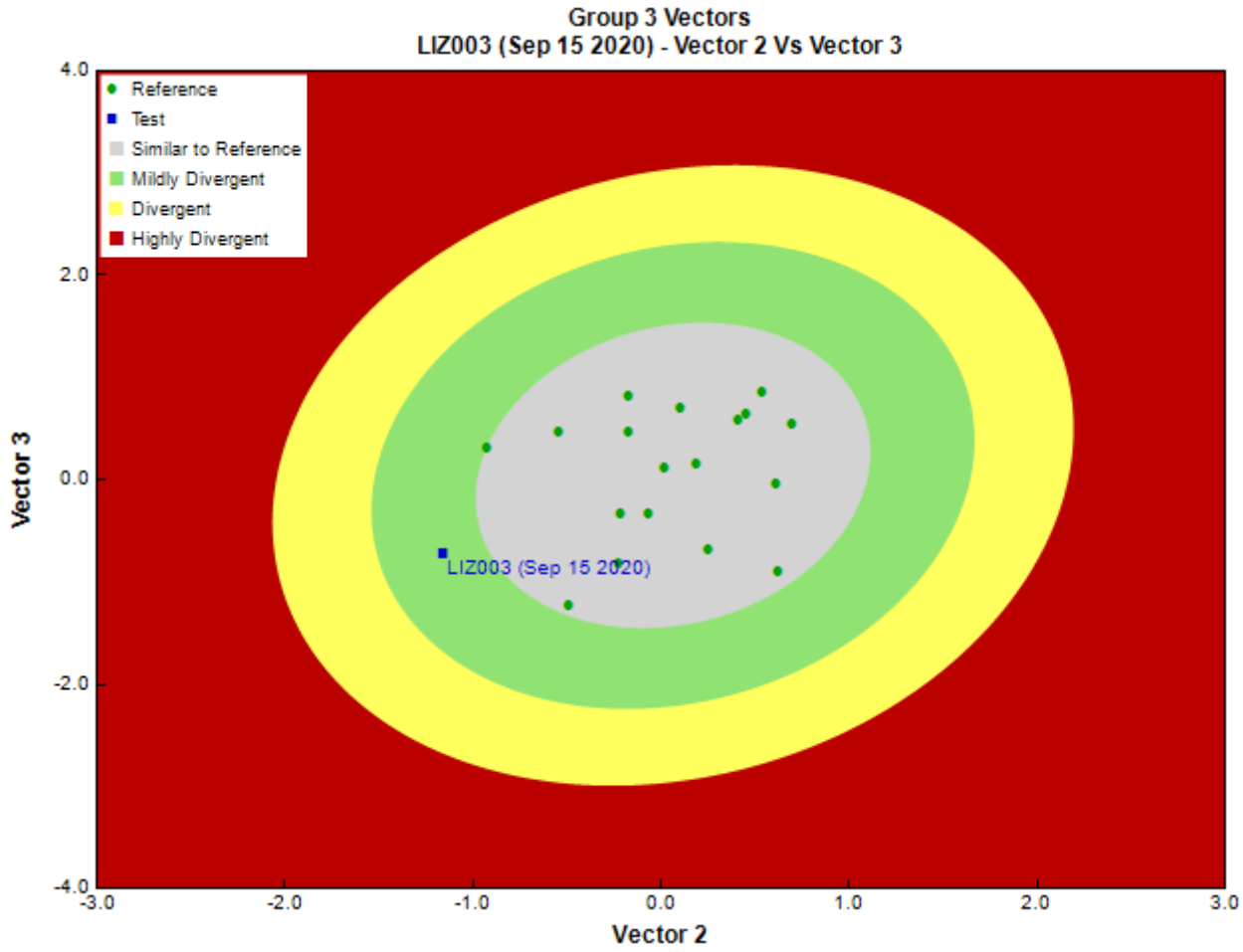

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

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 ± 0.2
Biotic Indices		
Intolerant taxa	--	1.0
Tolerant individuals (%)	--	0.6 ± 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 ± 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 ± 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 ± 0.1
Total Abundance	19740.0	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	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 ± 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 ± 0.1
Simpson's Evenness	0.4	0.3 ± 0.1
Total No. of Taxa	26.0	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 LIZ003
	Group 1	Group 2	Group 3	Group 4	Group 5	
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 and Probability of Taxa Occurrence

Reference Model Taxa	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at LIZ003
	Group 1	Group 2	Group 3	Group 4	Group 5	
Brachycentridae	11%	69%	0%	42%	3%	0.07
Capniidae	78%	55%	50%	92%	68%	0.56
Ceratopogonidae	0%	55%	28%	42%	5%	0.30
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
Elmidae	0%	86%	50%	50%	5%	0.50
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%	0.80
Hydroptilidae	11%	8%	0%	0%	0%	0.00
Hydrozetidae	0%	10%	17%	8%	16%	0.15
Hydryphantidae	11%	31%	11%	8%	8%	0.11
Hygrobatidae	0%	29%	0%	0%	11%	0.00
Lebertiidae	78%	65%	39%	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
Lumbriculidae	0%	20%	17%	25%	3%	0.18
Mideopsidae	0%	2%	0%	0%	0%	0.00
Naididae	0%	8%	39%	0%	3%	0.32
Nemouridae	100%	100%	100%	100%	100%	1.00
Pelecorhynchidae	0%	22%	6%	0%	0%	0.05
Peltoperlidae	22%	12%	6%	8%	41%	0.06
Perlidae	11%	84%	33%	100%	3%	0.43
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	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
Sperchontidae	78%	63%	50%	42%	65%	0.49
Stygothrombiidae	0%	4%	0%	17%	0%	0.02
Taeniopterygidae	89%	49%	100%	92%	97%	0.98
Thaumaleidae	11%	4%	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 : O: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 : O:E (p > 0.7)	1.05

Habitat Description

Variable	LIZ003	Predicted Group Reference Mean ±SD
Bedrock Geology		
Sedimentary (%)	100.00000	92.18813 ± 22.65908
Channel		
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	1 ± 0
Veg-Deciduous (Binary)	1	1 ± 0
Veg-GrassesFerns (Binary)	1	1 ± 0
Veg-Shrubs (Binary)	1	1 ± 0
Velocity-Avg (m/s)	0.29	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
Climate		
Precip10_OCT (mm)	50.00611	52.92857 ± 22.22704
Temp12_DECmin (Degrees Celsius)	-12.16556	-12.82063 ± 2.01422
Hydrology		
Drainage-Area (km^2)	41.12742	166.32560 ± 185.60049
Landcover		
Natl-Grassland (%)	3.33891	4.92979 ± 5.99508
Natl-ShrubLow (%)	6.54440	1.89085 ± 1.59075
Natl-Water (%)	0.16808	0.22269 ± 0.34683
Reg-Ice (%)	0.00000	0.46949 ± 1.15785
Substrate Data		
%Bedrock (%)	0	0 ± 0
%Boulder (%)	0	6 ± 7
%Cobble (%)	40	61 ± 27
%Gravel (%)	7	1 ± 2
%Pebble (%)	53	31 ± 28
%Sand (%)	0	0 ± 0
%Silt+Clay (%)	0	0 ± 1
D50 (cm)	5.55	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	4 ± 1
PeriphytonCoverage (Category(1-5))	3	2 ± 1
SurroundingMaterial (Category(0-9))	2	3 ± 1
Topography		
Reg-SlopeLT30% (%)	41.98937	27.92073 ± 14.83033
SlopeMax (%)	204.47122	616.97887 ± 680.88955
Water Chemistry		
Ag (mg/L)	0.0000250	0.0000004 ± 0.0000014
Al (mg/L)	0.0091000	0.0059500 ± 0.0039700
As (mg/L)	0.0002500	0.0002175 ± 0.0001795
B (mg/L)	0.0250000	0.0500000

Habitat Description

Variable	LIZ003	Predicted Group Reference Mean ±SD
Ba (mg/L)	0.0668000	0.0639025 ± 0.0450861
Be (mg/L)	0.0000500	0.0000025 ± 0.0000062
Bi (mg/L)	0.0000500	0.0000004 ± 0.0000014
Ca (mg/L)	95.1000000	38.6142857 ± 14.8464843
Cd (mg/L)	0.0000130	0.0000059 ± 0.0000067
Chloride-Total (mg/L)	0.1900000	0.0000000 ± 0.0000000
Co (mg/L)	0.0000500	0.0000043 ± 0.0000057
Cr (mg/L)	0.0002500	0.0000833 ± 0.0001403
Cu (mg/L)	0.0002000	0.0001875 ± 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 ± 84.0864011
General-Hardness (mg/L)	329.0000000	146.8222222 ± 41.6699011
General-pH (pH)	8.4	8.0 ± 0.6
General-SolidsTSS (mg/L)	1.0000000	0.5604289 ± 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 ± 0.0000000
Hg (ng/L)	0.0000200	0.0000000 ± 0.0000000
K (mg/L)	0.4100000	0.6471429 ± 0.7154652
Li (mg/L)	0.0042600	0.0011817 ± 0.0004768
Mg (mg/L)	23.5000000	9.8814286 ± 6.1601202
Mn (mg/L)	0.0035700	0.0011426 ± 0.0016097
Mo (mg/L)	0.0019200	0.0024883 ± 0.0065339
Na (mg/L)	1.6800000	2.6357143 ± 3.7712414
Ni (mg/L)	0.0002000	0.0000808 ± 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)	0.0120000	0.0130000 ± 0.0088111
Nitrogen-NO3 (mg/L)	0.0120000	0.0245003 ± 0.0229452
Nitrogen-TKN (mg/L)	0.0250000	0.0233333 ± 0.0161433
Nitrogen-TN (mg/L)	0.0250000	0.0688889 ± 0.0759171
Pb (mg/L)	0.0001000	0.0000224 ± 0.0000176
Phosphorus-TP (mg/L)	0.0179000	0.0032778 ± 0.0061816
S (mg/L)	68.9000000	5.0000000
Sb (mg/L)	0.0001000	0.0000361 ± 0.0000135
Se (mg/L)	0.0002500	0.0004382 ± 0.0004486
Si (mg/L)	2.5000000	3.0657143 ± 1.4070046
Sn (mg/L)	0.0001000	0.0000167 ± 0.0000078
SO4 (mg/L)	192.0000000	14.9647059 ± 10.8432549
Sr (mg/L)	1.5700000	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)	0.0025000	0.0009000
Tl (mg/L)	0.0000100	0.0000038 ± 0.0000064
U (mg/L)	0.0004070	0.0005298 ± 0.0003220
V (mg/L)	0.0005000	0.0001642 ± 0.0001203
Zn (mg/L)	0.0020000	0.0004083 ± 0.0008361
Zr (mg/L)	0.0000500	0.0000000 ± 0.0000000

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-Okanagan Preliminary March 2010
Analysis Date	January 07, 2022
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, 2020	Divergent				

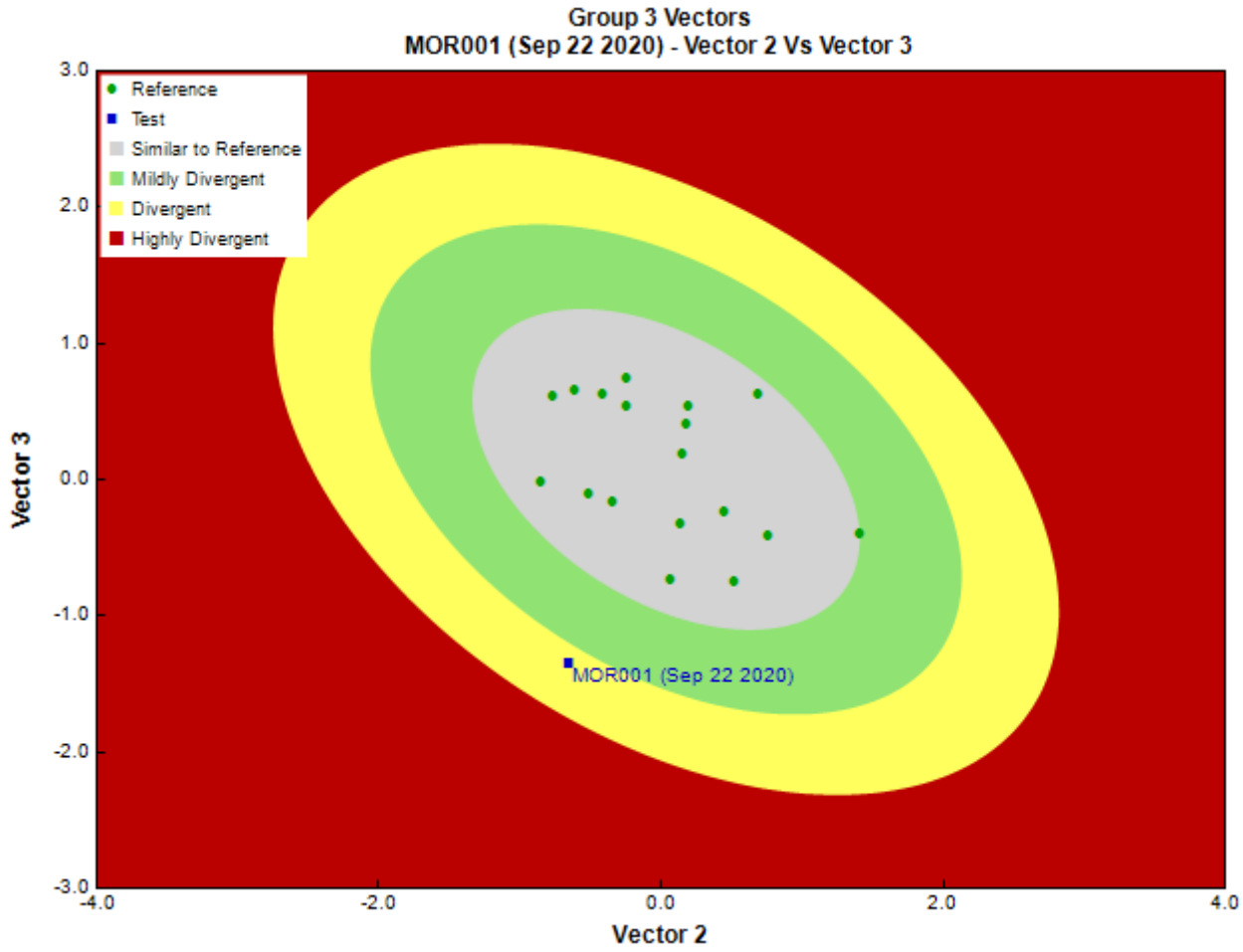

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

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	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

Name	MOR001	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.77	0.4 ± 0.2
Biotic Indices		
Intolerant taxa	--	1.0
Tolerant individuals (%)	0.5	0.6 ± 0.4
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	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
% 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
Trichoptera taxa	5.0	3.6 ± 1.5

Frequency and Probability of Taxa Occurrence

Reference Model Taxa	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at MOR001
	Group 1	Group 2	Group 3	Group 4	Group 5	
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 and Probability of Taxa Occurrence

Reference Model Taxa	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at MOR001
	Group 1	Group 2	Group 3	Group 4	Group 5	
Ceratopogonidae	0%	55%	28%	42%	5%	0.30
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
Dytiscidae	0%	8%	6%	0%	0%	0.05
Elmidae	0%	86%	50%	50%	5%	0.52
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%	0.40
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%	0.79
Hydroptilidae	11%	8%	0%	0%	0%	0.00
Hydrozetidae	0%	10%	17%	8%	16%	0.16
Hydryphantidae	11%	31%	11%	8%	8%	0.12
Hygrobatidae	0%	29%	0%	0%	11%	0.01
Lebertiidae	78%	65%	39%	58%	5%	0.41
Lepidostomatidae	0%	53%	6%	17%	8%	0.08
Leptohyphidae	0%	2%	0%	0%	0%	0.00
Leptophlebiidae	0%	90%	11%	33%	3%	0.16
Leuctridae	22%	43%	56%	67%	54%	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
Nemouridae	100%	100%	100%	100%	100%	1.00
Pelecorhynchidae	0%	22%	6%	0%	0%	0.06
Peltoperlidae	22%	12%	6%	8%	41%	0.06
Perlidae	11%	84%	33%	100%	3%	0.39
Perlodidae	78%	78%	89%	92%	81%	0.88
Philopotamidae	0%	31%	0%	0%	3%	0.02
Pisidiidae	0%	6%	0%	8%	0%	0.01
Planariidae	0%	8%	67%	17%	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
Stygothrombiidae	0%	4%	0%	17%	0%	0.01
Taeniopterygidae	89%	49%	100%	92%	97%	0.97
Thaumaleidae	11%	4%	0%	0%	0%	0.00
Tipulidae	56%	55%	28%	67%	43%	0.31
Torrenticolidae	11%	86%	11%	17%	11%	0.15
Uenoidae	22%	37%	17%	25%	46%	0.18
Valvatidae	0%	2%	6%	0%	0%	0.05

RIVPACS Ratios

RIVPACS : Expected taxa P>0.50	13.69
RIVPACS : Observed taxa P>0.50	13.00
RIVPACS : O: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 : O:E (p > 0.7)	0.95

Habitat Description

Variable	MOR001	Predicted Group Reference Mean ±SD
Bedrock Geology		
Sedimentary (%)	100.00000	92.18813 ± 22.65908
Channel		
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 ± 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	1 ± 0
Reach-StraightRun (Binary)	0	1 ± 0
Slope (m/m)	0.0175000	0.0235102 ± 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)	0.23	0.50 ± 0.25
Velocity-Max (m/s)	0.46	0.75 ± 0.28
Width-Bankfull (m)	11.9	15.6 ± 12.8
Width-Wetted (m)	5.7	10.2 ± 7.0
XSEC-VelMethod (Category(1-3))	1	2 ± 1
Climate		
Precip10_OCT (mm)	51.59276	52.92857 ± 22.22704
Temp12_DECmin (Degrees Celsius)	-12.07931	-12.82063 ± 2.01422
Hydrology		
Drainage-Area (km^2)	70.83074	166.32560 ± 185.60049
Landcover		
Natl-Grassland (%)	0.00000	4.92979 ± 5.99508
Natl-ShrubLow (%)	4.94777	1.89085 ± 1.59075
Natl-Water (%)	0.00000	0.22269 ± 0.34683
Reg-Ice (%)	0.00000	0.46949 ± 1.15785
Substrate Data		
%Bedrock (%)	0	0 ± 0
%Boulder (%)	6	6 ± 7
%Cobble (%)	55	61 ± 27
%Gravel (%)	8	1 ± 2
%Pebble (%)	30	31 ± 28
%Sand (%)	0	0 ± 0
%Silt+Clay (%)	1	0 ± 1
D50 (cm)	9.35	79.45 ± 47.98
Dg (cm)	7.0	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
Topography		
Reg-SlopeLT30% (%)	64.31823	27.92073 ± 14.83033
SlopeMax (%)	149.28961	616.97887 ± 680.88955
Water 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 ± 0.0001795
B (mg/L)	0.0250000	0.0500000
Ba (mg/L)	0.1630000	0.0639025 ± 0.0450861
Be (mg/L)	0.0000500	0.0000025 ± 0.0000062

Habitat Description

Variable	MOR001	Predicted Group Reference Mean ±SD
Bi (mg/L)	0.0000500	0.0000004 ± 0.0000014
Ca (mg/L)	41.2000000	38.6142857 ± 14.8464843
Cd (mg/L)	0.0000330	0.0000059 ± 0.0000067
Co (mg/L)	0.0000500	0.0000043 ± 0.0000057
Cr (mg/L)	0.0002500	0.0000833 ± 0.0001403
Cu (mg/L)	0.0007400	0.0001875 ± 0.0001434
Fe (mg/L)	0.0130000	0.0090000
General-Alkalinity (mg/L)	141.0000000	121.5944444 ± 36.7225924
General-Conductivity (µS/cm)	146.2700000	186.8500000 ± 84.0864011
General-Hardness (mg/L)	136.0000000	146.8222222 ± 41.6699011
General-pH (pH)	8.2	8.0 ± 0.6
General-SolidsTSS (mg/L)	1.0000000	0.5604289 ± 1.4627232
General-SpCond (µS/cm)	197.1000000	214.2437500 ± 77.1891440
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Hg (ng/L)	0.0000200	0.0000000 ± 0.0000000
K (mg/L)	0.5300000	0.6471429 ± 0.7154652
Li (mg/L)	0.0042100	0.0011817 ± 0.0004768
Mg (mg/L)	9.0400000	9.8814286 ± 6.1601202
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Ni (mg/L)	0.0002000	0.0000808 ± 0.0000811
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Nitrogen-NO2+NO3 (mg/L)	0.0050000	0.0130000 ± 0.0088111
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S (mg/L)	5.0000000	5.0000000
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Se (mg/L)	0.0002500	0.0004382 ± 0.0004486
Si (mg/L)	2.3000000	3.0657143 ± 1.4070046
Sn (mg/L)	0.0001000	0.0000167 ± 0.0000078
Sr (mg/L)	0.1510000	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)	0.0025000	0.0009000
Tl (mg/L)	0.0000100	0.0000038 ± 0.0000064
U (mg/L)	0.0003340	0.0005298 ± 0.0003220
V (mg/L)	0.0005000	0.0001642 ± 0.0001203
Zn (mg/L)	0.0020000	0.0004083 ± 0.0008361
Zr (mg/L)	0.0000500	0.0000000 ± 0.0000000

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-Okanagan Preliminary March 2010
Analysis Date	January 07, 2022
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				

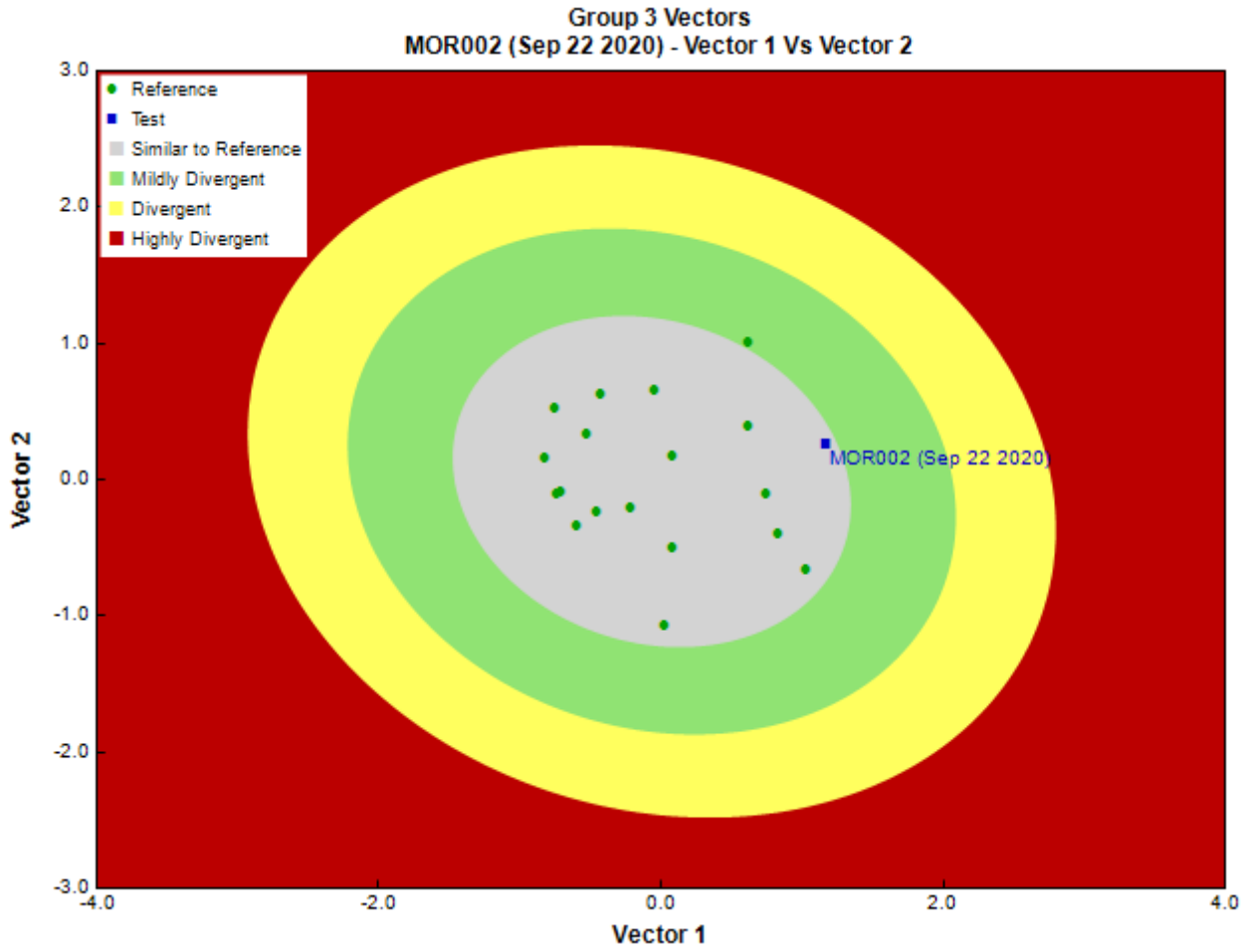


Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

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	5	83.3
			Total	335	5,583.6

Metrics

Name	MOR002	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.69	0.4 ± 0.2
Biotic Indices		
Intolerant taxa	--	1.0
Tolerant individuals (%)	--	0.6 ± 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 ± 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 ± 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 ± 0.1
Total Abundance	5583.3	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	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 ± 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	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at MOR002
	Group 1	Group 2	Group 3	Group 4	Group 5	
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 and Probability of Taxa Occurrence

Reference Model Taxa	Frequency of Occurrence in Reference Sites					Probability Of Occurrence at MOR002
	Group 1	Group 2	Group 3	Group 4	Group 5	
Brachycentridae	11%	69%	0%	42%	3%	0.10
Capniidae	78%	55%	50%	92%	68%	0.51
Ceratopogonidae	0%	55%	28%	42%	5%	0.32
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%	0.01
Deuterophlebiidae	0%	0%	0%	0%	3%	0.00
Dixidae	0%	10%	0%	0%	0%	0.01
Dytiscidae	0%	8%	6%	0%	0%	0.06
Elmidae	0%	86%	50%	50%	5%	0.55
Empididae	67%	55%	50%	67%	57%	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
Glossosomatidae	11%	49%	39%	42%	35%	0.40
Heptageniidae	100%	100%	100%	100%	100%	1.00
Hydraenidae	0%	4%	0%	0%	0%	0.01
Hydrophilidae	11%	2%	0%	0%	0%	0.00
Hydropsychidae	11%	92%	78%	92%	86%	0.80
Hydroptilidae	11%	8%	0%	0%	0%	0.01
Hydrozetidae	0%	10%	17%	8%	16%	0.16
Hydryphantidae	11%	31%	11%	8%	8%	0.14
Hygrobatidae	0%	29%	0%	0%	11%	0.04
Lebertiidae	78%	65%	39%	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
Lumbriculidae	0%	20%	17%	25%	3%	0.17
Mideopsidae	0%	2%	0%	0%	0%	0.00
Naididae	0%	8%	39%	0%	3%	0.34
Nemouridae	100%	100%	100%	100%	100%	1.00
Pelecorhynchidae	0%	22%	6%	0%	0%	0.08
Peltoperlidae	22%	12%	6%	8%	41%	0.07
Perlidae	11%	84%	33%	100%	3%	0.41
Perlodidae	78%	78%	89%	92%	81%	0.87
Philopotamidae	0%	31%	0%	0%	3%	0.04
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
Sperchontidae	78%	63%	50%	42%	65%	0.52
Stygothrombiidae	0%	4%	0%	17%	0%	0.01
Taeniopterygidae	89%	49%	100%	92%	97%	0.93
Thaumaleidae	11%	4%	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

RIVPACS Ratios

RIVPACS : Expected taxa P>0.50	13.63
RIVPACS : Observed taxa P>0.50	14.00
RIVPACS : O: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 : O:E (p > 0.7)	0.96

Habitat Description

Variable	MOR002	Predicted Group Reference Mean ±SD
Bedrock Geology		
Sedimentary (%)	100.00000	92.18813 ± 22.65908
Channel		
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 ± 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 ± 7.0
XSEC-VelMethod (Category(1-3))	1	2 ± 1
Climate		
Precip10_OCT (mm)	54.48857	52.92857 ± 22.22704
Temp12_DECmin (Degrees Celsius)	-12.63857	-12.82063 ± 2.01422
Hydrology		
Drainage-Area (km^2)	16.01314	166.32560 ± 185.60049
Landcover		
Natl-Grassland (%)	0.00000	4.92979 ± 5.99508
Natl-ShrubLow (%)	2.55232	1.89085 ± 1.59075
Natl-Water (%)	0.00000	0.22269 ± 0.34683
Reg-Ice (%)	0.00000	0.46949 ± 1.15785
Substrate Data		
%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	0 ± 1
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-2nd (Category(0-9))	7	6 ± 2
Embeddedness (Category(1-5))	2	4 ± 1
PeriphytonCoverage (Category(1-5))	4	2 ± 1
SurroundingMaterial (Category(0-9))	3	3 ± 1
Topography		
Reg-SlopeLT30% (%)	83.40667	27.92073 ± 14.83033
SlopeMax (%)	83.89085	616.97887 ± 680.88955
Water Chemistry		
Ag (mg/L)	0.0000250	0.0000004 ± 0.0000014
Al (mg/L)	0.0108000	0.0059500 ± 0.0039700
As (mg/L)	0.0002500	0.0002175 ± 0.0001795
B (mg/L)	0.0250000	0.0500000

Habitat Description

Variable	MOR002	Predicted Group Reference Mean ±SD
Ba (mg/L)	0.2070000	0.0639025 ± 0.0450861
Be (mg/L)	0.0000500	0.0000025 ± 0.0000062
Bi (mg/L)	0.0000500	0.0000004 ± 0.0000014
Ca (mg/L)	20.3000000	38.6142857 ± 14.8464843
Cd (mg/L)	0.0000380	0.0000059 ± 0.0000067
Co (mg/L)	0.0000500	0.0000043 ± 0.0000057
Cr (mg/L)	0.0002500	0.0000833 ± 0.0001403
Cu (mg/L)	0.0055600	0.0001875 ± 0.0001434
Fe (mg/L)	0.0120000	0.0090000
General-Alkalinity (mg/L)	66.7000000	121.5944444 ± 36.7225924
General-Conductivity (µS/cm)	46.5000000	186.8500000 ± 84.0864011
General-Hardness (mg/L)	64.4000000	146.8222222 ± 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 ± 4.2
General-TempWater (Degrees Celsius)	7.5000000	6.6716667 ± 2.0277755
General-Turbidity (NTU)	0.3600000	0.0000000 ± 0.0000000
Hg (ng/L)	0.0000200	0.0000000 ± 0.0000000
K (mg/L)	0.4600000	0.6471429 ± 0.7154652
Li (mg/L)	0.0022900	0.0011817 ± 0.0004768
Mg (mg/L)	4.3100000	9.8814286 ± 6.1601202
Mn (mg/L)	0.0019000	0.0011426 ± 0.0016097
Mo (mg/L)	0.0005900	0.0024883 ± 0.0065339
Na (mg/L)	1.4500000	2.6357143 ± 3.7712414
Ni (mg/L)	0.0012700	0.0000808 ± 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)	0.0050000	0.0130000 ± 0.0088111
Nitrogen-NO3 (mg/L)	0.0050000	0.0245003 ± 0.0229452
Nitrogen-TKN (mg/L)	0.0250000	0.0233333 ± 0.0161433
Nitrogen-TN (mg/L)	0.0250000	0.0688889 ± 0.0759171
Pb (mg/L)	0.0001000	0.0000224 ± 0.0000176
Phosphorus-TP (mg/L)	0.0025000	0.0032778 ± 0.0061816
S (mg/L)	3.1000000	5.0000000
Sb (mg/L)	0.0001000	0.0000361 ± 0.0000135
Se (mg/L)	0.0002500	0.0004382 ± 0.0004486
Si (mg/L)	0.5000000	3.0657143 ± 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	0.0000000 ± 0.0000000
Th (mg/L)	0.0000500	0.0000000 ± 0.0000000
Ti (mg/L)	0.0025000	0.0009000
Tl (mg/L)	0.0000100	0.0000038 ± 0.0000064
U (mg/L)	0.0002030	0.0005298 ± 0.0003220
V (mg/L)	0.0005000	0.0001642 ± 0.0001203
Zn (mg/L)	0.0020000	0.0004083 ± 0.0008361
Zr (mg/L)	0.0000500	0.0000000 ± 0.0000000

Appendix B: Raw Data/Datasheets

Chad @ CABIN SITE

Field Crew: Chad Hughes + Beth Millions Site Code: ALX01

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

☐ **Occupational Health & Safety: Site Inspection Sheet completed**

PRIMARY SITE DATA

CABIN Study Name: CBWM Local Basin Name: Elk River

River/Stream Name: Alexander Creek Stream Order: (map scale 1:50,000) _____

Select one: ☒ Test Site ☐ Potential Reference Site

Geographical Description/Notes: Park at highway by bridge over Michel Cr walk d/s to confluence, u/s Alex for ~10m. Site has tag on alder.

Surrounding Land Use: (check those present) Information Source: visual, maps

☒ Forest ☐ Field/Pasture ☐ Agriculture ☐ Residential/Urban

☒ Logging ☒ Mining ☒ Commercial/Industrial ☒ Other Train

Dominant Surrounding Land Use: (check one) Information Source: Visual

☒ Forest ☐ Field/Pasture ☐ Agriculture ☐ Residential/Urban

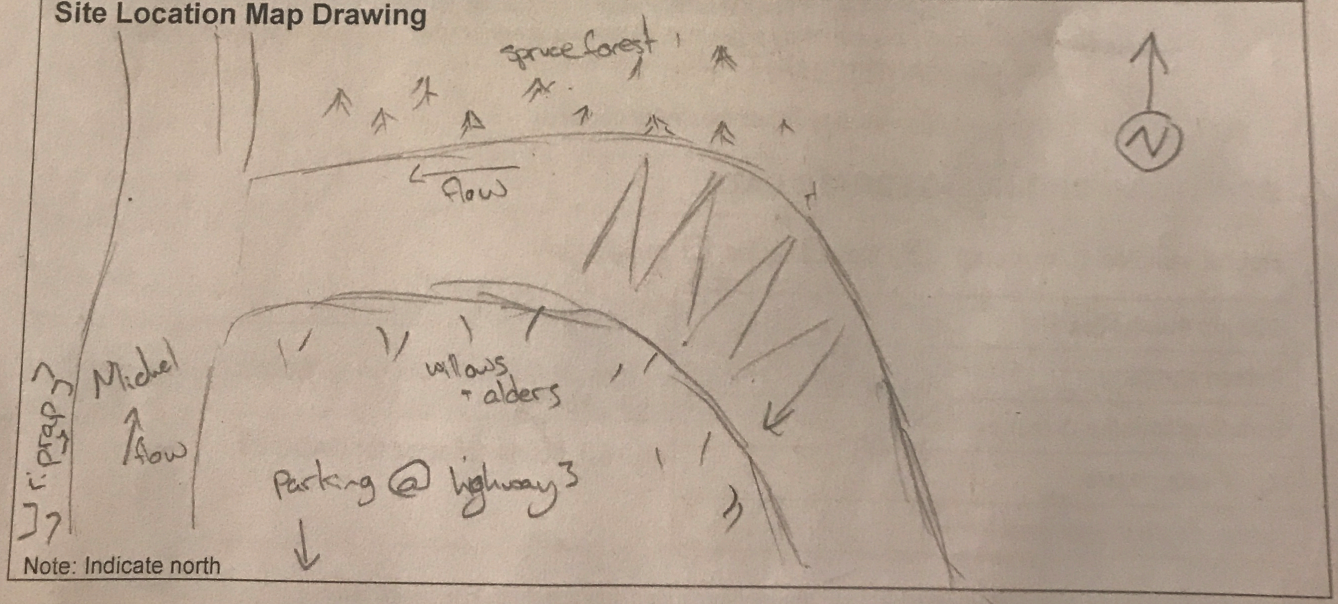
☐ Logging ☐ Mining ☐ Commercial/Industrial ☐ Other _____

Location Data

Latitude: _____N Longitude: - _____W (DMS or DD)

Elevation: _____(fasl *or* masl) GPS Datum: ☐ GRS80 (NAD83/WGS84) ☐ Other: _____

Site Location Map Drawing



Note: Indicate north

Field Crew: Chad Hughes + Beth Millions Site Code: AL201

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

Photos

☒ Field Sheet ☒ Upstream ☒ Downstream ☒ Across Site ☐ Aerial View

☒ Substrate (exposed) ☒ Substrate (aquatic) ☐ Other _____

REACH DATA *(represents 6 times bankfull width)*

1. Habitat Types: *(check those present)*

☒ Riffle ☐ Rapids ☐ Straight run ☐ Pool/Back Eddy

2. Canopy Coverage: *(stand in middle of stream and look up, check one)*

☐ 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)*

☒ ferns/grasses ☒ shrubs ☒ deciduous trees ☒ coniferous trees

5. Dominant Streamside Vegetation: *(check one)*

☐ ferns/grasses ☒ 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)

☒ **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 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)

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	
Person sampling	Chad Hughes
Sampling time (i.e. 3 min.)	3 min
No. of sample jars	1
Typical depth in kick area (cm)	20

Preservative used: 99% IPA

Sampled sieved on site using "Bucket Swirling Method":
☒ YES ☐ NO

If YES, debris collected for QAQC ☒

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

Field Crew: Cloud Hughes + Bell Williams Site Code: ALX01

Sampling Date: (DD/MM/YYYY) 2/09/2020

WATER CHEMISTRY DATA Time: 09:30 (24 hr clock) Time zone: MT

Air Temp: 2 (°C) Water Temp: 5.9 (°C) pH: 8.22

Specific Conductance: 208.4 (µs/cm) DO: — (mg/L) Turbidity: 12.67 (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) ☐ Other_____

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**

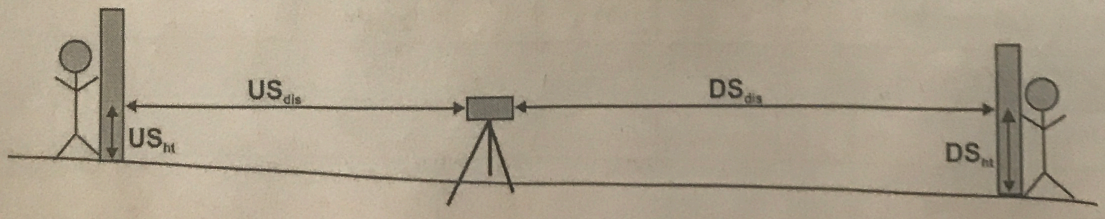
Scale: _____ (Note: small scale map recommended if field measurement is not possible - i.e. 1:20,000).
contour interval (vertical distance) _____ (m),
distance between contour intervals (horizontal distance) _____ (m)
slope = vertical distance/horizontal distance =_____

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
[a]Top Hairline (T)			
[a]Mid Hairline (ht) OR [b]Height of rod			
[a]Bottom Hairline (B)			
[b]Distance (dis) OR [a]T-B x 100	[a]US_{dis}=T-B	[a]DS_{dis}=T-B	$US_{dis}+DS_{dis}$=
Change in height (Δht)			$DS_{ht}-US_{ht}$=
Slope (Δht/total dis)			0.007



Field Crew: Chad Hughes + Beth Millions Site Code: MX01

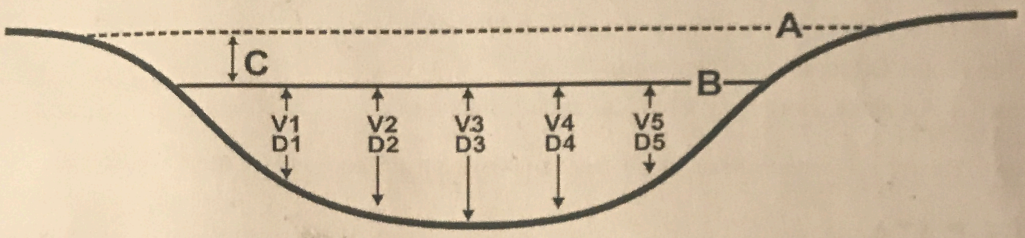
Sampling Date: (DD/MM/YYYY) 21/09/2020

Widths and Depth

Location at site: U/S of kick area (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)



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)	1.5	3	4.5	6	7.5	9	
Depth (**D**) (cm)							
Velocity Head Rod (ruler)							
Flowing water Depth (D_1) (cm)	42.5	29.2	16.7	17.6	16.0	12.2	
Depth of Stagnation (D_2) (cm)	51.5	33	17.7	18.4	17.0	12.2	
Change in depth ($\Delta D=D_2-D_1$) (cm)	9	13.8	1	0.8	1	0	
Rotary meter							
Revolutions							
Time (minimum 40 seconds)							
Direct Measurement or calculation							
Velocity (**V**) (m/s)							

Field Crew: Claud Hughes + Beth Millions Site Code: ALX01

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/silt/clay (particles < 0.2 cm) and O for organic material.
- Embededness 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		Diameter (cm)	E
1	4.4		26	9.2		51	5.5		76	16.5	
2	10.2		27	13		52	5.2		77	27	
3	8.6		28	11.4		53	9.2		78	14.5	
4	2.0		29	3.6		54	3		79	2.5	
5	10.2		(30)	11.2	1/4	55	10.5		(80)	18.5	3/4
6	35.0		31	10		56	3.9		81	9.5	
7	14.0		32	8.5		57	25		82	4.7	
8	3.5		33	10.6		58	1.5		83	7	
9	13.5		34	10.4		59	21		84	7.5	
(10)	10	1	35	5.1		(60)	8.5	O	85	4	
11	17		36	5.4		61	5.4		86	16.7	
12	2		37	2.9		62	5.5		87	7.9	
13	38		38	11.3		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	4		41	4.6		66	2.0		91	6.9	
17	5.5		42	13.1		67	7.6		92	2.9	
18	6		43	4.3		68	25		93	6.7	
19	11		44	5.2		69	19.5		94	31	
(20)	14.5	1/4	45	11		(70)	24.5	1/4	95	3.6	
21	27		46	15		71	18.5		96	7.7	
22	3		47	11.4		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	1/4	75	29		(100)	10	O

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 + Betty Site Code: ALX01

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

SITE INSPECTION

Site Inspected by: Betty Mallory

Communication Information

☐ Itinerary left with contact person (include contact numbers)

Contact Person: Kevin Whiting Time checked-in: 10:00

Form of communication: ☐ radio ☒ cell ☐ satellite ☐ hotel/pay phone ☐ SPOT

Phone number: (403) 732-4868

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:

Chad @ Cabin site

Field Crew: Chad Hughes + Beth Millar Site Code: AL-03

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

☑ **Occupational Health & Safety: Site Inspection Sheet completed**

PRIMARY SITE DATA

CABIN Study Name: CBWM Local Basin Name: Elk River

River/Stream Name: Alexander Creek Stream Order: (map scale 1:50,000) _____

Select one: ☑ Test Site ☐ Potential Reference Site

Geographical Description/Notes:
Park at pullout on highway u/s of gun range. Drive to illegal camping area, park, walk to stream (~20 m)

Surrounding Land Use: (check those present) Information Source: visual / maps

☑ Forest ☐ Field/Pasture ☐ Agriculture ☐ Residential/Urban
☑ Logging ☑ Mining ☐ Commercial/Industrial ☑ Other recreation (gun range)

Dominant Surrounding Land Use: (check one) Information Source: visual

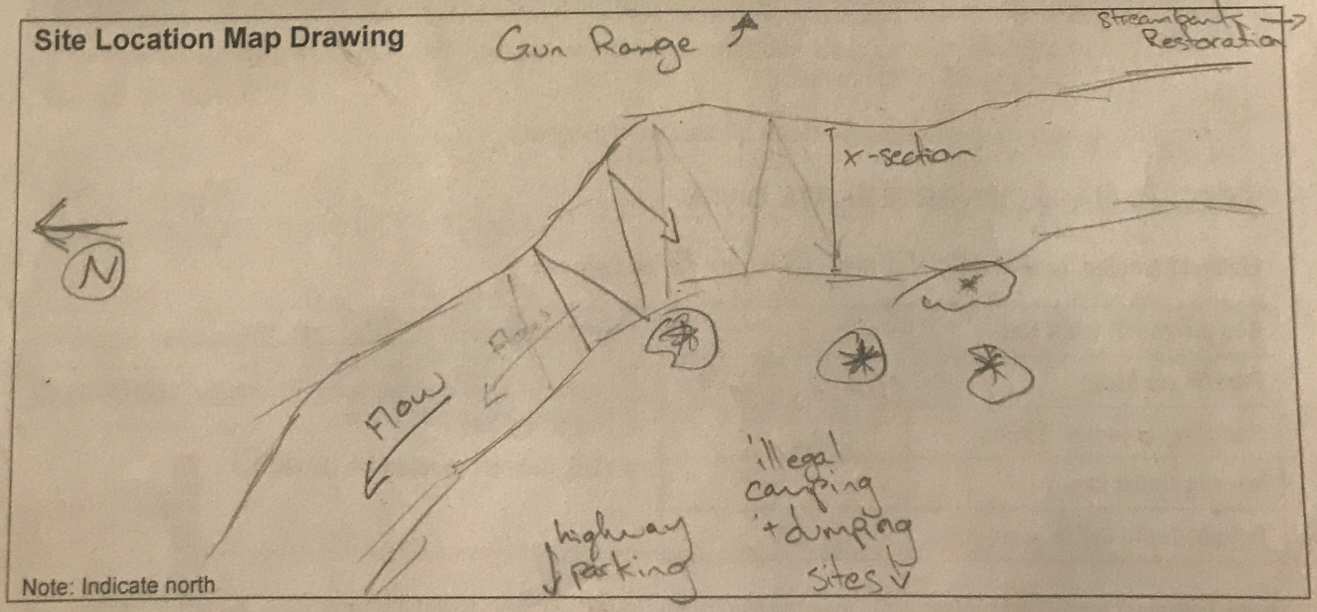
☑ Forest ☐ Field/Pasture ☐ Agriculture ☐ Residential/Urban
☐ Logging ☐ Mining ☐ Commercial/Industrial ☐ Other _____

Location Data

Latitude: 49.654909 N Longitude: - 114.730206 W (DMS or DD)

Elevation: _____ (fasl *or* masl) GPS Datum: ☐ GRS80 (NAD83/WGS84) ☐ Other: _____

Site Location Map Drawing



Note: Indicate north

Field Crew: Chad Hughes - Beth Millions Site Code: ALX03

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

Photos

☒ Field Sheet ☒ Upstream ☒ Downstream ☑ Across Site ☐ Aerial View

☒ Substrate (exposed) ☑ Substrate (aquatic) ☐ Other _____

REACH DATA *(represents 6 times bankfull width)*

1. Habitat Types: *(check those present)*

☒ Riffle ☐ Rapids ☒ Straight run ☐ Pool/Back Eddy

2. Canopy Coverage: *(stand in middle of stream and look up, check one)*

☐ 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)*

☒ ferns/grasses ☒ shrubs ☒ deciduous trees ☒ coniferous trees

5. Dominant Streamside Vegetation: *(check one)*

☐ ferns/grasses ☒ 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)

☒ **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 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)

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	
Person sampling	Chad Hughes
Sampling time (i.e. 3 min.)	3 min
No. of sample jars	1
Typical depth in kick area (cm)	20

Preservative used: 99% ISO

Sampled sieved on site using "Bucket Swirling Method":
☐ YES ☐ NO

If YES, debris collected for QAQC ☐

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

Field Crew: Chad Hughes + Bella Millions Site Code: ALX03

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

WATER CHEMISTRY DATA Time: 16:00 (24 hr clock) Time zone: MT

Air Temp: 14.5 (°C) Water Temp: 8.4 (°C) pH: 8.35

Specific Conductance: 214.5 (µs/cm) DO: 11 (mg/L) Turbidity: 0.5.1 (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) ☐ Other_____

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**

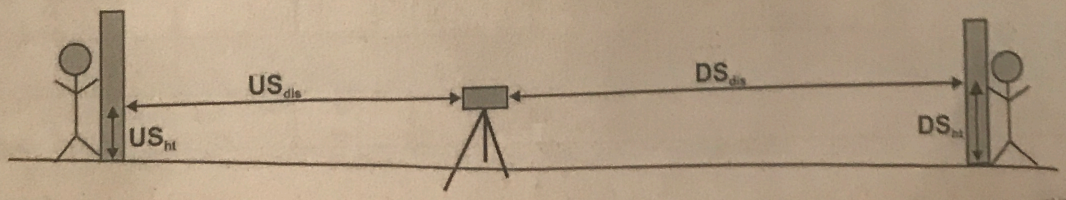
Scale: _____ (Note: small scale map recommended if field measurement is not possible - i.e. 1:20,000).
contour interval (vertical distance) _____ (m),
distance between contour intervals (horizontal distance) _____ (m)
slope = vertical distance/horizontal distance =_____

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
[a]Top Hairline (T)			
[a]Mid Hairline (ht) OR [b]Height of rod	1.43 m	2.00 m	
[a]Bottom Hairline (B)			
[b]Distance (dis) OR [a]T-B x 100	30 m [a]US_{dis}=T-B	30 m [a]DS_{dis}=T-B	$US_{dis}+DS_{dis}$= 60 m
Change in height (Δht)			$DS_{ht}-US_{ht}$= 2-1.43 0.57 m
Slope (Δht/total dis)			0.95%



Field Crew: Chad Hughes + Beth Millions Site Code: ALX03

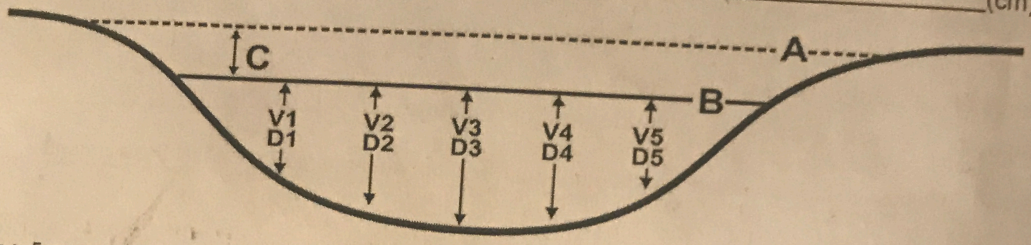
Sampling Date: (DD/MM/YYYY) 20/09/2020

Widths and Depth

Location at site: U/S of kicknet site (Indicate where in sample reach, ex. d/s of kick area)

A - Bankfull Width: 10.1 (m) B - Wetted Stream Width: 9.08 (m)

C - Bankfull–Wetted Depth (height from water surface to Bankfull): 14 (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.	2.5	4	5.5	7	8.5	
Depth (**D**) (cm)							
Velocity Head Rod (ruler)							
Flowing water Depth (D_1) (cm)	19	34.3	39.3	46.5	37.7	24.5	
Depth of Stagnation (D_2) (cm)	19.1	36.8	39.9	47.3	38.4	24.9	
Change in depth ($\Delta D=D_2-D_1$) (cm)	0.1	2.5	0.6	0.8	0.7	0.4	
Rotary meter							
Revolutions							
Time (minimum 40 seconds)							
Direct Measurement or calculation							
Velocity (**V**) (m/s)							

Field Crew: Beth Millions + Chad Hughes Site Code: AI x03

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

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.
- Embededness 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		Diameter (cm)	E
1	9.8		26	12.7		51	5.2		76	60.0	
2	24.0		27	10.2		52	12.4		77	16.0	
3	19.5		28	4.9		53	9.6		78	6.5	
4	33.0		29	7.5		54	18.0		79	16.5	
5	14.0		(30)	15.0	1/4	55	13.6		(80)	19.0	1/2
6	22.5		31	Sand		56	18.5		81	1.4	
7	11.3		32	4.8		57	6.0		82	11.7	
8	28		33	3.7		58	17.0		83	8.2	
9	2.3		34	8.7		59	12.5		84	4.4	
(10)	6.5	1/2	35	Sand		(60)	1.5		85	3.9	
11	37.5		36	14.5		61	11.4	3/4	86	17.5	
12	22		37	14.5		62	17.0		87	9.0	
13	13		38	3.8		63	7.4		88	9.9	
14	8.5		39	14.8		64	13.0		89	16.0	
15	11.0		(40)	36.0	3/4	65	10.0		(90)	11.5	1/4
16	0.9		41	11.1		66	14.8		91	12.5	
17	6.1		42	21.1		67	2.2		92	10.6	
18	4		43	29.4		68	6.5		93	5.4	
19	9.5		44	10.5		69	9.7		94	0.9	
(20)	7.0	O	45	5.3		(70)	24.5	1/2	95	19.0	
21	81.0		46	8.0		71	8.5		96	52.5	
22	8.3		47	7.2		72	6.0		97	9.5	
23	14.5		48	20.8		73	10.5		98	9.5	
24	1.8		49	10.8		74	10.0		99	10.5	
25	5.0		(50)	42	O	75	14.7		(100)	3.2	1/1

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.

Field Crew: Beth Millions - Chad Hughes Site Code: ALX03

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

SITE INSPECTION

Site Inspected by: Beth Millions

Communication Information

☒ Itinerary left with contact person (include contact numbers)

Contact Person: Kevin Whiting Time checked-in: 16:30

Form of communication: ☐ radio ☒ cell ☐ satellite ☐ hotel/pay phone ☐ SPOT

Phone number: (403) 702-4868

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:

Field Crew: Beth Millions + Chad Hughes Site Code: BOV01

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

Photos
☑ Field Sheet ☑ Upstream ☑ Downstream ☐ Across Site ☑ Aerial View
☑ Substrate (exposed) ☑ Substrate (aquatic) ☐ Other _____

REACH DATA *(represents 6 times bankfull width)*

1. Habitat Types: *(check those present)*
☑ Riffle ☐ Rapids ☐ Straight run ☐ Pool/Back Eddy

2. Canopy Coverage: *(stand in middle of stream and look up, check one)*
☑ 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)*
☑ ferns/grasses ☐ shrubs ☐ deciduous trees ☑ coniferous trees

5. Dominant Streamside Vegetation: *(check one)*
☑ ferns/grasses ☐ 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)
☑ **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 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)

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	
Person sampling	Chad Hughes
Sampling time (i.e. 3 min.)	3 min
No. of sample jars	1
Typical depth in kick area (cm)	25

Preservative used: 99% ISO

Sampled sieved on site using "Bucket Swirling Method":
☑ YES ☐ NO

If YES, debris collected for QAQC ☑

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

CABIN

Field Crew: Beth Millions + Chad Hughes Site Code: BOVO1

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

WATER CHEMISTRY DATA Time: 09:15 (24 hr clock) Time zone: MT

Air Temp: 9.5 (°C) Water Temp: 5.3 (°C) pH: 8.22

Specific Conductance: 22.7 (µs/cm) DO: 10 (mg/L) Turbidity: 0.43 (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) ☐ Other_____

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**

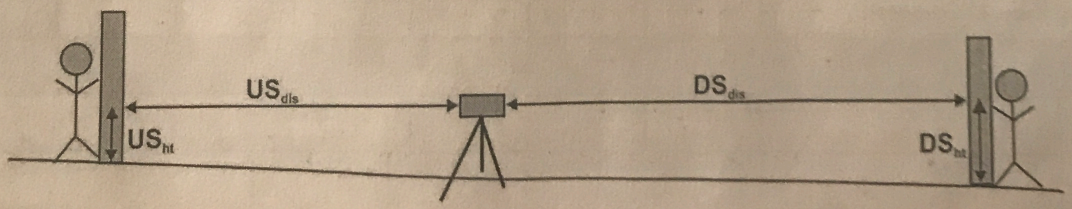
Scale: _____ (Note: small scale map recommended if field measurement is not possible - i.e. 1:20,000).
contour interval (vertical distance) _____ (m),
distance between contour intervals (horizontal distance) _____ (m)
slope = vertical distance/horizontal distance =_____

OR

☑ **Measured in field**

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

Measurements	Upstream (U/S)	Downstream(D/S)	Calculation
[a]Top Hairline (T)			
[a]Mid Hairline (ht) OR [b]Height of rod			
[a]Bottom Hairline (B)			
[b]Distance (dis) OR [a]T-B x 100	[a]US_{dis}=T-B	[a]DS_{dis}=T-B	$US_{dis}+DS_{dis}$=
Change in height (Δht)			$DS_{ht}-US_{ht}$=
Slope (Δht/total dis)			0.026



Field Crew: Chad Hughes + Beth Millions Site Code: DOVO1

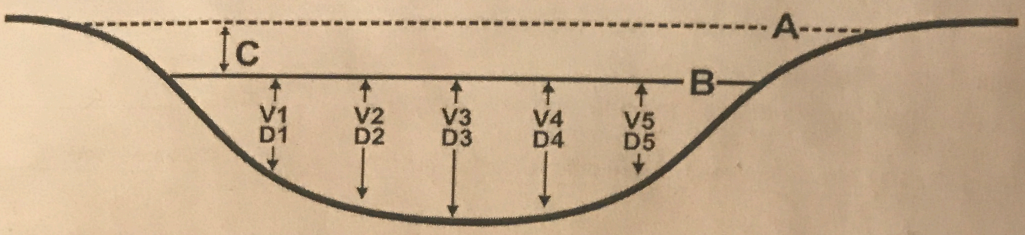
Sampling Date: (DD/MM/YYYY) 20/09/2010

Widths and Depth

Location at site: at eroded slope, d/s kick (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)



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	2	3	4	5	6	
Depth (**D**) (cm)							
Velocity Head Rod (ruler)							
Flowing water Depth (D_1) (cm)	38.2	27.1	20.8	15.5	20.9	23	
Depth of Stagnation (D_2) (cm)	41.5	31	25.2	23	29	34.4	
Change in depth ($\Delta D=D_2-D_1$) (cm)	3.3	3.9	4.4	7.5	8.1	10.4	
Rotary meter							
Revolutions							
Time (minimum 40 seconds)							
Direct Measurement or calculation							
Velocity (**V**) (m/s)							

Field Crew: Chad Hughes + Beth Millions Site Code: BOW01

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

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.
- Embededness 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		Diameter (cm)	E
1	4.4		26	14		51	4.9		76	8.5	
2	10		27	7.5		52	8.9		77	20.1	
3	9.8		28	4.4		53	4.7		78	5.5	
4	6.5		29	39.0		54	21		79	18.2	3/4
5	6.1		30	4.5	1/2	55	3.9		80	1.8	
6	17		31	2.9		56	4		81	8.2	
7	14.5		32	1.3		57	4.2		82	7.5	
8	9.2		33	13.0		58	4.1		83	3.1	
9	1.5		34	8.4		59	3.2		84	1.8	
10	8.8	1/4	35	5.2		60	1.8	O	85	4.4	
11	12		36	2.8		61	8.9		86	2.1	
12	11.4		37	27		62	14.2		87	2.5	
13	4.2		38	3.3		63	6.5		88	2.7	
14	4.2		39	3.2		64	11.4		89	4.2	
15	6		40	9.7	3/4	65	7.8		90	7.5	1/2
16	0.8		41	3.5		66	7.2		91	9.5	
17	8.6		42	5.7		67	17.3		92	3.1	
18	8.9		43	Sand		68	15.5		93	4.4	
19	22.5		44	4.1		69	16.3		94	7.6	
20	11.7	1/2	45	5.6		70	6.8	O	95	10.5	
21	9.8		46	Sand		71	17.5		96	7.0	
22	11.8		47	1.7		72	11.5		97	25.5	
23	13.5		48	2		73	5.2		98	9.8	
24	/		49	6.5		74	2.2		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.

Field Crew: Chad Hughes + Beth Millions Site Code: BOVO1

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

SITE INSPECTION

Site Inspected by: Beth Millions

Communication Information

☐ Itinerary left with contact person (include contact numbers)

Contact Person: Kevin Whiting Time checked-in: 10.00

Form of communication: ☐ radio ☒ cell ☐ satellite ☐ hotel/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:

Chad - Cabin site - 2020 12 11

Field Crew: Chad Hughes + Beth Millions Site Code: BOW07

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

☐ **Occupational Health & Safety: Site Inspection Sheet completed**

PRIMARY SITE DATA

CABIN Study Name: CBWM Local Basin Name: Elk River

River/Stream Name: Bow Stream Order: (map scale 1:50,000) _____

Select one: ☒ Test Site ☐ Potential Reference Site

Geographical Description/Notes: Park at x-country ski trails, walk down quad trail to bridge, walk u/s to drooping spruce.

Surrounding Land Use: (check those present) Information Source: Visual + Maps

☒ Forest ☐ Field/Pasture ☐ Agriculture ☐ Residential/Urban

☒ Logging ☐ Mining ☒ Commercial/Industrial ☐ Other _____

Dominant Surrounding Land Use: (check one) Information Source: Visual + Maps

☒ Forest ☐ Field/Pasture ☐ Agriculture ☐ Residential/Urban

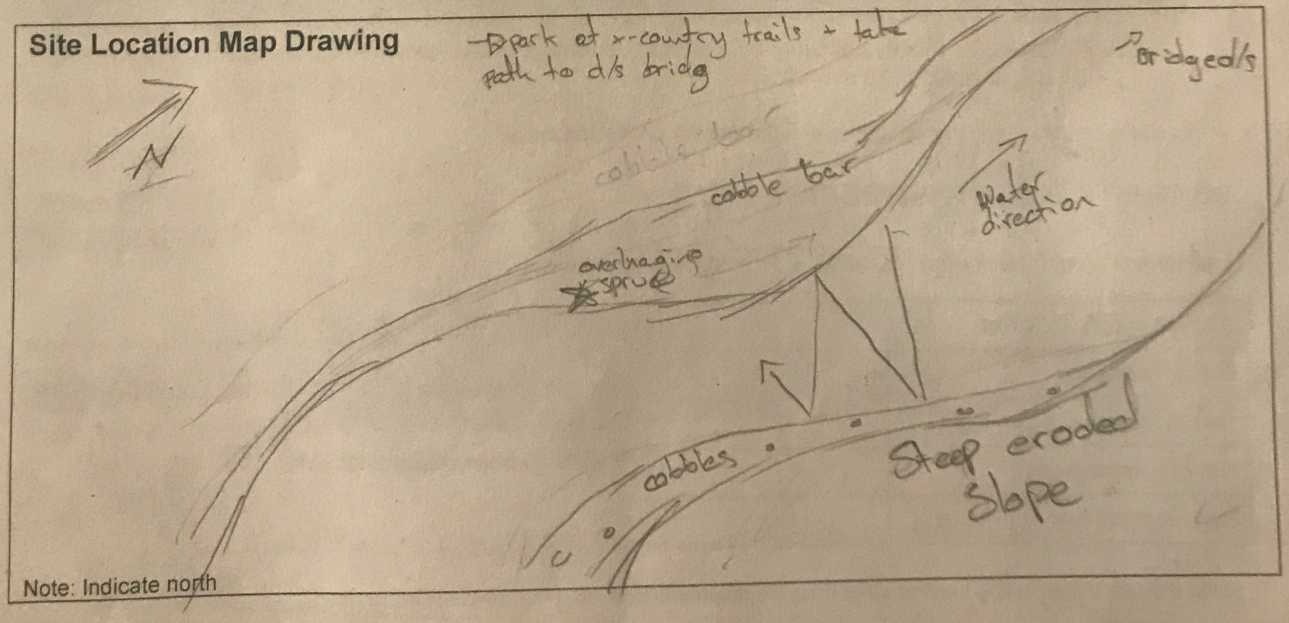
☐ Logging ☐ Mining ☐ Commercial/Industrial ☐ Other _____

Location Data

Latitude: _____N Longitude: - _____W (DMS or DD)

Elevation: _____(fasl *or* masl) GPS Datum: ☐ GRS80 (NAD83/WGS84) ☐ Other: _____

Site Location Map Drawing



Note: Indicate north

Field Crew: Chad Hughes + Beth Millions Site Code: SOVO2

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

Photos

☒ Field Sheet ☒ Upstream ☒ Downstream ☒ Across Site ☐ Aerial View
☒ Substrate (exposed) ☒ Substrate (aquatic) ☐ Other _____

REACH DATA *(represents 6 times bankfull width)*

1. Habitat Types: *(check those present)*
☒ Riffle ☐ Rapids ☐ Straight run ☐ Pool/Back Eddy

2. Canopy Coverage: *(stand in middle of stream and look up, check one)*
☐ 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)*
☒ ferns/grasses ☒ shrubs ☒ deciduous trees ☒ coniferous trees

5. Dominant Streamside Vegetation: *(check one)*
☐ ferns/grasses ☒ 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)
☒ **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 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)

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	
Person sampling	Chad Hughes
Sampling time (i.e. 3 min.)	3 min
No. of sample jars	1
Typical depth in kick area (cm)	25cm

Preservative used: 99% iso

Sampled sieved on site using "Bucket Swirling Method":
☒ YES ☐ NO
If YES, debris collected for QAQC ☒

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

Field Crew: Chad Hughes - Beth Millions Site Code: BOVO2

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

WATER CHEMISTRY DATA **Time:** 12:00 (24 hr clock) **Time zone:** MT

Air Temp: 11.5 (°C) Water Temp: 5.4 (°C) pH: 8.25

Specific Conductance: 213.0 (µs/cm) DO: "5" ?? (mg/L) Turbidity: 0.44 (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)
- ☐ Other_____

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**

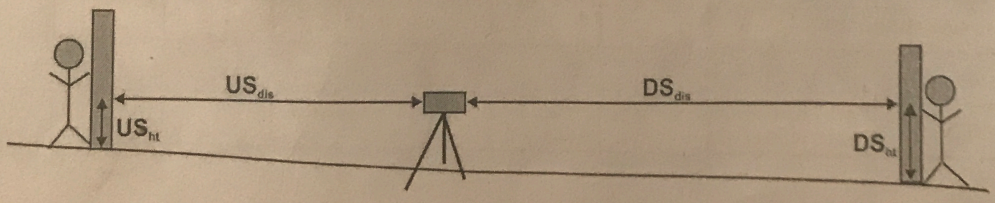
Scale: _____ (Note: small scale map recommended if field measurement is not possible - i.e. 1:20,000).
contour interval (vertical distance) _____ (m),
distance between contour intervals (horizontal distance) _____ (m)
slope = vertical distance/horizontal distance = _____

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
[a]Top Hairline (T)			
[a]Mid Hairline (ht) OR [b]Height of rod	1.208	2.975	
[a]Bottom Hairline (B)			
[b]Distance (dis) OR [a]T-B x 100	30 [a]US_{dis}=T-B	30m [a]DS_{dis}=T-B	$US_{dis}+DS_{dis}$= 60
Change in height (Δht)			$DS_{ht}-US_{ht}$= 1.767
Slope (Δht/total dis)			2.945



Field Crew: Chad Hughes + Beth Millions Site Code: BOV02

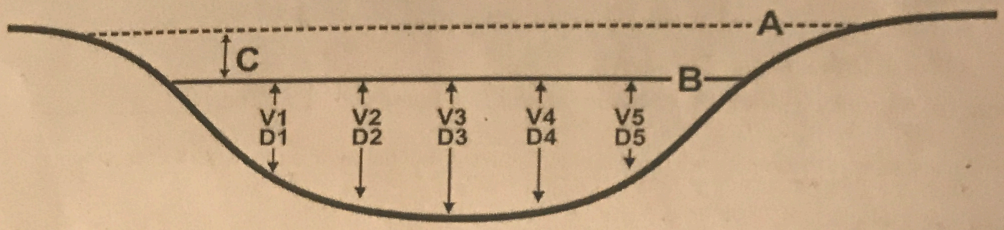
Sampling Date: (DD/MM/YYYY) 20/09/2020

Widths and Depth

Location at site: u/s kicked (Indicate where in sample reach, ex. d/s of kick area)

A - Bankfull Width: 11.6 (m) B - Wetted Stream Width: 11.2 (m)

C - Bankfull–Wetted Depth (height from water surface to Bankfull): 28' (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)	2	4	6	8	10		
Depth (D) (cm)	2.2						
Velocity Head Rod (ruler)							
Flowing water Depth (D_1) (cm)	18.7	30.1	27	28.5	32.5		
Depth of Stagnation (D_2) (cm)	20.9	35	31	33	34		
Change in depth ($\Delta D=D_2-D_1$) (cm)	2.2	4.9	9	4.5	1.5		
Rotary meter							
Revolutions							
Time (minimum 40 seconds)							
Direct Measurement or calculation							
Velocity (V) (m/s)							

Field Crew: Chad Hughes, Beth Millions Site Code: BONO2

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

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.
- Embededness 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		Diameter (cm)	E
1	2.8		26	9.7		51	4.2		76	2.3	
2	5.2		27	6.1		52	4.1		77	4.1	
3	16.5		28	14.8		53	10.0		78	12.2	
4	11.8		29	1.8		54	3.0		79	14.0	
5	15.5		30	10.1	1/4	55	1.0		80	26.0	1/4
6	5.9		31	5.7		56	0.8		81	2.4	
7	0.9		32	16.1		57	10.5		82	4.9	
8	14.8		33	11.2		58	4.6		83	28.0	
9	5.7		34	10.2		59	23.5		84	3.5	
10	0.7	Ø	35	11.0		60	9.0		85	2.6	
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	2.7		64	9.2		89	10.0	
15	5.5		40	5.0	Ø	65	7.0		90	17.0	100
16	1.5		41	3.5		66	Org		91	16.0	
17	8.5		42	Sand		67	9.0	Ø	92	9.6	
18	0.3		43	29.5		68	40.0		93	5.4	
19	4.9		44	8.8		69	24.0	100	94	4.3	
20	20.5	1/4	45	7.5		70	13.0		95	1.0	
21	4.5		46	11.5		71	11.2		96	2.7	
22	10.3		47	16.0		72	11.5		97	15.0	
23	14.0		48	10.3		73	17.0		98	8.0	
24	6.5		49	14.0		74	0.3		99	1.4	
25	5.8		50	10.3	1/4	75	0.8		100	14.5	100

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 + Beth Millions Site Code: BOVO7

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

SITE INSPECTION

Site Inspected by: Beth Millions

Communication Information

☐ Itinerary left with contact person (include contact numbers)

Contact Person: Kevin Whiting Time checked-in: 14:30

Form of communication: ☐ radio ☒ cell ☐ satellite ☐ hotel/pay phone ☐ SPOT

Phone number: (403) 702-4868

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:

Field Crew: Beth Millions, Chad Hughes, Ayla Bennett Site Code: LIZ-01

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

-chad Hughes CABIN Site 2020 12 11

☐ **Occupational Health & Safety: Site Inspection Sheet completed**

PRIMARY SITE DATA

CABIN Study Name: Elk River tributaries Local Basin Name: Lizard Creek

River/Stream Name: Lizard Creek Stream 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

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: _____

☐ Forest ☐ Field/Pasture ☐ Agriculture ☐ Residential/Urban

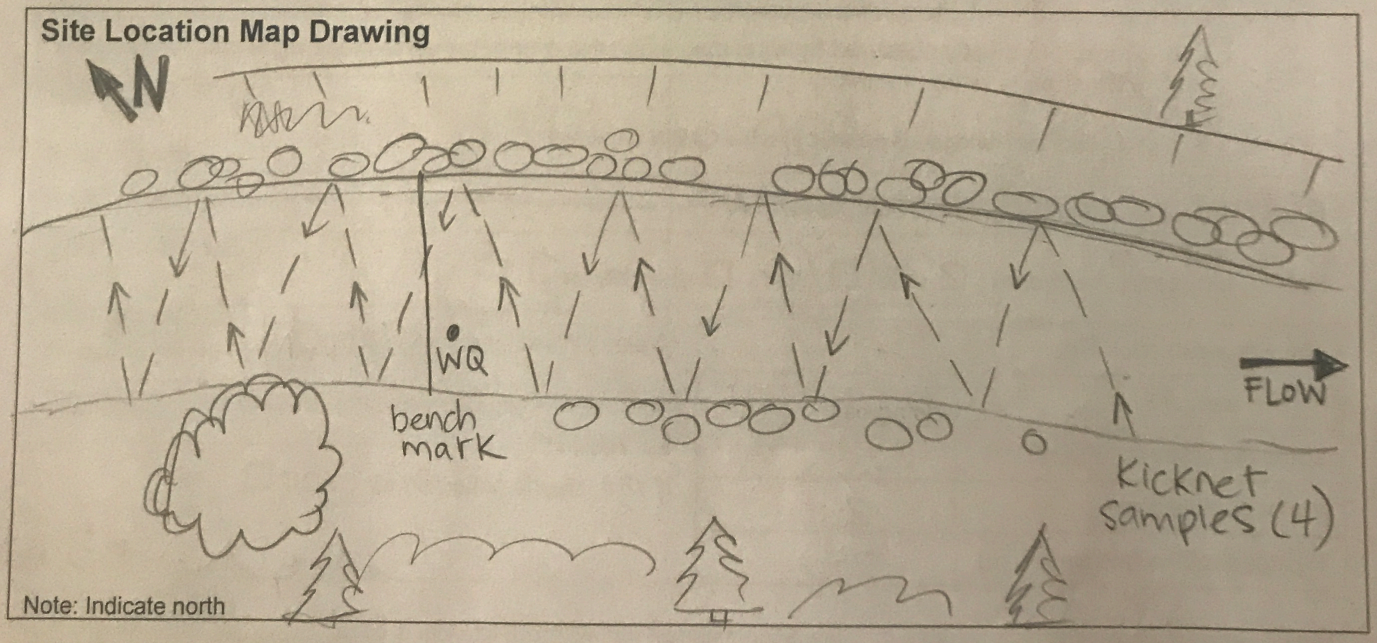
☐ Logging ☐ Mining ☐ Commercial/Industrial ☐ Other _____

Location Data

Latitude: _____N Longitude: - _____W (DMS or DD)

Elevation: _____(fasl *or* masl) GPS Datum: ☐ GRS80 (NAD83/WGS84) ☐ Other: _____

Site Location Map Drawing



Note: Indicate north

Field Crew: BM, AB, CH Site Code: LIZ-01

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

Photos

☐ Field Sheet ☐ Upstream ☐ Downstream ☐ Across Site ☐ Aerial View

☐ Substrate (exposed) ☐ Substrate (aquatic) ☐ Other

REACH DATA *(represents 6 times bankfull width)*

1. Habitat Types: *(check those present)*
   ☑ Riffle ☐ Rapids ☐ Straight run ☐ Pool/Back Eddy

2. Canopy Coverage: *(stand in middle of stream and look up, check one)*
   ☐ 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)*
   ☑ ferns/grasses ☑ shrubs ☑ deciduous trees ☑ coniferous trees

5. Dominant Streamside Vegetation: *(check one)*
   ☑ ferns/grasses ☐ 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)
   ☐ **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 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)

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	
Person sampling	Both
Sampling time (i.e. 3 min.)	3 min
No. of sample jars	2
Typical depth in kick area (cm)	25.

Preservative used: isopropanol 99%

Sampled sieved on site using "Bucket Swirling Method":
☐ YES ☑ NO

If YES, debris collected for QAQC ☐

eDNA → 3 additional jars

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

CABIN

Field Crew: [illegible] Site Code: LIZ-01

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

WATER CHEMISTRY DATA Time: 09:45 (24 hr clock) Time zone: Mountain

Air Temp: 8.0 (°C) Water Temp: 6.1 (°C) pH: 8.33

Specific Conductance: 610 (µs/cm) DO: 4.77 (mg/L) Turbidity: 1.28 (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)
- ☐ Other _____

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**

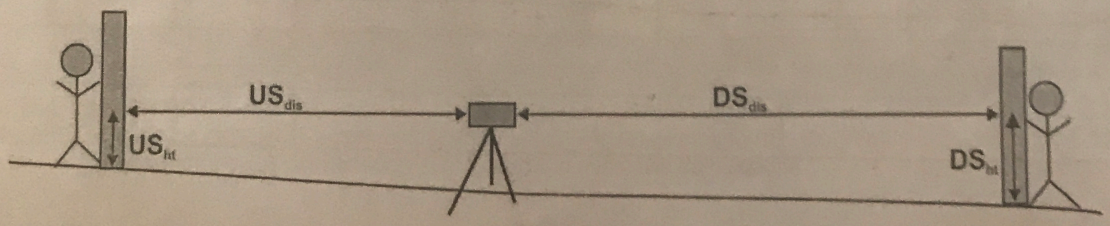
Scale: _____ (Note: small scale map recommended if field measurement is not possible - i.e. 1:20,000).
contour interval (vertical distance) _____ (m),
distance between contour intervals (horizontal distance) _____ (m)
slope = vertical distance/horizontal distance = _____

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
[a] ~~Top Hairline (T)~~			
[a] Mid Hairline (ht) OR [b] Height of rod	1.34 m.	2.14 m.	
[a] ~~Bottom Hairline (B)~~			
[b] Distance (dis) OR [a] ~~T-B x 100~~	25.0 m. [a] US_{dis}=T-B	25.0m [a] DS_{dis}=T-B	$US_{dis}+DS_{dis}$= 50.0 m
Change in height (Δht)			$DS_{ht}-US_{ht}$= 0.8m
Slope (Δht/total dis)			0.016 = 1.6%



Field Crew: AB, BM, CH Site Code: LIZ-01

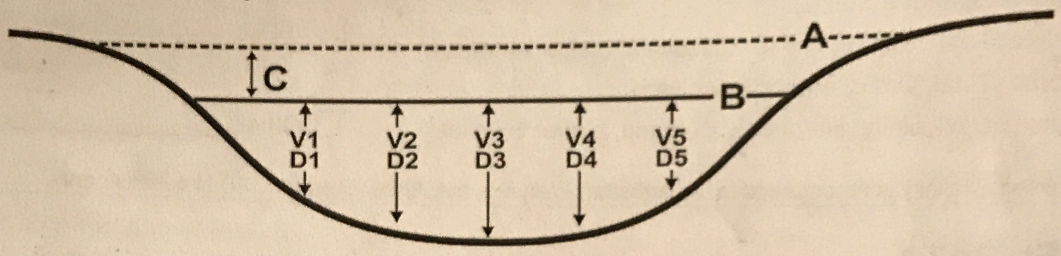
Sampling Date: (DD/MM/YYYY) 09/09/2020

Widths and Depth

Location at site: @ benchmark (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) = √ [2(ΔD/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	24.0	17.0	
Velocity Head Rod (ruler)							
Flowing water Depth (D_1) (cm)	4	9	15.5	22.0	24.0	17.0	
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	0	3.0	3.0	4.0	1.5	
Rotary meter							
Revolutions							
~~Time (minimum 40 seconds)~~							
Direct Measurement or calculation							
Velocity (**V**) (m/s)	0	0					

Field Crew: BU, AB, CH Site Code: L17-01

Sampling Date: (DD/MM/YYYY) 04/09/2020

SUBSTRATE DATA

Surrounding/Interstitial Material

Circle the substrate size category for the surrounding material.

#3 ~~Coarse Sand~~ gravel

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.
- Embededness 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		Diameter (cm)	E
1	0.3		26	15		51	11.5		76	1.9	
2	3.2		27	6.4		52	4.6		77	29.0	
3	2.8		28	9.4		53	12.2		78	5.1	
4	7.5		29	Brg		54	17.6		79	16.1	
5	26		(30)	35	1/4	55	10.0		(80)	26.3	3/4
6	0.9		31	22		56	27.3		81	10.9	
7	15		32	4.8		57	10.1		82	19.8	
8	Brg		33	11.9		58	0.1		83	14.0	
9	21		34	6.0		59	14.5		84	19.9	
(10)	1.5	1	35	5.4		(60)	21.2	1	85	1.3	
11	3.9		36	4.5		61	15.6		86	19.5	
12	11.5		37	28.5		62	22.4		87	2.7	
13	0.5		38	7.7		63	3.8		88	8.1	
14	28.1		39	36.2		64	0		89	54.5	
15	7.7		(40)	11.5	0	65	5.1		(90)	1.8	0
16	11.4		41	11.1		66	10.9		91	8.6	
17	1.8		42	3.8		67	10.5		92	20.3	
18	32		43	10		68	23.5		93	12.1	
19	14.5		44	21		69	6.1		94	18.8	
(20)	2.1	0	45	12		(70)	3.8	0	95	8.4	
21	17.2		46	12.1		71	11.7		96	12.4	
22	19.9		47	23.3		72	17.6		97	10.0	
23	26.5		48	15.2		73	11.2		98	7.9	
24	6.6		49	35.9		74	39.8		99	15.2	
25	8.7		(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.

Field Crew: BM, AB, CH Site Code: L17-01

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

SITE INSPECTION

Site Inspected by: Ayla Bennett

Communication Information

☑ Itinerary left with contact person (include contact numbers)

Contact Person: Mike Bennett Time checked-in: 9:00AM

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)

N/A ☐ PFD worn

☑ Appropriate footwear, waders, wading belt

N/A ☐ Belay used

Notes:

Chad Hughes
CABIN Site 2020 12 11

Field Crew: Chad Hughes Site Code: LIZ03

Sampling Date: (DD/MM/YYYY) 15/09/2020

☐ **Occupational Health & Safety: Site Inspection Sheet completed**

PRIMARY SITE DATA

CABIN Study Name: CBWM Local Basin Name: Elk River

River/Stream Name: Lizard Creek Stream Order: (map scale 1:50,000)

Select one: ☒ Test Site ☐ Potential Reference Site

Geographical Description/Notes:
Park at east end of campground day use area by nordic trail. Follow trail parallel to stream to coordinates on left.

Surrounding Land Use: (check those present) Information Source: Visual

☒ Forest ☐ Field/Pasture ☐ Agriculture ☐ Residential/Urban
☐ Logging ☐ Mining ☐ Commercial/Industrial ☒ Other camping

Dominant Surrounding Land Use: (check one) Information Source: Visual

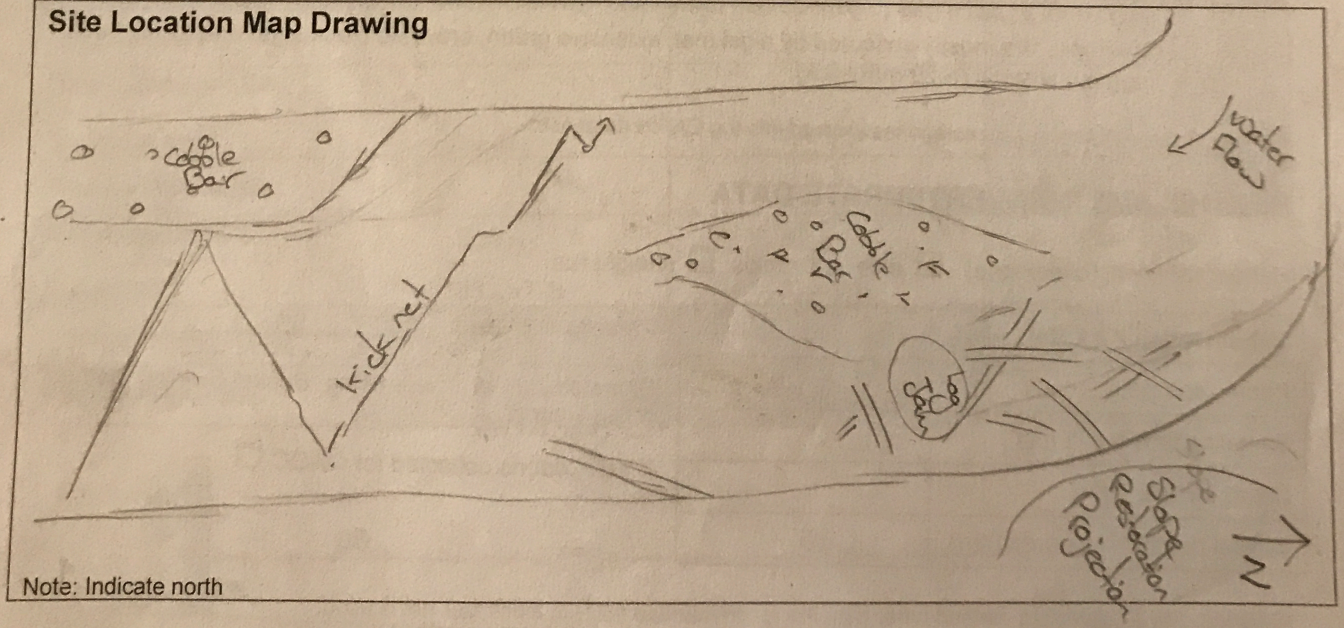
☒ Forest ☐ Field/Pasture ☐ Agriculture ☐ Residential/Urban
☐ Logging ☐ Mining ☐ Commercial/Industrial ☐ Other

Location Data

Latitude: 49.485840 N Longitude: - 115.094551 W (DMS or DD)

Elevation: 1021.78 (fasl *or* masl) GPS Datum: ☒ GRS80 (NAD83/WGS84) ☐ Other:

Site Location Map Drawing



Note: Indicate north

Field Crew: Chad Hughes + Beth Millions Site Code: L1203

Sampling Date: (DD/MM/YYYY) 15/09/2020

Photos

☒ Field Sheet ☒ Upstream ☒ Downstream ☒ Across Site ☐ Aerial View

☒ Substrate (exposed) ☒ Substrate (aquatic) ☐ Other _____

REACH DATA *(represents 6 times bankfull width)*

1. Habitat Types: *(check those present)*

☒ Riffle ☐ Rapids ☐ Straight run ☐ Pool/Back Eddy

2. Canopy Coverage: *(stand in middle of stream and look up, check one)*

☐ 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)*

☒ ferns/grasses ☒ shrubs ☒ deciduous trees ☒ coniferous trees

5. Dominant Streamside Vegetation: *(check one)*

☐ ferns/grasses ☒ 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)

☐ **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 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)

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	
Person sampling	Chad Hughes
Sampling time (i.e. 3 min.)	3 min
No. of sample jars	2
Typical depth in kick area (cm)	10cm

Preservative used: 99% ISO

Sampled sieved on site using "Bucket Swirling Method":

☐ YES ☒ NO

If YES, debris collected for QAQC ☐

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

Field Crew: Chad Hughes + Beth Millions Site Code: LL207

Sampling Date: (DD/MM/YYYY) 15/09/2020

WATER CHEMISTRY DATA **Time:** 12:50 (24 hr clock) **Time zone:** MT

Air Temp: 21.5 (°C) Water Temp: 10.1 (°C) pH: 8.4

Specific Conductance: 598 (µs/cm) DO: 8" (mg/L) Turbidity: 0.83 (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) ☐ Other_____

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**

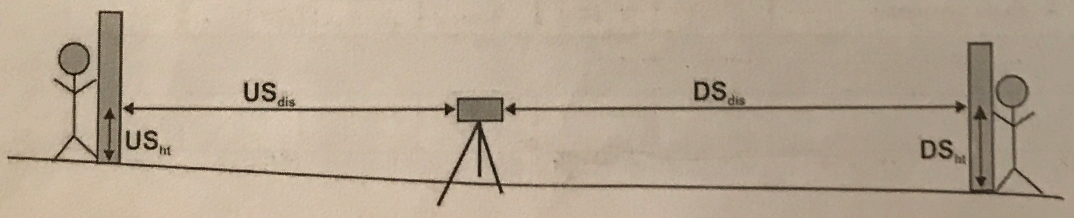
Scale: _____ (Note: small scale map recommended if field measurement is not possible - i.e. 1:20,000).
contour interval (vertical distance) _____ (m),
distance between contour intervals (horizontal distance) _____ (m)
slope = vertical distance/horizontal distance =_____

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
[a]~~Top Hairline (T)~~			
[a]~~Mid Hairline (ht)~~ OR [b]Height of rod	1.48m	1.95	
[a]~~Bottom Hairline (B)~~			
[b]Distance (dis) OR [a]~~T-B x 100~~	30m [a]US_{dis}=T-B	30m [a]DS_{dis}=T-B	$US_{dis}+DS_{dis}$= 30+30=60m
Change in height (Δht)			$DS_{ht}-US_{ht}$= 1.95-1.48=0.47m
Slope (Δht/total dis)			0.47m/60m = 0.78% ×100%



Field Crew: Chad Hughes + Beth Millings Site Code: L1203

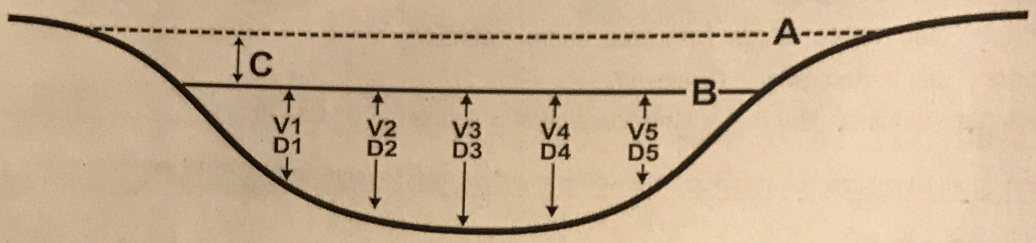
Sampling Date: (DD/MM/YYYY) 15/09/2020

Widths and Depth

Location at site: at kick area (Indicate where in sample reach, ex. d/s of kick area)

A - Bankfull Width: 8.7 (m) B - Wetted Stream Width: 8.5 (m)

C - Bankfull–Wetted Depth (height from water surface to Bankfull): 27.1 (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)	1.2	2.4	3.6	4.8	6	7.2	
Depth (D) (cm)	1.3	1.1	0	0	0.9	0.7	
Velocity Head Rod (ruler)							
Flowing water Depth (D_1) (cm)	18.4	15.4	0.2	11.0	16.2	24.3	
Depth of Stagnation (D_2) (cm)	19.7	16.5	0.2	11.0	17.1	25.0	
Change in depth ($\Delta D=D_2-D_1$) (cm)	1.3	1.1	0	0	0.9	0.7	
Rotary meter							
Revolutions							
Time (minimum 40 seconds)							
Direct Measurement or calculation							
Velocity (V) (m/s)							

Field Crew: Chad Hughes + B Site Code: L1203

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
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.
- Embededness 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		Diameter (cm)	E
1	8.5		26	5.5		51	9.6		76	6.5	
2	7.5		27	4.5		52	9.0		77	2.3	
3	0.9		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		(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	1/2
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	0	35	4.2		(60)	3.6		85	7.6	
11	1.3		36	6.7		61	6.9	0	86	3.0	
12	9.8		37	5.8		62	9.2		87	14.8	
13	1.5		38	8.3		63	3.2		88	9.2	
14	8.0		39	22.8		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	8.6		43	3.6		68	3.5		93	7.1	
19	4.5		44	2.6		69	5.6		94	8.0	
(20)	0.8	0	45	3.9		(70)	1.6	0	95	5.2	
21	5		46	5.4		71	2.2		96	4.9	
22	8		47	7.6		72	7.0		97	6.0	
23	2.5		48	5.8		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	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.

Field Crew: Bella Millions + Ayla Bennett Site Code: LIZ03

Sampling Date: (DD/MM/YYYY) 15/09/2020

SITE INSPECTION

Site Inspected by: Bella Millions

Communication Information

☑ Itinerary left with contact person (include contact numbers)

Contact Person: Kevin Whiting Time checked-in: 13:30

Form of communication: ☐ radio ☐ cell ☐ satellite ☐ hotel/pay phone ☐ SPOT

Phone number: (403) 702 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:

CABINsite 20201211

Field Crew: Chad Hughes + Beth Millions Site Code: MORO1

Sampling Date: (DD/MM/YYYY) 27/09/2020

☐ **Occupational Health & Safety: Site Inspection Sheet completed**

PRIMARY SITE DATA

CABIN Study Name: CBWM Local Basin Name: Elk River

River/Stream Name: Morrissey Stream Order: (map scale 1:50,000) _____

Select one: ☒ Test Site ☐ Potential Reference Site

Geographical Description/Notes: Take Morrissey Forest Service Rd to Lodgepole Forest Service Rd; turn Right onto unnamed logging road. Drive to Railway crossing over creek; park. Walk d/s 50 m to site.

Surrounding Land Use: (check those present) Information Source: visual, maps

☒ Forest ☐ Field/Pasture ☐ Agriculture ☐ Residential/Urban

☒ Logging ☐ Mining ☐ Commercial/Industrial ☒ Other hunting, snowmobiling

Dominant Surrounding Land Use: (check one) Information Source: visual

☒ Forest ☐ Field/Pasture ☐ Agriculture ☐ Residential/Urban

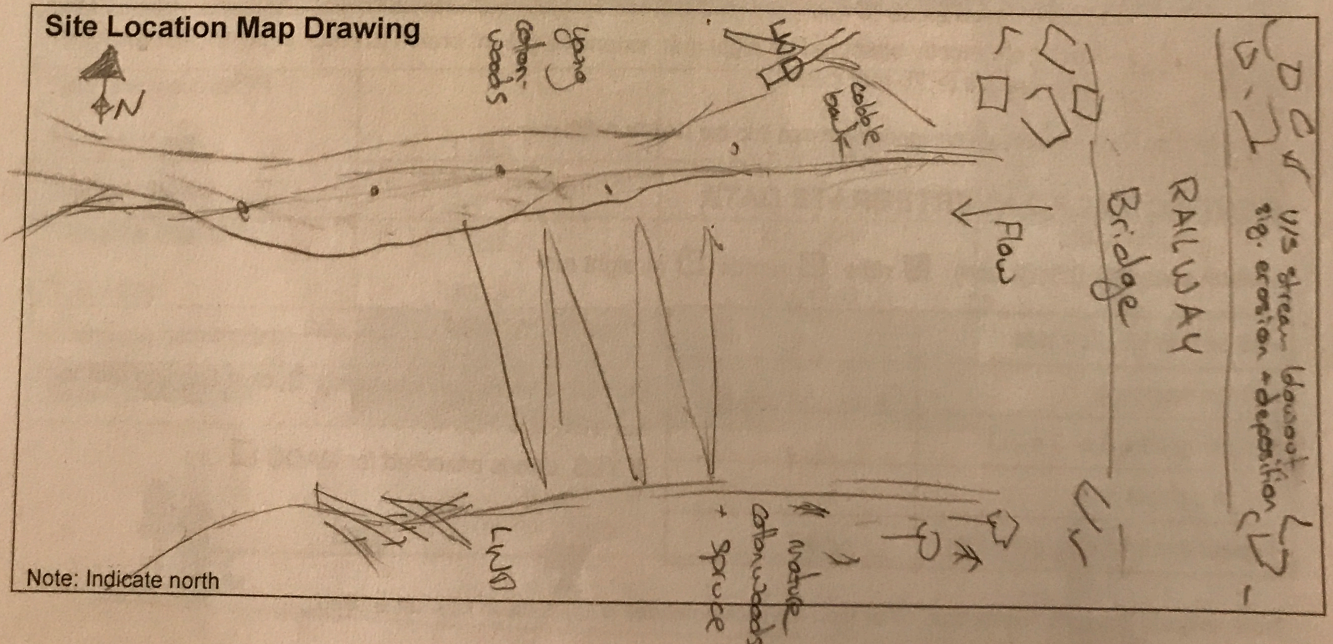
☐ Logging ☐ Mining ☐ Commercial/Industrial ☐ Other _____

Location Data

Latitude: 49.35806 N Longitude: - 115.00088 W (DMS or DD)

Elevation: 941.63 (fasl *or* masl) GPS Datum: ☒ GRS80 (NAD83/WGS84) ☐ Other: _____

Site Location Map Drawing



Note: Indicate north

Field Crew: Chad Hughes + Beth Millions Site Code: MORO1

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

Photos
☒ Field Sheet ☒ Upstream ☒ Downstream ☒ Across Site ☐ Aerial View
☒ Substrate (exposed) ☒ Substrate (aquatic) ☐ Other _____

REACH DATA *(represents 6 times bankfull width)*

1. Habitat Types: *(check those present)*
☒ Riffle ☐ Rapids ☐ Straight run ☐ Pool/Back Eddy

2. Canopy Coverage: *(stand in middle of stream and look up, check one)*
☐ 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)*
☒ ferns/grasses ☒ shrubs ☒ deciduous trees ☒ coniferous trees

5. Dominant Streamside Vegetation: *(check one)*
☐ ferns/grasses ☐ 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)
☒ **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 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)

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	
Person sampling	Chad Hughes
Sampling time (i.e. 3 min.)	3 min
No. of sample jars	1
Typical depth in kick area (cm)	15cm

Preservative used: 99% iso

Sampled sieved on site using "Bucket Swirling Method":
☐ YES ☒ NO
If YES, debris collected for QAQC ☐

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

Field Crew: Chad Hughes + Beth Millions Site Code: MORO1

Sampling Date: (DD/MM/YYYY) 22/09/2018

WATER CHEMISTRY DATA **Time:** 12:30 (24 hr clock) **Time zone:** MT

Air Temp: 11.5 (°C) Water Temp: 11.5 (°C) pH: 8.23

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) ☐ Other_____

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**

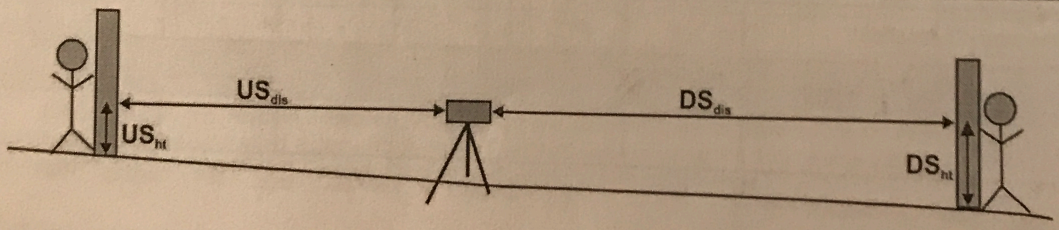
Scale: _____ (Note: small scale map recommended if field measurement is not possible - i.e. 1:20,000).
contour interval (vertical distance) _____ (m),
distance between contour intervals (horizontal distance) _____ (m)
slope = vertical distance/horizontal distance =_____

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
[a]Top Hairline (T)			
[a]Mid Hairline (ht) OR [b]Height of rod	1.21	2.26m	
[a]Bottom Hairline (B)			
[b]Distance (dis) OR [a]T-B x 100	30m [a]US_{dis}=T-B	30 m [a]DS_{dis}=T-B	$US_{dis}+DS_{dis}$= 60 m
Change in height (Δht)			$DS_{ht}-US_{ht}$= 1.05
Slope (Δht/total dis)			0.0175→1.75%



Field Crew: Chad Higher + Beth Millions Site Code: MoR01

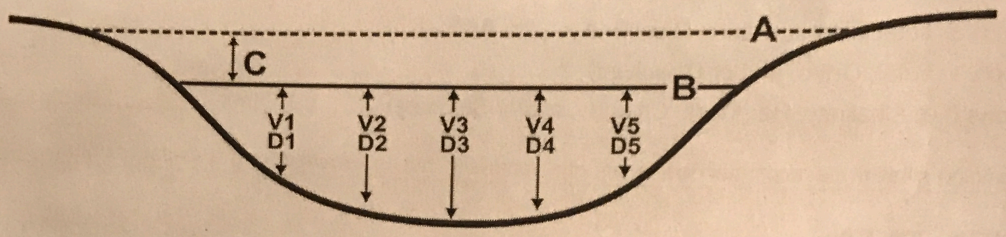
Sampling Date: (DD/MM/YYYY) 22/09/2020

Widths and Depth

Location at site: @ kick-at area (Indicate where in sample reach, ex. d/s of kick area)

A - Bankfull Width: 11.9 (m) B - Wetted Stream Width: 5.72 (m)

C - Bankfull–Wetted Depth (height from water surface to Bankfull): 67 (cm)



2.16
7.88

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	2	3	4	5		
Depth (**D**) (cm)							
Velocity Head Rod (ruler)							
Flowing water Depth (D_1) (cm)	4	12.9	14.4	12.4	16.3		
Depth of Stagnation (D_2) (cm)	4	14	14.4	12.7	16.6		
Change in depth ($\Delta D = D_2 - D_1$) (cm)	0	1.1	0	0.3	0.3		
Rotary meter							
Revolutions							
Time (minimum 40 seconds)							
Direct Measurement or calculation							
Velocity (**V**) (m/s)							

* note: took measurements 2 m up from x-section b/c of large rock in river

Field Crew: Chad Hughes + Beth Millions Site Code: MORO1

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

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.
- Embededness 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		Diameter (cm)	E
1	8.0		26	1.7		51	2.7		76	3.9	
2	4.0		27	2.5		52	3.2		77	13.9	
3	1.5		28	18.4		53	21.0		78	20.5	
4	9.5		29	17.2		54	1.5		79	10.4	
5	19.0		(30)	6.4	1/2	55	25		(80)	10.8	1/4
6	3.0		31	0.6		56	8.8		81	3.5	
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		34	18.7		59	3.7		84	11.9	
(10)	23.4	1/2	35	5.0		(60)	2.2	O	85	12.1	
11	4.1		36	9.8		61	22.0		86	11.8	
12	5.9		37	10.2		62	15.8		87	1.6	
13	0.4		38	8.2		63	5.3		88	16.3	
14	4.6		39	17.3		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	12.3		68	27.3		93	14.5	
19	12.0		44	3.5		69	18.9		94	6.0	
(20)	3.6	1/4	45	11.7		(70)	1.9	O	95	1.1	
21	11.5		46	6.7		71	14.6		96	8.7	
22	17.5		47	14.3		72	Sand		97	10.8	
23	6.3		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)	13.1	O	75	8.4		(100)	9.2	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.

Field Crew: Chad Hughes + Beth Millions Site Code: MORO1

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

SITE INSPECTION

Site Inspected by: Beth Millions

Communication Information

☐ Itinerary left with contact person (include contact numbers)

Contact Person: Kevin Whiting Time checked-in: 1520

Form of communication: ☐ radio ☐ cell ☐ satellite ☐ hotel/pay phone ☐ SPOT

Phone number: (403) 702-4868

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: 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:

Field Crew: Chad Hughes + Beth Millions Site Code: MoR02

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 River

River/Stream Name: Morrissey Stream Order: (map scale 1:50,000) _____

Select one: ☒ Test Site ☐ Potential Reference Site

Geographical Description/Notes: Drive on Morrissey Forest Service Road until 3rd bridge, park @ bridge. Walk d/s from bridge 50 m. *note* want 4 wheel drive, high clearance vehicle

Surrounding Land Use: (check those present) Information Source: visual, maps

☒ Forest ☐ Field/Pasture ☐ Agriculture ☐ Residential/Urban
☒ Logging ☐ Mining ☐ Commercial/Industrial ☐ Other _____

Dominant Surrounding Land Use: (check one) Information Source: visual

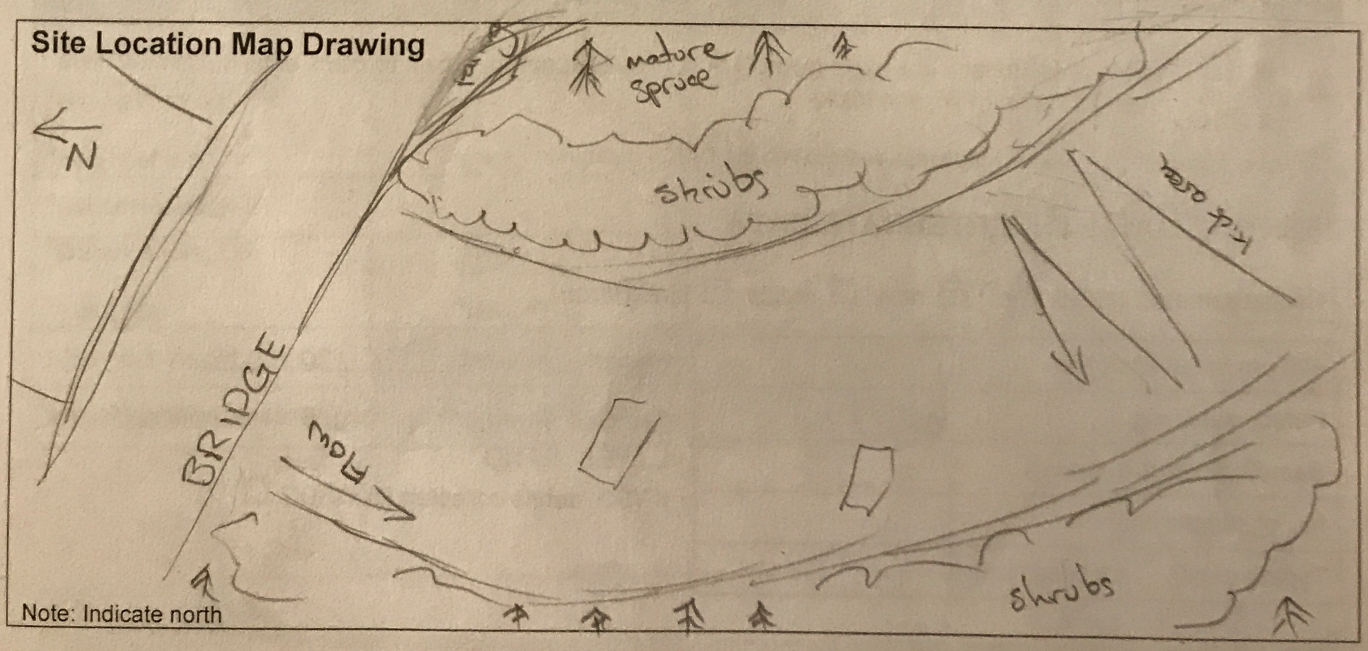
☒ Forest ☐ Field/Pasture ☐ Agriculture ☐ Residential/Urban
☐ Logging ☐ Mining ☐ Commercial/Industrial ☐ Other _____

Location Data

Latitude: 49.412076 N Longitude: - 114.91049 W (DMS or DD)

Elevation: 1529.35 (fasl or masl) GPS Datum: ☒ GRS80 (NAD83/WGS84) ☐ Other: _____

Site Location Map Drawing



Note: Indicate north

Field Crew: Chad Hughes + Beth Millions Site Code: MOR07

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

Photos

☒ Field Sheet ☒ Upstream ☒ Downstream ☒ Across Site ☐ Aerial View

☒ Substrate (exposed) ☒ Substrate (aquatic) ☐ Other _____

REACH DATA *(represents 6 times bankfull width)*

1. Habitat Types: *(check those present)*

☒ Riffle ☐ Rapids ☒ Straight run ☒ Pool/Back Eddy

2. Canopy Coverage: *(stand in middle of stream and look up, check one)* ← bankfull was 26-50.1.

☐ 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)*

☒ ferns/grasses ☒ shrubs ☒ deciduous trees ☒ coniferous trees

5. Dominant Streamside Vegetation: *(check one)*

☐ ferns/grasses ☒ 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)

☐ **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 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)

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	
Person sampling	Chad Hughes
Sampling time (i.e. 3 min.)	3 min
No. of sample jars	1
Typical depth in kick area (cm)	10 cm

Preservative used: 99% IPA

Sampled sieved on site using "Bucket Swirling Method":

☐ YES ☒ NO

If YES, debris collected for QAQC ☐

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

Field Crew: Chad Hughes + Beth Millions Site Code: MOR02

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

WATER CHEMISTRY DATA **Time:** 09:30 (24 hr clock) **Time zone:** MT

Air Temp: 6.5 (°C) Water Temp: 7.5 (°C) pH: 7.64

Specific Conductance: 69.9 (µs/cm) DO: "6" (mg/L) Turbidity: 0.36 (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) ☐ Other_____

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**

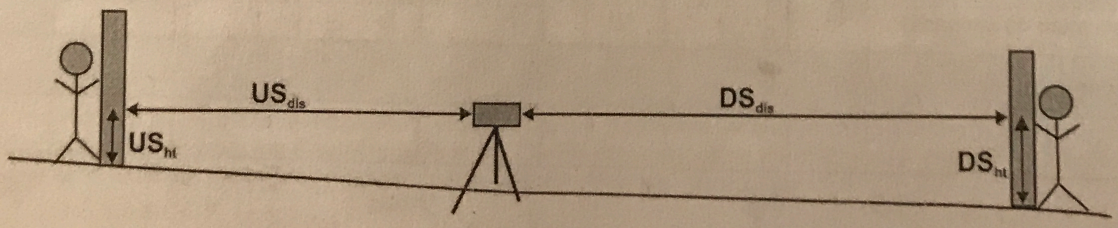
Scale: _____ (Note: small scale map recommended if field measurement is not possible - i.e. 1:20,000).
contour interval (vertical distance) _____ (m),
distance between contour intervals (horizontal distance) _____ (m)
slope = vertical distance/horizontal distance =_____

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
[a]Top Hairline (T)			
[a]Mid Hairline (ht) OR [b]Height of rod	1.30	2.30	
[a]Bottom Hairline (B)			
[b]Distance (dis) OR [a]T-B x 100	30 [a]US_{dis}=T-B	30 [a]DS_{dis}=T-B	$US_{dis}+DS_{dis}$= 60
Change in height (Δht)			$DS_{ht}-US_{ht}$= 1
Slope (Δht/total dis) ×100			1.67%



Field Crew: Chad Hughes + Beth Millions Site Code: MOR07

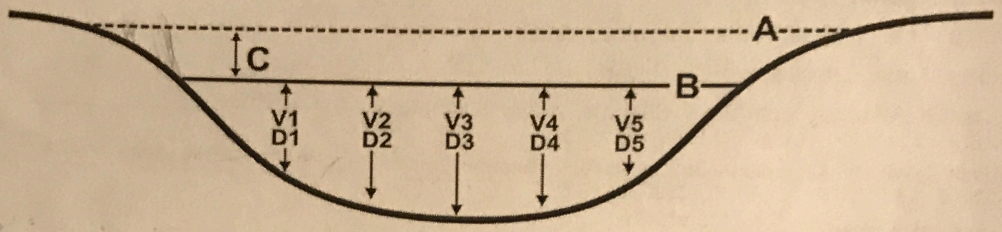
Sampling Date: (DD/MM/YYYY) 22/09/2020

Widths and Depth

Location at site: At kicknet (Indicate where in sample reach, ex. d/s of kick area)

A - Bankfull Width: 10.56 (m) B - Wetted Stream Width: 4.66 (m)

C - Bankfull–Wetted Depth (height from water surface to Bankfull): 56 (cm)



Note:
Wetted widths > 5 m, measure a minimum of 5-6 equidistant locations;
Wetted widths < 5 m, measure 3-4 equidistant locations.

6.16
1.5

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) = √ [2(ΔD/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)	0.75	1.5	2.25	3	3.75	4.5	
Depth (**D**) (cm)							
Velocity Head Rod (ruler)							
Flowing water Depth (D_1) (cm)	1.2	8.9	6.0	4	0	4.2	
Depth of Stagnation (D_2) (cm)	1.2	9.7	6.1	4	0	4.2	
Change in depth ($\Delta D = D_2 - D_1$) (cm)							
Rotary meter							
Revolutions							
Time (minimum 40 seconds)							
Direct Measurement or calculation							
Velocity (**V**) (m/s)							

for volume
(8cm)

7.7 | 6.4 | 98 | 10 | (12) | 4.4 | (26 bolts) | 2.0 | 5.9 | 11.3 | 11.5 | 3.0 | 20 | 5.2 | 3 | 90
8.5 | 6.5 | 9.8 | 10 | (bolts) | 4.5 | | 3.0 | 6.1 | 11.6 | 11.5 | 3.4 | | 5.2 | 2 |

0.3 | 4.5 | 4.3 | 5 | 4.2 | 2.5
0.3 | 4.5 | 4.3 | 5 | 4.2 | 2.5

Field Crew: Chad Hughes - Beth Millions Site Code: MOR02

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

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.
- 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		Diameter (cm)	E
1	9.0		26	1.8		51	9.5		76	2.7	
2	1.8		27	6.8		52	4		77	33.5	
3	0.3		28	5.6		53	10.1		78	31.0	
4	11.6		29	14.9		54	30.0		79	5.4	
5	0.7		(30)	9.9	3/4	55	12.0		(80)	11.0	3/4
6	11.2		31	11.4		56	1.0		81	7.0	
7	13.8		32	8.9		57	42.4		82	8.8	
8	24.0		33	6.0		58	11.7		83	Sand	
9	2.2		34	9.7		59	32.5		84	16.5	
(10)	11.0	Ø	35	7.5		(60)	22.7	3/4	85	9.6	
11	1.7		36	36.5		61	24.7		86	5.0	
12	24.5		37	69.9		62	15.9		87	73.5	
13	12.3		38	28.5		63	17.0		88	1.1	
14	2.3		39	2.7		64	81.5		89	6.5	
15	5.8		(40)	9.8	1	65	5.0		(90)	16.0	1/4
16	14.5		41	5.8		66	6.4		91	2.2	
17	4.9		42	7.8		67	9.5		92	11.7	
18	1.6		43	7.9		68	14.4		93	2.7	
19	11.5		44	9.0		69	4.5		94	1.3	
(20)	7.8	3/4	45	9.5		(70)	10	1/2	95	12.6	
21	19.8		46	9.5		71	5		96	25.5	
22	11.7		47	8.9		72	38.7		97	2.5	
23	21.8		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

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 Hyland + Beth Millions Site Code: MORC2

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

SITE INSPECTION

Site Inspected by: Beth Millions

Communication Information

☒ Itinerary left with contact person (include contact numbers)

Contact Person: Kevin Whiting Time checked-in: 0830

Form of communication: ☐ radio ☒ cell ☐ satellite ☐ hotel/pay phone ☐ SPOT

Phone number: (403) 702 - 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:

Field Crew: Beth Millions, Chad Hughes, Ayla Bennett Site Code: COL01

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

☒ **Occupational Health & Safety: Site Inspection Sheet completed**

PRIMARY SITE DATA

CABIN Study Name: Elk River Tributaries Local Basin Name: Coal Creek

River/Stream Name: Coal Creek Stream Order: (map scale 1:50,000) _____

Select one: ☒ Test Site ☐ Potential Reference Site

Geographical Description/Notes: COL-01 site between Park Ave + train bridge
ACCESS VIA END OF ELK VIEW CRESENT

Surrounding Land Use: (check those present) Information Source: VISUAL

☑ Forest ☐ Field/Pasture ☐ Agriculture ☒ Residential/Urban
☐ Logging ☐ Mining ☐ Commercial/Industrial ☑ Other trail, train bridge u/s

Dominant Surrounding Land Use: (check one) Information Source: VISUAL

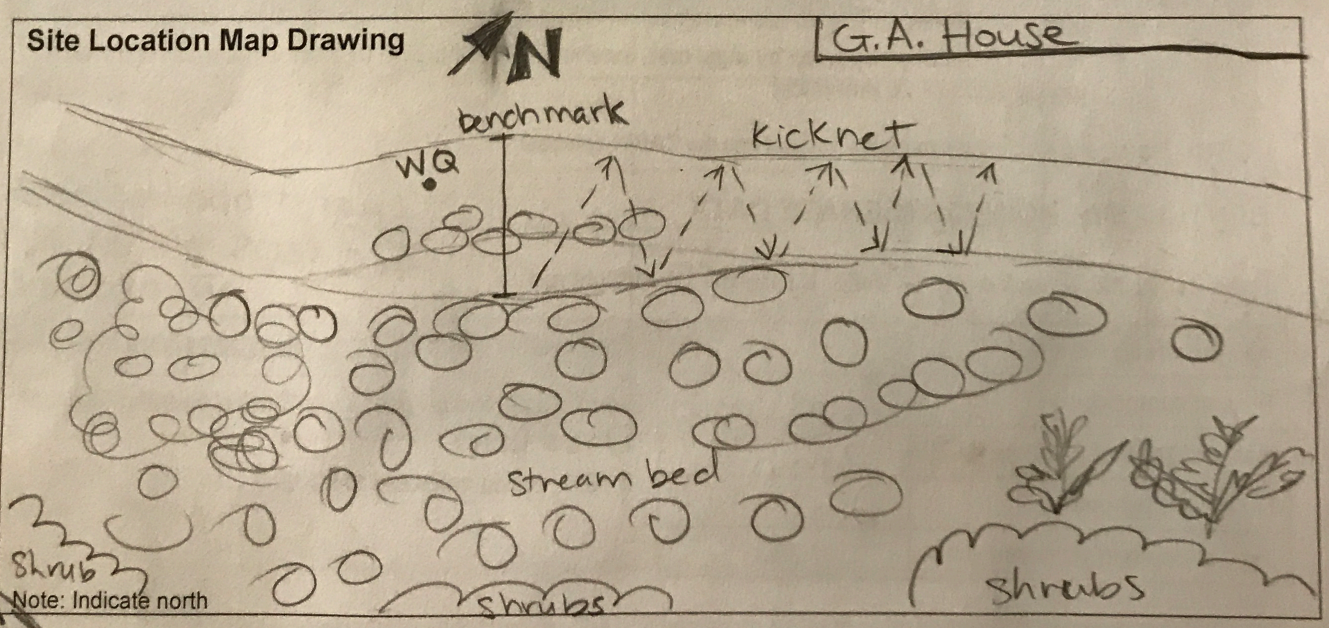
☐ Forest ☐ Field/Pasture ☐ Agriculture ☑ Residential/Urban
☐ Logging ☐ Mining ☐ Commercial/Industrial ☐ Other _____

Location Data

Latitude: 49.49556 N Longitude: - 115.06644 W (DMS or DD)

Elevation: 999 (fasl *or* masl) GPS Datum: ☑ GRS80 (NAD83/WGS84) ☐ Other: _____

Site Location Map Drawing



Note: Indicate north

Field Crew: BM, CH, AB Site Code: COL-01

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

Photos
☑ Field Sheet ☑ Upstream ☑ Downstream ☑ Across Site ☐ Aerial View
☑ Substrate (exposed) ☑ Substrate (aquatic) ☐ Other _____

REACH DATA *(represents 6 times bankfull width)*

1. Habitat Types: *(check those present)*
☑ Riffle ☐ Rapids ☑ Straight run ☐ Pool/Back Eddy

2. Canopy Coverage: *(stand in middle of stream and look up, check one)*
☐ 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)*
☑ ferns/grasses ☑ shrubs ☑ deciduous trees ☐ coniferous trees

5. Dominant Streamside Vegetation: *(check one)*
☐ ferns/grasses ☑ 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)
☑ **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 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)

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	
Person sampling	Chad Hughes
Sampling time (i.e. 3 min.)	3 min
No. of sample jars	2
Typical depth in kick area (cm)	20

additional 3 jars (3x1)
+ 3 reps of eDNA w antifreeze.

Preservative used: 99% isopropyl alcohol

Sampled sieved on site using "Bucket Swirling Method":
☐ YES ☒ NO
If YES, debris collected for QAQC ☐

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

Field Crew: BM, CH, AB Site Code: COL-01

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

WATER CHEMISTRY DATA **Time:** 13:30 (24 hr clock) **Time zone:** MST

Air Temp: 14.0 (°C) Water Temp: 12.2 (°C) pH: 8.33

Specific Conductance: 2495 (µs/cm) DO: 7.0 (mg/L) Turbidity: 0.52 (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)
- ☑ Other total + dissolved metals

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 = _____

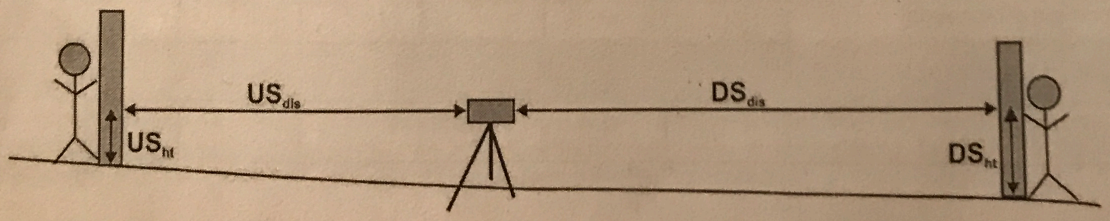
OR

☑ **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
[a]Top Hairline (T)			
[a]Mid Hairline (ht) OR [b]Height of rod			
[a]Bottom Hairline (B)			
[b]Distance (dis) OR [a]T-B x 100	[a]US_{dis}=T-B	[a]DS_{dis}=T-B	$US_{dis}+DS_{dis}$=
Change in height (Δht)			$DS_{ht}-US_{ht}$=
Slope (Δht/total dis)			0.01



Field Crew: BM, CH, AB Site Code: COL-01

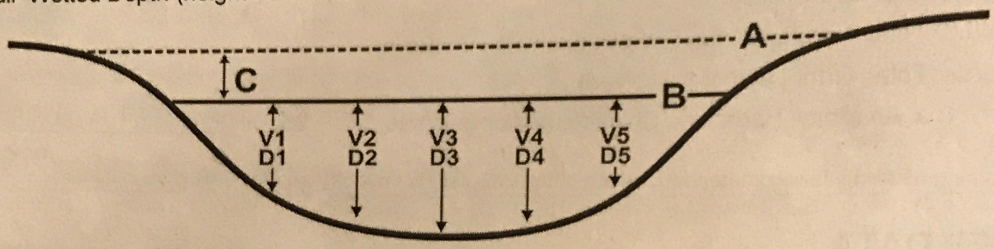
Sampling Date: (DD/MM/YYYY) 08/09/2020

Widths and Depth

Location at site: @ benchmark (Indicate where in sample reach, ex. d/s of kick area)

A - Bankfull Width: 19.4 (m) B - Wetted Stream Width: 8.4 (m)

C - Bankfull–Wetted Depth (height from water surface to Bankfull): 29 (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) = √ [2(ΔD/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)	1.2	2.4	3.6	4.8	6.0	7.2	
Depth (**D**) (cm)	36.5	14.	1.5	3.5	7.0	6.5	
Velocity Head Rod (ruler)							
Flowing water Depth (D_1) (cm)	36.5	14	1.5	3.5	7	6.5	
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	0	0	0	0	
Rotary meter							
Revolutions							
Time (minimum 40 seconds)							
Direct Measurement or calculation							
Velocity (**V**) (m/s)							

Field Crew: BM, CH, AB Site Code: COL-01

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

SUBSTRATE DATA

Surrounding/Interstitial Material

Circle the substrate size category for the surrounding material.

Coarse sand

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.
- Embededness 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		Diameter (cm)	E
1	9.0		26	2.0		51	4.0		76	9.5	
2	11.5		27	3.5		52	9.5		77	1.0	
3	2.0		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)	9.5	1/2
6	7.0		31	6.5		56	12.0		81	9.0	
7	11.5		32	6.7		57	0.2		82	21.0	
8	8.0		33	30.0		58	6.0		83	3.5	
9	5.5		34	2.5		59	5.6		84	7.0	
(10)	3.5	O	35	10.0		(60)	11.0	1	85	1.9	
11	26.0		36	9.5		61	0.6		86	4.5	
12	2.5		37	0.3		62	14.5		87	8.0	
13	2.3		38	7.2		63	1.3		88	32.0	
14	6.5		39	4.8		64	22.0		89	8.6	
15	0.7		(40)	0.9	O	65	1.7		(90)	5.5	O
16	1.2		41	1.5		66	1.6		91	13.1	
17	16.0		42	5.5		67	6.8		92	15.0	
18	0.2		43	4.5		68	23.5		93	3.2	
19	9.5		44	0.2		69	19.0		94	12.5	
(20)	14.5	3/4	45	0.3		(70)	14.5	3/4	95	4.5	
21	5.0		46	11.0		71	S		96	9.5	
22	0.1		47	8.5		72	0.8		97	7.5	
23	0.2		48	5.9		73	8.5		98	8.5	
24	5.5		49	5.5		74	1.0		99	6.2	
25	Org.		(50)	10.7	1/4	75	5.5		(100)	0.4	O

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: BM CH + AB Site Code: COL-01

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

SITE INSPECTION

Site Inspected by: Chad Hughes

Communication Information

☑ Itinerary left with contact person (include contact numbers)

Contact Person: Mike Bennett Time checked-in: 12:00

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)

N/A ☐ PFD worn

☑ Appropriate footwear, waders, wading belt

N/A ☐ Belay used

Notes:

Chad Hughes - Cabin Site - 2020 2 11

DO-10

Field Crew: Bella Millions, Chad Hughes + Ayla Bennett 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: Elk River tributaries Local Basin Name: Coal Creek

River/Stream Name: Coal Creek Stream 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

Surrounding Land Use: (check those present) Information Source: VISUAL

☒ Forest ☐ Field/Pasture ☐ Agriculture ☐ Residential/Urban

☒ Logging ☐ Mining ☐ Commercial/Industrial ☒ Other hunting camp

Dominant Surrounding Land Use: (check one) Information Source: VISUAL

☐ Forest ☐ Field/Pasture ☐ Agriculture ☐ Residential/Urban

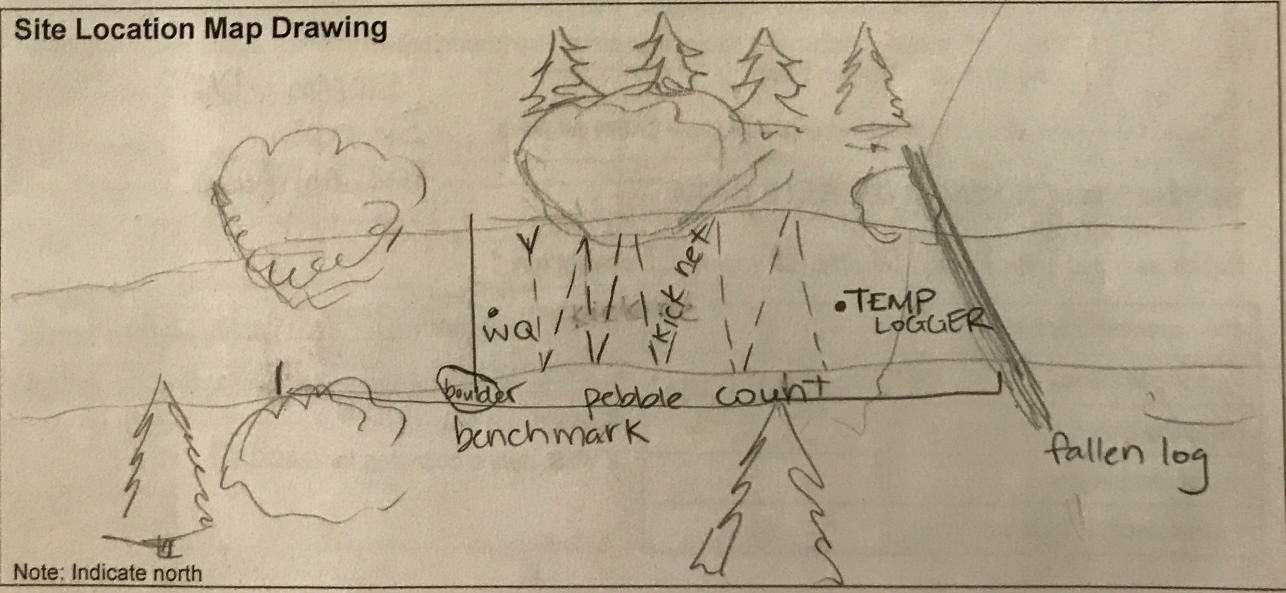
☐ Logging ☐ Mining ☐ Commercial/Industrial ☐ Other _____

Location Data

Latitude: 49.45387 N Longitude: -114.88066 W (DMS or DD)

Elevation: _____ (fasl or masl) GPS Datum: ☐ GRS80 (NAD83/WGS84) ☐ Other: _____

Site Location Map Drawing



Note: Indicate north

Field Crew: BM, CH, AB Site Code: COL-03

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

Photos

☑ Field Sheet ☑ Upstream ☑ Downstream ☑ Across Site ☐ Aerial View

☑ Substrate (exposed) ☑ Substrate (aquatic) ☐ Other _____

REACH DATA *(represents 6 times bankfull width)*

1. Habitat Types: *(check those present)*

☑ Riffle ☐ Rapids ☐ Straight run ☑ Pool/Back Eddy

2. Canopy Coverage: *(stand in middle of stream and look up, check one)*

☐ 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)*

☑ ferns/grasses ☑ shrubs ☐ deciduous trees ☑ coniferous trees

5. Dominant Streamside Vegetation: *(check one)*

☐ ferns/grasses ☑ 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)

☑ **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 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)

Note: 1 through 5 represent categories entered into the CABIN database.

STREAM eDNA
3x, reps.
Pres: Antifreeze.

BENTHIC MACROINVERTEBRATE DATA

Habitat sampled: *(check one)* ☑ riffle ☐ rapids ☐ straight run

400 µm mesh Kick Net	✓
Person sampling	Chad Hughes
Sampling time (i.e. 3 min.)	3 min
No. of sample jars	1
Typical depth in kick area (cm)	5.0 cm

Preservative used: 99% isopropyl

Sampled sieved on site using "Bucket Swirling Method":
☐ YES ☐ NO

If YES, debris collected for QAQC ☐

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

Field Crew: P.M. C.H. A.B Site Code: COL-03

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

WATER CHEMISTRY DATA **Time:** 10:05 (24 hr clock) **Time zone:** MST

Air Temp: 4.8 (°C) Water Temp: 3.5 (°C) pH: 7.26

Specific Conductance: 104 (µs/cm) DO: 10 (mg/L) Turbidity: 0.75 (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)
- ☑ Other total + dissolved metals

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 = _____

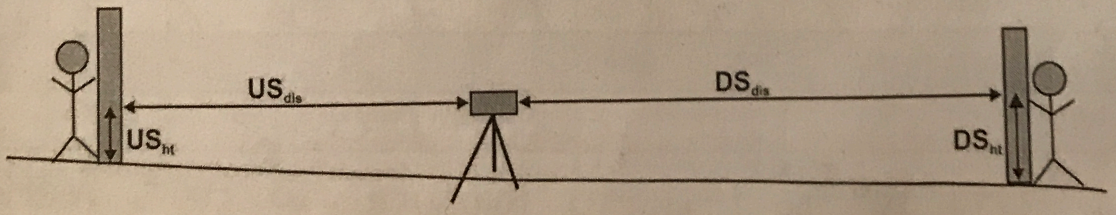
OR

☑ **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
[a]Top Hairline (T)			
[a]Mid Hairline (ht) OR [b]Height of rod	1.37 m	2.51 m	
[a]Bottom Hairline (B)			
[b]Distance (dis) OR [a]T-B x 100	11.2 m [a]US_{dis}=T-B	12.8 [a]DS_{dis}=T-B	$US_{dis}+DS_{dis}$= 24.0 m
Change in height (Δht)			$DS_{ht}-US_{ht}$= 1.14
Slope (Δht/total dis)			1.14 / 24.0 = 0.048



Field Crew: BM, CH + AB Site Code: COL-03

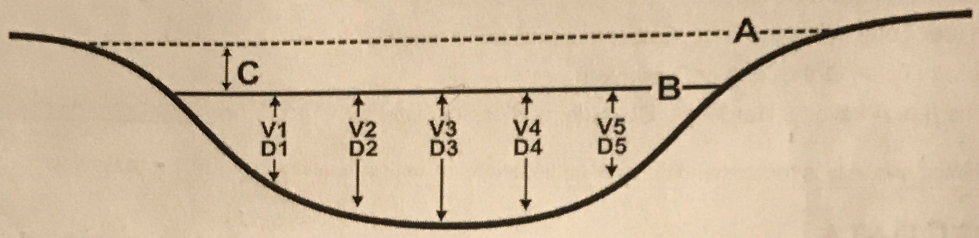
Sampling Date: (DD/MM/YYYY) 08/09/2020

Widths and Depth

Location at site: @ benchmark (Indicate where in sample reach, ex. d/s of kick area)

A - Bankfull Width: 3.3 (m) B - Wetted Stream Width: 2.4 (m)

C - Bankfull–Wetted Depth (height from water surface to Bankfull): 17 (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) = √ [2(ΔD/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_____

11 1.6

	1	2	3	4	5	6	AVG
Distance from Shore (m)	0.5	1.0	1.5	2.0			
Depth (**D**) (cm)	2.0	2.5	4.0	1.0			2.38
Velocity Head Rod (ruler)							
Flowing water Depth (D_1) (cm)	2.0	2.5	4.0	1.0			
Depth of Stagnation (D_2) (cm)	2.0	2.5	4.0	1.0			
Change in depth ($\Delta D = D_2 - D_1$) (cm)	0	0	0	0			
Rotary meter							
Revolutions							
Time (minimum 40 seconds)							
Direct Measurement or calculation							
Velocity (**V**) (m/s)	0	0	0	0			

(*) Velocity + H2O level too low to measure w this method

Field Crew: BM, CH, AB Site Code: COL-03

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

SUBSTRATE DATA

Surrounding/Interstitial Material

Circle the substrate size category for the surrounding material.

gravel

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.
- Embededness 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		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	4.9		28	11.5		53	7.7		78	1.5	
4	2.8		29	23.0		54	4.3		79	16.0	
5	14.0		(30)	8.9	1/2	55	19.6		(80)	10.2	O
6	5.7		31	3.0		56	3.7		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	1/4	35	2.9		(60)	10.0	3/4	85	B	
11	6.6		36	3.5		61	19.6		86	2.5	
12	11.5		37	6.8		62	20.0		87	4.2	
13	18.5		38	5.0		63	8.0		88	5.2	
14	3.0		39	14.0		64	49.7		89	8.1	
15	5.5		(40)	28.0	1/4	65	0.6		(90)	6.0	1/4
16	3.0		41	3.7		66	7.0		91	2.3	
17	0.8		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	O	45	7.5		(70)	11.0	1/4	95	30.0	
21	22.0		46	0.8		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	O

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: BM, CH + AB Site Code: COL-03

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

SITE INSPECTION

Site Inspected by: Chad Hughes

Communication Information

☑ Itinerary left with contact person (include contact numbers)

Contact Person: Mike Bennett Time checked-in: 9:00AM

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)

N/A ☐ PFD worn

☑ Appropriate footwear, waders, wading belt

N/A ☐ Belay used

Notes:

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		**RECEIVED / TEMP**	2020-09-10 09:30 / 5°C
PROJECT	ERA-CBWM	**REPORTED**	2020-09-17 16:55
PROJECT INFO	[info]	**COC NUMBER**	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.

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.

We've Got Chemistry

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.

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

CARO ANALYTICAL SERVICES

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
COL-03_200908_1030 (0091166-01) | Matrix: Water | Sampled: 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	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	**0.0850**	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	**0.000060**	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	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	
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	0.10	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	mg/L	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	

CARO ANALYTICAL SERVICES

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
COL-03_200908_1030 (0091166-01) | Matrix: Water | Sampled: 2020-09-08 10:05, Continued						
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	mg/L	2020-09-17	
Nickel, total	**0.00061**	N/A	0.00040	mg/L	2020-09-17	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2020-09-17	
Potassium, total	**0.23**	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	**1.1**	N/A	1.0	mg/L	2020-09-17	

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO Elk River Alliance
PROJECT ERA-CBWM

WORK ORDER 0091166
REPORTED 2020-09-17 16:55

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
COL-03_200908_1030 (0091166-01) | Matrix: Water | Sampled: 2020-09-08 10:05, Continued						
Total Metals, 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	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	**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	

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
COL01_200908_1330 (0091166-02) | Matrix: Water | Sampled: 2020-09-08 13:30, Continued						
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, dissolved	**8.66**	N/A	0.010	mg/L	2020-09-16	
Manganese, dissolved	**0.00451**	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	**0.00079**	N/A	0.00010	mg/L	2020-09-16	
Nickel, dissolved	**0.00051**	N/A	0.00040	mg/L	2020-09-16	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2020-09-16	
Potassium, dissolved	**0.79**	N/A	0.10	mg/L	2020-09-16	
Selenium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-09-16	
Silicon, dissolved	**1.9**	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, dissolved	**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, dissolved	< 0.00050	N/A	0.00050	mg/L	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	
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	**0.000456**	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)	**117**	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)	**117**	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	**0.053**	N/A	0.050	mg/L	2020-09-15	
Phosphorus, Total (as P)	**0.0136**	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	**0.0131**	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	

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
COL01_200908_1330 (0091166-02) | Matrix: Water | Sampled: 2020-09-08 13:30, Continued						
Total Metals, Continued						
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, total	**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	Elk River Alliance	**WORK ORDER**	0091166
PROJECT	ERA-CBWM	**REPORTED**	2020-09-17 16:55

Analysis Description	Method Ref.	Technique	Accredited	Location
Alkalinity in Water	SM 2320 B* (2017)	Titration with H2SO4	✓	Kelowna
Anions in Water	SM 4110 B (2017)	Ion Chromatography	✓	Kelowna
Biochemical Oxygen Demand in Water	SM 5210 B (2017)	Dissolved Oxygen Meter	✓	Kelowna
Chemical Oxygen Demand in Water	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
Nitrogen, Total Kjeldahl in Water	SM 4500-Norg D* (2017)	Block Digestion and Flow Injection Analysis	✓	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Solids, Total Suspended in Water	SM 2540 D* (2017)	Gravimetry (Dried at 103-105C)	✓	Kelowna
Total Metals in Water	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	**WORK ORDER**	0091166
PROJECT	ERA-CBWM	**REPORTED**	2020-09-17 16:55

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 not 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.

APPENDIX 2: QUALITY CONTROL RESULTS

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 Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B0I1063										
Blank (B0I1063-BLK1)				Prepared: 2020-09-12, Analyzed: 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: 2020-09-13, Analyzed: 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: 2020-09-12, Analyzed: 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: 2020-09-13, Analyzed: 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			
Phosphate (as P)	0.965	0.0050	mg/L	1.00		96	80-120			
Sulfate	16.0	1.0	mg/L	16.0		100	90-110			
Dissolved Metals, Batch B0I1383										
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							

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B0I1383, 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						
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			

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B0I1383, Continued										
LCS (B0I1383-BS1), Continued				Prepared: 2020-09-16, Analyzed: 2020-09-16						
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-SRM1)				Prepared: 2020-09-16, Analyzed: 2020-09-16						
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	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, dissolved	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	0.502	0.050	mg/L	0.499		101	70-130			
Potassium, dissolved	3.04	0.10	mg/L	2.88		105	70-130			
Selenium, dissolved	0.0348	0.00050	mg/L	0.0324		107	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			
Uranium, dissolved	0.251	0.000020	mg/L	0.258		97	70-130			
Vanadium, dissolved	0.824	0.0010	mg/L	0.873		94	70-130			
Zinc, dissolved	0.894	0.0040	mg/L	0.848		105	70-130			
General Parameters, Batch B0I1072										
Blank (B0I1072-BLK1)				Prepared: 2020-09-12, Analyzed: 2020-09-17						
BOD, 5-day	< 2.0	2.0	mg/L							
LCS (B0I1072-BS1)				Prepared: 2020-09-12, Analyzed: 2020-09-17						
BOD, 5-day	177	2.0	mg/L	180		98	85-115			
General Parameters, Batch B0I1134										

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B0I1134, Continued										
Blank (B0I1134-BLK1)				Prepared: 2020-09-14, Analyzed: 2020-09-14						
Solids, Total Suspended	< 2.0	2.0	mg/L							
Blank (B0I1134-BLK2)				Prepared: 2020-09-14, Analyzed: 2020-09-14						
Solids, Total Suspended	< 2.0	2.0	mg/L							
LCS (B0I1134-BS1)				Prepared: 2020-09-14, Analyzed: 2020-09-14						
Solids, Total Suspended	104	10.0	mg/L	100		104	85-115			
LCS (B0I1134-BS2)				Prepared: 2020-09-14, Analyzed: 2020-09-14						
Solids, Total Suspended	110	10.0	mg/L	100		110	85-115			
General Parameters, Batch B0I1173										
Blank (B0I1173-BLK1)				Prepared: 2020-09-14, Analyzed: 2020-09-15						
Nitrogen, Total Kjeldahl	< 0.050	0.050	mg/L							
Blank (B0I1173-BLK2)				Prepared: 2020-09-14, Analyzed: 2020-09-15						
Nitrogen, Total Kjeldahl	< 0.050	0.050	mg/L							
LCS (B0I1173-BS1)				Prepared: 2020-09-14, Analyzed: 2020-09-15						
Nitrogen, Total Kjeldahl	1.02	0.050	mg/L	1.00		102	85-115			
LCS (B0I1173-BS2)				Prepared: 2020-09-14, Analyzed: 2020-09-15						
Nitrogen, Total Kjeldahl	1.03	0.050	mg/L	1.00		103	85-115			
General Parameters, Batch B0I1220										
Blank (B0I1220-BLK1)				Prepared: 2020-09-15, Analyzed: 2020-09-15						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 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 (B0I1220-BLK2)				Prepared: 2020-09-15, Analyzed: 2020-09-15						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 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 (B0I1220-BS1)				Prepared: 2020-09-15, Analyzed: 2020-09-15						
Alkalinity, Total (as CaCO3)	88.1	1.0	mg/L	100		88	80-120			
LCS (B0I1220-BS2)				Prepared: 2020-09-15, Analyzed: 2020-09-15						
Alkalinity, Total (as CaCO3)	89.9	1.0	mg/L	100		90	80-120			
General Parameters, Batch B0I1233										
Blank (B0I1233-BLK1)				Prepared: 2020-09-15, Analyzed: 2020-09-15						
Chemical Oxygen Demand	< 20	20	mg/L							
LCS (B0I1233-BS1)				Prepared: 2020-09-15, Analyzed: 2020-09-15						
Chemical Oxygen Demand	507	20	mg/L	500		101	89-115			

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B0I1237										
Blank (B0I1237-BLK1)				Prepared: 2020-09-15, Analyzed: 2020-09-15						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Blank (B0I1237-BLK2)				Prepared: 2020-09-15, Analyzed: 2020-09-15						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
LCS (B0I1237-BS1)				Prepared: 2020-09-15, Analyzed: 2020-09-15						
Phosphorus, Total (as P)	0.103	0.0050	mg/L	0.100		103	85-115			
LCS (B0I1237-BS2)				Prepared: 2020-09-15, Analyzed: 2020-09-15						
Phosphorus, Total (as P)	0.103	0.0050	mg/L	0.100		103	85-115			
Duplicate (B0I1237-DUP2)		**Source: 0091166-02**		Prepared: 2020-09-15, Analyzed: 2020-09-15						
Phosphorus, Total (as P)	0.0139	0.0050	mg/L		0.0136				15	
Matrix Spike (B0I1237-MS2)		**Source: 0091166-02**		Prepared: 2020-09-15, Analyzed: 2020-09-15						
Phosphorus, Total (as P)	0.119	0.0050	mg/L	0.102	0.0136	103	70-125			
Total Metals, Batch B0I1450										
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							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO Elk River Alliance
PROJECT ERA-CBWM

WORK ORDER 0091166
REPORTED 2020-09-17 16:55

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B0I1450, Continued										
Blank (B0I1450-BLK1), Continued				Prepared: 2020-09-16, Analyzed: 2020-09-17						
Zinc, total	< 0.0040	0.0040	mg/L							
Zirconium, total	< 0.00010	0.00010	mg/L							
LCS (B0I1450-BS1)				Prepared: 2020-09-16, Analyzed: 2020-09-17						
Aluminum, total	0.0198	0.0050	mg/L	0.0199		100	80-120			
Antimony, total	0.0200	0.00020	mg/L	0.0200		100	80-120			
Arsenic, total	0.0199	0.00050	mg/L	0.0200		100	80-120			
Barium, total	0.0209	0.0050	mg/L	0.0198		106	80-120			
Beryllium, total	0.0197	0.00010	mg/L	0.0198		100	80-120			
Bismuth, total	0.0209	0.00010	mg/L	0.0200		104	80-120			
Boron, total	< 0.0500	0.0500	mg/L	0.0200		112	80-120			
Cadmium, total	0.0197	0.000010	mg/L	0.0199		99	80-120			
Calcium, total	2.01	0.20	mg/L	2.02		100	80-120			
Chromium, total	0.0200	0.00050	mg/L	0.0198		101	80-120			
Cobalt, total	0.0209	0.00010	mg/L	0.0199		105	80-120			
Copper, total	0.0207	0.00040	mg/L	0.0200		103	80-120			
Iron, total	2.03	0.010	mg/L	2.02		100	80-120			
Lead, total	0.0198	0.00020	mg/L	0.0199		99	80-120			
Lithium, total	0.0199	0.00010	mg/L	0.0200		99	80-120			
Magnesium, total	2.20	0.010	mg/L	2.02		109	80-120			
Manganese, total	0.0202	0.00020	mg/L	0.0199		102	80-120			
Mercury, total	0.00109	0.000040	mg/L	0.00100		109	80-120			
Molybdenum, total	0.0199	0.00010	mg/L	0.0200		99	80-120			
Nickel, total	0.0200	0.00040	mg/L	0.0200		100	80-120			
Phosphorus, total	2.04	0.050	mg/L	2.00		102	80-120			
Potassium, total	2.04	0.10	mg/L	2.02		101	80-120			
Selenium, total	0.0198	0.00050	mg/L	0.0200		99	80-120			
Silicon, total	2.0	1.0	mg/L	2.00		102	80-120			
Silver, total	0.0200	0.000050	mg/L	0.0200		100	80-120			
Sodium, total	2.22	0.10	mg/L	2.02		110	80-120			
Strontium, total	0.0200	0.0010	mg/L	0.0200		100	80-120			
Sulfur, total	5.4	3.0	mg/L	5.00		108	80-120			
Tellurium, total	0.0191	0.00050	mg/L	0.0200		95	80-120			
Thallium, total	0.0210	0.000020	mg/L	0.0199		106	80-120			
Thorium, total	0.0195	0.00010	mg/L	0.0200		98	80-120			
Tin, total	0.0202	0.00020	mg/L	0.0200		101	80-120			
Titanium, total	0.0186	0.0050	mg/L	0.0200		93	80-120			
Tungsten, total	0.0209	0.0010	mg/L	0.0200		104	80-120			
Uranium, total	0.0205	0.000020	mg/L	0.0200		103	80-120			
Vanadium, total	0.0184	0.0010	mg/L	0.0200		92	80-120			
Zinc, total	0.0238	0.0040	mg/L	0.0200		119	80-120			
Zirconium, total	0.0197	0.00010	mg/L	0.0200		99	80-120			
Reference (B0I1450-SRM1)				Prepared: 2020-09-16, Analyzed: 2020-09-17						
Aluminum, total	0.281	0.0050	mg/L	0.299		94	70-130			
Antimony, total	0.0494	0.00020	mg/L	0.0517		96	70-130			
Arsenic, total	0.118	0.00050	mg/L	0.119		99	70-130			
Barium, total	0.783	0.0050	mg/L	0.801		98	70-130			
Beryllium, total	0.0485	0.00010	mg/L	0.0501		97	70-130			
Boron, total	3.82	0.0500	mg/L	4.11		93	70-130			
Cadmium, total	0.0478	0.000010	mg/L	0.0503		95	70-130			
Calcium, total	10.8	0.20	mg/L	10.7		101	70-130			
Chromium, total	0.247	0.00050	mg/L	0.250		99	70-130			
Cobalt, total	0.0402	0.00010	mg/L	0.0384		105	70-130			
Copper, total	0.467	0.00040	mg/L	0.487		96	70-130			
Iron, total	0.541	0.010	mg/L	0.504		107	70-130			
Lead, total	0.269	0.00020	mg/L	0.278		97	70-130			

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B0I1450, Continued										
Reference (B0I1450-SRM1), Continued				Prepared: 2020-09-16, Analyzed: 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 Fernie cha, BC V0B1M0		
ATTENTION	Chad Hughes	**WORK ORDER**	0091213
PO NUMBER		**RECEIVED / TEMP**	2020-09-11 09:35 / 9°C
PROJECT	ERA-CBWM	**REPORTED**	2020-09-18 20:16
PROJECT INFO	[info]	**COC NUMBER**	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.

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.

We've Got Chemistry

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.

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

CARO ANALYTICAL SERVICES

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
LIZ01_200909_945 (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	mg/L	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	mg/L	2020-09-13	HT1
Sulfate	**192**	AO ≤ 500	1.0	mg/L	2020-09-13	
Calculated Parameters						
Hardness, Total (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	mg/L	2020-09-18	
Aluminum, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-09-18	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-09-18	
Arsenic, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-09-18	
Barium, dissolved	**0.0696**	N/A	0.0050	mg/L	2020-09-18	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-09-18	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-09-18	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2020-09-18	
Cadmium, dissolved	**0.000022**	N/A	0.000010	mg/L	2020-09-18	
Calcium, dissolved	**106**	N/A	0.20	mg/L	2020-09-18	
Chromium, dissolved	**0.00058**	N/A	0.00050	mg/L	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, dissolved	**23.5**	N/A	0.010	mg/L	2020-09-18	
Manganese, dissolved	**0.00149**	N/A	0.00020	mg/L	2020-09-18	
Mercury, dissolved	< 0.000040	N/A	0.000040	mg/L	2020-09-18	
Molybdenum, dissolved	**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, dissolved	< 0.050	N/A	0.050	mg/L	2020-09-18	
Potassium, dissolved	**0.44**	N/A	0.10	mg/L	2020-09-18	
Selenium, dissolved	< 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	**1.58**	N/A	0.10	mg/L	2020-09-18	
Strontium, dissolved	**1.61**	N/A	0.0010	mg/L	2020-09-18	
Sulfur, dissolved	**71.0**	N/A	3.0	mg/L	2020-09-18	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-09-18	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2020-09-18	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-09-18	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-09-18	

CARO ANALYTICAL SERVICES

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
LIZ01_200909_945 (0091213-01) | Matrix: 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	

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
LIZ01_200909_945 (0091213-01) | Matrix: Water | Sampled: 2020-09-09 09:45, Continued						
Total Metals, Continued						
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	Elk River Alliance	**WORK ORDER**	0091213
PROJECT	ERA-CBWM	**REPORTED**	2020-09-18 20:16

Analysis Description	Method Ref.	Technique	Accredited	Location
Alkalinity in Water	SM 2320 B* (2017)	Titration with H2SO4	✓	Kelowna
Anions in Water	SM 4110 B (2017)	Ion Chromatography	✓	Kelowna
Biochemical Oxygen Demand in Water	SM 5210 B (2017)	Dissolved Oxygen Meter	✓	Kelowna
Chemical Oxygen Demand in Water	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
Nitrogen, Total Kjeldahl in Water	SM 4500-Norg D* (2017)	Block Digestion and Flow Injection Analysis	✓	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Solids, Total Suspended in Water	SM 2540 D* (2017)	Gravimetry (Dried at 103-105C)	✓	Kelowna
Total Metals in Water	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	**WORK ORDER**	0091213
PROJECT	ERA-CBWM	**REPORTED**	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 not 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.

APPENDIX 2: QUALITY CONTROL RESULTS

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 Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B0I1063										
Blank (B0I1063-BLK1)				Prepared: 2020-09-12, Analyzed: 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: 2020-09-13, Analyzed: 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: 2020-09-12, Analyzed: 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: 2020-09-13, Analyzed: 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			
Phosphate (as P)	0.965	0.0050	mg/L	1.00		96	80-120			
Sulfate	16.0	1.0	mg/L	16.0		100	90-110			
Dissolved Metals, Batch B0I1528										
Blank (B0I1528-BLK1)				Prepared: 2020-09-18, Analyzed: 2020-09-18						
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							

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B0I1528, Continued										
Blank (B0I1528-BLK1), Continued				Prepared: 2020-09-18, Analyzed: 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, Analyzed: 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			
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			

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B0I1528, Continued										
LCS (B0I1528-BS1), Continued				Prepared: 2020-09-18, Analyzed: 2020-09-18						
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-SRM1)				Prepared: 2020-09-18, Analyzed: 2020-09-18						
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, dissolved	0.408	0.00010	mg/L	0.404		101	70-130			
Nickel, dissolved	0.849	0.00040	mg/L	0.835		102	70-130			
Phosphorus, dissolved	0.534	0.050	mg/L	0.499		107	70-130			
Potassium, dissolved	3.13	0.10	mg/L	2.88		109	70-130			
Selenium, dissolved	0.0330	0.00050	mg/L	0.0324		102	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			
Thallium, dissolved	0.0420	0.000020	mg/L	0.0385		109	70-130			
Uranium, dissolved	0.262	0.000020	mg/L	0.258		102	70-130			
Vanadium, dissolved	0.865	0.0010	mg/L	0.873		99	70-130			
Zinc, dissolved	0.852	0.0040	mg/L	0.848		100	70-130			
General Parameters, Batch B0I1072										
Blank (B0I1072-BLK1)				Prepared: 2020-09-12, Analyzed: 2020-09-17						
BOD, 5-day	< 2.0	2.0	mg/L							
LCS (B0I1072-BS1)				Prepared: 2020-09-12, Analyzed: 2020-09-17						
BOD, 5-day	177	2.0	mg/L	180		98	85-115			
General Parameters, Batch B0I1134										

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B0I1134, Continued										
Blank (B0I1134-BLK1)				Prepared: 2020-09-14, Analyzed: 2020-09-14						
Solids, Total Suspended	< 2.0	2.0	mg/L							
Blank (B0I1134-BLK2)				Prepared: 2020-09-14, Analyzed: 2020-09-14						
Solids, Total Suspended	< 2.0	2.0	mg/L							
LCS (B0I1134-BS1)				Prepared: 2020-09-14, Analyzed: 2020-09-14						
Solids, Total Suspended	104	10.0	mg/L	100		104	85-115			
LCS (B0I1134-BS2)				Prepared: 2020-09-14, Analyzed: 2020-09-14						
Solids, Total Suspended	110	10.0	mg/L	100		110	85-115			
General Parameters, Batch B0I1305										
Blank (B0I1305-BLK1)				Prepared: 2020-09-15, Analyzed: 2020-09-16						
Nitrogen, Total Kjeldahl	< 0.050	0.050	mg/L							
Blank (B0I1305-BLK2)				Prepared: 2020-09-15, Analyzed: 2020-09-16						
Nitrogen, Total Kjeldahl	< 0.050	0.050	mg/L							
LCS (B0I1305-BS1)				Prepared: 2020-09-15, Analyzed: 2020-09-16						
Nitrogen, Total Kjeldahl	0.984	0.050	mg/L	1.00		98	85-115			
LCS (B0I1305-BS2)				Prepared: 2020-09-15, Analyzed: 2020-09-16						
Nitrogen, Total Kjeldahl	1.06	0.050	mg/L	1.00		106	85-115			
General Parameters, Batch B0I1337										
Blank (B0I1337-BLK1)				Prepared: 2020-09-15, Analyzed: 2020-09-15						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 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 (B0I1337-BLK2)				Prepared: 2020-09-15, Analyzed: 2020-09-15						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 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 (B0I1337-BS1)				Prepared: 2020-09-15, Analyzed: 2020-09-15						
Alkalinity, Total (as CaCO3)	89.1	1.0	mg/L	100		89	80-120			
LCS (B0I1337-BS2)				Prepared: 2020-09-15, Analyzed: 2020-09-15						
Alkalinity, Total (as CaCO3)	89.2	1.0	mg/L	100		89	80-120			
General Parameters, Batch B0I1366										
Blank (B0I1366-BLK1)				Prepared: 2020-09-16, Analyzed: 2020-09-16						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Blank (B0I1366-BLK2)				Prepared: 2020-09-16, Analyzed: 2020-09-16						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B0I1366, Continued										
LCS (B0I1366-BS1)				Prepared: 2020-09-16, Analyzed: 2020-09-16						
Phosphorus, Total (as P)	0.110	0.0050	mg/L	0.100		110	85-115			
LCS (B0I1366-BS2)				Prepared: 2020-09-16, Analyzed: 2020-09-16						
Phosphorus, Total (as P)	0.109	0.0050	mg/L	0.100		109	85-115			
Duplicate (B0I1366-DUP2)		**Source: 0091213-01**		Prepared: 2020-09-16, Analyzed: 2020-09-16						
Phosphorus, Total (as P)	0.0141	0.0050	mg/L		0.0149				15	
Matrix Spike (B0I1366-MS2)		**Source: 0091213-01**		Prepared: 2020-09-16, Analyzed: 2020-09-16						
Phosphorus, Total (as P)	0.124	0.0050	mg/L	0.102	0.0149	107	70-125			
General Parameters, Batch B0I1494										
Blank (B0I1494-BLK1)				Prepared: 2020-09-17, Analyzed: 2020-09-17						
Chemical Oxygen Demand	< 20	20	mg/L							
LCS (B0I1494-BS1)				Prepared: 2020-09-17, Analyzed: 2020-09-17						
Chemical Oxygen Demand	508	20	mg/L	500		102	89-115			
Total Metals, Batch B0I1589										
Blank (B0I1589-BLK1)				Prepared: 2020-09-17, 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							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO Elk River Alliance
PROJECT ERA-CBWM

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B0I1589, Continued										
Blank (B0I1589-BLK1), Continued				Prepared: 2020-09-17, Analyzed: 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							
LCS (B0I1589-BS1)				Prepared: 2020-09-17, Analyzed: 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			
Barium, total	0.0216	0.0050	mg/L	0.0198		109	80-120			
Beryllium, total	0.0235	0.00010	mg/L	0.0198		119	80-120			
Bismuth, 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			
Iron, total	2.10	0.010	mg/L	2.02		104	80-120			
Lead, total	0.0239	0.00020	mg/L	0.0199		120	80-120			
Lithium, total	0.0219	0.00010	mg/L	0.0200		110	80-120			
Magnesium, 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			
Mercury, total	0.00115	0.000040	mg/L	0.00100		115	80-120			
Molybdenum, total	0.0208	0.00010	mg/L	0.0200		104	80-120			
Nickel, total	0.0211	0.00040	mg/L	0.0200		105	80-120			
Phosphorus, 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			
Selenium, total	0.0241	0.00050	mg/L	0.0200		120	80-120			
Silicon, total	2.2	1.0	mg/L	2.00		112	80-120			
Silver, 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			
Tellurium, total	0.0221	0.00050	mg/L	0.0200		111	80-120			
Thallium, 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			
Tin, total	0.0217	0.00020	mg/L	0.0200		109	80-120			
Titanium, total	0.0238	0.0050	mg/L	0.0200		119	80-120			
Tungsten, total	0.0206	0.0010	mg/L	0.0200		103	80-120			
Uranium, total	0.0219	0.000020	mg/L	0.0200		109	80-120			
Vanadium, 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)				Prepared: 2020-09-17, Analyzed: 2020-09-17						
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			

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B0I1589, Continued										
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		**RECEIVED / TEMP**	2020-09-23 09:05 / 7°C
PROJECT	ERA-CBWM	**REPORTED**	2020-10-05 17:04
PROJECT INFO	[info]	**COC NUMBER**	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.

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.

We've Got Chemistry

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.

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

CARO ANALYTICAL SERVICES

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
BOV01_200920_0930 (0092642-01) | Matrix: Water | Sampled: 2020-09-20 09:30						
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 Parameters						
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	< 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	**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, dissolved	**0.00060**	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	**0.040**	N/A	0.010	mg/L	2020-10-01	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-01	
Magnesium, dissolved	**13.1**	N/A	0.010	mg/L	2020-10-01	
Manganese, dissolved	**0.00024**	N/A	0.00020	mg/L	2020-10-01	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2020-09-27	
Molybdenum, dissolved	**0.00151**	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	**0.30**	N/A	0.10	mg/L	2020-10-01	
Selenium, dissolved	**0.00117**	N/A	0.00050	mg/L	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	**0.556**	N/A	0.0010	mg/L	2020-10-01	
Sulfur, dissolved	**21.8**	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	

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
BOV01_200920_0930 (0092642-01) | Matrix: Water | Sampled: 2020-09-20 09:30, Continued						
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	mg/L	2020-09-30	

CARO ANALYTICAL SERVICES

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
BOV01_200920_0930 (0092642-01) | Matrix: Water | Sampled: 2020-09-20 09:30, Continued						
Total Metals, Continued						
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	
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	
BOV03_200920_1250 (0092642-02) | Matrix: Water | Sampled: 2020-09-20 12:50						
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	

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
BOV03_200920_1250 (0092642-02) | Matrix: Water | Sampled: 2020-09-20 12:50, Continued						
Dissolved Metals, Continued						
Manganese, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-01	
Mercury, dissolved	< 0.000040	N/A	0.000040	mg/L	2020-10-01	
Molybdenum, dissolved	**0.00140**	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	**0.31**	N/A	0.10	mg/L	2020-10-01	
Selenium, dissolved	**0.00106**	N/A	0.00050	mg/L	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 CaCO3)	< 1.0	N/A	1.0	mg/L	2020-09-28	
Alkalinity, Bicarbonate (as CaCO3)	**130**	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	**0.061**	N/A	0.050	mg/L	2020-09-29	
Phosphorus, Total (as P)	**0.0050**	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	**0.0062**	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	**0.0292**	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	

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
BOV03_200920_1250 (0092642-02) | Matrix: Water | Sampled: 2020-09-20 12:50, Continued						
Total Metals, Continued						
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	mg/L	2020-09-30	
Zirconium, total	< 0.00010	N/A	0.00010	mg/L	2020-09-30	
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	

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
ALX01_200921_0930 (0092642-03) | Matrix: Water | Sampled: 2020-09-21 09:30, Continued						
Dissolved Metals						
Lithium, dissolved	**0.00438**	N/A	0.00010	mg/L	2020-10-01	
Aluminum, dissolved	**0.0057**	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	**0.0719**	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	**0.000031**	N/A	0.000010	mg/L	2020-10-01	
Calcium, dissolved	**45.9**	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	**13.2**	N/A	0.010	mg/L	2020-10-01	
Manganese, dissolved	**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, dissolved	**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, dissolved	< 0.050	N/A	0.050	mg/L	2020-10-01	
Potassium, dissolved	**0.46**	N/A	0.10	mg/L	2020-10-01	
Selenium, dissolved	**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, dissolved	**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, 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	**0.000557**	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)	**169**	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)	**169**	N/A	1.0	mg/L	2020-09-28	

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
ALX01_200921_0930 (0092642-03) | Matrix: Water | Sampled: 2020-09-21 09:30, Continued						
General Parameters, Continued						
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	**0.066**	N/A	0.050	mg/L	2020-09-29	
Phosphorus, Total (as P)	**0.0056**	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	**0.0058**	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	< 0.00050	MAC = 0.01	0.00050	mg/L	2020-09-30	
Barium, total	**0.0787**	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	**0.000011**	MAC = 0.005	0.000010	mg/L	2020-09-30	
Calcium, total	**48.8**	None Required	0.20	mg/L	2020-09-30	
Chromium, total	**0.00056**	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	**0.00059**	MAC = 2	0.00040	mg/L	2020-09-30	
Iron, total	**0.015**	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	**0.00464**	N/A	0.00010	mg/L	2020-09-30	
Magnesium, total	**13.8**	None Required	0.010	mg/L	2020-09-30	
Manganese, total	**0.00104**	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	**0.00085**	N/A	0.00010	mg/L	2020-09-30	
Nickel, total	**0.00042**	N/A	0.00040	mg/L	2020-09-30	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2020-09-30	
Potassium, total	**0.46**	N/A	0.10	mg/L	2020-09-30	
Selenium, total	**0.00057**	MAC = 0.05	0.00050	mg/L	2020-09-30	
Silicon, total	**2.5**	N/A	1.0	mg/L	2020-09-30	
Silver, total	< 0.000050	None Required	0.000050	mg/L	2020-09-30	
Sodium, total	**1.83**	AO ≤ 200	0.10	mg/L	2020-09-30	
Strontium, total	**0.135**	7	0.0010	mg/L	2020-09-30	
Sulfur, total	**7.9**	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	

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
ALX01_200921_0930 (0092642-03) | Matrix: Water | Sampled: 2020-09-21 09:30, Continued						
Total Metals, Continued						
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_1600 (0092642-04) | Matrix: Water | Sampled: 2020-09-20 16:00						
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)	**160**	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	**0.00382**	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	**0.0701**	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	**0.000022**	N/A	0.000010	mg/L	2020-10-01	
Calcium, dissolved	**43.4**	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	**12.5**	N/A	0.010	mg/L	2020-10-01	
Manganese, dissolved	**0.00123**	N/A	0.00020	mg/L	2020-10-01	
Mercury, dissolved	< 0.000040	N/A	0.000040	mg/L	2020-10-01	
Molybdenum, dissolved	**0.00068**	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	**0.42**	N/A	0.10	mg/L	2020-10-01	
Selenium, dissolved	**0.00063**	N/A	0.00050	mg/L	2020-10-01	
Silicon, dissolved	**2.1**	N/A	1.0	mg/L	2020-10-01	

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
ALX03_200920_1600 (0092642-04) | Matrix: Water | Sampled: 2020-09-20 16:00, Continued						
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	
Total Metals						
Aluminum, total	**0.0089**	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	< 0.00050	MAC = 0.01	0.00050	mg/L	2020-09-30	
Barium, total	**0.0741**	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	**0.000012**	MAC = 0.005	0.000010	mg/L	2020-09-30	
Calcium, total	**46.8**	None Required	0.20	mg/L	2020-09-30	
Chromium, total	**0.00068**	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	**0.019**	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	**0.00406**	N/A	0.00010	mg/L	2020-09-30	

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
ALX03_200920_1600 (0092642-04) | Matrix: Water | Sampled: 2020-09-20 16:00, Continued						
Total 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

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

Analysis Description	Method Ref.	Technique	Accredited	Location
Alkalinity in Water	SM 2320 B* (2017)	Titration with H2SO4	✓	Kelowna
Ammonia, Total in Water	SM 4500-NH3 G* (2017)	Automated Colorimetry (Phenate)	✓	Kelowna
Anions in Water	SM 4110 B (2017)	Ion Chromatography	✓	Kelowna
Biochemical Oxygen Demand in Water	SM 5210 B (2017)	Dissolved Oxygen Meter	✓	Kelowna
Chemical Oxygen Demand in Water	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 in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	✓	Richmond
Mercury, total in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	✓	Richmond
Nitrogen, Total Kjeldahl in Water	SM 4500-Norg D* (2017)	Block Digestion and Flow Injection Analysis	✓	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Solids, Total Suspended in Water	SM 2540 D* (2017)	Gravimetry (Dried at 103-105C)	✓	Kelowna
Total Metals in Water	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	**WORK ORDER**	0092642
PROJECT	ERA-CBWM	**REPORTED**	2020-10-05 17:04

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 not 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.

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	0092642
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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 B0I2281										
Blank (B0I2281-BLK1)				Prepared: 2020-09-26, Analyzed: 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 (B0I2281-BLK2)				Prepared: 2020-09-27, Analyzed: 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 (B0I2281-BLK3)				Prepared: 2020-09-27, Analyzed: 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 (B0I2281-BS1)				Prepared: 2020-09-26, Analyzed: 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 (B0I2281-BS2)				Prepared: 2020-09-27, Analyzed: 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 (B0I2281-BS3)				Prepared: 2020-09-27, Analyzed: 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 B0I2438										
Blank (B0I2438-BLK1)				Prepared: 2020-09-26, Analyzed: 2020-09-27						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Blank (B0I2438-BLK2)				Prepared: 2020-09-26, Analyzed: 2020-09-27						
Mercury, dissolved	< 0.000010	0.000010	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B0I2438, Continued										
Reference (B0I2438-SRM1)				Prepared: 2020-09-26, Analyzed: 2020-09-27						
Mercury, dissolved	0.00701	0.000010	mg/L	0.00581		121	70-130			
Reference (B0I2438-SRM2)				Prepared: 2020-09-26, Analyzed: 2020-09-27						
Mercury, dissolved	0.00649	0.000010	mg/L	0.00581		112	70-130			
Dissolved Metals, Batch B0I2727										
Blank (B0I2727-BLK1)				Prepared: 2020-09-30, Analyzed: 2020-09-30						
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: 2020-09-30, Analyzed: 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			
Beryllium, dissolved	0.0199	0.00010	mg/L	0.0198		100	80-120			
Bismuth, dissolved	0.0190	0.00010	mg/L	0.0200		95	80-120			
Boron, dissolved	< 0.0500	0.0500	mg/L	0.0200		103	80-120			

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B0I2727, Continued										
LCS (B0I2727-BS1), Continued				Prepared: 2020-09-30, Analyzed: 2020-09-30						
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	mg/L	0.0198		100	80-120			
Cobalt, dissolved	0.0200	0.00010	mg/L	0.0199		101	80-120			
Copper, dissolved	0.0205	0.00040	mg/L	0.0200		102	80-120			
Iron, dissolved	1.99	0.010	mg/L	2.02		98	80-120			
Lead, dissolved	0.0185	0.00020	mg/L	0.0199		93	80-120			
Magnesium, dissolved	1.93	0.010	mg/L	2.02		96	80-120			
Manganese, dissolved	0.0199	0.00020	mg/L	0.0199		100	80-120			
Mercury, dissolved	0.000867	0.000040	mg/L	0.00100		87	80-120			
Molybdenum, dissolved	0.0198	0.00010	mg/L	0.0200		99	80-120			
Nickel, dissolved	0.0196	0.00040	mg/L	0.0200		98	80-120			
Phosphorus, dissolved	2.04	0.050	mg/L	2.00		102	80-120			
Potassium, dissolved	2.04	0.10	mg/L	2.02		101	80-120			
Selenium, dissolved	0.0186	0.00050	mg/L	0.0200		93	80-120			
Silicon, dissolved	2.0	1.0	mg/L	2.00		100	80-120			
Silver, dissolved	0.0191	0.000050	mg/L	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	3.0	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	mg/L	0.0200		89	80-120			
Tin, dissolved	0.0196	0.00020	mg/L	0.0200		98	80-120			
Titanium, dissolved	0.0216	0.0050	mg/L	0.0200		108	80-120			
Tungsten, dissolved	0.0181	0.0010	mg/L	0.0200		91	80-120			
Uranium, dissolved	0.0180	0.000020	mg/L	0.0200		90	80-120			
Vanadium, dissolved	0.0195	0.0010	mg/L	0.0200		98	80-120			
Zinc, dissolved	0.0215	0.0040	mg/L	0.0200		108	80-120			
Zirconium, dissolved	0.0192	0.00010	mg/L	0.0200		96	80-120			
Duplicate (B0I2727-DUP1)		**Source: 0092642-02**		Prepared: 2020-10-01, Analyzed: 2020-10-01						
Lithium, dissolved	0.00138	0.00010	mg/L		0.00148			8	20	
Aluminum, dissolved	< 0.0050	0.0050	mg/L		0.0055				20	
Antimony, dissolved	< 0.00020	0.00020	mg/L		< 0.00020				20	
Arsenic, dissolved	0.00056	0.00050	mg/L		0.00055				20	
Barium, dissolved	0.0274	0.0050	mg/L		0.0276			< 1	20	
Beryllium, dissolved	< 0.00010	0.00010	mg/L		< 0.00010				20	
Bismuth, dissolved	< 0.00010	0.00010	mg/L		< 0.00010				20	
Boron, dissolved	< 0.0500	0.0500	mg/L		< 0.0500				20	
Cadmium, dissolved	0.000072	0.000010	mg/L		0.000058			21	20	RPD
Calcium, dissolved	47.9	0.20	mg/L		47.5			< 1	20	
Chromium, dissolved	0.00062	0.00050	mg/L		0.00065				20	
Cobalt, dissolved	< 0.00010	0.00010	mg/L		< 0.00010				20	
Copper, dissolved	< 0.00040	0.00040	mg/L		< 0.00040				20	
Iron, dissolved	< 0.010	0.010	mg/L		< 0.010				20	
Lead, dissolved	< 0.00020	0.00020	mg/L		< 0.00020				20	
Magnesium, dissolved	13.0	0.010	mg/L		12.9			< 1	20	
Manganese, dissolved	< 0.00020	0.00020	mg/L		< 0.00020				20	
Mercury, dissolved	< 0.000040	0.000040	mg/L		< 0.000040				20	
Molybdenum, dissolved	0.00153	0.00010	mg/L		0.00140			8	20	
Nickel, dissolved	< 0.00040	0.00040	mg/L		< 0.00040				20	
Phosphorus, dissolved	< 0.050	0.050	mg/L		< 0.050				20	
Potassium, dissolved	0.31	0.10	mg/L		0.31				20	
Selenium, dissolved	0.00098	0.00050	mg/L		0.00106				20	
Silicon, dissolved	2.0	1.0	mg/L		2.1				20	

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B0I2727, Continued										
Duplicate (B0I2727-DUP1), Continued		**Source: 0092642-02**		Prepared: 2020-10-01, Analyzed: 2020-10-01						
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		< 0.0010				20	
Uranium, dissolved	0.000898	0.000020	mg/L		0.000887			1	20	
Vanadium, dissolved	< 0.0010	0.0010	mg/L		< 0.0010				20	
Zinc, dissolved	< 0.0040	0.0040	mg/L		< 0.0040				20	
Zirconium, dissolved	< 0.00010	0.00010	mg/L		< 0.00010				20	
Reference (B0I2727-SRM1)				Prepared: 2020-10-01, Analyzed: 2020-10-01						
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, dissolved	6.55	0.010	mg/L	6.59		99	70-130			
Manganese, dissolved	0.352	0.00020	mg/L	0.342		103	70-130			
Molybdenum, dissolved	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, dissolved	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	0.0010	mg/L	0.873		97	70-130			
Zinc, dissolved	0.876	0.0040	mg/L	0.848		103	70-130			
General Parameters, Batch B0I2299										
Blank (B0I2299-BLK1)				Prepared: 2020-09-25, Analyzed: 2020-09-30						
BOD, 5-day	< 2.0	2.0	mg/L							
LCS (B0I2299-BS1)				Prepared: 2020-09-25, Analyzed: 2020-09-30						
BOD, 5-day	176	49.6	mg/L	180		98	85-115			
General Parameters, Batch B0I2345										
Blank (B0I2345-BLK1)				Prepared: 2020-09-25, Analyzed: 2020-09-25						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B0I2345, Continued										
Blank (B0I2345-BLK2)				Prepared: 2020-09-25, Analyzed: 2020-09-25						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
LCS (B0I2345-BS1)				Prepared: 2020-09-25, Analyzed: 2020-09-25						
Ammonia, Total (as N)	0.992	0.050	mg/L	1.00		99	90-115			
LCS (B0I2345-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 B0I2367										
Blank (B0I2367-BLK1)				Prepared: 2020-09-28, Analyzed: 2020-09-28						
Chemical Oxygen Demand	< 20	20	mg/L							
LCS (B0I2367-BS1)				Prepared: 2020-09-28, Analyzed: 2020-09-28						
Chemical Oxygen Demand	510	20	mg/L	500		102	89-115			
General Parameters, Batch B0I2420										
Blank (B0I2420-BLK1)				Prepared: 2020-09-27, Analyzed: 2020-09-27						
Solids, Total Suspended	< 2.0	2.0	mg/L							
Blank (B0I2420-BLK2)				Prepared: 2020-09-27, Analyzed: 2020-09-27						
Solids, Total Suspended	< 2.0	2.0	mg/L							
LCS (B0I2420-BS1)				Prepared: 2020-09-27, Analyzed: 2020-09-27						
Solids, Total Suspended	94.0	10.0	mg/L	100		94	85-115			
LCS (B0I2420-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 B0I2495										
Blank (B0I2495-BLK2)				Prepared: 2020-09-28, Analyzed: 2020-09-28						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
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										
Blank (B0I2496-BLK1)				Prepared: 2020-09-28, Analyzed: 2020-09-29						
Nitrogen, Total Kjeldahl	< 0.050	0.050	mg/L							
Blank (B0I2496-BLK2)				Prepared: 2020-09-28, Analyzed: 2020-09-29						
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			
LCS (B0I2496-BS2)				Prepared: 2020-09-28, Analyzed: 2020-09-29						
Nitrogen, Total Kjeldahl	0.994	0.050	mg/L	1.00		99	85-115			
General Parameters, Batch B0I2542										

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B0I2542, Continued										
Blank (B0I2542-BLK1)				Prepared: 2020-09-28, Analyzed: 2020-09-28						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 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-BLK2)				Prepared: 2020-09-28, Analyzed: 2020-09-28						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 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: 2020-09-28, Analyzed: 2020-09-28						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 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: 2020-09-28, Analyzed: 2020-09-28						
Alkalinity, Total (as CaCO3)	104	1.0	mg/L	100		104	80-120			
LCS (B0I2542-BS2)				Prepared: 2020-09-28, Analyzed: 2020-09-28						
Alkalinity, Total (as CaCO3)	105	1.0	mg/L	100		105	80-120			
LCS (B0I2542-BS3)				Prepared: 2020-09-28, Analyzed: 2020-09-28						
Alkalinity, Total (as CaCO3)	106	1.0	mg/L	100		106	80-120			
Total Metals, Batch B0I2439										
Blank (B0I2439-BLK1)				Prepared: 2020-09-26, Analyzed: 2020-09-29						
Mercury, total	< 0.000010	0.000010	mg/L							
Blank (B0I2439-BLK2)				Prepared: 2020-09-26, Analyzed: 2020-09-29						
Mercury, total	< 0.000010	0.000010	mg/L							
Reference (B0I2439-SRM1)				Prepared: 2020-09-26, Analyzed: 2020-09-29						
Mercury, total	0.00625	0.000010	mg/L	0.00581		107	70-130			
Reference (B0I2439-SRM2)				Prepared: 2020-09-26, Analyzed: 2020-09-29						
Mercury, total	0.00679	0.000010	mg/L	0.00581		117	70-130			
Total Metals, Batch B0I2647										
Blank (B0I2647-BLK1)				Prepared: 2020-09-29, Analyzed: 2020-09-30						
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							

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B0I2647, Continued										
Blank (B0I2647-BLK1), Continued				Prepared: 2020-09-29, Analyzed: 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							
LCS (B0I2647-BS1)				Prepared: 2020-09-29, Analyzed: 2020-09-30						
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			

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B0I2647, Continued										
LCS (B0I2647-BS1), Continued				Prepared: 2020-09-29, Analyzed: 2020-09-30						
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 (B0I2647-SRM1)				Prepared: 2020-09-29, Analyzed: 2020-09-30						
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 Fernie cha, BC V0B1M0		
ATTENTION	Beth Millions	**WORK ORDER**	0092807
PO NUMBER		**RECEIVED / TEMP**	2020-09-25 09:30 / 11°C
PROJECT	ERA-CBWM	**REPORTED**	2020-10-05 11:55
PROJECT INFO	[info]	**COC NUMBER**	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.

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.

We've Got Chemistry

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.

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

CARO ANALYTICAL SERVICES

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MOR02_200922_0930 (0092807-01) | 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	HT1
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-09-27	HT1
Calculated Parameters						
Hardness, Total (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, dissolved	**0.0084**	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	**0.192**	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	**0.000024**	N/A	0.000010	mg/L	2020-10-01	
Calcium, dissolved	**19.0**	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	**4.10**	N/A	0.010	mg/L	2020-10-01	
Manganese, dissolved	**0.00113**	N/A	0.00020	mg/L	2020-10-01	
Mercury, dissolved	< 0.000040	N/A	0.000040	mg/L	2020-10-01	
Molybdenum, dissolved	**0.00059**	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	**0.44**	N/A	0.10	mg/L	2020-10-01	
Selenium, dissolved	< 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	mg/L	2020-10-01	
Sodium, dissolved	**1.42**	N/A	0.10	mg/L	2020-10-01	
Strontium, dissolved	**0.114**	N/A	0.0010	mg/L	2020-10-01	
Sulfur, dissolved	< 3.0	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	

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MOR02_200922_0930 (0092807-01) | Matrix: Water | Sampled: 2020-09-22 09:30, Continued						
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	mg/L	2020-10-03	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2020-10-03	
Copper, total	**0.00556**	MAC = 2	0.00040	mg/L	2020-10-03	
Iron, total	**0.012**	AO ≤ 0.3	0.010	mg/L	2020-10-03	
Lead, total	< 0.00020	MAC = 0.005	0.00020	mg/L	2020-10-03	
Lithium, total	**0.00229**	N/A	0.00010	mg/L	2020-10-03	
Magnesium, total	**4.31**	None Required	0.010	mg/L	2020-10-03	
Manganese, total	**0.00190**	MAC = 0.12	0.00020	mg/L	2020-10-03	
Mercury, total	< 0.000040	MAC = 0.001	0.000040	mg/L	2020-10-03	
Molybdenum, total	**0.00059**	N/A	0.00010	mg/L	2020-10-03	
Nickel, total	**0.00127**	N/A	0.00040	mg/L	2020-10-03	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2020-10-03	
Potassium, total	**0.46**	N/A	0.10	mg/L	2020-10-03	
Selenium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2020-10-03	
Silicon, total	< 1.0	N/A	1.0	mg/L	2020-10-03	
Silver, total	< 0.000050	None Required	0.000050	mg/L	2020-10-03	

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MOR02_200922_0930 (0092807-01) | Matrix: Water | Sampled: 2020-09-22 09:30, Continued						
Total Metals, Continued						
Sodium, total	**1.45**	AO ≤ 200	0.10	mg/L	2020-10-03	
Strontium, total	**0.117**	7	0.0010	mg/L	2020-10-03	
Sulfur, total	**3.1**	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	0.000020	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	
Vanadium, total	< 0.0010	N/A	0.0010	mg/L	2020-10-03	
Zinc, total	< 0.0040	AO ≤ 5	0.0040	mg/L	2020-10-03	
Zirconium, total	< 0.00010	N/A	0.00010	mg/L	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	HT1
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-09-27	HT1
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	

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MOR01_200922_0930 (0092807-02) | Matrix: Water | Sampled: 2020-09-22 09:30, Continued						
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	mg/L	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	**2.11**	N/A	0.10	mg/L	2020-10-01	
Strontium, dissolved	**0.148**	N/A	0.0010	mg/L	2020-10-01	
Sulfur, dissolved	**6.9**	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	**0.000319**	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)	**141**	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)	**141**	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)	**0.0104**	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	**0.0128**	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	**0.163**	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	mg/L	2020-10-03	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2020-10-03	

TEST RESULTS

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

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MOR01_200922_0930 (0092807-02) | Matrix: Water | Sampled: 2020-09-22 09:30, Continued						
Total 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	< 0.00010	N/A	0.00010	mg/L	2020-10-03	
Copper, total	**0.00074**	MAC = 2	0.00040	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	
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	
Manganese, total	**0.00387**	MAC = 0.12	0.00020	mg/L	2020-10-03	
Mercury, total	< 0.000010	MAC = 0.001	0.000010	mg/L	2020-10-01	
Molybdenum, total	**0.00065**	N/A	0.00010	mg/L	2020-10-03	
Nickel, total	< 0.00040	N/A	0.00040	mg/L	2020-10-03	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2020-10-03	
Potassium, total	**0.53**	N/A	0.10	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	1.0	mg/L	2020-10-03	
Silver, total	< 0.000050	None Required	0.000050	mg/L	2020-10-03	
Sodium, total	**2.08**	AO ≤ 200	0.10	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	< 0.000020	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	**0.000334**	MAC = 0.02	0.000020	mg/L	2020-10-03	
Vanadium, total	< 0.0010	N/A	0.0010	mg/L	2020-10-03	
Zinc, total	< 0.0040	AO ≤ 5	0.0040	mg/L	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	Elk River Alliance	**WORK ORDER**	0092807
PROJECT	ERA-CBWM	**REPORTED**	2020-10-05 11:55

Analysis Description	Method Ref.	Technique	Accredited	Location
Alkalinity in Water	SM 2320 B* (2017)	Titration with H2SO4	✓	Kelowna
Ammonia, Total in Water	SM 4500-NH3 G* (2017)	Automated Colorimetry (Phenate)	✓	Kelowna
Anions in Water	SM 4110 B (2017)	Ion Chromatography	✓	Kelowna
Biochemical Oxygen Demand in Water	SM 5210 B (2017)	Dissolved Oxygen Meter	✓	Kelowna
Chemical Oxygen Demand in Water	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 in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	✓	Richmond
Mercury, total in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	✓	Richmond
Nitrogen, Total Kjeldahl in Water	SM 4500-Norg D* (2017)	Block Digestion and Flow Injection Analysis	✓	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Solids, Total Suspended in Water	SM 2540 D* (2017)	Gravimetry (Dried at 103-105C)	✓	Kelowna
Total Metals in Water	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	**WORK ORDER**	0092807
PROJECT	ERA-CBWM	**REPORTED**	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 not 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.

APPENDIX 2: QUALITY CONTROL RESULTS

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 B0I2386										
Blank (B0I2386-BLK1)				Prepared: 2020-09-27, Analyzed: 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: 2020-09-28, Analyzed: 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: 2020-09-27, Analyzed: 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: 2020-09-28, Analyzed: 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)		**Source: 0092807-02**		Prepared: 2020-09-28, Analyzed: 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)		**Source: 0092807-02**		Prepared: 2020-09-28, Analyzed: 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 B0I2734										
Blank (B0I2734-BLK1)				Prepared: 2020-09-30, Analyzed: 2020-10-01						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Reference (B0I2734-SRM1)				Prepared: 2020-09-30, Analyzed: 2020-10-01						
Mercury, dissolved	0.00694	0.000010	mg/L	0.00581		119	70-130			

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B0J0127										
Blank (B0J0127-BLK1)				Prepared: 2020-10-01, Analyzed: 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, Analyzed: 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	0.0200		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			
Bismuth, dissolved	0.0198	0.00010	mg/L	0.0200		99	80-120			
Boron, dissolved	< 0.0500	0.0500	mg/L	0.0200		109	80-120			
Cadmium, dissolved	0.0199	0.000010	mg/L	0.0199		100	80-120			
Calcium, dissolved	2.17	0.20	mg/L	2.02		107	80-120			
Chromium, dissolved	0.0196	0.00050	mg/L	0.0198		99	80-120			
Cobalt, dissolved	0.0200	0.00010	mg/L	0.0199		101	80-120			
Copper, dissolved	0.0197	0.00040	mg/L	0.0200		99	80-120			
Iron, dissolved	1.97	0.010	mg/L	2.02		97	80-120			
Lead, dissolved	0.0201	0.00020	mg/L	0.0199		101	80-120			
Magnesium, dissolved	2.03	0.010	mg/L	2.02		100	80-120			

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B0J0127, Continued										
LCS (B0J0127-BS1), Continued				Prepared: 2020-10-01, Analyzed: 2020-10-01						
Manganese, dissolved	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, dissolved	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, dissolved	1.94	0.050	mg/L	2.00		97	80-120			
Potassium, dissolved	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 (B0J0127-SRM1)				Prepared: 2020-10-01, Analyzed: 2020-10-01						
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, dissolved	6.82	0.010	mg/L	6.59		103	70-130			
Manganese, dissolved	0.339	0.00020	mg/L	0.342		99	70-130			
Molybdenum, dissolved	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, dissolved	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 B0I2422										
Blank (B0I2422-BLK1)				Prepared: 2020-09-26, Analyzed: 2020-10-01						
BOD, 5-day	< 2.0	2.0	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B0I2422, Continued										
LCS (B0I2422-BS1)				Prepared: 2020-09-26, Analyzed: 2020-10-01						
BOD, 5-day	190	50.1	mg/L	180		105	85-115			
General Parameters, Batch B0I2454										
Blank (B0I2454-BLK1)				Prepared: 2020-09-28, Analyzed: 2020-09-28						
Solids, Total Suspended	< 2.0	2.0	mg/L							
Blank (B0I2454-BLK2)				Prepared: 2020-09-28, Analyzed: 2020-09-28						
Solids, Total Suspended	< 2.0	2.0	mg/L							
LCS (B0I2454-BS1)				Prepared: 2020-09-28, Analyzed: 2020-09-28						
Solids, Total Suspended	97.0	10.0	mg/L	100		97	85-115			
LCS (B0I2454-BS2)				Prepared: 2020-09-28, Analyzed: 2020-09-28						
Solids, Total Suspended	113	10.0	mg/L	100		113	85-115			
General Parameters, Batch B0I2603										
Blank (B0I2603-BLK1)				Prepared: 2020-09-29, Analyzed: 2020-09-29						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
Blank (B0I2603-BLK2)				Prepared: 2020-09-29, Analyzed: 2020-09-29						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
Blank (B0I2603-BLK3)				Prepared: 2020-09-29, Analyzed: 2020-09-29						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
LCS (B0I2603-BS1)				Prepared: 2020-09-29, Analyzed: 2020-09-29						
Ammonia, Total (as N)	1.07	0.050	mg/L	1.00		107	90-115			
LCS (B0I2603-BS2)				Prepared: 2020-09-29, Analyzed: 2020-09-29						
Ammonia, Total (as N)	1.07	0.050	mg/L	1.00		107	90-115			
LCS (B0I2603-BS3)				Prepared: 2020-09-29, Analyzed: 2020-09-29						
Ammonia, Total (as N)	1.01	0.050	mg/L	1.00		101	90-115			
General Parameters, Batch B0I2746										
Blank (B0I2746-BLK1)				Prepared: 2020-09-30, Analyzed: 2020-09-30						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 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 (B0I2746-BLK2)				Prepared: 2020-09-30, Analyzed: 2020-09-30						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 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 (B0I2746-BS1)				Prepared: 2020-09-30, Analyzed: 2020-09-30						
Alkalinity, Total (as CaCO3)	107	1.0	mg/L	100		107	80-120			

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B0I2746, Continued										
LCS (B0I2746-BS2)				Prepared: 2020-09-30, Analyzed: 2020-09-30						
Alkalinity, Total (as CaCO3)	95.2	1.0	mg/L	100		95	80-120			
General Parameters, Batch B0I2781										
Blank (B0I2781-BLK1)				Prepared: 2020-09-30, Analyzed: 2020-10-01						
Nitrogen, Total Kjeldahl	< 0.050	0.050	mg/L							
Blank (B0I2781-BLK2)				Prepared: 2020-09-30, Analyzed: 2020-10-01						
Nitrogen, Total Kjeldahl	< 0.050	0.050	mg/L							
LCS (B0I2781-BS1)				Prepared: 2020-09-30, Analyzed: 2020-10-01						
Nitrogen, Total Kjeldahl	1.03	0.050	mg/L	1.00		103	85-115			
LCS (B0I2781-BS2)				Prepared: 2020-09-30, Analyzed: 2020-10-01						
Nitrogen, Total Kjeldahl	1.01	0.050	mg/L	1.00		101	85-115			
General Parameters, Batch B0J0006										
Blank (B0J0006-BLK1)				Prepared: 2020-10-01, Analyzed: 2020-10-01						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Blank (B0J0006-BLK2)				Prepared: 2020-10-01, Analyzed: 2020-10-01						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Blank (B0J0006-BLK3)				Prepared: 2020-10-01, Analyzed: 2020-10-01						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
LCS (B0J0006-BS1)				Prepared: 2020-10-01, Analyzed: 2020-10-01						
Phosphorus, Total (as P)	0.0979	0.0050	mg/L	0.100		98	85-115			
LCS (B0J0006-BS2)				Prepared: 2020-10-01, Analyzed: 2020-10-01						
Phosphorus, Total (as P)	0.0975	0.0050	mg/L	0.100		97	85-115			
LCS (B0J0006-BS3)				Prepared: 2020-10-01, Analyzed: 2020-10-01						
Phosphorus, Total (as P)	0.0962	0.0050	mg/L	0.100		96	85-115			
General Parameters, Batch B0J0086										
Blank (B0J0086-BLK1)				Prepared: 2020-10-01, Analyzed: 2020-10-01						
Chemical Oxygen Demand	< 20	20	mg/L							
LCS (B0J0086-BS1)				Prepared: 2020-10-01, Analyzed: 2020-10-01						
Chemical Oxygen Demand	508	20	mg/L	500		102	89-115			
Total Metals, Batch B0J0079										
Blank (B0J0079-BLK1)				Prepared: 2020-10-01, Analyzed: 2020-10-01						
Mercury, total	< 0.000010	0.000010	mg/L							
Duplicate (B0J0079-DUP1)			**Source: 0092807-02**	Prepared: 2020-10-01, Analyzed: 2020-10-01						
Mercury, total	< 0.000010	0.000010	mg/L		< 0.000010				20	
Reference (B0J0079-SRM1)				Prepared: 2020-10-01, Analyzed: 2020-10-01						
Mercury, total	0.00625	0.000010	mg/L	0.00581		108	70-130			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	0092807
PROJECT	ERA-CBWM	**REPORTED**	2020-10-05 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)				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							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	0092807
PROJECT	ERA-CBWM	**REPORTED**	2020-10-05 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: 2020-10-02, Analyzed: 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							
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							
LCS (B0J0176-BS1)				Prepared: 2020-10-02, Analyzed: 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	0.0211	0.00050	mg/L	0.0200		105	80-120			
Barium, total	0.0212	0.0050	mg/L	0.0198		107	80-120			
Beryllium, total	0.0231	0.00010	mg/L	0.0198		117	80-120			
Bismuth, total	0.0204	0.00010	mg/L	0.0200		102	80-120			
Boron, total	< 0.0500	0.0500	mg/L	0.0200		111	80-120			
Cadmium, total	0.0195	0.000010	mg/L	0.0199		98	80-120			
Calcium, total	2.41	0.20	mg/L	2.02		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			
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	0.0230	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			
Mercury, 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			
Tellurium, 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			

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B0J0176, Continued										
LCS (B0J0176-BS1), Continued				Prepared: 2020-10-02, Analyzed: 2020-10-02						
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-BS2)				Prepared: 2020-10-02, Analyzed: 2020-10-03						
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	0.0209	0.0050	mg/L	0.0198		105	80-120			
Beryllium, total	0.0224	0.00010	mg/L	0.0198		113	80-120			
Bismuth, total	0.0203	0.00010	mg/L	0.0200		102	80-120			
Boron, total	< 0.0500	0.0500	mg/L	0.0200		110	80-120			
Cadmium, total	0.0196	0.000010	mg/L	0.0199		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	0.0198	0.00010	mg/L	0.0200		99	80-120			
Nickel, total	0.0205	0.00040	mg/L	0.0200		103	80-120			
Phosphorus, total	2.24	0.050	mg/L	2.00		112	80-120			
Potassium, total	1.97	0.10	mg/L	2.02		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	0.0204	0.0050	mg/L	0.0200		102	80-120			
Tungsten, total	0.0206	0.0010	mg/L	0.0200		103	80-120			
Uranium, total	0.0202	0.000020	mg/L	0.0200		101	80-120			
Vanadium, total	0.0185	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 (B0J0176-SRM1)				Prepared: 2020-10-02, Analyzed: 2020-10-02						
Aluminum, total	0.315	0.0050	mg/L	0.299		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			

APPENDIX 2: QUALITY CONTROL RESULTS

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B0J0176, Continued										
Reference (B0J0176-SRM1), Continued				Prepared: 2020-10-02, Analyzed: 2020-10-02						
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 (B0J0176-SRM2)				Prepared: 2020-10-02, Analyzed: 2020-10-03						
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	0.491	0.00040	mg/L	0.487		101	70-130			
Iron, total	0.511	0.010	mg/L	0.504		101	70-130			
Lead, total	0.274	0.00020	mg/L	0.278		99	70-130			
Lithium, total	0.442	0.00010	mg/L	0.398		111	70-130			
Magnesium, total	3.68	0.010	mg/L	3.59		103	70-130			
Manganese, total	0.112	0.00020	mg/L	0.111		101	70-130			
Mercury, total	0.00545	0.000040	mg/L	0.00581		94	70-130			
Molybdenum, total	0.196	0.00010	mg/L	0.196		100	70-130			
Nickel, total	0.251	0.00040	mg/L	0.248		101	70-130			
Phosphorus, total	0.200	0.050	mg/L	0.213		94	70-130			
Potassium, total	5.90	0.10	mg/L	5.89		100	70-130			
Selenium, total	0.119	0.00050	mg/L	0.120		99	70-130			
Sodium, total	8.70	0.10	mg/L	8.71		100	70-130			
Strontium, total	0.382	0.0010	mg/L	0.393		97	70-130			
Thallium, total	0.0794	0.000020	mg/L	0.0787		101	70-130			
Uranium, total	0.0337	0.000020	mg/L	0.0344		98	70-130			
Vanadium, total	0.389	0.0010	mg/L	0.391		99	70-130			
Zinc, total	2.50	0.0040	mg/L	2.50		100	70-130			

Appendix D: Benthic Macroinvertebrate Taxonomy Report

ELK River Alliance			Site	ALX001	ALX003	BOV001	BOV002	COL001	COL003	LIZ001	LIZ003	MOR001	MOR002
2020 CABIN Benthos			Stream	Alexander Creek	Alexander Creek	Boivin Creek	Boivin Creek	Coal Creek	Coal Creek	Lizard Creek	Lizard Creek	Morrissey Creek	Morrissey Creek
Taxonomist: Pina Viola			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**										
Ephemeroptera	**Ameletidae**	Ameletus		1	1	0	3	0	29	1	0	0	7
	Baetidae			0	0	0	0	2	3	2	2	0	0
		Acentrella		0	0	0	0	3	0	0	0	0	0
		Baetis		103	38	19	25	12	5	49	123	3	80
		Diphetor		0	0	0	0	0	0	0	0	0	6
	Ephemerellidae			81	75	2	2	9	10	9	72	13	3
			Caudatella	1	4	0	0	0	0	0	0	0	0
			Drunella coloradensis	1	0	0	2	0	0	0	1	0	0
			Drunella doddsi	17	12	9	90	0	1	0	43	0	0
			Drunella grandis/spinifera	0	1	0	0	0	0	0	0	0	0
	Heptageniidae			28	30	29	25	2	2	3	18	3	7
		Cinygmula		11	14	10	6	6	9	5	35	38	12
		Epeorus		5	17	10	25	0	0	0	0	0	0
		Rhithrogena		12	13	38	27	0	0	0	0	0	1
	Leptophlebiidae			1	0	0	1	0	2	0	0	4	4
		Neoleptophlebia		0	0	0	0	0	0	0	0	0	1
Plecoptera				0	0	0	0	0	0	0	6	1	0
	Capniidae			0	0	1	1	8	13	4	4	0	15
	Chloroperlidae			0	2	1	9	1	3	2	6	0	1
		Sweltza		2	5	2	0	3	32	0	8	1	11
	Leuctridae			5	4	1	2	0	2	0	0	0	1
	Nemouridae	Visoka		0	0	0	0	0	11	0	0	0	0
		Zapada		10	5	3	0	1	3	3	21	0	5
			Zapada cinctipes	31	27	0	0	4	0	42	122	10	3
			Zapada columbiana	1	4	18	19	0	10	1	11	3	10
			Zapada oregonensis/haisi	9	5	2	0	0	0	1	10	0	4
	Peltoperlidae			0	0	0	0	0	1	0	0	0	0

		Yoraperla		0	0	0	1	0	0	0	0	0	0
	Perlidae			1	0	0	0	0	9	2	7	0	4
		Doroneuria		0	0	0	0	1	5	4	12	1	1
	Perlodidae			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
	Lepidostomatidae	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
			Rhyacophila vetina complex	0	0	0	3	0	0	0	0	0	0
	Uenoidae	Neothremma		0	1	1	0	0	0	0	0	0	5
		Oligophlebodes		3	0	0	0	0	0	9	44	0	0
Coleoptera	**Dytiscidae**			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
	Pelecorhynchidae	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-Trombidiformes			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
		Hygrobates	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 (Tubificidae)		1	0	0	0	41	0	33	1	1	0

TOTAL	**515**	**428**	**349**	**328**	**472**	**314**	**418**	**987**	**558**	**335**

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

STREAM

WWF Canada

Environment and Climate Change Canada

Living Lakes Canada

Table of Contents

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.

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 high-quality data in large quantities and allows identification to a finer resolution than traditional methods (Baird and Hajibabaei, 2012; Hajibabaei et al., 2012).

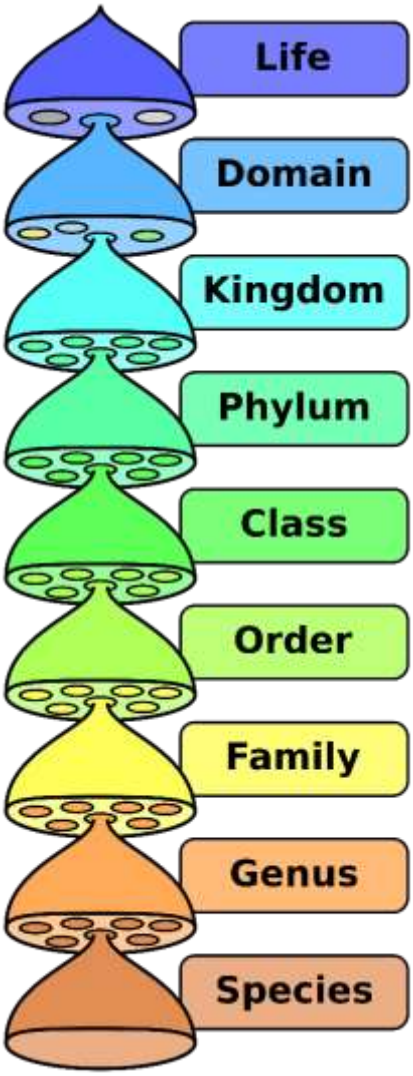

Figure 1. Graphical representation the classification of organisms.

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.

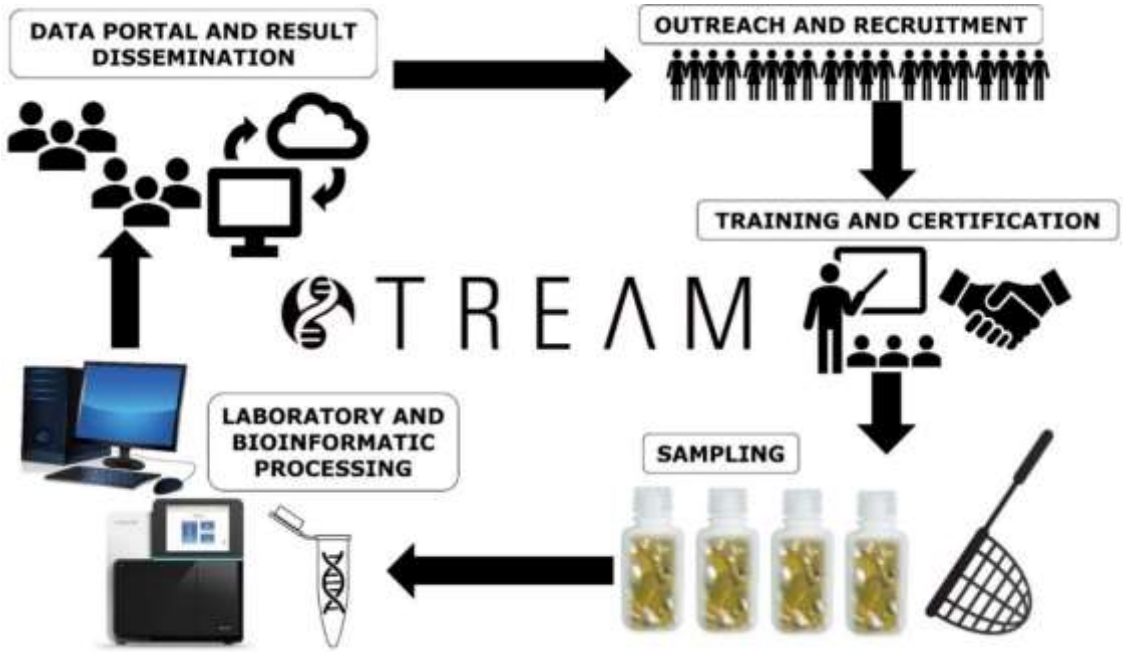

Figure 2. Graphical representation of the STREAM collaborative workflow for DNA biomonitoring of benthic invertebrates.

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

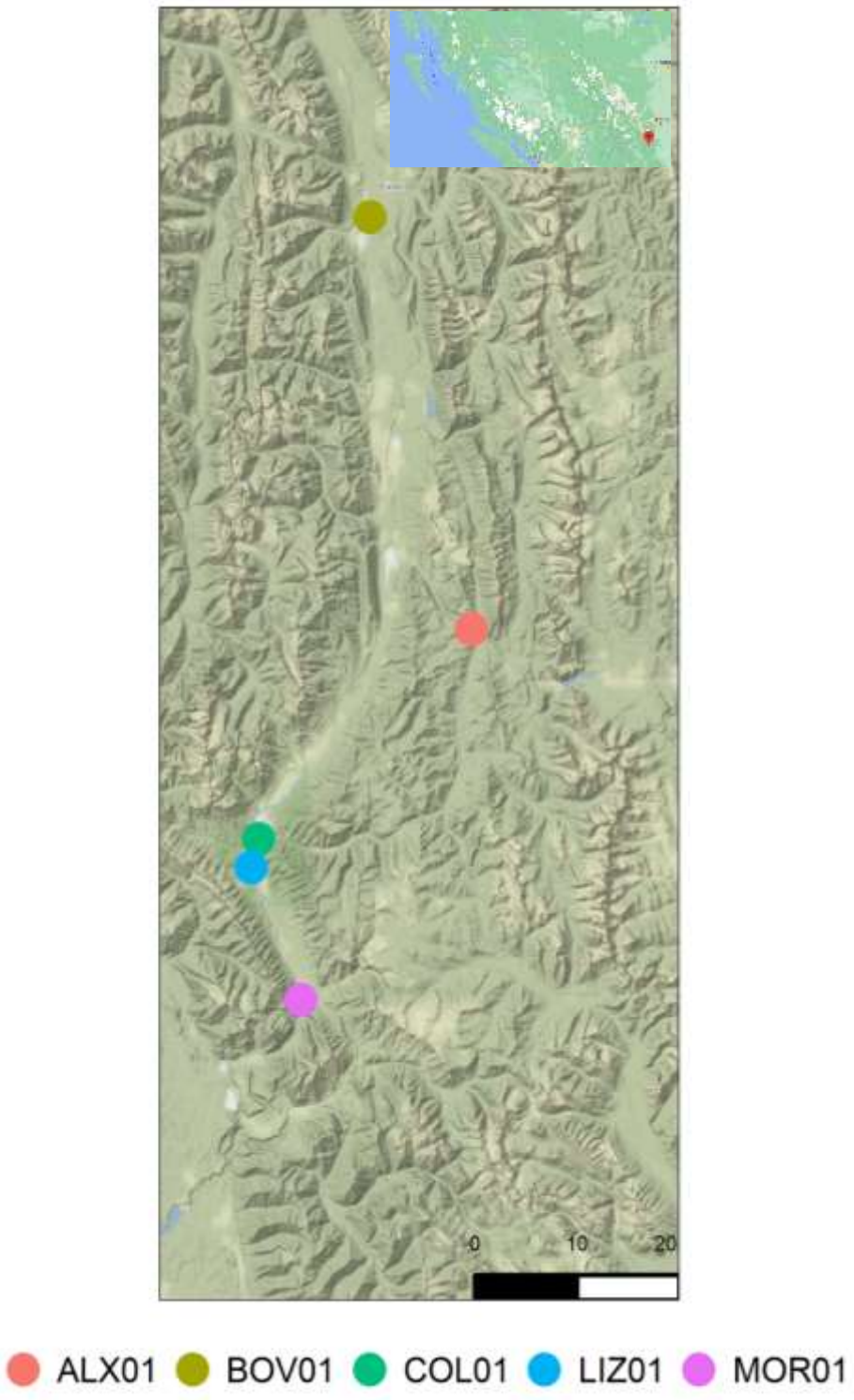

Figure 3. Map of sampling locations within the Elk River (BC). Inset map (top right) shows location of sampling area with respect to BC. Scale bar shown in kilometres.

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 DNA samples in wadeable streams (v1.0 June 2019) 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: https://github.com/terrimporter/MetaWorks.

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).

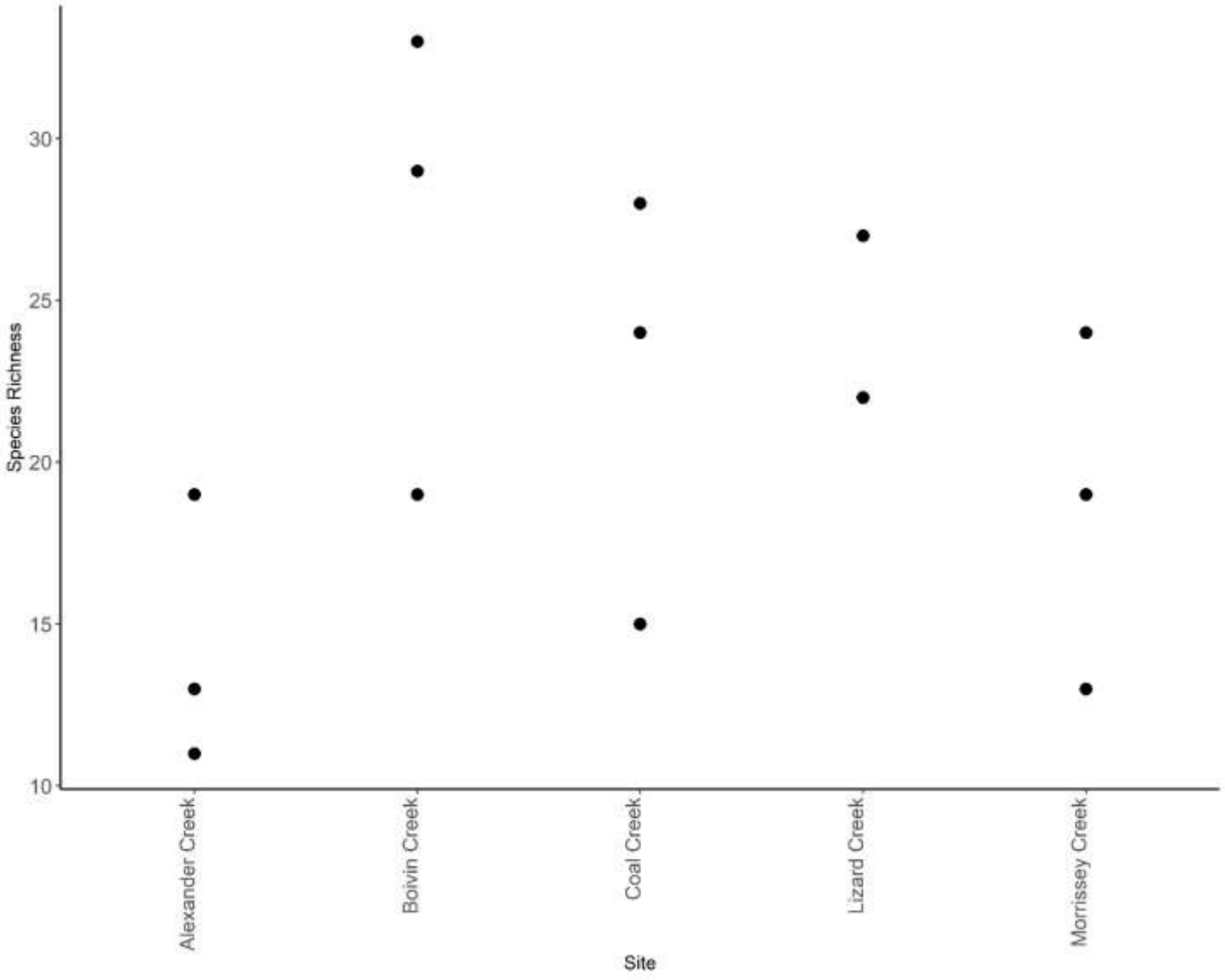

Figure 4. Species richness of each site sampled. Each replicate plotted separately. Only species taxonomically assigned with high confidence (bootstrap support >= 0.70) are included. Based on normalized data.

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

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

Plecoptera	Capniidae	Small winter stoneflies	*Capnia coloradensis*				P	
Plecoptera	Capniidae	Small winter stoneflies	*Capnia gracilaria*				P	
Plecoptera	Capniidae	Small winter stoneflies	*Eucapnopsis brevicauda*		P	P	P	P
Plecoptera	Capniidae	Small winter stoneflies	*Utacapnia columbiana*				P	
Plecoptera	Capniidae	Small winter stoneflies	*Utacapnia logana*					P
Plecoptera	Chloroperlidae	Green stoneflies	*Alloperla serrata*	P				
Plecoptera	Chloroperlidae	Green stoneflies	*Paraperla frontalis*		P	P		
Plecoptera	Chloroperlidae	Green stoneflies	*Plumiperla diversa*		P		P	
Plecoptera	Chloroperlidae	Green stoneflies	*Sweltsa borealis*		P		P	
Plecoptera	Chloroperlidae	Green stoneflies	*Sweltsa coloradensis*					P
Plecoptera	Chloroperlidae	Green stoneflies	*Sweltsa urticae*	P				
Plecoptera	Leuctridae	Rolled-winged stoneflies	*Paraleuctra occidentalis*	P	P	P	P	
Plecoptera	Nemouridae	Spring stoneflies	*Prostoia besametsa*		P	P	P	
Plecoptera	Nemouridae	Spring stoneflies	*Visoka cataractae*				P	
Plecoptera	Nemouridae	Spring stoneflies	*Zapada cinctipes*	P	P	P	P	P
Plecoptera	Nemouridae	Spring stoneflies	*Zapada columbiana*	P	P	P	P	P
Plecoptera	Nemouridae	Spring stoneflies	*Zapada haysi*	P	P	P	P	
Plecoptera	Nemouridae	Spring stoneflies	*Zapada oregonensis*	P	P	P		
Plecoptera	Perlidae	Common stoneflies	*Doroneuria theodora*	P	P	P	P	P
Plecoptera	Perlidae	Common stoneflies	*Hesperoperla pacifica*				P	P
Plecoptera	Perlodidae	Springflies	*Isoperla petersoni*		P		P	
Plecoptera	Perlodidae	Springflies	*Kogotus modestus*		P	P	P	
Plecoptera	Perlodidae	Springflies	*Megarcys signata*	P			P	
Plecoptera	Perlodidae	Springflies	*Megarcys watertoni*	P	P	P	P	
Plecoptera	Perlodidae	Springflies	*Setvena bradleyi*	P			P	
Plecoptera	Pteronarcyidae	Giant stoneflies	*Pteronarcys princeps*					P
Plecoptera	Taeniopterygidae	Winter stoneflies	*Doddsia occidentalis*	P	P	P	P	
Plecoptera	Taeniopterygidae	Winter stoneflies	*Taenionema pallidum*				P	
Plectida	Plectidae	Worms	*Plectus aquatilis*		P		P	P
Psocoptera	Peripsocidae	Stout barklice (T)	*Peripsocus subfasciatus*				P	
Trichoptera	Apataniidae	Early smoky wing sedges	*Apatania comosa*		P	P		P
Trichoptera	Apataniidae	Early smoky wing sedges	*Apatania sorex*		P	P		P
Trichoptera	Brachycentridae	Humpless casemaker caddisflies	*Brachycentrus americanus*					P
Trichoptera	Brachycentridae	Humpless casemaker caddisflies	*Micrasema bactro*			P		P
Trichoptera	Glossosomatidae	Saddle casemaker caddisflies	*Glossosoma alascense*				P	

Trichoptera	Glossosomatidae	Saddle casemaker caddisflies	*Glossosoma pyroxum*		P	P		
Trichoptera	Glossosomatidae	Saddle casemaker caddisflies	*Glossosoma verdonum*	P				
Trichoptera	Hydropsychidae	Net-spinning caddisflies	*Arctopsyche grandis*		P	P	P	P
Trichoptera	Hydropsychidae	Net-spinning caddisflies	*Ceratopsyche oslari*		P	P	P	P
Trichoptera	Hydropsychidae	Net-spinning caddisflies	*Parapsyche elsis*	P	P	P	P	
Trichoptera	Lepidostomatidae	Bizarre caddisflies	*Lepidostoma pluviale*			P		P
Trichoptera	Lepidostomatidae	Bizarre caddisflies	*Lepidostoma rayneri*			P		P
Trichoptera	Leptoceridae	Long-horned caddisflies	*Oecetis inconspicua*	P				
Trichoptera	Limnephilidae	Tube-case caddisflies	*Onocosmoecus unicolor*			P		
Trichoptera	Philopotamidae	Finger-net caddisflies	*Dolophilodes aequalis*				P	
Trichoptera	Rhyacophilidae	Free-living caddisflies	*Rhyacophila angelita*					P
Trichoptera	Rhyacophilidae	Free-living caddisflies	*Rhyacophila brunnea*		P			P
Trichoptera	Rhyacophilidae	Free-living caddisflies	*Rhyacophila pellisa*		P			
Trichoptera	Rhyacophilidae	Free-living caddisflies	*Rhyacophila vaccua*		P			
Trichoptera	Rhyacophilidae	Free-living caddisflies	*Rhyacophila vao*				P	
Gastropoda	Lymnaeidae	Pond snails	*Ladislavella elodes*					P

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 no documented cases of Whirling disease in BC, 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 sample	This refers to the collection and removal of a reasonable 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 (eDNA)	The DNA released into the environment through faeces, 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 sequencing (NGS)	Use of next-generation sequencers (i.e. Illumina) to 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 homogenization	The process of making an environmental sample (i.e. benthos) uniform. For liquid/benthos samples, this often involves mixing using a blender so that DNA is evenly distributed within the sample.
Taxa	Unit used in the science of biological classification, or taxonomy.