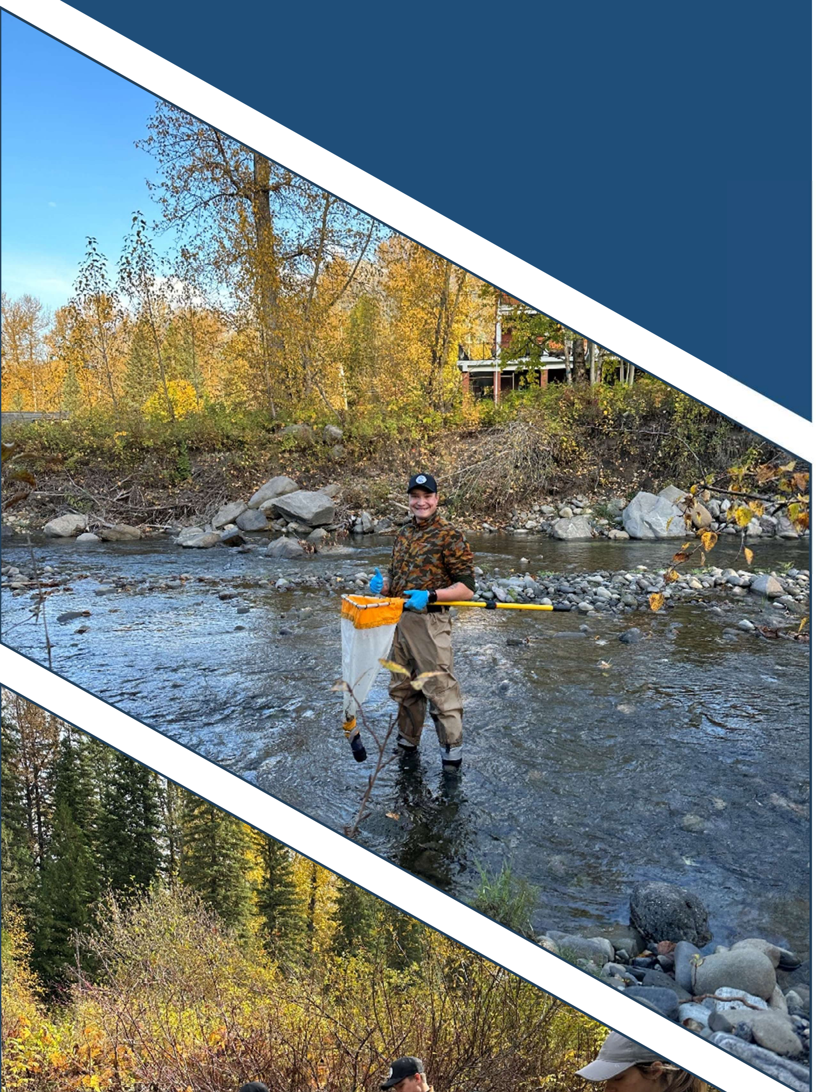

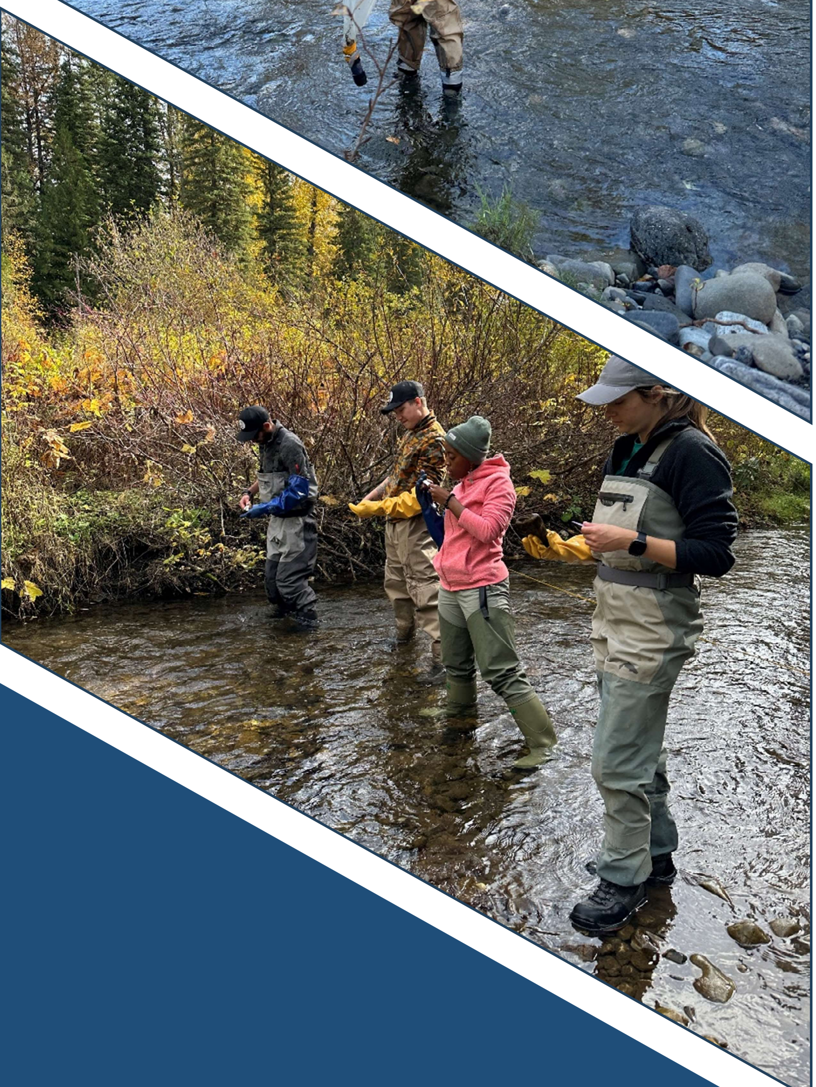

ELK RIVER ALLIANCE

COMMUNITY-BASED WATER MONITORING

2023 CABIN REPORT

2023

PREPARED BY:

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ELK RIVER ALLIANCE
FERNIE, BC

WITH FINANCIAL SUPPORT FROM:

The Province of British Columbia's BC Community Gaming Grant

Columbia Basin Trust's Resident Directed Grant (via Regional District of East Kootenay)

The Real Estate Foundation of British Columbia

The ERA Community

Land Acknowledgment

The Elk River Alliance recognizes that our work takes place on the traditional land and waters of Yaq̓I tʔa·k nuqǂi ‘it ‘ʔakanuxunik̓ ʔamakʔis the People from where the water comes out, within Qukin ʔamakʔis - the Land of the Raven in the Ktunaxa language.

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. At the time of reporting, the Elk Valley is home to 4 active metallurgical coal mines, with two additional mines and a mine extension either currently submitted or pending submission 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 population and expanding urban centers and linear development such as road, rail, power, and natural gas also have their impacts on the Elk River and its tributaries. As government and industry water monitoring programs focus on the effects of mining operations, the Elk River Alliance's CABIN program focuses on streams impacted by other land uses, which are not directly affected by current mining operations.

Analysis of 2023 sampling data indicated that sites on Boivin Creek (BOI001, BOI002) are in similar condition to their associated reference sites, based on their benthic macroinvertebrate communities, meaning that these streams likely contain healthy aquatic habitats. Conversely, sites on lower Coal Creek (COL001), lower Morrissey Creek (MOR001), and both Lizard Creek locations (LIZ001, LIZ003) remained deviated significantly from "reference condition" indicating potentially degraded aquatic systems. Although there has been some fluctuation in the upper Coal Creek site, 2023 sampling indicated that the upper Coal Creek (COL003) and upper Morrissey Creek (MOR002) sites were both "mildly divergent" from "reference condition". As of 2023, both sites on Alexander Creek (ALX001, ALX003) have been newly assessed as "mildly divergent" and may be moving away from "reference condition". Initial investigations have not identified a clear cause for these shifts. Further in-depth research is needed to determine the accuracy of these results and potential stressors affecting these tributaries.

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The **Province of BC** provides $140 million annually through the BC Community Gaming Grant to not-for-profit organizations throughout B.C., to support their delivery of ongoing programs and services that meet the needs of their communities.

https://strongerbc.gov.bc.ca

The **Columbia Basin Trust** supports projects that benefit the broad community and public good through community-based decision-making and ensuring an opportunity for resident input on projects through Resident Directed Grants (Regional District of East Kootenay). These grants are funded by the Trust and delivered in partnership with local governments and First Nations in the Basin.

https://ourtrust.org/

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

Introduction

The Elk River Alliance

Operating since 2010, the Elk River Alliance (ERA) is a community-based water charity that connects people to the Elk River using science, education and community collaboration to ensure sustainable stewardship of the Elk River watershed. 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 (ERA Director)

Stella is an aquatic biologist whose 45 year-career has included management of the Aquatic Biology Group at the Saskatchewan 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 cumulative effects. Stella has contributed to dozens of environmental impact assessments, ecological risk assessments and human health risk assessments. She provides strategic advice regarding the regulatory requirements for resource development projects and facilitates multidisciplinary teams working on a wide range of environmental issues. 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 served on the Nuclear Waste Management Advisory Council from 2020-2024 to provide advice on siting a high-level nuclear waste facility in Canada. 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. Stella is currently a member of the International Joint Commission Elk-Kootenai/y Study Board, which is tasked with conducting transparent and coordinated transboundary data and knowledge sharing; synthesizing and analysing data and information to support a common understanding of pollution within the Kootenai/y watershed and the impacts of that pollution on people and species; and, reporting results and making recommendations in a transparent and publicly available format.

Staff and Volunteer Credentials

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

Chris Bush, Environmental Technician

Alyx Madill, CWFCCC Volunteer

Brandon Bart, CWFCCC Volunteer

Megan Cowperthwaite, CWFCCC Volunteer

Zanele Chrisolm, CWFCCC Volunteer

Staff were trained and received CABIN Field Technician (Chris Bush) and Project Manager level certification (Kaileigh McCallum), through the Canadian Rivers Institute and Living Lakes Canada (LLC). LLC also provided training on the STREAM e-DNA program.

Canadian Aquatic Biomonitoring Network (CABIN)

The Elk River Alliance's Canadian Aquatic Biomonitoring Network (CABIN) program collects baseline data on aquatic habitat health to inform 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. Trained staff and volunteers conduct monitoring and research on targeted Elk River tributaries and share relevant findings with the community.

The Elk 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

ERA's CABIN program is located in the Elk River watershed, within the East Kootenay region of British Columbia (Figure 1). This watershed begins at the Elk Lakes near the Continental Divide and extends to Lake Koocanusa, which continues across the Canada-US border. The communities of Elkford, Sparwood, Hosmer, Fernie and Elko are located along the river as well as rural properties in the Regional District of East Kootenay.

In 2023, the CABIN program assessed ten sites across five major tributaries – Lizard Creek, Alexander Creek, Coal Creek, Boivin Creek and Morrissey Creek (Figure 1). These sites were chosen as they are areas of community interest and/or contain good aquatic habitat that ERA identified as important to monitor, preserve, or restore. Other CABIN sites implemented by environmental consultant companies, industry and government bodies also exist in the Elk River Watershed but are focused on monitoring mine-impacted tributaries of the Elk River.

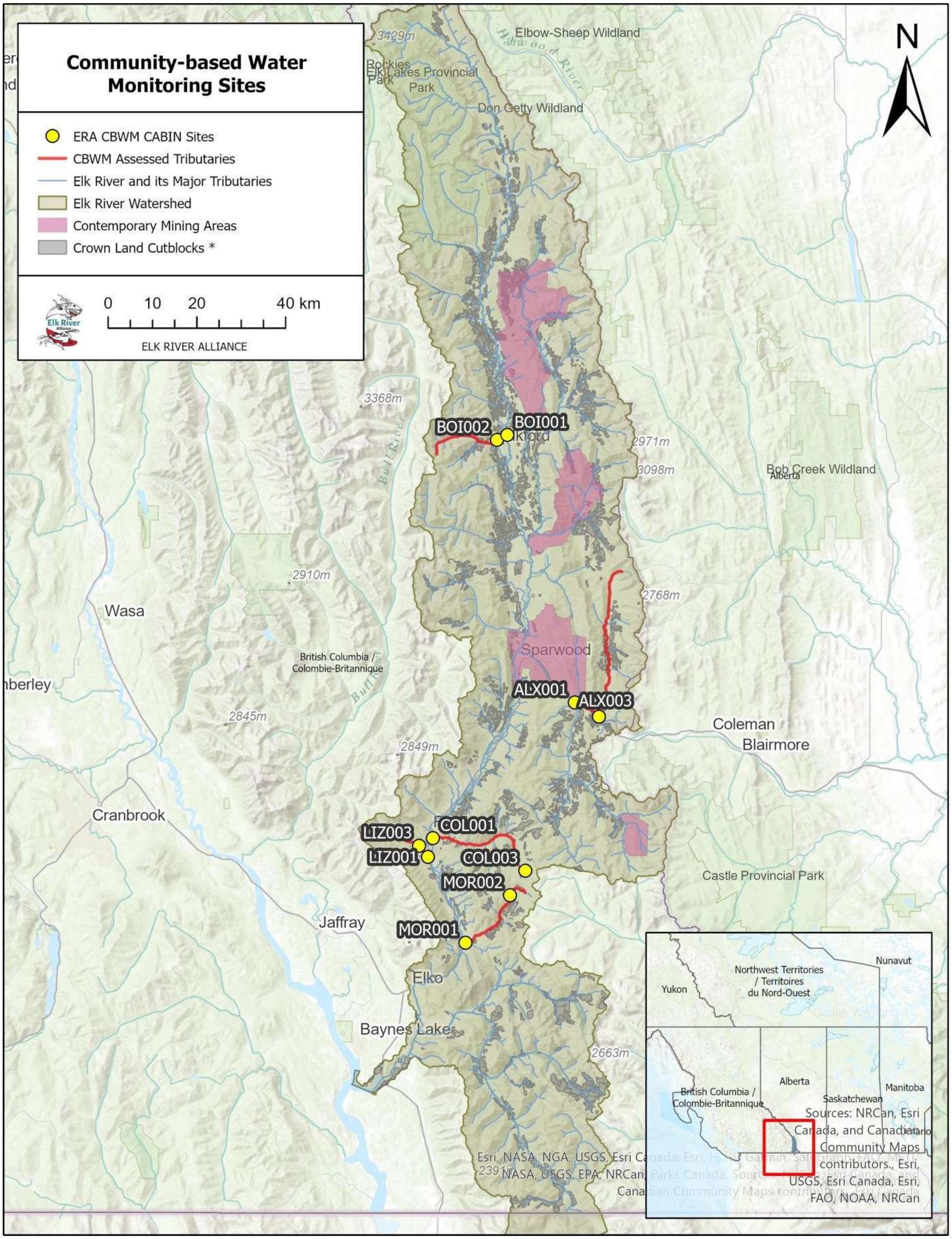


Figure 1. Elk River watershed (British Columbia) and CABIN site locations. ERA sites are chosen based on community input and focus largely on non-mine-affected tributaries. 2023 study locations include Boivin Creek, Alexander Creek, Lizard Creek, Coal Creek and Morrissey Creek.

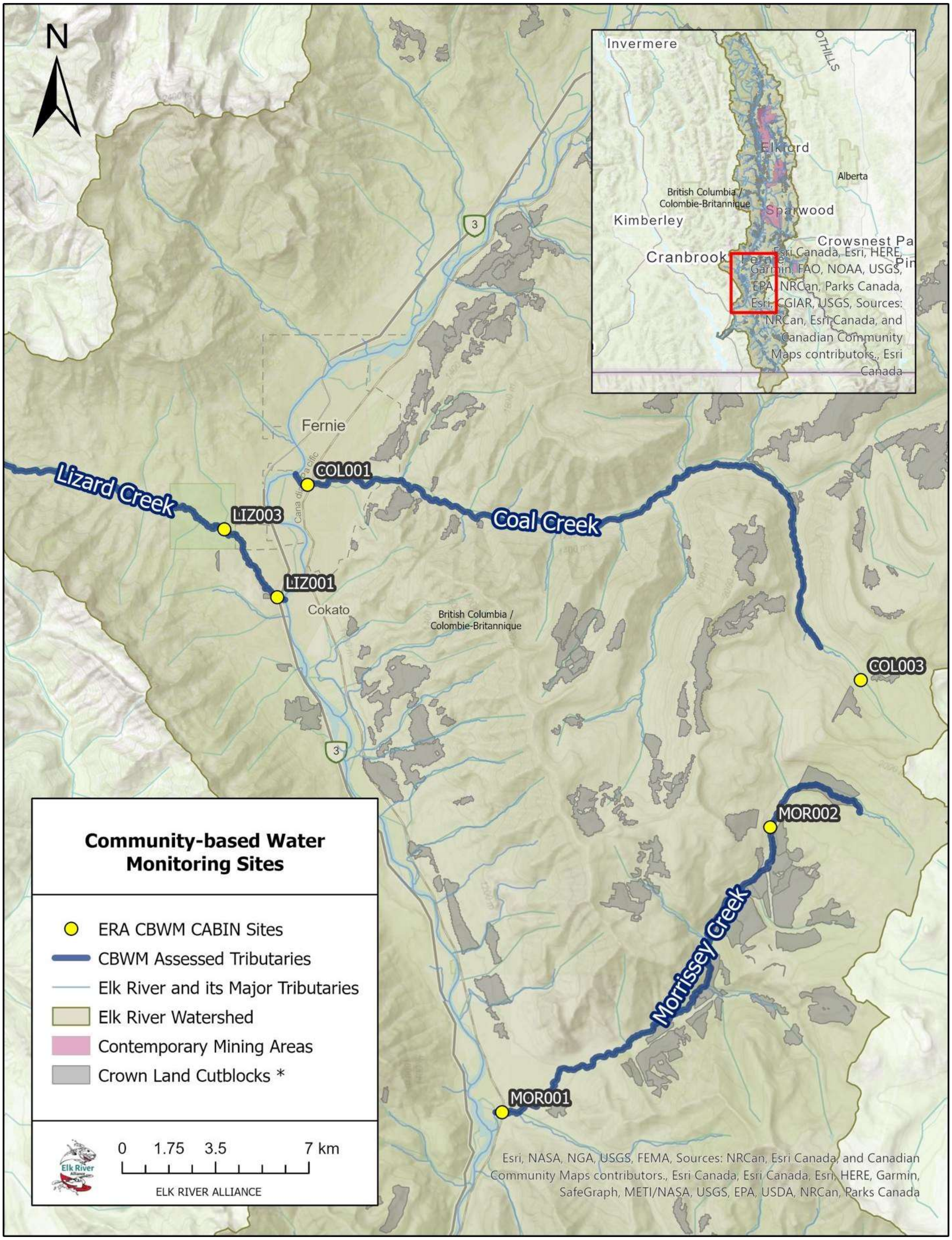


Figure 2. Close-up of Lizard Creek (LIZ001, LIZ003), Coal Creek (COL001, COL003) and Morrissey Creek (MOR001, MOR002), the southern-most study sites in the CABIN program.

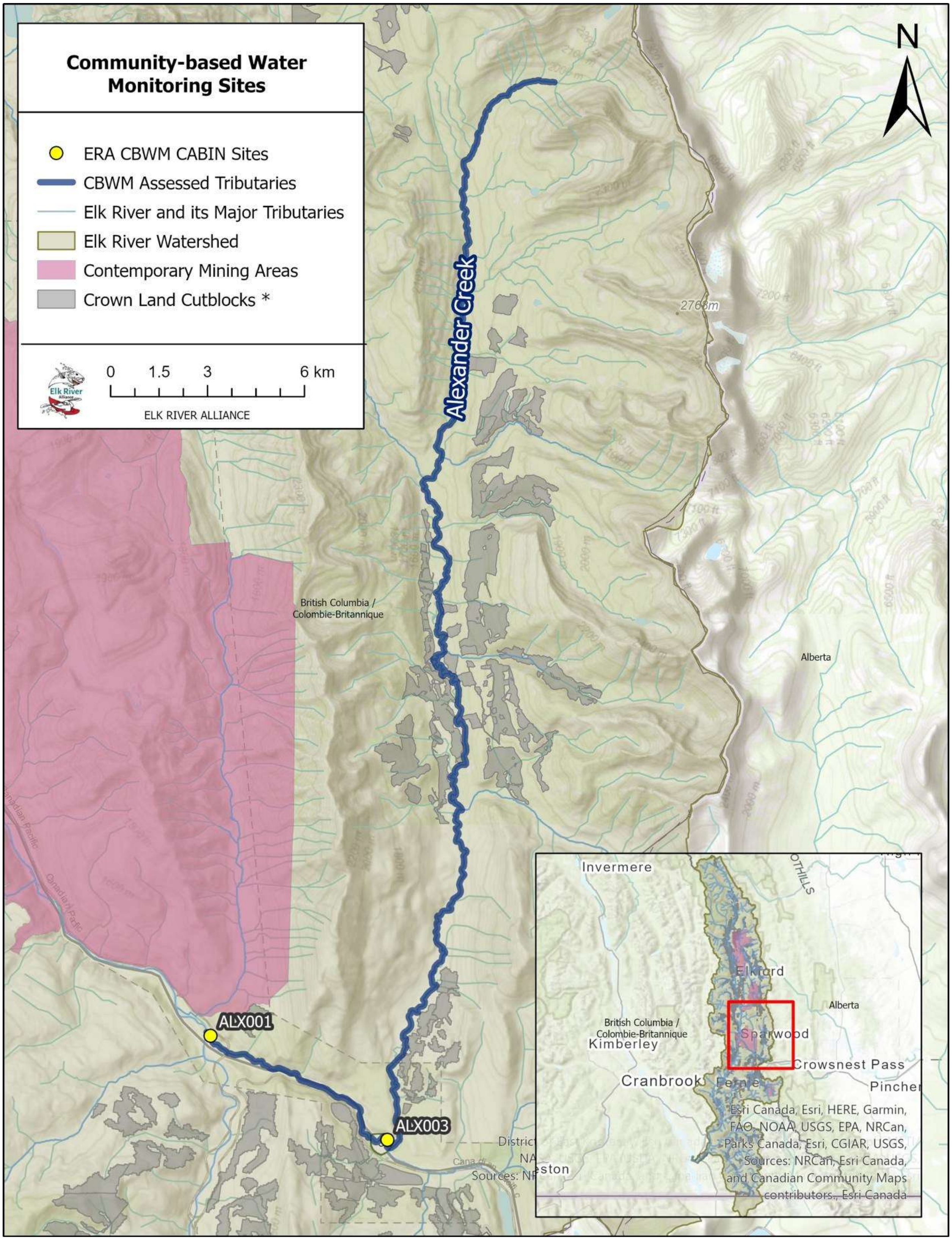


Figure 3. Alexander Creek site locations (ALX001, ALX003), just East of Sparwood, BC.

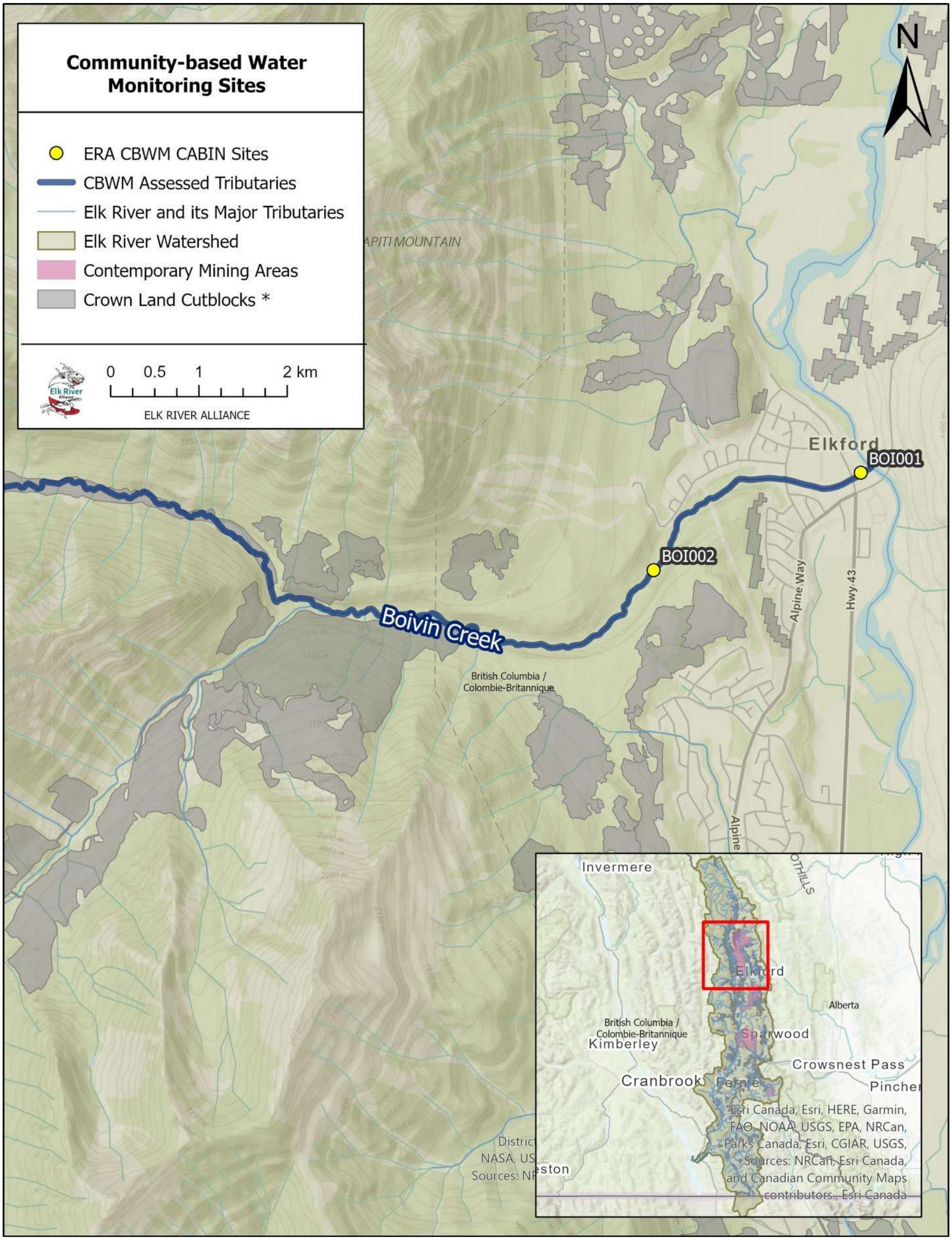


Figure 4. CABIN sites (BOI001, BOI002) on Boivin Creek in Elkford.

Lizard Creek

Lizard Creek, located approximately 5 km south of Fernie, was the first Elk River tributary for ERA's CABIN program. It was initially assessed as a 'reference site' in 2011 since at the time, the creek and its catchment had relatively little residential development and no active industrial activity (although logging had occurred historically). 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 gravel access roads. Residential development in the Lizard Creek Catchment downstream of the provincial park began in 2018. Lizard Creek has continued to be monitored as it contains important spawning grounds for Westslope cutthroat trout (Elk River Alliance, 2020; Hocking *et al.*, 2021).

Since 2018, the Lizard Creek catchment downstream of the provincial park has seen increasing urban, road and trail development, including the Galloway Lands Development area. ERA continues to pay special attention to these sites as the surrounding land-use changes.

LIZ001

Figure 5. Images of LIZ001: upstream across the stream and downstream. The major flooding event in November 2021 left sections of Lizard Creek scoured down to the clay bed. Exposed clay sections were first noticed in streambed in 2022 and continue to be present along the side of the left bank. Clay sections are larger in 2023.

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 to include Elkford in CABIN 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 riprap 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 CABIN program in 2019. According to community discussions, this creek purportedly contained good quality habitat for Westslope cutthroat trout in the past; 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 CABIN monitoring locations, added in 2020 due to the presence of good quality trout spawning habitat coupled with logging, resource road use 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.

These Morrissey Creek locations may also allow ERA to monitor the effects of short-term developments. In 2022, TC Energy began pipeline work in the Morrissey area - this included the expansion and increased use of roadways that run alongside Morrissey Creek. The pipeline development was completed in the early summer of 2024, and no further development is planned at the time of writing this report.

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 ERA's transition from Streamkeepers-based 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 (Carter, 2012). ERA staff and volunteers have been trained by certified CABIN trainers.

The reference system approach to assessment means study sites or "test sites" are compared to sites in pristine condition, without the presence of human impact, called "reference sites". CABIN uses a combination of physical, chemical and biological parameters, to statistically categorize a test site and analyze it based on benthic macroinvertebrate (aquatic insects, worms, etc. – see "Benthic Invertebrates" section below for more details) assemblages, 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 that a test site in good condition will have similarly 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.

In 2020, a new statistical CABIN model for the Columbia Basin was released (Strachan, 2020). Beginning in 2021, ERA's CABIN program upgraded from using the older Okanagan-Columbia 2010 model to the Columbia Basin 2020 model, which is tailored to a smaller, more specific region in BC, and includes the use of different criteria for site organization and assessment.

Habitat Variables

Geology, topography, stream morphology, climate and vegetation cover all play a critical role in stream health. The CABIN approach uses these characteristics to categorize and then assess test sites for similarities with reference sites. The physical characteristics of a test site are used to assign the site to a reference group for comparison.

These characteristics are important because the natural "pristine" state of a site is dependant upon these traits. If the CABIN test site was not compared to a suitable group of reference sites with similar physical variables, results would not accurately assess the health of an area. For example, a creek with limestone as the primary underlying rock will naturally have a higher pH than a stream dominated by sandstone, resulting in assemblages of benthic macroinvertebrates reflective of these respective natural conditions. If a limestone-based creek was compared to a sandstone-based "reference site", the different benthic macroinvertebrate community may be misinterpreted as a sign of an unhealthy aquatic system due to a pollutant causing a higher pH, rather than a natural occurrence.

Physical Properties of Water

The physical properties of water – colour, temperature, turbidity, taste and odour - are useful indicators of what is occurring within a stream. The CABIN program 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 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 most 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^{o}C, oxygen levels will fall below the guideline for protection of embryos and alevins (British Columbia Ministry of Environment and Climate Change Strategy, 2021).

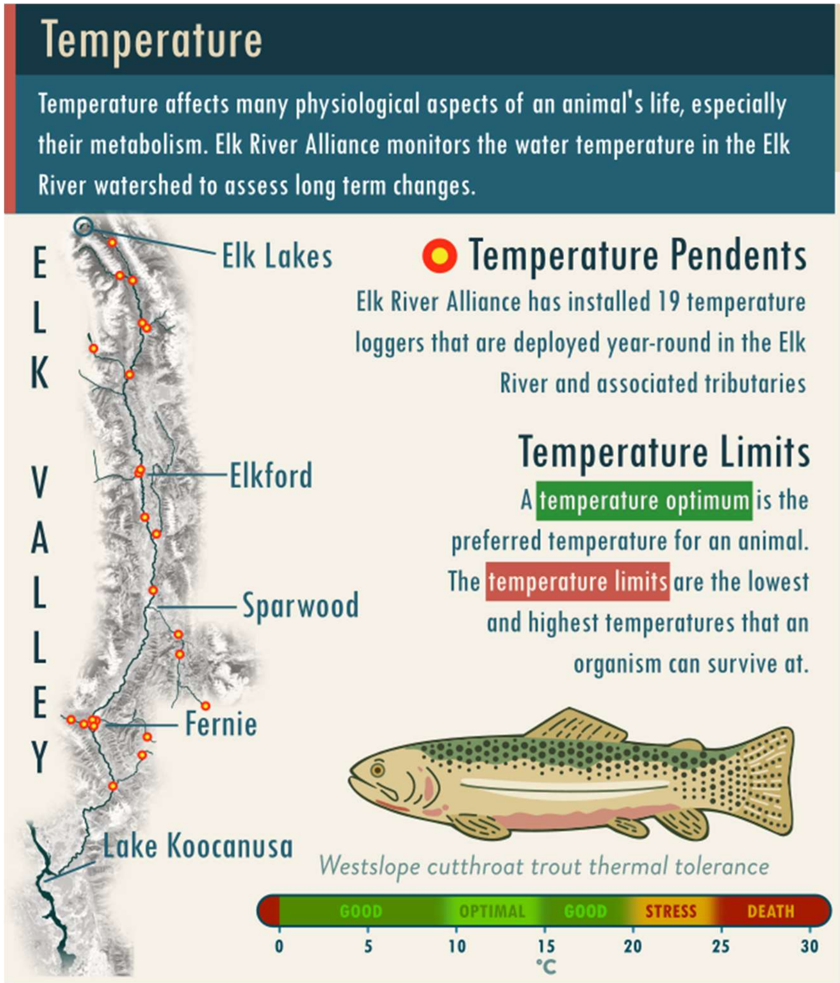


Figure 15. ERA Infographic outlining the importance of temperature to aquatic systems.

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, 2021b). Excess sediment can negatively affect 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).

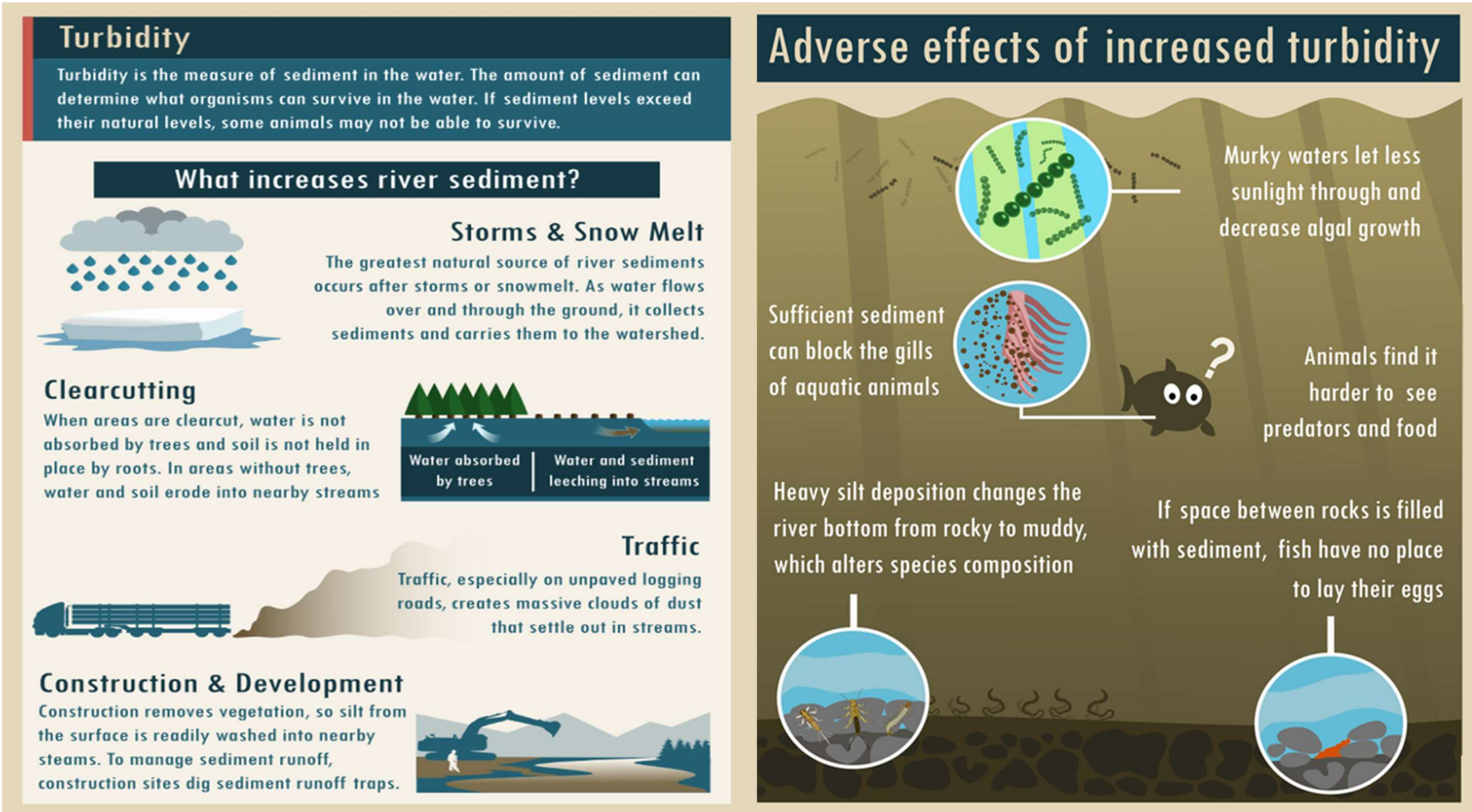


Figure 16. ERA CABIN infographic explaining turbidity and its importance.

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.

Dissolved oxygen, pH and conductivity are fundamental 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 animals require enough dissolved oxygen for them to breathe easily. Oxygen levels depend on whether water is flowing or still, whether there are rocks or other obstacles for water to flow over, how many plants are growing in the water, and water temperature. Common causes of low dissolved oxygen are increases in temperature, decaying organic matter and weather (i.e. cloudy days reduce oxygen production from aquatic plants and algae). Excess nutrients added to the water via sewage or stormwater discharges, agricultural runoff or mine water discharges can cause excessive algae growth which then decompose, using up oxygen. The amount of dissolved oxygen in water affects the types and health of aquatic life present. The lower the oxygen content, the less life that can persist in the water.

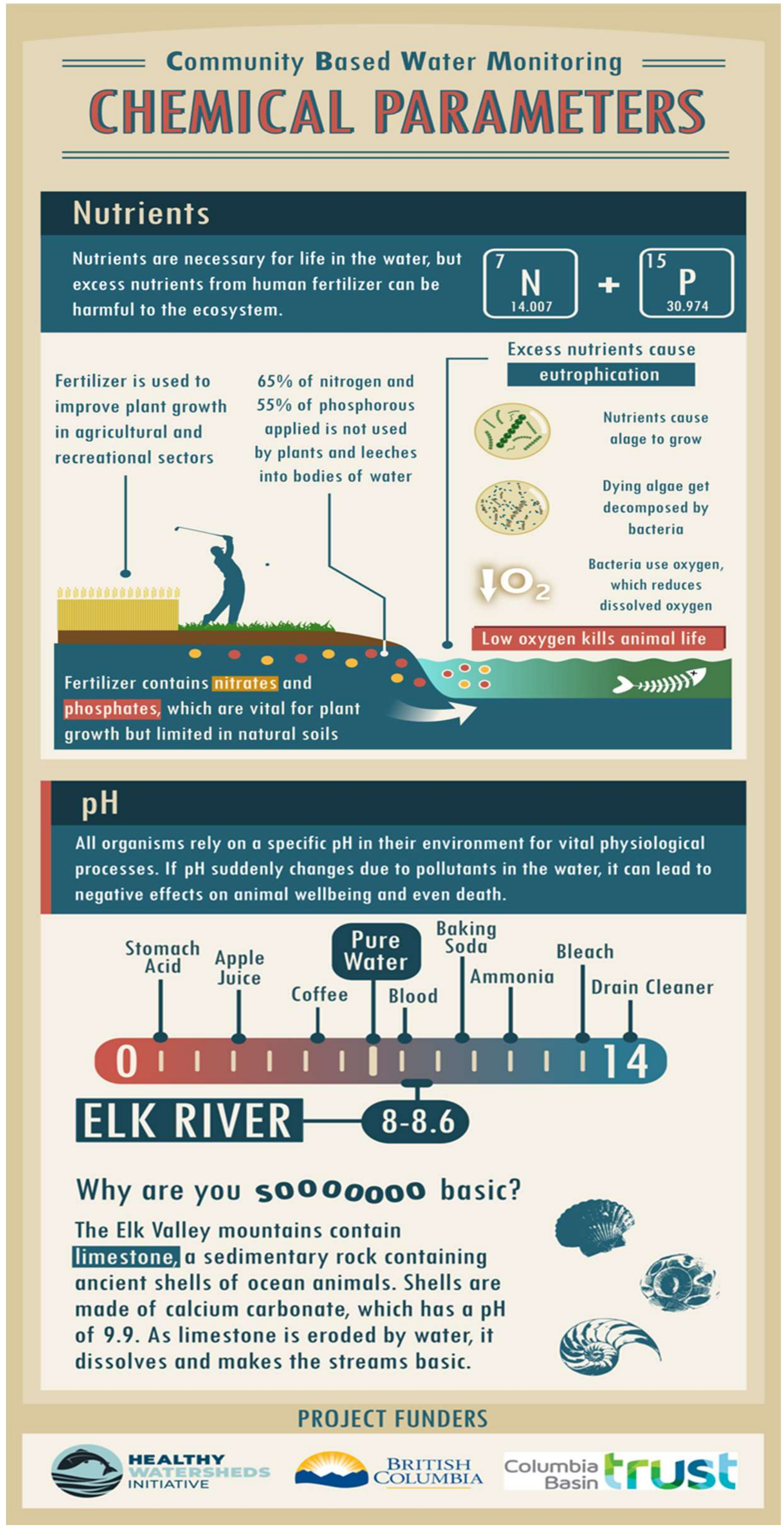


Figure 17. ERA infographic on chemical parameters associated with the CABIN program.

The pH range for freshwater aquatic life set by BC water quality guidelines is 6.5-9.0. Pure distilled water has a neutral pH of 7. The local geology of an area can result in water that is alkaline or acidic. In the Elk River watershed, streams are more alkaline due to a limestone-based geology, and aquatic organisms have adapted to these conditions. When pH levels deviate from natural ambient conditions, there may be direct or indirect effects on the health of aquatic organisms and partial or complete changes in species composition. The pH of water affects the solubility (amount that can be dissolved in water) and bioavailability (amount that can be used by aquatic life) of chemicals in water such as metals or nutrients (Government of British Columbia, 2023). Low pH increases the solubility of metals, meaning that a decrease in the pH of a stream causes an increase in the amount of dissolved metals in that water. These high amounts of dissolved metal can attach to the surface of fish gills, damaging the gills and reducing oxygen uptake. Increases in pH can also increase the concentration of the more toxic forms of chemicals, like ammonia, in the water, killing fish quickly (B.C. Ministry of Environment and Climate Change Strategy, 2021a). Significant changes in pH can be caused by historic mine wastes, landfill leachate, runoff from cattle feedlots, recent draining of wetlands, asphalt production or disposal, and limestone gravel roads (US EPA, 2003).

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 such as sodium, potassium, magnesium, chloride and sulphate (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

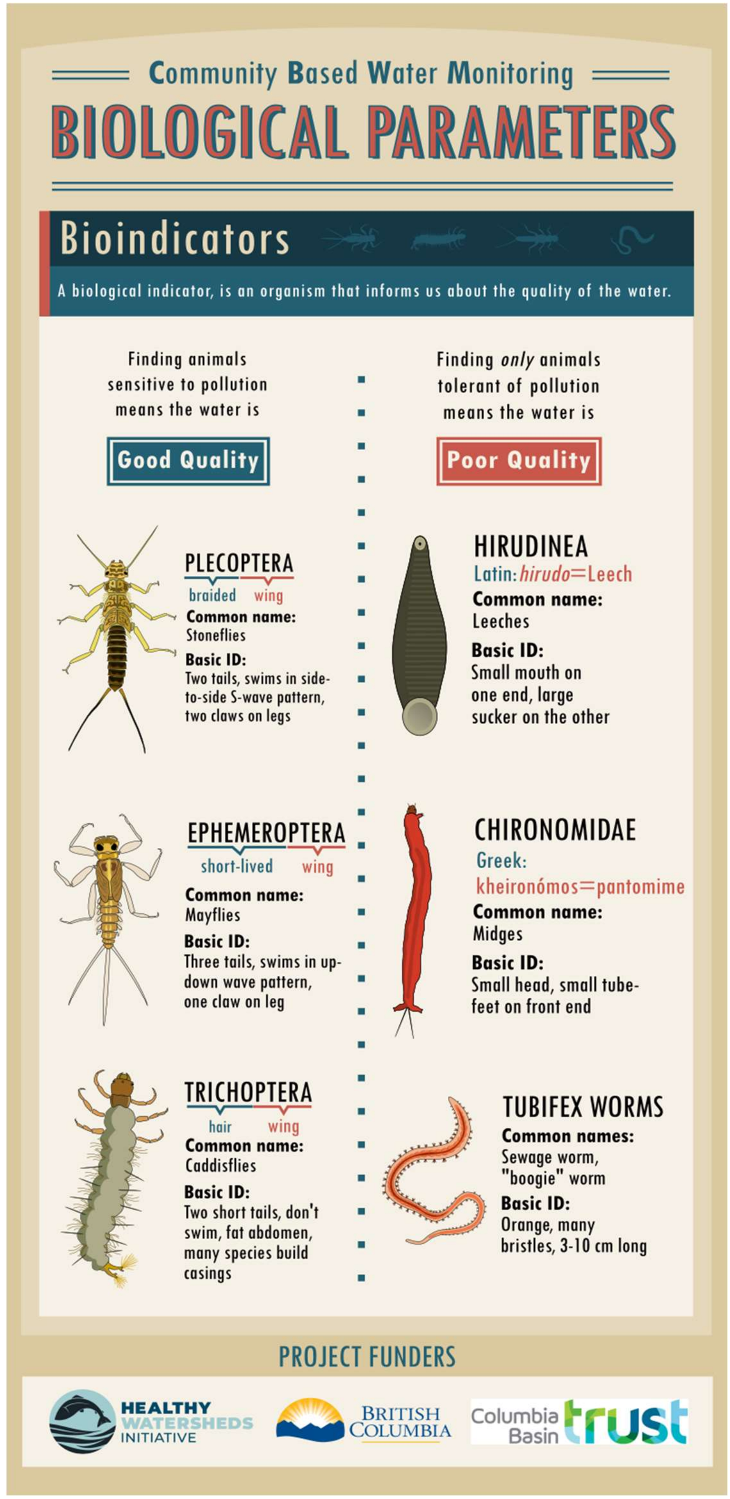


Figure 18. ERA infographic outlining the biological parameters associated with the CABIN program.

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.

In addition to measurement of dissolved oxygen, pH and conductivity, the CABIN program includes water samples collected for laboratory analysis of nutrients, total and dissolved metals, and major ions (salts).

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.

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, consistent, long-term monitoring is needed to detect unusual changes to a specific water chemistry parameter and identify the underlying reasons for the change.

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 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 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 CABIN 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 allows for the examination of benthic communities at a finer taxonomic resolution and 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.

Methods

Site Selection

The Elk River Alliance's CABIN sites are chosen based on community input and/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 a 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.

Aquatic Habitat Assessment

Test 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, including GPS location, surrounding land-use, site drawing, photographs, and reach characteristics are 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 – i.e. algae, cyanobacteria, etc.) coverage.

Water chemistry measurements and water 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 of metals, nutrients, and major 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 are 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 upstream. STREAM samples are collected in sampling jars and preserved according to STREAM protocols. Only the lower site on each creek (near the mouth) 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 are 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, dissolved oxygen, and turbidity – 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 water chemistry analyses. Typically, ERA CABIN sites are assessed for total and dissolved metals, nutrients, cations and anions (e.g. chloride, sulphate, carbonate) (Appendix C: CARO Reports).

Benthic Invertebrate Taxonomy

ERA contracted Summerland-based, CABIN-approved, aquatic invertebrate taxonomist, Scott Finlayson (B.Sc. Freshwater Science, SFS) to assess benthic macroinvertebrate samples for the CABIN program. He 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 Wadeable Streams Protocols, all data collected was entered into the Environment and Climate Change Canada (ECCC) national CABIN database, under “CBWQ – Elk study”.

In 2021, ERA shifted from using the older Okanagan-Columbia 2010 preliminary model to the new Columbia Basin 2020 model, to perform CABIN assessments. The new model includes 156 reference sites across the Columbia Basin, with 11 of these falling within the Elk River Watershed, an additional 4 in the neighbouring Flathead area, and 1 within the Bull River basin (Strachan, 2020).

To prepare site data for CABIN analysis, characteristics based on GIS data were assembled. Catchments for each site were delineated using GIS software and analysed for model requirements: drainage area (km^2); % grassland; % low shrubland; % water; mean precipitation for October; minimum temperature for December; % sedimentary rock; and maximum 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 “community ellipses” for each site, which is an ordination plot that visually represents how similar reference sites are to each other and where a test site fits into the comparison among sites. The center ellipse represents reference condition. The further out from the center ellipse a test site appears, the more it has diverged from the reference condition and the more likely it is to be in poor condition.

Where sites appeared to be diverging from reference condition, data were further explored to investigate patterns associated with these sites. Water chemistry parameters were assessed for any notable results. RIVPACS, Bray-Curtis dissimilarities, and metrics related to the presence and abundance of specific invertebrates (i.e. EPT, *Diptera* and non-insects) were used to explore potential 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 2023, 10 sites were assessed across 5 tributaries – Lizard Creek, Alexander Creek, Boivin Creek, Coal Creek and Morrissey Creek. CABIN analyses tools generally yielded similar results to the previous year (see ERA's 2022 Report for details), with sites along Boivin Creek (BOI001, BOI002) having similar benthic community structures to their associated reference sites and upper Morrissey (MOR002) maintaining its condition of mildly divergent, while lower Coal Creek (COL001), lower Morrissey Creek (MOR001), and both Lizard Creek sites (LIZ001, LIZ003) diverge significantly from the designated 'reference condition'. This year, however, both the Alexander Creek (ALX001, ALX003) sites appear to have diverged from reference condition and were assessed as mildly divergent while the upper Coal (COL003) has reverted to its 2021 state of mildly divergent.

ERA is concerned about these results and what they could mean for the health of these streams. However, the reason for these results is still uncertain. In 2020, CABIN introduced a new statistical model for aquatic habitat assessments in the Columbia Basin – Columbia 2020 model. The use of this model saw unexpected shifts in assessment results for ERA's test sites. This new model is generally considered more accurate and more sensitive to potential stressors – it is tailored more specifically to the region, focusing on the Columbia Basin rather than the previous model's focus on both the Columbia and Okanagan Basins, and features double the amount of reference sites than the previous model (Gaber, 2012; Strachan, 2020). Due to these unexpected shifts in assessment results, ERA is recommending further investigations on "divergent" streams to examine potential unknown stressors on these systems and eliminate the possibility of inaccurate or exaggerated results related to the model's ability to represent test sites in the Elk Valley, BC.

The composition of the benthic macroinvertebrate communities at many of these sites appears to align with these new assessment results. Water chemistry sampling results at all sites consistently remain below BC Water Quality Guideline limits for aquatic life and although some elevated levels of certain water quality parameters were observed at Morrisey sites in 2023, there are no obvious trends to lend support to any specific cause for divergence at Morrisey or any other site. ERA will continue the long-term monitoring of these sites into 2024, and is recommending further investigation, outside of CABIN assessments, to explore potential reasons for these results.

Lizard Creek

In 2023, Lizard Creek sites – LIZ001, LIZ003 – were assessed as "highly divergent" from reference condition based on the Columbia 2020 CABIN model (Figure 19). Year to year changes using the new model continue to indicate a steady shift at LIZ001 from reference condition to highly divergent from 2014 to 2017, then remaining highly divergent from 2017-2023.

Although this appears to suggest a potential trend of site degradation over time, it is worth noting that this CABIN model sorted the LIZ001 site for comparison with a different set reference groups for 2012, 2014 and 2015, compared to the rest of the assessment years. Generally, sites are expected to be compared with the same reference group from year to year (based on the assumption that the fundamental geological, topographic, climate, stream morphological and vegetation cover characteristics remain the same). Capturing the full range of ecological variation of reference sites using an adequate number of sites sampled with sufficient frequency is critical for confident interpretation of CABIN data (Strachan and Reynolds, 2014). The changing assignment of the reference group for the LIZ001 site may indicate a technician error or model issue rather than a truly changing site condition. Looking at the variables used to sort test sites into model reference site, only four changed between years – latitude, altitude, channel slope and % canopy cover. Of these predictor variables, only % canopy coverage had an obvious pattern between years sorted into the model's Reference Group 3 (2012, 2014 and 2015) which were all assessed as having 26-50% canopy coverage and Reference Group 2 (2013, 2016-2023), which were assessed as having 1-25% canopy coverage. Changing the canopy coverage in the data for the years sorted into Group 3 results in new assessments for these monitoring events, with 2012 changing to "Mildly Divergent", while 2014 and 2015 both become "Divergent". Essentially, by changing a single variable, and having all the LIZ001 site visits compared to the same set of reference sites, the pattern of increasing divergence that can be seen from 2014 to 2017 changes significantly. This may point to an issue with this CABIN model's ability to sort LIZ001 into a group with appropriate reference sites.

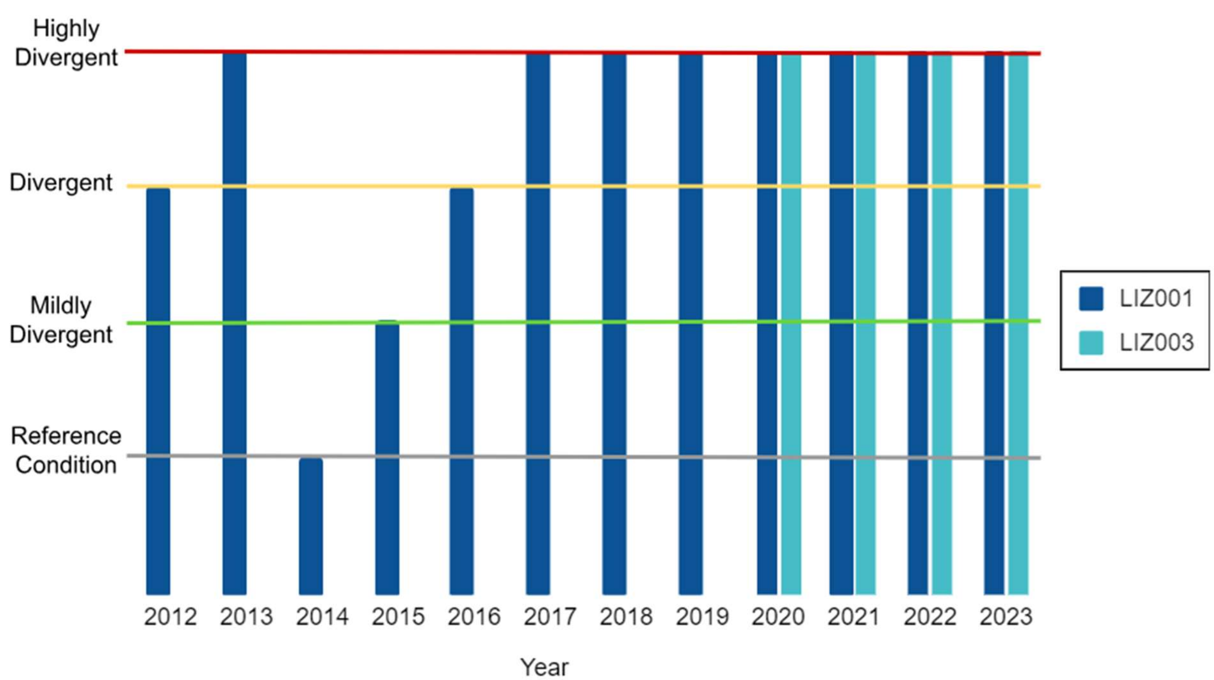


Figure 19. CABIN analysis results for Lizard Creek sites from 2012 – 2023 using the Columbia 2020 CABIN model.

Further examination into 2023 data, suggests that both Lizard Creek sites differ from reference sites according to the Bray-Curtis dissimilarity, which uses taxa richness and abundance for comparison (LIZ001: 0.96, LIZ003: 0.92); however, RIVPACS analysis, which take an exclusive presence/absence approach to assessment (LIZ001: 1.05, LIZ003: 1.05) suggests that these sites still have relatively good taxa richness. This difference may be in part due to the larger number of taxa present at Lizard Creek sites, compared to reference sites (Table 1).

Taking a closer look at the benthic macroinvertebrate community composition, the percentage of EPT individuals (*Ephemeroptera, Plecoptera, Trichoptera* - typically pollutant-sensitive taxa) for LIZ001 and LIZ003 (28.79% and 60.16%, respectively) is lower than what would be expected based on the reference site means (88.13% ±9.26; 91.94% ±7.29). Though in the past LIZ003 had EPT values similar to the values seen at Alexander Creek and Boivin Creek, which both have a history of being near "reference condition", this appears to no longer be the case, with both LIZ001 and LIZ001 showing EPT declines of around 20% from 2022 to 2023. Total abundance of benthic macroinvertebrates was significantly higher than expected according to mean reference site values which may contribute to the unexpected significant divergence from reference condition (i.e. LIZ003, the upper Lizard Creek site's abundance for 2023 was almost 20,000 higher than that of associated reference sites' mean) (Table 1). Although ERA is currently unsure of the cause, total abundance of benthic macroinvertebrates at Lizard Creek has been increasing over time - the data available for LIZ001 show a distinct pattern of increasing abundance since 2012 (LIZ003 has not been monitored long enough to begin confidently assessing any trends within this data) (Figure 20). Unfortunately, decreasing EPT appears to be accompanying this increase in abundance (Figure 20). There also continues to be a noticeable increase in the amount of *Tubifida,* a pollution-tolerant taxonomic order of worms, at LIZ001, which further suggests the introduction of a pollutant or disturbance affecting this site.

The high abundance with lower diversity (and low EPT) within the populations at LIZ001 likely suggests the introduction of a pollutant to the system and may signify the declining health of this site; however, further investigation of this area is needed to confirm and explore potential causation.

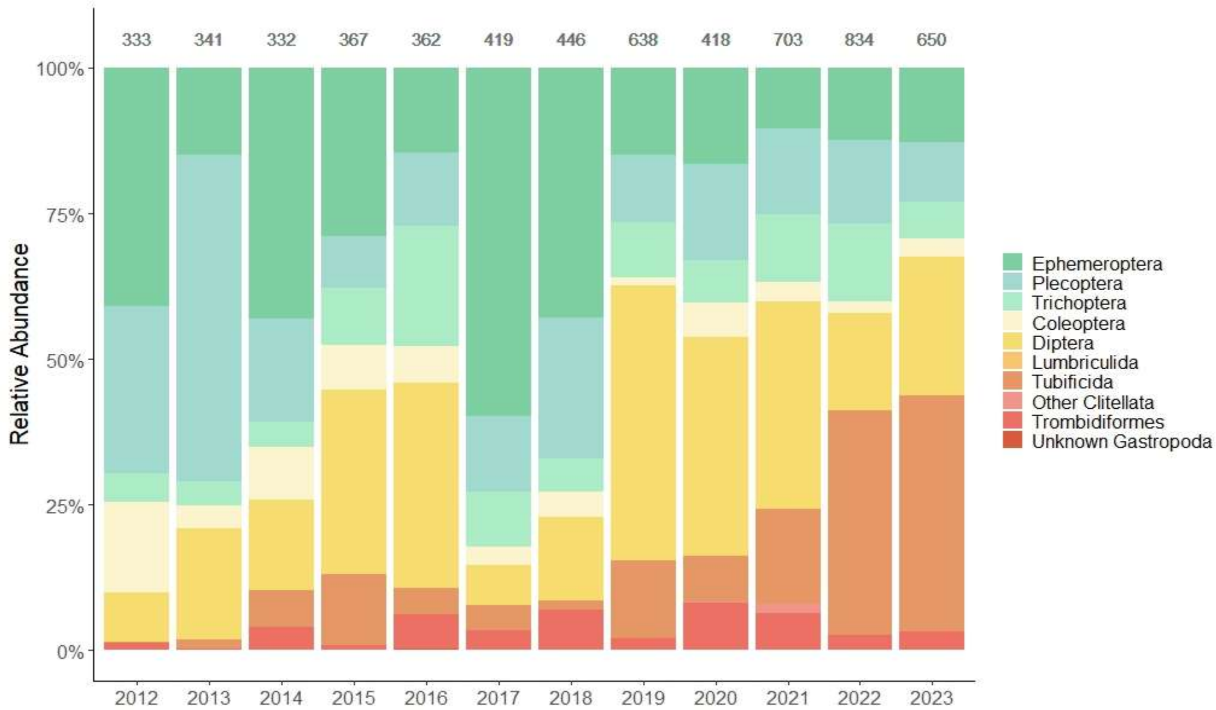


Figure 20. Plot of benthic macroinvertebrate community composition based on taxonomic order of samples collected at LIZ001 during CABIN sampling over time. The cool colours (blues, greens) represent orders that are generally sensitive to pollution (Ephemeroptera, Plecoptera, Tricoptera), while the orders in warm colours (yellow, orange, red) are more tolerant to pollutants. The numbers along the top of the graph are the raw individual counts of all benthic macroinvertebrates found at this site in each year.

Based on ERA's understanding of Lizard Creek, poor aquatic health at LIZ003 is unexpected. The LIZ003 site is within Mount Fernie provincial park and Island Lake Lodge is located near the headwaters of the creek (cat skiing, hotel, and restaurant operations). There is a resource road that runs alongside Lizard Creek for approximately 9.5 kilometers from Highway 3 to Island Lake Lodge and comes within 300 meters of the creek at different points along the way (See Figure 21 for more details on land use within the Lizard Creek catchment). There are also several tributaries that cross over this road and eventually feed into Lizard Creek. Recreational use is moderate-to-high depending on the time of year, with many formal and informal trails used for skiing, biking, hiking, and horseback riding. Anecdotal observations indicate the presence of fish in good condition in Lizard Creek as well as spawning redd and fry and fingerling rearing area. However, regular visitors to the creek have noted increasing algae growth (particularly filamentous algae). Increased algae growth may indicate increased nutrient inputs to the creek.

LIZ001 is closer to the Lizard Creek confluence into the Elk River (Figure 21). This site is downstream from the provincial park and has greater potential to be affected by human disturbance from residential development adjacent to the stream as well as recreational uses in the provincial park and adjacent private lands. Proposed future residential development adjacent to Lizard Creek including the Galloway Lands development, with associated access roads, water withdrawals from aquifers (which contribute to baseflow in the creek), and increased access for recreational uses may contribute additional impacts to those which may already be occurring. ERA is committed to continued monitoring of Lizard Creek as human activities in the catchment increase.

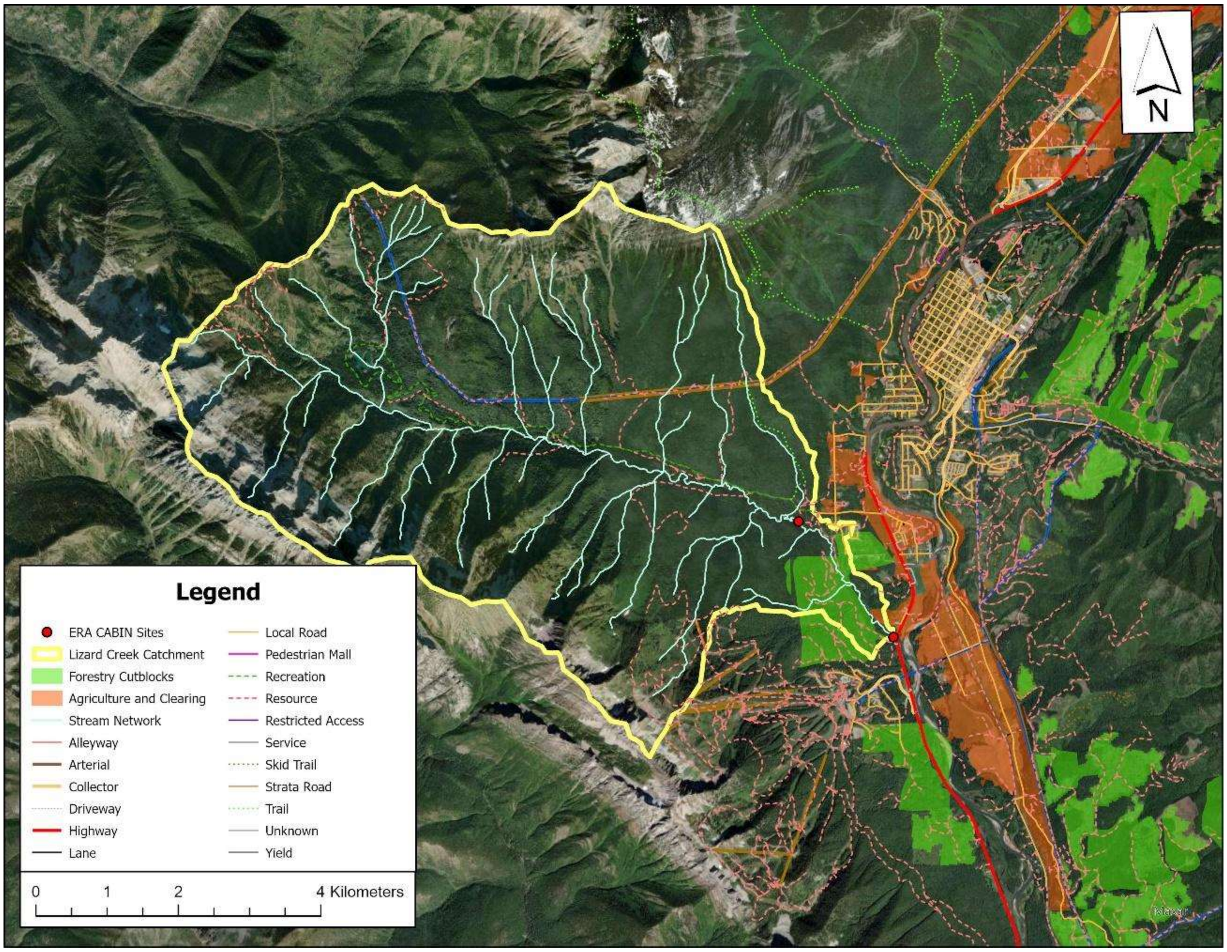


Figure 21. Land use in the Lizard Creek Catchment as of 2023.

Preliminary investigations into water quality parameters have not identified a clear cause - all measured water quality variables met BC guidelines for the protection of aquatic life and there have been no notable trends in water quality parameters (See Water Quality Trends section). However, trends cannot reliably be determined by "snapshot" sampling.

Initial examinations of water quality parameters in 2021 allowed ERA to begin flagging specific water quality parameters for continued monitoring. Although there were no exceedances of BC Water Quality Guidelines, LIZ001 and LIZ001 continue to have consistently higher amounts of sulfate, total phosphorus (as P), hardness (as CaCO3), conductivity, total calcium and total magnesium than other CABIN monitored creeks (Figure 22; Figure 23; Figure 39).

Although high amounts of some of these parameters, namely, hardness, calcium, magnesium and conductivity, can, in the right conditions, result in the precipitation of calcite on rocks within a stream, naturally elevated levels are not a concern. In this case, these elevated levels can likely be attributed to the limestone-based geology of the area and increased groundwater influence (more interaction with the limestone) at Lizard Creek – as water erodes the limestone, minerals like calcium and magnesium are deposited into the stream, thereby also increasing the conductivity and hardness, but further investigation is needed to confirm this. If these levels are natural, further assessment of the ability of this CABIN model to accurately assess these sites is recommended, with associated reference samples containing significantly lower levels of many of these parameters – hardness (E100 ± 77.36 mg/L), magnesium (E9 ± 7.544 mg/L), and conductivity (E120 ± 104.00 uS/cm).

Anecdotal observations of algal growth, led to an exploration of nutrient levels within Lizard Creek – both phosphorus and sulfate levels were flagged in 2021, and noted to be regularly higher than the other CABIN monitored creeks. Although there is currently no Water Quality Guideline for phosphorus in streams in BC, the long-term chronic limit within lakes is 0.015mg/L, which Lizard Creek sites regularly meet and/or exceed. Initial data investigations in 2021, also flagged sulfate as another parameter to watch. Although sulfate measurements at Lizard Creek sites are higher than ERA's other CABIN sites, they are all well below limits outlined in the BC Water Quality Guidelines (429 mg/L). It may be worth noting that ERA's Coal Creek sites (COL001, COL003), which have also been diverging significantly from reference condition, are the only other ERA test sites that reach similar phosphorus levels. Unfortunately, in 2022 the lab analyzing samples was unable to perform the test necessary to quantify total phosphorus (as P) or sulfate, so ERA was unable to complete a 2022 assessment, but assessments were resumed in 2023. ERA will continue to monitor these parameters and recommend that it be considered for future examinations.

As noted in the 2022 report, a potential pattern of increasing alkalinity continued to occur in 2023 at Lizard Creek sites. This pattern seems to be shared amongst all of ERA's CABIN test sites. Similar to hardness, calcium and magnesium, elevated alkalinity is usually a result of the limestone-based geology of the local area. ERA will continue to monitor this parameter over time to continue to assess emerging trends (Figure 24).

In-depth investigations outside of CABIN assessments are needed to better understand what is occurring at Lizard Creek.

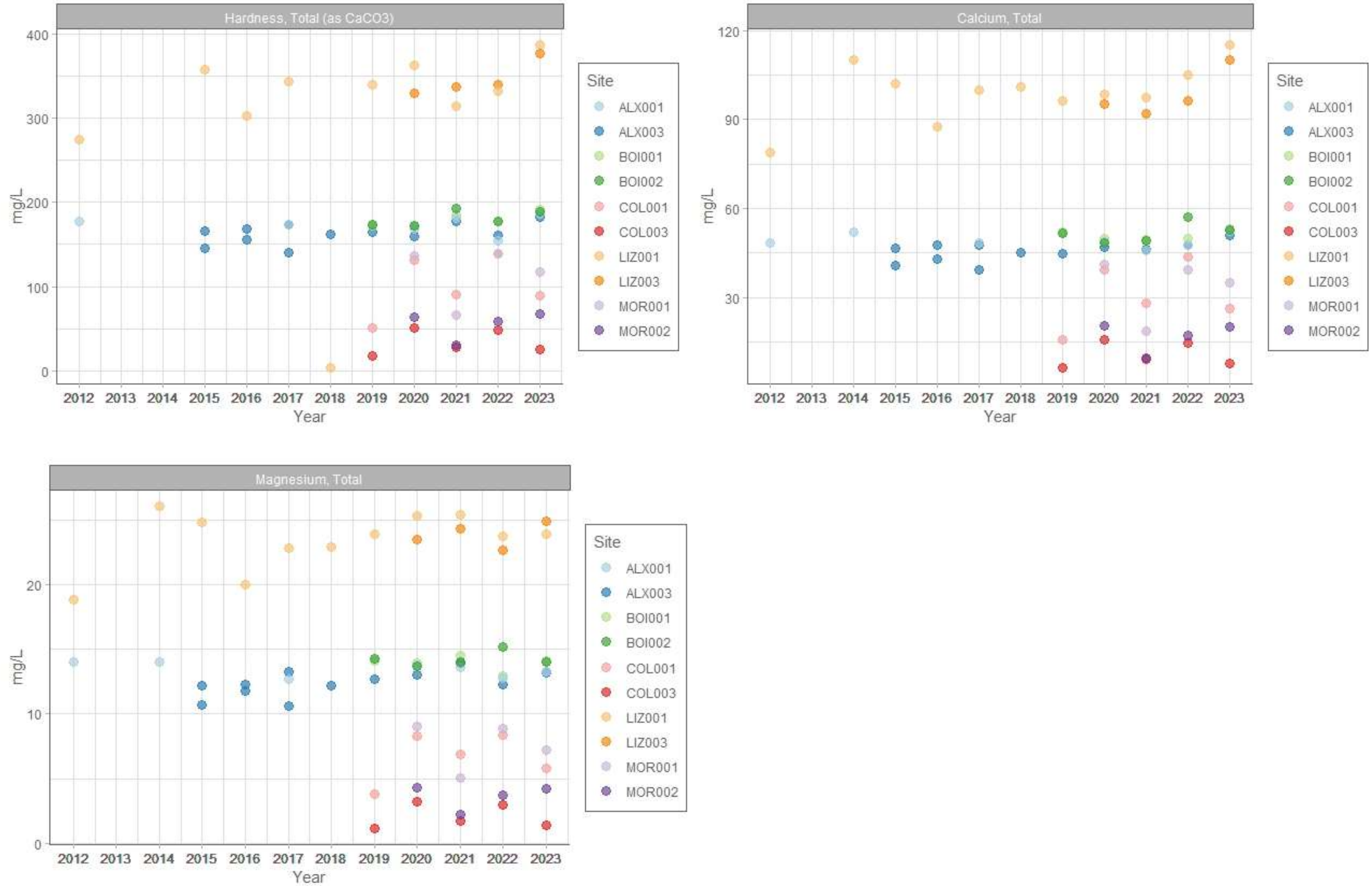


Figure 22. Total hardness (as CaCO3), total calcium and total magnesium in samples at ERA CABIN sites between 2012 and 2023. Note that Lizard Creek sites have levels higher than the other monitored sites. All these parameters are likely a reflection of the limestone-based geology in the region and an increased groundwater influence at Lizard Creek.

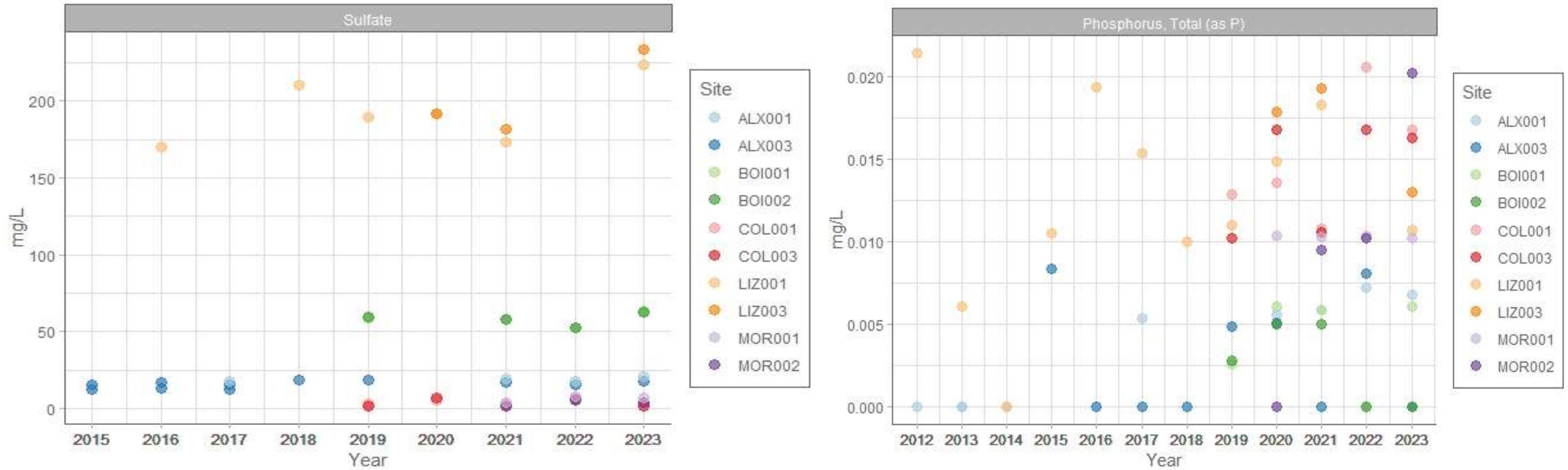


Figure 23. Total phosphorus (as P) and total sulfate at ERA CABIN sites between 2012 and 2023. Lizard Creek consistently has higher values within these parameters across years. Phosphorus levels below detection were assumed to be zero to control for different detection limits over different years.

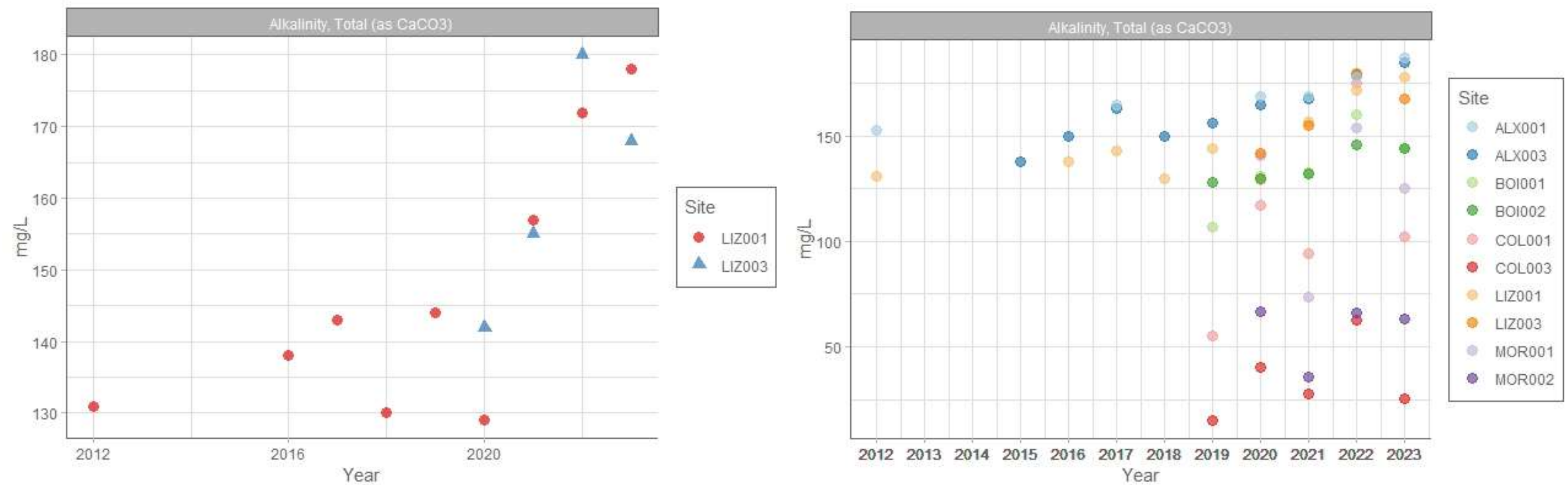
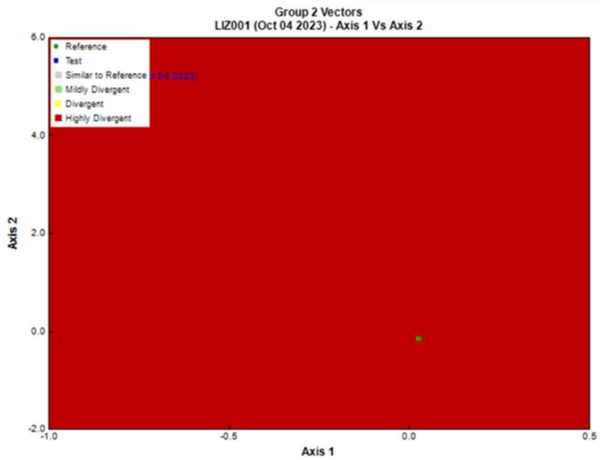


Figure 24. Total alkalinity (as CaCO3) over time. The plot on the left focuses on the Lizard Creek sites, while the graph on the right allows for comparison across sites. Although alkalinity is usually a result of the local geology, this analyte appears to be increasing over time.



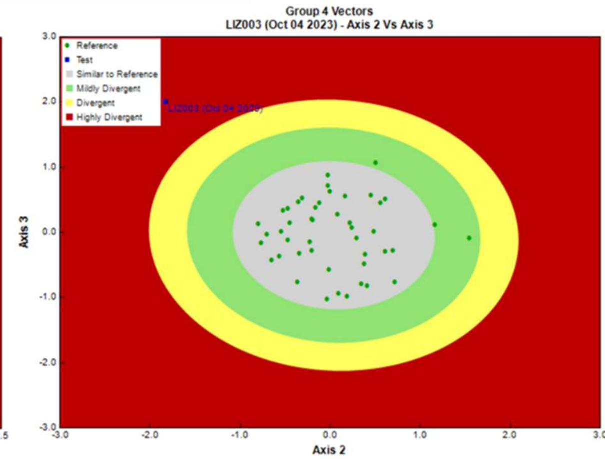


Figure 25. CABIN community ellipses for LIZ001 and LIZ003, respectively, in 2023. Note that in the LIZ001 diagram, the site is divergent to the point where the ellipses is the green dot in the bottom right of the diagram, while the point representing LIZ001 is to the top left, partially covered by the diagram's legend.

Alexander Creek

Both the upstream (ALX003) and downstream (ALX001) sites showed a move away from reference condition, becoming mildly divergent in 2023 according to CABIN analysis (Figure 26). Despite these changes, water chemistry variables remained consistent with good health, with all measurements for both sites meeting the BC guidelines for the protection of aquatic life. There have been no consistent trends in dissolved oxygen, pH, conductivity, turbidity, or temperature (see the Water Quality Trends section below). However, trends cannot reliably be determined by "snapshot" sampling. ERA has now implemented a network of real-time discharge and temperature monitoring in CABIN streams, which will allow for better monitoring.

Prior to 2023, CABIN results from Alexander Creek sites have been relatively consistent over time, generally remaining in reference condition, however ALX001 was found to be highly divergent in 2012 and divergent in 2017. Further statistical testing (Bray-Curtis, RIVPACS, % EPT) indicates that sites on Alexander Creek were similar to reference sites in taxa diversity, although ALX003 exhibited slightly lower species richness (Bray-Curtis: 0.69). With both Alexander Creek sites showing a departure from reference condition, the ERA will continue to monitor ALX001 and ALX003 to confirm CABIN results and explore if this divergence is part of a trend or instead related to an intermittent disturbance. If the sites continue to diverge from reference sites, ERA will seek to investigate further, as there were no major land-use changes to the stream area in 2023, and declining conditions are not expected.

Alexander Creek runs alongside the Crowsnest highway for about 4 kilometers, is crossed by the CP Rail mainline, and passes a gun range and local logging roads. Fluctuations in CABIN assessment may result from intermittent disturbances caused by the use of these areas, combined with events such as runoff from heavy or prolonged rain causing erosion of disturbed 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.

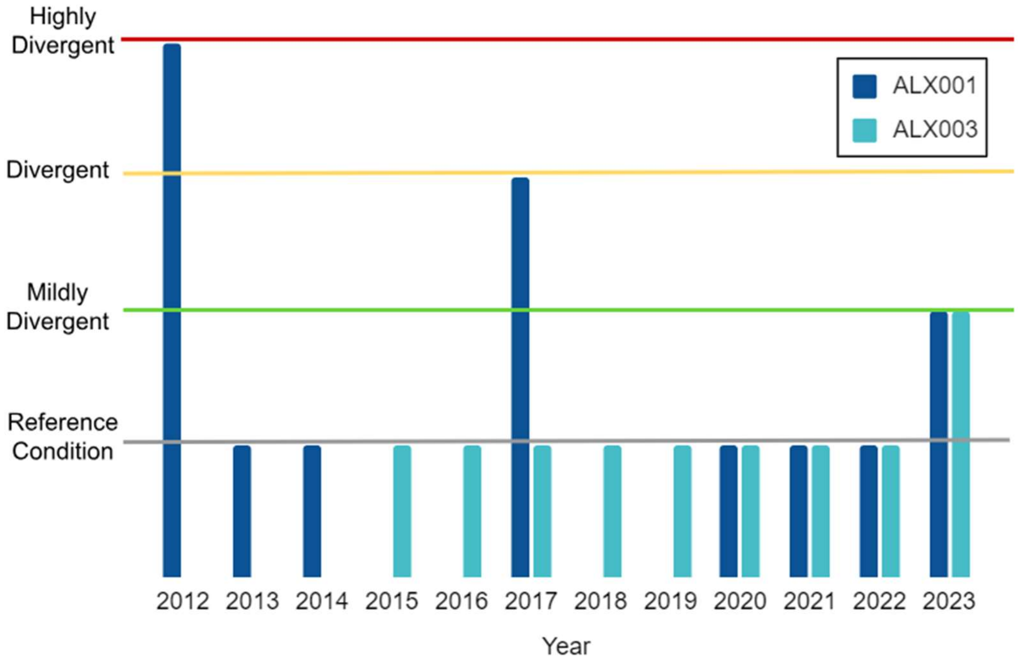


Figure 26. CABIN analysis results for Alexander Creek sites from 2012 - 2023. Both sites experienced a decline in condition, going from reference condition to mildly divergent in 2023. Continued monitoring will allow ERA to assess if this is a developing pattern.

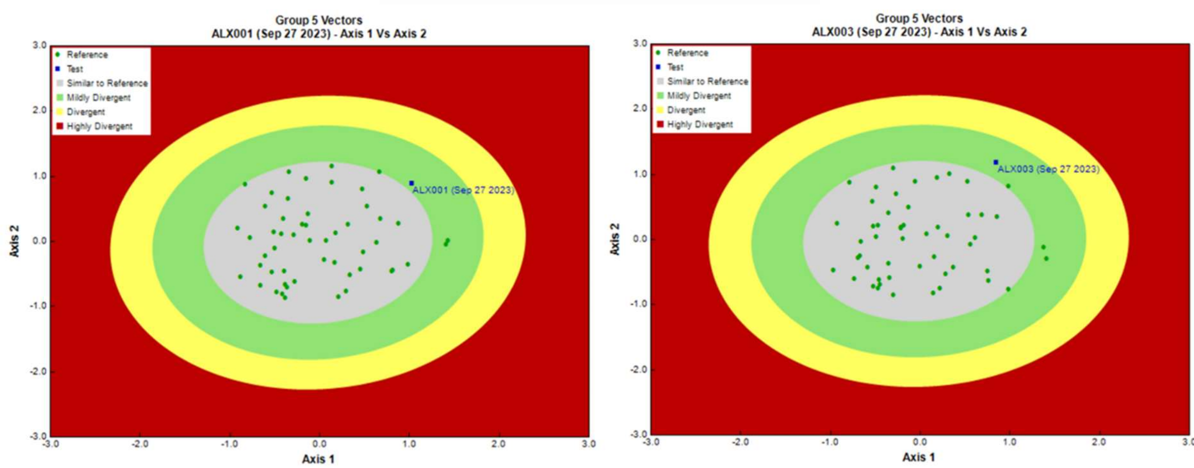


Figure 27. CABIN community ellipses for Alexander Creek sites (ALX001 & ALX003) in 2023, showing both sites have become "mildly divergent".

Boivin Creek

In the five years (2019 to 2023) of monitoring on Boivin Creek, sites have remained in relatively good, stable condition (Figure 28). 2023 CABIN analysis showed that both Boivin Creek sites were in similar condition to their associated reference sites. The shift to a "mildly divergent" condition seen in 2021 at the lower Boivin Creek site (BOI001) was likely a result of the natural variability of benthic invertebrate communities, or a smaller disturbance. Further analysis of metrics associated with benthic invertebrate community structure suggested that in 2021, BOI001 may have been experiencing a slightly lower species richness (RIVPACS) which could have contributed to this assessment. While there have been some fluctuations in monitoring results year to year for both BOI001 and BOI002, species richness and diversity metrics such as RIVPACS, Bray-Curtis and %EPT continue to remain relatively steady, other than BOI002 exhibiting a lower RIVPACS value (0.85) in 2023, which may impact results if it continues in future years (Table 1).

ERA began monitoring this site to assess the impacts of artificial riprap that stretches along large sections of the creek as it passes through Elkford. CABIN results at the lower site (BOI001) with rip rap present and at the upstream site (BOI002) with no rip rap both show that the creek is similar to comparable reference sites to date. Since monitoring began after the rip rap was installed, it is unclear how the rip rap may have altered the downstream site (BOI001). Continued monitoring efforts, including implementation of real-time monitoring of discharge and temperature 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.

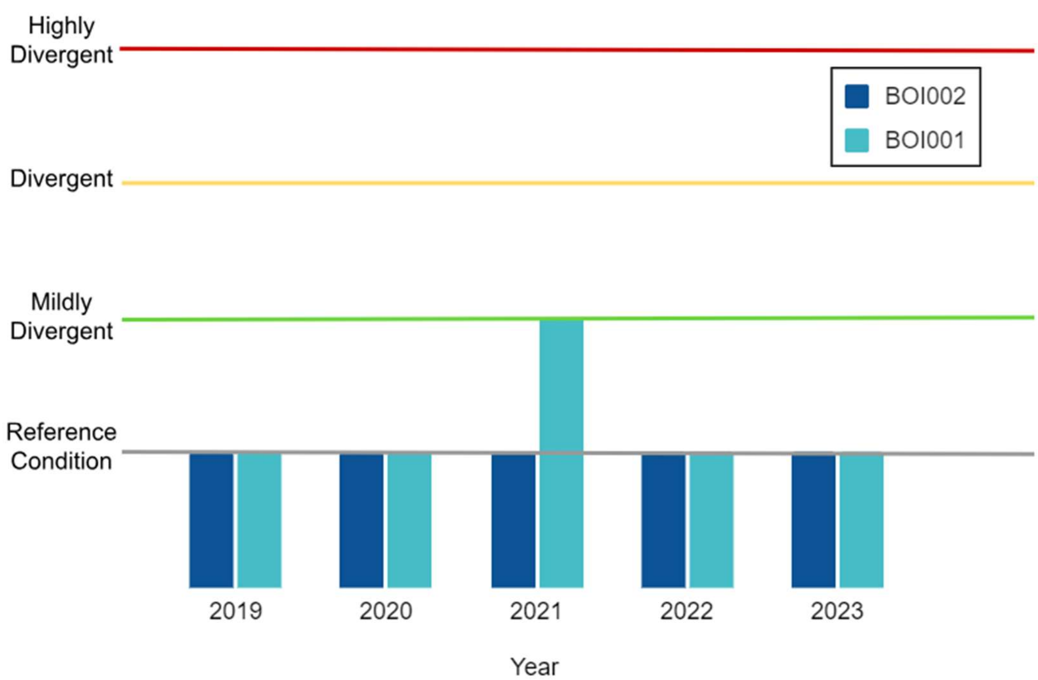
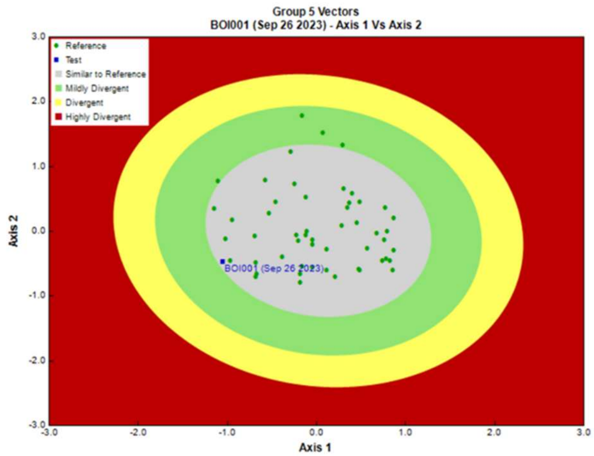


Figure 28. CABIN results for Boivin Creek sites in 2019 - 2023. The upstream (BOI002) site has remained in a similar state to reference condition, while the downstream site (BOI001) has experienced some fluctuation in state. Continued monitoring will allow for ERA to assess any developing patterns.



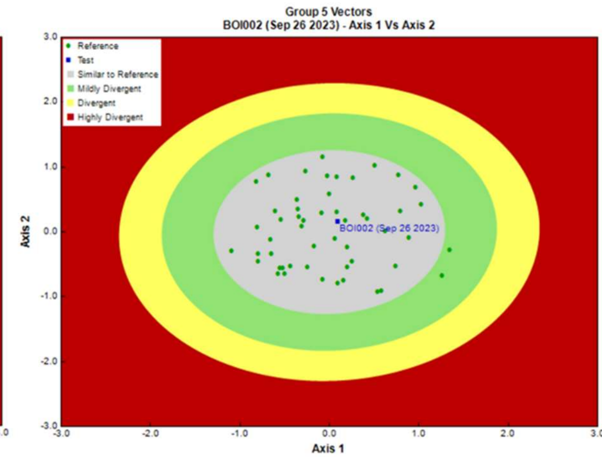


Figure 29. CABIN community ellipses for Boivin Creek sites (BOI001, BOI002) in 2023, showing both sites to be "similar to reference".

Coal Creek

Coal Creek was added to the CABIN assessments in 2019. Results indicate the creek is divergent from reference condition, with more dramatic results seen at the site near the mouth (COL001) (Figure 30). According to additional analyses, the lower site of Coal Creek (COL001) exhibited species diversity diverging from reference sites (Bray-Curtis: 0.88), and COL003 had low taxa richness when compared with reference sites (RIVPACS) (Table 1). Total abundance of individuals was much higher than expected for the lower Coal Creek site (more than 7,000 above what would be expected based on CABIN reference sites) which may push results to a more divergent classification, although total abundance was less than in 2022.

Further analyses revealed low numbers of EPT individuals (generally sensitive to pollutants and their abundance is considered an indicator of good health) compared with Diptera and non-insects (generally pollutant-tolerant) - 44% of the benthic invertebrates sampled at COL001 were EPT individuals while 56% belonged to Diptera or non-insect groups, and COL003 having 51% EPT and 49% Diptera and non-insects.

All measured water quality variables met BC guidelines for the protection of aquatic life. The Coal Creek sites were established too recently to enable comparison of water quality results over time. Furthermore, as noted for the other creeks in the CABIN program, one-time sampling for water quality is not sufficient for indicating true trends.

The COL001 site is downstream of historic mining sites, a decommissioned landfill, cattle grazing, recreational ATV trails, and current clear-cut logging practices. The final kilometer stretch flows through a portion of Fernie before arriving at the sampling site. This urban portion of Coal Creek is confined by riprap and concrete armoring along the sides of the channel. Recreational use of the lower portion of the creek sometimes includes the construction of weirs in the streambed with large rocks and cobble to create swimming or wading areas. There have also been increasing anecdotal observations of algal growth in the lower regions of Coal Creek, which may warrant further investigation into stream nutrient levels.

The highly divergent results for the COL001 site are not unexpected, given the multiple historic and current stressors in the catchment. Benthic invertebrates integrate the effects of these multiple stressors, particularly flow, turbidity, and temperature, but may also be responding to short and long-term changes in water quality parameters such as nutrients. The consistent categorization of COL001 as "highly divergent" from reference condition over the four years it has been monitored, along with the list of known stressors affecting this stream, give ERA confidence in these results.

ERA will continue to monitor COL001 and COL003 to confirm CABIN results and acquire sufficient data to begin to evaluate trends. Although COL003 returned to being classified as "mildly divergent" in 2023, if the 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.

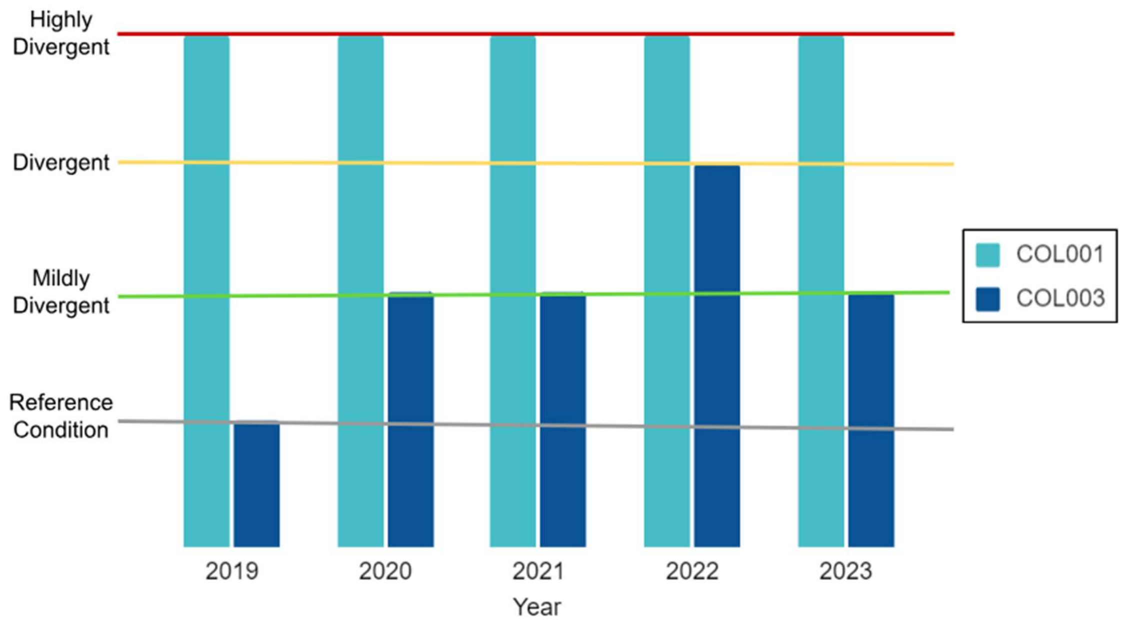


Figure 30. CABIN results for Coal Creek sites in 2019 – 2023.

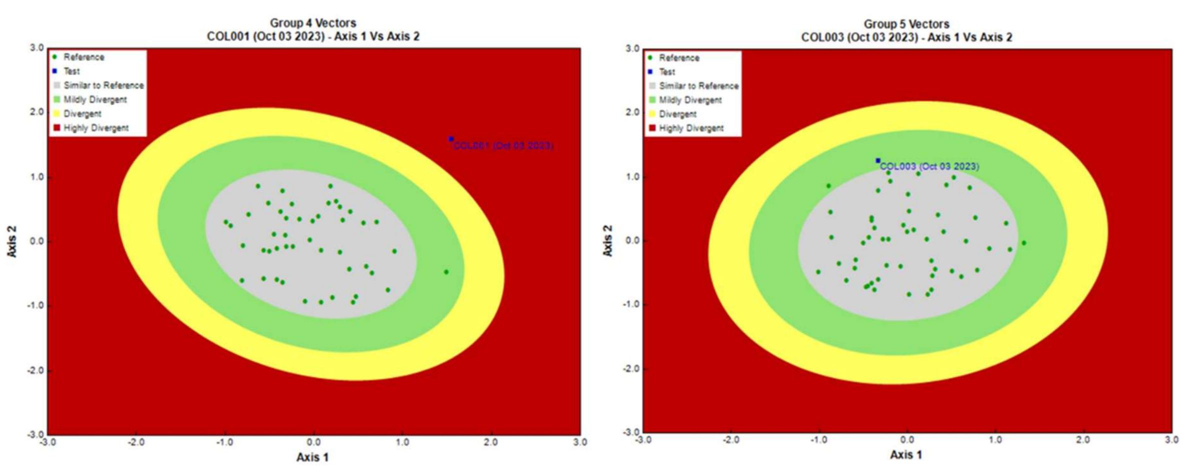


Figure 31. 2023 CABIN analysis community ellipses for Coal Creek sites, showing COL001 highly divergent from reference condition (left) and COL003 mildly divergent from reference condition (right).

Morrissey Creek

2023 was the fourth year of CABIN assessments for Morrissey Creek. The upstream site, MOR002, maintained its 2022 shift to “mildly divergent”, while the downstream site, MOR001, remained highly divergent (Figure 32). Although the RIVPACS ratio suggests both Morrisey sites were in good condition, the Bray-Curtis scores (MOR001: 0.70, MOR002: 0.90) indicate the taxa diversity at both sites was low. As in 2022, EPT values for MOR001 remained significantly lower this year than in 2021 (54% compared to 86% in 2021) (Table 1). Like all sites in 2023, both Morrissey Creek sites also had very high total individual abundance numbers (13,360.00 compared to a mean reference site abundance of 1449.38 ± 859.74 for MOR001).

While there were no exceedances of BC Water Quality Guidelines, some water quality parameters showed a sudden increase at one or both Morrisey sites in 2023, which may be related to the TC Energy Pipeline work that was ongoing in the area throughout 2023. Parameters impacted included total aluminum, total ammonia (as N), chloride, manganese, total phosphorus (as P) total titanium and turbidity. Turbidity values showed the most radical jump, with values going from consistently below 1 NTU prior to 2023, to 11.85 NTU (MOR002) and 44 NTU (MOR001) in 2023 (Figure 38). The Morrissey Creek sites were established too recently to enable any valuable comparison of water quality results over time, but the ERA will continue to observe these parameters following TC Energy pipeline construction completion in 2024. Furthermore, as noted for the other creeks in the CABIN program, one-time sampling for water quality is not sufficient for indicating trends. Morrissey Creek is part of ERA’s continuous temperature and discharge monitoring network, which is continuing to be implemented.

Morrissey Creek originates from a geographically similar location to Coal Creek, with similar historical logging in the upstream reaches. MOR001 is downstream of active logging roads, ATV trails, cattle grazing, and an active farming area. Previously, MOR002 was above most potential disturbance, but has been exposed to significant disturbance through the construction of the TC Energy pipeline starting late 2022, with the bulk of work occurring during 2023. Pipeline work caused significant traffic and construction on roadways and bridges directly upstream of the MOR002 location and MOR001 to a much lesser extent. Pipeline and roadway construction has been completed at the time of writing this report, and clean-up and monitoring is underway. Results in 2023 do not show significant changes to the benthic invertebrate community at MOR002 (other than the maintained decrease in *Trichoptera,* leaving *Ephemeroptera* and *Plecoptera* to dominate the EPT portion of individuals in the stream). The total abundance of individuals sampled at MOR002 has continued to increase between years and has now surpassed the range of the associated reference mean (Table 1).

The downstream sites in both Coal and Morrissey Creeks have multiple land use-related stressors in their catchments. Therefore, divergence from reference condition is not unexpected in either. Continued monitoring over time should begin to reveal patterns in site characteristics that may help identify the cause of these results. Further investigation, outside of CABIN monitoring, will be needed in future to fully understand the dynamics of this stream and the stressors affecting it.

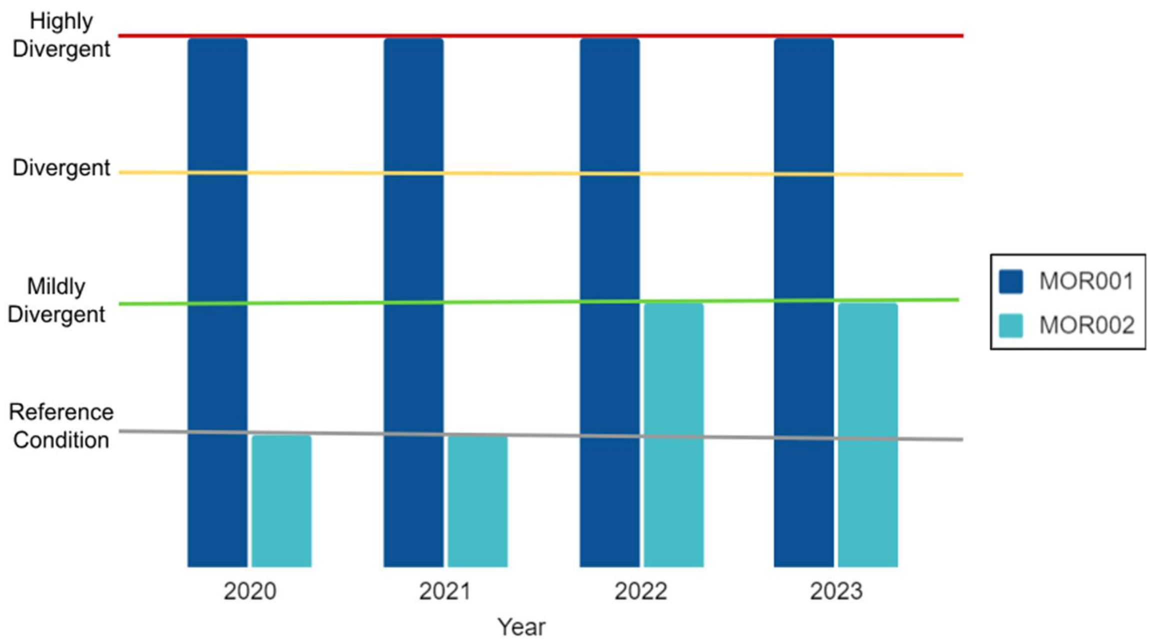


Figure 32. Results of CABIN assessment for Morrissey Creek sites in 2020-2023. This year, MOR001 was again classified as "highly divergent" while MOR002 was again classified as "mildly divergent."

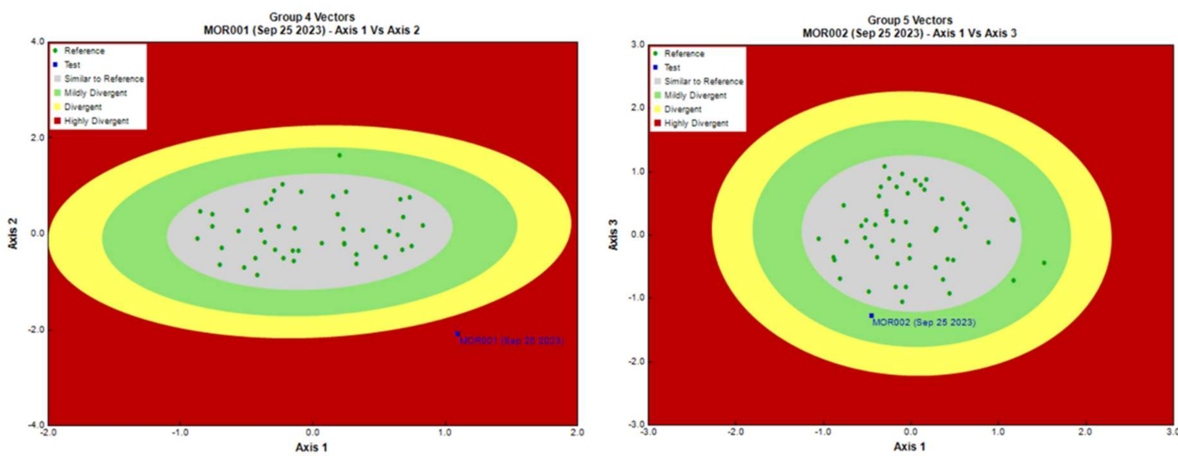


Figure 33. 2023 CABIN analysis community ellipses for the Morrissey Creek sites, showing MOR001 significantly diverging from reference condition (left) and MOR002 beginning to diverge from reference condition (right).

Benthic Macroinvertebrate Communities

CABIN assessments assign test sites a condition based on the structure of the benthic macroinvertebrate community. Figure 34 shows the general diversity in each CABIN test stream, based on the proportion of individuals belonging to each taxonomic order. Sites with a higher proportion of EPT (pollution sensitive taxa) coincide with those deemed less divergent from reference condition through CABIN assessments, and sites with the lowest proportion of EPT are those that have been assessed as the most divergent. Of the sites assessed as most divergent, LIZ001 and COL001, have significantly smaller proportions of pollution-sensitive individuals, as well as higher numbers Tubifida (an order of pollution-tolerant worms).

The exceptions are the upper Lizard Creek site (LIZ003) and the lower Morrissey Creek site (MOR001), which were assessed as “Highly Divergent”, yet a majority of the taxa present are part of the pollution sensitive group (EPT). In past years, MOR002 has exhibited much lower proportions of EPT individuals, similar to the LIZ001 and COL001 sites, so the shift towards pollution-sensitive taxa is unexpected. It is also worth noting that despite the upper Coal Creek site (COL003) has been assessed as being only mildly divergent, there was a marked decrease in the proportion of EPT taxa for 2023. Different levels of species-specific sensitivity are seen within these EPT groups, with some exhibiting higher tolerances and even thriving in certain disturbed environments (Houghtona, 2004). It is unclear what might have caused these changes in proportions in 2023, and further exploration is needed to fully understand these results.

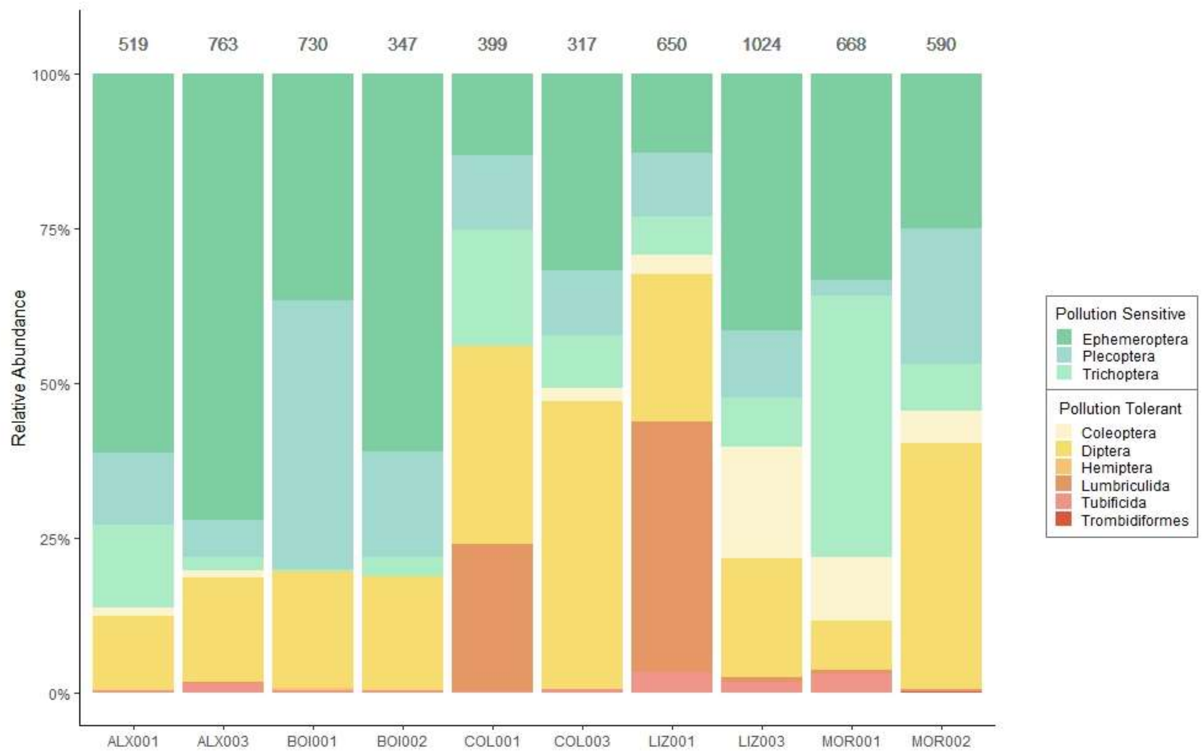


Figure 34. Graph representing the proportions of different taxonomic orders of benthic macroinvertebrates at each CABIN site. The three cool-coloured bars (greens, blues) represent pollution-sensitive taxa (Ephemeroptera, Plecoptera, Trichoptera), while the warm-coloured bars (red, orange, yellow) represent more pollution-tolerant taxa. Higher % EPT is generally considered to equate to healthier streams. The numbers along the top of the graph are the raw counts of all benthic macroinvertebrate individuals found at each site.

Table 1 takes a closer look at these results within benthic communities at each CABIN site using RIVPACS, Bray-Curtis Dissimilarity, %EPT and total abundance. The highlighted cells indicate values that differ significantly (i.e. 2 x standard deviation from the mean) from what is expected from a site in “reference condition”.

Table 1. A comparison of CABIN sites, their classification according to 2023 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 reference site in good condition.

Stream Name	Site ID	CABIN Analysis	RIVPACS O:E (P>0.5)	Bray-Curtis Dissimilarity*	% EPT	Total Abundance
Alexander Creek	ALX001	Mildly Divergent	1.13	0.64[a]	86.32[a]	10,380.00[a]
	ALX003	Mildly Divergent	1.04	0.69[a]	80.29[a]	15,260.00[a]
Boivin Creek	BOI001	Reference	1.06	0.61[a]	80.52[a]	14,600.00[a]
	BOI002	Reference	0.85	0.34[a]	81.27[a]	4,337.00[a]
Coal Creek	COL001	Highly Divergent	0.93	0.88[b]	43.97[b]	7,980.00[b]
	COL003	Mildly Divergent	0.87	0.60[a]	50.79[a]	6,340.00[a]
Lizard Creek	LIZ001	Highly Divergent	1.05	0.96[c]	28.79[c]	13,000.00[c]
	LIZ003	Highly Divergent	1.05	0.92[b]	60.16[b]	20,480.00[b]
Morrissey Creek	MOR001	Highly Divergent	0.89	0.70[b]	78.38[b]	13,360.00[b]
	MOR002	Mildly Divergent	0.96	0.90[a]	54.39[a]	11,800.00[a]
	Reference Mean			(a) 0.40 ±0.14 (b) 0.34 ±0.10 (c) 0.34 ±0.10	(a) 89.20 ±10.03 (b) 91.94 ±7.29 (c) 88.13 ±9.26	(a) 4,661.00 ±3,118.98 (b) 1,449.38 ±859.74 (c) 1,083.09 ±932.35

* 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 information regarding species richness at each site.

ERA's inclusion of STREAM e-DNA monitoring allowed for the identification of *Tubifex tubifex,* one of the two host species necessary for the presence of whirling disease, caused by the *Myxobolus cerebralis* parasite at ERA CABIN monitoring sites, leading to the creation of ERA's Whirling Disease Education and Monitoring program.

Tubifex tubifex was identified in Alexander, Coal and Lizard Creek in 2023. *Tubifex tubifex* was identified at Alexander, Coal and Lizard Creek in 2023, and has been identified at Morrissey, Lizard and Boivin Creeks in previous years, meaning that each of the five monitored creeks has had its presence confirmed at some point in time. In December of 2023, the first case of whirling disease in British Columbia was confirmed in Yoho National Park, part of the Columbia River Watershed (Canadian Food Inspection Agency, 2024). More recently, the presence of whirling disease was confirmed in the southern arm of Kootenay Lake in December of 2024 (Ministry of Water, Land and Resource Stewardship, 2024).

The Columbia River watershed has been declared an "infected" area and the rest of British Columbia has been classified as a "buffer" zone, meaning disease may occur due to links with infected areas (Canadian Food Inspection Agency, 2024). With whirling disease already widespread in the neighbouring parts of Alberta, including the Oldman watershed which borders the Elk River watershed (Veillard and James, 2020), the Elk River watershed is now a high-risk area for a whirling disease outbreak. The initial identification of this species at Boivin Creek led to the creation of a new ERA program, the 'Elk Valley Whirling Disease Project', an outreach and monitoring initiative within the Elk Valley to identify potentially high-risk locations for future spread and educate the community and visitors to prevent the introduction of this disease.

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

Water Quality Trends

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

pH

PH levels at all sites have been relatively 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 (B.C. Ministry of Environment and Climate Change Strategy, 2021a). 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 changes to the species composition of the stream can occur (B.C. Ministry of Environment and Climate Change Strategy, 2021a).

In 2022, Boivin Creek (BOI001, BOI002) sites had a noticeably lower pH value than the other CABIN monitoring locations. This drop in pH in Boivin Creek remains exclusive to 2022 results. Further years of monitoring are necessary to begin to decipher between natural variation and patterns indicative of disturbance or permanent changes to aquatic habitats. Similarly, results appear to suggest a pattern of increasing pH over time at the upper Coal Creek site (COL003), although this site exhibited noticeably lower pH than other CABIN locations in 2023.

There is not yet enough year-to-year data to draw any concrete conclusions and ERA will continue to monitor for any potential patterns through yearly CABIN sampling.

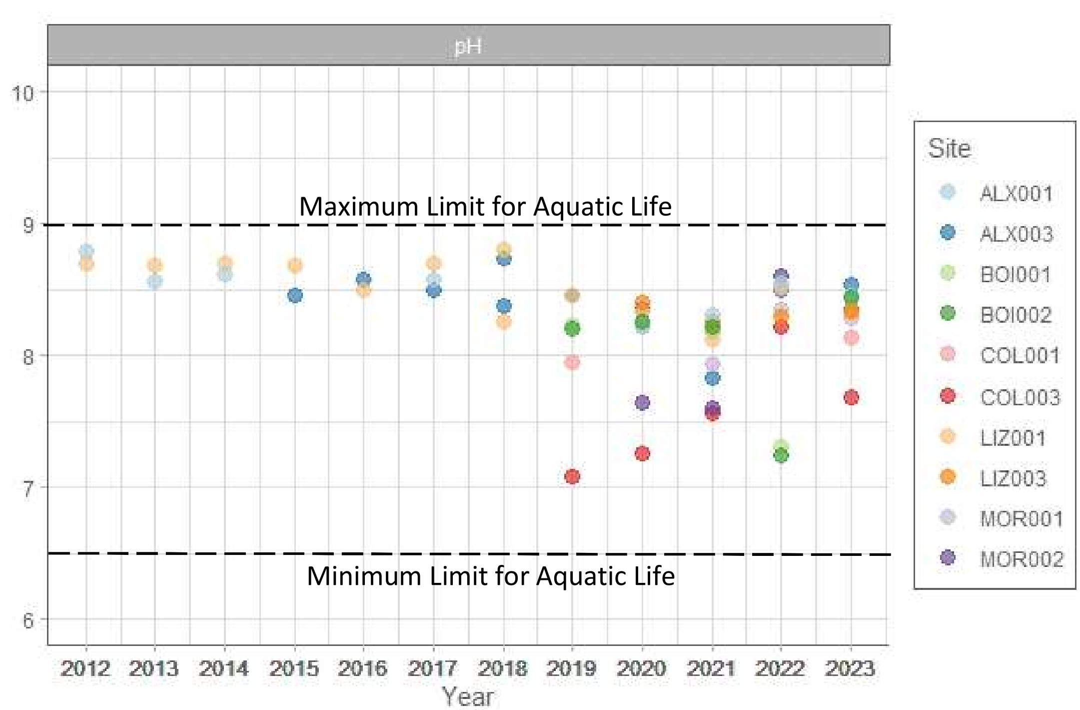


Figure 35. pH values for CABIN sites from 2012-2023. All sites remain within the range of limits outlined within the BC Water Quality Guidelines.

Temperature

In light of the potential effects of climate change on the Elk River system and key species such as Westslope cutthroat trout (WCT), understanding long-term temperature trends is a priority for ERA. 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), with WCT beginning to experience thermal stress around 20-25°C and acute mortality in water temperatures above 25°C.

Temperatures measured during CABIN monitoring varied considerably between sampling years at all sites (Figure 36). However, this can be attributed to natural climatic variability and sampling date. 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, and a single annual measurement is insufficient to understand long term trends. Temperatures remained within the critical limit for important local species like the WCT and bull trout (DFO, 2017).

In depth analysis of temperature is only possible with ongoing, frequent monitoring using instream logging equipment. To this end, as part of its broader monitoring program, ERA has developed a separate hydrometric monitoring program to examine stream temperature throughout the Elk Valley in more detail.

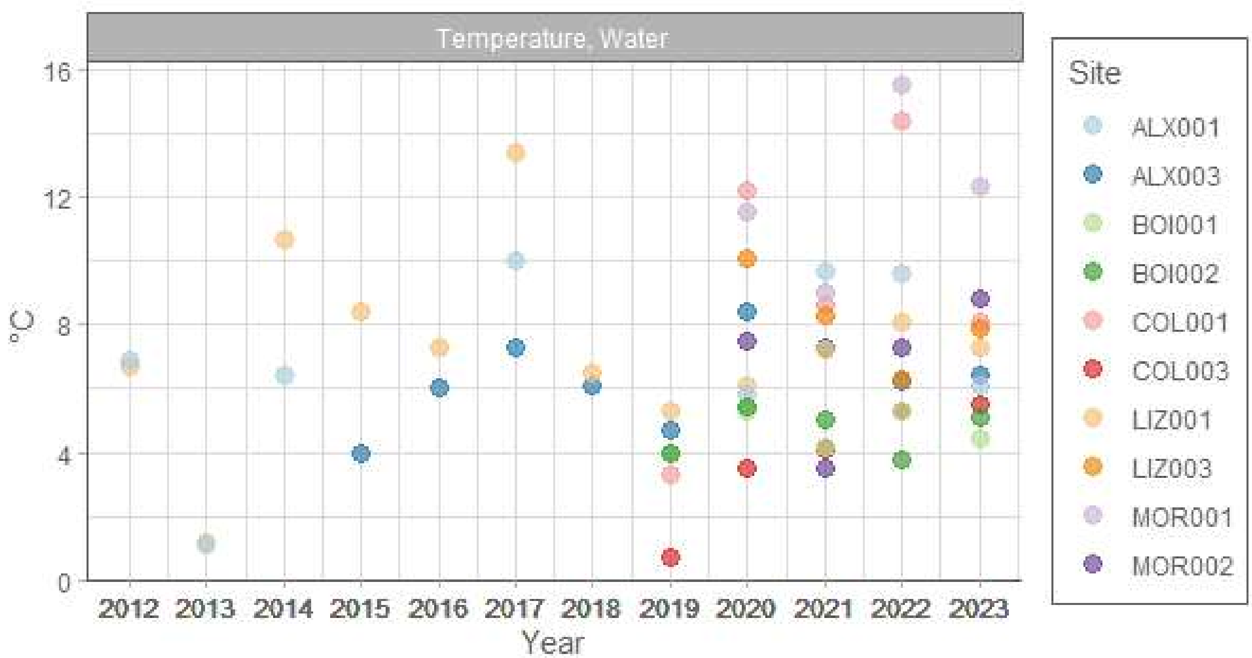


Figure 36. September water temperature values for CABIN sites from 2012-2023.

Dissolved Oxygen

The concentration of dissolved oxygen (DO) at all CABIN sites has remained stable over time and is consistently above the BC Water Quality Guideline long-term minimum level of 8 mg/L (Figure 37) (British Columbia Ministry of Environment and Climate Change Strategy, 2021). Dissolved oxygen measurements are more consistent across sites since 2021, this is likely due to the use of new, more accurate equipment (YSI ProDSS). This consistency amongst these measurements is expected to be observed in future.

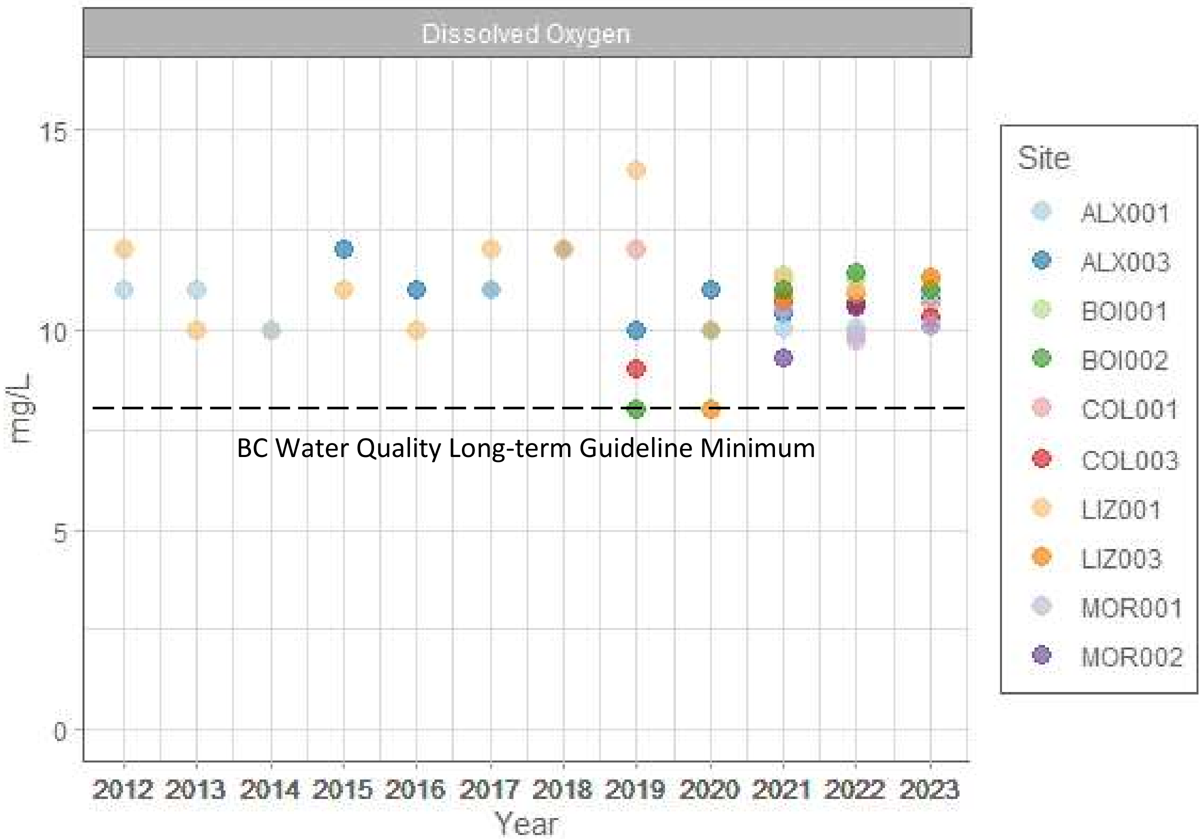


Figure 37. The amount of dissolved oxygen at CABIN sites in mg/L from 2012-2023. Site values do not fall below the BC water Quality Long-term Guideline minimum for Freshwater Aquatic Life (8 mg/L).

Turbidity

Canadian Water Quality guidelines suggest that environmental samples vary within the normal range of 1 to 1000 NTU. High turbidity has been shown to negatively affect fish and turbidity levels as low as 25 NTU can impact fish growth (Canadian Council of Ministers of the Environment, 1999). Since 2012, CABIN site turbidity readings have remained below 4 NTU, with most readings below 2 NTU.

ERA staff and community observations indicate all tributaries in the Elk River watershed experience significant turbidity spikes during rainfall events and spring freshet. However, all monitored creeks tend to have low turbidity readings during low-flow conditions, with turbidity spikes generally being indicative of upstream disturbance coupled with high rainfall/snowmelt events, particularly during the May-July freshet. In 2023, turbidity readings in Morrissey Creek (MOR001: 11.89 NTU, MOR002: 44 NTU) were noticeably higher than in past years and higher than the turbidity readings of all other creeks. The turbid conditions in Morrisey Creek in 2023 are likely related to the significant traffic and construction on roads and bridges directly upstream of sampling locations as part of the TC Energy Pipeline project, which was ongoing at the time of sampling. This impact is especially apparent for the upper Morrissey (MOR002) site.

According to the BC Water Quality Guidelines, turbidity is 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). Annual single occurrence sampling is not sufficient to detect these changes. In 2023, ERA began phase 2 of its Sedimentation program, working with Ed Clayton, a PhD candidate from the University of Auckland, to explore the use of a low-cost sensor that hopes to enable continuous turbidity measurements throughout the year in Lizard Creek. Phase 2 of this sediment exploration is ongoing.

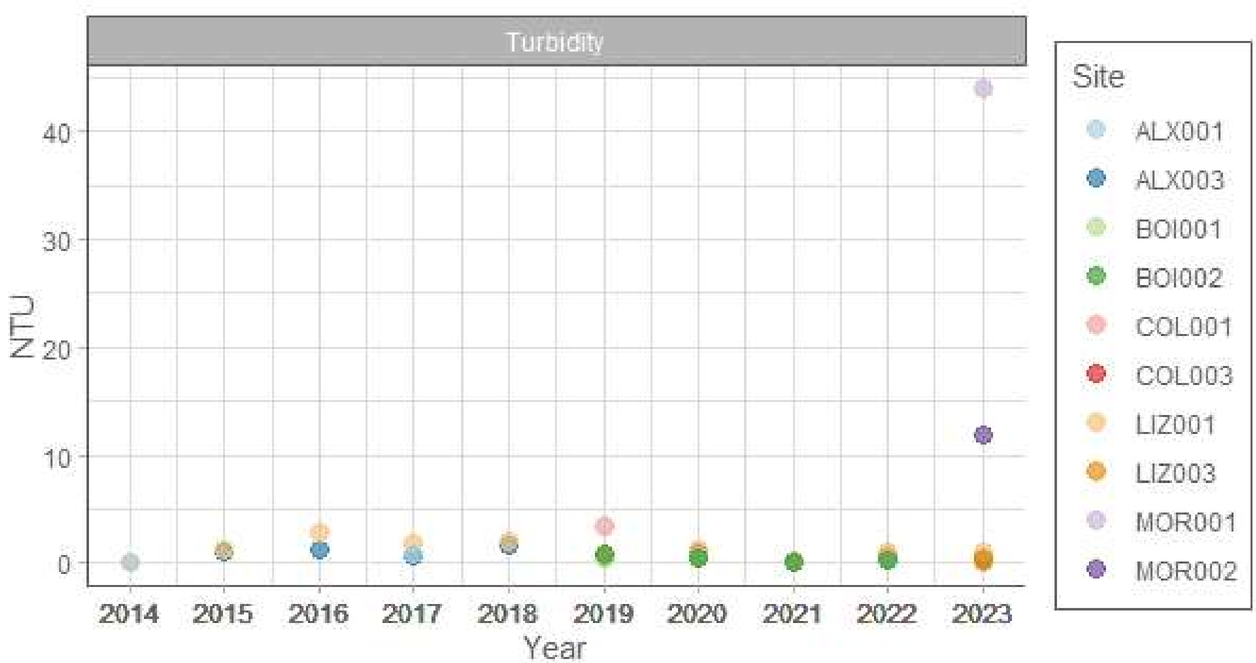


Figure 38. The turbidity (NTU) measured at CABIN sites from 2014-2023.

Conductivity

In general, conductivity levels for a freshwater river system range between 0 and 1000 uS/cm – conductivity levels above this are usually indicative of a saltwater system. Although all monitored sites fall within this range, the Lizard Creek sites have significantly higher conductivity levels than the other sites, likely due to high groundwater influence at this stream. This plot also shows a steep decrease in conductivity levels at LIZ001 between 2013 and 2014, followed by levels more than doubling in 2016. Although conductivity levels can fluctuate, the large change may have been a result of some added stressor.

Figure 39. Conductivity levels measured at CABIN sites from 2012-2023.

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 (Figure 40). Discharge measurements at all sites remained relatively stable, fluctuating within site-specific ranges between years.

Like other measured parameters, discharge can fluctuate from day to day (and within the day). A single annual measurement is not sufficient to detect long term trends. In depth analysis of discharge is only possible with ongoing, frequent monitoring (e.g. hourly logging). To address this, ERA has begun implementing a hydrometric monitoring program to examine discharge in more detail.

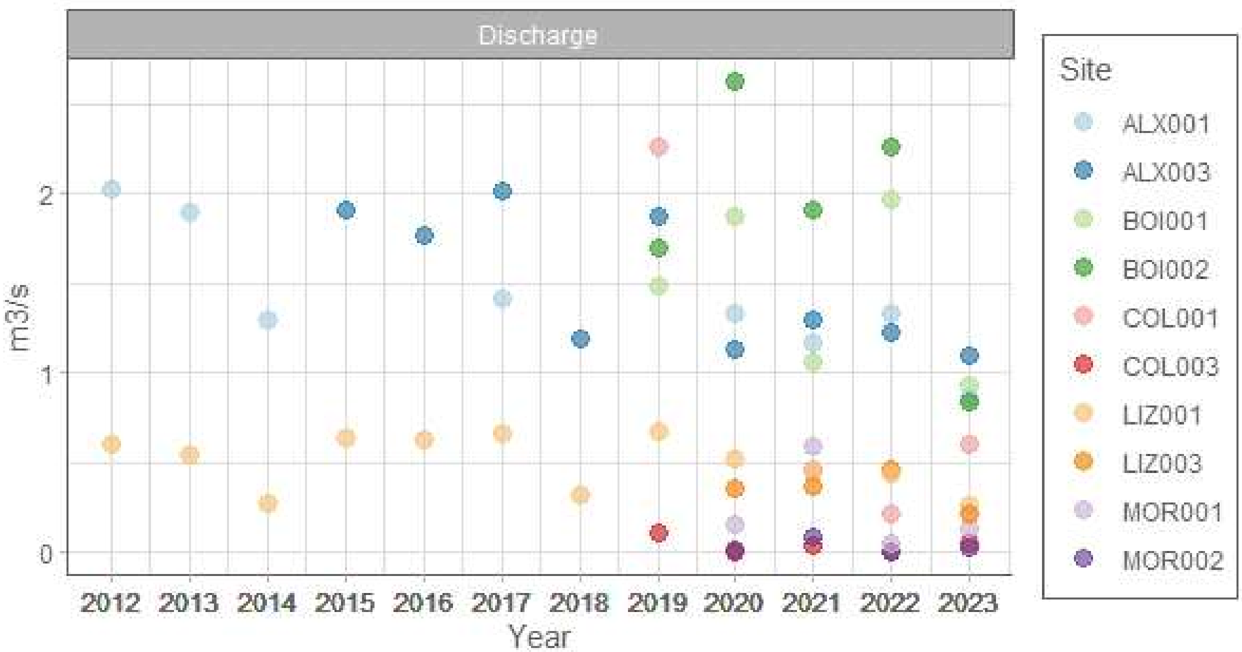


Figure 40. Discharge measurements calculated for CABIN sites from 2012- 2023.

Metals & Nutrients

Water chemistry data collected during the 2023 sampling period indicates there were no exceedances in metals or nutrients based on BC Water Quality Guidelines and no notable overall trends were observed.

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 constituents of serious concern in this region. At the time of this report, the International Joint Commission is beginning to look into the transboundary effects of selenium and potential impacts to downstream cross-boundary watersheds, which speaks to the scale of concern surrounding selenium and the importance of monitoring efforts.

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 (selenate), 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 0.002 mg/L (milligrams/litre). The BC human drinking water consumption guideline is 0.01 mg/L (British Columbia Ministry of Environment and Climate Change Strategy, 2021). It is worth noting that selenium bioavailability is impacted by the form of selenium. Selenate is less prone to bioaccumulation in fish, but upon uptake by plants, algae, or microbes, selenate can be converted to selenite. Selenite is more likely to be bioaccumulated and turn into organoselenium, increasing toxicity potential (Arnold, 2015; ADEPT Environmental Sciences Ltd., Samuel N Luoma, and TKB Ecosystem Health Services Ltd., 2022; Foster *et al.*, 2024). These different forms of selenium can also impact how, and how fast selenium moves through a watershed. These different forms of selenium can also impact how, and how fast selenium moves through a watershed.

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). CABIN 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.

Tributary catchments assessed with ERA's CABIN program are not affected by contemporary mining activities and are not expected to exhibit associated contaminant issues. Selenium concentrations at the CABIN sites do not exceed reference levels and remain below the water quality guideline for freshwater aquatic life (Figure 41) (British Columbia Ministry of Environment and Climate Change Strategy, 2021). For comparison, Figure 42 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 CABIN assessed tributaries in 2020. 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.

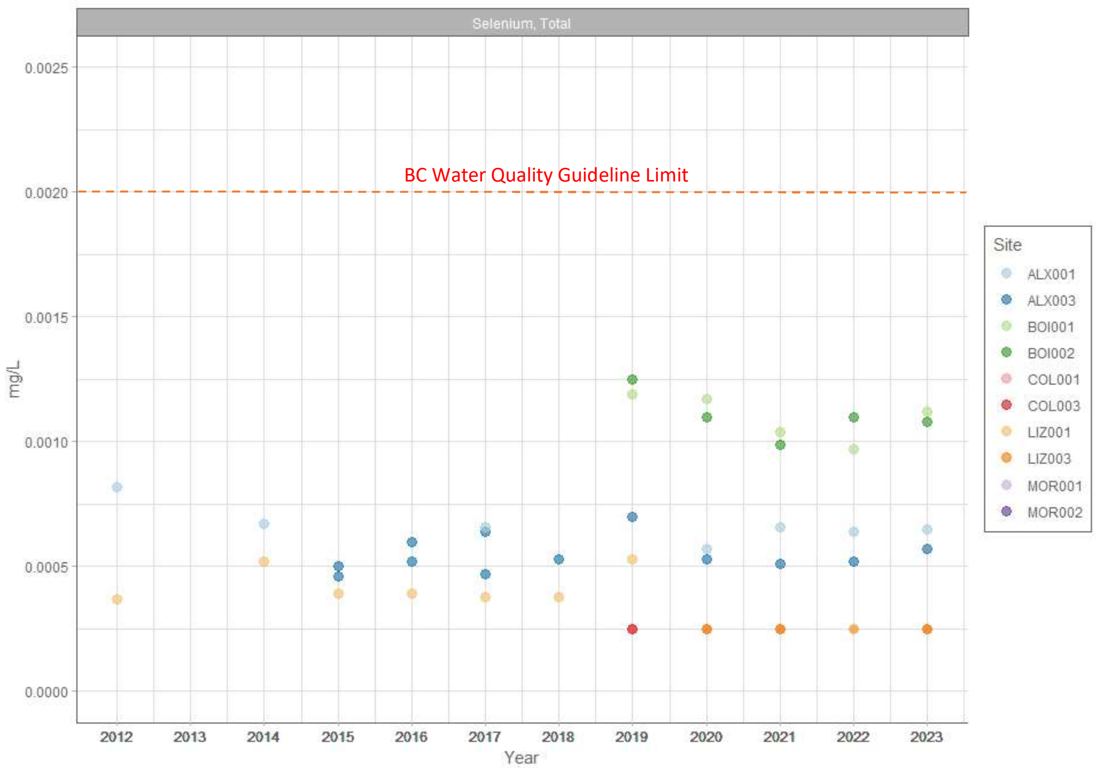


Figure 41. Total selenium concentrations at CABIN sites from 2012 to 2023. All concentrations are well below the BC water quality guideline of 0.002 mg/L (2µg/L).

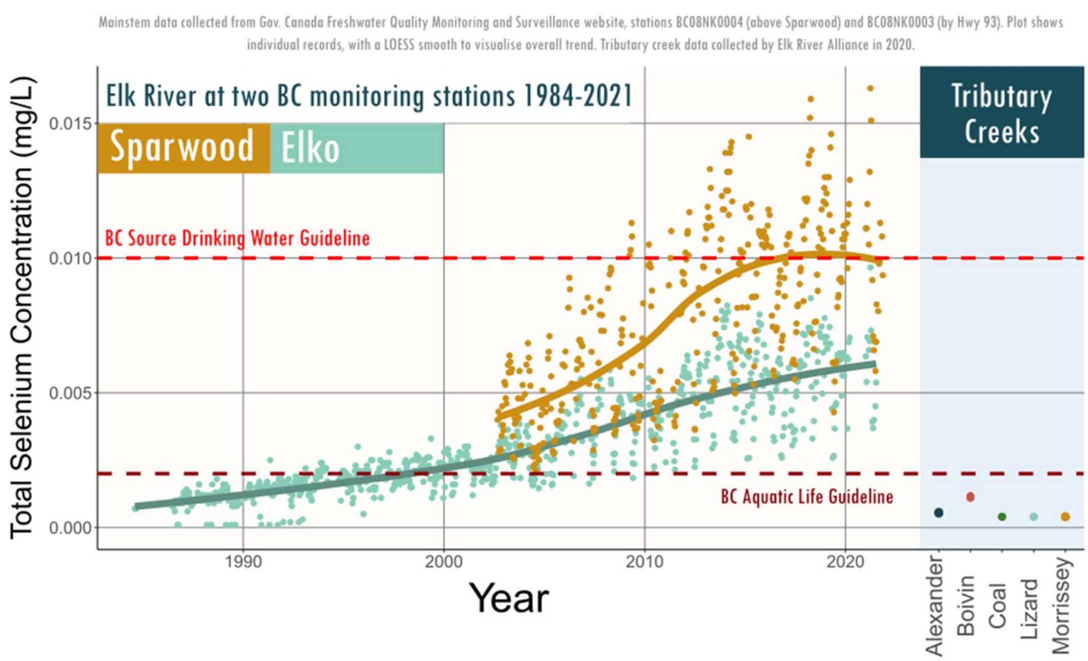


Figure 42. Total selenium in the Elk River mainstem at the outflow to Lake Koocanusa. Approximate concentrations at CABIN tributaries are included to the right and coincides with Elk River concentrations in the 1990s.

Study Limitations

A breakdown of some of the potential limitations for the 2023 CABIN 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	Staff members performing site assessments are trained in CABIN protocols through the Canadian Rivers Institute, ECCC and/or Living Lakes Canada. Individuals in these teams have varying levels of experience practicing CABIN protocols, however field teams are led by a more experienced ERA staff member certified in CABIN protocol. Tasks such as kicking are only completed by certified staff.
Timing / weather / seasonality	No	All monitoring is completed during low flow conditions, typically between August and November. Site visits are rescheduled if weather is not conducive to CABIN sampling (i.e. heavy rains that may change stream flow or benthic invertebrate communities).
CABIN Model	Maybe	In 2020 a new CABIN model was produced for the Columbia Basin which when applied to ERA sites, yielded substantially different results than with the previous model. ERA is currently investigating these issues to explore whether they are a result of unknown stressors on the aquatic systems, issues with the new model's ability to sort and assess ERA's sites, GIS, or field technician error.
Scope	No	The scope was clearly defined and realistically achievable within the designated time-frame.
Proportion of task achieved, and further work which might be needed	Maybe	All sites were successfully sampled and assessed, but there is room for improvement and expansion. The CABIN 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. With the development of the Elk River Watershed Monitoring Collaborative, ERA's CABIN program focus will aim to align with the initiatives of this group and will gain further expertise in several different fields through its involvement in this program. In the past, ERA has had limited access to industry-standard equipment. In 2021, ERA was able to begin upgrading equipment. Physical water quality parameters are being assessed using the YSI ProDSS which increases the accuracy of measurements.
Access	No	All sites were accessible. Initial CABIN site selection includes evaluating the accessibility of a site prior to inclusion in the program.

Conclusion & Recommended Actions

ERA's CABIN program is an ongoing program used to assess streams of concern identified through research and community input. Methodology in 2023 continued to center around CABIN-based assessments and included STREAM e-DNA sampling.

While study sites on Boivin Creek appear to be in healthy condition, the lower Coal Creek site (COL001), the lower Morrisey Creek site (MOR001), and both Lizard Creek sites (LIZ001 and LIZ003), are being assessed as "highly divergent" from reference condition, which suggests that these sites may not be in good health. Previously in healthy condition, both Alexander sites are now also assessed as "mildly divergent" according to CABIN assessments and may beginning to experience a decline in health similar to COL003 and MOR002, which continue to be assessed as "mildly divergent".

Both Coal Creek and Morrissey Creek have large amounts of current and historical upstream development, including recent work related to the TC Energy Pipeline in the Morrisey area, which is why the poor assessment results at the lower sites (COL001, MOR001) were not entirely unexpected. Analysis of water quality parameters associated with these sites does not indicate any obvious red flags due to exceedances of water quality guidelines that would point to causes for divergence, but the diversity of the benthic communities at these locations appears abnormal compared to reference condition sites. Additionally, Morrissey sites showed a sudden increase in some water quality parameters, especially turbidity, which is likely related to the TC Energy pipeline road construction and road use. The potential decline in health of Alexander Creek sites is unexpected since there have been no major changes along this stream and neither water quality, nor benthic parameters indicate any trends that might have caused this divergence. Continuing to monitor these sites and watching for patterns in water quality parameters over time is a priority going forward.

The unexpected results for the Lizard Creek sites are a concern given the creek's importance in Westslope cutthroat trout population recruitment (Elk River Alliance, 2020). Although there are no specific exceedances of any water quality parameters based on BC guidelines, the benthic communities differ from what is expected from a typical healthy aquatic habitat, with numbers of pollutant-tolerant families becoming more prominent.

For each of these sites that have been assessed as "highly divergent", the total abundance of benthic invertebrates has been significantly higher than at associated reference sites. Furthermore, based on several measured water quality parameters, Lizard Creek may have unique conditions that are not captured by assigned reference sites (elevated alkalinity, hardness, calcium, magnesium, etc.). Due to the nature of CABIN models, which match a test site with a collection of specific reference sites and then compare the benthic communities, its possible that these high abundances have exaggerated how different the sites are, and produced these more extreme results, or that the differences in the natural state of this creek and reference creeks is too great to compare, yielding inaccurate results.

Understanding why these shifts in state have occurred, whether it is a data error, CABIN model issue, or a sign of a quickly degrading important aquatic habitat, is a high priority. ERA is recommending further investigations into potential stressors affecting these "highly divergent" CABIN monitoring sites. Lizard Creek is a high priority creek for more in-depth monitoring in future.

ERA has established and continues to engage with the Elk River Watershed Collaborative Monitoring Program (ERWCMP). With the growth of new partnerships, the development of new research questions and access to previously inaccessible data, ERA hopes to continue to expand the CABIN program in the coming years and better integrate ERA CABIN sites with other regional work and ERWCMP's partner input to improve our understanding of watershed health. The primary focus will continue to be filling in current data gaps and finding answers to the local community's environmental concerns. ERA will seek to engage the ERWCMP on the potential issues with Lizard Creek and hopes to enlist this group to take a leading role in new monitoring efforts on this Creek.

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Appendix A: CABIN Reports

Site Description

Study Name	CBWQ-Elk
Site	ALX001
Sampling Date	Sep 27 2023
Know Your Watershed Basin	Central Kootenay
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera EcoZone Northern Continental Divide EcoRegion
Coordinates (decimal degrees)	49.67424 N, 114.78019 W
Altitude	1219
Local Basin Name	Alexander Creek
	Elk River
Stream Order	4

Figure 1. Location Map

Cabin Assessment Results

Reference Model Summary	
Model	Columbia Basin 2020
Analysis Date	November 20, 2024
Taxonomic Level	Family
Predictive Model Variables	Altitude Drainage-Area Longitude Natl-Grassland Natl-ShrubLow Natl-Water Precip10_Oct Reach-%CanopyCoverage Sedimentary Slope SlopeMax Temp12_DECmin

Reference Groups	**1**	**2**	**3**	**4**	**5**	**6**
Number of Reference Sites	13	24	28	35	32	15
Group Error Rate	53.8%	55.2%	34.1%	52.2%	23.1%	29.4%
Overall Model Error Rate	39.4%					
Probability of Group Membership	3.3%	4.3%	2.8%	4.3%	84.1%	1.2%
CABIN Assessment of ALX001 on Sep 27, 2023	Mildly Divergent					

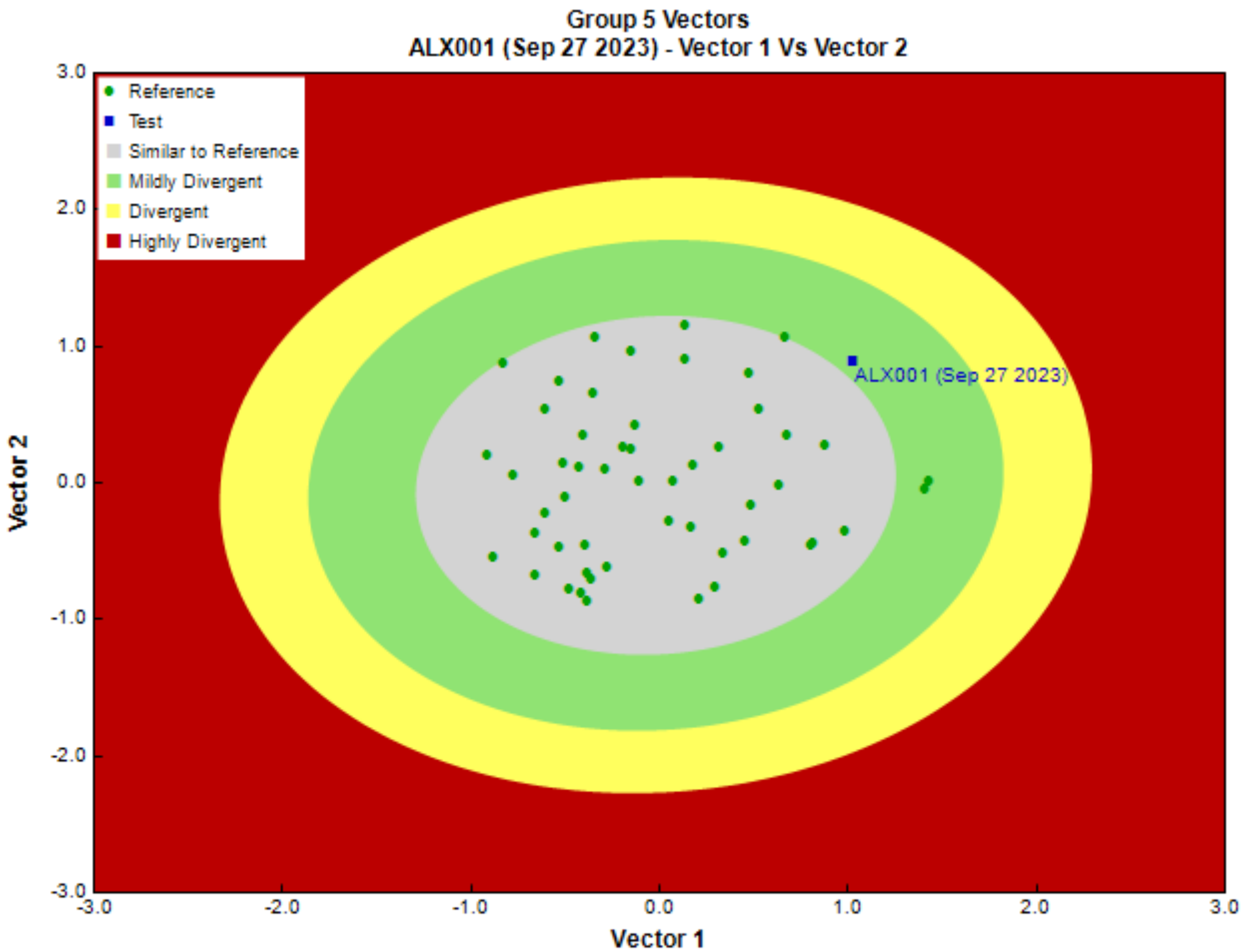


Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	-
	-
Sub-Sample Proportion	5/100

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
Arthropoda	Arachnida	Trombidiformes	Lebertiidae	1	20.0
			Sperchontidae	1	20.0
	Insecta	Coleoptera	Elmidae	7	140.0
		Diptera	Chironomidae	41	820.0
			Empididae	4	80.0
			Psychodidae	16	320.0
			Tipulidae	1	20.0
		Ephemeroptera	Ameletidae	1	20.0
			Baetidae	199	3,980.0
			Ephemerellidae	78	1,560.0
			Heptageniidae	40	800.0
		Plecoptera	Chloroperlidae	7	140.0
			Leuctridae	1	20.0
			Nemouridae	38	760.0
			Perlidae	3	60.0
			Perlodidae	10	200.0

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
			Taeniopterygidae	1	20.0
		Trichoptera	Apataniidae	3	60.0
			Brachycentridae	5	100.0
			Glossosomatidae	27	540.0
			Hydropsychidae	2	40.0
			Rhyacophilidae	24	480.0
			Uenoidae	9	180.0
			Total	519	10,380.0

Metrics

Name	ALX001	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.64	0.4 ± 0.1
Biotic Indices		
Hilsenhoff Family index (Mid-Atlantic)	3.9	3.4 ± 0.4
Hilsenhoff Family index (North-West)	3.9	3.1 ± 0.5
Intolerant taxa	--	1.0 ± 0.0
Long-lived taxa	4.0	1.7 ± 1.2
Tolerant individuals (%)	--	0.3 ± 0.0
Functional Measures		
% Filterers	--	
% Gatherers	38.3	45.8 ± 14.9
% Predatores	17.5	14.8 ± 9.8
% Scrapers	55.5	59.4 ± 19.6
% Shredder	10.8	30.7 ± 17.4
No. Clinger Taxa	34.0	19.8 ± 4.0
Number Of Individuals		
% Chironomidae	7.9	7.5 ± 8.6
% Coleoptera	1.3	0.1 ± 0.3
% Diptera + Non-insects	12.3	10.7 ± 9.9
% Ephemeroptera	61.3	47.2 ± 15.8
% Ephemeroptera that are Baetidae	62.6	25.4 ± 20.8
% EPT Individuals	86.3	89.2 ± 10.0
% Odonata	--	0.0 ± 0.0
% of 2 dominant taxa	53.4	58.3 ± 10.6
% of 5 dominant taxa	76.3	83.6 ± 6.3
% of dominant taxa	38.3	37.8 ± 11.1
% Plecoptera	11.6	36.3 ± 16.7
% Tribe Tanyatarisini	--	
% Trichoptera that are Hydropsychida	2.9	25.4 ± 24.6
% Tricoptera	13.5	5.7 ± 3.9
No. EPT individuals/Chironomids+EPT Individuals	0.9	0.9 ± 0.1
Total Abundance	10380.0	4661.0 ± 3119.0
Richness		
Chironomidae taxa (genus level only)	1.0	1.0 ± 0.1
Coleoptera taxa	1.0	0.1 ± 0.3
Diptera taxa	4.0	2.8 ± 1.0
Ephemeroptera taxa	4.0	3.7 ± 0.5
EPT Individuals (Sum)	8960.0	4035.4 ± 2618.4
EPT taxa (no)	16.0	12.3 ± 1.9
Odonata taxa	--	0.0 ± 0.0
Pielou's Evenness	0.7	0.7 ± 0.1
Plecoptera taxa	6.0	5.5 ± 1.1
Shannon-Wiener Diversity	2.1	1.9 ± 0.3
Simpson's Diversity	0.8	0.8 ± 0.1
Simpson's Evenness	0.2	0.3 ± 0.1
Total No. of Taxa	23.0	17.0 ± 3.1
Trichoptera taxa	6.0	3.1 ± 1.2

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	Group 6	

RIVPACS Ratios

RIVPACS : Expected taxa P>0.50	12.44
RIVPACS : Observed taxa P>0.50	14.00
RIVPACS : O:E (p > 0.5)	1.13
RIVPACS : Expected taxa P>0.70	9.51
RIVPACS : Observed taxa P>0.70	10.00
RIVPACS : O:E (p > 0.7)	1.05

Habitat Description

Variable	ALX001	Predicted Group Reference Mean ±SD
Bedrock Geology		
Sedimentary (%)	100.00000	98.46051 ± 8.10999
Channel		
Depth-Avg (cm)	27.0	20.0 ± 8.6
Depth-BankfullMinusWetted (cm)	35.90	46.71 ± 35.00
Depth-Max (cm)	32.0	28.8 ± 13.7
Discharge (m^3/s)	0.142	0.682
Macrophyte (PercentRange)	0	0 ± 0
Reach-%CanopyCoverage (PercentRange)	1.00	1.04 ± 0.95
Reach-%Logging (PercentRange)	0	0 ± 0
Reach-DomStreamsideVeg (Category(1-4))	2	3 ± 1
Reach-Pools (Binary)	0	1 ± 0
Reach-Rapids (Binary)	0	0 ± 0
Reach-Riffles (Binary)	1	1 ± 0
Reach-StraightRun (Binary)	1	1 ± 0
Slope (m/m)	0.0695000	0.0270638 ± 0.0257534
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)	0.52	0.58 ± 0.20
Velocity-Max (m/s)	0.82	0.85 ± 0.27
Width-Bankfull (m)	13.6	16.1 ± 13.1
Width-Wetted (m)	6.1	9.8 ± 7.7
XSEC-VelInstrumentDirect (Category(1-3))	2	3 ± 0
XSEC-VelMethod (Category(1-3))	3	2 ± 1
Climate		
Precip10_OCT (mm)	44.44840	64.42223 ± 33.96544
Temp12_DECmin (Degrees Celsius)	-14.37000	-12.74810 ± 1.73767
Hydrology		
Drainage-Area (km^2)	179.83405	100.09787 ± 132.80561
Landcover		
Natl-Grassland (%)	4.13231	7.47766 ± 6.29880
Natl-ShrubLow (%)	0.08024	1.80492 ± 1.50412
Natl-Water (%)	0.00000	0.32077 ± 0.59001
Reg-Ice (%)	0.00000	1.28005 ± 3.54484
Substrate Data		
%Bedrock (%)	0	0 ± 0
%Boulder (%)	5	6 ± 6
%Cobble (%)	63	57 ± 15
%Gravel (%)	2	2 ± 3
%Pebble (%)	30	34 ± 16
%Sand (%)	0	0 ± 0
%Silt+Clay (%)	0	0 ± 1
D50 (cm)	8.05	24.05 ± 35.66
Dg (cm)	7.9	23.0 ± 33.8
Dominant-1st (Category(0-9))	6	6 ± 1
Dominant-2nd (Category(0-9))	5	6 ± 1
Embeddedness (Category(1-5))	4	4 ± 1

Habitat Description

Variable	ALX001	Predicted Group Reference Mean ±SD
PeriphytonCoverage (Category(1-5))	2	2 ± 1
SurroundingMaterial (Category(0-9))	2	3 ± 1
Topography		
Reg-SlopeLT30% (%)	39.74502	20.01334 ± 7.41149
SlopeMax (%)	353.26163	488.94077 ± 542.32910
Water Chemistry		
Ag (mg/L)	0.0000250	0.0000018 ± 0.0000013
Al (mg/L)	0.0025000	0.0078031 ± 0.0090962
As (mg/L)	0.0002500	0.0002735 ± 0.0001787
B (mg/L)	0.0250000	0.0127286 ± 0.0135802
Ba (mg/L)	0.0721000	0.0677069 ± 0.0514113
Be (mg/L)	0.0000500	0.0000043 ± 0.0000039
Bi (mg/L)	0.0000500	0.0000018 ± 0.0000013
Br (mg/L)	0.0500000	0.0303333 ± 0.0788597
Ca (mg/L)	52.4000000	28.2142857 ± 13.7707094
Cd (mg/L)	0.0000050	0.0000100 ± 0.0000293
Chloride-Total (mg/L)	1.0200000	0.0000000 ± 0.0000000
Co (mg/L)	0.0000500	0.0000075 ± 0.0000060
Cr (mg/L)	0.0002500	0.0001514 ± 0.0001361
Cu (mg/L)	0.0002000	0.0001604 ± 0.0001447
F (mg/L)	0.1600000	0.0876667 ± 0.0847823
Fe (mg/L)	0.0050000	0.0101789 ± 0.0111495
General-Alkalinity (mg/L)	187.0000000	98.9704545 ± 43.8308301
General-CarbonDOC (mg/L)	1.5300000	0.8383333 ± 0.4040008
General-CarbonTOC (mg/L)	1.1600000	0.5586957 ± 0.6229060
General-Conductivity (μS/cm)	309.0000000	173.5150000 ± 86.2502071
General-DO (mg/L)	10.8900000	10.7243478 ± 0.8596502
General-Hardness (mg/L)	186.0000000	109.1853659 ± 48.3470504
General-pH (pH)	8.5	8.0 ± 0.6
General-SolidsTSS (mg/L)	1.0000000	5.2717002 ± 27.1908288
General-SpCond (μS/cm)	309.0000000	196.0710526 ± 116.3908975
General-TempAir (Degrees Celsius)	8.0	7.2 ± 5.7
General-TempWater (Degrees Celsius)	6.1000000	6.2042553 ± 2.0993816
General-Turbidity (NTU)	0.3300000	0.4347619 ± 0.5563328
Hg (ng/L)	0.0000050	0.0000000 ± 0.0000000
K (mg/L)	0.4100000	0.3312424 ± 0.1572675
Li (mg/L)	0.0043100	0.0009183 ± 0.0003795
Mg (mg/L)	13.3000000	7.8748571 ± 3.9958945
Mn (mg/L)	0.0008500	0.0007721 ± 0.0008518
Mo (mg/L)	0.0007800	0.0012835 ± 0.0042333
Na (mg/L)	1.8100000	0.7930303 ± 0.4756164
Ni (mg/L)	0.0002000	0.0001266 ± 0.0001131
Nitrogen-NO2 (mg/L)	0.0050000	0.0049953 ± 0.0199967
Nitrogen-NO2+NO3 (mg/L)	0.0050000	0.0287300 ± 0.0357249
Nitrogen-NO3 (mg/L)	0.0050000	0.0336397 ± 0.0328125
Nitrogen-TKN (mg/L)	0.0770000	0.0352941 ± 0.0299453
Nitrogen-TN (mg/L)	0.0770000	0.0675581 ± 0.0509763
Pb (mg/L)	0.0001000	0.0000179 ± 0.0000156
Phosphorus-OrthoP (mg/L)	0.0025000	0.1105304 ± 0.5208890
Phosphorus-TP (mg/L)	0.0068000	0.0031912 ± 0.0087929
S (mg/L)	7.1000000	3.6625000 ± 1.5619928
Sb (mg/L)	0.0001000	0.0000337 ± 0.0000157
Se (mg/L)	0.0006500	0.0002782 ± 0.0002859
Si (mg/L)	2.4000000	2.0400303 ± 0.8510321
Sn (mg/L)	0.0001000	0.0000300 ± 0.0000407
SO4 (mg/L)	20.6000000	13.3070732 ± 13.0883468
Sr (mg/L)	0.1210000	0.0893414 ± 0.0805860
Te (mg/L)	0.0002500	0.0000000 ± 0.0000000
Th (mg/L)	0.0000500	0.0000000 ± 0.0000000
Ti (mg/L)	0.0025000	0.0003150 ± 0.0001205
Tl (mg/L)	0.0000100	0.0000040 ± 0.0000067
U (mg/L)	0.0006280	0.0003872 ± 0.0002299

Habitat Description

Variable	ALX001	Predicted Group Reference Mean ±SD
V (mg/L)	0.0025000	0.0001617 ± 0.0001537
Zn (mg/L)	0.0020000	0.0003724 ± 0.0003377
Zr (mg/L)	0.0000500	0.0000500 ± 0.0000000

Site Description

Study Name	CBWQ-Elk
Site	ALX003
Sampling Date	Sep 27 2023
Know Your Watershed Basin	Central Kootenay
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera EcoZone Northern Continental Divide EcoRegion
Coordinates (decimal degrees)	49.65563 N, 114.73078 W
Altitude	1311
Local Basin Name	Alexander Creek
	Elk River Watershed
Stream Order	4

Figure 1. Location Map

Cabin Assessment Results

Reference Model Summary	
Model	Columbia Basin 2020
Analysis Date	November 20, 2024
Taxonomic Level	Family
Predictive Model Variables	Altitude Drainage-Area Longitude Natl-Grassland Natl-ShrubLow Natl-Water Precip10_Oct Reach-%CanopyCoverage Sedimentary Slope SlopeMax Temp12_DECmin

Reference Groups	**1**	**2**	**3**	**4**	**5**	**6**
Number of Reference Sites	13	24	28	35	32	15
Group Error Rate	53.8%	55.2%	34.1%	52.2%	23.1%	29.4%
Overall Model Error Rate	39.4%					
Probability of Group Membership	1.3%	2.0%	3.8%	6.9%	85.1%	0.9%
CABIN Assessment of ALX003 on Sep 27, 2023	Mildly Divergent					

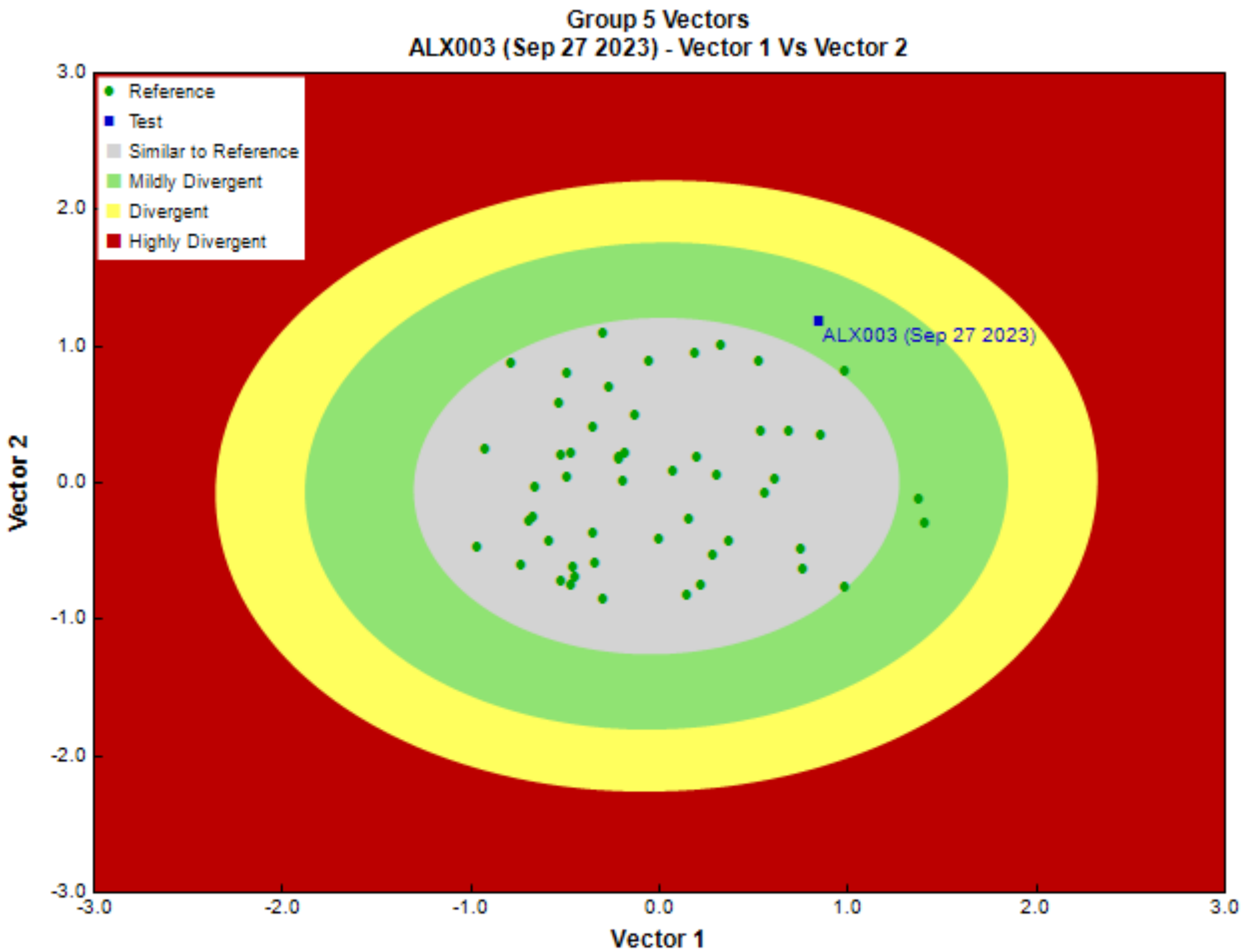


Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	-
	-
Sub-Sample Proportion	5/100

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
Annelida	Clitellata	Tubificida	Naididae	2	40.0
Arthropoda	Arachnida	Trombidiformes	Aturidae	1	20.0
			Lebertiidae	4	80.0
			Sperchontidae	5	100.0
			Torrenticolidae	1	20.0
	Insecta	Coleoptera	Elmidae	8	160.0
		Diptera	Chironomidae	61	1,220.0
			Empididae	4	80.0
			Psychodidae	60	1,200.0
			Simuliidae	4	80.0
		Ephemeroptera	Ameletidae	1	20.0
			Baetidae	334	6,680.0
			Ephemerellidae	132	2,640.0
			Heptageniidae	83	1,660.0
		Plecoptera		2	40.0
			Chloroperlidae	4	80.0

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
			Nemouridae	35	700.0
			Perlodidae	2	40.0
			Taeniopterygidae	3	60.0
		Trichoptera	Brachycentridae	2	40.0
			Glossosomatidae	2	40.0
			Hydropsychidae	2	40.0
			Rhyacophilidae	10	200.0
			Uenoidae	1	20.0
			Total	763	15,260.0

Metrics

Name	ALX003	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.69	0.4 ± 0.1
Biotic Indices		
Hilsenhoff Family index (Mid-Atlantic)	4.1	3.4 ± 0.4
Hilsenhoff Family index (North-West)	4.1	3.1 ± 0.5
Intolerant taxa	--	1.0 ± 0.0
Long-lived taxa	2.0	1.7 ± 1.2
Tolerant individuals (%)	--	0.3 ± 0.0
Functional Measures		
% Filterers	--	
% Gatherers	41.0	45.8 ± 14.9
% Predatores	12.6	14.8 ± 9.8
% Scrapers	57.3	59.4 ± 19.6
% Shredder	6.3	30.7 ± 17.4
No. Clinger Taxa	31.0	19.8 ± 4.0
Number Of Individuals		
% Chironomidae	8.0	7.5 ± 8.6
% Coleoptera	1.1	0.1 ± 0.3
% Diptera + Non-insects	18.7	10.7 ± 9.9
% Ephemeroptera	72.3	47.2 ± 15.8
% Ephemeroptera that are Baetidae	60.7	25.4 ± 20.8
% EPT Individuals	80.3	89.2 ± 10.0
% Odonata	--	0.0 ± 0.0
% of 2 dominant taxa	61.2	58.3 ± 10.6
% of 5 dominant taxa	88.0	83.6 ± 6.3
% of dominant taxa	43.9	37.8 ± 11.1
% Plecoptera	5.8	36.3 ± 16.7
% Tribe Tanyatarisini	--	
% Trichoptera that are Hydropsychida	11.8	25.4 ± 24.6
% Tricoptera	2.2	5.7 ± 3.9
No. EPT individuals/Chironomids+EPT Individuals	0.9	0.9 ± 0.1
Total Abundance	15260.0	4661.0 ± 3119.0
Richness		
Chironomidae taxa (genus level only)	1.0	1.0 ± 0.1
Coleoptera taxa	1.0	0.1 ± 0.3
Diptera taxa	4.0	2.8 ± 1.0
Ephemeroptera taxa	4.0	3.7 ± 0.5
EPT Individuals (Sum)	12220.0	4035.4 ± 2618.4
EPT taxa (no)	13.0	12.3 ± 1.9
Odonata taxa	--	0.0 ± 0.0
Pielou's Evenness	0.6	0.7 ± 0.1
Plecoptera taxa	4.0	5.5 ± 1.1
Shannon-Wiener Diversity	1.8	1.9 ± 0.3
Simpson's Diversity	0.8	0.8 ± 0.1
Simpson's Evenness	0.2	0.3 ± 0.1
Total No. of Taxa	23.0	17.0 ± 3.1
Trichoptera taxa	5.0	3.1 ± 1.2

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	Group 6	

RIVPACS Ratios

RIVPACS : Expected taxa P>0.50	12.47
RIVPACS : Observed taxa P>0.50	13.00
RIVPACS : O:E (p > 0.5)	1.04
RIVPACS : Expected taxa P>0.70	9.54
RIVPACS : Observed taxa P>0.70	10.00
RIVPACS : O:E (p > 0.7)	1.05

Habitat Description

Variable	ALX003	Predicted Group Reference Mean ±SD
Bedrock Geology		
Sedimentary (%)	100.00000	98.46051 ± 8.10999
Channel		
Depth-Avg (cm)	27.7	20.0 ± 8.6
Depth-BankfullMinusWetted (cm)	15.50	46.71 ± 35.00
Depth-Max (cm)	44.0	28.8 ± 13.7
Discharge (m^3/s)	0.115	0.682
Macrophyte (PercentRange)	0	0 ± 0
Reach-%CanopyCoverage (PercentRange)	1.00	1.04 ± 0.95
Reach-%Logging (PercentRange)	0	0 ± 0
Reach-DomStreamsideVeg (Category(1-4))	2	3 ± 1
Reach-Pools (Binary)	1	1 ± 0
Reach-Rapids (Binary)	0	0 ± 0
Reach-Riffles (Binary)	1	1 ± 0
Reach-StraightRun (Binary)	1	1 ± 0
Slope (m/m)	0.0155400	0.0270638 ± 0.0257534
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)	0.42	0.58 ± 0.20
Velocity-Max (m/s)	0.55	0.85 ± 0.27
Width-Bankfull (m)	10.9	16.1 ± 13.1
Width-Wetted (m)	9.5	9.8 ± 7.7
XSEC-VelInstrumentDirect (Category(1-3))	3	3 ± 0
XSEC-VelMethod (Category(1-3))	3	2 ± 1
Climate		
Precip10_OCT (mm)	43.56508	64.42223 ± 33.96544
Temp12_DECmin (Degrees Celsius)	-14.37000	-12.74810 ± 1.73767
Hydrology		
Drainage-Area (km^2)	145.66791	100.09787 ± 132.80561
Landcover		
Natl-Grassland (%)	2.54675	7.47766 ± 6.29880
Natl-ShrubLow (%)	0.09901	1.80492 ± 1.50412
Natl-Water (%)	0.00000	0.32077 ± 0.59001
Reg-Ice (%)	0.00000	1.28005 ± 3.54484
Substrate Data		
%Bedrock (%)	0	0 ± 0
%Boulder (%)	4	6 ± 6
%Cobble (%)	71	57 ± 15
%Gravel (%)	5	2 ± 3
%Pebble (%)	20	34 ± 16
%Sand (%)	0	0 ± 0
%Silt+Clay (%)	0	0 ± 1
D50 (cm)	8.75	24.05 ± 35.66
Dg (cm)	8.2	23.0 ± 33.8
Dominant-1st (Category(0-9))	6	6 ± 1
Dominant-2nd (Category(0-9))	7	6 ± 1
Embeddedness (Category(1-5))	3	4 ± 1

Habitat Description

Variable	ALX003	Predicted Group Reference Mean ±SD
PeriphytonCoverage (Category(1-5))	2	2 ± 1
SurroundingMaterial (Category(0-9))	2	3 ± 1
Topography		
Reg-SlopeLT30% (%)	37.52888	20.01334 ± 7.41149
SlopeMax (%)	353.26163	488.94077 ± 542.32910
Water Chemistry		
Ag (mg/L)	0.0000250	0.0000018 ± 0.0000013
Al (mg/L)	0.0070000	0.0078031 ± 0.0090962
As (mg/L)	0.0002500	0.0002735 ± 0.0001787
B (mg/L)	0.0250000	0.0127286 ± 0.0135802
Ba (mg/L)	0.0709000	0.0677069 ± 0.0514113
Be (mg/L)	0.0000500	0.0000043 ± 0.0000039
Bi (mg/L)	0.0000500	0.0000018 ± 0.0000013
Br (mg/L)	0.0500000	0.0303333 ± 0.0788597
Ca (mg/L)	51.1000000	28.2142857 ± 13.7707094
Cd (mg/L)	0.0000050	0.0000100 ± 0.0000293
Chloride-Total (mg/L)	0.7700000	0.0000000 ± 0.0000000
Co (mg/L)	0.0000500	0.0000075 ± 0.0000060
Cr (mg/L)	0.0002500	0.0001514 ± 0.0001361
Cu (mg/L)	0.0002000	0.0001604 ± 0.0001447
F (mg/L)	0.1400000	0.0876667 ± 0.0847823
Fe (mg/L)	0.0150000	0.0101789 ± 0.0111495
General-Alkalinity (mg/L)	185.0000000	98.9704545 ± 43.8308301
General-CarbonDOC (mg/L)	1.7900000	0.8383333 ± 0.4040008
General-CarbonTOC (mg/L)	1.6800000	0.5586957 ± 0.6229060
General-Conductivity (μS/cm)	299.7000000	173.5150000 ± 86.2502071
General-DO (mg/L)	10.8500000	10.7243478 ± 0.8596502
General-Hardness (mg/L)	182.0000000	109.1853659 ± 48.3470504
General-pH (pH)	8.5	8.0 ± 0.6
General-SolidsTSS (mg/L)	1.0000000	5.2717002 ± 27.1908288
General-SpCond (μS/cm)	299.7000000	196.0710526 ± 116.3908975
General-TempAir (Degrees Celsius)	12.0	7.2 ± 5.7
General-TempWater (Degrees Celsius)	6.4000000	6.2042553 ± 2.0993816
General-Turbidity (NTU)	0.4300000	0.4347619 ± 0.5563328
Hg (ng/L)	0.0000050	0.0000000 ± 0.0000000
K (mg/L)	0.4000000	0.3312424 ± 0.1572675
Li (mg/L)	0.0039400	0.0009183 ± 0.0003795
Mg (mg/L)	13.2000000	7.8748571 ± 3.9958945
Mn (mg/L)	0.0013700	0.0007721 ± 0.0008518
Mo (mg/L)	0.0006600	0.0012835 ± 0.0042333
Na (mg/L)	1.6000000	0.7930303 ± 0.4756164
Ni (mg/L)	0.0002000	0.0001266 ± 0.0001131
Nitrogen-NO2 (mg/L)	0.0050000	0.0049953 ± 0.0199967
Nitrogen-NO2+NO3 (mg/L)	0.0050000	0.0287300 ± 0.0357249
Nitrogen-NO3 (mg/L)	0.0050000	0.0336397 ± 0.0328125
Nitrogen-TKN (mg/L)	0.0250000	0.0352941 ± 0.0299453
Nitrogen-TN (mg/L)	0.0250000	0.0675581 ± 0.0509763
Pb (mg/L)	0.0001000	0.0000179 ± 0.0000156
Phosphorus-OrthoP (mg/L)	0.0025000	0.1105304 ± 0.5208890
Phosphorus-TP (mg/L)	0.0025000	0.0031912 ± 0.0087929
S (mg/L)	6.2000000	3.6625000 ± 1.5619928
Sb (mg/L)	0.0001000	0.0000337 ± 0.0000157
Se (mg/L)	0.0005700	0.0002782 ± 0.0002859
Si (mg/L)	2.2000000	2.0400303 ± 0.8510321
Sn (mg/L)	0.0001000	0.0000300 ± 0.0000407
SO4 (mg/L)	18.2000000	13.3070732 ± 13.0883468
Sr (mg/L)	0.1170000	0.0893414 ± 0.0805860
Te (mg/L)	0.0002500	0.0000000 ± 0.0000000
Th (mg/L)	0.0000500	0.0000000 ± 0.0000000
Ti (mg/L)	0.0025000	0.0003150 ± 0.0001205
Tl (mg/L)	0.0000100	0.0000040 ± 0.0000067
U (mg/L)	0.0005670	0.0003872 ± 0.0002299

Habitat Description

Variable	ALX003	Predicted Group Reference Mean ±SD
V (mg/L)	0.0025000	0.0001617 ± 0.0001537
Zn (mg/L)	0.0020000	0.0003724 ± 0.0003377
Zr (mg/L)	0.0000500	0.0000500 ± 0.0000000

Site Description

Study Name	CBWQ-Elk
Site	BOI001
Sampling Date	Sep 26 2023
Know Your Watershed Basin	Central Kootenay
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera EcoZone Northern Continental Divide EcoRegion
Coordinates (decimal degrees)	50.02314 N, 114.91614 W
Altitude	1261
Local Basin Name	Elk River
	Boivin Creek
Stream Order	4

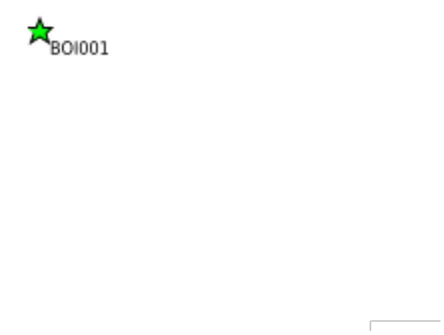


Figure 1. Location Map

Cabin Assessment Results

Reference Model Summary	
Model	Columbia Basin 2020
Analysis Date	November 20, 2024
Taxonomic Level	Family
Predictive Model Variables	Altitude Drainage-Area Longitude Natl-Grassland Natl-ShrubLow Natl-Water Precip10_Oct Reach-%CanopyCoverage Sedimentary Slope SlopeMax Temp12_DECmin

Reference Groups	**1**	**2**	**3**	**4**	**5**	**6**
Number of Reference Sites	13	24	28	35	32	15
Group Error Rate	53.8%	55.2%	34.1%	52.2%	23.1%	29.4%
Overall Model Error Rate	39.4%					
Probability of Group Membership	5.6%	9.0%	4.7%	18.9%	57.7%	4.1%
CABIN Assessment of BOI001 on Sep 26, 2023	Similar to Reference					

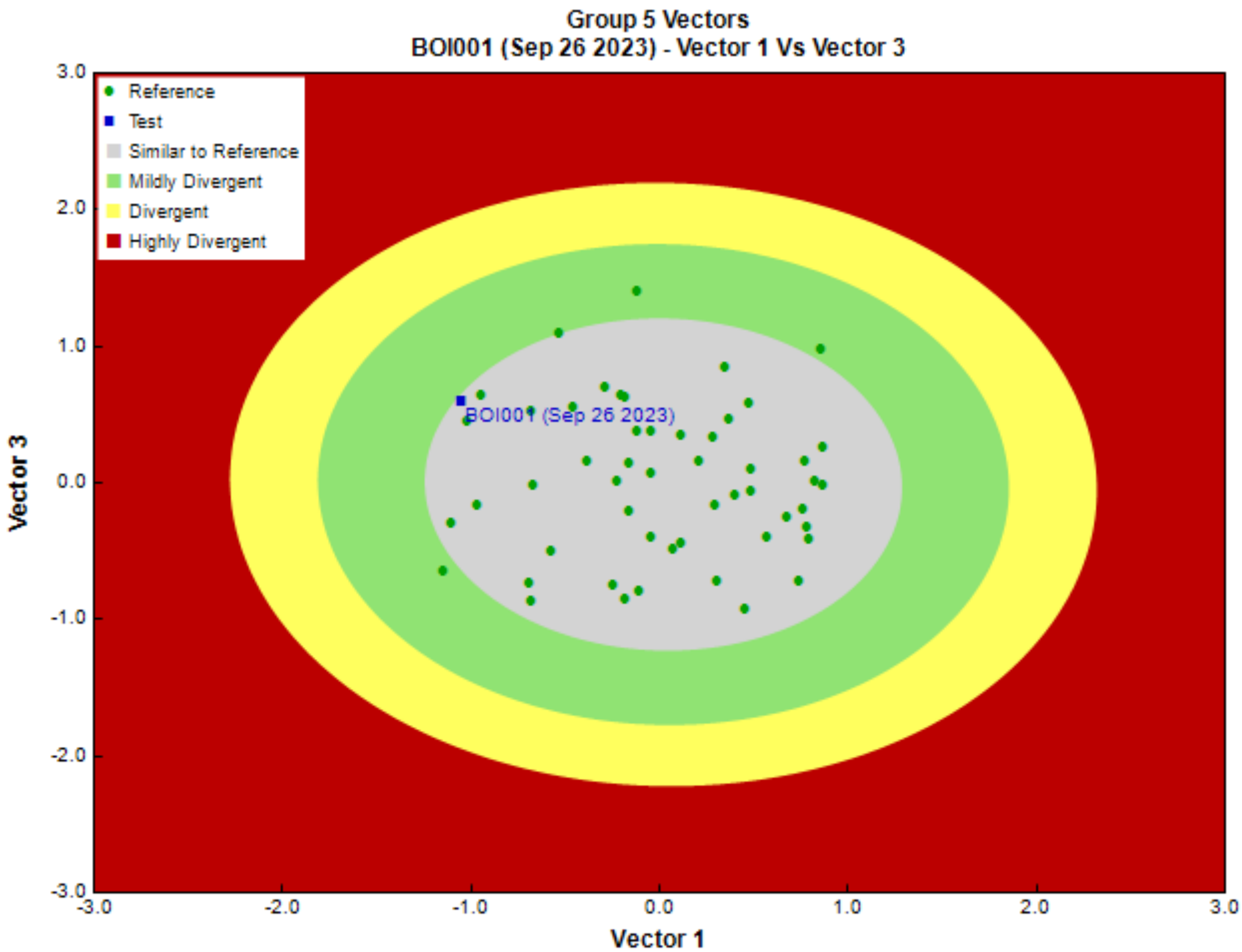


Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	-
	-
Sub-Sample Proportion	5/100

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
Annelida	Clitellata	Lumbriculida	Lumbriculidae	2	40.0
Arthropoda	Arachnida	Trombidiformes	Lebertiidae	1	20.0
			Sperchontidae	2	40.0
	Insecta	Diptera		2	40.0
			Chironomidae	117	2,340.0
			Empididae	1	20.0
			Psychodidae	5	100.0
			Simuliidae	13	260.0
		Ephemeroptera	Ameletidae	7	140.0
			Baetidae	25	500.0
			Ephemerellidae	16	320.0
			Heptageniidae	220	4,400.0
		Plecoptera		3	60.0
			Capniidae	3	60.0
			Chloroperlidae	8	160.0
			Leuctridae	1	20.0

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
			Nemouridae	82	1,640.0
			Peltoperlidae	1	20.0
			Perlodidae	17	340.0
			Taeniopterygidae	201	4,020.0
		Trichoptera		1	20.0
			Apataniidae	1	20.0
			Rhyacophilidae	1	20.0
			Total	730	14,600.0

Metrics

Name	BOI001	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.61	0.4 ± 0.1
Biotic Indices		
Hilsenhoff Family index (Mid-Atlantic)	3.2	3.4 ± 0.4
Hilsenhoff Family index (North-West)	3.2	3.1 ± 0.5
Intolerant taxa	--	1.0 ± 0.0
Long-lived taxa	--	1.7 ± 1.2
Tolerant individuals (%)	--	0.3 ± 0.0
Functional Measures		
% Filterers	--	
% Gatherers	60.7	45.8 ± 14.9
% Predatores	20.8	14.8 ± 9.8
% Scrapers	63.0	59.4 ± 19.6
% Shredder	39.6	30.7 ± 17.4
No. Clinger Taxa	26.0	19.8 ± 4.0
Number Of Individuals		
% Chironomidae	16.2	7.5 ± 8.6
% Coleoptera	0.0	0.1 ± 0.3
% Diptera + Non-insects	19.5	10.7 ± 9.9
% Ephemeroptera	37.0	47.2 ± 15.8
% Ephemeroptera that are Baetidae	9.3	25.4 ± 20.8
% EPT Individuals	80.5	89.2 ± 10.0
% Odonata	--	0.0 ± 0.0
% of 2 dominant taxa	58.1	58.3 ± 10.6
% of 5 dominant taxa	89.1	83.6 ± 6.3
% of dominant taxa	30.4	37.8 ± 11.1
% Plecoptera	43.2	36.3 ± 16.7
% Tribe Tanyatarisini	--	
% Trichoptera that are Hydropsychida	0.0	25.4 ± 24.6
% Tricoptera	0.3	5.7 ± 3.9
No. EPT individuals/Chironomids+EPT Individuals	0.8	0.9 ± 0.1
Total Abundance	14600.0	4661.0 ± 3119.0
Richness		
Chironomidae taxa (genus level only)	1.0	1.0 ± 0.1
Coleoptera taxa	0.0	0.1 ± 0.3
Diptera taxa	4.0	2.8 ± 1.0
Ephemeroptera taxa	4.0	3.7 ± 0.5
EPT Individuals (Sum)	11660.0	4035.4 ± 2618.4
EPT taxa (no)	13.0	12.3 ± 1.9
Odonata taxa	--	0.0 ± 0.0
Pielou's Evenness	0.6	0.7 ± 0.1
Plecoptera taxa	7.0	5.5 ± 1.1
Shannon-Wiener Diversity	1.9	1.9 ± 0.3
Simpson's Diversity	0.8	0.8 ± 0.1
Simpson's Evenness	0.2	0.3 ± 0.1
Total No. of Taxa	20.0	17.0 ± 3.1
Trichoptera taxa	2.0	3.1 ± 1.2

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	Group 6	
Baetidae	100%	100%	100%	100%	100%	100%	1.00

RIVPACS Ratios

RIVPACS : Expected taxa P>0.50	11.28
RIVPACS : Observed taxa P>0.50	12.00
RIVPACS : O:E (p > 0.5)	1.06
RIVPACS : Expected taxa P>0.70	9.42
RIVPACS : Observed taxa P>0.70	9.00
RIVPACS : O:E (p > 0.7)	0.96

Habitat Description

Variable	BOI001	Predicted Group Reference Mean ±SD
Bedrock Geology		
Sedimentary (%)	100.00000	98.46051 ± 8.10999
Channel		
Depth-Avg (cm)	25.8	20.0 ± 8.6
Depth-BankfullMinusWetted (cm)	7.00	46.71 ± 35.00
Depth-Max (cm)	35.0	28.8 ± 13.7
Discharge (m^3/s)	0.138	0.682
Macrophyte (PercentRange)	0	0 ± 0
Reach-%CanopyCoverage (PercentRange)	0.00	1.04 ± 0.95
Reach-%Logging (PercentRange)	0	0 ± 0
Reach-DomStreamsideVeg (Category(1-4))	1	3 ± 1
Reach-Pools (Binary)	0	1 ± 0
Reach-Rapids (Binary)	1	0 ± 0
Reach-Riffles (Binary)	1	1 ± 0
Reach-StraightRun (Binary)	1	1 ± 0
Slope (m/m)	0.0219000	0.0270638 ± 0.0257534
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)	0.54	0.58 ± 0.20
Velocity-Max (m/s)	1.17	0.85 ± 0.27
Width-Bankfull (m)	6.8	16.1 ± 13.1
Width-Wetted (m)	9.2	9.8 ± 7.7
XSEC-VelInstrumentDirect (Category(1-3))	2	3 ± 0
XSEC-VelMethod (Category(1-3))	3	2 ± 1
Climate		
Precip10_OCT (mm)	45.44750	64.42223 ± 33.96544
Temp12_DECmin (Degrees Celsius)	-14.85000	-12.74810 ± 1.73767
Hydrology		
Drainage-Area (km^2)	63.55090	100.09787 ± 132.80561
Landcover		
Natl-Grassland (%)	0.92278	7.47766 ± 6.29880
Natl-ShrubLow (%)	0.38854	1.80492 ± 1.50412
Natl-Water (%)	0.00000	0.32077 ± 0.59001
Reg-Ice (%)	0.00000	1.28005 ± 3.54484
Substrate Data		
%Bedrock (%)	0	0 ± 0
%Boulder (%)	3	6 ± 6
%Cobble (%)	47	57 ± 15
%Gravel (%)	3	2 ± 3
%Pebble (%)	46	34 ± 16
%Sand (%)	0	0 ± 0
%Silt+Clay (%)	0	0 ± 1
D50 (cm)	6.35	24.05 ± 35.66
Dg (cm)	5.9	23.0 ± 33.8

Habitat Description

Variable	BOI001	Predicted Group Reference Mean ±SD
Dominant-1st (Category(0-9))	5	6 ± 1
Dominant-2nd (Category(0-9))	6	6 ± 1
Embeddedness (Category(1-5))	4	4 ± 1
PeriphytonCoverage (Category(1-5))	3	2 ± 1
SurroundingMaterial (Category(0-9))	2	3 ± 1
Topography		
Reg-SlopeLT30% (%)	18.45671	20.01334 ± 7.41149
SlopeMax (%)	317.63962	488.94077 ± 542.32910
Water Chemistry		
Ag (mg/L)	0.0000250	0.0000018 ± 0.0000013
Al (mg/L)	0.0025000	0.0078031 ± 0.0090962
As (mg/L)	0.0002500	0.0002735 ± 0.0001787
B (mg/L)	0.0250000	0.0127286 ± 0.0135802
Ba (mg/L)	0.0284000	0.0677069 ± 0.0514113
Be (mg/L)	0.0000500	0.0000043 ± 0.0000039
Bi (mg/L)	0.0000500	0.0000018 ± 0.0000013
Br (mg/L)	0.0500000	0.0303333 ± 0.0788597
Ca (mg/L)	53.1000000	28.2142857 ± 13.7707094
Cd (mg/L)	0.0000240	0.0000100 ± 0.0000293
Chloride-Total (mg/L)	0.1000000	0.0000000 ± 0.0000000
Co (mg/L)	0.0000500	0.0000075 ± 0.0000060
Cr (mg/L)	0.0002500	0.0001514 ± 0.0001361
Cu (mg/L)	0.0002000	0.0001604 ± 0.0001447
F (mg/L)	0.2400000	0.0876667 ± 0.0847823
Fe (mg/L)	0.0050000	0.0101789 ± 0.0111495
General-Alkalinity (mg/L)	144.0000000	98.9704545 ± 43.8308301
General-CarbonDOC (mg/L)	3.5200000	0.8383333 ± 0.4040008
General-CarbonTOC (mg/L)	3.0100000	0.5586957 ± 0.6229060
General-Conductivity (μS/cm)	329.9000000	173.5150000 ± 86.2502071
General-DO (mg/L)	11.1900000	10.7243478 ± 0.8596502
General-Hardness (mg/L)	191.0000000	109.1853659 ± 48.3470504
General-pH (pH)	8.4	8.0 ± 0.6
General-SolidsTSS (mg/L)	1.0000000	5.2717002 ± 27.1908288
General-SpCond (μS/cm)	329.9000000	196.0710526 ± 116.3908975
General-TempAir (Degrees Celsius)	7.0	7.2 ± 5.7
General-TempWater (Degrees Celsius)	4.4000000	6.2042553 ± 2.0993816
General-Turbidity (NTU)	0.4000000	0.4347619 ± 0.5563328
Hg (ng/L)	0.0000050	0.0000000 ± 0.0000000
K (mg/L)	0.3000000	0.3312424 ± 0.1572675
Li (mg/L)	0.0015300	0.0009183 ± 0.0003795
Mg (mg/L)	14.1000000	7.8748571 ± 3.9958945
Mn (mg/L)	0.0001000	0.0007721 ± 0.0008518
Mo (mg/L)	0.0014800	0.0012835 ± 0.0042333
Na (mg/L)	0.6100000	0.7930303 ± 0.4756164
Ni (mg/L)	0.0007200	0.0001266 ± 0.0001131
Nitrogen-NO2 (mg/L)	0.0050000	0.0049953 ± 0.0199967
Nitrogen-NO2+NO3 (mg/L)	0.0288000	0.0287300 ± 0.0357249
Nitrogen-NO3 (mg/L)	0.0290000	0.0336397 ± 0.0328125
Nitrogen-TKN (mg/L)	0.1540000	0.0352941 ± 0.0299453
Nitrogen-TN (mg/L)	0.1830000	0.0675581 ± 0.0509763
Pb (mg/L)	0.0001000	0.0000179 ± 0.0000156
Phosphorus-OrthoP (mg/L)	0.0025000	0.1105304 ± 0.5208890
Phosphorus-TP (mg/L)	0.0061000	0.0031912 ± 0.0087929
S (mg/L)	21.7000000	3.6625000 ± 1.5619928
Sb (mg/L)	0.0001000	0.0000337 ± 0.0000157
Se (mg/L)	0.0011200	0.0002782 ± 0.0002859
Si (mg/L)	2.2000000	2.0400303 ± 0.8510321
Sn (mg/L)	0.0001000	0.0000300 ± 0.0000407
SO4 (mg/L)	63.1000000	13.3070732 ± 13.0883468
Sr (mg/L)	0.6650000	0.0893414 ± 0.0805860
Te (mg/L)	0.0002500	0.0000000 ± 0.0000000
Th (mg/L)	0.0000500	0.0000000 ± 0.0000000

Habitat Description

Variable	BOI001	Predicted Group Reference Mean ±SD
Ti (mg/L)	0.0025000	0.0003150 ± 0.0001205
Tl (mg/L)	0.0000100	0.0000040 ± 0.0000067
U (mg/L)	0.0010100	0.0003872 ± 0.0002299
V (mg/L)	0.0025000	0.0001617 ± 0.0001537
Zn (mg/L)	0.0020000	0.0003724 ± 0.0003377
Zr (mg/L)	0.0000500	0.0000500 ± 0.0000000

Site Description

Study Name	CBWQ-Elk
Site	BOI002
Sampling Date	Sep 26 2023
Know Your Watershed Basin	Central Kootenay
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera EcoZone Northern Continental Divide EcoRegion
Coordinates (decimal degrees)	50.01693 N, 114.93698 W
Altitude	1316
Local Basin Name	Elk River
	Boivin Creek
Stream Order	4

Figure 1. Location Map

Cabin Assessment Results

Reference Model Summary	
Model	Columbia Basin 2020
Analysis Date	November 20, 2024
Taxonomic Level	Family
Predictive Model Variables	Altitude Drainage-Area Longitude Natl-Grassland Natl-ShrubLow Natl-Water Precip10_Oct Reach-%CanopyCoverage Sedimentary Slope SlopeMax Temp12_DECmin

Reference Groups	**1**	**2**	**3**	**4**	**5**	**6**
Number of Reference Sites	13	24	28	35	32	15
Group Error Rate	53.8%	55.2%	34.1%	52.2%	23.1%	29.4%
Overall Model Error Rate	39.4%					
Probability of Group Membership	4.6%	5.3%	7.1%	12.0%	68.8%	2.2%
CABIN Assessment of BOI002 on Sep 26, 2023	Similar to Reference					

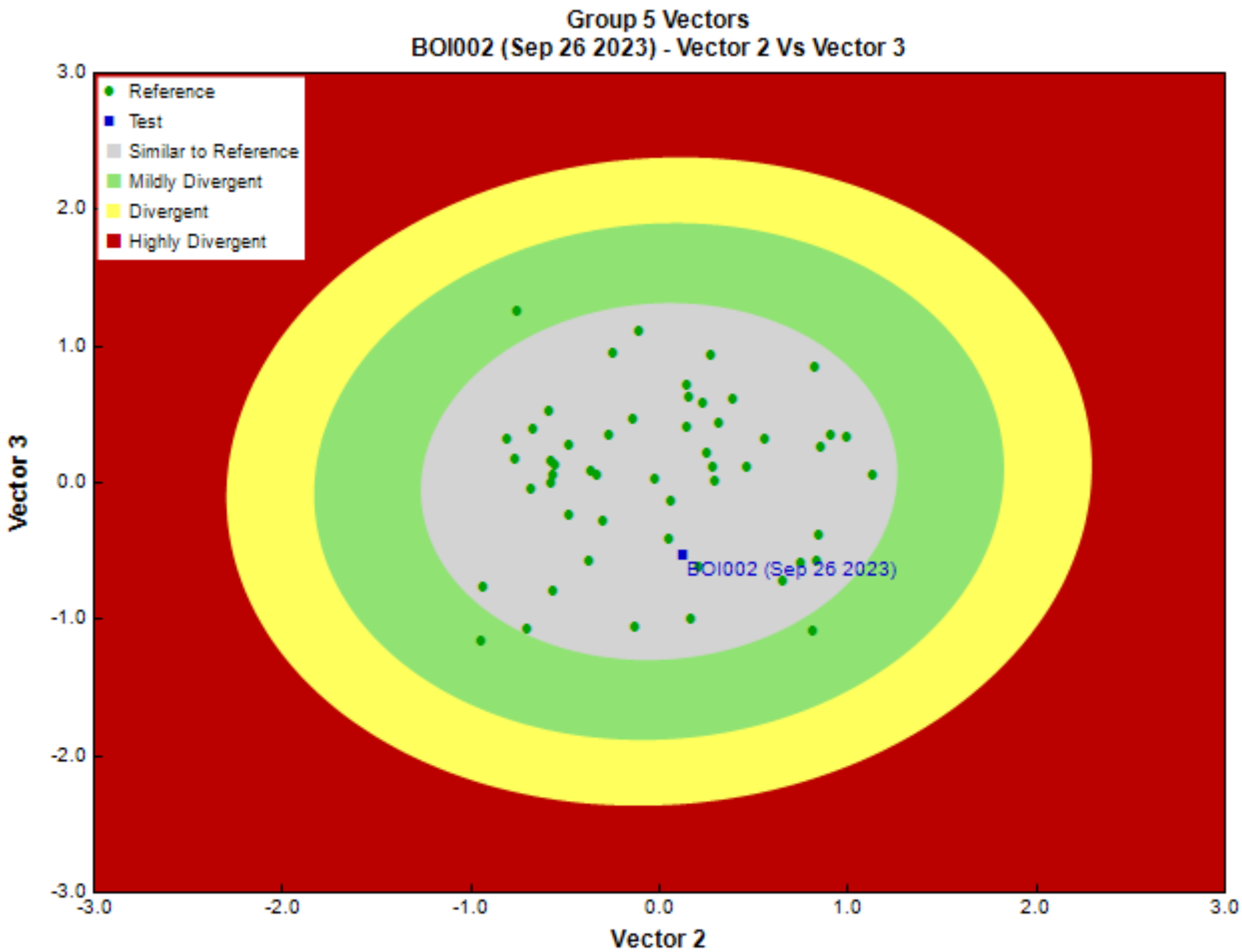


Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	-
	-
Sub-Sample Proportion	8/100

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
Arthropoda	Arachnida	Trombidiformes	Hydryphantidae	1	12.5
	Insecta	Diptera	Chironomidae	42	525.0
			Psychodidae	1	12.5
			Simuliidae	18	225.0
			Tipulidae	3	37.5
		Ephemeroptera	Ameletidae	2	25.0
			Baetidae	62	775.0
			Ephemerellidae	78	975.0
			Heptageniidae	70	875.0
		Plecoptera	Chloroperlidae	10	125.0
			Nemouridae	10	125.0
			Peltoperlidae	1	12.5
			Perlodidae	13	162.5
			Taeniopterygidae	25	312.5
		Trichoptera	Rhyacophilidae	10	125.0
			Uenoidae	1	12.5

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
			Total	347	4,337.5

Metrics

Name	BOI002	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.34	0.4 ± 0.1
Biotic Indices		
Hilsenhoff Family index (Mid-Atlantic)	3.8	3.4 ± 0.4
Hilsenhoff Family index (North-West)	3.8	3.1 ± 0.5
Intolerant taxa	--	1.0 ± 0.0
Long-lived taxa	--	1.7 ± 1.2
Tolerant individuals (%)	--	0.3 ± 0.0
Functional Measures		
% Filterers	--	
% Gatherers	51.9	45.8 ± 14.9
% Predatores	24.2	14.8 ± 9.8
% Scrapers	50.7	59.4 ± 19.6
% Shredder	11.2	30.7 ± 17.4
No. Clinger Taxa	22.0	19.8 ± 4.0
Number Of Individuals		
% Chironomidae	12.1	7.5 ± 8.6
% Coleoptera	0.0	0.1 ± 0.3
% Diptera + Non-insects	18.7	10.7 ± 9.9
% Ephemeroptera	61.1	47.2 ± 15.8
% Ephemeroptera that are Baetidae	29.2	25.4 ± 20.8
% EPT Individuals	81.3	89.2 ± 10.0
% Odonata	--	0.0 ± 0.0
% of 2 dominant taxa	42.7	58.3 ± 10.6
% of 5 dominant taxa	79.8	83.6 ± 6.3
% of dominant taxa	22.5	37.8 ± 11.1
% Plecoptera	17.0	36.3 ± 16.7
% Tribe Tanyatarisini	--	
% Trichoptera that are Hydropsychida	0.0	25.4 ± 24.6
% Tricoptera	3.2	5.7 ± 3.9
No. EPT individuals/Chironomids+EPT Individuals	0.9	0.9 ± 0.1
Total Abundance	4337.5	4661.0 ± 3119.0
Richness		
Chironomidae taxa (genus level only)	1.0	1.0 ± 0.1
Coleoptera taxa	0.0	0.1 ± 0.3
Diptera taxa	4.0	2.8 ± 1.0
Ephemeroptera taxa	4.0	3.7 ± 0.5
EPT Individuals (Sum)	3525.0	4035.4 ± 2618.4
EPT taxa (no)	11.0	12.3 ± 1.9
Odonata taxa	--	0.0 ± 0.0
Pielou's Evenness	0.8	0.7 ± 0.1
Plecoptera taxa	5.0	5.5 ± 1.1
Shannon-Wiener Diversity	2.1	1.9 ± 0.3
Simpson's Diversity	0.9	0.8 ± 0.1
Simpson's Evenness	0.4	0.3 ± 0.1
Total No. of Taxa	16.0	17.0 ± 3.1
Trichoptera taxa	2.0	3.1 ± 1.2

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	Group 6	
Baetidae	100%	100%	100%	100%	100%	100%	1.00

RIVPACS Ratios

RIVPACS : Expected taxa P>0.50	11.82

RIVPACS Ratios

RIVPACS : Observed taxa P>0.50	10.00
RIVPACS : O:E (p > 0.5)	0.85
RIVPACS : Expected taxa P>0.70	9.45
RIVPACS : Observed taxa P>0.70	9.00
RIVPACS : O:E (p > 0.7)	0.95

Habitat Description

Variable	BOI002	Predicted Group Reference Mean ±SD
Bedrock Geology		
Sedimentary (%)	100.00000	98.46051 ± 8.10999
Channel		
Depth-Avg (cm)	28.3	20.0 ± 8.6
Depth-BankfullMinusWetted (cm)	19.50	46.71 ± 35.00
Depth-Max (cm)	34.0	28.8 ± 13.7
Discharge (m^3/s)	0.136	0.682
Macrophyte (PercentRange)	0	0 ± 0
Reach-%CanopyCoverage (PercentRange)	1.00	1.04 ± 0.95
Reach-%Logging (PercentRange)	0	0 ± 0
Reach-DomStreamsideVeg (Category(1-4))	2	3 ± 1
Reach-Pools (Binary)	0	1 ± 0
Reach-Rapids (Binary)	1	0 ± 0
Reach-Riffles (Binary)	1	1 ± 0
Reach-StraightRun (Binary)	0	1 ± 0
Slope (m/m)	0.0505700	0.0270638 ± 0.0257534
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)	0.48	0.58 ± 0.20
Velocity-Max (m/s)	0.76	0.85 ± 0.27
Width-Bankfull (m)	9.7	16.1 ± 13.1
Width-Wetted (m)	6.2	9.8 ± 7.7
XSEC-VelInstrumentDirect (Category(1-3))	2	3 ± 0
XSEC-VelMethod (Category(1-3))	3	2 ± 1
Climate		
Precip10_OCT (mm)	45.58192	64.42223 ± 33.96544
Temp12_DECmin (Degrees Celsius)	-14.85000	-12.74810 ± 1.73767
Hydrology		
Drainage-Area (km^2)	59.44235	100.09787 ± 132.80561
Landcover		
Natl-Grassland (%)	0.67640	7.47766 ± 6.29880
Natl-ShrubLow (%)	0.28480	1.80492 ± 1.50412
Natl-Water (%)	0.00000	0.32077 ± 0.59001
Reg-Ice (%)	0.00000	1.28005 ± 3.54484
Substrate Data		
%Bedrock (%)	0	0 ± 0
%Boulder (%)	0	6 ± 6
%Cobble (%)	58	57 ± 15
%Gravel (%)	2	2 ± 3
%Pebble (%)	40	34 ± 16
%Sand (%)	0	0 ± 0
%Silt+Clay (%)	0	0 ± 1
D50 (cm)	6.95	24.05 ± 35.66
Dg (cm)	6.6	23.0 ± 33.8
Dominant-1st (Category(0-9))	6	6 ± 1
Dominant-2nd (Category(0-9))	5	6 ± 1
Embeddedness (Category(1-5))	4	4 ± 1
PeriphytonCoverage (Category(1-5))	2	2 ± 1
SurroundingMaterial (Category(0-9))	2	3 ± 1
Topography		
Reg-SlopeLT30% (%)	16.55265	20.01334 ± 7.41149
SlopeMax (%)	317.63962	488.94077 ± 542.32910

Habitat Description

Variable	BOI002	Predicted Group Reference Mean ±SD
Water Chemistry		
Ag (mg/L)	0.0000250	0.0000018 ± 0.0000013
Al (mg/L)	0.0025000	0.0078031 ± 0.0090962
As (mg/L)	0.0002500	0.0002735 ± 0.0001787
B (mg/L)	0.0250000	0.0127286 ± 0.0135802
Ba (mg/L)	0.0284000	0.0677069 ± 0.0514113
Be (mg/L)	0.0000500	0.0000043 ± 0.0000039
Bi (mg/L)	0.0000500	0.0000018 ± 0.0000013
Br (mg/L)	0.0500000	0.0303333 ± 0.0788597
Ca (mg/L)	52.6000000	28.2142857 ± 13.7707094
Cd (mg/L)	0.0000280	0.0000100 ± 0.0000293
Chloride-Total (mg/L)	0.0500000	0.0000000 ± 0.0000000
Co (mg/L)	0.0000500	0.0000075 ± 0.0000060
Cr (mg/L)	0.0002500	0.0001514 ± 0.0001361
Cu (mg/L)	0.0002000	0.0001604 ± 0.0001447
F (mg/L)	0.2600000	0.0876667 ± 0.0847823
Fe (mg/L)	0.0050000	0.0101789 ± 0.0111495
General-Alkalinity (mg/L)	144.0000000	98.9704545 ± 43.8308301
General-CarbonDOC (mg/L)	1.6500000	0.8383333 ± 0.4040008
General-CarbonTOC (mg/L)	1.6500000	0.5586957 ± 0.6229060
General-Conductivity (µS/cm)	328.7000000	173.5150000 ± 86.2502071
General-DO (mg/L)	11.0100000	10.7243478 ± 0.8596502
General-Hardness (mg/L)	189.0000000	109.1853659 ± 48.3470504
General-pH (pH)	8.4	8.0 ± 0.6
General-SolidsTSS (mg/L)	1.0000000	5.2717002 ± 27.1908288
General-SpCond (µS/cm)	328.7000000	196.0710526 ± 116.3908975
General-TempAir (Degrees Celsius)	11.0	7.2 ± 5.7
General-TempWater (Degrees Celsius)	5.1000000	6.2042553 ± 2.0993816
General-Turbidity (NTU)	0.4500000	0.4347619 ± 0.5563328
Hg (ng/L)	0.0000050	0.0000000 ± 0.0000000
K (mg/L)	0.3000000	0.3312424 ± 0.1572675
Li (mg/L)	0.0013900	0.0009183 ± 0.0003795
Mg (mg/L)	14.0000000	7.8748571 ± 3.9958945
Mn (mg/L)	0.0001000	0.0007721 ± 0.0008518
Mo (mg/L)	0.0015300	0.0012835 ± 0.0042333
Na (mg/L)	0.6000000	0.7930303 ± 0.4756164
Ni (mg/L)	0.0002000	0.0001266 ± 0.0001131
Nitrogen-NO2 (mg/L)	0.0050000	0.0049953 ± 0.0199967
Nitrogen-NO2+NO3 (mg/L)	0.0228000	0.0287300 ± 0.0357249
Nitrogen-NO3 (mg/L)	0.0230000	0.0336397 ± 0.0328125
Nitrogen-TKN (mg/L)	0.1300000	0.0352941 ± 0.0299453
Nitrogen-TN (mg/L)	0.1530000	0.0675581 ± 0.0509763
Pb (mg/L)	0.0001000	0.0000179 ± 0.0000156
Phosphorus-OrthoP (mg/L)	0.0025000	0.1105304 ± 0.5208890
Phosphorus-TP (mg/L)	0.0025000	0.0031912 ± 0.0087929
S (mg/L)	21.7000000	3.6625000 ± 1.5619928
Sb (mg/L)	0.0001000	0.0000337 ± 0.0000157
Se (mg/L)	0.0010800	0.0002782 ± 0.0002859
Si (mg/L)	2.2000000	2.0400303 ± 0.8510321
Sn (mg/L)	0.0001000	0.0000300 ± 0.0000407
SO4 (mg/L)	62.6000000	13.3070732 ± 13.0883468
Sr (mg/L)	0.6420000	0.0893414 ± 0.0805860
Te (mg/L)	0.0002500	0.0000000 ± 0.0000000
Th (mg/L)	0.0000500	0.0000000 ± 0.0000000
Ti (mg/L)	0.0025000	0.0003150 ± 0.0001205
Tl (mg/L)	0.0000100	0.0000040 ± 0.0000067
U (mg/L)	0.0010100	0.0003872 ± 0.0002299
V (mg/L)	0.0025000	0.0001617 ± 0.0001537
Zn (mg/L)	0.0020000	0.0003724 ± 0.0003377
Zr (mg/L)	0.0000500	0.0000500 ± 0.0000000

Site Description

Study Name	CBWQ-Elk
Site	COL001
Sampling Date	Oct 03 2023
Know Your Watershed Basin	Central Kootenay
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera EcoZone Northern Continental Divide EcoRegion
Coordinates (decimal degrees)	49.49574 N, 115.06643 W
Altitude	999
Local Basin Name	Elk River
	Coal Creek
Stream Order	3

Figure 1. Location Map

Cabin Assessment Results

Reference Model Summary	
Model	Columbia Basin 2020
Analysis Date	November 20, 2024
Taxonomic Level	Family
Predictive Model Variables	Altitude Drainage-Area Longitude Natl-Grassland Natl-ShrubLow Natl-Water Precip10_Oct Reach-%CanopyCoverage Sedimentary Slope SlopeMax Temp12_DECmin

Reference Groups	**1**	**2**	**3**	**4**	**5**	**6**
Number of Reference Sites	13	24	28	35	32	15
Group Error Rate	53.8%	55.2%	34.1%	52.2%	23.1%	29.4%
Overall Model Error Rate	39.4%					
Probability of Group Membership	2.6%	13.2%	11.9%	48.4%	21.6%	2.2%
CABIN Assessment of COL001 on Oct 03, 2023	Highly Divergent					

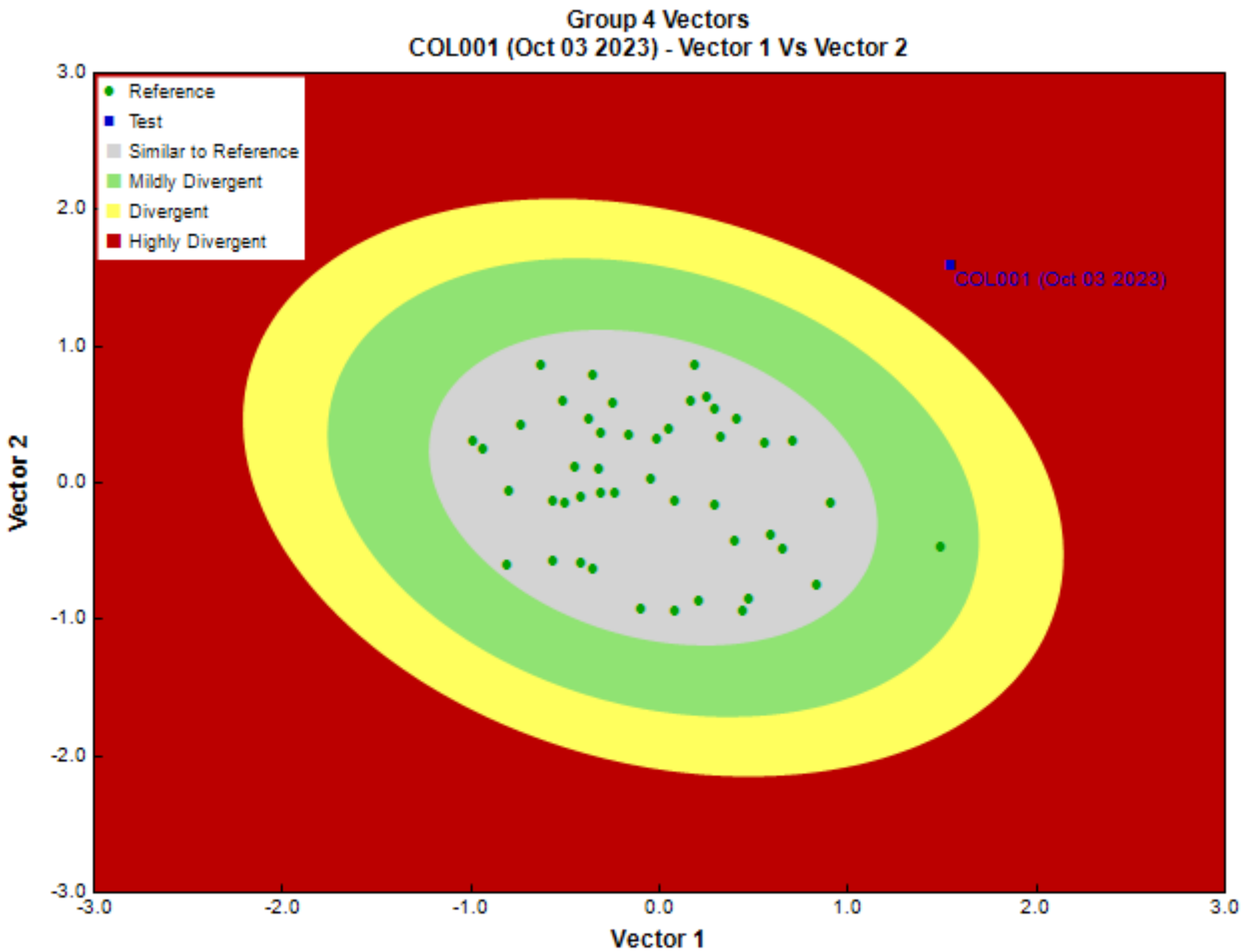


Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	-
	-
Sub-Sample Proportion	5/100

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
Annelida	Clitellata		Enchytraeidae	9	180.0
		Tubificida	Naididae	86	1,720.0
Arthropoda	Arachnida	Trombidiformes	Lebertiidae	1	20.0
	Insecta	Diptera	Athericidae	1	20.0
			Chironomidae	114	2,280.0
			Empididae	4	80.0
			Tipulidae	8	160.0
		Ephemeroptera	Ameletidae	10	200.0
			Baetidae	13	260.0
			Ephemerellidae	9	180.0
			Heptageniidae	13	260.0
			Leptophlebiidae	8	160.0
		Plecoptera		1	20.0
			Capniidae	42	840.0
			Leuctridae	1	20.0
			Nemouridae	2	40.0

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
			Perlodidae	2	40.0
		Trichoptera	Brachycentridae	1	20.0
			Hydropsychidae	3	60.0
			Hydroptilidae	4	80.0
			Lepidostomatidae	67	1,340.0
			Total	399	7,980.0

Metrics

Name	COL001	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.88	0.3 ± 0.1
Biotic Indices		
Hilsenhoff Family index (Mid-Atlantic)	6.2	3.2 ± 0.4
Hilsenhoff Family index (North-West)	6.2	2.9 ± 0.3
Intolerant taxa	--	1.0 ± 0.0
Long-lived taxa	--	1.9 ± 1.0
Tolerant individuals (%)	0.3	0.5 ± 0.4
Functional Measures		
% Filterers	--	0.3
% Gatherers	85.2	47.1 ± 15.4
% Predatores	31.6	12.9 ± 7.3
% Scrapers	8.3	68.3 ± 16.1
% Shredder	30.3	36.7 ± 14.6
No. Clinger Taxa	17.0	20.2 ± 4.4
Number Of Individuals		
% Chironomidae	28.6	5.2 ± 5.7
% Coleoptera	0.0	0.6 ± 2.2
% Diptera + Non-insects	53.8	7.4 ± 7.0
% Ephemeroptera	13.3	45.8 ± 15.1
% Ephemeroptera that are Baetidae	24.5	28.9 ± 20.8
% EPT Individuals	44.0	91.9 ± 7.3
% Odonata	--	0.0 ± 0.0
% of 2 dominant taxa	50.3	59.5 ± 11.3
% of 5 dominant taxa	80.9	85.1 ± 6.5
% of dominant taxa	28.6	37.7 ± 10.4
% Plecoptera	11.8	40.5 ± 13.3
% Tribe Tanyatarisini	--	
% Trichoptera that are Hydropsychida	4.0	23.9 ± 23.6
% Tricoptera	18.8	5.6 ± 3.9
No. EPT individuals/Chironomids+EPT Individuals	0.6	0.9 ± 0.1
Total Abundance	7980.0	1449.4 ± 859.7
Richness		
Chironomidae taxa (genus level only)	1.0	1.0 ± 0.2
Coleoptera taxa	0.0	0.2 ± 0.5
Diptera taxa	4.0	2.6 ± 1.1
Ephemeroptera taxa	5.0	3.7 ± 0.6
EPT Individuals (Sum)	3500.0	1352.9 ± 804.6
EPT taxa (no)	13.0	12.2 ± 2.1
Odonata taxa	--	0.0 ± 0.0
Pielou's Evenness	0.7	0.7 ± 0.1
Plecoptera taxa	4.0	5.4 ± 1.2
Shannon-Wiener Diversity	2.1	1.9 ± 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	16.4 ± 3.5
Trichoptera taxa	4.0	3.2 ± 1.3

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	Group 6	

RIVPACS Ratios

RIVPACS : Expected taxa P>0.50	11.84
RIVPACS : Observed taxa P>0.50	11.00
RIVPACS : O:E (p > 0.5)	0.93
RIVPACS : Expected taxa P>0.70	10.12
RIVPACS : Observed taxa P>0.70	8.00
RIVPACS : O:E (p > 0.7)	0.79

Habitat Description

Variable	COL001	Predicted Group Reference Mean ±SD
Bedrock Geology		
Sedimentary (%)	100.00000	90.78003 ± 16.48787
Channel		
Depth-Avg (cm)	24.7	27.7 ± 12.1
Depth-BankfullMinusWetted (cm)	125.00	48.41 ± 32.00
Depth-Max (cm)	28.0	41.6 ± 18.0
Discharge (m^3/s)	0.050	4.100
Macrophyte (PercentRange)	1	0 ± 0
Reach-%CanopyCoverage (PercentRange)	1.00	1.20 ± 0.86
Reach-%Logging (PercentRange)	0	0 ± 0
Reach-DomStreamsideVeg (Category(1-4))	3	3 ± 1
Reach-Pools (Binary)	0	1 ± 1
Reach-Rapids (Binary)	0	1 ± 1
Reach-Riffles (Binary)	1	1 ± 0
Reach-StraightRun (Binary)	1	1 ± 0
Slope (m/m)	0.0043750	0.0302442 ± 0.0225320
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)	0.19	0.65 ± 0.30
Velocity-Max (m/s)	0.30	1.02 ± 0.40
Width-Bankfull (m)	19.6	22.0 ± 20.4
Width-Wetted (m)	12.0	14.4 ± 14.2
XSEC-VelInstrumentDirect (Category(1-3))	2	2 ± 1
XSEC-VelMethod (Category(1-3))	3	2 ± 1
Climate		
Precip10_OCT (mm)	52.84964	101.93711 ± 37.08464
Temp12_DECmin (Degrees Celsius)	-13.25000	-12.60285 ± 1.55807
Hydrology		
Drainage-Area (km^2)	117.65190	153.19859 ± 249.47160
Landcover		
Natl-Grassland (%)	0.08905	4.14423 ± 3.51761
Natl-ShrubLow (%)	2.06878	4.00461 ± 2.77104
Natl-Water (%)	0.00000	0.26551 ± 0.58793
Reg-Ice (%)	0.00000	2.39543 ± 4.09623
Substrate Data		
%Bedrock (%)	0	0 ± 0
%Boulder (%)	3	8 ± 8
%Cobble (%)	52	53 ± 15
%Gravel (%)	4	4 ± 6
%Pebble (%)	41	33 ± 14
%Sand (%)	0	0 ± 0
%Silt+Clay (%)	0	0 ± 0
D50 (cm)	6.75	14.48 ± 20.33
Dg (cm)	6.2	13.1 ± 19.3
Dominant-1st (Category(0-9))	6	6 ± 1
Dominant-2nd (Category(0-9))	5	6 ± 1
Embeddedness (Category(1-5))	3	4 ± 1
PeriphytonCoverage (Category(1-5))	3	2 ± 1
SurroundingMaterial (Category(0-9))	2	3 ± 2
Topography		
Reg-SlopeLT30% (%)	44.43454	17.11832 ± 8.21512

Habitat Description

Variable	COL001	Predicted Group Reference Mean ±SD
SlopeMax (%)	161.32619	386.22536 ± 140.72382
Water Chemistry		
Ag (mg/L)	0.0000250	0.0000028 ± 0.0000036
Al (mg/L)	0.0183000	0.0136410 ± 0.0145846
As (mg/L)	0.0002500	0.0001754 ± 0.0001818
B (mg/L)	0.0250000	0.0305833 ± 0.0370084
Ba (mg/L)	0.2140000	0.0435560 ± 0.0571949
Be (mg/L)	0.0000500	0.0000056 ± 0.0000072
Bi (mg/L)	0.0000500	0.0000028 ± 0.0000036
Br (mg/L)	0.0500000	0.0268750 ± 0.0585132
Ca (mg/L)	26.1000000	20.8384848 ± 13.6841012
Cd (mg/L)	0.0000330	0.0000115 ± 0.0000149
Chloride-Total (mg/L)	0.4600000	0.0000000 ± 0.0000000
Co (mg/L)	0.0000500	0.0000298 ± 0.0000226
Cr (mg/L)	0.0002500	0.0000900 ± 0.0000889
Cu (mg/L)	0.0007300	0.0003212 ± 0.0001572
F (mg/L)	0.0500000	0.0484615 ± 0.0355181
Fe (mg/L)	0.0170000	0.0442667 ± 0.0348579
General-Alkalinity (mg/L)	102.0000000	59.4800000 ± 43.9851975
General-CarbonDOC (mg/L)	4.5700000	0.6500000 ± 0.3535534
General-CarbonTOC (mg/L)	4.1800000	0.3944444 ± 0.3157179
General-Conductivity (μS/cm)	160.3000000	117.1461538 ± 96.2732948
General-DO (mg/L)	10.7000000	12.6802381 ± 11.2165934
General-Hardness (mg/L)	89.1000000	76.7342857 ± 54.3511564
General-pH (pH)	8.1	7.9 ± 0.4
General-SolidsTSS (mg/L)	1.0000000	1.9034611 ± 3.0161707
General-SpCond (μS/cm)	160.3000000	153.2777778 ± 120.2707781
General-TempAir (Degrees Celsius)	9.0	10.6 ± 5.4
General-TempWater (Degrees Celsius)	8.1000000	6.4219048 ± 2.3475813
General-Turbidity (NTU)	0.1000000	2.7965000 ± 4.1415171
Hg (ng/L)	0.0000050	0.0000000 ± 0.0000000
K (mg/L)	0.5800000	0.4511613 ± 0.2901093
Li (mg/L)	0.0095500	0.0016910 ± 0.0023918
Mg (mg/L)	5.7700000	5.1886364 ± 5.0072212
Mn (mg/L)	0.0014200	0.0028572 ± 0.0019872
Mo (mg/L)	0.0006700	0.0006660 ± 0.0004339
Na (mg/L)	2.7600000	0.9945806 ± 0.9373003
Ni (mg/L)	0.0002000	0.0002298 ± 0.0001811
Nitrogen-NO2 (mg/L)	0.0050000	0.0042917 ± 0.0108893
Nitrogen-NO2+NO3 (mg/L)	0.0050000	0.0732400 ± 0.0567225
Nitrogen-NO3 (mg/L)	0.0050000	0.0865111 ± 0.0538993
Nitrogen-TKN (mg/L)	0.1520000	97.0987778 ± 290.9629753
Nitrogen-TN (mg/L)	0.1520000	24.3739167 ± 145.4787822
Pb (mg/L)	0.0001000	0.0000559 ± 0.0000496
Phosphorus-OrthoP (mg/L)	0.0025000	0.0008667 ± 0.0013292
Phosphorus-TP (mg/L)	0.0168000	0.0031194 ± 0.0039854
S (mg/L)	1.5000000	362.2600000 ± 803.7224104
Sb (mg/L)	0.0001000	0.0000288 ± 0.0000136
Se (mg/L)	0.0002500	0.0002422 ± 0.0003912
Si (mg/L)	1.5000000	1.9070000 ± 0.6500353
Sn (mg/L)	0.0001000	0.0000988 ± 0.0001602
SO4 (mg/L)	4.0000000	18.1942857 ± 18.0693910
Sr (mg/L)	0.0912000	0.1493500 ± 0.1276611
Te (mg/L)	0.0002500	0.0000000 ± 0.0000000
Th (mg/L)	0.0000500	0.0000000 ± 0.0000000
Ti (mg/L)	0.0025000	0.0008433 ± 0.0009290
Tl (mg/L)	0.0000100	0.0000031 ± 0.0000048
U (mg/L)	0.0001940	0.0005805 ± 0.0003382
V (mg/L)	0.0025000	0.0001220 ± 0.0001369
Zn (mg/L)	0.0020000	0.0009430 ± 0.0009518
Zr (mg/L)	0.0000500	0.0000900 ± 0.0000894

Site Description

Study Name	CBWQ-Elk
Site	COL003
Sampling Date	Oct 03 2023
Know Your Watershed Basin	Central Kootenay
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera EcoZone Northern Continental Divide EcoRegion
Coordinates (decimal degrees)	49.45285 N, 114.87999 W
Altitude	1737
Local Basin Name	Elk River
	Coal Creek
Stream Order	1

Figure 1. Location Map

Cabin Assessment Results

Reference Model Summary	
Model	Columbia Basin 2020
Analysis Date	November 20, 2024
Taxonomic Level	Family
Predictive Model Variables	Altitude Drainage-Area Longitude Natl-Grassland Natl-ShrubLow Natl-Water Precip10_Oct Reach-%CanopyCoverage Sedimentary Slope SlopeMax Temp12_DECmin

Reference Groups	**1**	**2**	**3**	**4**	**5**	**6**
Number of Reference Sites	13	24	28	35	32	15
Group Error Rate	53.8%	55.2%	34.1%	52.2%	23.1%	29.4%
Overall Model Error Rate	39.4%					
Probability of Group Membership	0.3%	0.0%	1.7%	1.1%	96.9%	0.0%
CABIN Assessment of COL003 on Oct 03, 2023	Mildly Divergent					

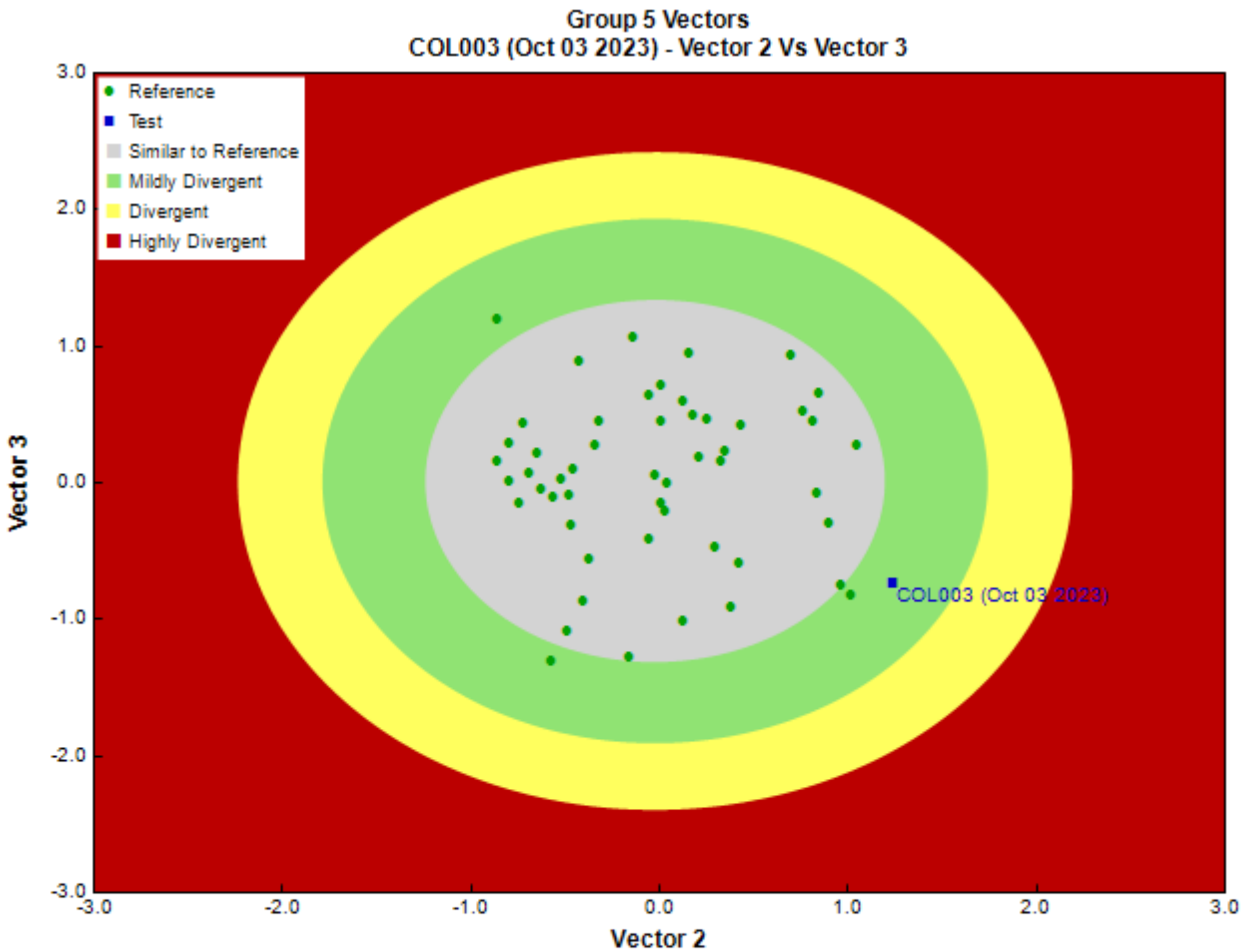


Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	-
	-
Sub-Sample Proportion	5/100

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
Arthropoda	Arachnida	Trombidiformes	Sperchontidae	2	40.0
	Insecta	Coleoptera	Elmidae	7	140.0
		Diptera	Ceratopogonidae	1	20.0
			Chironomidae	145	2,900.0
			Empididae	1	20.0
		Ephemeroptera	Ameletidae	34	680.0
			Baetidae	13	260.0
			Ephemerellidae	26	520.0
			Heptageniidae	27	540.0
			Leptophlebiidae	1	20.0
		Plecoptera	Capniidae	3	60.0
			Chloroperlidae	11	220.0
			Nemouridae	14	280.0
			Perlidae	2	40.0
			Perlodidae	3	60.0
		Trichoptera	Brachycentridae	22	440.0

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
			Limnephilidae	1	20.0
			Rhyacophilidae	4	80.0
			Total	317	6,340.0

Metrics

Name	COL003	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.6	0.4 ± 0.1
Biotic Indices		
Hilsenhoff Family index (Mid-Atlantic)	3.1	3.4 ± 0.4
Hilsenhoff Family index (North-West)	3.1	3.1 ± 0.5
Intolerant taxa	--	1.0 ± 0.0
Long-lived taxa	4.0	1.7 ± 1.2
Tolerant individuals (%)	--	0.3 ± 0.0
Functional Measures		
% Filterers	--	
% Gatherers	78.5	45.8 ± 14.9
% Predatores	56.5	14.8 ± 9.8
% Scrapers	15.1	59.4 ± 19.6
% Shredder	14.8	30.7 ± 17.4
No. Clinger Taxa	24.0	19.8 ± 4.0
Number Of Individuals		
% Chironomidae	45.7	7.5 ± 8.6
% Coleoptera	2.2	0.1 ± 0.3
% Diptera + Non-insects	47.0	10.7 ± 9.9
% Ephemeroptera	31.9	47.2 ± 15.8
% Ephemeroptera that are Baetidae	12.9	25.4 ± 20.8
% EPT Individuals	50.8	89.2 ± 10.0
% Odonata	--	0.0 ± 0.0
% of 2 dominant taxa	56.5	58.3 ± 10.6
% of 5 dominant taxa	80.1	83.6 ± 6.3
% of dominant taxa	45.7	37.8 ± 11.1
% Plecoptera	10.4	36.3 ± 16.7
% Tribe Tanyatarisini	--	
% Trichoptera that are Hydropsychida	0.0	25.4 ± 24.6
% Tricoptera	8.5	5.7 ± 3.9
No. EPT individuals/Chironomids+EPT Individuals	0.5	0.9 ± 0.1
Total Abundance	6340.0	4661.0 ± 3119.0
Richness		
Chironomidae taxa (genus level only)	1.0	1.0 ± 0.1
Coleoptera taxa	1.0	0.1 ± 0.3
Diptera taxa	3.0	2.8 ± 1.0
Ephemeroptera taxa	5.0	3.7 ± 0.5
EPT Individuals (Sum)	3220.0	4035.4 ± 2618.4
EPT taxa (no)	13.0	12.3 ± 1.9
Odonata taxa	--	0.0 ± 0.0
Pielou's Evenness	0.7	0.7 ± 0.1
Plecoptera taxa	5.0	5.5 ± 1.1
Shannon-Wiener Diversity	1.9	1.9 ± 0.3
Simpson's Diversity	0.8	0.8 ± 0.1
Simpson's Evenness	0.2	0.3 ± 0.1
Total No. of Taxa	18.0	17.0 ± 3.1
Trichoptera taxa	3.0	3.1 ± 1.2

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	Group 6	

RIVPACS Ratios

RIVPACS : Expected taxa P>0.50	12.58
RIVPACS : Observed taxa P>0.50	11.00
RIVPACS : O:E (p > 0.5)	0.87
RIVPACS : Expected taxa P>0.70	9.58
RIVPACS : Observed taxa P>0.70	8.00
RIVPACS : O:E (p > 0.7)	0.83

Habitat Description

Variable	COL003	Predicted Group Reference Mean ±SD
Bedrock Geology		
Sedimentary (%)	100.00000	98.46051 ± 8.10999
Channel		
Depth-Avg (cm)	12.0	20.0 ± 8.6
Depth-BankfullMinusWetted (cm)	16.00	46.71 ± 35.00
Depth-Max (cm)	16.0	28.8 ± 13.7
Discharge (m^3/s)	0.014	0.682
Macrophyte (PercentRange)	0	0 ± 0
Reach-%CanopyCoverage (PercentRange)	2.00	1.04 ± 0.95
Reach-%Logging (PercentRange)	0	0 ± 0
Reach-DomStreamsideVeg (Category(1-4))	2	3 ± 1
Reach-Pools (Binary)	1	1 ± 0
Reach-Rapids (Binary)	0	0 ± 0
Reach-Riffles (Binary)	1	1 ± 0
Reach-StraightRun (Binary)	1	1 ± 0
Slope (m/m)	0.0194000	0.0270638 ± 0.0257534
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)	0.11	0.58 ± 0.20
Velocity-Max (m/s)	0.15	0.85 ± 0.27
Width-Bankfull (m)	5.1	16.1 ± 13.1
Width-Wetted (m)	4.0	9.8 ± 7.7
XSEC-VelInstrumentDirect (Category(1-3))	2	3 ± 0
XSEC-VelMethod (Category(1-3))	3	2 ± 1
Climate		
Precip10_OCT (mm)	52.73000	64.42223 ± 33.96544
Temp12_DECmin (Degrees Celsius)	-13.00000	-12.74810 ± 1.73767
Hydrology		
Drainage-Area (km^2)	5.65737	100.09787 ± 132.80561
Landcover		
Natl-Grassland (%)	0.00000	7.47766 ± 6.29880
Natl-ShrubLow (%)	0.14265	1.80492 ± 1.50412
Natl-Water (%)	0.00000	0.32077 ± 0.59001
Reg-Ice (%)	0.00000	1.28005 ± 3.54484
Substrate Data		
%Bedrock (%)	0	0 ± 0
%Boulder (%)	3	6 ± 6
%Cobble (%)	38	57 ± 15
%Gravel (%)	3	2 ± 3
%Pebble (%)	56	34 ± 16
%Sand (%)	0	0 ± 0
%Silt+Clay (%)	0	0 ± 1
D50 (cm)	5.60	24.05 ± 35.66
Dg (cm)	5.8	23.0 ± 33.8
Dominant-1st (Category(0-9))	5	6 ± 1
Dominant-2nd (Category(0-9))	6	6 ± 1
Embeddedness (Category(1-5))	4	4 ± 1
PeriphytonCoverage (Category(1-5))	1	2 ± 1
SurroundingMaterial (Category(0-9))	3	3 ± 1
Topography		
Reg-SlopeLT30% (%)	73.39946	20.01334 ± 7.41149

Habitat Description

Variable	COL003	Predicted Group Reference Mean ±SD
SlopeMax (%)	101.76495	488.94077 ± 542.32910
Water Chemistry		
Ag (mg/L)	0.0000250	0.0000018 ± 0.0000013
Al (mg/L)	0.0891000	0.0078031 ± 0.0090962
As (mg/L)	0.0002500	0.0002735 ± 0.0001787
B (mg/L)	0.0250000	0.0127286 ± 0.0135802
Ba (mg/L)	0.0494000	0.0677069 ± 0.0514113
Be (mg/L)	0.0000500	0.0000043 ± 0.0000039
Bi (mg/L)	0.0000500	0.0000018 ± 0.0000013
Br (mg/L)	0.0500000	0.0303333 ± 0.0788597
Ca (mg/L)	7.9100000	28.2142857 ± 13.7707094
Cd (mg/L)	0.0000660	0.0000100 ± 0.0000293
Chloride-Total (mg/L)	0.3500000	0.0000000 ± 0.0000000
Co (mg/L)	0.0000500	0.0000075 ± 0.0000060
Cr (mg/L)	0.0002500	0.0001514 ± 0.0001361
Cu (mg/L)	0.0006300	0.0001604 ± 0.0001447
F (mg/L)	0.0500000	0.0876667 ± 0.0847823
Fe (mg/L)	0.0350000	0.0101789 ± 0.0111495
General-Alkalinity (mg/L)	25.1000000	98.9704545 ± 43.8308301
General-CarbonDOC (mg/L)	5.4800000	0.8383333 ± 0.4040008
General-CarbonTOC (mg/L)	4.4300000	0.5586957 ± 0.6229060
General-Conductivity (μS/cm)	43.9000000	173.5150000 ± 86.2502071
General-DO (mg/L)	10.3000000	10.7243478 ± 0.8596502
General-Hardness (mg/L)	25.6000000	109.1853659 ± 48.3470504
General-pH (pH)	7.7	8.0 ± 0.6
General-SolidsTSS (mg/L)	1.0000000	5.2717002 ± 27.1908288
General-SpCond (μS/cm)	43.9000000	196.0710526 ± 116.3908975
General-TempAir (Degrees Celsius)	8.0	7.2 ± 5.7
General-TempWater (Degrees Celsius)	5.5000000	6.2042553 ± 2.0993816
General-Turbidity (NTU)	0.2800000	0.4347619 ± 0.5563328
Hg (ng/L)	0.0000050	0.0000000 ± 0.0000000
K (mg/L)	0.2600000	0.3312424 ± 0.1572675
Li (mg/L)	0.0001800	0.0009183 ± 0.0003795
Mg (mg/L)	1.4200000	7.8748571 ± 3.9958945
Mn (mg/L)	0.0007600	0.0007721 ± 0.0008518
Mo (mg/L)	0.0001800	0.0012835 ± 0.0042333
Na (mg/L)	0.1900000	0.7930303 ± 0.4756164
Ni (mg/L)	0.0006200	0.0001266 ± 0.0001131
Nitrogen-NO2 (mg/L)	0.0050000	0.0049953 ± 0.0199967
Nitrogen-NO2+NO3 (mg/L)	0.0050000	0.0287300 ± 0.0357249
Nitrogen-NO3 (mg/L)	0.0050000	0.0336397 ± 0.0328125
Nitrogen-TKN (mg/L)	0.2280000	0.0352941 ± 0.0299453
Nitrogen-TN (mg/L)	0.2280000	0.0675581 ± 0.0509763
Pb (mg/L)	0.0001000	0.0000179 ± 0.0000156
Phosphorus-OrthoP (mg/L)	0.0025000	0.1105304 ± 0.5208890
Phosphorus-TP (mg/L)	0.0163000	0.0031912 ± 0.0087929
S (mg/L)	1.5000000	3.6625000 ± 1.5619928
Sb (mg/L)	0.0001000	0.0000337 ± 0.0000157
Se (mg/L)	0.0002500	0.0002782 ± 0.0002859
Si (mg/L)	1.5000000	2.0400303 ± 0.8510321
Sn (mg/L)	0.0001000	0.0000300 ± 0.0000407
SO4 (mg/L)	1.8000000	13.3070732 ± 13.0883468
Sr (mg/L)	0.0120000	0.0893414 ± 0.0805860
Te (mg/L)	0.0002500	0.0000000 ± 0.0000000
Th (mg/L)	0.0000500	0.0000000 ± 0.0000000
Ti (mg/L)	0.0025000	0.0003150 ± 0.0001205
Tl (mg/L)	0.0000100	0.0000040 ± 0.0000067
U (mg/L)	0.0000420	0.0003872 ± 0.0002299
V (mg/L)	0.0025000	0.0001617 ± 0.0001537
Zn (mg/L)	0.0020000	0.0003724 ± 0.0003377
Zr (mg/L)	0.0003000	0.0000500 ± 0.0000000

Site Description

Study Name	CBWQ-Elk
Site	LIZ001
Sampling Date	Oct 04 2023
Know Your Watershed Basin	Central Kootenay
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera EcoZone Northern Continental Divide EcoRegion
Coordinates (decimal degrees)	49.47116 N, 115.07716 W
Altitude	994
Local Basin Name	Lizard Creek
	Elk River
Stream Order	3

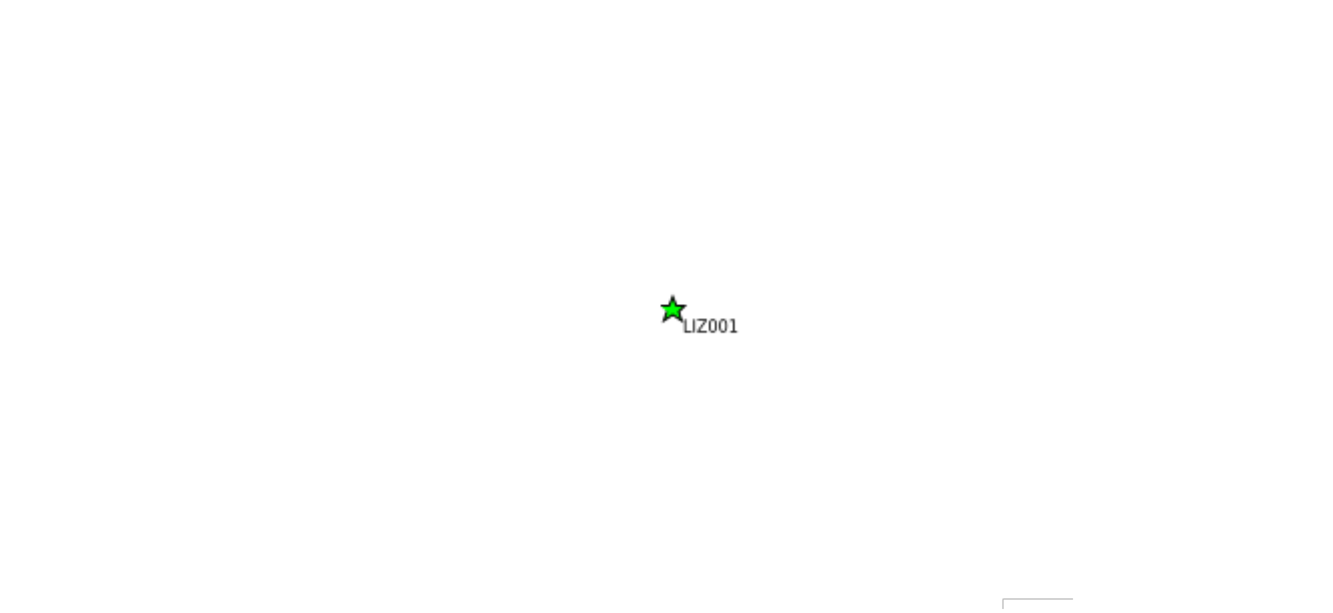


Figure 1. Location Map

Cabin Assessment Results

Reference Model Summary	
Model	Columbia Basin 2020
Analysis Date	November 20, 2024
Taxonomic Level	Family
Predictive Model Variables	Altitude Drainage-Area Longitude Natl-Grassland Natl-ShrubLow Natl-Water Precip10_Oct Reach-%CanopyCoverage Sedimentary Slope SlopeMax Temp12_DECmin

Reference Groups	**1**	**2**	**3**	**4**	**5**	**6**
Number of Reference Sites	13	24	28	35	32	15
Group Error Rate	53.8%	55.2%	34.1%	52.2%	23.1%	29.4%
Overall Model Error Rate	39.4%					
Probability of Group Membership	5.2%	35.1%	17.4%	28.1%	8.6%	5.7%
CABIN Assessment of LIZ001 on Oct 04, 2023	Highly Divergent					

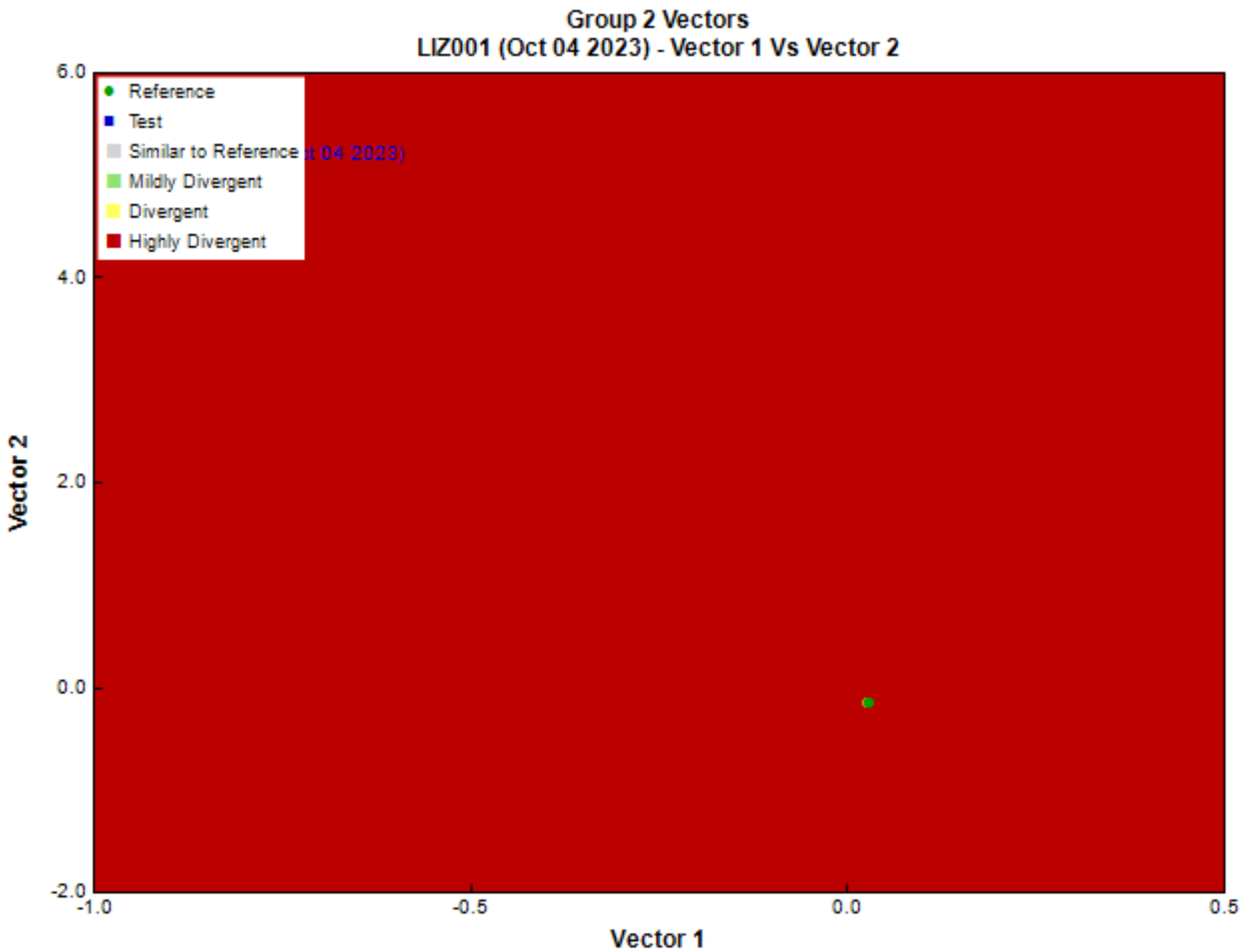


Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	-
	-
Sub-Sample Proportion	5/100

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
Annelida	Clitellata	Tubificida	Naididae	263	5,260.0
Arthropoda	Arachnida	Trombidiformes	Feltriidae	1	20.0
			Lebertiidae	17	340.0
			Sperchontidae	2	40.0
			Torrenticolidae	1	20.0
	Insecta	Coleoptera	Elmidae	21	420.0
		Diptera	Chironomidae	90	1,800.0
			Empididae	20	400.0
			Psychodidae	42	840.0
			Tipulidae	3	60.0
		Ephemeroptera	Baetidae	63	1,260.0
			Ephemerellidae	17	340.0
			Heptageniidae	3	60.0
		Plecoptera		3	60.0
			Capniidae	24	480.0
			Chloroperlidae	1	20.0

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
			Nemouridae	31	620.0
			Perlidae	2	40.0
			Perlodidae	6	120.0
		Trichoptera		1	20.0
			Brachycentridae	8	160.0
			Hydropsychidae	20	400.0
			Hydroptilidae	3	60.0
			Lepidostomatidae	5	100.0
			Rhyacophilidae	3	60.0
			Total	650	13,000.0

Metrics

Name	LIZ001	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.96	0.3 ± 0.1
Biotic Indices		
Hilsenhoff Family index (Mid-Atlantic)	8.3	3.6 ± 0.4
Hilsenhoff Family index (North-West)	8.3	3.2 ± 0.3
Intolerant taxa	--	1.0 ± 0.0
Long-lived taxa	3.0	2.7 ± 1.5
Tolerant individuals (%)	--	0.9 ± 0.2
Functional Measures		
% Filterers	--	0.6 ± 0.3
% Gatherers	117.1	38.1 ± 14.1
% Predatores	26.0	15.8 ± 9.1
% Scrapers	16.9	60.8 ± 14.6
% Shredder	14.2	23.9 ± 11.1
No. Clinger Taxa	25.0	22.0 ± 5.6
Number Of Individuals		
% Chironomidae	13.9	6.0 ± 5.6
% Coleoptera	3.3	1.7 ± 4.1
% Diptera + Non-insects	68.0	10.1 ± 7.7
% Ephemeroptera	12.8	53.4 ± 13.8
% Ephemeroptera that are Baetidae	75.9	29.5 ± 17.8
% EPT Individuals	28.8	88.1 ± 9.3
% Odonata	--	0.0 ± 0.0
% of 2 dominant taxa	54.6	54.4 ± 11.4
% of 5 dominant taxa	75.7	81.6 ± 8.1
% of dominant taxa	40.7	35.2 ± 11.4
% Plecoptera	9.9	28.8 ± 11.6
% Tribe Tanyatarisini	--	
% Trichoptera that are Hydropsychida	51.3	28.7 ± 28.3
% Tricoptera	6.0	6.0 ± 5.0
No. EPT individuals/Chironomids+EPT Individuals	0.7	0.9 ± 0.1
Total Abundance	13000.0	1083.1 ± 932.3
Richness		
Chironomidae taxa (genus level only)	1.0	1.0 ± 0.1
Coleoptera taxa	1.0	0.3 ± 0.5
Diptera taxa	4.0	3.1 ± 1.3
Ephemeroptera taxa	3.0	3.8 ± 0.6
EPT Individuals (Sum)	3720.0	941.8 ± 766.3
EPT taxa (no)	13.0	12.4 ± 2.4
Odonata taxa	--	0.0 ± 0.0
Pielou's Evenness	0.7	0.7 ± 0.1
Plecoptera taxa	5.0	5.3 ± 1.3
Shannon-Wiener Diversity	2.1	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	23.0	18.2 ± 4.7
Trichoptera taxa	5.0	3.3 ± 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	Group 6	
Baetidae	100%	100%	100%	100%	100%	100%	1.00

RIVPACS Ratios

RIVPACS : Expected taxa P>0.50	12.35
RIVPACS : Observed taxa P>0.50	13.00
RIVPACS : O:E (p > 0.5)	1.05
RIVPACS : Expected taxa P>0.70	10.05
RIVPACS : Observed taxa P>0.70	10.00
RIVPACS : O:E (p > 0.7)	0.99

Habitat Description

Variable	LIZ001	Predicted Group Reference Mean ±SD
Bedrock Geology		
Sedimentary (%)	100.00000	91.25558 ± 24.81348
Channel		
Depth-Avg (cm)	20.3	31.4 ± 15.4
Depth-BankfullMinusWetted (cm)	44.00	54.15 ± 36.59
Depth-Max (cm)	24.0	46.8 ± 23.7
Discharge (m^3/s)	0.051	0.000 ± 0.000
Macrophyte (PercentRange)	0	0 ± 0
Reach-%CanopyCoverage (PercentRange)	1.00	1.00 ± 0.96
Reach-%Logging (PercentRange)	0	0 ± 0
Reach-DomStreamsideVeg (Category(1-4))	1	3 ± 1
Reach-Pools (Binary)	1	1 ± 1
Reach-Rapids (Binary)	0	0 ± 0
Reach-Riffles (Binary)	1	1 ± 0
Reach-StraightRun (Binary)	1	1 ± 1
Slope (m/m)	0.0227000	0.0435622 ± 0.0544263
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)	0.25	0.63 ± 0.23
Velocity-Max (m/s)	0.38	0.95 ± 0.33
Width-Bankfull (m)	10.4	23.6 ± 18.9
Width-Wetted (m)	5.3	14.0 ± 9.6
XSEC-VelInstrumentDirect (Category(1-3))	2	2 ± 0
XSEC-VelMethod (Category(1-3))	3	2 ± 1
Climate		
Precip10_OCT (mm)	48.29762	93.78954 ± 37.73803
Temp12_DECmin (Degrees Celsius)	-13.15000	-12.77499 ± 1.90440
Hydrology		
Drainage-Area (km^2)	45.25148	267.49128 ± 347.95771
Landcover		
Natl-Grassland (%)	3.20456	4.84000 ± 3.39798
Natl-ShrubLow (%)	6.94321	4.94988 ± 4.53147
Natl-Water (%)	0.16023	0.22026 ± 0.32058
Reg-Ice (%)	0.00000	4.18114 ± 6.57069
Substrate Data		
%Bedrock (%)	0	0 ± 1
%Boulder (%)	1	6 ± 7
%Cobble (%)	41	51 ± 23
%Gravel (%)	9	4 ± 6
%Pebble (%)	48	39 ± 23
%Sand (%)	0	0 ± 0
%Silt+Clay (%)	0	0 ± 0
D50 (cm)	5.45	8.79 ± 6.32
Dg (cm)	5.1	7.7 ± 3.1

Habitat Description

Variable	LIZ001	Predicted Group Reference Mean ±SD
Dominant-1st (Category(0-9))	5	6 ± 1
Dominant-2nd (Category(0-9))	6	6 ± 1
Embeddedness (Category(1-5))	3	4 ± 1
PeriphytonCoverage (Category(1-5))	4	2 ± 1
SurroundingMaterial (Category(0-9))	2	3 ± 1
Topography		
Reg-SlopeLT30% (%)	35.05430	22.23150 ± 8.61518
SlopeMax (%)	223.55025	475.68167 ± 413.51912
Water Chemistry		
Ag (mg/L)	0.0000250	0.0000038 ± 0.0000018
Al (mg/L)	0.0236000	0.0064450 ± 0.0021850
As (mg/L)	0.0002500	0.0002615 ± 0.0000120
B (mg/L)	0.0250000	0.0262500 ± 0.0335876
Ba (mg/L)	0.0796000	0.0683500 ± 0.0002121
Be (mg/L)	0.0000500	0.0000075 ± 0.0000035
Bi (mg/L)	0.0000500	0.0000038 ± 0.0000018
Br (mg/L)	0.0500000	0.0140909 ± 0.0253375
Ca (mg/L)	115.0000000	24.6363636 ± 20.0629852
Cd (mg/L)	0.0000160	0.0000038 ± 0.0000018
Chloride-Total (mg/L)	0.2600000	0.0000000 ± 0.0000000
Co (mg/L)	0.0000500	0.0000114 ± 0.0000019
Cr (mg/L)	0.0002500	0.0000750 ± 0.0000354
Cu (mg/L)	0.0002000	0.0001155 ± 0.0000219
F (mg/L)	0.0500000	0.0633810 ± 0.0630004
Fe (mg/L)	0.0260000	0.0105500 ± 0.0036062
General-Alkalinity (mg/L)	178.0000000	74.2125000 ± 53.9915558
General-CarbonDOC (mg/L)	1.8900000	0.0000000 ± 0.0000000
General-CarbonTOC (mg/L)	1.8100000	0.9750000 ± 0.4596194
General-Conductivity (μS/cm)	604.0000000	121.7600000 ± 104.0053005
General-DO (mg/L)	10.9600000	11.0129630 ± 0.8955266
General-Hardness (mg/L)	386.0000000	95.8956522 ± 77.3576081
General-pH (pH)	8.3	7.7 ± 0.8
General-SolidsTSS (mg/L)	11.4000000	5.9463636 ± 8.6422279
General-SpCond (μS/cm)	604.0000000	165.1777778 ± 128.4575336
General-TempAir (Degrees Celsius)	12.0	11.5 ± 5.9
General-TempWater (Degrees Celsius)	7.3000000	6.4451852 ± 2.2997548
General-Turbidity (NTU)	1.0600000	5.7154545 ± 6.9690564
Hg (ng/L)	0.0000050	0.0000000 ± 0.0000000
K (mg/L)	0.4600000	0.4604091 ± 0.2737828
Li (mg/L)	0.0042600	0.0011000 ± 0.0000000
Mg (mg/L)	23.9000000	8.6045455 ± 7.5439965
Mn (mg/L)	0.0025100	0.0007470 ± 0.0001937
Mo (mg/L)	0.0017500	0.0006780 ± 0.0000170
Na (mg/L)	1.8200000	1.0881818 ± 0.7163042
Ni (mg/L)	0.0002000	0.0001625 ± 0.0001945
Nitrogen-NO2 (mg/L)	0.0050000	0.0034091 ± 0.0048394
Nitrogen-NO2+NO3 (mg/L)	0.0187000	0.0789333 ± 0.0140433
Nitrogen-NO3 (mg/L)	0.0190000	0.0719000 ± 0.0408583
Nitrogen-TKN (mg/L)	0.0580000	0.0200000
Nitrogen-TN (mg/L)	0.0767000	0.0929091 ± 0.0373336
Pb (mg/L)	0.0001000	0.0000337 ± 0.0000259
Phosphorus-OrthoP (mg/L)	0.0025000	0.0005167 ± 0.0006974
Phosphorus-TP (mg/L)	0.0107000	0.0049864 ± 0.0043795
S (mg/L)	81.7000000	5.0000000
Sb (mg/L)	0.0001000	0.0000635 ± 0.0000092
Se (mg/L)	0.0002500	0.0001105 ± 0.0000134
Si (mg/L)	2.6000000	2.5681818 ± 1.4562562
Sn (mg/L)	0.0001000	0.0000075 ± 0.0000035
SO4 (mg/L)	223.0000000	23.3522727 ± 29.9414845
Sr (mg/L)	1.7900000	0.0445000 ± 0.0002828
Te (mg/L)	0.0002500	0.0000000 ± 0.0000000
Th (mg/L)	0.0000500	0.0000000 ± 0.0000000

Habitat Description

Variable	LIZ001	Predicted Group Reference Mean ±SD
Ti (mg/L)	0.0025000	0.0005000
Tl (mg/L)	0.0000100	0.0000015 ± 0.0000007
U (mg/L)	0.0004180	0.0012050 ± 0.0000495
V (mg/L)	0.0025000	0.0001500 ± 0.0000707
Zn (mg/L)	0.0020000	0.0006400 ± 0.0005091
Zr (mg/L)	0.0000500	0.0000000 ± 0.0000000

Site Description

Study Name	CBWQ-Elk
Site	LIZ003
Sampling Date	Oct 04 2023
Know Your Watershed Basin	Central Kootenay
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera EcoZone Northern Continental Divide EcoRegion
Coordinates (decimal degrees)	49.48569 N, 115.09432 W
Altitude	1022
Local Basin Name	Lizard Creek
	Central Kootenay
Stream Order	3

Figure 1. Location Map

Cabin Assessment Results

Reference Model Summary	
Model	Columbia Basin 2020
Analysis Date	November 20, 2024
Taxonomic Level	Family
Predictive Model Variables	Altitude Drainage-Area Longitude Natl-Grassland Natl-ShrubLow Natl-Water Precip10_Oct Reach-%CanopyCoverage Sedimentary Slope SlopeMax Temp12_DECmin

Reference Groups	**1**	**2**	**3**	**4**	**5**	**6**
Number of Reference Sites	13	24	28	35	32	15
Group Error Rate	53.8%	55.2%	34.1%	52.2%	23.1%	29.4%
Overall Model Error Rate	39.4%					
Probability of Group Membership	4.0%	27.9%	18.0%	33.1%	11.3%	5.7%
CABIN Assessment of LIZ003 on Oct 04, 2023	Highly Divergent					

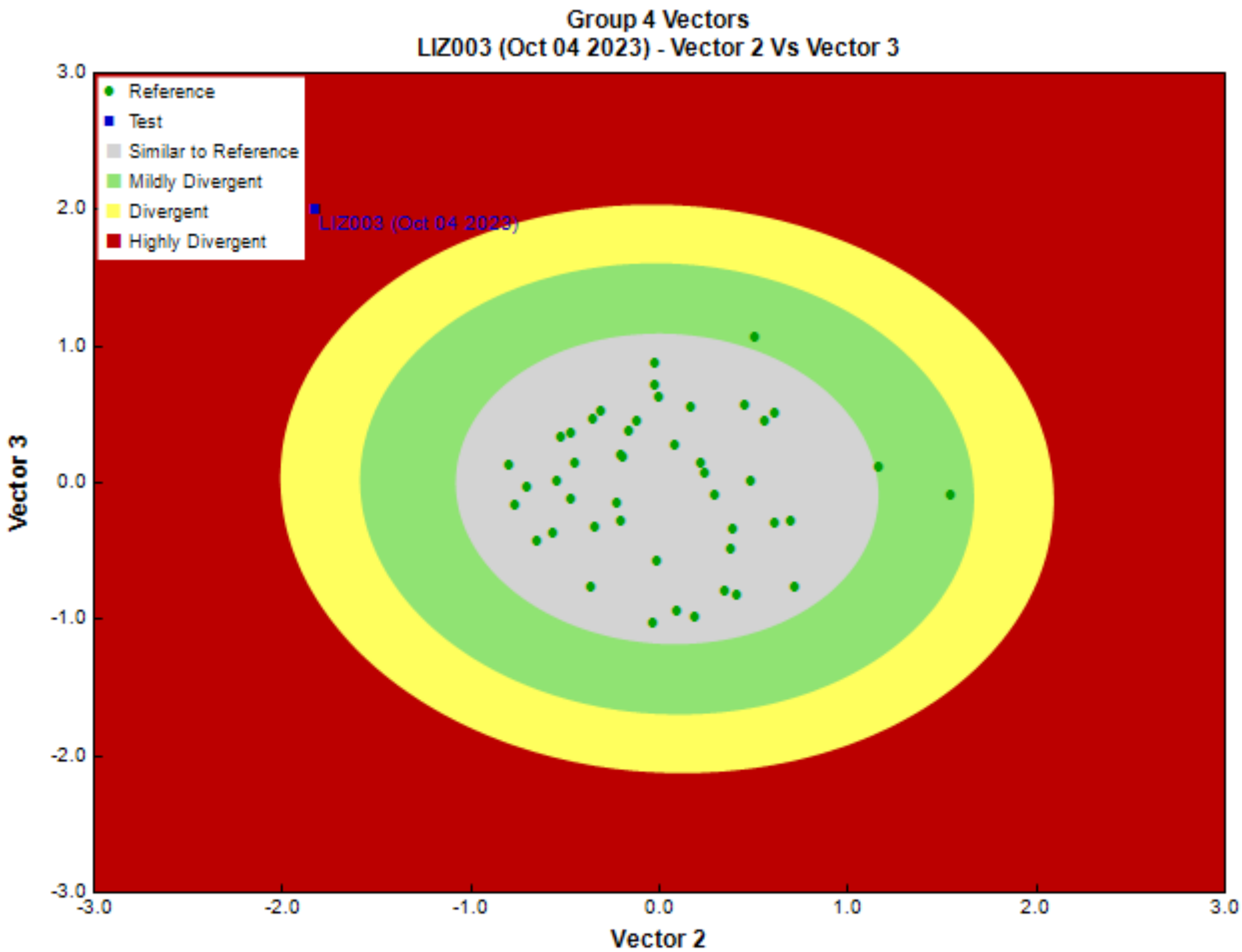


Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	-
	-
Sub-Sample Proportion	5/100

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
Annelida	Clitellata	Tubificida	Naididae	7	140.0
Arthropoda	Arachnida	Trombidiformes	Lebertiidae	8	160.0
			Torrenticolidae	10	200.0
	Insecta	Coleoptera	Elmidae	186	3,720.0
		Diptera		1	20.0
			Ceratopogonidae	1	20.0
			Chironomidae	15	300.0
			Empididae	3	60.0
			Pelecorhynchidae	1	20.0
			Psychodidae	164	3,280.0
			Tipulidae	11	220.0
		Ephemeroptera	Baetidae	197	3,940.0
			Ephemerellidae	184	3,680.0
			Heptageniidae	45	900.0
		Plecoptera		4	80.0
			Capniidae	16	320.0

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
			Chloroperlidae	10	200.0
			Nemouridae	56	1,120.0
			Perlidae	16	320.0
			Perlodidae	5	100.0
			Taeniopterygidae	3	60.0
		Trichoptera	Apataniidae	4	80.0
			Brachycentridae	19	380.0
			Hydropsychidae	35	700.0
			Limnephilidae	1	20.0
			Rhyacophilidae	15	300.0
			Uenoidae	7	140.0
			Total	1,024	20,480.0

Metrics

Name	LIZ003	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.92	0.3 ± 0.1
Biotic Indices		
Hilsenhoff Family index (Mid-Atlantic)	3.9	3.2 ± 0.4
Hilsenhoff Family index (North-West)	3.9	2.9 ± 0.3
Intolerant taxa	--	1.0 ± 0.0
Long-lived taxa	5.0	1.9 ± 1.0
Tolerant individuals (%)	--	0.5 ± 0.4
Functional Measures		
% Filterers	--	0.3
% Gatherers	67.8	47.1 ± 15.4
% Predatores	12.4	12.9 ± 7.3
% Scrapers	46.7	68.3 ± 16.1
% Shredder	28.9	36.7 ± 14.6
No. Clinger Taxa	32.0	20.2 ± 4.4
Number Of Individuals		
% Chironomidae	1.5	5.2 ± 5.7
% Coleoptera	18.3	0.6 ± 2.2
% Diptera + Non-insects	21.6	7.4 ± 7.0
% Ephemeroptera	41.8	45.8 ± 15.1
% Ephemeroptera that are Baetidae	46.2	28.9 ± 20.8
% EPT Individuals	60.2	91.9 ± 7.3
% Odonata	--	0.0 ± 0.0
% of 2 dominant taxa	37.6	59.5 ± 11.3
% of 5 dominant taxa	77.2	85.1 ± 6.5
% of dominant taxa	19.3	37.7 ± 10.4
% Plecoptera	10.4	40.5 ± 13.3
% Tribe Tanyatarisini	--	
% Trichoptera that are Hydropsychida	43.2	23.9 ± 23.6
% Tricoptera	7.9	5.6 ± 3.9
No. EPT individuals/Chironomids+EPT Individuals	1.0	0.9 ± 0.1
Total Abundance	20480.0	1449.4 ± 859.7
Richness		
Chironomidae taxa (genus level only)	1.0	1.0 ± 0.2
Coleoptera taxa	1.0	0.2 ± 0.5
Diptera taxa	6.0	2.6 ± 1.1
Ephemeroptera taxa	3.0	3.7 ± 0.6
EPT Individuals (Sum)	12260.0	1352.9 ± 804.6
EPT taxa (no)	15.0	12.2 ± 2.1
Odonata taxa	--	0.0 ± 0.0
Pielou's Evenness	0.7	0.7 ± 0.1
Plecoptera taxa	6.0	5.4 ± 1.2
Shannon-Wiener Diversity	2.3	1.9 ± 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	16.4 ± 3.5
Trichoptera taxa	6.0	3.2 ± 1.3

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	Group 6	
Baetidae	100%	100%	100%	100%	100%	100%	1.00

RIVPACS Ratios

RIVPACS : Expected taxa P>0.50	12.33
RIVPACS : Observed taxa P>0.50	13.00
RIVPACS : O:E (p > 0.5)	1.05
RIVPACS : Expected taxa P>0.70	10.06
RIVPACS : Observed taxa P>0.70	11.00
RIVPACS : O:E (p > 0.7)	1.09

Habitat Description

Variable	LIZ003	Predicted Group Reference Mean ±SD
Bedrock Geology		
Sedimentary (%)	100.00000	90.78003 ± 16.48787
Channel		
Depth-Avg (cm)	17.5	27.7 ± 12.1
Depth-BankfullMinusWetted (cm)	16.00	48.41 ± 32.00
Depth-Max (cm)	22.0	41.6 ± 18.0
Discharge (m^3/s)	0.042	4.100
Macrophyte (PercentRange)	0	0 ± 0
Reach-%CanopyCoverage (PercentRange)	1.00	1.20 ± 0.86
Reach-%Logging (PercentRange)	0	0 ± 0
Reach-DomStreamsideVeg (Category(1-4))	2	3 ± 1
Reach-Pools (Binary)	1	1 ± 1
Reach-Rapids (Binary)	0	1 ± 1
Reach-Riffles (Binary)	1	1 ± 0
Reach-StraightRun (Binary)	1	1 ± 0
Slope (m/m)	0.0073700	0.0302442 ± 0.0225320
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)	0.24	0.65 ± 0.30
Velocity-Max (m/s)	0.50	1.02 ± 0.40
Width-Bankfull (m)	8.0	22.0 ± 20.4
Width-Wetted (m)	5.0	14.4 ± 14.2
XSEC-VelInstrumentDirect (Category(1-3))	2	2 ± 1
XSEC-VelMethod (Category(1-3))	3	2 ± 1
Climate		
Precip10_OCT (mm)	50.00611	101.93711 ± 37.08464
Temp12_DECmin (Degrees Celsius)	-13.15000	-12.60285 ± 1.55807
Hydrology		
Drainage-Area (km^2)	41.13000	153.19859 ± 249.47160
Landcover		
Natl-Grassland (%)	3.33072	4.14423 ± 3.51761
Natl-ShrubLow (%)	6.54389	4.00461 ± 2.77104
Natl-Water (%)	0.17633	0.26551 ± 0.58793
Reg-Ice (%)	0.00000	2.39543 ± 4.09623
Substrate Data		
%Bedrock (%)	0	0 ± 0
%Boulder (%)	1	8 ± 8
%Cobble (%)	43	53 ± 15
%Gravel (%)	2	4 ± 6
%Pebble (%)	54	33 ± 14
%Sand (%)	0	0 ± 0
%Silt+Clay (%)	0	0 ± 0
D50 (cm)	5.75	14.48 ± 20.33
Dg (cm)	5.5	13.1 ± 19.3

Habitat Description

Variable	LIZ003	Predicted Group Reference Mean ±SD
Dominant-1st (Category(0-9))	5	6 ± 1
Dominant-2nd (Category(0-9))	6	6 ± 1
Embeddedness (Category(1-5))	4	4 ± 1
PeriphytonCoverage (Category(1-5))	2	2 ± 1
SurroundingMaterial (Category(0-9))	2	3 ± 2
Topography		
Reg-SlopeLT30% (%)	30.96964	17.11832 ± 8.21512
SlopeMax (%)	223.55025	386.22536 ± 140.72382
Water Chemistry		
Ag (mg/L)	0.0000250	0.0000028 ± 0.0000036
Al (mg/L)	0.0144000	0.0136410 ± 0.0145846
As (mg/L)	0.0002500	0.0001754 ± 0.0001818
B (mg/L)	0.0250000	0.0305833 ± 0.0370084
Ba (mg/L)	0.0767000	0.0435560 ± 0.0571949
Be (mg/L)	0.0000500	0.0000056 ± 0.0000072
Bi (mg/L)	0.0000500	0.0000028 ± 0.0000036
Br (mg/L)	0.0500000	0.0268750 ± 0.0585132
Ca (mg/L)	110.0000000	20.8384848 ± 13.6841012
Cd (mg/L)	0.0000210	0.0000115 ± 0.0000149
Chloride-Total (mg/L)	0.2600000	0.0000000 ± 0.0000000
Co (mg/L)	0.0000500	0.0000298 ± 0.0000226
Cr (mg/L)	0.0005000	0.0000900 ± 0.0000889
Cu (mg/L)	0.0002000	0.0003212 ± 0.0001572
F (mg/L)	0.1000000	0.0484615 ± 0.0355181
Fe (mg/L)	0.0210000	0.0442667 ± 0.0348579
General-Alkalinity (mg/L)	168.0000000	59.4800000 ± 43.9851975
General-CarbonDOC (mg/L)	2.1800000	0.6500000 ± 0.3535534
General-CarbonTOC (mg/L)	1.5000000	0.3944444 ± 0.3157179
General-Conductivity (µS/cm)	607.0000000	117.1461538 ± 96.2732948
General-DO (mg/L)	11.3100000	12.6802381 ± 11.2165934
General-Hardness (mg/L)	377.0000000	76.7342857 ± 54.3511564
General-pH (pH)	8.3	7.9 ± 0.4
General-SolidsTSS (mg/L)	1.0000000	1.9034611 ± 3.0161707
General-SpCond (µS/cm)	607.0000000	153.2777778 ± 120.2707781
General-TempAir (Degrees Celsius)	16.0	10.6 ± 5.4
General-TempWater (Degrees Celsius)	7.9000000	6.4219048 ± 2.3475813
General-Turbidity (NTU)	0.3000000	2.7965000 ± 4.1415171
Hg (ng/L)	0.0000050	0.0000000 ± 0.0000000
K (mg/L)	0.4600000	0.4511613 ± 0.2901093
Li (mg/L)	0.0043900	0.0016910 ± 0.0023918
Mg (mg/L)	24.9000000	5.1886364 ± 5.0072212
Mn (mg/L)	0.0038000	0.0028572 ± 0.0019872
Mo (mg/L)	0.0017400	0.0006660 ± 0.0004339
Na (mg/L)	1.9500000	0.9945806 ± 0.9373003
Ni (mg/L)	0.0002000	0.0002298 ± 0.0001811
Nitrogen-NO2 (mg/L)	0.0050000	0.0042917 ± 0.0108893
Nitrogen-NO2+NO3 (mg/L)	0.0050000	0.0732400 ± 0.0567225
Nitrogen-NO3 (mg/L)	0.0050000	0.0865111 ± 0.0538993
Nitrogen-TKN (mg/L)	0.0570000	97.0987778 ± 290.9629753
Nitrogen-TN (mg/L)	0.0570000	24.3739167 ± 145.4787822
Pb (mg/L)	0.0001000	0.0000559 ± 0.0000496
Phosphorus-OrthoP (mg/L)	0.0025000	0.0008667 ± 0.0013292
Phosphorus-TP (mg/L)	0.0130000	0.0031194 ± 0.0039854
S (mg/L)	77.9000000	362.2600000 ± 803.7224104
Sb (mg/L)	0.0001000	0.0000288 ± 0.0000136
Se (mg/L)	0.0002500	0.0002422 ± 0.0003912
Si (mg/L)	2.8000000	1.9070000 ± 0.6500353
Sn (mg/L)	0.0001000	0.0000988 ± 0.0001602
SO4 (mg/L)	233.0000000	18.1942857 ± 18.0693910
Sr (mg/L)	1.7800000	0.1493500 ± 0.1276611
Te (mg/L)	0.0002500	0.0000000 ± 0.0000000
Th (mg/L)	0.0000500	0.0000000 ± 0.0000000

Habitat Description

Variable	LIZ003	Predicted Group Reference Mean ±SD
Ti (mg/L)	0.0025000	0.0008433 ± 0.0009290
Tl (mg/L)	0.0000100	0.0000031 ± 0.0000048
U (mg/L)	0.0003960	0.0005805 ± 0.0003382
V (mg/L)	0.0025000	0.0001220 ± 0.0001369
Zn (mg/L)	0.0020000	0.0009430 ± 0.0009518
Zr (mg/L)	0.0000500	0.0000900 ± 0.0000894

Site Description

Study Name	CBWQ-Elk
Site	MOR001
Sampling Date	Sep 25 2023
Know Your Watershed Basin	Central Kootenay
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera EcoZone Northern Continental Divide EcoRegion
Coordinates (decimal degrees)	49.35832 N, 115.00067 W
Altitude	948
Local Basin Name	Morrissey Creek
	Central Kootenay
Stream Order	4

Figure 1. Location Map

Cabin Assessment Results

Reference Model Summary	
Model	Columbia Basin 2020
Analysis Date	November 20, 2024
Taxonomic Level	Family
Predictive Model Variables	Altitude Drainage-Area Longitude Natl-Grassland Natl-ShrubLow Natl-Water Precip10_Oct Reach-%CanopyCoverage Sedimentary Slope SlopeMax Temp12_DECmin

Reference Groups	**1**	**2**	**3**	**4**	**5**	**6**
Number of Reference Sites	13	24	28	35	32	15
Group Error Rate	53.8%	55.2%	34.1%	52.2%	23.1%	29.4%
Overall Model Error Rate	39.4%					
Probability of Group Membership	2.9%	22.6%	14.6%	47.8%	9.6%	2.5%
CABIN Assessment of MOR001 on Sep 25, 2023	Highly Divergent					

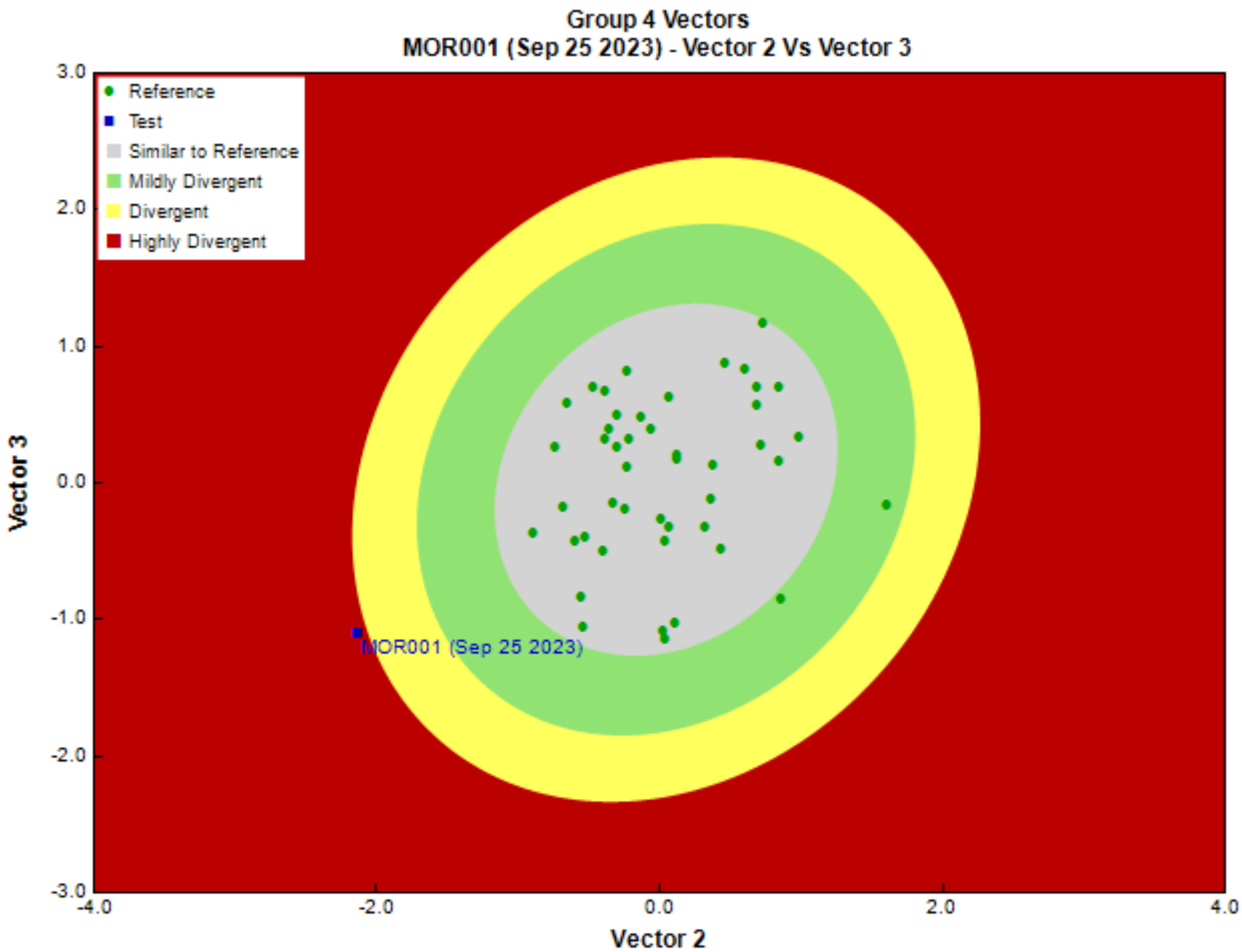


Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	-
	-
Sub-Sample Proportion	5/100

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
Annelida	Clitellata	Tubificida	Naididae	4	80.0
Arthropoda	Arachnida	Trombidiformes	Hydryphantidae	1	20.0
			Lebertiidae	9	180.0
			Sperchontidae	7	140.0
			Torrenticolidae	4	80.0
	Insecta	Coleoptera	Elmidae	69	1,380.0
		Diptera		2	40.0
			Chironomidae	37	740.0
			Psychodidae	3	60.0
			Tipulidae	10	200.0
		Ephemeroptera	Baetidae	15	300.0
			Ephemerellidae	40	800.0
			Heptageniidae	115	2,300.0
			Leptophlebiidae	53	1,060.0
		Plecoptera	Capniidae	2	40.0
			Chloroperlidae	1	20.0

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
			Leuctridae	3	60.0
			Nemouridae	7	140.0
			Perlodidae	4	80.0
		Trichoptera	Apataniidae	1	20.0
			Brachycentridae	7	140.0
			Hydropsychidae	34	680.0
			Lepidostomatidae	240	4,800.0
			Total	668	13,360.0

Metrics

Name	MOR001	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.9	0.3 ± 0.1
Biotic Indices		
Hilsenhoff Family index (Mid-Atlantic)	2.2	3.2 ± 0.4
Hilsenhoff Family index (North-West)	2.2	2.9 ± 0.3
Intolerant taxa	--	1.0 ± 0.0
Long-lived taxa	4.0	1.9 ± 1.0
Tolerant individuals (%)	--	0.5 ± 0.4
Functional Measures		
% Filterers	--	0.3
% Gatherers	40.1	47.1 ± 15.4
% Predatores	15.4	12.9 ± 7.3
% Scrapers	35.0	68.3 ± 16.1
% Shredder	50.7	36.7 ± 14.6
No. Clinger Taxa	22.0	20.2 ± 4.4
Number Of Individuals		
% Chironomidae	5.6	5.2 ± 5.7
% Coleoptera	10.4	0.6 ± 2.2
% Diptera + Non-insects	11.3	7.4 ± 7.0
% Ephemeroptera	33.5	45.8 ± 15.1
% Ephemeroptera that are Baetidae	6.7	28.9 ± 20.8
% EPT Individuals	78.4	91.9 ± 7.3
% Odonata	--	0.0 ± 0.0
% of 2 dominant taxa	53.3	59.5 ± 11.3
% of 5 dominant taxa	77.6	85.1 ± 6.5
% of dominant taxa	36.0	37.7 ± 10.4
% Plecoptera	2.6	40.5 ± 13.3
% Tribe Tanyatarisini	--	
% Trichoptera that are Hydropsychida	12.1	23.9 ± 23.6
% Tricoptera	42.3	5.6 ± 3.9
No. EPT individuals/Chironomids+EPT Individuals	0.9	0.9 ± 0.1
Total Abundance	13360.0	1449.4 ± 859.7
Richness		
Chironomidae taxa (genus level only)	1.0	1.0 ± 0.2
Coleoptera taxa	1.0	0.2 ± 0.5
Diptera taxa	3.0	2.6 ± 1.1
Ephemeroptera taxa	4.0	3.7 ± 0.6
EPT Individuals (Sum)	10440.0	1352.9 ± 804.6
EPT taxa (no)	13.0	12.2 ± 2.1
Odonata taxa	--	0.0 ± 0.0
Pielou's Evenness	0.7	0.7 ± 0.1
Plecoptera taxa	5.0	5.4 ± 1.2
Shannon-Wiener Diversity	2.1	1.9 ± 0.3
Simpson's Diversity	0.8	0.8 ± 0.1
Simpson's Evenness	0.2	0.3 ± 0.1
Total No. of Taxa	22.0	16.4 ± 3.5
Trichoptera taxa	4.0	3.2 ± 1.3

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	Group 6	

RIVPACS Ratios

RIVPACS : Expected taxa P>0.50	12.35
RIVPACS : Observed taxa P>0.50	11.00
RIVPACS : O:E (p > 0.5)	0.89
RIVPACS : Expected taxa P>0.70	10.11
RIVPACS : Observed taxa P>0.70	9.00
RIVPACS : O:E (p > 0.7)	0.89

Habitat Description

Variable	MOR001	Predicted Group Reference Mean ±SD
Bedrock Geology		
Sedimentary (%)	100.00000	90.78003 ± 16.48787
Channel		
Depth-Avg (cm)	27.4	27.7 ± 12.1
Depth-BankfullMinusWetted (cm)	54.00	48.41 ± 32.00
Depth-Max (cm)	32.0	41.6 ± 18.0
Discharge (m^3/s)	0.023	4.100
Macrophyte (PercentRange)	0	0 ± 0
Reach-%CanopyCoverage (PercentRange)	1.00	1.20 ± 0.86
Reach-%Logging (PercentRange)	0	0 ± 0
Reach-DomStreamsideVeg (Category(1-4))	4	3 ± 1
Reach-Pools (Binary)	1	1 ± 1
Reach-Rapids (Binary)	0	1 ± 1
Reach-Riffles (Binary)	1	1 ± 0
Reach-StraightRun (Binary)	1	1 ± 0
Slope (m/m)	0.0080400	0.0302442 ± 0.0225320
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)	0.08	0.65 ± 0.30
Velocity-Max (m/s)	0.12	1.02 ± 0.40
Width-Bankfull (m)	19.9	22.0 ± 20.4
Width-Wetted (m)	5.6	14.4 ± 14.2
XSEC-VelInstrumentDirect (Category(1-3))	2	2 ± 1
XSEC-VelMethod (Category(1-3))	3	2 ± 1
Climate		
Precip10_OCT (mm)	51.55424	101.93711 ± 37.08464
Temp12_DECmin (Degrees Celsius)	-13.00000	-12.60285 ± 1.55807
Hydrology		
Drainage-Area (km^2)	81.94000	153.19859 ± 249.47160
Landcover		
Natl-Grassland (%)	0.00000	4.14423 ± 3.51761
Natl-ShrubLow (%)	4.53336	4.00461 ± 2.77104
Natl-Water (%)	0.00000	0.26551 ± 0.58793
Reg-Ice (%)	0.00000	2.39543 ± 4.09623
Substrate Data		
%Bedrock (%)	0	0 ± 0
%Boulder (%)	0	8 ± 8
%Cobble (%)	67	53 ± 15
%Gravel (%)	6	4 ± 6
%Pebble (%)	27	33 ± 14
%Sand (%)	0	0 ± 0
%Silt+Clay (%)	0	0 ± 0
D50 (cm)	8.00	14.48 ± 20.33
Dg (cm)	5.9	13.1 ± 19.3
Dominant-1st (Category(0-9))	6	6 ± 1
Dominant-2nd (Category(0-9))	5	6 ± 1
Embeddedness (Category(1-5))	4	4 ± 1

Habitat Description

Variable	MOR001	Predicted Group Reference Mean ±SD
PeriphytonCoverage (Category(1-5))	1	2 ± 1
SurroundingMaterial (Category(0-9))	2	3 ± 2
Topography		
Reg-SlopeLT30% (%)	50.32512	17.11832 ± 8.21512
SlopeMax (%)	209.87454	386.22536 ± 140.72382
Water Chemistry		
Ag (mg/L)	0.0000250	0.0000028 ± 0.0000036
Al (mg/L)	0.0242000	0.0136410 ± 0.0145846
As (mg/L)	0.0002500	0.0001754 ± 0.0001818
B (mg/L)	0.0250000	0.0305833 ± 0.0370084
Ba (mg/L)	0.1430000	0.0435560 ± 0.0571949
Be (mg/L)	0.0000500	0.0000056 ± 0.0000072
Bi (mg/L)	0.0000500	0.0000028 ± 0.0000036
Br (mg/L)	0.0500000	0.0268750 ± 0.0585132
Ca (mg/L)	35.0000000	20.8384848 ± 13.6841012
Cd (mg/L)	0.0000220	0.0000115 ± 0.0000149
Chloride-Total (mg/L)	3.0400000	0.0000000 ± 0.0000000
Co (mg/L)	0.0000500	0.0000298 ± 0.0000226
Cr (mg/L)	0.0002500	0.0000900 ± 0.0000889
Cu (mg/L)	0.0005000	0.0003212 ± 0.0001572
F (mg/L)	0.0500000	0.0484615 ± 0.0355181
Fe (mg/L)	0.0290000	0.0442667 ± 0.0348579
General-Alkalinity (mg/L)	125.0000000	59.4800000 ± 43.9851975
General-CarbonDOC (mg/L)	3.7300000	0.6500000 ± 0.3535534
General-CarbonTOC (mg/L)	3.3900000	0.3944444 ± 0.3157179
General-Conductivity (µS/cm)	205.3000000	117.1461538 ± 96.2732948
General-DO (mg/L)	10.1100000	12.6802381 ± 11.2165934
General-Hardness (mg/L)	117.0000000	76.7342857 ± 54.3511564
General-pH (pH)	8.3	7.9 ± 0.4
General-SolidsTSS (mg/L)	1.0000000	1.9034611 ± 3.0161707
General-SpCond (µS/cm)	205.3000000	153.2777778 ± 120.2707781
General-TempAir (Degrees Celsius)	15.0	10.6 ± 5.4
General-TempWater (Degrees Celsius)	12.3000000	6.4219048 ± 2.3475813
General-Turbidity (NTU)	44.0000000	2.7965000 ± 4.1415171
Hg (ng/L)	0.0000050	0.0000000 ± 0.0000000
K (mg/L)	0.5500000	0.4511613 ± 0.2901093
Li (mg/L)	0.0030100	0.0016910 ± 0.0023918
Mg (mg/L)	7.2400000	5.1886364 ± 5.0072212
Mn (mg/L)	0.0112000	0.0028572 ± 0.0019872
Mo (mg/L)	0.0006600	0.0006660 ± 0.0004339
Na (mg/L)	1.9600000	0.9945806 ± 0.9373003
Ni (mg/L)	0.0002000	0.0002298 ± 0.0001811
Nitrogen-NO2 (mg/L)	0.0050000	0.0042917 ± 0.0108893
Nitrogen-NO2+NO3 (mg/L)	0.0050000	0.0732400 ± 0.0567225
Nitrogen-NO3 (mg/L)	0.0050000	0.0865111 ± 0.0538993
Nitrogen-TKN (mg/L)	0.1160000	97.0987778 ± 290.9629753
Nitrogen-TN (mg/L)	0.1160000	24.3739167 ± 145.4787822
Pb (mg/L)	0.0001000	0.0000559 ± 0.0000496
Phosphorus-OrthoP (mg/L)	0.0025000	0.0008667 ± 0.0013292
Phosphorus-TP (mg/L)	0.0102000	0.0031194 ± 0.0039854
S (mg/L)	1.5000000	362.2600000 ± 803.7224104
Sb (mg/L)	0.0001000	0.0000288 ± 0.0000136
Se (mg/L)	0.0002500	0.0002422 ± 0.0003912
Si (mg/L)	1.7000000	1.9070000 ± 0.6500353
Sn (mg/L)	0.0001000	0.0000988 ± 0.0001602
SO4 (mg/L)	6.9000000	18.1942857 ± 18.0693910
Sr (mg/L)	0.1230000	0.1493500 ± 0.1276611
Te (mg/L)	0.0002500	0.0000000 ± 0.0000000
Th (mg/L)	0.0000500	0.0000000 ± 0.0000000
Ti (mg/L)	0.0025000	0.0008433 ± 0.0009290
Tl (mg/L)	0.0000100	0.0000031 ± 0.0000048
U (mg/L)	0.0002480	0.0005805 ± 0.0003382

Habitat Description

Variable	MOR001	Predicted Group Reference Mean ±SD
V (mg/L)	0.0025000	0.0001220 ± 0.0001369
Zn (mg/L)	0.0020000	0.0009430 ± 0.0009518
Zr (mg/L)	0.0000500	0.0000900 ± 0.0000894

Site Description

Study Name	CBWQ-Elk
Site	MOR002
Sampling Date	Sep 25 2023
Know Your Watershed Basin	Central Kootenay
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera EcoZone Northern Continental Divide EcoRegion
Coordinates (decimal degrees)	49.42056 N, 114.91069 W
Altitude	1544
Local Basin Name	Morrissey Creek
	Central Kootenay
Stream Order	3

Figure 1. Location Map

Cabin Assessment Results

Reference Model Summary	
Model	Columbia Basin 2020
Analysis Date	November 20, 2024
Taxonomic Level	Family
Predictive Model Variables	Altitude Drainage-Area Longitude Natl-Grassland Natl-ShrubLow Natl-Water Precip10_Oct Reach-%CanopyCoverage Sedimentary Slope SlopeMax Temp12_DECmin

Reference Groups	**1**	**2**	**3**	**4**	**5**	**6**
Number of Reference Sites	13	24	28	35	32	15
Group Error Rate	53.8%	55.2%	34.1%	52.2%	23.1%	29.4%
Overall Model Error Rate	39.4%					
Probability of Group Membership	1.2%	0.5%	9.0%	6.3%	82.8%	0.1%
CABIN Assessment of MOR002 on Sep 25, 2023	Mildly Divergent					

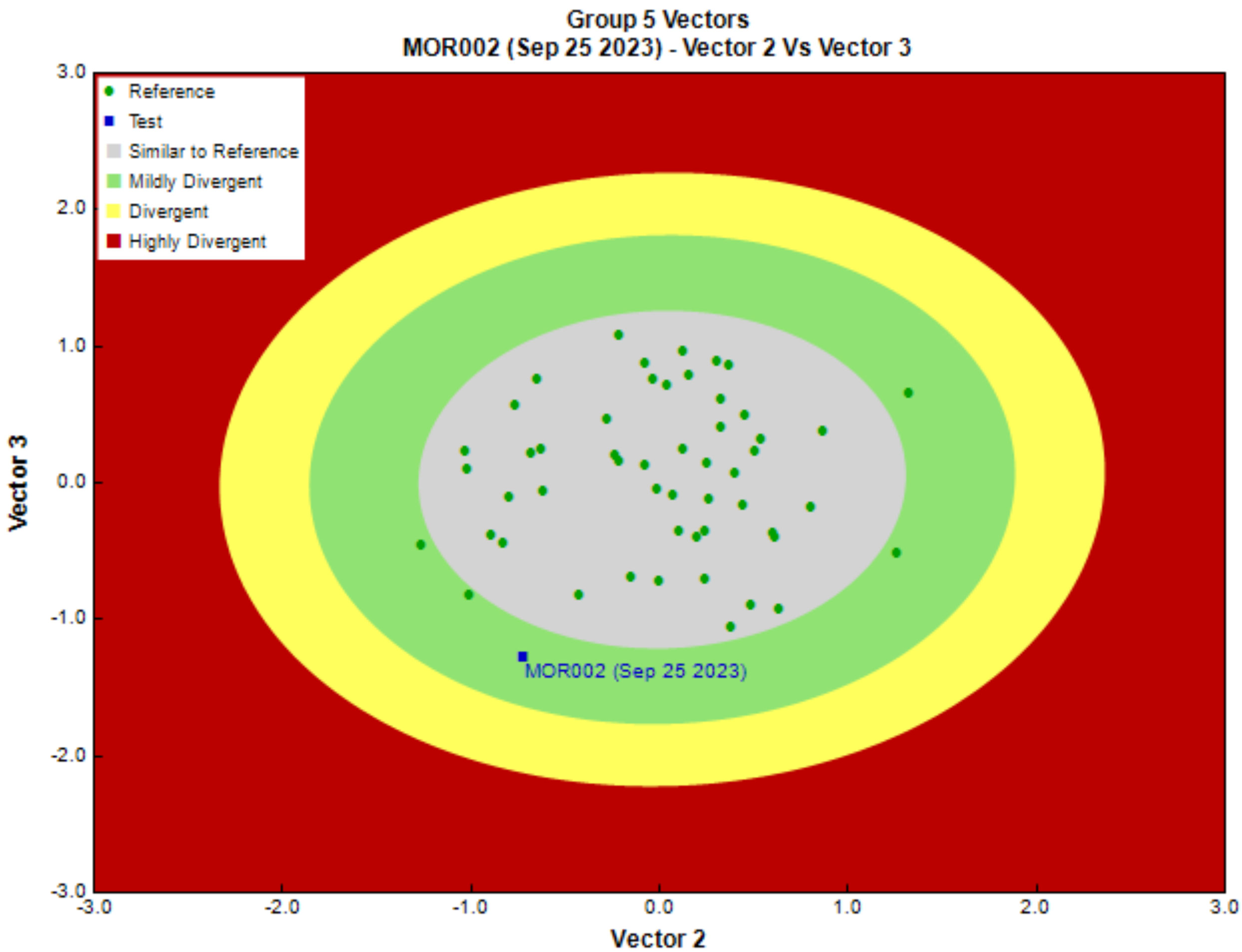


Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	-
	-
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		1	20.0
	Insecta	Coleoptera	Elmidae	30	600.0
		Diptera		1	20.0
			Chironomidae	225	4,500.0
			Tipulidae	9	180.0
		Ephemeroptera	Ameletidae	13	260.0
			Baetidae	60	1,200.0
			Ephemerellidae	11	220.0
			Heptageniidae	47	940.0
			Leptophlebiidae	17	340.0
		Hemiptera		1	20.0
		Plecoptera		6	120.0
			Capniidae	42	840.0
			Chloroperlidae	60	1,200.0
			Nemouridae	3	60.0

Community Structure

Phylum	Class	Order	Family	Raw Count	Total Count
			Perlidae	6	120.0
			Perlodidae	11	220.0
			Taeniopterygidae	1	20.0
		Trichoptera	Brachycentridae	29	580.0
			Hydropsychidae	1	20.0
			Hydroptilidae	1	20.0
			Leptoceridae	1	20.0
			Limnephilidae	2	40.0
			Rhyacophilidae	8	160.0
			Uenoidae	3	60.0
			Total	590	11,800.0

Metrics

Name	MOR002	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.7	0.4 ± 0.1
Biotic Indices		
Hilsenhoff Family index (Mid-Atlantic)	2.8	3.4 ± 0.4
Hilsenhoff Family index (North-West)	2.8	3.1 ± 0.5
Intolerant taxa	--	1.0 ± 0.0
Long-lived taxa	4.0	1.7 ± 1.2
Tolerant individuals (%)	--	0.3 ± 0.0
Functional Measures		
% Filterers	--	
% Gatherers	58.6	45.8 ± 14.9
% Predatores	47.5	14.8 ± 9.8
% Scrapers	24.6	59.4 ± 19.6
% Shredder	19.8	30.7 ± 17.4
No. Clinger Taxa	33.0	19.8 ± 4.0
Number Of Individuals		
% Chironomidae	38.7	7.5 ± 8.6
% Coleoptera	5.2	0.1 ± 0.3
% Diptera + Non-insects	40.4	10.7 ± 9.9
% Ephemeroptera	25.5	47.2 ± 15.8
% Ephemeroptera that are Baetidae	40.5	25.4 ± 20.8
% EPT Individuals	54.4	89.2 ± 10.0
% Odonata	--	0.0 ± 0.0
% of 2 dominant taxa	49.1	58.3 ± 10.6
% of 5 dominant taxa	74.7	83.6 ± 6.3
% of dominant taxa	38.7	37.8 ± 11.1
% Plecoptera	21.2	36.3 ± 16.7
% Tribe Tanyatarisini	--	
% Trichoptera that are Hydropsychida	2.2	25.4 ± 24.6
% Tricoptera	7.7	5.7 ± 3.9
No. EPT individuals/Chironomids+EPT Individuals	0.6	0.9 ± 0.1
Total Abundance	11800.0	4661.0 ± 3119.0
Richness		
Chironomidae taxa (genus level only)	1.0	1.0 ± 0.1
Coleoptera taxa	1.0	0.1 ± 0.3
Diptera taxa	2.0	2.8 ± 1.0
Ephemeroptera taxa	5.0	3.7 ± 0.5
EPT Individuals (Sum)	6320.0	4035.4 ± 2618.4
EPT taxa (no)	18.0	12.3 ± 1.9
Odonata taxa	--	0.0 ± 0.0
Pielou's Evenness	0.7	0.7 ± 0.1
Plecoptera taxa	6.0	5.5 ± 1.1
Shannon-Wiener Diversity	2.2	1.9 ± 0.3
Simpson's Diversity	0.8	0.8 ± 0.1
Simpson's Evenness	0.2	0.3 ± 0.1
Total No. of Taxa	22.0	17.0 ± 3.1
Trichoptera taxa	7.0	3.1 ± 1.2

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	Group 6	

RIVPACS Ratios

RIVPACS : Expected taxa P>0.50	12.45
RIVPACS : Observed taxa P>0.50	12.00
RIVPACS : O:E (p > 0.5)	0.96
RIVPACS : Expected taxa P>0.70	9.52
RIVPACS : Observed taxa P>0.70	10.00
RIVPACS : O:E (p > 0.7)	1.05

Habitat Description

Variable	MOR002	Predicted Group Reference Mean ±SD
Bedrock Geology		
Sedimentary (%)	100.00000	98.46051 ± 8.10999
Channel		
Depth-Avg (cm)	18.8	20.0 ± 8.6
Depth-BankfullMinusWetted (cm)	51.00	46.71 ± 35.00
Depth-Max (cm)	26.0	28.8 ± 13.7
Discharge (m^3/s)	0.017	0.682
Macrophyte (PercentRange)	1	0 ± 0
Reach-%CanopyCoverage (PercentRange)	2.00	1.04 ± 0.95
Reach-%Logging (PercentRange)	0	0 ± 0
Reach-DomStreamsideVeg (Category(1-4))	2	3 ± 1
Reach-Pools (Binary)	0	1 ± 0
Reach-Rapids (Binary)	0	0 ± 0
Reach-Riffles (Binary)	1	1 ± 0
Reach-StraightRun (Binary)	1	1 ± 0
Slope (m/m)	0.0217500	0.0270638 ± 0.0257534
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)	0.09	0.58 ± 0.20
Velocity-Max (m/s)	0.23	0.85 ± 0.27
Width-Bankfull (m)	8.6	16.1 ± 13.1
Width-Wetted (m)	2.4	9.8 ± 7.7
XSEC-VelInstrumentDirect (Category(1-3))	2	3 ± 0
XSEC-VelMethod (Category(1-3))	3	2 ± 1
Climate		
Precip10_OCT (mm)	54.52875	64.42223 ± 33.96544
Temp12_DECmin (Degrees Celsius)	-13.00000	-12.74810 ± 1.73767
Hydrology		
Drainage-Area (km^2)	17.89000	100.09787 ± 132.80561
Landcover		
Natl-Grassland (%)	0.00000	7.47766 ± 6.29880
Natl-ShrubLow (%)	2.38954	1.80492 ± 1.50412
Natl-Water (%)	0.00000	0.32077 ± 0.59001
Reg-Ice (%)	0.00000	1.28005 ± 3.54484
Substrate Data		
%Bedrock (%)	0	0 ± 0
%Boulder (%)	2	6 ± 6
%Cobble (%)	38	57 ± 15
%Gravel (%)	8	2 ± 3
%Pebble (%)	51	34 ± 16
%Sand (%)	0	0 ± 0
%Silt+Clay (%)	1	0 ± 1
D50 (cm)	5.40	24.05 ± 35.66
Dg (cm)	4.4	23.0 ± 33.8
Dominant-1st (Category(0-9))	6	6 ± 1

Habitat Description

Variable	MOR002	Predicted Group Reference Mean ±SD
Dominant-2nd (Category(0-9))	5	6 ± 1
Embeddedness (Category(1-5))	4	4 ± 1
PeriphytonCoverage (Category(1-5))	3	2 ± 1
SurroundingMaterial (Category(0-9))	2	3 ± 1
Topography		
Reg-SlopeLT30% (%)	73.39946	20.01334 ± 7.41149
SlopeMax (%)	97.94038	488.94077 ± 542.32910
Water Chemistry		
Ag (mg/L)	0.0000250	0.0000018 ± 0.0000013
Al (mg/L)	0.5580000	0.0078031 ± 0.0090962
As (mg/L)	0.0002500	0.0002735 ± 0.0001787
B (mg/L)	0.0250000	0.0127286 ± 0.0135802
Ba (mg/L)	0.1910000	0.0677069 ± 0.0514113
Be (mg/L)	0.0000500	0.0000043 ± 0.0000039
Bi (mg/L)	0.0000500	0.0000018 ± 0.0000013
Br (mg/L)	0.0500000	0.0303333 ± 0.0788597
Ca (mg/L)	20.2000000	28.2142857 ± 13.7707094
Cd (mg/L)	0.0000450	0.0000100 ± 0.0000293
Chloride-Total (mg/L)	11.7000000	0.0000000 ± 0.0000000
Co (mg/L)	0.0001800	0.0000075 ± 0.0000060
Cr (mg/L)	0.0007100	0.0001514 ± 0.0001361
Cu (mg/L)	0.0008300	0.0001604 ± 0.0001447
F (mg/L)	0.0500000	0.0876667 ± 0.0847823
Fe (mg/L)	0.3970000	0.0101789 ± 0.0111495
General-Alkalinity (mg/L)	63.1000000	98.9704545 ± 43.8308301
General-CarbonDOC (mg/L)	3.3300000	0.8383333 ± 0.4040008
General-CarbonTOC (mg/L)	2.7200000	0.5586957 ± 0.6229060
General-Conductivity (μS/cm)	132.9000000	173.5150000 ± 86.2502071
General-DO (mg/L)	10.1000000	10.7243478 ± 0.8596502
General-Hardness (mg/L)	67.8000000	109.1853659 ± 48.3470504
General-pH (pH)	8.4	8.0 ± 0.6
General-SolidsTSS (mg/L)	7.0000000	5.2717002 ± 27.1908288
General-SpCond (μS/cm)	132.9000000	196.0710526 ± 116.3908975
General-TempAir (Degrees Celsius)	11.0	7.2 ± 5.7
General-TempWater (Degrees Celsius)	8.8000000	6.2042553 ± 2.0993816
General-Turbidity (NTU)	11.8500000	0.4347619 ± 0.5563328
Hg (ng/L)	0.0000050	0.0000000 ± 0.0000000
K (mg/L)	0.6900000	0.3312424 ± 0.1572675
Li (mg/L)	0.0017700	0.0009183 ± 0.0003795
Mg (mg/L)	4.2100000	7.8748571 ± 3.9958945
Mn (mg/L)	0.0064500	0.0007721 ± 0.0008518
Mo (mg/L)	0.0005200	0.0012835 ± 0.0042333
Na (mg/L)	1.5900000	0.7930303 ± 0.4756164
Ni (mg/L)	0.0008200	0.0001266 ± 0.0001131
Nitrogen-NO2 (mg/L)	0.0050000	0.0049953 ± 0.0199967
Nitrogen-NO2+NO3 (mg/L)	0.0050000	0.0287300 ± 0.0357249
Nitrogen-NO3 (mg/L)	0.0050000	0.0336397 ± 0.0328125
Nitrogen-TKN (mg/L)	0.1220000	0.0352941 ± 0.0299453
Nitrogen-TN (mg/L)	0.1220000	0.0675581 ± 0.0509763
Pb (mg/L)	0.0002400	0.0000179 ± 0.0000156
Phosphorus-OrthoP (mg/L)	0.0025000	0.1105304 ± 0.5208890
Phosphorus-TP (mg/L)	0.0202000	0.0031912 ± 0.0087929
S (mg/L)	1.5000000	3.6625000 ± 1.5619928
Sb (mg/L)	0.0001000	0.0000337 ± 0.0000157
Se (mg/L)	0.0002500	0.0002782 ± 0.0002859
Si (mg/L)	2.0000000	2.0400303 ± 0.8510321
Sn (mg/L)	0.0001000	0.0000300 ± 0.0000407
SO4 (mg/L)	3.6000000	13.3070732 ± 13.0883468
Sr (mg/L)	0.1180000	0.0893414 ± 0.0805860
Te (mg/L)	0.0002500	0.0000000 ± 0.0000000
Th (mg/L)	0.0000500	0.0000000 ± 0.0000000
Ti (mg/L)	0.0100000	0.0003150 ± 0.0001205

Habitat Description

Variable	MOR002	Predicted Group Reference Mean ±SD
Tl (mg/L)	0.0000100	0.0000040 ± 0.0000067
U (mg/L)	0.0001490	0.0003872 ± 0.0002299
V (mg/L)	0.0025000	0.0001617 ± 0.0001537
Zn (mg/L)	0.0020000	0.0003724 ± 0.0003377
Zr (mg/L)	0.0002400	0.0000500 ± 0.0000000

Appendix B: Raw CABIN Datasheets

Field Crew: K McCallum, C.Bush, BB, AM, ZC, MC Site Code: ALX001
Sampling Date (DD/MM/YYYY): 27/09/2023

☒ **Occupational Health & Safety: Site Inspection Sheet completed (see page 6)**

PRIMARY SITE DATA

CABIN Study Name: CBWQ - Elk Local Basin Name: Elk River

River/Stream Name: Alexander Creek Stream Order: (map scale 1:50,000) 4

Select one: ☒ Test Site ☐ Potential Reference Site

Geographical Description/Notes:

Take left turnoff from Hwy 3, before Michel Crk. bridge (Sparwood → AB). Follow dirt road through forest - stay right + park @ river. Walk up Michel to Alx confluence. Site is ≈70m u/s of confluence. (near temp. logger)

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

☒ Forest ☐ Field/Pasture ☐ Agriculture ☐ Residential/Urban
☐ Logging ☒ Mining ☒ Commercial/Industrial highway. ☒ Other CP Railway

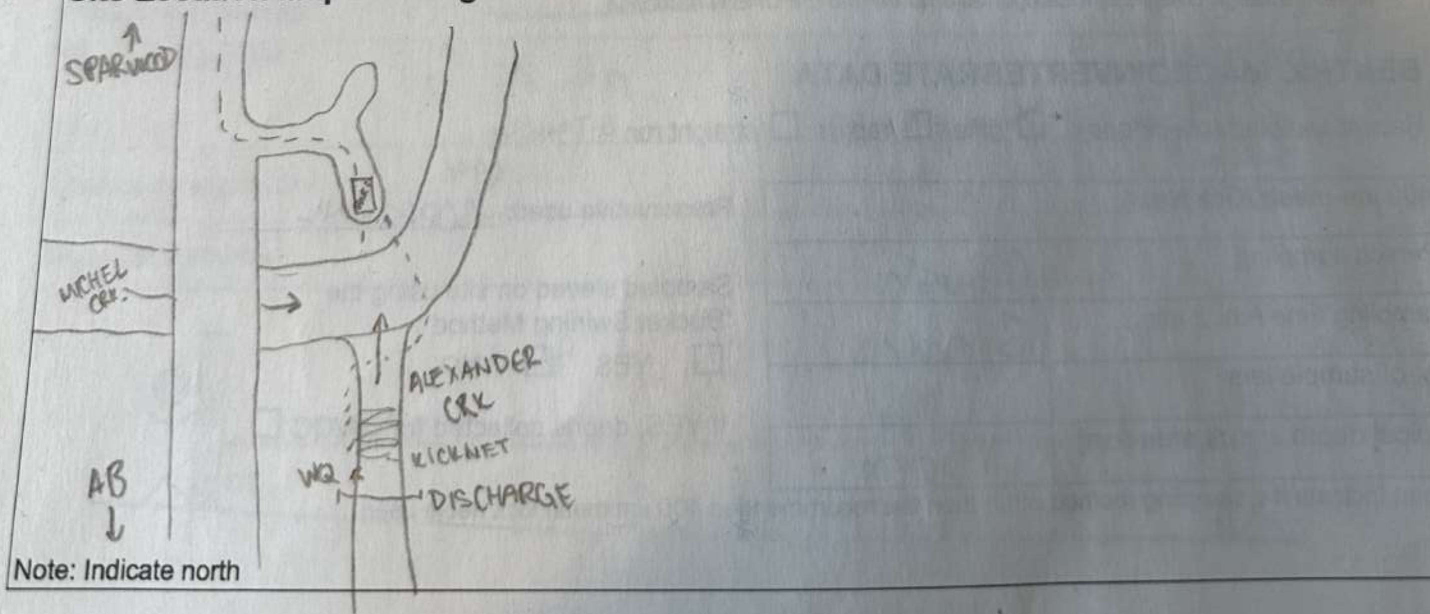
Dominant Surrounding Land Use: (check one) Information Source: visual, maps

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

Location Data

Latitude: 49.674237 N Longitude: -114.780191 W (DMS or DD)
Elevation: 1219.0 (fasl or masl) GPS Datum: ☒ GRS80 (NAD83/WGS84) ☐ Other: ________

Site Location Map Drawing



Note: Indicate north

Field Crew: KM, CB, BB, MC, ZC, AM

Site Code: ALX001

Sampling Date (DD/MM/YYYY): 27/09/2023

Photos

- [ ] Field Sheet
- [x] Upstream
- [x] Downstream
- [x] Across Site
- [ ] Aerial View
- [x] Substrate (exposed)
- [x] Substrate (aquatic)
- [ ] Other ____

REACH DATA *(represents 6 times bankfull width)*

1. Habitat Types: *(check those present)*
   - [x] Riffle
   - [ ] Rapids
   - [x] Straight run
   - [ ] Pool/Back Eddy

2. Canopy Coverage: *(stand in middle of stream and look up, check one)*
   - [ ] 0 %
   - [x] 1-25 %
   - [ ] 26-50 %
   - [ ] 51-75 %
   - [ ] 76-100 %

3. Macrophyte Coverage: *(not algae or moss, check one)*
   - [x] 0 %
   - [ ] 1-25 %
   - [ ] 26-50 %
   - [ ] 51-75 %
   - [ ] 76-100 %

4. Streamside Vegetation: *(check those present)*
   - [x] ferns/grasses
   - [x] shrubs
   - [x] deciduous trees
   - [x] coniferous trees

5. Dominant Streamside Vegetation: *(check one)*
   - [ ] ferns/grasses
   - [x] shrubs
   - [ ] deciduous trees
   - [ ] coniferous trees

6. Periphyton Coverage on Substrate: *(benthic algae, not moss, check one)*
   - [ ] **1** - Thin layer, no obvious colour (< 0.5 mm thick)
   - [x] **2** - Yellow-brown to light green colour (0.5-1 mm thick)
   - [ ] **3** - Patches of thicker green to brown algae (1-5 mm thick)
   - [ ] **4** - Numerous large clumps of green to dark brown algae (5-20 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*): [x] riffle [ ] rapids [ ] straight run

400 µm mesh Kick Net *	
Person sampling	C. Bush
Sampling time (i.e. 3 min.)	3 mins
No. of sample jars	1
Typical depth in kick area (cm)	15cm

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

Preservative used: 99% ISOPROPYL

Sampled sieved on site using the "Bucket Swirling Method":

[ ] YES [x] NO

If YES, debris collected for QA/QC [ ]

Field Crew: KM, CB, BB, MC, ZC, AM Site Code: ALY001
Sampling Date (DD/MM/YYYY): 27/09/2023

WATER CHEMISTRY DATA Time: 9:45 (24 hr clock) Time zone: MDT

Air Temp: 8.0 (°C) Water Temp: 6.1 (°C) pH: 8.45

Specific Conductance: 309.0 (µs/cm) DO: 10.89 (mg/L) Turbidity: 0.33 (NTU)

Check if water samples were collected for the following analyses: DO%: 87.7

- ☑ TSS (Total Suspended Solids)
- ☑ Nitrogen (i.e. Total, Nitrate, Nitrite, Dissolved, and/or Ammonia) ORP: 140.3 mV
- ☑ Phosphorus (Total, Ortho, and/or Dissolved)
- ☐ Major Ions (i.e. Alkalinity, Hardness, Chloride, and/or Sulphate) ☑ Other Anions

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 = ____________

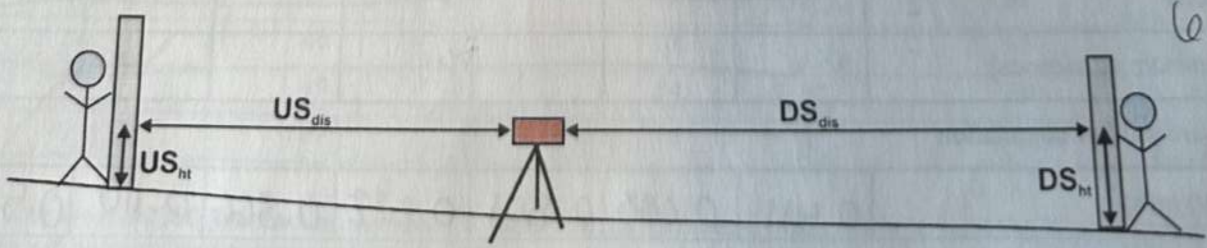
OR

☑ **Measured in field**

Circle device used and fill out table according to device:
a. Survey Equipment b. Hand Level & Measuring Tape 36.6

Measurements	Upstream (U/S)	Downstream(D/S)	Calculation
[a]Top Hairline (T)			
[a]Mid Hairline (ht) OR [b]Height of rod	1.043	1.499	
[a]Bottom Hairline (B)			
[b]Distance (dis) OR [a]T-B x 100	18.3m $_aUS_{dis}$=T-B	18.3m $_aDS_{dis}$=T-B	$US_{dis}+DS_{dis}$= ~~2.542~~ 36.6
Change in height (Δht)			$DS_{ht}-US_{ht}$= 2.542
Slope (Δht/total dis)			0.0695

6.95%



Field Crew: KM, CB, BB, MC, ZC, AM

Site Code: ALX001

Sampling Date (DD/MM/YYYY): 27/09/2023

0.7 0.1 6.2

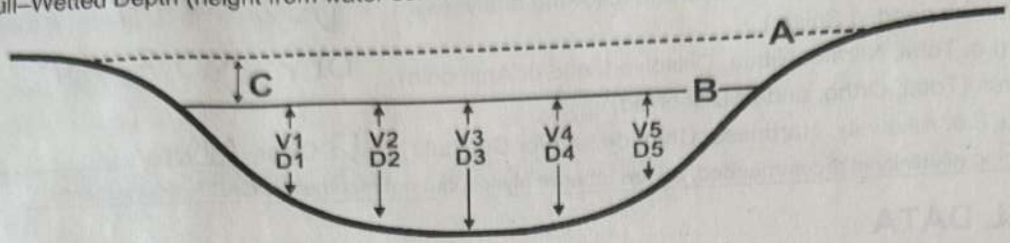
Widths and Depth

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

A - Bankfull Width: 13.62 (m)

B - Wetted Stream Width: 6.10 (m)

C - Bankfull–Wetted Depth (height from water surface to Bankfull): 35.9 (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]

0.87

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

☒ **Direct velocity measurements**: ☐ Marsh-McBirney ☒ Sontek or ☐ Other Flow Tracker 1

0.1 0.97 1.84 2.71 3.58 4.45 5.32

	1	2	3	4	5	6	AVG
Distance from Shore (m)	0.87	1.74	2.61	3.48	4.35	5.22	
Depth (D) (cm)	0.21	0.32	0.32	0.25	0.30	0.22	27
Velocity Head Rod (ruler)							
Flowing water Depth (D_1) (cm)							
Depth of Stagnation (D_2) (cm)							
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)	0.411	0.638	0.801	0.822	0.366	0.110	0.525

Field Crew: KM, CR, BB, MC, ZC, AM Site Code: ALX001

Sampling Date (DD/MM/YYYY): 27/09/2023

SUBSTRATE DATA

1. 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
  - 75% embedded = ¾
  - 50% embedded= ½
  - 25% embedded = ¼
  - Unembedded = 0

2. 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

	Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E
1	7.9		26	13.5		51	2.1		76	13.5	
2	7.2		27	2.6		52	4.8		77	12.4	
3	6.9		28	7.3		53	2.0		78	12.6	
4	7.6		29	6.3		54	15.8		79	8.3	
5	3.6		30	11.4	0	55	17.6		80	4.8	0
6	8.2		31	4.2		56	15.5		81	5.8	
7	8.5		32	15.8		57	11.9		82	12.2	
8	3.9		33	20.2		58	7.4		83	7.5	
9	2.0		34	5.6		59	7.5		84	7.6	
10	59.0	75	35	1.9		60	9.1	0	85	15.6	
11	8.2		36	11.8		61	4.2		86	4.4	
12	3.3		37	9.0		62	6.7		87	4.9	
13	7.0		38	15.4		63	12.0		88	10.1	
14	7.8		39	7.9		64	5.7		89	14.5	
15	1.1		40	8.8	50	65	4.0		90	17.8	50
16	8.4		41	4.5		66	37.6		91	22.3	
17	29.0		42	8.5		67	5.9		92	1.9	
18	5.6		43	6.0		68	15.0		93	8.2	
19	2.4		44	5.5		69	8.2		94	7.8	
20	8.4	50	45	25.6		70	9.8	25	95	8.2	
21	15.0		46	7.3		71	11.9		96	6.3	
22	10.4		47	1.9		72	15.4		97	6.9	
23	18.0		48	3.1		73	6.6		98	5.3	
24	8.3		49	5.8		74	9.5		99	10.8	
25	34.6		50	8.2	25	75	7.5		100	12.6	75

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: KM, CB, ZC, AM, BB, MC Site Code: ALX001
Sampling Date (DD/MM/YYYY): 27/09/2023

SITE INSPECTION

Site Inspected by: K. McCallum

Communication Information

☑ Itinerary left with contact person (include contact numbers)

Contact Person: A.C. Kroeger Time checked-in: 9:00

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

Phone number: (514) 664-6815

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: K.McCallum, C.Bush, MC, BB, ZC, AM Site Code: ALX003
Sampling Date (DD/MM/YYYY): 27/09/2023

☒ **Occupational Health & Safety: Site Inspection Sheet completed (see page 6)**

PRIMARY SITE DATA

CABIN Study Name: CBWQ - Elk Local Basin Name: Elk River

River/Stream Name: Alexander Creek Stream Order: (map scale 1:50,000) 4

Select one: ☒ Test Site ☐ Potential Reference Site

Geographical Description/Notes:

From Hwy 3 (Sparwood → Alberta), take left turn off onto dirt road (turnoff before weigh station). Keep left + park. Walk into forest (past campground) to the Creek. Site is ≃ 30 m u/s (across from rifle range)

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

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

☒ Logging ☒ Mining ☐ Commercial/Industrial ☒ Other rifle range, campground

exploration for potential NWP mine.

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

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

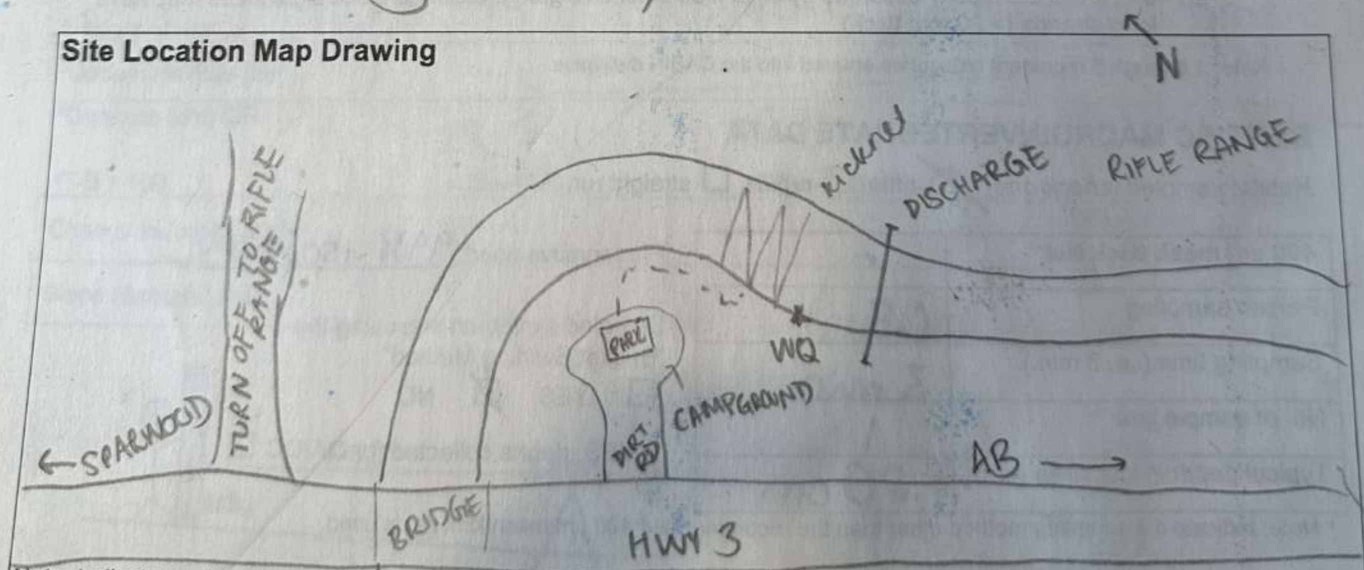
☐ Logging ☐ Mining ☐ Commercial/Industrial ☐ Other ____________

Location Data

Latitude: 49.655630 N Longitude: - 114.73078 W (DMS or DD)

Elevation: 1311.0 (fasl or masl) GPS Datum: ☒ GRS80 (NAD83/WGS84) ☐ Other: ____________

Site Location Map Drawing



Note: Indicate north

Site Code: ALX003

Field Crew: KM, CB, MC, ZC, AM, BB
Sampling Date (DD/MM/YYYY): 27/09/2023

Photos
- [x] Field Sheet
- [x] Upstream
- [x] Downstream
- [x] Across Site
- [ ] Aerial View
- [x] Substrate (exposed)
- [x] Substrate (aquatic)
- [ ] Other ______

REACH DATA *(represents 6 times bankfull width)*

1. Habitat Types: *(check those present)*
   - [x] Riffle
   - [ ] Rapids
   - [x] Straight run
   - [x] Pool/Back Eddy

2. Canopy Coverage: *(stand in middle of stream and look up, check one)*
   - [ ] 0 %
   - [x] 1-25 %
   - [ ] 26-50 %
   - [ ] 51-75 %
   - [ ] 76-100 %

3. Macrophyte Coverage: *(not algae or moss, check one)*
   - [x] 0 %
   - [ ] 1-25 %
   - [ ] 26-50 %
   - [ ] 51-75 %
   - [ ] 76-100 %

4. Streamside Vegetation: *(check those present)*
   - [x] ferns/grasses
   - [x] shrubs
   - [x] deciduous trees
   - [x] coniferous trees

5. Dominant Streamside Vegetation: *(check one)*
   - [ ] ferns/grasses
   - [x] shrubs
   - [ ] deciduous trees
   - [ ] coniferous trees

6. Periphyton Coverage on Substrate: *(benthic algae, not moss, check one)*
   - [ ] **1 -** Thin layer, no obvious colour (< 0.5 mm thick)
   - [x] **2 -** Yellow-brown to light green colour (0.5-1 mm thick)
   - [ ] **3 -** Patches of thicker green to brown algae (1-5 mm thick)
   - [ ] **4 -** Numerous large clumps of green to dark brown algae (5-20 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*):
- [x] riffle
- [ ] rapids
- [ ] straight run

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

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

Preservative used: 99% ISOPROPYL

Sampled sieved on site using the "Bucket Swirling Method":
- [ ] YES
- [x] NO

If YES, debris collected for QA/QC ☐

Field Crew: KM, CB, MC, ZC, AM, BB Site Code: ALX003
Sampling Date (DD/MM/YYYY): 27/09/2023

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

Air Temp: 12 (°C) Water Temp: 6.4 (°C) pH: 8.53

Specific Conductance: 299.7 (µs/cm) DO: 10.85 (mg/L) Turbidity: 0.43 (NTU)

Check if water samples were collected for the following analyses: DO%: 88.2 ORP: 130.4

- ☑ 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)

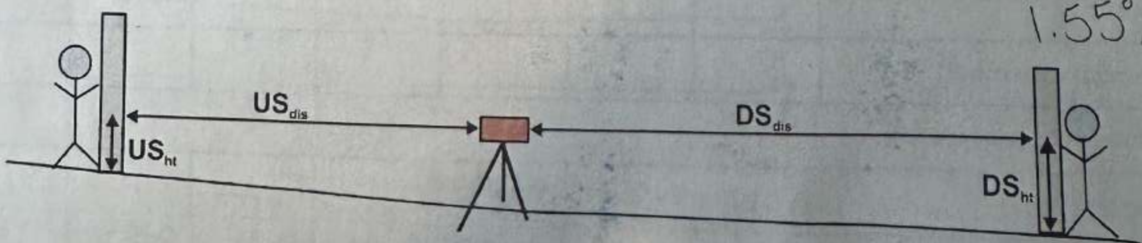
☐ **Calculated from map**
Scale: ________ (Note: small scale map recommended if field measurement is not possible - i.e. 1:20,000).
contour interval (vertical distance) ________ (m),
distance between contour intervals (horizontal distance) ________ (m)
slope = vertical distance/horizontal distance =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

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	0.879	1.765m	
[a]Bottom Hairline (B)			
[b]Distance (dis) OR [a]T-B x 100	28.5 $^{a}US_{dis}$=T-B	28.5 $^{a}DS_{dis}$=T-B	$US_{dis}+DS_{dis}$= 57
Change in height (Δht)			$DS_{ht}-US_{ht}$= 0.886
Slope (Δht/total dis)			0.01554

1.55%



Field Crew: KM, CB, AM, ZC, MC, BB Site Code: ALX003

Sampling Date (DD/MM/YYYY): 27/09/2023

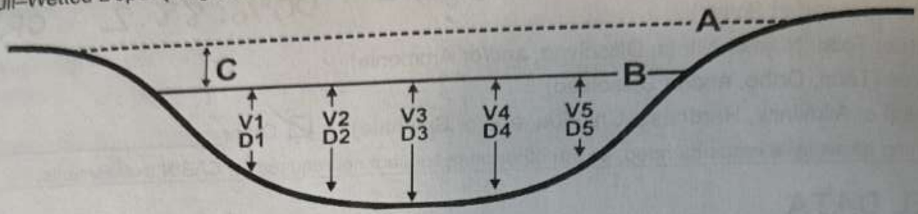
970.2

Widths and Depth

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

A - Bankfull Width: 10.9 (m) B - Wetted Stream Width: 9.50 (m)

C - Bankfull–Wetted Depth (height from water surface to Bankfull): 15.5 (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) 1.35

☒ **Direct velocity measurements**: ☐ Marsh-McBirney ☒ Sontek or ☒ Other ~~Flowtracker~~ km , Flowprobe

1.55 2.9 4.25 5.6 6.95 8.3

	1	2	3	4	5	6	AVG
Distance from Shore (m)	1.35	2.70	4.05	5.40	6.75	8.10	
Depth (D) (cm)	120	32	44	31	34	13	27.67
Velocity Head Rod (ruler)							
Flowing water Depth (D_1) (cm)							
Depth of Stagnation (D_2) (cm)							
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)	km ~~0.118~~	km ~~0.390~~	km ~~0.456~~	km ~~0.423~~			
Flow Probe (m/s)	0.25	0.45	0.50	0.50	0.55	0.25	0.417

* Flowtracker battery died part way through measurements (Re-do with Flowprobe)

Field Crew: KM, CB, AM, ZC, MC, BB   Site Code: ALX003

Sampling Date (DD/MM/YYYY): 27/09/2023

SUBSTRATE DATA

1. 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
  - 75% embedded = ¾
  - 50% embedded= ½
  - 25% embedded = ¼
  - Unembedded = 0

2. 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

	Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E
1	10.3		26	13.4		51	6.0		76	12.5	
2	6.8		27	4.0		52	7.5		77	13.0	
3	13.5		28	8.9		53	5.2		78	26.3	
4	5.0		29	21.4		54	5.6		79	0.4	
5	9.0		30	9.4	1/25	55	8.5		80	6.9	1/4
6	8.4		31	5.3		56	8.2		81	11.0	
7	12.2		32	7.8		57	13.3		82	10.	
8	3.5		33	14.0		58	8.1		83	8.5	
9	5.3		34	9.9		59	8.3		84	11.6	
10	7.0	1/4	35	7.0		60	18.7	1/2	85	16.1	
11	5.0		36	12.5		61	15.0		86	8.6	
12	24.0		37	1.0		62	8.0		87	5.1	
13	15.0		38	3.3		63	8.0		88	39.5	
14	28.2		39	8.4		64	4.5		89	4.1	
15	20.1		40	13.7	3/4	65	9.9		90	11.6	3/4
16	0.7		41	7.0		66	37.0		91	6.5	
17	7.0		42	9.1		67	14.1		92	15	
18	12.9		43	11.8		68	8.4		93	10.9	
19	1.2		44	11.0		69	11.6		94	9.8	
20	5.8	3/4	45	11.7		70	15	1/2	95	4	
21	10.5		46	3.5		71	14.1		96	1.5	
22	7.4		47	10.7		72	13.2		97	8.5	
23	4.0		48	8.9		73	4.2		98	6.4	
24	6.0		49	7.5		74	15.4		99	10.4	
25	6.7		50	5.4	1/2	75	12.4		100	10.8	3/4

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: KM, CB, AM, ZC, MC, BB Site Code: ALX003
Sampling Date (DD/MM/YYYY): 27/09/2023

SITE INSPECTION

Site Inspected by: K. McCallum

Communication Information

☑ Itinerary left with contact person (include contact numbers)

Contact Person: A.C. Kroeger Time checked-in: 12:00

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

Phone number: (514) 664-6815

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: K.McCallum, C.Bush, MC, BB, ZC, AM Site Code: BO1001

Sampling Date (DD/MM/YYYY): 26/09/2023

☒ **Occupational Health & Safety: Site Inspection Sheet completed (see page 6)**

PRIMARY SITE DATA

CABIN Study Name: CBWM-Elk Local Basin Name: Elk River

River/Stream Name: Boivin Creek Stream Order: (map scale 1:50,000) 4

Select one: ☒ Test Site ☐ Potential Reference Site

Geographical Description/Notes:
Boivin Crk above confluence into Elk, below in town bridge

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

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

☐ Logging ☐ Mining ☒ Commercial/Industrial ☐ Other ____________

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

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

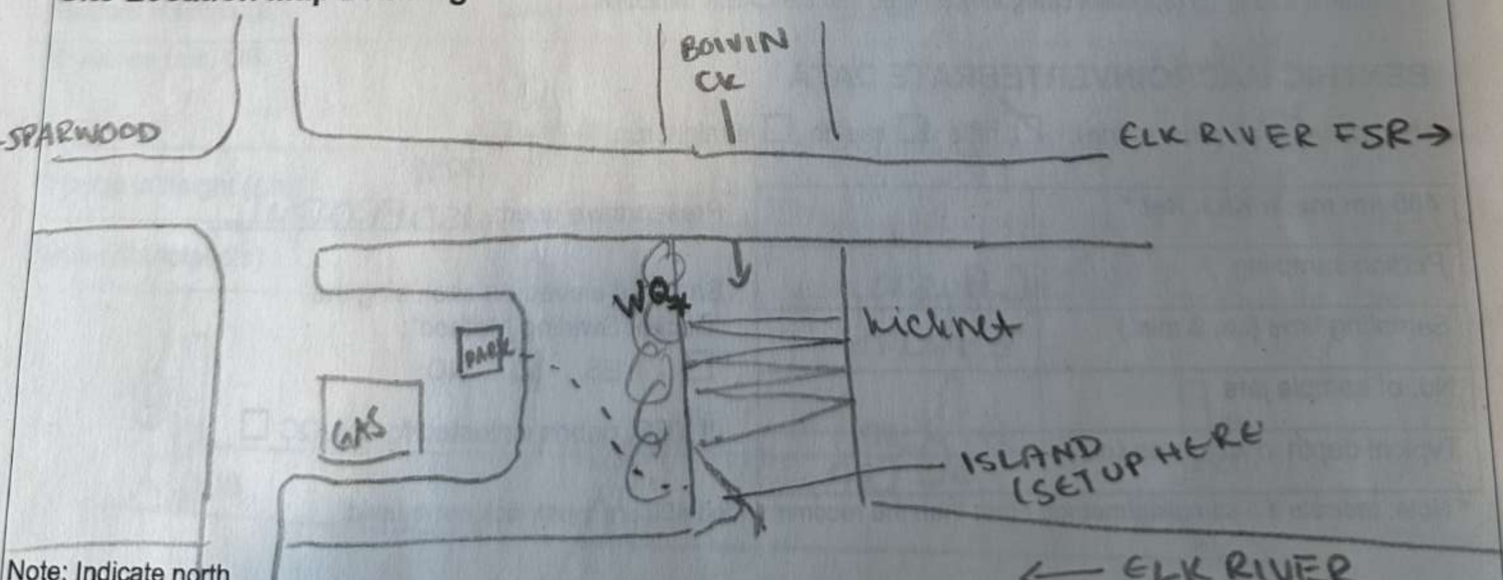
☐ Logging ☐ Mining ☒ Commercial/Industrial (in town of Elkford) ☐ Other ____________

Location Data

Latitude: 50.023144 N Longitude: - 114.916138 W (DMS or DD)

Elevation: 1261 (fasl or masl) GPS Datum: ☒ GRS80 (NAD83/WGS84) ☐ Other: ____________

Site Location Map Drawing



Note: Indicate north

Field Crew: KM, CB, MC, BB, ZC, AM Site Code: BO1001

Sampling Date (DD/MM/YYYY): 26/09/2023

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** - Thin layer, no obvious colour (< 0.5 mm thick)
   ☐ **2** - Yellow-brown to light green colour (0.5-1 mm thick)
   ☑ **3** - Patches of thicker green to brown algae (1-5 mm thick)
   ☐ **4** - Numerous large clumps of green to dark brown algae (5-20 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	C.Bush
Sampling time (i.e. 3 min.)	3 min
No. of sample jars	2
Typical depth in kick area (cm)	30 cm

Preservative used: 99% ISOPROPYL

Sampled sieved on site using the "Bucket Swirling Method":

☐ YES ☑ NO

If YES, debris collected for QA/QC ☐

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

Field Crew: KM, CB, MC, BB, ZC, AM Site Code: BO1001
Sampling Date (DD/MM/YYYY): 26/09/2023

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

Air Temp: 7.0°C (°C) Water Temp: 4.4 (°C) pH: 8.43

Specific Conductance: 329.9 (µs/cm) DO: 11.19 (mg/L) Turbidity: 0.40 (NTU)

DO%: 86.4 ORP: 108.9.

Check if water samples were collected for the following analyses:

- [x] TSS (Total Suspended Solids)
- [x] Nitrogen (i.e. Total, Nitrate, Nitrite, Dissolved, and/or Ammonia)
- [x] Phosphorus (Total, Ortho, and/or Dissolved)
- [x] Major Ions (i.e. Alkalinity, Hardness, Chloride, and/or Sulphate) [x] Other Anions

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 = ________

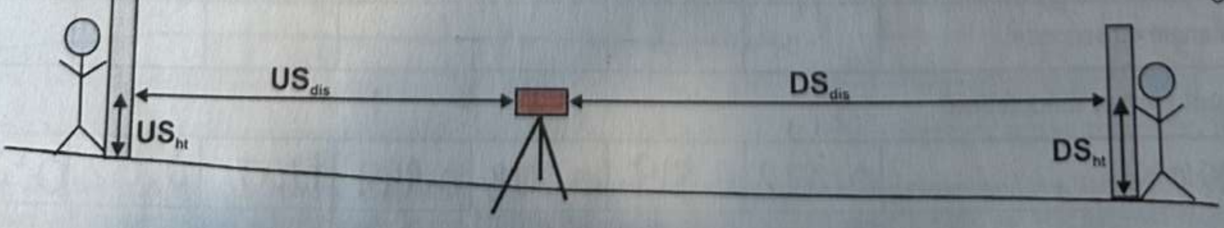
OR

- [x] **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
ᵃTop Hairline (T)	—	—	—
ᵃMid Hairline (ht) OR ᵇHeight of rod	0.497	1.388	
ᵃBottom Hairline (B)	—	—	—
ᵇDistance (dis) OR ᵃT-B x 100	20.3 ᵃUSdis=T-B	20.3 ᵃDSdis=T-B	USdis+DSdis= 40.6
Change in height (Δht)	—	—	DSht-USht= 0.891
Slope (Δht/total dis)			0.0219

2.19%



Field Crew: KM, CB, MC, BB, ZC, AM

Site Code: BO100 1

Sampling Date (DD/MM/YYYY): 25/09/2023

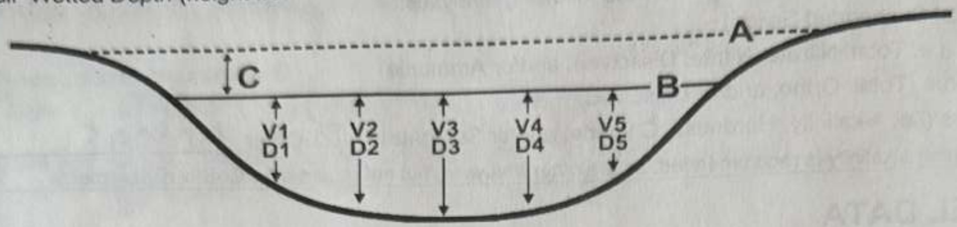
Widths and Depth

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

A - Bankfull Width: 9.22 (m)

B - Wetted Stream Width: 6.76 (m)

C - Bankfull–Wetted Depth (height from water surface to Bankfull): 7.0 (cm)



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

Velocity and Depth

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

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

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

☑ **Direct velocity measurements**: ☐ Marsh-McBirney ☑ Sontek or ☐ Other Flow Tracker 1

1.44 2.39 3.34 4.29 5.24 6.19 7.14

	1	2	3	4	5	6	AVG
Distance from Shore (m)	0.95	1.90	2.85	3.80	4.75	5.70	
Depth (D) (cm)	0.07	0.16	0.29	0.35	0.35	0.33	0.258
Velocity Head Rod (ruler)							
Flowing water Depth (D_1) (cm)							
Depth of Stagnation (D_2) (cm)							
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)	0.272	0.319	0.378	0.944	1.167	0.132	0.535

Field Crew: KM, CB, MC, BB, ZC, AM

Sampling Date (DD/MM/YYYY): 26/09/2023

Site Code: BO1001

SUBSTRATE DATA

1. 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
  - 75% embedded = ¾
  - 50% embedded= ½
  - 25% embedded = ¼
  - Unembedded = 0

2. 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)	[illegible]
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

	Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E
1	2.4Cm		26	3.8		51	3.9		76	4.6	
2	9.5		27	6.1		52	4.6		77	5.8	
3	1.6		28	7.9		53	14.4		78	5.8	
4	4		29	7.5		54	4.5		79	3.4	
5	2.1		30	27.3	75	55	11.3		80	12.9	25
6	10.6		31	3.3		56	2.6		81	9.6	
7	11.1		32	8.8		57	18		82	8.7	
8	11.3		33	2.3		58	5.6		83	6.4	
9	15.2		34	3.6		59	0.5		84	27.2	
10	8.6	25%	35	9		60	10.5	50	85	3.4	
11	5.5		36	6.4		61	4.4		86	29.5	
12	8		37	4		62	3.5		87	0.9	
13	7.2		38	9.3		63	6.3		88	6.0	
14	6.8		39	14		64	7		89	8	
15	4.9		40	8.4	0	65	5.2		90	2.9	0
16	8		41	11.3		66	12.1		91	13	
17	17.5		42	4.9		67	4.1		92	0.3	
18	17.2		43	2.5		68	17.2		93	9.9	
19	4.8		44	2		69	9.2		94	organic cover	
20	3.4	50%	45	13.2		70	10.4	25	95	5.4	
21	23		46	3.3		71	13		96	14	
22	6.3		47	9		72	11.7		97	1.9	
23	2.4		48	4		73	3		98	9.1	
24	3.5		49	4		74	3.4		99	8.9	
25	5.1		50	3.1	0	75	12		100	15.1	50

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: KM, CB, MC, BB, AM, ZC Site Code: BO1001
Sampling Date (DD/MM/YYYY): 26/09/2023

SITE INSPECTION

Site Inspected by: K. McCallum

Communication Information

☑ Itinerary left with contact person (include contact numbers)

Contact Person: A.C. Kroeger Time checked-in: 9:00

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

Phone number: (514) 664-6815

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:

9.7

Field Crew: K.McCallum, C.Bush, MC, BB, ZC, AM Site Code: BO1002
Sampling Date (DD/MM/YYYY): 26/09/2023

[x] **Occupational Health & Safety: Site Inspection Sheet completed (see page 6)**

PRIMARY SITE DATA

CABIN Study Name: CBWQ-Elk Local Basin Name: Elk River
River/Stream Name: Boivin Creek Stream Order: (map scale 1:50,000) 4

Select one: [x] Test Site [ ] Potential Reference Site

Geographical Description/Notes:
Park @ XC-ski trails (on Natal Rd), follow path to bridge, stay on LWB, head u/s until "nightmare before christmas tree"

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

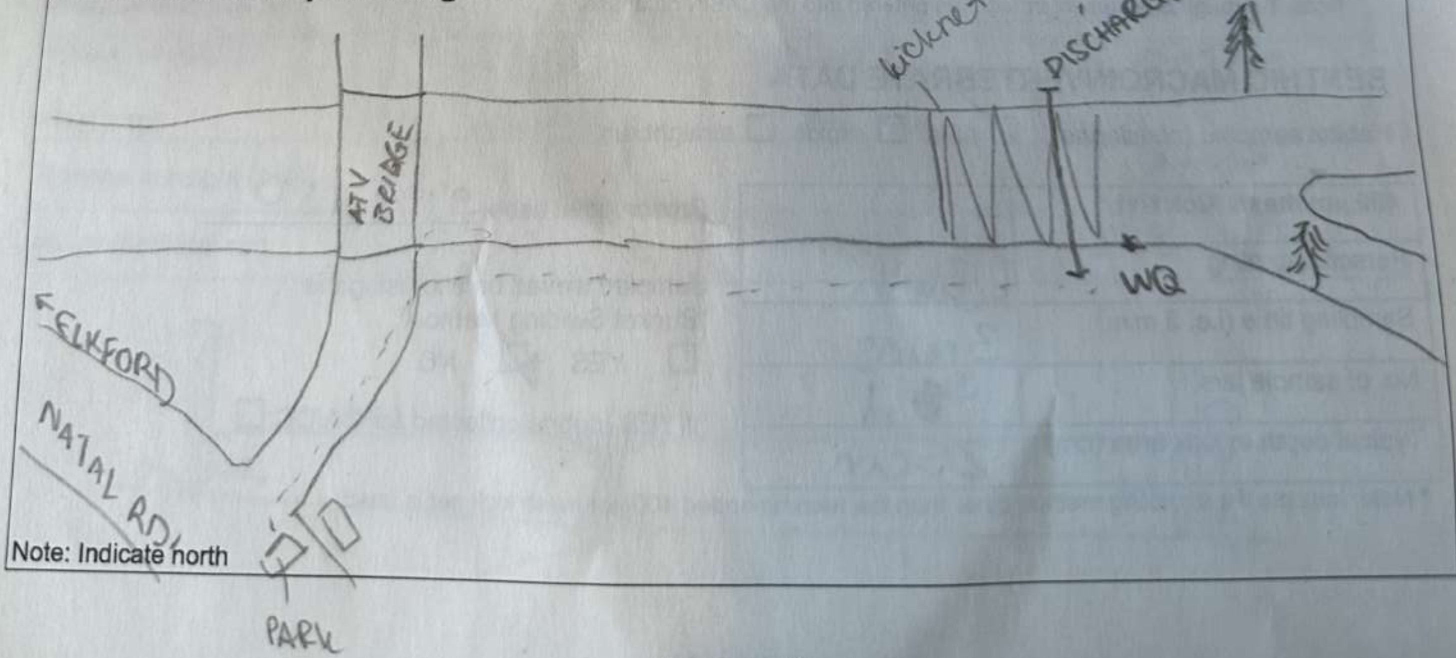
[x] Forest [ ] Field/Pasture [ ] Agriculture [ ] Residential/Urban
[x] Logging [ ] Mining [ ] Commercial/Industrial [x] Other recreational (XC, ATV) trail

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

[x] Forest [ ] Field/Pasture [ ] Agriculture [ ] Residential/Urban
[ ] Logging [ ] Mining [ ] Commercial/Industrial [x] Other recreational trails (XC, ATV)

Location Data
Latitude: 50.016927 N Longitude: - 114.936979 W (DMS or DD)
Elevation: 1316 (fasl or masl) GPS Datum: [x] GRS80 (NAD83/WGS84) [ ] Other: ____

Site Location Map Drawing



Note: Indicate north

Field Crew: km, CB, MC, BB, AM, ZC
Sampling Date (DD/MM/YYYY): 26/09/2023
Site Code: BO1002

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** - Thin layer, no obvious colour (< 0.5 mm thick)
   ☑ **2** - Yellow-brown to light green colour (0.5-1 mm thick)
   ☐ **3** - Patches of thicker green to brown algae (1-5 mm thick)
   ☐ **4** - Numerous large clumps of green to dark brown algae (5-20 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	C. Bush
Sampling time (i.e. 3 min.)	3 mins
No. of sample jars	1
Typical depth in kick area (cm)	25cm

Preservative used: 99% ISO

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

If YES, debris collected for QA/QC ☐

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

Field Crew: KM, CB, MC, BB, AM, ZG Site Code: BO1002
Sampling Date (DD/MM/YYYY): 26/09/2023

WATER CHEMISTRY DATA Time: 12:40 (24 hr clock) Time zone: MDT

Air Temp: 11.0°C (°C) Water Temp: 5.1 (°C) pH: 8.44

Specific Conductance: 329.7 (μs/cm) DO: 11.01 (mg/L) Turbidity: 0.45 (NTU)

DO% 86.4 ORP: 117.0

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 Anions

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)

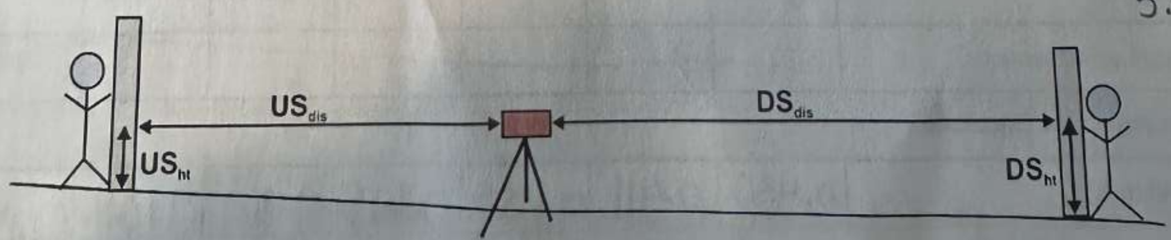
☐ **Calculated from map**
Scale: ________ (Note: small scale map recommended if field measurement is not possible - i.e. 1:20,000).
contour interval (vertical distance) ________ (m),
distance between contour intervals (horizontal distance) ________ (m)
slope = vertical distance/horizontal distance =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

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
aTop Hairline (T)	—	—	—
aMid Hairline (ht) OR bHeight of rod	0.588	1.650	
aBottom Hairline (B)	—	—	—
bDistance (dis) OR aT-B x 100	18.50 aUSdis=T-B	18.50 aDSdis=T-B	USdis+DSdis= 210
Change in height (Δht)			DSht-USht= 1.062
Slope (Δht/total dis)			0.05057

5.06%



Field Crew: KM CB ZC AM MC BB

Site Code: BOI002

Sampling Date (DD/MM/YYYY): 26/09/2023

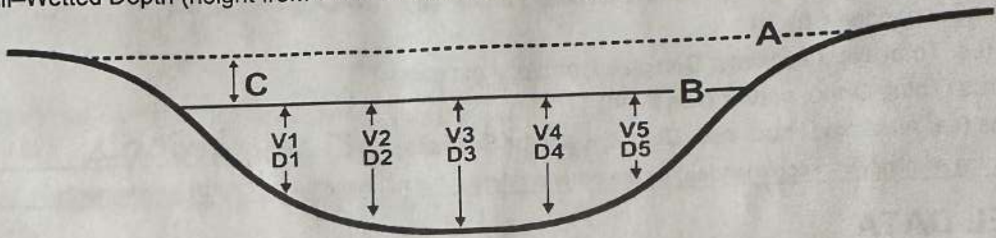
Widths and Depth

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

A - Bankfull Width: 9.70 (m)

B - Wetted Stream Width: 6.17 (m)

C - Bankfull–Wetted Depth (height from water surface to Bankfull): 19.5 (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]

0.88

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

☒ **Direct velocity measurements**: ☐ Marsh-McBirney ☒ Sontek or ☐ Other Flow Tracker 1

0.45 1.33 2.21 3.09 3.97 4.85 5.73

	1	2	3	4	5	6	AVG
Distance from Shore (m)	0.88	1.76	2.64	3.52	4.40	5.28	
Depth (D) (~~cm~~) (m)	0.18	0.30	0.22	0.32	0.34	0.34	0.283
Velocity Head Rod (ruler)							
Flowing water Depth (D_1) (cm)							
Depth of Stagnation (D_2) (cm)							
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)	0.480	0.411	0.459	0.615	0.761	0.164	0.482

Field Crew: KM, CB, ZC, MC, Site Code: BO1002

Sampling Date (DD/MM/YYYY): 26/09/2023

SUBSTRATE DATA

1. 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
  - 75% embedded = ¾
  - 50% embedded= ½
  - 25% embedded = ¼
  - Unembedded = 0

2. 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

	Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E
1	6.5		26	15.2		51	4.7		76	5.0	
2	8.0		27	4.4		52	8.0		77	6.0	
3	8.7		28	8.6		53	5.1		78	7.9	
4	23.5		29	9.5		54	6.9		79	3.4	
5	6.5		30	7.3	0	55	5.5		80	15.5	50
6	5.9		31	5.0		56	4.2		81	15.2	
7	9.3		32	9.5		57	11.5		82	7.2	
8	24.0		33	22.1		58	6.8		83	5.5	
9	17.0		34	4.7		59	9.0		84	12.3	
10	3.0	0	35	10.2		60	15.3	75	85	4.7	
11	6.0		36	11.5		61	5.1		86	8.5	
12	9.0		37	6.3		62	5.5		87	2.4	
13	8.5		38	23.4		63	10.2		88	4.0	
14	5.1		39	6.5		64	0.9		89	7.3	
15	7.9		40	3.5	1/4	65	8.5		90	7.0	0
16	8.7		41	8		66	7.0		91	4.5	
17	7.5		42	5.7		67	7.3		92	6.8	
18	4.0		43	11.8		68	10.5		93	6.5	
19	15.1		44	11.5		69	3.7		94	3.0	
20	17.3	75%	45	0.7		70	7.5	25	95	2.6	
21	7.0		46	5		71	4.2		96	4.2	
22	8.4		47	8.9		72	2.7		97	5.5	
23	14.8		48	5.5		73	2.0		98	7.0	
24	8.2		49	3.2		74	9.1		99	4.8	
25	1.6		50	4.1	25%	75	8.1		100	6.0	50

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: KM, CB, ZC, AM, MC, BB
Sampling Date (DD/MM/YYYY): 26/09/2023

Site Code: BO1002

SITE INSPECTION

Site Inspected by: K McCallum

Communication Information

☑ Itinerary left with contact person (include contact numbers)

Contact Person: A-C Kroeger Time checked-in: 9:00

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

Phone number: (514) 664-6815

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: K.McCallum, C.Bush, ZC, AM, MC, BB Site Code: COL001
Sampling Date (DD/MM/YYYY): 03/10/2023

[x] **Occupational Health & Safety: Site Inspection Sheet completed (see page 6)**

PRIMARY SITE DATA

CABIN Study Name: CBWQ-Elk Local Basin Name: Elk River

River/Stream Name: Coal Creek Stream Order: (map scale 1:50,000) 3

Select one: [x] Test Site [ ] Potential Reference Site

Geographical Description/Notes:

Site btw/ Park Ave + train bridge (across from Sombrowski's giant red house)

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

[x] Forest [ ] Field/Pasture [ ] Agriculture [x] Residential/Urban
[x] Logging [ ] Mining [ ] Commercial/Industrial [x] Other Recreational trail/train

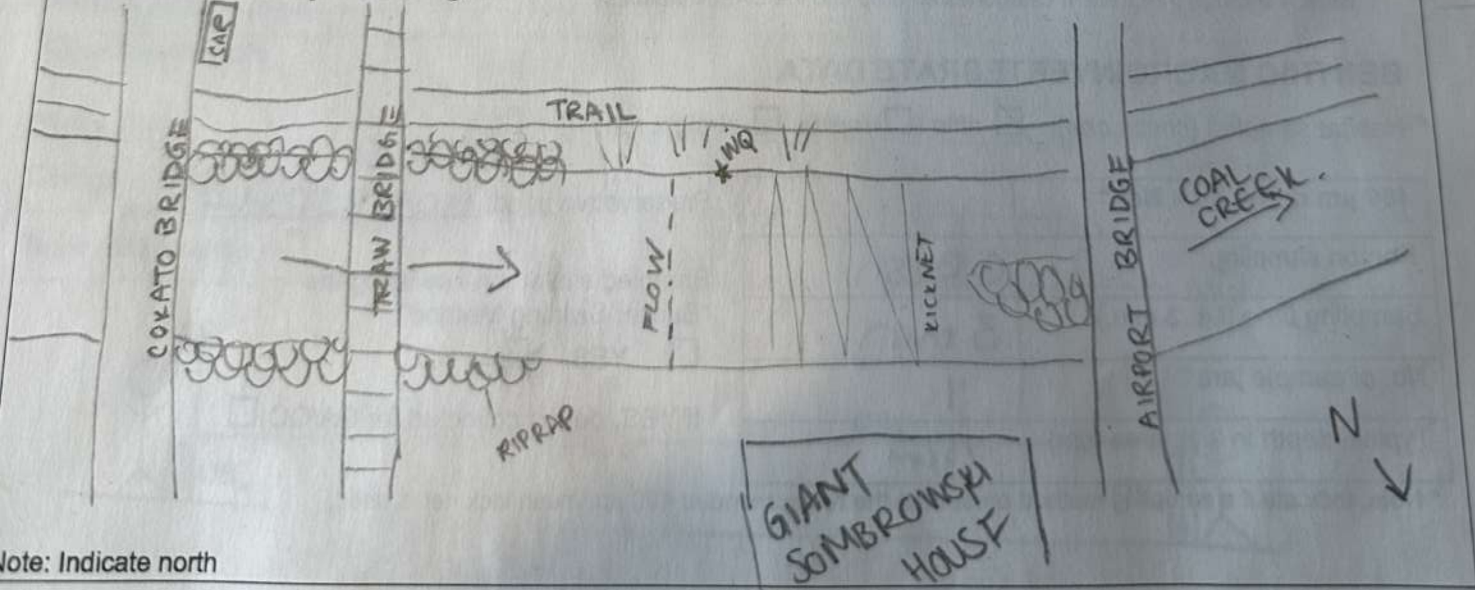
Dominant Surrounding Land Use: (check one) Information Source: ____

[ ] Forest [ ] Field/Pasture [ ] Agriculture [x] Residential/Urban
[ ] Logging [ ] Mining [ ] Commercial/Industrial [ ] Other ____

Location Data

Latitude: 49.495744 N Longitude: - 115.066434 W (DMS or DD)
Elevation: 999 (fasl or masl) GPS Datum: [x] GRS80 (NAD83/WGS84) [ ] Other: ____

Site Location Map Drawing



Note: Indicate north

Field Crew: KM, CB, MC, AM, ZC, BB

Site Code: COL001

Sampling Date (DD/MM/YYYY): 03/10/2023

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 % * NEW THIS YEAR HAVE PHOTOS

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)* - SCOURED BANK d/s OF SITE
   ☐ **1 -** Thin layer, no obvious colour (< 0.5 mm thick)
   ☐ **2 -** Yellow-brown to light green colour (0.5-1 mm thick)
   ☑ **3 -** Patches of thicker green to brown algae (1-5 mm thick) BEARDY GROWTH
   ☐ **4 -** Numerous large clumps of green to dark brown algae (5-20 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	C. Bush
Sampling time (i.e. 3 min.)	3 min
No. of sample jars	1
Typical depth in kick area (cm)	15cm

Preservative used: 99% ISO PROPYL

Sampled sieved on site using the "Bucket Swirling Method":

☐ YES ☑ NO

If YES, debris collected for QA/QC ☐

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

Field Crew: K.M, CB, MC, BB, ZC, AM Site Code: COL001

Sampling Date (DD/MM/YYYY): 03/10/2023

WATER CHEMISTRY DATA Time: 09:10 (24 hr clock) **Time zone:** MDT

Air Temp: 9.0 (°C) Water Temp: 8.1 (°C) pH: 8.13

Specific Conductance: 160.3 (µs/cm) DO: 10.70 (mg/L) Turbidity: 0.10 (NTU)

DO% : 90.5 ORP: 117.1

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 Ammonia

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) ~~72~~ (m)
slope = vertical distance/horizontal distance = ____

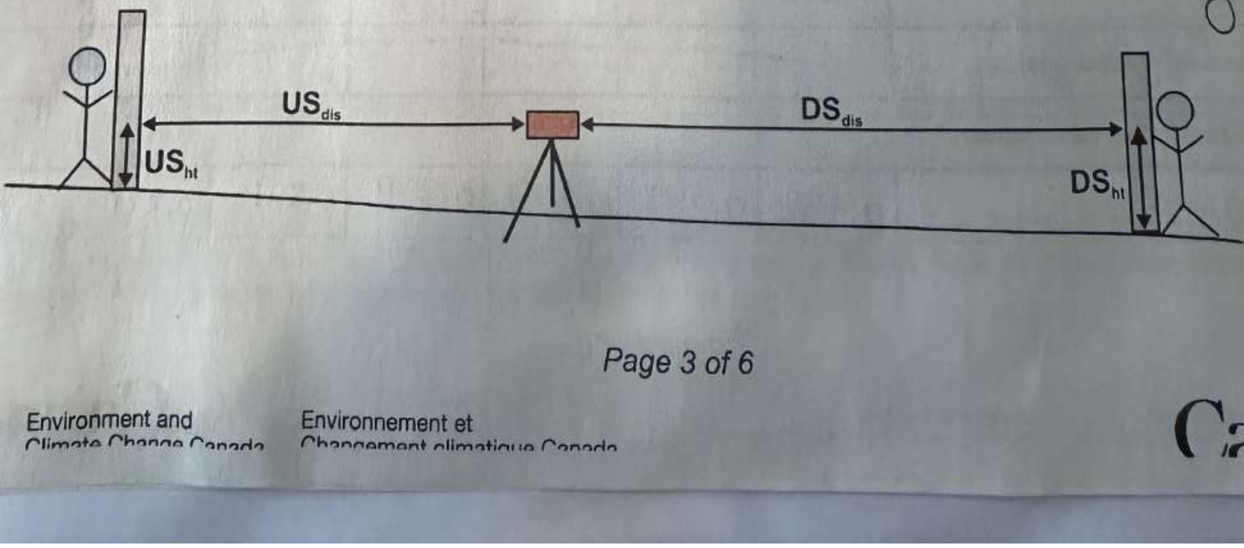
OR

☒ **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)~~		~~1.483~~	
[a]Mid Hairline (ht) OR [b]Height of rod	1.168	1.483	
~~[a]Bottom Hairline (B)~~			
[b]Distance (dis) OR [a]T-B x 100	36 $_aUS_{dis}$=T-B	36 $_aDS_{dis}$=T-B	$US_{dis}+DS_{dis}$= 72m
Change in height (Δht)			$DS_{ht}-US_{ht}$= 0.315
Slope (Δht/total dis)			0.004375

0.438%



Field Crew: KM, CB, BB, MC, ZC, AM Site Code: COL001

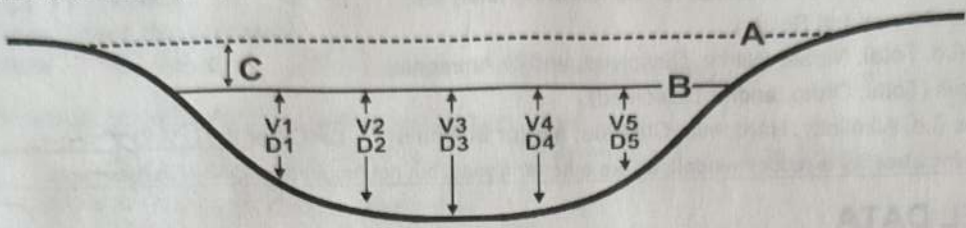
Sampling Date (DD/MM/YYYY): 03/09/2023

Widths and Depth

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

A - Bankfull Width: 19.60 (m) B - Wetted Stream Width: 12.00 (m)

C - Bankfull–Wetted Depth (height from water surface to Bankfull): 1.25 m. (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 Flowtracker

	1	2	3	4	5	6	AVG
Distance from Shore (m)	2.0	3.7	5.4	7.1	8.8	10.5	
Depth (D) (cm)	~~20~~ 19	22	26	26	28	27	24.67
Velocity Head Rod (ruler)							
Flowing water Depth (D_1) (cm)							
Depth of Stagnation (D_2) (cm)							
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)	0.132	0.042	0.207	0.249	0.301	0.225	0.203

Field Crew: KM, CB, AM, ZC, BB, MC.   Site Code: COL001

Sampling Date (DD/MM/YYYY): 03/09/2023

SUBSTRATE DATA

1. 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
  - 75% embedded = ¾
  - 50% embedded= ½
  - 25% embedded = ¼
  - Unembedded = 0

• FINE SEDIMENT COVERING ROCKS

2. 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

	Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E
1	8.9		26	4.4		51	4.1		76	7.0	
2	4.1		27	6.0		52	5.4		77	5.5	
3	9.2		28	30.2		53	13.5		78	3.6	
4	3.2		29	6.2		54	4.5		79	4.3	
5	6.6		30	5.0	1/8	55	10.7		80	8.3	1/2
6	11.2		31	5.6		56	8.0		81	1.8	
7	12.5		32	8.4		57	8.4		82	9.2	
8	21.0		33	6.0		58	7.2		83	9.2	
9	4.7		34	7.0		59	8.2		84	7.5	
10	27.0	3/4	35	4.5		60	13.0	1/2	85	6.4	
11	8.0		36	3.4		61	36		86	10.4	
12	6.6		37	6.5		62	9.2		87	3.4	
13	8.8		38	4.5		63	3.7		88	4.6	
14	8.7		39	10.2		64	8.3		89	5.9	
15	7.3		40	8.3	0	65	4.7		90	10.2	3/4
16	0.9		41	8.3		66	1.4		91	25.0	
17	2.5		42	9.8		67	9.0		92	6.8	
18	11.5		43	10.2		68	1.6		93	6.0	
19	7.0		44	3.9		69	3.1		94	3.3	
20	5.0	1/4	45	60		70	5.3	1/2	95	10.6	
21	9.2		46	6.7		71	6.2		96	9.1	
22	9.3		47	6.2		72	10.0		97	9.1	
23	5.5		48	10.8		73	3.4		98	1.9	
24	9.7		49	2.5		74	4.6		99	7.0	
25	6.8		50	0.5	0	75	0.9		100	7.0	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: K.M, CB, MC, BB, AM, ZC Site Code: CO4001
Sampling Date (DD/MM/YYYY): 03/09/2023

SITE INSPECTION

Site Inspected by: K. McCallum

Communication Information

☒ Itinerary left with contact person (include contact numbers)

Contact Person: E. Matveev Time checked-in: 9:00

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

Phone number: (709) 763-9678

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: K. McCallum, C. Bush, A.M, ZC, ~~BB, MC~~ Site Code: COL003

Sampling Date (DD/MM/YYYY): 03/09/2023

☒ **Occupational Health & Safety: Site Inspection Sheet completed (see page 6)**

PRIMARY SITE DATA

CABIN Study Name: CBWQ - Elk Local Basin Name: Elk River

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

Select one: ☒ Test Site ☐ Potential Reference Site

Geographical Description/Notes:
Coming from Coal Creek Rd: Take Coal Crk. Rd to Paiges Draw. Park @ left pullout before road gets windy.
Coming from Morrissey: Head up Morrissey, past FWA, past MOR002 continue until fork with sign for Coal Creek. Follow to left. Continue to pullout on right (past right-side turnoff to Morrissey).
Follow flagging tape from pulloff to river (above old man pool)

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

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

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

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

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

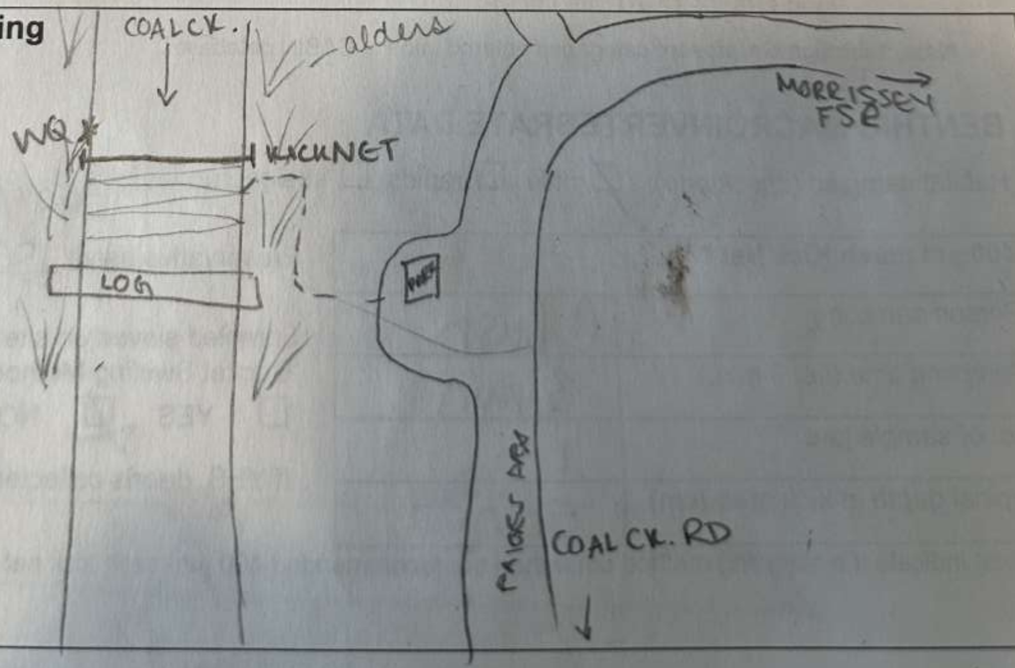
☐ Logging ☐ Mining ☐ Commercial/Industrial ☐ Other ____________

Location Data

Latitude: 49.452853 N Longitude: - 114.87999 W (DMS or DD)

Elevation: 1737.0 (fasl or masl) GPS Datum: ☒ GRS80 (NAD83/WGS84) ☐ Other: ____________

Site Location Map Drawing



Note: Indicate north

Field Crew: KM, CB, AM, ZC Site Code: COL003

Sampling Date (DD/MM/YYYY): 03/10/2023

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 -** Thin layer, no obvious colour (< 0.5 mm thick)
   ☐ **2 -** Yellow-brown to light green colour (0.5-1 mm thick)
   ☐ **3 -** Patches of thicker green to brown algae (1-5 mm thick)
   ☐ **4 -** Numerous large clumps of green to dark brown algae (5-20 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	C.Bush
Sampling time (i.e. 3 min.)	3 min
No. of sample jars	1
Typical depth in kick area (cm)	5cm

Preservative used: 99% ISOPROPYL

Sampled sieved on site using the "Bucket Swirling Method":

☐ YES ☑ NO

If YES, debris collected for QA/QC ☐

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

Field Crew: KM, CB, AM, ZC Site Code: COL003

Sampling Date (DD/MM/YYYY): 03/10/2023

WATER CHEMISTRY DATA Time: 13:57 (24 hr clock) Time zone: MDT

Air Temp: 8.0 (°C) Water Temp: 5.5 (°C) pH: 7.68

Specific Conductance: 43.9 (µs/cm) DO: 10.3 (mg/L) Turbidity: 0.28 (NTU)

Check if water samples were collected for the following analyses: DO% 81.6% ORP: 120.5

- [x] TSS (Total Suspended Solids)
- [x] Nitrogen (i.e. Total, Nitrate, Nitrite, Dissolved, and/or Ammonia)
- [ ] Phosphorus (Total, Ortho, and/or Dissolved)
- [x] Major Ions (i.e. Alkalinity, Hardness, Chloride, and/or Sulphate) [x] Other Anions

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 = ______

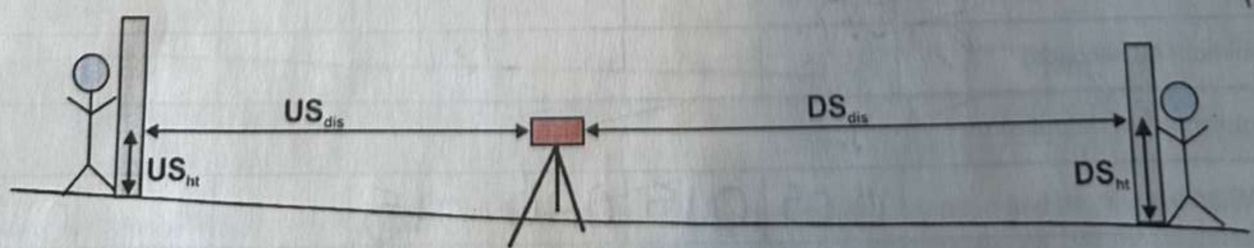
OR

- [x] **Measured in field** 1.745

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
ᵃTop Hairline (T)			
ᵃMid Hairline (ht) OR ᵇHeight of rod	1.280	1.745	
ᵃBottom Hairline (B)			
ᵇDistance (dis) OR ᵃT-B x 100	12.0 ᵃUS_{dis}=T-B	12.0 ᵃDS_{dis}=T-B	$US_{dis}+DS_{dis}$= 24
Change in height (Δht)			$DS_{ht}-US_{ht}$= 0.465
Slope (Δht/total dis)			0.0194

1.94%



Field Crew: KM, CB, AM, ZC Site Code: COL003

Sampling Date (DD/MM/YYYY): 03/10/2023

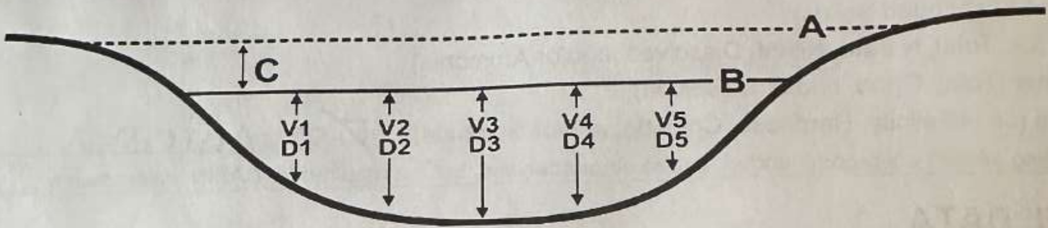
21.20 0.2

Widths and Depth

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

A - Bankfull Width: 5.13 (m) B - Wetted Stream Width: 4.0 (m)

C - Bankfull–Wetted Depth (height from water surface to Bankfull): 16.0 (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 FlowProbe

	1	2	3	4	5	6	AVG
Distance from Shore (m)	0.8	1.60	2.40	3.2			
Depth (D) (cm)	16.0	15.0	10.0	7.0			12.0
Velocity Head Rod (ruler)							
Flowing water Depth (D_1) (cm)							
Depth of Stagnation (D_2) (cm)							
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)	0.05	0.15	0.10	0.15			0.1125

Field Crew: KM, CB, ZC, AM

Sampling Date (DD/MM/YYYY): 03/10/2023

Site Code: COL003

SUBSTRATE DATA

1. 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
  - 75% embedded = ¾
  - 50% embedded= ½
  - 25% embedded = ¼
  - Unembedded = 0

2. 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

	Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E
1	3.3		26	8.0		51	25.6		76	7.8	
2	3.9		27	4.0		52	6.0		77	3.0	
3	2.2		28	3.2		53	5.7		78	9.5	
4	3.9		29	5.8		54	4.0		79	2.9	
5	10.5		30	15.9	1/2	55	21.0		80	9.8	0
6	36.0		31	3.2		56	10.5		81	4.0	
7	3.0		32	4.1		57	4.3		82	6.2	
8	5.3		33	5.5		58	1.8		83	3.4	
9	13.8		34	4.9		59	9.0		84	6.3	
10	8.8	3/4	35	7.2		60	2.7	0	85	5.1	
11	5.5		36	5.4		61	4.8		86	6.9	
12	5.3		37	6.8		62	2.2		87	12.6	
13	1.2		38	13.0		63	7.3		88	3.1	
14	6.5		39	4.7		64	6.5		89	13.6	
15	1.1		40	7.3	1	65	8.4		90	6.0	1/4
16	5.0		41	4.0		66	28.7		91	5.3	
17	5.0		42	17.2		67	6.0		92	7.9	
18	12.1		43	5.0		68	6.4		93	1.8	
19	14.5		44	4.0		69	9.0		94	6.2	
20	5.0	3/4	45	5.2		70	3.4	1/25	95	1.8	
21	9.0		46	3.2		71	7.9		96	13.5	
22	7.1		47	2.6		72	4.8		97	9.0	
23	4.0		48	0.5		73	6.0		98	8.0	
24	2.8		49	5.5		74	8.0		99	8.0	
25	4.5		50	2.8	0	75	11.1		100	21.8	3/4

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: K.M, CB, MC, BB, AM, ZC Site Code: COL003
Sampling Date (DD/MM/YYYY): 03/09/2023

SITE INSPECTION

Site Inspected by: K.McCallum

Communication Information

☑ Itinerary left with contact person (include contact numbers)

Contact Person: E.Matveev Time checked-in: 9:00

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

Phone number: (709) 763-9678

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: K.McCallum, C.Bush, AM, ZC, MC, BB Site Code: LIZ001
Sampling Date (DD/MM/YYYY): 04/10/2023

[x] **Occupational Health & Safety: Site Inspection Sheet completed (see page 6)**

PRIMARY SITE DATA

CABIN Study Name: CBWQ - Elk Local Basin Name: Elk River

River/Stream Name: Lizard Creek Stream Order: (map scale 1:50,000) 3

Select one: [x] Test Site [ ] Potential Reference Site

Geographical Description/Notes:
≃100m u/s from hwy 3 LIZ. Creek bridge, above scoured portion of river

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

[x] Forest [x] Field/Pasture [ ] Agriculture [x] Residential/Urban
[ ] Logging [ ] Mining [ ] Commercial/Industrial [x] Other recreational (prov. park)

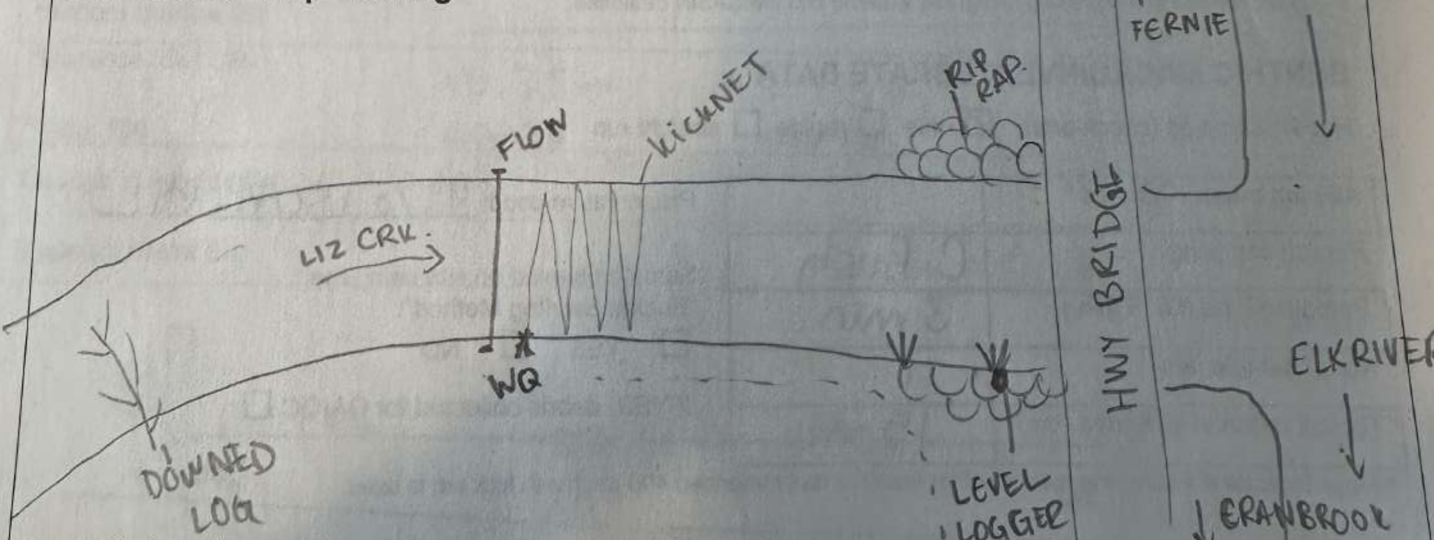
Dominant Surrounding Land Use: (check one) Information Source: visual

[x] Forest [ ] Field/Pasture [ ] Agriculture [ ] Residential/Urban
[ ] Logging [ ] Mining [ ] Commercial/Industrial [ ] Other ____________

Location Data

Latitude: 49.471164 N Longitude: - 115.077159 W (DMS or DD)
Elevation: 994.0 (fasl or masl) GPS Datum: [x] GRS80 (NAD83/WGS84) [ ] Other: __________

Site Location Map Drawing



Note: Indicate north

Field Crew: KM, CB, ZC, BB, MC, AM Site Code: LIZ001
Sampling Date (DD/MM/YYYY): 04/10/2023

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 -** Thin layer, no obvious colour (< 0.5 mm thick)
   - ☐ **2 -** Yellow-brown to light green colour (0.5-1 mm thick)
   - ☐ **3 -** Patches of thicker green to brown algae (1-5 mm thick)
   - ☑ **4 -** Numerous large clumps of green to dark brown algae (5-20 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	C. Bush
Sampling time (i.e. 3 min.)	3 min.
No. of sample jars	1
Typical depth in kick area (cm)	15cm

Preservative used: 99% ISOPROPYL

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

If YES, debris collected for QA/QC ☐

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

Field Crew: KM, CB, ZC, BB, AM, MC. Site Code: 42001
Sampling Date (DD/MM/YYYY): 04/10/2023

WATER CHEMISTRY DATA Time: 09:00 (24 hr clock) Time zone: MDT

Air Temp: 12.0 (°C) Water Temp: 7.3°C (°C) pH: 8.32

Specific Conductance: 604 (µs/cm) DO: 10.94 (mg/L) Turbidity: 1.06 (NTU)

DO%: 9.12 ORP: 106.9µS/cm

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 Anions

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 = ____________

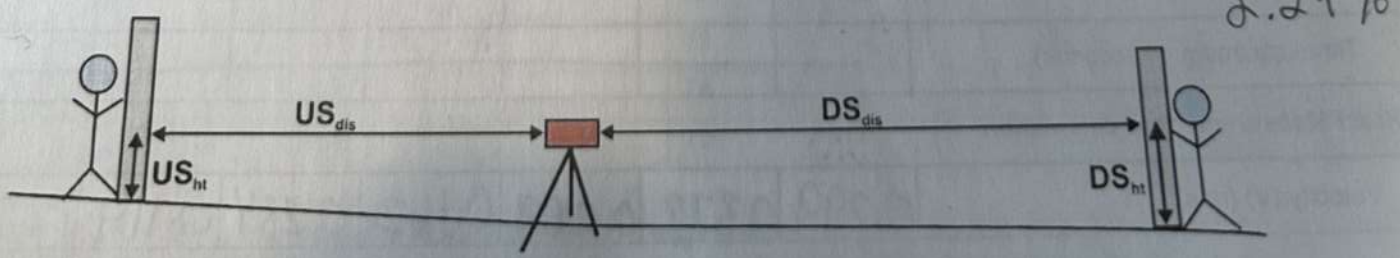
OR

☒ **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	1.249 m	1.964 m	
[a]Bottom Hairline (B)			
[b]Distance (dis) OR [a]T-B x 100	15.75 m aUS$_{dis}$=T-B	15.75 m aDS$_{dis}$=T-B	US$_{dis}$+DS$_{dis}$= 31.50m
Change in height (Δht)			DS$_{ht}$-US$_{ht}$= 0.715
Slope (Δht/total dis)			0.0227

2.27%



Field Crew: KM, CB, AM, BB, ZC, MC Site Code: L12001

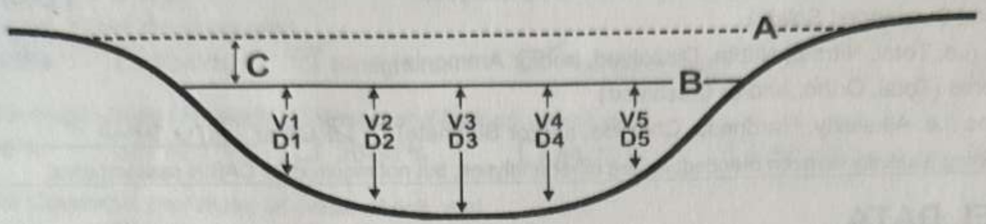
Sampling Date (DD/MM/YYYY): 04/10/2023

Widths and Depth

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

A - Bankfull Width: 10.40 (m) B - Wetted Stream Width: 5.25 (m)

C - Bankfull–Wetted Depth (height from water surface to Bankfull): 44.0 (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

6.95 1.7 0

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

5.25

☐ **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 Flowtracker I

2.45 3.20 3.95 4.7 5.45 6.20

	1	2	3	4	5	6	AVG
Distance from Shore (m)	0.75	1.50	2.25	3.0	3.75	4.5	
Depth (**D**) (cm)	20.0	22.0	22.0	24.0	16.0	18.0	20.33
Velocity Head Rod (ruler)							
Flowing water Depth (D_1) (cm)							
Depth of Stagnation (D_2) (cm)							
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)	0.299	0.378	0.262	0.162	0.264	0.114	0.250

Field Crew: KM, CB, AM, ZC, BB, MC Site Code: L12001

Sampling Date (DD/MM/YYYY): 04/10/2023

SUBSTRATE DATA

1. 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
  - 75% embedded = ¾
  - 50% embedded= ½
  - 25% embedded = ¼
  - Unembedded = 0

2. 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

	Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E
1	11.2		26	5.1		51	7.9		76	5.5	
2	13.1		27	5.0		52	8.0		77	9.2	
3	10.2		28	14.0		53	1.8		78	5.0	
4	13.4		29	4.4		54	9.0		79	9.2	
5	5.0		30	2.2	1/2	55	7.7		80	4.2	1/2
6	7.9		31	0.5		56	9.7		81	1.3	
7	4.0		32	8.9		57	5.6		82	7.0	
8	0.8		33	12.0		58	3.0		83	10.3	
9	37.1		34	3.8		59	8.4		84	6.6	
10	2.2	1/4	35	3.4		60	11.0	1/2	85	8.1	
11	4.8		36	6.5		61	11.6		86	12.2	
12	1.3		37	4.6		62	2.4		87	3.0	
13	3.2		38	12.7		63	5.7		88	6.7	
14	8.0		39	4.3		64	3.6		89	1.4	
15	5.5		40	5.5	1/4	65	11.1		90	25.5	1/2
16	0.4		41	23.4		66	3.1		91	1.5	
17	6.1		42	4.0		67	7.9		92	10.2	
18	0.2		43	7.2		68	3.5		93	17.8	
19	5.0		44	5.0		69	3.5		94	6.0	
20	4.0	1/2	45	3.0		70	4.3	1/25	95	18.0	
21	7.6		46	6.6		71	1.0		96	8.0	
22	7.1		47	4.5		72	6.3		97	4.3	
23	7.6		48	4.3		73	4.5		98	18.3	
24	2.7		49	3.3		74	3.1		99	4.0	
25	3.0		50	3.0	1/2	75	0		100	13.2	3/4

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: KM, CB, AM, ZC, BB, MC Site Code: L12001
Sampling Date (DD/MM/YYYY): 04/10/2023

SITE INSPECTION

Site Inspected by: K. McCallum

Communication Information

☒ Itinerary left with contact person (include contact numbers)

Contact Person: E. Matveev Time checked-in: 8:00

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

Phone number: (709) 763-9678

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: K McCallum, C. Bush, ZC, AM Site Code: LIZ003

Sampling Date (DD/MM/YYYY): 04/10/2023

☒ Occupational Health & Safety: Site Inspection Sheet completed (see page 6)

PRIMARY SITE DATA

CABIN Study Name: CBWQ - Elk Local Basin Name: Elk River

River/Stream Name: Lizard Creek Stream Order: (map scale 1:50,000) 3

Select one: ☒ Test Site ☐ Potential Reference Site

Geographical Description/Notes:

Park at the visitor parking (big one beside Nordic center), take trail u/s, follow until old ERA sign. Head down to river + walk u/s to site (site d/s of bank restoration).

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

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

☐ Logging ☐ Mining ☐ Commercial/Industrial ☒ Other recreation (Island lake lodge, prov. park) trails

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

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

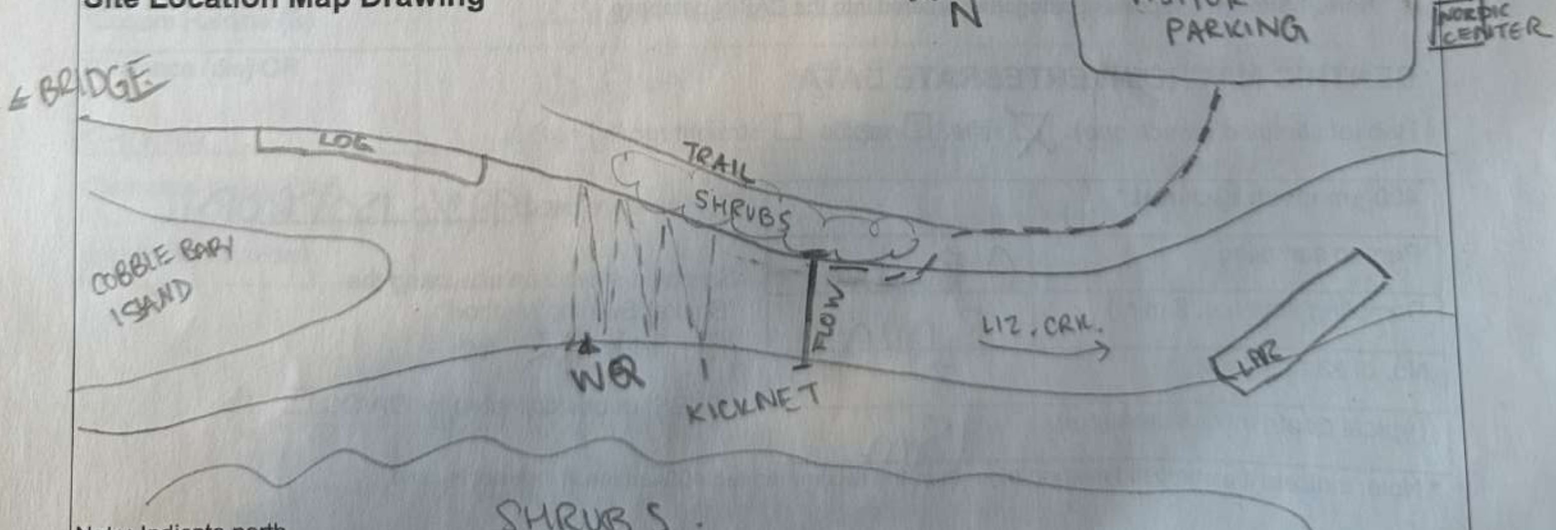
☐ Logging ☐ Mining ☐ Commercial/Industrial ☐ Other ____

Location Data

Latitude: 49.485690 N Longitude: -115.094321 W (DMS or DD)

Elevation: 1022.0 (fasl or masl) GPS Datum: ☒ GRS80 (NAD83/WGS84) ☐ Other: ____

Site Location Map Drawing



Note: Indicate north

Field Crew: KM, CB, BB, ZC, AM, MC
Site Code: LI2003
Sampling Date (DD/MM/YYYY): 04/10/2023

Photos

- [x] Field Sheet
- [x] Upstream
- [x] Downstream
- [x] Across Site
- [ ] Aerial View
- [x] Substrate (exposed)
- [x] Substrate (aquatic)
- [ ] Other ________

REACH DATA *(represents 6 times bankfull width)*

1. Habitat Types: *(check those present)*
   - [x] Riffle
   - [ ] Rapids
   - [x] Straight run
   - [x] Pool/Back Eddy
2. Canopy Coverage: *(stand in middle of stream and look up, check one)*
   - [ ] 0 %
   - [x] 1-25 %
   - [ ] 26-50 %
   - [ ] 51-75 %
   - [ ] 76-100 %
3. Macrophyte Coverage: *(not algae or moss, check one)*
   - [x] 0 %
   - [ ] 1-25 %
   - [ ] 26-50 %
   - [ ] 51-75 %
   - [ ] 76-100 %
4. Streamside Vegetation: (*check those present)*
   - [x] ferns/grasses
   - [x] shrubs
   - [x] deciduous trees
   - [x] coniferous trees
5. Dominant Streamside Vegetation: *(check one)*
   - [ ] ferns/grasses
   - [x] shrubs
   - [ ] deciduous trees
   - [ ] coniferous trees
6. Periphyton Coverage on Substrate: *(benthic algae, not moss, check one)*
   - [ ] **1 -** Thin layer, no obvious colour (< 0.5 mm thick)
   - [x] 2 - Yellow-brown to light green colour (0.5-1 mm thick)
   - [ ] 3 - Patches of thicker green to brown algae (1-5 mm thick)
   - [ ] 4 - Numerous large clumps of green to dark brown algae (5-20 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*): [x] riffle [ ] rapids [ ] straight run

400 µm mesh Kick Net *	
Person sampling	C. Bush
Sampling time (i.e. 3 min.)	3 min
No. of sample jars	3
Typical depth in kick area (cm)	15cm.

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

Preservative used: 99% ISOPROPYL

Sampled sieved on site using the "Bucket Swirling Method":
[ ] YES [x] NO

If YES, debris collected for QA/QC [ ]

Field Crew: KM, CB, ZC, AM, BB, MC

Sampling Date (DD/MM/YYYY): 04/10/2023

Site Code: LL2003

WATER CHEMISTRY DATA

Time: 12:10 (24 hr clock) Time zone: MDT

Air Temp: 16.0 (°C) Water Temp: 7.9 (°C) pH: 8.33

Specific Conductance: 607.0 (µs/cm) DO: 11.31 (mg/L) Turbidity: 0.30 (NTU)

DO%: 95.5 ORP: 113.5 µS/cm

Check if water samples were collected for the following analyses:

- [x] TSS (Total Suspended Solids)
- [x] Nitrogen (i.e. Total, Nitrate, Nitrite, Dissolved, and/or Ammonia)
- [x] Phosphorus (Total, Ortho, and/or Dissolved)
- [x] Major Ions (i.e. Alkalinity, Hardness, Chloride, and/or Sulphate)
- [x] Other Anions

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 = ________

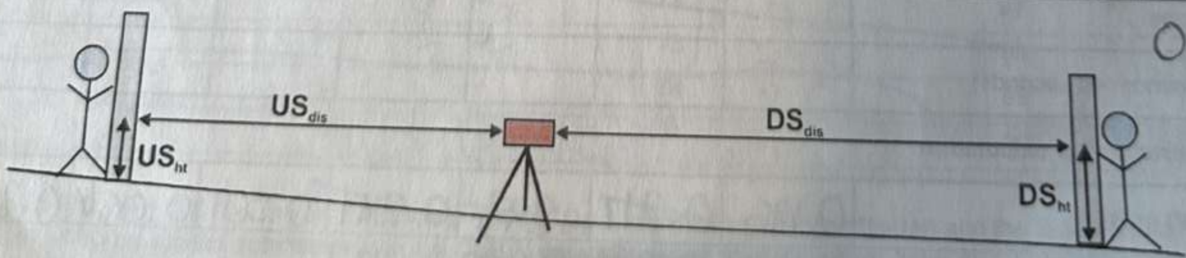
OR

- [x] **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
aTop Hairline (T)			
aMid Hairline (ht) OR bHeight of rod	0.979m	1.20 m	
aBottom Hairline (B)			
bDistance (dis) OR aT-B x 100	15.0m aUSdis=T-B	15.0m aDSdis=T-B	USdis+DSdis= 30 m
Change in height (Δht)			DSht-USht= 0.221
Slope (Δht/total dis)			0.00737

0.74%



Field Crew: KM, AM, CB, MC, BR, ZC

Site Code: LJZ003

Sampling Date (DD/MM/YYYY): 04/10/2023

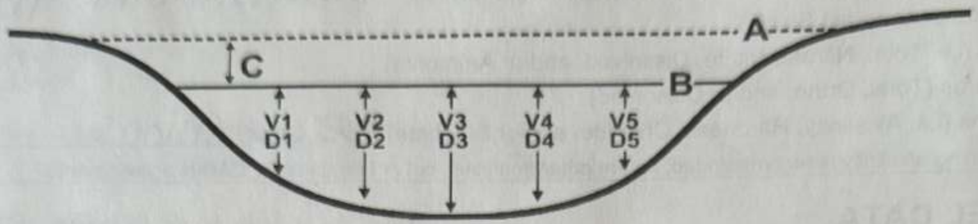
Widths and Depth

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

A - Bankfull Width: 80 (m)

B - Wetted Stream Width: 5.0 (m)

C - Bankfull–Wetted Depth (height from water surface to Bankfull): 16.0 (cm)



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

Velocity and Depth

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

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

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

☑ **Direct velocity measurements**: ☐ Marsh-McBirney ☑ Sontek or ☐ Other Flowtracker I

	1	2	3	4	5	6	AVG
	2.45	3.15	3.85	4.55	5.25	5.95	
Distance from Shore (m)	0.7	1.4	2.1	2.8	3.5	4.2	
Depth (D) (cm)	13	14	22	20 20	18	18	17.5
Velocity Head Rod (ruler)							
Flowing water Depth (D_1) (cm)							
Depth of Stagnation (D_2) (cm)							
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)	~~0.195~~	~~0.217~~	~~.243~~	~~0.291~~	0.501	0.086	0.241
	0.195	0.236	0.192	0.237			

3.85 70 4.55

4.55 70 5.25

5.25 70 5.95

Field Crew: KM, CB, AM, ZC, BB, MC Site Code: LIZ003
Sampling Date (DD/MM/YYYY): 04/10/2023

SUBSTRATE DATA

1. 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
  75% embedded = ¾
  50% embedded= ½
  25% embedded = ¼
  Unembedded = 0

2. 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

	Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E
1	10.0		26	12.1		51	9.0		76	9.0	
2	2.3		27	8.9		52	4.3		77	5.1	
3	4.1		28	9.1		53	4.0		78	26.0	
4	6.8		29	11.4		54	3.3		79	8.0	
5	11.0		30	5.6	3/4	55	7.7		80	6.0	1/2
6	5.4		31	5.0		56	7.0		81	9.5	
7	1.5		32	5.0		57	6.0		82	0	
8	6.0		33	4.9		58	2.0		83	10.5	
9	2.8		34	3.6		59	3.3		84	6.9	
10	7.5	3/4	35	4.1		60	7.0	0	85	5.4	
11	4.0		36	4.0		61	9.8		86	5.8	
12	7.0		37	8.5		62	2.3		87	7.2	
13	6.9		38	7.2		63	9.5		88	5.7	
14	4.5		39	3.2		64	4.4		89	6.7	
15	3.6		40	6.5	1/2	65	11.0		90	3.5	0
16	3.5		41	12.8		66	4.3		91	19.3	
17	7.1		42	6.5		67	7.0		92	1.5	
18	4.2		43	5.2		68	8.0		93	3.5	
19	5.1		44	8.6		69	6.4		94	6.4	
20	5.6	1/2	45	8.0		70	4.6	1/4	95	6.2	
21	5.0		46	8.4		71	7.0		96	4.4	
22	4.9		47	8.5		72	5.0		97	3.0	
23	4.1		48	3.7		73	24.0		98	11.4	
24	3.2		49	1.8		74	9.0		99	6.2	
25	6.5		50	5.6	0	75	4.6		100	4.8	0

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

Field Crew: KM, CB, BB, AM, ZC, MC Site Code: LI2003
Sampling Date (DD/MM/YYYY): 04/10/2023

SITE INSPECTION

Site Inspected by: K. McCallum

Communication Information

☑ Itinerary left with contact person (include contact numbers)

Contact Person: E. Matveev Time checked-in: 12:00

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

Phone number: (706) 768-9678

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: K.McCallum, C.Bush, AM, Z.C Site Code: MOR001
Sampling Date (DD/MM/YYYY): 25/09/2023

☑ **Occupational Health & Safety: Site Inspection Sheet completed (see page 6)**

PRIMARY SITE DATA

CABIN Study Name: CBWM-Elk Local Basin Name: Elk River
River/Stream Name: Morrissey Stream Order: (map scale 1:50,000) 4

Select one: ☑ Test Site ☐ Potential Reference Site

Geographical Description/Notes:
Morrissey FSR to Lodgepole. Turn right near Snowmobile Association sign on left). Drive to railway, park + walk 50m d/s to site

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

☑ Forest ☐ Field/Pasture ☑ Agriculture ☐ Residential/Urban
☑ Logging ☐ Mining ☐ Commercial/Industrial ☑ Other pipeline, hunting, railway u/s

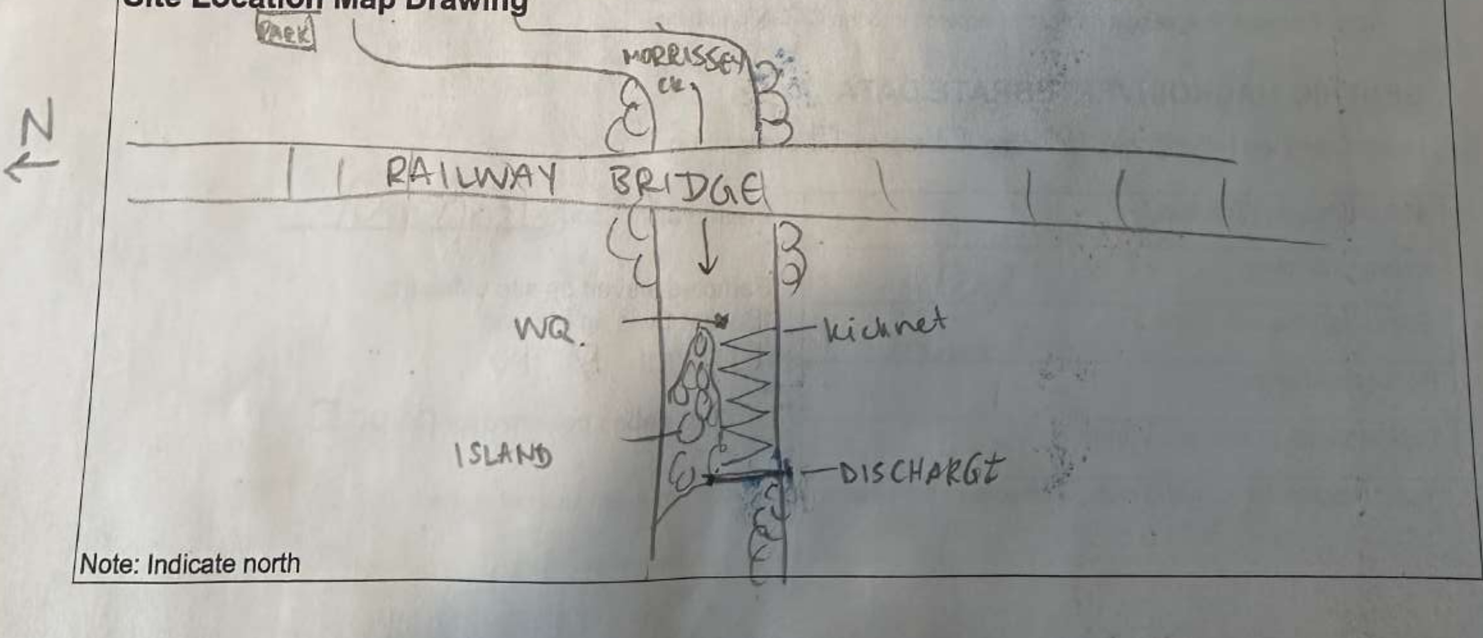
Dominant Surrounding Land Use: (check one) Information Source: ____

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

Location Data

Latitude: 49.358322 N Longitude: -115.000669 W (DMS or DD)
Elevation: 948.0 (fasl or masl) GPS Datum: ☑ GRS80 (NAD83/WGS84) ☐ Other: ____

Site Location Map Drawing



Note: Indicate north

Field Crew: KM, CB, ZC, AM
Site Code: MOR001
Sampling Date (DD/MM/YYYY): 25/09/2023

Photos

- [x] Field Sheet
- [x] Upstream
- [x] Downstream
- [x] Across Site
- [ ] Aerial View
- [x] Substrate (exposed)
- [x] Substrate (aquatic)
- [ ] Other ____

REACH DATA *(represents 6 times bankfull width)*

1. Habitat Types: *(check those present)*
   - [x] Riffle
   - [ ] Rapids
   - [x] Straight run
   - [x] Pool/Back Eddy
2. Canopy Coverage: *(stand in middle of stream and look up, check one)*
   - [ ] 0 %
   - [x] 1-25 %
   - [ ] 26-50 %
   - [ ] 51-75 %
   - [ ] 76-100 %
3. Macrophyte Coverage: *(not algae or moss, check one)*
   - [x] 0 %
   - [ ] 1-25 %
   - [ ] 26-50 %
   - [ ] 51-75 %
   - [ ] 76-100 %
4. Streamside Vegetation: (*check those present)*
   - [x] ferns/grasses
   - [x] shrubs
   - [x] deciduous trees
   - [x] coniferous trees
5. Dominant Streamside Vegetation: *(check one)*
   - [ ] ferns/grasses
   - [ ] shrubs
   - [ ] deciduous trees
   - [x] coniferous trees
6. Periphyton Coverage on Substrate: *(benthic algae, not moss, check one)*
   - [x] **1** - Thin layer, no obvious colour (< 0.5 mm thick)
   - [ ] **2** - Yellow-brown to light green colour (0.5-1 mm thick)
   - [ ] **3** - Patches of thicker green to brown algae (1-5 mm thick)
   - [ ] **4** - Numerous large clumps of green to dark brown algae (5-20 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*): [x] riffle [ ] rapids [ ] straight run

400 µm mesh Kick Net *	
Person sampling	C.Bush
Sampling time (i.e. 3 min.)	3 mins
No. of sample jars	1
Typical depth in kick area (cm)	10cm

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

Preservative used: isopropyl

Sampled sieved on site using the "Bucket Swirling Method":
[ ] YES [x] NO

If YES, debris collected for QA/QC [ ]

Field Crew: KM, CB, AM, ZC

Sampling Date (DD/MM/YYYY): 25/09/2023 Site Code: MOR001

WATER CHEMISTRY DATA

Time: 12:30 PM (24 hr clock) Time zone: MDT

Air Temp: 15.0°C (°C) Water Temp: 12.3 (°C) pH: 8.28 PH

Specific Conductance: 205.3 (µs/cm) DO: ~~94.4%~~ 10.11 (mg/L) Turbidity: ~~[illegible]~~44 (NTU) ORP: 165.2

DO%: 94.5

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 Anions

Note: Determining alkalinity is recommended, as are other analyses, but not required for CABIN assessments.

CHANNEL DATA

12.5

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 = ____________

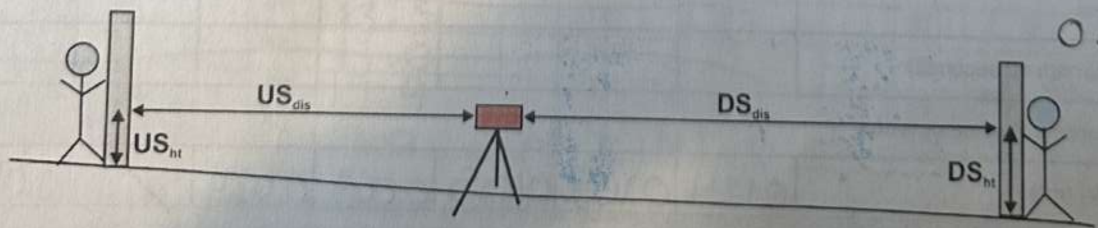
OR

☒ **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
aTop Hairline (T)			
aMid Hairline (ht) OR bHeight of rod	1.340 m	1.541 m	
aBottom Hairline (B)			
bDistance (dis) OR aT-B x 100	12.5 m aUSdis=T-B	12.5 m aDSdis=T-B	USdis+DSdis= 25.0 m
Change in height (Δht)			DSht-USht= 0.201 m
Slope (Δht/total dis)			0.201/25.0 = 0.00804 0.80%



Field Crew: KM, CB, AM, ZC.

Site Code: MOR001

Sampling Date (DD/MM/YYYY): 25/09/2023

Widths and Depth

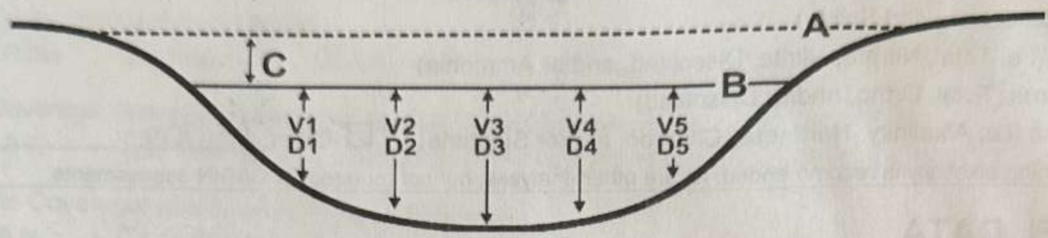
Location at site: D/S of kicknet (Indicate where in sample reach, ex. d/s of kick area)

6.2
0.65

A - Bankfull Width: 19.9 (m)

B - Wetted Stream Width: 5.55 (m)

C - Bankfull–Wetted Depth (height from water surface to Bankfull): 54.0 (cm)



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

Velocity and Depth

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

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

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

☒ **Direct velocity measurements**: ☐ Marsh-McBirney ☒ Sontek or ☐ Other Flowtracker 1

	1	2	3	4	5	6	AVG
	5.3	4.4	3.5	2.6	1.7	0.8	
Distance from Shore (m)	0.9	1.8	2.7	3.6	4.5	~~5.4~~	
Depth (D) (cm)	17	28	32	30	30	/	27.4
Velocity Head Rod (ruler)							
Flowing water Depth (D_1) (cm)							
Depth of Stagnation (D_2) (cm)							
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)	0.124	0.105	0.105	0.063	0.024	/	0.0842

Field Crew: KM, CB, ZC, AM

Site Code: MØR001

Sampling Date (DD/MM/YYYY): 25/09/2023

SUBSTRATE DATA

1. 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
  - 75% embedded = ¾
  - 50% embedded= ½
  - 25% embedded = ¼
  - Unembedded = 0

2. 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

*fine sediment covering rocks (settled from u/s)

	Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E
1	3.4		26	6.0		51	8.0		76	8.3	
2	10.0		27	8.0		52	8.8		77	6.0	
3	4.0		28	11.5		53	8.3		78	7.8	
4	8.0		29	8.5		54	0.8		79	9.0	
5	12.0		30	15.8	1/4	55	15.0		80	12.0	1/2
6	14.6		31	10.3		56	7.5		81	23.1	
7	5.0		32	9.0		57	3.5		82	12.0	
8	8.5		33	15.0		58	7.0		83	11.0	
9	8.5		34	7.0		59	0.6		84	8.1	
10	0.3	0	35	10.0		60	13.6	1/2	85	1.3	
11	8.0		36	5.5		61	11.0		86	8.0	
12	5.5		37	5.5		62	4.9		87	5.0	
13	10.5		38	15.2		63	11.0		88	7.0	
14	8.0		39	11.2		64	0		89	0.3	
15	4.5		40	9.3	3/4	65	9.3		90	7.0	1/4
16	9.3		41	6.2		66	2.4		91	2.3	
17	9.0		42	8.3		67	15.0		92	5.8	
18	4.0		43	18.0		68	9.0		93	4.0	
19	7.0		44	7.0		69	7.0		94	2.2	
20	12.0	1/4	45	7.2		70	6.8	1/4	95	0	
21	7.0		46	9.3		71	4.4		96	3.8	
22	23.0		47	13.5		72	8.0		97	1.8	
23	6.4		48	13.0		73	5.9		98	5.2	
24	7.0		49	17.9		74	9.0		99	0.5	
25	3.8		50	9.0	1/4	75	41.0		100	8.1	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: KM, CB, AM, ZC. Site Code: MOR001
Sampling Date (DD/MM/YYYY): 25/09/2023

SITE INSPECTION

Site Inspected by: K. McCallum

Communication Information

☑ Itinerary left with contact person (include contact numbers)

Contact Person: A.C. Kroeger Time checked-in: 9:00

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

Phone number: (514) 664-6815

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: K. McCallum, C. Bush, A.M, Z.C. Site Code: MOR002
Sampling Date (DD/MM/YYYY): 25/09/2023

☑ **Occupational Health & Safety: Site Inspection Sheet completed (see page 6)**

PRIMARY SITE DATA

CABIN Study Name: CBWM-Elk Local Basin Name: Elk River

River/Stream Name: Morrissey Stream Order: (map scale 1:50,000) 3

Select one: ☒ Test Site ☐ Potential Reference Site

Geographical Description/Notes:
Drive Morrissey FSR until 3rd bridge, walk ~50m d/s to site

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

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

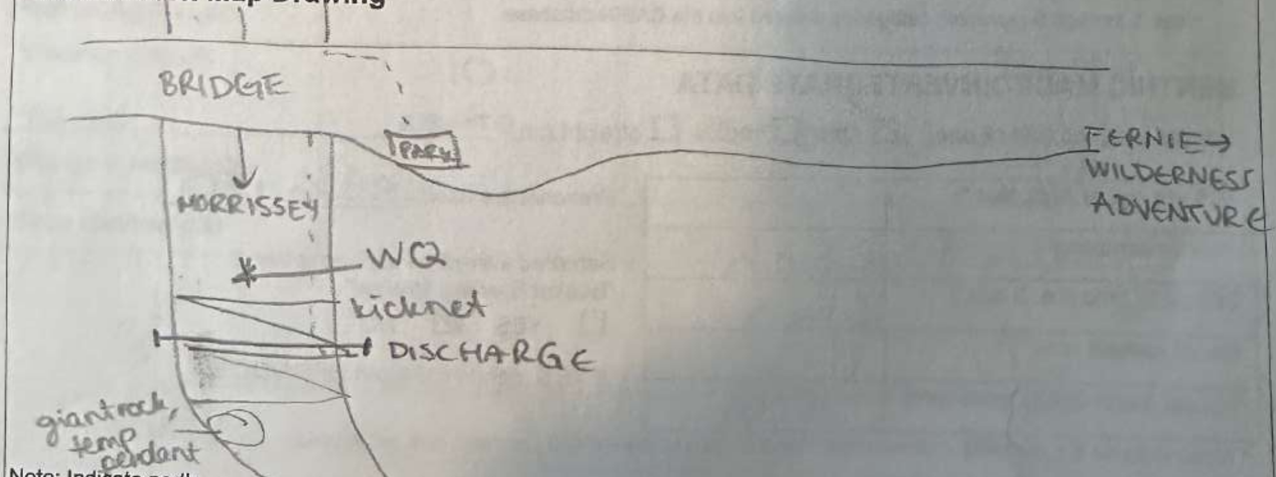
Dominant Surrounding Land Use: (check one) Information Source: ____

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

Location Data

Latitude: 49.420558 N Longitude: - 114.910687 W (DMS or DD)
Elevation: 1544.0 (fasl or masl) GPS Datum: ☒ GRS80 (NAD83/WGS84) ☐ Other: ____

Site Location Map Drawing



Note: Indicate north

Field Crew: K. McCallum, C. Bush, AM, ZC. Site Code: MOR002
Sampling Date (DD/MM/YYYY): 25/09/2023

Photos

[x] Field Sheet [x] Upstream [x] Downstream [ ] Across Site [x] Aerial View
[x] Substrate (exposed) [x] Substrate (aquatic) [x] Other cars

REACH DATA *(represents 6 times bankfull width)*

1. Habitat Types: *(check those present)*
   [x] Riffle [ ] Rapids [x] Straight run [ ] Pool/Back Eddy
2. Canopy Coverage: *(stand in middle of stream and look up, check one)*
   [ ] 0 % [ ] 1-25 % [x] 26-50 % [ ] 51-75 % [ ] 76-100 %
3. Macrophyte Coverage: *(not algae or moss, check one)*
   [ ] 0 % [x] 1-25 % [ ] 26-50 % [ ] 51-75 % [ ] 76-100 %
4. Streamside Vegetation: *(check those present)*
   [x] ferns/grasses [x] shrubs [ ] deciduous trees [x] coniferous trees
5. Dominant Streamside Vegetation: *(check one)*
   [ ] ferns/grasses [x] shrubs [ ] deciduous trees [ ] coniferous trees
6. Periphyton Coverage on Substrate: *(benthic algae, not moss, check one)*
   [ ] **1** - Thin layer, no obvious colour (< 0.5 mm thick)
   [ ] **2** - Yellow-brown to light green colour (0.5-1 mm thick)
   [x] **3** - Patches of thicker green to brown algae (1-5 mm thick)
   [ ] **4** - Numerous large clumps of green to dark brown algae (5-20 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*): [x] riffle [ ] rapids [ ] straight run

400 µm mesh Kick Net *	
Person sampling	C.Bush
Sampling time (i.e. 3 min.)	3 min
No. of sample jars	1
Typical depth in kick area (cm)	10cm

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

Preservative used: 99% ISO

Sampled sieved on site using the "Bucket Swirling Method":
[ ] YES [x] NO

If YES, debris collected for QA/QC [ ]

Field Crew: CB, KM, ZC, AM Site Code: MOR007

Sampling Date (DD/MM/YYYY): 25/09/2023

WATER CHEMISTRY DATA Time: 16:20 (24 hr clock) Time zone: MDT

Air Temp: 11.0°C (°C) Water Temp: 8.8 (°C) pH: 8.35 ORP 142.5

Specific Conductance: 132.9 (μs/cm) DO: 10.10 (mg/L) Turbidity: 11.85 (NTU)

Check if water samples were collected for the following analyses: DO% 86.9

- [x] TSS (Total Suspended Solids)
- [x] Nitrogen (i.e. Total, Nitrate, Nitrite, Dissolved, and/or Ammonia)
- [x] Phosphorus (Total, Ortho, and/or Dissolved)
- [x] Major Ions (i.e. Alkalinity, Hardness, Chloride, and/or Sulphate) ☐ Other ~~11.85~~ Anions

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 = ________

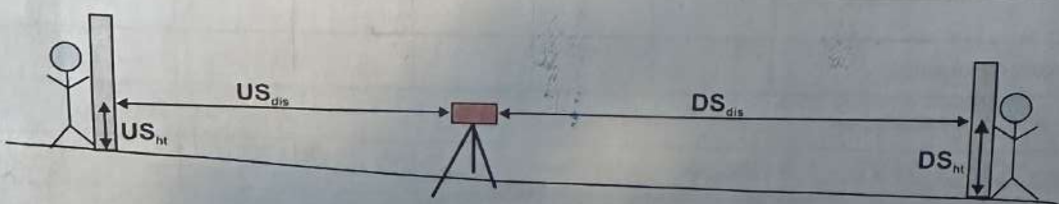
OR

☒ **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
aTop Hairline (T)			
aMid Hairline (ht) OR bHeight of rod	0.920	1.355	
aBottom Hairline (B)			
bDistance (dis) OR aT-B x 100	10 aUS$_{dis}$=T-B	10 aDS$_{dis}$=T-B	US$_{dis}$+DS$_{dis}$= 20.0
Change in height (Δht)			DS$_{ht}$-US$_{ht}$= 0.435
Slope (Δht/total dis)			0.02175

2.18%



Field Crew: KM,CB,AM,ZC Site Code: MOR002
Sampling Date (DD/MM/YYYY): 25/09/2023

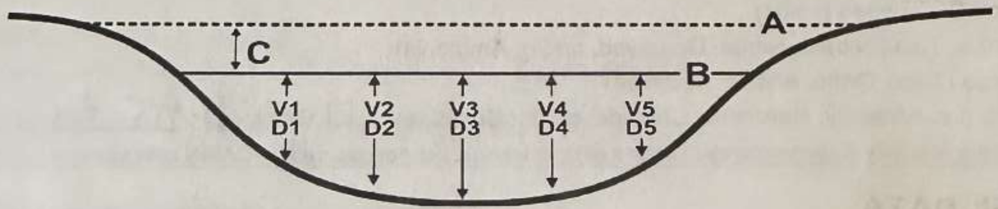
Widths and Depth

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

A - Bankfull Width: 8.6 (m) B - Wetted Stream Width: 2.4 (m)

C - Bankfull–Wetted Depth (height from water surface to Bankfull): 51 (cm)

0.45



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 Flowtracker

	1	2	3	4	5	6	AVG
Distance from Shore (m) RWE	0.5	1.0	1.5	2.0	—	—	
Depth (**D**) (cm)	~~20~~ 20	26	14	15	—	—	12.5
Velocity Head Rod (ruler)							
Flowing water Depth (**D_1**) (cm)							
Depth of Stagnation (**D_2**) (cm)							
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)	0.105	0.017	0.230	0.009	—	—	0.090

Field Crew: KM, AM ZC CR

Sampling Date (DD/MM/YYYY): 25/09/2023

Site Code: MOR002

SUBSTRATE DATA

1. 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
  - 75% embedded = ¾
  - 50% embedded= ½
  - 25% embedded = ¼
  - Unembedded = 0

2. 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

	Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E		Diameter (cm)	E
1	7.2		26	15.8		51	7.2		76	2	
2	6.5		27	2.1		52	6.3		77	23	
3	.7		28	4.5		53	5.4		78	6.4	
4	13.2		29	3.8		54	6.4		79	5.4	
5	1.4		30	5.6	3/4	55	11.2		80	3.5	0
6	5.7		31	3.2		56	20.9		81	11	
7	6.8		32	37		57	1.1		82	1.2	
8	6.8		33	5.2		58	3.4		83	2.9	
9	10		34	2		59	10.8		84	9	
10	10.5	0	35	8.4		60	3.4	0	85	6	
11	2.3		36	3.1		61	18		86	8	
12	2.9		37	S		62	2		87	2.7	
13	31.5		38	7.5		63	2.4		88	4.5	
14	8.4		39	1.2		64	2		89	7	
15	2.4		40	2.9	1/2	65	7.4		90	3.1	0
16	6.2		41	4.2		66	4.9		91	11.5	
17	8		42	2.1		67	4		92	7.4	
18	1		43	3.5		68	6.5		93	5.8	
19	3.7		44	2.8		69	2.8		94	7.9	
20	1.7	1/2	45	0		70	6	3/4	95	8	
21	12		46	15.8		71	6.4		96	22	
22	~~8~~ 5		47	1.6		72	8.3		97	7.4	
23	2.9		48	4.4		73	6.2		98	6	
24	.7		49	1.8		74	8		99	2.9	
25	2.5		50	1.4	1/4	75	23.5		100	3.3	0

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

Field Crew: KM, CB, AM, ZC Site Code: MOROO2
Sampling Date (DD/MM/YYYY): 25/09/2023

SITE INSPECTION

Site Inspected by: K.McCallum

Communication Information

☑ Itinerary left with contact person (include contact numbers)

Contact Person: A.C. Kroeger Time checked-in: 9:00

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

Phone number: (514) 664-6815

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:

Appendix C: CARO Reports

CERTIFICATE OF ANALYSIS

REPORTED TO	Elk River Alliance PO Box 2095, 1111 2nd Ave Fernie, BC V0B1M0		
ATTENTION	Kaileigh McCallum	**WORK ORDER**	23I3752
PO NUMBER		**RECEIVED / TEMP**	2023-09-29 14:09 / 7.3°C
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 14:07
PROJECT INFO	[info]	**COC NUMBER**	No Number

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

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Ahead of the Curve

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Authorized By:

Team CARO
Client Service Representative

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3752
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 14:07

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
ALX001_20230927_0945 (23I3752-01) | Matrix: Water | Sampled: 2023-09-27 09:45						
Anions						
Bromide	< 0.10	N/A	0.10	mg/L	2023-10-01	
Chloride	**1.02**	AO ≤ 250	0.10	mg/L	2023-10-01	
Fluoride	**0.16**	MAC = 1.5	0.10	mg/L	2023-10-01	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2023-10-01	HT1
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2023-10-01	HT1
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2023-10-01	HT1
Sulfate	**20.6**	AO ≤ 500	1.0	mg/L	2023-10-01	
BCMOE Aggregate Hydrocarbons						
EPHw10-19	< 250	N/A	250	µg/L	2023-10-06	
EPHw19-32	< 250	N/A	250	µg/L	2023-10-06	
Surrogate: 2-Methylnonane (EPH/F2-4)	*91*		*60-140*	%	*2023-10-06*	
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	**187**	N/A	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	**0.0770**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Aluminum, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-07	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-07	
Arsenic, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-07	
Barium, dissolved	**0.0791**	N/A	0.0050	mg/L	2023-10-07	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-07	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-07	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2023-10-07	
Cadmium, dissolved	< 0.000010	N/A	0.000010	mg/L	2023-10-07	
Calcium, dissolved	**50.8**	N/A	0.20	mg/L	2023-10-07	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-07	
Cobalt, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-07	
Copper, dissolved	< 0.00040	N/A	0.00040	mg/L	2023-10-07	
Iron, dissolved	< 0.010	N/A	0.010	mg/L	2023-10-07	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-07	
Lithium, dissolved	**0.00438**	N/A	0.00010	mg/L	2023-10-07	
Magnesium, dissolved	**14.6**	N/A	0.010	mg/L	2023-10-07	
Manganese, dissolved	**0.00052**	N/A	0.00020	mg/L	2023-10-07	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2023-10-06	
Molybdenum, dissolved	**0.00074**	N/A	0.00010	mg/L	2023-10-07	
Nickel, dissolved	< 0.00040	N/A	0.00040	mg/L	2023-10-07	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2023-10-07	
Potassium, dissolved	**0.44**	N/A	0.10	mg/L	2023-10-07	
Selenium, dissolved	**0.00071**	N/A	0.00050	mg/L	2023-10-07	
Silicon, dissolved	**2.3**	N/A	1.0	mg/L	2023-10-07	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2023-10-07	

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
ALX001_20230927_0945 (23I3752-01) | Matrix: Water | Sampled: 2023-09-27 09:45, Continued						
Dissolved Metals, Continued						
Sodium, dissolved	**1.87**	N/A	0.10	mg/L	2023-10-07	
Strontium, dissolved	**0.130**	N/A	0.0010	mg/L	2023-10-07	
Sulfur, dissolved	**6.6**	N/A	3.0	mg/L	2023-10-07	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-07	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2023-10-07	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-07	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-07	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-07	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2023-10-07	
Uranium, dissolved	**0.000631**	N/A	0.000020	mg/L	2023-10-07	
Vanadium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-07	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2023-10-07	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-07	
General Parameters						
Alkalinity, Total (as CaCO3)	**187**	N/A	1.0	mg/L	2023-10-05	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-05	
Alkalinity, Bicarbonate (as CaCO3)	**187**	N/A	1.0	mg/L	2023-10-05	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-05	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-05	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2023-10-03	
BOD, 5-day	< 4.6	N/A	2.0	mg/L	2023-10-05	
Carbon, Total Organic	**1.53**	N/A	0.50	mg/L	2023-10-09	
Carbon, Dissolved Organic	**1.16**	N/A	0.50	mg/L	2023-10-09	
Chemical Oxygen Demand	< 20	N/A	20	mg/L	2023-10-04	
Nitrogen, Total Kjeldahl	**0.077**	N/A	0.050	mg/L	2023-10-06	
Phosphorus, Total (as P)	**0.0068**	N/A	0.0050	mg/L	2023-10-05	
Solids, Total Suspended	< 2.3	N/A	2.0	mg/L	2023-10-06	HT1
Total Metals						
Aluminum, total	< 0.0050	OG < 0.1	0.0050	mg/L	2023-10-07	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2023-10-07	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2023-10-07	
Barium, total	**0.0721**	MAC = 2	0.0050	mg/L	2023-10-07	
Beryllium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-07	
Bismuth, total	< 0.00010	N/A	0.00010	mg/L	2023-10-07	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2023-10-07	
Cadmium, total	< 0.000010	MAC = 0.007	0.000010	mg/L	2023-10-07	
Calcium, total	**52.4**	None Required	0.20	mg/L	2023-10-07	
Chromium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2023-10-07	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2023-10-07	
Copper, total	< 0.00040	MAC = 2	0.00040	mg/L	2023-10-07	
Iron, total	< 0.010	AO ≤ 0.3	0.010	mg/L	2023-10-07	
Lead, total	< 0.00020	MAC = 0.005	0.00020	mg/L	2023-10-07	

TEST RESULTS

REPORTED TO	Elk River Alliance	WORK ORDER	23I3752
PROJECT	CBWM-2023	REPORTED	2023-10-17 14:07

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
ALX001_20230927_0945 (23I3752-01) | Matrix: Water | Sampled: 2023-09-27 09:45, Continued						
Total Metals, Continued						
Lithium, total	**0.00431**	N/A	0.00010	mg/L	2023-10-07	
Magnesium, total	**13.3**	None Required	0.010	mg/L	2023-10-07	
Manganese, total	**0.00085**	MAC = 0.12	0.00020	mg/L	2023-10-07	
Mercury, total	< 0.000010	MAC = 0.001	0.000010	mg/L	2023-10-06	
Molybdenum, total	**0.00078**	N/A	0.00010	mg/L	2023-10-07	
Nickel, total	< 0.00040	N/A	0.00040	mg/L	2023-10-07	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2023-10-07	
Potassium, total	**0.41**	N/A	0.10	mg/L	2023-10-07	
Selenium, total	**0.00065**	MAC = 0.05	0.00050	mg/L	2023-10-07	
Silicon, total	**2.4**	N/A	1.0	mg/L	2023-10-07	
Silver, total	< 0.000050	None Required	0.000050	mg/L	2023-10-07	
Sodium, total	**1.81**	AO ≤ 200	0.10	mg/L	2023-10-07	
Strontium, total	**0.121**	MAC = 7	0.0010	mg/L	2023-10-07	
Sulfur, total	**7.1**	N/A	3.0	mg/L	2023-10-07	
Tellurium, total	< 0.00050	N/A	0.00050	mg/L	2023-10-07	
Thallium, total	< 0.000020	N/A	0.000020	mg/L	2023-10-07	
Thorium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-07	
Tin, total	< 0.00020	N/A	0.00020	mg/L	2023-10-07	
Titanium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-07	
Tungsten, total	< 0.0010	N/A	0.0010	mg/L	2023-10-07	
Uranium, total	**0.000628**	MAC = 0.02	0.000020	mg/L	2023-10-07	
Vanadium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-07	
Zinc, total	< 0.0040	AO ≤ 5	0.0040	mg/L	2023-10-07	
Zirconium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-07	
ALX003_20230927_1230 (23I3752-02) | Matrix: Water | Sampled: 2023-09-27 12:30						
Anions						
Bromide	< 0.10	N/A	0.10	mg/L	2023-10-01	
Chloride	**0.77**	AO ≤ 250	0.10	mg/L	2023-10-01	
Fluoride	**0.14**	MAC = 1.5	0.10	mg/L	2023-10-01	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2023-10-01	HT1
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2023-10-01	HT1
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2023-10-01	HT1
Sulfate	**18.2**	AO ≤ 500	1.0	mg/L	2023-10-01	
BCMOE Aggregate Hydrocarbons						
EPHw10-19	< 250	N/A	250	µg/L	2023-10-06	
EPHw19-32	< 250	N/A	250	µg/L	2023-10-06	
Surrogate: 2-Methylnonane (EPH/F2-4)	*90*		*60-140*	%	*2023-10-06*	
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	**183**	N/A	0.500	mg/L	N/A	

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
ALX003_20230927_1230 (23I3752-02) | Matrix: Water | Sampled: 2023-09-27 12:30, Continued						
Calculated Parameters, Continued						
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						
Aluminum, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-07	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-07	
Arsenic, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-07	
Barium, dissolved	**0.0784**	N/A	0.0050	mg/L	2023-10-07	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-07	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-07	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2023-10-07	
Cadmium, dissolved	< 0.000010	N/A	0.000010	mg/L	2023-10-07	
Calcium, dissolved	**49.6**	N/A	0.20	mg/L	2023-10-07	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-07	
Cobalt, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-07	
Copper, dissolved	< 0.00040	N/A	0.00040	mg/L	2023-10-07	
Iron, dissolved	< 0.010	N/A	0.010	mg/L	2023-10-07	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-07	
Lithium, dissolved	**0.00417**	N/A	0.00010	mg/L	2023-10-07	
Magnesium, dissolved	**14.3**	N/A	0.010	mg/L	2023-10-07	
Manganese, dissolved	**0.00094**	N/A	0.00020	mg/L	2023-10-07	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2023-10-06	
Molybdenum, dissolved	**0.00062**	N/A	0.00010	mg/L	2023-10-07	
Nickel, dissolved	< 0.00040	N/A	0.00040	mg/L	2023-10-07	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2023-10-07	
Potassium, dissolved	**0.43**	N/A	0.10	mg/L	2023-10-07	
Selenium, dissolved	**0.00058**	N/A	0.00050	mg/L	2023-10-07	
Silicon, dissolved	**2.2**	N/A	1.0	mg/L	2023-10-07	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2023-10-07	
Sodium, dissolved	**1.65**	N/A	0.10	mg/L	2023-10-07	
Strontium, dissolved	**0.124**	N/A	0.0010	mg/L	2023-10-07	
Sulfur, dissolved	**5.9**	N/A	3.0	mg/L	2023-10-07	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-07	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2023-10-07	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-07	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-07	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-07	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2023-10-07	
Uranium, dissolved	**0.000572**	N/A	0.000020	mg/L	2023-10-07	
Vanadium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-07	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2023-10-07	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-07	

General Parameters

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3752
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 14:07

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
ALX003_20230927_1230 (23I3752-02) | Matrix: Water | Sampled: 2023-09-27 12:30, Continued						
General Parameters, Continued						
Alkalinity, Total (as CaCO3)	**185**	N/A	1.0	mg/L	2023-10-05	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-05	
Alkalinity, Bicarbonate (as CaCO3)	**185**	N/A	1.0	mg/L	2023-10-05	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-05	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-05	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2023-10-03	
BOD, 5-day	< 4.6	N/A	2.0	mg/L	2023-10-05	
Carbon, Total Organic	**1.79**	N/A	0.50	mg/L	2023-10-11	
Carbon, Dissolved Organic	**1.68**	N/A	0.50	mg/L	2023-10-09	
Chemical Oxygen Demand	< 20	N/A	20	mg/L	2023-10-04	
Nitrogen, Total Kjeldahl	< 0.050	N/A	0.050	mg/L	2023-10-06	
Phosphorus, Total (as P)	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Solids, Total Suspended	< 2.2	N/A	2.0	mg/L	2023-10-06	HT1
Total Metals						
Aluminum, total	**0.0070**	OG < 0.1	0.0050	mg/L	2023-10-07	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2023-10-07	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2023-10-07	
Barium, total	**0.0709**	MAC = 2	0.0050	mg/L	2023-10-07	
Beryllium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-07	
Bismuth, total	< 0.00010	N/A	0.00010	mg/L	2023-10-07	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2023-10-07	
Cadmium, total	< 0.000010	MAC = 0.007	0.000010	mg/L	2023-10-07	
Calcium, total	**51.1**	None Required	0.20	mg/L	2023-10-07	
Chromium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2023-10-07	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2023-10-07	
Copper, total	< 0.00040	MAC = 2	0.00040	mg/L	2023-10-07	
Iron, total	**0.015**	AO ≤ 0.3	0.010	mg/L	2023-10-07	
Lead, total	< 0.00020	MAC = 0.005	0.00020	mg/L	2023-10-07	
Lithium, total	**0.00394**	N/A	0.00010	mg/L	2023-10-07	
Magnesium, total	**13.2**	None Required	0.010	mg/L	2023-10-07	
Manganese, total	**0.00137**	MAC = 0.12	0.00020	mg/L	2023-10-07	
Mercury, total	< 0.000010	MAC = 0.001	0.000010	mg/L	2023-10-06	
Molybdenum, total	**0.00066**	N/A	0.00010	mg/L	2023-10-07	
Nickel, total	< 0.00040	N/A	0.00040	mg/L	2023-10-07	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2023-10-07	
Potassium, total	**0.40**	N/A	0.10	mg/L	2023-10-07	
Selenium, total	**0.00057**	MAC = 0.05	0.00050	mg/L	2023-10-07	
Silicon, total	**2.2**	N/A	1.0	mg/L	2023-10-07	
Silver, total	< 0.000050	None Required	0.000050	mg/L	2023-10-07	
Sodium, total	**1.60**	AO ≤ 200	0.10	mg/L	2023-10-07	
Strontium, total	**0.117**	MAC = 7	0.0010	mg/L	2023-10-07	
Sulfur, total	**6.2**	N/A	3.0	mg/L	2023-10-07	

TEST RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3752
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 14:07

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
ALX003_20230927_1230 (23I3752-02) | Matrix: Water | Sampled: 2023-09-27 12:30, Continued						
Total Metals, Continued						
Tellurium, total	< 0.00050	N/A	0.00050	mg/L	2023-10-07	
Thallium, total	< 0.000020	N/A	0.000020	mg/L	2023-10-07	
Thorium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-07	
Tin, total	< 0.00020	N/A	0.00020	mg/L	2023-10-07	
Titanium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-07	
Tungsten, total	< 0.0010	N/A	0.0010	mg/L	2023-10-07	
Uranium, total	**0.000567**	MAC = 0.02	0.000020	mg/L	2023-10-07	
Vanadium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-07	
Zinc, total	< 0.0040	AO ≤ 5	0.0040	mg/L	2023-10-07	
Zirconium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-07	

Sample Qualifiers:

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

CARO ANALYTICAL SERVICES

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3752
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 14:07

Analysis Description	Method Ref.	Technique	Accredited	Location
Alkalinity in Water	SM 2320 B* (2021)	Titration with H2SO4	✓	Kelowna
Ammonia, Total in Water	SM 4500-NH3 G* (2021)	Automated Colorimetry (Phenate)	✓	Kelowna
Anions in Water	SM 4110 B (2020)	Ion Chromatography	✓	Kelowna
Biochemical Oxygen Demand in Water	SM 5210 B (2019)	Dissolved Oxygen Meter	✓	Kelowna
Carbon, Dissolved Organic in Water	SM 5310 B (2022)	Combustion, Infrared CO2 Detection	✓	Kelowna
Carbon, Total Organic in Water	SM 5310 B (2022)	Combustion, Infrared CO2 Detection	✓	Kelowna
Chemical Oxygen Demand in Water	SM 5220 D* (2022)	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
EPH in Water	EPA 3511* / BCMOE EPHw	Hexane MicroExtraction (Base/Neutral) / Gas Chromatography (GC-FID)	✓	Richmond
Hardness in Water	SM 2340 B (2021)	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* (2021)	Block Digestion and Flow Injection Analysis	✓	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2021)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Solids, Total Suspended in Water	Solids in Water, Filtered / SM 2540 D* (2020)	Solids in Water, Filtered / 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)
µg/L	Micrograms per litre
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, September 2022)

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**	23I3752
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 14:07

General Comments:

The results in this report apply to the received 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. Caro will dispose of all samples within 30 days of sample receipt, unless otherwise agreed.

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**	23I3752
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 14:07

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 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 B3J0010										
Blank (B3J0010-BLK1)				Prepared: 2023-10-01, Analyzed: 2023-10-01						
Bromide	< 0.05	0.05	mg/L							
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.05	0.05	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	< 0.5	0.5	mg/L							
Blank (B3J0010-BLK2)				Prepared: 2023-10-01, Analyzed: 2023-10-01						
Bromide	< 0.05	0.05	mg/L							
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.05	0.05	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	< 0.5	0.5	mg/L							
Blank (B3J0010-BLK3)				Prepared: 2023-10-01, Analyzed: 2023-10-01						
Bromide	< 0.05	0.05	mg/L							
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.05	0.05	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	< 0.5	0.5	mg/L							
LCS (B3J0010-BS1)				Prepared: 2023-10-01, Analyzed: 2023-10-01						
Bromide	3.99	0.05	mg/L	4.00		100	85-115			
Chloride	16.0	0.10	mg/L	16.0		100	90-110			
Fluoride	3.93	0.05	mg/L	4.00		98	88-108			
Nitrate (as N)	3.93	0.010	mg/L	4.00		98	90-110			
Nitrite (as N)	2.01	0.010	mg/L	2.00		101	85-115			
Phosphate (as P)	0.964	0.0050	mg/L	1.00		96	80-120			
Sulfate	16.0	0.5	mg/L	16.0		100	90-110			
LCS (B3J0010-BS2)				Prepared: 2023-10-01, Analyzed: 2023-10-01						
Bromide	4.01	0.05	mg/L	4.00		100	85-115			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3752
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 14:07

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B3J0010, Continued										
LCS (B3J0010-BS2), Continued				Prepared: 2023-10-01, Analyzed: 2023-10-01						
Chloride	15.8	0.10	mg/L	16.0		98	90-110			
Fluoride	4.03	0.05	mg/L	4.00		101	88-108			
Nitrate (as N)	4.03	0.010	mg/L	4.00		101	90-110			
Nitrite (as N)	2.01	0.010	mg/L	2.00		100	85-115			
Phosphate (as P)	0.950	0.0050	mg/L	1.00		95	80-120			
Sulfate	15.4	0.5	mg/L	16.0		96	90-110			
LCS (B3J0010-BS3)				Prepared: 2023-10-01, Analyzed: 2023-10-01						
Bromide	4.01	0.05	mg/L	4.00		100	85-115			
Chloride	15.9	0.10	mg/L	16.0		99	90-110			
Fluoride	4.00	0.05	mg/L	4.00		100	88-108			
Nitrate (as N)	4.00	0.010	mg/L	4.00		100	90-110			
Nitrite (as N)	2.01	0.010	mg/L	2.00		100	85-115			
Phosphate (as P)	0.936	0.0050	mg/L	1.00		94	80-120			
Sulfate	15.8	0.5	mg/L	16.0		99	90-110			
BCMOE Aggregate Hydrocarbons, Batch B3J0458										
Blank (B3J0458-BLK1)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
EPHw10-19	< 250	250	µg/L							
EPHw19-32	< 250	250	µg/L							
Surrogate: 2-Methylnonane (EPH/F2-4)	*1990*		*µg/L*	2200		*90*	*60-140*			
LCS (B3J0458-BS2)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
EPHw10-19	15200	250	µg/L	15400		98	70-130			
EPHw19-32	22700	250	µg/L	22200		102	70-130			
Surrogate: 2-Methylnonane (EPH/F2-4)	*1710*		*µg/L*	2200		*78*	*60-140*			
LCS Dup (B3J0458-BSD2)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
EPHw10-19	15800	250	µg/L	15400		102	70-130	4	20	
EPHw19-32	23700	250	µg/L	22200		107	70-130	4	20	
Surrogate: 2-Methylnonane (EPH/F2-4)	*2000*		*µg/L*	2200		*91*	*60-140*			
Dissolved Metals, Batch B3J0462										
Blank (B3J0462-BLK1)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Blank (B3J0462-BLK2)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Blank (B3J0462-BLK3)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
LCS (B3J0462-BS1)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, dissolved	0.000251	0.000010	mg/L	0.000250		100	80-120			
LCS (B3J0462-BS2)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, dissolved	0.000224	0.000010	mg/L	0.000250		90	80-120			
LCS (B3J0462-BS3)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, dissolved	0.000238	0.000010	mg/L	0.000250		95	80-120			

Dissolved Metals, Batch B3J0628

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B3J0628, Continued										
Blank (B3J0628-BLK1)				Prepared: 2023-10-07, Analyzed: 2023-10-07						
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							
Lithium, dissolved	< 0.00010	0.00010	mg/L							
Magnesium, dissolved	< 0.010	0.010	mg/L							
Manganese, dissolved	< 0.00020	0.00020	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	< 0.0050	0.0050	mg/L							
Zinc, dissolved	< 0.0040	0.0040	mg/L							
Zirconium, dissolved	< 0.00010	0.00010	mg/L							
LCS (B3J0628-BS1)				Prepared: 2023-10-07, Analyzed: 2023-10-07						
Aluminum, dissolved	4.10	0.0050	mg/L	4.00		102	80-120			
Antimony, dissolved	0.0417	0.00020	mg/L	0.0400		104	80-120			
Arsenic, dissolved	0.410	0.00050	mg/L	0.400		103	80-120			
Barium, dissolved	0.0417	0.0050	mg/L	0.0400		104	80-120			
Beryllium, dissolved	0.0410	0.00010	mg/L	0.0400		103	80-120			
Bismuth, dissolved	0.0416	0.00010	mg/L	0.0400		104	80-120			
Boron, dissolved	0.405	0.0500	mg/L	0.400		101	80-120			
Cadmium, dissolved	0.0413	0.000010	mg/L	0.0400		103	80-120			
Calcium, dissolved	4.21	0.20	mg/L	4.00		105	80-120			
Chromium, dissolved	0.0420	0.00050	mg/L	0.0400		105	80-120			
Cobalt, dissolved	0.0413	0.00010	mg/L	0.0400		103	80-120			
Copper, dissolved	0.0410	0.00040	mg/L	0.0400		103	80-120			
Iron, dissolved	4.15	0.010	mg/L	4.00		104	80-120			
Lead, dissolved	0.0417	0.00020	mg/L	0.0400		104	80-120			
Lithium, dissolved	0.0413	0.00010	mg/L	0.0400		103	80-120			
Magnesium, dissolved	4.18	0.010	mg/L	4.00		105	80-120			
Manganese, dissolved	0.0418	0.00020	mg/L	0.0400		104	80-120			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3752
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 14:07

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B3J0628, Continued										
LCS (B3J0628-BS1), Continued				Prepared: 2023-10-07, Analyzed: 2023-10-07						
Molybdenum, dissolved	0.0401	0.00010	mg/L	0.0400		100	80-120			
Nickel, dissolved	0.0411	0.00040	mg/L	0.0400		103	80-120			
Phosphorus, dissolved	4.11	0.050	mg/L	4.00		103	80-120			
Potassium, dissolved	4.17	0.10	mg/L	4.00		104	80-120			
Selenium, dissolved	0.399	0.00050	mg/L	0.400		100	80-120			
Silicon, dissolved	4.2	1.0	mg/L	4.00		104	80-120			
Silver, dissolved	0.0412	0.000050	mg/L	0.0400		103	80-120			
Sodium, dissolved	4.23	0.10	mg/L	4.00		106	80-120			
Strontium, dissolved	0.0414	0.0010	mg/L	0.0400		104	80-120			
Sulfur, dissolved	40.8	3.0	mg/L	40.0		102	80-120			
Tellurium, dissolved	0.0406	0.00050	mg/L	0.0400		102	80-120			
Thallium, dissolved	0.0411	0.000020	mg/L	0.0400		103	80-120			
Thorium, dissolved	0.0421	0.00010	mg/L	0.0400		105	80-120			
Tin, dissolved	0.0414	0.00020	mg/L	0.0400		104	80-120			
Titanium, dissolved	0.0417	0.0050	mg/L	0.0400		104	80-120			
Tungsten, dissolved	0.0422	0.0010	mg/L	0.0400		105	80-120			
Uranium, dissolved	0.0416	0.000020	mg/L	0.0400		104	80-120			
Vanadium, dissolved	0.0413	0.0050	mg/L	0.0400		103	80-120			
Zinc, dissolved	0.412	0.0040	mg/L	0.400		103	80-120			
Zirconium, dissolved	0.0430	0.00010	mg/L	0.0400		107	80-120			
Dissolved Metals, Batch B3J0629										
Blank (B3J0629-BLK1)				Prepared: 2023-10-07, Analyzed: 2023-10-07						
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							
Lithium, dissolved	< 0.00010	0.00010	mg/L							
Magnesium, dissolved	< 0.010	0.010	mg/L							
Manganese, dissolved	< 0.00020	0.00020	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							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3752
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 14:07

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B3J0629, Continued										
Blank (B3J0629-BLK1), Continued				Prepared: 2023-10-07, Analyzed: 2023-10-07						
Tungsten, dissolved	< 0.0010	0.0010	mg/L							
Uranium, dissolved	< 0.000020	0.000020	mg/L							
Vanadium, dissolved	< 0.0050	0.0050	mg/L							
Zinc, dissolved	< 0.0040	0.0040	mg/L							
Zirconium, dissolved	< 0.00010	0.00010	mg/L							
LCS (B3J0629-BS1)				Prepared: 2023-10-07, Analyzed: 2023-10-07						
Aluminum, dissolved	4.20	0.0050	mg/L	4.00		105	80-120			
Antimony, dissolved	0.0420	0.00020	mg/L	0.0400		105	80-120			
Arsenic, dissolved	0.414	0.00050	mg/L	0.400		104	80-120			
Barium, dissolved	0.0410	0.0050	mg/L	0.0400		103	80-120			
Beryllium, dissolved	0.0418	0.00010	mg/L	0.0400		105	80-120			
Bismuth, dissolved	0.0416	0.00010	mg/L	0.0400		104	80-120			
Boron, dissolved	0.413	0.0500	mg/L	0.400		103	80-120			
Cadmium, dissolved	0.0416	0.000010	mg/L	0.0400		104	80-120			
Calcium, dissolved	4.00	0.20	mg/L	4.00		100	80-120			
Chromium, dissolved	0.0422	0.00050	mg/L	0.0400		105	80-120			
Cobalt, dissolved	0.0412	0.00010	mg/L	0.0400		103	80-120			
Copper, dissolved	0.0417	0.00040	mg/L	0.0400		104	80-120			
Iron, dissolved	4.22	0.010	mg/L	4.00		105	80-120			
Lead, dissolved	0.0415	0.00020	mg/L	0.0400		104	80-120			
Lithium, dissolved	0.0418	0.00010	mg/L	0.0400		104	80-120			
Magnesium, dissolved	4.21	0.010	mg/L	4.00		105	80-120			
Manganese, dissolved	0.0419	0.00020	mg/L	0.0400		105	80-120			
Molybdenum, dissolved	0.0404	0.00010	mg/L	0.0400		101	80-120			
Nickel, dissolved	0.0416	0.00040	mg/L	0.0400		104	80-120			
Phosphorus, dissolved	4.18	0.050	mg/L	4.00		105	80-120			
Potassium, dissolved	4.18	0.10	mg/L	4.00		105	80-120			
Selenium, dissolved	0.398	0.00050	mg/L	0.400		99	80-120			
Silicon, dissolved	4.3	1.0	mg/L	4.00		106	80-120			
Silver, dissolved	0.0365	0.000050	mg/L	0.0400		91	80-120			
Sodium, dissolved	4.30	0.10	mg/L	4.00		108	80-120			
Strontium, dissolved	0.0415	0.0010	mg/L	0.0400		104	80-120			
Sulfur, dissolved	40.4	3.0	mg/L	40.0		101	80-120			
Tellurium, dissolved	0.0372	0.00050	mg/L	0.0400		93	80-120			
Thallium, dissolved	0.0402	0.000020	mg/L	0.0400		100	80-120			
Thorium, dissolved	0.0410	0.00010	mg/L	0.0400		103	80-120			
Tin, dissolved	0.0418	0.00020	mg/L	0.0400		104	80-120			
Titanium, dissolved	0.0418	0.0050	mg/L	0.0400		104	80-120			
Tungsten, dissolved	0.0416	0.0010	mg/L	0.0400		104	80-120			
Uranium, dissolved	0.0412	0.000020	mg/L	0.0400		103	80-120			
Vanadium, dissolved	0.0413	0.0050	mg/L	0.0400		103	80-120			
Zinc, dissolved	0.414	0.0040	mg/L	0.400		104	80-120			
Zirconium, dissolved	0.0429	0.00010	mg/L	0.0400		107	80-120			
Duplicate (B3J0629-DUP1)		**Source: 23I3752-02**		Prepared: 2023-10-07, Analyzed: 2023-10-07						
Aluminum, dissolved	< 0.0050	0.0050	mg/L		< 0.0050				20	
Antimony, dissolved	< 0.00020	0.00020	mg/L		< 0.00020				20	
Arsenic, dissolved	< 0.00050	0.00050	mg/L		< 0.00050				20	
Barium, dissolved	0.0785	0.0050	mg/L		0.0784			< 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	< 0.000010	0.000010	mg/L		< 0.000010				20	
Calcium, dissolved	49.8	0.20	mg/L		49.6			< 1	20	
Chromium, dissolved	< 0.00050	0.00050	mg/L		< 0.00050				20	
Cobalt, dissolved	< 0.00010	0.00010	mg/L		< 0.00010				20	

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B3J0629, Continued										
Duplicate (B3J0629-DUP1), Continued		**Source: 23I3752-02**		Prepared: 2023-10-07, Analyzed: 2023-10-07						
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	
Lithium, dissolved	0.00409	0.00010	mg/L		0.00417			2	20	
Magnesium, dissolved	14.4	0.010	mg/L		14.3			1	20	
Manganese, dissolved	0.00088	0.00020	mg/L		0.00094				20	
Molybdenum, dissolved	0.00063	0.00010	mg/L		0.00062			< 1	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	0.42	0.10	mg/L		0.43				20	
Selenium, dissolved	0.00059	0.00050	mg/L		0.00058				20	
Silicon, dissolved	2.2	1.0	mg/L		2.2				20	
Silver, dissolved	< 0.000050	0.000050	mg/L		< 0.000050				20	
Sodium, dissolved	1.65	0.10	mg/L		1.65			< 1	20	
Strontium, dissolved	0.124	0.0010	mg/L		0.124			< 1	20	
Sulfur, dissolved	6.1	3.0	mg/L		5.9				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	0.000549	0.000020	mg/L		0.000572			4	20	
Vanadium, dissolved	< 0.0050	0.0050	mg/L		< 0.0050				20	
Zinc, dissolved	< 0.0040	0.0040	mg/L		< 0.0040				20	
Zirconium, dissolved	< 0.00010	0.00010	mg/L		< 0.00010				20	
General Parameters, Batch B3I3034										
Blank (B3I3034-BLK1)				Prepared: 2023-09-29, Analyzed: 2023-10-05						
BOD, 5-day	< 2.0	2.0	mg/L							
LCS (B3I3034-BS1)				Prepared: 2023-09-29, Analyzed: 2023-10-05						
BOD, 5-day	219	38.2	mg/L	198		111	85-115			
General Parameters, Batch B3J0057										
Blank (B3J0057-BLK1)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
Blank (B3J0057-BLK2)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
Blank (B3J0057-BLK3)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
Blank (B3J0057-BLK4)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
Blank (B3J0057-BLK5)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
Blank (B3J0057-BLK6)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3752
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 14:07

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B3J0057, Continued										
LCS (B3J0057-BS1)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	0.992	0.050	mg/L	1.00		99	85-115			
LCS (B3J0057-BS2)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	0.983	0.050	mg/L	1.00		98	85-115			
LCS (B3J0057-BS3)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	0.988	0.050	mg/L	1.00		99	85-115			
LCS (B3J0057-BS4)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	1.00	0.050	mg/L	1.00		100	85-115			
LCS (B3J0057-BS5)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	0.998	0.050	mg/L	1.00		100	85-115			
LCS (B3J0057-BS6)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	0.988	0.050	mg/L	1.00		99	85-115			
General Parameters, Batch B3J0149										
Blank (B3J0149-BLK1)				Prepared: 2023-10-04, Analyzed: 2023-10-04						
Chemical Oxygen Demand	< 20	20	mg/L							
LCS (B3J0149-BS1)				Prepared: 2023-10-04, Analyzed: 2023-10-04						
Chemical Oxygen Demand	520	20	mg/L	500		104	89-115			
General Parameters, Batch B3J0305										
Blank (B3J0305-BLK1)				Prepared: 2023-10-04, Analyzed: 2023-10-05						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Blank (B3J0305-BLK2)				Prepared: 2023-10-04, Analyzed: 2023-10-05						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Blank (B3J0305-BLK3)				Prepared: 2023-10-04, Analyzed: 2023-10-05						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Blank (B3J0305-BLK4)				Prepared: 2023-10-04, Analyzed: 2023-10-05						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
LCS (B3J0305-BS1)				Prepared: 2023-10-04, Analyzed: 2023-10-05						
Phosphorus, Total (as P)	0.105	0.0050	mg/L	0.100		105	85-115			
LCS (B3J0305-BS2)				Prepared: 2023-10-04, Analyzed: 2023-10-05						
Phosphorus, Total (as P)	0.106	0.0050	mg/L	0.100		106	85-115			
LCS (B3J0305-BS3)				Prepared: 2023-10-04, Analyzed: 2023-10-05						
Phosphorus, Total (as P)	0.105	0.0050	mg/L	0.100		105	85-115			
LCS (B3J0305-BS4)				Prepared: 2023-10-04, Analyzed: 2023-10-05						
Phosphorus, Total (as P)	0.106	0.0050	mg/L	0.100		106	85-115			
General Parameters, Batch B3J0359										
Blank (B3J0359-BLK1)				Prepared: 2023-10-05, Analyzed: 2023-10-05						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B3J0359, Continued										
Blank (B3J0359-BLK1), Continued				Prepared: 2023-10-05, Analyzed: 2023-10-05						
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 (B3J0359-BLK2)				Prepared: 2023-10-05, Analyzed: 2023-10-05						
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 (B3J0359-BLK3)				Prepared: 2023-10-05, Analyzed: 2023-10-05						
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 (B3J0359-BS1)				Prepared: 2023-10-05, Analyzed: 2023-10-05						
Alkalinity, Total (as CaCO3)	109	1.0	mg/L	100		109	80-120			
Alkalinity, Phenolphthalein (as CaCO3)	55.2	1.0	mg/L	50.0		110	0-200			
LCS (B3J0359-BS2)				Prepared: 2023-10-05, Analyzed: 2023-10-05						
Alkalinity, Total (as CaCO3)	111	1.0	mg/L	100		111	80-120			
Alkalinity, Phenolphthalein (as CaCO3)	52.8	1.0	mg/L	50.0		106	0-200			
LCS (B3J0359-BS3)				Prepared: 2023-10-05, Analyzed: 2023-10-05						
Alkalinity, Total (as CaCO3)	110	1.0	mg/L	100		110	80-120			
Alkalinity, Phenolphthalein (as CaCO3)	49.5	1.0	mg/L	50.0		99	0-200			
General Parameters, Batch B3J0389										
Blank (B3J0389-BLK1)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Nitrogen, Total Kjeldahl	< 0.050	0.050	mg/L							
Blank (B3J0389-BLK2)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Nitrogen, Total Kjeldahl	< 0.050	0.050	mg/L							
LCS (B3J0389-BS1)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Nitrogen, Total Kjeldahl	0.999	0.050	mg/L	1.00		100	85-115			
LCS (B3J0389-BS2)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Nitrogen, Total Kjeldahl	0.993	0.050	mg/L	1.00		99	85-115			
General Parameters, Batch B3J0521										
Blank (B3J0521-BLK1)				Prepared: 2023-10-06, Analyzed: 2023-10-06						
Solids, Total Suspended	< 2.0	2.0	mg/L							
LCS (B3J0521-BS1)				Prepared: 2023-10-06, Analyzed: 2023-10-06						
Solids, Total Suspended	103	10.0	mg/L	100		103	85-115			
General Parameters, Batch B3J0603										
Blank (B3J0603-BLK1)				Prepared: 2023-10-09, Analyzed: 2023-10-09						
Carbon, Total Organic	< 0.50	0.50	mg/L							

CARO ANALYTICAL SERVICES

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3752
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 14:07

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B3J0603, Continued										
Blank (B3J0603-BLK1), Continued				Prepared: 2023-10-09, Analyzed: 2023-10-09						
Carbon, Dissolved Organic	< 0.50	0.50	mg/L							
Blank (B3J0603-BLK2)				Prepared: 2023-10-09, Analyzed: 2023-10-09						
Carbon, Total Organic	< 0.50	0.50	mg/L							
Carbon, Dissolved Organic	< 0.50	0.50	mg/L							
Blank (B3J0603-BLK3)				Prepared: 2023-10-09, Analyzed: 2023-10-09						
Carbon, Total Organic	< 0.50	0.50	mg/L							
Carbon, Dissolved Organic	< 0.50	0.50	mg/L							
LCS (B3J0603-BS1)				Prepared: 2023-10-09, Analyzed: 2023-10-09						
Carbon, Total Organic	9.24	0.50	mg/L	10.0		92	78-116			
Carbon, Dissolved Organic	9.02	0.50	mg/L	10.0		90	78-116			
LCS (B3J0603-BS2)				Prepared: 2023-10-09, Analyzed: 2023-10-09						
Carbon, Total Organic	9.42	0.50	mg/L	10.0		94	78-116			
Carbon, Dissolved Organic	11.0	0.50	mg/L	10.0		110	78-116			
LCS (B3J0603-BS3)				Prepared: 2023-10-09, Analyzed: 2023-10-09						
Carbon, Total Organic	9.40	0.50	mg/L	10.0		94	78-116			
Carbon, Dissolved Organic	9.09	0.50	mg/L	10.0		91	78-116			
Duplicate (B3J0603-DUP2)	**Source: 23I3752-01**			Prepared: 2023-10-09, Analyzed: 2023-10-09						
Carbon, Total Organic	1.80	0.50	mg/L		1.53				16	
Carbon, Dissolved Organic	1.20	0.50	mg/L		1.16				15	
Matrix Spike (B3J0603-MS2)	**Source: 23I3752-01**			Prepared: 2023-10-09, Analyzed: 2023-10-09						
Carbon, Total Organic	10.7	0.50	mg/L	10.0	1.53	92	70-130			
Carbon, Dissolved Organic	10.1	0.50	mg/L	10.0	1.16	89	70-130			
Total Metals, Batch B3J0454										
Blank (B3J0454-BLK1)				Prepared: 2023-10-05, Analyzed: 2023-10-07						
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							
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							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3752
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 14:07

Total Metals, Batch B3J0454, Continued

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Blank (B3J0454-BLK1), Continued				Prepared: 2023-10-05, Analyzed: 2023-10-07						
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	< 0.0050	0.0050	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
Zirconium, total	< 0.00010	0.00010	mg/L							
LCS (B3J0454-BS1)				Prepared: 2023-10-05, Analyzed: 2023-10-07						
Aluminum, total	3.95	0.0050	mg/L	4.00		99	80-120			
Antimony, total	0.0401	0.00020	mg/L	0.0400		100	80-120			
Arsenic, total	0.389	0.00050	mg/L	0.400		97	80-120			
Barium, total	0.0393	0.0050	mg/L	0.0400		98	80-120			
Beryllium, total	0.0403	0.00010	mg/L	0.0400		101	80-120			
Bismuth, total	0.0398	0.00010	mg/L	0.0400		100	80-120			
Boron, total	0.407	0.0500	mg/L	0.400		102	80-120			
Cadmium, total	0.0396	0.000010	mg/L	0.0400		99	80-120			
Calcium, total	4.00	0.20	mg/L	4.00		100	80-120			
Chromium, total	0.0396	0.00050	mg/L	0.0400		99	80-120			
Cobalt, total	0.0395	0.00010	mg/L	0.0400		99	80-120			
Copper, total	0.0396	0.00040	mg/L	0.0400		99	80-120			
Iron, total	3.90	0.010	mg/L	4.00		97	80-120			
Lead, total	0.0397	0.00020	mg/L	0.0400		99	80-120			
Lithium, total	0.0401	0.00010	mg/L	0.0400		100	80-120			
Magnesium, total	4.13	0.010	mg/L	4.00		103	80-120			
Manganese, total	0.0398	0.00020	mg/L	0.0400		99	80-120			
Molybdenum, total	0.0393	0.00010	mg/L	0.0400		98	80-120			
Nickel, total	0.0390	0.00040	mg/L	0.0400		97	80-120			
Phosphorus, total	3.92	0.050	mg/L	4.00		98	80-120			
Potassium, total	3.89	0.10	mg/L	4.00		97	80-120			
Selenium, total	0.395	0.00050	mg/L	0.400		99	80-120			
Silicon, total	4.2	1.0	mg/L	4.00		105	80-120			
Silver, total	0.0385	0.000050	mg/L	0.0400		96	80-120			
Sodium, total	3.85	0.10	mg/L	4.00		96	80-120			
Strontium, total	0.0394	0.0010	mg/L	0.0400		99	80-120			
Sulfur, total	40.5	3.0	mg/L	40.0		101	80-120			
Tellurium, total	0.0387	0.00050	mg/L	0.0400		97	80-120			
Thallium, total	0.0402	0.000020	mg/L	0.0400		100	80-120			
Thorium, total	0.0401	0.00010	mg/L	0.0400		100	80-120			
Tin, total	0.0410	0.00020	mg/L	0.0400		102	80-120			
Titanium, total	0.0403	0.0050	mg/L	0.0400		101	80-120			
Tungsten, total	0.0408	0.0010	mg/L	0.0400		102	80-120			
Uranium, total	0.0407	0.000020	mg/L	0.0400		102	80-120			
Vanadium, total	0.0389	0.0050	mg/L	0.0400		97	80-120			
Zinc, total	0.388	0.0040	mg/L	0.400		97	80-120			
Zirconium, total	0.0404	0.00010	mg/L	0.0400		101	80-120			
Matrix Spike (B3J0454-MS1)		**Source: 23I3752-01**		Prepared: 2023-10-05, Analyzed: 2023-10-07						
Aluminum, total	3.19	0.0050	mg/L	4.00	< 0.0050	80	70-130			
Antimony, total	0.0311	0.00020	mg/L	0.0400	< 0.00020	78	70-130			
Arsenic, total	0.335	0.00050	mg/L	0.400	< 0.00050	84	70-130			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO Elk River Alliance
PROJECT CBWM-2023

WORK ORDER 23I3752
REPORTED 2023-10-17 14:07

Total Metals, Batch B3J0454, Continued

Matrix Spike (B3J0454-MS1), Continued — **Source: 23I3752-01** — Prepared: 2023-10-05, Analyzed: 2023-10-07

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Barium, total	0.107	0.0050	mg/L	0.0400	0.0721	87	70-130			
Beryllium, total	0.0285	0.00010	mg/L	0.0400	< 0.00010	71	70-130			
Bismuth, total	0.0318	0.00010	mg/L	0.0400	< 0.00010	79	70-130			
Boron, total	0.308	0.0500	mg/L	0.400	< 0.0500	75	70-130			
Cadmium, total	0.0325	0.000010	mg/L	0.0400	< 0.000010	81	70-130			
Calcium, total	53.9	0.20	mg/L	4.00	52.4	38	70-130			MS2
Chromium, total	0.0323	0.00050	mg/L	0.0400	< 0.00050	80	70-130			
Cobalt, total	0.0317	0.00010	mg/L	0.0400	< 0.00010	79	70-130			
Copper, total	0.0312	0.00040	mg/L	0.0400	< 0.00040	78	70-130			
Iron, total	3.14	0.010	mg/L	4.00	< 0.010	78	70-130			
Lead, total	0.0334	0.00020	mg/L	0.0400	< 0.00020	84	70-130			
Lithium, total	0.0340	0.00010	mg/L	0.0400	0.00431	74	70-130			
Magnesium, total	16.1	0.010	mg/L	4.00	13.3	71	70-130			
Manganese, total	0.0332	0.00020	mg/L	0.0400	0.00085	81	70-130			
Molybdenum, total	0.0369	0.00010	mg/L	0.0400	0.00078	90	70-130			
Nickel, total	0.0312	0.00040	mg/L	0.0400	< 0.00040	78	70-130			
Phosphorus, total	3.34	0.050	mg/L	4.00	< 0.050	83	70-130			
Potassium, total	3.95	0.10	mg/L	4.00	0.41	88	70-130			
Selenium, total	0.309	0.00050	mg/L	0.400	0.00065	77	70-130			
Silicon, total	5.9	1.0	mg/L	4.00	2.4	88	70-130			
Silver, total	0.0334	0.000050	mg/L	0.0400	< 0.000050	83	70-130			
Sodium, total	5.20	0.10	mg/L	4.00	1.81	85	70-130			
Strontium, total	0.153	0.0010	mg/L	0.0400	0.121	82	70-130			
Sulfur, total	39.1	3.0	mg/L	40.0	7.1	80	70-130			
Tellurium, total	0.0322	0.00050	mg/L	0.0400	< 0.00050	80	70-130			
Thallium, total	0.0362	0.000020	mg/L	0.0400	< 0.000020	91	70-130			
Thorium, total	0.0298	0.00010	mg/L	0.0400	< 0.00010	75	70-130			
Tin, total	0.0367	0.00020	mg/L	0.0400	< 0.00020	92	70-130			
Titanium, total	0.0372	0.0050	mg/L	0.0400	< 0.0050	93	70-130			
Tungsten, total	0.0373	0.0010	mg/L	0.0400	< 0.0010	93	70-130			
Uranium, total	0.0332	0.000020	mg/L	0.0400	0.000628	81	70-130			
Vanadium, total	0.0328	0.0050	mg/L	0.0400	< 0.0050	82	70-130			
Zinc, total	0.319	0.0040	mg/L	0.400	< 0.0040	80	70-130			
Zirconium, total	0.0366	0.00010	mg/L	0.0400	< 0.00010	91	70-130			

Total Metals, Batch B3J0455

Blank (B3J0455-BLK1) — Prepared: 2023-10-05, Analyzed: 2023-10-07

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
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							
Molybdenum, total	< 0.00010	0.00010	mg/L							

Total Metals, Batch B3J0455, Continued

Blank (B3J0455-BLK1), Continued — Prepared: 2023-10-05, Analyzed: 2023-10-07

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
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	< 0.0050	0.0050	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
Zirconium, total	< 0.00010	0.00010	mg/L							

LCS (B3J0455-BS1) — Prepared: 2023-10-05, Analyzed: 2023-10-07

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Aluminum, total	3.97	0.0050	mg/L	4.00		99	80-120			
Antimony, total	0.0393	0.00020	mg/L	0.0400		98	80-120			
Arsenic, total	0.395	0.00050	mg/L	0.400		99	80-120			
Barium, total	0.0381	0.0050	mg/L	0.0400		95	80-120			
Beryllium, total	0.0400	0.00010	mg/L	0.0400		100	80-120			
Bismuth, total	0.0388	0.00010	mg/L	0.0400		97	80-120			
Boron, total	0.402	0.0500	mg/L	0.400		100	80-120			
Cadmium, total	0.0390	0.000010	mg/L	0.0400		97	80-120			
Calcium, total	3.96	0.20	mg/L	4.00		99	80-120			
Chromium, total	0.0402	0.00050	mg/L	0.0400		101	80-120			
Cobalt, total	0.0397	0.00010	mg/L	0.0400		99	80-120			
Copper, total	0.0395	0.00040	mg/L	0.0400		99	80-120			
Iron, total	3.91	0.010	mg/L	4.00		98	80-120			
Lead, total	0.0391	0.00020	mg/L	0.0400		98	80-120			
Lithium, total	0.0399	0.00010	mg/L	0.0400		100	80-120			
Magnesium, total	4.09	0.010	mg/L	4.00		102	80-120			
Manganese, total	0.0398	0.00020	mg/L	0.0400		100	80-120			
Molybdenum, total	0.0387	0.00010	mg/L	0.0400		97	80-120			
Nickel, total	0.0397	0.00040	mg/L	0.0400		99	80-120			
Phosphorus, total	3.90	0.050	mg/L	4.00		97	80-120			
Potassium, total	3.90	0.10	mg/L	4.00		98	80-120			
Selenium, total	0.396	0.00050	mg/L	0.400		99	80-120			
Silicon, total	4.2	1.0	mg/L	4.00		105	80-120			
Silver, total	0.0380	0.000050	mg/L	0.0400		95	80-120			
Sodium, total	3.99	0.10	mg/L	4.00		100	80-120			
Strontium, total	0.0399	0.0010	mg/L	0.0400		100	80-120			
Sulfur, total	40.9	3.0	mg/L	40.0		102	80-120			
Tellurium, total	0.0379	0.00050	mg/L	0.0400		95	80-120			
Thallium, total	0.0394	0.000020	mg/L	0.0400		98	80-120			
Thorium, total	0.0385	0.00010	mg/L	0.0400		96	80-120			
Tin, total	0.0405	0.00020	mg/L	0.0400		101	80-120			
Titanium, total	0.0419	0.0050	mg/L	0.0400		105	80-120			
Tungsten, total	0.0404	0.0010	mg/L	0.0400		101	80-120			
Uranium, total	0.0402	0.000020	mg/L	0.0400		100	80-120			
Vanadium, total	0.0397	0.0050	mg/L	0.0400		99	80-120			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3752
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 14:07

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B3J0455, Continued										
LCS (B3J0455-BS1), Continued				Prepared: 2023-10-05, Analyzed: 2023-10-07						
Zinc, total	0.392	0.0040	mg/L	0.400		98	80-120			
Zirconium, total	0.0398	0.00010	mg/L	0.0400		99	80-120			
Total Metals, Batch B3J0461										
Blank (B3J0461-BLK1)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, total	< 0.000010	0.000010	mg/L							
Blank (B3J0461-BLK2)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, total	< 0.000010	0.000010	mg/L							
LCS (B3J0461-BS1)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, total	0.000240	0.000010	mg/L	0.000250		96	80-120			
LCS (B3J0461-BS2)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, total	0.000226	0.000010	mg/L	0.000250		90	80-120			

QC Qualifiers:

MS2 The native sample concentration is greater than the spike concentration hence the matrix spike limits do not apply.

CARO ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

REPORTED TO	Elk River Alliance PO Box 2095, 1111 2nd Ave Fernie, BC V0B1M0		
ATTENTION	Kaileigh McCallum	**WORK ORDER**	23I3653
PO NUMBER		**RECEIVED / TEMP**	2023-09-28 13:36 / 8.8°C
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:37
PROJECT INFO		**COC NUMBER**	No Number

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

TEST RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3653
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:37

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
B01001_20230926_ (23I3653-01) | Matrix: Water | Sampled: 2023-09-26 13:36						
Anions						
Bromide	< 0.10	N/A	0.10	mg/L	2023-10-01	
Chloride	**0.10**	AO ≤ 250	0.10	mg/L	2023-10-01	
Fluoride	**0.24**	MAC = 1.5	0.10	mg/L	2023-10-01	
Nitrate (as N)	**0.029**	MAC = 10	0.010	mg/L	2023-10-01	HT1
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2023-10-01	HT1
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2023-10-01	HT1
Sulfate	**63.1**	AO ≤ 500	1.0	mg/L	2023-10-01	
BCMOE Aggregate Hydrocarbons						
EPHw10-19	< 250	N/A	250	µg/L	2023-10-06	
EPHw19-32	< 250	N/A	250	µg/L	2023-10-06	
Surrogate: 2-Methylnonane (EPH/F2-4)	*86*		*60-140*	%	*2023-10-06*	
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	**193**	N/A	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	**0.0288**	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	**0.183**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Aluminum, dissolved	**0.0052**	N/A	0.0050	mg/L	2023-10-05	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Arsenic, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Barium, dissolved	**0.0281**	N/A	0.0050	mg/L	2023-10-05	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2023-10-05	
Cadmium, dissolved	**0.000028**	N/A	0.000010	mg/L	2023-10-05	
Calcium, dissolved	**53.1**	N/A	0.20	mg/L	2023-10-05	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Cobalt, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Copper, dissolved	< 0.00040	N/A	0.00040	mg/L	2023-10-05	
Iron, dissolved	< 0.010	N/A	0.010	mg/L	2023-10-05	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Lithium, dissolved	**0.00158**	N/A	0.00010	mg/L	2023-10-05	
Magnesium, dissolved	**14.7**	N/A	0.010	mg/L	2023-10-05	
Manganese, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2023-10-06	
Molybdenum, dissolved	**0.00149**	N/A	0.00010	mg/L	2023-10-05	
Nickel, dissolved	< 0.00040	N/A	0.00040	mg/L	2023-10-05	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2023-10-05	
Potassium, dissolved	**0.29**	N/A	0.10	mg/L	2023-10-05	
Selenium, dissolved	**0.00117**	N/A	0.00050	mg/L	2023-10-05	
Silicon, dissolved	**2.1**	N/A	1.0	mg/L	2023-10-05	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2023-10-05	

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO Elk River Alliance
PROJECT CBWM-2023

WORK ORDER 23I3653
REPORTED 2023-10-11 14:37

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
B01001_20230926_ (23I3653-01) | Matrix: Water | Sampled: 2023-09-26 13:36, Continued						
Dissolved Metals, Continued						
Sodium, dissolved	**0.63**	N/A	0.10	mg/L	2023-10-05	
Strontium, dissolved	**0.667**	N/A	0.0010	mg/L	2023-10-05	
Sulfur, dissolved	**20.9**	N/A	3.0	mg/L	2023-10-05	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2023-10-05	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2023-10-05	
Uranium, dissolved	**0.000998**	N/A	0.000020	mg/L	2023-10-05	
Vanadium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2023-10-05	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
General Parameters						
Alkalinity, Total (as CaCO3)	**144**	N/A	1.0	mg/L	2023-10-03	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-03	
Alkalinity, Bicarbonate (as CaCO3)	**144**	N/A	1.0	mg/L	2023-10-03	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-03	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-03	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2023-10-03	
BOD, 5-day	< 6.5	N/A	2.0	mg/L	2023-10-04	
Carbon, Total Organic	**3.52**	N/A	0.50	mg/L	2023-10-09	
Carbon, Dissolved Organic	**3.01**	N/A	0.50	mg/L	2023-10-09	
Chemical Oxygen Demand	< 20	N/A	20	mg/L	2023-10-02	
Nitrogen, Total Kjeldahl	**0.154**	N/A	0.050	mg/L	2023-10-05	
Phosphorus, Total (as P)	**0.0061**	N/A	0.0050	mg/L	2023-10-03	
Solids, Total Suspended	< 4.0	N/A	2.0	mg/L	2023-10-05	HT1
Total Metals						
Aluminum, total	< 0.0050	OG < 0.1	0.0050	mg/L	2023-10-06	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2023-10-06	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2023-10-06	
Barium, total	**0.0284**	MAC = 2	0.0050	mg/L	2023-10-06	
Beryllium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-06	
Bismuth, total	< 0.00010	N/A	0.00010	mg/L	2023-10-06	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2023-10-06	
Cadmium, total	**0.000024**	MAC = 0.007	0.000010	mg/L	2023-10-06	
Calcium, total	**53.1**	None Required	0.20	mg/L	2023-10-06	
Chromium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2023-10-06	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2023-10-06	
Copper, total	< 0.00040	MAC = 2	0.00040	mg/L	2023-10-06	
Iron, total	< 0.010	AO ≤ 0.3	0.010	mg/L	2023-10-06	
Lead, total	< 0.00020	MAC = 0.005	0.00020	mg/L	2023-10-06	

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
B01001_20230926_ (23I3653-01) | Matrix: Water | Sampled: 2023-09-26 13:36, Continued						
Total Metals, Continued						
Lithium, total	**0.00153**	N/A	0.00010	mg/L	2023-10-06	
Magnesium, total	**14.1**	None Required	0.010	mg/L	2023-10-06	
Manganese, total	< 0.00020	MAC = 0.12	0.00020	mg/L	2023-10-06	
Mercury, total	< 0.000010	MAC = 0.001	0.000010	mg/L	2023-10-06	
Molybdenum, total	**0.00148**	N/A	0.00010	mg/L	2023-10-06	
Nickel, total	**0.00072**	N/A	0.00040	mg/L	2023-10-06	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2023-10-06	
Potassium, total	**0.30**	N/A	0.10	mg/L	2023-10-06	
Selenium, total	**0.00112**	MAC = 0.05	0.00050	mg/L	2023-10-06	
Silicon, total	**2.2**	N/A	1.0	mg/L	2023-10-06	
Silver, total	< 0.000050	None Required	0.000050	mg/L	2023-10-06	
Sodium, total	**0.61**	AO ≤ 200	0.10	mg/L	2023-10-06	
Strontium, total	**0.665**	MAC = 7	0.0010	mg/L	2023-10-06	
Sulfur, total	**21.7**	N/A	3.0	mg/L	2023-10-06	
Tellurium, total	< 0.00050	N/A	0.00050	mg/L	2023-10-06	
Thallium, total	< 0.000020	N/A	0.000020	mg/L	2023-10-06	
Thorium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-06	
Tin, total	< 0.00020	N/A	0.00020	mg/L	2023-10-06	
Titanium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-06	
Tungsten, total	< 0.0010	N/A	0.0010	mg/L	2023-10-06	
Uranium, total	**0.00101**	MAC = 0.02	0.000020	mg/L	2023-10-06	
Vanadium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-06	
Zinc, total	< 0.0040	AO ≤ 5	0.0040	mg/L	2023-10-06	
Zirconium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-06	
B01002_20230926_ (23I3653-02) | Matrix: Water | Sampled: 2023-09-26 12:40						
Anions						
Bromide	< 0.10	N/A	0.10	mg/L	2023-10-01	
Chloride	< 0.10	AO ≤ 250	0.10	mg/L	2023-10-01	
Fluoride	**0.26**	MAC = 1.5	0.10	mg/L	2023-10-01	
Nitrate (as N)	**0.023**	MAC = 10	0.010	mg/L	2023-10-01	HT1
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2023-10-01	HT1
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2023-10-01	HT1
Sulfate	**62.6**	AO ≤ 500	1.0	mg/L	2023-10-01	
BCMOE Aggregate Hydrocarbons						
EPHw10-19	< 250	N/A	250	µg/L	2023-10-05	
EPHw19-32	< 250	N/A	250	µg/L	2023-10-05	
Surrogate: 2-Methylnonane (EPH/F2-4)	*11*		*60-140*	%	*2023-10-05*	S09a
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	**195**	N/A	0.500	mg/L	N/A	

TEST RESULTS

REPORTED TO	Elk River Alliance	WORK ORDER	23I3653
PROJECT	CBWM-2023	REPORTED	2023-10-11 14:37

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
B01002_20230926_ (23I3653-02) | Matrix: Water | Sampled: 2023-09-26 12:40, Continued						
Calculated Parameters, Continued						
Nitrate+Nitrite (as N)	**0.0228**	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	**0.153**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Aluminum, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Arsenic, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Barium, dissolved	**0.0280**	N/A	0.0050	mg/L	2023-10-05	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2023-10-05	
Cadmium, dissolved	**0.000024**	N/A	0.000010	mg/L	2023-10-05	
Calcium, dissolved	**53.5**	N/A	0.20	mg/L	2023-10-05	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Cobalt, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Copper, dissolved	< 0.00040	N/A	0.00040	mg/L	2023-10-05	
Iron, dissolved	< 0.010	N/A	0.010	mg/L	2023-10-05	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Lithium, dissolved	**0.00159**	N/A	0.00010	mg/L	2023-10-05	
Magnesium, dissolved	**14.9**	N/A	0.010	mg/L	2023-10-05	
Manganese, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2023-10-06	
Molybdenum, dissolved	**0.00152**	N/A	0.00010	mg/L	2023-10-05	
Nickel, dissolved	< 0.00040	N/A	0.00040	mg/L	2023-10-05	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2023-10-05	
Potassium, dissolved	**0.29**	N/A	0.10	mg/L	2023-10-05	
Selenium, dissolved	**0.00113**	N/A	0.00050	mg/L	2023-10-05	
Silicon, dissolved	**2.1**	N/A	1.0	mg/L	2023-10-05	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2023-10-05	
Sodium, dissolved	**0.62**	N/A	0.10	mg/L	2023-10-05	
Strontium, dissolved	**0.660**	N/A	0.0010	mg/L	2023-10-05	
Sulfur, dissolved	**20.8**	N/A	3.0	mg/L	2023-10-05	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2023-10-05	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2023-10-05	
Uranium, dissolved	**0.000998**	N/A	0.000020	mg/L	2023-10-05	
Vanadium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Zinc, dissolved	**0.0126**	N/A	0.0040	mg/L	2023-10-05	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
General Parameters						

B01002_20230926_ (23I3653-02) | Matrix: Water | Sampled: 2023-09-26 12:40, Continued

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
General Parameters, Continued						
Alkalinity, Total (as CaCO3)	**144**	N/A	1.0	mg/L	2023-10-03	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-03	
Alkalinity, Bicarbonate (as CaCO3)	**144**	N/A	1.0	mg/L	2023-10-03	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-03	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-03	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2023-10-03	
BOD, 5-day	< 6.5	N/A	2.0	mg/L	2023-10-04	
Carbon, Total Organic	**1.65**	N/A	0.50	mg/L	2023-10-09	
Carbon, Dissolved Organic	**1.65**	N/A	0.50	mg/L	2023-10-09	
Chemical Oxygen Demand	< 20	N/A	20	mg/L	2023-10-02	
Nitrogen, Total Kjeldahl	**0.130**	N/A	0.050	mg/L	2023-10-05	
Phosphorus, Total (as P)	< 0.0050	N/A	0.0050	mg/L	2023-10-03	
Solids, Total Suspended	< 4.0	N/A	2.0	mg/L	2023-10-05	HT1
Total Metals						
Aluminum, total	< 0.0050	OG < 0.1	0.0050	mg/L	2023-10-06	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2023-10-06	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2023-10-06	
Barium, total	**0.0284**	MAC = 2	0.0050	mg/L	2023-10-06	
Beryllium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-06	
Bismuth, total	< 0.00010	N/A	0.00010	mg/L	2023-10-06	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2023-10-06	
Cadmium, total	**0.000028**	MAC = 0.007	0.000010	mg/L	2023-10-06	
Calcium, total	**52.6**	None Required	0.20	mg/L	2023-10-06	
Chromium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2023-10-06	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2023-10-06	
Copper, total	< 0.00040	MAC = 2	0.00040	mg/L	2023-10-06	
Iron, total	< 0.010	AO ≤ 0.3	0.010	mg/L	2023-10-06	
Lead, total	< 0.00020	MAC = 0.005	0.00020	mg/L	2023-10-06	
Lithium, total	**0.00139**	N/A	0.00010	mg/L	2023-10-06	
Magnesium, total	**14.0**	None Required	0.010	mg/L	2023-10-06	
Manganese, total	< 0.00020	MAC = 0.12	0.00020	mg/L	2023-10-06	
Mercury, total	< 0.000010	MAC = 0.001	0.000010	mg/L	2023-10-06	
Molybdenum, total	**0.00153**	N/A	0.00010	mg/L	2023-10-06	
Nickel, total	< 0.00040	N/A	0.00040	mg/L	2023-10-06	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2023-10-06	
Potassium, total	**0.30**	N/A	0.10	mg/L	2023-10-06	
Selenium, total	**0.00108**	MAC = 0.05	0.00050	mg/L	2023-10-06	
Silicon, total	**2.2**	N/A	1.0	mg/L	2023-10-06	
Silver, total	< 0.000050	None Required	0.000050	mg/L	2023-10-06	
Sodium, total	**0.60**	AO ≤ 200	0.10	mg/L	2023-10-06	
Strontium, total	**0.642**	MAC = 7	0.0010	mg/L	2023-10-06	
Sulfur, total	**21.7**	N/A	3.0	mg/L	2023-10-06	

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3653
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:37

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
B01002_20230926_ (23I3653-02) | Matrix: Water | Sampled: 2023-09-26 12:40, Continued						
Total Metals, Continued						
Tellurium, total	< 0.00050	N/A	0.00050	mg/L	2023-10-06	
Thallium, total	< 0.000020	N/A	0.000020	mg/L	2023-10-06	
Thorium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-06	
Tin, total	< 0.00020	N/A	0.00020	mg/L	2023-10-06	
Titanium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-06	
Tungsten, total	< 0.0010	N/A	0.0010	mg/L	2023-10-06	
Uranium, total	**0.00101**	MAC = 0.02	0.000020	mg/L	2023-10-06	
Vanadium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-06	
Zinc, total	< 0.0040	AO ≤ 5	0.0040	mg/L	2023-10-06	
Zirconium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-06	

Sample Qualifiers:

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

S09a The surrogate recovery for this sample is outside of established control limits wide mouth data, not data affected

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3653
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:37

Analysis Description	Method Ref.	Technique	Accredited	Location
Alkalinity in Water	SM 2320 B* (2021)	Titration with H_2SO_4	✓	Kelowna
Ammonia, Total in Water	SM 4500-NH3 G* (2021)	Automated Colorimetry (Phenate)	✓	Kelowna
Anions in Water	SM 4110 B (2020)	Ion Chromatography	✓	Kelowna
Biochemical Oxygen Demand in Water	SM 5210 B (2019)	Dissolved Oxygen Meter	✓	Kelowna
Carbon, Dissolved Organic in Water	SM 5310 B (2022)	Combustion, Infrared CO_2 Detection	✓	Kelowna
Carbon, Total Organic in Water	SM 5310 B (2022)	Combustion, Infrared CO_2 Detection	✓	Kelowna
Chemical Oxygen Demand in Water	SM 5220 D* (2022)	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
EPH in Water	EPA 3511* / BCMOE EPHw	Hexane MicroExtraction (Base/Neutral) / Gas Chromatography (GC-FID)	✓	Richmond
Hardness in Water	SM 2340 B (2021)	Calculation: 2.497 [diss Ca] + 4.118 [diss Mg]	✓	N/A
Mercury, dissolved in Water	EPA 245.7*	$BrCl_2$ Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	✓	Richmond
Mercury, total in Water	EPA 245.7*	$BrCl_2$ Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	✓	Richmond
Nitrogen, Total Kjeldahl in Water	SM 4500-Norg D* (2021)	Block Digestion and Flow Injection Analysis	✓	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2021)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Solids, Total Suspended in Water	Solids in Water, Filtered / SM 2540 D* (2020)	Solids in Water, Filtered / Gravimetry (Dried at 103-105C)	✓	Kelowna
Total Metals in Water	EPA 200.2 / EPA 6020B	HNO_3+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)
µg/L	Micrograms per litre
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, September 2022)

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**	23I3653
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:37

General Comments:

The results in this report apply to the received 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. Caro will dispose of all samples within 30 days of sample receipt, unless otherwise agreed.

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.

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 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 B3J0010										
Blank (B3J0010-BLK1)				Prepared: 2023-10-01, Analyzed: 2023-10-01						
Bromide	< 0.05	0.05	mg/L							
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.05	0.05	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	< 0.5	0.5	mg/L							
Blank (B3J0010-BLK2)				Prepared: 2023-10-01, Analyzed: 2023-10-01						
Bromide	< 0.05	0.05	mg/L							
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.05	0.05	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	< 0.5	0.5	mg/L							
Blank (B3J0010-BLK3)				Prepared: 2023-10-01, Analyzed: 2023-10-01						
Bromide	< 0.05	0.05	mg/L							
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.05	0.05	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	< 0.5	0.5	mg/L							
LCS (B3J0010-BS1)				Prepared: 2023-10-01, Analyzed: 2023-10-01						
Bromide	3.99	0.05	mg/L	4.00		100	85-115			
Chloride	16.0	0.10	mg/L	16.0		100	90-110			
Fluoride	3.93	0.05	mg/L	4.00		98	88-108			
Nitrate (as N)	3.93	0.010	mg/L	4.00		98	90-110			
Nitrite (as N)	2.01	0.010	mg/L	2.00		101	85-115			
Phosphate (as P)	0.964	0.0050	mg/L	1.00		96	80-120			
Sulfate	16.0	0.5	mg/L	16.0		100	90-110			
LCS (B3J0010-BS2)				Prepared: 2023-10-01, Analyzed: 2023-10-01						
Bromide	4.01	0.05	mg/L	4.00		100	85-115			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3653
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:37

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B3J0010, Continued										
LCS (B3J0010-BS2), Continued				Prepared: 2023-10-01, Analyzed: 2023-10-01						
Chloride	15.8	0.10	mg/L	16.0		98	90-110			
Fluoride	4.03	0.05	mg/L	4.00		101	88-108			
Nitrate (as N)	4.03	0.010	mg/L	4.00		101	90-110			
Nitrite (as N)	2.01	0.010	mg/L	2.00		100	85-115			
Phosphate (as P)	0.950	0.0050	mg/L	1.00		95	80-120			
Sulfate	15.4	0.5	mg/L	16.0		96	90-110			
LCS (B3J0010-BS3)				Prepared: 2023-10-01, Analyzed: 2023-10-01						
Bromide	4.01	0.05	mg/L	4.00		100	85-115			
Chloride	15.9	0.10	mg/L	16.0		99	90-110			
Fluoride	4.00	0.05	mg/L	4.00		100	88-108			
Nitrate (as N)	4.00	0.010	mg/L	4.00		100	90-110			
Nitrite (as N)	2.01	0.010	mg/L	2.00		100	85-115			
Phosphate (as P)	0.936	0.0050	mg/L	1.00		94	80-120			
Sulfate	15.8	0.5	mg/L	16.0		99	90-110			
BCMOE Aggregate Hydrocarbons, Batch B3J0347										
Blank (B3J0347-BLK1)				Prepared: 2023-10-05, Analyzed: 2023-10-05						
EPHw10-19	< 250	250	µg/L							
EPHw19-32	< 250	250	µg/L							
Surrogate: 2-Methylnonane (EPH/F2-4)	*1640*		*µg/L*	2200		*74*	*60-140*			
LCS (B3J0347-BS2)				Prepared: 2023-10-05, Analyzed: 2023-10-05						
EPHw10-19	17000	250	µg/L	15400		110	70-130			
EPHw19-32	24200	250	µg/L	22200		109	70-130			
Surrogate: 2-Methylnonane (EPH/F2-4)	*902*		*µg/L*	2200		*41*	*60-140*			*S09*
LCS Dup (B3J0347-BSD2)				Prepared: 2023-10-05, Analyzed: 2023-10-05						
EPHw10-19	16800	417	µg/L	15400		109	70-130	1	20	
EPHw19-32	24300	417	µg/L	22200		110	70-130	< 1	20	
Surrogate: 2-Methylnonane (EPH/F2-4)	*938*		*µg/L*	2200		*43*	*60-140*			*S09*
BCMOE Aggregate Hydrocarbons, Batch B3J0458										
Blank (B3J0458-BLK1)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
EPHw10-19	< 250	250	µg/L							
EPHw19-32	< 250	250	µg/L							
Surrogate: 2-Methylnonane (EPH/F2-4)	*1990*		*µg/L*	2200		*90*	*60-140*			
LCS (B3J0458-BS2)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
EPHw10-19	15200	250	µg/L	15400		98	70-130			
EPHw19-32	22700	250	µg/L	22200		102	70-130			
Surrogate: 2-Methylnonane (EPH/F2-4)	*1710*		*µg/L*	2200		*78*	*60-140*			
LCS Dup (B3J0458-BSD2)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
EPHw10-19	15800	250	µg/L	15400		102	70-130	4	20	
EPHw19-32	23700	250	µg/L	22200		107	70-130	4	20	
Surrogate: 2-Methylnonane (EPH/F2-4)	*2000*		*µg/L*	2200		*91*	*60-140*			
Dissolved Metals, Batch B3J0401										
Blank (B3J0401-BLK1)				Prepared: 2023-10-05, Analyzed: 2023-10-05						
Aluminum, dissolved	< 0.0050	0.0050	mg/L							
Antimony, dissolved	< 0.00020	0.00020	mg/L							

CARO ANALYTICAL SERVICES

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3653
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:37

Dissolved Metals, Batch B3J0401, Continued

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Blank (B3J0401-BLK1), Continued				Prepared: 2023-10-05, Analyzed: 2023-10-05						
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							
Lithium, dissolved	< 0.00010	0.00010	mg/L							
Magnesium, dissolved	< 0.010	0.010	mg/L							
Manganese, dissolved	< 0.00020	0.00020	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	< 0.0050	0.0050	mg/L							
Zinc, dissolved	< 0.0040	0.0040	mg/L							
Zirconium, dissolved	< 0.00010	0.00010	mg/L							
LCS (B3J0401-BS1)				Prepared: 2023-10-05, Analyzed: 2023-10-05						
Aluminum, dissolved	4.24	0.0050	mg/L	4.00		106	80-120			
Antimony, dissolved	0.0413	0.00020	mg/L	0.0400		103	80-120			
Arsenic, dissolved	0.404	0.00050	mg/L	0.400		101	80-120			
Barium, dissolved	0.0417	0.0050	mg/L	0.0400		104	80-120			
Beryllium, dissolved	0.0427	0.00010	mg/L	0.0400		107	80-120			
Bismuth, dissolved	0.0413	0.00010	mg/L	0.0400		103	80-120			
Boron, dissolved	0.425	0.0500	mg/L	0.400		106	80-120			
Cadmium, dissolved	0.0407	0.000010	mg/L	0.0400		102	80-120			
Calcium, dissolved	4.20	0.20	mg/L	4.00		105	80-120			
Chromium, dissolved	0.0410	0.00050	mg/L	0.0400		102	80-120			
Cobalt, dissolved	0.0403	0.00010	mg/L	0.0400		101	80-120			
Copper, dissolved	0.0401	0.00040	mg/L	0.0400		100	80-120			
Iron, dissolved	4.14	0.010	mg/L	4.00		103	80-120			
Lead, dissolved	0.0413	0.00020	mg/L	0.0400		103	80-120			
Lithium, dissolved	0.0434	0.00010	mg/L	0.0400		108	80-120			
Magnesium, dissolved	4.17	0.010	mg/L	4.00		104	80-120			
Manganese, dissolved	0.0421	0.00020	mg/L	0.0400		105	80-120			
Molybdenum, dissolved	0.0393	0.00010	mg/L	0.0400		98	80-120			
Nickel, dissolved	0.0405	0.00040	mg/L	0.0400		101	80-120			

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APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3653
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:37

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B3J0401, Continued										
LCS (B3J0401-BS1), Continued				Prepared: 2023-10-05, Analyzed: 2023-10-05						
Phosphorus, dissolved	4.21	0.050	mg/L	4.00		105	80-120			
Potassium, dissolved	4.20	0.10	mg/L	4.00		105	80-120			
Selenium, dissolved	0.402	0.00050	mg/L	0.400		100	80-120			
Silicon, dissolved	4.5	1.0	mg/L	4.00		111	80-120			
Silver, dissolved	0.0389	0.000050	mg/L	0.0400		97	80-120			
Sodium, dissolved	4.19	0.10	mg/L	4.00		105	80-120			
Strontium, dissolved	0.0431	0.0010	mg/L	0.0400		108	80-120			
Sulfur, dissolved	42.4	3.0	mg/L	40.0		106	80-120			
Tellurium, dissolved	0.0407	0.00050	mg/L	0.0400		102	80-120			
Thallium, dissolved	0.0411	0.000020	mg/L	0.0400		103	80-120			
Thorium, dissolved	0.0399	0.00010	mg/L	0.0400		100	80-120			
Tin, dissolved	0.0417	0.00020	mg/L	0.0400		104	80-120			
Titanium, dissolved	0.0416	0.0050	mg/L	0.0400		104	80-120			
Tungsten, dissolved	0.0413	0.0010	mg/L	0.0400		103	80-120			
Uranium, dissolved	0.0421	0.000020	mg/L	0.0400		105	80-120			
Vanadium, dissolved	0.0410	0.0050	mg/L	0.0400		103	80-120			
Zinc, dissolved	0.409	0.0040	mg/L	0.400		102	80-120			
Zirconium, dissolved	0.0422	0.00010	mg/L	0.0400		105	80-120			
Dissolved Metals, Batch B3J0462										
Blank (B3J0462-BLK1)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Blank (B3J0462-BLK2)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Blank (B3J0462-BLK3)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
LCS (B3J0462-BS1)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, dissolved	0.000251	0.000010	mg/L	0.000250		100	80-120			
LCS (B3J0462-BS2)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, dissolved	0.000224	0.000010	mg/L	0.000250		90	80-120			
LCS (B3J0462-BS3)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, dissolved	0.000238	0.000010	mg/L	0.000250		95	80-120			
General Parameters, Batch B3I2942										
Blank (B3I2942-BLK1)				Prepared: 2023-09-29, Analyzed: 2023-10-04						
BOD, 5-day	< 2.0	2.0	mg/L							
LCS (B3I2942-BS1)				Prepared: 2023-09-29, Analyzed: 2023-10-04						
BOD, 5-day	203	53.9	mg/L	198		103	85-115			
General Parameters, Batch B3J0025										
Blank (B3J0025-BLK1)				Prepared: 2023-10-02, Analyzed: 2023-10-02						
Chemical Oxygen Demand	< 20	20	mg/L							
LCS (B3J0025-BS1)				Prepared: 2023-10-02, Analyzed: 2023-10-02						
Chemical Oxygen Demand	500	20	mg/L	500		100	89-115			

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REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3653
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Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B3J0045										
Blank (B3J0045-BLK1)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
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 (B3J0045-BLK2)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
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 (B3J0045-BLK3)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
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 (B3J0045-BLK4)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
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 (B3J0045-BS1)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Alkalinity, Total (as CaCO3)	120	1.0	mg/L	100		120	80-120			
Alkalinity, Phenolphthalein (as CaCO3)	79.6	1.0	mg/L	50.0		159	0-200			
LCS (B3J0045-BS2)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Alkalinity, Total (as CaCO3)	110	1.0	mg/L	100		110	80-120			
Alkalinity, Phenolphthalein (as CaCO3)	45.0	1.0	mg/L	50.0		90	0-200			
LCS (B3J0045-BS3)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Alkalinity, Total (as CaCO3)	107	1.0	mg/L	100		107	80-120			
Alkalinity, Phenolphthalein (as CaCO3)	53.7	1.0	mg/L	50.0		107	0-200			
LCS (B3J0045-BS4)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Alkalinity, Total (as CaCO3)	110	1.0	mg/L	100		110	80-120			
Alkalinity, Phenolphthalein (as CaCO3)	53.9	1.0	mg/L	50.0		108	0-200			
General Parameters, Batch B3J0051										
Blank (B3J0051-BLK1)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Blank (B3J0051-BLK2)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
LCS (B3J0051-BS1)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Phosphorus, Total (as P)	0.104	0.0050	mg/L	0.100		104	85-115			
LCS (B3J0051-BS2)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Phosphorus, Total (as P)	0.104	0.0050	mg/L	0.100		104	85-115			

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APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3653
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:37

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B3J0057										
Blank (B3J0057-BLK1)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
Blank (B3J0057-BLK2)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
Blank (B3J0057-BLK3)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
Blank (B3J0057-BLK4)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
Blank (B3J0057-BLK5)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
Blank (B3J0057-BLK6)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
LCS (B3J0057-BS1)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	0.992	0.050	mg/L	1.00		99	85-115			
LCS (B3J0057-BS2)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	0.983	0.050	mg/L	1.00		98	85-115			
LCS (B3J0057-BS3)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	0.988	0.050	mg/L	1.00		99	85-115			
LCS (B3J0057-BS4)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	1.00	0.050	mg/L	1.00		100	85-115			
LCS (B3J0057-BS5)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	0.998	0.050	mg/L	1.00		100	85-115			
LCS (B3J0057-BS6)				Prepared: 2023-10-03, Analyzed: 2023-10-03						
Ammonia, Total (as N)	0.988	0.050	mg/L	1.00		99	85-115			
General Parameters, Batch B3J0253										
Blank (B3J0253-BLK1)				Prepared: 2023-10-04, Analyzed: 2023-10-05						
Nitrogen, Total Kjeldahl	< 0.050	0.050	mg/L							
Blank (B3J0253-BLK2)				Prepared: 2023-10-04, Analyzed: 2023-10-05						
Nitrogen, Total Kjeldahl	< 0.050	0.050	mg/L							
LCS (B3J0253-BS1)				Prepared: 2023-10-04, Analyzed: 2023-10-05						
Nitrogen, Total Kjeldahl	1.07	0.050	mg/L	1.00		107	85-115			
LCS (B3J0253-BS2)				Prepared: 2023-10-04, Analyzed: 2023-10-05						
Nitrogen, Total Kjeldahl	1.08	0.050	mg/L	1.00		108	85-115			
General Parameters, Batch B3J0360										
Blank (B3J0360-BLK1)				Prepared: 2023-10-05, Analyzed: 2023-10-05						
Solids, Total Suspended	< 2.0	2.0	mg/L							
LCS (B3J0360-BS1)				Prepared: 2023-10-05, Analyzed: 2023-10-05						
Solids, Total Suspended	98.0	10.2	mg/L	100		98	85-115			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3653
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:37

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B3J0603										
Blank (B3J0603-BLK1)				Prepared: 2023-10-09, Analyzed: 2023-10-09						
Carbon, Total Organic	< 0.50	0.50	mg/L							
Carbon, Dissolved Organic	< 0.50	0.50	mg/L							
Blank (B3J0603-BLK2)				Prepared: 2023-10-09, Analyzed: 2023-10-09						
Carbon, Total Organic	< 0.50	0.50	mg/L							
Carbon, Dissolved Organic	< 0.50	0.50	mg/L							
Blank (B3J0603-BLK3)				Prepared: 2023-10-09, Analyzed: 2023-10-09						
Carbon, Total Organic	< 0.50	0.50	mg/L							
Carbon, Dissolved Organic	< 0.50	0.50	mg/L							
LCS (B3J0603-BS1)				Prepared: 2023-10-09, Analyzed: 2023-10-09						
Carbon, Total Organic	9.24	0.50	mg/L	10.0		92	78-116			
Carbon, Dissolved Organic	9.02	0.50	mg/L	10.0		90	78-116			
LCS (B3J0603-BS2)				Prepared: 2023-10-09, Analyzed: 2023-10-09						
Carbon, Total Organic	9.42	0.50	mg/L	10.0		94	78-116			
Carbon, Dissolved Organic	11.0	0.50	mg/L	10.0		110	78-116			
LCS (B3J0603-BS3)				Prepared: 2023-10-09, Analyzed: 2023-10-09						
Carbon, Total Organic	9.40	0.50	mg/L	10.0		94	78-116			
Carbon, Dissolved Organic	9.09	0.50	mg/L	10.0		91	78-116			
Total Metals, Batch B3J0453										
Blank (B3J0453-BLK1)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
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							
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							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3653
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:37

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B3J0453, Continued										
Blank (B3J0453-BLK1), Continued				Prepared: 2023-10-05, Analyzed: 2023-10-06						
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	< 0.0050	0.0050	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
Zirconium, total	< 0.00010	0.00010	mg/L							
LCS (B3J0453-BS1)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Aluminum, total	3.94	0.0050	mg/L	4.00		98	80-120			
Antimony, total	0.0404	0.00020	mg/L	0.0400		101	80-120			
Arsenic, total	0.406	0.00050	mg/L	0.400		102	80-120			
Barium, total	0.0399	0.0050	mg/L	0.0400		100	80-120			
Beryllium, total	0.0375	0.00010	mg/L	0.0400		94	80-120			
Bismuth, total	0.0403	0.00010	mg/L	0.0400		101	80-120			
Boron, total	0.383	0.0500	mg/L	0.400		96	80-120			
Cadmium, total	0.0397	0.000010	mg/L	0.0400		99	80-120			
Calcium, total	3.75	0.20	mg/L	4.00		94	80-120			
Chromium, total	0.0399	0.00050	mg/L	0.0400		100	80-120			
Cobalt, total	0.0402	0.00010	mg/L	0.0400		101	80-120			
Copper, total	0.0399	0.00040	mg/L	0.0400		100	80-120			
Iron, total	3.99	0.010	mg/L	4.00		100	80-120			
Lead, total	0.0401	0.00020	mg/L	0.0400		100	80-120			
Lithium, total	0.0362	0.00010	mg/L	0.0400		90	80-120			
Magnesium, total	4.04	0.010	mg/L	4.00		101	80-120			
Manganese, total	0.0399	0.00020	mg/L	0.0400		100	80-120			
Molybdenum, total	0.0388	0.00010	mg/L	0.0400		97	80-120			
Nickel, total	0.0400	0.00040	mg/L	0.0400		100	80-120			
Phosphorus, total	4.06	0.050	mg/L	4.00		101	80-120			
Potassium, total	4.04	0.10	mg/L	4.00		101	80-120			
Selenium, total	0.401	0.00050	mg/L	0.400		100	80-120			
Silicon, total	4.2	1.0	mg/L	4.00		105	80-120			
Silver, total	0.0404	0.000050	mg/L	0.0400		101	80-120			
Sodium, total	3.98	0.10	mg/L	4.00		99	80-120			
Strontium, total	0.0404	0.0010	mg/L	0.0400		101	80-120			
Sulfur, total	40.8	3.0	mg/L	40.0		102	80-120			
Tellurium, total	0.0390	0.00050	mg/L	0.0400		98	80-120			
Thallium, total	0.0396	0.000020	mg/L	0.0400		99	80-120			
Thorium, total	0.0414	0.00010	mg/L	0.0400		104	80-120			
Tin, total	0.0406	0.00020	mg/L	0.0400		101	80-120			
Titanium, total	0.0406	0.0050	mg/L	0.0400		102	80-120			
Tungsten, total	0.0404	0.0010	mg/L	0.0400		101	80-120			
Uranium, total	0.0409	0.000020	mg/L	0.0400		102	80-120			
Vanadium, total	0.0397	0.0050	mg/L	0.0400		99	80-120			
Zinc, total	0.399	0.0040	mg/L	0.400		100	80-120			
Zirconium, total	0.0410	0.00010	mg/L	0.0400		102	80-120			
Total Metals, Batch B3J0461										
Blank (B3J0461-BLK1)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, total	< 0.000010	0.000010	mg/L							
Blank (B3J0461-BLK2)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, total	< 0.000010	0.000010	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3653
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:37

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B3J0461, Continued										
LCS (B3J0461-BS1)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, total	0.000240	0.000010	mg/L	0.000250		96	80-120			
LCS (B3J0461-BS2)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, total	0.000226	0.000010	mg/L	0.000250		90	80-120			

QC Qualifiers:

S09 The surrogate recovery for this sample is outside of established control limits Suspected matrix interference , data not affected

CERTIFICATE OF ANALYSIS

REPORTED TO	Elk River Alliance PO Box 2095, 1111 2nd Ave Fernie, BC V0B1M0		
ATTENTION	Kaileigh McCallum	**WORK ORDER**	23J0772
PO NUMBER		**RECEIVED / TEMP**	2023-10-06 09:10 / 16.4°C
PROJECT	CBWM-2023	**REPORTED**	2023-10-18 14:09
PROJECT INFO	[info]	**COC NUMBER**	No Number

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**	23J0772
PROJECT	CBWM-2023	**REPORTED**	2023-10-18 14:09

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
COL001_20231003_0910 (23J0772-01) | Matrix: Water | Sampled: 2023-10-03 09:10						
Anions						
Bromide	< 0.10	N/A	0.10	mg/L	2023-10-08	
Chloride	**0.46**	AO ≤ 250	0.10	mg/L	2023-10-08	
Fluoride	< 0.10	MAC = 1.5	0.10	mg/L	2023-10-08	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2023-10-06	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2023-10-06	
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2023-10-08	HT1
Sulfate	**4.0**	AO ≤ 500	1.0	mg/L	2023-10-08	
BCMOE Aggregate Hydrocarbons						
EPHw10-19	< 250	N/A	250	µg/L	2023-10-11	
EPHw19-32	< 250	N/A	250	µg/L	2023-10-11	
Surrogate: 2-Methylnonane (EPH/F2-4)	*73*		*60-140*	%	*2023-10-11*	
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	**92.1**	N/A	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	**0.152**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Aluminum, dissolved	**0.0065**	N/A	0.0050	mg/L	2023-10-11	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-11	
Arsenic, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-11	
Barium, dissolved	**0.216**	N/A	0.0050	mg/L	2023-10-11	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-11	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-11	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2023-10-11	
Cadmium, dissolved	**0.000029**	N/A	0.000010	mg/L	2023-10-11	
Calcium, dissolved	**27.0**	N/A	0.20	mg/L	2023-10-11	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-11	
Cobalt, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-11	
Copper, dissolved	**0.00064**	N/A	0.00040	mg/L	2023-10-11	
Iron, dissolved	< 0.010	N/A	0.010	mg/L	2023-10-11	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-11	
Lithium, dissolved	**0.0102**	N/A	0.00010	mg/L	2023-10-11	
Magnesium, dissolved	**5.99**	N/A	0.010	mg/L	2023-10-11	
Manganese, dissolved	**0.00113**	N/A	0.00020	mg/L	2023-10-11	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2023-10-14	
Molybdenum, dissolved	**0.00061**	N/A	0.00010	mg/L	2023-10-11	
Nickel, dissolved	< 0.00040	N/A	0.00040	mg/L	2023-10-11	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2023-10-11	
Potassium, dissolved	**0.59**	N/A	0.10	mg/L	2023-10-11	
Selenium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-11	
Silicon, dissolved	**1.5**	N/A	1.0	mg/L	2023-10-11	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2023-10-11	

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0772
PROJECT	CBWM-2023	**REPORTED**	2023-10-18 14:09

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
COL001_20231003_0910 (23J0772-01) | Matrix: Water | Sampled: 2023-10-03 09:10, Continued						
Dissolved Metals, Continued						
Sodium, dissolved	**2.80**	N/A	0.10	mg/L	2023-10-11	
Strontium, dissolved	**0.0936**	N/A	0.0010	mg/L	2023-10-11	
Sulfur, dissolved	< 3.0	N/A	3.0	mg/L	2023-10-11	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-11	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2023-10-11	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-11	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-11	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-11	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2023-10-11	
Uranium, dissolved	**0.000183**	N/A	0.000020	mg/L	2023-10-11	
Vanadium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-11	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2023-10-11	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-11	
General Parameters						
Alkalinity, Total (as CaCO3)	**102**	N/A	1.0	mg/L	2023-10-11	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-11	
Alkalinity, Bicarbonate (as CaCO3)	**102**	N/A	1.0	mg/L	2023-10-11	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-11	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-11	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2023-10-10	
BOD, 5-day	< 6.3	N/A	2.0	mg/L	2023-10-11	
Chemical Oxygen Demand	< 20	N/A	20	mg/L	2023-10-12	
Nitrogen, Total Kjeldahl	**0.152**	N/A	0.050	mg/L	2023-10-14	
Phosphorus, Total (as P)	**0.0168**	N/A	0.0050	mg/L	2023-10-12	
Solids, Total Suspended	< 2.0	N/A	2.0	mg/L	2023-10-14	HT1
Total Metals						
Aluminum, total	**0.0183**	OG < 0.1	0.0050	mg/L	2023-10-11	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2023-10-11	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2023-10-11	
Barium, total	**0.214**	MAC = 2	0.0050	mg/L	2023-10-11	
Beryllium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-11	
Bismuth, total	< 0.00010	N/A	0.00010	mg/L	2023-10-11	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2023-10-11	
Cadmium, total	**0.000033**	MAC = 0.007	0.000010	mg/L	2023-10-11	
Calcium, total	**26.1**	None Required	0.20	mg/L	2023-10-11	
Chromium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2023-10-11	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2023-10-11	
Copper, total	**0.00073**	MAC = 2	0.00040	mg/L	2023-10-11	
Iron, total	**0.017**	AO ≤ 0.3	0.010	mg/L	2023-10-11	
Lead, total	< 0.00020	MAC = 0.005	0.00020	mg/L	2023-10-11	
Lithium, total	**0.00955**	N/A	0.00010	mg/L	2023-10-11	
Magnesium, total	**5.77**	None Required	0.010	mg/L	2023-10-11	

TEST RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0772
PROJECT	CBWM-2023	**REPORTED**	2023-10-18 14:09

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
COL001_20231003_0910 (23J0772-01) | Matrix: Water | Sampled: 2023-10-03 09:10, Continued						
Total Metals, Continued						
Manganese, total	**0.00142**	MAC = 0.12	0.00020	mg/L	2023-10-11	
Mercury, total	< 0.000010	MAC = 0.001	0.000010	mg/L	2023-10-12	
Molybdenum, total	**0.00067**	N/A	0.00010	mg/L	2023-10-11	
Nickel, total	< 0.00040	N/A	0.00040	mg/L	2023-10-11	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2023-10-11	
Potassium, total	**0.58**	N/A	0.10	mg/L	2023-10-11	
Selenium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2023-10-11	
Silicon, total	**1.5**	N/A	1.0	mg/L	2023-10-11	
Silver, total	< 0.000050	None Required	0.000050	mg/L	2023-10-11	
Sodium, total	**2.76**	AO ≤ 200	0.10	mg/L	2023-10-11	
Strontium, total	**0.0912**	MAC = 7	0.0010	mg/L	2023-10-11	
Sulfur, total	< 3.0	N/A	3.0	mg/L	2023-10-11	
Tellurium, total	< 0.00050	N/A	0.00050	mg/L	2023-10-11	
Thallium, total	< 0.000020	N/A	0.000020	mg/L	2023-10-11	
Thorium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-11	
Tin, total	< 0.00020	N/A	0.00020	mg/L	2023-10-11	
Titanium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-11	
Tungsten, total	< 0.0010	N/A	0.0010	mg/L	2023-10-11	
Uranium, total	**0.000194**	MAC = 0.02	0.000020	mg/L	2023-10-11	
Vanadium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-11	
Zinc, total	< 0.0040	AO ≤ 5	0.0040	mg/L	2023-10-11	
Zirconium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-11	
COL003_20231003_1357 (23J0772-02) | Matrix: Water | Sampled: 2023-10-03 13:57						
Anions						
Bromide	< 0.10	N/A	0.10	mg/L	2023-10-08	
Chloride	**0.35**	AO ≤ 250	0.10	mg/L	2023-10-08	
Fluoride	< 0.10	MAC = 1.5	0.10	mg/L	2023-10-08	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2023-10-06	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2023-10-06	
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2023-10-08	HT1
Sulfate	**1.8**	AO ≤ 500	1.0	mg/L	2023-10-08	
BCMOE Aggregate Hydrocarbons						
EPHw10-19	< 250	N/A	250	µg/L	2023-10-11	
EPHw19-32	< 250	N/A	250	µg/L	2023-10-11	
Surrogate: 2-Methylnonane (EPH/F2-4)	*75*		*60-140*	%	*2023-10-11*	
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	**25.2**	N/A	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	**0.228**	N/A	0.0500	mg/L	N/A	

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0772
PROJECT	CBWM-2023	**REPORTED**	2023-10-18 14:09

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
COL003_20231003_1357 (23J0772-02) | Matrix: Water | Sampled: 2023-10-03 13:57, Continued						
Dissolved Metals						
Aluminum, dissolved	**0.0732**	N/A	0.0050	mg/L	2023-10-11	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-11	
Arsenic, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-11	
Barium, dissolved	**0.0490**	N/A	0.0050	mg/L	2023-10-11	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-11	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-11	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2023-10-11	
Cadmium, dissolved	**0.000086**	N/A	0.000010	mg/L	2023-10-13	RE2
Calcium, dissolved	**7.65**	N/A	0.20	mg/L	2023-10-11	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-11	
Cobalt, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-11	
Copper, dissolved	**0.00062**	N/A	0.00040	mg/L	2023-10-11	
Iron, dissolved	**0.024**	N/A	0.010	mg/L	2023-10-11	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-11	
Lithium, dissolved	**0.00015**	N/A	0.00010	mg/L	2023-10-11	
Magnesium, dissolved	**1.47**	N/A	0.010	mg/L	2023-10-11	
Manganese, dissolved	**0.00058**	N/A	0.00020	mg/L	2023-10-11	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2023-10-14	
Molybdenum, dissolved	**0.00014**	N/A	0.00010	mg/L	2023-10-11	
Nickel, dissolved	**0.00059**	N/A	0.00040	mg/L	2023-10-11	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2023-10-11	
Potassium, dissolved	**0.27**	N/A	0.10	mg/L	2023-10-11	
Selenium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-11	
Silicon, dissolved	**1.5**	N/A	1.0	mg/L	2023-10-11	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2023-10-11	
Sodium, dissolved	**0.21**	N/A	0.10	mg/L	2023-10-11	
Strontium, dissolved	**0.0119**	N/A	0.0010	mg/L	2023-10-11	
Sulfur, dissolved	< 3.0	N/A	3.0	mg/L	2023-10-11	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-11	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2023-10-11	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-11	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-11	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-11	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2023-10-11	
Uranium, dissolved	**0.000040**	N/A	0.000020	mg/L	2023-10-11	
Vanadium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-11	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2023-10-11	
Zirconium, dissolved	**0.00030**	N/A	0.00010	mg/L	2023-10-11	
General Parameters						
Alkalinity, Total (as CaCO3)	**25.1**	N/A	1.0	mg/L	2023-10-11	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-11	
Alkalinity, Bicarbonate (as CaCO3)	**25.1**	N/A	1.0	mg/L	2023-10-11	

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
COL003_20231003_1357 (23J0772-02) | Matrix: Water | Sampled: 2023-10-03 13:57, Continued						
General Parameters, Continued						
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-11	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-11	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2023-10-10	
BOD, 5-day	< 6.3	N/A	2.0	mg/L	2023-10-11	
Chemical Oxygen Demand	< 20	N/A	20	mg/L	2023-10-12	
Nitrogen, Total Kjeldahl	**0.228**	N/A	0.050	mg/L	2023-10-14	
Phosphorus, Total (as P)	**0.0163**	N/A	0.0050	mg/L	2023-10-12	
Solids, Total Suspended	< 2.0	N/A	2.0	mg/L	2023-10-14	HT1
Total Metals						
Aluminum, total	**0.0891**	OG < 0.1	0.0050	mg/L	2023-10-12	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2023-10-12	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2023-10-12	
Barium, total	**0.0494**	MAC = 2	0.0050	mg/L	2023-10-12	
Beryllium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-12	
Bismuth, total	< 0.00010	N/A	0.00010	mg/L	2023-10-12	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2023-10-12	
Cadmium, total	**0.000066**	MAC = 0.007	0.000010	mg/L	2023-10-12	
Calcium, total	**7.91**	None Required	0.20	mg/L	2023-10-12	
Chromium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2023-10-12	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2023-10-12	
Copper, total	**0.00063**	MAC = 2	0.00040	mg/L	2023-10-12	
Iron, total	**0.035**	AO ≤ 0.3	0.010	mg/L	2023-10-12	
Lead, total	< 0.00020	MAC = 0.005	0.00020	mg/L	2023-10-12	
Lithium, total	**0.00018**	N/A	0.00010	mg/L	2023-10-12	
Magnesium, total	**1.42**	None Required	0.010	mg/L	2023-10-12	
Manganese, total	**0.00076**	MAC = 0.12	0.00020	mg/L	2023-10-12	
Mercury, total	< 0.000010	MAC = 0.001	0.000010	mg/L	2023-10-12	
Molybdenum, total	**0.00018**	N/A	0.00010	mg/L	2023-10-12	
Nickel, total	**0.00062**	N/A	0.00040	mg/L	2023-10-12	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2023-10-12	
Potassium, total	**0.26**	N/A	0.10	mg/L	2023-10-12	
Selenium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2023-10-12	
Silicon, total	**1.5**	N/A	1.0	mg/L	2023-10-12	
Silver, total	< 0.000050	None Required	0.000050	mg/L	2023-10-12	
Sodium, total	**0.19**	AO ≤ 200	0.10	mg/L	2023-10-12	
Strontium, total	**0.0120**	MAC = 7	0.0010	mg/L	2023-10-12	
Sulfur, total	< 3.0	N/A	3.0	mg/L	2023-10-12	
Tellurium, total	< 0.00050	N/A	0.00050	mg/L	2023-10-12	
Thallium, total	< 0.000020	N/A	0.000020	mg/L	2023-10-12	
Thorium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-12	
Tin, total	< 0.00020	N/A	0.00020	mg/L	2023-10-12	
Titanium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-12	

TEST RESULTS

REPORTED TO	Elk River Alliance	WORK ORDER	23J0772
PROJECT	CBWM-2023	REPORTED	2023-10-18 14:09

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
COL003_20231003_1357 (23J0772-02) | Matrix: Water | Sampled: 2023-10-03 13:57, Continued						
Total Metals, Continued						
Tungsten, total	< 0.0010	N/A	0.0010	mg/L	2023-10-12	
Uranium, total	**0.000042**	MAC = 0.02	0.000020	mg/L	2023-10-12	
Vanadium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-12	
Zinc, total	< 0.0040	AO ≤ 5	0.0040	mg/L	2023-10-12	
Zirconium, total	**0.00030**	N/A	0.00010	mg/L	2023-10-12	

Sample Qualifiers:

HT1	The sample was prepared and/or analyzed past the recommended holding time.
RE2	Result was confirmed by re-analysis prior to reporting.

CARO ANALYTICAL SERVICES

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0772
PROJECT	CBWM-2023	**REPORTED**	2023-10-18 14:09

Analysis Description	Method Ref.	Technique	Accredited	Location
Alkalinity in Water	SM 2320 B* (2021)	Titration with H2SO4	✓	Kelowna
Ammonia, Total in Water	SM 4500-NH3 G* (2021)	Automated Colorimetry (Phenate)	✓	Kelowna
Anions in Water	SM 4110 B (2020)	Ion Chromatography	✓	Kelowna
Biochemical Oxygen Demand in Water	SM 5210 B (2019)	Dissolved Oxygen Meter	✓	Kelowna
Chemical Oxygen Demand in Water	SM 5220 D* (2022)	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
EPH in Water	EPA 3511* / BCMOE EPHw	Hexane MicroExtraction (Base/Neutral) / Gas Chromatography (GC-FID)	✓	Richmond
Hardness in Water	SM 2340 B (2021)	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* (2021)	Block Digestion and Flow Injection Analysis	✓	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2021)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Solids, Total Suspended in Water	Solids in Water, Filtered / SM 2540 D* (2020)	Solids in Water, Filtered / 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)
µg/L	Micrograms per litre
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, September 2022)

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**	23J0772
PROJECT	CBWM-2023	**REPORTED**	2023-10-18 14:09

General Comments:

The results in this report apply to the received 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. Caro will dispose of all samples within 30 days of sample receipt, unless otherwise agreed.

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**	23J0772
PROJECT	CBWM-2023	**REPORTED**	2023-10-18 14:09

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 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 B3J0541										
Blank (B3J0541-BLK1)				Prepared: 2023-10-06, Analyzed: 2023-10-06						
Bromide	< 0.10	0.10	mg/L							
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 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 (B3J0541-BLK2)				Prepared: 2023-10-08, Analyzed: 2023-10-08						
Bromide	< 0.10	0.10	mg/L							
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 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 (B3J0541-BLK3)				Prepared: 2023-10-08, Analyzed: 2023-10-08						
Bromide	< 0.10	0.10	mg/L							
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 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 (B3J0541-BS1)				Prepared: 2023-10-06, Analyzed: 2023-10-06						
Bromide	3.91	0.10	mg/L	4.00		98	85-115			
Chloride	16.3	0.10	mg/L	16.0		102	90-110			
Fluoride	4.02	0.10	mg/L	4.00		100	88-108			
Nitrate (as N)	3.88	0.010	mg/L	4.00		97	90-110			
Nitrite (as N)	2.00	0.010	mg/L	2.00		100	85-115			
Phosphate (as P)	1.08	0.0050	mg/L	1.00		108	80-120			
Sulfate	16.1	1.0	mg/L	16.0		101	90-110			
LCS (B3J0541-BS2)				Prepared: 2023-10-08, Analyzed: 2023-10-08						
Bromide	3.54	0.10	mg/L	4.00		88	85-115			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0772
PROJECT	CBWM-2023	**REPORTED**	2023-10-18 14:09

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B3J0541, Continued										
LCS (B3J0541-BS2), Continued				Prepared: 2023-10-08, Analyzed: 2023-10-08						
Chloride	15.7	0.10	mg/L	16.0		98	90-110			
Fluoride	3.95	0.10	mg/L	4.00		99	88-108			
Nitrate (as N)	3.63	0.010	mg/L	4.00		91	90-110			
Nitrite (as N)	1.99	0.010	mg/L	2.00		100	85-115			
Phosphate (as P)	0.859	0.0050	mg/L	1.00		86	80-120			
Sulfate	15.4	1.0	mg/L	16.0		96	90-110			
LCS (B3J0541-BS3)				Prepared: 2023-10-08, Analyzed: 2023-10-08						
Bromide	3.54	0.10	mg/L	4.00		88	85-115			
Chloride	15.7	0.10	mg/L	16.0		98	90-110			
Fluoride	3.95	0.10	mg/L	4.00		99	88-108			
Nitrate (as N)	3.63	0.010	mg/L	4.00		91	90-110			
Nitrite (as N)	1.99	0.010	mg/L	2.00		100	85-115			
Phosphate (as P)	0.859	0.0050	mg/L	1.00		86	80-120			
Sulfate	15.4	1.0	mg/L	16.0		96	90-110			
Duplicate (B3J0541-DUP3)	**Source: 23J0772-02**			Prepared: 2023-10-08, Analyzed: 2023-10-08						
Bromide	< 0.10	0.10	mg/L		< 0.10				10	
Chloride	0.35	0.10	mg/L		0.35				10	
Fluoride	< 0.10	0.10	mg/L		< 0.10				10	
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	
Sulfate	1.8	1.0	mg/L		1.8				10	
Matrix Spike (B3J0541-MS3)	**Source: 23J0772-02**			Prepared: 2023-10-08, Analyzed: 2023-10-08						
Bromide	3.66	0.10	mg/L	4.00	< 0.10	92	80-120			
Chloride	17.3	0.10	mg/L	16.0	0.35	106	75-125			
Fluoride	4.15	0.10	mg/L	4.00	< 0.10	103	75-125			
Nitrate (as N)	3.70	0.010	mg/L	4.00	< 0.010	93	75-125			
Nitrite (as N)	2.05	0.010	mg/L	2.00	< 0.010	102	80-120			
Phosphate (as P)	0.742	0.0050	mg/L	1.00	< 0.0050	74	70-130			
Sulfate	18.2	1.0	mg/L	16.0	1.8	102	75-125			
BCMOE Aggregate Hydrocarbons, Batch B3J0831										
Blank (B3J0831-BLK1)				Prepared: 2023-10-10, Analyzed: 2023-10-11						
EPHw10-19	< 250	250	µg/L							
EPHw19-32	< 250	250	µg/L							
Surrogate: 2-Methylnonane (EPH/F2-4)	*1730*		*µg/L*	2200		*78*	*60-140*			
LCS (B3J0831-BS2)				Prepared: 2023-10-10, Analyzed: 2023-10-11						
EPHw10-19	16800	250	µg/L	15400		109	70-130			
EPHw19-32	19600	250	µg/L	22200		88	70-130			
Surrogate: 2-Methylnonane (EPH/F2-4)	*1360*		*µg/L*	2200		*61*	*60-140*			
LCS Dup (B3J0831-BSD2)				Prepared: 2023-10-10, Analyzed: 2023-10-11						
EPHw10-19	17000	250	µg/L	15400		110	70-130	1	20	
EPHw19-32	19700	250	µg/L	22200		89	70-130	< 1	20	
Surrogate: 2-Methylnonane (EPH/F2-4)	*1530*		*µg/L*	2200		*69*	*60-140*			
Dissolved Metals, Batch B3J0799										
Blank (B3J0799-BLK1)				Prepared: 2023-10-11, Analyzed: 2023-10-11						
Aluminum, dissolved	< 0.0050	0.0050	mg/L							
Antimony, dissolved	< 0.00020	0.00020	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	WORK ORDER	23J0772
PROJECT	CBWM-2023	REPORTED	2023-10-18 14:09

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B3J0799, Continued										
Blank (B3J0799-BLK1), Continued				Prepared: 2023-10-11, Analyzed: 2023-10-11						
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							
Lithium, dissolved	< 0.00010	0.00010	mg/L							
Magnesium, dissolved	< 0.010	0.010	mg/L							
Manganese, dissolved	< 0.00020	0.00020	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	< 0.0050	0.0050	mg/L							
Zinc, dissolved	< 0.0040	0.0040	mg/L							
Zirconium, dissolved	< 0.00010	0.00010	mg/L							
LCS (B3J0799-BS1)				Prepared: 2023-10-11, Analyzed: 2023-10-11						
Aluminum, dissolved	4.00	0.0050	mg/L	4.00		100	80-120			
Antimony, dissolved	0.0397	0.00020	mg/L	0.0400		99	80-120			
Arsenic, dissolved	0.402	0.00050	mg/L	0.400		101	80-120			
Barium, dissolved	0.0391	0.0050	mg/L	0.0400		98	80-120			
Beryllium, dissolved	0.0403	0.00010	mg/L	0.0400		101	80-120			
Bismuth, dissolved	0.0402	0.00010	mg/L	0.0400		101	80-120			
Boron, dissolved	0.391	0.0500	mg/L	0.400		98	80-120			
Cadmium, dissolved	0.0391	0.000010	mg/L	0.0400		98	80-120			
Calcium, dissolved	3.85	0.20	mg/L	4.00		96	80-120			
Chromium, dissolved	0.0399	0.00050	mg/L	0.0400		100	80-120			
Cobalt, dissolved	0.0400	0.00010	mg/L	0.0400		100	80-120			
Copper, dissolved	0.0403	0.00040	mg/L	0.0400		101	80-120			
Iron, dissolved	3.98	0.010	mg/L	4.00		99	80-120			
Lead, dissolved	0.0403	0.00020	mg/L	0.0400		101	80-120			
Lithium, dissolved	0.0402	0.00010	mg/L	0.0400		101	80-120			
Magnesium, dissolved	4.11	0.010	mg/L	4.00		103	80-120			
Manganese, dissolved	0.0402	0.00020	mg/L	0.0400		100	80-120			
Molybdenum, dissolved	0.0381	0.00010	mg/L	0.0400		95	80-120			
Nickel, dissolved	0.0402	0.00040	mg/L	0.0400		101	80-120			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0772
PROJECT	CBWM-2023	**REPORTED**	2023-10-18 14:09

Dissolved Metals, Batch B3J0799, Continued

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
LCS (B3J0799-BS1), Continued				Prepared: 2023-10-11, Analyzed: 2023-10-11						
Phosphorus, dissolved	3.96	0.050	mg/L	4.00		99	80-120			
Potassium, dissolved	3.97	0.10	mg/L	4.00		99	80-120			
Selenium, dissolved	0.399	0.00050	mg/L	0.400		100	80-120			
Silicon, dissolved	4.1	1.0	mg/L	4.00		103	80-120			
Silver, dissolved	0.0378	0.000050	mg/L	0.0400		95	80-120			
Sodium, dissolved	4.06	0.10	mg/L	4.00		101	80-120			
Strontium, dissolved	0.0402	0.0010	mg/L	0.0400		100	80-120			
Sulfur, dissolved	38.6	3.0	mg/L	40.0		97	80-120			
Tellurium, dissolved	0.0391	0.00050	mg/L	0.0400		98	80-120			
Thallium, dissolved	0.0390	0.000020	mg/L	0.0400		98	80-120			
Thorium, dissolved	0.0400	0.00010	mg/L	0.0400		100	80-120			
Tin, dissolved	0.0397	0.00020	mg/L	0.0400		99	80-120			
Titanium, dissolved	0.0408	0.0050	mg/L	0.0400		102	80-120			
Tungsten, dissolved	0.0403	0.0010	mg/L	0.0400		101	80-120			
Uranium, dissolved	0.0397	0.000020	mg/L	0.0400		99	80-120			
Vanadium, dissolved	0.0388	0.0050	mg/L	0.0400		97	80-120			
Zinc, dissolved	0.400	0.0040	mg/L	0.400		100	80-120			
Zirconium, dissolved	0.0401	0.00010	mg/L	0.0400		100	80-120			
Matrix Spike (B3J0799-MS1)	**Source: 23J0772-02**			Prepared: 2023-10-11, Analyzed: 2023-10-11						
Aluminum, dissolved	3.93	0.0050	mg/L	4.00	0.0732	96	70-130			
Antimony, dissolved	0.0383	0.00020	mg/L	0.0400	< 0.00020	96	70-130			
Arsenic, dissolved	0.411	0.00050	mg/L	0.400	< 0.00050	103	70-130			
Barium, dissolved	0.0916	0.0050	mg/L	0.0400	0.0490	106	70-130			
Beryllium, dissolved	0.0395	0.00010	mg/L	0.0400	< 0.00010	99	70-130			
Bismuth, dissolved	0.0340	0.00010	mg/L	0.0400	< 0.00010	85	70-130			
Boron, dissolved	0.379	0.0500	mg/L	0.400	< 0.0500	94	70-130			
Cadmium, dissolved	0.0417	0.000010	mg/L	0.0400	0.000086	104	70-130			
Calcium, dissolved	11.4	0.20	mg/L	4.00	7.65	94	70-130			
Chromium, dissolved	0.0398	0.00050	mg/L	0.0400	< 0.00050	99	70-130			
Cobalt, dissolved	0.0401	0.00010	mg/L	0.0400	< 0.00010	100	70-130			
Copper, dissolved	0.0411	0.00040	mg/L	0.0400	0.00062	101	70-130			
Iron, dissolved	4.01	0.010	mg/L	4.00	0.024	100	70-130			
Lead, dissolved	0.0420	0.00020	mg/L	0.0400	< 0.00020	105	70-130			
Lithium, dissolved	0.0395	0.00010	mg/L	0.0400	0.00015	98	70-130			
Magnesium, dissolved	5.41	0.010	mg/L	4.00	1.47	98	70-130			
Manganese, dissolved	0.0411	0.00020	mg/L	0.0400	0.00058	101	70-130			
Molybdenum, dissolved	0.0382	0.00010	mg/L	0.0400	0.00014	95	70-130			
Nickel, dissolved	0.0399	0.00040	mg/L	0.0400	0.00059	98	70-130			
Phosphorus, dissolved	3.92	0.050	mg/L	4.00	< 0.050	98	70-130			
Potassium, dissolved	4.29	0.10	mg/L	4.00	0.27	100	70-130			
Selenium, dissolved	0.412	0.00050	mg/L	0.400	< 0.00050	103	70-130			
Silicon, dissolved	5.5	1.0	mg/L	4.00	1.5	100	70-130			
Silver, dissolved	0.0327	0.000050	mg/L	0.0400	< 0.000050	82	70-130			
Sodium, dissolved	4.22	0.10	mg/L	4.00	0.21	100	70-130			
Strontium, dissolved	0.0523	0.0010	mg/L	0.0400	0.0119	101	70-130			
Sulfur, dissolved	38.9	3.0	mg/L	40.0	< 3.0	97	70-130			
Tellurium, dissolved	0.0413	0.00050	mg/L	0.0400	< 0.00050	103	70-130			
Thallium, dissolved	0.0412	0.000020	mg/L	0.0400	< 0.000020	103	70-130			
Thorium, dissolved	0.0411	0.00010	mg/L	0.0400	< 0.00010	103	70-130			
Tin, dissolved	0.0416	0.00020	mg/L	0.0400	< 0.00020	104	70-130			
Titanium, dissolved	0.0419	0.0050	mg/L	0.0400	< 0.0050	102	70-130			
Tungsten, dissolved	0.0413	0.0010	mg/L	0.0400	< 0.0010	103	70-130			
Uranium, dissolved	0.0408	0.000020	mg/L	0.0400	0.000040	102	70-130			
Vanadium, dissolved	0.0397	0.0050	mg/L	0.0400	< 0.0050	99	70-130			
Zinc, dissolved	0.427	0.0040	mg/L	0.400	< 0.0040	106	70-130			

CARO ANALYTICAL SERVICES

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0772
PROJECT	CBWM-2023	**REPORTED**	2023-10-18 14:09

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B3J0799, Continued										
Matrix Spike (B3J0799-MS1), Continued	**Source: 23J0772-02**			Prepared: 2023-10-11, Analyzed: 2023-10-11						
Zirconium, dissolved	0.0434	0.00010	mg/L	0.0400	0.00030	108	70-130			
Dissolved Metals, Batch B3J1084										
Blank (B3J1084-BLK1)				Prepared: 2023-10-12, Analyzed: 2023-10-14						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Blank (B3J1084-BLK2)				Prepared: 2023-10-12, Analyzed: 2023-10-14						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Blank (B3J1084-BLK3)				Prepared: 2023-10-12, Analyzed: 2023-10-14						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Blank (B3J1084-BLK4)				Prepared: 2023-10-12, Analyzed: 2023-10-14						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Blank (B3J1084-BLK5)				Prepared: 2023-10-12, Analyzed: 2023-10-14						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
LCS (B3J1084-BS1)				Prepared: 2023-10-12, Analyzed: 2023-10-14						
Mercury, dissolved	0.000237	0.000010	mg/L	0.000250		95	80-120			
LCS (B3J1084-BS2)				Prepared: 2023-10-12, Analyzed: 2023-10-14						
Mercury, dissolved	0.000229	0.000010	mg/L	0.000250		91	80-120			
LCS (B3J1084-BS3)				Prepared: 2023-10-12, Analyzed: 2023-10-14						
Mercury, dissolved	0.000245	0.000010	mg/L	0.000250		98	80-120			
LCS (B3J1084-BS4)				Prepared: 2023-10-12, Analyzed: 2023-10-14						
Mercury, dissolved	0.000251	0.000010	mg/L	0.000250		101	80-120			
LCS (B3J1084-BS5)				Prepared: 2023-10-12, Analyzed: 2023-10-15						
Mercury, dissolved	0.000229	0.000010	mg/L	0.000250		92	80-120			
Duplicate (B3J1084-DUP2)	**Source: 23J0772-01**			Prepared: 2023-10-12, Analyzed: 2023-10-14						
Mercury, dissolved	< 0.000010	0.000010	mg/L		< 0.000010				20	
Matrix Spike (B3J1084-MS2)	**Source: 23J0772-02**			Prepared: 2023-10-12, Analyzed: 2023-10-15						
Mercury, dissolved	0.000197	0.000010	mg/L	0.000250	< 0.000010	77	70-130			
General Parameters, Batch B3J0533										
Blank (B3J0533-BLK1)				Prepared: 2023-10-06, Analyzed: 2023-10-11						
BOD, 5-day	< 2.0	2.0	mg/L							
LCS (B3J0533-BS1)				Prepared: 2023-10-06, Analyzed: 2023-10-11						
BOD, 5-day	213	52.6	mg/L	198		108	85-115			
General Parameters, Batch B3J0735										
Blank (B3J0735-BLK1)				Prepared: 2023-10-10, Analyzed: 2023-10-10						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
Blank (B3J0735-BLK2)				Prepared: 2023-10-10, Analyzed: 2023-10-10						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0772
PROJECT	CBWM-2023	**REPORTED**	2023-10-18 14:09

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B3J0735, Continued										
Blank (B3J0735-BLK3)				Prepared: 2023-10-10, Analyzed: 2023-10-10						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
LCS (B3J0735-BS1)				Prepared: 2023-10-10, Analyzed: 2023-10-10						
Ammonia, Total (as N)	1.07	0.050	mg/L	1.00		107	85-115			
LCS (B3J0735-BS2)				Prepared: 2023-10-10, Analyzed: 2023-10-10						
Ammonia, Total (as N)	1.11	0.050	mg/L	1.00		111	85-115			
LCS (B3J0735-BS3)				Prepared: 2023-10-10, Analyzed: 2023-10-10						
Ammonia, Total (as N)	1.04	0.050	mg/L	1.00		104	85-115			
General Parameters, Batch B3J0863										
Blank (B3J0863-BLK1)				Prepared: 2023-10-11, Analyzed: 2023-10-11						
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 (B3J0863-BLK2)				Prepared: 2023-10-11, Analyzed: 2023-10-11						
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 (B3J0863-BS1)				Prepared: 2023-10-11, Analyzed: 2023-10-11						
Alkalinity, Total (as CaCO3)	107	1.0	mg/L	100		107	80-120			
Alkalinity, Phenolphthalein (as CaCO3)	48.3	1.0	mg/L	50.0		97	0-200			
LCS (B3J0863-BS2)				Prepared: 2023-10-11, Analyzed: 2023-10-11						
Alkalinity, Total (as CaCO3)	107	1.0	mg/L	100		107	80-120			
Alkalinity, Phenolphthalein (as CaCO3)	43.5	1.0	mg/L	50.0		87	0-200			
General Parameters, Batch B3J0991										
Blank (B3J0991-BLK1)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Blank (B3J0991-BLK2)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Blank (B3J0991-BLK3)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Blank (B3J0991-BLK4)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Blank (B3J0991-BLK5)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
LCS (B3J0991-BS1)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	0.101	0.0050	mg/L	0.100		101	85-115			
LCS (B3J0991-BS2)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	0.101	0.0050	mg/L	0.100		101	85-115			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0772
PROJECT	CBWM-2023	**REPORTED**	2023-10-18 14:09

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B3J0991, Continued										
LCS (B3J0991-BS3)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	0.103	0.0050	mg/L	0.100		103	85-115			
LCS (B3J0991-BS4)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	0.102	0.0050	mg/L	0.100		102	85-115			
LCS (B3J0991-BS5)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	0.104	0.0050	mg/L	0.100		104	85-115			
General Parameters, Batch B3J1025										
Blank (B3J1025-BLK1)				Prepared: 2023-10-12, Analyzed: 2023-10-12						
Chemical Oxygen Demand	< 20	20	mg/L							
LCS (B3J1025-BS1)				Prepared: 2023-10-12, Analyzed: 2023-10-12						
Chemical Oxygen Demand	527	20	mg/L	500		105	89-115			
General Parameters, Batch B3J1200										
Blank (B3J1200-BLK2)				Prepared: 2023-10-13, Analyzed: 2023-10-14						
Nitrogen, Total Kjeldahl	< 0.050	0.050	mg/L							
LCS (B3J1200-BS2)				Prepared: 2023-10-13, Analyzed: 2023-10-14						
Nitrogen, Total Kjeldahl	0.986	0.050	mg/L	1.00		99	85-115			
General Parameters, Batch B3J1287										
Blank (B3J1287-BLK1)				Prepared: 2023-10-14, Analyzed: 2023-10-14						
Solids, Total Suspended	< 2.0	2.0	mg/L							
LCS (B3J1287-BS1)				Prepared: 2023-10-14, Analyzed: 2023-10-14						
Solids, Total Suspended	115	10.0	mg/L	100		115	85-115			
Total Metals, Batch B3J0840										
Blank (B3J0840-BLK1)				Prepared: 2023-10-10, Analyzed: 2023-10-11						
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							
Molybdenum, total	< 0.00010	0.00010	mg/L							
Nickel, total	< 0.00040	0.00040	mg/L							
Phosphorus, total	< 0.050	0.050	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0772
PROJECT	CBWM-2023	**REPORTED**	2023-10-18 14:09

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B3J0840, Continued										
Blank (B3J0840-BLK1), Continued				Prepared: 2023-10-10, Analyzed: 2023-10-11						
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	0.000061	0.000050	mg/L							BLK
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	< 0.0050	0.0050	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
Zirconium, total	< 0.00010	0.00010	mg/L							
LCS (B3J0840-BS1)				Prepared: 2023-10-10, Analyzed: 2023-10-12						
Aluminum, total	3.80	0.0050	mg/L	4.00		95	80-120			
Antimony, total	0.0390	0.00020	mg/L	0.0400		97	80-120			
Arsenic, total	0.399	0.00050	mg/L	0.400		100	80-120			
Barium, total	0.0399	0.0050	mg/L	0.0400		100	80-120			
Beryllium, total	0.0386	0.00010	mg/L	0.0400		97	80-120			
Bismuth, total	0.0384	0.00010	mg/L	0.0400		96	80-120			
Boron, total	0.398	0.0500	mg/L	0.400		99	80-120			
Cadmium, total	0.0389	0.000010	mg/L	0.0400		97	80-120			
Calcium, total	4.26	0.20	mg/L	4.00		106	80-120			
Chromium, total	0.0394	0.00050	mg/L	0.0400		98	80-120			
Cobalt, total	0.0399	0.00010	mg/L	0.0400		100	80-120			
Copper, total	0.0399	0.00040	mg/L	0.0400		100	80-120			
Iron, total	3.95	0.010	mg/L	4.00		99	80-120			
Lead, total	0.0389	0.00020	mg/L	0.0400		97	80-120			
Lithium, total	0.0359	0.00010	mg/L	0.0400		90	80-120			
Magnesium, total	3.92	0.010	mg/L	4.00		98	80-120			
Manganese, total	0.0401	0.00020	mg/L	0.0400		100	80-120			
Molybdenum, total	0.0393	0.00010	mg/L	0.0400		98	80-120			
Nickel, total	0.0400	0.00040	mg/L	0.0400		100	80-120			
Phosphorus, total	3.90	0.050	mg/L	4.00		98	80-120			
Potassium, total	3.87	0.10	mg/L	4.00		97	80-120			
Selenium, total	0.402	0.00050	mg/L	0.400		100	80-120			
Silicon, total	4.1	1.0	mg/L	4.00		102	80-120			
Silver, total	0.0384	0.000050	mg/L	0.0400		96	80-120			
Sodium, total	3.88	0.10	mg/L	4.00		97	80-120			
Strontium, total	0.0405	0.0010	mg/L	0.0400		101	80-120			
Sulfur, total	41.5	3.0	mg/L	40.0		104	80-120			
Tellurium, total	0.0384	0.00050	mg/L	0.0400		96	80-120			
Thallium, total	0.0387	0.000020	mg/L	0.0400		97	80-120			
Thorium, total	0.0384	0.00010	mg/L	0.0400		96	80-120			
Tin, total	0.0396	0.00020	mg/L	0.0400		99	80-120			
Titanium, total	0.0436	0.0050	mg/L	0.0400		109	80-120			
Tungsten, total	0.0399	0.0010	mg/L	0.0400		100	80-120			
Uranium, total	0.0389	0.000020	mg/L	0.0400		97	80-120			
Vanadium, total	0.0390	0.0050	mg/L	0.0400		97	80-120			
Zinc, total	0.391	0.0040	mg/L	0.400		98	80-120			
Zirconium, total	0.0407	0.00010	mg/L	0.0400		102	80-120			

CARO ANALYTICAL SERVICES

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0772
PROJECT	CBWM-2023	**REPORTED**	2023-10-18 14:09

Total Metals, Batch B3J0842

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Blank (B3J0842-BLK1)				Prepared: 2023-10-10, Analyzed: 2023-10-11						
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							
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	< 0.0050	0.0050	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
Zirconium, total	< 0.00010	0.00010	mg/L							
LCS (B3J0842-BS1)				Prepared: 2023-10-10, Analyzed: 2023-10-11						
Aluminum, total	3.94	0.0050	mg/L	4.00		98	80-120			
Antimony, total	0.0393	0.00020	mg/L	0.0400		98	80-120			
Arsenic, total	0.396	0.00050	mg/L	0.400		99	80-120			
Barium, total	0.0389	0.0050	mg/L	0.0400		97	80-120			
Beryllium, total	0.0372	0.00010	mg/L	0.0400		93	80-120			
Bismuth, total	0.0385	0.00010	mg/L	0.0400		96	80-120			
Boron, total	0.378	0.0500	mg/L	0.400		95	80-120			
Cadmium, total	0.0394	0.000010	mg/L	0.0400		98	80-120			
Calcium, total	3.80	0.20	mg/L	4.00		95	80-120			
Chromium, total	0.0409	0.00050	mg/L	0.0400		102	80-120			
Cobalt, total	0.0406	0.00010	mg/L	0.0400		102	80-120			
Copper, total	0.0408	0.00040	mg/L	0.0400		102	80-120			
Iron, total	4.05	0.010	mg/L	4.00		101	80-120			
Lead, total	0.0385	0.00020	mg/L	0.0400		96	80-120			
Lithium, total	0.0363	0.00010	mg/L	0.0400		91	80-120			
Magnesium, total	3.87	0.010	mg/L	4.00		97	80-120			
Manganese, total	0.0404	0.00020	mg/L	0.0400		101	80-120			

CARO ANALYTICAL SERVICES

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0772
PROJECT	CBWM-2023	**REPORTED**	2023-10-18 14:09

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B3J0842, Continued										
LCS (B3J0842-BS1), Continued				Prepared: 2023-10-10, Analyzed: 2023-10-11						
Molybdenum, total	0.0386	0.00010	mg/L	0.0400		97	80-120			
Nickel, total	0.0406	0.00040	mg/L	0.0400		101	80-120			
Phosphorus, total	3.87	0.050	mg/L	4.00		97	80-120			
Potassium, total	3.90	0.10	mg/L	4.00		97	80-120			
Selenium, total	0.397	0.00050	mg/L	0.400		99	80-120			
Silicon, total	4.1	1.0	mg/L	4.00		102	80-120			
Silver, total	0.0388	0.000050	mg/L	0.0400		97	80-120			
Sodium, total	4.13	0.10	mg/L	4.00		103	80-120			
Strontium, total	0.0399	0.0010	mg/L	0.0400		100	80-120			
Sulfur, total	38.8	3.0	mg/L	40.0		97	80-120			
Tellurium, total	0.0374	0.00050	mg/L	0.0400		93	80-120			
Thallium, total	0.0393	0.000020	mg/L	0.0400		98	80-120			
Thorium, total	0.0395	0.00010	mg/L	0.0400		99	80-120			
Tin, total	0.0395	0.00020	mg/L	0.0400		99	80-120			
Titanium, total	0.0398	0.0050	mg/L	0.0400		100	80-120			
Tungsten, total	0.0402	0.0010	mg/L	0.0400		101	80-120			
Uranium, total	0.0396	0.000020	mg/L	0.0400		99	80-120			
Vanadium, total	0.0409	0.0050	mg/L	0.0400		102	80-120			
Zinc, total	0.394	0.0040	mg/L	0.400		99	80-120			
Zirconium, total	0.0404	0.00010	mg/L	0.0400		101	80-120			
Total Metals, Batch B3J0947										
Blank (B3J0947-BLK1)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Mercury, total	< 0.000010	0.000010	mg/L							
Blank (B3J0947-BLK2)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Mercury, total	< 0.000010	0.000010	mg/L							
Blank (B3J0947-BLK3)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Mercury, total	< 0.000010	0.000010	mg/L							
LCS (B3J0947-BS1)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Mercury, total	0.000247	0.000010	mg/L	0.000250		99	80-120			
LCS (B3J0947-BS2)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Mercury, total	0.000235	0.000010	mg/L	0.000250		94	80-120			
LCS (B3J0947-BS3)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Mercury, total	0.000224	0.000010	mg/L	0.000250		89	80-120			

QC Qualifiers:

BLK Analyte concentration in the Method Blank is above the Reporting Limit (RL).

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

REPORTED TO	Elk River Alliance PO Box 2095, 1111 2nd Ave Fernie, BC V0B1M0		
ATTENTION	Kaileigh McCallum	**WORK ORDER**	23J0884
PO NUMBER		**RECEIVED / TEMP**	2023-10-06 14:30 / 11.5°C
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 09:51
PROJECT INFO	[info]	**COC NUMBER**	No Number

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.

By engaging our services, you are agreeing to CARO Analytical Service's Standard Terms and Conditions outlined here: https://www.caro.ca/terms-conditions

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

Authorized By:

Team CARO
Client Service Representative

TEST RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0884
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 09:51

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
L12001_20231004_0900 (23J0884-01) | Matrix: Water | Sampled: 2023-10-04 09:00						
Anions						
Bromide	< 0.10	N/A	0.10	mg/L	2023-10-10	
Chloride	**0.26**	AO ≤ 250	0.10	mg/L	2023-10-10	
Fluoride	< 0.10	MAC = 1.5	0.10	mg/L	2023-10-10	
Nitrate (as N)	**0.019**	MAC = 10	0.010	mg/L	2023-10-10	HT1
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2023-10-10	HT1
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2023-10-10	HT1
Sulfate	**223**	AO ≤ 500	1.0	mg/L	2023-10-10	
BCMOE Aggregate Hydrocarbons						
EPHw10-19	< 250	N/A	250	µg/L	2023-10-11	
EPHw19-32	< 250	N/A	250	µg/L	2023-10-11	
Surrogate: 2-Methylnonane (EPH/F2-4)	*73*		*60-140*	%	*2023-10-11*	
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	**381**	N/A	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	**0.0187**	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	**0.0767**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Aluminum, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-12	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-12	
Arsenic, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-12	
Barium, dissolved	**0.0852**	N/A	0.0050	mg/L	2023-10-12	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-12	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-12	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2023-10-12	
Cadmium, dissolved	**0.000016**	N/A	0.000010	mg/L	2023-10-12	
Calcium, dissolved	**107**	N/A	0.20	mg/L	2023-10-12	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-12	
Cobalt, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-12	
Copper, dissolved	< 0.00040	N/A	0.00040	mg/L	2023-10-12	
Iron, dissolved	< 0.010	N/A	0.010	mg/L	2023-10-12	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-12	
Lithium, dissolved	**0.00482**	N/A	0.00010	mg/L	2023-10-12	
Magnesium, dissolved	**27.4**	N/A	0.010	mg/L	2023-10-12	
Manganese, dissolved	**0.00129**	N/A	0.00020	mg/L	2023-10-12	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2023-10-12	
Molybdenum, dissolved	**0.00165**	N/A	0.00010	mg/L	2023-10-12	
Nickel, dissolved	< 0.00040	N/A	0.00040	mg/L	2023-10-12	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2023-10-12	
Potassium, dissolved	**0.45**	N/A	0.10	mg/L	2023-10-12	
Selenium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-12	
Silicon, dissolved	**2.8**	N/A	1.0	mg/L	2023-10-12	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2023-10-12	

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
L12001_20231004_0900 (23J0884-01) | Matrix: Water | Sampled: 2023-10-04 09:00, Continued						
Dissolved Metals, Continued						
Sodium, dissolved	**1.99**	N/A	0.10	mg/L	2023-10-12	
Strontium, dissolved	**1.88**	N/A	0.0010	mg/L	2023-10-12	
Sulfur, dissolved	**79.2**	N/A	3.0	mg/L	2023-10-12	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-12	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2023-10-12	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-12	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-12	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-12	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2023-10-12	
Uranium, dissolved	**0.000389**	N/A	0.000020	mg/L	2023-10-12	
Vanadium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-12	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2023-10-12	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-12	
General Parameters						
Alkalinity, Total (as CaCO3)	**178**	N/A	1.0	mg/L	2023-10-11	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-11	
Alkalinity, Bicarbonate (as CaCO3)	**178**	N/A	1.0	mg/L	2023-10-11	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-11	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-11	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2023-10-10	
BOD, 5-day	< 7.0	N/A	2.0	mg/L	2023-10-12	
Carbon, Total Organic	**1.89**	N/A	0.50	mg/L	2023-10-16	
Carbon, Dissolved Organic	**1.81**	N/A	0.50	mg/L	2023-10-16	
Chemical Oxygen Demand	< 20	N/A	20	mg/L	2023-10-12	
Nitrogen, Total Kjeldahl	**0.058**	N/A	0.050	mg/L	2023-10-14	
Phosphorus, Total (as P)	**0.0107**	N/A	0.0050	mg/L	2023-10-12	
Solids, Total Suspended	**11.4**	N/A	2.0	mg/L	2023-10-11	
Total Metals						
Aluminum, total	**0.0236**	OG < 0.1	0.0050	mg/L	2023-10-13	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2023-10-13	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2023-10-13	
Barium, total	**0.0796**	MAC = 2	0.0050	mg/L	2023-10-13	
Beryllium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-13	
Bismuth, total	< 0.00010	N/A	0.00010	mg/L	2023-10-13	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2023-10-13	
Cadmium, total	**0.000016**	MAC = 0.007	0.000010	mg/L	2023-10-13	
Calcium, total	**115**	None Required	0.20	mg/L	2023-10-13	
Chromium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2023-10-13	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2023-10-13	
Copper, total	< 0.00040	MAC = 2	0.00040	mg/L	2023-10-13	
Iron, total	**0.026**	AO ≤ 0.3	0.010	mg/L	2023-10-13	
Lead, total	< 0.00020	MAC = 0.005	0.00020	mg/L	2023-10-13	

TEST RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0884
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 09:51

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
L12001_20231004_0900 (23J0884-01) | Matrix: Water | Sampled: 2023-10-04 09:00, Continued						
Total Metals, Continued						
Lithium, total	**0.00426**	N/A	0.00010	mg/L	2023-10-13	
Magnesium, total	**23.9**	None Required	0.010	mg/L	2023-10-13	
Manganese, total	**0.00251**	MAC = 0.12	0.00020	mg/L	2023-10-13	
Mercury, total	< 0.000010	MAC = 0.001	0.000010	mg/L	2023-10-12	
Molybdenum, total	**0.00175**	N/A	0.00010	mg/L	2023-10-13	
Nickel, total	< 0.00040	N/A	0.00040	mg/L	2023-10-13	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2023-10-13	
Potassium, total	**0.46**	N/A	0.10	mg/L	2023-10-13	
Selenium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2023-10-13	
Silicon, total	**2.6**	N/A	1.0	mg/L	2023-10-13	
Silver, total	< 0.000050	None Required	0.000050	mg/L	2023-10-13	
Sodium, total	**1.82**	AO ≤ 200	0.10	mg/L	2023-10-13	
Strontium, total	**1.79**	MAC = 7	0.0010	mg/L	2023-10-13	
Sulfur, total	**81.7**	N/A	3.0	mg/L	2023-10-13	
Tellurium, total	< 0.00050	N/A	0.00050	mg/L	2023-10-13	
Thallium, total	< 0.000020	N/A	0.000020	mg/L	2023-10-13	
Thorium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-13	
Tin, total	< 0.00020	N/A	0.00020	mg/L	2023-10-13	
Titanium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-13	
Tungsten, total	< 0.0010	N/A	0.0010	mg/L	2023-10-13	
Uranium, total	**0.000418**	MAC = 0.02	0.000020	mg/L	2023-10-13	
Vanadium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-13	
Zinc, total	< 0.0040	AO ≤ 5	0.0040	mg/L	2023-10-13	
Zirconium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-13	
L12003_20231004_1210 (23J0884-02) | Matrix: Water | Sampled: 2023-10-04 12:10						
Anions						
Bromide	< 0.10	N/A	0.10	mg/L	2023-10-10	
Chloride	**0.26**	AO ≤ 250	0.10	mg/L	2023-10-10	
Fluoride	**0.10**	MAC = 1.5	0.10	mg/L	2023-10-10	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2023-10-10	HT1
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2023-10-10	HT1
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2023-10-10	HT1
Sulfate	**233**	AO ≤ 500	1.0	mg/L	2023-10-10	
BCMOE Aggregate Hydrocarbons						
EPHw10-19	< 250	N/A	250	µg/L	2023-10-11	
EPHw19-32	< 250	N/A	250	µg/L	2023-10-11	
Surrogate: 2-Methylnonane (EPH/F2-4)	*74*		*60-140*	%	*2023-10-11*	
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	**397**	N/A	0.500	mg/L	N/A	

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
L12003_20231004_1210 (23J0884-02) | Matrix: Water | Sampled: 2023-10-04 12:10, Continued						
Calculated Parameters, Continued						
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	**0.0570**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Aluminum, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-12	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-12	
Arsenic, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-12	
Barium, dissolved	**0.0794**	N/A	0.0050	mg/L	2023-10-12	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-12	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-12	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2023-10-12	
Cadmium, dissolved	**0.000011**	N/A	0.000010	mg/L	2023-10-12	
Calcium, dissolved	**114**	N/A	0.20	mg/L	2023-10-12	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-12	
Cobalt, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-12	
Copper, dissolved	< 0.00040	N/A	0.00040	mg/L	2023-10-12	
Iron, dissolved	< 0.010	N/A	0.010	mg/L	2023-10-12	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-12	
Lithium, dissolved	**0.00469**	N/A	0.00010	mg/L	2023-10-12	
Magnesium, dissolved	**27.2**	N/A	0.010	mg/L	2023-10-12	
Manganese, dissolved	**0.00299**	N/A	0.00020	mg/L	2023-10-12	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2023-10-12	
Molybdenum, dissolved	**0.00168**	N/A	0.00010	mg/L	2023-10-12	
Nickel, dissolved	< 0.00040	N/A	0.00040	mg/L	2023-10-12	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2023-10-12	
Potassium, dissolved	**0.46**	N/A	0.10	mg/L	2023-10-12	
Selenium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-12	
Silicon, dissolved	**3.0**	N/A	1.0	mg/L	2023-10-12	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2023-10-12	
Sodium, dissolved	**1.92**	N/A	0.10	mg/L	2023-10-12	
Strontium, dissolved	**1.97**	N/A	0.0010	mg/L	2023-10-12	
Sulfur, dissolved	**82.3**	N/A	3.0	mg/L	2023-10-12	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-12	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2023-10-12	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-12	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-12	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-12	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2023-10-12	
Uranium, dissolved	**0.000391**	N/A	0.000020	mg/L	2023-10-12	
Vanadium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-12	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2023-10-12	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-12	

General Parameters

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
L12003_20231004_1210 (23J0884-02) | Matrix: Water | Sampled: 2023-10-04 12:10, Continued						
General Parameters, Continued						
Alkalinity, Total (as CaCO3)	**168**	N/A	1.0	mg/L	2023-10-11	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-11	
Alkalinity, Bicarbonate (as CaCO3)	**168**	N/A	1.0	mg/L	2023-10-11	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-11	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-10-11	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2023-10-10	
BOD, 5-day	< 7.0	N/A	2.0	mg/L	2023-10-12	
Carbon, Total Organic	**2.18**	N/A	0.50	mg/L	2023-10-16	
Carbon, Dissolved Organic	**1.50**	N/A	0.50	mg/L	2023-10-16	
Chemical Oxygen Demand	< 20	N/A	20	mg/L	2023-10-12	
Nitrogen, Total Kjeldahl	**0.057**	N/A	0.050	mg/L	2023-10-14	
Phosphorus, Total (as P)	**0.0130**	N/A	0.0050	mg/L	2023-10-12	
Solids, Total Suspended	< 2.0	N/A	2.0	mg/L	2023-10-11	
Total Metals						
Aluminum, total	**0.0144**	OG < 0.1	0.0050	mg/L	2023-10-12	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2023-10-12	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2023-10-12	
Barium, total	**0.0767**	MAC = 2	0.0050	mg/L	2023-10-12	
Beryllium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-12	
Bismuth, total	< 0.00010	N/A	0.00010	mg/L	2023-10-12	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2023-10-12	
Cadmium, total	**0.000021**	MAC = 0.007	0.000010	mg/L	2023-10-12	
Calcium, total	**110**	None Required	0.20	mg/L	2023-10-12	
Chromium, total	**0.00050**	MAC = 0.05	0.00050	mg/L	2023-10-12	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2023-10-12	
Copper, total	< 0.00040	MAC = 2	0.00040	mg/L	2023-10-12	
Iron, total	**0.021**	AO ≤ 0.3	0.010	mg/L	2023-10-12	
Lead, total	< 0.00020	MAC = 0.005	0.00020	mg/L	2023-10-12	
Lithium, total	**0.00439**	N/A	0.00010	mg/L	2023-10-12	
Magnesium, total	**24.9**	None Required	0.010	mg/L	2023-10-12	
Manganese, total	**0.00380**	MAC = 0.12	0.00020	mg/L	2023-10-12	
Mercury, total	< 0.000010	MAC = 0.001	0.000010	mg/L	2023-10-12	
Molybdenum, total	**0.00174**	N/A	0.00010	mg/L	2023-10-12	
Nickel, total	< 0.00040	N/A	0.00040	mg/L	2023-10-12	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2023-10-12	
Potassium, total	**0.46**	N/A	0.10	mg/L	2023-10-12	
Selenium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2023-10-12	
Silicon, total	**2.8**	N/A	1.0	mg/L	2023-10-12	
Silver, total	< 0.000050	None Required	0.000050	mg/L	2023-10-12	
Sodium, total	**1.95**	AO ≤ 200	0.10	mg/L	2023-10-12	
Strontium, total	**1.78**	MAC = 7	0.0010	mg/L	2023-10-12	
Sulfur, total	**77.9**	N/A	3.0	mg/L	2023-10-12	

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0884
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 09:51

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
L12003_20231004_1210 (23J0884-02) | Matrix: Water | Sampled: 2023-10-04 12:10, Continued						
Total Metals, Continued						
Tellurium, total	< 0.00050	N/A	0.00050	mg/L	2023-10-12	
Thallium, total	< 0.000020	N/A	0.000020	mg/L	2023-10-12	
Thorium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-12	
Tin, total	< 0.00020	N/A	0.00020	mg/L	2023-10-12	
Titanium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-12	
Tungsten, total	< 0.0010	N/A	0.0010	mg/L	2023-10-12	
Uranium, total	**0.000396**	MAC = 0.02	0.000020	mg/L	2023-10-12	
Vanadium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-12	
Zinc, total	< 0.0040	AO ≤ 5	0.0040	mg/L	2023-10-12	
Zirconium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-12	

Sample Qualifiers:

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

CARO ANALYTICAL SERVICES

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0884
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 09:51

Analysis Description	Method Ref.	Technique	Accredited	Location
Alkalinity in Water	SM 2320 B* (2021)	Titration with H2SO4	✓	Kelowna
Ammonia, Total in Water	SM 4500-NH3 G* (2021)	Automated Colorimetry (Phenate)	✓	Kelowna
Anions in Water	SM 4110 B (2020)	Ion Chromatography	✓	Kelowna
Biochemical Oxygen Demand in Water	SM 5210 B (2019)	Dissolved Oxygen Meter	✓	Kelowna
Carbon, Dissolved Organic in Water	SM 5310 B (2022)	Combustion, Infrared CO2 Detection	✓	Kelowna
Carbon, Total Organic in Water	SM 5310 B (2022)	Combustion, Infrared CO2 Detection	✓	Kelowna
Chemical Oxygen Demand in Water	SM 5220 D* (2022)	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
EPH in Water	EPA 3511* / BCMOE EPHw	Hexane MicroExtraction (Base/Neutral) / Gas Chromatography (GC-FID)	✓	Richmond
Hardness in Water	SM 2340 B (2021)	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* (2021)	Block Digestion and Flow Injection Analysis	✓	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2021)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Solids, Total Suspended in Water	Solids in Water, Filtered / SM 2540 D* (2020)	Solids in Water, Filtered / 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)
µg/L	Micrograms per litre
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, September 2022)

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**	23J0884
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 09:51

General Comments:

The results in this report apply to the received 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. Caro will dispose of all samples within 30 days of sample receipt, unless otherwise agreed.

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**	23J0884
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 09:51

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 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 B3J0723										
Blank (B3J0723-BLK1)				Prepared: 2023-10-09, Analyzed: 2023-10-09						
Bromide	< 0.10	0.10	mg/L							
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 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 (B3J0723-BLK2)				Prepared: 2023-10-10, Analyzed: 2023-10-10						
Bromide	< 0.10	0.10	mg/L							
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 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 (B3J0723-BLK3)				Prepared: 2023-10-10, Analyzed: 2023-10-10						
Bromide	< 0.10	0.10	mg/L							
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 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 (B3J0723-BS1)				Prepared: 2023-10-09, Analyzed: 2023-10-09						
Bromide	3.92	0.10	mg/L	4.00		98	85-115			
Chloride	15.8	0.10	mg/L	16.0		99	90-110			
Fluoride	3.83	0.10	mg/L	4.00		96	88-108			
Nitrate (as N)	4.00	0.010	mg/L	4.00		100	90-110			
Nitrite (as N)	1.96	0.010	mg/L	2.00		98	85-115			
Phosphate (as P)	0.846	0.0050	mg/L	1.00		85	80-120			
Sulfate	15.4	1.0	mg/L	16.0		96	90-110			
LCS (B3J0723-BS2)				Prepared: 2023-10-10, Analyzed: 2023-10-10						
Bromide	3.83	0.10	mg/L	4.00		96	85-115			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0884
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 09:51

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B3J0723, Continued										
LCS (B3J0723-BS2), Continued				Prepared: 2023-10-10, Analyzed: 2023-10-10						
Chloride	15.8	0.10	mg/L	16.0		99	90-110			
Fluoride	3.86	0.10	mg/L	4.00		97	88-108			
Nitrate (as N)	3.96	0.010	mg/L	4.00		99	90-110			
Nitrite (as N)	1.96	0.010	mg/L	2.00		98	85-115			
Phosphate (as P)	0.919	0.0050	mg/L	1.00		92	80-120			
Sulfate	16.1	1.0	mg/L	16.0		101	90-110			
LCS (B3J0723-BS3)				Prepared: 2023-10-10, Analyzed: 2023-10-10						
Bromide	3.99	0.10	mg/L	4.00		100	85-115			
Chloride	15.8	0.10	mg/L	16.0		99	90-110			
Fluoride	3.97	0.10	mg/L	4.00		99	88-108			
Nitrate (as N)	4.09	0.010	mg/L	4.00		102	90-110			
Nitrite (as N)	1.96	0.010	mg/L	2.00		98	85-115			
Phosphate (as P)	1.07	0.0050	mg/L	1.00		107	80-120			
Sulfate	15.7	1.0	mg/L	16.0		98	90-110			
Duplicate (B3J0723-DUP3)	**Source: 23J0884-02**			Prepared: 2023-10-10, Analyzed: 2023-10-10						
Bromide	< 0.10	0.10	mg/L		< 0.10				10	
Chloride	0.26	0.10	mg/L		0.26				10	
Fluoride	0.10	0.10	mg/L		0.10				10	
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	
Sulfate	233	1.0	mg/L		233			< 1	10	
Matrix Spike (B3J0723-MS3)	**Source: 23J0884-02**			Prepared: 2023-10-10, Analyzed: 2023-10-10						
Bromide	3.94	0.10	mg/L	4.00	< 0.10	99	80-120			
Chloride	16.4	0.10	mg/L	16.0	0.26	101	75-125			
Fluoride	3.97	0.10	mg/L	4.00	0.10	97	75-125			
Nitrate (as N)	4.18	0.010	mg/L	4.00	< 0.010	105	75-125			
Nitrite (as N)	1.98	0.010	mg/L	2.00	< 0.010	99	80-120			
Phosphate (as P)	0.717	0.0050	mg/L	1.00	< 0.0050	72	70-130			
BCMOE Aggregate Hydrocarbons, Batch B3J0984										
Blank (B3J0984-BLK1)				Prepared: 2023-10-11, Analyzed: 2023-10-11						
EPHw10-19	< 250	250	µg/L							
EPHw19-32	< 250	250	µg/L							
Surrogate: 2-Methylnonane (EPH/F2-4)	*1600*		*µg/L*	2200		*73*	*60-140*			
LCS (B3J0984-BS2)				Prepared: 2023-10-11, Analyzed: 2023-10-11						
EPHw10-19	15800	250	µg/L	15400		103	70-130			
EPHw19-32	17800	250	µg/L	22200		80	70-130			
Surrogate: 2-Methylnonane (EPH/F2-4)	*1400*		*µg/L*	2200		*64*	*60-140*			
LCS Dup (B3J0984-BSD2)				Prepared: 2023-10-11, Analyzed: 2023-10-11						
EPHw10-19	15900	250	µg/L	15400		103	70-130	< 1	20	
EPHw19-32	18300	250	µg/L	22200		82	70-130	2	20	
Surrogate: 2-Methylnonane (EPH/F2-4)	*1590*		*µg/L*	2200		*72*	*60-140*			
Dissolved Metals, Batch B3J0948										
Blank (B3J0948-BLK1)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Mercury, dissolved	< 0.000010	0.000010	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0884
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 09:51

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B3J0948, Continued										
Blank (B3J0948-BLK2)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Blank (B3J0948-BLK3)				Prepared: 2023-10-11, Analyzed: 2023-10-13						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
LCS (B3J0948-BS1)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Mercury, dissolved	0.000235	0.000010	mg/L	0.000250		94	80-120			
LCS (B3J0948-BS2)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Mercury, dissolved	0.000248	0.000010	mg/L	0.000250		99	80-120			
LCS (B3J0948-BS3)				Prepared: 2023-10-11, Analyzed: 2023-10-13						
Mercury, dissolved	0.000266	0.000010	mg/L	0.000250		106	80-120			
Dissolved Metals, Batch B3J0982										
Blank (B3J0982-BLK1)				Prepared: 2023-10-12, Analyzed: 2023-10-12						
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							
Lithium, dissolved	< 0.00010	0.00010	mg/L							
Magnesium, dissolved	< 0.010	0.010	mg/L							
Manganese, dissolved	< 0.00020	0.00020	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	< 0.0050	0.0050	mg/L							
Zinc, dissolved	< 0.0040	0.0040	mg/L							
Zirconium, dissolved	< 0.00010	0.00010	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B3J0982, Continued										
LCS (B3J0982-BS1)				Prepared: 2023-10-12, Analyzed: 2023-10-12						
Aluminum, dissolved	3.98	0.0050	mg/L	4.00		100	80-120			
Antimony, dissolved	0.0408	0.00020	mg/L	0.0400		102	80-120			
Arsenic, dissolved	0.411	0.00050	mg/L	0.400		103	80-120			
Barium, dissolved	0.0414	0.0050	mg/L	0.0400		103	80-120			
Beryllium, dissolved	0.0431	0.00010	mg/L	0.0400		108	80-120			
Bismuth, dissolved	0.0401	0.00010	mg/L	0.0400		100	80-120			
Boron, dissolved	0.424	0.0500	mg/L	0.400		106	80-120			
Cadmium, dissolved	0.0408	0.000010	mg/L	0.0400		102	80-120			
Calcium, dissolved	4.33	0.20	mg/L	4.00		108	80-120			
Chromium, dissolved	0.0408	0.00050	mg/L	0.0400		102	80-120			
Cobalt, dissolved	0.0411	0.00010	mg/L	0.0400		103	80-120			
Copper, dissolved	0.0412	0.00040	mg/L	0.0400		103	80-120			
Iron, dissolved	3.98	0.010	mg/L	4.00		100	80-120			
Lead, dissolved	0.0400	0.00020	mg/L	0.0400		100	80-120			
Lithium, dissolved	0.0442	0.00010	mg/L	0.0400		111	80-120			
Magnesium, dissolved	4.03	0.010	mg/L	4.00		101	80-120			
Manganese, dissolved	0.0409	0.00020	mg/L	0.0400		102	80-120			
Molybdenum, dissolved	0.0392	0.00010	mg/L	0.0400		98	80-120			
Nickel, dissolved	0.0415	0.00040	mg/L	0.0400		104	80-120			
Phosphorus, dissolved	3.93	0.050	mg/L	4.00		98	80-120			
Potassium, dissolved	4.02	0.10	mg/L	4.00		101	80-120			
Selenium, dissolved	0.405	0.00050	mg/L	0.400		101	80-120			
Silicon, dissolved	4.3	1.0	mg/L	4.00		109	80-120			
Silver, dissolved	0.0396	0.000050	mg/L	0.0400		99	80-120			
Sodium, dissolved	4.19	0.10	mg/L	4.00		105	80-120			
Strontium, dissolved	0.0432	0.0010	mg/L	0.0400		108	80-120			
Sulfur, dissolved	42.6	3.0	mg/L	40.0		107	80-120			
Tellurium, dissolved	0.0407	0.00050	mg/L	0.0400		102	80-120			
Thallium, dissolved	0.0406	0.000020	mg/L	0.0400		101	80-120			
Thorium, dissolved	0.0412	0.00010	mg/L	0.0400		103	80-120			
Tin, dissolved	0.0395	0.00020	mg/L	0.0400		99	80-120			
Titanium, dissolved	0.0408	0.0050	mg/L	0.0400		102	80-120			
Tungsten, dissolved	0.0430	0.0010	mg/L	0.0400		108	80-120			
Uranium, dissolved	0.0401	0.000020	mg/L	0.0400		100	80-120			
Vanadium, dissolved	0.0408	0.0050	mg/L	0.0400		102	80-120			
Zinc, dissolved	0.414	0.0040	mg/L	0.400		104	80-120			
Zirconium, dissolved	0.0406	0.00010	mg/L	0.0400		101	80-120			
General Parameters, Batch B3J0673										
Blank (B3J0673-BLK1)				Prepared: 2023-10-07, Analyzed: 2023-10-12						
BOD, 5-day	< 2.0	2.0	mg/L							
LCS (B3J0673-BS1)				Prepared: 2023-10-07, Analyzed: 2023-10-12						
BOD, 5-day	200	50.7	mg/L	198		101	85-115			
General Parameters, Batch B3J0735										
Blank (B3J0735-BLK1)				Prepared: 2023-10-10, Analyzed: 2023-10-10						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
Blank (B3J0735-BLK2)				Prepared: 2023-10-10, Analyzed: 2023-10-10						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
Blank (B3J0735-BLK3)				Prepared: 2023-10-10, Analyzed: 2023-10-10						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0884
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 09:51

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B3J0735, Continued										
LCS (B3J0735-BS1)				Prepared: 2023-10-10, Analyzed: 2023-10-10						
Ammonia, Total (as N)	1.07	0.050	mg/L	1.00		107	85-115			
LCS (B3J0735-BS2)				Prepared: 2023-10-10, Analyzed: 2023-10-10						
Ammonia, Total (as N)	1.11	0.050	mg/L	1.00		111	85-115			
LCS (B3J0735-BS3)				Prepared: 2023-10-10, Analyzed: 2023-10-10						
Ammonia, Total (as N)	1.04	0.050	mg/L	1.00		104	85-115			
General Parameters, Batch B3J0757										
Blank (B3J0757-BLK1)				Prepared: 2023-10-16, Analyzed: 2023-10-16						
Carbon, Total Organic	< 0.50	0.50	mg/L							
Carbon, Dissolved Organic	< 0.50	0.50	mg/L							
Blank (B3J0757-BLK2)				Prepared: 2023-10-16, Analyzed: 2023-10-16						
Carbon, Total Organic	< 0.50	0.50	mg/L							
Carbon, Dissolved Organic	< 0.50	0.50	mg/L							
Blank (B3J0757-BLK3)				Prepared: 2023-10-16, Analyzed: 2023-10-16						
Carbon, Total Organic	< 0.50	0.50	mg/L							
Carbon, Dissolved Organic	< 0.50	0.50	mg/L							
Blank (B3J0757-BLK4)				Prepared: 2023-10-16, Analyzed: 2023-10-16						
Carbon, Total Organic	< 0.50	0.50	mg/L							
Carbon, Dissolved Organic	< 0.50	0.50	mg/L							
LCS (B3J0757-BS1)				Prepared: 2023-10-16, Analyzed: 2023-10-16						
Carbon, Total Organic	9.36	0.50	mg/L	10.0		94	78-116			
Carbon, Dissolved Organic	10.4	0.50	mg/L	10.0		104	78-116			
LCS (B3J0757-BS2)				Prepared: 2023-10-16, Analyzed: 2023-10-16						
Carbon, Total Organic	8.27	0.50	mg/L	10.0		83	78-116			
Carbon, Dissolved Organic	9.42	0.50	mg/L	10.0		94	78-116			
LCS (B3J0757-BS3)				Prepared: 2023-10-16, Analyzed: 2023-10-16						
Carbon, Total Organic	9.32	0.50	mg/L	10.0		93	78-116			
Carbon, Dissolved Organic	9.20	0.50	mg/L	10.0		92	78-116			
LCS (B3J0757-BS4)				Prepared: 2023-10-16, Analyzed: 2023-10-16						
Carbon, Total Organic	8.98	0.50	mg/L	10.0		90	78-116			
Carbon, Dissolved Organic	9.33	0.50	mg/L	10.0		93	78-116			
Duplicate (B3J0757-DUP4)	**Source: 23J0884-01**			Prepared: 2023-10-17, Analyzed: 2023-10-17						
Carbon, Total Organic	1.86	0.50	mg/L		1.89				16	
Carbon, Dissolved Organic	1.77	0.50	mg/L		1.81				15	
Matrix Spike (B3J0757-MS4)	**Source: 23J0884-01**			Prepared: 2023-10-17, Analyzed: 2023-10-17						
Carbon, Total Organic	10.7	0.50	mg/L	10.0	1.89	88	70-130			
Carbon, Dissolved Organic	9.63	0.50	mg/L	10.0	1.81	78	70-130			
General Parameters, Batch B3J0957										
Blank (B3J0957-BLK1)				Prepared: 2023-10-11, Analyzed: 2023-10-11						
Solids, Total Suspended	< 2.0	2.0	mg/L							
Blank (B3J0957-BLK2)				Prepared: 2023-10-11, Analyzed: 2023-10-11						
Solids, Total Suspended	< 2.0	2.0	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0884
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 09:51

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B3J0957, Continued										
LCS (B3J0957-BS1)				Prepared: 2023-10-11, Analyzed: 2023-10-11						
Solids, Total Suspended	94.9	10.1	mg/L	100		95	85-115			
LCS (B3J0957-BS2)				Prepared: 2023-10-11, Analyzed: 2023-10-11						
Solids, Total Suspended	94.0	10.0	mg/L	100		94	85-115			
General Parameters, Batch B3J0967										
Blank (B3J0967-BLK1)				Prepared: 2023-10-11, Analyzed: 2023-10-11						
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 (B3J0967-BLK2)				Prepared: 2023-10-11, Analyzed: 2023-10-11						
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 (B3J0967-BLK3)				Prepared: 2023-10-11, Analyzed: 2023-10-11						
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 (B3J0967-BS1)				Prepared: 2023-10-11, Analyzed: 2023-10-11						
Alkalinity, Total (as CaCO3)	109	1.0	mg/L	100		109	80-120			
Alkalinity, Phenolphthalein (as CaCO3)	50.5	1.0	mg/L	50.0		101	0-200			
LCS (B3J0967-BS2)				Prepared: 2023-10-11, Analyzed: 2023-10-11						
Alkalinity, Total (as CaCO3)	110	1.0	mg/L	100		110	80-120			
Alkalinity, Phenolphthalein (as CaCO3)	42.6	1.0	mg/L	50.0		85	0-200			
LCS (B3J0967-BS3)				Prepared: 2023-10-11, Analyzed: 2023-10-11						
Alkalinity, Total (as CaCO3)	109	1.0	mg/L	100		109	80-120			
Alkalinity, Phenolphthalein (as CaCO3)	37.7	1.0	mg/L	50.0		75	0-200			
General Parameters, Batch B3J0991										
Blank (B3J0991-BLK1)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Blank (B3J0991-BLK2)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Blank (B3J0991-BLK3)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Blank (B3J0991-BLK4)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Blank (B3J0991-BLK5)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0884
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 09:51

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B3J0991, Continued										
LCS (B3J0991-BS1)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	0.101	0.0050	mg/L	0.100		101	85-115			
LCS (B3J0991-BS2)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	0.101	0.0050	mg/L	0.100		101	85-115			
LCS (B3J0991-BS3)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	0.103	0.0050	mg/L	0.100		103	85-115			
LCS (B3J0991-BS4)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	0.102	0.0050	mg/L	0.100		102	85-115			
LCS (B3J0991-BS5)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Phosphorus, Total (as P)	0.104	0.0050	mg/L	0.100		104	85-115			
General Parameters, Batch B3J1025										
Blank (B3J1025-BLK1)				Prepared: 2023-10-12, Analyzed: 2023-10-12						
Chemical Oxygen Demand	< 20	20	mg/L							
LCS (B3J1025-BS1)				Prepared: 2023-10-12, Analyzed: 2023-10-12						
Chemical Oxygen Demand	527	20	mg/L	500		105	89-115			
General Parameters, Batch B3J1200										
Blank (B3J1200-BLK2)				Prepared: 2023-10-13, Analyzed: 2023-10-14						
Nitrogen, Total Kjeldahl	< 0.050	0.050	mg/L							
LCS (B3J1200-BS2)				Prepared: 2023-10-13, Analyzed: 2023-10-14						
Nitrogen, Total Kjeldahl	0.986	0.050	mg/L	1.00		99	85-115			
Total Metals, Batch B3J0947										
Blank (B3J0947-BLK1)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Mercury, total	< 0.000010	0.000010	mg/L							
Blank (B3J0947-BLK2)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Mercury, total	< 0.000010	0.000010	mg/L							
Blank (B3J0947-BLK3)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Mercury, total	< 0.000010	0.000010	mg/L							
LCS (B3J0947-BS1)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Mercury, total	0.000247	0.000010	mg/L	0.000250		99	80-120			
LCS (B3J0947-BS2)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Mercury, total	0.000235	0.000010	mg/L	0.000250		94	80-120			
LCS (B3J0947-BS3)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Mercury, total	0.000224	0.000010	mg/L	0.000250		89	80-120			
Total Metals, Batch B3J0950										
Blank (B3J0950-BLK1)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Aluminum, total	< 0.0050	0.0050	mg/L							
Antimony, total	< 0.00020	0.00020	mg/L							
Arsenic, total	< 0.00050	0.00050	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0884
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 09:51

Total Metals, Batch B3J0950, Continued

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Blank (B3J0950-BLK1), Continued				Prepared: 2023-10-11, Analyzed: 2023-10-12						
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							
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	< 0.0050	0.0050	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
Zirconium, total	< 0.00010	0.00010	mg/L							
LCS (B3J0950-BS1)				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Aluminum, total	3.94	0.0050	mg/L	4.00		98	80-120			
Antimony, total	0.0392	0.00020	mg/L	0.0400		98	80-120			
Arsenic, total	0.400	0.00050	mg/L	0.400		100	80-120			
Barium, total	0.0391	0.0050	mg/L	0.0400		98	80-120			
Beryllium, total	0.0379	0.00010	mg/L	0.0400		95	80-120			
Bismuth, total	0.0387	0.00010	mg/L	0.0400		97	80-120			
Boron, total	0.390	0.0500	mg/L	0.400		97	80-120			
Cadmium, total	0.0391	0.000010	mg/L	0.0400		98	80-120			
Calcium, total	3.91	0.20	mg/L	4.00		98	80-120			
Chromium, total	0.0410	0.00050	mg/L	0.0400		102	80-120			
Cobalt, total	0.0406	0.00010	mg/L	0.0400		102	80-120			
Copper, total	0.0410	0.00040	mg/L	0.0400		102	80-120			
Iron, total	4.08	0.010	mg/L	4.00		102	80-120			
Lead, total	0.0389	0.00020	mg/L	0.0400		97	80-120			
Lithium, total	0.0370	0.00010	mg/L	0.0400		93	80-120			
Magnesium, total	3.91	0.010	mg/L	4.00		98	80-120			
Manganese, total	0.0406	0.00020	mg/L	0.0400		102	80-120			
Molybdenum, total	0.0384	0.00010	mg/L	0.0400		96	80-120			
Nickel, total	0.0413	0.00040	mg/L	0.0400		103	80-120			
Phosphorus, total	3.92	0.050	mg/L	4.00		98	80-120			

CARO ANALYTICAL SERVICES

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0884
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 09:51

Total Metals, Batch B3J0950, Continued

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
LCS (B3J0950-BS1), Continued				Prepared: 2023-10-11, Analyzed: 2023-10-12						
Potassium, total	3.89	0.10	mg/L	4.00		97	80-120			
Selenium, total	0.398	0.00050	mg/L	0.400		99	80-120			
Silicon, total	4.0	1.0	mg/L	4.00		101	80-120			
Silver, total	0.0388	0.000050	mg/L	0.0400		97	80-120			
Sodium, total	4.03	0.10	mg/L	4.00		101	80-120			
Strontium, total	0.0397	0.0010	mg/L	0.0400		99	80-120			
Sulfur, total	38.7	3.0	mg/L	40.0		97	80-120			
Tellurium, total	0.0363	0.00050	mg/L	0.0400		91	80-120			
Thallium, total	0.0395	0.000020	mg/L	0.0400		99	80-120			
Thorium, total	0.0399	0.00010	mg/L	0.0400		100	80-120			
Tin, total	0.0393	0.00020	mg/L	0.0400		98	80-120			
Titanium, total	0.0404	0.0050	mg/L	0.0400		101	80-120			
Tungsten, total	0.0403	0.0010	mg/L	0.0400		101	80-120			
Uranium, total	0.0396	0.000020	mg/L	0.0400		99	80-120			
Vanadium, total	0.0404	0.0050	mg/L	0.0400		101	80-120			
Zinc, total	0.398	0.0040	mg/L	0.400		99	80-120			
Zirconium, total	0.0403	0.00010	mg/L	0.0400		101	80-120			

Total Metals, Batch B3J1199

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Blank (B3J1199-BLK1)				Prepared: 2023-10-13, Analyzed: 2023-10-13						
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							
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	< 0.0050	0.0050	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0884
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 09:51

Total Metals, Batch B3J1199, Continued

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Blank (B3J1199-BLK1), Continued				Prepared: 2023-10-13, Analyzed: 2023-10-13						
Zinc, total	< 0.0040	0.0040	mg/L							
Zirconium, total	< 0.00010	0.00010	mg/L							
LCS (B3J1199-BS1)				Prepared: 2023-10-13, Analyzed: 2023-10-13						
Aluminum, total	3.95	0.0050	mg/L	4.00		99	80-120			
Antimony, total	0.0399	0.00020	mg/L	0.0400		100	80-120			
Arsenic, total	0.395	0.00050	mg/L	0.400		99	80-120			
Barium, total	0.0391	0.0050	mg/L	0.0400		98	80-120			
Beryllium, total	0.0462	0.00010	mg/L	0.0400		116	80-120			
Bismuth, total	0.0398	0.00010	mg/L	0.0400		99	80-120			
Boron, total	0.459	0.0500	mg/L	0.400		115	80-120			
Cadmium, total	0.0388	0.000010	mg/L	0.0400		97	80-120			
Calcium, total	4.73	0.20	mg/L	4.00		118	80-120			
Chromium, total	0.0407	0.00050	mg/L	0.0400		102	80-120			
Cobalt, total	0.0410	0.00010	mg/L	0.0400		102	80-120			
Copper, total	0.0407	0.00040	mg/L	0.0400		102	80-120			
Iron, total	4.07	0.010	mg/L	4.00		102	80-120			
Lead, total	0.0392	0.00020	mg/L	0.0400		98	80-120			
Lithium, total	0.0456	0.00010	mg/L	0.0400		114	80-120			
Magnesium, total	4.03	0.010	mg/L	4.00		101	80-120			
Manganese, total	0.0402	0.00020	mg/L	0.0400		101	80-120			
Molybdenum, total	0.0382	0.00010	mg/L	0.0400		96	80-120			
Nickel, total	0.0402	0.00040	mg/L	0.0400		101	80-120			
Phosphorus, total	3.93	0.050	mg/L	4.00		98	80-120			
Potassium, total	4.27	0.10	mg/L	4.00		107	80-120			
Selenium, total	0.406	0.00050	mg/L	0.400		101	80-120			
Silicon, total	4.6	1.0	mg/L	4.00		115	80-120			
Silver, total	0.0393	0.000050	mg/L	0.0400		98	80-120			
Sodium, total	4.20	0.10	mg/L	4.00		105	80-120			
Strontium, total	0.0412	0.0010	mg/L	0.0400		103	80-120			
Sulfur, total	45.1	3.0	mg/L	40.0		113	80-120			
Tellurium, total	0.0373	0.00050	mg/L	0.0400		93	80-120			
Thallium, total	0.0390	0.000020	mg/L	0.0400		98	80-120			
Thorium, total	0.0412	0.00010	mg/L	0.0400		103	80-120			
Tin, total	0.0391	0.00020	mg/L	0.0400		98	80-120			
Titanium, total	0.0452	0.0050	mg/L	0.0400		113	80-120			
Tungsten, total	0.0409	0.0010	mg/L	0.0400		102	80-120			
Uranium, total	0.0409	0.000020	mg/L	0.0400		102	80-120			
Vanadium, total	0.0398	0.0050	mg/L	0.0400		99	80-120			
Zinc, total	0.399	0.0040	mg/L	0.400		100	80-120			
Zirconium, total	0.0399	0.00010	mg/L	0.0400		100	80-120			
Matrix Spike (B3J1199-MS1)	**Source: 23J0884-01**			Prepared: 2023-10-13, Analyzed: 2023-10-13						
Aluminum, total	4.19	0.0050	mg/L	4.00	0.0236	104	70-130			
Antimony, total	0.0410	0.00020	mg/L	0.0400	< 0.00020	102	70-130			
Arsenic, total	0.428	0.00050	mg/L	0.400	< 0.00050	107	70-130			
Barium, total	0.123	0.0050	mg/L	0.0400	0.0796	108	70-130			
Beryllium, total	0.0440	0.00010	mg/L	0.0400	< 0.00010	110	70-130			
Bismuth, total	0.0413	0.00010	mg/L	0.0400	< 0.00010	103	70-130			
Boron, total	0.449	0.0500	mg/L	0.400	< 0.0500	109	70-130			
Cadmium, total	0.0432	0.000010	mg/L	0.0400	0.000016	108	70-130			
Calcium, total	116	0.20	mg/L	4.00	115	31	70-130			MS2
Chromium, total	0.0432	0.00050	mg/L	0.0400	< 0.00050	107	70-130			
Cobalt, total	0.0420	0.00010	mg/L	0.0400	< 0.00010	105	70-130			
Copper, total	0.0414	0.00040	mg/L	0.0400	< 0.00040	103	70-130			
Iron, total	4.30	0.010	mg/L	4.00	0.026	107	70-130			
Lead, total	0.0414	0.00020	mg/L	0.0400	< 0.00020	104	70-130			

CARO ANALYTICAL SERVICES

REPORTED TO	Elk River Alliance	**WORK ORDER**	23J0884
PROJECT	CBWM-2023	**REPORTED**	2023-10-17 09:51

Total Metals, Batch B3J1199, Continued

Matrix Spike (B3J1199-MS1), Continued **Source: 23J0884-01** Prepared: 2023-10-13, Analyzed: 2023-10-13

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Lithium, total	0.0507	0.00010	mg/L	0.0400	0.00426	116	70-130			
Magnesium, total	29.1	0.010	mg/L	4.00	23.9	131	70-130			MS2
Manganese, total	0.0449	0.00020	mg/L	0.0400	0.00251	106	70-130			
Molybdenum, total	0.0447	0.00010	mg/L	0.0400	0.00175	107	70-130			
Nickel, total	0.0410	0.00040	mg/L	0.0400	< 0.00040	102	70-130			
Phosphorus, total	4.38	0.050	mg/L	4.00	< 0.050	109	70-130			
Potassium, total	4.97	0.10	mg/L	4.00	0.46	113	70-130			
Selenium, total	0.433	0.00050	mg/L	0.400	< 0.00050	108	70-130			
Silicon, total	7.2	1.0	mg/L	4.00	2.6	115	70-130			
Silver, total	0.0410	0.000050	mg/L	0.0400	< 0.000050	103	70-130			
Sodium, total	6.39	0.10	mg/L	4.00	1.82	114	70-130			
Strontium, total	1.82	0.0010	mg/L	0.0400	1.79	60	70-130			MS2
Sulfur, total	123	3.0	mg/L	40.0	81.7	104	70-130			
Tellurium, total	0.0431	0.00050	mg/L	0.0400	< 0.00050	108	70-130			
Thallium, total	0.0417	0.000020	mg/L	0.0400	< 0.000020	104	70-130			
Thorium, total	0.0439	0.00010	mg/L	0.0400	< 0.00010	110	70-130			
Tin, total	0.0431	0.00020	mg/L	0.0400	< 0.00020	108	70-130			
Titanium, total	0.0466	0.0050	mg/L	0.0400	< 0.0050	116	70-130			
Tungsten, total	0.0441	0.0010	mg/L	0.0400	< 0.0010	110	70-130			
Uranium, total	0.0454	0.000020	mg/L	0.0400	0.000418	112	70-130			
Vanadium, total	0.0434	0.0050	mg/L	0.0400	< 0.0050	108	70-130			
Zinc, total	0.415	0.0040	mg/L	0.400	< 0.0040	104	70-130			
Zirconium, total	0.0446	0.00010	mg/L	0.0400	< 0.00010	111	70-130			

QC Qualifiers:

MS2 The native sample concentration is greater than the spike concentration hence the matrix spike limits do not apply.

CARO ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

REPORTED TO	Elk River Alliance PO Box 2095, 1111 2nd Ave Fernie, BC V0B1M0		
ATTENTION	Kaileigh McCallum	**WORK ORDER**	23I3535
PO NUMBER		**RECEIVED / TEMP**	2023-09-27 13:24 / 1.4°C
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:07
PROJECT INFO		**COC NUMBER**	No #

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**	23I3535
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:07

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MOR001-20230925-1230 (23I3535-01) | Matrix: Water | Sampled: 2023-09-25 12:30						
Anions						
Bromide	< 0.10	N/A	0.10	mg/L	2023-10-01	
Chloride	**3.04**	AO ≤ 250	0.10	mg/L	2023-10-01	
Fluoride	< 0.10	MAC = 1.5	0.10	mg/L	2023-10-01	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2023-10-01	HT1
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2023-10-01	HT1
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2023-10-01	HT1
Sulfate	**6.9**	AO ≤ 500	1.0	mg/L	2023-10-01	
BCMOE Aggregate Hydrocarbons						
EPHw10-19	< 250	N/A	250	µg/L	2023-10-03	
EPHw19-32	< 250	N/A	250	µg/L	2023-10-03	
Surrogate: 2-Methylnonane (EPH/F2-4)	*66*		*60-140*	%	*2023-10-03*	
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	**118**	N/A	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	**0.116**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Aluminum, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Arsenic, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Barium, dissolved	**0.146**	N/A	0.0050	mg/L	2023-10-05	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2023-10-05	
Cadmium, dissolved	**0.000017**	N/A	0.000010	mg/L	2023-10-05	
Calcium, dissolved	**34.5**	N/A	0.20	mg/L	2023-10-05	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Cobalt, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Copper, dissolved	**0.00047**	N/A	0.00040	mg/L	2023-10-05	
Iron, dissolved	< 0.010	N/A	0.010	mg/L	2023-10-05	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Lithium, dissolved	**0.00291**	N/A	0.00010	mg/L	2023-10-05	
Magnesium, dissolved	**7.70**	N/A	0.010	mg/L	2023-10-05	
Manganese, dissolved	**0.00956**	N/A	0.00020	mg/L	2023-10-05	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2023-10-06	
Molybdenum, dissolved	**0.00068**	N/A	0.00010	mg/L	2023-10-05	
Nickel, dissolved	< 0.00040	N/A	0.00040	mg/L	2023-10-05	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2023-10-05	
Potassium, dissolved	**0.54**	N/A	0.10	mg/L	2023-10-05	
Selenium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Silicon, dissolved	**1.6**	N/A	1.0	mg/L	2023-10-05	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2023-10-05	

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MOR001-20230925-1230 (23I3535-01) | Matrix: Water | Sampled: 2023-09-25 12:30, Continued						
Dissolved Metals, Continued						
Sodium, dissolved	**2.06**	N/A	0.10	mg/L	2023-10-05	
Strontium, dissolved	**0.128**	N/A	0.0010	mg/L	2023-10-05	
Sulfur, dissolved	< 3.0	N/A	3.0	mg/L	2023-10-05	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2023-10-05	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2023-10-05	
Uranium, dissolved	**0.000251**	N/A	0.000020	mg/L	2023-10-05	
Vanadium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2023-10-05	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
General Parameters						
Alkalinity, Total (as CaCO3)	**125**	N/A	1.0	mg/L	2023-09-30	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-09-30	
Alkalinity, Bicarbonate (as CaCO3)	**125**	N/A	1.0	mg/L	2023-09-30	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-09-30	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-09-30	
Ammonia, Total (as N)	**0.051**	None Required	0.050	mg/L	2023-10-02	
BOD, 5-day	< 7.0	N/A	2.0	mg/L	2023-10-03	
Carbon, Total Organic	**3.73**	N/A	0.50	mg/L	2023-10-09	
Carbon, Dissolved Organic	**3.39**	N/A	0.50	mg/L	2023-10-09	
Chemical Oxygen Demand	< 20	N/A	20	mg/L	2023-09-29	
Nitrogen, Total Kjeldahl	**0.116**	N/A	0.050	mg/L	2023-10-03	
Phosphorus, Total (as P)	**0.0102**	N/A	0.0050	mg/L	2023-09-29	
Solids, Total Suspended	< 2.0	N/A	2.0	mg/L	2023-10-04	HT1
Total Metals						
Aluminum, total	**0.0242**	OG < 0.1	0.0050	mg/L	2023-10-05	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2023-10-05	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2023-10-05	
Barium, total	**0.143**	MAC = 2	0.0050	mg/L	2023-10-05	
Beryllium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Bismuth, total	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2023-10-05	
Cadmium, total	**0.000022**	MAC = 0.007	0.000010	mg/L	2023-10-05	
Calcium, total	**35.0**	None Required	0.20	mg/L	2023-10-05	
Chromium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2023-10-05	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Copper, total	**0.00050**	MAC = 2	0.00040	mg/L	2023-10-05	
Iron, total	**0.029**	AO ≤ 0.3	0.010	mg/L	2023-10-05	
Lead, total	< 0.00020	MAC = 0.005	0.00020	mg/L	2023-10-05	

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3535
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:07

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MOR001-20230925-1230 (23I3535-01) | Matrix: Water | Sampled: 2023-09-25 12:30, Continued						
Total Metals, Continued						
Lithium, total	**0.00301**	N/A	0.00010	mg/L	2023-10-05	
Magnesium, total	**7.24**	None Required	0.010	mg/L	2023-10-05	
Manganese, total	**0.0112**	MAC = 0.12	0.00020	mg/L	2023-10-05	
Mercury, total	< 0.000010	MAC = 0.001	0.000010	mg/L	2023-10-06	
Molybdenum, total	**0.00066**	N/A	0.00010	mg/L	2023-10-05	
Nickel, total	< 0.00040	N/A	0.00040	mg/L	2023-10-05	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2023-10-05	
Potassium, total	**0.55**	N/A	0.10	mg/L	2023-10-05	
Selenium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2023-10-05	
Silicon, total	**1.7**	N/A	1.0	mg/L	2023-10-05	
Silver, total	< 0.000050	None Required	0.000050	mg/L	2023-10-05	
Sodium, total	**1.96**	AO ≤ 200	0.10	mg/L	2023-10-05	
Strontium, total	**0.123**	MAC = 7	0.0010	mg/L	2023-10-05	
Sulfur, total	< 3.0	N/A	3.0	mg/L	2023-10-05	
Tellurium, total	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Thallium, total	< 0.000020	N/A	0.000020	mg/L	2023-10-05	
Thorium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Tin, total	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Titanium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Tungsten, total	< 0.0010	N/A	0.0010	mg/L	2023-10-05	
Uranium, total	**0.000248**	MAC = 0.02	0.000020	mg/L	2023-10-05	
Vanadium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Zinc, total	< 0.0040	AO ≤ 5	0.0040	mg/L	2023-10-05	
Zirconium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
MOR002-20230925-1630 (23I3535-02) | Matrix: Water | Sampled: 2023-09-25 16:30						
Anions						
Bromide	< 0.10	N/A	0.10	mg/L	2023-10-01	
Chloride	**11.7**	AO ≤ 250	0.10	mg/L	2023-10-01	
Fluoride	< 0.10	MAC = 1.5	0.10	mg/L	2023-10-01	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2023-10-01	HT1
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2023-10-01	HT1
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2023-10-01	HT1
Sulfate	**3.6**	AO ≤ 500	1.0	mg/L	2023-10-01	
BCMOE Aggregate Hydrocarbons						
EPHw10-19	< 250	N/A	250	µg/L	2023-10-05	
EPHw19-32	< 250	N/A	250	µg/L	2023-10-05	
Surrogate: 2-Methylnonane (EPH/F2-4)	*89*		*60-140*	%	*2023-10-05*	
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	**69.8**	N/A	0.500	mg/L	N/A	

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3535
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:07

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MOR002-20230925-1630 (23I3535-02) | Matrix: Water | Sampled: 2023-09-25 16:30, Continued						
Calculated Parameters, Continued						
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	**0.122**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Aluminum, dissolved	**0.0141**	N/A	0.0050	mg/L	2023-10-05	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Arsenic, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Barium, dissolved	**0.184**	N/A	0.0050	mg/L	2023-10-05	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2023-10-05	
Cadmium, dissolved	**0.000028**	N/A	0.000010	mg/L	2023-10-05	
Calcium, dissolved	**20.8**	N/A	0.20	mg/L	2023-10-05	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Cobalt, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Copper, dissolved	**0.00044**	N/A	0.00040	mg/L	2023-10-05	
Iron, dissolved	< 0.010	N/A	0.010	mg/L	2023-10-05	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Lithium, dissolved	**0.00134**	N/A	0.00010	mg/L	2023-10-05	
Magnesium, dissolved	**4.32**	N/A	0.010	mg/L	2023-10-05	
Manganese, dissolved	**0.00144**	N/A	0.00020	mg/L	2023-10-05	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2023-10-06	
Molybdenum, dissolved	**0.00050**	N/A	0.00010	mg/L	2023-10-05	
Nickel, dissolved	< 0.00040	N/A	0.00040	mg/L	2023-10-05	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2023-10-05	
Potassium, dissolved	**0.54**	N/A	0.10	mg/L	2023-10-05	
Selenium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Silicon, dissolved	**1.1**	N/A	1.0	mg/L	2023-10-05	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2023-10-05	
Sodium, dissolved	**1.65**	N/A	0.10	mg/L	2023-10-05	
Strontium, dissolved	**0.123**	N/A	0.0010	mg/L	2023-10-05	
Sulfur, dissolved	< 3.0	N/A	3.0	mg/L	2023-10-05	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2023-10-05	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2023-10-05	
Uranium, dissolved	**0.000132**	N/A	0.000020	mg/L	2023-10-05	
Vanadium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2023-10-05	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
General Parameters						

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3535
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:07

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MOR002-20230925-1630 (23I3535-02) | Matrix: Water | Sampled: 2023-09-25 16:30, Continued						
General Parameters, Continued						
Alkalinity, Total (as CaCO3)	**63.1**	N/A	1.0	mg/L	2023-09-30	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-09-30	
Alkalinity, Bicarbonate (as CaCO3)	**63.1**	N/A	1.0	mg/L	2023-09-30	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-09-30	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-09-30	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2023-10-02	
BOD, 5-day	< 7.0	N/A	2.0	mg/L	2023-10-03	
Carbon, Total Organic	**3.33**	N/A	0.50	mg/L	2023-10-09	
Carbon, Dissolved Organic	**2.72**	N/A	0.50	mg/L	2023-10-09	
Chemical Oxygen Demand	< 20	N/A	20	mg/L	2023-09-29	
Nitrogen, Total Kjeldahl	**0.122**	N/A	0.050	mg/L	2023-10-03	
Phosphorus, Total (as P)	**0.0202**	N/A	0.0050	mg/L	2023-09-29	
Solids, Total Suspended	**7.0**	N/A	2.0	mg/L	2023-10-04	HT1
Total Metals						
Aluminum, total	**0.558**	OG < 0.1	0.0050	mg/L	2023-10-05	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2023-10-05	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2023-10-05	
Barium, total	**0.191**	MAC = 2	0.0050	mg/L	2023-10-05	
Beryllium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Bismuth, total	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2023-10-05	
Cadmium, total	**0.000045**	MAC = 0.007	0.000010	mg/L	2023-10-05	
Calcium, total	**20.2**	None Required	0.20	mg/L	2023-10-05	
Chromium, total	**0.00071**	MAC = 0.05	0.00050	mg/L	2023-10-05	
Cobalt, total	**0.00018**	N/A	0.00010	mg/L	2023-10-05	
Copper, total	**0.00083**	MAC = 2	0.00040	mg/L	2023-10-05	
Iron, total	**0.397**	AO ≤ 0.3	0.010	mg/L	2023-10-05	
Lead, total	**0.00024**	MAC = 0.005	0.00020	mg/L	2023-10-05	
Lithium, total	**0.00177**	N/A	0.00010	mg/L	2023-10-05	
Magnesium, total	**4.21**	None Required	0.010	mg/L	2023-10-05	
Manganese, total	**0.00645**	MAC = 0.12	0.00020	mg/L	2023-10-05	
Mercury, total	< 0.000010	MAC = 0.001	0.000010	mg/L	2023-10-06	
Molybdenum, total	**0.00052**	N/A	0.00010	mg/L	2023-10-05	
Nickel, total	**0.00082**	N/A	0.00040	mg/L	2023-10-05	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2023-10-05	
Potassium, total	**0.69**	N/A	0.10	mg/L	2023-10-05	
Selenium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2023-10-05	
Silicon, total	**2.0**	N/A	1.0	mg/L	2023-10-05	
Silver, total	< 0.000050	None Required	0.000050	mg/L	2023-10-05	
Sodium, total	**1.59**	AO ≤ 200	0.10	mg/L	2023-10-05	
Strontium, total	**0.118**	MAC = 7	0.0010	mg/L	2023-10-05	
Sulfur, total	< 3.0	N/A	3.0	mg/L	2023-10-05	

TEST RESULTS

REPORTED TO	Elk River Alliance	WORK ORDER	23I3535
PROJECT	CBWM-2023	REPORTED	2023-10-11 14:07

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MOR002-20230925-1630 (23I3535-02) | Matrix: Water | Sampled: 2023-09-25 16:30, Continued						
Total Metals, Continued						
Tellurium, total	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Thallium, total	< 0.000020	N/A	0.000020	mg/L	2023-10-05	
Thorium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Tin, total	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Titanium, total	**0.0100**	N/A	0.0050	mg/L	2023-10-05	
Tungsten, total	< 0.0010	N/A	0.0010	mg/L	2023-10-05	
Uranium, total	**0.000149**	MAC = 0.02	0.000020	mg/L	2023-10-05	
Vanadium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Zinc, total	< 0.0040	AO ≤ 5	0.0040	mg/L	2023-10-05	
Zirconium, total	**0.00024**	N/A	0.00010	mg/L	2023-10-05	
FLD001-20230925-1630 (23I3535-03) | Matrix: Water | Sampled: 2023-09-25 16:30						
Anions						
Bromide	< 0.10	N/A	0.10	mg/L	2023-10-01	
Chloride	**0.12**	AO ≤ 250	0.10	mg/L	2023-10-01	
Fluoride	< 0.10	MAC = 1.5	0.10	mg/L	2023-10-01	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2023-10-01	HT1
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2023-10-01	HT1
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2023-10-01	HT1
Sulfate	< 1.0	AO ≤ 500	1.0	mg/L	2023-10-01	
BCMOE Aggregate Hydrocarbons						
EPHw10-19	< 250	N/A	250	µg/L	2023-10-03	
EPHw19-32	< 250	N/A	250	µg/L	2023-10-03	
Surrogate: 2-Methylnonane (EPH/F2-4)	*84*		*60-140*	%	*2023-10-03*	
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	< 0.500	N/A	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	**0.0680**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Aluminum, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Arsenic, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Barium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2023-10-05	
Cadmium, dissolved	**0.000014**	N/A	0.000010	mg/L	2023-10-06	RE2
Calcium, dissolved	< 0.20	N/A	0.20	mg/L	2023-10-05	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Cobalt, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	

TEST RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3535
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:07

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
FLD001-20230925-1630 (23I3535-03) | Matrix: Water | Sampled: 2023-09-25 16:30, Continued						
Dissolved Metals, Continued						
Copper, dissolved	< 0.00040	N/A	0.00040	mg/L	2023-10-05	
Iron, dissolved	< 0.010	N/A	0.010	mg/L	2023-10-05	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Lithium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Magnesium, dissolved	< 0.010	N/A	0.010	mg/L	2023-10-05	
Manganese, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2023-10-06	
Molybdenum, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Nickel, dissolved	< 0.00040	N/A	0.00040	mg/L	2023-10-05	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2023-10-05	
Potassium, dissolved	< 0.10	N/A	0.10	mg/L	2023-10-05	
Selenium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Silicon, dissolved	< 1.0	N/A	1.0	mg/L	2023-10-05	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2023-10-05	
Sodium, dissolved	< 0.10	N/A	0.10	mg/L	2023-10-05	
Strontium, dissolved	< 0.0010	N/A	0.0010	mg/L	2023-10-05	
Sulfur, dissolved	< 3.0	N/A	3.0	mg/L	2023-10-05	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2023-10-05	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2023-10-05	
Uranium, dissolved	< 0.000020	N/A	0.000020	mg/L	2023-10-05	
Vanadium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2023-10-05	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
General Parameters						
Alkalinity, Total (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-09-30	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-09-30	
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-09-30	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-09-30	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-09-30	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2023-10-02	
BOD, 5-day	< 7.0	N/A	2.0	mg/L	2023-10-03	
Carbon, Total Organic	**1.67**	N/A	0.50	mg/L	2023-10-09	
Carbon, Dissolved Organic	**1.59**	N/A	0.50	mg/L	2023-10-09	
Chemical Oxygen Demand	< 20	N/A	20	mg/L	2023-09-29	
Nitrogen, Total Kjeldahl	**0.068**	N/A	0.050	mg/L	2023-10-03	
Phosphorus, Total (as P)	< 0.0050	N/A	0.0050	mg/L	2023-09-29	
Solids, Total Suspended	< 2.0	N/A	2.0	mg/L	2023-10-04	HT1
Total Metals						

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
FLD001-20230925-1630 (23I3535-03) | Matrix: Water | Sampled: 2023-09-25 16:30, Continued						
Total Metals, Continued						
Aluminum, total	< 0.0050	OG < 0.1	0.0050	mg/L	2023-10-05	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2023-10-05	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2023-10-05	
Barium, total	< 0.0050	MAC = 2	0.0050	mg/L	2023-10-05	
Beryllium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Bismuth, total	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2023-10-05	
Cadmium, total	< 0.000010	MAC = 0.007	0.000010	mg/L	2023-10-05	
Calcium, total	< 0.20	None Required	0.20	mg/L	2023-10-05	
Chromium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2023-10-05	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Copper, total	< 0.00040	MAC = 2	0.00040	mg/L	2023-10-05	
Iron, total	< 0.010	AO ≤ 0.3	0.010	mg/L	2023-10-05	
Lead, total	< 0.00020	MAC = 0.005	0.00020	mg/L	2023-10-05	
Lithium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Magnesium, total	< 0.010	None Required	0.010	mg/L	2023-10-05	
Manganese, total	< 0.00020	MAC = 0.12	0.00020	mg/L	2023-10-05	
Mercury, total	< 0.000010	MAC = 0.001	0.000010	mg/L	2023-10-06	
Molybdenum, total	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Nickel, total	< 0.00040	N/A	0.00040	mg/L	2023-10-05	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2023-10-05	
Potassium, total	< 0.10	N/A	0.10	mg/L	2023-10-05	
Selenium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2023-10-05	
Silicon, total	< 1.0	N/A	1.0	mg/L	2023-10-05	
Silver, total	< 0.000050	None Required	0.000050	mg/L	2023-10-05	
Sodium, total	< 0.10	AO ≤ 200	0.10	mg/L	2023-10-05	
Strontium, total	< 0.0010	MAC = 7	0.0010	mg/L	2023-10-05	
Sulfur, total	< 3.0	N/A	3.0	mg/L	2023-10-05	
Tellurium, total	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Thallium, total	< 0.000020	N/A	0.000020	mg/L	2023-10-05	
Thorium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Tin, total	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Titanium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Tungsten, total	< 0.0010	N/A	0.0010	mg/L	2023-10-05	
Uranium, total	< 0.000020	MAC = 0.02	0.000020	mg/L	2023-10-05	
Vanadium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Zinc, total	< 0.0040	AO ≤ 5	0.0040	mg/L	2023-10-05	
Zirconium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
DUP001-20230925-1230 (23I3535-04) | Matrix: Water | Sampled: 2023-09-25 12:30						
Anions						
Bromide	< 0.10	N/A	0.10	mg/L	2023-10-01	

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3535
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:07

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
DUP001-20230925-1230 (23I3535-04) | Matrix: Water | Sampled: 2023-09-25 12:30, Continued						
Anions, Continued						
Chloride	**3.04**	AO ≤ 250	0.10	mg/L	2023-10-01	
Fluoride	< 0.10	MAC = 1.5	0.10	mg/L	2023-10-01	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2023-10-01	HT1
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2023-10-01	HT1
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2023-10-01	HT1
Sulfate	**6.9**	AO ≤ 500	1.0	mg/L	2023-10-01	
BCMOE Aggregate Hydrocarbons						
EPHw10-19	< 250	N/A	250	µg/L	2023-10-03	
EPHw19-32	< 250	N/A	250	µg/L	2023-10-03	
Surrogate: 2-Methylnonane (EPH/F2-4)	*76*		*60-140*	%	*2023-10-03*	
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	**119**	N/A	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	**0.0980**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Aluminum, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Arsenic, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Barium, dissolved	**0.145**	N/A	0.0050	mg/L	2023-10-05	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2023-10-05	
Cadmium, dissolved	**0.000014**	N/A	0.000010	mg/L	2023-10-05	
Calcium, dissolved	**34.9**	N/A	0.20	mg/L	2023-10-05	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Cobalt, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Copper, dissolved	**0.00047**	N/A	0.00040	mg/L	2023-10-05	
Iron, dissolved	< 0.010	N/A	0.010	mg/L	2023-10-05	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Lithium, dissolved	**0.00286**	N/A	0.00010	mg/L	2023-10-05	
Magnesium, dissolved	**7.68**	N/A	0.010	mg/L	2023-10-05	
Manganese, dissolved	**0.00953**	N/A	0.00020	mg/L	2023-10-05	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2023-10-06	
Molybdenum, dissolved	**0.00074**	N/A	0.00010	mg/L	2023-10-05	
Nickel, dissolved	< 0.00040	N/A	0.00040	mg/L	2023-10-05	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2023-10-05	
Potassium, dissolved	**0.52**	N/A	0.10	mg/L	2023-10-05	
Selenium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Silicon, dissolved	**1.6**	N/A	1.0	mg/L	2023-10-05	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2023-10-05	
Sodium, dissolved	**2.19**	N/A	0.10	mg/L	2023-10-05	

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
DUP001-20230925-1230 (23I3535-04) | Matrix: Water | Sampled: 2023-09-25 12:30, Continued						
Dissolved Metals, Continued						
Strontium, dissolved	**0.128**	N/A	0.0010	mg/L	2023-10-05	
Sulfur, dissolved	< 3.0	N/A	3.0	mg/L	2023-10-05	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2023-10-05	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2023-10-05	
Uranium, dissolved	**0.000250**	N/A	0.000020	mg/L	2023-10-05	
Vanadium, dissolved	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2023-10-05	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
General Parameters						
Alkalinity, Total (as CaCO3)	**130**	N/A	1.0	mg/L	2023-09-30	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-09-30	
Alkalinity, Bicarbonate (as CaCO3)	**130**	N/A	1.0	mg/L	2023-09-30	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-09-30	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2023-09-30	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2023-10-02	
BOD, 5-day	< 7.0	N/A	2.0	mg/L	2023-10-03	
Carbon, Total Organic	**3.26**	N/A	0.50	mg/L	2023-10-09	
Carbon, Dissolved Organic	**3.17**	N/A	0.50	mg/L	2023-10-09	
Chemical Oxygen Demand	< 20	N/A	20	mg/L	2023-09-29	
Nitrogen, Total Kjeldahl	**0.098**	N/A	0.050	mg/L	2023-10-03	
Phosphorus, Total (as P)	**0.0096**	N/A	0.0050	mg/L	2023-09-29	
Solids, Total Suspended	< 2.0	N/A	2.0	mg/L	2023-10-04	HT1
Total Metals						
Aluminum, total	**0.0320**	OG < 0.1	0.0050	mg/L	2023-10-05	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2023-10-05	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2023-10-05	
Barium, total	**0.144**	MAC = 2	0.0050	mg/L	2023-10-05	
Beryllium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Bismuth, total	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2023-10-05	
Cadmium, total	**0.000024**	MAC = 0.007	0.000010	mg/L	2023-10-05	
Calcium, total	**34.4**	None Required	0.20	mg/L	2023-10-05	
Chromium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2023-10-05	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Copper, total	**0.00050**	MAC = 2	0.00040	mg/L	2023-10-05	
Iron, total	**0.034**	AO ≤ 0.3	0.010	mg/L	2023-10-05	
Lead, total	< 0.00020	MAC = 0.005	0.00020	mg/L	2023-10-05	
Lithium, total	**0.00291**	N/A	0.00010	mg/L	2023-10-05	

TEST RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3535
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:07

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
DUP001-20230925-1230 (23I3535-04) | Matrix: Water | Sampled: 2023-09-25 12:30, Continued						
Total Metals, Continued						
Magnesium, total	**7.33**	None Required	0.010	mg/L	2023-10-05	
Manganese, total	**0.0114**	MAC = 0.12	0.00020	mg/L	2023-10-05	
Mercury, total	< 0.000010	MAC = 0.001	0.000010	mg/L	2023-10-06	
Molybdenum, total	**0.00067**	N/A	0.00010	mg/L	2023-10-05	
Nickel, total	< 0.00040	N/A	0.00040	mg/L	2023-10-05	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2023-10-05	
Potassium, total	**0.55**	N/A	0.10	mg/L	2023-10-05	
Selenium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2023-10-05	
Silicon, total	**1.7**	N/A	1.0	mg/L	2023-10-05	
Silver, total	< 0.000050	None Required	0.000050	mg/L	2023-10-05	
Sodium, total	**1.97**	AO ≤ 200	0.10	mg/L	2023-10-05	
Strontium, total	**0.121**	MAC = 7	0.0010	mg/L	2023-10-05	
Sulfur, total	< 3.0	N/A	3.0	mg/L	2023-10-05	
Tellurium, total	< 0.00050	N/A	0.00050	mg/L	2023-10-05	
Thallium, total	< 0.000020	N/A	0.000020	mg/L	2023-10-05	
Thorium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-05	
Tin, total	< 0.00020	N/A	0.00020	mg/L	2023-10-05	
Titanium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Tungsten, total	< 0.0010	N/A	0.0010	mg/L	2023-10-05	
Uranium, total	**0.000251**	MAC = 0.02	0.000020	mg/L	2023-10-05	
Vanadium, total	< 0.0050	N/A	0.0050	mg/L	2023-10-05	
Zinc, total	< 0.0040	AO ≤ 5	0.0040	mg/L	2023-10-05	
Zirconium, total	< 0.00010	N/A	0.00010	mg/L	2023-10-05	

Sample Qualifiers:

HT1	The sample was prepared and/or analyzed past the recommended holding time.
RE2	Result was confirmed by re-analysis prior to reporting.

CARO ANALYTICAL SERVICES

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3535
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:07

Analysis Description	Method Ref.	Technique	Accredited	Location
Alkalinity in Water	SM 2320 B* (2021)	Titration with H2SO4	✓	Kelowna
Ammonia, Total in Water	SM 4500-NH3 G* (2021)	Automated Colorimetry (Phenate)	✓	Kelowna
Anions in Water	SM 4110 B (2020)	Ion Chromatography	✓	Kelowna
Biochemical Oxygen Demand in Water	SM 5210 B (2019)	Dissolved Oxygen Meter	✓	Kelowna
Carbon, Dissolved Organic in Water	SM 5310 B (2022)	Combustion, Infrared CO2 Detection	✓	Kelowna
Carbon, Total Organic in Water	SM 5310 B (2022)	Combustion, Infrared CO2 Detection	✓	Kelowna
Chemical Oxygen Demand in Water	SM 5220 D* (2022)	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
EPH in Water	EPA 3511* / BCMOE EPHw	Hexane MicroExtraction (Base/Neutral) / Gas Chromatography (GC-FID)	✓	Richmond
Hardness in Water	SM 2340 B (2021)	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* (2021)	Block Digestion and Flow Injection Analysis	✓	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2021)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Solids, Total Suspended in Water	Solids in Water, Filtered / SM 2540 D* (2020)	Solids in Water, Filtered / 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)
µg/L	Micrograms per litre
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, September 2022)

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**	23I3535
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:07

General Comments:

The results in this report apply to the received 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. Caro will dispose of all samples within 30 days of sample receipt, unless otherwise agreed.

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.

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 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 B3I2980										
Blank (B3I2980-BLK1)				Prepared: 2023-09-29, Analyzed: 2023-09-29						
Bromide	< 0.10	0.10	mg/L							
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 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	< 0.5	0.5	mg/L							
Blank (B3I2980-BLK2)				Prepared: 2023-09-30, Analyzed: 2023-09-30						
Bromide	< 0.10	0.10	mg/L							
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 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	< 0.5	0.5	mg/L							
Blank (B3I2980-BLK3)				Prepared: 2023-10-01, Analyzed: 2023-10-01						
Bromide	< 0.10	0.10	mg/L							
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 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	< 0.5	0.5	mg/L							
Blank (B3I2980-BLK4)				Prepared: 2023-10-01, Analyzed: 2023-10-01						
Bromide	< 0.10	0.10	mg/L							
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 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	< 0.5	0.5	mg/L							
LCS (B3I2980-BS1)				Prepared: 2023-09-29, Analyzed: 2023-09-29						
Bromide	4.05	0.10	mg/L	4.00		101	85-115			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3535
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:07

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B3I2980, Continued										
LCS (B3I2980-BS1), Continued				Prepared: 2023-09-29, Analyzed: 2023-09-29						
Chloride	15.9	0.10	mg/L	16.0		99	90-110			
Fluoride	3.99	0.10	mg/L	4.00		100	88-108			
Nitrate (as N)	3.94	0.010	mg/L	4.00		99	90-110			
Nitrite (as N)	1.99	0.010	mg/L	2.00		99	85-115			
Phosphate (as P)	1.01	0.0050	mg/L	1.00		101	80-120			
Sulfate	16.3	0.5	mg/L	16.0		102	90-110			
LCS (B3I2980-BS2)				Prepared: 2023-09-30, Analyzed: 2023-09-30						
Bromide	3.92	0.10	mg/L	4.00		98	85-115			
Chloride	15.9	0.10	mg/L	16.0		99	90-110			
Fluoride	3.92	0.10	mg/L	4.00		98	88-108			
Nitrate (as N)	3.86	0.010	mg/L	4.00		96	90-110			
Nitrite (as N)	1.98	0.010	mg/L	2.00		99	85-115			
Phosphate (as P)	0.917	0.0050	mg/L	1.00		92	80-120			
Sulfate	15.4	0.5	mg/L	16.0		96	90-110			
LCS (B3I2980-BS3)				Prepared: 2023-10-01, Analyzed: 2023-10-01						
Bromide	3.59	0.10	mg/L	4.00		90	85-115			
Chloride	15.8	0.10	mg/L	16.0		99	90-110			
Fluoride	3.99	0.10	mg/L	4.00		100	88-108			
Nitrate (as N)	3.70	0.010	mg/L	4.00		93	90-110			
Nitrite (as N)	2.01	0.010	mg/L	2.00		100	85-115			
Phosphate (as P)	1.01	0.0050	mg/L	1.00		101	80-120			
Sulfate	15.4	0.5	mg/L	16.0		96	90-110			
LCS (B3I2980-BS4)				Prepared: 2023-10-01, Analyzed: 2023-10-01						
Bromide	3.77	0.10	mg/L	4.00		94	85-115			
Chloride	15.7	0.10	mg/L	16.0		98	90-110			
Fluoride	3.96	0.10	mg/L	4.00		99	88-108			
Nitrate (as N)	3.93	0.010	mg/L	4.00		98	90-110			
Nitrite (as N)	2.00	0.010	mg/L	2.00		100	85-115			
Phosphate (as P)	0.856	0.0050	mg/L	1.00		86	80-120			
Sulfate	15.4	0.5	mg/L	16.0		97	90-110			
Duplicate (B3I2980-DUP3)		**Source: 23I3535-01**		Prepared: 2023-10-01, Analyzed: 2023-10-01						
Bromide	< 0.10	0.10	mg/L		< 0.10				10	
Chloride	3.03	0.10	mg/L		3.04			< 1	10	
Fluoride	< 0.10	0.10	mg/L		< 0.10				10	
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	
Sulfate	6.9	1.0	mg/L		6.9			< 1	10	
Matrix Spike (B3I2980-MS3)		**Source: 23I3535-01**		Prepared: 2023-10-01, Analyzed: 2023-10-01						
Bromide	4.19	0.10	mg/L	4.00	< 0.10	104	80-120			
Chloride	19.9	0.10	mg/L	16.0	3.04	105	75-125			
Fluoride	4.15	0.10	mg/L	4.00	< 0.10	103	75-125			
Nitrate (as N)	4.12	0.010	mg/L	4.00	< 0.010	103	75-125			
Nitrite (as N)	2.06	0.010	mg/L	2.00	< 0.010	103	80-120			
Phosphate (as P)	0.927	0.0050	mg/L	1.00	< 0.0050	93	70-130			
Sulfate	23.0	0.5	mg/L	16.0	6.9	101	75-125			
BCMOE Aggregate Hydrocarbons, Batch B3J0034										
Blank (B3J0034-BLK1)				Prepared: 2023-10-02, Analyzed: 2023-10-03						
EPHw10-19	< 250	250	µg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3535
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:07

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
BCMOE Aggregate Hydrocarbons, Batch B3J0034, Continued										
Blank (B3J0034-BLK1), Continued				Prepared: 2023-10-02, Analyzed: 2023-10-03						
EPHw19-32	< 250	250	µg/L							
Surrogate: 2-Methylnonane (EPH/F2-4)	*1860*		*µg/L*	2200		*84*	*60-140*			
LCS (B3J0034-BS2)				Prepared: 2023-10-02, Analyzed: 2023-10-03						
EPHw10-19	18400	250	µg/L	15400		119	70-130			
EPHw19-32	22000	250	µg/L	22200		99	70-130			
Surrogate: 2-Methylnonane (EPH/F2-4)	*1390*		*µg/L*	2200		*63*	*60-140*			
LCS Dup (B3J0034-BSD2)				Prepared: 2023-10-02, Analyzed: 2023-10-03						
EPHw10-19	17500	250	µg/L	15400		113	70-130	5	20	
EPHw19-32	20600	250	µg/L	22200		93	70-130	6	20	
Surrogate: 2-Methylnonane (EPH/F2-4)	*1360*		*µg/L*	2200		*62*	*60-140*			
BCMOE Aggregate Hydrocarbons, Batch B3J0307										
Blank (B3J0307-BLK1)				Prepared: 2023-10-04, Analyzed: 2023-10-05						
EPHw10-19	< 250	250	µg/L							
EPHw19-32	< 250	250	µg/L							
Surrogate: 2-Methylnonane (EPH/F2-4)	*2030*		*µg/L*	2200		*92*	*60-140*			
LCS (B3J0307-BS2)				Prepared: 2023-10-04, Analyzed: 2023-10-05						
EPHw10-19	15400	250	µg/L	15400		100	70-130			
EPHw19-32	23100	250	µg/L	22200		104	70-130			
Surrogate: 2-Methylnonane (EPH/F2-4)	*1630*		*µg/L*	2200		*74*	*60-140*			
LCS Dup (B3J0307-BSD2)				Prepared: 2023-10-04, Analyzed: 2023-10-05						
EPHw10-19	15900	250	µg/L	15400		103	70-130	3	20	
EPHw19-32	23300	250	µg/L	22200		105	70-130	1	20	
Surrogate: 2-Methylnonane (EPH/F2-4)	*1870*		*µg/L*	2200		*85*	*60-140*			
Dissolved Metals, Batch B3J0401										
Blank (B3J0401-BLK1)				Prepared: 2023-10-05, Analyzed: 2023-10-05						
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							
Lithium, dissolved	< 0.00010	0.00010	mg/L							
Magnesium, dissolved	< 0.010	0.010	mg/L							
Manganese, dissolved	< 0.00020	0.00020	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							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3535
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:07

Dissolved Metals, Batch B3J0401, Continued

Blank (B3J0401-BLK1), Continued Prepared: 2023-10-05, Analyzed: 2023-10-05

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
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	< 0.0050	0.0050	mg/L							
Zinc, dissolved	< 0.0040	0.0040	mg/L							
Zirconium, dissolved	< 0.00010	0.00010	mg/L							

LCS (B3J0401-BS1) Prepared: 2023-10-05, Analyzed: 2023-10-05

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Aluminum, dissolved	4.24	0.0050	mg/L	4.00		106	80-120			
Antimony, dissolved	0.0413	0.00020	mg/L	0.0400		103	80-120			
Arsenic, dissolved	0.404	0.00050	mg/L	0.400		101	80-120			
Barium, dissolved	0.0417	0.0050	mg/L	0.0400		104	80-120			
Beryllium, dissolved	0.0427	0.00010	mg/L	0.0400		107	80-120			
Bismuth, dissolved	0.0413	0.00010	mg/L	0.0400		103	80-120			
Boron, dissolved	0.425	0.0500	mg/L	0.400		106	80-120			
Cadmium, dissolved	0.0407	0.000010	mg/L	0.0400		102	80-120			
Calcium, dissolved	4.20	0.20	mg/L	4.00		105	80-120			
Chromium, dissolved	0.0410	0.00050	mg/L	0.0400		102	80-120			
Cobalt, dissolved	0.0403	0.00010	mg/L	0.0400		101	80-120			
Copper, dissolved	0.0401	0.00040	mg/L	0.0400		100	80-120			
Iron, dissolved	4.14	0.010	mg/L	4.00		103	80-120			
Lead, dissolved	0.0413	0.00020	mg/L	0.0400		103	80-120			
Lithium, dissolved	0.0434	0.00010	mg/L	0.0400		108	80-120			
Magnesium, dissolved	4.17	0.010	mg/L	4.00		104	80-120			
Manganese, dissolved	0.0421	0.00020	mg/L	0.0400		105	80-120			
Molybdenum, dissolved	0.0393	0.00010	mg/L	0.0400		98	80-120			
Nickel, dissolved	0.0405	0.00040	mg/L	0.0400		101	80-120			
Phosphorus, dissolved	4.21	0.050	mg/L	4.00		105	80-120			
Potassium, dissolved	4.20	0.10	mg/L	4.00		105	80-120			
Selenium, dissolved	0.402	0.00050	mg/L	0.400		100	80-120			
Silicon, dissolved	4.5	1.0	mg/L	4.00		111	80-120			
Silver, dissolved	0.0389	0.000050	mg/L	0.0400		97	80-120			
Sodium, dissolved	4.19	0.10	mg/L	4.00		105	80-120			
Strontium, dissolved	0.0431	0.0010	mg/L	0.0400		108	80-120			
Sulfur, dissolved	42.4	3.0	mg/L	40.0		106	80-120			
Tellurium, dissolved	0.0407	0.00050	mg/L	0.0400		102	80-120			
Thallium, dissolved	0.0411	0.000020	mg/L	0.0400		103	80-120			
Thorium, dissolved	0.0399	0.00010	mg/L	0.0400		100	80-120			
Tin, dissolved	0.0417	0.00020	mg/L	0.0400		104	80-120			
Titanium, dissolved	0.0416	0.0050	mg/L	0.0400		104	80-120			
Tungsten, dissolved	0.0413	0.0010	mg/L	0.0400		103	80-120			
Uranium, dissolved	0.0421	0.000020	mg/L	0.0400		105	80-120			
Vanadium, dissolved	0.0410	0.0050	mg/L	0.0400		103	80-120			
Zinc, dissolved	0.409	0.0040	mg/L	0.400		102	80-120			
Zirconium, dissolved	0.0422	0.00010	mg/L	0.0400		105	80-120			

Duplicate (B3J0401-DUP1) **Source: 23I3535-01** Prepared: 2023-10-05, Analyzed: 2023-10-05

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Aluminum, dissolved	< 0.0050	0.0050	mg/L		< 0.0050				20	
Antimony, dissolved	< 0.00020	0.00020	mg/L		< 0.00020				20	

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3535
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:07

Dissolved Metals, Batch B3J0401, Continued

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Duplicate (B3J0401-DUP1), Continued		**Source: 23I3535-01**		Prepared: 2023-10-05, Analyzed: 2023-10-05						
Arsenic, dissolved	< 0.00050	0.00050	mg/L		< 0.00050				20	
Barium, dissolved	0.145	0.0050	mg/L		0.146			< 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	0.000021	0.000010	mg/L		0.000017				20	
Calcium, dissolved	34.3	0.20	mg/L		34.5			< 1	20	
Chromium, dissolved	< 0.00050	0.00050	mg/L		< 0.00050				20	
Cobalt, dissolved	< 0.00010	0.00010	mg/L		< 0.00010				20	
Copper, dissolved	0.00048	0.00040	mg/L		0.00047				20	
Iron, dissolved	< 0.010	0.010	mg/L		< 0.010				20	
Lead, dissolved	< 0.00020	0.00020	mg/L		< 0.00020				20	
Lithium, dissolved	0.00285	0.00010	mg/L		0.00291			2	20	
Magnesium, dissolved	7.66	0.010	mg/L		7.70			< 1	20	
Manganese, dissolved	0.00942	0.00020	mg/L		0.00956			1	20	
Molybdenum, dissolved	0.00068	0.00010	mg/L		0.00068			< 1	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	0.53	0.10	mg/L		0.54			1	20	
Selenium, dissolved	< 0.00050	0.00050	mg/L		< 0.00050				20	
Silicon, dissolved	1.6	1.0	mg/L		1.6				20	
Silver, dissolved	< 0.000050	0.000050	mg/L		< 0.000050				20	
Sodium, dissolved	2.08	0.10	mg/L		2.06			1	20	
Strontium, dissolved	0.128	0.0010	mg/L		0.128			< 1	20	
Sulfur, dissolved	< 3.0	3.0	mg/L		< 3.0				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	0.000248	0.000020	mg/L		0.000251			1	20	
Vanadium, dissolved	< 0.0050	0.0050	mg/L		< 0.0050				20	
Zinc, dissolved	< 0.0040	0.0040	mg/L		< 0.0040				20	
Zirconium, dissolved	< 0.00010	0.00010	mg/L		< 0.00010				20	
Matrix Spike (B3J0401-MS1)		**Source: 23I3535-02**		Prepared: 2023-10-05, Analyzed: 2023-10-05						
Aluminum, dissolved	4.31	0.0050	mg/L	4.00	0.0141	107	70-130			
Antimony, dissolved	0.0423	0.00020	mg/L	0.0400	< 0.00020	105	70-130			
Arsenic, dissolved	0.411	0.00050	mg/L	0.400	< 0.00050	103	70-130			
Barium, dissolved	0.236	0.0050	mg/L	0.0400	0.184	130	70-130			
Beryllium, dissolved	0.0428	0.00010	mg/L	0.0400	< 0.00010	107	70-130			
Bismuth, dissolved	0.0358	0.00010	mg/L	0.0400	< 0.00010	90	70-130			
Boron, dissolved	0.391	0.0500	mg/L	0.400	< 0.0500	97	70-130			
Cadmium, dissolved	0.0427	0.000010	mg/L	0.0400	0.000028	107	70-130			
Calcium, dissolved	25.2	0.20	mg/L	4.00	20.8	110	70-130			
Chromium, dissolved	0.0408	0.00050	mg/L	0.0400	< 0.00050	102	70-130			
Cobalt, dissolved	0.0390	0.00010	mg/L	0.0400	< 0.00010	97	70-130			
Copper, dissolved	0.0382	0.00040	mg/L	0.0400	0.00044	95	70-130			
Iron, dissolved	4.14	0.010	mg/L	4.00	< 0.010	103	70-130			
Lead, dissolved	0.0426	0.00020	mg/L	0.0400	< 0.00020	106	70-130			
Lithium, dissolved	0.0448	0.00010	mg/L	0.0400	0.00134	109	70-130			
Magnesium, dissolved	8.40	0.010	mg/L	4.00	4.32	102	70-130			
Manganese, dissolved	0.0438	0.00020	mg/L	0.0400	0.00144	106	70-130			
Molybdenum, dissolved	0.0401	0.00010	mg/L	0.0400	0.00050	99	70-130			
Nickel, dissolved	0.0392	0.00040	mg/L	0.0400	< 0.00040	97	70-130			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3535
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:07

Dissolved Metals, Batch B3J0401, Continued

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Matrix Spike (B3J0401-MS1), Continued		**Source: 23I3535-02**		Prepared: 2023-10-05, Analyzed: 2023-10-05						
Phosphorus, dissolved	4.41	0.050	mg/L	4.00	< 0.050	110	70-130			
Potassium, dissolved	4.66	0.10	mg/L	4.00	0.54	103	70-130			
Selenium, dissolved	0.412	0.00050	mg/L	0.400	< 0.00050	103	70-130			
Silicon, dissolved	5.4	1.0	mg/L	4.00	1.1	108	70-130			
Silver, dissolved	0.0384	0.000050	mg/L	0.0400	< 0.000050	96	70-130			
Sodium, dissolved	5.78	0.10	mg/L	4.00	1.65	103	70-130			
Strontium, dissolved	0.168	0.0010	mg/L	0.0400	0.123	112	70-130			
Sulfur, dissolved	41.9	3.0	mg/L	40.0	< 3.0	102	70-130			
Tellurium, dissolved	0.0447	0.00050	mg/L	0.0400	< 0.00050	112	70-130			
Thallium, dissolved	0.0426	0.000020	mg/L	0.0400	< 0.000020	107	70-130			
Thorium, dissolved	0.0412	0.00010	mg/L	0.0400	< 0.00010	103	70-130			
Tin, dissolved	0.0432	0.00020	mg/L	0.0400	< 0.00020	108	70-130			
Titanium, dissolved	0.0422	0.0050	mg/L	0.0400	< 0.0050	105	70-130			
Tungsten, dissolved	0.0419	0.0010	mg/L	0.0400	< 0.0010	105	70-130			
Uranium, dissolved	0.0421	0.000020	mg/L	0.0400	0.000132	105	70-130			
Vanadium, dissolved	0.0412	0.0050	mg/L	0.0400	< 0.0050	103	70-130			
Zinc, dissolved	0.420	0.0040	mg/L	0.400	< 0.0040	105	70-130			
Zirconium, dissolved	0.0441	0.00010	mg/L	0.0400	< 0.00010	110	70-130			

Dissolved Metals, Batch B3J0462

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Blank (B3J0462-BLK1)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Blank (B3J0462-BLK2)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Blank (B3J0462-BLK3)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
LCS (B3J0462-BS1)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, dissolved	0.000251	0.000010	mg/L	0.000250		100	80-120			
LCS (B3J0462-BS2)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, dissolved	0.000224	0.000010	mg/L	0.000250		90	80-120			
LCS (B3J0462-BS3)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, dissolved	0.000238	0.000010	mg/L	0.000250		95	80-120			
Duplicate (B3J0462-DUP1)		**Source: 23I3535-01**		Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, dissolved	< 0.000010	0.000010	mg/L		< 0.000010				20	
Matrix Spike (B3J0462-MS1)		**Source: 23I3535-02**		Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, dissolved	0.000239	0.000010	mg/L	0.000250	< 0.000010	96	70-130			

General Parameters, Batch B3I2862

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Blank (B3I2862-BLK1)				Prepared: 2023-09-28, Analyzed: 2023-10-03						
BOD, 5-day	< 2.0	2.0	mg/L							
LCS (B3I2862-BS1)				Prepared: 2023-09-28, Analyzed: 2023-10-03						
BOD, 5-day	202	58.6	mg/L	198		102	85-115			

General Parameters, Batch B3I2913

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3535
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:07

General Parameters, Batch B3I2913, Continued

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Blank (B3I2913-BLK1)				Prepared: 2023-09-28, Analyzed: 2023-09-29						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Blank (B3I2913-BLK2)				Prepared: 2023-09-28, Analyzed: 2023-09-29						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Blank (B3I2913-BLK3)				Prepared: 2023-09-28, Analyzed: 2023-09-29						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Blank (B3I2913-BLK4)				Prepared: 2023-09-28, Analyzed: 2023-09-29						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
LCS (B3I2913-BS1)				Prepared: 2023-09-28, Analyzed: 2023-09-29						
Phosphorus, Total (as P)	0.100	0.0050	mg/L	0.100		100	85-115			
LCS (B3I2913-BS2)				Prepared: 2023-09-28, Analyzed: 2023-09-29						
Phosphorus, Total (as P)	0.100	0.0050	mg/L	0.100		100	85-115			
LCS (B3I2913-BS3)				Prepared: 2023-09-28, Analyzed: 2023-09-29						
Phosphorus, Total (as P)	0.100	0.0050	mg/L	0.100		100	85-115			
LCS (B3I2913-BS4)				Prepared: 2023-09-28, Analyzed: 2023-09-29						
Phosphorus, Total (as P)	0.102	0.0050	mg/L	0.100		102	85-115			

General Parameters, Batch B3I2991

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Blank (B3I2991-BLK1)				Prepared: 2023-09-29, Analyzed: 2023-09-29						
Chemical Oxygen Demand	< 20	20	mg/L							
LCS (B3I2991-BS1)				Prepared: 2023-09-29, Analyzed: 2023-09-29						
Chemical Oxygen Demand	524	20	mg/L	500		105	89-115			

General Parameters, Batch B3I3065

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Blank (B3I3065-BLK1)				Prepared: 2023-09-30, Analyzed: 2023-09-30						
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 (B3I3065-BLK2)				Prepared: 2023-09-30, Analyzed: 2023-09-30						
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 (B3I3065-BLK3)				Prepared: 2023-09-30, Analyzed: 2023-09-30						
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 (B3I3065-BS1)				Prepared: 2023-09-30, Analyzed: 2023-09-30						
Alkalinity, Total (as CaCO3)	108	1.0	mg/L	100		108	80-120			
Alkalinity, Phenolphthalein (as CaCO3)	54.4	1.0	mg/L	50.0		109	0-200			

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B3I3065, Continued										
LCS (B3I3065-BS2)				Prepared: 2023-09-30, Analyzed: 2023-09-30						
Alkalinity, Total (as CaCO3)	93.4	1.0	mg/L	100		93	80-120			
Alkalinity, Phenolphthalein (as CaCO3)	44.2	1.0	mg/L	50.0		88	0-200			
LCS (B3I3065-BS3)				Prepared: 2023-09-30, Analyzed: 2023-09-30						
Alkalinity, Total (as CaCO3)	107	1.0	mg/L	100		107	80-120			
Alkalinity, Phenolphthalein (as CaCO3)	47.9	1.0	mg/L	50.0		96	0-200			
General Parameters, Batch B3J0026										
Blank (B3J0026-BLK1)				Prepared: 2023-10-02, Analyzed: 2023-10-02						
Ammonia, Total (as N)	0.024	0.010	mg/L							
Blank (B3J0026-BLK2)				Prepared: 2023-10-02, Analyzed: 2023-10-02						
Ammonia, Total (as N)	< 0.010	0.010	mg/L							
Blank (B3J0026-BLK3)				Prepared: 2023-10-02, Analyzed: 2023-10-02						
Ammonia, Total (as N)	< 0.010	0.010	mg/L							
Blank (B3J0026-BLK4)				Prepared: 2023-10-02, Analyzed: 2023-10-02						
Ammonia, Total (as N)	< 0.010	0.010	mg/L							
Blank (B3J0026-BLK5)				Prepared: 2023-10-02, Analyzed: 2023-10-02						
Ammonia, Total (as N)	0.030	0.010	mg/L							
Blank (B3J0026-BLK6)				Prepared: 2023-10-02, Analyzed: 2023-10-02						
Ammonia, Total (as N)	0.029	0.010	mg/L							
LCS (B3J0026-BS1)				Prepared: 2023-10-02, Analyzed: 2023-10-02						
Ammonia, Total (as N)	0.982	0.010	mg/L	1.00		98	85-115			
LCS (B3J0026-BS2)				Prepared: 2023-10-02, Analyzed: 2023-10-02						
Ammonia, Total (as N)	0.981	0.010	mg/L	1.00		98	85-115			
LCS (B3J0026-BS3)				Prepared: 2023-10-02, Analyzed: 2023-10-02						
Ammonia, Total (as N)	0.974	0.010	mg/L	1.00		97	85-115			
LCS (B3J0026-BS4)				Prepared: 2023-10-02, Analyzed: 2023-10-02						
Ammonia, Total (as N)	0.993	0.010	mg/L	1.00		99	85-115			
LCS (B3J0026-BS5)				Prepared: 2023-10-02, Analyzed: 2023-10-02						
Ammonia, Total (as N)	0.971	0.010	mg/L	1.00		97	85-115			
LCS (B3J0026-BS6)				Prepared: 2023-10-02, Analyzed: 2023-10-02						
Ammonia, Total (as N)	0.947	0.010	mg/L	1.00		95	85-115			
General Parameters, Batch B3J0036										
Blank (B3J0036-BLK1)				Prepared: 2023-10-02, Analyzed: 2023-10-03						
Nitrogen, Total Kjeldahl	< 0.050	0.050	mg/L							
Blank (B3J0036-BLK2)				Prepared: 2023-10-02, Analyzed: 2023-10-03						
Nitrogen, Total Kjeldahl	< 0.050	0.050	mg/L							
LCS (B3J0036-BS1)				Prepared: 2023-10-02, Analyzed: 2023-10-03						
Nitrogen, Total Kjeldahl	0.858	0.050	mg/L	1.00		86	85-115			

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B3J0036, Continued										
LCS (B3J0036-BS2)				Prepared: 2023-10-02, Analyzed: 2023-10-03						
Nitrogen, Total Kjeldahl	1.01	0.050	mg/L	1.00		101	85-115			
General Parameters, Batch B3J0163										
Blank (B3J0163-BLK1)				Prepared: 2023-10-04, Analyzed: 2023-10-04						
Solids, Total Suspended	< 2.0	2.0	mg/L							
LCS (B3J0163-BS1)				Prepared: 2023-10-04, Analyzed: 2023-10-04						
Solids, Total Suspended	85.0	10.0	mg/L	100		85	85-115			
General Parameters, Batch B3J0543										
Blank (B3J0543-BLK1)				Prepared: 2023-10-08, Analyzed: 2023-10-10						
Carbon, Total Organic	< 0.50	0.50	mg/L							
Carbon, Dissolved Organic	< 0.50	0.50	mg/L							
Blank (B3J0543-BLK2)				Prepared: 2023-10-09, Analyzed: 2023-10-10						
Carbon, Total Organic	< 0.50	0.50	mg/L							
Carbon, Dissolved Organic	< 0.50	0.50	mg/L							
Blank (B3J0543-BLK3)				Prepared: 2023-10-09, Analyzed: 2023-10-10						
Carbon, Total Organic	< 0.50	0.50	mg/L							
Carbon, Dissolved Organic	< 0.50	0.50	mg/L							
LCS (B3J0543-BS1)				Prepared: 2023-10-08, Analyzed: 2023-10-10						
Carbon, Total Organic	8.83	0.50	mg/L	10.0		88	78-116			
Carbon, Dissolved Organic	9.60	0.50	mg/L	10.0		96	78-116			
LCS (B3J0543-BS2)				Prepared: 2023-10-09, Analyzed: 2023-10-10						
Carbon, Total Organic	8.82	0.50	mg/L	10.0		88	78-116			
Carbon, Dissolved Organic	8.79	0.50	mg/L	10.0		88	78-116			
LCS (B3J0543-BS3)				Prepared: 2023-10-10, Analyzed: 2023-10-10						
Carbon, Total Organic	9.24	0.50	mg/L	10.0		92	78-116			
Carbon, Dissolved Organic	9.02	0.50	mg/L	10.0		90	78-116			
Total Metals, Batch B3J0405										
Blank (B3J0405-BLK1)				Prepared: 2023-10-05, Analyzed: 2023-10-05						
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							

CARO ANALYTICAL SERVICES

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Elk River Alliance	**WORK ORDER**	23I3535
PROJECT	CBWM-2023	**REPORTED**	2023-10-11 14:07

Total Metals, Batch B3J0405, Continued

Blank (B3J0405-BLK1), Continued Prepared: 2023-10-05, Analyzed: 2023-10-05

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
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	< 0.0050	0.0050	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
Zirconium, total	< 0.00010	0.00010	mg/L							

LCS (B3J0405-BS1) Prepared: 2023-10-05, Analyzed: 2023-10-05

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Aluminum, total	4.10	0.0050	mg/L	4.00		103	80-120			
Antimony, total	0.0427	0.00020	mg/L	0.0400		107	80-120			
Arsenic, total	0.411	0.00050	mg/L	0.400		103	80-120			
Barium, total	0.0414	0.0050	mg/L	0.0400		103	80-120			
Beryllium, total	0.0418	0.00010	mg/L	0.0400		104	80-120			
Bismuth, total	0.0420	0.00010	mg/L	0.0400		105	80-120			
Boron, total	0.428	0.0500	mg/L	0.400		107	80-120			
Cadmium, total	0.0411	0.000010	mg/L	0.0400		103	80-120			
Calcium, total	4.19	0.20	mg/L	4.00		105	80-120			
Chromium, total	0.0416	0.00050	mg/L	0.0400		104	80-120			
Cobalt, total	0.0411	0.00010	mg/L	0.0400		103	80-120			
Copper, total	0.0415	0.00040	mg/L	0.0400		104	80-120			
Iron, total	4.11	0.010	mg/L	4.00		103	80-120			
Lead, total	0.0416	0.00020	mg/L	0.0400		104	80-120			
Lithium, total	0.0414	0.00010	mg/L	0.0400		103	80-120			
Magnesium, total	4.11	0.010	mg/L	4.00		103	80-120			
Manganese, total	0.0409	0.00020	mg/L	0.0400		102	80-120			
Molybdenum, total	0.0404	0.00010	mg/L	0.0400		101	80-120			
Nickel, total	0.0414	0.00040	mg/L	0.0400		104	80-120			
Phosphorus, total	4.10	0.050	mg/L	4.00		103	80-120			
Potassium, total	4.08	0.10	mg/L	4.00		102	80-120			
Selenium, total	0.422	0.00050	mg/L	0.400		106	80-120			
Silicon, total	4.3	1.0	mg/L	4.00		107	80-120			
Silver, total	0.0420	0.000050	mg/L	0.0400		105	80-120			
Sodium, total	4.04	0.10	mg/L	4.00		101	80-120			
Strontium, total	0.0412	0.0010	mg/L	0.0400		103	80-120			
Sulfur, total	41.4	3.0	mg/L	40.0		103	80-120			
Tellurium, total	0.0416	0.00050	mg/L	0.0400		104	80-120			
Thallium, total	0.0416	0.000020	mg/L	0.0400		104	80-120			
Thorium, total	0.0441	0.00010	mg/L	0.0400		110	80-120			
Tin, total	0.0416	0.00020	mg/L	0.0400		104	80-120			
Titanium, total	0.0411	0.0050	mg/L	0.0400		103	80-120			
Tungsten, total	0.0429	0.0010	mg/L	0.0400		107	80-120			
Uranium, total	0.0434	0.000020	mg/L	0.0400		109	80-120			

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B3J0405, Continued										
LCS (B3J0405-BS1), Continued				Prepared: 2023-10-05, Analyzed: 2023-10-05						
Vanadium, total	0.0422	0.0050	mg/L	0.0400		105	80-120			
Zinc, total	0.411	0.0040	mg/L	0.400		103	80-120			
Zirconium, total	0.0422	0.00010	mg/L	0.0400		105	80-120			
Duplicate (B3J0405-DUP1)		**Source: 23I3535-01**		Prepared: 2023-10-05, Analyzed: 2023-10-05						
Aluminum, total	0.0239	0.0050	mg/L		0.0242				20	
Antimony, total	< 0.00020	0.00020	mg/L		< 0.00020				20	
Arsenic, total	< 0.00050	0.00050	mg/L		< 0.00050				20	
Barium, total	0.141	0.0050	mg/L		0.143			< 1	20	
Beryllium, total	< 0.00010	0.00010	mg/L		< 0.00010				20	
Bismuth, total	< 0.00010	0.00010	mg/L		< 0.00010				20	
Boron, total	< 0.0500	0.0500	mg/L		< 0.0500				20	
Cadmium, total	0.000025	0.000010	mg/L		0.000022				20	
Calcium, total	34.1	0.20	mg/L		35.0			3	20	
Chromium, total	< 0.00050	0.00050	mg/L		< 0.00050				20	
Cobalt, total	< 0.00010	0.00010	mg/L		< 0.00010				20	
Copper, total	0.00051	0.00040	mg/L		0.00050				20	
Iron, total	0.031	0.010	mg/L		0.029				20	
Lead, total	< 0.00020	0.00020	mg/L		< 0.00020				20	
Lithium, total	0.00294	0.00010	mg/L		0.00301			3	20	
Magnesium, total	7.35	0.010	mg/L		7.24			2	20	
Manganese, total	0.0112	0.00020	mg/L		0.0112			< 1	20	
Molybdenum, total	0.00067	0.00010	mg/L		0.00066			1	20	
Nickel, total	< 0.00040	0.00040	mg/L		< 0.00040				20	
Phosphorus, total	< 0.050	0.050	mg/L		< 0.050				20	
Potassium, total	0.55	0.10	mg/L		0.55			< 1	20	
Selenium, total	< 0.00050	0.00050	mg/L		< 0.00050				20	
Silicon, total	1.7	1.0	mg/L		1.7				20	
Silver, total	< 0.000050	0.000050	mg/L		< 0.000050				20	
Sodium, total	1.95	0.10	mg/L		1.96			< 1	20	
Strontium, total	0.122	0.0010	mg/L		0.123			< 1	20	
Sulfur, total	< 3.0	3.0	mg/L		< 3.0				20	
Tellurium, total	< 0.00050	0.00050	mg/L		< 0.00050				20	
Thallium, total	< 0.000020	0.000020	mg/L		< 0.000020				20	
Thorium, total	< 0.00010	0.00010	mg/L		< 0.00010				20	
Tin, total	< 0.00020	0.00020	mg/L		< 0.00020				20	
Titanium, total	< 0.0050	0.0050	mg/L		< 0.0050				20	
Tungsten, total	< 0.0010	0.0010	mg/L		< 0.0010				20	
Uranium, total	0.000246	0.000020	mg/L		0.000248			< 1	20	
Vanadium, total	< 0.0050	0.0050	mg/L		< 0.0050				20	
Zinc, total	< 0.0040	0.0040	mg/L		< 0.0040				20	
Zirconium, total	< 0.00010	0.00010	mg/L		< 0.00010				20	
Matrix Spike (B3J0405-MS1)		**Source: 23I3535-02**		Prepared: 2023-10-05, Analyzed: 2023-10-05						
Aluminum, total	4.71	0.0050	mg/L	4.00	0.558	104	70-130			
Antimony, total	0.0324	0.00020	mg/L	0.0400	< 0.00020	81	70-130			
Arsenic, total	0.412	0.00050	mg/L	0.400	< 0.00050	103	70-130			
Barium, total	0.238	0.0050	mg/L	0.0400	0.191	119	70-130			
Beryllium, total	0.0425	0.00010	mg/L	0.0400	< 0.00010	106	70-130			
Bismuth, total	0.0413	0.00010	mg/L	0.0400	< 0.00010	103	70-130			
Boron, total	0.424	0.0500	mg/L	0.400	< 0.0500	105	70-130			
Cadmium, total	0.0414	0.000010	mg/L	0.0400	0.000045	103	70-130			
Calcium, total	24.3	0.20	mg/L	4.00	20.2	104	70-130			
Chromium, total	0.0422	0.00050	mg/L	0.0400	0.00071	104	70-130			
Cobalt, total	0.0407	0.00010	mg/L	0.0400	0.00018	101	70-130			
Copper, total	0.0411	0.00040	mg/L	0.0400	0.00083	101	70-130			
Iron, total	4.51	0.010	mg/L	4.00	0.397	103	70-130			

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier

Total Metals, Batch B3J0405, Continued

Matrix Spike (B3J0405-MS1), Continued		**Source: 23I3535-02**		Prepared: 2023-10-05, Analyzed: 2023-10-05						
Lead, total	0.0415	0.00020	mg/L	0.0400	0.00024	103	70-130			
Lithium, total	0.0434	0.00010	mg/L	0.0400	0.00177	104	70-130			
Magnesium, total	8.09	0.010	mg/L	4.00	4.21	97	70-130			
Manganese, total	0.0470	0.00020	mg/L	0.0400	0.00645	101	70-130			
Molybdenum, total	0.0403	0.00010	mg/L	0.0400	0.00052	99	70-130			
Nickel, total	0.0408	0.00040	mg/L	0.0400	0.00082	100	70-130			
Phosphorus, total	4.22	0.050	mg/L	4.00	< 0.050	105	70-130			
Potassium, total	4.91	0.10	mg/L	4.00	0.69	105	70-130			
Selenium, total	0.416	0.00050	mg/L	0.400	< 0.00050	104	70-130			
Silicon, total	6.3	1.0	mg/L	4.00	2.0	107	70-130			
Silver, total	0.0422	0.000050	mg/L	0.0400	< 0.000050	106	70-130			
Sodium, total	5.58	0.10	mg/L	4.00	1.59	100	70-130			
Strontium, total	0.159	0.0010	mg/L	0.0400	0.118	102	70-130			
Sulfur, total	42.9	3.0	mg/L	40.0	< 3.0	104	70-130			
Tellurium, total	0.0416	0.00050	mg/L	0.0400	< 0.00050	104	70-130			
Thallium, total	0.0404	0.000020	mg/L	0.0400	< 0.000020	101	70-130			
Thorium, total	0.0407	0.00010	mg/L	0.0400	< 0.00010	102	70-130			
Tin, total	0.0417	0.00020	mg/L	0.0400	< 0.00020	104	70-130			
Titanium, total	0.0528	0.0050	mg/L	0.0400	0.0100	107	70-130			
Tungsten, total	0.0416	0.0010	mg/L	0.0400	< 0.0010	104	70-130			
Uranium, total	0.0423	0.000020	mg/L	0.0400	0.000149	105	70-130			
Vanadium, total	0.0439	0.0050	mg/L	0.0400	< 0.0050	105	70-130			
Zinc, total	0.418	0.0040	mg/L	0.400	< 0.0040	104	70-130			
Zirconium, total	0.0428	0.00010	mg/L	0.0400	0.00024	106	70-130			

Total Metals, Batch B3J0461

Blank (B3J0461-BLK1)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, total	< 0.000010	0.000010	mg/L							
Blank (B3J0461-BLK2)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, total	< 0.000010	0.000010	mg/L							
LCS (B3J0461-BS1)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, total	0.000240	0.000010	mg/L	0.000250		96	80-120			
LCS (B3J0461-BS2)				Prepared: 2023-10-05, Analyzed: 2023-10-06						
Mercury, total	0.000226	0.000010	mg/L	0.000250		90	80-120			

Appendix D: Benthic Macroinvertebrate Taxonomy Report

CORDILLERA CONSULTING
FRESHWATER INVERTEBRATE TAXONOMY

Project: Community-based Water Monitoring - 2023
Elk River Alliance
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023
Sample:	ALX001	ALX003	BOI001	BOI002	COL001	COL003	LIZ001	LIZ003	MOR001	MOR002
Sample Collection Date:	27-Sep-23	27-Sep-23	26-Sep-23	26-Sep-23	3-Oct-23	3-Oct-23	4-Oct-23	4-Oct-23	25-Sep-23	25-Sep-23
CC #:	CC241427	CC241428	CC241429	CC241430	CC241431	CC241432	CC241433	CC241434	CC241435	CC241436
Sieve Size:	400	400	400	400	400	400	400	400	400	400
SubSample %:	5	5	5	8	5	5	5	5	5	5
Phylum: Arthropoda	0	0	0	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0	0	0	0	0
| Order: Coleoptera	0	0	0	0	0	0	0	0	0	0
| Family: Elmidae	5	4	0	0	0	3	13	92	38	19
Heterlimnius	2	4	0	0	0	4	8	93	11	11
Optioservus	0	0	0	0	0	0	0	1	14	0
Zaitzevia	0	0	0	0	0	0	0	0	6	0
| Order: Ephemeroptera	0	0	0	0	0	0	0	0	0	0
| Family: Ameletidae	0	0	0	0	0	0	0	0	0	0
Ameletus	1	1	7	2	10	34	0	0	0	13
| Family: Baetidae	81	161	12	8	9	9	57	159	12	24
Anafroptilum	0	0	0	0	2	0	0	0	0	0
Baetis	39	78	2	16	2	0	6	17	1	7
Baetis rhodani group	79	95	11	38	0	0	0	21	2	4
Diphetor hageni	0	0	0	0	0	4	0	0	0	25
| Family: Ephemerellidae	51	96	9	6	4	18	14	158	18	8
Caudatella	2	15	0	0	0	0	0	0	0	0
Drunella	0	3	1	24	0	0	0	5	0	0
Drunella doddsii	7	5	6	48	0	0	0	18	0	0
Drunella spinifera	0	4	0	0	0	1	1	3	0	1
Ephemerella	18	9	0	0	5	7	2	0	22	2

| Family: Heptageniidae	21	56	97	37	11	13	3	38	96	39
Cinygmula	7	3	14	2	2	14	0	4	19	5
Epeorus	3	18	25	20	0	0	0	0	0	0
Rhithrogena	9	6	84	11	0	0	0	3	0	3
| Family: Leptophlebiidae	0	0	0	0	7	1	0	0	27	13
Neoleptophlebia	0	0	0	0	1	0	0	0	26	4
| Order: Plecoptera	0	2	3	0	1	0	3	4	0	6
| Family: Capniidae	0	0	3	0	42	3	24	16	2	42
| Family: Chloroperlidae	2	2	3	1	0	4	0	5	0	30
Haploperla	1	0	0	0	0	3	0	5	0	5
Plumiperla	0	0	1	9	0	0	0	0	0	0
Sweltsa	4	2	4	0	0	4	1	0	1	25
| Family: Leuctridae	1	0	1	0	1	0	0	0	3	0
| Family: Nemouridae	10	20	22	3	0	5	3	41	2	0
Visoka cataractae	0	0	12	1	0	6	1	0	0	0
Zapada	6	8	1	0	0	0	3	2	0	0
Zapada cinctipes	13	3	3	0	2	0	24	11	5	2
Zapada columbiana	2	1	43	6	0	3	0	1	0	1
Zapada oregonensis group	7	3	1	0	0	0	0	1	0	0
| Family: Peltoperlidae	0	0	0	0	0	0	0	0	0	0
Yoraperla	0	0	1	1	0	0	0	0	0	0
| Family: Perlidae	1	0	0	0	0	1	0	2	0	1
Doroneuria	2	0	0	0	0	1	2	14	0	5
| Family: Perlodidae	4	0	0	0	1	0	2	0	0	0
Isoperla	0	0	2	0	0	3	0	0	0	2
Kogotus	4	0	0	0	0	0	0	2	0	2
Megarcys	2	2	15	13	1	0	0	1	0	7
Skwala	0	0	0	0	0	0	4	2	4	0
| Family: Taeniopterygidae	1	3	201	25	0	0	0	3	0	1
| Order: Trichoptera	0	0	1	0	0	0	1	0	0	0
| Family: Apataniidae	0	0	0	0	0	0	0	0	0	0
Apatania	3	0	1	0	0	0	0	4	1	0
| Family: Brachycentridae	0	0	0	0	0	0	0	0	0	0
Brachycentrus	4	2	0	0	1	0	0	0	0	0
Micrasema	1	0	0	0	0	22	8	19	7	29
| Family: Glossosomatidae	2	1	0	0	0	0	0	0	0	0
Glossosoma	25	1	0	0	0	0	0	0	0	0
| Family: Hydropsychidae	1	0	0	0	0	0	1	13	3	1
Arctopsyche	0	0	0	0	0	0	1	0	0	0
Cheumatopsyche	0	0	0	0	0	0	0	0	1	0

Hydropsyche	0	0	0	0	3	0	18	22	30	0
Parapsyche	1	0	0	0	0	0	0	0	0	0
Parapsyche elsis	0	2	0	0	0	0	0	0	0	0
| Family: Hydroptilidae	0	0	0	0	2	0	1	0	0	1
Hydroptila	0	0	0	0	2	0	2	0	0	0
| Family: Lepidostomatidae	0	0	0	0	0	0	0	0	0	0
Lepidostoma	0	0	0	0	67	0	5	0	240	0
| Family: Leptoceridae	0	0	0	0	0	0	0	0	0	1
| Family: Limnephilidae	0	0	0	0	0	1	0	1	0	1
Ecclisomyia	0	0	0	0	0	0	0	0	0	1
| Family: Rhyacophilidae	0	0	0	0	0	0	0	0	0	0
Rhyacophila	15	2	1	1	0	3	0	3	0	2
Rhyacophila atrata complex	0	1	0	0	0	0	0	1	0	0
Rhyacophila betteni group	4	5	0	0	0	0	0	1	0	1
Rhyacophila brunnea/vemna group	2	0	0	1	0	0	3	10	0	1
Rhyacophila hyalinata group	3	2	0	0	0	0	0	0	0	1
Rhyacophila narvae	0	0	0	0	0	1	0	0	0	3
Rhyacophila viquaea group	0	0	0	8	0	0	0	0	0	0
| Family: Thremmatidae	0	0	0	0	0	0	0	0	0	0
Neophylax	0	0	0	0	0	0	0	0	0	3
Oligophlebodes	9	0	0	1	0	0	0	7	0	0
| Family: Uenoidae	0	0	0	0	0	0	0	0	0	0
Neothremma	0	1	0	0	0	0	0	0	0	0
| Order: Diptera	0	0	2	0	0	0	0	0	0	1
| Family: Athericidae	0	0	0	0	0	0	0	0	0	0
Atherix	0	0	0	0	1	0	0	0	0	0
| Family: Ceratopogonidae	0	0	0	0	0	1	0	0	0	0
Mallochohelea	0	0	0	0	0	0	0	1	0	0
| Family: Chironomidae	1	4	26	0	13	0	2	0	0	1
| Subfamily: Chironominae	0	0	0	0	0	0	0	0	0	0
| Tribe: Chironomini	0	0	0	0	0	0	0	0	0	0
Polypedilum	13	0	0	0	0	1	4	1	17	30
Stictochironomus	0	0	0	0	6	0	0	0	0	0
| Tribe: Tanytarsini	0	0	0	0	0	0	0	0	0	0
Constempellina sp. C	0	0	0	0	0	0	0	0	0	1
Micropsectra	0	9	7	1	38	47	9	0	7	34
Paratanytarsus	0	0	0	0	6	0	0	0	0	0
Rheotanytarsus	1	0	0	0	0	0	0	1	0	0
Stempellinella	0	0	0	0	0	37	0	0	0	4
Tanytarsus	9	0	0	0	0	0	0	0	0	0
| Subfamily: Diamesinae	0	0	0	0	0	0	0	0	0	0

Pagastia orthogonia	0	0	0	0	0	0	0	0	0	2
| Tribe: Diamesini	0	0	0	0	0	0	0	0	0	0
Diamesa	0	3	48	19	0	0	5	1	0	7
Pagastia	1	3	0	0	0	1	41	0	1	0
Potthastia longimana group	0	0	0	0	5	0	0	0	0	0
Pseudodiamesa	0	1	0	0	0	0	0	0	0	0
| Subfamily: Orthocladiinae	0	0	0	0	0	0	0	0	0	0
Brillia	0	0	0	0	0	2	0	1	0	2
Corynoneura	0	0	0	0	0	0	1	1	0	0
Cricotopus (Nostococladius)	1	0	0	0	1	1	1	0	0	11
Eukiefferiella	5	10	15	22	1	5	2	2	0	2
Heterotrissocladius	0	0	0	0	0	1	0	0	0	0
Limnophyes	0	0	2	0	0	0	0	0	0	0
Nanocladius	0	0	0	0	0	1	0	0	0	0
Orthocladius complex	2	14	19	0	9	16	15	0	0	49
Parametriocnemus	0	0	0	0	0	2	0	0	0	1
Parorthocladius	0	0	0	0	0	0	0	0	0	11
Rheocricotopus	2	1	0	0	0	15	0	0	0	55
Thienemanniella	0	0	0	0	1	0	0	0	0	0
Tvetenia	6	16	0	0	0	13	2	0	1	3
| Subfamily: Tanypodinae	0	0	0	0	0	0	0	0	0	0
| Tribe: Pentaneurini	0	0	0	0	0	0	0	0	0	0
Thienemannimyia group	0	0	0	0	34	3	8	8	11	12
| Family: Empididae	4	3	1	0	1	1	10	2	0	0
Hemerodromia	0	0	0	0	1	0	0	0	0	0
Neoplasta	0	1	0	0	1	0	0	0	0	0
Roederiodes	0	0	0	0	1	0	10	1	0	0
| Family: Limoniidae	0	0	0	0	0	0	0	0	0	0
Eloeophila	0	0	0	0	0	0	0	1	2	0
| Family: Pelecorhynchidae	0	0	0	0	0	0	0	0	0	0
Glutops	0	0	0	0	0	0	0	1	0	0
| Family: Psychodidae	0	30	0	0	0	0	0	0	0	0
Pericoma/Telmatoscopus	16	30	5	1	0	0	42	164	3	0
| Family: Simuliidae	0	2	3	2	0	0	0	0	0	0
Prosimulium/Helodon	0	0	3	13	0	0	0	0	0	0
Simulium	0	2	7	3	0	0	0	0	0	0
| Family: Tipulidae	0	0	0	3	7	0	0	0	0	1
Antocha	1	0	0	0	0	0	3	10	4	0
Cryptolabis	0	0	0	0	0	0	0	0	2	0
Dicranota	0	0	0	0	0	0	0	1	0	0
Hexatoma	0	0	0	0	0	0	0	0	4	7
Tipula	0	0	0	0	1	0	0	0	0	1

| Order: Hemiptera	0	0	0	0	0	0	0	0	0	1
Subphylum: Chelicerata	0	0	0	0	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0	0	0	0	0
| Order: Trombidiformes	0	0	0	0	0	0	0	0	0	1
| Family: Aturidae	0	0	0	0	0	0	0	0	0	0
Aturus	0	1	0	0	0	0	0	0	0	0
| Family: Feltriidae	0	0	0	0	0	0	0	0	0	0
Feltria	0	0	0	0	0	0	1	0	0	0
| Family: Hydryphantidae	0	0	0	0	0	0	0	0	0	0
Albertathyas	0	0	0	1	0	0	0	0	0	0
Protzia	0	0	0	0	0	0	0	0	1	0
| Family: Lebertiidae	0	0	0	0	0	0	0	0	0	0
Lebertia	1	4	1	0	1	0	17	8	9	0
| Family: Sperchontidae	0	0	0	0	0	0	0	0	0	0
Sperchon	1	5	2	0	0	2	2	0	7	0
| Family: Torrenticolidae	0	0	0	0	0	0	0	0	0	0
Testudacarus	0	0	0	0	0	0	1	10	2	0
Torrenticola	0	1	0	0	0	0	0	0	2	0
Phylum: Annelida	0	0	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0	0	0	0
| Order: Lumbriculida	0	0	0	0	0	0	0	0	0	0
| Family: Lumbriculidae	0	0	0	0	0	0	0	0	0	0
Rhynchelmis	0	0	2	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0	0	0	0	0	0
Enchytraeus	0	0	0	0	9	0	0	0	0	0
| Family: Naididae	0	0	0	0	0	0	0	0	0	0
Nais	0	2	0	0	86	0	263	7	4	1
Totals:	**519**	**763**	**730**	**347**	**399**	**317**	**650**	**1024**	**668**	**590**

Taxa present but not included:

Phylum: Arthropoda	0	0	0	0	0	0	0	0	0	0

| Class: Copepoda	0	0	0	0	1	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0	0	0	0	0
| Class: Ostracoda	1	0	1	1	0	1	1	1	0	1
Phylum: Annelida	0	0	0	0	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0	0	0	0	0
| Family: Lumbricidae	0	0	0	0	0	0	0	1	0	0
Phylum: Nemata	0	0	1	0	0	0	0	0	1	0
Phylum: Platyhelminthes	0	0	0	0	0	0	0	0	0	0
| Class: Turbellaria	1	1	1	0	0	0	0	0	1	1
Totals:	**2**	**1**	**3**	**1**	**1**	**1**	**1**	**2**	**2**	**2**

Appendix E: Stream Report

Preliminary DNA Data

Elk River Alliance
Elk River Watershed, BC
October 2024

www.STREAM-DNA.org

Hajibabaei Lab, Centre for Biodiversity Genomics, University of Guelph

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.

INTRODUCTION

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).

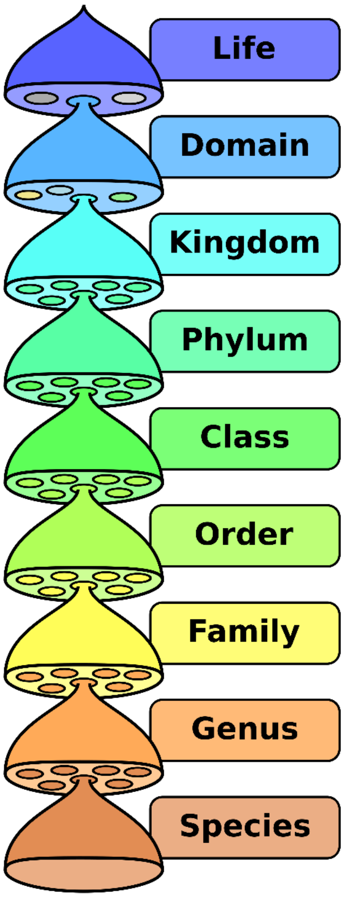

Figure 1. Graphical representation the classification of organisms.

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 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) with World Wildlife Fund Canada as a founding member organization. In 2023 STREAM released a stand-alone field protocol, which was largely modified from the Canadian Aquatic Biomonitoring Network (CABIN) protocol, with a focus on collection for DNA metabarcoding, though groups trained in the CABIN/STREAM are still able to contribute samples as normal.

A 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. To date this timeline has not been regularly met, but steps are being taken to further optimize lab processing and reporting to more regularly meet this timeline.

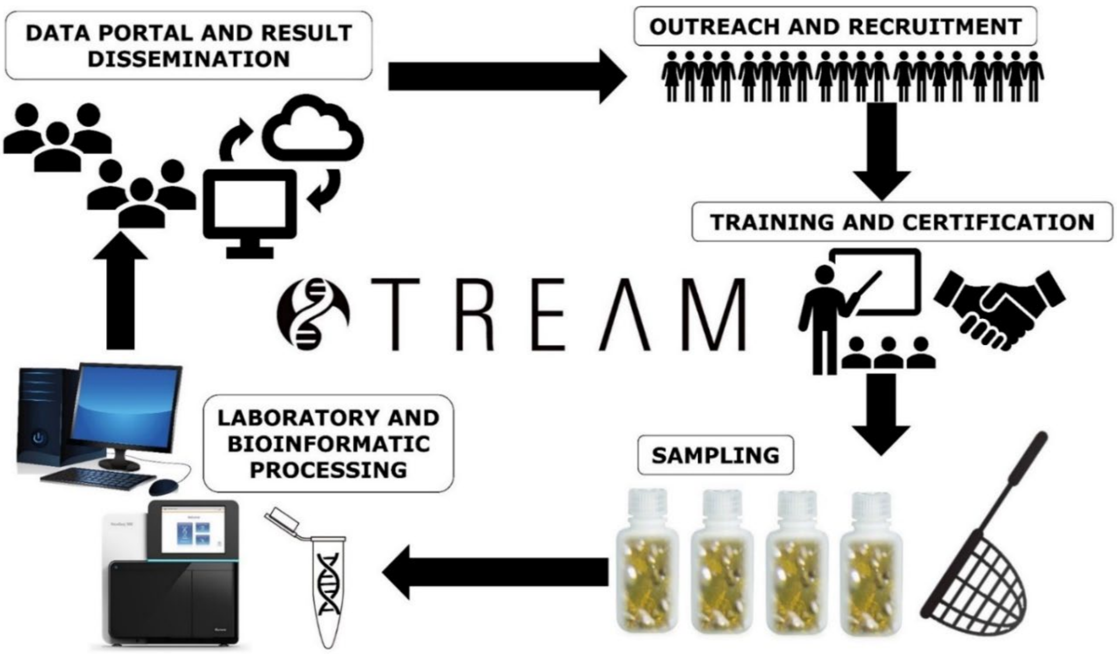

Figure 2. Graphical representation of the STREAM collaborative workflow for DNA biomonitoring of benthic invertebrates.

Objective of Report

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

METHODOLOGY

Study Area

This study was conducted in July through October of 2023 across five pre-determined sampling locations in the Elk River Watershed (BC) (Figure 3). Sampling was conducted by members of the Elk River Alliance. Five additional samples were collected to screen for the presence of the sludgeworm, *Tubifex tubifex*.

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

DNA Sampling and Processing Methods

Measures to Avoid Contamination

Prior to sampling, kick-nets were sanitized in bleach for 5 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.

Benthic Macroinvertebrate Field Sampling Protocol

Benthic macroinvertebrate DNA samples were collected following the STREAM modifications 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.

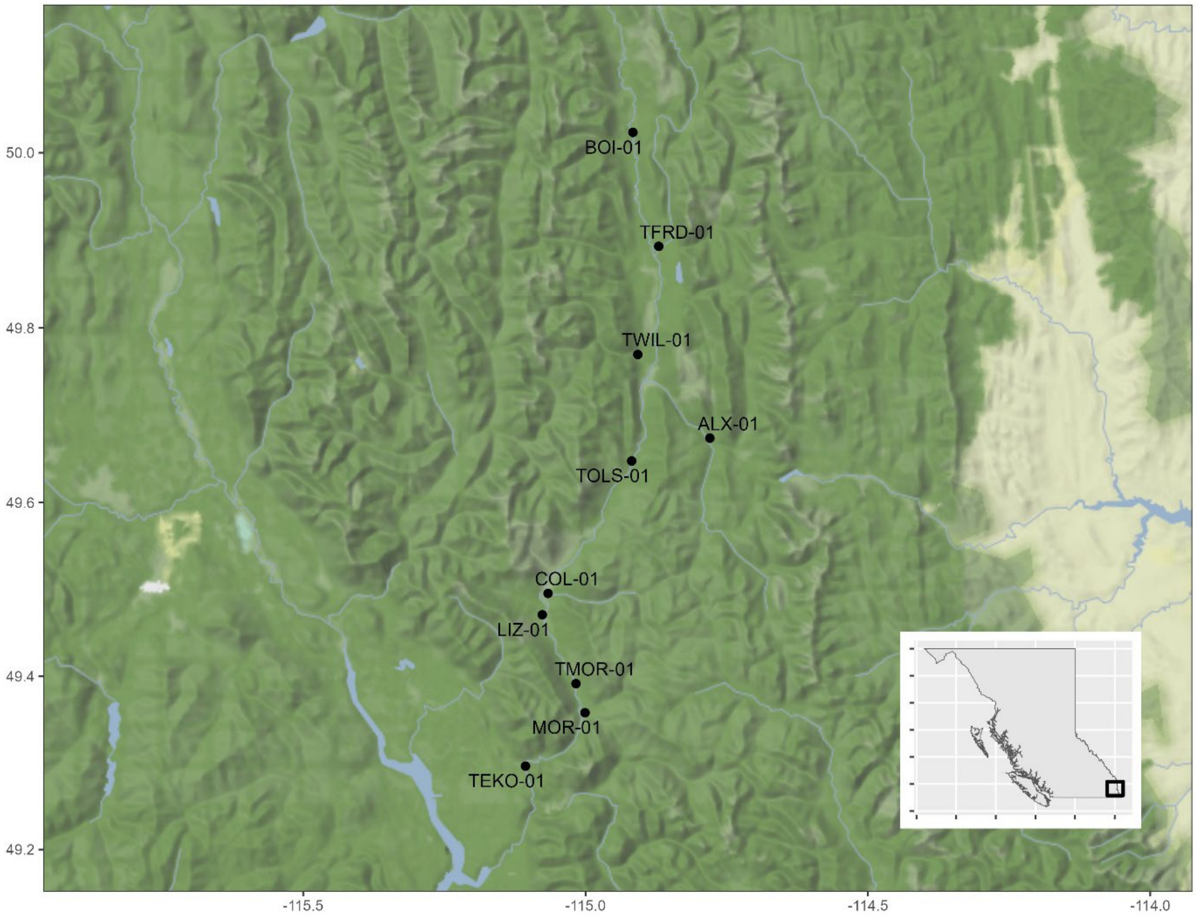

Figure 3. Map of sampling locations in the Elk River Watershed (BC). Inset map (bottom right) shows location of sampling area with respect to British Columbia.

Laboratory Methods

Benthic samples were preserved in Absolute Zero Antifreeze and stored at -20°C until processing. Benthic samples were coarsely homogenized in a sterile blender and DNA was extracted using a DNeasy® PowerSoil® Pro 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 (v1.13.0) pipeline: https://github.com/terrimporter/MetaWorks.

RESULTS

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 **25 Orders, 83 Families, 121 Genera, and 132 species of macroinvertebrates**. Species richness (number of species present) ranged from a low of 14 in MOR-01-A to a high of 43 in ALX-01-A (**Figure 4**). A full taxonomic list identified to the raw genus and species level for macroinvertebrates is included as a separate Excel spreadsheet (STREAM_ERA_Taxonomic_Results_2023.xlsx).

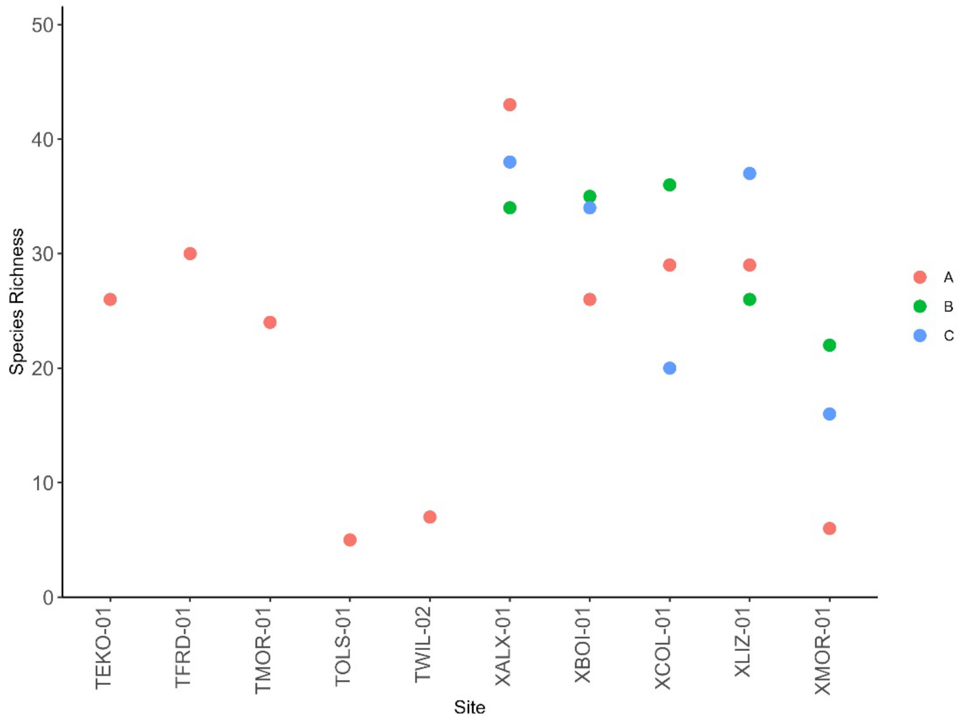

Figure 4. Species richness of each site sampled. Only species taxonomically assigned with high confidence (bootstrap support >= 0.70) are included.

Taxonomic Coverage

A range of macroinvertebrate species were detected. Traditional bioindicator EPT species were detected across the sampling sites, including 26 species of Ephemeroptera (mayflies), 32 Plecoptera (stoneflies), and 22 Trichoptera (caddisflies; **Table 1**). Some families of these EPT 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. Genera included in the CABIN database have been highlighted in blue in the taxonomic results.

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).

Several additional samples were collected in more suitable habitat for *T. tubifex* in order to assess the potential spread of whirling disease to these areas based on the presence of the secondary host.

T. tubifex was found at the sites; TEKO, TFRD, TMOR, and TWIL, as well as at ALX-01, COL-01 and LIZ-01 in the standard STREAM samples.

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APPENDICES

Appendix A. Summary table of sample sites, including site name, and site coordinates and project.

Site	Latitude	Longitude	Project
ALX-01	49.6739400	-114.7799000	STREAM
COL-01	49.4955600	-115.0664400	STREAM
LIZ-01	49.4709400	-115.0766000	STREAM
MOR-01	49.3580600	-115.0008800	STREAM
BOI-01	50.0231440	-114.9161380	STREAM
TMOR-01	49.3916230	-115.0169530	Tubifex
TWIL-01	49.7696340	-114.9074810	Tubifex
TEKO-01	49.2963750	-115.1063340	Tubifex
TOLS-01	49.6476899	-114.9182914	Tubifex
TFRD-01	49.8932601	-114.8703798	Tubifex

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.