



2024 Northern Water Benthic Macroinvertebrate Biomonitoring Program Summary Report

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Introduction

The Northern Water Baseline Biomonitoring Program was established in 2008 by the Northern Colorado Water Conservancy District (Northern Water) to monitor benthic macroinvertebrate communities upstream and downstream from areas exposed to potential stressors associated with water storage and water distribution systems on the West Slope and East Slope of Colorado. Much of the water resources for the East Slope of Colorado are diverted from the West Slope through a series of canals, tunnels, reservoirs, and existing streams and rivers ¹. These operations utilize impoundments and water transfer systems that may alter the natural temperature and flow regimes in streams at various locations throughout the year. In addition to operational challenges, there are substantial environmental conditions (such as climate change, wildfires, etc.) that Northern Water faces while attempting to balance the needs between growing population centers and agricultural production ². Interbasin water diversions have been a topic of continuing controversy and conflict in the field of water resource development ³. It has been well-documented that these types of diversions can result in the loss of biogeographical integrity, the introduction of invasive species, the genetic intermixing of once separated populations, and the alteration of natural hydrological and temperature regimes ^{4,5}. The results from this baseline biomonitoring study represent an important and proactive approach to provide historical and current information regarding the health of aquatic communities in rivers and streams influenced by water development and distribution projects in North Central Colorado. Additional information regarding the Colorado-Big Thompson project can be found on Northern Water's website ⁶.

The biomonitoring of benthic macroinvertebrates has become an essential part of water quality assessment programs across North America ^{7,8}. Benthic macroinvertebrates have relatively long-life spans, limited mobility, different tolerances to a variety of stressors (such as pollution, temperature changes, and flow variations), and are abundant through lotic systems ⁸⁻¹⁰. Additionally, they are relatively easy to collect and identify. Due to these unique features, evaluating macroinvertebrate communities can provide an in-depth assessment of aquatic conditions. The results provided by consistent sampling and accurate identifications improve the value of information regarding temporal changes in aquatic conditions. Long-term monitoring studies, such as this one conducted by Northern Water, are essential for the understanding of anthropogenic impacts in watersheds and ecosystems ^{11,12}.

Analyzing macroinvertebrate data requires the use of several biotic indices (metrics) since certain taxa can survive (or thrive) in the presence of various contaminants. While individual metrics are often designed to provide insight into specific types of stress, multiple metric indices provide a more general assessment of aquatic conditions ^{13,14}. For this study, data was analyzed using individual metrics and multi-metric indices to make comparisons among sampling sites. These analysis tools were also used to

provide information regarding the level of stress at each sampling location, and to evaluate seasonal variability in the health of aquatic communities.

This biomonitoring program was specifically designed to test for possible stressors that could be directly attributed to water transport and distribution operations conducted by Northern Water and is conducted at three-year intervals. Results from data collected during the spring (April) and fall (September) of 2024 provided information regarding the overall ecological integrity of the aquatic environment at each site. Analysis of samples and comparisons among study sites helped identify locations with potential impacts and possible types of stress occurring within this study area.

Objectives

The goal of the Northern Water Baseline Biomonitoring Program is to evaluate the biological and ecological integrity of streams on the West Slope and East Slope of Northern Colorado that may be influenced by Northern Water activities. Specific objectives for this study include the following:

1. Assess the existing state of aquatic ecosystems related to the Colorado-Big Thompson (C-BT) and Windy Gap projects.
2. Monitor trends and changes in the health of the aquatic ecosystems in the C-BT and Windy Gap project areas.
3. Monitor and assess potential impacts of C-BT and Windy Gap operations on the health of aquatic ecosystems.
4. Analyze data using a variety of techniques that allow for cross examination of the evaluation tools recommended by the Water Quality Control Division (WQCD).
5. Assess compliance with the WQCD's Methodology to Determine Use Attainment for Rivers and Streams implemented for aquatic life in Policy 10-1¹⁵.

2024 Key Findings

1. Site CR-SMD obtained an MMI v4 score resulting in an impairment designation. All other sampling locations were in attainment for aquatic life-use.
2. On the West Slope, there were notable impacts to macroinvertebrate communities at sites positioned directly downstream from reservoirs.
3. There was evidence of increased stress at sites on the Little Thompson River (specifically site SVSC-LTD) during both sampling seasons in the East Slope study area. Most individual and multi-metric tools detected stress at this location, though the exact source could not be determined. Ongoing monitoring will be

critical for evaluating whether the site continues to exhibit biological stress and for identifying the potential sources contributing to that condition.

4. While there was evidence of stress at multiple sites across the study area, impacts directly and solely associated with Northern Water activities could not be confirmed.
5. A comparison of 2024 results to historical means indicated that site SVSC-LTD obtained lower MMI (v4) scores than expected, as well as lower Diversity and higher HBI values.

Study Area

Northern Water transports water from the West Slope of Colorado to the East Slope via the Colorado-Big Thompson (C-BT) Project using an array of canals, diversions and other distribution systems to move water from reservoirs located in the Upper Colorado River Basin to several streams and rivers along the Northern Colorado front range. The geographic scope of the biomonitoring sites covers both the collection and distribution systems managed by Northern Water. On the West Slope, biomonitoring sites are located upstream and downstream of C-BT and Windy Gap facilities to assess the potential impact of these facilities on the aquatic ecosystem. On the East Slope, study sites are located upstream and downstream of locations where C-BT project water is introduced into tributaries of the South Platte River (Table 1).

Benthic macroinvertebrate sampling was conducted as part of the Northern Water Biomonitoring Program in April and September of 2024 at seven study sites on the West Slope and eight sites on the East Slope of Colorado (Table 1). Sampling locations on the West Slope included one site on the East Inlet of Grand Lake (EI-GLU) that provided reference information, two sampling locations (one on the Colorado River and one on the Fraser River) with little or no influence from Northern Water activities (CR-SMU and FR-WGU), and four study sites on the Colorado River (sites CR-SMD, CR-GRD, CR-WGU, and CR-WGD) that may be influenced by water collection and transfer systems. The distribution and elevation of West Slope study sites varied within the study area (Figure 1); however, a general increase in stream size and discharge occurred in a downstream direction.

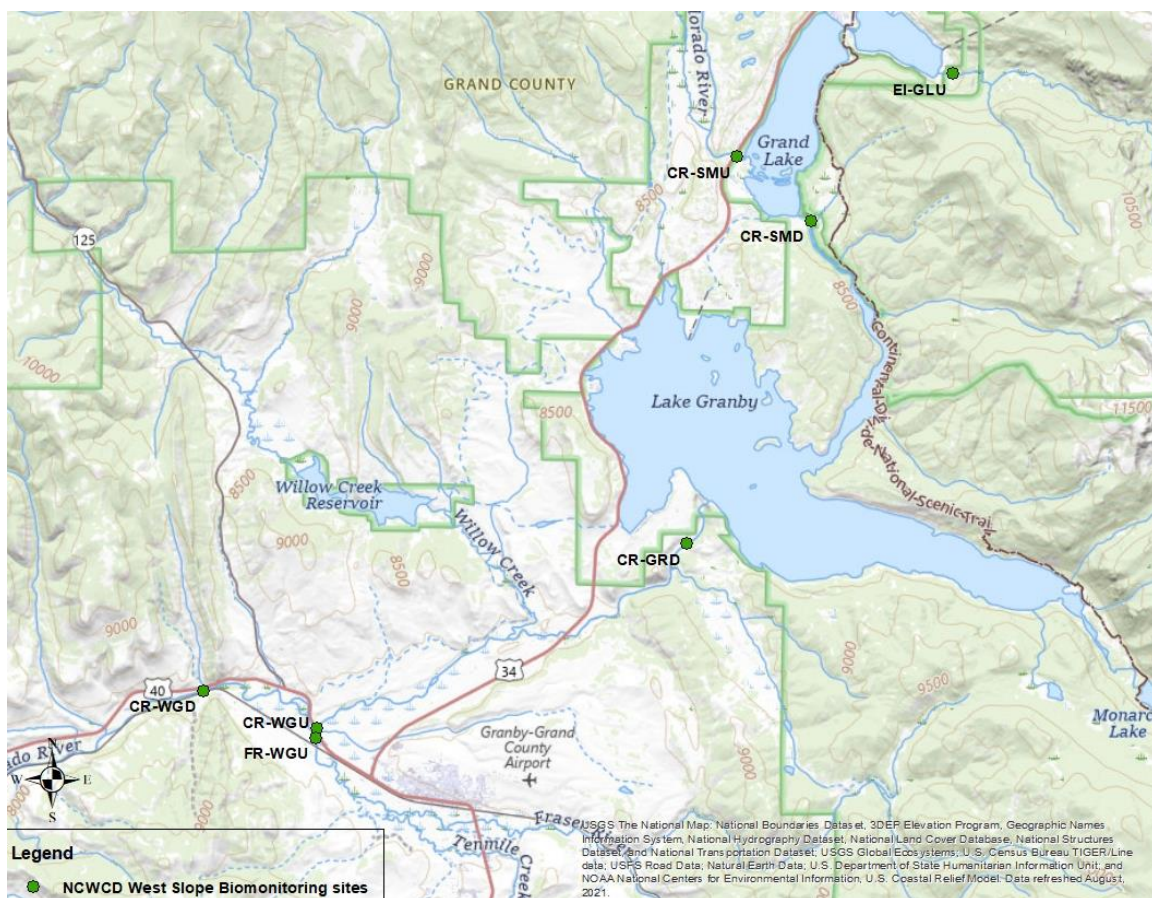


Figure 1. West Slope macroinvertebrate monitoring locations.

East Slope sampling sites were strategically positioned at locations that would assist in the evaluation of introduced water in four streams: the Cache la Poudre River, Big Thompson River, Little Thompson River, and Saint Vrain Creek (Figure 2). Paired study sites (one upstream and one downstream of introduced water) were established at each receiving stream to detect potential impacts on the macroinvertebrate communities, and to provide information that could be specifically related to Northern Water activities. A comparison of upstream and downstream results for each stream provides information regarding aquatic conditions at both sampling locations and identifies possible influences of introduced water in these streams.

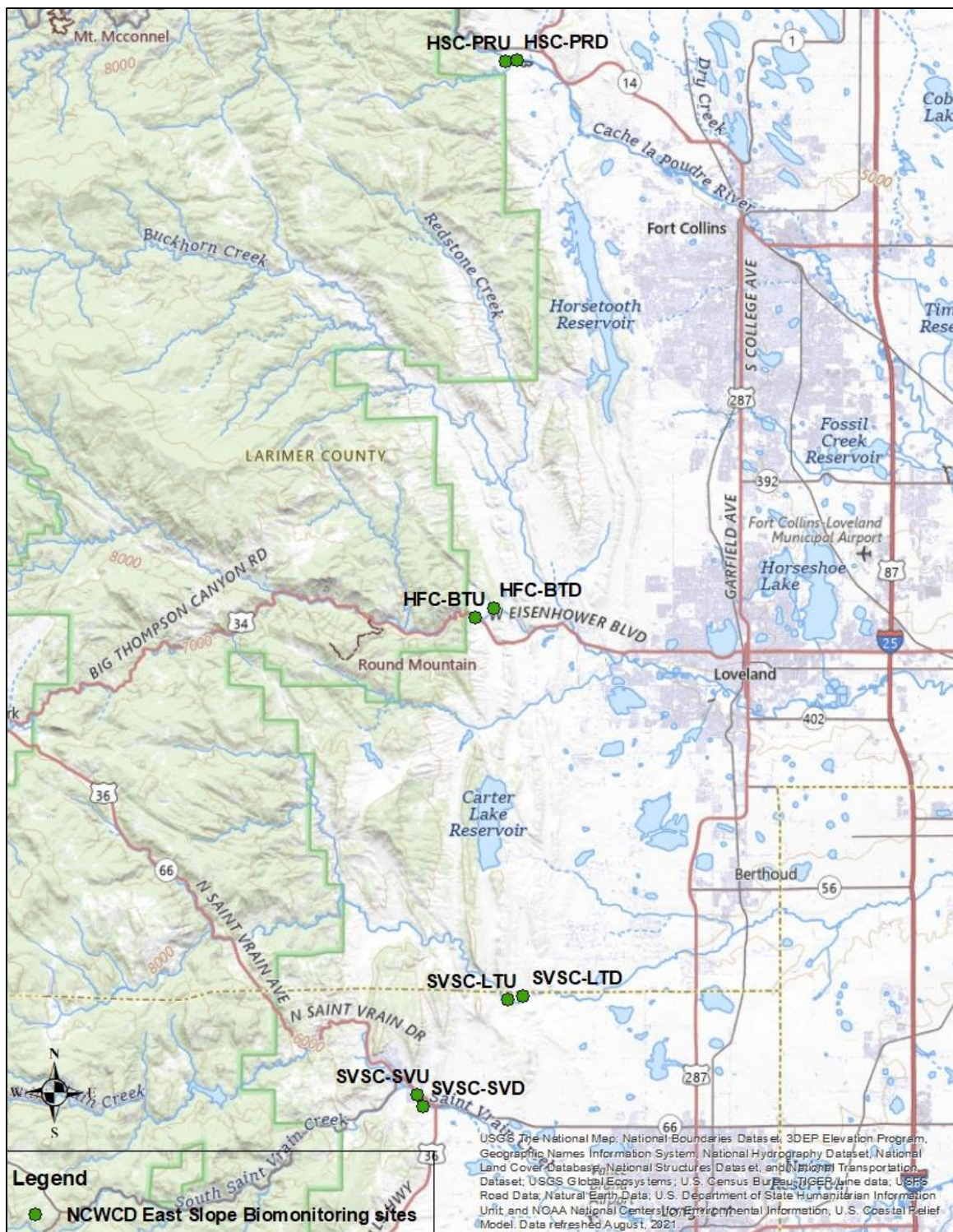


Figure 2. East Slope macroinvertebrate monitoring locations.

Table 1. Benthic macroinvertebrate biomonitoring sites.

Station ID	Description	Zone	Easting (m)	Northing (m)	Elevation (ft)
West Slope Study Area					
EI-GLU	East Inlet upstream of Grand Lake	13T	432015	4454303	8443
CR-SMU	North Fork of the Colorado River upstream of Shadow Mountain Reservoir	13T	426988	4452443	8419
CR-SMD	Colorado River downstream of Shadow Mountain Reservoir	13T	428681	4450952	8374
CR-GRD	Colorado River downstream of Granby Reservoir	13T	425739	4443531	8093
CR-WGU	Colorado River upstream of Windy Gap Reservoir	13T	417111	4439359	7877
FR-WGU	Fraser River upstream of Windy Gap Reservoir	13T	417076	4439148	7893
CR-WGD	Colorado River downstream of Windy Gap Reservoir	13T	414472	4440260	7840
East Slope Study Area					
HSC-PRU	Cache la Poudre River upstream of the Hansen Supply Canal	13T	482280	4501040	5240
HSC-PRD	Cache la Poudre River downstream of the Hansen Supply Canal	13T	482809	4501110	5231
HFC-BTU	Big Thompson River upstream of the Hansen Feeder Canal	13T	480732	4474634	5354
HFC-BTD	Big Thompson River downstream of the Hansen Feeder Canal	13T	481633	4475071	5283
SVSC-LTU	Little Thompson River upstream of the Saint Vrain Supply Canal	13T	482281	4456451	5261
SVSC-LTD	Little Thompson River downstream of the Saint Vrain Supply Canal	13T	483012	4456592	5224
SVSC-SVU	Saint Vrain Creek upstream of the Saint Vrain Supply Canal	13T	477907	4451916	5325
SVSC-SVD	Saint Vrain Creek downstream of the Saint Vrain Supply Canal	13T	478204	4451376	5285

Methods

The biomonitoring and analysis approach in this project was designed to identify the location and nature of disturbances while accounting for seasonal variations in the spring and fall of 2024. A Hess sampler was used to take three replicate samples from similar riffle habitat at each site on the West Slope and East Slope to provide comparable quantitative benthic macroinvertebrate data. Substrates within each sample were thoroughly agitated and individual rocks were scrubbed by hand to dislodge benthic organisms. All macroinvertebrates were rinsed into sample jars and preserved in 80% ethanol solution. Each sample jar was labeled on the inside and outside with date, location, and sample ID number. After samples were collected, they were transported to the laboratory where benthic macroinvertebrates were sorted, identified and enumerated. The sorting and identification process was conducted for each entire sample to provide the most accurate quantitative information while avoiding potential problems or controversy associated with subsampling.

Sorting consisted of separating individuals/specimens from debris and placing them into vials containing coarse taxonomic groups. Macroinvertebrates were identified to the “lowest practical taxonomic level” (a level permitted by available physical characteristics and species keys using a dissecting microscope) based primarily on Merritt et al. (2008), Ward et al. (2002), and other taxonomic keys. This level of identification consisted of genus or species for mayflies, stoneflies, caddisflies, and many dipterans. The family Chironomidae was identified to the subfamily or tribe level during the spring and the genus level during the fall season. For quality control, all sorted and identified macroinvertebrate samples were checked for accuracy, and approximately 10% of identifications were checked by a certified SFS taxonomist. In all cases where the classification of a species was difficult or questionable, identifications of specimens were validated by another professional taxonomist.

Macroinvertebrate population densities and species lists were developed for each sampling site in the study area; however, much of the analysis of macroinvertebrate data for this study was specific to the geographical location of the study sites. Samples from the West Slope were collected at a higher elevation with a colder mean annual air temperature, while sites on the East Slope were in the transitional zone between the mountains and plains with lower elevation and warmer temperatures. The WQCD for the Colorado Department of Public Health and Environment (CDPHE) has found that there are expected changes in macroinvertebrate communities that can be attributed to natural changes in environmental conditions in Colorado streams ^{15,16}, and has recommended different tools for analyzing macroinvertebrate data from different Biotypes (in this case, mountain vs. transition zone streams) in Colorado. Additional metrics were used to provide relevant information to evaluate data from both Biotypes.

A total of 21 different tools were used to describe and evaluate macroinvertebrate communities at the study sites. The variety of analysis techniques used in this study included a core set of metrics that were applied to all macroinvertebrate data regardless of location or season, as well as additional analysis tools tailored to specific seasons or site locations.

A multiple metric index that provided an alternative Multi-Index Score (aMIS) was constructed to produce general information regarding aquatic conditions in both Biotypes. The aMIS was applied during both seasons of 2024, and the individual metrics used in the aMIS were specific to East Slope and West Slope study areas. The WQCD has calibrated the Multi-Metric Index version 4 (MMI v4) using data that was mostly collected during summer or fall seasons; therefore, it was only applied to data collected during the fall season. Each multiple metric tool was designed to provide general aquatic community information, while individual metrics offered more specific information regarding aquatic conditions. Nine additional metrics were incorporated into the analysis to enhance comparability with the concurrent biomonitoring study conducted in the same basin by the Learning By Doing (LBD) Stakeholder Group. These metrics included: Insect Taxa, Percent Shredders and Scrapers, Density of *Pteronarcys californica* (#/m²), Percent EPT (excluding Baetidae), Percent Chironomidae, Percent Hydropsychidae, Percent Tolerant Taxa, Percent Intolerant Taxa and Biomass. Descriptions of these metrics can be found in the 2024 Learning By Doing Benthic Macroinvertebrate Biomonitoring Summary Report. The following sections provide descriptions of other metrics used in this study.

Alternative Analysis Tools (aMIS)

The aMIS was developed specifically for this study using a similar approach to the MMI v4, generating a composite score from equally weighted metrics. However, the aMIS differs in both the selection of metrics and thresholds that describe various levels of stress. Since state-wide reference values were not available for the metrics used in the aMIS, metric values from reference sites within the study area were used for comparison. For the West Slope, site EI-GLU was used to provide reference conditions as it receives minimal anthropogenic influences. Reference values for the East Slope were weighted using optimum values observed among East Slope study sites and reference information provided in the development of the MMI¹⁶. Each metric value for a non-reference site was expressed as a percentage of the value obtained at the reference location. The aMIS score was calculated as the mean value of the six relative percentage values at each non-reference site. The methodology for development of the aMIS was taken from the EPA Rapid Bioassessment Protocols¹⁷ and the Wyoming Bioassessment Method¹⁸. The preliminary scale that was used for the aMIS to evaluate aquatic conditions was also based on these previous studies. The scale for the aMIS is as follows:

aMIS SCALE	
80-100	No Detectable Stress
50-79	Slightly Stressed
21-49	Moderately Stressed
0-20	Severely Stressed

Each metric used in the aMIS was selected because it provided useful information for the evaluation of aquatic conditions in the State of Colorado and other Rocky Mountain streams. Additionally, these metrics have been consistently used for Northern Water's Baseline Biomonitoring Program. A description of the six metrics used in the aMIS is provided in the sections below:

Shannon Diversity (Diversity) and Evenness (Evenness)

Diversity and Evenness values were used at all sites in the Northern Water Biomonitoring Study to detect changes in macroinvertebrate community structure and balance. In clean waters, Diversity values typically range from near 3.0 to 4.0, and in polluted waters, this value is generally less than 1.0 ¹⁹. Evenness values range between 0.0 and 1.0, with values lower than 0.3 generally considered indicative of organic pollution or other substantial perturbations ¹⁹.

Diversity and Taxa Index (DAT)

The DAT was also used throughout the study area to assist in the evaluation of aquatic conditions. This metric is useful because it incorporates components of community balance with taxa richness to evaluate water quality. Calculated DAT values fall within a range of numbers that are correlated to a scale describing aquatic conditions ²⁰. This index has been previously used to indicate changes in water quality and/or habitat that have occurred in Boulder Creek and other Front Range streams in Colorado ²¹. The DAT scale is as follows:

DAT Value	SCALE
18-30+	Excellent
11-17	Good
6-10	Fair
0-5	Poor

Ephemeroptera Plecoptera Trichoptera (EPT)

The design of the EPT metric is based on the assumption that the orders of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) are generally more sensitive to pollution than other benthic macroinvertebrate orders ²². The EPT metric is currently an important and widely used metric in many regions of the United States ¹⁷. The EPT value is given as the total number of distinguishable taxa in the orders Ephemeroptera, Plecoptera, and Trichoptera found at each station. This number will naturally vary among river systems, but it can be an excellent indicator of disturbance within a specific drainage. The EPT score is expected to decrease in response to a variety of stressors, including nutrients ²³.

Hilsenhoff Biotic Index (HBI)

The HBI was used in this study due to its widespread application and/or recommendation in numerous regional biomonitoring studies ¹⁶. Most of its value lies in the detection of nutrient enrichment, but it is also used to evaluate aquatic conditions in a variety of other circumstances. The HBI was originally developed using macroinvertebrate taxa from streams in Wisconsin; therefore, it often requires regional modifications ²⁴. Tolerance values for taxa occurring in this study area were taken from a list provided by the WQCD, which was derived from a variety of regional sources. Although the value indicating a certain water quality rating may vary among regions, comparison of the values produced within the same system should provide information regarding sites with impacts from nutrient enrichment or other stressors. Values for the HBI range from 0.0 to 10.0 and increase as water quality decreases.

Total Taxa (Taxa Richness)

The Total Taxa metric is reported as the total number of identifiable taxa collected from each sampling location. Total Taxa has become one of the most widely used metrics to evaluate stream health, and it provides a general indication of community health and stability ²⁵. Total Taxa values are expected to decrease with increased perturbation to the aquatic environment ²⁶.

Other Analysis Tools

Density

Macroinvertebrate abundance (Density) was reported as the mean number of macroinvertebrates per m² collected from each study site. Density provides a means of

measuring and comparing standing crop at each site and provides an indication of productivity for the macroinvertebrate portion of the food web at each sampling location.

Biomass

Biomass was reported as the mean dry weight of benthic macroinvertebrates per m² at each site. Biomass values were obtained by drying macroinvertebrates from each sample in a scientific drying oven at 100° C for 24 hours or until all water content had evaporated. Biomass values provide production-related information in terms of weight of macroinvertebrates produced at each site. Density and Biomass values offered a strategy for measuring standing crop, which provided an indication of productivity for the macroinvertebrate portion of the food web at each sampling location.

Functional Feeding Groups

Most of the previously described metrics use macroinvertebrate information that relies on community structure; however, macroinvertebrate taxa were also separated into functional guilds based on methods of food acquisition to provide a measurement of ecological function. Some representation of each group usually indicates good aquatic conditions, although it is normal for certain groups (such as collector-gatherers) to be more abundant than others ^{19,27}. Scrapers and shredders are often considered sensitive to disturbance because they are specialized feeders ¹⁷. Most feeding groups (including sensitive groups) are expected to be well-represented in healthy streams. Much of the value from this type of analysis comes from comparisons among sites within a specific drainage or study area. Changes in the proportion of functional feeding groups can provide insight into various types of stress in river systems ¹⁹. The major functional feeding groups are 1) scrapers/grazers which consume algae and associated material; 2) shredders, which consume leaf litter or other coarse particulate organic matter (CPOM), including wood; 3) collector-gatherers, which collect fine particulate organic matter (FPOM) from the stream bottom; 4) collectors-filterers, which collect FPOM from the water column using a variety of filters; 5) predators, which feed on other consumers; and 6) omnivores or other species that simply do not fit neatly into the other categories ^{28,29}.

CDPHE Multi-Metric Index

In the fall of 2010, the Water Quality Control Division (WQCD) of the Colorado Department of Public Health and Environment (CDPHE) published specific guidelines for benthic macroinvertebrate sampling and analysis to assist in the evaluation of aquatic life in Colorado streams ³⁰. These guidelines described the protocols for using a Multi-Metric Index (MMI) to analyze benthic macroinvertebrate data between 2010 and 2017. The MMI v3 provided a single index score based on five or six equally weighted

metrics. The group of metrics used in MMI v3 calculations depended on the location of sampling sites and corresponding Biotype (Mountains, Transitional, or Plains). The study area for the Northern Water Baseline Biomonitoring Program is located within both Biotype 1 (the Transition Zone) and Biotype 2 (the Mountain Zone), which includes low and high elevation (respectively) mountain streams. Each of the metrics used in the MMI produces a value that is adjusted to a scale from 1 to 100 based on the range of metric scores found at 'reference sites' in the State of Colorado. Additional information regarding the selection of individual metrics, construction of the MMI v3, and thresholds for attainment can be found in *Aquatic Life Use Attainment: Methodology to Determine Use Attainment for Rivers and Streams, Policy 2010-1* ³⁰.

In 2017, the MMI was recalibrated and updated to produce a new analysis tool - the MMI v4 ³¹. This version of the MMI was developed in the same way as the MMI v3 but uses eight equally weighted metrics to provide a single index score. For both the MMI v3 and MMI v4, all metric calculations and MMI scores are based on a subsample if the number of individuals in one sample is greater than 360 individuals. In Biotype 1, these metrics include: EPT Taxa, Percent Non-Insect Individuals, Percent EPT Individuals (excluding Baetidae), Percent Coleoptera Individuals, Percent Intolerant Taxa, Percent Increaser Individuals (Mid-Elevation), Clinger Taxa, and Predator/Shredder Taxa. In Biotype 2, the individual metrics include: EPT Taxa, Percent EPT Individuals (excluding Baetidae), Clinger Taxa, Total Taxa, Intolerant Taxa, Percent Increaser Individuals (Mountains), Predator Taxa, and Percent Scraper Individuals. A detailed description of these metrics and methods used to calculate MMI v4 scores can be found in the *Aquatic Life Use Attainment: Methodology to Determine Use Attainment for Rivers and Streams, Policy 10-1* and Appendix D in the *Section 303(d) Listing Methodology 2026 Listing Cycle* ^{31,32}. Thresholds for the MMI v4 in Biotypes 1 and 2 are as follows:

<u>Biotype</u>	<u>Attainment Threshold</u>	<u>Impairment Threshold</u>
Transition (Biotype 1)	45.2	33.7
Mountains (Biotype 2)	47.5	39.8

When scores from the MMI fall between the thresholds for 'attainment' and 'impairment' they are in the 'grey zone' and require further evaluation using two auxiliary metrics, Diversity and HBI. Calculations for these metrics have been previously described, and thresholds developed by the WQCD for the MMI v4 are:

<u>Biotype</u>	<u>HBI</u>	<u>Diversity</u>
Transition (Biotype 1)	5.8	2.1
Mountains (Biotype 2)	4.9	3.2

The MMI requires the identification of benthic macroinvertebrates to a consistent level known as Operational Taxonomic Unit (OTU). This level of identification is usually genus or species for mayflies, stoneflies, caddisflies and many dipterans. The MMI (v4) was applied to East Slope and West Slope data collected during the fall of 2024. The information generated from the MMI was used to: 1) evaluate study sites based on State standards, 2) compare aquatic conditions among sites, and 3) compare results from the State's analysis tools with other analysis tools.

TIV

The sediment Tolerance Indicator Value (TIV) was specifically developed for Colorado streams by the CDPHE. This value is derived from the proportions of different macroinvertebrate taxa in a sample and their various tolerances to sedimentation. The TIV scale ranges from 0 to 10, with higher values indicating greater stress. It is important to note that TIV scores are related to what ecoregion a site is in, but not every ecoregion has the information needed to produce a TIV score, which is why not all sites in this study have an associated TIV value. Sites in this study were in either Sediment Region 1 or Sediment Region 3. The thresholds for samples collected is 6.1 in Sediment Region 1 and 6.3 for Sediment Region 3.

Results

Spring Sampling - 2024

West Slope

On 21 April 2024, benthic macroinvertebrate sampling in the Upper Colorado River Basin was conducted to evaluate existing aquatic conditions and monitor potential impacts from Northern Water activities in the West Slope study area. Species lists were created after samples were sorted, identified, and enumerated using the previously described methods ([Appendix A: Tables A1-A7](#)). The MMI v4 analysis tool was not utilized during the spring sampling event due to seasonal limitations in its applicability. Overall, results from individual metrics indicated that sites located directly beneath reservoirs experienced greater negative impacts to macroinvertebrate community structure and balance than other sampling locations in the spring of 2024.

The most upstream site, EI-GLU, was used to provide reference information for the West Slope study area. This site had little potential for anthropogenic stress, due to its location immediately downstream from the boundary of Rocky Mountain National Park. During spring sampling, this site produced the most optimal values for most metrics in the study area (Table 2). The Diversity and Evenness values indicated that this sampling location consisted of a well-balanced benthic macroinvertebrate community. Additionally, the DAT value of 20.7 suggests that aquatic conditions at this site could be considered “Excellent” in supporting macroinvertebrate communities. Based on scores from the EPT, Percent Shredders and Scrapers, Percent EPT (excluding Baetidae), and Percent Intolerant Taxa, this site was able to support a relatively high number of specialized and sensitive macroinvertebrates (Table 2). Overall, this sampling location provided valuable reference information for the remainder of the sites in the West Slope study area.

Upstream from Shadow Mountain Reservoir, site CR-SMU was within an area of residential development, and downstream from a large area that was burned during the East Troublesome Fire in the fall of 2020. Overall, this site received an aMIS score indicating “No Detectable Stress” and an “Excellent” DAT score (Table 2). However, a shift in community structure included a slight reduction in community balance based on Evenness and Diversity results compared to the reference site. While there was a greater number of total taxa collected, metrics that monitor sensitive and specialized taxa were lower than the reference site (Table 2). Additionally, the Percent Tolerant Taxa value increased from the reference site to 17.50%, and an increase in the HBI value to 4.39 indicates a higher proportion of nutrient-tolerant individuals collected (Table 2). Despite these minor differences, aquatic conditions at site CR-SMU appeared to be able to support relatively healthy benthic macroinvertebrate communities in 2024.

Sites CR-SMD and CR-GRD were strategically located on the Colorado River immediately downstream from Shadow Mountain Reservoir and Granby Reservoir (respectively) to evaluate the influence of regulated flows and altered temperature regimes on benthic macroinvertebrates. A clear shift in macroinvertebrate community structure occurred at these sites. While the abundance of macroinvertebrates at these sampling locations increased (based on Density values), the variety of different macroinvertebrates collected (Total Taxa and Insect Taxa), including those considered sensitive to disturbances (EPT), sharply declined (Table 2). Many of the individuals collected at these sites were from the fairly tolerant families Baetidae (a type of mayfly) and Chironomidae (Appendix A; Tables A3 and A4). While both sampling locations appeared to be influenced by their proximity to reservoir impoundments, most metric values indicated that site CR-GRD exhibited more stress than site CR-SMD. The DAT value of 12 at site CR-SMD suggest there was “Good” water quality for macroinvertebrate communities at this location, and the aMIS score of 63 indicated a “slight” increase in stress from the reference site. Comparatively, site CR-GRD had a DAT score (3.8) indicating “Poor” water quality and could be considered moderately stressed with the result from the aMIS metric (39). Additionally, site CR-GRD obtained the lowest values for Diversity and Evenness, and was the only sampling location in the West Slope study area that did not have members of the caddisfly family Hydropsychidae represented (Table 2). Interestingly, this site had the highest percentage of intolerant taxa collected in the study area. However, the limited number of insect taxa (9) collected possibly influenced this percentage. Overall, benthic macroinvertebrate community structure and balance at sites CR-SMD and CR-GRD were negatively influenced by their proximity to dams, which have long been known to impact aquatic communities ^{33–38}.

Site CR-WGU was situated approximately 10 km downstream from Granby Reservoir and less than 1 km upstream from Windy Gap Reservoir. The distance downstream from Granby Reservoir provided enough space for the macroinvertebrate community at this site to recover and return to a more ‘typical’ balance and structure, with most individual metric results aligning closely with values observed further upstream at CR-SMU (Table 2). The aMIS score of 84 indicated that there was “No Detectable Stress” at this location when compared to the reference site, and water quality returned to the “Excellent” category, according to the DAT score of 18.3. The presence of sensitive and specialized taxa increased according to values obtained from the EPT, Percent Shredders and Scrapers, and the Percent Hydropsychidae metrics (Table 2). The Diversity score of 3.17 and Evenness value of 0.645 indicated that this site supported a relatively well-balanced macroinvertebrate community assemblage in 2024.

Table 2. Individual metric values and aMIS scores for macroinvertebrate samples collected from the Upper Colorado River drainage (West Slope study area) on 21 April 2024. All metrics are based on full count Hess samples.

Metric	EI-GLU	CR-SMU	CR-SMD	CR-GRD	CR-WGU	FR-WGU	CR-WGD
Density (estimated #/m ²)	3,030	4,283	25,799	21,512	4,833	2,864	6,922
Biomass (g/m ²)	1.02	1.68	6.37	1.95	6.45	0.95	3.05
Diversity	3.68	3.17	2.32	1.43	3.17	3.00	2.63
Evenness	0.72	0.60	0.51	0.41	0.65	0.62	0.54
DAT	20.7	18.6	12.0	3.8	18.3	13.7	14.7
EPT	23	20	10	5	17	16	17
HBI	3.46	4.39	4.68	5.34	4.32	3.90	4.26
Total Taxa	35	40	23	11	30	28	30
aMIS	--	87	63	39	84	79	76
Insect Taxa	33	34	18	9	25	23	26
Percent Shredders and Scrapers	22.49%	10.45%	0.20%	0.14%	9.57%	3.67%	1.46%
Density of <i>Pteronarcys californica</i> (#/m ²)	0	0	0	0	0	0	0
Percent EPT (excluding Baetidae)	34.32%	28.43%	10.26%	0.20%	25.82%	23.51%	11.44%
Percent Chironomidae	12.72%	52.32%	26.60%	19.70%	52.13%	45.24%	61.02%
Percent Hydropsychidae	2.83%	1.63%	1.76%	0.00%	4.34%	1.90%	1.01%
Percent Tolerant Taxa	8.57%	17.50%	26.09%	9.09%	20.00%	14.29%	16.67%
Percent Intolerant Taxa	62.86%	50.00%	39.13%	63.64%	46.67%	50.00%	53.33%

One sampling location was located on the Fraser River (FR-WGU), immediately upstream from Windy Gap Reservoir. While water quality at this sampling location could be considered “Good” for supporting macroinvertebrate communities (based off the DAT score), the aMIS value of 79 was just below the “No Stress” threshold of 80, indicating “Slight Stress” to the community at this location. Nutrient enrichment was not detected in the HBI value, but a decline in the proportion of sensitive and specialized taxa (based on Percent Shredders and Scrapers) occurred (Table 2). This site was likely influenced by the lowest abundance of macroinvertebrates collected (Density = 2,864 individuals/m², Biomass = 0.95 g/m²) in the West Slope study area, and while the abundance values were fairly similar to the numbers found at the reference site, there was a comparatively lower variety of taxa present, including those considered sensitive to disturbances (Table 2). Despite these differences, the macroinvertebrate community appeared to be relatively well-balanced, with a Diversity score of 3.00 and an Evenness value of 0.62.

The furthest downstream sampling location in the West Slope study area (site CR-WGD) was used to assess potential impacts associated with the operations of Windy Gap Reservoir. While the Total Taxa, Insect Taxa, and EPT metric values were similar to the two upstream sites, there was a shift in macroinvertebrate community balance. Diversity and Evenness values were lower than the upstream sampling locations, and this site had the highest percentage of Chironomidae collected (61.02%) in the study area, a family generally considered tolerant to disturbances. Additionally, the aMIS score indicated this site was “Slightly Stressed” in the spring of 2024 (Table 2). Impacts to this site from reservoir operations may be alleviated during future sampling events due to the recent construction of the Connectivity Channel around Windy Gap Reservoir, allowing for a natural flow and temperature regime to continue in the Colorado River. However, it is important to note that there are other anthropogenic influences nearby (urban development, runoff from roads, etc.) that could have impacted the macroinvertebrate community in 2024.

The Functional Feeding Group analysis generally supported the findings from the aMIS and individual metrics (Table 3, Figure 3). Collector-gatherers were proportionally dominant at all sampling locations except the reference site, EI-GLU, which produced the most optimal feeding group assemblage in the study area (Figure 3). The impacts to sites directly below reservoirs are clearly illustrated in Figure 3, where collector-gatherers comprised over 92% of the feeding group proportion, and representation from other groups are minimal or absent (Table 3). Sites CR-SMU and CR-WGU had representation from all feeding groups present, with fairly well-balanced assemblages (Table 3, Figure 3). Overall, the results from the Functional Feeding Group analysis supported findings from individual metrics and the aMIS, and provided further evidence of increased stress to sites directly beneath reservoir impoundments in 2024.

Table 3. Relative abundance of functional feeding groups for spring 2024 sampling at Northern Water West Slope study sites.

Site	Functional Feeding Group					
	Collector-Gatherer	Collector-Filterer	Shredder	Scraper	Omnivore	Predator
EI-GLU	33.16%	34.70%	5.01%	17.48%	0.00%	9.64%
CR-SMU	65.76%	16.80%	7.72%	2.72%	2.91%	4.09%
CR-SMD	95.51%	3.26%	0.00%	0.20%	0.00%	1.04%
CR-GRD	94.18%	3.42%	0.07%	0.07%	2.20%	0.05%
CR-WGU	62.67%	15.53%	4.18%	5.39%	9.90%	2.33%
FR-WGU	82.74%	3.13%	0.27%	3.40%	0.27%	10.19%
CR-WGD	92.20%	3.87%	0.50%	0.95%	0.06%	2.41%

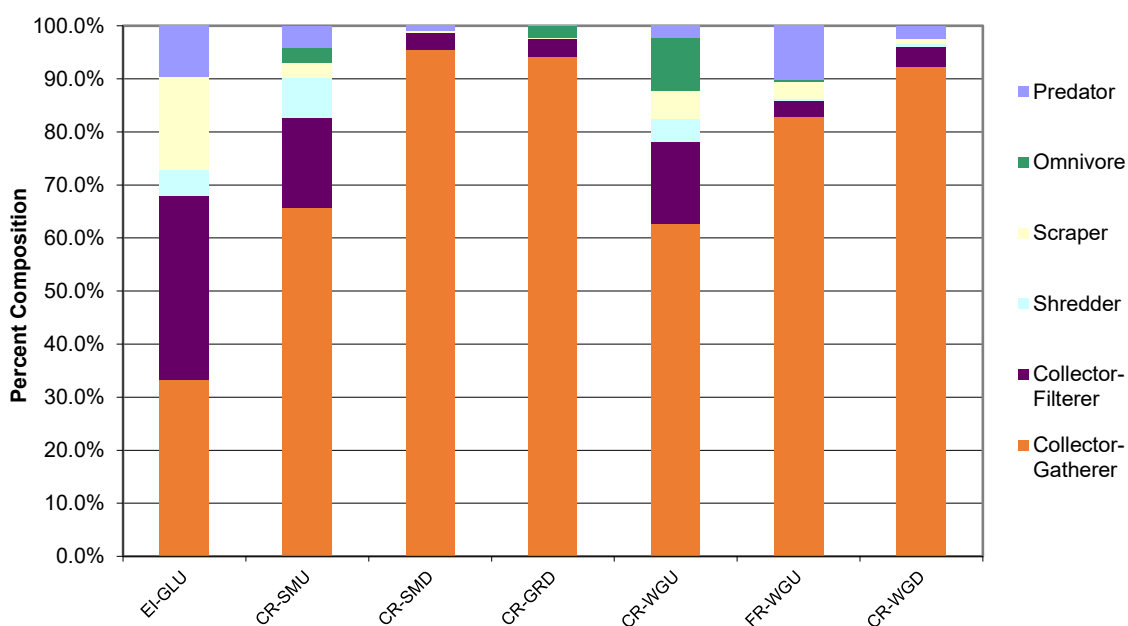


Figure 3. Functional feeding group composition for West Slope study sites during spring 2024.

East Slope

On 13 April 2024, benthic macroinvertebrates were collected from paired study sites on four Colorado Front Range streams: the Cache la Poudre River, Big Thompson River, Little Thompson River, and Saint Vrain Creek (Table 1). After all samples were collected and processed, taxa lists were constructed for each study site ([Appendix B: Tables B1-B8](#)), and macroinvertebrate data were evaluated using the same metrics as the West Slope study area (Table 4). In general, the results from metrics in the spring of 2024 were inconsistent in their ability to detect stress, with little evidence of stress caused solely from Northern Water operations. In fact, two of the streams (Big Thompson and Saint Vrain Creek) achieved higher scores for most metrics at the sites located downstream of introduced water (Table 4). There are other potential sources of stress with the ability to impact macroinvertebrate communities in the East Slope study area, including runoff from roads and highways, runoff from residential areas, and sedimentation from construction activities and/or wildfires.

On the Cache la Poudre River, sampling occurred at paired sites upstream (HSC-PRU) and downstream (HSC-PRD) from the Hansen Supply Canal. Overall, the aMIS scores did not detect stress to macroinvertebrate communities at either sampling location, and DAT values indicated “Excellent” water quality for supporting a balanced macroinvertebrate community (Table 4). Sites on the Cache la Poudre River had the highest abundances of the giant stonefly, *Pteronarcys californica*, from all sampling locations during the spring of 2024. While many metric results were similar, some minor differences in community structure from upstream to downstream could be detected. There was an increase in the HBI value downstream at HSC-PRD, indicating a slightly higher proportion of nutrient-tolerant individuals collected along with a decrease in the number of caddisflies in the Hydropsychidae family and a reduction in the percent EPT (excluding Baetidae) (Table 4). Both sampling locations supported highly productive macroinvertebrate communities, based on the high (and similar) Density values (Table 4). Notably, the downstream sampling location produced a much higher Biomass estimate, which was likely due to the increase in *Baetis tricaudatus* (mayfly) and *Brachycentrus occidentalis* (caddisfly) collected compared to the upstream site (Appendix B; Tables B1 and B2). Despite a mild decrease in the community balance (based on Diversity and Evenness values) downstream at HSC-PRD, the number of Insect Taxa, Total Taxa, and EPT Taxa were similar between the two sites (Table 4). Overall, the macroinvertebrate communities at both sampling locations on the Cache la Poudre River could be considered relatively healthy in the spring of 2024, and shifts in community structure and balance were minor.

Table 4. Individual metric values and aMIS scores for macroinvertebrate samples collected from East Slope sample sites on 13 April 2024.

Metric	HSC-PRU	HSC-PRD	HFC-BTU	HFC-BTD	SVSC-LTU	SVSC-LTD	SVSC-SVU	SVSC-SVD
Density (estimated #/m ²)	10,395	10,802	1,462	1,132	4,153	2,476	3,486	6,639
Biomass (g/m ²)	5.56	12.73	0.55	1.18	4.54	2.22	2.47	6.41
Diversity	2.92	2.52	3.10	3.76	2.80	2.11	2.78	3.19
Evenness	0.57	0.50	0.65	0.77	0.59	0.52	0.56	0.60
DAT	19.4	18.8	12.2	16.4	13.3	6.7	13.5	23.7
EPT	22	22	18	20	14	8	18	25
HBI	3.88	4.56	3.86	3.07	4.48	5.38	4.77	4.89
Total Taxa	35	34	27	30	27	17	32	41
aMIS	91	86	86	95	79	55	84	91
Insect Taxa	32	31	24	27	21	12	28	37
Percent Shredders and Scrapers	2.88%	3.09%	13.87%	15.92%	3.27%	0.78%	8.26%	8.25%
Density of <i>Pteronarcys californica</i> (#/m ²)	16	19	8	4	0	0	8	4
Percent EPT (excluding Baetidae)	42.68%	16.71%	45.87%	62.28%	32.74%	2.83%	8.48%	15.92%
Percent Chironomidae	32.37%	36.11%	44.00%	22.15%	34.80%	43.33%	28.24%	36.34%
Percent Hydropsychidae	8.92%	2.05%	7.73%	10.38%	29.00%	2.04%	0.00%	4.56%
Percent Tolerant Taxa	11.43%	8.82%	11.11%	10.00%	7.41%	11.76%	15.63%	14.63%
Percent Intolerant Taxa	57.14%	64.71%	66.67%	66.67%	33.33%	35.29%	53.13%	43.90%

Upstream and downstream from the confluence with the Hansen Feeder Canal on the Big Thompson River were sites HFC-BTU and HFC-BTD (respectively). It is important to note that impacts from the 2020 Cameron Peak fire are still influencing aquatic conditions on the Big Thompson River. Interestingly, the sampling location below the feeder canal produced more-optimal values for most metrics when compared to the upstream site (Table 4). There were more taxa collected (as seen in the Total Taxa and Insect Taxa values), including those considered sensitive to disturbances (EPT) at HFC-BTD. This site also supported the highest percentage of specialized and sensitive feeders (Shredders and Scrapers), as well as the highest Percent EPT (excluding Baetidae), in the East Slope study area (Table 4). Despite these differences in community structure, both sampling locations had relatively high values for Diversity and Evenness, and DAT values indicated good community balance. In 2024, there was no detectable stress at either sampling location on the Big Thompson River based on aMIS scores of 86 and 95 upstream and downstream (respectively) of the Hansen Feeder Canal.

On the Little Thompson River, samples were collected upstream (SVSC-LTU) and downstream (SVSC-LTD) of the Saint Vrain Supply Canal. Results from the aMIS indicated “Slight Stress” at both sampling locations; however, negative impacts to the macroinvertebrate community appeared to be greater at the downstream site (Table 4). Downstream, macroinvertebrate community balance declined (based on lower Diversity, Evenness, and DAT values) and abundance was greatly reduced (based on Density and Biomass estimates). Further comparison showed a decline in Total Taxa and Insect Taxa (17 and 12, respectively) from upstream to downstream, and a decline in EPT, percent EPT (excluding Baetidae), Percent Shredders and Scrapers, and Percent Hydropsychidae indicated a loss of sensitive or specialized taxa (Table 4). Despite this decline in community balance and structure at the site below the Saint Vrain Supply Canal, it is unlikely that impacts to the macroinvertebrate community are solely due to introduced water, as this pattern did not occur at sites on the other East Slope streams. It is possible that low flow during the winter months could lead to sediment deposition in preferred habitats, which would contribute to negative impacts on community balance.

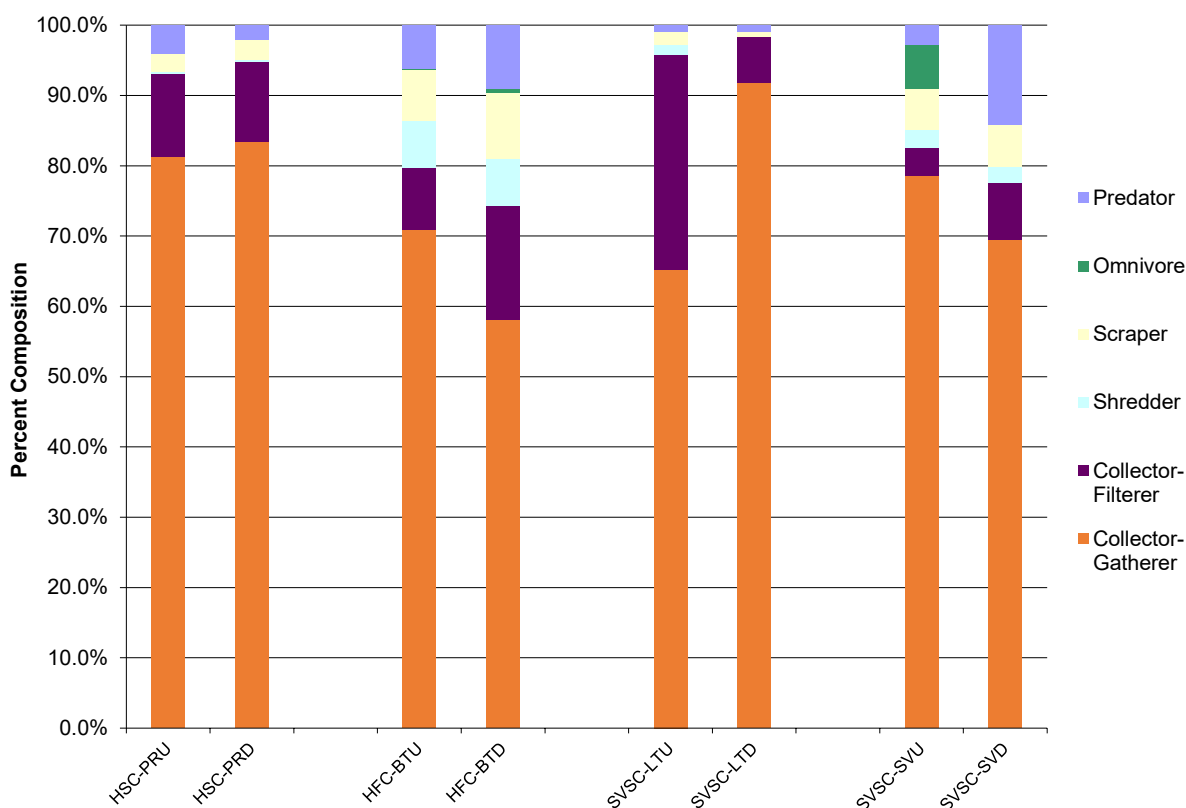
Benthic macroinvertebrate sampling on Saint Vrain Creek also occurred above (SVSC-SVU) and below (SVSC-SVD) the Saint Vrain Supply Canal. Results indicated that aquatic conditions appeared to be more favorable for supporting macroinvertebrate communities at the downstream sampling location (SVSC-SVD), though no stress could be detected at either site based on the aMIS scores (Table 4). The abundance of macroinvertebrates (Density) increased by more than 90% from upstream to downstream (3,486/m² to 6,639/m²), including an increase in sensitive taxa (EPT) from 18 to 25. There was a notable improvement to DAT values upstream to downstream, going from “Good” to “Excellent”, and a relatively large increase in the Diversity value (Table 4). There did not appear to be an impact from nutrient enrichment at either

sampling location (based on HBI values) and each site was able to support a similar percentage of Shredders and Scrapers (Table 4). There is potential for slightly more anthropogenic disturbances at site SVSC-SVU due to its closer proximity to the Town of Lyons, which could account for some of the variability in metric results from upstream to downstream. Overall, sites on the Saint Vrain Creek appeared to support relatively healthy macroinvertebrate communities during the spring of 2024.

The assessment of aquatic life and macroinvertebrate community health in the East Slope study area during the spring of 2024 was further analyzed with an evaluation of functional feeding groups (Table 5, Figure 4). With the exception of the sites on the Little Thompson River, the proportions of feeding groups remained similar at sites within a stream, and the greatest variability came from comparisons between streams. All sampling locations were dominated (>58%) by collector-gatherers, though the most specialized and sensitive groups (Shredders and Scrapers) were collected at all locations (Table 5). On the Cache la Poudre River, the proportions of all feeding groups were incredibly similar between paired sites (Table 5, Figure 4). The sampling locations on the Big Thompson River had the most optimal assemblages of feeding groups, with the downstream location supporting the highest percentage of shredders and scrapers (15.91% combined) in the study area. The evidence of mild stress at sites on the Little Thompson River were further illustrated, with 91.84% of the community consisting of collector-gatherers at SVSC-LTD. While the upstream location (SVSC-LTU) did not have an ideal community composition, there was a better representation of collector-filterers when compared to the upstream site (Table 5). Finally, paired sites on the Saint Vrain Creek had similar proportions of all feeding groups, with a decent increase in the proportion of predators at the downstream location (Figure 4). Overall, results from the functional feeding group analysis supported findings from individual metrics and the aMIS, indicating: 1) similar macroinvertebrate communities at both sampling locations on the Cache la Poudre River, 2) improved assemblages at the downstream sites on the Big Thompson River and Saint Vrain Creek, and 3) an increase in stress to the site below the Saint Vrain Supply Canal on the Little Thompson River in 2024.

Table 5. Relative abundance of functional feeding groups at Northern Water East Slope study sites during April of 2024.

Site	Functional Feeding Group					
	Collector-Gatherer	Collector-Filterer	Shredder	Scraper	Omnivore	Predator
HSC-PRU	81.22%	11.91%	0.19%	2.69%	0.00%	4.00%
HSC-PRD	83.47%	11.32%	0.32%	2.77%	0.00%	2.12%
HFC-BTU	70.93%	8.80%	6.67%	7.20%	0.27%	6.13%
HFC-BTD	58.13%	16.26%	6.57%	9.34%	0.69%	9.00%
SVSC-LTU	65.20%	30.59%	1.50%	1.78%	0.00%	0.94%
SVSC-LTD	91.84%	6.44%	0.16%	0.63%	0.00%	0.94%
SVSC-SVU	78.57%	4.02%	2.46%	5.80%	6.36%	2.79%
SVSC-SVD	69.51%	8.07%	2.22%	6.03%	0.00%	14.16%

**Figure 4. Functional feeding group composition for East Slope study sites during spring 2024.**

Fall Sampling - 2024

West Slope

On the 17-18 September 2024, benthic macroinvertebrate sampling was conducted in the West Slope study area at the same seven study sites that were sampled during the spring season (Table 1). Samples were collected and processed in the same way as spring samples, and taxa lists can be found in [Appendix C: Tables C1-C7](#). In addition to the metrics used for analyzing data during spring sampling, the MMI was applied to the fall data, as it was calibrated using data from summer and/or fall sampling events. While no *Pteronarcys californica* were collected at West Slope sites in the fall, results indicated that most sampling locations supported relatively healthy macroinvertebrate communities (Table 6). Exceptions occurred at CR-SMD and CR-GRD, where the hypolimnetic releases from the dams likely had an impact to the aquatic communities. A review of site-specific results has been provided to assist in the evaluation of macroinvertebrate community parameters.

Due to its location upstream from Northern Water activities and most other potential sources of anthropogenic stress, EI-GLU was again used as the reference site in the West Slope study area during the 2024 fall sampling season. Results from individual metrics and the aMIS indicated that this site was able to support a healthy macroinvertebrate community during the fall of 2024. Community balance was good, based on results from DAT, Diversity, and Evenness (Table 6) and a high number of taxa (Total Taxa = 50, Insect Taxa = 45), including those considered sensitive to disturbances (EPT = 29) was supported at this site. The MMI v4 value was well-above the attainment thresholds, indicating aquatic life use was not negatively impacted by stress in the time leading up to sampling. While this site produced the lowest abundance of macroinvertebrates in the West Slope study area (based on Density and Biomass), there was no evidence of impacts from sedimentation (based on the TIV score of 5.29), and there was not an overly high proportion of nutrient-tolerant individuals (based on the HBI score of 3.63). Overall, metric results obtained from site EI-GLU in September of 2024 provided valuable reference information that was used to assess the health of aquatic communities at the remaining sampling locations in the West Slope study area; though notably, a few downstream sampling locations received higher values for select individual metrics (Table 6).

Table 6. Individual metric values and aMIS scores for macroinvertebrate samples collected from the Upper Colorado River drainage (West Slope study area) on 17-18 September 2024. All metrics are based on full-count Hess samples.

Metric	EI-GLU	CR-SMU	CR-SMD	CR-GRD	CR-WGU	FR-WGU	CR-WGD
Density (estimated #/m ²)	2,114	4,538	9,588	14,179	7,711	5,919	13,793
Biomass (g/m ²)	0.85	1.58	1.41	2.35	1.84	1.89	3.90
Diversity	4.12	4.09	2.60	2.58	4.25	4.31	3.67
Evenness	0.73	0.72	0.53	0.51	0.73	0.73	0.62
DAT	25.4	28.5	15.8	16.2	39.4	39.5	38.1
EPT	29	21	13	13	25	31	33
HBI	3.84	4.56	6.02	5.14	3.69	3.30	3.28
Total Taxa	50	52	31	34	58	59	60
aMIS	--	92	61	64	98	100	96
Insect Taxa	45	43	23	27	50	48	52
Percent Shredders and Scrapers	8.69%	15.88%	0.49%	0.19%	19.86%	36.45%	9.48%
Density of <i>Pteronarcys californica</i> (#/m ²)	0	0	0	0	0	0	0
Percent EPT (excluding Baetidae)	41.59%	29.53%	8.78%	0.98%	39.67%	63.22%	68.22%
Percent Chironomidae	14.97%	38.88%	11.61%	28.62%	35.43%	5.92%	13.20%
Percent Hydropsychidae	17.56%	11.24%	0.89%	0.16%	9.88%	14.34%	32.76%
Percent Tolerant Taxa	12.00%	21.15%	25.81%	23.53%	18.97%	16.95%	13.33%
Percent Intolerant Taxa	44.00%	34.62%	22.58%	41.18%	37.93%	44.07%	48.33%

Table 7. Individual component metric scores and MMI v4 scores for macroinvertebrate samples collected from the Upper Colorado River drainage (West Slope study area) in Biotypes 1 and 2 in September 2024. MMI v4 scores highlighted in red indicate 'impairment'. All metrics are based on a 300 count subsample.

Metric	EI-GLU	CR-SMU	CR-SMD	CR-GRD	CR-WGU	FR-WGU	CR-WGD
	Biotype 2			Biotype 1			
EPT Taxa	100.0	69.4	36.7	33.3	91.7	100.0	79.2
% EPT Individuals, no Baetidae	56.1	35.5	12.6	3.3	56.8	82.5	92.5
Clinger Taxa	100.0	90.0	35.0	33.7	86.5	100.0	81.7
Total Taxa	100.0	95.2	50.0				
Intolerant Taxa	100.0	81.0	23.8				
% Increasers, Mountains	57.7	20.2	10.6				
Predator Taxa	84.6	53.8	7.7				
% Scraper Individuals	24.2	35.4	15.3				
% Non-Insect Individuals				61.6	59.8	92.9	96.9
% Coleoptera Individuals				0.0	9.8	34.1	12.3
% Intolerant Taxa				62.5	74.5	74.5	84.3
% Increasers, Mid-Elevation				86.2	88.2	93.5	98.8
Predator/Shredder Taxa				35.7	71.4	64.3	50.0
MMI v4 Score	77.8	60.1	24.0	39.5	67.3	80.2	74.5
Auxiliary Metrics							
Diversity	4.29	4.13	2.68	2.65	4.31	4.36	3.73
HBI	3.63	4.00	5.97	5.14	2.78	2.89	3.24
TIV (Sediment Region 2)	5.29	5.99	6.07	5.91	NA	4.66	4.91

Site CR-SMU was located on the Colorado River upstream from Shadow Mountain Reservoir, outside influence of reservoir operations but potentially affected by nearby residential developments. The aMIS score of 92 indicated no additional stress compared to the reference site. Although the MMI v4 score was lower (60.1) than the score at EI-GLU, the value remained well above the attainment threshold. Diversity, Evenness, and DAT metrics all generated values indicating a relatively well-balanced macroinvertebrate community (Table 6). Compared to other sampling locations not positioned directly below reservoirs, this site had a relatively low total EPT and percent EPT (excluding Baetidae), though the Total Taxa value remained high (Table 6). Finally, the TIV score (5.99) and HBI value (4.00) did not indicate an issue from sedimentation or nutrient-enrichment. Overall, site CR-SMU supported a relatively healthy macroinvertebrate community during the fall of 2024.

Immediately downstream from Shadow Mountain Reservoir, site CR-SMD was positioned to monitor influences from the reservoir and potential impacts from reservoir operations. This site obtained an MMI v4 score indicating 'impairment' for aquatic life use (Table 6). The two auxiliary metrics, Diversity and HBI, also received impaired scores (2.68 and 5.97, respectively), indicating a limited variety of taxa and a high proportion of nutrient-tolerant individuals. While the TIV value (6.07) was below the threshold of impairment (6.3 for Sediment Region 3), it was the highest score in the study area and may indicate that sedimentation could be impacting the available macroinvertebrate habitat. This observation is supported by the low scores in other metrics that monitor sensitive individuals: EPT Taxa, Percent EPT (excluding Baetidae), Percent Shredders and Scrapers, and Percent Intolerant Taxa (Table 6). While this site had the lowest number of taxa collected (Total Taxa =31, Insect Taxa =23), there was a relatively high number of individuals (Density = 9,588 individuals per m²). However, most of these individuals were representatives of taxa considered tolerant to disturbances: *Baetis tricaudatus*, *Simulium*, and *Caecidotea* (Appendix C; Table C3). The aMIS score of 61 was the lowest in the study area and indicated "slight stress" to the community. As noted previously, impacts to macroinvertebrate communities directly downstream of reservoirs are common due to altered temperature and flow regimes. Therefore, while these scores are not ideal, they are consistent with expected conditions.

Site CR-GRD was located downstream from a deep-release reservoir (Granby Reservoir) and the benthic macroinvertebrate community exhibited many of the same characteristics that were found at site CR-SMD (Table 6). Even though the macroinvertebrate communities at these two sites experienced similar influences (altered temperature and flow regimes), site CR-SMD was located in Biotype 2 and site CR-GRD was farther downstream in Biotype 1. While the application of individual metrics and aMIS remained the same for these two sites, the MMI (v4) required different component metrics to calculate final scores due to the difference in Biotype. Therefore,

individual metrics and aMIS were more appropriate tools for comparing macroinvertebrate community structure between sites CR-SMD and CR-GRD.

Community balance and taxa richness were quite similar at CR-GRD to site CR-SMD, based on multiple metrics: Diversity, Evenness, DAT, EPT, Total Taxa, Insect Taxa, Percent Tolerant Taxa, Percent Shredders and Scrapers, and Percent Hydropsychidae (Tables 6). However, CR-GRD did not receive impairment designations for Diversity and HBI auxiliary metrics. This indicates slightly better community balance, with a smaller proportion of nutrient-tolerant individuals comprising the community at the site below Granby Reservoir than Shadow Mountain Reservoir. The biggest difference between the two sites is observed in the MMI v4 scores. Site CR-GRD received an MMI v4 score (39.5) in the 'grey zone' but ultimately could be considered in attainment based on the auxiliary metric scores. Overall, the lower MMI and aMIS scores at sites CR-SMD and CR-GRD are likely attributed to the altered temperature regime and flow patterns that can occur below reservoirs.

Site CR-WGU was positioned approximately 10 km downstream from Granby Reservoir and immediately upstream from Windy Gap Reservoir. Compared to the two upstream sites, there was a huge improvement in all individual and multi-metric results, with some metric values obtaining more optimal scores than the reference site (Tables 6 & 7). A variety of insect taxa was supported, as seen in the Total Taxa and Insect Taxa metric values (Table 6). There was evidence of a return in sensitive and specialized taxa, with 25 different EPT taxa collected (a higher proportion of which were not in the family Baetidae) and an increase in the percentage of shredders and scrapers (Table 6). Community balance could be considered relatively healthy, based on Diversity (4.25), Evenness (0.726), and "Excellent" DAT score (39.4). Overall, the stress associated with the impoundments at CR-SMD and CR-GRD appeared to be alleviated at site CR-WGU, with an MMI (v4) score in attainment and an aMIS score indicating no detectable stress compared to the reference site in 2024.

The single sampling location on the Fraser River (FR-WGU) generated very high results for all individual and multi-metric parameters in the West Slope study area in 2024 (Tables 6 & 7). Overall, this site obtained an MMI v4 score well-above the attainment threshold (80.2) and the aMIS of 100 demonstrates reference-level quality. Additionally, the MMI v4 score was the highest at this sampling location on the West Slope study area. There was a large representation of taxa collected (Total Taxa = 59), many of which were considered sensitive to disturbances (EPT = 31). The HBI indicated a low proportion of nutrient tolerant individuals comprised the community, and community balance could be considered relatively healthy (based on Diversity, Evenness, and DAT). Ultimately, FR-WGU maintained a well-balanced and healthy macroinvertebrate community assemblage at the time of sampling in the fall of 2024.

The farthest downstream site in the West Slope study area, CR-WGD, was positioned below Windy Gap Reservoir. Despite the potential of this sampling location to receive impacts from a variety of upstream sources (including runoff from roads and residential areas, and impacts associated with reservoir operations, results from the applied metrics indicated that this sampling location supported a well-balanced macroinvertebrate community with a variety of taxa (including sensitive taxa). The high Density and Biomass values (13,793 individuals/m² and 3.90 g/m²) for site CR-WGD was an indication that the water quality and habitat at this site was able to maintain a highly productive aquatic community. Additionally, this site obtained the lowest HBI value in the West Slope study area, suggesting that nutrient-enrichment was not an issue (Table 6). The aMIS score of 96 indicates that there was no detectable increase in stress when compared to the reference site, and the MMI v4 generated a score indicating attainment for aquatic life use in the fall of 2024.

An evaluation of functional feeding groups helped to demonstrate the range of ecological conditions in the West Slope study area, and results supported many of the individual metrics and multi-metric tools (Table 8, Figure 5). Notably, the reference site (EI-GLU) had a high proportion of collector-gatherers and was lacking in representation from shredders and scrapers. Since most metrics indicated healthy aquatic conditions at EI-GLU, the shift in the proportions of various feeding groups was likely related to the availability of various food resources, rather than impacts from anthropogenic activities. All other sampling locations maintained relatively healthy proportions of feeding groups in the fall of 2024. The most significant effects on macroinvertebrate communities were again observed downstream of reservoirs, although the impacts seemed less distinct compared to those observed during spring sampling (Table 3, Figure 3). Sites CR-SMD and CR-GRD were dominated (>72%) by collector-gatherers and had minimal (<1%) representation from shredders and scrapers, which are considered to be the more sensitive and specialized groups (Table 8). As expected, farther downstream at site CR-WGU, the macroinvertebrate community returned to a more 'normal' assemblage due to distance from the impoundment. Site FR-WGU had the most optimal macroinvertebrate community assemblage, with adequate representation from most feeding groups (Figure 5).

Table 8. Relative abundance of functional feeding groups for fall 2024 sampling at Northern Water West Slope study sites.

Site	Functional Feeding Group					
	Collector-Gatherer	Collector-Filterer	Shredder	Scraper	Omnivore	Predator
EI-GLU	60.26%	18.85%	1.48%	7.21%	0.00%	12.20%
CR-SMU	49.87%	20.00%	6.52%	9.36%	7.21%	7.04%
CR-SMD	72.08%	26.63%	0.04%	0.45%	0.00%	0.81%
CR-GRD	73.49%	10.64%	0.05%	0.14%	15.08%	0.60%
CR-WGU	43.90%	16.43%	13.05%	6.80%	15.88%	3.93%
FR-WGU	36.84%	21.71%	18.16%	18.29%	0.07%	4.93%
CR-WGD	47.90%	36.67%	2.20%	7.29%	0.06%	5.88%

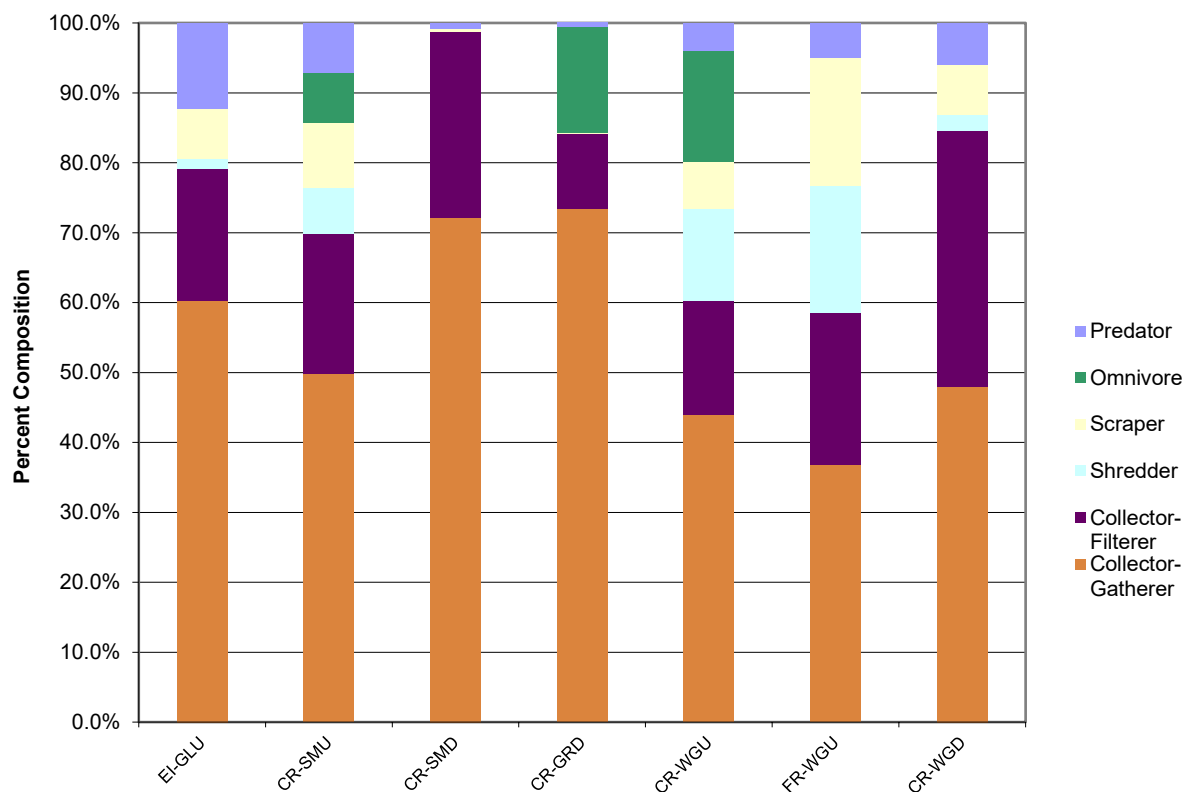


Figure 5. Functional feeding group composition for West Slope study sites during the fall of 2024.

East Slope

Fall benthic macroinvertebrate sampling in the East Slope study area was conducted on 30 September 2024. Samples were collected at the same paired study sites that were utilized during the spring season, and these sites consisted of locations upstream and downstream from water transfer systems on the Cache la Poudre, Big Thompson, Little Thompson, and Saint Vrain rivers. Specimens were processed the same way as previously described, and taxa lists can be found in [Appendix D: Tables D1-D8](#). In addition to the individual metrics used during the spring season, the MMI (v4) was used to evaluate the overall health of benthic macroinvertebrate communities in this study area. In the fall of 2024, there appeared to be minor to moderate impacts to benthic macroinvertebrate communities at the downstream sites on all streams, and paired sites on the Little Thompson had the most evidence of stress among sampled streams (Tables 9 & 10). Additionally, HBI values consistently increased at the downstream locations on all streams.

The sampling locations on the Cache la Poudre River were positioned upstream (HSC-PRU) and downstream (HSC-PRD) from the Hansen Supply Canal (Table 1, Figure 2). While community balance was similar at both sampling locations based on Diversity and Evenness values, there was a shift in taxa richness and assemblages (Tables 9 & 10). The abundance of macroinvertebrates increased from upstream to downstream based on Density and Biomass values, which included an increase in taxa richness based on Total Taxa and Insect Taxa (Table 9). The number of different EPT taxa was higher at the downstream sampling location, and while the Giant Stonefly, *Pteronarcys californica*, was collected at both sites, it was notably more abundant at HSC-PRD (Table 9). Additionally, an increase to the proportion of nutrient-tolerant individuals occurred downstream, as seen in the elevated HBI value (Table 9). Other metrics that yielded similar results at both locations included: Percent Shredders and Scrapers, Percent Chironomidae, Percent Tolerant Taxa, and Percent Intolerant Taxa (Table 9). Despite these differences in community structure, the aMIS could not detect any additional stress at either location and DAT values at both sites indicated “Excellent” water quality for macroinvertebrate communities. The MMI v4 was 16.3 points lower at the downstream site compared to the upstream site (Table 10). This difference was due to the lower % Non-Insect Individuals and % Increasers Mid-Elevation component metrics (Appendix D; Table D-2). Notably, much of the water flow on the Cache la Poudre River in September is provided by releases of cool water from Horsetooth Reservoir via the Hansen Supply Canal, which might have contributed to differences in aquatic communities between the two sites. Overall, both sampling locations on the Cache la Poudre River supported a well-balanced macroinvertebrate community and the river did not seem to be heavily impacted by water transfer systems.

Table 9. Individual metric values and aMIS scores for full count macroinvertebrate samples collected from East Slope sample sites in September 2024.

Metric	HSC-PRU	HSC-PRD	HFC-BTU	HFC-BTD	SVSC-LTU	SVSC-LTD	SVSC-SVU	SVSC-SVD
Density (estimated #/m ²)	6,091	13,095	3,068	5,563	711	1,218	6,295	6,553
Biomass (g/m ²)	4.70	14.78	1.97	9.80	0.41	1.99	6.30	7.74
Diversity	3.47	3.60	3.49	3.71	3.76	2.26	3.51	3.33
Evenness	0.66	0.64	0.69	0.73	0.83	0.59	0.67	0.58
DAT	23.7	33.5	19.3	23.5	12.5	5.3	22.4	29.4
EPT	23	30	21	20	13	9	23	29
HBI	3.00	4.48	2.32	3.41	4.66	5.53	1.95	3.48
Total Taxa	39	50	33	34	23	14	38	53
aMIS	97	93	99	97	80	56	99	94
Insect Taxa	35	47	30	30	21	11	33	46
Percent Shredders and Scrapers	16.72%	11.65%	31.09%	15.64%	14.36%	8.63%	59.57%	16.20%
Density of <i>Pteronarcys californica</i> (#/m ²)	20	74	0	0	0	0	4	0
Percent EPT (excluding Baetidae)	55.97%	47.08%	73.73%	56.56%	57.46%	42.49%	78.27%	64.69%
Percent Chironomidae	6.57%	6.34%	3.43%	10.06%	14.36%	1.28%	1.79%	5.88%
Percent Hydropsychidae	8%	13%	10%	16%	36%	33%	10%	32%
Percent Tolerant Taxa	7.69%	4.00%	9.09%	8.82%	8.70%	0.00%	13.16%	11.32%
Percent Intolerant Taxa	48.72%	56.00%	48.48%	47.06%	30.43%	21.43%	44.74%	39.62%

Table 10. Component metric scores and MMI v4 scores for macroinvertebrate samples collected from East Slope study sites (Biotype 1) in September 2024. Scores highlighted in red indicate ‘impairment’. All metrics are based on a 300 count subsample.

Metric	HSC-PRU	HSC-PRD	HFC-BTU	HFC-BTD	SVSC-LTU	SVSC-LTD	SVSC-SVU	SVSC-SVD
	Biotype 1							
EPT Taxa	100.0	100.0	76.5	100.0	98.0	100.0	100.0	100.0
% Non-Insect Individuals	97.3	57.5	97.7	98.6	77.1	0.0	93.9	94.0
% EPT Individuals, no Baetidae	69.5	56.7	95.6	68.4	78.8	58.3	100.0	82.9
% Coleoptera Individuals	10.1	6.8	7.8	5.3	0.0	0.0	17.1	7.5
% Intolerant Taxa	100.0	100.0	82.8	100.0	68.8	58.2	97.2	100.0
% Increasers, Mid-Elevation	97.3	15.5	96.9	100.0	97.7	100.0	97.2	97.0
Clinger Taxa	100.0	100.0	71.1	95.2	90.6	43.6	100.0	100.0
Predator/Shredder Taxa	78.6	85.7	50.0	71.4	7.1	14.3	78.6	64.3
MMI v4 Score	81.6	65.3	72.3	79.9	64.8	46.8	85.5	80.7
	Auxiliary Metrics							
Diversity	3.50	3.64	3.41	3.70	3.76	2.26	3.68	3.49
HBI	3.15	4.74	2.24	3.47	4.60	5.53	1.71	3.39
TIV (Sediment Region 3)	4.78	4.91	4.72	4.76	5.42	5.54	4.16	4.77

Most metrics indicated a similar and healthy macroinvertebrate community at sampling locations upstream and downstream of the supply canal on the Big Thompson River (HFC-BTU and HFC-BTD, respectively) during the fall sampling season. Community structure was nearly identical based on values from EPT, Total Taxa, and Insect Taxa, as well as the proportion of tolerant and intolerant individuals (based on % Tolerant and % Intolerant metrics) (Table 9). A slight improvement to community balance occurred at HFC-BTD, demonstrated by an increase in Diversity, Evenness, and DAT scores (Table 9). The biggest difference between the sites was observed in macroinvertebrate abundance, with Density and Biomass estimates largely increasing at HFC-BTD. The elevated Biomass value was likely due to number of caddisfly individuals collected, specifically *Glossosoma* sp., *Brachycentrus occidentalis*, and *Hydropsyche* sp. Notably, *Glossosoma* sp. and *Brachycentrus occidentalis* make cases out of rocks and pieces of bark. The insects are not removed from their cases prior to drying, which may account for the large increase in biomass. Overall, MMI v4 values were similar and well-above the attainment thresholds, and the aMIS metric did not detect any additional stress at either sampling location in the fall of 2024. Interestingly, the macroinvertebrate community in the Big Thompson River showed minimal signs of impact from the Alexander Fire, which began in July 2024. Future sampling efforts will be crucial to assess whether any delayed effects, such as increased sedimentation, become apparent over time.

Benthic macroinvertebrate communities both upstream (SVSC-LTU) and downstream (SVSC-LTD) of the Saint Vrain Supply Canal on the Little Thompson River appeared to be experiencing some level of stress in 2024 (Tables 9 & 10). While the paired sites on this stream produced the lowest scores for most metrics (individual and multi-metric tools) in the study area, there was also a decline in values upstream to downstream (Table 9). When compared to other streams, there was a relatively low abundance (Density and Biomass) of macroinvertebrates collected on the Little Thompson River. Impacts to the macroinvertebrate community appeared to be greater at the downstream site, SVSC-LTD, where a lower number of taxa (Total Taxa and Insect Taxa), including those sensitive to disturbance (EPT) were collected (Table 9). Additionally, community balance appeared to be heavily impacted, with lower Diversity and Evenness scores and a DAT value (5.3) indicating “Poor” quality. The HBI value (5.53) at SVSC-LTD was the highest in the study area, indicating a high proportion of nutrient-tolerant individuals making up the community. While the aMIS score at the upstream site was just above the range indicating “No Detectable Stress”, site SVSC-SVD had a score of 53, indicating “Slight Stress”. A comparison of MMI v4 scores further demonstrated elevated stress downstream, when SVSC-LTU obtained a score (64.8) well-above attainment and SVSC-LTD had a score (46.8) slightly above the attainment threshold. It is possible that this site was being negatively impacted by sedimentation, due to fine sediment deposition in low velocity habitat (based on the relatively high TIV scores). Overall, results indicated that both sites on the Little Thompson River appeared to be negatively

influenced by stress in the fall of 2024, and macroinvertebrate communities at the downstream sampling location were more impacted.

Results from metrics from paired sampling locations above (SVSC-SVU) and below (SVSC-SVD) the Saint Vrain Supply Canal on St. Vrain Creek indicated that macroinvertebrate communities could be considered relatively healthy in the fall of 2024. Both sampling locations obtained DAT values indicating “Excellent” community balance, which was supported by the high Diversity and Evenness scores (Table 9). While paired sites supported similar abundances of macroinvertebrates (based on Density and Biomass values), site SVSC-SVD had a larger variety of taxa, including those sensitive to disturbances (Table 9). Additionally, the upstream sampling location had a very low HBI value (1.71), indicating a small proportion of the community consisted of nutrient-tolerant individuals. The upstream location also had four *Pteronarcys californica* collected (per m²), the only site other than paired sites on the Cache la Poudre to support the giant stonefly during the fall season. A similar proportion of tolerant and intolerant individuals were also collected at each site. Overall, the aMIS scores indicated no detectable stress at either location and results from the MMI were well-above the attainment threshold for aquatic life use in the fall of 2024.

Macroinvertebrate assemblages were further evaluated based on their ecological role through a review of functional feeding groups in the East Slope study area. Paired sites on the Cache la Poudre River had similar proportions of all feeding groups, indicating minimal influence from supply canal operations. Sampling locations on the Big Thompson River had more optimal and balanced functional feeding group assemblages (Table 11, Figure 6). No shredders were collected at either site on the Little Thompson River. Additionally, the downstream location (SVSC-LTD) had an abnormally low proportion of collector-gatherers (4.15%) and a high proportion of omnivores (46.96%), which typically consist of insects that do not easily fit into the other categories^{28,29}. Finally, sites on Saint Vrain Creek had adequate representation from all feeding groups, with a very high percentage of the specialized scraper group collected upstream at SVSC-SVU (Table 11). In general, the proportion of sensitive and specialized feeding groups, such as shredders and scrapers, declined at the downstream locations of all paired study sites. However, it remains unclear if this reduction is linked to supply canal operations, other anthropogenic influences, natural variability, or a combination of these factors. Overall, the functional feeding group analysis generally supported findings from the previously described metrics, indicating increased stress at sites on the Little Thompson, and relatively healthy communities at other sampling locations in the fall of 2024.

Table 11. Relative abundance of functional feeding groups for fall 2024 sampling at Northern Water East Slope study sites.

Site	Functional Feeding Group					
	Collector-Gatherer	Collector-Filterer	Shredder	Scraper	Omnivore	Predator
HSC-PRU	63.18%	14.29%	0.38%	16.34%	0.00%	5.81%
HSC-PRD	61.22%	21.91%	1.07%	10.58%	0.00%	5.22%
HFC-BTU	47.34%	18.91%	3.43%	27.66%	0.00%	2.66%
HFC-BTD	29.68%	47.14%	0.49%	15.15%	0.00%	7.54%
SVSC-LTU	31.49%	43.65%	0.00%	14.36%	10.50%	0.00%
SVSC-LTD	4.15%	33.23%	0.00%	8.63%	46.96%	7.03%
SVSC-SVU	24.63%	12.65%	7.04%	52.53%	0.00%	3.15%
SVSC-SVD	47.30%	34.07%	3.56%	12.64%	0.00%	2.43%

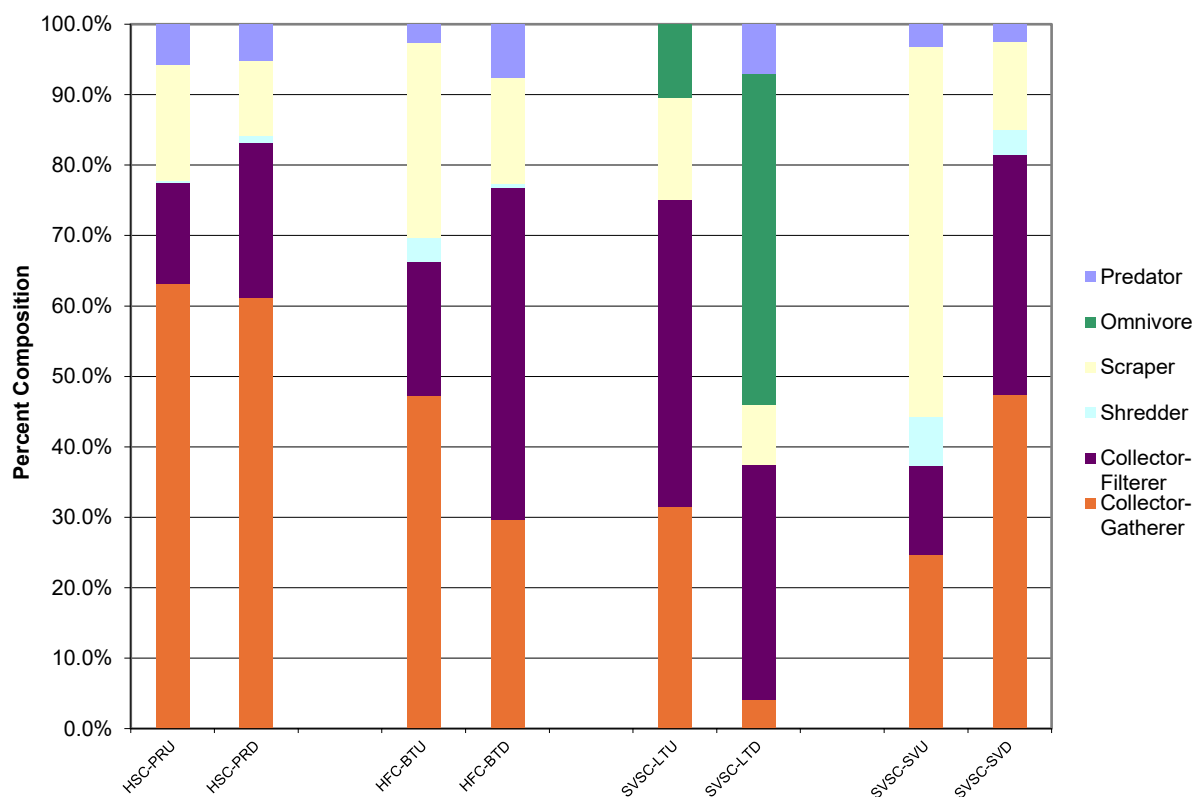


Figure 6. Functional feeding group composition for East Slope study sites during the fall of 2024.

Individual metrics and aMIS

West Slope

In 2024, results from individual metrics and the aMIS detected greater stress at sampling locations directly below reservoirs in the West Slope study area. During both sampling seasons, the sites below Shadow Mountain Reservoir (CR-SMD) and Granby Reservoir (CR-GRD) produced aMIS scores indicating slight-to-moderate stress to the macroinvertebrate communities. An evaluation of individual metrics indicated that much of this stress caused a reduction in the diversity and evenness of the community, as well as a loss of taxa (including those sensitive to disturbances). Site CR-GRD was particularly impacted during spring sampling. There was a very high abundance of macroinvertebrates, but a low variety of taxa and a DAT score indicating poor community balance. This site might have been further impacted by nutrient-enrichment (based on the high HBI value), in association with reservoir operations during spring sampling. Sites CR-SMD and CR-GRD have consistently received some of the lowest aMIS scores in the West Slope study area (Figures 7 and 8). While these results are not ideal, they were consistent with observations from other studies regarding the influence of water releases from dams in regulated streams^{33,39–41}. All 2024 results were compared to a historical (2008-2021) average from previous sampling events.

Sites FR-WGU and CR-WGD also received aMIS scores indicating slight stress during the spring of 2024, but most individual metrics indicated these sites maintained a relatively healthy macroinvertebrate community. Site FR-WGU received an aMIS score of 79, just below the threshold of 80 indicating “no detectable stress”. While site CR-WGD is located directly beneath Windy Gap Reservoir, the small size and specific operations of this reservoir appeared to have less of an influence on macroinvertebrate community structure and function than the other sites located beneath reservoirs; likely due to releases that more closely resemble natural temperature and flow conditions. All other sampling locations maintained well-balanced and taxa rich macroinvertebrate communities and received aMIS scores that did not indicate additional stress during both sampling seasons in 2024.

A comparison of 2024 aMIS results to historical results displayed similar patterns of stress and recovery within the West Slope study area, though some deviations from historical mean values were observed (Figures 7 and 8). In the spring, sites CR-SMU and CR-SMD obtained slightly higher aMIS scores than expected (based on the standard deviation of averaged historical results), and site FR-WGU produced a slightly lower value (Figure 7). Comparatively, in the fall, site FR-WGU produced an aMIS score of 100, which was higher than expected and indicates that aquatic conditions were near-identical to (or greater than) the reference site. Minor variations to the aMIS value could be due to seasonal or spatial changes in the watershed, and no extreme deviation indicating major anthropogenic stress occurred in 2024.

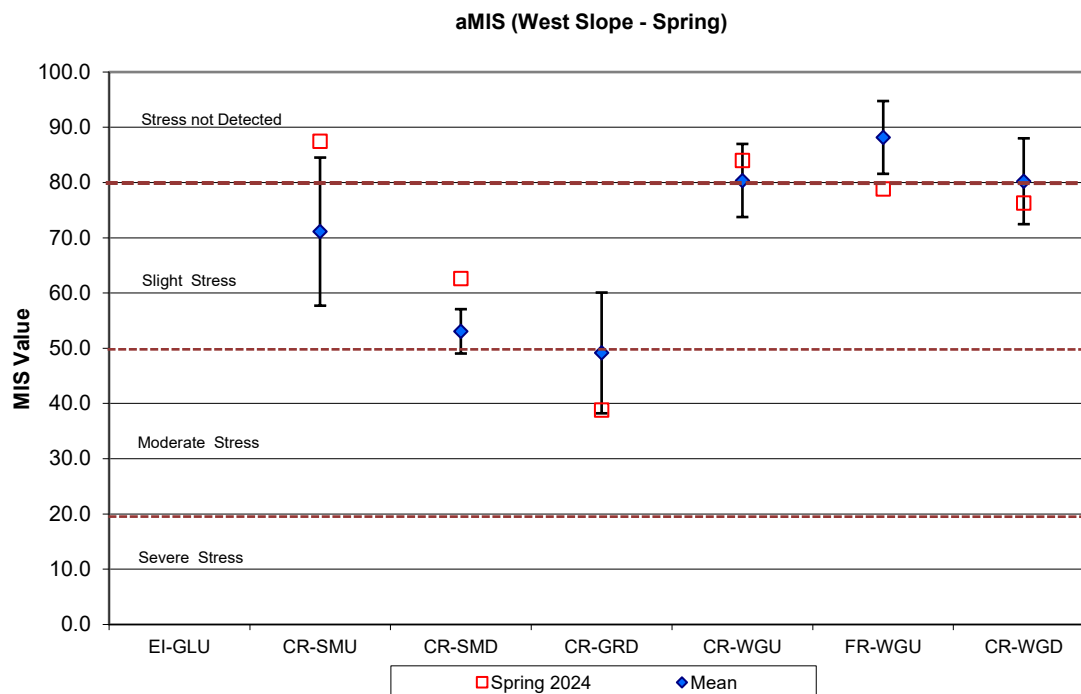


Figure 7. Historical (2008-2021) mean aMIS (± 1 SD) scores for the West Slope study compared to the spring of 2024.

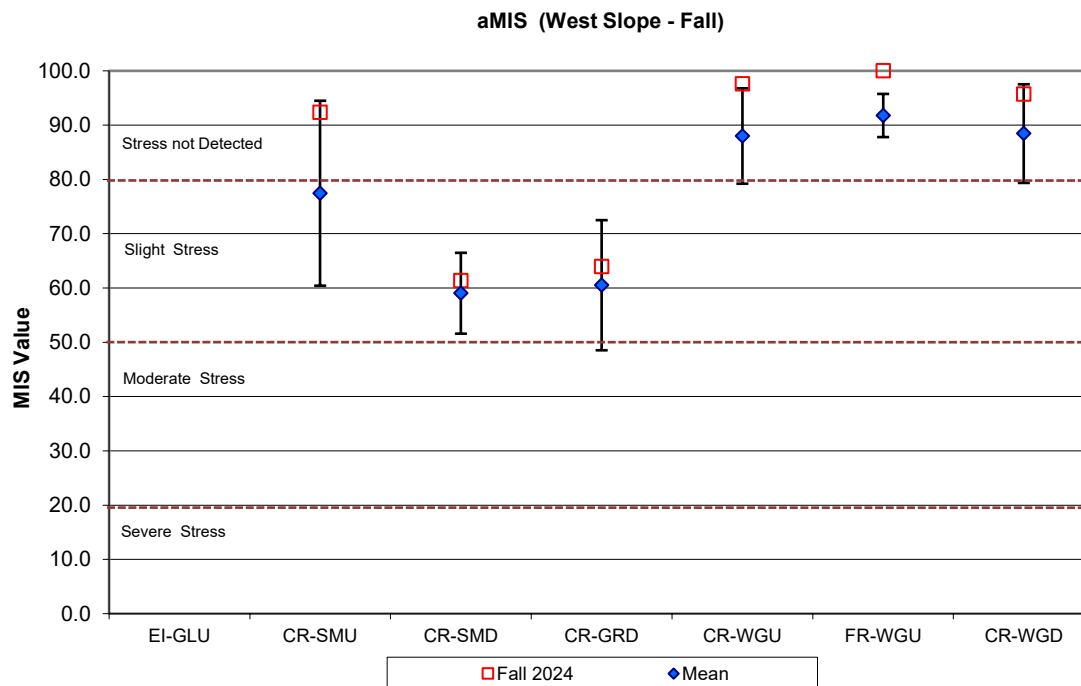


Figure 8. Historical (2008-2021) mean aMIS (± 1 SD) scores for the West Slope study compared to the fall of 2024.

East Slope

Sampling locations in the East Slope study area were strategically positioned upstream and downstream of water-transfer systems that introduce water from the West Slope into South Platte tributaries as part of the C-BT (Colorado-Big Thompson) project. The circumstances for exposure to reservoir water on the East Slope were quite different (and much less studied) than conditions that were previously described for the West Slope. Water from the West Slope is transported to the East Slope through a series of canals, tunnels, and storage reservoirs before it is finally distributed into Front Range streams through a series of canals. These canals essentially provide a buffer between the reservoirs and receiving systems; however, the structure of macroinvertebrate communities in canals has been found to differ from communities in nearby rivers depending on the available habitat and flow ⁴².

In the spring of 2024, all sampling locations obtained aMIS scores that were within their expected range, based on historical sampling averages (Figure 9). Paired sites on the Cache la Poudre River had no detectable stress, though the downstream location produced a slightly lower aMIS score. On the Big Thompson River and Saint Vrain Creek, the downstream locations received slightly higher aMIS values than their upstream counterparts, and no stress could be detected at any location. Only the Little Thompson River had both sites receive aMIS values indicating “Slight Stress”, and the downstream location appeared to be more heavily impacted. Ultimately, site SVSC-LTD had low taxa richness, including sensitive taxa, and an elevated HBI value, indicating a higher proportion of nutrient-tolerant individuals during the spring of 2024.

Perturbations appeared to persist on the Little Thompson River during the fall season, with both sites obtaining aMIS scores below the expected historical range (Figure 10). While the stress was categorized as “Slight”, SVSC-LTD produced an aMIS well-below what was expected based on historical means. Community balance at this site was poor (based on the DAT value and supported by suboptimal Diversity and Evenness values), and the low taxa richness and elevated HBI observed during spring sampling persisted in the fall. It is possible that both sites on the Little Thompson River were impacted by the same source of stress such as construction, sedimentation, or nutrient-enrichment. All other sampling locations had no detectable stress, though the downstream sites on all streams produced slightly lower aMIS values compared to the upstream locations.

Overall, results from aMIS on the East Slope were inconsistent in detecting potential influences from Northern Water activities on benthic communities. Results suggest that introduced water may have had minor positive or negative influences on the communities, depending on site location and season. Future sampling results and analysis will provide better precision in the range of natural variability, which will help in the assessment of anthropogenic stressors in the East Slope study area.

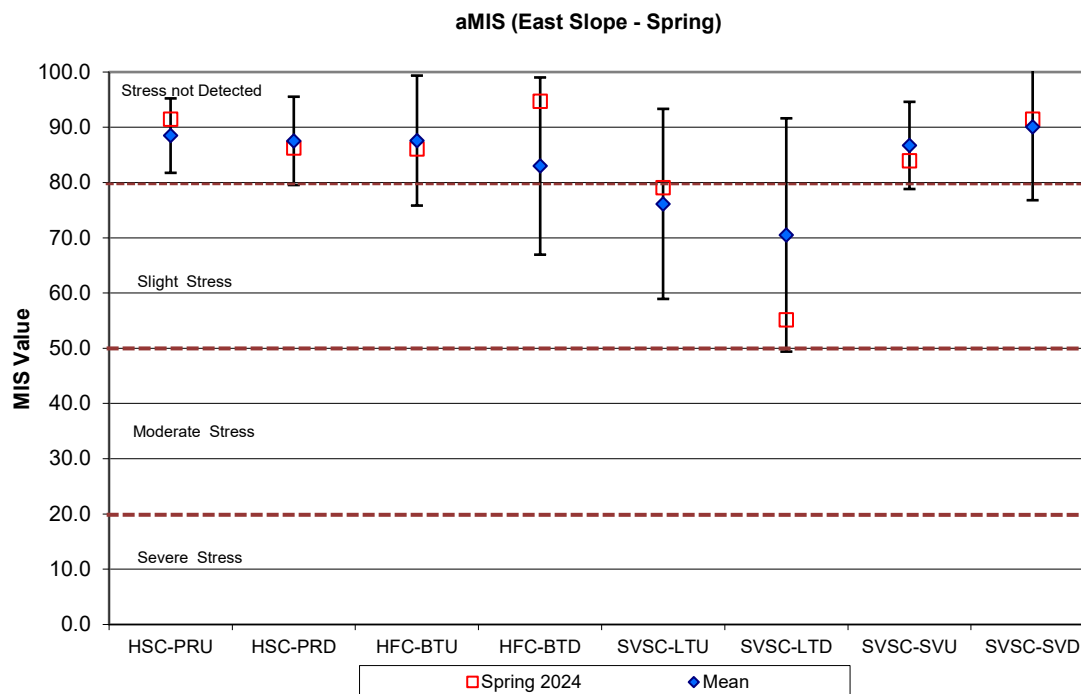


Figure 9. Historical (2008-2021) mean aMIS (± 1 SD) scores for the East Slope study compared to the spring of 2024.

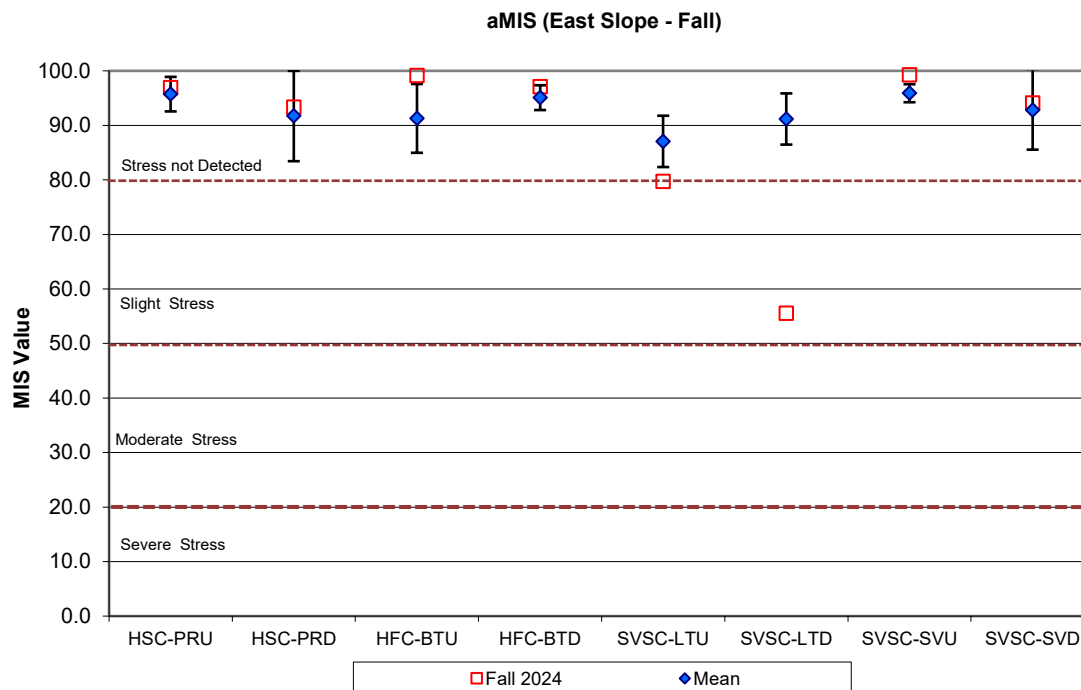


Figure 10. Historical (2008-2021) mean aMIS (± 1 SD) scores for the East Slope study compared to the fall of 2024.

The MMI (version 4)

During the fall season in 2024, additional data analysis was conducted using the multi-metric tool (MMI) recommended by the WQCD. The MMI v4 utilizes different component metrics for Biotypes 1 and 2, which resulted in slightly different perspectives regarding the health of aquatic life. West Slope study sites that were upstream from Granby Reservoir were included in Biotype 2, and sampling sites downstream were in Biotype 1. All study sites on the East Slope were located within Biotype 1. Thresholds to determine ‘attainment’ or ‘impairment’ were adjusted according to the appropriate Biotype.

The MMI v4 is currently the accepted version of the MMI to assess aquatic life use designations in Colorado. In 2024, results from the MMI v4 detected impairment at site CR-SMD; all other sampling locations on the East and West Slope were in attainment for aquatic life use (Table 12). On the West Slope, all MMI v4 scores fell within the expected historical range (Figure 11). The MMI v4 score at site CR-GRD fell within the ‘grey zone’, and an evaluation of auxiliary metrics resulted in an ‘attainment’ designation. All sampling locations in the East Slope study area obtained ‘attainment’ designations; however, there was some greater deviation from expected values at sites HSC-PRD and SVSC-LTD (Figure 12). The low MMI v4 score at SVSC-LTD was not surprising, based on the previously discussed individual and multi-metric values in 2024. The lower score at HSC-PRD, however, was unexpected. This site had a healthy community balance (based on Diversity, Evenness, and DAT scores) and supported a large number of different taxa, including those sensitive to disturbances. There was a slightly higher proportion of nutrient-tolerant taxa in 2024 than previously observed, which may have indicated mild impacts from nutrient-enrichment prior to sampling (Figure 14). Overall, the low score at HSC-PRD was influenced by a couple component metrics in the MMI v4 calculation, and future sampling events will determine if these lower values persist.

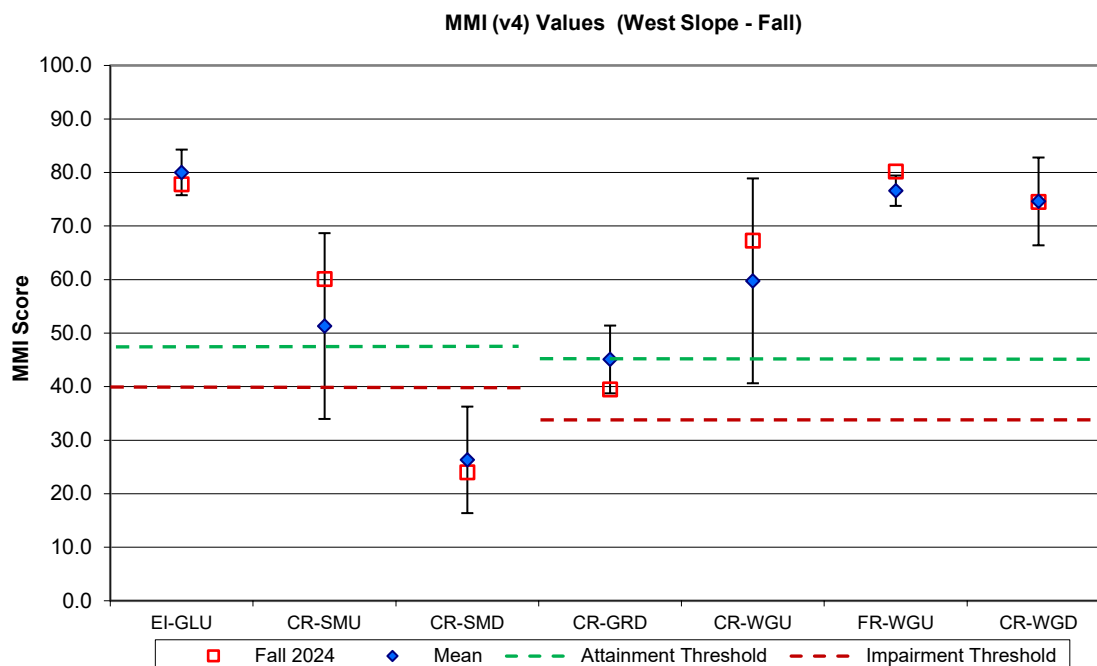


Figure 11. Historical (2008-2021) mean MMI v4 values ($\pm$ SD) for the West Slope study compared to the fall of 2024.

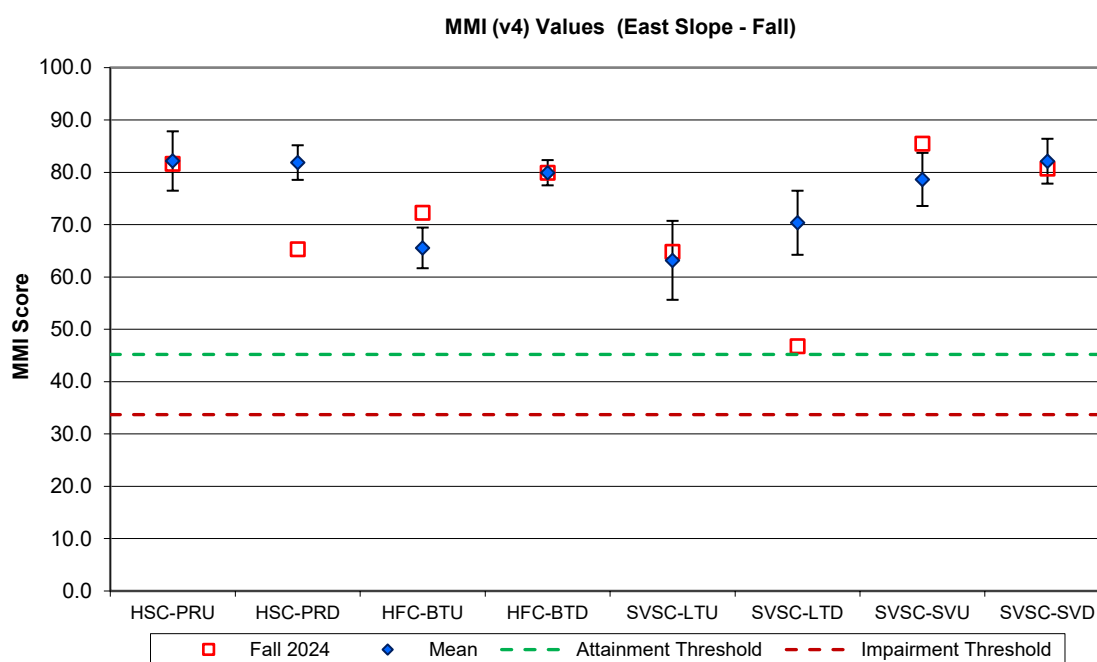


Figure 12. Historical (2008-2021) mean MMI v4 values ($\pm$ SD) for the East Slope study compared to the fall of 2024.

Auxiliary metrics (Diversity and HBI) were applied as part of the data analysis process for all sampling locations in this study and are illustrated in Figures 13-16. Results from the HBI indicated that a higher proportion of nutrient-tolerant individuals were collected at sites HSC-PRD and SVSC-LTD in 2024. All other sampling locations in the East and West slope study areas obtained similar or lower (better) HBI values than historically produced (Figures 13 & 14). Diversity values at most sampling locations were similar to historical values. Exceptions occurred at sites EI-GLU, FR-WGU, and HSC-BTD, where improvements to the community balance were observed, and a reduction in diversity occurred at SVSC-LTD. Additionally, the Diversity value at site CR-SMD was below the impairment threshold, but not outside of the expected historical range (Figure 15). All other study sites on the West Slope and East Slope study areas appeared to maintain relatively healthy aquatic conditions during the fall of 2024 (Figures 13-16).

Overall, a review of all results indicated that most sampling locations in the East and West Slope study areas supported healthy macroinvertebrate communities. Exceptions occurred at sites directly beneath reservoirs, which was expected, as well as evidence of some stress impacting both sites on the Little Thompson River. Operations conducted by Northern Water may have had some influence (positive and/or negative) on sampling sites, though results were inconsistent in their ability to detect a pattern. Other potential sources of stress (adjacent roads, urban runoff, construction, etc.) appeared to have minimal influences on benthic macroinvertebrate communities at most other study sites. Results from this study described aquatic community parameters as they existed during the spring and fall of 2024. It is likely that some variability will occur from year to year, due to natural changes in precipitation and ambient conditions. Since most of the study area supported a high proportion of sensitive taxa, increases in anthropogenic stress are expected to produce noticeable changes in macroinvertebrate community structure and function. Future biomonitoring surveys should provide valuable information that can be used to monitor changes in the health of aquatic communities in this study area.

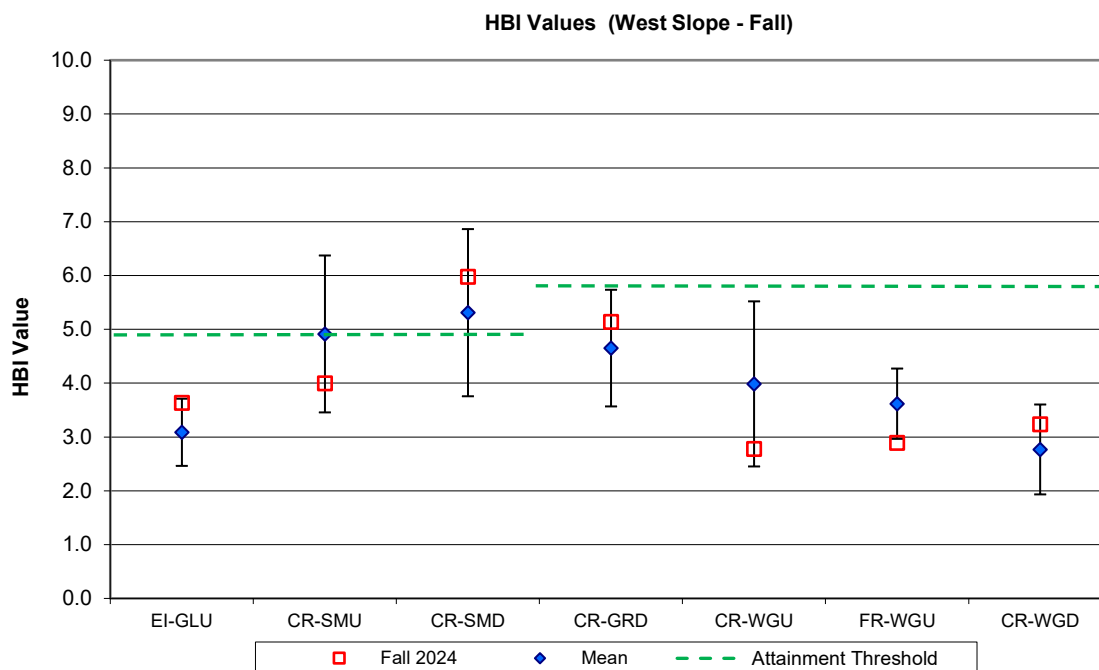


Figure 13. Historical (2008-2021) mean HBI values ($\pm$ SD) for the West Slope study compared to the fall of 2024. Metrics are calculated based on a subsample.

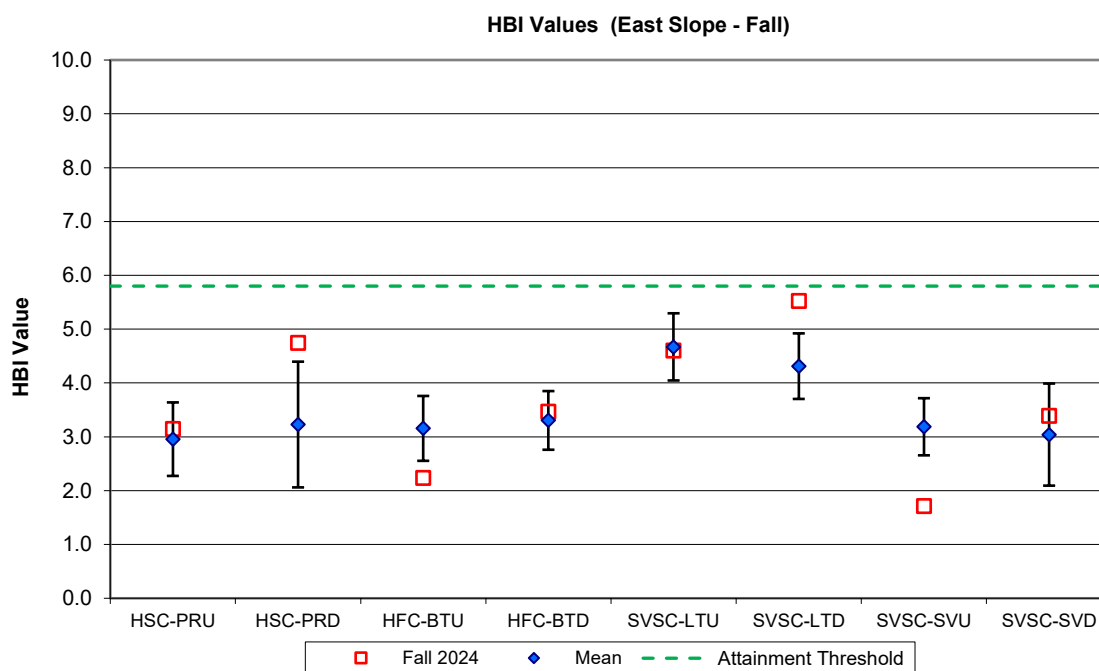


Figure 14. Historical (2008-2021) mean HBI values ($\pm$ SD) for the East Slope study compared to the fall of 2024. Metrics are calculated based on a subsample.

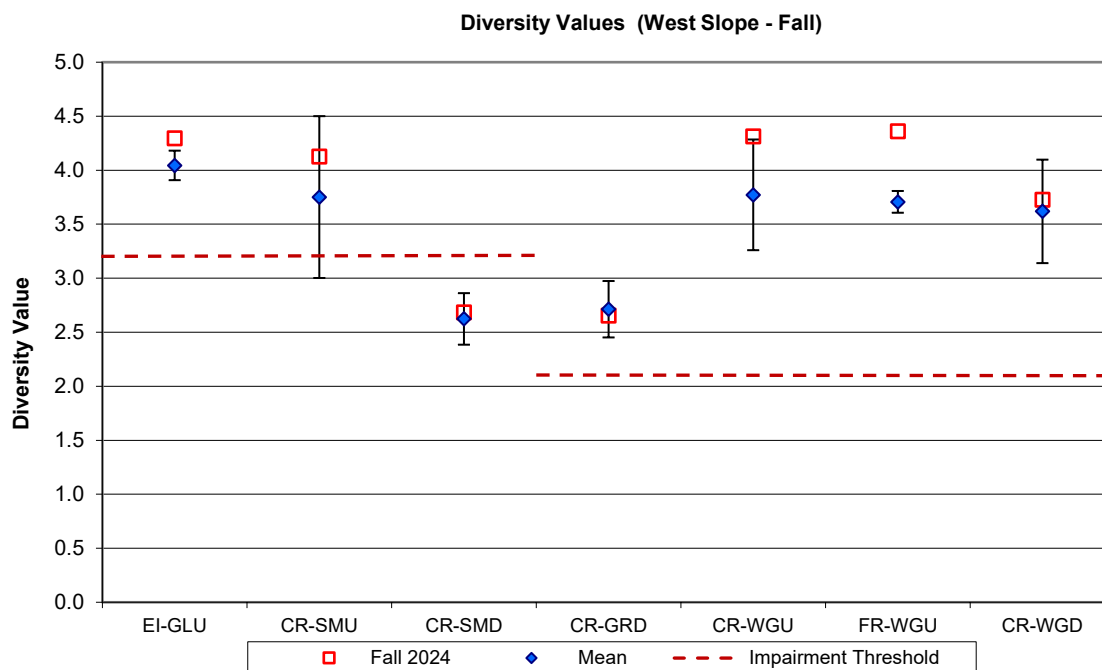


Figure 15. Historical (2008-2021) mean Diversity values ($\pm$ SD) for the West Slope study compared to the fall of 2024. Metrics are calculated based on a subsample.

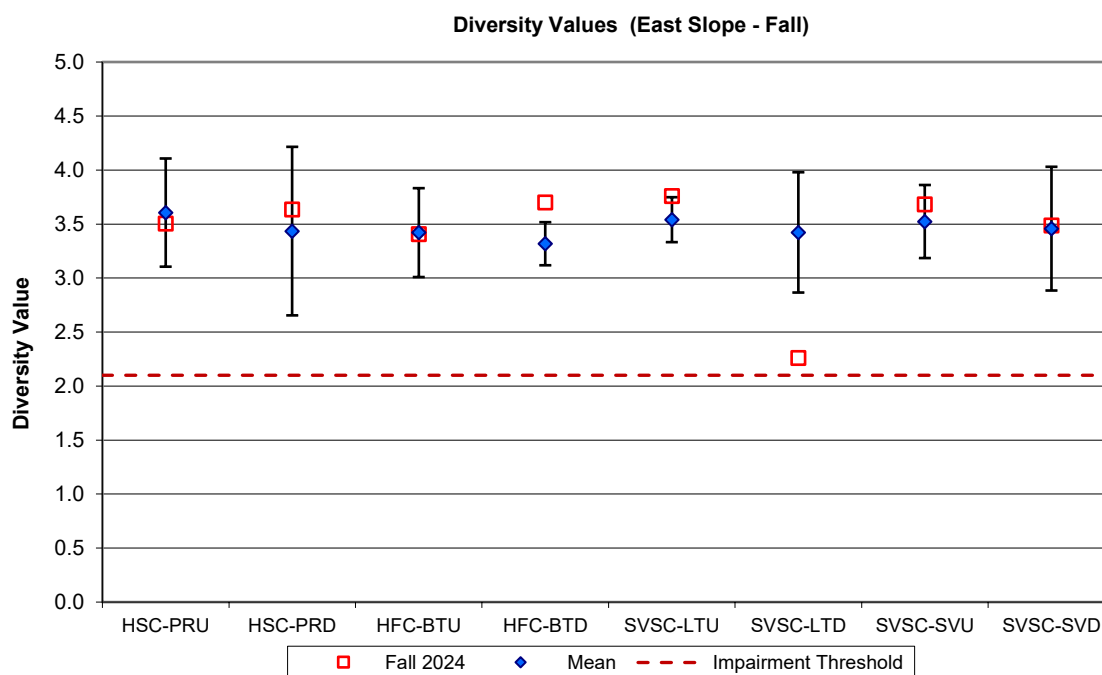


Figure 16. Historical (2008-2021) mean Diversity values ($\pm$ SD) for the East Slope study compared to the fall of 2024. Metrics are calculated based on a subsample.

Table 12. Aquatic life use designations based on MMI v4 scores from samples collected at West Slope and East Slope sampling sites during September of 2024.

Aquatic Life Designations in 2024	
Site	West Slope
EI-GLU	Attainment
CR-SMU	Attainment
CR-SMD	Impairment
CR-GRD	Attainment
CR-WGU	Attainment
FR-WGU	Attainment
CR-WGD	Attainment
	East Slope
HSC-PRU	Attainment
HSC-PRD	Attainment
HFC-BTU	Attainment
HFC-BTD	Attainment
SVSC-LTU	Attainment
SVSC-LTD	Attainment
SVSC-SVU	Attainment
SVSC-SVD	Attainment

Conclusion

The sixth year of Northern Water's Baseline Biomonitoring Program seasonal macroinvertebrate sampling was conducted in the spring (April) and fall (September) of 2024. Sampling included the same 15 study sites (seven on the West Slope and eight on the East Slope) that have been sampled since the onset of this study in 2008. West Slope study sites were strategically positioned to evaluate potential impacts from water transfer operations surrounding Shadow Mountain Reservoir, Granby Reservoir, and Windy Gap Reservoir, while on the East Slope, sites were selected to evaluate the effects of water distribution systems on the Cache la Poudre River, Big Thompson River, Little Thompson River, and Saint Vrain Creek.

Results from the analysis of macroinvertebrate samples were compared to historical data from previous sampling events (when applicable) to evaluate recent patterns among study sites and to assess spatial changes over time. A portion of the metric results from 2008 could not be included in these comparisons because the final MMI calculations (and associated taxonomic identification requirements) were not developed by the Water Quality Control Division until 2010 (Colorado Department of Public Health and Environment 2010). The recalibrated Multi-metric Index (MMI v4), implemented in fall 2018, was retrospectively applied to applicable historical datasets to support the evaluation of 2024 bioassessment results. In 2024, evidence of anthropogenic influences at specific sampling locations could be ascertained from seasonal macroinvertebrate sampling results. Some of the detectable stress was possibly due to Northern Water operations, while some stress was likely related to other types of disturbances.

In general, benthic macroinvertebrate communities in the West Slope study area exhibited a loss of sensitive taxa and decline in community balance at study sites located downstream from reservoirs during both sampling seasons. Metric results from the East Slope study area indicated that macroinvertebrate communities were relatively stable and showed little evidence of anthropogenic impacts on three of the streams (Cache la Poudre River, Big Thompson River, and Saint Vrain Creek), and greater perturbations were impacting the macroinvertebrate community on the Little Thompson River. Sources of stress in the East Slope study area could likely be attributed to sedimentation (possibly associated with construction or wildfires in 2020), and runoff from roads and residential areas. Future sampling events will help to validate recent observations and provide a continued assessment of stream segments that may be potentially impacted by a variety of natural and anthropogenic stressors, including operations conducted by Northern Water. The following sections provide a brief review of important findings from select metrics, and a comparison to historical sampling results.

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Appendix A

West Slope Benthic Macroinvertebrate Data

Spring 2024

Table A1. Macroinvertebrate data collected from site EI-GLU on 21 Apr 2024.

East Inlet								
EI-GLU		Sample						
21 April 2024	1	2	3		Mean	Count		HBI
Ephemeroptera								
<i>Ameletus</i> sp.		1			0.33	1		0.0000
<i>Baetis (bicaudatus)</i>	6	5	21		10.67	1		0.0823
<i>Baetis (tricaudatus)</i>	13	4	24		13.67	1		0.2635
<i>Diphetor hageni</i>	5	10	1		5.33	1		0.1028
<i>Drunella doddsii</i>	1	1	2		1.33	1		0.0000
<i>Drunella grandis</i>		1			0.33	1		0.0000
<i>Ephemerella dorothea infrequens</i>	12	9	3		8.00	1		0.0308
<i>Cinygmula</i> sp.	7	13	8		9.33	1		0.1440
<i>Epeorus</i> sp.	36	35	37		36.00	1		0.2776
<i>Paraleptophlebia</i> sp.		5			1.67	1		0.0064
Plecoptera								
Chloroperlidae	3	3			2.00	1		0.0077
<i>Sweltsa</i> sp.								
<i>Triznaka</i> sp.								
<i>Prostoia besametsa</i>	11	16	7		11.33	1		0.0874
<i>Zapada cinctipes</i>	1	1			0.67	1		0.0051
<i>Claassenia sabulosa</i>	3	1	3		2.33	1		0.0270
<i>Hesperoperla pacifica</i>	2	1	3		2.00	1		0.0077
<i>Cultus aestivalis</i>								
<i>Diura knowltoni</i>								
<i>Isoperla fulva</i>								
<i>Isoperla</i> sp.								
<i>Skwala americana</i>								
<i>Pteronarcella badia</i>								
Trichoptera								
<i>Brachycentrus americanus</i>	1		1		0.67	1		0.0026
<i>Brachycentrus occidentalis</i>								
<i>Micrasema bacro</i>	2				0.67	1		0.0026
<i>Glossosoma</i> sp.								
<i>Arctopsyche grandis</i>		14	7		7.00	1		0.0540
<i>Ceratopsyche morosa</i>								
<i>Cheumatopsyche</i> sp.								
<i>Hydropsyche cockerelli</i>								
<i>Hydropsyche occidentalis</i>								
<i>Hydropsyche oslari</i>	1				0.33	1		0.0051
<i>Hydroptila</i> sp.								
<i>Lepidostoma</i> sp.	1				0.33	1		0.0051
<i>Ceraclea</i> sp.								
<i>Rhyacophila brunnea</i>	2	1	1		1.33	1		0.0051
<i>Rhyacophila coloradensis</i>	5		4		3.00	1		0.0116
<i>Rhyacophila sibirica</i>	1				0.33	1		0.0013

Table A1 cont. Macroinvertebrate data collected from site EI-GLU on 21 Apr 2024.

Diptera							
Orthocladiinae	19	35	15		23.00	1	0.5321
Tanypodinae		1	1		0.67	1	0.0180
Tanytarsini	8	16	3		9.00	1	0.1041
Chironomini							
Diamesinae			1		0.33	1	0.0026
Ceratopogoninae							
<i>Chelifera</i> sp.							
<i>Wiedemannia</i> sp.	7	17	6		10.00	1	0.2314
<i>Lispoides</i> sp.							
<i>Pericoma</i> sp.							
<i>Prosimulium</i> sp.	65	2	175		80.67	1	0.9332
<i>Simulium</i> sp.	2		2		1.33	1	0.0308
<i>Antocha</i> sp.			1		0.33	1	0.0039
<i>Dicranota</i> sp.							
<i>Hexatoma</i> sp.							
<i>Tipula</i> sp.							
Coleoptera							
<i>Liodes</i> sp.							
<i>Cleptelmis</i> sp.	1				0.33	1	0.0051
<i>Heterlimnius corpulentus</i>	5	4	4		4.33	1	0.0668
<i>Optioservus</i> sp.							
Miscellaneous							
Acarina	3	2			1.67	1	0.0514139
<i>Caecidotea</i> sp.							
<i>Crangonyx</i> sp.							
<i>Physa</i> sp.							
<i>Pisidium</i> sp.							
<i>Polycelis coronata</i>							
Oligochaeta	5	21	1		9.00	1	0.3470
Erpobdellidae							
Totals	228	219	331		259.33	35	3.46

Table A2. Macroinvertebrate data collected from site CR-SMU on 21 Apr 2024.

Colorado River								
CR-SMU		Sample						
21 April 2024	1	2	3		Mean	Count		HBI
Ephemeroptera								
<i>Ameletus</i> sp.								
<i>Baetis (bicaudatus)</i>	1	1			0.67	1		0.0036
<i>Baetis (tricaudatus)</i>	33	15	6		18.00	1		0.2452
<i>Diphetor hageni</i>		28	3		10.33	1		0.1408
<i>Drunella doddsii</i>								
<i>Drunella grandis</i>		1	1		0.67	1		0.0000
<i>Ephemerella dorothea infrequens</i>	1	4	1		2.00	1		0.0054
<i>Cinygmula</i> sp.	1				0.33	1		0.0036
<i>Epeorus</i> sp.		9	6		5.00	1		0.0272
<i>Paraleptophlebia</i> sp.		4			1.33	1		0.0036
Plecoptera								
Chloroperlidae	2				0.67	1		0.0018
<i>Sweltsa</i> sp.		8			2.67	1		0.0073
<i>Triznaka</i> sp.		7			2.33	1		0.0064
<i>Prostoia besametsa</i>								
<i>Zapada cinctipes</i>								
<i>Claassenia sabulosa</i>		1			0.33	1		0.0027
<i>Hesperoperla pacifica</i>								
<i>Cultus aestivalis</i>								
<i>Diura knowltoni</i>								
<i>Isoperla fulva</i>		1			0.33	1		0.0018
<i>Isoperla</i> sp.								
<i>Skwala americana</i>								
<i>Pteronarcella badia</i>		2			0.67	1		0.0000
Trichoptera								
<i>Brachycentrus americanus</i>	67	49	46		54.00	1		0.1471
<i>Brachycentrus occidentalis</i>								
<i>Micrasema bactro</i>								
<i>Glossosoma</i> sp.								
<i>Arctopsyche grandis</i>	1	1	1		1.00	1		0.0054
<i>Ceratopsyche morosa</i>								
<i>Cheumatopsyche</i> sp.								
<i>Hydropsyche cockerelli</i>			4		1.33	1		0.0145
<i>Hydropsyche occidentalis</i>								
<i>Hydropsyche oslari</i>	5	3	3		3.67	1		0.0400
<i>Hydroptila</i> sp.								
<i>Lepidostoma</i> sp.	7	67	9		27.67	1		0.3015
<i>Ceraclea</i> sp.								
<i>Rhyacophila brunnea</i>								
<i>Rhyacophila coloradensis</i>		1			0.33	1		0.0009
<i>Rhyacophila sibirica</i>								

Table A2 cont. Macroinvertebrate data collected from site CR-SMU on 21 Apr 2024.

Diptera							
Orthocladinae	129	233	98		153.33	1	2.5068
Tanypodinae		1			0.33	1	0.0064
Tanytarsini	4	22	2		9.33	1	0.0763
Chironomini		3			1.00	1	0.0218
Diamesinae	27	34	23		28.00	1	0.1526
Ceratopogoninae	1				0.33	1	0.0054
<i>Chelifera</i> sp.	1	4			1.67	1	0.0272
<i>Wiedemannia</i> sp.							
<i>Lispoides</i> sp.							
<i>Pericoma</i> sp.		1			0.33	1	0.0036
<i>Prosimulium</i> sp.							
<i>Simulium</i> sp.	2	1			1.00	1	0.0163
<i>Antocha</i> sp.	2		1		1.00	1	0.0082
<i>Dicranota</i> sp.		1			0.33	1	0.0027
<i>Hexatoma</i> sp.	2				0.67	1	0.0036
<i>Tipula</i> sp.							
Coleoptera							
<i>Liodes</i> sp.							
<i>Cleptelmis</i> sp.							
<i>Heterolimnius corpulentus</i>		2	2		1.33	1	0.0145
<i>Optioservus</i> sp.	5	6	3		4.67	1	0.0509
Miscellaneous							
Acarina	3	7	2		4.00	1	0.0871935
<i>Caecidotea</i> sp.		1			0.33	1	0.0073
<i>Crangonyx</i> sp.							
<i>Physa</i> sp.							
<i>Pisidium</i> sp.		2			0.67	1	0.0145
<i>Polycelis coronata</i>	8	20	4		10.67	1	0.0291
Oligochaeta	14	24	5		14.33	1	0.3906
Erpobdellidae		1			0.33	1	0.0073
Totals	316	565	220		367.00	40	4.39

Table A3. Macroinvertebrate data collected from site CR-SMD on 21 Apr 2024.

Colorado River								
CR-SMD		Sample						
21 April 2024	1	2	3		Mean	Count		HBI
Ephemeroptera								
<i>Ameletus</i> sp.								
<i>Baetis (bicaudatus)</i>	368	110	171		216.33	1		0.1951
<i>Baetis (tricaudatus)</i>	1206	609	1281		1032.00	1		2.3264
<i>Dipheter hageni</i>								
<i>Drunella doddsii</i>								
<i>Drunella grandis</i>								
<i>Ephemerella dorothea infrequens</i>	131	178	219		176.00	1		0.0794
<i>Cinygmula</i> sp.								
<i>Epeorus</i> sp.								
<i>Paraleptophlebia</i> sp.								
Plecoptera								
Chloroperlidae								
<i>Sweltsa</i> sp.								
<i>Triznaka</i> sp.								
<i>Prostoia besametsa</i>								
<i>Zapada cinctipes</i>								
<i>Claassenia sabulosa</i>								
<i>Hesperoperla pacifica</i>								
<i>Cultus aestivalis</i>								
<i>Diura knowltoni</i>								
<i>Isoperla fulva</i>								
<i>Isoperla</i> sp.								
<i>Skwala americana</i>								
<i>Pteronarcella badia</i>								
Trichoptera								
<i>Brachycentrus americanus</i>	1	1	1		1.00	1		0.0005
<i>Brachycentrus occidentalis</i>								
<i>Micrasema bactro</i>								
<i>Glossosoma</i> sp.								
<i>Arctopsyche grandis</i>		1			0.33	1		0.0003
<i>Ceratopsyche morosa</i>	8	8	3		6.33	1		0.0057
<i>Cheumatopsyche</i> sp.								
<i>Hydropsyche cockerelli</i>								
<i>Hydropsyche occidentalis</i>								
<i>Hydropsyche oslari</i>	27	52	18		32.33	1		0.0583
<i>Hydroptila</i> sp.	2	2	2		2.00	1		0.0054
<i>Lepidostoma</i> sp.								
<i>Ceraclea</i> sp.	2		2		1.33	1		0.0030
<i>Rhyacophila brunnea</i>								
<i>Rhyacophila coloradensis</i>	18	1	6		8.33	1		0.0038
<i>Rhyacophila sibirica</i>								

Table A3 cont. Macroinvertebrate data collected from site CR-SMD on 21 Apr 2024.

Diptera							
Orthocladiinae	1142	282	116		513.33	1	1.3886
Tanypodinae	27	8	3		12.67	1	0.0400
Tanytarsini	1		1		0.67	1	0.0009
Chironomini							
Diamesinae	85	78	27		63.33	1	0.0571
Ceratopogoninae							
<i>Chelifera</i> sp.							
<i>Wiedemannia</i> sp.	2		2		1.33	1	0.0036
<i>Lispoides</i> sp.			1		0.33	1	0.0009
<i>Pericoma</i> sp.							
<i>Prosimulium</i> sp.							
<i>Simulium</i> sp.	17	25	55		32.33	1	0.0875
<i>Antocha</i> sp.	1				0.33	1	0.0005
<i>Dicranota</i> sp.							
<i>Hexatoma</i> sp.							
<i>Tipula</i> sp.							
Coleoptera							
<i>Liodes</i> sp.							
<i>Cleptelmis</i> sp.							
<i>Heterolimnius corpulentus</i>							
<i>Optioservus</i> sp.							
Miscellaneous							
Acarina			1		0.33	1	0.0012023
<i>Caecidotea</i> sp.	185	87	63		111.67	1	0.4028
<i>Crangonyx</i> sp.		1	3		1.33	1	0.0042
<i>Phylla</i> sp.	6		1		2.33	1	0.0084
<i>Pisidium</i> sp.							
<i>Polycelis coronata</i>							
Oligochaeta	6				2.00	1	0.0090
Erpobdellidae							
Totals	3235	1443	1976		2218.00	23	4.68

Table A4. Macroinvertebrate data collected from site CR-GRD on 21 Apr 2024.

Colorado River								
CR-GRD		Sample						
21 April 2024	1	2	3		Mean	Count		HBI
Ephemeroptera								
<i>Ameletus</i> sp.								
<i>Baetis (bicaudatus)</i>								
<i>Baetis (tricaudatus)</i>	1168	922	1758		1282.67	1		3.4673
<i>Diphetero hageni</i>								
<i>Drunella doddsii</i>								
<i>Drunella grandis</i>								
<i>Ephemerella dorothea infrequens</i>								
<i>Cinygmula</i> sp.								
<i>Epeorus</i> sp.	2	1	1		1.33	1		0.0014
<i>Paraleptophlebia</i> sp.								
Plecoptera								
Chloroperlidae								
<i>Sweltsa</i> sp.								
<i>Triznaka</i> sp.			1		0.33	1		0.0002
<i>Prostoia besametsa</i>								
<i>Zapada cinctipes</i>	2		2		1.33	1		0.0014
<i>Claassenia sabulosa</i>								
<i>Hesperoperla pacifica</i>								
<i>Cultus aestivalis</i>								
<i>Diura knowltoni</i>								
<i>Isoperla fulva</i>								
<i>Isoperla</i> sp.								
<i>Skwala americana</i>								
<i>Pteronarcella badia</i>								
Trichoptera								
<i>Brachycentrus americanus</i>								
<i>Brachycentrus occidentalis</i>								
<i>Micrasema bacro</i>								
<i>Glossosoma</i> sp.								
<i>Arctopsyche grandis</i>								
<i>Ceratopsyche morosa</i>								
<i>Cheumatopsyche</i> sp.								
<i>Hydropsyche cockerelli</i>								
<i>Hydropsyche occidentalis</i>								
<i>Hydropsyche osleri</i>								
<i>Hydroptila</i> sp.								
<i>Lepidostoma</i> sp.								
<i>Ceraclea</i> sp.								
<i>Rhyacophila brunnea</i>								
<i>Rhyacophila coloradensis</i>			2		0.67	1		0.0004
<i>Rhyacophila sibirica</i>								

Table A4 cont. Macroinvertebrate data collected from site CR-GRD on 21 Apr 2024.

Diptera								
Orthocladinae	193	136	683		337.33	1		1.0943
Tanypodinae								
Tanytarsini	1				0.33	1		0.0005
Chironomini								
Diamesinae	15	16	49		26.67	1		0.0288
Ceratopogoninae								
<i>Chelifera</i> sp.								
<i>Wiedemannia</i> sp.								
<i>Lispoides</i> sp.								
<i>Pericoma</i> sp.								
<i>Prosimulium</i> sp.								
<i>Simulium</i> sp.	24	32	134		63.33	1		0.2054
<i>Antocha</i> sp.								
<i>Dicranota</i> sp.								
<i>Hexatoma</i> sp.								
<i>Tipula</i> sp.								
Coleoptera								
<i>Liodes</i> sp.								
<i>Cleptelmis</i> sp.								
<i>Heterolimnius corpulentus</i>								
<i>Optioservus</i> sp.								
Miscellaneous								
Acarina								
<i>Caecidotea</i> sp.								
<i>Crangonyx</i> sp.								
<i>Physa</i> sp.								
<i>Pisidium</i> sp.								
<i>Polycelis coronata</i>	78	33	11		40.67	1		0.0220
Oligochaeta	219	66			95.00	1		0.5136
Erpobdellidae								
Totals	1702	1206	2641		1849.67	11		5.34

Table A5. Macroinvertebrate data collected from site CR-WGU on 21 Apr 2024.

Colorado River								
CR-WGU		Sample						
21 April 2024	1	2	3		Mean	Count		HBI
Ephemeroptera								
<i>Ameletus</i> sp.								
<i>Baetis (bicaudatus)</i>								
<i>Baetis (tricaudatus)</i>	20	14	14		16.00	1		0.1931
<i>Dipheter hageni</i>	7	3			3.33	1		0.0402
<i>Drunella doddsii</i>								
<i>Drunella grandis</i>	3	1			1.33	1		0.0000
<i>Ephemerella dorothea infrequens</i>	6	7	3		5.33	1		0.0129
<i>Cinygmula</i> sp.								
<i>Epeorus</i> sp.	2	28	15		15.00	1		0.0724
<i>Paraleptophlebia</i> sp.								
Plecoptera								
Chloroperlidae								
<i>Sweltsa</i> sp.								
<i>Triznaka</i> sp.								
<i>Prostoia besametsa</i>								
<i>Zapada cinctipes</i>								
<i>Claassenia sabulosa</i>								
<i>Hesperoperla pacifica</i>								
<i>Cultus aestivalis</i>								
<i>Diura knowltoni</i>								
<i>Isoperla fulva</i>	1	1			0.67	1		0.0032
<i>Isoperla</i> sp.		1	1		0.67	1		0.0032
<i>Skwala americana</i>	1	2			1.00	1		0.0048
<i>Pteronarcella badia</i>								
Trichoptera								
<i>Brachycentrus americanus</i>	27	17	13		19.00	1		0.0459
<i>Brachycentrus occidentalis</i>	45	27	8		26.67	1		0.0644
<i>Micrasema bacro</i>								
<i>Glossosoma</i> sp.	1	1	2		1.33	1		0.0000
<i>Arctopsyche grandis</i>	14	4	8		8.67	1		0.0418
<i>Ceratopsyche morosa</i>								
<i>Cheumatopsyche</i> sp.	1	3	1		1.67	1		0.0241
<i>Hydropsyche cockerelli</i>	5	8	8		7.00	1		0.0676
<i>Hydropsyche occidentalis</i>								
<i>Hydropsyche oslari</i>			2		0.67	1		0.0064
<i>Hydroptila</i> sp.								
<i>Lepidostoma</i> sp.	38	12	2		17.33	1		0.1673
<i>Ceraclea</i> sp.								
<i>Rhyacophila brunnea</i>		2			0.67	1		0.0016
<i>Rhyacophila coloradensis</i>								
<i>Rhyacophila sibirica</i>								

Table A5 cont. Macroinvertebrate data collected from site CR-WGU on 21 Apr 2024.

Diptera							
Orthocladinae	163	242	143		182.67	1	2.6452
Tanypodinae	5	2			2.33	1	0.0394
Tanytarsini	3	1	2		2.00	1	0.0145
Chironomini	2	1			1.00	1	0.0193
Diamesinae	18	46	20		28.00	1	0.1352
Ceratopogoninae							
<i>Chelifera</i> sp.	4	1			1.67	1	0.0241
<i>Wiedemannia</i> sp.							
<i>Lispoides</i> sp.							
<i>Pericoma</i> sp.							
<i>Prosimulium</i> sp.							
<i>Simulium</i> sp.		1	1		0.67	1	0.0097
<i>Antocha</i> sp.							
<i>Dicranota</i> sp.							
<i>Hexatoma</i> sp.							
<i>Tipula</i> sp.							
Coleoptera							
<i>Liodes</i> sp.							
<i>Cleptelmis</i> sp.							
<i>Heterolimnius corpulentus</i>							
<i>Optioservus</i> sp.	5	9	1		5.00	1	0.0483
Miscellaneous							
Acarina		3	1		1.33	1	0.0257442
<i>Caecidotea</i> sp.	5	6	1		4.00	1	0.0772
<i>Crangonyx</i> sp.							
<i>Physa</i> sp.		3			1.00	1	0.0193
<i>Pisidium</i> sp.							
<i>Polycelis coronata</i>	71	37	15		41.00	1	0.0990
Oligochaeta	8	39	5		17.33	1	0.4183
Erpobdellidae							
Totals	455	522	266		414.33	30	4.32

Table A6. Macroinvertebrate data collected from site FR-WGU on 21 Apr 2024.

Fraser River								
FR-WGU		Sample						
21 April 2024	1	2	3		Mean	Count		HBI
Ephemeroptera								
<i>Ameletus</i> sp.	1	1			0.67	1		0.0000
<i>Baetis (bicaudatus)</i>								
<i>Baetis (tricaudatus)</i>	47	105	35		62.33	1		1.2704
<i>Diphetor hageni</i>	9	12	3		8.00	1		0.1630
<i>Drunella doddsii</i>								
<i>Drunella grandis</i>								
<i>Ephemerella dorothea infrequens</i>	4	24	6		11.33	1		0.0462
<i>Cinygmula</i> sp.								
<i>Epeorus</i> sp.	6	8	4		6.00	1		0.0489
<i>Paraleptophlebia</i> sp.	7	16	1		8.00	1		0.0326
Plecoptera								
Chloroperlidae								
<i>Sweltsa</i> sp.								
<i>Triznaka</i> sp.	17	38	9		21.33	1		0.0870
<i>Prostoia besametsa</i>								
<i>Zapada cinctipes</i>								
<i>Claassenia sabulosa</i>								
<i>Hesperoperla pacifica</i>								
<i>Cultus aestivalis</i>		3	1		1.33	1		0.0109
<i>Diura knowltoni</i>		1			0.33	1		0.0027
<i>Isoperla fulva</i>	1	2			1.00	1		0.0082
<i>Isoperla</i> sp.	2		2		1.33	1		0.0109
<i>Skwala americana</i>								
<i>Pteronarcella badia</i>								
Trichoptera								
<i>Brachycentrus americanus</i>	3	1			1.33	1		0.0054
<i>Brachycentrus occidentalis</i>								
<i>Micrasema bactro</i>								
<i>Glossosoma</i> sp.								
<i>Arctopsyche grandis</i>								
<i>Ceratopsyche morosa</i>	3	3			2.00	1		0.0163
<i>Cheumatopsyche</i> sp.								
<i>Hydropsyche cockerelli</i>								
<i>Hydropsyche occidentalis</i>	1				0.33	1		0.0054
<i>Hydropsyche osleri</i>	3	4			2.33	1		0.0380
<i>Hydroptila</i> sp.								
<i>Lepidostoma</i> sp.	1				0.33	1		0.0054
<i>Ceraclea</i> sp.								
<i>Rhyacophila brunnea</i>								
<i>Rhyacophila coloradensis</i>								
<i>Rhyacophila sibirica</i>								

Table A6 cont. Macroinvertebrate data collected from site FR-WGU on 21 Apr 2024.

Diptera							
Orthocladinae	54	132	16		67.33	1	1.6467
Tanypodinae							
Tanytarsini		3			1.00	1	0.0122
Chironomini							
Diamesinae	27	80	21		42.67	1	0.3478
Ceratopogoninae							
<i>Chelifera</i> sp.							
<i>Wiedemannia</i> sp.							
<i>Lispoides</i> sp.							
<i>Pericoma</i> sp.							
<i>Prosimulium</i> sp.							
<i>Simulium</i> sp.	2	2	1		1.67	1	0.0408
<i>Antocha</i> sp.							
<i>Dicranota</i> sp.							
<i>Hexatoma</i> sp.							
<i>Tipula</i> sp.		1			0.33	1	0.0054
Coleoptera							
<i>Liodes</i> sp.							
<i>Cleptelmis</i> sp.							
<i>Heterolimnius corpulentus</i>		1			0.33	1	0.0054
<i>Optioservus</i> sp.	1	4			1.67	1	0.0272
Miscellaneous							
Acarina							
<i>Caecidotea</i> sp.		1			0.33	1	0.0109
<i>Crangonyx</i> sp.			1		0.33	1	0.0095
<i>Physa</i> sp.		1			0.33	1	0.0109
<i>Pisidium</i> sp.							
<i>Polycelis coronata</i>		2			0.67	1	0.0027
Oligochaeta		2			0.67	1	0.0272
Erpobdellidae							
Totals	189	447	100		245.33	28	3.90

Table A7. Macroinvertebrate data collected from site CR-WGD on 21 Apr 2024.

Colorado River								
CR-WGD		Sample						
21 April 2024	1	2	3		Mean	Count		HBI
Ephemeroptera								
<i>Ameletus</i> sp.								
<i>Baetis (bicaudatus)</i>								
<i>Baetis (tricaudatus)</i>	72	264	84		140.00	1		1.1778
<i>Dipheter hageni</i>		2	1		1.00	1		0.0084
<i>Drunella doddsii</i>								
<i>Drunella grandis</i>		1			0.33	1		0.0000
<i>Ephemerella dorothea infrequens</i>	18	65	13		32.00	1		0.0538
<i>Cinygmula</i> sp.		1			0.33	1		0.0022
<i>Epeorus</i> sp.	3	7	4		4.67	1		0.0157
<i>Paraleptophlebia</i> sp.	8	3	2		4.33	1		0.0073
Plecoptera								
Chloroperlidae								
<i>Sweltsa</i> sp.								
<i>Triznaka</i> sp.	6	5	4		5.00	1		0.0084
<i>Prostoia besametsa</i>								
<i>Zapada cinctipes</i>								
<i>Claassenia sabulosa</i>								
<i>Hesperoperla pacifica</i>								
<i>Cultus aestivalis</i>								
<i>Diura knowltoni</i>		2			0.67	1		0.0022
<i>Isoperla fulva</i>	1		1		0.67	1		0.0022
<i>Isoperla</i> sp.	3	1	3		2.33	1		0.0079
<i>Skwala americana</i>	4	5	1		3.33	1		0.0112
<i>Pteronarcella badia</i>								
Trichoptera								
<i>Brachycentrus americanus</i>	2	12			4.67	1		0.0079
<i>Brachycentrus occidentalis</i>								
<i>Micrasema bactro</i>								
<i>Glossosoma</i> sp.								
<i>Arctopsyche grandis</i>								
<i>Ceratopsyche morosa</i>								
<i>Cheumatopsyche</i> sp.								
<i>Hydropsyche cockerelli</i>								
<i>Hydropsyche occidentalis</i>								
<i>Hydropsyche osleri</i>		18			6.00	1		0.0404
<i>Hydroptila</i> sp.								
<i>Lepidostoma</i> sp.	1	8			3.00	1		0.0202
<i>Ceraclea</i> sp.								
<i>Rhyacophila brunnea</i>		1			0.33	1		0.0006
<i>Rhyacophila coloradensis</i>	1				0.33	1		0.0006
<i>Rhyacophila sibirica</i>								

Table A7 cont. Macroinvertebrate data collected from site CR-WGD on 21 Apr 2024.

Diptera							
Orthoclaadiinae	219	163	215		199.00	1	2.0090
Tanypodinae	1				0.33	1	0.0039
Tanytarsini	13	2	18		11.00	1	0.0555
Chironomini	8		6		4.67	1	0.0628
Diamesinae	110	176	157		147.67	1	0.4969
Ceratopogoninae	1				0.33	1	0.0034
<i>Chelifera</i> sp.							
<i>Wiedemannia</i> sp.							
<i>Lispoides</i> sp.							
<i>Pericoma</i> sp.							
<i>Prosimulium</i> sp.							
<i>Simulium</i> sp.		36	1		12.33	1	0.1245
<i>Antocha</i> sp.							
<i>Dicranota</i> sp.			2		0.67	1	0.0034
<i>Hexatoma</i> sp.							
<i>Tipula</i> sp.							
Coleoptera							
<i>Liodes</i> sp.	1	1			0.67	1	0.0056
<i>Cleptelmis</i> sp.							
<i>Heterolimnius corpulentus</i>							
<i>Optioservus</i> sp.							
Miscellaneous							
Acarina							
<i>Caecidotea</i> sp.	1	2	2		1.67	1	0.0224
<i>Crangonyx</i> sp.			3		1.00	1	0.0118
<i>Physa</i> sp.							
<i>Pisidium</i> sp.							
<i>Polycelis coronata</i>	1				0.33	1	0.0006
Oligochaeta	10	1	6		5.67	1	0.0953
Erpobdellidae							
Totals	484	776	523		594.33	30	4.26

Appendix B

East Slope Benthic Macroinvertebrate Data

Spring 2024

Table B1. Macroinvertebrate data collected from site HSC-PRU on 13 Apr 2024.

Cache la Poudre River								
HSC-PRU		Sample						
13 April 2024	1	2	3		Mean	Count		HBI
Ephemeroptera								
<i>Baetis tricaudatus</i>	157	157	274		196.00	1		1.0978342
<i>Diphetor hageni</i>			2		0.67	1		0.0037
<i>Fallceon quilleri</i>								
<i>Drunella doddsii</i>								
<i>Drunella grandis</i>								
<i>Ephemerella</i> sp.	202	94	381		225.67	1		0.2528
<i>Cinygmula</i> sp.								
<i>Epeorus longimanus</i>	7	9	9		8.33	1		0.0187
<i>Heptagenia</i> sp.								
<i>Rhithrogena</i> sp.	1				0.33	1		0.0000
<i>Tricorythodes</i> sp.			1		0.33	1		0.0019
<i>Paraleptophlebia</i> sp.	4	7	19		10.00	1		0.0112
Plecoptera								
<i>Capnia</i> sp.								
<i>Eucapnopsis brevicauda</i>								
<i>Triznaka signata</i>	8		2		3.33	1		0.0037
<i>Prostoia besametsa</i>								
<i>Claassenia sabulosa</i>	4	1	2		2.33	1		0.0078
<i>Cultus</i> sp.			3		1.00	1		0.0022
<i>Isoperla</i> sp.	33	8	34		25.00	1		0.0560
<i>Isoperla fulva</i>		1	1		0.67	1		0.0015
<i>Skwala americana</i>	1				0.33	1		0.0007
<i>Pteronarcella badia</i>			1		0.33	1		0.0000
<i>Pteronarcys californica</i>			4		1.33	1		0.0000
Trichoptera								
<i>Brachycentrus americanus</i>								
<i>Brachycentrus occidentalis</i>	8	7	21		12.00	1		0.0134
<i>Culoptila</i> sp.	1	7	1		3.00	1		0.0000
<i>Glossosoma</i> sp.	3	9	10		7.33	1		0.0000
<i>Protoptila</i> sp.								
<i>Arctopsyche grandis</i>		1	7		2.67	1		0.0060
<i>Ceratopsyche morosa</i>								
<i>Cheumatopsyche</i> sp.								
<i>Hydropsyche cockerelli</i>		24	40		21.33	1		0.0956
<i>Hydropsyche occidentalis</i>	6	52	102		53.33	1		0.2390
<i>Hydropsyche oslari</i>			7		2.33	1		0.0105
<i>Leucotrichia pictipes</i>								
<i>Lepidostoma</i> sp.								
<i>Oecetis</i> sp.								
<i>Hesperophylax</i> sp.								
<i>Psychomyia flava</i>								
<i>Rhyacophila coloradensis</i>								

Table B1 cont. Macroinvertebrate data collected from site HSC-PRU on 13 Apr 2024.

Diptera							
Orthocladiinae	202	182	377		253.67	1	1.7050
Tanypodinae							
Tanytarsini			3		1.00	1	0.0034
Chironomini	9	4	36		16.33	1	0.1464
Diamesinae	16	13	25		18.00	1	0.0403
<i>Atherix pachypus</i>			1		0.33	1	0.0007
<i>Bibiocephala grandis</i>		2	3		1.67	1	0.0000
Ceratopogoninae							
<i>Chelifera</i> sp.							
<i>Hemerodromia</i> sp.	1				0.33	1	0.0022
<i>Simulium</i> sp.	8	14	22		14.67	1	0.0986
<i>Dicranota</i> sp.							
<i>Pedicia</i> sp.							
<i>Tipula</i> sp.							
Coleoptera							
<i>Optioservus</i> sp.	2	1	7		3.33	1	0.0149
<i>Zaitzevia</i> sp.			3		1.00	1	0.0045
Miscellaneous							
Acarina	2	4	1		2.33	1	0.0209111
<i>Gammarus</i> sp.							
<i>Caecidotea</i> sp.			1		0.33	1	0.0030
<i>Ferrissia</i> sp.							
<i>Physa</i> sp.							
<i>Dugesia</i> sp.							
<i>Polycelis coronata</i>							
Oligochaeta	3	2	1		2.00	1	0.0224
Nematoda							
Totals	678	599	1401		892.67	35	3.88

Table B2. Macroinvertebrate data collected from site HSC-PRD on 13 Apr 2024.

Cache la Poudre River								
HSC-PRD		Sample						
13 April 2024	1	2	3		Mean	Count		HBI
Ephemeroptera								
<i>Baetis tricaudatus</i>	388	446	372		402.00	1		2.1667266
<i>Dipheter hageni</i>								
<i>Fallceon quilleri</i>								
<i>Drunella doddsii</i>	1	2			1.00	1		0.0000
<i>Drunella grandis</i>								
<i>Ephemerella</i> sp.	43	10	20		24.33	1		0.0262
<i>Cinygmula</i> sp.								
<i>Epeorus longimanus</i>	4	1			1.67	1		0.0036
<i>Heptagenia</i> sp.	1	1			0.67	1		0.0014
<i>Rhithrogena</i> sp.			1		0.33	1		0.0000
<i>Tricorythodes</i> sp.								
<i>Paraleptophlebia</i> sp.	1	1	3		1.67	1		0.0018
Plecoptera								
<i>Capnia</i> sp.								
<i>Eucapnopsis brevicauda</i>								
<i>Triznaka signata</i>		4	8		4.00	1		0.0043
<i>Prostoia besametsa</i>								
<i>Claassenia sabulosa</i>		2	1		1.00	1		0.0032
<i>Cultus</i> sp.	1		1		0.67	1		0.0014
<i>Isoperla</i> sp.	11	4	8		7.67	1		0.0165
<i>Isoperla fulva</i>	1	1	2		1.33	1		0.0029
<i>Skwala americana</i>		2	1		1.00	1		0.0022
<i>Pteronarcella badia</i>			1		0.33	1		0.0000
<i>Pteronarcys californica</i>	1		4		1.67	1		0.0000
Trichoptera								
<i>Brachycentrus americanus</i>								
<i>Brachycentrus occidentalis</i>	46	17	144		69.00	1		0.0744
<i>Culoptila</i> sp.	1	1			0.67	1		0.0000
<i>Glossosoma</i> sp.	13	5	36		18.00	1		0.0000
<i>Protoptila</i> sp.								
<i>Arctopsyche grandis</i>	6	2	1		3.00	1		0.0065
<i>Ceratopsyche morosa</i>								
<i>Cheumatopsyche</i> sp.								
<i>Hydropsyche cockerelli</i>	14	6	12		10.67	1		0.0460
<i>Hydropsyche occidentalis</i>	12	3	1		5.33	1		0.0230
<i>Hydropsyche osleri</i>								
<i>Leucotrichia pictipes</i>								
<i>Lepidostoma</i> sp.		2	1		1.00	1		0.0043
<i>Oecetis</i> sp.								
<i>Hesperophylax</i> sp.								
<i>Psychomyia flvida</i>								
<i>Rhyacophila coloradensis</i>								

Table B2 cont. Macroinvertebrate data collected from site HSC-PRD on 13 Apr 2024.

Diptera							
Orthocladiinae	268	150	378		265.33	1	1.7161
Tanypodinae							
Tanytarsini			1		0.33	1	0.0011
Chironomini	10	3	14		9.00	1	0.0776
Diamesinae	42	55	84		60.33	1	0.1301
<i>Atherix pachypus</i>	1	1	5		2.33	1	0.0050
<i>Bibiocephala grandis</i>	1		2		1.00	1	0.0000
Ceratopogoninae							
<i>Chelifera</i> sp.							
<i>Hemerodromia</i> sp.							
<i>Simulium</i> sp.	20	25	6		17.00	1	0.1100
<i>Dicranota</i> sp.							
<i>Pedicia</i> sp.							
<i>Tipula</i> sp.							
Coleoptera							
<i>Optioservus</i> sp.	3	4	3		3.33	1	0.0144
<i>Zaitzevia</i> sp.	1		3		1.33	1	0.0057
Miscellaneous							
Acarina	1				0.33	1	0.0028746
<i>Gammarus</i> sp.							
<i>Caecidotea</i> sp.							
<i>Ferrissia</i> sp.							
<i>Physa</i> sp.							
<i>Dugesia</i> sp.			1		0.33	1	0.0022
<i>Polycelis coronata</i>							
Oligochaeta	5	23	2		10.00	1	0.1078
Nematoda							
Totals	896	771	1116		927.67	34	4.56

Table B3. Macroinvertebrate data collected from site HFC-BTU on 13 Apr 2024.

Big Thompson River							
HFC-BTU		Sample					
13 April 2024	1	2	3		Mean	Count	HBI
Ephemeroptera							
<i>Baetis tricaudatus</i>	6	5			3.67	1	0.1466667
<i>Dipheter hageni</i>							
<i>Fallceon quilleri</i>							
<i>Drunella doddsii</i>	1				0.33	1	0.0000
<i>Drunella grandis</i>							
<i>Ephemerella</i> sp.	50	16	15		27.00	1	0.2160
<i>Cinygmula</i> sp.							
<i>Epeorus longimanus</i>	6	4	1		3.67	1	0.0587
<i>Heptagenia</i> sp.		1			0.33	1	0.0053
<i>Rhithrogena</i> sp.							
<i>Tricorythodes</i> sp.							
<i>Paraleptophlebia</i> sp.	3	2			1.67	1	0.0133
Plecoptera							
<i>Capnia</i> sp.							
<i>Eucapnopsis brevicauda</i>			1		0.33	1	0.0027
<i>Triznaka signata</i>							
<i>Prostoia besametsa</i>	1	1			0.67	1	0.0107
<i>Claassenia sabulosa</i>							
<i>Cultus</i> sp.							
<i>Isoperla</i> sp.	1				0.33	1	0.0053
<i>Isoperla fulva</i>	4				1.33	1	0.0213
<i>Skwala americana</i>							
<i>Pteronarcella badia</i>							
<i>Pteronarcys californica</i>	2				0.67	1	0.0000
Trichoptera							
<i>Brachycentrus americanus</i>	3				1.00	1	0.0080
<i>Brachycentrus occidentalis</i>	1				0.33	1	0.0027
<i>Culoptila</i> sp.	2	3	1		2.00	1	0.0000
<i>Glossosoma</i> sp.							
<i>Protoptila</i> sp.							
<i>Arctopsyche grandis</i>							
<i>Ceratopsyche morosa</i>							
<i>Cheumatopsyche</i> sp.							
<i>Hydropsyche cockerelli</i>	1				0.33	1	0.0107
<i>Hydropsyche occidentalis</i>							
<i>Hydropsyche oslari</i>	20	4	4		9.33	1	0.2987
<i>Leucotrichia pictipes</i>							
<i>Lepidostoma</i> sp.	4	7	9		6.67	1	0.2133
<i>Oecetis</i> sp.							
<i>Hesperophylax</i> sp.							
<i>Psychomyia flava</i>							
<i>Rhyacophila coloradensis</i>	3	1			1.33	1	0.0107

Table B3 cont. Macroinvertebrate data collected from site HFC-BTU on 13 Apr 2024.

Diptera							
Orthocladiinae	58	38	43		46.33	1	2.2240
Tanypodinae							
Tanytarsini							
Chironomini	1				0.33	1	0.0213
Diamesinae	13	5	7		8.33	1	0.1333
<i>Atherix pachypus</i>			1		0.33	1	0.0053
<i>Bibiocephala grandis</i>		1			0.33	1	0.0000
Ceratopogoninae							
<i>Chelifera</i> sp.							
<i>Hemerodromia</i> sp.							
<i>Simulium</i> sp.							
<i>Dicranota</i> sp.							
<i>Pedicia</i> sp.							
<i>Tipula</i> sp.							
Coleoptera							
<i>Optioservus</i> sp.	2	3	3		2.67	1	0.0853
<i>Zaitzevia</i> sp.							
Miscellaneous							
Acarina	3	6	3		4.00	1	0.256
<i>Gammarus</i> sp.							
<i>Caecidotea</i> sp.							
<i>Ferrissia</i> sp.							
<i>Physa</i> sp.							
<i>Dugesia</i> sp.							
<i>Polycelis coronata</i>	1				0.33	1	0.0027
Oligochaeta			4		1.33	1	0.1067
Nematoda							
Totals	186	97	92		125.00	27	3.86

Table B4. Macroinvertebrate data collected from site HFC-BTD on 13 Apr 2024.

Big Thompson River							
HFC-BTD		Sample					
13 April 2024	1	2	3		Mean	Count	HBI
Ephemeroptera							
<i>Baetis tricaudatus</i>	10	6	3		6.33	1	0.3287197
<i>Dipheter hageni</i>							
<i>Fallceon quilleri</i>							
<i>Drunella doddsii</i>							
<i>Drunella grandis</i>	1				0.33	1	0.0000
<i>Ephemerella</i> sp.	54	18	5		25.67	1	0.2664
<i>Cinygmula</i> sp.							
<i>Epeorus longimanus</i>							
<i>Heptagenia</i> sp.							
<i>Rhithrogena</i> sp.		1			0.33	1	0.0000
<i>Tricorythodes</i> sp.							
<i>Paraleptophlebia</i> sp.	1				0.33	1	0.0035
Plecoptera							
<i>Capnia</i> sp.							
<i>Eucapnopsis brevicauda</i>							
<i>Triznaka signata</i>							
<i>Prostoia besametsa</i>	6				2.00	1	0.0415
<i>Claassenia sabulosa</i>			1		0.33	1	0.0104
<i>Cultus</i> sp.	12				4.00	1	0.0830
<i>Isoperla</i> sp.	1	1			0.67	1	0.0138
<i>Isoperla fulva</i>	2				0.67	1	0.0138
<i>Skwala americana</i>							
<i>Pteronarcella badia</i>							
<i>Pteronarcys californica</i>			1		0.33	1	0.0000
Trichoptera							
<i>Brachycentrus americanus</i>	4		1		1.67	1	0.0173
<i>Brachycentrus occidentalis</i>	6	5	1		4.00	1	0.0415
<i>Culoptila</i> sp.	12	2	2		5.33	1	0.0000
<i>Glossosoma</i> sp.			1		0.33	1	0.0000
<i>Protoptila</i> sp.							
<i>Arctopsyche grandis</i>	1				0.33	1	0.0069
<i>Ceratopsyche morosa</i>							
<i>Cheumatopsyche</i> sp.							
<i>Hydropsyche cockerelli</i>	5	2	2		3.00	1	0.1246
<i>Hydropsyche occidentalis</i>	3	3	2		2.67	1	0.1107
<i>Hydropsyche oslari</i>	5	5	2		4.00	1	0.1661
<i>Leucotrichia pictipes</i>							
<i>Lepidostoma</i> sp.	5	5	2		4.00	1	0.1661
<i>Oecetis</i> sp.							
<i>Hesperophylax</i> sp.							
<i>Psychomyia flava</i>							
<i>Rhyacophila coloradensis</i>							

Table B4 cont. Macroinvertebrate data collected from site HFC-BTD on 13 Apr 2024.

Diptera							
Orthocladiinae	38	6	9		17.67	1	1.1003
Tanypodinae							
Tanytarsini	2				0.67	1	0.0208
Chironomini	1				0.33	1	0.0277
Diamesinae	7	1			2.67	1	0.0554
<i>Atherix pachypus</i>	3		2		1.67	1	0.0346
<i>Bibiocephala grandis</i>							
Ceratopogoninae							
<i>Chelifera</i> sp.							
<i>Hemerodromia</i> sp.							
<i>Simulium</i> sp.							
<i>Dicranota</i> sp.	1				0.33	1	0.0104
<i>Pedicia</i> sp.							
<i>Tipula</i> sp.							
Coleoptera							
<i>Optioservus</i> sp.	5	1	3		3.00	1	0.1246
<i>Zaitzevia</i> sp.							
Miscellaneous							
Acarina	1	1			0.67	1	0.0553633
<i>Gammarus</i> sp.							
<i>Caecidotea</i> sp.							
<i>Ferrissia</i> sp.							
<i>Physa</i> sp.							
<i>Dugesia</i> sp.							
<i>Polycelis coronata</i>	2				0.67	1	0.0069
Oligochaeta	5		2		2.33	1	0.2422
Nematoda							
Totals	193	57	39		96.33	30	3.07

Table B5. Macroinvertebrate data collected from site SVSC-LTU on 13 Apr 2024.

Little Thompson River							
SVSC-LTU		Sample					
13 April 2024	1	2	3		Mean	Count	HBI
Ephemeroptera							
<i>Baetis tricaudatus</i>	50	22	22		31.33	1	0.4396632
<i>Dipheter hageni</i>							
<i>Fallceon quilleri</i>		1			0.33	1	0.0037
<i>Drunella doddsii</i>							
<i>Drunella grandis</i>							
<i>Ephemerella</i> sp.	1	1			0.67	1	0.0019
<i>Cinygmula</i> sp.							
<i>Epeorus longimanus</i>	7	1	1		3.00	1	0.0168
<i>Heptagenia</i> sp.	1	1			0.67	1	0.0037
<i>Rhithrogena</i> sp.							
<i>Tricorythodes</i> sp.		1			0.33	1	0.0047
<i>Paraleptophlebia</i> sp.							
Plecoptera							
<i>Capnia</i> sp.		9	6		5.00	1	0.0140
<i>Eucapnopsis brevicauda</i>							
<i>Triznaka signata</i>							
<i>Prostoia besametsa</i>							
<i>Claassenia sabulosa</i>							
<i>Cultus</i> sp.							
<i>Isoperla</i> sp.							
<i>Isoperla fulva</i>							
<i>Skwala americana</i>							
<i>Pteronarcella badia</i>							
<i>Pteronarcys californica</i>							
Trichoptera							
<i>Brachycentrus americanus</i>							
<i>Brachycentrus occidentalis</i>							
<i>Culoptila</i> sp.							
<i>Glossosoma</i> sp.	1	1			0.67	1	0.0000
<i>Protoptila</i> sp.							
<i>Arctopsyche grandis</i>							
<i>Ceratopsyche morosa</i>	124	83	17		74.67	1	0.4191
<i>Cheumatopsyche</i> sp.	52	15	2		23.00	1	0.3873
<i>Hydropsyche cockerelli</i>							
<i>Hydropsyche occidentalis</i>	13	4			5.67	1	0.0636
<i>Hydropsyche oslari</i>							
<i>Leucotrichia pictipes</i>	3				1.00	1	0.0168
<i>Lepidostoma</i> sp.							
<i>Oecetis</i> sp.							
<i>Hesperophylax</i> sp.	1				0.33	1	0.0047
<i>Psychomyia flavida</i>		5			1.67	1	0.0094
<i>Rhyacophila coloradensis</i>							

Table B5 cont. Macroinvertebrate data collected from site SVSC-LTU on 13 Apr 2024.

Diptera							
Orthocladiinae	155	124	73		117.33	1	1.9757
Tanypodinae							
Tanytarsini	1	1			0.67	1	0.0056
Chironomini							
Diamesinae	6	3	9		6.00	1	0.0337
<i>Atherix pachypus</i>							
<i>Bibiocephala grandis</i>							
Ceratopogoninae		1			0.33	1	0.0056
<i>Chelifera</i> sp.	3	1			1.33	1	0.0225
<i>Hemerodromia</i> sp.							
<i>Simulium</i> sp.	2	13	2		5.67	1	0.0954
<i>Dicranota</i> sp.							
<i>Pedicia</i> sp.			1		0.33	1	0.0056
<i>Tipula</i> sp.							
Coleoptera							
<i>Optioservus</i> sp.							
<i>Zaitzevia</i> sp.							
Miscellaneous							
Acarina		1			0.33	1	0.0074836
<i>Gammarus</i> sp.	74	110	24		69.33	1	0.7783
<i>Caecidotea</i> sp.							
<i>Ferrissia</i> sp.		2	1		1.00	1	0.0168
<i>Physa</i> sp.							
<i>Dugesia</i> sp.			1		0.33	1	0.0056
<i>Polycelis coronata</i>							
Oligochaeta	3	9	2		4.67	1	0.1310
Nematoda		1	1		0.67	1	0.0094
Totals	497	410	162		356.33	27	4.48

Table B6. Macroinvertebrate data collected from site SVSC-LTD on 13 Apr 2024.

Little Thompson River							
SVSC-LTD		Sample					
13 April 2024	1	2	3		Mean	Count	HBI
Ephemeroptera							
<i>Baetis tricaudatus</i>	14	3	14		10.33	1	0.2433281
<i>Dipheter hageni</i>							
<i>Fallceon quilleri</i>							
<i>Drunella doddsii</i>							
<i>Drunella grandis</i>							
<i>Ephemerella</i> sp.							
<i>Cinygmula</i> sp.							
<i>Epeorus longimanus</i>	1				0.33	1	0.0031
<i>Heptagenia</i> sp.	1		1		0.67	1	0.0063
<i>Rhithrogena</i> sp.							
<i>Tricorythodes</i> sp.		1			0.33	1	0.0078
<i>Paraleptophlebia</i> sp.							
Plecoptera							
<i>Capnia</i> sp.	1				0.33	1	0.0016
<i>Eucapnopsis brevicauda</i>							
<i>Triznaka signata</i>							
<i>Prostoia besametsa</i>							
<i>Claassenia sabulosa</i>							
<i>Cultus</i> sp.							
<i>Isoperla</i> sp.							
<i>Isoperla fulva</i>							
<i>Skwala americana</i>							
<i>Pteronarcella badia</i>							
<i>Pteronarcys californica</i>							
Trichoptera							
<i>Brachycentrus americanus</i>							
<i>Brachycentrus occidentalis</i>							
<i>Culoptila</i> sp.							
<i>Glossosoma</i> sp.							
<i>Protoptila</i> sp.							
<i>Arctopsyche grandis</i>							
<i>Ceratopsyche morosa</i>	2	1	3		2.00	1	0.0188
<i>Cheumatopsyche</i> sp.	5	1			2.00	1	0.0565
<i>Hydropsyche cockerelli</i>			1		0.33	1	0.0063
<i>Hydropsyche occidentalis</i>							
<i>Hydropsyche oslari</i>							
<i>Leucotrichia pictipes</i>							
<i>Lepidostoma</i> sp.							
<i>Oecetis</i> sp.							
<i>Hesperophylax</i> sp.							
<i>Psychomyia flava</i>							
<i>Rhyacophila coloradensis</i>							

Table B6 cont. Macroinvertebrate data collected from site SVSC-LTD on 13 Apr 2024.

Diptera							
Orthocladinae	128	58	82		89.33	1	2.5243
Tanypodinae							
Tanytarsini	1				0.33	1	0.0047
Chironomini							
Diamesinae		4	3		2.33	1	0.0220
<i>Atherix pachypus</i>							
<i>Bibiocephala grandis</i>							
Ceratopogoninae							
<i>Chelifera</i> sp.							
<i>Hemerodromia</i> sp.							
<i>Simulium</i> sp.	10	12	6		9.33	1	0.2637
<i>Dicranota</i> sp.							
<i>Pedicia</i> sp.							
<i>Tipula</i> sp.							
Coleoptera							
<i>Optioservus</i> sp.							
<i>Zaitzevia</i> sp.							
Miscellaneous							
Acarina	1				0.33	1	0.0125589
<i>Gammarus</i> sp.	168	49	16		77.67	1	1.4631
<i>Caecidotea</i> sp.							
<i>Ferrissia</i> sp.	1				0.33	1	0.0094
<i>Physa</i> sp.							
<i>Dugesia</i> sp.	1	1	3		1.67	1	0.0471
<i>Polycelis coronata</i>							
Oligochaeta	11	3	30		14.67	1	0.6907
Nematoda							
Totals	345	133	159		212.33	17	5.38

Table B7. Macroinvertebrate data collected from site SVSC-SVU on 13 Apr 2024.

St. Vrain Creek								
SVSC-SVU		Sample						
13 April 2024	1	2	3		Mean	Count		HBI
Ephemeroptera								
<i>Baetis tricaudatus</i>	127	87	194		136.00	1		2.2767857
<i>Dipheter hageni</i>	2		1		1.00	1		0.0167
<i>Fallceon quilleri</i>								
<i>Drunella doddsii</i>								
<i>Drunella grandis</i>	1				0.33	1		0.0000
<i>Ephemerella</i> sp.	6	9	4		6.33	1		0.0212
<i>Cinygmula</i> sp.								
<i>Epeorus longimanus</i>			1		0.33	1		0.0022
<i>Heptagenia</i> sp.								
<i>Rhithrogena</i> sp.								
<i>Tricorythodes</i> sp.		1			0.33	1		0.0056
<i>Paraleptophlebia</i> sp.	4	2	1		2.33	1		0.0078
Plecoptera								
<i>Capnia</i> sp.								
<i>Eucapnopsis brevicauda</i>								
<i>Triznaka signata</i>	2	1	1		1.33	1		0.0045
<i>Prostoia besametsa</i>								
<i>Claassenia sabulosa</i>	1				0.33	1		0.0033
<i>Cultus</i> sp.								
<i>Isoperla</i> sp.								
<i>Isoperla fulva</i>	1				0.33	1		0.0022
<i>Skwala americana</i>		1	1		0.67	1		0.0045
<i>Pteronarcella badia</i>								
<i>Pteronarcys californica</i>		2			0.67	1		0.0000
Trichoptera								
<i>Brachycentrus americanus</i>	1	2	1		1.33	1		0.0045
<i>Brachycentrus occidentalis</i>	1				0.33	1		0.0011
<i>Culoptila</i> sp.	1				0.33	1		0.0000
<i>Glossosoma</i> sp.			2		0.67	1		0.0000
<i>Protoptila</i> sp.	7		7		4.67	1		0.0156
<i>Arctopsyche grandis</i>								
<i>Ceratopsyche morosa</i>								
<i>Cheumatopsyche</i> sp.								
<i>Hydropsyche cockerelli</i>								
<i>Hydropsyche occidentalis</i>								
<i>Hydropsyche oslari</i>								
<i>Leucotrichia pictipes</i>								
<i>Lepidostoma</i> sp.	7	5	3		5.00	1		0.0670
<i>Oecetis</i> sp.								
<i>Hesperophylax</i> sp.								
<i>Psychomyia flvida</i>								
<i>Rhyacophila coloradensis</i>								

Table B7 cont. Macroinvertebrate data collected from site SVSC-SVU on 13 Apr 2024.

Diptera							
Orthocladinae	63	104	39		68.67	1	1.3795
Tanypodinae			2		0.67	1	0.0156
Tanytarsini	4	12			5.33	1	0.0536
Chironomini	5	17			7.33	1	0.1964
Diamesinae		6	1		2.33	1	0.0156
<i>Atherix pachypus</i>							
<i>Bibiocephala grandis</i>							
Ceratopogoninae							
<i>Chelifera</i> sp.							
<i>Hemerodromia</i> sp.			3		1.00	1	0.0201
<i>Simulium</i> sp.	5	5	21		10.33	1	0.2076
<i>Dicranota</i> sp.							
<i>Pedicia</i> sp.							
<i>Tipula</i> sp.	4		1		1.67	1	0.0223
Coleoptera							
<i>Optioservus</i> sp.	3	25	5		11.00	1	0.1473
<i>Zaitzevia</i> sp.		7	2		3.00	1	0.0402
Miscellaneous							
Acarina	6		5		3.67	1	0.0982143
<i>Gammarus</i> sp.							
<i>Caecidotea</i> sp.							
<i>Ferrissia</i> sp.							
<i>Physa</i> sp.			1		0.33	1	0.0089
<i>Dugesia</i> sp.							
<i>Polycelis coronata</i>	22	24	11		19.00	1	0.0636
Oligochaeta	3	3			2.00	1	0.0670
Nematoda							
Totals	276	313	307		298.67	32	4.77

Table B8. Macroinvertebrate data collected from site SVSC-SVD on 13 Apr 2024.

St. Vrain Creek								
SVSC-SVD		Sample						
13 April 2024	1	2	3		Mean	Count		HBI
Ephemeroptera								
<i>Baetis tricaudatus</i>	134	170	191		165.00	1		1.4482153
<i>Dipheter hageni</i>		2	1		1.00	1		0.0088
<i>Fallceon quilleri</i>								
<i>Drunella doddsii</i>								
<i>Drunella grandis</i>	1		1		0.67	1		0.0000
<i>Ephemerella</i> sp.	14	32	14		20.00	1		0.0351
<i>Cinygmula</i> sp.			1		0.33	1		0.0023
<i>Epeorus longimanus</i>	13	3	7		7.67	1		0.0269
<i>Heptagenia</i> sp.								
<i>Rhithrogena</i> sp.								
<i>Tricorythodes</i> sp.		3			1.00	1		0.0088
<i>Paraleptophlebia</i> sp.	8	3	2		4.33	1		0.0076
Plecoptera								
<i>Capnia</i> sp.								
<i>Eucapnopsis brevicauda</i>								
<i>Triznaka signata</i>		2			0.67	1		0.0012
<i>Prostoia besametsa</i>	1	2			1.00	1		0.0035
<i>Claassenia sabulosa</i>	6	4	4		4.67	1		0.0246
<i>Cultus</i> sp.								
<i>Isoperla</i> sp.		1	1		0.67	1		0.0023
<i>Isoperla fulva</i>								
<i>Skwala americana</i>								
<i>Pteronarcella badia</i>								
<i>Pteronarcys californica</i>	1				0.33	1		0.0000
Trichoptera								
<i>Brachycentrus americanus</i>	9	14	7		10.00	1		0.0176
<i>Brachycentrus occidentalis</i>	4	1			1.67	1		0.0029
<i>Culoptila</i> sp.	8	2	1		3.67	1		0.0000
<i>Glossosoma</i> sp.	2				0.67	1		0.0000
<i>Protoptila</i> sp.								
<i>Arctopsyche grandis</i>	1				0.33	1		0.0012
<i>Ceratopsyche morosa</i>								
<i>Cheumatopsyche</i> sp.	1				0.33	1		0.0035
<i>Hydropsyche cockerelli</i>	2				0.67	1		0.0047
<i>Hydropsyche occidentalis</i>	45	5	14		21.33	1		0.1498
<i>Hydropsyche oslari</i>	8	1	1		3.33	1		0.0234
<i>Leucotrichia pictipes</i>								
<i>Lepidostoma</i> sp.	7	2	8		5.67	1		0.0398
<i>Oecetis</i> sp.			4		1.33	1		0.0187
<i>Hesperophylax</i> sp.								
<i>Psychomyia flavida</i>			1		0.33	1		0.0012
<i>Rhyacophila coloradensis</i>								

Table B8 cont. Macroinvertebrate data collected from site SVSC-SVD on 13 Apr 2024.

Diptera							
Orthocladinae	115	193	221		176.33	1	1.8572
Tanypodinae	6	2	3		3.67	1	0.0451
Tanytarsini	9	6	3		6.00	1	0.0316
Chironomini	9	4	1		4.67	1	0.0655
Diamesinae	12	10	27		16.33	1	0.0573
<i>Atherix pachypus</i>		14			4.67	1	0.0164
<i>Bibiocephala grandis</i>							
Ceratopogoninae		1			0.33	1	0.0035
<i>Chelifera</i> sp.	1	4	1		2.00	1	0.0211
<i>Hemerodromia</i> sp.		1	9		3.33	1	0.0351
<i>Simulium</i> sp.	8	11	6		8.33	1	0.0878
<i>Dicranota</i> sp.							
<i>Pedicia</i> sp.							
<i>Tipula</i> sp.	5	1	11		5.67	1	0.0398
Coleoptera							
<i>Optioservus</i> sp.	27	5	34		22.00	1	0.1545
<i>Zaitzevia</i> sp.							
Miscellaneous							
Acarina	1	1	4		2.00	1	0.0280866
<i>Gammarus</i> sp.							
<i>Caecidotea</i> sp.		1			0.33	1	0.0047
<i>Ferrissia</i> sp.							
<i>Physa</i> sp.							
<i>Dugesia</i> sp.	70	6	94		56.67	1	0.5968
<i>Polycelis coronata</i>							
Oligochaeta	1	1			0.67	1	0.0117
Nematoda							
Totals	529	508	672		569.67	41	4.89

Appendix C

West Slope Benthic Macroinvertebrate Data

Fall 2024

Table C1. Macroinvertebrate data collected from site EI-GLU on 17 Sept 2024.

East Inlet							
EI-GLU		Sample					
17 Sept. 2024	1	2	3		Mean	Count	HBI
Ephemeroptera							
<i>Acentrella</i> sp.		1	2		1.00	1	0.0222
<i>Acentrella turbida</i>							
<i>Baetis flavistriga</i>	4	1	2		2.33	1	0.0518
<i>Baetis (tricaudatus)</i>	7	3	5		5.00	1	0.1386
<i>Dipheter hageni</i>	58	14	2		24.67	1	0.6839
<i>Attenella margarita</i>							
<i>Drunella doddii</i>	3		6		3.00	1	0.0000
<i>Drunella grandis</i>	1				0.33	1	0.0000
<i>Ephemerella dorothea infrequens</i>	12	9	26		15.67	1	0.0869
<i>Cinygmula</i> sp.	12	11	4		9.00	1	0.1996
<i>Epeorus longimanus</i>			5		1.67	1	0.0185
<i>Rhithrogena</i> sp.							
<i>Tricorythodes explicatus</i>							
<i>Paraleptophlebia</i> sp.	4	1			1.67	1	0.0092
Plecoptera							
Capniidae							
<i>Paracapnia angulata</i>							
Chloroperlidae							
<i>Sweltsa</i> sp.							
<i>Malenka</i> sp.							
<i>Zapada cinctipes</i>	1		2		1.00	1	0.0111
<i>Claassenia sabulosa</i>	5				1.67	1	0.0277
<i>Hesperoperla pacifica</i>			1		0.33	1	0.0018
Perlodidae (<i>Cultus</i> sp.)							
<i>Isoperla</i> sp.							
<i>Isoperla fulva</i>							
<i>Skwala americana</i>		1			0.33	1	0.0037
<i>Pteronarcella badia</i>							
<i>Taenionema</i> sp.			1		0.33	1	0.0037
Trichoptera							
<i>Brachycentrus americanus</i>	1				0.33	1	0.0018
<i>Brachycentrus occidentalis</i>							
<i>Micrasema bactro</i>	2		1		1.00	1	0.0055
<i>Culoptila</i> sp.							
<i>Glossosoma</i> sp.	1	1	2		1.33	1	0.0000
<i>Protoptila</i> sp.							
<i>Helicopsyche borealis</i>							
<i>Arctopsyche grandis</i>	12	8	68		29.33	1	0.3253
<i>Ceratopsyche morosa</i>							
<i>Cheumatopsyche</i> sp.	2				0.67	1	0.0222
<i>Hydropsyche</i> sp.	1				0.33	1	0.0074
<i>Hydropsyche cockerelli</i>							
<i>Hydropsyche occidentalis</i>							
<i>Hydropsyche oslari</i>		1	3		1.33	1	0.0296
<i>Agraylea</i> sp.							
<i>Hydroptila</i> sp.							
<i>Ochrotrichia</i> sp.	1	1			0.67	1	0.0222
<i>Lepidostoma</i> sp.	2				0.67	1	0.0148
<i>Ceraclea</i> sp.							
<i>Oecetis</i> sp.							
Limnephilidae							
<i>Dolophilodes</i> sp.			1		0.33	1	0.0018
<i>Psychomyia flavida</i>							
<i>Rhyacophila brunnea</i>			3		1.00	1	0.0055
<i>Rhyacophila coloradensis</i>	1		3		1.33	1	0.0074
<i>Rhyacophila harmstoni</i>							
<i>Rhyacophila sibirica</i> group			4		1.33	1	0.0074
<i>Oligophlebodes</i> sp.			1		0.33	1	0.0018

Table C1 cont. Macroinvertebrate data collected from site EI-GLU on 17 Sept 2024.

Diptera							
Chironomidae							
<i>Cardiocladius</i> sp.							
<i>Cladotanytarsus</i> sp.							
<i>Corynoneura</i> sp.							
<i>Cricotopus nostocicola</i>							
<i>Cricotopus/Orthocladius</i> sp.	5	8	1	4.67	1	0.1553	
<i>Cryptochironomus</i> sp.							
<i>Diamesa</i> sp.	4			1.33	1	0.0370	
<i>Eukiefferiella</i> sp.	4	1	8	4.33	1	0.1922	
<i>Limnophyes</i> sp.							
<i>Micropsectra/Tanytarsus</i> sp.		1	1	0.67	1	0.0259	
<i>Microtendipes</i> sp.							
<i>Nanocladius</i> sp.							
<i>Pagastia</i> sp.			2	0.67	1	0.0037	
<i>Parakiefferiella</i> sp.							
<i>Parametriocnemus</i> sp.							
<i>Phaenopsectra</i> sp.							
<i>Polypedilum</i> sp.							
<i>Potthastia</i> sp.							
<i>Potthastia gaedii</i>							
<i>Rheotanytarsus</i> sp.							
<i>Sublettea</i> sp.		3		1.00	1	0.0333	
<i>Synorthocladius</i> sp.	1			0.33	1	0.0037	
<i>Thienemanniella</i> sp.							
<i>Thienemannimyia</i> group	11	4	10	8.33	1	0.2773	
<i>Tvetenia</i> sp.	3	1	13	5.67	1	0.1571	
Other Diptera							
<i>Atherix pachypus</i>							
<i>Chelifera/Neoplata</i> sp.		1		0.33	1	0.0111	
<i>Wiedemannia</i> sp.	1			0.33	1	0.0111	
<i>Lispoides</i> sp.							
<i>Simulium</i> sp.	1		1	0.67	1	0.0222	
<i>Antocha</i> sp.							
<i>Dicranota</i> sp.							
<i>Hexatoma</i> sp.			1	0.33	1	0.0037	
Coleoptera							
<i>Cleptelmis</i> sp.	1	2	3	2.00	1	0.0444	
<i>Heterolimnius corpulentus</i>	41	30	30	33.67	1	0.7468	
<i>Microcylloepus pusillus</i>							
<i>Optioservus</i> sp.	1			0.33	1	0.0074	
<i>Zaitzevia parvula</i>							
Miscellaneous							
<i>Atractides</i> sp.	1			0.33	1	0.0148	
<i>Hygrobates</i> sp.							
<i>Lebertia</i> sp.	1			0.33	1	0.0148	
<i>Protzia</i> sp.							
<i>Sperchon</i> sp.	2		1	1.00	1	0.0333	
<i>Torrenticola</i> sp.		1		0.33	1	0.0148	
<i>Caecidotea</i> sp.							
<i>Crangonyx</i> sp.							
<i>Physa</i> sp.							
<i>Gyraulus</i> sp.							
<i>Polycelis coronata</i>							
Enchytraeidae	10	3	4	5.67	1	0.3142	
Lumbricidae							
Naididae							
Tubificidae w/out hair chaetae							
Nematoda							
Totals	217	107	217	180.33	50	3.84	

Table C2. Macroinvertebrate data collected from site CR-SMU on 17 Sept 2024.

Colorado River							
CR-SMU		Sample					
17 Sept. 2024	1	2	3		Mean	Count	HB1
Ephemeroptera							
<i>Acentrella</i> sp.		2			0.67	1	0.0069
<i>Acentrella turbida</i>							
<i>Baetis flavistriga</i>							
<i>Baetis (tricaudatus)</i>	5	2	1		2.67	1	0.0343
<i>Dipheter hageni</i>	4	6	2		4.00	1	0.0515
<i>Attenella margarita</i>							
<i>Drunella doddii</i>							
<i>Drunella grandis</i>		1			0.33	1	0.0000
<i>Ephemerella dorothea infrequens</i>		3	3		2.00	1	0.0052
<i>Cinygmula</i> sp.							
<i>Epeorus longimanus</i>		4	1		1.67	1	0.0086
<i>Rhithrogena</i> sp.							
<i>Tricorythodes explicatus</i>	1				0.33	1	0.0043
<i>Paraleptophlebia</i> sp.		27	4		10.33	1	0.0266
Plecoptera							
Capniidae							
<i>Paracapnia angulata</i>							
Chloroperlidae							
<i>Sweltsa</i> sp.		4	2		2.00	1	0.0052
<i>Malenka</i> sp.							
<i>Zapada cinctipes</i>		2			0.67	1	0.0034
<i>Claassenia sabulosa</i>		2			0.67	1	0.0052
<i>Hesperoperla pacifica</i>							
Perlodidae (<i>Cultus</i> sp.)							
<i>Isoperla</i> sp.							
<i>Isoperla fulva</i>							
<i>Skwala americana</i>							
<i>Pteronarcella badia</i>		1			0.33	1	0.0000
<i>Taenionema</i> sp.							
Trichoptera							
<i>Brachycentrus americanus</i>	32	51	5		29.33	1	0.0755
<i>Brachycentrus occidentalis</i>							
<i>Micrasema bacro</i>							
<i>Culoptila</i> sp.							
<i>Glossosoma</i> sp.							
<i>Protoptila</i> sp.							
<i>Helicopsyche borealis</i>							
<i>Arctopsyche grandis</i>	1	10	2		4.33	1	0.0223
<i>Ceratopsyche morosa</i>							
<i>Cheumatopsyche</i> sp.							
<i>Hydropsyche</i> sp.							
<i>Hydropsyche cockerelli</i>	5	42	15		20.67	1	0.2129
<i>Hydropsyche occidentalis</i>							
<i>Hydropsyche oslari</i>	9	38	9		18.67	1	0.1923
<i>Agraylea</i> sp.							
<i>Hydroptila</i> sp.	1				0.33	1	0.0052
<i>Ochrotrichia</i> sp.		1			0.33	1	0.0052
<i>Lepidostoma</i> sp.	3	52	8		21.00	1	0.2163
<i>Ceraclea</i> sp.							
<i>Oecetis</i> sp.							
Limnephilidae							
<i>Dolophilodes</i> sp.							
<i>Psychomyia flavida</i>							
<i>Rhyacophila brunnea</i>							
<i>Rhyacophila coloradensis</i>		2	2		1.33	1	0.0034
<i>Rhyacophila harmstoni</i>			1		0.33	1	0.0009
<i>Rhyacophila sibirica</i> group							
<i>Oligophlebodes</i> sp.							

Table C2 cont. Macroinvertebrate data collected from site CR-SMU on 17 Sept 2024.

Diptera							
Chironomidae							
<i>Cardiocladius</i> sp.							
<i>Cladotanytarsus</i> sp.							
<i>Corynoneura</i> sp.	1			0.33	1		0.0060
<i>Cricotopus nostocicola</i>							
<i>Cricotopus/Orthocladius</i> sp.	159	96	48	101.00	1		1.5605
<i>Cryptochironomus</i> sp.							
<i>Diamesa</i> sp.							
<i>Eukiefferiella</i> sp.	27	10	10	15.67	1		0.3227
<i>Limnophyes</i> sp.							
<i>Micropectra/Tanytarsus</i> sp.	1	2		1.00	1		0.0180
<i>Microtendipes</i> sp.							
<i>Nanocladius</i> sp.							
<i>Pagastia</i> sp.	2	2	1	1.67	1		0.0043
<i>Parakiefferiella</i> sp.	2			0.67	1		0.0103
<i>Parametriocnemus</i> sp.							
<i>Phaenopsectra</i> sp.		1		0.33	1		0.0060
<i>Polypedilum</i> sp.	3	7		3.33	1		0.0515
<i>Potthastia</i> sp.	10			3.33	1		0.0343
<i>Potthastia gaedii</i>							
<i>Rheotanytarsus</i> sp.							
<i>Sublettea</i> sp.	13		1	4.67	1		0.0721
<i>Synorthocladius</i> sp.	1	1		0.67	1		0.0034
<i>Thienemanniella</i> sp.							
<i>Thienemannimyia</i> group		4		1.33	1		0.0206
<i>Tvetenia</i> sp.	11	30	10	17.00	1		0.2189
Other Diptera							
<i>Atherix pachypus</i>							
<i>Chelifera/Neoplata</i> sp.	10	28	2	13.33	1		0.2060
<i>Wiedemannia</i> sp.	1			0.33	1		0.0052
<i>Lispoides</i> sp.							
<i>Simulium</i> sp.							
<i>Antocha</i> sp.	3	5	6	4.67	1		0.0361
<i>Dicranota</i> sp.		1		0.33	1		0.0026
<i>Hexatoma</i> sp.	1	1		0.67	1		0.0034
Coleoptera							
<i>Cleptelmis</i> sp.		2	1	1.00	1		0.0103
<i>Heterolimnius corpulentus</i>		3	1	1.33	1		0.0137
<i>Microcylloepus pusillus</i>							
<i>Optioservus</i> sp.	8	58	36	34.00	1		0.3502
<i>Zaitzevia parvula</i>		21	2	7.67	1		0.0790
Miscellaneous							
<i>Atractides</i> sp.		1		0.33	1		0.0069
<i>Hygrobates</i> sp.			1	0.33	1		0.0069
<i>Lebertia</i> sp.	1	8	1	3.33	1		0.0687
<i>Protzia</i> sp.		1		0.33	1		0.0069
<i>Sperchon</i> sp.	2	3	1	2.00	1		0.0309
<i>Torrenticola</i> sp.		1		0.33	1		0.0069
<i>Caecidotea</i> sp.		1		0.33	1		0.0069
<i>Crangonyx</i> sp.							
<i>Physa</i> sp.							
<i>Gyraulus</i> sp.							
<i>Polycelis coronata</i>	7	65	12	28.00	1		0.0721
Enchytraeidae							
Lumbricidae							
Naididae	36	15		17.00	1		0.4378
Tubificidae w/out hair chaetae							
Nematoda							
Totals	360	617	188	388.33	52		4.56

Table C3. Macroinvertebrate data collected from site CR-SMD on 17 Sept 2024.

Colorado River							
CR-SMD		Sample					
17 Sept. 2024	1	2	3		Mean	Count	HBI
Ephemeroptera							
<i>Acentrella</i> sp.							
<i>Acentrella turbida</i>							
<i>Baetis flavistriga</i>							
<i>Baetis (tricaudatus)</i>	198	269	118		195.00	1	1.1837
<i>Dipheter hageni</i>							
<i>Attenella margarita</i>							
<i>Drunella doddsii</i>							
<i>Drunella grandis</i>							
<i>Ephemerella dorothea infrequens</i>	60	72	47		59.67	1	0.0724
<i>Cinygmula</i> sp.							
<i>Epeorus longimanus</i>							
<i>Rhithrogena</i> sp.							
<i>Tricorythodes explicatus</i>							
<i>Paraleptophlebia</i> sp.							
Plecoptera							
Capniidae							
<i>Paracapnia angulata</i>	1				0.33	1	0.0004
Chloroperlidae							
<i>Sweltsa</i> sp.							
<i>Malenka</i> sp.							
<i>Zapada cinctipes</i>							
<i>Claassenia sabulosa</i>							
<i>Hesperoperla pacifica</i>							
Perlodidae (<i>Cultus</i> sp.)							
<i>Isoperla</i> sp.							
<i>Isoperla fulva</i>							
<i>Skwala americana</i>							
<i>Pteronarcella badia</i>							
<i>Taenionema</i> sp.							
Trichoptera							
<i>Brachycentrus americanus</i>	1		1		0.67	1	0.0008
<i>Brachycentrus occidentalis</i>							
<i>Micrasema bactro</i>							
<i>Culoptila</i> sp.							
<i>Glossosoma</i> sp.	2				0.67	1	0.0000
<i>Protoptila</i> sp.			1		0.33	1	0.0004
<i>Helicopsyche borealis</i>							
<i>Arctopsyche grandis</i>	1				0.33	1	0.0008
<i>Ceratopsyche morosa</i>	3	5	3		3.67	1	0.0089
<i>Cheumatopsyche</i> sp.							
<i>Hydropsyche</i> sp.							
<i>Hydropsyche cockerelli</i>			1		0.33	1	0.0016
<i>Hydropsyche occidentalis</i>							
<i>Hydropsyche oslari</i>	3	2	4		3.00	1	0.0146
<i>Agraylea</i> sp.	2				0.67	1	0.0065
<i>Hydroptila</i> sp.		1			0.33	1	0.0024
<i>Ochrotrichia</i> sp.							
<i>Lepidostoma</i> sp.							
<i>Ceraclea</i> sp.	4	3			2.33	1	0.0142
<i>Oecetis</i> sp.							
Limnephilidae							
<i>Dolophilodes</i> sp.							
<i>Psychomyia flvida</i>							
<i>Rhyacophila brunnea</i>							
<i>Rhyacophila coloradensis</i>							
<i>Rhyacophila harmstoni</i>							
<i>Rhyacophila sibirica</i> group							
<i>Oligophlebodes</i> sp.							

Table C3 cont. Macroinvertebrate data collected from site CR-SMD on 17 Sept 2024.

Diptera							
Chironomidae							
<i>Cardiocladius</i> sp.							
<i>Cladotanytarsus</i> sp.							
<i>Corynoneura</i> sp.							
<i>Cricotopus nostocicola</i>							
<i>Cricotopus/Orthocladius</i> sp.	20	11	14		15.00	1	0.1093
<i>Cryptochironomus</i> sp.							
<i>Diamesa</i> sp.							
<i>Eukiefferiella</i> sp.	35	81	22		46.00	1	0.4468
<i>Limnophyes</i> sp.							
<i>Micropsectra/Tanytarsus</i> sp.	1				0.33	1	0.0028
<i>Microtendipes</i> sp.							
<i>Nanocladius</i> sp.							
<i>Pagastia</i> sp.							
<i>Parakiefferiella</i> sp.							
<i>Parametriocnemus</i> sp.							
<i>Phaenopsectra</i> sp.							
<i>Polypedilum</i> sp.							
<i>Potthastia</i> sp.	12	5	6		7.67	1	0.0372
<i>Potthastia gaedii</i>							
<i>Rheotanytarsus</i> sp.							
<i>Sublettea</i> sp.							
<i>Synorthocladius</i> sp.							
<i>Thienemanniella</i> sp.							
<i>Thienemannimyia</i> group	8	2	2		4.00	1	0.0291
<i>Tvetenia</i> sp.	14	45	9		22.67	1	0.1376
Other Diptera							
<i>Atherix pachypus</i>							
<i>Chelifera/Neoplasta</i> sp.							
<i>Wiedemannia</i> sp.	1		1		0.67	1	0.0049
<i>Lispoides</i> sp.							
<i>Simulium</i> sp.	272	277	85		211.33	1	1.5395
<i>Antocha</i> sp.							
<i>Dicranota</i> sp.							
<i>Hexatoma</i> sp.							
Coleoptera							
<i>Cleptelmis</i> sp.							
<i>Heterimnius corpulentus</i>	1				0.33	1	0.0016
<i>Microcylloepus pusillus</i>							
<i>Optioservus</i> sp.	1				0.33	1	0.0016
<i>Zaitzevia parvula</i>							
Miscellaneous							
<i>Atractides</i> sp.							
<i>Hygrobates</i> sp.							
<i>Lebertia</i> sp.			1		0.33	1	0.0032
<i>Protzia</i> sp.							
<i>Sperchon</i> sp.		1	2		1.00	1	0.0073
<i>Torrenticola</i> sp.							
<i>Caecidotea</i> sp.	335	170	219		241.33	1	2.3440
<i>Crangonyx</i> sp.	5	1	1		2.33	1	0.0198
<i>Physa</i> sp.	1	2	1		1.33	1	0.0130
<i>Gyraulus</i> sp.	1	1			0.67	1	0.0065
<i>Polycelis coronata</i>							
Enchytraeidae							
Lumbricidae	1				0.33	1	0.0024
Naididae							
Tubificidae w/out hair chaetae							
Nematoda	1	1			0.67	1	0.0040
Totals	984	949	538		823.67	31	6.02

Table C4. Macroinvertebrate data collected from site CR-GRD on 18 Sept 2024.

Colorado River							
CR-GRD		Sample					
18 Sept. 2024	1	2	3		Mean	Count	HBI
Ephemeroptera							
<i>Acentrella</i> sp.	1				0.33	1	0.0011
<i>Acentrella turbida</i>							
<i>Baetis flavistriga</i>							
<i>Baetis (tricaudatus)</i>	302	643	586		510.33	1	2.0944
<i>Dipheter hageni</i>							
<i>Attenella margarita</i>							
<i>Drunella doddii</i>							
<i>Drunella grandis</i>		1			0.33	1	0.0000
<i>Ephemerella dorothea infrequens</i>	5	8	5		6.00	1	0.0049
<i>Cinygmula</i> sp.							
<i>Epeorus longimanus</i>							
<i>Rhithrogena</i> sp.							
<i>Tricorythodes explicatus</i>							
<i>Paraleptophlebia</i> sp.							
Plecoptera							
Capniidae							
<i>Paracapnia angulata</i>	1				0.33	1	0.0003
Chloroperlidae							
<i>Sweltsa</i> sp.		1			0.33	1	0.0003
<i>Malenka</i> sp.			1		0.33	1	0.0005
<i>Zapada cinctipes</i>							
<i>Claassenia sabulosa</i>							
<i>Hesperoperla pacifica</i>							
Perlodidae (<i>Cultus</i> sp.)							
<i>Isoperla</i> sp.	1	2			1.00	1	0.0016
<i>Isoperla fulva</i>			1		0.33	1	0.0005
<i>Skwala americana</i>							
<i>Pteronarcella badia</i>							
<i>Taenionema</i> sp.							
Trichoptera							
<i>Brachycentrus americanus</i>							
<i>Brachycentrus occidentalis</i>	1	1			0.67	1	0.0005
<i>Micrasema bacro</i>							
<i>Culoptila</i> sp.							
<i>Glossosoma</i> sp.		1			0.33	1	0.0000
<i>Protoptila</i> sp.							
<i>Helicopsyche borealis</i>							
<i>Arctopsyche grandis</i>							
<i>Ceratopsyche morosa</i>							
<i>Cheumatopsyche</i> sp.							
<i>Hydropsyche</i> sp.							
<i>Hydropsyche cockerelli</i>							
<i>Hydropsyche occidentalis</i>							
<i>Hydropsyche oslari</i>	3	3			2.00	1	0.0066
<i>Agraylea</i> sp.							
<i>Hydroptila</i> sp.							
<i>Ochrotrichia</i> sp.							
<i>Lepidostoma</i> sp.							
<i>Ceraclea</i> sp.							
<i>Oecetis</i> sp.							
Limnephilidae							
<i>Dolophilodes</i> sp.							
<i>Psychomyia flavida</i>							
<i>Rhyacophila brunnea</i>							
<i>Rhyacophila coloradensis</i>			1		0.33	1	0.0003
<i>Rhyacophila harmstoni</i>							
<i>Rhyacophila sibirica</i> group							
<i>Oligophlebodes</i> sp.							

Table C4 cont. Macroinvertebrate data collected from site CR-GRD on 18 Sept 2024.

Diptera							
Chironomidae							
<i>Cardiocladius</i> sp.							
<i>Cladotanytarsus</i> sp.							
<i>Corynoneura</i> sp.							
<i>Cricotopus nostocicola</i>							
<i>Cricotopus/Orthocladius</i> sp.	30	46	46	40.67	1	0.2003	
<i>Cryptochironomus</i> sp.							
<i>Diamesa</i> sp.		1	2	1.00	1	0.0041	
<i>Eukiefferiella</i> sp.	115	350	211	225.33	1	1.4796	
<i>Limnophyes</i> sp.			2	0.67	1	0.0044	
<i>Micropsectra/Tanytarsus</i> sp.	11	28	15	18.00	1	0.1034	
<i>Microtendipes</i> sp.							
<i>Nanocladius</i> sp.	1			0.33	1	0.0008	
<i>Pagastia</i> sp.	10	31	15	18.67	1	0.0153	
<i>Parakiefferiella</i> sp.							
<i>Parametriocnemus</i> sp.							
<i>Phaenopsectra</i> sp.			1	0.33	1	0.0019	
<i>Polypedilum</i> sp.							
<i>Potthastia</i> sp.	1	4	3	2.67	1	0.0088	
<i>Potthastia gaedii</i>							
<i>Rheotanytarsus</i> sp.							
<i>Sublettea</i> sp.							
<i>Synorthocladius</i> sp.	9	2	1	4.00	1	0.0066	
<i>Thienemanniella</i> sp.							
<i>Thienemannimyia</i> group							
<i>Tvetenia</i> sp.	12	59	40	37.00	1	0.1518	
Other Diptera							
<i>Atherix pachypus</i>							
<i>Chelifera/Neoplasta</i> sp.							
<i>Wiedemannia</i> sp.							
<i>Lispoides</i> sp.		2		0.67	1	0.0033	
<i>Simulium</i> sp.	80	157	144	127.00	1	0.6254	
<i>Antocha</i> sp.							
<i>Dicranota</i> sp.							
<i>Hexatoma</i> sp.							
Coleoptera							
<i>Cleptelmis</i> sp.							
<i>Heterolimnius corpulentus</i>							
<i>Microcylloepus pusillus</i>							
<i>Optioservus</i> sp.	3			1.00	1	0.0033	
<i>Zaitzevia parvula</i>							
Miscellaneous							
<i>Atractides</i> sp.							
<i>Hygrobates</i> sp.							
<i>Lebertia</i> sp.	4	4	1	3.00	1	0.0197	
<i>Protzia</i> sp.							
<i>Sperchon</i> sp.							
<i>Torrenticola</i> sp.							
<i>Caecidotea</i> sp.	2	2		1.33	1	0.0088	
<i>Crangonyx</i> sp.		1		0.33	1	0.0019	
<i>Physa</i> sp.							
<i>Gyraulus</i> sp.							
<i>Polycelis coronata</i>	105	306	140	183.67	1	0.1508	
Enchytraeidae							
Lumbricidae	7			2.33	1	0.0115	
Naididae	73	5	4	27.33	1	0.2244	
Tubificidae w/out hair chaetae							
Nematoda	1			0.33	1	0.0014	
Totals	778	1658	1219	1218.33	34	5.14	

Table C5. Macroinvertebrate data collected from site CR-WGU on 17 Sept 2024.

Colorado River							
CR-WGU		Sample					
17 Sept. 2024	1	2	3		Mean	Count	HB1
Ephemeroptera							
<i>Acentrella</i> sp.							
<i>Acentrella turbida</i>							
<i>Baetis flavistriga</i>							
<i>Baetis (tricaudatus)</i>	14	7	12		11.00	1	0.0832
<i>Dipheter hageni</i>	3		1		1.33	1	0.0101
<i>Attenella margarita</i>			1		0.33	1	0.0015
<i>Drunella doddii</i>							
<i>Drunella grandis</i>	3	3	1		2.33	1	0.0000
<i>Ephemerella dorothea infrequens</i>	32	36	55		41.00	1	0.0620
<i>Cinygmula</i> sp.							
<i>Epeorus longimanus</i>	8		3		3.67	1	0.0111
<i>Rhithrogena</i> sp.							
<i>Tricorythodes explicatus</i>	1		1		0.67	1	0.0050
<i>Paraleptophlebia</i> sp.		1	10		3.67	1	0.0055
Plecoptera							
Capniidae							
<i>Paracapnia angulata</i>	3	1	10		4.67	1	0.0071
Chloroperlidae	1	2	4		2.33	1	0.0035
<i>Sweltsa</i> sp.							
<i>Malenka</i> sp.							
<i>Zapada cinctipes</i>							
<i>Claassenia sabulosa</i>		1			0.33	1	0.0015
<i>Hesperoperla pacifica</i>							
Perlodidae (<i>Cultus</i> sp.)	1		3		1.33	1	0.0040
<i>Isoperla</i> sp.	1		2		1.00	1	0.0030
<i>Isoperla fulva</i>							
<i>Skwala americana</i>	10	4	7		7.00	1	0.0212
<i>Pteronarcella badia</i>							
<i>Taenionema</i> sp.							
Trichoptera							
<i>Brachycentrus americanus</i>	35	17	13		21.67	1	0.0328
<i>Brachycentrus occidentalis</i>	10	11	29		16.67	1	0.0252
<i>Micrasema bactro</i>							
<i>Culoptila</i> sp.							
<i>Glossosoma</i> sp.	2	26	31		19.67	1	0.0000
<i>Protoptila</i> sp.							
<i>Helicopsyche borealis</i>							
<i>Arctopsyche grandis</i>	18	12	31		20.33	1	0.0615
<i>Ceratopsyche morosa</i>	17	1	1		6.33	1	0.0192
<i>Cheumatopsyche</i> sp.	2		2		1.33	1	0.0121
<i>Hydropsyche</i> sp.							
<i>Hydropsyche cockerelli</i>	22	23	31		25.33	1	0.1532
<i>Hydropsyche occidentalis</i>							
<i>Hydropsyche oslari</i>	15	5	16		12.00	1	0.0726
<i>Agraylea</i> sp.							
<i>Hydroptila</i> sp.							
<i>Ochrotrichia</i> sp.							
<i>Lepidostoma</i> sp.	29	46	134		69.67	1	0.4214
<i>Ceraclea</i> sp.							
<i>Oecetis</i> sp.							
Limnephilidae			2		0.67	1	0.0040
<i>Dolophilodes</i> sp.							
<i>Psychomyia flavida</i>							
<i>Rhyacophila brunnea</i>	1				0.33	1	0.0005
<i>Rhyacophila coloradensis</i>							
<i>Rhyacophila harmstoni</i>							
<i>Rhyacophila sibirica</i> group							
<i>Oligophlebodes</i> sp.							

Table C5 cont. Macroinvertebrate data collected from site CR-WGU on 17 Sept 2024.

Diptera							
Chironomidae							
<i>Cardiocladius</i> sp.		1			0.33	1	0.0025
<i>Cladotanytarsus</i> sp.			1		0.33	1	0.0035
<i>Corynoneura</i> sp.							
<i>Cricotopus nostocicola</i>		4	1		1.67	1	0.0176
<i>Cricotopus/Orthocladius</i> sp.	104	138	97		113.00	1	1.0252
<i>Cryptochironomus</i> sp.		1			0.33	1	0.0040
<i>Diamesa</i> sp.	1				0.33	1	0.0025
<i>Eukiefferiella</i> sp.	22	35	12		23.00	1	0.2782
<i>Limnophyes</i> sp.							
<i>Micropsectra/Tanytarsus</i> sp.	8	6	6		6.67	1	0.0706
<i>Microtendipes</i> sp.	1	2	7		3.33	1	0.0302
<i>Nanocladius</i> sp.			1		0.33	1	0.0015
<i>Pagastia</i> sp.	4	8	7		6.33	1	0.0096
<i>Parakiefferiella</i> sp.	3		2		1.67	1	0.0151
<i>Parametriocnemus</i> sp.	3	1	6		3.33	1	0.0252
<i>Phaenopsectra</i> sp.							
<i>Polypedilum</i> sp.	1	23	7		10.33	1	0.0938
<i>Potthastia</i> sp.	1	4			1.67	1	0.0101
<i>Potthastia gaedii</i>		1	1		0.67	1	0.0040
<i>Rheotanytarsus</i> sp.	1				0.33	1	0.0030
<i>Sublettea</i> sp.							
<i>Synorthocladius</i> sp.	2	2	1		1.67	1	0.0050
<i>Thienemanniella</i> sp.		2			0.67	1	0.0060
<i>Thienemannimyia</i> group	4	4	9		5.67	1	0.0514
<i>Tvetenia</i> sp.	38	66	54		52.67	1	0.3982
Other Diptera							
<i>Atherix pachypus</i>							
<i>Chelifera/Neoplata</i> sp.	1		2		1.00	1	0.0091
<i>Wiedemannia</i> sp.							
<i>Lispoides</i> sp.							
<i>Simulium</i> sp.	1	3			1.33	1	0.0121
<i>Antocha</i> sp.	1	1			0.67	1	0.0030
<i>Dicranota</i> sp.							
<i>Hexatoma</i> sp.							
Coleoptera							
<i>Cleptelmis</i> sp.							
<i>Heterolimnius corpulentus</i>							
<i>Microcylloepus pusillus</i>							
<i>Optioservus</i> sp.	16	24	22		20.67	1	0.1250
<i>Zaitzevia parvula</i>							
Miscellaneous							
<i>Atractides</i> sp.							
<i>Hygrobates</i> sp.		1	1		0.67	1	0.0081
<i>Lebertia</i> sp.	1	1	5		2.33	1	0.0282
<i>Protzia</i> sp.		1			0.33	1	0.0040
<i>Sperchon</i> sp.			1		0.33	1	0.0030
<i>Torrenticola</i> sp.							
<i>Caecidotea</i> sp.	31	6	5		14.00	1	0.1694
<i>Crangonyx</i> sp.							
<i>Physa</i> sp.		1			0.33	1	0.0040
<i>Gyraulus</i> sp.							
<i>Polycelis coronata</i>	51	61	203		105.00	1	0.1588
Enchytraeidae							
Lumbricidae							
Naididae		8	9		5.67	1	0.0857
Tubificidae w/out hair chaetae							
Nematoda							
Totals	523	601	860		661.33	58	3.69

Table C6. Macroinvertebrate data collected from site FR-WGU on 17 Sept 2024.

Fraser River							
FR-WGU		Sample					
17 Sept. 2024	1	2	3		Mean	Count	HB1
Ephemeroptera							
<i>Acentrella</i> sp.							
<i>Acentrella turbida</i>	14	7	16		12.33	1	0.0974
<i>Baetis flavistriga</i>		1	1		0.67	1	0.0053
<i>Baetis (tricaudatus)</i>	59	37	86		60.67	1	0.5987
<i>Dipheter hageni</i>		1			0.33	1	0.0033
<i>Attenella margarita</i>							
<i>Drunella doddii</i>							
<i>Drunella grandis</i>	1	1	3		1.67	1	0.0000
<i>Ephemerella dorothea infrequens</i>	51	44	40		45.00	1	0.0888
<i>Cinygmula</i> sp.							
<i>Epeorus longimanus</i>	13	6	16		11.67	1	0.0461
<i>Rhithrogena</i> sp.							
<i>Tricorythodes explicatus</i>							
<i>Paraleptophlebia</i> sp.	49	14	17		26.67	1	0.0526
Plecoptera							
Capniidae							
<i>Paracapnia angulata</i>	2	1	2		1.67	1	0.0033
Chloroperlidae	12	7	9		9.33	1	0.0184
<i>Sweltsa</i> sp.							
<i>Malenka</i> sp.							
<i>Zapada cinctipes</i>							
<i>Claassenia sabulosa</i>	1	1	1		1.00	1	0.0059
<i>Hesperoperla pacifica</i>							
Perlodidae (<i>Cultus</i> sp.)	2	1	11		4.67	1	0.0184
<i>Isoperla</i> sp.		1	1		0.67	1	0.0026
<i>Isoperla fulva</i>	1		1		0.67	1	0.0026
<i>Skwala americana</i>							
<i>Pteronarcella badia</i>							
<i>Taenionema</i> sp.							
Trichoptera							
<i>Brachycentrus americanus</i>	40	29	26		31.67	1	0.0625
<i>Brachycentrus occidentalis</i>	7	3	2		4.00	1	0.0079
<i>Micrasema bactro</i>			1		0.33	1	0.0007
<i>Culoptila</i> sp.	3	3	1		2.33	1	0.0000
<i>Glossosoma</i> sp.	3	6	5		4.67	1	0.0000
<i>Protoptila</i> sp.	15	6	12		11.00	1	0.0217
<i>Helicopsyche borealis</i>		1	2		1.00	1	0.0059
<i>Arctopsyche grandis</i>	7	5	3		5.00	1	0.0197
<i>Ceratopsyche morosa</i>	33	9	9		17.00	1	0.0671
<i>Cheumatopsyche</i> sp.	3	1	3		2.33	1	0.0276
<i>Hydropsyche</i> sp.	5	9	32		15.33	1	0.1211
<i>Hydropsyche cockerelli</i>	26	19	18		21.00	1	0.1658
<i>Hydropsyche occidentalis</i>		1			0.33	1	0.0026
<i>Hydropsyche osleri</i>	17		18		11.67	1	0.0921
<i>Agraylea</i> sp.							
<i>Hydroptila</i> sp.							
<i>Ochrotrichia</i> sp.							
<i>Lepidostoma</i> sp.	100	110	56		88.67	1	0.7000
<i>Ceraclea</i> sp.							
<i>Oecetis</i> sp.			1		0.33	1	0.0053
Limnephilidae							
<i>Dolophilodes</i> sp.							
<i>Psychomyia flavida</i>	1		1		0.67	1	0.0026
<i>Rhyacophila brunnea</i>							
<i>Rhyacophila coloradensis</i>							
<i>Rhyacophila harmstoni</i>							
<i>Rhyacophila sibirica</i> group							
<i>Oligophlebodes</i> sp.							

Table C6 cont. Macroinvertebrate data collected from site FR-WGU on 17 Sept 2024.

Diptera							
Chironomidae							
<i>Cardiocladius</i> sp.	1				0.33	1	0.0033
<i>Cladotanytarsus</i> sp.							
<i>Corynoneura</i> sp.							
<i>Cricotopus nostocicola</i>			1		0.33	1	0.0046
<i>Cricotopus/Orthocladius</i> sp.	2	1	3		2.00	1	0.0237
<i>Cryptochironomus</i> sp.							
<i>Diamesa</i> sp.							
<i>Eukiefferiella</i> sp.	8	1	5		4.67	1	0.0737
<i>Limnophyes</i> sp.							
<i>Micropsectra/Tanytarsus</i> sp.							
<i>Microtendipes</i> sp.							
<i>Nanocladius</i> sp.			2		0.67	1	0.0039
<i>Pagastia</i> sp.	2				0.67	1	0.0013
<i>Parakiefferiella</i> sp.							
<i>Parametriocnemus</i> sp.	1				0.33	1	0.0033
<i>Phaenopsectra</i> sp.							
<i>Polypedilum</i> sp.	2		1		1.00	1	0.0118
<i>Potthastia</i> sp.							
<i>Potthastia gaedii</i>							
<i>Rheotanytarsus</i> sp.							
<i>Sublettea</i> sp.							
<i>Synorthocladius</i> sp.	1	4	2		2.33	1	0.0092
<i>Thienemanniella</i> sp.							
<i>Thienemannimyia</i> group		1	5		2.00	1	0.0237
<i>Tvetenia</i> sp.	22	4	21		15.67	1	0.1546
Other Diptera							
<i>Atherix pachypus</i>							
<i>Chelifera/Neoplasta</i> sp.			3		1.00	1	0.0118
<i>Wiedemannia</i> sp.							
<i>Lispoides</i> sp.							
<i>Simulium</i> sp.	1	2	2		1.67	1	0.0197
<i>Antocha</i> sp.	2		3		1.67	1	0.0099
<i>Dicranota</i> sp.							
<i>Hexatoma</i> sp.		2			0.67	1	0.0026
Coleoptera							
<i>Cleptelmis</i> sp.							
<i>Heterolimnius corpulentus</i>							
<i>Microcylloepus pusillus</i>							
<i>Optioservus</i> sp.	77	55	35		55.67	1	0.4395
<i>Zaitzevia parvula</i>	9	12	6		9.00	1	0.0711
Miscellaneous							
<i>Atractides</i> sp.							
<i>Hygrobates</i> sp.							
<i>Lebertia</i> sp.							
<i>Protzia</i> sp.	1				0.33	1	0.0053
<i>Sperchon</i> sp.	2	2	2		2.00	1	0.0237
<i>Torrenticola</i> sp.							
<i>Caecidotea</i> sp.	2	1			1.00	1	0.0158
<i>Crangonyx</i> sp.		1			0.33	1	0.0046
<i>Physa</i> sp.	3	6	4		4.33	1	0.0684
<i>Gyraulus</i> sp.	3	2	1		2.00	1	0.0316
<i>Polycelis coronata</i>			1		0.33	1	0.0007
Enchytraeidae			1		0.33	1	0.0066
Lumbricidae	2	1			1.00	1	0.0118
Naididae							
Tubificidae w/out hair chaetae		2			0.67	1	0.0132
Nematoda			1		0.33	1	0.0033
Totals	606	421	493		506.67	59	3.30

Table C7. Macroinvertebrate data collected from site CR-WGD on 17 Sept 2024.

Colorado River							
CR-WGD		Sample					
17 Sept. 2024	1	2	3		Mean	Count	HB1
Ephemeroptera							
<i>Acentrella</i> sp.							
<i>Acentrella turbida</i>	4	7	4		5.00	1	0.0169
<i>Baetis flavistriga</i>		2			0.67	1	0.0023
<i>Baetis (tricaudatus)</i>	63	89	125		92.33	1	0.3898
<i>Dipheter hageni</i>	2		2		1.33	1	0.0056
<i>Attenella margarita</i>							
<i>Drunella doddii</i>							
<i>Drunella grandis</i>	2	1			1.00	1	0.0000
<i>Ephemerella dorothea infrequens</i>	233	322	326		293.67	1	0.2480
<i>Cinygmula</i> sp.							
<i>Epeorus longimanus</i>	11	9	17		12.33	1	0.0208
<i>Rhithrogena</i> sp.		2			0.67	1	0.0000
<i>Tricorythodes explicatus</i>							
<i>Paraleptophlebia</i> sp.	15	8	27		16.67	1	0.0141
Plecoptera							
Capniidae		1			0.33	1	0.0003
<i>Paracapnia angulata</i>	2	2			1.33	1	0.0011
Chloroperlidae	4	9	24		12.33	1	0.0104
<i>Sweltsa</i> sp.							
<i>Malenka</i> sp.							
<i>Zapada cinctipes</i>		1			0.33	1	0.0006
<i>Claassenia sabulosa</i>	2	4	5		3.67	1	0.0093
<i>Hesperoperla pacifica</i>							
Perlodidae (<i>Cultus</i> sp.)		1	2		1.00	1	0.0017
<i>Isoperla</i> sp.	1	4	4		3.00	1	0.0051
<i>Isoperla fulva</i>			2		0.67	1	0.0011
<i>Skwala americana</i>		1	1		0.67	1	0.0011
<i>Pteronarcella badia</i>							
<i>Taenionema</i> sp.							
Trichoptera							
<i>Brachycentrus americanus</i>	34	33	45		37.33	1	0.0315
<i>Brachycentrus occidentalis</i>	9	4	4		5.67	1	0.0048
<i>Micrasema bactro</i>	1				0.33	1	0.0003
<i>Culoptila</i> sp.		1	2		1.00	1	0.0000
<i>Glossosoma</i> sp.	2	5	5		4.00	1	0.0000
<i>Protoptila</i> sp.	1				0.33	1	0.0003
<i>Helicopsyche borealis</i>							
<i>Arctopsyche grandis</i>	1	12	9		7.33	1	0.0124
<i>Ceratopsyche morosa</i>		1	4		1.67	1	0.0028
<i>Cheumatopsyche</i> sp.							
<i>Hydropsyche</i> sp.		20	31		17.00	1	0.0574
<i>Hydropsyche cockerelli</i>	70	120	210		133.33	1	0.4503
<i>Hydropsyche occidentalis</i>							
<i>Hydropsyche oslari</i>	130	219	337		228.67	1	0.7723
<i>Agraylea</i> sp.							
<i>Hydroptila</i> sp.			1		0.33	1	0.0017
<i>Ochrotrichia</i> sp.							
<i>Lepidostoma</i> sp.	27	20	17		21.33	1	0.0721
<i>Ceraclea</i> sp.		1			0.33	1	0.0014
<i>Oecetis</i> sp.							
Limnephilidae							
<i>Dolophilodes</i> sp.							
<i>Psychomyia flavida</i>	3	1	1		1.67	1	0.0028
<i>Rhyacophila brunnea</i>							
<i>Rhyacophila coloradensis</i>							
<i>Rhyacophila harmstoni</i>							
<i>Rhyacophila sibirica</i> group							
<i>Oligophlebodes</i> sp.							

Table C7 cont. Macroinvertebrate data collected from site CR-WGD on 17 Sept 2024.

Diptera							
Chironomidae							
<i>Cardiocladius</i> sp.							
<i>Cladotanytarsus</i> sp.							
<i>Corynoneura</i> sp.		1			0.33	1	0.0020
<i>Cricotopus nostocicola</i>							
<i>Cricotopus/Orthocladius</i> sp.	25	39	29		31.00	1	0.1571
<i>Cryptochironomus</i> sp.							
<i>Diamesa</i> sp.							
<i>Eukiefferiella</i> sp.	33	28	44		35.00	1	0.2364
<i>Limnophyes</i> sp.							
<i>Micropsectra/Tanytarsus</i> sp.	1	1	1		1.00	1	0.0059
<i>Microtendipes</i> sp.							
<i>Nanocladius</i> sp.	1	3			1.33	1	0.0034
<i>Pagastia</i> sp.							
<i>Parakiefferiella</i> sp.							
<i>Parametriocnemus</i> sp.	4	9	2		5.00	1	0.0211
<i>Phaenopsectra</i> sp.							
<i>Polypedilum</i> sp.	2	5			2.33	1	0.0118
<i>Potthastia</i> sp.							
<i>Potthastia gaedii</i>							
<i>Rheotanytarsus</i> sp.	1				0.33	1	0.0017
<i>Sublettea</i> sp.							
<i>Synorthocladius</i> sp.	4	3			2.33	1	0.0039
<i>Thienemanniella</i> sp.		2			0.67	1	0.0034
<i>Thienemannimyia</i> group	1	4	6		3.67	1	0.0186
<i>Tvetenia</i> sp.	54	80	86		73.33	1	0.3096
Other Diptera							
<i>Atherix pachypus</i>	34	35	40		36.33	1	0.0614
<i>Chelifera/Neoplata</i> sp.	1	1	2		1.33	1	0.0068
<i>Wiedemannia</i> sp.							
<i>Lispoides</i> sp.							
<i>Simulium</i> sp.	1	8			3.00	1	0.0152
<i>Antocha</i> sp.	1	2	1		1.33	1	0.0034
<i>Dicranota</i> sp.							
<i>Hexatoma</i> sp.							
Coleoptera							
<i>Cleptelmis</i> sp.							
<i>Heterolimnius corpulentus</i>							
<i>Microcylloepus pusillus</i>			1		0.33	1	0.0006
<i>Optioservus</i> sp.	56	99	47		67.33	1	0.2274
<i>Zaitzevia parvula</i>	1	1	7		3.00	1	0.0101
Miscellaneous							
<i>Atractides</i> sp.	1	4	1		2.00	1	0.0135
<i>Hygrobates</i> sp.							
<i>Lebertia</i> sp.							
<i>Protzia</i> sp.	1		1		0.67	1	0.0045
<i>Sperchon</i> sp.	3	2	4		3.00	1	0.0152
<i>Torrenticola</i> sp.		1			0.33	1	0.0023
<i>Caecidotea</i> sp.							
<i>Crangonyx</i> sp.							
<i>Physa</i> sp.			1		0.33	1	0.0023
<i>Gyraulius</i> sp.							
<i>Polycelis coronata</i>	1	1			0.67	1	0.0006
Enchytraeidae							
Lumbricidae			1		0.33	1	0.0017
Naididae			2		0.67	1	0.0056
Tubificidae w/out hair chaetae							
Nematoda							
Totals	843	1229	1481		1184.33	60	3.28

Appendix D

East Slope Benthic Macroinvertebrate Data

Fall 2024

Table D1. Macroinvertebrate data collected from site HSC-PRU on 30 Sept 2024.

Poudre River							
HSC-PRU		Sample					
30 Sept. 2024	1	2	3		Mean	Count	HBI
Ephemeroptera							
<i>Ameletus</i> sp.	6	2	1		3.00	1	0.0000
<i>Acentrella insignificans</i>	5	22	10		12.33	1	0.0944
<i>Baetis flavistriga</i>							
<i>Baetis notos</i>							
<i>Baetis tricaudatus</i>	83	95	271		149.67	1	1.4327
<i>Diphetero hageni</i>							
<i>Fallceon quilleri</i>							
<i>Drunella doddsi</i>	1				0.33	1	0.0000
<i>Drunella grandis</i>							
<i>Ephemerella dorothea infrequens</i>	39	103	214		118.67	1	0.2272
<i>Serratella micheneri</i>							
<i>Epeorus longimanus</i>	1	1	2		1.33	1	0.0051
<i>Heptagenia</i> sp.			2		0.67	1	0.0051
<i>Rhithrogena</i> sp.	3	6	4		4.33	1	0.0000
<i>Tricorythodes explicatus</i>							
<i>Paraleptophlebia</i> sp.		7	23		10.00	1	0.0191
Plecoptera							
<i>Triznaka</i> sp.			6		2.00	1	0.0038
<i>Zapada cinctipes</i>							
<i>Claassenia sabulosa</i>	2	7	19		9.33	1	0.0536
<i>Cultus</i> sp.							
<i>Isoperla</i> sp.	2	4	14		6.67	1	0.0255
<i>Isoperla fulva</i>							
<i>Skwala americana</i>		1			0.33	1	0.0013
<i>Pteronarcella badia</i>							
<i>Pteronarcys californica</i>		4	1		1.67	1	0.0000
Trichoptera							
<i>Brachycentrus americanus</i>							
<i>Brachycentrus occidentalis</i>	2	32	63		32.33	1	0.0619
<i>Culoptila</i> sp.	6	71	67		48.00	1	0.0000
<i>Glossosoma</i> sp.	2	17	9		9.33	1	0.0000
<i>Protoptila</i> sp.	1	4	3		2.67	1	0.0051
<i>Arctopsyche grandis</i>	2	2			1.33	1	0.0051
<i>Ceratopsyche morosa</i>							
<i>Cheumatopsyche</i> sp.							
<i>Hydropsyche cockerelli</i>	4	1	3		2.67	1	0.0204
<i>Hydropsyche occidentalis</i>	9	36	63		36.00	1	0.2757
<i>Hydropsyche osleri</i>							
<i>Leucotrichia</i> sp.		3	1		1.33	1	0.0153
<i>Lepidostoma</i> sp.			1		0.33	1	0.0026
<i>Oecetis</i> sp.							
<i>Psychomyia flava</i>							
<i>Rhyacophila coloradensis</i>							

Table D1 cont. Macroinvertebrate data collected from site HSC-PRU on 30 Sept 2024.

Diptera							
Chironomidae							
<i>Cardiocladius</i> sp.	2	5	4		3.67	1	0.0351
<i>Corynoneura</i> sp.							
<i>Cricotopus/Orthocladius</i> sp.	3	3	9		5.00	1	0.0574
<i>Eukiefferiella</i> sp.	15	29	29		24.33	1	0.3727
<i>Nanocladius</i> sp.							
<i>Pagastia</i> sp.							
<i>Parametriocnemus</i> sp.							
<i>Paratanytarsus</i> sp.							
<i>Polypedilum</i> sp.							
<i>Potthastia</i> sp.							
<i>Pseudorthocladius</i> sp.							
<i>Rheocricotopus</i> sp.							
<i>Rheotanytarsus</i> sp.	1				0.33	1	0.0038
<i>Synorthocladius</i> sp.			1		0.33	1	0.0013
<i>Thienemanniella</i> sp.	1				0.33	1	0.0038
<i>Thienemannimyia</i> group			1		0.33	1	0.0038
<i>Tvetenia</i> sp.							
Other Diptera							
<i>Atherix pachypus</i>		3	4		2.33	1	0.0089
<i>Bibiocephala grandis</i>	1	5	11		5.67	1	0.0000
<i>Hemerodromia</i> sp.							
<i>Simulium</i> sp.	4	1	1		2.00	1	0.0230
<i>Hexatoma</i> sp.							
Coleoptera							
<i>Optioservus</i> sp.	1	15	20		12.00	1	0.0919
<i>Zaitzevia parvula</i>		2	9		3.67	1	0.0281
Lepidoptera							
<i>Petrophila</i> sp.							
Miscellaneous							
<i>Atractides</i> sp.							
<i>Sperchon</i> sp.		1	5		2.00	1	0.0230
<i>Crangonyx</i> sp.							
<i>Gammarus</i> sp.							
<i>Potamopyrgus antipodarum</i>							
<i>Physa</i> sp.							
<i>Asellus</i> sp.							
<i>Dugesia</i> sp.		1	9		3.33	1	0.0383
Erpobdellidae							
Enchytraeidae							
Lumbricidae							
Naididae	1	2	4		2.33	1	0.0447
Tubificidae w/out hair chaetae			1		0.33	1	0.0064
Nematoda							
Totals	197	485	885		522.33	39	3.00

Table D2. Macroinvertebrate data collected from site HSC-PRD on 30 Sept 2024.

Poudre River							
HSC-PRD		Sample					
30 Sept. 2024	1	2	3		Mean	Count	HBI
Ephemeroptera							
<i>Ameletus</i> sp.							
<i>Acentrella insignificans</i>	1	1			0.67	1	0.0024
<i>Baetis flavistriga</i>		1			0.33	1	0.0012
<i>Baetis notos</i>							
<i>Baetis tricaudatus</i>	276	288	238		267.33	1	1.1889
<i>Diphetero hageni</i>							
<i>Fallceon quilleri</i>							
<i>Drunella doddsi</i>	4	1	1		2.00	1	0.0000
<i>Drunella grandis</i>	6	1			2.33	1	0.0000
<i>Ephemerella dorothea infrequens</i>	188	117	83		129.33	1	0.1150
<i>Serratella micheneri</i>	1	2	1		1.33	1	0.0012
<i>Epeorus longimanus</i>	2	1	2		1.67	1	0.0030
<i>Heptagenia</i> sp.	6	10	4		6.67	1	0.0237
<i>Rhithrogena</i> sp.	6	3	1		3.33	1	0.0000
<i>Tricorythodes explicatus</i>							
<i>Paraleptophlebia</i> sp.	6	12	8		8.67	1	0.0077
Plecoptera							
<i>Triznaka</i> sp.	11	23	5		13.00	1	0.0116
<i>Zapada cinctipes</i>		1	1		0.67	1	0.0012
<i>Claassenia sabulosa</i>	12	4	3		6.33	1	0.0169
<i>Cultus</i> sp.	4				1.33	1	0.0024
<i>Isoperla</i> sp.	15	11	16		14.00	1	0.0249
<i>Isoperla fulva</i>	3				1.00	1	0.0018
<i>Skwala americana</i>	2				0.67	1	0.0012
<i>Pteronarcella badia</i>	1				0.33	1	0.0000
<i>Pteronarcys californica</i>	8	7	4		6.33	1	0.0000
Trichoptera							
<i>Brachycentrus americanus</i>							
<i>Brachycentrus occidentalis</i>	125	123	53		100.33	1	0.0892
<i>Culoptila</i> sp.	17	11	3		10.33	1	0.0000
<i>Glossosoma</i> sp.	81	104	32		72.33	1	0.0000
<i>Protoptila</i> sp.	2	2			1.33	1	0.0012
<i>Arctopsyche grandis</i>	4	4	5		4.33	1	0.0077
<i>Ceratopsyche morosa</i>							
<i>Cheumatopsyche</i> sp.							
<i>Hydropsyche cockerelli</i>	50	47	49		48.67	1	0.1731
<i>Hydropsyche occidentalis</i>	100	95	66		87.00	1	0.3095
<i>Hydropsyche oslari</i>		2	1		1.00	1	0.0036
<i>Leucotrichia</i> sp.							
<i>Lepidostoma</i> sp.							
<i>Oecetis</i> sp.							
<i>Psychomyia flava</i>	2				0.67	1	0.0012
<i>Rhyacophila coloradensis</i>	5	7	1		4.33	1	0.0039

Table D2 cont. Macroinvertebrate data collected from site HSC-PRD on 30 Sept 2024.

Diptera							
Chironomidae							
<i>Cardiocladius</i> sp.		1	1		0.67	1	0.0030
<i>Corynoneura</i> sp.							
<i>Cricotopus/Orthocladius</i> sp.	22	6	8		12.00	1	0.0640
<i>Eukiefferiella</i> sp.	59	51	36		48.67	1	0.3463
<i>Nanocladius</i> sp.	2		1		1.00	1	0.0027
<i>Pagastia</i> sp.							
<i>Parametriocnemus</i> sp.							
<i>Paratanytarsus</i> sp.							
<i>Polypedilum</i> sp.	7	5	2		4.67	1	0.0249
<i>Potthastia</i> sp.							
<i>Pseudorthocladius</i> sp.			1		0.33	1	0.0000
<i>Rheocricotopus</i> sp.	1				0.33	1	0.0018
<i>Rheotanytarsus</i> sp.							
<i>Synorthocladius</i> sp.	1				0.33	1	0.0006
<i>Thienemanniella</i> sp.		1			0.33	1	0.0018
<i>Thienemannimyia</i> group	1				0.33	1	0.0018
<i>Tvetenia</i> sp.	4	3	1		2.67	1	0.0119
Other Diptera							
<i>Atherix pachypus</i>	15	4	4		7.67	1	0.0136
<i>Bibiocephala grandis</i>	1		1		0.67	1	0.0000
<i>Hemerodromia</i> sp.	1				0.33	1	0.0018
<i>Simulium</i> sp.	10	2	3		5.00	1	0.0267
<i>Hexatoma</i> sp.							
Coleoptera							
<i>Optioservus</i> sp.	33	19	16		22.67	1	0.0806
<i>Zaitzevia parvula</i>	6	7	2		5.00	1	0.0178
Lepidoptera							
<i>Petrophila</i> sp.							
Miscellaneous							
<i>Atractides</i> sp.							
<i>Sperchon</i> sp.	6	4	1		3.67	1	0.0196
<i>Crangonyx</i> sp.							
<i>Gammarus</i> sp.							
<i>Potamopyrgus antipodarum</i>							
<i>Physa</i> sp.							
<i>Asellus</i> sp.							
<i>Dugesia</i> sp.							
Erpobdellidae							
Enchytraeidae							
Lumbricidae							
Naididae	369	214	45		209.33	1	1.8618
Tubificidae w/out hair chaetae							
Nematoda	3				1.00	1	0.0044
Totals	1479	1195	699		1124.33	50	4.48

Table D3. Macroinvertebrate data collected from site HFC-BTU on 30 Sept 2024.

Big Thompson River							
HFC-BTU		Sample					
30 Sept. 2024	1	2	3		Mean	Count	HBI
Ephemeroptera							
<i>Ameletus</i> sp.							
<i>Acentrella insignificans</i>	2		1		1.00	1	0.0152
<i>Baetis flavistriga</i>	1	3			1.33	1	0.0203
<i>Baetis notos</i>							
<i>Baetis tricaudatus</i>	26	58	35		39.67	1	0.7551
<i>Diphetor hageni</i>							
<i>Fallceon quilleri</i>							
<i>Drunella doddsi</i>							
<i>Drunella grandis</i>	1		1		0.67	1	0.0000
<i>Ephemerella dorothea infrequens</i>	65	73	71		69.67	1	0.2652
<i>Serratella micheneri</i>							
<i>Epeorus longimanus</i>			12		4.00	1	0.0305
<i>Heptagenia</i> sp.	1	1	3		1.67	1	0.0254
<i>Rhithrogena</i> sp.		1			0.33	1	0.0000
<i>Tricorythodes explicatus</i>							
<i>Paraleptophlebia</i> sp.		3	4		2.33	1	0.0089
Plecoptera							
<i>Triznaka</i> sp.							
<i>Zapada cinctipes</i>							
<i>Claassenia sabulosa</i>	1				0.33	1	0.0038
<i>Cultus</i> sp.							
<i>Isoperla</i> sp.	1				0.33	1	0.0025
<i>Isoperla fulva</i>	1	3	3		2.33	1	0.0178
<i>Skwala americana</i>	1	1	3		1.67	1	0.0127
<i>Pteronarcella badia</i>							
<i>Pteronarcys californica</i>							
Trichoptera							
<i>Brachycentrus americanus</i>							
<i>Brachycentrus occidentalis</i>	22	3	17		14.00	1	0.0533
<i>Culoptila</i> sp.	73	24	57		51.33	1	0.0000
<i>Glossosoma</i> sp.	19	8			9.00	1	0.0000
<i>Protoptila</i> sp.		1			0.33	1	0.0013
<i>Arctopsyche grandis</i>							
<i>Ceratopsyche morosa</i>							
<i>Cheumatopsyche</i> sp.							
<i>Hydropsyche cockerelli</i>	7	1			2.67	1	0.0406
<i>Hydropsyche occidentalis</i>	9	6	20		11.67	1	0.1777
<i>Hydropsyche oslari</i>	17	13	7		12.33	1	0.1878
<i>Leucotrichia</i> sp.							
<i>Lepidostoma</i> sp.	17	6	4		9.00	1	0.1371
<i>Oecetis</i> sp.							
<i>Psychomyia flava</i>							
<i>Rhyacophila coloradensis</i>							

Table D3 cont. Macroinvertebrate data collected from site HFC-BTU on 30 Sept 2024.

Diptera							
Chironomidae							
<i>Cardiocladius</i> sp.							
<i>Corynoneura</i> sp.							
<i>Cricotopus/Orthocladius</i> sp.							
<i>Eukiefferiella</i> sp.	3	5	2		3.33	1	0.1015
<i>Nanocladius</i> sp.							
<i>Pagastia</i> sp.							
<i>Parametriocnemus</i> sp.	2		1		1.00	1	0.0190
<i>Paratanytarsus</i> sp.							
<i>Polypedilum</i> sp.							
<i>Potthastia</i> sp.							
<i>Pseudorthocladius</i> sp.							
<i>Rheocricotopus</i> sp.							
<i>Rheotanytarsus</i> sp.	1				0.33	1	0.0076
<i>Synorthocladius</i> sp.	4	1	1		2.00	1	0.0152
<i>Thienemanniella</i> sp.							
<i>Thienemannimyia</i> group							
<i>Tvetenia</i> sp.	5	2			2.33	1	0.0444
Other Diptera							
<i>Atherix pachypus</i>	1		1		0.67	1	0.0051
<i>Bibiocephala grandis</i>	1				0.33	1	0.0000
<i>Hemerodromia</i> sp.							
<i>Simulium</i> sp.	5	8	13		8.67	1	0.1980
<i>Hexatoma</i> sp.							
Coleoptera							
<i>Optioservus</i> sp.	4	6	7		5.67	1	0.0863
<i>Zaitzevia parvula</i>							
Lepidoptera							
<i>Petrophila</i> sp.							
Miscellaneous							
<i>Atractides</i> sp.							
<i>Sperchon</i> sp.		1	1		0.67	1	0.0152
<i>Crangonyx</i> sp.							
<i>Gammarus</i> sp.							
<i>Potamopyrgus antipodarum</i>							
<i>Physa</i> sp.							
<i>Asellus</i> sp.							
<i>Dugesia</i> sp.							
Erpobdellidae		1			0.33	1	0.0102
Enchytraeidae							
Lumbricidae							
Naididae		5			1.67	1	0.0635
Tubificidae w/out hair chaetae							
Nematoda							
Totals	290	234	264		262.67	33	2.32

Table D4. Macroinvertebrate data collected from site HFC-BTD on 30 Sept 2024.

Big Thompson River							
HFC-BTD		Sample					
30 Sept. 2024	1	2	3		Mean	Count	HBI
Ephemeroptera							
<i>Ameletus</i> sp.							
<i>Acentrella insignificans</i>	3	7	6		5.33	1	0.0447
<i>Baetis flavistriga</i>							
<i>Baetis notos</i>							
<i>Baetis tricaudatus</i>	19	44	34		32.33	1	0.3387
<i>Diphetor hageni</i>							
<i>Fallceon quilleri</i>							
<i>Drunella doddsi</i>							
<i>Drunella grandis</i>		2			0.67	1	0.0000
<i>Ephemerella dorothea infrequens</i>	50	97	78		75.00	1	0.1571
<i>Serratella micheneri</i>							
<i>Epeorus longimanus</i>	2	4			2.00	1	0.0084
<i>Heptagenia</i> sp.		2	1		1.00	1	0.0084
<i>Rhithrogena</i> sp.							
<i>Tricorythodes explicatus</i>							
<i>Paraleptophlebia</i> sp.	1	13	1		5.00	1	0.0105
Plecoptera							
<i>Triznaka</i> sp.							
<i>Zapada cinctipes</i>							
<i>Claassenia sabulosa</i>		2	1		1.00	1	0.0063
<i>Cultus</i> sp.							
<i>Isoperla</i> sp.	1	3	2		2.00	1	0.0084
<i>Isoperla fulva</i>			1		0.33	1	0.0014
<i>Skwala americana</i>	3	4	3		3.33	1	0.0140
<i>Pteronarcella badia</i>							
<i>Pteronarcys californica</i>							
Trichoptera							
<i>Brachycentrus americanus</i>							
<i>Brachycentrus occidentalis</i>	29	20	75		41.33	1	0.0866
<i>Culoptila</i> sp.	25	55	26		35.33	1	0.0000
<i>Glossosoma</i> sp.	4	50	19		24.33	1	0.0000
<i>Protoptila</i> sp.							
<i>Arctopsyche grandis</i>	2	1	3		2.00	1	0.0084
<i>Ceratopsyche morosa</i>							
<i>Cheumatopsyche</i> sp.							
<i>Hydropsyche cockerelli</i>	7	18	24		16.33	1	0.1369
<i>Hydropsyche occidentalis</i>	27	56	48		43.67	1	0.3659
<i>Hydropsyche oslari</i>	7	15	20		14.00	1	0.1173
<i>Leucotrichia</i> sp.							
<i>Lepidostoma</i> sp.	2	2	3		2.33	1	0.0196
<i>Oecetis</i> sp.							
<i>Psychomyia flvida</i>							
<i>Rhyacophila coloradensis</i>			1		0.33	1	0.0007

Table D4 cont. Macroinvertebrate data collected from site HFC-BTD on 30 Sept 2024.

Diptera							
Chironomidae							
<i>Cardiocladius</i> sp.	3	49	22		24.67	1	0.2584
<i>Corynoneura</i> sp.							
<i>Cricotopus/Orthocladius</i> sp.	1	7	5		4.33	1	0.0545
<i>Eukiefferiella</i> sp.	8	16	17		13.67	1	0.2291
<i>Nanocladius</i> sp.	2				0.67	1	0.0042
<i>Pagastia</i> sp.							
<i>Parametriocnemus</i> sp.							
<i>Paratanytarsus</i> sp.							
<i>Polypedilum</i> sp.							
<i>Potthastia</i> sp.		2			0.67	1	0.0056
<i>Pseudorthocladius</i> sp.							
<i>Rheocricotopus</i> sp.							
<i>Rheotanytarsus</i> sp.							
<i>Synorthocladius</i> sp.		2			0.67	1	0.0028
<i>Thienemanniella</i> sp.							
<i>Thienemannimyia</i> group							
<i>Tvetenia</i> sp.	2	7	1		3.33	1	0.0349
Other Diptera							
<i>Atherix pachypus</i>		2	1		1.00	1	0.0042
<i>Bibiocephala grandis</i>							
<i>Hemerodromia</i> sp.							
<i>Simulium</i> sp.	50	194	79		107.67	1	1.3534
<i>Hexatoma</i> sp.							
Coleoptera							
<i>Optioservus</i> sp.	7	16	6		9.67	1	0.0810
<i>Zaitzevia parvula</i>							
Lepidoptera							
<i>Petrophila</i> sp.							
Miscellaneous							
<i>Atractides</i> sp.		1			0.33	1	0.00558659
<i>Sperchon</i> sp.		1	1		0.67	1	0.0084
<i>Crangonyx</i> sp.							
<i>Gammarus</i> sp.							
<i>Potamopyrgus antipodarum</i>							
<i>Physa</i> sp.							
<i>Asellus</i> sp.							
<i>Dugesia</i> sp.	1	2	2		1.67	1	0.0209
Erpobdellidae							
Enchytraeidae							
Lumbricidae							
Naididae	1	1			0.67	1	0.0140
Tubificidae w/out hair chaetae							
Nematoda							
Totals	257	695	480		477.33	34	3.41

Table D5. Macroinvertebrate data collected from site SVSC-LTU on 30 Sept 2024.

Little Thompson River							
SVSC-LTU		Sample					
30 Sept. 2024	1	2	3		Mean	Count	HBI
Ephemeroptera							
<i>Ameletus</i> sp.							
<i>Acentrella insignificans</i>							
<i>Baetis flavistriga</i>							
<i>Baetis notos</i>			2		0.67	1	0.0442
<i>Baetis tricaudatus</i>		2	13		5.00	1	0.4144
<i>Diphetero hageni</i>							
<i>Fallceon quilleri</i>							
<i>Drunella doddsi</i>							
<i>Drunella grandis</i>							
<i>Ephemerella dorothea infrequens</i>	4	1			1.67	1	0.0276
<i>Serratella micheneri</i>							
<i>Epeorus longimanus</i>	1				0.33	1	0.0110
<i>Heptagenia</i> sp.							
<i>Rhithrogena</i> sp.							
<i>Tricorythodes explicatus</i>		2	3		1.67	1	0.1381
<i>Paraleptophlebia</i> sp.							
Plecoptera							
<i>Triznaka</i> sp.							
<i>Zapada cinctipes</i>							
<i>Claassenia sabulosa</i>							
<i>Cultus</i> sp.							
<i>Isoperla</i> sp.							
<i>Isoperla fulva</i>							
<i>Skwala americana</i>							
<i>Pteronarcella badia</i>							
<i>Pteronarcys californica</i>							
Trichoptera							
<i>Brachycentrus americanus</i>							
<i>Brachycentrus occidentalis</i>							
<i>Culoptila</i> sp.	1				0.33	1	0.0000
<i>Glossosoma</i> sp.							
<i>Protophila</i> sp.	2	2			1.33	1	0.0221
<i>Arctopsyche grandis</i>							
<i>Ceratopsyche morosa</i>	8	10	20		12.67	1	0.4199
<i>Cheumatopsyche</i> sp.	8	3	7		6.00	1	0.5967
<i>Hydropsyche cockerelli</i>							
<i>Hydropsyche occidentalis</i>	2		6		2.67	1	0.1768
<i>Hydropsyche oslari</i>			1		0.33	1	0.0221
<i>Leucotrichia</i> sp.			19		6.33	1	0.6298
<i>Lepidostoma</i> sp.							
<i>Oecetis</i> sp.							
<i>Psychomyia flava</i>	1	2	1		1.33	1	0.0442
<i>Rhyacophila coloradensis</i>							

Table D5 cont. Macroinvertebrate data collected from site SVSC-LTU on 30 Sept 2024.

Diptera							
Chironomidae							
<i>Cardiocladius</i> sp.							
<i>Corynoneura</i> sp.							
<i>Cricotopus/Orthocladius</i> sp.	5	2			2.33	1	0.2320
<i>Eukiefferiella</i> sp.	2	6	4		4.00	1	0.5304
<i>Nanocladius</i> sp.							
<i>Pagastia</i> sp.			1		0.33	1	0.0055
<i>Parametriocnemus</i> sp.							
<i>Paratanytarsus</i> sp.		1	1		0.67	1	0.0663
<i>Polypedium</i> sp.							
<i>Potthastia</i> sp.							
<i>Pseudorthocladius</i> sp.							
<i>Rheocricotopus</i> sp.							
<i>Rheotanytarsus</i> sp.	1				0.33	1	0.0331
<i>Synorthocladius</i> sp.							
<i>Thienemanniella</i> sp.	1	1	1		1.00	1	0.0994
<i>Thienemannimyia</i> group							
<i>Tvetenia</i> sp.							
Other Diptera							
<i>Atherix pachypus</i>							
<i>Bibiocephala grandis</i>							
<i>Hemerodromia</i> sp.							
<i>Simulium</i> sp.	2	1	10		4.33	1	0.4309
<i>Hexatoma</i> sp.							
Coleoptera							
<i>Optioservus</i> sp.							
<i>Zaitzevia parvula</i>							
Lepidoptera							
<i>Petrophila</i> sp.			1		0.33	1	0.0276
Miscellaneous							
<i>Atractides</i> sp.							
<i>Sperchon</i> sp.							
<i>Crangonyx</i> sp.							
<i>Gammarus</i> sp.	7	2	10		6.33	1	0.6298
<i>Potamopyrgus antipodarum</i>							
<i>Physa</i> sp.							
<i>Asellus</i> sp.							
<i>Dugesia</i> sp.							
Erpobdellidae							
Enchytraeidae							
Lumbricidae							
Naididae	1				0.33	1	0.0552
Tubificidae w/out hair chaetae							
Nematoda							
Totals	46	35	100		60.33	23	4.66

Table D6. Macroinvertebrate data collected from site SVSC-LTD on 30 Sept 2024.

Little Thompson River							
SVSC-LTD		Sample					
30 Sept. 2024	1	2	3		Mean	Count	HBI
Ephemeroptera							
<i>Ameletus</i> sp.							
<i>Acentrella insignificans</i>							
<i>Baetis flavistriga</i>	3				1.00	1	0.0383
<i>Baetis notos</i>							
<i>Baetis tricaudatus</i>	1		1		0.67	1	0.0319
<i>Diphetero hageni</i>							
<i>Fallceon quilleri</i>	1		1		0.67	1	0.0256
<i>Drunella doddsi</i>							
<i>Drunella grandis</i>							
<i>Ephemerella dorothea infrequens</i>							
<i>Serratella micheneri</i>							
<i>Epeorus longimanus</i>			3		1.00	1	0.0192
<i>Heptagenia</i> sp.							
<i>Rhithrogena</i> sp.							
<i>Tricorythodes explicatus</i>		1			0.33	1	0.0160
<i>Paraleptophlebia</i> sp.							
Plecoptera							
<i>Triznaka</i> sp.							
<i>Zapada cinctipes</i>							
<i>Claassenia sabulosa</i>							
<i>Cultus</i> sp.							
<i>Isoperla</i> sp.	1				0.33	1	0.0064
<i>Isoperla fulva</i>							
<i>Skwala americana</i>							
<i>Pteronarcella badia</i>							
<i>Pteronarcys californica</i>							
Trichoptera							
<i>Brachycentrus americanus</i>							
<i>Brachycentrus occidentalis</i>							
<i>Culoptila</i> sp.							
<i>Glossosoma</i> sp.							
<i>Protophila</i> sp.							
<i>Arctopsyche grandis</i>							
<i>Ceratopsyche morosa</i>	10	3	16		9.67	1	0.1853
<i>Cheumatopsyche</i> sp.	30	7	38		25.00	1	1.4377
<i>Hydropsyche cockerelli</i>							
<i>Hydropsyche occidentalis</i>							
<i>Hydropsyche oslari</i>							
<i>Leucotrichia</i> sp.	2	3	19		8.00	1	0.4601
<i>Lepidostoma</i> sp.							
<i>Oecetis</i> sp.							
<i>Psychomyia flava</i>							
<i>Rhyacophila coloradensis</i>							

Table D6 cont. Macroinvertebrate data collected from site SVSC-LTD on 30 Sept 2024.

Diptera							
Chironomidae							
<i>Cardiocladius</i> sp.							
<i>Corynoneura</i> sp.							
<i>Cricotopus/Orthocladius</i> sp.			1		0.33	1	0.0192
<i>Eukiefferiella</i> sp.							
<i>Nanocladius</i> sp.							
<i>Pagastia</i> sp.							
<i>Parametriocnemus</i> sp.							
<i>Paratanytarsus</i> sp.							
<i>Polypedilum</i> sp.							
<i>Potthastia</i> sp.							
<i>Pseudorthocladius</i> sp.							
<i>Rheocricotopus</i> sp.							
<i>Rheotanytarsus</i> sp.							
<i>Synorthocladius</i> sp.							
<i>Thienemanniella</i> sp.							
<i>Thienemannimyia</i> group							
<i>Tvetenia</i> sp.	1	2			1.00	1	0.0479
Other Diptera							
<i>Atherix pachypus</i>							
<i>Bibiocephala grandis</i>							
<i>Hemerodromia</i> sp.							
<i>Simulium</i> sp.							
<i>Hexatoma</i> sp.							
Coleoptera							
<i>Optioservus</i> sp.							
<i>Zaitzevia parvula</i>							
Lepidoptera							
<i>Petrophila</i> sp.							
Miscellaneous							
<i>Atractides</i> sp.							
<i>Sperchon</i> sp.							
<i>Crangonyx</i> sp.							
<i>Gammarus</i> sp.	47	40	60		49.00	1	2.8179
<i>Potamopyrgus antipodarum</i>							
<i>Physa</i> sp.							
<i>Asellus</i> sp.							
<i>Dugesia</i> sp.	8		13		7.00	1	0.4026
Erpobdellidae							
Enchytraeidae							
Lumbricidae			1		0.33	1	0.0192
Naididae							
Tubificidae w/out hair chaetae							
Nematoda							
Totals	104	56	153		104.33	14	5.53

Table D7. Macroinvertebrate data collected from site SVSC-SVU on 30 Sept 2024.

St. Vrain Creek							
SVSC-SVU		Sample					
30 Sept. 2024	1	2	3		Mean	Count	HBI
Ephemeroptera							
<i>Ameletus</i> sp.			1		0.33	1	0.0000
<i>Acentrella insignificans</i>		2	1		1.00	1	0.0074
<i>Baetis flavistriga</i>							
<i>Baetis notos</i>							
<i>Baetis tricaudatus</i>	40	79	51		56.67	1	0.5247
<i>Diphetero hageni</i>							
<i>Fallceon quilleri</i>							
<i>Drunella doddsi</i>							
<i>Drunella grandis</i>	3		5		2.67	1	0.0000
<i>Ephemerella dorothea infrequens</i>	20	92	44		52.00	1	0.0963
<i>Serratella micheneri</i>							
<i>Epeorus longimanus</i>	2	7	6		5.00	1	0.0185
<i>Heptagenia</i> sp.							
<i>Rhithrogena</i> sp.							
<i>Tricorythodes explicatus</i>							
<i>Paraleptophlebia</i> sp.	1	7	7		5.00	1	0.0093
Plecoptera							
<i>Triznaka</i> sp.							
<i>Zapada cinctipes</i>							
<i>Claassenia sabulosa</i>	1	3	4		2.67	1	0.0148
<i>Cultus</i> sp.							
<i>Isoperla</i> sp.							
<i>Isoperla fulva</i>							
<i>Skwala americana</i>							
<i>Pteronarcella badia</i>		2			0.67	1	0.0000
<i>Pteronarcys californica</i>		1			0.33	1	0.0000
Trichoptera							
<i>Brachycentrus americanus</i>	5	13	6		8.00	1	0.0148
<i>Brachycentrus occidentalis</i>	1	9	4		4.67	1	0.0086
<i>Culoptila</i> sp.	62	219	125		135.33	1	0.0000
<i>Glossosoma</i> sp.	16	43	177		78.67	1	0.0000
<i>Protophila</i> sp.	1	35	76		37.33	1	0.0691
<i>Arctopsyche grandis</i>			1		0.33	1	0.0012
<i>Ceratopsyche morosa</i>							
<i>Cheumatopsyche</i> sp.	1	1			0.67	1	0.0074
<i>Hydropsyche cockerelli</i>			2		0.67	1	0.0049
<i>Hydropsyche occidentalis</i>	21	84	50		51.67	1	0.3827
<i>Hydropsyche oslari</i>		2	1		1.00	1	0.0074
<i>Leucotrichia</i> sp.							
<i>Lepidostoma</i> sp.	12	78	15		35.00	1	0.2593
<i>Oecetis</i> sp.			1		0.33	1	0.0049
<i>Psychomyia flava</i>							
<i>Rhyacophila coloradensis</i>			1		0.33	1	0.0006

Table D7 cont. Macroinvertebrate data collected from site SVSC-SVU on 30 Sept 2024.

Diptera							
Chironomidae							
<i>Cardiocladius</i> sp.							
<i>Corynoneura</i> sp.							
<i>Cricotopus/Orthocladius</i> sp.		1			0.33	1	0.0037
<i>Eukiefferiella</i> sp.		4	1		1.67	1	0.0247
<i>Nanocladius</i> sp.			1		0.33	1	0.0019
<i>Pagastia</i> sp.							
<i>Parametriocnemus</i> sp.							
<i>Paratanytarsus</i> sp.							
<i>Polypedilum</i> sp.		4	2		2.00	1	0.0222
<i>Potthastia</i> sp.	2	2			1.33	1	0.0099
<i>Pseudorthocladius</i> sp.							
<i>Rheocricotopus</i> sp.							
<i>Rheotanytarsus</i> sp.							
<i>Synorthocladius</i> sp.							
<i>Thienemanniella</i> sp.							
<i>Thienemannimyia</i> group							
<i>Tvetenia</i> sp.	1	9	2		4.00	1	0.0370
Other Diptera							
<i>Atherix pachypus</i>							
<i>Bibiocephala grandis</i>							
<i>Hemerodromia</i> sp.							
<i>Simulium</i> sp.	1	3			1.33	1	0.0148
<i>Hexatoma</i> sp.		1			0.33	1	0.0012
Coleoptera							
<i>Optioservus</i> sp.	9	50	23		27.33	1	0.2025
<i>Zaitzevia parvula</i>	1	21	7		9.67	1	0.0716
Lepidoptera							
<i>Petrophila</i> sp.							
Miscellaneous							
<i>Atractides</i> sp.		1	1		0.67	1	0.00987654
<i>Sperchon</i> sp.	3	3	8		4.67	1	0.0519
<i>Crangonyx</i> sp.							
<i>Gammarus</i> sp.							
<i>Potamopyrgus antipodarum</i>							
<i>Physa</i> sp.							
<i>Asellus</i> sp.			1		0.33	1	0.0049
<i>Dugesia</i> sp.		9	7		5.33	1	0.0593
Erpobdellidae							
Enchytraeidae	1				0.33	1	0.0062
Lumbricidae							
Naididae							
Tubificidae w/out hair chaetae							
Nematoda							
Totals	204	785	631		540.00	38	1.95

Table D8. Macroinvertebrate data collected from site SVSC-SVD on 30 Sept 2024.

St. Vrain Creek							
SVSC-SVD		Sample					
30 Sept. 2024	1	2	3		Mean	Count	HBI
Ephemeroptera							
<i>Ameletus</i> sp.							
<i>Acentrella insignificans</i>		1			0.33	1	0.0024
<i>Baetis flavistriga</i>	4	1	1		2.00	1	0.0142
<i>Baetis notos</i>							
<i>Baetis tricaudatus</i>	53	154	181		129.33	1	1.1513
<i>Diphetero hageni</i>			1		0.33	1	0.0030
<i>Fallceon quilleri</i>							
<i>Drunella doddsi</i>							
<i>Drunella grandis</i>	1	5	2		2.67	1	0.0000
<i>Ephemerella dorothea infrequens</i>	69	114	68		83.67	1	0.1490
<i>Serratella micheneri</i>							
<i>Epeorus longimanus</i>	8	7	7		7.33	1	0.0261
<i>Heptagenia</i> sp.							
<i>Rhithrogena</i> sp.		1			0.33	1	0.0000
<i>Tricorythodes explicatus</i>		3	1		1.33	1	0.0119
<i>Paraleptophlebia</i> sp.	17	5	13		11.67	1	0.0208
Plecoptera							
<i>Triznaka</i> sp.	1				0.33	1	0.0006
<i>Zapada cinctipes</i>	1		1		0.67	1	0.0024
<i>Claassenia sabulosa</i>	1	5	2		2.67	1	0.0142
<i>Cultus</i> sp.							
<i>Isoperla</i> sp.	4	2	2		2.67	1	0.0095
<i>Isoperla fulva</i>	1		1		0.67	1	0.0024
<i>Skwala americana</i>							
<i>Pteronarcella badia</i>			2		0.67	1	0.0000
<i>Pteronarcys californica</i>							
Trichoptera							
<i>Brachycentrus americanus</i>	2	4			2.00	1	0.0036
<i>Brachycentrus occidentalis</i>	8	4	7		6.33	1	0.0113
<i>Culoptila</i> sp.	11	30	23		21.33	1	0.0000
<i>Glossosoma</i> sp.	9	13	31		17.67	1	0.0000
<i>Protoptila</i> sp.		2	1		1.00	1	0.0018
<i>Arctopsyche grandis</i>			2		0.67	1	0.0024
<i>Ceratopsyche morosa</i>	3	3			2.00	1	0.0071
<i>Cheumatopsyche</i> sp.	1				0.33	1	0.0036
<i>Hydropsyche cockerelli</i>	1	1	2		1.33	1	0.0095
<i>Hydropsyche occidentalis</i>	67	230	220		172.33	1	1.2273
<i>Hydropsyche oslari</i>	1	11	4		5.33	1	0.0380
<i>Leucotrichia</i> sp.	1				0.33	1	0.0036
<i>Lepidostoma</i> sp.	13	25	16		18.00	1	0.1282
<i>Oecetis</i> sp.							
<i>Psychomyia flava</i>							
<i>Rhyacophila coloradensis</i>							

Table D8 cont. Macroinvertebrate data collected from site SVSC-SVD on 30 Sept 2024.

Diptera							
Chironomidae							
<i>Cardiocladius</i> sp.							
<i>Corynoneura</i> sp.		1			0.33	1	0.0042
<i>Cricotopus/Orthocladius</i> sp.		2			0.67	1	0.0071
<i>Eukiefferiella</i> sp.	6	24	10		13.33	1	0.1899
<i>Nanocladius</i> sp.	1	2	1		1.33	1	0.0071
<i>Pagastia</i> sp.							
<i>Parametriocnemus</i> sp.							
<i>Paratanytarsus</i> sp.							
<i>Polypedilum</i> sp.		2			0.67	1	0.0071
<i>Potthastia</i> sp.	1	5	2		2.67	1	0.0190
<i>Pseudorthocladius</i> sp.							
<i>Rheocricotopus</i> sp.							
<i>Rheotanytarsus</i> sp.		1			0.33	1	0.0036
<i>Synorthocladius</i> sp.	3				1.00	1	0.0036
<i>Thienemanniella</i> sp.	2	2	1		1.67	1	0.0178
<i>Thienemannimyia</i> group		1			0.33	1	0.0036
<i>Tvetenia</i> sp.	7	15	10		10.67	1	0.0950
Other Diptera							
<i>Atherix pachypus</i>			2		0.67	1	0.0024
<i>Bibiocephala grandis</i>							
<i>Hemerodromia</i> sp.			1		0.33	1	0.0036
<i>Simulium</i> sp.	1		1		0.67	1	0.0071
<i>Hexatoma</i> sp.							
Coleoptera							
<i>Optioservus</i> sp.	16	32	17		21.67	1	0.1543
<i>Zaitzevia parvula</i>	3	6			3.00	1	0.0214
Lepidoptera							
<i>Petrophila</i> sp.		2			0.67	1	0.0059
Miscellaneous							
<i>Atractides</i> sp.							
<i>Sperchon</i> sp.	1		1		0.67	1	0.0071
<i>Crangonyx</i> sp.		1			0.33	1	0.0042
<i>Gammarus</i> sp.							
<i>Potamopyrgus antipodarum</i>	1				0.33	1	0.0047
<i>Physa</i> sp.		1			0.33	1	0.0047
<i>Asellus</i> sp.							
<i>Dugesia</i> sp.	1	5	2		2.67	1	0.0285
Erpobdellidae							
Enchytraeidae							
Lumbricidae		1			0.33	1	0.0036
Naididae		3	2		1.67	1	0.0297
Tubificidae w/out hair chaetae							
Nematoda							
Totals	320	727	638		561.67	53	3.48