2025 Learning By Doing Benthic Macroinvertebrate Biomonitoring Summary Report

Prepared for:
Grand County
Learning By Doing Stakeholder Group

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1. Introduction

Rivers and streams represent one of the most valuable natural resources in the state of Colorado by supporting aquatic and terrestrial life in both rural and urban regions. The protection and maintenance of the biological integrity of these waterways is a fundamental responsibility of our society.[1] Unfortunately, human impacts on water quality and quantity can pose major threats to river systems and the aquatic life they support.[2] Historically, urban development of human populations in the United States has occurred near river systems,[3] which often results in a variety of negative impacts to aquatic communities.[4–7] One way to evaluate the impact of human development on rivers and streams involves assessing water quality. Biomonitoring benthic macroinvertebrates is often considered an integral part of these water quality assessment protocols.[8–14]

Biomonitoring aquatic life in streams allows for a scientific and defensible assessment of aquatic conditions that cannot be effectively accomplished through other types of monitoring programs (such as chemical or physical). Ecological pressures and evolution have resulted in benthic macroinvertebrate communities with specific requirements and responses to the dynamic environments in which they live.[15–17] These aquatic organisms exhibit well-documented sensitivities to a wide range of environmental disturbances and pollution. Furthermore, macroinvertebrate community composition typically reflects the physical and chemical conditions that occur within a stream and associated watershed over time.[9,18,19] Additionally, most macroinvertebrate taxa have limited mobility and a relatively long aquatic life stage.[16,20] Due to these unique characteristics, changes in macroinvertebrate community structure and function can help identify sources of stress, ranging from local sources of pollution to watershed-scale disturbance, thereby providing opportunities for the assessment, management, and protection of aquatic resources.[9,21]

The Grand County Learning By Doing (LBD) biomonitoring study was designed to monitor and assess the health of aquatic life in a portion of the Upper Colorado River Basin in Grand County, Colorado. The specific study area includes sampling locations on several streams including segments of the Fraser River, Vasquez Creek, Ranch Creek, Willow Creek, Williams Fork, and Colorado River (**Table 1**; **Figure 1**). These streams support a variety of aquatic and terrestrial life; however, there are several potential sources of anthropogenic stress ranging from impoundments (which alter the natural temperature and flow regime) to runoff from roads, agricultural areas, urbanized areas, and portions of the watershed that were previously burned in a wildfire. Results from this study are used to provide an assessment of benthic macroinvertebrate community structure and function at specific locations within the study area.

2. Objective

The main objective for the LBD Benthic Macroinvertebrate Bioassessment Study in Grand County, Colorado, was to provide an overall evaluation of the health of benthic macroinvertebrate communities at each study site in the project area, and to identify stream segments and specific locations affected by potential anthropogenic perturbations.

3. 2025 Key Findings

Some notable observations from 2025 sampling include:

1. One sampling location, WC-2.3 (Willow Creek upstream of Bunte Highline Ditch Diversion), obtained a Multi Metric Index (MMI) (v5) score indicating impairment and two sampling locations, WC-2.3 and WF-5.5 (Williams Fork above Williams Fork Reservoir), obtained MMI (v4) scores indicating impairment; all other sampling locations were well above the attainment threshold for both versions of the MMI (v4 and v5).
2. The Hilsenhoff Biotic Index (HBI) values in the Colorado River and Williams Fork study areas were above average and/or higher than the upper bound of the standard deviation at most sampling locations (Figure 13). This indicates that the macroinvertebrate community comprises a higher proportion of nutrient-tolerant taxa and the perturbation appears to be across the watershed. It is possible runoff from the 2020 East Troublesome and Williams Fork fires continue to impact on the macroinvertebrate communities and could influence the assemblages up to 10 years post-fire.[22–25]
3. The giant stonefly, *Pteronarcys californica*, was collected at four sites in the study area: CR-28.7 (Colorado River downstream of Windy Gap Reservoir), CR-16.7 (Colorado River upstream of Williams Fork), CR-R3 (Colorado River at Reach 3 downstream from bridge), and CR-9.1 (Colorado River at CR39 Bridge – KB Ditch). This species is typically associated with cold, well-oxygenated streams and is sensitive to habitat degradation and declining water quality. Its presence at multiple sampling sites suggests the availability of suitable habitat conditions and provides an important indicator of stream ecosystem health.

4. Study Area

In fall 2025, benthic macroinvertebrate data from three different biomonitoring studies (LBD, Denver Water, and Northern Water) were compiled to assist in the evaluation of aquatic life in the Upper Colorado River and Fraser River basins in Grand County, Colorado. A comprehensive evaluation of spatial changes in benthic macroinvertebrate community health was made possible by the coordinated efforts provided by LBD, Denver Water, and Northern Water.

4.1 Learning By Doing Cooperative Effort Area Study Sites

In 2025, the LBD Cooperative Effort Area (CEA) included a total of 20 study sites: five on the Fraser River, one on Ranch Creek, one on Vasquez Creek, two on Willow Creek, one on the Williams Fork, and ten on the Colorado River (see Table 1 and Figure 1). On the Fraser River, LBD monitored the most upstream study site (FR-27.2), which was located in riffle habitat upstream of Jim Creek and the Union Pacific Railroad (UPRR) Moffat Tunnel. Farther downstream, site (FR-25.1) was located upstream of Winter Park and the UPRR Moffat Tunnel. One study site, RC-1.1, was also sampled on Ranch Creek (a tributary to the Fraser River) downstream from Meadow Creek.

LBD was also responsible for macroinvertebrate sampling at several locations along the Colorado River and associated tributaries. In fall 2025, study sites on tributaries of the Colorado River included two sampling locations on Willow Creek and one site on the Williams Fork. The most upstream site on Willow Creek (WC-2.3) was located upstream of the Bunte Highline Ditch Diversion, while the downstream site (WC-0.5) was used to assess the macroinvertebrate community structure in Willow Creek upstream from the Colorado River (see Table 1 and **Figure 3**). The single study site on the Williams Fork (WF-5.5) was strategically positioned immediately upstream of the reservoir at a location that would assist in the evaluation of a recent habitat improvement project.

LBD sampling locations on the Colorado River include site CRCC-0.5 on the Colorado River Connectivity Channel (CRCC); site CR-9.1, located upstream from the CR39 Bridge; and site CR-1.7, established upstream from the confluence with the Blue River near the Town of Kremmling (see Table 1 and Figure 3). Several other sampling locations along the Fraser and Colorado rivers were sampled as part of the Denver Water and Northern Water biomonitoring studies. Results from these studies were used to provide supplementary information within the LBD CEA.

4.2 Denver Water Study Sites

For the Denver Water biomonitoring study, benthic macroinvertebrates were collected from three sampling locations on the Fraser River and one study site on Vasquez Creek during fall 2025 (see

Table 1 and **Figure 2**). These four study sites were selected to monitor benthic macroinvertebrate communities at locations that have historically (prior to 2018) produced low MMI (v3) scores, some resulting in "impairment" designations. Denver Water's most upstream study site on the Fraser River (FR-23.2) was established immediately upstream from the Winter Park Water and Sanitation District (Figure 2). Site VC-0 (also known as VC-WP) was located on Vasquez Creek immediately upstream from its confluence with the Fraser River within the Town of Winter Park (Figure 2). Downstream from the confluence of the Fraser River and Vasquez Creek, sites FR-20 and FR-14 were used to assess potential influences from a variety of anthropogenic sources, including runoff from roads and urbanized areas, water diversions, elevated stream temperatures, and habitat improvement projects.

4.3 Northern Water Study Sites

Study sites for the Northern Water Conservancy District (Northern Water) included seven sampling locations on the Colorado River in 2025 (see Table 1 and Figure 3). Four of the sites have been routinely sampled as part of the Windy Gap Firming Project (WGFP) for the last eight years to assess the influence of Windy Gap Reservoir operations on benthic macroinvertebrate communities. These sites include site CR-31.0 (WGU), located immediately upstream from Windy Gap Reservoir; site CR-28.7 (WGD) approximately 1.7 km downstream from Windy Gap Reservoir at River Mile 28.7; and sites CR-22.1 (HSPP) and CR-16.7 (WFU), both located farther downstream on the Colorado River at River Miles 22.1 and 16.7, respectively. The other three sampling locations were established in 2020 and are sampled intermittently to assess the effects of a habitat improvement project and include site CR-bWF, the reference site located downstream from the confluence of the Williams Fork and Colorado River and upstream from the Habitat Project construction; site CR-R3, located near a wing deflector in Reach 3 of the habitat improvement area; and site CR-R4, established in a riffle near the lower boundary of the habitat improvements (see Table 1 and Figure 3).

Table 1. Learning By Doing, Denver Water, and Northern Water biomonitoring study sites in the Upper Colorado River Basin during fall 2025.

Station ID	Monitoring Project	Location	Latitude	Longitude
FR-27.2	Learning By Doing	Fraser River above Jim Creek	39.84536	-105.75177
FR-25.1	Learning By Doing	Fraser River above UP Moffat Tunnel	39.8775	-105.7535
FR-23.2	Denver Water	Fraser River above Winter Park Sanitation District	39.89445	-105.76821
VC-0 (WP)	Denver Water	Vasquez Creek at Winter Park	39.9203	-105.78498
FR-20	Denver Water	Fraser River at Rendezvous Bridge	39.93412	-105.7896
FR-14	Denver Water	Fraser River at Tabernash below bridge on CR83	39.99053	-105.8299
RC-1.1	Learning By Doing	Ranch Creek below Meadow Creek	39.99912	-105.82746
WC-2.3	Learning By Doing	Willow Creek upstream Bunte Highline Ditch Diversion	40.13765	-105.9284
WC-0.5	Learning By Doing	Willow Creek upstream Colorado River	40.12963	-105.91741
CR-31.0	Northern Water	Colorado River upstream of Windy Gap Reservoir	40.10045	-105.97248
CRCC-0.5	Learning By Doing	Colorado River in Connectivity Channel	40.10391	-105.98517
CR-28.7	Northern Water	Colorado River downstream of Windy Gap Reservoir	40.10830	-106.00356
CR-22.1	Northern Water	Colorado River near Hot Sulphur Springs	40.07394	-106.10959
CR-16.7	Northern Water	Colorado River upstream of Williams Fork	40.04689	-106.14299
WF-5.5	Learning By Doing	Williams Fork above Williams Fork Reservoir	39.99293	-106.17079
CR-bWF	Northern Water	Colorado River below Williams Fork	40.06262	-106.18113
CR-R3	Northern Water	Colorado River at Reach 3 downstream from bridge	40.06300	-106.19860
CR-R4	Northern Water	Colorado River at Reach 4 downstream from bridge	40.0623	-106.20423
CR-9.1	Learning By Doing	Colorado River at CR39 Bridge - KB Ditch	40.05377	-106.28945
CR-1.7	Learning By Doing	Colorado River above Blue River	40.0465	-106.373

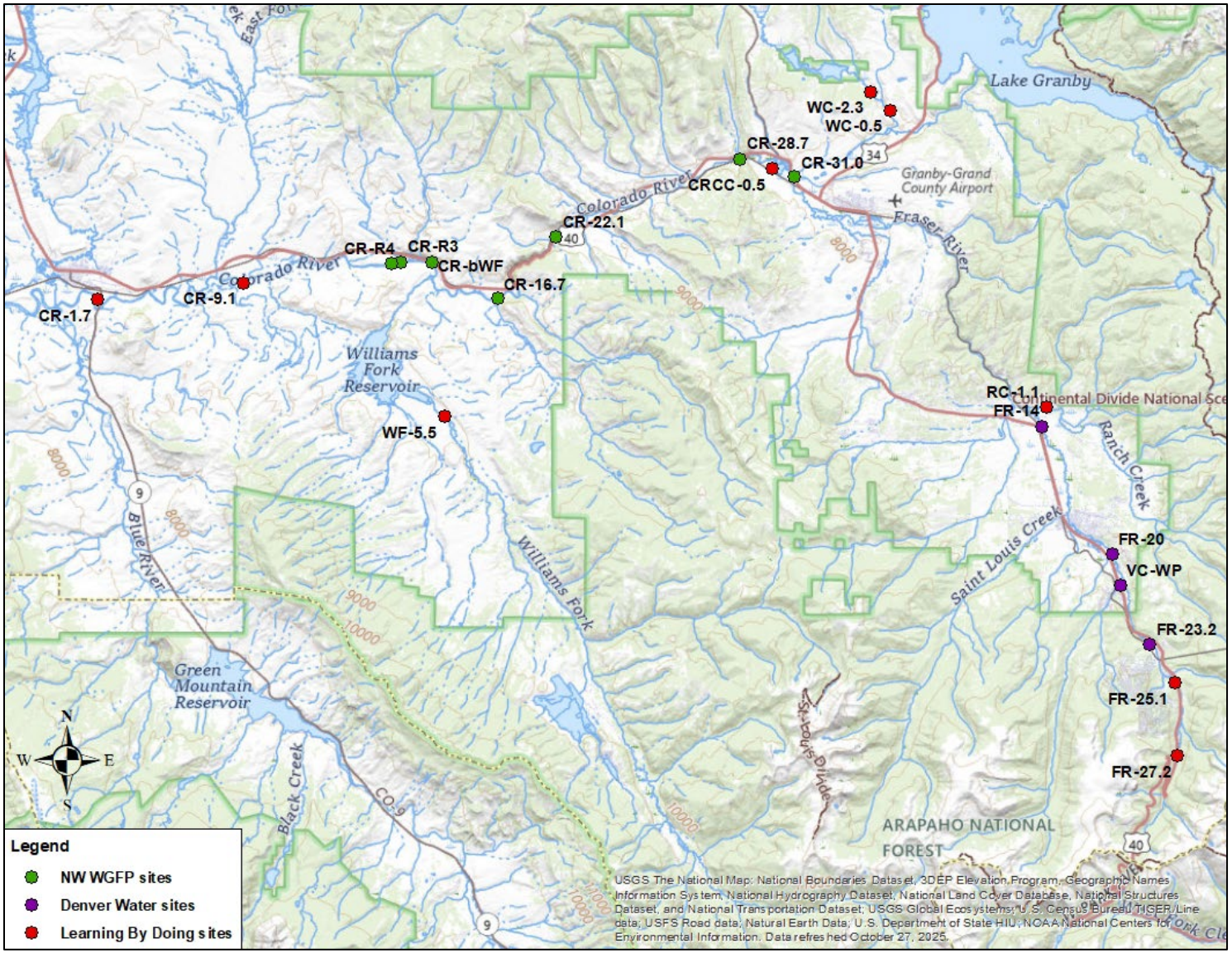

Figure 1. 2025 Learning By Doing, Denver Water, and Northern Water biomonitoring sites.

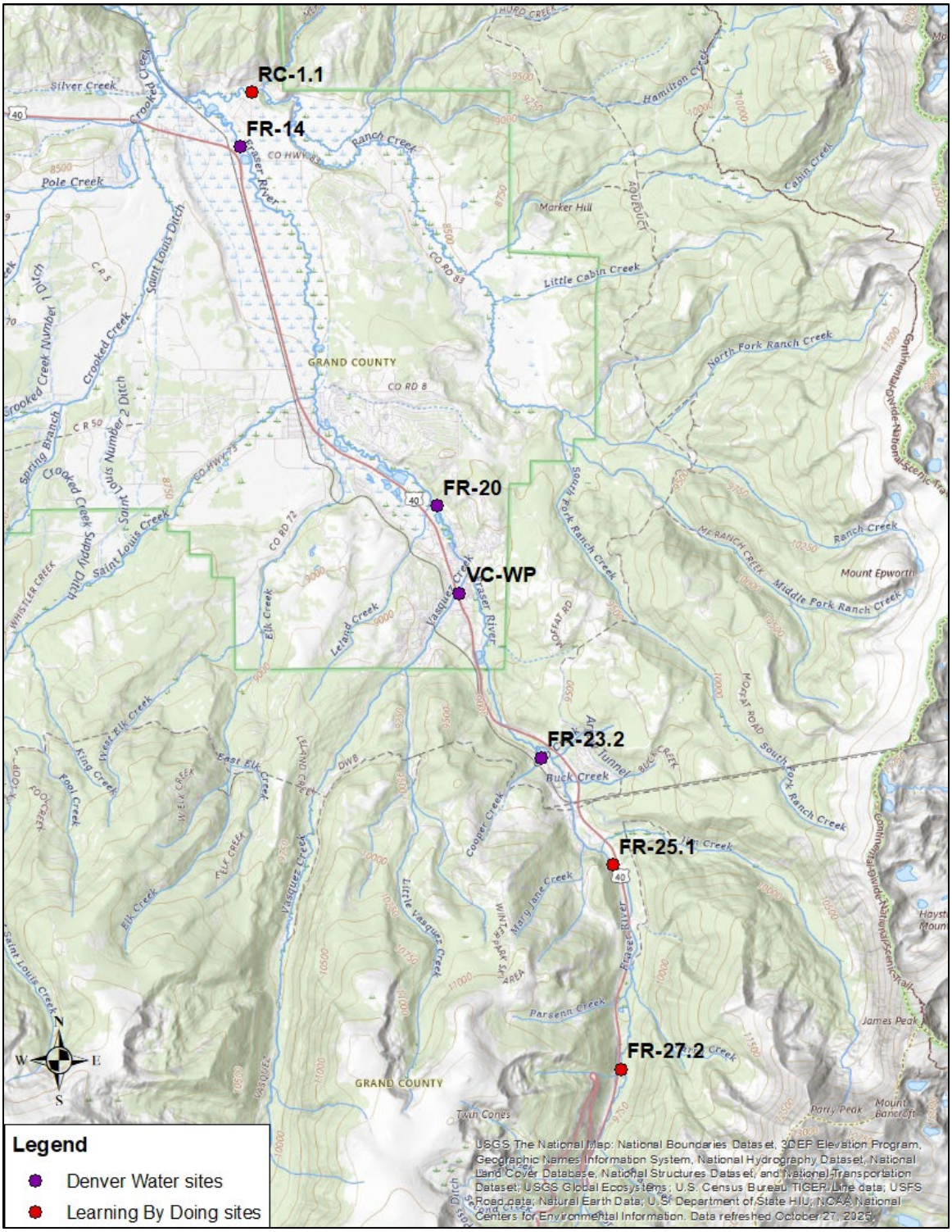

Figure 2. Learning By Doing and Denver Water biomonitoring study sites in the Fraser River drainage during the fall of 2025.

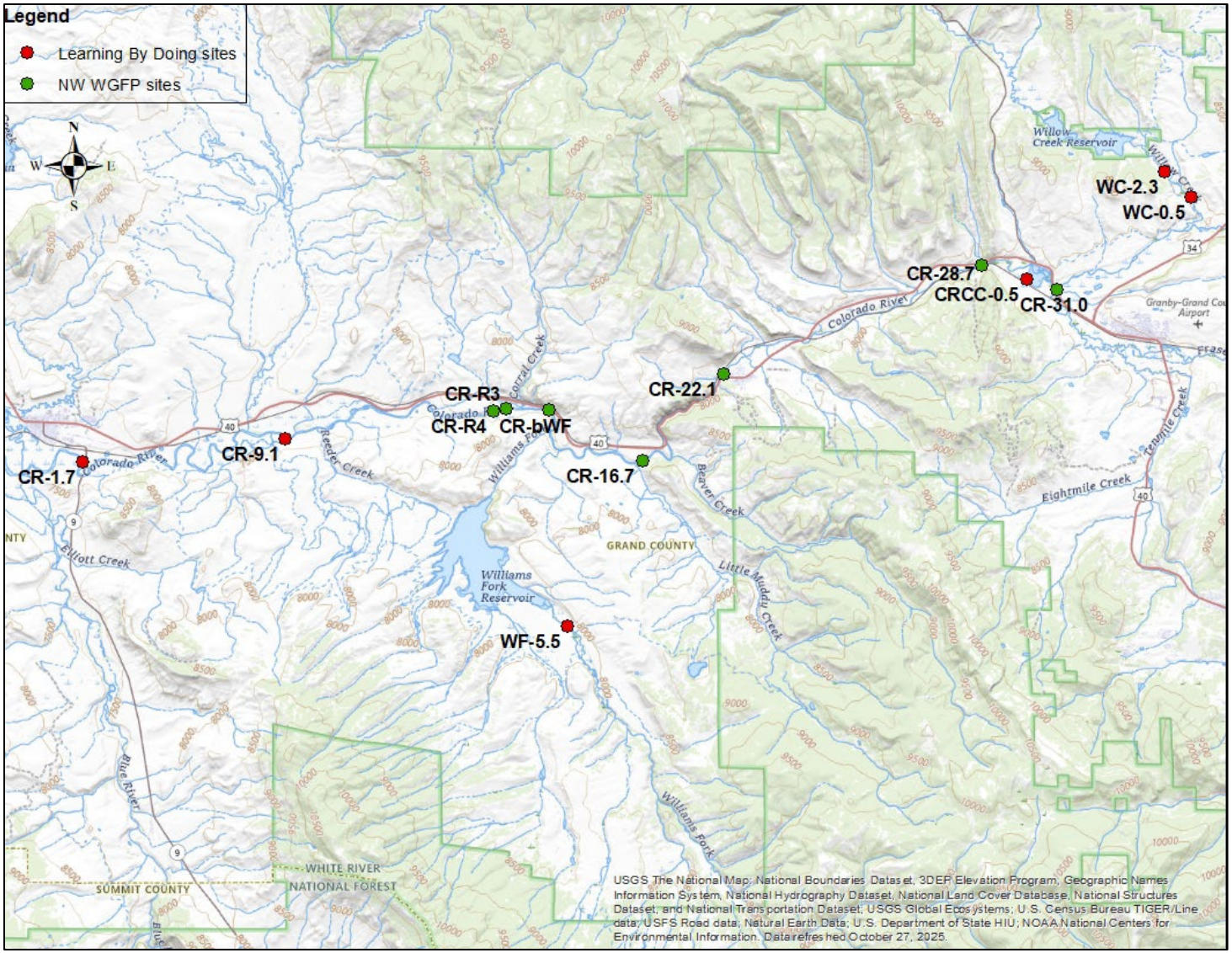

Figure 3. Learning By Doing and Northern Water biomonitoring study sites on Colorado River, Willow Creek and Williams Fork in the fall of 2025.

5. Results and Discussion

5.1 Benthic Macroinvertebrate Sampling

In September 2025, benthic macroinvertebrate samples were collected from 20 sampling locations in the Upper Colorado River Basin in Grand County, Colorado, for LBD, Denver Water, and Northern Water. Data and results from these three projects were shared to provide a comprehensive evaluation of macroinvertebrate community structure and function in the Fraser River, Vasquez Creek, Ranch Creek, Willow Creek, Colorado River, and Williams Fork. Following collection, samples were sorted, identified, and enumerated (**Appendix A, B, and C**).

A variety of metrics and analysis tools (**Appendix G**) were applied to the macroinvertebrate data to provide a detailed assessment of community structure and function within the study area (See **Tables 2-11**). Results provided by select metrics (MMI v4 and v5, Diversity, HBI, EPT, and % EPT-excluding Baetidae) were also used to illustrate differences or similarities in community parameters among sites (**Figures 4-17**). Both MMI v4 and v5 scores are presented to maintain continuity with previously reported biological assessments while incorporating the current assessment methodology. All 2025 benthic macroinvertebrate samples were evaluated using MMI v5; however, MMI v5 scores are not currently available for all historical sampling events. MMI v4 and MMI v5 are based on different index calibrations and incorporate different combinations of biological metrics used to calculate MMI scores; consequently, the two versions are not directly comparable. Both metrics are therefore reported where available to support interpretation of biological condition over time. The Functional Feeding Group analysis was used to provide an evaluation of ecological function (see Tables 10-11 and **Figures 18-19**). Results from 2025 sampling indicated that site WC-2.3 was impaired for aquatic life use according to MMI (v4 and v5), and site WF-5.5 also received a MMI (v4) impairment designation; all other sampling locations were in attainment. A detailed evaluation of data from individual metrics helps identify possible sources of stress.

5.2 Results from the Multi-Metric Index

5.2.1 Fraser River Study Area

The Fraser River study area consisted of seven sites: five on the Fraser River (FR-27.2, FR-25.1, FR-23.2, FR-20, and FR-14), one on Vasquez Creek (VC-0), and one on Ranch Creek (RC-1.1) (Table 2). Sites FR-27.2 and FR-25.1 were located in Biotype 2; all others were in Biotype 1 (Table 3). All sampling locations received MMI (v4 and v5) scores well above the attainment threshold for aquatic life use during 2025 sampling (see Tables 3 and 4, and Figures 4 and 5). MMI (v5) scores ranged from 61.7 to 86.9 at FR-23.2 and RC-1.1, respectively (Table 3). Running historical data through the newly

implemented MMI (v5) would allow for a more up-to-date comparison of historical changes throughout the stream segment; in 2025, the MMI (v4) is used for that purpose. All sampling locations in the Fraser River study area received MMI (v4) scores higher than their historical average, with five of the sites receiving higher scores than expected (based on the upper bounds of the standard deviation) (Figure 5). Additionally, four sites (FR-27.2, FR-25.1, VC-0, and FR-14) obtained the highest MMI (v4) scores recorded since sampling began in 2017 (see Figure 6). In general, scores from both versions of the MMI (v4 and v5) indicated that the Fraser River study area maintained healthy aquatic conditions for macroinvertebrate communities.

An evaluation of the auxiliary metrics (Diversity and HBI) and the Indicator Value (TIV) sediment scores further supported the MMI results, noting healthy aquatic conditions throughout the Fraser River study area (see Table 3). The Diversity value at each site demonstrated well-balanced communities throughout the study area, and sites FR-25.1 and FR-23.2 obtained higher values (4.52 and 4.30, respectively) in 2025 than the average of historical sampling events (see Figure 7). However, site RC-1.1 received a lower Diversity value than expected (3.34); a score that was likely impacted by the high abundance of *Lepidostoma* sp. (n = 730), *Culoptila* sp. (n = 280), and *Optioservus* sp. (n = 234) compared to other species at this site (see **Appendix A, Table A-3**). The HBI metric values suggested a limited presence of nutrient-tolerant individuals at all sampling locations, though one location (FR 27.2) obtained a higher score (worse) than anticipated when compared to previous years (see Figure 8). Finally, the TIV scores produced for the sites did not indicate any negative impacts from sedimentation, and variability in scores could probably be attributed to natural changes in habitat (e.g., stream size, gradient) (see Table 3). Overall, all sampling locations in the Fraser River study area obtained MMI (v4 and v5) scores that did not indicate substantial anthropogenic impacts at the time of sampling, and higher than average MMI (v4) scores were obtained at all sites.

Table 2. Aquatic life use designations based on MMI scores for sites in the Fraser River study area during fall of 2025.

Station ID	Monitoring Project	MMI v5	MMI v4
FR-27.2	Learning By Doing	Attainment	Attainment
FR-25.1	Learning By Doing	Attainment	Attainment
FR-23.2	Denver Water	Attainment	Attainment
VC-0	Denver Water	Attainment	Attainment
FR-20	Denver Water	Attainment	Attainment
FR-14	Denver Water	Attainment	Attainment
RC-1.1	Learning By Doing	Attainment	Attainment

Table 3. Individual metrics and MMI v5 scores from benthic macroinvertebrate samples collected in the Fraser River study area during the fall of 2025. All metric scores based on the MMI subsampling process. Any scores indicating 'impairment' are provided in *red*.[i]

Metric	Station ID						
	Biotype 2		Biotype 1				
	FR-27.2	FR-25.1	FR-23.2	VC-0	FR-20	FR-14	RC-1.1
TotalTax	85.0	100.0					
EPTTax	95.0	100.0	100.0	100.0	94.7	100.0	100.0
EPTnoBPct	78.3	59.5	38.1	62.2	21.9	61.6	100.0
PredTaxFAC	91.7	100.0					
ScrapPctFAC	61.5	54.7					
TolerPctTax	48.3	61.5					
ClngrPctTax	68.6	75.4	64.9	88.2	73.0	75.0	94.3
pi_ModDecrMtn	73.2	56.8					
ColeoPct			17.7	60.0	68.8	67.4	39.0
NonInPct			66.5	71.7	67.9	93.5	91.7
IntolPT			82.8	100.0	87.3	89.7	95.0
PredShrTaxFAC			80.0	100.0	100.0	86.7	80.0
pi_ModDecrTrans			43.2	66.3	50.7	80.6	94.9
MMI v5	**75.2**	**76.0**	**61.7**	**81.1**	**70.5**	**81.8**	**86.9**
Auxiliary Metrics							
Diversity	4.22	4.52	4.30	4.07	3.60	3.73	3.34
HBI	3.41	3.40	4.11	3.08	3.86	3.09	1.87
Sediment Region	SR1				SR2		
TIV	4.95	5.81	5.75	5.85	6.21	5.76	4.03

[i] Note: Auxiliary metrics shown in red indicate threshold exceedance for that metric only and do not necessarily signify overall site impairment.

Table 4. Individual metrics and MMI v4 scores from benthic macroinvertebrate samples collected in the Fraser River study area during the fall of 2025. All metric scores based on the MMI subsampling process. Any scores indicating 'impairment' are provided in *red*.[ii]

Metric	Station ID						
	Biotype 2		Biotype 1				
	FR-27.2	FR-25.1	FR-23.2	VC-0	FR-20	FR-14	RC-1.1
EPT taxa	77.6	100.0	83.3	100.0	75.0	79.2	79.2
% Non-Insect individuals			70.3	74.9	71.5	94.2	92.7
% EPT individuals, no Baetidae	75.2	57.2	37.3	60.9	21.4	60.3	100.0
% Coleoptera individuals			18.7	63.2	72.5	70.9	41.0
% Intolerant Taxa			79.9	100.0	84.2	86.5	91.6
% Increasers, Mid-Elevation			63.8	80.2	83.4	93.5	98.7
Clinger taxa	70.0	95.0	72.1	100.0	76.9	76.9	91.3
Predator/Shredder taxa			85.7	100.0	100.0	92.9	85.7
Total Taxa	81.0	100.0					
Intolerant Taxa	95.2	100.0					
% Increasers, Mountain Trn	68.2	54.3					
Predator Taxa	84.6	92.3					
% Scraper individuals	61.4	54.6					
MMI v4	**76.6**	**81.7**	**63.9**	**84.9**	**73.1**	**81.8**	**85.0**
Auxiliary Metrics							
Diversity	4.22	4.52	4.30	4.07	3.60	3.73	3.34
HBI	3.41	3.40	4.11	3.08	3.86	3.09	1.87

[ii] Note: Auxiliary metrics shown in red indicate threshold exceedance for that metric only and do not necessarily signify overall site impairment.

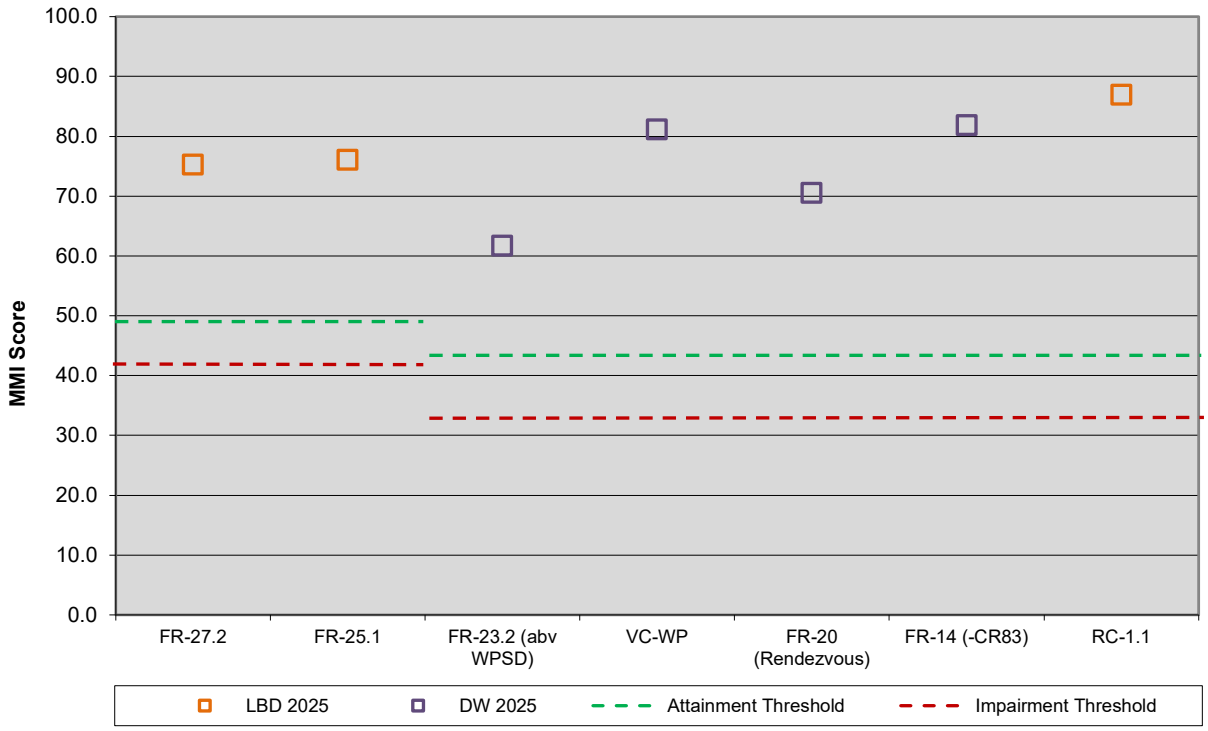

Figure 4. MMI v5 scores for the fall 2025 Fraser River study area.

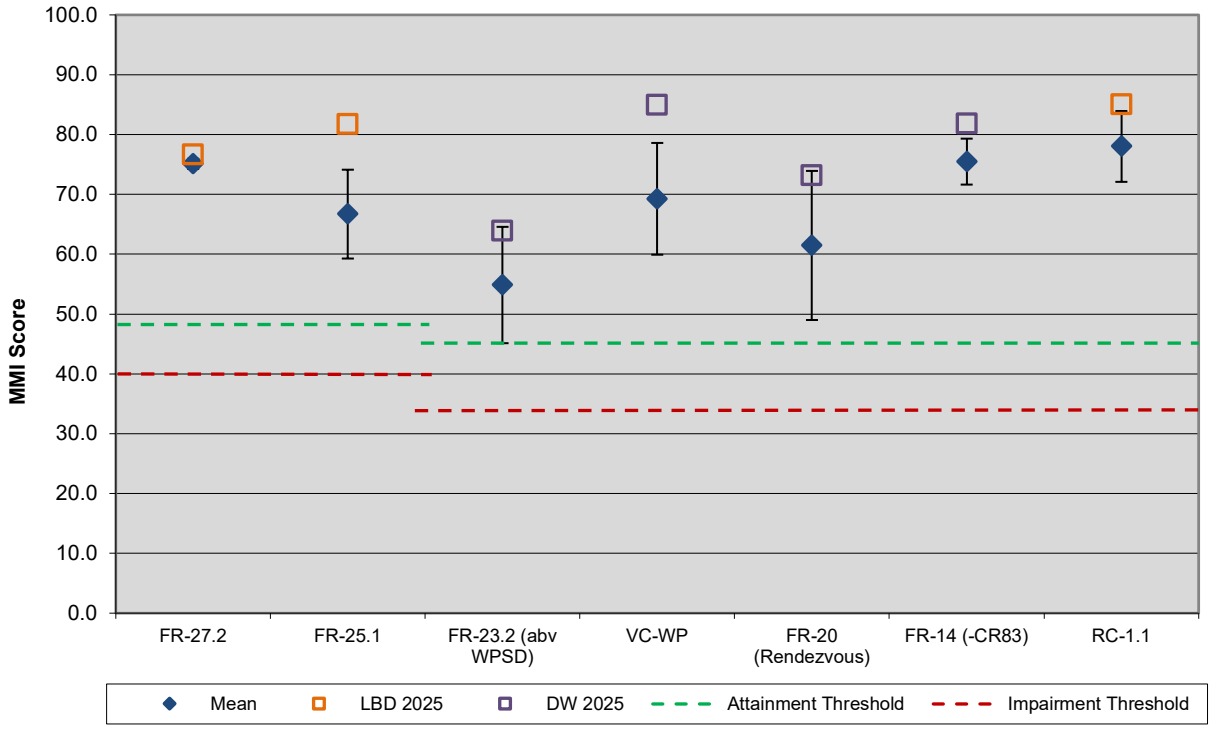

Figure 5. MMI v4 scores for the fall 2025 Fraser River study area and historical mean MMI scores (±1 SD).

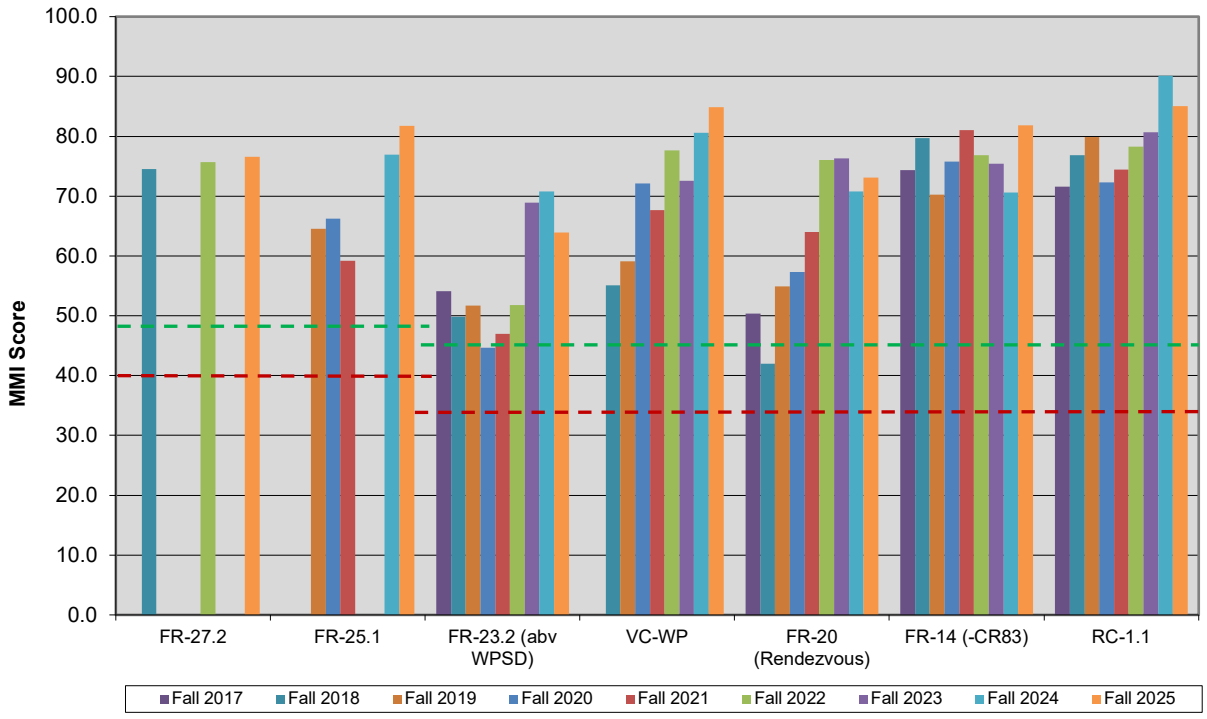

Figure 6. Historical MMI v4 scores for the Fraser River study area.

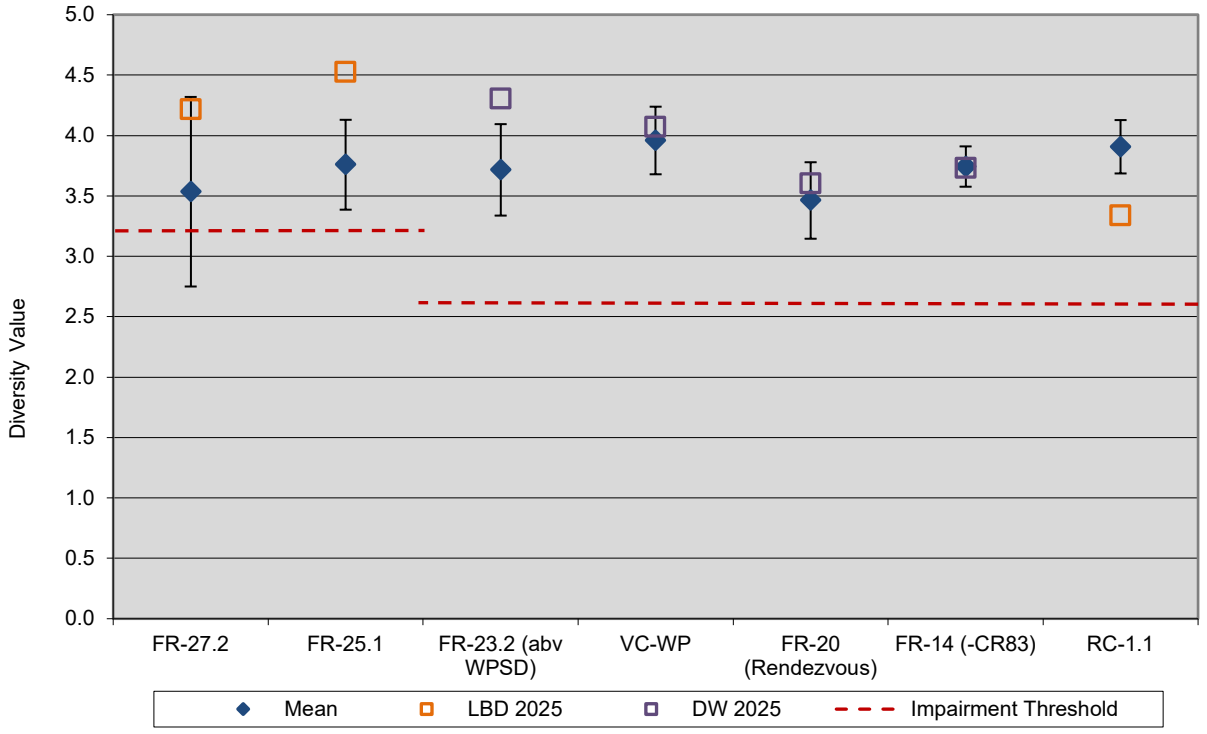

Figure 7. Diversity values in the fall 2025 Fraser River study area and mean Diversity values compared to historical means (±1 SD).

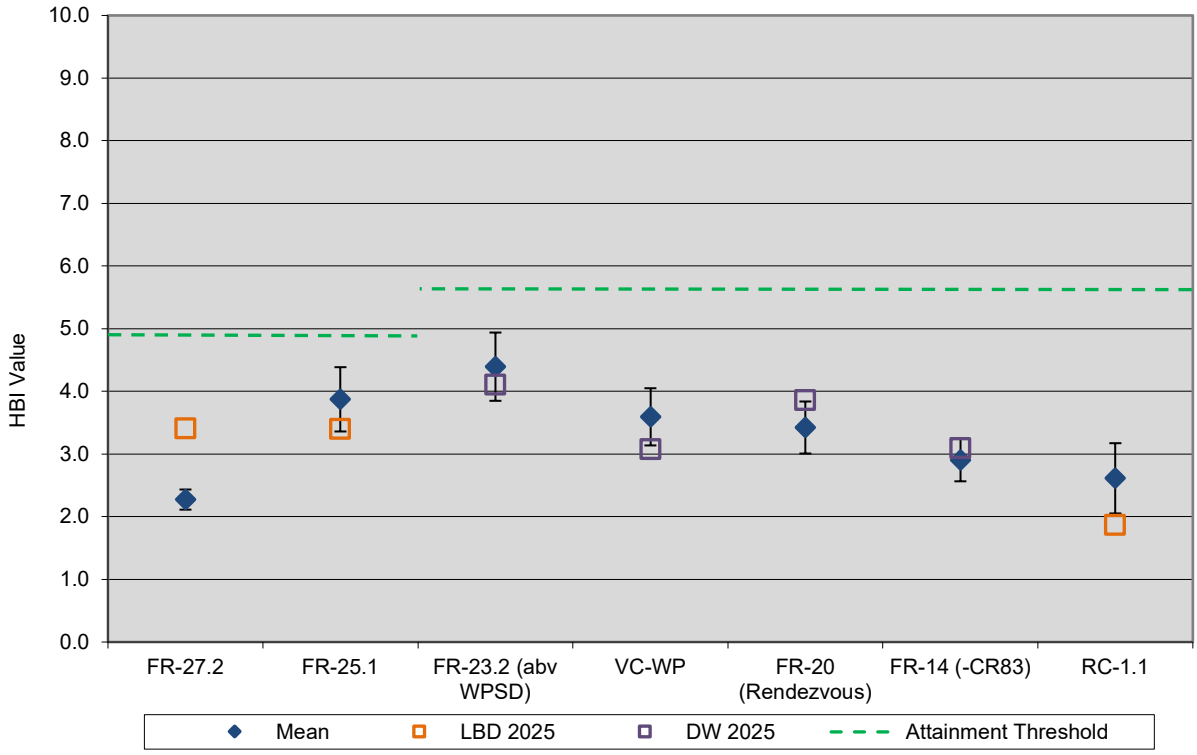

Figure 8. HBI values in the fall 2025 Fraser River study area and historical mean HBI values (±1 SD). HBI is inversely related to water quality, with lower scores indicating lower levels of organic pollution and better biological condition.

5.2.2 Colorado River and Williams Fork Study Area

In 2025, sampling in the Colorado River and Williams Fork Study Area consisted of thirteen sites: ten on the Colorado River, two on Willow Creek, and one on Williams Fork (see Table 5). Site CRCC-0.5 was established in 2024 on the recently completed CRCC. The CRCC was created to help minimize the impact from the reservoir on the ecological function of the Colorado River by allowing fish, macroinvertebrates, and sediment to maintain river connectivity around the reservoir.[26] Site CRCC-0.5 will help to evaluate the effectiveness of the CRCC in maintaining benthic macroinvertebrate communities and provide valuable data for potentially similar future projects. Overall, one sampling location (WC-2.3) obtained an MMI (v5) score below the impairment threshold, while two sampling locations (WC-2.3 and WF-5.5) obtained MMI (v4) scores indicating impairment in 2025 (see Tables 5-7 and Figures 9 and 10).

Two sites were sampled on Willow Creek; one directly below Willow Creek Reservoir (WC-2.3), and one farther downstream (WC-0.5). Site WC-2.3 historically produces some of the lowest MMI scores in the study area due to its proximity to reservoir releases and the associated changes to stream flow and temperature regimes. The MMI (v4 and v5) scores at this site during 2025 sampling were consistent with historical results, with both values (31.2 and 30.4, respectively) indicating impairment

for aquatic life use (see Tables 6 and 7). Further downstream at WC-0.5, aquatic conditions improved in their ability to support benthic macroinvertebrate communities, with both MMI (v4 and v5) scores well above the attainment threshold (see Figures 9 and 10). Since sampling began at WC-0.5 in 2022, MMI (v4) scores have consistently improved each year (see Figure 11).

The ten benthic macroinvertebrate sampling locations on the Colorado River were located upstream from the Windy Gap Reservoir (CR-31.0) to almost the confluence with the Blue River (CR-1.7). All sites obtained MMI (v4 and v5) scores above the attainment thresholds (see Figures 9 and 10), with the lowest values observed at site CR-31.0 (56.7 and 55.3, respectively) and highest values at site CR-28.7 (84.0 and 79.6, respectively). Notably, the site on the CRCC (CRCC-0.5) obtained a higher MMI (v4) score in 2025 than last year, indicating stable aquatic conditions and a slightly improved macroinvertebrate community (see Figure 10). Two sampling locations, CR-R3 and CR-R4, had lower MMI (v4) scores than expected (based on the lower bounds of the standard deviation) and were the lowest results observed at these locations (see Figures 10 and 11). While some differences from historical sampling were observed, the macroinvertebrate community appeared healthy at all sampling locations on the Colorado River at the time of 2025 sampling.

Results from the two auxiliary metrics, Diversity and HBI, were within their respective attainment thresholds; however, there was considerable variability in 2025 results compared to historical ranges (see Figures 12 and 13). Diversity scores were similar to or improved upon historical values at almost all sampling locations on the Colorado River, with sites CR-16.7 and CR-R3 obtaining higher values than expected (see Figure 12). These scores indicate that all sampling locations continued to maintain a stable and well-balanced macroinvertebrate community assemblage in 2025. Comparatively, the HBI values at most sampling locations were higher than average (worse), with four sites (CR-bWF, CR-R3, CR-R4, and CR-9.1) obtaining values much higher than anticipated (see Figure 13). While all scores were still in attainment, these elevated values indicate that the macroinvertebrate community at most sites comprises a higher proportion of nutrient-tolerant individuals. Notably, the HBI score at CRCC-0.5 (2.80) was much lower than the score observed in 2024 (4.23), suggesting the macroinvertebrate community at this site is establishing well after the channel was implemented.

Benthic macroinvertebrate sampling was also conducted at one site on the Williams Fork (WF-5.5) in 2025. Located above Williams Fork Reservoir, this site was in attainment for aquatic life use according to the most recent version of the MMI (v5), with a score of 50.5 (Table 6; Figure 9). However, this site obtained the lowest MMI (v4) score (43.9) observed at this location since the onset of sampling here in 2018 (Figure 11), a value that fell within the "gray zone." Further evaluation of the auxiliary metrics (Diversity and HBI) indicated that this site was impaired for aquatic life use (Table 7). Specifically, the HBI value of 6.09 exceeded the impairment threshold, indicating a very high proportion of nutrient tolerant individuals were present during 2025 sampling. Future monitoring studies will help to determine if elevated HBI values persist, or if the higher proportions of nutrient-tolerant individuals were a 2025 anomaly.

A review of 2025 results from two versions of the MMI (v4 and v5), as well as auxiliary metrics, provided a strong overview of macroinvertebrate community health in the Colorado River and Wiliams Fork study area. According to the most recent version of the MMI (v5), one sampling location (WC-2.3) was impaired for aquatic life use while all others were in attainment (Table 6; Figure 9). Comparatively, two sampling locations (WC-2.3 and WF-5.5) were impaired for aquatic life use based on MMI (v4) scores and/or HBI values (see Table 7). While Diversity values at all sites indicated relatively healthy and well-balanced macroinvertebrate communities, the HBI scores were elevated across most of the study area (see Figure 13). Future biomonitoring efforts will help to determine if the higher HBI values are a persistent phenomenon or if perturbations were limited to 2025 sampling.

Table 5. Aquatic life use designations based on MMI scores for sites in the Colorado River and Williams Fork study area during fall of 2025.

Station ID	Monitoring Project	MMI v5	MMI v4
WC-2.3	Learning By Doing	Impairment	Impairment
WC-0.5	Learning By Doing	Attainment	Attainment
CR-31.0	Northern Water	Attainment	Attainment
CRCC-0.5	Learning By Doing	Attainment	Attainment
CR-28.7	Northern Water	Attainment	Attainment
CR-22.1	Northern Water	Attainment	Attainment
CR-16.7	Northern Water	Attainment	Attainment
CR-bWF	Northern Water	Attainment	Attainment
CR-R3	Northern Water	Attainment	Attainment
CR-R4	Northern Water	Attainment	Attainment
CR-9.1	Learning By Doing	Attainment	Attainment
CR-1.7	Learning By Doing	Attainment	Attainment
WF-5.5	Learning By Doing	Attainment	Impairment

Table 6. Component metrics and MMI v5 scores from benthic macroinvertebrate samples collected in the Colorado River/Williams Fork study area during the fall of 2025. All scores are based on the MMI subsampling and 'impairment' values are shown in *red*.[iii]

Metric	Station ID												
	Biotype 1												
	WC-2.3	WC-0.5	CR-31.0 (WGU)	CRCC-0.5	CR-28.7 (WGD)	CR-22.1 (HSPP)	CR-16.7 (WFU)	CR-bWF	CR-R3	CR-R4	CR-9.1	CR-1.7	WF-5.5
EPTTax	52.6	100.0	100.0	100.0	100.0	100.0	100.0	89.5	94.7	94.7	100.0	84.2	57.9
EPTnoBPct	7.1	46.0	41.6	99.0	81.9	52.0	78.1	77.3	63.3	44.8	36.4	21.1	15.9
ClngrPctTax	54.6	62.4	72.9	74.1	80.5	86.3	87.7	84.4	82.0	73.6	75.4	60.9	46.0
ColeoPct	3.4	75.2	3.7	15.8	37.1	11.9	8.1	6.2	9.7	1.5	19.2	75.3	66.0
NonInPct	33.5	63.4	54.0	83.7	93.4	97.4	88.5	53.9	93.6	88.3	65.0	92.2	6.1
IntolPT	35.0	66.5	65.7	78.8	73.4	71.2	81.6	79.3	72.9	65.4	65.1	56.7	72.1
PredShrTaxFAC	53.3	100.0	66.7	53.3	86.7	60.0	93.3	46.7	60.0	73.3	80.0	80.0	86.7
pi_Mod DecrTrans	3.8	60.0	37.5	86.6	83.5	35.5	41.5	73.8	56.1	40.0	39.3	61.0	53.4
MMI v5	30.4	**71.7**	**55.3**	**73.9**	**79.6**	**64.3**	**72.4**	**63.9**	**66.5**	**60.2**	**60.1**	**66.4**	**50.5**
Auxiliary Metrics													
Diversity	3.16	3.71	4.18	3.73	3.99	4.06	4.59	3.50	3.87	3.49	4.37	3.38	3.38
HBI	6.80	4.34	4.73	2.80	2.93	4.03	3.44	2.74	3.43	4.04	4.98	4.66	6.09
Sediment Region	SR4	SR4	SR4	SR4	SR2	SR4	SR2	SR4	SR4	SR4	SR4	SR4	SR4
TIV	6.17	6.75	4.83	4.24	4.78	6.06	5.50	3.08	5.13	5.44	5.16	5.92	5.05

[iii] Note: Auxiliary metrics shown in red indicate threshold exceedance for that metric only and do not necessarily signify overall site impairment.

Table 7. Component metrics and MMI v4 scores from benthic macroinvertebrate samples collected in the Colorado River/Williams Fork study area during the fall of 2025. All scores are based on the MMI subsampling and 'impairment' values are shown in *red.*[iv]

Metric	Station ID												
	Biotype 1												
	WC-2.3	WC-0.5	CR-31.0 (WGU)	CRCC-0.5	CR-28.7 (WGD)	CR-22.1 (HSPP)	CR-16.7 (WFU)	CR-bWF	CR-R3	CR-R4	CR-9.1	CR-1.7	WF-5.5
EPT taxa	44.2	85.4	95.8	91.7	100.0	95.8	100.0	70.8	75.0	75.0	93.2	75.8	45.8
% Non-Insect individuals	41.0	67.6	59.2	85.6	94.2	97.7	89.8	59.1	94.4	89.6	69.0	93.1	16.8
% EPT individuals, no Baetidae	7.0	45.0	40.7	96.9	80.2	50.9	76.5	75.7	61.9	43.8	35.6	20.6	15.6
% Coleoptera individuals	3.5	79.2	3.9	16.7	39.1	12.5	8.5	6.5	10.3	1.5	20.3	79.3	69.5
% Intolerant Taxa	35.0	65.2	61.9	76.0	70.8	68.6	77.1	74.0	70.3	63.1	62.2	57.5	67.5
% Increasers, Mid-Elevation	6.4	92.4	29.0	73.2	94.8	96.4	87.7	64.6	94.9	82.7	50.6	91.6	0.0
Clinger taxa	55.1	83.3	91.3	86.5	100.0	100.0	100.0	72.1	81.7	81.7	100.0	68.3	43.3
Predator/Shredder taxa	57.1	100.0	71.4	57.1	92.9	64.3	100.0	50.0	64.3	78.6	85.7	85.7	92.9
MMI v4	31.2	**77.3**	**56.7**	**73.0**	**84.0**	**73.3**	**80.0**	**59.1**	**69.1**	**64.5**	**64.6**	**71.5**	43.9
Auxiliary Metrics													
Diversity	3.16	3.71	4.18	3.73	3.99	4.06	4.59	3.50	3.87	3.49	4.37	3.38	3.38
HBI	6.80	4.34	4.73	2.80	2.93	4.03	3.44	2.74	3.43	4.04	4.98	4.66	6.09

[iv] Note: Auxiliary metrics shown in red indicate threshold exceedance for that metric only and do not necessarily signify overall site impairment.

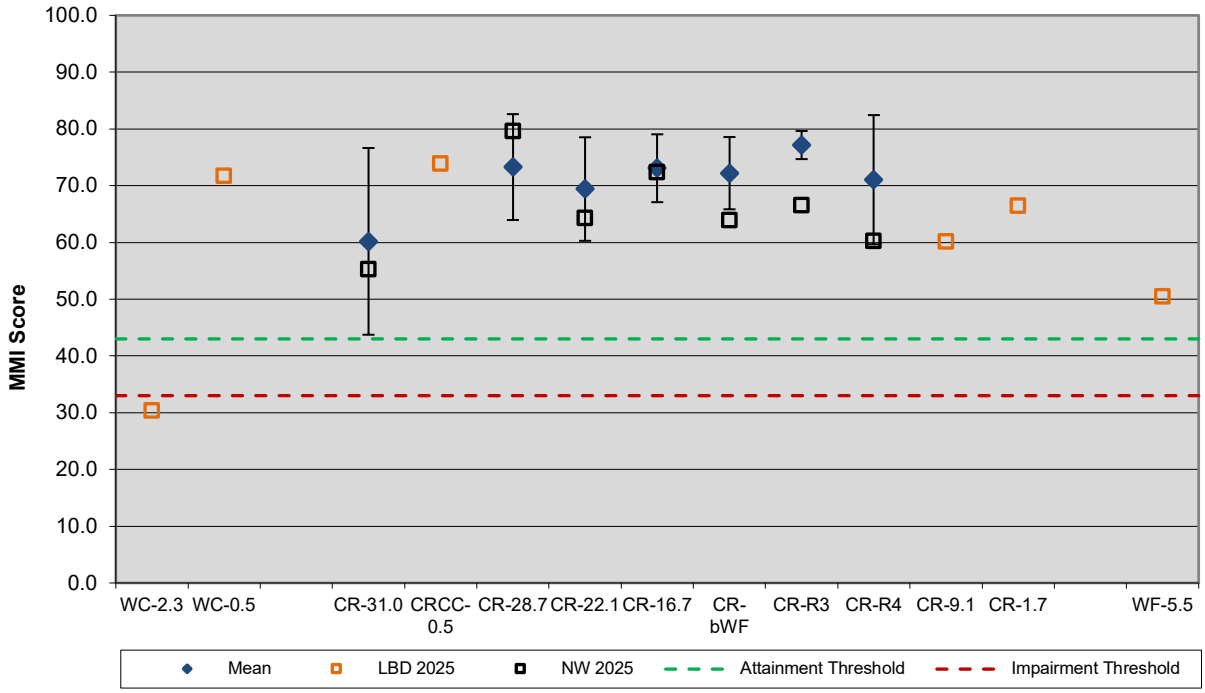

Figure 9. MMI v5 scores for the fall 2025 Colorado River and Williams Fork study area. Historical mean scores (±1 SD) provided when available.

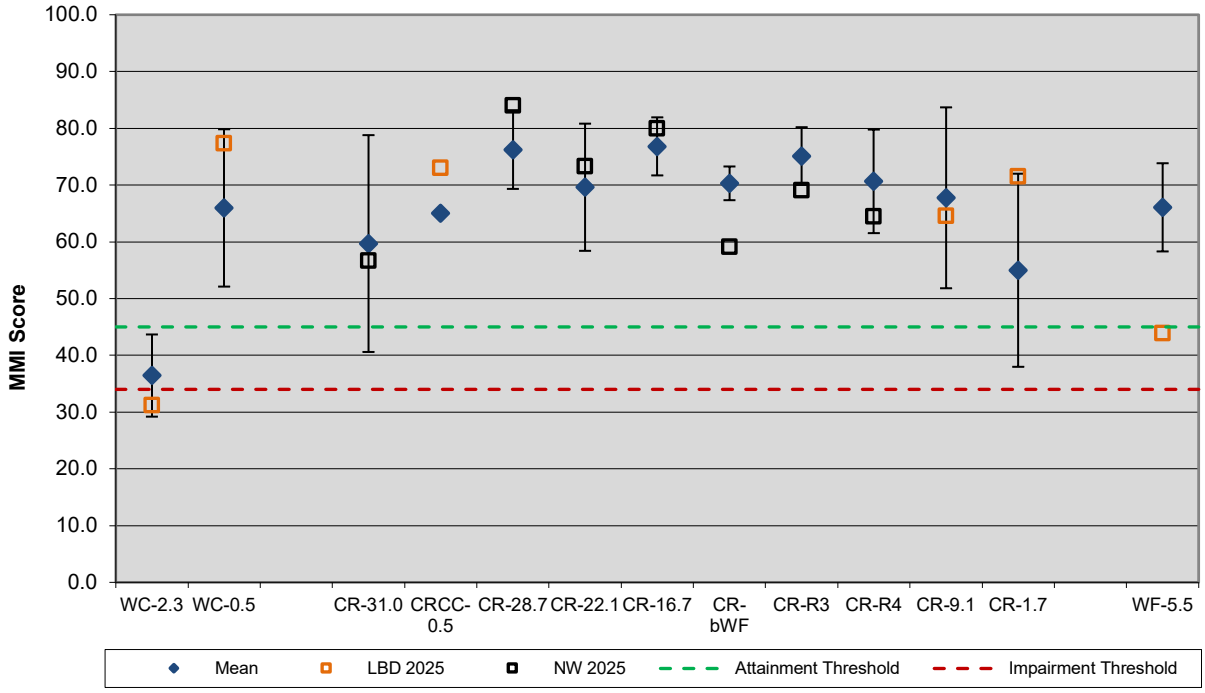

Figure 10. MMI v4 scores for the fall 2025 Colorado River and Williams Fork study area compared to historical mean MMI v4 scores (±1 SD).

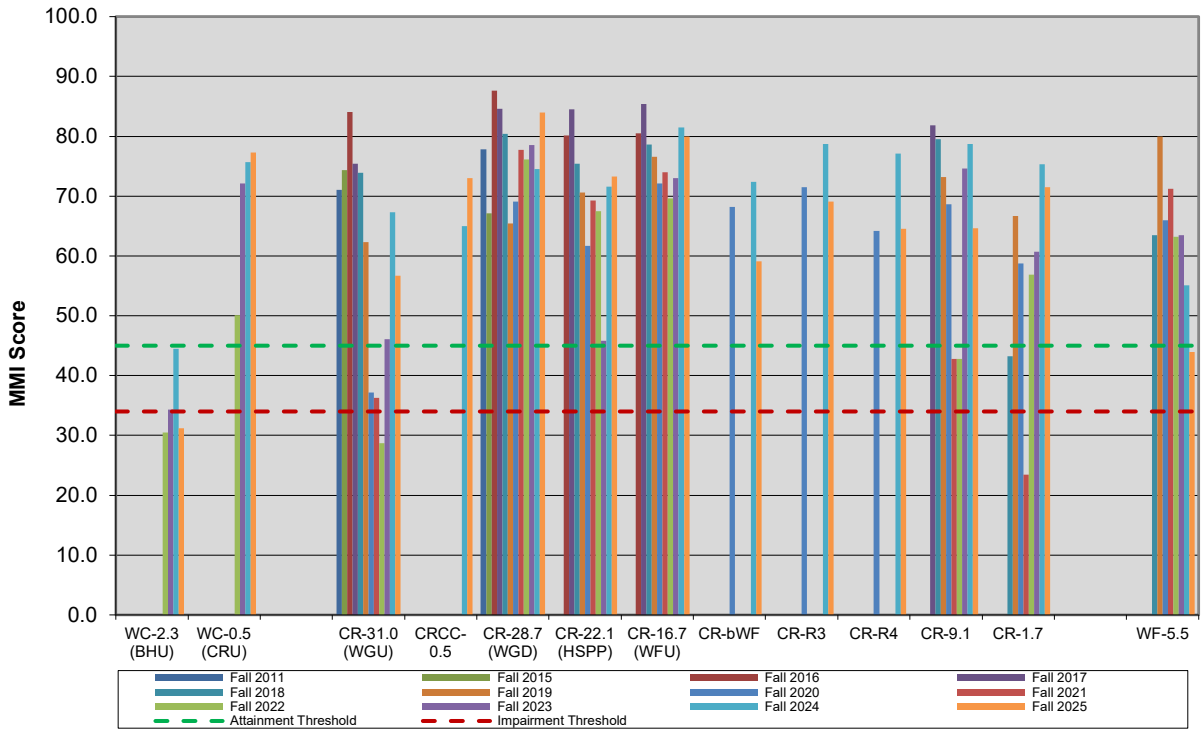

Figure 11. Historical MMI v4 scores for the Colorado River and Williams Fork study area.

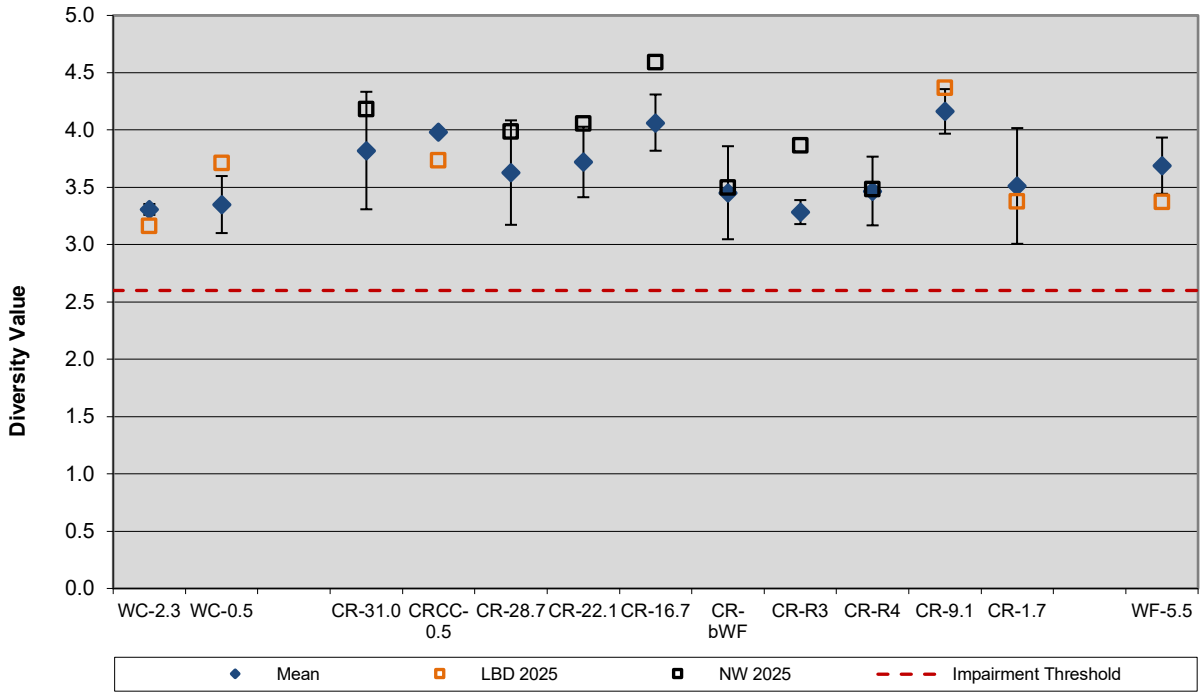

Figure 12. Diversity values for the Colorado River and Williams Fork study area from the fall of 2025 and mean historical Diversity values (±1 SD).

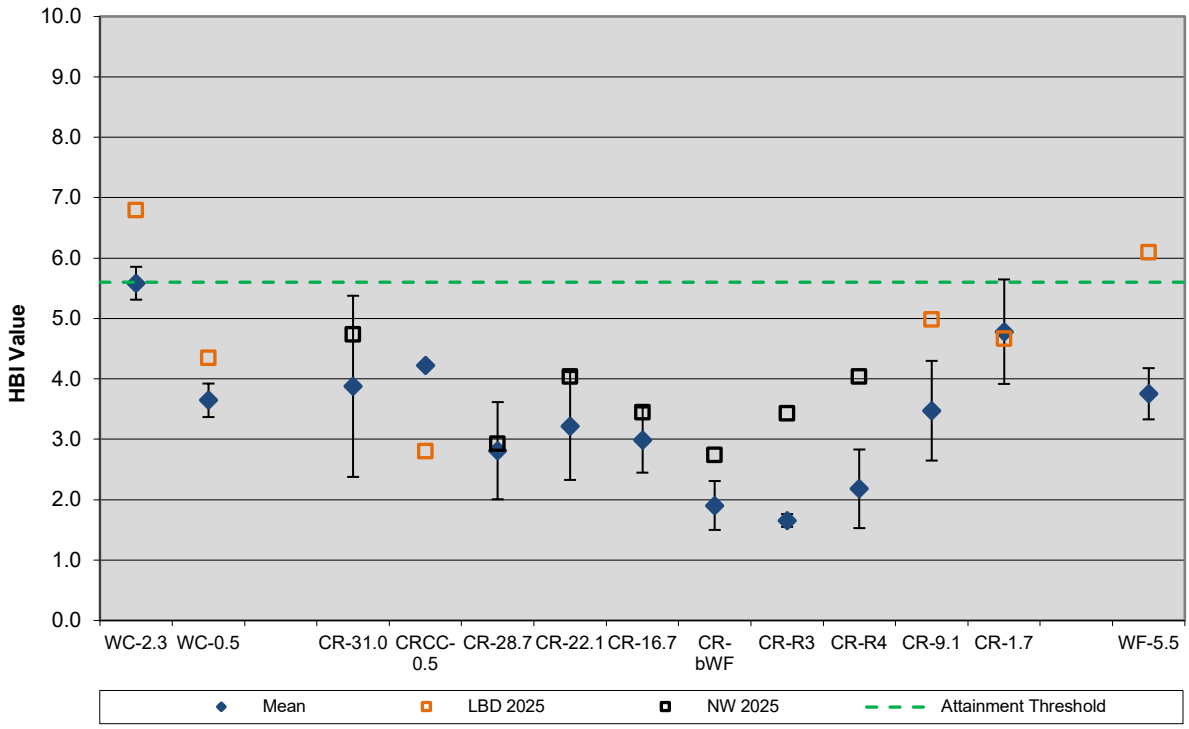

Figure 13. HBI values for the Colorado River and Williams Fork study area from the fall of 2025 and mean historical HBI values (±1 SD). HBI is inversely related to water quality, with lower scores indicating lower levels of organic pollution and better biological condition.

5.3 Results from Additional Metrics

An additional ten metrics were used to further analyze macroinvertebrate data collected from the Fraser River, Colorado River, and Williams Fork study areas during fall 2025 (see Tables 8 and 9 and Figures 14-17). Each metric was selected due to its ability to measure certain structural characteristics of the overall macroinvertebrate community. This type of analysis should provide a more detailed assessment of community dynamics; however, it is important to recognize that some stressors (or combination of stressors) will still be difficult to identify. Potential sources of stress in these study areas include the following:

- Regulated flows
- Deviations from the natural temperature regime
- Runoff from developed areas
- Runoff from portions of the watershed recently burned in wildfires
- Potential interactions between these and other environmental conditions

Some positive influences on macroinvertebrate communities may include pristine water quality, natural temperature and flow regimes, and the benefits associated with quality habitat and/or

habitat improvement projects. The location of a study site generally determines which influences or stressors were likely contributing to the observed macroinvertebrate community structure and function.

In 2025, most sampling locations in the Fraser River, Colorado River, and Williams Fork study areas supported a variety of macroinvertebrates (Taxa Richness: 41 to 69), many of which are typically considered sensitive to disturbances (EPT Taxa: 14 to 36) (see Tables 8 and 9). The giant stonefly *Pteronarcys californica*, an indicator of quality cold-water stream habitat,[27] was collected at four sites on the Colorado River: CR-28.7, CR-16.7, CR-R3, and CR-9.1 (see Tables 8 and 9). All detections of this important species were downstream of the recently constructed CRCC, and continued biomonitoring efforts will help to determine if the channel increases the presence and abundance of this species at additional sites along the Colorado River.

5.3.1 Fraser River Study Area

All seven sampling locations in the Fraser River study area supported robust macroinvertebrate communities, based on results from individual metrics (see Table 8). Taxa Richness values ranged from 41 (at FR-27.2) to 62 (at FR-20) and the most sensitive taxa (EPT) were well represented at all sites, with values ranging from 21 (at RC-1.1) to 31 (at FR-20). Most study sites had a higher-than-expected number of EPT taxa present, except for RC-1.1; however, the value (21) still fell within the expected historical range (see Figure 14). Notably, while the number of EPT taxa at all sites was somewhat constant across the sites, the % EPT-excluding Baetidae varied (see Table 8). Baetidae are considered one of the more tolerant members of the EPT orders, and excluding them provides a different view of the proportion of sensitive taxa. These metric values ranged from 16.06% (FR-20) to 78.89% (RC-1.1), indicating that RC-1.1 had a very high proportion of the community consisting of sensitive taxa, even though the number of different sensitive taxa (EPT) was lower than other sites. All sites had high proportions (>44.19%) of Intolerant Taxa and relatively low proportions of Tolerant Taxa (<16.28%) throughout the study area, further illustrating the ability of the sites to support sensitive individuals (see Table 8).

The remaining metrics (Density, Biomass, % Chironomidae, and % Hydropsychidae) had greater variability in results between sites (see Table 8). Density values ranged from 4,351 individuals at VC-0 to 14,392 individuals at FR-14, with biomass values of 0.6864 to 12.9640 (FR-25.1 and FR-14). The family Chironomidae are typically considered tolerant of disturbances and can rapidly recolonize recently disturbed habitats. Percentage values for this family ranged from 1.91% at RC-1.1 to 29.84% at FR-23.2 (see Table 8). Finally, five of the sites had % Hydropsychidae values less than 1% (Table 8), with the downstream site on Fraser River (FR-14) obtaining the highest proportion of Hydropsychidae (12.19%) followed by the sole site on Ranch Creek (RC-1.1 = 7.42%). Differences in community structure at sites in the Fraser River study area are likely attributed to natural changes in habitat, stream size, gradient, and minor anthropogenic influences. A complete review of individual metric values from previous sampling events (2017 to 2024) can be found in **Appendix D, Tables D-9 through D16**.

Table 8. Additional individual metrics and comparative values for benthic macroinvertebrate samples collected from the Fraser River study area during fall of 2025. All additional metric values are based on full count (quantitative) Hess samples.

	FR-27.2	FR-25.1	FR-23.2	VC-0	FR-20	FR-14	RC-1.1
Density (mean #/m^2)	7,382	5,164	9,273	4,351	10,182	14,392	7,749
Taxa Richness	41	52	51	50	62	51	43
EPT Taxa	22	29	25	29	31	27	21
Density of Pteronarcys californica (#/m^2)	0	0	0	0	0	0	0
% EPT-excluding Baetidae	58.45%	44.42%	25.17%	45.03%	16.06%	45.10%	78.89%
% Chironomidae	21.12%	16.52%	29.84%	7.70%	29.42%	15.97%	1.91%
% Hydropsychidae	0.00%	0.08%	0.29%	0.54%	0.80%	12.19%	7.42%
% Tolerant Taxa	12.20%	11.54%	13.73%	12.00%	9.68%	13.73%	16.28%
% Intolerant Taxa	56.10%	53.85%	50.98%	58.00%	51.61%	45.10%	44.19%
Biomass (g/m^2)	1.0907	0.6864	1.4709	1.2322	2.0977	12.9640	3.6922

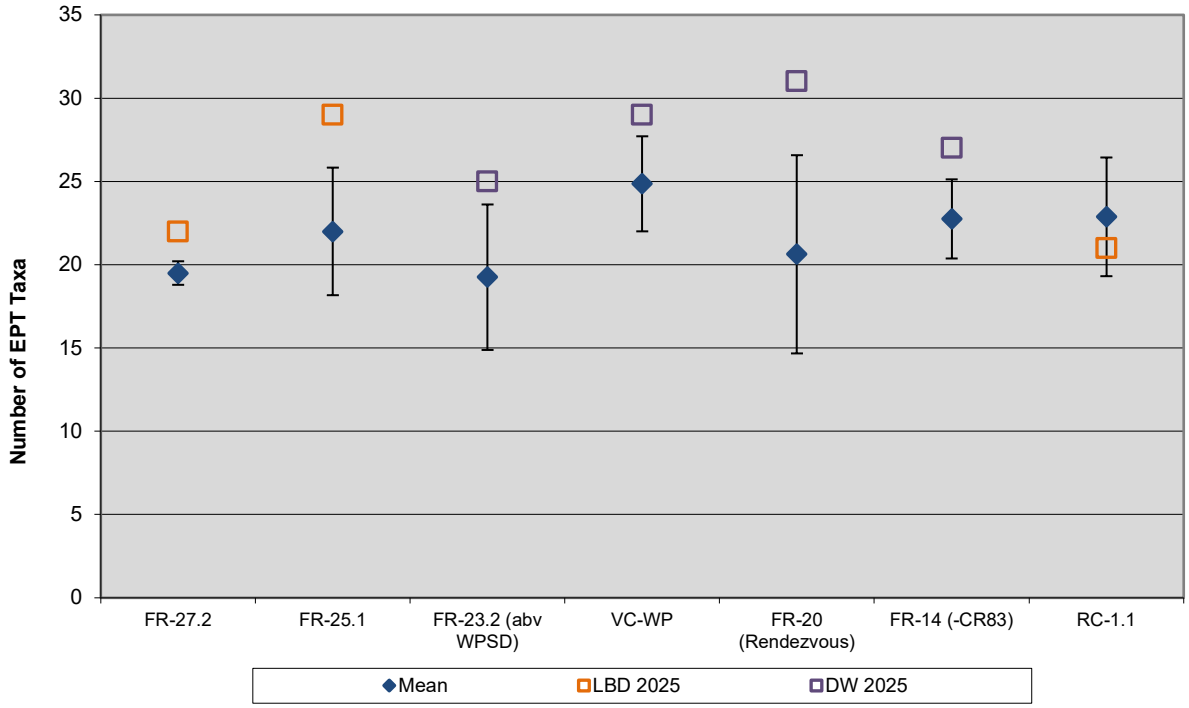

Figure 14. EPT Taxa values, Fraser River, fall 2025 and mean values (±1 standard deviation) from previous sampling events.

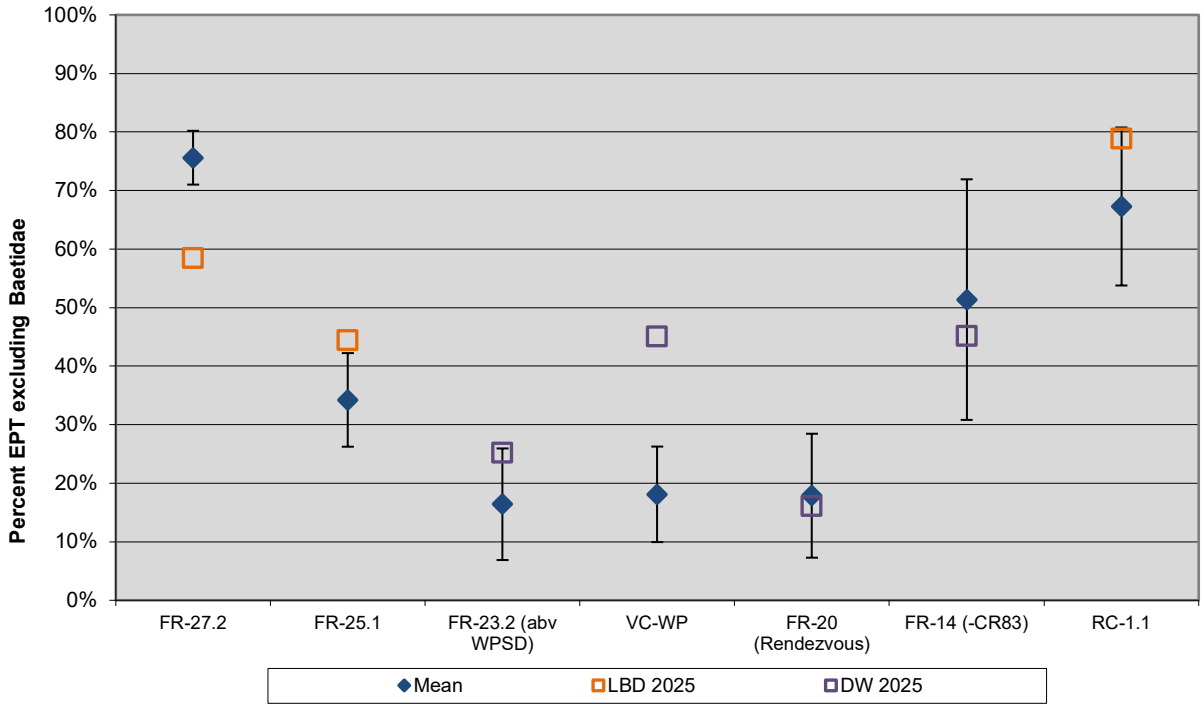

Figure 15. Percent EPT (excluding Baetidae) values from fall 2025 compared to historical means (±1 SD) in the Fraser River study area.

5.3.2 Colorado River and Williams Fork Study Area

In the Colorado River and Williams fork study area, most of the individual metric results supported findings from the MMI (v4 and v5), noting relatively healthy aquatic conditions for macroinvertebrate communities across the study area but detecting increased stress at sites WC-2.3 and WF-5.5 (see Table 9; Figures 16 and 17). On Willow Creek, the site directly below Willow Creek Reservoir (WC-2.3) obtained some of the least optimal results for multiple metrics (see Table 9). This site had the lowest Taxa Richness and EPT Taxa values in the study area (46 and 14, respectively), as well as the lowest % EPT-excluding Baetidae (4.38%) and % Hydropsychidae (1.09%). Furthermore, the highest % Tolerant Taxa and lowest % Intolerant Taxa values in the study area were collected at WC-2.3, suggesting that sensitive taxa have a harder time thriving here compared to other sites (see Table 9). These low values are typical of locations directly below reservoirs, due to altered temperature and flow regimes from reservoir releases. Farther downstream at WC-0.5, the macroinvertebrate community appeared to recover, and the site supported the highest % Hydropsychidae value (20.51%) in the LBD CEA study area (see Tables 8 and 9). Notably, WC-0.5 supported a higher number of EPT taxa than expected based on historical results (see Figure 16); however, both sites on Willow Creek had lower % EPT-excluding Baetidae values than anticipated given historical data (Figure 17).

On the Colorado River, individual metrics indicated that all sites supported stable macroinvertebrate community assemblages, though differences were seen between sites and over time (see Table 9 and Figures 16 and 17). Site CRCC-0.5, situated on the CRCC, obtained the highest % EPT-excluding Baetidae value (70.29%) in the study area, along with a low % Tolerant Taxa value (16.67%). These scores indicate that the site maintained relatively healthy water quality that was able support sensitive macroinvertebrate species. In the middle of the study area, site CR-16.7 had the highest Taxa Richness and EPT Taxa values (69 and 36, respectively), as well as the lowest % Tolerant Taxa (11.59%). Interestingly, almost all sites on the Colorado River obtained EPT Taxa values above historical sampling averages, six of which were higher than anticipated based on the upper bounds of the standard deviation (see Figure 16). However, all sites (except CRCC-0.5) had % EPT-excluding Baetidae values that were lower than historical averages, four of which were lower than anticipated (Figure 17). This indicates that while total EPT taxa values increased from previous years, there was a higher proportion of tolerant individuals making up the macroinvertebrate community at most sites on the Colorado River. Finally, the giant stonefly, *Pteronarcys californica* were collected at four sites with abundances ranging from 4-24 individuals/m^2 (Table 9).

The single sampling location on the Williams Fork (WF-5.5) showed evidence of stress compared to other sites in the study area, based on individual metric results (see Table 9). This site was on the lower end of Total Taxa and EPT taxa collected (see Table 9), and the % EPT-excluding Baetidae was much lower than expected compared to historical sampling events (Figure 17). Despite having the lowest % Chironomidae value in the study area (7.15%), the macroinvertebrate community did not appear to support a high abundance of sensitive species (based on EPT taxa, %EPT-excluding Baetidae, % Hydropsychidae, and % Tolerant Taxa values) (see Table 9). Future sampling at this site,

and others along the Williams Fork, would help to determine if the impacts to WF-5.5 are affecting other reaches of the stream, and/or if perturbations persist or are limited to 2025 sampling.

Table 9. Additional individual metrics and comparative values for benthic macroinvertebrate samples collected from the Colorado River and Williams Fork study area during fall of 2025. All additional metric values are based on full count (quantitative) Hess samples.

Metric	WC-2.3	WC-0.5	CR-31.0 (WGU)	CRCC-0.5	CR-28.7 (WGD)	CR-22.1 (HSPP)	CR-16.7 (WFU)	CR-bWF	CR-R3	CR-R4	CR-9.1	CR-1.7	WF-5.5
Density (mean #/m^2)	13,215	10,609	23,913	11,647	19,770	24,004	16,978	23,814	30,136	36,570	27,222	17,978	12,602
Taxa Richness	46	57	63	54	66	69	69	49	63	67	68	66	48
EPT Taxa	14	27	33	26	32	30	36	25	27	30	32	25	15
Density of Pteronarcys californica (#/m^2)	0	0	0	0	8	0	24	0	16	0	4	0	0
% EPT-excluding Baetidae	4.38%	34.29%	29.45%	70.29%	57.62%	36.60%	55.91%	55.61%	43.80%	32.64%	23.55%	16.22%	10.48%
% Chironomidae	57.24%	15.86%	39.22%	10.77%	10.55%	50.64%	30.69%	12.58%	32.83%	59.14%	34.45%	30.51%	7.15%
% Hydropsychidae	1.09%	20.51%	3.50%	10.90%	9.17%	4.17%	11.91%	4.59%	7.29%	1.36%	4.70%	1.60%	1.23%
% Tolerant Taxa	30.43%	19.30%	14.29%	16.67%	19.70%	20.29%	11.59%	18.37%	17.46%	20.90%	19.12%	22.73%	25.00%
% Intolerant Taxa	21.74%	33.33%	36.51%	37.04%	37.88%	31.88%	40.58%	36.73%	38.10%	34.33%	36.76%	24.24%	33.33%
Biomass (g/m^2)	4.0124	4.2399	4.0484	2.9884	5.1275	4.8465	6.0209	6.0926	9.2345	5.6240	7.8085	3.9620	1.7516

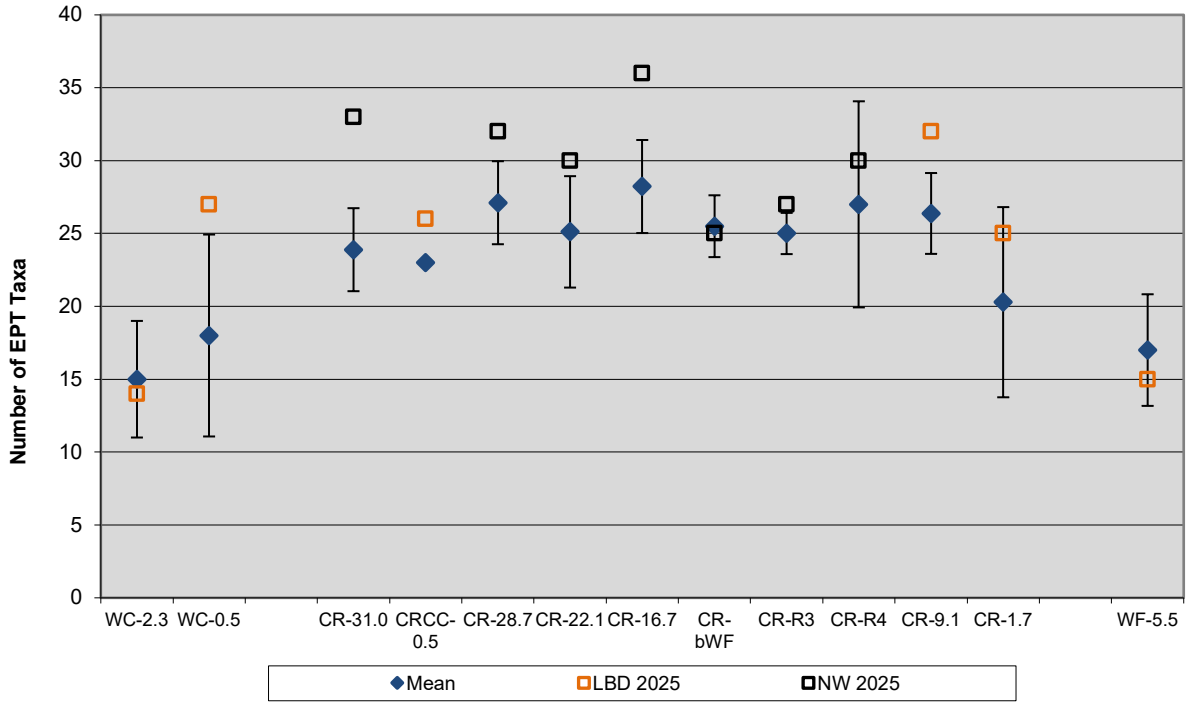

Figure 16. EPT Taxa values from the Colorado River and Williams Fork study area during the fall of 2025 and historical mean values (±1 SD).

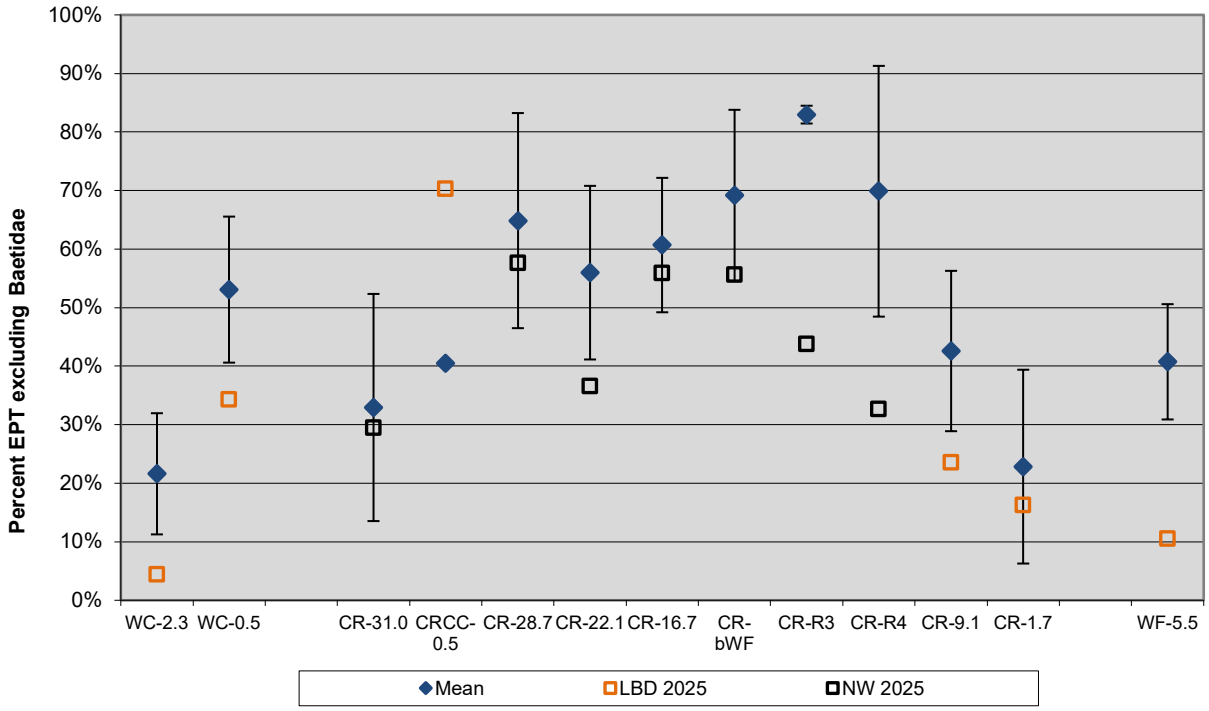

Figure 17. Percent EPT-excluding Baetidae values from the Colorado River and Williams Fork study area during the fall of 2025 and historical mean values (±1 SD).

5.4 Functional Feeding Group Analysis

In 2025, the ecological balance of macroinvertebrate communities at all sampling sites in the LBD, Denver Water, and Northern Water study areas were evaluated by the proportional distribution of feeding groups (see Tables 10 and 11 and Figures 18 and 19). Healthy Colorado streams typically support diverse macroinvertebrate communities that exhibit a variety of feeding strategies; however, it is common for certain feeding groups (such as collector-gatherers) to be slightly dominant.[21] The major functional feeding groups are shown below.

Functional Feeding Group	Role
Scrapers/Grazers	Consume algae and associated material
Shredders	Consume leaf litter or other coarse particulate organic matter (CPOM), including wood
Collector-gatherers	Collect fine particulate organic matter (FPOM) from the stream bottom
Collector-filterers	Collect FPOM from the water column using a variety of filters
Predators	Feed on other consumers
Omnivores	Feeds on both plant/algal material and animal prey. Do not fit easily into the other categories

5.4.1 Fraser River Study Area

The functional feeding group analysis from the Fraser River study area further supported results from the MMI (v4 and v5) and individual metrics, suggesting all sites maintained relatively healthy macroinvertebrate communities during 2025 sampling (see Table 10 and Figure 18). Collector-gatherers were the primary feeding group at all sites except RC-1.1, where shredders made up the highest proportion of the community (see Table 10). This shift in feeding group dominance at RC-1.1 is probably due to differences in available food particles rather than an impact from disturbance. There was a relatively low proportion of collector-filterers at all sites (>10.53%), which could indicate that there were low amounts of FPOM throughout the study area. All sampling locations were able to support the most sensitive feeding groups, scrapers and shredders, with RC-1.1 having a combined 70.52% of the community consist of these specialized feeders (see Table 10). In general, all sites in the Fraser River study area appeared to support relatively healthy proportions of different feeding groups during 2025 sampling.

Table 10. Relative abundance of functional feeding groups in the Fraser River study area during the fall of 2025.

Site	Functional Feeding Group					
	Collector-Gatherer	Collector-Filterer	Shredder	Scraper	Predator	Omnivore
FR-27.2	47.97%	0.00%	6.69%	23.49%	21.06%	0.79%
FR-25.1	47.59%	2.41%	4.22%	18.63%	26.70%	0.45%
FR-23.2	62.58%	0.76%	7.53%	3.11%	25.51%	0.51%
VC-0	43.87%	2.06%	10.12%	22.47%	14.06%	7.43%
FR-20	70.05%	2.82%	2.44%	6.33%	9.39%	8.97%
FR-14	66.66%	14.05%	1.75%	5.10%	12.41%	0.03%
RC-1.1	9.43%	10.53%	38.82%	31.70%	9.53%	0.00%

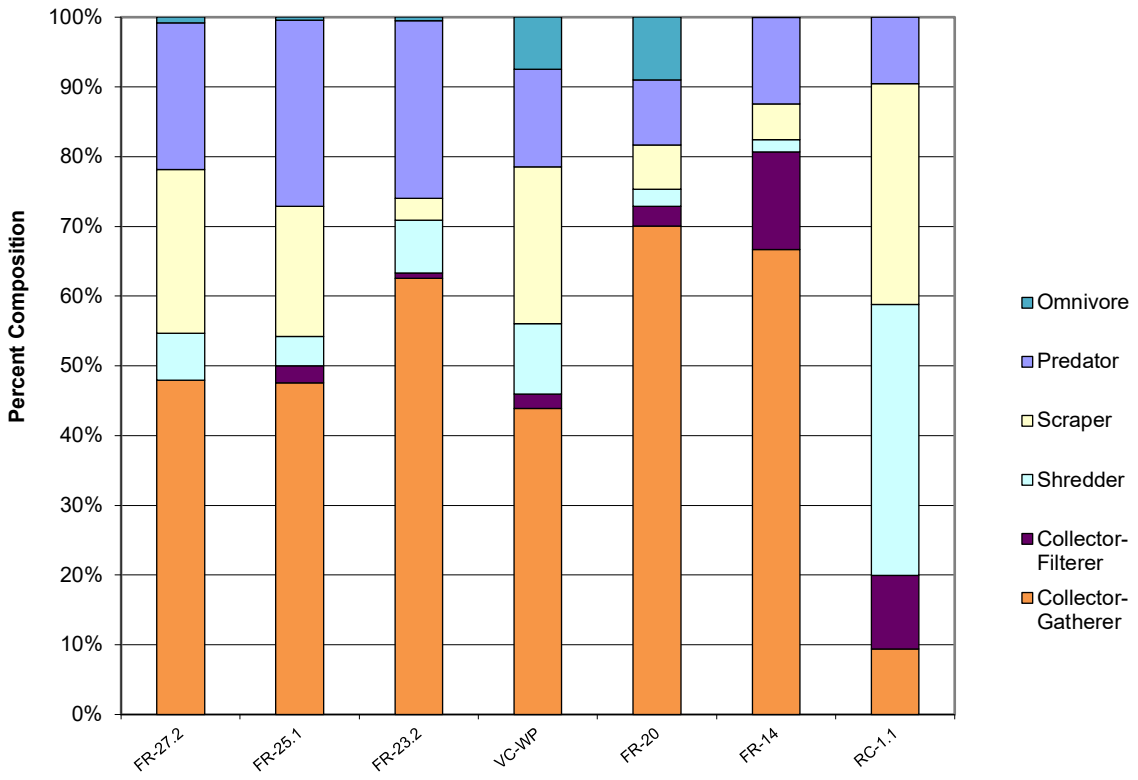

Figure 18. Functional feeding group composition for study sites in the Fraser River study area during the fall of 2025.

5.4.2 Colorado River and Williams Fork Study Area

Ecological function was also monitored via functional feeding group analyses in the combined Colorado River and Williams Fork study area in 2025 (see Table 11 and Figure 19). On Willow Creek, the site directly below the dam (WC-2.3) was dominated (82.76%) by collector-gatherers, and while sensitive feeding groups were present, they comprised a very small proportion (2.83%) of the community (see Table 11). Farther downstream at site WC-0.5, the community structure balanced out, with the specialized scraper group the primary feeding group collected (see Table 11). On the Colorado River, all sites had adequate representation of most feeding groups; though proportions were clearly variable (see Table 11). Site CR-R4 had the least functionally balanced community, with collector-gatherers making up over 76% of the community and sensitive groups representing less than 6% of the community (see Table 11). Site CRCC-0.5 on the Connectivity Channel had high proportions (>50%) of shredders and scrapers, furthering other metric results indicating high values of sensitive taxa presence at this location (see Table 11). On the Williams Fork, site WF-5.5 had a relatively low proportion (0.74%) of shredders compared to other sites within the study area, suggesting that there may be a limited amount of coarse particulate organic matter for this feeding group to survive on at this site. In general, results from the functional feeding group analysis agreed with findings from the MMI (v4 and v5) and individual metrics, detecting a fairly balanced and stable macroinvertebrate community at most sites in the study area and evidence of increased stress at sites WC-2.3 and WF-5.5 (see Table 11 and Figure 19).

Table 11. Relative abundance of functional feeding groups in the 2025 Colorado River and Williams Fork study area.

Site	Functional Feeding Group					
	Collector-Gatherer	Collector-Filterer	Shredder	Scraper	Predator	Omnivore
WC-2.3	82.76%	5.76%	0.06%	2.76%	6.84%	1.82%
WC-0.5	21.25%	21.58%	2.89%	42.42%	11.87%	0.00%
CR-31.0	61.92%	15.67%	12.45%	3.94%	4.14%	1.88%
CRCC-0.5	29.68%	16.44%	40.31%	10.14%	3.43%	0.00%
CR-28.7	47.64%	12.14%	15.16%	20.01%	4.93%	0.12%
CR-22.1	67.18%	8.21%	3.43%	16.83%	4.35%	0.00%
CR-16.7	49.58%	14.36%	6.70%	24.15%	3.98%	1.23%
CR-bWF	22.67%	40.51%	19.32%	6.03%	0.96%	10.51%
CR-R3	60.67%	22.21%	6.46%	5.92%	3.57%	1.17%
CR-R4	76.92%	5.10%	12.69%	2.57%	2.65%	0.07%
CR-9.1	46.51%	29.60%	11.06%	9.22%	3.28%	0.33%
CR-1.7	38.16%	20.06%	11.03%	28.37%	2.35%	0.02%
WF-5.5	39.94%	17.57%	0.74%	26.35%	14.95%	0.46%

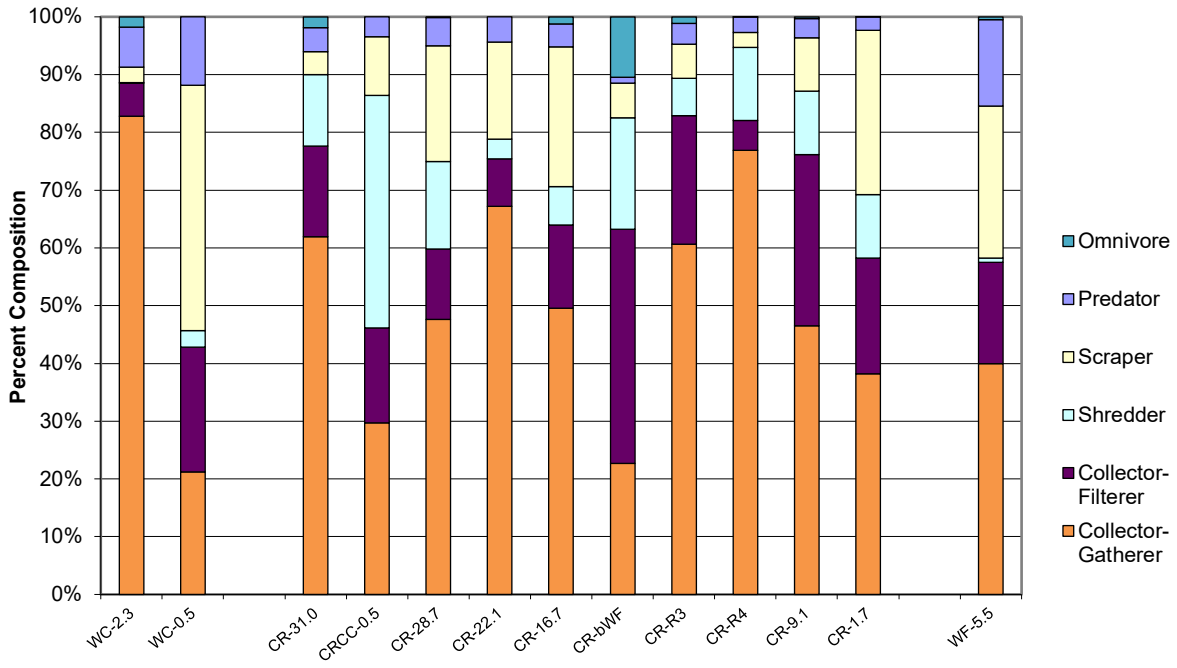

Figure 19. Functional feeding group composition for study sites in the Colorado River and Williams Fork study area during the fall of 2025.

6. Conclusions

In 2025, benthic macroinvertebrate biomonitoring studies were conducted along sections of the Fraser River, Colorado River, Williams Fork River, and several tributaries to assess the aquatic health of three major drainages in Grand County, Colorado, for LBD, Denver Water, and Northern Water. To achieve this goal, the structure and function of macroinvertebrate communities were evaluated using two versions of the MMI (v4 and v5), ten individual metrics, and a functional feeding group analysis. The newly implemented MMI (v5) indicated that one site, WC-2.3, was impaired for aquatic life use, while the previous version (MMI v4) noted impaired conditions at WC-2.3 and WF-5.5. Both sites also had HBI values above the accepted threshold, indicating high proportions of nutrient-tolerant individuals present. While the aquatic community at site WC-2.3 was likely impacted by its proximity below Willow Creek Reservoir, site WF-5.5 is situated above the Williams Fork impoundment and not influenced by reservoir releases. The observed impairment at WF-5.5 may reflect upstream watershed influences, including post-fire effects, changes in sediment delivery, nutrient enrichment, hydrologic alteration, or other localized stressors; however, the available data are insufficient to identify a specific cause. Additional biomonitoring at upstream and downstream locations would help determine whether the observed impairment is localized or indicative of broader watershed conditions. All other sampling locations were in attainment for aquatic life use. However, almost all sampling locations in the Colorado River and Williams Fork study areas had HBI values above the historical sampling averages, with seven of the sites obtaining values higher than their respective standard deviations (Figure 13). This points to a watershed-wide impact, perhaps elevated nutrient enrichment or runoff around the time of sampling or continued impacts from the 2020 East Troublesome and Williams Fork fires. Alternatively, the recently established (2024) site on the Connectivity Channel, CRCC-0.5, showed improvements to the macroinvertebrate community in 2025, indicating the ability of the site to maintain healthy aquatic insect assemblages. Possible sources of stress on the Fraser River, Colorado River, and Williams Fork could be attributed to changes in stream dynamics (e.g., flow, temperature regimes) or delayed impacts from wildfires. Future biomonitoring efforts will continue to assess changes in the influences of human activities as well as an ongoing assessment of habitat improvement projects.

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Appendix A. Learning By Doing: Benthic Macroinvertebrate Data – Fall 2025

Table A-1. Macroinvertebrate data collected from site FR-27.2 on 24 Sept. 2025.

Fraser River						
FR-27.2		Sample				
24 September 2025	1	2	3		Total	Estimated #/m²
Ephemeroptera (mayflies)						
Ameletus sp.	18	2	21		41	159
Acentrella sp.						
Baetis flavistriga						
Baetis (*tricaudatus*)	10	7	12		29	113
Diphetor hageni						
Attenella margarita						
Drunella coloradensis		1	2		3	12
Drunella doddsii	98	58	57		213	826
Drunella grandis						
Ephemerella dorothea infrequens	81	41	38		160	621
Heptageniidae						
Cinygmula sp.	21	20	14		55	214
Epeorus deceptivus	2				2	8
Epeorus longimanus						
Rhithrogena sp.	12	28	16		56	218
Tricorythodes explicatus						
Paraleptophlebia sp.						
Plecoptera (stoneflies)						
Capniidae	10	12	5		27	105
Paracapnia angulata						
Chloroperlidae						
Sweltsa sp.	20	35	12		67	260
Triznaka signata						
Prostoia besametsa	1	2	2		5	20
Zapada cinctipes		1			1	4
Zapada oregonensis	20	44	30		94	365
Claassenia sabulosa						
Perlodidae						
Isoperla sp.	3	2	8		13	51
Isoperla fulva						
Megarcys signata	6	8	9		23	90
Skwala americana						
Pteronarcella badia						
Pteronarcys californica						
Taenionema sp.	46	119	39		204	791
Trichoptera (caddisflies)						
Brachycentrus americanus						
Brachycentrus occidentalis						
Micrasema bactro						
Anagapetus sp.						
Culoptila sp.						
Glossosoma sp.	6	2	2		10	39
Protoptila sp.						
Helicopsyche borealis						

Arctopsyche grandis						
Cheumatopsyche sp.						
Hydropsyche sp.						
Hydropsyche cockerelli						
Hydropsyche occidentalis						
Hydropsyche oslari						
Hydroptila sp.						
Lepidostoma sp.						
Oecetis sp.						
Limnephilidae						
Psychomyia sp.						
Rhyacophila brunnea	1		1		2	8
Rhyacophila coloradensis	2	1			3	12
Rhyacophila hyalinata	4	1	1		6	24
Rhyacophila sibirica group	3	2	3		8	32
Oligophlebodes sp.	49	4	64		117	454
Diptera (true flies)						
Chironomidae (chironomids)						
Brillia sp.						
Cardiocladius sp.						
Cricotopus nostocicola						
Cricotopus/Orthocladius sp.	2		3		5	20
Cryptochironomus sp.						
Diamesa sp.			1		1	4
Dicrotendipes sp.						
Eukiefferiella sp.	5	5	16		26	101
Heleniella sp.	1		1		2	8
Heterotrissocladius sp.						
Lopescladius sp.						
Micropsectra/Tanytarsus sp.	119	31	154		304	1,179
Microtendipes sp.						
Nanocladius sp.						
Pagastia sp.	5		3		8	32
Parakiefferiella sp.						
Parametriocnemus sp.						
Paratanytarsus sp.						
Parorthocladius sp.	1	1	2		4	16
Polypedilum sp.						
Potthastia sp.						
Rheocricotopus sp.	1		4		5	20
Rheotanytarsus sp.						
Sublettea sp.						
Synorthocladius sp.						
Thienemanniella sp.						
Thienemannimyia group						
Tvetenia sp.	10	14	22		46	179
Other Diptera (true flies)						
Atherix pachypus						
Ceratopogoninae	15	3	13		31	121
Chelifera/Neoplasta sp.						
Hemerodromia sp.						
Oreogeton sp.						

Lispoides sp.						
Pericoma sp.						
Simulium sp.						
Antocha sp.						
Dicranota sp.	2	1	3		6	24
Hexatoma sp.						
Tipula sp.						
Coleoptera (beetles)						
Helichus sp.						
Dytiscidae						
Liodessus sp.						
Heterlimnius sp.	43	10	40		93	361
Optioservus sp.	1	1			2	8
Zaitzevia parvula						
Brychius sp.						
Hemiptera (true bugs)						
Corixidae						
Miscellaneous						
Atractides sp.						
Hygrobates sp.						
Lebertia sp.	2		1		3	12
Protzia sp.						
Sperchon sp.	4		16		20	78
Torrenticola sp.						
Caecidotea sp.						
Ferrissia sp.						
Lymnaeidae						
Physa sp.						
Gyraulus sp.						
Polycelis coronata	4	3	8		15	59
Crangonyx sp.						
Hyalella azteca						
Gammarus lacustris						
Erpobdellidae						
Helobdella sp.						
Enchytraeidae	71	43	71		185	718
Lumbricidae						
Naididae	3				3	12
Nematoda			1		1	4
Totals	**702**	**502**	**695**		**1899**	**7,382**

Table A-2. Macroinvertebrate data collected from site FR-25.1 on 24 Sept. 2025.

Fraser River						
FR-25.1		Sample				
24 September 2025	1	2	3		Total	Estimated #/m²
Ephemeroptera (mayflies)						
Ameletus sp.	1	2			3	12
Acentrella sp.	2	2	2		6	24
Baetis flavistriga						
Baetis (*tricaudatus*)	34	61	54		149	578
Diphetor hageni						
Attenella margarita						
Drunella coloradensis						
Drunella doddsii	18	10	32		60	233
Drunella grandis						
Ephemerella dorothea infrequens	1	49			50	194
Heptageniidae						
Cinygmula sp.		2	5		7	28
Epeorus deceptivus	1		6		7	28
Epeorus longimanus	2				2	8
Rhithrogena sp.	3	3	4		10	39
Tricorythodes explicatus			1		1	4
Paraleptophlebia sp.						
Plecoptera (stoneflies)						
Capniidae	2	3	1		6	24
Paracapnia angulata						
Chloroperlidae	2		6		8	32
Sweltsa sp.	1	1	4		6	24
Triznaka signata						
Prostoia besametsa		11	3		14	55
Zapada cinctipes	1	1	5		7	28
Zapada oregonensis	13	7	4		24	94
Claassenia sabulosa						
Perlodidae						
Isoperla sp.	18	27	9		54	210
Isoperla fulva						
Megarcys signata	3	2	2		7	28
Skwala americana						
Pteronarcella badia						
Pteronarcys californica						
Taenionema sp.	75	14	107		196	760
Trichoptera (caddisflies)						
Brachycentrus americanus			2		2	8
Brachycentrus occidentalis						
Micrasema bactro		3			3	12
Anagapetus sp.		2			2	8
Culoptila sp.						
Glossosoma sp.		1			1	4
Protoptila sp.						
Helicopsyche borealis						

Arctopsyche grandis			1		1	4
Cheumatopsyche sp.						
Hydropsyche sp.						
Hydropsyche cockerelli						
Hydropsyche occidentalis						
Hydropsyche oslari						
Hydroptila sp.						
Lepidostoma sp.		1			1	4
Oecetis sp.						
Limnephilidae						
Psychomyia sp.						
Rhyacophila brunnea	9	7	9		25	97
Rhyacophila coloradensis		30	4		34	132
Rhyacophila hyalinata						
Rhyacophila sibirica group	7	3	26		36	140
Oligophlebodes sp.		16	6		22	86
Diptera (true flies)						
Chironomidae (chironomids)						
Brillia sp.			1		1	4
Cardiocladius sp.						
Cricotopus nostocicola						
Cricotopus/Orthocladius sp.	2	82	7		91	353
Cryptochironomus sp.						
Diamesa sp.	1				1	4
Dicrotendipes sp.						
Eukiefferiella sp.	13	57	10		80	311
Heleniella sp.						
Heterotrissocladius sp.						
Lopescladius sp.						
Micropsectra/Tanytarsus sp.	9	8	11		28	109
Microtendipes sp.						
Nanocladius sp.						
Pagastia sp.		11	3		14	55
Parakiefferiella sp.						
Parametriocnemus sp.						
Paratanytarsus sp.						
Parorthocladius sp.						
Polypedilum sp.						
Potthastia sp.						
Rheocricotopus sp.			1		1	4
Rheotanytarsus sp.						
Sublettea sp.						
Synorthocladius sp.						
Thienemanniella sp.						
Thienemannimyia group						
Tvetenia sp.		1	2		3	12
Other Diptera (true flies)						
Atherix pachypus						
Ceratopogoninae	7	2	6		15	59
Chelifera/Neoplasta sp.	1		2		3	12
Hemerodromia sp.						
Oreogeton sp.			2		2	8

Lispoides sp.						
Pericoma sp.	8	7	20		35	136
Simulium sp.	1	1	27		29	113
Antocha sp.						
Dicranota sp.		2	2		4	16
Hexatoma sp.			1		1	4
Tipula sp.						
Coleoptera (beetles)						
Helichus sp.						
Dytiscidae						
Liodessus sp.						
Heterlimnius sp.	19	105	23		147	570
Optioservus sp.						
Zaitzevia parvula						
Brychius sp.						
Hemiptera (true bugs)						
Corixidae						
Miscellaneous						
Atractides sp.						
Hygrobates sp.						
Lebertia sp.		16	3		19	74
Protzia sp.						
Sperchon sp.	2	35	1		38	148
Torrenticola sp.						
Caecidotea sp.			1		1	4
Ferrissia sp.						
Lymnaeidae						
Physa sp.						
Gyraulus sp.						
Polycelis coronata		1	5		6	24
Crangonyx sp.						
Hyalella azteca						
Gammarus lacustris						
Erpobdellidae						
Helobdella sp.						
Enchytraeidae			16		16	63
Lumbricidae						
Naididae			6		6	24
Nematoda	18	1	22		41	159
Totals	**274**	**587**	**465**		**1326**	**5,164**

Table A-3. Macroinvertebrate data collected from site RC-1.1 on 24 Sept. 2025.

Ranch Creek						
RC-1.1		Sample				
24 September 2025	1	2	3		Total	Estimated #/m²
Ephemeroptera (mayflies)						
Ameletus sp.						
Acentrella sp.						
Baetis flavistriga						
Baetis (*tricaudatus*)	3	3			6	24
Diphetor hageni						
Attenella margarita						
Drunella coloradensis						
Drunella doddsii						
Drunella grandis	9	49	11		69	268
Ephemerella dorothea infrequens	7	73	7		87	338
Heptageniidae						
Cinygmula sp.	5	6	2		13	51
Epeorus deceptivus						
Epeorus longimanus	33	18	6		57	221
Rhithrogena sp.						
Tricorythodes explicatus						
Paraleptophlebia sp.	5	5	4		14	55
Plecoptera (stoneflies)						
Capniidae						
Paracapnia angulata						
Chloroperlidae	4				4	16
Sweltsa sp.	4	12	1		17	66
Triznaka signata						
Prostoia besametsa						
Zapada cinctipes						
Zapada oregonensis						
Claassenia sabulosa		3	1		4	16
Perlodidae						
Isoperla sp.						
Isoperla fulva	4	12			16	63
Megarcys signata						
Skwala americana		2			2	8
Pteronarcella badia						
Pteronarcys californica						
Taenionema sp.						
Trichoptera (caddisflies)						
Brachycentrus americanus	16	33	5		54	210
Brachycentrus occidentalis	3	4			7	28
Micrasema bactro	2	21			23	90
Anagapetus sp.						
Culoptila sp.	48	171	61		280	1,086
Glossosoma sp.	10	25	1		36	140
Protoptila sp.	6	3	3		12	47
Helicopsyche borealis						

Arctopsyche grandis	3	12			15	59
Cheumatopsyche sp.						
Hydropsyche sp.						
Hydropsyche cockerelli	5	18	1		24	94
Hydropsyche occidentalis						
Hydropsyche oslari	8	96	5		109	423
Hydroptila sp.						
Lepidostoma sp.	492	164	74		730	2,830
Oecetis sp.						
Limnephilidae						
Psychomyia sp.						
Rhyacophila brunnea						
Rhyacophila coloradensis						
Rhyacophila hyalinata						
Rhyacophila sibirica group						
Oligophlebodes sp.						
Diptera (true flies)						
Chironomidae (chironomids)						
Brillia sp.						
Cardiocladius sp.						
Cricotopus nostocicola		10	10		20	78
Cricotopus/Orthocladius sp.		2			2	8
Cryptochironomus sp.						
Diamesa sp.						
Dicrotendipes sp.						
Eukiefferiella sp.	1	7			8	32
Heleniella sp.						
Heterotrissocladius sp.						
Lopescladius sp.						
Micropsectra/Tanytarsus sp.	1				1	4
Microtendipes sp.						
Nanocladius sp.						
Pagastia sp.		3			3	12
Parakiefferiella sp.						
Parametriocnemus sp.						
Paratanytarsus sp.						
Parorthocladius sp.						
Polypedilum sp.	1				1	4
Potthastia sp.						
Rheocricotopus sp.						
Rheotanytarsus sp.			1		1	4
Sublettea sp.						
Synorthocladius sp.						
Thienemanniella sp.						
Thienemannimyia group		1			1	4
Tvetenia sp.		1			1	4
Other Diptera (true flies)						
Atherix pachypus	1	2	3		6	24
Ceratopogoninae	1	1			2	8
Chelifera/Neoplasta sp.		1	1		2	8
Hemerodromia sp.						
Oreogeton sp.						

Lispoides sp.						
Pericoma sp.	4	8	5		17	66
Simulium sp.						
Antocha sp.	3	4	1		8	32
Dicranota sp.						
Hexatoma sp.						
Tipula sp.						
Coleoptera (beetles)						
Helichus sp.						
Dytiscidae						
Liodessus sp.						
Heterlimnius sp.						
Optioservus sp.	88	77	69		234	907
Zaitzevia parvula	21	16	4		41	159
Brychius sp.						
Hemiptera (true bugs)						
Corixidae						
Miscellaneous						
Atractides sp.	1				1	4
Hygrobates sp.						
Lebertia sp.	5	4			9	35
Protzia sp.	14	13	5		32	125
Sperchon sp.	6	13	3		22	86
Torrenticola sp.	2				2	8
Caecidotea sp.						
Ferrissia sp.						
Lymnaeidae						
Physa sp.						
Gyraulus sp.						
Polycelis coronata						
Crangonyx sp.						
Hyalella azteca						
Gammarus lacustris						
Erpobdellidae						
Helobdella sp.						
Enchytraeidae						
Lumbricidae						
Naididae						
Nematoda		1			1	4
Totals	**816**	**894**	**284**		**1994**	**7,749**

Table A-4. Macroinvertebrate data collected from site WC-2.3 on 24 Sept. 2025.

Willow Creek						
WC-2.3 (BHU)		Sample				
24 September 2025	1	2	3		Total	Estimated #/m²
Ephemeroptera (mayflies)						
Ameletus sp.						
Acentrella sp.	7	3			10	39
Baetis flavistriga						
Baetis (*tricaudatus*)	24	35	3		62	241
Diphetor hageni						
Attenella margarita		1			1	4
Drunella coloradensis						
Drunella doddsii						
Drunella grandis						
Ephemerella dorothea infrequens	2	1			3	12
Heptageniidae						
Cinygmula sp.						
Epeorus deceptivus						
Epeorus longimanus						
Rhithrogena sp.						
Tricorythodes explicatus	12	43	20		75	291
Paraleptophlebia sp.						
Plecoptera (stoneflies)						
Capniidae						
Paracapnia angulata						
Chloroperlidae						
Sweltsa sp.						
Triznaka signata						
Prostoia besametsa						
Zapada cinctipes						
Zapada oregonensis						
Claassenia sabulosa						
Perlodidae						
Isoperla sp.						
Isoperla fulva						
Megarcys signata						
Skwala americana						
Pteronarcella badia						
Pteronarcys californica						
Taenionema sp.						
Trichoptera (caddisflies)						
Brachycentrus americanus	1	8	3		12	47
Brachycentrus occidentalis						
Micrasema bactro		1	1		2	8
Anagapetus sp.						
Culoptila sp.	1				1	4
Glossosoma sp.						
Protoptila sp.						
Helicopsyche borealis						

Arctopsyche grandis		1			1	4
Cheumatopsyche sp.						
Hydropsyche sp.						
Hydropsyche cockerelli						
Hydropsyche occidentalis						
Hydropsyche oslari	15	21			36	140
Hydroptila sp.	5	6	2		13	51
Lepidostoma sp.						
Oecetis sp.						
Limnephilidae		2			2	8
Psychomyia sp.						
Rhyacophila brunnea	1	1			2	8
Rhyacophila coloradensis		1			1	4
Rhyacophila hyalinata						
Rhyacophila sibirica group						
Oligophlebodes sp.						
Diptera (true flies)						
Chironomidae (chironomids)						
Brillia sp.						
Cardiocladius sp.						
Cricotopus nostocicola						
Cricotopus/Orthocladius sp.	654	580	203		1437	5,570
Cryptochironomus sp.						
Diamesa sp.	26	51	23		100	388
Dicrotendipes sp.	11	4	9		24	94
Eukiefferiella sp.	98	115	21		234	907
Heleniella sp.						
Heterotrissocladius sp.						
Lopescladius sp.						
Micropsectra/Tanytarsus sp.	1	15	12		28	109
Microtendipes sp.	2	25	4		31	121
Nanocladius sp.						
Pagastia sp.						
Parakiefferiella sp.	2				2	8
Parametriocnemus sp.						
Paratanytarsus sp.	3	7	3		13	51
Parorthocladius sp.						
Polypedilum sp.						
Potthastia sp.		1			1	4
Rheocricotopus sp.						
Rheotanytarsus sp.						
Sublettea sp.						
Synorthocladius sp.		3			3	12
Thienemanniella sp.	7	7	6		20	78
Thienemannimyia group						
Tvetenia sp.	16	31	9		56	218
Other Diptera (true flies)						
Atherix pachypus						
Ceratopogoninae						
Chelifera/Neoplasta sp.		1			1	4
Hemerodromia sp.						
Oreogeton sp.						

Lispoides sp.	1		1		2	8
Pericoma sp.						
Simulium sp.	49	65	2		116	450
Antocha sp.						
Dicranota sp.			1		1	4
Hexatoma sp.						
Tipula sp.						
Coleoptera (beetles)						
Helichus sp.						
Dytiscidae						
Liodessus sp.						
Heterlimnius sp.						
Optioservus sp.	1	31	3		35	136
Zaitzevia parvula						
Brychius sp.	1	5	11		17	66
Hemiptera (true bugs)						
Corixidae		20	1		21	82
Miscellaneous						
Atractides sp.	3	2	2		7	28
Hygrobates sp.						
Lebertia sp.	5	10	13		28	109
Protzia sp.						
Sperchon sp.	1				1	4
Torrenticola sp.						
Caecidotea sp.	110	422	269		801	3,105
Ferrissia sp.						
Lymnaeidae						
Physa sp.		1			1	4
Gyraulus sp.	2	5	18		25	97
Polycelis coronata						
Crangonyx sp.	5	6	6		17	66
Hyalella azteca						
Gammarus lacustris	5	39	18		62	241
Erpobdellidae	11	14	30		55	214
Helobdella sp.			12		12	47
Enchytraeidae		2			2	8
Lumbricidae						
Naididae			29		29	113
Nematoda		2			2	8
Totals	**1082**	**1588**	**735**		**3405**	**13,215**

Table A-5. Macroinvertebrate data collected from site WC-0.5 on 24 Sept. 2025.

Willow Creek						
WC-0.5		Sample				
24 September 2025	1	2	3		Total	Estimated #/m²
Ephemeroptera (mayflies)						
Ameletus sp.						
Acentrella sp.	2	1			3	12
Baetis flavistriga		6			6	24
Baetis (*tricaudatus*)	25	3	6		34	132
Diphetor hageni	6	8	2		16	63
Attenella margarita						
Drunella coloradensis						
Drunella doddsii						
Drunella grandis						
Ephemerella dorothea infrequens	21	30	6		57	221
Heptageniidae						
Cinygmula sp.						
Epeorus deceptivus						
Epeorus longimanus	4	28	4		36	140
Rhithrogena sp.						
Tricorythodes explicatus			2		2	8
Paraleptophlebia sp.	16	10			26	101
Plecoptera (stoneflies)						
Capniidae						
Paracapnia angulata	1	6	2		9	35
Chloroperlidae						
Sweltsa sp.						
Triznaka signata	3	76	10		89	345
Prostoia besametsa						
Zapada cinctipes						
Zapada oregonensis						
Claassenia sabulosa	1				1	4
Perlodidae						
Isoperla sp.	2	6	4		12	47
Isoperla fulva	1				1	4
Megarcys signata						
Skwala americana	1	2	4		7	28
Pteronarcella badia						
Pteronarcys californica						
Taenionema sp.						
Trichoptera (caddisflies)						
Brachycentrus americanus	12	3	1		16	63
Brachycentrus occidentalis			1		1	4
Micrasema bactro	12	29	7		48	187
Anagapetus sp.						
Culoptila sp.	1		2		3	12
Glossosoma sp.	5	1	9		15	59
Protoptila sp.		1	6		7	28
Helicopsyche borealis	11	10	2		23	90

Arctopsyche grandis						
Cheumatopsyche sp.			1		1	4
Hydropsyche sp.	2	5			7	28
Hydropsyche cockerelli	1				1	4
Hydropsyche occidentalis						
Hydropsyche oslari	207	111	233		551	2,136
Hydroptila sp.						
Lepidostoma sp.	1	16	5		22	86
Oecetis sp.						
Limnephilidae						
Psychomyia sp.						
Rhyacophila brunnea			1		1	4
Rhyacophila coloradensis						
Rhyacophila hyalinata						
Rhyacophila sibirica group						
Oligophlebodes sp.						
Diptera (true flies)						
Chironomidae (chironomids)						
Brillia sp.						
Cardiocladius sp.						
Cricotopus nostocicola						
Cricotopus/Orthocladius sp.	145	37	67		249	966
Cryptochironomus sp.						
Diamesa sp.	31	17	16		64	249
Dicrotendipes sp.						
Eukiefferiella sp.	32	8	15		55	214
Heleniella sp.						
Heterotrissocladius sp.						
Lopescladius sp.						
Micropsectra/Tanytarsus sp.		1	4		5	20
Microtendipes sp.			5		5	20
Nanocladius sp.						
Pagastia sp.						
Parakiefferiella sp.						
Parametriocnemus sp.	1	1	1		3	12
Paratanytarsus sp.	3		4		7	28
Parorthocladius sp.						
Polypedilum sp.						
Potthastia sp.						
Rheocricotopus sp.						
Rheotanytarsus sp.						
Sublettea sp.						
Synorthocladius sp.	1	3	1		5	20
Thienemanniella sp.		2	1		3	12
Thienemannimyia group	3	1	1		5	20
Tvetenia sp.	13	11	8		32	125
Other Diptera (true flies)						
Atherix pachypus						
Ceratopogoninae	1		1		2	8
Chelifera/Neoplasta sp.	2		6		8	32
Hemerodromia sp.						
Oreogeton sp.						

Lispoides sp.						
Pericoma sp.						
Simulium sp.	6		1		7	28
Antocha sp.	4	1			5	20
Dicranota sp.						
Hexatoma sp.						
Tipula sp.						
Coleoptera (beetles)						
Helichus sp.						
Dytiscidae		3			3	12
Liodessus sp.						
Heterlimnius sp.						
Optioservus sp.	281	218	316		815	3,159
Zaitzevia parvula	7	3	1		11	43
Brychius sp.						
Hemiptera (true bugs)						
Corixidae						
Miscellaneous						
Atractides sp.		1			1	4
Hygrobates sp.	8	24	43		75	291
Lebertia sp.	2	2	6		10	39
Protzia sp.			1		1	4
Sperchon sp.	13	11	18		42	163
Torrenticola sp.						
Caecidotea sp.	4	26	15		45	175
Ferrissia sp.						
Lymnaeidae		3	1		4	16
Physa sp.	1		2		3	12
Gyraulus sp.	41	168	43		252	977
Polycelis coronata						
Crangonyx sp.						
Hyalella azteca						
Gammarus lacustris						
Erpobdellidae	2				2	8
Helobdella sp.						
Enchytraeidae						
Lumbricidae	3		6		9	35
Naididae	3	4			7	28
Nematoda						
Totals	**942**	**897**	**891**		**2730**	**10,609**

Table A-6. Macroinvertebrate data collected from site CRCC-0.5 on 25 Sept. 2025.

Colorado River						
CRCC-0.5		Sample				
25 September 2025	1	2	3		Total	Estimated #/m²
Ephemeroptera (mayflies)						
Ameletus sp.						
Acentrella sp.	2	2	7		11	43
Baetis flavistriga	7	4	2		13	51
Baetis (*tricaudatus*)	2	8	83		93	361
Diphetor hageni	2	1	3		6	24
Attenella margarita						
Drunella coloradensis						
Drunella doddsii						
Drunella grandis		2			2	8
Ephemerella dorothea infrequens	78	54	110		242	938
Heptageniidae						
Cinygmula sp.						
Epeorus deceptivus						
Epeorus longimanus	21	17	20		58	225
Rhithrogena sp.			1		1	4
Tricorythodes explicatus	44	11	19		74	287
Paraleptophlebia sp.	8	9	17		34	132
Plecoptera (stoneflies)						
Capniidae						
Paracapnia angulata	9	12	25		46	179
Chloroperlidae						
Sweltsa sp.						
Triznaka signata	3	6	35		44	171
Prostoia besametsa						
Zapada cinctipes						
Zapada oregonensis						
Claassenia sabulosa						
Perlodidae	1	1			2	8
Isoperla sp.			1		1	4
Isoperla fulva			1		1	4
Megarcys signata						
Skwala americana	1	6	3		10	39
Pteronarcella badia						
Pteronarcys californica						
Taenionema sp.						
Trichoptera (caddisflies)						
Brachycentrus americanus	9	10	39		58	225
Brachycentrus occidentalis	4	1	4		9	35
Micrasema bactro						
Anagapetus sp.						
Culoptila sp.	3	10	8		21	82
Glossosoma sp.	2	8	1		11	43
Protoptila sp.	3	8	1		12	47
Helicopsyche borealis						

Arctopsyche grandis	2		12		14	55
Cheumatopsyche sp.		2			2	8
Hydropsyche sp.						
Hydropsyche cockerelli	12	18	52		82	318
Hydropsyche occidentalis						
Hydropsyche oslari	20	40	169		229	888
Hydroptila sp.						
Lepidostoma sp.	444	364	347		1155	4,477
Oecetis sp.						
Limnephilidae						
Psychomyia sp.						
Rhyacophila brunnea						
Rhyacophila coloradensis						
Rhyacophila hyalinata						
Rhyacophila sibirica group						
Oligophlebodes sp.						
Diptera (true flies)						
Chironomidae (chironomids)						
Brillia sp.						
Cardiocladius sp.			4		4	16
Cricotopus nostocicola	2				2	8
Cricotopus/Orthocladius sp.	30	20	75		125	485
Cryptochironomus sp.						
Diamesa sp.						
Dicrotendipes sp.						
Eukiefferiella sp.	26	7	55		88	342
Heleniella sp.						
Heterotrissocladius sp.						
Lopescladius sp.						
Micropsectra/Tanytarsus sp.	3				3	12
Microtendipes sp.	9	1	6		16	63
Nanocladius sp.						
Pagastia sp.	2		2		4	16
Parakiefferiella sp.						
Parametriocnemus sp.		1	2		3	12
Paratanytarsus sp.						
Parorthocladius sp.						
Polypedilum sp.			6		6	24
Potthastia sp.						
Rheocricotopus sp.						
Rheotanytarsus sp.			3		3	12
Sublettea sp.						
Synorthocladius sp.			2		2	8
Thienemanniella sp.	1				1	4
Thienemannimyia group	4	5	1		10	39
Tvetenia sp.	9	7	40		56	218
Other Diptera (true flies)						
Atherix pachypus						
Ceratopogoninae						
Chelifera/Neoplasta sp.	2		2		4	16
Hemerodromia sp.						
Oreogeton sp.						

Lispoides sp.						
Pericoma sp.						
Simulium sp.			80		80	311
Antocha sp.	2		4		6	24
Dicranota sp.						
Hexatoma sp.						
Tipula sp.						
Coleoptera (beetles)						
Helichus sp.						
Dytiscidae						
Liodessus sp.						
Heterlimnius sp.						
Optioservus sp.	20	29	98		147	570
Zaitzevia parvula	1	2	5		8	32
Brychius sp.						
Hemiptera (true bugs)						
Corixidae						
Miscellaneous						
Atractides sp.						
Hygrobates sp.						
Lebertia sp.	2		3		5	20
Protzia sp.						
Sperchon sp.		8	9		17	66
Torrenticola sp.	1				1	4
Caecidotea sp.	23	22	29		74	287
Ferrissia sp.						
Lymnaeidae						
Physa sp.	16	16	8		40	156
Gyraulus sp.	8	5	1		14	55
Polycelis coronata						
Crangonyx sp.						
Hyalella azteca						
Gammarus lacustris						
Erpobdellidae						
Helobdella sp.						
Enchytraeidae						
Lumbricidae	1		1		2	8
Naididae	31		14		45	175
Nematoda	1		1		2	8
Totals	**871**	**717**	**1411**		**2999**	**11,647**

Table A-7. Macroinvertebrate data collected from site CR-9.1 on 25 Sept. 2025.

Colorado River						
CR-9.1		Sample				
25 September 2025	1	2	3		Total	Estimated #/m²
Ephemeroptera (mayflies)						
Ameletus sp.						
Acentrella sp.	2				2	8
Baetis flavistriga						
Baetis (*tricaudatus*)	46	77	66		189	733
Diphetor hageni	3	8	9		20	78
Attenella margarita						
Drunella coloradensis						
Drunella doddsii						
Drunella grandis	1	1	4		6	24
Ephemerella dorothea infrequens	24	15	94		133	516
Heptageniidae						
Cinygmula sp.	1				1	4
Epeorus deceptivus						
Epeorus longimanus	5	26	6		37	144
Rhithrogena sp.			1		1	4
Tricorythodes explicatus	2	1	4		7	28
Paraleptophlebia sp.	3	16	28		47	183
Plecoptera (stoneflies)						
Capniidae						
Paracapnia angulata		2	1		3	12
Chloroperlidae	1	1	8		10	39
Sweltsa sp.						
Triznaka signata						
Prostoia besametsa						
Zapada cinctipes						
Zapada oregonensis						
Claassenia sabulosa	6	6	6		18	70
Perlodidae	1		3		4	16
Isoperla sp.		1	2		3	12
Isoperla fulva			1		1	4
Megarcys signata						
Skwala americana	2	1	1		4	16
Pteronarcella badia						
Pteronarcys californica			1		1	4
Taenionema sp.						
Trichoptera (caddisflies)						
Brachycentrus americanus	177	105	244		526	2,039
Brachycentrus occidentalis						
Micrasema bactro		1			1	4
Anagapetus sp.						
Culoptila sp.			1		1	4
Glossosoma sp.			10		10	39
Protoptila sp.			8		8	32
Helicopsyche borealis						

Arctopsyche grandis	1	1			2	8
Cheumatopsyche sp.						
Hydropsyche sp.						
Hydropsyche cockerelli	14	5	26		45	175
Hydropsyche occidentalis	11	5	4		20	78
Hydropsyche oslari	90	72	101		263	1,020
Hydroptila sp.	15	4	3		22	86
Lepidostoma sp.	73	90	305		468	1,814
Oecetis sp.	5	2			7	28
Limnephilidae						
Psychomyia sp.	2				2	8
Rhyacophila brunnea			1		1	4
Rhyacophila coloradensis						
Rhyacophila hyalinata						
Rhyacophila sibirica group						
Oligophlebodes sp.						
Diptera (true flies)						
Chironomidae (chironomids)						
Brillia sp.						
Cardiocladius sp.	18	14	46		78	303
Cricotopus nostocicola	108	37	140		285	1,105
Cricotopus/Orthocladius sp.	151	135	121		407	1,578
Cryptochironomus sp.			1		1	4
Diamesa sp.		1	1		2	8
Dicrotendipes sp.						
Eukiefferiella sp.	329	252	226		807	3,128
Heleniella sp.						
Heterotrissocladius sp.						
Lopescladius sp.		4			4	16
Micropsectra/Tanytarsus sp.	8	1	5		14	55
Microtendipes sp.	1		1		2	8
Nanocladius sp.						
Pagastia sp.	33	11	102		146	566
Parakiefferiella sp.						
Parametriocnemus sp.	2	5	2		9	35
Paratanytarsus sp.						
Parorthocladius sp.						
Polypedilum sp.	5	3	9		17	66
Potthastia sp.	4	4	11		19	74
Rheocricotopus sp.						
Rheotanytarsus sp.	9	14	7		30	117
Sublettea sp.						
Synorthocladius sp.		1			1	4
Thienemanniella sp.	4	7	1		12	47
Thienemannimyia group	5	6	13		24	94
Tvetenia sp.	181	153	225		559	2,167
Other Diptera (true flies)						
Atherix pachypus						
Ceratopogoninae						
Chelifera/Neoplasta sp.	11	10	4		25	97
Hemerodromia sp.						
Oreogeton sp.						

Lispoides sp.						
Pericoma sp.						
Simulium sp.	509	219	461		1189	4,609
Antocha sp.	10	2	9		21	82
Dicranota sp.						
Hexatoma sp.						
Tipula sp.		1			1	4
Coleoptera (beetles)						
Helichus sp.						
Dytiscidae						
Liodessus sp.						
Heterlimnius sp.						
Optioservus sp.	62	108	281		451	1,749
Zaitzevia parvula	2	19	20		41	159
Brychius sp.						
Hemiptera (true bugs)						
Corixidae						
Miscellaneous						
Atractides sp.						
Hygrobates sp.						
Lebertia sp.		1	3		4	16
Protzia sp.	1	5	13		19	74
Sperchon sp.	3	1	12		16	63
Torrenticola sp.						
Caecidotea sp.	167	415	69		651	2,524
Ferrissia sp.						
Lymnaeidae						
Physa sp.	39	56	21		116	450
Gyraulus sp.						
Polycelis coronata	2	10	11		23	90
Crangonyx sp.	3	2			5	20
Hyalella azteca		1			1	4
Gammarus lacustris						
Erpobdellidae	2	2	1		5	20
Helobdella sp.						
Enchytraeidae						
Lumbricidae	10	35	5		50	194
Naididae	21	33	62		116	450
Nematoda	1		1		2	8
Totals	**2186**	**2008**	**2822**		**7016**	**27,222**

Table A-8. Macroinvertebrate data collected from site CR-1.7 on 25 Sept. 2025.

Colorado River						
CR-1.7		Sample				
25 September 2025	1	2	3		Total	Estimated #/m²
Ephemeroptera (mayflies)						
Ameletus sp.						
Acentrella sp.	1		1		2	8
Baetis flavistriga						
Baetis (*tricaudatus*)	6	33	18		57	221
Diphetor hageni	2	26	4		32	125
Attenella margarita						
Drunella coloradensis						
Drunella doddsii						
Drunella grandis		2			2	8
Ephemerella dorothea infrequens	1	36	8		45	175
Heptageniidae	1				1	4
Cinygmula sp.						
Epeorus deceptivus						
Epeorus longimanus	2	1	10		13	51
Rhithrogena sp.	5	13	12		30	117
Tricorythodes explicatus	1				1	4
Paraleptophlebia sp.	2	21	5		28	109
Plecoptera (stoneflies)						
Capniidae						
Paracapnia angulata			1		1	4
Chloroperlidae		6			6	24
Sweltsa sp.						
Triznaka signata						
Prostoia besametsa						
Zapada cinctipes						
Zapada oregonensis						
Claassenia sabulosa	1	1			2	8
Perlodidae		3	1		4	16
Isoperla sp.	1	17	9		27	105
Isoperla fulva						
Megarcys signata						
Skwala americana		2	1		3	12
Pteronarcella badia	1	19	3		23	90
Pteronarcys californica						
Taenionema sp.						
Trichoptera (caddisflies)						
Brachycentrus americanus						
Brachycentrus occidentalis						
Micrasema bactro						
Anagapetus sp.						
Culoptila sp.		2	1		3	12
Glossosoma sp.						
Protoptila sp.						
Helicopsyche borealis						

Arctopsyche grandis						
Cheumatopsyche sp.	1	30	12		43	167
Hydropsyche sp.						
Hydropsyche cockerelli		4			4	16
Hydropsyche occidentalis		9			9	35
Hydropsyche oslari		14	4		18	70
Hydroptila sp.	2	10	2		14	55
Lepidostoma sp.	67	204	201		472	1,830
Oecetis sp.		2			2	8
Limnephilidae						
Psychomyia sp.						
Rhyacophila brunnea						
Rhyacophila coloradensis						
Rhyacophila hyalinata						
Rhyacophila sibirica group						
Oligophlebodes sp.						
Diptera (true flies)						
Chironomidae (chironomids)						
Brillia sp.						
Cardiocladius sp.	1	1	9		11	43
Cricotopus nostocicola		1	5		6	24
Cricotopus/Orthocladius sp.	24	101	44		169	656
Cryptochironomus sp.			1		1	4
Diamesa sp						
Dicrotendipes sp.		1			1	4
Eukiefferiella sp.	30	237	114		381	1,477
Heleniella sp.						
Heterotrissocladius sp.	1	4	6		11	43
Lopescladius sp.						
Micropsectra/Tanytarsus sp.	3	9	26		38	148
Microtendipes sp.		6			6	24
Nanocladius sp.		1			1	4
Pagastia sp.		2	1		3	12
Parakiefferiella sp.						
Parametriocnemus sp.	1	3	2		6	24
Paratanytarsus sp.	2	2	3		7	28
Parorthocladius sp.						
Polypedilum sp.	1	5	2		8	32
Potthastia sp.		11	2		13	51
Rheocricotopus sp.						
Rheotanytarsus sp.						
Sublettea sp.		12			12	47
Synorthocladius sp.						
Thienemanniella sp.		3	1		4	16
Thienemannimyia group	1	8	3		12	47
Tvetenia sp.	17	569	137		723	2,803
Other Diptera (true flies)						
Atherix pachypus						
Ceratopogoninae						
Chelifera/Neoplasta sp.	1				1	4
Hemerodromia sp.		1			1	4
Oreogeton sp.						

Lispoides sp.						
Pericoma sp.						
Simulium sp.	4	426	407		837	3,245
Antocha sp.						
Dicranota sp.						
Hexatoma sp.						
Tipula sp.						
Coleoptera (beetles)						
Helichus sp.			1		1	4
Dytiscidae						
Liodessus sp.			2		2	8
Heterlimnius sp.						
Optioservus sp.	131	585	503		1219	4,725
Zaitzevia parvula	5	31	25		61	237
Brychius sp.						
Hemiptera (true bugs)						
Corixidae						
Miscellaneous						
Atractides sp.						
Hygrobates sp.	1	5			6	24
Lebertia sp.						
Protzia sp.		2			2	8
Sperchon sp.	1	11	5		17	66
Torrenticola sp.			1		1	4
Caecidotea sp.	14	20	25		59	229
Ferrissia sp.		1			1	4
Lymnaeidae	10	1			11	43
Physa sp.	7	7	4		18	70
Gyraulus sp.	4				4	16
Polycelis coronata						
Crangonyx sp.	3	2	18		23	90
Hyalella azteca						
Gammarus lacustris		1			1	4
Erpobdellidae	2		5		7	28
Helobdella sp.						
Enchytraeidae						
Lumbricidae		1			1	4
Naididae	25	29	47		101	392
Nematoda		1	1		2	8
Totals	**383**	**2555**	**1693**		**4631**	**17,978**

Table A-9. Macroinvertebrate data collected from site WF-5.5 on 26 Sept. 2025.

Williams Fork						
WF-5.5		Sample				
26 September 2025	1	2	3		Total	Estimated #/m²
Ephemeroptera (mayflies)						
Ameletus sp.						
Acentrella sp.	6	7	13		26	101
Baetis flavistriga						
Baetis (*tricaudatus*)	5	47	36		88	342
Diphetor hageni						
Attenella margarita						
Drunella coloradensis						
Drunella doddsii						
Drunella grandis						
Ephemerella dorothea infrequens		1	1		2	8
Heptageniidae						
Cinygmula sp.						
Epeorus deceptivus						
Epeorus longimanus						
Rhithrogena sp.						
Tricorythodes explicatus						
Paraleptophlebia sp.	1		1		2	8
Plecoptera (stoneflies)						
Capniidae	3		2		5	20
Paracapnia angulata						
Chloroperlidae						
Sweltsa sp.	2	1	4		7	28
Triznaka signata	3	3	1		7	28
Prostoia besametsa						
Zapada cinctipes						
Zapada oregonensis						
Claassenia sabulosa			1		1	4
Perlodidae						
Isoperla sp.						
Isoperla fulva						
Megarcys signata						
Skwala americana						
Pteronarcella badia						
Pteronarcys californica						
Taenionema sp.						
Trichoptera (caddisflies)						
Brachycentrus americanus	37	68	62		167	648
Brachycentrus occidentalis						
Micrasema bactro						
Anagapetus sp.						
Culoptila sp.						
Glossosoma sp.						
Protoptila sp.						
Helicopsyche borealis						

Arctopsyche grandis						
Cheumatopsyche sp.						
Hydropsyche sp.		2	6		8	32
Hydropsyche cockerelli						
Hydropsyche occidentalis						
Hydropsyche oslari	4	12	16		32	125
Hydroptila sp.			3		3	12
Lepidostoma sp.	9		7		16	63
Oecetis sp.						
Limnephilidae						
Psychomyia sp.						
Rhyacophila brunnea	17	26	15		58	225
Rhyacophila coloradensis	7	12	13		32	125
Rhyacophila hyalinata						
Rhyacophila sibirica group						
Oligophlebodes sp.						
Diptera (true flies)						
Chironomidae (chironomids)						
Brillia sp.						
Cardiocladius sp.						
Cricotopus nostocicola		3			3	12
Cricotopus/Orthocladius sp.	21	45	32		98	380
Cryptochironomus sp.						
Diamesa sp.						
Dicrotendipes sp.						
Eukiefferiella sp.	6	56	22		84	326
Heleniella sp.						
Heterotrissocladius sp.			3		3	12
Lopescladius sp.						
Micropsectra/Tanytarsus sp.	3				3	12
Microtendipes sp.	1	1			2	8
Nanocladius sp.			1		1	4
Pagastia sp.	4	1	4		9	35
Parakiefferiella sp.						
Parametriocnemus sp.						
Paratanytarsus sp.						
Parorthocladius sp.						
Polypedilum sp.						
Potthastia sp.	9	1	1		11	43
Rheocricotopus sp.						
Rheotanytarsus sp.						
Sublettea sp.						
Synorthocladius sp.						
Thienemanniella sp.						
Thienemannimyia group	9	2	3		14	55
Tvetenia sp.		3	1		4	16
Other Diptera (true flies)						
Atherix pachypus						
Ceratopogoninae		1	1		2	8
Chelifera/Neoplasta sp.	10	9	12		31	121
Hemerodromia sp.						
Oreogeton sp.						

Lispoides sp.						
Pericoma sp.						
Simulium sp.	26	298	37		361	1,400
Antocha sp.		1	1		2	8
Dicranota sp.	1	3	1		5	20
Hexatoma sp.	2		5		7	28
Tipula sp.						
Coleoptera (beetles)						
Helichus sp.						
Dytiscidae						
Liodessus sp.						
Heterlimnius sp.			1		1	4
Optioservus sp.	415	163	271		849	3,291
Zaitzevia parvula	16	7	9		32	125
Brychius sp.						
Hemiptera (true bugs)						
Corixidae						
Miscellaneous						
Atractides sp.	2		2		4	16
Hygrobates sp.	7		1		8	32
Lebertia sp.	75	56	43		174	675
Protzia sp.	19	4	9		32	125
Sperchon sp.	2	16	9		27	105
Torrenticola sp.	36	15	24		75	291
Caecidotea sp.						
Ferrissia sp.						
Lymnaeidae	1		1		2	8
Physa sp.	1				1	4
Gyraulus sp.						
Polycelis coronata	4		11		15	59
Crangonyx sp.						
Hyalella azteca		1			1	4
Gammarus lacustris						
Erpobdellidae	1				1	4
Helobdella sp.						
Enchytraeidae						
Lumbricidae			2		2	8
Naididae	409	149	369		927	3,594
Nematoda						
Totals	**1174**	**1014**	**1057**		**3245**	**12,602**

Appendix B. Northern Water: Benthic Macroinvertebrate Data – Fall 2025

Table B-1. Macroinvertebrate data collected from site CR-31.0 on 25 Sept. 2025.

Colorado River						
CR-WGU (31.0)		Sample				**Estimated #/m²**
25 Sept. 2025	1	2	3		**Total**	
Ephemeroptera						
Acentrella turbida	23	17	14		**54**	**210**
Baetis flavistriga	1				**1**	**4**
Baetis (*tricaudatus*)	73	133	82		**288**	**1,117**
Diphetor hageni	12	4	4		**20**	**78**
Attenella margarita						
Drunella grandis	3	11	12		**26**	**101**
Ephemerella dorothea infrequens	87	113	94		**294**	**1,140**
Epeorus longimanus	39	19	16		**74**	**287**
Heptagenia sp.						
Rhithrogena sp.		1			**1**	**4**
Tricorythodes explicatus	18	4	20		**42**	**163**
Paraleptophlebia sp.	10	10	5		**25**	**97**
Plecoptera						
Capniidae						
Paracapnia angulata	1	4	5		**10**	**39**
Chloroperlidae	1	20	13		**34**	**132**
Triznaka signata						
Claassenia sabulosa	4				**4**	**16**
Perlodidae		1			**1**	**4**
Isoperla sp.	3	6	5		**14**	**55**
Isoperla fulva		1	1		**2**	**8**
Skwala americana	2				**2**	**8**
Pteronarcys californica						
Trichoptera						
Brachycentrus americanus	156	150	172		**478**	**1,853**
Brachycentrus occidentalis	4	1	7		**12**	**47**
Micrasema bactro		1			**1**	**4**
Culoptila sp.						
Glossosoma sp.	3	2	1		**6**	**24**
Protoptila sp.						
Helicopsyche borealis						
Arctopsyche grandis	17	18	11		**46**	**179**
Cheumatopsyche sp.	3		6		**9**	**35**
Hydropsyche sp.	8	2	1		**11**	**43**
Hydropsyche (cockerelli)	24	40	20		**84**	**326**
Hydropsyche occidentalis			1		**1**	**4**
Hydropsyche oslari	15	18	32		**65**	**252**
Hydroptila sp.	8	2	8		**18**	**70**
Lepidostoma sp.	255	141	149		**545**	**2,113**
Ceraclea sp.		1			**1**	**4**
Oecetis sp.						
Limnephilidae			3		**3**	**12**
Psychomyia flavida						
Rhyacophila brunnea	2	1			**3**	**12**
Rhyacophila coloradensis	2		1		**3**	**12**
Diptera						
Chironomidae						
Cardiocladius sp.						
Cricotopus nostocicola	56	55	99		**210**	**814**
Cricotopus/Orthocladius sp.	504	229	469		**1202**	**4,659**
Cryptochironomus sp.						
Diamesa sp.			1		**1**	**4**

Table B-2. Macroinvertebrate data collected from site CR-28.7 on 25 Sept. 2025 (Continued).

Eukiefferiella sp.	158	182	219		**559**	**2,167**
Hydrosmittia sp.						
Lopescladius sp.						
Micropsectra/*Tanytarsus* sp.	26	16	20		**62**	**241**
Microtendipes sp.	46	7	53		**106**	**411**
Monodiamesa sp.						
Nanocladius sp.						
Pagastia sp.	12	10	8		**30**	**117**
Parametriocnemus sp.			5		**5**	**20**
Paratanytarsus sp.						
Phaenopsectra sp.						
Polypedilum sp.		1			**1**	**4**
Potthastia sp.	22	5	35		**62**	**241**
Potthastia gaedii						
Rheocricotopus sp.						
Rheotanytarsus sp.			3		**3**	**12**
Stempellinella sp.						
Synorthocladius sp.	1		1		**2**	**8**
Thienemanniella sp.	4	1	1		**6**	**24**
Thienemannimyia group	21	2	13		**36**	**140**
Tvetenia sp.	40	48	44		**132**	**512**
Other Diptera						
Atherix pachypus						
Ceratopogoninae						
Culicoides sp.						
Chelifera/Neoplasta sp.	31	22	41		**94**	**365**
Hemerodromia sp.						
Wiedemannia sp.			1		**1**	**4**
Pericoma sp.						
Simulium sp.	7	132	12		**151**	**586**
Antocha sp.	9	9	12		**30**	**117**
Coleoptera						
Helichus striatus						
Optioservus sp.	59	53	23		**135**	**524**
Zaitzevia parvula						
Miscellaneous						
Atractides sp.						
Hygrobates sp.						
Lebertia sp.	5	7	12		**24**	**94**
Protzia sp.						
Sperchon sp.		1	2		**3**	**12**
Crangonyx sp.	3		3		**6**	**24**
Pisidium sp.						
Caecidotea sp.	506	96	335		**937**	**3,632**
Polycelis coronata	37	60	19		**116**	**450**
Ferrissia sp.						
Physa sp.			6		**6**	**24**
Gyraulus sp.						
Erpobdellidae	2				**2**	**8**
Lumbricidae		2	5		**7**	**28**
Naididae	10	6	35		**51**	**198**
Nematoda		3	2		**5**	**20**
Totals	**2333**	**1668**	**2162**		**6163**	**23,913**

Table B-2. Macroinvertebrate data collected from site CR-28.7 on 25 Sept. 2025 (Continued).

Colorado River						
CR-WGD (28.7)		Sample				**Estimated #/m²**
25 Sept. 2025	1	2	3		**Total**	
Ephemeroptera						
Acentrella turbida	7	8	20		**35**	**136**
Baetis flavistriga		2	2		**4**	**16**
Baetis (*tricaudatus*)	165	38	287		**490**	**1,900**
Diphetor hageni	10	2	12		**24**	**94**
Attenella margarita						
Drunella grandis	8	12	4		**24**	**94**
Ephemerella dorothea infrequens	319	334	408		**1061**	**4,113**
Epeorus longimanus	40	35	36		**111**	**431**
Heptagenia sp.						
Rhithrogena sp.						
Tricorythodes explicatus	16	21	16		**53**	**206**
Paraleptophlebia sp.	24	47	57		**128**	**497**
Plecoptera						
Capniidae						
Paracapnia angulata		3			**3**	**12**
Chloroperlidae						
Triznaka signata			2		**2**	**8**
Claassenia sabulosa		4	1		**5**	**20**
Perlodidae	2	4	3		**9**	**35**
Isoperla sp.		1	6		**7**	**28**
Isoperla fulva		1	1		**2**	**8**
Skwala americana	1				**1**	**4**
Pteronarcys californica			2		**2**	**8**
Trichoptera						
Brachycentrus americanus	11	17	71		**99**	**384**
Brachycentrus occidentalis	4	3	15		**22**	**86**
Micrasema bactro						
Culoptila sp.	2	13	33		**48**	**187**
Glossosoma sp.		13	15		**28**	**109**
Protoptila sp.	6	34	5		**45**	**175**
Helicopsyche borealis						
Arctopsyche grandis			2		**2**	**8**
Cheumatopsyche sp.			3		**3**	**12**
Hydropsyche sp.	4	2			**6**	**24**
Hydropsyche (cockerelli)	22	25	103		**150**	**582**
Hydropsyche occidentalis						
Hydropsyche oslari	53	38	215		**306**	**1,187**
Hydroptila sp.	3	2	4		**9**	**35**
Lepidostoma sp.	78	378	308		**764**	**2,962**
Ceraclea sp.	4		1		**5**	**20**
Oecetis sp.	10	6	4		**20**	**78**
Limnephilidae						
Psychomyia flavida	4	5	10		**19**	**74**
Rhyacophila brunnea						
Rhyacophila coloradensis						
Diptera						
Chironomidae						
Cardiocladius sp.						
Cricotopus nostocicola	2				**2**	**8**
Cricotopus/Orthocladius sp.	32	11	51		**94**	**365**
Cryptochironomus sp.	1		1		**2**	**8**
Diamesa sp.	1				**1**	**4**

Table B-2. Macroinvertebrate data collected from site CR-28.7 on 25 Sept. 2025 (Continued).

Eukiefferiella sp.	13	7	99		**119**	**462**
Hydrosmittia sp.						
Lopescladius sp.						
Micropsectra/Tanytarsus sp.	2	4	4		**10**	**39**
Microtendipes sp.		2	4		**6**	**24**
Monodiamesa sp.						
Nanocladius sp.			1		**1**	**4**
Pagastia sp.	1		1		**2**	**8**
Parametriocnemus sp.	8	2	21		**31**	**121**
Paratanytarsus sp.						
Phaenopsectra sp.						
Polypedilum sp.	1				**1**	**4**
Potthastia sp.		1			**1**	**4**
Potthastia gaedii						
Rheocricotopus sp.						
Rheotanytarsus sp.	2	3	9		**14**	**55**
Stempellinella sp.						
Synorthocladius sp.		1	2		**3**	**12**
Thienemanniella sp.			2		**2**	**8**
Thienemannimyia group	6	7	13		**26**	**101**
Tvetenia sp.	42	36	144		**222**	**861**
Other Diptera						
Atherix pachypus	15	41	61		**117**	**454**
Ceratopogoninae						
Culicoides sp.						
Chelifera/Neoplasta sp.	2	1	3		**6**	**24**
Hemerodromia sp.						
Wiedemannia sp.						
Pericoma sp.						
Simulium sp.	2		8		**10**	**39**
Antocha sp.		5	11		**16**	**63**
Coleoptera						
Helichus striatus						
Optioservus sp.	124	235	390		**749**	**2,904**
Zaitzevia parvula	1	2	9		**12**	**47**
Miscellaneous						
Atractides sp.			2		**2**	**8**
Hygrobates sp.	1	2			**3**	**12**
Lebertia sp.	1	2	3		**6**	**24**
Protzia sp.						
Sperchon sp.	3	3	10		**16**	**63**
Crangonyx sp.						
Pisidium sp.						
Caecidotea sp.	21	3	10		**34**	**132**
Polycelis coronata	4	1	1		**6**	**24**
Ferrissia sp.						
Physa sp.	1	2	3		**6**	**24**
Gyraulus sp.	10	10	3		**23**	**90**
Erpobdellidae		2			**2**	**8**
Lumbricidae			1		**1**	**4**
Naididae	16	17	26		**59**	**229**
Nematoda						
Totals	**1105**	**1448**	**2539**		**5092**	**19,770**

Table B-3. Macroinvertebrate data collected from site CR-22.1 on 25 Sept. 2025.

Colorado River						
CR-HSPP (22.1)		Sample				**Estimated #/m²**
25 Sept. 2025	1	2	3		**Total**	
Ephemeroptera						
Acentrella turbida	4	8	4		**16**	**63**
Baetis flavistriga						
Baetis (*tricaudatus*)	53	79	31		**163**	**632**
Diphetor hageni	24	3	2		**29**	**113**
Attenella margarita						
Drunella grandis	6	6	11		**23**	**90**
Ephemerella dorothea infrequens	376	253	209		**838**	**3,249**
Epeorus longimanus	10	9	12		**31**	**121**
Heptagenia sp.						
Rhithrogena sp.		1			**1**	**4**
Tricorythodes explicatus	5	1	3		**9**	**35**
Paraleptophlebia sp.	18	15	6		**39**	**152**
Plecoptera						
Capniidae						
Paracapnia angulata	1				**1**	**4**
Chloroperlidae						
Triznaka signata	2	3	4		**9**	**35**
Claassenia sabulosa	5	5	6		**16**	**63**
Perlodidae	4		6		**10**	**39**
Isoperla sp.		1	2		**3**	**12**
Isoperla fulva						
Skwala americana						
Pteronarcys californica						
Trichoptera						
Brachycentrus americanus	1	7	6		**14**	**55**
Brachycentrus occidentalis	1				**1**	**4**
Micrasema bactro						
Culoptila sp.	28	132	112		**272**	**1,055**
Glossosoma sp.	1		3		**4**	**16**
Protoptila sp.	15	11	50		**76**	**295**
Helicopsyche borealis	1		4		**5**	**20**
Arctopsyche grandis	1	4	4		**9**	**35**
Cheumatopsyche sp.	10	8	15		**33**	**128**
Hydropsyche sp.	2	4	1		**7**	**28**
Hydropsyche (cockerelli)	11	21	12		**44**	**171**
Hydropsyche occidentalis			3		**3**	**12**
Hydropsyche oslari	41	57	64		**162**	**628**
Hydroptila sp.	192	124	87		**403**	**1,563**
Lepidostoma sp.	48	79	73		**200**	**776**
Ceraclea sp.						
Oecetis sp.	2	5	10		**17**	**66**
Limnephilidae						
Psychomyia flavida	21	3	10		**34**	**132**
Rhyacophila brunnea						
Rhyacophila coloradensis						
Diptera						
Chironomidae						
Cardiocladius sp.		5			**5**	**20**
Cricotopus nostocicola		1	1		**2**	**8**
Cricotopus/Orthocladius sp.	532	370	185		**1087**	**4,214**
Cryptochironomus sp.			1		**1**	**4**
Diamesa sp.	9	3	1		**13**	**51**

Table B-3. Macroinvertebrate data collected from site CR-22.1 on 25 Sept. 2025 (Continued).

Eukiefferiella sp.	185	216	90		**491**	**1,904**
Hydrosmittia sp.						
Lopescladius sp.			3		**3**	**12**
Micropsectra/Tanytarsus sp.	6	2	1		**9**	**35**
Microtendipes sp.	5		3		**8**	**32**
Monodiamesa sp.						
Nanocladius sp.	1	2			**3**	**12**
Pagastia sp.		1			**1**	**4**
Parametriocnemus sp.	35	22	18		**75**	**291**
Paratanytarsus sp.						
Phaenopsectra sp.	2		2		**4**	**16**
Polypedilum sp.	3	2	4		**9**	**35**
Potthastia sp.	55	28	17		**100**	**388**
Potthastia gaedii						
Rheocricotopus sp.	3	1			**4**	**16**
Rheotanytarsus sp.	4	4			**8**	**32**
Stempellinella sp.						
Synorthocladius sp.	1	2	1		**4**	**16**
Thienemanniella sp.	16	1	3		**20**	**78**
Thienemannimyia group	53	32	36		**121**	**469**
Tvetenia sp.	486	472	206		**1164**	**4,512**
Other Diptera						
Atherix pachypus						
Ceratopogoninae			2		**2**	**8**
Culicoides sp.						
Chelifera/Neoplasta sp.		3	1		**4**	**16**
Hemerodromia sp.	1	1			**2**	**8**
Wiedemannia sp.						
Pericoma sp.						
Simulium sp.	22	185	12		**219**	**849**
Antocha sp.	4		3		**7**	**28**
Coleoptera						
Helichus striatus						
Optioservus sp.	76	75	87		**238**	**923**
Zaitzevia parvula	3	5	11		**19**	**74**
Miscellaneous						
Atractides sp.	1	1			**2**	**8**
Hygrobates sp.		1			**1**	**4**
Lebertia sp.	3		2		**5**	**20**
Protzia sp.	4		1		**5**	**20**
Sperchon sp.	6	9	11		**26**	**101**
Crangonyx sp.						
Pisidium sp.						
Caecidotea sp.			1		**1**	**4**
Polycelis coronata						
Ferrissia sp.						
Physa sp.		1	2		**3**	**12**
Gyraulus sp.	1		3		**4**	**16**
Erpobdellidae						
Lumbricidae		3			**3**	**12**
Naididae	5	3	28		**36**	**140**
Nematoda	2		2		**4**	**16**
Totals	**2407**	**2290**	**1488**		**6185**	**24,004**

Table B-4. Macroinvertebrate data collected from site CR-16.7 on 25 Sept. 2025.

Colorado River						
CR-WFU (16.7)		Sample				**Estimated #/m²**
25 Sept. 2025	1	2	3		**Total**	
Ephemeroptera						
Acentrella turbida	6	14	3		**23**	**90**
Baetis flavistriga						
Baetis (*tricaudatus*)	33	41	61		**135**	**524**
Diphetor hageni		2			**2**	**8**
Attenella margarita						
Drunella grandis	7	12	2		**21**	**82**
Ephemerella dorothea infrequens	85	220	309		**614**	**2,380**
Epeorus longimanus	18	28	16		**62**	**241**
Heptagenia sp.	1				**1**	**4**
Rhithrogena sp.	3	7	24		**34**	**132**
Tricorythodes explicatus	1				**1**	**4**
Paraleptophlebia sp.	2	37	8		**47**	**183**
Plecoptera						
Capniidae	1				**1**	**4**
Paracapnia angulata			1		**1**	**4**
Chloroperlidae						
Triznaka signata		3	2		**5**	**20**
Claassenia sabulosa	1	9	4		**14**	**55**
Perlodidae	7	7	4		**18**	**70**
Isoperla sp.	5	11	14		**30**	**117**
Isoperla fulva		1			**1**	**4**
Skwala americana	1	1			**2**	**8**
Pteronarcys californica		2	4		**6**	**24**
Trichoptera						
Brachycentrus americanus	23	12	25		**60**	**233**
Brachycentrus occidentalis	4	11	2		**17**	**66**
Micrasema bactro						
Culoptila sp.	55	89	407		**551**	**2,136**
Glossosoma sp.			37		**37**	**144**
Protoptila sp.	7	42	75		**124**	**481**
Helicopsyche borealis	5	5	1		**11**	**43**
Arctopsyche grandis		1			**1**	**4**
Cheumatopsyche sp.	7	13	8		**28**	**109**
Hydropsyche sp.	4	37	2		**43**	**167**
Hydropsyche (cockerelli)	14	11	61		**86**	**334**
Hydropsyche occidentalis	9	25	26		**60**	**233**
Hydropsyche oslari	33	60	210		**303**	**1,175**
Hydroptila sp.	40	58	15		**113**	**438**
Lepidostoma sp.	42	34	64		**140**	**543**
Ceraclea sp.						
Oecetis sp.	4	4	1		**9**	**35**
Limnephilidae						
Psychomyia flavida	1	1			**2**	**8**
Rhyacophila brunnea						
Rhyacophila coloradensis			2		**2**	**8**
Diptera						
Chironomidae						
Cardiocladius sp.						
Cricotopus nostocicola	35	33	70		**138**	**535**
Cricotopus/Orthocladius sp.	118	276	14		**408**	**1,582**
Cryptochironomus sp.		1			**1**	**4**
Diamesa sp.		7			**7**	**28**

Table B-4. Macroinvertebrate data collected from site CR-16.7 on 25 Sept. 2025 (Continued).

Eukiefferiella sp.	138	313	50		**501**	**1,942**
Hydrosmittia sp.						
Lopescladius sp.	1		6		**7**	**28**
Micropsectra/Tanytarsus sp.						
Microtendipes sp.		1			**1**	**4**
Monodiamesa sp.						
Nanocladius sp.	1	3			**4**	**16**
Pagastia sp.	3	3	3		**9**	**35**
Parametriocnemus sp.	5	42	4		**51**	**198**
Paratanytarsus sp.						
Phaenopsectra sp.						
Polypedilum sp.	1	4	1		**6**	**24**
Potthastia sp.	8	13			**21**	**82**
Potthastia gaedii						
Rheocricotopus sp.						
Rheotanytarsus sp.		1			**1**	**4**
Stempellinella sp.						
Synorthocladius sp.						
Thienemanniella sp.	3	6			**9**	**35**
Thienemannimyia group	4	8	1		**13**	**51**
Tvetenia sp.	32	88	45		**165**	**640**
Other Diptera						
Atherix pachypus			1		**1**	**4**
Ceratopogoninae	1	1			**2**	**8**
Culicoides sp.						
Chelifera/Neoplasta sp.	5	10	1		**16**	**63**
Hemerodromia sp.	3	5			**8**	**32**
Wiedemannia sp.						
Pericoma sp.						
Simulium sp.	5	17	6		**28**	**109**
Antocha sp.	1	2			**3**	**12**
Coleoptera						
Helichus striatus		1			**1**	**4**
Optioservus sp.	35	56	28		**119**	**462**
Zaitzevia parvula	1	10	17		**28**	**109**
Miscellaneous						
Atractides sp.						
Hygrobates sp.						
Lebertia sp.						
Protzia sp.	1		3		**4**	**16**
Sperchon sp.	6	4	10		**20**	**78**
Crangonyx sp.						
Pisidium sp.						
Caecidotea sp.	11	92	4		**107**	**415**
Polycelis coronata	15	10	29		**54**	**210**
Ferrissia sp.			1		**1**	**4**
Physa sp.	1	2			**3**	**12**
Gyraulus sp.						
Erpobdellidae						
Lumbricidae		1	2		**3**	**12**
Naididae	3	12	13		**28**	**109**
Nematoda						
Totals	**856**	**1820**	**1697**		**4373**	**16,978**

Table B-5. Macroinvertebrate data collected from site CR-bWF on 26 Sept. 2025.

Colorado River						
CR-bWF		Sample				**Estimated #/m²**
26 Sept. 2025	1	2	3		**Total**	
Ephemeroptera						
Acentrella turbida	12	5	10		**27**	**105**
Baetis flavistriga			2		**2**	**8**
Baetis (*tricaudatus*)	28	40	30		**98**	**380**
Diphetor hageni		1	3		**4**	**16**
Attenella margarita						
Drunella grandis			1		**1**	**4**
Ephemerella dorothea infrequens	7	5	1		**13**	**51**
Epeorus longimanus	12	13	8		**33**	**128**
Heptagenia sp.						
Rhithrogena sp.						
Tricorythodes explicatus						
Paraleptophlebia sp.		1			**1**	**4**
Plecoptera						
Capniidae						
Paracapnia angulata						
Chloroperlidae						
Triznaka signata						
Claassenia sabulosa			1		**1**	**4**
Perlodidae						
Isoperla sp.						
Isoperla fulva						
Skwala americana	1				**1**	**4**
Pteronarcys californica						
Trichoptera						
Brachycentrus americanus	470	758	656		**1884**	**7,303**
Brachycentrus occidentalis	2	5	2		**9**	**35**
Micrasema bactro	1				**1**	**4**
Culoptila sp.	2		18		**20**	**78**
Glossosoma sp.						
Protoptila sp.			3		**3**	**12**
Helicopsyche borealis						
Arctopsyche grandis	5	2	2		**9**	**35**
Cheumatopsyche sp.						
Hydropsyche sp.	25	37	15		**77**	**299**
Hydropsyche (cockerelli)	5	4	3		**12**	**47**
Hydropsyche occidentalis		3	4		**7**	**28**
Hydropsyche oslari	77	43	57		**177**	**687**
Hydroptila sp.	3	8	26		**37**	**144**
Lepidostoma sp.	357	128	637		**1122**	**4,349**
Ceraclea sp.						
Oecetis sp.		1	2		**3**	**12**
Limnephilidae						
Psychomyia flavida						
Rhyacophila brunnea	1	1			**2**	**8**
Rhyacophila coloradensis		1			**1**	**4**
Diptera						
Chironomidae						
Cardiocladius sp.	4		2		**6**	**24**
Cricotopus nostocicola	14	1	48		**63**	**245**
Cricotopus/Orthocladius sp.	62	72	240		**374**	**1,450**
Cryptochironomus sp.						
Diamesa sp.						

Table B-5. Macroinvertebrate data collected from site CR-bWF on 26 Sept. 2025 (Continued).

Eukiefferiella sp.	34	55	128		**217**	**842**
Hydrosmittia sp.						
Lopescladius sp.						
Micropsectra/Tanytarsus sp.						
Microtendipes sp.	1		2		**3**	**12**
Monodiamesa sp.						
Nanocladius sp.						
Pagastia sp.	7	11	41		**59**	**229**
Parametriocnemus sp.	3	5			**8**	**32**
Paratanytarsus sp.						
Phaenopsectra sp.						
Polypedilum sp.						
Potthastia sp.	1	2	5		**8**	**32**
Potthastia gaedii						
Rheocricotopus sp.						
Rheotanytarsus sp.						
Stempellinella sp.						
Synorthocladius sp.		2			**2**	**8**
Thienemanniella sp.						
Thienemannimyia group						
Tvetenia sp.	6	11	15		**32**	**125**
Other Diptera						
Atherix pachypus						
Ceratopogoninae						
Culicoides sp.						
Chelifera/Neoplasta sp.	6	18	13		**37**	**144**
Hemerodromia sp.						
Wiedemannia sp.						
Pericoma sp.						
Simulium sp.	55	210	43		**308**	**1,194**
Antocha sp.	13	4	51		**68**	**264**
Coleoptera						
Helichus striatus						
Optioservus sp.	74	47	74		**195**	**756**
Zaitzevia parvula	2		3		**5**	**20**
Miscellaneous						
Atractides sp.						
Hygrobates sp.						
Lebertia sp.						
Protzia sp.						
Sperchon sp.	2		2		**4**	**16**
Crangonyx sp.	1	1	1		**3**	**12**
Pisidium sp.			1		**1**	**4**
Caecidotea sp.	138	107	209		**454**	**1,760**
Polycelis coronata	269	84	292		**645**	**2,500**
Ferrissia sp.						
Physa sp.	31	14	37		**82**	**318**
Gyraulus sp.						
Erpobdellidae	1				**1**	**4**
Lumbricidae						
Naididae	3		14		**17**	**66**
Nematoda		2			**2**	**8**
Totals	**1735**	**1702**	**2702**		**6139**	**23,814**

Table B-6. Macroinvertebrate data collected from site CR-R3 on 26 Sept. 2025.

Colorado River						
CR-R3		Sample				**Estimated #/m²**
26 Sept. 2025	1	2	3		**Total**	
Ephemeroptera						
Acentrella turbida	7	9	6		**22**	**86**
Baetis flavistriga						
Baetis (*tricaudatus*)	91	62	127		**280**	**1,086**
Diphetor hageni	2				**2**	**8**
Attenella margarita						
Drunella grandis	39	27	33		**99**	**384**
Ephemerella dorothea infrequens	677	525	498		**1700**	**6,590**
Epeorus longimanus	2	3	7		**12**	**47**
Heptagenia sp.						
Rhithrogena sp.		1	1		**2**	**8**
Tricorythodes explicatus	14	8	9		**31**	**121**
Paraleptophlebia sp.	23	14	23		**60**	**233**
Plecoptera						
Capniidae						
Paracapnia angulata	1		2		**3**	**12**
Chloroperlidae						
Triznaka signata	3	11	4		**18**	**70**
Claassenia sabulosa	3	2	5		**10**	**39**
Perlodidae	2	5	3		**10**	**39**
Isoperla sp.	9	6	7		**22**	**86**
Isoperla fulva			1		**1**	**4**
Skwala americana	3	1	3		**7**	**28**
Pteronarcys californica	2	1	1		**4**	**16**
Trichoptera						
Brachycentrus americanus	69	51	103		**223**	**865**
Brachycentrus occidentalis						
Micrasema bactro						
Culoptila sp.						
Glossosoma sp.	60	89	29		**178**	**690**
Protoptila sp.	1	1			**2**	**8**
Helicopsyche borealis						
Arctopsyche grandis	2		4		**6**	**24**
Cheumatopsyche sp.						
Hydropsyche sp.						
Hydropsyche (cockerelli)	144	104	90		**338**	**1,311**
Hydropsyche occidentalis		2			**2**	**8**
Hydropsyche oslari	71	60	89		**220**	**853**
Hydroptila sp.		1	1		**2**	**8**
Lepidostoma sp.	191	142	118		**451**	**1,749**
Ceraclea sp.						
Oecetis sp.						
Limnephilidae						
Psychomyia flavida						
Rhyacophila brunnea			1		**1**	**4**
Rhyacophila coloradensis						
Diptera						
Chironomidae						
Cardiocladius sp.	6	10	15		**31**	**121**
Cricotopus nostocicola	3	2	6		**11**	**43**
Cricotopus/Orthocladius sp.	419	161	393		**973**	**3,772**
Cryptochironomus sp.	1				**1**	**4**
Diamesa sp.			3		**3**	**12**

Table B-6. Macroinvertebrate data collected from site CR-R3 on 26 Sept. 2025 (Continued).

Eukiefferiella sp.	177	86	196		**459**	**1,780**
Hydrosmittia sp.			1		**1**	**4**
Lopescladius sp.	1				**1**	**4**
Micropsectra/Tanytarsus sp.	9	2	7		**18**	**70**
Microtendipes sp.	3				**3**	**12**
Monodiamesa sp.						
Nanocladius sp.			1		**1**	**4**
Pagastia sp.	5	5	6		**16**	**63**
Parametriocnemus sp.	3	6	2		**11**	**43**
Paratanytarsus sp.						
Phaenopsectra sp.						
Polypedilum sp.	11	9	13		**33**	**128**
Potthastia sp.	11	8	8		**27**	**105**
Potthastia gaedii			1		**1**	**4**
Rheocricotopus sp.						
Rheotanytarsus sp.						
Stempellinella sp.						
Synorthocladius sp.			1		**1**	**4**
Thienemanniella sp.			1		**1**	**4**
Thienemannimyia group	9	8	11		**28**	**109**
Tvetenia sp.	339	212	379		**930**	**3,605**
Other Diptera						
Atherix pachypus						
Ceratopogoninae	1				**1**	**4**
Culicoides sp.						
Chelifera/Neoplasta sp.	8	4	5		**17**	**66**
Hemerodromia sp.						
Wiedemannia sp.						
Pericoma sp.						
Simulium sp.	150	474	309		**933**	**3,617**
Antocha sp.	32	23	43		**98**	**380**
Coleoptera						
Helichus striatus						
Optioservus sp.	136	70	57		**263**	**1,020**
Zaitzevia parvula	14	7	3		**24**	**94**
Miscellaneous						
Atractides sp.		3			**3**	**12**
Hygrobates sp.			1		**1**	**4**
Lebertia sp.	3	3	1		**7**	**28**
Protzia sp.			2		**2**	**8**
Sperchon sp.	3	3	1		**7**	**28**
Crangonyx sp.						
Pisidium sp.						
Caecidotea sp.	2	2	1		**5**	**20**
Polycelis coronata	42	29	20		**91**	**353**
Ferrissia sp.						
Physa sp.		1			**1**	**4**
Gyraulus sp.						
Erpobdellidae						
Lumbricidae						
Naididae	6	14	31		**51**	**198**
Nematoda	3	3	2		**8**	**32**
Totals	**2813**	**2270**	**2685**		**7768**	**30,136**

Table B-7. Macroinvertebrate data collected from site CR-R4 on 26 Sept. 2025.

Colorado River						
CR-R4		Sample				**Estimated #/m²**
26 Sept. 2025	1	2	3		**Total**	
Ephemeroptera						
Acentrella turbida	5	1	1		**7**	**28**
Baetis flavistriga						
Baetis (*tricaudatus*)	27	36	57		**120**	**466**
Diphetor hageni	5	6	7		**18**	**70**
Attenella margarita	2	2	1		**5**	**20**
Drunella grandis	9	11	23		**43**	**167**
Ephemerella dorothea infrequens	370	404	216		**990**	**3,838**
Epeorus longimanus	12	14	18		**44**	**171**
Heptagenia sp.						
Rhithrogena sp.	1				**1**	**4**
Tricorythodes explicatus	101	60	51		**212**	**822**
Paraleptophlebia sp.	33	19	45		**97**	**376**
Plecoptera						
Capniidae						
Paracapnia angulata						
Chloroperlidae						
Triznaka signata		4	4		**8**	**32**
Claassenia sabulosa		2			**2**	**8**
Perlodidae	1	3	4		**8**	**32**
Isoperla sp.	8	8	20		**36**	**140**
Isoperla fulva		1			**1**	**4**
Skwala americana	6	2	3		**11**	**43**
Pteronarcys californica						
Trichoptera						
Brachycentrus americanus	70	78	108		**256**	**993**
Brachycentrus occidentalis						
Micrasema bactro			1		**1**	**4**
Culoptila sp.	1				**1**	**4**
Glossosoma sp.	3	44	2		**49**	**190**
Protoptila sp.		2			**2**	**8**
Helicopsyche borealis						
Arctopsyche grandis		2	2		**4**	**16**
Cheumatopsyche sp.						
Hydropsyche sp.	1				**1**	**4**
Hydropsyche (cockerelli)	1	10	11		**22**	**86**
Hydropsyche occidentalis			1		**1**	**4**
Hydropsyche oslari	19	22	59		**100**	**388**
Hydroptila sp.	5	3	3		**11**	**43**
Lepidostoma sp.	485	385	297		**1167**	**4,524**
Ceraclea sp.		3			**3**	**12**
Oecetis sp.	1				**1**	**4**
Limnephilidae						
Psychomyia flavida						
Rhyacophila brunnea						
Rhyacophila coloradensis						
Diptera						
Chironomidae						
Cardiocladius sp.						
Cricotopus nostocicola		1			**1**	**4**
Cricotopus/Orthocladius sp.	1762	455	1015		**3232**	**12,528**
Cryptochironomus sp.						
Diamesa sp.	1	1	7		**9**	**35**

Table B-7. Macroinvertebrate data collected from site CR-R4 on 26 Sept. 2025 (Continued).

Eukiefferiella sp.	317	179	405		**901**	**3,493**
Hydrosmittia sp.						
Lopescladius sp.						
Micropsectra/Tanytarsus sp.	80	16	52		**148**	**574**
Microtendipes sp.	24	13	4		**41**	**159**
Monodiamesa sp.			1		**1**	**4**
Nanocladius sp.						
Pagastia sp.	1	4	5		**10**	**39**
Parametriocnemus sp.	28	5	12		**45**	**175**
Paratanytarsus sp.	2	1			**3**	**12**
Phaenopsectra sp.	2				**2**	**8**
Polypedilum sp.	13	9	5		**27**	**105**
Potthastia sp.	21	19	20		**60**	**233**
Potthastia gaedii	1		1		**2**	**8**
Rheocricotopus sp.			1		**1**	**4**
Rheotanytarsus sp.						
Stempellinella sp.		1			**1**	**4**
Synorthocladius sp.	2		1		**3**	**12**
Thienemanniella sp.	11	4	12		**27**	**105**
Thienemannimyia group	18	19	31		**68**	**264**
Tvetenia sp.	322	224	448		**994**	**3,853**
Other Diptera						
Atherix pachypus	1		1		**2**	**8**
Ceratopogoninae						
Culicoides sp.	2		2		**4**	**16**
Chelifera/Neoplasta sp.	13	11	18		**42**	**163**
Hemerodromia sp.						
Wiedemannia sp.						
Pericoma sp.			1		**1**	**4**
Simulium sp.	7	10	38		**55**	**214**
Antocha sp.	2	4	1		**7**	**28**
Coleoptera						
Helichus striatus						
Optioservus sp.	6	37	33		**76**	**295**
Zaitzevia parvula						
Miscellaneous						
Atractides sp.		3	1		**4**	**16**
Hygrobates sp.						
Lebertia sp.	2	1	4		**7**	**28**
Protzia sp.						
Sperchon sp.		1			**1**	**4**
Crangonyx sp.						
Pisidium sp.			1		**1**	**4**
Caecidotea sp.	181	33	54		**268**	**1,039**
Polycelis coronata	2	3	2		**7**	**28**
Ferrissia sp.						
Physa sp.	42	2	12		**56**	**218**
Gyraulus sp.						
Erpobdellidae	1	1			**2**	**8**
Lumbricidae						
Naididae	57	10	29		**96**	**373**
Nematoda			1		**1**	**4**
Totals	**4087**	**2189**	**3152**		**9428**	**36,570**

Appendix C. Denver Water: Benthic Macroinvertebrate Data – Fall 2025

Table C-1. Macroinvertebrate data collected from site FR-23.2 on 24 Sept. 2025.

Fraser River						
FR-23.2 (abvWPSD)		Sample				Estimated Total # /m²
24 September 2025	1	2	3		Total	
Ephemeroptera (mayflies)						
Ameletus sp.	5	1	2		8	32
Acentrella turbida	6	4	2		12	47
Baetis flavistriga	18	18	12		48	187
Baetis (*tricaudatus*)	93	73	24		190	737
Diphetor hageni						
Drunella coloradensis						
Drunella doddsii	9	18	4		31	121
Drunella grandis						
Ephemerella dorothea infrequens	33	45	35		113	438
Serratella tibialis	2				2	8
Cinygmula sp.	1				1	4
Epeorus deceptivus						
Epeorus longimanus						
Rhithrogena sp.						
Tricorythodes explicatus						
Paraleptophlebia sp.						
Plecoptera (stoneflies)						
Capniidae			1		1	4
Chloroperlidae	1	8	2		11	43
Sweltsa sp.	57	32	30		119	462
Prostoia besametsa	63	90	16		169	656
Zapada cinctipes		2			2	8
Zapada oregonensis group	1	2			3	12
Diura knowltoni	3				3	12
Isoperla sp.	11	18	3		32	125
Isoperla fulva						
Megarcys signata		1	1		2	8
Skwala americana						
Pteronarcella badia						
Taenionema sp.	5	12			17	66
Trichoptera (caddisflies)						
Brachycentrus americanus	2	8			10	39
Micrasema bactro						
Agapetus sp.						
Anagapetus debilis						
Culoptila sp.						
Glossosoma sp.	1	2			3	12
Protoptila sp.						
Arctopsyche grandis	2	4	1		7	28
Cheumatopsyche sp.						
Hydropsyche cockerelli						
Hydropsyche oslari						
Lepidostoma sp.		1	1		2	8
Oecetis sp.						
Rhyacophila brunnea						
Rhyacophila coloradensis	1	1	1		3	12
Rhyacophila sibirica group	1	5	4		10	39
Oligophlebodes sp.	18	10	21		49	190

Table C-1. Macroinvertebrate data collected from site FR-23.2 on 24 Sept. 2025 (Continued).

Diptera (true flies)						
Chironomidae (chironomids)						
Brillia sp.			1		1	44
Cricotopus nostocicola						
Cricotopus/Orthocladius sp.	223	195	22		440	1706
Diamesa sp.		3	1		4	16
Eukiefferiella sp.	7	9			16	63
Micropsectra/Tanytarsus sp.	34	35	11		80	311
Microtendipes sp.						
Pagastia sp.	15	26	3		44	171
Parorthocladius sp.	17	25	15		57	221
Polypedilum sp.						
Potthastia sp.						
Rheocricotopus sp.	22	31	2		55	214
Rheotanytarsus sp.						
Stempellina sp.	3	4			7	28
Stictochironomus sp.						
Synorthocladius sp.						
Thienemanniella sp.						
Thienemannimyia group						
Tvetenia sp.	2	2	1		5	20
Other Diptera (true flies)						
Atherix pachypus						
Ceratopogoninae	29	29	16		74	287
Chelifera/Neoplasta sp.	2		1		3	12
Wiedemannia sp.						
Pericoma sp.	67	93	27		187	725
Simulium sp.		1			1	4
Antocha sp.		1			1	4
Dicranota sp.			1		1	4
Tipula sp.			1		1	4
Coleoptera (beetles)						
Heterlimnius sp.	51	81	60		192	745
Optioservus sp.						
Zaitzevia parvula						
Miscellaneous						
Hygrobates sp.	1	2			3	12
Lebertia sp.	69	62	54		185	718
Protzia sp.						
Sperchon sp.	48	30	50		128	497
Pisidium sp.						
Physa sp.	1				1	4
Caecidotea sp.						
Polycelis coronata	3	2	7		12	47
Enchytraeidae		4	3		7	28
Lumbricidae			1		1	4
Naididae	3	13	6		22	86
Nematoda						
Totals	**930**	**1003**	**443**		**2376**	**9273**

Table C-2. Macroinvertebrate data collected from site VC-0 on 24 Sept. 2025.

Vasquez Creek						
VC-0 (WP)		Sample				Estimated Total # /m²
24 September 2025	1	2	3		Total	
Ephemeroptera (mayflies)						
Ameletus sp.		2	1		3	12
Acentrella turbida	1	2			3	12
Baetis flavistriga						
Baetis (*tricaudatus*)	25	56	9		90	349
Diphetor hageni						
Drunella coloradensis	2		1		3	12
Drunella doddsii	12	9	4		25	97
Drunella grandis		1			1	4
Ephemerella dorothea infrequens		2	1		3	12
Serratella tibialis	2				2	8
Cinygmula sp.	3	1	8		12	47
Epeorus deceptivus	5				5	20
Epeorus longimanus	2				2	8
Rhithrogena sp.		1			1	4
Tricorythodes explicatus						
Paraleptophlebia sp.						
Plecoptera (stoneflies)						
Capniidae		1	2		3	12
Chloroperlidae		1			1	4
Sweltsa sp.	10	1	2		13	51
Prostoia besametsa						
Zapada cinctipes	1		4		5	20
Zapada oregonensis group	4	6	2		12	47
Diura knowltoni						
Isoperla sp.	3	9	3		15	59
Isoperla fulva						
Megarcys signata		2	2		4	16
Skwala americana						
Pteronarcella badia						
Taenionema sp.	21	15	2		38	148
Trichoptera (caddisflies)						
Brachycentrus americanus		1	2		3	12
Micrasema bactro	17	56	14		87	338
Agapetus sp.						
Anagapetus debilis	4	6	3		13	51
Culoptila sp.						
Glossosoma sp.		2			2	8
Protoptila sp.						
Arctopsyche grandis	3	1	2		6	24
Cheumatopsyche sp.						
Hydropsyche cockerelli						
Hydropsyche oslari						
Lepidostoma sp.						
Oecetis sp.						
Rhyacophila brunnea	8	12	4		24	94
Rhyacophila coloradensis		2			2	8
Rhyacophila sibirica group	3	22	15		40	156
Oligophlebodes sp.	81	38	59		178	690

Table C-2. Macroinvertebrate data collected from site VC-0 on 24 Sept. 2025 (Continued).

Diptera (true flies)						
Chironomidae (chironomids)						
Brillia sp.						
Cricotopus nostocicola		4	2		6	24
Cricotopus/Orthocladius sp.	9	10	1		20	78
Diamesa sp.	1	1			2	8
Eukiefferiella sp.	20	12	3		35	136
Micropsectra/Tanytarsus sp.	2	7	2		11	43
Microtendipes sp.						
Pagastia sp.	3	1			4	16
Parorthocladius sp.						
Polypedilum sp.						
Potthastia sp.						
Rheocricotopus sp.	1				1	4
Rheotanytarsus sp.						
Stempellina sp.			2		2	8
Stictochironomus sp.						
Synorthocladius sp.						
Thienemanniella sp.			1		1	4
Thienemannimyia group						
Tvetenia sp.	4				4	16
Other Diptera (true flies)						
Atherix pachypus						
Ceratopogoninae		1	2		3	12
Chelifera/Neoplasta sp.		1	2		3	12
Wiedemannia sp.						
Pericoma sp.	1	2	1		4	16
Simulium sp.	11	2	1		14	55
Antocha sp.						
Dicranota sp.						
Tipula sp.						
Coleoptera (beetles)						
Heterlimnius sp.	94	113	69		276	1070
Optioservus sp.						
Zaitzevia parvula						
Miscellaneous						
Hygrobates sp.						
Lebertia sp.	4	4	7		15	59
Protzia sp.						
Sperchon sp.		1	3		4	16
Pisidium sp.						
Physa sp.						
Caecidotea sp.						
Polycelis coronata	22	33	28		83	322
Enchytraeidae	18	8	4		30	117
Lumbricidae						
Naididae			1		1	4
Nematoda	1	1			2	8
Totals	**398**	**450**	**269**		**1117**	**4351**

Table C-3. Macroinvertebrate data collected from site FR-20 on 24 Sept. 2025.

Fraser River						
FR-20 (Rendezvous)		Sample				Estimated Total # /m²
24 September 2025	1	2	3		Total	
Ephemeroptera (mayflies)						
Ameletus sp.						
Acentrella turbida	1	1			2	8
Baetis flavistriga			1		1	4
Baetis (*tricaudatus*)	109	89	38		236	915
Diphetor hageni		1			1	4
Drunella coloradensis						
Drunella doddsii	7	3			10	39
Drunella grandis	15	10	2		27	105
Ephemerella dorothea infrequens	1	3	1		5	20
Serratella tibialis						
Cinygmula sp.	12	3	2		17	66
Epeorus deceptivus						
Epeorus longimanus						
Rhithrogena sp.						
Tricorythodes explicatus						
Paraleptophlebia sp.		1			1	4
Plecoptera (stoneflies)						
Capniidae		1			1	4
Chloroperlidae	1				1	4
Sweltsa sp.	27	27	8		62	241
Prostoia besametsa	3	2			5	20
Zapada cinctipes		2			2	8
Zapada oregonensis group		4	1		5	20
Diura knowltoni	1	1			2	8
Isoperla sp.	10	2	3		15	59
Isoperla fulva	3	2			5	20
Megarcys signata	3		1		4	16
Skwala americana	3		2		5	20
Pteronarcella badia						
Taenionema sp.	11	6	2		19	74
Trichoptera (caddisflies)						
Brachycentrus americanus	18	16	3		37	144
Micrasema bactro	12	1			13	51
Agapetus sp.	1		1		2	8
Anagapetus debilis						
Culoptila sp.						
Glossosoma sp.	1	2			3	12
Protoptila sp.						
Arctopsyche grandis	10	11			21	82
Cheumatopsyche sp.						
Hydropsyche cockerelli						
Hydropsyche oslari						
Lepidostoma sp.	8	17	6		31	121
Oecetis sp.						
Rhyacophila brunnea	2				2	8
Rhyacophila coloradensis		1			1	4
Rhyacophila sibirica group		2			2	8
Oligophlebodes sp.	64	19	40		123	477

Table C-3. Macroinvertebrate data collected from site FR-20 on 24 Sept. 2025 (Continued).

Diptera (true flies)						
Chironomidae (chironomids)						
Brillia sp.						
Cricotopus nostocicola						
Cricotopus/Orthocladius sp.	168	167	165		500	1938
Diamesa sp.	16	2	2		20	78
Eukiefferiella sp.	77	48	5		130	504
Micropsectra/Tanytarsus sp.	2	11	5		18	70
Microtendipes sp.						
Pagastia sp.	15	10	3		28	109
Parorthocladius sp.	2	6	13		21	82
Polypedilum sp.	7				7	28
Potthastia sp.			1		1	4
Rheocricotopus sp.	1	1			2	8
Rheotanytarsus sp.	1		1		2	8
Stempellina sp.	1	1			2	8
Stictochironomus sp.			22		22	86
Synorthocladius sp.	1		2		3	12
Thienemanniella sp.		1			1	4
Thienemannimyia group	1				1	4
Tvetenia sp.	1	12			13	51
Other Diptera (true flies)						
Atherix pachypus						
Ceratopogoninae	1	1	1		3	12
Chelifera/Neoplasta sp.	1		1		2	8
Wiedemannia sp.		1			1	4
Pericoma sp.	26	40	5		71	276
Simulium sp.	3	10			13	51
Antocha sp.	2	6	1		9	35
Dicranota sp.	1		2		3	12
Tipula sp.						
Coleoptera (beetles)						
Heterlimnius sp.	349	225	166		740	2869
Optioservus sp.						
Zaitzevia parvula						
Miscellaneous						
Hygrobates sp.						
Lebertia sp.	21	17	12		50	194
Protzia sp.						
Sperchon sp.	10	2	3		15	59
Pisidium sp.			1		1	4
Physa sp.						
Caecidotea sp.		1			1	4
Polycelis coronata	96	103	36		235	911
Enchytraeidae						
Lumbricidae						
Naididae	12		16		28	109
Nematoda	12	2	3		17	66
Totals	**1150**	**894**	**577**		**2621**	**10182**

Table C-4. Macroinvertebrate data collected from site FR-14 on 24 Sept. 2025.

Fraser River						
FR-14 (CR83)		Sample				Estimated Total # /m²
24 September 2025	1	2	3		Total	
Ephemeroptera (mayflies)						
Ameletus sp.						
Acentrella turbida		2	1		3	12
Baetis flavistriga						
Baetis (*tricaudatus*)	35	114	122		271	1051
Diphetor hageni		2	2		4	16
Drunella coloradensis						
Drunella doddsii						
Drunella grandis	81	117	76		274	1063
Ephemerella dorothea infrequens	177	177	179		533	2066
Serratella tibialis						
Cinygmula sp.			1		1	4
Epeorus deceptivus						
Epeorus longimanus	1	3	4		8	32
Rhithrogena sp.						
Tricorythodes explicatus	10	1			11	43
Paraleptophlebia sp.	2	4	3		9	35
Plecoptera (stoneflies)						
Capniidae	1				1	4
Chloroperlidae	12	24	3		39	152
Sweltsa sp.	1	1	7		9	35
Prostoia besametsa						
Zapada cinctipes						
Zapada oregonensis group						
Diura knowltoni						
Isoperla sp.						
Isoperla fulva		9	6		15	59
Megarcys signata						
Skwala americana	1				1	4
Pteronarcella badia		2			2	8
Taenionema sp.						
Trichoptera (caddisflies)						
Brachycentrus americanus	5	34	20		59	229
Micrasema bactro	10	1	3		14	55
Agapetus sp.						
Anagapetus debilis						
Culoptila sp.	1	3	4		8	32
Glossosoma sp.	4	72	81		157	609
Protoptila sp.	6	6	2		14	55
Arctopsyche grandis		12	25		37	144
Cheumatopsyche sp.		1			1	4
Hydropsyche cockerelli	3	128	218		349	1353
Hydropsyche oslari	3	28	34		65	252
Lepidostoma sp.	19	11	18		48	187
Oecetis sp.			1		1	4
Rhyacophila brunnea						
Rhyacophila coloradensis		10	6		16	63
Rhyacophila sibirica group						
Oligophlebodes sp.						

Table C-4. Macroinvertebrate data collected from site FR-14 on 24 Sept. 2025 (Continued).

Diptera (true flies)						
Chironomidae (chironomids)						
Brillia sp.						
Cricotopus nostocicola						
Cricotopus/Orthocladius sp.	110	170	68		348	1349
Diamesa sp.	29	16	11		56	218
Eukiefferiella sp.	21	33	29		83	322
Micropsectra/Tanytarsus sp.	6	4	6		16	63
Microtendipes sp.	7				7	28
Pagastia sp.	2	8	8		18	70
Parorthocladius sp.						
Polypedilum sp.						
Potthastia sp.		4	1		5	20
Rheocricotopus sp.						
Rheotanytarsus sp.		2	1		3	12
Stempellina sp.						
Stictochironomus sp.						
Synorthocladius sp.	2	1			3	12
Thienemanniella sp.						
Thienemannimyia group	1	2	3		6	24
Tvetenia sp.		21	26		47	183
Other Diptera (true flies)						
Atherix pachypus	1	3	1		5	20
Ceratopogoninae			2		2	8
Chelifera/Neoplasta sp.	1	4	7		12	47
Wiedemannia sp.						
Pericoma sp.		1			1	4
Simulium sp.						
Antocha sp.	7	31	20		58	225
Dicranota sp.						
Tipula sp.						
Coleoptera (beetles)						
Heterlimnius sp.						
Optioservus sp.	250	444	342		1036	4016
Zaitzevia parvula		1	4		5	20
Miscellaneous						
Hygrobates sp.						
Lebertia sp.		2	2		4	16
Protzia sp.			2		2	8
Sperchon sp.	9	7	2		18	70
Pisidium sp.						
Physa sp.	1				1	4
Caecidotea sp.						
Polycelis coronata	1				1	4
Enchytraeidae						
Lumbricidae						
Naididae	15	1	4		20	78
Nematoda						
Totals	**835**	**1517**	**1355**		**3707**	**14392**

Appendix D. Learning By Doing: Historical MMI v4 and Individual Metric Results – 2017-2024

Table D-1. Individual component metrics and MMI v4 scores from benthic macroinvertebrate samples collected in the Learning By Doing study area during the fall of 2017 using the MMI v4 subsampling.

Metric	Station ID							
	FR-23.2	FR-20	FR-15	FR-14	RC-1.1	FR-12.4	FR-1.9	CR-9.1
EPT Taxa	50.0	45.8	58.3	62.5	66.7	75.0	100.0	93.2
% Non-Insect Individuals	70.4	55.6	92.7	94.1	80.6	86.2	94.6	83.1
% EPT Individuals-no Baetidae	19.6	15.0	29.1	61.7	53.5	81.3	79.4	68.1
% Coleoptera Individuals	16.2	9.5	4.6	31.6	44.8	47.4	54.8	52.3
% Intolerant Taxa	76.5	82.0	71.7	72.3	71.5	72.9	100.0	89.0
% Increasers, Mid-Elevation	70.9	58.9	87.7	95.5	91.2	85.5	95.3	92.9
Clinger Taxa	43.3	43.3	72.1	76.9	72.1	62.5	100.0	97.4
Predator/Shredder Taxa	85.7	92.9	71.4	100.0	92.9	100.0	100.0	78.6
MMI v4	**54.1**	**50.4**	**61.0**	**74.3**	**71.6**	**76.3**	**90.5**	**81.8**
				Auxiliary	Metrics			
Diversity	3.44	3.08	3.49	3.95	3.98	3.49	4.41	4.23
HBI	4.50	3.95	4.66	3.64	3.57	2.68	3.23	3.09
Sediment Region	SR2	SR2	SR2	SR2	SR2			
TIV	6.39	5.88	6.31	5.64	5.56	--	--	--

Table D-2. Individual component metrics and MMI v4 scores from benthic macroinvertebrate samples collected in the Learning By Doing study area during the fall of 2018. All metric scores are based on the MMI v4 subsampling process.

Metric	Station ID									
	FR-27.2	SLC-0	FR-15	RC-1.1	WF-13.1	WF-5.5	WF-2.0	CR-9.1	CR-7.4	CR-1.7
EPT Taxa	65.3	66.7	45.8	70.8	75.0	45.8	29.2	84.8	100.0	52.1
% EPT, no Baetidae	100.0	35.6	72.1	90.6	85.0	62.1	4.3	50.9	58.0	24.9
Clinger Taxa	65.0	81.7	67.3	67.3	72.1	57.7	33.7	100.0	100.0	57.8
Total Taxa	59.5	--	--	--	--	--	--	--	--	--
Intolerant Taxa	81.0	--	--	--	--	--	--	--	--	--
% Increasers, Mountains	63.9	--	--	--	--	--	--	--	--	--
Predator Taxa	61.5	--	--	--	--	--	--	--	--	--
% Scraper Individuals	100.0	--	--	--	--	--	--	--	--	--
% Non-Insect Individuals	--	70.4	82.2	74.3	86.5	66.6	92.3	76.7	81.7	30.4
% Coleoptera Individuals	--	62.6	70.5	46.6	6.2	66.5	0.8	89.4	73.1	67.9
% Intolerant Taxa	--	65.6	62.2	76.8	94.4	43.4	51.8	79.0	94.9	55.0
% Increasers, Mid-Elev.	--	49.7	85.3	87.8	84.2	87.3	98.7	83.5	88.7	0.0
Predator/Shredder Taxa	--	100.0	57.1	100.0	100.0	78.6	42.9	71.4	92.9	57.1
MMI	**74.5**	**66.5**	**67.8**	**76.8**	**75.4**	**63.5**	**44.2**	**79.5**	**86.2**	**43.2**
					Auxiliary	Metrics				
Diversity	2.98	3.87	3.25	3.66	3.61	3.58	2.64	4.13	4.02	3.54
HBI	2.16	4.05	3.15	2.85	3.23	3.42	4.69	3.42	3.46	5.08
Sediment Region	SR1	SR2	SR2	SR2	SR2					
TIV	2.28	6.20	4.79	4.59	4.25	--	--	--	--	--

Table D-3. Individual component metrics and MMI v4 scores from benthic macroinvertebrate samples collected in the Learning By Doing study area during the fall of 2019 based on the MMI v4 subsampling.

Metric	Station ID									
	FR-25.1	FR-15	FR-1.9	RC-1.1	WF-5.5	WF-2.0	WF-0.5	CR-9.1	CR-7.4	CR-1.7
EPT Taxa	73.5	66.7	100.0	87.5	83.3	41.6	35.6	93.2	100.0	85.3
% EPT, no Baetidae	45.8	45.6	78.9	83.1	81.5	15.1	17.9	68.3	72.9	80.6
Clinger Taxa	70.0	62.5	96.1	76.9	76.9	52.9	35.3	92.6	100.0	84.1
Total Taxa	71.4	--	--	--	--	--	--	--	--	--
Intolerant Taxa	81.0	--	--	--	--	--	--	--	--	--
% Increasers, Mountains	41.3	--	--	--	--	--	--	--	--	--
Predator Taxa	76.9	--	--	--	--	--	--	--	--	--
% Scraper Individuals	56.2	--	--	--	--	--	--	--	--	--
% Non-Insect Individuals	--	88.3	95.8	84.5	90.1	47.0	58.9	78.1	86.0	71.8
% Coleoptera Individuals	--	53.4	58.5	34.8	41.8	1.0	0.0	25.8	33.1	33.1
% Intolerant Taxa	--	74.9	92.4	82.0	77.7	60.7	76.0	75.1	95.2	67.8
% Increasers, Mid-Elev.	--	91.1	97.2	90.5	88.6	93.4	94.5	88.2	80.1	46.7
Predator/Shredder Taxa	--	78.6	64.3	100.0	100.0	71.4	50.0	64.3	57.1	64.3
MMI	**64.5**	**70.1**	**85.4**	**79.9**	**80.0**	**47.9**	**46.0**	**73.2**	**78.1**	**66.7**
Auxiliary Metrics										
Diversity	4.11	3.69	4.18	4.08	3.73	3.25	2.66	4.30	4.05	2.92
HBI	**3.60**	**3.91**	**2.85**	**3.22**	**3.13**	**3.74**	**4.07**	**3.10**	**3.40**	**3.27**
Sediment Region	SR1	SR2		SR2						
TIV	4.92	5.69	--	5.20	--	--	--	--	--	--

Table D-4. Individual component metrics and MMI v4 scores from benthic macroinvertebrate samples collected in the Learning By Doing study area during the fall of 2020. All metric scores are based on the MMI v4 subsampling process.

Metric	Station ID									
	FR-25.1	FR-15	FR-12.4	RC-1.1	WF-5.5	WF-2.0	WF-0.5	CR-9.1	CR-7.4	CR-1.7
EPT Taxa	81.6	54.2	75.0	70.8	58.3	41.6	44.6	89.0	100.0	71.1
% EPT, no Baetidae	32.5	100.0	100.0	92.9	59.1	6.1	8.4	75.1	60.6	32.7
Clinger Taxa	70.0	52.9	67.3	67.3	57.7	48.1	45.4	92.6	100.0	73.6
Total Taxa	92.9	--	--	--	--	--	--	--	--	--
Intolerant Taxa	100.0	--	--	--	--	--	--	--	--	--
% Increasers, Mountains	26.4	--	--	--	--	--	--	--	--	--
Predator Taxa	92.3	--	--	--	--	--	--	--	--	--
% Scraper individuals	33.9	--	--	--	--	--	--	--	--	--
% Non-Insect individuals	--	96.2	95.8	80.0	95.8	88.6	93.6	59.6	92.2	76.7
% Coleoptera individuals	--	10.4	17.7	20.5	15.0	0.0	0.8	32.8	50.6	21.6
% Intolerant Taxa	--	64.4	84.3	77.1	71.7	89.5	99.0	74.2	100.0	70.9
% Increasers, Mid-Elev.	--	97.4	97.2	91.0	98.6	98.6	100.0	68.4	93.4	58.4
Predator/Shredder taxa	--	71.4	64.3	78.6	71.4	50.0	28.6	57.1	71.4	64.3
MMI	**66.2**	**68.4**	**75.2**	**72.3**	**66.0**	**52.8**	**52.5**	**68.6**	**83.5**	**58.7**
	Auxiliary Metrics									
Diversity	3.82	2.40	3.46	3.80	3.78	2.89	2.26	4.29	4.29	3.54
HBI	4.53	1.93	2.13	2.47	3.61	5.43	5.05	2.86	3.36	4.97
Sediment Region	SR1	SR2		SR2						
TIV	5.44	3.93	--	4.69	--	--	--	--	--	--

Table D-5. Individual component metrics and MMI v4 scores from benthic macroinvertebrate samples collected in the Learning By Doing study area during the fall of 2021. All metric scores are based on the MMI v4 subsampling process.

Metric	Station ID										
	FR-25.1	FR-15	RC-1.1	FR-1.9	WF-13.1	WF-5.5 (mod)	WF-2 (mod)	WF-0.5	CR-9.1	CR-7.4	CR-1.7
EPT Taxa	65.3	66.7	70.8	100.0	70.8	58.3	33.3	53.5	67.8	100.0	23.7
% EPT, no Baetidae	38.4	80.3	100.0	63.8	79.7	58.4	3.4	17.9	39.1	47.2	5.5
Clinger Taxa	70.0	67.3	67.3	100.0	72.1	52.9	38.5	45.4	77.9	84.4	21.0
Total Taxa	64.3	--	--	--	--	--	--	--	--	--	--
Intolerant Taxa	85.7	--	--	--	--	--	--	--	--	--	--
% Increasers, Mountains	41.2	--	--	--	--	--	--	--	--	--	--
Predator Taxa	69.2	--	--	--	--	--	--	--	--	--	--
% Scraper individuals	39.3	--	--	--	--	--	--	--	--	--	--
% Non-Insect individuals	--	92.5	93.4	95.2	88.4	87.1	77.8	70.5	10.1	85.9	15.4
% Coleoptera individuals	--	12.8	27.7	95.9	28.5	96.2	0.8	0.0	22.2	46.7	70.1
% Intolerant Taxa	--	82.0	79.1	100.0	100.0	60.9	77.7	85.5	74.9	68.5	16.1
% Increasers, Mid-Elev.	--	91.7	100.0	97.6	100.0	84.4	92.3	91.3	0.0	82.0	0.0
Predator/Shredder taxa	--	64.3	57.1	71.4	78.6	71.4	35.7	57.1	50.0	78.6	35.7
MMI	**59.2**	**69.7**	**74.4**	**90.5**	**77.3**	**71.2**	**44.9**	**52.7**	**42.8**	**74.2**	**23.4**
	Auxiliary Metrics										
Diversity	3.23	3.65	3.75	3.63	3.39	3.18	2.40	3.20	3.96	3.91	2.77
HBI	4.01	2.27	2.25	3.05	2.28	3.76	4.31	4.19	4.02	4.29	6.02
Sediment Region	SR1	SR2	SR2		SR2						
TIV	4.54	4.58	4.47	--	4.54	--	--	--	--	--	--

Table D-6. Individual component metrics and MMI v4 scores from benthic macroinvertebrate samples collected in the Learning By Doing study area during the fall of 2022. All metric scores are based on the MMI v4 subsampling process.

Metric	Station ID											
	FR-27.2	SLC-0	RC-1.1	WC-BHU	WC-CRU	CR-24.9	WF-5.5 (mod)	WF-2 (mod)	WF-0.5	CR-9.1	CR-7.4	CR-1.7
EPT Taxa	69.4	91.7	79.2	39.8	38.4	70.8	58.3	37.4	49.0	72.0	82.4	66.4
% EPT, no Baetidae	93.5	91.1	100.0	19.9	57.3	82.3	56.5	5.0	9.6	26.5	41.2	30.2
Clinger Taxa	60.0	91.3	81.7	45.1	44.1	76.9	52.9	43.3	40.3	68.2	60.3	68.3
Total Taxa	76.2	--	--	--	--	--	--	--	--	--	--	--
Intolerant Taxa	76.2	--	--	--	--	--	--	--	--	--	--	--
% Increasers, Mountains	82.6	--	--	--	--	--	--	--	--	--	--	--
Predator Taxa	76.9	--	--	--	--	--	--	--	--	--	--	--
% Scraper individuals	70.6	--	--	--	--	--	--	--	--	--	--	--
% Non-Insect individuals	--	92.2	92.5	16.8	74.6	86.7	95.1	36.1	44.3	38.6	64.3	78.4
% Coleoptera individuals	--	37.5	17.2	22.0	13.0	27.9	24.5	0.0	0.0	7.7	22.0	50.5
% Intolerant Taxa	--	95.6	91.6	50.4	66.7	54.6	57.9	78.1	89.6	56.8	38.7	40.0
% Increasers, Mid-Elev.	--	94.3	100.0	0.0	71.1	86.6	96.3	93.8	98.5	8.1	36.4	64.1
Predator/Shredder taxa	--	78.6	64.3	50.0	35.7	78.6	64.3	42.9	57.1	64.3	42.9	57.1
MMI	**75.7**	**84.0**	**78.3**	**30.5**	**50.1**	**70.6**	**63.2**	**42.1**	**48.6**	**42.8**	**48.5**	**56.9**
	Auxiliary Metrics											
Diversity	4.09	3.92	3.97	3.34	3.19	3.72	3.82	2.67	2.84	3.81	3.81	3.70
HBI	2.39	2.55	2.48	5.87	3.97	3.07	3.87	3.51	3.26	5.26	4.95	4.84
Sediment Region	**SR1**	**SR2**	**SR2**									
TIV	3.55	5.02	4.68	--	--	--	--	--	--	--	--	--

Table D-7. Individual component metrics and MMI v4 scores from benthic macroinvertebrate samples collected in the Learning By Doing study area during the fall of 2023. All metric scores are based on the MMI v4 subsampling process.

Metric	Station ID													
	RC-5.3	RC-1.1	FR-12.4	FR-KP	FR-1.9	WC-2.3	WC-0.5	CR-24.9	WF-5.5	WF-2.0	WF-0.5	CR-9.1	CR-7.4	CR-1.7
EPT Taxa	79.2	79.2	79.2	100.0	100.0	44.2	68.3	83.3	45.8	25.0	40.1	89.0	100.0	75.8
% Non-Insect individuals	98.6	96.4	89.4	98.5	95.0	23.4	89.2	93.3	95.2	57.5	78.4	85.8	92.2	79.4
% EPT, no Baetidae	46.3	98.5	48.6	98.9	64.8	47.6	87.7	72.3	44.0	5.0	11.3	65.4	50.6	25.3
% Coleoptera individuals	22.6	24.8	22.7	37.7	79.4	6.7	29.5	6.5	34.0	0.9	0.0	16.2	15.1	55.9
% Intolerant Taxa	84.5	97.3	77.9	98.4	96.5	45.4	78.4	82.0	54.6	60.4	100.0	71.1	75.6	48.4
% Increasers, Mid-Elev.	100.0	98.5	97.5	98.5	97.4	0.0	91.0	91.0	95.8	87.5	95.3	93.2	87.1	63.3
Clinger Taxa	76.9	86.5	86.5	100.0	100.0	50.1	68.6	81.7	52.9	33.7	40.3	97.4	100.0	73.6
Predator/Shredder taxa	92.9	64.3	85.7	78.6	78.6	57.1	64.3	64.3	85.7	42.9	42.9	78.6	64.3	64.3
MMI	**75.1**	**80.7**	**73.4**	**88.8**	**89.0**	**34.3**	**72.1**	**71.8**	**63.5**	**39.1**	**51.0**	**74.6**	**73.1**	**60.7**
	Auxiliary Metrics													
Diversity	3.81	4.31	4.24	4.08	4.27	3.25	3.23	3.83	3.85	2.83	2.29	4.18	4.03	4.02
HBI	3.81	2.10	3.56	3.54	3.20	5.55	3.48	3.57	4.05	4.19	4.59	3.31	3.93	5.14
Sediment Region	SR2													
TIV	5.94	4.73	5.42	--	--	--	--	--	--	--	--	--	--	--

Table D-8. Individual component metrics and MMI v4 scores from benthic macroinvertebrate samples collected in the Learning By Doing study area during the fall of 2024. All metric scores are based on the MMI v4 subsampling process.

Metric	Station ID														
	Biotype 2	Biotype 1													
	FR-25.1	FR-15	RC-1.1	FR-3.5	WC-2.3	WC-0.5	CRCC-0.5	CR-24.9	WF-13.1	WF-5.5	WF-2.0	WF-0.5	CR-9.1	CR-7.4	CR-1.7
EPT Taxa	93.9	75.0	91.7	91.7	48.6	72.6	70.8	87.5	62.5	41.7	29.1	40.1	80.5	100.0	90.1
% Non-Insect individuals	--	97.1	96.0	99.4	64.0	97.0	94.8	97.0	83.1	76.1	61.5	71.6	92.7	94.3	84.1
% EPT, no Baetidae	54.2	70.5	100.0	87.5	23.9	79.5	50.6	83.8	63.4	34.2	3.0	5.4	76.1	69.3	32.1
% Coleoptera individuals	--	15.7	44.7	43.7	4.9	39.6	10.7	9.3	22.0	60.2	0.8	0.0	25.0	31.1	100.0
% Intolerant Taxa	--	89.0	91.1	92.2	36.1	94.5	62.0	82.0	90.4	49.7	59.6	81.4	80.9	83.6	71.9
% Increasers, Mid-Elev.	--	100.0	97.3	100.0	52.3	97.0	94.7	98.5	92.7	64.4	87.0	94.5	96.0	92.9	70.5
Clinger Taxa	95.0	86.5	100.0	100.0	55.1	68.6	72.1	81.7	72.1	43.3	38.5	40.3	92.6	100.0	89.3
Predator/Shredder taxa	--	85.7	100.0	57.1	71.4	57.1	64.3	64.3	100.0	71.4	42.9	42.9	85.7	78.6	64.3
Total Taxa	88.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Intolerant Taxa	100.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
% Increasers, Mountain Trn	53.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Predator Taxa	84.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--
% Scraper individuals	46.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MMI	**76.9**	**77.4**	**90.1**	**83.9**	**44.5**	**75.7**	**65.0**	**75.5**	**73.3**	**55.1**	**40.3**	**47.0**	**78.7**	**81.2**	**75.3**
	Auxiliary Metrics														
Diversity	3.87	3.80	3.70	4.24	3.33	3.64	3.98	4.07	3.67	3.88	2.46	2.47	4.40	4.18	4.09
HBI	3.36	2.86	1.96	3.20	5.33	3.49	4.23	2.96	2.67	4.43	4.98	4.65	2.72	2.90	4.15
Sediment Region	SR1	SR2							SR2						
TIV	4.95	5.08	4.33	--	--	--	--	--	5.57	--	--	--	--	--	--

Table D-9. Additional individual metrics and comparative values for macroinvertebrate samples collected from the Learning By Doing study area in the fall of 2017. All additional metric values are based on full count Hess samples.

Metric	FR-23.2	FR-20	FR-15	FR-14	RC-1.1	FR-12.4	FR-1.9	CR-9.1
Density (mean #/m^2)	3,866	10,789	8,284	8,908	9,388	11,725	7,934	8,618
Taxa Richness	34	39	42	47	43	53	50	49
EPT	15	14	16	22	19	24	28	25
Density of *Pteronarcys californica* (#/m^2)	0	0	0	0	0	0	4	4
% EPT-excluding Baetidae	14.49%	10.36%	22.50%	46.51%	40.28%	55.51%	57.79%	48.42%
% Chironomidae	48.99%	47.45%	48.57%	25.33%	25.89%	15.01%	11.56%	17.00%
% Hydropsychidae	31.91%	9.32%	31.33%	72.59%	19.77%	21.38%	49.66%	17.14%
% Tolerant Taxa	17.65%	15.38%	19.05%	14.89%	23.26%	20.75%	18.00%	24.49%
% Intolerant Taxa	44.12%	43.59%	33.33%	36.17%	44.19%	37.74%	50.00%	42.86%

Table D-10. Additional individual metrics and comparative values for macroinvertebrate samples collected from the Learning By Doing study area in the fall of 2018. All additional metric values are based on full count Hess samples.

Metric	FR-27.2	SLC-0	FR-15	RC-1.1	WF-13.1	WF-5.5	WF-2.0	CR-9.1	CR-7.4	CR-1.7
Density (mean #/m^2)	3,862	3,524	8,770	8,566	3,231	6,429	8,755	7,037	7,384	6,197
Taxa Richness	33	46	42	42	37	45	25	55	56	42
EPT	19	22	16	22	20	12	9	28	28	15
Density of *Pteronarcys californica* (#/m^2)	0	0	0	0	0	0	0	19	0	0
% EPT-excluding Baetidae	78.85%	28.73%	54.32%	64.10%	61.93%	46.34%	2.62%	35.23%	43.58%	17.68%
% Chironomidae	2.01%	5.75%	6.02%	2.77%	23.25%	1.57%	74.34%	12.09%	10.16%	11.72%
% Hydropsychidae	0.00%	16.42%	86.99%	35.47%	47.22%	26.01%	6.06%	19.45%	19.81%	9.91%
% Tolerant Taxa	12.12%	15.22%	19.05%	23.81%	13.51%	31.11%	16.00%	16.36%	23.21%	28.57%
% Intolerant Taxa	57.58%	41.30%	35.71%	42.86%	54.05%	28.89%	28.00%	43.64%	39.29%	21.43%

Table D-11. Additional individual metrics and comparative values for macroinvertebrate samples collected from the Learning By Doing study area in the fall of 2019. All additional metric values are based on full count Hess samples.

Metric	FR-25.1	FR-15	FR-1.9	RC-1.1	WF-5.5	WF-2.0	WF-0.5	CR-9.1	CR-7.4	CR-1.7
Density (mean #/m^2)	1,087	8,521	5,528	7,180	10,328	7,264	1,801	10,060	12,549	8,758
Taxa Richness	31	52	48	49	56	33	20	53	58	49
EPT Taxa	19	24	25	24	23	15	8	27	29	23
Density of *Pteronarcys californica* (#/m^2)	0	0	0	0	0	0	0	0	0	0
% EPT-excluding Baetidae	36.33%	34.64%	57.78%	57.68%	57.11%	8.39%	14.90%	49.54%	53.00%	57.36%
% Chironomidae	18.71%	27.71%	7.18%	15.91%	3.46%	17.85%	6.70%	17.49%	6.47%	4.96%
% Hydropsychidae	9.52%	61.29%	21.48%	40.78%	37.60%	22.83%	3.28%	24.09%	14.98%	2.35%
% Tolerant Taxa	12.90%	17.31%	20.83%	26.53%	21.43%	18.18%	20.00%	20.75%	22.41%	30.61%
% Intolerant Taxa	54.84%	40.38%	39.58%	40.82%	39.29%	30.30%	35.00%	37.74%	37.93%	28.57%

Table D-12. Additional individual metrics and comparative values for macroinvertebrate samples collected from the Learning By Doing study area in the fall of 2020. All additional metric values are based on full count Hess samples.

Metric	FR-25.1	FR-15	FR-12.4	RC-1.1	WF-5.5	WF-2.0	WF-0.5	CR-9.1	CR-7.4	CR-1.7
Density (mean #/m^2)	1,848	28,703	14,088	2,329	7,099	14,133	10,366	9,386	10,326	6,808
Taxa Richness	43	47	52	37	47	36	28	53	55	45
EPT Taxa	23	19	25	18	21	18	14	28	29	21
Density of *Pteronarcys californica* (#/m^2)	0	0	0	0	0	0	0	0	0	0
% EPT-excluding Baetidae	28.33%	78.30%	76.52%	66.00%	38.26%	2.91%	4.79%	52.63%	46.56%	24.14%
% Chironomidae	6.13%	11.73%	8.16%	15.58%	20.63%	47.87%	10.63%	8.32%	11.92%	14.16%
% Hydropsychidae	6.25%	55.37%	38.15%	5.02%	24.43%	20.00%	5.88%	14.16%	24.59%	47.88%
% Tolerant Taxa	11.63%	17.02%	23.08%	21.62%	14.89%	16.67%	14.29%	18.87%	18.18%	24.44%
% Intolerant Taxa	53.49%	31.91%	44.23%	43.24%	38.30%	38.89%	46.43%	37.74%	40.00%	31.11%

Table D-13. Additional individual metrics and comparative values for macroinvertebrate samples collected from the Learning By Doing study area in the fall of 2021. All additional metric values are based on full count Hess samples.

Metric	FR-25.1	FR-15	RC-1.1	FR-1.9	WF-13.1	WF-5.5 (mod)	WF-2 (mod)	WF-0.5	CR-9.1	CR-7.4	CR-1.7
Density (#/m^2)	1,795	6,993	3,436	4,871	3,539	4,211	8,597	9,909	11,520	8,184	2,924
Taxa Richness	33	42	33	46	31	41	25	28	47	54	30
EPT	19	19	21	26	20	16	12	14	22	27	8
Density of *Pteronarcys californica* (#/m^2)	0	0	0	4	0	0	0	0	4	0	0
% EPT excluding Baetidae	27.61%	59.58%	79.75%	46.77%	56.26%	41.74%	2.17%	9.79%	27.26%	33.13%	3.46%
% Chironomidae	13.70%	27.37%	5.20%	3.43%	2.97%	2.95%	40.34%	23.61%	7.04%	15.99%	14.49%
% Hydropsychidae	10.00%	23.63%	31.37%	33.19%	3.01%	64.18%	25.00%	0.00%	14.88%	76.66%	0.00%
%Tolerant Taxa	12.12%	14.29%	21.21%	21.74%	3.23%	26.83%	24.00%	17.86%	19.15%	20.37%	43.33%
% Intolerant Taxa	57.58%	45.24%	45.45%	50.00%	61.29%	29.27%	44.00%	42.86%	38.30%	35.19%	6.67%

Table D-14. Additional individual metrics and comparative values for macroinvertebrate samples collected from the Learning By Doing study area in the fall of 2022. All additional metric values are based on full count Hess samples.

Metric	FR-27.2	SLC-0	RC-1.1	WC-BHU	WC-CRU	CR-24.9	WF-5.5 (mod)	WF-2 (mod)	WF-0.5	CR-9.1	CR-7.4	CR-1.7
Density (#/m^2)	3,604	4,364	7,320	5,495	8,611	19,913	6,886	13,889	13,031	9,741	5,767	10,550
Taxa Richness	37	49	47	34	28	56	45	28	30	54	45	58
EPT	20	27	24	11	10	25	14	11	16	23	17	26
Density of *Pteronarcys californica* (#/m^2)	0	0	0	0	0	12	0	0	0	0	0	0
% EPT excluding Baetidae	72.35%	65.57%	80.00%	14.13%	39.03%	58.05%	40.91%	2.37%	7.62%	18.94%	25.47%	17.56%
% Chironomidae	7.78%	2.50%	6.84%	5.72%	2.03%	8.98%	29.68%	15.72%	20.24%	17.86%	34.43%	17.34%
% Hydropsychidae	0.00%	29.04%	31.40%	48.72%	27.55%	13.69%	87.37%	6.38%	3.08%	24.04%	20.57%	9.21%
% Tolerant Taxa	16.22%	18.37%	17.02%	38.24%	32.14%	25.00%	26.67%	28.57%	20.00%	24.07%	28.89%	29.31%
% Intolerant Taxa	54.05%	51.02%	51.06%	26.47%	28.57%	33.93%	26.67%	39.29%	33.33%	31.48%	17.78%	24.14%

Table D-15. Additional individual metrics and comparative values for macroinvertebrate samples collected from the Learning By Doing study area in the fall of 2023. All additional metric values are based on full count Hess samples.

Metric	RC-5.3	RC-1.1	FR-12.4	FR-KP	FR-1.9	WC-2.3	WC-0.5	CR-24.9	WF-5.5	WF-2.0	WF-0.5	CR-9.1	CR-7.4	CR-1.7
Estimated Density (#/m^2)	13,293	9,259	15,911	5,400	6,560	5,987	13,150	4,452	6,256	10,538	20,039	11,358	11,233	6,712
Taxa Richness	58	51	68	52	53	44	53	41	49	30	34	60	47	45
EPT	24	28	33	31	27	15	22	22	16	11	17	28	25	24
Density of *Pteronarcys californica* (#/m^2)	0	0	0	8	0	0	0	0	0	0	0	0	0	0
% EPT excluding Baetidae	37.65%	75.17%	36.58%	70.48%	47.01%	33.42%	62.86%	53.89%	35.96%	3.68%	6.10%	52.55%	38.16%	18.69%
%Chironomidae	30.17%	8.81%	28.33%	2.66%	4.80%	16.68%	5.70%	5.59%	17.58%	27.61%	6.14%	9.26%	22.05%	21.41%
% Hydropsychidae	23.50%	23.72%	60.10%	75.76%	39.38%	73.05%	61.62%	48.90%	63.80%	3.33%	1.33%	7.98%	29.98%	73.22%
%Tolerant Taxa	18.97%	17.65%	23.53%	17.31%	18.87%	31.82%	22.64%	19.51%	20.41%	26.67%	23.53%	26.67%	21.28%	17.78%
% Intolerant Taxa	39.66%	50.98%	41.18%	48.08%	43.40%	31.82%	41.51%	41.46%	26.53%	36.67%	38.24%	31.67%	38.30%	28.89%

Table D-16. Additional individual metrics and comparative values for macroinvertebrate samples collected from the Learning By Doing study area in the fall of 2024. All additional metric values are based on full count Hess samples.

Metric	FR-25.1	FR-15	RC-1.1	FR-3.5	WC-2.3	WC-0.5	CRCC-0.5	CR-24.9	WF-13.1	WF-5.5	WF-2.0	WF-0.5	CR-9.1	CR-7.4	CR-1.7
Estimated Density (#/m^2)	2,664	16,668	7,693	5,480	8,575	5,095	7,902	8,681	5,143	7,523	13,563	12,245	10,439	9,684	6,359
Taxa Richness	43	57	46	48	49	44	54	48	41	50	30	30	59	65	50
EPT	27	28	27	29	19	22	23	26	21	17	11	15	30	35	25
Density of Pteronarcys californica (#/m^2)	0	0	0	4	0	0	0	0	0	0	0	0	0	4	0
Percent EPT excluding Baetidae	44.66%	52.28%	75.20%	65.08%	17.26%	57.33%	40.53%	62.94%	44.60%	24.85%	1.46%	4.44%	56.08%	53.93%	20.93%
Percent Chironomidae	9.08%	34.00%	2.68%	2.41%	58.31%	17.33%	19.43%	20.19%	10.73%	16.17%	30.75%	12.14%	21.81%	28.97%	16.77%
Percent Hydropsychidae	0.44%	14.76%	6.11%	30.94%	9.06%	29.16%	24.20%	13.70%	0.08%	4.65%	0.03%	0.03%	4.65%	3.85%	4.90%
Percent Tolerant Taxa	6.98%	5.26%	15.22%	16.67%	24.49%	15.91%	20.37%	6.25%	12.20%	26.00%	20.00%	13.33%	15.25%	18.46%	16.00%
Percent Intolerant Taxa	58.14%	45.61%	50.00%	43.75%	26.53%	43.18%	31.48%	41.67%	48.78%	24.00%	36.67%	46.67%	42.37%	40.00%	36.00%
Biomass (g/m^2)	0.5740	9.6236	2.5426	3.5926	1.1267	2.5457	1.8880	2.6302	3.2225	1.5667	2.4360	2.1609	12.2043	1.9202	1.5895

Appendix E. Northern Water (WGFP) and Denver Water: Metric Results from the Fall of 2024

Table E-1. Individual metrics and MMI v4 scores from benthic macroinvertebrate samples collected from Northern Water sampling sites on the Colorado River in September 2024. All scores are based on the MMI v4 subsampling and 'impairment' is shown in red.

Metric	Station ID						
	CR-WGU	CR-WGD	CR-HSPP	CR-WFU	CR-bWF	CR-R3	CR-R4
EPT Taxa	91.7	79.2	87.5	100.0	83.3	75.0	83.3
% Non-Insect Individuals	59.8	96.9	94.8	93.1	77.8	96.3	94.3
% EPT Individuals, no Baetidae	56.8	92.5	86.7	88.8	100.0	100.0	100.0
% Coleoptera Individuals	9.8	12.3	6.6	8.7	3.2	9.2	1.6
% Intolerant Taxa	74.5	84.3	82.0	88.0	89.9	99.4	100.0
% Increaser Individuals, Mid-Elevation	88.2	98.8	90.8	94.9	93.6	96.3	98.7
Clinger Taxa	86.5	81.7	81.7	100.0	81.7	81.7	81.7
Predator/Shredder Taxa	71.4	50.0	42.9	78.6	50.0	71.4	57.1
MMI v4	**67.3**	**74.5**	**71.6**	**81.5**	**72.4**	**78.7**	**77.1**
	Auxiliary Metrics						
Diversity	4.31	3.73	3.18	3.90	3.17	3.36	3.26
HBI	2.78	3.24	2.73	2.95	1.62	1.58	1.72
TIV (Sediment Region 2)	N/A	4.91	N/A	4.69	--	--	--

Table E-2. Additional metrics and comparative values for macroinvertebrate samples collected from Northern Water sampling sites on the Colorado River in September 2024. All metrics are based on full count Hess samples.

Metric	CR-WGU	CR-WGD	CR-HSPP	CR-WFU	CR-bWF	CR-R3	CR-R4
EPT	25	33	30	33	24	26	32
Evenness	0.726	0.621	0.584	0.666	0.571	0.569	0.568
DAT	39.4	38.1	31.0	35.7	28.5	30.5	32.1
Insect Taxa	50	52	44	52	41	48	49
Total Taxa	58	60	50	58	48	54	55
Percent Shredders and Scrapers	19.86%	9.48%	9.56%	14.65%	23.26%	31.49%	20.40%
Density of Pteronarcys californica (#/m^2)	0	0	0	16	4	0	4
Percent EPT (excluding Baetidae)	39.67%	68.22%	62.76%	63.14%	79.50%	84.04%	85.02%
Density (mean #/m^2)	7,711	13,793	14,821	7,823	12,520	14,151	12,180
Percent Chironomidae	35.43%	13.20%	19.72%	16.00%	3.50%	5.79%	6.69%
Percent Hydropsychidae	9.88%	32.76%	8.46%	15.00%	10.23%	7.57%	13.55%
Percent Tolerant Taxa	18.97%	13.33%	10.00%	10.34%	14.58%	12.96%	14.55%
Percent Intolerant Taxa	37.93%	48.33%	42.00%	43.10%	43.75%	44.44%	47.27%
Biomass (g/m^2)	1.8446	3.9019	3.5659	5.1233	3.4926	13.4919	14.9609

Table E-3. Individual metrics and MMI v4 scores from benthic macroinvertebrate samples collected in the Denver Water study area (Fraser River and Vasquez Creek) during fall of 2024. MMI v4 scores indicating 'impairment' would be provided in red.

Metric	Station ID			
	FR-abvWPSD	VC-0	FR-Rendezvous	FR-CR83
	Biotype 1			
EPT Taxa	95.8	100.0	66.7	66.7
% Non-Insect Individuals	71.6	71.7	87.8	97.4
% EPT Individuals, no Baetidae	46.8	37.0	31.9	69.0
% Coleoptera Individuals	12.2	87.1	37.5	20.2
% Intolerant Taxa	88.0	95.0	89.9	87.4
% Increasers Mid-Elevation	70.6	74.4	90.2	97.4
Clinger Taxa	81.7	79.3	62.5	62.5
Predator/Shredder Taxa	100.0	100.0	100.0	64.3
Total Taxa	--	--	--	--
Intolerant Taxa	--	--	--	--
% Increasers Individuals, Mountain Trn	--	--	--	--
Predator Taxa	--	--	--	--
% Scraper Individuals	--	--	--	--
MMI	**70.8**	**80.6**	**70.8**	**70.6**
	Auxiliary Metrics			
Diversity	4.53	3.89	3.60	3.82
HBI	3.66	3.61	3.26	2.92
TIV (Sediment Region 2)	5.54	5.96	6.04	5.09

Table E-4. Additional metrics and comparative values for macroinvertebrate samples collected from the Denver Water study area (Fraser River and Vasquez Creek) in fall of 2024. All additional metric values are based on full count Hess samples.

	FR-abvWPSD	VC-0	FR-Rendezvous	FR-CR83
Density (#/m^2)	2155	6573	10288	5442
Taxa Richness	46	52	49	44
EPT	26	28	24	22
Density of Pteronarcys californica (#/m^2)	0	0	0	0
% EPT excluding Baetidae	37.75%	32.01%	22.42%	49.68%
% Chironomidae	35.03%	9.53%	39.30%	33.31%
Evenness	0.812	0.667	0.637	0.705
DAT Index	30.5	32.3	31.4	25.6
% Hydropsychidae	0.91%	0.18%	0.87%	14.72%
%Tolerant Taxa	10.87%	11.54%	10.20%	13.64%
% Intolerant Taxa	56.52%	50.00%	51.02%	45.45%
Biomass (g/m^2)	0.9167	1.7287	4.3612	6.2674

Appendix F. Learning By Doing, Northern Water (WGFP) and Denver Water: Additional Metric Figures

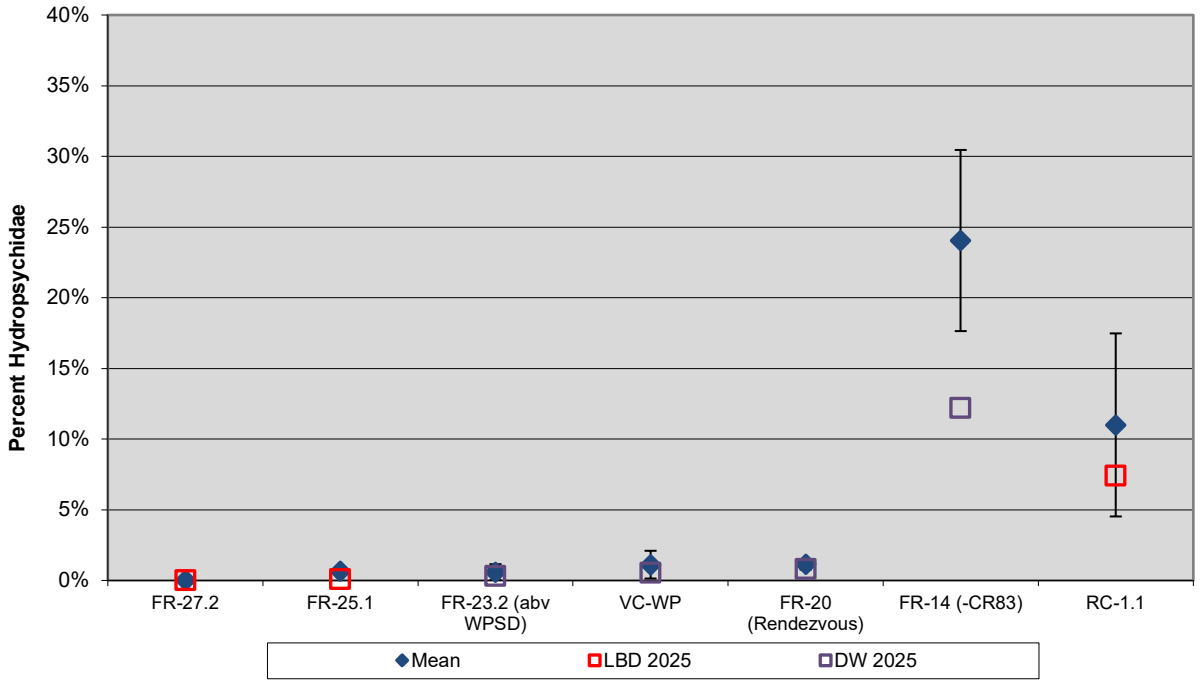

Figure F-1. Percent Hydropsychidae values from study sites in the Fraser River study area from fall 2025 and historical mean values (±1 SD).

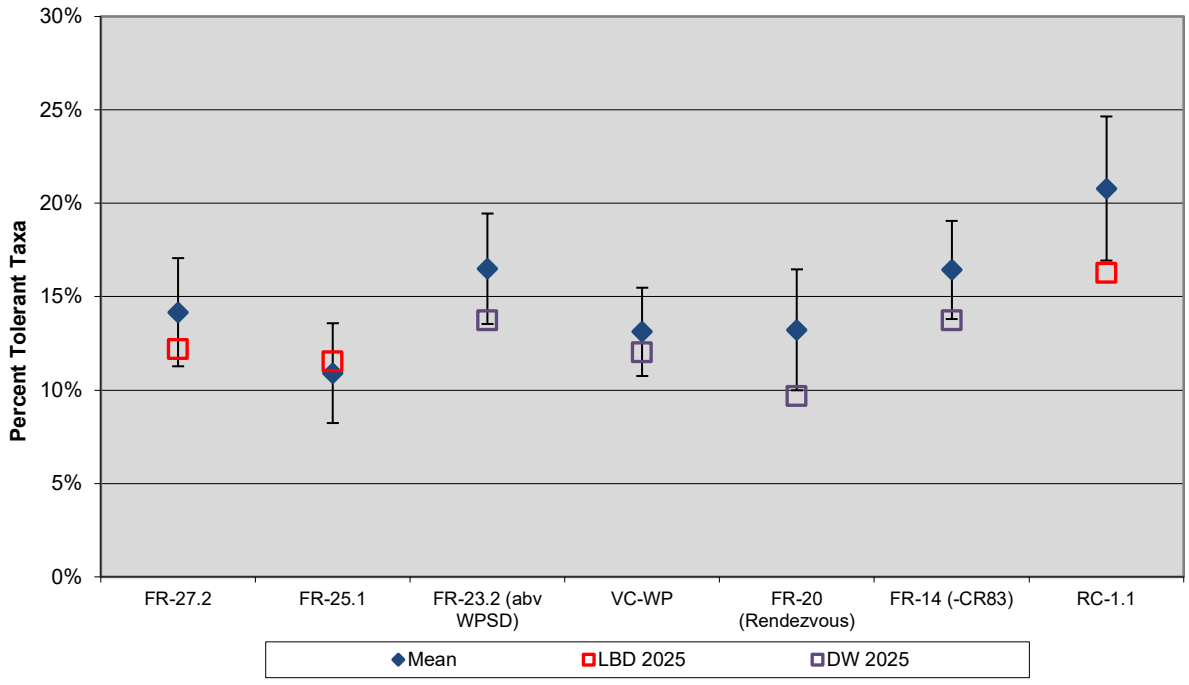

Figure F-2. Percent Tolerant Taxa values from the Fraser River study area from fall 2025 and historical mean values (±1 SD).

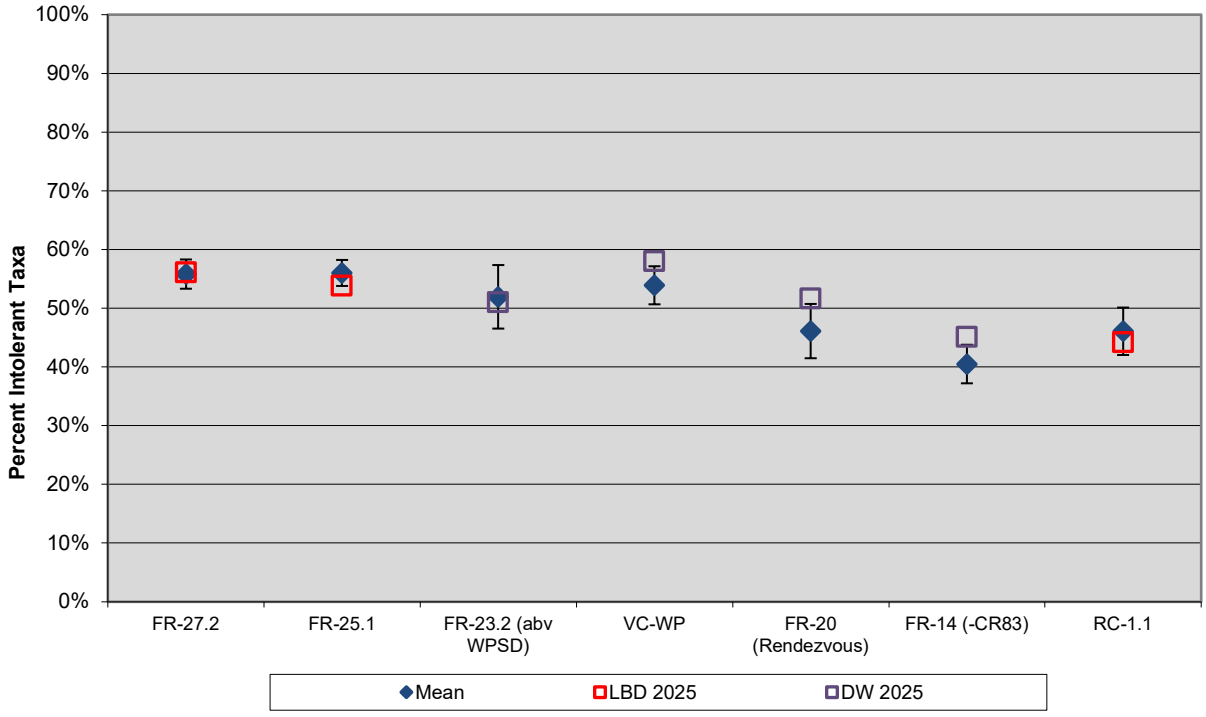

Figure F-3. Percent Intolerant Taxa values from study sites in the Fraser River study area from fall 2025 and mean values (±1 SD) from previous sampling events.

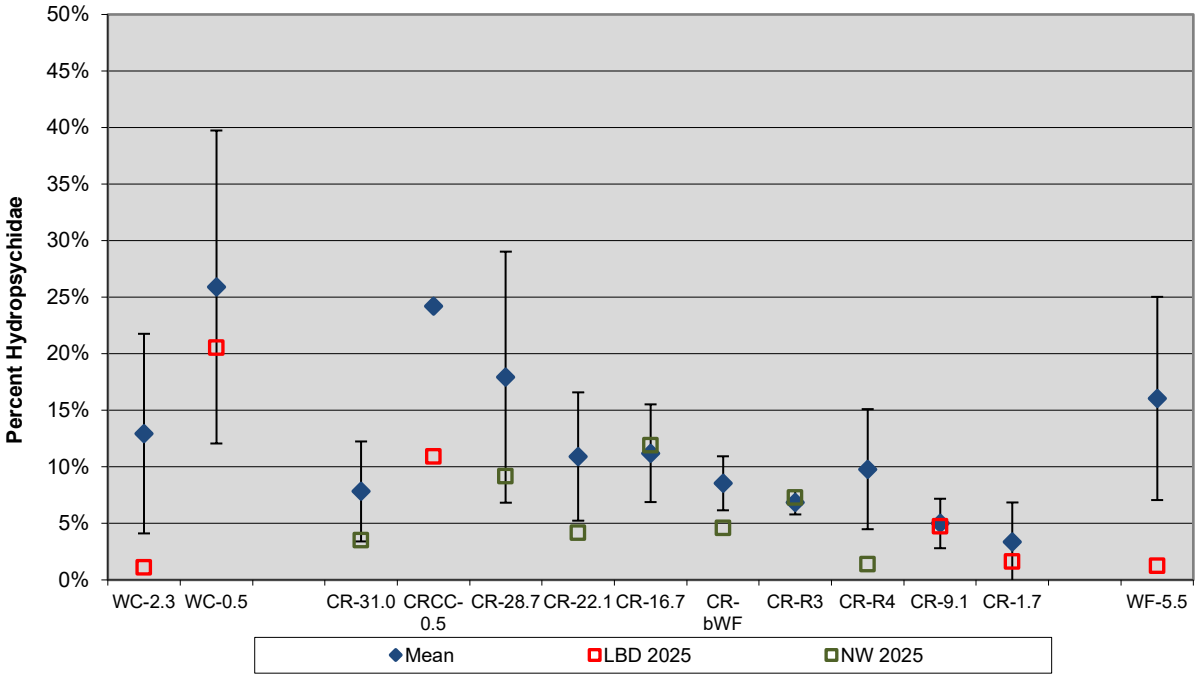

Figure F-4. Percent Hydropsychidae values from study sites in the Colorado River/Williams Fork study area from fall 2025 and mean values (±1 SD) from previous sampling events.

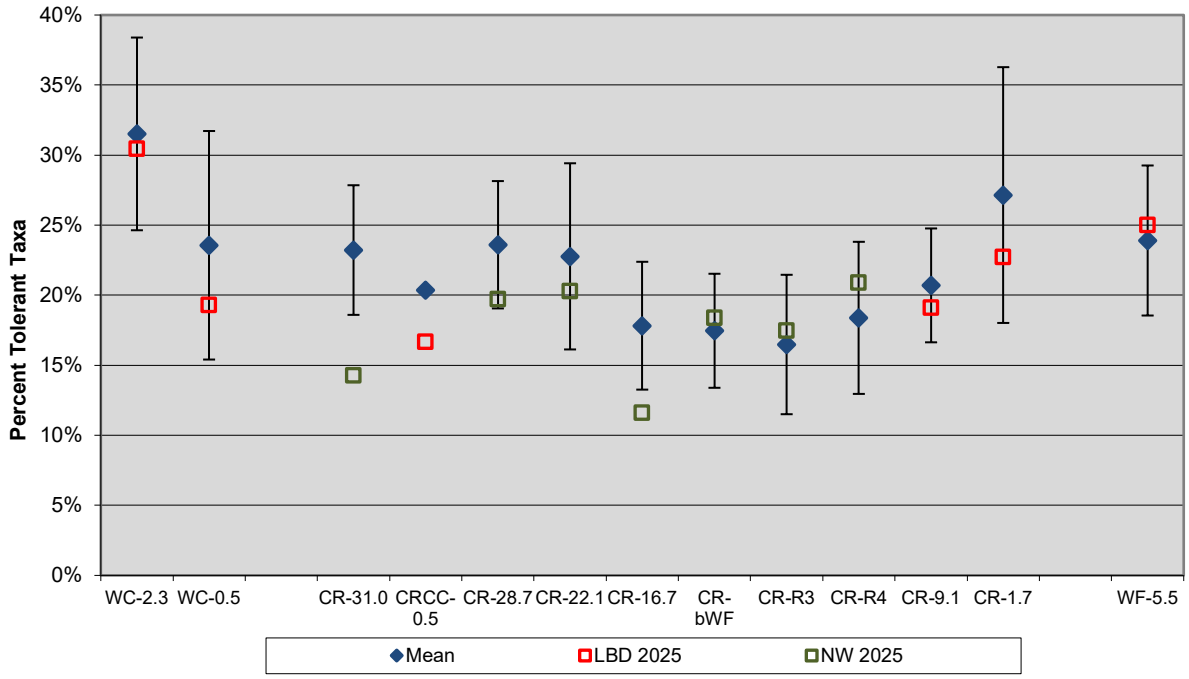

Figure F-5. Percent Tolerant Taxa values from study sites in the Colorado River/Williams Fork study area from fall 2025 and mean values (±1 SD) from previous sampling events.

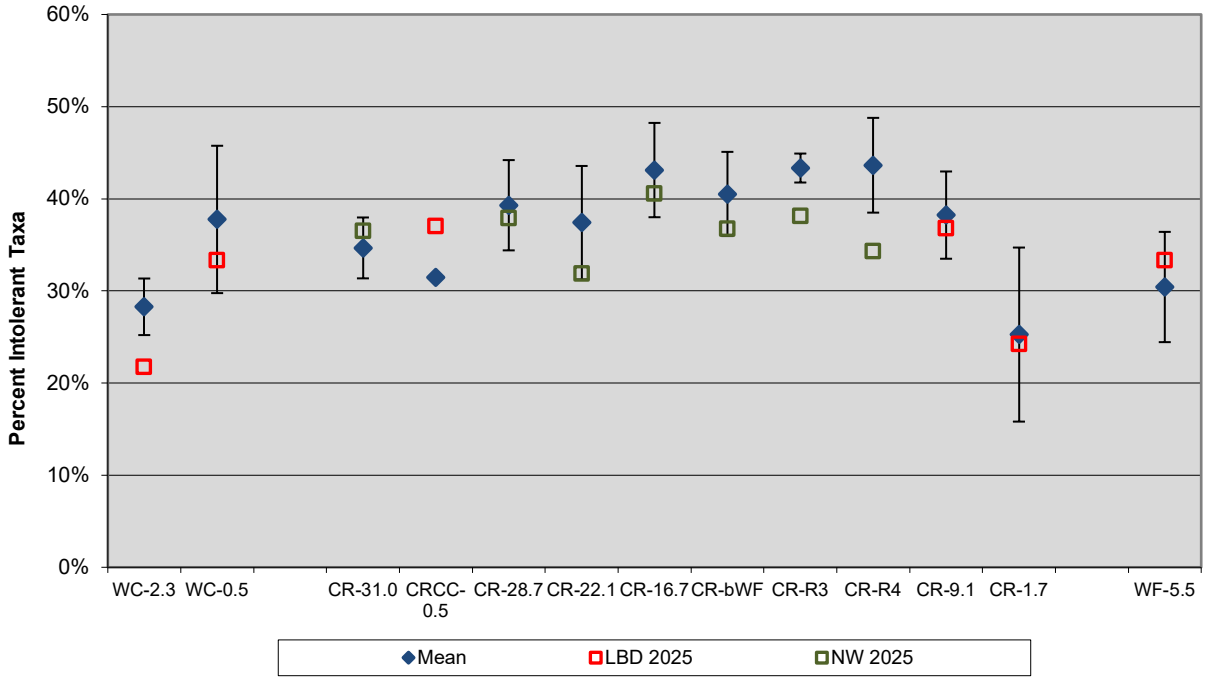

Figure F-6. Percent Intolerant Taxa values from study sites in the Colorado River/Williams Fork study area from fall 2025 and mean values (±1 SD) from previous sampling events.

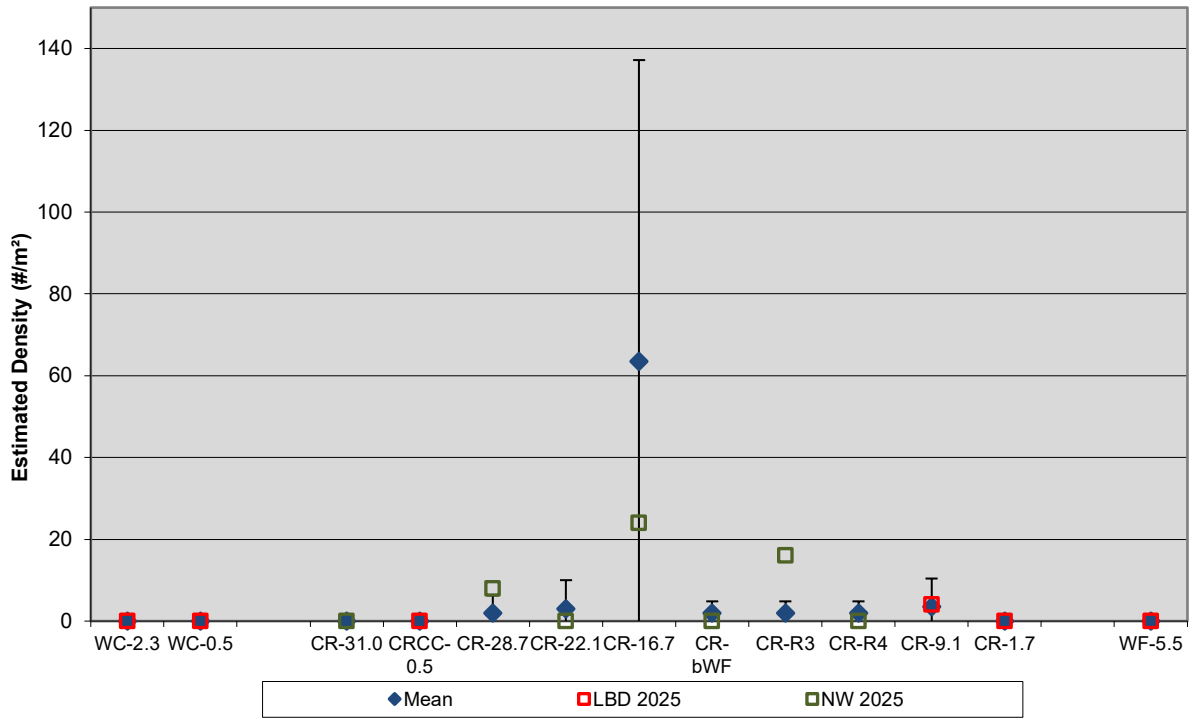

Figure F-7. Density of *Pteronarcys californica* in the Colorado River/Williams Fork study area from fall 2025 and mean values (±1 SD) from previous sampling events.

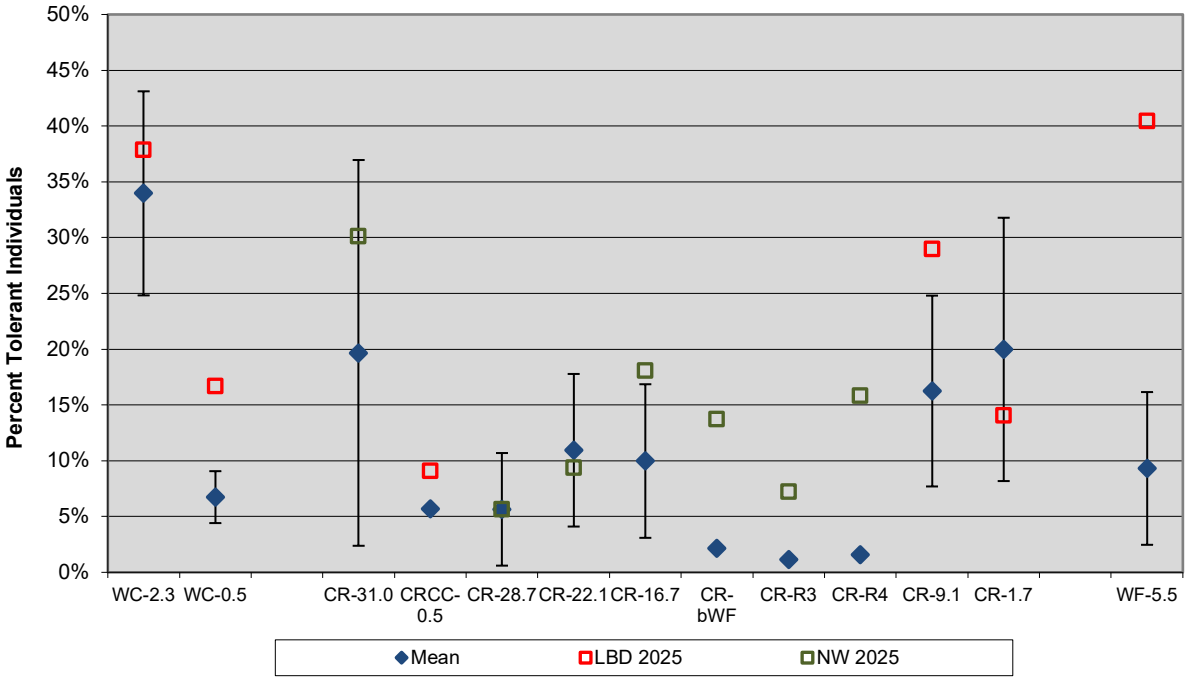

Figure F-8. Percent Tolerant Individuals values in the Colorado River/Williams Fork study area from fall 2025 and mean values (±1 SD) from previous sampling events.

Appendix G. Learning By Doing: Methods and Metric Descriptions

Methods

Benthic macroinvertebrate sampling occurred during the 24th-26th of September 2025. Three replicate, quantitative Hess bottom samples[28] were taken from similar riffle habitat (based on substrate size, water depth, and velocity) at each study site. Substrate within each sample area was thoroughly agitated and individual rocks were scrubbed by hand to dislodge all benthic organisms. Each sample jar was labeled (with date, location, and sample ID number) on the outside and inside of each container, and the contents were preserved in 80% ethanol solution.

After collection, samples were transported to the lab in Fort Collins, Colorado, where specimens were sorted, identified, and enumerated. To ensure accuracy and eliminate potential bias or inconsistency associated with subsampling, the entire contents of each sample were processed in full. All benthic macroinvertebrate samples were processed according to the guidelines 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*. [26,27]

All benthic macroinvertebrates collected from the study area were identified to a taxonomic level consistent with the Operational Taxonomic Unit (OTU) established by the Colorado Department of Public Health and Environment (CDPHE). Specimens were identified using a variety of taxonomic keys including Ward et al. (2002) and Merritt et al. (2019). This level of identification was typically genus or species for mayflies, stoneflies, caddisflies, and many dipterans. Members of the family Chironomidae were also identified to the genus level. As part of the quality control protocols all sorted macroinvertebrate samples were checked by a qualified taxonomist, and approximately 10% of the identifications were checked for accuracy by an SFS certified taxonomist. The following section provides a description of the MMI and other analysis tools used in this study.

The Multi-Metric Index

In 2010, the Colorado Department of Public Health and Environment (CDPHE) published guidelines for benthic macroinvertebrate sampling and analysis, introducing the Multi-Metric Index (MMI v3) for evaluating aquatic life1. The MMI was updated to v4 in 2017, and again to the current MMI v5 in 2025. A detailed description of the metrics and methods used to calculate MMI v5 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 Section 303(d) Listing Methodology 2026 Listing Cycle1,2.

Each of the metrics used in the MMI v5 produces a score that is adjusted to a scale from 1 to 100 based on "reference sites" in the State of Colorado.

Biotype	Attainment Threshold	Impairment Threshold
Transitional (Biotype 1)	43	33
Mountains (Biotype 2)	49	42

Metric scores that fall between the thresholds for 'attainment' and 'impairment' (the 'Gray Zone') require further evaluation using auxiliary metrics to determine an aquatic life use designation. The additional metrics include the Shannon Diversity (Diversity) and Hilsenhoff Biotic Index (HBI). Specific thresholds for the auxiliary metrics in Biotype 1 and Biotype 2 are listed below, followed by descriptions of each metric:

Biotype	HBI	Diversity
Transitional (Biotype 1)	5.6	2.6
Mountains (Biotype 2)	4.9	3.2

Shannon Diversity (Diversity): Diversity was used as an auxiliary metric for the MMI and as an independent metric in this study to evaluate changes in macroinvertebrate community structure by providing a measure of community balance. In unpolluted waters, Diversity values typically range from near 3.0 to 4.0. In polluted waters, this value is generally less than 1.0.[21]

Hilsenhoff Biotic Index (HBI): The HBI is another auxiliary metric used for the MMI; however, it is also valuable as an independent metric and has been widely used and/or recommended in numerous regional biomonitoring studies. Most of the value from this metric lies in the detection of organic pollution (nutrient-enrichment), but it can also be used to evaluate aquatic conditions in a variety of other circumstances. The HBI was originally developed using macroinvertebrate taxa from streams in Wisconsin;[29] however, tolerance values for most taxa occurring in this study area have been derived from a variety of regional sources and provided by the CDPHE. Although HBI values may naturally vary among regions, a comparison of the values produced within the same river system should provide information regarding locations impacted by nutrients and/or other aquatic disturbances. Values from the HBI range from 0.0 to 10.0 and increase as water quality decreases. An additional means of determining 'attainment' or 'impairment' designations using the MMI v5 involves the rapid decline of scores in high scoring waters. When MMI v5 scores are available from multiple years at the same sampling location, and a large decline in scores occurs over the span of at least 12 months, a site will automatically be considered 'impaired' for aquatic life use. The requirements for an allowable decline in MMI v5 scores for Biotype 1 and Biotype 2 are as follows:

Biotype	High Scoring Water (MMI score)	Allowable MMI Decline
Transitional (Biotype 1)	>53	-20
Mountains (Biotype 2)	>62	-20

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 0.0 to 10.0, 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. The thresholds for samples collected is 6.2 in Sediment Region 1 and 7.2 for Sediment Region 2.

Additional metrics used in this study:

In addition to the MMI and associated metrics, several individual metrics were applied in the analysis of macroinvertebrate data from the LBD, Denver Water, and Northern Water study areas to provide a more thorough evaluation of macroinvertebrate community structure and function. The following section provides a description of each individual metric used in this study:

Density: Macroinvertebrate abundance (Density) was reported as the mean number of macroinvertebrates/m^2 found at each study site. The Density metric provides an opportunity to measure and compare standing crop among study sites. This metric becomes more useful when paired with other individual metrics or when monitoring the abundances of certain sensitive taxa throughout the study area.

Biomass: Biomass was reported as the mean dry weight of benthic macroinvertebrates per square meter (g/m^2) 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 (no decrease in weight could be detected). 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.

Taxa Richness (Total Taxa): Taxa Richness was reported as the total number of identifiable taxa collected from each sampling location. Taxa Richness has become one of the most widely used metrics to evaluate stream health, as it provides a general indication of community health and stability.[30] Taxa Richness values are expected to decrease with increased perturbations in the aquatic environment.[31]

Ephemeroptera Plecoptera Trichoptera Taxa (EPT Taxa): The design of this 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.[32] The EPT taxa metric is currently an important and widely used metric in many regions of the United States.[10] The EPT taxa value is simply given as the total number of distinguishable taxa in the orders Ephemeroptera, Plecoptera, and Trichoptera found at each sampling location. This number will naturally vary among river systems, but it can be an excellent indicator of disturbances within a specific drainage. The EPT taxa value is expected to decrease in response to a variety of stressors, including nutrients.[33]

Density of *Pteronarcys californica*: This metric measures the abundance of *Pteronarcys californica* from three replicate quantitative samples at each study site to provide an estimate of the number of individuals per square meter. *Pteronarcys californica* is a large species of stonefly that requires specific aquatic conditions and a relatively long period of time (four years) to complete its life cycle.[27] Therefore, this species is known to be sensitive to a variety of anthropogenic disturbances. Additionally, *Pteronarcys californica* is considered an important part of the aquatic food-web because it typically requires leaf material from a healthy riparian corridor to process.

Percent EPT-excluding Baetidae: As previously stated, most taxa in the orders Ephemeroptera, Plecoptera, and Trichoptera are expected to be sensitive to environmental perturbations or pollution. However, members of the mayfly family Baetidae (Order: Ephemeroptera) tend to be more tolerant to disturbances than other EPT taxa. Therefore, the Percent EPT-excluding Baetidae metric provides a measure of the percent composition of benthic macroinvertebrates at each sampling location that are expected to be highly sensitive to anthropogenic stressors or pollution. A decrease in this metric value suggests that negative impacts to the aquatic environment, such as poor water quality or degraded habitat, may be responsible for reducing the proportions of the most sensitive individuals at a sampling location.

Percent Chironomidae: Members of the family Chironomidae are considered relatively tolerant to environmental disturbances when compared to other aquatic insect families.[10] The Percent Chironomidae metric relies on the assumption that the proportion of Chironomidae will increase with decreasing water quality at a given location. Streams that are undisturbed often have similar proportional distributions of Ephemeroptera, Plecoptera, Trichoptera, and Chironomidae[34], while study sites degraded by metals, nutrients, or other pollutants are often dominated by individuals in the Chironomidae family.[35] Most species of Chironomidae tend to have relatively short life-cycles, which also enables them to continually re-colonize unstable or polluted habitats.[36]

Percent Hydropsychidae: The Percent Hydropsychidae metric was reported for each study site as the proportion of caddisflies (Order: Trichoptera) in the family Hydropsychidae. Members of this family provide some insight into macroinvertebrate community structure and function because they are almost always collector-filterers, and their large body size makes them an important food source for fish. These caddisflies are known to be moderately sensitive to a variety of stressors, particularly ammonia and fine sediment. Seven taxa representing the family Hydropsychidae (*Arctopsyche grandis*, *Cheumatopsyche* sp., *Ceratopsyche morosa* grp., *Hydropsyche* sp., *Hydropsyche cockerelli*,

Hydropsyche occidentalis, and *Hydropsyche oslari*) were found in this study area during the fall of 2025.

Percent Tolerant Taxa: The Percent Tolerant Taxa metric value was reported as the percentage of taxa that are considered tolerant to a variety of environmental disturbances and stressors. This metric measures the relative abundance of taxa that have tolerance values of 7 or greater.

Percent Intolerant Taxa: This metric was expressed as the proportion of taxa expected to be sensitive to a variety of anthropogenic disturbances and environmental stressors. Intolerant taxa include taxa with tolerance values of 3 or lower.

Functional Feeding Groups: Most of the previously described metrics utilize macroinvertebrate information that is related to community structure; however, macroinvertebrate taxa were also separated into functional guilds based on their method of food acquisition to provide a measure of ecological function at each site. When reviewing the proportions of various feeding groups, it is important that most groups are adequately represented; however, it is common for certain groups (such as collector-gatherers) to be more abundant than others.[21,37] Scrapers and shredders are often considered sensitive to disturbance because they are specialized feeders.[10] Consequently, scrapers, shredders (and sometimes collector-filterers) are expected to respond poorly to anthropogenic disturbances. A more balanced distribution among feeding groups is typically an indication of better aquatic conditions. Much of the value from this type of analysis comes from comparisons among sites within a specific study area. Changes in the proportion of functional feeding groups can provide insight into various types of stress in river systems.[38]