Technical Report No. 26-08

Baseline Aquatic Biomonitoring at Illinois Creek and Associated Prospects, 2025

By
Olivia N. Edwards

June 2026

Alaska Department of Fish and Game Habitat Section

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Habitat Section, as well as the Divisions of Sport Fish, and Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, Technical Reports and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat or long
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	log_2, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

TECHNICAL REPORT NO. 26-08

BASELINE AQUATIC BIOMONITORING AT ILLINOIS CREEK AND ASSOCIATED PROSPECTS, 2025

By

Olivia N. Edwards
Habitat Section, Fairbanks

Alaska Department of Fish and Game
Habitat Section
1300 College Rd, Fairbanks, Alaska, 99701

June 2026

Cover: Alaska Blackfish captured in the wetland at Milepost 10 along a proposed access road. Photo by Olivia Edwards.

Technical Reports are available through the Alaska State Library, Alaska Resources Library and Information Services (ARLIS), and on the Internet: http://www.adfg.alaska.gov/index.cfm?adfg=habitat_publications.main. This publication has undergone editorial and peer review.

Note: Product names used in the publication are included for completeness but do not constitute product endorsement. The Alaska Department of Fish and Game does not endorse or recommend any specific company or their products.

Olivia N. Edwards
Alaska Department of Fish and Game, Habitat Section
1300 College Rd., Fairbanks, AK 99701-1599, USA

This document should be cited as:
Edwards, O. N. 2026. Baseline Aquatic Biomonitoring at Illinois Creek and Associated Prospects, 2025. Alaska Department of Fish and Game, Technical Report No 26-08, Fairbanks, Alaska.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

The authors thank Alaska Silver for their financial and logistical support for the 2025 aquatic biomonitoring work. We specifically acknowledge the assistance provided by Jack DiMarchi and Wade Hopkins.

Olivia Edwards and Maria Wessel (ADF&G Habitat) performed field sampling. Olivia Edwards and Lauren Yancy (ADF&G Habitat) processed chlorophyll samples. Thomas House (Epeorus Environmental) was responsible for the sorting and identification of macroinvertebrates. Maria Wessel, Chelsea Clawson, Audra Brase, and Al Ott (all ADF&G Habitat) and Jack DiMarchi (Alaska Silver) provided constructive reviews for this report.

EXECUTIVE SUMMARY

This report summarizes results of 2025 aquatic biomonitoring work conducted in streams in the vicinity of the historic Illinois Creek mine and associated exploratory prospects. Aquatic biomonitoring included surveys of water quality, periphyton, benthic macroinvertebrates (BMI), and fish; these data have been collected annually since 2020. The sampling program was expanded in 2024 and continued in 2025 with a total of 20 sites visited. In 2025, two new sites were sampled for fish in the wetlands adjacent to the West Fork Little Mud River along a proposed access road route. Due to time constraints, three sites previously visited were not sampled.

Measurements of water quality, periphyton standing crop, BMI, and fish presence varied among the sample sites in 2025. As in 2024, mean chlorophyll-a concentration was lowest in Lower Dome Creek at 1.03 mg/m^2 (SD = 0.47) and highest in Lower California Creek 1 at 31.10 mg/m^2 (SD = 33.41). Mean BMI densities across all sites ranged from a low of 1,804 BMI/m^2 (SD = 330) in Lower Dome Creek to a high of 19,323 BMI/m^2 (SD = 3,198) in Waterpump Creek. Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa were present in some capacity at all sites in 2025. The percentage of EPT taxa present exceeded the percentage of Diptera in the samples at two sites, Eddy Creek and Lower Dome Creek. BMI taxa richness was similar among all sites ranging from 21 at Eddy Creek to 27 at Upper Illinois Creek. Fish were captured at all sites in 2025. Coho salmon were captured at 6 sites with catch per unit effort (CPUE) ranging from 1 to 86 fish. Dolly Varden were captured at 13 sites with CPUE ranging from 1 to 29 fish. Alaska blackfish and slimy sculpin were captured at 16 sites with CPUE ranging from 1 to 24 fish.

INTRODUCTION

The historic Illinois Creek gold and silver mine and associated prospects are located in the southern Kaiyuh Mountains approximately 90 km southwest of Galena, Alaska. An open pit mine was operated in the area by USMX Incorporated from 1996 to 1998 and Viceroy Resources Corporation from 1998 to 2000. American Reclamation Group leased the mine from the State of Alaska until 2002, and fees from their operation were used for reclamation. The operation has since been acquired by Alaska Silver and there is active exploration occurring, but no mining at this time. There are five main exploration targets held by Alaska Silver in the Illinois Creek Mining District (Figure 1). The historic Illinois Creek Mine gold and silver deposit is southwest of camp. The Waterpump Creek silver, zinc, and lead targets are adjacent to the Illinois Creek deposit. Northwest of these is the Honker gold vein. To the northeast are the Round Top silver, copper, and molybdenum targets and the TG/TG North silver, zinc, and lead target. Tentative plans for future development include two proposed roads in the mining area which would cross multiple drainages that support resident and anadromous fish. An additional access road was proposed in 2025 between the mining area and a proposed barge landing on the Yukon River. The road would cross two anadromous rivers (West Fork Little Mud River via bridge and Khotol River via ferry) and multiple other water bodies that support resident fish via culverts.

The ADF&G Habitat Section collected fish presence data and relative abundance in streams near the mine between 1995 and 1998 (Winters 1996–1998b). During this period, sampling focused on Illinois Creek due to its proximity to the mine pit using minnow traps for juvenile salmon, and visual surveys on foot for adult salmon. Whole body element and histological analyses were performed on juvenile coho salmon from Illinois Creek in 1995. Limited minnow trapping was done in California Creek in 1995. Annual aquatic biomonitoring sampling resumed in 2020 and expanded to include additional sampling protocols and sites.

Streams in the area vary considerably in physical characteristics but tend to rapidly transition from steep upland streams to lower gradient meandering streams in the lowlands. The dominant rock type in the area is schist, which erodes easily, and stream substrate transitions from small boulders to sand and silt within a few kilometers.

Fish communities vary depending on stream characteristics. The high gradient headwater streams are primarily inhabited by Dolly Varden, and mixed communities of Alaska blackfish, slimy sculpin, Arctic grayling, and juvenile salmon occupy the lower reaches. Abundant large beaver dam complexes in these drainages can alter fish distribution by creating fish passage barriers that may fragment habitat and exclude species previously present in upper stream reaches. Conversely, when dam complexes are destroyed via high water events or structural failure, fish can recolonize previously fragmented areas.

The goal of annual aquatic biomonitoring is to quantify baseline conditions and document natural variability in biological conditions in Illinois Creek and nearby watersheds. This report summarizes in-situ water quality, periphyton, BMI, and fish data collected in 2025.

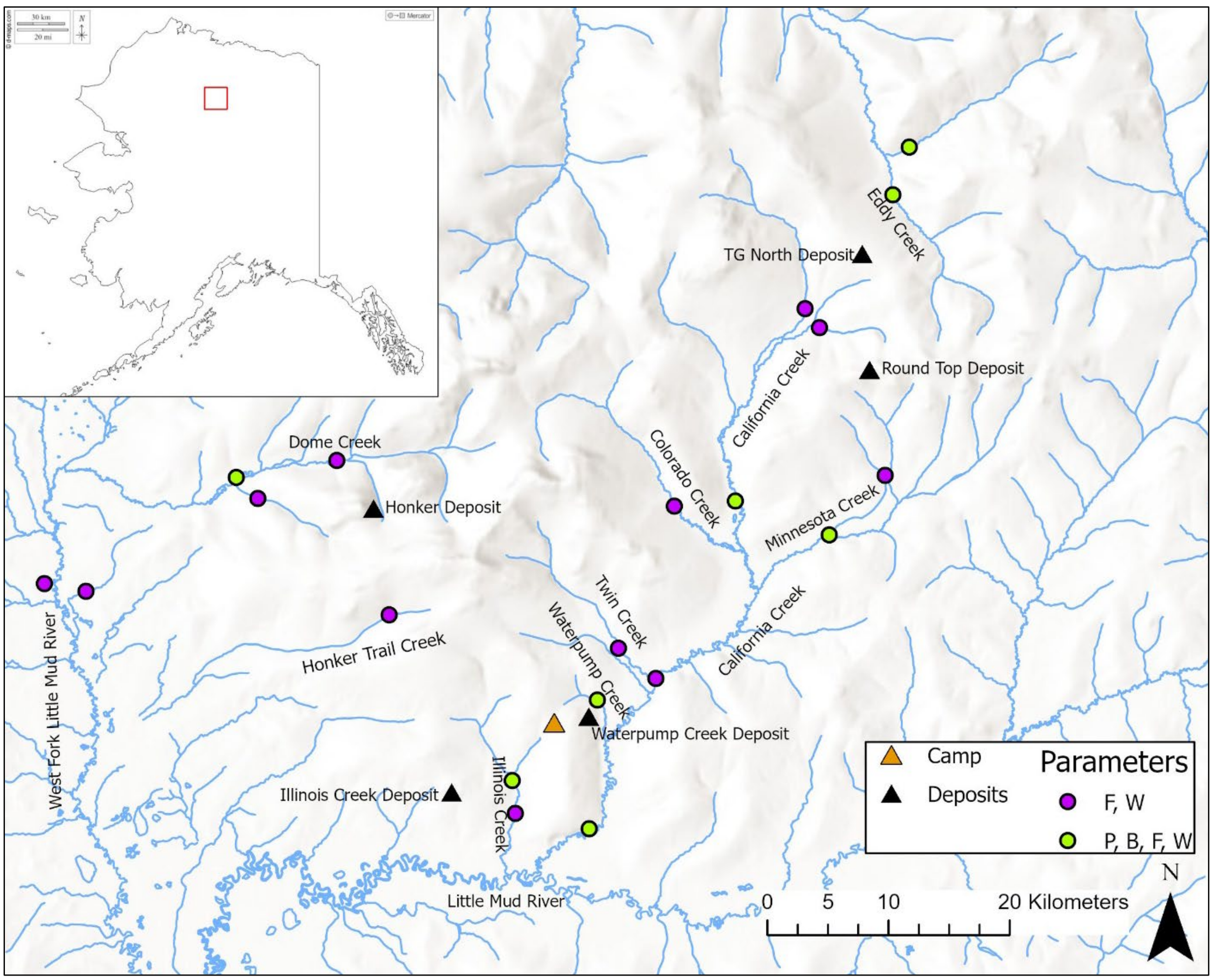

Figure 1.–July 2025 sample sites surrounding the historic Illinois Creek Mine and target deposits (black triangles). Sampling parameters are abbreviated as follows: P=periphyton, B=benthic macroinvertebrates, F=fish, and W=water quality.

LOCATION AND DESCRIPTION OF MONITORING SITES

In 2025, aquatic biomonitoring activities were performed at a total of 20 sites in the Illinois Creek Mining District (Figure 1; Table 1). Of these, 19 sites may be impacted by mining activity or road construction, and one is outside of the area of potential impact as a control site. Two of the sites visited in 2025 are at proposed culvert crossing locations along a proposed access road route from camp to the Yukon River. Three sites previously sampled (Minnesota Creek Tributary 1, Minnesota Creek Tributary 2, and California Creek Tributary 2) were not sampled in 2025 due to time constraints.

Illinois Creek

- **Lower Illinois Creek** is a low-gradient stream characterized by deep runs and pools with a silty mud bed and abundant decayed organic matter. Deciduous shrubs and grasses line the banks (Figure 2).
- **Upper Illinois Creek** is approximately 1.5 river km upstream of the lower Illinois Creek site. This site is characterized by pool and riffle habitat with silt, cobble, and small boulder substrate. Wet grassy meadows and deciduous shrubs line the stream banks (Figure 2). A warm groundwater spring enters approximately 200 m upstream of the sampling reach.

California Creek and Tributaries

- **Lower California Creek 1** is the downstream-most site in the California drainage. This site is approximately 12–20 m wide and meanders through low lying grassy wetlands with mature spruce trees along sections of the riverbanks. The creek is low gradient with deep pools and large woody debris built up at river bends. Silt and gravel are the predominant substrate and wadable riffle sections are sparse (Figure 3).
- **Lower California Creek 2** is approximately 13 river km upstream of the lower California Creek 1 site and has similar characteristics, but the substrate is comprised of more gravel and sand, and less silt (Figure 3).
- **Waterpump Creek** is a small tributary to California Creek with headwaters just north of the camp and airstrip. The site is characterized by moderate gradient, cobble and gravel substrate, cut banks, and woody debris in the stream. Spruce, alder, and willow vegetation line the stream banks (Figure 4).

- **Upper Twin Creek** is below a series of active beaver complexes with a portion of the sampling reach located in a recently breached beaver dam where the channel has been re-established and revegetation is beginning. The creek is characterized by riffle, run, and pool habitats with small cobble, gravel, and sandy substrate. There is dense willow and alder growth along the banks (Figure 4).
- **Colorado Creek** is characterized by moderate gradient riffle and run habitat with sand and gravel substrate. The banks are dominated by deciduous shrubs. There are abundant off-channel beaver complexes that do not impede the main channel flow (Figure 5).

California Creek and Tributaries (continued)

- **California Creek upstream Colorado Creek** is approximately 3.5 river km upstream of the mouth of Colorado Creek. It is characterized by shallow, swift reaches with occasional deeper pools and cobble substrate. The site is surrounded by black spruce bog with mature willows along the banks (Figure 5).
- **California Creek Headwaters** is the most upstream site on California Creek. There is a large beaver complex downstream of the sample site, but at the site the stream is wide with shallow riffle and pool habitats with cobble and gravel substrate. The riparian vegetation consists of white spruce and willows (Figure 6).
- **California Creek Tributary 1** is a small stream, approximately 2 m wide and has a moderate gradient with cobble and small boulder substrate. Cutbanks are abundant and riparian vegetation consists of alder and willows (Figure 6).
- **California Creek Tributary 2** is characterized by high gradient cascading step pools with vertical drops up to 1.5 m. There is dense alder and willow canopy intertwining across the stream with boulder and some cobble substrate (Figure 7). This site was not sampled in 2025.

Minnesota Creek

- **Lower Minnesota Creek** is just downstream of the confluence with Minnesota Creek Tributary 3. The creek is approximately 4 m wide and is characterized by shallow riffles, runs, and pools with cobble substrate. Riparian vegetation includes willows and grasses (Figure 7).

- **Minnesota Creek Tributary 1** is a narrow and braided stream with intermittent sections of subsurface flow. Step pools formed by large boulders are intermittent. Some sections of the stream are only 1 m wide, and the riparian vegetation is dense, intertwining across the stream (Figure 8). This site was not sampled in 2025.
- **Minnesota Creek Tributary 2** is approximately 150 m east of Minnesota Tributary 1 and converges 100 m below the sample sites. The creek has red precipitate accumulation on the gravel substrate, with deciduous shrubs along the bank (Figure 8). This site was not sampled in 2025.
- **Minnesota Creek Tributary 3** is approximately 1.5 m wide with cut banks, gravel substrate, and silty pools. There is intermittent dense overhanging vegetation along the banks (Figure 9).

Eddy Creek

- **Eddy Creek** is a tributary of the Khotol River. The sample site has been relocated downstream over the last few years because beaver complexes are likely creating a barrier to juvenile coho salmon. The current site is characterized by moderate gradient with swift riffles and interspersed deeper pools and runs with gravel and cobble substrate. There is thick grassy and deciduous vegetation along the banks (Figure 9).
- **Eddy Creek Tributary (Control Site)** is established as a reference site since it is outside the area of potential mining impact. The creek is approximately 3 m wide and is characterized by shallow riffles, runs, and small pools with cobble substrate. Riparian vegetation includes willow, grass, and spruce trees (Figure 10).

Honker Trail Creek is a tributary of the West Fork Mud River. It is a high gradient first order stream with abundant step pools and riffles. Boulder and cobble are the dominant substrate, and dense alder and willows shade the stream (Figure 10).

Dome Creek

- **Lower Dome Creek** is characterized by shallow riffles, runs, and deep pools with gravel and cobble substrate. There is abundant beaver activity above and below this site. The sample reach contains a breached beaver dam with some regrowth of vegetation in the previously submerged flood plain (Figure 11).

- **Upper Dome Creek** is a fast-flowing shallow stream with interspersed pools. Adjacent beaver complexes overflow into the creek and active dams create a series of potential fish barriers from the lower to the upper Dome Creek sites. Riparian vegetation varies along the sample reach ranging from tall grasses and sedges to large birch trees (Figure 11).
- **Dome Creek Tributary** is a small stream with cut banks and fine gravel substrate. Alders and willows shade significant portions of the stream (Figure 12).

Proposed Access Road Crossings

- **Milepost 10** is a wetland complex with a defined but discontinuous channel that drains to the West Fork Little Mud River. There is minimal flow with sedges and grasses lining the channel (Figure 13). A culvert battery is proposed for this site along the proposed access road to the Yukon River.
- **Milepost 11** is a wetland complex in the Little Mud River floodplain with undefined channels and little to no flow. There may be some connectivity to the river during high water events. There were two channels in the area of sampling with inundated grasses and sedges between them (Figure 13). The sample site is on the west side channel. A culvert battery is proposed for this site along the proposed access road to the Yukon River.

Table 1.–Illinois Creek sampling locations (WGS 84), 2025.

Site	Latitude	Longitude	BMI	Periphyton	Fish
Lower Illinois	64.0280	-157.8667			X
Upper Illinois	64.0387	-157.8691	X	X	X
Lower California 1	64.0230	-157.8117	X	X	X
Lower California 2	64.0718	-157.7624			X
Waterpump*	64.0649	-157.8057	X	X	X
Upper Twin*	64.0816	-157.7903			X
Colorado	64.1276	-157.7487			X
California u/s Colorado	64.1292	-157.7033	X	X	X
California Headwaters	64.1918	-157.6515			X
California Tributary 1	64.1854	-157.6413			X
Lower Minnesota	64.1184	-157.6339	X	X	X
Minnesota Tributary 3	64.1376	-157.5924			X
Eddy	64.2281	-157.5873	X	X	X
Control Site	64.2435	-157.5744	X	X	X
Honker Trail*	64.0924	-157.9603			X
Lower Dome	64.1369	-158.0737	X	X	X
Upper Dome	64.1424	-157.9989			X
Dome Tributary	64.1301	-158.0574			X
MP 10 Culvert	64.1001	-158.1848			X
MP 11 Culvert	64.1025	-158.2159			X

*Unnamed streams with locally recognized names

Figure 2.–Sample sites on Lower Illinois Creek (left) and Upper Illinois Creek (right) July 2025.

Figure 3.–Sample sites on Lower California Creek 1 at high water July 2025 (left) and Lower California Creek 2 June 2024 (right).

Figure 4.–Sample sites on Waterpump Creek (left) and Upper Twin Creek (right) July 2025.

Figure 5.–Sample sites on Colorado Creek (left) and California Creek upstream of Colorado Creek (right) July 2025.

Figure 6.–Sample sites on California Creek headwaters (left) and California Creek Tributary 1 (right) July 2025.

Figure 7.–Sample sites on California Creek Tributary 2 June 2024 (left) and Lower Minnesota Creek July 2025 (right).

Figure 8.–Sample sites on Minnesota Creek Tributary 1 (left) and Minnesota Creek Tributary 2 (right) June 2024.

Figure 9.–Sample sites on Minnesota Creek Tributary 3 (left) and Eddy Creek (right) July 2025.

Figure 10.–Sample sites on Eddy Creek Tributary Control Site (left) and Honker Trail Creek (right) July 2025.

Figure 11.–Sample sites on Lower Dome Creek July 2025 (left) and Upper Dome Creek June 2024 (right).

Figure 12.–Sample site on Dome Creek tributary June 2024 (left) and July 2025 (right).

Figure 13.–Sample sites on the proposed milepost 10 (left) and milepost 11 (right) culvert crossings on the proposed road from camp to the Yukon River July 2025.

METHODS

SAMPLING OVERVIEW

The objective of the Illinois Creek aquatic biomonitoring program is to document in-situ productivity of the aquatic communities at each sample site. In 2025 there was one sample event in the Illinois Creek area which took place from July 14–22 during which a total of 20 sites were sampled.

Water levels at most sites were below bankfull for the majority of the trip and conducive for minnow trapping. Following heavy rain, the water level in California Creek rose over 30 cm between evening of July 14 and morning of July 16 resulting in two misplaced traps at the California Creek 1 site that were retrieved when the water level went down. Black bear and moose sightings were notably abundant throughout the trip. At Lower California Creek 2 two black bears in the vicinity delayed minnow trap retrieval by several days. At Minnesota Creek Tributary 3 a cow moose and her calf delayed minnow trap retrieval by a full day.

Replicate samples of the aquatic community were collected, including periphyton, BMI, and fish. Fish sampling was conducted and water quality data was recorded at all sample sites while periphyton and BMI samples were collected at 8 sites (Table 1). Coho salmon whole body fish element analysis in Illinois Creek was suspended in 2024 with a new schedule for lethal fish sampling set for every three years. Previous whole body fish element results can be found in Technical Report No 24-09 (Yancy and Edwards 2024).

WATER QUALITY

A handheld multiparameter YSI was used to measure water temperature (°C), dissolved oxygen (mg/L), specific conductance (µS/cm), conductivity (µS/cm), and pH. The probe was placed in flowing water, and measurements were allowed to equilibrate for approximately 10–15 minutes before being recorded.

PERIPHYTON

Field Methods

Periphyton is composed of chlorophyll producing organisms, such as algae, attached to submerged surfaces in a waterbody. Algal density and community structure are influenced by water and sediment quality through physical chemical and biological factors that change throughout the year

(Barbour et al. 1999). The concentration of chlorophyll-a pigments in periphyton samples provides an estimate of active algal biomass and is often used in monitoring studies to detect changes in aquatic communities. Periphyton samples were collected at 8 sites around the Illinois Creek historic mine area (Table 1; Figure 1).

Periphyton sample collection and lab analyses follow the rapid bioassessment techniques of Barbour et al. 1999. Ten flat rocks, each larger than 25 cm^2 were collected from submerged areas at each site. A 5 cm x 5 cm square of high-density flexible foam was placed on the rock. All the material around the foam was scrubbed off with a toothbrush and rinsed back into the stream. The foam square was then removed from the rock, and that section of the rock was brushed and rinsed onto a 0.45 µm glass fiber filter receptacle attached to a hand vacuum pump. Material from the toothbrush was also rinsed onto the filter. The water was extracted from the periphyton covered filter using a hand vacuum pump. Just before all the water was pumped through the filter, one to two drops of magnesium carbonate ($MgCO_3$) were added to the water to prevent acidification and additional conversion of chlorophyll-a to phaeophytin.

Filters from each rock were folded in half, with the sample material on the inside, and placed in individual dry paper coffee filters. All ten coffee filters were placed in a zip-lock bag containing desiccant to absorb remaining moisture. The bags were then wrapped in aluminum foil to prevent light from reaching the samples, placed in a cooler with ice packs, then transferred to a freezer at the Illinois Creek camp. Samples were kept frozen until they were analyzed at the ADF&G laboratory in Fairbanks.

Laboratory Methods

In the lab, periphyton samples were removed from the freezer, the glass fiber filters were cut into small pieces and placed in individual 15 ml centrifuge tubes with 10 ml of 90% spectrophotometric grade acetone. The centrifuge tubes were secured in a vial rack covered with aluminum foil to reduce light exposure and stored in a dark refrigerator overnight. On the following day (18-24 hours after preparation), sample tubes were placed in a centrifuge and spun at 1,600 rpm for 20 minutes. Samples were then decanted individually into cuvettes and absorption values at 750 nm, 664 nm, 647 nm, and 630 nm were recorded on a split beam spectrophotometer. Each sample was treated with 80 µL of 0.1N hydrochloric acid for 90 seconds to convert the chlorophyll to phaeophytin and then absorbance was measured at 750 nm and 665 nm.

Trichromatic equations were used to estimate chlorophyll a, -b, and -c concentrations. Phaeophytin was calculated to determine if a chlorophyll-a conversion had occurred, and to correct chlorophyll-a concentrations for the presence of phaeophytin. Additional details regarding periphyton sampling and analysis methods can be found in ADF&G Technical Report No. 26-03 (Clawson 2026).

BENTHIC MACROINVERTEBRATES

Field Methods

At each benthic macroinvertebrate (BMI) sample site, five replicates were collected using a Hess sampler (Table 1). The Hess stream bottom sampler has a 0.086 m^2 sample area and material is captured in a 200 mL cod end–both constructed with 300 µm mesh net. Rocks within the sample area were scoured by hand, and gravel, sand, and silt were disturbed to approximately 10 cm depth to dislodge macroinvertebrates occupying the benthos into the net. The cod end contents were then removed and placed in individual pre-labeled Nalgene bottles with denatured ethyl alcohol to preserve the macroinvertebrates.

A Surber sampler was used in 2020, which adds a component of drift collection to the benthic sampling. While Surber and Hess samples are not directly comparable due to the added drift component with the Surber sampler, the Surber results are still included in comparisons because both methods sample macroinvertebrates from the benthos, and the units are the same.

Laboratory Methods

Samples were sorted and invertebrates identified by a private aquatic invertebrate lab in Fairbanks to the lowest practicable taxonomic level. BMI of the orders Ephemeroptera, Plecoptera, Trichoptera were identified to genus. Dipterans were identified to genus, except the nonbiting midges of the family Chironomidae. Copepoda, Collembola, and Coleoptera were identified to genus. Cladocera and Hydroida were identified to order. Oligochaeta, Ostracoda, Platyhelminthes, Nematoda, and Nematomorpha were identified to class level. Because invertebrates belonging to the orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) (EPT) are more sensitive to water quality, the total number of individual specimens of EPT was calculated and compared to groups of other invertebrates, which are less sensitive. The BMI density was calculated for each sample by dividing the number of BMI by 0.086 m^2, the Hess sampling area. Mean density was estimated for each site by calculating the mean density among the five samples.

Taxa richness is reported as the number of taxonomic groups identified to the lowest practical level. Terrestrial organisms were excluded from all calculations.

FISH PRESENCE

Ten minnow traps baited with cured salmon roe in perforated plastic bags were set at each sample site for approximately 24 hours. When traps were collected, the species and fork length (FL; mm) of every captured salmonid were recorded. Total length (TL; mm) was recorded for other species with round caudal fins, such as slimy sculpin and Alaska blackfish. Results are reported as catch per unit effort (CPUE) which is the total number of fish caught at a site over a 24-hour period. This is calculated by dividing the number of fish caught by hours of actual effort then multiplying by 24. Length-frequency histograms are presented for juvenile coho salmon and Dolly Varden.

RESULTS

WATER QUALITY

The MP 10 Culvert Crossing site along the proposed haul road route had the lowest dissolved oxygen, pH, and specific conductance among all sites at 7.77 mg/L, 4.48, and 26.4 µs/cm, respectively. Water temperature was the highest among all sites at MP 10 Culvert Crossing at 13.7°C. Conversely, water temperature was lowest at Honker Trail Creek at 4.7°C. Specific conductance and pH were highest at Waterpump Creek at 146.4 µs/cm and 8.26, respectively. Dissolved oxygen was highest at California Creek Headwaters at 14.0 mg/L. In-situ water quality data from all years are presented in Appendix A.

PERIPHYTON

In 2025, mean chlorophyll-a concentration in Upper Illinois Creek was 13.26 mg/m^2 (SD = 10.12), which is very similar to 2024 (Figure 14). Lower California Creek 1 had the highest mean chlorophyll-a concentration in both 2024 and 2025, but also the most variability among individual samples (Figure 14; Figure 15). Conversely, Lower Dome Creek had the lowest mean chlorophyll-a concentration in both 2024 and 2025 with very little variability among samples. Mean chlorophyll-a concentrations were generally similar at most sites among years. However, means were higher at Lower California Creek 1 and Waterpump Creek in 2025 than in 2024. The mean at Lower Minnesota Creek in 2025 was approximately 75% less than the mean in 2024 (Figure 14). Periphyton data from 2025 are presented in Appendix B.

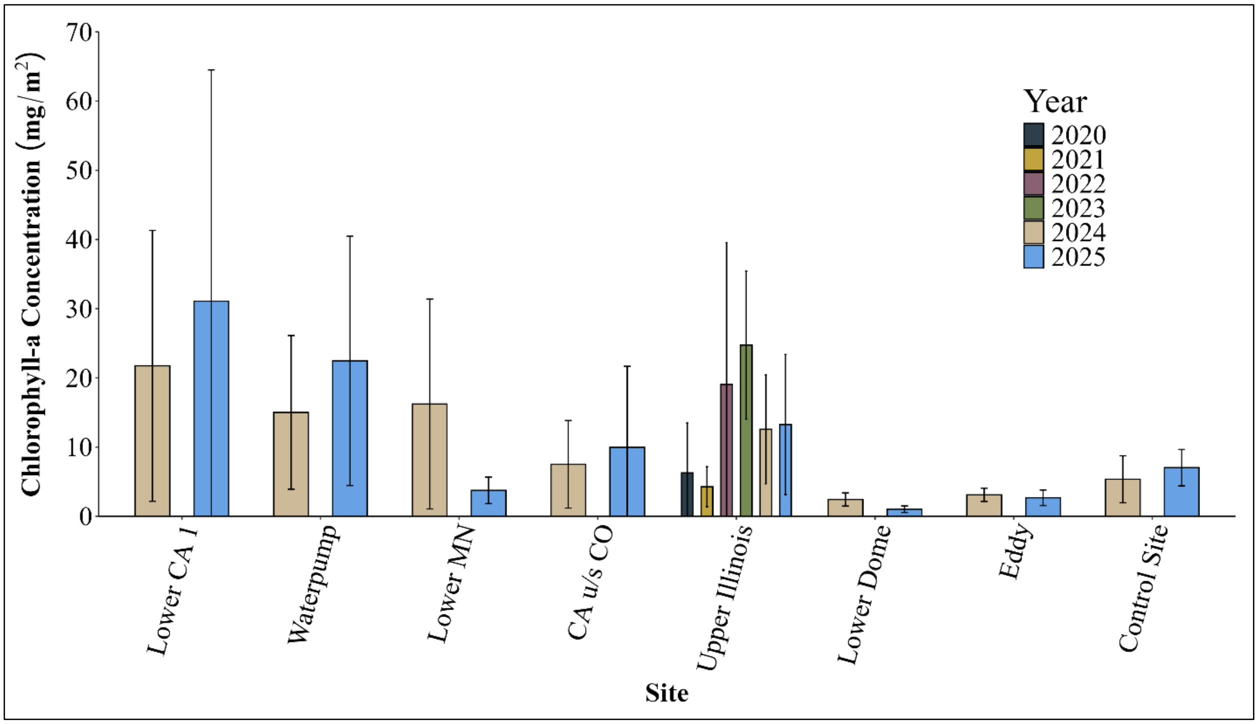

Figure 14.–Mean chlorophyll-a concentrations (± 1 SD), 2020–2025 at Illinois Creek and 2024–2025 at all other sites.

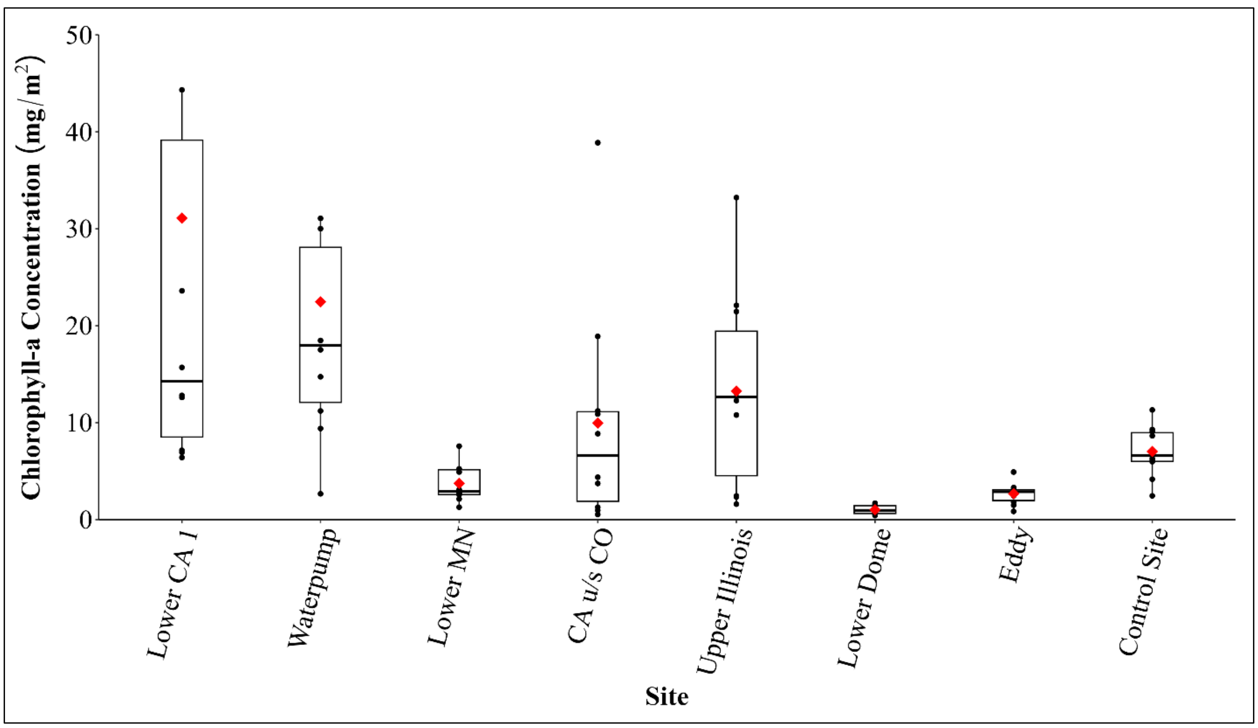

Figure 15.– Chlorophyll-a concentration boxplots by site, 2025. Raw data are depicted by black dots and mean values are depicted in red. Note that the raw data points 93.98 mg/m^2 and 87.47 mg/m^2 at Lower California Creek 1 and 67.18 mg/m^2 at Waterpump Creek are excluded from this plot but not from statistical analyses.

BENTHIC MACROINVERTEBRATES

Mean BMI density in Upper Illinois Creek in 2025 was 9,028 BMI/m^2 (SD = 4,982). This is similar to the mean densities recorded in 2020 and 2022, but much less than the mean density in 2023 (Figure 16). Lower California Creek 1, Waterpump Creek, and California Creek upstream of Colorado Creek all had higher mean BMI densities than Upper Illinois Creek in 2025 ranging from 9,786 BMI/m^2 to 19,323 BMI/m^2. The remaining sites ranged from 1,805 BMI/m^2 (SD = 330) at Lower Dome Creek to 3,653 BMI/m^2 (SD = 1,535) at the Control Site (Figure 16).

The BMI taxa composition in Upper Illinois Creek was similar in 2025 to the previous 4 years but different than the composition in 2020 potentially due to the switch from Surber to Hess samplers after 2020 (Figure 17). Although Upper Illinois Creek, California Creek 1, Waterpump Creek, and California Creek upstream of Colorado Creek had relatively high BMI densities in 2025, Diptera made up the majority of these samples (Figure 16; Figure 17; Figure 18). For example, Diptera made up 71% of the samples from Waterpump Creek while EPT taxa made up 18%. In contrast, EPT taxa made up the majority of the samples at the two sites with the lowest mean densities, Eddy Creek and Lower Dome Creek (Figure 16; Figure 18).

Taxa richness in 2025 exhibited a relatively small range among sites, from 21 taxa in Eddy Creek to 27 taxa at Upper Illinois Creek. A wider range was apparent in Upper Illinois Creek among years, from 17 taxa in 2024 to 30 taxa in 2020 (Figure 19). BMI data from 2025 are presented in Appendix C.

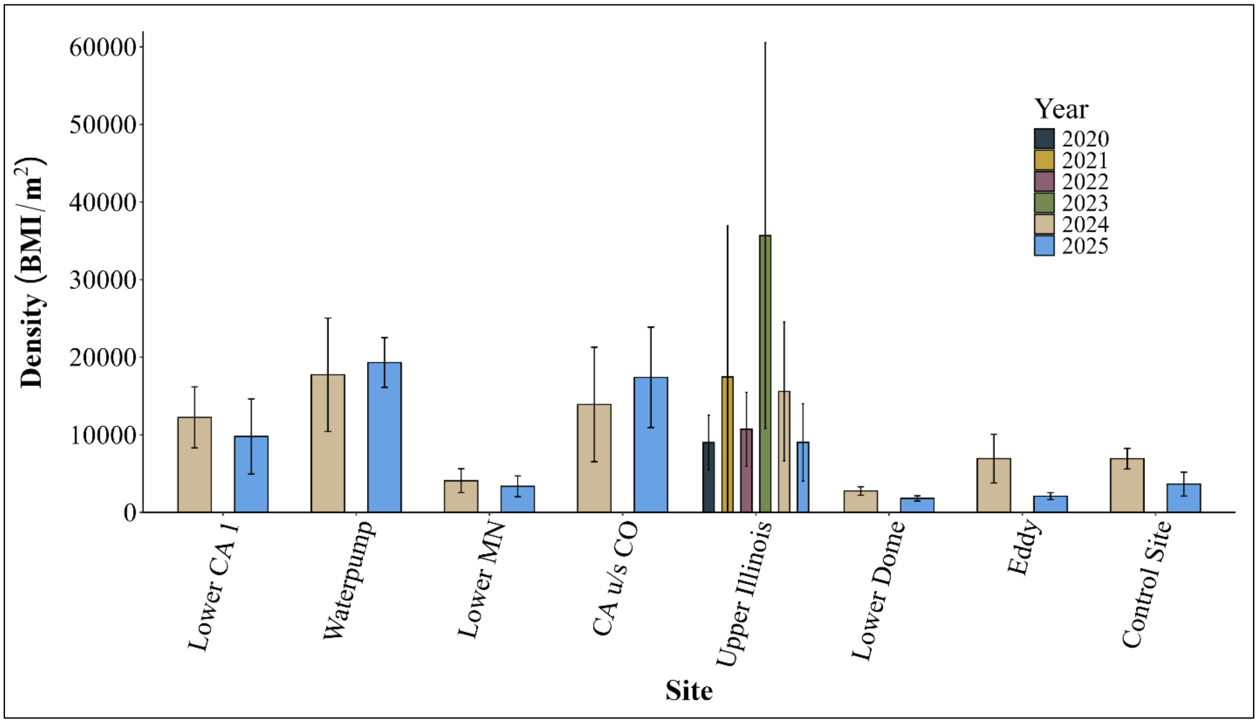

Figure 16.–Mean BMI density (± 1 SD), 2020–2025 at Illinois Creek and 2024–2025 at all other sites. Note that Surber samplers were used in 2020 and Hess samplers were used in all other years.

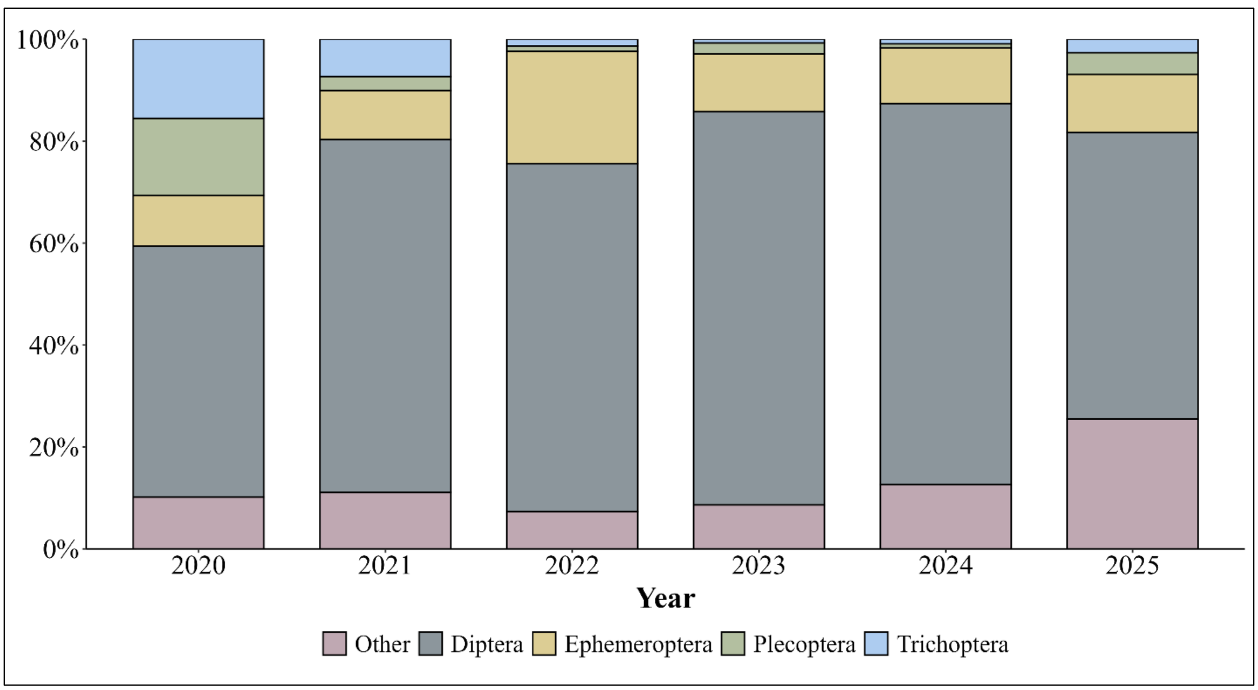

Figure 17.–Mean percent EPT, Diptera, and other taxa in BMI samples from Upper Illinois Creek, 2020–2025. Note that Surber samplers were used in 2020 and Hess samplers were used in all other years.

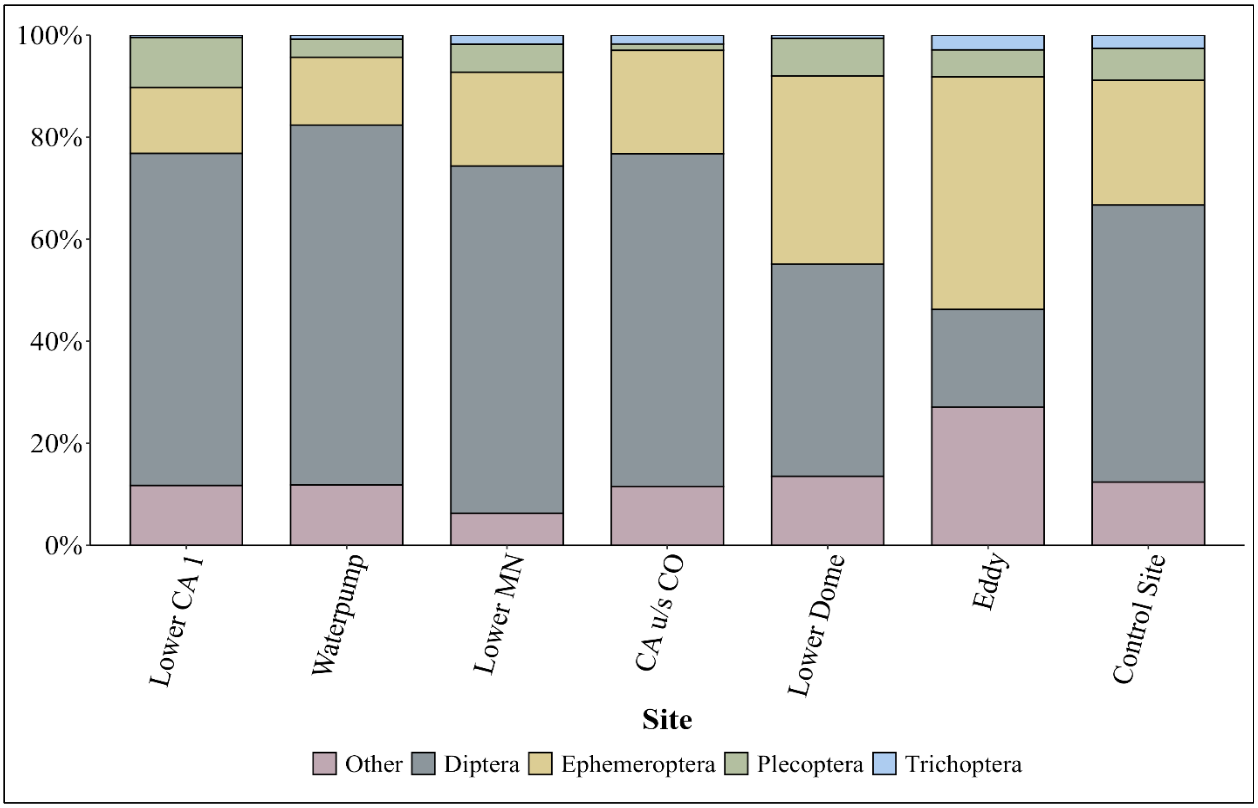

Figure 18.–Mean percent EPT, Diptera, and other taxa in BMI samples from all sites except Upper Illinois Creek, 2025.

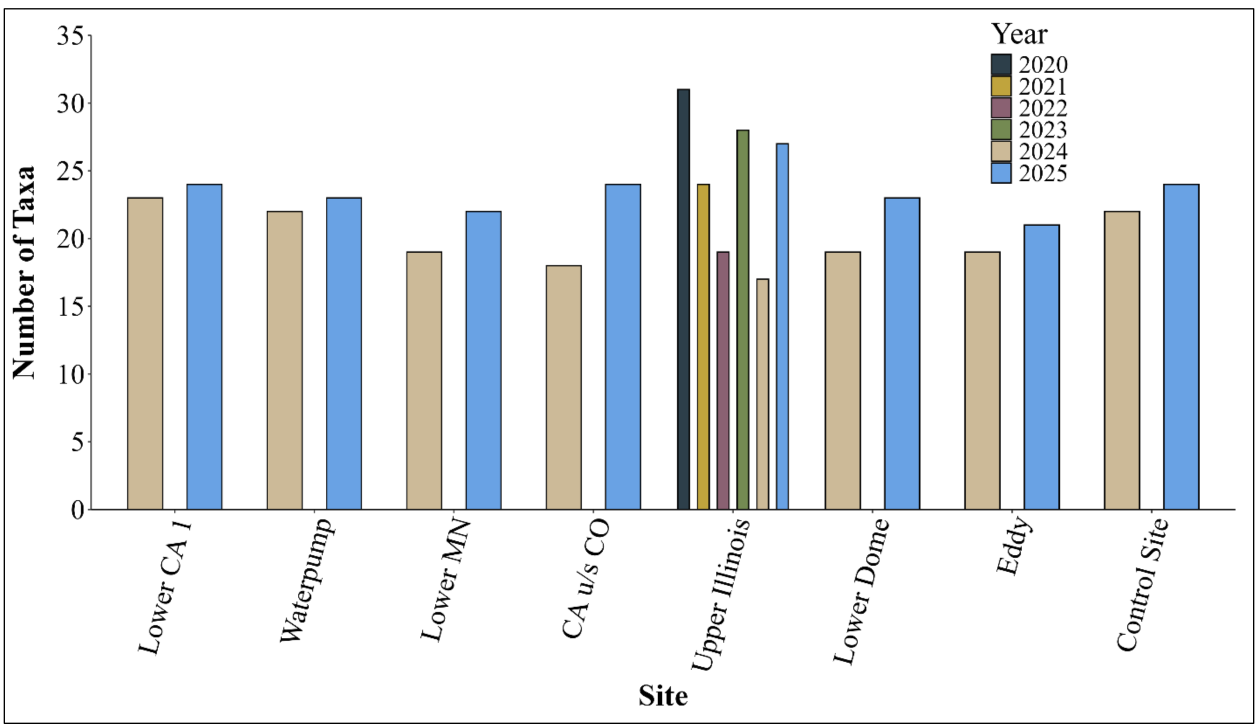

Figure 19.– Taxa richness in BMI samples from Illinois Creek in 2020–2025 and in 2024–2025 from all other sites. Note that Surber samplers were used in 2020 and Hess samplers were used in all other years.

FISH PRESENCE

Fish were captured in minnow traps at all sites in 2025. Catch per unit effort (CPUE) for the 16 sites where the resident fish species slimy sculpin and Alaska blackfish were captured ranged from 1 fish at Eddy Creek to 24 fish at Lower Minnesota Creek (Figure 20). Slimy sculpin were captured at 13 sites in 2025 and have been captured at a total of 17 sites among all years of data. Alaska blackfish were captured at 10 sites in 2025, including the Milepost 10 and Milepost 11 culvert crossing sites, and have been captured at a total of 15 sites among all years of data. One Arctic grayling was captured in Lower California Creek 2 in 2020, but none have been captured since. Arctic grayling are generally not very susceptible to minnow traps.

Coho salmon were captured at a total of 6 sites in 2025. CPUE for coho salmon ranged from 9 fish at Lower California Creek 2 to 147 fish at California Creek upstream of Colorado Creek (Figure 21). The mean fork length of all coho salmon captured in 2025 was 80.22 mm (SD = 15.8). Fork lengths ranged from 49 mm to 121 mm and the length frequency plot has a normal distribution (Figure 22).

Among all years of data, Dolly Varden have been captured at least once at all sites except for Lower and Upper Illinois Creek and the Milepost 10 and Milepost 11 culvert crossing sites, which were added in 2025. It has not been determined if these populations of Dolly Varden are resident or anadromous. Dolly Varden were captured at a total of 13 sites in 2025. CPUE for Dolly Varden ranged from 1 fish at California Creek headwaters to 29 fish at the Control Site (Figure 23). The mean fork length of all Dolly Varden captured in 2025 was 111.1 mm (SD = 25.7). Fork lengths ranged from 59 mm to 152 mm and the length frequency plot shows a generally uniform distribution (Figure 24). Fish presence data from all years are presented in Appendix D.

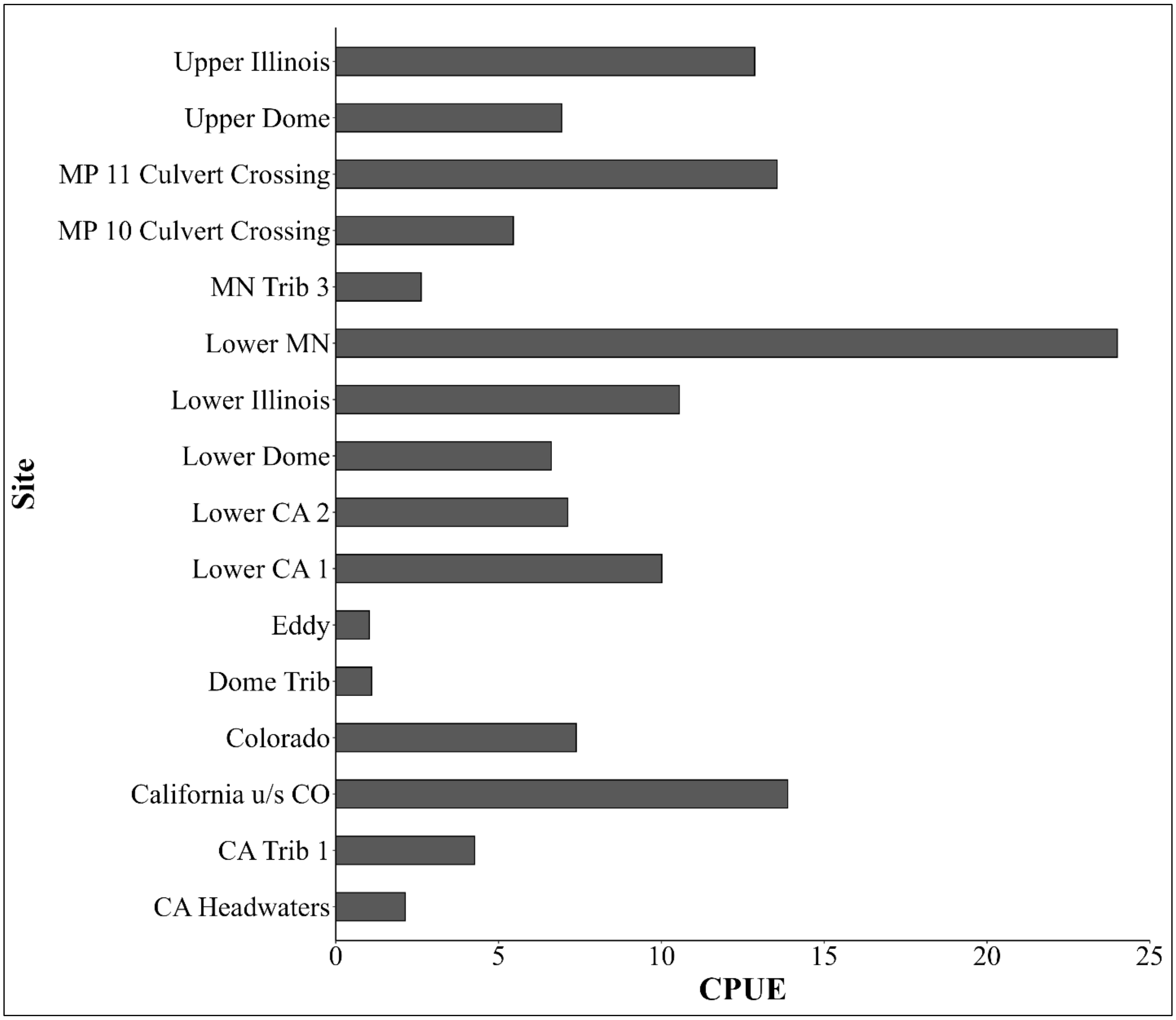

Figure 20.–Resident fish species (slimy sculpin and Alaska blackfish) catch per unit effort (CPUE) at all sites where these species were captured, 2025.

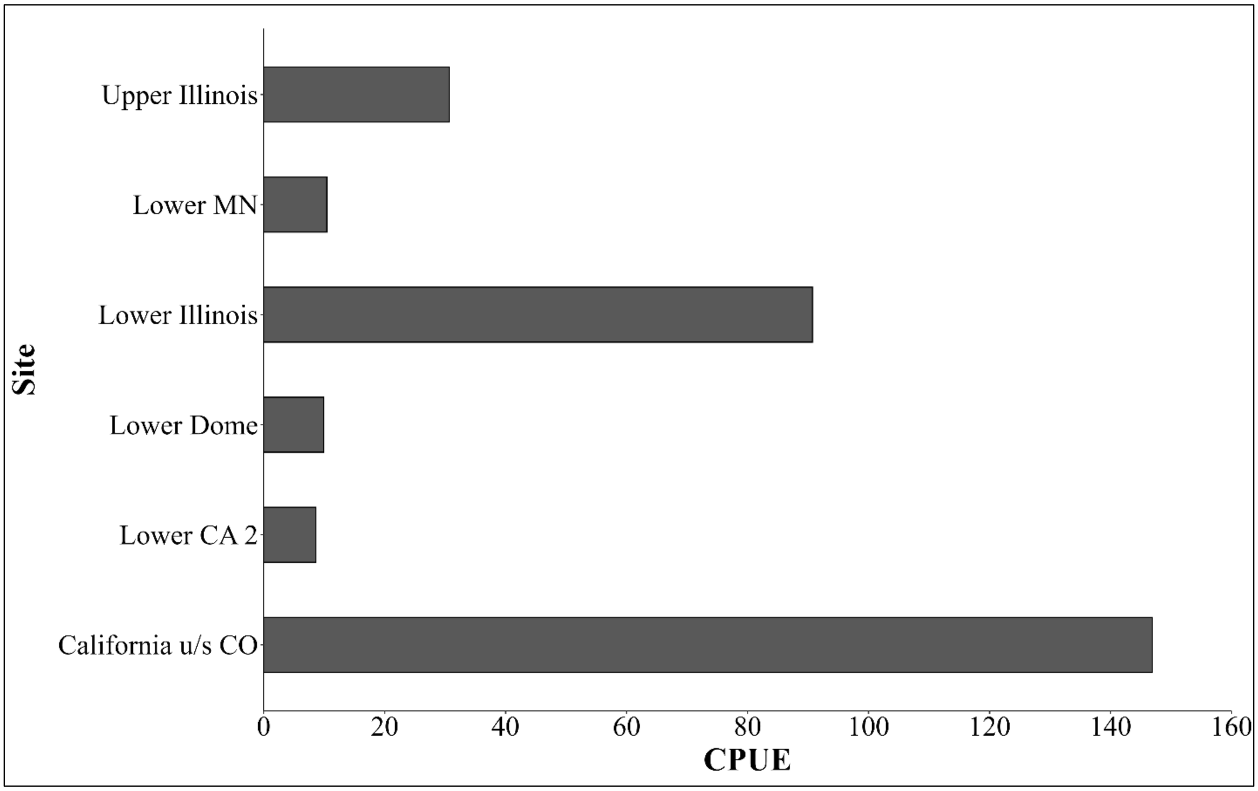

Figure 21.–Coho salmon catch per unit effort (CPUE) at all sites where coho salmon were captured, 2025.

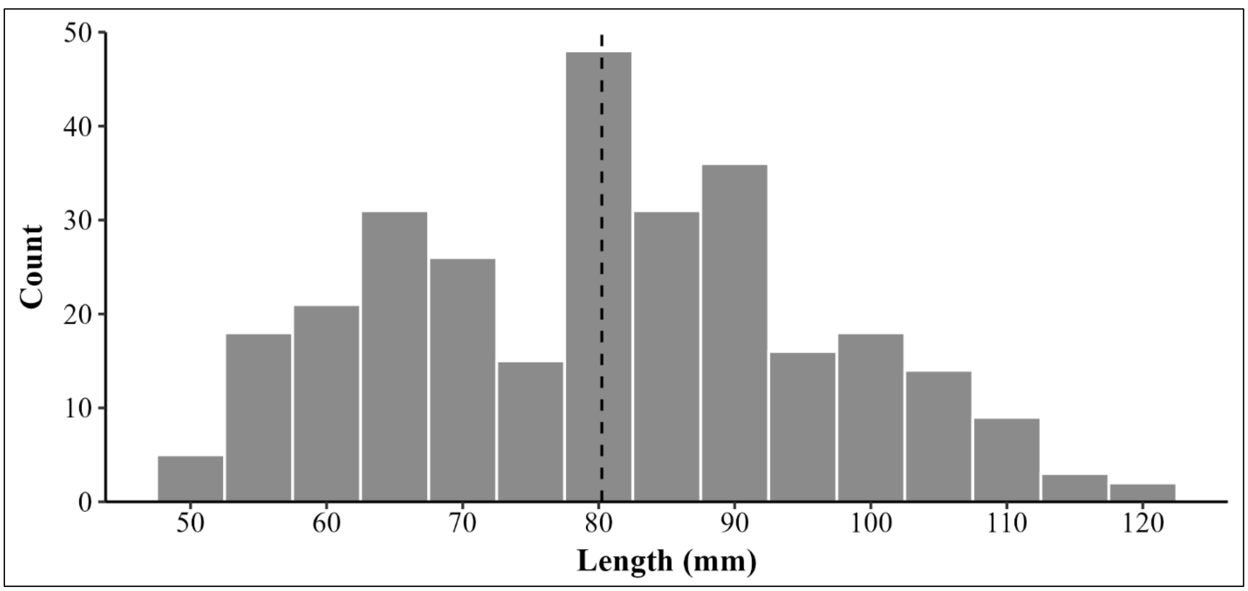

Figure 22.–Length frequency for coho salmon captured in minnow traps at all sites in 2025. The vertical dashed line represents the sample mean length.

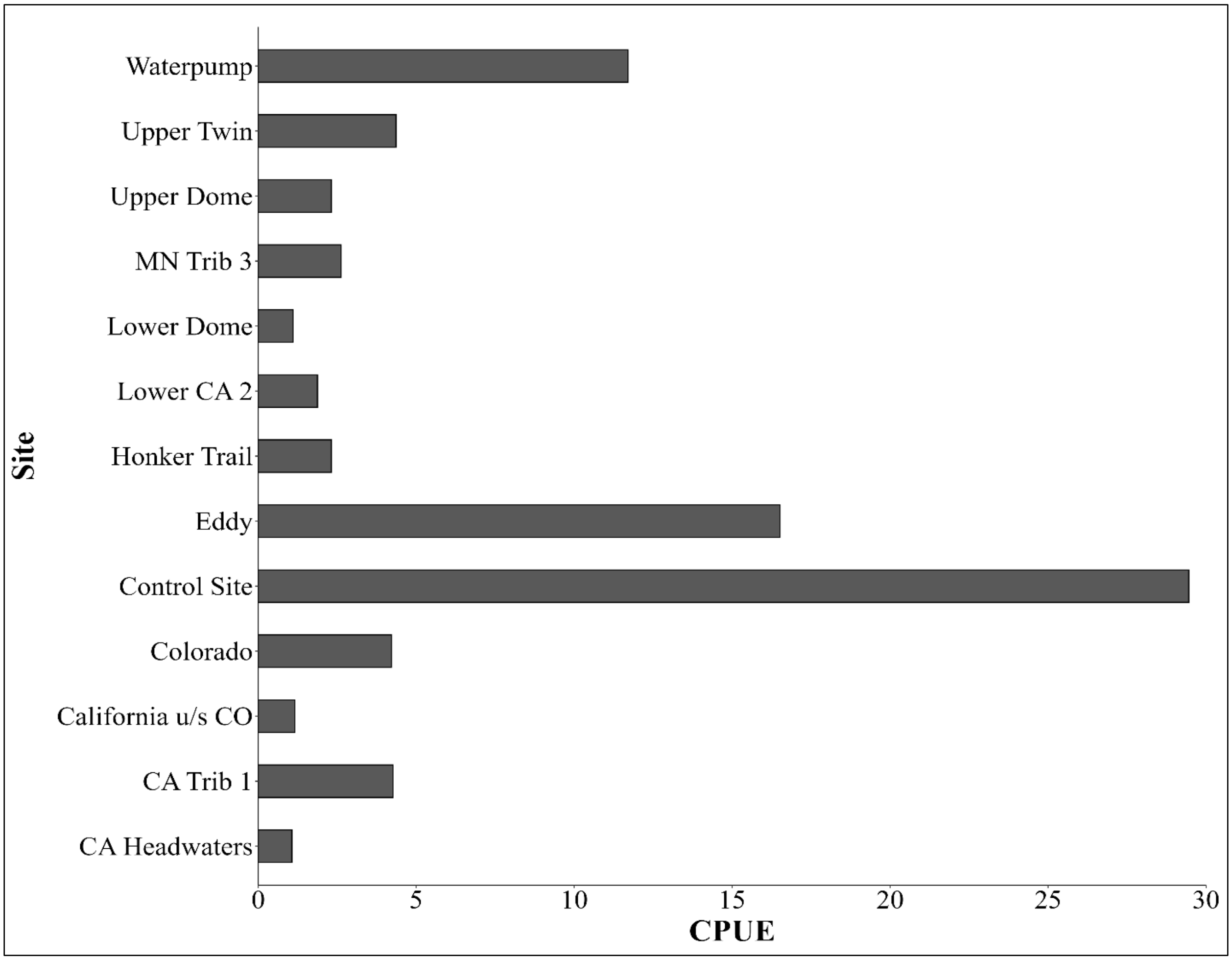

Figure 23.–Dolly Varden catch per unit effort (CPUE) at all sites where Dolly Varden were captured, 2025.

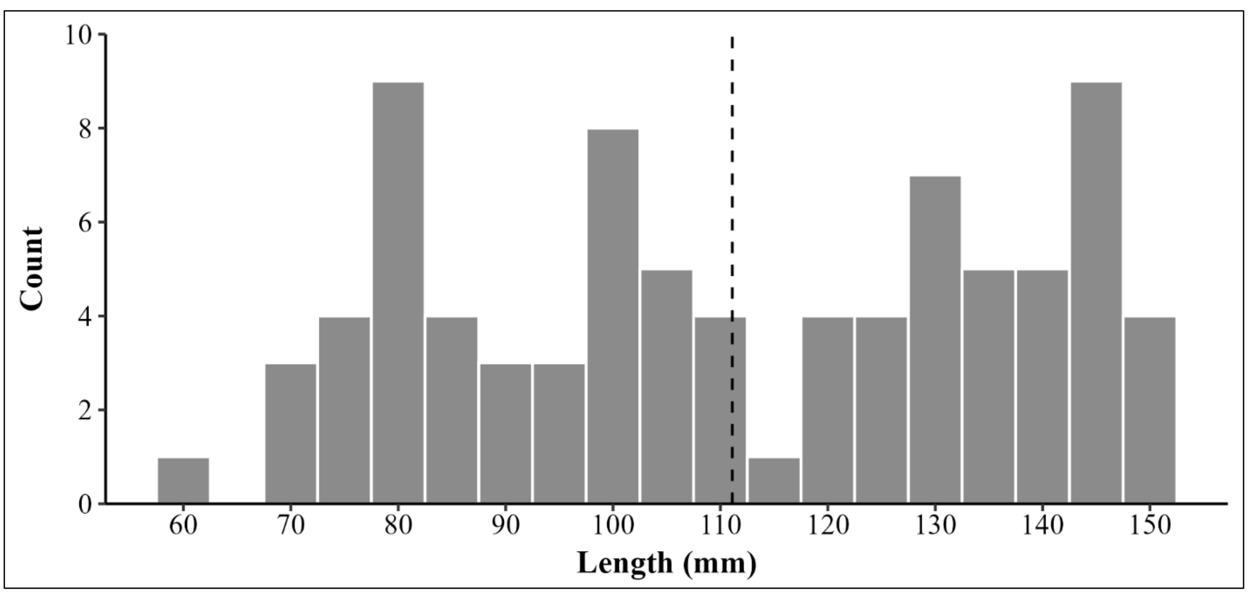

Figure 24.–Length frequency for Dolly Varden captured in minnow traps at all sites, 2025. The vertical dashed line represents the sample mean length.

CONCLUSION

This report summarizes the current biological conditions in watersheds near the historic Illinois Creek Mine and surrounding prospects. Water quality parameters in 2025 remained similar to previous years at all sites. At the two new sites (Milepost 10 and Milepost 11) along the proposed access road, pH was notably low at 4.48 and 5.46, respectively. Dissolved oxygen was also low at Milepost 10 at 7.77 mg/L. There was high variability in mean chlorophyll-a concentrations among sites in 2025 with mean values ranging from 1.03 mg/m^2 at Lower Dome Creek to 31.10 mg/m^2 at Lower California Creek 1. For the second year in a row, Lower California Creek 1 had the highest mean chlorophyll-a concentration but also the greatest variability among individual samples. Four out of eight sites had mean chlorophyll-a concentrations below 10 mg/m^2 with notably less variability among individual samples. Mean values around 10 mg/m^2 or less are similar to many streams sampled near the Arctic-Bornite prospects in the southern end of the Brooks Range (Edwards 2025). The mean chlorophyll-a concentration at Upper Illinois Creek in 2025 remained two to three times higher than those in 2020 and 2021 but approximately half the mean in 2022 and 2023. The variability among individual sample results within sites illustrate the importance of examining data structure rather than just comparing means to understand differences in primary productivity both among and within sites.

Variability was also apparent in BMI samples, particularly for density and composition analyses. At most sites with generally lower densities, EPT taxa composed the majority of the samples. Conversely, at sites with generally higher densities, Diptera composed the majority of the samples. Upper Illinois Creek had generally high density in 2025, but this was not the case in all years and the previously discussed correlation between density and taxa composition is not consistently apparent among years at this site. Lower Minnesota Creek exhibited this correlation in 2024, but despite a similar density in 2025 Diptera instead of EPT composed the majority of the samples. Taxa richness was higher at every site in 2025 compared to 2024.

Fish sampling results were not explicitly compared among years in this report, but some variation has been apparent (Appendix D; Yancy and Edwards 2024; Edwards 2025a). This does not necessarily mean that abundance or community composition has changed as these fish inhabit open systems that allow free movement between stream reaches. Additionally, the sampling period has varied from late July in 2020, 2021, and 2025 and mid-June in 2022, 2023, and 2024. This may explain the general decrease in juvenile coho salmon catches seen since 2022, but it could also be a result of a decline in coho salmon escapement estimates documented across the Yukon River drainage (Donnellan and Munro 2023). The three most commonly captured species among all sites are slimy sculpin, Dolly Varden, and coho salmon. Fish were captured at all sites in 2025. Coho salmon dominated catches in California Creek upstream of Colorado Creek and Upper and Lower Illinois Creek. Dolly Varden dominated catches at the Control Site, Eddy Creek, and Waterpump Creek. It is uncommon for high catch rates of both coho salmon and Dolly Varden to occur in the same stream in this area.

Overall, the apparent variability in results among years and sites illustrates the importance of conducting sampling over multiple years and across the full area of potential impact to capture the magnitude of natural variability at these sites prior to development. We recommend continuing the annual aquatic biomonitoring program. Sites where the sole impact would be access roads could be sampled biennially to minimize field time and project costs. Continued annual fish sampling in areas that may be impacted by mining activity would be beneficial to inform future permitting decisions. The proposed road route between camp and the Yukon River should be further investigated with additional sampling at crossings with flow rates substantial enough to support fish. Other recommendations to consider include conducting aerial surveys in August and/or September to determine if there are coho, chum and/or Chinook salmon or anadromous Dolly Varden spawning in the vicinity of the Illinois Creek mine and associated prospects.

LITERATURE CITED

Barbour, M. T., J. Gerritsen, B. D. Snyder, and J. B. Stribling. 1999. Rapid bioassessment protocols for use in streams and wadeable rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.

Clawson, C. M. 2026. Methods for Aquatic Life Monitoring at the Red Dog Mine Site. Alaska Department of Fish and Game Technical Report No. 26-03. Fairbanks, Alaska.

Donnellan, S. J., and A. R. Munro, editors. 2023. Run forecasts and harvest projections for 2023 Alaska salmon fisheries and review of the 2022 season. Alaska Department of Fish and Game, Special Publication No. 23-10, Anchorage, Alaska.

Edwards, O. N., 2025. Baseline Aquatic Biomonitoring at the Arctic-Bornite Exploratory Mining Prospects, 2024. Alaska Department of Fish and Game, Technical Report No. 25-09, Fairbanks, Alaska.

Edwards, O. N., 2025a. Baseline Aquatic Biomonitoring at Illinois Creek and Associated Prospects, 2024. Alaska Department of Fish and Game, Technical Report No. 25-10, Fairbanks, Alaska.

Winters, J. F. 1996. Illinois Creek Mine Fish Monitoring Study: Emphasis on Juvenile Chinook Salmon. Alaska Department of Fish and Game, Technical Report No. 96-7, Fairbanks, Alaska.

Winters, J. F. 1997. Illinois Creek Mine Fish Monitoring Study: Emphasis on Juvenile Chinook Salmon – Year 2 (1996). Alaska Department of Fish and Game, Internal Memo, Fairbanks, Alaska.

Winters, J. F. 1998a. Illinois Creek Mine Fish Monitoring Study: Emphasis on Juvenile Chinook Salmon – Year 3 (1997). Alaska Department of Fish and Game, Internal Memo, Fairbanks, Alaska.

Winters, J. F. 1998b. Illinois Creek Mine Fish Monitoring Study: Emphasis on Juvenile Chinook Salmon – Year 4 (1998). Alaska Department of Fish and Game, Internal Memo, Fairbanks, Alaska.

Yancy, L. E., and O. N. Edwards. 2024. Baseline Aquatic Biomonitoring at Illinois Creek Mine and Associated Prospects, 2023. Alaska Department of Fish and Game, Technical Report No 24-09, Fairbanks, Alaska.

APPENDIX A: IN SITU WATER QUALITY DATA, 2020–2025.

Year	Site	Water Temp	Atm Pressure	Conductivity	Dissolved Oxygen	Specific Conductivity	Turbidity	pH
2025	CA Creek u/s of CO Crk	9.5	29.76	61.7	13.12	87.7	0	7.97
2024	CA Creek u/s of CO Crk	8.9	751	59.4	12.36	85.7	0	8.01
2023	CA Creek u/s of CO Crk	6.3	748.2	56.2	14.19	87.2	0.55	7.87
2022	CA Creek u/s of CO Crk	7.3	0	0	0	0	0	0
2025	CA Crk Headwaters	5.7	29.5	56.5	14	89.6	0	7.89
2024	CA Crk Headwaters	5.5	742.6	53.8	12.63	85.8	0	7.81
2023	CA Crk Headwaters	6.1	733.7	55	13.04	86.1	0.45	8.11
2022	CA Crk Headwaters	4	0	0	0	0	0	0
2025	CA Crk Tributary 1	7.4	29.53	29.9	13.03	44.9	0	7.33
2024	CA Crk Tributary 1	5.8	744.5	26.5	12.76	41.8	0	7.73
2023	CA Crk Tributary 1	6.7	736	26.6	13	41	0.71	7.45
2022	CA Crk Tributary 1	5.4						
2024	CA Crk Tributary 2	4.2	726.7	81.4	12.73	134.9		8.67
2023	CA Crk Tributary 2	5	719.9	80	13.05	129.6	0.01	7.88
2022	CA Crk Tributary 2	3.8						
2025	Colorado Creek	6.6	29.65	40.4	13.28	62.2		7.62
2024	Colorado Creek	7.7	748	39.6	11.9	59.2		7.55
2023	Colorado Creek	5.6	745.9	39.8	13.46	63.1	0.31	7.59
2022	Colorado Creek	7.3						
2025	Eddy Crk Tributary (Control Site)	6.5	29.59	84.9	13.3	131.5		7.88
2024	Eddy Crk Tributary (Control Site)	5.1	748.2	84.1	12.77	135.6		8.32
2025	Dome Crk Tributary	6.2	29.84	58.9	12.9	91.9		7.55
2024	Dome Crk Tributary	4.5	750.1	67.7	13.33	111.2		7.96
2023	Dome Crk Tributary	4.2	749	62.5	15.7	104.1	1.32	7.64
2022	Dome Crk Tributary	4.3						
2025	Eddy Creek	7.6	29.61	50.6	12.97	75.9		7.55
2024	Eddy Creek	5.1	748.7	49	12.9	79.1		7.9
2023	Eddy Creek	5.7	737.5	49.1	13.4	77.9	0.74	7.61
2022	Eddy Creek	3.6						
2025	Honker Trail Creek	4.7	29.18	42.7	13.74	69.8	0	8.13
2024	Honker Trail Creek	2.9	738.4	41.4	13.43	71.6	0	7.76
2023	Honker Trail Creek	3.7	732.6	41.5	13.62	70	1.82	7.75
2022	Honker Trail Creek	4						
2025	Lower CA Creek 1	10.8	30.06	58.4	12.61	80.2		7.63
2024	Lower CA Creek 1	9.9	757.1	52.8	12.43	74.3		7.91
2023	Lower CA Creek 1	9.6	749.7	53.5	12.8	75.7	2.27	7.77
2022	Lower CA Creek 1	9.5						
2025	Lower CA Creek 2	11.1	30.01	58.9	12.86	80.2		7.94
2024	Lower CA Creek 2	9.4	754.8	52.8	12.44	75.1		8.18
2023	Lower CA Creek 2	9.9	748	52.4	12.8	73.6	1.34	8.42
2022	Lower CA Creek 2	9.5						
2025	Lower Dome Creek	7.5	29.89	41.6	12.59	62.5		7.28
2024	Lower Dome Creek	5.4	756	46.4	12.57	74.2		7.62
2023	Lower Dome Creek	6	749	45.4	12.72	71.2	1.01	7.54
2022	Lower Dome Creek	6.9						
2025	Lower Illinois Creek	10.1	29.98	99.5	11.3	139.2		7.7
2024	Lower Illinois Creek	9.6	757.2	108.5	10.99	153.8		8.13
2023	Lower Illinois Creek	9.9	749.9	96.7	11.49	135.9	0.59	7.99
2022	Lower Illinois Creek	10.1						
2020	Lower Illinois Creek	9.5						
2025	Lower MN Creek	8.7	29.76	66.9	11.7	97.1		7.35
2024	Lower MN Creek	7.9	752.8	71.2	11.43	105.6		7.61

Year	Site	Water Temp	Atm Pressure	Conductivity	Dissolved Oxygen	Specific Conductivity	Turbidity	pH
2024	MN Crk Tributary 1	9.2	744.1	56.7	10.72	81.3		7.78
2023	MN Crk Tributary 1	5.7	742.1	52.3	11.77	82.8	0.14	7.91
2022	MN Crk Tributary 1	7.1						
2023	MN Crk Tributary 2	4.5	741.4	51.6	13.72	84.9	1.72	7.59
2022	MN Crk Tributary 2	5.4						
2025	MN Crk Tributary 3	7.6	29.68	37.4	12.37	56.1		7.45
2024	MN Crk Tributary 3	6.3	749.3	37.1	11.88	60.8		7.65
2023	MN Crk Tributary 3	5.7	746.8	33.6	12.37	53.2	0.24	7.71
2022	MN Crk Tributary 3	6.9						
2025	MP10 Culvert Crossing	13.7	29.99	20.5	7.77	26.4		4.48
2025	MP11 Culvert Crossing	10.5	30.01	24.5	11.2	33.1		5.46
2025	Upper Dome Creek	7.2	29.66	48	12.94	72.7		7.72
2024	Upper Dome Creek	5.4	748.7	47.9	12.63	76.5		7.64
2023	Upper Dome Creek	4.5	744.3	45.6	13.46	74.9	0.53	7.42
2022	Upper Dome Creek	5.5						
2025	Upper Illinois Creek	9	29.91	68.4	11.21	98.6		7.69
2024	Upper Illinois Creek	9.2	751.9	94	10.71	134.9		7.7
2023	Upper Illinois Creek	7.3	749.4	78.1	11.06	118.5	0.55	7.72
2022	Upper Illinois Creek	7.2						
2020	Upper Illinois Creek	7.1						
2025	Upper Twin Creek	6	29.84	34.8	13.57	54.6		7.34
2024	Upper Twin Creek	4.3	751.4	33.4	13	55.2		7.67
2023	Upper Twin Creek	4.4	745.8	33.2	13.84	54.8	0.8	7.67
2022	Upper Twin Creek	4.7						
2025	Waterpump Creek	5.2	301	91	13.68	146.4		8.26
2024	Waterpump Creek	5	752.2	95.7	12.71	154.4		8.18
2023	Waterpump Creek	5	746.9	94.4	13.39	152.8	0.54	8.57
2022	Waterpump Creek	6						

APPENDIX B: PHAEOPHYTIN-CORRECTED CHLOROPHYLL-A CONCENTRATIONS, 2025.

All samples measured greater than the annual estimated detection limit of 0.08 mg/m^2.

Year	Site	Chlorophyll-a (phaeo corrected; mg/m2)	664/665 Ratio	Chlorophyll-b (mg/m2)	Chlorophyll-c (mg/m2)
2025	CA Creek u/s of CO Crk	8.8644	1.6803	0	0.949
2025	CA Creek u/s of CO Crk	11.214	1.6954	0	0.569
2025	CA Creek u/s of CO Crk	4.3788	1.6406	0.167	0.582
2025	CA Creek u/s of CO Crk	0.534	1.625	0.022	0.086
2025	CA Creek u/s of CO Crk	1.2816	1.6667	0.042	0.114
2025	CA Creek u/s of CO Crk	18.9036	1.6782	0	0.558
2025	CA Creek u/s of CO Crk	10.8936	1.6711	1.585	0.637
2025	CA Creek u/s of CO Crk	38.8752	1.6679	0.307	3.55
2025	CA Creek u/s of CO Crk	0.9612	1.6923	0.142	0.1
2025	CA Creek u/s of CO Crk	3.738	1.6863	0	0.424
2025	Eddy Crk Tributary (Control Site)	8.6508	1.6807	0	0.479
2025	Eddy Crk Tributary (Control Site)	2.4564	1.697	0	0.181
2025	Eddy Crk Tributary (Control Site)	6.942	1.6989	0	0.769
2025	Eddy Crk Tributary (Control Site)	11.3208	1.6928	0	1.364
2025	Eddy Crk Tributary (Control Site)	4.1652	1.7358	0	0.452
2025	Eddy Crk Tributary (Control Site)	6.0876	1.7125	0	0.601
2025	Eddy Crk Tributary (Control Site)	9.2916	1.685	0	1.146
2025	Eddy Crk Tributary (Control Site)	6.3012	1.6941	0	0.758
2025	Eddy Crk Tributary (Control Site)	5.9808	1.6914	0	0.669
2025	Eddy Crk Tributary (Control Site)	9.078	1.7025	0	0.936
2025	Eddy Creek	2.9904	1.7	0	0.236
2025	Eddy Creek	4.9128	1.7188	0	0.413
2025	Eddy Creek	1.8156	1.7083	0	0.109
2025	Eddy Creek	2.4564	1.7188	0	0.09
2025	Eddy Creek	3.0972	1.725	0	0.199
2025	Eddy Creek	3.3108	1.7045	0	0.295
2025	Eddy Creek	3.0972	1.7073	0	0.193
2025	Eddy Creek	0.8544	1.7273	0	0.113
2025	Eddy Creek	2.7768	1.7222	0	0.178
2025	Eddy Creek	1.4952	1.7	0	0.02
2025	Lower CA Creek 1	6.942	1.65	0	0.729
2025	Lower CA Creek 1	15.6996	1.6447	0	1.669
2025	Lower CA Creek 1	87.4692	1.3721	6.741	14.84
2025	Lower CA Creek 1	93.984	1.5926	0	7.441
2025	Lower CA Creek 1	7.1556	1.6147	0	0.693
2025	Lower CA Creek 1	12.6024	1.6821	0	1.042
2025	Lower CA Creek 1	23.6028	1.6717	0	2.051
2025	Lower CA Creek 1	6.408	1.6593	0	0.65
2025	Lower CA Creek 1	12.816	1.6186	0	1.234
2025	Lower CA Creek 1	44.322	1.6346	0	3.821
2025	Lower Dome Creek	1.068	1.7692	0.036	0.124
2025	Lower Dome Creek	0.534	1.625	0.022	0.086
2025	Lower Dome Creek	1.4952	1.7778	0	0.101
2025	Lower Dome Creek	0.6408	1.8571	0	0.116
2025	Lower Dome Creek	1.7088	1.6667	0.034	0.349
2025	Lower Dome Creek	0.4272	1.6667	0.014	0.038
2025	Lower Dome Creek	0.8544	1.5714	0	0.063
2025	Lower Dome Creek	1.602	1.7143	0	0.142
2025	Lower Dome Creek	0.6408	1.6	0.031	0.133
2025	Lower Dome Creek	1.2816	1.75	0	0.091

Year	Site	Chlorophyll-a (phaeo corrected; mg/m2)	664/665 Ratio	Chlorophyll-b (mg/m2)	Chlorophyll-c (mg/m2)
2025	Lower MN Creek	2.7768	1.6842	0	0.233
2025	Lower MN Creek	3.0972	1.6905	0	0.155
2025	Lower MN Creek	2.136	1.6452	0	0.147
2025	Lower MN Creek	1.2816	1.7059	0	0.053
2025	Lower MN Creek	7.5828	1.6827	0	0.602
2025	Lower MN Creek	5.2332	1.6712	0	0.204
2025	Lower MN Creek	5.2332	1.6622	0	0.597
2025	Lower MN Creek	2.67	1.6944	0	0.117
2025	Lower MN Creek	2.5632	1.7059	0	0.07
2025	Lower MN Creek	4.9128	1.4894	0	0.46
2025	Upper Illinois Creek	10.7868	1.6392	0	0.352
2025	Upper Illinois Creek	13.35	1.6188	0	0.92
2025	Upper Illinois Creek	2.4564	1.6053	0	0.185
2025	Upper Illinois Creek	2.3496	1.6667	0.034	0.225
2025	Upper Illinois Creek	21.4668	1.6442	0.316	2.704
2025	Upper Illinois Creek	22.1076	1.6017	0	1.801
2025	Upper Illinois Creek	13.0296	1.6354	0	0.916
2025	Upper Illinois Creek	33.2148	1.5846	0	3.777
2025	Upper Illinois Creek	12.282	1.5928	0	0.98
2025	Upper Illinois Creek	1.602	1.6522	0.015	0.196
2025	Waterpump Creek	17.52	1.66	0	1.2
2025	Waterpump Creek	67.1772	1.6143	0.005	8.115
2025	Waterpump Creek	14.7384	1.6732	0.154	1.369
2025	Waterpump Creek	30.0108	1.6565	0	2.208
2025	Waterpump Creek	18.4764	1.6384	0.525	0.898
2025	Waterpump Creek	2.67	1.6098	0.436	0.203
2025	Waterpump Creek	22.3212	1.5838	0.445	3.003
2025	Waterpump Creek	31.0788	1.6178	1.281	5.616
2025	Waterpump Creek	11.214	1.6481	0.02	0.448
2025	Waterpump Creek	9.3984	1.6567	0	0.359

APPENDIX C: BENTHIC MACROINVERTEBRATES IDENTIFIED IN SAMPLES AND CORRECTED FOR SUBSAMPLING, 2025.

Year	Order	Family	Genus	Upper Illinois	CA u/s CO	Eddy Trib (Control)	Eddy	Lower CA 1	Lower Dome	Lower MN	Waterpump
2025	Acari	Acarina	spp	297	614	14	2	353	7	20	297
2025	Coleoptera	Carabidae	spp	2	0	0	0	0	0	0	0
2025	Collembola	Sminthuridae	Sminthurus	0	0	1	0	0	0	0	0
2025	Collembola	Onychiuridae	spp	0	0	0	0	1	0	0	0
2025	Collembola	Entomobryidae	spp	0	0	0	0	0	1	0	0
2025	Copepoda	Harpacticoida	spp	23	2	0	0	0	0	0	0
2025	Copepoda	Cyclopoida	spp	5	0	0	0	0	0	0	0
2025	Diptera	Ceratopogonidae	spp	15	348	1	6	212	7	16	0
2025	Diptera	Chironomidae	spp	2078	4454	812	147	2490	297	921	5686
2025	Diptera	Empididae	Chelifera	72	2	28	6	2	1	1	1
2025	Diptera	Psychodidae	spp	8	56	0	0	5	0	0	5
2025	Diptera	Simuliidae	spp	2	16	8	13	5	16	45	142
2025	Diptera	Empididae	Oreogeton	0	0	3	0	0	0	0	24
2025	Diptera	Tipulidae	Dicranota	5	0	1	0	25	2	1	2
2025	Diptera	Tipulidae	Rhabdomastix	0	0	0	1	0	0	0	0
2025	Diptera	Ephydridae	spp	0	0	0	0	0	0	1	0
2025	Diptera	spp	spp	2	0	0	0	0	0	0	0
2025	Ephemeroptera	Baetidae	Acentrella	0	302	1	0	296	5	73	0
2025	Ephemeroptera	Baetidae	Baetis	335	26	183	143	2	59	28	20
2025	Ephemeroptera	Ephemerellidae	Drunella	0	424	5	7	2	4	10	186
2025	Ephemeroptera	Ephemerellidae	Ephemerella	101	635	0	0	1	0	0	15
2025	Ephemeroptera	Ephemerellidae	spp	2	5	10	18	229	140	75	128
2025	Ephemeroptera	Heptageniidae	Cinygmula	3	76	174	213	4	64	76	748
2025	Ephemeroptera	Heptageniidae	Epeorus	0	14	8	29	0	14	4	0
2025	Ephemeroptera	spp	spp	0	38	0	2	10	0	0	0
2025	Ephemeroptera	Ameletidae	Ameletus	1	0	3	0	0	0	0	5
2025	Gammaridae	spp	spp	5	0	0	0	0	0	0	0
2025	Hymenoptera:Symphyta	spp	spp	1	0	0	0	0	1	0	0
2025	Nematoda	spp	spp	15	38	4	0	74	8	0	43
2025	Oligochaeta	spp	spp	168	10	163	121	51	60	15	96
2025	Ostracoda	spp	spp	387	113	6	3	6	24	10	194
2025	Platyhelminthes	spp	spp	88	89	7	119	9	4	46	356

Year	Order	Family	Genus	Upper Illinois	CA u/s CO	Eddy Trib (Control)	Eddy	Lower CA 1	Lower Dome	Lower MN	Waterpump
2025	Plecoptera	Chloroperlidae	Kathroperla	0	6	19	12	12	9	9	20
2025	Plecoptera	Chloroperlidae	Suwallia	0	22	0	1	5	21	7	0
2025	Plecoptera	Chloroperlidae	Sweltsa	0	1	0	0	0	0	0	0
2025	Plecoptera	Leutridae	Despaxia	0	1	0	1	0	0	0	5
2025	Plecoptera	Nemouridae	Zapada	90	50	38	16	12	12	23	198
2025	Plecoptera	spp	spp	64	14	39	15	383	13	40	19
2025	Plecoptera	Capniidae	spp	0	0	2	1	0	0	0	33
2025	Plecoptera	Leutridae	spp	5	0	0	2	0	0	0	18
2025	Plecoptera	Perlodidae	spp	0	0	0	0	0	2	0	0
2025	Plecoptera	Perlodidae	Isoperla	7	0	0	0	0	0	0	0
2025	Trichoptera	Brachycentridae	Brachycentrus	56	118	1	0	2	0	7	0
2025	Trichoptera	Ryachophiliide	Ryachophilia	19	2	35	12	1	3	2	50
2025	Trichoptera	spp	spp	0	10	1	9	3	0	2	0
2025	Trichoptera	Glossosomatidae	spp	10	0	4	4	4	0	3	10
2025	Trichoptera	Limnephilidae	spp	9	0	0	1	9	2	9	8
2025	Trichoptera	Limnephilidae	Limnephilus	8	0	0	0	0	0	1	0
2025	Trichoptera	Ryachophiliide	spp	0	0	0	0	0	0	2	0

APPENDIX D: TOTAL FISH CAPTURED, 2020–2025.

Year	Site	coho salmon	Dolly Varden	slimy sculpin	Alaska blackfish	Arctic grayling	Total
2025	CA Creek u/s of CO Crk	127	1	11	1	0	140
2024	CA Creek u/s of CO Crk	86	2	13	1	0	102
2023	CA Creek u/s of CO Crk	5	2	13	1	0	21
2022	CA Creek u/s of CO Crk	23	0	2	0	0	25
2021	CA Creek u/s of CO Crk	4	1	9	1	0	15
2020	CA Creek u/s of CO Crk	42	1	2	1	0	46
2025	CA Crk Headwaters	0	1	2	0	0	3
2024	CA Crk Headwaters	0	5	0	0	0	5
2023	CA Crk Headwaters	0	3	0	0	0	3
2022	CA Crk Headwaters	0	5	0	0	0	5
2020	CA Crk Headwaters	0	9	3	0	0	12
2025	CA Crk Tributary 1	0	4	4	0	0	8
2024	CA Crk Tributary 1	1	5	3	0	0	9
2023	CA Crk Tributary 1	0	5	3	0	0	8
2022	CA Crk Tributary 1	0	0	9	0	0	9
2020	CA Crk Tributary 1	7	2	3	0	0	12
2024	CA Crk Tributary 2	0	16	0	0	0	16
2023	CA Crk Tributary 2	0	20	0	0	0	20
2022	CA Crk Tributary 2	0	20	0	0	0	20
2020	CA Crk Tributary 2	0	8	0	0	0	8
2025	Colorado Creek	0	4	0	7	0	11
2024	Colorado Creek	0	2	3	0	0	5
2023	Colorado Creek	0	8	1	0	0	9
2022	Colorado Creek	0	2	3	0	0	5
2020	Colorado Creek	0	3	2	0	0	5
2025	Eddy Crk Tributary (Control Site)	0	27	0	0	0	27
2024	Eddy Crk Tributary (Control Site)	0	13	0	0	0	13
2025	Dome Creek Tributary	0	0	1	0	0	1
2024	Dome Creek Tributary	0	2	0	0	0	2
2023	Dome Creek Tributary	0	0	0	0	0	0
2022	Dome Creek Tributary	0	1	1	0	0	2
2021	Dome Creek Tributary	0	23	0	0	0	23
2020	Dome Creek Tributary	0	4	0	0	0	4
2025	Eddy Creek	0	16	1	0	0	17
2024	Eddy Creek	1	9	3	1	0	14
2023	Eddy Creek	0	9	1	0	0	10
2022	Eddy Creek	0	3	1	0	0	4
2021	Eddy Creek	0	7	1	0	0	8
2020	Eddy Creek	6	6	1	0	0	13
2025	Honker Trail Creek	0	2	0	0	0	2
2024	Honker Trail Creek	0	4	0	0	0	4
2023	Honker Trail Creek	0	9	0	0	0	9
2022	Honker Trail Creek	0	10	0	0	0	10
2021	Honker Trail Creek	0	11	0	0	0	11
2020	Honker Trail Creek	0	15	0	0	0	15
2025	Lower CA Creek 1	0	0	41	4	0	45
2024	Lower CA Creek 1	0	0	3	4	0	7
2023	Lower CA Creek 1	5	0	15	0	0	20
2022	Lower CA Creek 1	0	0	7	0	0	7
2021	Lower CA Creek 1	2	0	10	1	0	13
2020	Lower CA Creek 1	11	0	4	1	0	16
2025	Lower CA Creek 2	30	6	20	1	0	57
2024	Lower CA Creek 2	9	0	5	1	0	15
2023	Lower CA Creek 2	11	2	4	1	0	18
2022	Lower CA Creek 2	11	1	6	3	0	21
2021	Lower CA Creek 2	34	0	0	0	0	34
2020	Lower CA Creek 2	79	0	0	1	1	81

Year	Site	Coho Salmon	Dolly Varden	Slimy Sculpin	Alaska Blackfish	Arctic Grayling	Total
2025	Lower Dome Creek	9	1	3	3	0	16
2024	Lower Dome Creek	9	0	5	0	0	14
2023	Lower Dome Creek	0	3	3	3	0	9
2022	Lower Dome Creek	0	6	3	8	0	17
2021	Lower Dome Creek	0	7	2	12	0	21
2020	Lower Dome Creek	6	1	6	1	0	14
2025	Lower Illinois Creek	86	0	10	0	0	96
2024	Lower Illinois Creek	45	0	6	0	0	51
2023	Lower Illinois Creek	22	0	11	0	0	38
2022	Lower Illinois Creek	31	0	3	2	0	36
2021	Lower Illinois Creek	116	0	8	1	0	125
2020	Lower Illinois Creek	304	0	7	0	0	311
2025	Lower MN Creek	10	0	11	12	0	33
2024	Lower MN Creek	3	2	3	3	0	11
2022	Lower Twin Creek	0	3	1	0	0	4
2024	MN Creek Tributary 1	0	7	0	0	0	7
2023	MN Creek Tributary 1	0	1	0	0	0	1
2022	MN Creek Tributary 1	0	6	0	0	0	6
2020	MN Creek Tributary 1	0	2	0	0	0	2
2024	MN Creek Tributary 2	0	0	0	0	0	0
2023	MN Creek Tributary 2	0	1	0	0	0	1
2022	MN Creek Tributary 2	0	0	0	0	0	0
2020	MN Creek Tributary 2	0	0	0	0	0	0
2025	MN Creek Tributary 3	0	5	5	0	0	10
2024	MN Creek Tributary 3	0	5	4	1	0	10
2023	MN Creek Tributary 3	0	0	0	0	0	0
2022	MN Creek Tributary 3	0	1	2	1	0	4
2020	MN Creek Tributary 3	11	4	9	2	0	26
2025	Upper Dome Creek	0	2	5	1	0	8
2024	Upper Dome Creek	0	1	3	0	0	4
2023	Upper Dome Creek	0	1	2	0	0	3
2022	Upper Dome Creek	0	1	3	0	0	4
2021	Upper Dome Creek	0	0	16	2	0	18
2020	Upper Dome Creek	0	0	4	2	0	6
2025	Upper Illinois Creek	31	0	11	2	0	44
2024	Upper Illinois Creek	5	0	16	0	0	21
2023	Upper Illinois Creek	6	0	11	0	0	19
2022	Upper Illinois Creek	8	0	8	0	0	16
2021	Upper Illinois Creek	229	0	7	0	0	236
2020	Upper Illinois Creek	62	0	6	0	0	68
2023	Upper MN Creek	1	7	3	1	0	14
2022	Upper MN Creek	2	10	9	0	0	21
2020	Upper MN Creek	14	3	0	0	0	17
2025	Upper Twin Creek	0	4	0	0	0	4
2024	Upper Twin Creek	0	2	0	4	0	6
2023	Upper Twin Creek	0	1	0	0	0	1
2022	Upper Twin Creek	0	1	0	1	0	2
2020	Upper Twin Creek	0	3	0	0	0	3
2025	Waterpump Creek	0	10	0	0	0	10
2024	Waterpump Creek	8	18	0	0	0	26
2023	Waterpump Creek	4	8	5	0	0	17
2022	Waterpump Creek	26	3	0	0	0	29
2025	Milepost 10 Culvert Crossing	0	0	0	5	0	5
2025	Milepost 11 Culvert Crossing	0	0	0	12	0	12