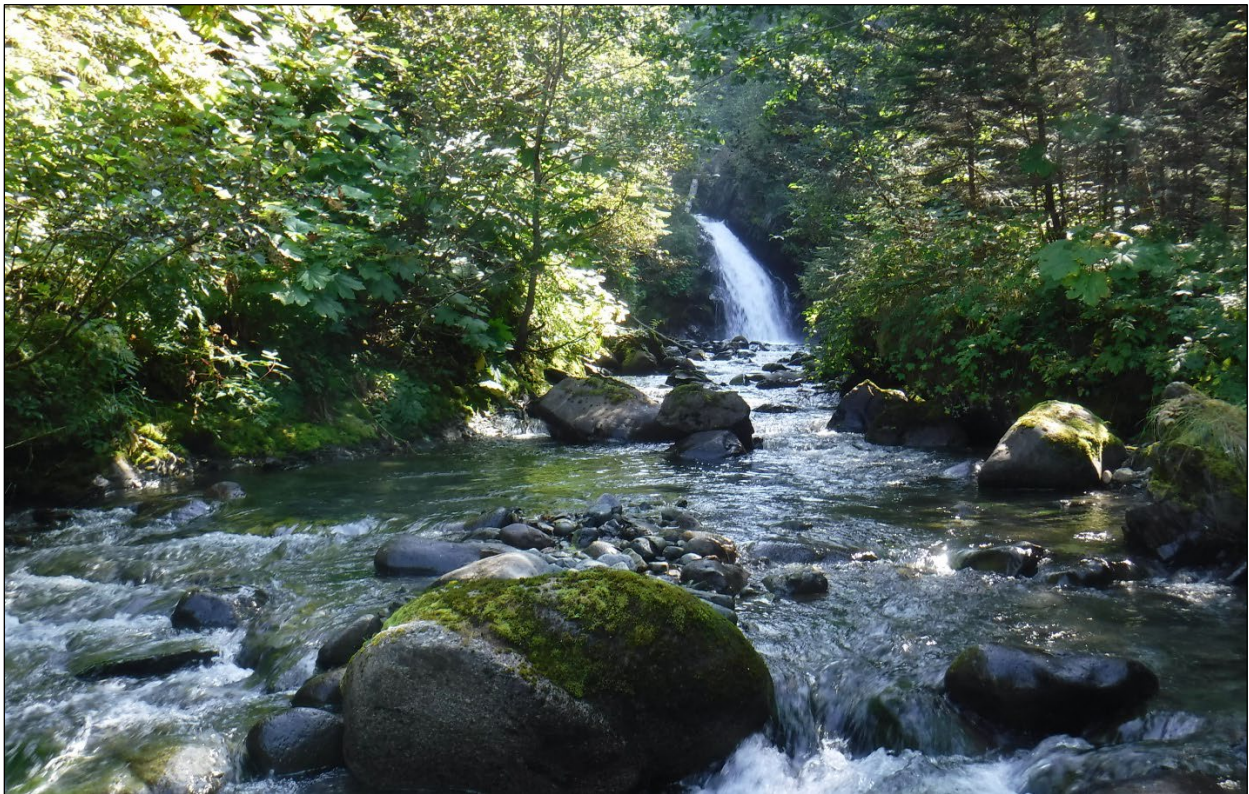


Technical Report No. 20-04

Aquatic Studies at Kensington Gold Mine, 2019

By

William J. Kane



February 2020

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 reports by the Divisions of Sport Fish and Commercial Fisheries and Habitat Section. 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 figures or figure captions.

Weights and measures (metric)		General		Measures (fisheries)	
centimeter	cm	Alaska Administrative Code	AAC	fork length	FL
deciliter	dL	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	mid-eye-to-fork	MEF
gram	g	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	mid-eye-to-tail fork	METF
hectare	ha	at	@	standard length	SL
kilogram	kg	compass directions:		total length	TL
kilometer	km	east	E		
liter	L	north	N	Mathematics, statistics	
meter	m	south	S	<i>all standard mathematical signs, symbols and abbreviations</i>	
milliliter	mL	west	W	alternate hypothesis	H _A
millimeter	mm	copyright	©	base of natural logarithm	e
nanometer	nm	corporate suffixes:		catch per unit effort	CPUE
		Company	Co.	coefficient of variation	CV
Weights and measures (English)		Corporation	Corp.	common test statistics	(F, t, χ^2 , etc.)
cubic feet per second	ft ³ /s	Incorporated	Inc.	confidence interval	CI
foot	ft	Limited	Ltd.	correlation coefficient	
gallon	gal	District of Columbia	D.C.	(multiple)	R
inch	in	et alii (and others)	et al.	correlation coefficient	
mile	mi	et cetera (and so forth)	etc.	(simple)	r
nautical mile	nmi	exempli gratia		covariance	cov
ounce	oz	(for example)	e.g.	degree (angular)	°
pound	lb	Federal Information Code	FIC	degrees of freedom	df
quart	qt	idest (that is)	i.e.	expected value	E
yard	yd	latitude or longitude	lat. or long.	greater than	>
		monetary symbols		greater than or equal to	≥
Time and temperature		(U.S.)	\$, ¢	harvest per unit effort	HPUE
day	d	months (tables and figures): first three letters	Jan,...,Dec	less than	<
degrees Celsius	°C	registered trademark	®	less than or equal to	≤
degrees Fahrenheit	°F	trademark	™	logarithm (natural)	ln
degrees kelvin	K	United States	U.S.	logarithm (base 10)	log
hour	h	(adjective)		logarithm (specify base)	log ₂ , etc.
hour	h	United States of America (noun)	USA	minute (angular)	'
minute	min	U.S.C.	United States Code	no data	ND
second	s	U.S. state	use two-letter abbreviations (e.g., AK, WA)	not significant	NS
				null hypothesis	H ₀
Physics and chemistry				percent	%
all atomic symbols				probability	P
alternating current	AC			probability of a type I error (rejection of the null hypothesis when true)	α
ampere	A			probability of a type II error (acceptance of the null hypothesis when false)	β
calorie	cal			second (angular)	"
direct current	DC			standard deviation	SD
hertz	Hz			standard error	SE
horsepower	hp			variance	
hydrogen ion activity (negative log of)	pH			population	Var
inch of mercury	inHg			sample	var
Kilopascal	kPa				
Nephelometric Turbidity Unit	NTU				
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

TECHNICAL REPORT NO. 20-04

AQUATIC STUDIES AT KENSINGTON GOLD MINE, 2019

by

William J. Kane

Alaska Department of Fish and Game
Habitat Section, Southeast Region
802 3rd Street, Douglas, Alaska, 99824

February 2020

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Cover: Lower Sherman Creek, August 5, 2019.

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Habitat Section staff assisted with both field and office work. Habitat Biologist Greg Albrecht assisted with planning field studies and collecting and entering the data. Habitat Biologists Dylan Krull, Evan Fritz, and Jesse Lindgren, and Fish and Wildlife Technician Marc Heifetz assisted with data collection. Mr. Albrecht and Mr. Fritz verified data entry. Mr. Albrecht assisted in processing periphyton samples and benthic macroinvertebrate identification quality control. Mr. Lindgren reviewed the report and assisted with map preparation. Habitat Section Operations Manager Dr. Al Ott and Southeast Regional Supervisor Kate Kanouse reviewed and edited the report. Matthew Kern of Alder Grove Farm identified benthic macroinvertebrates.

Thank you all for your contribution.

EXECUTIVE SUMMARY

Since 2011, the Alaska Department of Fish and Game Habitat Section has completed the aquatic resource monitoring the U.S. Forest Service and Alaska Department of Environmental Conservation require for Coeur Alaska Inc.'s Kensington Gold Mine. This partnership provides the Alaska Department of Fish and Game the opportunity to gather and review data throughout the year, and help identify, assess, and resolve issues at the mine as they arise.

The National Weather Service (2020) reports the Juneau area continued to be categorized as in moderate drought during 2019, which began in mid-2017, and experienced warmer than normal temperatures with annual precipitation (154 cm) about 3% below normal and snowfall (110 cm) about 50% below normal. Low snowpack early in the year and little precipitation spring through summer contributed to low streamflows regionwide.

The summer 2019 mean chlorophyll *a* density among periphyton samples collected at Lower and Upper Slate Creek was greater than mean densities observed since 2011; mean chlorophyll *a* density at other sampling sites were similar to mean densities previously observed. We also sampled periphyton in Lower Slate Creek and East Fork Slate Creek in early May to continue monitoring for changes that may occur from the tailings treatment facility and found similar mean chlorophyll *a* densities compared to previous spring sampling results.^a

The spring 2019 mean benthic macroinvertebrate density was among the lowest observed at Lower and Upper Slate Creek sampling sites; mean density at other sampling sites was similar to mean densities previously observed. The 2019 Lower Sherman Creek mean benthic macroinvertebrate density for each sampling site was greater than observed 2017–2018 and the proportion of insects classified under the orders Ephemeroptera, Plecoptera, and Trichoptera among the 2018 and 2019 samples were greater than observed 2014–2017.

We observed a comparatively weak pink salmon *Oncorhynchus gorbuscha* return in Lower Slate Creek in 2019, given the strong parent year return in 2017. The pink salmon return observed in Johnson and Sherman Creeks also was comparatively low for the dominant odd-year populations in these systems. Low streamflows inhibited fish passage throughout the spawning season. We cannot quantify marine survival factors influencing adult salmon returns so are unable to attribute changes in adult salmon abundance to construction or operation of the Kensington Gold Mine.

The geometric mean particle size of pink salmon spawning gravel in Lower Slate Creek has increased by several millimeters at both sample sites since we began sampling in 2011.

Most element concentrations in the 2019 sediment samples were within the ranges observed at each site since 2011; in Lower Slate Creek we observed lower concentrations of aluminum and chromium, and in Lower Sherman Creek we observed a greater arsenic concentration. Arsenic, copper, nickel, and zinc concentrations at each site remain near or above freshwater sediment toxicity screening guidelines, and we observed additional element concentrations above the guidelines at East Fork and Upper Slate Creeks. While we find sediment guidelines useful for evaluating the sample data, we recognize organisms may respond differently in nature.

^a Bill Kane, Habitat Biologist, to Kate Kanouse, Southeast Regional Supervisor, ADF&G Habitat Section. Memorandum: 2019 Kensington Gold Mine periphyton; dated 1/6/2020. Unpublished document can be obtained from the Southeast Regional Supervisor, ADF&G Habitat Section, 802 3rd Street, Douglas, AK.

INTRODUCTION

The Kensington Gold Mine is located near Berners Bay in Southeast Alaska (Figure 1), about 72 km north of Juneau and 56 km south of Haines within the City and Borough of Juneau and the Tongass National Forest (Tetra Tech Inc. et al. 2004a, 2004b). The mine is owned and operated by Coeur Alaska Inc. (Coeur), a wholly owned subsidiary of Coeur Mining Inc.

The underground mine began producing gold concentrate for export on June 24, 2010. Tailings are disposed underground as paste backfill and in the tailings treatment facility (TTF) as slurry through a pipeline from the mill. Mine infrastructure is located in three drainages that support resident and anadromous fish: the TTF and water treatment plant in the Slate Creek drainage; the waste rock pile, camp, and mill facilities in the Johnson Creek drainage; and the waste rock pile and mine water treatment plant in the Sherman Creek drainage.

Contractors gathered aquatic data for the Kensington Gold Mine from the late 1980s through 2005, which provided a basis for the Alaska Department of Fish and Game (ADF&G) Habitat Section permit decisions, Plan of Operations monitoring requirements (Coeur 2005), the U.S. Environmental Protection Agency (USEPA) National Pollutant Elimination Discharge System Permit No. AK-005057-1, and the Alaska Department of Environmental Conservation Alaska Pollutant Elimination System (APDES) Permit No. AK0050571.^b Monitoring and research reports published during project development and operations are in Aquatic Science Inc. (2006, 2007, 2008, 2009a, 2009b, 2009c, 2009d, 2011), Timothy and Kanouse (2012, 2013, 2014), Kanouse (2015), Brewster (2016), Willson-Naranjo and Kanouse (2016), Kanouse and Zutz (2017), Zutz (2018), and Albrecht (2018, 2019).

Habitat Section staff completed the aquatic studies required for the Kensington Gold Mine in Slate, Johnson, and Sherman Creeks since 2011. The APDES Permit requires sampling periphyton, benthic macroinvertebrates (BMI), and sediment. We assess stream health using estimates of chlorophyll density and composition, BMI density and community composition, pink salmon spawning substrate composition, and sediment element concentrations. Habitat Section staff also completed the adult salmon counts required in the project Plan of Operations (Coeur 2005).

PURPOSE

This technical report summarizes the 2019 aquatic study data and documents the condition of biological communities and sediments in Slate, Johnson, and Sherman Creeks near mine development and operations, satisfying the aquatic study requirements in the project Plan of Operations (Coeur 2005) and APDES Permit AK0050571.

^b Contractor reports are listed in Zutz (2018).



Figure 1.—Kensington Gold Mine project area map.

AQUATIC STUDIES

We completed the Kensington Gold Mine aquatic studies required in the project Plan of Operations (Coeur 2005) and APDES Permit AK0050571 (Table 1).

Table 1.–Aquatic studies required by the Plan of Operations and APDES permit, 2019.

Location	Description	Aquatic Study	Frequency
Lower Slate Creek	1 km reach between the stream mouth in Slate Cove and a 25 m waterfall.	Chlorophyll density and composition	1/year
		Benthic macroinvertebrate density and composition	1/year
		Adult salmon counts	Seasonally
		Spawning substrate composition	1/year
		Sediment composition and element concentrations	1/year
West Fork Slate Creek	A tributary to Lower Slate Creek, upstream of a waterfall and mine influence.	Chlorophyll density and composition	1/year
		Benthic macroinvertebrate density and composition	1/year
East Fork Slate Creek	A tributary to Lower Slate Creek, 1 km reach between the TTF plunge pool and waterfall at Lower Slate Creek.	Chlorophyll density and composition	1/year
		Benthic macroinvertebrate density and composition	1/year
		Sediment composition and element concentrations	1/year
Upper Slate Creek	A tributary to Upper Slate Lake and upstream of mine influence.	Chlorophyll density and composition	1/year
		Benthic macroinvertebrate density and composition	1/year
		Sediment composition and element concentrations	1/year
Lower Johnson Creek	1.5 km reach between the stream mouth in Berners Bay and a 30 m waterfall.	Adult salmon counts	Seasonally
		Sediment composition and element concentrations	1/year
Upper Johnson Creek	Upstream of Bridge #2 to the headwaters, adjacent to the upper camp and mill bench.	Benthic macroinvertebrate density and composition	1/year
Lower Sherman Creek	360 m reach between the stream mouth in Lynn Canal and a 15 m waterfall.	Chlorophyll density and composition	1/year
		Benthic macroinvertebrate density and composition	1/year
		Adult salmon counts	Seasonally
		Sediment composition and element concentrations	1/year

STUDY AREA

Slate Creek Drainage

Slate Creek drains a 10.5 km² watershed into Slate Cove on the northwest side of Berners Bay (Coeur 2005; Figure 2). Two waterfalls at the confluence of East and West Forks, about 1 km upstream of the mouth of Lower Slate Creek, prevent upstream fish migration. East Fork Slate Creek flows between the TTF dam plunge pool and the waterfall at Lower Slate Creek. Coeur operates the TTF in Lower Slate Lake and discharges TTF water treatment plant effluent (Outfall 002)^c to East Fork Slate Creek. Upstream of the TTF, a concrete dam diverts water from Upper Slate Lake through a diversion pipeline and into East Fork Slate Creek at the TTF dam plunge pool, bypassing the TTF. Upper Slate Creek is the inlet to Upper Slate Lake.

^c Outfall 002 began discharging to East Fork Slate Creek in December 2010.

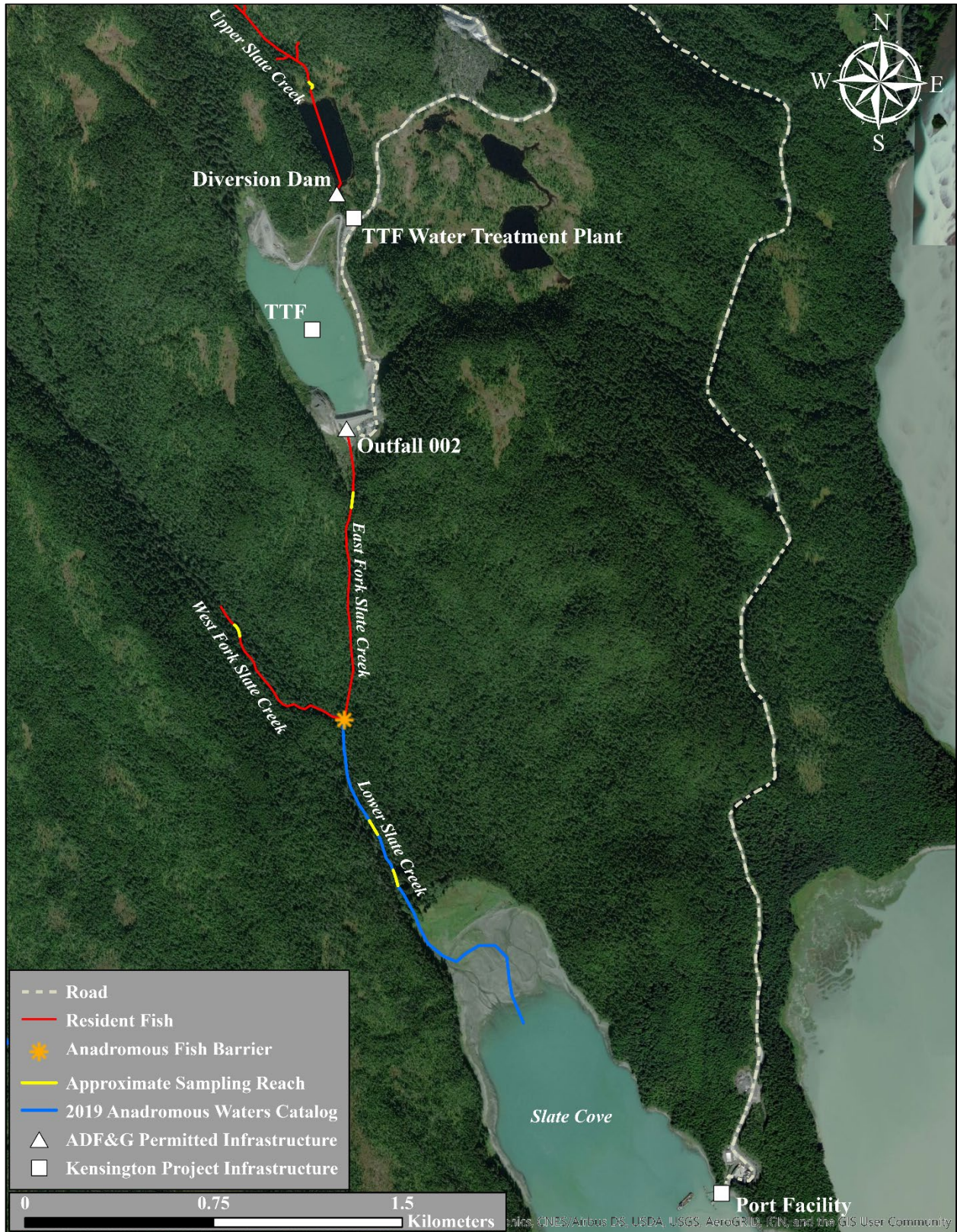


Figure 2.—Slate Creek map.

Lower Slate Creek

Lower Slate Creek provides spawning habitat for chum *O. keta*, coho *O. kisutch*, and pink salmon, and eulachon *Thaleichthys pacificus*, and rearing habitat for coho salmon (Stream No. 115-20-10030; Johnson and Blossom 2019). We also have documented juvenile Dolly Varden char *Salvelinus malma* and adult cutthroat trout *O. clarkii* in the system (Timothy and Kanouse 2012).

Lower Slate Creek is a mixture of water from the East and West Forks, Outfall 002, and Upper Slate Lake. We sample periphyton, BMIs, pink salmon spawning substrate, and sediment at Sample Point 1 (SP1; Figure 3) and pink salmon spawning substrate at Sample Point 2 (SP2; Figure 4), both a moderate gradient (2–6%) mixed control channel type (Paustian 2010), and count adult salmon throughout Lower Slate Creek.



Figure 3.—Lower Slate Creek at SP1, August 1, 2019.



Figure 4.—Lower Slate Creek at SP2, July 25, 2019.

West Fork Slate Creek

West Fork Slate Creek (Figure 5) provides habitat for Dolly Varden char (Timothy and Kanouse 2014) and is not influenced by the mine. We sample periphyton and BMIs about 600 m upstream of the waterfall at Lower Slate Creek in a cobble-dominated moderate gradient mixed control channel (Paustian 2010).



Figure 5.—West Fork Slate Creek, May 1, 2019.

East Fork Slate Creek

East Fork Slate Creek (Figure 6) provides habitat and a corridor for Dolly Varden char and threespine stickleback *Gasterosteus aculeatus* (Kanouse and Zutz 2017) emigrating from Upper Slate Lake, currently via the diversion pipeline and formerly via Lower Slate Lake. East Fork Slate Creek discharge is dependent on Upper Slate Lake discharge, routed through the diversion pipeline bypassing the TTF, and Outfall 002 effluent discharge from the TTF water treatment plant.^d We sample periphyton, BMIs, and sediments in East Fork Slate Creek within 200 m downstream of the TTF in a moderate gradient bedrock contained channel (Paustian 2010) where angular cobble substrate is dominant.

Since August 2011, Coeur staff sampled surface waters monthly in and around the TTF for ammonia, chlorophyll *a*, nitrate, nitrite, organic carbon, phosphorus, potassium, and sulfur to investigate the cause of recurring algal blooms (unpublished data obtained from P. Strow, Senior Environmental Coordinator, Coeur Alaska, Inc., Juneau).

^d Daily mean discharge data combining the diversion pipeline and Outfall 002 data for July was presented 2011–2018 (Albrecht 2019).



Figure 6.—East Fork Slate Creek, August 1, 2019.

Upper Slate Creek

Upper Slate Creek (Figure 7) provides habitat for Dolly Varden char (Albrecht 2018) and is not influenced by the mine. We sample periphyton, BMIs, and sediments in Upper Slate Creek within 75 m of Upper Slate Lake in a moderate gradient mixed control channel (Paustian 2010).



Figure 7.—Upper Slate Creek, April 30, 2019.

Johnson Creek Drainage

Johnson Creek drains a 14.6 km² watershed to the Lace River on the northwest shore of Berners Bay (Coeur 2005; Figure 8). A 30 m waterfall about 1.5 km upstream of the Lower Johnson Creek mouth prevents upstream fish migration. Middle Johnson Creek is the 2.5 km reach between the waterfall and Jualin Road Bridge #2. Upper Johnson Creek is the reach upstream of Jualin Road Bridge #2 to the headwaters.

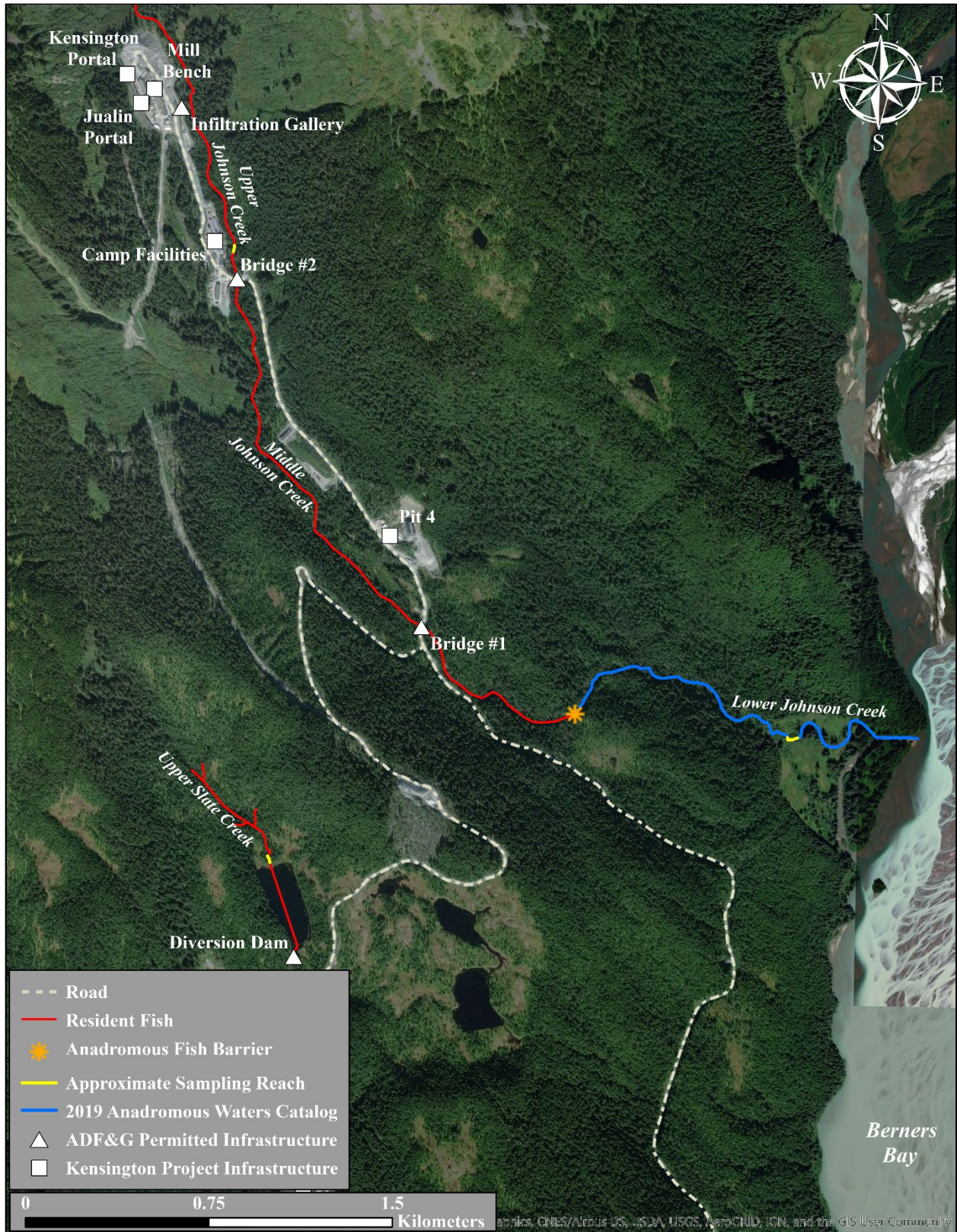


Figure 8.—Johnson Creek map.

Lower Johnson Creek

Lower Johnson Creek provides spawning habitat for chum, coho, and pink salmon, and rearing habitat for coho salmon (Stream No. 115-20-10030; Johnson and Blossom 2019). We also have documented Dolly Varden char and cutthroat trout in the system (Timothy and Kanouse 2012). Lower Johnson Creek is a mixture of drainages near and from mine infrastructure in Middle^e and Upper Johnson Creeks. We sample sediment about 600 m upstream from the mouth in a moderate width low gradient (less than 2%) floodplain channel (Paustian 2010) and count adult salmon throughout Lower Johnson Creek (Figure 9).



Figure 9.–Lower Johnson Creek, July 22, 2019.

Upper Johnson Creek

Upper Johnson Creek provides habitat for Dolly Varden char (Timothy and Kanouse 2012) and flows adjacent to the camp facilities, mill bench, Kensington and Jualin portals, and the waste rock pile. Water is collected through an infiltration gallery in Upper Johnson Creek near the mill bench to support the camp. We sample BMIs about 50 m upstream of Jualin Road Bridge #2 (Figure 10) where the stream is a medium width mixed control channel (Paustian 2010) with boulder and cobble substrate.



Figure 10.–Upper Johnson Creek, May 1, 2019.

^e Mine facilities include the domestic wastewater treatment plant, warehouse, reclamation material and acid-generating rock storage piles, bridges, and Pit 4; drainages include Snowslide Gulch, the domestic wastewater outfall, and storm water discharges; aquatic studies are not required in Middle Johnson Creek.

Sherman Creek Drainage

Sherman Creek drains a 10.84 km² watershed to the east shore of Lynn Canal (Coeur 2005; Figure 11). A 15 m waterfall about 360 m upstream from the Lower Sherman Creek mouth prevents upstream fish migration. Middle Sherman Creek is the 2 km reach between the waterfall and the Comet Beach Road bridge. Upper Sherman Creek is the reach upstream of the bridge to the headwaters.

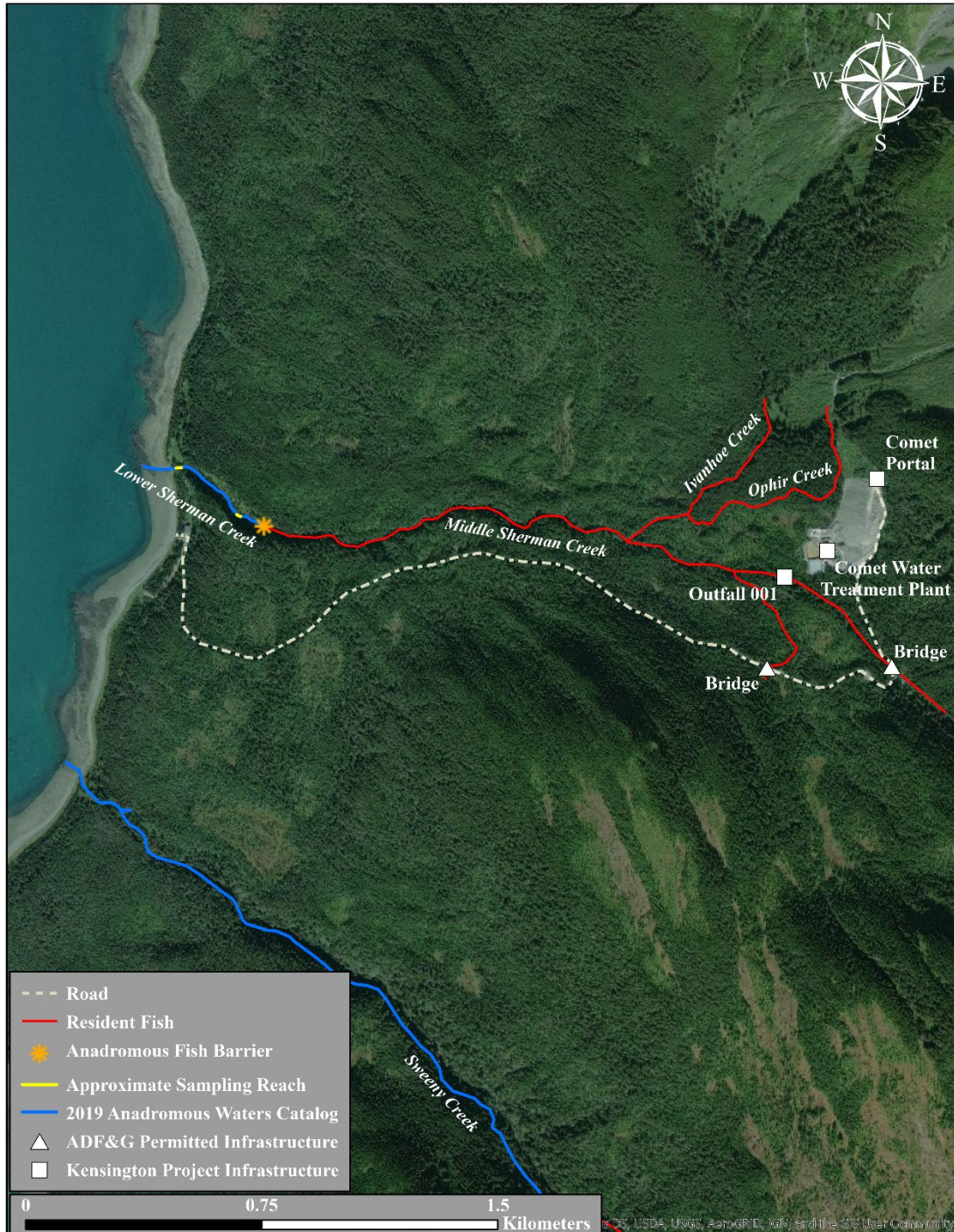


Figure 11.—Sherman Creek map.

Lower Sherman Creek

Lower Sherman Creek provides spawning habitat for chum and pink salmon (Stream No. 115-31-10330; Johnson and Blossom 2019). We also have documented juvenile Dolly Varden char in the system (Timothy and Kanouse 2012). Lower Sherman Creek is a mixture of drainages near and from mine infrastructure in Middle Sherman Creek^f and its tributaries. We sample periphyton, BMIs, and sediment in a moderate gradient medium width mixed control channel (Paustian 2010) at Sample Point 1 (SP1; Figure 12), periphyton and BMIs at Sample Point 2 (SP2; Figure 13), a similar channel type. We count adult salmon throughout Lower Sherman Creek to the barrier falls.



Figure 12.—Lower Sherman Creek at SP1, August 2, 2019.



Figure 13.—Lower Sherman Creek at SP2, August 5, 2019.

^f Mine facilities include the Comet water treatment plant, waste rock pile, bridges and culverts; drainages include Ivanhoe Creek, Ophir Creek, South Fork Sherman Creek, and Comet water treatment plant Outfall 001; aquatic studies are not required in Middle or Upper Sherman Creeks.

SAMPLING SCHEDULE

We collected data between April 30 and October 31 in 2019 (Table 2).

Table 2.—Aquatic studies sampling schedule, 2019.

Aquatic Study	Lower Slate	West Fork Slate	East Fork Slate	Upper Slate	Lower Johnson	Upper Johnson	Lower Sherman
Periphyton	5/1 ^a	---	4/30 ^a	---	---	---	---
	8/1	8/1	8/1	8/1	---	---	8/2
Benthic macroinvertebrates	5/1	5/1	4/30	4/30	---	5/1	4/30
Adult salmon counts	7/25–10/31	---	---	---	7/25–10/31	---	7/24–9/17
Spawning substrate	7/22, 7/25	---	---	---	---	---	---
Sediment element concentrations	7/22	---	7/22	8/5	7/22	---	7/22

^a Sampling not required by APDES permit or Plan of Operations.

SAMPLING LOCATIONS

We recorded coordinates for each sample site (Table 3) and adult salmon count reach markers in Lower Slate Creek, Lower Johnson Creek, and Lower Sherman Creek (Tables 4–6).

Table 3.—Aquatic study sample sites, 2019.

Location	Sample Site	Latitude	Longitude
Lower Slate Creek	Periphyton and benthic macroinvertebrates	58.7905	-135.0345
	Spawning substrate		
	Sample Point 1	58.7905	-135.0345
	Sample Point 2	58.7920	-135.0360
	Sediment composition and element concentrations	58.7905	-135.0345
West Fork Slate Creek	Periphyton and benthic macroinvertebrates	58.7993	-135.0457
East Fork Slate Creek	Periphyton and benthic macroinvertebrates	58.8045	-135.0381
	Sediment composition and element concentrations	58.8053	-135.0383
Upper Slate Creek	Periphyton and benthic macroinvertebrates	58.8189	-135.0415
	Sediment composition and element concentrations	58.8189	-135.0416
Lower Johnson Creek	Sediment composition and element concentrations	58.8235	-135.0024
Upper Johnson Creek	Benthic macroinvertebrates	58.8407	-135.0450
Lower Sherman Creek	Periphyton and benthic macroinvertebrates		
	Sample Point 1	58.8687	-135.1415
	Sample Point 2	58.8674	-135.1381
	Sediment composition and element concentrations	58.8687	-135.1413

Note: WGS84 datum.

Table 4.–Lower Slate Creek adult salmon count reach markers.

Location	Latitude	Longitude
100 m	58.7884	-135.0324
200 m	58.7893	-135.0337
300 m	58.7905	-135.0349
400 m	58.7915	-135.0359
500 m	58.7922	-135.0361
600 m	58.7930	-135.0368
700 m	58.7936	-135.0379
800 m	58.7944	-135.0384
900 m	58.7953	-135.0385
Falls	58.7964	-135.0389

Table 5.–Lower Johnson Creek adult salmon count reach markers.

Location	Latitude	Longitude
Lace	58.8215	-135.0010
Johnson Mouth	58.8236	-135.9987
Trap Site	58.8235	-135.0007
Site #4	58.8236	-135.0039
Site #7	58.8243	-135.0072
Site #10	58.8254	-135.0109
Power House	58.8259	-135.0148
Log Falls	58.8258	-135.0168
Site #15	58.8252	-135.0190
Falls	58.8243	-135.0201

Table 6.–Lower Sherman Creek adult salmon count reach markers.

Location	Latitude	Longitude
50 m	58.8687	-135.1416
100 m	58.8687	-135.1408
150 m	58.8684	-135.1401
200 m	58.8682	-135.1394
250 m	58.8679	-135.1388
300 m	58.8675	-135.1383
350 m	58.8673	-135.1374
Falls	58.8671	-135.1367

METHODS

We annually review data sets to ensure accuracy and consistency with modifications to methods, and report corrections and updates in the document and appendices. The most recent technical report presents the current data sets and should be used to analyze data from previous years.

PERIPHYTON: CHLOROPHYLL DENSITY AND COMPOSITION

Periphyton is composed of primary producing organisms such as algae, cyanobacteria, heterotrophic microbes, and detritus, attached to the submerged surfaces of aquatic ecosystems. 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* (Chl-*a*) pigment in periphyton samples provides an estimate of active algal biomass (density), while concentrations of chlorophyll *b* (Chl-*b*) and chlorophyll *c* (Chl-*c*) pigments estimate the composition of algal organisms present, such as green algae that produce Chl-*b*, and diatoms and brown algae that produce Chl-*c*.

Requirement APDES 1.5.3.5.2

The APDES permit requires monitoring periphyton chlorophyll density and composition in Lower Slate Creek, East Fork Slate Creek, and Lower Sherman Creek annually between late-June and early-August and not within three weeks following peak discharge to detect changes over time. The APDES permit also requires monitoring at reference sites in West Fork Slate Creek and Upper Slate Creek at the same time to detect variations due to natural factors, such as mineral seeps, climate, and stream flow.

Sample Collection and Analysis

We collected 10 smooth, flat, undisturbed, and perennially wetted rocks from submerged cobble in riffle habitats in less than 0.45 m water depth at each sample site and submerged the rocks in the creek with the sample area facing up until sampling. We held a 5 × 5 cm square of high-density foam on the sample area and scrubbed the area around the foam with a toothbrush to remove algae and other organisms outside the sample area, then rinsed the rock by dipping it in the stream while holding the foam in place. We also rinsed the toothbrush in the stream.

We placed a 47 mm diameter Type A/E 1 μm glass fiber filter into a Nalgene® filter holder attached to a vacuum pump with a gauge, then removed the foam square and scrubbed the underside of the foam and the sample area with the toothbrush into the filter holder. We used stream water in a wash bottle to rinse the loosened periphyton from the foam, rock, toothbrush, and the inside of the filter holder onto the filter. We scrubbed the sample area a second time and repeated the rinse cycle. We pumped most of the water through the filter, maintaining pressure less than 34 kPa, and added a few drops^g of saturated magnesium carbonate solution^h to the filter before pumping the sample dry. We removed the glass fiber filter, folded it in half with the sample on the inside, and wrapped it in a white coffee filter to absorb additional water. We placed the samples in a sealed, labeled plastic bag with desiccant and stored the samples in a light-proof cooler containing frozen icepacks during transportation, in a camp freezer while onsite, and in a -20°C ADF&G Douglas laboratory freezer until processing.

We followed USEPA (1997) protocol for chlorophyll extraction and measurement, determining instrument and estimated detection limits, and data analysis.ⁱ We removed the samples from the freezer, cut them into small pieces, and placed the filter pieces for each sample into individual 15 mL screw cap centrifuge tubes containing 10 mL of 90% buffered acetone. We capped the centrifuge tubes and shook each tube vigorously to submerge the filter pieces, placed them in a rack, covered them with aluminum foil, and stored them in a refrigerator overnight to extract the chlorophyll.^j

The following day, we centrifuged the samples for 20 min at 500 relative centrifugal force, individually decanted the supernatant into a cuvette, and measured each sample absorbance at wavelengths 664 nm, 647 nm, 630 nm, and 750 nm using a Shimadzu UV-1800 spectrophotometer. Prior to measuring samples, we inserted two cuvettes with 90% acetone to correct for the absorbance of the solvent at each wavelength. We treated each sample with 80 μL of 0.1 N hydrochloric acid for 90 seconds to convert the chlorophyll to phaeophytin, and measured absorbance at wavelengths 665 nm and 750 nm.

We used trichromatic equations to estimate Chl-*a*, Chl-*b*, and Chl-*c* concentrations, and corrected for turbidity using the 750 nm absorbance value. We corrected Chl-*a* concentrations when phaeophytin was detected. When Chl-*a* was not detected in a sample, we report the concentration at the spectrophotometer estimated detection limit and do not report values for Chl-*b* or Chl-*c*. The 2019 estimated detection limit for Chl-*a* concentration was 0.10 mg/m².

Data Presentation

For each site and by year, we present mean Chl-*a*, Chl-*b*, and Chl-*c* densities in a table, Chl-*a* densities in a figure, and mean proportions of Chl-*a*, Chl-*b*, and Chl-*c* in a figure. We also provide the annual data from 2011 through 2019 (Appendix A). Periphyton sampling during April is not required by the APDES permit or Plan of Operations.

^g This measurement is not exact as the amount of water and MgCO_3 used to create a saturated solution varies and does not affect sample integrity. We used supernatant solution to avoid MgCO_3 solids.

^h To prevent acidification and conversion of chlorophyll to phaeophytin.

ⁱ Except we stored the samples longer than 3.5 weeks, and we cut the sample filters, rather than homogenize them, to reduce acetone exposure for laboratory staff.

^j We allowed samples to saturate for at least 12 h and not more than 24 h.

BENTHIC MACROINVERTEBRATE DENSITY AND COMMUNITY COMPOSITION

Benthic macroinvertebrates (BMI) classified in the orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies), collectively known as EPT taxa, have complex and short life cycles and many genera are sensitive to changes in water and sediment quality (Barbour et al. 1999). These organisms are secondary producers, feed on periphyton and other macroinvertebrates, and are a food source for fish.

Requirement APDES 1.5.3.2

The APDES permit requires monitoring BMI density and community composition in Lower Slate Creek, East Fork Slate Creek, Upper Johnson Creek, and Lower Sherman Creek annually between late-March and late-May after spring breakup and before peak snowmelt to detect changes over time. The APDES permit also requires monitoring at reference sites in West Fork Slate Creek and Upper Slate Creek at the same time to detect variations due to natural factors.

Sample Collection and Analysis

We opportunistically collected 6 BMI samples from each site using a Surber stream bottom sampler in riffles and runs with gravel substrate and different flow velocities: habitats that support greater BMI densities and taxonomic richness (Barbour et al. 1999). We do not sample other habitat types (e.g. pools) to reduce variability of the data.

The Surber stream bottom sampler has a 0.093 m² sample area and material is captured in a 200 mL cod end, both constructed with 300 µm mesh net. After securing the frame on the substrate, we scrubbed rocks within the sample area with a brush and disturbed gravels, sand, and silt to about 10 cm depth to dislodge macroinvertebrates into the net. We rinsed the net in the stream to ensure all organisms floated into the cod end, transferred each sample from the cod end to a labeled 500 mL plastic bottle, and preserved the samples in 95% ethanol at a ratio of three parts ethanol to one part sample. We discarded samples when sediment overfilled the cod end.

Contractor Matt Kern of Alder Grove Farm used an elutriator system and 0.5 mm and 0.3 mm sieves to sort macroinvertebrates from debris,^{k,1} and identified organisms to the lowest practical taxonomic level^m using Merritt and Cummins (1996) and Stewart and Oswood (2006). Habitat biologists provided quality control by verifying macroinvertebrate identification of 5 samples.

We calculated BMI density (per m²) for each sample by dividing the number of macroinvertebrates by 0.093 m²: the Surber sampling area. We estimated mean BMI density for each site by calculating the mean density among the 6 samples. We report taxa richness as the number of

^k Gordon Willson-Naranjo and Greg Albrecht, Habitat Biologists, to Jackie Timothy, Southeast Regional Supervisor, ADF&G Division of Habitat. Memorandum: Benthic macroinvertebrate elutriation trials amendment; dated 12/17/2013. Unpublished document can be obtained from the Southeast Regional Supervisor, ADF&G Division of Habitat, 802 3rd Street, Douglas, AK.

¹ Katrina Lee, Administrative Assistant, to Jackie Timothy, Southeast Regional Supervisor, ADF&G Division of Habitat. Memorandum: Benthic macroinvertebrate sample enumeration procedures; dated 6/28/2016. Unpublished document can be obtained from the Southeast Regional Supervisor, ADF&G Division of Habitat, 802 3rd Street, Douglas, AK.

^m Insects of the orders Ephemeroptera, Plecoptera, Trichoptera, and Diptera to genus, except nonbiting midges to family Chironomidae, and all others to class or order.

taxonomic groups identified to the lowest practical level and exclude terrestrialⁿ organisms from all calculations.

Shannon Diversity (H) and Evenness (E) Indices provide measures of taxonomic diversity and abundance equality. We calculate these indices using the following equations given in Magurran (1988):

$$H = - \sum_{i=1}^S (P_i \log_{10} P_i)$$

and

$$E = \frac{H}{\log_{10} S},$$

where P_i is the number of macroinvertebrates per taxonomic group divided by the total number of macroinvertebrates in the sample, and S is the number of taxonomic groups in the sample.^o A single taxa macroinvertebrate community has an H value of 0, which increases with the number of taxa (richness) and abundance equality (evenness). The Evenness calculation normalizes the H value to a number between 0 and 1, with an E value of 1 indicating all taxa are equally abundant.

Data Presentation

For each site and by year, we present a table summarizing mean BMI density, total taxa, total EPT taxa, percent EPT, and mean Shannon Diversity and Evenness scores, and illustrate mean densities in a figure. Data summaries from 2011 through 2019 also are presented (Appendix B).

ADULT SALMON COUNTS

Requirement Plan of Operations

The Plan of Operations (Coeur 2005) requires weekly surveys of adult chum, coho, and pink salmon in Lower Slate Creek, Lower Johnson Creek, and Lower Sherman Creek throughout the spawning season.

Sample Collection

We surveyed Slate Creek, Johnson Creek, and Sherman Creek downstream of fish migration barriers once per week between mid-July and late-August and counted the number of adult pink salmon, chum salmon, and carcasses. We surveyed Slate and Sherman Creeks by foot and Johnson Creek by helicopter, using polarized glasses as necessary to improve visibility. We also surveyed Slate and Johnson Creeks by foot once per week from late-September through October to count the number of adult coho salmon and carcasses. To improve coho salmon observations, we recorded underwater videos with a GoPro in large pools and around large woody debris, habitats where adult coho salmon tend to concentrate.

ⁿ Including adult terrestrial insects of the orders Ephemeroptera, Plecoptera, Trichoptera, and Diptera.

^o Assuming all taxonomic groups are represented.

We began each survey at the stream mouth, moving upstream by section and ending at the fish migration barrier. Slate Creek is sectioned in 100 m reaches, Johnson Creek by landmarks, and Sherman Creek in 50 m reaches. For Johnson Creek aerial surveys, a team of two biologists independently recorded the number of live fish and carcasses by species in each section and we used the average of the two biologists' counts to estimate the total number of fish by species for each reach and survey, and rounded down all decimal numerals to integers in the calculations. For Slate and Sherman Creeks, one biologist recorded quantity by species while the other biologist verified counts and provided bear protection. We also recorded approximate weather and flow conditions during each survey.

Data Presentation

For each site, we present figures of the weekly adult pink salmon count and distribution and provide the 2011–2019 counts by species in a table. We have also compiled the 2019 data and 2011–2019 pink salmon counts by statistical week and reach (Appendix C).

SPAWNING SUBSTRATE COMPOSITION

Requirement APDES 1.5.3.5.1

The APDES permit requires annually sampling pink salmon spawning substrate during early-July at Lower Slate Creek SP1 and SP2 to detect change in composition over time. We calculate the geometric mean particle size, an index of substrate textural composition, for each sample and among samples collected at each site each year.

Sample Collection

We collected four sediment samples at two locations in Lower Slate Creek using a McNeil sampler, which has a 15 cm basal core diameter and 25 cm core depth. We selected sample sites with substrate measuring less than 10 cm, the maximum gravel size used by pink salmon (Lotspeich and Everest 1981, Kondolf and Wolman 1993), and where the stream gradient was less than 3%^p. We pushed the McNeil sampler into the substrate until the sample core was buried, then transferred the sediments to a bucket. We wet-sieved samples onsite using sieve sizes 101.6, 50.8, 25.4, 12.7, 6.35, 1.68, 0.42, and 0.15 mm and measured the contents of each sieve to the nearest 25 mL by the volume of water displaced in 600 mL and 1 L plastic beakers.^q We transferred the fines that passed through the 0.15 mm sieve to Imhoff cones, allowed 10 min settling time, and measured the sediment volume to the nearest 1 mL using the Imhoff cone gradations.

^p Valentine, B. E. 2001. Unpublished. Stream substrate quality for salmonids: Guidelines for Sampling, Processing, and Analysis. California Department of Forestry and Fire Protection, Coast Cascade Regional Office, Santa Rosa, CA.

^q Except we measure the contents of the 0.15 mm sieve to the nearest 1 mL using an Imhoff cone.

For the fines that pass through the 0.15 mm sieve, we converted sediment wet weights to dry weights using standards identified by Zollinger (1981). For all other sediments, we converted wet weights to dry weights using a correction factor derived from Shirazi et al. (1981), assuming a gravel density of 2.6 g/cm³ (Aquatic Science Inc. 2011). We calculated the geometric mean particle size (d_g) using methods developed by Lotspeich and Everest (1981), where the midpoint diameter of particles retained in each sieve (d) are raised to a power equal to the decimal fraction of volume retained by that sieve (w), and multiplied the products of each sieve size to obtain the final product,

$$d_g = d_1^{w_1} \times d_2^{w_2} \times d_3^{w_3} \dots d_n^{w_n}$$

Data Presentation

We present a table of the geometric mean particle sizes (GMPS) for the 2011–2019 data at each site. The annual data from 2011 through 2019 also are presented (Appendix D).

SEDIMENT COMPOSITION AND ELEMENT CONCENTRATIONS

Requirement APDES 1.5.2

Sediment element concentrations are influenced by a variety of factors, such as geochemical composition and weathering within the watershed, sediment grain size, organic content, and development (Tchounwou et al. 2012). Subsequently, sediment element concentrations influence benthic aquatic productivity, and heavy metals in sediments can decrease BMI taxa richness and change the composition of BMI communities (Qu et al. 2010).

The APDES permit requires annually sampling fine sediments in Lower Slate Creek, East Fork Slate Creek, Upper Slate Creek, Lower Johnson Creek, and Lower Sherman Creek for particle size, total solids, total volatile solids, total sulfide, total organic carbon, and total concentrations of silver (Ag), aluminum (Al), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), selenium (Se), and zinc (Zn).

Sample Collection and Analysis

Wearing latex gloves, we opportunistically collected submerged sand and silt at each site within actively flowing channels and retained the top 4 cm of sediment in three glass jars provided by the laboratory.^r We stored the samples in a cooler with frozen icepacks during transport and in an ADF&G Douglas laboratory fridge until we shipped them to the ALS Environmental laboratory in Kelso, WA for analyses.

We shipped the samples in a cooler with frozen icepacks via overnight air freight and maintained written chain of custody documentation. ALS Environmental measured particle size, total solids, total volatile solids, total sulfide, total organic carbon, and total concentrations of Ag, Al, As, Cd, Cr, Cu, Hg, Ni, Pb, Se, and Zn on a dry-weight basis (Table 7).^s The laboratory provided Tier II quality assurance and quality control information, including results for matrix spikes, sample blanks, and sample duplicates.

^r In 2015, we discontinued sieving sediments during collection to avoid washing contaminants from the sample.

^s The AECOM Environmental Toxicology lab in Fort Collins, CO completed the 2011–2013 sediment sample analyses, and the ALS Environmental lab in Kelso, WA has completed the sediment sample analyses since 2014.

Table 7.–Sediment tests, analytes, and methods.

Test Description	Analyte	Method
Standard test method for particle-size analysis of soils	Particle size determination	ASTM D422
Puget Sound Estuary Program sediment total organic carbon	Total organic carbon	PSEP TOC
Total solids on liquids, modified for solids	Total solids	160.3 Modified
Puget Sound Estuary Program sediment sulfide	Total sulfide	PSEP Sulfide
Total volatile solids, modified for solids	Total volatile solids	160.4 Modified
Mercury in solid or semisolid waste	Hg	7471B
Determination of trace elements in waters and wastes by ICP/MS	Ag, Al, As, Cd, Cr, Cu, Ni, Pb, Se, Zn	200.8

Data Presentation

We present two figures for each site: the 2019 sample concentrations and results by analyte for the 2011–2019 data. We report mean values when sample duplicate data are available and we illustrate sediment element concentrations undetected as an empty circle (◦) at the method reporting limit and measured element concentrations as a solid circle (•).

We compare the data with the threshold effects concentrations (TEC) and the probable effects concentrations (PEC) for inorganics in freshwater sediment guidelines developed by the National Oceanic and Atmospheric Administration (Buchman 2008). The guidelines are based on results of controlled laboratory bioassays, wherein element concentrations below the TEC are not expected to adversely affect aquatic life survival and growth, and element concentrations above the PEC are expected to adversely affect aquatic life survival and growth more often than not (MacDonald et al. 2000).

We also provide the 2011–2019 sediment composition and element concentration data by site and the 2019 laboratory report (Appendix E).

RESULTS

SLATE CREEK

Lower Slate Creek

Periphyton: Chlorophyll Density and Composition

The 2019 Lower Slate Creek mean chlorophyll *a* and *c* densities were 33.71 mg/m² and 6.49 mg/m², respectively: both greater than the mean densities observed since 2011 (Table 8; Figure 14) and mean densities observed at other sampling sites near the project. The mean proportion of chlorophylls *a*, *b*, and *c* was similar to previous years (Figure 15).

Table 8.–Lower Slate Creek mean chlorophylls *a*, *b*, and *c* densities, 2011–2019.

	07/29/11	07/25/12	07/31/13	07/30/14	07/28/15	07/26/16	07/24/17	08/07/18	08/01/19
Chl- <i>a</i> (mg/m ²)	5.15	2.31	12.59	3.97	2.16	5.26	2.30	4.21	33.71
Chl- <i>b</i> (mg/m ²)	0.43	0.05	0.00	0.85	0.10	0.21	0.23	0.04	0.00
Chl- <i>c</i> (mg/m ²)	0.26	0.18	1.64	0.30	0.21	0.62	0.23	0.63	6.49

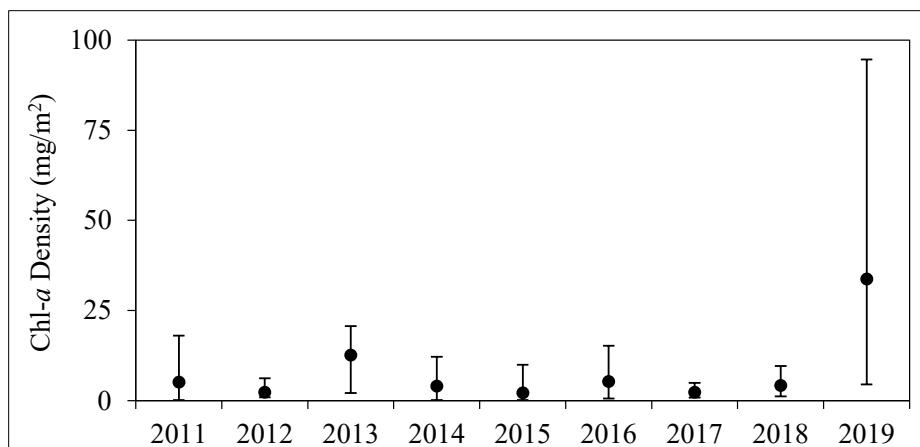


Figure 14.–Lower Slate Creek mean chlorophyll *a* densities, 2011–2019.
Note: Minimum, mean, and maximum values.

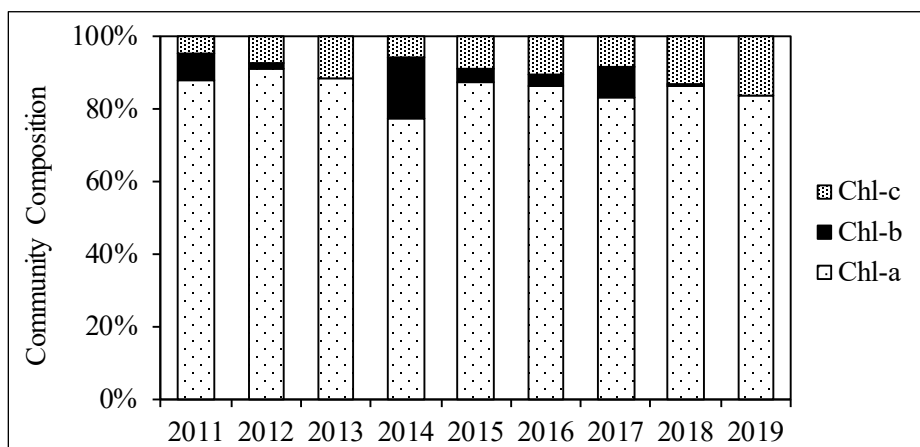


Figure 15.–Lower Slate Creek mean proportions of chlorophylls *a*, *b*, and *c*, 2011–2019.

Benthic Macroinvertebrate Density and Community Composition

Among the 2019 Lower Slate Creek BMI samples, we identified 18 taxa and estimate mean density at 934 BMI/m², of which 57% were EPT insects (Table 9; Figure 16). Mean BMI density and taxa richness were among the lowest observed since 2011, similar to the 2018 results. The Shannon Diversity and Evenness scores were within ranges observed 2011–2018. The dominant taxa were Diptera: Chironomidae (nonbiting midges) and Ephemeroptera: *Baetis*, composing 29% and 18% of the samples.

Table 9.–Lower Slate Creek BMI data summaries, 2011–2019.

	05/04/11	05/02/12	04/30/13	04/30/14	04/27/15	04/26/16	04/25/17	05/03/18	05/01/19
Mean BMI density (per m ²)	2,057	3,154	2,581	4,136	3,407	3,394	1,308	482	934
Total BMI taxa	29	32	27	32	26	24	27	17	18
Number of EPT taxa	13	17	16	17	13	11	13	9	9
% EPT	14%	38%	51%	19%	24%	15%	50%	45%	57%
Shannon Diversity score	0.51	0.69	0.85	0.64	0.70	0.65	0.81	0.81	0.83
Evenness score	0.48	0.58	0.70	0.52	0.58	0.57	0.73	0.84	0.81

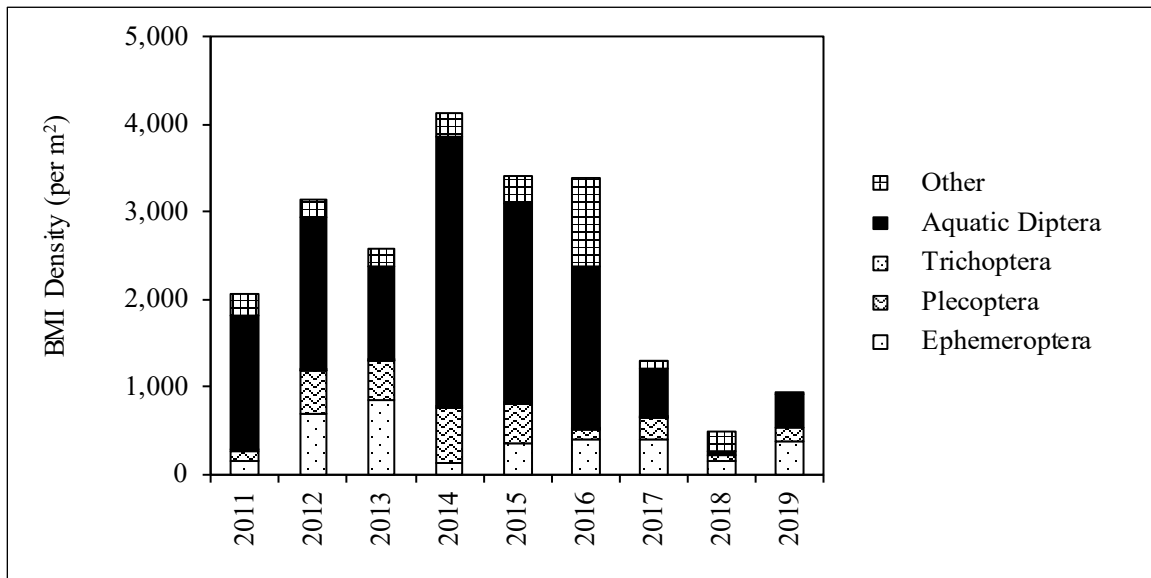


Figure 16.–Lower Slate Creek mean BMI densities and community compositions, 2011–2019.

Adult Salmon Counts

We counted 837 pink salmon, 0 chum salmon, and 1 coho salmon in Lower Slate Creek during 2019 (Table 10; Figure 17).

Table 10.–Lower Slate Creek adult salmon counts, 2011–2019.

	2011	2012	2013	2014	2015	2016	2017	2018	2019
Pink salmon	6,254	7,272	3,337	41	7,580	79	7,416	4	837
Chum salmon	59	1	1	0	13	45	1	0	0
Coho salmon	0	0	26	5	0	2	5	1	1

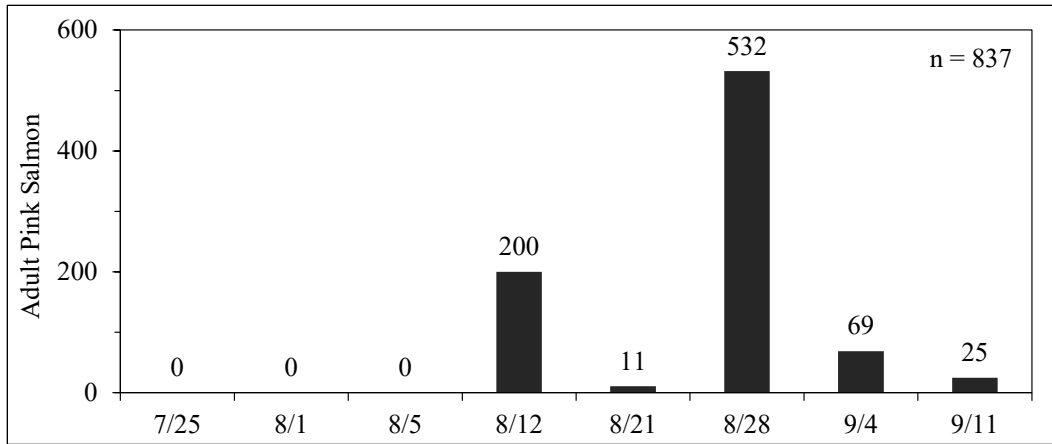


Figure 17.–Lower Slate Creek weekly adult pink salmon counts, 2019.

Spawning Substrate Composition

Sample Points 1 and 2

The 2019 Lower Slate Creek GMPS was 14.8 mm at SP1 and 23.1 mm at SP2 (Table 11). The SP1 GMPS was similar to the 2017–2018 results, and the SP2 GMPS was larger than previously observed.

Table 11.–Lower Slate Creek spawning substrate geometric mean particle sizes (mm), 2011–2019.

	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sample Point 1	10.3	10.8	14.2	12.9	13.3	13.6	14.7	14.5	14.8
Sample Point 2	11.1	11.2	13.2	16.5	17.5	11.6	13.0	17.3	23.1

Sediment Element Concentrations

In the 2019 Lower Slate Creek sediment sample, the Al and Cr concentrations were less than the ranges observed 2011–2018 and the remaining element concentrations were within the ranges previously observed (Figures 18, 19). The As, Cu, Ni, and Zn values remain above the TEC freshwater sediment toxicity guidelines.

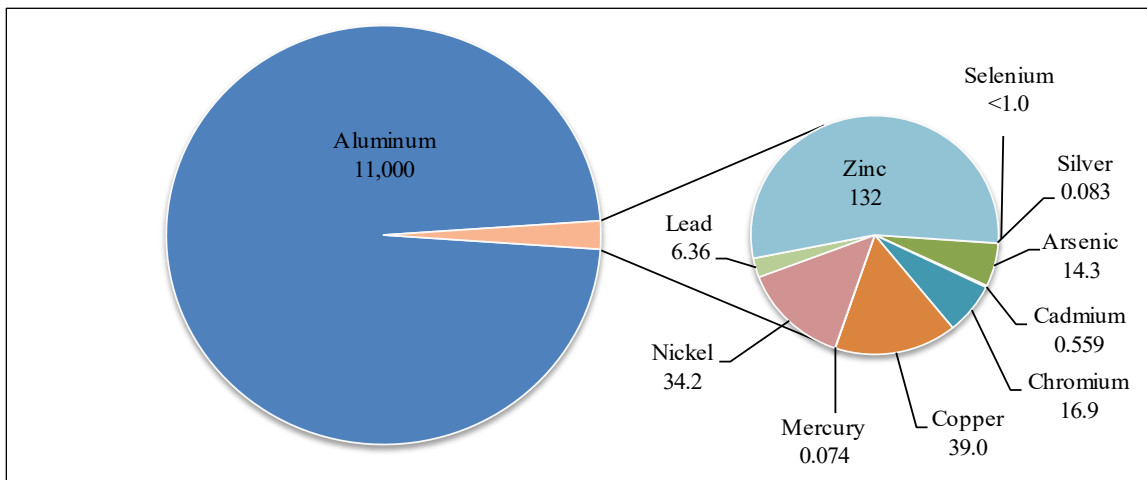


Figure 18.–Lower Slate Creek sediment element concentrations (mg/kg), 2019.

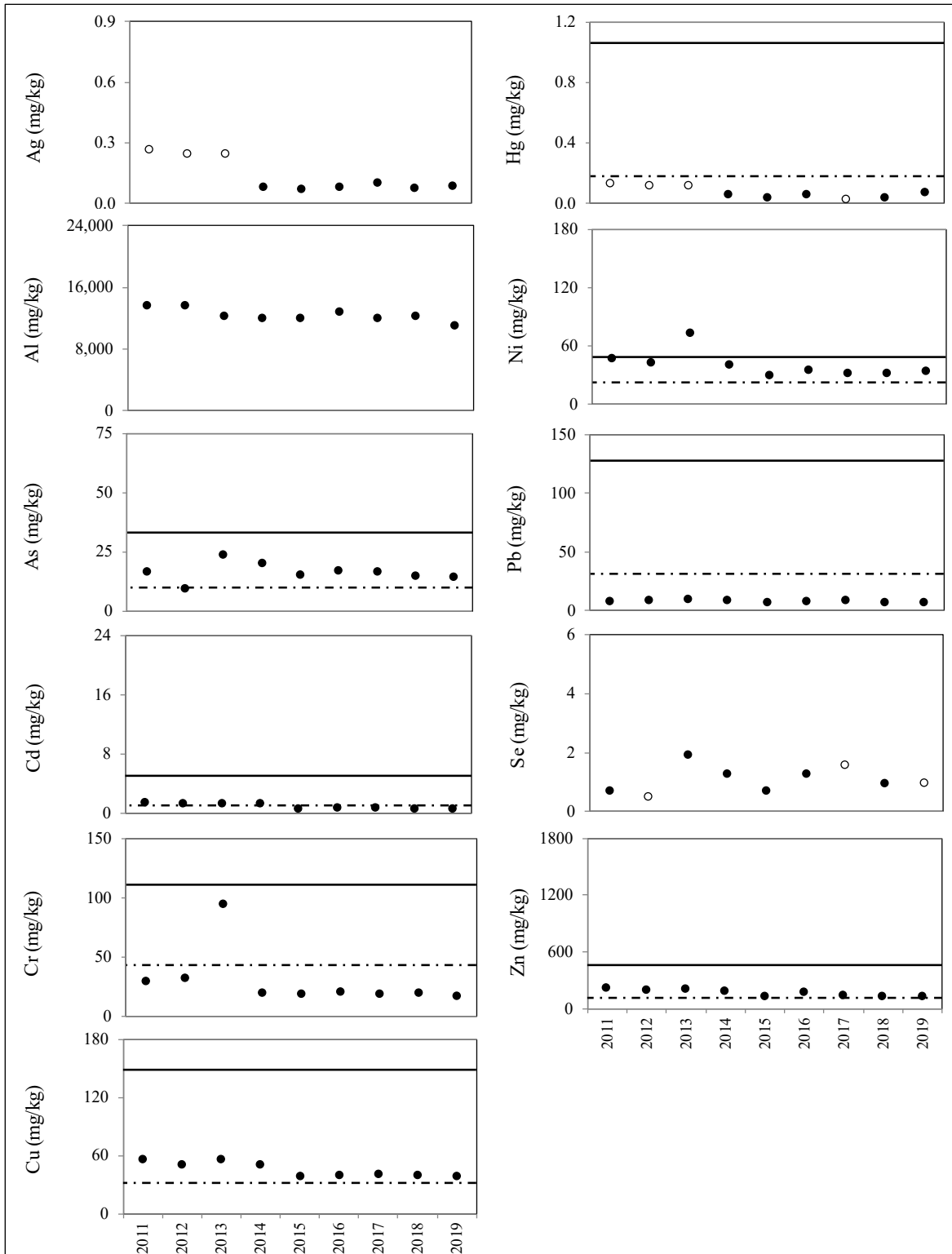


Figure 19.—Lower Slate Creek sediment element concentrations, 2011–2019.
Note: Elements undetected (o) are presented at the method reporting limit. The dashed line represents TEC and solid line represents the PEC; guidelines are not published for Ag, Al, or Se (Buchman 2008).

West Fork Slate Creek

Periphyton: Chlorophyll Density and Composition

The 2019 West Fork Slate Creek mean chlorophyll *a* density was 2.95 mg/m², within the range observed since 2011 (Table 12; Figure 20). The mean proportion of chlorophylls *a*, *b*, and *c* was similar to previous years (Figure 21).

Table 12.—West Fork Slate Creek mean chlorophylls *a*, *b*, and *c* densities, 2011–2019.

	07/29/11	07/25/12	07/31/13	07/30/14	07/28/15	07/26/16	07/24/17	07/25/18	08/01/19
Chl- <i>a</i> (mg/m ²)	3.92	1.01	4.22	0.77	0.92	4.93	4.96	3.85	2.95
Chl- <i>b</i> (mg/m ²)	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00
Chl- <i>c</i> (mg/m ²)	0.27	0.10	0.61	0.06	0.06	0.66	0.85	0.74	0.46

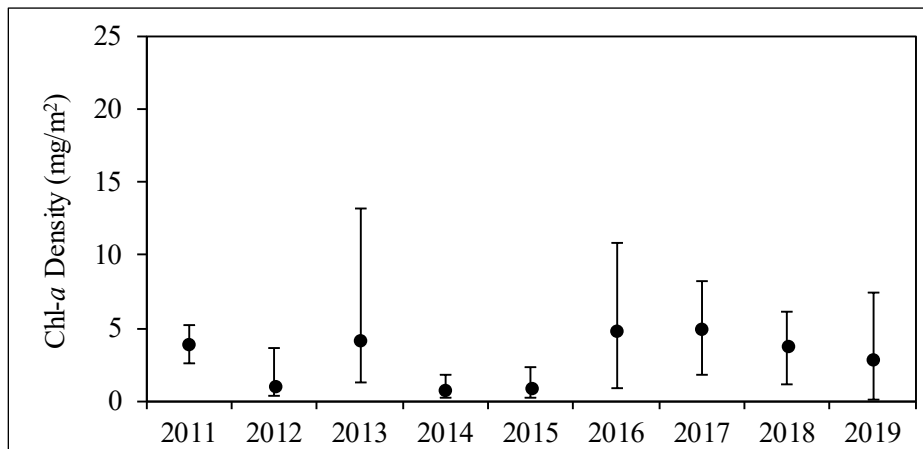


Figure 20.—West Fork Slate Creek mean chlorophyll *a* densities, 2011–2019.

Note: Minimum, mean, and maximum values.

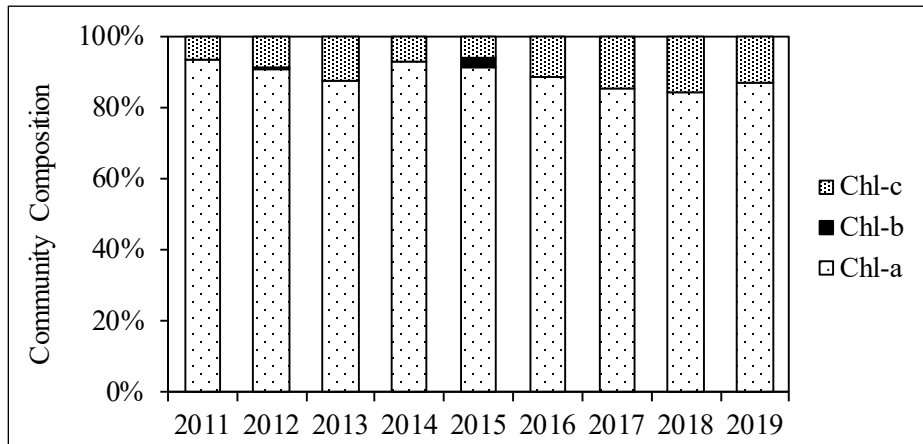


Figure 21.—West Fork Slate Creek mean proportions of chlorophylls *a*, *b*, and *c*, 2011–2019.

Benthic Macroinvertebrate Density and Community Composition

Among the 2019 West Fork Slate Creek BMI samples, we identified 16 taxa and estimate mean density at 1,299 BMI/m², of which 91% were EPT insects (Table 13; Figure 22). BMI taxa richness was the lowest observed since 2011 and the Shannon Diversity and Evenness scores were among the lowest observed. The dominant taxon was Ephemeroptera: *Baetis*, composing 54% of the samples.

Table 13.–West Fork Slate Creek BMI data summaries, 2011–2019.

	05/04/11	05/02/12	04/30/13	04/30/14	04/27/15	04/26/16	04/25/17	05/03/18	05/01/19
Mean BMI density (per m ²)	502	1,819	2,446	973	2,634	1,470	885	328	1,299
Total BMI taxa	21	31	28	29	28	25	21	18	16
Number of EPT taxa	11	21	18	17	16	15	13	12	11
% EPT	80%	80%	90%	71%	82%	77%	82%	84%	91%
Shannon Diversity score	0.63	0.84	0.73	0.91	0.82	0.72	0.78	0.72	0.64
Evenness score	0.78	0.71	0.61	0.79	0.71	0.69	0.78	0.83	0.64

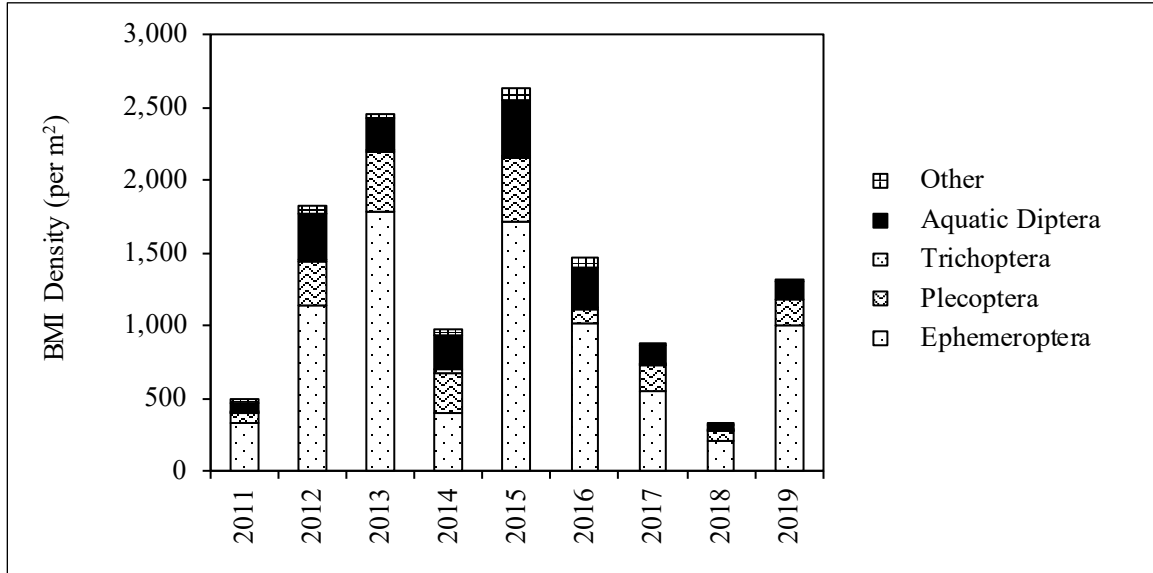


Figure 22.–West Fork Slate Creek mean BMI densities and community compositions, 2011–2019.

East Fork Slate Creek

Periphyton: Chlorophyll Density and Composition

The 2019 East Fork Slate Creek mean chlorophyll *a* density was 3.51 mg/m², within the range observed since 2011 (Table 14; Figure 23). The mean proportion of chlorophylls *a*, *b*, and *c* was similar to previous years (Figure 24).

Table 14.–East Fork Slate Creek mean chlorophylls *a*, *b*, and *c* densities, 2011–2019.

	07/28/11	07/24/12	07/30/13	07/30/14	07/27/15	07/25/16	07/25/17	07/24/18	08/01/19
Chl- <i>a</i> (mg/m ²)	8.84	5.08	2.28	0.27	1.56	1.21	0.64	1.67	3.51
Chl- <i>b</i> (mg/m ²)	1.56	0.57	0.06	0.02	0.00	0.00	0.00	0.00	0.01
Chl- <i>c</i> (mg/m ²)	0.24	0.18	0.20	0.03	0.15	0.15	0.06	0.16	0.34

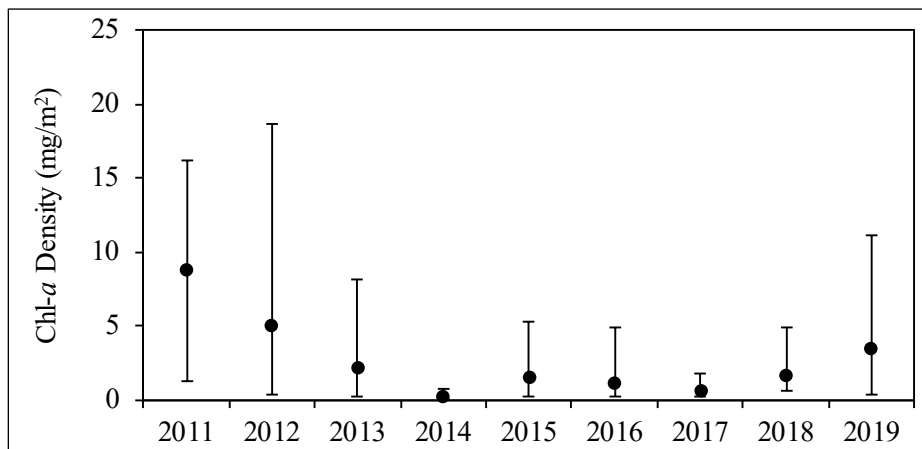


Figure 23.–East Fork Slate Creek mean chlorophyll *a* densities, 2011–2019.
Note: Minimum, mean, and maximum values.

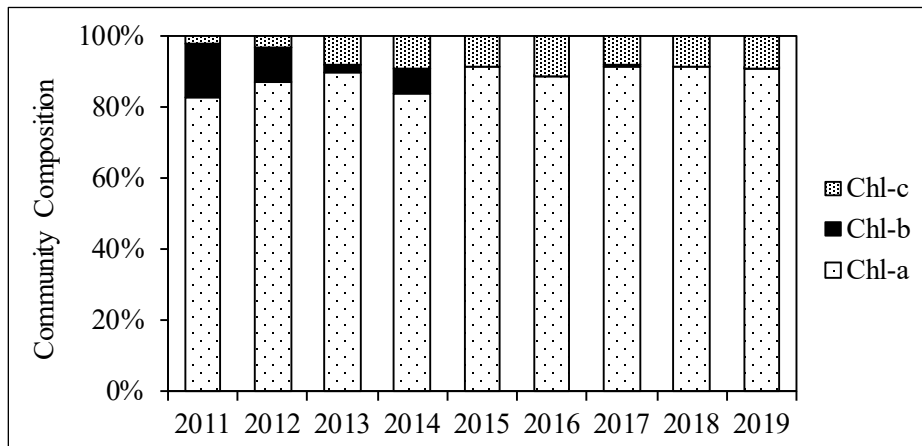


Figure 24.–East Fork Slate Creek mean proportions of chlorophylls *a*, *b*, and *c*, 2011–2019.

Benthic Macroinvertebrate Density and Community Composition

Among the 2019 East Fork Slate Creek BMI samples, we identified 25 taxa and estimate mean density at 3,866 BMI/m², of which 18% were EPT insects, all within ranges observed 2011–2018 (Table 15; Figure 25). The Shannon Diversity and Evenness scores were consistent with most previous years, and the dominant taxon was Bivalvia: *Pisidium* (pea clams), composing 56% of the samples.

Table 15.–East Fork Slate Creek BMI data summaries, 2011–2019.

	05/12/11	04/27/12	04/29/13	04/30/14	04/29/15	04/25/16	04/27/17	05/03/18	04/30/19
Mean BMI density (per m ²)	4,688	4,633	9,407	2,048	3,854	2,002	6,783	3,588	3,866
Total BMI taxa	27	33	33	24	28	21	27	26	25
Number of EPT taxa	15	17	17	9	16	11	13	15	15
% EPT	19%	23%	3%	2%	18%	28%	11%	8%	18%
Shannon Diversity score	0.64	0.78	0.57	0.70	0.92	0.92	0.62	0.54	0.62
Evenness score	0.54	0.61	0.47	0.63	0.72	0.78	0.51	0.46	0.53

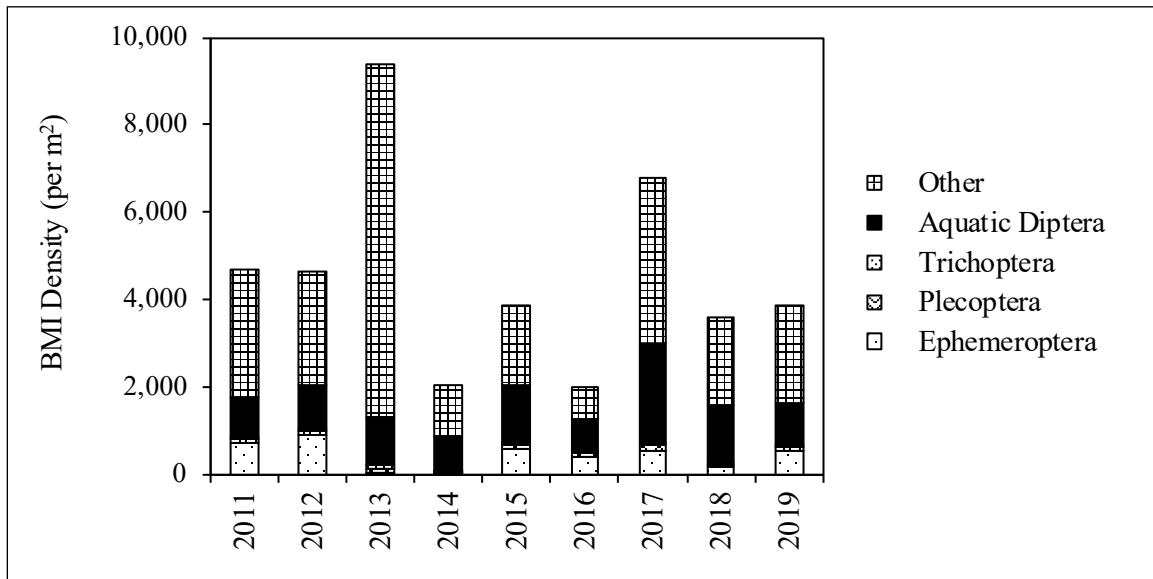


Figure 25.–East Fork Slate Creek mean BMI densities and community compositions, 2011–2019.

Sediment Element Concentrations

The 2019 East Fork Slate Creek sediment sample contained element concentrations within the ranges observed 2011–2018 (Figures 26, 27). The As, Cd, Ni, and Zn concentrations remain above the PEC and the Cu concentration remains above the TEC freshwater sediment toxicity guidelines.

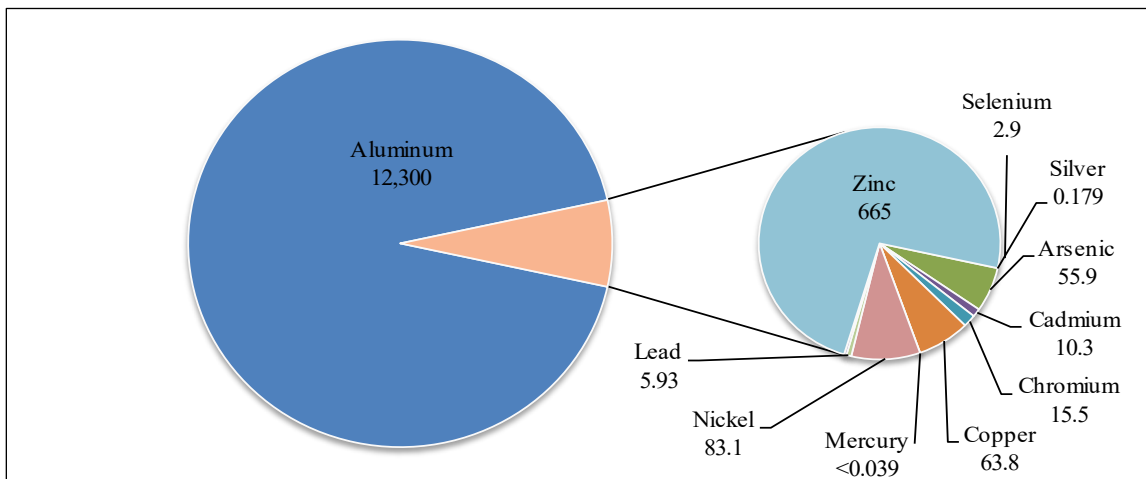


Figure 26.–East Fork Slate Creek sediment element concentrations (mg/kg), 2019.

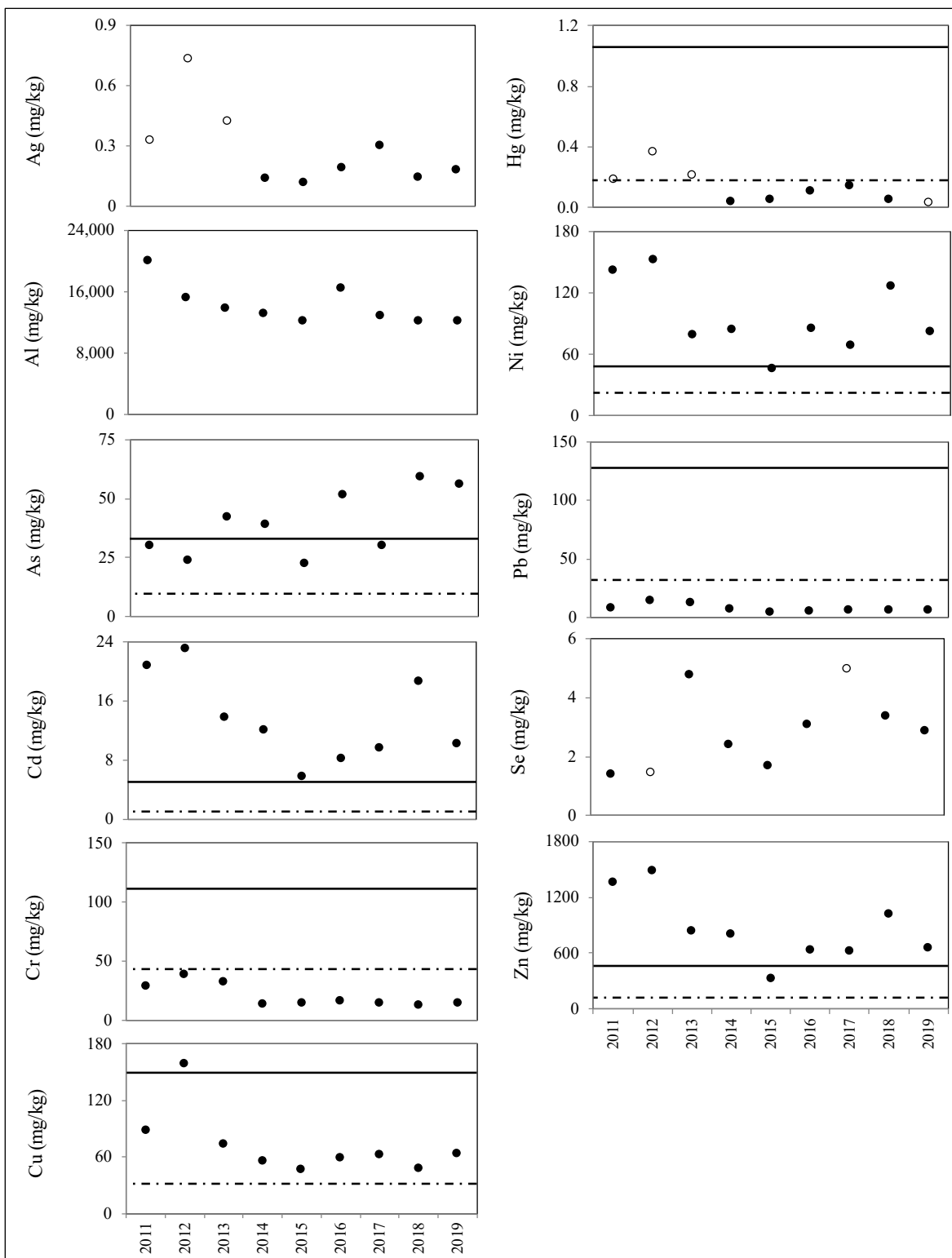


Figure 27.—East Fork Slate Creek sediment element concentrations, 2011–2019.
Note: Elements undetected (o) are presented at the method reporting limit. The dashed line represents TEC and solid line represents the PEC; guidelines are not published for Ag, Al, or Se (Buchman 2008).

Upper Slate Creek

Periphyton: Chlorophyll Density and Composition

The 2019 Upper Slate Creek mean chlorophyll *a* density was 7.47 mg/m², above the range observed since 2011 (Table 16; Figure 28). The mean proportion of chlorophylls *a*, *b*, and *c* was similar to previous years (Figure 29).

Table 16.–Upper Slate Creek mean chlorophylls *a*, *b*, and *c* densities, 2011–2019.

	07/29/11	07/24/12	07/30/13	07/30/14	07/27/15	07/25/16	07/24/17	07/25/18	08/01/19
Chl- <i>a</i> (mg/m ²)	0.76	1.26	2.13	1.09	0.63	3.86	0.83	2.57	7.47
Chl- <i>b</i> (mg/m ²)	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
Chl- <i>c</i> (mg/m ²)	0.05	0.07	0.13	0.06	0.09	0.42	0.04	0.36	0.60

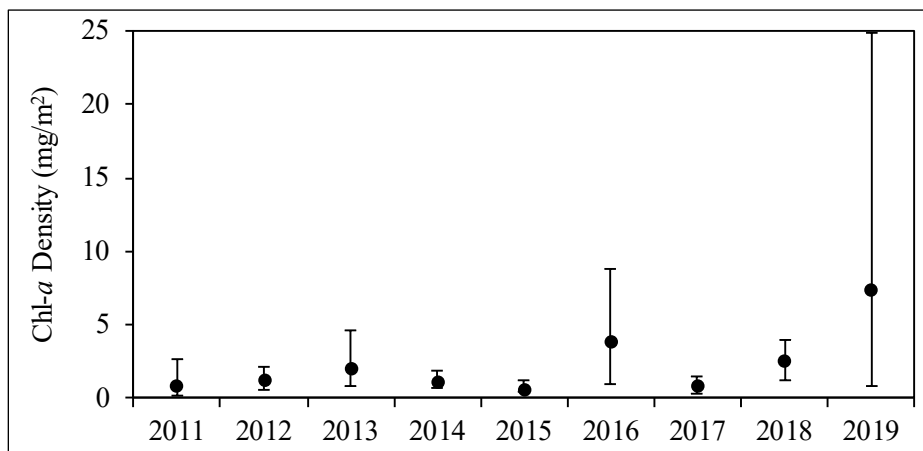


Figure 28.–Upper Slate Creek mean chlorophyll *a* densities, 2011–2019.
Note: Minimum, mean, and maximum values.

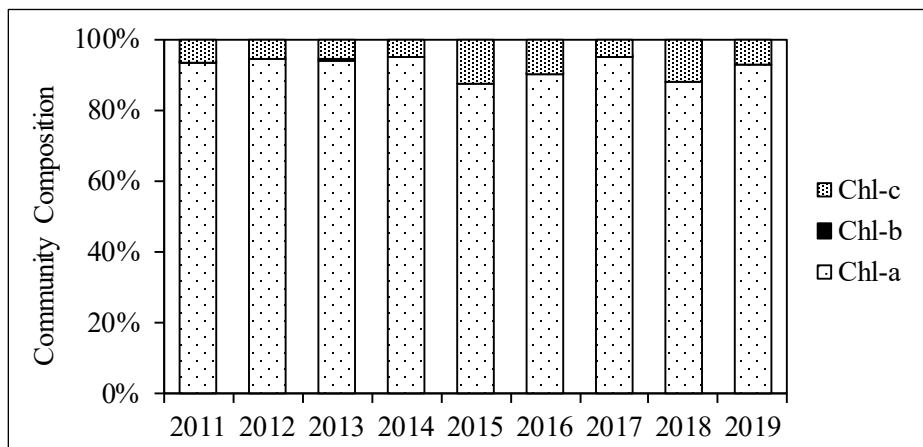


Figure 29.–Upper Slate Creek mean proportions of chlorophylls *a*, *b*, and *c*, 2011–2019.

Benthic Macroinvertebrate Density and Community Composition

Among the 2019 Upper Slate Creek BMI samples, we identified 24 taxa and estimate mean density at 1,634 BMI/m², of which 83% were EPT insects (Table 17; Figure 30). Mean BMI density was among the lowest observed since 2011 and EPT insects composed a larger proportion of samples than previous years. The Shannon Diversity and Evenness scores were consistent with previous years. The dominant taxa were Ephemeroptera: *Baetis* and *Cinygmula*, composing 29% and 12% of the samples.

Table 17.–Upper Slate Creek BMI data summaries, 2011–2019.

	05/12/11	04/27/12	04/29/13	04/28/14	04/29/15	04/25/16	04/27/17	05/02/18	04/30/19
Mean BMI density (per m ²)	2,523	2,256	2,880	3,125	3,776	2,398	2,029	1,548	1,634
Total BMI taxa	33	39	34	36	31	28	30	31	24
Number of EPT taxa	18	21	20	20	19	15	19	18	18
% EPT	63%	68%	72%	63%	68%	68%	61%	68%	83%
Shannon Diversity score	0.97	1.04	1.02	1.03	0.98	1.06	0.96	0.92	0.99
Evenness score	0.76	0.79	0.78	0.76	0.74	0.82	0.73	0.75	0.80

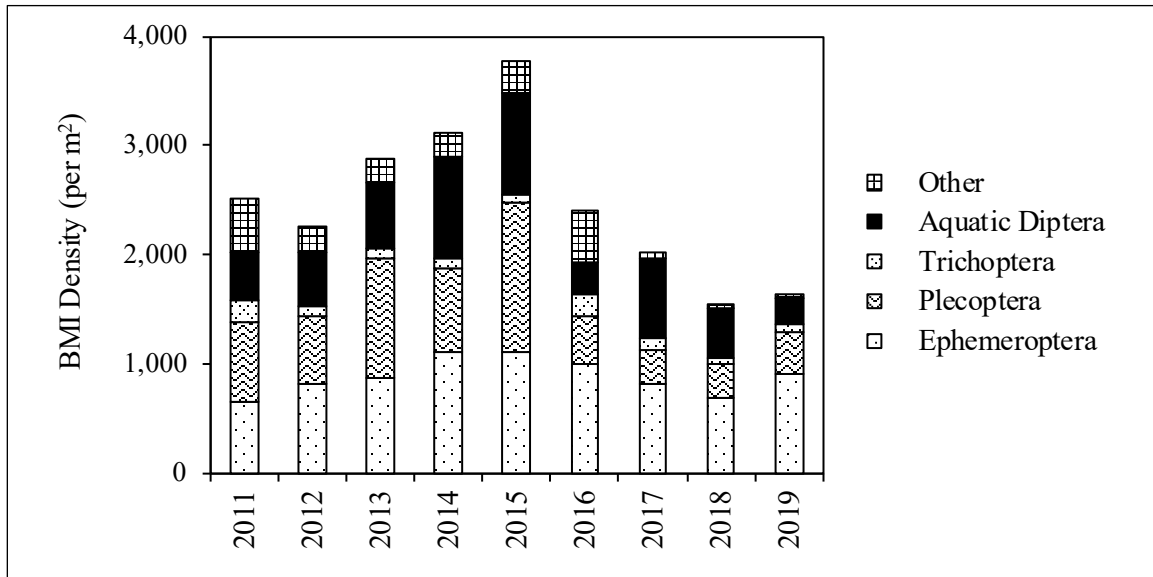


Figure 30.–Upper Slate Creek mean BMI densities and community compositions, 2011–2019.

Sediment Element Concentrations

The 2019 Upper Slate Creek sediment sample contained element concentrations generally within the ranges observed 2011–2018 (Figures 31, 32). The As, Cr, and Cu concentrations remain above the TEC and the Ni concentration remains above the PEC freshwater sediment toxicity guidelines.

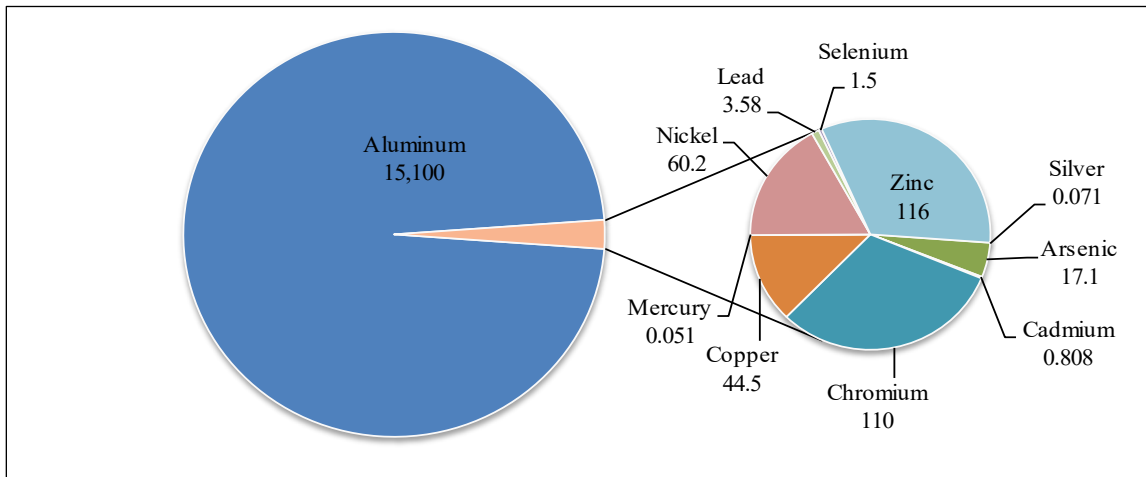


Figure 31.—Upper Slate Creek sediment element concentrations (mg/kg), 2019.

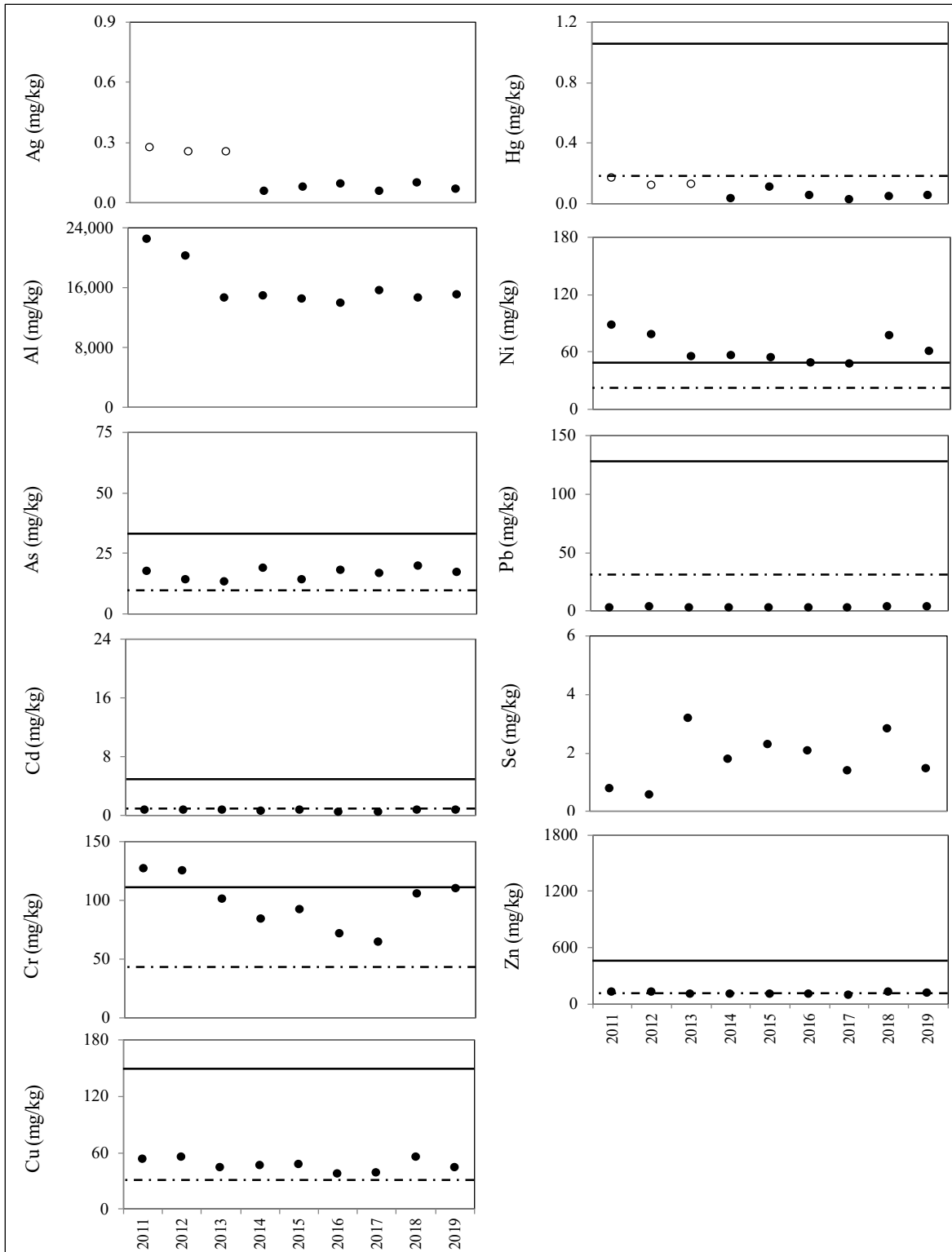


Figure 32.—Upper Slate Creek sediment element concentrations, 2011–2019.
Note: Elements undetected (o) are presented at the method reporting limit. The dashed line represents TEC and solid line represents the PEC; guidelines are not published for Ag, Al, or Se (Buchman 2008).

JOHNSON CREEK

Lower Johnson Creek

Adult Salmon Counts

We counted 4,996 pink salmon, 334 chum salmon, and 94 coho salmon in Lower Johnson Creek during 2019 (Table 18; Figure 33). We did not survey coho salmon during the fourth week of October due to high water and poor visibility.

Table 18.–Lower Johnson Creek adult salmon counts, 2011–2019.

	2011	2012	2013	2014	2015	2016	2017	2018	2019
Pink salmon	17,499	5,016	8,186	189	51,325	428	23,239	434	4,996
Chum salmon	21	99	17	3	0	39	0	2	334
Coho salmon	33	90	64	107	88	24	83	36	94

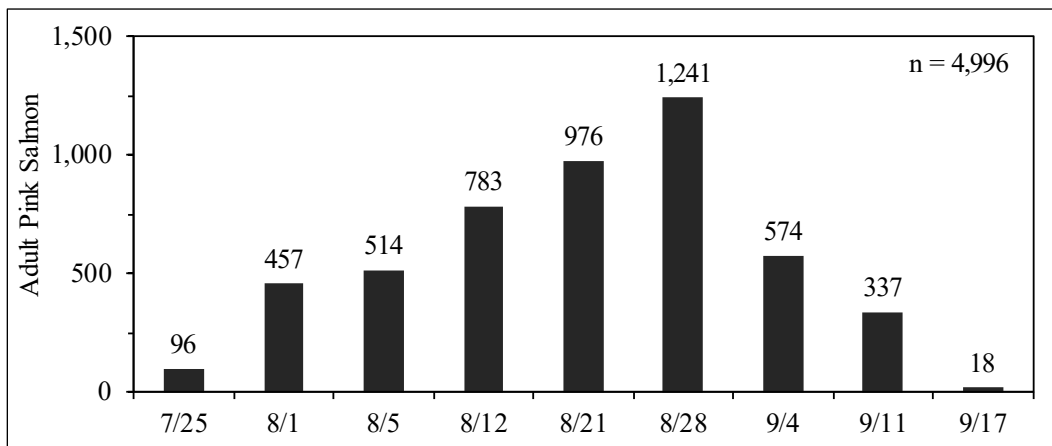


Figure 33.–Lower Johnson Creek weekly pink salmon count, 2019.

Sediment Element Concentrations

The 2019 Lower Johnson Creek sediment sample contained element concentrations within the ranges observed 2011–2018 (Figures 34, 35). The As and Cu concentrations remain above the TEC freshwater sediment toxicity guidelines.

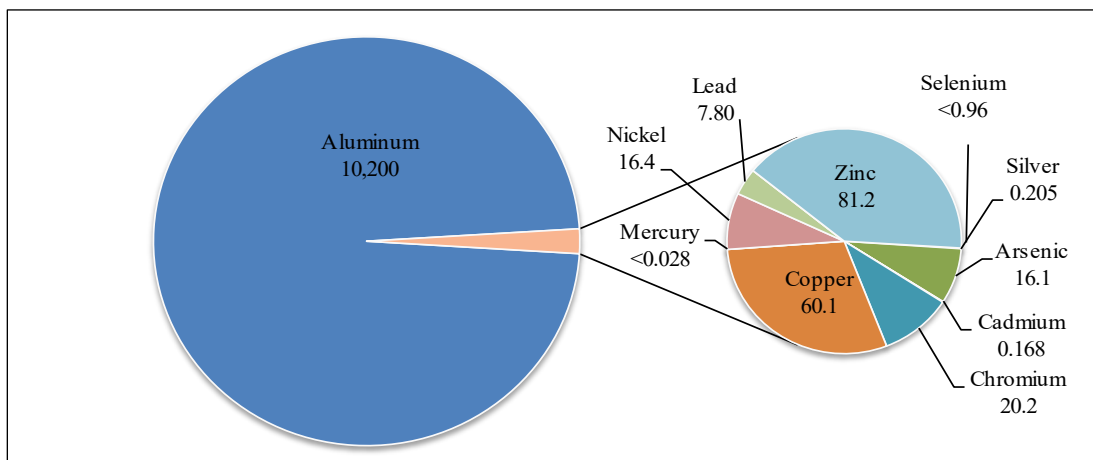


Figure 34.–Lower Johnson Creek sediment element concentrations (mg/kg), 2019.

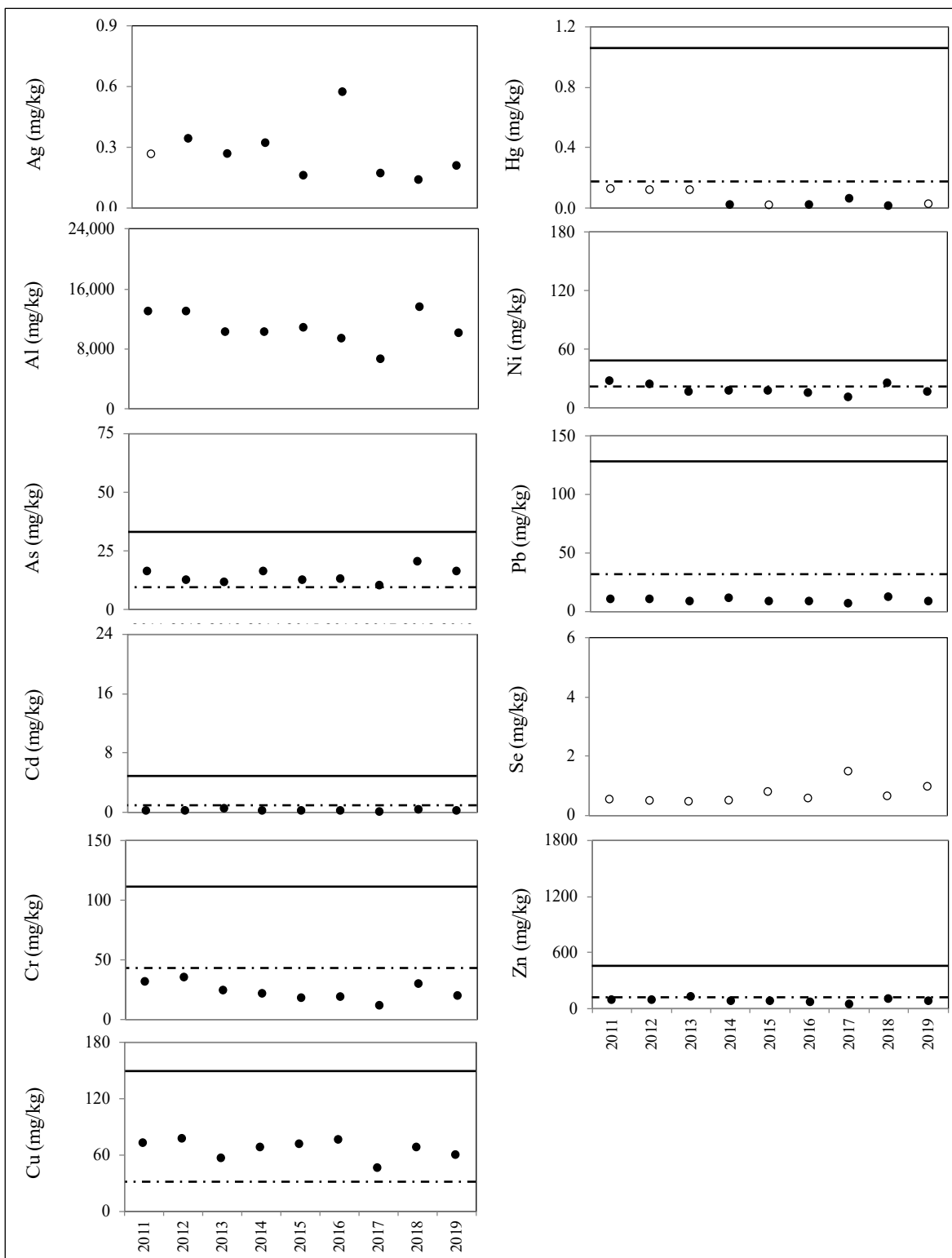


Figure 35.—Lower Johnson Creek sediment element concentrations, 2011–2019.
Note: Elements undetected (o) are presented at the method reporting limit. The dashed line represents TEC and solid line represents the PEC; guidelines are not published for Ag, Al, or Se (Buchman 2008).

Upper Johnson Creek

Benthic Macroinvertebrate Density and Community Composition

Among the 2019 Upper Johnson Creek BMI samples, we identified 25 taxa and estimate mean density at 3,369 BMI/m², of which 70% were EPT insects, all within ranges observed 2011–2018 (Table 19; Figure 36). The Shannon Diversity and Evenness scores also were consistent with previous years. The dominant taxa were Ephemeroptera: *Baetis* and Diptera: Chironomidae, composing 29% and 28% of the samples.

Table 19.–Upper Johnson Creek BMI data summaries, 2011–2019.

	05/03/11	04/26/12	04/29/13	04/29/14	04/28/15	04/27/16	04/26/17	05/04/18	05/01/19
Mean BMI density (per m ²)	3,735	3,968	5,265	2,658	2,789	3,681	2,901	2,996	3,369
Total BMI taxa	24	28	34	32	28	32	33	31	25
Number of EPT taxa	14	14	24	21	17	21	19	20	18
% EPT	55%	64%	65%	69%	71%	71%	51%	67%	70%
Shannon Diversity score	0.76	0.81	0.74	0.74	0.87	0.88	0.68	0.81	0.71
Evenness score	0.66	0.68	0.59	0.59	0.71	0.70	0.55	0.66	0.61

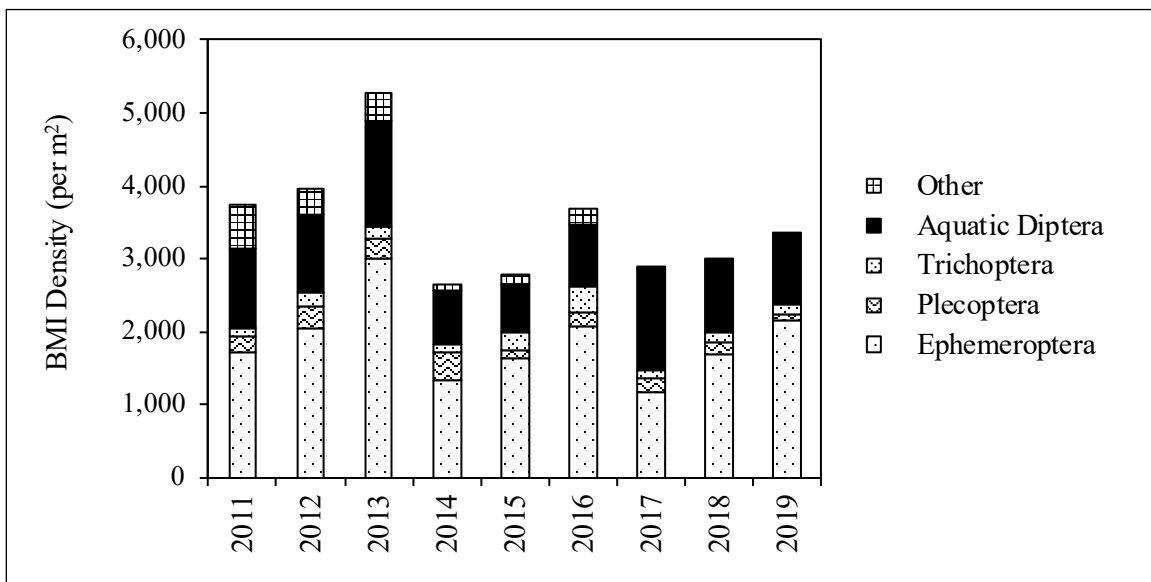


Figure 36.–Upper Johnson Creek mean BMI densities and community compositions, 2011–2019.

SHERMAN CREEK

Lower Sherman Creek

Periphyton: Chlorophyll Density and Composition

Sample Point 1

The 2019 Lower Sherman Creek SP1 mean chlorophyll *a* density was 2.74 mg/m², within the range observed since 2011 (Table 20; Figure 37). The mean proportion of chlorophylls *a*, *b*, and *c* was similar to previous years (Figure 38).

Table 20.—Lower Sherman Creek SP1 mean chlorophylls *a*, *b*, and *c* densities, 2011–2019.

	07/28/11	07/26/12	07/29/13	07/28/14	07/27/15	07/25/16	07/25/17	07/24/18	08/02/19
Chl- <i>a</i> (mg/m ²)	7.60	2.54	3.69	1.34	1.36	3.70	3.86	2.64	2.74
Chl- <i>b</i> (mg/m ²)	0.69	0.93	0.00	0.00	0.00	0.74	0.00	0.00	0.09
Chl- <i>c</i> (mg/m ²)	0.49	0.08	0.51	0.18	0.17	0.33	0.56	0.33	0.49

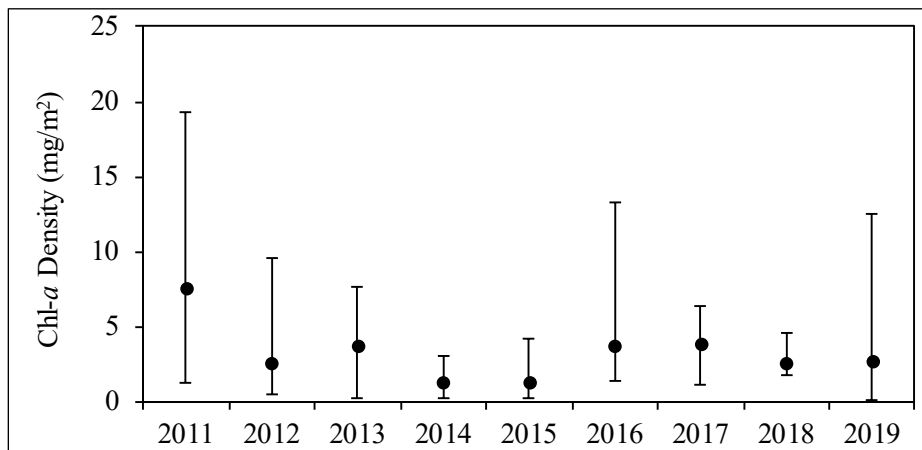


Figure 37.—Lower Sherman SP1 mean chlorophyll *a* densities, 2011–2019.
Note: Minimum, mean, and maximum values.

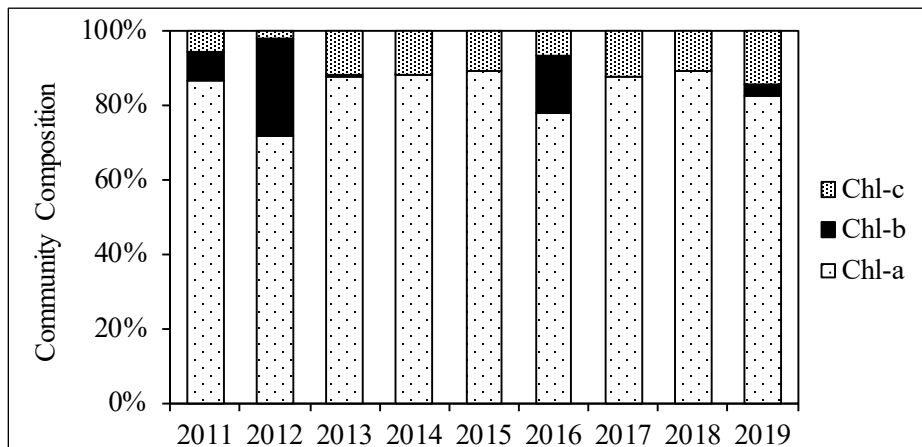


Figure 38.—Lower Sherman SP1 mean proportions of chlorophylls *a*, *b*, and *c*, 2011–2019.

Sample Point 2

The 2019 Lower Sherman Creek SP2 mean chlorophyll *a* density was 2.12 mg/m², within the range observed since 2011 (Table 21; Figure 39). The mean proportion of chlorophylls *a*, *b*, and *c* was similar to previous years (Figure 40).

Table 21.—Lower Sherman Creek SP2 mean chlorophylls *a*, *b*, and *c* densities, 2011–2019.

	07/28/11	07/26/12	07/29/13	07/28/14	07/27/15	07/25/16	07/25/17	07/24/18	08/02/19
Chl- <i>a</i> (mg/m ²)	5.61	0.67	2.87	1.32	1.62	1.42	1.15	1.49	2.12
Chl- <i>b</i> (mg/m ²)	0.02	0.01	0.00	0.00	0.15	0.04	0.00	0.00	0.00
Chl- <i>c</i> (mg/m ²)	0.32	0.09	0.32	0.12	0.27	0.19	0.12	0.19	0.29

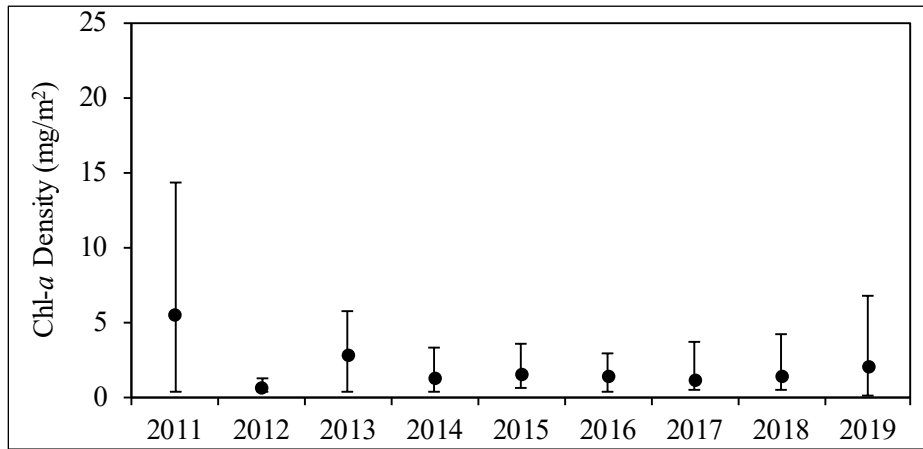


Figure 39.—Lower Sherman SP2 mean chlorophyll *a* densities, 2011–2019.
Note: Minimum, mean, and maximum values.

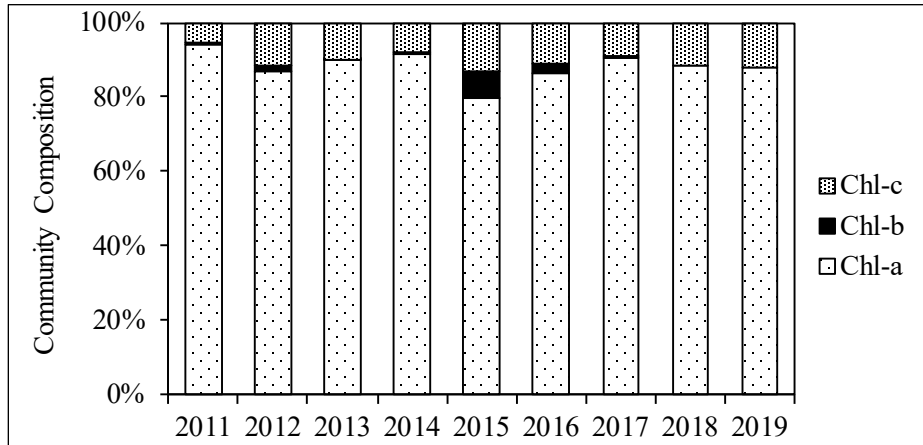


Figure 40.—Lower Sherman SP2 mean proportions of chlorophylls *a*, *b*, and *c*, 2011–2019.

Benthic Macroinvertebrate Density and Community Composition

Sample Point 1

Among the 2019 Lower Sherman Creek SP1 BMI samples, we identified 25 taxa and estimate mean density at 1,263 BMI/m², of which 64% were EPT insects, all within ranges observed 2011–2018 (Table 22; Figure 41). The Shannon Diversity and Evenness scores were consistent with previous years. The dominant taxa were Ephemeroptera: *Baetis* and Diptera: Chironomidae, composing 34% and 27% of the samples.

Table 22.–Lower Sherman Creek SP1 BMI data summaries, 2011–2019.

	05/04/11	04/30/12	05/01/13	04/29/14	04/28/15	04/27/16	04/26/17	05/02/18	04/30/19
Mean BMI density (per m ²)	1,118	2,733	1,796	3,023	1,651	6,839	1,009	912	1,263
Total BMI taxa	26	31	28	30	26	26	25	26	25
Number of EPT taxa	15	18	16	13	13	13	13	16	14
% EPT	32%	66%	64%	14%	27%	4%	31%	69%	64%
Shannon Diversity score	0.76	0.74	0.85	0.71	0.84	0.32	0.81	0.73	0.79
Evenness score	0.71	0.62	0.71	0.57	0.70	0.27	0.69	0.71	0.71

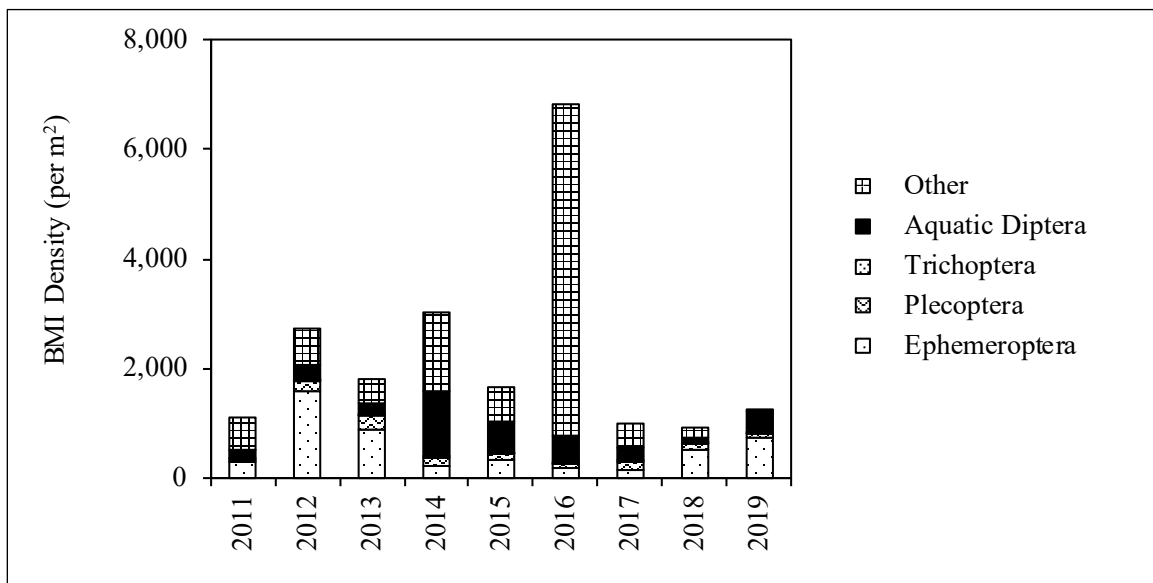


Figure 41.–Lower Sherman Creek SP1 mean BMI densities and community compositions, 2011–2019.

Sample Point 2

Among the 2019 Lower Sherman Creek SP2 BMI samples, we identified 25 taxa and estimate mean density at 1,624 BMI/m², of which 85% were EPT insects, all within ranges observed 2011–2018 (Table 23; Figure 42). The Shannon Diversity and Evenness scores were consistent with previous years. The dominant taxon was Ephemeroptera: *Baetis*, composing 55% of the samples.

Table 23.–Lower Sherman Creek SP2 BMI data summaries, 2011–2019.

	05/03/11	04/30/12	04/30/13	04/29/14	04/28/15	04/27/16	04/26/17	05/02/18	04/30/19
Mean BMI density (per m ²)	1,651	2,823	3,385	1,185	1,609	1,873	428	973	1,624
Total BMI taxa	30	37	39	28	23	23	26	21	25
Number of EPT taxa	17	26	25	16	13	13	14	18	15
% EPT	76%	79%	72%	12%	25%	12%	28%	88%	85%
Shannon Diversity score	0.93	0.70	0.84	0.70	0.77	0.53	0.84	0.61	0.64
Evenness score	0.76	0.57	0.65	0.62	0.66	0.49	0.80	0.57	0.60

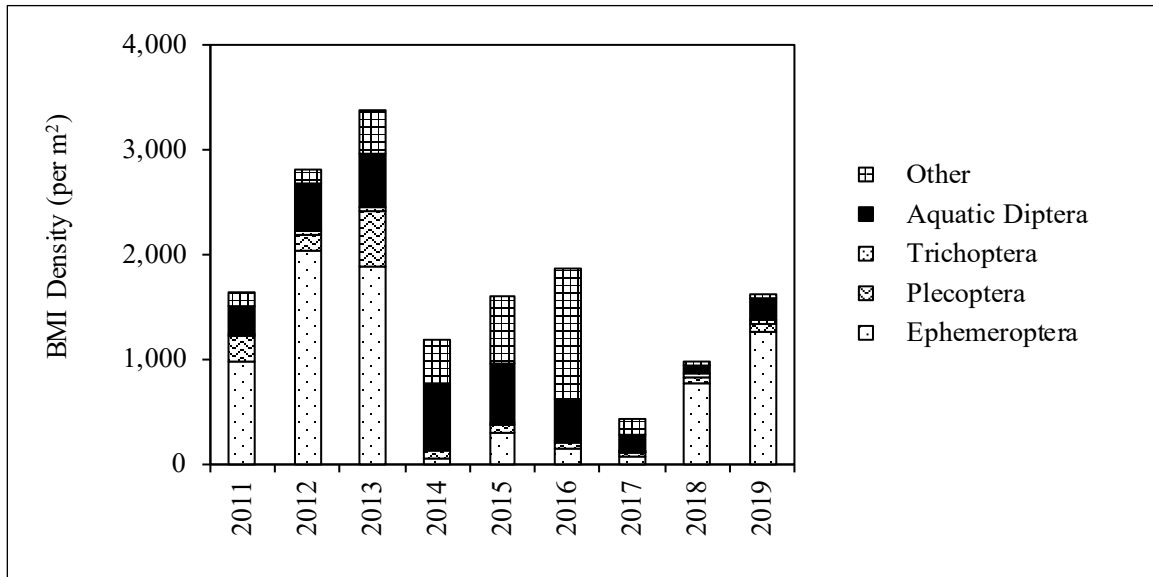


Figure 42.–Lower Sherman Creek SP2 mean BMI densities and community compositions, 2011–2019.

Adult Salmon Counts

We counted 2,816 pink salmon and 147 chum salmon in Lower Sherman Creek during 2019 (Table 24; Figure 43). Since coho salmon do not use Sherman Creek, we did not survey for adults.

Table 24.–Lower Sherman Creek adult salmon counts, 2011–2019.

	2011	2012	2013	2014	2015	2016	2017	2018	2019
Pink salmon	4,605	1,608	4,981	70	2,798	26	5,690	86	2,816
Chum salmon	0	0	12	0	1	5	122	7	147

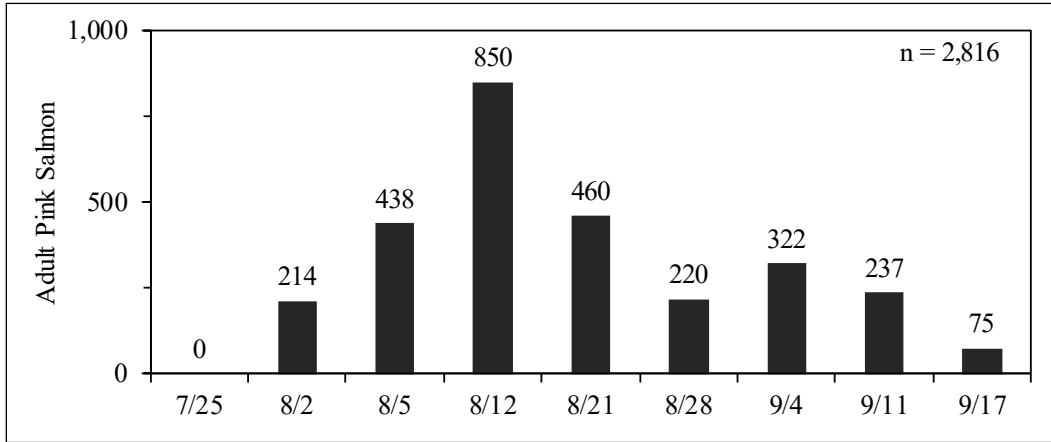


Figure 43.–Lower Sherman Creek weekly pink salmon count, 2019.

Sediment Element Concentrations

The 2019 Lower Sherman Creek sediment sample contained a greater As concentration than the range observed 2011–2018, and other element concentrations were within ranges previously observed (Figures 44, 45). The Cu and Ni concentrations remain above the TEC and the As concentration was above the PEC freshwater sediment toxicity guidelines, as observed in 2015 and 2018.

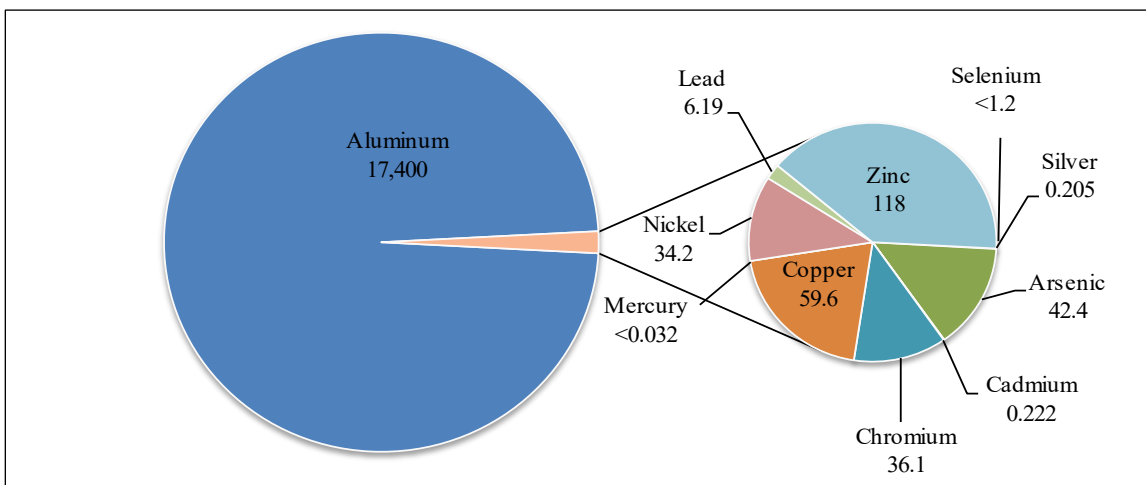


Figure 44.–Lower Sherman Creek sediment element concentrations (mg/kg), 2019.

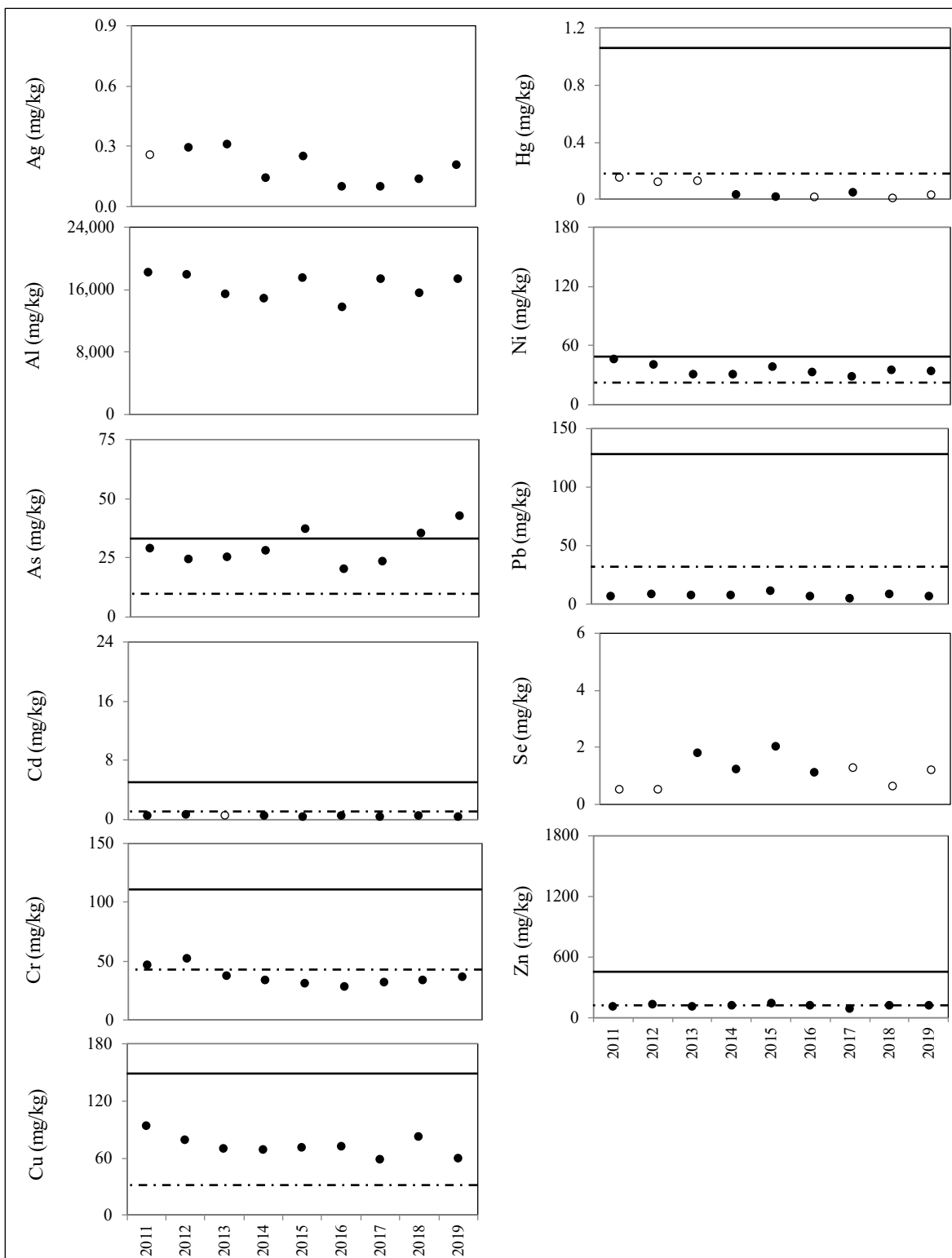


Figure 45.–Lower Sherman Creek sediment element concentrations, 2011–2019.
Note: Elements undetected (o) are presented at the method reporting limit. The dashed line represents TEC and solid line represents the PEC; guidelines are not published for Ag, Al, or Se (Buchman 2008).

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APPENDIX A: CHLOROPHYLL DATA

Appendix A.1.–Lower Slate Creek chlorophylls *a*, *b*, and *c* densities, 2011–2019.

		07/29/11			07/25/12		
mg/m ²	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	
	0.21	0.05	0.00	1.60	0.13	0.07	
	1.28	0.02	0.11	4.06	0.00	0.39	
	0.85	0.01	0.07	2.03	0.00	0.18	
	3.31	0.08	0.25	0.96	0.00	0.04	
	11.85	3.11	0.30	2.56	0.04	0.22	
	18.05	0.42	0.91	0.92	0.00	0.01	
	0.72	0.13	0.00	1.49	0.13	0.13	
	0.43	0.05	0.00	2.35	0.12	0.19	
	8.54	0.39	0.58	6.19	0.05	0.54	
	6.30	0.03	0.38	0.96	0.00	0.06	
mean	5.15	0.43	0.26	2.31	0.05	0.18	
maximum	18.05	3.11	0.91	6.19	0.13	0.54	
minimum	0.21	0.01	0.00	0.92	0.00	0.01	
		07/31/13			07/30/14		
mg/m ²	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	
	14.10	0.00	1.56	0.00	0.00	0.00	
	20.72	0.00	3.11	9.29	3.22	0.48	
	10.89	0.00	1.01	1.45	0.00	0.23	
	17.84	0.00	2.66	12.18	5.27	0.38	
	2.14	0.00	0.24	0.75	0.00	0.05	
	6.09	0.00	0.95	4.70	0.00	0.67	
	15.49	0.00	1.99	2.88	0.00	0.49	
	12.71	0.00	1.58	1.82	0.00	0.15	
	11.32	0.00	1.87	0.73	0.00	0.07	
	14.63	0.00	1.46	5.87	0.00	0.51	
mean	12.59	0.00	1.64	3.97	0.85	0.30	
maximum	20.72	0.00	3.11	12.18	5.27	0.67	
minimum	2.14	0.00	0.24	0.00	0.00	0.00	
		07/28/15			07/26/16		
mg/m ²	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	
	0.45	0.10	0.01	0.60	0.00	0.12	
	3.06	0.00	0.28	15.27	0.00	2.14	
	0.95	0.09	0.04	6.41	0.00	0.97	
	0.85	0.00	0.06	2.35	0.00	0.22	
	0.72	0.13	0.00	9.51	0.76	0.88	
	2.24	0.44	0.12	2.88	0.66	0.20	
	9.93	0.00	1.13	3.52	0.00	0.40	
	0.19	ND	ND	2.03	0.00	0.28	
	2.88	0.14	0.28	5.34	0.67	0.36	
	0.32	0.01	0.00	4.70	0.00	0.65	
mean	2.16	0.10	0.21	5.26	0.21	0.62	
maximum	9.93	0.44	1.13	15.27	0.76	2.14	
minimum	0.19	0.00	0.00	0.60	0.00	0.12	

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		07/24/17			08/07/18		
mg/m ²	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	
	3.84	0.33	0.19	2.35	0.00	0.42	
	1.71	0.00	0.27	3.31	0.00	0.56	
	1.60	0.00	0.26	7.16	0.00	1.27	
	2.14	0.00	0.41	3.63	0.00	0.59	
	2.14	0.06	0.09	1.17	0.00	0.19	
	4.91	1.86	0.16	3.10	0.08	0.26	
	0.87	0.00	0.14	4.45	0.00	0.61	
	2.14	0.00	0.36	9.61	0.30	1.21	
	1.60	0.05	0.11	1.50	0.00	0.26	
	2.01	0.00	0.32	5.77	0.00	0.91	
mean	2.30	0.23	0.23	4.21	0.04	0.63	
maximum	4.91	1.86	0.41	9.61	0.30	1.27	
minimum	0.87	0.00	0.09	1.17	0.00	0.19	
		05/01/19			08/01/19		
mg/m ²	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	
	2.78	0.00	0.46	6.73	0.00	1.02	
	0.53	0.01	0.18	66.22	0.00	12.14	
	2.35	0.00	0.48	4.49	0.00	0.71	
	3.95	0.00	0.68	22.11	0.00	3.96	
	2.29	0.00	0.45	15.38	0.00	3.57	
	10.89	0.00	1.71	94.62	0.00	17.74	
	2.99	0.00	0.49	8.12	0.00	1.59	
	4.44	0.00	0.85	39.41	0.00	6.52	
	4.17	0.47	0.21	14.95	0.00	2.64	
	4.06	0.00	0.72	65.04	0.00	15.02	
mean	3.84	0.05	0.62	33.71	0.00	6.49	
maximum	10.89	0.47	1.71	94.62	0.00	17.74	
minimum	0.53	0.00	0.18	4.49	0.00	0.71	

Note: Bold values are the spectrophotometer estimated detection limit; chlorophyll *a* not detected.

Appendix A.2.–West Fork Slate Creek chlorophylls *a*, *b*, and *c* densities, 2011–2019.

mg/m ²	07/29/11			07/25/12		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	2.52	0.00	0.19	1.15	0.00	0.04
	4.70	0.00	0.43	0.41	0.00	0.08
	2.78	0.00	0.26	0.53	0.00	0.02
	3.35	0.00	0.04	0.64	0.00	0.16
	4.27	0.00	0.25	3.62	0.00	0.24
	4.91	0.00	0.42	0.85	0.00	0.14
	3.95	0.00	0.27	0.96	0.01	0.07
	3.10	0.00	0.25	0.41	0.00	0.08
	4.38	0.00	0.39	0.60	0.00	0.12
	5.23	0.00	0.20	0.96	0.00	0.06
mean	3.92	0.00	0.27	1.01	0.00	0.10
maximum	5.23	0.00	0.43	3.62	0.01	0.24
minimum	2.52	0.00	0.04	0.41	0.00	0.02
mg/m ²	07/31/13			07/30/14		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	4.70	0.00	0.74	0.32	0.00	0.01
	1.39	0.00	0.16	0.19	0.00	0.00
	13.14	0.00	2.19	0.75	0.00	0.05
	4.38	0.00	0.47	0.88	0.00	0.00
	1.28	0.00	0.11	1.60	0.00	0.19
	3.10	0.00	0.50	0.23	0.00	0.03
	3.74	0.00	0.53	0.41	0.00	0.00
	2.03	0.00	0.33	0.33	0.00	0.02
	5.02	0.00	0.67	1.18	0.00	0.13
	3.40	0.00	0.36	1.82	0.00	0.15
mean	4.22	0.00	0.61	0.77	0.00	0.06
maximum	13.14	0.00	2.19	1.82	0.00	0.19
minimum	1.28	0.00	0.11	0.19	0.00	0.00
mg/m ²	07/28/15			07/26/16		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	1.34	0.00	0.21	7.48	0.00	1.16
	0.92	0.00	0.01	4.70	0.00	0.71
	0.77	0.02	0.03	3.22	0.00	0.25
	0.54	0.05	0.00	5.34	0.00	0.61
	0.19	ND	ND	2.67	0.00	0.34
	1.64	0.00	0.04	3.31	0.00	0.45
	2.35	0.00	0.21	4.27	0.00	0.44
	0.53	0.12	0.00	0.92	0.00	0.01
	0.56	0.00	0.06	10.89	0.00	1.64
	0.32	0.05	0.00	6.51	0.00	0.95
mean	0.92	0.03	0.06	4.93	0.00	0.66
maximum	2.35	0.12	0.21	10.89	0.00	1.64
minimum	0.19	0.00	0.00	0.92	0.00	0.01

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07/24/17				07/25/18		
mg/m ²	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	5.13	0.00	0.60	1.17	0.00	0.22
	5.13	0.00	0.96	4.17	0.00	0.86
	1.82	0.00	0.19	2.35	0.00	0.32
	3.95	0.00	0.83	5.02	0.00	0.93
	5.87	0.00	1.22	5.55	0.00	1.22
	8.22	0.00	1.38	4.91	0.00	1.12
	8.22	0.00	1.58	3.10	0.00	0.53
	3.74	0.00	0.53	1.71	0.00	0.24
	2.78	0.00	0.33	4.38	0.00	0.75
	4.70	0.00	0.92	6.09	0.00	1.16
mean	4.96	0.00	0.85	3.85	0.00	0.74
maximum	8.22	0.00	1.58	6.09	0.00	1.22
minimum	1.82	0.00	0.19	1.17	0.00	0.22
08/01/19						
mg/m ²	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>			
	0.10	ND	ND			
	4.17	0.00	0.49			
	6.15	0.00	0.88			
	1.28	0.00	0.14			
	3.42	0.00	0.27			
	7.38	0.00	1.17			
	4.04	0.00	0.34			
	0.73	0.00	0.16			
	2.14	0.00	0.19			
	0.10	ND	ND			
mean	2.95	0.00	0.46			
maximum	7.38	0.00	1.17			
minimum	0.10	0.00	0.14			

Note: Bold values are the spectrophotometer estimated detection limit; chlorophyll *a* not detected.

Appendix A.3.–East Fork Slate Creek chlorophylls *a*, *b*, and *c* densities, 2011–2019.

mg/m ²	07/28/11			07/24/12		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	9.51	2.16	0.24	11.53	3.24	0.28
	9.18	0.02	0.20	0.41	0.04	0.04
	1.28	0.03	0.00	0.88	0.00	0.05
	5.13	1.15	0.11	0.50	0.00	0.03
	16.02	0.18	0.44	3.42	0.00	0.11
	8.86	1.94	0.70	0.64	0.08	0.05
	4.70	0.70	0.13	18.58	0.00	0.66
	16.13	5.35	0.28	13.67	2.32	0.57
	4.91	0.49	0.12	0.69	0.00	0.00
	12.71	3.59	0.15	0.43	0.00	0.00
mean	8.84	1.56	0.24	5.08	0.57	0.18
maximum	16.13	5.35	0.70	18.58	3.24	0.66
minimum	1.28	0.02	0.00	0.41	0.00	0.00
mg/m ²	07/30/13			07/30/14		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	8.12	0.00	0.67	0.14	0.00	0.00
	0.24	ND	ND	0.64	0.00	0.07
	1.07	0.03	0.07	0.05	ND	ND
	0.32	0.07	0.00	0.75	0.14	0.10
	0.64	0.10	0.00	0.05	ND	ND
	5.02	0.16	0.35	0.37	0.00	0.00
	0.43	0.00	0.03	0.05	ND	ND
	6.41	0.11	0.50	0.11	0.00	0.00
	0.32	0.00	0.00	0.53	0.00	0.01
	0.24	ND	ND	0.05	ND	ND
mean	2.28	0.06	0.20	0.27	0.02	0.03
maximum	8.12	0.16	0.67	0.75	0.14	0.10
minimum	0.24	0.00	0.00	0.05	0.00	0.00
mg/m ²	07/27/15			07/25/16		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	0.85	0.00	0.12	0.23	0.00	0.03
	0.19	ND	ND	4.91	0.00	0.69
	1.92	0.00	0.09	0.75	0.00	0.05
	0.96	0.00	0.09	1.42	0.00	0.14
	1.60	0.00	0.22	0.85	0.02	0.17
	5.34	0.00	0.55	1.56	0.00	0.12
	2.14	0.00	0.09	0.64	0.00	0.08
	0.37	0.00	0.00	0.19	ND	ND
	0.92	0.00	0.11	0.87	0.00	0.02
	1.28	0.00	0.08	0.64	0.00	0.06
mean	1.56	0.00	0.15	1.21	0.00	0.15
maximum	5.34	0.00	0.55	4.91	0.02	0.69
minimum	0.19	0.00	0.00	0.19	0.00	0.02

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mg/m ²	07/25/17			07/24/18		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	0.56	0.00	0.00	0.64	0.00	0.00
	0.51	0.00	0.00	2.14	0.00	0.12
	0.27	0.03	0.00	1.39	0.00	0.00
	0.41	0.00	0.08	0.75	0.00	0.02
	0.96	0.00	0.00	4.91	0.00	0.92
	0.85	0.00	0.15	0.69	0.00	0.00
	0.32	0.00	0.08	0.88	0.00	0.05
	1.74	0.00	0.16	1.61	0.00	0.11
	0.32	0.00	0.08	2.71	0.00	0.36
	0.46	0.00	0.00	0.96	0.00	0.00
mean	0.64	0.00	0.06	1.67	0.00	0.16
maximum	1.74	0.03	0.16	4.91	0.00	0.92
minimum	0.27	0.00	0.00	0.64	0.00	0.00
mg/m ²	04/30/19			08/01/19		
	Chl-a	Chl-b	Chl-c	Chl-a	Chl-b	Chl-c
	0.96	0.00	0.06	0.75	0.00	0.02
	7.26	0.00	0.75	1.92	0.00	0.33
	0.10	ND	ND	5.07	0.00	0.31
	0.21	0.05	0.00	1.60	0.00	0.19
	2.66	0.00	0.17	0.63	0.07	0.15
	0.21	0.03	0.00	9.51	0.00	1.15
	1.17	0.00	0.29	0.32	0.00	0.08
	ND	ND	ND	0.85	0.01	0.07
	0.41	0.04	0.04	11.17	0.00	0.80
	4.17	0.00	0.45	3.30	0.00	0.34
mean	1.91	0.01	0.22	3.51	0.01	0.34
maximum	7.26	0.05	0.75	11.17	0.07	1.15
minimum	0.10	0.00	0.00	0.32	0.00	0.02

Note: Bold values are the spectrophotometer estimated detection limit; chlorophyll *a* not detected.

Appendix A.4.–Upper Slate Creek chlorophylls *a*, *b*, and *c* densities, 2011–2019.

		07/29/11			07/24/12		
mg/m ²	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	
	0.41	0.00	0.00	2.03	0.00	0.14	
	0.32	0.00	0.04	0.96	0.00	0.09	
	0.96	0.01	0.07	0.75	0.00	0.00	
	0.11	0.00	0.00	0.50	0.00	0.03	
	2.67	0.00	0.26	2.03	0.00	0.14	
	0.28	0.00	0.00	1.07	0.00	0.14	
	0.60	0.00	0.12	0.55	0.00	0.02	
	1.14	0.00	0.01	1.71	0.00	0.06	
	0.53	0.00	0.00	2.14	0.00	0.12	
	0.60	0.00	0.02	0.83	0.00	0.00	
mean	0.76	0.00	0.05	1.26	0.00	0.07	
maximum	2.67	0.01	0.26	2.14	0.00	0.14	
minimum	0.11	0.00	0.00	0.50	0.00	0.00	
		07/30/13			07/30/14		
mg/m ²	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	
	1.82	0.00	0.27	0.92	0.00	0.11	
	0.85	0.01	0.07	1.20	0.00	0.07	
	2.94	0.00	0.13	1.52	0.00	0.06	
	1.39	0.00	0.12	1.82	0.00	0.15	
	2.99	0.00	0.11	0.85	0.00	0.00	
	4.59	0.00	0.20	0.64	0.00	0.01	
	0.85	0.00	0.01	1.18	0.00	0.07	
	2.03	0.00	0.20	0.96	0.00	0.00	
	0.85	0.00	0.00	0.64	0.00	0.01	
	2.94	0.00	0.20	1.17	0.00	0.12	
mean	2.13	0.00	0.13	1.09	0.00	0.06	
maximum	4.59	0.01	0.27	1.82	0.00	0.15	
minimum	0.85	0.00	0.00	0.64	0.00	0.00	
		07/27/15			07/25/16		
mg/m ²	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	
	0.37	0.00	0.08	1.15	0.00	0.07	
	0.64	0.00	0.08	8.86	0.00	1.12	
	0.64	0.00	0.07	1.52	0.00	0.06	
	0.51	0.00	0.06	5.34	0.00	0.93	
	0.43	0.00	0.08	2.85	0.00	0.14	
	0.55	0.00	0.28	1.01	0.00	0.09	
	0.64	0.00	0.02	4.81	0.00	0.40	
	0.64	0.00	0.08	2.40	0.16	0.21	
	0.69	0.00	0.00	4.49	0.00	0.36	
	1.17	0.00	0.13	6.19	0.00	0.79	
mean	0.63	0.00	0.09	3.86	0.02	0.42	
maximum	1.17	0.00	0.28	8.86	0.16	1.12	
minimum	0.37	0.00	0.00	1.01	0.00	0.06	

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		07/24/17			07/25/18		
mg/m ²		Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
		0.43	0.00	0.00	3.95	0.00	0.67
		1.06	0.00	0.00	3.31	0.00	0.73
		0.64	0.00	0.00	1.82	0.00	0.13
		0.50	0.00	0.03	2.88	0.00	0.37
		0.96	0.00	0.00	2.24	0.00	0.14
		1.17	0.00	0.03	1.17	0.00	0.03
		1.07	0.00	0.14	3.52	0.00	0.55
		0.64	0.00	0.00	2.56	0.00	0.35
		0.32	0.01	0.00	1.60	0.00	0.41
		1.47	0.00	0.23	2.67	0.00	0.18
	mean	0.83	0.00	0.04	2.57	0.00	0.36
	maximum	1.47	0.01	0.23	3.95	0.00	0.73
	minimum	0.32	0.00	0.00	1.17	0.00	0.03
		08/01/19					
mg/m ²		Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>			
		24.88	0.00	1.78			
		23.39	0.00	2.08			
		2.78	0.00	0.16			
		3.11	0.00	0.21			
		2.43	0.00	0.23			
		1.70	0.00	0.17			
		7.67	0.00	0.57			
		0.87	0.00	0.11			
		3.71	0.00	0.29			
		4.17	0.00	0.36			
	mean	7.47	0.00	0.60			
	maximum	24.88	0.00	2.08			
	minimum	0.87	0.00	0.11			

Appendix A.5.–Lower Sherman Creek SP1 chlorophylls *a*, *b*, and *c* densities, 2011–2019.

mg/m ²	07/28/11			07/26/12		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	1.28	0.00	0.05	1.07	0.00	0.14
	5.34	0.00	0.36	2.88	0.87	0.16
	5.98	0.00	0.54	0.41	0.04	0.04
	3.84	0.10	0.48	2.67	1.27	0.00
	15.59	3.98	0.17	0.60	0.00	0.12
	11.11	2.64	0.28	1.07	0.00	0.11
	19.33	0.00	1.65	3.63	1.56	0.03
	7.26	0.00	0.74	9.61	4.12	0.08
	1.92	0.04	0.19	2.99	1.43	0.02
	4.38	0.17	0.44	0.43	0.00	0.06
mean	7.60	0.69	0.49	2.54	0.93	0.08
maximum	19.33	3.98	1.65	9.61	4.12	0.16
minimum	1.28	0.00	0.05	0.41	0.00	0.00
mg/m ²	07/29/13			07/28/14		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	4.06	0.00	0.38	2.46	0.00	0.30
	5.55	0.00	0.73	0.74	0.00	0.10
	0.24	ND	ND	0.19	0.00	0.00
	4.67	0.00	0.55	0.92	0.00	0.14
	7.69	0.00	0.89	0.83	0.00	0.15
	7.37	0.00	0.62	2.99	0.00	0.47
	0.24	ND	ND	1.39	0.00	0.17
	2.67	0.00	0.35	2.46	0.00	0.25
	0.75	0.03	0.08	0.45	0.01	0.04
	ND	ND	ND	0.96	0.00	0.16
mean	3.69	0.00	0.51	1.34	0.00	0.18
maximum	7.69	0.03	0.89	2.99	0.01	0.47
minimum	0.24	0.00	0.08	0.19	0.00	0.00
mg/m ²	07/27/15			07/25/16		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	0.28	0.00	0.03	3.31	0.52	0.31
	0.19	ND	ND	4.27	0.00	0.76
	0.92	0.00	0.11	1.39	0.00	0.16
	0.64	0.00	0.01	2.14	0.00	0.37
	2.67	0.00	0.31	2.28	0.00	0.32
	0.79	0.00	0.00	13.24	6.47	0.31
	2.78	0.00	0.32	2.78	0.13	0.23
	0.19	ND	ND	2.24	0.00	0.31
	4.17	0.00	0.49	3.31	0.12	0.35
	1.01	0.00	0.09	2.03	0.20	0.17
mean	1.36	0.00	0.17	3.70	0.74	0.33
maximum	4.17	0.00	0.49	13.24	6.47	0.76
minimum	0.19	0.00	0.00	1.39	0.00	0.16

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07/25/17				07/24/18		
mg/m ²	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	5.02	0.00	0.68	2.88	0.00	0.36
	5.13	0.00	0.93	3.95	0.00	0.50
	2.35	0.00	0.28	2.14	0.00	0.38
	2.99	0.00	0.40	2.43	0.00	0.23
	4.49	0.00	0.64	2.56	0.00	0.36
	3.84	0.00	0.55	2.06	0.00	0.15
	6.30	0.00	1.05	1.82	0.00	0.20
	4.06	0.00	0.63	4.58	0.00	0.63
	1.10	0.00	0.05	2.24	0.00	0.35
	3.31	0.00	0.39	1.71	0.00	0.15
mean	3.86	0.00	0.56	2.64	0.00	0.33
maximum	6.30	0.00	1.05	4.58	0.00	0.63
minimum	1.10	0.00	0.05	1.71	0.00	0.15
08/02/19						
mg/m ²	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>			
	ND	ND	ND			
	0.10	ND	ND			
	0.43	0.07	0.10			
	0.50	0.00	0.13			
	0.10	ND	ND			
	5.66	0.47	0.45			
	0.10	ND	ND			
	5.02	0.00	0.66			
	12.50	0.00	1.56			
	0.21	0.00	0.03			
mean	2.74	0.09	0.49			
maximum	12.50	0.47	1.56			
minimum	0.10	0.00	0.03			

Note: Bold values are the spectrophotometer estimated detection limit; chlorophyll *a* not detected.

Appendix A.6.–Lower Sherman Creek SP2 chlorophylls *a*, *b*, and *c* densities, 2011–2019.

mg/m ²	07/28/11			07/26/12		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	3.10	0.00	0.26	1.05	0.04	0.12
	6.30	0.19	0.62	0.64	0.00	0.11
	4.59	0.00	0.38	0.73	0.00	0.07
	0.32	0.00	0.00	0.50	0.07	0.10
	13.88	0.00	0.54	0.34	ND	ND
	7.37	0.00	0.46	0.51	0.00	0.06
	1.50	0.00	0.09	0.96	0.00	0.16
	14.31	0.00	0.59	0.37	0.00	0.00
	0.85	0.00	0.01	1.28	0.00	0.09
	3.84	0.00	0.25	0.34	ND	ND
mean	5.61	0.02	0.32	0.67	0.01	0.09
maximum	14.31	0.19	0.62	1.28	0.07	0.16
minimum	0.32	0.00	0.00	0.34	0.00	0.00
mg/m ²	07/29/13			07/28/14		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	1.07	0.00	0.14	0.74	0.00	0.10
	3.84	0.00	0.34	1.38	0.00	0.18
	0.96	0.00	0.15	2.83	0.00	0.15
	4.81	0.00	0.49	3.31	0.00	0.31
	5.77	0.00	0.78	0.75	0.00	0.06
	0.32	0.02	0.10	0.85	0.03	0.08
	4.70	0.00	0.44	0.85	0.00	0.01
	3.52	0.00	0.35	1.39	0.00	0.16
	0.53	0.00	0.02	0.43	0.01	0.04
	3.20	0.00	0.43	0.69	0.00	0.07
mean	2.87	0.00	0.32	1.32	0.00	0.12
maximum	5.77	0.02	0.78	3.31	0.03	0.31
minimum	0.32	0.00	0.02	0.43	0.00	0.01
mg/m ²	07/27/15			07/25/16		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	0.69	0.00	0.00	1.50	0.00	0.17
	0.96	0.00	0.00	2.03	0.00	0.30
	0.85	0.00	0.11	0.43	0.00	0.13
	1.28	0.00	0.16	2.98	0.00	0.38
	2.14	0.00	0.24	0.96	0.00	0.09
	3.63	0.65	0.43	1.28	0.04	0.26
	0.96	0.07	0.03	1.71	0.00	0.22
	2.14	0.78	1.30	1.92	0.35	0.16
	1.07	0.00	0.14	0.41	0.00	0.08
	2.46	0.00	0.24	0.96	0.00	0.06
mean	1.62	0.15	0.27	1.42	0.04	0.19
maximum	3.63	0.78	1.30	2.98	0.35	0.38
minimum	0.69	0.00	0.00	0.41	0.00	0.06

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mg/m ²	07/25/17			07/24/18		
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>
	0.75	0.00	0.05	0.96	0.00	0.09
	0.85	0.01	0.07	1.38	0.00	0.21
	0.88	0.00	0.05	1.60	0.00	0.17
	0.69	0.00	0.07	0.53	0.00	0.02
	3.70	0.00	0.46	1.50	0.00	0.26
	0.69	0.00	0.07	1.60	0.00	0.23
	0.64	0.00	0.07	0.64	0.00	0.11
	1.82	0.00	0.20	4.17	0.00	0.58
	0.92	0.00	0.11	0.96	0.00	0.09
	0.55	0.00	0.02	1.60	0.00	0.15
mean	1.15	0.00	0.12	1.49	0.00	0.19
maximum	3.70	0.01	0.46	4.17	0.00	0.58
minimum	0.55	0.00	0.02	0.53	0.00	0.02
mg/m ²	08/02/19					
	Chl- <i>a</i>	Chl- <i>b</i>	Chl- <i>c</i>			
	0.43	0.00	0.03			
	1.60	0.00	0.23			
	6.84	0.00	1.07			
	1.11	0.00	0.08			
	1.33	0.00	0.18			
	0.18	0.00	0.00			
	5.02	0.00	0.63			
	0.85	0.00	0.13			
	2.14	0.00	0.31			
	1.71	0.00	0.21			
mean	2.12	0.00	0.29			
maximum	6.84	0.00	1.07			
minimum	0.18	0.00	0.00			

Note: Bold values are the spectrophotometer estimated detection limit; chlorophyll *a* not detected.

APPENDIX B: BENTHIC MACROINVERTEBRATE DATA

Appendix B.1.–Lower Slate Creek BMI data summary, 2011–2019.

	05/04/11	05/02/12	04/30/13	04/30/14	04/27/15	04/26/16	04/25/17	05/03/18	05/01/19
Total BMI Taxa	29	32	27	32	26	24	27	17	18
Total EPT Taxa	13	17	16	17	13	11	13	9	9
Total BMI Counted	1,148	1,760	1,200	2,308	1,901	1,894	730	269	521
Ephemeroptera	85	387	400	73	196	225	219	84	214
Plecoptera	70	274	203	352	258	61	145	37	85
Trichoptera	2	8	6	17	6	3	3	0	0
Aquatic Diptera	862	975	503	1,711	1,268	1,038	308	32	208
Other	129	116	88	155	173	567	55	116	14
% Ephemeroptera	7%	22%	33%	3%	10%	12%	30%	31%	41%
% Plecoptera	6%	16%	17%	15%	14%	3%	20%	14%	16%
% Trichoptera	0.2%	0.5%	0.5%	0.7%	0.3%	0.2%	0.4%	0.0%	0.0%
% Aquatic Diptera	75%	55%	42%	74%	67%	55%	42%	12%	40%
% Other	11%	7%	7%	7%	9%	30%	8%	43%	3%
% EPT	14%	38%	51%	19%	24%	15%	50%	45%	57%
% Chironomidae	72%	53%	35%	68%	64%	51%	36%	11%	29%
Shannon Diversity Score	0.51	0.69	0.85	0.64	0.70	0.65	0.81	0.81	0.83
Evenness Score	0.48	0.58	0.70	0.52	0.58	0.57	0.73	0.84	0.81
Total Sample Area (m ²)	0.558	0.558	0.465	0.558	0.558	0.558	0.558	0.558	0.558
Mean BMI/m ²	2,057	3,154	2,581	4,136	3,407	3,394	1,308	482	934
±1 SD	1,046	1,849	551	3,592	2,458	1,667	436	461	267
Terrestrial Invertebrates	0	4	0	1	3	88	1	0	7
Juvenile Fish	1	0	0	1	0	0	0	1	0

Appendix B.6.–Lower Sherman Creek SP1 BMI data summary, 2011–2019.

	05/04/11	04/30/12	05/01/13	04/29/14	04/28/15	04/27/16	04/26/17	05/02/18	04/30/19
Total BMI Taxa	26	31	28	30	26	26	25	26	25
Total EPT Taxa	15	18	16	13	13	13	13	16	14
Total BMI Counted	624	1,525	1,002	1,687	921	3,816	563	509	705
Ephemeroptera	157	876	499	114	175	101	88	293	404
Plecoptera	36	103	135	97	67	41	72	48	41
Trichoptera	7.0	14	6	18	6	9	16	11	4
Aquatic Diptera	89	160	131	648	326	273	123	51	228
Other	335	372	231	810	347	3,392	264	106	28
% Ephemeroptera	25%	58%	50%	7%	19%	3%	16%	58%	57%
% Plecoptera	6%	7%	13%	6%	7%	1%	13%	9%	6%
% Trichoptera	1%	0.9%	0.6%	1%	1%	0.2%	3%	2%	1%
% Aquatic Diptera	14%	11%	13%	38%	35%	7%	22%	10%	32%
% Other	54%	24%	23%	48%	38%	89%	47%	21%	4%
% EPT	32%	66%	64%	14%	27%	4%	31%	69%	64%
% Chironomidae	6%	8%	12%	33%	33%	7%	13%	7%	27%
Shannon Diversity Score	0.76	0.74	0.85	0.71	0.84	0.32	0.81	0.73	0.79
Evenness Score	0.71	0.62	0.71	0.57	0.70	0.27	0.69	0.71	0.71
Total Sample Area (m ²)	0.558	0.558	0.558	0.558	0.558	0.558	0.558	0.558	0.558
Mean BMI/m ²	1,118	2,733	1,796	3,023	1,651	6,839	1,009	912	1,263
±1 SD	1,000	1,410	247	936	718	1,398	168	408	345
Terrestrial Invertebrates	1	0	14	1	14	21	1	0	2
Juvenile Fish	10	12	0	8	0	77	0	11	0

Appendix B.7.–Lower Sherman Creek SP2 BMI data summary, 2011–2019.

	05/03/11	04/30/12	04/30/13	04/29/14	04/28/15	04/27/16	04/26/17	05/02/18	04/30/19
Total BMI Taxa	30	36	39	28	23	23	26	21	25
Total EPT Taxa	17	26	25	16	13	13	14	18	15
Total BMI Counted	921	1,573	1,889	661	898	1,045	239	543	906
Ephemeroptera	548	1,143	1,049	31	163	84	37	427	708
Plecoptera	137	77	299	40	47	32	25	39	35
Trichoptera	14	26	18	7	13	10	5	13	23
Aquatic Diptera	143	254	289	354	315	224	88	43	124
Other	79	75	234	229	360	695	84	21	16
% Ephemeroptera	60%	73%	56%	5%	18%	8%	15%	79%	78%
% Plecoptera	15%	5%	16%	6%	5%	3%	10%	7%	4%
% Trichoptera	2%	2%	1%	1%	1%	1%	2%	2%	3%
% Aquatic Diptera	16%	16%	15%	54%	35%	21%	37%	8%	14%
% Other	9%	5%	12%	35%	40%	67%	35%	4%	2%
% EPT	76%	79%	72%	12%	25%	12%	28%	88%	85%
% Chironomidae	11%	15%	14%	48%	33%	20%	24%	6%	11%
Shannon Diversity Score	0.93	0.70	0.84	0.70	0.77	0.53	0.84	0.61	0.64
Evenness Score	0.76	0.57	0.65	0.62	0.66	0.49	0.80	0.57	0.60
Total Sample Area (m ²)	0.558	0.558	0.558	0.558	0.558	0.558	0.558	0.558	0.558
Mean BMI/m ²	1,651	2,823	3,385	1,185	1,609	1,873	428	973	1,624
±1 SD	927	1,174	1,471	769	748	982	219	370	712
Terrestrial Invertebrates	1	2	18	1	10	4	2	1	4
Juvenile Fish	0	0	14	0	0	6	0	13	0

APPENDIX C: ADULT SALMON DATA

Appendix C.3.–Lower Johnson Creek weekly adult pink salmon count by reach, 2019.

Stream Reach	07/25/19		08/01/19		08/05/19		08/12/19		08/21/19		08/28/19	
	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass
Con-Lace	35	0	27	0	15	0	15	0	110	0	35	0
Lace-JM	2	0	31	0	5	0	0	0	0	0	297	5
JM-Trap Site	0	0	60	0	112	0	301	0	166	0	112	0
Trap-Site #4	12	0	135	1	97	1	129	0	260	3	110	10
Site #4-Site #7	33	0	77	7	153	10	140	2	180	3	150	15
Site #7-Site #10	14	0	77	8	120	12	173	9	170	16	420	10
Site #10-PH	0	0	50	1	12	0	25	3	90	5	117	5
PH-LF	0	0	0	0	0	0	0	0	0	0	0	0
LF-Site #15	0	0	0	0	0	0	0	0	0	0	0	0
Site #15-Falls	0	0	0	0	0	0	0	0	0	0	0	0
Total	96	0	457	17	514	23	783	14	976	27	1,241	45

Stream Reach	09/04/19		09/11/19		09/17/19	
	Count	Carcass	Count	Carcass	Count	Carcass
Con-Lace	0	0	0	0	0	0
Lace-JM	0	0	0	0	0	0
JM-Trap Site	14	2	75	5	0	0
Trap-Site #4	193	11	100	10	14	1
Site #4-Site #7	163	20	145	50	4	0
Site #7-Site #10	157	25	17	135	0	0
Site #10-PH	47	5	0	10	0	0
PH-LF	0	0	0	0	0	0
LF-Site #15	0	0	0	0	0	0
Site #15-Falls	0	0	0	0	0	0
Total	574	63	337	210	18	1

Appendix C.4.–Lower Johnson Creek weekly adult chum salmon count by reach, 2019.

Stream Reach	07/25/19		08/01/19		08/05/19		08/12/19		08/21/19		08/28/19	
	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass
Con-Lace	37	0	0	0	0	0	0	0	1	0	1	0
Lace-JM	0	0	0	0	0	0	0	0	0	0	0	0
JM-Trap Site	3	0	14	0	0	0	0	0	0	0	0	0
Trap-Site #4	19	0	34	0	10	0	4	0	0	0	0	0
Site #4-Site #7	47	0	13	0	13	0	0	0	0	0	0	0
Site #7-Site #10	32	0	70	0	20	0	1	0	0	0	0	0
Site #10-PH	0	0	15	0	0	0	0	0	0	0	0	0
PH-LF	0	0	0	0	0	0	0	0	0	0	0	0
LF-Site #15	0	0	0	0	0	0	0	0	0	0	0	0
Site #15-Falls	0	0	0	0	0	0	0	0	0	0	0	0
Total	138	0	146	0	43	0	5	0	1	0	1	0

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Stream Reach	09/04/19		09/11/19		09/17/19	
	Count	Carcass	Count	Carcass	Count	Carcass
Con-Lace	0	0	0	0	0	0
Lace-JM	0	0	0	0	0	0
JM-Trap Site	0	0	0	0	0	0
Trap-Site #4	0	0	0	0	0	0
Site #4-Site #7	0	0	0	0	0	0
Site #7-Site #10	0	0	0	0	0	0
Site #10-PH	0	0	0	0	0	0
PH-LF	0	0	0	0	0	0
LF-Site #15	0	0	0	0	0	0
Site #15-Falls	0	0	0	0	0	0
Total	0	0	0	0	0	0

Appendix C.5.–Lower Johnson Creek weekly adult coho salmon count by reach, 2019.

Stream Reach	09/26/19		10/03/19		10/09/19		10/16/19		10/23/19		10/31/19	
	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass
Con-Lace	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lace-JM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
JM-Trap Site	0	0	13	0	23	0	12	0	ND	ND	0	0
Trap-Site #4	1	0	10	0	0	0	7	0	ND	ND	2	0
Site #4-Site #7	11	0	5	0	1	0	0	0	ND	ND	1	0
Site #7-Site #10	0	0	0	0	0	0	0	0	ND	ND	4	0
Site #10-PH	0	0	2	0	0	0	0	0	ND	ND	2	0
PH-LF	0	0	0	0	0	0	0	0	ND	ND	0	0
LF-Site #15	0	0	4	0	1	0	0	0	ND	ND	0	0
Site #15-Falls	3	0	1	0	0	0	0	0	ND	ND	0	0
Total	15	0	35	0	25	0	19	0	ND	ND	9	0

Appendix C.6.–Lower Sherman Creek weekly adult pink salmon count by reach, 2019.

Stream Reach	07/25/19		08/02/19		08/05/19		08/12/19		08/21/19		08/28/19	
	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass
0-50 m	0	0	15	0	45	4	204	39	85	116	56	10
50-100 m	0	0	45	0	38	0	75	17	39	48	20	21
100-150 m	0	0	20	0	88	0	186	9	142	81	46	28
150-200 m	0	0	38	0	95	0	151	15	89	51	51	17
200-250 m	0	0	45	1	47	0	107	8	61	29	9	12
250-300 m	0	0	13	2	31	0	28	8	15	11	10	14
300-350 m	0	0	28	0	44	0	48	3	9	1	8	3
350-Falls	0	0	10	0	50	0	51	0	20	0	20	0
Total	0	0	214	3	438	4	850	99	460	337	220	105

Stream Reach	09/04/19		09/11/19		09/17/19	
	Count	Carcass	Count	Carcass	Count	Carcass
0-50 m	56	24	54	57	30	21
50-100 m	29	20	32	34	11	8
100-150 m	73	21	77	39	20	9
150-200 m	78	7	59	16	12	2
200-250 m	27	3	15	7	2	0
250-300 m	12	1	0	0	0	0
300-350 m	7	0	0	0	0	0
350-Falls	40	0	0	0	0	0
Total	322	76	237	153	75	40

Appendix C.7.–Lower Sherman Creek weekly adult chum salmon count by reach, 2019.

Stream Reach	07/25/19		08/02/19		08/05/19		08/12/19		08/21/19		08/28/19	
	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass	Count	Carcass
0-50 m	0	0	2	0	19	1	13	8	2	1	1	0
50-100 m	0	0	7	0	9	0	0	0	0	2	0	0
100-150 m	0	0	4	0	5	0	1	7	0	0	0	0
150-200 m	0	0	5	0	10	0	3	3	0	0	1	0
200-250 m	0	0	9	0	7	0	6	3	0	0	0	0
250-300 m	0	0	7	0	1	0	1	0	0	0	0	0
300-350 m	0	0	12	1	5	0	3	2	0	1	0	0
350-Falls	0	0	2	0	10	0	2	0	0	0	0	0
Total	0	0	48	1	66	1	29	23	2	4	2	0

Stream Reach	09/04/19		09/11/19		09/17/19	
	Count	Carcass	Count	Carcass	Count	Carcass
0-50 m	0	0	0	0	0	0
50-100 m	0	0	0	0	0	0
100-150 m	0	0	0	0	0	0
150-200 m	0	1	0	0	0	0
200-250 m	0	0	0	0	0	0
250-300 m	0	0	0	0	0	0
300-350 m	0	0	0	0	0	0
350-Falls	0	0	0	0	0	0
Total	0	1	0	0	0	0

Appendix C.8.–Lower Slate Creek adult pink salmon count by statistical week, 2011–2019.

Statistical Week No.	2011	2012	2013	2014	2015	2016	2017	2018	2019
29	ND	0	0	0	ND	ND	0	ND	ND
30	0	0	7	0	12	0	0	0	0
31	0	364	66	2	487	0	7	ND	0
32	369	1,106	604	14	1,769	1	386	0	0
33	763	3,152	864	13	1,783	0	477	3	200
34	1,394	2,331	1,199	12	1,543	64	2,818	1	11
35	1,646	318	472	0	850	12	1,340	ND	532
36	1,807	1	97	ND	527	2	1,811	ND	69
37	229	0	27	ND	575	ND	577	ND	25
38	46	ND	1	ND	32	ND	ND	ND	ND
39	0	ND	ND	ND	2	ND	0	ND	ND
40	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total	6,254	7,272	3,337	41	7,580	79	7,416	4	837

Note: Bold numbers indicate incomplete surveys.

Appendix C.9.–Lower Johnson Creek adult pink salmon count by statistical week, 2011–2019.

Statistical Week No.	2011	2012	2013	2014	2015	2016	2017	2018	2019
29	ND	0	59	ND	ND	ND	109	ND	ND
30	1	73	200	44	4,512	0	1,222	42	96
31	180	411	2,250	48	568	6	3,291	90	457
32	1,891	753	1,456	84	17,517	154	2,272	91	514
33	3,850	1,698	1,873	2	19,028	125	3,364	145	783
34	5,264	1,816	1,557	11	5,444	15	4,010	66	976
35	1,350	198	545	0	2,057	95	5,165	0	1,241
36	3,712	60	149	ND	1,238	33	1,775	0	574
37	670	7	97	ND	702	ND	1,587	ND	337
38	436	0	ND	ND	249	ND	288	ND	18
39	145	ND	ND	ND	10	ND	156	ND	ND
40	ND	ND	ND	ND	ND	ND	0	ND	ND
Total	17,499	5,016	8,186	189	51,325	428	23,239	434	4,996

Note: Bold numbers indicate incomplete surveys.

Appendix C.10.–Lower Sherman Creek adult pink salmon count by statistical week, 2011–2019.

Statistical Week No.	2011	2012	2013	2014	2015	2016	2017	2018	2019
29	ND	0	2	ND	ND	ND	0	ND	ND
30	1	2	164	0	120	0	4	0	0
31	298	9	860	6	38	0	61	0	214
32	773	97	979	40	348	0	778	4	438
33	1,049	285	765	10	723	0	1,076	81	850
34	397	521	549	4	334	0	730	1	460
35	157	521	785	10	ND	24	941	ND	220
36	870	145	624	0	413	2	781	ND	322
37	416	25	232	ND	648	ND	841	ND	237
38	609	3	21	ND	159	ND	478	ND	75
39	35	ND	ND	ND	15	ND	ND	ND	ND
40	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total	4,605	1,608	4,981	70	2,798	26	5,690	86	2,816

Note: Bold numbers indicate incomplete surveys.

APPENDIX D: SPAWNING SUBSTRATE DATA

Appendix D.1.–Lower Slate Creek SP1 pink salmon spawning substrate data, 2011–2019.

Sample Date	Sample No.	Volume (mL/L) Retained Each Sieve (mm)								Imhoff	GMPS
		101.6	50.8	25.4	12.7	6.35	1.68	0.42	0.15		
08/17/11	1	0	0	470	260	340	425	225	20	22.0	9.8
08/17/11	2	750	70	460	250	200	280	100	25	8.0	14.0
08/17/11	3	525	280	240	210	290	440	100	70	20.5	12.2
08/17/11	4	0	0	250	340	495	1425	525	55	68.0	5.2
07/09/12	1	1,050	140	140	280	190	395	95	15	24.0	10.6
07/09/12	2	0	0	200	225	140	325	140	15	24.0	8.2
07/09/12	3	0	515	310	225	250	580	240	27	65.0	12.8
07/09/12	4	0	570	510	260	290	750	435	53	54.0	11.8
07/02/13	1	0	400	460	430	320	365	145	25	66.0	15.4
07/02/13	2	0	150	400	250	245	515	225	36	53.0	9.8
07/02/13	3	0	800	325	320	255	445	205	25	60.0	18.0
07/02/13	4	0	275	565	385	245	495	250	19	28.0	13.5
07/01/14	1	600	420	375	225	235	320	165	22	57.0	15.5
07/01/14	2	0	50	350	300	175	225	25	7.5	41.0	14.0
07/01/14	3	0	100	510	465	275	420	250	38	52.0	11.0
07/01/14	4	400	275	260	220	225	375	225	19	51.0	11.2
07/06/15	1	0	75	300	350	325	350	325	70	42.0	8.2
07/06/15	2	0	225	350	400	325	525	300	24	20.5	10.8
07/06/15	3	0	150	475	150	150	200	50	6	6.5	19.6
07/06/15	4	0	275	400	225	275	375	150	16	17.0	14.6
07/05/16	1	0	175	600	300	375	625	100	25	34.0	12.8
07/05/16	2	0	500	375	375	300	700	100	50	26.0	14.6
07/05/16	3	0	275	300	475	725	500	100	25	15.0	12.9
07/05/16	4	0	100	725	250	300	500	125	25	15.0	13.9
07/06/17	1	0	625	400	425	400	600	300	62	47.0	13.7
07/06/17	2	0	550	275	350	250	575	275	44	34.0	13.3
07/06/17	3	0	775	200	325	300	575	175	14	13.0	17.6
07/06/17	4	0	550	325	325	400	525	250	44	25.0	14.0
06/28/18	1	0	700	150	200	150	300	100	18	7.5	23.2
06/28/18	2	700	275	250	450	300	375	125	13	6.0	14.5
06/28/18	3	0	100	500	375	400	625	250	50	33.0	9.9
06/28/18	4	0	250	400	350	450	700	225	66	39.0	10.3
07/22/19	1	0	350	200	175	150	100	25	2	2.0	26.9
07/22/19	2	0	300	325	350	300	450	225	25	56.0	11.7
07/22/19	3	0	225	350	300	325	600	275	30	57.0	9.7
07/22/19	4	0	125	425	300	25	450	225	25	31.0	10.8

Appendix D.2.–Lower Slate Creek SP2 pink salmon spawning substrate data, 2011–2019.

Sample Date	Sample No.	Volume (mL/L) Retained Each Sieve (mm)								Imhoff	GMPS
		101.6	50.8	25.4	12.7	6.35	1.68	0.42	0.15		
08/17/11	1	1,050	130	305	210	205	350	200	20	11.5	11.0
08/17/11	2	0	120	320	405	335	740	415	85	53.0	7.3
08/17/11	3	0	400	350	295	290	540	200	40	17.5	13.4
08/17/11	4	0	100	450	580	320	390	160	15	25.0	12.8
07/09/12	1	0	250	380	270	260	475	195	23	46.5	11.8
07/09/12	2	600	75	395	295	180	375	135	15	18.5	12.0
07/09/12	3	0	450	340	370	340	590	295	30	18.0	12.8
07/09/12	4	0	0	320	460	285	545	300	28	16.5	8.3
07/02/13	1	0	310	490	440	505	640	410	35	107.5	9.8
07/02/13	2	0	420	270	240	215	560	150	34	42.0	13.1
07/02/13	3	0	550	885	375	290	570	290	45	108.0	15.0
07/02/13	4	0	785	230	340	240	580	330	30	46.5	14.8
07/01/14	1	0	1225	450	495	305	760	300	12	110.0	17.7
07/01/14	2	0	450	250	250	200	300	100	11	65.0	16.5
07/01/14	3	0	850	480	200	175	490	175	30	106.0	18.4
07/01/14	4	0	150	350	200	225	300	120	15	20.0	13.3
07/06/15	1	0	75	175	325	425	475	50	6	5.5	10.7
07/06/15	2	500	825	225	225	175	250	50	11	8.0	28.9
07/06/15	3	300	225	500	200	175	300	50	15	21.5	18.1
07/06/15	4	275	100	200	200	150	225	100	22	9.0	12.2
07/05/16	1	0	300	275	400	350	525	100	25	26.0	13.1
07/05/16	2	0	0	200	600	575	550	150	25	30.0	9.0
07/05/16	3	0	0	100	1150	450	650	100	25	26.0	10.1
07/05/16	4	125	275	575	525	450	475	150	25	39.0	14.3
07/06/17	1	0	0	675	600	550	525	350	82	47.0	9.8
07/06/17	2	0	300	300	650	475	500	375	60	28.0	10.8
07/06/17	3	0	525	450	500	475	400	50	5	3.0	19.7
07/06/17	4	0	375	375	550	475	625	325	58	22.0	11.7
06/28/18	1	0	450	575	475	600	625	175	28	14.0	14.9
06/28/18	2	725	325	400	400	300	375	150	22	18.0	15.4
06/28/18	3	700	525	500	275	225	200	100	28	12.0	23.1
06/28/18	4	0	575	400	250	375	725	125	20	8.0	15.6
07/25/19	1	0	550	225	225	200	175	25	4	4.0	27.3
07/25/19	2	0	1150	375	275	425	575	325	75	62.0	17.5
07/25/19	3	0	800	200	325	325	375	175	15	22.0	19.7
07/25/19	4	0	975	550	300	375	275	75	5	5.0	28.0

APPENDIX E: SEDIMENT DATA AND LAB REPORT

Appendix E.1.–Sediment compositions, 2011–2019.

Sample Date	Particle Size Data				% Total Solids	% Total Volatile Solids	Total Sulfide (mg/kg)	% Total Organic Carbon
	% Clay	% Silt	% Sand	% Coarse material (> 2 mm)				
Lower Slate Creek								
10/03/11	2.0	4.0	94.0	0.4	78.00	3.38	ND	2.04
07/03/12	2.0	0.0	98.0	0.1	79.22	3.37	ND	1.67
07/02/13	2.0	2.0	96.0	0.0	74.57	1.63	ND	1.67
07/28/14	2.3	3.8	91.8	0.9	75.3	3.28	<1.3	0.58
07/06/15	1.8	3.1	72.2	22.8	83.5	ND	<1.2	0.473
07/05/16	0.0	23.1	55.1	21.8	70.3	7.70	<2.5	0.585
07/07/17	1.5	6.9	84.5	7.1	59.6	2.80	<3.2	0.494
06/28/18	1.5	3.3	69.6	25.6	64.2	3.00	<2.9	0.416
07/22/19	0.0	2.6	37.4	60.0	67.2	2.90	<2.6	0.366
East Fork Slate Creek								
10/03/11	10.0	4.0	86.0	1.7	60.17	7.81	ND	11.00
07/10/12	40.0	34.0	26.0	0.0	23.72	28.54	ND	16.70
07/01/13	6.0	12.0	82.0	0.0	43.66	13.30	ND	18.30
07/30/14	3.8	21.1	75.0	0.1	65.5	6.21	<1.5	1.84
07/07/15	2.3	6.9	82.3	8.5	76.2	ND	<1.3	0.792
07/06/16	3.5	24.8	53.7	18.0	21.0	31.40	<6.8	13.0
07/07/17	34.9	32.2	28.8	4.0	18.9	32.50	<9.0	16.3
06/29/18	1.5	6.5	53.5	38.5	74.8	6.70	<1.8	1.75
07/22/19	0.5	4.5	47.5	47.5	39.1	9.30	<4.5	1.72
Upper Slate Creek								
10/06/11	4.0	2.0	94.0	0.0	72.10	4.12	ND	5.46
07/02/12	2.0	0.0	98.0	0.3	79.58	2.90	ND	3.74
07/01/13	4.0	0.0	96.0	0.2	74.21	2.73	ND	5.50
07/30/14	4.3	8.2	87.5	0.0	72.4	3.88	<1.4	0.87
07/07/15	1.5	0.2	31.9	66.3	76.5	ND	<1.3	1.04
07/06/16	0.0	2.9	73.1	24.0	62.9	5.00	<2.2	2.14
07/07/17	3.0	4.6	89.9	2.5	72.7	3.45	<2.4	0.84
06/28/18	2.7	5.3	80.6	11.4	67.6	4.10	<2.7	0.815
08/05/19	2.5	0.4	60.5	36.7	72.4	3.75	<2.4	0.676
Lower Johnson Creek								
10/03/11	2.0	2.0	96.0	0.0	74.28	2.01	ND	0.89
07/02/12	8.0	0.0	92.0	0.0	77.67	2.55	ND	1.19
07/01/13	2.0	2.0	96.0	0.3	73.21	0.90	ND	1.08
07/30/14	2.9	4.8	91.4	0.2	73.7	1.93	<1.4	0.26
07/06/15	0.4	1.1	41.9	56.6	80.0	ND	<1.3	0.376
08/08/16	5.1	25.4	69.4	0.0	71.9	2.40	<2.5	0.422
07/07/17	4.1	20.8	72.6	2.5	57.6	4.60	<3.3	1.6
06/29/18	2.8	5.6	89.4	2.2	77.6	2.35	<2.5	0.483
07/22/19	1.1	2.4	89.5	7.0	71.3	2.50	<2.8	0.452
Lower Sherman Creek								
10/04/11	2.0	2.0	96.0	0.1	73.15	2.75	ND	0.54
07/03/12	4.0	0.0	96.0	0.1	78.55	3.05	ND	0.82
07/01/13	2.0	2.0	96.0	0.6	75.66	0.75	ND	0.61
07/28/14	3.4	6.5	89.9	0.3	76.7	2.50	<1.3	0.35
07/07/15	1.8	3.0	86.1	9.0	76.2	ND	<1.3	0.399
07/06/16	0.1	0.9	71.2	27.8	80.5	3.10	<2.4	0.322
07/07/17	1.5	5.4	67.0	26.1	76.5	2.00	<2.5	0.288
06/29/18	2.3	2.5	88.9	6.3	69.3	2.50	<2.6	0.294
07/22/19	0.0	1.6	72.2	26.2	61.4	2.60	<3.2	0.317

Appendix E.2.—Sediment element concentrations, 2011–2019.

Sample Date	Concentration (mg/kg dry weight)										
	Ag	Al	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
Lower Slate Creek											
10/03/11	<0.267	13,600	16.2	1.46	29.4	56.7	<0.136	47.4	7.79	0.720	220
07/03/12	<0.250	13,600	9.31	1.22	32.0	50.7	<0.122	43.2	8.45	<0.500	200
07/02/13	<0.246	12,300	23.7	1.29	94.5	56.7	<0.122	73.4	9.14	1.94	205
07/28/14	0.08	12,000	20.1	1.21	20.0	51.1	0.06	40.8	8.78	1.3	189
07/06/15	0.07	12,000	14.9	0.53	18.9	39.1	0.04	30.0	6.86	0.7	131
07/05/16	0.079	12,800	17.0	0.735	20.4	39.8	0.057	35.2	7.16	1.3	173
07/07/17	0.101	12,000	16.4	0.681	18.3	40.9	<0.031	31.7	8.16	<1.6	145
06/28/18	0.077	12,300	14.6	0.554	19.3	40.1	0.038	32.4	6.93	0.98	129
07/22/19	0.083	11,000	14.3	0.559	16.9	39.0	0.074	34.2	6.36	<1.0	132
East Fork Slate Creek											
10/03/11	<0.335	20,100	30.0	20.9	29.5	88.4	<0.188	143	8.50	1.41	1,360
07/10/12	<0.739	15,300	24.0	23.2	38.9	159.0	<0.369	153	14.2	<1.48	1,490
07/01/13	<0.425	13,900	42.2	13.9	32.7	73.4	<0.216	79.8	12.5	4.79	844
07/30/14	0.14	13,300	39.1	12.1	14.6	55.7	0.04	85.3	6.94	2.4	812
07/07/15	0.12	12,300	22.3	5.87	15.1	46.7	0.05	46.8	4.48	1.7	333
07/06/16	0.190	16,500	51.5	8.20	16.5	59.5	0.109	86.1	5.54	3.1	634
07/07/17	0.30	12,900	29.9	9.65	15.0	62.3	0.143	69.9	6.61	<5.0	625
06/29/18	0.146	12,300	59.1	18.7	13.0	47.6	0.049	127	6.07	3.37	1,020
07/22/19	0.179	12,300	55.9	10.3	15.5	63.8	<0.039	83.1	5.93	2.9	665
Upper Slate Creek											
10/06/11	<0.278	22,500	17.9	0.722	127	53.4	<0.169	87.5	3.37	0.809	130
07/02/12	<0.256	20,300	14.4	0.776	125	55.4	<0.126	78.4	4.05	0.606	134
07/01/13	<0.256	14,600	13.5	0.750	101	44.6	<0.131	55.0	2.70	3.21	105
07/30/14	0.06	14,900	19.2	0.69	84.2	45.8	0.03	55.7	2.86	1.8	111
07/07/15	0.08	14,500	14.2	0.76	92.2	47.0	0.11	54.0	3.17	2.3	109
07/06/16	0.092	14,000	18.0	0.507	71.7	37.0	0.051	48.5	2.69	2.1	111
07/07/17	0.060	15,600	17.0	0.490	64.1	38.1	0.030	47.3	3.06	1.4	101
06/28/18	0.101	14,700	19.7	0.789	105	55.1	0.047	76.4	3.97	2.86	133
08/05/19	0.071	15,100	17.1	0.808	110	44.5	0.051	60.2	3.58	1.5	116
Lower Johnson Creek											
10/03/11	<0.266	13,100	16.2	0.238	31.5	73.1	<0.133	27.3	9.76	<0.533	93.3
07/02/12	0.342	13,100	12.8	0.250	35.5	76.8	<0.123	23.4	9.45	<0.493	97.3
07/01/13	0.269	10,300	11.9	0.492	24.4	56.1	<0.122	15.7	8.00	<0.481	121
07/30/14	0.32	10,300	16.5	0.16	22.2	68.2	0.02	16.9	10.9	<0.5	83.4
07/06/15	0.16	10,900	12.5	0.15	18.1	71.1	<0.02	17.7	8.04	<0.8	79.7
08/08/16	0.574	9,470	13.0	0.150	18.9	76.3	0.020	15.1	8.41	<0.57	65.7
07/06/17	0.172	6,730	10.3	0.115	11.7	46.2	0.064	10.3	5.96	<1.5	48.0
06/29/18	0.139	13,600	20.5	0.264	30.2	68.4	0.015	24.6	11.9	<0.63	109
07/22/19	0.205	10,200	16.1	0.168	20.2	60.1	<0.028	16.4	7.80	<0.96	81.2
Lower Sherman Creek											
10/04/11	<0.259	18,200	28.9	0.389	46.2	94.0	<0.157	45.9	6.70	<0.517	110
07/03/12	0.289	17,900	24.3	0.578	51.4	79.1	<0.124	40.2	8.43	<0.512	128
07/01/13	0.306	15,400	25.4	<0.520	37.4	69.4	<0.133	30.9	7.39	1.77	111
07/28/14	0.14	14,900	27.9	0.360	33.6	68.4	0.03	31.1	6.97	1.2	119
07/07/15	0.25	17,500	37.0	0.32	30.9	70.8	0.02	38.0	11.0	2.0	134
07/06/16	0.097	13,800	19.9	0.388	27.5	72.5	<0.020	32.9	6.6	1.1	123
07/06/17	0.097	17,400	23.5	0.194	31.8	58.1	0.045	28.5	4.69	<1.3	90.2
06/29/18	0.135	15,600	35.2	0.353	33.7	81.9	<0.014	34.8	8.05	<0.65	120
07/22/19	0.205	17,400	42.4	0.222	36.1	59.6	<0.032	34.2	6.19	<1.2	118



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August 21, 2019

Analytical Report for Service Request No: K1906868

Bill Kane
Alaska Department of Fish and Game
Division of Habitat
802 3rd Street
P.O. Box 110024
Douglas, AK 99811-0024

RE: Coeur AK Biomonitoring

Dear Bill,

Enclosed are the results of the sample(s) submitted to our laboratory July 26, 2019
For your reference, these analyses have been assigned our service request number **K1906868**.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3356. You may also contact me via email at Kurt.Clarkson@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Kurt Clarkson
Sr. Project Manager



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Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Inorganic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- E The result is an estimate amount because the value exceeded the instrument calibration range.
- J The result is an estimated value.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.
- H The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

- # The control limit criteria is not applicable. See case narrative.
- J The result is an estimated value.
- E The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
- M The duplicate injection precision was not met.
- N The Matrix Spike sample recovery is not within control limits. See case narrative.
- S The reported value was determined by the Method of Standard Additions (MSA).
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- W The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
 - i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- + The correlation coefficient for the MSA is less than 0.995.
- Q See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- A A tentatively identified compound, a suspected aldol-condensation product.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- C The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
- D The reported result is from a dilution.
- E The result is an estimated value.
- J The result is an estimated value.
- N The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
- P The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

- F The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
- L The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
- H The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
- O The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
- Y The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
- Z The chromatographic fingerprint does not resemble a petroleum product.

**ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses**

Agency	Web Site	Number
Alaska DEH	http://dec.alaska.gov/eh/lab/cs/csapproval.htm	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L16-58-R4
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	http://health.hawaii.gov/	-
ISO 17025	http://www.pjllabs.com/	L16-57
Louisiana DEQ	http://www.deq.louisiana.gov/page/la-lab-accreditation	03016
Maine DHS	http://www.maine.gov/dhhs/	WA01276
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/enforcement/oqa.html	WA005
New York - DOH	https://www.wadsworth.org/regulatory/elap	12060
North Carolina DEQ	https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab-certification	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/EnvironmentalLabCertification/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wyoming (EPA Region 8)	https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.

Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/analyte is offered by that state.



Case Narrative

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1906868
Date Received: 07/26/2019

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples for the Tier II level requested by the client.

Sample Receipt:

Four sediment samples were received for analysis at ALS Environmental on 07/26/2019. Any discrepancies upon initial sample inspection are annotated on the sample receipt and preservation form included within this report. The samples were stored at minimum in accordance with the analytical method requirements.

Metals:

Method 200.8, 07/31/2019: The Relative Percent Difference (RPD) for the replicate analysis of Silver in sample 2019KGMLJC was outside the normal ALS control limits. The variability in the results was attributed to the heterogeneous character of the sample. Standard mixing techniques were used, but were not sufficient for complete homogenization of this sample.

General Chemistry:

No significant anomalies were noted with this analysis.

Approved by 

Date 08/21/2019



Chain of Custody

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com



CHAIN OF CUSTODY
100720

002

SR# K1906868
COC Set _____ of _____
COC# _____

1317 South 13th Ave, Kelso, WA 98626 Phone (360) 577-7222 / 800-695-7222 / FAX (360) 636-1068
www.alsglobal.com

Project Name <u>Coeur AK Biomonitoring</u>		Project Number:		NUMBER OF CONTAINERS	7D	14D	28D	180D	999D						Remarks							
Project Manager <u>Bill Kane</u>										160.4 Modified / TVS	PSEP Sulfide / PSEP Sulfide	PSEP TOC / PSEP TOC T	7471B / Hg	200.8 / Metals T		ASTM D422 / Part Size	160.3 Modified / TS	1	2	3	4	5
Company <u>Coeur AK / ADF3G</u>																		6	7	8	9	10
Address <u>802 3rd St. Douglas, AK 99824</u>																		11	12	13	14	15
Phone # <u>907.465.6474</u>		email <u>william.kane@alaska.gov</u>																16	17	18	19	20
Sampler Signature <u>W Kane</u>		Sampler Printed Name <u>William Kane</u>		21	22	23	24	25														

Report Requirements <input type="checkbox"/> I. Routine Report: Method Blank, Surrogate, as required <input checked="" type="checkbox"/> II. Report Dup., MS, MSD as required <input type="checkbox"/> III. CLP Like Summary (no raw data) <input type="checkbox"/> IV. Data Validation Report <input type="checkbox"/> V. EDD	Invoice Information P.O.# _____ Bill To: <u>Coeur AK</u> <u>Keppers@coeur.com</u> Turnaround Requirements <input type="checkbox"/> 24 hr. <input type="checkbox"/> 48 hr. <input type="checkbox"/> 5 Day <input checked="" type="checkbox"/> Standard Requested Report Date _____	Circle which metals are to be analyzed Total Metals: Al () As () Sb Ba Be B Ca Cd () Co () Cr () Cu () Fe () Pb () Mg Mn Mo Ni () K () Ag () Na () Se () Sr Ti Sn V () Zn () Hg () Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Ti Sn V Zn Hg Special Instructions/Comments: _____ *Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other _____ (Circle One)
--	---	--

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature <u>W Kane</u>	Signature <u>Cody Groves</u>	Signature	Signature	Signature	Signature
Printed Name <u>William Kane</u>	Printed Name <u>ALS</u>	Printed Name	Printed Name	Printed Name	Printed Name
Firm <u>ADF+G</u>	Firm <u>7/26/19 0950</u>	Firm	Firm	Firm	Firm
Date/Time <u>7/23/19 09:00</u>	Date/Time	Date/Time	Date/Time	Date/Time	Date/Time



PC KC

Cooler Receipt and Preservation Form

Client Coeur AK/AK Dept of Fish & Game Service Request K19 06868
 Received: 7/26/19 Opened: 7/26/19 By: CG Unloaded: 7/26/19 By: CG

- Samples were received via? USPS Fed Ex UPS DHL PDX Courier Hand Delivered
- Samples were received in: (circle) Cooler Box Envelope Other NA
- Were custody seals on coolers? NA Y N If yes, how many and where? 1 Front
 If present, were custody seals intact? Y N If present, were they signed and dated? Y N

Raw Cooler Temp	Corrected Cooler Temp	Raw Temp-Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID NA	Tracking Number NA	Filed
10.4	10.5	13.4	13.5	+0.1	362	100720	7886 3750 5235	

- Packing material: Inserts Baggies Bubble Wrap Gel Packs Wet Ice Dry Ice Sleeves
- Were custody papers properly filled out (ink, signed, etc.)? NA Y N
- Were samples received in good condition (temperature, unbroken)? *Indicate in the table below.* NA Y N
 If applicable, tissue samples were received: Frozen Partially Thawed Thawed
- Were all sample labels complete (i.e analysis, preservation, etc.)? NA Y N
- Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* NA Y N
- Were appropriate bottles/containers and volumes received for the tests indicated? NA Y N
- Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA Y N
- Were VOA vials received without headspace? *Indicate in the table below.* NA Y N
- Was C12/Res negative? NA Y N

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time
All		X								

Notes, Discrepancies, & Resolutions:

SHORT HOLD TIME



Total Solids

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment
Analysis Method: 160.3 Modified
Prep Method: None

Service Request: K1906868
Date Collected: 07/22/19
Date Received: 07/26/19
Units: Percent
Basis: As Received

Solids, Total

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
2019KGMLJC	K1906868-001	70.7	-	1	07/30/19 15:11	
2019KGMLSC	K1906868-002	67.2	-	1	07/30/19 15:11	
2019KGMLSH	K1906868-003	61.4	-	1	07/30/19 15:11	
2019KGMEFSC	K1906868-004	39.1	-	1	07/30/19 15:11	
Method Blank	K1906868-MB	ND U	-	1	07/30/19 15:11	

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1906868
Date Collected: 07/22/19
Date Received: 07/26/19
Date Analyzed: 07/30/19

Replicate Sample Summary

Inorganic Parameters

Sample Name: 2019KGMLJC
Lab Code: K1906868-001

Units: Percent
Basis: As Received

<u>Analyte Name</u>	<u>Analysis Method</u>	<u>MRL</u>	<u>Sample Result</u>	<u>Duplicate Sample K1906868-001DUP Result</u>	<u>Average</u>	<u>RPD</u>	<u>RPD Limit</u>
Solids, Total	160.3 Modified	-	70.7	71.8	71.3	2	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment
Analysis Method: 160.4 Modified
Prep Method: None

Service Request: K1906868
Date Collected: 07/22/19
Date Received: 07/26/19

Units: Percent
Basis: Dry, per Method

Solids, Total Volatile

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
2019KGMLJC	K1906868-001	2.50	0.021	1	07/30/19 15:11	*
2019KGMLSC	K1906868-002	2.90	0.022	1	07/30/19 15:11	*
2019KGMLSH	K1906868-003	2.60	0.020	1	07/30/19 15:11	*
2019KGMEFSC	K1906868-004	9.30	0.022	1	07/30/19 15:11	*
Method Blank	K1906868-MB	ND U	0.020	1	07/30/19 15:11	

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1906868
Date Collected: 07/22/19
Date Received: 07/26/19
Date Analyzed: 07/30/19

Replicate Sample Summary
General Chemistry Parameters

Sample Name: 2019KGMLJC
Lab Code: K1906868-001

Units: Percent
Basis: Dry, per Method

<u>Analyte Name</u>	<u>Analysis Method</u>	<u>MRL</u>	<u>Sample Result</u>	<u>Duplicate Sample K1906868-001DUP Result</u>	<u>Average</u>	<u>RPD</u>	<u>RPD Limit</u>
Solids, Total Volatile	160.4 Modified	0.020	2.50	2.50	2.50	<1	20

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General Chemistry

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment
Analysis Method: PSEP Sulfide
Prep Method: Method

Service Request: K1906868
Date Collected: 07/22/19
Date Received: 07/26/19
Units: mg/Kg
Basis: Dry

Sulfide, Total

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Date Extracted	Q
2019KGMLJC	K1906868-001	ND U	2.8	1	07/27/19 13:34	7/27/19	
2019KGMLSC	K1906868-002	ND U	2.6	1	07/27/19 13:34	7/27/19	
2019KGMLSH	K1906868-003	ND U	3.2	1	07/27/19 13:34	7/27/19	
2019KGMEFSC	K1906868-004	ND U	4.5	1	07/27/19 13:34	7/27/19	
Method Blank	K1906868-MB	ND U	1.0	1	07/27/19 13:34	7/27/19	

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1906868
Date Collected: 07/22/19
Date Received: 07/26/19
Date Analyzed: 07/27/19

Triplicate Sample Summary
General Chemistry Parameters

Sample Name: 2019KGMLJC
Lab Code: K1906868-001
Analysis Method: PSEP Sulfide
Prep Method: Method

Units: mg/Kg
Basis: Dry

Analyte Name	MRL	Sample Result	Duplicate K1906868- 001DUP Result	Triplicate K1906868- 001TRP Result	Average	RSD	RSD Limit
Sulfide, Total	2.6	ND	ND	ND	NC	NC	20

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1906868
Date Collected: 07/22/19
Date Received: 07/26/19
Date Analyzed: 07/27/19
Date Extracted: 07/27/19

Duplicate Matrix Spike Summary
Sulfide, Total

Sample Name: 2019KGMLJC
Lab Code: K1906868-001
Analysis Method: PSEP Sulfide
Prep Method: Method

Units: mg/Kg
Basis: Dry

Analyte Name	Sample Result	Result	Matrix Spike K1906868-001MS		Duplicate Matrix Spike K1906868-001DMS		% Rec Limits	RPD	RPD Limit	
			Spike Amount	% Rec	Result	Spike Amount				% Rec
Sulfide, Total	ND U	1190	1070	111	1170	1080	109	28-175	1	20

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1906868
Date Analyzed: 07/27/19
Date Extracted: 07/27/19

Lab Control Sample Summary
Sulfide, Total

Analysis Method: PSEP Sulfide
Prep Method: Method

Units: mg/Kg
Basis: Dry
Analysis Lot: 645227

Sample Name	Lab Code	Result	Spike Amount	% Rec	% Rec Limits
Lab Control Sample	K1906868-LCS1	470	400	118	39-166
Lab Control Sample	K1906868-LCS2	460	400	118	39-166
Lab Control Sample	K1906868-LCS3	470	400	118	39-166
Lab Control Sample	K1906868-LCS4	470	400	118	39-166

ALS Group USA, Corp.
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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment
Analysis Method: PSEP TOC
Prep Method: ALS SOP

Service Request: K1906868
Date Collected: 07/22/19
Date Received: 07/26/19

Units: Percent
Basis: Dry, per Method

Carbon, Total Organic (TOC)

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Date Extracted	Q
2019KGMLJC	K1906868-001	0.449	0.050	1	07/29/19 12:30	7/29/19	
2019KGMLSC	K1906868-002	0.366	0.050	1	07/29/19 12:30	7/29/19	
2019KGMLSH	K1906868-003	0.317	0.050	1	07/29/19 12:30	7/29/19	
2019KGMEFSC	K1906868-004	1.72	0.050	1	07/29/19 12:30	7/29/19	
Method Blank	K1906868-MB	ND U	0.050	1	07/29/19 12:30	7/29/19	

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1906868
Date Collected: 07/22/19
Date Received: 07/26/19
Date Analyzed: 07/29/19

Triplicate Sample Summary
General Chemistry Parameters

Sample Name: 2019KGMLJC
Lab Code: K1906868-001
Analysis Method: PSEP TOC
Prep Method: ALS SOP

Units: Percent
Basis: Dry, per Method

Analyte Name	MRL	Sample Result	Duplicate K1906868-001DUP Result	Triplicate K1906868-001TRP Result	Average	RSD	RSD Limit
Carbon, Total Organic (TOC)	0.050	0.449	0.454	0.452	0.452	<1	27

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1906868
Date Collected: 07/22/19
Date Received: 07/26/19
Date Analyzed: 07/29/19
Date Extracted: 07/29/19

Duplicate Matrix Spike Summary
Carbon, Total Organic (TOC)

Sample Name: 2019KGMLJC
Lab Code: K1906868-001
Analysis Method: PSEP TOC
Prep Method: ALS SOP

Units: Percent
Basis: Dry, per Method

Analyte Name	Sample Result	Matrix Spike K1906868-001MS			Duplicate Matrix Spike K1906868-001DMS			% Rec Limits	RPD	RPD Limit
		Result	Spike Amount	% Rec	Result	Spike Amount	% Rec			
Carbon, Total Organic (TOC)	0.449	3.78	3.32	100	4.09	3.64	100	69-123	<1	27

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1906868
Date Analyzed: 07/29/19
Date Extracted: 07/29/19

Lab Control Sample Summary
Carbon, Total Organic (TOC)

Analysis Method: PSEP TOC
Prep Method: ALS SOP

Units: Percent
Basis: Dry, per Method
Analysis Lot: 645103

Sample Name	Lab Code	Result	Spike Amount	% Rec	% Rec Limits
Lab Control Sample	K1906868-LCS1	0.553	0.603	92	74-118

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1906868
Date Collected: 7/22/2019
Date Received: 7/26/2019
Date Analyzed: 8/9/2019

Particle Size Determination
ASTM D422

Sample Name: 2019KGMLJC
Lab Code: K1906868-001

Gravel and Sand
(Sieve Analysis)

Description	Sieve Size	Weight (g)	Percent Passing
Gravel (19.0 mm)	No.3/4"(19.0 mm)	0.0000	99.77
Gravel (9.50 mm)	No.3/8"(9.50 mm)	0.0000	99.77
Gravel, Medium	No.4 (4.75 mm)	0.6029	98.28
Gravel, Fine	No.10 (2.00 mm)	2.1512	92.96
Sand, Very Coarse	No.20 (0.850 mm)	8.8997	70.97
Sand, Coarse	No.40 (0.425 mm)	18.4836	25.32
Sand, Medium	No.60 (0.250 mm)	6.3766	9.56
Sand, Fine	No.140 (0.106 mm)	2.2557	3.99
Sand, Very Fine	No.200 (0.0750 mm)	0.2132	3.47

Silt and Clay
(Hydrometer Analysis)

Particle Diameter	Percent Passing
0.074 mm	4.67
0.005 mm	1.09
0.001 mm	0.57

ALS Group USA, Corp.
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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1906868
Date Collected: 7/22/2019
Date Received: 7/26/2019
Date Analyzed: 8/9/2019

Particle Size Determination
ASTM D422

Sample Name: 2019KGMLSC
Lab Code: K1906868-002

Gravel and Sand
(Sieve Analysis)

Description	Sieve Size	Weight (g)	Percent Passing
Gravel (19.0 mm)	No.3/4"(19.0 mm)	0.0000	98.21
Gravel (9.50 mm)	No.3/8"(9.50 mm)	0.0000	98.21
Gravel, Medium	No.4 (4.75 mm)	4.0524	88.86
Gravel, Fine	No.10 (2.00 mm)	21.1525	40.02
Sand, Very Coarse	No.20 (0.850 mm)	12.4477	12.48
Sand, Coarse	No.40 (0.425 mm)	2.8370	6.20
Sand, Medium	No.60 (0.250 mm)	1.0458	3.88
Sand, Fine	No.140 (0.106 mm)	0.5093	2.76
Sand, Very Fine	No.200 (0.0750 mm)	0.0533	2.64

Silt and Clay
(Hydrometer Analysis)

Particle Diameter	Percent Passing
0.074 mm	3.54
0.005 mm	0.00
0.001 mm	0.00

ALS Group USA, Corp.
 dba ALS Environmental
Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1906868
Date Collected: 7/22/2019
Date Received: 7/26/2019
Date Analyzed: 8/9/2019

Particle Size Determination
ASTM D422

Sample Name: 2019KGMLSH
Lab Code: K1906868-003

Gravel and Sand
(Sieve Analysis)

Description	Sieve Size	Weight (g)	Percent Passing
Gravel (19.0 mm)	No.3/4"(19.0 mm)	0.0000	99.26
Gravel (9.50 mm)	No.3/8"(9.50 mm)	0.0000	99.26
Gravel, Medium	No.4 (4.75 mm)	1.1914	96.29
Gravel, Fine	No.10 (2.00 mm)	8.9875	73.82
Sand, Very Coarse	No.20 (0.850 mm)	17.0188	31.67
Sand, Coarse	No.40 (0.425 mm)	9.8511	7.27
Sand, Medium	No.60 (0.250 mm)	1.9165	2.52
Sand, Fine	No.140 (0.106 mm)	0.3363	1.69
Sand, Very Fine	No.200 (0.0750 mm)	0.0253	1.63

Silt and Clay
(Hydrometer Analysis)

Particle Diameter	Percent Passing
0.074 mm	5.99
0.005 mm	0.00
0.001 mm	0.00

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1906868
Date Collected: 7/22/2019
Date Received: 7/26/2019
Date Analyzed: 8/9/2019

Particle Size Determination
ASTM D422

Sample Name: 2019KGMEFSC
Lab Code: K1906868-004

Gravel and Sand
(Sieve Analysis)

Description	Sieve Size	Weight (g)	Percent Passing
Gravel (19.0 mm)	No.3/4"(19.0 mm)	0.0000	97.96
Gravel (9.50 mm)	No.3/8"(9.50 mm)	0.0000	97.96
Gravel, Medium	No.4 (4.75 mm)	4.0794	86.79
Gravel, Fine	No.10 (2.00 mm)	13.2456	50.54
Sand, Very Coarse	No.20 (0.850 mm)	12.1171	18.29
Sand, Coarse	No.40 (0.425 mm)	3.9367	7.81
Sand, Medium	No.60 (0.250 mm)	0.4734	6.55
Sand, Fine	No.140 (0.106 mm)	0.3438	5.63
Sand, Very Fine	No.200 (0.0750 mm)	0.0746	5.43

Silt and Clay
(Hydrometer Analysis)

Particle Diameter	Percent Passing
0.074 mm	6.33
0.005 mm	0.58
0.001 mm	0.00

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1906868
Date Collected: 7/22/2019
Date Received: 7/26/2019
Date Analyzed: 8/9/2019

Particle Size Determination
ASTM D422

Sample Name: 2019KGMEFSC
Lab Code: K1906868-004DUP

Gravel and Sand
(Sieve Analysis)

Description	Sieve Size	Weight (g)	Percent Passing
Gravel (19.0 mm)	No.3/4"(19.0 mm)	0.0000	98.98
Gravel (9.50 mm)	No.3/8"(9.50 mm)	0.0000	98.98
Gravel, Medium	No.4 (4.75 mm)	4.5343	86.28
Gravel, Fine	No.10 (2.00 mm)	11.3277	54.56
Sand, Very Coarse	No.20 (0.850 mm)	11.9928	21.20
Sand, Coarse	No.40 (0.425 mm)	4.8723	7.65
Sand, Medium	No.60 (0.250 mm)	0.6439	5.86
Sand, Fine	No.140 (0.106 mm)	0.3846	4.79
Sand, Very Fine	No.200 (0.0750 mm)	0.0729	4.59

Silt and Clay
(Hydrometer Analysis)

Particle Diameter	Percent Passing
0.074 mm	6.51
0.005 mm	0.41
0.001 mm	0.00



Metals

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment
Sample Name: 2019KGMLJC
Lab Code: K1906868-001

Service Request: K1906868
Date Collected: 07/22/19 08:45
Date Received: 07/26/19 09:50

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	9630	mg/Kg	2.2	5	07/31/19 15:31	07/26/19	
Arsenic	200.8	14.7	mg/Kg	0.55	5	07/31/19 15:31	07/26/19	
Cadmium	200.8	0.157	mg/Kg	0.022	5	07/31/19 15:31	07/26/19	
Chromium	200.8	18.2	mg/Kg	0.22	5	07/31/19 15:31	07/26/19	
Copper	200.8	62.8	mg/Kg	0.11	5	07/31/19 15:31	07/26/19	
Lead	200.8	7.06	mg/Kg	0.055	5	07/31/19 15:31	07/26/19	
Mercury	7471B	ND U	mg/Kg	0.028	1	08/07/19 10:37	08/05/19	
Nickel	200.8	15.0	mg/Kg	0.22	5	07/31/19 15:31	07/26/19	
Selenium	200.8	ND U	mg/Kg	1.1	5	07/31/19 15:31	07/26/19	
Silver	200.8	0.274	mg/Kg	0.022	5	07/31/19 15:31	07/26/19	
Zinc	200.8	77.3	mg/Kg	0.55	5	07/31/19 15:31	07/26/19	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1906868
Date Collected: 07/22/19 10:15
Date Received: 07/26/19 09:50

Sample Name: 2019KGMLSC
Lab Code: K1906868-002

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	11000	mg/Kg	2.1	5	07/31/19 15:39	07/26/19	
Arsenic	200.8	14.3	mg/Kg	0.52	5	07/31/19 15:39	07/26/19	
Cadmium	200.8	0.559	mg/Kg	0.021	5	07/31/19 15:39	07/26/19	
Chromium	200.8	16.9	mg/Kg	0.21	5	07/31/19 15:39	07/26/19	
Copper	200.8	39.0	mg/Kg	0.10	5	07/31/19 15:39	07/26/19	
Lead	200.8	6.36	mg/Kg	0.052	5	07/31/19 15:39	07/26/19	
Mercury	7471B	0.074	mg/Kg	0.026	1	08/07/19 10:42	08/05/19	
Nickel	200.8	34.2	mg/Kg	0.21	5	07/31/19 15:39	07/26/19	
Selenium	200.8	ND U	mg/Kg	1.0	5	07/31/19 15:39	07/26/19	
Silver	200.8	0.083	mg/Kg	0.021	5	07/31/19 15:39	07/26/19	
Zinc	200.8	132	mg/Kg	0.52	5	07/31/19 15:39	07/26/19	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1906868
Date Collected: 07/22/19 13:35
Date Received: 07/26/19 09:50

Sample Name: 2019KGMLSH
Lab Code: K1906868-003

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	17400	mg/Kg	2.3	5	07/31/19 15:42	07/26/19	
Arsenic	200.8	42.4	mg/Kg	0.58	5	07/31/19 15:42	07/26/19	
Cadmium	200.8	0.222	mg/Kg	0.023	5	07/31/19 15:42	07/26/19	
Chromium	200.8	36.1	mg/Kg	0.23	5	07/31/19 15:42	07/26/19	
Copper	200.8	59.6	mg/Kg	0.12	5	07/31/19 15:42	07/26/19	
Lead	200.8	6.19	mg/Kg	0.058	5	07/31/19 15:42	07/26/19	
Mercury	7471B	ND U	mg/Kg	0.032	1	08/07/19 10:44	08/05/19	
Nickel	200.8	34.2	mg/Kg	0.23	5	07/31/19 15:42	07/26/19	
Selenium	200.8	ND U	mg/Kg	1.2	5	07/31/19 15:42	07/26/19	
Silver	200.8	0.205	mg/Kg	0.023	5	07/31/19 15:42	07/26/19	
Zinc	200.8	118	mg/Kg	0.58	5	07/31/19 15:42	07/26/19	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment
Sample Name: 2019KGMEFSC
Lab Code: K1906868-004

Service Request: K1906868
Date Collected: 07/22/19 14:45
Date Received: 07/26/19 09:50

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	12300	mg/Kg	4.6	5	07/31/19 15:45	07/26/19	
Arsenic	200.8	55.9	mg/Kg	1.1	5	07/31/19 15:45	07/26/19	
Cadmium	200.8	10.3	mg/Kg	0.046	5	07/31/19 15:45	07/26/19	
Chromium	200.8	15.5	mg/Kg	0.46	5	07/31/19 15:45	07/26/19	
Copper	200.8	63.8	mg/Kg	0.23	5	07/31/19 15:45	07/26/19	
Lead	200.8	5.93	mg/Kg	0.11	5	07/31/19 15:45	07/26/19	
Mercury	7471B	ND U	mg/Kg	0.039	1	08/07/19 10:46	08/05/19	
Nickel	200.8	83.1	mg/Kg	0.46	5	07/31/19 15:45	07/26/19	
Selenium	200.8	2.9	mg/Kg	2.3	5	07/31/19 15:45	07/26/19	
Silver	200.8	0.179	mg/Kg	0.046	5	07/31/19 15:45	07/26/19	
Zinc	200.8	665	mg/Kg	1.1	5	07/31/19 15:45	07/26/19	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment
Sample Name: Method Blank
Lab Code: KQ1910515-03

Service Request: K1906868
Date Collected: NA
Date Received: NA
Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	ND U	mg/Kg	2.0	5	07/31/19 15:25	07/26/19	
Arsenic	200.8	ND U	mg/Kg	0.5	5	07/31/19 15:25	07/26/19	
Cadmium	200.8	ND U	mg/Kg	0.020	5	07/31/19 15:25	07/26/19	
Chromium	200.8	ND U	mg/Kg	0.20	5	07/31/19 15:25	07/26/19	
Copper	200.8	ND U	mg/Kg	0.10	5	07/31/19 15:25	07/26/19	
Lead	200.8	ND U	mg/Kg	0.05	5	07/31/19 15:25	07/26/19	
Nickel	200.8	ND U	mg/Kg	0.20	5	07/31/19 15:25	07/26/19	
Selenium	200.8	ND U	mg/Kg	1.0	5	07/31/19 15:25	07/26/19	
Silver	200.8	ND U	mg/Kg	0.020	5	07/31/19 15:25	07/26/19	
Zinc	200.8	ND U	mg/Kg	0.5	5	07/31/19 15:25	07/26/19	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment
Sample Name: Method Blank
Lab Code: KQ1910869-01

Service Request: K1906868
Date Collected: NA
Date Received: NA
Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Mercury	7471B	ND U	mg/Kg	0.02	1	08/07/19 10:08	08/05/19	

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1906868
Date Collected: 07/22/19
Date Received: 07/26/19
Date Analyzed: 07/31/19

Replicate Sample Summary
Total Metals

Sample Name: 2019KGMLJC
Lab Code: K1906868-001

Units: mg/Kg
Basis: Dry

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample		Average	RPD	RPD Limit
				KQ1910515-01				
				Result	Result			
Aluminum	200.8	1.9	9630	10800	10200	11	30	
Arsenic	200.8	0.48	14.7	17.5	16.1	18	30	
Cadmium	200.8	0.019	0.157	0.178	0.168	13	30	
Chromium	200.8	0.19	18.2	22.1	20.2	19	30	
Copper	200.8	0.096	62.8	57.4	60.1	9	30	
Lead	200.8	0.048	7.06	8.54	7.80	19	30	
Nickel	200.8	0.19	15.0	17.8	16.4	17	30	
Selenium	200.8	0.96	ND U	ND U	ND	-	30	
Silver	200.8	0.019	0.274	0.136	0.205	68 *	30	
Zinc	200.8	0.48	77.3	85.0	81.2	9	30	

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1906868
Date Collected: 07/22/19
Date Received: 07/26/19
Date Analyzed: 07/31/19
Date Extracted: 07/26/19

Matrix Spike Summary
Total Metals

Sample Name: 2019KGMLJC
Lab Code: K1906868-001
Analysis Method: 200.8
Prep Method: EPA 3050B

Units: mg/Kg
Basis: Dry

Matrix Spike
KQ1910515-02

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Aluminum	9630	11400	390	449 #	70-130
Arsenic	14.7	117	97.6	105	70-130
Cadmium	0.157	9.90	9.76	100	70-130
Chromium	18.2	60.3	39.0	108	70-130
Copper	62.8	103	48.8	82	70-130
Lead	7.06	103	97.6	99	70-130
Nickel	15.0	114	97.6	101	70-130
Selenium	ND U	98.0	97.6	100	70-130
Silver	0.274	10.0	9.76	100	70-130
Zinc	77.3	180	97.6	105	70-130

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1906868
Date Analyzed: 07/31/19

Lab Control Sample Summary
Total Metals

Units:mg/Kg
Basis:Dry

Lab Control Sample
KQ1910515-04

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Aluminum	200.8	6710	10100	66	42-124
Arsenic	200.8	162	171	95	66-122
Cadmium	200.8	213	225	95	70-117
Chromium	200.8	132	144	92	66-123
Copper	200.8	162	174	93	71-119
Lead	200.8	106	111	96	71-129
Nickel	200.8	93.2	98.3	95	65-121
Selenium	200.8	192	206	93	64-122
Silver	200.8	44.9	45.5	99	66-124
Zinc	200.8	196	207	95	67-125

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1906868
Date Analyzed: 08/07/19

Lab Control Sample Summary
Total Metals

Units:mg/Kg
Basis:Dry

Lab Control Sample
KQ1910869-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Mercury	7471B	12.2	12.0	102	60-139



ALS Environmental
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August 27, 2019

Analytical Report for Service Request No: K1907246

Kate Kanouse
Alaska Department of Fish and Game
Division of Habitat
802 3rd Street
P.O. Box 110024
Douglas, AK 99811-0024

RE: Coeur AK Biomonitoring

Dear Kate,

Enclosed are the results of the sample(s) submitted to our laboratory August 07, 2019
For your reference, these analyses have been assigned our service request number **K1907246**.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3356. You may also contact me via email at Kurt.Clarkson@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Kurt Clarkson
Sr. Project Manager



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Acronyms

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Chain of Custody

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General Chemistry

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Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Inorganic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- E The result is an estimate amount because the value exceeded the instrument calibration range.
- J The result is an estimated value.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.
- H The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

- # The control limit criteria is not applicable. See case narrative.
- J The result is an estimated value.
- E The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
- M The duplicate injection precision was not met.
- N The Matrix Spike sample recovery is not within control limits. See case narrative.
- S The reported value was determined by the Method of Standard Additions (MSA).
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- W The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
 - i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- + The correlation coefficient for the MSA is less than 0.995.
- Q See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- A A tentatively identified compound, a suspected aldol-condensation product.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- C The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
- D The reported result is from a dilution.
- E The result is an estimated value.
- J The result is an estimated value.
- N The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
- P The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

- F The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
- L The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
- H The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
- O The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
- Y The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
- Z The chromatographic fingerprint does not resemble a petroleum product.

**ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses**

Agency	Web Site	Number
Alaska DEH	http://dec.alaska.gov/eh/lab/cs/csapproval.htm	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L16-58-R4
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	http://health.hawaii.gov/	-
ISO 17025	http://www.pjllabs.com/	L16-57
Louisiana DEQ	http://www.deq.louisiana.gov/page/la-lab-accreditation	03016
Maine DHS	http://www.maine.gov/dhhs/	WA01276
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/enforcement/oqa.html	WA005
New York - DOH	https://www.wadsworth.org/regulatory/elap	12060
North Carolina DEQ	https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab-certification	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/EnvironmentalLabCertification/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wyoming (EPA Region 8)	https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.

Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/analyte is offered by that state.



Chain of Custody

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SR# _____
COC Set _____ of _____
COC# _____

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K1907246

Project Name: Coeur AK Biomonitoring		Project Number:		NUMBER OF CONTAINERS	7D	14D	28D	180D	999D	1	2	3	4	5	Remarks
Project Manager: Kate Kanouse															
Company: Coeur AK / ADFG															
Address: 802 3rd St Douglas, AK 99824															
Phone #: 907-465-4290	email: Kate.Kanouse@alaska.gov														
Sampler Signature: Kate Kanouse		Sampler Printed Name: Kate Kanouse		160.4 Modified / TVS	PSEP Sulfide / PSEP Sulfide	PSEP TOC / PSEP TOC T	7471B / Hg	200.8 / Metals T	ASTM D422 / Part Size	160.3 Modified / TS					
CLIENT SAMPLE ID	LABID	SAMPLING Date	Time	Matrix											
1. 2019KAMUSC		8/5/19	1030	soil	3	✓	✓	✓	✓	✓					
2.															
3.															
4.															
5.															
6.															
7.															
8.															
9.															
10.															

Report Requirements <input type="checkbox"/> I. Routine Report: Method Blank, Surrogate, as required <input checked="" type="checkbox"/> II. Report Dup., MS, MSD as required <input type="checkbox"/> III. CLP Like Summary (no raw data) <input type="checkbox"/> IV. Data Validation Report <input type="checkbox"/> V. EDD	Invoice Information P.O.# _____ Bill To: Coeur AK keppers@coeur.com	Circle which metals are to be analyzed Total Metals: <input checked="" type="checkbox"/> Al <input checked="" type="checkbox"/> As <input type="checkbox"/> Sb <input type="checkbox"/> Ba <input type="checkbox"/> Be <input type="checkbox"/> B <input type="checkbox"/> Ca <input checked="" type="checkbox"/> Cd <input checked="" type="checkbox"/> Co <input checked="" type="checkbox"/> Cr <input checked="" type="checkbox"/> Cu <input type="checkbox"/> Fe <input checked="" type="checkbox"/> Pb <input type="checkbox"/> Mg <input type="checkbox"/> Mn <input type="checkbox"/> Mo <input checked="" type="checkbox"/> Ni <input type="checkbox"/> K <input type="checkbox"/> Ag <input type="checkbox"/> Na <input checked="" type="checkbox"/> Se <input type="checkbox"/> Sr <input type="checkbox"/> Ti <input type="checkbox"/> Sn <input type="checkbox"/> V <input checked="" type="checkbox"/> Zn <input checked="" type="checkbox"/> Hg Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Ti Sn V Zn Hg	
	Turnaround Requirements <input type="checkbox"/> 24 hr. <input type="checkbox"/> 48 hr. <input type="checkbox"/> 5 Day <input type="checkbox"/> Standard	Special Instructions/Comments: _____ *Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other _____ (Circle One)	
	Requested Report Date		

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature: Kate Kanouse	Signature: Naomi Pedersen	Signature:	Signature:	Signature:	Signature:
Printed Name: Kate Kanouse	Printed Name: ALS	Printed Name:	Printed Name:	Printed Name:	Printed Name:
Firm: ADFG	Firm: ALS	Firm:	Firm:	Firm:	Firm:
Date/Time: 8/6/19 0930	Date/Time: 8-7-19 1010	Date/Time:	Date/Time:	Date/Time:	Date/Time:



PC KC

Cooler Receipt and Preservation Form

Client: Coenr AH/ ADFG Service Request K19 07246
 Received: 8-7-19 Opened: 8-7-19 By: NP Unloaded: 8-7-19 By: NP

- Samples were received via? USPS Fed Ex UPS DHL PDX Courier Hand Delivered
- Samples were received in: (circle) Cooler Box Envelope Other _____ NA
- Were custody seals on coolers? NA N If yes, how many and where? 1 side
 If present, were custody seals intact? N If present, were they signed and dated? N

Raw Cooler Temp	Corrected Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID NA	Tracking Number NA	Filed
4.5	4.6	5.9	6.0	0.1	370	101357	7889 5209 1438	

- Packing material: Inserts Baggies Bubble Wrap Gel Packs Wet Ice Dry Ice Sleeves _____
- Were custody papers properly filled out (ink, signed, etc.)? NA Y N
- Were samples received in good condition (temperature, unbroken)? *Indicate in the table below.* NA Y N
 If applicable, tissue samples were received: Frozen Partially Thawed Thawed
- Were all sample labels complete (i.e analysis, preservation, etc.)? NA Y N
- Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* NA Y N
- Were appropriate bottles/containers and volumes received for the tests indicated? NA Y N
- Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA Y N
- Were VOA vials received without headspace? *Indicate in the table below.* NA Y N
- Was C12/Res negative? NA Y N

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count	Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, & Resolutions: _____



Total Solids

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ALS Group USA, Corp.
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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment
Analysis Method: 160.3 Modified
Prep Method: None

Service Request: K1907246
Date Collected: 08/5/19
Date Received: 08/7/19
Units: Percent
Basis: As Received

Solids, Total

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
2019KGMUSC	K1907246-001	72.6	-	1	08/08/19 11:53	

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1907246
Date Collected: 08/05/19
Date Received: 08/07/19
Date Analyzed: 08/08/19

Replicate Sample Summary
Inorganic Parameters

Sample Name: 2019KGMUSC
Lab Code: K1907246-001

Units: Percent
Basis: As Received

<u>Analyte Name</u>	<u>Analysis Method</u>	<u>MRL</u>	<u>Sample Result</u>	<u>Duplicate Sample K1907246-001DUP Result</u>	<u>Average</u>	<u>RPD</u>	<u>RPD Limit</u>
Solids, Total	160.3 Modified	-	72.6	72.2	72.4	<1	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment
Analysis Method: 160.4 Modified
Prep Method: None

Service Request: K1907246
Date Collected: 08/5/19
Date Received: 08/7/19

Units: Percent
Basis: Dry, per Method

Solids, Total Volatile

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
2019KGMUSC	K1907246-001	3.80	0.030	1	08/09/19 13:40	
Method Blank	K1907246-MB	ND U	0.020	1	08/09/19 13:40	

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1907246
Date Collected: 08/05/19
Date Received: 08/07/19
Date Analyzed: 08/09/19

Replicate Sample Summary
General Chemistry Parameters

Sample Name: 2019KGMUSC
Lab Code: K1907246-001

Units: Percent
Basis: Dry, per Method

<u>Analyte Name</u>	<u>Analysis Method</u>	<u>MRL</u>	<u>Sample Result</u>	<u>Duplicate Sample K1907246-001DUP Result</u>	<u>Average</u>	<u>RPD</u>	<u>RPD Limit</u>
Solids, Total Volatile	160.4 Modified	0.031	3.80	3.70	3.75	3	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.



General Chemistry

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ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment
Analysis Method: PSEP Sulfide
Prep Method: Method

Service Request: K1907246
Date Collected: 08/5/19
Date Received: 08/7/19
Units: mg/Kg
Basis: Dry

Sulfide, Total

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Date Extracted	Q
2019KGMUSC	K1907246-001	ND U	2.4	1	08/09/19 12:34	8/7/19	
Method Blank	K1907246-MB	ND U	1.0	1	08/09/19 12:34	8/7/19	

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1907246
Date Collected: 08/05/19
Date Received: 08/07/19
Date Analyzed: 08/09/19

Triplicate Sample Summary
General Chemistry Parameters

Sample Name: 2019KGMUSC
Lab Code: K1907246-001
Analysis Method: PSEP Sulfide
Prep Method: Method

Units: mg/Kg
Basis: Dry

Analyte Name	MRL	Sample Result	Duplicate K1907246- 001DUP Result	Triplicate K1907246- 001TRP Result	Average	RSD	RSD Limit
Sulfide, Total	2.7	ND	ND	ND	NC	NC	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Printed 8/27/2019 10:44:29 AM

SuperSet Reference:19-0000518287 rev 00

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1907246
Date Collected: 08/05/19
Date Received: 08/07/19
Date Analyzed: 08/9/19
Date Extracted: 08/7/19

Duplicate Matrix Spike Summary
Sulfide, Total

Sample Name: 2019KGMUSC
Lab Code: K1907246-001
Analysis Method: PSEP Sulfide
Prep Method: Method

Units: mg/Kg
Basis: Dry

Analyte Name	Sample Result	Result	Matrix Spike		Result	Duplicate Matrix Spike		% Rec Limits	RPD	RPD Limit
			Spike Amount	% Rec		Spike Amount	% Rec			
Sulfide, Total	ND U	440	450	98	500	510	98	28-175	12	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

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ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1907246
Date Analyzed: 08/09/19
Date Extracted: 08/07/19

Lab Control Sample Summary
Sulfide, Total

Analysis Method: PSEP Sulfide
Prep Method: Method

Units: mg/Kg
Basis: Dry
Analysis Lot: 647031

Sample Name	Lab Code	Result	Spike Amount	% Rec	% Rec Limits
Lab Control Sample	K1907246-LCS	200	190	106	39-166

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment
Analysis Method: PSEP TOC
Prep Method: ALS SOP

Service Request: K1907246
Date Collected: 08/5/19
Date Received: 08/7/19

Units: Percent
Basis: Dry, per Method

Carbon, Total Organic (TOC)

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Date Extracted	Q
2019KGMUSC	K1907246-001	0.676	0.050	1	08/16/19 12:15	8/15/19	
Method Blank	K1907246-MB	ND U	0.050	1	08/16/19 12:15	8/15/19	

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1907246
Date Collected: 08/05/19
Date Received: 08/07/19
Date Analyzed: 08/16/19

Triplicate Sample Summary
General Chemistry Parameters

Sample Name: 2019KGMUSC
Lab Code: K1907246-001
Analysis Method: PSEP TOC
Prep Method: ALS SOP

Units: Percent
Basis: Dry, per Method

Analyte Name	MRL	Sample Result	Duplicate K1907246-001DUP Result	Triplicate K1907246-001TRP Result	Average	RSD	RSD Limit
Carbon, Total Organic (TOC)	0.050	0.676	0.677	0.673	0.676	<1	27

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ALS Group USA, Corp.
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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1907246
Date Collected: 08/05/19
Date Received: 08/07/19
Date Analyzed: 08/16/19
Date Extracted: 08/15/19

**Duplicate Matrix Spike Summary
Carbon, Total Organic (TOC)**

Sample Name: 2019KGMUSC
Lab Code: K1907246-001
Analysis Method: PSEP TOC
Prep Method: ALS SOP

Units: Percent
Basis: Dry, per Method

Analyte Name	Sample Result	Matrix Spike K1907246-001MS			Duplicate Matrix Spike K1907246-001DMS			% Rec Limits	RPD	RPD Limit
		Result	Spike Amount	% Rec	Result	Spike Amount	% Rec			
Carbon, Total Organic (TOC)	0.676	4.05	3.33	101	3.94	3.24	101	69-123	<1	27

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ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1907246
Date Analyzed: 08/16/19
Date Extracted: 08/15/19

Lab Control Sample Summary
Carbon, Total Organic (TOC)

Analysis Method: PSEP TOC
Prep Method: ALS SOP

Units: Percent
Basis: Dry, per Method
Analysis Lot: 647633

Sample Name	Lab Code	Result	Spike Amount	% Rec	% Rec Limits
Lab Control Sample	K1907246-LCS	0.486	0.508	96	74-118

ALS Group USA, Corp.
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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1907246
Date Collected: 8/5/2019
Date Received: 8/7/2019
Date Analyzed: 8/9/2019

Particle Size Determination
ASTM D422

Sample Name: 2019KGMUSC
Lab Code: K1907246-001

Gravel and Sand
(Sieve Analysis)

Description	Sieve Size	Weight (g)	Percent Passing
Gravel (19.0 mm)	No.3/4"(19.0 mm)	0.0000	99.41
Gravel (9.50 mm)	No.3/8"(9.50 mm)	0.0000	99.41
Gravel, Medium	No.4 (4.75 mm)	1.8502	94.40
Gravel, Fine	No.10 (2.00 mm)	11.4612	63.35
Sand, Very Coarse	No.20 (0.850 mm)	14.5133	24.29
Sand, Coarse	No.40 (0.425 mm)	7.1172	5.13
Sand, Medium	No.60 (0.250 mm)	0.6419	3.40
Sand, Fine	No.140 (0.106 mm)	0.1600	2.97
Sand, Very Fine	No.200 (0.0750 mm)	0.0426	2.86

Silt and Clay
(Hydrometer Analysis)

Particle Diameter	Percent Passing
0.074 mm	3.30
0.005 mm	2.51
0.001 mm	2.03

ALS Group USA, Corp.
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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1907246
Date Collected: 8/5/2019
Date Received: 8/7/2019
Date Analyzed: 8/9/2019

Particle Size Determination
ASTM D422

Sample Name: 2019KGMUSC
Lab Code: K1907246-001DUP

Gravel and Sand
(Sieve Analysis)

Description	Sieve Size	Weight (g)	Percent Passing
Gravel (19.0 mm)	No.3/4"(19.0 mm)	0.0000	98.94
Gravel (9.50 mm)	No.3/8"(9.50 mm)	0.0000	98.94
Gravel, Medium	No.4 (4.75 mm)	4.2256	87.87
Gravel, Fine	No.10 (2.00 mm)	12.6248	54.77
Sand, Very Coarse	No.20 (0.850 mm)	14.8281	16.52
Sand, Coarse	No.40 (0.425 mm)	5.0109	3.59
Sand, Medium	No.60 (0.250 mm)	0.2770	2.88
Sand, Fine	No.140 (0.106 mm)	0.0959	2.63
Sand, Very Fine	No.200 (0.0750 mm)	0.0233	2.57

Silt and Clay
(Hydrometer Analysis)

Particle Diameter	Percent Passing
0.074 mm	3.63
0.005 mm	0.00
0.001 mm	0.00



Metals

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
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ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment
Sample Name: 2019KGMUSC
Lab Code: K1907246-001

Service Request: K1907246
Date Collected: 08/05/19 10:30
Date Received: 08/07/19 10:10

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	15100	mg/Kg	2.4	5	08/16/19 16:17	08/14/19	
Arsenic	200.8	17.1	mg/Kg	0.61	5	08/16/19 16:17	08/14/19	
Cadmium	200.8	0.808	mg/Kg	0.024	5	08/16/19 16:17	08/14/19	
Chromium	200.8	110	mg/Kg	0.24	5	08/16/19 16:17	08/14/19	
Copper	200.8	44.5	mg/Kg	0.12	5	08/16/19 16:17	08/14/19	
Lead	200.8	3.58	mg/Kg	0.061	5	08/16/19 16:17	08/14/19	
Mercury	7471B	0.028	mg/Kg	0.025	1	08/19/19 12:11	08/16/19	
Nickel	200.8	60.2	mg/Kg	0.24	5	08/16/19 16:17	08/14/19	
Selenium	200.8	1.5	mg/Kg	1.2	5	08/16/19 16:17	08/14/19	
Silver	200.8	0.071	mg/Kg	0.024	5	08/16/19 16:17	08/14/19	
Zinc	200.8	116	mg/Kg	0.61	5	08/16/19 16:17	08/14/19	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment
Sample Name: Method Blank
Lab Code: KQ1911405-01

Service Request: K1907246
Date Collected: NA
Date Received: NA
Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.8	ND U	mg/Kg	2.0	5	08/16/19 15:51	08/14/19	
Arsenic	200.8	ND U	mg/Kg	0.5	5	08/16/19 15:51	08/14/19	
Cadmium	200.8	ND U	mg/Kg	0.020	5	08/16/19 15:51	08/14/19	
Chromium	200.8	ND U	mg/Kg	0.20	5	08/16/19 15:51	08/14/19	
Copper	200.8	ND U	mg/Kg	0.10	5	08/16/19 15:51	08/14/19	
Lead	200.8	ND U	mg/Kg	0.05	5	08/16/19 15:51	08/14/19	
Nickel	200.8	ND U	mg/Kg	0.20	5	08/16/19 15:51	08/14/19	
Selenium	200.8	ND U	mg/Kg	1.0	5	08/16/19 15:51	08/14/19	
Silver	200.8	ND U	mg/Kg	0.020	5	08/16/19 15:51	08/14/19	
Zinc	200.8	ND U	mg/Kg	0.5	5	08/16/19 15:51	08/14/19	

ALS Group USA, Corp.
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Analytical Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment
Sample Name: Method Blank
Lab Code: KQ1911124-03

Service Request: K1907246
Date Collected: NA
Date Received: NA
Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Mercury	7471B	ND U	mg/Kg	0.02	1	08/19/19 11:31	08/16/19	

ALS Group USA, Corp.

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1907246
Date Collected: 08/05/19
Date Received: 08/07/19
Date Analyzed: 08/19/19

Replicate Sample Summary

Total Metals

Sample Name: 2019KGMUSC
Lab Code: K1907246-001

Units: mg/Kg
Basis: Dry

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample	Average	RPD	RPD Limit
				KQ1911124-01 Result			
Mercury	7471B	0.024	0.028	0.073	0.051	90 #	20

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1907246
Date Collected: 08/05/19
Date Received: 08/07/19
Date Analyzed: 08/19/19
Date Extracted: 08/16/19

Matrix Spike Summary
Total Metals

Sample Name: 2019KGMUSC
Lab Code: K1907246-001
Analysis Method: 7471B
Prep Method: Method

Units: mg/Kg
Basis: Dry

Matrix Spike
KQ1911124-02

<u>Analyte Name</u>	<u>Sample Result</u>	<u>Result</u>	<u>Spike Amount</u>	<u>% Rec</u>	<u>% Rec Limits</u>
Mercury	0.028	0.736	0.675	105	80-120

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ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1907246
Date Analyzed: 08/16/19

Lab Control Sample Summary
Total Metals

Units:mg/Kg
Basis:Dry

Lab Control Sample
KQ1911405-02

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Aluminum	200.8	6280	10100	62	42-124
Arsenic	200.8	158	171	92	66-122
Cadmium	200.8	209	225	93	70-117
Chromium	200.8	130	144	90	66-123
Copper	200.8	159	174	91	71-119
Lead	200.8	109	111	98	71-129
Nickel	200.8	90.8	98.3	92	65-121
Selenium	200.8	191	206	93	64-122
Silver	200.8	43.3	45.5	95	66-124
Zinc	200.8	192	207	93	67-125

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Coeur AK Biomonitoring
Sample Matrix: Sediment

Service Request: K1907246
Date Analyzed: 08/19/19

Lab Control Sample Summary
Total Metals

Units:mg/Kg
Basis:Dry

Lab Control Sample
KQ1911124-04

Analyte Name	Analytical Method	Result	Spike Amount	% Rec	% Rec Limits
Mercury	7471B	12.3	12.0	103	60-139