

Technical Report No. 16-10

Glacier Creek Aquatic Studies, 2016

by

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and

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December 2016

Alaska Department of Fish and Game

Division of Habitat



Symbols and Abbreviations

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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	<i>e</i>
		corporate suffixes:		catch per unit effort	CPUE
Weights and measures (English)		Company	Co.	coefficient of variation	CV
cubic feet per second	ft ³ /s	Corporation	Corp.	common test statistics	(F, t, χ^2 , etc.)
foot	ft	Incorporated	Inc.	confidence interval	CI
gallon	gal	Limited	Ltd.	correlation coefficient	
inch	in	District of Columbia	D.C.	(multiple)	R
mile	mi	et alii (and others)	et al.	correlation coefficient	
nautical mile	nmi	et cetera (and so forth)	etc.	(simple)	r
ounce	oz	exempli gratia	e.g.	covariance	cov
pound	lb	(for example)		degree (angular)	°
quart	qt	Federal Information Code	FIC	degrees of freedom	df
yard	yd	id est (that is)	i.e.	expected value	<i>E</i>
		latitude or longitude	lat. or long.	greater than	>
Time and temperature		monetary symbols		greater than or equal to	≥
day	d	(U.S.)	\$, ¢	harvest per unit effort	HPUE
degrees Celsius	°C	months (tables and figures): first three letters	Jan,...,Dec	less than	<
degrees Fahrenheit	°F	registered trademark	®	less than or equal to	≤
degrees kelvin	K	trademark	™	logarithm (natural)	ln
hour	h	United States (adjective)	U.S.	logarithm (base 10)	log
minute	min	United States of America (noun)	USA	logarithm (specify base)	log ₂ , etc.
second	s	U.S.C.	United States Code	minute (angular)	'
		U.S. state	use two-letter abbreviations (e.g., AK, WA)	not significant	NS
Physics and chemistry				null hypothesis	H ₀
all atomic symbols				percent	%
alternating current	AC			probability	P
ampere	A			probability of a type I error	
calorie	cal			(rejection of the null hypothesis when true)	α
direct current	DC			probability of a type II error	
hertz	Hz			(acceptance of the null hypothesis when false)	β
horsepower	hp			second (angular)	"
hydrogen ion activity	pH			standard deviation	SD
(negative log of)				standard error	SE
parts per million	ppm			variance	
parts per thousand	ppt, ‰			population	Var
				sample	var
volts	V				
watts	W				

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GLACIER CREEK AQUATIC STUDIES, 2016

By

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December 2016

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Cover: Nicole Legere and Darsie Culbeck electrofishing Middle Glacier Creek.

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Division of Habitat Southeast Regional Supervisor Jackie Timothy collaborated on study design, Habitat Biologist Greg Albrecht processed the periphyton samples, Program Technician Katrina Lee and Habitat Biologist Johnny Zutz sorted the benthic macroinvertebrate samples, and Ms. Lee assisted with benthic macroinvertebrate data entry. Division of Habitat Operations Manager Dr. Al Ott, Ms. Timothy, and Habitat Biologist Parker Bradley reviewed and edited the report, and Nora Foster of NRF Taxonomic Services identified the benthic macroinvertebrates.

Thank you all for your contribution.

EXECUTIVE SUMMARY

Constantine North, Inc. (CNI) began exploratory drilling at the Palmer Prospect in 2006 and has identified copper, zinc, gold, silver, and barite deposits within the volcanogenic massive sulfide belt that may support industrial mining. CNI contracted with the Alaska Department of Fish and Game (ADF&G) Division of Habitat to study aquatic resources in Glacier Creek, a glacial water body draining the area. With CNI, Division of Habitat biologists developed a plan to study periphyton (algae), benthic macroinvertebrates (aquatic insects), fish, and sediment at two sites in Glacier Creek in spring 2016 to document baseline aquatic productivity and sediment conditions.

We sampled the lower and middle reaches of Glacier Creek on June 7 and 8, 2016. Mean periphyton density was greater among the Lower Glacier Creek samples. Mean benthic macroinvertebrate density was greater among the Middle Glacier Creek samples, and both benthic macroinvertebrate communities were dominated by Diptera: Chironomidae, aquatic insects that are generally fast colonizers, easily adapt to changing habitats, and can exercise more than one feeding strategy (Entrekin et al. 2007).

We captured ten Dolly Varden char *Salvelinus malma* at each site, all in good condition, and found greater median whole body cadmium, lead, mercury, selenium, and zinc concentrations among fish collected from Lower Glacier Creek. Median whole body arsenic, copper, and silver concentrations were similar among fish from both sites. All concentrations were reasonable when compared with samples collected from reference and exploration sites elsewhere in Alaska (Legere and Timothy 2016).

We sampled fine sediment at each site for aluminum, arsenic, cadmium, copper, iron, lead, mercury, silver, selenium, and zinc and found greater concentrations of most analytes in Lower Glacier Creek. Copper and lead concentrations were greater in Middle Glacier Creek, and mercury was not detected in either sample. The baseline cadmium, copper, and zinc concentrations were above the freshwater sediment guidelines suggested in Buchman (2008). While we find the sediment guidelines useful for evaluating the data, we also recognize organisms can respond differently in nature and in a lab.

INTRODUCTION

The Palmer Exploration Project is located in the Porcupine Mining District about 55 km north of Haines by air in the southeastern extent of the Saint Elias Mountains near the U.S./Canada border (Figure 1). At the site, placer gold mining in Glacier Creek and its tributaries occurred during the 20th century, and in 1969 local prospector Merrill Palmer discovered base-metal sulfides and barite that initiated exploration drill programs by several different companies in the following years, including CNI beginning in 2006 (CNI 2015). The project is located on the same volcanogenic massive sulfide belt as the Greens Creek Mine^a, and CNI has identified copper, zinc, gold, silver, and barite as potential mineable resources (CNI 2015).

^a Owned and operated by Hecla Greens Creek Mining Company on Admiralty Island in Southeast Alaska.

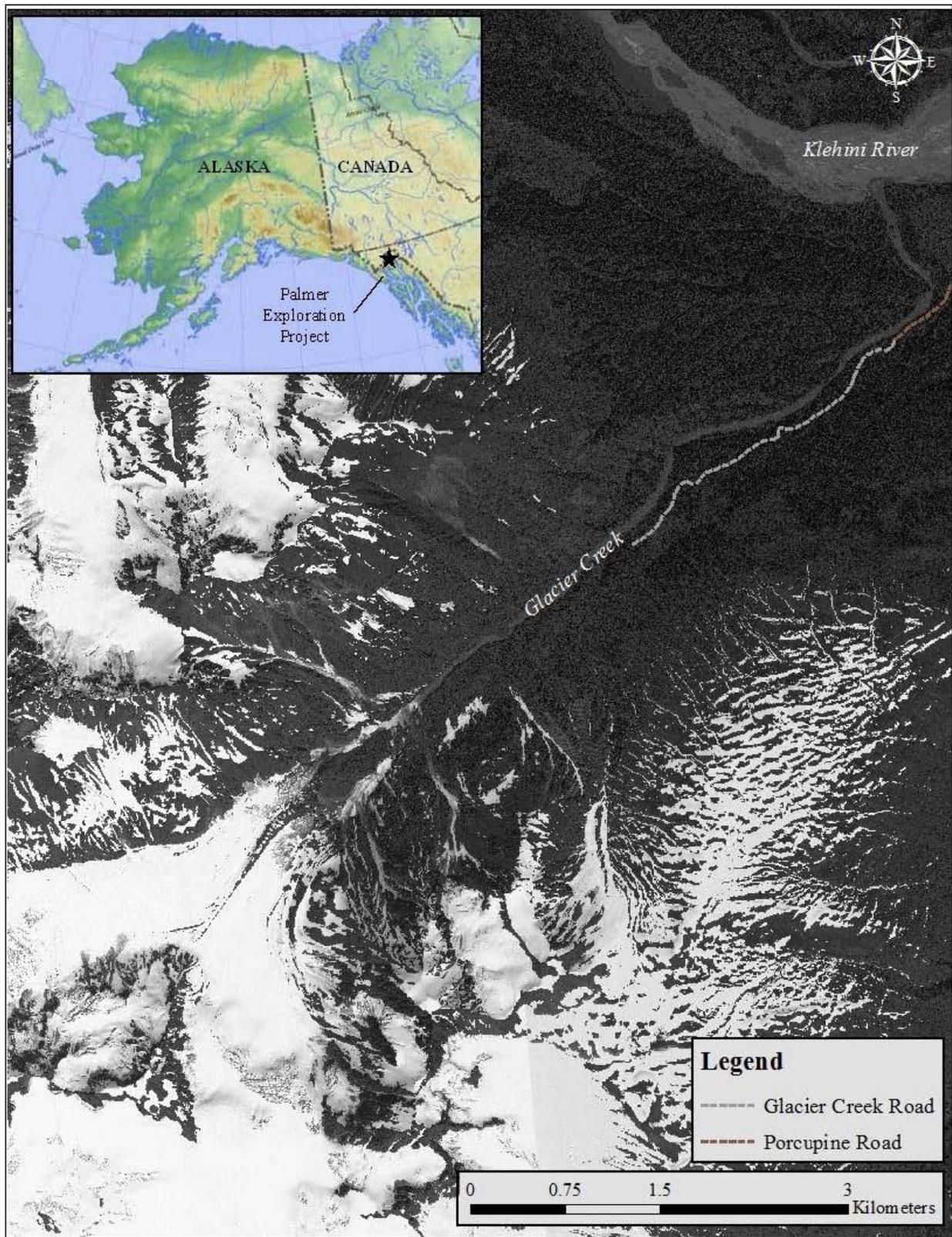


Figure 1.–Palmer Exploration Project area map.

Since 2013, Tetra Tech (2013) and ADF&G biologists documented^b Dolly Varden char in Glacier Creek and three tributaries. No other aquatic biological data exist for the project area. CNI contracted with the ADF&G Division of Habitat to complete baseline studies in Glacier Creek during 2016. Following review of CNI's water quality sample data, Division of Habitat biologists developed a study plan to investigate and document aquatic resources in Glacier Creek, similar to aquatic sampling programs at the Greens Creek Mine and Kensington Gold Mine (Kanouse 2015; Timothy and Kanouse 2014), underground hard rock mines in Southeast Alaska. The study plan included sampling periphyton, benthic macroinvertebrates, and fish, aquatic resources influenced by water and sediment quality through natural processes and development, to provide baseline information on aquatic productivity in Glacier Creek.

PURPOSE

The purpose of this investigation and technical report is to document the condition and composition of biological communities and sediments in Glacier Creek.

AQUATIC STUDIES

We completed the following studies in Glacier Creek:

- periphyton density and community composition;
- benthic macroinvertebrate density and community composition;
- Dolly Varden char condition and whole body metals concentrations; and
- sediment composition and metals concentrations.

We attempted to document fish species presence in the lower portion of Glacier Creek, between the mouth and the former bridge crossing site about 1.5 km upstream, however high flows prevented safe access. We will attempt to investigate fish presence again in 2017.

STUDY AREA

Glacier Creek is about 7 km long, drains a 39 km² watershed between its headwaters at the Saksai Glacier and its confluence with the Klehini River, and contributes about 5% of the total Klehini River drainage area measured from the U.S. Geological Survey gage at the Klehini River bridge—about 20 km downstream of the project.^c

Continuous discharge data do not exist for Glacier Creek. Based on the relative size of the Glacier Creek and Klehini River drainage areas, Integral Consulting, Inc.^d estimates average Glacier Creek discharge between May and September at 150 ft³/s, less than the discharges measured in June 2015, August 2015, and June 2016, which ranged 225–272 ft³/s.

^b Matthew Kern, Habitat Biologist, to Jackie Timothy, Southeast Regional Supervisor, ADF&G Habitat Division. Memorandum: Glacier Creek Investigation Trip Report; dated 6/26/2014. Unpublished document, can be obtained from the Southeast Regional Supervisor, ADF&G Habitat Division, 803 3rd St, Douglas, AK.

^c Marcia Greenblatt and Alice Conovitz, Integral Consulting, to Darwin Green, Constantine North. Memorandum: Klehini River and Glacier Creek Hydrologic Data Summary; dated 2/24/2016. Unpublished document, can be obtained from Constantine North, Inc., 800 W. Pender St. Ste. 320, Vancouver, BC, Canada.

^d Marcia Greenblatt and Alice Conovitz, Integral Consulting, to Darwin Green and Allegra Cairns, Constantine North. Memorandum: DRAFT Klehini River and Glacier Creek Hydrologic Data Summary—Fall 2016 Update; dated 11/8/2016. Unpublished document, can be obtained from Constantine North, Inc., 800 W. Pender St. Ste. 320, Vancouver, BC, Canada.

CNI's 2008–2014 Glacier Creek water quality data documents total suspended solids ranging 9–2,470 mg/L, turbidity ranging 18–2,760 nephelometric turbidity units (NTU), and pH ranging 6.59–8.33 (USDI 2016). Nutrients, arsenic, and other analytes were generally below detection limits, except aluminum, which usually exceeded the 2008 Alaska acute aquatic life criteria.

The lower 1 km of Glacier Creek (Stream No. 115-32-10250-2077-3151) provides habitat for coho salmon *Oncorhynchus kisutch*, cutthroat trout *O. clarkii*, and Dolly Varden char (Johnson and Litchfield 2016). Tetra Tech (2013) and ADF&G^e have documented Dolly Varden char in Glacier Creek up to Christmas Creek, a non-glacial tributary located about 4.5 km upstream of the Glacier Creek confluence with the Klehini River. We sampled two locations in Glacier Creek: Lower Glacier Creek and Middle Glacier Creek (Figure 2).

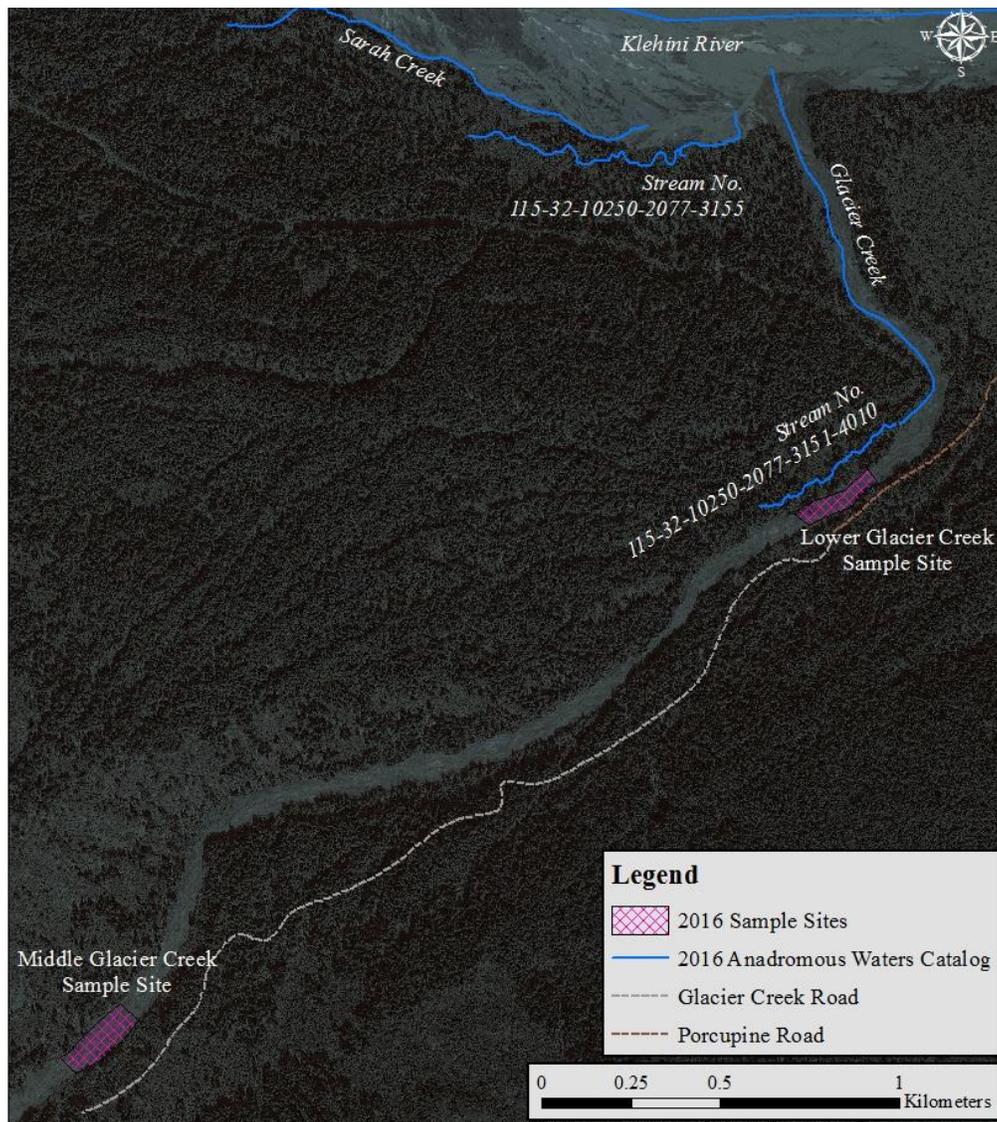


Figure 2.—Glacier Creek sample sites map.

^e Matthew Kern, Habitat Biologist, to Jackie Timothy, Southeast Regional Supervisor, ADF&G Habitat Division. Memorandum: Glacier Creek Investigation Trip Report; dated 6/26/2014. Unpublished document, can be obtained from the Southeast Regional Supervisor, ADF&G Habitat Division, 803 3rd St, Douglas, AK.

Lower Glacier Creek

The Lower Glacier Creek sample site is located at the former Glacier Creek bridge near 230 m elevation, about 1.5 km upstream of the Klehini River (Table 1). We accessed the site from the old bridge abutment at the end of Porcupine Road. CNI samples water quality within this reach at Site P06.

Lower Glacier Creek is a medium glacial outwash channel (Paustian 2010). Gradient ranged 4–5% and the substrate was composed of gravel, cobble, sand, and silt. We sampled a 200 m reach, collecting periphyton, benthic macroinvertebrate, and sediment samples within the upper 50 m where the main channel split into four channels (Figure 3), and fish in a side channel within the lower 75 m of the sample reach (Figure 4). We did not sample the main channel margin, which was too deep and swift to access safely.

Table 1.–Lower Glacier Creek sample site location data.

	Latitude	Longitude
Upper extent	59.41667	-136.30339
Lower extent	59.41771	-136.30050

Note: WGS84 datum.



Figure 3.–Lower Glacier Creek sample site, upper extent.



Figure 4.–Lower Glacier Creek sample site, lower extent.

Middle Glacier Creek

The Middle Glacier Creek sample site is located near 350 m elevation, about 4.5 km upstream of the Klehini River (Table 2). We accessed the site from Glacier Creek Road, using a trail near CNI's weather station, and observed mining debris from a 1970s placer gold mining operation (Hoekzema et al. 1986). CNI samples water quality in Christmas Creek at Site P05.

Middle Glacier Creek is also characterized as a medium glacial outwash channel (Paustian 2010). Gradient ranged 3–6% and the substrate was composed of cobble, gravel, sand, and silt. We sampled a 200 m reach, collecting periphyton, benthic macroinvertebrate, and sediment samples in three side channels within the upper 100 m (Figure 5), and fish within the entire site. Christmas Creek flowed within the Glacier Creek floodplain and converged with a channel braid at the lower end of the sample site (Figure 6). We did not sample the main channel margin, which was too deep and swift to access safely.

Table 2.—Middle Glacier Creek sample site location data.

	Latitude	Longitude
Upper extent	59.40272	-136.33965
Lower extent	59.40371	-136.33735

Note: WGS84 datum.



Figure 5.—Middle Glacier Creek sample site, upper extent.



Figure 6.—Middle Glacier Creek sample site and Christmas Creek (left).

METHODS

We sampled during spring as soon as the Glacier Creek Road was open and prior to peak Glacier Creek discharge as high flows that scour the streambed and cause bedload movement can influence results.

WATER QUALITY

We collected basic water quality data with a YSI Pro 2030, a Hach 2100P Portable Turbidimeter, and colorpHast pH indicator strips^f, and calibrated the YSI and the Hach instruments on site per the manufacturer's instructions before sampling. We present the data by site in a table.

PERIPHYTON DENSITY AND COMMUNITY COMPOSITION

Periphyton is composed of primary producing organisms, such as algae, cyanobacteria, and 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 disturbances that change throughout the year (Barbour 1999). We sampled periphyton in Lower Glacier Creek and Middle Glacier Creek to estimate algal density and community composition at each site, using concentrations of chlorophylls *a*, *b*, and *c*. Chlorophyll *a* pigment is produced by algae and provides an estimate of active algal density. Chlorophyll *b* and *c* pigments provide an estimate of the composition of algal organisms present, such as green algae that produces chlorophyll *b*, and diatoms and brown algae that produce chlorophyll *c*. We use the periphyton data to document baseline primary productivity.

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. We placed a 5 × 5 cm square of high-density foam on each rock and scrubbed the area around the foam with a toothbrush to remove algae and other organisms outside the covered area, then rinsed the rock by dipping it with foam intact in the stream.

We removed the foam square and scrubbed the sample area with a rinsed toothbrush over a 1 μm, 47 mm glass fiber filter attached to a vacuum pump. We used stream water in a wash bottle to rinse the loosened periphyton from the rock, the toothbrush, and the inside of the vacuum pump onto the filter. We pumped most of the water through the filter and added a few drops^g of saturated magnesium carbonate (MgCO₃) to the filter to prevent acidification and conversion of chlorophyll to phaeophytin, before we pumped 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 freezer until we processed them in an ADF&G laboratory.

^f Sensitivity 0.5 units; in the future we will use a pH meter with improved sensitivity.

^g This measurement is not exact as the amount of water used to saturate the magnesium carbonate solution is not exact and fixes the sample regardless of the concentration and without affecting sample integrity.

We followed U.S. Environmental Protection Agency (1997) protocol for chlorophyll extraction and measurement, determining instrument and estimated detection limits, and data analysis.^h We removed the samples from the freezer, cut them into small pieces, and placed the filter pieces for each sample into individual centrifuge tubes containing 10 mL of 90% buffered acetone. We cap the centrifuge tubes, placed them in a rack, covered them with aluminum foil, and stored them in a refrigerator for less than 24 h to extract the chlorophyll. We centrifuged the samples for 20 min at 1,600 rpm and read them on a Shimadzu UV-1800 Spectrophotometer at optical densities (OD) 664 nm, OD 647 nm, and OD 630 nm, and used an acetone blank to correct for the solvent. We also read the samples at OD 750 nm to correct for turbidity. We treated each sample with 80 μ L of 0.1 N hydrochloric acid to convert the chlorophyll to phaeophytin, and read each sample again at OD 665 nm and OD 750 nm.

We used trichromatic equations to estimate chlorophylls *a*, *b*, and *c* concentrations, and correct chlorophyll *a* concentrations when phaeophytin was detected. When chlorophyll *a* was not detected in a sample, we report the concentration at the estimated detection limit and do not report values for chlorophylls *b* or *c*. The 2016 chlorophyll *a* concentration estimated detection limit was 0.19 mg/m².

Data Presentation

We present mean density of chlorophylls *a*, *b*, and *c* by site in a table, mean periphyton density estimated by chlorophyll *a* concentration by site in a figure, mean proportions of chlorophylls *a*, *b*, and *c* by site in a figure, and provide the raw data in Appendix A.

BENTHIC MACROINVERTEBRATE DENSITY AND COMMUNITY COMPOSITION

Benthic macroinvertebrates classified in the orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies), collectively known as EPT taxa, have limited mobility, 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 upon on periphyton and other macroinvertebrates, and provide an important food source for fish. We sampled benthic macroinvertebrates in Lower Glacier Creek and Middle Glacier Creek to estimate density and community composition at each site and document baseline conditions.

Sample Collection and Analysis

We opportunistically sampled benthic macroinvertebrates using a Surber stream bottom sampler in riffle and run habitats with cobble substrate and different flow velocities (Barbour et al. 1999), collecting six samples at each site. Sampling only riffles and runs, habitats that support greater benthic macroinvertebrate densities and number of taxa, reduces variability in the data.

The Surber stream bottom sampler has a 0.093 m² sample area and a 0.3 mm mesh net and cod end. 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 of the Surber sampler, transferred each sample from the cod end to labeled 500 mL plastic bottles, and preserved the samples in 95% ethanol at a ratio of three parts ethanol to one part sample.

^h Except, we store the samples longer than 3.5 weeks and we cut the sample filters, rather than homogenize them, to reduce risk of acetone exposure.

Habitat biologists used an elutriator system and 0.5 mm and 0.3 mm sieves to sort macroinvertebrates from debris,^{i,j} and shipped the samples to NRF Taxonomic Services in Fairbanks, Alaska, for taxonomic identification to the lowest practical level.^k NRF Taxonomic Services provided quality assurance and control by verifying macroinvertebrate identification in three samples.

We calculated benthic macroinvertebrate density (per m²) for each sample by dividing the number of macroinvertebrates by 0.093 m², the Surber sampling area. We estimated mean benthic macroinvertebrate density for each site by calculating the mean density among the six samples. We report taxa richness as the number of taxonomic groups identified to the lowest practical level, and exclude terrestrial 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.¹ 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

We present mean benthic macroinvertebrate data by site in a table, illustrate mean density and community composition by site in figures, and provide the raw data for each sample and a summary of the data for each site in Appendix B.

FISH CONDITION

Age, sex, season, maturation, diet, gut contents, fat reserve, and muscular development affect fish condition. We measured and weighed fish captured in Lower Glacier Creek and Middle Glacier Creek to estimate fish condition.

ⁱ Gordon Willson-Naranjo and Greg Albrecht, Habitat Biologists, to Jackie Timothy, Southeast Regional Supervisor, ADF&G Habitat Division. Memorandum: Benthic macroinvertebrate elutriation trials amendment; dated 12/17/2013.

^j Katrina Lee, Administrative Assistant, to Jackie Timothy, Southeast Regional Supervisor, ADF&G Habitat Division. Memorandum: Benthic macroinvertebrate sample enumeration procedures; dated 6/28/2016.

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

¹ Assuming all taxonomic groups were represented.

Sample Collection and Analysis

We measured FL and weight of resident Dolly Varden char retained for metals concentrations analyses, recording FL to the nearest 1 mm and weight to the nearest 0.1 g. We used the length and weight data to calculate Fulton's condition factor (K) for each fish using the equation given in Anderson and Neumann (1996), where the fish weight (W) is divided by the cubed length (L), and the product multiplied by 100,000:

$$K = \frac{W}{L^3} \times 100,000$$

Data Presentation

We present the mean fish condition factor by species for each site, and provide the raw data in Appendix C.

RESIDENT FISH METALS CONCENTRATIONS

Heavy metals bioavailability and bioaccumulation depends on physical and chemical factors and interactions among biological communities (Tchounwou et al. 2012). Similar to other studies in Alaska (Legere and Timothy 2016), we sampled resident Dolly Varden char in Lower Glacier Creek and Middle Glacier Creek and measured whole body concentrations of silver (Ag), arsenic (As), cadmium (Cd), copper (Cu), lead (Pb), mercury (Hg), selenium (Se), and zinc (Zn) to document baseline concentrations and variability. We chose these analytes based on CNI's Glacier Creek water sample data and potential target metals identified in the ore body.

Sample Collection and Analysis

At Lower Glacier Creek, we captured fish using 11 two-piece 0.635 cm galvanized steel minnow traps following methods described in (Magnus et al. 2006). We baited the traps with disinfected salmon eggs contained in a punctured plastic bag to prevent ingestion and reduce the possibility of sample contamination, and set traps where water depth and flow allowed. At Middle Glacier Creek we captured fish using a Smithroot LR-24 backpack electrofisher in side channels and the lower 50 m of Christmas Creek that flowed within the Glacier Creek floodplain.

We attempted to capture Dolly Varden char measuring 90–130 mm FL, as other Southeast Alaska Dolly Varden char sampling programs require (Kanouse 2015; Legere and Timothy 2016; Timothy and Kanouse 2014). A 90 mm fish meets the minimum weight requirement for laboratory testing, while a 130 mm fish is 2–3 years old and young enough to reasonably conclude it is resident and nonanadromous. We retained fish as they were captured, some outside the size criteria, assuming all fish were resident based on headwater location—nearly 60 km upriver from Chilkat Inlet.

We wore latex gloves when handling fish and placed each fish in an individually labeled plastic bag. We place all samples from each site in a larger plastic bag labeled with the sample location. We stored the samples in a cooler with frozen icepacks during transport, in a camp freezer while onsite, and in a -20 °C freezer in a Juneau ADF&G lab. Upon returning to the Juneau lab, we measured FL and weight of each fish in the sample bag, and corrected for bag weight.

We shipped the samples to ALS Environmental in a cooler with frozen icepacks via overnight air freight, and maintained written chain of custody documentation. ALS Environmental measured total concentrations of Ag, As, Cd, Cu, Pb, Hg, Se, and Zn in each sample on a dry-weight basis,

following EPA method 1631E (Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry) for Hg, and EPA method 200.8 for the other analytes. The laboratory provided Tier II quality assurance/quality information including results for matrix spikes, standard reference materials, sample blanks, and sample duplicates.

Data Presentation

We present minimum, median, and maximum whole body concentrations by site in a figure. A table with the raw data, and the laboratory report, are in Appendix C.

SEDIMENT METALS CONCENTRATIONS

Sediment metals concentrations are influenced by a variety of factors, such as geochemical composition and weathering within the watershed, sediment grain size, organic content, and development. Subsequently, sediment metals concentrations influence benthic aquatic productivity (Tchounwou et al. 2012). We sampled Lower Glacier Creek and Middle Glacier Creek fine sediments for total solids, total volatile solids, total sulfide, total organic carbon, and total concentrations of Ag, aluminum (Al), As, Cd, Cu, iron (Fe), Hg, Pb, Se, and Zn to document baseline conditions. We chose these analytes based on CNI’s Glacier Creek water sample data and potential target metals identified in the ore body.

Sample Collection and Analysis

Wearing latex gloves, we opportunistically collected sand and silt within actively flowing channels and retained the top 4 cm of sediment in three glass jars provided by the laboratory at each site. We stored the samples in a cooler with frozen icepacks during transport, in a camp fridge while onsite, and in a Juneau ADF&G laboratory fridge.

We shipped the samples to ALS Environmental in a cooler with frozen icepacks via overnight air freight, and maintained written chain of custody documentation. ALS Environmental measured total solids, total volatile solids, total sulfide, total organic carbon, and total concentrations of Ag, Al, As, Cd, Cu, Fe, Hg, Pb, Se, and Zn on a dry-weight basis using the methods listed in Table 3. The laboratory provided Tier II quality assurance and quality control information, including results for matrix spikes, sample blanks, and sample duplicates.

Table 3.–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 sulfides	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 ^a	Ag, Al, As, Cd, Cu, Fe, Pb, Se, Zn	200.8

^a ALS Environmental digested the samples per EPA method 3050B and did not sift the samples with a 2000 µm sieve due to the uniform and fine particles present (S. Samy, Kelso Laboratory Senior Project Manager, ALS Environmental, Kelso, WA, personal communication).

Data Presentation

We present sediment composition data by site in a table, sediment metals concentrations by site in a figure, and compare the metals data with the Screening Quick Reference Tables (SQuiRTs) for inorganics in freshwater sediment guidelines developed by the National Oceanic and Atmospheric Administration (Buchman 2008), specifically the threshold effects concentration (TEC) and the probable effects concentrations (PEC). The guidelines are based on results of controlled laboratory bioassays, wherein metals concentrations below the TEC rarely affect aquatic life survival and growth, and metals concentrations above the PEC can affect aquatic life survival and growth. Appendix D contains the laboratory report.

RESULTS

Glacier Creek discharge data were not collected within three weeks prior to sampling to evaluate potential scour that may have influenced the sample data, and fast stream flow prevented us from crossing the stream to measure discharge with a SonTek FlowTracker Acoustic Doppler Velocimeter during sampling. CNI’s Middle Glacier Creek weather station data suggests mostly dry conditions occurring within three weeks prior to sampling, except rainfall a few days before (Figure 7). We were unable to use the weather data to evaluate Glacier Creek discharge, since peak spring discharge may be dependent on glacial and snow melt rates.^m

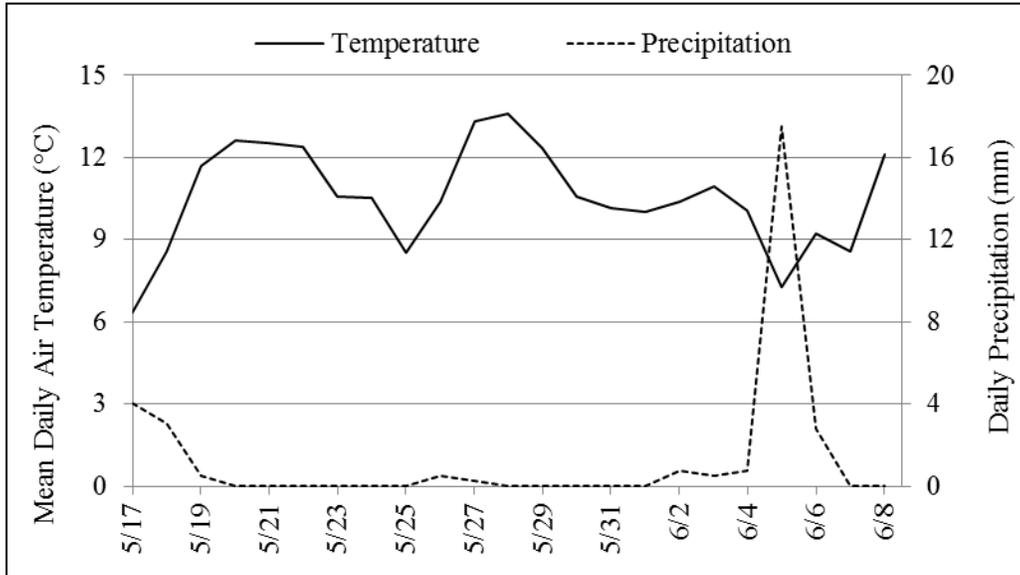


Figure 7.—Air temperature and precipitation three weeks prior to sampling.
 Note: CNI weather station data collected near Middle Glacier Creek.

LOWER GLACIER CREEK

We sampled Lower Glacier Creek on June 7, 2016, and measured basic water quality at 0730 (Table 4).

Table 4.—Lower Glacier Creek water quality data.

Temperature (°C)	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Turbidity (NTU)	pH (SU)
3.3	12.6	115	126	6

Periphyton Density and Community Composition

Among the Lower Glacier Creek periphyton samples, mean chlorophyll *a* density was 2.27 mg/m² and samples contained about 85% chlorophyll *a* and 15% chlorophyll *c*. We did not observe chlorophyll *b* in the samples.

^m Marcia Greenblatt and Alice Conovitz, Integral Consulting, to Darwin Green, Constantine North. Memorandum: Klehini River and Glacier Creek Hydrologic Data Summary; dated 2/24/2016. Unpublished document, can be obtained from Constantine North, Inc., 800 W. Pender St. Ste. 320, Vancouver, BC.

Benthic Macroinvertebrate Density and Community Composition

Among the Lower Glacier Creek benthic macroinvertebrate samples, we identified 17 taxa and estimate benthic macroinvertebrate density at 995 insects/m², of which 10% were EPT insects. The dominant taxon was Diptera: Chironomidae, representing 85% of the samples.

Fish Condition and Metals Concentrations

Mean fish condition of the 10 Dolly Varden char we captured and retained (68–113 mm) was 1.2. We did not capture other fish species while sampling Lower Glacier Creek. Median whole body Dolly Varden char metals concentrations are presented in Table 5.

Table 5.–Lower Glacier Creek Dolly Varden char median metals concentrations.

Ag (mg/kg)	As (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
0.020	0.50	0.613	3.67	0.0414	0.180	6.75	154

Sediment Composition and Metals Concentrations

The Lower Glacier Creek sediment sample was composed of particles less than 2 mm. Total volatile solids measured 2.40%, total organic carbon measured 0.274%, and sulfide was not detected at the method reporting limit of 2.0 mg/kg.

Metals concentrations for the Lower Glacier Creek sediment sample are illustrated in Figure 8. The predominant metals were Al and Fe, which made up 99.4% of the 10 analytes measured. Hg was not detected at the method reporting limit of 0.020 mg/kg.

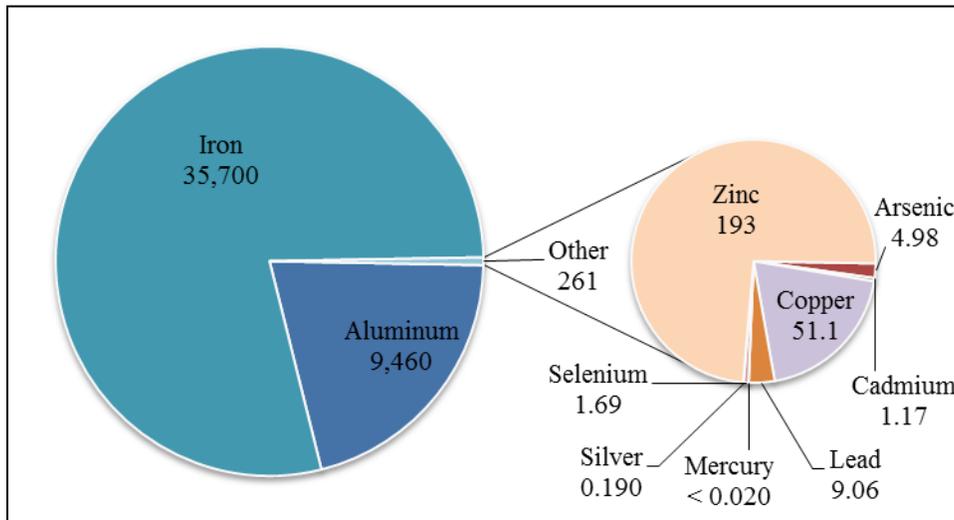


Figure 8.–Lower Glacier Creek sediment metals concentrations (mg/kg).

MIDDLE GLACIER CREEK

We sampled Middle Glacier Creek on June 8, 2016, and measured basic water quality at 0900 (Table 6).

Table 6.–Middle Glacier Creek water quality data.

Temperature (°C)	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Turbidity (NTU)	pH (SU)
3.1	14.1	129	57	6

Periphyton Density and Community Composition

Among the Middle Glacier Creek periphyton samples, mean chlorophyll *a* density was 1.50 mg/m² and samples contained about 85% chlorophyll *a* and 15% chlorophyll *c*.ⁿ We did not observe chlorophyll *b* in the samples.

Benthic Macroinvertebrate Density and Community Composition

Among the Middle Glacier Creek benthic macroinvertebrate samples, we identified 22 taxa and estimate benthic macroinvertebrate density at 2,299 insects/m², of which 13% were EPT insects. The dominant taxon was Diptera: Chironomidae, representing 85% of the samples.

Fish Condition and Metals Concentrations

Mean fish condition of the 10 Dolly Varden char we captured and retained (70–180 mm) was 1.3. We did not capture other fish species while sampling Middle Glacier Creek. Median whole body Dolly Varden char metals concentrations are presented in Table 7.

Table 7.–Middle Glacier Creek Dolly Varden char median metals concentrations.

Ag (mg/kg)	As (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
0.020	0.50	0.328	3.45	0.0300	0.099	5.41	133

Sediment Composition and Metals Concentrations

The Middle Glacier Creek sediment sample was composed of particles less than 2 mm. Total volatile solids measured 3.30%, total organic carbon measured 0.491%, and sulfide was not detected at the method reporting limit of 1.9 mg/kg.

Metals concentrations for the Middle Glacier Creek sediment sample are illustrated in Figure 9. The predominant metals were Al and Fe, which made up 99.4% of the 10 analytes measured (Figure 9). Hg was not detected at the method reporting limit of 0.020 mg/kg.

ⁿ Chlorophylls *a*, *b*, and *c* were not detected in one sample.

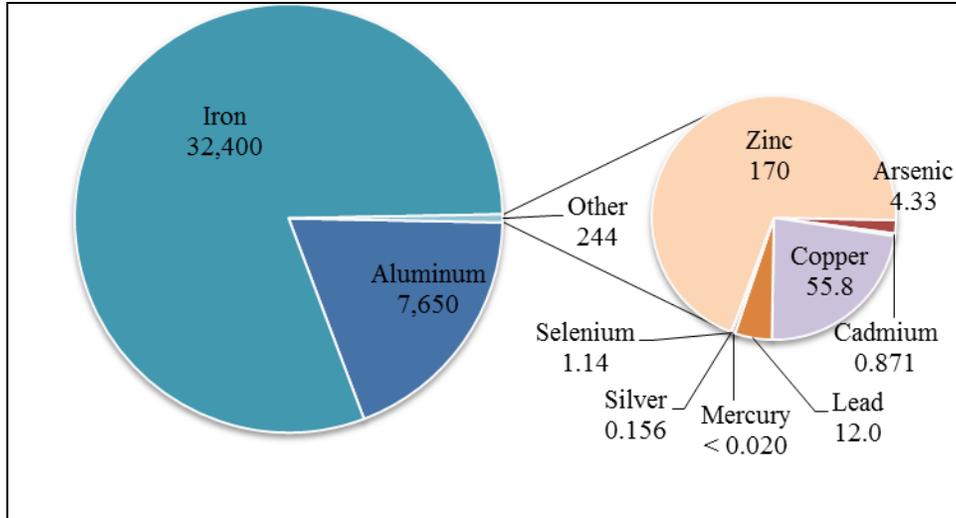


Figure 9.—Middle Glacier Creek sediment metals concentrations (mg/kg).

COMPARISON AMONG SITES

Periphyton Density and Community Composition

Mean periphyton density was slightly greater among the Lower Glacier Creek samples than the Middle Glacier Creek samples, and community composition was similar with most samples containing about 85% chlorophyll *a* and 15% chlorophyll *c* (Table 8; Figures 10, 11). We did not observe chlorophyll *b* in samples from either site.

Table 8.—Glacier Creek mean chlorophylls *a*, *b*, and *c* densities.

Site	Chlorophyll <i>a</i> (mg/m ²)	Chlorophyll <i>b</i> (mg/m ²)	Chlorophyll <i>c</i> (mg/m ²)
Lower Glacier Creek	2.27 ± 1.07	0.00	0.35
Middle Glacier Creek	1.50 ± 1.18	0.00	0.25

Note: ± 1 SD shown with the mean chlorophyll *a* density data.

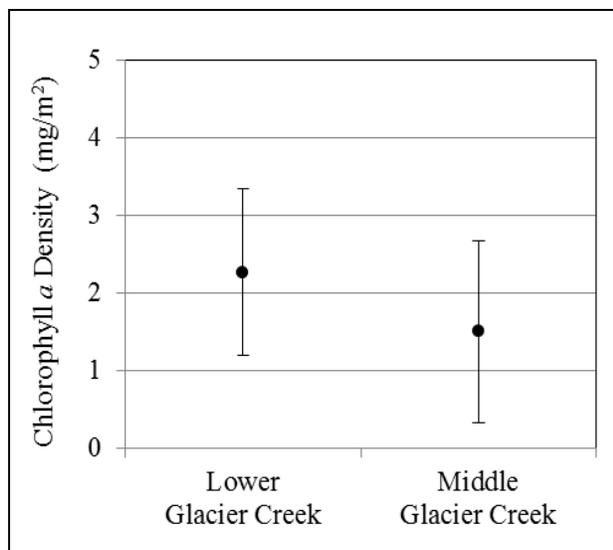


Figure 10.—Glacier Creek mean periphyton densities \pm one standard deviation.

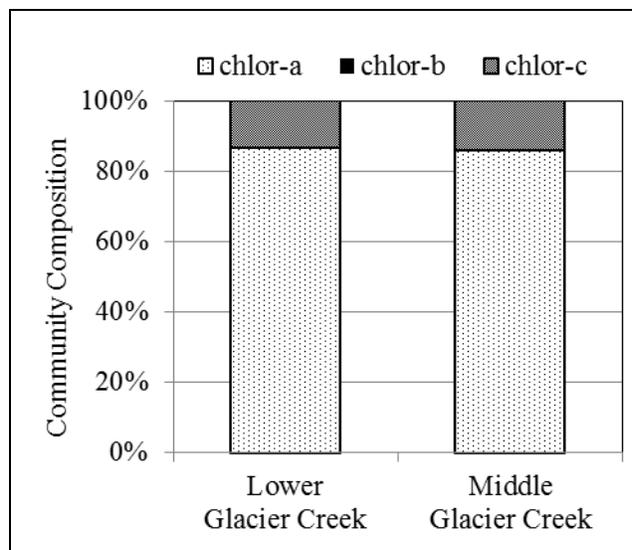


Figure 11.—Glacier Creek mean chlorophylls *a*, *b*, and *c* proportions.

Benthic Macroinvertebrate Density and Community Composition

Mean benthic macroinvertebrate density and number of taxa were greater among Middle Glacier Creek samples than the Lower Glacier Creek samples, while the proportions of EPT insects and dominant taxon, Diptera: Chironomidae, were similar among sites (Table 9; Figures 12, 13). The Shannon diversity and evenness scores were similar among sites, suggesting low diversity and unequal abundance of taxa within the benthic macroinvertebrate communities.

Table 9.—Glacier Creek benthic macroinvertebrate data summaries.

	Lower Glacier Creek	Middle Glacier Creek
Mean benthic macroinvertebrate density (number / m ²)	995 \pm 373	2,299 \pm 976
Number of taxa	17	22
Proportion of EPT insects	10%	13%
Proportion of dominant taxon	85%	85%
Shannon diversity score	0.28	0.26
Evenness score	0.35	0.27

Note: \pm 1 SD shown with the mean benthic macroinvertebrate density data.

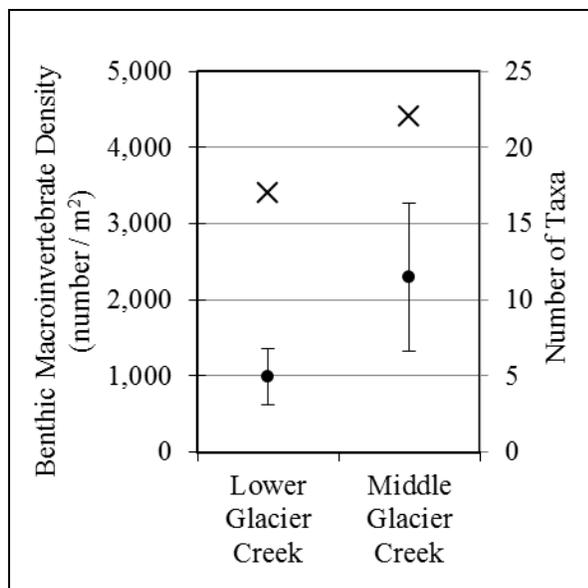


Figure 12.—Glacier Creek mean benthic macroinvertebrate densities \pm one standard deviation and total taxa (\times).

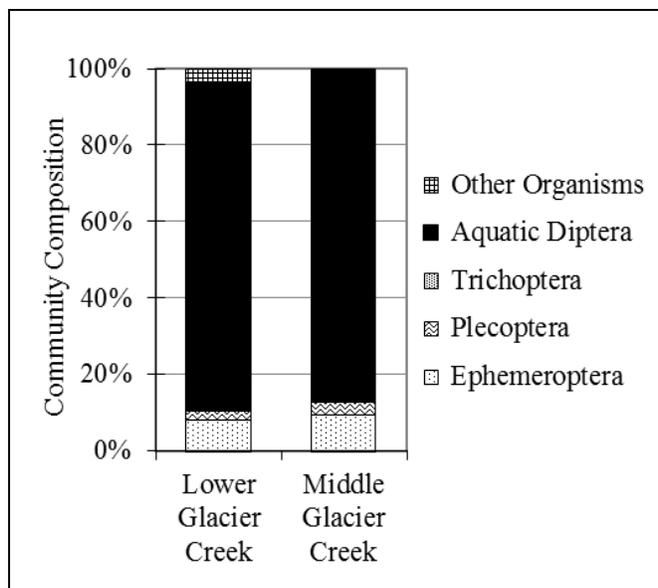


Figure 13.—Glacier Creek mean benthic macroinvertebrate community composition.

Fish Condition and Metals Concentrations

Median whole body Dolly Varden char Cd, Hg, Pb, Se, and Zn concentrations were greatest among the Lower Glacier Creek samples, while Ag, As, and Cu median concentrations were similar among sites (Figure 14), and all concentrations were reasonable when compared with samples collected from reference and exploration sites elsewhere in Alaska (Timothy and Legere 2016). Mean fish condition was similar among the Lower and Middle Glacier Creek Dolly Varden char, and similar to resident Dolly Varden char condition data collected in Southeast Alaska (Brewster 2016a; Brewster 2016b).

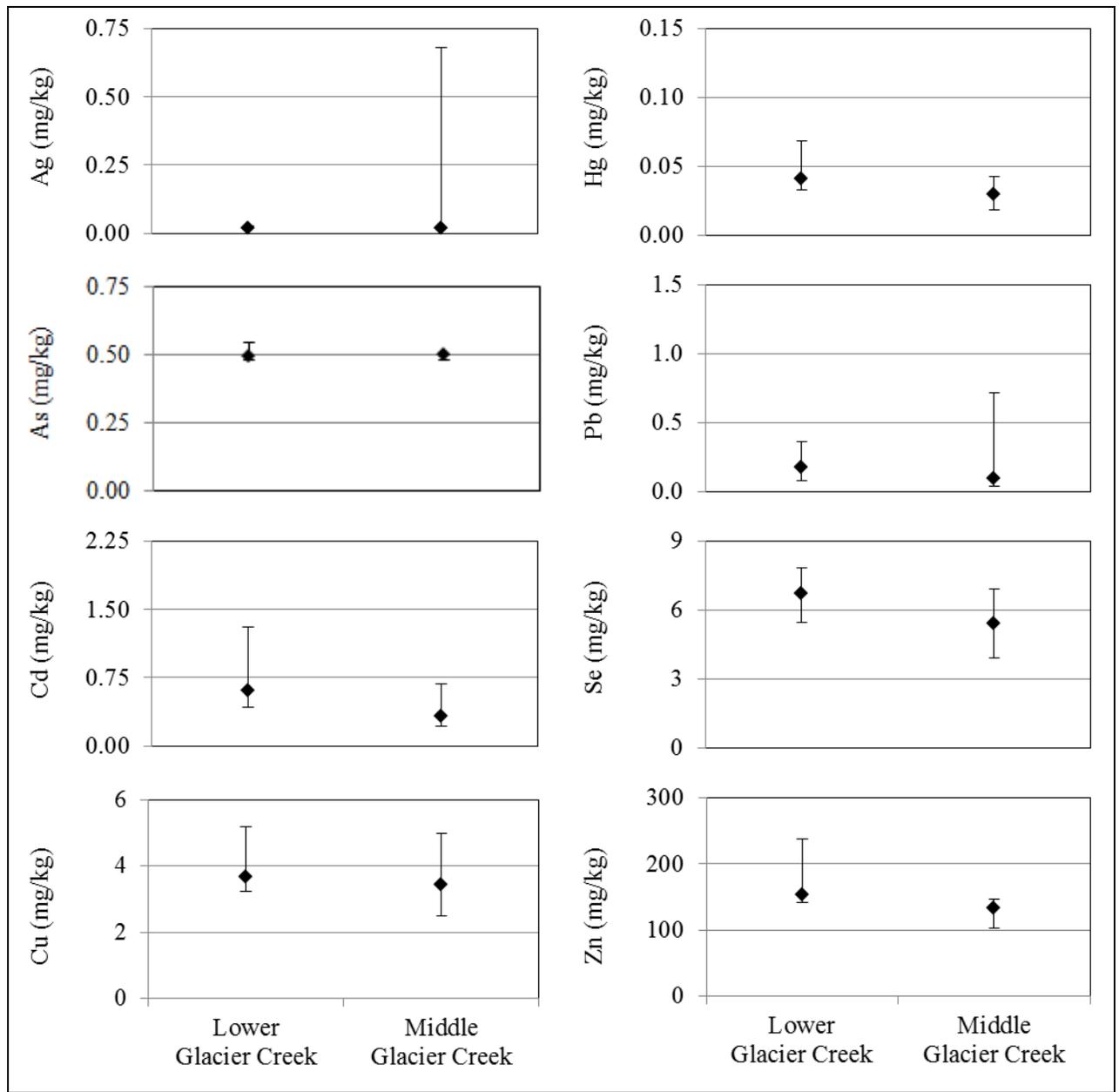


Figure 14.—Glacier Creek whole body Dolly Varden char metals concentrations.
Note: Median, minimum, and maximum concentrations presented.

Sediment Composition and Metals Concentrations

Particle size distribution of the Lower and Middle Glacier Creek sediment samples were similar, and percent total solids, total volatile solids, and total organic carbon were greater in the Middle Glacier Creek sample (Table 10). Sulfide was not detected in either sample.

Table 10.–Glacier Creek sediment sample compositions.

	Lower Glacier Creek	Middle Glacier Creek
Particle size (%)		
Clay	4.0	3.5
Silt	29.8	29.8
Sand	66.2	66.7
Coarse material (> 2 mm)	0.0	0.0
Total solids (%)	78.8	80.5
Total volatile solids (%)	2.40	3.30
Total organic carbon (%)	0.274	0.491
Total sulfides (mg/kg)	< 2.0	< 1.9

Most metals concentrations were greatest in the Lower Glacier Creek sample, except Cu and Pb (Figure 15). Hg was not detected in either sample.

We evaluated the data against the SQuiRT guidelines for freshwater sediments (Buchman 2008) and found Cd, Cu, and Zn concentrations near or above the TEC values, and As, Hg, and Pb concentrations below the TEC values at both sites (Figure 15).^o Guidelines are not published for Ag, Al, Fe, or Se.

^o Metals concentrations below the TEC value rarely affect aquatic life survival and growth (Buchman 2008).

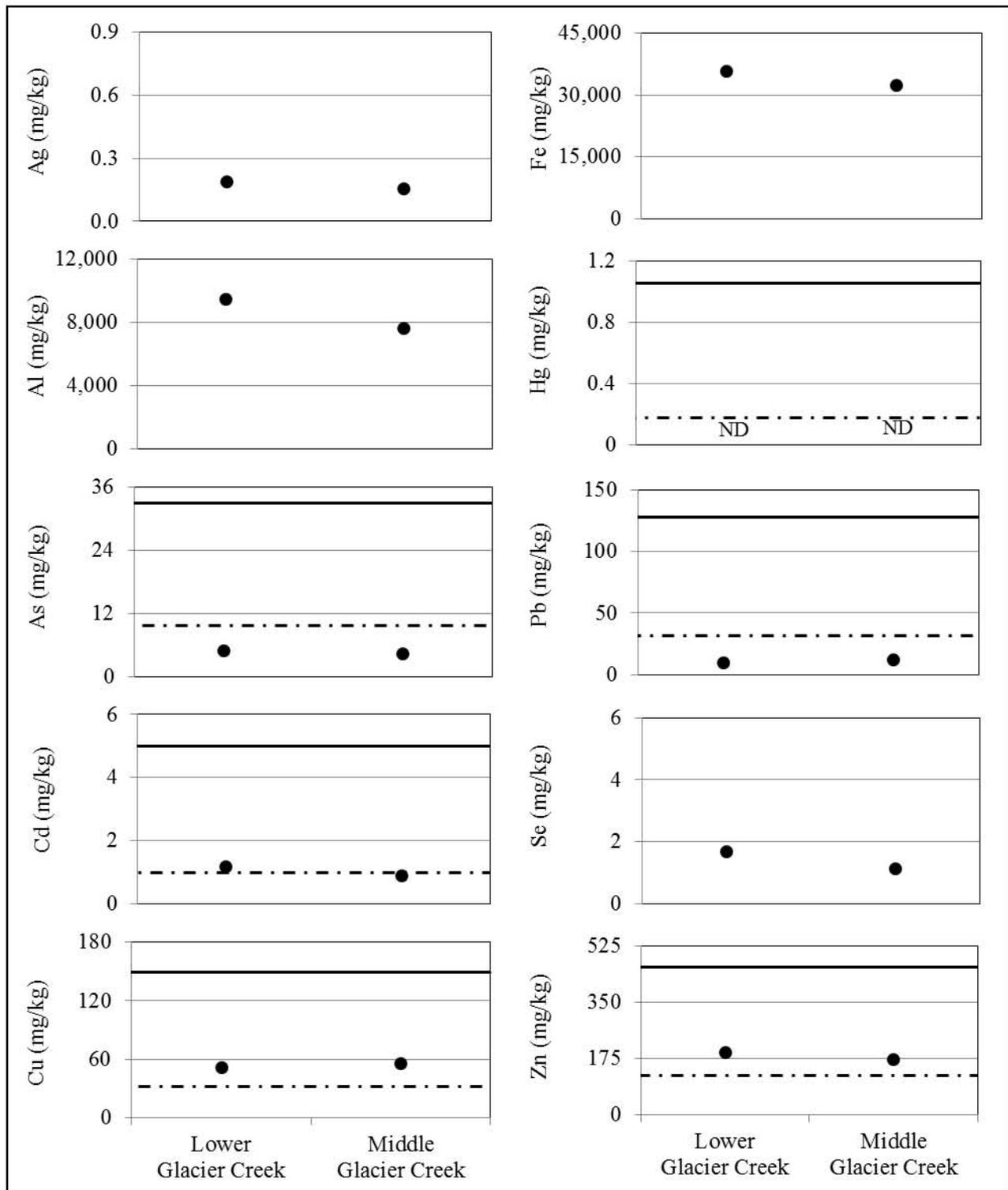


Figure 15.–Glacier Creek sediment metals concentrations.

Note: The dashed line represents the TEC and the solid line represents the PEC for each analyte in freshwater sediments (Buchman 2008); guidelines are not published for Ag, Al, Fe, or Se; ND = not detected.

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APPENDIX A: PERIPHYTON DATA

Appendix A.1.–2016 Glacier Creek chlorophylls *a*, *b*, and *c* density data.

mg/m ²	Lower Glacier Creek			Middle Glacier Creek		
	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>	chlor- <i>a</i>	chlor- <i>b</i>	chlor- <i>c</i>
	3.35	0.00	0.47	1.82	0.00	0.30
	3.31	0.00	0.51	4.38	0.00	0.75
	2.56	0.00	0.45	0.96	0.00	0.10
	1.28	0.00	0.29	1.60	0.00	0.26
	3.10	0.00	0.38	0.19	---	---
	1.97	0.00	0.29	1.17	0.00	0.13
	0.53	0.00	0.11	0.96	0.00	0.15
	2.03	0.00	0.30	1.82	0.00	0.27
	3.52	0.00	0.63	0.28	0.00	0.00
	1.01	0.00	0.09	1.82	0.00	0.27
Mean	2.27	0.00	0.35	1.50	0.00	0.25
Median	2.30	0.00	0.34	1.39	0.00	0.26
Maximum	3.52	0.00	0.63	4.38	0.00	0.75
Minimum	0.53	0.00	0.09	0.19	0.00	0.00

Note: Bold value is the estimated detection limit, chlorophyll *a* was not detected in the sample.

APPENDIX B: BENTHIC MACROINVERTEBRATE DATA

Appendix B.1.–2016 Lower Glacier Creek benthic macroinvertebrate sample data.

Class	Order	Family	Genus	Sample Number						Total
				1	2	3	4	5	6	
Insecta	Ephemeroptera	Baetidae	Baetis	6	4	3	6	3	9	31
		Ephemerellidae	Drunella	1	0	0	0	1	0	2
		Heptageniidae	Cinygmula	0	0	0	0	0	0	0
			Epeorus	0	2	0	0	0	0	2
			Rhithrogena	0	0	1	0	4	0	5
			Unidentified	Unidentified	2	1	0	0	1	0
	Plecoptera	Chloroperlidae	Alaskaperla	0	0	0	0	0	0	0
			Haploperla	0	0	0	1	1	1	3
		Nemouridae	Podmosta	0	0	0	2	0	0	2
			Zapada	0	1	0	0	0	0	1
		Perlodidae	Megarcys	0	0	0	0	0	0	0
			Unidentified	Unidentified	1	0	0	0	0	0
		Unidentified	Unidentified	0	0	0	3	2	1	6
	Trichoptera	Hydropsychidae	Hydropsyche	0	0	0	0	0	1	1
		Rhyacophilidae	Rhyacophila	0	0	0	0	0	0	0
	Diptera	Chironomidae	Unidentified	107	83	52	31	71	126	470
		Dixidae	Unidentified	0	0	1	0	0	0	1
		Empididae	Chelifera	0	0	0	0	0	0	0
			Unidentified	0	0	0	0	0	0	0
		Limoniidae	Gonomyodes	0	0	1	1	1	0	3
		Simuliidae	Simulium	0	0	0	0	0	0	0
Tipulidae		Dicranota	0	1	0	0	0	0	1	
		Tipula	0	0	1	0	0	0	1	
Unidentified		Unidentified	1	1	0	0	0	0	2	
Coleoptera	Unidentified	Unidentified	0	0	0	0	0	0	0	
Entognatha	Collembola	Unidentified	Unidentified	0	0	0	1	1	0	2
Oligochaeta	Unidentified	Unidentified	Unidentified	1	2	3	4	3	3	16
Ostracoda	Unidentified	Unidentified	Unidentified	0	0	0	0	0	1	1
Total				119	95	62	49	88	142	555

Appendix B.2.–2016 Middle Glacier Creek benthic macroinvertebrate sample data.

Class	Order	Family	Genus	Sample Number						Total
				1	2	3	4	5	6	
Insecta	Ephemeroptera	Baetidae	Baetis	11	15	13	36	9	3	87
		Ephemerellidae	Drunella	1	0	0	0	0	0	1
		Heptageniidae	Cinygmula	1	1	1	3	2	1	9
			Epeorus	0	0	0	2	2	0	4
			Rhithrogena	2	1	0	2	4	4	13
	Unidentified	Unidentified	0	0	0	5	0	0	5	
	Plecoptera	Chloroperlidae	Alaskaperla	0	3	1	1	0	0	5
			Haploperla	0	0	0	0	0	0	0
		Nemouridae	Podmosta	0	2	0	0	1	0	3
			Zapada	2	5	0	7	2	0	16
		Perlodidae	Megarcys	0	1	0	1	0	0	2
			Unidentified	0	0	5	0	0	0	5
	Unidentified	Unidentified	1	9	0	4	0	0	14	
	Trichoptera	Hydropsychidae	Hydropsyche	0	0	0	0	1	1	2
		Rhyacophilidae	Rhyacophila	1	0	1	0	0	0	2
	Diptera	Chironomidae	Unidentified	129	237	289	220	141	79	1,095
		Dixidae	Unidentified	0	0	0	0	0	0	0
		Empididae	Chelifera	0	0	0	0	1	0	1
			Unidentified	0	0	0	1	0	0	1
		Limoniidae	Gonomyodes	2	0	1	2	1	0	6
Simuliidae		Simulium	1	1	0	0	1	0	3	
Tipulidae		Dicranota	0	1	0	0	0	0	1	
		Tipula	0	0	0	0	0	0	0	
Unidentified		Unidentified	0	0	0	0	0	0	0	
Coleoptera	Unidentified	Unidentified	1	1	1	0	0	0	3	
Entognatha	Collembola	Unidentified	Unidentified	0	0	0	0	0	0	
Oligochaeta	Unidentified	Unidentified	Unidentified	1	1	2	0	0	4	
Ostracoda	Unidentified	Unidentified	Unidentified	0	0	1	0	0	1	
Total				153	278	315	284	165	88	1,283

Appendix B.3.–2016 Glacier Creek benthic macroinvertebrate data summaries.

	Lower Glacier Creek	Middle Glacier Creek
Total benthic macroinvertebrate taxa counted	17	22
Number of Ephemeroptera	44	119
Number of Plecoptera	13	45
Number of Trichoptera	1	4
Number of aquatic Diptera	478	1,107
Number of other organisms	19	8
% Ephemeroptera	8%	9%
% Plecoptera	2%	4%
% Trichoptera	0%	0%
% Aquatic Diptera	86%	86%
% Other organisms	3%	1%
% EPT	10%	13%
% Chironomidae	85%	85%
Shannon diversity score (<i>H</i>)	0.28	0.26
Evenness score (<i>E</i>)	0.35	0.27
Number of terrestrial organisms	17	19
Number of benthic macroinvertebrates	555	1,283
Total terrestrial and macroinvertebrates counted	572	1,302
% Sample aquatic	97.0%	98.5%
% Sample terrestrial	3.0%	1.5%
Total Sample Area (m ²)	0.558	0.558
Mean benthic macroinvertebrate density per m ²	995	2,299
SD ± 1 standard deviation	373	976

**APPENDIX C: FISH METALS CONCENTRATIONS
AND LABORATORY REPORT**

Appendix C.1.–2016 Lower Glacier Creek whole body Dolly Varden char metals concentrations data.

Sample Date	Sample No.	Length (mm)	Weight (g)	Condition (K)	Ag (mg/kg)	As (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
6/7/2016	1	108	12.7	1.0	<0.019	<0.48	0.429	3.55	0.0466	0.076	7.23	153
6/7/2016	2	68	4.8	1.5	<0.020	<0.50	0.501	3.75	0.0330	0.182	7.60	173
6/7/2016	3	112	17.7	1.3	0.025	<0.48	1.31	3.63	0.0567	0.230	5.48	145
6/7/2016	4	105	15.9	1.4	<0.019	<0.48	0.585	3.23	0.0509	0.078	7.56	150
6/7/2016	5	113	14.3	1.0	<0.02	0.50	0.420	3.42	0.0427	0.177	6.21	154
6/7/2016	6	94	10.8	1.3	<0.019	0.52	0.441	4.35	0.0381	0.195	7.83	167
6/7/2016	7	109	14.6	1.1	0.026	<0.50	1.25	5.20	0.0683	0.362	6.46	238
6/7/2016	8	97	11.2	1.2	<0.019	<0.49	0.641	3.71	0.0401	0.172	6.11	154
6/8/2016	9	93	9.5	1.2	<0.020	<0.49	0.960	3.32	0.0349	0.091	7.04	141
6/8/2016	10	73	4.7	1.2	0.025	0.54	0.730	4.67	0.0353	0.360	6.31	168

Appendix C.2.–2016 Middle Glacier Creek whole body Dolly Varden char metals concentrations data.

Sample Date	Sample No.	Length (mm)	Weight (g)	Condition (K)	Ag (mg/kg)	As (mg/kg)	Cd (mg/kg)	Cu (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Se (mg/kg)	Zn (mg/kg)
6/8/2016	1	150	36.0	1.1	0.031	<0.48	0.605	3.37	0.0429	0.069	5.66	143
6/8/2016	2	108	15.9	1.3	<0.020	<0.50	0.327	4.33	0.0337	0.183	6.91	147
6/8/2016	3	123	26.5	1.4	<0.020	<0.50	0.683	3.83	0.0301	0.717	5.64	117
6/8/2016	4	73	5.2	1.3	<0.020	<0.49	0.288	4.99	0.0260	0.128	3.94	128
6/8/2016	5	180	66.7	1.1	<0.020	<0.50	0.329	3.11	0.0376	0.061	5.17	132
6/8/2016	6	77	6.0	1.3	<0.020	<0.50	0.215	3.53	0.0259	0.259	4.8	146
6/8/2016	7	83	7.8	1.4	<0.020	<0.50	0.280	3.75	0.0247	0.182	6.05	132
6/8/2016	8	146	31.5	1.0	<0.020	<0.50	0.521	2.50	0.0299	0.062	4.9	103
6/8/2016	9	83	7.0	1.2	<0.020	<0.50	0.678	2.56	0.0328	0.046	4.66	139
6/8/2016	10	70	5.0	1.5	0.682	<0.50	0.257	2.63	0.0184	0.036	6.29	133



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August 02, 2016

Analytical Report for Service Request No: K1606675

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

RE: 2016 Glacier Creek Biomonitoring Samples

Dear Kate,

Enclosed are the results of the sample(s) submitted to our laboratory June 16, 2016
For your reference, these analyses have been assigned our service request number **K1606675**.

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 3293. You may also contact me via email at Shar.Samy@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Shar Samy, Ph.D.
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 DEC UST	http://dec.alaska.gov/applications/eh/ehllabreports/USTLabs.aspx	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	L14-51
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	Not available	-
ISO 17025	http://www.pjllabs.com/	L16-57
Louisiana DEQ	http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx	03016
Maine DHS	Not available	WA01276
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Montana DPHHS	http://www.dphhs.mt.gov/publichealth/	CERT0047
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/oqa/	WA005
North Carolina DWQ	http://www.dwqlab.org/	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/envserv/	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
Wisconsin DNR	http://dnr.wi.gov/	998386840
Wyoming (EPA Region 8)	http://www.epa.gov/region8/water/dwhome/wyomingdi.html	-
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

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ALS ENVIRONMENTAL

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue

Service Request No.: K1606675
Date Received: 06/16/16

Case Narrative

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples designated for Tier II data deliverables. When appropriate to the method, method blank results have been reported with each analytical test. Additional quality control analyses reported herein include: Laboratory Duplicate (DUP), Matrix Spike (MS), and Matrix/Duplicate Matrix Spike (MS/DMS).

Sample Receipt

Twenty animal tissue samples were received for analysis at ALS Environmental on 06/16/16. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored frozen at -20°C upon receipt at the laboratory.

Total Metals

No anomalies associated with the analysis of these samples were observed.

Approved by _____





Chain of Custody

ALS Environmental—Kelso Laboratory
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Phone (360)577-7222 Fax (360)636-1068
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Palmer Project
 2016 Glacier Creek Biomonitoring Samples
 Juvenile Dolly Varden char for whole body metals analyses
 Basis, all samples: dry weight, report % solids
 Requested Analysis for each sample: Ag,As, Cd, Cu, Hg, Pb, Se, Zn

R1606075

Matrix	Collector	Date Collected	Sample Name	Lab Sample Name	Analysis Requested	Fork Length (mm)	Weight (g)
Whole Body	ADF&G	6/7/2016	Lower Glacier Creek DV Metals Fish Sample #1	060716LGCDV1	Ag, As, Cd, Cu, Hg, Pb, Se, Zn	108	12.7
Whole Body	ADF&G	6/7/2016	Lower Glacier Creek DV Metals Fish Sample #2	060716LGCDV2	Ag, As, Cd, Cu, Hg, Pb, Se, Zn	68	4.8
Whole Body	ADF&G	6/7/2016	Lower Glacier Creek DV Metals Fish Sample #3	060716LGCDV3	Ag, As, Cd, Cu, Hg, Pb, Se, Zn	112	17.7
Whole Body	ADF&G	6/7/2016	Lower Glacier Creek DV Metals Fish Sample #4	060716LGCDV4	Ag, As, Cd, Cu, Hg, Pb, Se, Zn	105	15.9
Whole Body	ADF&G	6/7/2016	Lower Glacier Creek DV Metals Fish Sample #5	060716LGCDV5	Ag, As, Cd, Cu, Hg, Pb, Se, Zn	113	14.3
Whole Body	ADF&G	6/7/2016	Lower Glacier Creek DV Metals Fish Sample #6	060716LGCDV6	Ag, As, Cd, Cu, Hg, Pb, Se, Zn	94	10.8
Whole Body	ADF&G	6/7/2016	Lower Glacier Creek DV Metals Fish Sample #7	060716LGCDV7	Ag, As, Cd, Cu, Hg, Pb, Se, Zn	109	14.6
Whole Body	ADF&G	6/7/2016	Lower Glacier Creek DV Metals Fish Sample #8	060716LGCDV8	Ag, As, Cd, Cu, Hg, Pb, Se, Zn	97	11.2
Whole Body	ADF&G	6/8/2016	Lower Glacier Creek DV Metals Fish Sample #9	060816LGCDV9	Ag, As, Cd, Cu, Hg, Pb, Se, Zn	93	9.5
Whole Body	ADF&G	6/8/2016	Lower Glacier Creek DV Metals Fish Sample #10	060816LGCDV10	Ag, As, Cd, Cu, Hg, Pb, Se, Zn	73	4.7
Whole Body	ADF&G	6/8/2016	Middle Glacier Creek DV Metals Fish Sample #1	060816MGCDV1	Ag, As, Cd, Cu, Hg, Pb, Se, Zn	150	36.0
Whole Body	ADF&G	6/8/2016	Middle Glacier Creek DV Metals Fish Sample #2	060816MGCDV2	Ag, As, Cd, Cu, Hg, Pb, Se, Zn	108	15.9
Whole Body	ADF&G	6/8/2016	Middle Glacier Creek DV Metals Fish Sample #3	060816MGCDV3	Ag, As, Cd, Cu, Hg, Pb, Se, Zn	123	26.5
Whole Body	ADF&G	6/8/2016	Middle Glacier Creek DV Metals Fish Sample #4	060816MGCDV4	Ag, As, Cd, Cu, Hg, Pb, Se, Zn	73	5.2
Whole Body	ADF&G	6/8/2016	Middle Glacier Creek DV Metals Fish Sample #5	060816MGCDV5	Ag, As, Cd, Cu, Hg, Pb, Se, Zn	180	66.7
Whole Body	ADF&G	6/8/2016	Middle Glacier Creek DV Metals Fish Sample #6	060816MGCDV6	Ag, As, Cd, Cu, Hg, Pb, Se, Zn	77	6.0
Whole Body	ADF&G	6/8/2016	Middle Glacier Creek DV Metals Fish Sample #7	060816MGCDV7	Ag, As, Cd, Cu, Hg, Pb, Se, Zn	83	7.8
Whole Body	ADF&G	6/8/2016	Middle Glacier Creek DV Metals Fish Sample #8	060816MGCDV8	Ag, As, Cd, Cu, Hg, Pb, Se, Zn	146	31.5
Whole Body	ADF&G	6/8/2016	Middle Glacier Creek DV Metals Fish Sample #9	060816MGCDV9	Ag, As, Cd, Cu, Hg, Pb, Se, Zn	83	7.0
Whole Body	ADF&G	6/8/2016	Middle Glacier Creek DV Metals Fish Sample #10	060816MGCDV10	Ag, As, Cd, Cu, Hg, Pb, Se, Zn	70	5.0

Rec'd 6/16/16 1010
[Signature]



PC Shar

Cooler Receipt and Preservation Form

Client Alaska Dept. of Fish and Game Service Request K16 06079

Received: June 16, 11 Opened: 6/16 By: SD Unloaded: 6/16 By: SD

- 1. Samples were received via? Mail Fed Ex UPS DHL PDX Courier Hand Delivered
- 2. Samples were received in: (circle) Cooler Box Envelope Other _____ NA
- 3. 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
<u>3.5</u>	<u>3.4</u>	<u>3.8</u>	<u>3.7</u>	<u>0.1</u>	<u>323</u>		<u>78335322203</u>	

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

Sample ID on Bottle	Sample ID on COC	Identified by:

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

Notes, Discrepancies, & Resolutions COC NOT signed by client



Total Solids

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ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Analysis Method: Freeze Dry
Prep Method: None

Service Request: K1606675
Date Collected: 06/07/16 - 06/08/16
Date Received: 06/16/16
Units: Percent
Basis: Wet

Total Solids

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
060716LGCDV1	K1606675-001	25.2	-	1	07/14/16 15:43	
060716LGCDV2	K1606675-002	24.0	-	1	07/14/16 15:43	
060716LGCDV3	K1606675-003	25.3	-	1	07/14/16 15:43	
060716LGCDV4	K1606675-004	25.5	-	1	07/14/16 15:43	
060716LGCDV5	K1606675-005	25.8	-	1	07/14/16 15:43	
060716LGCDV6	K1606675-006	25.2	-	1	07/14/16 15:43	
060716LGCDV7	K1606675-007	21.8	-	1	07/14/16 15:43	
060716LGCDV8	K1606675-008	24.8	-	1	07/14/16 15:43	
060816LGCDV9	K1606675-009	25.2	-	1	07/14/16 15:43	
060816LGCDV10	K1606675-010	24.1	-	1	07/14/16 15:43	
060816MGCDV1	K1606675-011	26.5	-	1	07/14/16 15:43	
060816MGCDV2	K1606675-012	25.3	-	1	07/14/16 15:43	
060816MGCDV3	K1606675-013	27.1	-	1	07/14/16 15:43	
060816MGCDV4	K1606675-014	24.4	-	1	07/14/16 15:43	
060816MGCDV5	K1606675-015	23.3	-	1	07/14/16 15:43	
060816MGCDV6	K1606675-016	25.6	-	1	07/14/16 15:43	
060816MGCDV7	K1606675-017	24.0	-	1	07/14/16 15:43	
060816MGCDV8	K1606675-018	27.2	-	1	07/14/16 15:43	
060816MGCDV9	K1606675-019	23.1	-	1	07/14/16 15:43	
060816MGCDV10	K1606675-020	23.8	-	1	07/14/16 15:43	



Metals

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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: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal tissue

Service Request: K1606675
Date Collected: 06/07-06/08/16
Date Received: 06/16/16

Mercury, Total

Prep Method: METHOD
Analysis Method: 1631E
Test Notes:

Units: ng/g
Basis: Dry

Sample Name	Lab Code	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
060716LGCDV1	K1606675-001	4.8	5	07/25/16	07/26/16	46.6	
060716LGCDV2	K1606675-002	2.0	2	07/25/16	07/26/16	33.0	
060716LGCDV3	K1606675-003	5.0	5	07/25/16	07/26/16	56.7	
060716LGCDV4	K1606675-004	5.0	5	07/25/16	07/26/16	50.9	
060716LGCDV5	K1606675-005	4.8	5	07/25/16	07/26/16	42.7	
060716LGCDV6	K1606675-006	4.9	5	07/25/16	07/26/16	38.1	
060716LGCDV7	K1606675-007	5.0	5	07/25/16	07/26/16	68.3	
060716LGCDV8	K1606675-008	4.9	5	07/25/16	07/26/16	40.1	
060816LGCDV9	K1606675-009	4.8	5	07/25/16	07/26/16	34.9	
060816LGCDV10	K1606675-010	2.0	2	07/25/16	07/26/16	35.3	
060816MGCDV1	K1606675-011	4.8	5	07/25/16	07/26/16	42.9	
060816MGCDV2	K1606675-012	4.9	5	07/25/16	07/26/16	33.7	
060816MGCDV3	K1606675-013	5.0	5	07/25/16	07/26/16	30.1	
060816MGCDV4	K1606675-014	2.0	2	07/25/16	07/26/16	26.0	
060816MGCDV5	K1606675-015	5.0	5	07/25/16	07/26/16	37.6	
060816MGCDV6	K1606675-016	1.9	2	07/25/16	07/26/16	25.9	
060816MGCDV7	K1606675-017	4.9	5	07/25/16	07/26/16	24.7	
060816MGCDV8	K1606675-018	4.8	5	07/25/16	07/26/16	29.9	
060816MGCDV9	K1606675-019	5.0	5	07/25/16	07/26/16	32.8	
060816MGCDV10	K1606675-020	1.9	2	07/25/16	07/26/16	18.4	
Method Blank 1	K1606675-MB1	1.0	1	07/25/16	07/26/16	ND	
Method Blank 2	K1606675-MB2	1.0	1	07/25/16	07/26/16	ND	
Method Blank 3	K1606675-MB3	1.0	1	07/25/16	07/26/16	ND	

ALS Group USA, Corp.
dba ALS Environmental
 QA/QC Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal tissue

Service Request: K1606675
Date Collected: 06/08/16
Date Received: 06/16/16
Date Extracted: 07/25/16
Date Analyzed: 07/26/16

Matrix Spike/Duplicate Matrix Spike Summary
 Total Metals

Sample Name: 060816MGCDV1 Units: ng/g
 Lab Code: K1606675-011MS, K1606675-011MSD Basis: Dry
 Test Notes:

Analyte	Prep Method	Analysis Method	MRL	Spike Level		Sample Result	Spike Result		Percent Recovery		ALS Acceptance Limits	Relative Percent Difference	Result Notes
				MS	DMS		MS	DMS	MS	DMS			
Mercury	METHOD	1631E	4.9	243	244	42.9	297	298	105	105	70-130	<1	

ALS Group USA, Corp.
dba ALS Environmental
 QA/QC Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal tissue

Service Request: K1606675
Date Collected: 06/08/16
Date Received: 06/16/16
Date Extracted: 07/25/16
Date Analyzed: 07/26/16

Matrix Spike/Duplicate Matrix Spike Summary
 Total Metals

Sample Name: 060816MGCDV3 Units: ng/g
 Lab Code: K1606675-013MS, K1606675-013MSD Basis: Dry
 Test Notes:

Analyte	Prep Method	Analysis Method	MRL	Spike Level		Sample Result	Spike Result		Percent Recovery		ALS Acceptance Limits	Relative Percent Difference	Result Notes
				MS	DMS		MS	DMS	MS	DMS			
Mercury	METHOD	1631E	5.0	245	251	30.1	292	299	107	107	70-130	2	

ALS Group USA, Corp.
 dba ALS Environmental
 QA/QC Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
LCS Matrix: Water

Service Request: K1606675
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 07/26/16

Ongoing Precision and Recovery (OPR) Sample Summary
 Total Metals

Sample Name: Ongoing Precision and Recovery (Initial) Units: ng/g
 Basis: NA

Test Notes:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS	Result Notes
						Percent Recovery Acceptance Limits	
Mercury	METHOD	1631E	5.00	4.92	98	70-130	

ALS Group USA, Corp.
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QA/QC Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
LCS Matrix: Water

Service Request: K1606675
Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 07/26/16

Ongoing Precision and Recovery (OPR) Sample Summary
 Total Metals

Sample Name: Ongoing Precision and Recovery (Final) Units: ng/g
 Basis: NA

Test Notes:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS	Result Notes
						Percent Recovery Acceptance Limits	
Mercury	METHOD	1631E	5.00	4.58	92	70-130	

ALS Group USA, Corp.
 dba ALS Environmental
 QA/QC Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
LCS Matrix: Animal tissue

Service Request: K1606675
Date Collected: NA
Date Received: NA
Date Extracted: 07/25/16
Date Analyzed: 07/26/16

Quality Control Sample (QCS) Summary
 Total Metals

Sample Name: Quality Control Sample Units: ng/g
 Lab Code: Basis: Dry
 Test Notes:

Source: TORT-3

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	ALS	Result Notes
						Percent Recovery Acceptance Limits	
Mercury	METHOD	1631E	292	293	100	70-130	

ALS Group USA, Corp.
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Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Sample Name: 060716LGCDV1
Lab Code: K1606675-001

Service Request: K1606675
Date Collected: 06/07/16
Date Received: 06/16/16 10:10

Basis: Dry, per Method

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	ND U	mg/Kg	0.50	5	07/26/16 08:22	07/21/16	
Cadmium	200.8	0.439	mg/Kg	0.020	5	07/26/16 08:22	07/21/16	
Copper	200.8	3.41	mg/Kg	0.10	5	07/26/16 08:22	07/21/16	
Lead	200.8	0.082	mg/Kg	0.020	5	07/28/16 10:31	07/21/16	
Selenium	200.8	7.1	mg/Kg	1.0	5	07/26/16 08:22	07/21/16	
Silver	200.8	ND U	mg/Kg	0.020	5	07/26/16 08:22	07/21/16	
Zinc	200.8	149	mg/Kg	0.50	5	07/26/16 08:22	07/21/16	

ALS Group USA, Corp.
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Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Sample Name: 060716LGCDV2
Lab Code: K1606675-002

Service Request: K1606675
Date Collected: 06/07/16
Date Received: 06/16/16 10:10

Basis: Dry, per Method

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	ND U	mg/Kg	0.50	5	07/26/16 08:37	07/21/16	
Cadmium	200.8	0.501	mg/Kg	0.020	5	07/26/16 08:37	07/21/16	
Copper	200.8	3.75	mg/Kg	0.099	5	07/26/16 08:37	07/21/16	
Lead	200.8	0.182	mg/Kg	0.020	5	07/28/16 10:36	07/21/16	
Selenium	200.8	7.60	mg/Kg	0.99	5	07/26/16 08:37	07/21/16	
Silver	200.8	ND U	mg/Kg	0.020	5	07/26/16 08:37	07/21/16	
Zinc	200.8	173	mg/Kg	0.50	5	07/26/16 08:37	07/21/16	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Sample Name: 060716LGCDV3
Lab Code: K1606675-003

Service Request: K1606675
Date Collected: 06/07/16
Date Received: 06/16/16 10:10
Basis: Dry, per Method

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	ND U	mg/Kg	0.48	5	07/26/16 08:42	07/21/16	
Cadmium	200.8	1.31	mg/Kg	0.019	5	07/26/16 08:42	07/21/16	
Copper	200.8	3.63	mg/Kg	0.097	5	07/26/16 08:42	07/21/16	
Lead	200.8	0.230	mg/Kg	0.019	5	07/28/16 10:37	07/21/16	
Selenium	200.8	5.48	mg/Kg	0.97	5	07/26/16 08:42	07/21/16	
Silver	200.8	0.025	mg/Kg	0.019	5	07/26/16 08:42	07/21/16	
Zinc	200.8	145	mg/Kg	0.48	5	07/26/16 08:42	07/21/16	

ALS Group USA, Corp.
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Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Sample Name: 060716LGCDV4
Lab Code: K1606675-004

Service Request: K1606675
Date Collected: 06/07/16
Date Received: 06/16/16 10:10

Basis: Dry, per Method

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	ND U	mg/Kg	0.48	5	07/26/16 08:47	07/21/16	
Cadmium	200.8	0.585	mg/Kg	0.019	5	07/26/16 08:47	07/21/16	
Copper	200.8	3.23	mg/Kg	0.096	5	07/26/16 08:47	07/21/16	
Lead	200.8	0.078	mg/Kg	0.019	5	07/28/16 10:38	07/21/16	
Selenium	200.8	7.56	mg/Kg	0.96	5	07/26/16 08:47	07/21/16	
Silver	200.8	ND U	mg/Kg	0.019	5	07/26/16 08:47	07/21/16	
Zinc	200.8	150	mg/Kg	0.48	5	07/26/16 08:47	07/21/16	

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dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Sample Name: 060716LGCDV5
Lab Code: K1606675-005

Service Request: K1606675
Date Collected: 06/07/16
Date Received: 06/16/16 10:10

Basis: Dry, per Method

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	0.50	mg/Kg	0.49	5	07/26/16 08:52	07/21/16	
Cadmium	200.8	0.420	mg/Kg	0.020	5	07/26/16 08:52	07/21/16	
Copper	200.8	3.42	mg/Kg	0.099	5	07/26/16 08:52	07/21/16	
Lead	200.8	0.177	mg/Kg	0.020	5	07/28/16 10:40	07/21/16	
Selenium	200.8	6.21	mg/Kg	0.99	5	07/26/16 08:52	07/21/16	
Silver	200.8	ND U	mg/Kg	0.020	5	07/26/16 08:52	07/21/16	
Zinc	200.8	154	mg/Kg	0.49	5	07/26/16 08:52	07/21/16	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Sample Name: 060716LGCDV6
Lab Code: K1606675-006

Service Request: K1606675
Date Collected: 06/07/16
Date Received: 06/16/16 10:10

Basis: Dry, per Method

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	0.52	mg/Kg	0.49	5	07/26/16 08:57	07/21/16	
Cadmium	200.8	0.441	mg/Kg	0.019	5	07/26/16 08:57	07/21/16	
Copper	200.8	4.35	mg/Kg	0.097	5	07/26/16 08:57	07/21/16	
Lead	200.8	0.195	mg/Kg	0.019	5	07/28/16 10:41	07/21/16	
Selenium	200.8	7.83	mg/Kg	0.97	5	07/26/16 08:57	07/21/16	
Silver	200.8	ND U	mg/Kg	0.019	5	07/26/16 08:57	07/21/16	
Zinc	200.8	167	mg/Kg	0.49	5	07/26/16 08:57	07/21/16	

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dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Sample Name: 060716LGCDV7
Lab Code: K1606675-007

Service Request: K1606675
Date Collected: 06/07/16
Date Received: 06/16/16 10:10
Basis: Dry, per Method

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	ND U	mg/Kg	0.50	5	07/26/16 09:02	07/21/16	
Cadmium	200.8	1.25	mg/Kg	0.020	5	07/26/16 09:02	07/21/16	
Copper	200.8	5.20	mg/Kg	0.099	5	07/26/16 09:02	07/21/16	
Lead	200.8	0.362	mg/Kg	0.020	5	07/28/16 10:45	07/21/16	
Selenium	200.8	6.46	mg/Kg	0.99	5	07/26/16 09:02	07/21/16	
Silver	200.8	0.026	mg/Kg	0.020	5	07/26/16 09:02	07/21/16	
Zinc	200.8	238	mg/Kg	0.50	5	07/26/16 09:02	07/21/16	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Sample Name: 060716LGCDV8
Lab Code: K1606675-008

Service Request: K1606675
Date Collected: 06/07/16
Date Received: 06/16/16 10:10
Basis: Dry, per Method

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	ND U	mg/Kg	0.49	5	07/26/16 09:07	07/21/16	
Cadmium	200.8	0.641	mg/Kg	0.019	5	07/26/16 09:07	07/21/16	
Copper	200.8	3.71	mg/Kg	0.097	5	07/26/16 09:07	07/21/16	
Lead	200.8	0.172	mg/Kg	0.019	5	07/28/16 10:47	07/21/16	
Selenium	200.8	6.11	mg/Kg	0.97	5	07/26/16 09:07	07/21/16	
Silver	200.8	ND U	mg/Kg	0.019	5	07/26/16 09:07	07/21/16	
Zinc	200.8	154	mg/Kg	0.49	5	07/26/16 09:07	07/21/16	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Sample Name: 060816LGCDV9
Lab Code: K1606675-009

Service Request: K1606675
Date Collected: 06/08/16
Date Received: 06/16/16 10:10

Basis: Dry, per Method

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	ND U	mg/Kg	0.49	5	07/26/16 09:22	07/21/16	
Cadmium	200.8	0.960	mg/Kg	0.020	5	07/26/16 09:22	07/21/16	
Copper	200.8	3.32	mg/Kg	0.099	5	07/26/16 09:22	07/21/16	
Lead	200.8	0.091	mg/Kg	0.020	5	07/28/16 10:48	07/21/16	
Selenium	200.8	7.04	mg/Kg	0.99	5	07/26/16 09:22	07/21/16	
Silver	200.8	ND U	mg/Kg	0.020	5	07/26/16 09:22	07/21/16	
Zinc	200.8	141	mg/Kg	0.49	5	07/26/16 09:22	07/21/16	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Sample Name: 060816LGCDV10
Lab Code: K1606675-010

Service Request: K1606675
Date Collected: 06/08/16
Date Received: 06/16/16 10:10
Basis: Dry, per Method

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	0.54	mg/Kg	0.50	5	07/26/16 09:27	07/21/16	
Cadmium	200.8	0.730	mg/Kg	0.020	5	07/26/16 09:27	07/21/16	
Copper	200.8	4.67	mg/Kg	0.099	5	07/26/16 09:27	07/21/16	
Lead	200.8	0.360	mg/Kg	0.020	5	07/28/16 10:50	07/21/16	
Selenium	200.8	6.31	mg/Kg	0.99	5	07/26/16 09:27	07/21/16	
Silver	200.8	0.025	mg/Kg	0.020	5	07/26/16 09:27	07/21/16	
Zinc	200.8	168	mg/Kg	0.50	5	07/26/16 09:27	07/21/16	

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dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Sample Name: 060816MGCDV1
Lab Code: K1606675-011

Service Request: K1606675
Date Collected: 06/08/16
Date Received: 06/16/16 10:10

Basis: Dry, per Method

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	ND U	mg/Kg	0.49	5	07/26/16 09:32	07/21/16	
Cadmium	200.8	0.613	mg/Kg	0.020	5	07/26/16 09:32	07/21/16	
Copper	200.8	3.41	mg/Kg	0.099	5	07/26/16 09:32	07/21/16	
Lead	200.8	0.071	mg/Kg	0.020	5	07/28/16 10:51	07/21/16	
Selenium	200.8	5.55	mg/Kg	0.99	5	07/26/16 09:32	07/21/16	
Silver	200.8	0.034	mg/Kg	0.020	5	07/26/16 09:32	07/21/16	
Zinc	200.8	140	mg/Kg	0.49	5	07/26/16 09:32	07/21/16	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Sample Name: 060816MGCDV2
Lab Code: K1606675-012

Service Request: K1606675
Date Collected: 06/08/16
Date Received: 06/16/16 10:10

Basis: Dry, per Method

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	ND U	mg/Kg	0.50	5	07/26/16 09:47	07/21/16	
Cadmium	200.8	0.327	mg/Kg	0.020	5	07/26/16 09:47	07/21/16	
Copper	200.8	4.33	mg/Kg	0.099	5	07/26/16 09:47	07/21/16	
Lead	200.8	0.183	mg/Kg	0.020	5	07/28/16 10:55	07/21/16	
Selenium	200.8	6.91	mg/Kg	0.99	5	07/26/16 09:47	07/21/16	
Silver	200.8	ND U	mg/Kg	0.020	5	07/26/16 09:47	07/21/16	
Zinc	200.8	147	mg/Kg	0.50	5	07/26/16 09:47	07/21/16	

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dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Sample Name: 060816MGCDV3
Lab Code: K1606675-013

Service Request: K1606675
Date Collected: 06/08/16
Date Received: 06/16/16 10:10

Basis: Dry, per Method

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	ND U	mg/Kg	0.50	5	07/26/16 09:52	07/21/16	
Cadmium	200.8	0.683	mg/Kg	0.020	5	07/26/16 09:52	07/21/16	
Copper	200.8	3.83	mg/Kg	0.099	5	07/26/16 09:52	07/21/16	
Lead	200.8	0.717	mg/Kg	0.020	5	07/28/16 10:57	07/21/16	
Selenium	200.8	5.64	mg/Kg	0.99	5	07/26/16 09:52	07/21/16	
Silver	200.8	ND U	mg/Kg	0.020	5	07/26/16 09:52	07/21/16	
Zinc	200.8	117	mg/Kg	0.50	5	07/26/16 09:52	07/21/16	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Sample Name: 060816MGCDV4
Lab Code: K1606675-014

Service Request: K1606675
Date Collected: 06/08/16
Date Received: 06/16/16 10:10
Basis: Dry, per Method

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	ND U	mg/Kg	0.49	5	07/26/16 09:57	07/21/16	
Cadmium	200.8	0.288	mg/Kg	0.020	5	07/26/16 09:57	07/21/16	
Copper	200.8	4.99	mg/Kg	0.098	5	07/26/16 09:57	07/21/16	
Lead	200.8	0.128	mg/Kg	0.020	5	07/28/16 10:58	07/21/16	
Selenium	200.8	3.94	mg/Kg	0.98	5	07/26/16 09:57	07/21/16	
Silver	200.8	ND U	mg/Kg	0.020	5	07/26/16 09:57	07/21/16	
Zinc	200.8	128	mg/Kg	0.49	5	07/26/16 09:57	07/21/16	

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dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Sample Name: 060816MGCDV5
Lab Code: K1606675-015

Service Request: K1606675
Date Collected: 06/08/16
Date Received: 06/16/16 10:10

Basis: Dry, per Method

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	ND U	mg/Kg	0.50	5	07/26/16 10:02	07/21/16	
Cadmium	200.8	0.329	mg/Kg	0.020	5	07/26/16 10:02	07/21/16	
Copper	200.8	3.11	mg/Kg	0.099	5	07/26/16 10:02	07/21/16	
Lead	200.8	0.061	mg/Kg	0.020	5	07/28/16 11:02	07/21/16	
Selenium	200.8	5.17	mg/Kg	0.99	5	07/26/16 10:02	07/21/16	
Silver	200.8	ND U	mg/Kg	0.020	5	07/26/16 10:02	07/21/16	
Zinc	200.8	132	mg/Kg	0.50	5	07/26/16 10:02	07/21/16	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Sample Name: 060816MGCDV6
Lab Code: K1606675-016

Service Request: K1606675
Date Collected: 06/08/16
Date Received: 06/16/16 10:10

Basis: Dry, per Method

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	ND U	mg/Kg	0.50	5	07/26/16 10:07	07/21/16	
Cadmium	200.8	0.215	mg/Kg	0.020	5	07/26/16 10:07	07/21/16	
Copper	200.8	3.53	mg/Kg	0.10	5	07/26/16 10:07	07/21/16	
Lead	200.8	0.259	mg/Kg	0.020	5	07/28/16 11:04	07/21/16	
Selenium	200.8	4.8	mg/Kg	1.0	5	07/26/16 10:07	07/21/16	
Silver	200.8	ND U	mg/Kg	0.020	5	07/26/16 10:07	07/21/16	
Zinc	200.8	146	mg/Kg	0.50	5	07/26/16 10:07	07/21/16	

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Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Sample Name: 060816MGCDV7
Lab Code: K1606675-017

Service Request: K1606675
Date Collected: 06/08/16
Date Received: 06/16/16 10:10
Basis: Dry, per Method

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	ND U	mg/Kg	0.50	5	07/26/16 10:23	07/21/16	
Cadmium	200.8	0.280	mg/Kg	0.020	5	07/26/16 10:23	07/21/16	
Copper	200.8	3.75	mg/Kg	0.099	5	07/26/16 10:23	07/21/16	
Lead	200.8	0.182	mg/Kg	0.020	5	07/28/16 11:05	07/21/16	
Selenium	200.8	6.05	mg/Kg	0.99	5	07/26/16 10:23	07/21/16	
Silver	200.8	ND U	mg/Kg	0.020	5	07/26/16 10:23	07/21/16	
Zinc	200.8	132	mg/Kg	0.50	5	07/26/16 10:23	07/21/16	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Sample Name: 060816MGCDV8
Lab Code: K1606675-018

Service Request: K1606675
Date Collected: 06/08/16
Date Received: 06/16/16 10:10

Basis: Dry, per Method

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	ND U	mg/Kg	0.50	5	07/26/16 10:28	07/21/16	
Cadmium	200.8	0.521	mg/Kg	0.020	5	07/26/16 10:28	07/21/16	
Copper	200.8	2.50	mg/Kg	0.10	5	07/26/16 10:28	07/21/16	
Lead	200.8	0.062	mg/Kg	0.020	5	07/28/16 11:07	07/21/16	
Selenium	200.8	4.9	mg/Kg	1.0	5	07/26/16 10:28	07/21/16	
Silver	200.8	ND U	mg/Kg	0.020	5	07/26/16 10:28	07/21/16	
Zinc	200.8	103	mg/Kg	0.50	5	07/26/16 10:28	07/21/16	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Sample Name: 060816MGCDV9
Lab Code: K1606675-019

Service Request: K1606675
Date Collected: 06/08/16
Date Received: 06/16/16 10:10

Basis: Dry, per Method

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	ND U	mg/Kg	0.50	5	07/26/16 10:33	07/21/16	
Cadmium	200.8	0.678	mg/Kg	0.020	5	07/26/16 10:33	07/21/16	
Copper	200.8	2.56	mg/Kg	0.100	5	07/26/16 10:33	07/21/16	
Lead	200.8	0.046	mg/Kg	0.020	5	07/28/16 11:08	07/21/16	
Selenium	200.8	4.66	mg/Kg	1.00	5	07/26/16 10:33	07/21/16	
Silver	200.8	ND U	mg/Kg	0.020	5	07/26/16 10:33	07/21/16	
Zinc	200.8	139	mg/Kg	0.50	5	07/26/16 10:33	07/21/16	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Sample Name: 060816MGCDV10
Lab Code: K1606675-020

Service Request: K1606675
Date Collected: 06/08/16
Date Received: 06/16/16 10:10
Basis: Dry, per Method

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	ND U	mg/Kg	0.50	5	07/26/16 10:38	07/21/16	
Cadmium	200.8	0.257	mg/Kg	0.020	5	07/26/16 10:38	07/21/16	
Copper	200.8	2.63	mg/Kg	0.100	5	07/26/16 10:38	07/21/16	
Lead	200.8	0.036	mg/Kg	0.020	5	07/28/16 11:09	07/21/16	
Selenium	200.8	6.29	mg/Kg	1.00	5	07/26/16 10:38	07/21/16	
Silver	200.8	0.682	mg/Kg	0.020	5	07/26/16 10:38	07/21/16	
Zinc	200.8	133	mg/Kg	0.50	5	07/26/16 10:38	07/21/16	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue
Sample Name: Method Blank
Lab Code: KQ1608425-01

Service Request: K1606675
Date Collected: NA
Date Received: NA

Basis: Dry, per Method

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Arsenic	200.8	ND U	mg/Kg	0.50	5	07/26/16 07:52	07/21/16	
Cadmium	200.8	ND U	mg/Kg	0.020	5	07/26/16 07:52	07/21/16	
Copper	200.8	ND U	mg/Kg	0.10	5	07/26/16 07:52	07/21/16	
Lead	200.8	ND U	mg/Kg	0.020	5	07/28/16 10:23	07/21/16	
Selenium	200.8	ND U	mg/Kg	1.0	5	07/26/16 07:52	07/21/16	
Silver	200.8	ND U	mg/Kg	0.020	5	07/26/16 07:52	07/21/16	
Zinc	200.8	ND U	mg/Kg	0.50	5	07/26/16 07:52	07/21/16	

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue

Service Request: K1606675
Date Collected: 06/07/16
Date Received: 06/16/16
Date Analyzed: 07/26/16 - 07/28/16

Replicate Sample Summary

Total Metals

Sample Name: 060716LGCDV1
Lab Code: K1606675-001

Units: mg/Kg
Basis: Dry, per Method

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample		Average	RPD	RPD Limit
				KQ1608425-05				
				Result	Result			
Arsenic	200.8	0.48	ND U	ND U	ND	ND	-	20
Cadmium	200.8	0.019	0.439	0.418	0.429	0.429	5	20
Copper	200.8	0.096	3.41	3.69	3.55	3.55	8	20
Lead	200.8	0.019	0.082	0.069	0.076	0.076	17	20
Selenium	200.8	0.96	7.14	7.31	7.23	7.23	2	20
Silver	200.8	0.019	ND U	ND U	ND	ND	-	20
Zinc	200.8	0.48	149	156	153	153	4	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

QA/QC Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue

Service Request: K1606675
Date Collected: 06/08/16
Date Received: 06/16/16
Date Analyzed: 07/26/16 - 07/28/16

Replicate Sample Summary
Total Metals

Sample Name: 060816MGCDV1
Lab Code: K1606675-011

Units: mg/Kg
Basis: Dry, per Method

Table with 8 columns: Analyte Name, Analysis Method, MRL, Sample Result, Duplicate Sample Result (KQ1608425-07), Average, RPD, RPD Limit. Rows include Arsenic, Cadmium, Copper, Lead, Selenium, Silver, and Zinc.

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: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue

Service Request: K1606675
Date Collected: 06/07/16
Date Received: 06/16/16
Date Analyzed: 07/26/16
Date Extracted: 07/21/16

Matrix Spike Summary
Total Metals

Sample Name: 060716LGCDV1
Lab Code: K1606675-001
Analysis Method: 200.8
Prep Method: PSEP Metals

Units: mg/Kg
Basis: Dry, per Method

Matrix Spike
KQ1608425-06

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	ND U	19.1	16.3	117	70-130
Cadmium	0.439	5.50	4.90	103	70-130
Copper	3.41	26.2	24.5	93	70-130
Selenium	7.14	26.7	16.3	120	70-130
Silver	ND U	4.72	4.90	96	70-130
Zinc	149	202	49.0	107	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: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue

Service Request: K1606675
Date Collected: 06/08/16
Date Received: 06/16/16
Date Analyzed: 07/26/16
Date Extracted: 07/21/16

Matrix Spike Summary
Total Metals

Sample Name: 060816MGCDV1
Lab Code: K1606675-011
Analysis Method: 200.8
Prep Method: PSEP Metals

Units: mg/Kg
Basis: Dry, per Method

Matrix Spike
KQ1608425-08

Analyte Name	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	ND U	19.4	16.7	116	70-130
Cadmium	0.613	6.03	5.00	108	70-130
Copper	3.41	27.9	25.0	98	70-130
Selenium	5.6	26.2	16.7	124	70-130
Silver	0.034	5.03	5.00	100	70-130
Zinc	140	200	50.0	120	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: 2016 Glacier Creek Biomonitoring Samples
Sample Matrix: Animal Tissue

Service Request: K1606675
Date Analyzed: 07/26/16
Date Extracted: 07/21/16

Lab Control Sample Summary
Total Metals

Analysis Method: 200.8
Prep Method: PSEP Metals

Units: mg/Kg
Basis: Dry, per Method
Analysis Lot: 507244

Lab Control Sample
KQ1608425-02

Analyte Name	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	17.2	16.7	103	85-115
Cadmium	4.99	5.00	100	85-115
Copper	24.2	25.0	97	85-115
Lead	48.8	50.0	98	85-115
Selenium	17.7	16.7	106	85-115
Silver	4.91	5.00	98	85-115
Zinc	48.7	50.0	97	85-115

ALS Group USA, Corp.
 dba ALS Environmental
 QA/QC Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
LCS Matrix: Tissue

Service Request: K1606675
Date Collected: NA
Date Received: NA
Date Extracted: 07/21/16
Date Analyzed: 07/26,28/16

Standard Reference Material Summary
 Total Metals

Sample Name: Standard Reference Material Units: mg/Kg (ppm)
 Lab Code: K1606675-SRM1 Basis: Dry
 Test Notes: Dorm-4 Solids = 94.5%

Source: N.R.C.C. Dorm-4

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Arsenic	PSEP Tissue	6020A	6.8	7.4	109	4.93-8.93	
Cadmium	PSEP Tissue	6020A	0.306	0.307	100	0.233 - 0.385	
Copper	PSEP Tissue	6020A	15.9	14.6	92	12.0 - 20.2	
Lead	PSEP Tissue	6020A	0.416	0.311	75	0.290 - 0.563	
Selenium	PSEP Tissue	6020A	3.56	4.42	124	2.58 - 4.68	
Zinc	PSEP Tissue	6020A	52.20	53.5	102	39.2 - 66.5	

ALS Group USA, Corp.
 dba ALS Environmental
 QA/QC Report

Client: Alaska Department of Fish and Game
Project: 2016 Glacier Creek Biomonitoring Samples
LCS Matrix: Tissue

Service Request: K1606675
Date Collected: NA
Date Received: NA
Date Extracted: 07/21/16
Date Analyzed: 07/26,28/16

Standard Reference Material Summary
 Total Metals

Sample Name: Standard Reference Material Units: mg/Kg (ppm)
 Lab Code: K1606675-SRM2 Basis: Dry
 Test Notes: Tort-3 Solids = 99.1%

Source: N.R.C.C. Tort-3

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Arsenic	PSEP Tissue	6020A	59.5	70.4	118	44.6-76.0	
Cadmium	PSEP Tissue	6020A	42.3	42.0	99	32.4-52.9	
Copper	PSEP Tissue	6020A	497	426	86	380-623	
Lead	PSEP Tissue	6020A	0.225	0.180	80	0.166-0.292	
Selenium	PSEP Tissue	7742	10.9	12.6	116	7.9-14.3	
Zinc	PSEP Tissue	6020A	136	134	99	104-170	

**APPENDIX D: SEDIMENT METALS CONCENTRATIONS AND
LABORATORY REPORT**



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August 12, 2016

Analytical Report for Service Request No: K1606617

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

RE: Palmer Project Glacier Creek

Dear Kate,

Enclosed are the results of the sample(s) submitted to our laboratory June 16, 2016
For your reference, these analyses have been assigned our service request number **K1606617**.

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 3293. You may also contact me via email at Shar.Samy@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Shar Samy, Ph.D.
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 DEC UST	http://dec.alaska.gov/applications/eh/ehllabreports/USTLabs.aspx	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	L14-51
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	Not available	-
ISO 17025	http://www.pjllabs.com/	L16-57
Louisiana DEQ	http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx	03016
Maine DHS	Not available	WA01276
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Montana DPHHS	http://www.dphhs.mt.gov/publichealth/	CERT0047
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/oqa/	WA005
North Carolina DWQ	http://www.dwqlab.org/	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/envserv/	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
Wisconsin DNR	http://dnr.wi.gov/	998386840
Wyoming (EPA Region 8)	http://www.epa.gov/region8/water/dwhome/wyomingdi.html	-
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
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ALS ENVIRONMENTAL

Client:	Alaska Department of Fish and Game	Service Request No.:	K1606617
Project:	Palmer Project Glacier Creek	Date Received:	06/16/16
Sample Matrix:	Sediment		

Case Narrative

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples designated for Tier II data deliverables. When appropriate to the method, method blank results have been reported with each analytical test. Additional quality control analyses reported herein include: Laboratory Duplicate (DUP), Matrix Spike (MS), and Matrix/Duplicate Matrix Spike (MS/DMS).

Sample Receipt

Two sediment samples were received for analysis at ALS Environmental on 06/16/16. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored in a refrigerator at 4°C upon receipt at the laboratory.

General Chemistry Parameters

Total Volatile Solids by EPA Method 160.4 Modified and Total Sulfide by PESP:

Samples Lower Glacier Creek and Middle Glacier Creek were received past holding time. The analysis was performed as soon as possible after receipt by the laboratory. The data was flagged to indicate the holding time violation.

No other anomalies associated with the analysis of these samples were observed.

Total Metals

Matrix Spike Recovery Exceptions:

The control criteria for matrix spike recovery of Aluminum, Iron, and Zinc for sample Lower Glacier Creek were not applicable. The analyte concentration in the sample was significantly higher than the added spike concentration, preventing accurate evaluation of the spike recovery.

No other anomalies associated with the analysis of these samples were observed.

Approved by _____ 



Chain of Custody

ALS Environmental—Kelso Laboratory
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CHAIN OF CUSTODY

70616

001

SR# 71100607
 COC Set ___ of ___
 COC# _____

1317 South 13th Ave, Kelso, WA 98626 Phone (360) 577-7222 / 800-695-7222 / FAX (360) 636-1068
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Project Name: <u>Palmer Project Glacier Creek</u>		Project Number:		NUMBER OF CONTAINERS	7D	14D	28D	180D	999D					Remarks		
Project Manager: <u>Kate Kanouse</u>					PSEP Sulfide / PSEP Sulfide	PSEP TOC / PSEP TOC T	7471B / Hg	200.8 / Metals T	ASTM D422 / Part Size	180.3 Modified / TS	100.4 mod - TWS	2	3		4	6
Company: <u>Alaska Dept. of Fish and Game</u>																
Address: <u>607. 3rd Street</u>		Phone #: <u>(907) 465-4296</u>														
Phone #: <u>Douglas, AK 99824</u>		email: <u>kate.kanouse@alaska.gov</u>														
Sampler Signature: <u>[Signature]</u>		Sampler Printed Name: <u>Kate Kanouse</u>														
CLIENT SAMPLE ID	LABID	SAMPLING Date	SAMPLING Time	Matrix												
1. <u>Lower Glacier Creek</u>		<u>6/7/16</u>	<u>1100</u>		3	X	X	X	X	X	X					
2. <u>Middle Glacier Creek</u>		<u>6/9/16</u>	<u>1000</u>		3	X	X	X	X	X	X					
3.																
4.																
5.																
6.																
7.																
8.																
9.																
10.																

Report Requirements <input type="checkbox"/> I. Routine Report: Method Blank, Surrogate, as required <input 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 checked="" type="checkbox"/> V. EDD	Invoice Information P.O.# <u>MR. D Green</u> Bill To: <u>800 W. Pender St.</u> <u>Ste 320 Vancouver, BC</u> <u>V6C2V6 Canada</u>	Circle which metals are to be analyzed Total Metals: <u>(Al)</u> <u>(As)</u> Sb Ba Be B Ca <u>(Cd)</u> Co Cr <u>(Cu)</u> <u>(Fe)</u> <u>(Pb)</u> Mg Mn Mo Ni K <u>(Ag)</u> Na <u>(Se)</u> Sr Ti Sn V <u>(Zn)</u> <u>(Hg)</u> 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. _____ 48 hr. <input type="checkbox"/> 5 Day <input checked="" type="checkbox"/> Standard	Special Instructions/Comments: <u>*Indicate State Hydrocarbon Procedure: AK CA WI Northwest Other _____ (Circle One)</u>	
	Requested Report Date		

Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature: <u>[Signature]</u>	Signature: <u>[Signature]</u>	Signature:	Signature:	Signature:	Signature:
Printed Name: <u>Kate Kanouse</u>	Printed Name: <u>[Signature]</u>	Printed Name:	Printed Name:	Printed Name:	Printed Name:
Firm: <u>ADFG</u>	Firm: <u>ALS</u>	Firm:	Firm:	Firm:	Firm:
Date/Time: <u>6/14/16 0800</u>	Date/Time: <u>6/16/16 1010</u>	Date/Time:	Date/Time:	Date/Time:	Date/Time:



PC Shaw

Cooler Receipt and Preservation Form

Client ALASKA Dept of Fish & Game Service Request K16 060617
 Received: 6/16/16 Opened: 6/16/16 By: [Signature] Unloaded: 6/16/16 By: [Signature]

1. Samples were received via? Mail Red Ex UPS DHL PDX Courier Hand Delivered
2. Samples were received in: (circle) Cooler Box Envelope Other _____ NA
3. 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	Tracking Number	NA	Filed
3.3	3.1	—	—	0.2	371	70616	783353222199		

4. Packing material: Inserts Baggies Bubble Wrap Get Packs Wet Ice Dry Ice Sleeves _____
5. Were custody papers properly filled out (ink, signed, etc.)? NA Y N
6. Did all bottles arrive in good condition (unbroken)? *Indicate in the table below.* NA Y N
7. Were all sample labels complete (i.e analysis, preservation, etc.)? NA Y N
8. Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* NA Y N
9. Were appropriate bottles/containers and volumes received for the tests indicated? NA Y N
10. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA Y N
11. Were VOA vials received without headspace? *Indicate in the table below.* NA Y N
12. 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

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: Palmer Project Glacier Creek
Sample Matrix: Sediment
Analysis Method: 160.3 Modified
Prep Method: None

Service Request: K1606617
Date Collected: 06/07/16 - 06/08/16
Date Received: 06/16/16
Units: Percent
Basis: As Received

Solids, Total

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
Lower Glacier Creek	K1606617-001	78.8	-	1	06/30/16 14:17	
Middle Glacier Creek	K1606617-002	80.5	-	1	06/30/16 14:17	

ALS Group USA, Corp.

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QA/QC Report

Client: Alaska Department of Fish and Game
Project Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Collected: 06/07/16
Date Received: 06/16/16
Date Analyzed: 06/30/16

Replicate Sample Summary

Inorganic Parameters

Sample Name: Lower Glacier Creek
Lab Code: K1606617-001

Units: Percent
Basis: As Received

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample K1606617-001DUP Result	Average	RPD	RPD Limit
Solids, Total	160.3 Modified	-	78.8	78.3	78.6	<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.



General Chemistry

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment
Analysis Method: 160.4 Modified
Prep Method: None

Service Request: K1606617
Date Collected: 06/07/16 - 06/08/16
Date Received: 06/16/16
Units: Percent
Basis: Dry, per Method

Solids, Total Volatile

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
Lower Glacier Creek	K1606617-001	2.40	0.010	1	06/27/16 08:15	*
Middle Glacier Creek	K1606617-002	3.30	0.010	1	06/27/16 08:15	*
Method Blank	K1606617-MB	ND U	0.010	1	06/27/16 08:15	

ALS Group USA, Corp.

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Collected: NA
Date Received: NA
Date Analyzed: 06/27/16

Replicate Sample Summary
General Chemistry Parameters

Sample Name: Batch QC
Lab Code: K1606842-008

Units: Percent
Basis: Dry, per Method

<u>Analyte Name</u>	<u>Analysis Method</u>	<u>MRL</u>	<u>Sample Result</u>	<u>Duplicate Sample K1606842-008DUP Result</u>	<u>Average</u>	<u>RPD</u>	<u>RPD Limit</u>
Solids, Total Volatile	160.4 Modified	0.010	55.8	57.2	56.5	2	20

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ALS Group USA, Corp.
 dba ALS Environmental
Analytical Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Collected: 6/7/2016
Date Received: 6/16/2016
Date Analyzed: 6/27/2016

Particle Size Determination
ASTM D422

Sample Name: Lower Glacier Creek
Lab Code: K1606617-001

Gravel and Sand
(Sieve Analysis)

Description	Sieve Size	Weight (g)	Percent Passing
Gravel (19.0 mm)	No.3/4"(19.0 mm)	0.0000	100.00
Gravel (9.50 mm)	No.3/8"(9.50 mm)	0.0000	100.00
Gravel, Medium	No.4 (4.75 mm)	0.0000	100.00
Gravel, Fine	No.10 (2.00 mm)	0.0000	100.00
Sand, Very Coarse	No.20 (0.850 mm)	1.2114	96.77
Sand, Coarse	No.40 (0.425 mm)	5.7038	81.54
Sand, Medium	No.60 (0.250 mm)	7.0782	62.64
Sand, Fine	No.140 (0.106 mm)	8.6352	39.58
Sand, Very Fine	No.200 (0.0750 mm)	2.4002	33.17

Silt and Clay
(Hydrometer Analysis)

Particle Diameter	Percent Passing
0.074 mm	33.78
0.005 mm	4.00
0.001 mm	0.00

ALS Group USA, Corp.
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Analytical Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Collected: 6/7/2016
Date Received: 6/16/2016
Date Analyzed: 6/27/2016

Particle Size Determination
ASTM D422

Sample Name: Lower Glacier Creek
Lab Code: K1606617-001DUP

Gravel and Sand
(Sieve Analysis)

Description	Sieve Size	Weight (g)	Percent Passing
Gravel (19.0 mm)	No.3/4"(19.0 mm)	0.0000	100.00
Gravel (9.50 mm)	No.3/8"(9.50 mm)	0.0000	100.00
Gravel, Medium	No.4 (4.75 mm)	0.0000	100.00
Gravel, Fine	No.10 (2.00 mm)	0.0000	100.00
Sand, Very Coarse	No.20 (0.850 mm)	1.0579	97.21
Sand, Coarse	No.40 (0.425 mm)	4.8939	84.29
Sand, Medium	No.60 (0.250 mm)	7.0827	65.60
Sand, Fine	No.140 (0.106 mm)	8.7703	42.45
Sand, Very Fine	No.200 (0.0750 mm)	2.7344	35.24

Silt and Clay
(Hydrometer Analysis)

Particle Diameter	Percent Passing
0.074 mm	35.78
0.005 mm	4.06
0.001 mm	0.00

ALS Group USA, Corp.
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Analytical Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Collected: 6/8/2016
Date Received: 6/16/2016
Date Analyzed: 6/27/2016

Particle Size Determination
ASTM D422

Sample Name: Middle Glacier Creek
Lab Code: K1606617-002

Gravel and Sand
(Sieve Analysis)

Description	Sieve Size	Weight (g)	Percent Passing
Gravel (19.0 mm)	No.3/4"(19.0 mm)	0.0000	100.00
Gravel (9.50 mm)	No.3/8"(9.50 mm)	0.0000	100.00
Gravel, Medium	No.4 (4.75 mm)	0.0000	100.00
Gravel, Fine	No.10 (2.00 mm)	0.0000	100.00
Sand, Very Coarse	No.20 (0.850 mm)	1.9318	94.42
Sand, Coarse	No.40 (0.425 mm)	4.3961	81.73
Sand, Medium	No.60 (0.250 mm)	5.5438	65.73
Sand, Fine	No.140 (0.106 mm)	9.7470	37.59
Sand, Very Fine	No.200 (0.0750 mm)	2.8485	29.37

Silt and Clay
(Hydrometer Analysis)

Particle Diameter	Percent Passing
0.074 mm	33.34
0.005 mm	3.54
0.001 mm	0.00

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment
Analysis Method: PSEP Sulfide
Prep Method: Method

Service Request: K1606617
Date Collected: 06/07/16 - 06/08/16
Date Received: 06/16/16
Units: mg/Kg
Basis: Dry

Sulfide, Total

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Date Extracted	Q
Lower Glacier Creek	K1606617-001	ND U	2.0	1	06/17/16 19:50	6/17/16	*
Middle Glacier Creek	K1606617-002	ND U	1.9	1	06/17/16 19:50	6/17/16	*
Method Blank	K1606617-MB	ND U	1.0	1	06/17/16 19:50	6/17/16	

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Collected: 06/07/16
Date Received: 06/16/16
Date Analyzed: 06/17/16

Triplicate Sample Summary
General Chemistry Parameters

Sample Name: Lower Glacier Creek
Lab Code: K1606617-001
Analysis Method: PSEP Sulfide
Prep Method: Method

Units: mg/Kg
Basis: Dry

Analyte Name	MRL	Sample Result	Duplicate K1606617- 001DUP Result	Triplicate K1606617- 001TRP Result	Average	RSD	RSD Limit
Sulfide, Total	1.8	ND	ND	ND	NC	NC	20

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Collected: 06/07/16
Date Received: 06/16/16
Date Analyzed: 06/17/16
Date Extracted: 06/17/16

Duplicate Matrix Spike Summary
Sulfide, Total

Sample Name: Lower Glacier Creek
Lab Code: K1606617-001
Analysis Method: PSEP Sulfide
Prep Method: Method

Units: mg/Kg
Basis: Dry

Analyte Name	Sample Result	Result	Matrix Spike		Duplicate Matrix Spike		% Rec Limits	RPD	RPD Limit	
			Spike Amount	% Rec	Result	Spike Amount				% Rec
Sulfide, Total	ND U	500	660	77	490	650	76	28-175	2	20

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Analyzed: 06/17/16
Date Extracted: 06/17/16

Lab Control Sample Summary
Sulfide, Total

Analysis Method: PSEP Sulfide
Prep Method: Method

Units: mg/Kg
Basis: Dry
Analysis Lot: 501525

Sample Name	Lab Code	Result	Spike Amount	% Rec	% Rec Limits
Lab Control Sample	K1606617-LCS	270	320	84	39-166

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment
Analysis Method: PSEP TOC
Prep Method: ALS SOP

Service Request: K1606617
Date Collected: 06/07/16 - 06/08/16
Date Received: 06/16/16
Units: Percent
Basis: Dry, per Method

Carbon, Total Organic (TOC)

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Date Extracted	Q
Lower Glacier Creek	K1606617-001	0.274	0.050	1	06/21/16 13:30	6/21/16	
Middle Glacier Creek	K1606617-002	0.491	0.050	1	06/21/16 13:30	6/21/16	
Method Blank	K1606617-MB	ND U	0.050	1	06/21/16 13:30	6/21/16	

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Collected: NA
Date Received: NA
Date Analyzed: 06/21/16

Triplicate Sample Summary
General Chemistry Parameters

Sample Name: Batch QC
Lab Code: K1605882-001
Analysis Method: PSEP TOC
Prep Method: ALS SOP

Units: Percent
Basis: Dry, per Method

Analyte Name	MRL	Sample Result	Duplicate K1605882-001DUP Result	Triplicate K1605882-001TRP Result	Average	RSD	RSD Limit
Carbon, Total Organic (TOC)	0.050	11.9	11.8	11.8	11.8	<1	27

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QA/QC Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Collected: N/A
Date Received: N/A
Date Analyzed: 06/21/16
Date Extracted: 06/21/16

Duplicate Matrix Spike Summary
Carbon, Total Organic (TOC)

Sample Name: Batch QC
Lab Code: K1605882-001
Analysis Method: PSEP TOC
Prep Method: ALS SOP

Units: Percent
Basis: Dry, per Method

Analyte Name	Sample Result	Matrix Spike K1605882-001MS			Duplicate Matrix Spike K1605882-001DMS			% Rec Limits	RPD	RPD Limit
		Result	Spike Amount	% Rec	Result	Spike Amount	% Rec			
Carbon, Total Organic (TOC)	11.9	21.4	9.76	98	23.1	11.3	99	69-123	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: Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Analyzed: 06/21/16
Date Extracted: 06/21/16

Lab Control Sample Summary
Carbon, Total Organic (TOC)

Analysis Method: PSEP TOC
Prep Method: ALS SOP

Units: Percent
Basis: Dry, per Method
Analysis Lot: 503612

Sample Name	Lab Code	Result	Spike Amount	% Rec	% Rec Limits
Lab Control Sample	K1606617-LCS	0.558	0.582	96	74-118



Metals

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

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Analytical Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment
Sample Name: Lower Glacier Creek
Lab Code: K1606617-001

Service Request: K1606617
Date Collected: 06/07/16 11:00
Date Received: 06/16/16 10:10

Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.7	9730	mg/Kg	5.7	2	07/11/16 06:28	07/07/16	
Arsenic	200.8	4.48	mg/Kg	0.36	5	07/22/16 01:49	07/07/16	
Cadmium	200.8	1.08	mg/Kg	0.014	5	07/22/16 01:49	07/07/16	
Copper	200.8	51.9	mg/Kg	0.072	5	07/22/16 01:49	07/07/16	
Iron	200.7	36500	mg/Kg	2.9	2	07/11/16 06:28	07/07/16	
Lead	200.8	8.17	mg/Kg	0.036	5	07/22/16 01:49	07/07/16	
Mercury	7471B	ND U	mg/Kg	0.020	1	07/05/16 01:11	07/05/16	
Selenium	200.8	1.61	mg/Kg	0.72	5	07/22/16 01:49	07/07/16	
Silver	200.8	0.200	mg/Kg	0.014	5	07/22/16 01:49	07/07/16	
Zinc	200.8	180	mg/Kg	0.36	5	07/22/16 01:49	07/07/16	

ALS Group USA, Corp.
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Analytical Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment
Sample Name: Middle Glacier Creek
Lab Code: K1606617-002

Service Request: K1606617
Date Collected: 06/08/16 10:00
Date Received: 06/16/16 10:10
Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.7	7650	mg/Kg	5.6	2	07/11/16 06:36	07/07/16	
Arsenic	200.8	4.33	mg/Kg	0.35	5	07/22/16 02:02	07/07/16	
Cadmium	200.8	0.871	mg/Kg	0.014	5	07/22/16 02:02	07/07/16	
Copper	200.8	55.8	mg/Kg	0.070	5	07/22/16 02:02	07/07/16	
Iron	200.7	32400	mg/Kg	2.8	2	07/11/16 06:36	07/07/16	
Lead	200.8	12.0	mg/Kg	0.035	5	07/22/16 02:02	07/07/16	
Mercury	7471B	ND U	mg/Kg	0.020	1	07/05/16 01:16	07/05/16	
Selenium	200.8	1.14	mg/Kg	0.70	5	07/22/16 02:02	07/07/16	
Silver	200.8	0.156	mg/Kg	0.014	5	07/22/16 02:02	07/07/16	
Zinc	200.8	170	mg/Kg	0.35	5	07/22/16 02:02	07/07/16	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment
Sample Name: Method Blank
Lab Code: KQ1607415-01

Service Request: K1606617
Date Collected: NA
Date Received: NA
Basis: Dry

Total Metals

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Aluminum	200.7	ND U	mg/Kg	8.0	2	07/11/16 06:24	07/07/16	
Arsenic	200.8	ND U	mg/Kg	0.50	5	07/22/16 01:40	07/07/16	
Cadmium	200.8	ND U	mg/Kg	0.020	5	07/22/16 01:40	07/07/16	
Copper	200.8	ND U	mg/Kg	0.10	5	07/22/16 01:40	07/07/16	
Iron	200.7	ND U	mg/Kg	4.0	2	07/11/16 06:24	07/07/16	
Lead	200.8	ND U	mg/Kg	0.050	5	07/22/16 01:40	07/07/16	
Selenium	200.8	ND U	mg/Kg	1.0	5	07/22/16 01:40	07/07/16	
Silver	200.8	ND U	mg/Kg	0.020	5	07/22/16 01:40	07/07/16	
Zinc	200.8	ND U	mg/Kg	0.50	5	07/22/16 01:40	07/07/16	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment
Sample Name: Method Blank
Lab Code: KQ1607456-01

Service Request: K1606617
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	0.020	1	07/05/16 12:33	07/05/16	

ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Collected: 06/07/16
Date Received: 06/16/16
Date Analyzed: 07/11/16 - 07/22/16

Replicate Sample Summary

Total Metals

Sample Name: Lower Glacier Creek
Lab Code: K1606617-001

Units: mg/Kg
Basis: Dry

Table with 8 columns: Analyte Name, Analysis Method, MRL, Sample Result, Duplicate Sample Result (KQ1607415-03), Average, RPD, RPD Limit. Rows include Aluminum, Arsenic, Cadmium, Copper, Iron, Lead, Selenium, Silver, and Zinc.

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QA/QC Report

Client: Alaska Department of Fish and Game
Project Palmer Project Glacier Creek
Sample Matrix: Paperboard

Service Request: K1606617
Date Collected: NA
Date Received: NA
Date Analyzed: 07/05/16

Replicate Sample Summary

Total Metals

Sample Name: Batch QC
Lab Code: K1606214-009

Units: mg/Kg
Basis: Dry

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample	Average	RPD	RPD Limit
				KQ1607456-04			
Mercury	7471B	0.019	ND U	ND U	ND	-	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

QA/QC Report

Client: Alaska Department of Fish and Game
Project Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Collected: NA
Date Received: NA
Date Analyzed: 07/05/16

Replicate Sample Summary

Total Metals

Sample Name: Batch QC
Lab Code: K1606561-001

Units: mg/Kg
Basis: Dry

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample	Average	RPD	RPD Limit
				KQ1607456-06 Result			
Mercury	7471B	0.023	ND U	ND U	ND	-	20

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ALS Group USA, Corp.

dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Collected: 06/07/16
Date Received: 06/16/16
Date Analyzed: 07/05/16

Replicate Sample Summary

Total Metals

Sample Name: Lower Glacier Creek
Lab Code: K1606617-001

Units: mg/Kg
Basis: Dry

Analyte Name	Analysis Method	MRL	Sample Result	Duplicate Sample	Average	RPD	RPD Limit
				KQ1607456-09			
Mercury	7471B	0.020	ND U	ND U	ND	-	20

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ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Collected: 06/07/16
Date Received: 06/16/16
Date Analyzed: 07/11/16 - 07/22/16

Matrix Spike Summary
Total Metals

Sample Name: Lower Glacier Creek
Lab Code: K1606617-001

Units: mg/Kg
Basis: Dry

Matrix Spike
KQ1607415-04

Analyte Name	Method	Sample Result	Result	Spike Amount	% Rec	% Rec Limits
Aluminum	200.7	9730	10300	280	187 #	70-130
Arsenic	200.8	4.48	85.0	70.1	115	70-130
Cadmium	200.8	1.08	8.96	7.01	113	70-130
Copper	200.8	51.9	96.9	35.0	129	70-130
Iron	200.7	36500	35400	140	-799 #	70-130
Lead	200.8	8.17	83.0	70.1	107	70-130
Selenium	200.8	1.61	76.8	70.1	107	70-130
Silver	200.8	0.200	7.87	7.01	110	70-130
Zinc	200.8	180	272	70.1	132 #	70-130

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ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Paperboard

Service Request: K1606617
Date Collected: N/A
Date Received: N/A
Date Analyzed: 07/5/16
Date Extracted: 07/5/16

Matrix Spike Summary
Total Metals

Sample Name: Batch QC
Lab Code: K1606214-009
Analysis Method: 7471B
Prep Method: Method

Units: mg/Kg
Basis: Dry

Matrix Spike
KQ1607456-05

<u>Analyte Name</u>	<u>Sample Result</u>	<u>Result</u>	<u>Spike Amount</u>	<u>% Rec</u>	<u>% Rec Limits</u>
Mercury	ND U	0.439	0.483	91	80-120

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ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Collected: N/A
Date Received: N/A
Date Analyzed: 07/5/16
Date Extracted: 07/5/16

Matrix Spike Summary
Total Metals

Sample Name: Batch QC
Lab Code: K1606561-001
Analysis Method: 7471B
Prep Method: Method

Units: mg/Kg
Basis: Dry

Matrix Spike
KQ1607456-07

<u>Analyte Name</u>	<u>Sample Result</u>	<u>Result</u>	<u>Spike Amount</u>	<u>% Rec</u>	<u>% Rec Limits</u>
Mercury	ND U	0.588	0.577	99	80-120

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: Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Collected: 06/07/16
Date Received: 06/16/16
Date Analyzed: 07/5/16
Date Extracted: 07/5/16

Matrix Spike Summary
Total Metals

Sample Name: Lower Glacier Creek
Lab Code: K1606617-001
Analysis Method: 7471B
Prep Method: Method

Units: mg/Kg
Basis: Dry

Matrix Spike
KQ1607456-10

<u>Analyte Name</u>	<u>Sample Result</u>	<u>Result</u>	<u>Spike Amount</u>	<u>% Rec</u>	<u>% Rec Limits</u>
Mercury	ND U	0.481	0.495	97	80-120

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: Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Collected: N/A
Date Received: N/A
Date Analyzed: 07/5/16
Date Extracted: 07/5/16

Duplicate Matrix Spike Summary
Total Metals

Sample Name: Batch QC
Lab Code: K1606561-001
Analysis Method: 7471B
Prep Method: Method

Units: mg/Kg
Basis: Dry

Analyte Name	Sample Result	Result	Matrix Spike KQ1607456-07		Result	Duplicate Matrix Spike KQ1607456-08		% Rec Limits	RPD	RPD Limit
			Spike Amount	% Rec		Spike Amount	% Rec			
Mercury	ND U	0.588	0.577	99	0.576	0.577	97	80-120	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.

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Analyzed: 07/11/16
Date Extracted: 07/07/16

Lab Control Sample Summary
Total Metals

Analysis Method: 200.7
Prep Method: EPA 3050B

Units: mg/Kg
Basis: Dry
Analysis Lot: 504738

Lab Control Sample
KQ1607415-02

Analyte Name	Result	Spike Amount	% Rec	% Rec Limits
Aluminum	5710	7930	72	39-161
Iron	13000	14400	90	36-164

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Analyzed: 07/22/16
Date Extracted: 07/07/16

Lab Control Sample Summary
Total Metals

Analysis Method: 200.8
Prep Method: EPA 3050B

Units: mg/Kg
Basis: Dry
Analysis Lot: 506598

Lab Control Sample
KQ1607415-02

Analyte Name	Result	Spike Amount	% Rec	% Rec Limits
Arsenic	105	98.5	107	69-145
Cadmium	152	146	104	73-127
Copper	111	106	104	75-125
Lead	128	130	98	72-127
Selenium	166	154	108	68-132
Silver	41.2	40.9	101	66-134
Zinc	197	191	103	70-130

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Analyzed: 07/05/16
Date Extracted: 07/05/16

Lab Control Sample Summary
Total Metals

Analysis Method: 7471B
Prep Method: Method

Units: mg/Kg
Basis: Dry
Analysis Lot: 504034

Lab Control Sample
KQ1607456-02

Analyte Name	Result	Spike Amount	% Rec	% Rec Limits
Mercury	0.506	0.500	101	80-120

ALS Group USA, Corp.
dba ALS Environmental

QA/QC Report

Client: Alaska Department of Fish and Game
Project: Palmer Project Glacier Creek
Sample Matrix: Sediment

Service Request: K1606617
Date Analyzed: 07/05/16
Date Extracted: 07/05/16

Lab Control Sample Summary
Total Metals

Analysis Method: 7471B
Prep Method: Method

Units: mg/Kg
Basis: Dry
Analysis Lot: 504034

Lab Control Sample
KQ1607456-03

Analyte Name	Result	Spike Amount	% Rec	% Rec Limits
Mercury	6.92	7.10	97	51-149