AQUATICS EXISTING CONDITIONS INVESTIGATIONS

AT

CLINTON CREEK MINE SITE, 2016



FOR

Yukon

ASSESSMENT AND ABANDONED MINES

ENERGY MINES AND RESOURCES

BY

Laberge ENVIRONMENTAL SERVICES

March 2017

EXECUTIVE SUMMARY

The Clinton Creek asbestos mine operated from 1967 to 1978, and Cassiar Asbestos Corporation Ltd. retained ownership until 1991. A closure plan was never accepted and the Northern Affairs Program of Indian and Northern Affairs Canada (INAC) and Yukon Government have monitored the site since.

Physical mitigation measures have been undertaken over the years; removal of all structures, risk management of the outlet structures at Hudgeon Lake, construction of a rock lined channel to prevent the undercutting of the tailings by Wolverine Creek (AECOM, 2011) and continued road maintenance. These efforts have not been sufficient to control the release of metals and tailings from reaching the receiving environment.

Conditions at the time of the investigations reflect a typical fall season in the north central Yukon. All stream levels appeared to be normal for the time of the year. Many of the sampled creeks were running relatively clear while the remainder did exhibit moderate turbidity.

The existing aquatic conditions at the Clinton Creek mine site indicate that the waste rock dump and the tailings have some impact on Wolverine and Clinton creeks. Both the right and left canyon walls of the channel below the gabion structures respectively contribute waste rock and shattered or exfoliated bedrock to the stream channel (von Finster, 2012). The detailed water chemistry reveals that Canadian Council Ministers of the Environment Guidelines for the protection of freshwater aquatic life (CCME-FAL) for total aluminium, total copper, total iron, total selenium and total chromium were exceeded at many of the monitoring sites (both exposed and reference). Eagle Creek (E4) exhibited the greatest degree of exceedance for most of these total metals. Eagle Creek had a high suspended sediment load at the time of sampling. Dissolved metals concentrations were much lower. Porcupine Creek and the exposed sites on Clinton Creek near the waste rock dump (E1 and E2) had high concentrations of some metals and several CCME-FAL guidelines were exceeded.

Most of the stream sediment samples from the reference sites were found to be devoid of asbestos fibres. The amount of asbestos reported in the stream sediments downstream of the tailings at exposed sites appears to vary and is likely dependent on events flushing exposed tailings through the system. Although asbestos fibres do not seem to be a significant issue to the aquatic receiving environment in water (Laberge, 2010) or in fish (Marty et al, 2012), the associate trace metals may create detrimental effects to aquatic biota (Schreier et al, 1987).

Several CCME recommended guidelines for the protection of freshwater aquatic life were exceeded in the stream sediments at the exposed sites close to the waste rock dump and the tailings. Chromium was one of the most common metals found in high concentrations in the stream sediments and the PEL was exceeded at E1, Porcupine Creek, E2 and E4. The high concentrations of chromium documented here are likely due to the fact that the mineral chromite (iron chromium oxide) is associated with the serpentine minerals in this area (Htoon, 1979). Nickel concentrations were much higher at the stream sediments at the exposed sites. No guidelines for nickel in sediments have been developed. (The CCME-FAL guideline for nickel in water was met at all sites, however the exposed sites did have higher concentrations). Arsenic concentrations in stream sediments were high

throughout the study area and the ISQG was exceeded at all sites except upstream on Wolverine Creek, R3.

Periphyton communities were the largest in terms of density and biomass at the Clinton Creek sites downstream of Hudgeon Lake; E1 and E2. The lake acts as a heat sink and temperatures were still warm in Clinton Creek at these sites. It is likely that the lake is a source of nutrients. Clinton Creek at E2 is located downstream of Porcupine Creek, and the area adjacent and upstream of E2 was overlain by a large beaver pond until recently. The decomposing organic material probably adds to nutrient availability. The periphyton community at Eagle Creek, E4, had the lowest abundance.

The most abundant periphyton species based on cell density was *Heteroleibeinia profundal* of Cyanophyta (27%), and was identified at all of the sites, with higher densities usually documented at the exposed sites. Based on cell biomass, the species *Synedra ulna* (Nitzsch), a diatom, represented 51% of the periphyton in the study area. However, this species was not identified at any of the reference sites.

The benthic communities at the exposed sites E1, E2 and Porcupine Creek were heavily dominated by Chironomids of the order Diptera. These invertebrates can tolerate stresses to the environment more than many other groups of insects. The proportion of the insect orders (Ephemeroptera, Plecoptera and Trichoptera) that have a very low tolerance to pollution was much lower at these sites than the others in the study area. As benthic invertebrates populate on and in the substrate, the high concentrations of metals in the stream sediments at these exposed sites are likely inhibiting colonization of the more sensitive species.

Beaver dams still play a role in the distribution of fish in Clinton Creek and the gabion structure downstream of Hudgeon Lake continues to be the upper limit of fish utilization. The perched culverts on Eagle and Wolverine Creeks prevent movement into these watersheds. A large beaver dam (3m x ~100m) located approximately two kilometres upstream of sample station R6 likely poses a barrier to both upstream and downstream passage of fish. There will likely be small or complete breaches during the 2017 spring freshet and salmon trapped upstream for the overwinter period should have no difficulty exiting the creek at that time.

The instability of the canyon walls downstream of the gabion structures continues to introduce material to Clinton Creek, especially following precipitation events.

All age classes of slimy sculpin were documented throughout Clinton Creek. The spill pond immediately below the gabion structures had the greatest densities of fish. Numerous juvenile chinook salmon, sub adult and juvenile Arctic grayling, and very rarely, adult Arctic grayling were captured at this location.

The tissue analysis of the resident species Slimy Sculpin show much higher concentrations of several metals in the tissues at E1 than from sculpin at the downstream sites on Clinton Creek. The mercury CCME tissue residue guideline for protecting wildlife consumers of aquatic biota was exceeded in all sculpin tissues, all grayling livers and in most of the grayling muscle tissues. The mercury levels in the Clinton Creek sculpin tissues were far greater than the Yukon wide mean. The source of mercury is likely methylmercury production in Hudgeon Lake.

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1.0 BACKGROUND

The former Clinton Creek Asbestos Mine Site is located northwest of Dawson City, Yukon, approximately 100 km by road, and is eight km upstream of the confluence of Clinton Creek and the Forty Mile River. The mine operated from 1967 to 1978. The site encompasses three open pits (Porcupine, Snowshoe and Creek), two waste rock piles (Clinton Creek Dump and Porcupine Creek Dump), and a tailings pile. The abandoned mine property falls within the Traditional Territory of the Tr'ondëk Hwëch'in First Nation.

During the operational life of the mine, approximately 14 million tonnes of tailings were deposited over a slope adjacent to the Wolverine Creek valley. In 1974, the original tailings deposit (the south lobe) slid down the valley blocking the flow of Wolverine Creek and forming a small lake. The blockage was almost immediately breached dispersing tailings as far as two kilometres downstream. Following the failure of the south lobe, tailings were placed further to the north. By 1986 the north lobe had reached the valley floor forming a second pond.

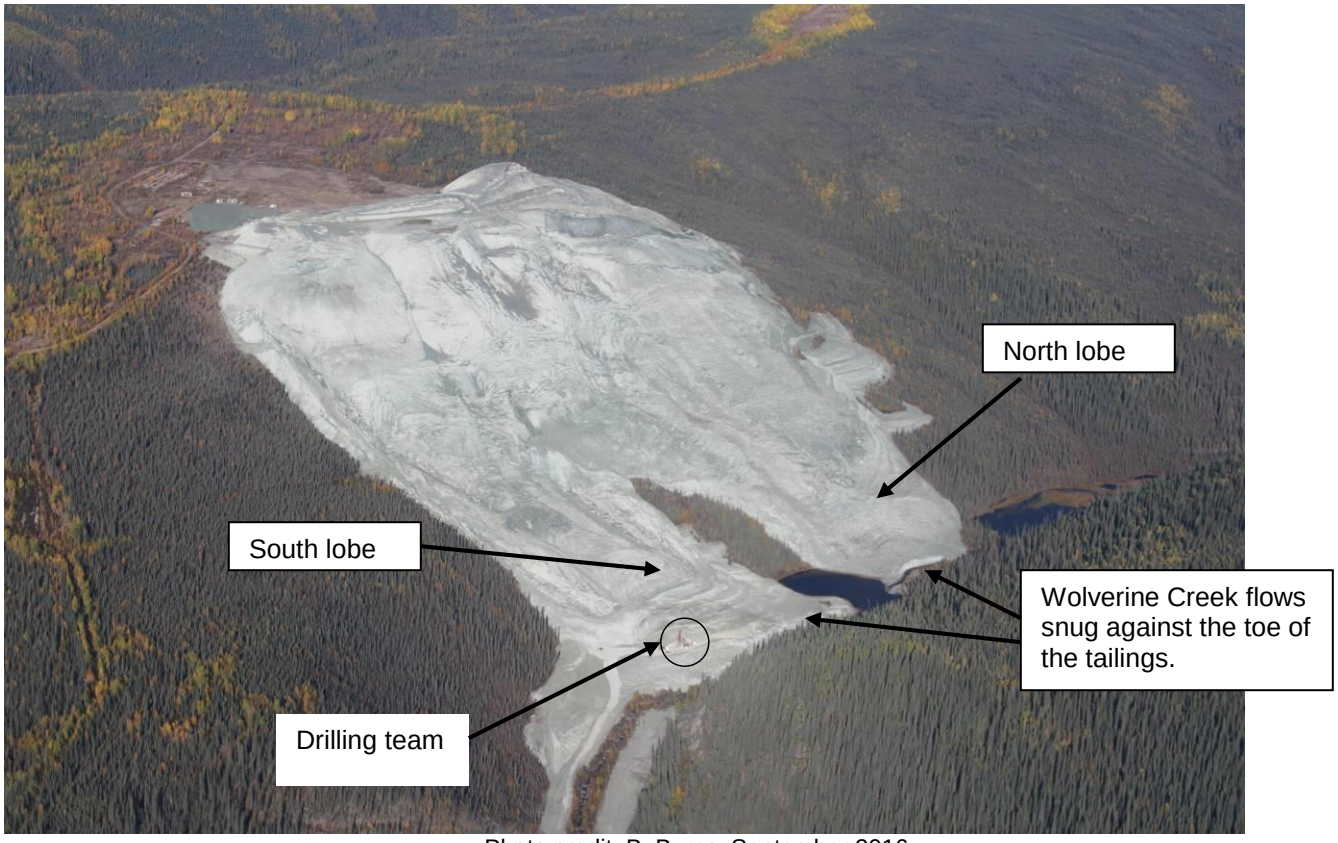
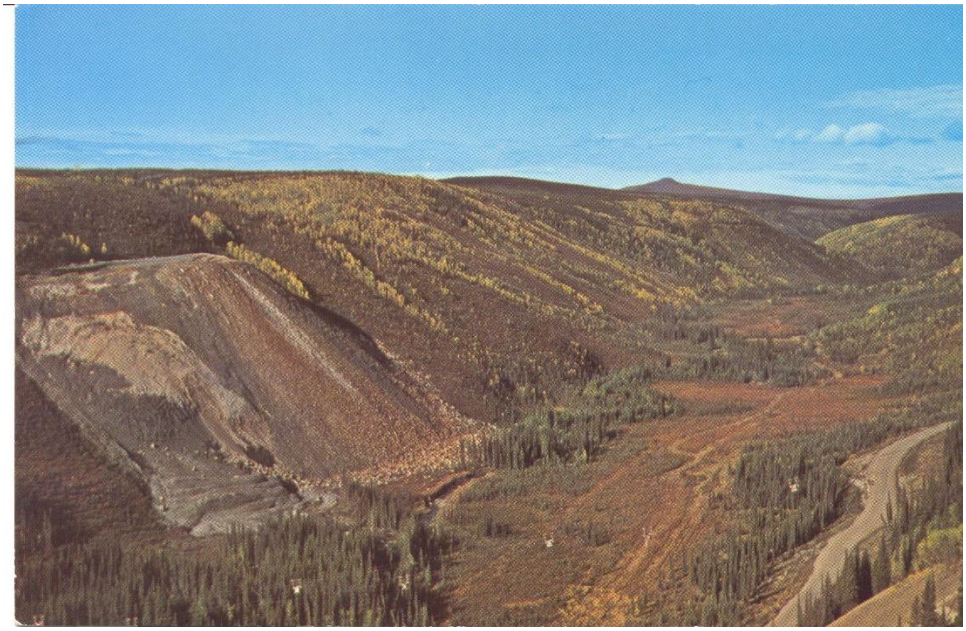


Photo credit: B. Burns, September 2016

Also in 1974, 60 million tonnes of the Clinton Creek waste rock pile slumped across the Clinton Creek valley creating Hudgeon Lake. The waste rock dam displaced Clinton Creek at the outflow of the lake approximately 25 m above the valley floor and cut a new channel into the waste material and the northern valley wall (Liebau, 2010). During the 1980s various weirs were constructed to reinforce the Clinton Creek channel in attempts to stabilize and control the outflow from Hudgeon Lake, with limited success. The structures were washed out during a high flow

event in 1997. The Federal Government (Department of Indian Affairs and Northern Development) assumed responsibility for the site in 1999; following Devolution in 2003, the Government of Yukon (YG) assumed responsibility for site management. In a series of stages from 2002 to 2015, gabion drop structures were constructed within the channel downstream of the Hudgeon Lake outlet. YG continues to monitor these structures and conducts repairs as necessary. Further reinforcement to the structures occurred in 2015.

The undated photo below is a postcard of Clinton Creek (B. Burns, personal collection) taken sometime prior to 1974 before the slumping of the waste rock and the formation of Hudgeon Lake. The valley with the original location of Clinton Creek can be observed and the tramline transporting crushed asbestos ore from Porcupine Pit to the mill can be seen in foreground.



The above photo can be compared to the cover photo to observe the significant changes that have occurred in the landscape since the late 1960s. The status, as of September 2016, of the outlet of Hudgeon Lake following the upgrades to the structures and reinforcement to the lower portion by the canyon entrance in 2015, can be viewed in the photo below.



1.1 Scope of Work

To aid in the completion of a decommissioning plan for the Clinton Creek abandoned asbestos mine site, it was necessary to investigate and characterize the existing aquatic conditions of the watersheds affected as well as document the current conditions at the reference sites. The resulting information will form a component towards the preparation of a Yukon Environmental and Socio-economic Assessment Act (YESAA) Project Proposal.

The objective of the project as stated in the Scope of Work is as follows:

> The objective is to investigate and characterize aquatic existing conditions in anticipation of preparing a Yukon Environmental and Socio-economic Assessment Act (YESAA) Project Proposal.

Assessment and Abandoned Mines (AAM) retained Laberge Environmental Services (Laberge) to conduct a detailed survey of the existing aquatic conditions at several sites. The survey included the following disciplines:

- Fisheries: presence, abundance, health, habitat use, tissue analysis
- Habitat: descriptions using CABIN and RICs, determine and map barriers to fish movements
- Benthic invertebrates: community abundance and structure using CABIN methods
- Water Temperature Profiling: installation of temperature loggers
- Water Quality: snap shot of conditions at time of sampling
- Stream Sediments: asbestos, metals and organic contents, particle sizing
- Periphyton: determine primary productivity

Table 1 below details the activities by site.

TABLE 1 DISCIPLINES TO BE UNDERTAKEN PER SITE

Relevant Water Sampling Station Code	Station Description	Fish Condition and Growth	Fish Sampling – Tissue Metals	Aquatic Habitat Mapping	Temperature Profiling	Benthic Macroinvertebrates	Periphyton	Stream Sediments
Exposed Sites								
n/a	Clinton Creek (General)	•	•					
E1	Clinton Creek downstream of gabions and canyon, but upstream of Porcupine Creek			•	•	•	•	•
E2	Clinton Creek, downstream of Porcupine Creek but upstream of Wolverine Creek					•	•	•
E3	Wolverine Creek, upstream of culvert			•	•	•	•	•
E4	Clinton Creek downstream of Wolverine Creek but upstream of Eagle Creek			•		•	•	•
E6	Clinton Creek upstream of ford crossing to town site			•	•	•	•	•
E8	Forty Mile River downstream of Clinton Creek			•		•	•	•

TABLE 1 DISCIPLINES TO BE UNDERTAKEN PER SITE								
Relevant Water Sampling Station Code	**Station Description**	**Fish Condition and Growth**	**Fish Sampling – Tissue Metals**	**Aquatic Habitat Mapping**	**Temperature Profiling**	**Benthic Macroinvertebrates**	**Periphyton**	**Stream Sediments**
n/a	Porcupine Creek at its discharge into Clinton Creek (below beaver ponds)				•	•	•	•
Reference Sites								
R1	Clinton Creek upstream of Hudgeon Lake			•	•	•	•	•
R2	Easter Creek upstream of Hudgeon Lake					•	•	•
R3	Wolverine Creek, upstream of tailings			•		•	•	•
R4	Eagle Creek, upstream of culvert			•		•	•	•
R6	Forty Mile River, upstream of Clinton Creek			•		•	•	•
n/a	Maiden Creek or other off-site reference	•						

2.0 STUDY AREA

The study area lies in the north-west section of the Klondike Plateau Ecoregion. This ecoregion is part of Beringia and due to the lack of glaciation, V-shaped valleys and extensive upland boulder fields are characteristic (Smith et al, 2006). Permafrost is discontinuous but widespread. In the Clinton Creek valley, the south facing slopes are generally well drained and are vegetated with aspen, birch and white spruce. The north facing slopes tend to be underlain with permafrost and contain stands of black spruce.

The study area encompasses tributaries to Hudgeon Lake, Clinton Creek and some of its tributaries, Maiden Creek, and two sites on the Forty Mile River. Site descriptions and locations are presented in Figure 1 and below in Table 2. The sample sites within the study area are categorized as either reference sites or exposed sites. During an evaluation of existing information and data at Clinton Creek, Minnow Environmental Inc recommended a sampling design to identify exposure to any influences from the abandoned asbestos mine (Minnow, 2009). This resulted in the identification of several reference and exposed sample sites. The reference sites R1, R2, R3, R4 and R6 are all located upstream of any mining related influences or upstream of the potentially affected portion of Clinton Creek. The reference site Maiden Creek was provided to Laberge by AAM as an off-site location. All of the exposed sites are potentially influenced by effects from the waste rock dumps, the tailings or Hudgeon Lake.

Conditions during the sampling period (September 4th to 9th) in 2016 appeared typical for the season. Water levels were low to moderate. The large gravel bar on the Forty Mile River just downstream of the bridge was fully exposed, the ford across Clinton Creek to the Clinton Creek Townsite was very navigable, and flows were well within their channels at the assessed streams. Judging by the water levels it did not appear that any significant rain events had occurred recently. Weather conditions were generally sunny, calm, warm during the day and cool at night, frequently associated with frost. No weather related factors affected the sampling programs.

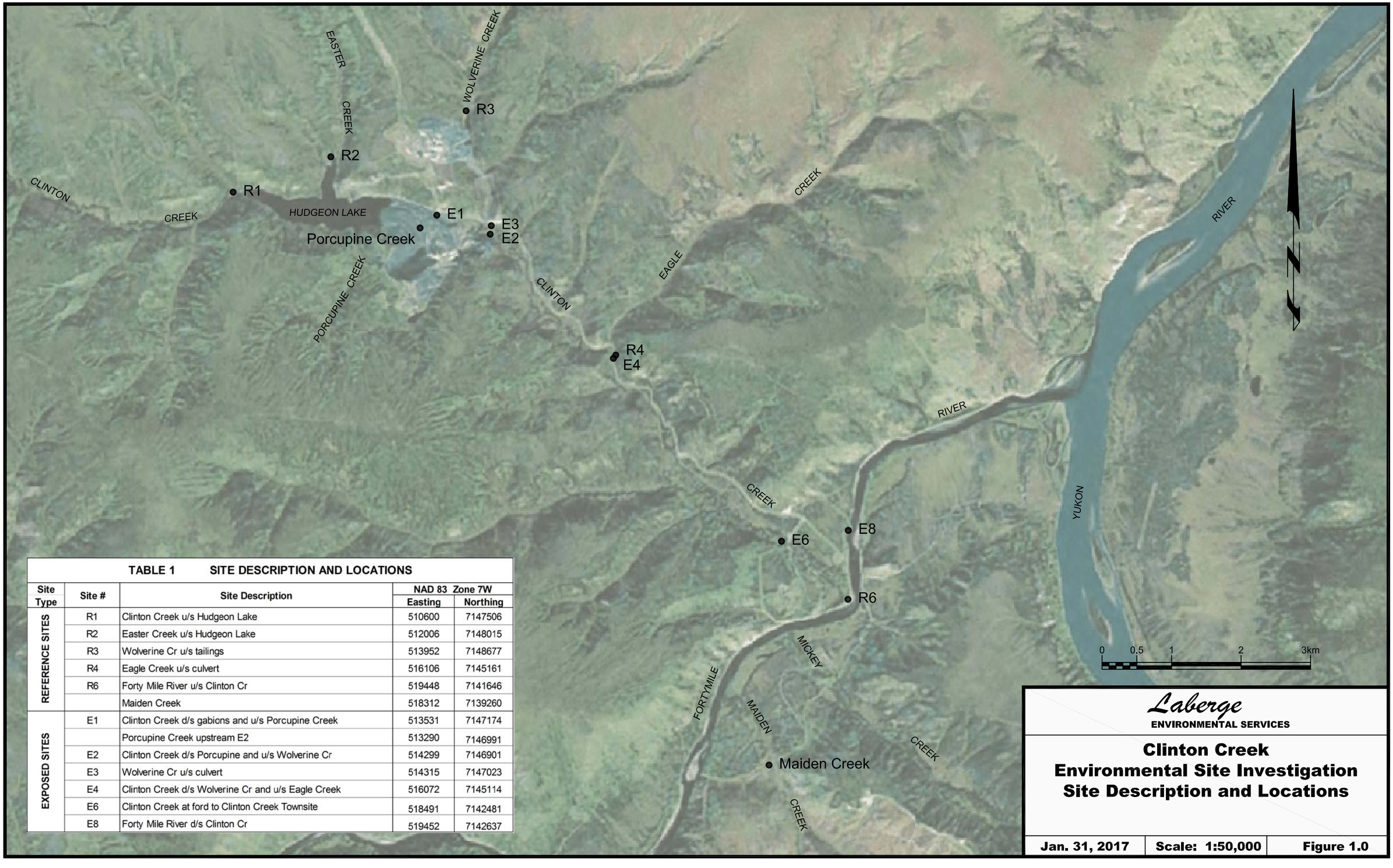


TABLE 1 SITE DESCRIPTION AND LOCATIONS

Site Type	Site #	Site Description	NAD 83 Zone 7W Easting	Northing
REFERENCE SITES	R1	Clinton Creek u/s Hudgeon Lake	510600	7147506
	R2	Easter Creek u/s Hudgeon Lake	512006	7148015
	R3	Wolverine Cr u/s tailings	513952	7148677
	R4	Eagle Creek u/s culvert	516106	7145161
	R6	Forty Mile River u/s Clinton Cr	519448	7141646
		Maiden Creek	518312	7139260
EXPOSED SITES	E1	Clinton Creek d/s gabions and u/s Porcupine Creek	513531	7147174
		Porcupine Creek upstream E2	513290	7146991
	E2	Clinton Creek d/s Porcupine and u/s Wolverine Cr	514299	7146901
	E3	Wolverine Cr u/s culvert	514315	7147023
	E4	Clinton Creek d/s Wolverine Cr and u/s Eagle Creek	516072	7145114
	E6	Clinton Creek at ford to Clinton Creek Townsite	518491	7142481
	E8	Forty Mile River d/s Clinton Cr	519452	7142637

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Clinton Creek
Environmental Site Investigation
Site Description and Locations

Jan. 31, 2017	Scale: 1:50,000	Figure 1.0

TABLE 2 SITE DESCRIPTION AND LOCATIONS				
Site Type	Site #	Site Description	NAD 83 Zone 7W	
			Easting	Northing
REFERENCE SITES	R1	Clinton Creek u/s Hudgeon Lake	510600	7147506
	R2	Easter Creek u/s Hudgeon Lake	512006	7148015
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	E4	Clinton Creek d/s Wolverine Cr and u/s Eagle Creek	516072	7145114
	E6	Clinton Creek at ford to Clinton Creek Townsite	518491	7142481
	E8	Forty Mile River d/s Clinton Cr	519452	7142637

3.0 SURFACE WATER QUALITY

The monitoring programs were conducted from September 4th to 9th, 2016. The upstream sites R1 and R2 were accessed by boat from Hudgeon Lake. All other sites were accessed by foot.

The objective of the water sampling program undertaken during the aquatic investigations was to obtain a snap shot of the conditions at the time of sampling the various media at each site during September 2016. The characterization of this medium provides important information on the conditions of this segment of the habitat since aquatic biota are in constant contact with water. Water quality can change rapidly in response to rainfall events and other disturbances, natural or anthropogenic. Regular water quality monitoring and hydrology studies have been completed at the Clinton Creek mine site for the past two years by Hemmera/ELR.

3.1 Methods

Water samples were collected midstream prior to any other sampling activity at each site. *In-situ* readings were collected using a YSI 600XML sonde and YSI 650 display. The sonde was deployed at each site for approximately 10 min. The YSI 650 was configured to log readings at one second intervals for temperature, pH, specific conductance, dissolved oxygen and oxygen reduction potential (ORP). All data files were later downloaded from the YSI 650 Display unit, reviewed and averaged for reporting purposes. Conductivity, pH and ORP were calibrated daily with certified calibration solutions. Dissolved oxygen was calibrated daily using the instrument's % saturation method.

The ALS Whitehorse depot supplied Laberge with the necessary sample kits prior to the field trip. Samples to be analysed for total suspended solids (TSS), pH, conductivity, alkalinity, and hardness were collected in 500 mL plastic bottles. Sulphate samples were collected in 125 mL plastic bottles. Samples to be analysed for total metals were collected in 125 mL plastic bottles and preserved with nitric acid. As total metals analysis includes any suspended sediment within the sample, dissolved samples were also collected to determine the metal concentration in the water column. These samples were filtered in the field using disposable syringes equipped with 45 micron filters and then preserved with nitric acid. Total mercury samples were collected in 50 mL vials and preserved with hydrochloric acid (HCl). Dissolved mercury samples were also collected and were filtered as described above and preserved with HCl. Except for samples to be analysed for dissolved parameters, each bottle was rinsed three times with the sample waters and then filled. The bottles for dissolved parameters were rinsed with the filtrate.

Samples were immediately placed into coolers after collection and kept cool with frozen ice packs. As the ice packs thawed they were replaced with frozen ones stored in the freezer at the Clinton Creek Townsite. At the termination of the sampling program the coolers of water samples were air shipped from Dawson to Whitehorse to ensure arrival before the laboratory closed for the weekend in order to meet the appropriate holding times. The coolers were then delivered to the ALS depot, logged in, and the appropriate samples were forwarded to their laboratory in Burnaby, BC. For these analyses, ALS used methods as described in Standard Methods for the Examination of Water and Wastewater and from the US Environment Protection Agency test methods. Further details per parameter are provided in the analytical report in Appendix B.

The data was compared to the most recent Canadian Council of Ministers on the Environment (CCME) Water Quality Guidelines for Protection of Aquatic Life (CCME-FAL), where applicable. Hardness plays an important role regarding the toxicity of several constituents. Generally, an increase in hardness decreases the toxicity of some metals to freshwater aquatic life, and thus CCME-FAL guidelines vary accordingly for these parameters. Soft waters are defined as having a hardness value of 0 to 60 mg/L as $CaCO_3$, medium hard waters have a hardness value of 60 to 120 mg/L, hard waters have a hardness value of 120 to 180 mg/L, and very hard waters are any over 180 mg/L. The guidelines for cadmium, copper, lead and nickel range depending on hardness, and parameter specific equations are used for specified ranges of hardness. To determine the site-specific guideline for cadmium when hardness was less than 280 mg/L as $CaCO_3$, the following equation was used:

$$10^{\{0.83(log[hardness])-2.46\}}$$

The following equation was used to derive the guideline for copper for samples with moderately hard waters:

$$0.2 * e^{\{0.8545[ln(hardness)]-1.465\}}$$

The guideline for lead was determined for all samples using the following equation:

$$e^{\{1.273[ln(hardness)]-4.705\}}$$

The guideline for nickel was determine for all samples using the following equation:

$$e^{\{1.273[ln(hardness)]-4.705\}}$$

3.2 Quality Assurance / Quality Control (QA/QC)

QA/QC was maintained in the field through the use of dedicated disposable gloves for sampling and handling at each site. Sample procedures and protocols were strictly adhered to for all sample types and parameters, as described in Section 3.1. An undisturbed, fast flowing section of the stream channel at each site was chosen for sampling prior to any other activity. In addition, one duplicate sample was collected, alongside one field blank and one travel blank.

A duplicate sample was collected at E2, Clinton Creek upstream of Wolverine, and data for both sets were very similar (Appendix B). Relative percent difference (RPD) was performed on each parameter, with a difference of 20% or more indicating a sampling or analytical bias. The RPD was calculated according to the following formula:

RPF = (value in sample – value in duplicate)/((value in sample + value in duplicate)/2) *100

Of the 70 constituents tested, cadmium had the greatest RPD of 9.4% (Table 5, Appendix B). The very low RPDs for all parameters indicates no concerns with sampling or analytical techniques.

No constituents were detected in the field blank, which was prepared at R6, indicating that no contamination was introduced during preparation and filtering. Although a travel blank was requested from the lab, only prepared samples for general analysis and sulphate were provided. All analyses were below the method detection limit, and pH was reported at 5.53. Based on this, no contamination occurred during the field trip or via shipping.

The ALS laboratory performs their own QA/QC for each of the parameters tested and these are included in the analytical report in Appendix B.

3.3 Results and Discussion

In-situ data were collected at each site and are presented below in Table 3. Water temperatures were generally cool and reflected late summer/early autumn conditions. The warmest temperatures were documented in Clinton Creek downstream of Hudgeon Lake which acts as a modifying effect until it has cooled as well. Conductivity was very high in Porcupine Creek (1,980 uS/cm) which drains the waste rock and would contain greater concentrations of dissolved mineral ions. The conductivity in the waters of the Forty Mile River (243 µS/cm at R6 and 250 uS/cm at E8) and in Maiden Creek (196 µS/cm) were considerably lower.

Generally, all sites were well aerated. The concentration of dissolved oxygen was the lowest at Porcupine Creek (7.2 mg/L) which does not meet the CCME-FAL minimum allowable concentration of 9.5 mg/L for the early life stages of cold water fish. The primary source of Porcupine Creek at this site location are groundwater seeps from the waste rock dump, which would have very low levels of dissolved oxygen. The dissolved oxygen at the other sites ranged from 10.0 mg/L at E4 to 12.9 mg/L at R1.

All sites were slightly alkaline with pH ranging from 7.88 at E6 to 8.67 at E3. ORP is a measure of the sampled water's ability to reduce or oxidize other substances. The higher the ORP the

greater the number of oxidizing agents present. ORP ranged from 10.3 mV at E2 to 70.1 mV at E6.

TABLE 3 ***IN-SITU*** **DATA, CLINTON CREEK SEPTEMBER 2016**

	Site	Date & Time	Temp C	Cond uS/cm	DO mg/L	pH	ORP mV
REFERENCE SITES	R1	9/7/2016 12:41	3.07	670	12.9	8.46	29.8
	R2	9/7/2016 15:03	4.02	594	12.8	8.42	40.1
	R3	9/6/2016 11:13	3.15	659	12.8	8.28	42.3
	R4	9/5/2016 14:30	3.02	600	11.4	8.37	53.8
	R6	9/8/2016 16:23	9.05	257	11.4	8.26	46.4
	Maiden Creek	9/8/2016 12:00	0.50	220	----	8.16	---
EXPOSED SITES	E1	9/6/2016 14:20	9.92	511	11.1	8.55	42.0
	Porcupine Creek	9/7/2016 9:23	4.83	1968	7.2	8.11	29.7
	E2	9/6/2016 16:03	9.34	632	10.5	8.33	10.3
	E3	9/6/2016 8:54	3.32	616	12.2	8.67	36.9
	E4	9/5/2016 13:23	8.40	684	10.0	7.92	48.0
	E6	9/5/2016 9:30	5.69	699	11.1	7.88	70.1
	E8	9/8/2016 14:49	8.28	264	12.1	8.65	31.8

The analytical data has been summarized in Table 4. Total suspended solids (TSS) ranged considerably throughout the study area. The streams were visibly turbid at R4 (Eagle Creek), and Maiden Creek with TSS concentrations of 130 mg/L and 98 mg/L respectively. It is unknown why the water was so turbid at R4 as water levels throughout the study area did not indicate the possibility of recent rainfall events. A possible explanation may be effects from the documented landslide located upstream (see Section 8.2.3). Placer mining activity occurring upstream on a tributary to Maiden Creek produced the suspended sediment load visible at the sample site here. The clearest waters were documented in Clinton Creek at E1, E2, E4 and E6, as well as in Porcupine Creek.

Currently there are no national (CCME) guidelines for Sulphate for the protection of freshwater aquatic life. The BC Ministry of the Environment (BC MoE) has set guidelines that vary with hardness; 309 mg/L for moderately hard to hard waters and 429 mg/L for very hard waters (Meays and Nordin, 2013). The concentration of sulphate was below the BC MoE guideline at all sites except for Porcupine Creek where a concentration of 1090 mg/L was reported.

The sampled waters were hard (120 to 180 mg/L as $CaCO_3$) to very hard (greater than 180 mg/L as $CaCO_3$) except at the Forty Mile River sites and in Maiden Creek where the water was moderately hard (60 to 120 mg/L as $CaCO_3$).

Of 33 metals analysed, five were below the method detection limits in all samples; beryllium, bismuth, phosphorus, thallium and tin (Appendix B). Table 4 summarizes the total and dissolved metals data for select parameters and includes comparisons to the most recent CCME-FAL. Although the guidelines apply to total metals only, both phases have been included in the table and compared to the guidelines due to a high suspended sediment load at some of the sites.

The concentrations of arsenic, lead, molybdenum, nickel, silver, uranium and zinc were below the respective CCME-FAL guidelines in both the dissolved and total phases at all sites. Due to changes of toxicity with hardness, site-specific guidelines for lead and nickel were generated using the equations described in Section 3.1.

Concentrations of aluminium exceeded the CCME-FAL guideline (0.100 mg/L) in the total metals samples from all of the sites except for E1, E2 and Porcupine Creek, and ranged from 0.0051 mg/L in Porcupine Creek to 2.22 mg/L in Eagle Creek (R4). The guideline was also exceeded in the dissolved sample from Maiden Creek (0.172 mg/L).

Boron was only detected at Porcupine Creek but the concentration did not exceed the CCME-FAL guideline.

The CCME-FAL guideline for cadmium varies with hardness and the equation was used to determine each site-specific guideline for the samples where hardness was less than 280 mg/L as $CaCO_3$. The CCME-FAL guideline of 0.00037 mg/L is used where the hardness is greater than 280 mg/L as $CaCO_3$. Detected cadmium ranged from 0.000127 to 0.00139 mg/L. Only total cadmium at Maiden Creek exceeded its site-specific guideline.

There is no CCME guideline for total chromium but there are guidelines for two species of chromium, trivalent chromium and hexavalent chromium. Trivalent chromium is commonly found in reducing environments such as sediments and wetlands whereas hexavalent is the dominant species found in surface waters (CCME, 1997). For the purposes of this report the guideline for hexavalent chromium (0.001 mg/L) was used to assess the sites where chromium may pose an issue for freshwater aquatic life. Testing completed by Hemmera/ELR (2016) showed that hexavalent chromium concentrations were frequently similar to total chromium concentrations. This guideline was exceeded in the total metals samples from all of the sites except at R6, E1, E2, and E8. Dissolved chromium was only detected at Porcupine Creek and E3, where it also exceeded the guideline.

Copper is another metal whose toxicity varies with hardness. The CCME-FAL guideline for very hard waters (greater than 180 mg/L as CaCO3) is 0.004 mg/L. For moderately hard water the copper equation as described in Section 3.1 was used. Total copper exceeded the applicable guideline at R1, R4, R6, Maiden Creek, E3, E6 and E8. The softer water sites, R6, Maiden Creek and E8 also exceeded the guideline in the dissolved samples.

The CCME-FAL guideline for iron (0.30 mg/L) was exceeded in all of the total samples except at Porcupine Creek, and in the dissolved samples at R2, R3, R6, Maiden Creek and E6.

Detectable concentrations of total mercury ranged from 0.0000051 to 0.0000640 mg/L and the CCME-FAL guideline of 0.000026 mg/L was exceeded at Eagle Creek, R4 (0.0000640 mg/L). Dissolved mercury was detected in the samples from Maiden Creek and E6 but concentrations were below the recommended CCME-FAL guideline.

The CCME-FAL guideline for the protection of freshwater aquatic life for selenium (0.001 mg/L) was exceeded in both the dissolved and total phases at R1, R4, E1, Porcupine Creek, E2, E3, E4 and E6.

TABLE 4 **SUMMARY OF ANALYTICAL RESULTS, SEPTEMBER 2016**

	Method Detection Limit	REFERENCE SITES						EXPOSED SITES							
		R-1	R-2	R-3	R-4	R-6	MAIDEN CR	E-1	PORCUPINE CR	E-2	E-3	E-4	E-6	E-8	CCME-FAL mg/L
Date Sampled		7-Sep-2016	7-Sep-2016	6-Sep-2016	5-Sep-2016	8-Sep-2016	8-Sep-2016	6-Sep-2016	7-Sep-2016	6-Sep-2016	6-Sep-2016	5-Sep-2016	5-Sep-2016	8-Sep-2016	
Time Sampled		12:45	15:00	11:30	11:40	16:40	12:00	14:30	9:40	16:30	9:00	13:10	9:30	14:50	
Hardness (as CaCO3)	0.50	375	328	367	324	111	84	281	1370	370	337	386	385	116	
TSS (mg/L)	2.0	37.0	9.8	12.0	130.0	4.9	98.0	2.4	2.4	2.2	63.0	4.9	32.0	7.7	
Sulfate (SO4) (mg/L)	0.30	224	169	218	159	45.9	53.5	151	**1090**	219	191	236	235	47.9	BC MoE*
Aluminum (Al)-Dissolved (mg/L)	0.0050	0.0289	0.0406	0.0298	0.0199	0.0846	**0.172**	0.0432	<0.0050	0.0348	0.0303	0.0294	0.0286	0.0922	0.100
Aluminum (Al)-Total (mg/L)	0.0050	**0.819**	**0.316**	**0.345**	**2.22**	**0.334**	**2.21**	0.0656	0.0051	0.0516	**1.23**	**0.185**	**0.549**	**0.281**	0.100
Arsenic (As)-Dissolved (mg/L)	0.00050	0.00057	0.00108	0.00067	0.00207	0.00059	0.00076	0.00078	0.00255	0.00105	0.00085	0.00108	0.00123	0.00060	0.00500
Arsenic (As)-Total (mg/L)	0.00050	0.00148	0.00132	0.00101	0.00493	0.00078	0.00210	0.00090	0.00239	0.00109	0.00198	0.00135	0.00195	0.00079	0.00500
Boron (B)-Dissolved (mg/L)	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.22	<0.10	<0.10	<0.10	<0.10	<0.10	1.5
Boron (B)-Total (mg/L)	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.23	<0.10	<0.10	<0.10	<0.10	<0.10	1.5
Cadmium (Cd)-Dissolved (mg/L)	0.0000050	0.0000749	0.0000271	0.0000190	0.0000464	0.0000227	0.0000397	0.0000391	0.000181	0.0000500	0.0000248	0.0000419	0.0000492	0.0000256	0.00037 or
Cadmium (Cd)-Total (mg/L)	0.0000050	0.000174	0.0000351	0.0000320	0.000365	0.0000315	**0.000186**	0.0000453	0.000162	0.0000474	0.000186	0.0000621	0.000104	0.0000339	equation
CCME Cadmium calculated:		*0.000370*	*0.000370*	*0.000370*	*0.000370*	*0.0001728*	*0.000137*	*0.000370*	*0.000370*	*0.000370*	*0.000370*	*0.000370*	*0.000370*	*0.0001793*	
Chromium (Cr)-Dissolved (mg/L)	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	**0.0024**	<0.0010	**0.0051**	<0.0010	<0.0010	<0.0010	0.001**
Chromium (Cr)-Total (mg/L)	0.0010	**0.0018**	**0.0013**	**0.0013**	**0.0052**	<0.0010	**0.0039**	<0.0010	**0.0024**	<0.0010	**0.0032**	**0.0011**	**0.0023**	<0.0010	0.001**
Copper (Cu)-Dissolved (mg/L)	0.0010	0.0019	0.0016	0.0018	0.0019	**0.0026**	**0.0039**	0.0027	0.0011	0.0024	0.0018	0.0021	0.0022	**0.0027**	0.002 or
Copper (Cu)-Total (mg/L)	0.0010	**0.0041**	0.0021	0.0027	**0.0123**	**0.0033**	**0.0081**	0.0030	0.0020	0.0026	**0.0062**	0.0028	**0.0042**	**0.0031**	0.0040
CCME Copper Guideline		*0.0040*	*0.0040*	*0.0040*	*0.0040*	*0.0020*	*0.0020*	*0.0040*	*0.0040*	*0.0040*	*0.0040*	*0.0040*	*0.0040*	*0.0020*	
Iron (Fe)-Dissolved (mg/L)	0.030	0.269	**0.519**	**0.365**	0.159	**0.306**	**0.516**	0.246	<0.030	0.268	0.280	0.284	**0.323**	0.300	0.300
Iron (Fe)-Total (mg/L)	0.030	**1.73**	**1.01**	**1.01**	**4.98**	**0.762**	**3.38**	**0.323**	<0.030	**0.349**	**2.67**	**0.645**	**1.40**	**0.634**	0.30
Lead (Pb)-Dissolved (mg/L)	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.025 to
Lead (Pb)-Total (mg/L)	0.00050	0.00132	<0.00050	<0.00050	0.00330	<0.00050	0.00189	<0.00050	<0.00050	<0.00050	0.00141	<0.00050	0.00077	<0.00050	0.007
CCME Lead Guideline		*0.007*	*0.007*	*0.007*	*0.007*	*0.004*	*0.003*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	*0.004*	
Mercury (Hg)-Dissolved (mg/L)	0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000059	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000051	<0.0000050	0.000026
Mercury (Hg)-Total (mg/L)	0.0000050	0.0000128	0.0000052	0.0000056	**0.000064**	<0.0000050	0.0000108	0.0000057	0.0000051	0.0000062	0.0000189	0.0000068	0.0000114	<0.0000050	0.000026
Molybdenum (Mo)-Dissolved (mg/L)	0.0010	0.0012	<0.0010	0.0011	0.0013	<0.0010	<0.0010	0.0012	0.0024	0.0014	0.0012	0.0014	0.0014	<0.0010	0.0730
Molybdenum (Mo)-Total (mg/L)	0.0010	0.0015	<0.0010	0.0013	0.0024	<0.0010	<0.0010	0.0013	0.0026	0.0015	0.0017	0.0016	0.0016	<0.0010	0.0730
Nickel (Ni)-Dissolved (mg/L)	0.0010	0.0042	0.0041	0.0037	0.0117	0.0032	0.0050	0.0044	0.0594	0.0107	0.0080	0.0117	0.0131	0.0034	0.150 or
Nickel (Ni)-Total (mg/L)	0.0010	0.0065	0.0047	0.0044	0.0242	0.0040	0.0087	0.0046	0.0573	0.0110	0.0093	0.0134	0.0164	0.0038	equation
CCME Nickel Guideline		*0.150*	*0.150*	*0.150*	*0.150*	*0.103*	*0.084*	*0.150*	*0.150*	*0.150*	*0.150*	*0.150*	*0.150*	*0.107*	
Selenium (Se)-Dissolved (mg/L)	0.000050	**0.00291**	0.000725	0.000994	**0.00324**	0.000257	0.000574	**0.00192**	**0.00514**	**0.00198**	**0.00146**	**0.00196**	**0.00186**	0.000295	0.0010
Selenium (Se)-Total (mg/L)	0.000050	**0.00298**	0.000780	0.000985	**0.00363**	0.000280	0.000582	**0.00188**	**0.00501**	**0.00194**	**0.00167**	**0.00179**	**0.00190**	0.000317	0.0010
Silver (Ag)-Dissolved (mg/L)	0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	0.00025
Silver (Ag)-Total (mg/L)	0.000020	0.000031	<0.000020	<0.000020	0.000169	<0.000020	0.000036	<0.000020	<0.000020	<0.000020	0.000053	<0.000020	0.000033	<0.000020	0.00025
Uranium (U)-Dissolved (mg/L)	0.00020	0.00226	0.00341	0.00302	0.00314	0.00087	0.00042	0.00178	0.00526	0.00196	0.00236	0.00207	0.00231	0.00098	0.0150
Uranium (U)-Total (mg/L)	0.00020	0.00253	0.00350	0.00319	0.00353	0.00099	0.00067	0.00185	0.00530	0.00207	0.00248	0.00223	0.00242	0.00100	0.0150
Zinc (Zn)-Dissolved (mg/L)	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0063	<0.0050	<0.0050	<0.0050	0.0062	<0.0050	0.0300
Zinc (Zn)-Total (mg/L)	0.0050	0.0138	<0.0050	<0.0050	0.0245	0.0057	0.0214	<0.0050	0.0067	<0.0050	0.0147	<0.0050	0.0147	0.0054	0.0300

* BC MoE: British Columbia Ministry of the Environment Guideline: 309 mg/L for medium hard to hard water; 429 mg/L for very hard water

** This guideline is actually applicable to hexavalent chromium, as described in the text.

Values are in bold and highlighted where the recommended guideline has been exceeded.

When examining the reference data exclusively, the concentrations for most parameters were the greatest at Eagle Creek (R4), where the recommended CCME-FAL guidelines for total aluminium, chromium, copper, iron, mercury and selenium were exceeded. As discussed previously, the concentration of TSS was high here, 130 mg/L. The dissolved concentrations of these parameters, except for selenium, were much lower indicating that the majority of the metals were contained in the suspended matter.

For the exposed sites dataset, greatest concentrations of several parameters were recorded at Porcupine Creek, with selenium exceeding the recommended CCME-FAL guideline and sulphate exceeding the BC MoE guideline. Total and dissolved chromium also exceeded the CCME-FAL guideline here but higher concentrations were documented at E3, Wolverine Creek. In addition, maximum levels of aluminium, copper and iron were recorded at E3.

4.0 WATER TEMPERATURE LOGGERS

Temperature data loggers were installed in five locations in the Clinton Creek study area to assess the thermal regime over the course of a one-year period. This will assist in the determination of over wintering potential for fish at these areas.

Temperature data loggers have been installed at several locations in Clinton Creek and at groundwater seep areas during the summer months only in 2010 (Laberge, 2011) and 2012, 2013, 201 and 2015 (von Finster, 2016).

4.1 METHODS

Hobo “Tidbit V2” temperature loggers were installed at R1, E1, Porcupine Creek, E3 and E6. Each data logger was installed inside a short piece of open ended two-inch diameter black PVC pipe tethered to a steel weight. The tether used was 3/16 inch plastic coated steel clothes line cable. All cable ends were secured with two aluminum cable clamps. The tethered data logger was then deployed where water was deepest and where there was some protection such as a back eddy or in a slow moving section of the creek (See Photos 1 and 2 in Appendix A). By choosing deeper sections of the creek, there is less likelihood of freezing to the substrate. GPS coordinates were collected at each of the data logger sites. The tether was secured to either a nearby tree or stand of willow. The tethered tree and PVC pipe were marked with orange flagging. In some cases, local cobble material was placed on top of the submerged cable and/or PVC pipe to provide additional protection during high flow periods.

The Hobo data loggers were initiated on August 31, 2016 prior to deployment. Table 6 lists the site, the logger ID, submerged start time and coordinates for each of the dataloggers. The data loggers were initiated on a 15 minute interval starting on the hour and will be deployed for a one year period. Battery life should last approximately 2.5 years. It is recommended that the temperature loggers be downloaded in September 2017.

Table 6 INSTALLATION DESCRIPTIONS FOR THE TEMPERATURE LOGGERS								
Site	Hobo Tidbit V2 serial number	NAD 83 Zone 7W		Elevation (m)	Bank	Date Installed	Time Installed	First Reading
		Easting	Northing					
R 1	10956744	510575	7147490	416.1	Right	9/7/2016	13:10	13:30
E 1	10956743	513652	7147096	371.6	Right	9/6/2016	15:20	15:30
Porcupine Cr	10956741	513920	7146991	353.3	Right	9/7/2016	10:15	10:30
E 3	10956739	514184	7147196	368.3	Left	9/6/2016	9:40	10:00
E 6	10956742	518491	7142481	305.4	Left	9/5/2016	10:10	10:30

5.0 STREAM SEDIMENTS

5.1 Methods

Triplicate stream sediments were collected from depositional areas at each of the 12 benthic invertebrate sites. A stainless steel scoop was used to place the stream sediments into two glass jars per sample (a total of six jars per site). One jar was for the analysis of asbestos and the other jar provided material for the analyses of metals, particle size analysis and loss of ignition (LOI). Samples were kept cool prior to shipment to the ALS laboratory in Whitehorse, Yukon, where they were logged in and sent on to the ALS lab in Edmonton, AB.

The ALS lab analyzed each sample for asbestos content prior to the initiation of the other parameters (metals, LOI and particle sizing). All of the stream sediment samples collected from the exposed sites (all those with the prefix E) contained asbestos, and these samples were sent to the Golder Laboratory in Burnaby, BC, for the analyses of particle sizing and LOI due to Workers' Compensation Safety regulations related to asbestos fibres.

For the samples where asbestos was not detected, the ALS lab in Edmonton completed LOI, particle size analysis, and the 33 metals scan. For the asbestos positive samples, a wet analysis for metals was performed and converted to dry weight, due to the presence of asbestos fibres and health and safety concerns. The complete analytical report is provided in Appendix C. Details on the laboratory methods used for all parameters are provided in Appendix C as well.

5.2 Results and Discussion

5.2.1 Asbestos Content

Most of the samples from the reference sites (R1-A, R1-B, R1-C, R2C, R3-B, R4-B, R6-B and R6-C) were found to be devoid of asbestos fibres, although other forms of fibre were occasionally present (cellulose, mica, etc.). The fibre content of all samples is displayed

in Table 7, Appendix C. None of the samples where asbestos was detected was greater than 5%.

Stream sediments from the Clinton Creek site have been analysed for asbestos on two other occasions; in 1998 by Royal Roads University (1999) and in 2009 by Laberge, (2010). In 1998, asbestos was not detected in the sediments from Wolverine Creek upstream of the tailings (R3) and asbestos fibre content was determined to be 10% in the sediments in Wolverine Creek upstream of Clinton Creek at E3. In 2009, stream sediments were collected from E3 and E4 (Clinton Creek downstream of Wolverine Creek), and analysed for asbestos. The reported fibre content at both sites was 15 to 20% (Laberge, 2010). The amount of asbestos occurring in the stream sediments downstream of the tailings appears to vary and is likely dependant on events flushing tailings through the system.

5.2.2 Geochemistry

The stream sediment samples were analysed for 33 metals and the complete analytical report can be found in Appendix C. Metals that are known to have toxic effects to aquatic biota and/or are present in the waste rock or tailings were examined. Data for the triplicate samples were averaged for arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc with the results tabulated below in Table 8. The CCME guidelines for the protection of freshwater aquatic life are also included; Interim Freshwater Sediment Quality (ISQG) and Probable Effects Levels (PEL). Values in bold indicate that the ISQG has been exceeded and the cells that are highlighted represent where the PEL is also exceeded.

TABLE 8 CONCENTRATIONS OF METALS (mg/kg) IN THE STREAM SEDIMENTS, SEPTEMBER 2016

Site	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
E-1	**18.3**	**1.13**	**266**	31.4	12.1	**0.262**	436	95.9
Porcupine Cr	**14.3**	**0.83**	**226**	18.6	5.8	0.112	356	65.5
E-2	**15.8**	**0.87**	**257**	27.2	10.6	0.150	402	84.6
E-3	**7.8**	0.49	**45**	22.7	9.7	0.077	58	84.5
E-4	**9.1**	0.54	**106**	19.5	7.3	0.078	155	71.3
E-6	**12.2**	0.34	**51**	17.6	8.3	0.050	73	65.9
E-8	**12.2**	0.16	13	11.8	4.1	0.071	13	46.8
R-1	**11.9**	**0.86**	36	34.4	13.9	**0.187**	42	105.1
R-2	**12.2**	0.32	32	17.6	8.0	0.035	54	61.1
R-3	5.3	0.33	**38**	18.4	6.6	0.067	44	57.7
R-4	**16.8**	**0.70**	**42**	23.9	9.4	0.060	68	86.3
R-6	**9.0**	0.34	35	25.1	8.8	0.060	30	84.4
ISQG	5.9	0.6	37.3	35.7	35	0.170		123
PEL	17	3.5	90	197	91.3	0.486		315

Note: ISQG = Interim freshwater Sediment Quality Guidelines, in **bold** where exceeded.
PEL = Probable Effects Level (>50% of adverse effects occur above this level), shaded and in bold where exceeded.

Arsenic concentrations were high throughout the study area and the ISQG was exceeded at all sites except upstream on Wolverine Creek (R3). The PEL was exceeded as well at E1, Clinton Creek at the base of the waste rock dump.

The ISQG was exceeded for cadmium at E1, Porcupine Creek, E2, R1 and R4.

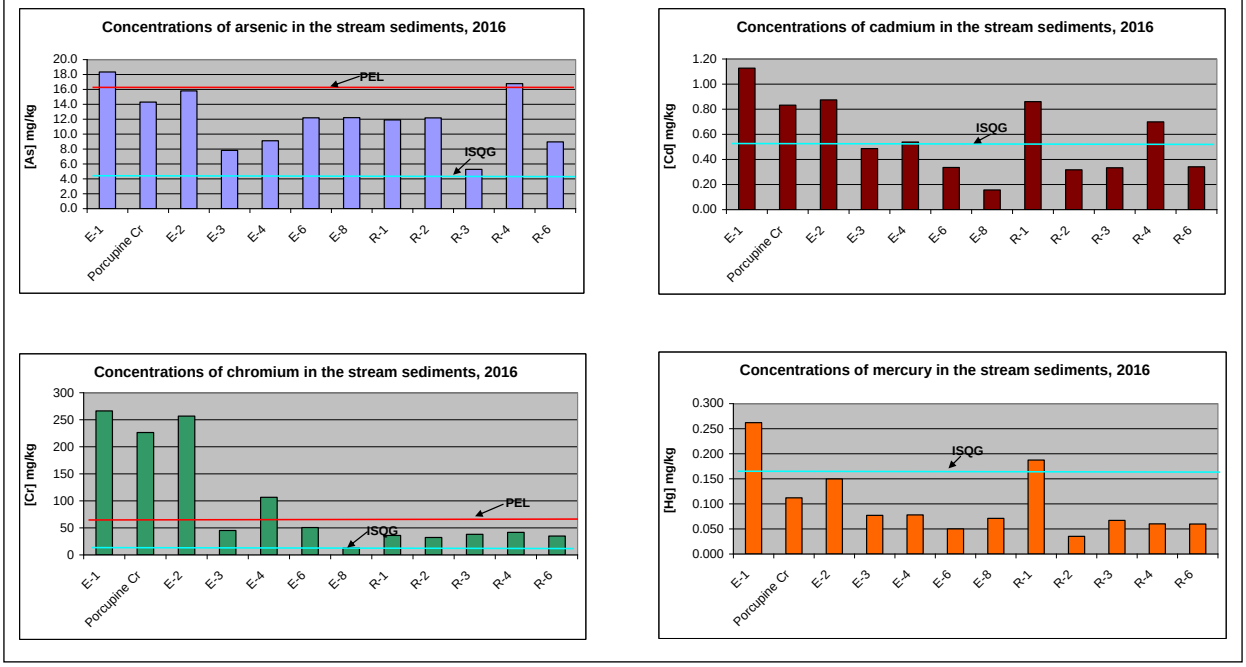
Chromium has been identified as a potential contaminant of concern at the Clinton Creek site (Laberge, 2012). In general, concentrations of chromium in the stream sediments were considerably higher at the exposed sites than at the reference sites. Concentrations of chromium exceeded the ISQG and the PEL in the stream sediments at E1, Porcupine Creek, E2 and E4. The ISQG was also exceeded at E3, E6, R3 and R4. The type of chrysotile asbestos fibres that were mined at Clinton Creek, contain high levels of nickel, chromium, cobalt and manganese (Schreier et al, 1987). Chromium appears to be mobilizing out of the asbestos mineralogy from the waste rock and the tailings.

Concentrations of copper, lead and zinc were low in the stream sediments at all sites and no guidelines were exceeded. There are no CCME guidelines for nickel. Concentrations of nickel were far greater at the exposed sites near and downstream of the waste rock and Wolverine Creek than at the other sites. As nickel is a component of the asbestos mineralogy, the high levels documented at the sites near the waste rock indicate that it could have possible influences to the receiving environment.

The ISQG was exceeded for mercury in the stream sediments at E1 and R1 only.

The metals where guidelines have been exceeded are graphically displayed in Figure 2.

FIGURE 2 CONCENTRATIONS OF METALS (mg/kg) IN THE STREAM SEDIMENTS AT CLINTON CREEK, 2016



Stream sediment samples have been collected on a few previous occasions; in 1998 (Royal Roads University), 2009 (Laberge), 2010 (Laberge) and 2011 (Laberge), however not all sites were sampled during each sampling event. Table 9 in Appendix C summarizes the data for arsenic, cadmium, chromium and nickel from these monitoring programs.

Arsenic concentrations appear to be background levels of the study area since there is little fluctuation over time or between sites, although slightly higher values are found at the upper exposed sites. Likewise, there is little change over time in the cadmium concentrations. Chromium decreased at Wolverine Creek (E3) after 2010. It was speculated that the scouring action of the extreme flows that occurred during flooding events in August 2010 flushed the fines through the system (Laberge, 2012). There has been little change at the reference sites indicating ambient chromium levels at these sites. Concentrations of nickel in the stream sediments at Wolverine Creek (E3) have also decreased considerably after 2010. The tailings were tested in 2011 (Laberge, 2012) and the average concentration (N=3) of chromium and nickel was 1650 mg/kg and 2797 mg/kg respectively. Based on the low upstream concentrations in Wolverine Creek at R3, and the increased concentrations at E3, the tailings have contributed chromium and nickel to the creek. It appears that nickel and chromium have mobilized down the creek over the past five years as concentrations have increased downstream at E4 (Clinton Creek upstream of Eagle Creek).

5.2.3 Particle Size

Due to the presence of asbestos in many of the sediment samples, two different labs completed the particle size analysis, as described in Section 5.1. Each laboratory (ALS and Golder) reported the results for different sieve sizes. Although both labs received the same instruction, Golder reported more fractions. Table 10, Appendix C, displays the lowest common denominator of particle sizes so that all samples can be viewed equally. Figure 3 in Appendix C, is a graphical representation of the fractional components of each sample. Gravels formed the largest component of the stream sediments collected at E8, Forty Mile River d/s of Clinton Creek. The dominant class form at the other exposed sites was medium to fine sand. Samples from the reference sites R1, R2, R3 and R6 were comprised primarily of silt.

5.2.4 Organic Content

Loss on ignition analysis was performed by both labs on the sediment samples to determine the percentage of organic content. There were very low levels of organic content throughout the study area ranging from 0.4% in the sediments at the Forty Mile River downstream of Clinton Creek (E8-B) to 16.4% in sample R3B, Wolverine Creek upstream of the tailings (Table 11, Appendix C). The lotic conditions at each of the sites provided little opportunity for the deposition of organic material that may be carried downstream. Macrophytes were not present at any of the sample sites which also would have provided organic material.

6.0 PERIPHYTON

The objective of the periphyton sampling program is to describe the current periphyton communities in relation to the Clinton Creek site. Periphyton studies have not been undertaken at the site previously.

Periphyton are a complex assemblage of algae and microbes that grow on submerged substrates (e.g., rocks, woody debris, macrophyte plants) in aquatic ecosystems. It serves

as an important food source for invertebrates and certain fish species, and can be an important sorber of contaminants (Wu, 2016). The abundance and taxonomic diversity of periphyton communities can be used to assess the health of a stream and identify the presence of stressors (e.g., sedimentation, metals contamination, nutrient enrichment).

6.1 Methods

Replicate periphyton samples were collected at each site. Larger flat-surfaced rocks were selected from the wetted stream channel at each of the sites visited. Due to the lack of suitable sized rocks at R1, no periphyton samples could be collected. All stream bed material at R1 was comprised of sand and small gravels.

A stainless steel cup with a 30mm diameter rubber ring was securely clamped to the upper rock surface for sampling (see Appendix A, Photo #3). A small rigid brush was used to rigorously scour the enclosed surface area of the rock. Each sample area was rinsed into the sample container and then brushed and rinsed a second time. The brush was also rinsed into the sample container to ensure as much of the material removed from the rock surface was collected. Triplicate samples were collected in this manner to produce a composite periphyton sample, representing a total sample area of 21.2 cm^2 per site. The labelled sample was preserved with Lugol's Solution and shipped to "Plankton R Us" in Winnipeg, Manitoba, for identification and enumeration.

At "Plankton R Us", all samples were taken to a constant volume using water filtered through 2µm mesh Nitex netting. Depending on the density of algal and silt/detritus material, 1 to 2 mL subsamples of epilithic suspension were sonicated for 10-20 s using a Sonifer Cell Disruptor (model w140) (Findlay et al.1999) and gravity settled for 24 h in an Ütermohl chamber. Cells were identified, counted and measured from random fields until 100 cells of the dominant species were found. Only cells that were intact and contained viable chloroplasts, identifiable by staining from the Lugol's, were enumerated. Cell counts were converted to biomass (wet weight µg cm^{-2}) by estimating cell volumes and assuming a specific gravity of 1. Estimates of cell volume for each species were obtained by measurements of up to 50 cells of an individual species and applying the geometric formula best fitted to the shape of the cell (Rott, 1981).

Replicate counts were performed on 10% of the samples as a QA/QC protocol. Replicate samples were chosen at random and processed at different times from the original analysis to reduce bias. For this study replicate counts were completed on the periphyton sample collected from E3, Wolverine Creek, to fulfil the QA/QC requirement of reanalysis of 10% of the samples. The sample was reanalyzed and was 13% higher than the original analysis which is within the variance of ±15% suggested in the literature. The largest variance between samples was due to *Audouinella sp.*

A duplicate set of three rock scrapings, following the above field protocols, was also collected at each site for chlorophyll analysis. These samples were filtered a short time later using a field hand vacuum filtration apparatus and 0.45 µm filters. Filters were then carefully removed, folded and stored in small 20mL black plastic vials, labelled and kept cool on ice until delivered to the ALS laboratory in Whitehorse, Yukon. Once the samples were logged in they were forwarded to the ALS lab in Burnaby, BC. Chlorophyll in biota

was analyzed by Fluorimeter. This analysis is done using procedures adapted from EPA Method 445.0. Chlorophyll-a is determined by a routine acetone extraction followed with analysis by fluorometry using the non-acidification procedure. Although the analysis of Chlorophyll-b was requested in the scope of work, Chlorophyll-b is a degradation product of chlorophyll and is not reported separately. However, its concentration is captured in the analysis of pheophytin. Pheophytin is determined by a routine acetone extraction followed with analysis by fluorometry using the acidification procedure.

6.2 Results and Discussion

6.2.1 Periphyton Community Structure

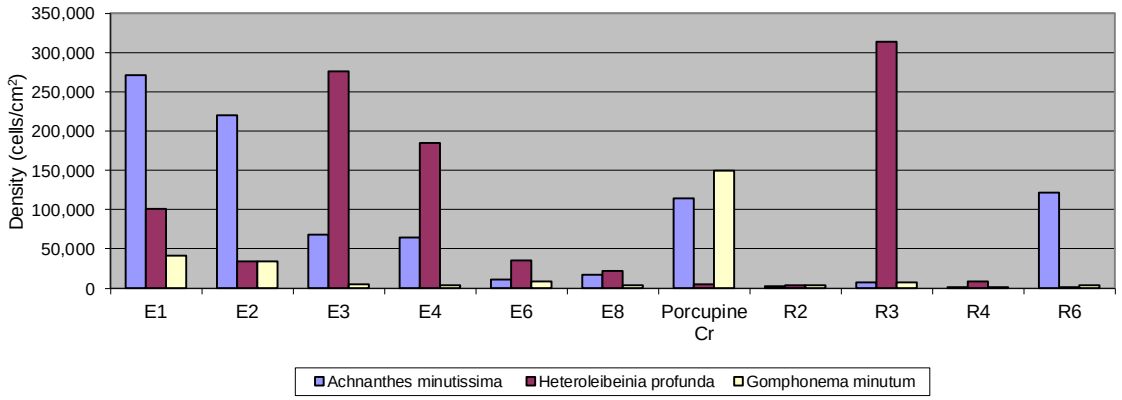
Four phyla were identified in the study area; Cyanophyta (cyanobacteria), Chlorophyta (green algae), Bacillariophyta (Diatoms) and Rhodophyta (red algae). Data are presented in Appendix D as density (cells/cm^2) and as biomass (µg/cm^2). Bacillariophyta formed the greatest density throughout the study area (47%) followed closely by Cyanophyta (40%). Ryodophyta was not represented at E6, R4 and R6. Chlorophyta was only detected at the Porcupine Creek site. Based on biomass, Bacillariophyta was dominant in the study area (70%) followed by Rhodophyta (23%).

Small alpine and montane streams without blooms of filamentous green algae are generally dominated by diatoms and cyanobacteria (Brown et al, 2008) which appears typical of the Clinton Creek watershed. However, filamentous green algae have frequently been observed on the gabion structures (White Mountain Environmental Consulting, 2008, von Finster, 2016) and in areas of groundwater upwellings throughout the mine site (Laberge, 2011, Laberge, 2012, von Finster, 2016). Filamentous green algae were not observed in September 2016 at any of the sample sites. Cyanobacterial cells are generally small compared to diatoms, so high numerical abundance does not necessarily translate to dominance of biomass (Brown et al, 2008) thus both cell density and cell biomass are included in the tables and discussion.

Within these phyla, several species were identified and this data is also included in Appendix D.

The most abundant species based on cell density was *Heteroleibeinia profunda* of Cyanophyta (27%), and was identified at all of the sites, with higher densities usually documented at the exposed sites. Two other species were found at all of the sites; *Achnanthes minutissima* and *Gomphonema minutum*, both belonging to Bacillariophyta (Diatoms). The densities of these three species are presented in Figure 4 to show the distribution throughout the study area.

FIGURE 4 DISTRIBUTION OF THREE PERIPHYTON SPECIES



Based on cell biomass, the species *Synedra ulna* (Nitzsch), also a diatom, represented 51% the periphyton in the study area. However, this species was not identified at any of the reference sites, but was present at all of the exposed sites.

Each site has been examined individually and metrics are presented in Table 12. The greatest cell density and cell biomass occurred at E2 (Clinton Creek downstream of Porcupine Creek and upstream of Wolverine Creek). The substrate here had visible organic growth on the rocks (Appendix A, Photo #4). The lowest cell density and biomass was recorded at R4 (Eagle Creek) and the rocks at this site were quite devoid of any growth or biofilm (Appendix A, Photo #5).

Taxonomic richness (diversity) is a metric used to determine the health of a stream and involves enumerating the different taxa present per site. Diversity ranged slightly over the study area from 8 different species identified at R4 to 15 at E8.

TABLE 12 SUMMARIZED PERIPHYTON DATA, SEPTEMBER 2016							
Site	Density (cells/cm^2)	Biomass (ug/cm^2)	Species Richness	Dominant Species as Density	% Dominant Species as Density	Dominant Species as Biomass	% Dominant Species as Biomass
E1	697,674	478.1	13	Achnanthes minutissima Kutzing	38.9	Synedra ulna (Nitzsch) Ehrenberg	63.7
E2	813,954	735.5	14	Audouinella / Chantransia stage	30.7	Synedra ulna (Nitzsch) Ehrenberg	51.5
E3	503,876	62.9	10	Heteroleibeinia profunda Komarek	54.7	Heteroleibeinia profunda Komarek	38.9
E4	428,510	240.4	12	Heteroleibeinia profunda Komarek	43.2	Synedra ulna (Nitzsch) Ehrenberg	75.0
E6	85,271	12.5	9	Heteroleibeinia profunda Komarek	41.4	Synedra ulna (Nitzsch) Ehrenberg	28.2
E8	96,402	30.1	15	Chamaesiphon incrustans Smith	35.4	Didymosphenia geminata Schmidt	44.0
Porcupine Cr	340,224	212.2	13	Gomphonema minutum	43.9	Gomphonema minutum	34.7
R2	25,409	14.7	11	Audouinella / Chantransia stage	43.6	Phormidium autumnale Agardh	41.4
R3	446,454	49.5	9	Heteroleibeinia profunda Komarek	70.1	Heteroleibeinia profunda Komarek	67.9
R4	22,136	1.6	8	Heteroleibeinia profunda Komarek	39.3	Heteroleibeinia profunda Komarek	37.1
R6	175,711	30.5	11	Achnanthes minutissima Kutzing	69.1	Fragilaria capucina Grunow	33.9
Study Area	3,635,621	1867.9	29	Heteroleibeinia profunda Komarek	27.1	Synedra ulna (Nitzsch) Ehrenberg	51.0

The dominant species in terms of cell density and cell biomass for each site, including the proportion within the community, is also depicted in Table 12. *Heteroleibeinia profunda*, of the phylum Cyanophyta, was the dominant species at E3, E4, E6, R3 and R4 in both cell density and cell biomass, except at E4 where *Synedra ulna*, a diatom species, was dominant for cell biomass. The density of the periphyton communities at E1 and R6 was dominated by the diatom species, *Achnanthes minutissima*. The community at Porcupine Creek was dominated by another diatom species, *Gomphonema minutum*, both as cell density and cell biomass. The periphyton community at R2, Easter Creek, was the only site where a red algal species was dominant, *Audouinella/Chantransia*. *Synedra ulna* dominated the Clinton Creek sites (E1, E2, E4 and E6) in terms of cell biomass.

Small numbers of *Didymosphenia geminata*, commonly known as Didymo, were documented only at E8 (Forty Mile River downstream of Clinton Creek) where it was also the dominant species in terms of cell biomass. Didymo is considered an invasive species and was first documented in western Canada (on Vancouver Island) in 1989 (Leland et al, 2015). Although present in Yukon waters, it hasn't been determined if it is spreading, and it may be native to the Yukon (Environment Yukon, 2014[1]). In the summer of 2014, Environment Yukon conducted a study to understand the distribution of Didymo in the Yukon Territory. Didymo was more widespread than anticipated and occurred in all Yukon watersheds except the Southwest Alaska drainage (Copper River area). The survey gave a baseline for presence and not detected. It does not indicate whether Didymo is a native species to Yukon, if it is spreading, or if it affects aquatic environments (Environment Yukon, 2014[2]). Further studies will be required before conclusive statements can be made. Didymo is characterized as a cold water species and appears to thrive in streams where phosphorus levels are low or undetected. (Leland et al, 2015). Phosphorus was not detected at any of the sites in the study area (Appendix B).

The available literature regarding the biomonitoring purpose of analysing periphyton relate to the tolerance and sensitivity to nutrient enrichment via organic pollution. Little information could be found related to chemical influences. As mentioned above, *Heteroleibeinia profundal* was common throughout the study area. The taxonomist for the Clinton Creek set of samples has identified this species in the Arctic, the Canadian Shield and in British Columbia (D. Findlay, personal communication, Feb 20, 2016).

The diatom *Achnanthes minutissima* was also found at all of the sites and in fairly high numbers throughout the study area. This species is typically found in unpolluted clean waters (Wu, 201; Agarwal, 2005).

The diatom *Synedra ulna* had high representation as biomass but was only found at the exposed sites. Different studies have shown *Synedra ulna* to be both highly tolerant and highly sensitive to metal pollution (Kelly et al, 1991). Its abundant presence at only the exposed sites is difficult to explain within the current dataset and the documented existing conditions.

6.2.2 Chlorophyll Analysis

Chlorophyll *a* and Pheophytin *a* content of the periphyton were determined and are presented in Table 13. The quantity of Chlorophyll *a* is a measure of live biomass. Chlorophyll degrades naturally as communities age and cells die. This results in the formation of phaeopigments and the analysis of Pheophytin *a* presents the quantity of degradation products in the periphyton sample, including Chlorophyll b. The total biomass per site is also included in Table 13 as well as total density.

Chlorophyll *a* and Pheophytin *a* generally followed the same trend within the study area. Periphyton Chlorophyll *a* and Pheophytin *a* concentrations reflected the density of organisms at each site with the highest concentrations at E2 (Clinton Creek downstream of Porcupine Creek) and the lowest at R4 (Eagle Creek). This corresponded to the visual observations of growth on the rocks that were sampled at the sites.

TABLE 13 CHLOROPHYLL CONCENTRATIONS IN PERIPHYTON SAMPLES

	Site	Total Density (cells/cm^2)	Total Biomass (ug/cm^2)	Chlorophyll *a* (ug/21.2cm^2)	Pheophytin *a* (ug/21.2cm^2)
Exposed Sites	E1	697,674	478.1	70.6	56.0
	Porcupine Cr	340,224	735.5	37.4	31.7
	E2	813,954	62.9	87.0	75.1
	E3	503,876	240.4	26.4	19.6
	E4	428,510	12.5	31.9	27.5
	E6	85,271	30.1	24.1	20.7
	E8	96,402	212.2	11.3	10.3
Reference Sites	R2	25,409	14.7	16.5	14.6
	R3	446,454	49.5	22.0	17.3
	R4	22,136	1.6	0.1	0.11
	R6	175,711	30.5	18.3	14.4

The amount of Chlorophyll *a* varies among taxonomic groups and this can result in apparent biomass differences among communities when quantities of organic matter vary only a little (Biggs and Kilroy, 2000). In terms of biomass, the periphyton communities at E1, E2, E3, E4, E6, E8, Porcupine Creek and R6 were all dominated by diatoms. Cyanophytes dominated the sites at R2, R3 and R4.

7.0 BENTHIC INVERTEBRATES

The objective of the benthic invertebrate program was to collect data to describe current benthic macroinvertebrate communities in relation to the Clinton Creek Site, including community composition, species present, abundance, and community indicator indices.

Benthic invertebrates are bottom dwelling organisms that reside in lotic (running water) or lentic (standing water) environments. They are common inhabitants and are important in moving energy through food webs. Unlike chemical measures, invertebrate assemblages reflect long-term exposure to varying water quality conditions and thus integrate effects of contaminants over time (Rosenberg and Resh, 1993). Benthic invertebrates have been used to monitor ecological effects of contaminants, including metals, on stream communities since the early 1900s. These organisms are useful in this respect as their abundance and taxonomic diversity respond to a wide range of impacts including sedimentation, organic loading and changes in water chemistry. Using benthic invertebrates as biomonitoring tools offers many advantages for the following reasons; they are ubiquitous, they are abundant and easy to collect, there are a large number of species offering a spectrum of responses to environmental stress, they are generally sedentary and therefore are representative of local conditions, and they have long life cycles compared to other groups (i.e. periphyton). As such, benthic macroinvertebrates act as continuous monitors of the water they inhabit and therefore can serve as sentinels of change in local conditions.

7.1 Methods

Canadian Aquatic Biomonitoring Network (CABIN) procedures as outlined in the 2012 manual were followed for the collection of benthic invertebrates. Samples were collected

from twelve sites in the study area in late summer (September 5th and 8th, 2016) using the kick and sweep method. A D-net equipped with a 400 µm mesh size was used to capture disturbed invertebrates while kicking the substrate in each stream for a duration of three minutes while moving upstream in a zigzag pattern for approximately 10 m. The captured detritus and benthic invertebrates were placed in a one litre nalgene bottle and preserved with 10% buffered formalin. Samples were stored and shipped in coolers.

Quality assurance and quality control (QA/QC) procedures for the field component consisted of; ensuring all personnel were adequately trained, sampling methods per site and between sites were consistent, samples were correctly collected, labeled and preserved, equipment was properly maintained, detailed field notes were kept, chain-of-custody forms were used and safe shipping and storage methods were followed. The samples were shipped by ground transport to Cordillera Consulting in Summerland, B.C. for sorting, enumeration and identification following CABIN protocols.

At the Cordillera Consulting lab, the following procedures were followed:

• Using a gridded Petri dish, fine forceps and a low power stereo-microscope (Olympus, Nikon, Leica) the sorting technicians removed the invertebrates and sorted them into family/orders.

• The sorting technician kept a running tally of total numbers excluding organisms from Porifera, Nemata, Platyhelminthes, Ostracoda, Copepoda, Cladocera and terrestrial drop-ins such as aphids. These organisms were marked for their presence (given a value of 1) only and left in the sample. They were not included towards the 300-organism subsample count.

• Where specimens are broken or damaged, only heads were counted.

• Subsampling was conducted with the use of a Marchant Box.

• When using the Marchant box, cells were extracted at the same time in the order indicated by a random number table. If the 300th organism was found part way into sorting a cell then the balance of that cell was sorted. If the organism count had not reached 300 by the 50th cell then the entire sample was sorted.

• The total number of cells sorted and the number of organisms removed were recorded manually on a bench sheet and then recorded into the database INSTAR1.

• Organisms were stored in vials containing 80% ethanol and an interior label indicating the site names, date of sampling, site code numbers and portion subsampled. This information was also recorded on the laboratory bench sheet and on INSTAR1.

• The sorted portion of the debris was preserved and labeled separately from the unsorted portion and was tested for sorting efficiency (Sorting Quality Control – Sorting Efficiency). The unsorted portion was also labeled and preserved in separate jars.

• Identifications were made at the genus/species level for all insect organisms found including Chironomidae (Based on CABIN protocol).

• Non-insect organisms (except those not included in CABIN count) were identified to genus/species where possible and to a minimum of family level with intact and mature specimens.

• The Standard Taxonomic Effort lists compiled by the CABIN manual1, Southwest Association of freshwater Invertebrate Taxonomists (SAFIT2), and Pacific Northwest Aquatic Monitoring Partnership (PMAMP3) were used as a guideline for what level of identification to achieve where the condition and maturity of the organism enabled.

• Organisms from the same families/order were kept in separate vials with 80% ethanol and an interior label of printed laser paper.

• Chironomidae was identified to genus/species level where possible and was aided by slide mounts. CMC-10 was used to clear and mount the slide.

• Oligochaetes were identified to family/genus level with the aid of slide mounts. CMC-10 was used to clear and mount the slide.

• Other Annelida (leeches, polychaetes) were identified to the family/genus/species level with undamaged, mature specimens.

• Decapoda, Amphipoda and Isopoda were identified at family/genus/species level where possible.

• Bryozoans and Nemata remained at the phylum level.

Taxonomic QC was performed in house by a technician other than the original taxonomist:
• Quality control protocol involved complete, blind re-identification and re-enumeration of at least 10% of samples by a second SFS-certified taxonomist.
• Samples for taxonomic quality control were randomly selected and quality control procedures were conducted as the project progressed through the laboratories.

The data was subjected to several metrics and indices to describe the benthic populations. Abundance was determined by summing all of the individuals present in the sample. Taxonomic richness is a simple measure of diversity where each type of invertebrate is counted per sample. Diversity can be refined using many different indices and the Shannon Weiner Diversity Index (Pielou,1966) was used on this dataset using the equation:

$$H' = \sum \left(P_i (\log 10 P_i) \right)$$

where P_i equals n_i divided by N. n_i is the total number of individuals in the ith taxa in one sample and N represents the total number of individuals in one sample.

To determine how evenly distributed the different types of individuals are within the community the Shannon Wiener Evenness Index was performed using the following equation:

$$\frac{H'}{\log_{10} S}$$

where the Shannon Weiner Diversity index is divided by the log of the total number of individuals in the sample.

A percent similarity index (Brock, 1977) was used to describe the similarity within the benthic communities at the different sites. The following formula was used where 'a' and 'b' are for a given taxa percentage of the total samples A and B which that taxa represents. The absolute value of their difference is summed over all taxa, K.

$$Psc = 100 - 0.5 \sum^{k} |a - b|$$

Biotic indices are often used to ascertain the general water quality at a particular site. The Hilsenhoff Biotic Index is based on a formula using pre-assigned pollution tolerance scores for families. The following equation was used where n equals the number of individuals in taxa i, a is the preassigned pollution tolerance value assigned to taxa i, and N is the total number of individuals in the sample.

$$HBI = \frac{\sum n_i \times a_i}{N}$$

7.2 Results and Discussion

Benthic invertebrate samples were collected from twelve sites in the Clinton Creek drainage and the dataset is provided in Appendix E. Site descriptions are detailed in Section 8.1.2 and in Appendix F. Four phyla were found in the study area: Arthropoda, Nemata, Annelida, and Platyhelminthes. Of these, Cordillera Consulting does not consider Nemata or Platyhelminthes to be benthic organisms. In addition, crustaceans within the phylum Arthropoda were not considered as benthos. The numbers for these taxa indicated in Appendix E reflect presence, not total numbers, of individuals in the sample. The portion of the sample that was sorted and identified is indicated in Appendix E, in the row under the date each sample was collected.

Of the organisms that were enumerated, a total of 12,670 invertebrates, representing 90 different taxonomic groups were identified in the study area. The following sections pertain to these taxa.

7.2.1 Abundance and Taxonomic Richness

The total number of organisms per site represents the abundance, which ranged from 80 individuals at the reference site R1, Clinton Creek upstream of Hudgeon Lake, to 3,687 individuals at E8, Forty Mile River downstream of Clinton Creek (Table 14).

The simplest method for determining diversity for each site is by enumerating all the taxonomic groups identified from species to phylum. High taxa richness is assumed to indicate high biotic integrity because many species are adapted to the conditions present in the habitat. The most diverse community occurred at E1 (Clinton Creek downstream of the gabions) with 33 different taxa identified. The community at E8 was the least diverse with only 11 different taxa present (Table 14). Another form of representing diversity is to use the Shannon Wiener Diversity Index which takes into account taxa richness as well as the proportion of each taxa in the community. The higher the index the greater the biodiversity in that community. The Shannon Wiener Diversity Index ranged from 0.20 at E8 to 1.2 at E2, Clinton Creek downstream of Porcupine Creek.

To determine how evenly the taxa were distributed within the community, the Evenness Index was used, which incorporates the index generated by the Shannon Wiener Diversity Index. This index ranges from zero, where there is only one taxa in the community to 10 where each taxa is represented equally. Evenness ranged from 0.20 at E8 to 0.83 at E2.

TABLE 14 GENERAL STATISTICS ON THE BENTHIC COMMUNITIES, 2016

Site	Site Description	Abundance (# of individuals)	Taxonomic Richness (# of taxa)	Shannon Wiener Diversity Index	Evenness Index
E-1	Clinton Cr d/s gabions and u/s Porcupine Cr	459	33	1.17	0.75
Porcupine Creek	Porcupine Cr u/s Wolverine Cr	2809	24	0.94	0.67
E-2	Clinton Cr u/s Wolverine Cr	1120	28	1.21	0.83
E-3	Wolverine Cr u/s Clinton Cr	451	30	1.10	0.75
E-4	Clinton Cr d/s Wolverine Cr	255	26	0.84	0.58
E-6	Clinton Cr u/s road crossing to Townsite	299	27	0.78	0.53
E-8	Forty Mile R d/s Clinton Cr	3687	11	0.20	0.20
R-1	Clinton Cr u/s Hudgeon L	80	13	0.70	0.63
R-2	Easter Cr	1149	27	0.99	0.68
R-3	Wolverine Cr u/s tailings	902	30	1.01	0.67
R-4	Eagle Cr	257	16	0.72	0.59
R-6	Forty Mile R u/s Clinton Cr	1202	20	0.48	0.37

7.2.2 Community Composition

The composition of the benthos communities was calculated as a percentage of the major taxonomic orders present, with pie charts generated for each site (Appendix E, Figure 5). The grouping “Other” consists of invertebrates from Collembola, Arachnida, Amphipoda and Hirudinea. Based on the percentages, taxa were then classified with respect to their dominance within the community (Table 15).

Plecoptera (stoneflies) and/or Diptera (true flies) were the dominant orders at all of the sites. Many of these populations had a very high percentage of the dominant order, and thus did not have any subdominant groups. The communities at the exposed sites closest to Hudgeon Lake and the waste rock dump were dominated by Diptera of over 70%. The

majority of the Dipterans belonged to the family Chironomidae. The community upstream on Wolverine Creek (R3) also was largely dominated by Diptera.

Plecoptera formed the majority of the remaining populations, with the communities at E8, R1, R4 and R6 comprised of 78% or more.

TABLE 15 TAXONOMIC DISTRIBUTION OF THE BENTHIC COMMUNITIES, 2016

SITE	DOMINANT (>25%)	SUBDOMINANT (10% to 24.9%)	COMMON (1.0% to 9.9%)	RARE (0.1% to 0.9%)
E-1	Diptera		Trichoptera Oligochaeta Ephemeroptera Other	Plecoptera
Porcupine Cr	Diptera	Other Plecoptera	Oligochaeta	Trichoptera
E-2	Diptera	Oligochaeta	Trichoptera Plecoptera Other	Ephemeroptera
E-3	Plecoptera Diptera	Other Trichoptera Oligochaeta		
E-4	Plecoptera Oligochaeta	Diptera	Other Trichoptera	Ephemeroptera
E-6	Oligochaeta Plecoptera	Diptera	Other	Trichoptera
E-8	Plecoptera		Oligochaeta Diptera	Other
R-1	Plecoptera	Diptera	Other	
R-2	Plecoptera Diptera	Ephemeroptera	Oligochaeta	Trichoptera
R-3	Diptera	Plecoptera	Ephemeroptera Oligochaeta	Other
R-4	Plecoptera	Diptera	Oligochaeta	Other
R-6	Plecoptera	Diptera	Oligochaeta Ephemeroptera	

To determine how similar the composition of the benthic communities were to each other throughout the study area, a percent similarity index (PSI) (Brock, 1977) was applied to the dataset. Higher values indicate a greater similarity between the two sites (Table 16).

There were a few notable observations. The two sites on the Forty Mile River, (R6 upstream Clinton Creek, and E8, downstream Clinton Creek) were very similar to each at 83.68% suggesting that influence from Clinton Creek to the benthic community downstream is minimal . E1 and E2 were quite similar to each other with a PSI of 53.12 %, but had very low similarities to any of the other sites in the study area. The benthic community at Porcupine Creek was unlike any of the other communities with low similarities to the majority of the sites.

TABLE 16	PERCENT SIMILARITY FOR ALL SITES, 2016										
Site	**E2**	**E3**	**E4**	**E6**	**E8**	**Porcupine Creek**	**R1**	**R2**	**R3**	**R4**	**R6**
E1	53.12	26.90	11.33	10.20	3.42	19.01	4.62	23.94	37.14	9.22	7.25
E2		25.44	20.03	20.84	9.53	17.36	7.58	17.24	18.23	7.82	12.38
E3			23.31	30.39	16.61	27.74	34.94	37.10	44.69	49.25	19.28
E4				59.02	49.14	9.61	48.58	46.13	13.79	33.34	51.66
E6					36.53	11.78	39.44	46.23	16.09	34.82	38.84
E8						6.39	46.79	36.45	10.83	33.07	83.68
Porcupine Creek							16.20	23.92	35.80	14.39	10.50
R1								47.01	24.64	47.76	47.50
R2									34.87	46.09	40.84
R3										33.58	16.55
R4											32.64

The community at E4 had close to 50% similarity with several sites, E6, E8, R1, R2 and R6.

Many aquatic insects require good water quality to thrive. Larvae of mayflies (Ephemeroptera), stoneflies (Plecoptera) and caddisflies (Trichoptera) require clear, clean, well oxygenated water and have very low tolerance to pollution (Rosenberg and Resh, 1993). Analyzing the combined EPT (Ephemeroptera, Plecoptera, Trichoptera) at a site, gives an indication of the overall health of the stream. Table 17 summarizes the number of EPT found per site, the number of EPT taxa (richness) and the proportion of EPT in each community.

TABLE 17	EPT ABUNDANCE, PROPORTION AND RICHNESS			
Site	**Site Description**	**EPT Abundance**	**EPT Proportion**	**EPT Richness**
E-1	Clinton Cr d/s gabions and u/s Porcupine Cr	48	10.5%	11
Porcupine Creek	Porcupine Cr u/s Wolverine Cr	325	11.6%	4
E-2	Clinton Cr u/s Wolverine Cr	153	13.7%	8
E-3	Wolverine Cr u/s Clinton Cr	235	52.1%	10
E-4	Clinton Cr d/s Wolverine Cr	130	51.0%	6
E-6	Clinton Cr at road crossing to Townsite	107	35.8%	4
E-8	Forty Mile R d/s Clinton Cr	3356	91.0%	1
R-1	Clinton Cr u/s Hudgeon L	67	83.8%	3
R-2	Easter Cr	655	57.0%	9
R-3	Wolverine Cr u/s tailings	294	32.6%	9
R-4	Eagle Cr	219	85.2%	4
R-6	Forty Mile R u/s Clinton Cr	993	82.6%	5

The community at E8 (Forty Mile River d/s Clinton Creek) had the greatest abundance of EPT, which formed 91% of the population, however only one taxon was represented, Capniidae, a family of Plecoptera. These are cold water stoneflies and the nymphs inhabit the zone of flow beneath the rocks and gravel on the bottom of streams and rivers, known as the hyporheic zone. They move near the substrate surface prior to emergence (Nelson, 1996). Due to the capture of numerous Capniidae at E8 as well as at many other sites, the sampling period probably coincided with a period of imminent emergence.

The lowest abundance occurred at E1 with 48 individuals, however this community had the greatest EPT richness with 11 different taxa identified and each of the EPT orders was represented (Figure 5).

EPT representation at E2 was low, however this site had the greatest proportion of Trichoptera (caddisflies) in the study area (Figure 5, Appendix E). Caddisflies were readily observed attached to the subsurface of the rocks in the creek (Photo #6).

The Pacific Stream Keepers Federation has indicated that streams with an EPT richness greater than 8 are of good quality (DFO). Based on this water quality assessment protocol, sites R2, R3, E3 and E1 are of good quality. Richness values below 5 could indicate that the habitat is compromised in some way. This situation applies to sites E8, R1, Porcupine Creek, E6 and R4.

Another method to determine the health of a stream is to calculate the Hilsenholf Biotic Index (Hauer and Lamberti, 2006). Due to differences in their tolerance to pollution, the presence or absence of certain invertebrates can provide valuable information on stream water quality. The HBI ranges from 0 to 10, where lower numbers indicate the presence of pollution sensitive organisms and the higher numbers represent a greater presence of pollution tolerant families. Therefore, sites with excellent water quality would contain benthic communities with a high number of pollution sensitive families. Table 18 gives the listing of the categories for the condition of the water and Table 19 summarizes the data for Clinton Creek.

TABLE 18 WATER QUALITY BASED ON HBI

Hilsenhoff Biotic Index	Water Quality Category
0.00 - 3.75	Excellent
3.76 - 4.25	Very Good
4.26 - 5.00	Good
5.01 - 5.75	Fair
5.76 - 6.50	Fairly Poor
6.51 - 7.25	Poor
7.26 - 10.00	Very Poor

TABLE 19 WATER QUALITY BASED ON HBI FOR CLINTON CREEK

Site Type	Site	Hilsenhoff Biotic Index	Water Quality Category
Exposed Sites	E-1	5.84	Fairly Poor
	Porcupine Creek	5.02	Fair
	E-2	5.23	Fair
	E-3	3.64	Excellent
	E-4	2.59	Excellent
	E-6	4.88	Good
	E-8	1.58	Excellent
Reference Sites	R-1	2.01	Excellent
	R-2	3.81	Very Good
	R-3	5.66	Fair
	R-4	2.35	Excellent
	R-6	1.94	Excellent

The HBI metric lists the water quality at E1, Porcupine Creek, E2 and R3 as Fair or Fairly Poor. These sites were heavily dominated by Chironomids (Figure 5, Appendix E), invertebrates that have a wide range of tolerance to a wide variety of habitat conditions (Merrit and Cummins, 1984). As such, the family Chironomidae would have a high pollution tolerance score. Additionally, the stream sediments at the first three sites have high concentrations of metals (Table 8, Figure 2), compromising stream health. The PEL for arsenic and chromium was exceeded at E1, and for chromium at Porcupine Creek and E2. Aquatic organisms may be adversely affected by exposure to elevated levels and the more tolerant organisms would tend to dwell there.

There was excellent water quality at E3, E4, E8, R1, R4 and R6, however a review of Table 4 shows that that aluminium, chromium, copper, iron and selenium exceeded the CCME-FAL guidelines at most of these sites. This would suggest that the metals are likely not in a bioavailable form allowing for the presence of sensitive species at these sites.

Some of these metrics contradict each other, thus other aspects must also be taken into consideration. The Pacific Stream Keepers Federation rates E8 as a site of poor quality yet the HBI rates it as excellent. The laboratory analysis of the water and sediment quality, and the in-situ conditions at E8 all indicate a healthy environment at the time of sampling (i.e. low metal concentrations in the water and the sediments, high dissolved oxygen, clear water, etc). In Appendix E, only 9% of the total benthic sample for E8 was sorted and identified. As stated in the Methods section, 7.1, the whole sample is subsampled until a minimum of 300 organisms are counted and the totals are then calculated accordingly. This would lead one to believe that many individuals were present in the whole sample collected from E8, resulting with the apparent capture of emerging stoneflies. Conversely, the complete benthic sample collected from E1, E3, E4, E6, R1 and R4 was sorted and counted.

Benthic invertebrates have been collected at the Clinton Creek site on only one other occasion at most of the sampling sites and using the same sampling methodology. In late summer of 2009, Laberge conducted environmental monitoring studies at the Clinton Creek site following a program designed by Minnow Environmental Inc (Laberge, 2010). Benthic invertebrate samples were not collected from Porcupine Creek or E6 in 2009. Triplicate samples were collected in 2009 and averages have been presented in Table 20.

A review of the two years of benthic data shows that abundance fluctuated between sites and between sampling periods (Table 20). Some sites had greater populations during 2009 while others had greater populations during 2016. Diversity was generally similar or higher during the 2016 sampling period. Composition of the benthic communities was quite similar between the two years. Diptera formed large portions of the communities at the exposed sites, where it was the dominant order except at E8 (Forty Mile River). Plecoptera was abundant at most of the other sites. However, two years of data is insufficient to perform statistical analysis and determine any trends.

TABLE 20 2009 AND 2016 BENTHIC INVERTEBRATE DATA				
Site	**Year**	**Abundance**	**Taxa Richness**	**Dominant Group**
E1	2009	4335	20	Diptera
	2016	459	33	Diptera
E2	2009	2146	25	Diptera
	2016	1120	28	Diptera
E3	2009	2852	13	Diptera
	2016	451	30	Plecoptera and Diptera
E4	2009	214	19	Diptera
	2016	255	26	Plecoptera
E8	2009	304	19	Plecoptera and Ephemeroptera
	2016	3687	11	Plecoptera
R1	2009	2152	13	Plecoptera
	2016	80	13	Plecoptera
R2	2009	602	23	Diptera
	2016	1149	27	Plecoptera and Diptera
R3	2009	437	19	Plecoptera and Diptera
	2016	902	30	Diptera
R4	2009	1792	17	Plecoptera and Oligochaeta
	2016	257	16	Plecoptera
R6	2009	767	17	Plecoptera
	2016	1202	20	Plecoptera

8.0 FISHERIES

8.1 Methods

Fish habitat and fish utilization assessments were conducted at sample stations within the Clinton Creek study area between September 5 and 9, 2016. The fish utilization assessments were conducted under the Authority of License to collect fish # XR 286 2016 issued by the Federal Department of Fisheries and Oceans (DFO), Whitehorse. A total of 9 sites were evaluated for habitat and 7 of these were evaluated for the presence and condition of fish.

Fish habitat assessments consisted of a suite of criteria designed to encompass both CABIN standards and British Columbia's Resource Inventory Committee's (RICs) reconnaissance fish and fish habitat inventory modelling (Appendix F). A representative reach of creek that varied in length between 60 and 300 meters was chosen for each of the pre-identified sample sites. Each selected sample reach consisted of a variety of available habitats (riffle, rapid, run, pool) for that site and each of the selected sample reaches was assessed for wetted width, dry width (normal high water mark), average depth calculated from 10 to 12 depth measurements, flood depth (difference between high water mark and existing flow level), % slope was determined with a clinometer, velocity using either a Marsh McBirney meter or floating object method, morphology and channel stability (lateral movement), bank characteristics, and for substrates an assessment of substrate composition and compaction, a measure of the B axis of the largest substrate (D 90) and a measure of the largest particles moved during recent flows (D). The sites

were also assessed for available cover, surrounding vegetation and potential barriers to fish passage. A set of photos looking upstream, downstream, across the creek and of any unusual features representative of the site, was taken for each site. And finally an assessment of available cover as described in the RICs manual was conducted.

Fish utilization assessments to describe species utilization and collect specimens for metal analysis and general condition, were conducted with minnow trapping as the primary tool; angling, electro-fishing and seining were also used to augment the data set, provide a greater account of species utilization and to collect fish samples for analysis of metals in tissues.

Minnow trapping was conducted with ¼" G-type minnow traps baited with chinook salmon roe (Yukon River origin) and were set in a variety of habitats within the study area. Traps were set for an overnight period and an approximate 24 hour soak time. Care was taken to keep traps out of flows greater than 0.5m/second in an effort to reduce mortalities. G-traps are known as an excellent measure of juvenile chinook salmon (jcs) and slimy sculpin utilization. Electro-fishing was conducted with a Smith-Root POW back pack electro-fisher at an R5, 200 volt setting with a small anode ring in all available habitats within the sample reach. Seining was conducted with a 5 meter long pole seine with 1/8" rochel weave netting where conditions allowed at the plunge pool below the gabion structure. Angling was conducted using light spinning gear with small spinners or small dry flies. Fork or total lengths were measured and recorded on all fish captured in the minnow traps. To decrease stress to the captured fish, handling was kept to a minimum. Captured fish were identified by species and either released, live sampled for fork or total length depending on the species, and released back to the water of capture or sacrificed for metal analysis and detailed sampling. Fish maturity was based on the size of the fish. Chinook salmon were assumed to be juveniles and 0+ years of age although it was possible that some may be 1+. Sculpin were assessed as juvenile if less than 30 mm, sub adults >30 mm and <55 mm, and adults >55 mm. Arctic grayling were assessed as juveniles when <140 mm, sub adults between 140 and 180 mm and as adults when larger than 180 mm. External development such as fin size was also used in assessing maturity of live grayling.

Fishing effort in addition to the standard sampling was exerted to meet the required sample size of 15 Arctic grayling and 30 slimy sculpin for metals analysis. Fish taken for metal samples were processed at the end of each day. The defined sample size was collected and each sacrificed fish was assessed for external lesions and parasites, measured for fork or total length depending on species (mm), weighed for round weight (g), and the gonads were internally examined to determine sex and sexual maturity.

Age determination was not in the scope of work, however DFO had requested otoliths from any of the sacrificed fish. DFO covered the analytical costs and the data would be provided when available. Otolith bones were removed from each fish, dried and stored in individual sample envelopes with the data for that fish clearly labelled. The otoliths were delivered to Whitehorse DFO for the purposes of age determination for both the Arctic grayling and slimy sculpin samples.

Upon completion of the above, each sacrificed fish was processed for laboratory analysis of metals in the flesh. Slimy sculpin samples were maintained as whole body samples and

each sample represented a single adult fish. Arctic grayling samples were dissected and the liver was removed and processed as a separate sample. A portion of the whole mid body spanning the dorsal fin of each grayling was also taken as an individual sample, meaning that each grayling had both a liver and flesh sample taken. Samples were frozen the day they were taken and were sent to ALS laboratories in Burnaby, BC for analysis immediately after the conclusion of the field session.

Condition factor (K) is a measure of fish health based on a correlation between length and weight using the following equation:

$$K = \frac{10^N W}{L^3}$$

where N=5, W is the weight and L is the length of the fish.

All field data was recorded on field sheets and later transferred to an electronic format.

8.2 Results and Discussion

8.2.1 Fish Habitat and Utilization Assessment

Previous work at the Clinton Creek site identified three reaches for the main channel of Clinton Creek below Hudgeon Lake (von Finster, 2012). Reach 1 is 3,170 m long, commencing at the mouth and meanders through a large valley. Reach 2 is 3,500 m long and flows in a confined valley. Reach 3 is also approximately 3,500 m long and includes the section of Clinton Creek that receives any direct effects from the abandoned mine and includes the existing physical mitigation measures. Ground truthing during the September 2016 investigation confirms the delineation of these reaches. The main observation during the 2016 reach assessment was that the substrate in Reach 1 gradually became coarser moving up the reach. The terminus of Reach 1 coincides with the first partial obstruction on the creek, old abandoned beaver dams (see Section 8.2.2).

Individual reaches were established at each of the sample sites, and tables per site incorporating all of the information recorded on the CABIN and RICs forms are provided in Appendix F. Lengths were taken on all fish captured in the minnow traps (Table 21 in Appendix F). To decrease stress to the captured fish handling was kept to a minimum and weights were not always measured. Fish were live released at the site of capture as soon as the lengths were recorded. Summaries of the habitat and utilization assessment for the sites are presented below.

EXPOSED SITES:

Site E1, Clinton Creek Ford at Waste Rock
A sample reach 120 meters in length was assessed at site E1. At the time of investigation E1 had an average channel width of 6.5m an average wetted width of 5.1m, an average depth of 0.35m and an average velocity of >1m/sec. The substrate consisted of angular materials from the waste rock pile that consisted of 60% boulder, 30% cobble and 10% sand and fines. The substrates were not consolidated at all and the channel was partially

confined by eroding waste rock piles. Water temperature at the time of investigation was 9.8°C.

A set of 15 minnow traps set at this site recorded an abundance of robust juvenile chinook salmon (jcs) with a total of 20 captured. The sampled jcs had an average length of 92.3mm and ranged in length from 72 to 103mm. Also captured were 11 juvenile Arctic grayling with an average length of 101 mm (range 87-140mm) and 9 adult slimy sculpin with average length of 93.1mm (range 88-109mm). (Table 21, Appendix F).

Electro-fishing for 312 seconds at this site recorded 8 slimy sculpin that ranged in length from 45 to 102 mm, 6 juvenile Arctic grayling that ranged in length from 77 to 109mm and 2 jcs. Angling for 30 minutes at this site captured no fish.

The access road to Hudgeon Lake fords Clinton Creek at this sample site. The ford requires semi constant maintenance and is utilized regularly by vehicle traffic resulting in the lower section of the sample reach having a more or less constant destabilization of the banks. The site cuts through old waste rock and the stream channel has not stabilized.

Site E2, Clinton Creek Upstream of Wolverine Creek

A sample reach 160 meters in length was assessed and at the time of investigation this site had an average channel width of 13m, an average wetted width of 7.5m, an average depth of 0.19m and an average velocity of 0.6 m/sec. The substrates were loosely consolidated and consisted of 50% gravel, 20% cobble, 5% boulder and 25% sand and fines. The channel was partially confined on the left bank by the access road berm and was open on the right bank. The sample site is located at the downstream edge of what was a large beaver dam that has breached in recent years and the channel upstream of the sample site is a new channel that courses through the old beaver pond. Water temperature at the time of investigation was 9.3°C.

A set of 10 minnow traps set at E2 captured 65 robust jcs. A subsample of 33 were measured and had an average length of 84.7mm that ranged in length from 66 to 107 mm, four adult slimy sculpin were also captured in the minnow traps, with an average length of 80.5mm. Electrofishing at this sample site for 300 seconds captured 3 adult slimy sculpin (55 to 83mm) and 5 juvenile slimy sculpin (31 to 40mm). A single adult Arctic grayling was observed. Angling for 75 minutes captured 2 adults and 1 sub-adult Arctic grayling.

Site E3, Wolverine Creek Upstream of Confluence with Clinton Creek

A sample reach 200 meters in length was assessed. The site had an average channel width of 6.7m, an average wetted width of 4.2m, an average depth of 0.12m and an average velocity of 0.54 m/sec. The substrates consisted of partially embedded substrates consisting of 30% cobble, 50% gravel and 20% fines that were the result of washed tailings. The channel was partially confined by deposition banks in an entirely open flood plain with no vegetation opposite banks with newly established willow and young spruce. Water temperature at the time of investigation was 3.3°C. This site contains no cover for fish and virtually no fish habitat at the water level observed during sampling. Possible fish habitat is limited upstream of the first tributary flowing into Wolverine Creek from the east, due to the high gradient (von Finster, 2016). The perched culvert at the Clinton Creek access road prevents fish movement into Wolverine Creek.

Site E4, Clinton Creek Upstream of Eagle Creek

A sample reach 100 meters in length was assessed. At the time of investigation this sample site had an average channel width of 7.0m an average wetted width of 6.5m, an average depth of 0.4m and an average velocity of 1.2 m/sec. The substrates consisted of mostly flat rocks that varied from loosely to tightly embedded with 35% gravel, 25% boulder, 25% cobble and 15% silty sand and the channel was partially entrenched. The channel flows 90% as fast riffle through a very straight channel. Water temperature at the time of investigation was 8.4°C.

A set of eight minnow traps captured 3 jcs and 9 adult slimy sculpins. The jcs had an average length of 79.7mm with a range of 75-82 mm and the sculpin had an average length of 73.6 mm and ranged in length from 54 to 99mm. Electro-fishing for 280 seconds recorded 8 slimy sculpin and angling for 45 minutes captured 2 sub adult and 1 adult Arctic grayling.

Site E6, Clinton Creek at the Old Town Site Access Road

A sample reach 120 meters in length, upstream of the ford, was assessed. At the time of investigation this sample site had an average channel width of 13.5m an average wetted width of 11m, an average depth of 0.25m and an average velocity of 0.7m/sec. The substrates consisted of 50% gravel, 30% cobble and 20% fines and were loosely compacted. The channel was partially confined in the upper areas of the reach by a bedrock wall and was open to the valley bottom flood plain on the opposite bank. Flows consisted of 60% glide and 30% riffle with occasional pools. Water temperature at the time of investigation was 6.4°C.

The downstream end of the sample site is used as a ford for the road that accesses the residence nearby and the old town site. The old bridge used to access the historic town site still remains (abandoned) immediately downstream of the active ford.

A set of 14 minnow traps captured 35 jcs and 1 adult sculpin. The jcs had an average length of 70.3mm and ranged in length from 55-88mm. Electro-fishing for 220 seconds captured 1 sub adult Arctic grayling (165mm), 1 juvenile Arctic grayling (82 mm), 5 sub adult slimy sculpin (52-63 mm) and 1 adult slimy sculpin (88 mm). Angling for 40 minutes captured 2 sub-adult Arctic grayling (147 and 153 mm).

The jcs and slimy sculpin captured at E1 were the largest of any of the sites sampled and it was noted that length decreased moving downstream through the creek. The jcs captured at E6 were significantly smaller than those captured higher up in the creek. Table 22 summarizes the average lengths of the fish captured in the minnow traps, and decreasing length of fish coincides with greater distance from the upstream site (E1).

TABLE 22 AVERAGE LENGTHS (mm) OF LIVE SAMPLED FISH FROM MINNOW TRAPPING, CLINTON CREEK, SEPTEMBER 2016						
Site	**Juvenile Chinook Salmon**		**Arctic Grayling**		**Slimy Sculpin**	
	Length (mm)	**N**	**Length (mm)**	**N**	**Length (mm)**	**N**
E1	92.3	20	100.5	11	93.1	9
E2	84.7	33		0	80.5	4
E4	79.7	3		0	73.6	9
E6	70.3	35		0	72.0	1

REFERENCE SITES:

No fish assessments were to be completed on the reference sites with the exception of Maiden Creek (Table 1), however habitat assessments were completed. Fish have not been documented at the reference sites in the past (WMEC, 2008), and the perched culverts on Wolverine and Eagle Creeks, and the gabion structure at Hudgeon Lake prevent movement of fish to these sites. Nonetheless, general observations were made while on site.

Site R1, Clinton Creek Upstream of Hudgeon Lake
A sample reach 100 meters in length was assessed and at the time of investigation this sample site had an average channel width of 7.0m, an average wetted width of 6.0m, an average depth of 0.2m and an average velocity of 0.5 m/sec. The substrates consisted of unconsolidated shifting small gravels over silt with silt deposition in off-channel areas. The creek flows predominantly as a glide with occasional riffling and side pools. The channel was partially entrenched on the right bank giving way to an open flood plain on the left bank, confined with shallow banks that rose 0.25m. Habitats at this immediate site have limited potential for fish utilization with little cover available and shifting substrates. However, most of Upper Clinton Creek beyond the first tributary would provide fish habitat if this area was accessible (see Section 8.2.2). Water temperature at the time of investigation was 3.1°C. No fish were observed during the habitat assessment.

Site R2, Easter Creek Upstream of Hudgeon Lake
A sample reach 55 meters in length was assessed and at the time of investigation this sample site had an average channel width of 4.2m, an average wetted width of 2.2m, an average depth of 0.25m and an average velocity of 0.7 m/sec. The substrates consisted of loosely consolidated shifting gravel (70%) and silty sand (30%) and the channel was partially confined with banks that rose 0.65m opposite of an open flood plain. Water temperature at the time of investigation was 4.1°C. No fish were observed in Easter Creek during the 2016 visit.

R4, Eagle Creek Immediately Upstream of the Confluence with Clinton Creek
A sample reach 80 meters in length was assessed. At the time of investigation this site had an average channel width of 1.6m, an average wetted width of 1.5m, an average depth of 0.2m and an average velocity of 0.75 m/sec. The creek flows entirely as a fast

riffle. The substrates consisted of tightly embedded 40%cobble, 30% gravel and 30% sand and the channel was entirely entrenched. Water temperature at the time of investigation was 3.3°C.

No fish were observed in Eagle Creek. Eagle Creek has a straight and uniformly featureless channel that outflows to Clinton Creek through a perched culvert that does not allow for fish passage. An old log bridge structure still spans Eagle Creek on the upstream side of the present culvert.

Maiden Creek
Active placer mining occurred on Maiden Creek during the 2016 season and although the 2016 activity was likely conducted off channel the creek has a long history of placer mining and the habitat and creek structure has been modified by historic mining activity. The reach sampled appeared to have been mined decades ago on the east bank side and the west bank side was old growth forest.

A sample reach 300 meters in length was assessed and at the time of investigation this sample site had an average channel width of 8.0m, an average wetted width of 3.2m, an average depth of 0.6m and an average velocity of >1.5m/sec. The substrates consisted of unconsolidated gravels and sand with occasional cobbles. The channel was partially confined by banks rising up to 1.5 meters and became partially entrenched at the downstream end of the reach investigated. The creek was very cold at the time of sampling with water temperatures near 0°C and frazil ice forming in the water.

No fish were observed or captured in Maiden Creek during the 2016 sampling investigation. A set of 8 minnow traps were set in Maiden Creek and no fish were captured. Electro-fishing for 180 seconds produced the sample result. The electro-fishing effort was reduced at this site due to cold water temperatures (0.5^{o}C).

8.2.2 Barriers and Obstructions to Fish Passage Investigations

There are three previously known barriers to fish passage within the Clinton Creek study area. The perched culverts at Eagle and Wolverine Creeks prevent fish movement from Clinton Creek into these watersheds. The gabion structures at the outlet of Hudgeon Lake prevent fish passage to Hudgeon Lake and to upper Clinton Creek and Easter Creek.

Active slumping of the shale cliffs immediately downstream of the gabion structure continues to pose a threat to flows in Clinton Creek. Increased turbidity resulting from the slumping and introduction of sediment into Clinton Creek has the potential to impact fish. Observations of this area go back to 1991 and Roach et al (2002) noted active slumping on the north side of the channel due to undercutting of the native rock during a site visit in May, 2002. Several more areas were in the process of sliding downslope and into the creek downstream. AECOM (2010) performed a site inspection following the major flood event in the summer of 2010. Downstream of the last drop structure, the channel was 4 to 5 meters lower than it was before the flood. A number of large boulders were observed downstream indicative of the force of the flood waters required to displace them (AECOM, 2010). Water Resources conducted a site inspection on October 10th, 2010. The flood and heavy rains over the summer created severe erosion in the channel and downstream, and resulted in Clinton Creek changing its course and caused road washouts. The north valley

wall is unstable through the length of the canyon section downstream of the existing gabion structure (von Finster, 2016). No recent failures were observed during the September 2016 investigations, however the nature of the rock failure make it difficult to assess the time frames that failures had occurred.

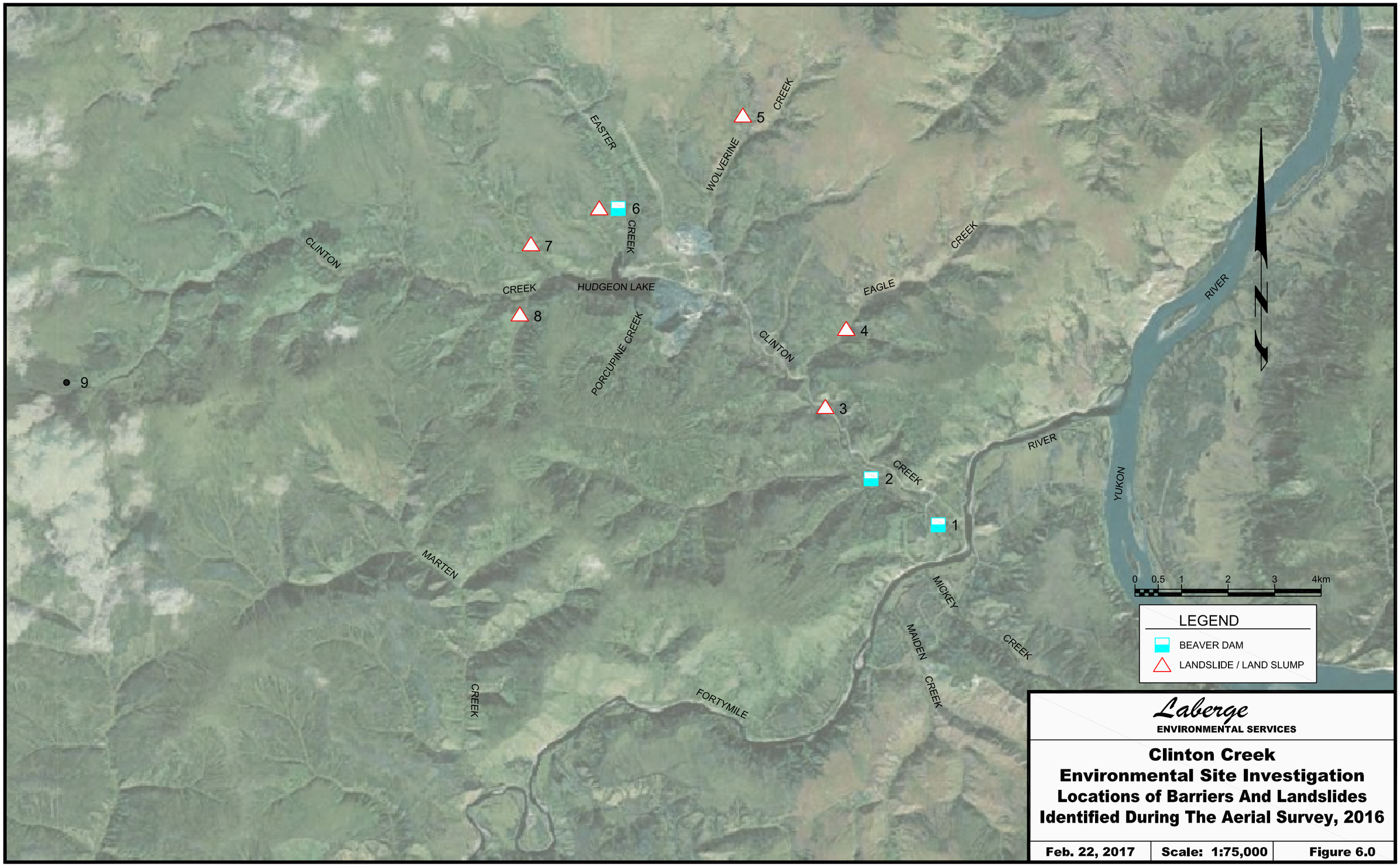
To determine if any barriers or obstructions to fish passage existed on Clinton Creek itself from the mouth at the Forty Mile River to Hudgeon Lake, an aerial survey was conducted on September 8th, 2016. The flight also included assessments on Eagle, Wolverine, Easter and Upper Clinton creeks to their respective headwaters. The objective of the survey was to document any active bank slumps, landslides and/or beaver dams that affected fish passage, fish habitat or water quality. Two experienced observers rode in the helicopter equipped with hand held GPS units and digital cameras.

Table 23 describes the observations, which are plotted on Figure 6. Photographs are in Appendix A.

TABLE 23 LOCATIONS OF BARRIERS AND LANDSLIDES IDENTIFIED DURING THE AERIAL SURVEY, 2016

Waypoint #	NAD 83		Description
	Easting	Northing	
1	518879	7142145	First beaver dam up from mouth of Clinton Cr
2	517437	7143135	Second beaver dam, plus large landslide near by
3	516455	7144639	Landslide on road
4	516903	7146314	Landslide on Eagle Creek
5	514682	7150894	Land slump on Wolverine, left fork
6	512006	7148935	Old landslide on Easter cr and old beaver dam a bit d/s
7	510130	7148132	Land slump on trib to Upper Clinton
8	509893	7146626	Slump along upper Clinton on left side looking up/s, very active
9	500156	7145200	Significant flow in upper Clinton Cr to this point

Waypoint #1 represents two partial barriers to fish passage that were observed at a point mid-way between the Forty Mile River and sample station E6. A crew hiked into these barriers after the flight to investigate. Both of the partial barriers consisted of old and abandoned beaver dams that had become stick and log jams that did not pose a barrier to fish passage or would they become a barrier at greater or lower flow levels (Appendix A, Photos #7 and #8). These two old beaver dams which have become log jams, were within 250 meters of each other and occur at a point in the Clinton Creek valley where the slope decreases and the creek enters the flood plain of the Forty Mile River.



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ENVIRONMENTAL SERVICES

Clinton Creek
Environmental Site Investigation
Locations of Barriers And Landslides Identified During The Aerial Survey, 2016

Feb. 22, 2017	Scale: 1:75,000	Figure 6.0

A large beaver dam located approximately two kilometres upstream of sample station E6 at Waypoint #2 (Appendix A, Photo #9) was also accessed on foot after the flight. This spectacular beaver dam appears to be a barrier to upstream passage of fish and likely is also a deterrent to downstream movement. Passive integrated transponders (Pit) radio tags were applied to six grayling in Clinton Creek during the summer of 2016 by DFO. The tagged fish were released near the gabions and of the six tags placed, only three moved past a receiver point downstream of E6, one in mid July and the last two were recorded in mid September (Jody Mackenzie-Grieve, personal communication, March 2017). The beaver dam has a face height of more than three meters and spanned more than 100 meters across the valley (Appendix A, Photo 10). Spillage from the beaver pond occurred on the east side in several small rivulets that cascaded through the forest before re-joining the main creek as far as 200 meters downstream of the dam, a difficult course for out migrating fish to attempt.

Waypoint #3 is the location of the active landslide on the Clinton Creek access road (Appendix A, Photo #11). Removal of the displaced earth and debris was undertaken just prior to the September field trip.

A small land slump was observed at Waypoint #4 on Eagle Creek (Photo #12). This slump appears to be degrading permafrost or ice lenses and threatens to deposit large quantities of materials into Eagle Creek. Eagle Creek upstream of the confluence with Clinton Creek is located in a steep valley and does not provide suitable flows for fish habitat.

Active slumping was observed on the upper reaches of the left fork of Wolverine Creek at Waypoint #5 (Photo #13), but no beaver activity was evident in this drainage.

An old landslide was noted on Easter Creek at Waypoint #6 (Photo #14). Evidence of old beaver dams was observed on the lower reaches of Easter Creek (Photo #15) but no active dams were observed.

Minor land movements were noted at Waypoint #7 on the southwest facing slope of the tributary entering upper Clinton Creek near the outlet to Hudgeon Lake.

Active slumping was observed at Waypoint #8 on the west facing slope in the upper reaches of a tributary draining from the south to upper Clinton Creek, just upstream of Hudgeon Lake. The slumping has been active and continuous over a period of years. The valley around this tributary appeared to have significant ice lens failures, as indicated by large up-slope unconsolidated and moving silty bed materials. Moving and slumping of the valley walls was extensive at this location (Photos #17 to #19). Turbidity derived from this slump affected sample station R1 but was settled out in the lake. There is a large muddy delta where Upper Clinton Creek enters Hudgeon Lake, indicative of many years of sediment deposition from areas upstream (Appendix A, Photo #20).

Waypoint #9 represents the uppermost limit on upper Clinton Creek that appears to have suitable habitat for fish (clear water with sufficient flow). This represents an approximate 10 km length of stream from the confluence of the south tributary (where Waypoint #8 is located) that is currently unutilized.

Several small active slumps were recorded on the lower reaches of Clinton Creek but were not new nor were they considered to be affecting fish habitat or fish passage.

8.2.3 Fish Distribution

Fish studies have been undertaken in the Clinton Creek area since 1976 (von Finster, 2012) and the same common three species documented in the past, utilized the site during the September 2016 survey; slimy sculpin, Arctic grayling and juvenile Chinook salmon. Beaver dams still play a role in the distribution of fish and the gabion structure downstream of Hudgeon Lake continues to be the upper limit of fish utilization in Clinton Creek. A large amount of small creek fish habitat exists upstream of Hudgeon Lake with no fish presence. The gabion structure is a barrier to fish passage to Hudgeon Lake and the spill pool immediately below the gabions had the greatest abundance of fish found in Clinton Creek. Seining at this site was the source of most of the Arctic grayling metal samples.

The spill pool held significant numbers of large juvenile chinook salmon (jcs from here and E1 were 15 to 20% longer than those from E6 (Table 21, Appendix F, and Table 22)), many sub adult and juvenile Arctic grayling and also an occasional adult grayling. The abundance of fish likely results from a combination of three factors. First, Hudgeon Lake acts as a thermal heat sink and during September the spill water from the lake was as much as 5°C warmer than downstream at site E6. The second reason being Hudgeon Lake has an abundance of nutrients spilling over the gabions that is not being cropped by fish within the lake. Lastly, the gabions are a barrier to fish passage resulting in the congregation of fish as this is the farthest point they can traverse upstream.

Large numbers of fish have been documented in the spill pool on several other occasions (Roach and Ricks, 2003; Copland, 2004 and 2008; ELR, 2015). The high densities of fish here may reflect their inability to move higher into the watershed rather than be a response to the availability of food organisms present (von Finster, 2016).

The large beaver dam two kilometers upstream of the ford to the old town site has created a barrier to fish passage for the fall/ winter of 2016/17. The dam will likely restrict out migrations of fish during the fall and all fish above the dam may be forced to remain in the creek for the winter period. Dams such as this typically have small or complete breaches during the spring freshet and salmon trapped upstream for the overwinter period should have no difficulty exiting the creek at that time.

Unlike the earlier investigation in 2007 (White Mountain Environmental Consulting, 2008), when a missing length class of sculpin was observed in the 3 or 4 year class, all length classes of slimy sculpin were recorded in 2016. Juvenile Arctic grayling were well distributed throughout the creek.

Adult Arctic grayling were not common in Clinton Creek during either the 2007 or the 2016 investigations. This may simply be a factor of the lateness of the season that sampling was conducted. Arctic grayling are known to travel up small tributaries during early spring, feed for the summer and move back into larger water for the fall and winter.

Although considerable effort was expended, no fish were observed or captured at Maiden Creek during the investigation. This is likely due to the near zero water temperatures and/or the disturbance to the watershed through active placer mining.

Greater distributions of fish in Clinton Creek occurred in the upper reaches near the gabion structure. Condition factor (K) was calculated for each fish (Table 24, Appendix G) and the average per site is presented below in Table 25. Higher numbers indicate that the fish is in better condition and thus healthier than those with lower K values. Almost all of the Arctic grayling samples were captured in the same area, in the upper reaches of the creek immediately downstream of Hudgeon Lake. These grayling all had a consistent K value of near 1 (average 1.0) and were visually healthy fish, both internally and externally.

TABLE 25 CONDITION FACTOR (K) FOR FISH AT CLINTON CREEK

	Site	Average K	Standard Deviation	Range	N
Slimy Sculpin	E1	1.2	0.09	1.0-1.3	12
	E2	1.0	0.05	1.0-1.1	9
	E4	1.0	0.21	0.8-1.4	7
	E6	0.85	0.01	0.8-0.9	2
Arctic Grayling	Gabion Pool	1.0	0.1	0.9-1.1	14
	E2	1.1	na	na	1

Slimy sculpin were more evenly distributed throughout Clinton Creek, however at the downstream site of E6, only two sculpin were captured. The K values for the sculpin taken from various stations throughout the drainage clearly show an increase in the K value for samples taken progressively closer to the outlet of Hudgeon Lake. Sculpin samples from E1 had the highest average condition factor with a K value of 1.2. The K values at stations downstream decreased to the lowest K from a sculpin captured at E6, 0.8 (Table 24, Appendix G).

When this information is coupled with the consistent increase of fork length from jcs in the upper reach (Table 21, Appendix F) it can be inferred that the upper reaches of Clinton Creek have a greater productivity than the lower reaches. This increase in productivity can be directly related to the warmer water temperatures observed in the flows coming over the gabion structure from Hudgeon Lake. Hudgeon Lake undoubtedly acts as a heat sink that attenuates temperature variations. It is also very likely that an important nutrient supply comes with this warmer flow because with no fish in the lake, exploitation of those nutrients will be very limited.

8.2.4 Tissue Analysis

The objective of the tissue analysis was to document the current levels of metals in fish tissue in the surface waters in relation to the Clinton Creek Site. This data will both provide current data describing the levels of metals in fish tissue, and will serve as a baseline with which to compare monitoring data during and after the reclamation. Fish tissue analysis has not been performed at the Clinton Creek site for metals. Slimy sculpin tissues were analyzed in 2010 for asbestos presence and to determine health implications of short and long term exposure to asbestos fibers through histological examination (Marty et al, 2014).

There are two main vectors of metal uptake by aquatic organisms, from the water with which they inhabit and from the food that they consume. Sediments represent the most concentrated pool of metals in aquatic environments (Luoma, 1983). Benthic (bottom dwelling) organisms live in close contact with the sediments and ingest and / or adsorb particles. Depending on the bioavailability of the metals they may be incorporated into the tissues or exoskeleton, or eliminated from the body.

Slimy sculpin are a bottom dwelling, resident fish common in Clinton Creek. They are thought to be relatively sedentary and analysis of their tissues would tend to reflect the local environment. Thirty whole body sculpins, captured throughout Clinton Creek were analyzed for the presence of metals. Arctic grayling migrate into and out of Clinton Creek seasonally and the liver and muscle tissue of 15 Arctic grayling were analyzed.

The analytical report containing all of the tissue results are presented in Appendix G. Lengths and weights were measured on each of the sacrificed fish and this data is presented in Table 24 (Appendix G), along with the mass (g) of tissue that was analysed and the moisture content (%). Since the tissue data is reported as dry weight, concentrations of selected parameters were converted to wet weight to allow comparisons to guidelines and databases (Tables 26 and 27, Appendix G). Metals that are known to create adverse effects to fish, and metals that are known to be components of the Clinton Creek asbestos mineralogy were those that were selected for closer examination.

The data was averaged per site of capture for each species and compared to the CCME (1999) tissue residue guidelines (TRG) for the protection of wildlife consumers of aquatic biota, and to the Canadian Food Inspection Agency guidelines for chemical contaminants and toxins in freshwater fish and fish products.

The Northern Contaminants Program in the Yukon maintained a database for metals in whole body slimy sculpin collected throughout the Yukon, and the maximum concentration and mean for each metal is also compared to the Clinton Creek sculpin data in Table 28.

The US Geological Survey maintains a database on metals in muscle tissue for northern pike, longnose sucker and burbot. The maximum concentration and mean for these three species was compared to the Arctic grayling data (Table 29) and also to the sculpin data to provide more information.

The main observations and points of interest in this first set of tissue data are summarized below:

- Concentrations of chromium, manganese and nickel were higher in the sculpin tissues captured from E1 than at the downstream sites.

- Slimy sculpin mercury concentrations were consistently higher than the reported means for sculpin in the Northern Contaminants Program database, at all of the sites.

- Average mercury concentrations of Arctic grayling liver and muscle, as well as whole body slimy sculpin, were above the mercury CCME-TRG (0.033 µg/g wet weight) for the protection of wildlife consumers of aquatic biota. This guideline was exceeded in all of the sculpin samples and ranged from 0.04 to 0.14 µg/g wet weight. Concentrations in all the grayling livers exceeded the guideline and ranged from 0.08 to 0.24 µg/g wet weight. The guideline was exceeded in most of the grayling muscle tissue samples and ranged from 0.03 to 0.20 µg/g wet weight.

- Cadmium, copper, iron, selenium and zinc concentrations were higher in the Arctic grayling liver samples compared to grayling muscle tissue samples.

- Arctic grayling tissue samples were below the food inspection guideline for arsenic, lead and mercury for chemical contaminants and toxins for fish and fish products.

- Arctic grayling tissue samples were generally below reported means for northern pike, longnose sucker and burbot tissues for the Yukon River in the USGS Large Rivers Monitoring Network in Alaska. Adult northern pike, longnose sucker and burbot have longer life expectancies than Arctic grayling and are therefore prone to bioaccumulate more contaminants with age.

The relatively high mercury concentrations found in all of the fish tissues (almost all of the 60 tissue samples exceeded the CCME-TRG) may be the result of methylmercury production in Hudgeon Lake. Methylmercury is formed during microbial action on decomposing vegetation under water. The valley was flooded in 1974 with the creation of Hudgeon Lake. Due to its northern location, the submerged vegetation has likely been rotting at a slow rate, and likely will continue to do so for a long time. It is reasonable to assume that mercury has gradually been released to Clinton Creek in the form of methylmercury. Methylation of mercury is highest during the warm months and under anoxic conditions (Hall et al, 1998). Hudgeon Lake is known to be anoxic several meters below the surface, however it is also a meromictic lake and very little mixing occurs (Liebau, 2010). Low levels of mercury were detected in the water samples in Clinton Creek and the highest concentration of mercury in the stream sediments was documented at E1, where it exceeded the ISQG. Studies on Hudgeon Lake would be required before the degree of methylmercury production could be determined.

Methylmercury is very toxic and accumulates readily in aquatic biota. It can be absorbed directly from water across the gills of fish or absorbed from the food it eats (Hecky el al, 1991) although most of mercury in fish comes from the diet (Hall et al, 1998). The concentrations of methylmercury increase as it passes through the food chain from periphyton to aquatic insects and on to fish. Tissue analysis was not performed on these lower trophic forms.

TABLE 28
COMPARISON OF SLIMY SCULPIN WHOLE BODY METAL CONCENTRATIONS (WET WEIGHT) CLINTON CREEK, YUKON 2016

DESCRIPTION			ARSENIC (ug/g)	CADMIUM (ug/g)	CHROMIUM (ug/g)	COPPER (ug/g)	IRON (ug/g)	LEAD (ug/g)	MAGANESE (ug/g)	MERCURY (ug/g)	NICKEL (ug/g)	SELENIUM (ug/g)	ZINC (ug/g)
WHOLE BODY	SITE NUMBER (N)	E1 (12)	0.10	0.04	0.41	0.78	76.79	0.08	22.93	0.08	1.08	1.56	26.00
		E2 (9)	0.08	0.03	0.10	0.60	38.90	0.04	12.82	0.08	0.32	1.48	23.77
		E4 (7)	0.09	0.03	0.11	0.62	28.17	0.05	13.86	0.09	0.42	1.45	26.56
		E6 (2)	0.14	0.04	0.12	0.63	58.14	0.07	14.81	0.13	0.66	1.32	30.54
CCME guideline			-	-	-	-	-	-	-	0.033[a]	-	-	-
CFIA guideline			3.50[b]	-	-	-	-	0.50[b]	-	0.50[b]	-	-	-
NCP Yukon Database (SS)	Maximum		10.2	1.03	5.71	27.6	476	29.4	188	0.17	4.5	9.0	187.1
	Mean (N)		1.85 (72)	0.16 (72)	0.60 (72)	1.6 (72)	83.1 (72)	2.44 (72)	24.8 (72)	0.02 (62)	0.69 (72)	1.71 (56)	42.2 (72)
USGS Yukon River Database (NP, LNS, BB)	Maximum		1.08	0.12	1.64	1.49	341.9	-	15.6	0.65	0.71	0.85	56.4
	Mean (N)		0.15 (30)	0.07 (9)	0.49 (25)	0.69 (30)	39.1 (27)	<0.3 (30)	5.10 (30)	0.24 (30)	0.41 (3)	0.51 (30)	35.6 (30)

CCME = Canadian Council of Ministers of the Environment, Canadian Guidelines for the Protection of Wildlife Consumers of Aquatic Biota – [a] MeHg Tissue Residue Guideline; CFIA = Canadian Food Inspection Agency, Canadian Guidelines for Chemical Contaminants and Toxins in Fish and Fish Products – [b] for all freshwater fish products; NCP = DIAND, Northern Contaminants Program Yukon Database for slimy sculpin (SS); USGS = US Geological Survey – Biomonitoring of Environmental Status and Trends (BEST) Large Rivers Monitoring Network – Database for freshwater fish (NP=northern pike, LNS=longnose sucker, BB=burbot). Reported concentration means only used data from individual samples that were above the limits of detection for each element.

TABLE 29
COMPARISON OF ARCTIC GRAYLING TISSUE METAL CONCENTRATIONS (WET WEIGHT) CLINTON CREEK, YUKON 2016

DESCRIPTION			ARSENIC (ug/g)	CADMIUM (ug/g)	CHROMIUM (ug/g)	COPPER (ug/g)	IRON (ug/g)	LEAD (ug/g)	MAGANESE (ug/g)	MERCURY (ug/g)	NICKEL (ug/g)	SELENIUM (ug/g)	ZINC (ug/g)
LIVER	SITE NUMBER (N)	Gabion Pool (14)	0.02	0.24	0.19	1.54	41.45	<0.02	1.43	0.16	0.10	2.93	18.67
		E2 (1)	0.01	0.25	<0.08	1.39	54.00	<0.02	1.31	0.11	<0.08	4.75	16.93
MUSCLE	SITE NUMBER (N)	Gabion Pool (14)	0.03	0.01	0.07	0.50	11.18	0.01	1.98	0.11	0.08	1.27	13.82
		E2 (1)	0.02	0.01	0.05	0.49	6.63	<0.01	2.08	0.11	<0.06	2.16	12.52
CCME guideline			-	-		-		-		0.033[a]		-	-
CFIA guideline			3.50[b]	-		-		0.50[b]		0.50[b]		-	-
USGS Yukon River Database (Muscle-NP, LNS, BB)	Maximum		1.08	0.12	1.64	1.49	341.9	-	15.6	0.65	0.71	0.85	56.4
	Mean (N)		0.15 (30)	0.07 (9)	0.49 (25)	0.69 (30)	39.1 (27)	<0.3 (30)	5.10 (30)	0.24 (30)	0.41 (3)	0.51 (30)	35.6 (30)

CCME = Canadian Council of Ministers of the Environment, Canadian Guidelines for the Protection of Wildlife Consumers of Aquatic Biota – [a] MeHg Tissue Residue Guideline; CFIA = Canadian Food Inspection Agency, Canadian Guidelines for Chemical Contaminants and Toxins in Fish and Fish Products – [b] for all freshwater fish products; NCP = DIAND, Northern Contaminants Program Yukon Database for slimy sculpin (SS); USGS = US Geological Survey – Biomonitoring of Environmental Status and Trends (BEST) Large Rivers Monitoring Network – Database for freshwater fish (NP=northern pike, LNS=longnose sucker, BB=burbot). Reported concentration means only used data from individual samples that were above the limits of detection for each element.

9.0 RECOMMENDATIONS

This investigation of the existing aquatic conditions of Clinton Creek provides new and updated information and data for the area, however a few recommendations are suggested to create a more complete assessment.

It is recommended that the temperature data loggers be downloaded in September 2017 which will give a full year of thermal activity at these five sites. This will provide useful information on winter conditions in Clinton Creek related to temperature. It may be beneficial to redeploy them at these locations for another year, and possibly to additional sites.

It is highly recommended that a suitable reference fisheries site be established. It is well documented that the reference sites for surface water quality within the study area do not contain fish (due to the various barriers) and thus a nearby reference site is required. The creek specified for this study (Maiden Creek) was actively placer mined preceding and during the 2016 assessment and no fish were observed or captured. Research will need to be undertaken prior to field work to ensure a proposed reference creek is currently not undergoing any activity. This can be accomplished by checking with the Dawson Mining Recorder's office and consulting the land use maps. By having a reliable reference site, it can be determined if the health and metal burden of the fish in Clinton Creek are typical of the area or if there is impact from the abandoned asbestos mine. It is suggested that upstream of Clinton Creek on the Forty Mile River could be one of the locations for a reference site as it would be off-site yet is very local. They are very different sized water bodies, however the collected data could serve as a background check. Another reference site on a similar sized creek as Clinton Creek should definitely be included. In addition, it is recommended that all media be sampled at the fisheries reference site(s); water quality, stream sediments, periphyton and benthic invertebrates.

It is also recommended that periphyton and benthic invertebrate tissues be analyzed for metals. Because of their importance in nutrient cycling and as a food source for fish, periphyton and benthic invertebrates can provide a means of metals transfer to higher trophic levels (Poulton et al, 1995). As well, some metals bioaccumulate providing an increased dose to consumers higher up the food chain. The fish species in the study area (jcs, slimy sculpin and Arctic grayling) consume periphyton and/or benthic invertebrates at some stage in the life cycles. The analysis of periphyton and benthic invertebrate tissues will provide an indication of the dose of metals fish may be consuming in their diet.

Since it is well documented that fish congregate in the pool and area immediately below the gabion structures, it is recommended that another exposed site be established here, if safety factors allow. Samples for the food sources for fish, periphyton and benthic invertebrates, should be collected, identified and analysed for metals. Sediment and surface water should also be sampled. Data collected from this area will provide information on possible influences from Hudgeon Lake.

It is also recommended that a water quality program be undertaken on Hudgeon Lake. Very limited data exists on the water quality of the lake and no analytical data on metals could be located. Liebau (2010) conducted a study on Hudgeon Lake and determined it was a meromictic lake and anoxic a few meters below the surface. Profiling should be repeated

with the addition of water quality samples collected at various depths, with a focus on mercury. Additionally, it is recommended that horizontal plankton hauls are carried out to identify any pelagic life in the upper layer of the lake. Surface water samples for the analysis of chlorophyll are suggested to determine the productivity of the active layer of the lake during the summer.

10.0 REFERENCES

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APPENDIX A

PHOTOGRAPHS OF THE SITES IN THE

CLINTON CREEK STUDY AREA

SEPTEMBER 2016



Photo #1: Temperature logger installation at Porcupine Creek.



Photo #2: Temperature logger installation at E6, secured to spruce tree.



Photo #3: Periphyton sampling apparatus clamped to a rock at E-6, September 2016.

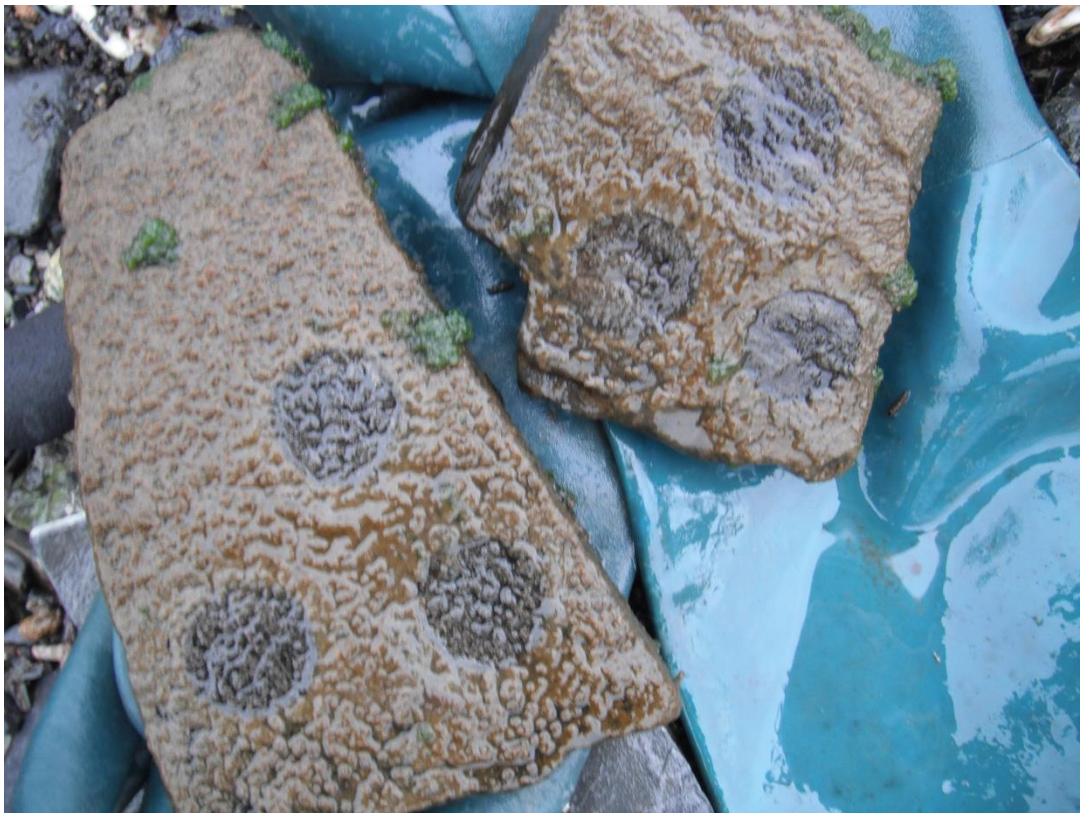


Photo #4: Visible periphyton growth on sampled rocks at E-2, Clinton Creek upstream Wolverine Cr.



Photo #5: The rocks at Eagle Creek R-4 contain very little periphyton growth as evidenced on this sampled rock.

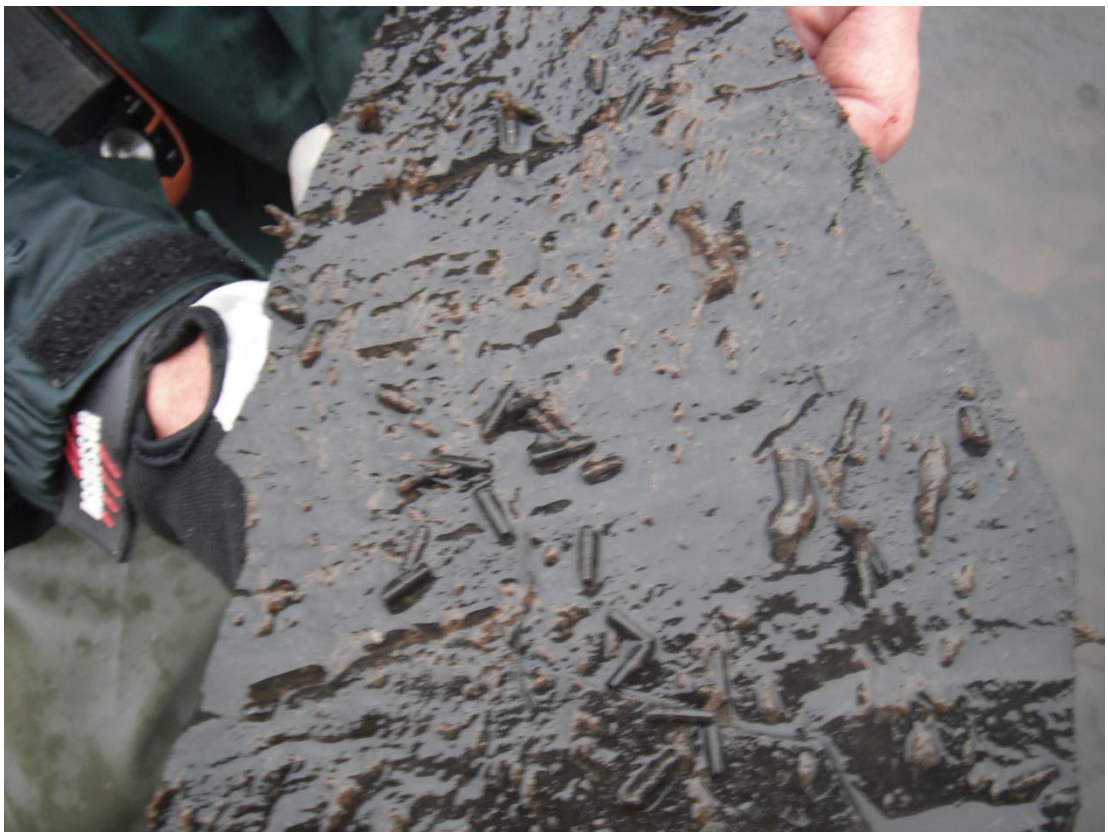


Photo #6: Trichopterans (*Brachycentrus spp*.) on the underside of a rock at E-2. Trichoptera formed 9.5% of the benthic community here.

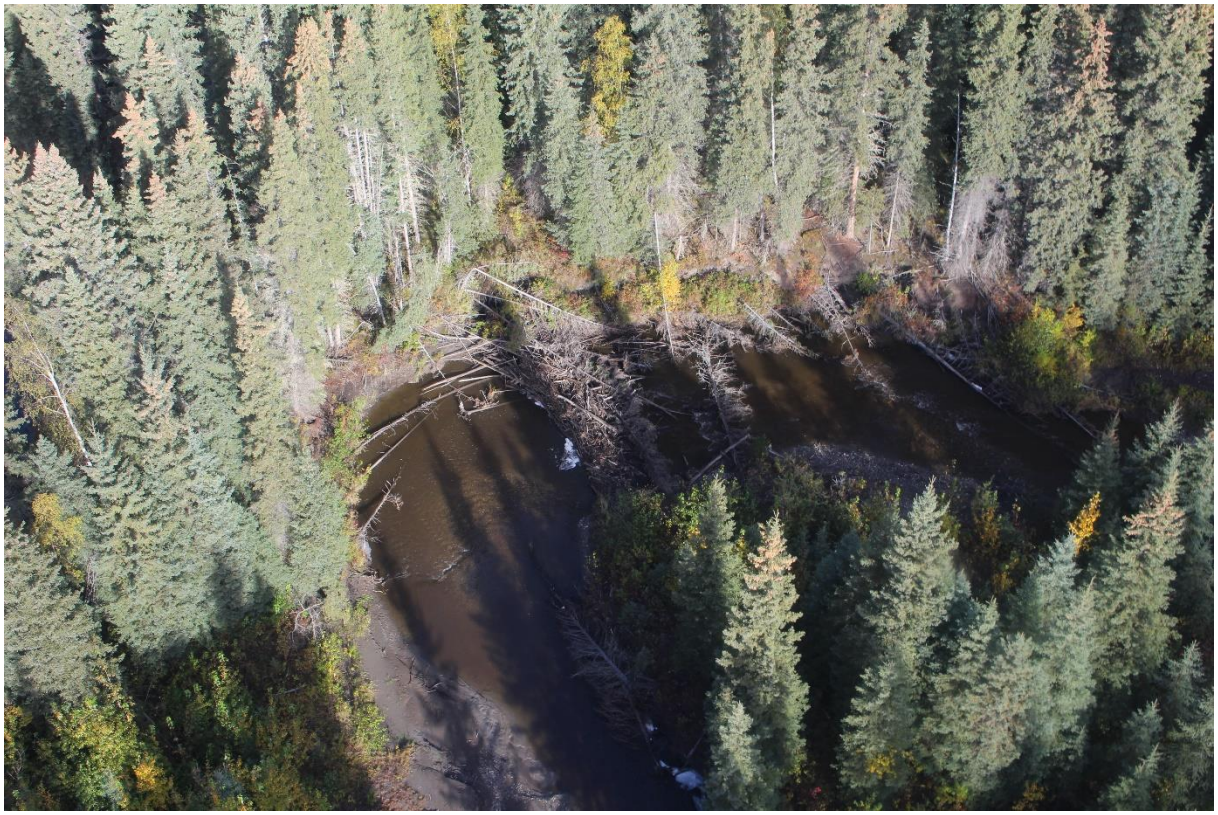


Photo #7: Aerial view of stick and debris jam resulting from an old abandoned beaver dam at Waypoint #1, September 2016.



Photo #8: Ground view of the above, Waypoint #1, that did not pose a barrier to fish passage.



Photo #9: Aerial view of active beaver dam at Waypoint #2 that likely prevents fish passage.



Photo #10: Downstream view of the massive beaver dam at Waypoint #2, September 2016.



Photo #11: Waypoint #3, landslide on Clinton Creek road.

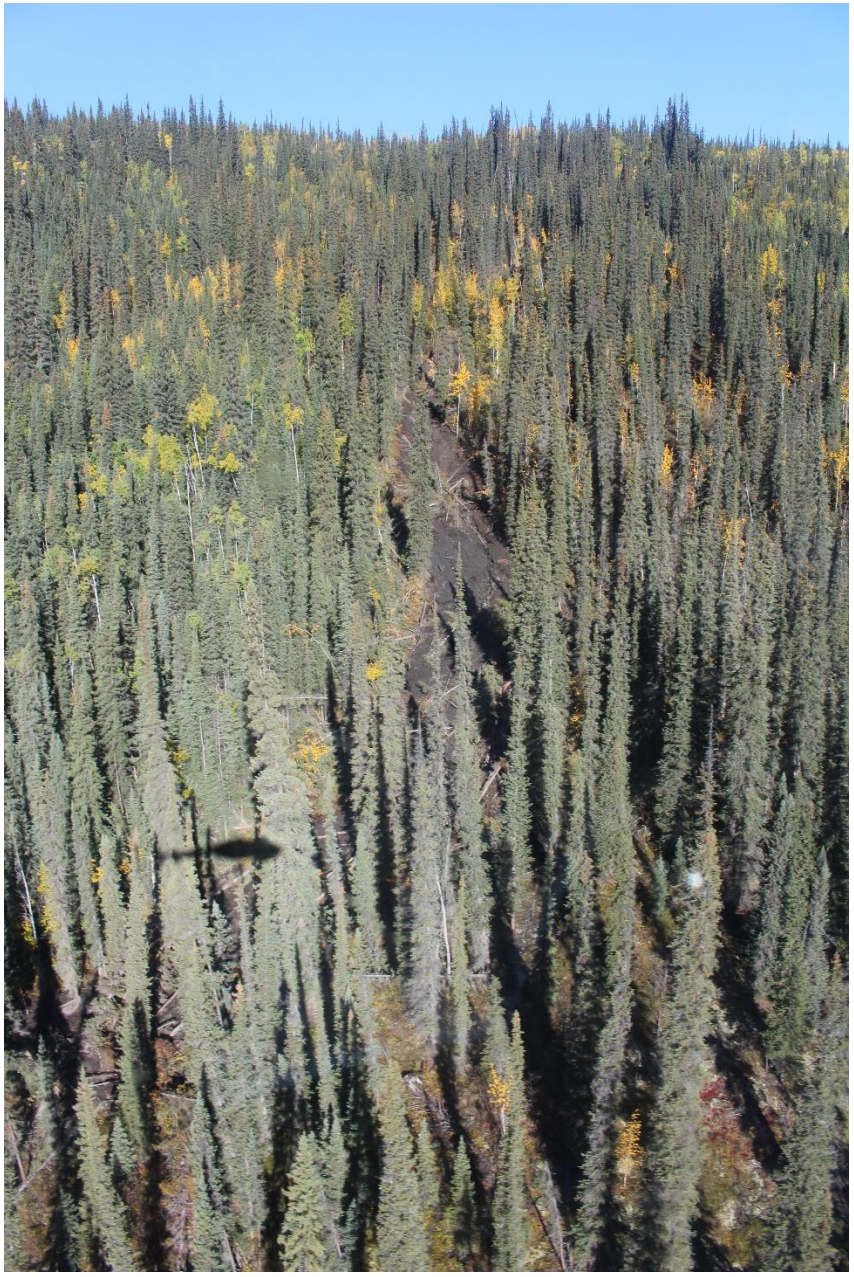


Photo #12: Waypoint #4, small landslide on Eagle Creek.

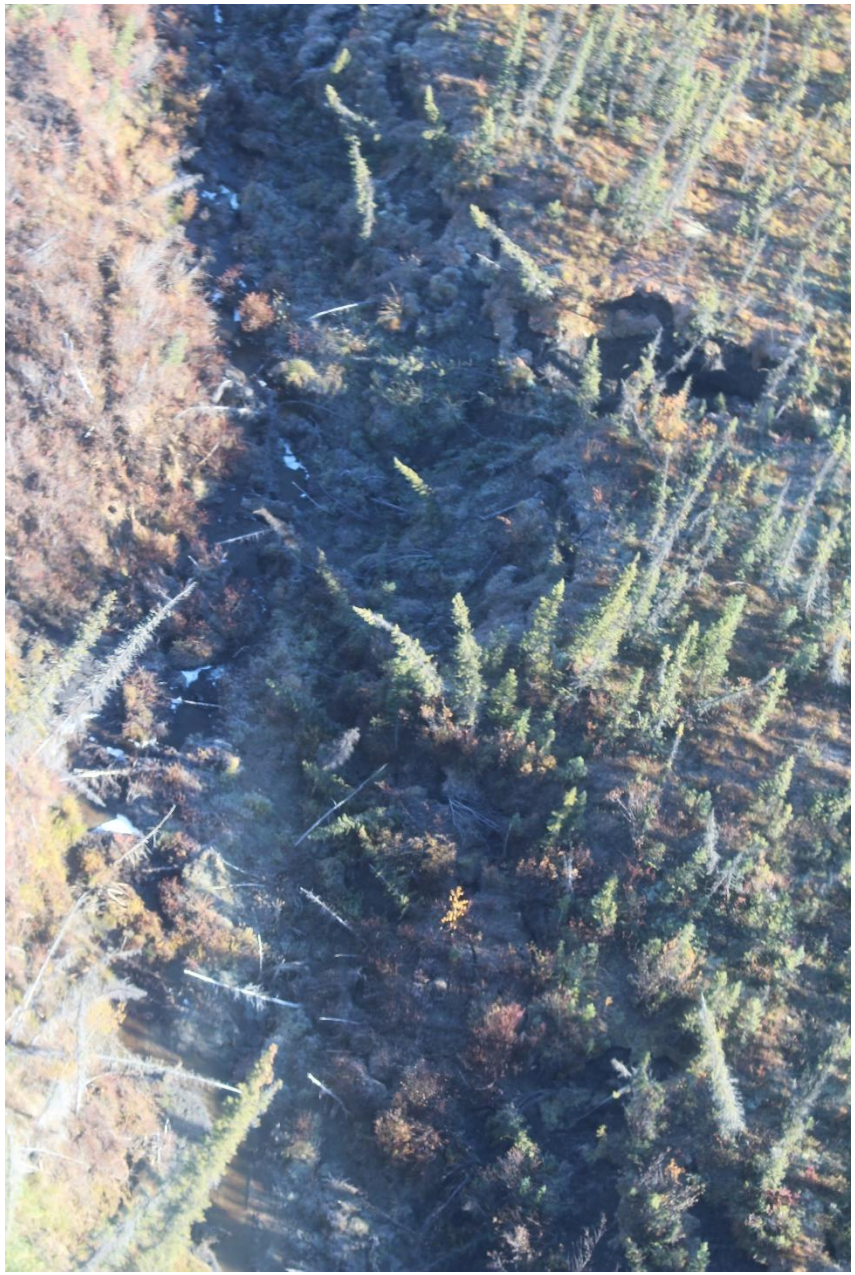


Photo #13: Waypoint #5, Landslide on left fork of Wolverine Creek.



Photo #14: Waypoint #6, landslide on Easter Creek, Sept 2016.



Photo #15: Near Waypoint #6, old breached beaver dam on Easter Creek, Sept 2016.



Photo 16: Headwaters of Easter Creek, September 8th, 2016.



Photo 17: Active landslide area at Waypoint #8, on south tributary to upper Clinton Creek.



Photo 18: The stream has cut through the deposited slumped material.



Photo 19: Looking upstream to the active slope degradation at Waypoint #8. Note numerous areas of deposition of mobilized sediments.

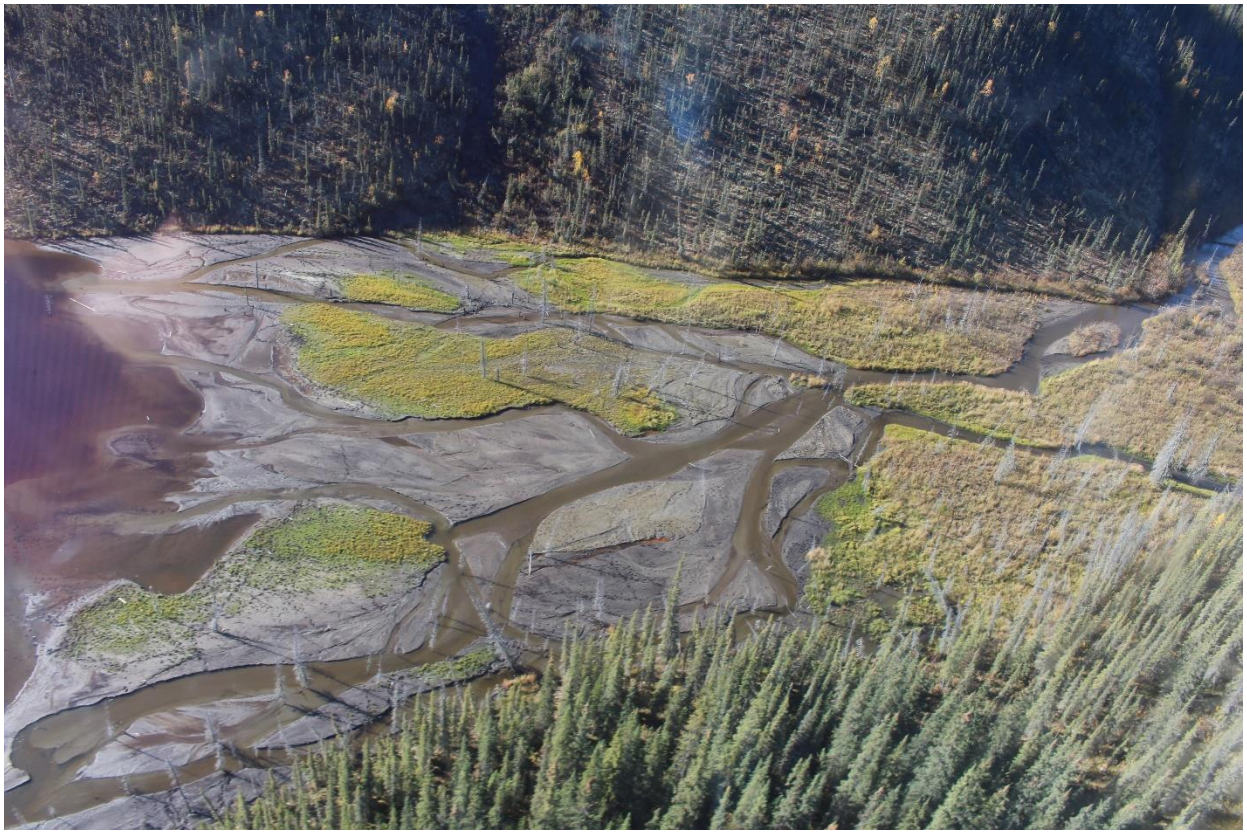


Photo 20: The delta region of upper Clinton Creek as it enters Hudgeon Lake.

APPENDIX B

WATER QUALITY ANALYTICAL DATA, 2016

TABLE 5 RPD VALUES FOR DUPLICATE SAMPLE			
	E-2	DUPLICATE	RPD %
Date Sampled	6-Sep-2016	6-Sep-2016	
Physical Tests (Water)			
Conductivity	664	684	3.0
Hardness (as CaCO3)	370	366	1.1
pH	8.11	8.09	0.2
Anions and Nutrients (Water)			
Sulfate (SO4)	219	219	0.0
Total Metals (Water)			
Aluminum (Al)-Total	0.0516	0.0525	1.7
Antimony (Sb)-Total	<0.00050	<0.00050	N/A
Arsenic (As)-Total	0.00109	0.00115	5.4
Barium (Ba)-Total	0.066	0.066	0.0
Beryllium (Be)-Total	<0.0010	<0.0010	N/A
Bismuth (Bi)-Total	<0.20	<0.20	N/A
Boron (B)-Total	<0.10	<0.10	N/A
Cadmium (Cd)-Total	0.0000474	0.0000521	9.4
Calcium (Ca)-Total	78.3	80.1	2.3
Chromium (Cr)-Total	<0.0010	<0.0010	N/A
Cobalt (Co)-Total	0.00064	0.00067	4.6
Copper (Cu)-Total	0.0026	0.0026	0.0
Iron (Fe)-Total	0.349	0.355	1.7
Lead (Pb)-Total	<0.00050	<0.00050	N/A
Lithium (Li)-Total	0.0074	0.0073	1.4
Magnesium (Mg)-Total	42.9	43.9	2.3
Manganese (Mn)-Total	0.166	0.179	7.5
Mercury (Hg)-Total	0.0000062	0.0000058	6.7
Molybdenum (Mo)-Total	0.0015	0.0014	6.9
Nickel (Ni)-Total	0.0110	0.0115	4.4
Phosphorus (P)-Total	<0.30	<0.30	N/A
Potassium (K)-Total	<2.0	<2.0	N/A
Selenium (Se)-Total	0.00194	0.00184	5.3
Silicon (Si)-Total	5.05	5.13	1.6
Silver (Ag)-Total	<0.000020	<0.000020	N/A
Sodium (Na)-Total	3.7	3.5	5.6
Strontium (Sr)-Total	0.418	0.412	1.4
Thallium (Tl)-Total	<0.00020	<0.00020	N/A
Tin (Sn)-Total	<0.00050	<0.00050	N/A
Titanium (Ti)-Total	<0.010	<0.010	N/A
Uranium (U)-Total	0.00207	0.00198	4.4
Vanadium (V)-Total	0.00067	0.00071	5.8
Zinc (Zn)-Total	<0.0050	<0.0050	N/A
Average RPD for total metals: 3.9%			
Dissolved Metals (Water)			
Aluminum (Al)-Dissolved	0.0348	0.0370	6.1
Antimony (Sb)-Dissolved	<0.00050	<0.00050	N/A
Arsenic (As)-Dissolved	0.00105	0.00106	0.9
Barium (Ba)-Dissolved	0.059	0.058	1.7
Beryllium (Be)-Dissolved	<0.0010	<0.0010	N/A
Bismuth (Bi)-Dissolved	<0.20	<0.20	N/A
Boron (B)-Dissolved	<0.10	<0.10	N/A
Cadmium (Cd)-Dissolved	0.0000500	0.0000497	0.6
Calcium (Ca)-Dissolved	74.9	73.2	2.3
Chromium (Cr)-Dissolved	<0.0010	<0.0010	N/A
Cobalt (Co)-Dissolved	0.00061	0.00063	3.2
Copper (Cu)-Dissolved	0.0024	0.0024	0.0
Iron (Fe)-Dissolved	0.268	0.256	4.6
Lead (Pb)-Dissolved	<0.00050	<0.00050	N/A
Lithium (Li)-Dissolved	0.0073	0.0072	1.4
Magnesium (Mg)-Dissolved	44.5	44.5	0.0
Manganese (Mn)-Dissolved	0.160	0.166	3.7
Mercury (Hg)-Dissolved	<0.0000050	0.0000051	N/A
Molybdenum (Mo)-Dissolved	0.0014	0.0014	0.0
Nickel (Ni)-Dissolved	0.0107	0.0110	2.8
Phosphorus (P)-Dissolved	<0.30	<0.30	N/A
Potassium (K)-Dissolved	<2.0	<2.0	N/A
Selenium (Se)-Dissolved	0.00198	0.00195	1.5
Silicon (Si)-Dissolved	4.86	4.75	2.3
Silver (Ag)-Dissolved	<0.000020	<0.000020	N/A
Sodium (Na)-Dissolved	2.9	2.8	3.5
Strontium (Sr)-Dissolved	0.373	0.368	1.3
Thallium (Tl)-Dissolved	<0.00020	<0.00020	N/A
Tin (Sn)-Dissolved	<0.00050	<0.00050	N/A
Titanium (Ti)-Dissolved	<0.010	<0.010	N/A
Uranium (U)-Dissolved	0.00196	0.00199	1.5
Vanadium (V)-Dissolved	<0.00050	<0.00050	N/A
Zinc (Zn)-Dissolved	<0.0050	<0.0050	N/A
Average RPD for dissolved metals: 2.1%			

LABERGE ENVIRONMENTAL
ATTN: Bonnie Burns
PO Box 21072
Whitehorse YT Y1A 6P7

Date Received: 12-SEP-16
Report Date: 29-SEP-16 11:58 (MT)
Version: FINAL

Client Phone: 867-668-6838

Certificate of Analysis

Lab Work Order #: L1829615

Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers: 14-470932, 14-470930
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1829615-1	L1829615-2	L1829615-3	L1829615-4	L1829615-5
Description	Water	Water	Water	Water	Water
Sampled Date	06-SEP-16	07-SEP-16	06-SEP-16	06-SEP-16	05-SEP-16
Sampled Time	14:30	09:40	16:30	09:00	13:10
Client ID	E-1	PORCUPINE CR	E-2	E-3	E-4
Grouping / **Analyte**					
WATER					
Physical Tests Conductivity (uS/cm)	531	1980	664	622	708
Hardness (as CaCO3) (mg/L)	281	1370	370	337	386
pH (pH)	8.20	8.38	8.11	8.15	8.14
Anions and Nutrients Sulfate (SO4) (mg/L)	151	1090	219	191	236
Total Metals Aluminum (Al)-Total (mg/L)	0.0656	0.0051	0.0516	1.23	0.185
Antimony (Sb)-Total (mg/L)	<0.00050	0.00148	<0.00050	0.00066	<0.00050
Arsenic (As)-Total (mg/L)	0.00090	0.00239	0.00109	0.00198	0.00135
Barium (Ba)-Total (mg/L)	0.071	0.026	0.066	0.107	0.067
Beryllium (Be)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.20	<0.20	<0.20
Boron (B)-Total (mg/L)	<0.10	0.23	<0.10	<0.10	<0.10
Cadmium (Cd)-Total (mg/L)	0.0000453	0.000162	0.0000474	0.000186	0.0000621
Calcium (Ca)-Total (mg/L)	68.1	187	78.3	65.0	76.0
Chromium (Cr)-Total (mg/L)	<0.0010	0.0024	<0.0010	0.0032	0.0011
Cobalt (Co)-Total (mg/L)	0.00049	<0.00030	0.00064	0.00164	0.00085
Copper (Cu)-Total (mg/L)	0.0030	0.0020	0.0026	0.0062	0.0028
Iron (Fe)-Total (mg/L)	0.323	<0.030	0.349	2.67	0.645
Lead (Pb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	0.00141	<0.00050
Lithium (Li)-Total (mg/L)	0.0028	0.0645	0.0074	0.0045	0.0095
Magnesium (Mg)-Total (mg/L)	28.0	209	42.9	42.0	46.2
Manganese (Mn)-Total (mg/L)	0.182	0.00134	0.166	0.226	0.193
Mercury (Hg)-Total (mg/L)	0.0000057	0.0000051	0.0000062	0.0000189	0.0000068
Molybdenum (Mo)-Total (mg/L)	0.0013	0.0026	0.0015	0.0017	0.0016
Nickel (Ni)-Total (mg/L)	0.0046	0.0573	0.0110	0.0093	0.0134
Phosphorus (P)-Total (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Total (mg/L)	<2.0	2.6	<2.0	<2.0	<2.0
Selenium (Se)-Total (mg/L)	0.00188	0.00501	0.00194	0.00167	0.00179
Silicon (Si)-Total (mg/L)	5.13	6.10	5.05	7.74	5.26
Silver (Ag)-Total (mg/L)	<0.000020	<0.000020	<0.000020	0.000053	<0.000020
Sodium (Na)-Total (mg/L)	2.9	13.7	3.7	4.9	4.2
Strontium (Sr)-Total (mg/L)	0.304	1.62	0.418	0.327	0.426
Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Titanium (Ti)-Total (mg/L)	<0.010	<0.010	<0.010	0.030	<0.010
Uranium (U)-Total (mg/L)	0.00185	0.00530	0.00207	0.00248	0.00223
Vanadium (V)-Total (mg/L)	0.00069	<0.00050	0.00067	0.00430	0.00105
Zinc (Zn)-Total (mg/L)	<0.0050	0.0067	<0.0050	0.0147	<0.0050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1829615-6	L1829615-7	L1829615-8	L1829615-9	L1829615-10
Description	Water	Water	Water	Water	Water
Sampled Date	05-SEP-16	08-SEP-16	07-SEP-16	07-SEP-16	06-SEP-16
Sampled Time	09:30	14:50	12:45	15:00	11:30
Client ID	E-6	E-8	R-1	R-2	R-3
Grouping / **Analyte**					
WATER					
Physical Tests Conductivity (uS/cm)	716	250	700	618	682
Hardness (as CaCO3) (mg/L)	385	116	375	328	367
pH (pH)	8.20	8.06	8.21	8.25	8.17
Anions and Nutrients Sulfate (SO4) (mg/L)	235	47.9	224	169	218
Total Metals Aluminum (Al)-Total (mg/L)	0.549	0.281	0.819	0.316	0.345
Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic (As)-Total (mg/L)	0.00195	0.00079	0.00148	0.00132	0.00101
Barium (Ba)-Total (mg/L)	0.089	0.048	0.081	0.062	0.080
Beryllium (Be)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.20	<0.20	<0.20
Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd)-Total (mg/L)	0.000104	0.0000339	0.000174	0.0000351	0.0000320
Calcium (Ca)-Total (mg/L)	78.0	31.2	93.6	61.9	71.2
Chromium (Cr)-Total (mg/L)	0.0023	<0.0010	0.0018	0.0013	0.0013
Cobalt (Co)-Total (mg/L)	0.00166	0.00073	0.00142	0.00054	0.00076
Copper (Cu)-Total (mg/L)	0.0042	0.0031	0.0041	0.0021	0.0027
Iron (Fe)-Total (mg/L)	1.40	0.634	1.73	1.01	1.01
Lead (Pb)-Total (mg/L)	0.00077	<0.00050	0.00132	<0.00050	<0.00050
Lithium (Li)-Total (mg/L)	0.0088	0.0035	0.0039	0.0058	0.0033
Magnesium (Mg)-Total (mg/L)	45.0	9.51	34.5	42.2	45.5
Manganese (Mn)-Total (mg/L)	0.378	0.0625	0.400	0.143	0.280
Mercury (Hg)-Total (mg/L)	0.0000114	<0.0000050	0.0000128	0.0000052	0.0000056
Molybdenum (Mo)-Total (mg/L)	0.0016	<0.0010	0.0015	<0.0010	0.0013
Nickel (Ni)-Total (mg/L)	0.0164	0.0038	0.0065	0.0047	0.0044
Phosphorus (P)-Total (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Total (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
Selenium (Se)-Total (mg/L)	0.00190	0.000317	0.00298	0.000780	0.000985
Silicon (Si)-Total (mg/L)	6.02	5.82	6.02	6.36	6.61
Silver (Ag)-Total (mg/L)	0.000033	<0.000020	0.000031	<0.000020	<0.000020
Sodium (Na)-Total (mg/L)	4.2	3.7	3.5	3.2	4.4
Strontium (Sr)-Total (mg/L)	0.433	0.158	0.425	0.328	0.347
Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Titanium (Ti)-Total (mg/L)	0.021	<0.010	0.032	0.012	0.011
Uranium (U)-Total (mg/L)	0.00242	0.00100	0.00253	0.00350	0.00319
Vanadium (V)-Total (mg/L)	0.00227	0.00151	0.00255	0.00164	0.00172
Zinc (Zn)-Total (mg/L)	0.0147	0.0054	0.0138	<0.0050	<0.0050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1829615-11	L1829615-12	L1829615-13	L1829615-14	L1829615-15
Description	Water	Water	Water	Water	Water
Sampled Date	05-SEP-16	08-SEP-16	08-SEP-16		
Sampled Time	11:40	16:40	12:00		
Client ID	R-4	R-6	MAIDEN CR	FIELD BLANK	TRAVEL BLANK
Grouping / **Analyte**					
WATER					
Physical Tests Conductivity (uS/cm)	610	243	196	<2.0	<2.0
Hardness (as CaCO3) (mg/L)	324	111	84.0	<0.50	
pH (pH)	8.26	8.06	7.15	5.57	5.53
Anions and Nutrients Sulfate (SO4) (mg/L)	159	45.9	53.5	<0.30	<0.30
Total Metals Aluminum (Al)-Total (mg/L)	2.22	0.334	2.21	<0.0050	
Antimony (Sb)-Total (mg/L)	0.00067	<0.00050	<0.00050	<0.00050	
Arsenic (As)-Total (mg/L)	0.00493	0.00078	0.00210	<0.00050	
Barium (Ba)-Total (mg/L)	0.183	0.052	0.104	<0.020	
Beryllium (Be)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.20	<0.20	
Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	
Cadmium (Cd)-Total (mg/L)	0.000365	0.0000315	0.000186	<0.0000050	
Calcium (Ca)-Total (mg/L)	84.1	32.3	17.2	<0.10	
Chromium (Cr)-Total (mg/L)	0.0052	<0.0010	0.0039	<0.0010	
Cobalt (Co)-Total (mg/L)	0.00376	0.00078	0.00272	<0.00030	
Copper (Cu)-Total (mg/L)	0.0123	0.0033	0.0081	<0.0010	
Iron (Fe)-Total (mg/L)	4.98	0.762	3.38	<0.030	
Lead (Pb)-Total (mg/L)	0.00330	<0.00050	0.00189	<0.00050	
Lithium (Li)-Total (mg/L)	0.0040	0.0031	0.0021	<0.0010	
Magnesium (Mg)-Total (mg/L)	33.4	10.0	12.1	<0.10	
Manganese (Mn)-Total (mg/L)	0.433	0.0676	0.252	<0.00010	
Mercury (Hg)-Total (mg/L)	0.000064 DLM	<0.0000050	0.0000108	<0.0000050	
Molybdenum (Mo)-Total (mg/L)	0.0024	<0.0010	<0.0010	<0.0010	
Nickel (Ni)-Total (mg/L)	0.0242	0.0040	0.0087	<0.0010	
Phosphorus (P)-Total (mg/L)	<0.30	<0.30	<0.30	<0.30	
Potassium (K)-Total (mg/L)	<2.0	<2.0	<2.0	<2.0	
Selenium (Se)-Total (mg/L)	0.00363	0.000280	0.000582	<0.000050	
Silicon (Si)-Total (mg/L)	8.86	6.35	8.56	<0.050	
Silver (Ag)-Total (mg/L)	0.000169	<0.000020	0.000036	<0.000020	
Sodium (Na)-Total (mg/L)	4.5	3.9	2.4	<2.0	
Strontium (Sr)-Total (mg/L)	0.439	0.166	0.0852	<0.0050	
Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	
Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
Titanium (Ti)-Total (mg/L)	0.058	0.011	0.066	<0.010	
Uranium (U)-Total (mg/L)	0.00353	0.00099	0.00067	<0.00020	
Vanadium (V)-Total (mg/L)	0.00774	0.00169	0.00631	<0.00050	
Zinc (Zn)-Total (mg/L)	0.0245	0.0057	0.0214	<0.0050	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1829615-16				
	Description	Water				
	Sampled Date	06-SEP-16				
	Sampled Time					
	Client ID	DUPLICATE				
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	684				
	Hardness (as CaCO3) (mg/L)	366				
	pH (pH)	8.09				
Anions and Nutrients	Sulfate (SO4) (mg/L)	219				
Total Metals	Aluminum (Al)-Total (mg/L)	0.0525				
	Antimony (Sb)-Total (mg/L)	<0.00050				
	Arsenic (As)-Total (mg/L)	0.00115				
	Barium (Ba)-Total (mg/L)	0.066				
	Beryllium (Be)-Total (mg/L)	<0.0010				
	Bismuth (Bi)-Total (mg/L)	<0.20				
	Boron (B)-Total (mg/L)	<0.10				
	Cadmium (Cd)-Total (mg/L)	0.0000521				
	Calcium (Ca)-Total (mg/L)	80.1				
	Chromium (Cr)-Total (mg/L)	<0.0010				
	Cobalt (Co)-Total (mg/L)	0.00067				
	Copper (Cu)-Total (mg/L)	0.0026				
	Iron (Fe)-Total (mg/L)	0.355				
	Lead (Pb)-Total (mg/L)	<0.00050				
	Lithium (Li)-Total (mg/L)	0.0073				
	Magnesium (Mg)-Total (mg/L)	43.9				
	Manganese (Mn)-Total (mg/L)	0.179				
	Mercury (Hg)-Total (mg/L)	0.0000058				
	Molybdenum (Mo)-Total (mg/L)	0.0014				
	Nickel (Ni)-Total (mg/L)	0.0115				
	Phosphorus (P)-Total (mg/L)	<0.30				
	Potassium (K)-Total (mg/L)	<2.0				
	Selenium (Se)-Total (mg/L)	0.00184				
	Silicon (Si)-Total (mg/L)	5.13				
	Silver (Ag)-Total (mg/L)	<0.000020				
	Sodium (Na)-Total (mg/L)	3.5				
	Strontium (Sr)-Total (mg/L)	0.412				
	Thallium (Tl)-Total (mg/L)	<0.00020				
	Tin (Sn)-Total (mg/L)	<0.00050				
	Titanium (Ti)-Total (mg/L)	<0.010				
	Uranium (U)-Total (mg/L)	0.00198				
	Vanadium (V)-Total (mg/L)	0.00071				
	Zinc (Zn)-Total (mg/L)	<0.0050				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1829615-1	L1829615-2	L1829615-3	L1829615-4	L1829615-5
Description	Water	Water	Water	Water	Water
Sampled Date	06-SEP-16	07-SEP-16	06-SEP-16	06-SEP-16	05-SEP-16
Sampled Time	14:30	09:40	16:30	09:00	13:10
Client ID	E-1	PORCUPINE CR	E-2	E-3	E-4
Grouping / **Analyte**					
WATER					
Dissolved Metals Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved (mg/L)	0.0432	<0.0050	0.0348	0.0303	0.0294
Antimony (Sb)-Dissolved (mg/L)	<0.00050	0.00148	<0.00050	0.00054	<0.00050
Arsenic (As)-Dissolved (mg/L)	0.00078	0.00255	0.00105	0.00085	0.00108
Barium (Ba)-Dissolved (mg/L)	0.065	0.025	0.059	0.063	0.058
Beryllium (Be)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.20	<0.20	<0.20
Boron (B)-Dissolved (mg/L)	<0.10	0.22	<0.10	<0.10	<0.10
Cadmium (Cd)-Dissolved (mg/L)	0.0000391	0.000181	0.0000500	0.0000248	0.0000419
Calcium (Ca)-Dissolved (mg/L)	64.4	185	74.9	60.8	73.9
Chromium (Cr)-Dissolved (mg/L)	<0.0010	0.0024	<0.0010	0.0051	<0.0010
Cobalt (Co)-Dissolved (mg/L)	0.00043	<0.00030	0.00061	0.00051	0.00066
Copper (Cu)-Dissolved (mg/L)	0.0027	0.0011	0.0024	0.0018	0.0021
Iron (Fe)-Dissolved (mg/L)	0.246	<0.030	0.268	0.280	0.284
Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Lithium (Li)-Dissolved (mg/L)	0.0028	0.0629	0.0073	0.0035	0.0091
Magnesium (Mg)-Dissolved (mg/L)	29.3	221	44.5	44.9	49.0
Manganese (Mn)-Dissolved (mg/L)	0.164	0.00116	0.160	0.170	0.174
Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum (Mo)-Dissolved (mg/L)	0.0012	0.0024	0.0014	0.0012	0.0014
Nickel (Ni)-Dissolved (mg/L)	0.0044	0.0594	0.0107	0.0080	0.0117
Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved (mg/L)	<2.0	2.8	<2.0	<2.0	<2.0
Selenium (Se)-Dissolved (mg/L)	0.00192	0.00514	0.00198	0.00146	0.00196
Silicon (Si)-Dissolved (mg/L)	4.88	6.08	4.86	5.77	4.93
Silver (Ag)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Sodium (Na)-Dissolved (mg/L)	2.3	14.0	2.9	4.0	3.5
Strontium (Sr)-Dissolved (mg/L)	0.278	1.65	0.373	0.284	0.389
Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Dissolved (mg/L)	0.00178	0.00526	0.00196	0.00236	0.00207
Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	0.00055	<0.00050
Zinc (Zn)-Dissolved (mg/L)	<0.0050	0.0063	<0.0050	<0.0050	<0.0050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1829615-6 Water 05-SEP-16 09:30 E-6	L1829615-7 Water 08-SEP-16 14:50 E-8	L1829615-8 Water 07-SEP-16 12:45 R-1	L1829615-9 Water 07-SEP-16 15:00 R-2	L1829615-10 Water 06-SEP-16 11:30 R-3
WATER						
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0286	0.0922	0.0289	0.0406	0.0298
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Dissolved (mg/L)	0.00123	0.00060	0.00057	0.00108	0.00067
	Barium (Ba)-Dissolved (mg/L)	0.068	0.043	0.057	0.052	0.064
	Beryllium (Be)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B)-Dissolved (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Dissolved (mg/L)	0.0000492	0.0000256	0.0000749	0.0000271	0.0000190
	Calcium (Ca)-Dissolved (mg/L)	74.7	30.8	90.2	59.4	69.5
	Chromium (Cr)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Cobalt (Co)-Dissolved (mg/L)	0.00111	0.00056	0.00071	0.00034	0.00052
	Copper (Cu)-Dissolved (mg/L)	0.0022	0.0027	0.0019	0.0016	0.0018
	Iron (Fe)-Dissolved (mg/L)	0.323	0.300	0.269	0.519	0.365
	Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Lithium (Li)-Dissolved (mg/L)	0.0087	0.0036	0.0028	0.0057	0.0027
	Magnesium (Mg)-Dissolved (mg/L)	48.3	9.40	36.4	43.6	46.9
	Manganese (Mn)-Dissolved (mg/L)	0.351	0.0544	0.331	0.130	0.261
	Mercury (Hg)-Dissolved (mg/L)	0.0000051	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.0014	<0.0010	0.0012	<0.0010	0.0011
	Nickel (Ni)-Dissolved (mg/L)	0.0131	0.0034	0.0042	0.0041	0.0037
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Dissolved (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Selenium (Se)-Dissolved (mg/L)	0.00186	0.000295	0.00291	0.000725	0.000994
	Silicon (Si)-Dissolved (mg/L)	4.98	5.54	4.71	5.82	6.00
	Silver (Ag)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Sodium (Na)-Dissolved (mg/L)	3.4	3.0	2.6	2.4	3.6
	Strontium (Sr)-Dissolved (mg/L)	0.383	0.143	0.374	0.293	0.311
	Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.00231	0.00098	0.00226	0.00341	0.00302
	Vanadium (V)-Dissolved (mg/L)	<0.00050	0.00079	<0.00050	0.00066	0.00060
	Zinc (Zn)-Dissolved (mg/L)	0.0062	<0.0050	<0.0050	<0.0050	<0.0050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1829615-11	L1829615-12	L1829615-13	L1829615-14	L1829615-15
Description	Water	Water	Water	Water	Water
Sampled Date	05-SEP-16	08-SEP-16	08-SEP-16		
Sampled Time	11:40	16:40	12:00		
Client ID	R-4	R-6	MAIDEN CR	FIELD BLANK	TRAVEL BLANK
Grouping / **Analyte**					
WATER					
Dissolved Metals Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	
Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	
Aluminum (Al)-Dissolved (mg/L)	0.0199	0.0846	0.172	<0.0050	
Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
Arsenic (As)-Dissolved (mg/L)	0.00207	0.00059	0.00076	<0.00050	
Barium (Ba)-Dissolved (mg/L)	0.090	0.041	0.049	<0.020	
Beryllium (Be)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.20	<0.20	
Boron (B)-Dissolved (mg/L)	<0.10	<0.10	<0.10	<0.10	
Cadmium (Cd)-Dissolved (mg/L)	0.0000464	0.0000227	0.0000397	<0.0000050	
Calcium (Ca)-Dissolved (mg/L)	76.7	29.3	15.6	<0.10	
Chromium (Cr)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
Cobalt (Co)-Dissolved (mg/L)	0.00123	0.00055	0.00126	<0.00030	
Copper (Cu)-Dissolved (mg/L)	0.0019	0.0026	0.0039	<0.0010	
Iron (Fe)-Dissolved (mg/L)	0.159	0.306	0.516	<0.030	
Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
Lithium (Li)-Dissolved (mg/L)	0.0020	0.0032	<0.0010	<0.0010	
Magnesium (Mg)-Dissolved (mg/L)	32.1	9.09	10.9	<0.10	
Manganese (Mn)-Dissolved (mg/L)	0.299	0.0508	0.188	<0.00010	
Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	0.0000059	<0.0000050	
Molybdenum (Mo)-Dissolved (mg/L)	0.0013	<0.0010	<0.0010	<0.0010	
Nickel (Ni)-Dissolved (mg/L)	0.0117	0.0032	0.0050	<0.0010	
Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30	
Potassium (K)-Dissolved (mg/L)	<2.0	<2.0	<2.0	<2.0	
Selenium (Se)-Dissolved (mg/L)	0.00324	0.000257	0.000574	<0.000050	
Silicon (Si)-Dissolved (mg/L)	5.44	5.56	5.74	<0.050	
Silver (Ag)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	
Sodium (Na)-Dissolved (mg/L)	3.6	3.0	<2.0	<2.0	
Strontium (Sr)-Dissolved (mg/L)	0.371	0.140	0.0714	<0.0050	
Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	
Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	
Uranium (U)-Dissolved (mg/L)	0.00314	0.00087	0.00042	<0.00020	
Vanadium (V)-Dissolved (mg/L)	<0.00050	0.00080	0.00078	<0.00050	
Zinc (Zn)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1829615-16
	Description	Water
	Sampled Date	06-SEP-16
	Sampled Time	
	Client ID	DUPLICATE
Grouping	**Analyte**	
WATER		
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD
	Dissolved Metals Filtration Location	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0370
	Antimony (Sb)-Dissolved (mg/L)	<0.00050
	Arsenic (As)-Dissolved (mg/L)	0.00106
	Barium (Ba)-Dissolved (mg/L)	0.058
	Beryllium (Be)-Dissolved (mg/L)	<0.0010
	Bismuth (Bi)-Dissolved (mg/L)	<0.20
	Boron (B)-Dissolved (mg/L)	<0.10
	Cadmium (Cd)-Dissolved (mg/L)	0.0000497
	Calcium (Ca)-Dissolved (mg/L)	73.2
	Chromium (Cr)-Dissolved (mg/L)	<0.0010
	Cobalt (Co)-Dissolved (mg/L)	0.00063
	Copper (Cu)-Dissolved (mg/L)	0.0024
	Iron (Fe)-Dissolved (mg/L)	0.256
	Lead (Pb)-Dissolved (mg/L)	<0.00050
	Lithium (Li)-Dissolved (mg/L)	0.0072
	Magnesium (Mg)-Dissolved (mg/L)	44.5
	Manganese (Mn)-Dissolved (mg/L)	0.166
	Mercury (Hg)-Dissolved (mg/L)	0.0000051
	Molybdenum (Mo)-Dissolved (mg/L)	0.0014
	Nickel (Ni)-Dissolved (mg/L)	0.0110
	Phosphorus (P)-Dissolved (mg/L)	<0.30
	Potassium (K)-Dissolved (mg/L)	<2.0
	Selenium (Se)-Dissolved (mg/L)	0.00195
	Silicon (Si)-Dissolved (mg/L)	4.75
	Silver (Ag)-Dissolved (mg/L)	<0.000020
	Sodium (Na)-Dissolved (mg/L)	2.8
	Strontium (Sr)-Dissolved (mg/L)	0.368
	Thallium (Tl)-Dissolved (mg/L)	<0.00020
	Tin (Sn)-Dissolved (mg/L)	<0.00050
	Titanium (Ti)-Dissolved (mg/L)	<0.010
	Uranium (U)-Dissolved (mg/L)	0.00199
	Vanadium (V)-Dissolved (mg/L)	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Aluminum (Al)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Antimony (Sb)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Uranium (U)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Aluminum (Al)-Total	MS-B	L1829615-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Aluminum (Al)-Total	MS-B	L1829615-10, -11, -12, -13, -14, -16, -9
Matrix Spike	Manganese (Mn)-Total	MS-B	L1829615-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Manganese (Mn)-Total	MS-B	L1829615-10, -11, -12, -13, -14, -16, -9
Matrix Spike	Calcium (Ca)-Total	MS-B	L1829615-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Iron (Fe)-Total	MS-B	L1829615-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Iron (Fe)-Total	MS-B	L1829615-10, -11, -12, -13, -14, -16, -9
Matrix Spike	Silicon (Si)-Total	MS-B	L1829615-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Silicon (Si)-Total	MS-B	L1829615-10, -11, -12, -13, -14, -16, -9
Matrix Spike	Strontium (Sr)-Total	MS-B	L1829615-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sulfate (SO4)	MS-B	L1829615-2
Matrix Spike	Sulfate (SO4)	MS-B	L1829615-2

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
AREA SAMPLED-VA	Biota	Area Sampled (cm2)	Not Applicable

Reference Information

CHLOROA-F-VA Biota Chlorophyll a in Biota by Fluorometer EPA 445.0

This analysis is done using procedures adapted from EPA Method 445.0. Chlorophyll-a is determined by a routine acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b. Note: Biota samples are typically submitted as scrapings on a filter.

EC-PCT-VA Water Conductivity (Automated) APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

HARDNESS-CALC-VA Water Hardness APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA Water Diss. Mercury in Water by CVAAS or CVAFS APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-CVAA-VA Water Total Mercury in Water by CVAAS or CVAFS EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-DIS-ICP-VA Water Dissolved Metals in Water by ICPOES EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-TOT-ICP-VA Water Total Metals in Water by ICPOES EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H "pH Value"

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PHEOPHYTIN-F-VA Biota Pheophytin a in Biota by Fluorometer EPA 445.0

This analysis is done using procedures modified from EPA 445.0 . Pheopigments present in a biota sample are determined collectively as pheophytin a. Pheophytin a is determined by a routine acetone extraction followed with analysis by flourometry using the acidification procedure.
Note: Biota samples are typically submitted as scrapings on a filter.

Reference Information

SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

14-470932, 14-470930

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

23-Sep-2016

Brent Mack
ALS Environmental
8081 Lougheed HWY
Suite 100
Burnaby, BC V5A1W9

Tel: (604) 253-4188
Fax:

Re: L1829615 Work Order: **1609561**

Dear Brent,

ALS Environmental received 16 samples on 20-Sep-2016 10:35 AM for the analyses presented in the following report.

The analytical data provided relates directly to the samples received by ALS Environmental and for only the analyses requested.

QC sample results for this data met laboratory specifications. Any exceptions are noted in the Case Narrative, or noted with qualifiers in the report or QC batch information. Should this laboratory report need to be reproduced, it should be reproduced in full unless written approval has been obtained from ALS Laboratory Group. Samples will be disposed in 30 days unless storage arrangements are made.

The total number of pages in this report is 22.

If you have any questions regarding this report, please feel free to contact me.

Sincerely,

Shawn Smythe

Electronically approved by: Chris Gibson

Shawn Smythe
Project Manager

ALS Environmental

Date: 23-Sep-16

Client: ALS Environmental
Project: L1829615
Work Order: **1609561**

Work Order Sample Summary

Lab Samp ID	Client Sample ID	Matrix	Tag Number	Collection Date	Date Received	Hold
1609561-01	L1829615-1	Water		9/6/2016	9/20/2016 10:35	☐
1609561-02	L1829615-2	Water		9/7/2016	9/20/2016 10:35	☐
1609561-03	L1829615-3	Water		9/6/2016	9/20/2016 10:35	☐
1609561-04	L1829615-4	Water		9/6/2016	9/20/2016 10:35	☐
1609561-05	L1829615-5	Water		9/5/2016	9/20/2016 10:35	☐
1609561-06	L1829615-6	Water		9/5/2016	9/20/2016 10:35	☐
1609561-07	L1829615-7	Water		9/8/2016	9/20/2016 10:35	☐
1609561-08	L1829615-8	Water		9/7/2016	9/20/2016 10:35	☐
1609561-09	L1829615-9	Water		9/7/2016	9/20/2016 10:35	☐
1609561-10	L1829615-10	Water		9/6/2016	9/20/2016 10:35	☐
1609561-11	L1829615-11	Water		9/5/2016	9/20/2016 10:35	☐
1609561-12	L1829615-12	Water		9/8/2016	9/20/2016 10:35	☐
1609561-13	L1829615-13	Water		9/8/2016	9/20/2016 10:35	☐
1609561-14	L1829615-14	Water			9/20/2016 10:35	☐
1609561-15	L1829615-15	Water			9/20/2016 10:35	☐
1609561-16	L1829615-16	Water			9/20/2016 10:35	☐

ALS Environmental

Date: 23-Sep-16

Client: ALS Environmental
Project: L1829615
Work Order: 1609561

Case Narrative

The sample condition upon receipt was acceptable except where noted.

Results relate only to the items tested and are not blank corrected unless indicated.

Compound identification is based upon retention time matching only. Any compound with a similar retention time will interfere.

Samples were prepared and analyzed by the analytical method and the laboratory's applicable standard operating procedure listed below:
- IH-001- "Determination of Analytes Using NIOSH and OSHA Methods Using Gas Chromatography."
- IH-002- "Determination of Suspended Particulates in the Atmosphere Using Various Media"
- IH-003- "Determination of Suspended Particulates Not Otherwise Regulated (Total and Respirable)."
- IH-004- "Determination of Analytes by NIOSH and OSHA Methods Using Liquid Chromatography."
- IH-005- "Benzene-Soluble Fraction and Total Particulate (Asphalt Fume)."
- IH-006- "Methods IO-3.1 and IO-3.4 Modified for Metals Preparation and Analysis for Suspended Particulates."
- IH-196- "Carbon Black by OSHA 196."
- IH-6009- "Determination of Mercury in Industrial Hygiene Samples by Manual Cold Vapor Atomic Absorption Spectroscopy."
- ENV-6010B- "Determination of Trace Metals in Solution by Inductively Coupled Plasma-Atomic Emission Spectroscopy by EPA Method 6010B Non-VAP."
- IH-7300 modified- "Elements by ICP."

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-1	**Lab ID:**	1609561-01
Collection Date:	9/6/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**2.4**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-2	**Lab ID:**	1609561-02
Collection Date:	9/7/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**2.4**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-3	**Lab ID:**	1609561-03
Collection Date:	9/6/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**2.2**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-4	**Lab ID:**	1609561-04
Collection Date:	9/6/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**63**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-5	**Lab ID:**	1609561-05
Collection Date:	9/5/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**4.9**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-6	**Lab ID:**	1609561-06
Collection Date:	9/5/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**32**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-7	**Lab ID:**	1609561-07
Collection Date:	9/8/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**7.7**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-8	**Lab ID:**	1609561-08
Collection Date:	9/7/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**37**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-9	**Lab ID:**	1609561-09
Collection Date:	9/7/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**9.8**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-10	**Lab ID:**	1609561-10
Collection Date:	9/6/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**12**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-11	**Lab ID:**	1609561-11
Collection Date:	9/5/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**130**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-12	**Lab ID:**	1609561-12
Collection Date:	9/8/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**4.9**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client: ALS Environmental
Project: L1829615 **Work Order:** 1609561
Sample ID: L1829615-13 **Lab ID:** 1609561-13
Collection Date: 9/8/2016 **Matrix:** WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**98**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client: ALS Environmental
Project: L1829615
Sample ID: L1829615-14
Collection Date:

Work Order: 1609561
Lab ID: 1609561-14
Matrix: WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**2.6**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client: ALS Environmental
Project: L1829615
Sample ID: L1829615-15
Collection Date:

Work Order: 1609561
Lab ID: 1609561-15
Matrix: WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**2.0**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client: ALS Environmental
Project: L1829615
Sample ID: L1829615-16
Collection Date:

Work Order: 1609561
Lab ID: 1609561-16
Matrix: WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	ND		2.0	mg/L	1	9/20/2016

Note:

ALS Environmental

Date: 23-Sep-16

Client: ALS Environmental

Work Order: 1609561

Project: L1829615

QC BATCH REPORT

Batch ID: **R133102** Instrument ID **WETCHEM** Method: **E160.2**

MBLK Sample ID: **MB-R133102-R133102** Units: **mg/L** Analysis Date: **9/20/2016**

Client ID: Run ID: **WETCHEM_160920C** SeqNo: **1360373** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Total suspended solids	ND	2.0								

LCS Sample ID: **LCS-R133102-R133102** Units: **mg/L** Analysis Date: **9/20/2016**

Client ID: Run ID: **WETCHEM_160920C** SeqNo: **1360374** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Total suspended solids	942.1	2.0	1000	0	94.2	70-130	0			

DUP Sample ID: **1609561-02A Dup** Units: **mg/L** Analysis Date: **9/20/2016**

Client ID: **L1829615-2** Run ID: **WETCHEM_160920C** SeqNo: **1360378** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Total suspended solids	2.91	2.0	0	0	0		2.39	19.6		

DUP Sample ID: **1609561-16A Dup** Units: **mg/L** Analysis Date: **9/20/2016**

Client ID: **L1829615-16** Run ID: **WETCHEM_160920C** SeqNo: **1360393** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Total suspended solids	ND	2.0	0	0	0		1.6	0		

The following samples were analyzed in this batch:

1609561-01A	1609561-02A	1609561-03A
1609561-04A	1609561-05A	1609561-06A
1609561-07A	1609561-08A	1609561-09A
1609561-10A	1609561-11A	1609561-12A
1609561-13A	1609561-14A	1609561-15A
1609561-16A		

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

ALS Environmental

Date: 23-Sep-16

Client: ALS Environmental
Project: L1829615
WorkOrder: **1609561**

QUALIFIERS, ACRONYMS, UNITS

Qualifier	Description
*	Value exceeds Regulatory Limit
a	Not accredited
B	Analyte detected in the associated Method Blank above the Reporting Limit
E	Value above quantitation range
H	Analyzed outside of Holding Time
J	Analyte detected below quantitation limit
n	Not offered for accreditation
ND	Not Detected at the Reporting Limit
O	Sample amount is > 4 times amount spiked
P	Dual Column results percent difference > 40%
R	RPD above laboratory control limit
S	Spike Recovery outside laboratory control limits
U	Analyzed but not detected above the MDL

Acronym	Description
DUP	Method Duplicate
E	EPA Method
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MBLK	Method Blank
MDL	Method Detection Limit
MQL	Method Quantitation Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PDS	Post Digestion Spike
PQL	Practical Quantitaion Limit
SDL	Sample Detection Limit
SW	SW-846 Method

Units Reported	Description
mg/L	

ALS Environmental

Sample Receipt Checklist

Client Name: **ALS-VANCOUVER** Date/Time Received: **20-Sep-16 10:35**

Work Order: **1609561** Received by: **RDN**

Checklist completed by Stephanie Harrington 20-Sep-16 Reviewed by: Shawn Smythe 21-Sep-16

eSignature Date eSignature Date

Matrices:

Carrier name: FedEx

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	
Temperature(s)/Thermometer(s):	5.2		
Cooler(s)/Kit(s):			
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	N/A ☑
pH adjusted?	Yes ☐	No ☐	N/A ☑
pH adjusted by:	-		

Login Notes:

Client Contacted: Date Contacted: Person Contacted:

Contacted By: Regarding:

Comments:

CorrectiveAction:

Short Holding Time

○ Rush Processing

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1829615-COFC

COC Number: 14 - 470932

Page 1 of 2

Report To		Report Format / Distribution		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	Laberge Environmental Services	Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3pm)
Contact:	Bonnie Burns	Quality Control (QC) Report with Report	☑ Yes ☐ No	P ☐ Priority (2-4 business days if received by 3pm)
Address:	P.O. Box 21072, Whitehorse YT Y1A6P7	☑ Criteria on Report - provide details below if box checked		E ☐ Emergency (1-2 business days if received by 3pm)
		Select Distribution:	☐ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency if received by 10am – contact ALS for surcharge.
Phone:	867-668-6838	Email 1 or Fax	bonnie burns @ northwestel.net	Specify Date Required for E2,E or P:
		Email 2		Analysis Request

Invoice To		Invoice Distribution	
	Same as Report To ☑ Yes ☐ No	Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
	Copy of Invoice with Report ☐ Yes ☐ No	Email 1 or Fax	bonnie burns @ northwestel.net
Company:	Same as above	Email 2	
Contact:		Oil and Gas Required Fields (client use)	

Project Information			
ALS Quote #:	14 16 12 DN	Approver ID:	Cost Center:
Job #:	Clinton Creek	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)	L1829615	ALS Contact:	Sampler: B. Burns

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total metals Low level	Dissolved metals low level	Total Mercury	Dissolved Mercury	General, TSS etc	Sat etc	Chlorophyll a + Phaeophytin							Number of Containers
1	E-1	5/9/16	14:30	H2O	✓	✓	✓	✓	✓	✓	✓	✓						7
2	Porcupine Cr	7/9/16	9:40	"	✓	✓	✓	✓	✓	✓	✓	✓						7
3	E-2	6/9/16	16:30	"	✓	✓	✓	✓	✓	✓	✓	✓						7
4	E-3	6/9/16	09:00	"	✓	✓	✓	✓	✓	✓	✓	✓						7
5	E-4	5/9/16	13:10	"	✓	✓	✓	✓	✓	✓	✓	✓						7
6	E-6	5/9/16	9:30	"	✓	✓	✓	✓	✓	✓	✓	✓						7
7	E-8	8/9/16	14:50	"	✓	✓	✓	✓	✓	✓	✓	✓						7
8	R-1	7/9/16	12:45	"	✓	✓	✓	✓	✓	✓								5
9	R-2	7/9/16	15:00	"	✓	✓	✓	✓	✓	✓	✓	✓						7
10	R-3	6/9/16	11:30	"	✓	✓	✓	✓	✓	✓	✓	✓						7
11	R-4	5/9/16	14:40	"	✓	✓	✓	✓	✓	✓	✓	✓						7
12	R-6	8/9/16	16:40	"	✓	✓	✓	✓	✓	✓	✓	✓						7

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☐ No	to meet CCME freshwater aquatic life criteria. All samples preserved & filtered as necessary
Are samples for human drinking water use? ☐ Yes ☐ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐	
Ice packs	Yes ☑	No ☐	Custody seal intact	Yes ☑	No ☐
Cooling Initiated	☑				

INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C		
4.4	2.2			6

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Bonnie Burns	Sept 9/16			12-SEP-16	9:15	HMC		10:55

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

ALS FM-03256 v09 Front/BH January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form.**

SEP 13 2016

Short Holding Time

Rush Processing

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1829615-COFC

COC Number: 14 - 470930

Page 1 of 2

Report To		Report Format / Distribution		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	Labrege Env. Serv.	Select Report Format:	PDF ☑ EXCEL ☐ EDD (DIGITAL)	R ☐ Regular (Standard TAT if received by 3pm)
Contact:		Quality Control (QC) Report with Report	☐ Yes ☐ No	P ☐ Priority (2-4 business days if received by 3pm)
Address:		☑ Criteria on Report - provide details below if box checked		E ☐ Emergency (1-2 business days if received by 3pm)
		Select Distribution:	☐ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency if received by 10am – contact ALS for surcharge.
Phone:	867-668-6838	Email 1 or Fax	bonnieburns@northwestel.net	Specify Date Required for E2,E or P:
		Email 2		

Invoice To	Same as Report To ☐ Yes ☐ No	Invoice Distribution		Analysis Request
	Copy of Invoice with Report ☐ Yes ☐ No	Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
Company:		Email 1 or Fax	bonnieburns@northwestel.net	
Contact:		Email 2		

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	141612 DN	Approver ID:	Cost Center:
Job #:	Clinton Cr	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)	L1829615	ALS Contact:	Sampler:

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total metals - low level	Dissolved metals (low level)	Total Mercury	Dissolved Mercury	General, TSS etc	Soil etc.	Number of Containers
13	Maiden Cr	8/9/16		H_2O	L	L	L	L	L	L	5
14	Field Blank			"	L	L	L	L	L	L	5
15	Travel blank			"	~~L~~	~~L~~	~~L~~	~~L~~	L	L	5
16	Duplicate	8/9/16		"	L	L	L	L	L	L	5

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)	SAMPLE CONDITION AS RECEIVED (lab use only)
Are samples taken from a Regulated DW System? ☐ Yes ☐ No	Note there wasn't travel blanks for metals or Hg.	Frozen ☐ SIF Observations Yes ☐ No ☐
Are samples for human drinking water use? ☐ Yes ☐ No		Ice packs Yes ☑ No ☐ Custody seal intact Yes ☑ No ☐ Cooling Initiated ☑

INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C			
4.4	2.2				6

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Bonnie Burns	Sept 9/16			12-SEP-16	9:15	HMC	SEP 12 2016	10:55

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ALS FM-0038e WOR Front/04 January 2014

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

APPENDIX C

STREAM SEDIMENT DATA, 2016

TABLE 7 BULK ASBESTOS CONTENT (%) IN THE SEDIMENT SAMPLES, CLINTON CREEK, SEPTEMBER 2016

Sample ID	Asbestos: Actinolite	Asbestos By Point Count	Asbestos: Chrysotile	Asbestos: Tremolite	Other Fibres: Cellulose	Other Fibres: MMVF	Mica
MDL	0.10	0.10	0.1	0.10	1	1.0	1
E-1A			1-5		1-5		Trace <1
E-1B			1-5		1-5		Trace <1
E-1C			1-5		Trace <1		Trace <1
E-2A			1-5		Trace <1		Trace <1
E-2B			1-5				Trace <1
E-2C			1-5				Trace <1
E-3A			1-5		1-5		1-5
E-3B			1-5				Trace <1
E-3C			1-5		1-5		1-5
E-4A			1-5				Trace <1
E-4B			1-5				1-5
E-4C			1-5				Trace <1
E-8A	0.10		0.10		1-5	Trace <1	1-5
E-8B	0.10				1-5	Trace <1	1-5
E-8C	0.10			0.10	1-5	Trace <1	1-5
PORCUPINE CR-A			1-5				Trace <1
PORCUPINE CR-B			1-5				Trace <1
PORCUPINE CR-C			1-5		1-5		Trace <1
R-1A		<0.10			Trace <1	Trace <1	1-5
R-1B		<0.10				Trace <1	1-5
R-1C		<0.10			Trace <1	Trace <1	1-5
R-2A	0.10		0.30		1-5	Trace <1	1-5
R-2B	0.10		0.20		Trace <1	Trace <1	1-5
R-2C		<0.10			Trace <1	Trace <1	1-5
R-3A			0.20		1-5	Trace <1	1-5
R-3B		<.1			Trace <1	Trace <1	1-5
R-3C			0.10		1-5		1-5
R-4A	0.20						1-5
R-4B		<0.10				Trace <1	1-5
R-4C	0.10				Trace <1		1-5
R-6A			0.10		Trace <1		Trace <1
R-6B		<0.10			Trace <1	Trace <1	1-5
R-6C		<0.10			Trace <1	Trace <1	1-5
E-6A			0.50		Trace <1		1-5
E-6B			0.80				1-5
E-6C			1-5				5-10

TABLE 9 **SEVERAL YEARS OF CONCENTRATIONS OF METALS (ug/g) IN STREAM SEDIMENTS, CLINTON CREEK**

Site Type	Parameter	Arsenic					Cadmium					Chromium					Nickel				
	Year	1998	2009	2010	2011	2016	1998	2009	2010	2011	2016	1998	2009	2010	2011	2016	1998	2009	2010	2011	2016
Reference	**R1** - Clinton Cr u/s Hudgeon Lake				4.5	**11.9**				0.54	**0.86**				28.7	36				29	42
	R2 - Easter Cr u/s Hudgeon Lake				5.2	**12.2**				0.5	0.32				**39.3**	32				50.8	54
	R3 - Wolverine Cr u/s tailings	**11**		5.3	3.4	5.3	0.6		**0.96**	0.3	0.33	**62**		**40.1**	24.7	**38**	70		50.6	29.1	44
	R4 - Eagle Cr u/s culverts			**6.2**	**8.2**	**16.8**			0.4	**0.61**	**0.70**			24	33.5	**42**			27.8	42.3	68
	R6 - Forty Mile River u/s Clinton Creek				1.5	**9.0**				0.1	0.34				20.8	35				16	30
Exposed	**E1** - Clinton Cr d/s gabions and u/s Porcupine Cr				**23.7**	**18.3**				**1.2**	**1.13**				**458**	**266**				844	436
	E2 - Clinton Cr d/s Porcupine u/s Wolverine			**25.4**	**22.9**	**15.8**			**2**	**1.1**	**0.87**			**283**	**337**	**257**			715	675	402
	E3 - Wolverine Cr u/s culverts	**11**	**8.6**	5.5	4.2	**7.8**	<0.1	0.15	<0.05	0.55	0.49	**1670**	**1180**	**1160**	**72.5**	**45**	1860	1660	2200	109	58
	E4 - Clinton Cr d/s Wolverine u/s Eagle		**11.6**	**13.2**	3.6	**9.1**		0.19	**0.7**	**0.64**	0.54		**1170**	**222**	34.8	**106**			472	60.6	155
	E8 - Forty Mile River d/s Clinton Creek			3.9	2.1	**12.2**			0.08	0.1	0.16			21.7	23	13			17.9	16.9	13
	ISQG	5.9					0.6					37.3									
	PEL	17					3.5					90.0									

Note: ISQG = Interim freshwater Sediment Quality Guidelines, in **bold** where exceeded.
PEL = Probable Effects Level (>50% of adverse effects occur above this level), highlighted and in **bold** where exceeded.

TABLE 10	FRACTIONAL COMPONENTS OF THE STREAM SEDIMENTS, 2016								
Classification	**Gravel**	**Course Sand**		**Medium Sand**	**Fine Sand**		**Silt**		**Clay**
Particle Size	**(>2mm)**	**(2.00mm - 1.00mm)**	**(1.00mm - 0.50mm)**	**(0.50mm - 0.25mm)**	**(0.25mm - 0.125mm)**	**(0.125mm - 0.063mm)**	**(0.063mm - 0.0312mm)**	**(0.0312mm - 0.004mm)**	**(<4um)**
E-1A	3.18	1.12	0.94	13.65	13.76	26.03	21.31	10.10	9.91
E-1B	1.46	2.76	10.90	39.44	9.16	12.00	9.03	5.86	9.39
E-1C	3.87	3.84	10.39	36.56	10.84	15.27	6.91	4.89	7.43
E-2A	11.34	31.97	22.76	21.85	2.61	2.53	1.78	2.03	3.14
E-2B	3.27	3.90	5.18	30.93	11.09	24.74	8.91	5.14	6.84
E-2C	5.67	6.66	9.01	30.06	11.98	18.46	6.91	5.09	6.16
E-3A	0.02	0.25	0.40	12.40	8.62	29.93	27.97	12.04	8.38
E-3B	0.02	0.08	0.97	16.01	10.93	35.97	21.88	8.15	5.99
E-3C	0.01	0.57	2.91	21.82	10.18	29.88	18.05	9.57	7.00
E-4A	6.85	0.75	4.08	50.11	8.93	9.16	10.14	4.87	5.11
E-4B	2.97	0.30	1.33	14.41	9.94	34.48	21.24	9.70	5.63
E-4C	0.19	1.67	5.99	26.49	8.86	27.67	14.65	8.41	6.08
E-6A	0.41	0.60	2.77	17.50	6.64	24.64	29.53	12.19	5.72
E-6B	0.02	0.17	1.31	26.04	12.68	27.67	18.40	8.37	5.34
E-6C	0.02	0.16	5.62	53.06	11.50	16.40	5.41	4.60	3.23
E-8A	75.39	3.95	4.12	12.54	1.00	0.18	1.26	0.68	0.87
E-8B	72.15	7.22	4.09	12.21	1.17	0.61	1.01	0.84	0.69
E-8C	74.09	5.99	4.05	11.44	1.13	0.89	1.03	0.77	0.61
Porcupine Cr-A	23.29	14.15	16.80	24.37	2.41	2.17	7.30	6.15	3.35
Porcupine Cr-B	12.66	31.92	21.91	7.40	1.04	1.71	10.48	9.97	2.90
Porcupine Cr-C	46.29	20.99	15.64	9.13	0.68	1.32	1.49	2.89	1.56
R1-A	0.7	1.3	1.9	5.9	9.5	9.4	33.3	34.2	3.8
R1-B	<1.0	<1.0	<1.0	<1.0	1.1	7.2	40.2	45.5	5.8
R1-C	<1.0	<1.0	<1.0	<1.0	<1.0	3.7	40.9	48.7	6.3
R-2A	0.75	1.52	5.98	16.40	3.73	29.69	25.94	11.02	4.98
R-2B	5.73	13.88	27.14	23.00	2.74	8.45	10.51	4.74	3.81
R-2C	<1.0	<1.0	<1.0	<1.0	<1.0	13	39.6	41	5.5
R3-A	1.30	1.03	3.10	3.49	0.79	24.60	29.98	26.25	9.46
R3-B	8.1	<1.0	<1.0	<1.0	<1.0	<1.0	34.3	47.3	9.4
R-3C	0.82	0.08	0.30	0.54	0.11	22.47	29.28	35.93	10.47
R-4A	0.19	2.87	11.68	26.77	8.20	22.43	14.02	7.45	6.39
R4-B	0.3	2.3	6	10.2	9.5	15.8	26.4	25.7	3.8
R-4C	0.56	8.13	15.40	17.45	5.01	26.05	14.90	8.07	4.44
R-6A	30.77	0.54	0.80	3.54	2.12	15.18	16.64	23.43	6.97
R6-B	6.2	<1.0	<1.0	<1.0	3.8	8.6	30.6	41.3	9.2
R6-C	<1.0	<1.0	<1.0	<1.0	2.3	8	35.6	45.7	8.2

FIGURE 3 Proportion of Particle Sizes at each site, 2016

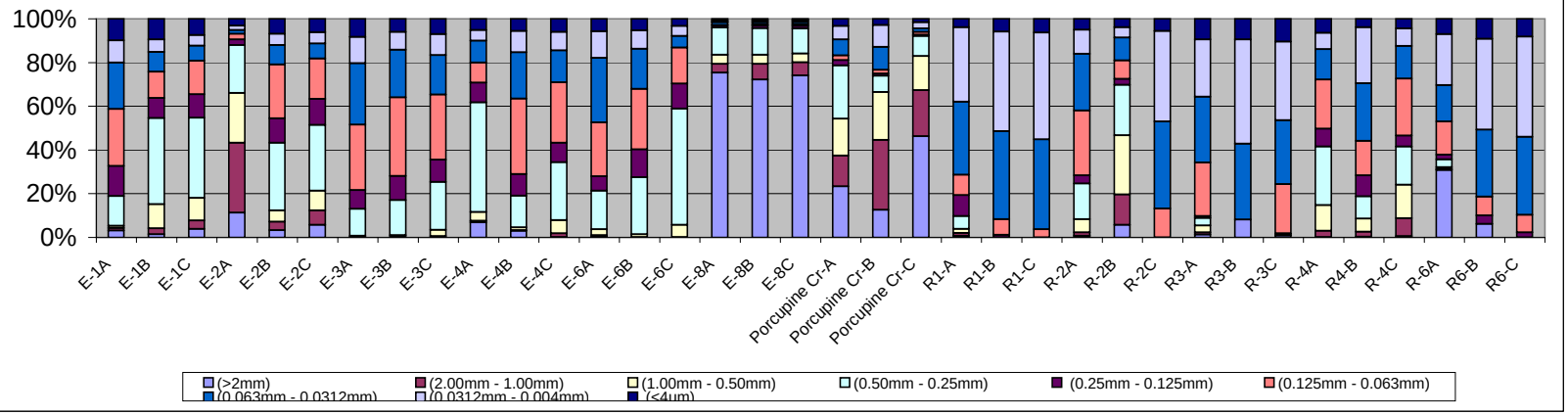


TABLE 11 LOSS ON IGNITION ANALYSIS			
Sample Number	**Water Content (%)**	**Ash Content (%)**	**Organic Matter (%)**
E-1A	35.8	97.5	2.5
E-1B	22.0	97.6	2.4
E-1C	22.1	98.4	1.6
E-2A	27.5	98.5	1.5
E-2B	32.0	97.6	2.4
E-2C	29.8	97.8	2.2
E-3A	30.3	96.7	3.3
E-3B	27.0	97.2	2.8
E-3C	26.7	97.3	2.7
E-4A	25.8	97.8	2.2
E-4B	30.7	96.4	3.6
E-4C	29.7	96.3	3.7
E-6A	28.3	96.7	3.3
E-6B	27.5	97.5	2.5
E-6C	28.9	98.1	1.9
E-8A	10.0	99.4	0.6
E-8B	5.6	99.6	0.4
E-8C	6.5	99.5	0.5
PORCUPINE CR-A	19.1	97.9	2.1
PORCUPINE CR-B	24.4	97.5	2.5
PORCUPINE CR-C	18.1	98.3	1.7
R-1A	NR	NR	6
R-1B	NR	NR	9
R-1C	NR	NR	14
R-2A	44.7	94.3	5.7
R-2B	23.1	97.6	2.4
R-2C	NR	NR	6
R-3A	95.5	83.6	16.4
R-3B	NR	NR	6
R-3C	49.9	91.2	8.8
R-4A	23.6	97.8	2.2
R-4B	NR	NR	2
R-4C	20.2	97.9	2.1
R-6A	46.1	92.8	7.2
R-6B	NR	NR	11
R-6C	NR	NR	10
NR = not reported			

LABERGE ENVIRONMENTAL
ATTN: Bonnie Burns
PO Box 21072
Whitehorse YT Y1A 6P7

Date Received: 16-SEP-16
Report Date: 16-NOV-16 08:58 (MT)
Version: FINAL REV. 3

Client Phone: 867-668-6838

Certificate of Analysis

Lab Work Order #: L1829672

Project P.O. #: NOT SUBMITTED
Job Reference: CLINTON CREEK
C of C Numbers: 14-470676, 14-470677, 14-470939
Legal Site Desc:

Comments: ADDITIONAL 21-OCT-16 13:36

Taryn Williams, B.Sc.
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1829672-1	L1829672-2	L1829672-3	L1829672-4	L1829672-5
Description	SOIL	SOIL	SOIL	SOIL	SOIL
Sampled Date	06-SEP-16	06-SEP-16	06-SEP-16	06-SEP-16	06-SEP-16
Sampled Time					
Client ID	E-1A	E-1B	E-1C	E-2A	E-2B
Grouping / **Analyte**					
BULK					
Asbestos/Quartz/ Other Fibres					
Asbestos: Actinolite (%)					
Asbestos By Point Count (%)					
Other Fibres: Cellulose (%)	1-5	1-5	Trace <1	Trace <1	
Asbestos: Chrysotile (%)	1-5	1-5	1-5	1-5	1-5
Other Fibres: MMVF (%)					
Mica (%)	Trace <1	Trace <1	Trace <1	Trace <1	Trace <1
Asbestos: Tremolite (%)					

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1829672-6 SOIL 06-SEP-16 E-2C	L1829672-7 SOIL 06-SEP-16 E-3A	L1829672-8 SOIL 06-SEP-16 E-3B	L1829672-9 SOIL 06-SEP-16 E-3C	L1829672-10 SOIL 06-SEP-16 E-4A
BULK						
Asbestos/Quartz/ Other Fibres	Asbestos: Actinolite (%)					
	Asbestos By Point Count (%)					
	Other Fibres: Cellulose (%)		1-5		1-5	
	Asbestos: Chrysotile (%)	1-5	1-5	1-5	1-5	1-5
	Other Fibres: MMVF (%)					
	Mica (%)	Trace <1	1-5	Trace <1	1-5	Trace <1
	Asbestos: Tremolite (%)					

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1829672-11 SOIL 06-SEP-16 E-4B	L1829672-12 SOIL 06-SEP-16 E-4C	L1829672-13 SOIL 06-SEP-16 E-8A	L1829672-14 SOIL 06-SEP-16 E-8B	L1829672-15 SOIL 06-SEP-16 E-8C
BULK						
Asbestos/Quartz/ Other Fibres	Asbestos: Actinolite (%)			0.10	0.10	0.10
	Asbestos By Point Count (%)					
	Other Fibres: Cellulose (%)			1-5	1-5	1-5
	Asbestos: Chrysotile (%)	1-5	1-5	0.10		
	Other Fibres: MMVF (%)			Trace <1	Trace <1	Trace <1
	Mica (%)	1-5	Trace <1	1-5	1-5	1-5
	Asbestos: Tremolite (%)					0.10

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1829672-16 SOIL 06-SEP-16 PORCUPINE CR-A	L1829672-17 SOIL 06-SEP-16 PORCUPINE CR-B	L1829672-18 SOIL 06-SEP-16 PORCUPINE CR-C	L1829672-19 SOIL 06-SEP-16 R-1A	L1829672-20 SOIL 06-SEP-16 R-1B
BULK						
Asbestos/Quartz/ Other Fibres	Asbestos: Actinolite (%)					
	Asbestos By Point Count (%)				<0.10	<0.10
	Other Fibres: Cellulose (%)			1-5	Trace <1	
	Asbestos: Chrysotile (%)	1-5	1-5	1-5		
	Other Fibres: MMVF (%)				Trace <1	Trace <1
	Mica (%)	Trace <1	Trace <1	Trace <1	1-5	1-5
	Asbestos: Tremolite (%)					

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1829672-21	L1829672-22	L1829672-23	L1829672-24	L1829672-25
Description	SOIL	SOIL	SOIL	SOIL	SOIL
Sampled Date	06-SEP-16	06-SEP-16	06-SEP-16	06-SEP-16	06-SEP-16
Sampled Time					
Client ID	R-1C	R-2A	R-2B	R-2C	R-3A
Grouping / **Analyte**					
BULK					
Asbestos/Quartz/ Other Fibres					
Asbestos: Actinolite (%)		0.10	0.10		
Asbestos By Point Count (%)	<0.10			<0.10	
Other Fibres: Cellulose (%)	Trace <1	1-5	Trace <1	Trace <1	1-5
Asbestos: Chrysotile (%)		0.30	0.20		0.20
Other Fibres: MMVF (%)	Trace <1	Trace <1	Trace <1	Trace <1	Trace <1
Mica (%)	1-5	1-5	1-5	1-5	1-5
Asbestos: Tremolite (%)					

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1829672-26 SOIL 06-SEP-16 R-3B	L1829672-27 SOIL 06-SEP-16 R-3C	L1829672-28 SOIL 06-SEP-16 R-4A	L1829672-29 SOIL 06-SEP-16 R-4B	L1829672-30 SOIL 06-SEP-16 R-4C
BULK						
Asbestos/Quartz/ Other Fibres	Asbestos: Actinolite (%)			0.20		0.10
	Asbestos By Point Count (%)	<.1			<0.10	
	Other Fibres: Cellulose (%)	Trace <1	1-5			Trace <1
	Asbestos: Chrysotile (%)		0.10			
	Other Fibres: MMVF (%)	Trace <1			Trace <1	
	Mica (%)	1-5	1-5	1-5	1-5	1-5
	Asbestos: Tremolite (%)					

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1829672-31 SOIL 06-SEP-16 R-6A	L1829672-32 SOIL 06-SEP-16 R-6B	L1829672-33 SOIL 06-SEP-16 R-6C	L1829672-34 SOIL 06-SEP-16 E-6A	L1829672-35 SOIL 06-SEP-16 E-6B
BULK						
Asbestos/Quartz/ Other Fibres	Asbestos: Actinolite (%)					
	Asbestos By Point Count (%)		<0.10	<0.10		
	Other Fibres: Cellulose (%)	Trace <1	Trace <1	Trace <1	Trace <1	
	Asbestos: Chrysotile (%)	0.10			0.50	0.80
	Other Fibres: MMVF (%)		Trace <1	Trace <1		
	Mica (%)	Trace <1	1-5	1-5	1-5	1-5
	Asbestos: Tremolite (%)					

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1829672-36				
	Description	SOIL				
	Sampled Date	06-SEP-16				
	Sampled Time					
	Client ID	E-6C				
Grouping	**Analyte**					
BULK						
Asbestos/Quartz/ Other Fibres	Asbestos: Actinolite (%)					
	Asbestos By Point Count (%)					
	Other Fibres: Cellulose (%)					
	Asbestos: Chrysotile (%)	1-5				
	Other Fibres: MMVF (%)					
	Mica (%)	5-10				
	Asbestos: Tremolite (%)					

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	Sample ID: L1829672-19 Description: SOIL Sampled Date: 06-SEP-16 Sampled Time: Client ID: R-1A	L1829672-20 SOIL 06-SEP-16 R-1B	L1829672-21 SOIL 06-SEP-16 R-1C	L1829672-24 SOIL 06-SEP-16 R-2C	L1829672-26 SOIL 06-SEP-16 R-3B
SOIL						
Physical Tests	Loss On Ignition @ 420 C (%)	6	9	14	6	6
Particle Size	% Gravel (>2mm) (%)	<1.0	<1.0	<1.0	<1.0	8.1
	% Sand (2.00mm - 1.00mm) (%)	1.3	<1.0	<1.0	<1.0	<1.0
	% Sand (1.00mm - 0.50mm) (%)	1.9	<1.0	<1.0	<1.0	<1.0
	% Sand (0.50mm - 0.25mm) (%)	5.9	<1.0	<1.0	<1.0	<1.0
	% Sand (0.25mm - 0.125mm) (%)	9.5	1.1	<1.0	<1.0	<1.0
	% Sand (0.125mm - 0.063mm) (%)	9.4	7.2	3.7	13.0	<1.0
	% Silt (0.063mm - 0.0312mm) (%)	33.3	40.2	40.9	39.6	34.3
	% Silt (0.0312mm - 0.004mm) (%)	34.2	45.5	48.7	41.0	47.3
	% Clay (<4um) (%)	3.8	5.8	6.3	5.5	9.4
	Texture	Silt loam	Silt	Silt	Silt loam / Silt	Silt
Metals	Aluminum (Al) (mg/kg)	10300	11000	11100	11800	12700
	Antimony (Sb) (mg/kg)	1.48	1.33	1.35	1.42	0.80
	Arsenic (As) (mg/kg)	13.2	10.9	11.6	11.2	7.95
	Barium (Ba) (mg/kg)	172	228	269	265	419
	Beryllium (Be) (mg/kg)	0.32	0.36	0.39	0.36	0.38
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B) (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Cadmium (Cd) (mg/kg)	0.691	0.849	1.04	0.359	0.437
	Calcium (Ca) (mg/kg)	6070	8500	11100	6520	7100
	Chromium (Cr) (mg/kg)	38.9	33.4	35.5	34.5	28.5
	Cobalt (Co) (mg/kg)	13.2	11.3	12.1	10.7	9.48
	Copper (Cu) (mg/kg)	31.3	33.0	38.9	20.9	26.0
	Iron (Fe) (mg/kg)	28300	24200	25300	22500	22500
	Lead (Pb) (mg/kg)	13.1	14.2	14.4	8.66	10.1
	Lithium (Li) (mg/kg)	9.4	9.0	9.3	10.4	11.3
	Magnesium (Mg) (mg/kg)	7540	6200	6590	5660	5550
	Manganese (Mn) (mg/kg)	646	498	606	434	412
	Mercury (Hg) (mg/kg)	0.150	0.191	0.221	0.0351	0.0748
	Molybdenum (Mo) (mg/kg)	4.96	3.78	3.85	0.99	1.54
	Nickel (Ni) (mg/kg)	46.2	37.6	41.1	38.5	29.9
	Phosphorus (P) (mg/kg)	787	732	767	740	660
	Potassium (K) (mg/kg)	700	780	810	550	870
	Selenium (Se) (mg/kg)	1.78	1.90	2.30	0.55	0.87
	Silver (Ag) (mg/kg)	0.23	0.35	0.45	0.11	0.17
	Sodium (Na) (mg/kg)	75	141	131	182	216

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1829672-29	L1829672-32	L1829672-33		
	Description	SOIL	SOIL	SOIL		
	Sampled Date	06-SEP-16	06-SEP-16	06-SEP-16		
	Sampled Time					
	Client ID	R-4B	R-6B	R-6C		
Grouping	**Analyte**					
SOIL						
Physical Tests	Loss On Ignition @ 420 C (%)	2	11	10		
Particle Size	% Gravel (>2mm) (%)	<1.0	6.2	<1.0		
	% Sand (2.00mm - 1.00mm) (%)	2.3	<1.0	<1.0		
	% Sand (1.00mm - 0.50mm) (%)	6.0	<1.0	<1.0		
	% Sand (0.50mm - 0.25mm) (%)	10.2	<1.0	<1.0		
	% Sand (0.25mm - 0.125mm) (%)	9.5	3.8	2.3		
	% Sand (0.125mm - 0.063mm) (%)	15.8	8.6	8.0		
	% Silt (0.063mm - 0.0312mm) (%)	26.4	30.6	35.6		
	% Silt (0.0312mm - 0.004mm) (%)	25.7	41.3	45.7		
	% Clay (<4um) (%)	3.8	9.2	8.2		
	Texture	Silt loam / Sandy loam	Silt loam	Silt		
Metals	Aluminum (Al) (mg/kg)	9290	16400	18100		
	Antimony (Sb) (mg/kg)	1.84	0.68	0.69		
	Arsenic (As) (mg/kg)	18.5	9.80	10.5		
	Barium (Ba) (mg/kg)	246	272	280		
	Beryllium (Be) (mg/kg)	0.27	0.49	0.47		
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20		
	Boron (B) (mg/kg)	<5.0	<5.0	<5.0		
	Cadmium (Cd) (mg/kg)	0.784	0.396	0.406		
	Calcium (Ca) (mg/kg)	7680	8560	9230		
	Chromium (Cr) (mg/kg)	48.5	37.9	40.1		
	Cobalt (Co) (mg/kg)	13.2	13.3	14.3		
	Copper (Cu) (mg/kg)	27.3	28.8	30.5		
	Iron (Fe) (mg/kg)	27100	28200	29800		
	Lead (Pb) (mg/kg)	10.7	9.85	10.1		
	Lithium (Li) (mg/kg)	10.2	15.2	14.3		
	Magnesium (Mg) (mg/kg)	8230	7940	8420		
	Manganese (Mn) (mg/kg)	639	540	626		
	Mercury (Hg) (mg/kg)	0.0631	0.0615	0.0581		
	Molybdenum (Mo) (mg/kg)	3.17	0.80	0.85		
	Nickel (Ni) (mg/kg)	77.3	33.6	35.8		
	Phosphorus (P) (mg/kg)	992	644	686		
	Potassium (K) (mg/kg)	440	1320	1440		
	Selenium (Se) (mg/kg)	1.48	0.48	0.49		
	Silver (Ag) (mg/kg)	0.19	0.14	0.14		
	Sodium (Na) (mg/kg)	102	232	257		

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1829672-19	L1829672-20	L1829672-21	L1829672-24	L1829672-26
Description	SOIL	SOIL	SOIL	SOIL	SOIL
Sampled Date	06-SEP-16	06-SEP-16	06-SEP-16	06-SEP-16	06-SEP-16
Sampled Time					
Client ID	R-1A	R-1B	R-1C	R-2C	R-3B
Grouping / **Analyte**					
SOIL					
Metals Strontium (Sr) (mg/kg)	41.6	53.6	63.9	41.8	47.8
Thallium (Tl) (mg/kg)	0.102	0.136	0.136	0.075	0.109
Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti) (mg/kg)	266	338	286	419	467
Uranium (U) (mg/kg)	1.18	1.30	1.47	1.06	1.53
Vanadium (V) (mg/kg)	34.8	37.1	37.8	42.0	42.7
Zinc (Zn) (mg/kg)	117	98.5	99.9	67.9	84.2
Zirconium (Zr) (mg/kg)	3.0	2.7	3.3	1.7	2.6

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1829672-29	L1829672-32	L1829672-33		
Description	SOIL	SOIL	SOIL		
Sampled Date	06-SEP-16	06-SEP-16	06-SEP-16		
Sampled Time					
Client ID	R-4B	R-6B	R-6C		
Grouping / **Analyte**					
SOIL					
Metals					
Strontium (Sr) (mg/kg)	47.6	54.3	54.7		
Thallium (Tl) (mg/kg)	0.073	0.121	0.126		
Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0		
Titanium (Ti) (mg/kg)	311	786	874		
Uranium (U) (mg/kg)	0.771	1.50	1.54		
Vanadium (V) (mg/kg)	34.0	54.6	59.3		
Zinc (Zn) (mg/kg)	102	93.2	99.8		
Zirconium (Zr) (mg/kg)	2.7	2.5	2.6		

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1829672-1	L1829672-2	L1829672-3	L1829672-4	L1829672-5
Description	SOIL	SOIL	SOIL	SOIL	SOIL
Sampled Date	06-SEP-16	06-SEP-16	06-SEP-16	06-SEP-16	06-SEP-16
Sampled Time					
Client ID	E-1A	E-1B	E-1C	E-2A	E-2B
Grouping / **Analyte**					
WASTE					
Metals Aluminum (Al) (mg/kg wwt)	4980	5200	4570	3580	5160
Antimony (Sb) (mg/kg wwt)	4.84	5.69	4.79	3.22	4.08
Arsenic (As) (mg/kg wwt)	17.3	20.9	16.8	14.3	15.7
Barium (Ba) (mg/kg wwt)	369	223	241	74.2	165
Beryllium (Be) (mg/kg wwt)	0.30	0.37	0.31	0.24	0.30
Bismuth (Bi) (mg/kg wwt)	<0.20	0.21	<0.20	<0.20	<0.20
Boron (B) (mg/kg wwt)	16.3	14.8	19.9	16.6	17.3
Cadmium (Cd) (mg/kg wwt)	1.01	1.36	1.01	0.752	0.849
Calcium (Ca) (mg/kg wwt)	16800	22200	17500	14100	13400
Chromium (Cr) (mg/kg wwt)	264	266	269	258	248
Cobalt (Co) (mg/kg wwt)	29.4	31.3	28.2	25.4	24.1
Copper (Cu) (mg/kg wwt)	28.1	35.4	30.6	21.1	27.9
Iron (Fe) (mg/kg wwt)	30200	36100	32900	28100	26600
Lead (Pb) (mg/kg wwt)	11.2	13.6	11.4	9.68	10.0
Lithium (Li) (mg/kg wwt)	6.0	7.1	6.1	4.5	7.3
Magnesium (Mg) (mg/kg wwt)	37100	31900	36200	35400	33600
Manganese (Mn) (mg/kg wwt)	682	950	503	655	351
Mercury (Hg) (mg/kg wwt)	0.273	0.251	0.262	0.105	0.169
Molybdenum (Mo) (mg/kg wwt)	4.65	7.19	5.92	3.93	4.95
Nickel (Ni) (mg/kg wwt)	448	452	408	425	362
Phosphorus (P) (mg/kg wwt)	818	1040	715	491	597
Potassium (K) (mg/kg wwt)	520	530	480	270	510
Selenium (Se) (mg/kg wwt)	2.82	3.99	3.20	2.24	2.41
Silver (Ag) (mg/kg wwt)	0.25	0.34	0.26	0.18	0.23
Sodium (Na) (mg/kg wwt)	65	51	<50	<50	53
Strontium (Sr) (mg/kg wwt)	86.9	107	86.1	67.3	71.9
Thallium (Tl) (mg/kg wwt)	0.184	0.203	0.162	0.079	0.132
Tin (Sn) (mg/kg wwt)	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti) (mg/kg wwt)	55.3	48.2	35.4	29.8	61.4
Uranium (U) (mg/kg wwt)	1.44	1.72	1.34	1.17	1.32
Vanadium (V) (mg/kg wwt)	21.1	22.5	19.7	16.3	18.9
Zinc (Zn) (mg/kg wwt)	83.4	112	92.3	82.0	80.4
Zirconium (Zr) (mg/kg wwt)	5.0	5.4	6.9	4.2	7.4

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1829672-6	L1829672-7	L1829672-8	L1829672-9	L1829672-10
Description	SOIL	SOIL	SOIL	SOIL	SOIL
Sampled Date	06-SEP-16	06-SEP-16	06-SEP-16	06-SEP-16	06-SEP-16
Sampled Time					
Client ID	E-2C	E-3A	E-3B	E-3C	E-4A
Grouping / **Analyte**					
WASTE					
Metals Aluminum (Al) (mg/kg wwt)	5470	7570	7650	7590	6180
Antimony (Sb) (mg/kg wwt)	4.34	1.18	1.23	1.30	2.15
Arsenic (As) (mg/kg wwt)	17.4	7.81	7.38	8.26	10.8
Barium (Ba) (mg/kg wwt)	190	184	185	215	217
Beryllium (Be) (mg/kg wwt)	0.34	0.23	0.23	0.25	0.23
Bismuth (Bi) (mg/kg wwt)	<0.20	<0.20	<0.20	<0.20	<0.20
Boron (B) (mg/kg wwt)	18.1	<5.0	5.2	5.3	10.1
Cadmium (Cd) (mg/kg wwt)	1.02	0.501	0.473	0.485	0.525
Calcium (Ca) (mg/kg wwt)	17000	3540	3350	3640	7650
Chromium (Cr) (mg/kg wwt)	264	28.5	54.6	52.4	171
Cobalt (Co) (mg/kg wwt)	27.0	8.12	9.32	10.2	21.7
Copper (Cu) (mg/kg wwt)	32.5	23.0	21.3	23.8	20.7
Iron (Fe) (mg/kg wwt)	30600	18400	18300	20700	26600
Lead (Pb) (mg/kg wwt)	12.0	9.99	9.22	9.93	7.77
Lithium (Li) (mg/kg wwt)	7.9	6.2	6.5	7.4	6.9
Magnesium (Mg) (mg/kg wwt)	36900	5050	7720	7000	20200
Manganese (Mn) (mg/kg wwt)	547	298	272	316	527
Mercury (Hg) (mg/kg wwt)	0.175	0.080	0.071	0.080	0.081
Molybdenum (Mo) (mg/kg wwt)	6.02	4.42	4.87	4.98	3.65
Nickel (Ni) (mg/kg wwt)	418	39.9	69.9	65.6	246
Phosphorus (P) (mg/kg wwt)	769	621	578	658	557
Potassium (K) (mg/kg wwt)	510	710	700	790	460
Selenium (Se) (mg/kg wwt)	2.85	1.51	1.47	1.54	1.83
Silver (Ag) (mg/kg wwt)	0.26	0.19	0.18	0.17	0.17
Sodium (Na) (mg/kg wwt)	<50	96	99	88	61
Strontium (Sr) (mg/kg wwt)	83.9	29.7	28.8	30.1	48.1
Thallium (Tl) (mg/kg wwt)	0.154	0.074	0.073	0.074	0.072
Tin (Sn) (mg/kg wwt)	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti) (mg/kg wwt)	49.0	203	248	257	185
Uranium (U) (mg/kg wwt)	1.66	0.963	0.999	0.994	0.963
Vanadium (V) (mg/kg wwt)	20.5	26.1	26.9	28.7	24.2
Zinc (Zn) (mg/kg wwt)	91.5	85.5	80.8	87.3	82.3
Zirconium (Zr) (mg/kg wwt)	7.3	4.0	4.3	5.2	4.1

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1829672-11	L1829672-12	L1829672-13	L1829672-14	L1829672-15
Description	SOIL	SOIL	SOIL	SOIL	SOIL
Sampled Date	06-SEP-16	06-SEP-16	06-SEP-16	06-SEP-16	06-SEP-16
Sampled Time					
Client ID	E-4B	E-4C	E-8A	E-8B	E-8C
Grouping / **Analyte**					
WASTE					
Metals Aluminum (Al) (mg/kg wwt)	6380	5340	3880	5660	4340
Antimony (Sb) (mg/kg wwt)	1.11	1.42	0.29	0.49	0.25
Arsenic (As) (mg/kg wwt)	9.19	7.32	18.1	5.12	13.4
Barium (Ba) (mg/kg wwt)	172	153	54.4	88.4	90.6
Beryllium (Be) (mg/kg wwt)	0.25	0.20	0.12	0.15	0.14
Bismuth (Bi) (mg/kg wwt)	<0.20	<0.20	<0.20	<0.20	<0.20
Boron (B) (mg/kg wwt)	5.9	6.2	<5.0	<5.0	<5.0
Cadmium (Cd) (mg/kg wwt)	0.577	0.512	0.084	0.119	0.266
Calcium (Ca) (mg/kg wwt)	6080	5560	1870	2870	2130
Chromium (Cr) (mg/kg wwt)	73.2	75.2	10.5	16.9	10.7
Cobalt (Co) (mg/kg wwt)	11.5	10.1	4.12	6.15	6.82
Copper (Cu) (mg/kg wwt)	21.2	16.7	13.0	9.77	12.7
Iron (Fe) (mg/kg wwt)	18800	15200	8830	14600	14800
Lead (Pb) (mg/kg wwt)	8.00	6.15	2.55	3.62	6.22
Lithium (Li) (mg/kg wwt)	6.4	5.0	3.7	6.0	4.4
Magnesium (Mg) (mg/kg wwt)	11100	10800	2370	3600	2660
Manganese (Mn) (mg/kg wwt)	405	367	239	323	347
Mercury (Hg) (mg/kg wwt)	0.084	0.069	<0.050	<0.050	0.071
Molybdenum (Mo) (mg/kg wwt)	3.41	2.41	0.34	0.72	0.75
Nickel (Ni) (mg/kg wwt)	110	108	9.80	12.6	15.3
Phosphorus (P) (mg/kg wwt)	597	483	269	326	331
Potassium (K) (mg/kg wwt)	480	410	420	490	500
Selenium (Se) (mg/kg wwt)	1.64	1.38	<0.20	0.35	0.77
Silver (Ag) (mg/kg wwt)	0.19	0.15	<0.10	<0.10	<0.10
Sodium (Na) (mg/kg wwt)	80	72	90	87	77
Strontium (Sr) (mg/kg wwt)	39.7	37.2	12.9	21.6	13.3
Thallium (Tl) (mg/kg wwt)	0.076	0.060	<0.050	<0.050	<0.050
Tin (Sn) (mg/kg wwt)	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti) (mg/kg wwt)	126	178	196	224	196
Uranium (U) (mg/kg wwt)	0.885	0.795	0.459	0.562	0.581
Vanadium (V) (mg/kg wwt)	23.2	20.1	15.6	20.3	16.9
Zinc (Zn) (mg/kg wwt)	74.0	57.5	27.8	37.2	75.4
Zirconium (Zr) (mg/kg wwt)	3.6	2.4	<1.0	1.0	<1.0

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1829672-16	L1829672-17	L1829672-18	L1829672-22	L1829672-23
Description	SOIL	SOIL	SOIL	SOIL	SOIL
Sampled Date	06-SEP-16	06-SEP-16	06-SEP-16	06-SEP-16	06-SEP-16
Sampled Time					
Client ID	PORCUPINE CR-A	PORCUPINE CR-B	PORCUPINE CR-C	R-2A	R-2B
Grouping **Analyte**					
WASTE					
Metals Aluminum (Al) (mg/kg wwt)	2590	4490	2460	6000	6260
Antimony (Sb) (mg/kg wwt)	2.16	2.45	4.73	1.42	3.21
Arsenic (As) (mg/kg wwt)	11.9	13.5	17.5	9.43	15.9
Barium (Ba) (mg/kg wwt)	121	119	55.0	147	159
Beryllium (Be) (mg/kg wwt)	0.15	0.24	0.19	0.20	0.25
Bismuth (Bi) (mg/kg wwt)	<0.20	<0.20	<0.20	<0.20	<0.20
Boron (B) (mg/kg wwt)	8.6	15.4	21.4	<5.0	<5.0
Cadmium (Cd) (mg/kg wwt)	0.509	0.727	1.26	0.238	0.355
Calcium (Ca) (mg/kg wwt)	8940	16800	31700	3180	2010
Chromium (Cr) (mg/kg wwt)	150	250	279	22.1	40.0
Cobalt (Co) (mg/kg wwt)	15.4	21.3	25.2	6.96	12.9
Copper (Cu) (mg/kg wwt)	13.7	19.5	22.5	12.8	19.2
Iron (Fe) (mg/kg wwt)	17200	24100	26500	13700	22300
Lead (Pb) (mg/kg wwt)	4.61	6.46	6.39	5.61	9.69
Lithium (Li) (mg/kg wwt)	3.4	6.0	4.0	5.5	7.6
Magnesium (Mg) (mg/kg wwt)	19500	31400	38900	3470	6340
Manganese (Mn) (mg/kg wwt)	238	362	404	380	761
Mercury (Hg) (mg/kg wwt)	0.091	0.090	0.155	<0.050	<0.050
Molybdenum (Mo) (mg/kg wwt)	2.07	2.47	4.50	0.89	2.16
Nickel (Ni) (mg/kg wwt)	234	361	474	30.8	92.8
Phosphorus (P) (mg/kg wwt)	333	499	516	384	473
Potassium (K) (mg/kg wwt)	240	390	210	380	460
Selenium (Se) (mg/kg wwt)	1.37	1.66	2.26	0.42	0.78
Silver (Ag) (mg/kg wwt)	0.13	0.14	0.28	<0.10	<0.10
Sodium (Na) (mg/kg wwt)	<50	98	<50	93	<50
Strontium (Sr) (mg/kg wwt)	44.6	83.0	123	22.8	19.1
Thallium (Tl) (mg/kg wwt)	0.077	0.093	0.114	<0.050	0.051
Tin (Sn) (mg/kg wwt)	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti) (mg/kg wwt)	65.5	116	29.4	206	107
Uranium (U) (mg/kg wwt)	0.567	0.914	1.17	0.591	0.732
Vanadium (V) (mg/kg wwt)	12.0	20.9	13.2	22.6	21.8
Zinc (Zn) (mg/kg wwt)	45.5	65.4	85.5	43.5	71.9
Zirconium (Zr) (mg/kg wwt)	2.9	2.4	3.9	1.4	2.6

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1829672-25	L1829672-27	L1829672-28	L1829672-30	L1829672-31
Description	SOIL	SOIL	SOIL	SOIL	SOIL
Sampled Date	06-SEP-16	06-SEP-16	06-SEP-16	06-SEP-16	06-SEP-16
Sampled Time					
Client ID	R-3A	R-3C	R-4A	R-4C	R-6A
Grouping / **Analyte**					
WASTE					
Metals Aluminum (Al) (mg/kg wwt)	4300	7360	6640	7380	10100
Antimony (Sb) (mg/kg wwt)	0.94	0.47	1.55	1.72	0.44
Arsenic (As) (mg/kg wwt)	3.15	4.71	14.3	17.5	6.57
Barium (Ba) (mg/kg wwt)	125	243	169	175	153
Beryllium (Be) (mg/kg wwt)	0.17	0.24	0.20	0.23	0.26
Bismuth (Bi) (mg/kg wwt)	<0.20	<0.20	<0.20	<0.20	<0.20
Boron (B) (mg/kg wwt)	6.3	<5.0	<5.0	<5.0	<5.0
Cadmium (Cd) (mg/kg wwt)	0.293	0.270	0.595	0.717	0.222
Calcium (Ca) (mg/kg wwt)	4970	4170	5370	5470	7370
Chromium (Cr) (mg/kg wwt)	68.1	17.3	36.1	40.2	26.3
Cobalt (Co) (mg/kg wwt)	6.96	5.72	9.86	10.9	7.76
Copper (Cu) (mg/kg wwt)	13.4	15.7	21.2	23.1	16.1
Iron (Fe) (mg/kg wwt)	9870	13800	19700	21900	17600
Lead (Pb) (mg/kg wwt)	3.51	6.19	8.36	9.14	6.45
Lithium (Li) (mg/kg wwt)	3.8	7.3	7.6	9.1	9.4
Magnesium (Mg) (mg/kg wwt)	9960	3300	5700	6700	4870
Manganese (Mn) (mg/kg wwt)	173	229	494	640	364
Mercury (Hg) (mg/kg wwt)	0.051	0.075	0.063	0.054	<0.050
Molybdenum (Mo) (mg/kg wwt)	0.51	0.91	2.68	2.60	0.52
Nickel (Ni) (mg/kg wwt)	82.8	18.2	58.1	70.0	20.7
Phosphorus (P) (mg/kg wwt)	290	459	768	905	479
Potassium (K) (mg/kg wwt)	410	520	380	440	780
Selenium (Se) (mg/kg wwt)	0.80	0.56	1.29	1.42	0.34
Silver (Ag) (mg/kg wwt)	<0.10	0.12	0.19	0.16	0.12
Sodium (Na) (mg/kg wwt)	70	127	64	79	154
Strontium (Sr) (mg/kg wwt)	29.6	29.2	35.9	37.4	41.1
Thallium (Tl) (mg/kg wwt)	<0.050	0.063	0.056	0.063	0.068
Tin (Sn) (mg/kg wwt)	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti) (mg/kg wwt)	104	169	146	220	457
Uranium (U) (mg/kg wwt)	2.55	0.914	0.591	0.794	0.696
Vanadium (V) (mg/kg wwt)	13.9	24.8	24.8	27.4	34.0
Zinc (Zn) (mg/kg wwt)	38.6	50.4	73.0	83.9	60.1
Zirconium (Zr) (mg/kg wwt)	1.6	2.1	2.8	3.3	1.6

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1829672-34	L1829672-35	L1829672-36		
	Description	SOIL	SOIL	SOIL		
	Sampled Date	06-SEP-16	06-SEP-16	06-SEP-16		
	Sampled Time					
	Client ID	E-6A	E-6B	E-6C		
Grouping	**Analyte**					
WASTE						
Metals	Aluminum (Al) (mg/kg wwt)	6020	5580	5530		
	Antimony (Sb) (mg/kg wwt)	0.99	1.10	1.55		
	Arsenic (As) (mg/kg wwt)	9.46	10.8	16.3		
	Barium (Ba) (mg/kg wwt)	130	124	161		
	Beryllium (Be) (mg/kg wwt)	0.18	0.18	0.19		
	Bismuth (Bi) (mg/kg wwt)	<0.20	<0.20	<0.20		
	Boron (B) (mg/kg wwt)	<5.0	<5.0	<5.0		
	Cadmium (Cd) (mg/kg wwt)	0.290	0.326	0.391		
	Calcium (Ca) (mg/kg wwt)	4680	3960	4140		
	Chromium (Cr) (mg/kg wwt)	36.8	42.3	72.7		
	Cobalt (Co) (mg/kg wwt)	8.70	8.85	13.4		
	Copper (Cu) (mg/kg wwt)	15.9	17.3	19.5		
	Iron (Fe) (mg/kg wwt)	15500	16200	20800		
	Lead (Pb) (mg/kg wwt)	7.92	7.87	9.07		
	Lithium (Li) (mg/kg wwt)	5.8	5.0	5.5		
	Magnesium (Mg) (mg/kg wwt)	6140	6860	11600		
	Manganese (Mn) (mg/kg wwt)	382	362	632		
	Mercury (Hg) (mg/kg wwt)	<0.050	<0.050	0.050		
	Molybdenum (Mo) (mg/kg wwt)	1.62	1.77	2.54		
	Nickel (Ni) (mg/kg wwt)	50.3	60.2	108		
	Phosphorus (P) (mg/kg wwt)	545	540	518		
	Potassium (K) (mg/kg wwt)	480	490	500		
	Selenium (Se) (mg/kg wwt)	0.71	0.78	1.02		
	Silver (Ag) (mg/kg wwt)	<0.10	0.11	0.11		
	Sodium (Na) (mg/kg wwt)	79	62	<50		
	Strontium (Sr) (mg/kg wwt)	28.2	25.5	27.9		
	Thallium (Tl) (mg/kg wwt)	0.054	0.055	0.057		
	Tin (Sn) (mg/kg wwt)	<2.0	<2.0	<2.0		
	Titanium (Ti) (mg/kg wwt)	207	158	121		
	Uranium (U) (mg/kg wwt)	0.604	0.676	0.836		
	Vanadium (V) (mg/kg wwt)	23.0	20.7	21.6		
	Zinc (Zn) (mg/kg wwt)	58.0	61.9	77.7		
	Zirconium (Zr) (mg/kg wwt)	2.2	2.1	3.5		

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ASBESTOS-BULK-ED	Bulk	Bulk Asbestos Content	NIOSH 9002-Polarized Microscopy

Bulk samples are examined under a stereoscopic microscope. Individual fibers or fibre bundles are mounted in refractive index liquids and are observed under a polarized light microscope with a special dispersion staining objective. The dispersion staining colours are compared to reference samples of known asbestiforms.

Note: For non-friable organically bound asbestos (eg. floor tile) Polarized Light microscopy is not a definitive technique when negative results are obtained. Transmission electron microscopy is recommended to confirm the asbestos in these materials.

Asbestos results reported as <1% indicates that no asbestos fibers were observed.

ASBESTOS-PTCT-ED	Bulk	Quantitation of asbestos by point count	EPA/600/R-93/116

Bulk samples are examined under a stereoscopic microscope. Individual fibers or fiber bundles are mounted in refractive index liquids and are observed under a polarized light microscope, with a special dispersion staining objective. The dispersion staining colors are compared to reference samples of known asbestiforms.

Polarized microscopy is not a definitive technique for negative results for non-friable organically bound material (i.e.floor tiles). Transmission electron microscopy is recommended to confirm the asbestos in these materials.
Asbestos results reported as <0.10% indicates that no asbestos fibers were observed.

HG-200.2-CVAA-ED	Soil	Mercury in Soil by CVAAS	EPA 200.2/1631E (Mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAAS.

HG-WET-200.2-CVAA-ED	Waste	Mercury (Hg) in waste	EPA 200.2/245.1

Waste samples are prepared for analysis by mixing to homogenize the as-received waste, then subsampling. The subsample is digested according to the EPA 200.2 method, using nitric and hydrochloric acids. Analysis is carried out by cold vapour atomic absorption. Results are reported on a wet basis (not corrected for any moisture content).

LOI-420-SK	Soil	Loss on Ignition @ 420 C	CSSS (1978) METHOD 3.81

The dry-ash method involves the removal of organic matter by combustion at 420OC for 2 hours. Samples are dried prior to combustion.

Reference: McKeague, J.A. Soil Sampling and Methods of Analysis. Can. Soc. Soil Sci.(1978) method 3.81

MET-200.2-CCMS-ED	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CRC ICPMS.

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. This method does not dissolve all silicate materials and may result in a partial extraction. depending on the sample matrix, for some metals, including, but not limited to Al, Ba, Be, Cr, Sr, Ti, Tl, and V.

MET-WET200.2-CCMS-ED	Waste	Metals in Waste by CRC ICPMS	EPA 200.2/6020A

This analysis is carried out using procedures from CSR Analytical Method: "Strong Acid Leachable Metals (SALM) in Soil", BC Ministry of Environment, 26 June 2009, and procedures adapted from EPA Method 200.2. The sample is manually homogenized, dried at 60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve, and a representative subsample of the dry material is weighed. The sample is then digested at 95 degrees Celsius for 2 hours by block digester using concentrated nitric and hydrochloric acids. Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

PSA-PIPET-DETAIL-SK	Soil	Particle size - Sieve and Pipette	SSIR-51 METHOD 3.2.1

Particle size distribution is determined by a combination of techniques. Dry sieving is performed for coarse particles, wet sieving for sand particles and the pipette sedimentation method for clay particles.

Reference:

Burt, R. (2009). Soil Survey Field and Laboratory Methods Manual. Soil Survey Investigations Report No. 5. Method 3.2.1.2.2. United States Department of Agriculture Natural Resources Conservation Service.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA

Reference Information

ED SK

ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA

Chain of Custody Numbers:

14-470676 14-470677 14-470939

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

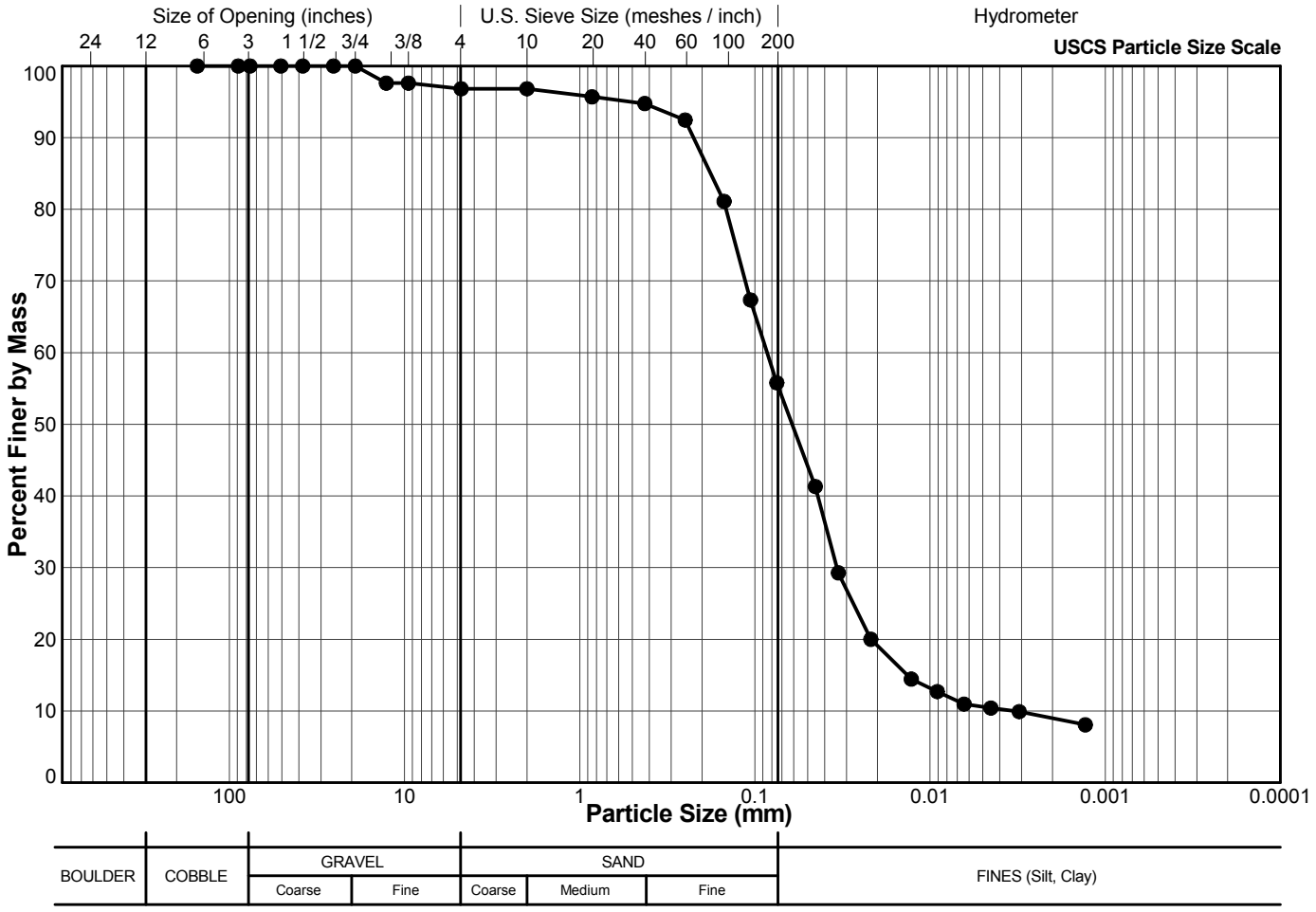
Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: E-1A
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		97.6
3/8"	9.5		97.6
#4 US MESH	4.75		96.8
#10 US MESH	2		96.8
#20 US MESH	0.85		95.7
#40 US MESH	0.425		94.8
#60 US MESH	0.25		92.5
#100 US MESH	0.15		81.1
#140 US MESH	0.106		67.4
#200 US MESH	0.075		55.8
		0.0452	41.3
		0.0334	29.3
		0.0218	20.0
		0.0128	14.4
		0.0091	12.7
		0.0064	11.0
		0.0045	10.4
		0.0031	9.9
		0.0013	8.1

LH/OA	11/8/2016	LH	11/15/2016
Tech	Date	Checked	Date

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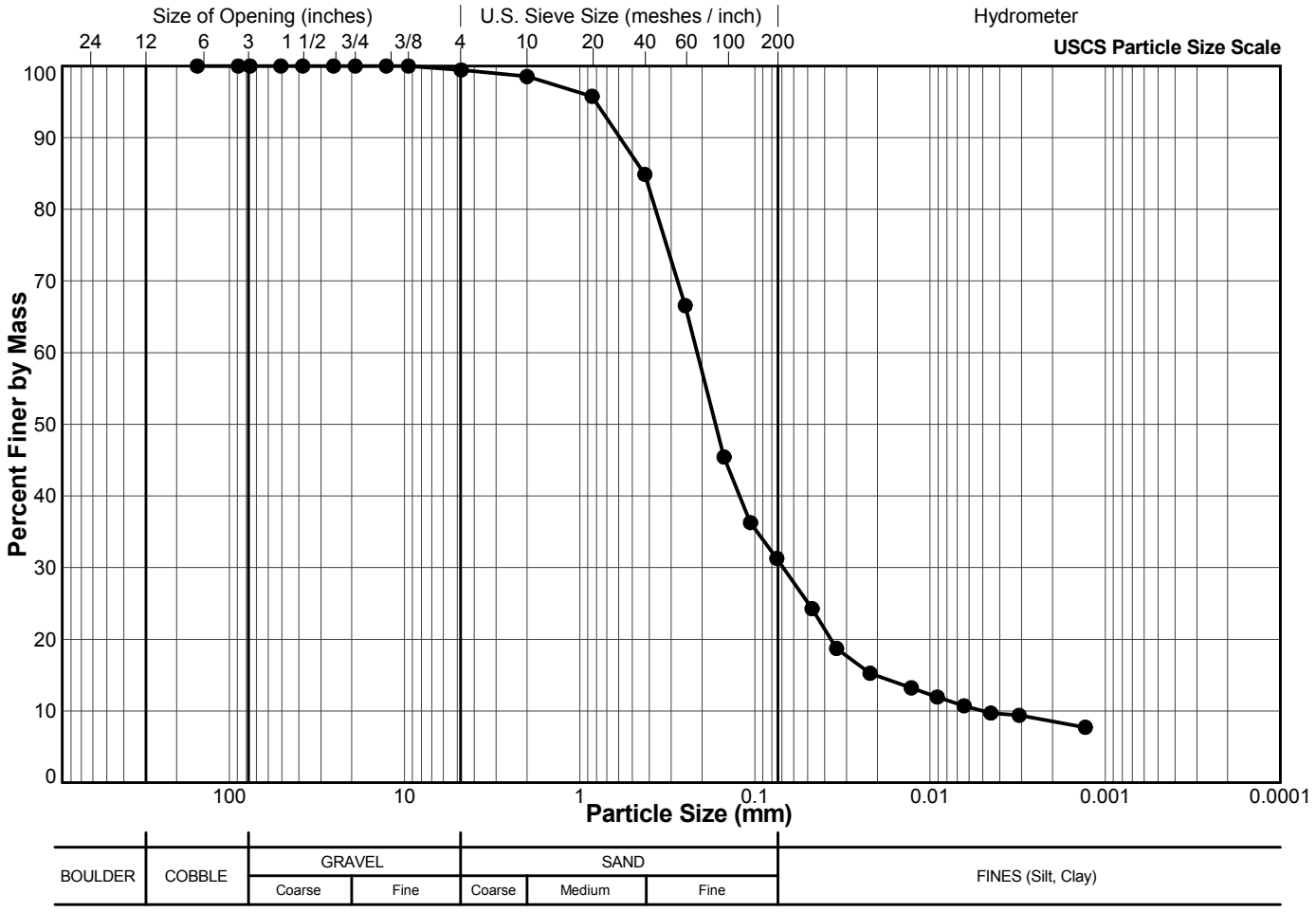
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: E-1B
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		99.4
#10 US MESH	2		98.5
#20 US MESH	0.85		95.8
#40 US MESH	0.425		84.9
#60 US MESH	0.25		66.6
#100 US MESH	0.15		45.4
#140 US MESH	0.106		36.3
#200 US MESH	0.075		31.3
		0.0472	24.3
		0.0342	18.7
		0.0220	15.3
		0.0128	13.2
		0.0091	11.9
		0.0064	10.7
		0.0045	9.7
		0.0031	9.4
		0.0013	7.7

LH/OA	11/8/2016	LH	11/15/2016
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:1467 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2015 lhu 15/11/16

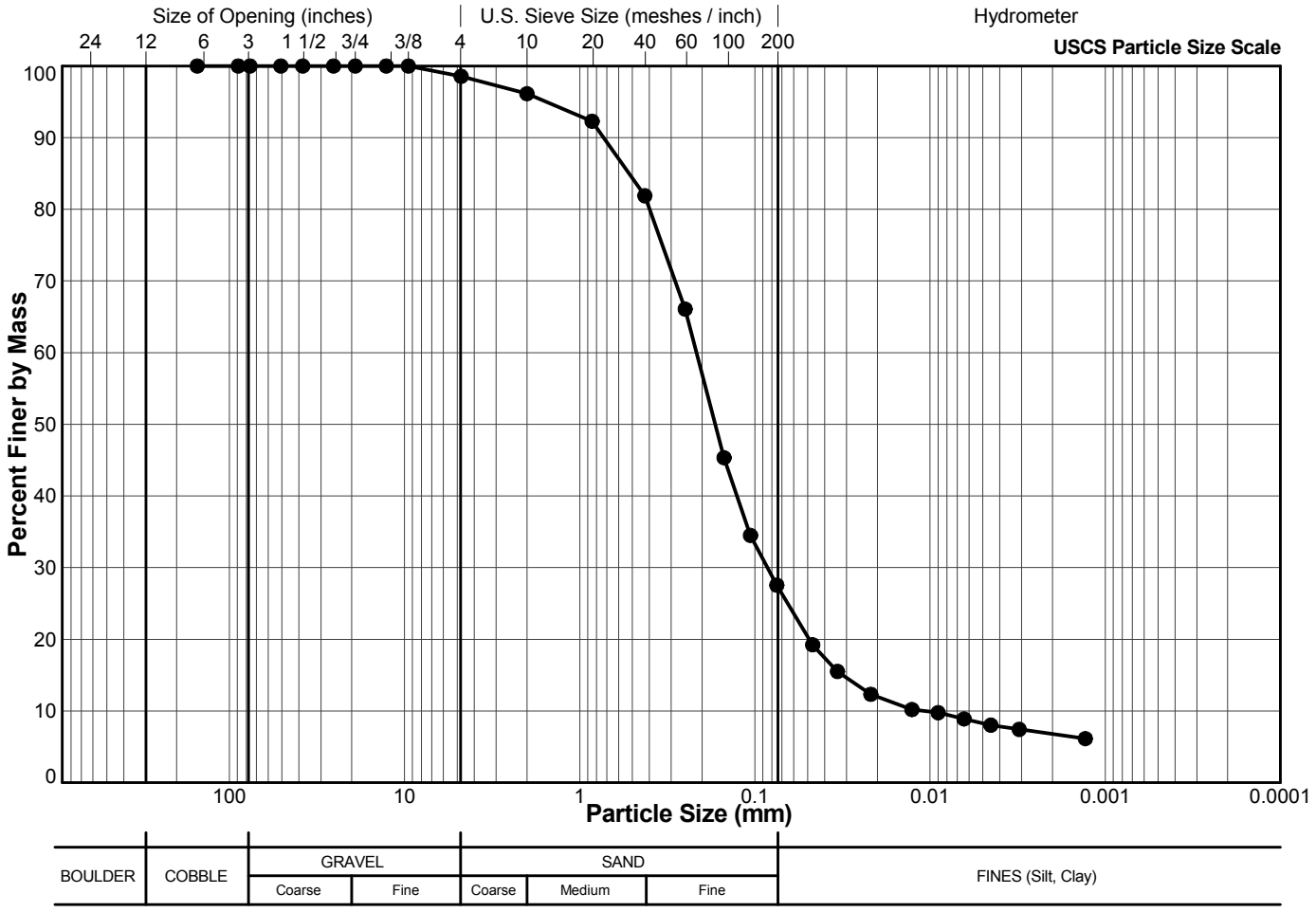
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: E-1C
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		98.6
#10 US MESH	2		96.1
#20 US MESH	0.85		92.3
#40 US MESH	0.425		81.9
#60 US MESH	0.25		66.1
#100 US MESH	0.15		45.3
#140 US MESH	0.106		34.5
#200 US MESH	0.075		27.6
		0.0468	19.2
		0.0338	15.5
		0.0218	12.3
		0.0127	10.2
		0.0090	9.8
		0.0064	8.9
		0.0045	8.0
		0.0031	7.4
		0.0013	6.1

LH/OA	11/8/2016	LH	11/15/2016
Tech	Date	Checked	Date

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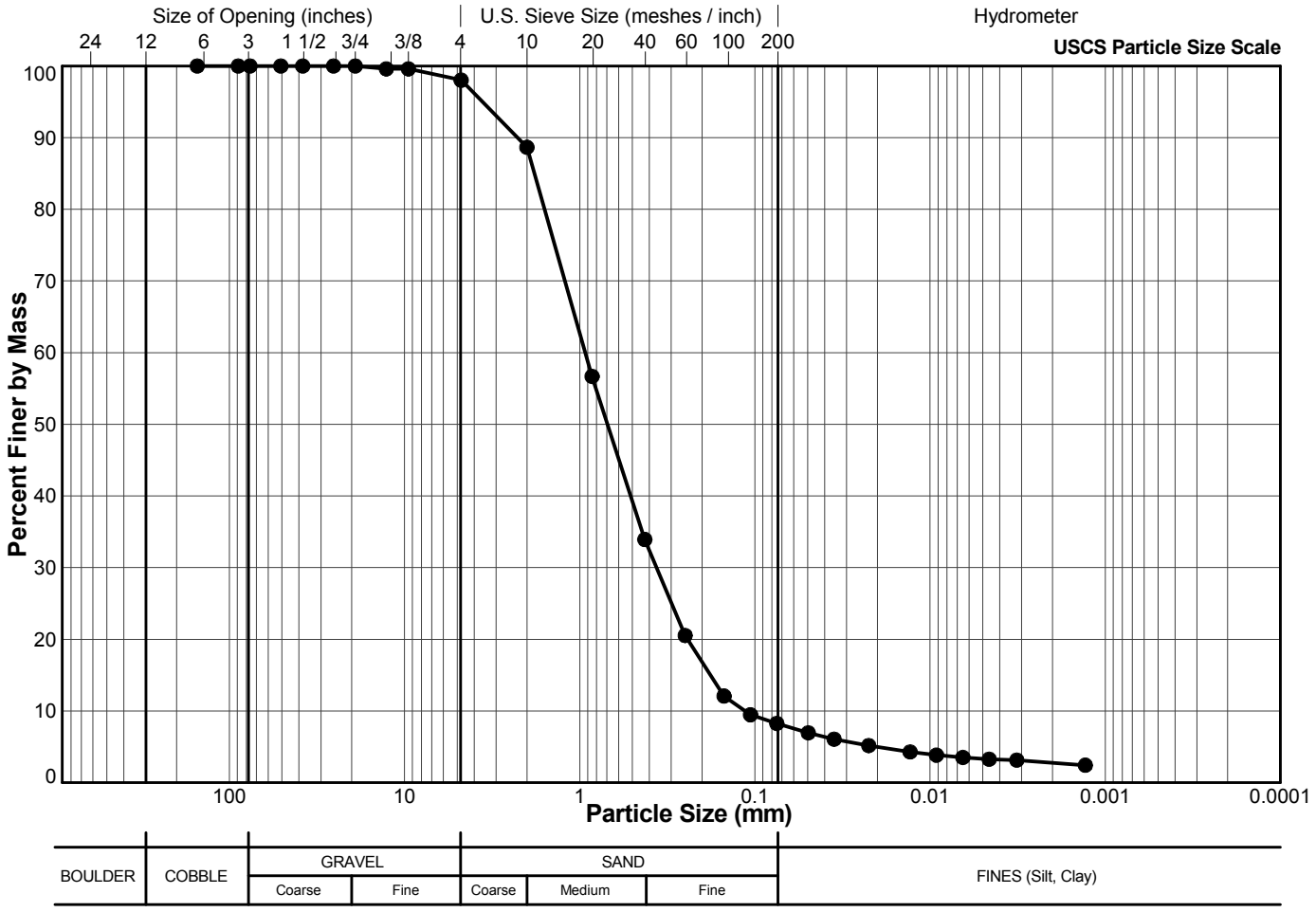
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: E-2A
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		99.6
3/8"	9.5		99.6
#4 US MESH	4.75		98.0
#10 US MESH	2		88.7
#20 US MESH	0.85		56.7
#40 US MESH	0.425		33.9
#60 US MESH	0.25		20.5
#100 US MESH	0.15		12.1
#140 US MESH	0.106		9.5
#200 US MESH	0.075		8.3
		0.0496	6.9
		0.0353	6.1
		0.0224	5.2
		0.0130	4.3
		0.0092	3.8
		0.0065	3.5
		0.0046	3.3
		0.0032	3.1
		0.0013	2.4

LH/OA	11/9/2016	LH	11/15/2016
Tech	Date	Checked	Date

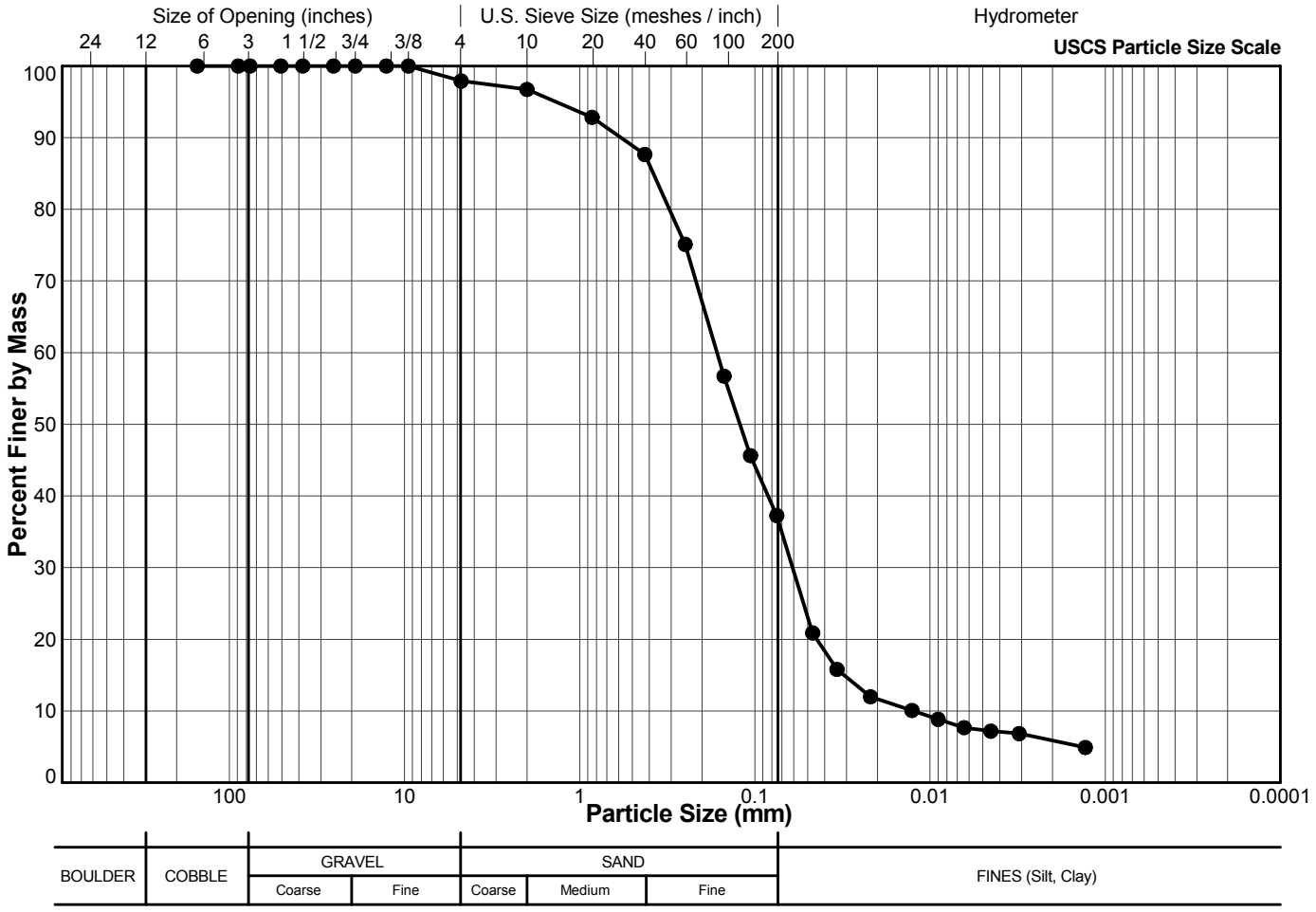
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: E-2B
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		97.9
#10 US MESH	2		96.7
#20 US MESH	0.85		92.8
#40 US MESH	0.425		87.7
#60 US MESH	0.25		75.1
#100 US MESH	0.15		56.7
#140 US MESH	0.106		45.6
#200 US MESH	0.075		37.3
		0.0468	20.9
		0.0340	15.8
		0.0219	12.0
		0.0127	10.1
		0.0090	8.8
		0.0064	7.7
		0.0045	7.2
		0.0031	6.8
		0.0013	4.9

LH/OA	11/9/2016	LH	11/15/2016
Tech	Date	Checked	Date

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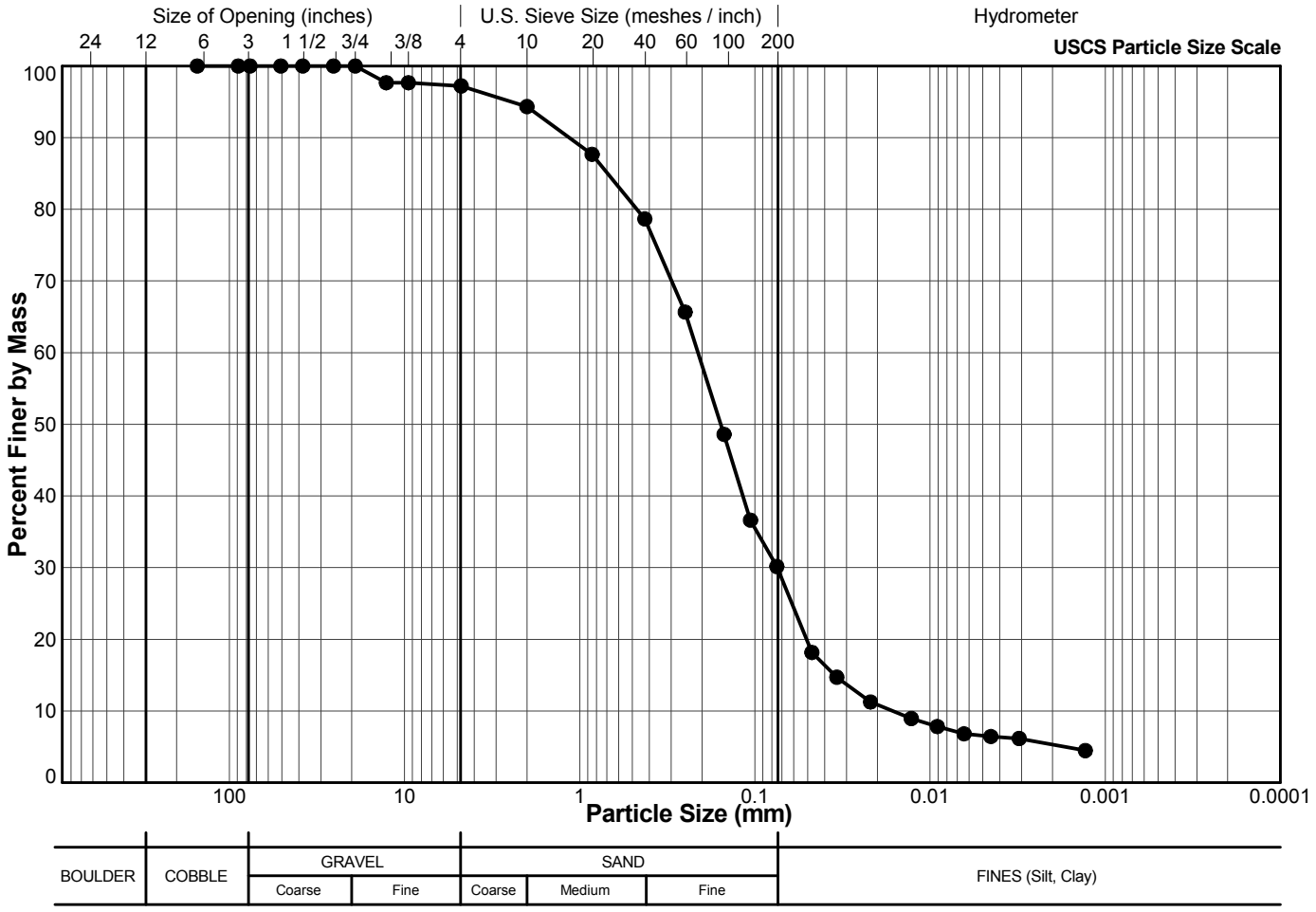
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: E-2C
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		97.7
3/8"	9.5		97.7
#4 US MESH	4.75		97.2
#10 US MESH	2		94.3
#20 US MESH	0.85		87.7
#40 US MESH	0.425		78.7
#60 US MESH	0.25		65.7
#100 US MESH	0.15		48.6
#140 US MESH	0.106		36.6
#200 US MESH	0.075		30.2
		0.0473	18.2
		0.0341	14.7
		0.0219	11.3
		0.0128	8.9
		0.0091	7.8
		0.0064	6.8
		0.0045	6.4
		0.0031	6.2
		0.0013	4.5

LH/OA	11/8/2016	LH	11/15/2016
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:1467 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2015 lhu 15/11/16

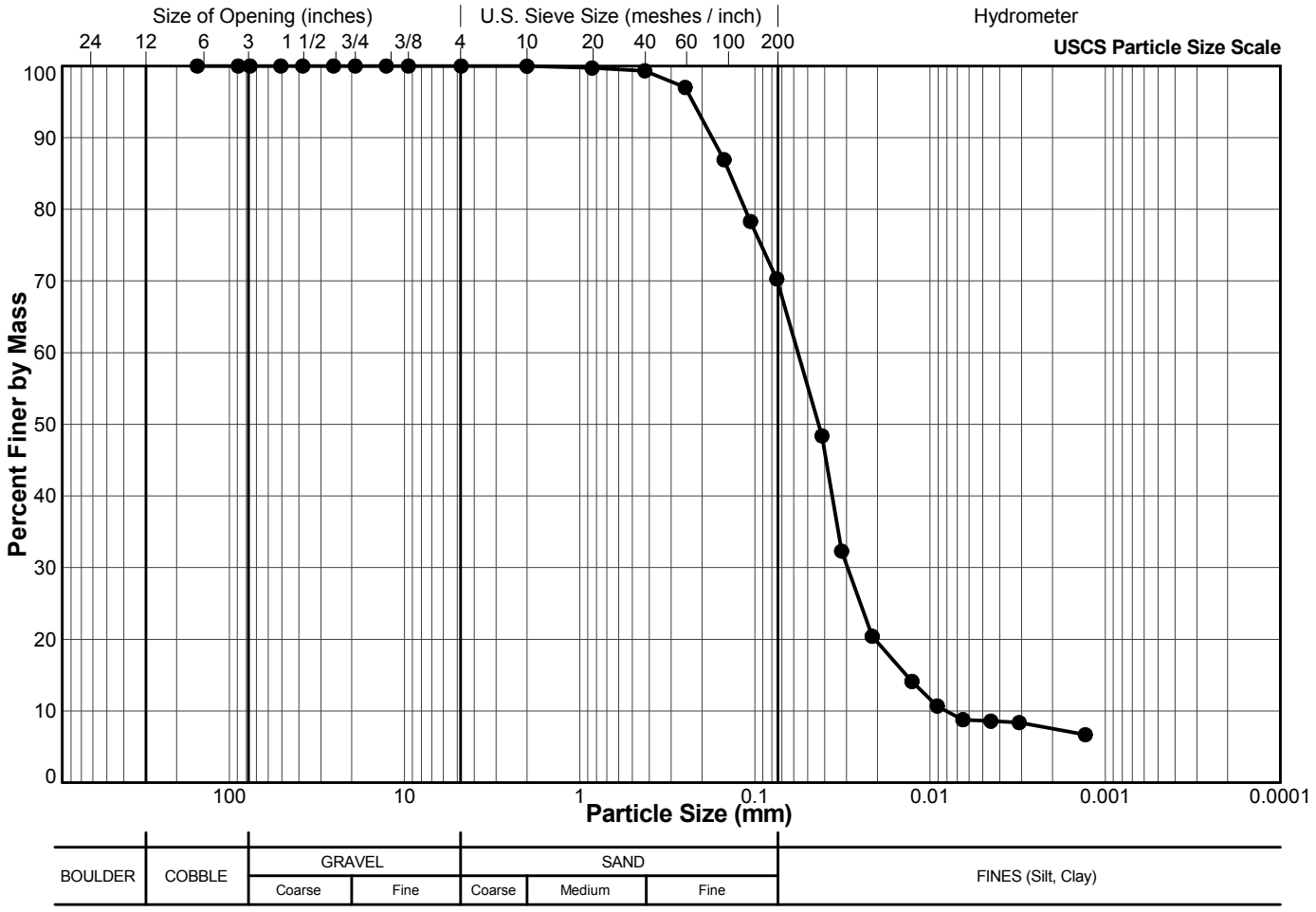
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: E-3A
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		100.0
#10 US MESH	2		100.0
#20 US MESH	0.85		99.7
#40 US MESH	0.425		99.3
#60 US MESH	0.25		97.0
#100 US MESH	0.15		86.9
#140 US MESH	0.106		78.3
#200 US MESH	0.075		70.3
		0.0414	48.4
		0.0320	32.3
		0.0214	20.4
		0.0127	14.1
		0.0091	10.7
		0.0065	8.8
		0.0045	8.6
		0.0031	8.4
		0.0013	6.7

LH/OA	11/8/2016	LH	11/15/2016
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:1467 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2015 lhu 15/11/16

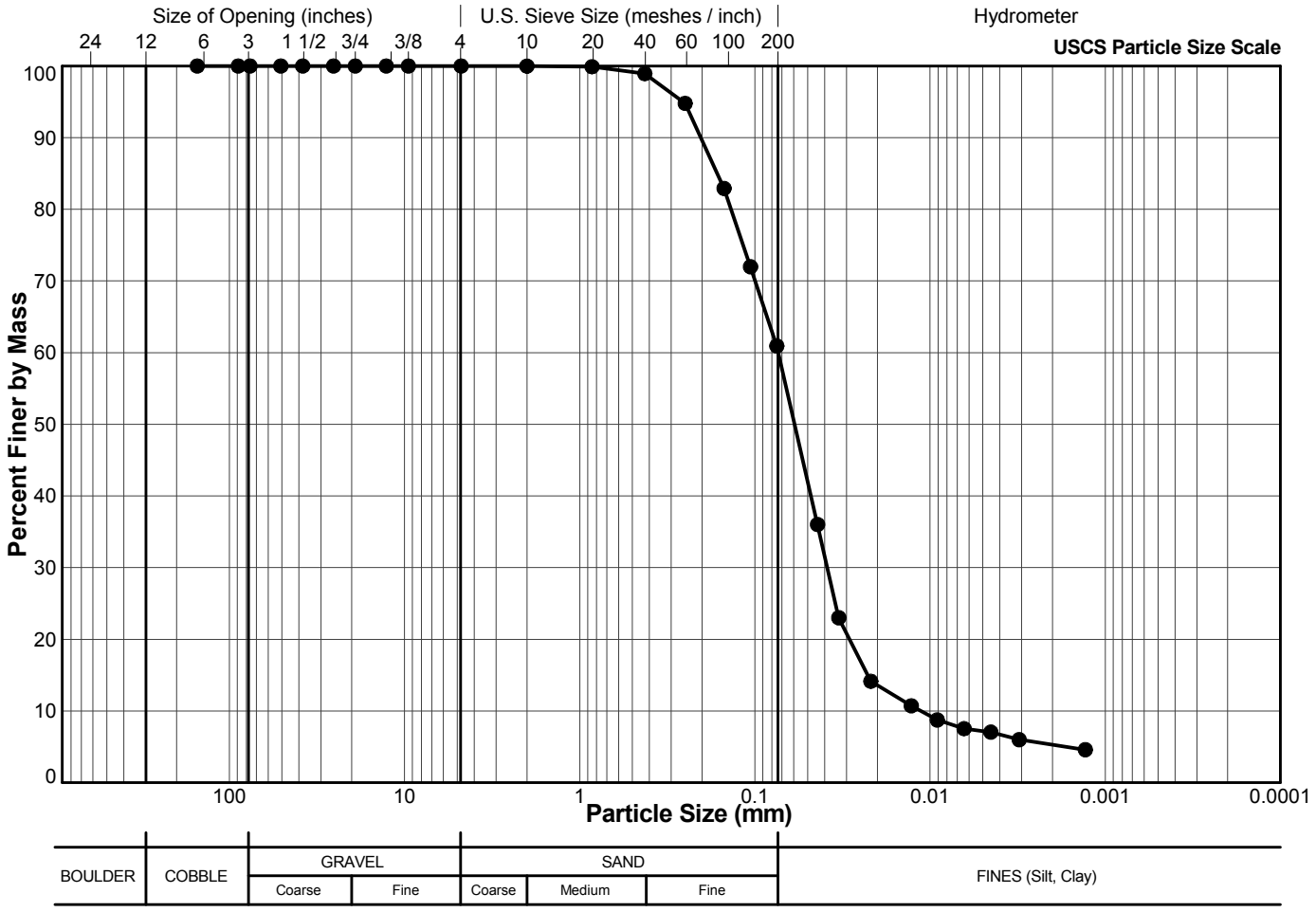
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: E-3B
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		100.0
#10 US MESH	2		100.0
#20 US MESH	0.85		99.9
#40 US MESH	0.425		98.9
#60 US MESH	0.25		94.8
#100 US MESH	0.15		82.9
#140 US MESH	0.106		72.0
#200 US MESH	0.075		60.9
		0.0439	36.0
		0.0332	23.0
		0.0218	14.1
		0.0128	10.7
		0.0091	8.7
		0.0064	7.5
		0.0045	7.0
		0.0031	6.0
		0.0013	4.6

LH/OA	11/8/2016	LH	11/15/2016
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:1467 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2015 lhu 15/11/16

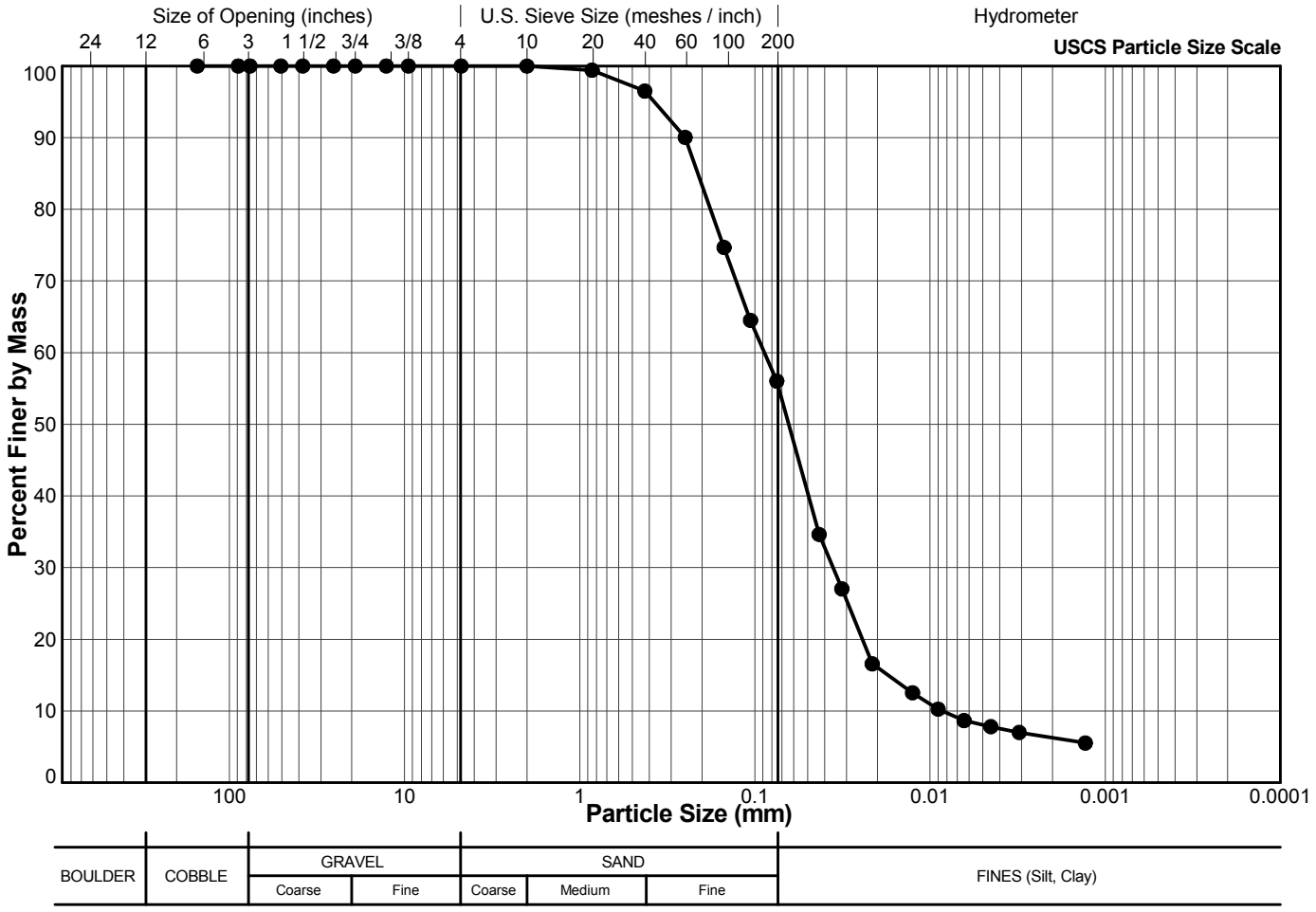
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: E-3C
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		100.0
#10 US MESH	2		100.0
#20 US MESH	0.85		99.4
#40 US MESH	0.425		96.5
#60 US MESH	0.25		90.0
#100 US MESH	0.15		74.7
#140 US MESH	0.106		64.5
#200 US MESH	0.075		56.0
		0.0430	34.6
		0.0319	27.0
		0.0214	16.6
		0.0126	12.5
		0.0090	10.3
		0.0064	8.7
		0.0045	7.8
		0.0031	7.0
		0.0013	5.5

LH/OA	11/8/2016	LH	11/15/2016
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:1467 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2015 lhu 15/11/16

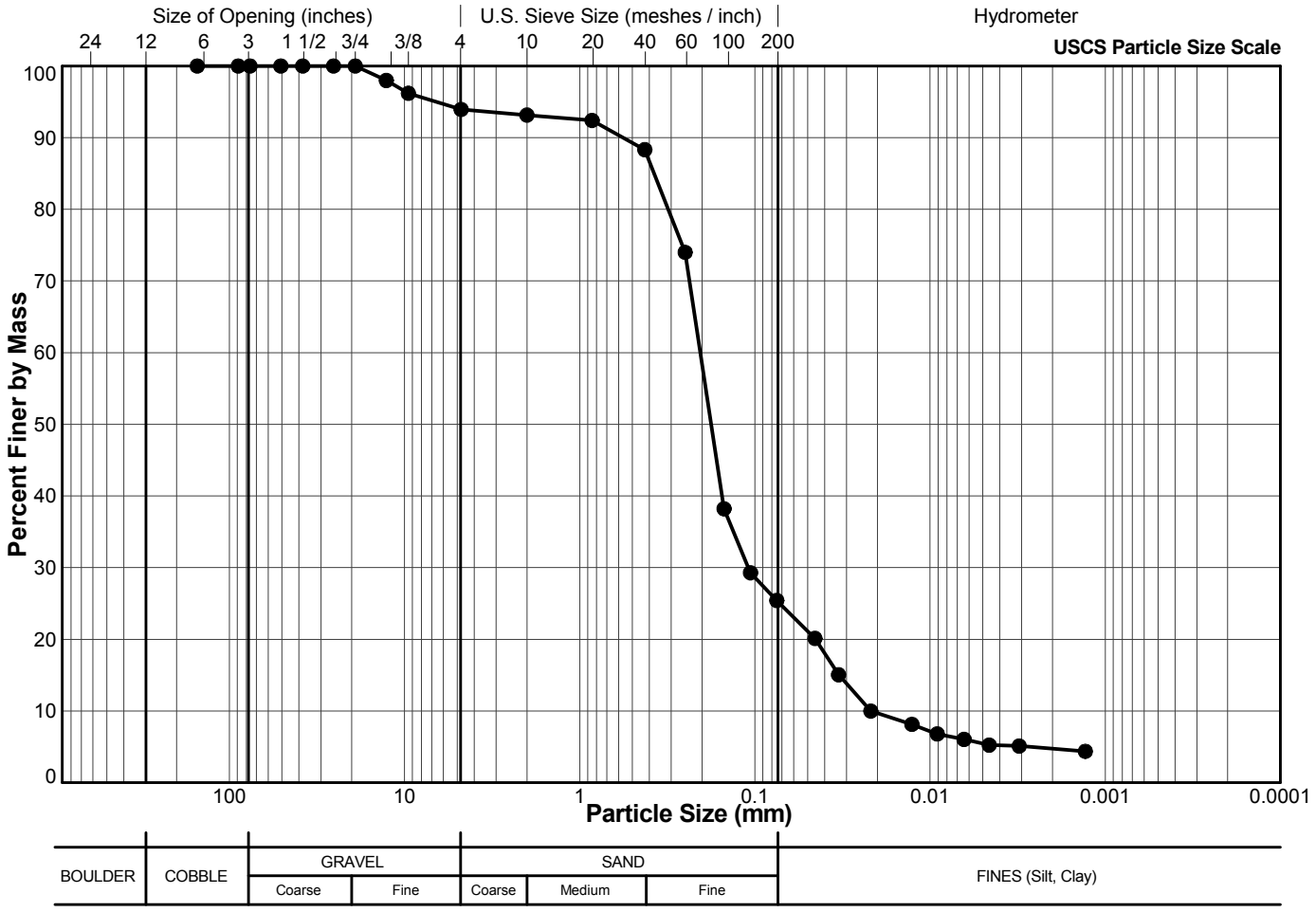
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: E-4A
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		98.0
3/8"	9.5		96.2
#4 US MESH	4.75		93.9
#10 US MESH	2		93.1
#20 US MESH	0.85		92.4
#40 US MESH	0.425		88.3
#60 US MESH	0.25		74.0
#100 US MESH	0.15		38.2
#140 US MESH	0.106		29.3
#200 US MESH	0.075		25.4
		0.0454	20.1
		0.0333	15.1
		0.0218	10.0
		0.0127	8.1
		0.0091	6.8
		0.0064	6.0
		0.0046	5.2
		0.0031	5.1
		0.0013	4.4

LH/OA	11/9/2016	LH	11/15/2016
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:1467 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2015 lhu 15/11/16

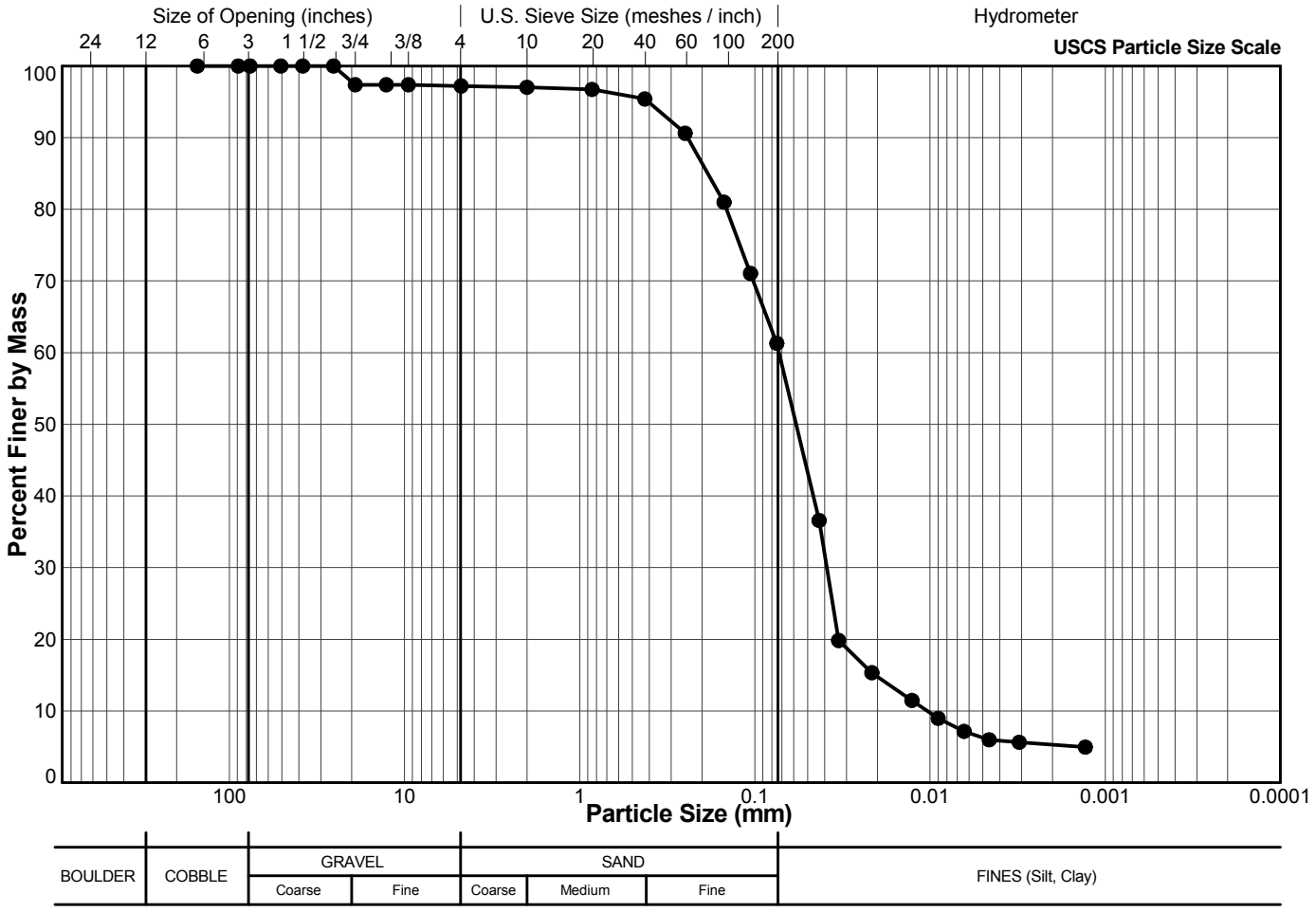
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: E-4B
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		97.4
1/2"	12.7		97.4
3/8"	9.5		97.4
#4 US MESH	4.75		97.2
#10 US MESH	2		97.0
#20 US MESH	0.85		96.7
#40 US MESH	0.425		95.4
#60 US MESH	0.25		90.6
#100 US MESH	0.15		81.0
#140 US MESH	0.106		71.1
#200 US MESH	0.075		61.3
		0.0430	36.6
		0.0333	19.8
		0.0215	15.3
		0.0127	11.5
		0.0090	9.0
		0.0064	7.2
		0.0046	6.0
		0.0031	5.6
		0.0013	5.0

LH/OA	11/9/2016	LH	11/15/2016
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:1467 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2015 lhu 15/11/16

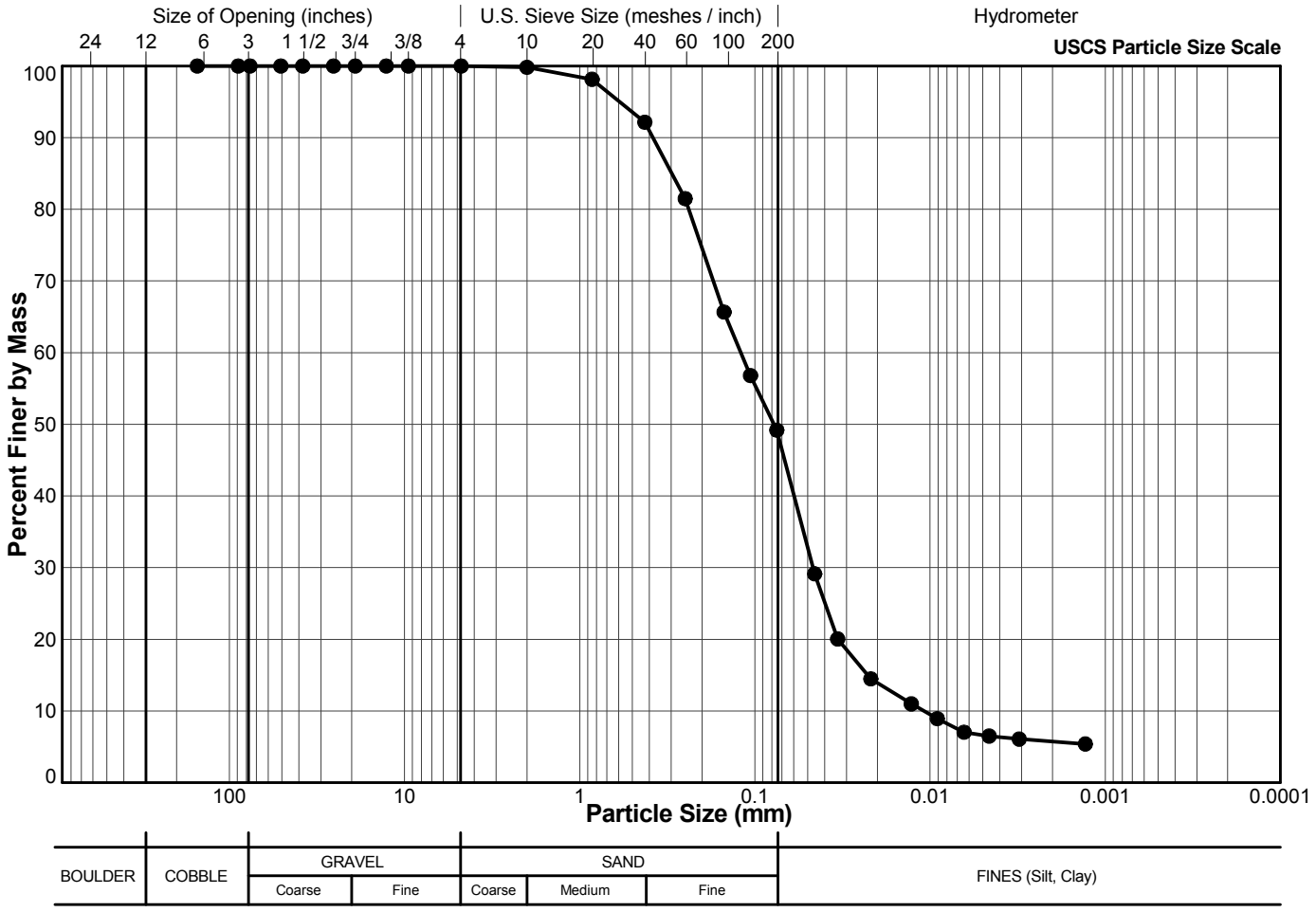
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: E-4C
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		100.0
#10 US MESH	2		99.8
#20 US MESH	0.85		98.1
#40 US MESH	0.425		92.2
#60 US MESH	0.25		81.5
#100 US MESH	0.15		65.7
#140 US MESH	0.106		56.8
#200 US MESH	0.075		49.2
		0.0456	29.1
		0.0337	20.0
		0.0218	14.5
		0.0128	11.0
		0.0091	8.9
		0.0064	7.0
		0.0046	6.5
		0.0031	6.1
		0.0013	5.4

LH/OA	11/8/2016	LH	11/15/2016
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:1467 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2015 lhu 15/11/16

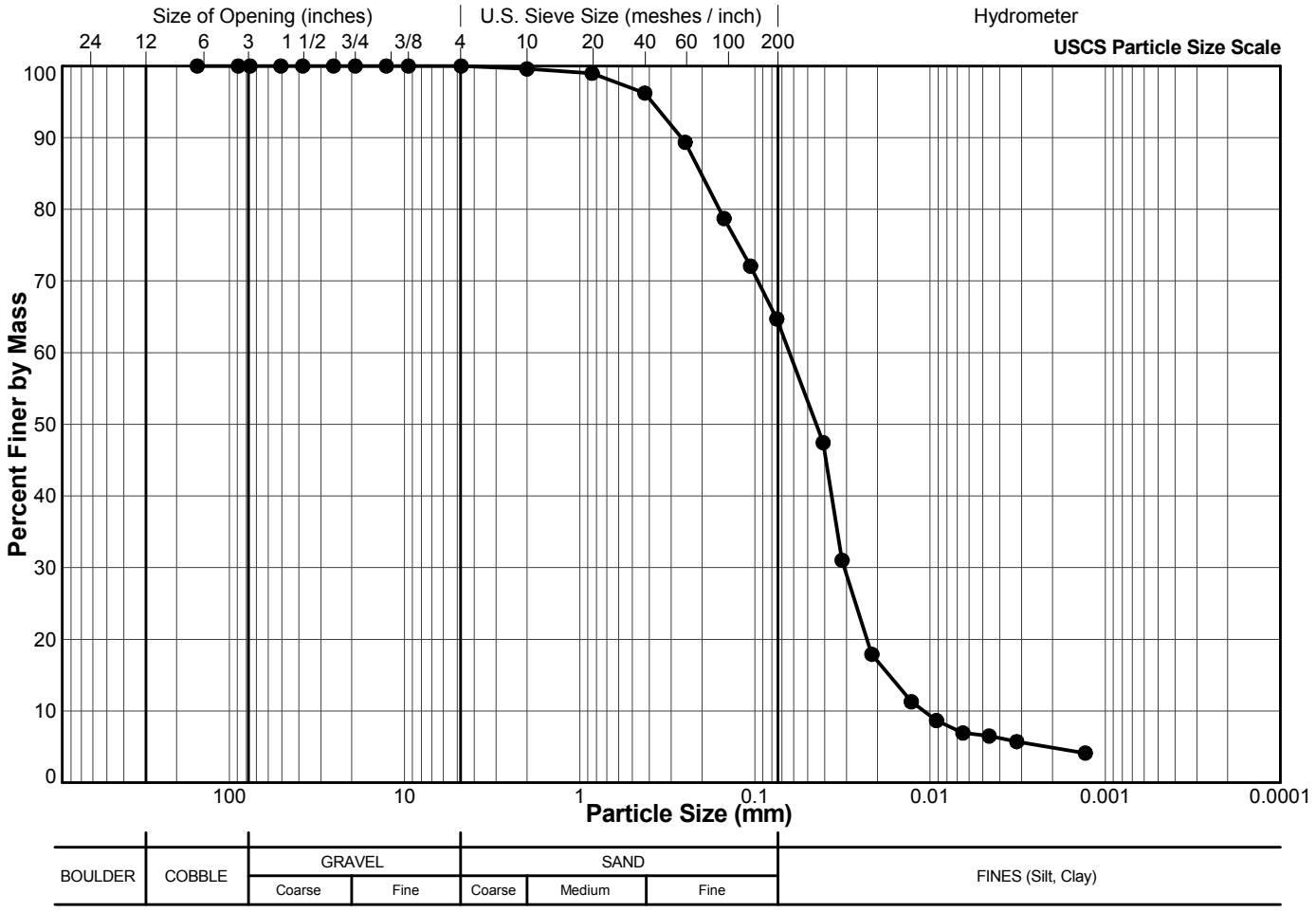
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: E-6A
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		100.0
#10 US MESH	2		99.6
#20 US MESH	0.85		99.0
#40 US MESH	0.425		96.2
#60 US MESH	0.25		89.4
#100 US MESH	0.15		78.7
#140 US MESH	0.106		72.1
#200 US MESH	0.075		64.7
		0.0408	47.4
		0.0318	31.0
		0.0215	17.9
		0.0128	11.3
		0.0092	8.7
		0.0065	6.9
		0.0046	6.5
		0.0032	5.7
		0.0013	4.1

LH/OA	11/10/2016	LH	11/15/2016
Tech	Date	Checked	Date

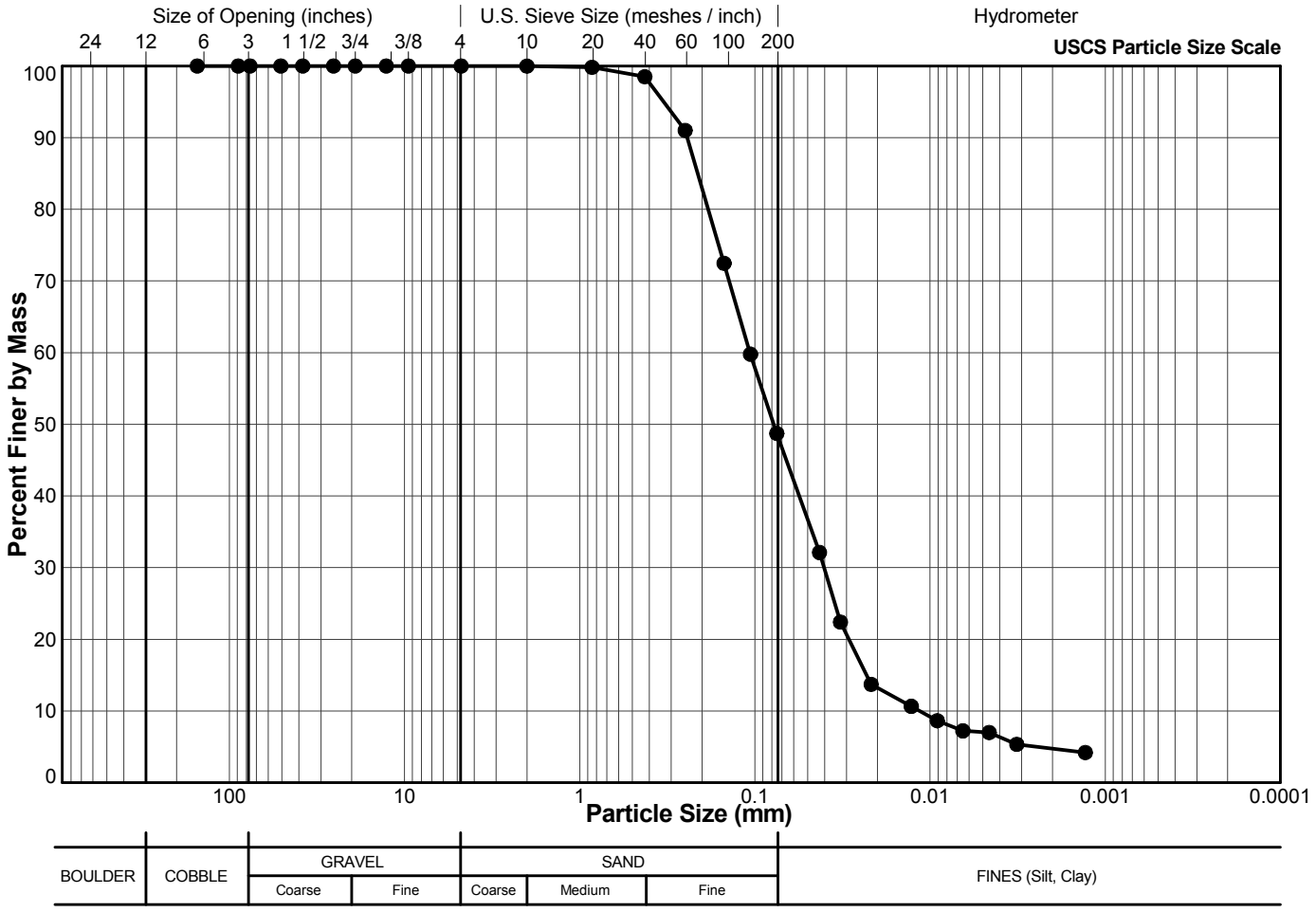
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: E-6B
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		100.0
#10 US MESH	2		100.0
#20 US MESH	0.85		99.8
#40 US MESH	0.425		98.5
#60 US MESH	0.25		91.0
#100 US MESH	0.15		72.5
#140 US MESH	0.106		59.8
#200 US MESH	0.075		48.7
		0.0428	32.1
		0.0325	22.4
		0.0217	13.7
		0.0128	10.6
		0.0091	8.6
		0.0065	7.2
		0.0046	7.0
		0.0032	5.3
		0.0013	4.2

LH/OA	11/8/2016	LH	11/15/2016
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:1467 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2015 lhu 15/11/16

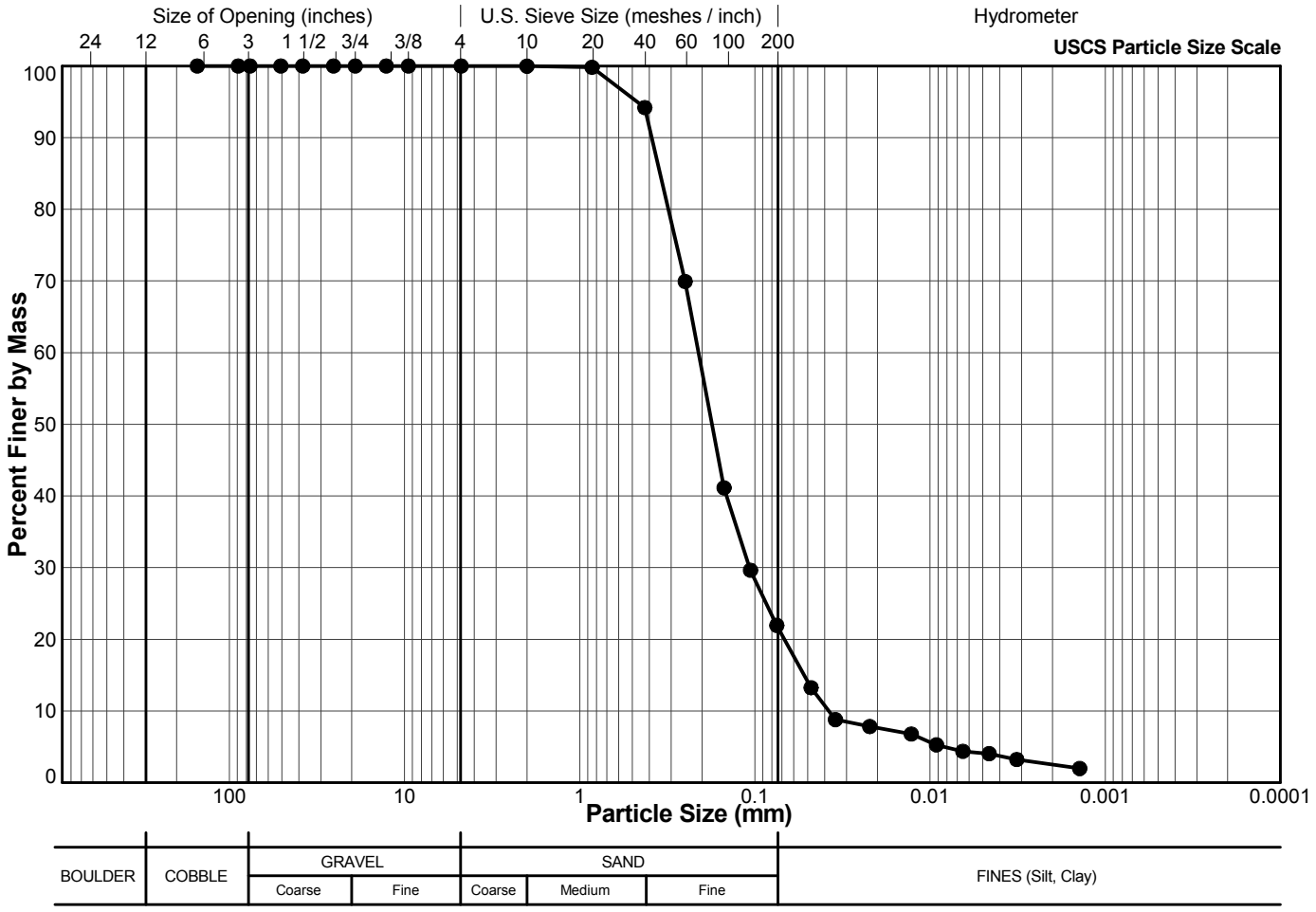
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: E-6C
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		100.0
#10 US MESH	2		100.0
#20 US MESH	0.85		99.8
#40 US MESH	0.425		94.2
#60 US MESH	0.25		69.9
#100 US MESH	0.15		41.1
#140 US MESH	0.106		29.6
#200 US MESH	0.075		21.9
		0.0478	13.2
		0.0347	8.8
		0.0221	7.8
		0.0128	6.8
		0.0092	5.3
		0.0065	4.4
		0.0046	4.0
		0.0032	3.2
		0.0014	2.0

LH/OA	11/10/2016	LH	11/15/2016
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:1467 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2015 lhu 15/11/16

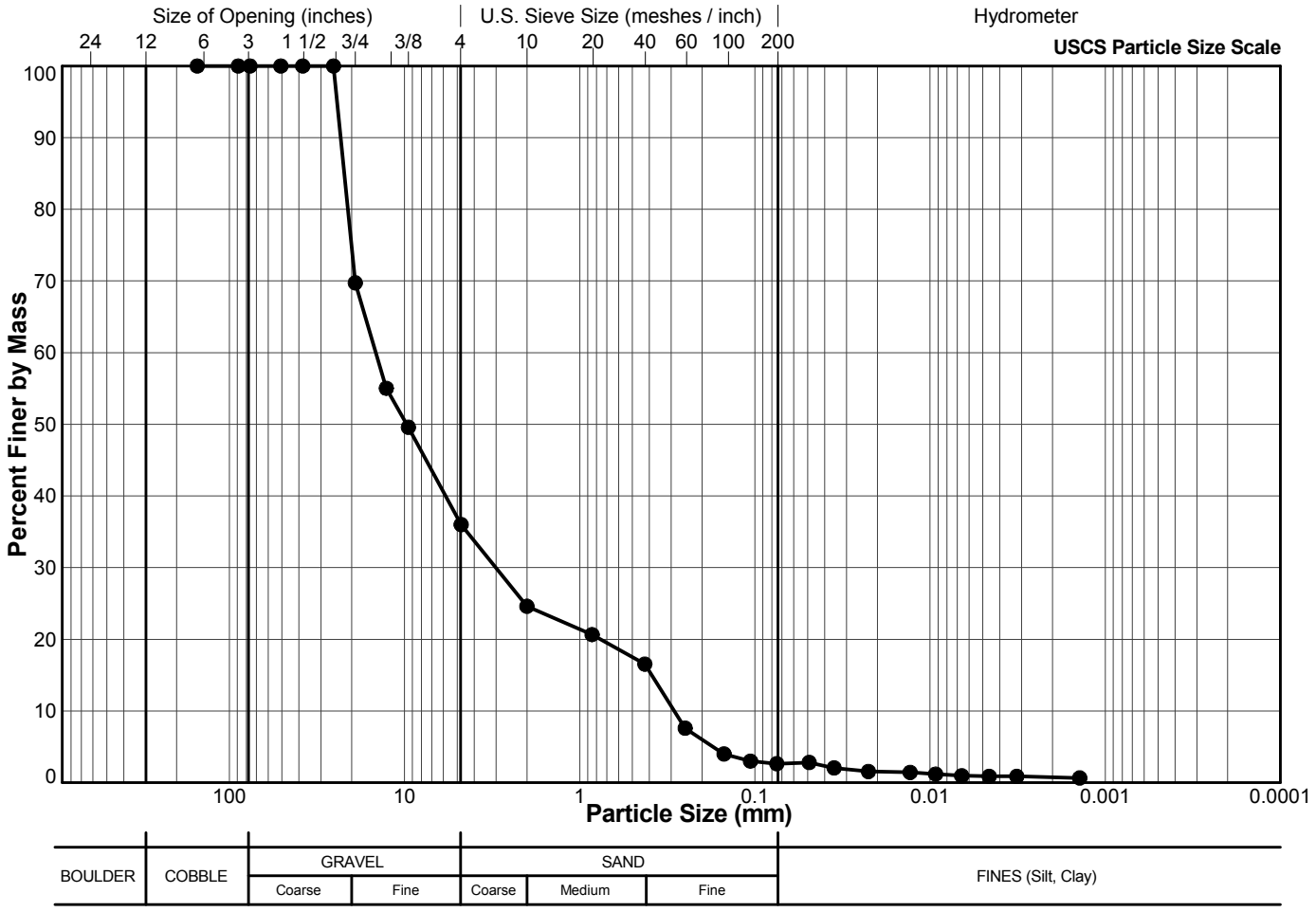
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: E-8A
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		69.7
1/2"	12.7		55.0
3/8"	9.5		49.6
#4 US MESH	4.75		36.0
#10 US MESH	2		24.6
#20 US MESH	0.85		20.7
#40 US MESH	0.425		16.5
#60 US MESH	0.25		7.6
#100 US MESH	0.15		4.0
#140 US MESH	0.106		3.0
#200 US MESH	0.075		2.6
		0.0490	2.8
		0.0353	2.1
		0.0225	1.6
		0.0130	1.4
		0.0093	1.2
		0.0066	1.0
		0.0046	0.9
		0.0032	0.9
		0.0014	0.7

LH/OA	11/8/2016	LH	11/15/2016
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:1467 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2015 lhu 15/11/16

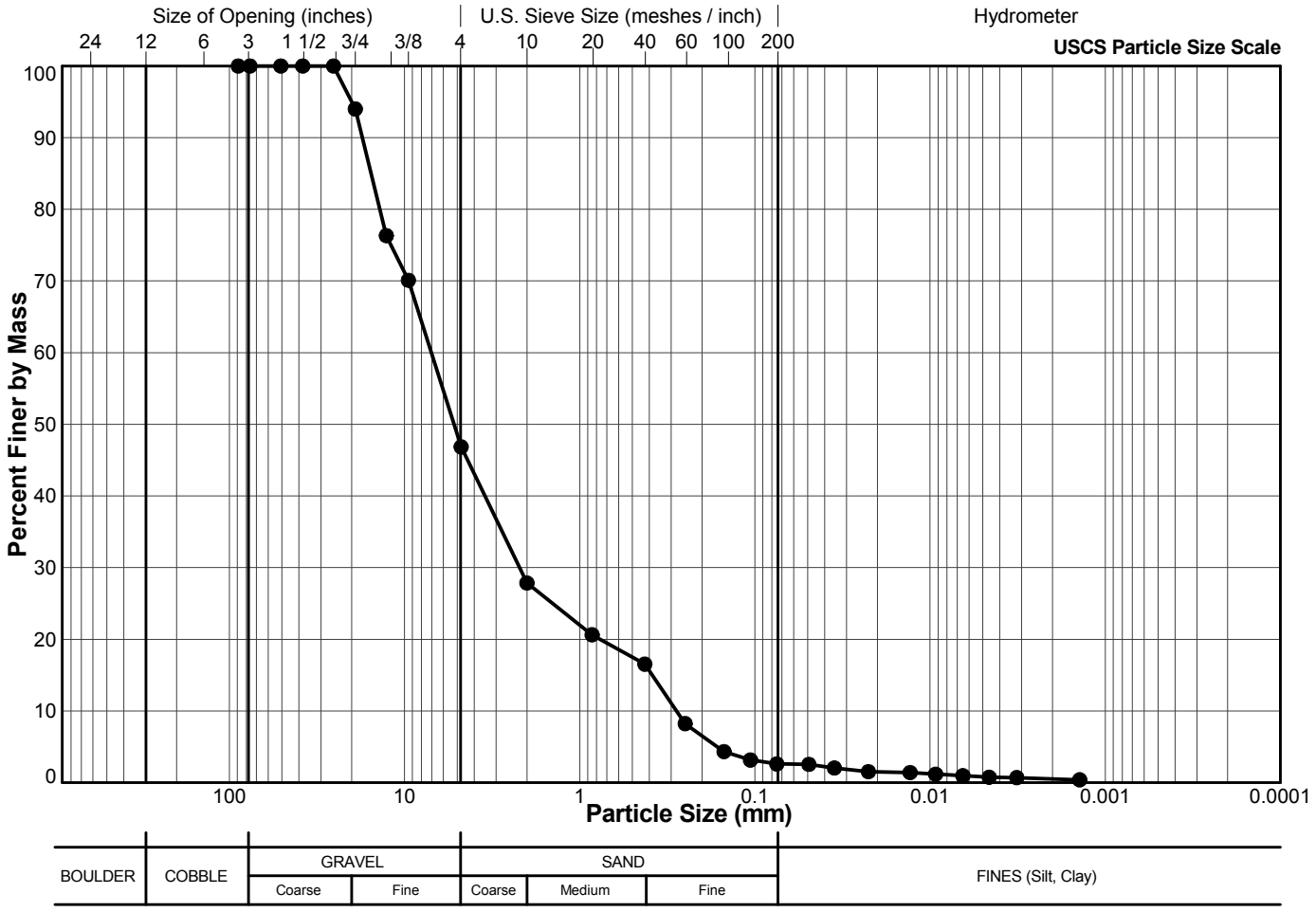
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: E-8B
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		94.0
1/2"	12.7		76.3
3/8"	9.5		70.1
#4 US MESH	4.75		46.8
#10 US MESH	2		27.9
#20 US MESH	0.85		20.6
#40 US MESH	0.425		16.5
#60 US MESH	0.25		8.2
#100 US MESH	0.15		4.3
#140 US MESH	0.106		3.2
#200 US MESH	0.075		2.6
		0.0492	2.5
		0.0352	2.0
		0.0225	1.5
		0.0130	1.4
		0.0093	1.2
		0.0065	1.0
		0.0046	0.8
		0.0032	0.7
		0.0014	0.4

LH/OA	11/9/2016	LH	11/15/2016
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:1467 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2015 lhu 15/11/16

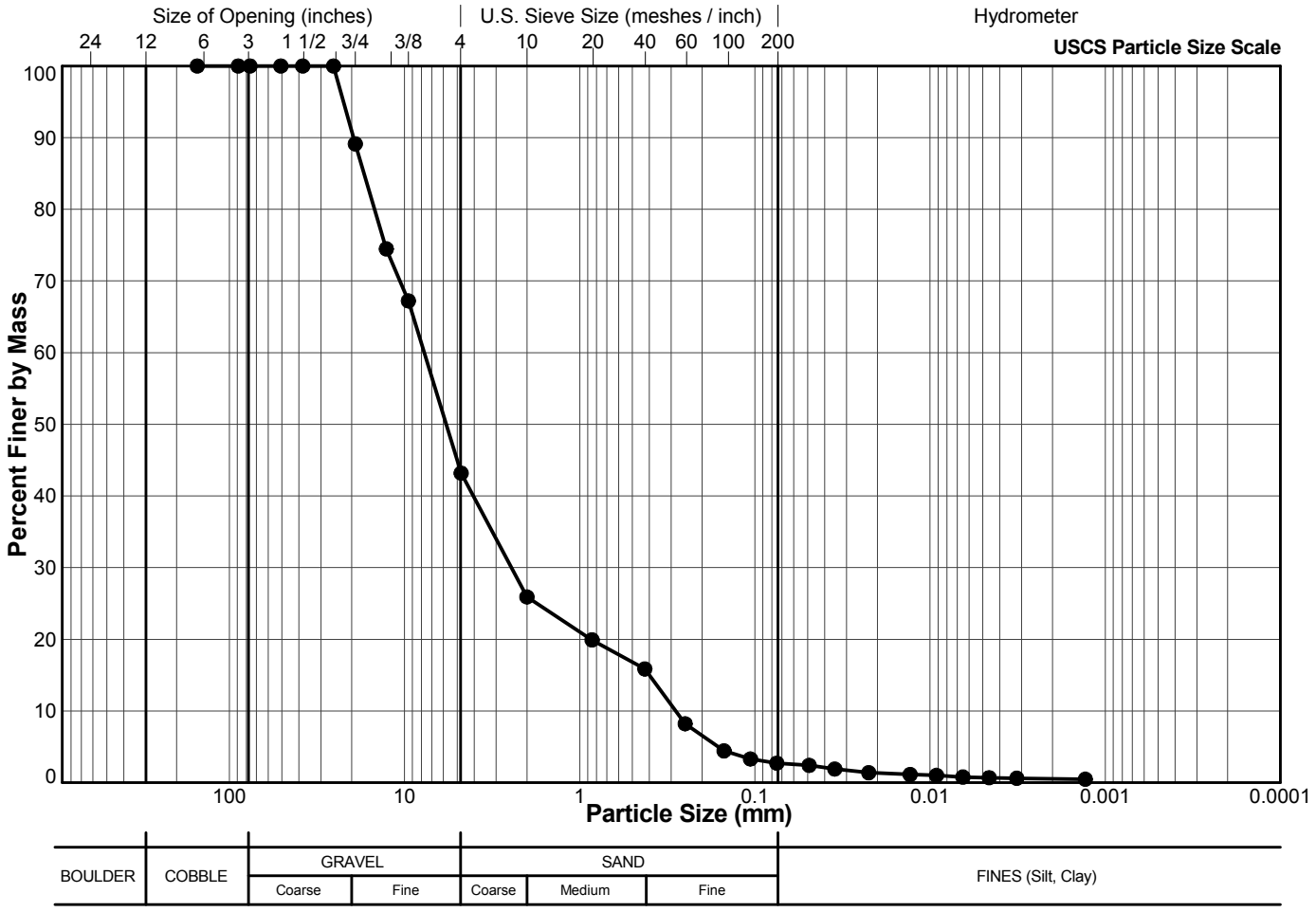
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: E-8C
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		89.1
1/2"	12.7		74.5
3/8"	9.5		67.2
#4 US MESH	4.75		43.2
#10 US MESH	2		25.9
#20 US MESH	0.85		19.9
#40 US MESH	0.425		15.9
#60 US MESH	0.25		8.2
#100 US MESH	0.15		4.4
#140 US MESH	0.106		3.3
#200 US MESH	0.075		2.7
		0.0490	2.4
		0.0350	1.9
		0.0224	1.4
		0.0130	1.1
		0.0092	1.0
		0.0065	0.8
		0.0046	0.7
		0.0032	0.6
		0.0013	0.5

LH/OA	11/9/2016	LH	11/15/2016
Tech	Date	Checked	Date

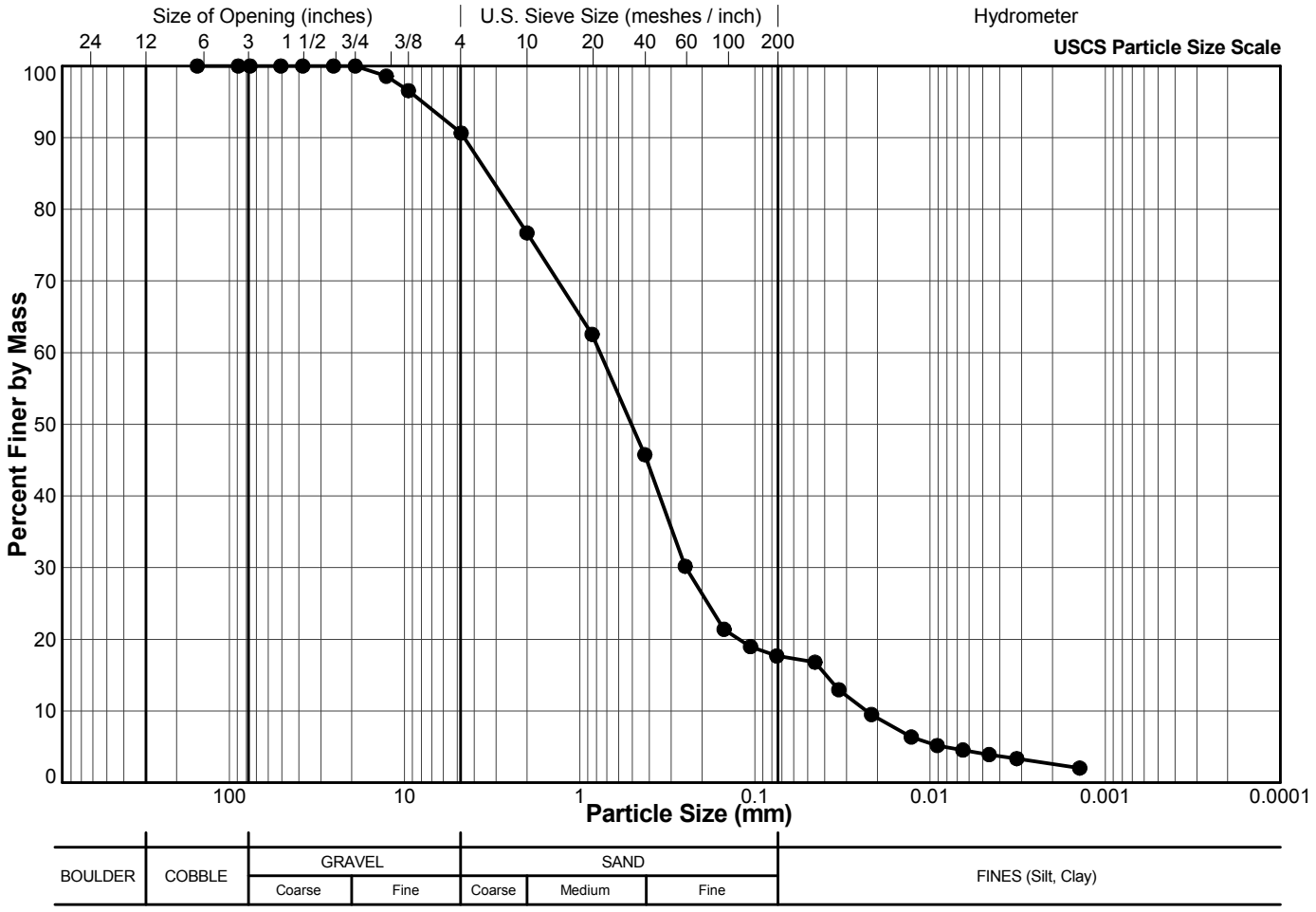
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: PORCUPINE CR-A
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		98.6
3/8"	9.5		96.6
#4 US MESH	4.75		90.6
#10 US MESH	2		76.7
#20 US MESH	0.85		62.6
#40 US MESH	0.425		45.8
#60 US MESH	0.25		30.2
#100 US MESH	0.15		21.4
#140 US MESH	0.106		19.0
#200 US MESH	0.075		17.7
		0.0454	16.8
		0.0332	13.0
		0.0216	9.5
		0.0128	6.4
		0.0091	5.2
		0.0065	4.5
		0.0046	3.9
		0.0032	3.3
		0.0014	2.0

LH/OA	11/10/2016	LH	11/15/2016
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:1467 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2015 lhu 15/11/16

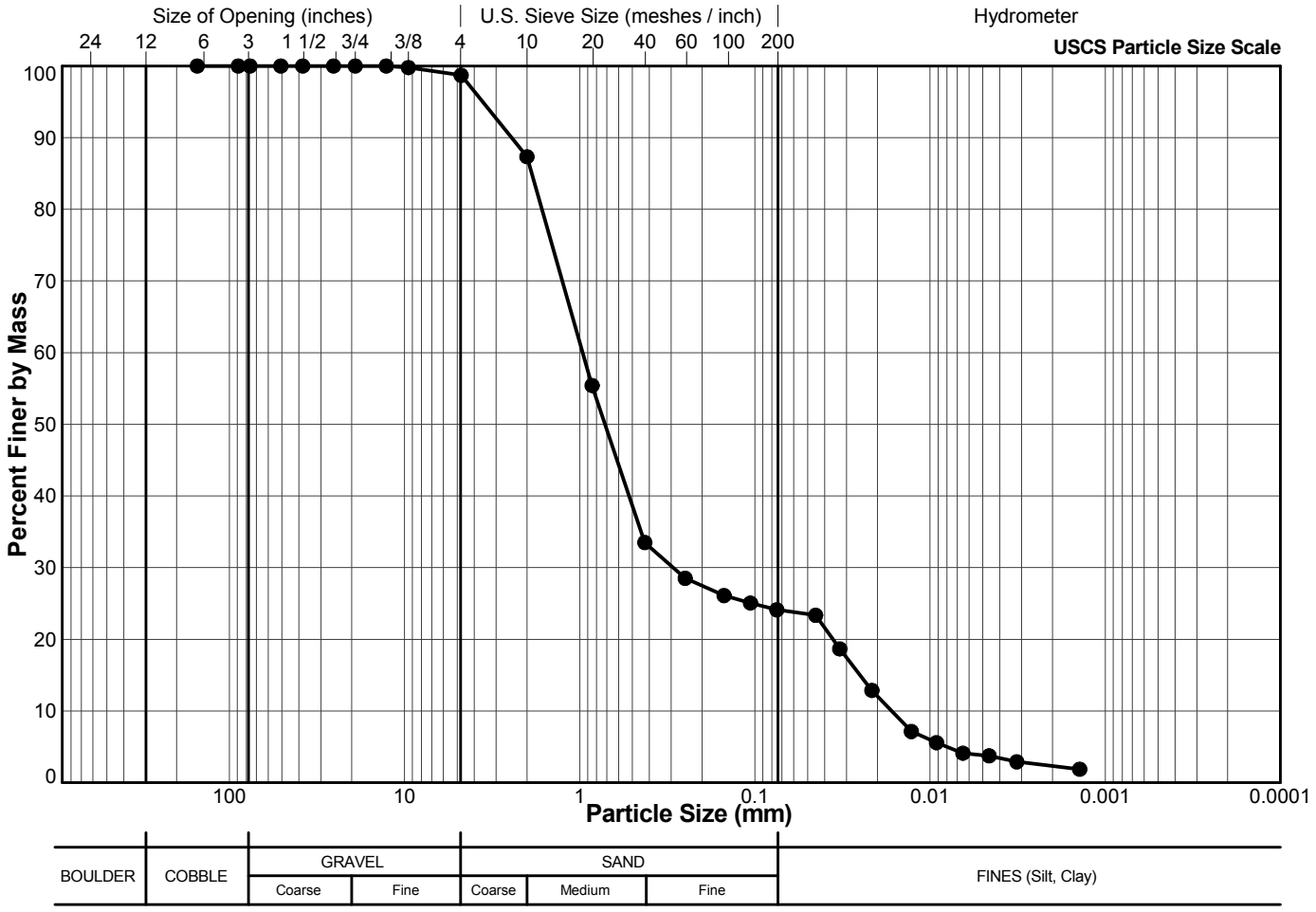
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: PORCUPINE CR-B
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		99.8
#4 US MESH	4.75		98.7
#10 US MESH	2		87.3
#20 US MESH	0.85		55.4
#40 US MESH	0.425		33.5
#60 US MESH	0.25		28.5
#100 US MESH	0.15		26.1
#140 US MESH	0.106		25.1
#200 US MESH	0.075		24.1
		0.0450	23.4
		0.0328	18.7
		0.0215	12.9
		0.0128	7.1
		0.0092	5.6
		0.0065	4.1
		0.0046	3.7
		0.0032	2.9
		0.0014	1.9

LH/OA	11/10/2016	LH	11/15/2016
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:1467 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2015 lhu 15/11/16

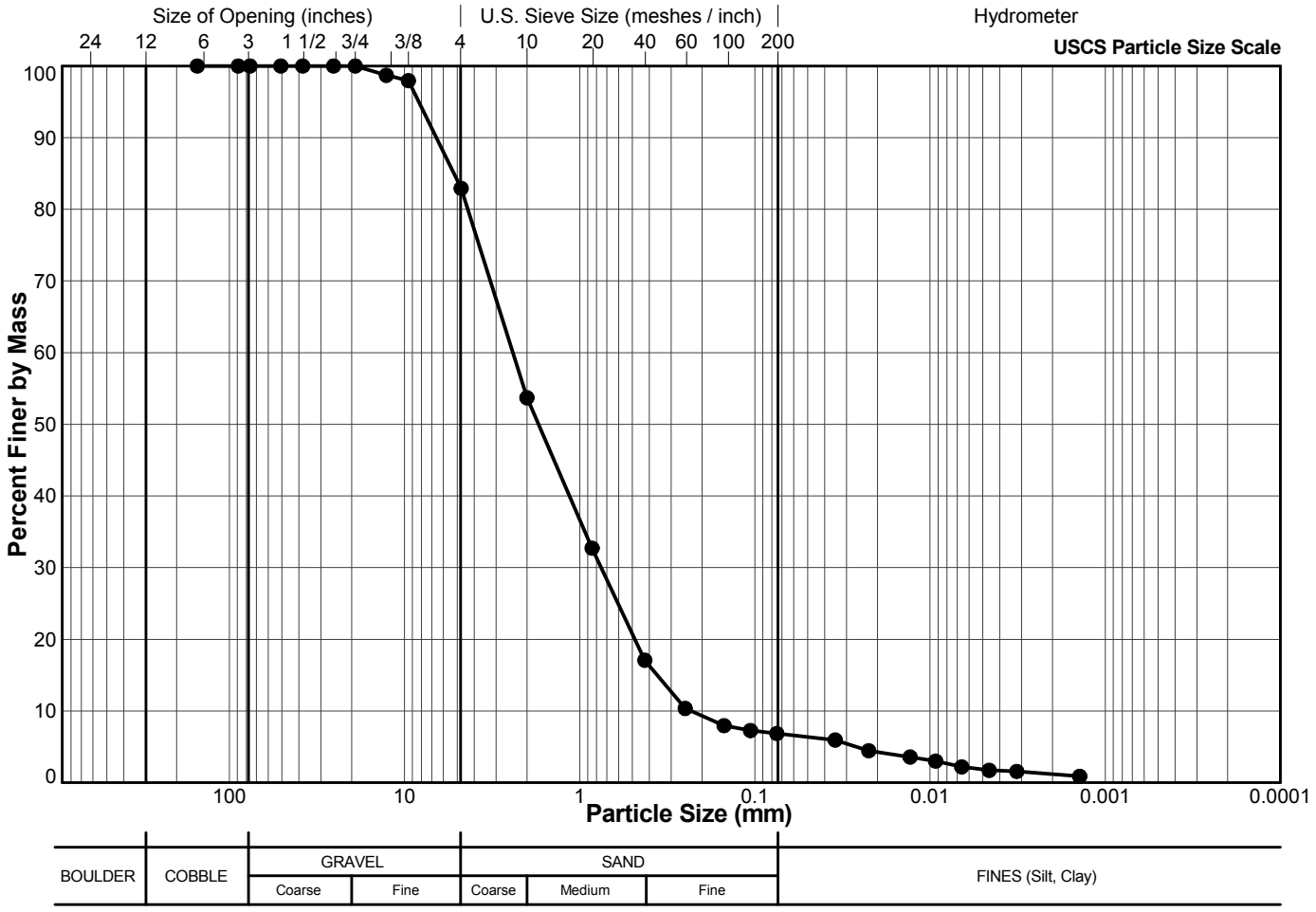
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: PORCUPINE CR-C
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		98.7
3/8"	9.5		98.0
#4 US MESH	4.75		82.9
#10 US MESH	2		53.7
#20 US MESH	0.85		32.7
#40 US MESH	0.425		17.1
#60 US MESH	0.25		10.4
#100 US MESH	0.15		7.9
#140 US MESH	0.106		7.3
#200 US MESH	0.075		6.9
		0.0348	5.9
		0.0224	4.5
		0.0130	3.6
		0.0093	3.0
		0.0066	2.2
		0.0046	1.7
		0.0032	1.6
		0.0014	0.9

LH/OA	11/10/2016	LH	11/15/2016
Tech	Date	Checked	Date

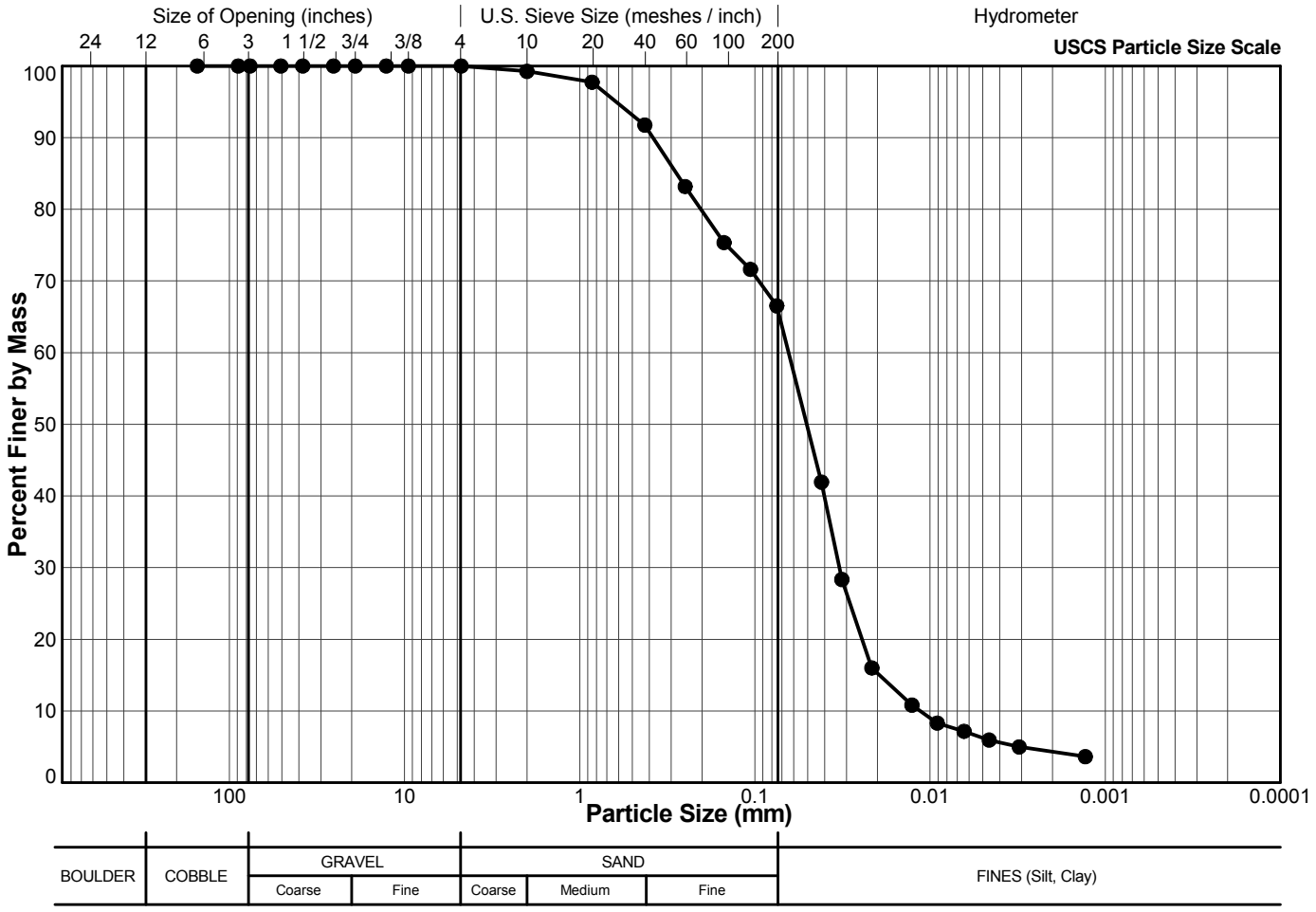
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: R-2A
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		100.0
#10 US MESH	2		99.3
#20 US MESH	0.85		97.7
#40 US MESH	0.425		91.8
#60 US MESH	0.25		83.2
#100 US MESH	0.15		75.4
#140 US MESH	0.106		71.6
#200 US MESH	0.075		66.5
		0.0417	41.9
		0.0319	28.3
		0.0215	16.0
		0.0127	10.8
		0.0091	8.3
		0.0064	7.2
		0.0046	5.9
		0.0031	5.0
		0.0013	3.6

LH/OA	11/10/2016	LH	11/15/2016
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:1467 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2015 lhu 15/11/16

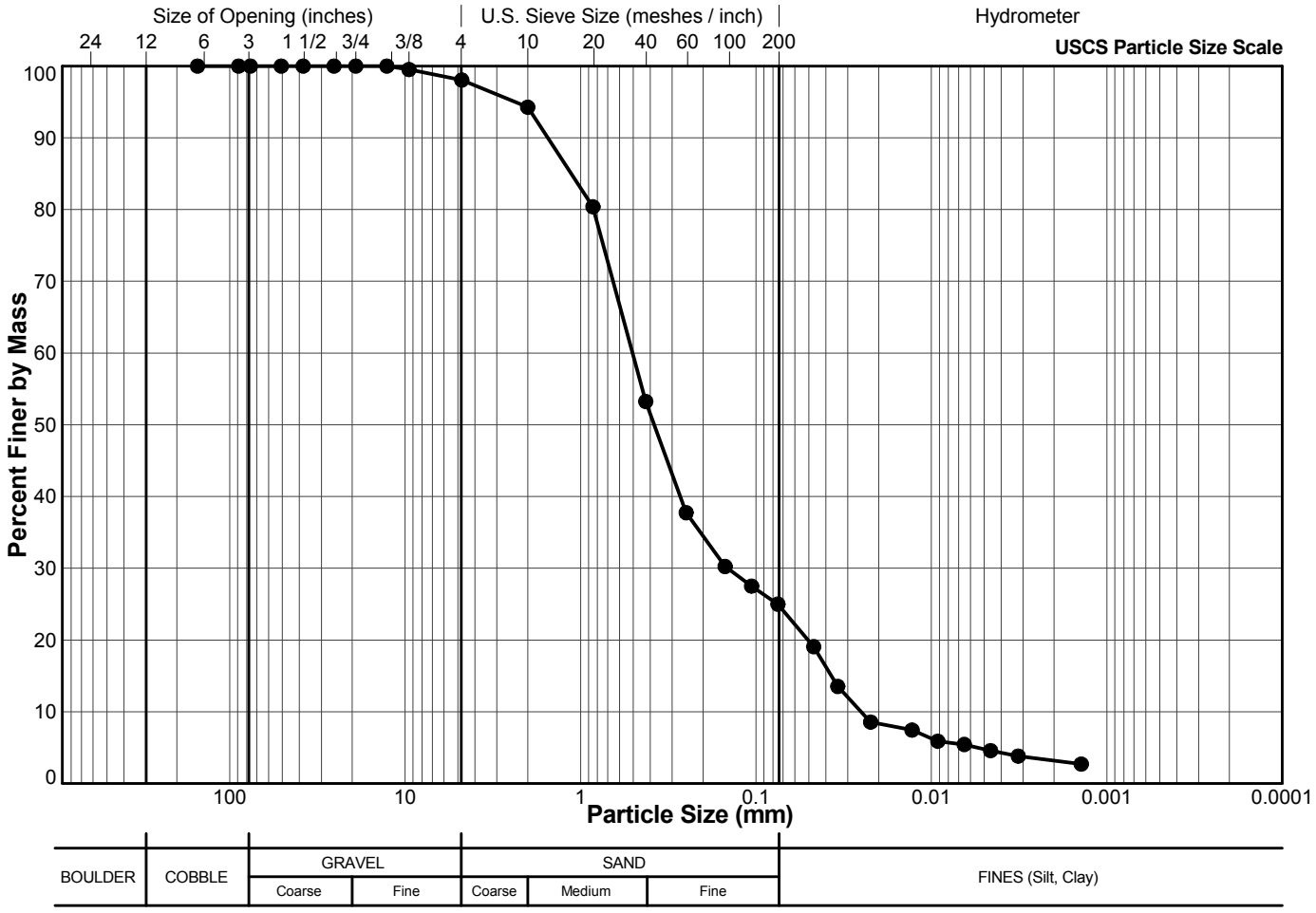
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: R-2B
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		99.5
#4 US MESH	4.75		98.1
#10 US MESH	2		94.3
#20 US MESH	0.85		80.4
#40 US MESH	0.425		53.2
#60 US MESH	0.25		37.7
#100 US MESH	0.15		30.2
#140 US MESH	0.106		27.5
#200 US MESH	0.075		25.0
		0.0469	19.1
		0.0342	13.5
		0.0222	8.6
		0.0129	7.4
		0.0092	5.9
		0.0065	5.4
		0.0046	4.6
		0.0032	3.8
		0.0014	2.7

LH/OA	11/10/2016	LH	11/15/2016
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:1467 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2015 lhu 15/11/16

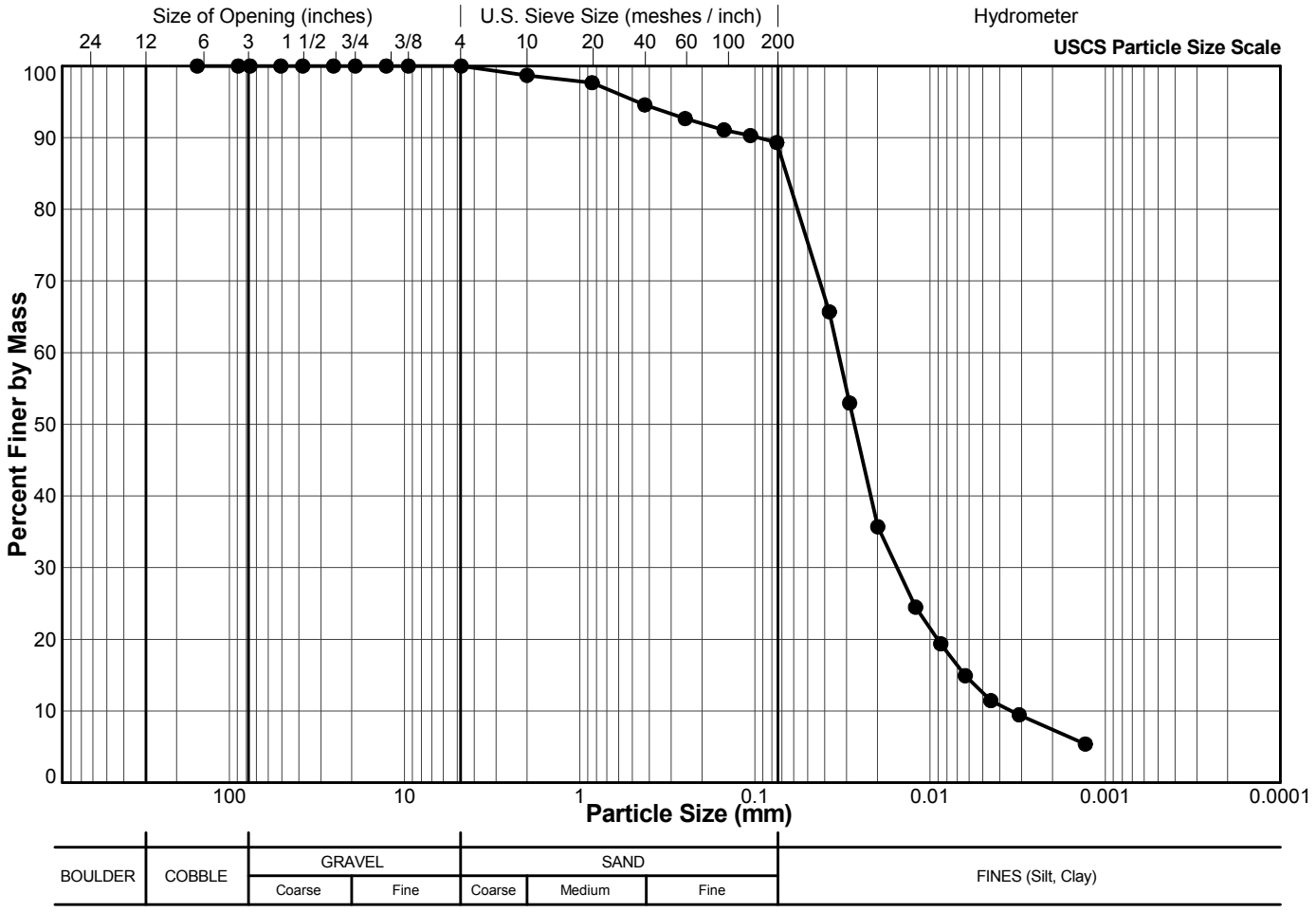
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: R-2C
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		100.0
#10 US MESH	2		98.7
#20 US MESH	0.85		97.7
#40 US MESH	0.425		94.6
#60 US MESH	0.25		92.7
#100 US MESH	0.15		91.1
#140 US MESH	0.106		90.3
#200 US MESH	0.075		89.3
		0.0376	65.7
		0.0288	53.0
		0.0199	35.7
		0.0121	24.5
		0.0087	19.4
		0.0063	14.9
		0.0045	11.4
		0.0031	9.5
		0.0013	5.4

LH/OA	11/10/2016	LH	11/15/2016
Tech	Date	Checked	Date

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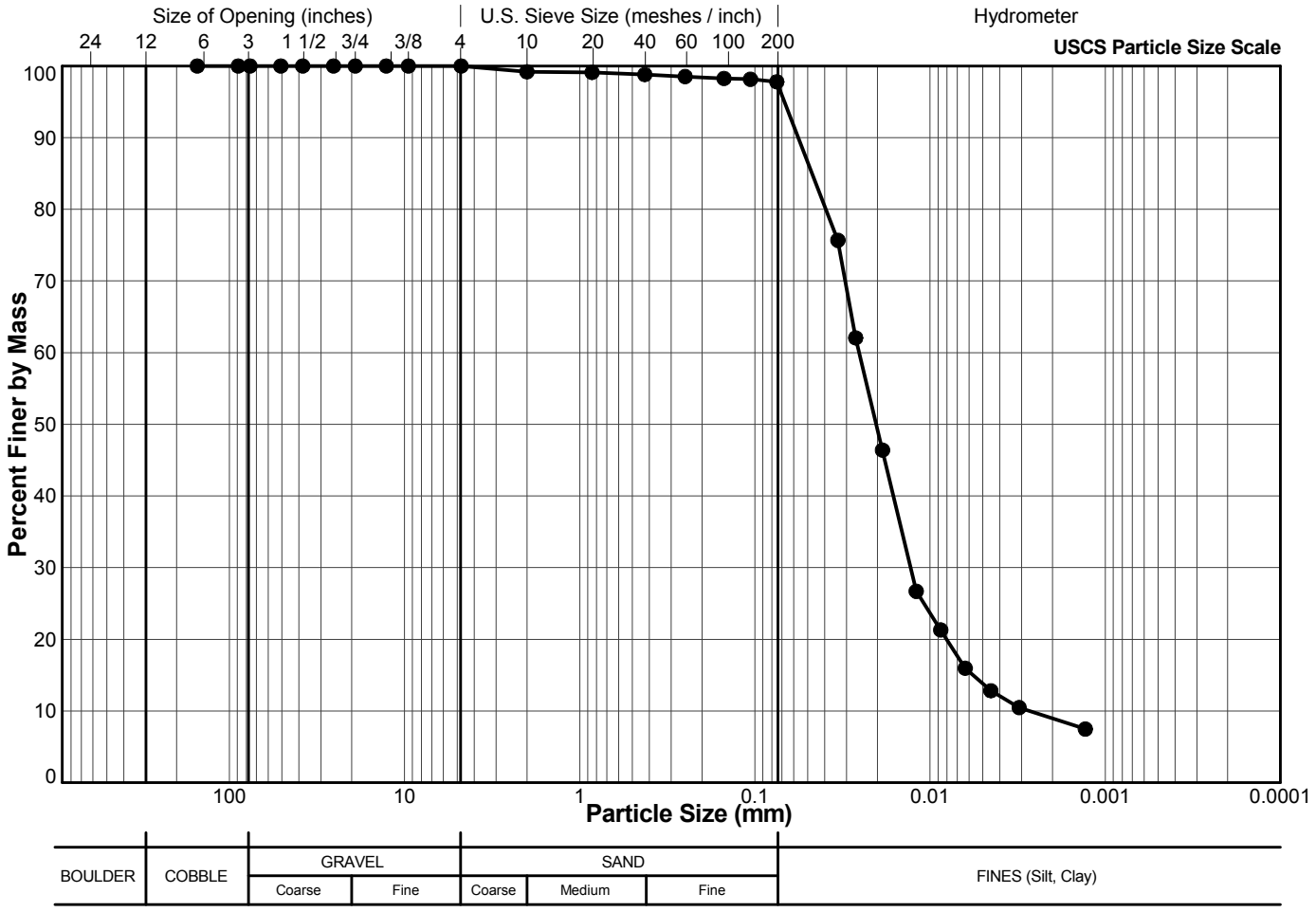
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: R-3C
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		100.0
#10 US MESH	2		99.2
#20 US MESH	0.85		99.1
#40 US MESH	0.425		98.8
#60 US MESH	0.25		98.5
#100 US MESH	0.15		98.3
#140 US MESH	0.106		98.2
#200 US MESH	0.075		97.8
		0.0336	75.7
		0.0266	62.1
		0.0187	46.4
		0.0120	26.7
		0.0087	21.3
		0.0063	16.0
		0.0045	12.8
		0.0031	10.5
		0.0013	7.5

LH/OA	11/10/2016	LH	11/15/2016
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:1467 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2015 lhu 15/11/16

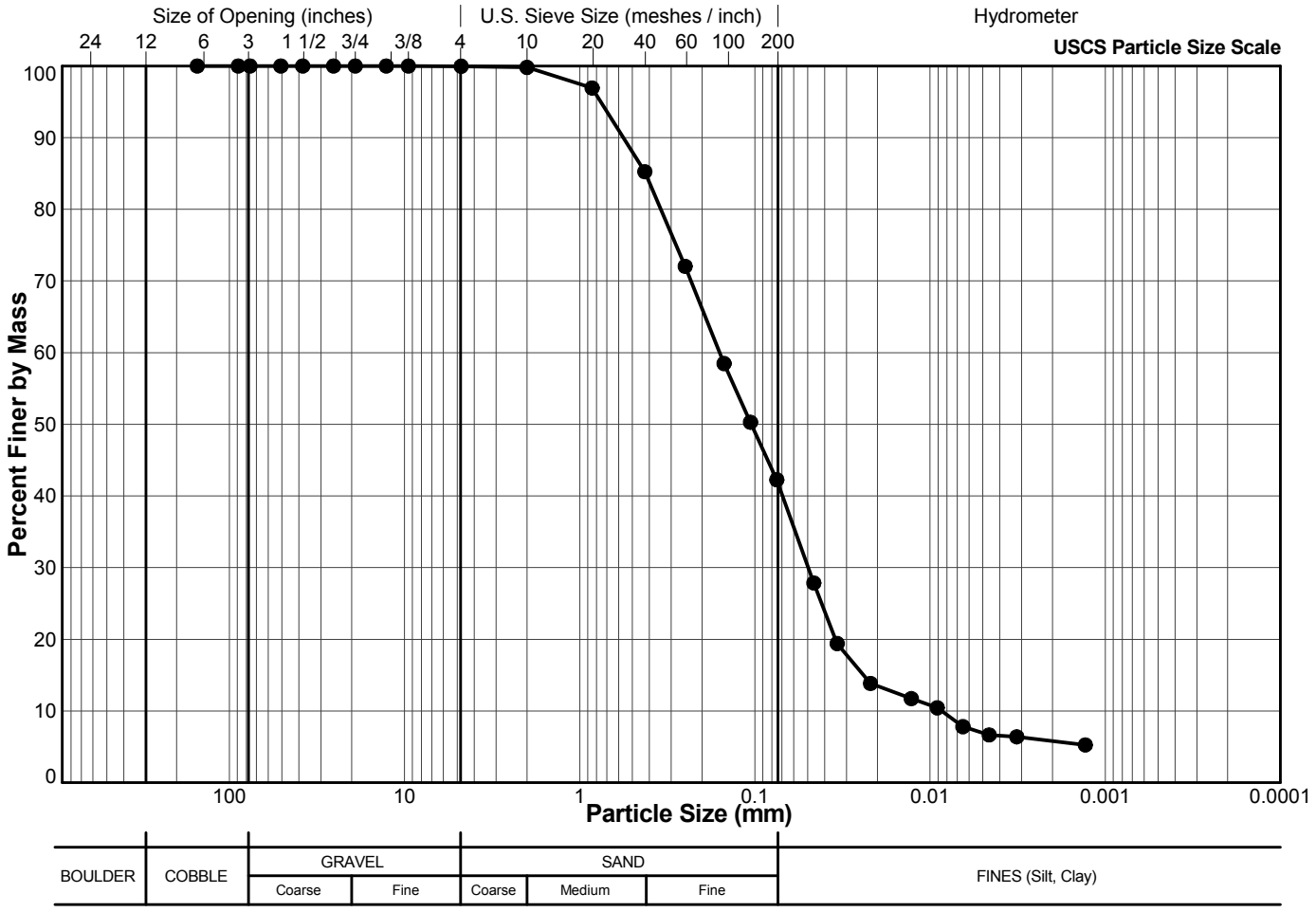
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: R-4A
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		100.0
#10 US MESH	2		99.8
#20 US MESH	0.85		96.9
#40 US MESH	0.425		85.3
#60 US MESH	0.25		72.0
#100 US MESH	0.15		58.5
#140 US MESH	0.106		50.3
#200 US MESH	0.075		42.3
		0.0461	27.9
		0.0339	19.4
		0.0219	13.8
		0.0128	11.7
		0.0091	10.4
		0.0065	7.8
		0.0046	6.7
		0.0032	6.4
		0.0013	5.3

LH/OA	11/9/2016	LH	11/15/2016
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:1467 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2015 lhu 15/11/16

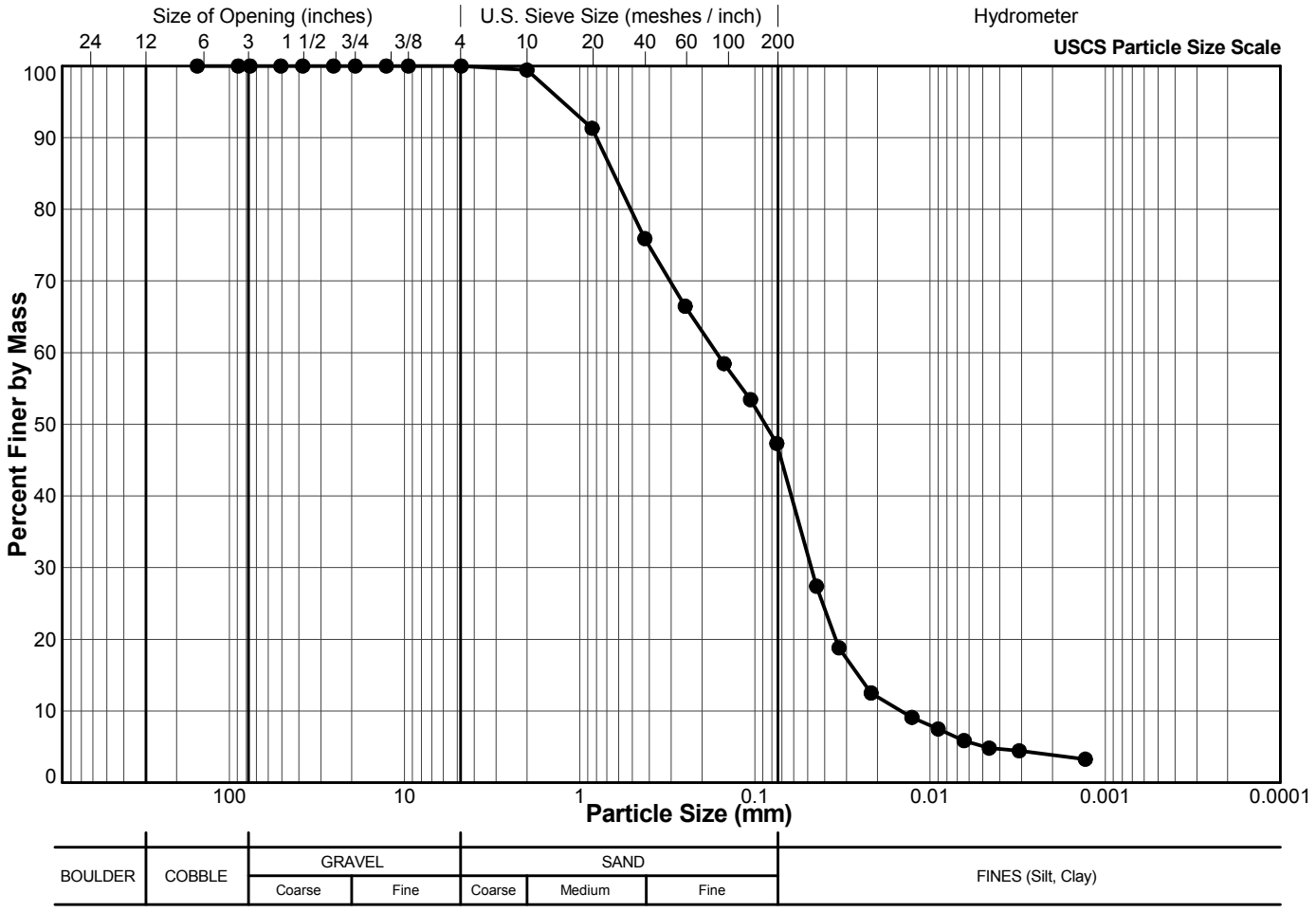
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: R-4C
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		100.0
#10 US MESH	2		99.4
#20 US MESH	0.85		91.3
#40 US MESH	0.425		75.9
#60 US MESH	0.25		66.5
#100 US MESH	0.15		58.5
#140 US MESH	0.106		53.5
#200 US MESH	0.075		47.3
		0.0445	27.4
		0.0331	18.8
		0.0217	12.5
		0.0127	9.1
		0.0090	7.5
		0.0064	5.9
		0.0046	4.8
		0.0031	4.4
		0.0013	3.3

LH/OA	11/9/2016	LH	11/15/2016
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:1467 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2015 lhu 15/11/16

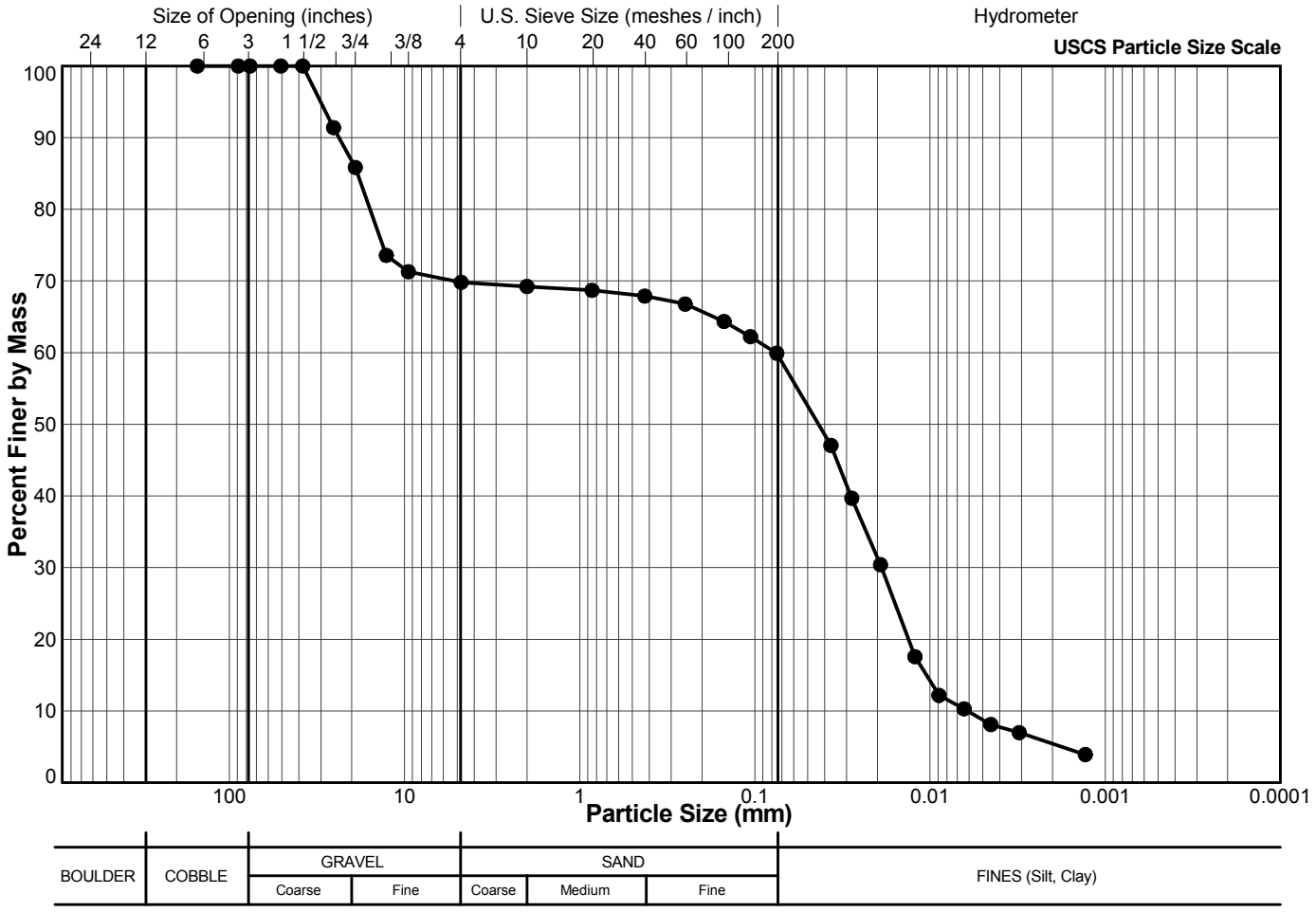
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SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: ALS
Project: L1829679 - LaBerge
Location: Clinton Creek, Yukon
Project No.: 1667729 **Phase:** 1000

Sample Location: LaBerge
Sample No.: R-6A
Depth (m): N/A
Lab Schedule No.:



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		91.4
3/4"	19.1		85.8
1/2"	12.7		73.6
3/8"	9.5		71.3
#4 US MESH	4.75		69.8
#10 US MESH	2		69.2
#20 US MESH	0.85		68.7
#40 US MESH	0.425		67.9
#60 US MESH	0.25		66.8
#100 US MESH	0.15		64.4
#140 US MESH	0.106		62.2
#200 US MESH	0.075		59.9
		0.0368	47.1
		0.0280	39.7
		0.0192	30.4
		0.0122	17.6
		0.0089	12.2
		0.0064	10.3
		0.0045	8.1
		0.0031	7.0
		0.0013	3.9

LH/OA	11/10/2016	LH	11/15/2016
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:1467 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2015 lhu 15/11/16

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** E-1A
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	35.8
Ash Content %	97.5
Organic Matter %	2.5

Note: percentages are based on oven-dried soil mass

** The test data given herein pertain to the sample provided only. This report constitutes a testing service only. Interpretation of the data can be provided upon request.*

OA/LH	November 8, 2016	LH	November 12, 2016
TESTED BY	DATE	CHECKED BY	DATE

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** E-1B
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	22.0
Ash Content %	97.6
Organic Matter %	2.4

Note: percentages are based on oven-dried soil mass

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** E-1C
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	22.1
Ash Content %	98.4
Organic Matter %	1.6

Note: percentages are based on oven-dried soil mass

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** E-2A
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	27.5
Ash Content %	98.5
Organic Matter %	1.5

Note: percentages are based on oven-dried soil mass

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** E-2B
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	32.0
Ash Content %	97.6
Organic Matter %	2.4

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** E-2C
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	29.8
Ash Content %	97.8
Organic Matter %	2.2

Note: percentages are based on oven-dried soil mass

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** E-3A
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	30.3
Ash Content %	96.7
Organic Matter %	3.3

Note: percentages are based on oven-dried soil mass

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** E-3B
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	27.0
Ash Content %	97.2
Organic Matter %	2.8

Note: percentages are based on oven-dried soil mass

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** E-3C
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Method:	Method A	**Other Remarks:**
Oven Temperature	110±5°C	
Furnace Temperature	440±22°C	

Moisture Content %	26.7
Ash Content %	97.3
Organic Matter %	2.7

Note: Moisture content as a percentage of oven-dried mass

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** E-4A
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	25.8
Ash Content %	97.8
Organic Matter %	2.2

Note: percentages are based on oven-dried soil mass

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** E-4B
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	30.7
Ash Content %	96.4
Organic Matter %	3.6

Note: percentages are based on oven-dried soil mass

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** E-4C
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	29.7
Ash Content %	96.3
Organic Matter %	3.7

Note: percentages are based on oven-dried soil mass

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** E-8A
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	10.0
Ash Content %	99.4
Organic Matter %	0.6

Note: percentages are based on oven-dried soil mass

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** E-8B
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	5.6
Ash Content %	99.6
Organic Matter %	0.4

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** E-8C
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	6.5
Ash Content %	99.5
Organic Matter %	0.5

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** PORCUPINE CR-A
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	19.1
Ash Content %	97.9
Organic Matter %	2.1

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** PORCUPINE CR-B
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	24.4
Ash Content %	97.5
Organic Matter %	2.5

Note: percentages are based on oven-dried soil mass

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** PORCUPINE CR-C
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	18.1
Ash Content %	98.3
Organic Matter %	1.7

Note: percentages are based on oven-dried soil mass

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** R-2A
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	44.7
Ash Content %	94.3
Organic Matter %	5.7

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** R-2B
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	23.1
Ash Content %	97.6
Organic Matter %	2.4

Note: percentages are based on oven-dried soil mass

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Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** R-2C
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	95.5
Ash Content %	83.6
Organic Matter %	16.4

Note: percentages are based on oven-dried soil mass

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Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** R-3C
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	49.9
Ash Content %	91.2
Organic Matter %	8.8

Note: percentages are based on oven-dried soil mass

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** R-4A
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	23.6
Ash Content %	97.8
Organic Matter %	2.2

Note: percentages are based on oven-dried soil mass

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** R-4C
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	20.2
Ash Content %	97.9
Organic Matter %	2.1

Note: percentages are based on oven-dried soil mass

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** R-6A
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	46.1
Ash Content %	92.8
Organic Matter %	7.2

Note: percentages are based on oven-dried soil mass

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** E-6A
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	28.3
Ash Content %	96.7
Organic Matter %	3.3

Note: percentages are based on oven-dried soil mass

** The test data given herein pertain to the sample provided only. This report constitutes a testing service only. Interpretation of the data can be provided upon request.*

OA/LH	November 8, 2016	LH	November 12, 2016
TESTED BY	DATE	CHECKED BY	DATE

Golder Associates Ltd
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Tel: (604) 412 6899 Fax: (604) 412 6812 www.golder.com

Golder Associates: Operations in Africa, Asia, Australasia, Europe, North America and South America

Golder Associates

MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** E-6B
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	27.5
Ash Content %	97.5
Organic Matter %	2.5

Note: percentages are based on oven-dried soil mass

** The test data given herein pertain to the sample provided only. This report constitutes a testing service only. Interpretation of the data can be provided upon request.*

OA/LH	November 8, 2016	LH	November 12, 2016
TESTED BY	DATE	CHECKED BY	DATE

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MOISTURE, ASH, AND ORGANIC MATTER OF ORGANIC SOILS		Reference(s) ASTM D2974
Client:	ALS	**Test Pit:** -
Project:	L1829672 - LaBerge	**Sample:** E-6C
Location:	Clinton Creek, Yukon	**Depth (m):** N/A
Project No.:	1667729-1000	**Lab ID No:** 440
Preparation Method:	Method A	**Other Remarks:**
Oven Temperature:	110±5°C	
Furnace Temperature:	440±22°C	

Moisture Content %	28.9
Ash Content %	98.1
Organic Matter %	1.9

Note: percentages are based on oven-dried soil mass

** The test data given herein pertain to the sample provided only. This report constitutes a testing service only. Interpretation of the data can be provided upon request.*

OA/LH	November 8, 2016	LH	November 12, 2016
TESTED BY	DATE	CHECKED BY	DATE

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WATER CONTENT DETERMINATION

Reference(s)
ASTM D 2216

Client:	ALS	**Project No.:** 1667729 **Phase:** 1000	
Project:	L1829679 - LaBerge	**Lab Schedule No.:**	
Location:	Clinton Creek, Yukon		

Sample Location	Sample No.	Specimen No.	Depth Interval		Water Content (%)
			Depth (m)	Bottom (m)	
LaBerge	**E-1A**		0.00	0.00	**35.8**
LaBerge	**E-1B**		0.00	0.00	**22.0**
LaBerge	**E-1C**		0.00	0.00	**22.1**
LaBerge	**E-2A**		0.00	0.00	**27.5**
LaBerge	**E-2B**		0.00	0.00	**32.0**
LaBerge	**E-2C**		0.00	0.00	**29.8**
LaBerge	**E-3A**		0.00	0.00	**30.3**
LaBerge	**E-3B**		0.00	0.00	**27.0**
LaBerge	**E-3C**		0.00	0.00	**26.7**
LaBerge	**E-4A**		0.00	0.00	**25.8**
LaBerge	**E-4B**		0.00	0.00	**30.7**
LaBerge	**E-4C**		0.00	0.00	**29.7**
LaBerge	**E-6A**		0.00	0.00	**28.3**
LaBerge	**E-6B**		0.00	0.00	**27.5**
LaBerge	**E-6C**		0.00	0.00	**28.9**
LaBerge	**E-8A**		0.00	0.00	**10.0**
LaBerge	**E-8B**		0.00	0.00	**5.6**
LaBerge	**E-8C**		0.00	0.00	**6.5**
LaBerge	**PORCUPINE CR-A**		0.00	0.00	**19.1**
LaBerge	**PORCUPINE CR-B**		0.00	0.00	**24.4**
LaBerge	**PORCUPINE CR-C**		0.00	0.00	**18.1**
LaBerge	**R-2A**		0.00	0.00	**44.7**
LaBerge	**R-2B**		0.00	0.00	**23.1**
LaBerge	**R-2C**		0.00	0.00	**95.5**
LaBerge	**R-3C**		0.00	0.00	**49.9**
LaBerge	**R-4A**		0.00	0.00	**23.6**
LaBerge	**R-4C**		0.00	0.00	**20.2**
LaBerge	**R-6A**		0.00	0.00	**46.1**

	LH	11/12/2016
	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID: Output Form: _LAB_WATER CONTENT (REPORT) thu 12/11/16

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Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 14 - 470676

Page 1 of 3

Report To		Report Format / Distribution		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	Laberge Environmental Services	Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3pm)
Contact:	Bonnie Burns	Quality Control (QC) Report with Report	☐ Yes ☐ No	P ☐ Priority (2-4 business days if received by 3pm)
Address:	P.O. Box 21072, Whitehorse, YT	☑ Criteria on Report - provide details below if box checked		E ☐ Emergency (1-2 business days if received by 3pm)
		Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency if received by 10am – contact ALS for surcharge.
Phone:	867-668-6838	Email 1 or Fax	bonnieburns@northwestel.net	Specify Date Required for E2,E or P:
		Email 2		

Invoice To		Invoice Distribution	
	Same as Report To ☑ Yes ☐ No	Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
	Copy of Invoice with Report ☐ Yes ☐ No	Email 1 or Fax	bonnieburns@northwestel.net
Company:	Laberge Environmental Services	Email 2	
Contact:	Bonnie Burns		

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	141612DN	Approver ID:	Cost Center:
Job #:	Clinton Creek	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)	L1829672	ALS Contact:	Sampler:

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals, incl Hg	LOI	asbestos	particle size analysis	Number of Containers
	E-1A	6/9/16		Soil	✓	✓	✓	✓	2
	E-1B	6/9/16		"	✓	✓	✓	✓	2
	E-1C	6/9/16		"	✓	✓	✓	✓	2
	E-2A	6/9/16		"	✓	✓	✓	✓	2
	E-2B	6/9/16		"	✓	✓	✓	✓	2
	E-2C	6/9/16		"	✓	✓	✓	✓	2
	E-3A	6/9/16		"	✓	✓	✓	✓	2
	E-3B	6/9/16		"	✓	✓	✓	✓	2
	E-3C	6/9/16		"	✓	✓	✓	✓	2
	E-4A	5/9/16		"	✓	✓	✓	✓	2
	E-4B	5/9/16		"	✓	✓	✓	✓	2
	E-4C	5/9/16		"	✓	✓	✓	✓	2

L1829672-COFC

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☐ No	to meet CCME freshwater aquatic life guidelines
Are samples for human drinking water use? ☐ Yes ☐ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐
Ice packs	Yes ☑	No ☐	Custody seal intact	Yes ☐	No ☐
Cooling Initiated	☑			

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
7.0, NP	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Bonnie Burns	Sept 12/16		EHF	12 Sep 2016	10:09	RM	9/16/16	8:30am

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION — WHITE - LABORATORY COPY — YELLOW - CLIENT COPY

NA-FM-0326e v09 Front/04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 14 - 470677

Page 2 of 3

Report To
Company: Laberge Env. Services
Contact: Bonnie Burns
Address: PO Box 21092, Whitehorse, YT
Phone: 867-668-6838

Report Format / Distribution
Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☑ Yes ☐ No
☑ Criteria on Report - provide details below if box checked
Select Distribution: ☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: bonnieburns@northwestel.net
Email 2

Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
R ☑ Regular (Standard TAT if received by 3pm)
P ☐ Priority (2-4 business days if received by 3pm)
E ☐ Emergency (1-2 business days if received by 3pm)
E2 ☐ Same day or weekend emergency if received by 10am – contact ALS for surcharge.
Specify Date Required for E2,E or P:

Invoice To Same as Report To ☑ Yes ☐ No
Copy of Invoice with Report ☑ Yes ☐ No
Company: Laberge Env. Serv.
Contact: Bonnie Burns

Invoice Distribution
Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax
Email 2

Project Information
ALS Quote #: 141612 DN
Job #: Clinton Creek
PO / AFE:
LSD:

Oil and Gas Required Fields (client use)
Approver ID: Cost Center:
GL Account: Routing Code:
Activity Code:
Location:

ALS Lab Work Order # (lab use only):
ALS Contact: Sampler:

Analysis Request
Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals incl Hg	LOI	Asbestos	Particle size analysis	Number of Containers
	E-8A	8/9/16		Soil	✓	✓	L	✓	2
	E-8B	8/9/16		"	✓	✓	✓	✓	2
	E-8C	8/9/16		"	✓	✓	✓	✓	2
	Porcupine Cr - A	7/9/16		"	✓	✓	✓	✓	2
	Porcupine Cr - B	7/9/16		"	✓	✓	✓	✓	2
	Porcupine Cr - C	7/9/16		"	✓	✓	✓	✓	2
	R-1A	7/9/16		"	✓	✓	✓	✓	2
	R-1B	7/9/16		"	✓	✓	✓	✓	2
	R-1C	7/9/16		"	✓	✓	✓	✓	2
	R-2A	7/9/16		"	✓	✓	✓	✓	2
	R-2B	7/9/16		"	✓	✓	✓	✓	2
	R-2C	7/9/16		"	✓	✓	✓	✓	2

L1829672-COFC

Drinking Water (DW) Samples[1] (client use)
Are samples taken from a Regulated DW System? ☐ Yes ☐ No
Are samples for human drinking water use? ☐ Yes ☐ No

Special Instructions / Specify Criteria to add on report (client Use)

SAMPLE CONDITION AS RECEIVED (lab use only)
Frozen ☐ SIF Observations Yes ☐ No ☐
Ice packs Yes ☑ No ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☑

INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C	
7.0	10.0		

SHIPMENT RELEASE (client use)
Released by: Date: Time:

INITIAL SHIPMENT RECEPTION (lab use only)
Received by: EHF Date: 12 Sep 2016 Time: 10:09

FINAL SHIPMENT RECEPTION (lab use only)
Received by: Date: Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form.**

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NA-FM-0326e v09 Front/04 January 2014

ALS Environmental
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Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 14 - 470939

Page 3 of 3

Report To
Company:
Contact: Same as 1 PJ
Address:
Phone:

Report Format / Distribution
Select Report Format: [x] PDF [x] EXCEL [ ] EDD (DIGITAL)
Quality Control (QC) Report with Report [x] Yes [ ] No
[x] Criteria on Report - provide details below if box checked
Select Distribution: [ ] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax
Email 2

Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
R [x] Regular (Standard TAT if received by 3pm)
P [ ] Priority (2-4 business days if received by 3pm)
E [ ] Emergency (1-2 business days if received by 3pm)
E2 [ ] Same day or weekend emergency if received by 10am – contact ALS for surcharge.
Specify Date Required for E2,E or P:

Invoice To Same as Report To [ ] Yes [ ] No
Copy of Invoice with Report [ ] Yes [ ] No
Company:
Contact: Same

Invoice Distribution
Select Invoice Distribution: [x] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax
Email 2

Project Information
ALS Quote #:
Job #: PJ
PO / AFE:
LSD:

Oil and Gas Required Fields (client use)
Approver ID: Cost Center:
GL Account: Routing Code:
Activity Code:
Location:

ALS Lab Work Order # (lab use only)

ALS Contact: **Sampler:**

Analysis Request
Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals incl Hg	LO1	asbestos	particle size analysis	Number of Containers
	R-3A	6/9/16		Soil	✓	✓	✓	✓	2
	R-3B	6/9/16		"	✓	✓	✓		2
	R-3C	6/9/16		"	✓	✓	✓	✓	2
	R-4A	5/9/16		"	✓	✓	✓	✓	2
	R-4B	5/9/16		"	✓	✓	✓	✓	2
	R-4C	5/9/16		"	✓	✓	✓	✓	2
	R-6A	8/9/16		"	✓	✓	✓	✓	2
	R-6B	8/9/16		"	✓	✓	✓	✓	2
	R-6C	8/9/16		"	✓	✓	✓	✓	2
	E-6A	5/9/16		"	✓	✓	✓	✓	2
	E-6B	5/9/16		"	✓	✓	✓	✓	2
	E-6C	5/9/16		"	✓	✓	✓	✓	2

L1829672-COFC

Drinking Water (DW) Samples[1] (client use)
Are samples taken from a Regulated DW System? [ ] Yes [ ] No
Are samples for human drinking water use? [ ] Yes [ ] No

Special Instructions / Specify Criteria to add on report (client Use)
to meet CCME Freshwater aquatic life guidelines

SAMPLE CONDITION AS RECEIVED (lab use only)
Frozen [ ] SIF Observations Yes [ ] No [ ]
Ice packs Yes [x] No [ ] Custody seal intact Yes [ ] No [ ]
Cooling Initiated [x]

INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C			
7.0	10.0				

SHIPMENT RELEASE (client use)
Released by: Date: Time:

INITIAL SHIPMENT RECEPTION (lab use only)
Received by: EHF Date: 12 Sep 2016 Time: 10:09

FINAL SHIPMENT RECEPTION (lab use only)
Received by: Date: Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

APPENDIX D

PERIPHYTON DATA, 2016

EPILITHIC ALGAL BIOMASS (ug/g) AND EPILITHIC ALGAL DENSITY (cells/cm2) FOR THE PERIPHYTON SAMPLES, 2016									
Location	Date	Cyanophyta		Chlorophyta		Bacillariophyta		Rhodophyta	
		µg/cm^2	cells/cm^2	µg/cm^2	cells/cm^2	µg/cm^2	cells/cm^2	µg/cm^2	cells/cm^2
E1	6/Sep/16	8.18	157,192	0.00	0	368.88	424,203	101.00	116,279
E2	6/Sep/16	3.10	66,753	0.00	0	468.71	497,416	263.67	249,785
E3	6/Sep/16	28.05	399,081	0.00	0	28.46	97,617	6.35	7,178
E4	5/Sep/16	20.39	257,321	0.00	0	196.13	144,272	23.90	26,916
E6	5/Sep/16	3.11	57,996	0.00	0	9.43	27,275	0.00	0
E8	8/Sep/16	3.21	58,968	0.00	0	24.71	33,459	2.20	3,975
PORCUPINE CR	7/Sep/16	8.65	7,178	4.47	2,871	172.20	304,335	26.84	25,840
R2	7/Sep/16	6.34	6,568	0.00	0	2.89	7,752	5.48	11,090
R3	6/Sep/16	37.13	407,695	0.00	0	6.16	24,404	6.22	14,355
R4	5/Sep/16	0.87	18,863	0.00	0	0.69	3,273	0.00	0
R6	8/Sep/16	0.67	18,088	0.00	0	29.87	157,623	0.00	0

R= QA/QC recount

E3**R**	6/Sep/16	26.31	377,548	0.00	0	31.96	97,617	13.97	15,791

2016 Epilithic algal species data, Clinton Creek

samples sorted by location

**** 1st number in species code = group 1=cyanophyte 2=chlorophyte 5=diatoms 6=Red Algae**
**** total daily biomass is sum of all species on a date**

Location	Date	Species code	Speceis name	density cells/cm^2	biomass µg/cm^2	length µ	width µ	cell volume µ^3
E1	5-Sep-16	1084	Gloeocapsa punctata	21533	1.10	4.60	4.60	51.00
E1	5-Sep-16	1131	Heteroleibeinia profunda Komarek	101206	6.23	19.60	2.00	61.60
E1	5-Sep-16	1223	Chamaesiphon incrustans Smith	34453	0.84	5.20	3.00	24.50
E1	5-Sep-16	5311	Cymbella minuta Kutzing	2153	0.70	16.00	7.20	325.70
E1	5-Sep-16	5523	Synedra ulna (Nitzsch) Ehrenberg	58140	304.42	200.00	10.00	5236.00
E1	5-Sep-16	5702	Achnanthes minutissima Kutzing	271318	18.29	16.10	4.00	67.40
E1	5-Sep-16	5836	Encyonema silesiacum (Bleisch) D.G. Mann	8613	10.15	30.00	10.00	1178.10
E1	5-Sep-16	5860	Diatoma vulgare Bory	32300	8.83	29.00	6.00	273.30
E1	5-Sep-16	5871	Cymbella lapponica	2153	2.48	44.00	10.00	1151.90
E1	5-Sep-16	5873	Gomphonema minutum	40913	18.92	27.60	8.00	462.40
E1	5-Sep-16	5875	Cocconies disculus Schum.	2153	3.09	28.00	14.00	1436.80
E1	5-Sep-16	5882	Anomoenies vitrea Ross	6460	2.01	33.00	6.00	311.00
E1	5-Sep-16	8001	Audouinella / Chantransia stage. Red alga	116279	101.00	32.00	7.20	868.60
E2	5-Sep-16	1131	Heteroleibeinia profunda Komarek	34453	2.30	21.30	2.00	66.90
E2	5-Sep-16	1223	Chamaesiphon incrustans Smith	32300	0.79	5.20	3.00	24.50
E2	5-Sep-16	5523	Synedra ulna (Nitzsch) Ehrenberg	68906	378.83	210.00	10.00	5497.80
E2	5-Sep-16	5702	Achnanthes minutissima Kutzing	219638	14.72	16.00	4.00	67.00
E2	5-Sep-16	5821	Eunotia exigua (Brebisson) Grunow	2153	0.59	29.00	6.00	273.30
E2	5-Sep-16	5836	Encyonema silesiacum (Bleisch) D.G. Mann	8613	10.15	30.00	10.00	1178.10
E2	5-Sep-16	5860	Diatoma vulgare Bory	139966	36.01	27.30	6.00	257.30
E2	5-Sep-16	5871	Cymbella lapponica	2153	2.31	41.00	10.00	1073.40
E2	5-Sep-16	5873	Gomphonema minutum	34453	15.53	26.90	8.00	450.70
E2	5-Sep-16	5875	Cocconies disculus Schum.	2153	3.01	27.20	14.00	1395.70
E2	5-Sep-16	5882	Anomoenies vitrea Ross	2153	0.69	34.00	6.00	320.40
E2	5-Sep-16	5916	Fragilaria capucina Grunow	15073	2.46	39.00	4.00	163.40
E2	5-Sep-16	5986	Meridion circulare Agardh	2153	4.42	40.00	14.00	2052.50
E2	5-Sep-16	8001	Audouinella / Chantransia stage. Red alga	249785	263.67	31.50	8.00	1055.60
E3	5-Sep-16	1131	Heteroleibeinia profunda Komarek	275624	24.45	25.60	2.10	88.70
E3	5-Sep-16	1223	Chamaesiphon incrustans Smith	123457	3.60	6.20	3.00	29.20
E3	5-Sep-16	5311	Cymbella minuta Kutzing	1436	0.52	14.30	8.00	359.40
E3	5-Sep-16	5523	Synedra ulna (Nitzsch) Ehrenberg	2871	15.03	200.00	10.00	5236.00
E3	5-Sep-16	5702	Achnanthes minutissima Kutzing	67471	4.78	16.90	4.00	70.80
E3	5-Sep-16	5836	Encyonema silesiacum (Bleisch) D.G. Mann	1436	1.69	30.00	10.00	1178.10
E3	5-Sep-16	5860	Diatoma vulgare Bory	17227	4.04	24.90	6.00	234.70
E3	5-Sep-16	5873	Gomphonema minutum	4307	1.90	26.40	8.00	442.30
E3	5-Sep-16	5916	Fragilaria capucina Grunow	2871	0.49	41.00	4.00	171.70
E3	5-Sep-16	8001	Audouinella / Chantransia stage. Red alga	7178	6.35	26.40	8.00	884.70
E3**R**	5-Sep-16	1131	Heteroleibeinia profunda Komarek	256962	22.79	25.60	2.10	88.70
E3**R**	5-Sep-16	1223	Chamaesiphon incrustans Smith	120586	3.52	6.20	3.00	29.20
E3**R**	5-Sep-16	5311	Cymbella minuta Kutzing	4307	1.55	14.30	8.00	359.40
E3**R**	5-Sep-16	5523	Synedra ulna (Nitzsch) Ehrenberg	2871	15.03	200.00	10.00	5236.00
E3**R**	5-Sep-16	5702	Achnanthes minutissima Kutzing	58857	4.17	16.90	4.00	70.80
E3**R**	5-Sep-16	5836	Encyonema silesiacum (Bleisch) D.G. Mann	1436	1.69	30.00	10.00	1178.10
E3**R**	5-Sep-16	5860	Diatoma vulgare Bory	20098	4.72	24.90	6.00	234.70
E3**R**	5-Sep-16	5871	Cymbella lapponica	1436	1.54	41.00	10.00	1073.40
E3**R**	5-Sep-16	5873	Gomphonema minutum	5742	2.54	26.40	8.00	442.30
E3**R**	5-Sep-16	5882	Anomoenies vitrea Ross	1436	0.48	35.30	6.00	332.70
E3**R**	5-Sep-16	5916	Fragilaria capucina Grunow	1436	0.25	41.00	4.00	171.70
E3**R**	5-Sep-16	8001	Audouinella / Chantransia stage. Red alga	15791	13.97	26.40	8.00	884.70
E4	5-Sep-16	1067	Cylindrospermum sp.	3230	0.38	46.00	2.20	116.60
E4	5-Sep-16	1131	Heteroleibeinia profunda Komarek	185185	18.04	31.00	2.00	97.40
E4	5-Sep-16	1223	Chamaesiphon incrustans Smith	68906	1.98	6.10	3.00	28.70
E4	5-Sep-16	5311	Cymbella minuta Kutzing	1077	0.40	14.90	8.00	374.50
E4	5-Sep-16	5523	Synedra ulna (Nitzsch) Ehrenberg	34453	180.40	200.00	10.00	5236.00
E4	5-Sep-16	5702	Achnanthes minutissima Kutzing	64599	4.14	15.30	4.00	64.10
E4	5-Sep-16	5781	Eunotia sp.	1077	0.19	24.00	5.30	176.50
E4	5-Sep-16	5860	Diatoma vulgare Bory	34453	8.51	26.20	6.00	246.90
E4	5-Sep-16	5873	Gomphonema minutum	3230	1.41	26.00	8.00	435.60
E4	5-Sep-16	5882	Anomoenies vitrea Ross	1077	0.34	34.00	6.00	320.40
E4	5-Sep-16	5916	Fragilaria capucina Grunow	4307	0.74	41.00	4.00	171.70
E4	5-Sep-16	8001	Audouinella / Chantransia stage. Red alga	26916	23.90	26.50	8.00	888.00
E6	5-Sep-16	1131	Heteroleibeinia profunda Komarek	35314	2.51	22.60	2.00	71.00
E6	5-Sep-16	1223	Chamaesiphon incrustans Smith	22682	0.60	5.60	3.00	26.40
E6	5-Sep-16	5306	Navicula minima Grunow	287	0.02	12.00	5.00	78.50
E6	5-Sep-16	5523	Synedra ulna (Nitzsch) Ehrenberg	574	3.53	235.00	10.00	6152.30
E6	5-Sep-16	5702	Achnanthes minutissima Kutzing	10910	0.73	16.00	4.00	67.00
E6	5-Sep-16	5860	Diatoma vulgare Bory	4020	1.03	27.10	6.00	255.40
E6	5-Sep-16	5873	Gomphonema minutum	8039	3.49	25.90	8.00	434.00
E6	5-Sep-16	5882	Anomoenies vitrea Ross	574	0.19	36.00	6.00	339.30
E6	5-Sep-16	5916	Fragilaria capucina Grunow	2871	0.43	36.00	4.00	150.80
E8	5-Sep-16	1084	Gloeocapsa punctata	3313	0.13	4.20	4.20	38.80
E8	5-Sep-16	1131	Heteroleibeinia profunda Komarek	21533	2.10	31.00	2.00	97.40

2016 Epilithic algal species data, Clinton Creek

samples sorted by location

**** 1st number in species code = group 1=cyanophyte 2=chlorophyte 5=diatoms 6=Red Algae**
**** total daily biomass is sum of all species on a date**

Location	Date	Species code	Speceis name	density cells/cm^2	biomass µg/cm^2	length µ	width µ	cell volume µ^3
E8	5-Sep-16	1223	Chamaesiphon incrustans Smith	34122	0.98	6.10	3.00	28.70
E8	5-Sep-16	5311	Cymbella minuta Kutzing	1656	0.67	16.00	8.00	402.10
E8	5-Sep-16	5460	Gomphonema truncatum Ehrenberg	331	0.40	46.00	10.00	1204.30
E8	5-Sep-16	5516	Fragilaria construens (Ehrenberg) Grunow	1325	0.10	18.00	4.00	75.40
E8	5-Sep-16	5523	Synedra ulna (Nitzsch) Ehrenberg	663	3.64	210.00	10.00	5497.80
E8	5-Sep-16	5702	Achnanthes minutissima Kutzing	17558	1.19	16.20	4.00	67.90
E8	5-Sep-16	5836	Encyonema silesiacum (Bleisch) D.G. Mann	1656	1.82	28.00	10.00	1099.60
E8	5-Sep-16	5860	Diatoma vulgare Bory	4638	1.09	25.00	6.00	235.60
E8	5-Sep-16	5870	Navicula radiosa Kutzing	331	0.62	72.00	10.00	1885.00
E8	5-Sep-16	5873	Gomphonema minutum	3975	1.73	26.00	8.00	435.60
E8	5-Sep-16	5880	Didymosphenia geminata Schmidt	331	13.26	118.00	36.00	40036.50
E8	5-Sep-16	5916	Fragilaria capucina Grunow	994	0.18	42.60	4.00	178.40
E8	5-Sep-16	8001	Audouinella / Chantransia stage. Red alga	3975	2.20	29.30	6.00	552.30
Porcupine Cr	5-Sep-16	1122	Phormidium autumnale Agardh	2871	8.20	101.00	6.00	2855.70
Porcupine Cr	5-Sep-16	1131	Heteroleibeinia profunda Komarek	4307	0.45	33.00	2.00	103.70
Porcupine Cr	5-Sep-16	2205	Mougeotia sp.	2871	4.47	31.00	8.00	1558.20
Porcupine Cr	5-Sep-16	5523	Synedra ulna (Nitzsch) Ehrenberg	11484	66.15	220.00	10.00	5759.60
Porcupine Cr	5-Sep-16	5702	Achnanthes minutissima Kutzing	114844	9.10	18.90	4.00	79.20
Porcupine Cr	5-Sep-16	5836	Encyonema silesiacum (Bleisch) D.G. Mann	4307	5.07	30.00	10.00	1178.10
Porcupine Cr	5-Sep-16	5860	Diatoma vulgare Bory	1436	0.38	28.00	6.00	263.90
Porcupine Cr	5-Sep-16	5870	Navicula radiosa Kutzing	1436	2.10	56.00	10.00	1466.10
Porcupine Cr	5-Sep-16	5873	Gomphonema minutum	149297	73.54	29.40	8.00	492.60
Porcupine Cr	5-Sep-16	5881	Diatoma elongatum Agardh	2871	0.49	41.00	4.00	171.70
Porcupine Cr	5-Sep-16	5884	Gomphonema angustum Agardh	11484	13.83	46.00	10.00	1204.30
Porcupine Cr	5-Sep-16	5916	Fragilaria capucina Grunow	7178	1.53	51.00	4.00	213.60
Porcupine Cr	5-Sep-16	8001	Audouinella / Chantransia stage. Red alga	25840	26.84	31.00	8.00	1038.80
R2	5-Sep-16	1122	Phormidium autumnale Agardh	1938	6.08	111.00	6.00	3138.50
R2	5-Sep-16	1131	Heteroleibeinia profunda Komarek	3445	0.23	21.10	2.00	66.30
R2	5-Sep-16	1223	Chamaesiphon incrustans Smith	1184	0.03	6.00	2.60	21.20
R2	5-Sep-16	5311	Cymbella minuta Kutzing	323	0.08	14.00	6.80	254.20
R2	5-Sep-16	5702	Achnanthes minutissima Kutzing	2261	0.15	16.20	4.00	67.90
R2	5-Sep-16	5836	Encyonema silesiacum (Bleisch) D.G. Mann	538	0.63	30.00	10.00	1178.10
R2	5-Sep-16	5860	Diatoma vulgare Bory	754	0.18	25.90	6.00	244.10
R2	5-Sep-16	5870	Navicula radiosa Kutzing	108	0.17	61.00	10.00	1597.00
R2	5-Sep-16	5873	Gomphonema minutum	3445	1.62	28.00	8.00	469.10
R2	5-Sep-16	5916	Fragilaria capucina Grunow	323	0.05	33.30	4.00	139.50
R2	5-Sep-16	8001	Audouinella / Chantransia stage. Red alga	11090	5.48	26.20	6.00	493.90
R3	5-Sep-16	1084	Gloeocapsa punctata	44502	1.73	4.20	4.20	38.80
R3	5-Sep-16	1131	Heteroleibeinia profunda Komarek	312949	33.61	31.00	2.10	107.40
R3	5-Sep-16	1223	Chamaesiphon incrustans Smith	35889	0.95	5.60	3.00	26.40
R3	5-Sep-16	1238	Clastidium cylindricum Whelden	14355	0.84	7.00	4.00	58.60
R3	5-Sep-16	5702	Achnanthes minutissima Kutzing	7178	0.48	16.00	4.00	67.00
R3	5-Sep-16	5821	Eunotia exigua (Brebisson) Grunow	1436	0.40	29.40	6.00	277.10
R3	5-Sep-16	5860	Diatoma vulgare Bory	8613	2.03	25.00	6.00	235.60
R3	5-Sep-16	5873	Gomphonema minutum	7178	3.25	27.00	8.00	452.40
R3	5-Sep-16	8001	Audouinella / Chantransia stage. Red alga	14355	6.22	23.00	6.00	433.50
R4	5-Sep-16	1084	Gloeocapsa punctata	3445	0.12	4.10	4.10	36.10
R4	5-Sep-16	1131	Heteroleibeinia profunda Komarek	8699	0.58	21.10	2.00	66.30
R4	5-Sep-16	1223	Chamaesiphon incrustans Smith	6718	0.17	5.60	2.90	24.70
R4	5-Sep-16	5311	Cymbella minuta Kutzing	172	0.07	15.60	8.00	392.10
R4	5-Sep-16	5702	Achnanthes minutissima Kutzing	1034	0.07	16.00	4.00	67.00
R4	5-Sep-16	5860	Diatoma vulgare Bory	1206	0.27	24.00	6.00	226.20
R4	5-Sep-16	5873	Gomphonema minutum	517	0.23	26.00	8.00	435.60
R4	5-Sep-16	5916	Fragilaria capucina Grunow	345	0.05	36.00	4.00	150.80
R6	5-Sep-16	1084	Gloeocapsa punctata	13781	0.50	4.10	4.10	36.10
R6	5-Sep-16	1131	Heteroleibeinia profunda Komarek	1723	0.10	19.00	2.00	59.70
R6	5-Sep-16	1223	Chamaesiphon incrustans Smith	2584	0.07	5.50	3.00	25.90
R6	5-Sep-16	5311	Cymbella minuta Kutzing	4307	1.27	15.30	7.00	294.40
R6	5-Sep-16	5702	Achnanthes minutissima Kutzing	121447	9.46	18.60	4.00	77.90
R6	5-Sep-16	5836	Encyonema silesiacum (Bleisch) D.G. Mann	4307	5.07	30.00	10.00	1178.10
R6	5-Sep-16	5871	Cymbella lapponica	861	0.97	43.00	10.00	1125.70
R6	5-Sep-16	5873	Gomphonema minutum	3445	1.67	29.00	8.00	485.90
R6	5-Sep-16	5884	Gomphonema angustum Agardh	861	0.92	41.00	10.00	1073.40
R6	5-Sep-16	5901	Denticula sp	861	0.15	18.00	6.00	169.60
R6	5-Sep-16	5916	Fragilaria capucina Grunow	21533	10.35	51.00	6.00	480.70

LABERGE ENVIRONMENTAL
ATTN: Bonnie Burns
PO Box 21072
Whitehorse YT Y1A 6P7

Date Received: 12-SEP-16
Report Date: 29-SEP-16 11:58 (MT)
Version: FINAL

Client Phone: 867-668-6838

Certificate of Analysis

Lab Work Order #: L1829615

Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers: 14-470932, 14-470930
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1829615-1 Water 06-SEP-16 14:30 E-1	L1829615-2 Water 07-SEP-16 09:40 PORCUPINE CR	L1829615-3 Water 06-SEP-16 16:30 E-2	L1829615-4 Water 06-SEP-16 09:00 E-3	L1829615-5 Water 05-SEP-16 13:10 E-4
BIOTA						
Plant Pigments	Chlorophyll a (ug)	70.6	37.4	87.0	26.4	31.9
	Pheophytin a (ug)	56.0	31.7	75.1	19.6	27.5

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1829615-6 Water 05-SEP-16 09:30 E-6	L1829615-7 Water 08-SEP-16 14:50 E-8	L1829615-9 Water 07-SEP-16 15:00 R-2	L1829615-10 Water 06-SEP-16 11:30 R-3	L1829615-11 Water 05-SEP-16 11:40 R-4
Sample ID **Description** **Sampled Date** **Sampled Time** **Client ID**						
BIOTA						
Plant Pigments	Chlorophyll a (ug)	24.1	11.3	16.5	22.0	0.126
	Pheophytin a (ug)	20.7	10.3	14.6	17.3	0.109

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1829615-12				
	Description	Water				
	Sampled Date	08-SEP-16				
	Sampled Time	16:40				
	Client ID	R-6				
Grouping	**Analyte**					
BIOTA						
Plant Pigments	Chlorophyll a (ug)	18.3				
	Pheophytin a (ug)	14.4				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1829615-1	L1829615-2	L1829615-3	L1829615-4	L1829615-5
Description	Water	Water	Water	Water	Water
Sampled Date	06-SEP-16	07-SEP-16	06-SEP-16	06-SEP-16	05-SEP-16
Sampled Time	14:30	09:40	16:30	09:00	13:10
Client ID	E-1	PORCUPINE CR	E-2	E-3	E-4
Grouping / **Analyte**					
WATER					
Physical Tests Conductivity (uS/cm)	531	1980	664	622	708
Hardness (as CaCO3) (mg/L)	281	1370	370	337	386
pH (pH)	8.20	8.38	8.11	8.15	8.14
Anions and Nutrients Sulfate (SO4) (mg/L)	151	1090	219	191	236
Total Metals Aluminum (Al)-Total (mg/L)	0.0656	0.0051	0.0516	1.23	0.185
Antimony (Sb)-Total (mg/L)	<0.00050	0.00148	<0.00050	0.00066	<0.00050
Arsenic (As)-Total (mg/L)	0.00090	0.00239	0.00109	0.00198	0.00135
Barium (Ba)-Total (mg/L)	0.071	0.026	0.066	0.107	0.067
Beryllium (Be)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.20	<0.20	<0.20
Boron (B)-Total (mg/L)	<0.10	0.23	<0.10	<0.10	<0.10
Cadmium (Cd)-Total (mg/L)	0.0000453	0.000162	0.0000474	0.000186	0.0000621
Calcium (Ca)-Total (mg/L)	68.1	187	78.3	65.0	76.0
Chromium (Cr)-Total (mg/L)	<0.0010	0.0024	<0.0010	0.0032	0.0011
Cobalt (Co)-Total (mg/L)	0.00049	<0.00030	0.00064	0.00164	0.00085
Copper (Cu)-Total (mg/L)	0.0030	0.0020	0.0026	0.0062	0.0028
Iron (Fe)-Total (mg/L)	0.323	<0.030	0.349	2.67	0.645
Lead (Pb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	0.00141	<0.00050
Lithium (Li)-Total (mg/L)	0.0028	0.0645	0.0074	0.0045	0.0095
Magnesium (Mg)-Total (mg/L)	28.0	209	42.9	42.0	46.2
Manganese (Mn)-Total (mg/L)	0.182	0.00134	0.166	0.226	0.193
Mercury (Hg)-Total (mg/L)	0.0000057	0.0000051	0.0000062	0.0000189	0.0000068
Molybdenum (Mo)-Total (mg/L)	0.0013	0.0026	0.0015	0.0017	0.0016
Nickel (Ni)-Total (mg/L)	0.0046	0.0573	0.0110	0.0093	0.0134
Phosphorus (P)-Total (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Total (mg/L)	<2.0	2.6	<2.0	<2.0	<2.0
Selenium (Se)-Total (mg/L)	0.00188	0.00501	0.00194	0.00167	0.00179
Silicon (Si)-Total (mg/L)	5.13	6.10	5.05	7.74	5.26
Silver (Ag)-Total (mg/L)	<0.000020	<0.000020	<0.000020	0.000053	<0.000020
Sodium (Na)-Total (mg/L)	2.9	13.7	3.7	4.9	4.2
Strontium (Sr)-Total (mg/L)	0.304	1.62	0.418	0.327	0.426
Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Titanium (Ti)-Total (mg/L)	<0.010	<0.010	<0.010	0.030	<0.010
Uranium (U)-Total (mg/L)	0.00185	0.00530	0.00207	0.00248	0.00223
Vanadium (V)-Total (mg/L)	0.00069	<0.00050	0.00067	0.00430	0.00105
Zinc (Zn)-Total (mg/L)	<0.0050	0.0067	<0.0050	0.0147	<0.0050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1829615-6	L1829615-7	L1829615-8	L1829615-9	L1829615-10
Description	Water	Water	Water	Water	Water
Sampled Date	05-SEP-16	08-SEP-16	07-SEP-16	07-SEP-16	06-SEP-16
Sampled Time	09:30	14:50	12:45	15:00	11:30
Client ID	E-6	E-8	R-1	R-2	R-3
Grouping / **Analyte**					
WATER					
Physical Tests Conductivity (uS/cm)	716	250	700	618	682
Hardness (as CaCO3) (mg/L)	385	116	375	328	367
pH (pH)	8.20	8.06	8.21	8.25	8.17
Anions and Nutrients Sulfate (SO4) (mg/L)	235	47.9	224	169	218
Total Metals Aluminum (Al)-Total (mg/L)	0.549	0.281	0.819	0.316	0.345
Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic (As)-Total (mg/L)	0.00195	0.00079	0.00148	0.00132	0.00101
Barium (Ba)-Total (mg/L)	0.089	0.048	0.081	0.062	0.080
Beryllium (Be)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.20	<0.20	<0.20
Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd)-Total (mg/L)	0.000104	0.0000339	0.000174	0.0000351	0.0000320
Calcium (Ca)-Total (mg/L)	78.0	31.2	93.6	61.9	71.2
Chromium (Cr)-Total (mg/L)	0.0023	<0.0010	0.0018	0.0013	0.0013
Cobalt (Co)-Total (mg/L)	0.00166	0.00073	0.00142	0.00054	0.00076
Copper (Cu)-Total (mg/L)	0.0042	0.0031	0.0041	0.0021	0.0027
Iron (Fe)-Total (mg/L)	1.40	0.634	1.73	1.01	1.01
Lead (Pb)-Total (mg/L)	0.00077	<0.00050	0.00132	<0.00050	<0.00050
Lithium (Li)-Total (mg/L)	0.0088	0.0035	0.0039	0.0058	0.0033
Magnesium (Mg)-Total (mg/L)	45.0	9.51	34.5	42.2	45.5
Manganese (Mn)-Total (mg/L)	0.378	0.0625	0.400	0.143	0.280
Mercury (Hg)-Total (mg/L)	0.0000114	<0.0000050	0.0000128	0.0000052	0.0000056
Molybdenum (Mo)-Total (mg/L)	0.0016	<0.0010	0.0015	<0.0010	0.0013
Nickel (Ni)-Total (mg/L)	0.0164	0.0038	0.0065	0.0047	0.0044
Phosphorus (P)-Total (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Total (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
Selenium (Se)-Total (mg/L)	0.00190	0.000317	0.00298	0.000780	0.000985
Silicon (Si)-Total (mg/L)	6.02	5.82	6.02	6.36	6.61
Silver (Ag)-Total (mg/L)	0.000033	<0.000020	0.000031	<0.000020	<0.000020
Sodium (Na)-Total (mg/L)	4.2	3.7	3.5	3.2	4.4
Strontium (Sr)-Total (mg/L)	0.433	0.158	0.425	0.328	0.347
Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Titanium (Ti)-Total (mg/L)	0.021	<0.010	0.032	0.012	0.011
Uranium (U)-Total (mg/L)	0.00242	0.00100	0.00253	0.00350	0.00319
Vanadium (V)-Total (mg/L)	0.00227	0.00151	0.00255	0.00164	0.00172
Zinc (Zn)-Total (mg/L)	0.0147	0.0054	0.0138	<0.0050	<0.0050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1829615-11	L1829615-12	L1829615-13	L1829615-14	L1829615-15
Description	Water	Water	Water	Water	Water
Sampled Date	05-SEP-16	08-SEP-16	08-SEP-16		
Sampled Time	11:40	16:40	12:00		
Client ID	R-4	R-6	MAIDEN CR	FIELD BLANK	TRAVEL BLANK
Grouping / **Analyte**					
WATER					
Physical Tests Conductivity (uS/cm)	610	243	196	<2.0	<2.0
Hardness (as CaCO3) (mg/L)	324	111	84.0	<0.50	
pH (pH)	8.26	8.06	7.15	5.57	5.53
Anions and Nutrients Sulfate (SO4) (mg/L)	159	45.9	53.5	<0.30	<0.30
Total Metals Aluminum (Al)-Total (mg/L)	2.22	0.334	2.21	<0.0050	
Antimony (Sb)-Total (mg/L)	0.00067	<0.00050	<0.00050	<0.00050	
Arsenic (As)-Total (mg/L)	0.00493	0.00078	0.00210	<0.00050	
Barium (Ba)-Total (mg/L)	0.183	0.052	0.104	<0.020	
Beryllium (Be)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.20	<0.20	
Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	
Cadmium (Cd)-Total (mg/L)	0.000365	0.0000315	0.000186	<0.0000050	
Calcium (Ca)-Total (mg/L)	84.1	32.3	17.2	<0.10	
Chromium (Cr)-Total (mg/L)	0.0052	<0.0010	0.0039	<0.0010	
Cobalt (Co)-Total (mg/L)	0.00376	0.00078	0.00272	<0.00030	
Copper (Cu)-Total (mg/L)	0.0123	0.0033	0.0081	<0.0010	
Iron (Fe)-Total (mg/L)	4.98	0.762	3.38	<0.030	
Lead (Pb)-Total (mg/L)	0.00330	<0.00050	0.00189	<0.00050	
Lithium (Li)-Total (mg/L)	0.0040	0.0031	0.0021	<0.0010	
Magnesium (Mg)-Total (mg/L)	33.4	10.0	12.1	<0.10	
Manganese (Mn)-Total (mg/L)	0.433	0.0676	0.252	<0.00010	
Mercury (Hg)-Total (mg/L)	0.000064 DLM	<0.0000050	0.0000108	<0.0000050	
Molybdenum (Mo)-Total (mg/L)	0.0024	<0.0010	<0.0010	<0.0010	
Nickel (Ni)-Total (mg/L)	0.0242	0.0040	0.0087	<0.0010	
Phosphorus (P)-Total (mg/L)	<0.30	<0.30	<0.30	<0.30	
Potassium (K)-Total (mg/L)	<2.0	<2.0	<2.0	<2.0	
Selenium (Se)-Total (mg/L)	0.00363	0.000280	0.000582	<0.000050	
Silicon (Si)-Total (mg/L)	8.86	6.35	8.56	<0.050	
Silver (Ag)-Total (mg/L)	0.000169	<0.000020	0.000036	<0.000020	
Sodium (Na)-Total (mg/L)	4.5	3.9	2.4	<2.0	
Strontium (Sr)-Total (mg/L)	0.439	0.166	0.0852	<0.0050	
Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	
Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
Titanium (Ti)-Total (mg/L)	0.058	0.011	0.066	<0.010	
Uranium (U)-Total (mg/L)	0.00353	0.00099	0.00067	<0.00020	
Vanadium (V)-Total (mg/L)	0.00774	0.00169	0.00631	<0.00050	
Zinc (Zn)-Total (mg/L)	0.0245	0.0057	0.0214	<0.0050	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1829615-16				
	Description	Water				
	Sampled Date	06-SEP-16				
	Sampled Time					
	Client ID	DUPLICATE				
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	684				
	Hardness (as CaCO3) (mg/L)	366				
	pH (pH)	8.09				
Anions and Nutrients	Sulfate (SO4) (mg/L)	219				
Total Metals	Aluminum (Al)-Total (mg/L)	0.0525				
	Antimony (Sb)-Total (mg/L)	<0.00050				
	Arsenic (As)-Total (mg/L)	0.00115				
	Barium (Ba)-Total (mg/L)	0.066				
	Beryllium (Be)-Total (mg/L)	<0.0010				
	Bismuth (Bi)-Total (mg/L)	<0.20				
	Boron (B)-Total (mg/L)	<0.10				
	Cadmium (Cd)-Total (mg/L)	0.0000521				
	Calcium (Ca)-Total (mg/L)	80.1				
	Chromium (Cr)-Total (mg/L)	<0.0010				
	Cobalt (Co)-Total (mg/L)	0.00067				
	Copper (Cu)-Total (mg/L)	0.0026				
	Iron (Fe)-Total (mg/L)	0.355				
	Lead (Pb)-Total (mg/L)	<0.00050				
	Lithium (Li)-Total (mg/L)	0.0073				
	Magnesium (Mg)-Total (mg/L)	43.9				
	Manganese (Mn)-Total (mg/L)	0.179				
	Mercury (Hg)-Total (mg/L)	0.0000058				
	Molybdenum (Mo)-Total (mg/L)	0.0014				
	Nickel (Ni)-Total (mg/L)	0.0115				
	Phosphorus (P)-Total (mg/L)	<0.30				
	Potassium (K)-Total (mg/L)	<2.0				
	Selenium (Se)-Total (mg/L)	0.00184				
	Silicon (Si)-Total (mg/L)	5.13				
	Silver (Ag)-Total (mg/L)	<0.000020				
	Sodium (Na)-Total (mg/L)	3.5				
	Strontium (Sr)-Total (mg/L)	0.412				
	Thallium (Tl)-Total (mg/L)	<0.00020				
	Tin (Sn)-Total (mg/L)	<0.00050				
	Titanium (Ti)-Total (mg/L)	<0.010				
	Uranium (U)-Total (mg/L)	0.00198				
	Vanadium (V)-Total (mg/L)	0.00071				
	Zinc (Zn)-Total (mg/L)	<0.0050				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1829615-1	L1829615-2	L1829615-3	L1829615-4	L1829615-5
Description	Water	Water	Water	Water	Water
Sampled Date	06-SEP-16	07-SEP-16	06-SEP-16	06-SEP-16	05-SEP-16
Sampled Time	14:30	09:40	16:30	09:00	13:10
Client ID	E-1	PORCUPINE CR	E-2	E-3	E-4
Grouping / **Analyte**					
WATER					
Dissolved Metals Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved (mg/L)	0.0432	<0.0050	0.0348	0.0303	0.0294
Antimony (Sb)-Dissolved (mg/L)	<0.00050	0.00148	<0.00050	0.00054	<0.00050
Arsenic (As)-Dissolved (mg/L)	0.00078	0.00255	0.00105	0.00085	0.00108
Barium (Ba)-Dissolved (mg/L)	0.065	0.025	0.059	0.063	0.058
Beryllium (Be)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.20	<0.20	<0.20
Boron (B)-Dissolved (mg/L)	<0.10	0.22	<0.10	<0.10	<0.10
Cadmium (Cd)-Dissolved (mg/L)	0.0000391	0.000181	0.0000500	0.0000248	0.0000419
Calcium (Ca)-Dissolved (mg/L)	64.4	185	74.9	60.8	73.9
Chromium (Cr)-Dissolved (mg/L)	<0.0010	0.0024	<0.0010	0.0051	<0.0010
Cobalt (Co)-Dissolved (mg/L)	0.00043	<0.00030	0.00061	0.00051	0.00066
Copper (Cu)-Dissolved (mg/L)	0.0027	0.0011	0.0024	0.0018	0.0021
Iron (Fe)-Dissolved (mg/L)	0.246	<0.030	0.268	0.280	0.284
Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Lithium (Li)-Dissolved (mg/L)	0.0028	0.0629	0.0073	0.0035	0.0091
Magnesium (Mg)-Dissolved (mg/L)	29.3	221	44.5	44.9	49.0
Manganese (Mn)-Dissolved (mg/L)	0.164	0.00116	0.160	0.170	0.174
Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum (Mo)-Dissolved (mg/L)	0.0012	0.0024	0.0014	0.0012	0.0014
Nickel (Ni)-Dissolved (mg/L)	0.0044	0.0594	0.0107	0.0080	0.0117
Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Dissolved (mg/L)	<2.0	2.8	<2.0	<2.0	<2.0
Selenium (Se)-Dissolved (mg/L)	0.00192	0.00514	0.00198	0.00146	0.00196
Silicon (Si)-Dissolved (mg/L)	4.88	6.08	4.86	5.77	4.93
Silver (Ag)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Sodium (Na)-Dissolved (mg/L)	2.3	14.0	2.9	4.0	3.5
Strontium (Sr)-Dissolved (mg/L)	0.278	1.65	0.373	0.284	0.389
Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Dissolved (mg/L)	0.00178	0.00526	0.00196	0.00236	0.00207
Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	0.00055	<0.00050
Zinc (Zn)-Dissolved (mg/L)	<0.0050	0.0063	<0.0050	<0.0050	<0.0050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1829615-6 Water 05-SEP-16 09:30 E-6	L1829615-7 Water 08-SEP-16 14:50 E-8	L1829615-8 Water 07-SEP-16 12:45 R-1	L1829615-9 Water 07-SEP-16 15:00 R-2	L1829615-10 Water 06-SEP-16 11:30 R-3
WATER						
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0286	0.0922	0.0289	0.0406	0.0298
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Dissolved (mg/L)	0.00123	0.00060	0.00057	0.00108	0.00067
	Barium (Ba)-Dissolved (mg/L)	0.068	0.043	0.057	0.052	0.064
	Beryllium (Be)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B)-Dissolved (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Dissolved (mg/L)	0.0000492	0.0000256	0.0000749	0.0000271	0.0000190
	Calcium (Ca)-Dissolved (mg/L)	74.7	30.8	90.2	59.4	69.5
	Chromium (Cr)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Cobalt (Co)-Dissolved (mg/L)	0.00111	0.00056	0.00071	0.00034	0.00052
	Copper (Cu)-Dissolved (mg/L)	0.0022	0.0027	0.0019	0.0016	0.0018
	Iron (Fe)-Dissolved (mg/L)	0.323	0.300	0.269	0.519	0.365
	Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Lithium (Li)-Dissolved (mg/L)	0.0087	0.0036	0.0028	0.0057	0.0027
	Magnesium (Mg)-Dissolved (mg/L)	48.3	9.40	36.4	43.6	46.9
	Manganese (Mn)-Dissolved (mg/L)	0.351	0.0544	0.331	0.130	0.261
	Mercury (Hg)-Dissolved (mg/L)	0.0000051	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.0014	<0.0010	0.0012	<0.0010	0.0011
	Nickel (Ni)-Dissolved (mg/L)	0.0131	0.0034	0.0042	0.0041	0.0037
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Dissolved (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Selenium (Se)-Dissolved (mg/L)	0.00186	0.000295	0.00291	0.000725	0.000994
	Silicon (Si)-Dissolved (mg/L)	4.98	5.54	4.71	5.82	6.00
	Silver (Ag)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Sodium (Na)-Dissolved (mg/L)	3.4	3.0	2.6	2.4	3.6
	Strontium (Sr)-Dissolved (mg/L)	0.383	0.143	0.374	0.293	0.311
	Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.00231	0.00098	0.00226	0.00341	0.00302
	Vanadium (V)-Dissolved (mg/L)	<0.00050	0.00079	<0.00050	0.00066	0.00060
	Zinc (Zn)-Dissolved (mg/L)	0.0062	<0.0050	<0.0050	<0.0050	<0.0050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1829615-11	L1829615-12	L1829615-13	L1829615-14	L1829615-15
Description	Water	Water	Water	Water	Water
Sampled Date	05-SEP-16	08-SEP-16	08-SEP-16		
Sampled Time	11:40	16:40	12:00		
Client ID	R-4	R-6	MAIDEN CR	FIELD BLANK	TRAVEL BLANK
Grouping / **Analyte**					
WATER					
Dissolved Metals Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	
Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	
Aluminum (Al)-Dissolved (mg/L)	0.0199	0.0846	0.172	<0.0050	
Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
Arsenic (As)-Dissolved (mg/L)	0.00207	0.00059	0.00076	<0.00050	
Barium (Ba)-Dissolved (mg/L)	0.090	0.041	0.049	<0.020	
Beryllium (Be)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.20	<0.20	
Boron (B)-Dissolved (mg/L)	<0.10	<0.10	<0.10	<0.10	
Cadmium (Cd)-Dissolved (mg/L)	0.0000464	0.0000227	0.0000397	<0.0000050	
Calcium (Ca)-Dissolved (mg/L)	76.7	29.3	15.6	<0.10	
Chromium (Cr)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
Cobalt (Co)-Dissolved (mg/L)	0.00123	0.00055	0.00126	<0.00030	
Copper (Cu)-Dissolved (mg/L)	0.0019	0.0026	0.0039	<0.0010	
Iron (Fe)-Dissolved (mg/L)	0.159	0.306	0.516	<0.030	
Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
Lithium (Li)-Dissolved (mg/L)	0.0020	0.0032	<0.0010	<0.0010	
Magnesium (Mg)-Dissolved (mg/L)	32.1	9.09	10.9	<0.10	
Manganese (Mn)-Dissolved (mg/L)	0.299	0.0508	0.188	<0.00010	
Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	0.0000059	<0.0000050	
Molybdenum (Mo)-Dissolved (mg/L)	0.0013	<0.0010	<0.0010	<0.0010	
Nickel (Ni)-Dissolved (mg/L)	0.0117	0.0032	0.0050	<0.0010	
Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30	
Potassium (K)-Dissolved (mg/L)	<2.0	<2.0	<2.0	<2.0	
Selenium (Se)-Dissolved (mg/L)	0.00324	0.000257	0.000574	<0.000050	
Silicon (Si)-Dissolved (mg/L)	5.44	5.56	5.74	<0.050	
Silver (Ag)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	
Sodium (Na)-Dissolved (mg/L)	3.6	3.0	<2.0	<2.0	
Strontium (Sr)-Dissolved (mg/L)	0.371	0.140	0.0714	<0.0050	
Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	
Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	
Uranium (U)-Dissolved (mg/L)	0.00314	0.00087	0.00042	<0.00020	
Vanadium (V)-Dissolved (mg/L)	<0.00050	0.00080	0.00078	<0.00050	
Zinc (Zn)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1829615-16
	Description	Water
	Sampled Date	06-SEP-16
	Sampled Time	
	Client ID	DUPLICATE
Grouping	**Analyte**	
WATER		
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD
	Dissolved Metals Filtration Location	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0370
	Antimony (Sb)-Dissolved (mg/L)	<0.00050
	Arsenic (As)-Dissolved (mg/L)	0.00106
	Barium (Ba)-Dissolved (mg/L)	0.058
	Beryllium (Be)-Dissolved (mg/L)	<0.0010
	Bismuth (Bi)-Dissolved (mg/L)	<0.20
	Boron (B)-Dissolved (mg/L)	<0.10
	Cadmium (Cd)-Dissolved (mg/L)	0.0000497
	Calcium (Ca)-Dissolved (mg/L)	73.2
	Chromium (Cr)-Dissolved (mg/L)	<0.0010
	Cobalt (Co)-Dissolved (mg/L)	0.00063
	Copper (Cu)-Dissolved (mg/L)	0.0024
	Iron (Fe)-Dissolved (mg/L)	0.256
	Lead (Pb)-Dissolved (mg/L)	<0.00050
	Lithium (Li)-Dissolved (mg/L)	0.0072
	Magnesium (Mg)-Dissolved (mg/L)	44.5
	Manganese (Mn)-Dissolved (mg/L)	0.166
	Mercury (Hg)-Dissolved (mg/L)	0.0000051
	Molybdenum (Mo)-Dissolved (mg/L)	0.0014
	Nickel (Ni)-Dissolved (mg/L)	0.0110
	Phosphorus (P)-Dissolved (mg/L)	<0.30
	Potassium (K)-Dissolved (mg/L)	<2.0
	Selenium (Se)-Dissolved (mg/L)	0.00195
	Silicon (Si)-Dissolved (mg/L)	4.75
	Silver (Ag)-Dissolved (mg/L)	<0.000020
	Sodium (Na)-Dissolved (mg/L)	2.8
	Strontium (Sr)-Dissolved (mg/L)	0.368
	Thallium (Tl)-Dissolved (mg/L)	<0.00020
	Tin (Sn)-Dissolved (mg/L)	<0.00050
	Titanium (Ti)-Dissolved (mg/L)	<0.010
	Uranium (U)-Dissolved (mg/L)	0.00199
	Vanadium (V)-Dissolved (mg/L)	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Aluminum (Al)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Antimony (Sb)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Uranium (U)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1829615-1, -10, -11, -12, -13, -14, -16, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Aluminum (Al)-Total	MS-B	L1829615-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Aluminum (Al)-Total	MS-B	L1829615-10, -11, -12, -13, -14, -16, -9
Matrix Spike	Manganese (Mn)-Total	MS-B	L1829615-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Manganese (Mn)-Total	MS-B	L1829615-10, -11, -12, -13, -14, -16, -9
Matrix Spike	Calcium (Ca)-Total	MS-B	L1829615-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Iron (Fe)-Total	MS-B	L1829615-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Iron (Fe)-Total	MS-B	L1829615-10, -11, -12, -13, -14, -16, -9
Matrix Spike	Silicon (Si)-Total	MS-B	L1829615-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Silicon (Si)-Total	MS-B	L1829615-10, -11, -12, -13, -14, -16, -9
Matrix Spike	Strontium (Sr)-Total	MS-B	L1829615-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sulfate (SO4)	MS-B	L1829615-2
Matrix Spike	Sulfate (SO4)	MS-B	L1829615-2

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
AREA SAMPLED-VA	Biota	Area Sampled (cm2)	Not Applicable

Reference Information

CHLOROA-F-VA Biota Chlorophyll a in Biota by Fluorometer EPA 445.0

This analysis is done using procedures adapted from EPA Method 445.0. Chlorophyll-a is determined by a routine acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b. Note: Biota samples are typically submitted as scrapings on a filter.

EC-PCT-VA Water Conductivity (Automated) APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

HARDNESS-CALC-VA Water Hardness APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA Water Diss. Mercury in Water by CVAAS or CVAFS APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-CVAA-VA Water Total Mercury in Water by CVAAS or CVAFS EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-DIS-ICP-VA Water Dissolved Metals in Water by ICPOES EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-TOT-ICP-VA Water Total Metals in Water by ICPOES EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H "pH Value"

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PHEOPHYTIN-F-VA Biota Pheophytin a in Biota by Fluorometer EPA 445.0

This analysis is done using procedures modified from EPA 445.0 . Pheopigments present in a biota sample are determined collectively as pheophytin a. Pheophytin a is determined by a routine acetone extraction followed with analysis by flourometry using the acidification procedure.
Note: Biota samples are typically submitted as scrapings on a filter.

Reference Information

SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

14-470932, 14-470930

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

23-Sep-2016

Brent Mack
ALS Environmental
8081 Lougheed HWY
Suite 100
Burnaby, BC V5A1W9

Tel: (604) 253-4188
Fax:

Re: L1829615 Work Order: **1609561**

Dear Brent,

ALS Environmental received 16 samples on 20-Sep-2016 10:35 AM for the analyses presented in the following report.

The analytical data provided relates directly to the samples received by ALS Environmental and for only the analyses requested.

QC sample results for this data met laboratory specifications. Any exceptions are noted in the Case Narrative, or noted with qualifiers in the report or QC batch information. Should this laboratory report need to be reproduced, it should be reproduced in full unless written approval has been obtained from ALS Laboratory Group. Samples will be disposed in 30 days unless storage arrangements are made.

The total number of pages in this report is 22.

If you have any questions regarding this report, please feel free to contact me.

Sincerely,

Shawn Smythe

Electronically approved by: Chris Gibson

Shawn Smythe
Project Manager

ALS Environmental

Date: 23-Sep-16

Client: ALS Environmental
Project: L1829615
Work Order: **1609561**

Work Order Sample Summary

Lab Samp ID	Client Sample ID	Matrix	Tag Number	Collection Date	Date Received	Hold
1609561-01	L1829615-1	Water		9/6/2016	9/20/2016 10:35	☐
1609561-02	L1829615-2	Water		9/7/2016	9/20/2016 10:35	☐
1609561-03	L1829615-3	Water		9/6/2016	9/20/2016 10:35	☐
1609561-04	L1829615-4	Water		9/6/2016	9/20/2016 10:35	☐
1609561-05	L1829615-5	Water		9/5/2016	9/20/2016 10:35	☐
1609561-06	L1829615-6	Water		9/5/2016	9/20/2016 10:35	☐
1609561-07	L1829615-7	Water		9/8/2016	9/20/2016 10:35	☐
1609561-08	L1829615-8	Water		9/7/2016	9/20/2016 10:35	☐
1609561-09	L1829615-9	Water		9/7/2016	9/20/2016 10:35	☐
1609561-10	L1829615-10	Water		9/6/2016	9/20/2016 10:35	☐
1609561-11	L1829615-11	Water		9/5/2016	9/20/2016 10:35	☐
1609561-12	L1829615-12	Water		9/8/2016	9/20/2016 10:35	☐
1609561-13	L1829615-13	Water		9/8/2016	9/20/2016 10:35	☐
1609561-14	L1829615-14	Water			9/20/2016 10:35	☐
1609561-15	L1829615-15	Water			9/20/2016 10:35	☐
1609561-16	L1829615-16	Water			9/20/2016 10:35	☐

ALS Environmental

Date: 23-Sep-16

Client: ALS Environmental
Project: L1829615
Work Order: 1609561

Case Narrative

The sample condition upon receipt was acceptable except where noted.

Results relate only to the items tested and are not blank corrected unless indicated.

Compound identification is based upon retention time matching only. Any compound with a similar retention time will interfere.

Samples were prepared and analyzed by the analytical method and the laboratory's applicable standard operating procedure listed below:
- IH-001- "Determination of Analytes Using NIOSH and OSHA Methods Using Gas Chromatography."
- IH-002- "Determination of Suspended Particulates in the Atmosphere Using Various Media"
- IH-003- "Determination of Suspended Particulates Not Otherwise Regulated (Total and Respirable)."
- IH-004- "Determination of Analytes by NIOSH and OSHA Methods Using Liquid Chromatography."
- IH-005- "Benzene-Soluble Fraction and Total Particulate (Asphalt Fume)."
- IH-006- "Methods IO-3.1 and IO-3.4 Modified for Metals Preparation and Analysis for Suspended Particulates."
- IH-196- "Carbon Black by OSHA 196."
- IH-6009- "Determination of Mercury in Industrial Hygiene Samples by Manual Cold Vapor Atomic Absorption Spectroscopy."
- ENV-6010B- "Determination of Trace Metals in Solution by Inductively Coupled Plasma-Atomic Emission Spectroscopy by EPA Method 6010B Non-VAP."
- IH-7300 modified- "Elements by ICP."

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-1	**Lab ID:**	1609561-01
Collection Date:	9/6/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**2.4**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-2	**Lab ID:**	1609561-02
Collection Date:	9/7/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**2.4**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-3	**Lab ID:**	1609561-03
Collection Date:	9/6/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**2.2**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-4	**Lab ID:**	1609561-04
Collection Date:	9/6/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**63**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-5	**Lab ID:**	1609561-05
Collection Date:	9/5/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**4.9**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-6	**Lab ID:**	1609561-06
Collection Date:	9/5/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**32**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-7	**Lab ID:**	1609561-07
Collection Date:	9/8/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**7.7**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-8	**Lab ID:**	1609561-08
Collection Date:	9/7/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**37**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-9	**Lab ID:**	1609561-09
Collection Date:	9/7/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**9.8**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-10	**Lab ID:**	1609561-10
Collection Date:	9/6/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**12**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-11	**Lab ID:**	1609561-11
Collection Date:	9/5/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**130**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client:	ALS Environmental		
Project:	L1829615	**Work Order:**	1609561
Sample ID:	L1829615-12	**Lab ID:**	1609561-12
Collection Date:	9/8/2016	**Matrix:**	WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**4.9**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client: ALS Environmental
Project: L1829615 **Work Order:** 1609561
Sample ID: L1829615-13 **Lab ID:** 1609561-13
Collection Date: 9/8/2016 **Matrix:** WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**98**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client: ALS Environmental
Project: L1829615
Sample ID: L1829615-14
Collection Date:

Work Order: 1609561
Lab ID: 1609561-14
Matrix: WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**2.6**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client: ALS Environmental
Project: L1829615
Sample ID: L1829615-15
Collection Date:

Work Order: 1609561
Lab ID: 1609561-15
Matrix: WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	**2.0**		**2.0**	**mg/L**	1	9/20/2016

Note:

ALS Environmental

Date: *23-Sep-16*

Client: ALS Environmental
Project: L1829615
Sample ID: L1829615-16
Collection Date:

Work Order: 1609561
Lab ID: 1609561-16
Matrix: WATER

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
TOTAL SUSPENDED SOLIDS			**E160.2**			Analyst: **rmb**
Total suspended solids	ND		2.0	mg/L	1	9/20/2016

Note:

ALS Environmental

Date: 23-Sep-16

Client: ALS Environmental

Work Order: 1609561

Project: L1829615

QC BATCH REPORT

Batch ID: **R133102** Instrument ID **WETCHEM** Method: **E160.2**

MBLK Sample ID: **MB-R133102-R133102** Units: **mg/L** Analysis Date: **9/20/2016**

Client ID: Run ID: **WETCHEM_160920C** SeqNo: **1360373** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Total suspended solids	ND	2.0								

LCS Sample ID: **LCS-R133102-R133102** Units: **mg/L** Analysis Date: **9/20/2016**

Client ID: Run ID: **WETCHEM_160920C** SeqNo: **1360374** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Total suspended solids	942.1	2.0	1000	0	94.2	70-130	0			

DUP Sample ID: **1609561-02A Dup** Units: **mg/L** Analysis Date: **9/20/2016**

Client ID: **L1829615-2** Run ID: **WETCHEM_160920C** SeqNo: **1360378** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Total suspended solids	2.91	2.0	0	0	0		2.39	19.6		

DUP Sample ID: **1609561-16A Dup** Units: **mg/L** Analysis Date: **9/20/2016**

Client ID: **L1829615-16** Run ID: **WETCHEM_160920C** SeqNo: **1360393** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Total suspended solids	ND	2.0	0	0	0		1.6	0		

The following samples were analyzed in this batch:

1609561-01A	1609561-02A	1609561-03A
1609561-04A	1609561-05A	1609561-06A
1609561-07A	1609561-08A	1609561-09A
1609561-10A	1609561-11A	1609561-12A
1609561-13A	1609561-14A	1609561-15A
1609561-16A		

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

ALS Environmental

Date: 23-Sep-16

Client: ALS Environmental
Project: L1829615
WorkOrder: **1609561**

QUALIFIERS, ACRONYMS, UNITS

Qualifier	Description
*	Value exceeds Regulatory Limit
a	Not accredited
B	Analyte detected in the associated Method Blank above the Reporting Limit
E	Value above quantitation range
H	Analyzed outside of Holding Time
J	Analyte detected below quantitation limit
n	Not offered for accreditation
ND	Not Detected at the Reporting Limit
O	Sample amount is > 4 times amount spiked
P	Dual Column results percent difference > 40%
R	RPD above laboratory control limit
S	Spike Recovery outside laboratory control limits
U	Analyzed but not detected above the MDL

Acronym	Description
DUP	Method Duplicate
E	EPA Method
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MBLK	Method Blank
MDL	Method Detection Limit
MQL	Method Quantitation Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PDS	Post Digestion Spike
PQL	Practical Quantitaion Limit
SDL	Sample Detection Limit
SW	SW-846 Method

Units Reported	Description
mg/L	

ALS Environmental

Sample Receipt Checklist

Client Name: **ALS-VANCOUVER** Date/Time Received: **20-Sep-16 10:35**

Work Order: **1609561** Received by: **RDN**

Checklist completed by Stephanie Harrington 20-Sep-16 Reviewed by: Shawn Smythe 21-Sep-16

eSignature Date eSignature Date

Matrices:

Carrier name: FedEx

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	
Temperature(s)/Thermometer(s):	5.2		
Cooler(s)/Kit(s):			
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	N/A ☑
pH adjusted?	Yes ☐	No ☐	N/A ☑
pH adjusted by:	-		

Login Notes:

Client Contacted: Date Contacted: Person Contacted:

Contacted By: Regarding:

Comments:

CorrectiveAction:

Short Holding Time

○ Rush Processing

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1829615-COFC

COC Number: 14 - 470932

Page 1 of 2

Report To		Report Format / Distribution		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	Laberge Environmental Services	Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3pm)
Contact:	Bonnie Burns	Quality Control (QC) Report with Report	☑ Yes ☐ No	P ☐ Priority (2-4 business days if received by 3pm)
Address:	P.O. Box 21072, Whitehorse YT Y1A6P7	☑ Criteria on Report - provide details below if box checked		E ☐ Emergency (1-2 business days if received by 3pm)
		Select Distribution:	☐ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency if received by 10am – contact ALS for surcharge.
Phone:	867-668-6838	Email 1 or Fax	bonnie burns @ northwestel.net	Specify Date Required for E2,E or P:
		Email 2		Analysis Request

Invoice To		Invoice Distribution	
	Same as Report To ☑ Yes ☐ No	Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
	Copy of Invoice with Report ☐ Yes ☐ No	Email 1 or Fax	bonnie burns @ northwestel.net
Company:	Same as above	Email 2	
Contact:		Oil and Gas Required Fields (client use)	

Project Information			
ALS Quote #:	14 16 12 DN	Approver ID:	Cost Center:
Job #:	Clinton Creek	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)	L1829615	ALS Contact:	Sampler: B. Burns

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total metals Low level	Dissolved metals low level	Total Mercury	Dissolved Mercury	General, TSS etc	Sat etc	Chlorophyll a + Phaeophytin							Number of Containers
1	E-1	5/9/16	14:30	H2O	✓	✓	✓	✓	✓	✓	✓	✓						7
2	Porcupine Cr	7/9/16	9:40	"	✓	✓	✓	✓	✓	✓	✓	✓						7
3	E-2	6/9/16	16:30	"	✓	✓	✓	✓	✓	✓	✓	✓						7
4	E-3	6/9/16	09:00	"	✓	✓	✓	✓	✓	✓	✓	✓						7
5	E-4	5/9/16	13:10	"	✓	✓	✓	✓	✓	✓	✓	✓						7
6	E-6	5/9/16	9:30	"	✓	✓	✓	✓	✓	✓	✓	✓						7
7	E-8	8/9/16	14:50	"	✓	✓	✓	✓	✓	✓	✓	✓						7
8	R-1	7/9/16	12:45	"	✓	✓	✓	✓	✓	✓								5
9	R-2	7/9/16	15:00	"	✓	✓	✓	✓	✓	✓	✓	✓						7
10	R-3	6/9/16	11:30	"	✓	✓	✓	✓	✓	✓	✓	✓						7
11	R-4	5/9/16	14:40	"	✓	✓	✓	✓	✓	✓	✓	✓						7
12	R-6	8/9/16	16:40	"	✓	✓	✓	✓	✓	✓	✓	✓						7

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☐ No	to meet CCME freshwater aquatic life criteria. All samples preserved & filtered as necessary
Are samples for human drinking water use? ☐ Yes ☐ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐	
Ice packs	Yes ☑	No ☐	Custody seal intact	Yes ☑	No ☐
Cooling Initiated	☑				

INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C		
4.4	2.2			6

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Bonnie Burns	Sept 9/16			12-SEP-16	9:15	HMC		10:55

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

ALS FM-03256 v09 Front/BH January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form.**

SEP 13 2016

Short Holding Time

Rush Processing

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1829615-COFC

COC Number: 14 - 470930

Page 1 of 2

Report To		Report Format / Distribution		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	Labrege Env. Serv.	Select Report Format:	PDF ☑ EXCEL ☐ EDD (DIGITAL)	R ☐ Regular (Standard TAT if received by 3pm)
Contact:		Quality Control (QC) Report with Report	☐ Yes ☐ No	P ☐ Priority (2-4 business days if received by 3pm)
Address:		☑ Criteria on Report - provide details below if box checked		E ☐ Emergency (1-2 business days if received by 3pm)
		Select Distribution:	☐ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency if received by 10am – contact ALS for surcharge.
Phone:	867-668-6838	Email 1 or Fax	bonnieburns@northwestel.net	Specify Date Required for E2,E or P:
		Email 2		

Invoice To	Same as Report To ☐ Yes ☐ No	Invoice Distribution		Analysis Request
	Copy of Invoice with Report ☐ Yes ☐ No	Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
Company:		Email 1 or Fax	bonnieburns@northwestel.net	
Contact:		Email 2		

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	141612 DN	Approver ID:	Cost Center:
Job #:	Clinton Cr	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)	L1829615	ALS Contact:	Sampler:

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total metals - low level	Dissolved metals (low level)	Total Mercury	Dissolved Mercury	General, TSS etc	Soil etc.	Number of Containers
13	Maiden Cr	8/9/16		H_2O	L	L	L	L	L	L	5
14	Field Blank			"	L	L	L	L	L	L	5
15	Travel blank			"	~~L~~	~~L~~	~~L~~	~~L~~	L	L	5
16	Duplicate	8/9/16		"	L	L	L	L	L	L	5

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)	SAMPLE CONDITION AS RECEIVED (lab use only)
Are samples taken from a Regulated DW System? ☐ Yes ☐ No	Note there wasn't travel blanks for metals or Hg.	Frozen ☐ SIF Observations Yes ☐ No ☐
Are samples for human drinking water use? ☐ Yes ☐ No		Ice packs Yes ☑ No ☐ Custody seal intact Yes ☑ No ☐ Cooling Initiated ☑

INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C			
4.4	2.2				6

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Bonnie Burns	Sept 9/16			12-SEP-16	9:15	HMC	SEP 12 2016	10:55

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

ALS FM-0038e WOR Front/04 January 2014

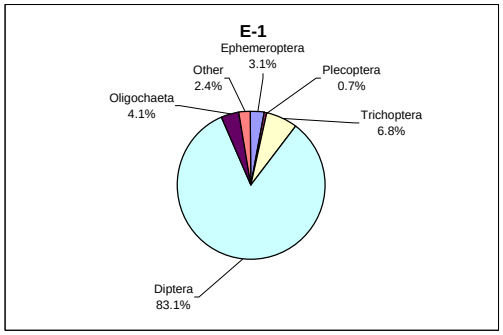
Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

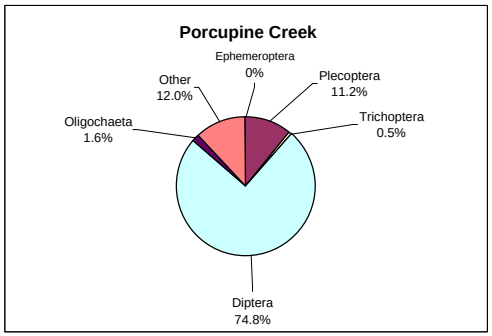
1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

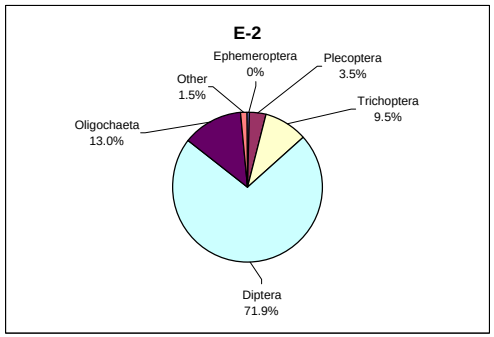
APPENDIX E

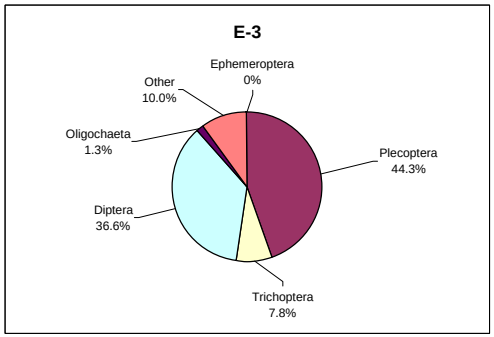
BENTHIC INVERTEBRATE DATA, 2016

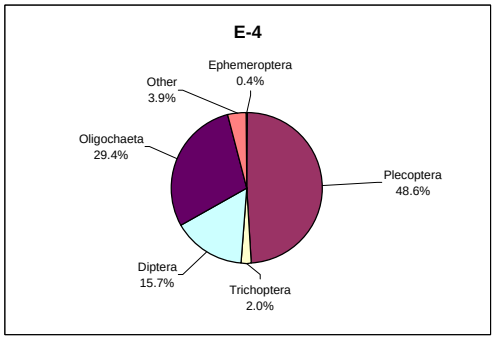
FIGURE 5 COMPOSTION OF EACH BENTHIC INVERTEBRATE COMMUNITY, SEPTEMBER 2016

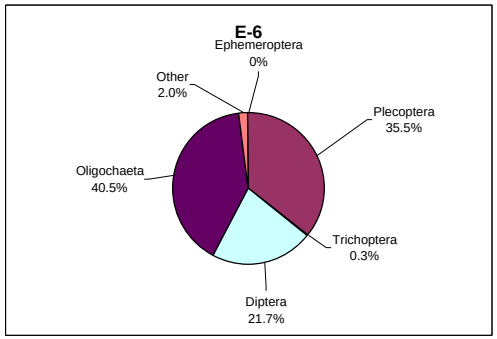


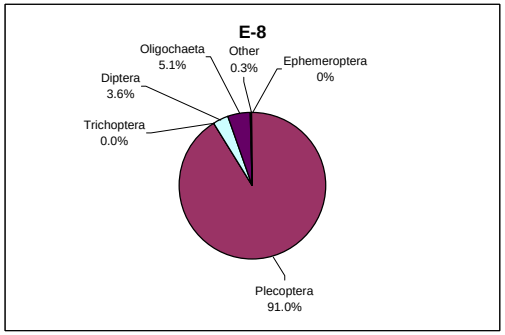


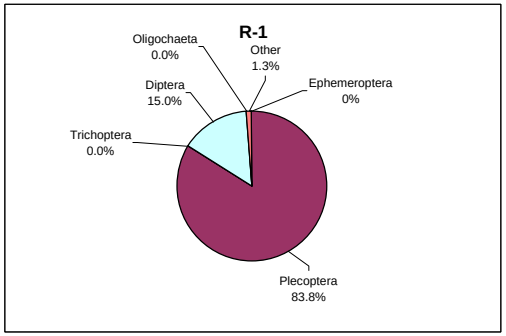


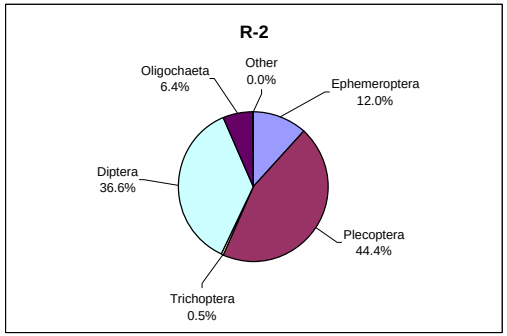


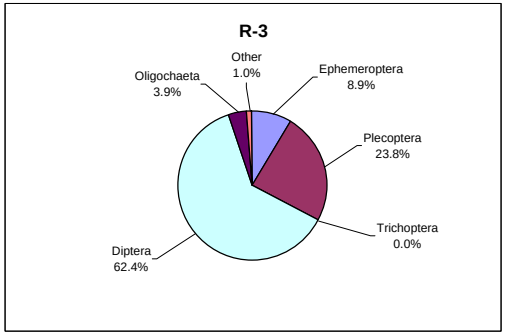


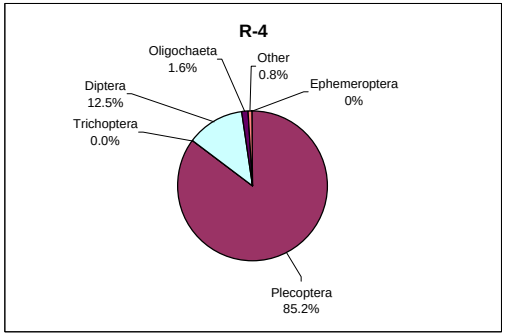


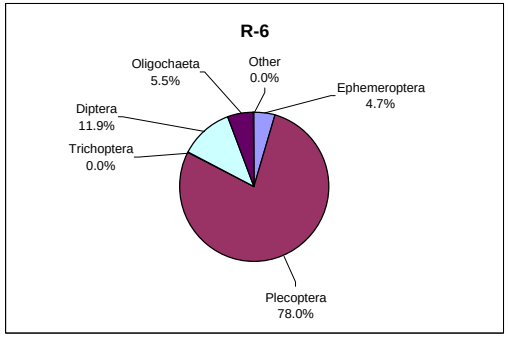












APPENDIX E

BENTHIC INVERTEBRATE DATA, CLINTON CREEK, SEPTEMBER 2016

Sample:	E-1	Porcupine Creek	E-2	E-3	E-4	E-6	E-8
Sample Collection Date:	06-Sep-16	07-Sep-16	06-Sep-16	06-Sep-16	05-Sep-16	05-Sep-16	08-Sep-16
SubSample %:	100	16	30	100	100	100	9
Phylum: Arthropoda							
| Order: Collembola							
| Family: Hypogastruridae							11
| Family: Sminthuridae						2	
Subphylum: Hexapoda							
| Class: Insecta							
| Order: Ephemeroptera							
| Family: Ameletidae							
Ameletus							
| Family: Baetidae	1				1		
Baetis	10		7				
Baetis tricaudatus group	1						
| Family: Ephemerellidae							
Ephemerella	1						
| Family: Heptageniidae	1						
Cinygmula							
Rhithrogena							
| Order: Plecoptera							
| Family: Capniidae	1	88	33	63	120	102	3356
| Family: Chloroperlidae	1				2		
Haploperla							
| Family: Leuctridae				1			
| Family: Nemouridae		138		77			
Nemoura		88	3	6			
Ostrocerca							
Podmosta				53			
Zapada columbiana	1						
| Family: Perlodidae							
Isoperla			3		2	3	
| Family: Taeniopterygidae							
Taenionema						1	
| Order: Trichoptera							
| Family: Apataniidae							
Apatania			3				
| Family: Brachycentridae							
Brachycentrus	4		13	15	3		
Brachycentrus americanus	26		83	2	2		
| Family: Glossosomatidae				5			
Glossosoma	1			12			
| Family: Hydropsychidae						1	
| Family: Limnephilidae		13	7				
Ecclisomyia				1			
| Order: Diptera				1	1	1	
| Family: Ceratopogonidae						1	
Probezzia		6	53		2		
| Family: Chironomidae	15	44	3		1	1	
| Subfamily: Chironominae							
| Tribe: Chironomini							
Polypedilum	1						11
| Tribe: Tanytarsini							
Cladotanytarsus							
Constempellina sp. C							

APPENDIX E

BENTHIC INVERTEBRATE DATA, CLINTON CREEK, SEPTEMBER 2016

Sample:	E-1	Porcupine Creek	E-2	E-3	E-4	E-6	E-8
Sample Collection Date:	06-Sep-16	07-Sep-16	06-Sep-16	06-Sep-16	05-Sep-16	05-Sep-16	08-Sep-16
SubSample %:	100	16	30	100	100	100	9
Micropsectra	14	31	13			1	
Paratanytarsus							
Stempellina					2		44
Tanytarsus							
| Subfamily: Diamesinae							
Pseudokiefferiella				1			
| Tribe: Diamesini							
Diamesa		381					
Pagastia		100	7	4	1	1	
Pseudodiamesa		6					
| Subfamily: Orthocladiinae	7	38					
Brillia							11
Corynoneura	1		3				
Diplocladius				1			
Eukiefferiella	78	44	30	57	2	6	11
Euryhapsis	2						
Hydrobaenus		19	7			4	
Hydrosmittia							
Krenosmittia					1	1	
Limnophyes							
Metriocnemus							
Nanocladius			3				
Orthocladius complex	42	1194	50	16	2	6	44
Parakiefferiella						1	
Parametriocnemus				1		0	
Paraphaenocladius	42		197		2	1	
Parorthocladius		13		1			
Pseudosmittia		6					
Tvetenia	41		77	15			
| Subfamily: Tanypodinae							
| Tribe: Pentaneurini							
Thienemannimyia group	78		63		1		
| Family: Empididae	9	6	63	50	6	26	11
Neoplasta	19		23	7	1		
Trichoclinocera	2				1		
| Family: Muscidae							
Limnophora		113					
| Family: Psychodidae							
Pericoma/Telmatoscopus		56					
| Family: Simuliidae	2				1		
Metacnephia				1			
Prosimulium							
Simulium	24		100			1	
| Family: Tabanidae							
Tabanus							
| Family: Tipulidae							
Dicranota	3	44	113	10	16	11	
Gonomyodes	1					2	
Limnophila						1	
Subphylum: Chelicerata							
| Class: Arachnida							
| Order: Trombidiformes							
| Family: Lebertiidae							
Lebertia				1	4		
| Family: Sperchontidae							

APPENDIX E

BENTHIC INVERTEBRATE DATA, CLINTON CREEK, SEPTEMBER 2016

Sample:	E-1	Porcupine Creek	E-2	E-3	E-4	E-6	E-8
Sample Collection Date:	06-Sep-16	07-Sep-16	06-Sep-16	06-Sep-16	05-Sep-16	05-Sep-16	08-Sep-16
SubSample %:	100	16	30	100	100	100	9
Sperchon	9	56	17	1	5	3	
| Order: Sarcoptiformes				0			
| Family: Hydrozetidae				1	1	1	
| Class: Malacostraca							
| Order: Amphipoda	1	281		42			
Phylum: Annelida							
Subphylum: Clitellata							
| Class: Hirudinea							
| Order: Rhynchobdellida							
| Family: Glossiphoniidae							
Helobdella stagnalis	1						
| Class: Oligochaeta							
| Order: Lumbriculida							
| Family: Lumbriculidae					35	118	11
Lumbriculus					40		
Rhynchelmis			3			1	
| Order: Tubificida							
| Family: Enchytraeidae							
Enchytraeus	19	25	53	4		2	44
| Family: Naididae							
Nais		19	90				133
Tubifex							
| Subfamily: Tubificinae without hair chaetae				2			
Totals:	**459**	**2809**	**1120**	**451**	**255**	**299**	**3687**
Diversity:	33	24	28	30	26	27	11
Taxa present but not included:							
Phylum: Arthropoda							
Subphylum: Crustacea							
| Class: Ostracoda	1	6			1		
| Class: Branchiopoda							
| Order: Cladocera			3		1	1	
| Class: Maxillipoda							
| Class: Copepoda	1			1			
Phylum: Nemata	1					1	
Phylum: Platyhelminthes							
| Class: Turbellaria						1	
Totals:	**3**	**6**	**3**	**1**	**2**	**3**	**0**

APPENDIX E

BENTHIC INVERTEBRATE DATA, CLINTON CREEK, SEPTEMBER 2016

Sample:	R-1	R-2	R-3	R-4	R-6
Sample Collection Date:	07-Sep-16	07-Sep-16	06-Sep-16	05-Sep-16	08-Sep-16
SubSample %:	100	31	35	100	27
Phylum: Arthropoda					
| Order: Collembola					
| Family: Hypogastruridae	1			2	
| Family: Sminthuridae					
Subphylum: Hexapoda					
| Class: Insecta					
| Order: Ephemeroptera					
| Family: Ameletidae					
Ameletus					30
| Family: Baetidae			3		
Baetis		6	57		
Baetis tricaudatus group			17		
| Family: Ephemerellidae					
Ephemerella					
| Family: Heptageniidae		116	3		19
Cinygmula		16			
Rhithrogena					7
| Order: Plecoptera					
| Family: Capniidae	36	394	74	80	933
| Family: Chloroperlidae		26			
Haploperla		13			
| Family: Leuctridae					
| Family: Nemouridae	22	74	103	35	4
Nemoura			9	5	
Ostrocerca	9				
Podmosta			26	99	
Zapada columbiana		3			
| Family: Perlodidae			3		
Isoperla					
| Family: Taeniopterygidae					
Taenionema					
| Order: Trichoptera					
| Family: Apataniidae					
Apatania					
| Family: Brachycentridae					
Brachycentrus					
Brachycentrus americanus					
| Family: Glossosomatidae					
Glossosoma					
| Family: Hydropsychidae					
| Family: Limnephilidae		6			
Ecclisomyia					
| Order: Diptera	2				
| Family: Ceratopogonidae					
Probezzia					4
| Family: Chironomidae	1		9		
| Subfamily: Chironominae					
| Tribe: Chironomini					
Polypedilum					
| Tribe: Tanytarsini					
Cladotanytarsus					4
Constempellina sp. C		3			

APPENDIX E

BENTHIC INVERTEBRATE DATA, CLINTON CREEK, SEPTEMBER 2016

Sample:	R-1	R-2	R-3	R-4	R-6
Sample Collection Date:	07-Sep-16	07-Sep-16	06-Sep-16	05-Sep-16	08-Sep-16
SubSample %:	100	31	35	100	27
Micropsectra					
Paratanytarsus	1				
Stempellina					19
Tanytarsus					11
| Subfamily: Diamesinae					
Pseudokiefferiella				5	
| Tribe: Diamesini					
Diamesa	2	87	3	1	
Pagastia		6	9		
Pseudodiamesa		3	3	3	
| Subfamily: Orthocladiinae			3	1	
Brillia					
Corynoneura					
Diplocladius		6	26		4
Eukiefferiella	1	168	297	17	7
Euryhapsis					
Hydrobaenus	1				
Hydrosmittia					15
Krenosmittia					
Limnophyes	2	3	3		
Metriocnemus				1	
Nanocladius					
Orthocladius complex	1	13	169		63
Parakiefferiella			3		4
Parametriocnemus					
Paraphaenocladius		3	3		
Parorthocladius					
Pseudosmittia		3			
Tvetenia			11		4
| Subfamily: Tanypodinae					
| Tribe: Pentaneurini					
Thienemannimyia group		3			4
| Family: Empididae		3			
Neoplasta					
Trichoclinocera					
| Family: Muscidae					
Limnophora			3		
| Family: Psychodidae					
Pericoma/Telmatoscopus		26	3		
| Family: Simuliidae			3		
Metacnephia			6	1	
Prosimulium				1	
Simulium		68			
| Family: Tabanidae					
Tabanus		3			
| Family: Tipulidae					
Dicranota	1	23	9	2	4
Gonomyodes					
Limnophila					
Subphylum: Chelicerata					
| Class: Arachnida					
| Order: Trombidiformes					
| Family: Lebertiidae					
Lebertia					
| Family: Sperchontidae					

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BENTHIC INVERTEBRATE DATA, CLINTON CREEK, SEPTEMBER 2016

Sample:	R-1	R-2	R-3	R-4	R-6
Sample Collection Date:	07-Sep-16	07-Sep-16	06-Sep-16	05-Sep-16	08-Sep-16
SubSample %:	100	31	35	100	27
Sperchon			9		
| Order: Sarcoptiformes					
| Family: Hydrozetidae					
| Class: Malacostraca					
| Order: Amphipoda					
Phylum: Annelida					
Subphylum: Clitellata					
| Class: Hirudinea					
| Order: Rhynchobdellida					
| Family: Glossiphoniidae					
Helobdella stagnalis					
| Class: Oligochaeta					
| Order: Lumbriculida					
| Family: Lumbriculidae		71		1	22
Lumbriculus					
Rhynchelmis					
| Order: Tubificida					
| Family: Enchytraeidae					
Enchytraeus			26	3	
| Family: Naididae					
Nais		3			37
Tubifex			6		7
| Subfamily: Tubificinae without			3		
Totals:	**80**	**1149**	**902**	**257**	**1202**
Diversity:	13	27	30	16	20
Taxa present but not included:					
Phylum: Arthropoda					
Subphylum: Crustacea					
| Class: Ostracoda		3	3	1	
| Class: Branchiopoda					
| Order: Cladocera					
| Class: Maxillipoda					
| Class: Copepoda			3		
Phylum: Nemata					
Phylum: Platyhelminthes					
| Class: Turbellaria					
Totals:	**0**	**3**	**6**	**1**	**0**

APPENDIX F

FISH HABITAT AND ASSESSMENT DATA, 2016

TABLE 21 LENGTHS (mm) OF LIVE SAMPLED FISH FROM MINNOW TRAPPING, CLINTON CREEK, SEPTEMBER 2016			
Site	**Juvenile Chinook Salmon**	**Arctic Grayling**	**Slimy Sculpin**
Pool below Gabion Structures	81 87 93 94 89 96 91 81 98 102		
Average	91.2		
E1	94 92 96 98 103 91 72 84 101 92 103 97 88 86 95 84 101 88 92 88	97 105 97 87 102 103 91 140 92 103 89	109 94 93 99 85 83 87 100 88
Average at E1	92.3	100.5	93.1
	75 82 78 86 78 78 107 86 101 92		89 75 56 102

E2	94 89 88 79 74 72 81 88 102 88 81 83 81 82 94 91 77 74 81 66 86 88 93		
Average at E2	84.7		80.5
E4	82 75 82		57 63 54 73 73 99 82 78 83
Average at E4	79.7		73.6
	62 57 65 77 71 84 88 72 74 72 77 68 62		72

E6	62 74 75 71 61 69 78 74 71 70 76 78 64 68 74 76 73 58 69 69 66 55		
Average at E6	70.3		72.0

Clinton Creek, Site Description, 2016

Site: E1 Clinton Creek, ford at mine site

Location: 513 684E 71 47 156N **Aspect**: East

Site	Survey Date (dd/mm/yr)	06/09/16
	Site Elevation (ft)	1304’
	Site Survey Length (m)	120
Channel	Ave. Channel Width (m)	6.5
	Ave. Wetted Width (m)	5.1
	Ave. Bankfull Channel Depth (m)	1.05
	Ave. Residual Pool Depth (m)	0.5
	Pool, Riffle, Run / Glide	60 rapid, 35 riffle, 5 side/bldr pools
	Gradient (%)	<2%
Cover	Cover Abundance	Moderate
	Dominant Cover Type	Perched boulders and cobbles
	Subdominant Cover Type	Small boulder pools
	Other Cover Types Present	none
	% Crown Closure	0
	Stream side Vegetation	Occasional willow and poplar
	Instream Vegetation	none
Morphology	Dominant Bed Material	60% angular boulders
	Subdominant Bed Material	30% angular cobble
	D95 (cm)	803
	D (cm)	150
	Morphology	Rapid riffle channel
	Pattern	Gentle meanders
	Islands	none
	Bars	none
	Confinement	Entrenched within abrupt unconsolidated waste rock

FISH OBSERVATIONS:

15 minnow traps set at this site recorded an abundance of robust jcs, juvenile Arctic grayling and adult slimy sculpin were also well represented in the catches. Angling for 30 minutes captured no fish

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COMMENTS: The access road to Hudgeon Lake fords Clinton Creek at this sample site. The ford requires semi constant maintenance and is utilized regularly by vehicle traffic resulting in the lower section of the sample reach having a more or less constant destabilization of the banks. The site cuts through old waste rock and the stream channel has not stabilized.

CREW: P. Sparling, M. Crill



CCE1 Photo 1: Looking across the ford through old tailings and waste rock at site E1 during September of 2016.



CCE1 Photo 2: Looking downstream from the ford at site E1 during September of 2016, note that the banks are unconsolidated and vegetation has not established along the creek banks.



CCE1 Photo 3: Looking upstream towards Hudgeon Lake during September 2016. The shifting waste rock piles and unconsolidated banks of the creek are very obvious in this photo.

Clinton Creek, Habitat and Site Description, 2016

Site: E-2, Clinton Creek upstream of Wolverine Creek

Location: 514 299E / 71 46901N **Aspect**: East/south/east

Site	Survey Date	Sept. 6, 2016
	Site Elevation (ft)	1225’
	Site Survey Length (m)	160m
Channel	Ave. Channel Width (m)	13.0m
	Ave. Wetted Width (m)	7.5m
	Ave. Bankfull Channel Depth (m)	0.73m
	Ave. Depth	0.19
	%Pool, Riffle, Run / Glide	10 pool, 10 glide, 80 riffle
	Gradient (%) and velocity m/sec	>1% , 0.6m/sec
Cover	Cover Abundance	Moderate
	Dominant Cover Type	Undercut banks and corner pools
	Subdominant Cover Type	Perched boulders and cobbles
	Other Cover Types Present	Overhanging veg and woody debris
	% Crown Closure	<2%
	Stream side Vegetation	Alder and grass
	Instream Vegetation	Aquatic moss
Morphology	Dominant Bed Material	Gravel
	Subdominant Bed Material	Sand
	D95 (cm)	190cm
	D (cm)	7.5cm
	Morphology	Active channel downstream of old beaver pond
	Pattern	meandering
	Islands	Small and occasional
	Bars	Wide gravel bar corners
	Confinement	Open flood plain

FISH OBSERVATIONS: Angling effort of 50 minutes captured 2 adult Arctic grayling, a set of 10 minnow traps through the study reach captured a total of 65 jcs and 4 adult slimy sculpin.

COMMENTS: This sample site is located immediately downstream of an old and large beaver pond that washed out within the past 4 years, resulting in an open flood plain with wide gravel bars. Piles of woody debris are present at the high water mark.

CREW:

P. Sparling, M. Crill and D. Davidge



Photo 1, site E2: Wolverine Creek looking upstream at site E2, September 2016. A large beaver dam crossed the creek at the top of this photo during the 2007 investigations, the exposed gravel bar on the left is a residual from the wash out from the dam.



Photo 2, site E2: Looking downstream on Clinton Creek at E2, Wolverine Creek enters at the bottom corner of the flow from the left side.



Photo 3, site E2: Filamentous algae attached to typical substrates at site E2, September 2016.

Clinton Creek, Site Description, 2016

Site: Wolverine Creek, E-3

Location: 514 168E / 71 47 116N **Aspect**: South

Site	Survey Date	September 6, 2016
	Site Elevation (ft)	1218’
	Site Survey Length (m)	200m
Channel	Ave. Channel Width (m)	6.7m
	Ave. Wetted Width (m)	4.2m
	Ave. Bankfull Channel Depth (m)	0.57m
	Ave. Depth (m)	0.12m
	% Pool, Riffle, Run / Glide	100% riffle
	Gradient (%) and velocity m/sec	1%, V= 0.54 m/sec
Cover	Cover Abundance	Limited
	Dominant Cover Type	Stream side vegetation
	Subdominant Cover Type	Leaf litter
	Other Cover Types Present	Occasional sticks
	% Crown Closure	>5%
	Stream side Vegetation	Young spruce and willow
	Instream Vegetation	None
Morphology	Dominant Bed Material	Gravel
	Subdominant Bed Material	Sand and fines (tailings)
	D95 (cm)	13.2 cm
	D (cm)	3.2 cm
	Morphology	Open flood plain, unstable banks
	Pattern	Sinuous meandering
	Islands	Occasional
	Bars	In disturbed open areas
	Confinement	Partially entrenched upstream

FISH OBSERVATIONS: No fish were recorded at this site.

COMMENTS: Wolverine Creek carries large amounts of tailings that have been transported by the creek from the mill site upstream; the tailings represent the majority of the bed materials. The sample site encompasses an extensively modified habitat with proximity to the access roads and old mine workings.

CREW: D. Davidge, M. Crill



Photo 1 Wolverine Creek: Wolverine Creek on September 6, 2016, looking upstream. Gravel bars consisting of tailings carried down the creek by the creek are visible on both banks.



Photo 2 Wolverine Creek: Wolverine Creek, September 2016, looking downstream. The gate on the access road is visible in the mid left of the photo and old mine workings across Clinton Creek are visible in the background.



Photo 3 Wolverine Creek: Installing a temperature data logger on Wolverine Creek, September 2016. Wolverine creek becomes more confined and has deeper flows upstream of the sample area, the turbid water is an indication of high flow levels.

Clinton Creek, Site Description, 2016

Site: E-4 Clinton Creek upstream of Eagle Creek

Location: 515 853E / 71 45 206N **Aspect**: East

Site	Survey Date	September 5, 2016
	Site Elevation (ft)	1143’
	Site Survey Length (m)	100m
Channel	Ave. Channel Width (m)	7.0m
	Ave. Wetted Width (m)	6.5m
	Ave. Bankfull Channel Depth (m)	1.05m
	Ave. Depth (m)	0.4m
	% Pool, Riffle, Run / Glide	90% riffle, 10% pool
	Gradient (%) and velocity m/sec	>1%, 1.2m/sec
Cover	Cover Abundance	moderate
	Dominant Cover Type	pools
	Subdominant Cover Type	boulders
	Other Cover Types Present	Cut banks
	% Crown Closure	>2%
	Stream side Vegetation	Alder, willow, young spruce
	Instream Vegetation	none
Morphology	Dominant Bed Material	gravel
	Subdominant Bed Material	Cobble and boulder
	D95 (cm)	419cm
	D (cm)	12cm
	Morphology	Stable channel with confining banks
	Pattern	sinuous
	Islands	None
	Bars	Sand at corner
	Confinement	Partially entrenched

FISH OBSERVATIONS: A set of 8 minnow traps captured 3 jcs and 8 adult slimy sculpin. Electro-fishing for 280 seconds recorded 8 slimy sculpin. Angling for 45 minutes captured 2 sub adult and 1 adult Arctic grayling.

COMMENTS: The sample reach is located immediately upstream of the confluence with Eagle Creek and has a mostly entrenched and straight channel. The water of Eagle Creek was very cold but as it enters Clinton Ck it creates a deep pool that held adult Arctic grayling

CREW: P. Sparling, M. Crill, B. Burns, D. Davidge



E-4 Photo 1: Looking upstream at the almost gunbarrel straight channel at site E4 during September 2016



E-4 Photo 2: Looking across the creek channel at site E4 during September 2016.



E-4 Photo 3: Looking downstream at site E4 during September 2015. Eagle Creek enters Clinton Creek just behind the sampler and before the creek makes the turn.

Clinton Creek, Site Description, 2016

Site: E-6, Clinton Creek near ford to Townsite

Location: 518 528E / 71 42 464N **Aspect**: East by south east

Site	Survey Date	Sept. 5, 2016
	Site Elevation (ft)	1010’
	Site Survey Length (m)	120m
Channel	Ave. Channel Width (m)	11m
	Ave. Wetted Width (m)	13.5m
	Ave. Bankfull Channel Depth (m)	0.86m
	Ave. Depth (m)	0.25
	% Pool, Riffle, Run / Glide	60 glide, 30 riffle, 10 pool
	Gradient (%) and velocity m/sec	<1%, 0.7m/sec
Cover	Cover Abundance	Moderate
	Dominant Cover Type	Light turbidity
	Subdominant Cover Type	Undercut bank
	Other Cover Types Present	Instream woody debris
	% Crown Closure	2%
	Stream side Vegetation	Willow, alder, birch with mature spruce
	Instream Vegetation	none
Morphology	Dominant Bed Material	Gravel
	Subdominant Bed Material	Cobbles
	D95 (cm)	27.7cm
	D (cm)	12cm
	Morphology	Stable channel freshet flooding 0.6m
	Pattern	Gentle meander
	Islands	None
	Bars	Gravel point bars
	Confinement	1m bank opposite open becomes confined upstream of site

FISH OBSERVATIONS: A set of 14 minnow traps captured 35 jcs and 1 adult sculpin. Electro-fishing for 220 seconds captured 1 sub adult Arctic grayling, 1 juvenile Arctic grayling, 5 sub adult slimy sculpin and 1 adult slimy sculpin

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COMMENTS: The downstream end of this reach is the ford across Clinton Creek used to access the local residence, the old bridge frame when the road went to the historic town site is still intact and just below the downstream end of the sample reach

CREW: P. Sparling, M. Crill



E-6 Photo 1: Looking across the ford at the downstream end of the ford at sample site R6 during September of 2016. The old bridge can be seen in the downstream area of the photo.



E-6 Photo 2: Looking upstream from the edge of the ford crossing at sample site R6 during September 2016.



E-6 Photo 3: The substrate at this site typically was loosely compacted and consisted of 50% gravel, 30% cobble, 20% fines and the occasional boulder.

Clinton Creek, Site Description, 2016

Site: R1 Upper Clinton Creek

Location: 510 597E / 71 47 494N **Aspect**: South by South East

Site	Survey Date	September 7, 2016
	Site Elevation (ft)	1389'
	Site Survey Length (m)	100m
Channel	Ave. Channel Width (m)	7m
	Ave. Wetted Width (m)	6m
	Ave. Bankfull Channel Depth (m)	0.42m
	Ave. Depth (m)	0.20m
	% Pool, Riffle, Run / Glide	90% glide, 5% riffle, 5% pool
	Gradient (%) and velocity m/sec	>0, 0.5 m/sec
Cover	Cover Abundance	limited
	Dominant Cover Type	Stream side vegetation
	Subdominant Cover Type	Woody debris
	Other Cover Types Present	Light turbidity
	% Crown Closure	>1%
	Stream side Vegetation	Willow, grass and dead spruce
	Instream Vegetation	None
Morphology	Dominant Bed Material	Gravel
	Subdominant Bed Material	Sand
	D95 (cm)	3.5cm
	D (cm)	All
	Morphology	Shifting bedload in open flood plain
	Pattern	Sinuous
	Islands	Occasional
	Bars	None
	Confinement	Banks rise 0.4 meters to open flood plain

FISH OBSERVATIONS: No fish were recorded at this site.

COMMENTS: This site is situated upstream of Hudgeon Lake and has a long shallow outflow area to the lake. The substrates in the sample reach were shifting at the time of investigation.

CREW: P. Sparling, M. Crill, B. Burns, D. Davidge



R1 Photo 1: Upper Clinton Creek looking upstream to the top of the sample reach, September 2016.


R1 Photo 2: Looking across the sample reach at R1, upper Clinton Creek during September 2016.



R1 Photo 3: Looking downstream at site R1, upper Clinton Creek.

Clinton Creek, Site Description, 2016

Site: R2 Easter Creek

Location: 512 139E / 71 48 297N **Aspect**: South West

Site	Survey Date	September 7, 2015
	Site Elevation (ft)	1392’
	Site Survey Length (m)	55m
Channel	Ave. Channel Width (m)	4.2m
	Ave. Wetted Width (m)	2.2m
	Ave. Bankfull Channel Depth (m)	0.65
	Ave. Depth (m)	0.25m
	% Pool, Riffle, Run / Glide	80% riffle, 20% glide, occ. pool
	Gradient (%) and velocity m/sec	>1%, 0.68m/sec
Cover	Cover Abundance	Limited
	Dominant Cover Type	Tree roots
	Subdominant Cover Type	Cut banks
	Other Cover Types Present	
	% Crown Closure	5%
	Stream side Vegetation	Spruce, alder, cinquefoil
	Instream Vegetation	None
Morphology	Dominant Bed Material	Gravel
	Subdominant Bed Material	Sand
	D95 (cm)	9.3cm
	D (cm)	8 cm
	Morphology	Shifting channel
	Pattern	Meandering
	Islands	Occasional
	Bars	Corners have sand
	Confinement	Open flood plain

FISH OBSERVATIONS: No fish were recorded at this site

COMMENTS: This small creek had no fish present and does not provide any fish habitat of any size and would likely not have fish even if they were present in the area. During the sample period new areas of channel were being flooded and other areas left dry.

CREW: P. Sparling, M. Crill, B. Burns, D. Davidge



R2 Photo 1: Easter Creek, site R2, looking downstream at the sample site, September, 2016.



R2 Photo 2: Looking upstream from the sample site at R2, September, 2016.



R2 Photo 3: Measuring the flow at site R2, gravel deposition and flooded vegetation is visible in the photo.

Clinton Creek, Site Description, 2016

Site: R-4, Eagle Creek

Location: 62° / 136° **Aspect**: South by South West

Site	Survey Date	September 5, 2016
	Site Elevation (ft)	
	Site Survey Length (m)	80m
Channel	Ave. Channel Width (m)	1.6m
	Ave. Wetted Width (m)	1.5m
	Ave. Bankfull Channel Depth (m)	2.0m
	Ave. Depth (m)	0.2m
	% Pool, Riffle, Run / Glide	100% riffle
	Gradient (%) and velocity m/sec	2%, 0.75 m/sec
Cover	Cover Abundance	None
	Dominant Cover Type	
	Subdominant Cover Type	
	Other Cover Types Present	
	% Crown Closure	80%
	Stream side Vegetation	Spruce, alder, willow
	Instream Vegetation	none
Morphology	Dominant Bed Material	Cobble
	Subdominant Bed Material	Gravel
	D95 (cm)	21cm
	D (cm)	Totally embedded
	Morphology	Straight and stable
	Pattern	Straight
	Islands	None
	Bars	None
	Confinement	Entrenched

FISH OBSERVATIONS:

No fish were observed in Eagle Creek, it does not provide for fish passage from Clinton Creek nor does it offer any cover or habitats for fish.

COMMENTS: Eagle Creek has a straight, featureless channel that outflows to Clinton Creek through a perched culvert that does not allow fish passage.

CREW: P. Sparling, B. Burns, M. Crill, D. Davidge



Eagle Creek Photo 1: Eagle Creek is a narrow entrenched channel with a well embedded substrate. September 2016.



Eagle Creek Photo 2: An old bridge crossing that parallels the existing road still spans Eagle Creek.

Clinton Creek, Site Description, 2016

Site: Maiden Creek

Location: 518 312 E / 71 39 251 N **Aspect**: North

Site	Survey Date	September 9, 2016
	Site Elevation (ft)	1080’
	Site Survey Length (m)	300m
Channel	Ave. Channel Width (m)	8.0m
	Ave. Wetted Width (m)	3.2m
	Ave. Bankfull Channel Depth (m)	1.35m
	Ave. Depth (m)	0.6m
	% Pool, Riffle, Run / Glide	60 riffle, 20 glide, 10 rapid, 10 eddy
	Gradient (%) and velocity m/sec	
Cover	Cover Abundance	Abundant
	Dominant Cover Type	LOD
	Subdominant Cover Type	Undercut banks
	Other Cover Types Present	Overhanging vegetation
	% Crown Closure	>5%
	Stream side Vegetation	Birch, alder, mat spruce
	Instream Vegetation	None
Morphology	Dominant Bed Material	Silt and sand
	Subdominant Bed Material	Gravel
	D95 (cm)	17cm
	D (cm)	12cm
	Morphology	Confined and stable
	Pattern	Meandering
	Islands	Occasional
	Bars	On points
	Confinement	Partially entrenched

FISH OBSERVATIONS: No fish were recorded at this site, electrofishing and minnow traps captured no fish.

COMMENTS: Maiden Creek was very cold at the time of sampling and frazzle ice was present in the moving water. Active placer mining occurred on Maiden Creek during the 2016 season within 500 meters of the sample station, although the mining was off channel flows were diverted to the sluicing area and back to the creek.

CREW: P. Sparling, M. Crill



Maiden Ck Photo 1: Maiden Creek, September, 2015 looking at the upper area of the sample reach.



Maiden Ck Photo 2: The downstream section of the sample reach on Maiden Creek, September 2016. Note the entrenchment on the opposite bank.



Maiden Ck Photo 3: Looking upstream of the sample reach on Maiden Creek, September 2016. This photo shows the large amounts of woody debris present in the sample area.



Maiden Ck Photo 4: Looking downstream during September, 2016 from the bridge accessing the placer claims. The area to the left of the creek was mined in previous years and the channel has been constructed.

APPENDIX G

TISSUE ANALYTICAL DATA, 2016

TABLE 24 DETAILS ON THE SACRIFICED FISH, CLINTON CREEK, 2016

Sample #	Sample Type	Length (mm)	Weight(g)	Sample Site	Condition Factor (K)	Total Homogenized Weight wet (g)	% Moisture	Sex and Maturity
Slimy Sculpin								
SS1	Whole body	92	8.1	E2	1.0	6.221	74.3	
SS2	Whole body	99	13.45	E4	1.4	10.998	72.7	
SS3	Whole body	73	4.2	E4	1.1	3.164	71.1	
SS4	Whole body	82	4.89	E4	0.9	3.758	73.2	
SS5	Whole body	79	3.75	E4	0.8	2.97	73.8	
SS6	Whole body	75	3.89	E4	0.9	2.938	73.6	
SS7	Whole body	81	6.1	E4	1.1	4.513	76.0	
SS8	Whole body	75	3.6	E4	0.9	5.46	73.4	
SS9	Whole body	71	3.1	E6	0.9	2.332	76.4	
SS10	Whole body	70	2.9	E6	0.8	2.209	77.4	
SS11	Whole body	86	7.71	E1	1.2	5.89	72.8	
SS12	Whole body	81	6.19	E1	1.2	4.547	72.0	
SS13	Whole body	91	9.51	E1	1.3	8.164	75.1	
SS14	Whole body	109	16.95	E1	1.3	15.091	74.9	
SS15	Whole body	85	6.37	E1	1.0	5.141	75.5	
SS16	Whole body	80	5.75	E1	1.1	4.54	75.4	
SS17	Whole body	91	9.08	E1	1.2	7.459	73.7	
SS18	Whole body	103	13.31	E1	1.2	11.356	74.6	
SS19	Whole body	100	10.72	E1	1.1	8.624	73.3	
SS20	Whole body	74	4.24	E1	1.0	3.057	72.3	
SS21	Whole body	99	12.1	E1	1.2	8.934	73.0	
SS22	Whole body	74	4.41	E1	1.1	3.232	70.7	
SS23	Whole body	65	2.66	E2	1.0	1.884	73.8	
SS24	Whole body	76	4.92	E2	1.1	3.66	72.9	
SS25	Whole body	82	5.43	E2	1.0	4.115	73.7	
SS26	Whole body	97	9.04	E2	1.0	6.812	76.6	
SS27	Whole body	73	4.16	E2	1.1	3.199	74.1	
SS28	Whole body	87	6.69	E2	1.0	2.691	76.4	
SS29	Whole body	85	5.94	E2	1.0	4.702	71.7	
SS30	Whole body	81	5.61	E2	1.1	4.383	70.8	
Arctic Grayling								
Ag 1	Liver	351	440	G pool*	1.0	3.395	69.1	mature male
Ag 1	Muscle					103.318	74.4	
Ag 2	Liver	220	120	G pool	1.1	0.82	69.1	immature female
Ag 2	Muscle					49.715	69.5	
Ag 3	Liver	245	140	G pool	1.0	0.982	59.9	mature male
Ag 3	Muscle					62.876	66.9	
Ag 4	Liver	268	210	G pool	1.1	2.389	60.2	mature male
Ag 4	Muscle					82.98	70.6	
Ag 5	Liver	291	265	G pool	1.1	3.224	75.9	mature female
Ag 5	Muscle					91.732	71.2	
Ag 6	Liver	252	170	G pool	1.1	2.061	60.9	mature female
Ag 6	Muscle					74.543	71.4	
Ag 7	Liver	286	258	G pool	1.1	2.129	55.8	mature male
Ag 7	Muscle					89.226	69.9	
Ag 8	Liver	178	58	G pool	1.0	0.57	71.3	immature male
Ag 8	Muscle					34.483	71.6	
Ag 9	Liver	164	48	G pool	1.1	0.548	71.7	immature male
Ag 9	Muscle					28.798	73.0	
Ag 10	Liver	177	57	G pool	1.0	0.615	65.5	immature male
Ag 10	Muscle					33.493	72.5	
Ag 11	Liver	169	46	G pool	1.0	0.781	74.4	immature male
Ag 11	Muscle					27.845	72.1	
Ag 12	Liver	162	44	G pool	1.0	0.399	74.2	immature female
Ag 12	Muscle					24.59	72.9	
Ag 13	Liver	181	51	G pool	0.9	0.61	76.3	immature male
Ag 13	Muscle					28.771	75.5	
Ag 14	Liver	207	81	G pool	0.9	0.978	78.8	immature male
Ag 14	Muscle					44.762	74.0	
Ag 15	Liver	325	375	E2	1.1	2.907	61.7	mature male
Ag 15	Muscle					111.127	70.4	
*G pool = Pool below Gabion structure								

TABLE 26 CONVERTED WET WEIGHTS FOR SELECTED METALS IN SCULPIN TISSUES

Site	Arsenic (ug/g)	Cadmium (ug/g)	Chromium (ug/g)	Copper (ug/g)	Iron (ug/g)	Lead (ug/g)	Maganese (ug/g)	Mercury (ug/g)	nickel (ug/g)	Selenium (ug/g)	Zinc (ug/g)
E1	0.08	0.02	0.15	0.7	42.43	0.05	11.34	0.12	0.45	1.6	29.1
E1	0.08	0.04	0.1	0.53	35.84	0.11	22.88	0.11	0.28	1.39	32.48
E1	0.12	0.04	1.43	0.85	104.08	0.06	19.67	0.08	2.54	1.87	28.14
E1	0.08	0.03	0.17	0.71	73.04	0.06	17.34	0.09	0.42	1.79	26.1
E1	0.15	0.05	0.38	1.12	126.18	0.09	30.38	0.1	1.01	1.63	34.55
E1	0.06	0.02	0.06	0.71	27.55	0.29	11.46	0.07	0.18	1.45	19.63
E1	0.08	0.06	0.26	0.75	67.33	0.06	38.66	0.06	0.58	2.04	32.09
E1	0.15	0.03	0.68	0.76	80.01	0.02	25.65	0.08	4.24	1.2	21.64
E1	0.06	0.03	0.11	0.66	41.12	0.04	22.11	0.06	0.26	1.55	23.36
E1	0.11	0.07	0.37	0.65	75.62	0.05	25.37	0.07	0.83	1.13	19.17
E1	0.16	0.05	0.77	0.96	150.66	0.07	33.21	0.12	1.49	1.76	26.43
E1	0.12	0.04	0.45	0.91	97.57	0.06	17.08	0.04	0.72	1.31	19.31
Mean	0.1	0.04	0.41	0.78	76.79	0.08	22.93	0.08	1.08	1.56	26
SD	0.04	0.01	0.39	0.16	37.83	0.07	8.34	0.03	1.19	0.28	5.43
E2	0.08	0.03	0.15	0.62	43.69	0.11	12.72	0.07	0.36	1.85	23.62
E2	0.07	0.02	<0.05	0.47	19.55	<0.01	5.34	0.06	0.16	1.06	23.74
E2	0.05	0.03	<0.05	0.57	18.48	<0.01	10.46	0.08	0.25	1.26	19.7
E2	0.08	0.03	0.08	0.51	32.61	0.01	10.94	0.07	0.33	1.35	18.8
E2	0.06	0.02	0.07	0.69	28.78	0.02	13.5	0.09	0.18	1.54	28.55
E2	0.07	0.08	<0.05	0.59	32.12	0.03	30.3	0.04	0.19	1.79	24.61
E2	0.09	0.03	0.09	0.45	26.67	0.03	11.23	0.14	0.31	1.29	28.08
E2	0.13	0.03	0.19	0.93	121.69	0.07	8.21	0.13	0.69	1.51	23.21
E2	0.09	0.04	0.06	0.61	26.48	0.03	12.7	0.09	0.44	1.65	23.62
Mean	0.08	0.03	0.1	0.6	38.9	0.04	12.82	0.08	0.32	1.48	23.77
SD	0.02	0.02	0.05	0.14	31.94	0.03	7.03	0.03	0.16	0.26	3.23
E4	0.04	0.02	0.02	0.64	18.13	0.05	11.66	0.06	0.07	1.36	18.54
E4	0.09	0.03	<0.06	0.52	22.17	0.05	14.07	0.05	0.17	1.2	22.25
E4	0.08	0.05	0.11	0.58	18.97	0.07	10.85	0.07	0.28	1.31	34.84
E4	0.11	0.05	0.19	0.55	49.26	0.07	20.62	0.14	1.17	1.46	36.42
E4	0.18	0.03	0.09	0.76	26.93	0.05	8.47	0.12	0.35	1.61	24.9
E4	0.08	0.02	0.12	0.56	29.52	0.04	18.94	0.13	0.53	1.46	29.76
E4	0.07	0.02	0.13	0.72	32.19	0.01	12.4	0.05	0.37	1.74	19.23
Mean	0.09	0.03	0.11	0.62	28.17	0.05	13.86	0.09	0.42	1.45	26.56
SD	0.04	0.01	0.06	0.09	10.69	0.02	4.41	0.04	0.36	0.18	7.25
E6	0.17	0.05	0.11	0.63	61.36	0.09	14.75	0.14	0.65	1.32	33.51
E6	0.12	0.03	0.14	0.63	54.92	0.05	14.87	0.11	0.68	1.31	27.57
Mean	0.14	0.04	0.12	0.63	58.14	0.07	14.81	0.13	0.66	1.32	30.54
SD	0.03	0.01	0.02	0	4.56	0.02	0.09	0.02	0.03	0.01	4.2

TABLE 27 CONVERTED WET WEIGHTS FOR SELECTED METALS IN ARCTIC GRAYLING TISSUES

Site	Arsenic (ug/g)	Cadmium (ug/g)	Chromium (ug/g)	Copper (ug/g)	Iron (ug/g)	Lead (ug/g)	Maganese (ug/g)	Mercury (ug/g)	nickel (ug/g)	Selenium (ug/g)	Zinc (ug/g)
E1	0.08	0.02	0.15	0.7	42.43	0.05	11.34	0.12	0.45	1.6	29.1
E1	0.08	0.04	0.1	0.53	35.84	0.11	22.88	0.11	0.28	1.39	32.48
E1	0.12	0.04	1.43	0.85	104.08	0.06	19.67	0.08	2.54	1.87	28.14
E1	0.08	0.03	0.17	0.71	73.04	0.06	17.34	0.09	0.42	1.79	26.1
E1	0.15	0.05	0.38	1.12	126.18	0.09	30.38	0.1	1.01	1.63	34.55
E1	0.06	0.02	0.06	0.71	27.55	0.29	11.46	0.07	0.18	1.45	19.63
E1	0.08	0.06	0.26	0.75	67.33	0.06	38.66	0.06	0.58	2.04	32.09
E1	0.15	0.03	0.68	0.76	80.01	0.02	25.65	0.08	4.24	1.2	21.64
E1	0.06	0.03	0.11	0.66	41.12	0.04	22.11	0.06	0.26	1.55	23.36
E1	0.11	0.07	0.37	0.65	75.62	0.05	25.37	0.07	0.83	1.13	19.17
E1	0.16	0.05	0.77	0.96	150.66	0.07	33.21	0.12	1.49	1.76	26.43
E1	0.12	0.04	0.45	0.91	97.57	0.06	17.08	0.04	0.72	1.31	19.31
Mean	0.1	0.04	0.41	0.78	76.79	0.08	22.93	0.08	1.08	1.56	26
SD	0.04	0.01	0.39	0.16	37.83	0.07	8.34	0.03	1.19	0.28	5.43
E2	0.08	0.03	0.15	0.62	43.69	0.11	12.72	0.07	0.36	1.85	23.62
E2	0.07	0.02	<0.05	0.47	19.55	<0.01	5.34	0.06	0.16	1.06	23.74
E2	0.05	0.03	<0.05	0.57	18.48	<0.01	10.46	0.08	0.25	1.26	19.7
E2	0.08	0.03	0.08	0.51	32.61	0.01	10.94	0.07	0.33	1.35	18.8
E2	0.06	0.02	0.07	0.69	28.78	0.02	13.5	0.09	0.18	1.54	28.55
E2	0.07	0.08	<0.05	0.59	32.12	0.03	30.3	0.04	0.19	1.79	24.61
E2	0.09	0.03	0.09	0.45	26.67	0.03	11.23	0.14	0.31	1.29	28.08
E2	0.13	0.03	0.19	0.93	121.69	0.07	8.21	0.13	0.69	1.51	23.21
E2	0.09	0.04	0.06	0.61	26.48	0.03	12.7	0.09	0.44	1.65	23.62
Mean	0.08	0.03	0.1	0.6	38.9	0.04	12.82	0.08	0.32	1.48	23.77
SD	0.02	0.02	0.05	0.14	31.94	0.03	7.03	0.03	0.16	0.26	3.23
E4	0.04	0.02	0.02	0.64	18.13	0.05	11.66	0.06	0.07	1.36	18.54
E4	0.09	0.03	<0.06	0.52	22.17	0.05	14.07	0.05	0.17	1.2	22.25
E4	0.08	0.05	0.11	0.58	18.97	0.07	10.85	0.07	0.28	1.31	34.84
E4	0.11	0.05	0.19	0.55	49.26	0.07	20.62	0.14	1.17	1.46	36.42
E4	0.18	0.03	0.09	0.76	26.93	0.05	8.47	0.12	0.35	1.61	24.9
E4	0.08	0.02	0.12	0.56	29.52	0.04	18.94	0.13	0.53	1.46	29.76
E4	0.07	0.02	0.13	0.72	32.19	0.01	12.4	0.05	0.37	1.74	19.23
Mean	0.09	0.03	0.11	0.62	28.17	0.05	13.86	0.09	0.42	1.45	26.56
SD	0.04	0.01	0.06	0.09	10.69	0.02	4.41	0.04	0.36	0.18	7.25
E6	0.17	0.05	0.11	0.63	61.36	0.09	14.75	0.14	0.65	1.32	33.51
E6	0.12	0.03	0.14	0.63	54.92	0.05	14.87	0.11	0.68	1.31	27.57
Mean	0.14	0.04	0.12	0.63	58.14	0.07	14.81	0.13	0.66	1.32	30.54
SD	0.03	0.01	0.02	0	4.56	0.02	0.09	0.02	0.03	0.01	4.2

LABERGE ENVIRONMENTAL
ATTN: Bonnie Burns
PO Box 21072
Whitehorse YT Y1A 6P7

Date Received: 13-SEP-16
Report Date: 18-OCT-16 18:10 (MT)
Version: FINAL

Client Phone: 867-668-6838

Certificate of Analysis

Lab Work Order #: L1829583

Project P.O. #: NOT SUBMITTED
Job Reference: CLINTON CREEK
C of C Numbers: 14-470934, 14-470935, 14-470936, 14-470937, 14-470938
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1829583-1 TISSUE 06-SEP-16 SS1	L1829583-2 TISSUE 06-SEP-16 SS2	L1829583-3 TISSUE 06-SEP-16 SS3	L1829583-4 TISSUE 06-SEP-16 SS4	L1829583-5 TISSUE 06-SEP-16 SS5
TISSUE						
Physical Tests	% Moisture (%)	74.3	72.7	71.1	73.2	73.8
Metals	Aluminum (Al)-Total (mg/kg)	34.5	9.5	11.9	14.3	33.2
	Antimony (Sb)-Total (mg/kg)	0.095	0.014	0.121	0.496	0.076
	Arsenic (As)-Total (mg/kg)	0.301	0.156	0.306	0.285	0.430
	Barium (Ba)-Total (mg/kg)	5.69	4.43	6.08	11.3	12.3
	Beryllium (Be)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Bismuth (Bi)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Boron (B)-Total (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
	Cadmium (Cd)-Total (mg/kg)	0.128	0.0589	0.106	0.198	0.196
	Calcium (Ca)-Total (mg/kg)	52200	41700	44500	66700	75900
	Cesium (Cs)-Total (mg/kg)	0.373	0.0649	0.363	0.514	0.705
	Chromium (Cr)-Total (mg/kg)	0.573	0.056	<0.20	0.40	0.72
	Cobalt (Co)-Total (mg/kg)	0.219	0.070	0.088	0.081	0.360
	Copper (Cu)-Total (mg/kg)	2.42	2.34	1.81	2.15	2.10
	Iron (Fe)-Total (mg/kg)	170	66.4	76.7	70.8	188
	Lead (Pb)-Total (mg/kg)	0.438	0.173	0.182	0.278	0.253
	Lithium (Li)-Total (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Magnesium (Mg)-Total (mg/kg)	1410	1340	1320	1720	2230
	Manganese (Mn)-Total (mg/kg)	49.5	42.7	48.7	40.5	78.7
	Mercury (Hg)-Total (mg/kg)	0.280	0.229	0.174	0.264	0.517
	Molybdenum (Mo)-Total (mg/kg)	0.088	0.063	0.063	0.060	0.087
	Nickel (Ni)-Total (mg/kg)	1.39	0.27	0.60	1.05	4.48
	Phosphorus (P)-Total (mg/kg)	29300	30500	30900	43300	46800
	Potassium (K)-Total (mg/kg)	9410	10600	8820	9450	8620
	Rubidium (Rb)-Total (mg/kg)	2.23	1.09	1.77	2.89	3.31
	Selenium (Se)-Total (mg/kg)	7.19	4.98	4.15	4.87	5.58
	Sodium (Na)-Total (mg/kg)	3800	4210	3590	3760	4820
	Strontium (Sr)-Total (mg/kg)	78.7	52.8	65.1	96.5	120
	Tellurium (Te)-Total (mg/kg)	<0.020	<0.020	<0.020	<0.020	<0.020
	Thallium (Tl)-Total (mg/kg)	0.0279	0.0194	0.0248	0.0360	0.0362
	Tin (Sn)-Total (mg/kg)	0.26	0.18	<0.10	0.18	<0.10
	Uranium (U)-Total (mg/kg)	0.0127	0.0087	0.0133	0.0325	0.0711
	Vanadium (V)-Total (mg/kg)	0.43	0.24	0.39	0.99	1.28
	Zinc (Zn)-Total (mg/kg)	91.9	67.9	77.0	130	139
	Zirconium (Zr)-Total (mg/kg)	0.25	<0.20	<0.20	<0.20	<0.20

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1829583-6 TISSUE 06-SEP-16 SS6	L1829583-7 TISSUE 06-SEP-16 SS7	L1829583-8 TISSUE 06-SEP-16 SS8	L1829583-9 TISSUE 06-SEP-16 SS9	L1829583-10 TISSUE 06-SEP-16 SS10
TISSUE						
Physical Tests	% Moisture (%)	73.6	76.0	73.4	76.4	77.4
Metals	Aluminum (Al)-Total (mg/kg)	18.8	18.0	16.7	92.4	69.1
	Antimony (Sb)-Total (mg/kg)	0.035	0.028	0.015	0.090	0.107
	Arsenic (As)-Total (mg/kg)	0.676	0.317	0.257	0.714	0.531
	Barium (Ba)-Total (mg/kg)	8.72	8.94	4.99	13.5	12.1
	Beryllium (Be)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Bismuth (Bi)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Boron (B)-Total (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
	Cadmium (Cd)-Total (mg/kg)	0.129	0.093	0.0883	0.216	0.142
	Calcium (Ca)-Total (mg/kg)	55500	65500	39600	70700	57500
	Cesium (Cs)-Total (mg/kg)	0.804	0.914	0.163	0.831	0.988
	Chromium (Cr)-Total (mg/kg)	0.34	0.48	0.500	0.45	0.60
	Cobalt (Co)-Total (mg/kg)	0.185	0.203	0.174	0.417	0.347
	Copper (Cu)-Total (mg/kg)	2.88	2.35	2.69	2.66	2.79
	Iron (Fe)-Total (mg/kg)	102	123	121	260	243
	Lead (Pb)-Total (mg/kg)	0.177	0.153	0.052	0.364	0.227
	Lithium (Li)-Total (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Magnesium (Mg)-Total (mg/kg)	1640	1830	1430	1780	1770
	Manganese (Mn)-Total (mg/kg)	32.1	78.9	46.6	62.5	65.8
	Mercury (Hg)-Total (mg/kg)	0.459	0.533	0.179	0.612	0.492
	Molybdenum (Mo)-Total (mg/kg)	0.062	0.139	0.060	0.119	0.081
	Nickel (Ni)-Total (mg/kg)	1.33	2.20	1.39	2.74	3.02
	Phosphorus (P)-Total (mg/kg)	36200	39300	29000	42700	38100
	Potassium (K)-Total (mg/kg)	9320	10700	10500	10500	10200
	Rubidium (Rb)-Total (mg/kg)	4.34	3.89	1.68	7.00	5.92
	Selenium (Se)-Total (mg/kg)	6.09	6.09	6.54	5.60	5.79
	Sodium (Na)-Total (mg/kg)	4180	4730	4190	4670	4590
	Strontium (Sr)-Total (mg/kg)	89.6	99.2	53.7	110	93.0
	Tellurium (Te)-Total (mg/kg)	<0.020	<0.020	<0.020	<0.020	<0.020
	Thallium (Tl)-Total (mg/kg)	0.0400	0.0338	0.0224	0.0354	0.0304
	Tin (Sn)-Total (mg/kg)	0.14	0.22	1.67	0.27	0.28
	Uranium (U)-Total (mg/kg)	0.0249	0.0306	0.0115	0.0787	0.0355
	Vanadium (V)-Total (mg/kg)	0.63	1.00	0.22	1.40	0.97
	Zinc (Zn)-Total (mg/kg)	94.3	124	72.3	142	122
	Zirconium (Zr)-Total (mg/kg)	<0.20	<0.20	<0.20	0.33	0.21

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1829583-11	L1829583-12	L1829583-13	L1829583-14	L1829583-15
Description	TISSUE	TISSUE	TISSUE	TISSUE	TISSUE
Sampled Date	07-SEP-16	07-SEP-16	07-SEP-16	07-SEP-16	07-SEP-16
Sampled Time					
Client ID	SS11	SS12	SS13	SS14	SS15
Grouping / **Analyte**					
TISSUE					
Physical Tests % Moisture (%)	72.8	72.0	75.1	74.9	75.5
Metals Aluminum (Al)-Total (mg/kg)	30.8	22.2	77.5	47.7	135
Antimony (Sb)-Total (mg/kg)	0.023	0.036	0.074	0.032	0.069
Arsenic (As)-Total (mg/kg)	0.298	0.303	0.491	0.309	0.603
Barium (Ba)-Total (mg/kg)	5.91	8.03	9.65	6.56	19.4
Beryllium (Be)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth (Bi)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
Boron (B)-Total (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium (Cd)-Total (mg/kg)	0.0749	0.155	0.141	0.132	0.187
Calcium (Ca)-Total (mg/kg)	45700	51000	39700	42600	74700
Cesium (Cs)-Total (mg/kg)	0.259	0.254	0.214	0.0686	0.225
Chromium (Cr)-Total (mg/kg)	0.545	0.34	5.74	0.670	1.54
Cobalt (Co)-Total (mg/kg)	0.163	0.133	0.640	0.239	0.523
Copper (Cu)-Total (mg/kg)	2.58	1.90	3.41	2.82	4.58
Iron (Fe)-Total (mg/kg)	156	128	418	291	515
Lead (Pb)-Total (mg/kg)	0.174	0.375	0.242	0.220	0.348
Lithium (Li)-Total (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)-Total (mg/kg)	1460	1520	1890	1500	2240
Manganese (Mn)-Total (mg/kg)	41.7	81.7	79.0	69.1	124
Mercury (Hg)-Total (mg/kg)	0.436	0.400	0.319	0.353	0.420
Molybdenum (Mo)-Total (mg/kg)	0.083	0.063	0.140	0.085	0.172
Nickel (Ni)-Total (mg/kg)	1.66	1.00	10.2	1.69	4.14
Phosphorus (P)-Total (mg/kg)	31000	32800	31100	31700	47400
Potassium (K)-Total (mg/kg)	9350	9500	11600	11700	11900
Rubidium (Rb)-Total (mg/kg)	1.37	2.07	2.05	1.83	1.95
Selenium (Se)-Total (mg/kg)	5.88	4.97	7.50	7.14	6.65
Sodium (Na)-Total (mg/kg)	3760	3810	4650	4530	4650
Strontium (Sr)-Total (mg/kg)	70.7	76.6	57.6	57.2	114
Tellurium (Te)-Total (mg/kg)	<0.020	<0.020	<0.020	<0.020	<0.020
Thallium (Tl)-Total (mg/kg)	0.0208	0.0327	0.0565	0.0349	0.0312
Tin (Sn)-Total (mg/kg)	0.12	0.11	0.16	0.12	0.22
Uranium (U)-Total (mg/kg)	0.0260	0.0255	0.0316	0.0353	0.0554
Vanadium (V)-Total (mg/kg)	0.44	0.94	0.80	0.53	0.99
Zinc (Zn)-Total (mg/kg)	107	116	113	104	141
Zirconium (Zr)-Total (mg/kg)	<0.20	<0.20	0.24	<0.20	0.45

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1829583-16 TISSUE 07-SEP-16 SS16	L1829583-17 TISSUE 07-SEP-16 SS17	L1829583-18 TISSUE 07-SEP-16 SS18	L1829583-19 TISSUE 07-SEP-16 SS19	L1829583-20 TISSUE 07-SEP-16 SS20
TISSUE						
Physical Tests	% Moisture (%)	75.4	73.7	74.6	73.3	72.3
Metals	Aluminum (Al)-Total (mg/kg)	20.3	53.6	87.1	23.7	92.8
	Antimony (Sb)-Total (mg/kg)	0.013	0.049	0.065	0.021	0.054
	Arsenic (As)-Total (mg/kg)	0.246	0.304	0.606	0.219	0.393
	Barium (Ba)-Total (mg/kg)	5.74	13.2	6.24	7.87	9.71
	Beryllium (Be)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Bismuth (Bi)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Boron (B)-Total (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
	Cadmium (Cd)-Total (mg/kg)	0.085	0.227	0.109	0.0984	0.244
	Calcium (Ca)-Total (mg/kg)	32700	54700	31500	40300	34400
	Cesium (Cs)-Total (mg/kg)	0.249	0.176	0.0644	0.0624	0.217
	Chromium (Cr)-Total (mg/kg)	0.25	1.00	2.69	0.409	1.34
	Cobalt (Co)-Total (mg/kg)	0.141	0.389	0.688	0.175	0.446
	Copper (Cu)-Total (mg/kg)	2.88	2.84	3.01	2.48	2.36
	Iron (Fe)-Total (mg/kg)	112	256	315	154	273
	Lead (Pb)-Total (mg/kg)	1.17	0.221	0.075	0.151	0.177
	Lithium (Li)-Total (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Magnesium (Mg)-Total (mg/kg)	1330	1710	4140	1500	1370
	Manganese (Mn)-Total (mg/kg)	46.6	147	101	82.8	91.6
	Mercury (Hg)-Total (mg/kg)	0.273	0.237	0.315	0.210	0.243
	Molybdenum (Mo)-Total (mg/kg)	0.055	0.126	0.041	0.069	0.116
	Nickel (Ni)-Total (mg/kg)	0.75	2.20	16.7	0.96	2.98
	Phosphorus (P)-Total (mg/kg)	24200	38500	28500	31400	23400
	Potassium (K)-Total (mg/kg)	11000	11100	11000	10700	8530
	Rubidium (Rb)-Total (mg/kg)	1.92	1.88	1.85	1.33	1.59
	Selenium (Se)-Total (mg/kg)	5.88	7.76	4.72	5.79	4.09
	Sodium (Na)-Total (mg/kg)	3890	4280	4390	4090	3200
	Strontium (Sr)-Total (mg/kg)	47.9	81.2	48.2	55.4	53.6
	Tellurium (Te)-Total (mg/kg)	<0.020	<0.020	<0.020	<0.020	<0.020
	Thallium (Tl)-Total (mg/kg)	0.0236	0.0404	0.0216	0.0284	0.0233
	Tin (Sn)-Total (mg/kg)	0.17	0.15	0.10	<0.10	0.11
	Uranium (U)-Total (mg/kg)	0.0151	0.0214	0.0117	0.0104	0.0295
	Vanadium (V)-Total (mg/kg)	0.36	0.76	0.84	0.37	0.60
	Zinc (Zn)-Total (mg/kg)	79.8	122	85.2	87.5	69.2
	Zirconium (Zr)-Total (mg/kg)	<0.20	<0.20	<0.20	<0.20	0.29

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1829583-21 TISSUE 07-SEP-16 SS21	L1829583-22 TISSUE 07-SEP-16 SS22	L1829583-23 TISSUE 07-SEP-16 SS23	L1829583-24 TISSUE 07-SEP-16 SS24	L1829583-25 TISSUE 07-SEP-16 SS25
TISSUE						
Physical Tests	% Moisture (%)	73.0	70.7	73.8	72.9	73.7
Metals	Aluminum (Al)-Total (mg/kg)	123	133	8.1	5.1	21.0
	Antimony (Sb)-Total (mg/kg)	0.076	0.046	0.013	0.092	0.013
	Arsenic (As)-Total (mg/kg)	0.575	0.413	0.259	0.200	0.300
	Barium (Ba)-Total (mg/kg)	15.2	8.81	7.22	6.18	6.18
	Beryllium (Be)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Bismuth (Bi)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Boron (B)-Total (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
	Cadmium (Cd)-Total (mg/kg)	0.176	0.123	0.073	0.095	0.114
	Calcium (Ca)-Total (mg/kg)	48700	38000	38600	45400	37200
	Cesium (Cs)-Total (mg/kg)	0.212	0.355	0.767	0.586	0.782
	Chromium (Cr)-Total (mg/kg)	2.84	1.52	<0.20	<0.20	0.29
	Cobalt (Co)-Total (mg/kg)	0.596	0.295	0.099	0.066	0.169
	Copper (Cu)-Total (mg/kg)	3.54	3.11	1.81	2.09	1.94
	Iron (Fe)-Total (mg/kg)	558	333	74.6	68.2	124
	Lead (Pb)-Total (mg/kg)	0.265	0.221	<0.050	<0.050	0.056
	Lithium (Li)-Total (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Magnesium (Mg)-Total (mg/kg)	1790	1360	1370	1520	1350
	Manganese (Mn)-Total (mg/kg)	123	58.3	20.4	38.6	41.6
	Mercury (Hg)-Total (mg/kg)	0.449	0.153	0.226	0.279	0.249
	Molybdenum (Mo)-Total (mg/kg)	0.168	0.142	0.060	0.059	0.072
	Nickel (Ni)-Total (mg/kg)	5.51	2.45	0.60	0.92	1.24
	Phosphorus (P)-Total (mg/kg)	32500	25800	27600	31500	26300
	Potassium (K)-Total (mg/kg)	9620	8460	9840	9560	10000
	Rubidium (Rb)-Total (mg/kg)	1.71	2.25	3.19	2.57	3.42
	Selenium (Se)-Total (mg/kg)	6.52	4.47	4.06	4.66	5.15
	Sodium (Na)-Total (mg/kg)	4050	2890	3860	3540	3600
	Strontium (Sr)-Total (mg/kg)	78.5	52.8	53.7	72.1	58.7
	Tellurium (Te)-Total (mg/kg)	<0.020	<0.020	<0.020	<0.020	<0.020
	Thallium (Tl)-Total (mg/kg)	0.0389	0.0309	0.0269	0.0211	0.0276
	Tin (Sn)-Total (mg/kg)	0.14	<0.10	0.19	<0.10	0.17
	Uranium (U)-Total (mg/kg)	0.0584	0.0242	0.0072	0.0179	0.0179
	Vanadium (V)-Total (mg/kg)	0.97	0.70	0.24	0.27	0.28
	Zinc (Zn)-Total (mg/kg)	97.9	65.9	90.6	72.7	71.5
	Zirconium (Zr)-Total (mg/kg)	0.36	0.35	<0.20	<0.20	<0.20

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1829583-26	L1829583-27	L1829583-28	L1829583-29	L1829583-30
Description	TISSUE	TISSUE	TISSUE	TISSUE	TISSUE
Sampled Date	07-SEP-16	07-SEP-16	07-SEP-16	07-SEP-16	07-SEP-16
Sampled Time					
Client ID	SS26	SS27	SS28	SS29	SS30
Grouping / **Analyte**					
TISSUE					
Physical Tests % Moisture (%)	76.6	74.1	76.4	71.7	70.8
Metals Aluminum (Al)-Total (mg/kg)	12.0	14.1	18.1	52.2	11.4
Antimony (Sb)-Total (mg/kg)	0.023	0.021	0.379	0.031	0.016
Arsenic (As)-Total (mg/kg)	0.253	0.287	0.382	0.466	0.292
Barium (Ba)-Total (mg/kg)	7.71	10.7	8.33	7.98	7.25
Beryllium (Be)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth (Bi)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
Boron (B)-Total (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium (Cd)-Total (mg/kg)	0.0933	0.310	0.140	0.109	0.134
Calcium (Ca)-Total (mg/kg)	64900	50900	55400	46100	38600
Cesium (Cs)-Total (mg/kg)	0.120	0.374	0.410	0.631	0.784
Chromium (Cr)-Total (mg/kg)	0.289	<0.20	0.38	0.67	0.20
Cobalt (Co)-Total (mg/kg)	0.128	0.148	0.119	0.223	0.115
Copper (Cu)-Total (mg/kg)	2.93	2.29	1.89	3.29	2.08
Iron (Fe)-Total (mg/kg)	123	124	113	430	90.7
Lead (Pb)-Total (mg/kg)	0.096	0.105	0.121	0.234	0.109
Lithium (Li)-Total (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)-Total (mg/kg)	1630	1560	1580	1500	1370
Manganese (Mn)-Total (mg/kg)	57.7	117	47.6	29.0	43.5
Mercury (Hg)-Total (mg/kg)	0.383	0.161	0.575	0.468	0.314
Molybdenum (Mo)-Total (mg/kg)	0.058	0.066	0.084	0.094	0.076
Nickel (Ni)-Total (mg/kg)	0.79	0.75	1.31	2.43	1.49
Phosphorus (P)-Total (mg/kg)	37600	33500	34600	29100	26800
Potassium (K)-Total (mg/kg)	10100	9970	10700	9110	8860
Rubidium (Rb)-Total (mg/kg)	1.57	1.91	3.44	3.34	3.55
Selenium (Se)-Total (mg/kg)	6.57	6.93	5.48	5.33	5.65
Sodium (Na)-Total (mg/kg)	4590	4080	4560	3500	3080
Strontium (Sr)-Total (mg/kg)	99.8	85.3	79.7	66.7	75.8
Tellurium (Te)-Total (mg/kg)	<0.020	<0.020	<0.020	<0.020	<0.020
Thallium (Tl)-Total (mg/kg)	0.0288	0.0180	0.0203	0.0397	0.0174
Tin (Sn)-Total (mg/kg)	<0.10	0.24	0.19	0.11	0.12
Uranium (U)-Total (mg/kg)	0.0160	0.0173	0.0272	0.0269	0.0281
Vanadium (V)-Total (mg/kg)	0.48	0.31	0.40	0.44	0.40
Zinc (Zn)-Total (mg/kg)	122	95.0	119	82.0	80.9
Zirconium (Zr)-Total (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1829583-31 TISSUE 05-SEP-16 AG1-LIVER	L1829583-32 TISSUE 05-SEP-16 AG1-MUSCLE	L1829583-33 TISSUE 05-SEP-16 AG2-LIVER	L1829583-34 TISSUE 05-SEP-16 AG2-MUSCLE	L1829583-35 TISSUE 05-SEP-16 AG3-LIVER
Sample ID						
Description						
Sampled Date						
Sampled Time						
Client ID						
TISSUE						
Physical Tests	% Moisture (%)	69.1	74.4	69.1	69.5	59.9
Metals	Aluminum (Al)-Total (mg/kg)	<5.0	2.9	<5.0	18.2	<5.0
	Antimony (Sb)-Total (mg/kg)	0.015	<0.010	<0.010	<0.010	<0.010
	Arsenic (As)-Total (mg/kg)	0.033	0.048	0.070	0.121	0.066
	Barium (Ba)-Total (mg/kg)	<0.050	1.57	<0.050	2.27	0.080
	Beryllium (Be)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Bismuth (Bi)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Boron (B)-Total (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
	Cadmium (Cd)-Total (mg/kg)	3.98	0.0303	0.428	0.0364	0.222
	Calcium (Ca)-Total (mg/kg)	162	24100	174	15000	921
	Cesium (Cs)-Total (mg/kg)	0.0292	0.142	0.0287	0.0755	0.0125
	Chromium (Cr)-Total (mg/kg)	<0.20	0.407	<0.20	0.288	<0.20
	Cobalt (Co)-Total (mg/kg)	1.60	0.092	0.513	0.115	0.346
	Copper (Cu)-Total (mg/kg)	4.95	1.54	5.47	1.54	4.10
	Iron (Fe)-Total (mg/kg)	274	41.8	81.9	73.9	67.8
	Lead (Pb)-Total (mg/kg)	<0.050	0.022	<0.050	0.043	<0.050
	Lithium (Li)-Total (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Magnesium (Mg)-Total (mg/kg)	428	1290	544	1020	342
	Manganese (Mn)-Total (mg/kg)	3.94	6.55	3.67	9.19	3.79
	Mercury (Hg)-Total (mg/kg)	0.780	0.782	0.508	0.266	0.319
	Molybdenum (Mo)-Total (mg/kg)	0.361	0.053	0.437	0.060	0.313
	Nickel (Ni)-Total (mg/kg)	<0.20	0.28	<0.20	0.26	<0.20
	Phosphorus (P)-Total (mg/kg)	7410	21500	9640	15600	6300
	Potassium (K)-Total (mg/kg)	8310	12800	10100	12100	6270
	Rubidium (Rb)-Total (mg/kg)	2.12	2.27	3.69	2.62	2.38
	Selenium (Se)-Total (mg/kg)	11.4	5.26	8.52	5.14	6.25
	Sodium (Na)-Total (mg/kg)	3310	2410	2660	2130	1980
	Strontium (Sr)-Total (mg/kg)	0.29	27.2	0.21	16.8	1.16
	Tellurium (Te)-Total (mg/kg)	<0.020	<0.020	<0.020	<0.020	<0.020
	Thallium (Tl)-Total (mg/kg)	0.156	0.0304	0.159	0.0297	0.119
	Tin (Sn)-Total (mg/kg)	0.21	<0.10	0.14	<0.10	0.33
	Uranium (U)-Total (mg/kg)	0.0042	0.0051	<0.0020	0.0055	<0.0020
	Vanadium (V)-Total (mg/kg)	0.25	<0.10	0.19	0.15	<0.10
	Zinc (Zn)-Total (mg/kg)	56.9	53.5	77.7	45.3	52.7
	Zirconium (Zr)-Total (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1829583-36 TISSUE 05-SEP-16 AG3-MUSCLE	L1829583-37 TISSUE 05-SEP-16 AG4-LIVER	L1829583-38 TISSUE 05-SEP-16 AG4-MUSCLE	L1829583-39 TISSUE 05-SEP-16 AG5-LIVER	L1829583-40 TISSUE 05-SEP-16 AG5-MUSCLE
TISSUE						
Physical Tests	% Moisture (%)	66.9	60.2	70.6	75.9	71.2
Metals	Aluminum (Al)-Total (mg/kg)	<2.0	<5.0	<2.0	<5.0	<2.0
	Antimony (Sb)-Total (mg/kg)	0.255	<0.010	<0.010	<0.010	<0.010
	Arsenic (As)-Total (mg/kg)	0.298	0.050	0.055	0.053	0.057
	Barium (Ba)-Total (mg/kg)	1.04	<0.050	0.581	0.111	1.21
	Beryllium (Be)-Total (mg/kg)	0.024	<0.010	<0.010	<0.010	<0.010
	Bismuth (Bi)-Total (mg/kg)	0.259	<0.010	<0.010	<0.010	<0.010
	Boron (B)-Total (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
	Cadmium (Cd)-Total (mg/kg)	0.0319	0.666	0.0255	1.33	0.0227
	Calcium (Ca)-Total (mg/kg)	14700	146	12900	514	14900
	Cesium (Cs)-Total (mg/kg)	0.0574	0.0133	0.0407	0.0474	0.0798
	Chromium (Cr)-Total (mg/kg)	0.145	0.63	0.146	<0.20	0.122
	Cobalt (Co)-Total (mg/kg)	0.100	0.437	0.043	0.595	0.111
	Copper (Cu)-Total (mg/kg)	1.18	3.66	1.35	6.58	1.63
	Iron (Fe)-Total (mg/kg)	23.8	96.8	23.5	131	42.1
	Lead (Pb)-Total (mg/kg)	0.142	<0.050	<0.020	<0.050	<0.020
	Lithium (Li)-Total (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Magnesium (Mg)-Total (mg/kg)	942	316	989	794	1190
	Manganese (Mn)-Total (mg/kg)	2.93	2.16	1.77	6.67	6.63
	Mercury (Hg)-Total (mg/kg)	0.321	0.196	0.354	0.588	0.349
	Molybdenum (Mo)-Total (mg/kg)	0.084	0.221	0.024	0.419	0.029
	Nickel (Ni)-Total (mg/kg)	0.30	<0.20	<0.20	<0.20	<0.20
	Phosphorus (P)-Total (mg/kg)	13500	5600	14200	14100	16000
	Potassium (K)-Total (mg/kg)	10900	5560	12800	13600	13300
	Rubidium (Rb)-Total (mg/kg)	2.20	2.33	2.68	6.44	3.39
	Selenium (Se)-Total (mg/kg)	4.09	6.16	3.92	14.4	6.26
	Sodium (Na)-Total (mg/kg)	1550	2040	1840	4540	2100
	Strontium (Sr)-Total (mg/kg)	17.5	0.24	13.3	0.83	18.6
	Tellurium (Te)-Total (mg/kg)	0.034	<0.020	<0.020	<0.020	<0.020
	Thallium (Tl)-Total (mg/kg)	0.280	0.116	0.0209	0.177	0.0247
	Tin (Sn)-Total (mg/kg)	0.16	<0.10	<0.10	0.51	<0.10
	Uranium (U)-Total (mg/kg)	0.0033	<0.0020	<0.0020	0.0024	0.0029
	Vanadium (V)-Total (mg/kg)	0.15	<0.10	<0.10	0.11	<0.10
	Zinc (Zn)-Total (mg/kg)	38.6	39.9	36.9	82.4	49.8
	Zirconium (Zr)-Total (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1829583-41 TISSUE 07-SEP-16 AG6-LIVER	L1829583-42 TISSUE 07-SEP-16 AG6-MUSCLE	L1829583-43 TISSUE 07-SEP-16 AG7-LIVER	L1829583-44 TISSUE 07-SEP-16 AG7-MUSCLE	L1829583-45 TISSUE 09-SEP-16 AG8-LIVER
TISSUE						
Physical Tests	% Moisture (%)	60.9	71.4	55.8	69.9	71.3
Metals	Aluminum (Al)-Total (mg/kg)	<5.0	4.4	<5.0	<2.0	<5.0
	Antimony (Sb)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Arsenic (As)-Total (mg/kg)	0.070	0.043	0.046	0.057	0.072
	Barium (Ba)-Total (mg/kg)	<0.050	1.46	<0.050	0.726	0.057
	Beryllium (Be)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Bismuth (Bi)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Boron (B)-Total (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
	Cadmium (Cd)-Total (mg/kg)	0.644	0.0514	1.05	0.0278	0.464
	Calcium (Ca)-Total (mg/kg)	172	19200	112	13500	221
	Cesium (Cs)-Total (mg/kg)	0.0166	0.0870	0.0107	0.0469	0.0467
	Chromium (Cr)-Total (mg/kg)	0.25	0.098	<0.20	0.140	<0.20
	Cobalt (Co)-Total (mg/kg)	0.373	0.077	0.637	0.072	0.458
	Copper (Cu)-Total (mg/kg)	3.69	1.77	3.25	1.66	6.60
	Iron (Fe)-Total (mg/kg)	145	31.6	141	30.6	100
	Lead (Pb)-Total (mg/kg)	<0.050	0.022	<0.050	<0.020	<0.050
	Lithium (Li)-Total (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Magnesium (Mg)-Total (mg/kg)	336	1210	285	1120	626
	Manganese (Mn)-Total (mg/kg)	2.41	5.07	2.87	4.60	6.89
	Mercury (Hg)-Total (mg/kg)	0.312	0.404	0.232	0.390	0.728
	Molybdenum (Mo)-Total (mg/kg)	0.215	0.026	0.226	0.022	0.409
	Nickel (Ni)-Total (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Phosphorus (P)-Total (mg/kg)	5700	18500	4980	15200	11100
	Potassium (K)-Total (mg/kg)	5850	14200	4970	14000	10400
	Rubidium (Rb)-Total (mg/kg)	2.19	2.80	1.57	2.31	4.58
	Selenium (Se)-Total (mg/kg)	6.37	3.64	9.73	5.13	9.98
	Sodium (Na)-Total (mg/kg)	2280	2200	1870	1860	2340
	Strontium (Sr)-Total (mg/kg)	0.27	19.8	0.17	14.9	0.32
	Tellurium (Te)-Total (mg/kg)	<0.020	<0.020	<0.020	<0.020	<0.020
	Thallium (Tl)-Total (mg/kg)	0.0848	0.0285	0.0745	0.0220	0.276
	Tin (Sn)-Total (mg/kg)	0.24	<0.10	0.22	<0.10	0.44
	Uranium (U)-Total (mg/kg)	<0.0020	0.0025	<0.0020	<0.0020	<0.0020
	Vanadium (V)-Total (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Zinc (Zn)-Total (mg/kg)	46.7	45.5	36.4	37.2	77.9
	Zirconium (Zr)-Total (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1829583-46 TISSUE 09-SEP-16 AG8-MUSCLE	L1829583-47 TISSUE 09-SEP-16 AG9-LIVER	L1829583-48 TISSUE 09-SEP-16 AG9-MUSCLE	L1829583-49 TISSUE 09-SEP-16 AG-10-LIVER	L1829583-50 TISSUE 09-SEP-16 AG-10-MUSCLE
Sample ID						
Description						
Sampled Date						
Sampled Time						
Client ID						
TISSUE						
Physical Tests	% Moisture (%)	71.6	71.7	73.0	65.5	72.5
Metals	Aluminum (Al)-Total (mg/kg)	4.0	<5.0	12.1	<5.0	2.6
	Antimony (Sb)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Arsenic (As)-Total (mg/kg)	0.069	0.097	0.081	0.129	0.077
	Barium (Ba)-Total (mg/kg)	2.23	0.066	2.32	<0.050	1.32
	Beryllium (Be)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Bismuth (Bi)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Boron (B)-Total (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
	Cadmium (Cd)-Total (mg/kg)	0.0449	0.549	0.0642	0.141	0.0191
	Calcium (Ca)-Total (mg/kg)	22600	246	19200	191	19300
	Cesium (Cs)-Total (mg/kg)	0.0600	0.0455	0.0464	0.0374	0.0801
	Chromium (Cr)-Total (mg/kg)	0.237	<0.20	0.388	<0.20	0.167
	Cobalt (Co)-Total (mg/kg)	0.055	0.287	0.079	0.325	0.052
	Copper (Cu)-Total (mg/kg)	2.07	5.65	2.08	4.87	2.18
	Iron (Fe)-Total (mg/kg)	28.2	121	66.5	113	34.0
	Lead (Pb)-Total (mg/kg)	0.028	<0.050	0.036	<0.050	<0.020
	Lithium (Li)-Total (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Magnesium (Mg)-Total (mg/kg)	1350	578	1300	479	1320
	Manganese (Mn)-Total (mg/kg)	8.71	3.92	10.7	4.05	4.56
	Mercury (Hg)-Total (mg/kg)	0.401	0.653	0.347	0.626	0.402
	Molybdenum (Mo)-Total (mg/kg)	0.034	0.398	0.056	0.401	0.026
	Nickel (Ni)-Total (mg/kg)	0.25	<0.20	0.39	<0.20	<0.20
	Phosphorus (P)-Total (mg/kg)	21900	10100	20100	8570	20400
	Potassium (K)-Total (mg/kg)	15100	11300	15400	8450	15500
	Rubidium (Rb)-Total (mg/kg)	2.15	3.60	1.90	3.26	2.69
	Selenium (Se)-Total (mg/kg)	3.39	9.86	4.20	8.46	4.04
	Sodium (Na)-Total (mg/kg)	2120	2610	2100	2260	2170
	Strontium (Sr)-Total (mg/kg)	28.9	0.35	23.8	0.29	22.7
	Tellurium (Te)-Total (mg/kg)	<0.020	<0.020	<0.020	<0.020	<0.020
	Thallium (Tl)-Total (mg/kg)	0.0244	0.206	0.0287	0.210	0.0312
	Tin (Sn)-Total (mg/kg)	<0.10	0.33	0.14	0.27	0.16
	Uranium (U)-Total (mg/kg)	0.0030	<0.0020	0.0039	<0.0020	<0.0020
	Vanadium (V)-Total (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Zinc (Zn)-Total (mg/kg)	57.0	60.7	49.3	61.1	61.9
	Zirconium (Zr)-Total (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1829583-51 TISSUE 09-SEP-16 AG11-LIVER	L1829583-52 TISSUE 09-SEP-16 AG11-MUSCLE	L1829583-53 TISSUE 09-SEP-16 AG12-LIVER	L1829583-54 TISSUE 09-SEP-16 AG12-MUSCLE	L1829583-55 TISSUE 09-SEP-16 AG13-LIVER
Sample ID						
Description						
Sampled Date						
Sampled Time						
Client ID						
TISSUE						
Physical Tests	% Moisture (%)	74.4	72.1	74.2	72.9	76.3
Metals	Aluminum (Al)-Total (mg/kg)	6.9	2.6	<5.0	2.0	5.3
	Antimony (Sb)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Arsenic (As)-Total (mg/kg)	0.150	0.071	0.060	0.085	0.116
	Barium (Ba)-Total (mg/kg)	0.451	1.53	0.090	1.86	0.169
	Beryllium (Be)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Bismuth (Bi)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Boron (B)-Total (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
	Cadmium (Cd)-Total (mg/kg)	0.250	0.0127	0.226	0.0258	0.229
	Calcium (Ca)-Total (mg/kg)	738	18700	226	20600	929
	Cesium (Cs)-Total (mg/kg)	0.0534	0.0345	0.0537	0.0559	0.201
	Chromium (Cr)-Total (mg/kg)	0.87	0.361	<0.20	0.217	<0.20
	Cobalt (Co)-Total (mg/kg)	0.332	0.045	0.336	0.059	0.719
	Copper (Cu)-Total (mg/kg)	5.97	2.00	5.71	2.22	5.25
	Iron (Fe)-Total (mg/kg)	159	29.6	145	35.7	177
	Lead (Pb)-Total (mg/kg)	<0.050	<0.020	<0.050	<0.020	<0.050
	Lithium (Li)-Total (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Magnesium (Mg)-Total (mg/kg)	798	1210	593	1430	686
	Manganese (Mn)-Total (mg/kg)	8.24	4.86	5.20	7.44	6.72
	Mercury (Hg)-Total (mg/kg)	0.781	0.390	0.549	0.335	0.424
	Molybdenum (Mo)-Total (mg/kg)	0.395	0.047	0.406	0.034	0.403
	Nickel (Ni)-Total (mg/kg)	0.64	0.31	<0.20	0.23	<0.20
	Phosphorus (P)-Total (mg/kg)	11600	18900	9810	21900	12300
	Potassium (K)-Total (mg/kg)	13300	14200	11400	16200	13200
	Rubidium (Rb)-Total (mg/kg)	4.29	2.26	4.33	2.69	8.03
	Selenium (Se)-Total (mg/kg)	10.9	3.76	11.7	4.75	11.3
	Sodium (Na)-Total (mg/kg)	3990	1880	2770	2210	3880
	Strontium (Sr)-Total (mg/kg)	1.97	21.1	0.35	25.4	1.34
	Tellurium (Te)-Total (mg/kg)	<0.020	<0.020	<0.020	<0.020	<0.020
	Thallium (Tl)-Total (mg/kg)	0.167	0.0260	0.245	0.0319	0.338
	Tin (Sn)-Total (mg/kg)	1.45	0.11	0.22	0.16	1.69
	Uranium (U)-Total (mg/kg)	0.0033	<0.0020	<0.0020	0.0029	0.0020
	Vanadium (V)-Total (mg/kg)	0.13	<0.10	<0.10	<0.10	0.11
	Zinc (Zn)-Total (mg/kg)	74.6	52.1	68.9	54.0	66.3
	Zirconium (Zr)-Total (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1829583-56 TISSUE 09-SEP-16 AG13-MUSCLE	L1829583-57 TISSUE 09-SEP-16 AG14-LIVER	L1829583-58 TISSUE 09-SEP-16 AG14-MUSCLE	L1829583-59 TISSUE 09-SEP-16 AG15-LIVER	L1829583-60 TISSUE 09-SEP-16 AG15-MUSCLE
Sample ID						
Description						
Sampled Date						
Sampled Time						
Client ID						
TISSUE						
Physical Tests	% Moisture (%)	75.5	78.8	74.0	61.7	70.4
Metals	Aluminum (Al)-Total (mg/kg)	5.7	<5.0	<2.0	<5.0	<2.0
	Antimony (Sb)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Arsenic (As)-Total (mg/kg)	0.130	0.085	0.080	0.033	0.055
	Barium (Ba)-Total (mg/kg)	2.81	0.258	1.46	<0.050	1.12
	Beryllium (Be)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Bismuth (Bi)-Total (mg/kg)	<0.010	<0.010	<0.010	<0.010	<0.010
	Boron (B)-Total (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
	Cadmium (Cd)-Total (mg/kg)	0.0400	0.486	0.0275	0.661	0.0203
	Calcium (Ca)-Total (mg/kg)	27400	514	21400	96	20900
	Cesium (Cs)-Total (mg/kg)	0.353	0.0837	0.0871	0.0291	0.159
	Chromium (Cr)-Total (mg/kg)	0.479	<0.20	0.347	<0.20	0.166
	Cobalt (Co)-Total (mg/kg)	0.227	0.829	0.076	0.683	0.057
	Copper (Cu)-Total (mg/kg)	1.92	6.27	1.65	3.62	1.67
	Iron (Fe)-Total (mg/kg)	71.2	151	28.8	141	22.4
	Lead (Pb)-Total (mg/kg)	0.030	<0.050	0.027	<0.050	<0.020
	Lithium (Li)-Total (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Magnesium (Mg)-Total (mg/kg)	1460	770	1390	348	1200
	Manganese (Mn)-Total (mg/kg)	21.2	8.96	7.18	3.42	7.02
	Mercury (Hg)-Total (mg/kg)	0.288	0.883	0.437	0.289	0.375
	Molybdenum (Mo)-Total (mg/kg)	0.073	0.504	0.032	0.304	0.023
	Nickel (Ni)-Total (mg/kg)	0.41	0.21	0.31	<0.20	<0.20
	Phosphorus (P)-Total (mg/kg)	25400	12700	21700	6140	20300
	Potassium (K)-Total (mg/kg)	16500	16300	16600	6730	13900
	Rubidium (Rb)-Total (mg/kg)	5.33	6.77	3.10	1.94	2.15
	Selenium (Se)-Total (mg/kg)	5.57	12.4	4.30	12.4	7.30
	Sodium (Na)-Total (mg/kg)	2460	4060	2360	1920	2120
	Strontium (Sr)-Total (mg/kg)	36.7	1.10	27.0	0.15	28.6
	Tellurium (Te)-Total (mg/kg)	<0.020	<0.020	<0.020	<0.020	<0.020
	Thallium (Tl)-Total (mg/kg)	0.0479	0.320	0.0330	0.102	0.0192
	Tin (Sn)-Total (mg/kg)	0.12	1.56	0.13	0.29	<0.10
	Uranium (U)-Total (mg/kg)	0.0103	0.0020	0.0050	<0.0020	0.0043
	Vanadium (V)-Total (mg/kg)	0.11	<0.10	<0.10	0.17	<0.10
	Zinc (Zn)-Total (mg/kg)	63.6	72.4	48.4	44.2	42.3
	Zirconium (Zr)-Total (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Antimony (Sb)-Total	DUP-H	L1829583-10, -27, -28, -3, -35, -4, -41, -43, -45, -49, -5, -59, -6, -7, -9
Duplicate	Chromium (Cr)-Total	DUP-H	L1829583-10, -27, -28, -3, -35, -4, -41, -43, -45, -49, -5, -59, -6, -7, -9
Duplicate	Iron (Fe)-Total	DUP-H	L1829583-12, -16, -20, -22, -23, -24, -25, -29, -30, -31, -33, -37, -39, -47
Duplicate	Iron (Fe)-Total	DUP-H	L1829583-47
Method Blank	Manganese (Mn)-Total	MB-LOR	L1829583-1, -11, -13, -14, -15, -17, -18, -19, -2, -21, -26, -32, -34, -36, -38, -40, -42, -44, -46, -48, -50, -52, -54, -56, -58, -60, -8
Method Blank	Manganese (Mn)-Total	MB-LOR	L1829583-1, -11, -13, -14, -15, -17, -18, -19, -2, -21, -26, -32, -34, -36, -38, -40, -42, -44, -46, -48, -50, -52, -54, -56, -58, -60, -8
Method Blank	Thallium (Tl)-Total	MB-LOR	L1829583-10, -27, -28, -3, -35, -4, -41, -43, -45, -49, -5, -59, -6, -7, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
HG-DRY-CVAFS-N-VA	Tissue	Mercury in Tissue by CVAFS (DRY)	EPA 200.3, EPA 245.7

This method is conducted following British Columbia Lab Manual method "Metals in Animal Tissue and Vegetation (Biota) - Prescriptive". Tissue samples are homogenized and sub-sampled prior to hotblock digestion with nitric and hydrochloric acids, in combination with addition of hydrogen peroxide. Analysis is by atomic fluorescence spectrophotometry or atomic absorption spectrophotometry, adapted from US EPA Method 245.7.

HG-DRY-MICR-CVAF-VA	Tissue	Mercury in Tissue by CVAFS Micro (DRY)	EPA 200.3, EPA 245.7

This method is adapted from US EPA Method 200.3 "Sample Procedures for Spectrochemical Determination of Total Recoverable Elements in Biological Tissues" (1996). Tissue samples are homogenized and sub-sampled prior to hotblock digestion with nitric and hydrochloric acids, in combination with repeated additions of hydrogen peroxide. Analysis is by atomic fluorescence spectrophotometry or atomic absorption spectrophotometry, adapted from US EPA Method 245.7.

MET-DRY-CCMS-N-VA	Tissue	Metals in Tissue by CRC ICPMS (DRY)	EPA 200.3/6020A

This method is conducted following British Columbia Lab Manual method "Metals in Animal Tissue and Vegetation (Biota) - Prescriptive". Tissue samples are homogenized and sub-sampled prior to hotblock digestion with nitric and hydrochloric acids, in combination with addition of hydrogen peroxide. Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.

MET-DRY-MICR-HRMS-VA	Tissue	Metals in Tissue by HR-ICPMS Micro (DRY)	EPA 200.3/200.8

Trace metals in tissue are analyzed by high resolution inductively coupled plasma mass spectrometry (HR-ICPMS) modified from US EPA Method 200.8, (Revision 5.5). The sample preparation procedure is modified from US EPA 200.3. Analytical results are reported on dry weight basis.

Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.

MOISTURE-TISS-VA	Tissue	% Moisture in Tissues	ASTM D2974-00 Method A

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

14-470934	14-470935	14-470936	14-470937	14-470938

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.