Winter 2016 Clinton Creek Surface Water Quality and Hydrological Monitoring Program Report

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HEMMERA

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1.0 INTRODUCTION

This Work was performed in accordance with Contract C00029477 between Hemmera Envirochem Inc. ("Hemmera") and Government of Yukon (YG), dated July 4, 2015 ("Contract"). T In performing this Work, Hemmera has relied in good faith on information provided by others, and has assumed that the information provided by those individuals is both complete and accurate. This Work was performed to current industry standard practice for similar environmental work, within the relevant jurisdiction and same locale. The findings presented herein should be considered within the context of the scope of work and project terms of reference; further, the findings are time sensitive and are considered valid only at the time the Report was produced. The conclusions and recommendations contained in this Report are based upon the applicable guidelines, regulations, and legislation existing at the time the Report was produced; any changes in the regulatory regime may alter the conclusions and/or recommendations.

Hemmera and Ecological Logistics & Research Ltd. (Hemmera/ELR) were retained by the YG, Assessment and Abandoned Mines (AAM) to conduct a water quality and hydrological monitoring program at the Clinton Creek Mine site during the 2015/2016 fiscal year.

The Clinton Creek Mine Site (herein referred to as the Site) is an abandoned asbestos mine, formerly owned and operated by Cassiar Asbestos Corporation Limited from 1967 to 1978. Mining activities ceased in 1978 when the economic-value of the asbestos operations were exhausted (YG 2013). During operation, approximately 16 million tons of serpentinite rock containing 940,000 tonnes of white asbestos (known as chrysotile) were removed from three pits at the mine site. From 1978 to 1992, the company attempted to implement an abandonment plan and completed limited remedial activities at the Site. Since then, various weather events have destabilized creek channels and caused erosion on-site which has increased the potential for flooding. In 2002, the federal government implemented a stabilizing program at the Site under emergency provisions of the Yukon *Waters Act* (YG 2007) to mitigate further impacts. Upon devolution in 2003, AAM assumed responsibility and control of the care, maintenance and closure of the Site.

The purpose of this Winter 2016 sampling program was to monitor water quality, hydrology, and meteorological station data from the Site as part of the overall care, maintenance and closure program objectives for the Site. The water quality and hydrology scope of work was based on program recommendations developed by Hemmera/ELR in 2015 (Hemmera 2015), while the meteorological station was installed and is managed by AAM, with maintenance work performed by other contractors.

1.1 SITE LOCATION AND HYDROLOGICAL SETTING

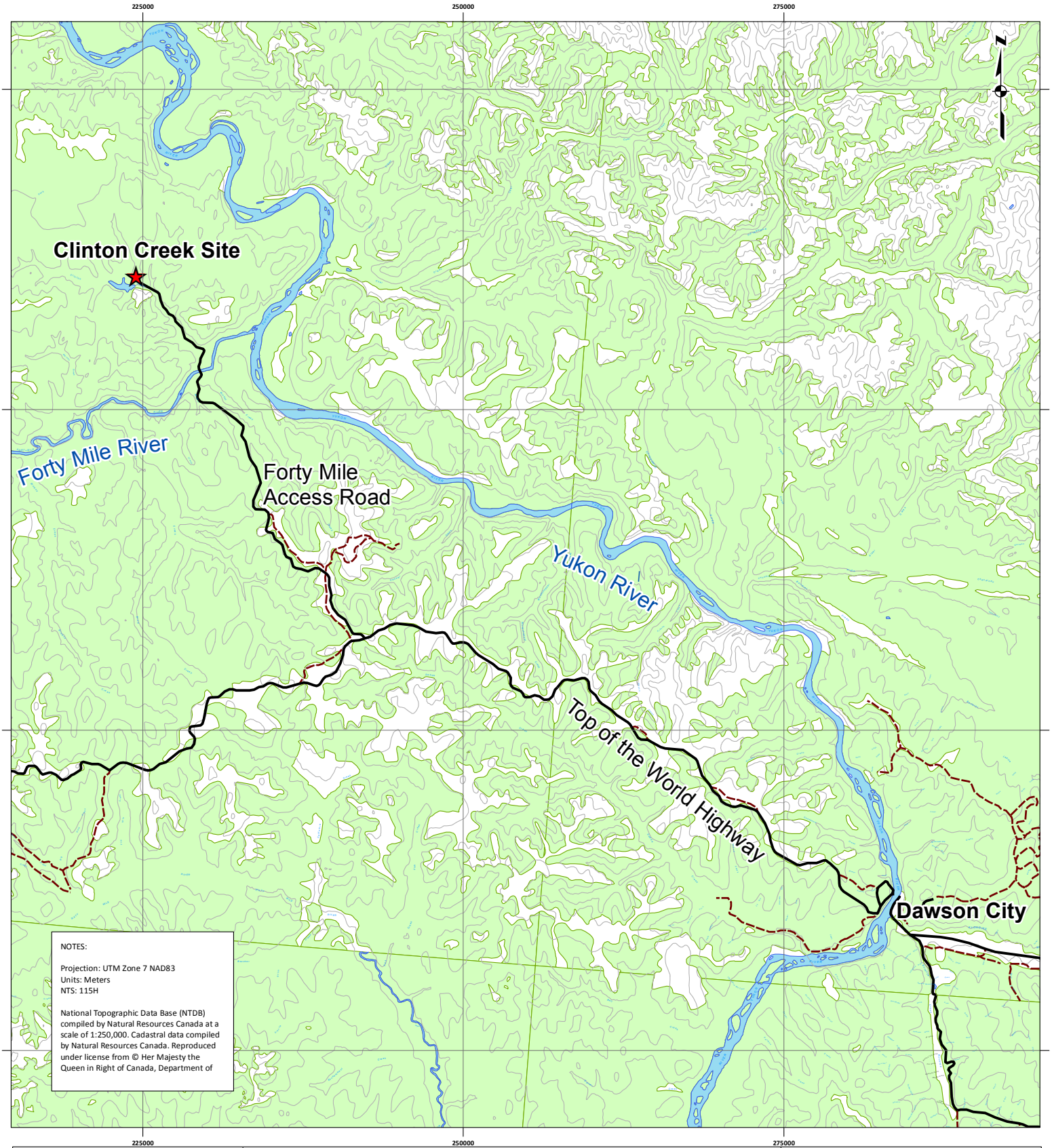
The Site is located approximately 75 kilometres (km) northwest of Dawson City (100 km by road), in the traditional territory of the Tr'ondëk Hwëch'in First Nation (**Figure 1**). The Site is within the Klondike

Plateau Ecoregion of the Boreal Cordillera Ecozone (Smith et al. 1994), near the northern extent of the Klondike Plateau, at the edge of the Tintina Trench.

The Site falls within the drainage of the Forty Mile River, a tributary to the Yukon River. Clinton Creek flows through the Site from the west then continues southeast for approximately 8 km before flowing into the Forty Mile River. Tailings slumping into the valley have dammed Clinton Creek, forming Hudgeon Lake. The four named tributaries of Clinton Creek at or near the Site are as follows:

- Easter Creek which flows into Hudgeon Lake;
- Porcupine Creek and Wolverine Creek which flow through the Site to Clinton Creek from the south and north, respectively; and,
- Eagle Creek which flows into Clinton Creek from the north, downstream from the Site.

Slumping tailings have interrupted the flow of Wolverine Creek creating two ponds. Past mining activities have also formed two pit lakes: Porcupine Pit Lake (PL) and Snowshoe Pit Lake (SL).



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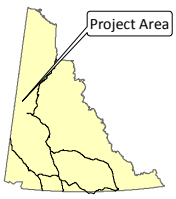
Legend

- Clinton Creek Site
- Road
- Limited-use road
- Wetlands
- Waterbodies
- Vegetation



Scale: 1:400,000

8 4 0 8 Km

Clinton Creek Surface Water Quality and Hydrological Monitoring Program

Figure 1
Project Area Overview

Date: March 24, 2016	Drawn by: AN
ELR Project #: 15-208.3 Hemmera Project #: 1343-005.15	Rev. #: 1

1.2 WINTER 2016 MONITORING PROGRAM SCOPE

In accordance with the documented *Scope of Work: Clinton Creek Surface Water Quality and Hydrological Monitoring Program,* provided to ELR/Hemmera by AAM, the 2016 monitoring program is focused on recording current water quality and hydrological conditions at the Site during the summer, fall, and winter of 2015/2016. The specific scope of work for the January 2016 sampling event included:

- Visiting 15 surface water quality sampling stations and seven (7) groundwater seep/pit lake stations. *In-situ* water quality measurements and samples for laboratory analysis were to be collected at each sample site, where possible;
- Measuring stream discharge where possible from sample sites where flowing water was present.
- Collecting survey data, staff gauge readings, and stream gauging data at two hydrometric monitoring sites.
- Downloading pressure and temperature data from two transducers; one manually and one using satellite uploaded data.
- Completing an on-site snow survey (depth, density and water equivalency).
- Downloading satellite uploaded meteorological station data.
- Shipping samples to an accredited laboratory for analysis according to requirements established by AAM;
- Summarizing data from the field and laboratory program; and,
- Preparing a report that outlines the sampling program and presents the raw data.

This report summarizes the monitoring activities and the method used to complete the field program, describes sample sites, summarizes data, including the quality assurance/quality control (QA/QC) program, and provides a summary of the overall success of the program.

1.3 2016 PROGRAM SAMPLE SITES

A total of 24 water quality and hydrology sites were included in the January program, including nine (9) reference surface water sites, eight (8) exposed surface water sites, five (5) exposed groundwater seepage sites, and two (2) pit lakes (two stations are divided into separate hydrology and water quality sites, therefore the number of sample sites is greater than noted above in **Section 1.2**). A summary of the sample sites including field-verified UTM locations, a description of the sites, and a summary of the sampling conducted at each sampling site is provided in **Table 1** below. The locations of sample sites are shown in **Figures 2** and **3**.

During the Winter 2016 program all water quality and hydrology sites were visited (with the exception of Porcupine Pit Lake). However, due to freezing conditions and decreased water flow, some sites did not have surface water present and these sites were not sampled. In the case of site E1 where no surface water flow was present, the water quality sample was collected upstream at site E1(H).

Reference sites were located on watercourses upstream from the Site that were not considered to be influenced by Site infrastructure or activities. Exposed sites included watercourses and water bodies under the influence of Site infrastructure (e.g. waste rock or tailings), and sites downstream of the Site that were considered to be part of the receiving environment.

Due to on-site safety concerns, sampling was not conducted in 2014, 2015 or 2016 at the Porcupine Pit Lake (PL) site. Access to this Site follows a roadway which begins in high ground on the northeast portion of the Site and descends along the southeast edge of the pit towards the sample site. There continues to be evidence of numerous rock falls along the length of the roadway, including one directly at the sample site. Similar concern was noted in relation to landing a helicopter at the Site during the Winter 2016 event, and therefore the site was not sampled.

Table 1 Sample Site Descriptions and Locations

Station Code	Hydrology Data Collected	Water Quality Samples Collected	Station Description	Location (UTM, Zone 7N)	
				Easting	Northing
Exposed Sites					
E1		F[3]	Clinton Creek downstream of gabions	513645	7147111
E1(H)	✓	✓[3]	Clinton Creek at the outlet of Hudgeon Lake	512806	7147438
E2		✓	Clinton Creek, downstream of Porcupine Creek but upstream of Wolverine Creek	514158	7147076
E3		✓	Wolverine Creek, upstream of culvert	514178	7147189
E3(H)	✓		Wolverine Creek approximately 300 m upstream of the Clinton Creek confluence	514170	7147608
E4	✓	✓	Clinton Creek downstream of Wolverine Creek but upstream of Eagle Creek	515950	7145287
E7	✓	✓	Clinton Creek near mouth	519400	7142042
E8		✓[3]	Forty Mile River downstream of Clinton Creek	519457	7142795
E9[1]			Porcupine Creek at its discharge into Clinton Creek	-	-
Reference Sites					
R1	✓	✓	Clinton Creek upstream of Hudgeon Lake	510718	7147525
R2	✓	✓	Easter Creek upstream of Hudgeon Lake	512023	7148061
R3	F	F	Wolverine Creek, upstream of tailings	513952	7148677
R4	F	F	Eagle Creek, upstream of culvert	515981	7145344
R6		✓[3]	Forty Mile River, upstream of Clinton Creek	519485	7141731
R7	F	F	Porcupine Creek, upstream of waste rock	513026	7145669
R8	F	F	Unnamed creek that enters Hudgeon Lake west of Easter Creek	511885	7147805
R9	F	F	Unnamed stream input on the south side of Hudgeon Lake	512343	7146753
Groundwater Seepage and Pit Sites					
GWCC-1		✓	Toe of the Waste Rock dump flowing into ponded area at Porcupine Creek	513902	7146960
GWCC-2		✓	Toe of the Waste Rock dump flowing into ponded area approx. 10 m northwest of GWCC-1	513899	7146968
GWCC-3		F	Toe of the Waste Rock dump flowing into side channel, approx. 10 m northwest of GWCC-2	513882	7147038
GWCC-4		✓	Toe of the Waste Rock dump flowing into side channel, approx. 10 m northwest of GWCC-3	513868	7147052
GWCC-5[2]	✓	✓	Groundwater flows in old Clinton Creek channel	513984	7147127
SL		F	Snowshoe Pit Lake from shore	513824	7146703
PL			Porcupine Pit Lake from shore	-	-

[1] – Site E9 was again not established during the Winter 2016 program as there was no surface water flow at the site.
[2] – An alternate method for hydrology data collection was used at Site GWCC-5 due to low flow (**Section 2.2.1.1**)
[3] – Alternate water quality sample locations were used for Sites E1, R6, and E8. Sample E1 was collected slightly upstream at Site E1(H) as site E1 was frozen. Samples E8 and R6 were collected upstream of their standard locations due to access safety concerns at the standard locations (See **Figure 3** for locations).
F – Parameter generally included in the program, however site was frozen or dry during winter 2016 event (streambed dry beneath ice or frozen to streambed.

Clinton Creek Surface Water Quality and Hydrological Monitoring

Client:

Yukon Energy, Mines and Resources
Assessment and Abandoned Mines

Legend

Water Type

- Surface Water
- Groundwater

Site Type

- Exposed
- Reference
- Snow Survey Location
- Topographic Watercourse Data
  (may not be truly representative of on-site conditions)

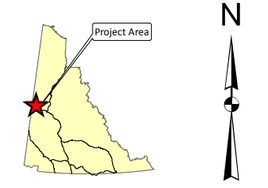


FIGURE 2

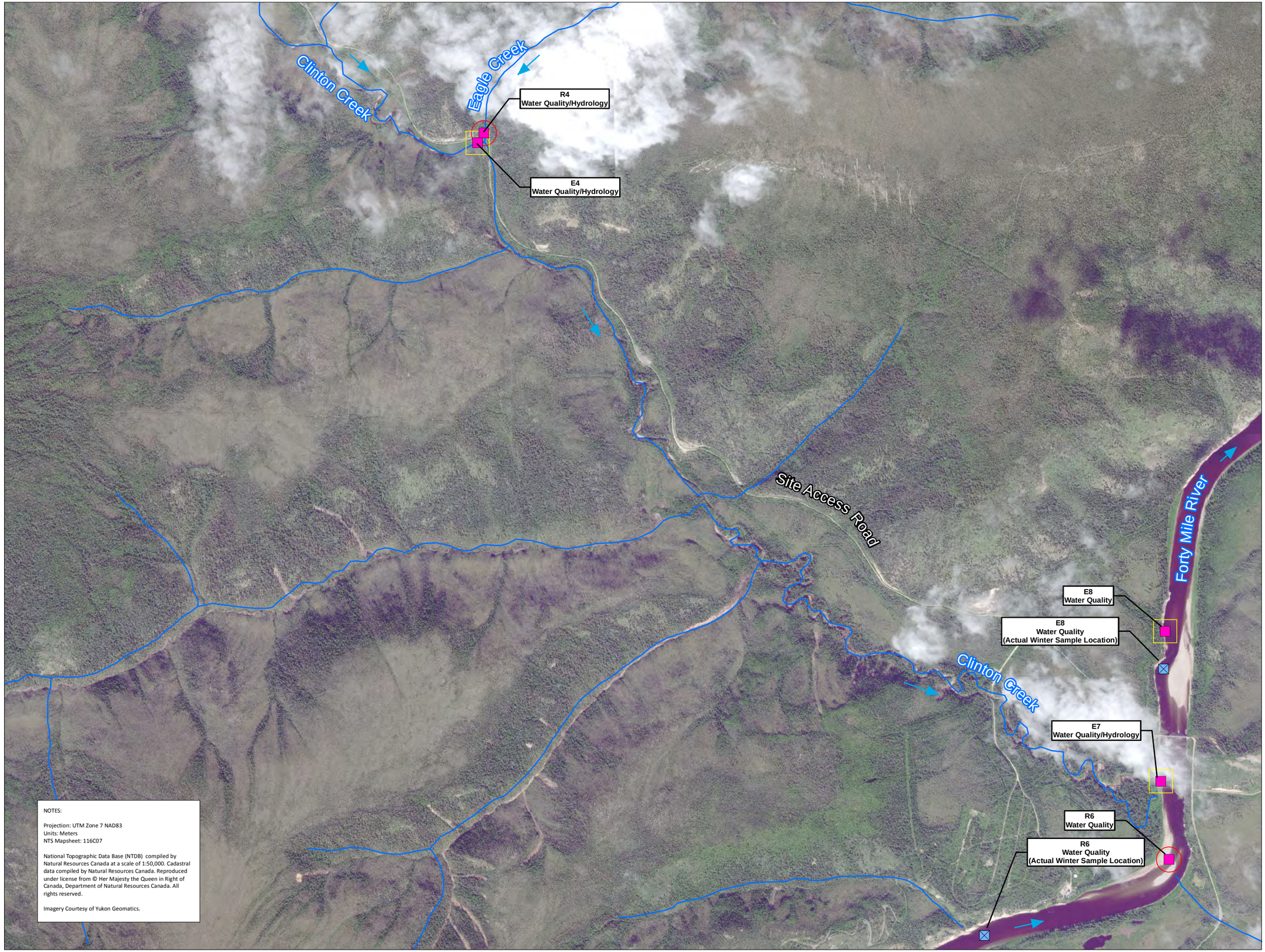
Sampling Stations

Site Area

Date: March 24, 2016	Scale: 1:15,000
ELR Project #: 15-208.3 Hemmera Project #: 1343-005.15	Rev. #: 1

NOTES:

Projection: UTM Zone 7 NAD83
Units: Meters
NTS Mapsheet: 116C07



NOTES:

Projection: UTM Zone 7 NAD83
Units: Meters
NTS Mapsheet: 116C07

National Topographic Data Base (NTDB) compiled by Natural Resources Canada at a scale of 1:50,000. Cadastral data compiled by Natural Resources Canada. Reproduced under license from © Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.

Imagery Courtesy of Yukon Geomatics.

Clinton Creek Surface Water Quality and Hydrological Monitoring

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Client:

Yukon
Energy, Mines and Resources
Assessment and Abandoned Mines

Legend

Water Type

Surface Water

Site Type

Exposed

Reference

Adjusted location for winter event

Topographic Watercourse Data

(may not be truly representative of on-site conditions)

N

0 190 380 760

Meters

FIGURE 3

Sampling Stations

Forty Mile River Area

Date: March 24, 2016	Scale: 1:18,000
ELR Project #: 15-208.3 Hemmera Project #: 1343-005.15	Rev. #: 1

2.0 METHODS

Two Hemmera/ELR staff (Chris Harwood and Aaron Nicholson) completed the surface water quality and hydrological field program between January 18 and January 27, 2016. Access to the Site was via helicopter from Dawson City, as both the Top of the World Highway and Forty Mile Access Road are not maintained during winter. Field staff were not on-site between January 20 and 22 due to poor weather that prevented access to the Site by helicopter. Specific methods used in sampling are summarized in the following sections.

2.1 SURFACE WATER QUALITY SAMPLING

2.1.1 Field Data Collection – Water Quality

Surface water quality sampling was conducted in accordance with *Standard Methods for the Examination of Water and Wastewater* (Rice et al. 2012*)*. Field *in-situ* water quality parameters were measured and laboratory analytical samples were collected at each sample site, as described below.

Upon arriving at each sample site, the following field *in-situ* water quality data were collected and recorded using a YSI Professional Plus water quality meter.

- Water temperature (˚C);
- pH (pH units);
- Oxidation-Reduction Potential (ORP; mv);
- Conductivity and Specific Conductivity (µs/cm); and,
- Dissolved oxygen (mg/L and percent saturation).

Following the collection of field *in-situ* parameters, samples for laboratory analysis were collected. Samples were collected directly into laboratory-supplied containers, and were field filtered and/or preserved according to laboratory instructions. The laboratory analytical bottle set for the 2016 monitoring program included nine (9) bottles for each site, as detailed in **Table 2**, below. Nitric acid (HNO_3) was used as a preservative for metals (dissolved and total), hydrochloric acid (HCl) was used to preserve samples for ultra-trace mercury testing, sulphuric acid (H_2SO_4) was used as a preservative for certain nutrient parameters and dissolved organic carbon (DOC), and sodium hydroxide (NaOH) was used as a preservative for speciated chromium.

Table 2 Analytical Sampling Bottle Set Summary

Bottle Number	Bottle Size	Bottle Type	Parameter Analyzed	Sample Treatment	Preservative Added
1 of 9	125 ml	Plastic	Low Level Dissolved Metals and Hardness	Field Filtered and Preserved	HNO_3
2 of 9	125 ml	Plastic	Low Level Total Metals and Hardness	Preserved	HNO_3
3 of 9	40 ml	Glass	Dissolved Mercury	Preserved	HCl
4 of 9	40 ml	Glass	Total Mercury	Preserved	HCl
5 of 9	250 ml	Glass	Nitrate, Nitrite, Ammonia-N and Total Phosphorous	Preserved	H_2SO_4
6 of 9	1L	Plastic	Total Suspended Solids (TSS), Sulphate	-	None
7 of 9	125 ml	Glass	Dissolved Organic Carbon (DOC)	Field Filtered and Preserved	H_2SO_4
8 of 9	125 ml	Plastic	Total Speciated Chromium Cr(VI) and Cr(III)	Preserved	NaOH
9 of 9	125 ml	Plastic	Dissolved Speciated Chromium Cr(VI) and Cr(III)	Field Filtered and Preserved	NaOH

At each sampling site, UTM coordinates were recorded using a Garmin Map 62s handheld GPS. The general condition and description of each sample site was recorded, including any identifiable features or conditions that may have influenced water quality results. Photos were taken at each sample site for reference purposes and to record sampling conditions. Photos were taken facing upstream, facing downstream, and facing across the sample site at each location. A set of the best representative photographs from each sample site can be found in **Appendix 1**.

2.1.2 Sample Care and Shipping

Samples were placed into coolers immediately following water collection and were kept cool with ice. Samples were shipped via air from Dawson, YT to the laboratory via Hemmera/ELR staff in Whitehorse, or transported by Hemmera/ELR by ground. All samples were delivered to ALS Global Laboratories (ALS) in Whitehorse, Yukon with appropriate chain of custody (COC) for analysis.

2.1.3 Laboratory Analysis

All surface water quality samples collected during the program were received by the analytical laboratory within 72 hours of sampling, and all primary analyses were conducted within laboratory hold time limits. Laboratory analytical reports are located in **Appendix 2**.

Laboratory analyses for the surface water quality monitoring program employed a variety of laboratory methods to determine the various water quality parameters required under this monitoring program. Specific methods were selected to ensure that reportable detection limits (RDL) were less than the Canadian Council of Ministers on the Environment (CCME) *Water Quality Guidelines for Protection of Aquatic Life* (CCME-FAL), where applicable (CCME 2014).

During the winter 2016 program, analysis of speciated Chromium was continued as part of the laboratory analysis to determine whether exceedances of CCME-FAL guidelines may be occurring on-site for either trivalent (III) or hexavalent (IV) Chromium. This was based on 2014 observations that unspeciated chromium in some cases exceeded the CCME-FAL guideline level for Chromium (III) or (IV), however no data was available to understand whether that may have represented an actual guideline exceedance. No CCME-FAL guideline level exists for unspeciated Chromium. During the winter 2016 program, water samples for both dissolved and total Chromium (III) and (IV) were collected, and were submitted to the lab on hold. Once the unspeciated results were reviewed, analysis of speciated Chromium was initiated for those results where the concentration of unspeciated Chromium exceeded either the Chromium (III) or (IV) CCME-FAL guideline (i.e., where there was a potential for Chromium (III) or (IV) exceedance).

2.1.4 QA/QC Program for Laboratory Analytical Sampling

2.1.4.1 Field QA/QC

Several controls were used by Hemmera/ELR staff while in the field to help ensure that sample integrity was maintained and that data were recorded completely and accurately. All equipment used during the sampling process was dedicated to individual sites, including laboratory provided pre-cleaned sample bottles, disposable filters, and disposable syringes. Field staff wore dedicated disposable nitrile gloves for all measurements, and sampling. Field instruments (YSI field meters) were checked and/or calibrated before each site visit to ensure the parameters recorded were as accurate as possible. All sample bottle sets were pre-labeled prior to sampling with location, analyte, and sample preservation method information. Samples were preserved immediately upon collection, where required by the laboratory, and samples were kept cool with ice during transportation to the laboratory. Field site data was confirmed in the field and date/time was recorded on bottle labels at the time of sampling,

Project-specific field data sheets were created for the sampling event to help ensure all required measurements were taken, and that information was recorded correctly.

2.1.4.2 Laboratory and Sampling QA/QC

Laboratory and sampling QA/QC measures taken as part of the fall sampling program include the collection of travel blanks, duplicates, and field blanks, as per the scope of work and standard industry practice. Duplicate samples were collected at a ratio of 10% of the regular samples (2 duplicates were collected in relation to 20 sample sites). Additionally, one field blank was collected and one travel blank accompanied the analytical supplies and samples during shipping to and from the laboratory.

The variation between sample and duplicate values was calculated as relative percent difference (RPD). RPD provides a measure of the relative difference between two values in comparison to their mean value, and is calculated as the difference between a sample and its field duplicate over the average of two values. RPD values greater than 20% indicates a greater variance than would normally be anticipated

and may be due to a number of factors (e.g., short -term change in parameter concentration, sediment in the sample, sampling or instrument error, large relative % difference but very low actual difference in concentration, such as 0.0001 vs 0.0002 mg/L). RPD was calculated according to the following formula:

$$\%RPD = \left(\frac{\chi_1 - \chi_2}{\left(\frac{\chi_1 + \chi_2}{2}\right)} \right) x\ 100$$

RPD is not calculated if either the sample or the field duplicate concentration is less than five times the detection limit.

Duplicate laboratory analytical samples were collected at sites E1 and GWCC-3, and the data were reviewed for instances where the RPD limit of 20% between duplicate and test results exceeded was exceeded. Field and travel blank sample results were reviewed for any detections where parameters exceeded the RDL value. Specific QA/QC results are provided in **Section 3.1.3**.

Laboratory replicates and additional quality control measures (i.e., measures against lab standards) were conducted by ALS.

2.2 HYDROLOGICAL MONITORING

Hydrological monitoring at thirteen (13) surface water and seepage sites was included in the program scope of work, following the recommendation of the Hemmera/ELR surface water and hydrology program review (Hemmera 2015). However, due to frozen conditions it was not possible to conduct hydrological monitoring at all designated sites. Included in the January 2016 program scope were 1 groundwater seepage site, seven (7) reference surface water sites, and four (4) exposed surface water sites, two of which are also monitored through automated discharge (pressure transducer) data collection. Hydrology data collection was not included in the program for sites where it was not considered safe to do so (such as the Forty Mile River), where it has not been possible to collect data (such as the majority of groundwater seeps), or where the data collection was redundant. See **Table 1** for a list of sites at which hydrological monitoring was conducted.

2.2.1 Manual Discharge Data Collection

Hemmera/ELR used a velocity-area method to measure discharge at surface water bodies during the monitoring program. Total discharge at each sample site was calculated using the area and velocity from a series of point measurements taken across the stream at each location. Stream flow and discharge calculations can be found in **Appendix 3**.

During the monitoring program, Hemmera/ELR chose hydrological monitoring locations at each sample site that were well suited to flow and velocity measurements (i.e., a straight channel with relatively flat stream bed and little vegetation or rocks, and few back-eddies that could hinder flow meter measurements). At each site, a cross section was established, and the active stream channel width was determined using a tape measure fixed to the top of the bank on each side. The stream was then divided into a series of sections (referred to as panels), where individual velocity and depth measurements were recorded. Stream channel widths were divided by 20 to establish the location of flow gauging panels. The number of panels was further reduced in cases where the resulting panel widths were less than 6.0 cm. At each point across the stream cross-section, water depth and mean flow were measured (at 60% depth) using a KROHNE Electromagnetic Current Velocity Meter.

At sites where surface ice was present at the monitoring location Hemmera/ELR manually opened an area of the channel by removing surface ice with hand tools. A suitable length of channel was opened so as to help reduce interference caused by eddying or backpressure from ice upstream or downstream of the monitoring station. Open lengths of channel were typically approximately 3 metres long. Following removal of ice and prior to conducting the hydrological monitoring event Hemmera/ELR waited 15 minutes and continuously monitored depth of water within the channel at a fixed point to ensure there was no blockage downstream causing flooding or an artificial increase in water column depth.

2.2.1.1 Alternate Manual Discharge Data Collection

At monitoring location GWCC-5 there was insufficient water to submerge the electromagnetic flow metre. Hemmera/ELR constructed a berm of ice, snow and sediment which allowed the limited flow to pass through a confined channel. A container of known volume was filled while timing with a stop-watch to ascertain approximate flow volume at this point. Stream flow and discharge calculations determined using this method can be found in **Appendix 3**.

2.2.1.2 QA/QC Program for Hydrology Field Measurements

Two sets of measurements were collected at each stream crossing location. The first crossing was used to establish the station locations and data, and the second crossing was used to collect a duplicate set of data for QA/QC purposes (i.e., to ensure station readings were accurate and that no significant variance between the two measurement sets had occurred).

2.2.1.3 Data Analysis for Manual Discharge Data Collection

For each sampling point (panel) at a crossing location (sample site), stream discharge (Q; m^3/s) was calculated by multiplying the cross sectional area of the panel (width of panel x mean depth; A; m^2) by the measured velocity (V; m/s), according to the following formula:

$$Q = AV$$

The total discharge for a sample site was then calculated by adding the discharge of all panels for each stream crossing location.

2.2.2 Automated Discharge Data Collection

Two pressure sensors (PS) were installed on-site in July of 2015 by Northern Avcom, on behalf of AAM; one in Hudgeon Lake, near the outlet of the lake to Clinton Creek [site E1(H)]; and one on Wolverine Creek, about 500 m upstream of the confluence with Clinton Creek [site E3(H)]. The purpose of the PSs is to provide regular data (15 minute intervals) on lake and stream water levels (stage) and temperature. The stage data are then used in conjunction with manually collected discharge data to create a stage-discharge relationship. Collectively, the data are then used to calculate ongoing discharge in Clinton Creek and Wolverine Creek over time.

The data collected by the PS installed in Hudgeon Lake are uploaded to a database on an ongoing basis via satellite connection, and were downloaded from the database by Hemmera/ELR following the field event. The data from the PS on Wolverine Creek were downloaded manually during the field sampling and monitoring event using a laptop computer with the required software installed.

2.2.2.1 QA/QC Program for Automated Discharge Monitoring

The data downloaded from each PS (water depth above the pressure sensor and water temperature) were checked for completeness (complete record since installation or the previous download) and reviewed for general expected ranges. For the PS installed on Wolverine Creek (E3[H]), a preliminary QA/QC review of the data was completed in the field.

In addition to the PS data, the benchmarks and PS housings at E1(H) and E3(H) were surveyed to check for any potential movements in the PS housing or the benchmarks over time, and manual staff gauge readings are collected to provide an additional stage reading that can be used in stream discharge calculations.

2.2.2.2 Data Analysis

Stage discharge relationships for both Clinton Creek and Wolverine Creek were developed using the water level data from the PSs (stage) and the corresponding manual stream gauging measurements (discharge) from site visits. The stage and discharge data were plotted, and the stage-discharge relationship curve for each stream was developed through regression by fitting an exponential curve function through the plotted stage-discharge data points. The recorded stage measurements from the PS can then be used to calculate a time history of stream discharge. Data from three manual discharge events (during moderate and low flow) have been collected to date (July and October 2015, and January 2016) which allowed flows to be calculated, although the stage discharge relationship is still considered to be preliminary and will be refined with the collection of additional manual discharge data from different flow periods (i.e., high, moderate and low).

In addition to stage data, water temperatures from each of the PSs were also graphed to present the data from October, 2015 to January, 2016.

2.2.3 Meteorological Data Collection

The meteorological station (MS) is located on a flat area of waste rock south of Clinton Creek and the data collection and satellite communications station (with remote camera) is located on a flat area of ground north of Clinton Creek, near the outlet of Hudgeon Lake. The MS is equipped with the following instrumentation:

- Rain gauge (not an all-weather precipitation gauge)
- Ambient air temperature and relative humidity
- Barometric pressure
- Wind speed and direction
- Snow depth sensor (installed July 2015)

2.2.4 Manual Snow Survey

A snow depth survey was completed to gauge snow depths at the Site and to calculate snow water equivalency and density. A graduated aluminum snow tube was used, following survey methods outlined in the *British Columbia, Ministry of Environment Snow Survey Sampling Guide* (date unknown). According to the sampling guide, a bulk sampling method was used as snow depths on-site were at or close to 0.5 m. This bulk sampling method generally provides more accurate data than does collecting individual snow core measurements. Site selection for the snow survey was based on finding a location that was relatively sheltered from high winds (to prevent drifting) and that had substrate that would allow for a dirt plug at the bottom of the snow tube, which would prevent snow from escaping the tube.

To perform the survey, a tare weight of an empty bulk sampling container is first recorded (using scales that are graduated in cm). The graduated snow tube is lowered through the snow and forced into the underlying ground to which forms a dirt plug. Snow depth readings are then recorded from the core based on snow tube readings (with and without the dirt plug) and then the snow collected in the snow tube is emptied into the bulk sampling container. This procedure is repeated ten to twelve times in order to collect a bulk sample of snow and multiple depth measurements. The bulk sample of snow, including the container, is then weighed.

The water equivalency is calculated by subtracting the tare weight of the container from the weight of the bulk sample divided by the number of snow cores collected. The formula used to calculate water equivalency is:

$$Water\ Equivalency = (A - B)/C$$

Where: *A* = Total bulk sample weight including container (in cm equivalent)
B = Tare weight of empty container (in cm equivalent)
C = Number of snow core samples emptied into the container

The percent snow density for a bulk sample is calculated by dividing the water equivalency value by the average snow depth and multiplying by one hundred. The formula used to calculate the percent snow density

$$\%\ Snow\ Density - \left(\frac{A}{B}\right) * 100$$

Where: *A* = Water equivalency (in cm equivalent)
B = Average snow depth (cm)

2.2.4.1 QA/QC Program for Meteorological Data Collection

The data downloaded from the MS were checked for completeness (e.g., complete record for the period pertaining to this report). The data were reviewed for general compliance with expected values (e.g. temperatures within expected ranges), and any omissions or anomalies in the data were reviewed and investigated. Where an anomaly was found, other data (e.g., local or regional meteorological data, or PS data) were used to check the anomalous data where possible.

2.2.4.2 Data Analysis

Data downloaded from the MS were converted to Microsoft Excel format to allow the data to be reviewed and graphed. Data for precipitation, ambient air temperature, relative humidity, barometric pressure and snow depth were graphed. A wind rose figure was created using WRPLOT View™, a software program designed to analyze specific meteorological data. A wind rose is a useful visual representation that presents an entire period of wind data on a single graph (wind speed, direction and frequency). The total duration of wind occurring within a specified speed range (metres per second - m/s) and compass direction are calculated as a percentage of the total reporting period. Mean hourly wind speeds are grouped into ranges (e.g., 0 to 1 m/s, 1 to 3 m/s, 3 to 6 m/s, 6 to 9 m/s etc. through to 18 m/s +). The wind direction is grouped into 16 compass direction ranges representing 22.5° each, starting at north. The wind speed and direction frequency are also tabulated to complement the wind rose figure.

3.0 RESULTS

3.1 SURFACE WATER QUALITY SAMPLING

A total of 13 water quality sites were sampled during the sampling program, including three (3) reference surface water sites, six (6) exposed surface water sites, and four (4) exposed groundwater seepage sites (**Table 1**). Hemmera/ELR staff found the condition at the sample sites to be representative of winter conditions with low flow or frozen conditions at multiple sites. No activities or observations were noted at the Site which had the potential to influence water quality results (e.g., no uncharacteristic sediment, flow, or instream activities).

3.1.1 Field *In-Situ* Water Quality Results

Field *in-situ* water quality monitoring results are presented in **Table 3**, with CCME-FAL exceedances highlighted in grey. Photographs of monitoring sites are provided in **Appendix 1**.

Surface water temperatures at reference sites ranged from 0˚C (R2) to 0.1˚C (R1, R6), while surface water temperatures at exposed sites ranged from 0˚C (E4, E7) to 4.9˚C (GWCC-5). Field pH readings at reference sites ranged from 7.21 (R1) to 7.74 (R2), while field pH readings at exposes sites ranged from 6.92 (E7) to 7.61 (GWCC-4).

Surface water conductivity varied significantly between sites. Reference site conductivity ranged between 255.4 µs/cm (R6) and 527 µs/cm (R1). Exposed stream sites ranged in conductivity from 248 µs/cm at site E8 to 1,476 µs/cm at site GWCC-1.

Measured concentrations of dissolved oxygen ranged from 0.15 mg/L (R1) to 12.07 mg/L (R6) at surface water sites (i.e., at both reference and exposed). The dissolved oxygen measured at all sites, with the exception of R6 and E8, was less than the CCME-FAL minimum of 9.5 mg/L. The lowest observed concentration of dissolved oxygen was at seepage site GWCC-5 (0.1 mg/L).

3.1.2 Laboratory Analytical Water Quality Results

Laboratory analytical results are summarized in **Table 3**. Laboratory analytical results are presented in comparison with CCME-FAL guideline, where exceedances of CCME-FAL guidelines are shaded grey.

For sites where duplicate samples were collected, test and duplicate samples were compared relative to the lab QA/QC analysis threshold of 20% RPD. These QA/QC results are provided in **Table 4** and are described in **Section 3.1.3**.

3.1.2.1 Reference Sites

Among the reference sites, exceedances of the CCME-FAL guidelines were identified in one or more sites for aluminum and iron.

Total aluminum exceeded the CCME-FAL guideline at site R6 (0.131 mg/L compared to CCME-FAL guideline of 0.1 mg/L), and there were no exceedances of dissolved aluminum. Total iron exceeded the CCME-FAL guideline level of 0.3 mg/L at site R1 (0.689 mg/L), while dissolved iron exceeded the CCME-FAL guideline of 0.3 mg/L at site R1 (0.643 mg/L).

3.1.2.2 Exposed Sites

Amongst the exposed sites (i.e., both surface water and groundwater seeps), exceedances of the CCME-FAL guidelines were identified in one or more sites for aluminum, chromium (VI; hexavalent), iron, and selenium.

Total aluminum exceeded the CCME-FAL guideline at site E8 (0.112 mg/L compared to CCME-FAL guideline of 0.1 mg/L). This exceedance was also observed in the Forty Mile River upstream from Clinton Creek (site R6), and is believed to be originating in the Forty Mile River (**Table 5**).

Total hexavalent chromium (VI) exceeded the CCME-FAL guideline level of 0.001 mg/L at sites E3 (0.0014 mg/L), GWCC-1 (0.0026 mg/L) and GWCC-2 (0.0017 mg/L). Dissolved hexavalent chromium (VI) exceeded the CCME-FAL guideline level of 0.001 mg/L at E3 (0.0012 mg/L), GWCC-1 (0.0025 mg/L) and GWCC-2 (0.0017 mg/L). No external influences on water quality were noted during the program that may have contributed to the exceedances at the two groundwater seeps. Potential influences on the occurrence of exceedances of hexavalent chromium (VI) at site E3 could not compared for the winter event as the upstream Wolverine Creek reference site (R3) was frozen during the sampling event. The winter 2016 event was the first where an exceedance of the CCME-FAL guideline for total hexavalent chromium (VI) had been observed at Site E3, however a similar exceedance at Site R3 was observed during the July 2015 sampling event (but not during the September sampling event). Accordingly, there is a potential that total hexavalent chromium (IV) at Site E3 is being influenced from a reference area.

Total iron exceeded the CCME-FAL guideline level of 0.3 mg/L at sites E2 (0.991 mg/L), and E4 (0.357 mg/L). Dissolved iron exceeded the CCME-FAL guideline level of 0.3 mg/L at sites E2 (0.735 mg/L). As noted in **Table 5**; site E4 may have been influenced by elevated total and dissolved iron at site R1, however neither total nor dissolved iron were elevated at site E1(H), which falls on the flow path between sites E4 and E2; therefore the specific influence cannot be determined with confidence.

Total selenium exceeded the CCME-FAL guideline level of 0.001 mg/L at sites E1(H) (0.00165 mg/L), E2 (0.00179 mg/L), GWCC-1 (0.00466 mg/L), GWCC-2 (0.00379 mg/L), GWCC-4 (0.00227 mg/L), and GWCC-5 (0.00372 mg/L). Dissolved selenium exceeded the CCME-FAL guideline level of 0.001 mg/L at sites E1(H)(0.00134 mg/L), E2 (0.00163 mg/L), E3 (0.00101 mg/L), E7 (0.00102 mg/L), GWCC-1 (0.00470 mg/L), GWCC-2 (0.00374 mg/L), GWCC-4 (0.00238 mg/L), and GWCC-5 (0.00205 mg/L). While no site-specific observations were made that describe why the selenium exceedances occurred at these sites, the exceedances noted at the groundwater seepage sites may have been a contributing factor to

the exceedance noted at site E2 (**Table 5**); it should be noted that the exceedance of selenium at site E1(H) is also contributing to elevated selenium at site E2. During the winter event, no immediate potential influences to elevated selenium at Site E1(H) were observed (no exceedences at Sites R1 or R2) However exceedences had previously been observed at Sites R1, R8, and R9 in either the July 2015 sampling, the September 2015 sampling, or both. Accordingly, an ongoing influence on both total and dissolved selenium from sites upstream of E1(H) are possible.

Table 5 Comparison of Parameter Exceedances for Related Exposed and Reference Sites

Parameter	Exposed Site	Exposed Site Concentration (mg/L)	Relevant Upstream Reference Site or Potential Influence and Concentration (mg/L)
Total Aluminum	E8	0.112	Site R6, upstream Forty Mile River (site R6; 0.131**)
Total Chromium (VI)	E3	0.0014	Potentially upstream Wolverine Creek, but could not be assessed as site R3 was frozen.
Total Iron	E2	0.991	Potentially R1 (0.689**), however site E1(H) between these was not elevated.
	E4	0.357	Potentially influenced by site E2 (0.991**)
Total Selenium	E2	0.00179	GWCC-1 (0.00466**), GWCC-2 (0.00379**), GWCC-4 (0.00227**), GWCC-5 (0.00372**)
Dissolved Chromium (VI)	E3	0.0012	Potentially upstream Wolverine Creek, but could not be assessed as site R3 was frozen.
Dissolved Iron	E2	0.735	Potentially R1 (0.643**), however site E1(H) between these was not elevated.
Dissolved Selenium	E2	0.00163	GWCC-1 (0.00470**), GWCC-2 (0.00374**), GWCC-4 (0.00238**), GWCC-5 (0.00205**)
	E3	0.00101	Potentially upstream Wolverine Creek, but could not be assessed as site R3 was frozen.
	E7	0.00102	GWCC-1 (0.00470**), GWCC-2 (0.00374**), GWCC-4 (0.00238**), GWCC-5 (0.00205**)

Note: ** CCME-FAL guideline is exceeded.

3.1.3 Quality Assurance/Quality Control (QA/QC) for Water Quality Monitoring

Two duplicate surface water samples were collected during the January sampling event (at sites R6 and E3). Two travel blanks were provided by the laboratory and accompanied the samples throughout the sampling program. One of the travel blanks was sent from Dawson to Whitehorse with samples via air freight, while the other travel blank remained with final samples in the Hemmera/ELR field vehicle for the return trip from Dawson to Whitehorse in order to capture the potential influence of both transport methods. One field blank was prepared during the sampling program (at site R1). Detailed results of the QA/QC sampling program are provided in **Table 4**, including RPD values for duplicate and sample pairs.

Travel blank and field blank analytical results were reported as less than the detection limits for all analysed parameters, with the exception of total ammonia-N in the two travel blanks. Concentrations of

0.0079 mg/L and 0.0138 mg/L were reported by ALS. In response to the results, the program analytical laboratory (ALS Global), indicated that the detection of low levels of ammonia occurs occasionally in travel blanks that are prepared too early in advance of the field program, and that this result should not be considered an indication of contamination.

All RPD values for duplicate samples (R6 and E3) were within an acceptable range of variability (i.e., less than 20%), with the exception of the following results in the R6 sample/duplicate pair:

- Total Copper (RPD 31.1%)

RPD values exceeding 20% for metals can indicate a sampling or analytical bias. With only one exception, the RPD for all metal parameters was within 20%, thus there does not seem to be a systemic bias. Sampling of total metals using unfiltered methods can introduce sediment from the watercourse, which could result in the observed variances, and is likely the cause of the RPD percentage of 31.1 for Total Copper at R6. It should be noted as well that the concentration of total copper reported in the duplicate collected at site R6 was 0.00258 mg/L, which is only marginally over the RPD calculation cut-off of 0.0025 mg/L (five times the detection limit of 0.00050 mg/L).

Laboratory replicates and additional quality control measures (i.e. matrix spikes) were also conducted by ALS (**Appendix 2**). All measures against laboratory standards were also within the acceptable limits specified by the laboratory.

In summary, the results of the analytical QA/QC program show only slight variability amongst metals results between one sample and duplicate result for copper. This does not suggest a systemic issue with sampling practices or contamination, as evidenced by the low level of variation between sample and duplicate results, and non-detection of parameters in the program field and travel blanks.

3.2 SURFACE WATER MANUAL DISCHARGE MONITORING RESULTS

Stream discharge monitoring was completed at seven (7) of the twelve (12) prescribed sites visited during the winter monitoring program (**Table 1**), including two where automated discharge monitoring is also conducted. Discharge monitoring was not conducted at sites R3, R4, R7, R8, or R9 due to frozen conditions. Duplicate stream crossings were successfully carried out at all sites.

Channel, velocity, and discharge measurements collected during the monitoring program are summarized in **Table 6**, below, while detailed data, calculations, and crossing profiles are attached in **Appendix 3**.

Table 6 Summary of Discharge Data Collected During the Monitoring Program

Site Type	Site	Wetted Width (m)	Mean Channel Depth (m)	Mean Velocity (m/s)	Mean Calculated Discharge (m^3/s)
Reference Sites	R1	2.4	0.12	0.01	0.0024
	R2	2.33	0.21	0.06	0.0437
	R3	Sites frozen			
	R4				
	R6	Forty Mile River			
	R7	Sites frozen			
	R8				
	R9				
Exposed Sites	E1(H)	5.1	0.025	0.12	0.020
	E3(H)	1.8	0.08	0.02	0.0045
	E4	5.35	0.125	0.07	0.059
	E7	5.05	0.205	0.05	0.0603
	E8	Forty Mile River			
	E9	Site Not Yet Established Due to Lack of Flow			
Groundwater Seepages and Pits	GWCC-1	Sites not included in program			
	GWCC-2				
	GWCC-3				
	GWCC-4				
	GWCC-5	-	-	-	0.00008
	SL	Not included in program			
	PL				

3.3 AUTOMATED DISCHARGE MONITORING

3.3.1 Hudgeon Lake (E1[H])

Data from the Hudgeon Lake PS were reviewed for the period October 1, 2015 to January 23, 2016. The PS stage data and water temperature for Hudgeon Lake are presented in **Figure 4**. For the reviewed data, the maximum and minimum stages (metres of water above the pressure sensor) at Hudgeon Lake were 0.694 m (October 5 & 6) and 0.471 m (January 9, 21 and 23), respectively. The mean stage over the same period was 0.575 (Standard Deviation [SD] = ±0.069 m).

The maximum water temperature at Hudgeon Lake between October 1, 2015 and January 23, 2016 was 4.2°C (October 1, 2015). The minimum water temperature for the same period was 0.3°C recorded on ten

separate days in January, 2016 (7-9,11,18-23) with a mean water temperature for the same period of 1.2°C (SD=$^{\pm}$0.8°C).

One data omission was noted by Hemmera/ELR in the PS data from site E1(H); an unexplained gap in recording is present from 10:15 on October 1 until 10:45 on October 2 (24 hours and 30 minutes). Hemmera/ELR have confirmed that the data do not exist on the database through multiple data downloads, and there is no immediate explanation for the data omission.

The stage-discharge relationship for Clinton Creek (which flows from Hudgeon Lake) is presented in **Figure 5**. The relationship was developed from the PS stage data and three manual discharge measurements collected on July 24, September 30, 2015 and January 23, 2016. The regression coefficient (R^2) was 0.9999 (based on three data points). To calculate the Clinton Creek discharge at a point in time from the stage data the following function was used, generated from the best fit curve.

$$y = 0.000006e^{17.271x}$$

Where: y = creek discharge (m^3/s)
e = base of the natural logarithm (2.71828)
x = recorded water depth over PS (m)

Although the calculated discharge values were very similar to the manual discharge values (between 1.07 and 2.8 RPD) and the stage discharge relationship appears to be predicting discharge values very well for low to moderate stage levels, the stage discharge relationship still does not provide accurate predictions at higher stage levels (due to a lack of manual readings at these levels). This is due to the fact that additional calibration points at high flow levels are still needed to build a more reliable relationship.

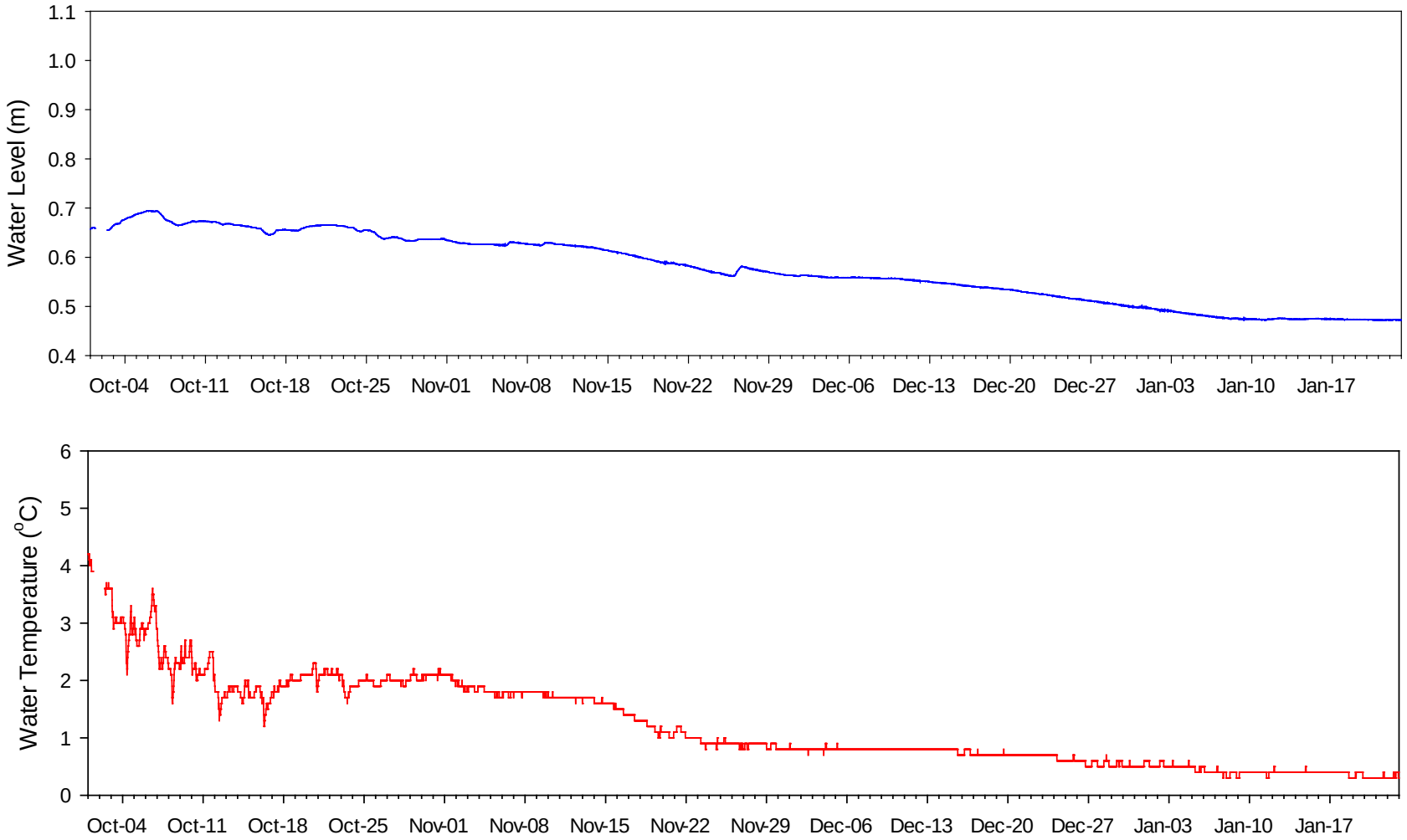


Figure 4 Plots of Water Level (stage) and Water Temperature as Read from the Hudgeon Lake PS, October 1 2015 to January 23, 2016

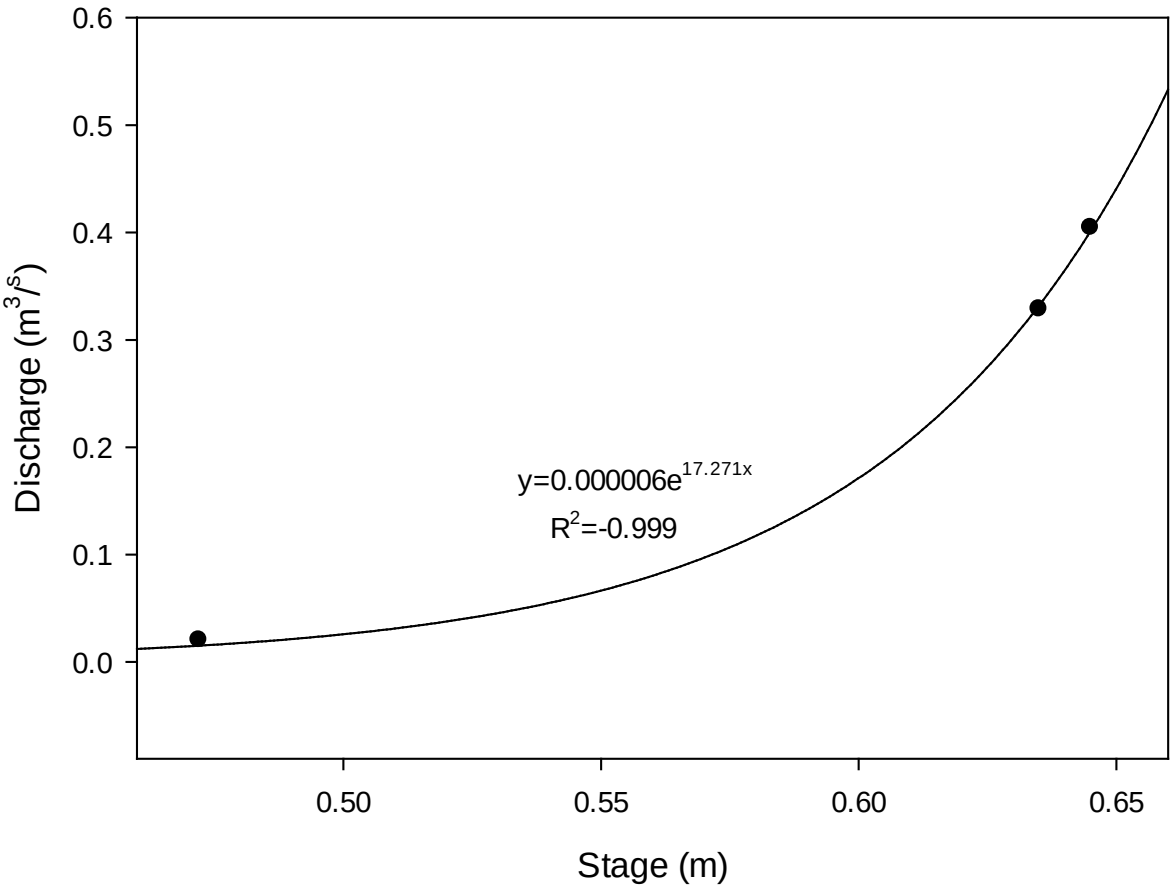


Figure 5 Stage Discharge Relationship for Clinton Creek at the Hudgeon Lake Outlet

3.3.2 Wolverine Creek (E3[H])

Data from the Wolverine Creek PS and datalogger were reviewed for the period of October 1, 2015 to January 24, 2016. The PS stage data and water temperature for Wolverine Creek are presented in **Figure 6**. Stage data and temperature data are complete except for a 30 minute period (2 data points) on October 3, 2015. The reason for the data gap is that the batteries were changed in the PS datalogger at this time and then a field test is completed to ensure that data are being logged.

For the reviewed data, the maximum and minimum stages at Wolverine Creek were 0.221 m (Oct 3 and 4) and 0.100 m (January 9 and 24), respectively. The mean stage over the same period was 0.147 m (SD = ±0.031 m).

The maximum water temperature at Wolverine Creek between October 3, 2015 and January 24, 2016 was 1.1°C (October 6). The minimum water temperature for the same period of record was -0.1°C, recorded on 10 separate days between October 8 and November 1 (October 8,17,23-28,31, November 1). The mean water temperature for the same period of record was 0.2°C (SD= ±0.2 °C).

The stage-discharge relationship for Wolverine Creek is presented in **Figure 7**. The relationship was developed from the PS stage data and three manual discharge measurements collected on July 23, October 1 and January 24. The regression coefficient (R^2) was 0.9943 (based on three data points). To calculate the Wolverine Creek discharge at a point in time from the stage data the following function was used, generated from the best fit curve.

$$y = 0.0004e^{25.664x}$$

Where: y = creek discharge (m^3/s)
e = base of the natural logarithm (2.71828)
x = recorded water depth over PS (m)

Although the calculated discharge values were very similar to the manual discharge values (between 1.6 and 10.1 RPD) and the stage discharge relationship appears to be predicting discharge values very well for low to moderate stage levels, the stage discharge relationship still does not provide accurate predictions at higher stage levels (due to a lack of manual readings at these levels). This is due to the fact that additional calibration points at high flow levels are still needed to build a more reliable relationship.

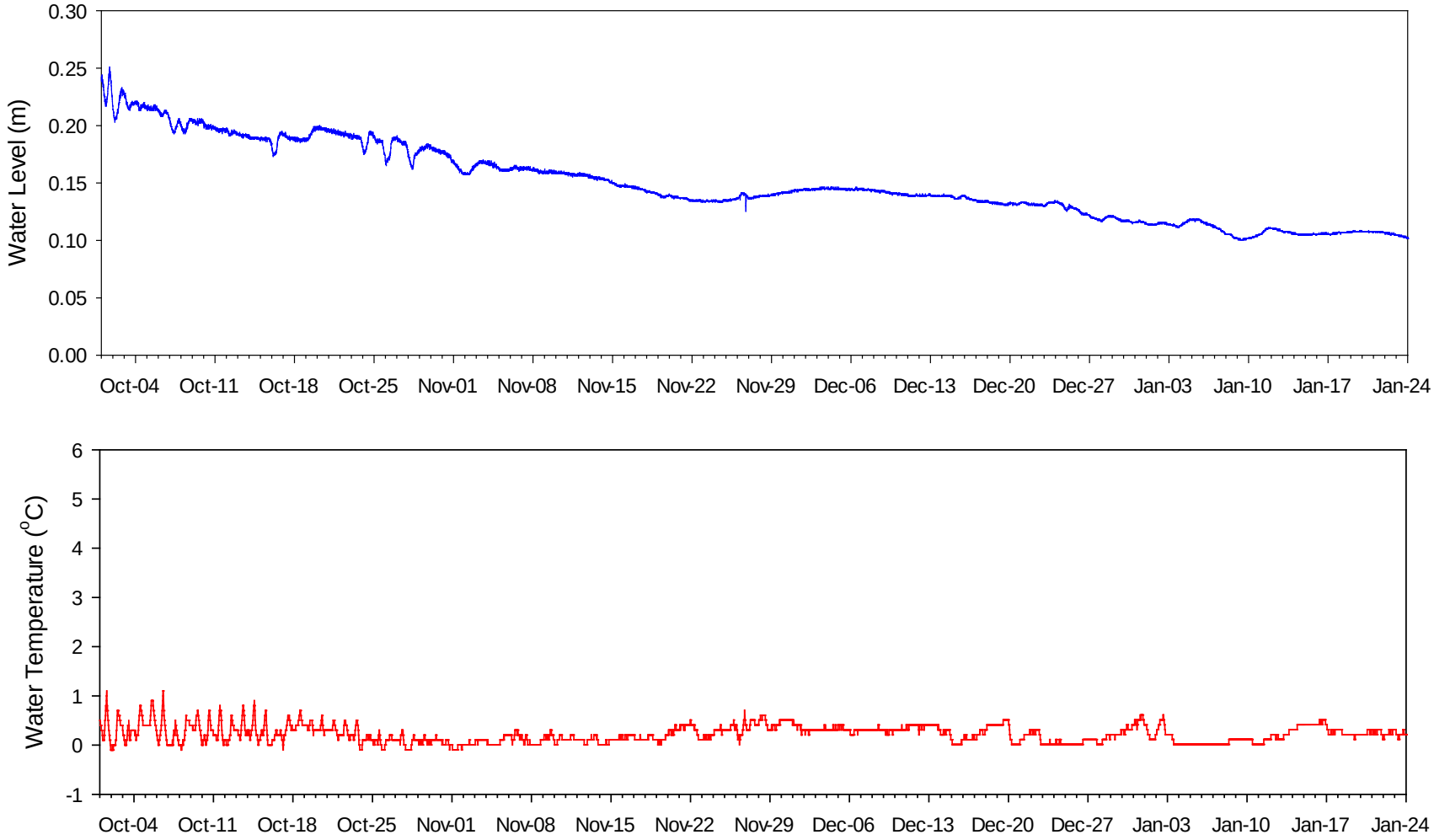


Figure 6 Plots of Water Level (stage) and Water Temperature as Read from the Wolverine Creek PS, October 1, 2015 to January 24, 2016

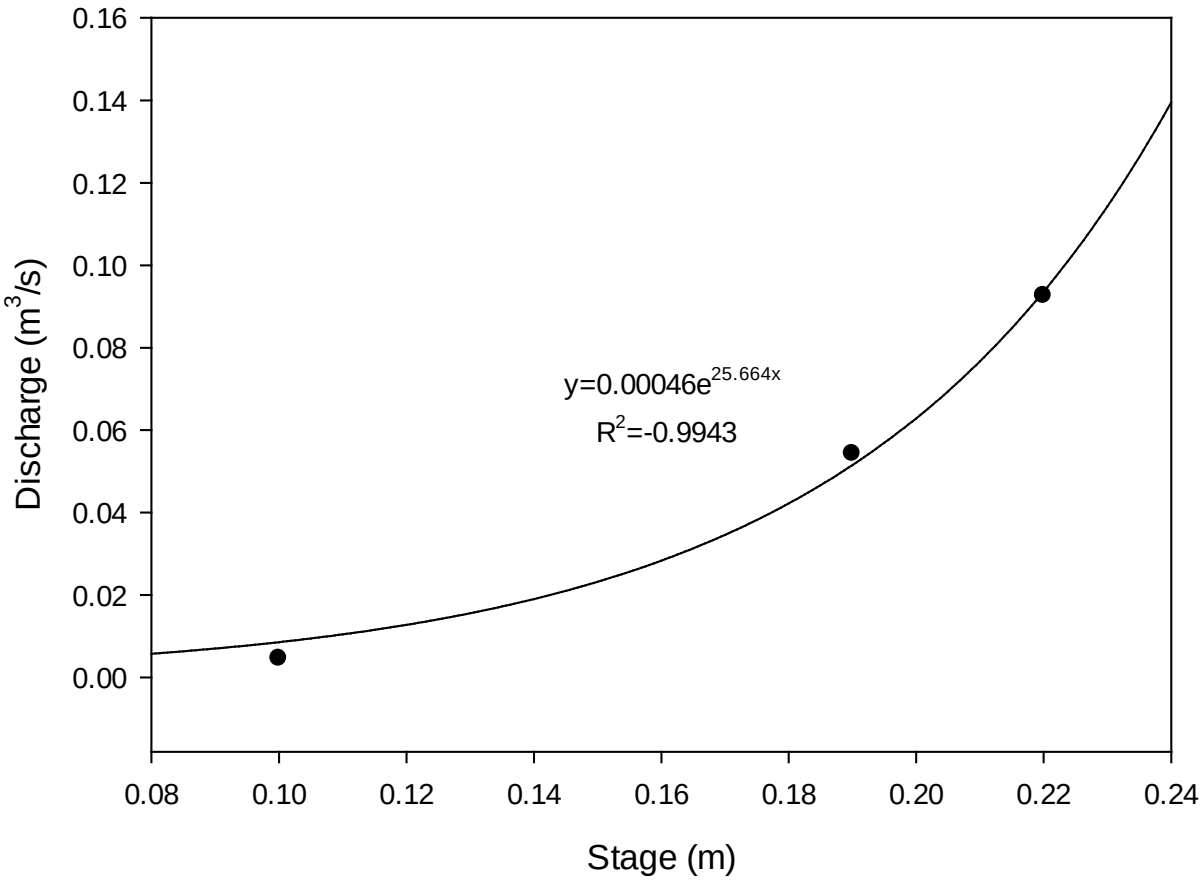


Figure 7 Stage Discharge Relationship for Wolverine Creek

3.3.3 QA/QC for Automated Discharge Monitoring

The stage-discharge relationships created for this report are based on three manual discharge data collection events. Additional data collection events in different seasons (including freshet) are required to improve confidence levels in the stage-discharge relationship.

During the sampling and monitoring events, instrument heights at Hudgeon Lake and Wolverine Creek (PS housings and staff gauges) were surveyed against benchmarks established in July, 2015. The January 2016 survey data were compared against the survey data collected in July and September, 2015. The comparison is done in order to check whether instruments (or possibly benchmarks) may have moved over time, which could affect data interpretation. A difference between the two readings of more than 3 mm (0.003 m) may indicate that either the instruments or the benchmarks had moved, or that survey error occurred and that corrective action should be investigated.

The surveyed instrument elevation differences between three survey events (July and October 2015 and January 2016) relative to the two local benchmarks (BM1 and BM2) at each monitoring site were reviewed following the winter 2016 program. Some of the survey data **(Table 7 and Table 8)** present differences that are greater than the expected values (>0.003 m) with some values ranging from 0.006 m to 0.133 m. These values would normally indicate that either the instruments or the benchmarks have shifted over time or that survey error occurred. Given the pattern of data (similar staff gauge to benchmark differences and much closer tolerances between September 2015 and July 2015 events), Hemmera/ELR are still of the opinion that a potential one-time error in surveying or a problem with survey equipment has occurred, and that this does not represent a concern for data collection at this time. Given that the most recent measurements occurred during winter conditions, the response suggested by Hemmera/ELR is to:

- Check all the instrumentation and benchmarks for movement during snow-free conditions.
- Re-survey all instrumentation and compare all survey data across all survey events in the field (under snow-free conditions).

Table 7 Hudgeon Lake Instrumentation Survey Results

	Difference between September 2015 and January 2016 events (m)	Difference between July 2015 and January 2016 events (m)	Difference between September 2015 and July 2015 events (m)
Staff Gauge - BM1 difference	0.125	0.133	0.008
Staff Gauge - BM2 difference	0.127	0.133	0.006
Station Casing - BM1 difference	*	0.053	*
Station Casing - BM2 difference	*	0.054	*

Note: *survey measurements were confirmed as collected from the wrong location so no comparative data are presented.

Table 8 Wolverine Creek (EH3) Instrumentation Survey Results

	Difference between October 2015 and January 2016 events (m)	Difference between July 2015 and January 2016 events (m)	Difference between October 2015 and July 2016 events (m)
Staff Gauge - BM1 difference	0.003	0.006	0.009
Staff Gauge - BM2 difference	0.009	0.021	0.012
Station Casing - BM1 difference	0.012	0.012	0.000
Station Casing - BM2 difference	0.001	0.003	0.003

3.4 METEOROLOGICAL DATA

Meteorological station (MS) data were downloaded and are reported for the period of November 1, 2015 to January 31, 2016. Hemmera/ELR found that the reporting period for all the data parameters was complete but that wind speed, rainfall and snow depth data contain anomalous data. Each recorded parameter is discussed further below.

3.4.1 Ambient Air Temperature

Hourly and daily air temperatures were recorded at the MS for the period of November 1, 2015 to January 31, 2016. Hourly mean air temperatures for the reporting period are shown in **Figure 8**. The temperatures are within an expected range and no anomalous data were observed. The maximum mean hourly air temperature recorded by the MS for the reporting period was 2.7°C on January 2 at 11:00 am and the minimum temperature recorded was -36.0°C on December 24 at 11:00 pm (**Figure 8**). The mean temperature for the reporting period was -16.4°C (Standard Deviation [SD] = ±6.6°C).

3.4.2 Relative Humidity

Relative humidity indicates the amount of water vapour in the air relative to the total amount of water vapour that could be present at the same temperature and is usually reported as a percentage. Higher percentages indicate more water vapour. Hourly and daily relative humidity data were recorded at the MS for the period November 1, 2015 to January 31, 2016. Mean hourly relative humidity data for the reporting period are presented in **Figure 8**. No anomalous data were observed. The maximum hourly mean relative humidity recorded by the MS over the reporting period was 96%, recorded on January 28. The mean relative humidity for the reporting period was to 81.8% (SD= $^{\pm}$6.09%).

3.4.3 Barometric Pressure

Barometric pressure (BP) is the pressure of air exerted by the earth's atmosphere at any given location. At the Clinton Creek MS, barometric pressure is recorded in millibars (mbar), where greater atmospheric pressure correlates to a higher number of mbars. Mean hourly BP was recorded at the MS for the period of November 1, 2015 to January 31, 2016 (**Figure 8**). No anomalous data were observed. The maximum BP recorded for the reporting period was 973 mbar on December 24 and 25. The minimum BP recorded for the same period was 927 mbar and the mean for the whole reporting period was 952 mbar (SD= ±9.4 mbar).

3.4.4 Rainfall

A rain gauge at the MS records hourly mean rainfall in millimetres (mm). Mean hourly mean rainfall was recorded at the MS for the period of November 1, 2015 to January 31, 2016 (**Figure 8**). The maximum mean hourly rainfall recorded during the reporting period was 0.3 mm on January 2 at 1:00 pm. The

calculated rainfall for the same entire day (January 2) was 0.6 mm. The minimum mean hourly rainfall recorded for the reporting period was 0 mm which accounted for approximately 99.8% of the entire reporting period. The total recorded rainfall for the entire reporting period was 0.7 mm. These data are discussed further in **Section 3.4.8**.

3.4.5 MS Snow depth

A snow depth sensor was fitted to the MS in July 2015 and snow depth is recorded hourly in centimetres (cm). Snow depth was recorded for the period of November 1, 2015 to January 31, 2016 (**Figure 8**). Although the data set was complete for the recording period, anomalous data were evident (e.g., negative values for snow depth, unusually high values and consistently low readings of less than 1 cm when no snow was present on-site). These anomalous data were removed from the data set before graphing.

The maximum snow depth recorded during the reporting period was 52 cm (December 19, 2015). The minimum snow depth recorded for the same period was 0.0 cm (August 9, 2015). The average snow depth for the same period was 20.5 cm (SD=$^{\pm}$17.2 cm). The snow depth data recorded by the MS are discussed further in **Section 3.4.8**.

In addition, snow depths were not reported from the previous field event in September 2015. As some reliable snow depth data were present for the period of July to September, 2015, all the MS data were graphed for the same period and are presented in **Appendix 5**.

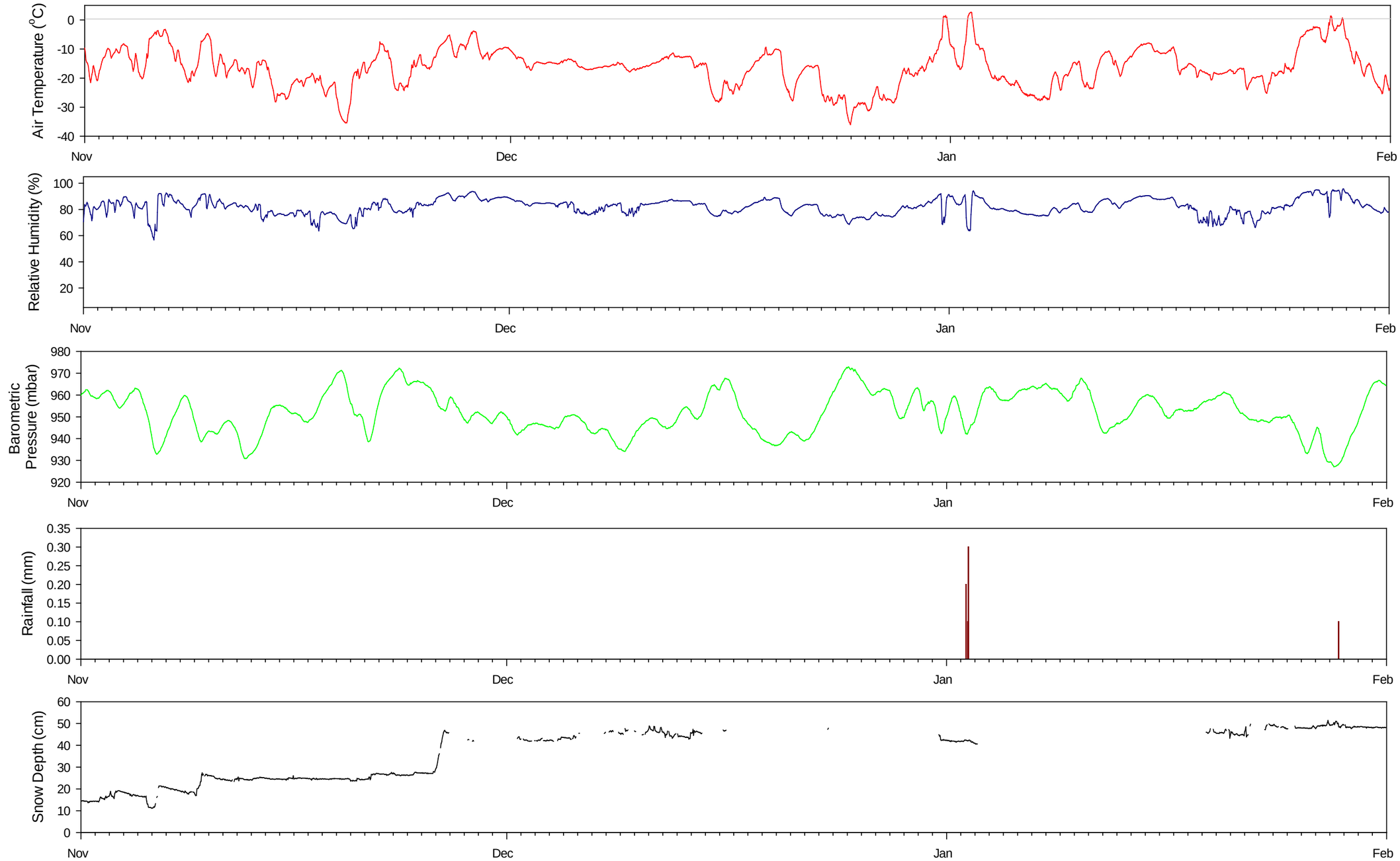


Figure 8 **Temperature, Relative Humidity, Barometric Pressure, Rainfall and Snow Depth Data from the Clinton Creek Meteorological Station, November 1 2015 to January 31, 2016**

3.4.6 Wind Speed and Direction

Mean hourly wind speed data, wind direction and frequency were recorded by the MS for the period of November 1, 2015 to January 31, 2016. Anomalous data were noted (long periods of zero wind speed). The anomalous data were removed from the data set and are discussed further in **Section 3.4.4**. The maximum mean hourly wind speed recorded at the MS was 6.69 m/s (about 24 kilometres per hour [km/h]), recorded on January 1 at 8:00 am. The lowest recorded mean hourly wind speed and the overall mean hourly wind speed (for the entire reporting period) are not reported because of bias created by the anomalous data. The mean hourly wind speed for the entire reporting period, but with anomalous data removed, was 1.14 m/s. Wind speed data for the reporting period are presented in **Figure 9** to demonstrate the time periods when no wind speed was recorded.

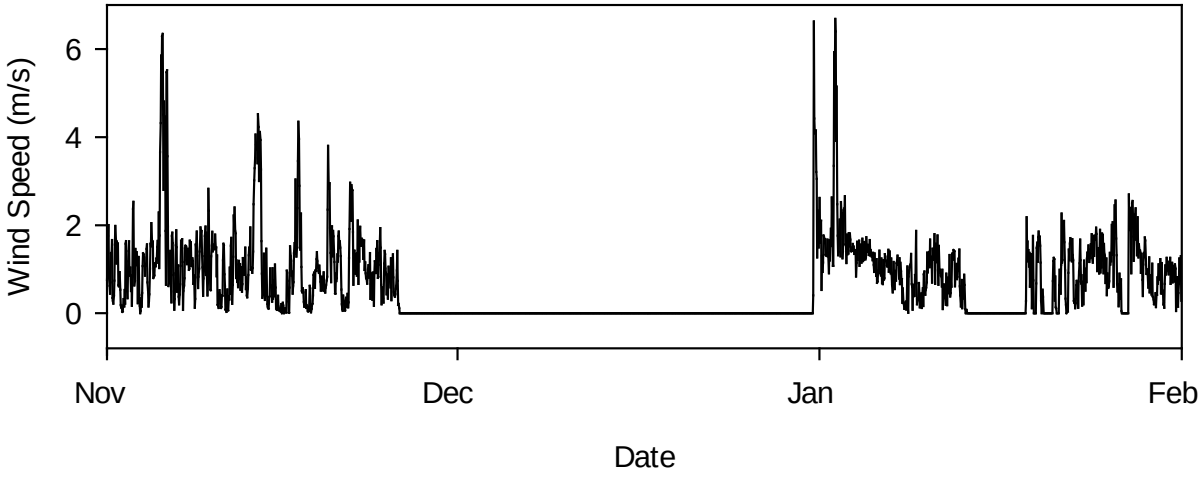


Figure 9 Wind Speed Measurements at the Clinton Creek MS, November 1 2015 to January 31 2016

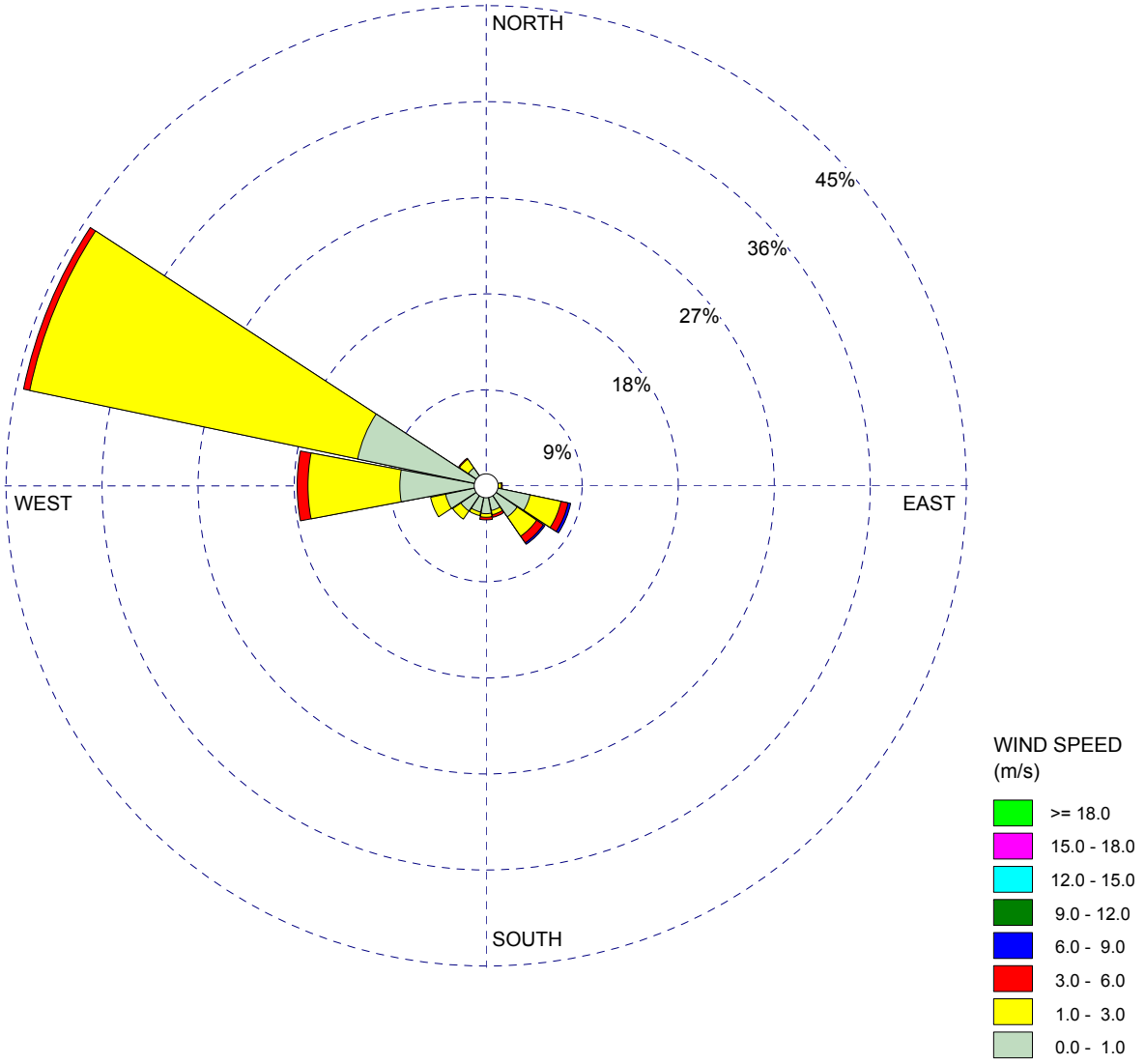
A wind rose for the entire reporting period is presented in **Figure 10**, and the tabulated wind speed and direction frequency for the same period is presented in **Table 9**. Missing wind speed data account for approximately 46% of the reporting period. The wind direction data were complete and indicate that about 33% of the recorded winds were from a west-north-west and westerly direction with speeds ranging from less than 1 to 6 m/s (**Figure 10**; **Table 9**). All wind speed data should be treated with caution because unreliable data for the reporting period were removed from the data set.

Table 9 Frequency of Wind Direction and Speed Classes from November 1, 2015 to January 31, 2016

Wind Directions		Wind Classes (m/s)								
		0.0 - 1.0	1.0 - 3.0	3.0 - 6.0	6.0 - 9.0	9.0 - 12.0	12.0 - 15.0	15.0 - 18.0	>= 18.0	**Total (%)**
N	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
NNE	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
NE	%	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
ENE	%	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.2**
E	%	0.9	0.5	0.1	0.0	0.0	0.0	0.0	0.0	**0.8**
ESE	%	4.2	2.9	0.7	0.3	0.0	0.0	0.0	0.0	**4.3**
SE	%	3.5	2.2	0.8	0.2	0.0	0.0	0.0	0.0	**3.6**
SSE	%	2.4	0.4	0.3	0.0	0.0	0.0	0.0	0.0	**1.6**
S	%	2.6	0.3	0.3	0.0	0.0	0.0	0.0	0.0	**1.7**
SSW	%	2.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	**1.5**
SW	%	2.9	0.9	0.0	0.0	0.0	0.0	0.0	0.0	**2.0**
WSW	%	3.9	1.4	0.0	0.0	0.0	0.0	0.0	0.0	**2.9**
W	%	8.1	8.6	1.0	0.0	0.0	0.0	0.0	0.0	**9.5**
WNW	%	12.3	31.3	0.6	0.0	0.0	0.0	0.0	0.0	**23.8**
NW	%	2.0	1.0	0.1	0.0	0.0	0.0	0.0	0.0	**1.7**
NNW	%	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.1**
Sub-Total	%	24.7	26.9	2.0	0.2	0.0	0.0	0.0	0.0	**53.8**
Missing/Incomplete Data										**46.2**
Total										**100.0**

WIND ROSE PLOT: Clinton Creek
Clinton Creek, YT
Wind Rose. November 2015 to January 2016

DISPLAY:
Wind Speed
Direction (blowing from)



Missing/incomplete Data = 46%

1 m/s equals 3.6 km/h.	DATA PERIOD: **Start Date: 11/1/2015 - 00:00** **End Date: 1/31/2016 - 23:00**	COMPANY NAME: Hemmera / ELR Ltd. **Hemmera / ELR Ltd.**	
		MODELER: **GMR**	HEMMERA
		TOTAL COUNT: **1188 hrs.**	
	AVG. WIND SPEED: **1.15 m/s**	DATE: **3/8/2016**	PROJECT NO.: 1343-005.14 Figure 10

3.4.7 Manual Snow Survey

A snow depth survey was completed on January 26, 2016 at 3:30 pm on the south side of Hudgeon Lake (**Figure 2**). The location provided some shelter from prevailing winds and the ground soils allowed for a dirt plug to be achieved in the bottom of the snow tube that helped to keep the snow inside the tube as it was lifted from the snow. The temperature during the survey was approximately -3°C and conditions were generally favourable although a surface ice crust, approximately 3 cm thick, was noted by the field crew which was difficult to penetrate without causing compression of the snow beneath it. The snow beneath the surface crust was noted as being very dry and powdery. Twelve snow core samples were collected to form a bulk sample. The snow depths ranged from 51 cm to 58 cm with an average snow depth of 53 cm (SD= ±2 cm). The calculated equivalent water and snow density measurements were 4.7 cm and 8.8%, respectively. The snow depth survey results are discussed further in **Section 3.4.4**.

3.4.8 QA/QC for Meteorological Data

Where meteorological data were outside expected ranges or where anomalous data were suspected to be present (e.g., sharp spikes in a graph or values), alternate regional or local meteorological data were reviewed (e.g., Environment Canada data, and/or Government of Yukon, Wildland Fire data, other on-site data). After reviewing the November 1, 2015 to January 31, 2016 MS data (August 1, 2015 to January 31, 2016 for the snow depth sensor data), the following parameters were investigated further.

Rainfall

Approximately 0.7 mm of rain was recorded at the MS the period of record. The rainfall was recorded when ambient air temperatures were just above 0°C (0.65 to 2.49°C) and so it is possible that these data represent rainfall rather than snow. However, it is just as likely that melting snow or ice around the gauge during the warmer ambient temperatures was recorded as rainfall. Hemmera/ELR understands that the rain gauge is not fitted with a snowfall adapter, nor is the gauge an all-weather precipitation gauge; therefore, the rainfall data during the colder months of the year may not be representative of actual precipitation (rain and snow).

Wind Speed

The wind speed data indicate wind speeds of 0 m/s for approximately 46% of the period of record with the longest period of 0 m/s recorded between December 9 and December 31 (**Figure 9**). However, the wind direction data continued to record and indicate changing wind directions during the time that the wind speed data indicated 0 m/s. The mostly likely explanation for this is that the propeller on the anemometer was prevented from turning periodically because of local climate conditions (e.g., ice) but the whole anemometer unit was still free to turn and face into the wind. A set of comparative data from the Government of Yukon's Forty Mile climate station were obtained for the same period of record, but that data set had large gaps in December and January that overlapped with the MS data gaps, so a direct

data comparison could not be made. The Forty Mile climate station does fail to transmit data sometimes when the battery power is too low (personal communication, Michael Smith, Government of Yukon, March 24, 2016), but the station does generally continue to collect data. Therefore a more complete data set from the Forty Mile climate station may be available in July, following manual servicing of the station.

MS Snow Depth

Approximately 43% of the snow depth measurements recorded by the MS between July 2015 and January 2016 indicate negative values (e.g., -232.4295 cm). In addition, some snow depth values appeared to be unusually high with 173.4 cm recorded for 4% of the period of record between mid-December 2015 and mid-January 2016. Also, snow depths of less than 1 cm were consistently recorded for about 28% of the period of record, including during August and most of September. ELR staff confirmed there was no snow on-site during unrelated fieldwork on August 10 and 11, 2015, and on September 2 and 3, 2015. The negative values, unusually high values and the values below 1 cm were removed from the data set before the remaining data were graphed (**Figure 8** and **Appendix 5**).

The manual snow survey indicated a mean depth of 53 cm near Hudgeon Lake on January 26, 2016. At that same time, the MS recorded a snow depth of 47.75 cm. The difference between these two readings is within an expected range and could be accounted for by differences in local snow conditions; the MS is a bit a more exposed area than the location of the snow survey.

Manual Snow Survey Data

The ice crust over the powdery, dry snow during the snow survey likely affected the survey crew's ability to collect fully representative snow cores because the ice crust would usually collapse when pressure was applied. As a result, it is likely not all of the ice crust was captured in the snow tube. As the ice crust was denser than the underlying snow the calculated water equivalency and percent density could have been skewed downwards. Although calculated percent snow densities of 10% can be expected (BC Guidelines – date unknown), the calculated percent snow density and water equivalency of 8.8% and 4.7 cm, respectively, could be slightly lower than actual values. The condition of snow is driven by local site conditions, and the ice crust was noted throughout the Site during the field program. This condition is often unavoidable if repeat site visits are not possible.

No other MS data were found to be outside of their expected ranges.

4.0 RECOMMENDATIONS

Hemmera/ELR have prepared the following recommendations based on the observations and results of the Winter 2016 water quality and hydrological monitoring program:

1. In order to prevent potentially absent and anomalous data between rainfall and snow fall and to ensure precipitation data are captured throughout the year, an all-weather precipitation gauge could be installed at the Clinton Creek site MS. It should be noted that this type of gauge would have a higher maintenance cost, due to the need to change fluids at least once per year.
2. In order to qualify readings from the snow depth sensor, a manual snow depth gauge could be installed near the MS, and could be read when staff are on-site to provide QA/QC of depth sensor data.
3. Continue to collect seasonal manual stream gauging data to build the stage discharge relationship for the automated discharge sites. In particular, it is critical to visit the Site at times of high flow to properly establish the stage-discharge relationship confidence for higher stage values.
4. Check all the PS and related instrumentation and benchmarks for looseness or signs of movement during snow-free conditions.
5. Re-survey all instrumentation with survey equipment under snow-free conditions and compare all survey data across all survey events while in the field to attempt to determine the source of anomalous survey data.
6. In order to collect discharge data from Site GWCC-1, the construction of a small isolation weir could be attempted at the site (to build a weir that seals to the pond substrate). This would isolate the seep and allow measurements and water collection at an overflow point.

5.0 CLOSURE

Hemmera/ELR are pleased to provide the Government of Yukon, Assessment and Abandoned Mines this report that summarizes the Winter 2016 water quality and hydrological monitoring program at the Clinton Creek Site. Please do not hesitate to contact us should you have any questions regarding this report.

Sincerely,

Written by:
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7.0 PERSONAL COMMUNICATIONS

Government of Yukon, 2016. Personal communication with Michael Smith, Meteorologist, Wildland Fire Management. March 24, 2016.

TABLES

Table 3: Analytical Chemistry Data

	Site Location	Surface Water - Reference Sites								Surface Water - Exposure Sites								Seepages - Exposure Sites				
	Sample ID	R1	R2	R3	R4	R6	R7	R8	R9	E1	E1(H)	E2	E3	E4	E7	E8	SL	GWCC-1	GWCC-2	GWCC-3	GWCC-4	GWCC-5
	Date Sampled	26/01/2016	26/01/2016	24/01/2016	25/01/2016	27/01/2016	26/01/2016	26/01/2016	26/01/2016	23/01/2016	23/01/2016	23/01/2016	23/01/2016	23/01/2016	19/01/2016	27/01/2016	27/01/2016	24/01/2016	24/01/2016	24/01/2016	24/01/2016	25/01/2016
	ALS Work Number	L1728272	L1728272	-	-	L1728530	-	-	-	-	L1727085	L1727085	L1727085	L1727085	L1726304	L1728530	-	L1727085	L1727085	-	L1727085	L1728272
Parameter	**Units**	CCME-FAL[1, 2, 3, 4]	Good	Good	Frozen	Frozen	Good	Frozen	Frozen	Frozen	Frozen	Good	Good	Good	Good	Good	Good	Frozen	Good	Good	Frozen	Good	Good
Physical Tests																							
Lab pH	pH units	6.5-9.0 [5]	7.29	7.68	-	-	7.45	-	-	-	-	7.70	7.65	8.05	7.37	7.53	7.89	-	7.56	7.66	-	7.64	7.37
Field pH	pH units	6.5-9.0 [5]	7.21	7.74	-	-	7.23	-	-	-	-	7.77	7.45	7.1	7.56	6.92	7.3	-	7.11	7.6	-	7.61	7.22
Field Temperature	C	-	0.1	0	-	-	0.1	-	-	-	-	0.4	0.9	0.3	0	0	0.3	-	2.1	1.5	-	1.8	4.9
Lab Conductivity	uS/cm	-	959	853	-	-	487	-	-	-	-	616	1450	1050	1350	1150	470	-	2410	1950	-	1060	887
Field Conductivity	uS/cm	-	527	479.5	-	-	255.4	-	-	-	-	302.2	798	564	545	650	248	-	1476	1034	-	489.7	584
Field Specific Conductivity	uS/cm	-	1003	918	-	-	487.5	-	-	-	-	571	1481	1069	1044	1244	470.3	-	2622	1876	-	879	948
Field Dissolved Oxygen	mg/L	9.5 [6]	0.15	0.22	-	-	12.07	-	-	-	-	0.29	0.24	0.17	0.26	0.21	10.91	-	0.2	0.22	-	0.24	0.1
Field Oxidation - Redox Potent	mV	-	37.3	44.6	-	-	151.6	-	-	-	-	128.7	-5.1	169.7	179.5	108.5	164.1	-	133.3	165.4	-	159.3	203.9
Total Suspended Solids	mg/L	-	<3.0	<3.0	-	-	<3.0	-	-	-	-	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	-	<3.0	<3.0	-	<3.0	<3.0
Total Hardness (as CaCO3)	mg/L	-	609	562	-	-	252	-	-	-	-	367	961	719	898	790	246	-	1880	1400	-	683	324
Anions and Nutrients																							
Nitrate (as N)	mg/L	13	0.028	0.074	-	-	0.350	-	-	-	-	0.186	0.180	0.439	0.145	0.130	0.424	-	0.523	0.425	-	0.187	0.053
Nitrite (as N)	mg/L	0.06	<0.0020	<0.0020	-	-	<0.0010	-	-	-	-	<0.0010	<0.0050	<0.0020	<0.0020	<0.0020	<0.0010	-	<0.010	<0.0050	-	<0.0020	<0.0020
Ammonia, Total (as N)	mg/L	Varies [7]	0.0897	0.0202	-	-	0.0118	-	-	-	-	0.0054	0.0470	<0.0050	0.0304	0.0343	0.0064	-	<0.0050	<0.0050	-	<0.0050	0.0180
Ammonia CCME-FAL	*mg/L*	-	*14.13*	*4.218*	-	-	*13.49*	-	-	-	-	3.808	*7.611*	*17.9*	*6.375*	*27.76*	*11.3*	-	*15.05*	*5.13*	-	*4.891*	*9.288*
Sulfate (SO4)	mg/L	-	387	316	-	-	123	-	-	-	-	203	763	397	627	471	119	-	1660	1180	-	470	344
Inorganic/Organic Carbon																							
Dissolved Organic Carbon	mg/L	-	9.75	3.59	-	-	4.17	-	-	-	-	15.7	7.77	6.79	8.02	8.64	4.17	-	5.09	7.31	-	8.75	4.23
Dissolved Metals																							
Aluminum (Al)-Dissolved	mg/L	Varies [8]	0.0063	0.0024	-	-	0.0415	-	-	-	-	0.0222	0.0022	0.0024	0.0022	0.0039	0.0372	-	<0.0020	0.0017	-	0.0012	<0.0010
Aluminum CCME-FAL	*mg/L*	-	*0.1000*	*0.1000*	-	-	*0.1000*	-	-	-	-	0.1000	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	-	*0.1000*	*0.1000*	-	*0.1000*	*0.1000*
Antimony (Sb)-Dissolved	mg/L	-	0.00015	0.00040	-	-	0.00011	-	-	-	-	0.00031	0.00061	0.00185	0.00041	0.00025	0.00012	-	0.00105	0.00090	-	0.00067	0.00034
Arsenic (As)-Dissolved	mg/L	0.005	0.00036	0.00072	-	-	0.00020	-	-	-	-	0.00061	0.00229	0.00182	0.00060	0.00037	0.00019	-	0.00203	0.00130	-	0.00124	0.00034
Barium (Ba)-Dissolved	mg/L	-	0.0919	0.0645	-	-	0.0737	-	-	-	-	0.0573	0.0543	0.0847	0.0619	0.0730	0.0742	-	0.0200	0.0222	-	0.0382	0.0326
Beryllium (Be)-Dissolved	mg/L	-	<0.000020	<0.000020	-	-	<0.000020	-	-	-	-	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	-	<0.000040	<0.000020	-	<0.000020	<0.000020
Bismuth (Bi)-Dissolved	mg/L	-	<0.000050	<0.000050	-	-	<0.000050	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	<0.00010	<0.000050	-	<0.000050	<0.000050
Boron (B)-Dissolved	mg/L	1.5	0.010	0.018	-	-	<0.010	-	-	-	-	0.010	0.146	0.311	0.116	0.075	<0.010	-	0.281	0.084	-	0.036	0.014
Cadmium (Cd)-Dissolved	mg/L	Varies [9]	0.000131	0.0000333	-	-	0.0000192	-	-	-	-	0.0000396	0.0000609	0.0000118	0.0000685	0.0000715	0.0000217	-	0.000198	0.000133	-	0.0000531	0.0000597
Cadmium CCME-FAL	*mg/L*	-	*0.00037*	*0.00037*	-	-	*0.000341*	-	-	-	-	0.00037	*0.00037*	*0.00037*	*0.00037*	*0.00037*	*0.000335*	-	*0.00037*	*0.00037*	-	*0.00037*	*0.00037*
Calcium (Ca)-Dissolved	mg/L	-	126	99.3	-	-	64.0	-	-	-	-	79.1	140	98.4	139	133	64.1	-	216	193	-	121	77.0
Chromium (Cr)-Dissolved	mg/L	-	0.00019	0.00014	-	-	0.00010	-	-	-	-	0.00042	0.00053	0.00116	0.00044	0.00045	0.00012	-	0.00242	0.00140	-	0.00047	0.00028
Chromium (III)-Dissolved	mg/L	0.0089	-	-	-	-	-	-	-	-	-	-	-	<0.00042	-	-	-	-	<0.00047	<0.00043	-	-	-
Chromium (VI)-Dissolved	mg/L	0.001	-	-	-	-	-	-	-	-	-	-	-	0.0012	-	-	-	-	0.0025	0.0017	-	-	-
Cobalt (Co)-Dissolved	mg/L	-	0.00740	0.00028	-	-	0.00012	-	-	-	-	0.00036	0.00320	<0.00010	0.00199	0.00120	<0.00010	-	<0.00020	<0.00010	-	<0.00010	<0.00010
Copper (Cu)-Dissolved	mg/L	Varies [10]	0.00056	0.00055	-	-	0.00152	-	-	-	-	0.00224	0.00058	0.00088	0.00079	0.00118	0.00147	-	0.00077	0.00100	-	0.00086	0.00050
Copper CCME-FAL	*mg/L*	-	*0.004*	*0.004*	-	-	*0.004*	-	-	-	-	0.004	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	-	*0.004*	*0.004*	-	*0.004*	*0.004*
Iron (Fe)-Dissolved	mg/L	0.3	0.643	0.175	-	-	0.021	-	-	-	-	0.169	0.735	<0.010	0.123	0.085	0.017	-	<0.010	<0.010	-	<0.010	0.012
Lead (Pb)-Dissolved	mg/L	Varies [11]	<0.000050	<0.000050	-	-	<0.000050	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	<0.00010	<0.000050	-	<0.000050	<0.000050
Lead CCME-FAL	*mg/L*	-	*0.007*	*0.007*	-	-	*0.007*	-	-	-	-	0.007	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	-	*0.007*	*0.007*	-	*0.007*	*0.007*
Lithium (Li)-Dissolved	mg/L	-	0.0098	0.0087	-	-	0.0085	-	-	-	-	0.0038	0.0263	0.0128	0.0301	0.0231	0.0078	-	0.0938	0.0126	-	0.0069	0.0048
Magnesium (Mg)-Dissolved	mg/L	-	71.4	76.3	-	-	22.5	-	-	-	-	41.2	148	115	134	111	21.0	-	327	222	-	92.3	32.0
Manganese (Mn)-Dissolved	mg/L	-	3.42	0.203	-	-	0.0125	-	-	-	-	0.256	0.319	0.00724	0.395	0.599	0.0125	-	<0.00020	0.00019	-	<0.00010	0.00120
Mercury (Hg)-Dissolved	mg/L	0.000026	<0.0000050	<0.0000050	-	-	<0.0000050	-	-	-	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050
Molybdenum (Mo)-Dissolved	mg/L	0.073	0.00139	0.000818	-	-	0.000461	-	-	-	-	0.00129	0.00245	0.00183	0.00175	0.00133	0.000469	-	0.00269	0.00273	-	0.00214	0.000951
Nickel (Ni)-Dissolved	mg/L	Varies [12]	0.0334	0.00283	-	-	0.00198	-	-	-	-	0.00454	0.0446	0.0247	0.0332	0.0182	0.00167	-	0.0742	0.0427	-	0.0320	0.0110
Nickel CCME-FAL	*mg/L*	-	*0.15*	*0.15*	-	-	*0.15*	-	-	-	-	0.15	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	-	*0.15*	*0.15*	-	*0.15*	*0.15*
Phosphorus (P)-Dissolved	mg/L	-	<0.050	<0.050	-	-	<0.050	-	-	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	-	<0.050	<0.050	-	<0.050	<0.050
Potassium (K)-Dissolved	mg/L	-	0.91	1.05	-	-	1.68	-	-	-	-	0.85	1.93	1.51	1.77	1.43	1.61	-	3.47	1.96	-	1.17	0.65
Selenium (Se)-Dissolved	mg/L	0.001	0.000229	0.000485	-	-	0.000428	-	-	-	-	0.00134	0.00163	0.00101	0.000988	0.00102	0.000442	-	0.00470	0.00374	-	0.00238	0.00205
Silicon (Si)-Dissolved	mg/L	-	5.12	5.52	-	-	4.94	-	-	-	-	5.23	5.82	6.34	5.62	5.26	4.88	-	5.96	4.88	-	4.94	2.71
Silver (Ag)-Dissolved	mg/L	0.0001	<0.000010	<0.000010	-	-	<0.000010	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	-	<0.000020	<0.000010	-	<0.000010	<0.000010
Sodium (Na)-Dissolved	mg/L	-	5.31	4.16	-	-	8.50	-	-	-	-	3.35	9.18	7.29	10.4	8.44	7.76	-	20.1	7.71	-	4.05	2.09
Strontium (Sr)-Dissolved	mg/L	-	0.705	0.551	-	-	0.337	-	-	-	-	0.374	1.02	0.632	1.02	0.912	0.330	-	2.10	1.07	-	0.578	0.406
Sulfur (S)-Dissolved	mg/L	-	119	97.5	-	-	38.3	-	-	-	-	65.6	223	126	195	159	36.6	-	504	358	-	149	61.9
Thallium (Tl)-Dissolved	mg/L	0.0008	<0.000010	<0.000010	-	-	<0.000010	-	-	-	-	<0.000010	0.000032	<0.000010	0.000011	<0.000010	<0.000010	-	0.000076	0.000049	-	0.000045	0.000013
Tin (Sn)-Dissolved	mg/L	-	<0.00010	<0.00010	-	-	<0.00010	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	-	<0.00020	<0.00010	-	<0.00010	<0.00010
Titanium (Ti)-Dissolved	mg/L	-	<0.00030	<0.00030	-	-	<0.00030	-	-	-	-	0.00039	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	-	<0.00060	<0.00030	-	<0.00030	<0.00030
Uranium (U)-Dissolved	mg/L	0.015	0.00356	0.00764	-	-	0.00257	-	-	-	-	0.00263	0.00377	0.00391	0.00428	0.00489	0.00253	-	0.00744	0.00443	-	0.00212	0.00145
Vanadium (V)-Dissolved	mg/L	-	<0.00050	<0.00050	-	-	<0.00050	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	-	<0.0010	<0.00050	-	<0.00050	<0.00050
Zinc (Zn)-Dissolved	mg/L	0.03	0.0024	0.0011	-	-	0.0032	-	-	-	-	0.0021	0.0020	<0.0010	0.0019	0.0030	0.0038	-	0.0065	0.0048	-	0.0016	<0.0010
Zirconium (Zr)-Dissolved	mg/L	-	0.00054	<0.00030	-	-	0.00035	-	-	-	-	0.00078	0.00038	<0.00030	0.00160	0.00138	<0.00030	-	<0.00060	<0.00030	-	<0.00030	<0.00030

Table 3: Analytical Chemistry Data

	Site Location	Surface Water - Reference Sites								Surface Water - Exposure Sites								Seepages - Exposure Sites				
	Sample ID	R1	R2	R3	R4	R6	R7	R8	R9	E1	E1(H)	E2	E3	E4	E7	E8	SL	GWCC-1	GWCC-2	GWCC-3	GWCC-4	GWCC-5
	Date Sampled	26/01/2016	26/01/2016	24/01/2016	25/01/2016	27/01/2016	26/01/2016	26/01/2016	26/01/2016	23/01/2016	23/01/2016	23/01/2016	23/01/2016	23/01/2016	19/01/2016	27/01/2016	27/01/2016	24/01/2016	24/01/2016	24/01/2016	24/01/2016	25/01/2016
	ALS Work Number	L1728272	L1728272	-	-	L1728530	-	-	-	-	L1727085	L1727085	L1727085	L1727085	L1726304	L1728530	-	L1727085	L1727085	-	L1727085	L1728272
Parameter	**Units**	CCME-FAL[1, 2, 3, 4]	Good	Good	Frozen	Frozen	Good	Frozen	Frozen	Frozen	Frozen	Good	Good	Good	Good	Good	Good	Frozen	Good	Good	Frozen	Good	Good
Total Metals																							
Aluminum (Al)-Total	mg/L	Varies [8]	0.0087	0.0304	-	-	0.131	-	-	-	-	0.0307	0.0035	0.0062	0.0045	0.0078	0.112	-	<0.0060	0.0230	-	<0.0030	0.0074
Aluminum CCME-FAL	*mg/L*	-	*0.1000*	*0.1000*	-	-	*0.1000*	-	-	-	-	0.1000	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	-	*0.1000*	*0.1000*	-	*0.1000*	*0.1000*
Antimony (Sb)-Total	mg/L	-	0.00017	0.00044	-	-	0.00017	-	-	-	-	0.00029	0.00064	0.00173	0.00043	0.00026	0.00014	-	0.00109	0.00093	-	0.00061	0.00060
Arsenic (As)-Total	mg/L	0.005	0.00039	0.00086	-	-	0.00024	-	-	-	-	0.00063	0.00254	0.00178	0.00095	0.00050	0.00022	-	0.00199	0.00145	-	0.00120	0.00069
Barium (Ba)-Total	mg/L	-	0.0902	0.0660	-	-	0.0757	-	-	-	-	0.0605	0.0544	0.0797	0.0630	0.0750	0.0745	-	0.0196	0.0225	-	0.0389	0.0571
Beryllium (Be)-Total	mg/L	-	<0.000020	<0.000020	-	-	<0.000020	-	-	-	-	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	-	<0.000040	<0.000020	-	<0.000020	<0.000020
Bismuth (Bi)-Total	mg/L	-	<0.000050	<0.000050	-	-	<0.000050	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	<0.00010	<0.000050	-	<0.000050	<0.000050
Boron (B)-Total	mg/L	1.5	0.010	0.019	-	-	<0.010	-	-	-	-	0.011	0.145	0.310	0.127	0.080	<0.010	-	0.313	0.092	-	0.036	0.025
Cadmium (Cd)-Total	mg/L	Varies [9]	0.000144	0.0000364	-	-	0.0000609	-	-	-	-	0.0000386	0.0000727	0.0000125	0.0000678	0.0000655	0.0000195	-	0.000202	0.000159	-	0.0000556	0.000123
Cadmium CCME-FAL	*mg/L*	-	*0.00037*	*0.00037*	-	-	*0.000341*	-	-	-	-	0.00037	*0.00037*	*0.00037*	*0.00037*	*0.00037*	*0.000335*	-	*0.00037*	*0.00037*	-	*0.00037*	*0.00037*
Calcium (Ca)-Total	mg/L	-	125	101	-	-	65.3	-	-	-	-	77.4	144	91.7	139	135	62.6	-	214	194	-	120	126
Chromium (Cr)-Total	mg/L	-	0.00026	0.00023	-	-	0.00020	-	-	-	-	0.00047	0.00088	0.00119	0.00067	0.00052	0.00013	-	0.00257	0.00428	-	0.00060	0.00083
Chromium (III)-Total	mg/L	0.0089	-	-	-	-	-	-	-	-	-	-	-	<0.00072	-	-	-	-	<0.00078	0.00258	-	-	-
Chromium (VI)-Total	mg/L	0.001	-	-	-	-	-	-	-	-	-	-	-	0.0014	-	-	-	-	0.0026	0.0017	-	-	-
Cobalt (Co)-Total	mg/L	-	0.00725	0.00030	-	-	0.00014	-	-	-	-	0.00040	0.00323	<0.00010	0.00210	0.00127	<0.00010	-	<0.00020	0.00019	-	<0.00010	0.00010
Copper (Cu)-Total	mg/L	Varies [10]	0.00064	0.00071	-	-	0.00353	-	-	-	-	0.00234	0.00069	0.00090	0.00091	0.00113	0.00155	-	<0.0010	0.00122	-	0.00090	0.00120
Copper CCME-FAL	*mg/L*	-	*0.004*	*0.004*	-	-	*0.004*	-	-	-	-	0.004	*0.004*	*0.004*	*0.004*	*0.004*	*0.004*	-	*0.004*	*0.004*	-	*0.004*	*0.004*
Iron (Fe)-Total	mg/L	0.3	0.689	0.299	-	-	0.050	-	-	-	-	0.187	0.991	0.010	0.357	0.154	0.040	-	<0.010	0.082	-	0.010	0.125
Lead (Pb)-Total	mg/L	Varies [11]	<0.000050	<0.000050	-	-	0.000127	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	<0.00010	<0.000050	-	<0.000050	<0.000050
Lead CCME-FAL	*mg/L*	-	*0.007*	*0.007*	-	-	*0.007*	-	-	-	-	0.007	*0.007*	*0.007*	*0.007*	*0.007*	*0.007*	-	*0.007*	*0.007*	-	*0.007*	*0.007*
Lithium (Li)-Total	mg/L	-	0.0100	0.0091	-	-	0.0087	-	-	-	-	0.0034	0.0286	0.0124	0.0310	0.0237	0.0075	-	0.101	0.0136	-	0.0063	0.0083
Magnesium (Mg)-Total	mg/L	-	72.9	79.3	-	-	23.5	-	-	-	-	40.9	152	111	137	114	21.4	-	336	231	-	94.3	54.1
Manganese (Mn)-Total	mg/L	-	3.34	0.210	-	-	0.0135	-	-	-	-	0.277	0.314	0.00717	0.404	0.624	0.0129	-	0.00021	0.00160	-	0.00023	0.00716
Mercury (Hg)-Total	mg/L	0.000026	<0.0000050	<0.0000050	-	-	<0.0000050	-	-	-	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050
Molybdenum (Mo)-Total	mg/L	0.073	0.00143	0.000911	-	-	0.000528	-	-	-	-	0.00131	0.00258	0.00182	0.00186	0.00139	0.000516	-	0.00284	0.00283	-	0.00207	0.00175
Nickel (Ni)-Total	mg/L	Varies [12]	0.0327	0.00296	-	-	0.00215	-	-	-	-	0.00465	0.0464	0.0240	0.0345	0.0189	0.00179	-	0.0762	0.0476	-	0.0328	0.0198
Nickel CCME-FAL	*mg/L*	-	*0.15*	*0.15*	-	-	*0.15*	-	-	-	-	0.15	*0.15*	*0.15*	*0.15*	*0.15*	*0.15*	-	*0.15*	*0.15*	-	*0.15*	*0.15*
Phosphorus (P)-Total	mg/L	-	<0.050	<0.050	-	-	<0.050	-	-	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	-	<0.050	<0.050	-	<0.050	<0.050
Potassium (K)-Total	mg/L	-	1.02	1.26	-	-	1.94	-	-	-	-	0.89	2.17	1.57	2.02	1.49	1.84	-	3.97	2.17	-	1.23	1.16
Selenium (Se)-Total	mg/L	0.001	0.000215	0.000448	-	-	0.000484	-	-	-	-	0.00165	0.00179	0.000946	0.00100	0.000999	0.000474	-	0.00466	0.00379	-	0.00227	0.00372
Silicon (Si)-Total	mg/L	-	5.21	5.72	-	-	5.13	-	-	-	-	5.23	5.89	6.02	5.77	5.42	4.87	-	6.11	5.06	-	5.08	4.60
Silver (Ag)-Total	mg/L	0.0001	<0.000010	<0.000010	-	-	0.000023	-	-	-	-	<0.000010	<0.000010	<0.000010	0.000024	<0.000010	0.000025	-	<0.000020	<0.000010	-	<0.000010	<0.000010
Sodium (Na)-Total	mg/L	-	5.20	4.29	-	-	8.76	-	-	-	-	3.39	9.69	7.03	10.8	8.91	7.80	-	21.5	8.06	-	4.24	3.63
Strontium (Sr)-Total	mg/L	-	0.710	0.569	-	-	0.352	-	-	-	-	0.355	1.07	0.604	1.05	0.937	0.333	-	2.18	1.08	-	0.515	0.701
Thallium (Tl)-Total	mg/L	-	<0.000010	<0.000010	-	-	<0.000010	-	-	-	-	<0.000010	0.000033	<0.000010	0.000013	<0.000010	<0.000010	-	0.000078	0.000054	-	0.000041	0.000017
Tin (Sn)-Total	mg/L	0.0008	<0.00010	<0.00010	-	-	<0.00010	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	-	<0.00020	<0.00010	-	<0.00010	<0.00010
Titanium (Ti)-Total	mg/L	-	<0.00030	<0.0012	-	-	0.00035	-	-	-	-	0.00058	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	-	<0.00060	<0.0012	-	<0.00030	<0.00030
Uranium (U)-Total	mg/L	-	0.00367	0.00807	-	-	0.00278	-	-	-	-	0.00260	0.00410	0.00376	0.00457	0.00507	0.00263	-	0.00785	0.00456	-	0.00193	0.00258
Vanadium (V)-Total	mg/L	0.015	<0.00050	<0.00050	-	-	<0.00050	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	-	<0.0010	<0.00050	-	<0.00050	<0.00050
Zinc (Zn)-Total	mg/L	-	<0.0030	<0.0030	-	-	0.0072	-	-	-	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0038	-	0.0071	0.0053	-	<0.0030	<0.0030
Zirconium (Zr)-Total	mg/L	0.03	0.00054	<0.00030	-	-	0.00039	-	-	-	-	0.00073	0.00041	<0.00030	0.00173	0.00142	<0.00030	-	<0.00060	0.00034	-	<0.00030	<0.00030

Table 4: Analytical Quality Assurance and Control

		Site Location	R1		R6			E3			Travel Blanks	
		Sample ID	R1	FB1 (R1)	R6	DUP2 (R6)	RPD (%)[13]	DUP 1 (E3)	E3	RPD (%)[13]	TRAVEL_BLANK	TRAVEL_BLANK
		Date Sampled	26/01/2016	26/01/2016	27/01/2016	27/01/2016		23/01/2016	23/01/2016		27/01/2016	29/01/2016
		ALS Work Number	L1728272	L1728272	L1728530	L1728530		L1727085	L1727085		L1728272	L1728530
Parameter	**Units**	CCME-FAL[1, 2, 3, 4]	Good	Good	Good	Good		Good	Good		-	-
Physical Tests												
Lab pH	pH units	6.5-9.0 [5]	7.29	5.6	7.45	7.77	4.20	8.05	8.05	0.00	5.5	5.5
Field pH	pH units	6.5-9.0 [5]	7.21	-	7.23	7.23	-	7.1	7.1	-	-	-
Field Temperature	C	-	0.1	-	0.1	0.1	-	0.3	0.3	-	-	-
Lab Conductivity	uS/cm	-	959	<2.0	487	470	3.55	1010	1050	3.88	<2.0	<2.0
Field Conductivity	uS/cm	-	527	-	255.4	255.4	-	564	564	-	-	-
Field Specific Conductivity	uS/cm	-	1003	-	487.5	487.5	-	1069	1069	-	-	-
Field Dissolved Oxygen	mg/L	9.5 [6]	0.15	-	12.07	12.07	-	0.17	0.17	-	-	-
Field Oxidation - Redox Potent	mV	-	37.3	-	151.6	151.6	-	169.7	169.7	-	-	-
Field Turbidity	NTU	-	-	-	-	-	-	-	-	-	-	-
Total Suspended Solids	mg/L	-	<3.0	<3.0	<3.0	<3.0	nc	<3.0	<3.0	nc	<3.0	<3.0
Total Hardness (as CaCO3)	mg/L	-	609	<0.50	252	263	4.27	722	719	0.42	<0.50	<0.50
Anions and Nutrients												
Nitrate (as N)	mg/L	13	0.028	<0.0050	0.350	0.349	0.29	0.429	0.439	2.30	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	<0.0020	<0.0010	<0.0010	0.0010	nc	<0.0020	<0.0020	nc	<0.0010	<0.0010
Ammonia, Total (as N)	mg/L	Varies [7]	0.0897	<0.0050	0.0118	0.0105	11.66	<0.0050	<0.0050	nc	**0.0079**	**0.0138**
Ammonia CCME-FAL	*mg/L*	-	*14.13*	-	*13.49*	*13.49*	-	*17.9*	*17.9*	-	-	-
Sulfate (SO4)	mg/L	-	387	<0.30	123	123	0.00	390	397	1.78	<0.30	<0.30
Inorganic/Organic Carbon												
Dissolved Organic Carbon	mg/L	-	9.75	<0.50	4.17	4.17	0.00	6.56	6.79	3.45	-	-
Dissolved Metals												
Aluminum (Al)-Dissolved	mg/L	Varies [8]	0.0063	<0.0010	0.0415	0.0431	3.78	0.0022	0.0024	8.70	-	-
Aluminum CCME-FAL	*mg/L*	-	*0.1000*	-	*0.1000*	*0.1000*	-	*0.1000*	*0.1000*	-	-	-
Antimony (Sb)-Dissolved	mg/L	-	0.00015	<0.00010	0.00011	0.00011	0.00	0.00188	0.00185	1.61	-	-
Arsenic (As)-Dissolved	mg/L	0.005	0.00036	<0.00010	0.00020	0.00020	0.00	0.00186	0.00182	2.17	-	-
Barium (Ba)-Dissolved	mg/L	-	0.0919	<0.000050	0.0737	0.0751	1.88	0.0825	0.0847	2.63	-	-
Beryllium (Be)-Dissolved	mg/L	-	<0.000020	<0.000020	<0.000020	<0.000020	nc	<0.000020	<0.000020	nc	-	-
Bismuth (Bi)-Dissolved	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	nc	<0.000050	<0.000050	nc	-	-
Boron (B)-Dissolved	mg/L	1.5	0.010	<0.010	<0.010	<0.010	nc	0.321	0.311	3.16	-	-
Cadmium (Cd)-Dissolved	mg/L	Varies [9]	0.000131	<0.0000050	0.0000192	0.0000185	3.71	0.0000136	0.0000118	14.17	-	-
Cadmium CCME-FAL	*mg/L*	-	*0.00037*	-	*0.000341*	*0.000354*	-	*0.00037*	*0.00037*	-	-	-
Calcium (Ca)-Dissolved	mg/L	-	126	<0.050	64.0	67.0	4.58	98.4	98.4	0.00	-	-
Chromium (Cr)-Dissolved	mg/L	-	0.00019	<0.00010	0.00010	<0.00010	nc	0.00118	0.00116	1.71	-	-
Chromium (III)-Dissolved	mg/L	0.0089	-	-	-	-	nc	-	<0.00042	nc	-	-
Hexavalent Chromium-Dissolved	mg/L	0.001	-	-	-	-	nc	-	0.0012	nc	-	-
Cobalt (Co)-Dissolved	mg/L	-	0.00740	<0.00010	0.00012	0.00012	0.00	<0.00010	<0.00010	nc	-	-
Copper (Cu)-Dissolved	mg/L	Varies [10]	0.00056	<0.00020	0.00152	0.00149	1.99	0.00088	0.00088	0.00	-	-
Copper CCME-FAL	*mg/L*	-	*0.004*	-	*0.004*	*0.004*	-	*0.004*	*0.004*	-	-	-
Iron (Fe)-Dissolved	mg/L	0.3	0.643	<0.010	0.021	0.021	0.00	<0.010	<0.010	nc	-	-
Lead (Pb)-Dissolved	mg/L	Varies [11]	<0.000050	<0.000050	<0.000050	<0.000050	nc	<0.000050	<0.000050	nc	-	-
Lead CCME-FAL	*mg/L*	-	*0.007*	-	*0.007*	*0.007*	-	*0.007*	*0.007*	-	-	-
Lithium (Li)-Dissolved	mg/L	-	0.0098	<0.0010	0.0085	0.0084	1.18	0.0132	0.0128	3.08	-	-
Magnesium (Mg)-Dissolved	mg/L	-	71.4	<0.10	22.5	23.2	3.06	116	115	0.87	-	-
Manganese (Mn)-Dissolved	mg/L	-	3.42	<0.00010	0.0125	0.0124	0.80	0.00715	0.00724	1.25	-	-
Mercury (Hg)-Dissolved	mg/L	0.000026	<0.0000050	<0.0000050	<0.0000050	<0.0000050	nc	<0.0000050	<0.0000050	nc	-	-
Molybdenum (Mo)-Dissolved	mg/L	0.073	0.00139	<0.000050	0.000461	0.000430	6.96	0.00183	0.00183	0.00	-	-
Nickel (Ni)-Dissolved	mg/L	Varies [12]	0.0334	<0.00050	0.00198	0.00200	1.01	0.0247	0.0247	0.00	-	-
Nickel CCME-FAL	*mg/L*	-	*0.15*	-	*0.15*	*0.15*	-	*0.15*	*0.15*	-	-	-
Phosphorus (P)-Dissolved	mg/L	-	<0.050	<0.050	<0.050	<0.050	nc	<0.050	<0.050	nc	-	-
Potassium (K)-Dissolved	mg/L	-	0.91	<0.10	1.68	1.69	0.59	1.48	1.51	2.01	-	-
Selenium (Se)-Dissolved	mg/L	0.001	0.000229	<0.000050	0.000428	0.000494	14.32	0.00107	0.00101	5.77	-	-
Silicon (Si)-Dissolved	mg/L	-	5.12	<0.050	4.94	5.10	3.19	6.35	6.34	0.16	-	-
Silver (Ag)-Dissolved	mg/L	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	nc	<0.000010	<0.000010	nc	-	-
Sodium (Na)-Dissolved	mg/L	-	5.31	<0.050	8.50	8.42	0.95	7.21	7.29	1.10	-	-
Strontium (Sr)-Dissolved	mg/L	-	0.705	<0.00020	0.337	0.342	1.47	0.633	0.632	0.16	-	-
Sulfur (S)-Dissolved	mg/L	-	119	<0.50	38.3	39.7	3.59	127	126	0.79	-	-
Thallium (Tl)-Dissolved	mg/L	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	nc	<0.000010	<0.000010	nc	-	-
Tin (Sn)-Dissolved	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	nc	<0.00010	<0.00010	nc	-	-
Titanium (Ti)-Dissolved	mg/L	-	<0.00030	<0.00030	<0.00030	<0.00030	nc	<0.00030	<0.00030	nc	-	-
Uranium (U)-Dissolved	mg/L	0.015	0.00356	<0.000010	0.00257	0.00241	6.43	0.00400	0.00391	2.28	-	-
Vanadium (V)-Dissolved	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	nc	-	-
Zinc (Zn)-Dissolved	mg/L	0.03	0.0024	<0.0010	0.0032	0.0031	3.17	<0.0010	<0.0010	nc	-	-
Zirconium (Zr)-Dissolved	mg/L	-	0.00054	<0.00030	0.00035	0.00034	2.90	<0.00030	<0.00030	nc	-	-

Table 4: Analytical Quality Assurance and Control

		Site Location	R1		R6			E3			Travel Blanks	
		Sample ID	R1	FB1 (R1)	R6	DUP2 (R6)	RPD (%)[13]	DUP 1 (E3)	E3	RPD (%)[13]	TRAVEL_BLANK	TRAVEL_BLANK
		Date Sampled	26/01/2016	26/01/2016	27/01/2016	27/01/2016		23/01/2016	23/01/2016		27/01/2016	29/01/2016
		ALS Work Number	L1728272	L1728272	L1728530	L1728530		L1727085	L1727085		L1728272	L1728530
Parameter	**Units**	CCME-FAL[1, 2, 3, 4]	Good	Good	Good	Good		Good	Good		-	-
Total Metals												
Aluminum (Al)-Total	mg/L	Varies [8]	0.0087	<0.0030	0.131	0.129	1.54	0.0054	0.0062	13.79	<0.0030	<0.0030
Aluminum CCME-FAL	*mg/L*	-	*0.1000*	-	*0.1000*	*0.1000*	-	*0.1000*	*0.1000*	-	-	-
Antimony (Sb)-Total	mg/L	-	0.00017	<0.00010	0.00017	0.00017	0.00	0.00190	0.00173	9.37	<0.00010	<0.00010
Arsenic (As)-Total	mg/L	0.005	0.00039	<0.00010	0.00024	0.00024	0.00	0.00191	0.00178	7.05	<0.00010	<0.00010
Barium (Ba)-Total	mg/L	-	0.0902	<0.000050	0.0757	0.0734	3.09	0.0874	0.0797	9.22	<0.000050	<0.000050
Beryllium (Be)-Total	mg/L	-	<0.000020	<0.000020	<0.000020	<0.000020	nc	<0.000020	<0.000020	nc	<0.000020	<0.000020
Bismuth (Bi)-Total	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	nc	<0.000050	<0.000050	nc	<0.000050	<0.000050
Boron (B)-Total	mg/L	1.5	0.010	<0.010	<0.010	<0.010	nc	0.341	0.310	9.52	<0.010	<0.010
Cadmium (Cd)-Total	mg/L	Varies [9]	0.000144	<0.0000050	0.0000609	0.0000527	14.44	0.0000145	0.0000125	14.81	<0.0000050	<0.0000050
Cadmium CCME-FAL	*mg/L*	-	*0.00037*	-	*0.000341*	*0.000354*	-	*0.00037*	*0.00037*	-	-	-
Calcium (Ca)-Total	mg/L	-	125	<0.050	65.3	63.3	3.11	95.4	91.7	3.96	<0.050	<0.050
Chromium (Cr)-Total	mg/L	-	0.00026	<0.00010	0.00020	0.00020	0.00	0.00127	0.00119	6.50	<0.00010	<0.00010
Chromium (III)-Total	mg/L	0.0089	-	-	-	-	nc	-	<0.00072	nc	-	-
Hexavalent Chromium	mg/L	0.001	-	-	-	-	nc	-	0.0014	nc	-	-
Cobalt (Co)-Total	mg/L	-	0.00725	<0.00010	0.00014	0.00014	0.00	<0.00010	<0.00010	nc	<0.00010	<0.00010
Copper (Cu)-Total	mg/L	Varies [10]	0.00064	<0.00050	0.00353	0.00258	***31.10***	0.00098	0.00090	8.51	<0.00050	<0.00050
Copper CCME-FAL	*mg/L*	-	*0.004*	-	*0.004*	*0.004*	-	*0.004*	*0.004*	-	-	-
Iron (Fe)-Total	mg/L	0.3	0.689	<0.010	0.050	0.057	13.08	0.010	0.010	0.00	<0.010	<0.010
Lead (Pb)-Total	mg/L	Varies [11]	<0.000050	<0.000050	0.000127	0.000088	nc	<0.000050	<0.000050	nc	<0.000050	<0.000050
Lead CCME-FAL	*mg/L*	-	*0.007*	-	*0.007*	*0.007*	-	*0.007*	*0.007*	-	-	-
Lithium (Li)-Total	mg/L	-	0.0100	<0.0010	0.0087	0.0083	4.71	0.0140	0.0124	12.12	<0.0010	<0.0010
Magnesium (Mg)-Total	mg/L	-	72.9	<0.10	23.5	22.9	2.59	116	111	4.41	<0.10	<0.10
Manganese (Mn)-Total	mg/L	-	3.34	<0.00010	0.0135	0.0129	4.55	0.00774	0.00717	7.65	<0.00010	<0.00010
Mercury (Hg)-Total	mg/L	0.000026	<0.0000050	<0.0000050	<0.0000050	<0.0000050	nc	<0.0000050	<0.0000050	nc	<0.0000050	<0.0000050
Molybdenum (Mo)-Total	mg/L	0.073	0.00143	<0.000050	0.000528	0.000534	1.13	0.00194	0.00182	6.38	<0.000050	<0.000050
Nickel (Ni)-Total	mg/L	Varies [12]	0.0327	<0.00050	0.00215	0.00212	1.41	0.0258	0.0240	7.23	<0.00050	<0.00050
Nickel CCME-FAL	*mg/L*	-	*0.15*	-	*0.15*	*0.15*	-	*0.15*	*0.15*	-	-	-
Phosphorus (P)-Total	mg/L	-	<0.050	<0.050	<0.050	<0.050	nc	<0.050	<0.050	nc	<0.050	<0.050
Potassium (K)-Total	mg/L	-	1.02	<0.10	1.94	1.92	1.04	1.63	1.57	3.75	<0.10	<0.10
Selenium (Se)-Total	mg/L	0.001	0.000215	<0.000050	0.000484	0.000461	4.87	0.00105	0.000946	10.42	<0.000050	<0.000050
Silicon (Si)-Total	mg/L	-	5.21	<0.050	5.13	4.97	3.17	6.32	6.02	4.86	<0.050	<0.050
Silver (Ag)-Total	mg/L	0.0001	<0.000010	<0.000010	0.000023	0.000020	13.95	<0.000010	<0.000010	nc	<0.000010	<0.000010
Sodium (Na)-Total	mg/L	-	5.20	<0.050	8.76	8.38	4.43	7.56	7.03	7.27	<0.050	<0.050
Strontium (Sr)-Total	mg/L	-	0.710	<0.00020	0.352	0.344	2.30	0.658	0.604	8.56	<0.00020	<0.00020
Thallium (Tl)-Total	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	nc	<0.000010	<0.000010	nc	<0.000010	<0.000010
Tin (Sn)-Total	mg/L	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	nc	<0.00010	<0.00010	nc	<0.00010	<0.00010
Titanium (Ti)-Total	mg/L	-	<0.00030	<0.00030	0.00035	<0.00030	nc	<0.00030	<0.00030	nc	<0.00030	<0.00030
Uranium (U)-Total	mg/L	-	0.00367	<0.000010	0.00278	0.00271	2.55	0.00414	0.00376	9.62	<0.000010	<0.000010
Vanadium (V)-Total	mg/L	0.015	<0.00050	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	nc	<0.00050	<0.00050
Zinc (Zn)-Total	mg/L	-	<0.0030	<0.0030	0.0072	0.0067	7.19	<0.0030	<0.0030	nc	<0.0030	<0.0030
Zirconium (Zr)-Total	mg/L	0.03	0.00054	<0.00030	0.00039	0.00041	5.00	<0.00030	<0.00030	nc	<0.00030	<0.00030

Notes

(1) CCME guideline exceedences shaded with dark grey. Light grey shading denotes reportable detection limit in exceedence of CCME Guideline. Where guideline value is dependent on hardness or pH, reported values have been compared against a guideline value calculated for each site based on the relevant value, and the guideline value has been noted as "varies".

(2) - = No standard or not analyzed

(3) CCME = Canadian Council of Ministers of the Environment, Canadian Environmental Quality Guidelines, 1999, updated to November 2014

(4) CCME FAL = Chapter 4, Canadian Water Quality Guidelines for the Protection of Aquatic Life, Freshwater, updated to November 2014

(5) CCME FAL stipulates pH not < 6.5 and not > 9

(6) Guideline note: Lowest acceptable dissolved oxygen concentration for cold-water biota, early life stages

(7) Ammonia varies with pH and temperature for CCME FAL; see the CCME ammonia fact sheet for details regarding the applicable criteria, ammonia-NH3 versus total ammonia-N,and other usage guidelines. CCME values listed in the table are expressed as ammonia (N) When field pH is not available, lab pH is used. When field and lab pH are both not available, the most stringent guideline has been used.

(8) Aluminum varies with pH as follows for CCME FAL:

0.005	if	pH<6.5
0.1	if	pH>=6.5

when field pH is not available, lab pH is used. When field and lab pH are both not available, the most stringent guideline has been used.

(9) Cadmium varies with Hardness in mg/L as follows for CCME FAL:

0.00	if	H<17
0.00004 - 0.00037	if	H>=17 and H<=280 as follows; CWQG (µg/L) = 10{0.83(log[hardness]) – 2.46 }
0.00	if	H>280

(10) Copper varies with Hardness in mg/L as follows for CCME FAL:

0.002	if	H<82
0.002 - 0.004	if	H>=82 and H<=180 as follows; CWQG (µg/L) = 0.2 * e{0.8545[ln(hardness)]-1.465}
0.004	if	H>180

(11) Lead varies with Hardness in mg/L as follows for CCME FAL:

0.001	if	H<60
.001 - 0.00	if	H>=60 and H<=180 as follows; CWQG (µg/L)= e{1.273[ln(hardness)]-4.705}
0.007	if	H>180

(12) Nickel varies with Hardness in mg/L as follows for CCME FAL:

0.025	if	H<60
025 - 0.15	if	H>=60 and H<=180 as follows; CWQG (µg/L) = e{0.76[ln(hardness)]+1.06}
0.15	if	H>180

(13) RPD = Relative Percent Difference. The difference between a sample and its field duplicate over the average of two values. *nc* = not calculated. RPD is not calculated if either the sample or the field duplicate concentration is less than five times the detection limit.

Italics text indicates the parameter-specific standard (calculated) for a particular sample.

Bold and underlined indicates values above RDL in Field Blank of Travel Blank

Bold and Italic Indicates QAQC values exceed expected results (i.e. RPD values exceed 20%).

APPENDIX 1
Site Photos

Photo 1: Station E1. View of frozen stream bed. Photo Taken January 23, 2016.

Photo 2: Station E1(H). View across stream. Photo Taken January 23, 2016

Photo 3: Station E2. View downstream. Photo taken January 23, 2016

Photo 4: Station E3. View of sample point. Photo taken January, 2016

Photo 5: Station E3(H) View of sample and hydrology station, looking upstream. Photo taken January 24, 2016

Photo 6: Station E4. View across stream of sample and hydrology station. Photo taken January 25, 2016.

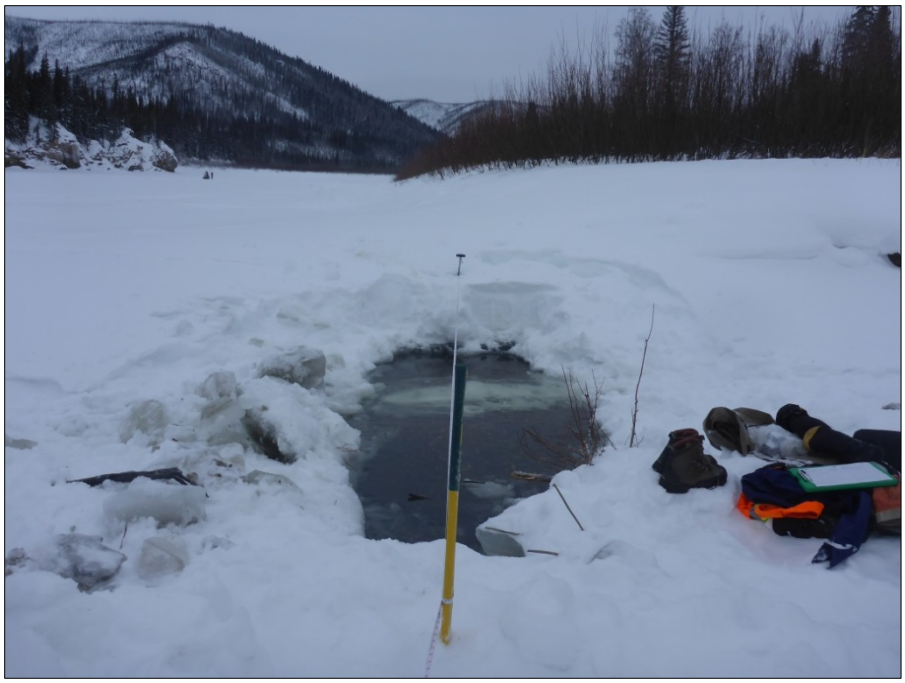


Photo 7: Station E7. View across stream of sample and hydrology station. Photo taken January 19, 2015.

Photo 8: Station E8. View of sample location. Photo taken January 27, 2016.

Photo 9: Station R1. View upstream of sampling and hydrology point. Photo taken January 26, 2016.

Photo 10: Station R2. View downstream of sampling and hydrology point. Photo taken January 26, 2016.

Photo 11: Station R3. View of stream bed. Insufficient water present for sampling or hydrology. Photo taken January 24, 2016.

Photo 12: Station R4. View of cascade. Insufficient water present for sampling or hydrology. Photo taken January 25, 2016.

Photo 13: Station R6. View of sampling point, looking across stream. Photo taken January 27, 2016.

Photo 14: Station R7. View of stream bed. Insufficient water present for sampling or hydrology. Photo taken January 26, 2016.

Photo 15: Station R8. View of stream bed. Insufficient water present for sampling or hydrology. Photo taken January 26, 2016

Photo 16: Station R9. View of stream bed. Insufficient water present for sampling or hydrology. Photo taken January 26, 2016

Photo 17: Station GWCC-1. Overhead view of seep output. Photo taken January 24, 2016.

Photo 18: Station GWCC-2. View of seep output. Photo taken January 24, 2016

Photo 19: Station GWCC-3. Insufficient water for sample collection. Photo taken January 24, 2016

Photo 20: Station GWCC-4. View of seep output. Photo taken January 24, 2016

Photo 21: Station GWCC-4. View of seep output. Photo taken January 24, 2016

Photo 22: Station SL. View of ELR personnel attempting to located water. Further access was unsafe. No water observed. Photo taken January 27, 2016.

APPENDIX 2

Water Quality Analytical Laboratory Reports

HEMMERA ENVIROCHEM INC.
ATTN: Natasha Sandys
230 - 2237 2nd Avenue
Whitehorse YK Y1A 0K7

Date Received: 22-JAN-16
Report Date: 02-FEB-16 13:31 (MT)
Version: FINAL

Client Phone: 867-456-4865

Certificate of Analysis

Lab Work Order #: L1726304

Project P.O. #: NOT SUBMITTED
Job Reference: 1343-005.15
C of C Numbers: 1
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1726304-1				
	Description	Water				
	Sampled Date	19-JAN-16				
	Sampled Time	11:30				
	Client ID	E7				
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	1150				
	Hardness (as CaCO3) (mg/L)	790				
	pH (pH)	7.53				
	Total Suspended Solids (mg/L)	<3.0				
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.0343				
	Nitrate (as N) (mg/L)	0.130				
	Nitrite (as N) (mg/L)	<0.0020 DLA				
	Phosphorus (P)-Total (mg/L)	0.0038				
	Sulfate (SO4) (mg/L)	471				
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	8.64				
Total Metals	Aluminum (Al)-Total (mg/L)	0.0078				
	Antimony (Sb)-Total (mg/L)	0.00026				
	Arsenic (As)-Total (mg/L)	0.00050				
	Barium (Ba)-Total (mg/L)	0.0750				
	Beryllium (Be)-Total (mg/L)	<0.000020				
	Bismuth (Bi)-Total (mg/L)	<0.000050				
	Boron (B)-Total (mg/L)	0.080				
	Cadmium (Cd)-Total (mg/L)	0.0000655				
	Calcium (Ca)-Total (mg/L)	135				
	Chromium (Cr)-Total (mg/L)	0.00052				
	Cobalt (Co)-Total (mg/L)	0.00127				
	Copper (Cu)-Total (mg/L)	0.00113				
	Iron (Fe)-Total (mg/L)	0.154				
	Lead (Pb)-Total (mg/L)	<0.000050				
	Lithium (Li)-Total (mg/L)	0.0237				
	Magnesium (Mg)-Total (mg/L)	114				
	Manganese (Mn)-Total (mg/L)	0.624				
	Mercury (Hg)-Total (mg/L)	<0.0000050				
	Molybdenum (Mo)-Total (mg/L)	0.00139				
	Nickel (Ni)-Total (mg/L)	0.0189				
	Phosphorus (P)-Total (mg/L)	<0.050				
	Potassium (K)-Total (mg/L)	1.49				
	Selenium (Se)-Total (mg/L)	0.000999				
	Silicon (Si)-Total (mg/L)	5.42				
	Silver (Ag)-Total (mg/L)	<0.000010				
	Sodium (Na)-Total (mg/L)	8.91				

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1726304-1				
	Description	Water				
	Sampled Date	19-JAN-16				
	Sampled Time	11:30				
	Client ID	E7				
Grouping	**Analyte**					
WATER						
Total Metals	Strontium (Sr)-Total (mg/L)	0.937				
	Sulfur (S)-Total (mg/L)	166				
	Thallium (Tl)-Total (mg/L)	<0.000010				
	Tin (Sn)-Total (mg/L)	<0.00010				
	Titanium (Ti)-Total (mg/L)	<0.00030				
	Uranium (U)-Total (mg/L)	0.00507				
	Vanadium (V)-Total (mg/L)	<0.00050				
	Zinc (Zn)-Total (mg/L)	<0.0030				
	Zirconium (Zr)-Total (mg/L)	0.00142				
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD				
	Dissolved Metals Filtration Location	FIELD				
	Aluminum (Al)-Dissolved (mg/L)	0.0039				
	Antimony (Sb)-Dissolved (mg/L)	0.00025				
	Arsenic (As)-Dissolved (mg/L)	0.00037				
	Barium (Ba)-Dissolved (mg/L)	0.0730				
	Beryllium (Be)-Dissolved (mg/L)	<0.000020				
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050				
	Boron (B)-Dissolved (mg/L)	0.075				
	Cadmium (Cd)-Dissolved (mg/L)	0.0000715				
	Calcium (Ca)-Dissolved (mg/L)	133				
	Chromium (Cr)-Dissolved (mg/L)	0.00045				
	Cobalt (Co)-Dissolved (mg/L)	0.00120				
	Copper (Cu)-Dissolved (mg/L)	0.00118				
	Iron (Fe)-Dissolved (mg/L)	0.085				
	Lead (Pb)-Dissolved (mg/L)	<0.000050				
	Lithium (Li)-Dissolved (mg/L)	0.0231				
	Magnesium (Mg)-Dissolved (mg/L)	111				
	Manganese (Mn)-Dissolved (mg/L)	0.599				
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050				
	Molybdenum (Mo)-Dissolved (mg/L)	0.00133				
	Nickel (Ni)-Dissolved (mg/L)	0.0182				
	Phosphorus (P)-Dissolved (mg/L)	<0.050				
	Potassium (K)-Dissolved (mg/L)	1.43				
	Selenium (Se)-Dissolved (mg/L)	0.00102				
	Silicon (Si)-Dissolved (mg/L)	5.26				
	Silver (Ag)-Dissolved (mg/L)	<0.000010				
	Sodium (Na)-Dissolved (mg/L)	8.44				

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1726304-1				
	Description	Water				
	Sampled Date	19-JAN-16				
	Sampled Time	11:30				
	Client ID	E7				
Grouping	**Analyte**					
WATER						
Dissolved Metals	Strontium (Sr)-Dissolved (mg/L)	0.912				
	Sulfur (S)-Dissolved (mg/L)	159				
	Thallium (Tl)-Dissolved (mg/L)	<0.000010				
	Tin (Sn)-Dissolved (mg/L)	<0.00010				
	Titanium (Ti)-Dissolved (mg/L)	<0.00030				
	Uranium (U)-Dissolved (mg/L)	0.00489				
	Vanadium (V)-Dissolved (mg/L)	<0.00050				
	Zinc (Zn)-Dissolved (mg/L)	0.0030				
	Zirconium (Zr)-Dissolved (mg/L)	0.00138				

* 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	Nitrite (as N)	DLA	L1726304-1
Duplicate	Bismuth (Bi)-Total	DLA	L1726304-1
Duplicate	Copper (Cu)-Total	DLA	L1726304-1
Duplicate	Lead (Pb)-Total	DLA	L1726304-1
Duplicate	Nickel (Ni)-Total	DLA	L1726304-1
Duplicate	Silver (Ag)-Total	DLA	L1726304-1
Duplicate	Thallium (Tl)-Total	DLA	L1726304-1
Duplicate	Tin (Sn)-Total	DLA	L1726304-1
Duplicate	Uranium (U)-Total	DLA	L1726304-1
Duplicate	Vanadium (V)-Total	DLA	L1726304-1
Duplicate	Zinc (Zn)-Total	DLA	L1726304-1
Duplicate	Zirconium (Zr)-Total	DLA	L1726304-1
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1726304-1
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1726304-1
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1726304-1
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1726304-1
Matrix Spike	Manganese (Mn)-Total	MS-B	L1726304-1
Matrix Spike	Sodium (Na)-Total	MS-B	L1726304-1
Matrix Spike	Strontium (Sr)-Total	MS-B	L1726304-1
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1726304-1
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1726304-1
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1726304-1
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1726304-1
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1726304-1
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1726304-1
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1726304-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
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**
BE-D-L-CCMS-VA	Water	Diss. Be (low) 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.

BE-T-L-CCMS-VA	Water	Total Be (Low) 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.

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.

EC-MAN-WR	Water	Conductivity by Meter	APHA 2510 (B)

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using an 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)

Reference Information

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-LOW-ICP-VA Water Dissolved Metals in Water by ICPOES EPA 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-LOW-ICP-VA Water Total Metals in Water by ICPOES EPA 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).

NH3-F-VA Water Ammonia in Water by Fluorescence APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-WR Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

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

NO3-L-IC-N-WR Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

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

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

PH-MAN-WR Water pH by Meter APHA 4500-H+

pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 – 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.

S-DIS-ICP-VA Water Dissolved Sulfur 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, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

S-TOT-ICP-VA Water Total Sulfur 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

Reference Information

microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

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

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

TSS-MAN-WR	Water	Total Suspended Solids by Gravimetric	APHA 2540 D

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids are determined by filtering a sample through a glass fibre filter and drying the filter at 104 degrees celsius.

** 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

Chain of Custody Numbers:

1

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.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L1726304-COFC

COC Number: 1

Page 1 of 1

Report To		Report Format / Distribution		Turnaround Time (TAT) (Rush TAT is not available for all tests)
Company:	Hemmera Environchem Inc.	Select Report Format:	☑PDF ☑EXCEL ☑EDD (DIGITAL)	R ☑Regular (Standard TAT if received by 3 pm - business days)
Contact:	Natasha Sandys	Quality Control (QC) Report with Report	☑ Yes ☐ No	P ☐Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	230 - 2237 2nd Avenue Whitehorse, YT	☐Criteria on Report - provide details below if box checked Select Distribution:	☑EMAIL ☐MAIL ☐FAX	E ☐Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 ☐Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Phone:	867-456-4865	Email 1 or Fax	nsandys@hemmera.com	Specify Date Required for E2,E or P:
		Email 2	chris@elr.ca	

Invoice To		Invoice Distribution		Analysis Request
	Same as Report To ☑ Yes ☐ No	Select Invoice Distribution:	☑EMAIL ☑MAIL ☐FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
	Copy of Invoice with Report ☐ Yes ☑ No	Email 1 or Fax	nsandys@hemmera.com	
Company:	Hemmera Environchem Inc.	Email 2	chris@elr.ca	
Contact:	Natasha Sandys			

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q51108	Approver ID:	Cost Center:
Job #:	1343-005.15	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact:	Sampler: AN/CH

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	Low Level Diss. Met (incl. Hg) and Hardness	Low Level Tot. Met (incl. Hg) and Hardness	Chromium Speciation (III/VI) - Total	Chromium Speciation (III/VI) - Dissolved	Ammonia - N	Dissolved Organic Carbon (DOC)	Nitrate-N	Nitrite - N	Total Phosphorus	Sulphate	pH, Conductivity, Total Susp Solids			Number of Containers
					F/P	P	P	F/P	P	F/P								
	E7	19-01-16	11:30	Water	R	R			R	R	R	R	R	R	R			9

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	Please hold samples for total and dissolved Chromium III/VI pending regular metals analysis results.	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		
2.5					

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date: JAN 22 '16	Time: 10-15.	Received by:	Date: 22-Jan-16	Time: 10:15	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

HEMMERA ENVIROCHEM INC.
ATTN: Natasha Sandys
230 - 2237 2nd Avenue
Whitehorse YK Y1A 0K7

Date Received: 26-JAN-16
Report Date: 24-FEB-16 11:36 (MT)
Version: FINAL REV. 2

Client Phone: 867-456-4865

Certificate of Analysis

Lab Work Order #: L1727085

Project P.O. #:	NOT SUBMITTED
Job Reference:	1343-005.15
C of C Numbers:	1
Legal Site Desc:	

Comments:

24-FEB-2016 This report replaces the previous version and contains additional analyses, as requested.

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1727085-1	L1727085-2	L1727085-3	L1727085-4	L1727085-5
Description	Water	Water	Water	Water	Water
Sampled Date	23-JAN-16	23-JAN-16	23-JAN-16	24-JAN-16	23-JAN-16
Sampled Time	10:45	10:48	14:50	14:35	13:15
Client ID	DUP 1	E3	E4	GWCC-2	E1(H)
Grouping / **Analyte**					
WATER					
Physical Tests Conductivity (uS/cm)	1010	1050	1350	1950	616
Hardness (as CaCO3) (mg/L)	722	719	898	1400	367
pH (pH)	8.05	8.05	7.37	7.66	7.70
Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0	<3.0	<3.0
Anions and Nutrients Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	0.0304	<0.0050	0.0054
Nitrate (as N) (mg/L)	0.429 DLA	0.439 DLA	0.145 DLA	0.425 DLA	0.186
Nitrite (as N) (mg/L)	<0.0020	<0.0020	<0.0020	<0.0050	<0.0010
Phosphorus (P)-Total (mg/L)	0.0051	0.0070	<0.0020	<0.0020	0.0100
Sulfate (SO4) (mg/L)	390	397	627	1180	203
Organic / Inorganic Carbon Dissolved Organic Carbon (mg/L)	6.56	6.79	8.02	7.31	15.7
Total Metals Aluminum (Al)-Total (mg/L)	0.0054	0.0062	0.0045	0.0230	0.0307
Antimony (Sb)-Total (mg/L)	0.00190	0.00173	0.00043	0.00093	0.00029
Arsenic (As)-Total (mg/L)	0.00191	0.00178	0.00095	0.00145	0.00063
Barium (Ba)-Total (mg/L)	0.0874	0.0797	0.0630	0.0225	0.0605
Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron (B)-Total (mg/L)	0.341	0.310	0.127	0.092	0.011
Cadmium (Cd)-Total (mg/L)	0.0000145	0.0000125	0.0000678	0.000159	0.0000386
Calcium (Ca)-Total (mg/L)	95.4	91.7	139	194	77.4
Chromium (Cr)-Total (mg/L)	0.00127	0.00119	0.00067	0.00428	0.00047
Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	0.00210	0.00019	0.00040
Copper (Cu)-Total (mg/L)	0.00098	0.00090	0.00091	0.00122	0.00234
Iron (Fe)-Total (mg/L)	0.010	0.010	0.357	0.082	0.187
Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)-Total (mg/L)	0.0140	0.0124	0.0310	0.0136	0.0034
Magnesium (Mg)-Total (mg/L)	116	111	137	231	40.9
Manganese (Mn)-Total (mg/L)	0.00774	0.00717	0.404	0.00160	0.277
Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum (Mo)-Total (mg/L)	0.00194	0.00182	0.00186	0.00283	0.00131
Nickel (Ni)-Total (mg/L)	0.0258	0.0240	0.0345	0.0476	0.00465
Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium (K)-Total (mg/L)	1.63	1.57	2.02	2.17	0.89
Selenium (Se)-Total (mg/L)	0.00105	0.000946	0.00100	0.00379	0.00165
Silicon (Si)-Total (mg/L)	6.32	6.02	5.77	5.06	5.23
Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	0.000024	<0.000010	<0.000010
Sodium (Na)-Total (mg/L)	7.56	7.03	10.8	8.06	3.39

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1727085-6 Water 23-JAN-16 11:45 E2	L1727085-7 Water 24-JAN-16 13:35 GWCC-1	L1727085-8 Water 24-JAN-16 15:10 GWCC-4		
	Sample ID	L1727085-6	L1727085-7	L1727085-8		
	Description	Water	Water	Water		
	Sampled Date	23-JAN-16	24-JAN-16	24-JAN-16		
	Sampled Time	11:45	13:35	15:10		
	Client ID	E2	GWCC-1	GWCC-4		
WATER						
Physical Tests	Conductivity (uS/cm)	1450	2410	1060		
	Hardness (as CaCO3) (mg/L)	961	1880	683		
	pH (pH)	7.65	7.56	7.64		
	Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0		
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.0470	<0.0050	<0.0050		
	Nitrate (as N) (mg/L)	0.180	0.523 HTD	0.187		
	Nitrite (as N) (mg/L)	<0.0050 DLA	<0.010 DLA	<0.0020 DLA		
	Phosphorus (P)-Total (mg/L)	0.0034	<0.0020	<0.0020		
	Sulfate (SO4) (mg/L)	763	1660	470		
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	7.77	5.09	8.75		
Total Metals	Aluminum (Al)-Total (mg/L)	0.0035	<0.0060 DLA	<0.0030		
	Antimony (Sb)-Total (mg/L)	0.00064	0.00109	0.00061		
	Arsenic (As)-Total (mg/L)	0.00254	0.00199	0.00120		
	Barium (Ba)-Total (mg/L)	0.0544	0.0196	0.0389		
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000040 DLA	<0.000020		
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.00010 DLA	<0.000050		
	Boron (B)-Total (mg/L)	0.145	0.313	0.036		
	Cadmium (Cd)-Total (mg/L)	0.0000727	0.000202	0.0000556		
	Calcium (Ca)-Total (mg/L)	144	214	120		
	Chromium (Cr)-Total (mg/L)	0.00088	0.00257	0.00060		
	Cobalt (Co)-Total (mg/L)	0.00323	<0.00020 DLA	<0.00010		
	Copper (Cu)-Total (mg/L)	0.00069	<0.0010 DLA	0.00090		
	Iron (Fe)-Total (mg/L)	0.991	<0.010	0.010		
	Lead (Pb)-Total (mg/L)	<0.000050	<0.00010 DLA	<0.000050		
	Lithium (Li)-Total (mg/L)	0.0286	0.101	0.0063		
	Magnesium (Mg)-Total (mg/L)	152	336	94.3		
	Manganese (Mn)-Total (mg/L)	0.314	0.00021	0.00023		
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050		
	Molybdenum (Mo)-Total (mg/L)	0.00258	0.00284	0.00207		
	Nickel (Ni)-Total (mg/L)	0.0464	0.0762	0.0328		
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050		
	Potassium (K)-Total (mg/L)	2.17	3.97	1.23		
	Selenium (Se)-Total (mg/L)	0.00179	0.00466	0.00227		
	Silicon (Si)-Total (mg/L)	5.89	6.11	5.08		
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000020 DLA	<0.000010		
	Sodium (Na)-Total (mg/L)	9.69	21.5	4.24		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1727085-1 Water 23-JAN-16 10:45 DUP 1	L1727085-2 Water 23-JAN-16 10:48 E3	L1727085-3 Water 23-JAN-16 14:50 E4	L1727085-4 Water 24-JAN-16 14:35 GWCC-2	L1727085-5 Water 23-JAN-16 13:15 E1(H)
WATER						
Total Metals	Strontium (Sr)-Total (mg/L)	0.658	0.604	1.05	1.08	0.355
	Sulfur (S)-Total (mg/L)	127	122	201	377	65.9
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	0.000013	0.000054	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.0012 DLM	0.00058
	Uranium (U)-Total (mg/L)	0.00414	0.00376	0.00457	0.00456	0.00260
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	0.0053	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	0.00173	0.00034	0.00073
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)	0.0022	0.0024	0.0022	0.0017	0.0222
	Antimony (Sb)-Dissolved (mg/L)	0.00188	0.00185	0.00041	0.00090	0.00031
	Arsenic (As)-Dissolved (mg/L)	0.00186	0.00182	0.00060	0.00130	0.00061
	Barium (Ba)-Dissolved (mg/L)	0.0825	0.0847	0.0619	0.0222	0.0573
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	0.321	0.311	0.116	0.084	0.010
	Cadmium (Cd)-Dissolved (mg/L)	0.0000136	0.0000118	0.0000685	0.000133	0.0000396
	Calcium (Ca)-Dissolved (mg/L)	98.4	98.4	139	193	79.1
	Chromium (Cr)-Dissolved (mg/L)	0.00118	0.00116	0.00044	0.00140	0.00042
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	0.00199	<0.00010	0.00036
	Copper (Cu)-Dissolved (mg/L)	0.00088	0.00088	0.00079	0.00100	0.00224
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	0.123	<0.010	0.169
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0132	0.0128	0.0301	0.0126	0.0038
	Magnesium (Mg)-Dissolved (mg/L)	116	115	134	222	41.2
	Manganese (Mn)-Dissolved (mg/L)	0.00715	0.00724	0.395	0.00019	0.256
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.00183	0.00183	0.00175	0.00273	0.00129
	Nickel (Ni)-Dissolved (mg/L)	0.0247	0.0247	0.0332	0.0427	0.00454
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	1.48	1.51	1.77	1.96	0.85
	Selenium (Se)-Dissolved (mg/L)	0.00107	0.00101	0.000988	0.00374	0.00134
	Silicon (Si)-Dissolved (mg/L)	6.35	6.34	5.62	4.88	5.23
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	7.21	7.29	10.4	7.71	3.35

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1727085-6	L1727085-7	L1727085-8		
	Description	Water	Water	Water		
	Sampled Date	23-JAN-16	24-JAN-16	24-JAN-16		
	Sampled Time	11:45	13:35	15:10		
	Client ID	E2	GWCC-1	GWCC-4		
Grouping	**Analyte**					
WATER						
Total Metals	Strontium (Sr)-Total (mg/L)	1.07	2.18	0.515		
	Sulfur (S)-Total (mg/L)	236	524	154		
	Thallium (Tl)-Total (mg/L)	0.000033	0.000078	0.000041		
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00020 DLA	<0.00010		
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00060 DLA	<0.00030		
	Uranium (U)-Total (mg/L)	0.00410	0.00785	0.00193		
	Vanadium (V)-Total (mg/L)	<0.00050	<0.0010 DLA	<0.00050		
	Zinc (Zn)-Total (mg/L)	<0.0030	0.0071	<0.0030		
	Zirconium (Zr)-Total (mg/L)	0.00041	<0.00060 DLA	<0.00030		
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD		
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD		
	Aluminum (Al)-Dissolved (mg/L)	0.0022	<0.0020 DLA	0.0012		
	Antimony (Sb)-Dissolved (mg/L)	0.00061	0.00105	0.00067		
	Arsenic (As)-Dissolved (mg/L)	0.00229	0.00203	0.00124		
	Barium (Ba)-Dissolved (mg/L)	0.0543	0.0200	0.0382		
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000040 DLA	<0.000020		
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.00010 DLA	<0.000050		
	Boron (B)-Dissolved (mg/L)	0.146	0.281	0.036		
	Cadmium (Cd)-Dissolved (mg/L)	0.0000609	0.000198	0.0000531		
	Calcium (Ca)-Dissolved (mg/L)	140	216	121		
	Chromium (Cr)-Dissolved (mg/L)	0.00053	0.00242	0.00047		
	Cobalt (Co)-Dissolved (mg/L)	0.00320	<0.00020 DLA	<0.00010		
	Copper (Cu)-Dissolved (mg/L)	0.00058	0.00077	0.00086		
	Iron (Fe)-Dissolved (mg/L)	0.735	<0.010	<0.010		
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.00010 DLA	<0.000050		
	Lithium (Li)-Dissolved (mg/L)	0.0263	0.0938	0.0069		
	Magnesium (Mg)-Dissolved (mg/L)	148	327	92.3		
	Manganese (Mn)-Dissolved (mg/L)	0.319	<0.00020 DLA	<0.00010		
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050		
	Molybdenum (Mo)-Dissolved (mg/L)	0.00245	0.00269	0.00214		
	Nickel (Ni)-Dissolved (mg/L)	0.0446	0.0742	0.0320		
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050		
	Potassium (K)-Dissolved (mg/L)	1.93	3.47	1.17		
	Selenium (Se)-Dissolved (mg/L)	0.00163	0.00470	0.00238		
	Silicon (Si)-Dissolved (mg/L)	5.82	5.96	4.94		
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000020 DLA	<0.000010		
	Sodium (Na)-Dissolved (mg/L)	9.18	20.1	4.05		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1727085-1	L1727085-2	L1727085-3	L1727085-4	L1727085-5
	Description	Water	Water	Water	Water	Water
	Sampled Date	23-JAN-16	23-JAN-16	23-JAN-16	24-JAN-16	23-JAN-16
	Sampled Time	10:45	10:48	14:50	14:35	13:15
	Client ID	DUP 1	E3	E4	GWCC-2	E1(H)
Grouping	**Analyte**					
WATER						
Dissolved Metals	Strontium (Sr)-Dissolved (mg/L)	0.633	0.632	1.02	1.07	0.374
	Sulfur (S)-Dissolved (mg/L)	127	126	195	358	65.6
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	0.000011	0.000049	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	0.00039
	Uranium (U)-Dissolved (mg/L)	0.00400	0.00391	0.00428	0.00443	0.00263
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	0.0019	0.0048	0.0021
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	0.00160	<0.00030	0.00078
Speciated Metals	Chromium (III)-Dissolved (mg/L)		<0.00042		<0.00043	
	Chromium (III)-Total (mg/L)		<0.00072		0.00258	
	Hexavalent Chromium (mg/L)		0.0014		0.0017	
	Hexavalent Chromium-Dissolved (mg/L)		0.0012		0.0017	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1727085-6	L1727085-7	L1727085-8		
	Description	Water	Water	Water		
	Sampled Date	23-JAN-16	24-JAN-16	24-JAN-16		
	Sampled Time	11:45	13:35	15:10		
	Client ID	E2	GWCC-1	GWCC-4		
Grouping	**Analyte**					
WATER						
Dissolved Metals	Strontium (Sr)-Dissolved (mg/L)	1.02	2.10	0.578		
	Sulfur (S)-Dissolved (mg/L)	223	504	149		
	Thallium (Tl)-Dissolved (mg/L)	0.000032	0.000076	0.000045		
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00020 DLA	<0.00010		
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00060 DLA	<0.00030		
	Uranium (U)-Dissolved (mg/L)	0.00377	0.00744	0.00212		
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.0010 DLA	<0.00050		
	Zinc (Zn)-Dissolved (mg/L)	0.0020	0.0065	0.0016		
	Zirconium (Zr)-Dissolved (mg/L)	0.00038	<0.00060 DLA	<0.00030		
Speciated Metals	Chromium (III)-Dissolved (mg/L)		<0.00047			
	Chromium (III)-Total (mg/L)		<0.00078			
	Hexavalent Chromium (mg/L)		0.0026			
	Hexavalent Chromium-Dissolved (mg/L)		0.0025			

* 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	Dissolved Organic Carbon	MS-B	L1727085-1, -2, -3, -4, -6, -7, -8
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1727085-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Boron (B)-Dissolved	MS-B	L1727085-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1727085-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1727085-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1727085-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1727085-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1727085-1, -2, -3, -4, -5, -6, -7, -8

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
DLM	Detection Limit Adjusted due to sample matrix effects.
HTD	Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.
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**
BE-D-L-CCMS-VA	Water	Diss. Be (low) 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.

BE-T-L-CCMS-VA	Water	Total Be (Low) 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.

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.

CR-CR3-DIS-CALC-ED	Water	Dissolved Trivalent Chromium in Water	CALCULATION

Chromium (III)-Dissolved is calculated as the difference between the dissolved chromium and the dissolved hexavalent chromium (Cr(VI)) results.

CR-CR3-TOT-CALC-ED	Water	Total Trivalent Chromium in Water	CALCULATION

Chromium (III)-Total is calculated as the difference between the total chromium and the hexavalent chromium (Cr(VI)) results.

CR-CR6-ED	Water	Chromium, Hexavalent (Cr +6)	APHA 3500-Cr C (Ion Chromatography)

This analysis is carried out using procedures adapted from method 3500-Cr C in "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from Method 1636 published by the United States Environmental Protection Agency (EPA). The procedure involves analysis for chromium (VI) by ion chromatography using diphenylcarbazide in a sulphuric acid solution.
Results are based on an un-filtered, field-preserved sample.

CR6-D-IC-ED	Water	Chromium, Dissolved Hexavalent (Cr +6)	APHA 3500-Cr C (Ion Chromatography)

This analysis is carried out using procedures adapted from method 3500-Cr C in "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from Method 1636 published by the United States Environmental Protection Agency (EPA). The procedure involves analysis for chromium (VI) by ion chromatography using diphenylcarbazide in a sulphuric acid solution.
Results are based on a field-filtered, field-preserved sample.

EC-MAN-WR	Water	Conductivity by Meter	APHA 2510 (B)

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using an 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)

Reference Information

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-LOW-ICP-VA Water Dissolved Metals in Water by ICPOES EPA 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-LOW-ICP-VA Water Total Metals in Water by ICPOES EPA 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).

NH3-F-VA Water Ammonia in Water by Fluorescence APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-WR Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

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

NO3-L-IC-N-WR Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

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

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

PH-MAN-WR Water pH by Meter APHA 4500-H+

pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 – 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.

S-DIS-ICP-VA Water Dissolved Sulfur 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, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

S-TOT-ICP-VA Water Total Sulfur 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

Reference Information

microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

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

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

TSS-MAN-WR	Water	Total Suspended Solids by Gravimetric	APHA 2540 D

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids are determined by filtering a sample through a glass fibre filter and drying the filter at 104 degrees celsius.

** 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

Chain of Custody Numbers:

1

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.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L1727085-COFC

COC Number: 1

Page 1 of 1

Report To		Report Format / Distribution		Turnaround Time (TAT) (Rush TAT is not available for all tests)	
Company:	Hemmera Environchem Inc.	Select Report Format:	☑PDF ☑EXCEL ☑EDD (DIGITAL)	R	☑Regular (Standard TAT if received by 3 pm - business days)
Contact:	Natasha Sandys	Quality Control (QC) Report with Report	☑ Yes ☐ No	P	☐Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	230 - 2237 2nd Avenue Whitehorse, YT	☐Criteria on Report - provide details below if box checked Select Distribution:	☑EMAIL ☐MAIL ☐FAX	E	☐Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
Phone:	867-456-4865	Email 1 or Fax	nsandys@hemmera.com	E2	☐Same day or weekend emergency - contact ALS to confirm TAT and surcharge
		Email 2	chris@elr.ca	Specify Date Required for E2,E or P:	

Invoice To	Same as Report To ☑ Yes ☐ No	Invoice Distribution	
	Copy of Invoice with Report ☐ Yes ☑ No	Select Invoice Distribution:	☑EMAIL ☑MAIL ☐FAX
Company:	Hemmera Environchem Inc.	Email 1 or Fax	nsandys@hemmera.com
Contact:	Natasha Sandys	Email 2	chris@elr.ca

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q51108	Approver ID:	Cost Center:
Job #:	1343-005.15	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact:	Sampler: AN/CH

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	Low Level Diss. Met (incl. Hg) and Hardness (F/P)	Low Level Tot. Met (incl. Hg) and Hardness (P)	Chromium Speciation (III/VI) - Total (P)	Chromium Speciation (III/VI) - Dissolved (F/P)	Ammonia - N (P)	Dissolved Organic Carbon (DOC) (F/P)	Nitrate-N	Nitrite - N	Total Phosphorus	Sulphate	pH, Conductivity, Total Susp Solids			Number of Containers
	Dup 1	23 01 16	10:45	Water	R	R			R	R	R	R	R	R	R			9
	E3	23 01 16	10:48	Water	R	R			R	R	R	R	R	R	R			
	E4	23 01 16	14:50	Water	R	R			R	R	R	R	R	R	R			
	GWCC-2	24 01 16	14:35	Water	R	R			R	R	R	R	R	R	R			
	E1(H)	23 01 16	13:15	Water	R	R			R	R	R	R	R	R	R			
	E2	23 01 16	11:45	Water	R	R			R	R	R	R	R	R	R			
	GWCC-1	24 01 16	13:55	Water	R	R			R	R	R	R	R	R	R			
	GWCC-4	24 01 16	15:10	Water	R	R			R	R	R	R	R	R	R			

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	~~Please hold samples for total and dissolved Chromium III/VI pending regular metals analysis~~ results.
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		
3.1				3.6	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date: Jan 26 2016	Time: 9-45	~~Received by:~~	Date: 26 Jan 16	Time: 9:45	Received by: Jean	Date: JAN 27 2016	Time: 12:53

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

HEMMERA ENVIROCHEM INC.
ATTN: Natasha Sandys
230 - 2237 2nd Avenue
Whitehorse YK Y1A 0K7

Date Received: 28-JAN-16
Report Date: 09-FEB-16 13:18 (MT)
Version: FINAL

Client Phone: 867-456-4865

Certificate of Analysis

Lab Work Order #: L1728272

Project P.O. #: NOT SUBMITTED
Job Reference: 1343-005.15
C of C Numbers: 1
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1728272-1	L1728272-2	L1728272-3	L1728272-4	L1728272-5
Description	Water	Water	Water	Water	Water
Sampled Date		25-JAN-16	26-JAN-16	26-JAN-16	26-JAN-16
Sampled Time		12:55	13:15	10:40	10:40
Client ID	TRAVEL BLANK	GWCC-5	R2	R1	FB1
Grouping / **Analyte**					
WATER					
Physical Tests Conductivity (uS/cm)	<2.0	887	853	959	<2.0
Hardness (as CaCO3) (mg/L)	<0.50	324	562	609	<0.50
pH (pH)	5.50	7.37	7.68	7.29	5.60
Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0	<3.0	<3.0
Anions and Nutrients Ammonia, Total (as N) (mg/L)	0.0079 RRV	0.0180	0.0202	0.0897	<0.0050
Nitrate (as N) (mg/L)	<0.0050	0.053	0.074	0.028	<0.0050
Nitrite (as N) (mg/L)	<0.0010	<0.0020 DLA	<0.0020 DLA	<0.0020 DLA	<0.0010
Phosphorus (P)-Total (mg/L)	<0.0020	0.0114	0.0063	<0.0020	<0.0020
Sulfate (SO4) (mg/L)	<0.30	344	316	387	<0.30
Organic / Inorganic Carbon Dissolved Organic Carbon (mg/L)		4.23	3.59	9.75	<0.50
Total Organic Carbon (mg/L)	<0.50				
Total Metals Aluminum (Al)-Total (mg/L)	<0.0030	0.0074	0.0304	0.0087	<0.0030
Antimony (Sb)-Total (mg/L)	<0.00010	0.00060	0.00044	0.00017	<0.00010
Arsenic (As)-Total (mg/L)	<0.00010	0.00069	0.00086	0.00039	<0.00010
Barium (Ba)-Total (mg/L)	<0.000050	0.0571	0.0660	0.0902	<0.000050
Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron (B)-Total (mg/L)	<0.010	0.025	0.019	0.010	<0.010
Cadmium (Cd)-Total (mg/L)	<0.0000050	0.000123	0.0000364	0.000144	<0.0000050
Calcium (Ca)-Total (mg/L)	<0.050	126	101	125	<0.050
Chromium (Cr)-Total (mg/L)	<0.00010	0.00083	0.00023	0.00026	<0.00010
Cobalt (Co)-Total (mg/L)	<0.00010	0.00010	0.00030	0.00725	<0.00010
Copper (Cu)-Total (mg/L)	<0.00050	0.00120	0.00071	0.00064	<0.00050
Iron (Fe)-Total (mg/L)	<0.010	0.125	0.299	0.689	<0.010
Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)-Total (mg/L)	<0.0010	0.0083	0.0091	0.0100	<0.0010
Magnesium (Mg)-Total (mg/L)	<0.10	54.1	79.3	72.9	<0.10
Manganese (Mn)-Total (mg/L)	<0.00010	0.00716	0.210	3.34	<0.00010
Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum (Mo)-Total (mg/L)	<0.000050	0.00175	0.000911	0.00143	<0.000050
Nickel (Ni)-Total (mg/L)	<0.00050	0.0198	0.00296	0.0327	<0.00050
Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium (K)-Total (mg/L)	<0.10	1.16	1.26	1.02	<0.10
Selenium (Se)-Total (mg/L)	<0.000050	0.00372	0.000448	0.000215	<0.000050
Silicon (Si)-Total (mg/L)	<0.050	4.60	5.72	5.21	<0.050
Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1728272-1	L1728272-2	L1728272-3	L1728272-4	L1728272-5
Description	Water	Water	Water	Water	Water
Sampled Date		25-JAN-16	26-JAN-16	26-JAN-16	26-JAN-16
Sampled Time		12:55	13:15	10:40	10:40
Client ID	TRAVEL BLANK	GWCC-5	R2	R1	FB1
Grouping / **Analyte**					
WATER					
Total Metals Sodium (Na)-Total (mg/L)	<0.050	3.63	4.29	5.20	<0.050
Strontium (Sr)-Total (mg/L)	<0.00020	0.701	0.569	0.710	<0.00020
Sulfur (S)-Total (mg/L)	<0.50	105	100	122	<0.50
Thallium (Tl)-Total (mg/L)	<0.000010	0.000017	<0.000010	<0.000010	<0.000010
Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.0012 DLM	<0.00030	<0.00030
Uranium (U)-Total (mg/L)	<0.000010	0.00258	0.00807	0.00367	<0.000010
Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	0.00054	<0.00030
Dissolved Metals Dissolved Mercury Filtration Location		FIELD	FIELD	FIELD	FIELD
Dissolved Metals Filtration Location		FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved (mg/L)		<0.0010	0.0024	0.0063	<0.0010
Antimony (Sb)-Dissolved (mg/L)		0.00034	0.00040	0.00015	<0.00010
Arsenic (As)-Dissolved (mg/L)		0.00034	0.00072	0.00036	<0.00010
Barium (Ba)-Dissolved (mg/L)		0.0326	0.0645	0.0919	<0.000050
Beryllium (Be)-Dissolved (mg/L)		<0.000020	<0.000020	<0.000020	<0.000020
Bismuth (Bi)-Dissolved (mg/L)		<0.000050	<0.000050	<0.000050	<0.000050
Boron (B)-Dissolved (mg/L)		0.014	0.018	0.010	<0.010
Cadmium (Cd)-Dissolved (mg/L)		0.0000597	0.0000333	0.000131	<0.0000050
Calcium (Ca)-Dissolved (mg/L)		77.0	99.3	126	<0.050
Chromium (Cr)-Dissolved (mg/L)		0.00028	0.00014	0.00019	<0.00010
Cobalt (Co)-Dissolved (mg/L)		<0.00010	0.00028	0.00740	<0.00010
Copper (Cu)-Dissolved (mg/L)		0.00050	0.00055	0.00056	<0.00020
Iron (Fe)-Dissolved (mg/L)		0.012	0.175	0.643	<0.010
Lead (Pb)-Dissolved (mg/L)		<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)-Dissolved (mg/L)		0.0048	0.0087	0.0098	<0.0010
Magnesium (Mg)-Dissolved (mg/L)		32.0	76.3	71.4	<0.10
Manganese (Mn)-Dissolved (mg/L)		0.00120	0.203	3.42	<0.00010
Mercury (Hg)-Dissolved (mg/L)		<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum (Mo)-Dissolved (mg/L)		0.000951	0.000818	0.00139	<0.000050
Nickel (Ni)-Dissolved (mg/L)		0.0110	0.00283	0.0334	<0.00050
Phosphorus (P)-Dissolved (mg/L)		<0.050	<0.050	<0.050	<0.050
Potassium (K)-Dissolved (mg/L)		0.65	1.05	0.91	<0.10
Selenium (Se)-Dissolved (mg/L)		0.00205	0.000485	0.000229	<0.000050
Silicon (Si)-Dissolved (mg/L)		2.71	5.52	5.12	<0.050
Silver (Ag)-Dissolved (mg/L)		<0.000010	<0.000010	<0.000010	<0.000010

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1728272-1	L1728272-2	L1728272-3	L1728272-4	L1728272-5
Description	Water	Water	Water	Water	Water
Sampled Date		25-JAN-16	26-JAN-16	26-JAN-16	26-JAN-16
Sampled Time		12:55	13:15	10:40	10:40
Client ID	TRAVEL BLANK	GWCC-5	R2	R1	FB1
Grouping / **Analyte**					
WATER					
Dissolved Metals Sodium (Na)-Dissolved (mg/L)		2.09	4.16	5.31	<0.050
Strontium (Sr)-Dissolved (mg/L)		0.406	0.551	0.705	<0.00020
Sulfur (S)-Dissolved (mg/L)		61.9	97.5	119	<0.50
Thallium (Tl)-Dissolved (mg/L)		0.000013	<0.000010	<0.000010	<0.000010
Tin (Sn)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Dissolved (mg/L)		<0.00030	<0.00030	<0.00030	<0.00030
Uranium (U)-Dissolved (mg/L)		0.00145	0.00764	0.00356	<0.000010
Vanadium (V)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050
Zinc (Zn)-Dissolved (mg/L)		<0.0010	0.0011	0.0024	<0.0010
Zirconium (Zr)-Dissolved (mg/L)		<0.00030	<0.00030	0.00054	<0.00030

* 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	Calcium (Ca)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Total Organic Carbon	MS-B	L1728272-1
Matrix Spike	Dissolved Organic Carbon	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Sodium (Na)-Total	MS-B	L1728272-1, -2, -3, -4, -5
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1728272-2, -3, -4, -5
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1728272-2, -3, -4, -5

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
DLM	Detection Limit Adjusted due to sample matrix effects.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BE-D-L-CCMS-VA	Water	Diss. Be (low) 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.

ALS Test Code	Matrix	Test Description	Method Reference**
BE-T-L-CCMS-VA	Water	Total Be (Low) 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.

ALS Test Code	Matrix	Test Description	Method Reference**
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.

Reference Information

CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

EC-MAN-WR	Water	Conductivity by Meter	APHA 2510 (B)

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using an 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-LOW-ICP-VA	Water	Dissolved Metals in Water by ICPOES	EPA 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-LOW-ICP-VA	Water	Total Metals in Water by ICPOES	EPA 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).

NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-WR	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

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

NO3-L-IC-N-WR	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)

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

P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

PH-MAN-WR	Water	pH by Meter	APHA 4500-H+

pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 – 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.

S-DIS-ICP-VA	Water	Dissolved Sulfur 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

Reference Information

States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

S-TOT-ICP-VA Water Total Sulfur 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, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

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

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

TSS-MAN-WR Water Total Suspended Solids by Gravimetric APHA 2540 D

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids are determined by filtering a sample through a glass fibre filter and drying the filter at 104 degrees celsius.

** 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

Chain of Custody Numbers:

1

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.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L1728272-COFC

COC Number: 1

Page 1 of 1

Report To		Report Format / Distribution		Turnaround Time (TAT) (Rush TAT is not available for all tests)
Company:	Hemmera Environchem Inc.	Select Report Format:	☑PDF ☑EXCEL ☑EDD (DIGITAL)	R ☑Regular (Standard TAT if received by 3 pm - business days)
Contact:	Natasha Sandys	Quality Control (QC) Report with Report	☑ Yes ☐ No	P ☐Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	230 - 2237 2nd Avenue Whitehorse, YT	☐Criteria on Report - provide details below if box checked		E ☐Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
		Select Distribution:	☑EMAIL ☐MAIL ☐FAX	E2 ☐Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Phone:	867-456-4865	Email 1 or Fax	nsandys@hemmera.com	Specify Date Required for E2,E or P:
		Email 2	chris@elr.ca	

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	nsandys@hemmera.com
Company:	Hemmera Environchem Inc.	Email 2	chris@elr.ca
Contact:	Natasha Sandys		

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q51108	Approver ID:	Cost Center:
Job #:	1343-005.15	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact:	Sampler: AN/CH

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	Low Level Diss. Met (incl. Hg) and Hardness (F/P)	Low Level Tot. Met (incl. Hg) and Hardness (P)	Chromium Speciation (III/VI) - Total (P)	Chromium Speciation (III/VI) - Dissolved (F/P)	Ammonia - N (P)	Dissolved Organic Carbon (DOC) (F/P)	Nitrate-N	Nitrite - N	Total Phosphorus	Sulphate	pH, Conductivity, Total Susp Solids			Number of Containers
	Travel Blank	-	-	Water		R			R		R	R	R	R	R			6
	GWCC-5	25 01 16	12:55	Water	R	R			R	R	R	R	R	R	R			9
	R2	26 01 16	13:15	Water	R	R			R	R	R	R	R	R	R			9
	R1	26 01 16	10:40	Water	R	R			R	R	R	R	R	R	R			9
	FB1	26 01 16	10:40	Water	R	R			R	R	R	R	R	R	R			9

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 Are samples for human drinking water use? ☐ Yes ☑ No	Please hold samples for total and dissolved Chromium III/VI pending regular metals analysis results.

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		
5.6				5C	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date: Jan 28 2016	Time: 9:45	Received by:	Date: 28Jan16	Time: 9:45	Received by: Jean	Date: JAN 29 2016	Time: 1651.5

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

HEMMERA ENVIROCHEM INC.
ATTN: Natasha Sandys
230 - 2237 2nd Avenue
Whitehorse YK Y1A 0K7

Date Received: 28-JAN-16
Report Date: 09-FEB-16 19:02 (MT)
Version: FINAL

Client Phone: 867-456-4865

Certificate of Analysis

Lab Work Order #: L1728530

Project P.O. #: NOT SUBMITTED
Job Reference: 1343-005.15
C of C Numbers: 1
Legal Site Desc:

Comments: ADDITIONAL 09-FEB-16 18:57

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1728530-1	L1728530-2	L1728530-3	L1728530-4	
Description	Water	Water	Water	Water	
Sampled Date		27-JAN-16	27-JAN-16	27-JAN-16	
Sampled Time		13:55	12:25	13:55	
Client ID	TRAVEL BLANK 2	E8	DUP2	R6	
Grouping	**Analyte**				
WATER					
Physical Tests	Conductivity (uS/cm)	<2.0	470	470	487
	Hardness (as CaCO3) (mg/L)	<0.50	246	263	252
	pH (pH)	5.50	7.89	7.77	7.45
	Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0	<3.0
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.0138 RRV	0.0064	0.0105	0.0118
	Nitrate (as N) (mg/L)	<0.0050	0.424	0.349	0.350
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	0.0010	<0.0010
	Phosphorus (P)-Total (mg/L)	<0.0020	<0.0020	0.0039	0.0025
	Sulfate (SO4) (mg/L)	<0.30	119	123	123
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)		4.17	4.17	4.17
Total Metals	Aluminum (Al)-Total (mg/L)	<0.0030	0.112	0.129	0.131
	Antimony (Sb)-Total (mg/L)	<0.00010	0.00014	0.00017	0.00017
	Arsenic (As)-Total (mg/L)	<0.00010	0.00022	0.00024	0.00024
	Barium (Ba)-Total (mg/L)	<0.000050	0.0745	0.0734	0.0757
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.0000050	0.0000195	0.0000527	0.0000609
	Calcium (Ca)-Total (mg/L)	<0.050	62.6	63.3	65.3
	Chromium (Cr)-Total (mg/L)	<0.00010	0.00013	0.00020	0.00020
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	0.00014	0.00014
	Copper (Cu)-Total (mg/L)	<0.00050	0.00155	0.00258	0.00353
	Iron (Fe)-Total (mg/L)	<0.010	0.040	0.057	0.050
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	0.000088	0.000127
	Lithium (Li)-Total (mg/L)	<0.0010	0.0075	0.0083	0.0087
	Magnesium (Mg)-Total (mg/L)	<0.10	21.4	22.9	23.5
	Manganese (Mn)-Total (mg/L)	<0.00010	0.0129	0.0129	0.0135
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	<0.000050	0.000516	0.000534	0.000528
	Nickel (Ni)-Total (mg/L)	<0.00050	0.00179	0.00212	0.00215
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	<0.10	1.84	1.92	1.94
	Selenium (Se)-Total (mg/L)	<0.000050	0.000474	0.000461	0.000484
	Silicon (Si)-Total (mg/L)	<0.050	4.87	4.97	5.13
	Silver (Ag)-Total (mg/L)	<0.000010	0.000025	0.000020	0.000023
	Sodium (Na)-Total (mg/L)	<0.050	7.80	8.38	8.76

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1728530-1	L1728530-2	L1728530-3	L1728530-4	
Description	Water	Water	Water	Water	
Sampled Date		27-JAN-16	27-JAN-16	27-JAN-16	
Sampled Time		13:55	12:25	13:55	
Client ID	TRAVEL BLANK 2	E8	DUP2	R6	
Grouping	**Analyte**				
WATER					
Total Metals	Strontium (Sr)-Total (mg/L)	<0.00020	0.333	0.344	0.352
	Sulfur (S)-Total (mg/L)	<0.50	36.6	38.3	39.8
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	0.00035
	Uranium (U)-Total (mg/L)	<0.000010	0.00263	0.00271	0.00278
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	0.0038	0.0067	0.0072
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	0.00041	0.00039
Dissolved Metals	Dissolved Mercury Filtration Location		FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location		FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)		0.0372	0.0431	0.0415
	Antimony (Sb)-Dissolved (mg/L)		0.00012	0.00011	0.00011
	Arsenic (As)-Dissolved (mg/L)		0.00019	0.00020	0.00020
	Barium (Ba)-Dissolved (mg/L)		0.0742	0.0751	0.0737
	Beryllium (Be)-Dissolved (mg/L)		<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)		<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)		<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)		0.0000217	0.0000185	0.0000192
	Calcium (Ca)-Dissolved (mg/L)		64.1	67.0	64.0
	Chromium (Cr)-Dissolved (mg/L)		0.00012	<0.00010	0.00010
	Cobalt (Co)-Dissolved (mg/L)		<0.00010	0.00012	0.00012
	Copper (Cu)-Dissolved (mg/L)		0.00147	0.00149	0.00152
	Iron (Fe)-Dissolved (mg/L)		0.017	0.021	0.021
	Lead (Pb)-Dissolved (mg/L)		<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)		0.0078	0.0084	0.0085
	Magnesium (Mg)-Dissolved (mg/L)		21.0	23.2	22.5
	Manganese (Mn)-Dissolved (mg/L)		0.0125	0.0124	0.0125
	Mercury (Hg)-Dissolved (mg/L)		<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)		0.000469	0.000430	0.000461
	Nickel (Ni)-Dissolved (mg/L)		0.00167	0.00200	0.00198
	Phosphorus (P)-Dissolved (mg/L)		<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)		1.61	1.69	1.68
	Selenium (Se)-Dissolved (mg/L)		0.000442	0.000494	0.000428
	Silicon (Si)-Dissolved (mg/L)		4.88	5.10	4.94
	Silver (Ag)-Dissolved (mg/L)		<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)		7.76	8.42	8.50

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1728530-1	L1728530-2	L1728530-3	L1728530-4	
Description	Water	Water	Water	Water	
Sampled Date		27-JAN-16	27-JAN-16	27-JAN-16	
Sampled Time		13:55	12:25	13:55	
Client ID	TRAVEL BLANK 2	E8	DUP2	R6	
Grouping / **Analyte**					
WATER					
Dissolved Metals Strontium (Sr)-Dissolved (mg/L)		0.330	0.342	0.337	
Sulfur (S)-Dissolved (mg/L)		36.6	39.7	38.3	
Thallium (Tl)-Dissolved (mg/L)		<0.000010	<0.000010	<0.000010	
Tin (Sn)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010	
Titanium (Ti)-Dissolved (mg/L)		<0.00030	<0.00030	<0.00030	
Uranium (U)-Dissolved (mg/L)		0.00253	0.00241	0.00257	
Vanadium (V)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	
Zinc (Zn)-Dissolved (mg/L)		0.0038	0.0031	0.0032	
Zirconium (Zr)-Dissolved (mg/L)		<0.00030	0.00034	0.00035	

* 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	Calcium (Ca)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Sulfate (SO4)	MS-B	L1728530-1, -2, -3, -4
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Dissolved Organic Carbon	MS-B	L1728530-2, -3, -4
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Sodium (Na)-Total	MS-B	L1728530-1, -2, -3, -4
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1728530-2, -3, -4

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BE-D-L-CCMS-VA	Water	Diss. Be (low) 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.

BE-T-L-CCMS-VA	Water	Total Be (Low) 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.

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.

EC-MAN-WR	Water	Conductivity by Meter	APHA 2510 (B)

Reference Information

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using an 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-LOW-ICP-VA Water Dissolved Metals in Water by ICPOES EPA 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-LOW-ICP-VA Water Total Metals in Water by ICPOES EPA 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).

NH3-F-VA Water Ammonia in Water by Fluorescence APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-WR Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

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

NO3-L-IC-N-WR Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

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

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

PH-MAN-WR Water pH by Meter APHA 4500-H+

pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 – 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.

S-DIS-ICP-VA Water Dissolved Sulfur 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, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in

Reference Information

submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

S-TOT-ICP-VA Water Total Sulfur 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, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

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

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

TSS-MAN-WR Water Total Suspended Solids by Gravimetric APHA 2540 D

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids are determined by filtering a sample through a glass fibre filter and drying the filter at 104 degrees celsius.

** 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

Chain of Custody Numbers:

1

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.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L1728530-COFC

COC Number: 1

Page 1 of 1

Report To		Report Format / Distribution	Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	Hemmera Environchem Inc.	Select Report Format: ☑PDF ☑EXCEL ☑EDD (DIGITAL)	R ☑Regular (Standard TAT if received by 3 pm - business days)
Contact:	Natasha Sandys	Quality Control (QC) Report with Report ☑ Yes ☐ No	P ☐Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	230 - 2237 2nd Avenue Whitehorse, YT	☐Criteria on Report - provide details below if box checked Select Distribution: ☑EMAIL ☐MAIL ☐FAX	E ☐Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 ☐Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Phone:	867-456-4865	Email 1 or Fax nsandys@hemmera.com	Specify Date Required for E2,E or P:
		Email 2 chris@elr.ca	

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:	Hemmera Environchem Inc.	Email 1 or Fax nsandys@hemmera.com	
Contact:	Natasha Sandys	Email 2 chris@elr.ca	

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q51108	Approver ID:	Cost Center:
Job #:	1343-005.15	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact:	Sampler: AN/CH

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	F/P Low Level Diss. Met (incl. Hg) and Hardness	P Low Level Tot. Met (incl. Hg) and Hardness	P Chromium Speciation (III/VI) - Total	F/P Chromium Speciation (III/VI) - Dissolved	P Ammonia - N	F/P Dissolved Organic Carbon (DOC)	Nitrate-N	Nitrite - N	Total Phosphorus	Sulphate	pH, Conductivity, Total Susp Solids			Number of Containers
	Travel Blank2	-	-	Water		R			R		R	R	R	R	R			6
	E8	27 01 16	13:55	Water	R	R			R	R	R	R	R	R	R			9
	Dup2	27 01 16	12:25	Water	R	R			R	R	R	R	R	R	R			9
	R6	27 01 16	12:25	Water	R	R			R	R	R	R	R	R	R			9

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	Please hold samples for total and dissolved Chromium III/VI pending regular metals analysis results.
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		
6.5				5	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date: JAN 28 2016	Time: 4:15 PM	Received by:	Date: 28 Jan 16	Time: 4:15	Received by: Jean JAN 29 2016	Date:	Time: 16:15

APPENDIX 3

Hydrological Monitoring Data Summaries

Stream Flow & Discharge Calculation

ELR Project No.	15-208.3
Site / Location:	Clinton Creek Site
Stream Name:	Clinton Creek
Station Name:	E1(H)
Date and Time:	Jan.23/2016, 14:07
Staff:	AN,CH
UTM Coordinates:	7. 512800. 7147438
Technique:	Electromagnetic Flow Meter
Temp., Water/Air (°C)	0.3/-20
Crossing Number	1

Ecological Logistics & Research Ltd.

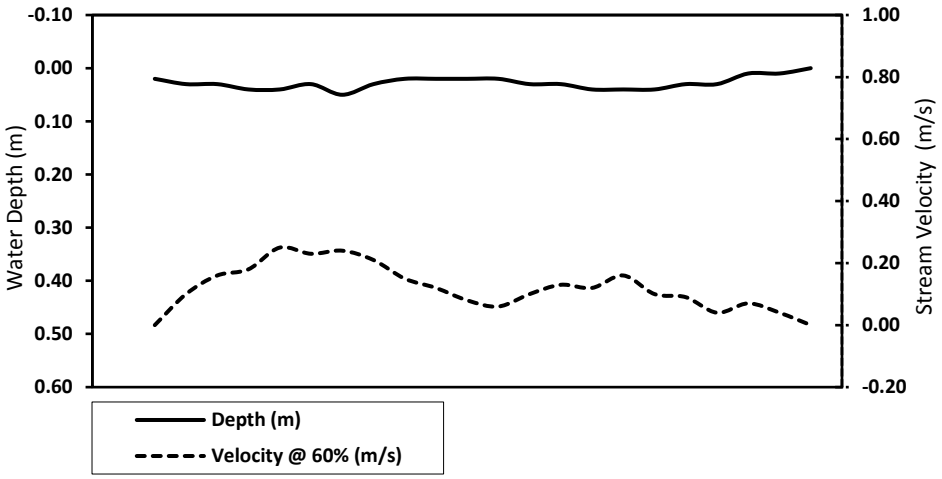
Left Bank	5.8
Right Bank	0.7
Wet.Width	5.1

Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m^2)	Panel Discharge (m^3/s)
0	0.70	0.125	0.02	0.00	0.003	0.0000
1	0.95	0.250	0.03	0.10	0.008	0.0008
2	1.20	0.250	0.03	0.16	0.008	0.0012
3	1.45	0.250	0.04	0.18	0.010	0.0018
4	1.70	0.250	0.04	0.25	0.010	0.0025
5	1.95	0.250	0.03	0.23	0.008	0.0017
6	2.20	0.250	0.05	0.24	0.013	0.0030
7	2.45	0.250	0.03	0.21	0.008	0.0016
8	2.70	0.250	0.02	0.15	0.005	0.0008
9	2.95	0.250	0.02	0.12	0.005	0.0006
10	3.20	0.250	0.02	0.08	0.005	0.0004
11	3.45	0.250	0.02	0.06	0.005	0.0003
12	3.70	0.250	0.03	0.10	0.008	0.0008
13	3.95	0.250	0.03	0.13	0.008	0.0010
14	4.20	0.250	0.04	0.12	0.010	0.0012
15	4.45	0.250	0.04	0.16	0.010	0.0016
16	4.70	0.250	0.04	0.10	0.010	0.0010
17	4.95	0.250	0.03	0.09	0.008	0.0007
18	5.20	0.250	0.03	0.04	0.008	0.0003
19	5.45	0.250	0.01	0.07	0.003	0.0002
20	5.70	0.175	0.01	0.04	0.002	0.0001
21	5.80	0.050	0.00	0.00	0.000	0.0000
end	5.80					

Mean Depth (m)	0.03
Mean Velocity (m/s)	0.12

Discharge (m^3/s)	0.0213

Plot of Channel Depth and Velocity Profile



Stream Flow & Discharge Calculation

ELR Project No.	15-208.3
Site / Location:	Clinton Creek Site
Stream Name:	Clinton Creek
Station Name:	E1(H)
Date and Time:	Jan.23/2016, 14:07
Staff:	AN,CH
UTM Coordinates:	7. 512800. 7147438
Technique:	Electromagnetic Flow Meter
Temp., Water/Air (°C)	0.3/-20
Crossing Number	2

Ecological Logistics & Research Ltd.

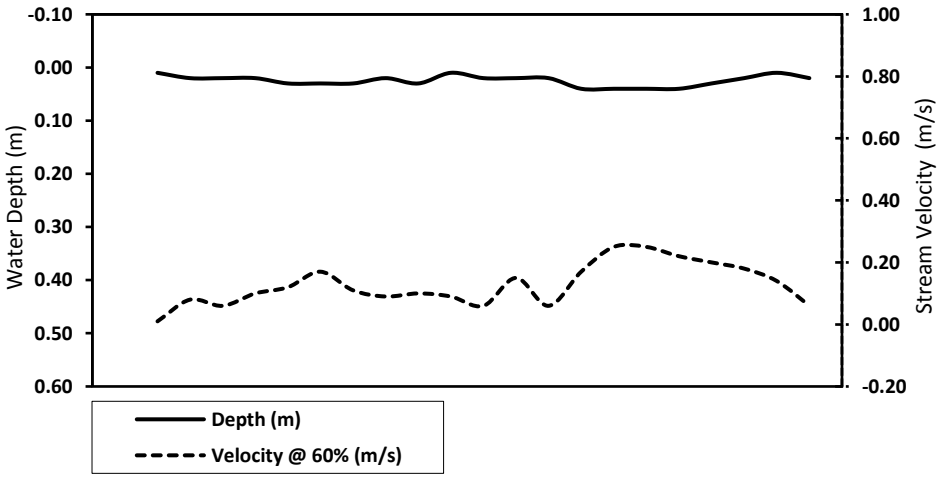
Left Bank	5.75
Right Bank	0.75
Wet.Width	5

Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m^2)	Panel Discharge (m^3/s)
0	5.75	0.125	0.01	0.01	0.001	0.0000
1	5.50	0.250	0.02	0.08	0.005	0.0004
2	5.25	0.250	0.02	0.06	0.005	0.0003
3	5.00	0.250	0.02	0.10	0.005	0.0005
4	4.75	0.250	0.03	0.12	0.008	0.0009
5	4.50	0.250	0.03	0.17	0.008	0.0013
6	4.25	0.250	0.03	0.11	0.008	0.0008
7	4.00	0.250	0.02	0.09	0.005	0.0005
8	3.75	0.250	0.03	0.10	0.008	0.0008
9	3.50	0.250	0.01	0.09	0.003	0.0002
10	3.25	0.250	0.02	0.06	0.005	0.0003
11	3.00	0.250	0.02	0.15	0.005	0.0008
12	2.75	0.250	0.02	0.06	0.005	0.0003
13	2.50	0.250	0.04	0.17	0.010	0.0017
14	2.25	0.250	0.04	0.25	0.010	0.0025
15	2.00	0.250	0.04	0.25	0.010	0.0025
16	1.75	0.250	0.04	0.22	0.010	0.0022
17	1.50	0.250	0.03	0.20	0.008	0.0015
18	1.25	0.250	0.02	0.18	0.005	0.0009
19	1.00	0.250	0.01	0.14	0.003	0.0004
20	0.75	0.125	0.02	0.06	0.003	0.0002
end	0.75					

Mean Depth (m)	0.02
Mean Velocity (m/s)	0.13

Discharge (m^3/s)	0.0188

Plot of Channel Depth and Velocity Profile



Stream Flow & Discharge Calculation

ELR Project No.	15-208.3
Site / Location:	Clinton Creek Site
Stream Name:	Wolverine Creek
Station Name:	E3(H)
Date and Time:	Jan.24/2016, 11:20
Staff:	AN,CH
UTM Coordinates:	7. 514170. 7147608
Technique:	Electromagnetic Flow Meter
Temp., Water/Air (°C)	0.4 / -6
Crossing Number	1

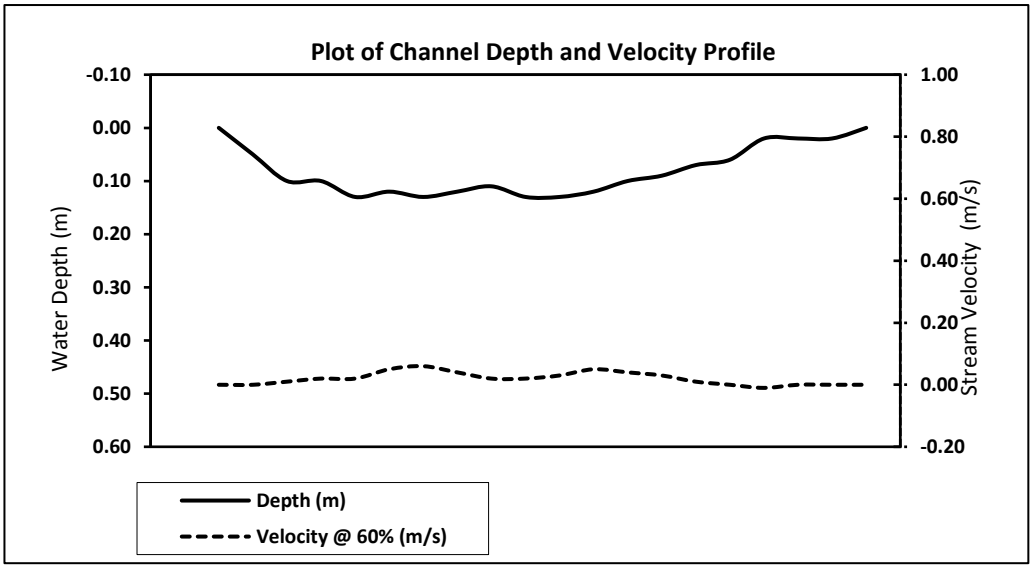
Ecological Logistics & Research Ltd.

Left Bank	0.88
Right Bank	2.71
Wet.Width	1.83

Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m^2)	Panel Discharge (m^3/s)
0	2.71	0.055	0.00	0.00	0.000	0.0000
1	2.60	0.105	0.05	0.00	0.005	0.0000
2	2.50	0.100	0.10	0.01	0.010	0.0001
3	2.40	0.100	0.10	0.02	0.010	0.0002
4	2.30	0.100	0.13	0.02	0.013	0.0003
5	2.20	0.100	0.12	0.05	0.012	0.0006
6	2.10	0.100	0.13	0.06	0.013	0.0008
7	2.00	0.100	0.12	0.04	0.012	0.0005
8	1.90	0.100	0.11	0.02	0.011	0.0002
9	1.80	0.100	0.13	0.02	0.013	0.0003
10	1.70	0.100	0.13	0.03	0.013	0.0004
11	1.60	0.100	0.12	0.05	0.012	0.0006
12	1.50	0.100	0.10	0.04	0.010	0.0004
13	1.40	0.100	0.09	0.03	0.009	0.0003
14	1.30	0.100	0.07	0.01	0.007	0.0001
15	1.20	0.100	0.06	0.00	0.006	0.0000
16	1.10	0.100	0.02	-0.01	0.002	0.0000
17	1.00	0.100	0.02	0.00	0.002	0.0000
18	0.90	0.060	0.02	0.00	0.001	0.0000
19	0.88	0.010	0.00	0.00	0.000	0.0000
end	0.88					

Mean Depth (m)	0.08
Mean Velocity (m/s)	0.02

Discharge (m^3/s)	0.0046



Stream Flow & Discharge Calculation

ELR Project No.	15-208.3
Site / Location:	Clinton Creek Site
Stream Name:	Wolverine Creek
Station Name:	E3(H)
Date and Time:	Jan.24/2016, 11:20
Staff:	AN,CH
UTM Coordinates:	7. 514170. 7147608
Technique:	Electromagnetic Flow Meter
Temp., Water/Air (°C)	0.4 / -6
Crossing Number	2

Ecological Logistics & Research Ltd.

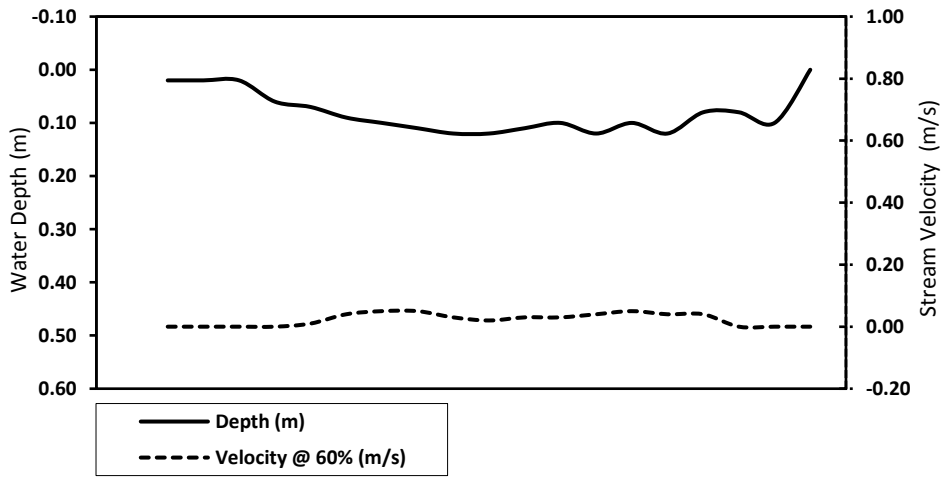
Left Bank	0.9
Right Bank	2.7
Wet.Width	1.8

Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m^2)	Panel Discharge (m^3/s)
0	0.90	0.050	0.02	0.00	0.001	0.0000
1	1.00	0.100	0.02	0.00	0.002	0.0000
2	1.10	0.100	0.02	0.00	0.002	0.0000
3	1.20	0.100	0.06	0.00	0.006	0.0000
4	1.30	0.100	0.07	0.01	0.007	0.0001
5	1.40	0.100	0.09	0.04	0.009	0.0004
6	1.50	0.100	0.10	0.05	0.010	0.0005
7	1.60	0.100	0.11	0.05	0.011	0.0006
8	1.70	0.100	0.12	0.03	0.012	0.0004
9	1.80	0.100	0.12	0.02	0.012	0.0002
10	1.90	0.100	0.11	0.03	0.011	0.0003
11	2.00	0.100	0.10	0.03	0.010	0.0003
12	2.10	0.100	0.12	0.04	0.012	0.0005
13	2.20	0.100	0.10	0.05	0.010	0.0005
14	2.30	0.100	0.12	0.04	0.012	0.0005
15	2.40	0.100	0.08	0.04	0.008	0.0003
16	2.50	0.100	0.08	0.00	0.008	0.0000
17	2.60	0.100	0.10	0.00	0.010	0.0000
18	2.70	0.050	0.00	0.00	0.000	0.0000
end	2.70					

Mean Depth (m)	0.08
Mean Velocity (m/s)	0.02

Discharge (m^3/s)	0.0045

Plot of Channel Depth and Velocity Profile



Stream Flow & Discharge Calculation

ELR Project No.	15-208.3
Site / Location:	Clinton Creek Site
Stream Name:	Clinton Creek
Station Name:	E4
Date and Time:	Jan.25/2016, 14:55
Staff:	AN,CH
UTM Coordinates:	7. 515950. 7145287
Technique:	Electromagnetic Flow Meter
Temp., Water/Air (°C)	0.0/-15
Crossing Number	1

Ecological Logistics & Research Ltd.

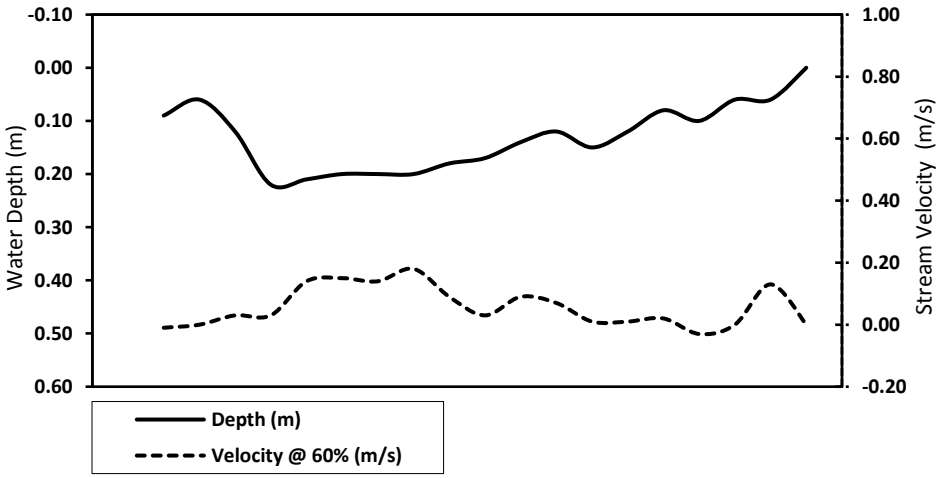
Left Bank	1.5
Right Bank	7
Wet.Width	5.5

Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m^2)	Panel Discharge (m^3/s)
0	1.50	0.150	0.09	-0.01	0.014	-0.0001
1	1.80	0.300	0.06	0.00	0.018	0.0000
2	2.10	0.300	0.12	0.03	0.036	0.0011
3	2.40	0.300	0.22	0.03	0.066	0.0020
4	2.70	0.300	0.21	0.14	0.063	0.0088
5	3.00	0.300	0.20	0.15	0.060	0.0090
6	3.30	0.300	0.20	0.14	0.060	0.0084
7	3.60	0.300	0.20	0.18	0.060	0.0108
8	3.90	0.300	0.18	0.09	0.054	0.0049
9	4.20	0.300	0.17	0.03	0.051	0.0015
10	4.50	0.300	0.14	0.09	0.042	0.0038
11	4.80	0.350	0.12	0.07	0.042	0.0029
12	5.20	0.350	0.15	0.01	0.053	0.0005
13	5.50	0.300	0.12	0.01	0.036	0.0004
14	5.80	0.300	0.08	0.02	0.024	0.0005
15	6.10	0.300	0.10	-0.03	0.030	-0.0009
16	6.40	0.300	0.06	0.00	0.018	0.0000
17	6.70	0.300	0.06	0.13	0.018	0.0023
18	7.00	0.150	0.00	0.00	0.000	0.0000
end	7.00					

Mean Depth (m)	0.13
Mean Velocity (m/s)	0.06

Discharge (m^3/s)	0.0559

Plot of Channel Depth and Velocity Profile



Stream Flow & Discharge Calculation

ELR Project No.	15-208.3
Site / Location:	Clinton Creek Site
Stream Name:	Clinton Creek
Station Name:	E4
Date and Time:	Jan.25/2016, 14:55
Staff:	AN,CH
UTM Coordinates:	7. 515950. 7145287
Technique:	Electromagnetic Flow Meter
Temp., Water/Air (°C)	0.0/-15
Crossing Number	2

Ecological Logistics & Research Ltd.

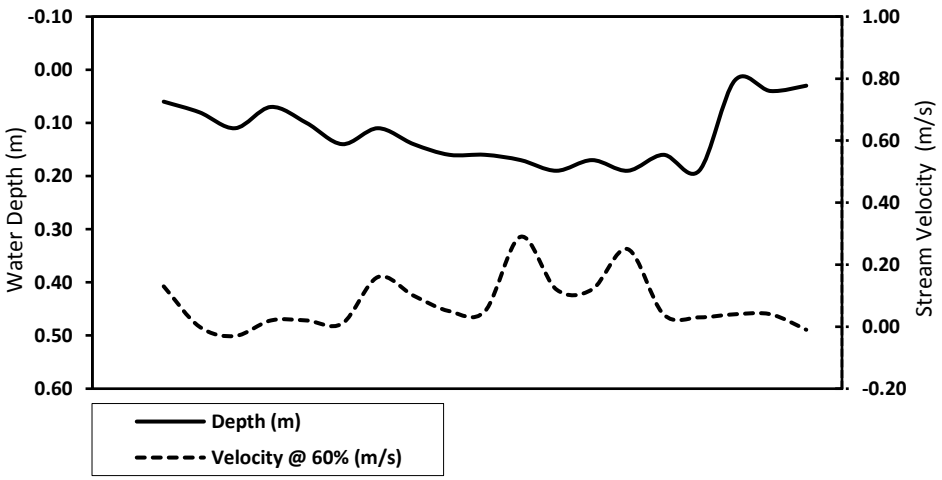
Left Bank	1.5
Right Bank	6.7
Wet.Width	5.2

Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m^2)	Panel Discharge (m^3/s)
0	6.70	0.150	0.06	0.13	0.009	0.0012
1	6.40	0.300	0.08	0.00	0.024	0.0000
2	6.10	0.300	0.11	-0.03	0.033	-0.0010
3	5.80	0.300	0.07	0.02	0.021	0.0004
4	5.50	0.300	0.10	0.02	0.030	0.0006
5	5.20	0.300	0.14	0.01	0.042	0.0004
6	4.90	0.300	0.11	0.16	0.033	0.0053
7	4.60	0.300	0.14	0.10	0.042	0.0042
8	4.30	0.300	0.16	0.05	0.048	0.0024
9	4.00	0.300	0.16	0.05	0.048	0.0024
10	3.70	0.300	0.17	0.29	0.051	0.0148
11	3.40	0.300	0.19	0.12	0.057	0.0068
12	3.10	0.300	0.17	0.12	0.051	0.0061
13	2.80	0.300	0.19	0.25	0.057	0.0143
14	2.50	0.300	0.16	0.04	0.048	0.0019
15	2.20	0.300	0.19	0.03	0.057	0.0017
16	1.90	0.300	0.02	0.04	0.006	0.0002
17	1.60	0.200	0.04	0.04	0.008	0.0003
18	1.50	0.050	0.03	-0.01	0.002	0.0000
end	1.50					

Mean Depth (m)	0.12
Mean Velocity (m/s)	0.08

Discharge (m^3/s)	0.0621

Plot of Channel Depth and Velocity Profile



Stream Flow & Discharge Calculation

ELR Project No.	15-208.3
Site / Location:	Clinton Creek Site
Stream Name:	Clinton Creek
Station Name:	E7
Date and Time:	Jan.19/2016, 13:30
Staff:	AN,CH
UTM Coordinates:	7. 519400. 7142042
Technique:	Electromagnetic Flow Meter
Temp., Water/Air (°C)	0.0/-15
Crossing Number	1

Ecological Logistics & Research Ltd.

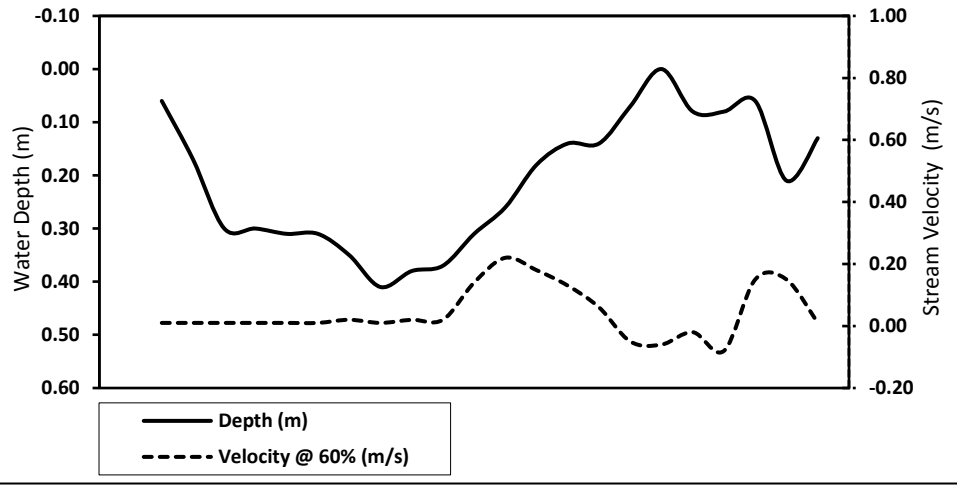
Left Bank	5.95
Right Bank	0.9
Wet.Width	5.05

Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m^2)	Panel Discharge (m^3/s)
0	5.95	0.100	0.06	0.01	0.006	0.0001
1	5.75	0.200	0.17	0.01	0.034	0.0003
2	5.55	0.200	0.30	0.01	0.060	0.0006
3	5.35	0.200	0.30	0.01	0.060	0.0006
4	5.15	0.200	0.31	0.01	0.062	0.0006
5	4.95	0.200	0.31	0.01	0.062	0.0006
6	4.75	0.200	0.35	0.02	0.070	0.0014
7	4.55	0.200	0.41	0.01	0.082	0.0008
8	4.35	0.200	0.38	0.02	0.076	0.0015
9	4.15	0.200	0.37	0.02	0.074	0.0015
10	3.95	0.200	0.31	0.14	0.062	0.0087
11	3.75	0.200	0.26	0.22	0.052	0.0114
12	3.55	0.200	0.18	0.18	0.036	0.0065
13	3.35	0.200	0.14	0.13	0.028	0.0036
14	3.15	0.200	0.14	0.06	0.028	0.0017
15	2.95	0.200	0.07	-0.05	0.014	-0.0007
16	2.75	0.300	0.00	-0.06	0.000	0.0000
17	2.35	0.300	0.08	-0.02	0.024	-0.0005
18	2.15	0.250	0.08	-0.08	0.020	-0.0016
19	1.85	0.500	0.06	0.15	0.030	0.0045
20	1.15	0.475	0.21	0.15	0.100	0.0150
21	0.90	0.125	0.13	0.01	0.016	0.0002
end	0.90					

Mean Depth (m)	0.21
Mean Velocity (m/s)	0.04

Discharge (m^3/s)	0.0568

Plot of Channel Depth and Velocity Profile



Stream Flow & Discharge Calculation

ELR Project No.	15-208.3
Site / Location:	Clinton Creek Site
Stream Name:	Clinton Creek
Station Name:	E7
Date and Time:	Jan.19/2016, 13:30
Staff:	AN,CH
UTM Coordinates:	7. 519400. 7142042
Technique:	Electromagnetic Flow Meter
Temp., Water/Air (°C)	0.0/-15
Crossing Number	2

Ecological Logistics & Research Ltd.

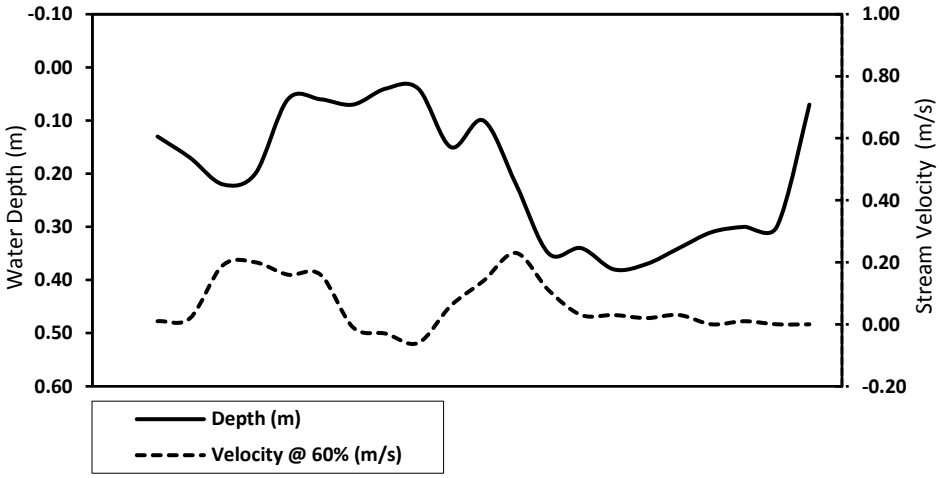
Left Bank	5.95
Right Bank	0.9
Wet.Width	5.05

Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m^2)	Panel Discharge (m^3/s)
0	0.90	0.125	0.13	0.01	0.016	0.0002
1	1.15	0.250	0.17	0.02	0.043	0.0009
2	1.40	0.250	0.22	0.19	0.055	0.0105
3	1.65	0.250	0.20	0.20	0.050	0.0100
4	1.90	0.250	0.06	0.16	0.015	0.0024
5	2.15	0.250	0.06	0.16	0.015	0.0024
6	2.40	0.250	0.07	-0.01	0.018	-0.0002
7	2.65	0.250	0.04	-0.03	0.010	-0.0003
8	2.90	0.250	0.04	-0.06	0.010	-0.0006
9	3.15	0.250	0.15	0.06	0.038	0.0023
10	3.40	0.250	0.10	0.14	0.025	0.0035
11	3.65	0.250	0.22	0.23	0.055	0.0127
12	3.90	0.250	0.35	0.11	0.088	0.0096
13	4.15	0.250	0.34	0.03	0.085	0.0026
14	4.40	0.250	0.38	0.03	0.095	0.0029
15	4.65	0.250	0.37	0.02	0.093	0.0019
16	4.90	0.250	0.34	0.03	0.085	0.0026
17	5.15	0.250	0.31	0.00	0.078	0.0000
18	5.40	0.250	0.30	0.01	0.075	0.0008
19	5.65	0.275	0.30	0.00	0.083	0.0000
20	5.95	0.150	0.07	0.00	0.011	0.0000
end	5.95					

Mean Depth (m)	0.20
Mean Velocity (m/s)	0.06

Discharge (m^3/s)	0.0638

Plot of Channel Depth and Velocity Profile



Stream Flow & Discharge Calculation

ELR Project No.	15-208.3
Site / Location:	Clinton Creek Site
Stream Name:	Clinton Creek
Station Name:	R1
Date and Time:	Jan.26/2016, 12:00
Staff:	AN,CH
UTM Coordinates:	7. 510718. 7147525
Technique:	Electromagnetic Flow Meter
Temp., Water/Air (°C)	0.2/-3
Crossing Number	1

Ecological Logistics & Research Ltd.

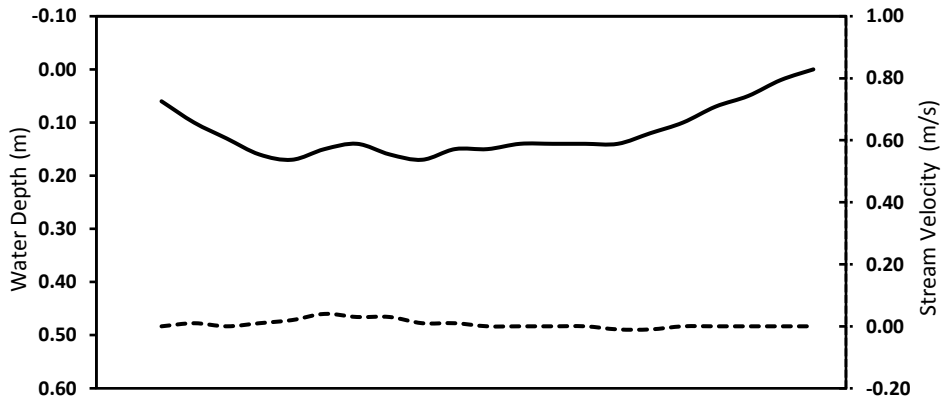
Left Bank	4.07
Right Bank	1.67
Wet.Width	2.4

Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m^2)	Panel Discharge (m^3/s)
0	4.07	0.060	0.06	0.00	0.004	0.0000
1	3.95	0.120	0.10	0.01	0.012	0.0001
2	3.83	0.120	0.13	0.00	0.016	0.0000
3	3.71	0.120	0.16	0.01	0.019	0.0002
4	3.59	0.120	0.17	0.02	0.020	0.0004
5	3.47	0.120	0.15	0.04	0.018	0.0007
6	3.35	0.120	0.14	0.03	0.017	0.0005
7	3.23	0.120	0.16	0.03	0.019	0.0006
8	3.11	0.120	0.17	0.01	0.020	0.0002
9	2.99	0.120	0.15	0.01	0.018	0.0002
10	2.87	0.120	0.15	0.00	0.018	0.0000
11	2.75	0.120	0.14	0.00	0.017	0.0000
12	2.63	0.120	0.14	0.00	0.017	0.0000
13	2.51	0.120	0.14	0.00	0.017	0.0000
14	2.39	0.120	0.14	-0.01	0.017	-0.0002
15	2.27	0.120	0.12	-0.01	0.014	-0.0001
16	2.15	0.120	0.10	0.00	0.012	0.0000
17	2.03	0.120	0.07	0.00	0.008	0.0000
18	1.91	0.120	0.05	0.00	0.006	0.0000
19	1.79	0.120	0.02	0.00	0.002	0.0000
20	1.67	0.060	0.00	0.00	0.000	0.0000
end	1.67					

Mean Depth (m)	0.12
Mean Velocity (m/s)	0.01

Discharge (m^3/s)	0.0026

Plot of Channel Depth and Velocity Profile



Stream Flow & Discharge Calculation

ELR Project No.	15-208.3
Site / Location:	Clinton Creek Site
Stream Name:	Clinton Creek
Station Name:	R1
Date and Time:	Jan.26/2016, 12:00
Staff:	AN,CH
UTM Coordinates:	7. 510718. 7147525
Technique:	Electromagnetic Flow Meter
Temp., Water/Air (°C)	0.2/-3
Crossing Number	2

Ecological Logistics & Research Ltd.

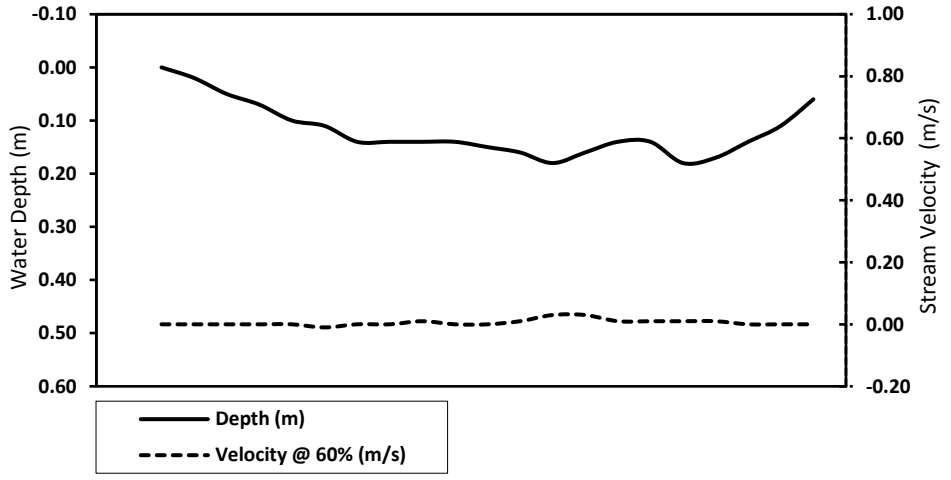
Left Bank	4.07
Right Bank	1.67
Wet.Width	2.4

Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m^2)	Panel Discharge (m^3/s)
0	1.67	0.055	0.00	0.00	0.000	0.0000
1	1.78	0.115	0.02	0.00	0.002	0.0000
2	1.90	0.120	0.05	0.00	0.006	0.0000
3	2.02	0.120	0.07	0.00	0.008	0.0000
4	2.14	0.120	0.10	0.00	0.012	0.0000
5	2.26	0.120	0.11	-0.01	0.013	-0.0001
6	2.38	0.120	0.14	0.00	0.017	0.0000
7	2.50	0.120	0.14	0.00	0.017	0.0000
8	2.62	0.120	0.14	0.01	0.017	0.0002
9	2.74	0.120	0.14	0.00	0.017	0.0000
10	2.86	0.120	0.15	0.00	0.018	0.0000
11	2.98	0.120	0.16	0.01	0.019	0.0002
12	3.10	0.120	0.18	0.03	0.022	0.0006
13	3.22	0.120	0.16	0.03	0.019	0.0006
14	3.34	0.120	0.14	0.01	0.017	0.0002
15	3.46	0.120	0.14	0.01	0.017	0.0002
16	3.58	0.120	0.18	0.01	0.022	0.0002
17	3.70	0.120	0.17	0.01	0.020	0.0002
18	3.82	0.120	0.14	0.00	0.017	0.0000
19	3.94	0.125	0.11	0.00	0.014	0.0000
20	4.07	0.065	0.06	0.00	0.004	0.0000
end	4.07					

Mean Depth (m)	0.12
Mean Velocity (m/s)	0.01

Discharge (m^3/s)	0.0022

Plot of Channel Depth and Velocity Profile



Stream Flow & Discharge Calculation

ELR Project No.	15-208.3
Site / Location:	Clinton Creek Site
Stream Name:	Easter Creek
Station Name:	R2
Date and Time:	Jan.26/2016, 14:30
Staff:	AN,CH
UTM Coordinates:	7. 512023. 7148061
Technique:	Electromagnetic Flow Meter
Temp., Water/Air (°C)	0.0/-3
Crossing Number	1

Ecological Logistics & Research Ltd.

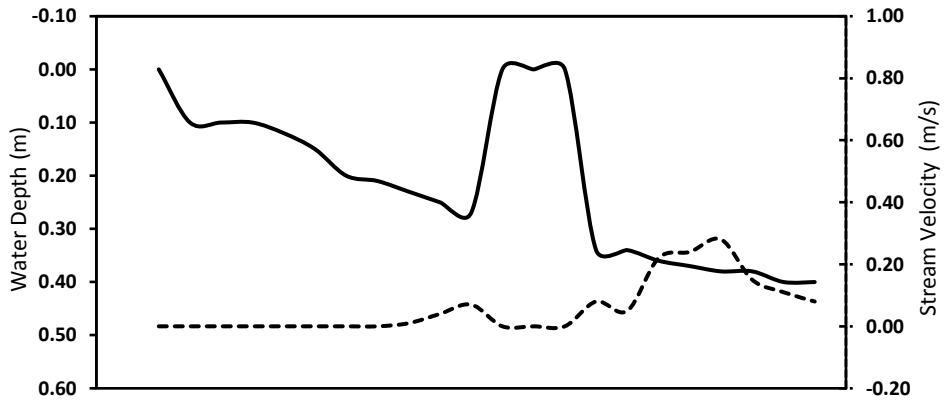
Left Bank	0.67
Right Bank	3
Wet.Width	2.33

Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m^2)	Panel Discharge (m^3/s)
0	3.00	0.050	0.00	0.00	0.000	0.0000
1	2.90	0.100	0.10	0.00	0.010	0.0000
2	2.80	0.100	0.10	0.00	0.010	0.0000
3	2.70	0.100	0.10	0.00	0.010	0.0000
4	2.60	0.100	0.12	0.00	0.012	0.0000
5	2.50	0.100	0.15	0.00	0.015	0.0000
6	2.40	0.100	0.20	0.00	0.020	0.0000
7	2.30	0.100	0.21	0.00	0.021	0.0000
8	2.20	0.100	0.23	0.01	0.023	0.0002
9	2.10	0.100	0.25	0.04	0.025	0.0010
10	2.00	0.100	0.27	0.07	0.027	0.0019
11	1.90	0.250	0.00	0.00	0.000	0.0000
12	1.50	0.250	0.00	0.00	0.000	0.0000
13	1.40	0.075	0.00	0.00	0.000	0.0000
14	1.35	0.075	0.34	0.08	0.026	0.0020
15	1.25	0.100	0.34	0.05	0.034	0.0017
16	1.15	0.100	0.36	0.22	0.036	0.0079
17	1.05	0.100	0.37	0.24	0.037	0.0089
18	0.95	0.100	0.38	0.28	0.038	0.0106
19	0.85	0.100	0.38	0.15	0.038	0.0057
20	0.75	0.090	0.40	0.11	0.036	0.0040
21	0.67	0.040	0.40	0.08	0.016	0.0013
end	0.67					

Mean Depth (m)	0.21
Mean Velocity (m/s)	0.06

Discharge (m^3/s)	0.0452

Plot of Channel Depth and Velocity Profile



Stream Flow & Discharge Calculation

ELR Project No.	15-208.3
Site / Location:	Clinton Creek Site
Stream Name:	Easter Creek
Station Name:	R2
Date and Time:	Jan.26/2016, 14:30
Staff:	AN,CH
UTM Coordinates:	7. 512023. 7148061
Technique:	Electromagnetic Flow Meter
Temp., Water/Air (°C)	0.0/-3
Crossing Number	2

Ecological Logistics & Research Ltd.

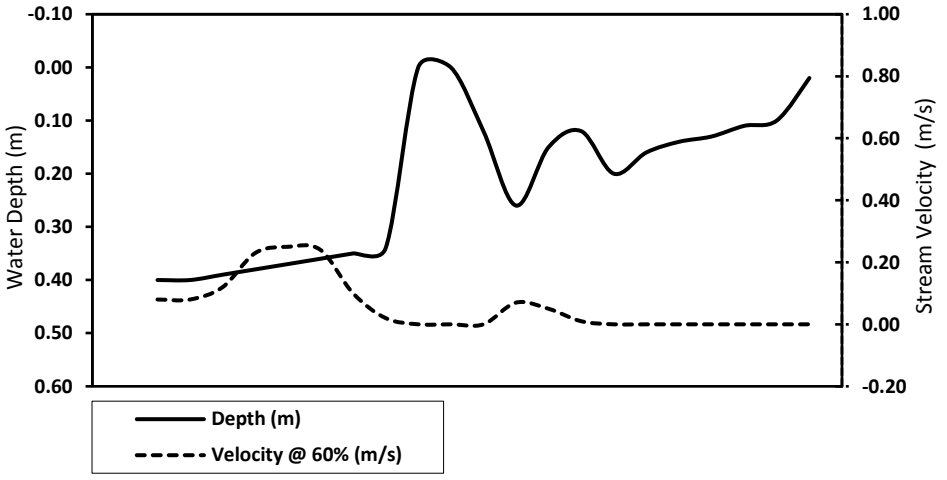
Left Bank	0.67
Right Bank	2.95
Wet.Width	2.28

Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m^2)	Panel Discharge (m^3/s)
0	0.67	0.040	0.40	0.08	0.016	0.0013
1	0.75	0.090	0.40	0.08	0.036	0.0029
2	0.85	0.100	0.39	0.12	0.039	0.0047
3	0.95	0.100	0.38	0.23	0.038	0.0087
4	1.05	0.100	0.37	0.25	0.037	0.0093
5	1.15	0.100	0.36	0.24	0.036	0.0086
6	1.25	0.100	0.35	0.10	0.035	0.0035
7	1.35	0.100	0.34	0.02	0.034	0.0007
8	1.45	0.250	0.00	0.00	0.000	0.0000
9	1.85	0.250	0.00	0.00	0.000	0.0000
10	1.95	0.100	0.12	0.00	0.012	0.0000
11	2.05	0.100	0.26	0.07	0.026	0.0018
12	2.15	0.100	0.15	0.05	0.015	0.0008
13	2.25	0.100	0.12	0.01	0.012	0.0001
14	2.35	0.100	0.20	0.00	0.020	0.0000
15	2.45	0.100	0.16	0.00	0.016	0.0000
16	2.55	0.100	0.14	0.00	0.014	0.0000
17	2.65	0.100	0.13	0.00	0.013	0.0000
18	2.75	0.100	0.11	0.00	0.011	0.0000
19	2.85	0.100	0.10	0.00	0.010	0.0000
20	2.95	0.050	0.02	0.00	0.001	0.0000
end	2.95					

Mean Depth (m)	0.21
Mean Velocity (m/s)	0.06

Discharge (m^3/s)	0.0423

Plot of Channel Depth and Velocity Profile



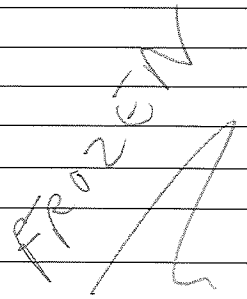
APPENDIX 4
Field Notes

SURFACE WATER SAMPLE COLLECTION SHEET

Sample Site:	E1	**Project Number:**	15-208	**Date:**	Jan. 23/2016
UTM Coordinates	Z 7 E 513645 N 7147111	**Client:**	Yukon Government (AAM)	**Samplers:**	AN, CH.
Waypoint	GPS ____ Name ____	**Project Name:**	Clinton Creek Surface Water Monitoring Program	**Weather/Temperature:**	Overcast ~ -20°C.
Photos	Cam ELR Nos. 98-100				
Sample Time (24h)	FROZEN				
Field Blank Collected:	☐ Yes Name ____	**Duplicate Collected:**	☐ Yes Name ____		

Field Parameter Measurements (note units if different than those stated)	
Sample Depth (m)	
Temperature (°C)	
pH (pH Units)	
Cond. (µs/cm)	
Specific Cond. (µs/cm)	
Redox (mV)	
DO (mg/L)	
DO (%)	
Turbidity (NTU)	
Appearance & Odour (Clear, Silty, HC odours, etc.)	

Site Sketch



Clinton Creek was found DRY/FROZEN @ site E1 location. Ice removed both both upstream and downstream of the primary ford (No flow). Ice removed down to creekbed. Clinton creek appears to run dry downstream of gabions and again regains flow upstream of Porcupine Creek confluence. (observed from Helicopter).

Field Measurements Log	
YSI Logged?	☐ Yes ☐ No
Time Logged on YSI	(hh:mm) ____
Time Synced on YSI	☐ Yes ☐ No Actual Time (hh:mm) ____
Unit Used	☐ Pro Plus ☐ Pen Unit Other ____

Sample Site (Con't): E1

Sample Date (Con't): Jan. 23/2016

* Sample not collected frozen/dry.

Bottle Type	Parameters Analyzed	Sample Treatment ☒	Preservative Added ☒	Collected ☒	No. Bottles	Comments (note number of bottles in duplicate)
500 ml (plastic)	General Chemistry	-	-	☐		Date/Time:
125 ml (plastic)	Total Metals	-	☐ Nitric Acid	☐		
125 ml (plastic)	Dissolved Metals	☐ Field Filtered	☐ Nitric Acid	☐		
40 ml (glass)	Total Mercury		☐ Hydrochloric Acid	☐		
40 ml (glass)	Dissolved Mercury	☐ Field Filtered	☐ Hydrochloric Acid	☐		
125 ml (amber)	Ammonia (NH3)		☐ Sulfuric Acid	☐		
125 ml (amber)	Dissolved Organic Carbon (DOC)	☐ Field Filtered	☐ Sulfuric Acid	☐		
125 ml (plastic)	Total Speciated Chromium – Cr(VI) and CR(III)		☐ NaOH	☐		
125 ml (plastic)	Dissolved Speciated Chromium – Cr(VI) and CR(III)	☐ Field Filtered	☐ NaOH	☐		
				☐		

FROZEN

General Notes:

SURFACE WATER SAMPLE COLLECTION SHEET

23

Sample Site:	Also E1(H)	**Project Number:**	15-208	**Date:**	Jan 18/2016
UTM Coordinates	Z 07E 0512852 N 7147480	**Client:**	Yukon Government (AAM)	**Samplers:**	AN, CH
Waypoint	GPS ELR Name E1H	**Project Name:**	Clinton Creek Surface Water Monitoring Program	**Weather/Temperature:**	Overcast light snow -20°C
Photos	Cam ELR Nos. 102-106				
Sample Time (24h)	13:15				
Field Blank Collected:	☐ Yes Name _____	**Duplicate Collected:**	☐ Yes Name _____		

Field Parameter Measurements (note units if different than those stated)	
Sample Depth (m)	0.05
Temperature (°C)	0.3
pH (pH Units)	7.88
Cond. (µs/cm)	296.3
Specific Cond. (µs/cm)	564.2
Redox (mV)	134.9
DO (mg/L)	1.9
DO (%)	0.27
Turbidity (NTU)	—
Appearance & Odour (Clear, Silty, HC odours, etc.)	Clear. Brown creek bed.

Site Sketch

Sample was collected @ E1(H) and not @ site E1. E1 was found dry/frozen on Jan. 23/2016.

Field Measurements Log	
YSI Logged?	☑ Yes ☐ No
Time Logged on YSI	(hh:mm) 13:17:58
Time Synced on YSI	☑ Yes ☐ No Actual Time (hh:mm) _____
Unit Used	☒ Pro Plus ☐ Pen Unit Other _____

Sample Site (Con't): EI(H)

Sample Date (Con't): Jan. 23/2016 13:15

Bottle Type	Parameters Analyzed	Sample Treatment ☒	Preservative Added ☒	Collected ☒	No. Bottles	Comments (note number of bottles in duplicate)
500 ml (plastic)	General Chemistry	-	-	☒	1	Date/Time: Jan. 23/2016
125 ml (plastic)	Total Metals	-	☒ Nitric Acid	☒	1	
125 ml (plastic)	Dissolved Metals	☒ Field Filtered	☒ Nitric Acid	☒	1	
40 ml (glass)	Total Mercury		☒ Hydrochloric Acid	☒	1	
40 ml (glass)	Dissolved Mercury	☒ Field Filtered	☒ Hydrochloric Acid	☒	1	
125 ml (amber)	Ammonia (NH3)		☒ Sulfuric Acid	☒	1	
125 ml (amber)	Dissolved Organic Carbon (DOC)	☒ Field Filtered	☒ Sulfuric Acid	☒	1	
125 ml (plastic)	Total Speciated Chromium – Cr(VI) and CR(III)		☒ NaOH	☒	1	
125 ml (plastic)	Dissolved Speciated Chromium – Cr(VI) and CR(III)	☒ Field Filtered	☒ NaOH	☒	1	
				☐		

General Notes:

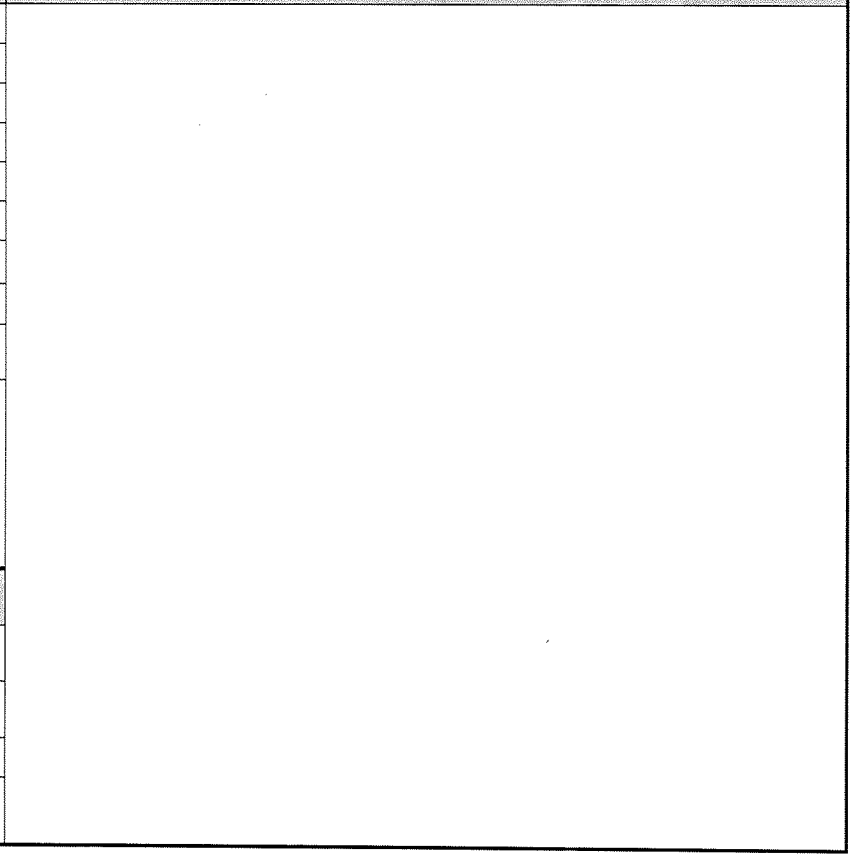
Total 9

SURFACE WATER SAMPLE COLLECTION SHEET

Sample Site:	E2	**Project Number:**	15-208	**Date:**	Jan 13, 2015
UTM Coordinates	Z 7 E 0514171 N 7147071	**Client:**	Yukon Government (AAM)	**Samplers:**	CH + AW
Waypoint	GPS ELR Name E2	**Project Name:**	Clinton Creek Surface Water Monitoring Program	**Weather/Temperature:**	Partly cloudy -15°C
Photos	Cam ELR Nos. 92-95				
Sample Time (24h)	11:45				
Field Blank Collected:	☐ Yes Name	**Duplicate Collected:**	☐ Yes Name		

Field Parameter Measurements (note units if different than those stated)	
Sample Depth (m)	0.05
Temperature (°C)	0.9°C
pH (pH Units)	7.42
Cond. (µs/cm)	799
Specific Cond. (µs/cm)	1481
Redox (mV)	-2.8
DO (mg/L)	0.23
DO (%)	1.7
Turbidity (NTU)	–
Appearance & Odour (Clear, Silty, HC odours, etc.)	Clear. Brown creek bed.

Site Sketch



Field Measurements Log	
YSI Logged?	☒ Yes ☐ No
Time Logged on YSI	(hh:mm) 11:49:02
Time Synced on YSI	☒ Yes ☐ No Actual Time (hh:mm)
Unit Used	☒ Pro Plus ☐ Pen Unit Other

Sample Site (Con't): E2

Sample Date (Con't): Jan. 23/2016 11:45

Bottle Type	Parameters Analyzed	Sample Treatment ☒	Preservative Added ☒	Collected ☒	No. Bottles	Comments (note number of bottles in duplicate)
500 ml (plastic)	General Chemistry	-	-	☒	1	Date/Time: Jan. 23/2016
125 ml (plastic)	Total Metals	-	☒ Nitric Acid	☒	1	
125 ml (plastic)	Dissolved Metals	☒ Field Filtered	☒ Nitric Acid	☒	1	
40 ml (glass)	Total Mercury		☒ Hydrochloric Acid	☒	1	
40 ml (glass)	Dissolved Mercury	☒ Field Filtered	☒ Hydrochloric Acid	☒	1	
125 ml (amber)	Ammonia (NH3)		☒ Sulfuric Acid	☒	1	
125 ml (amber)	Dissolved Organic Carbon (DOC)	☒ Field Filtered	☒ Sulfuric Acid	☒	1	
125 ml (plastic)	Total Speciated Chromium – Cr(VI) and CR(III)		☒ NaOH	☒	1	
125 ml (plastic)	Dissolved Speciated Chromium – Cr(VI) and CR(III)	☒ Field Filtered	☒ NaOH	☒	1	
				☐		

General Notes:

Total 9

SURFACE WATER SAMPLE COLLECTION SHEET

Sample Site:	E3	**Project Number:**	15-208	**Date:**	Jan. 23/2016
UTM Coordinates	Z 7 E 514178 N 7147189	**Client:**	Yukon Government (AAM)	**Samplers:**	AN, CH.
Waypoint	GPS ELR Name E3	**Project Name:**	Clinton Creek Surface Water Monitoring Program	**Weather/Temperature:**	Overcast ~ -15°C.
Photos	Cam ELR Nos. 88-91				
Sample Time (24h)	10:45				
Field Blank Collected:	☐ Yes Name	**Duplicate Collected:**	☒ Yes Name DUP1		

Field Parameter Measurements (note units if different than those stated)	
Sample Depth (m)	0.5
Temperature (°C)	0.3
pH (pH Units)	6.99
Cond. (µs/cm)	564
Specific Cond. (µs/cm)	1069
Redox (mV)	170.6
DO (mg/L)	0.17
DO (%)	1.3
Turbidity (NTU)	—
Appearance & Odour (Clear, Silty, HC odours, etc.)	Removed ice to collect sample. No odour clear water.

Site Sketch

Field Measurements Log	
YSI Logged?	☒ Yes ☐ No
Time Logged on YSI	(hh:mm) 10:49
Time Synced on YSI	☒ Yes ☐ No Actual Time (hh:mm) _____
Unit Used	☒ Pro Plus ☐ Pen Unit Other _____

Sample Site (Con't): E3

Sample Date (Con't): Jan. 23/2016 10:45

Bottle Type	Parameters Analyzed	Sample Treatment ☒	Preservative Added ☒	Collected ☒	No. Bottles	Comments (note number of bottles in duplicate)
500 ml (plastic)	General Chemistry	-	-	☑	1	Date/Time: Jan. 23/2016.
125 ml (plastic)	Total Metals	-	☒ Nitric Acid	☒	1	
125 ml (plastic)	Dissolved Metals	☒ Field Filtered	☒ Nitric Acid	☒	1	
40 ml (glass)	Total Mercury		☒ Hydrochloric Acid	☒	1	
40 ml (glass)	Dissolved Mercury	☒ Field Filtered	☒ Hydrochloric Acid	☒	1	
125 ml (amber)	Ammonia (NH3)		☒ Sulfuric Acid	☒	1	
125 ml (amber)	Dissolved Organic Carbon (DOC)	☒ Field Filtered	☒ Sulfuric Acid	☒	1	
125 ml (plastic)	Total Speciated Chromium – Cr(VI) and CR(III)		☒ NaOH	☒	1	
125 ml (plastic)	Dissolved Speciated Chromium – Cr(VI) and CR(III)	☒ Field Filtered	☒ NaOH	☒	1	
				☐		

General Notes:

DUP1 collected.

9/set

SURFACE WATER SAMPLE COLLECTION SHEET

Sample Site:	E4	**Project Number:**	15-208	**Date:**	Jan 23/2016
UTM Coordinates	Z 7 E 0515949 N 7145285	**Client:**	Yukon Government (AAM)	**Samplers:**	CH + AM
Waypoint	GPS ECR Name E4	**Project Name:**	Clinton Creek Surface Water Monitoring Program	**Weather/Temperature:**	Overcast ~ -15°C.
Photos	Cam ECR Nos. 164-168				
Sample Time (24h)	14:50				
Field Blank Collected:	☐ Yes Name	**Duplicate Collected:**	☐ Yes Name		

Field Parameter Measurements (note units if different than those stated)	
Sample Depth (m)	0.05
Temperature (°C)	0.0
pH (pH Units)	7.48
Cond. (µs/cm)	458.2
Specific Cond. (µs/cm)	913.6
Redox (mV)	181.9
DO (mg/L)	0.30
DO (%)	2.0
Turbidity (NTU)	–
Appearance & Odour (Clear, Silty, HC odours, etc.)	Clear, no odour. Removed ice in order to collect sample.

Site Sketch

Field Measurements Log	
YSI Logged?	☒ Yes ☐ No
Time Logged on YSI	(hh:mm) 14:49
Time Synced on YSI	☒ Yes ☐ No Actual Time (hh:mm) _____
Unit Used	☒ Pro Plus ☐ Pen Unit Other _____

Sample Site (Con't): E4

Sample Date (Con't): Jan. 23/2016 14:50

Bottle Type	Parameters Analyzed	Sample Treatment ☒	Preservative Added ☒	Collected ☒	No. Bottles	Comments (note number of bottles in duplicate)
500 ml (plastic)	General Chemistry	-	-	☒	1	Date/Time: Jan. 23/2016.
125 ml (plastic)	Total Metals	-	☒ Nitric Acid	☒	1	
125 ml (plastic)	Dissolved Metals	☒ Field Filtered	☒ Nitric Acid	☒	1	
40 ml (glass)	Total Mercury		☒ Hydrochloric Acid	☒	1	
40 ml (glass)	Dissolved Mercury	☒ Field Filtered	☒ Hydrochloric Acid	☒	1	
125 ml (amber)	Ammonia (NH3)		☒ Sulfuric Acid	☒	1	
125 ml (amber)	Dissolved Organic Carbon (DOC)	☒ Field Filtered	☒ Sulfuric Acid	☒	1	
125 ml (plastic)	Total Speciated Chromium – Cr(VI) and CR(III)		☒ NaOH	☒	1	
125 ml (plastic)	Dissolved Speciated Chromium – Cr(VI) and CR(III)	☒ Field Filtered	☒ NaOH	☒	1	
				☐		

General Notes:

SURFACE WATER SAMPLE COLLECTION SHEET

Sample Site:	E7	**Project Number:**	15-208.3	**Date:**	Jan 19/2016
UTM Coordinates	Z 7 E 0519422 N 7142044	**Client:**	Yukon Government (AAM)	**Samplers:**	AN, CH
Waypoint	GPS ELR Name E7	**Project Name:**	Clinton Creek Surface Water Monitoring Program	**Weather/Temperature:**	Overcast -15°C.
Photos	Cam ELR Nos. 38-42				
Sample Time (24h)	11:30				
Field Blank Collected:	☐ Yes Name	**Duplicate Collected:**	☐ Yes Name		

Field Parameter Measurements (note units if different than those stated)	
Sample Depth (m)	0.5
Temperature (°C)	0.0
pH (pH Units)	6.86
Cond. (µs/cm)	650
Specific Cond. (µs/cm)	1245
Redox (mV)	112.6
DO (mg/L)	0.24
DO (%)	1.7
Turbidity (NTU)	—
Appearance & Odour (Clear, Silty, HC odours, etc.)	Clear. Removed ice cover to collect sample.

Site Sketch

Field Measurements Log	
YSI Logged?	☒ Yes ☐ No
Time Logged on YSI	(hh:mm) 11:49
Time Synced on YSI	☒ Yes ☐ No Actual Time (hh:mm) _____
Unit Used	☒ Pro Plus ☐ Pen Unit Other _____

Sample Site (Con't): Jan. 19/2016 E7

Sample Date (Con't): 11:50

Bottle Type	Parameters Analyzed	Sample Treatment ☒	Preservative Added ☒	Collected ☒	No. Bottles	Comments (note number of bottles in duplicate)
500 ml (plastic)	General Chemistry	-	-	☒	1	Date/Time:
125 ml (plastic)	Total Metals	-	☒ Nitric Acid	☒	1	
125 ml (plastic)	Dissolved Metals	☒ Field Filtered	☒ Nitric Acid	☒	1	
40 ml (glass)	Total Mercury		☒ Hydrochloric Acid	☒	1	
40 ml (glass)	Dissolved Mercury	☒ Field Filtered	☒ Hydrochloric Acid	☒	1	
125 ml (amber)	Ammonia (NH3)		☒ Sulfuric Acid	☒	1	
125 ml (amber)	Dissolved Organic Carbon (DOC)	☒ Field Filtered	☒ Sulfuric Acid	☒	1	
125 ml (plastic)	Total Speciated Chromium – Cr(VI) and CR(III)		☒ NaOH	☒	1	
125 ml (plastic)	Dissolved Speciated Chromium – Cr(VI) and CR(III)	☒ Field Filtered	☒ NaOH	☒	1	
				☐		

9

General Notes:

Broke through ice to collect samples. Heli Access. Landed @ U/S forty-Mile site. (Waypt: Landl).

SURFACE WATER SAMPLE COLLECTION SHEET

Sample Site:	EB	**Project Number:**	15-208	**Date:**	Jan. 27/2016
UTM Coordinates	Z 7 E 0519445 N 7142569	**Client:**	Yukon Government (AAM)	**Samplers:**	AN, CH.
Waypoint	GPS ELR Name 002	**Project Name:**	Clinton Creek Surface Water Monitoring Program	**Weather/Temperature:**	Overcast ~ -6°C
Photos	Cam ELR Nos. 210-211				
Sample Time (24h)	13:55				
Field Blank Collected:	☐ Yes Name	**Duplicate Collected:**	☐ Yes Name		

Field Parameter Measurements (note units if different than those stated)	
Sample Depth (m)	0.1
Temperature (°C)	0.3
pH (pH Units)	7.29
Cond. (µs/cm)	248.1
Specific Cond. (µs/cm)	470.3
Redox (mV)	165.1
DO (mg/L)	11.05
DO (%)	76.2
Turbidity (NTU)	—
Appearance & Odour (Clear, Silty, HC odours, etc.)	Clear. Sample collected from auger hole in Forty-Mile River (mid-channel).

Site Sketch

Field Measurements Log	
YSI Logged?	☒ Yes ☐ No
Time Logged on YSI	(hh:mm) 14:03
Time Synced on YSI	☒ Yes ☐ No Actual Time (hh:mm) _____
Unit Used	☒ Pro Plus ☐ Pen Unit Other _____

Sample Site (Con't): E8

Sample Date (Con't): Jan. 27/2016 13:55

Bottle Type	Parameters Analyzed	Sample Treatment ☒	Preservative Added ☒	Collected ☒	No. Bottles	Comments (note number of bottles in duplicate)
500 ml (plastic)	General Chemistry	-	-	☑	1	Date/Time: Jan. 27/2016
125 ml (plastic)	Total Metals	-	☒ Nitric Acid	☑	1	
125 ml (plastic)	Dissolved Metals	☒ Field Filtered	☒ Nitric Acid	☒	1	
40 ml (glass)	Total Mercury		☒ Hydrochloric Acid	☒	1	
40 ml (glass)	Dissolved Mercury	☒ Field Filtered	☒ Hydrochloric Acid	☒	1	
125 ml (amber)	Ammonia (NH3)		☒ Sulfuric Acid	☑	1	
125 ml (amber)	Dissolved Organic Carbon (DOC)	☒ Field Filtered	☒ Sulfuric Acid	☑	1	
125 ml (plastic)	Total Speciated Chromium – Cr(VI) and CR(III)		☒ NaOH	☒	1	
125 ml (plastic)	Dissolved Speciated Chromium – Cr(VI) and CR(III)	☒ Field Filtered	☒ NaOH	☒	1	
				☐		

General Notes:

Total 17

SURFACE WATER SAMPLE COLLECTION SHEET

Sample Site:	R1	**Project Number:**	15-208.3	**Date:**	Jan 26/2016
UTM Coordinates	Z 7 E 510718 N 7147525	**Client:**	Yukon Government (AAM)	**Samplers:**	AN, CH.
Waypoint	GPS ____ Name ____	**Project Name:**	Clinton Creek Surface Water Monitoring Program	**Weather/Temperature:**	Overcast ~ -3°C
Photos	Cam ELR Nos. 169-172				
Sample Time (24h)	10:40				
Field Blank Collected:	☒ Yes Name FB1	**Duplicate Collected:**	☐ Yes Name ____		

Field Parameter Measurements (note units if different than those stated)	
Sample Depth (m)	0.05
Temperature (°C)	0.2
pH (pH Units)	7.20
Cond. (µs/cm)	523
Specific Cond. (µs/cm)	997
Redox (mV)	42.4
DO (mg/L)	0.15
DO (%)	1.0
Turbidity (NTU)	—
Appearance & Odour (Clear, Silty, HC odours, etc.)	Clear. red/orange algae/ diatoms (benthic). Gravel substrate.

Site Sketch

Field Measurements Log	
YSI Logged?	☒ Yes ☐ No
Time Logged on YSI	(hh:mm) 10:46
Time Synced on YSI	☒ Yes ☐ No Actual Time (hh:mm) ____
Unit Used	☒ Pro Plus ☐ Pen Unit Other ____

Sample Site (Con't): R1

Sample Date (Con't): Jan. 26/2016 10:40

Bottle Type	Parameters Analyzed	Sample Treatment ☒	Preservative Added ☒	Collected ☒	No. Bottles	Comments (note number of bottles in duplicate)
500 ml (plastic)	General Chemistry	-	-	☒	1	Date/Time: Jan. 26/2016.
125 ml (plastic)	Total Metals	-	☒ Nitric Acid	☒	1	
125 ml (plastic)	Dissolved Metals	☒ Field Filtered	☒ Nitric Acid	☒	1	
40 ml (glass)	Total Mercury		☒ Hydrochloric Acid	☒	1	
40 ml (glass)	Dissolved Mercury	☒ Field Filtered	☒ Hydrochloric Acid	☒	1	
125 ml (amber)	Ammonia (NH3)		☒ Sulfuric Acid	☒	1	
125 ml (amber)	Dissolved Organic Carbon (DOC)	☒ Field Filtered	☒ Sulfuric Acid	☒	1	
125 ml (plastic)	Total Speciated Chromium – Cr(VI) and CR(III)		☒ NaOH	☒	1	
125 ml (plastic)	Dissolved Speciated Chromium – Cr(VI) and CR(III)	☒ Field Filtered	☒ NaOH	☒	1	
				☐		

General Notes:

9 Total

SURFACE WATER SAMPLE COLLECTION SHEET

Sample Site:	R2	**Project Number:**	15-208	**Date:**	Jan. 26/2016
UTM Coordinates	Z 7 E 512023 N 7148061	**Client:**	Yukon Government (AAM)	**Samplers:**	AN, CH
Waypoint	~~GPS~~ ~~Name~~	**Project Name:**	Clinton Creek Surface Water Monitoring Program	**Weather/Temperature:**	Overcast ~ -3°C
Photos	Cam ELR Nos. 181-184				
Sample Time (24h)	13:15				
Field Blank Collected:	☐ Yes Name	**Duplicate Collected:**	☐ Yes Name		

Field Parameter Measurements (note units if different than those stated)	
Sample Depth (m)	0.1
Temperature (°C)	0.0
pH (pH Units)	7.74
Cond. (µs/cm)	479.4
Specific Cond. (µs/cm)	918.2
Redox (mV)	46.1
DO (mg/L)	0.23
DO (%)	1.5
Turbidity (NTU)	—
Appearance & Odour (Clear, Silty, HC odours, etc.)	Clear. Removed ice to collect sample. gravel substrate.

Site Sketch

Field Measurements Log	
YSI Logged?	☒ Yes ☐ No
Time Logged on YSI	(hh:mm) 13:14
Time Synced on YSI	☒ Yes ☐ No Actual Time (hh:mm) _____
Unit Used	☒ Pro Plus ☐ Pen Unit Other _____

Sample Site (Con't): RZ

Sample Date (Con't): Jan. 26/2016 13:15

Bottle Type	Parameters Analyzed	Sample Treatment ☒	Preservative Added ☒	Collected ☒	No. Bottles	Comments (note number of bottles in duplicate)
500 ml (plastic)	General Chemistry	-	-	☒	1	Date/Time: Jan. 26./2016.
125 ml (plastic)	Total Metals	-	☒ Nitric Acid	☒	1	
125 ml (plastic)	Dissolved Metals	☒ Field Filtered	☒ Nitric Acid	☒	1	
40 ml (glass)	Total Mercury		☒ Hydrochloric Acid	☒	1	
40 ml (glass)	Dissolved Mercury	☒ Field Filtered	☒ Hydrochloric Acid	☒	1	
125 ml (amber)	Ammonia (NH3)		☒ Sulfuric Acid	☒	1	
125 ml (amber)	Dissolved Organic Carbon (DOC)	☒ Field Filtered	☒ Sulfuric Acid	☒	1	
125 ml (plastic)	Total Speciated Chromium – Cr(VI) and CR(III)		☒ NaOH	☒	1	
125 ml (plastic)	Dissolved Speciated Chromium – Cr(VI) and CR(III)	☒ Field Filtered	☒ NaOH	☒	1	
				☐		

General Notes:

Total 9

SURFACE WATER SAMPLE COLLECTION SHEET

Sample Site:	R3	**Project Number:**	15-208	**Date:**	Jan. 24/2016
UTM Coordinates	Z 7 E 513952 N 7148677	**Client:**	Yukon Government (AAM)	**Samplers:**	AN, cH
Waypoint	GPS ~~Name~~ Name N/A.	**Project Name:**	Clinton Creek Surface Water Monitoring Program	**Weather/Temperature:**	Clear, sunny ~ -10°C.
Photos	Cam ELR Nos. 115-118				
Sample Time (24h)	FROZEN				
Field Blank Collected:	☐ Yes Name	**Duplicate Collected:**	☐ Yes Name		

Field Parameter Measurements (note units if different than those stated)	
Sample Depth (m)	
Temperature (°C)	
pH (pH Units)	
Cond. (µs/cm)	
Specific Cond. (µs/cm)	
Redox (mV)	
DO (mg/L)	
DO (%)	
Turbidity (NTU)	
Appearance & Odour (Clear, Silty, HC odours, etc.)	

Site Sketch

Wolverine Creek found frozen to ground @ R3 sample location.

Used axe to clip out section of ice (57 cm deep). Reached creek bed. Very low vol. seep observed in hole. Likely GW seeping through creek bed. Not sufficient vol. to collect sample.

Field Measurements Log	
YSI Logged?	☐ Yes ☐ No
Time Logged on YSI	(hh:mm)
Time Synced on YSI	☐ Yes ☐ No Actual Time (hh:mm)
Unit Used	☐ Pro Plus ☐ Pen Unit Other

Sample Site (Con't): R3 *Sample not collected

Sample Date (Con't): Jan. 24/2016 FROZEN.

Bottle Type	Parameters Analyzed	Sample Treatment ☒	Preservative Added ☒	Collected ☒	No. Bottles	Comments (note number of bottles in duplicate)
500 ml (plastic)	General Chemistry	-	-	☐		Date/Time:
125 ml (plastic)	Total Metals	-	☐ Nitric Acid	☐		
125 ml (plastic)	Dissolved Metals	☐ Field Filtered	☐ Nitric Acid	☐		
40 ml (glass)	Total Mercury		☐ Hydrochloric Acid	☐		
40 ml (glass)	Dissolved Mercury	☐ Field Filtered	☐ Hydrochloric Acid	☐		
125 ml (amber)	Ammonia (NH3)		☐ Sulfuric Acid	☐		
125 ml (amber)	Dissolved Organic Carbon (DOC)	☐ Field Filtered	☐ Sulfuric Acid	☐		
125 ml (plastic)	Total Speciated Chromium – Cr(VI) and CR(III)		☐ NaOH	☐		
125 ml (plastic)	Dissolved Speciated Chromium – Cr(VI) and CR(III)	☐ Field Filtered	☐ NaOH	☐		
				☐		

FROZEN

General Notes:

SURFACE WATER SAMPLE COLLECTION SHEET

Sample Site:	R4	**Project Number:**	15-208	**Date:**	Jan 25/2016
UTM Coordinates	Z 7 E 515981 N 7145344	**Client:**	Yukon Government (AAM)	**Samplers:**	AN, CH.
Waypoint	GPS ~~Name~~	**Project Name:**	Clinton Creek Surface Water Monitoring Program	**Weather/Temperature:**	Overcast ~-6°C
Photos	Cam ELR Nos. 62-63				
Sample Time (24h)	FROZEN				
Field Blank Collected:	☐ Yes Name ~~Name~~	**Duplicate Collected:**	☐ Yes ~~Name~~ Name		

Field Parameter Measurements (note units if different than those stated)	
Sample Depth (m)	
Temperature (°C)	
pH (pH Units)	
Cond. (µs/cm)	
Specific Cond. (µs/cm)	
Redox (mV)	
DO (mg/L)	
DO (%)	
Turbidity (NTU)	
Appearance & Odour (Clear, Silty, HC odours, etc.)	

FROZEN.

Field Measurements Log	
YSI Logged?	☐ Yes ☐ No
Time Logged on YSI	(hh:mm) _____
Time Synced on YSI	☐ Yes ☐ No Actual Time (hh:mm) _____
Unit Used	☐ Pro Plus ☐ Pen Unit Other _____

Site Sketch

No flow observed @ site R4.
Eagle Creek found frozen to creekbed.
No flow observed @ Eagle Creek culvert (Eagle/Clinton confluence).

Sample Site (Con't): Jan. 25/2016 FROZEN

Sample Date (Con't): R4

Bottle Type	Parameters Analyzed	Sample Treatment ☒	Preservative Added ☒	Collected ☒	No. Bottles	Comments (note number of bottles in duplicate)
500 ml (plastic)	General Chemistry	-	-	☐		Date/Time:
125 ml (plastic)	Total Metals	-	☐ Nitric Acid	☐		
125 ml (plastic)	Dissolved Metals	☐ Field Filtered	☐ Nitric Acid	☐		
40 ml (glass)	Total Mercury		☐ Hydrochloric Acid	☐		
40 ml (glass)	Dissolved Mercury	☐ Field Filtered	☐ Hydrochloric Acid	☐		
125 ml (amber)	Ammonia (NH3)		☐ Sulfuric Acid	☐		
125 ml (amber)	Dissolved Organic Carbon (DOC)	☐ Field Filtered	☐ Sulfuric Acid	☐		
125 ml (plastic)	Total Speciated Chromium – Cr(VI) and CR(III)		☐ NaOH	☐		
125 ml (plastic)	Dissolved Speciated Chromium – Cr(VI) and CR(III)	☐ Field Filtered	☐ NaOH	☐		
				☐		

FROZEN

General Notes:

SURFACE WATER SAMPLE COLLECTION SHEET

Sample Site:	RG	**Project Number:**	15-208	**Date:**	Jan. 27/2016
UTM Coordinates	Z 7 E 0518540 N 7141296	**Client:**	Yukon Government (AAM)	**Samplers:**	AN, CH
Waypoint	GPS ELR Name 001	**Project Name:**	Clinton Creek Surface Water Monitoring Program	**Weather/Temperature:**	Overcast ~ -6°C
Photos	Cam ELR Nos. 212-218				
Sample Time (24h)	12:15				
Field Blank Collected:	☐ Yes Name ____	**Duplicate Collected:**	☒ Yes Name DUP2		

Field Parameter Measurements (note units if different than those stated)	
Sample Depth (m)	0.1
Temperature (°C)	0.2
pH (pH Units)	7.23
Cond. (µs/cm)	256.8
Specific Cond. (µs/cm)	488.2
Redox (mV)	154.7
DO (mg/L)	12.26
DO (%)	84.1
Turbidity (NTU)	____
Appearance & Odour (Clear, Silty, HC odours, etc.)	clear. Sample collect from auger hole in mid-channel Forty-Mile River.

Field Measurements Log	
YSI Logged?	☒ Yes ☐ No
Time Logged on YSI	(hh:mm) 13:03
Time Synced on YSI	☒ Yes ☐ No Actual Time (hh:mm) ____
Unit Used	☒ Pro Plus ☐ Pen Unit Other ____

Site Sketch

Sample Site (Con't): R6

Sample Date (Con't): Jan. 27/2016 12:15

Bottle Type	Parameters Analyzed	Sample Treatment ☒	Preservative Added ☒	Collected ☒	No. Bottles	Comments (note number of bottles in duplicate)
500 ml (plastic)	General Chemistry	-	-	☑	1	Date/Time: Jan. 27/2016.
125 ml (plastic)	Total Metals	-	☑ Nitric Acid	☑	1	
125 ml (plastic)	Dissolved Metals	☒ Field Filtered	☒ Nitric Acid	☑	1	
40 ml (glass)	Total Mercury		☐ Hydrochloric Acid	☑	1	
40 ml (glass)	Dissolved Mercury	☑ Field Filtered	☐ Hydrochloric Acid	☑	1	
125 ml (amber)	Ammonia (NH3)		☐ Sulfuric Acid	☒	1	
125 ml (amber)	Dissolved Organic Carbon (DOC)	☑ Field Filtered	☐ Sulfuric Acid	☑	1	
125 ml (plastic)	Total Speciated Chromium – Cr(VI) and CR(III)		☐ NaOH	☑	1	
125 ml (plastic)	Dissolved Speciated Chromium – Cr(VI) and CR(III)	☑ Field Filtered	☑ NaOH	☒	1	
				☐		

General Notes:

Total 9

SURFACE WATER SAMPLE COLLECTION SHEET

Sample Site:	R7	**Project Number:**	15-208.3	**Date:**	Jan. 26/2016
UTM Coordinates	Z 7 E 513026 N 7145661	**Client:**	Yukon Government (AAM)	**Samplers:**	AN, CH.
Waypoint	~~GPS~~ ~~Name~~	**Project Name:**	Clinton Creek Surface Water Monitoring Program	**Weather/Temperature:**	Overcast ~-3°C
Photos	Cam ELR Nos. 173-180				
Sample Time (24h)	FROZEN				
Field Blank Collected:	☐ Yes Name	**Duplicate Collected:**	☐ Yes Name		

Field Parameter Measurements (note units if different than those stated)	
Sample Depth (m)	
Temperature (°C)	
pH (pH Units)	
Cond. (µs/cm)	
Specific Cond. (µs/cm)	
Redox (mV)	
DO (mg/L)	
DO (%)	
Turbidity (NTU)	
Appearance & Odour (Clear, Silty, HC odours, etc.)	

FROZEN.

Field Measurements Log	
YSI Logged?	☐ Yes ☐ No
Time Logged on YSI	(hh:mm) _____
Time Synced on YSI	☐ Yes ☐ No Actual Time (hh:mm) _____
Unit Used	☐ Pro Plus ☐ Pen Unit Other _____

Site Sketch

Site R7 was found frozen to ground during January field visit.

Sample Site (Con't): R7

Sample Date (Con't): Jan. 26/2016

Bottle Type	Parameters Analyzed	Sample Treatment ☒	Preservative Added ☒	Collected ☒	No. Bottles	Comments (note number of bottles in duplicate)
500 ml (plastic)	General Chemistry	-	-	☐		Date/Time:
125 ml (plastic)	Total Metals	-	☐ Nitric Acid	☐		
125 ml (plastic)	Dissolved Metals	☐ Field Filtered	☐ Nitric Acid	☐		
40 ml (glass)	Total Mercury		☐ Hydrochloric Acid	☐		
40 ml (glass)	Dissolved Mercury	☐ Field Filtered	☐ Hydrochloric Acid	☐		
125 ml (amber)	Ammonia (NH3)		☐ Sulfuric Acid	☐		
125 ml (amber)	Dissolved Organic Carbon (DOC)	☐ Field Filtered	☐ Sulfuric Acid	☐		
125 ml (plastic)	Total Speciated Chromium – Cr(VI) and CR(III)		☐ NaOH	☐		
125 ml (plastic)	Dissolved Speciated Chromium – Cr(VI) and CR(III)	☐ Field Filtered	☐ NaOH	☐		
				☐		

FROZEN

General Notes:

SURFACE WATER SAMPLE COLLECTION SHEET

Sample Site:	R8	**Project Number:**	15-208.3	**Date:**	Jan. 26/2016
UTM Coordinates	Z 2 E 511885 N 7147805	**Client:**	Yukon Government (AAM)	**Samplers:**	AN, CH.
Waypoint	~~GPS~~ ~~Name~~	**Project Name:**	Clinton Creek Surface Water Monitoring Program	**Weather/Temperature:**	Overcast ~-3°C.
Photos	Cam ELR Nos. 188-191				
Sample Time (24h)	FROZEN				
Field Blank Collected:	☐ Yes Name _____	**Duplicate Collected:**	☐ Yes Name _____		

Field Parameter Measurements (note units if different than those stated)	
Sample Depth (m)	
Temperature (°C)	
pH (pH Units)	
Cond. (µs/cm)	
Specific Cond. (µs/cm)	
Redox (mV)	
DO (mg/L)	
DO (%)	
Turbidity (NTU)	
Appearance & Odour (Clear, Silty, HC odours, etc.)	

Field Measurements Log	
YSI Logged?	☐ Yes ☐ No
Time Logged on YSI	(hh:mm) _____
Time Synced on YSI	☐ Yes ☐ No Actual Time (hh:mm) _____
Unit Used	☐ Pro Plus ☐ Pen Unit Other _____

Site Sketch

Reference site R8 was found frozen to ground during January 2016 field visit.

Sample Site (Con't): R8

Sample Date (Con't): Jan. 26/2016

FROZEN

Bottle Type	Parameters Analyzed	Sample Treatment ☒	Preservative Added ☒	Collected ☒	No. Bottles	Comments (note number of bottles in duplicate)
500 ml (plastic)	General Chemistry	-	-	☐		Date/Time:
125 ml (plastic)	Total Metals	-	☐ Nitric Acid	☐		
125 ml (plastic)	Dissolved Metals	☐ Field Filtered	☐ Nitric Acid	☐		
40 ml (glass)	Total Mercury		☐ Hydrochloric Acid	☐		
40 ml (glass)	Dissolved Mercury	☐ Field Filtered	☐ Hydrochloric Acid	☐		
125 ml (amber)	Ammonia (NH3)		☐ Sulfuric Acid	☐		
125 ml (amber)	Dissolved Organic Carbon (DOC)	☐ Field Filtered	☐ Sulfuric Acid	☐		
125 ml (plastic)	Total Speciated Chromium – Cr(VI) and CR(III)		☐ NaOH	☐		
125 ml (plastic)	Dissolved Speciated Chromium – Cr(VI) and CR(III)	☐ Field Filtered	☐ NaOH	☐		
				☐		

General Notes:

SURFACE WATER SAMPLE COLLECTION SHEET

Sample Site:	R9	**Project Number:**	15-208.3	**Date:**	Jan. 26/2016
UTM Coordinates	Z 7 E 512343 N 7146753	**Client:**	Yukon Government (AAM)	**Samplers:**	AN, CH.
Waypoint	~~GPS~~ _____ ~~Name~~ _____	**Project Name:**	Clinton Creek Surface Water Monitoring Program	**Weather/Temperature:**	Overcast ~-5°C.
Photos	Cam ELR Nos. 198-202				
Sample Time (24h)	FROZEN				
Field Blank Collected:	☐ Yes ~~Name~~ _____	**Duplicate Collected:**	☐ Yes Name _____		

Field Parameter Measurements (note units if different than those stated)	
Sample Depth (m)	
Temperature (°C)	
pH (pH Units)	
Cond. (µs/cm)	
Specific Cond. (µs/cm)	
Redox (mV)	
DO (mg/L)	
DO (%)	
Turbidity (NTU)	
Appearance & Odour (Clear, Silty, HC odours, etc.)	

Site Sketch

Site R9 was found frozen/Dry during Jan. 2016 field visit.

Field Measurements Log	
YSI Logged?	☐ Yes ☐ No
Time Logged on YSI	(hh:mm) _____
Time Synced on YSI	☐ Yes ☑ No Actual Time (hh:mm) _____
Unit Used	☐ Pro Plus ☐ Pen Unit Other _____

Sample Site (Con't): R9

Sample Date (Con't): Jan. 26/2016.

Bottle Type	Parameters Analyzed	Sample Treatment ☒	Preservative Added ☒	Collected ☒	No. Bottles	Comments (note number of bottles in duplicate)
500 ml (plastic)	General Chemistry	-	-	☐		Date/Time:
125 ml (plastic)	Total Metals	-	☐ Nitric Acid	☐		
125 ml (plastic)	Dissolved Metals	☐ Field Filtered	☐ Nitric Acid	☐		
40 ml (glass)	Total Mercury		☐ Hydrochloric Acid	☐		
40 ml (glass)	Dissolved Mercury	☐ Field Filtered	☐ Hydrochloric Acid	☐		
125 ml (amber)	Ammonia (NH3)		☐ Sulfuric Acid	☐		
125 ml (amber)	Dissolved Organic Carbon (DOC)	☐ Field Filtered	☐ Sulfuric Acid	☐		
125 ml (plastic)	Total Speciated Chromium – Cr(VI) and CR(III)		☐ NaOH	☐		
125 ml (plastic)	Dissolved Speciated Chromium – Cr(VI) and CR(III)	☐ Field Filtered	☐ NaOH	☐		
				☐		

General Notes:

SURFACE WATER SAMPLE COLLECTION SHEET

Sample Site:	GWCC-1	**Project Number:**	15-208	**Date:**	Jan. 24/2016
UTM Coordinates	Z 7 E 513902 N 7146960	**Client:**	Yukon Government (AAM)	**Samplers:**	AN, CH.
Waypoint	GPS ____ Name ____	**Project Name:**	Clinton Creek Surface Water Monitoring Program	**Weather/Temperature:**	Clear/sunny ~ -10°C.
Photos	Cam ELR Nos. 118-119/131				
Sample Time (24h)	13:55				
Field Blank Collected:	☐ Yes Name ____	**Duplicate Collected:**	☐ Yes Name ____		

Field Parameter Measurements (note units if different than those stated)	
Sample Depth (m)	0.08
Temperature (°C)	2.1
pH (pH Units)	5.8* / 7.11°
Cond. (µs/cm)	1476
Specific Cond. (µs/cm)	2622
Redox (mV)	133.3
DO (mg/L)	0.2
DO (%)	1.4
Turbidity (NTU)	—
Appearance & Odour (Clear, Silty, HC odours, etc.)	Clear. no odour. Sample collected from flowing open water in Beaver Pond.

Site Sketch

Field Measurements Log	
YSI Logged?	☐ Yes ☒ No
Time Logged on YSI	(hh:mm) ____
Time Synced on YSI	☐ Yes ☐ No Actual Time (hh:mm) ____
Unit Used	☐ Pro Plus ☐ Pen Unit Other ____

* YSI measurements could be off. pH sensor is damaged from cold weather.
° Reading w/ new YSI pH probe.

Sample Site (Con't): Jan. 24/2016 13:55

Sample Date (Con't): GWCC-1

Bottle Type	Parameters Analyzed	Sample Treatment ☒	Preservative Added ☒	Collected ☒	No. Bottles	Comments (note number of bottles in duplicate)
500 ml (plastic)	General Chemistry	-	-	☒	1	Date/Time: Jan. 24/2016
125 ml (plastic)	Total Metals	-	☒ Nitric Acid	☒	1	
125 ml (plastic)	Dissolved Metals	☒ Field Filtered	☒ Nitric Acid	☒	1	
40 ml (glass)	Total Mercury		☒ Hydrochloric Acid	☒	1	
40 ml (glass)	Dissolved Mercury	☒ Field Filtered	☒ Hydrochloric Acid	☒	1	
125 ml (amber)	Ammonia (NH3)		☒ Sulfuric Acid	☒	1	
125 ml (amber)	Dissolved Organic Carbon (DOC)	☒ Field Filtered	☒ Sulfuric Acid	☒	1	
125 ml (plastic)	Total Speciated Chromium – Cr(VI) and CR(III)		☒ NaOH	☒	1	
125 ml (plastic)	Dissolved Speciated Chromium – Cr(VI) and CR(III)	☒ Field Filtered	☒ NaOH	☒	1	
				☐		

General Notes:

9 Total.

SURFACE WATER SAMPLE COLLECTION SHEET

Sample Site:	GWCC-2	**Project Number:**	15-208	**Date:**	Jan. 24/2016
UTM Coordinates	Z 7 E 513899 N 7146968	**Client:**	Yukon Government (AAM)	**Samplers:**	AN, CH.
Waypoint	GPS ~~Name~~	**Project Name:**	Clinton Creek Surface Water Monitoring Program	**Weather/Temperature:**	Clear, sunny ~ -15°C.
Photos	Cam ELR Nos. 129-130				
Sample Time (24h)	14:35				
Field Blank Collected:	☐ Yes ~~Name~~	**Duplicate Collected:**	☐ Yes Name		

Field Parameter Measurements (note units if different than those stated)	
Sample Depth (m)	0.1
Temperature (°C)	1.3
pH (pH Units)	5.95* / 7.60°
Cond. (µs/cm)	1822
Specific Cond. (µs/cm)	1862
Redox (mV)	170.5
DO (mg/L)	0.24
DO (%)	1.6
Turbidity (NTU)	—
Appearance & Odour (Clear, Silty, HC odours, etc.)	Clear, marshy water seep emerging from slope into Beaver pond.

Site Sketch

Field Measurements Log	
YSI Logged?	☒ Yes ☐ No
Time Logged on YSI	(hh:mm) 14:35
Time Synced on YSI	☒ Yes ☐ No Actual Time (hh:mm) _____
Unit Used	☒ Pro Plus ☐ Pen Unit Other _____

* YSI measurement may be off. pH meter/sensor has been damaged. ° Reading is new YSI pH probe.

Sample Site (Con't): GWCC-2

Sample Date (Con't): Jan. 24/2016 14:35

Bottle Type	Parameters Analyzed	Sample Treatment ☒	Preservative Added ☒	Collected ☒	No. Bottles	Comments (note number of bottles in duplicate)
500 ml (plastic)	General Chemistry	-	-	☒	1	Date/Time: Jan. 24/2016.
125 ml (plastic)	Total Metals	-	☒ Nitric Acid	☒	1	
125 ml (plastic)	Dissolved Metals	☒ Field Filtered	☒ Nitric Acid	☒	1	
40 ml (glass)	Total Mercury		☒ Hydrochloric Acid	☒	1	
40 ml (glass)	Dissolved Mercury	☒ Field Filtered	☒ Hydrochloric Acid	☒	1	
125 ml (amber)	Ammonia (NH3)		☒ Sulfuric Acid	☒	1	
125 ml (amber)	Dissolved Organic Carbon (DOC)	☒ Field Filtered	☒ Sulfuric Acid	☒	1	
125 ml (plastic)	Total Speciated Chromium – Cr(VI) and CR(III)		☒ NaOH	☒	1	
125 ml (plastic)	Dissolved Speciated Chromium – Cr(VI) and CR(III)	☒ Field Filtered	☒ NaOH	☒	1	
				☐		

General Notes:

SURFACE WATER SAMPLE COLLECTION SHEET

Sample Site:	GWCC-3	**Project Number:**	15-208.3	**Date:**	Jan. 24/2016
UTM Coordinates	Z 7 E 517882 N 7147038	**Client:**	Yukon Government (AAM)	**Samplers:**	AN, CH.
Waypoint	~~GPS~~ ____ ~~Name~~ ____	**Project Name:**	Clinton Creek Surface Water Monitoring Program	**Weather/Temperature:**	Clear, Sunny ~ -15°C
Photos	Cam ELR Nos. 120-122				
Sample Time (24h)	FROZEN				
Field Blank Collected:	☐ Yes Name ____	**Duplicate Collected:**	☐ Yes Name ____		

Field Parameter Measurements (note units if different than those stated)	
Sample Depth (m)	
Temperature (°C)	
pH (pH Units)	
Cond. (µs/cm)	
Specific Cond. (µs/cm)	
Redox (mV)	
DO (mg/L)	
DO (%)	
Turbidity (NTU)	
Appearance & Odour (Clear, Silty, HC odours, etc.)	

FROZEN

Field Measurements Log	
YSI Logged?	☐ Yes ☐ No
Time Logged on YSI	(hh:mm) ____
Time Synced on YSI	☐ Yes ☐ No Actual Time (hh:mm) ____
Unit Used	☐ Pro Plus ☐ Pen Unit Other ____

Site Sketch

No water seepage found @ site GWCC-3.

Site found FROZEN/DRY.

Sample Site (Con't): GWCC-3 * Not Sampled FROZEN/DRY

Sample Date (Con't): Jan. 24/2016

Bottle Type	Parameters Analyzed	Sample Treatment ☒	Preservative Added ☒	Collected ☒	No. Bottles	Comments (note number of bottles in duplicate)
500 ml (plastic)	General Chemistry	-	-	☐		Date/Time:
125 ml (plastic)	Total Metals	-	☐ Nitric Acid	☐		
125 ml (plastic)	Dissolved Metals	☐ Field Filtered	☐ Nitric Acid	☐		
40 ml (glass)	Total Mercury		☐ Hydrochloric Acid	☐		
40 ml (glass)	Dissolved Mercury	☐ Field Filtered	☐ Hydrochloric Acid	☐		
125 ml (amber)	Ammonia (NH3)		☐ Sulfuric Acid	☐		
125 ml (amber)	Dissolved Organic Carbon (DOC)	☐ Field Filtered	☐ Sulfuric Acid	☐		
125 ml (plastic)	Total Speciated Chromium – Cr(VI) and CR(III)		☐ NaOH	☐		
125 ml (plastic)	Dissolved Speciated Chromium – Cr(VI) and CR(III)	☐ Field Filtered	☐ NaOH	☐		
				☐		

FROZEN

General Notes:

SURFACE WATER SAMPLE COLLECTION SHEET

Sample Site:	GWCC-4	**Project Number:**	15-208	**Date:**	Jan. 24/2016
UTM Coordinates	Z 7 E 513868 N 7147038	**Client:**	Yukon Government (AAM)	**Samplers:**	AN, CH.
Waypoint	~~GPS~~ ~~Name~~	**Project Name:**	Clinton Creek Surface Water Monitoring Program	**Weather/Temperature:**	Clear/sunny ~ -15°C.
Photos	Cam ELR Nos. 124-125				
Sample Time (24h)	15:10				
Field Blank Collected:	☐ Yes Name ~~Name~~	**Duplicate Collected:**	☐ Yes Name ~~Name~~		

Field Parameter Measurements (note units if different than those stated)	
Sample Depth (m)	0.05
Temperature (°C)	1.8
pH (pH Units)	6.0* / 7.61°
Cond. (µs/cm)	438.8
Specific Cond. (µs/cm)	768.8
Redox (mV)	185.6
DO (mg/L)	0.26
DO (%)	1.8
Turbidity (NTU)	—
Appearance & Odour (Clear, Silty, HC odours, etc.)	Sample collected from small pool of seep water. Below waste rock slope.

Site Sketch

fine sediment on bottom of small pool. Sediment becomes suspended slightly when sampling or clearing ice. May affect sample quality.

Field Measurements Log	
YSI Logged?	☒ Yes ☐ No
Time Logged on YSI	(hh:mm) 15:04
Time Synced on YSI	☒ Yes ☐ No Actual Time (hh:mm) _____
Unit Used	☒ Pro Plus ☐ Pen Unit Other _____

* YSI measurements may be inaccurate
pH sensor damaged from cold weather.
- Reading w new YSI pH probe.

Sample Site (Con't): GWCC-4

Sample Date (Con't): Jan. 24/2016 . 15:10

Bottle Type	Parameters Analyzed	Sample Treatment ☒	Preservative Added ☒	Collected ☒	No. Bottles	Comments (note number of bottles in duplicate)
500 ml (plastic)	General Chemistry	-	-	☒	1	Date/Time: Jan. 24/2016.
125 ml (plastic)	Total Metals	-	☒ Nitric Acid	☒	1	
125 ml (plastic)	Dissolved Metals	☒ Field Filtered	☒ Nitric Acid	☒	1	
40 ml (glass)	Total Mercury		☒ Hydrochloric Acid	☒	1	
40 ml (glass)	Dissolved Mercury	☒ Field Filtered	☒ Hydrochloric Acid	☒	1	
125 ml (amber)	Ammonia (NH3)		☒ Sulfuric Acid	☒	1	
125 ml (amber)	Dissolved Organic Carbon (DOC)	☒ Field Filtered	☒ Sulfuric Acid	☒	1	
125 ml (plastic)	Total Speciated Chromium – Cr(VI) and CR(III)		☒ NaOH	☒	1	
125 ml (plastic)	Dissolved Speciated Chromium – Cr(VI) and CR(III)	☒ Field Filtered	☒ NaOH	☒	1	
				☐		

General Notes:

Total 9

SURFACE WATER SAMPLE COLLECTION SHEET

Sample Site:	GWCC-5	**Project Number:**	15-208	**Date:**	Jan. 25/2016
UTM Coordinates	Z 7 E 513984 N 7147127	**Client:**	Yukon Government (AAM)	**Samplers:**	AN, CH.
Waypoint	GPS ~~Name~~	**Project Name:**	Clinton Creek Surface Water Monitoring Program	**Weather/Temperature:**	Overcast ~ -6°C.
Photos	Cam ELR Nos. 132-135				
Sample Time (24h)	12.55				
Field Blank Collected:	☐ Yes Name ~~Name~~	**Duplicate Collected:**	☐ Yes Name ~~Name~~		

Field Parameter Measurements (note units if different than those stated)	
Sample Depth (m)	0.1
Temperature (°C)	5.0
pH (pH Units)	7.18
Cond. (µs/cm)	587
Specific Cond. (µs/cm)	950
Redox (mV)	586
DO (mg/L)	6.10
DO (%)	0.7
Turbidity (NTU)	—
Appearance & Odour (Clear, Silty, HC odours, etc.)	Clear. Moving water flowing from small GW seep pool. old CC channel.

Field Measurements Log	
YSI Logged?	☒ Yes ☐ No
Time Logged on YSI	(hh:mm) 12:50
Time Synced on YSI	☒ Yes ☐ No Actual Time (hh:mm) _____
Unit Used	☒ Pro Plus ☐ Pen Unit Other _____

Site Sketch

Flow estimate:
Method:
Created "weir" of ice, sediment, and fractured creek bed rock. Altered creek bed to dry and collected flow over top of "weir" from a rocky point for a 1 Litre bottle. filled in 12.5 seconds
Flow through/below ground also likely.
1L / 12.5 seconds
= 4.8L / minute.

WQ Notes:
Total samples contain suspended algal matter.

Sample Site (Con't): GWCC-5

Sample Date (Con't): Jan 25, 2016 12:55

Bottle Type	Parameters Analyzed	Sample Treatment ☒	Preservative Added ☒	Collected ☒	No. Bottles	Comments (note number of bottles in duplicate)
500 ml (plastic)	General Chemistry	-	-	☑	1	Date/Time: Jan. 25/2016.
125 ml (plastic)	Total Metals	-	☒ Nitric Acid	☑	1	
125 ml (plastic)	Dissolved Metals	☒ Field Filtered	☒ Nitric Acid	☑	1	
40 ml (glass)	Total Mercury		☒ Hydrochloric Acid	☑	1	
40 ml (glass)	Dissolved Mercury	☒ Field Filtered	☒ Hydrochloric Acid	☑	1	
125 ml (amber)	Ammonia (NH3)		☒ Sulfuric Acid	☑	1	
125 ml (amber)	Dissolved Organic Carbon (DOC)	☒ Field Filtered	☒ Sulfuric Acid	☑	1	
125 ml (plastic)	Total Speciated Chromium – Cr(VI) and CR(III)		☒ NaOH	☑	1	
125 ml (plastic)	Dissolved Speciated Chromium – Cr(VI) and CR(III)	☑ Field Filtered	☒ NaOH	☑	1	
				☐		

General Notes:

SURFACE WATER SAMPLE COLLECTION SHEET

Sample Site:	SL	**Project Number:**	15-208.3	**Date:**	Jan. 27/2016
UTM Coordinates	Z 7 E 513824 N 7146703	**Client:**	Yukon Government (AAM)	**Samplers:**	AN, CH.
Waypoint	~~GPS~~ ____ Name ____	**Project Name:**	Clinton Creek Surface Water Monitoring Program	**Weather/Temperature:**	Overcast ~ -30C
Photos	Cam ELR. Nos. 207 - 209				
Sample Time (24h)	DRY/FROZEN.				
Field Blank Collected:	☐ Yes Name ____	**Duplicate Collected:**	☐ Yes Name ____		

Field Parameter Measurements (note units if different than those stated)	
Sample Depth (m)	
Temperature (°C)	
pH (pH Units)	
Cond. (µs/cm)	
Specific Cond. (µs/cm)	
Redox (mV)	
DO (mg/L)	
DO (%)	
Turbidity (NTU)	
Appearance & Odour (Clear, Silty, HC odours, etc.)	

DRY / Frozen.

Site Sketch

Snowshoe Pit Lake found DRY during Jan. 2016 field visit. Could not explore fully bottom of pit due to H/S concerns. refer to photos.

Field Measurements Log	
YSI Logged?	☐ Yes ☐ No
Time Logged on YSI	(hh:mm) ____
Time Synced on YSI	☐ Yes ☐ No Actual Time (hh:mm) ____
Unit Used	☐ Pro Plus ☐ Pen Unit Other ____

Sample Site (Con't): SL

Sample Date (Con't): Jan. 27/2016

DRY/FROZEN.

Bottle Type	Parameters Analyzed	Sample Treatment ☒	Preservative Added ☒	Collected ☒	No. Bottles	Comments (note number of bottles in duplicate)
500 ml (plastic)	General Chemistry	-	-	☐		Date/Time:
125 ml (plastic)	Total Metals	-	☐ Nitric Acid	☐		
125 ml (plastic)	Dissolved Metals	☐ Field Filtered	☐ Nitric Acid	☐		
40 ml (glass)	Total Mercury		☐ Hydrochloric Acid	☐		
40 ml (glass)	Dissolved Mercury	☐ Field Filtered	☐ Hydrochloric Acid	☐		
125 ml (amber)	Ammonia (NH3)		☐ Sulfuric Acid	☐		
125 ml (amber)	Dissolved Organic Carbon (DOC)	☐ Field Filtered	☐ Sulfuric Acid	☐		
125 ml (plastic)	Total Speciated Chromium – Cr(VI) and CR(III)		☐ NaOH	☐		
125 ml (plastic)	Dissolved Speciated Chromium – Cr(VI) and CR(III)	☐ Field Filtered	☐ NaOH	☐		
				☐		

General Notes:

ELR SNOW SURVEY FIELD FORM

Project Number and Name:	Date:	Air Temperature (°C)
15-208.3 Clinton Monitoring.	Jan. 26/2016	~ -3°C.

Ms	Waypoint #	Photo #s and Camera
AN, CH	7. 512343. 7146753	203 - 206. (ELR)

Surveyor Initials:	Number of Tube Sections Used:	Driving Wrence Used (Yes/No)?
AN.	2	YES.

Snow Survey Start Time: 15:00 Snow Survey End Time: 15:33

* 3 cm crust on top, condensing core length.

Station number	Weight of tube before sampling	Snow Depth (cm) With dirt plug	Snow Depth (cm) Without dirt plug	Snow depth using ruler (cm)	Core length (cm)	Weight of tube and snow core	Water equivalent (cm)[1]	Density (%)[2]
1	2.5	53.6	51.6	51.0	54.2			
2	↓	56.1	41.9	54.0	44.0	↓		
3		56.4	35.4	53.2	38.6			
4		57.0	35.4	53.8	38.6			
5		54.8	36.7	53.8	37.7			
6		62.1	36.4	56.2	42.3			
7		57.9	37.9	54.8	41.0			
8		54.2	36.3	51.8	38.7			
9		54.5	38.7	52.2	41.0			
10		55.8	39.7	53.2	42.3			
11		51.9	36.3	49.4	38.8	↓		
12	↓	61.5	40.5	57.6	44.4	59.0	56.5	
		Total	466.8			Total	56.5	↓
		Average (nearest cm)	38.9			Average (nearest 10th cm)	4.7	12.08%

1. Subtract "weight of tube before sampling" from "weight of tube and snow core"
2. Divide the "water equivalent" by the "snow depth without dirt plug" x 100

For regular sampling (snow depth > 0.5 m) see Steps 1 to 18 in the snow survey sampling guide (pages 4 to 14)

For bulk sampling (snow depths < 0.5 m), see steps 1 to 5 in part C of manual (pages 14 to 18)

Snow Survey. Additional Information

Use check marks for those statements that apply or write in answers

Weather Conditions

Freezing	✓		
Thawing			
Windy		Calm	✓
Skies: Clear		Partly cloudy	
Overcast	✓	Raining	
Snowing			

Surface Snow Conidtions at Snow Course

Fresh fallen snow (estimated cm)	1-2 cm		
Wet		Dry	✓
Soft		Crusted	✓
Snow support:		No support	
Support Person on snowshoes			N
Person on foot			N
Extensive drifting		Yes*	No

Sampling Conditions

Easy	✓	Moderate*	
Difficult*			
Ground reached on all samples			Y
Ice layer in snow pack			N
Ice layer at ground level			Y
Ground layer:			
Frozen	✓	Wet	
Dry		Damp	

*Remarks

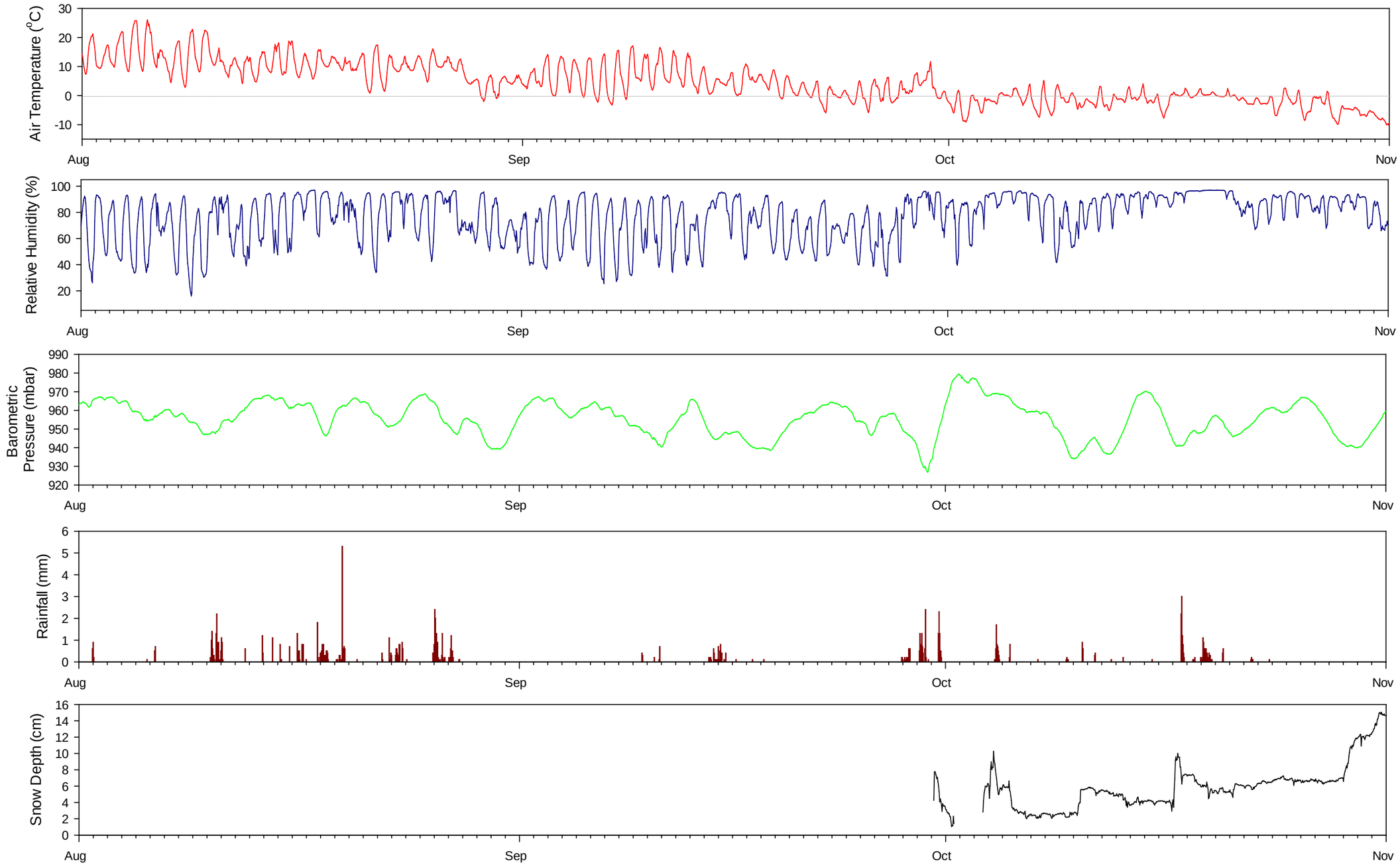
Snow survey conducted on Hudgeon Lake. Southern Bay near sample site R9.

Area was relatively protected and did not appear to be affected by drift or heavy winds.

Crust developed @ top of snow core. Crust pushes down bottom of core when inserted. This accounts for the difference between snow depth (using ruler) and core length.

APPENDIX 5

Meteorological Station Data July to September 2015



Temperature, Relative Humidity, Barometric Pressure, and Precipitation Data from the Clinton Creek Meteorological Station, August 1 2015 to October 31, 2015

APPENDIX 6
Response to Client Comments

Response to Comments from Draft Report Version (as Received from AAM on March 17, 2016)

Page Number	Comment Number	Comment	Response
i	1	There is a numbering issue in Section 3.4; please make changes to section numbers and ensure that in text references to sections are appropriate.	Numbering will be checked to ensure it is proper in the final report.
1	1	Just to note to Hemmera that this report will likely be distributed by AAM to other parties (i.e. either public or private) and that those parties may use the data/finding in this report.	Sentence removed
2	1	Have removed references to Figure 2 here given that I would like Figures 2 & 3 be placed together and end of Section 1	Agreed – figure placement will be changed.
4	1	Place at end of Section 1 with Figure 3	Figure placement has been updated.
5	1	List should include snow depth and density survey	The text has been updated to include this component.
7	1	I don't think this note applies here.	Note has been removed.
7	2	Similar comment applies to R6 and R8 judging from Figure 3.	The note has been added to Sites R6 and E8 to describe alternate sampling sites.
8	1	Error made in Figure: R8 Written instead of E8.	Figure has been updated to fix this error.
9	1	Insert small blurb: access to the site was completed by helicopter.	The text has been updated to include this information.
9	1	Remove: redundant to Section 2.1.2	This text has been removed.
12	1	Please bold all Section references, or don't; just be consistent.	The report has been reviewed to ensure all Section references are bold typed.
13	1	Long?	Text has been updated.
15	1,2	What were the methods employed (e.g. How was site selected, how is snow density and snow water equivalency determined (include formulas)? Some of this may be in section 3 although anything pertaining to methods/approach should be here. What is the bulk sampling method?	Additional text on sampling methods has been added along with the formulas for calculating water equivalence and snow density.
18	1	Could you do quick reference to the fall and/or summer event (i.e. when it wasn't frozen was there a potential influence)	The text has been updated to make reference to prior data.
18	2	What concentration?	The concentration has been added to the text.

Page Number	Comment Number	Comment	Response
19	1	Missing Selenium	Selenium was not included in the table as there was no immediate potential upstream influence identified, however reference to potential influences from prior events was added to the text for clarity.
19	2	Can sentence from MN GW report be inserted here as well: "The program analytical laboratory (ALS Global) indicated that the detection of low levels of ammonia should not be considered an indication of contamination as low concentrations of ammonia are occasionally detected in travel blanks that are prepared too early in advance of the field program."	The text has been updated with this information.
20	1	I believe this was a copy/paste error as E2 is not marked for hydro in Table1 nor is there data in Table 6.	This text has been removed as it was carried over from the previous report.
21	1	Given the chemistry contributed by GWCC-1, is there merit in doing some hydrology work at this station to gain understanding of relative contribution/loading? I am not sure if the station allows for hydro though.	Currently, GWCC-1 empties into a pool of water, below the water's surface and so it is not possible to directly measure hydrology. However, given the importance of water quality from this source (it's the main contributor to lower Porcupine Creek), it may be possible to try to construct a wier to isolate the seepage for that purpose. This can be considered for 2016 events.
28	1	Where are the survey results?	The instrumentation survey results have been included in Tables 7 and 8.
28	2	How much greater?	The range of values over 3 mm from the survey results have been stated in the text.
28	3	Include in recommendations.	The recommendations related to instrumentation surveys have been included in the recommendation section.
30	1	Section numbering issue starts here	The Section numbering has been updated.
33	1	Repeat; replace with what you meant.	The text has been updated to help clarify the difference between the two means reported in the results.

Page Number	Comment Number	Comment	Response
36	1	I thought that the density was calculated through weight and volume ratio. Provide more info in methods.	More information on calculating water equivalency and % snow density has been included in the methods section.
36	2	Why? [in regard to Forty Mile Station climate data]	The text has been updated to clarify why local comparative meteorological data were not available for comparison.
37	1	Was this during the same time as the snow survey; if not identify what the MS snow level was at time of snow survey.	The text has been updated. The unusually high snow depths recorded at site do not overlap with the snow survey.
37	2	Previous section states that this occurred on the 26th	Date has been updated to January 26th
37	3	In which direction would this have skewed the results? I thought the method would have caused an exaggeration of the density (which was eluded to in a previous section of this report) although here it appears that you are saying the contrary. Please provide a bit more detail as to why density is lower than the actual and why snow-water equivalent would be affected.	The text has been updated in the manual snow survey data write up in the QA/QC section.
37	4	Not sure here: I can imagine that density would be affected, although I don't know how/why the actual snow-water equivalent would be affected.	The text has been updated to help clarify why the calculated values may lower than actual site conditions.