

# July 2015 Clinton Creek Surface Water Quality and Hydrological Monitoring Program Report

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## 1.0 INTRODUCTION

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

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 2015 summer sampling program was to monitor the current status of water quality at the Site as part of the overall care, maintenance and closure program objectives for the Site.

### 1.1 SITE LOCATION AND HYDROLOGICAL SETTING

The Site is located approximately 75 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 (**Figure 2**). 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 (**Figure 2**). 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

**Clinton Creek Surface  
 Water Quality and  
 Hydrological Monitoring  
 Program**

Figure 1  
 Project Area Overview

Date: Nov. 26, 2015	Drawn by: CJ
ELR Project #: 15-208.1	Rev. #: 1
Hemmera Project #: 1343-005.10	

# Clinton Creek Surface Water Quality and Hydrological Monitoring



Client:



## Legend

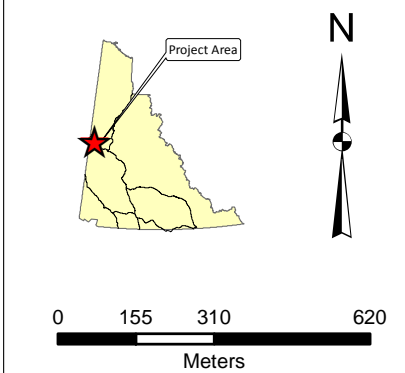
### Water Type

- Surface Water
- Groundwater

### Site Type

- Exposed
- Reference

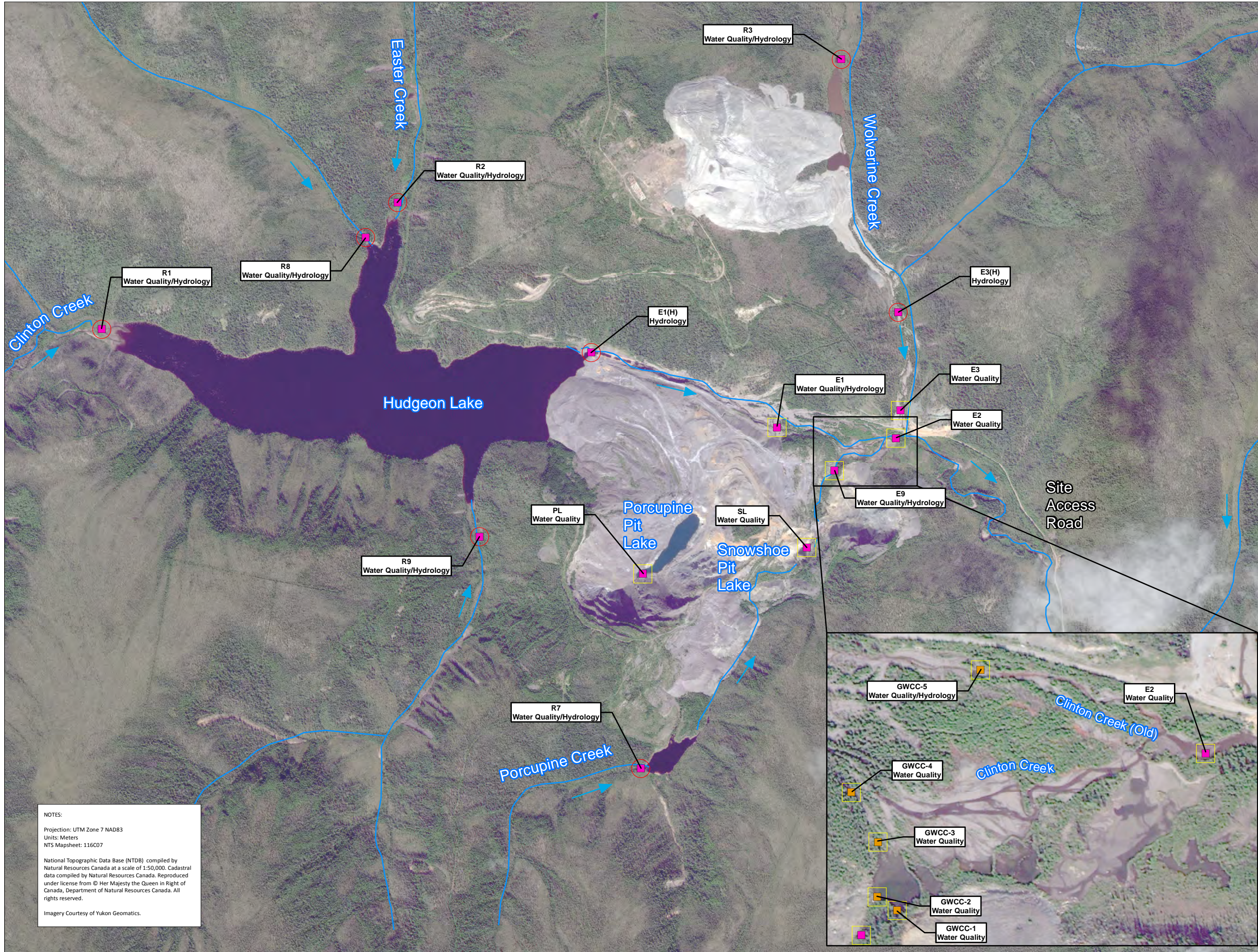
— Topographic Watercourse Data  
(may not be truly representative of on-site conditions)



**FIGURE 2**  
Sampling Stations  
Site Area

Date: Nov.25, 2015      Scale: 1:15,000

ELR Project #: 15-208.1      Rev. #: 3  
Hemmera Project #: 1343-005.10



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## 1.2 JULY 2015 MONITORING PROGRAM SCOPE

In accordance with the documented *Scope of Work: Clinton Creek Surface Water Quality and Hydrological Monitoring Program (July 2015)*, provided to ELR/Hemmera by AAM, the 2015 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 scope of work for the July sampling event included:

- Conducting surface water quality sampling at 15 designated water quality stations and 7 groundwater seep/pit lake stations. *In-situ* water quality measurements and samples for laboratory analysis are to be collected at each sample site;
- Measuring stream discharge at all sample sites where flowing water was present.
- Installing a staff gauge at the Snowshoe Pit lake.
- Assisting with the site selection for two new hydrometric stations, including the installation of staff gauges and benchmarks, and surveying.
- Clearing and marking trails for sampling identification along Wolverine Creek and Porcupine Creek.
- 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 methods 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 2015 PROGRAM SAMPLE SITES

A total of 24 water quality and hydrology sites were included in the July 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 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**.

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 and again in 2015 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. No other access route was identified that would provide safe access, and therefore the site was not sampled. Photos of the Porcupine Pit Lake taken during the site assessment are provided in **Appendix 1, Photo 15**.

For the 2015 program, two additional reference sites had been added to the monitoring program as per the gap analysis; *Review of Clinton Creek Surface Water Quality and Hydrological Monitoring Plan* provided to AAM in March 2015 (Hemmera/ELR 2015). The two new sites are R8 (tributary of Hudgeon Lake west of Easter Creek) and R9 (unnamed tributary to Hudgeon Lake located on the south of the lake) where both flow data water chemistry data were collected. These additions will provide further detail on the quantity and quality of stream inputs to Hudgeon Lake.

**Table 1 Sample Site Descriptions and Locations**

Station Code	Hydrology Data Collected	Water Quality Samples Collected	Station Description	Location (UTM, Zone 7N)	
				Easting	Northing
<b>Exposed Sites</b>					
E1		✓	Clinton Creek downstream of gabions	513645	7147111
E1(H)	✓		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		✓	Forty Mile River downstream of Clinton Creek	519457	7142795
E9 <sup>1</sup>			Porcupine Creek at its discharge into Clinton Creek	-	-
<b>Reference Sites</b>					
R1	✓	✓	Clinton Creek upstream of Hudgeon Lake	510718	7147525
R2	✓	✓	Easter Creek upstream of Hudgeon Lake	512023	7148061
R3	✓	✓	Wolverine Creek, upstream of tailings	513952	7148677
R4	✓	✓	Eagle Creek, upstream of culvert	515981	7145344
R6		✓	Forty Mile River, upstream of Clinton Creek	519485	7141731
R7	✓	✓	Porcupine Creek, upstream of waste rock	513026	7145669
R8	✓	✓	Unnamed creek that enters Hudgeon Lake west of Easter Creek	511885	7147805
R9	✓	✓	Unnamed stream input on the south side of Hudgeon Lake	512343	7146753
<b>Groundwater Seepage and Pit Sites</b>					
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		✓	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	✓	✓	Groundwater flows in old Clinton Creek channel	513984	7147127
SL		✓	Snowshoe Pit Lake from shore	513824	7146703
PL			Porcupine Pit Lake from shore	-	-

<sup>1</sup> - Site E9 was not established during the July 2015 program as there was no surface water flow at the site.

# Clinton Creek Surface Water Quality and Hydrological Monitoring



Client:



## Legend

### Water Type

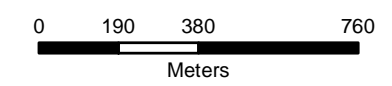
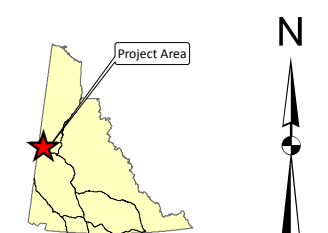
■ Surface Water

### Site Type

□ Exposed

○ Reference

— Topographic Watercourse Data  
(may not be truly representative of on-site conditions)



**FIGURE 3**  
Sampling Stations  
Forty Mile River Area

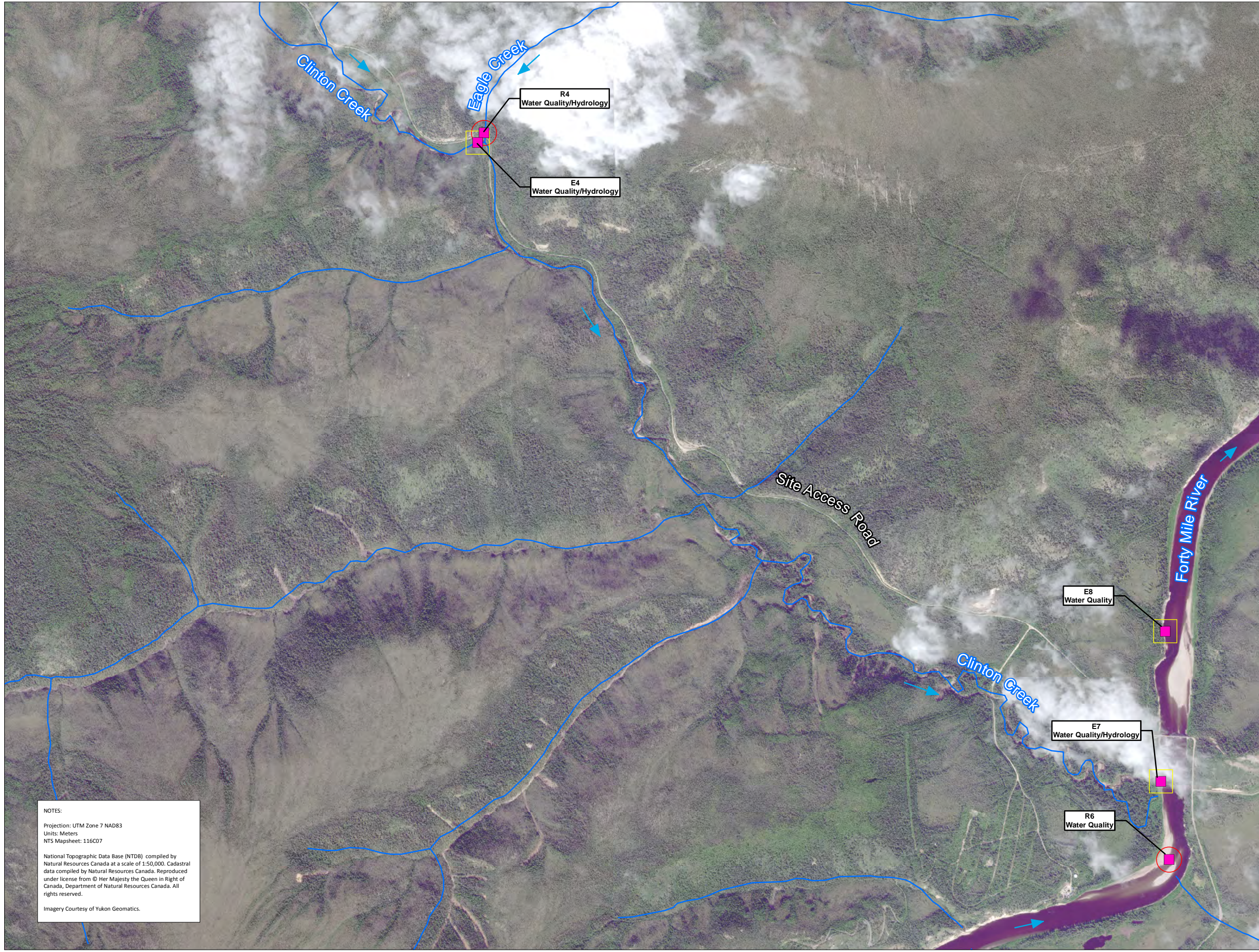
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ELR Project #: 15-208.1

Rev. #: 3

Hemmera Project #: 1343-005.10



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## 2.0 METHODS

Four (4) Hemmera/ELR staff (Chris Harwood, Glenn Rudman, Deb Bryant, and Aaron Nicholson) completed the surface water quality and hydrological field program from July 16, 17, and 24 to 26, 2015. 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 and Lamotte 2020e turbidity meter:

- Water temperature (°C);
- pH (pH units);
- Oxidation-Reduction Potential (ORP; mv);
- Turbidity (NTU);
- Conductivity and Specific Conductivity ( $\mu\text{s}/\text{cm}$ ); and,
- Dissolved oxygen (mg/L and percent saturation).

Following the collection of field *in-situ* parameters at each site, 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. Sites R4, E1, E2, E3, E4, and GWCC-5 were sampled over two days, with pH, conductivity, total suspended solids (TSS), nitrate, nitrite, and sulphate collected on the second day to ensure that laboratory hold times were met given the remote location of the site. The laboratory analytical bottle set for the 2015 monitoring program included nine (9) bottles for each site, as detailed in **Table 2**, below. Nitric acid ( $\text{HNO}_3$ ) 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 ( $\text{H}_2\text{SO}_4$ ) 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 <sub>3</sub>
2 of 9	125 ml	Plastic	Low Level Total Metals and Hardness	Preserved	HNO <sub>3</sub>
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 <sub>2</sub> SO <sub>4</sub>
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 <sub>2</sub> SO <sub>4</sub>
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 site was recorded, including any identifiable features or conditions that may have influenced water quality results. Photos were taken at each 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. These photographs 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 either transported by Hemmera/ELR or shipped via Air North under chain of custody and using custody seals to ALS Global laboratories in Whitehorse, Yukon 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).

For the 2015 sampling year, analysis of speciated Chromium was included with the laboratory analytical program to determine whether exceedances of CCME-FAL guidelines may be occurring on site for either Chromium (III) or (IV). This was based on 2014 observations that unspicated 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 unspicated Chromium. During the July 2015 sampling, water samples for both dissolved and total Chromium (III) and (IV) were collected, and were submitted to the lab on hold. Once the unspicated results were reviewed, analysis of speciated Chromium was initiated for those results where the concentration of unspicated Chromium exceeded the Chromium (III) or (IV) CCME-FAL guideline.

## **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 summer 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:

$$RPD = \left( \frac{\frac{(x_1 - x_2)}{(x_1 + x_2)}}{2} \right) \times 100$$

RPD is not calculated if either the sample or the field duplicate concentration is less than five times the detection limit. QA/QC analytical results including RPD values are presented in **Table 4**.

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

Duplicate laboratory analytical samples were collected at Sites E2 and GWCC-3, using the same duplicate methods. Corresponding test samples can be found in **Table 4**. Instances where the duplicate results and the test results exceeded the acceptable RPD limit of 20% are bold and underlined within the tables, and discussed in the following sections. Field and travel blank sample results are provided for comparison.

Specific QA/QC results are provided in section **3.1.3**.

## **2.2 HYDROLOGICAL MONITORING**

### **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 Swiffer Model 2100 Series Current Velocity Meter.

### **2.2.1.1 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 (to ensure station readings were accurate and that no significant variance between the two measurement sets had occurred).

### **2.2.1.2 Data Analysis**

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)]. Detailed information about each PS (e.g., specific location, PS type, photos, staff gauge, benchmarks and photos) is provided in **Appendix 4**. Hemmera/ELR worked with Northern Avcom during the installation of the PSs, where Hemmera/ELR provided direction on the location for PS installation, and Northern Avcom supplied all materials and completed the installation and setup. 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 downloaded remotely on an ongoing basis via a satellite connection through the meteorological station, and are downloaded by Hemmera/ELR following each field event. The data from the PS on Wolverine Creek are downloaded manually during each field sampling and monitoring event using a laptop computer with the required software installed on it.

### **2.2.2.1 QA/QC Program for Automated Discharge Monitoring**

The data downloaded from each PS are checked for completeness (complete record since installation or the previous download). For the PS installed on Wolverine Creek, a preliminary QA/QC review of the data can be completed in the field. Any omissions or anomalies in the data are reviewed and investigated.



Additional data are also collected during each field event at the PS locations. Previously installed benchmarks and PS housings are surveyed to check for any movement in the PS housing (and PS) over time and manual staff gauge readings are collected which provide an additional stage reading that can be used in stream discharge calculations.

#### **2.2.2.2 Data Analysis**

No analysis is provided in this report for automated discharge and stream temperature data as both PSs were installed in July 2015, within a few days of the field event when manual discharge data were collected. Future reports will present the method for calculating the stage-discharge relationship and the discharge values ( $\text{m}^3/\text{s}$ ) for each stream over time.

#### **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 commissioning/maintenance checklist information for the MS is provided in **Appendix 5** of this report. The MS is equipped with the following instrumentation:

- Precipitation gauge (not an all-weather precipitation gauge)
- Ambient air temperature and relative humidity
- Barometric pressure
- Wind speed and direction

##### **2.2.3.1 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 was 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 is found, other data (e.g., local or regional meteorological data, or PS data) was used to check the anomalous data wherever possible.

##### **2.2.3.2 Data Analysis**

Data downloaded from the MS were converted to Microsoft Excel format to allow the data to be reviewed and graphed. Data were graphed for precipitation, ambient air temperature, relative humidity, and barometric pressure. 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 20 water quality sites were sampled during the sampling program, including eight (8) reference surface water sites, six (6) exposed surface water sites, five (5) exposed groundwater seepage sites, and one (1) pit lake (**Table 1**). Hemmera/ELR staff found the condition at the sample sites to be representative of mid-summer conditions with low to moderate flows at the various sample sites. No activities or observations were made 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 5.9°C (R2) to 17.3°C (R6), while surface water temperatures at exposed sites ranged from 3.7°C (GWCC-1) to 19°C (E1). Field pH readings at reference sites ranged from 7.39 (R7) to 8.27 (R4), while field pH readings at exposed sites ranged from 7.36 (GWCC-1 and GWCC-5) to 8.27 (E1).

Surface water conductivity varied significantly between sites. Reference site conductivity ranged between 125.6 µs/cm (R7) and 492.5 µs/cm (R1), with the lowest observed values found at Sites R7 and R8. Exposed stream sites ranged in conductivity from 203 µs/cm at Site E8 to 1,418 µs/cm at Site GWCC-1. Exposed site conductivity was highest at the groundwater seepage sites GWCC-1 and GWCC-2 (1,418 and 1,045 µs/cm, respectively) as well as in Snowshoe Pit Lake (SL; 1,336 µs/cm).

Measured concentrations of dissolved oxygen ranged from 1.9 mg/L (GWCC-4) to 11.16 mg/L (R4) at surface water sites (both reference and exposed). The dissolved oxygen measured at all groundwater seepage sites was less than the CCME-FAL minimum of 5.5 mg/L. This is anticipated and a good indication that they are in fact groundwater seeps. Recorded values at sites GWCC-1, GWCC-2, GWCC-3, GWCC-4 and GWCC-5 were 4.24 mg/L, 5.01 mg/L, 3.78 mg/L, 1.9 mg/L and 2.23 mg/L, respectively.

#### 3.1.2 Laboratory Analytical Water Quality Results

Laboratory analytical results are summarized in **Table 3**. Laboratory analytical results are presented with comparison to CCME-FAL guidelines. Exceedances for CCME-FAL guidelines are shaded within those tables.

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 below in **Section 3.1.3**.

### **3.1.2.1 Reference Sites**

Amongst the reference sites, exceedances of the CCME-FAL guidelines were identified in one or more sites for aluminum, chromium (IV; hexavalent), copper, iron, and selenium.

Total aluminum exceeded the CCME-FAL guideline level of 0.1 mg/L at Sites R3 (2.08 mg/L), R6 (0.378 mg/L), R7 (0.383 mg/L), and R8 (0.147 mg/L). Dissolved aluminum exceeded the CCME-FAL guideline level of 0.1 mg/L at Site R7 (0.109 mg/L).

Total chromium (IV) exceeded the CCME-FAL guideline level of 0.001 mg/L at Site R3 (0.0033 mg/L).

Total copper exceeded the CCME-FAL guideline level at Sites R3 (0.0697 mg/L compared to CCME-FAL guideline of 0.004 mg/L), R6 (0.0035 mg/L compared to CCME-FAL guideline of 0.00292 mg/L), R7 (0.00484 mg/L compared to CCME-FAL guideline of 0.00245 mg/L), and R8 (0.00326 mg/L compared to CCME-FAL guideline of 0.002233 mg/L). Dissolved copper exceeded the CCME-FAL guideline level at Sites R7 (0.00435 mg/L compared to CCME-FAL guideline of 0.00245 mg/L), and R8 (0.00239 mg/L compared to CCME-FAL guideline of 0.002233 mg/L).

Total iron exceeded the CCME-FAL guideline level of 0.3 mg/L at Sites R1 (0.382 mg/L), R3 (3.99 mg/L), R4 (0.315 mg/L), R6 (0.646 mg/L), R7 (2.3 mg/L), and R9 (1.38 mg/L). Dissolved iron exceeded the CCME-FAL guideline level of 0.3 mg/L at Sites R3 (0.358 mg/L), R7 (1.65 mg/L), and R9 (1.17 mg/L).

Total selenium exceeded the CCME-FAL guideline level of 0.001 mg/L at Sites R1 (0.00126 mg/L), R4 (0.00225 mg/L), and R9 (0.00156 mg/L). Dissolved selenium exceeded the CCME-FAL guideline level of 0.001 mg/L at Sites R1 (0.00137 mg/L), R4 (0.00240 mg/L), and R9 (0.00159 mg/L).

### **3.1.2.2 Exposed Sites**

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

Total aluminum exceeded the CCME-FAL guideline level of 0.1 mg/L at Sites E3 (0.135 mg/L), E8 (2.32). While no site-specific observations were made that describe why these exceedances occurred, the monitoring data from related reference sites (R3 and R6) upstream from these sites also exceeded the total aluminum guideline, which suggests that inputs from upstream are likely contributors to the observed guideline exceedances (**Table 5**)

**Table 5 Comparison of Parameter Exceedences 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	E3	0.135	R3 (2.08)
	E8	2.32	R6 (0.378)
Total Copper	E8	0.00821	R6 (0.0035)
Total Iron	E8	3.83	R6 (0.646)
	E3	0.402	R3 (3.99)
Total Selenium	E1	0.00121	R1 (0.00126), R9 (0.00156)
	E2	0.00129	R1 (0.00126), R9 (0.00156), GWCC-1 (0.00419), GWCC-2 (0.00319), GWCC-3 (0.00129), GWCC-5 (0.00351)
	E4	0.00106	R1 (0.00126), R9 (0.00156), GWCC-1 (0.00419), GWCC-2 (0.00319), GWCC-3 (0.00129), GWCC-5 (0.00351)
Dissolved Selenium	E1	0.00121	R1 (0.00137), R9 (0.00159)
	E2	0.00121	R1 (0.00137), R9 (0.00159), GWCC-1 (0.00435), GWCC-2 (0.00323), GWCC-3 (0.00135), GWCC-5 (0.00357)
	E4	0.00116	R1 (0.00137), R9 (0.00159), GWCC-1 (0.00435), GWCC-2 (0.00323), GWCC-3 (0.00135), GWCC-5 (0.00357)

Both total and dissolved arsenic exceeded the CCME-FAL guideline level of 0.005 mg/L at Site SL (0.0146 mg/L and 0.0148 mg/L, respectively). As Site SL is an isolated pit, no potential external influences on water quality were noted during the program that may have contributed to these exceedences.

Total hexavalent chromium (IV) exceeded the CCME-FAL guideline level of 0.001 mg/L at Sites GWCC-1 (0.0024 mg/L) and GWCC-2 (0.0016 mg/L). Dissolved hexavalent chromium (IV) exceeded the CCME-FAL guideline level of 0.001 mg/L at Sites GWCC-1 (0.0018 mg/L) and GWCC-2 (0.0014 mg/L). As Sites GWCC-1 and GWCC-2 are groundwater seepages, no potential external influences on water quality were noted during the program that may have contributed to these exceedences.

Total copper exceeded the CCME-FAL guideline level at Site E8 (0.00821 mg/L compared to CCME-FAL guideline of 0.00276 mg/L). While no site-specific observations were made that describe why this exceedence occurred, the monitoring data from the reference site (R6) upstream from this site also exceeded the total copper guideline, which suggests that input from upstream is a likely contributor to the observed guideline exceedance at E8 (**Table 5**).

Total iron exceeded the CCME-FAL guideline level of 0.3 mg/L at Sites E3 (0.402 mg/L), E8 (3.83 mg/L). While no site-specific observations were made that describe why these exceedences occurred, the monitoring data from related reference sites (R6 and R3) upstream from these sites also exceeded the total iron guideline, which suggests that inputs from upstream are likely contributors to the observed guideline exceedences (**Table 5**).

Total selenium exceeded the CCME-FAL guideline level of 0.001 mg/L at Sites E1 (0.00121 mg/L), E2 (0.00129 mg/L), E3 (0.00132 mg/L), E4 (0.00106 mg/L), SL (0.0159 mg/L), GWCC-1 (0.00419 mg/L), GWCC-2 (0.00319 mg/L), GWCC-3 (0.00129 mg/L), and GWCC-5 (0.00351 mg/L). While no site-specific observations were made that describe why the total selenium exceedences occurred at these sites, exceedences were noted at other sites upstream to these sites that may have been a contributing factor. As noted in **Table 5**, Site E1 may have been influenced by elevated total selenium at Sites R1 and R9, and Sites E2 and E4 may have been influenced by elevated total selenium at Sites R1, R9, and GWCC seepage Sites 1, 2, 3, and 5.

Dissolved selenium exceeded the CCME-FAL guideline level of 0.001 mg/L at Sites E1 (0.00121 mg/L), E2 (0.00121 mg/L), E3 (0.00129 mg/L), E4 (0.00116 mg/L), SL (0.0169 mg/L), GWCC-1 (0.00435 mg/L), GWCC-2 (0.00323 mg/L), GWCC-3 (0.00135 mg/L), and GWCC-5 (0.00357 mg/L). While no site-specific observations were made that describe why the dissolved selenium exceedences occurred at these sites, exceedences were noted at other sites upstream to these sites that may have been a contributing factor. As noted in **Table 5**, Site E1 may have been influenced by elevated dissolved selenium at Sites R1 and R9, and Sites E2 and E4 may have been influenced by elevated total selenium at Sites R1, R9, and GWCC seepage Sites 1, 2, 3, and 5.

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

Two duplicate surface water samples were collected during the summer sampling event. One travel blank was provided by the laboratory and accompanied the samples throughout the sampling program. One field blank was prepared during the sampling program. Detailed results of 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 below detection limits for all analysed parameters with the exception of detected ammonia in the travel blank (0.0100 mg/L). Ammonia detection in the travel blank is considered to be acceptable and is a regular occurrence, and is not considered to represent any type of contamination issue.

All RPD values for duplicate samples (E2 and GWCC-3) were within an acceptable range of variability (below 20%), with the exception of the following results in sample E2:

- Total Aluminum (RPD 48.9%)
- Total Chromium (RPD 75.11%)
- Total Iron (RPD 47.38%)

RPD values exceeding 20% for metals can indicate a sampling or analytical bias. The RPD for other metal parameters in QA/QC samples was within 20%, thus there does not seem to be a systemic bias. Further, the observed RPD exceedances were for total metals and similar exceedances were not observed for dissolved metals. Sampling of total metals using unfiltered methods can introduce sediment from the watercourse, which could result in the observed variances.

Laboratory replicates and additional quality control measures (i.e. matrix spikes) were 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 slight variability amongst total metals results amongst sample and duplicate results for several metals, but do not suggest a systemic issue with sampling practices or contamination, as evidenced by acceptable variation between sample and duplicate results for dissolved metals, and non-detection of parameters in the program field blank.

### **3.2 SURFACE WATER MANUAL DISCHARGE MONITORING RESULTS**

Stream hydrological monitoring was completed at 12 of the 24 sites visited during the monitoring program. Hydrological monitoring was not conducted at the pit lakes or at groundwater sites GWCC-1, GWCC-2, GWCC-3 or GWCC-4, due to a lack of defined channels and/or sufficient flows. Hydrological measurements could not be collected by Hemmera/ELR at the Forty Mile River Sites (R6 and E8), as the river is too deep and wide to manually collect measurements safely.

Hydrological 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 Hydrological Data Collected During the Monitoring Program**

Site Type	Site	Wetted Width (m)	Mean Channel Depth (m)	Mean Velocity (m/s)	Mean Calculated Discharge (m <sup>3</sup> /s)
Reference Sites	R1	4.07	0.11	0.395	0.2119
	R2	1.78	0.09	0.235	0.0587
	R3	2.39	0.065	0.365	0.0754
	R4	1.68	0.045	0.63	0.0349
	R6	Forty Mile River			
	R7	0.90	0.23	0.0	0.000
	R8	0.49	0.08	0.06	0.0027
	R9	0.86	0.04	0.075	0.0032
	Exposed Sites	E1(H)	9.93	0.165	0.19
E2		Not included in program			
E3(H)		2.52	0.125	0.125	0.0542
E4		5.9	0.15	0.485	0.4936
E7		4.91	0.165	0.54	0.586
E8		Forty Mile River			
E9		No water present at Site			
Groundwater Seepages and Pits	GWCC-1	Insufficient measurable flow present			
	GWCC-2				
	GWCC-3				
	GWCC-4				
	GWCC-5	0.92	0.025	0.05	0.0029
	SL	Not included in program			
	PL				

Stream crossings were successfully carried out at all sites, twice. R7 was flowing too slowly for the Swiffer flow meter to measure any discharge. In addition to R7, low flows were also present at R2, R4, and GWCC-5. Turbulent flow was evident at R4, E4, E7, this is likely a combination of low flow conditions and the substrate present on site, however the data collected represents the best possible data available for the site at the time.

### 3.2.1 QA/QC for Surface Water Manual Discharge Measurements

### 3.3 AUTOMATED DISCHARGE MONITORING

No analysis is provided in this report for automated discharge and stream temperature data as both PSs were installed in late July 2015, within a few days of the field event to collect manual discharge data. Not enough time had elapsed for sufficient data to be collected. Future reports will present information on the stage-discharge relationship at each of the PSs, the discharge values (m<sup>3</sup>/s) and water temperatures (°C) for each stream over time.

Data from the PS datalogger installed in Hudgeon Lake [Site E1(H)] will also be downloaded and used within the surface water discharge section of this report.

### **3.4 METEOROLOGICAL DATA**

Meteorological station (MS) data were downloaded and are reported for the period of April 1 to July 31, 2015. Hemmera/ELR found all the data parameters to be complete for the period being reported except for five (5) hours of missing data on July 15, 2015, which accounts for only 0.03% of the reporting period. The missing data was due to the MS being powered down for a short period of time to allow for instrument upgrades. Each recorded parameter is discussed further below.

#### **3.4.1 Hourly Ambient Air Temperature**

Hourly and daily air temperatures were recorded at the MS for the period of April 1 to July 31, 2015. Hourly mean air temperatures for the reporting period are shown in **Figure 4**, with daily fluctuations in temperatures being apparent and within an expected range. No anomalous data were observed. The maximum mean hourly air temperature recorded by the MS for the reporting period was 28.8°C on May 23 at 4:00 pm and the minimum temperature recorded was -11.2°C on April 2 at 7:00 am (**Figure 4**). The mean temperature for the reporting period was 10.3°C (Standard Deviation [SD] =  $\pm 8.11^\circ\text{C}$ ).

#### **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 reported as a percentage. Higher percentages indicate more water vapour. Hourly and daily relative humidity data were recorded at the MS for the period April 1 to July 31, 2015. Mean hourly relative humidity data for the reporting period are presented in **Figure 4**. No anomalous data were observed. The maximum hourly mean relative humidity recorded by the MS over the reporting period was 97.8%, recorded on both April 10 and June 4 between 5:00 and 7:00 am. The mean relative humidity for the reporting period was 60.31% (SD=  $\pm 23.54\%$ ).

#### **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 April 1 to July 31, 2015 (**Figure 4**). No anomalous data were observed. The maximum BP recorded for the reporting period was 982 mbar on June 13 at 9:00 am. The minimum BP recorded for the same period was 929 mbar and the mean for the whole reporting period was 957 mbar (SD=  $\pm 7.85$  mbar).



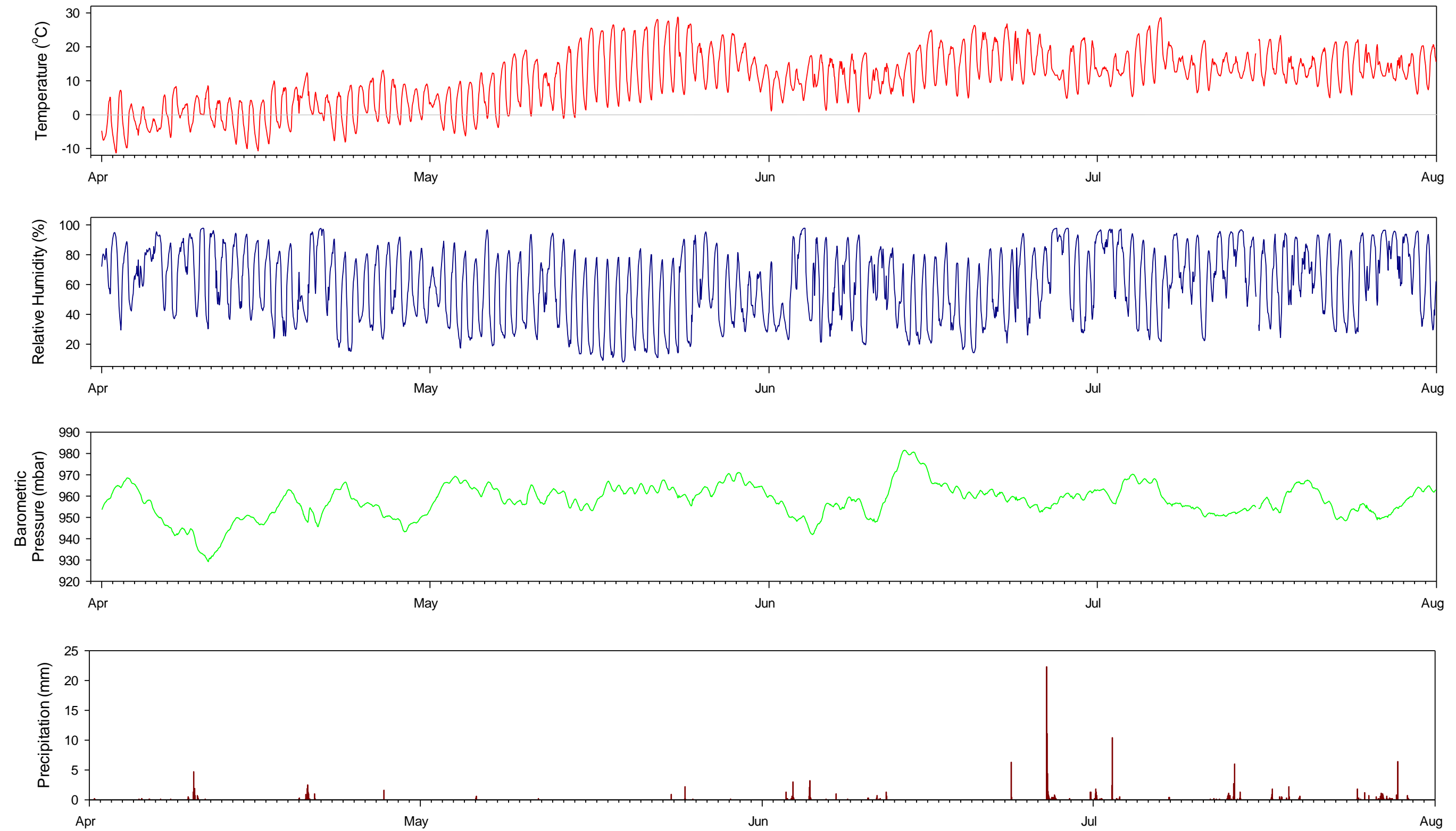


Figure 4 Temperature, Relative Humidity, Barometric Pressure, and Precipitation Data from the Clinton Creek Meteorological Station, April 1 2015 to July 31, 2015

### 3.4.4 Precipitation (rain)

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 April 1 to July 31, 2015 (**Figure 4**). The maximum mean hourly rainfall recorded during the reporting period was 22 mm on June 26 at 7:00 pm. The calculated rainfall for the same entire day (June 26, 2015) was 40 mm. The minimum mean hourly rainfall recorded for the reporting period was 0 mm which accounted for approximately 94% of the entire reporting period. The total recorded rainfall throughout the reporting period was 168.1 mm.

### 3.4.5 Wind Speed and Direction

Mean hourly wind speed data, wind direction and frequency were recorded by the MS for the period of April 1 to July 30, 2015. No anomalous data were observed. The maximum mean hourly wind speed recorded at the MS was 8.38 m/s (about 30 kilometres per hour [km/h]), recorded on April 19 at 8:00 am. The mean wind speed over the entire reporting period was 2.06 m/s (SD= ±1.29 m/s).

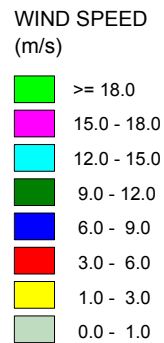
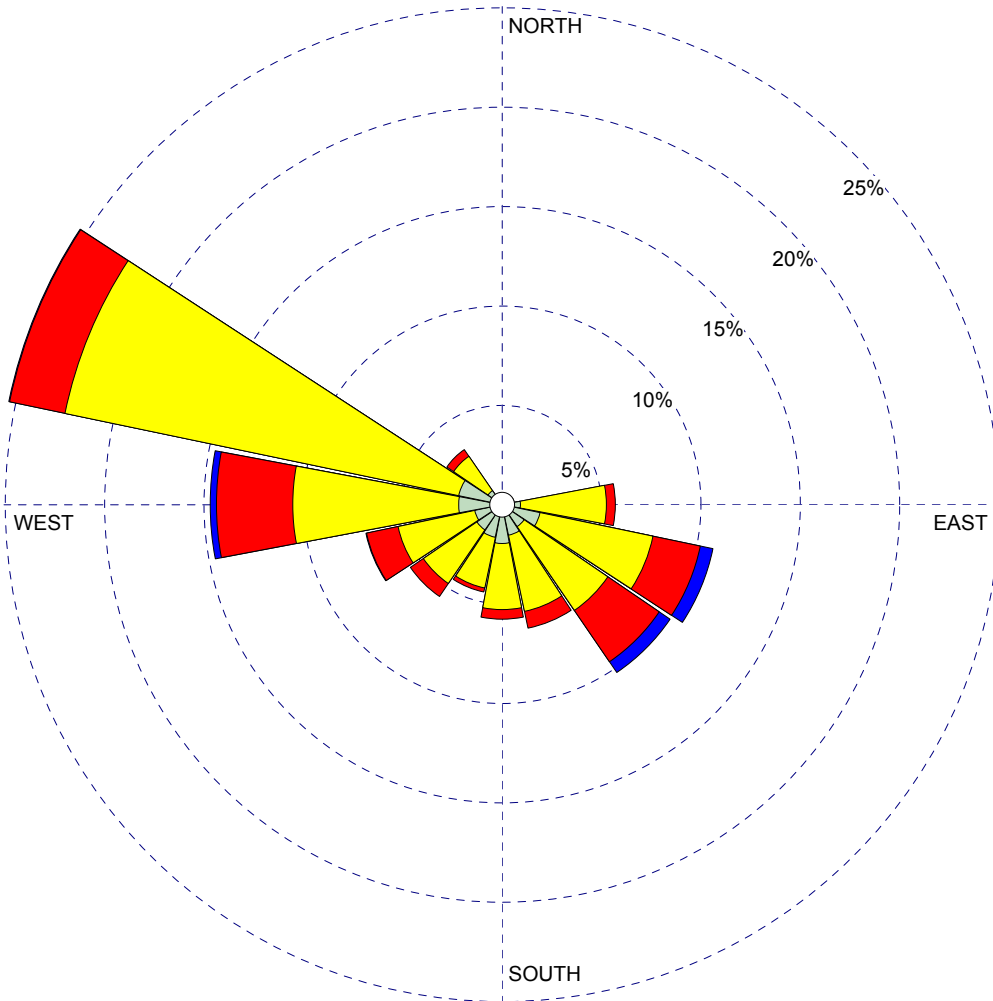
A wind rose for the entire reporting period is presented in **Figure 5**, and the tabulated wind speed and direction frequency for the same period is presented in **Table 7**. The wind data indicate that about 25% of the recorded winds were from a west-north-west direction with speeds ranging from less than 1 to 6 m/s, and about 21% of the recorded winds were from a south easterly and east-south-easterly direction and ranged in speed from less than 1 to 9 m/s (**Figure 5; Table 7**).

**Table 7 Frequency of Wind Direction and Speed Classes from April 1 – July 31 2015 MS Data**

Wind Directions		Wind Classes (m/s)								Total (%)
		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	
N	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<b>0.0</b>
NNE	%	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	<b>0.1</b>
NE	%	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	<b>0.2</b>
ENE	%	0.1	0.4	0.1	0.0	0.0	0.0	0.0	0.0	<b>0.6</b>
E	%	0.9	4.3	0.4	0.0	0.0	0.0	0.0	0.0	<b>5.7</b>
ESE	%	2.0	5.8	2.4	0.7	0.0	0.0	0.0	0.0	<b>10.8</b>
SE	%	1.3	5.1	3.1	0.7	0.0	0.0	0.0	0.0	<b>10.2</b>
SSE	%	1.6	3.9	0.9	0.0	0.0	0.0	0.0	0.0	<b>6.3</b>
S	%	2.0	3.3	0.5	0.0	0.0	0.0	0.0	0.0	<b>5.7</b>
SSW	%	1.7	2.6	0.2	0.0	0.0	0.0	0.0	0.0	<b>4.5</b>
SW	%	1.5	3.3	0.8	0.0	0.0	0.0	0.0	0.0	<b>5.6</b>
WSW	%	1.4	3.9	1.6	0.0	0.0	0.0	0.0	0.0	<b>7.0</b>
W	%	2.2	8.3	3.8	0.3	0.0	0.0	0.0	0.0	<b>14.6</b>
WNW	%	2.2	20.2	2.8	0.0	0.0	0.0	0.0	0.0	<b>25.3</b>
NW	%	0.9	2.1	0.4	0.0	0.0	0.0	0.0	0.0	<b>3.4</b>
NNW	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<b>0.0</b>
Total	%	17.8	63.4	17.1	1.7	0.0	0.0	0.0	0.0	<b>100.0</b>

WIND ROSE PLOT:  
**Clinton Creek, YT**  
**Wind Rose. April to July 2015**

DISPLAY:  
**Wind Speed**  
**Direction (blowing from)**



1 m/s equals 3.6 km/h.

DATA PERIOD:  
**Start Date: 4/1/2015 - 00:00**  
**End Date: 7/31/2015 - 23:00**

COMPANY NAME:  
**Hemmera / ELR Ltd.**

MODELER:  
**GMR**

TOTAL COUNT:  
**2922 hrs.**

AVG. WIND SPEED:  
**2.06 m/s**

DATE:  
**11/19/2015**



PROJECT NO.: 1343-005.10

### **3.4.6 QA/QC for Meteorological Data**

Where meteorological data were outside expected ranges or were suspected to be anomalous (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).

After reviewing the April 1 to July 31 MS data, only one data set was investigated further: the relatively high rainfall value recorded on June 26, 2015 was compared to the data collected at the Government of Yukon Wildland Fire Management meteorological station, located approximately 11 km southeast of the Clinton Creek MS. The corresponding rainfall recorded by the wildland fire meteorological station on June 26 was 18.4 mm, indicating that the value recorded at Clinton Creek, although high, is likely correct.

The precipitation values recorded in April 2015 (25.5 mm) coupled with the low air temperatures for the month (below 0°C) indicate that some of the precipitation at Clinton Creek in April may have been snow. 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 rain data during the colder months of the year may not be representative of actual rainfall.

## **4.0 RECOMMENDATIONS**

Hemmera/ELR has no recommendations for the current Clinton Creek water quality and hydrological monitoring program completed in July 2015. Hemmera/ELR is continuing to implement past recommendations (from the 2014 program) on site, and will continue to do so during the fall 2015 program. Any future recommendations will be detailed in this section of the report.

## 5.0 CLOSURE

Hemmera/ELR are pleased to provide the Government of Yukon, Assessment and Abandoned Mines this report that summarizes the July 2015 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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# **TABLES**

Table 3: Analytical Chemistry Data

Parameter	Units	Site Location		Surface Water - Reference Sites								Surface Water - Exposed Sites								Groundwater - Exposed Sites				
		Sample ID	R1	R2	R3	R4*	R6	R7	R8	R9	E1*	E2*	E3*	E4*	E7	E8	PL	SL	GWCC-1	GWCC-2	GWCC-3	GWCC-4	GWCC-5*	
		Date Sampled	25/07/2015	25/07/2015	26/07/2015	24/07/2015	24/07/2015	26/07/2015	25/07/2015	25/07/2015	24/07/2015	24/07/2015	23/07/2015	24/07/2015	24/07/2015	25/07/2015	-	26/07/2015	26/07/2015	26/07/2015	26/07/2015	26/07/2015	26/07/2015	24/07/2015
		ALS Work Number	L1648323	L1648323	L1649166	L1648323	L1648323	L1649166	L1648323	L1648323	L1648323	L1648323	L1648323	L1648323	L1648323	L1648323	L1648323	-	L1648323	L1649166	L1649166	L1649166	L1649166	L1648323
<b>Physical Tests</b>																								
Lab pH	pH units	6.5-9.0 <sup>5</sup>	7.95	7.98	7.99	8.10	7.55	7.40	7.56	7.64	8.07	7.87	8.12	7.87	7.93	7.95	-	8.29	7.44	7.63	7.55	7.55	7.43	
Field pH	pH units	6.5-9.0 <sup>5</sup>	7.97	8.03	8.2	8.27	7.77	7.39	7.72	7.67	8.27	7.92	8.23	7.9	7.95	8.05	-	8.26	7.36	7.54	7.44	7.5	7.36	
Field Temperature	C	-	9.6	5.9	7.5	7.8	17.3	6.7	7.4	9.3	19	15.6	12.7	16.3	14.2	16.5	-	15.7	3.7	7.5	9.8	11	11.1	
Lab Conductivity	uS/cm	-	795	733	679	846	297	176	217	589	514	789	840	858	817	295	-	1790	2340	1680	956	694	999	
Field Conductivity	uS/cm	-	492.5	410.4	480.9	476.2	202.3	125.6	126.8	367	406.6	567	576	637	628	203	-	1336	1418	1045	684	540	665	
Field Specific Conductivity	uS/cm	-	698	647	721	710	237.4	192.8	191	524	459.2	692	752	764	790	241.9	-	1628	2396	1566	965	735	901	
Field Dissolved Oxygen	mg/L	9.5 <sup>6</sup>	9.64	11.07	10.57	11.16	8.49	7.74	10.82	9.8	8.04	8.01	9.16	8.36	8.71	8.75	-	6.12	4.24	5.01	3.78	1.9	2.23	
Field Oxidation - Redox Potent	mV	-	90.6	76.5	62.9	96.9	101.9	65.4	96.8	56.2	71	35.6	99.3	87.6	86	110.2	-	105.7	142	130.6	123.7	122.2	37.4	
Field Turbidity	NTU	-	1.12	0.36	18.8	0.85	1.89	5.94	1.85	1.86	1.09	0.37	2.28	0.64	0.68	0.77	-	0.02	0.32	4.21	0.23	1.04	0.28	
Total Suspended Solids	mg/L	-	4.7	3.3	115	<3.0	100	11.3	11.3	4.0	<3.0	<3.0	<3.0	<3.0	4.7	5.3	-	<3.0	<3.0	<3.0	<3.0	<3.0	8.0	
Total Hardness (as CaCO3)	mg/L	-	411	383	440	418	128	104	93.0	302	263	400	444	431	469	120	-	1070	1720	1230	609	427	540	
<b>Anions and Nutrients</b>																								
Nitrate (as N)	mg/L	13	0.117	0.0277	0.0521	0.116	0.0449	0.0887	<0.0050	0.200	0.103	0.107	0.0781	0.0962	0.0907	0.0464	-	<0.025	0.466	0.373	0.158	0.0681	0.0141	
Nitrite (as N)	mg/L	0.06	0.0010	<0.0010	0.0019	<0.0010	<0.0010	<0.0010	<0.0010	0.0050	0.0018	0.0013	0.0016	0.0014	0.0011	<0.0010	-	<0.0050	<0.010	<0.0050	<0.0020	<0.0010	<0.0010	
Ammonia, Total (as N)	mg/L	Varies <sup>7</sup>	0.0361	0.0104	0.0300	0.0232	0.0138	0.0714	0.0066	0.0369	0.0164	0.0216	0.0126	0.0145	0.0138	0.0069	-	0.0103	<0.0050	<0.0050	<0.0050	0.0050	0.0195	
Ammonia CCME-FAL	mg/L	-	1.151	1.343	0.806	0.6732	1.014	5.437	2.415	2.331	0.2964	0.8192	0.5078	0.8139	0.2138	0.5734	-	0.3820	7.425	3.617	3.795	3.01	4.120	
Sulfate (SO4)	mg/L	-	232	187	264	237	55.6	29.6	48.6	171	135	244	255	264	263	47.3	-	885	1410	910	394	230	287	
<b>Inorganic/Organic Carbon</b>																								
Dissolved Organic Carbon	mg/L	-	12.1	8.23	17.7	13.1	10.9	29.0	17.7	23.8	17.0	14.2	13.5	13.2	12.9	10.4	-	6.52	5.53	7.42	9.67	10.4	7.51	
<b>Dissolved Metals</b>																								
Aluminum (Al)-Dissolved	mg/L	Varies <sup>8</sup>	0.0158	0.0130	0.0470	0.0217	0.0738	0.109	0.0458	0.0367	0.0326	0.0236	0.0242	0.0155	0.0121	0.0778	-	0.0024	0.0011	0.0012	0.0020	0.0025	0.0019	
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	0.1000	-	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	
Antimony (Sb)-Dissolved	mg/L	-	0.00025	0.00055	0.00020	0.00044	0.00013	0.00022	0.00068	0.00025	0.00038	0.00047	0.00105	0.00054	0.00045	0.00014	-	0.00299	0.00130	0.00111	0.00089	0.00090	0.00081	
Arsenic (As)-Dissolved	mg/L	0.005	0.00057	0.00080	0.00074	0.00177	0.00053	0.00177	0.00037	0.00089	0.00086	0.00108	0.00125	0.00114	0.00084	0.00052	-	0.0148	0.00194	0.00137	0.00083	0.00129	0.00075	
Barium (Ba)-Dissolved	mg/L	-	0.0565	0.0552	0.0482	0.0626	0.0485	0.0905	0.0387	0.0991	0.0548	0.0521	0.0578	0.0520	0.0550	0.0421	-	0.0227	0.0173	0.0193	0.0311	0.0327	0.0574	
Beryllium (Be)-Dissolved	mg/L	-	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	0.000031	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	-	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	
Bismuth (Bi)-Dissolved	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
Boron (B)-Dissolved	mg/L	1.5	0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.077	0.053	0.047	0.110	-	0.049	0.302	0.110	0.070	0.049	0.035	
Cadmium (Cd)-Dissolved	mg/L	Varies <sup>9</sup>	0.0000859	0.0000213	0.0000086	0.000105	0.0000241	0.0000325	0.0000376	0.0000577	0.0000395	0.0000662	0.0000229	0.0000487	0.0000557	0.0000222	-	0.0000325	0.000176	0.000167	0.0000878	0.0000611	0.000112	
Cadmium CCME-FAL	mg/L	-	0.00037	0.00037	0.00037	0.00037	0.000195	0.000164	0.0001492	0.00037	0.000354	0.00037	0.00037	0.00037	0.00037	0.000184	-	0.00037	0.00037	0.00037	0.00037	0.00037	0.00037	
Calcium (Ca)-Dissolved	mg/L	-	90.2	69.5	81.4	88.5	32.5	24.3	22.5	75.8	58.3	76.9	77.0	78.7	84.1	30.7	-	241	209	178	110	84.5	124	
Chromium (Cr)-Dissolved	mg/L	-	0.00021	0.00035	0.00060	0.00035	0.00030	0.00156	0.00101	0.00075	0.00053	0.00056	0.00112	0.00060	0.00052	0.00026	-	0.00099	0.00203	0.00110	0.00049	0.00041	0.00047	
Chromium (III)-Dissolved	mg/L	0.0089	-	-	-	-	-	0.00156	0.00101	-	-	-	0.00112	-	-	-	-	-	<0.00045	<0.00042	-	-	-	
Hexavalent Chromium-Dissolved	mg/L	0.001	-	-	-	-	-	<0.0010	<0.0010	-	-	-	<0.0010	-	-	-	-	-	0.0018	0.0014	-	-	-	
Cobalt (Co)-Dissolved	mg/L	-	0.00054	0.00015	0.00038	0.00079	0.00028	0.00092	<0.00010	0.00055	0.00021	0.00058	0.00021	0.00063	0.00053	0.00022	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00018	
Copper (Cu)-Dissolved	mg/L	Varies <sup>10</sup>	0.00223	0.00143	0.00208	0.00219	0.00257	0.00435	0.00239	0.00374	0.00283	0.00229	0.00210	0.00197	0.00202	0.00243	-	0.00084	0.00091	0.00112	0.00114	0.00135	0.00081	
Copper CCME-FAL	mg/L	-	0.004	0.004	0.004	0.004	0.00292	0.00245	0.002223	0.004	0.004	0.004	0.004	0.004	0.004	0.00276	-	0.004	0.004	0.004	0.004	0.004	0.004	
Iron (Fe)-Dissolved	mg/L	0.3	0.255	0.156	0.358	0.214	0.163	1.65	0.066	1.17	0.153	0.231	0.095	0.207	0.186	0.135	-	<0.010	0.013	<0.010	<0.010	<0.010	0.061	
Lead (Pb)-Dissolved	mg/L	Varies <sup>11</sup>	<0.000050	<0.000050	0.000116	<0.000050	<0.000050	0.000104	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
Lead CCME-FAL	mg/L	-	0.007	0.007	0.00436	0.007	0.00334	0.002901	0.007	0.00334	0.002901	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	-	0.0041	0.0067	0.0030	0.0049	0.0042	<0.0010	<0.0010	<0.0010	0.0029	0.0081	0.0054	0.0124	0.0132	0.0043	-	0.0109	0.0780	0.0127	0.0080	0.0066	0.0099	
Magnesium (Mg)-Dissolved	mg/L	-	45.0	50.7	57.4	48.0	11.5	10.5	8.93	27.3	28.4	50.5	61.0	57.1	62.8	10.6	-	114	292	191	81.4	52.5	55.6	
Manganese (Mn)-Dissolved	mg/L	-	0.339	0.0869	0.122	0.197	0.0424	0.290	0.00560	0.367	0.0492	0.0828	0.0542	0.118	0.191	0.0229	-	0.00207	0.00025	0.00013	0.00023	0.00052	0.0128	
Mercury (Hg)-Dissolved	mg/L	0.000026	0.0000053	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000063	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	0.0000056	0.0000076	<0.0000050	<0.0000050	
Molybdenum (Mo)-Dissolved	mg/L	0.073	0.00164	0.000802	0																			



Table 3: Analytical Chemistry Data

Parameter	Units	Site Location		Surface Water - Reference Sites									Surface Water - Exposed Sites						Groundwater - Exposed Sites					
		Sample ID	R1	R2	R3	R4*	R6	R7	R8	R9	E1*	E2*	E3*	E4*	E7	E8	PL	SL	GWCC-1	GWCC-2	GWCC-3	GWCC-4	GWCC-5*	
		Date Sampled	25/07/2015	25/07/2015	26/07/2015	24/07/2015	24/07/2015	26/07/2015	25/07/2015	25/07/2015	24/07/2015	24/07/2015	23/07/2015	24/07/2015	24/07/2015	25/07/2015	-	26/07/2015	26/07/2015	26/07/2015	26/07/2015	26/07/2015	26/07/2015	24/07/2015
		ALS Work Number	L1648323	L1648323	L1649166	L1648323	L1648323	L1649166	L1648323	L1648323	L1648323	L1648323	L1648323	L1648323	L1648323	L1648323	L1648323	-	L1648323	L1649166	L1649166	L1649166	L1649166	L1648323
CCME-FAL <sup>1,2,3,4</sup>																								
<b>Total Metals</b>																								
Aluminum (Al)-Total	mg/L	Varies <sup>5</sup>	0.0659	0.0568	2.08	0.0667	0.378	0.383	0.147	0.0512	0.0410	0.0310	0.135	0.0323	0.0503	2.32	-	0.0052	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	
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	0.1000	-	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	
Antimony (Sb)-Total	mg/L	-	0.00027	0.00058	0.00032	0.00047	0.00017	0.00024	0.00072	0.00026	0.00040	0.00050	0.00112	0.00056	0.00046	0.00026	-	0.00302	0.00121	0.00111	0.00094	0.00094	0.00085	
Arsenic (As)-Total	mg/L	0.005	0.00066	0.00088	0.00236	0.00187	0.00076	0.00200	0.00050	0.00096	0.00094	0.00120	0.00145	0.00125	0.00098	0.00254	-	0.0146	0.00196	0.00135	0.00087	0.00131	0.00079	
Barium (Ba)-Total	mg/L	-	0.0566	0.0562	0.123	0.0648	0.0494	0.0968	0.0419	0.0984	0.0560	0.0529	0.0636	0.0526	0.0544	0.0883	-	0.0223	0.0167	0.0194	0.0314	0.0324	0.0589	
Beryllium (Be)-Total	mg/L	-	<0.000020	<0.000020	0.000079	<0.000020	0.000026	0.000037	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	0.000092	-	<0.000020	<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	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
Boron (B)-Total	mg/L	1.5	0.012	0.015	0.013	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	0.037	0.083	0.057	0.052	<0.010	-	0.046	0.258	0.117	0.080	0.055	0.039	
Cadmium (Cd)-Total	mg/L	Varies <sup>9</sup>	0.0000937	0.0000274	0.0000949	0.000112	0.0000393	0.0000421	0.0000589	0.0000619	0.0000377	0.0000602	0.0000257	0.0000562	0.0000644	0.000131	-	0.0000278	0.000192	0.000163	0.0000788	0.0000500	0.000130	
Cadmium CCME-FAL	mg/L	-	0.00037	0.00037	0.00037	0.00037	0.000195	0.000164	0.0001492	0.00037	0.000354	0.00037	0.00037	0.00037	0.00037	0.000184	-	0.00037	0.00037	0.00037	0.00037	0.00037	0.00037	
Calcium (Ca)-Total	mg/L	-	88.8	68.8	80.0	87.0	29.2	23.9	21.8	74.1	56.7	76.0	76.7	80.2	80.2	31.5	-	231	196	165	108	82.0	123	
Chromium (Cr)-Total	mg/L	-	0.00042	0.00058	0.00471	0.00058	0.00111	0.00204	0.00124	0.00083	0.00066	0.00074	0.00137	0.00080	0.00080	0.00576	-	0.00137	0.00200	0.00120	0.00067	0.00048	0.00059	
Chromium (III)-Total	mg/L	0.0089	-	-	0.00141	-	0.00111	0.00204	0.00124	-	-	-	0.00137	-	-	0.00576	-	0.00137	<0.00048	<0.00044	-	-	-	
Hexavalent Chromium	mg/L	0.001	-	-	0.0033	-	<0.0010	<0.0010	<0.0010	-	-	-	<0.0010	-	-	<0.0010	-	<0.0010	0.0024	0.0016	-	-	-	
Cobalt (Co)-Total	mg/L	-	0.00060	0.00019	0.00180	0.00083	0.00055	0.00109	0.00014	0.00056	0.00025	0.00060	0.00028	0.00066	0.00060	0.00254	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00020	
Copper (Cu)-Total	mg/L	Varies <sup>10</sup>	0.00238	0.00156	0.00697	0.00241	0.0035	0.00484	0.00326	0.00380	0.00300	0.00236	0.00236	0.00208	0.00224	0.00821	-	0.00088	0.00096	0.00124	0.00119	0.00128	0.00086	
Copper CCME-FAL	mg/L	-	0.004	0.004	0.004	0.004	0.00292	0.00245	0.002223	0.004	0.004	0.004	0.004	0.004	0.004	0.00276	-	0.004	0.004	0.004	0.004	0.004	0.004	
Iron (Fe)-Total	mg/L	0.3	0.382	0.230	3.99	0.315	0.646	2.3	0.288	1.38	0.182	0.277	0.402	0.294	0.298	3.83	-	0.011	<0.010	<0.010	<0.010	<0.010	0.075	
Lead (Pb)-Total	mg/L	Varies <sup>11</sup>	0.000104	<0.000050	0.00183	0.000075	0.000314	0.000318	0.000145	0.000084	0.000061	<0.000050	0.000139	<0.000050	0.000081	0.00213	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
Lead CCME-FAL	mg/L	-	0.007	0.007	0.007	0.007	0.00436	0.00334	0.002901	0.007	0.007	0.007	0.007	0.007	0.007	0.00401	-	0.007	0.007	0.007	0.007	0.007	0.007	
Lithium (Li)-Total	mg/L	-	0.0040	0.0067	0.0046	0.0049	0.0041	0.0011	<0.0010	<0.0010	0.0029	0.0081	0.0055	0.0120	0.0128	0.0062	-	0.0106	0.0688	0.0128	0.0079	0.0068	0.0099	
Magnesium (Mg)-Total	mg/L	-	43.8	50.2	58.4	47.1	10.2	10.2	8.67	26.4	28.5	50.3	60.8	57.8	58.1	11.7	-	111	278	183	82.1	52.6	55.4	
Manganese (Mn)-Total	mg/L	-	0.335	0.0895	0.190	0.203	0.0509	0.294	0.0111	0.358	0.0584	0.0879	0.0624	0.122	0.196	0.157	-	0.00227	0.00023	<0.00010	0.00022	0.00057	0.0134	
Mercury (Hg)-Total	mg/L	0.000026	0.0000071	<0.0000050	0.0000136	<0.0000050	0.0000090	0.0000058	0.0000099	<0.0000050	0.0000065	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	0.0000055	0.0000063	<0.0000050	<0.0000050	
Molybdenum (Mo)-Total	mg/L	0.073	0.00162	0.000844	0.00135	0.00138	0.000496	0.000667	0.000616	0.00159	0.00137	0.00176	0.00154	0.00180	0.00159	0.000662	-	0.00203	0.00260	0.00277	0.00265	0.00257	0.00206	
Nickel (Ni)-Total	mg/L	Varies <sup>12</sup>	0.00500	0.00288	0.00893	0.0136	0.00334	0.00475	0.00375	0.00382	0.00606	0.0161	0.0131	0.0183	0.0157	0.0105	-	0.0180	0.0750	0.0424	0.0304	0.0330	0.0192	
Nickel CCME-FAL	mg/L	-	0.15	0.15	0.15	0.15	0.115	0.0985	0.09045	0.15	0.15	0.15	0.15	0.15	0.15	0.110	-	0.15	0.15	0.15	0.15	0.15	0.15	
Phosphorus (P)-Total	mg/L	-	<0.050	<0.050	0.094	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.120	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	
Potassium (K)-Total	mg/L	-	0.69	0.83	1.10	0.56	1.11	0.24	0.14	0.58	0.56	0.83	0.84	0.97	1.05	1.44	-	1.37	3.27	2.03	1.36	1.22	0.87	
Selenium (Se)-Total	mg/L	0.001	0.00126	0.000832	0.000642	0.00225	0.000207	0.000295	0.000722	0.00156	0.00121	0.00129	0.00132	0.00106	0.000857	0.000334	-	0.0159	0.00419	0.00319	0.00129	0.000712	0.00351	
Silicon (Si)-Total	mg/L	-	4.69	5.57	9.30	5.16	4.84	5.81	6.14	5.03	4.09	4.49	5.98	4.76	4.86	8.04	-	4.66	6.27	5.21	5.14	5.94	4.98	
Silver (Ag)-Total	mg/L	0.0001	<0.000010	<0.000010	0.000042	<0.000010	0.000013	<0.000010	0.000015	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000052	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
Sodium (Na)-Total	mg/L	-	3.62	3.42	4.49	4.96	4.17	1.47	3.18	2.61	2.56	3.56	4.63	4.52	4.57	4.25	-	2.81	17.0	6.34	3.66	2.88	3.78	
Strontium (Sr)-Total	mg/L	-	0.423	0.376	0.380	0.478	0.159	0.0756	0.0912	0.275	0.254	0.409	0.395	0.477	0.488	0.174	-	1.09	1.85	0.887	0.517	0.399	0.730	
Thallium (Tl)-Total	mg/L	-	<0.000010	<0.000010	0.000033	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000013	0.000030	<0.000010	0.000024	0.000014	0.000035	-	0.000017	0.000087	0.000065	0.000075	0.000073	0.000026	
Tin (Sn)-Total	mg/L	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
Titanium (Ti)-Total	mg/L	-	0.00193	0.00201	0.0544	0.00205	0.0116	0.0117	0.00251	0.00177	0.00088	0.00076	0.00328	0.00107	0.00181	0.0893	-	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	
Uranium (U)-Total	mg/L	-	0.00280	0.00487	0.00554	0.00595	0.00100	0.000116	0.000072	0.000779	0.00179	0.00206	0.00385	0.00229	0.00231	0.00126	-	0.00407	0.00664	0.00294	0.00142	0.000962	0.00221	
Vanadium (V)-Total	mg/L	0.015	0.00052	0.00064	0.00657	0.00060	0.00159	0.00253	0.00068	0.00085	0.00053	<0.00050	0.00101	0.00052	<0.00050	0.00734	-	&						

### Notes for Table 3

- (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-NH<sub>3</sub> 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;  

$$CWQG (\mu\text{g/L}) = 10\{0.83[\log(\text{hardness})] - 2.46\}$$
 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;  

$$CWQG (\mu\text{g/L}) = 0.2 * e\{0.8545[\ln(\text{hardness})] - 1.465\}$$
 0.004 if H > 180
- (11) Lead varies with Hardness in mg/L as follows for CCME FAL:  
 0.001 if H < 60  
 .001 - 0.001 if H ≥ 60 and H ≤ 180 as follows;  

$$CWQG (\mu\text{g/L}) = e\{1.273[\ln(\text{hardness})] - 4.705\}$$
 0.007 if H > 180
- (12) Nickel varies with Hardness in mg/L as follows for CCME FAL:  
 0.025 if H < 60  
 0.025 - 0.15 if H ≥ 60 and H ≤ 180 as follows;  

$$CWQG (\mu\text{g/L}) = e\{0.76[\ln(\text{hardness})] + 1.06\}$$
 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 or Travel Blank
- Bold*** and Italic Indicates QAQC values exceed expected results (i.e. RDP values exceed 20%).
- \*Indicates that samples were collected the following day for general chemistry analysis (i.e. pH, conductivity, TSS, nitrate, nitrite, and sulphate). This was necessary due to sampling holding time and the remote nature of the site.

Table 4: Analytical Quality Assurance and Control

Parameter	Units	Site Location	E2			GWCC-3			TRAVEL_BLANK	
		Sample ID	FB-1	DUP-1*	E2*	RPD (%) <sup>13</sup>	DUP-2	GWCC-3	RPD (%) <sup>13</sup>	26/07/2015
		Date Sampled	24/07/2015	24/07/2015	24/07/2015		26/07/2015	26/07/2015		
		ALS Work Number	L1648323	L1648323	L1648323		L1649166	L1649166		
		CCME-FAL <sup>1, 2, 3, 4</sup>								
<b>Physical Tests</b>										
Lab pH	pH units	6.5-9.0 <sup>5</sup>	5.4	7.83	7.87	0.51	7.53	7.55	0.27	5.01
Field pH	pH units	6.5-9.0 <sup>5</sup>	-	7.92	7.92	-	-	7.44	-	-
Field Temperature	C	-	-	15.6	15.6	-	-	9.8	-	-
Lab Conductivity	uS/cm	-	<2.0	795	789	0.76	982	956	2.68	<2.0
Field Conductivity	uS/cm	-	-	567	567	-	-	684	-	-
Field Specific Conductivity	uS/cm	-	-	692	692	-	-	965	-	-
Field Dissolved Oxygen	mg/L	9.5 <sup>6</sup>	-	8.01	8.01	-	-	3.78	-	-
Field Oxidation - Redox Potent	mV	-	-	35.6	35.6	-	-	123.7	-	-
Field Turbidity	NTU	-	-	0.37	0.37	-	-	0.23	-	-
Total Suspended Solids	mg/L	-	<3.0	<3.0	<3.0	nc	<3.0	<3.0	nc	<3.0
Total Hardness (as CaCO3)	mg/L	-	<0.50	391	400	2.28	614	609	0.82	<0.50
<b>Anions and Nutrients</b>										
Nitrate (as N)	mg/L	13	<0.0050	0.109	0.107	1.85	0.160	0.158	1.26	<0.0050
Nitrite (as N)	mg/L	0.06	<0.0010	0.0015	0.0013	14.29	<0.0020	<0.0020	nc	<0.0010
Ammonia, Total (as N)	mg/L	Varies <sup>7</sup>	<0.0050	0.0203	0.0216	6.21	0.0062	<0.0050	nc	<b>0.0100</b>
<i>Ammonia CCME-FAL</i>	mg/L	-	-	0.8192	0.8192	-	-	3.795	-	-
Sulfate (SO4)	mg/L	-	<0.30	244	244	0.00	391	394	0.76	<0.30
<b>Inorganic/Organic Carbon</b>										
Dissolved Organic Carbon	mg/L	-	<0.50	14.3	14.2	0.70	9.83	9.67	1.64	-

Table 4: Analytical Quality Assurance and Control

Parameter	Units	Site Location	E2			RPD (%) <sup>13</sup>	GWCC-3		RPD (%) <sup>13</sup>	TRAVEL_BLANK
		Sample ID	FB-1	DUP-1*	E2*		DUP-2	GWCC-3		26/07/2015
		Date Sampled	24/07/2015	24/07/2015	24/07/2015		26/07/2015	26/07/2015		L1649166
		ALS Work Number	L1648323	L1648323	L1648323		L1649166	L1649166		L1649166
		CCME-FAL <sup>1, 2, 3, 4</sup>								
<b>Dissolved Metals</b>										
Aluminum (Al)-Dissolved	mg/L	Varies <sup>8</sup>	<0.0010	0.0214	0.0236	9.78	0.0022	0.0020	9.52	-
<i>Aluminum CCME-FAL</i>	mg/L	-	0.005000	0.1000	0.1000	-	0.1000	0.1000	-	-
Antimony (Sb)-Dissolved	mg/L	-	<0.00010	0.00047	0.00047	0.00	0.00087	0.00089	2.27	-
Arsenic (As)-Dissolved	mg/L	0.005	<0.00010	0.00109	0.00108	0.92	0.00081	0.00083	2.44	-
Barium (Ba)-Dissolved	mg/L	-	<0.000050	0.0522	0.0521	-	0.0297	0.0311	4.61	-
Beryllium (Be)-Dissolved	mg/L	-	<0.000020	<0.000020	<0.000020	nc	<0.000020	<0.000020	nc	-
Bismuth (Bi)-Dissolved	mg/L	-	<0.000050	<0.000050	<0.000050	nc	<0.000050	<0.000050	nc	-
Boron (B)-Dissolved	mg/L	1.5	<0.010	0.034	0.034	0.00	0.068	0.070	2.90	-
Cadmium (Cd)-Dissolved	mg/L	Varies <sup>9</sup>	<0.0000050	0.0000572	0.0000662	14.59	0.0000849	0.0000878	3.36	-
<i>Cadmium CCME-FAL</i>	mg/L	-	0.0004	0.00037	0.00037	-	0.00037	0.00037	-	-
Calcium (Ca)-Dissolved	mg/L	-	<0.050	74.2	76.9	3.57	110	110	0.00	-
Chromium (Cr)-Dissolved	mg/L	-	<0.00010	0.00052	0.00056	7.41	0.00047	0.00049	4.17	-
Chromium (III)-Dissolved	mg/L	0.0089	-	-	-	nc	-	-	nc	-
Hexavalent Chromium-Dissolved	mg/L	0.001	-	-	-	nc	-	-	nc	-
Cobalt (Co)-Dissolved	mg/L	-	<0.00010	0.00055	0.00058	5.31	<0.00010	<0.00010	nc	-
Copper (Cu)-Dissolved	mg/L	Varies <sup>10</sup>	<0.00020	0.00222	0.00229	3.10	0.00112	0.00114	1.77	-
<i>Copper CCME-FAL</i>	mg/L	-	0.02	0.004	0.004	-	0.004	0.004	-	-
Iron (Fe)-Dissolved	mg/L	0.3	<0.010	0.222	0.231	3.97	<0.010	<0.010	nc	-
Lead (Pb)-Dissolved	mg/L	Varies <sup>11</sup>	<0.000050	<0.000050	<0.000050	nc	<0.000050	<0.000050	nc	-
<i>Lead CCME-FAL</i>	mg/L	-	0.001	0.007	0.007	-	0.007	0.007	-	-
Lithium (Li)-Dissolved	mg/L	-	<0.0010	0.0080	0.0081	1.24	0.0077	0.0080	3.82	-
Magnesium (Mg)-Dissolved	mg/L	-	<0.10	49.9	50.5	1.20	82.2	81.4	0.98	-
Manganese (Mn)-Dissolved	mg/L	-	<0.00010	0.0792	0.0828	4.44	0.00015	0.00023	nc	-
Mercury (Hg)-Dissolved	mg/L	0.000026	<0.0000050	<0.0000050	<0.0000050	nc	0.0000064	0.0000076	17.14	-
Molybdenum (Mo)-Dissolved	mg/L	0.073	<0.000050	0.00171	0.00170	0.59	0.00247	0.00255	3.19	-
Nickel (Ni)-Dissolved	mg/L	Varies <sup>12</sup>	<0.00050	0.0152	0.0156	2.60	0.0294	0.0304	3.34	-
<i>Nickel CCME-FAL</i>	mg/L	-	0.025	0.15	0.15	-	0.15	0.15	-	-
Phosphorus (P)-Dissolved	mg/L	-	<0.050	<0.050	<0.050	nc	<0.050	<0.050	nc	-
Potassium (K)-Dissolved	mg/L	-	<0.10	0.82	0.84	2.41	1.35	1.38	2.20	-
Selenium (Se)-Dissolved	mg/L	0.001	<0.000050	0.00124	0.00121	2.45	0.00131	0.00135	3.01	-
Silicon (Si)-Dissolved	mg/L	-	<0.050	4.50	4.51	0.22	5.15	5.14	0.19	-
Silver (Ag)-Dissolved	mg/L	0.0001	<0.000010	<0.000010	<0.000010	nc	<0.000010	<0.000010	nc	-
Sodium (Na)-Dissolved	mg/L	-	<0.050	3.47	3.62	4.23	3.47	3.60	3.68	-
Strontium (Sr)-Dissolved	mg/L	-	<0.00020	0.405	0.407	0.49	0.501	0.512	2.17	-
Sulfur (S)-Dissolved	mg/L	-	<0.50	80.2	78.6	2.02	128	128	0.00	-
Thallium (Tl)-Dissolved	mg/L	0.0008	<0.000010	0.000029	0.000028	3.51	0.000072	0.000075	4.08	-
Tin (Sn)-Dissolved	mg/L	-	<0.00010	<0.00010	<0.00010	nc	<0.00010	<0.00010	nc	-
Titanium (Ti)-Dissolved	mg/L	-	<0.00030	0.00041	0.00057	nc	<0.00030	<0.00030	nc	-
Uranium (U)-Dissolved	mg/L	0.015	<0.000010	0.00199	0.00199	-	0.00135	0.00137	1.47	-
Vanadium (V)-Dissolved	mg/L	-	<0.00050	<0.00050	<0.00050	nc	<0.00050	<0.00050	nc	-
Zinc (Zn)-Dissolved	mg/L	0.03	<0.0010	0.0010	0.0016	nc	0.0022	0.0029	nc	-
Zirconium (Zr)-Dissolved	mg/L	-	<0.00030	0.00070	0.00070	0.00	<0.00030	<0.00030	nc	-

Table 4: Analytical Quality Assurance and Control

Parameter	Units	Site Location	E2			RPD (%) <sup>13</sup>	GWCC-3		RPD (%) <sup>13</sup>	TRAVEL_BLANK
		Sample ID	FB-1	DUP-1*	E2*		DUP-2	GWCC-3		26/07/2015
		Date Sampled	24/07/2015	24/07/2015	24/07/2015		26/07/2015	26/07/2015		L1649166
		ALS Work Number	L1648323	L1648323	L1648323		L1649166	L1649166		L1649166
		CCME-FAL <sup>1, 2, 3, 4</sup>								
<b>Total Metals</b>					nc					
Aluminum (Al)-Total	mg/L	Varies <sup>8</sup>	<0.0030	0.0511	0.0310	<b>48.96</b>	0.0045	<0.0030	nc	<0.0030
<i>Aluminum CCME-FAL</i>	mg/L	-	0.005000	0.1000	0.1000	-	0.1000	0.1000	-	-
Antimony (Sb)-Total	mg/L	-	<0.00010	0.00049	0.00050	2.02	0.00093	0.00094	1.07	<0.00010
Arsenic (As)-Total	mg/L	0.005	<0.00010	0.00126	0.00120	4.88	0.00091	0.00087	4.49	<0.00010
Barium (Ba)-Total	mg/L	-	<0.000050	0.0513	0.0529	3.07	0.0314	0.0314	-	<0.000050
Beryllium (Be)-Total	mg/L	-	<0.000020	<0.000020	<0.000020	nc	<0.000020	<0.000020	nc	<0.000020
Bismuth (Bi)-Total	mg/L	-	<0.000050	<0.000050	<0.000050	nc	<0.000050	<0.000050	nc	<0.000050
Boron (B)-Total	mg/L	1.5	<0.010	0.036	0.037	2.74	0.082	0.080	2.47	<0.010
Cadmium (Cd)-Total	mg/L	Varies <sup>9</sup>	<0.0000050	0.0000687	0.0000602	13.19	0.0000817	0.0000788	3.61	<0.0000050
<i>Cadmium CCME-FAL</i>	mg/L	-	0.0004	0.00037	0.00037	-	0.00037	0.00037	-	-
Calcium (Ca)-Total	mg/L	-	<0.050	68.6	76.0	10.24	113	108	4.52	<0.050
Chromium (Cr)-Total	mg/L	-	<0.00010	0.00163	0.00074	<b>75.11</b>	0.00070	0.00067	4.38	<0.00010
Chromium (III)-Total	mg/L	0.0089	-	0.00163	-	nc	-	-	nc	-
Hexavalent Chromium	mg/L	0.001	-	<0.0010	-	nc	-	-	nc	-
Cobalt (Co)-Total	mg/L	-	<0.00010	0.00071	0.00060	16.79	<0.00010	<0.00010	nc	<0.00010
Copper (Cu)-Total	mg/L	Varies <sup>10</sup>	<0.00050	0.00245	0.00236	3.74	0.00125	0.00119	4.92	<0.00050
<i>Copper CCME-FAL</i>	mg/L	-	0.02	0.004	0.004	-	0.004	0.004	-	-
Iron (Fe)-Total	mg/L	0.3	<0.010	0.449	0.277	<b>47.38</b>	0.015	<0.010	nc	<0.010
Lead (Pb)-Total	mg/L	Varies <sup>11</sup>	<0.000050	0.000150	<0.000050	nc	<0.000050	<0.000050	nc	<0.000050
<i>Lead CCME-FAL</i>	mg/L	-	0.001	0.007	0.007	-	0.007	0.007	-	-
Lithium (Li)-Total	mg/L	-	<0.0010	0.0076	0.0081	6.37	0.0079	0.0079	0.00	<0.0010
Magnesium (Mg)-Total	mg/L	-	<0.10	46.0	50.3	8.93	85.4	82.1	3.94	<0.10
Manganese (Mn)-Total	mg/L	-	<0.00010	0.0904	0.0879	2.80	0.00050	0.00022	nc	<0.00010
Mercury (Hg)-Total	mg/L	0.000026	<0.0000050	<0.0000050	<0.0000050	nc	0.0000059	0.0000063	6.56	<0.0000050
Molybdenum (Mo)-Total	mg/L	0.073	<0.000050	0.00168	0.00176	4.65	0.00267	0.00265	0.75	<0.000050
Nickel (Ni)-Total	mg/L	Varies <sup>12</sup>	<0.00050	0.0175	0.0161	8.33	0.0315	0.0304	3.55	<0.00050
<i>Nickel CCME-FAL</i>	mg/L	-	0.025	0.15	0.15	-	0.15	0.15	-	-
Phosphorus (P)-Total	mg/L	-	<0.050	<0.050	<0.050	nc	<0.050	<0.050	nc	<0.050
Potassium (K)-Total	mg/L	-	<0.10	0.77	0.83	7.50	1.43	1.36	5.02	<0.10
Selenium (Se)-Total	mg/L	0.001	<0.000050	0.00114	0.00129	12.35	0.00134	0.00129	3.80	<0.000050
Silicon (Si)-Total	mg/L	-	<0.050	4.23	4.49	5.96	5.30	5.14	3.07	<0.050
Silver (Ag)-Total	mg/L	0.0001	<0.000010	<0.000010	<0.000010	nc	<0.000010	<0.000010	nc	<0.000010
Sodium (Na)-Total	mg/L	-	<0.050	3.44	3.56	3.43	3.75	3.66	2.43	<0.050
Strontium (Sr)-Total	mg/L	-	<0.00020	0.384	0.409	6.31	0.528	0.517	2.11	<0.00020
Thallium (Tl)-Total	mg/L	-	<0.000010	0.000029	0.000030	3.39	0.000074	0.000075	1.34	<0.000010
Tin (Sn)-Total	mg/L	0.0008	<0.00010	<0.00010	<0.00010	nc	<0.00010	<0.00010	nc	<0.00010
Titanium (Ti)-Total	mg/L	-	<0.00030	0.00135	0.00076	nc	<0.00030	<0.00030	nc	<0.00030
Uranium (U)-Total	mg/L	-	<0.000010	0.00198	0.00206	3.96	0.00142	0.00142	nc	<0.000010
Vanadium (V)-Total	mg/L	0.015	<0.00050	0.00057	<0.00050	nc	<0.00050	<0.00050	nc	<0.00050
Zinc (Zn)-Total	mg/L	-	<0.0030	<0.0030	<0.0030	nc	0.0033	0.0035	5.88	<0.0030
Zirconium (Zr)-Total	mg/L	0.03	<0.00030	0.00065	0.00066	1.53	<0.00030	<0.00030	nc	<0.00030

**APPENDIX 1**  
**Site Photos**



**Photo 1:** Downstream view of Site R1 (Clinton Creek upstream of Hudgeon Lake). Photo taken on July 25, 2015.



**Photo 2:** Downstream view of Site R2 (Easter Creek upstream of Hudgeon Lake). Photo taken on July 25, 2015.



**Photo 3:** Downstream view of Site R3 (Wolverine Creek, upstream of tailings). Photo taken on July 26, 2015.



**Photo 4:** Downstream view of Site R4 (Eagle Creek, upstream of culvert). Photo taken on July 24, 2015.





**Photo 5:** Downstream view of Site R6 (Forty Mile River, upstream of Clinton Creek). Photo taken on July 24, 2015.



**Photo 6:** Upstream view of Site R7 (Porcupine Creek, upstream of waste rock). Photo taken on July 26, 2015.



**Photo 7:** Downstream view of relocated Site E1 (Clinton Creek downstream of gabions, near ford). Photo taken on July 24, 2015.



**Photo 8:** Downstream view of Site E2 (Clinton Creek, downstream of Porcupine Creek but upstream of Wolverine Creek). Photo taken on July 24, 2015.



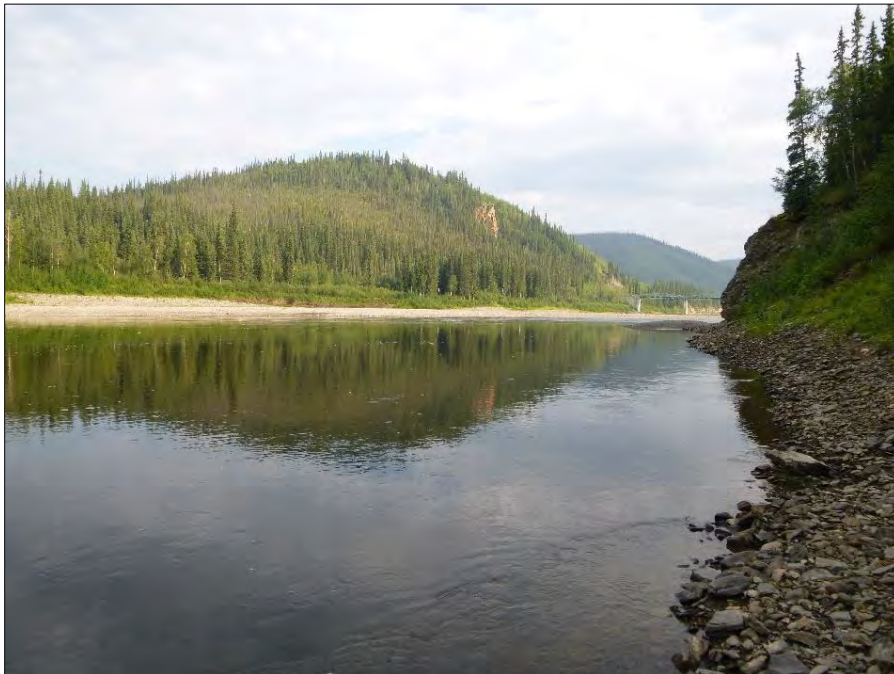
**Photo 9:** Downstream view of Site E3. Photo taken on July 23, 2015.



**Photo 10:** Downstream view of Site E4 (Clinton Creek downstream of Wolverine Creek but upstream of Eagle Creek). Photo taken on July 24, 2015.



**Photo 11:** Downstream view of Site E7 (Clinton Creek near mouth). Photo taken on July 24, 2015



**Photo 12:** Upstream view of Site E8 (Forty Mile River downstream of Clinton Creek). Photo taken on July 25, 2015.



**Photo 13:** View of E1(H) looking upstream towards Hudgeon Lake. Photo taken on July 24, 2015.



**Photo 14:** View of E3(H) looking downstream. Photo taken July 23, 2015

**No Photo of E9**

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**Photo 15:** View of Porcupine Pit Lake (Site PL). Photo taken on July 26, 2015.



**Photo 16:** View of Snowshoe Pit Lake (Site SL) with installed staff gauge. Photo taken and staff gauge installed on July 26, 2015.



**Photo 17:** View of groundwater seepage Site GWCC-1. Photo taken on July 23, 2015.



**Photo 18:** View of groundwater seepage Site GWCC-2. Photo taken on July 23, 2015.





**Photo 19:** View of groundwater seepage Site GWCC-3. Photo taken on July 26, 2015.



**Photo 19:** View of groundwater seepage Site GWCC-4. Photo taken on July 26, 2015.



**Photo 20:** View of groundwater seepage GWCC-5. Photo taken on July 24, 2015.

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**APPENDIX 2**  
**Water Quality Analytical Laboratory Reports**



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

Date Received: 27-JUL-15  
Report Date: 11-SEP-15 14:48 (MT)  
Version: FINAL REV. 3

Client Phone: 867-456-4865

## Certificate of Analysis

Lab Work Order #: L1648323  
Project P.O. #: NOT SUBMITTED  
Job Reference: 1343-005.10  
C of C Numbers: 1, 2  
Legal Site Desc:

Comments: 11-SEP-2015 This report replaces the previous work order and contains additional parameters as requested.

---

Brent Mack, B.Sc.  
Account Manager

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

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700  
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1648323-1 Water 24-JUL-15 14:15 E1	L1648323-2 Water 25-JUL-15 09:05 E1	L1648323-3 Water 24-JUL-15 10:30 E2	L1648323-4 Water 25-JUL-15 09:15 E2	L1648323-5 Water 23-JUL-15 18:05 E3
Grouping	Analyte				
<b>WATER</b>					
<b>Physical Tests</b>	Conductivity (uS/cm)		514	789	
	Hardness (as CaCO3) (mg/L)	263		400	444
	pH (pH)		8.07	7.87	
	Total Suspended Solids (mg/L)		<3.0	<3.0	
<b>Anions and Nutrients</b>	Ammonia, Total (as N) (mg/L)	0.0164		0.0216	0.0126
	Nitrate (as N) (mg/L)		0.103	0.107	
	Nitrite (as N) (mg/L)		0.0018	0.0013	
	Phosphorus (P)-Total (mg/L)	0.0035		0.0037	0.0065
	Sulfate (SO4) (mg/L)		135	244	
<b>Organic / Inorganic Carbon</b>	Dissolved Organic Carbon (mg/L)	17.0		14.2	13.5
<b>Total Metals</b>	Aluminum (Al)-Total (mg/L)	0.0410		0.0310	0.135
	Antimony (Sb)-Total (mg/L)	0.00040		0.00050	0.00112
	Arsenic (As)-Total (mg/L)	0.00094		0.00120	0.00145
	Barium (Ba)-Total (mg/L)	0.0560		0.0529	0.0636
	Beryllium (Be)-Total (mg/L)	<0.000020		<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050		<0.000050	<0.000050
	Boron (B)-Total (mg/L)	0.011		0.037	0.083
	Cadmium (Cd)-Total (mg/L)	0.0000377		0.0000602	0.0000257
	Calcium (Ca)-Total (mg/L)	56.7		76.0	76.7
	Chromium (Cr)-Total (mg/L)	0.00066		0.00074	0.00137
	Cobalt (Co)-Total (mg/L)	0.00025		0.00060	0.00028
	Copper (Cu)-Total (mg/L)	0.00300		0.00236	0.00236
	Iron (Fe)-Total (mg/L)	0.182		0.277	0.402
	Lead (Pb)-Total (mg/L)	0.000061		<0.000050	0.000139
	Lithium (Li)-Total (mg/L)	0.0029		0.0081	0.0055
	Magnesium (Mg)-Total (mg/L)	28.5		50.3	60.8
	Manganese (Mn)-Total (mg/L)	0.0584		0.0879	0.0624
	Mercury (Hg)-Total (mg/L)	0.0000065		<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.00137		0.00176	0.00154
	Nickel (Ni)-Total (mg/L)	0.00606		0.0161	0.0131
	Phosphorus (P)-Total (mg/L)	<0.050		<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.56		0.83	0.84
	Selenium (Se)-Total (mg/L)	0.00121		0.00129	0.00132
	Silicon (Si)-Total (mg/L)	4.09		4.49	5.98
	Silver (Ag)-Total (mg/L)	<0.000010		<0.000010	<0.000010
Sodium (Na)-Total (mg/L)	2.56		3.56	4.63	

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

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1648323-6 Water 25-JUL-15 08:45 E3	L1648323-7 Water 24-JUL-15 15:00 E4	L1648323-8 Water 25-JUL-15 08:30 E4	L1648323-9 Water 24-JUL-15 17:30 E7	L1648323-10 Water 25-JUL-15 19:10 E8	
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Conductivity (uS/cm)	840		858	817	295
	Hardness (as CaCO3) (mg/L)		431		469	120
	pH (pH)	8.12		7.87	7.93	7.95
	Total Suspended Solids (mg/L)	<3.0		<3.0	4.7	5.3
<b>Anions and Nutrients</b>	Ammonia, Total (as N) (mg/L)		0.0145		0.0138	0.0069
	Nitrate (as N) (mg/L)	0.0781		0.0962	0.0907	0.0464
	Nitrite (as N) (mg/L)	0.0016		0.0014	0.0011	<0.0010
	Phosphorus (P)-Total (mg/L)		0.0024		0.0041	0.0034
	Sulfate (SO4) (mg/L)	255		264	263	47.3
<b>Organic / Inorganic Carbon</b>	Dissolved Organic Carbon (mg/L)		13.2		12.9	10.4
<b>Total Metals</b>	Aluminum (Al)-Total (mg/L)		0.0323		0.0503	2.32
	Antimony (Sb)-Total (mg/L)		0.00056		0.00046	0.00026
	Arsenic (As)-Total (mg/L)		0.00125		0.00098	0.00254
	Barium (Ba)-Total (mg/L)		0.0526		0.0544	0.0883
	Beryllium (Be)-Total (mg/L)		<0.000020		<0.000020	0.000092
	Bismuth (Bi)-Total (mg/L)		<0.000050		<0.000050	<0.000050
	Boron (B)-Total (mg/L)		0.057		0.052	<0.010
	Cadmium (Cd)-Total (mg/L)		0.0000562		0.0000644	0.000131
	Calcium (Ca)-Total (mg/L)		80.2		80.2	31.5
	Chromium (Cr)-Total (mg/L)		0.00080		0.00080	0.00576
	Cobalt (Co)-Total (mg/L)		0.00066		0.00060	0.00254
	Copper (Cu)-Total (mg/L)		0.00208		0.00224	0.00821
	Iron (Fe)-Total (mg/L)		0.294		0.298	3.83
	Lead (Pb)-Total (mg/L)		<0.000050		0.000081	0.00213
	Lithium (Li)-Total (mg/L)		0.0120		0.0128	0.0062
	Magnesium (Mg)-Total (mg/L)		57.8		58.1	11.7
	Manganese (Mn)-Total (mg/L)		0.122		0.196	0.157
	Mercury (Hg)-Total (mg/L)		<0.0000050		<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)		0.00180		0.00159	0.000662
	Nickel (Ni)-Total (mg/L)		0.0183		0.0157	0.0105
	Phosphorus (P)-Total (mg/L)		<0.050		<0.050	0.120
	Potassium (K)-Total (mg/L)		0.97		1.05	1.44
	Selenium (Se)-Total (mg/L)		0.00106		0.000857	0.000334
	Silicon (Si)-Total (mg/L)		4.76		4.86	8.04
Silver (Ag)-Total (mg/L)		<0.000010		<0.000010	0.000052	
Sodium (Na)-Total (mg/L)		4.52		4.57	4.25	

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

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1648323-11 Water 25-JUL-15 14:00 R1	L1648323-12 Water 25-JUL-15 10:40 R2	L1648323-13 Water 24-JUL-15 14:20 R4	L1648323-14 Water 25-JUL-15 08:30 R4	L1648323-15 Water 24-JUL-15 18:36 R6
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Conductivity (uS/cm)	795	733		846	297
	Hardness (as CaCO3) (mg/L)	411	383	418		128
	pH (pH)	7.95	7.98		8.10	7.55
	Total Suspended Solids (mg/L)	4.7	3.3		<3.0	100
<b>Anions and Nutrients</b>	Ammonia, Total (as N) (mg/L)	0.0361	0.0104	0.0232		0.0138
	Nitrate (as N) (mg/L)	0.117	0.0277		0.116	0.0449
	Nitrite (as N) (mg/L)	0.0010	<0.0010		<0.0010	<0.0010
	Phosphorus (P)-Total (mg/L)	0.0028	0.0037	0.0048		0.0098
	Sulfate (SO4) (mg/L)	232	187		237	55.6
<b>Organic / Inorganic Carbon</b>	Dissolved Organic Carbon (mg/L)	12.1	8.23	13.1		10.9
<b>Total Metals</b>	Aluminum (Al)-Total (mg/L)	0.0659	0.0568	0.0667		0.378
	Antimony (Sb)-Total (mg/L)	0.00027	0.00058	0.00047		0.00017
	Arsenic (As)-Total (mg/L)	0.00066	0.00088	0.00187		0.00076
	Barium (Ba)-Total (mg/L)	0.0566	0.0562	0.0648		0.0494
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020		0.000026
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050		<0.000050
	Boron (B)-Total (mg/L)	0.012	0.015	<0.010		<0.010
	Cadmium (Cd)-Total (mg/L)	0.0000937	0.0000274	0.000112		0.0000393
	Calcium (Ca)-Total (mg/L)	88.8	68.8	87.0		29.2
	Chromium (Cr)-Total (mg/L)	0.00042	0.00058	0.00058		0.00111
	Cobalt (Co)-Total (mg/L)	0.00060	0.00019	0.00083		0.00055
	Copper (Cu)-Total (mg/L)	0.00238	0.00156	0.00241		0.00350
	Iron (Fe)-Total (mg/L)	0.382	0.230	0.315		0.646
	Lead (Pb)-Total (mg/L)	0.000104	<0.000050	0.000075		0.000314
	Lithium (Li)-Total (mg/L)	0.0040	0.0067	0.0049		0.0041
	Magnesium (Mg)-Total (mg/L)	43.8	50.2	47.1		10.2
	Manganese (Mn)-Total (mg/L)	0.335	0.0895	0.203		0.0509
	Mercury (Hg)-Total (mg/L)	0.0000071	<0.0000050	<0.0000050		0.0000090
	Molybdenum (Mo)-Total (mg/L)	0.00162	0.000844	0.00138		0.000496
	Nickel (Ni)-Total (mg/L)	0.00500	0.00288	0.0136		0.00334
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050		<0.050
	Potassium (K)-Total (mg/L)	0.69	0.83	0.56		1.11
	Selenium (Se)-Total (mg/L)	0.00126	0.000832	0.00225		0.000207
	Silicon (Si)-Total (mg/L)	4.69	5.57	5.16		4.84
Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010		0.000013	
Sodium (Na)-Total (mg/L)	3.62	3.42	4.96		4.17	

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

## ALS ENVIRONMENTAL ANALYTICAL REPORT

11-SEP-15 14:48 (MT)

Version: FINAL REV. 3

Sample ID Description Sampled Date Sampled Time Client ID	L1648323-16 Water 25-JUL-15 12:33 R8	L1648323-17 Water 25-JUL-15 16:30 R9	L1648323-18 Water 24-JUL-15 11:45 GWCC-5	L1648323-19 Water 25-JUL-15 09:10 GWCC-5	L1648323-20 Water 26-JUL-15 09:00 SL	
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Conductivity (uS/cm)	217	589		999	1790
	Hardness (as CaCO3) (mg/L)	93.0	302	540		1070
	pH (pH)	7.56	7.64		7.43	8.29
	Total Suspended Solids (mg/L)	11.3	4.0		8.0	<3.0
<b>Anions and Nutrients</b>	Ammonia, Total (as N) (mg/L)	0.0066	0.0369	0.0195		0.0103
	Nitrate (as N) (mg/L)	<0.0050	0.200		0.0141	<0.025 <sup>DLA</sup>
	Nitrite (as N) (mg/L)	<0.0010	0.0050		<0.0010	<0.0050 <sup>DLA</sup>
	Phosphorus (P)-Total (mg/L)	0.0056	0.0089	0.0103		0.0031
	Sulfate (SO4) (mg/L)	48.6	171		287	885
<b>Organic / Inorganic Carbon</b>	Dissolved Organic Carbon (mg/L)	17.7	23.8	7.51		6.52
<b>Total Metals</b>	Aluminum (Al)-Total (mg/L)	0.147	0.0512	<0.0030		0.0052
	Antimony (Sb)-Total (mg/L)	0.00072	0.00026	0.00085		0.00302
	Arsenic (As)-Total (mg/L)	0.00050	0.00096	0.00079		0.0146
	Barium (Ba)-Total (mg/L)	0.0419	0.0984	0.0589		0.0223
	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	0.039		0.046
	Cadmium (Cd)-Total (mg/L)	0.0000589	0.0000619	0.000130		0.0000278
	Calcium (Ca)-Total (mg/L)	21.8	74.1	123		231
	Chromium (Cr)-Total (mg/L)	0.00124	0.00083	0.00059		0.00137
	Cobalt (Co)-Total (mg/L)	0.00014	0.00056	0.00020		<0.00010
	Copper (Cu)-Total (mg/L)	0.00326	0.00380	0.00086		0.00088
	Iron (Fe)-Total (mg/L)	0.288	1.38	0.075		0.011
	Lead (Pb)-Total (mg/L)	0.000145	0.000084	<0.000050		<0.000050
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	0.0099		0.0106
	Magnesium (Mg)-Total (mg/L)	8.67	26.4	55.4		111
	Manganese (Mn)-Total (mg/L)	0.0111	0.358	0.0134		0.00227
	Mercury (Hg)-Total (mg/L)	0.0000099	<0.0000050	<0.0000050		<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.000616	0.00159	0.00206		0.00203
	Nickel (Ni)-Total (mg/L)	0.00375	0.00382	0.0192		0.0180
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050		<0.050
	Potassium (K)-Total (mg/L)	0.14	0.58	0.87		1.37
	Selenium (Se)-Total (mg/L)	0.000722	0.00156	0.00351		0.0159
	Silicon (Si)-Total (mg/L)	6.14	5.03	4.98		4.66
Silver (Ag)-Total (mg/L)	0.000015	<0.000010	<0.000010		<0.000010	
Sodium (Na)-Total (mg/L)	3.18	2.61	3.78		2.81	

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



# ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1648323-21 Water 24-JUL-15 10:30 DUP-1	L1648323-22 Water 25-JUL-15 09:15 DUP-1	L1648323-23 Water 24-JUL-15 11:30 FB-1	
Grouping	Analyte				
<b>WATER</b>					
<b>Physical Tests</b>	Conductivity (uS/cm)		795	<2.0	
	Hardness (as CaCO3) (mg/L)	391		<0.50	
	pH (pH)		7.83	5.40	
	Total Suspended Solids (mg/L)		<3.0	<3.0	
<b>Anions and Nutrients</b>	Ammonia, Total (as N) (mg/L)	0.0203		<0.0050	
	Nitrate (as N) (mg/L)		0.109	<0.0050	
	Nitrite (as N) (mg/L)		0.0015	<0.0010	
	Phosphorus (P)-Total (mg/L)	0.0037		<0.0020	
	Sulfate (SO4) (mg/L)		244	<0.30	
<b>Organic / Inorganic Carbon</b>	Dissolved Organic Carbon (mg/L)	14.3		<0.50	
<b>Total Metals</b>	Aluminum (Al)-Total (mg/L)	0.0511		<0.0030	
	Antimony (Sb)-Total (mg/L)	0.00049		<0.00010	
	Arsenic (As)-Total (mg/L)	0.00126		<0.00010	
	Barium (Ba)-Total (mg/L)	0.0513		<0.000050	
	Beryllium (Be)-Total (mg/L)	<0.000020		<0.000020	
	Bismuth (Bi)-Total (mg/L)	<0.000050		<0.000050	
	Boron (B)-Total (mg/L)	0.036		<0.010	
	Cadmium (Cd)-Total (mg/L)	0.0000687		<0.0000050	
	Calcium (Ca)-Total (mg/L)	68.6		<0.050	
	Chromium (Cr)-Total (mg/L)	0.00163		<0.00010	
	Cobalt (Co)-Total (mg/L)	0.00071		<0.00010	
	Copper (Cu)-Total (mg/L)	0.00245		<0.00050	
	Iron (Fe)-Total (mg/L)	0.449		<0.010	
	Lead (Pb)-Total (mg/L)	0.000150		<0.000050	
	Lithium (Li)-Total (mg/L)	0.0076		<0.0010	
	Magnesium (Mg)-Total (mg/L)	46.0		<0.10	
	Manganese (Mn)-Total (mg/L)	0.0904		<0.00010	
	Mercury (Hg)-Total (mg/L)	<0.0000050		<0.0000050	
	Molybdenum (Mo)-Total (mg/L)	0.00168		<0.000050	
	Nickel (Ni)-Total (mg/L)	0.0175		<0.00050	
	Phosphorus (P)-Total (mg/L)	<0.050		<0.050	
	Potassium (K)-Total (mg/L)	0.77		<0.10	
	Selenium (Se)-Total (mg/L)	0.00114		<0.000050	
	Silicon (Si)-Total (mg/L)	4.23		<0.050	
	Silver (Ag)-Total (mg/L)	<0.000010		<0.000010	
Sodium (Na)-Total (mg/L)	3.44		<0.050		

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

## ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1648323-1	L1648323-2	L1648323-3	L1648323-4	L1648323-5
		Description	Water	Water	Water	Water	Water
		Sampled Date	24-JUL-15	25-JUL-15	24-JUL-15	25-JUL-15	23-JUL-15
		Sampled Time	14:15	09:05	10:30	09:15	18:05
		Client ID	E1	E1	E2	E2	E3
Grouping	Analyte						
<b>WATER</b>							
<b>Total Metals</b>	Strontium (Sr)-Total (mg/L)		0.254		0.409		0.395
	Sulfur (S)-Total (mg/L)		44.8		78.1		82.6
	Thallium (Tl)-Total (mg/L)		0.000013		0.000030		<0.000010
	Tin (Sn)-Total (mg/L)		<0.00010		<0.00010		<0.00010
	Titanium (Ti)-Total (mg/L)		0.00088		0.00076		0.00328
	Uranium (U)-Total (mg/L)		0.00179		0.00206		0.00385
	Vanadium (V)-Total (mg/L)		0.00053		<0.00050		0.00101
	Zinc (Zn)-Total (mg/L)		<0.0030		<0.0030		<0.0030
	Zirconium (Zr)-Total (mg/L)		0.00077		0.00066		0.00069
<b>Dissolved Metals</b>	Dissolved Mercury Filtration Location		FIELD		FIELD		FIELD
	Dissolved Metals Filtration Location		FIELD		FIELD		FIELD
	Aluminum (Al)-Dissolved (mg/L)		0.0326		0.0236		0.0242
	Antimony (Sb)-Dissolved (mg/L)		0.00038		0.00047		0.00105
	Arsenic (As)-Dissolved (mg/L)		0.00086		0.00108		0.00125
	Barium (Ba)-Dissolved (mg/L)		0.0548		0.0521		0.0578
	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		0.034		0.077
	Cadmium (Cd)-Dissolved (mg/L)		0.0000395		0.0000662		0.0000229
	Calcium (Ca)-Dissolved (mg/L)		58.3		76.9		77.0
	Chromium (Cr)-Dissolved (mg/L)		0.00053		0.00056		0.00112
	Cobalt (Co)-Dissolved (mg/L)		0.00021		0.00058		0.00021
	Copper (Cu)-Dissolved (mg/L)		0.00283		0.00229		0.00210
	Iron (Fe)-Dissolved (mg/L)		0.153		0.231		0.095
	Lead (Pb)-Dissolved (mg/L)		<0.000050		<0.000050		<0.000050
	Lithium (Li)-Dissolved (mg/L)		0.0029		0.0081		0.0054
	Magnesium (Mg)-Dissolved (mg/L)		28.4		50.5		61.0
	Manganese (Mn)-Dissolved (mg/L)		0.0492		0.0828		0.0542
	Mercury (Hg)-Dissolved (mg/L)		0.0000063		<0.0000050		<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)		0.00134		0.00170		0.00142
	Nickel (Ni)-Dissolved (mg/L)		0.00573		0.0156		0.0127
	Phosphorus (P)-Dissolved (mg/L)		<0.050		<0.050		<0.050
	Potassium (K)-Dissolved (mg/L)		0.59		0.84		0.82
	Selenium (Se)-Dissolved (mg/L)		0.00121		0.00121		0.00129
	Silicon (Si)-Dissolved (mg/L)		4.23		4.51		5.74
	Silver (Ag)-Dissolved (mg/L)		<0.000010		<0.000010		<0.000010
	Sodium (Na)-Dissolved (mg/L)		2.45		3.62		4.59

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

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1648323-6 Water 25-JUL-15 08:45 E3	L1648323-7 Water 24-JUL-15 15:00 E4	L1648323-8 Water 25-JUL-15 08:30 E4	L1648323-9 Water 24-JUL-15 17:30 E7	L1648323-10 Water 25-JUL-15 19:10 E8
Grouping	Analyte					
<b>WATER</b>						
<b>Total Metals</b>	Strontium (Sr)-Total (mg/L)		0.477		0.488	0.174
	Sulfur (S)-Total (mg/L)		84.7		87.3	15.8
	Thallium (Tl)-Total (mg/L)		0.000024		0.000014	0.000035
	Tin (Sn)-Total (mg/L)		<0.00010		<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)		0.00107		0.00181	0.0893
	Uranium (U)-Total (mg/L)		0.00229		0.00231	0.00126
	Vanadium (V)-Total (mg/L)		0.00052		<0.00050	0.00734
	Zinc (Zn)-Total (mg/L)		<0.0030		<0.0030	0.0204
	Zirconium (Zr)-Total (mg/L)		0.00083		0.00109	0.00051
<b>Dissolved Metals</b>	Dissolved Mercury Filtration Location		FIELD		FIELD	FIELD
	Dissolved Metals Filtration Location		FIELD		FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)		0.0155		0.0121	0.0778
	Antimony (Sb)-Dissolved (mg/L)		0.00054		0.00045	0.00014
	Arsenic (As)-Dissolved (mg/L)		0.00114		0.00084	0.00052
	Barium (Ba)-Dissolved (mg/L)		0.0520		0.0550	0.0421
	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)		0.053		0.047	<0.010
	Cadmium (Cd)-Dissolved (mg/L)		0.0000487		0.0000557	0.0000222
	Calcium (Ca)-Dissolved (mg/L)		78.7		84.1	30.7
	Chromium (Cr)-Dissolved (mg/L)		0.00060		0.00052	0.00026
	Cobalt (Co)-Dissolved (mg/L)		0.00063		0.00053	0.00022
	Copper (Cu)-Dissolved (mg/L)		0.00197		0.00202	0.00243
	Iron (Fe)-Dissolved (mg/L)		0.207		0.186	0.135
	Lead (Pb)-Dissolved (mg/L)		<0.000050		<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)		0.0124		0.0132	0.0043
	Magnesium (Mg)-Dissolved (mg/L)		57.1		62.8	10.6
	Manganese (Mn)-Dissolved (mg/L)		0.118		0.191	0.0229
	Mercury (Hg)-Dissolved (mg/L)		<0.0000050		<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)		0.00179		0.00163	0.000520
	Nickel (Ni)-Dissolved (mg/L)		0.0178		0.0152	0.00264
	Phosphorus (P)-Dissolved (mg/L)		<0.050		<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)		0.94		1.08	1.08
	Selenium (Se)-Dissolved (mg/L)		0.00116		0.000877	0.000251
	Silicon (Si)-Dissolved (mg/L)		4.70		4.95	4.60
	Silver (Ag)-Dissolved (mg/L)		<0.000010		<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)		4.52		4.54	4.24

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

## ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1648323-11	L1648323-12	L1648323-13	L1648323-14	L1648323-15
		Description	Water	Water	Water	Water	Water
		Sampled Date	25-JUL-15	25-JUL-15	24-JUL-15	25-JUL-15	24-JUL-15
		Sampled Time	14:00	10:40	14:20	08:30	18:36
		Client ID	R1	R2	R4	R4	R6
Grouping	Analyte						
<b>WATER</b>							
<b>Total Metals</b>	Strontium (Sr)-Total (mg/L)		0.423	0.376	0.478		0.159
	Sulfur (S)-Total (mg/L)		77.6	62.4	74.2		15.7
	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)		0.00193	0.00201	0.00205		0.0116
	Uranium (U)-Total (mg/L)		0.00280	0.00487	0.00595		0.00100
	Vanadium (V)-Total (mg/L)		0.00052	0.00064	0.00060		0.00159
	Zinc (Zn)-Total (mg/L)		<0.0030	<0.0030	<0.0030		0.0053
	Zirconium (Zr)-Total (mg/L)		0.00068	0.00039	0.00108		0.00043
<b>Dissolved Metals</b>	Dissolved Mercury Filtration Location		FIELD	FIELD	FIELD		FIELD
	Dissolved Metals Filtration Location		FIELD	FIELD	FIELD		FIELD
	Aluminum (Al)-Dissolved (mg/L)		0.0158	0.0130	0.0217		0.0738
	Antimony (Sb)-Dissolved (mg/L)		0.00025	0.00055	0.00044		0.00013
	Arsenic (As)-Dissolved (mg/L)		0.00057	0.00080	0.00177		0.00053
	Barium (Ba)-Dissolved (mg/L)		0.0565	0.0552	0.0626		0.0485
	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)		0.010	0.012	<0.010		<0.010
	Cadmium (Cd)-Dissolved (mg/L)		0.0000859	0.0000213	0.000105		0.0000241
	Calcium (Ca)-Dissolved (mg/L)		90.2	69.5	88.5		32.5
	Chromium (Cr)-Dissolved (mg/L)		0.00021	0.00035	0.00035		0.00030
	Cobalt (Co)-Dissolved (mg/L)		0.00054	0.00015	0.00079		0.00028
	Copper (Cu)-Dissolved (mg/L)		0.00223	0.00143	0.00219		0.00257
	Iron (Fe)-Dissolved (mg/L)		0.255	0.156	0.214		0.163
	Lead (Pb)-Dissolved (mg/L)		<0.000050	<0.000050	<0.000050		<0.000050
	Lithium (Li)-Dissolved (mg/L)		0.0041	0.0067	0.0049		0.0042
	Magnesium (Mg)-Dissolved (mg/L)		45.0	50.7	48.0		11.5
	Manganese (Mn)-Dissolved (mg/L)		0.339	0.0869	0.197		0.0424
	Mercury (Hg)-Dissolved (mg/L)		0.0000053	<0.0000050	<0.0000050		<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)		0.00164	0.000802	0.00139		0.000462
	Nickel (Ni)-Dissolved (mg/L)		0.00478	0.00276	0.0131		0.00249
	Phosphorus (P)-Dissolved (mg/L)		<0.050	<0.050	<0.050		<0.050
	Potassium (K)-Dissolved (mg/L)		0.67	0.84	0.56		1.17
	Selenium (Se)-Dissolved (mg/L)		0.00137	0.000797	0.00240		0.000199
	Silicon (Si)-Dissolved (mg/L)		4.65	5.53	5.14		4.73
	Silver (Ag)-Dissolved (mg/L)		<0.000010	<0.000010	<0.000010		<0.000010
	Sodium (Na)-Dissolved (mg/L)		3.63	3.36	5.04		4.26

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

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1648323-16 Water 25-JUL-15 12:33 R8	L1648323-17 Water 25-JUL-15 16:30 R9	L1648323-18 Water 24-JUL-15 11:45 GWCC-5	L1648323-19 Water 25-JUL-15 09:10 GWCC-5	L1648323-20 Water 26-JUL-15 09:00 SL
Grouping	Analyte					
<b>WATER</b>						
<b>Total Metals</b>	Strontium (Sr)-Total (mg/L)	0.0912	0.275	0.730		1.09
	Sulfur (S)-Total (mg/L)	15.7	57.7	98.0		260
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	0.000026		0.000017
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010		<0.00010
	Titanium (Ti)-Total (mg/L)	0.00251	0.00177	<0.00030		<0.00030
	Uranium (U)-Total (mg/L)	0.000072	0.000779	0.00221		0.00407
	Vanadium (V)-Total (mg/L)	0.00068	0.00085	<0.00050		<0.00050
	Zinc (Zn)-Total (mg/L)	0.0035	<0.0030	<0.0030		<0.0030
	Zirconium (Zr)-Total (mg/L)	0.00064	0.00096	<0.00030		<0.00030
<b>Dissolved Metals</b>	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD		FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD		FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0458	0.0367	0.0019		0.0024
	Antimony (Sb)-Dissolved (mg/L)	0.00068	0.00025	0.00081		0.00299
	Arsenic (As)-Dissolved (mg/L)	0.00037	0.00089	0.00075		0.0148
	Barium (Ba)-Dissolved (mg/L)	0.0387	0.0991	0.0574		0.0227
	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)	<0.010	<0.010	0.035		0.044
	Cadmium (Cd)-Dissolved (mg/L)	0.0000376	0.0000577	0.000112		0.0000325
	Calcium (Ca)-Dissolved (mg/L)	22.5	75.8	124		241
	Chromium (Cr)-Dissolved (mg/L)	0.00101	0.00075	0.00047		0.00099
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	0.00055	0.00018		<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00239	0.00374	0.00081		0.00084
	Iron (Fe)-Dissolved (mg/L)	0.066	1.17	0.061		<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010	0.0099		0.0109
	Magnesium (Mg)-Dissolved (mg/L)	8.93	27.3	55.6		114
	Manganese (Mn)-Dissolved (mg/L)	0.00560	0.367	0.0128		0.00207
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050		<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.000513	0.00156	0.00192		0.00205
	Nickel (Ni)-Dissolved (mg/L)	0.00337	0.00381	0.0191		0.0178
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050		<0.050
	Potassium (K)-Dissolved (mg/L)	<0.10	0.55	0.85		1.42
	Selenium (Se)-Dissolved (mg/L)	0.000722	0.00159	0.00357		0.0169
	Silicon (Si)-Dissolved (mg/L)	6.20	5.13	5.02		4.86
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		<0.000010
	Sodium (Na)-Dissolved (mg/L)	3.27	2.67	3.74		2.74

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

# ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1648323-21 Water 24-JUL-15 10:30 DUP-1	L1648323-22 Water 25-JUL-15 09:15 DUP-1	L1648323-23 Water 24-JUL-15 11:30 FB-1	
Grouping	Analyte				
<b>WATER</b>					
<b>Total Metals</b>	Strontium (Sr)-Total (mg/L)	0.384		<0.00020	
	Sulfur (S)-Total (mg/L)	74.6		<0.50	
	Thallium (Tl)-Total (mg/L)	0.000029		<0.000010	
	Tin (Sn)-Total (mg/L)	<0.00010		<0.00010	
	Titanium (Ti)-Total (mg/L)	0.00135		<0.00030	
	Uranium (U)-Total (mg/L)	0.00198		<0.000010	
	Vanadium (V)-Total (mg/L)	0.00057		<0.00050	
	Zinc (Zn)-Total (mg/L)	<0.0030		<0.0030	
	Zirconium (Zr)-Total (mg/L)	0.00065		<0.00030	
<b>Dissolved Metals</b>	Dissolved Mercury Filtration Location	FIELD		FIELD	
	Dissolved Metals Filtration Location	FIELD		FIELD	
	Aluminum (Al)-Dissolved (mg/L)	0.0214		<0.0010	
	Antimony (Sb)-Dissolved (mg/L)	0.00047		<0.00010	
	Arsenic (As)-Dissolved (mg/L)	0.00109		<0.00010	
	Barium (Ba)-Dissolved (mg/L)	0.0522		<0.000050	
	Beryllium (Be)-Dissolved (mg/L)	<0.000020		<0.000020	
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050		<0.000050	
	Boron (B)-Dissolved (mg/L)	0.034		<0.010	
	Cadmium (Cd)-Dissolved (mg/L)	0.0000572		<0.0000050	
	Calcium (Ca)-Dissolved (mg/L)	74.2		<0.050	
	Chromium (Cr)-Dissolved (mg/L)	0.00052		<0.00010	
	Cobalt (Co)-Dissolved (mg/L)	0.00055		<0.00010	
	Copper (Cu)-Dissolved (mg/L)	0.00222		<0.00020	
	Iron (Fe)-Dissolved (mg/L)	0.222		<0.010	
	Lead (Pb)-Dissolved (mg/L)	<0.000050		<0.000050	
	Lithium (Li)-Dissolved (mg/L)	0.0080		<0.0010	
	Magnesium (Mg)-Dissolved (mg/L)	49.9		<0.10	
	Manganese (Mn)-Dissolved (mg/L)	0.0792		<0.00010	
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050		<0.0000050	
	Molybdenum (Mo)-Dissolved (mg/L)	0.00171		<0.000050	
	Nickel (Ni)-Dissolved (mg/L)	0.0152		<0.00050	
	Phosphorus (P)-Dissolved (mg/L)	<0.050		<0.050	
	Potassium (K)-Dissolved (mg/L)	0.82		<0.10	
	Selenium (Se)-Dissolved (mg/L)	0.00124		<0.000050	
	Silicon (Si)-Dissolved (mg/L)	4.50		<0.050	
	Silver (Ag)-Dissolved (mg/L)	<0.000010		<0.000010	
	Sodium (Na)-Dissolved (mg/L)	3.47		<0.050	

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

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L1648323-1	L1648323-2	L1648323-3	L1648323-4	L1648323-5
					Water	Water	Water	Water	Water
		24-JUL-15	14:15	E1	24-JUL-15	25-JUL-15	24-JUL-15	25-JUL-15	23-JUL-15
					14:15	09:05	10:30	09:15	18:05
					E1	E1	E2	E2	E3
Grouping	Analyte								
<b>WATER</b>									
<b>Dissolved Metals</b>	Strontium (Sr)-Dissolved (mg/L)				0.256		0.407		0.387
	Sulfur (S)-Dissolved (mg/L)				45.2		78.6		82.7
	Thallium (Tl)-Dissolved (mg/L)				0.000012		0.000028		<0.000010
	Tin (Sn)-Dissolved (mg/L)				<0.00010		<0.00010		<0.00010
	Titanium (Ti)-Dissolved (mg/L)				0.00063		0.00057		0.00053
	Uranium (U)-Dissolved (mg/L)				0.00172		0.00199		0.00379
	Vanadium (V)-Dissolved (mg/L)				<0.00050		<0.00050		<0.00050
	Zinc (Zn)-Dissolved (mg/L)				0.0013		0.0016		<0.0010
	Zirconium (Zr)-Dissolved (mg/L)				0.00081		0.00070		0.00062
<b>Speciated Metals</b>	Chromium (III)-Dissolved (mg/L)								0.00112
	Chromium (III)-Total (mg/L)								0.00137
	Hexavalent Chromium (mg/L)								<0.0010
	Hexavalent Chromium-Dissolved (mg/L)								<0.0010

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

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L1648323-6	L1648323-7	L1648323-8	L1648323-9	L1648323-10
					Water	Water	Water	Water	Water
		25-JUL-15	08:45	E3	25-JUL-15	24-JUL-15	25-JUL-15	24-JUL-15	25-JUL-15
					08:45	15:00	08:30	17:30	19:10
					E3	E4	E4	E7	E8
Grouping	Analyte								
<b>WATER</b>									
<b>Dissolved Metals</b>	Strontium (Sr)-Dissolved (mg/L)					0.481		0.499	0.166
	Sulfur (S)-Dissolved (mg/L)					85.9		91.0	16.0
	Thallium (Tl)-Dissolved (mg/L)					0.000024		0.000014	<0.000010
	Tin (Sn)-Dissolved (mg/L)					<0.00010		<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)					<0.00030		<0.00030	0.00051
	Uranium (U)-Dissolved (mg/L)					0.00225		0.00232	0.000938
	Vanadium (V)-Dissolved (mg/L)					<0.00050		<0.00050	0.00059
	Zinc (Zn)-Dissolved (mg/L)					<0.0010		0.0012	0.0020
	Zirconium (Zr)-Dissolved (mg/L)					0.00088		0.00104	0.00049
<b>Speciated Metals</b>	Chromium (III)-Dissolved (mg/L)								
	Chromium (III)-Total (mg/L)								0.00576
	Hexavalent Chromium (mg/L)								<0.0010
	Hexavalent Chromium-Dissolved (mg/L)								

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



## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1648323-11 Water 25-JUL-15 14:00 R1	L1648323-12 Water 25-JUL-15 10:40 R2	L1648323-13 Water 24-JUL-15 14:20 R4	L1648323-14 Water 25-JUL-15 08:30 R4	L1648323-15 Water 24-JUL-15 18:36 R6
Grouping	Analyte					
<b>WATER</b>						
<b>Dissolved Metals</b>	Strontium (Sr)-Dissolved (mg/L)	0.432	0.373	0.480		0.168
	Sulfur (S)-Dissolved (mg/L)	78.7	63.4	76.1		17.3
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		<0.00010
	Titanium (Ti)-Dissolved (mg/L)	0.00036	0.00033	0.00057		0.00057
	Uranium (U)-Dissolved (mg/L)	0.00287	0.00475	0.00595		0.000930
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050		0.00064
	Zinc (Zn)-Dissolved (mg/L)	0.0012	<0.0010	0.0020		0.0023
	Zirconium (Zr)-Dissolved (mg/L)	0.00074	0.00040	0.00120		0.00054
<b>Speciated Metals</b>	Chromium (III)-Dissolved (mg/L)					
	Chromium (III)-Total (mg/L)					0.00111
	Hexavalent Chromium (mg/L)					<0.0010
	Hexavalent Chromium-Dissolved (mg/L)					

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

## ALS ENVIRONMENTAL ANALYTICAL REPORT

11-SEP-15 14:48 (MT)

Version: FINAL REV. 3

Sample ID Description Sampled Date Sampled Time Client ID		L1648323-16 Water 25-JUL-15 12:33 R8	L1648323-17 Water 25-JUL-15 16:30 R9	L1648323-18 Water 24-JUL-15 11:45 GWCC-5	L1648323-19 Water 25-JUL-15 09:10 GWCC-5	L1648323-20 Water 26-JUL-15 09:00 SL
Grouping	Analyte					
<b>WATER</b>						
<b>Dissolved Metals</b>	Strontium (Sr)-Dissolved (mg/L)	0.0935	0.272	0.698		1.10
	Sulfur (S)-Dissolved (mg/L)	16.1	58.9	97.3		267
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	0.000024		0.000017
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		<0.00010
	Titanium (Ti)-Dissolved (mg/L)	0.00065	0.00135	<0.00030		<0.00030
	Uranium (U)-Dissolved (mg/L)	0.000049	0.000768	0.00217		0.00411
	Vanadium (V)-Dissolved (mg/L)	<0.00050	0.00063	<0.00050		<0.00050
	Zinc (Zn)-Dissolved (mg/L)	0.0015	<0.0010	<0.0010		<0.0010
	Zirconium (Zr)-Dissolved (mg/L)	0.00073	0.00099	<0.00030		<0.00030
<b>Speciated Metals</b>	Chromium (III)-Dissolved (mg/L)	0.00101				
	Chromium (III)-Total (mg/L)	0.00124				0.00137
	Hexavalent Chromium (mg/L)	<0.0010				<0.0010
	Hexavalent Chromium-Dissolved (mg/L)	<0.0010				

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

# ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1648323-21 Water 24-JUL-15 10:30 DUP-1	L1648323-22 Water 25-JUL-15 09:15 DUP-1	L1648323-23 Water 24-JUL-15 11:30 FB-1	
Grouping	Analyte				
<b>WATER</b>					
<b>Dissolved Metals</b>	Strontium (Sr)-Dissolved (mg/L)	0.405		<0.00020	
	Sulfur (S)-Dissolved (mg/L)	80.2		<0.50	
	Thallium (Tl)-Dissolved (mg/L)	0.000029		<0.000010	
	Tin (Sn)-Dissolved (mg/L)	<0.00010		<0.00010	
	Titanium (Ti)-Dissolved (mg/L)	0.00041		<0.00030	
	Uranium (U)-Dissolved (mg/L)	0.00199		<0.000010	
	Vanadium (V)-Dissolved (mg/L)	<0.00050		<0.00050	
	Zinc (Zn)-Dissolved (mg/L)	0.0010		<0.0010	
	Zirconium (Zr)-Dissolved (mg/L)	0.00070		<0.00030	
<b>Speciated Metals</b>	Chromium (III)-Dissolved (mg/L)				
	Chromium (III)-Total (mg/L)	0.00163			
	Hexavalent Chromium (mg/L)	<0.0010			
	Hexavalent Chromium-Dissolved (mg/L)				

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

## Reference Information

## QC Samples with Qualifiers &amp; Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Beryllium (Be)-Dissolved	DLA	L1648323-15
Duplicate	Bismuth (Bi)-Dissolved	DLA	L1648323-15
Duplicate	Cadmium (Cd)-Dissolved	DLA	L1648323-15
Duplicate	Chromium (Cr)-Dissolved	DLA	L1648323-15
Duplicate	Copper (Cu)-Dissolved	DLA	L1648323-15
Duplicate	Nickel (Ni)-Dissolved	DLA	L1648323-15
Duplicate	Silver (Ag)-Dissolved	DLA	L1648323-15
Duplicate	Tin (Sn)-Dissolved	DLA	L1648323-15
Duplicate	Titanium (Ti)-Dissolved	DLA	L1648323-15
Duplicate	Zirconium (Zr)-Dissolved	DLA	L1648323-15
Duplicate	Antimony (Sb)-Dissolved	DLA	L1648323-15
Duplicate	Bismuth (Bi)-Dissolved	DLA	L1648323-15
Duplicate	Cadmium (Cd)-Dissolved	DLA	L1648323-15
Duplicate	Chromium (Cr)-Dissolved	DLA	L1648323-15
Duplicate	Cobalt (Co)-Dissolved	DLA	L1648323-15
Duplicate	Copper (Cu)-Dissolved	DLA	L1648323-15
Duplicate	Lead (Pb)-Dissolved	DLA	L1648323-15
Duplicate	Nickel (Ni)-Dissolved	DLA	L1648323-15
Duplicate	Selenium (Se)-Dissolved	DLA	L1648323-15
Duplicate	Silver (Ag)-Dissolved	DLA	L1648323-15
Duplicate	Thallium (Tl)-Dissolved	DLA	L1648323-15
Duplicate	Tin (Sn)-Dissolved	DLA	L1648323-15
Duplicate	Titanium (Ti)-Dissolved	DLA	L1648323-15
Duplicate	Vanadium (V)-Dissolved	DLA	L1648323-15
Duplicate	Zinc (Zn)-Dissolved	DLA	L1648323-15
Duplicate	Zirconium (Zr)-Dissolved	DLA	L1648323-15
Duplicate	Beryllium (Be)-Dissolved	DLA	L1648323-15
Duplicate	Bismuth (Bi)-Dissolved	DLA	L1648323-15
Duplicate	Chromium (Cr)-Dissolved	DLA	L1648323-15
Duplicate	Cobalt (Co)-Dissolved	DLA	L1648323-15
Duplicate	Nickel (Ni)-Dissolved	DLA	L1648323-15
Duplicate	Titanium (Ti)-Dissolved	DLA	L1648323-15
Duplicate	Zirconium (Zr)-Dissolved	DLA	L1648323-15
Matrix Spike	Sulfate (SO4)	MS-B	L1648323-10, -11, -12, -14, -15, -16, -17, -19, -2, -20, -22, -23, -4, -6, -8, -9
Matrix Spike	Dissolved Organic Carbon	MS-B	L1648323-10, -11, -12, -13, -15, -18, -20, -21, -23, -3, -5, -7, -9
Matrix Spike	Dissolved Organic Carbon	MS-B	L1648323-10, -11, -12, -13, -15, -18, -20, -21, -23, -3, -5, -7, -9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1648323-1, -10, -11, -12, -13, -16, -17, -18, -20, -21, -23, -3, -5, -7, -9
Matrix Spike	Iron (Fe)-Dissolved	MS-B	L1648323-1, -10, -11, -12, -13, -16, -17, -18, -20, -21, -23, -3, -5, -7, -9
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1648323-1, -10, -11, -12, -13, -16, -17, -18, -20, -21, -23, -3, -5, -7, -9
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1648323-1, -10, -11, -12, -13, -16, -17, -18, -20, -21, -23, -3, -5, -7, -9
Matrix Spike	Copper (Cu)-Dissolved	MS-B	L1648323-1, -10, -11, -12, -13, -16, -17, -18, -20, -21, -23, -3, -5, -7, -9
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1648323-1, -10, -11, -12, -13, -16, -17, -18, -20, -21, -23, -3, -5, -7, -9
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1648323-1, -10, -11, -12, -13, -16, -17, -18, -20, -21, -23, -3, -5, -7, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1648323-1, -10, -11, -12, -13, -16, -17, -18, -20, -21, -23, -3, -5, -7, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1648323-1, -10, -11, -12, -13, -16, -17, -18, -20, -21, -23,

## Reference Information

	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Strontium (Sr)-Total	MS-B	-3, -5, -7, -9 L1648323-15, -16, -17, -18, -20, -21, -23
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1648323-1, -10, -11, -12, -13, -16, -17, -18, -20, -21, -23, -3, -5, -7, -9
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1648323-1, -10, -11, -12, -13, -16, -17, -18, -20, -21, -23, -3, -5, -7, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1648323-1, -10, -11, -12, -13, -16, -17, -18, -20, -21, -23, -3, -5, -7, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1648323-1, -10, -11, -12, -13, -16, -17, -18, -20, -21, -23, -3, -5, -7, -9
Matrix Spike	Uranium (U)-Dissolved	MS-B	L1648323-1, -10, -11, -12, -13, -16, -17, -18, -20, -21, -23, -3, -5, -7, -9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1648323-15
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1648323-15
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1648323-15
Matrix Spike	Arsenic (As)-Dissolved	MS-B	L1648323-15
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1648323-15
Matrix Spike	Aluminum (Al)-Dissolved	MS-B	L1648323-15
Matrix Spike	Antimony (Sb)-Dissolved	MS-B	L1648323-15
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1648323-15
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1648323-15
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1648323-15
Matrix Spike	Antimony (Sb)-Dissolved	MS-B	L1648323-15
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1648323-15
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1648323-15
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1648323-15
Matrix Spike	Uranium (U)-Dissolved	MS-B	L1648323-15
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1648323-15
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1648323-15
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1648323-15
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1648323-15
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1648323-15
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1648323-15
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1648323-15
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1648323-15
Matrix Spike	Aluminum (Al)-Dissolved	MS-B	L1648323-15
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1648323-15
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1648323-15
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1648323-15
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1648323-15
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1648323-15
Matrix Spike	Zinc (Zn)-Dissolved	MS-B	L1648323-15

## 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:

## Reference Information

ALS Test Code	Matrix	Test Description	Method Reference**
<b>BE-D-L-CCMS-VA</b>	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.	
<b>BE-T-L-CCMS-VA</b>	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.	
<b>CARBONS-DOC-VA</b>	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.	
<b>CR-CR3-DIS-CALC-ED</b>	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.	
<b>CR-CR3-ED</b>	Water	Chromium, Trivalent (Cr +3)	Total Dissolved Cr - Cr(+6)
		Chromium (III) is calculated as the difference between Total Chromium and Chromium (VI) results.	
<b>CR-CR3-TOT-CALC-ED</b>	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.	
<b>CR-CR6-ED</b>	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.	
<b>CR6-D-IC-ED</b>	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.	
<b>EC-MAN-WR</b>	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.	
<b>ETL-CR3DIS-ED</b>	Water	Chromium, Total Dissolved for Speciation	APHA 3120 B-ICP-OES
<b>HARDNESS-CALC-VA</b>	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.	
<b>HG-D-CVAA-VA</b>	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.	
<b>HG-T-CVAA-VA</b>	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.	
<b>MET-D-CCMS-VA</b>	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.	
<b>MET-DIS-LOW-ICP-VA</b>	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).	
<b>MET-T-CCMS-VA</b>	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)

## Reference Information

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.

<b>MET-TOT-LOW-ICP-VA</b>	Water	Total Metals in Water by ICPOES	EPA 3005A/6010B
<p>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).</p>			
<b>NH3-F-VA</b>	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)
<p>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.</p>			
<b>NH3-F-VA</b>	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
<p>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.</p>			
<b>NO2-L-IC-N-WR</b>	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			
<b>NO3-L-IC-N-WR</b>	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			
<b>P-T-PRES-COL-VA</b>	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
<p>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.</p>			
<b>PH-MAN-WR</b>	Water	pH by Meter	APHA 4500-H+
<p>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.</p>			
<b>S-DIS-ICP-VA</b>	Water	Dissolved Sulfur in Water by ICPOES	EPA SW-846 3005A/6010B
<p>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).</p>			
<p>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.</p>			
<b>S-TOT-ICP-VA</b>	Water	Total Sulfur in Water by ICPOES	EPA SW-846 3005A/6010B
<p>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).</p>			
<p>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.</p>			
<b>SO4-IC-N-WR</b>	Water	Sulfate in Water by IC	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			
<b>TSS-MAN-WR</b>	Water	Total Suspended Solids by Gravimetric	APHA 2540 D
<p>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.</p>			

\*\* 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
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## Reference Information

### Chain of Custody Numbers:

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1

2

#### **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 ww* - 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.*









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

Date Received: 28-JUL-15  
Report Date: 11-SEP-15 14:56 (MT)  
Version: FINAL REV. 3

Client Phone: 867-456-4865

## Certificate of Analysis

Lab Work Order #: L1649166  
Project P.O. #: NOT SUBMITTED  
Job Reference: 1343-005.10  
C of C Numbers: 1  
Legal Site Desc:

Comments: 11-SEP-2015 This report replaces the previous version and contains additional analyses, as requested.

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Brent Mack, B.Sc.  
Account Manager

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ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1649166-1 Water 26-JUL-15 15:45 R3	L1649166-2 Water 26-JUL-15 12:20 R7	L1649166-3 Water 26-JUL-15 20:00 GWCC-1	L1649166-4 Water 26-JUL-15 19:35 GWCC-2	L1649166-5 Water 26-JUL-15 19:00 GWCC-3	
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Conductivity (uS/cm)	679	176	2340	1680	956
	Hardness (as CaCO3) (mg/L)	440	104	1720	1230	609
	pH (pH)	7.99	7.40	7.44	7.63	7.55
	Total Suspended Solids (mg/L)	115	11.3	<3.0	<3.0	<3.0
<b>Anions and Nutrients</b>	Ammonia, Total (as N) (mg/L)	0.0300	0.0714	<0.0050	<0.0050	<0.0050
	Nitrate (as N) (mg/L)	0.0521	0.0887	0.466 <sup>DLA</sup>	0.373 <sup>DLA</sup>	0.158 <sup>DLA</sup>
	Nitrite (as N) (mg/L)	0.0019	<0.0010	<0.010	<0.0050	<0.0020
	Phosphorus (P)-Total (mg/L)	0.0448	0.0390	<0.0020	<0.0020	<0.0020
	Sulfate (SO4) (mg/L)	264	29.6	1410	910	394
<b>Organic / Inorganic Carbon</b>	Dissolved Organic Carbon (mg/L)	17.7	29.0	5.53	7.42	9.67
<b>Total Metals</b>	Aluminum (Al)-Total (mg/L)	2.08	0.383	<0.0030	<0.0030	<0.0030
	Antimony (Sb)-Total (mg/L)	0.00032	0.00024	0.00121	0.00111	0.00094
	Arsenic (As)-Total (mg/L)	0.00236	0.00200	0.00196	0.00135	0.00087
	Barium (Ba)-Total (mg/L)	0.123	0.0968	0.0167	0.0194	0.0314
	Beryllium (Be)-Total (mg/L)	0.000079	0.000037	<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)	0.013	<0.010	0.258	0.117	0.080
	Cadmium (Cd)-Total (mg/L)	0.0000949	0.0000421	0.000192	0.000163	0.0000788
	Calcium (Ca)-Total (mg/L)	80.0	23.9	196	165	108
	Chromium (Cr)-Total (mg/L)	0.00471	0.00204	0.00200	0.00120	0.00067
	Cobalt (Co)-Total (mg/L)	0.00180	0.00109	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	0.00697	0.00484	0.00096	0.00124	0.00119
	Iron (Fe)-Total (mg/L)	3.99	2.30	<0.010	<0.010	<0.010
	Lead (Pb)-Total (mg/L)	0.00183	0.000318	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	0.0046	0.0011	0.0688	0.0128	0.0079
	Magnesium (Mg)-Total (mg/L)	58.4	10.2	278	183	82.1
	Manganese (Mn)-Total (mg/L)	0.190	0.294	0.00023	<0.00010	0.00022
	Mercury (Hg)-Total (mg/L)	0.0000136	0.0000058	<0.0000050	0.0000055	0.0000063
	Molybdenum (Mo)-Total (mg/L)	0.00135	0.000667	0.00260	0.00277	0.00265
	Nickel (Ni)-Total (mg/L)	0.00893	0.00475	0.0750	0.0424	0.0304
	Phosphorus (P)-Total (mg/L)	0.094	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	1.10	0.24	3.27	2.03	1.36
	Selenium (Se)-Total (mg/L)	0.000642	0.000295	0.00419	0.00319	0.00129
	Silicon (Si)-Total (mg/L)	9.30	5.81	6.27	5.21	5.14
	Silver (Ag)-Total (mg/L)	0.000042	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	4.49	1.47	17.0	6.34	3.66

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

# ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1649166-6 Water 26-JUL-15 18:45 GWCC-4	L1649166-7 Water 26-JUL-15 19:00 DUP-2	L1649166-8 Water 26-JUL-15 19:00 TRAVEL BLANK	
Grouping	Analyte				
<b>WATER</b>					
<b>Physical Tests</b>	Conductivity (uS/cm)	694	982	<2.0	
	Hardness (as CaCO3) (mg/L)	427	614	<0.50	
	pH (pH)	7.55	7.53	5.01	
	Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0	
<b>Anions and Nutrients</b>	Ammonia, Total (as N) (mg/L)	0.0050	0.0062	0.0100 <sup>RRV</sup>	
	Nitrate (as N) (mg/L)	0.0681	0.160 <sup>DLA</sup>	<0.0050	
	Nitrite (as N) (mg/L)	<0.0010	<0.0020	<0.0010	
	Phosphorus (P)-Total (mg/L)	<0.0020	<0.0020	<0.0020	
	Sulfate (SO4) (mg/L)	230	391	<0.30	
<b>Organic / Inorganic Carbon</b>	Dissolved Organic Carbon (mg/L)	10.4	9.83		
<b>Total Metals</b>	Aluminum (Al)-Total (mg/L)	<0.0030	0.0045	<0.0030	
	Antimony (Sb)-Total (mg/L)	0.00094	0.00093	<0.00010	
	Arsenic (As)-Total (mg/L)	0.00131	0.00091	<0.00010	
	Barium (Ba)-Total (mg/L)	0.0324	0.0314	<0.000050	
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	
	Boron (B)-Total (mg/L)	0.055	0.082	<0.010	
	Cadmium (Cd)-Total (mg/L)	0.0000500	0.0000817	<0.0000050	
	Calcium (Ca)-Total (mg/L)	82.0	113	<0.050	
	Chromium (Cr)-Total (mg/L)	0.00048	0.00070	<0.00010	
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Copper (Cu)-Total (mg/L)	0.00128	0.00125	<0.00050	
	Iron (Fe)-Total (mg/L)	<0.010	0.015	<0.010	
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	
	Lithium (Li)-Total (mg/L)	0.0068	0.0079	<0.0010	
	Magnesium (Mg)-Total (mg/L)	52.6	85.4	<0.10	
	Manganese (Mn)-Total (mg/L)	0.00057	0.00050	<0.00010	
	Mercury (Hg)-Total (mg/L)	<0.0000050	0.0000059	<0.0000050	
	Molybdenum (Mo)-Total (mg/L)	0.00257	0.00267	<0.000050	
	Nickel (Ni)-Total (mg/L)	0.0330	0.0315	<0.00050	
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	
	Potassium (K)-Total (mg/L)	1.22	1.43	<0.10	
	Selenium (Se)-Total (mg/L)	0.000712	0.00134	<0.000050	
	Silicon (Si)-Total (mg/L)	5.94	5.30	<0.050	
Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010		
Sodium (Na)-Total (mg/L)	2.88	3.75	<0.050		

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

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1649166-1 Water 26-JUL-15 15:45 R3	L1649166-2 Water 26-JUL-15 12:20 R7	L1649166-3 Water 26-JUL-15 20:00 GWCC-1	L1649166-4 Water 26-JUL-15 19:35 GWCC-2	L1649166-5 Water 26-JUL-15 19:00 GWCC-3	
Grouping	Analyte					
<b>WATER</b>						
<b>Total Metals</b>	Strontium (Sr)-Total (mg/L)	0.380	0.0756	1.85	0.887	0.517
	Sulfur (S)-Total (mg/L)	93.9	10.2	441	298	130
	Thallium (Tl)-Total (mg/L)	0.000033	<0.000010	0.000087	0.000065	0.000075
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	0.0544	0.0117	<0.00030	<0.00030	<0.00030
	Uranium (U)-Total (mg/L)	0.00554	0.000116	0.00664	0.00294	0.00142
	Vanadium (V)-Total (mg/L)	0.00657	0.00253	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	0.0159	0.0035	0.0073	0.0050	0.0035
	Zirconium (Zr)-Total (mg/L)	0.00098	0.00110	<0.00030	<0.00030	<0.00030
<b>Dissolved Metals</b>	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0470	0.109	0.0011	0.0012	0.0020
	Antimony (Sb)-Dissolved (mg/L)	0.00020	0.00022	0.00130	0.00111	0.00089
	Arsenic (As)-Dissolved (mg/L)	0.00074	0.00177	0.00194	0.00137	0.00083
	Barium (Ba)-Dissolved (mg/L)	0.0482	0.0905	0.0173	0.0193	0.0311
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	0.000031	<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)	<0.010	<0.010	0.302	0.110	0.070
	Cadmium (Cd)-Dissolved (mg/L)	0.0000086	0.0000325	0.000176	0.000167	0.0000878
	Calcium (Ca)-Dissolved (mg/L)	81.4	24.3	209	178	110
	Chromium (Cr)-Dissolved (mg/L)	0.00060	0.00156	0.00203	0.00110	0.00049
	Cobalt (Co)-Dissolved (mg/L)	0.00038	0.00092	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00208	0.00435	0.00091	0.00112	0.00114
	Iron (Fe)-Dissolved (mg/L)	0.358	1.65	0.013	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	0.000116	0.000104	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0030	<0.0010	0.0780	0.0127	0.0080
	Magnesium (Mg)-Dissolved (mg/L)	57.4	10.5	292	191	81.4
	Manganese (Mn)-Dissolved (mg/L)	0.122	0.290	0.00025	0.00013	0.00023
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	0.0000056	0.0000076
	Molybdenum (Mo)-Dissolved (mg/L)	0.00108	0.000646	0.00260	0.00264	0.00255
	Nickel (Ni)-Dissolved (mg/L)	0.00363	0.00437	0.0723	0.0413	0.0304
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	0.76	0.25	3.34	2.13	1.38
	Selenium (Se)-Dissolved (mg/L)	0.000465	0.000303	0.00435	0.00323	0.00135
	Silicon (Si)-Dissolved (mg/L)	5.84	5.37	6.29	5.30	5.14
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	4.25	1.56	16.4	6.23	3.60

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

# ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1649166-6 Water 26-JUL-15 18:45 GWCC-4	L1649166-7 Water 26-JUL-15 19:00 DUP-2	L1649166-8 Water 26-JUL-15 19:00 TRAVEL BLANK	
Grouping	Analyte				
<b>WATER</b>					
<b>Total Metals</b>	Strontium (Sr)-Total (mg/L)	0.399	0.528	<0.00020	
	Sulfur (S)-Total (mg/L)	78.1	131	<0.50	
	Thallium (Tl)-Total (mg/L)	0.000073	0.000074	<0.000010	
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	
	Uranium (U)-Total (mg/L)	0.000962	0.00142	<0.000010	
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	
	Zinc (Zn)-Total (mg/L)	<0.0030	0.0033	<0.0030	
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	
<b>Dissolved Metals</b>	Dissolved Mercury Filtration Location	FIELD	FIELD		
	Dissolved Metals Filtration Location	FIELD	FIELD		
	Aluminum (Al)-Dissolved (mg/L)	0.0025	0.0022		
	Antimony (Sb)-Dissolved (mg/L)	0.00090	0.00087		
	Arsenic (As)-Dissolved (mg/L)	0.00129	0.00081		
	Barium (Ba)-Dissolved (mg/L)	0.0327	0.0297		
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020		
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050		
	Boron (B)-Dissolved (mg/L)	0.049	0.068		
	Cadmium (Cd)-Dissolved (mg/L)	0.0000611	0.0000849		
	Calcium (Ca)-Dissolved (mg/L)	84.5	110		
	Chromium (Cr)-Dissolved (mg/L)	0.00041	0.00047		
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010		
	Copper (Cu)-Dissolved (mg/L)	0.00135	0.00112		
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010		
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050		
	Lithium (Li)-Dissolved (mg/L)	0.0066	0.0077		
	Magnesium (Mg)-Dissolved (mg/L)	52.5	82.2		
	Manganese (Mn)-Dissolved (mg/L)	0.00052	0.00015		
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	0.0000064		
	Molybdenum (Mo)-Dissolved (mg/L)	0.00239	0.00247		
	Nickel (Ni)-Dissolved (mg/L)	0.0325	0.0294		
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050		
	Potassium (K)-Dissolved (mg/L)	1.19	1.35		
	Selenium (Se)-Dissolved (mg/L)	0.000672	0.00131		
	Silicon (Si)-Dissolved (mg/L)	5.90	5.15		
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010		
	Sodium (Na)-Dissolved (mg/L)	2.90	3.47		

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

## ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1649166-1	L1649166-2	L1649166-3	L1649166-4	L1649166-5
		Description	Water	Water	Water	Water	Water
		Sampled Date	26-JUL-15	26-JUL-15	26-JUL-15	26-JUL-15	26-JUL-15
		Sampled Time	15:45	12:20	20:00	19:35	19:00
		Client ID	R3	R7	GWCC-1	GWCC-2	GWCC-3
Grouping	Analyte						
<b>WATER</b>							
<b>Dissolved Metals</b>	Strontium (Sr)-Dissolved (mg/L)		0.376	0.0747	1.82	0.878	0.512
	Sulfur (S)-Dissolved (mg/L)		92.9	9.92	433	295	128
	Thallium (Tl)-Dissolved (mg/L)		<0.000010	<0.000010	0.000088	0.000067	0.000075
	Tin (Sn)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)		0.00090	0.00282	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)		0.00504	0.000090	0.00670	0.00295	0.00137
	Vanadium (V)-Dissolved (mg/L)		0.00079	0.00158	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)		0.0013	0.0021	0.0070	0.0046	0.0029
	Zirconium (Zr)-Dissolved (mg/L)		0.00070	0.00124	<0.00030	<0.00030	<0.00030
<b>Speciated Metals</b>	Chromium (III)-Dissolved (mg/L)			0.00156	<0.00045	<0.00042	
	Chromium (III)-Total (mg/L)		0.00141	0.00204	<0.00048	<0.00044	
	Hexavalent Chromium (mg/L)		0.0033 <sup>RRV</sup>	<0.0010	0.0024	0.0016	
	Hexavalent Chromium-Dissolved (mg/L)			<0.0010	0.0018	0.0014	

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



## ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1649166-6	L1649166-7	L1649166-8		
		Description	Water	Water	Water		
		Sampled Date	26-JUL-15	26-JUL-15	26-JUL-15		
		Sampled Time	18:45	19:00	19:00		
		Client ID	GWCC-4	DUP-2	TRAVEL BLANK		
Grouping	Analyte						
<b>WATER</b>							
<b>Dissolved Metals</b>	Strontium (Sr)-Dissolved (mg/L)		0.388	0.501			
	Sulfur (S)-Dissolved (mg/L)		76.5	128			
	Thallium (Tl)-Dissolved (mg/L)		0.000072	0.000072			
	Tin (Sn)-Dissolved (mg/L)		<0.00010	<0.00010			
	Titanium (Ti)-Dissolved (mg/L)		<0.00030	<0.00030			
	Uranium (U)-Dissolved (mg/L)		0.000913	0.00135			
	Vanadium (V)-Dissolved (mg/L)		<0.00050	<0.00050			
	Zinc (Zn)-Dissolved (mg/L)		0.0053	0.0022			
	Zirconium (Zr)-Dissolved (mg/L)		<0.00030	<0.00030			
<b>Speciated Metals</b>	Chromium (III)-Dissolved (mg/L)						
	Chromium (III)-Total (mg/L)						
	Hexavalent Chromium (mg/L)						
	Hexavalent Chromium-Dissolved (mg/L)						

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

## Reference Information

## Qualifiers for Individual Samples Listed:

Sample Number	Client Sample ID	Qualifier	Description
L1649166-1	R3	WSMT	Water sample(s) for total mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.
L1649166-9	R3 - HG ALS CUT FROM RA	WSMT SPL	Water sample(s) for total mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low. Sample was Preserved at the laboratory - Hg Vial preserved 28-Jul-15

## QC Samples with Qualifiers &amp; Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Antimony (Sb)-Dissolved	DLA	L1649166-1, -2, -3, -4, -5, -6, -7
Duplicate	Bismuth (Bi)-Dissolved	DLA	L1649166-1, -2, -3, -4, -5, -6, -7
Duplicate	Cadmium (Cd)-Dissolved	DLA	L1649166-1, -2, -3, -4, -5, -6, -7
Duplicate	Chromium (Cr)-Dissolved	DLA	L1649166-1, -2, -3, -4, -5, -6, -7
Duplicate	Copper (Cu)-Dissolved	DLA	L1649166-1, -2, -3, -4, -5, -6, -7
Duplicate	Lead (Pb)-Dissolved	DLA	L1649166-1, -2, -3, -4, -5, -6, -7
Duplicate	Silver (Ag)-Dissolved	DLA	L1649166-1, -2, -3, -4, -5, -6, -7
Duplicate	Thallium (Tl)-Dissolved	DLA	L1649166-1, -2, -3, -4, -5, -6, -7
Duplicate	Tin (Sn)-Dissolved	DLA	L1649166-1, -2, -3, -4, -5, -6, -7
Duplicate	Titanium (Ti)-Dissolved	DLA	L1649166-1, -2, -3, -4, -5, -6, -7
Duplicate	Uranium (U)-Dissolved	DLA	L1649166-1, -2, -3, -4, -5, -6, -7
Duplicate	Vanadium (V)-Dissolved	DLA	L1649166-1, -2, -3, -4, -5, -6, -7
Duplicate	Zinc (Zn)-Dissolved	DLA	L1649166-1, -2, -3, -4, -5, -6, -7
Duplicate	Zirconium (Zr)-Dissolved	DLA	L1649166-1, -2, -3, -4, -5, -6, -7
Duplicate	Bismuth (Bi)-Total	DLA	L1649166-2, -3, -4, -5, -6, -7, -8
Duplicate	Silver (Ag)-Total	DLA	L1649166-2, -3, -4, -5, -6, -7, -8
Duplicate	Thallium (Tl)-Total	DLA	L1649166-2, -3, -4, -5, -6, -7, -8
Duplicate	Tin (Sn)-Total	DLA	L1649166-2, -3, -4, -5, -6, -7, -8
Duplicate	Vanadium (V)-Total	DLA	L1649166-2, -3, -4, -5, -6, -7, -8
Duplicate	Zirconium (Zr)-Total	DLA	L1649166-2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sulfate (SO4)	MS-B	L1649166-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1649166-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1649166-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1649166-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Dissolved Organic Carbon	MS-B	L1649166-3, -4, -5, -6, -7
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1649166-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1649166-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1649166-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Barium (Ba)-Total	MS-B	L1649166-1
Matrix Spike	Copper (Cu)-Total	MS-B	L1649166-1
Matrix Spike	Sodium (Na)-Total	MS-B	L1649166-1
Matrix Spike	Strontium (Sr)-Total	MS-B	L1649166-1

## 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.
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.			

## Reference Information

<b>BE-T-L-CCMS-VA</b>	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.			
<b>CARBONS-DOC-VA</b>	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.			
<b>CARBONS-TOC-VA</b>	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)".			
<b>CR-CR3-DIS-CALC-ED</b>	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.			
<b>CR-CR3-ED</b>	Water	Chromium, Trivalent (Cr +3)	Total Dissolved Cr - Cr(+6)
Chromium (III) is calculated as the difference between Total Chromium and Chromium (VI) results.			
<b>CR-CR3-TOT-CALC-ED</b>	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.			
<b>CR-CR6-ED</b>	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.			
<b>CR6-D-IC-ED</b>	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.			
<b>EC-MAN-WR</b>	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.			
<b>ETL-CR3DIS-ED</b>	Water	Chromium, Total Dissolved for Speciation	APHA 3120 B-ICP-OES
<b>HARDNESS-CALC-VA</b>	Water	Hardness	APHA 2340B
Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO <sub>3</sub> equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.			
<b>HG-D-CVAA-VA</b>	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.			
<b>HG-T-CVAA-VA</b>	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.			
<b>MET-D-CCMS-VA</b>	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.			
<b>MET-DIS-LOW-ICP-VA</b>	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).			
<b>MET-T-CCMS-VA</b>	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.			

## Reference Information

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

<b>MET-TOT-LOW-ICP-VA</b>	Water	Total Metals in Water by ICPOES	EPA 3005A/6010B
<p>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).</p>			
<b>NH3-F-VA</b>	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)
<p>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.</p>			
<b>NH3-F-VA</b>	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
<p>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.</p>			
<b>NO2-L-IC-N-WR</b>	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			
<b>NO3-L-IC-N-WR</b>	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			
<b>P-T-PRES-COL-VA</b>	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
<p>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.</p>			
<b>PH-MAN-WR</b>	Water	pH by Meter	APHA 4500-H+
<p>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.</p>			
<b>S-DIS-ICP-VA</b>	Water	Dissolved Sulfur in Water by ICPOES	EPA SW-846 3005A/6010B
<p>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).</p>			
<p>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.</p>			
<b>S-TOT-ICP-VA</b>	Water	Total Sulfur in Water by ICPOES	EPA SW-846 3005A/6010B
<p>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).</p>			
<p>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.</p>			
<b>SO4-IC-N-WR</b>	Water	Sulfate in Water by IC	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			
<b>TSS-MAN-WR</b>	Water	Total Suspended Solids by Gravimetric	APHA 2540 D
<p>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.</p>			

\*\* 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:*

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**Laboratory Definition Code      Laboratory Location**

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**Chain of Custody Numbers:**

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## Reference Information

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.*



**APPENDIX 3**  
**Hydrological Monitoring Data Summaries**

## Stream Flow & Discharge Calculation

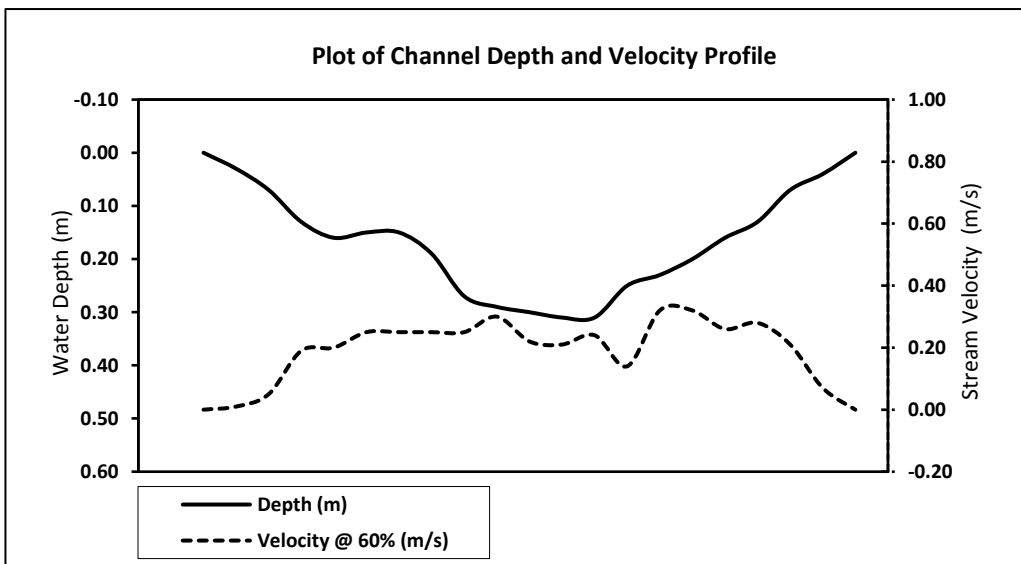
ELR Project No.	15-208		
Site / Location:	Clinton Creek Mine		
Stream Name:	Clinton Creek		
Station Name:	E1 (H)		
Date and Time:	24/07/2015 8:35		
Staff:	AN, CH		
UTM Coordinates:	07w 0512858 7147422		
Technique:	Swoffer	Left Bank	0.7
Temp., Water/Air (°C)	N/A	Right Bank	10.63
Crossing Number	1	Wet.Width	9.93



Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m <sup>2</sup> )	Panel Discharge (m <sup>3</sup> /s)
0	0.70	0.248	0.00	0.00	0.000	0.0000
1	1.20	0.496	0.03	0.01	0.015	0.0001
2	1.69	0.456	0.07	0.05	0.032	0.0016
3	2.11	0.496	0.13	0.19	0.064	0.0123
4	2.68	0.536	0.16	0.20	0.086	0.0172
5	3.18	0.496	0.15	0.25	0.074	0.0186
6	3.68	0.496	0.15	0.25	0.074	0.0186
7	4.17	0.496	0.19	0.25	0.094	0.0236
8	4.67	0.496	0.27	0.25	0.134	0.0335
9	5.16	0.496	0.29	0.30	0.144	0.0432
10	5.66	0.496	0.30	0.22	0.149	0.0327
11	6.16	0.496	0.31	0.21	0.154	0.0323
12	6.65	0.496	0.31	0.24	0.154	0.0369
13	7.15	0.506	0.25	0.14	0.127	0.0177
14	7.66	0.496	0.23	0.32	0.114	0.0365
15	8.14	0.486	0.20	0.32	0.097	0.0311
16	8.64	0.496	0.16	0.26	0.079	0.0206
17	9.13	0.496	0.13	0.28	0.064	0.0181
18	9.63	0.496	0.07	0.21	0.035	0.0073
19	10.12	0.501	0.04	0.07	0.020	0.0014
20	10.63	0.253	0.00	0.00	0.000	0.0000
end	10.63					

Mean Depth (m)	0.16
Mean Velocity (m/s)	0.19

Discharge (m <sup>3</sup> /s)	0.4032
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## Stream Flow & Discharge Calculation

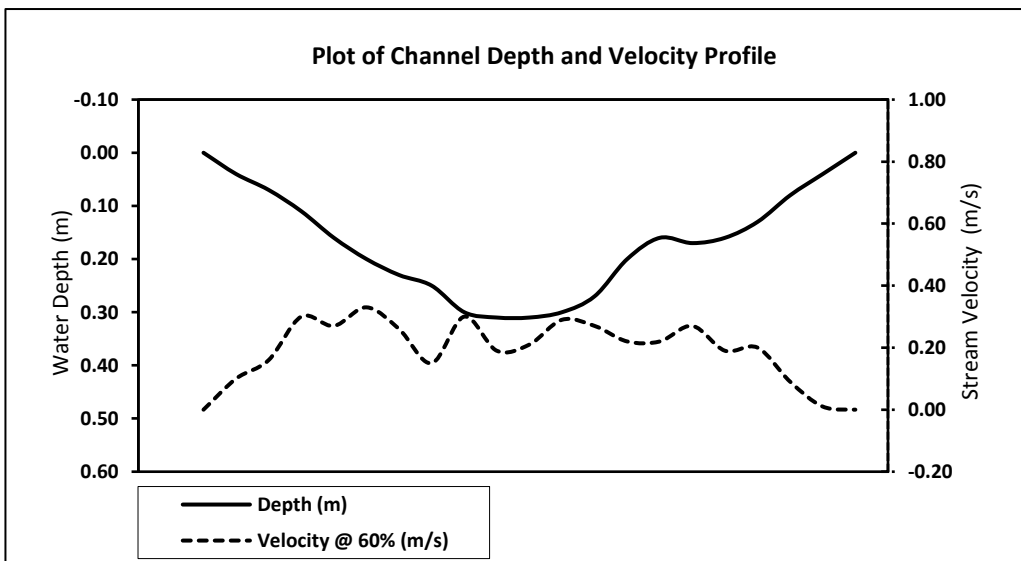
ELR Project No.	15-208		
Site / Location:	Clinton Creek Mine		
Stream Name:	Clinton Creek		
Station Name:	E1 (H)		
Date and Time:	24/07/2015 8:35		
Staff:	AN, CH		
UTM Coordinates:	07w 0512858 7147422		
Technique:	Swoffer	Left Bank	0.7
Temp., Water/Air (°C)	N/A	Right Bank	10.63
Crossing Number	2	Wet.Width	9.93



Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m <sup>2</sup> )	Panel Discharge (m <sup>3</sup> /s)
0	10.63	0.255	0.00	0.00	0.000	0.0000
1	10.12	0.501	0.04	0.1	0.020	0.0020
2	9.63	0.496	0.07	0.16	0.035	0.0056
3	9.13	0.496	0.11	0.30	0.055	0.0164
4	8.64	0.496	0.16	0.27	0.079	0.0214
5	8.14	0.496	0.20	0.33	0.099	0.0327
6	7.64	0.496	0.23	0.26	0.114	0.0297
7	7.15	0.496	0.25	0.15	0.124	0.0186
8	6.65	0.496	0.30	0.30	0.149	0.0446
9	6.16	0.496	0.31	0.19	0.154	0.0292
10	5.66	0.496	0.31	0.21	0.154	0.0323
11	5.16	0.496	0.30	0.29	0.149	0.0432
12	4.67	0.496	0.27	0.27	0.134	0.0362
13	4.17	0.496	0.20	0.22	0.099	0.0218
14	3.68	0.496	0.16	0.22	0.079	0.0175
15	3.18	0.496	0.17	0.27	0.084	0.0228
16	2.68	0.496	0.16	0.19	0.079	0.0151
17	2.19	0.496	0.13	0.20	0.064	0.0129
18	1.69	0.496	0.08	0.09	0.040	0.0036
19	1.20	0.496	0.04	0.01	0.020	0.0002
20	0.70	0.248	0.00	0.00	0.000	0.0000
end	0.70					

Mean Depth (m)	0.17
Mean Velocity (m/s)	0.19

Discharge (m <sup>3</sup> /s)	0.4056
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## Stream Flow & Discharge Calculation

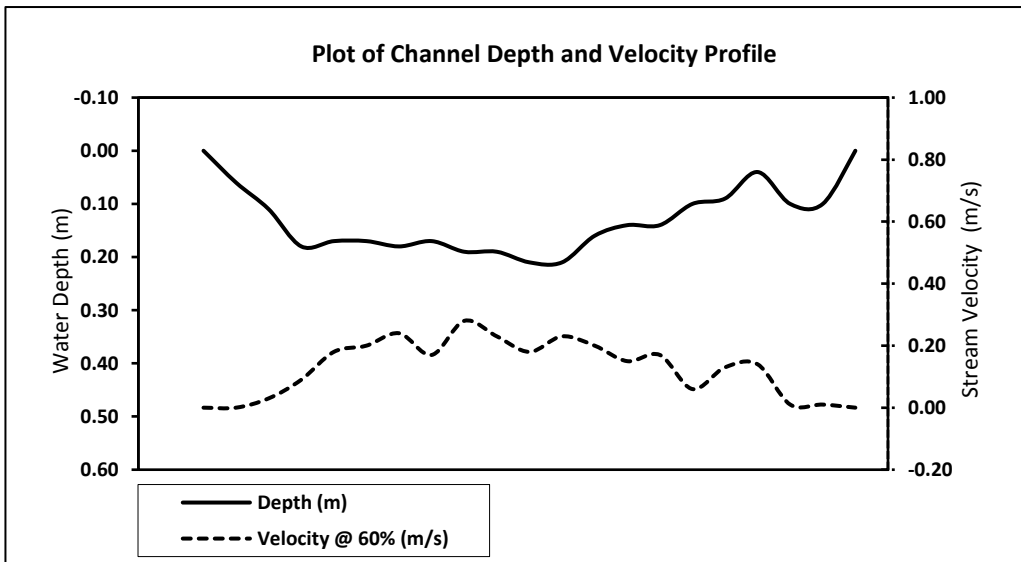
ELR Project No.	15-208		
Site / Location:	Clinton Creek Mine		
Stream Name:	Clinton Creek		
Station Name:	E3 (H)		
Date and Time:	23/07/2015 14:50		
Staff:	AN, CH		
UTM Coordinates:	07w 0514170 7147608		
Technique:	Swoffer	Left Bank	0.51
Temp., Water/Air (°C)	N/A	Right Bank	3.03
Crossing Number	1	Wet.Width	2.52



Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m <sup>2</sup> )	Panel Discharge (m <sup>3</sup> /s)
0	3.03	0.065	0.00	0.00	0.000	0.0000
1	2.90	0.126	0.06	0.00	0.008	0.0000
2	2.78	0.126	0.11	0.03	0.014	0.0004
3	2.65	0.126	0.18	0.09	0.023	0.0020
4	2.53	0.126	0.17	0.18	0.021	0.0039
5	2.40	0.126	0.17	0.20	0.021	0.0043
6	2.27	0.126	0.18	0.24	0.023	0.0054
7	2.15	0.126	0.17	0.17	0.021	0.0036
8	2.02	0.136	0.19	0.28	0.026	0.0072
9	1.88	0.126	0.19	0.23	0.024	0.0055
10	1.77	0.116	0.21	0.18	0.024	0.0044
11	1.64	0.126	0.21	0.23	0.026	0.0061
12	1.52	0.126	0.16	0.20	0.020	0.0040
13	1.39	0.126	0.14	0.15	0.018	0.0026
14	1.27	0.126	0.14	0.17	0.018	0.0030
15	1.14	0.126	0.10	0.06	0.013	0.0008
16	1.01	0.126	0.09	0.13	0.011	0.0015
17	0.89	0.126	0.04	0.14	0.005	0.0007
18	0.76	0.126	0.10	0.01	0.013	0.0001
19	0.64	0.126	0.10	0.01	0.013	0.0001
20	0.51	0.063	0.00	0.00	0.000	0.0000
end	0.51					

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

Discharge (m <sup>3</sup> /s)	0.0558
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## Stream Flow & Discharge Calculation

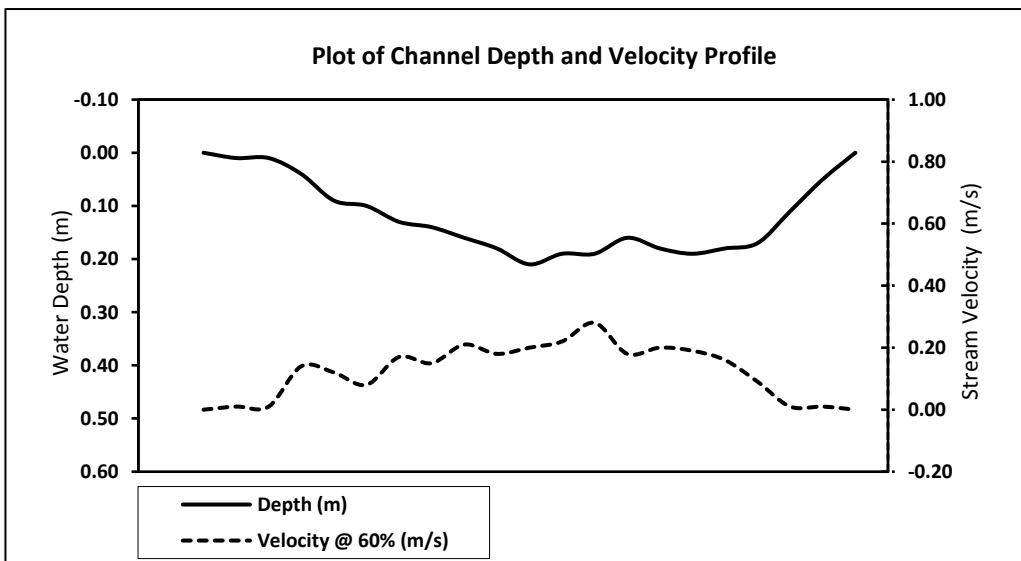
ELR Project No.	15-208		
Site / Location:	Clinton Creek Mine		
Stream Name:	Clinton Creek		
Station Name:	E3 (H)		
Date and Time:	23/07/2015 14:50		
Staff:	AN, CH		
UTM Coordinates:	07w 0514170 7147608		
Technique:	Swoffer	Left Bank	0.51
Temp., Water/Air (°C)	N/A	Right Bank	3.03
Crossing Number	2	Wet.Width	2.52



Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m <sup>2</sup> )	Panel Discharge (m <sup>3</sup> /s)
0	0.51	0.065	0.00	0.00	0.000	0.0000
1	0.64	0.126	0.01	0.01	0.001	0.0000
2	0.76	0.126	0.01	0.01	0.001	0.0000
3	0.89	0.126	0.04	0.14	0.005	0.0007
4	1.01	0.126	0.09	0.12	0.011	0.0014
5	1.14	0.126	0.10	0.08	0.013	0.0010
6	1.27	0.126	0.13	0.17	0.016	0.0028
7	1.39	0.126	0.14	0.15	0.018	0.0026
8	1.52	0.126	0.16	0.21	0.020	0.0042
9	1.64	0.126	0.18	0.18	0.023	0.0041
10	1.77	0.126	0.21	0.20	0.026	0.0053
11	1.90	0.126	0.19	0.22	0.024	0.0053
12	2.02	0.126	0.19	0.28	0.024	0.0067
13	2.15	0.126	0.16	0.18	0.020	0.0036
14	2.27	0.126	0.18	0.20	0.023	0.0045
15	2.40	0.126	0.19	0.19	0.024	0.0045
16	2.53	0.126	0.18	0.16	0.023	0.0036
17	2.65	0.126	0.17	0.09	0.021	0.0019
18	2.78	0.126	0.11	0.01	0.014	0.0001
19	2.90	0.126	0.05	0.01	0.006	0.0001
20	3.03	0.063	0.00	0.00	0.000	0.0000
end	3.03					

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

Discharge (m <sup>3</sup> /s)	0.0526
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## Stream Flow & Discharge Calculation

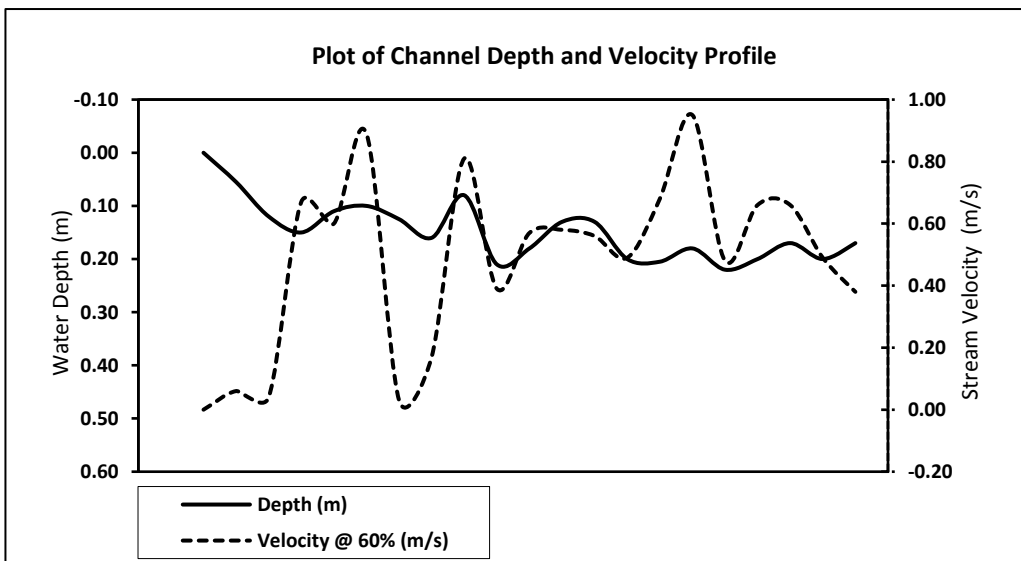
ELR Project No.	15-208		
Site / Location:	Clinton Creek Mine		
Stream Name:	Clinton Creek		
Station Name:	E4		
Date and Time:	24/07/2015 16:00		
Staff:	AN, CH, GMR		
UTM Coordinates:	07w 0515949 7145286		
Technique:	Swoffer	Left Bank	8.64
Temp., Water/Air (°C)	N/A	Right Bank	2.74
Crossing Number	1	Wet.Width	5.9



Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m <sup>2</sup> )	Panel Discharge (m <sup>3</sup> /s)
0	2.74	0.135	0.00	0.00	0.000	0.0000
1	3.01	0.270	0.06	0.06	0.015	0.0009
2	3.28	0.255	0.12	0.04	0.031	0.0012
3	3.52	0.305	0.15	0.67	0.046	0.0307
4	3.89	0.285	0.11	0.60	0.031	0.0188
5	4.09	0.250	0.10	0.89	0.025	0.0223
6	4.39	0.300	0.13	0.03	0.038	0.0011
7	4.69	0.275	0.16	0.17	0.044	0.0075
8	4.94	0.270	0.08	0.81	0.022	0.0175
9	5.23	0.295	0.21	0.39	0.062	0.0242
10	5.53	0.305	0.18	0.57	0.055	0.0313
11	5.84	0.285	0.13	0.58	0.037	0.0215
12	6.10	0.290	0.13	0.56	0.038	0.0211
13	6.42	0.290	0.20	0.49	0.058	0.0284
14	6.68	0.300	0.21	0.68	0.062	0.0418
15	7.02	0.310	0.18	0.95	0.056	0.0530
16	7.30	0.295	0.22	0.48	0.065	0.0312
17	7.61	0.300	0.20	0.66	0.060	0.0396
18	7.90	0.320	0.17	0.66	0.054	0.0359
19	8.25	0.370	0.20	0.49	0.074	0.0363
20	8.64	0.195	0.17	0.38	0.033	0.0126
end	8.64					

Mean Depth (m)	0.15
Mean Velocity (m/s)	0.48

Discharge (m <sup>3</sup> /s)	0.4767
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## Stream Flow & Discharge Calculation

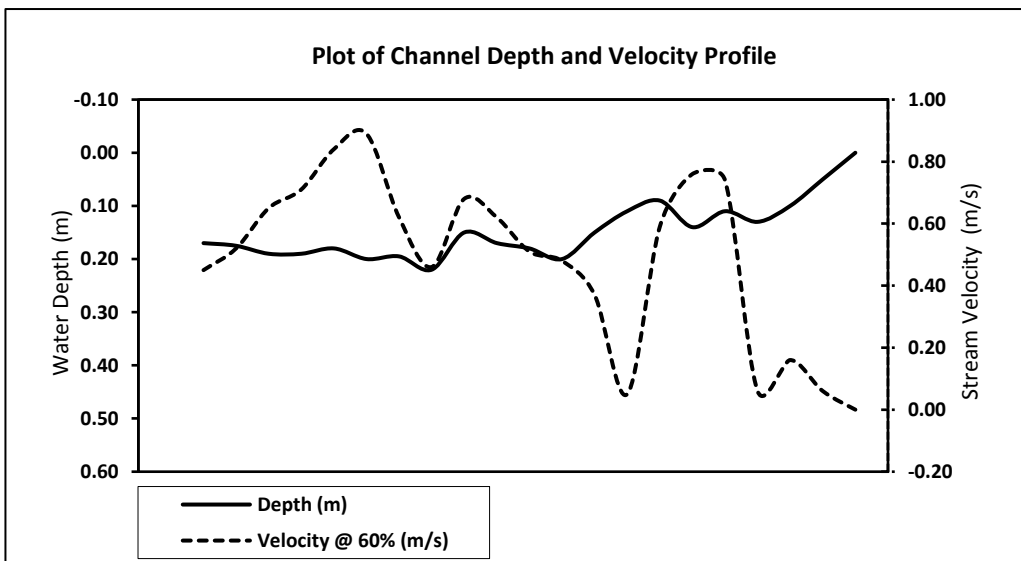
ELR Project No.	15-208		
Site / Location:	Clinton Creek Mine		
Stream Name:	Clinton Creek		
Station Name:	E4		
Date and Time:	24/07/2015 16:00		
Staff:	AN, CH, GMR		
UTM Coordinates:	07w 0515949 7145286		
Technique:	Swoffer	Left Bank	8.64
Temp., Water/Air (°C)	N/A	Right Bank	2.74
Crossing Number	2	Wet.Width	5.9



Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m <sup>2</sup> )	Panel Discharge (m <sup>3</sup> /s)
0	8.64	0.170	0.17	0.45	0.029	0.0130
1	8.30	0.320	0.18	0.52	0.056	0.0291
2	8.00	0.300	0.19	0.65	0.057	0.0371
3	7.70	0.300	0.19	0.71	0.057	0.0405
4	7.40	0.300	0.18	0.84	0.054	0.0454
5	7.10	0.310	0.20	0.89	0.062	0.0552
6	6.78	0.360	0.20	0.62	0.070	0.0435
7	6.38	0.310	0.22	0.46	0.068	0.0314
8	6.16	0.275	0.15	0.68	0.041	0.0281
9	5.83	0.300	0.17	0.62	0.051	0.0316
10	5.56	0.305	0.18	0.51	0.055	0.0280
11	5.22	0.355	0.20	0.48	0.071	0.0341
12	4.85	0.345	0.15	0.37	0.052	0.0191
13	4.53	0.315	0.11	0.05	0.035	0.0017
14	4.22	0.305	0.09	0.59	0.027	0.0162
15	3.92	0.280	0.14	0.76	0.039	0.0298
16	3.66	0.260	0.11	0.74	0.029	0.0212
17	3.40	0.210	0.13	0.06	0.027	0.0016
18	3.24	0.195	0.10	0.16	0.020	0.0031
19	3.01	0.280	0.05	0.06	0.014	0.0008
20	2.68	0.165	0.00	0.00	0.000	0.0000
end	2.68					

Mean Depth (m)	0.15
Mean Velocity (m/s)	0.49

Discharge (m <sup>3</sup> /s)	0.5105
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## Stream Flow & Discharge Calculation

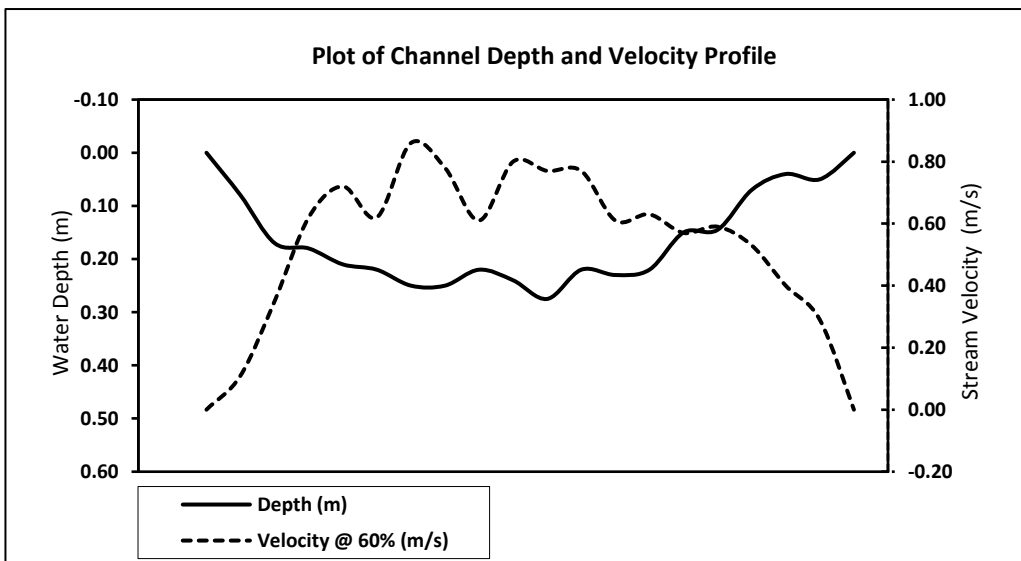
ELR Project No.	15-208		
Site / Location:	Clinton Creek Mine		
Stream Name:	Clinton Creek		
Station Name:	E7		
Date and Time:	24/07/2015 17:56		
Staff:	AN, CH, GMR		
UTM Coordinates:	07w 0515949 7145286		
Technique:	Swoffer	Left Bank	5.46
Temp., Water/Air (°C)	N/A	Right Bank	0.55
Crossing Number	1	Wet.Width	4.91



Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m <sup>2</sup> )	Panel Discharge (m <sup>3</sup> /s)
0	0.55	0.105	0.00	0.00	0.000	0.0000
1	0.76	0.180	0.08	0.11	0.014	0.0016
2	0.91	0.205	0.17	0.35	0.035	0.0122
3	1.17	0.275	0.18	0.62	0.050	0.0307
4	1.46	0.300	0.21	0.72	0.063	0.0454
5	1.77	0.300	0.22	0.62	0.066	0.0409
6	2.06	0.280	0.25	0.86	0.070	0.0602
7	2.33	0.310	0.25	0.78	0.078	0.0605
8	2.68	0.320	0.22	0.61	0.070	0.0429
9	2.97	0.285	0.24	0.80	0.068	0.0547
10	3.25	0.280	0.28	0.77	0.077	0.0593
11	3.53	0.250	0.22	0.77	0.055	0.0424
12	3.75	0.260	0.23	0.61	0.060	0.0365
13	4.05	0.275	0.22	0.63	0.061	0.0381
14	4.30	0.260	0.15	0.57	0.039	0.0222
15	4.57	0.270	0.15	0.59	0.039	0.0231
16	4.84	0.240	0.07	0.53	0.017	0.0089
17	5.05	0.180	0.04	0.40	0.007	0.0029
18	5.20	0.205	0.05	0.29	0.010	0.0030
19	5.46	0.130	0.00	0.00	0.000	0.0000
end	5.46					

Mean Depth (m)	0.16
Mean Velocity (m/s)	0.53

Discharge (m <sup>3</sup> /s)	0.5854
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### Stream Flow & Discharge Calculation

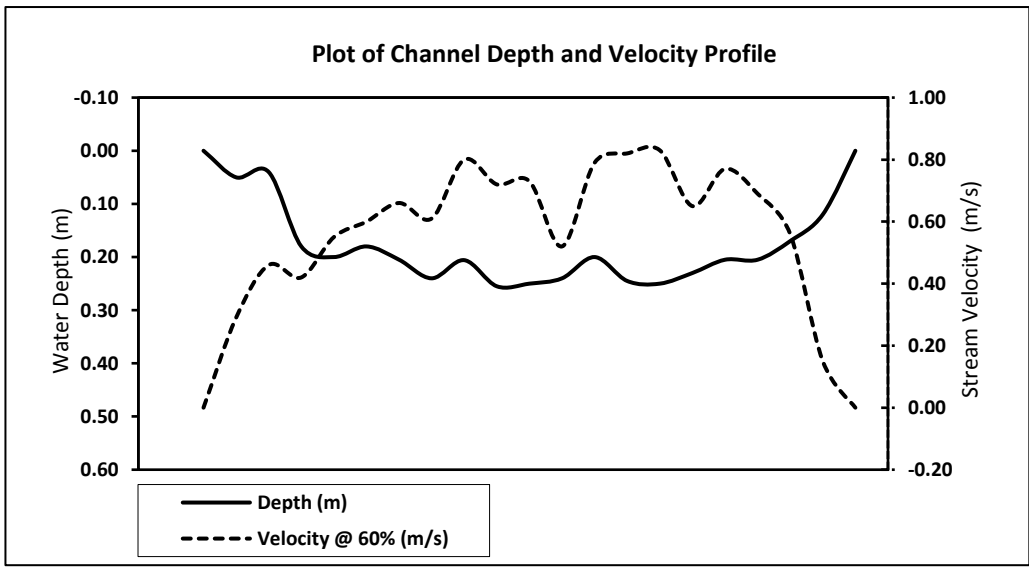
ELR Project No.	15-208		
Site / Location:	Clinton Creek Mine		
Stream Name:	Clinton Creek		
Station Name:	E7		
Date and Time:	24/07/2015 17:56		
Staff:	AN, CH, GMR		
UTM Coordinates:	07w 0515949 7145286		
Technique:	Swoffer	Left Bank	5.46
Temp., Water/Air (°C)	N/A	Right Bank	0.55
Crossing Number	2	Wet.Width	4.91



Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m <sup>2</sup> )	Panel Discharge (m <sup>3</sup> /s)
0	5.46	0.130	0.00	0.00	0.000	0.0000
1	5.20	0.240	0.05	0.29	0.012	0.0035
2	4.98	0.240	0.04	0.46	0.010	0.0044
3	4.72	0.255	0.18	0.42	0.046	0.0193
4	4.47	0.245	0.20	0.55	0.049	0.0270
5	4.23	0.235	0.18	0.60	0.042	0.0254
6	4.00	0.245	0.21	0.66	0.050	0.0331
7	3.74	0.270	0.24	0.61	0.065	0.0395
8	3.46	0.270	0.21	0.80	0.056	0.0445
9	3.20	0.255	0.26	0.72	0.065	0.0468
10	2.95	0.260	0.25	0.73	0.065	0.0475
11	2.68	0.245	0.24	0.52	0.059	0.0306
12	2.46	0.185	0.20	0.79	0.037	0.0292
13	2.31	0.205	0.25	0.82	0.050	0.0412
14	2.05	0.270	0.25	0.83	0.068	0.0560
15	1.77	0.260	0.23	0.65	0.060	0.0389
16	1.53	0.235	0.21	0.77	0.048	0.0371
17	1.30	0.250	0.21	0.69	0.051	0.0354
18	1.03	0.240	0.17	0.56	0.041	0.0228
19	0.82	0.245	0.12	0.15	0.029	0.0044
20	0.54	0.140	0.00	0.00	0.000	0.0000
end	0.54					

Mean Depth (m)	0.17
Mean Velocity (m/s)	0.55

Discharge (m <sup>3</sup> /s)	0.5865
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## Stream Flow & Discharge Calculation

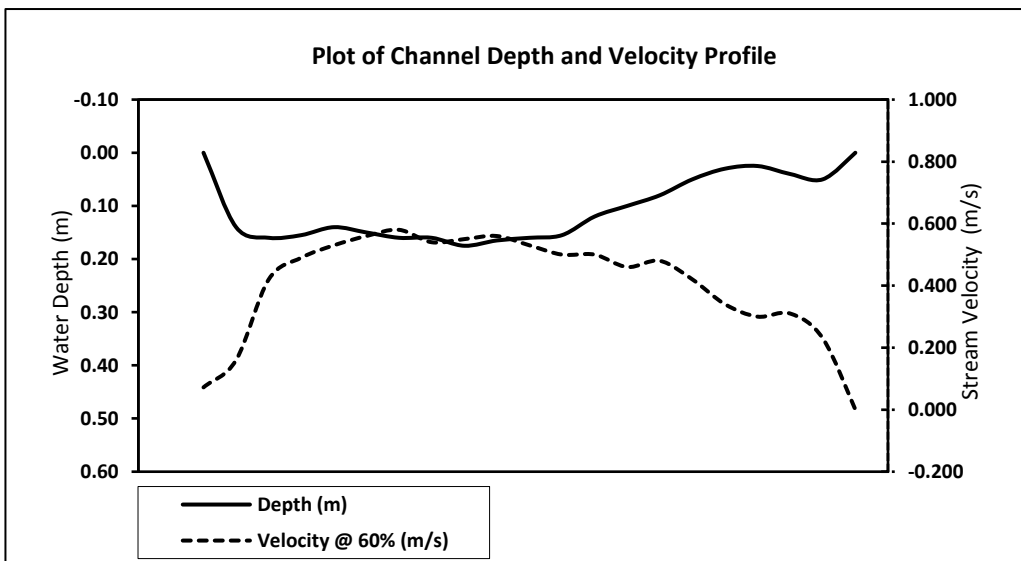
ELR Project No.	15-208		
Site / Location:	Clinton Creek Mine		
Stream Name:	Clinton Creek		
Station Name:	R1		
Date and Time:	25/07/2015 14:04		
Staff:	AN, CH, GMR		
UTM Coordinates:	07w 0510717 7147526		
Technique:	Swoffer	Left Bank	4.79
Temp., Water/Air (°C)	N/A	Right Bank	0.72
Crossing Number	1	Wet.Width	4.07



Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m <sup>2</sup> )	Panel Discharge (m <sup>3</sup> /s)
0	0.72	0.100	0.00	0.072	0.000	0.0000
1	0.92	0.200	0.14	0.160	0.028	0.0045
2	1.12	0.200	0.16	0.420	0.032	0.0134
3	1.32	0.190	0.16	0.490	0.029	0.0144
4	1.50	0.190	0.14	0.530	0.027	0.0141
5	1.70	0.200	0.15	0.560	0.030	0.0168
6	1.90	0.205	0.16	0.580	0.033	0.0190
7	2.11	0.205	0.16	0.540	0.033	0.0177
8	2.31	0.200	0.18	0.550	0.035	0.0193
9	2.51	0.200	0.17	0.560	0.033	0.0185
10	2.71	0.205	0.16	0.530	0.033	0.0174
11	2.92	0.195	0.16	0.500	0.030	0.0151
12	3.10	0.195	0.12	0.500	0.023	0.0117
13	3.31	0.215	0.10	0.460	0.022	0.0099
14	3.53	0.205	0.08	0.480	0.016	0.0079
15	3.72	0.200	0.05	0.420	0.010	0.0042
16	3.93	0.210	0.03	0.340	0.006	0.0021
17	4.14	0.210	0.03	0.300	0.005	0.0016
18	4.35	0.215	0.04	0.310	0.009	0.0027
19	4.57	0.220	0.05	0.230	0.011	0.0025
20	4.79	0.110	0.00	0.000	0.000	0.0000
end	4.79					

Mean Depth (m)	0.11
Mean Velocity (m/s)	0.41

Discharge (m <sup>3</sup> /s)	0.2128
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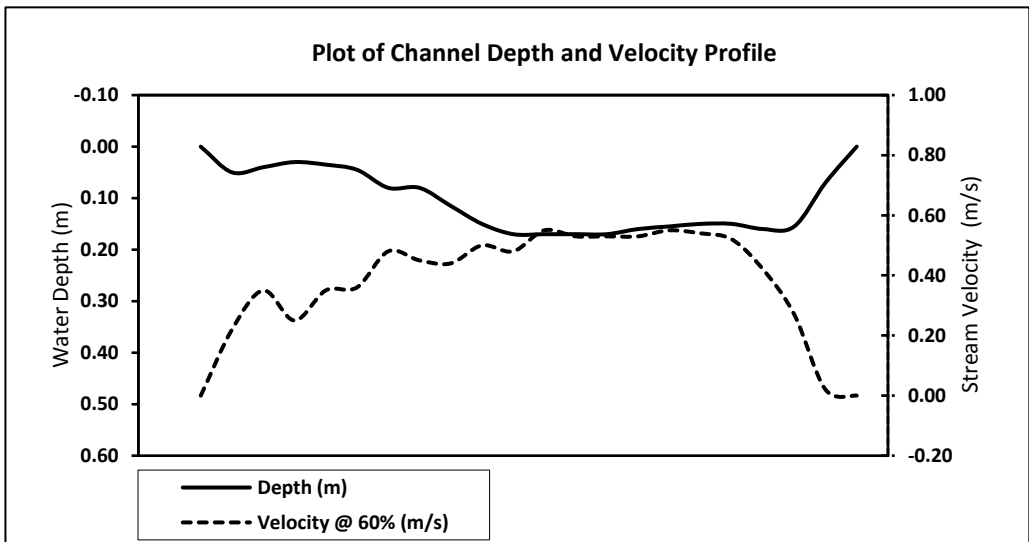
## Stream Flow & Discharge Calculation

ELR Project No.	15-208		
Site / Location:	Clinton Creek Mine		
Stream Name:	Clinton Creek		
Station Name:	R1		
Date and Time:	25/07/2015 14:04		
Staff:	AN, CH, GMR		
UTM Coordinates:	07w 0510717 7147526		
Technique:	Swoffer	Left Bank	4.79
Temp., Water/Air (°C)	N/A	Right Bank	0.72
Crossing Number	2	Wet.Width	4.07



Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m <sup>2</sup> )	Panel Discharge (m <sup>3</sup> /s)
0	4.79	0.095	0.00	0.00	0.000	0.0000
1	4.60	0.195	0.05	0.22	0.010	0.0021
2	4.40	0.200	0.04	0.35	0.008	0.0028
3	4.20	0.200	0.03	0.25	0.006	0.0015
4	4.00	0.200	0.04	0.35	0.007	0.0025
5	3.80	0.200	0.05	0.36	0.009	0.0032
6	3.60	0.200	0.08	0.48	0.016	0.0077
7	3.40	0.200	0.08	0.45	0.016	0.0072
8	3.20	0.200	0.12	0.44	0.023	0.0101
9	3.00	0.200	0.15	0.50	0.030	0.0150
10	2.80	0.200	0.17	0.48	0.034	0.0163
11	2.60	0.200	0.17	0.55	0.034	0.0187
12	2.40	0.200	0.17	0.53	0.034	0.0180
13	2.20	0.200	0.17	0.53	0.034	0.0180
14	2.00	0.200	0.16	0.53	0.032	0.0170
15	1.80	0.200	0.16	0.55	0.031	0.0171
16	1.60	0.200	0.15	0.54	0.030	0.0162
17	1.40	0.200	0.15	0.52	0.030	0.0156
18	1.20	0.200	0.16	0.42	0.032	0.0134
19	1.00	0.200	0.16	0.27	0.031	0.0084
20	0.80	0.140	0.07	0.02	0.010	0.0002
21	0.72	0.040	0.00	0.00	0.000	0.0000
end	0.72					

Mean Depth (m)	0.10	Discharge (m <sup>3</sup> /s)	0.2110
Mean Velocity (m/s)	0.38		



## Stream Flow & Discharge Calculation

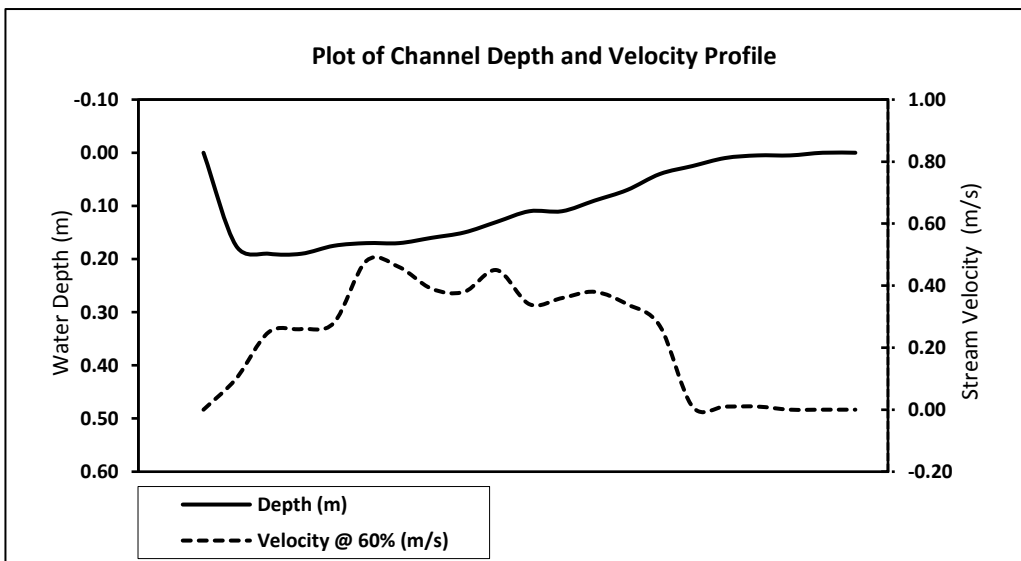
ELR Project No.	15-208		
Site / Location:	Clinton Creek Mine		
Stream Name:	Clinton Creek		
Station Name:	R2		
Date and Time:	25/07/2015 11:06		
Staff:	AN, CH, GMR		
UTM Coordinates:	07w 0512029 7148074		
Technique:	Swoffer	Left Bank	1.07
Temp., Water/Air (°C)	N/A	Right Bank	2.85
Crossing Number	1	Wet.Width	1.78



Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m <sup>2</sup> )	Panel Discharge (m <sup>3</sup> /s)
0	1.07	0.045	0.00	0.00	0.000	0.0000
1	1.16	0.090	0.18	0.1	0.016	0.0016
2	1.25	0.090	0.19	0.25	0.017	0.0043
3	1.34	0.090	0.19	0.26	0.017	0.0044
4	1.43	0.090	0.18	0.28	0.016	0.0044
5	1.52	0.090	0.17	0.48	0.015	0.0073
6	1.61	0.090	0.17	0.46	0.015	0.0070
7	1.70	0.090	0.16	0.39	0.014	0.0056
8	1.79	0.090	0.15	0.38	0.014	0.0051
9	1.88	0.090	0.13	0.45	0.012	0.0053
10	1.97	0.090	0.11	0.34	0.010	0.0034
11	2.06	0.090	0.11	0.36	0.010	0.0036
12	2.15	0.090	0.09	0.38	0.008	0.0031
13	2.24	0.090	0.07	0.34	0.006	0.0021
14	2.33	0.090	0.04	0.27	0.004	0.0010
15	2.42	0.090	0.03	0.01	0.002	0.0000
16	2.51	0.090	0.01	0.01	0.001	0.0000
17	2.60	0.090	0.01	0.01	0.000	0.0000
18	2.69	0.090	0.01	0.00	0.000	0.0000
19	2.78	0.080	0.00	0.00	0.000	0.0000
20	2.85	0.035	0.00	0.00	0.000	0.0000
end	2.85					

Mean Depth (m)	0.09
Mean Velocity (m/s)	0.23

Discharge (m <sup>3</sup> /s)	0.0583
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## Stream Flow & Discharge Calculation

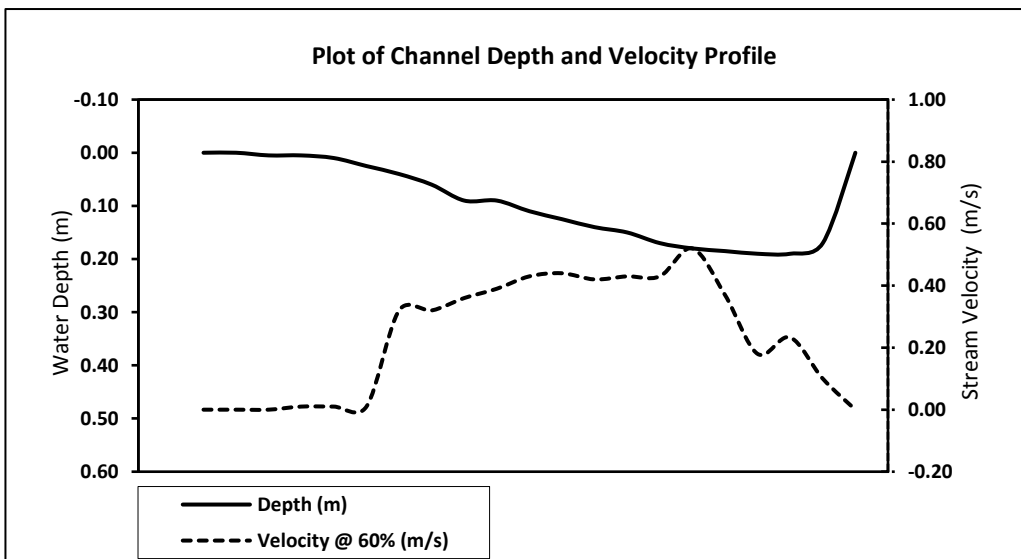
ELR Project No.	15-208		
Site / Location:	Clinton Creek Mine		
Stream Name:	Clinton Creek		
Station Name:	R2		
Date and Time:	25/07/2015 11:06		
Staff:	AN, CH, GMR		
UTM Coordinates:	07w 0512029 7148074		
Technique:	Swoffer	Left Bank	1.07
Temp., Water/Air (°C)	N/A	Right Bank	2.85
Crossing Number	2	Wet.Width	1.78



Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m <sup>2</sup> )	Panel Discharge (m <sup>3</sup> /s)
0	2.85	0.035	0.00	0.00	0.000	0.0000
1	2.78	0.080	0.00	0.00	0.000	0.0000
2	2.69	0.090	0.01	0.00	0.000	0.0000
3	2.60	0.090	0.01	0.01	0.000	0.0000
4	2.51	0.090	0.01	0.01	0.001	0.0000
5	2.42	0.090	0.03	0.01	0.002	0.0000
6	2.33	0.090	0.04	0.32	0.004	0.0012
7	2.24	0.090	0.06	0.32	0.005	0.0017
8	2.15	0.090	0.09	0.36	0.008	0.0029
9	2.06	0.090	0.09	0.39	0.008	0.0032
10	1.97	0.090	0.11	0.43	0.010	0.0043
11	1.88	0.090	0.13	0.44	0.011	0.0050
12	1.79	0.090	0.14	0.42	0.013	0.0053
13	1.70	0.090	0.15	0.43	0.014	0.0058
14	1.61	0.090	0.17	0.43	0.015	0.0066
15	1.52	0.090	0.18	0.52	0.016	0.0084
16	1.43	0.090	0.19	0.37	0.017	0.0062
17	1.34	0.090	0.19	0.18	0.017	0.0031
18	1.25	0.090	0.19	0.23	0.017	0.0040
19	1.16	0.090	0.17	0.10	0.015	0.0015
20	1.07	0.045	0.00	0.00	0.000	0.0000
end	1.07					

Mean Depth (m)	0.09
Mean Velocity (m/s)	0.24

Discharge (m <sup>3</sup> /s)	0.0591
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## Stream Flow & Discharge Calculation

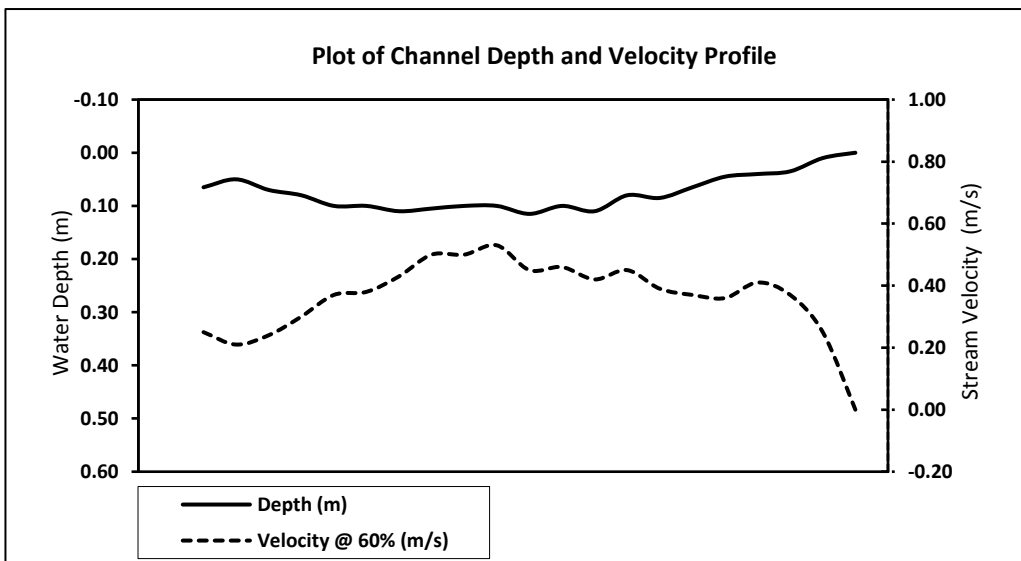
ELR Project No.	15-208		
Site / Location:	Clinton Creek Mine		
Stream Name:	Clinton Creek		
Station Name:	R3		
Date and Time:	26/07/2015 16:14		
Staff:	AN, CH		
UTM Coordinates:	07w 0513952 7148677		
Technique:	Swoffer	Left Bank	0.29
Temp., Water/Air (°C)	N/A	Right Bank	2.68
Crossing Number	1	Wet.Width	2.39



Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m <sup>2</sup> )	Panel Discharge (m <sup>3</sup> /s)
0	0.29	0.065	0.07	0.25	0.004	0.0011
1	0.42	0.125	0.05	0.21	0.006	0.0013
2	0.54	0.120	0.07	0.24	0.008	0.0020
3	0.66	0.120	0.08	0.30	0.010	0.0029
4	0.78	0.120	0.10	0.37	0.012	0.0044
5	0.90	0.120	0.10	0.38	0.012	0.0046
6	1.02	0.120	0.11	0.43	0.013	0.0057
7	1.14	0.120	0.11	0.50	0.013	0.0063
8	1.26	0.120	0.10	0.50	0.012	0.0060
9	1.38	0.120	0.10	0.53	0.012	0.0064
10	1.50	0.120	0.12	0.45	0.014	0.0062
11	1.62	0.120	0.10	0.46	0.012	0.0055
12	1.74	0.120	0.11	0.42	0.013	0.0055
13	1.86	0.120	0.08	0.45	0.010	0.0043
14	1.98	0.120	0.09	0.39	0.010	0.0040
15	2.10	0.120	0.07	0.37	0.008	0.0029
16	2.22	0.120	0.05	0.36	0.005	0.0019
17	2.34	0.120	0.04	0.41	0.005	0.0020
18	2.46	0.120	0.04	0.37	0.004	0.0016
19	2.58	0.110	0.01	0.25	0.001	0.0003
20	2.68	0.050	0.00	0.00	0.000	0.0000
end	2.68					

Mean Depth (m)	0.07
Mean Velocity (m/s)	0.36

Discharge (m <sup>3</sup> /s)	0.0748
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## Stream Flow & Discharge Calculation

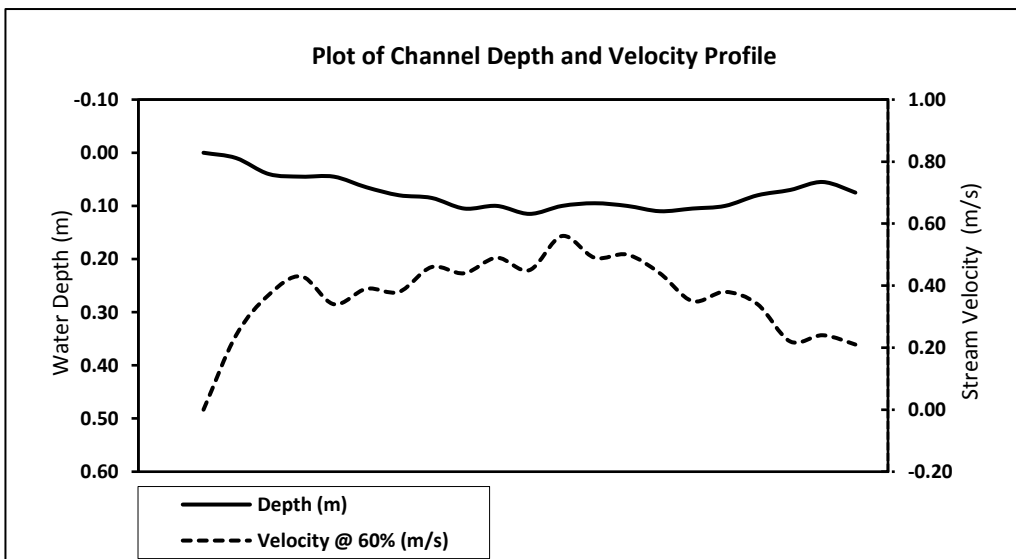
ELR Project No.	15-208		
Site / Location:	Clinton Creek Mine		
Stream Name:	Clinton Creek		
Station Name:	R3		
Date and Time:	26/07/2015 16:14		
Staff:	AN, CH		
UTM Coordinates:	07w 0513952 7148677		
Technique:	Swoffer	Left Bank	0.29
Temp., Water/Air (°C)	N/A	Right Bank	2.68
Crossing Number	2	Wet.Width	2.39



Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m <sup>2</sup> )	Panel Discharge (m <sup>3</sup> /s)
0	2.68	0.055	0.00	0.00	0.000	0.0000
1	2.57	0.115	0.01	0.24	0.001	0.0003
2	2.45	0.120	0.04	0.37	0.005	0.0018
3	2.33	0.120	0.05	0.43	0.005	0.0023
4	2.21	0.120	0.05	0.34	0.005	0.0018
5	2.09	0.120	0.07	0.39	0.008	0.0030
6	1.97	0.120	0.08	0.38	0.010	0.0036
7	1.85	0.120	0.09	0.46	0.010	0.0047
8	1.73	0.120	0.11	0.44	0.013	0.0055
9	1.61	0.120	0.10	0.49	0.012	0.0059
10	1.49	0.120	0.12	0.45	0.014	0.0062
11	1.37	0.120	0.10	0.56	0.012	0.0067
12	1.25	0.120	0.10	0.49	0.011	0.0056
13	1.13	0.120	0.10	0.50	0.012	0.0060
14	1.01	0.120	0.11	0.44	0.013	0.0058
15	0.89	0.120	0.11	0.35	0.013	0.0044
16	0.77	0.120	0.10	0.38	0.012	0.0046
17	0.65	0.120	0.08	0.34	0.010	0.0033
18	0.53	0.125	0.07	0.22	0.009	0.0019
19	0.40	0.120	0.06	0.24	0.007	0.0016
20	0.29	0.055	0.08	0.21	0.004	0.0009
end	0.29					

Mean Depth (m)	0.08
Mean Velocity (m/s)	0.37

Discharge (m <sup>3</sup> /s)	0.0759
-------------------------------	--------



## Stream Flow & Discharge Calculation

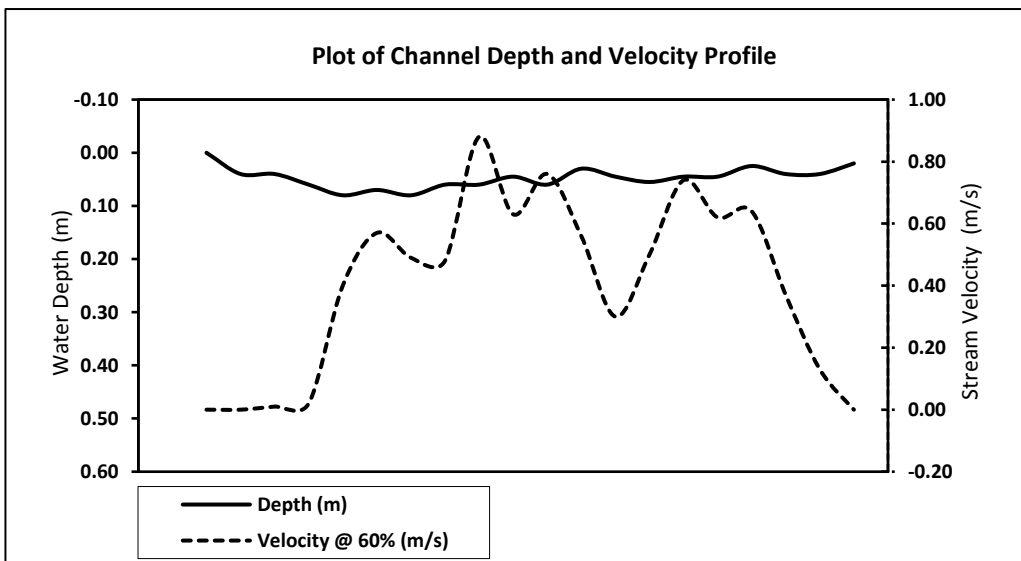
ELR Project No.	15-208		
Site / Location:	Clinton Creek Mine		
Stream Name:	Clinton Creek		
Station Name:	R4		
Date and Time:	25/07/2015 14:20		
Staff:	CH, GMR		
UTM Coordinates:	07w 0519437 7145344		
Technique:	Swoffer	Left Bank	2.33
Temp., Water/Air (°C)	N/A	Right Bank	0.65
Crossing Number	1	Wet.Width	1.68



Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m <sup>2</sup> )	Panel Discharge (m <sup>3</sup> /s)
0	0.65	0.045	0.00	0.00	0.000	0.0000
1	0.74	0.083	0.04	0	0.003	0.0000
2	0.82	0.083	0.04	0.01	0.003	0.0000
3	0.90	0.083	0.06	0.02	0.005	0.0001
4	0.98	0.085	0.08	0.40	0.007	0.0027
5	1.07	0.085	0.07	0.57	0.006	0.0034
6	1.15	0.085	0.08	0.49	0.007	0.0033
7	1.24	0.085	0.06	0.48	0.005	0.0024
8	1.32	0.100	0.06	0.88	0.006	0.0053
9	1.44	0.085	0.05	0.63	0.004	0.0024
10	1.49	0.070	0.06	0.76	0.004	0.0032
11	1.58	0.085	0.03	0.56	0.003	0.0014
12	1.66	0.085	0.05	0.30	0.004	0.0011
13	1.75	0.085	0.06	0.50	0.005	0.0023
14	1.83	0.085	0.05	0.74	0.004	0.0028
15	1.92	0.100	0.05	0.62	0.004	0.0028
16	2.03	0.100	0.03	0.64	0.003	0.0016
17	2.12	0.085	0.04	0.37	0.003	0.0013
18	2.20	0.105	0.04	0.13	0.004	0.0005
19	2.33	0.065	0.02	0.00	0.001	0.0000
end	2.33					

Mean Depth (m)	0.05
Mean Velocity (m/s)	0.41

Discharge (m <sup>3</sup> /s)	0.0368
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## Stream Flow & Discharge Calculation

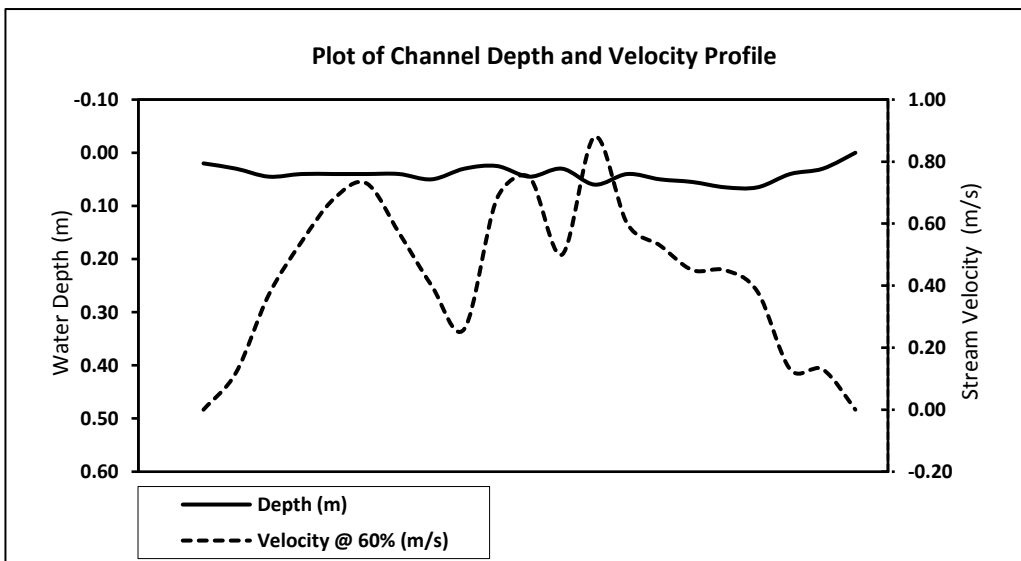
ELR Project No.	15-208		
Site / Location:	Clinton Creek Mine		
Stream Name:	Clinton Creek		
Station Name:	R4		
Date and Time:	25/07/2015 14:20		
Staff:	CH, GMR		
UTM Coordinates:	07w 0519437 7145344		
Technique:	Swoffer	Left Bank	2.33
Temp., Water/Air (°C)	N/A	Right Bank	0.65
Crossing Number	2	Wet.Width	1.68



Station No.	Distance (m)	Station Width (m)	Depth (m)	Velocity @ 60% (m/s)	Panel Area (m <sup>2</sup> )	Panel Discharge (m <sup>3</sup> /s)
0	2.33	0.055	0.02	0.00	0.001	0.0000
1	2.22	0.095	0.03	0.12	0.003	0.0003
2	2.14	0.080	0.05	0.37	0.004	0.0013
3	2.06	0.080	0.04	0.54	0.003	0.0017
4	1.98	0.080	0.04	0.68	0.003	0.0022
5	1.90	0.080	0.04	0.73	0.003	0.0023
6	1.82	0.080	0.04	0.57	0.003	0.0018
7	1.74	0.080	0.05	0.40	0.004	0.0016
8	1.66	0.080	0.03	0.26	0.002	0.0006
9	1.58	0.080	0.03	0.68	0.002	0.0014
10	1.50	0.080	0.05	0.75	0.004	0.0027
11	1.42	0.075	0.03	0.50	0.002	0.0011
12	1.35	0.085	0.06	0.88	0.005	0.0045
13	1.25	0.075	0.04	0.60	0.003	0.0018
14	1.20	0.065	0.05	0.53	0.003	0.0017
15	1.12	0.080	0.06	0.45	0.004	0.0020
16	1.04	0.080	0.07	0.45	0.005	0.0023
17	0.96	0.110	0.07	0.38	0.007	0.0027
18	0.82	0.105	0.04	0.13	0.004	0.0005
19	0.75	0.085	0.03	0.13	0.003	0.0003
20	0.65	0.050	0.00	0.00	0.000	0.0000
end	0.65					

Mean Depth (m)	0.04
Mean Velocity (m/s)	0.44

Discharge (m <sup>3</sup> /s)	0.0331
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# **APPENDIX 4**

## **Pressure Sensor Information**

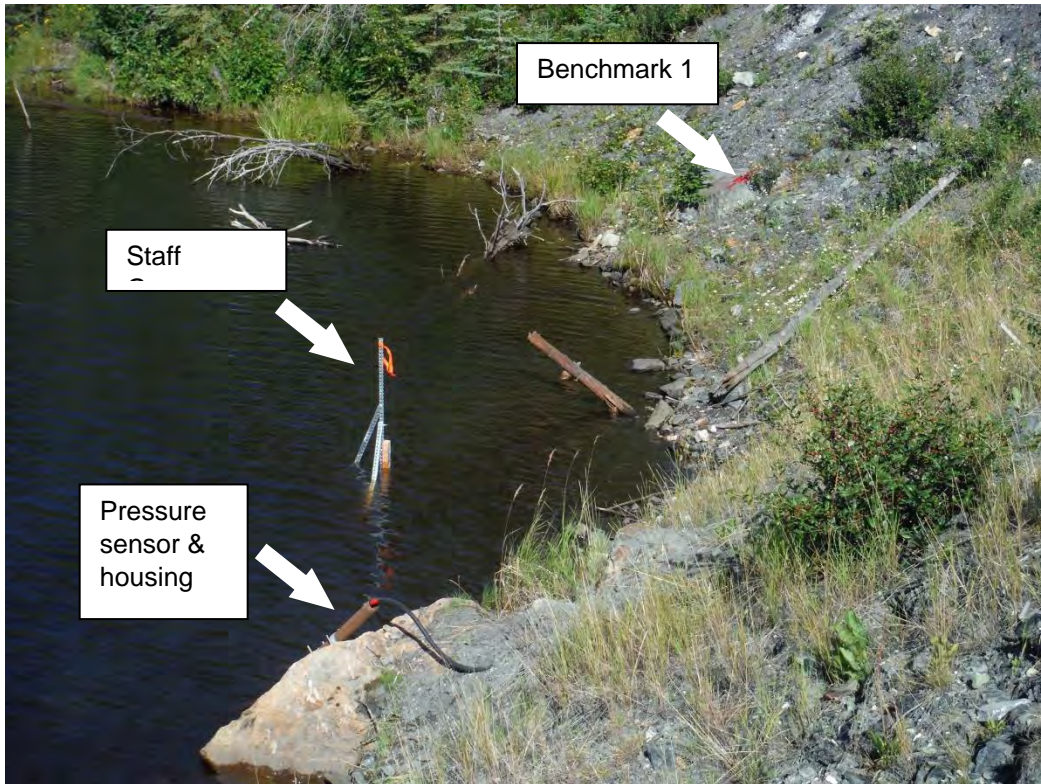


## APPENDIX 5 CLINTON CREEK PRESSURE SENSOR AND DATALOGGER INFORMATION

### Key Information – Pressure Sensor and Datalogger Located in Hudgeon Lake near Site E1(H).

Item	Data / Information	Notes
Location Description	Installed in Hudgeon Lake on shoreline (on a boulder), near the outlet to Clinton Creek, north of Clinton Creek and within 10 m of the datalogger and satellite communications tower for the meteorological station	Sensor is in a steel housing and mounted to a large boulder with brackets and rock bolts.
Date of Installation	July 16, 2015	Supplied and installed by Northern Avcom, YT with assistance provided by Hemmera/ELR
Pressure Sensor UTM's (NAD 83)	07W 512800 7147438	-
Staff Gauge UTM's	-	1 m long staff gauge within 4 m of the pressure sensor and mounted on angle iron
Benchmark 1 UTM's (HLBM1)	07W 512794 7147451	Rock bolt in boulder near shoreline
Benchmark 2 UTM's (HLBM2)	07W 512815 7147419	Top of steel abutment at outlet to Clinton Creek
Pressure Sensor Type	OTT PLS Sensor (serial number 365061). Factory test sheet is attached	Powered by the solar panel mounted on the satellite communications tower. Data are recorded directly by the CR1000 datalogger mounted to the tower.
Data Logging Interval	Every 15 minutes	
Pressure Logging Units	0.000 Metres (m)	
Temperature Logging Units	0.0° Celsius	
Data Retrieval	Remote download through satellite communications tower, meteorological station	Pressure sensor is hardwired into the datalogger on the nearby satellite communications tower

**Photos (July 2015)**



**Pressure Sensor Located in Hudgeon Lake – near Site E1(H) Continued**  
Benchmark 1. Rock bolt in boulder just above the shoreline of Hudgeon Lake

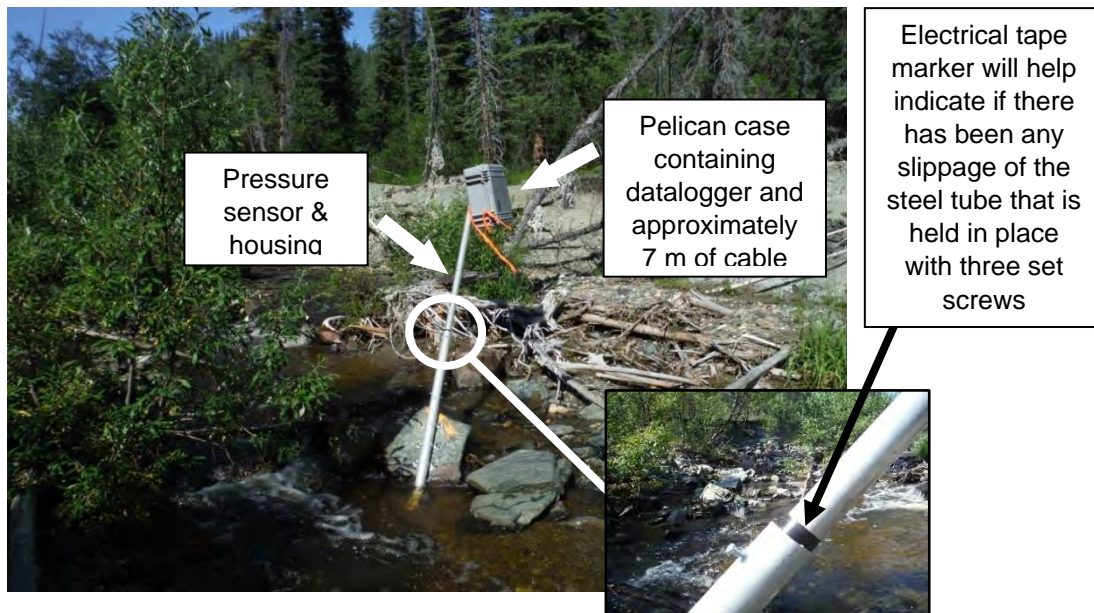


Benchmark 2. Top of steel abutment at outlet of Hudgeon Lake (north side)

Item	Data / Information	Notes
Location Description	Installed in Wolverine Creek about 500 m upstream of the confluence with Clinton Creek.	Sensor is in a steel housing and mounted to a boulder with brackets and rock bolts.
Date of Installation	July 16, 2015	Supplied and installed by Northern Avcom, YT with assistance provided by Hemmera/ELR
Pressure Sensor UTM's (NAD 83)	07W 514167 7147610	Steel housing with grey Pelican case attached containing the download module and about 10m of cable
Staff Gauge UTM's	07W 514186 7147585	1 m long staff gauge about 25 m downstream of the pressure sensor and adjacent to the left bank
Benchmark 1 UTM's (WCBM1)	07W 514172 7147607	Rock bolt in boulder, about 4 m downstream of the pressure sensor on the right bank
Benchmark 2 UTM's (WCBM2)	07W 514170 7147621	Rock bolt in boulder about 10 m upstream of the pressure sensor in right bank braid.
Pressure Sensor Type	OTT Orpheus Mini (serial number 368061). Factory test sheet is attached.	Powered by 3 x AA lithium batteries to be switched at least once each year (September/October) or when voltage readout is at 4.5 or lower.
Data Logging Interval	Every 15 minutes	Stores data on the quarter hour e.g., 00:15, 00:30 etc.
Pressure Logging Units	0.000 Metres (m).	
Temperature Logging Units	0.0° Celsius.	
Data Retrieval	Manual download through a laptop computer	Download cables and OTT Orpheus Mini software required (version 1.67.0 or later).

**Key Information – Pressure Sensor and Datalogger Located in Wolverine Creek – E3(H)**

**Photos (July 23, 2015)**





**Key Information – Pressure Sensor Located in Wolverine Creek – E3(H) continued.**

Photo taken at E3(H) gauging site, looking downstream

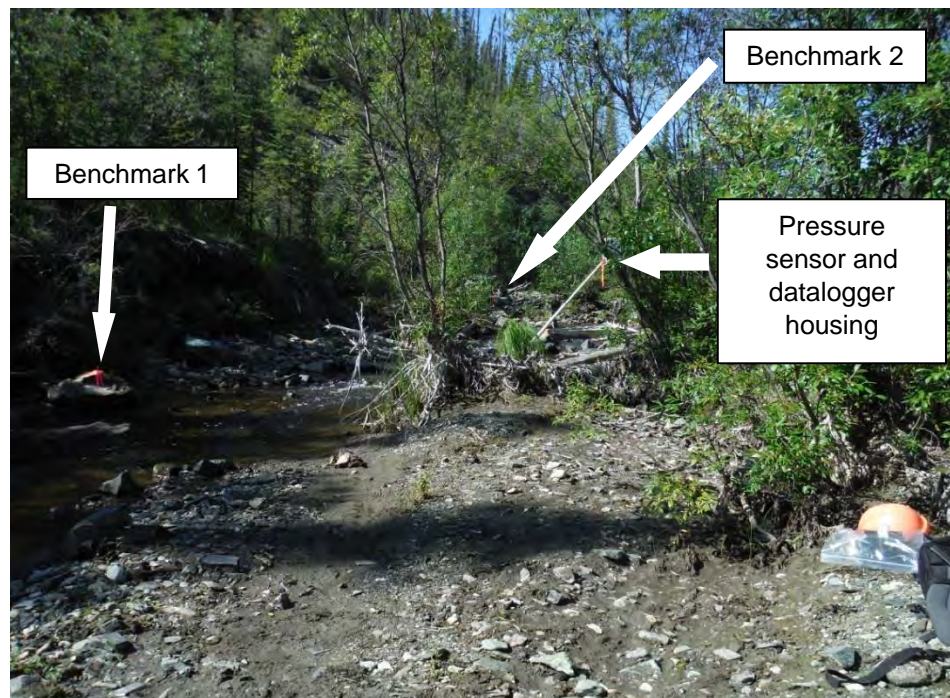


Photo taken at E3(H) gauging site, looking upstream. Photo of pressure sensor housing and benchmarks, looking upstream. Photo taken from a suitable location for the survey level

# FAT OTT PLS



Drucksensor

Pressure level sensor

Artikel-Nr.,  
 Manufacturer's part no. 63.037.001.9.0  
 Bearbeiter, Agent Blasskiewitz P.  
 Datum, Date 25.02.2015

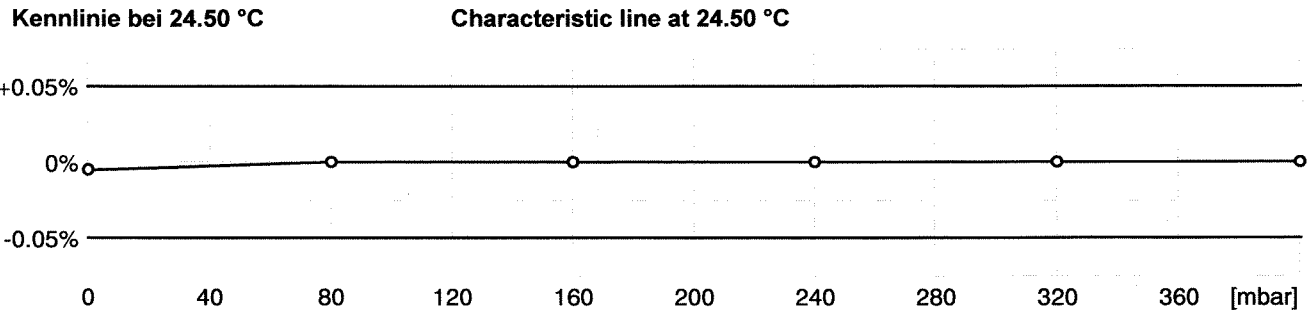
Abnahmeprüfzeugnis 3.1  
 DIN EN 10204:2004

Factory Acceptance Test 3.1  
 DIN EN 10204:2004

Unterschrift, Signature

<b>Serien-Nr.</b>	<b>Serial no.</b>	<b>365061</b>
Variante	Version	80 5 _ 0
Systemlänge [m]	System length [m]	80
Ausgang	Output	SDI-12
Kabelabschluss	Cable ends	Transportdose / Transport box
Messbereich [m]	Measuring range [m]	4
Einheit - Messwert	Unit - Measured value	m
Einheit - Temperatur	Unit - Temperature	°C
Mechanik-Stand	Mechanics status	4
<b>Leiterplatte</b>	<b>PCB</b>	<b>63.037.100.3.2 - A/1 - 78221 - 1878</b>
Bootloader	Bootloader	1.06.006
Firmware	Firmware	1.02.0
<b>Einstellungen (4-20 mA)</b>	<b>Settings (4-20 mA)</b>	
Min.-Wert [m]	Min.-value [m]	-/-
Max.-Wert [m]	Max.-value [m]	-/-

<b>Stromaufnahme bei 12 V</b>	<b>Power consumption at 12 V</b>	
Verbrauch [µA]	Consumption [µA]	(480 =<= 600) 509
<b>Sollwert</b>	<b>Target</b>	<b>Istwert / Current state</b>
4 mA	4 mA	-/-
20 mA	20 mA	-/-
<b>Funktionstest</b>	<b>Function test</b>	
SDI-12	SDI-12	<input checked="" type="checkbox"/>
SDI-12 über RS-485	SDI-12 via RS-485	<input checked="" type="checkbox"/>
Linearisierung	Linearizing	<input checked="" type="checkbox"/>



<b>Sichtkontrolle</b>	<b>Visual control</b>	
Serien-Nr., Messbereich	Serial no., measuring range	<input checked="" type="checkbox"/>

<b>Zubehör</b>	<b>Accessories</b>	
Betriebsanleitung	Operating instructions	<input type="checkbox"/>



# FAT OTT Orpheus Mini

Abnahmeprüfzeugnis 3.1  
DIN EN 10204:2004

Factory Acceptance Test 3.1  
DIN EN 10204:2004

Artikel-Nr. 55.440.002.3.2  
Manufacturer's part no. 55.440.002.3.2  
Bearbeiter, Agent Szegedi Janos  
Datum, Date 25.02.2015

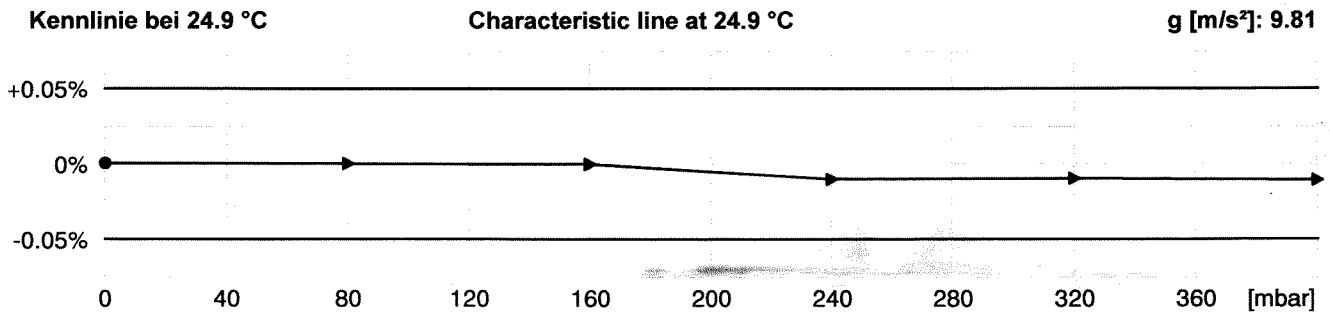
Unterschrift, Signature

*P.B.*

<b>Serien-Nr.</b>	<b>Serial no.</b>	<b>368061</b>
Sensor-Nr.	Sensor no.	JC042B01010
Messbereich [bar]	Measuring range [bar]	0.4
Systemlänge [m]	System length [m]	10.00
Mechanik-Stand	Mechanics status	3
Temperaturkalibrierung	Temperature calibration	<input type="checkbox"/>
<b>Leiterplatte Kommunikation</b>	<b>PCB Communication</b>	<b>55.440.101.3.2 - e/5 - 78661 - 0204</b>
Kommunikations-Software	Communication software	1.00.1
<b>Leiterplatte Sonde</b>	<b>PCB Probe</b>	<b>55.440.100.3.2 - c/1 - 78879 - 5664</b>
Bootloader	Bootloader	1.04
Testprogramm	Testprogram	1.05
Software	Software	1.53.4

<b>Stromaufnahme bei 4.7 V</b>	<b>Power consumption at 4.7 V</b>		
Ruhe [ $\mu$ A]	Sleep mode [ $\mu$ A]	(<= 45.0)	13.0
Aktiv [mA]	Active mode [mA]	(<= 30.00)	14.83
Kommunikation [mA]	Communication mode [mA]	(<= 65.00)	44.79

<b>Funktionstest</b>	<b>Test</b>	
mit Auslesekopf OTT IrDA-Link USB	with reading head OTT IrDA-Link USB	<input checked="" type="checkbox"/>



<b>Sichtkontrolle</b>	<b>Visual control</b>	
Serien-Nr., Messbereich	Serial no., measuring range	<input checked="" type="checkbox"/>

<b>Zubehör</b>	<b>Accessories</b>	
Stromversorgung 4.5 V	Power supply 4.5 V	3 x 1.5 V Alkaline (LR6)
Bedienprogramm	Operating program	<input checked="" type="checkbox"/>



# FAT OTT DuoLink

Optischer Auslesekopf

Optical reading head

Artikel-Nr.,  
Manufacturer's part no. 55.520.017.4.2  
Bearbeiter, Agent Klotz Claudia  
Datum, Date 08.04.2014

Abnahmeprüfzeugnis 3.1  
DIN EN 10204:2004

Factory Acceptance Test 3.1  
DIN EN 10204:2004

Unterschrift, Signature

**Serien-Nr.** **Serial no.** **335362**  
Mechanik-Stand Mechanics status 0

**Leiterplatte** **PCB** **97.360.151.4.5 - b/0 - 76102 - 0039**

### Stromaufnahme bei 5 V

### Power consumption at 5 V

DTR + [mA]	DTR + [mA]	(4.50 <= 5.00)	4.51
DTR - [mA]	DTR - [mA]	(3.50 <= 4.10)	3.57
RTS + [mA]	RTS + [mA]	(4.50 <= 5.00)	4.61
RTS - [mA]	RTS - [mA]	(3.50 <= 4.10)	3.99

### Funktionstest

### Function test

#### Kommunikation - IR

#### Communication - IR

9600 Bd	9600 Bd	<input checked="" type="checkbox"/>
19200 Bd	19200 Bd	<input checked="" type="checkbox"/>
38400 Bd	38400 Bd	<input checked="" type="checkbox"/>
57600 Bd	57600 Bd	<input checked="" type="checkbox"/>
115200 Bd	115200 Bd	<input checked="" type="checkbox"/>

#### Kommunikation - IrDA

#### Communication - IrDA

9600 Bd	9600 Bd	<input checked="" type="checkbox"/>
19200 Bd	19200 Bd	<input checked="" type="checkbox"/>
38400 Bd	38400 Bd	<input checked="" type="checkbox"/>
57600 Bd	57600 Bd	<input checked="" type="checkbox"/>
115200 Bd	115200 Bd	<input checked="" type="checkbox"/>

### Sichtkontrolle

### Visual control

Typenschild Instrument label



**APPENDIX 5**  
**Meteorological Station Checklist**

# Commissioning/Maintenance Checklist

---

September 2013 Clinton Creek – Installation

**Outline:**

The Station Maintenance Checklist is meant to be used as a field record of station maintenance, or calibration. Refer to following documentation: Site Binder and component literature.

Date of Visit: September 23, 2013	Client: Yukon Government, Assessment and Abandoned Mines
Contact Information: Erik Pit	
Technician: G. Van Delst / A. MacCannell	

**Station Notes:**

Site Installation

**Station Metadata:**

<b>Site Name:</b>	Clinton Creek Weather Station		
<b>Site Location:</b>	Latitude: 64.4502167 deg. N	Longitude: 140.7287167 deg. W	
<b>Site Elevation:</b>	453 meters		
<b>Site Description:</b>	Site is located on black waste rock on a reasonably flat area with little or no vegetation.		

**Station Peripherals & Supporting Hardware:**

<b>Mounting Structure (p/n &amp; description):</b>	Northern Avcom Timber Base with 30 foot Mast.		
<b>Power Supply:</b>	Solar		
<b>Power Supply Component List:</b>	Solar Panel, Sharp 80 W	m/n: SH-80	
	Charge Controller, 12V 8 Amp	m/n: ASC-12/8AF	
	Battery # 1, Eliminator 100 Ahr Solar	m/n: NA	
	Battery # 2, Eliminator 100 Ahr Solar	m/n: NA	
	Duncans, Insulated Battery Cabinet	m/n: NA	
<b>Communications &amp; Data Storage Equipment:</b>	Norcom Networks, MSAT Modem	m/n: SDT5000	s/n: 15603640 (Y206437)
		m/n:	s/n:
		m/n:	s/n:

**Station Components:**

	Parameter Type:	Model No.:	Serial No.:	Note:
<b>Controller</b>	Datalogger	CR1000-4M-55	56811	Campbell Scientific
	Duncans, Controller Cabinet			
<b>Sensors</b>	Air Temperature & Relative Humidity	HC2-S3-L	61081264	Campbell Scientific
	Wind Speed & Direction	05103AP-10-L	127034	RM Young Wind Monitor
	Precipitation	TE525M	55443-513	Texas Instruments, Rain Guage
	Barometric Pressure	CS-100	5470750	Campbell Scientific

## Datalogger / Controller Checklist:

Action: <input checked="" type="checkbox"/> Installation	<input type="checkbox"/> Commission	<input type="checkbox"/> Routine Maintenance	<input type="checkbox"/> Unscheduled Maintenance	<input type="checkbox"/> Other
Technician: G. Van Delst / A. MacCannell				

\*Fill out section for commissioning, maintenance, or calibration

<b>Data Logger Information:</b>	Manufacturer: Campbell Scientific Inc.	Part No.: CR1000-55	Serial No.: 56811
<b>Cabinet &amp; Mount Information:</b>	Cabinet manufactured by Duncans per Northern Avcom and mounted on timber base provided by Northern Avcom		

### CR1000 Commission:

<b>Data Logger Configuration:</b>	Serial Port Settings:			
	RS232 Baud Rate: 9600	CS I/O Baud Rate: NA	Com1 Baud Rate: N/A	Com2 Baud Rate: NA
	Programming:			
	File Name:	Loc.:	File Name:	Loc.:
	Clinton Creek Rev 1.CR1			

### CR1000 Datalogger / Controller Maintenance:

<b>Visual Inspection:</b>	Logger & Component Condition: NA		
	Mount and/or Housing Condition: NA		
	Period of Operation: NA		Date of Last Maintenance: NA
	<input type="checkbox"/> Check Fence Hardware and Gate Operation	<input type="checkbox"/> Check Cabling Inside Enclosures	<input type="checkbox"/> Clean Enclosure Door Seals
	<input type="checkbox"/> Check Datalogger Terminals	<input type="checkbox"/> Clean Debris Around Station	<input type="checkbox"/> Cabling Secure
	<input type="checkbox"/> Check Mounting of Equipment in ESS Controller	<input type="checkbox"/> Clean Solar Panel	<input type="checkbox"/> Check Charge Controller Terminals
	<input type="checkbox"/> Check Battery Terminals		
<b>Charging System:</b>	Measured Voltage		
	Battery Voltage	12.7	<input checked="" type="checkbox"/> Accept Observed Value
	Solar panel Voltage	13.05	<input checked="" type="checkbox"/> Accept Observed Value
<b>Component</b>	<input type="checkbox"/> Desiccant <input type="checkbox"/> Cabling <input type="checkbox"/> Sensor Interface <input type="checkbox"/> Communication Interface <input type="checkbox"/> Other (Specify)		

<b>Replacement:</b>				
<b>Controller Status:</b>	<b>OS Version:</b>	<b>Program Signature:</b>	<b>Battery Voltage:</b>	<b>Watchdog Errors:</b>
	CR1000.Std26	35985	12.69	0
	<b>Panel Temperature:</b>	<b>Lithium Battery:</b>	<b>Low 12V Count:</b>	<b>Low 5V Count:</b>
	2.82 deg C	3.36	0	0
<b>Controller Reading:</b>	<b>12V Measurement:</b>	<b>5V Measurement:</b>	<b>Other:</b>	<b>Other:</b>
	12.73	5.03		
	<input type="checkbox"/> Requires Testing/Calibration			

## Air Temperature and Relative Humidity Checklist:

Action: <input checked="" type="checkbox"/> Installation <input type="checkbox"/> Commissioning <input type="checkbox"/> Routine Maintenance <input type="checkbox"/> Unscheduled Maintenance <input type="checkbox"/> Other				
Technician: G. Van Delst / A. MacCannell			Date: September 23, 2013	

### Notes:

New calibrated sensor. See factory Calibration Certificate.

Single point functional test performed.

\*Fill out section for commissioning, maintenance, or calibration

<b>Sensor Information:</b>	Manufacturer: Campbell Scientific	Part No.: HC2-S3-L	Serial No.: 61081264
	Manufacturer: FTS	Part No.: THS-3-1	Serial No.: 028372
<b>Reference Standard Information:</b>	Certification: FTS		Date of Certification: Sept2012
	Manufacturer: RM YOUNG RADIATION SHIELD	Part No.: 41003-X R41046DS-15	Serial No.: NA
<b>Mount Information:</b>	Location:		Power Requirements: N/A

### Sensor Maintenance:

<b>Visual Inspection:</b>	Sensor & Cable Condition: NA									
	Mount and/or Housing Condition: NA									
<b>Clean Sensor &amp; Mount</b>	<input type="checkbox"/> Remove Debris <input type="checkbox"/> Clean Radiation Shield <input type="checkbox"/> Clean Sensor Filter <input type="checkbox"/> Clean Mount									
<b>Component Replacement:</b>	<input type="checkbox"/> Filter <input type="checkbox"/> RH Chip <input type="checkbox"/> Other (Specify)									
<b>Sensor Readings &amp; Comparisons</b>	Air Temperature Reading Degrees C					Relative Humidity Reading %				
	Air Temperature Reading (units) 2 Minute Intervals:					Relative Humidity Reading (units) 2 Minute Intervals:				
	0.61					66.3				
	Air Temperature Reference Reading (units) 2 Minute Intervals:					Relative Humidity Reference Reading (units) 2 Minute Intervals:				
	0.7					65				
	Average Air Temperature (A):					Average Relative Humidity (C):				
	0.6					66.3				
	Average Air Temperature Reference (B):					Average Relative Humidity Reference (D):				

	0.7		65	
	Difference of A Minus B	Expected + or - 1.1 C ( Pass/Fail)	Difference of C Minus D	Expected + or - 2 % (Pass/Fail)
	0.1	Pass	1.3	Pass



# CERTIFICATE

# rotronic

LEADING IN HUMIDITY MEASUREMENT

Device type	HC2-S3
Serialnumber	0061081270
RPC-number	7-0105124302

ROTRONIC AG certifies that this instrument meets the published specifications. It has been calibrated using standards and instruments as stated below and corresponds to the test requirements of ISO 9001-2008. The reference and service standards are traceable to national standards. The calibrated values are valid under above mentioned conditions only at the time of measurement and are referenced to the indicated references and working standards.

## FACTORY CALIBRATION

### Adjustment

Temperature	23.84°C
Humidity 1	10.56%rH (@23.82°C)
Humidity 2	34.23%rH (@23.85°C)
Humidity 3	77.90%rH (@23.88°C)

### Calibration

	Device	Reference
Temperature	23.86°C	23.83°C
Humidity	49.81%rH	49.84%rH

### Reference System

HC2-S (SCS certified)
-----------------------

Date of calibration: 19.12.2012

## FUNCTION TEST

Firmware	V2.0-2
Analog Output	Out1: Humi 0..100%rH (0..1V) Set: 40.00%rH, measured 40.03%rH (0.400V)  Out2: Temp -40..60°C (0..1V) Set: 20.00°C, measured 20.03°C (0.600V)
Printnumber	na

Final test passed – 21.12.2012 – quality engineer: S. Cetin

ROTRONIC AG, Grindelstrasse 6, CH - 8303 Bassersdorf  
[www.rotronic-humidity.com](http://www.rotronic-humidity.com)



## Wind Speed and Direction Checklist (WS/WD):

Action: <input checked="" type="checkbox"/> Installation <input type="checkbox"/> Commissioning <input type="checkbox"/> Routine Maintenance <input type="checkbox"/> Unscheduled Maintenance <input type="checkbox"/> Other	
Technician: G. Van Delst / A MacCannell	Date: September 23, 2013

### Notes:

New calibrated sensor. See factory Calibration Certificate.

Functional check performed on site, Wind direction read was 346 degrees which corresponded to the wind direction.

\*Fill out section for commissioning, maintenance, or calibration

<b>Sensor Information:</b>	Manufacturer: RM Young	Part No.: 05103AP-10-L	Serial No.: 127034
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### Sensor Commission:

<b>Sensor Connections:</b>	Interface Requirements: One Pulse input, One Single ended input and one excitation output to / from logger.	Wiring (at sensor and datalogger):  See Schematic	
	Power Requirements:  2.5 VDC Excitation		
<b>Mounting Location:</b>	Description: Mounted on mast on top of 30 ft mast.		
	Distance to Obstacles:		
<b>Sensor Orientation:</b>	Description: As per manufacturer specifications	Declination:  22 Deg	Junction box Orientation: south
	<b>Cabling:</b>	Cable Length: 35 feet	<input checked="" type="checkbox"/> Cabling Secured

<b>Sensor Output:</b>	WS Range/Units: 0 – 100 m/s	WD Range/Units: 0 – 355 degrees	
-----------------------	--------------------------------	------------------------------------	--

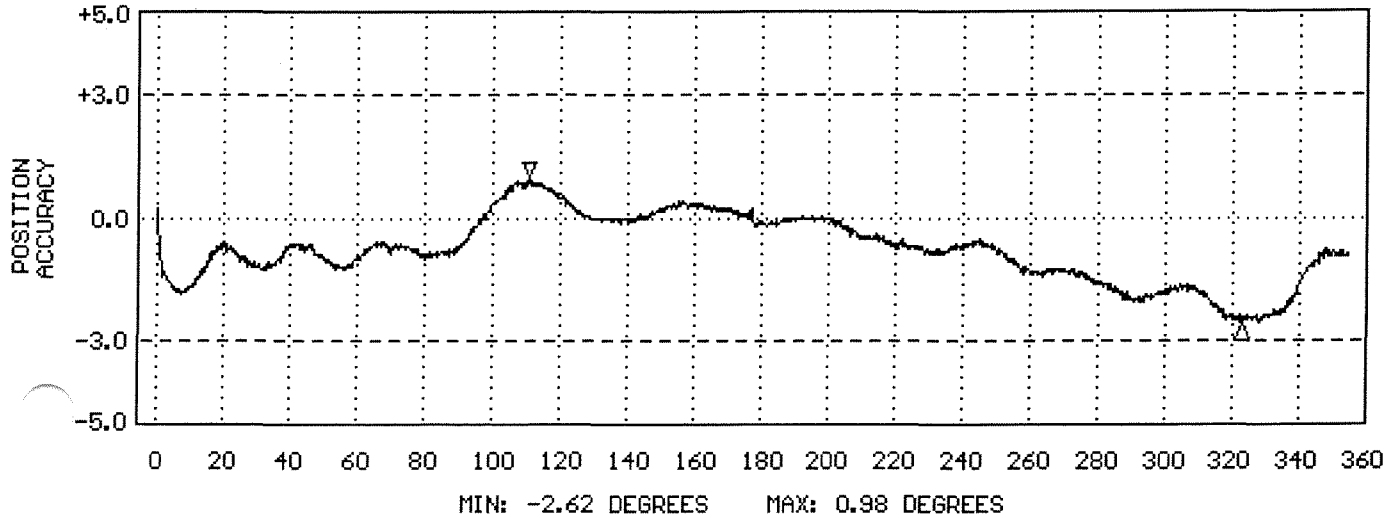
**Sensor Maintenance:**

<b>Visual Inspection:</b>	Sensor & Cable Condition:	
	<input type="checkbox"/> Propeller Spins Freely <input type="checkbox"/> Shaft Spins Freely <input type="checkbox"/> Sensor Body Intact <input type="checkbox"/> Propeller Intact	
	Mount Condition:	
<b>Clean Sensor &amp; Mount</b>	<input type="checkbox"/> Remove Debris <input type="checkbox"/> Clean Sensor <input type="checkbox"/> Clean Mount	
<b>Component Replacement:</b>	<input type="checkbox"/> Shaft Bearings <input type="checkbox"/> Flange Bearings <input type="checkbox"/> Potentiometer <input type="checkbox"/> Propeller <input type="checkbox"/> Nose Cone	
	<input type="checkbox"/> Sensor Body Component <input type="checkbox"/> Other (Specify):	
<b>Sensor Output:</b>	Wind Speed Reading:	
	Sensor: 2.81 ms	
	<input checked="" type="checkbox"/> Accept Observed Value	
	Wind Direction Reading	
	Sensor Reading at 0 degrees:	Sensor Reading at 90 degrees:
	Sensor Reading at 180 degrees:	Sensor Reading at 270 degrees:
	Sensor: 346 deg <input checked="" type="checkbox"/> Accept Observed Value	

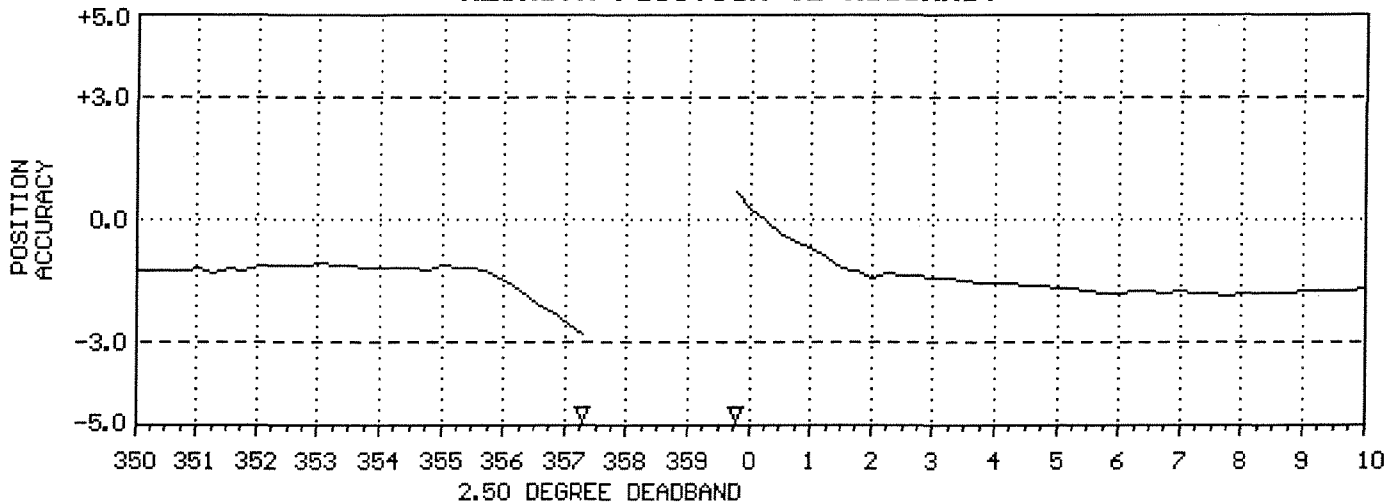
R. M. YOUNG COMPANY WIND SENSOR CALIBRATION CERTIFICATE

SENSOR: 05103-45-10A WIND MONITOR  
SENSOR SERIAL NUMBER: WM127034  
BEARINGS: SEALED/GREASE LUBE  
DATE: JUL 2 2013  
WIND SPEED THRESHOLD TEST: PASS  
LOW WIND SPEED AMPLITUDE/FREQUENCY TEST: PASS  
HIGH WIND SPEED AMPLITUDE/FREQUENCY TEST: PASS  
VANE TORQUE TEST: PASS  
SPECIAL NOTES:  
SPECIAL NOTES:

AZIMUTH POSITION vs ACCURACY



AZIMUTH POSITION vs ACCURACY



NOTE: Azimuth Position vs Accuracy graphs are accurate to within 0.5 degrees. The accuracy shown in the potentiometer deadband region between 355 and 0 degrees is the result of no resistance change while position changes. The gap represents the actual deadband (open circuit).

## Barometric Pressure Checklist:

Action: <input checked="" type="checkbox"/> Installation <input checked="" type="checkbox"/> Commissioning <input type="checkbox"/> Routine Maintenance <input type="checkbox"/> Unscheduled Maintenance <input type="checkbox"/> Other	
Technician: G. Van Delst / A. MacCannell	Date: September 23, 2013

### Notes:

New calibrated sensor. See factory Calibration Certificate.

Functional check performed at the office comparing measured value to Environment Canada.

Environment Canada adjusts the atmospheric pressure to sea level so pressure level measured in mbar would also need to be adjusted.

\*Fill out section for commissioning, maintenance, or calibration

<b>Sensor Information:</b>	Manufacturer: Campbell	Part No.: CS100	Serial No.: 5470750
<b>Reference Standard Information:</b>	Manufacturer:	Part No.:	Serial No.:
	Certification:		Date of Certification:
<b>Mount Information:</b>	Manufacturer:	Part No.:	Serial No.:
	Location: Mounted inside Controller enclosure		Power Requirements:

### Sensor Commission:

\*Allow Sensor and Comparison Standard to come to equilibrium before taking readings.

<b>Sensor Connections:</b>	Interface Requirements: One Differential input into the logger and one control port.	Wiring: See Wiring Diagram	
	Power Requirements: 12 VDC		
	Description of Sensor Venting: Sensor is mounted inside Controller Enclosure		
	<input checked="" type="checkbox"/> Remove Any Transducer Protection	<input checked="" type="checkbox"/> Venting Protected Against Moisture/Debris	
<b>Sensor Output:</b>	Pressure Range/Units: 600-1100 hPa	Pressure Reading:	
	Pressure Reference Reading:	Measured (mb)	Converted to kPa and adjusted to sea level (see manual)
	99.8 kPa(Environment Canada, Adjusted to sea level)	914.4 mb @ 712 m	99.7 kPa

**Sensor Maintenance:**

<b>Visual Inspection:</b>	Sensor & Cable Condition:	
	Mount and/or Housing Condition:	
<b>Sensor Readings &amp; Comparisons (before):</b>	Pressure Reference Reading	Pressure Reading
<b>Clean Sensor &amp; Mount</b>	<input type="checkbox"/> Remove Debris from Vent <input type="checkbox"/> Clean Vent <input type="checkbox"/> Clean Mount	
<b>Component Replacement:</b>	<input type="checkbox"/> Vent Filter/Tubing <input type="checkbox"/> Vent <input type="checkbox"/> Sensor (s/n:                    ) <input type="checkbox"/> Other (Specify)	
	Note:	
<b>Sensor Readings &amp; Comparisons (after):</b>	Pressure Reference Reading(A)	Pressure Reading(B)
	99.8 kPa	99.7 kPa
	Difference of A Minus B	Expected + or – 0.2 kPa ( Pass/Fail)
	0.1 kPa	Pass



# Calibration Certificate

Technician: SO 50  
Part No: 2781600MA1B2YT1  
Model: 278

Serial No: 5470750      Range: 610 to 1100 HPA/MB  
Work Order: 24088063    Nom. Output: 0.05 to 2.5 VDC  
Date: 05/16/2013      Supply: 24vdc

---

## CALIBRATION DATA

---

APPLIED PRESSURE (hPa)	TRANSDUCER OUTPUT (VDC)	PRESSURE CONVERSION (hPa)	ERROR (hPa)	EQUIPMENT UNCERTAINTY (hPa)
610.01	0.0496	609.92	-0.09	+/- 0.10
732.50	0.6619	732.37	-0.13	+/- 0.10
855.00	1.2752	855.05	0.05	+/- 0.10
977.49	1.8877	977.54	0.05	+/- 0.10
1100.00	2.5008	1100.16	0.16	+/- 0.10

---

### AMBIENT CONDITIONS:

Humidity: 30.0 %RH  
Pressure: 992.5 hPa

Temperature: 25.6 degree C

### SPECIFICATIONS:

Accuracy Specification: +/- 0.5 hPa @ +20 degree C (+68 degree F).

### NOTES:

1. This calibration was performed in compliance with ANSI/NC SL Z540-1-1994.
2. All errors are expressed in hPa.
3. Consult specification sheet for additional information.
4. This calibration is certified per N.I.S.T. traceable primary standards.  
Reference standard: I/N 00049-SN237-DHI PPC3-2M A1.4MS/A160KP.  
Reference standard cal. due date: 8/16/12 - 8/16/13.
5. This certificate may not be reproduced, except in full, without written approval from Setra Systems.
6. This calibration was performed using procedure P2781X.

**Precipitation Checklist:**

Action: <input checked="" type="checkbox"/> Installation <input type="checkbox"/> Commissioning <input type="checkbox"/> Routine Maintenance <input type="checkbox"/> Unscheduled Maintenance <input type="checkbox"/> Other	
Technician: G. Van Delst / A MacCannell	Date: September 23, 2013

**Notes:**

New calibrated sensor. See factory Calibration Certificate.

Functional test performed verifying that the measured output was 0.2mm for two tips of the rain gauge tipping mechanism.

\*Fill out section for commissioning, maintenance, or calibration

<b>Sensor Information:</b>	Manufacturer: Texas Instruments	Part No.: TE525M	Serial No.: 55443
<b>Mount Information:</b>	Manufacturer: NA	Part No.: NA	Serial No.: NA
	Location: Mounted on post approximately 4 ft above the ground.		

**Sensor Commission:**

<b>Sensor Connections:</b>	Interface Requirements: One Pulse Input	Wiring:  See site schematic	
	Sensor Power Requirements: NA		
<b>Sensor Output:</b>	0.1 mm per tip		



**Sensor Maintenance:**

<b>Visual Inspection:</b>	<input type="checkbox"/> Check Cable for Cracking <input checked="" type="checkbox"/> Check for Level <input checked="" type="checkbox"/> Check for Internal Damage
	Sensor & Cable Condition Note:
	Mount Condition Note:
<b>Clean Sensor &amp; Mount</b>	<input type="checkbox"/> Remove Debris (Inside & Out) <input type="checkbox"/> Clean Sensor Outside Surface <input type="checkbox"/> Clean Mount

**Sensor Test:**

Sensor Readings:													
<b>Sensor Output:</b>	<table border="1"> <tr> <td>Number of tips per 500ml of water slowly dripped into the sensor.</td> <td>Expected Value:</td> <td>Record Value:</td> </tr> <tr> <td>Expected 102 to 105 Tips ( Pass/Fail)</td> <td></td> <td></td> </tr> <tr> <td>Pass</td> <td></td> <td></td> </tr> <tr> <td><input type="checkbox"/> Requires Calibration/Repair</td> <td colspan="2"><input type="checkbox"/> Maintenance was Conducted</td> </tr> </table>	Number of tips per 500ml of water slowly dripped into the sensor.	Expected Value:	Record Value:	Expected 102 to 105 Tips ( Pass/Fail)			Pass			<input type="checkbox"/> Requires Calibration/Repair	<input type="checkbox"/> Maintenance was Conducted	
	Number of tips per 500ml of water slowly dripped into the sensor.	Expected Value:	Record Value:										
	Expected 102 to 105 Tips ( Pass/Fail)												
	Pass												
<input type="checkbox"/> Requires Calibration/Repair	<input type="checkbox"/> Maintenance was Conducted												

MODEL 523 SERIES CERTIFICATION/CALIBRATION INFORMATION

The sequence for calibration after the sensors are completely assembled is as follows:

1. The completed tipping bucket assembly is tested under a high-speed digital counter to check for multiple counts or missed counts and proper positioning of the sensor and actuator, then the assembly is installed into the main housing in which it will be shipped.
2. Sensors are then moved to the calibration stand that incorporated a bank of micro metering pumps that output at the rate of 1 inch per hour and a volume equal to 100 counts. The sensors are run through the calibration cycle until achieving 99 to 101 counts 3 times in a row.

The last 3 readings for this sensor were 100.5 100.5 100.1

Calibration Date 5/14/13

BY: CS SN: 55443

NOTICE!!!

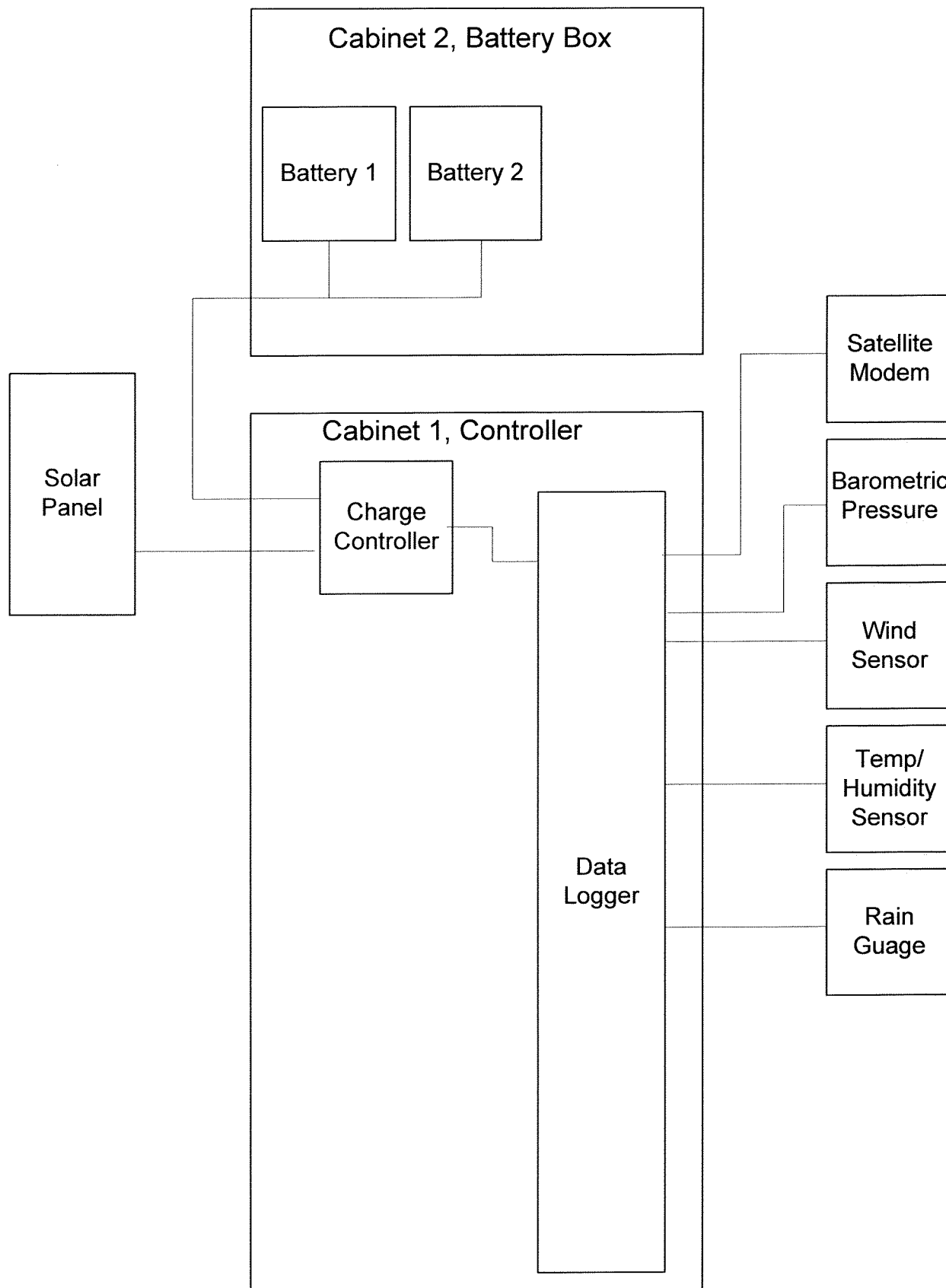
During shipment the tipping assembly has been secured to avoid possible damage to the pivot assembly. Lift off collection and remove rubber band from inside to release tipping mechanism before installation.

## CALIBRATION SUMMARY

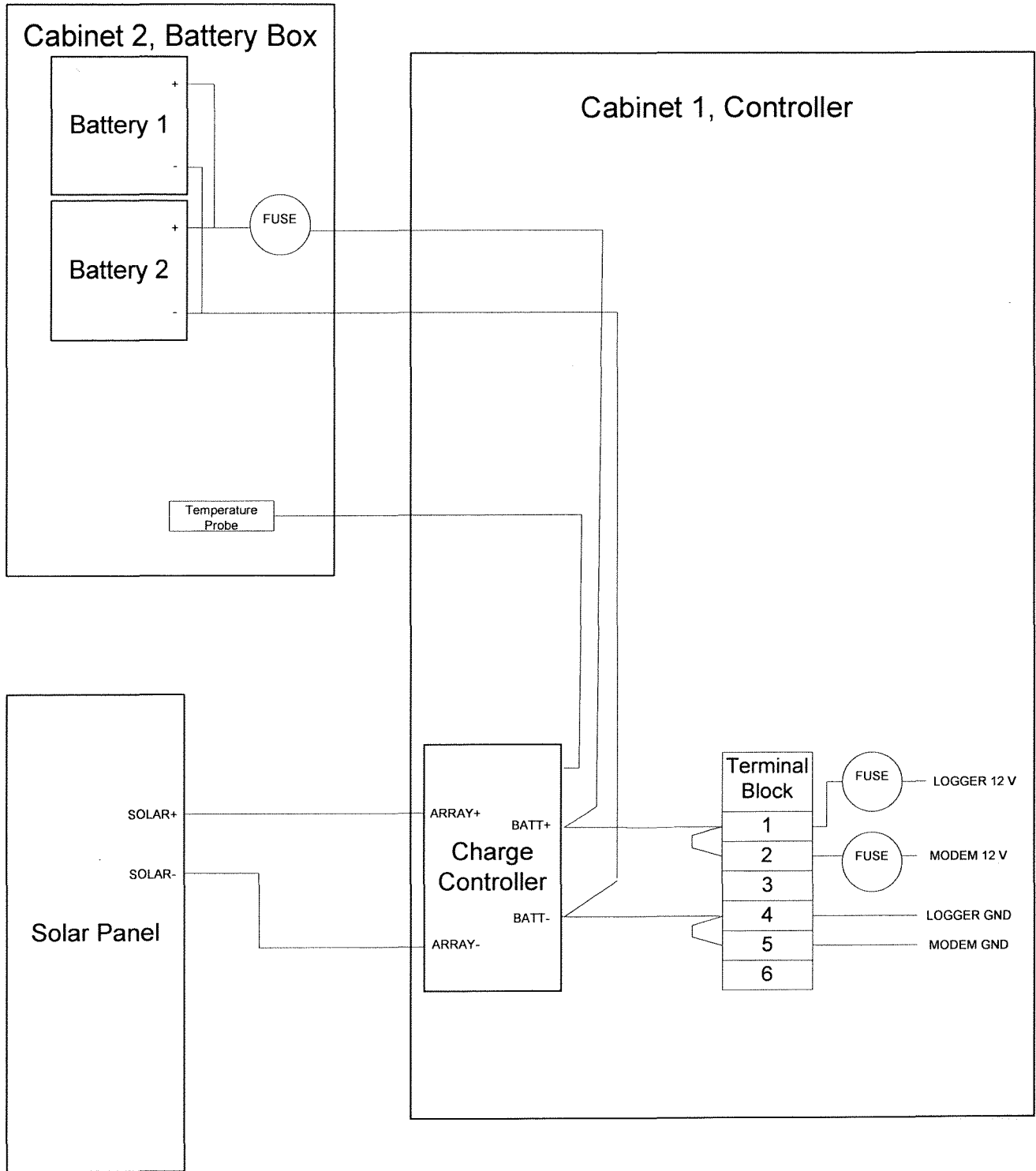
Parameter Type:	Model No.:	Serial No.:	Recommended Manufactures Calibration Schedule	Last Factory Calibration	Status
Datalogger	CR1000-4M-55	56811	2 years	2013(new)	
Air Temperature & Relative Humidity	HC2-S3-L	61081264	1 to 2 Years (sensor performance evaluation)	2013(new)	
Wind Speed & Direction	05103AP-10-L	127034	2 years	2013(new)	
Precipitation	TE525M	55443-513	1 Year done at site OK	2013(new)	
Barometric Pressure	CS-100	5470750	As required. Depends on end users specifications See comment below.	2013(new)	

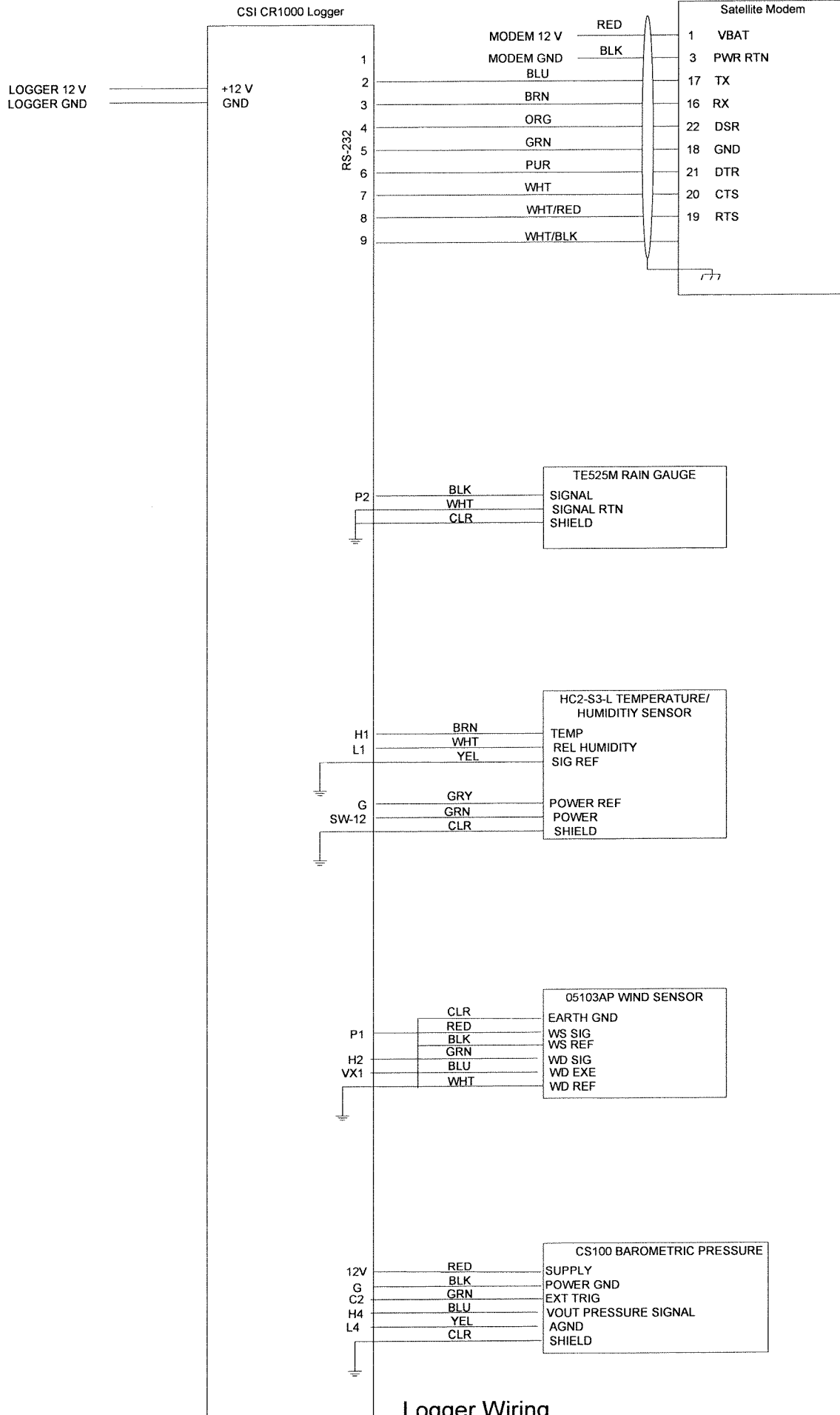
CS-100: We say "As Required" for these pressure sensors. That is because we don't know the specifications that the end-user needs to meet. Consider the CS-100 with a long-term stability of +/- 0.1 mb per year and a total accuracy of +/- 0.5 mb. If the client spec. was +/-1mb, it would be 5 years before the barometer would be suspect (in need of calibration). If the client spec. was +/-0.5mb, then the calibration interval would be yearly because the long-term stability could have it out of spec. in that time.

<b>Clinton Creek</b>				
<b>Weather Station</b>				
<b>Core Infrastructure</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>	<b>Installed Date</b>
Structure	NAL	Floating Base	N/A	September 23, 2013
Controller Cabinet	Duncans		N/A	September 23, 2013
Solar Panel, 80W	Sharp	SH-80	N/A	September 23, 2013
Charge Controller	ASC	ASC-12-8-A	N/A	September 23, 2013
Battery Cabinet	Duncans		N/A	September 23, 2013
Battery 1	Eliminator	100 amp/hr	N/A	September 23, 2013
Battery 2	Eliminator	100 amp/hr	N/A	September 23, 2013
Satellite Modem	Wireless Matrix	SDT5000	15603640(Y206437)	September 23, 2013
Data Logger	Campbell Sci	CR1000-55	56811	September 23, 2013
				September 23, 2013
<b>Sensors</b>				September 23, 2013
Rain Guage	Texas	TE525M	55443-513	September 23, 2013
T&H Sensor	Campbell Sci	HC2-S3-L	61081264	September 23, 2013
Wind Sensor	RM Young	05103AP-10-L	127034	September 23, 2013
Barometric Pressure	Campbell Sci	CS100	5470750	September 23, 2013
<b>Note:</b>				
Satellite Modem borrowed from Wildland Fire				



Block Diagram





Logger Wiring

Program: Clinton Creek Rev 1.CR1

'Program written for Clinton Creek

'Site configuration includes the following:

' - 1 Temperature/Humidity Sensor, HC2-S3-L, Temperature and Humidity recorded hourly wi  
' - 1 wind sensor RM Young 05103AP average wind speed in m/s and direction in degrees re  
' - Battery Voltage, minimum value recorded daily.  
' - 1 Precip sensor, TE525M tipping bucket, hourly total recorded in mm.  
' - Barometric Pressure Sensor CM100, hourly samples recorded in mbar.

'Program is written for a CR1000 datalogger

'Date: September , 2013

'Declare Variables and Units

Public BattV  
Public PTemp\_C  
Public WS\_ms  
Public WindDir  
Public Rain\_mm  
Public AirTC  
Public RH  
Public CS100\_temp  
Public pressure

Dim x

Units BattV=Volts  
Units PTemp\_C=Deg C  
Units WS\_ms=meters/second  
Units WindDir=degrees  
Units Rain\_mm=mm  
Units AirTC=Deg C  
Units RH=%  
Units pressure = mbar

'Define Data Tables

DataTable(Hourly, True, -1)  
  DataInterval(0, 60, Min, 10)  
  Average(1, WS\_ms, FP2, False)  
  Average(1, WindDir, FP2, False)  
  Totalize(1, Rain\_mm, FP2, False)  
  Average(1, AirTC, FP2, False)  
  Average(1, RH, FP2, False)  
  Sample(1, pressure, IEEE4)  
EndTable

DataTable(Daily, True, -1)  
  DataInterval(0, 1440, Min, 10)  
  Minimum(1, BattV, FP2, False, False)  
  Maximum(1, AirTC, FP2, False, False)  
  Minimum(1, AirTC, FP2, False, False)  
  Maximum(1, RH, FP2, False, False)  
  Minimum(1, RH, FP2, False, False)  
EndTable

'Main Program

BeginProg



Program: Clinton Creek Rev 1.CR1

```
'Main Scan

Scan(5,Min,1,0)

'Default Datalogger Battery Voltage measurement 'BattV'
Battery(BattV)

'Default Wiring Panel Temperature measurement 'PTemp_C'
PanelTemp(PTemp_C,_60Hz)

'HC2S3 (panel switched power) Temperature & Relative Humidity Sensor measurements 'Ai
' Relative Humidity connection to SE2)
PortSet(9,1)
Delay(0,3,Sec)
VoltSe(AirTC,1,mV2500,1,0,0,_60Hz,0.1,-50)
VoltSe(RH,1,mV2500,2,0,0,_60Hz,0.1,0)
PortSet(9,0)
If RH>100 AND RH<103 Then RH=100

'05103 Wind Speed & Direction Sensor measurements 'WS_ms' and 'WindDir' (Wind speed c
PulseCount(WS_ms,1,1,1,1,0.098,0)
BrHalf(WindDir,1,mV2500,3,Vx1,1,2500,True,0,_60Hz,355,0)
If WindDir>=360 Then WindDir=0

'TE525MM/TE525M Rain Gauge measurement 'Rain_mm' (connection to P2)
PulseCount(Rain_mm,1,2,2,0,0.1,0)

' Measure Barometric Pressure
' CS100 (cable switched power) Barometric Pressure Sensor measurements 'pressure'
' Enable power to sensor(connection C2)
' Measurement Is made every Scan outside the "If" statement, Sensor output connected

VoltDiff (CS100_temp,1,mV2500,4,True ,200,250,0.2,600)

' Turn on CS100 five minutes before the hour Set C2 high
If (IfTime (55,60,min)) Then WriteIO (&b10,&b10)

' Copy the correct value To a current variable called "pressure" at the top of the ho
' Turn off CS100 after measurement Set C2 low

If (IfTime (0,60,min)) Then
    pressure = CS100_temp
    WriteIO (&b10,&b0)
EndIf

'Call Data Tables and Store Data

CallTable(Hourly)
CallTable(Daily)

NextScan
EndProg
```

## **APPENDIX 6**

### **Response to Comments Received on Draft Report**

**Response to Comments from Draft Report Version (as Received and November 3 and 23, 2015).**

Comment No.	Page	Comment	Response
1	13	It was installed earlier. Can just remove sentence.	The text has been updated accordingly.
2	13	This is not true. New components/sensors were installed in 2014. New cameras and hydro stations and 'satellite modem' were installed in 2015. As per the contract, "Reporting for the spring monitoring event will cover the period of April 01, 2015 until the date of the spring monitoring event."	The text has been updated and data has been added to the report and reviewed by AAM.
3	14	Please identify min/max sites (as done in paragraphs below)	The report has been updated to identify the sites where minimum and maximum values were observed.
4	15	Part of the contract was to potential explanations of exceedances: "Any guideline exceedances must be highlighted, with pertinent rationale, observations or explanation where possible". I do not need a potential explanation for exceedances at reference stations, although I would like Hemmera/ELR to highlight where reference stations are the likely contributor of exceedances at downstream exposed stations (where applicable).	The report has been updated to provide context in regard to reference sites where we believe this may have contributed to the observed exceedances at exposure sites, and we have identified also where there were no such observations.
5	18	Remove; redundant to paragraph above.	The paragraph has been removed from the report.
6	18	Not accurate; revise as per previous comment regarding MS data.	This paragraph has been revised to reflect the inclusion of the April 1 to July 31 2015 data.