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EDI Project No: 15Y0146

Assessment and Abandoned Mines Branch (AAM) K-149
Department of Energy, Mines and Resources, Yukon Government
Room 2C Royal Center, 4114-4th Avenue
PO 2703, Whitehorse, YT, Y1A 2C6

Attention: Erik Pit, Type II Project Manager

RE: Mount Nansen Water Resources Investigations – Monthly Report: March 2016

Trip dates:	March 14-15, 2016
EDI field staff:	Dawn Hansen, Megan Sandford, and Danny Skookum
Weather during trip:	Conditions for the two days included air temperatures from -11 to -2°C, with clear to overcast skies and calm wind conditions.

The following monthly report includes a summary of site conditions and data collected during EDI's March 2016 trip to Mount Nansen as part of the 2015/16 Water Resources Investigations. The March 2016 trip represents the end of the winter season and thus a more detailed seasonal analysis of hydrology and meteorology data is provided for this period (October 16, 2015 to March 31, 2016). In addition to hydrology and meteorology, this report includes site conditions, water quality, program recommendations and additional trip information (Table 1).

Table 1. Summary of information provided in this monthly report.

Report Section	Description
Site Conditions	⌋ Summary of weather and general site conditions
Meteorology	⌋ Statement on station status and identification of any data gaps or QA/QC issues ⌋ Snow depth sensor QA/QC ⌋ Seasonal Meteorological Summary (October 2015 to March 2016)
Hydrology	⌋ Discussion of noteworthy hydrology observations for this month ⌋ Statement of QA/QC for the data collected this month ⌋ Seasonal Hydrological Summary (October 2015 to March 2016)
Water Quality	⌋ Summary of noteworthy water quality observations for this month ⌋ Statement on QA/QC sample results for this month
Program Recommendations	⌋ Program recommendations for meteorological, hydrology and water quality programs

Report Section	Description
Additional Trip Information	⁃ Project Safety Concerns ⁃ Wildlife sightings ⁃ Budget and schedule considerations
List of Attachments	1. Maps of Hydrometric Stations and Water Quality Sites 2. Site and Station Photos from the trip 3. Data Tables (March 2016 trip) ⁃ Hydrology – Site Conditions and Tasks Completed & Summary Table of Discharge Measurements. ⁃ Water Quality – Site Conditions and Samples Collected & Summary Table of In Situ Parameters and Lab Results 4. Seasonal Data Summary: October 16, 2015 – March 31, 2016 ⁃ Meteorology – rainfall and snowfall summary data tables, data plots ⁃ Hydrology – instantaneous measurements, and hydrographs 5. Copies of Lab Certificate of Analysis (COA) & Yukon Environmental Health Services Bacteriological Results (March 2016).

SITE CONDITIONS

The March 2016 sampling event represented late-winter conditions at the Mount Nansen Site. Air temperatures were relatively warm, with daytime highs ranging from -11 to -2°C. Weather conditions ranged from clear to overcast skies and calm winds. Ice cover was present across all watercourses and waterbodies, with ice thickness ranging from 2 cm to 70 cm, with the tailings pond having the thickest ice. Water levels were lower than during the previous winter trips at most stations. Stations and sites along Pony Creek, Back Creek and some areas of Dome Creek remain frozen to bed, and various seeps around the site remained frozen and could not be sampled.

METEOROLOGY

Meteorological data was collected at the ATM-ROAD station throughout the month of March 2016. EDI conducted a QA/QC review of the March 2016 data and all sensors appear to be functioning properly with the exception of the radiation sensors, where for short durations, the data values from the shortwave radiation sensor were below 0 W/m^2 and the longwave radiation sensor recorded readings above 0 W/m^2. These erroneous data were likely associated with the accumulation of snow, frost or detritus blocking the sensor. All erroneous data was removed prior to analysis.

The snow sensor data quality produced a good quality reading at the time of the field visit. On March 15, 2015, the snow depth measured by EDI was 48.0 cm, whereas the snow sensor measurement was 46.6 cm (Table 2). This indicates that to date, the snow sensor appears to be slightly underestimating snow depth, however there is likely enough spatial variability of the snow distribution and ground surface elevation in the vicinity of the meteorological station that would account for the differences. An additional snow sensor data quality metric called 'Snow_Depth_Qual' was added in the daily data recorded at the meteorological station; the data quality metric reflects the quality of the measurement (see Note 1, Table 2).

Table 2. Comparison of snow depth measured at the site with the snow sensor measurement.

Measurement Date/Time	Manual Snow Depth Measurement near Station (cm)	Meteorological Station Snow Sensor Measurement (cm)	Snow Sensor Quality[1]	Difference (cm)
October 13, 2015 13:00	0.0	0.6	181 (Good)	0.6
November 16, 2015 14:20	20.0	18.2	185 (Good)	1.8
December 15, 2015 18:05	29.1	27.1	182 (Good)	2.0
January 12, 2016 13:35	32.5	30.0	169 (Good)	2.5
February 16, 2016 09:45	41.6	41.3	177 (Good)	0.3
March 15, 2016 09:05	48.0	46.6	172 (Good)	1.4

Note:
[1]- Quality numbers provide an indication of surface density in snow monitoring applications. Values will increase during snowfall events consisting of low-density snow. Quality Numbers: 0 = Not able to read distance; 152-210 = Good Measurement Quality Numbers; 210-300= Reduced Echo Signal Strength; 300-600 = High measurement uncertainty

Seasonal Meteorological Summary: October 16, 2015 – March 31, 2016

Regular seasonal air temperature trends were generally reflected during the October 16, 2015 and March 31, 2016 period; however, there were also several unseasonal warm periods recorded. Mean daily air temperatures began to fall below 0°C starting on October 16, 2015 and stayed below 0°C starting on October 23, 2015. Unseasonal warm periods (days with a mean temperature above 0°C) were experienced between November 26 – 27, 2015, and January 26 – 28, February 11, and February 24 – 27, 2016. All months in the winter reporting season, except December, had periods above 0°C. In the spring, mean daily temperatures were first above 0°C on March 11, 2016, and remained warmer than 0°C from March 28, 2016 until the end of the month. October 2015 had the highest mean monthly temperature at -0.6°C, and December 2015 had the lowest mean monthly temperature at -11.8°C. The maximum hourly temperature recorded during the reporting period was 12.2°C on March 31, 2016, while the lowest recorded temperature was -27.9°C on November 19, 2015 (Table 2). Daily air temperature fluctuations throughout the winter season can be seen in more detail in Attachment 4A: Figure 1.

The ground surface temperature record followed similar seasonal patterns as air temperature. The daily average ground surface temperature was below 0°C starting on October 19, 2015, and began rising above 0°C on March 30, 2016. Ground surface temperatures did not go above 0°C in between these dates. The maximum ground temperature was 3.3°C on October 18, 2015, and the minimum ground temperature was -10.3°C on November 19, 2015 (Attachment 4A, Figure 1).

Seasonal rainfall and snowfall patterns were characteristic of the region for the October 16, 2015 to March 31, 2016 period, with a few unseasonal rainfall events. Rainfall events are defined as periods of rainfall greater than or equal to four hours, and/or have greater than or equal to 2.0 mm of rainfall recorded. Three rainfall events occurred during the winter when temperatures rose above 0°C; one event occurred in November and three occurred in February. The remaining rainfall events occurred in late fall and early

spring periods (Attachment 4A, Figure 2). Rainfall was recorded in all months during the winter period, except for December. Some of the rainfall records could be a result of sensor error, where the sensor picks up melt water rather than precipitation.

Snow was present on the ground throughout the October 16, 2015 to March 31, 2016 period. The depth of the snowpack at the beginning of the 2015/2016 winter period was 0.5 cm on October 16, 2015, and the depth at the end of the winter season was 26.1 cm on March 31, 2016. The snowpack reached its maximum at 48.1 cm on March 13, 2016. The snowpack began a rapid melt beginning on March 29, 2016 when snow depth decreased 16.8 cm in 52 hours. In total, 78 snowfall events occurred during the season (Attachment 4A: Table 2 and Figure 3). November and December 2015 represented the most intense and highest cumulative total monthly snowfall amounts. Total monthly snowfall during the month of November was the highest of the season (31.1 cm) and included 13 snowfall events. The largest snowfall event occurred on November 12 2015, lasted for nine hours, and produced a total of 10.0 cm of snow.

The dominant wind directions during the season were south-westerly (see Attachment 4a: Figure 4). The maximum mean hourly wind speed recorded during this period was 7.8 m/s (28.1 km/hr) on December 30, 2015. The month with the highest mean wind speed was February 2016 at 2.3 m/s (8.9 km/hr), while December had the lowest mean monthly wind speed at 1.5 m/s (5.4 km/hr) (see Attachment 4A: Figure 5).

Net radiation during the winter season ranged from a minimum of -70.7 W/m^2 on October 19, 2015 to a maximum recorded net radiation of 330.0 W/m^2 on March 15, 2016. March 2016 had the highest mean monthly net radiation at -4.2 W/m^2, while February had the lowest monthly mean net radiation at -18.1 W/m^2 (see Attachment 4A: Figure 6).

Mean daily relative humidity ranged from 69.8% to 86.7% during the season. The maximum recorded relative humidity occurred 99.5% on March 21, 2016. The minimum recorded relative humidity was 31.1% on March 31, 2016 (Attachment 4A: Figure 7). .

Table 1. Mount Nansen air temperature and precipitation statistics by month (October 16, 2015 to March 31, 2016).

Month	Air Temperature			Snowfall			Rainfall		
	Max (°C)	Min (°C)	Mean (°C)	Total Number of Events	Events Total (cm)	Max Event Total (cm)	Max Intensity (mm/hr)	Max Daily Total (mm)	Total Monthly (mm)
October	7.0	-11.9	-0.6	6	10.7	7.1	1.4	3.1	5.8
November	1.8	-27.9	-10.2	13	31.1	10.0	0.7	1.9	1.9
December	-1.5	-22.9	-11.8	17	30.3	5.1	0	0	0
January	0.1	-17.0	-7.5	13	18.1	4.3	0.1	0.1	0.1
February	2.6	-22.5	-7.5	15	20.8	4.6	1.2	2.4	7.3
March	12.2	-11.1	-3.6	14	10.8	2.6	1.9	2.6	5.3

HYDROLOGY

Discharge measurements were collected at all stations with suitable measurement conditions during the March 2016 trip. Flowrates continued to decline to baseflow conditions and represented the lowest levels to date in the 2015/2016 winter period, except at H-DC-M WP and H-VC-R+290. Hydrometric stations at H-PC-DSP, H-BC, H-DC-B, H-DC-R and H-DC-D1b remain frozen to substrate. H-DC-DX+105 was frozen to bed in March for the first time during the winter period. Continuous water level records are available for five stations for the period up to March 15, 2016: H-VC-U, H-VC-DBC, H-VC-UMN, H-VC-R and H-VC-R+290. Data could not be downloaded successfully from the continuous water level logger at H-DC-M WP in March and the channel was frozen to bed in the vicinity of the logger. Data was successfully downloaded in January 2016 however the download successes have been sporadic over the winter and it is suspected that there is damage to the direct read communication cable, not the logger itself. Regardless, the logger and sensor will be checked for damage after thaw occurs and the direct read cable will be replaced (see Program Recommendations and Additional Trip Information Section for details).

Surface water conditions and hydrometric monitoring tasks completed at each station in March 2016 are summarized in Attachment 3. Quality control and quality assurance was conducted for all hydrometric data.

Site Observations - March

- Discharge measurements were collected with an ADV using the velocity-area method at all Victoria Creek stations, H-VC-U, H-VC-DBC, H-VC-UMN, H-VC-R+290, with discharge values that ranged from 0.012 to 0.063 m^3/s.
    - The measured discharge at H-VC-DBC (0.063 m^3/s) is greater than at the downstream station at H-VC-UMN (0.017 m^3/s). Typically discharge increases in the downstream direction of a watercourse as the contributing watershed area increases, therefore this decreasing winter flow pattern may indicate that the Victoria Creek reaches are losing surface flow to groundwater pathways. Similar discharge patterns have been previously noted along Victoria Creek in July 2014, May-July 2015, and November 2015-February 2016. A more detailed review of the Victoria Creek water balance is provided in the Seasonal Hydrology Summary section below.
- At H-DC-M WP, overflow ice originating from the seepage discharge site has covered the weir pond with a thick layer of ice and has advanced downstream of the water quality site. No discharge measurement could be collected at this site. Less than half of the water was flowing through the weir at the time of the site visit with the remainder flowing over the right edge of the support wall of the pond. Additionally, water continues to flow between the metal weir plate and wooden support structure (similar to that observed in January and February 2016). No confined channel could be located downstream of the pond and water was suspected to be flowing between layers of ice; conditions were not suitable for discharge measurement.

- H-DC-DX+105 was frozen to bed for the first time during the winter period and therefore no discharge measurement was completed.
- The H-SEEP volumetric discharge measurement (0.002 m^3/s) was identical to the flow rate measured at the pump in the seepage pond shack (0.002 m^3/s).
- Overflow ice conditions were present along Dome Creek in the vicinity of H-DC-R and H-DC-B. The H-DC-B station was frozen to bed, no measurements could be collected. Denison Environmental Services had recently excavated overflow ice from the diversion channel upstream of the bridge. The H-DC-R and H-DC-D1b stations are considered frozen to substrate for the winter.

Seasonal Hydrological Summary: October 16, 2015 to March 31, 2016

Stage hydrographs were developed for all hydrometric stations where continuous water level logger data was available at the Mount Nansen site during the winter season. These included H-DC-M WP, H-VC-U, H-VC-DBC, H-VC-UMN, H-VC-R, and H-VC-R+290. Stage-discharge rating curves are not updated during the winter period due to the influence of ice on water levels and subsequently the relationship between stage and discharge described by the rating curve. As a result, no continuous discharge hydrographs are produced for the winter season; however, the instantaneous discharge measurements completed at these stations during the winter season are also plotted on the hydrographs (Attachment 4B). Loggers at H-PC-DSP, H-DC-B, H-DC-R and H-BC were removed prior to the winter season. Hydrometric stations at H-DC-D1b and H-BC and H-TP were frozen to bed for the entire winter period and therefore no discharge measurements were collected.

Hydrographs were prepared for hydrometric stations where instantaneous discharge measurements were collected (Attachment 4B). This includes stations H-DC-DX+105, H-DC-B, H-DC-R, H-SEEP and H-PW. The hydrograph for H-SEEP includes the instantaneous flowrate, recorded daily at the seepage pond flow meter by Denison Environmental Services.

The Solinst Edge M1.5 barologger located at ATM-VC5 began malfunctioning during the winter season (November 2015). The barologger is used to compensate all the continuous water level loggers for atmospheric pressure. The barologger at ATM-VC5 was replaced in January 2016 therefore for the majority of winter season the barologger produced unreliable data. A redundant barometric sensor located at the AAM meteorological station (ATM-ROAD) was used for compensation for the entire winter season. The redundant sensor is located at a higher elevation (approximately 1260 m, asl) than ATM-VC5 (1015 m, asl), therefore an elevation-based model correction was required to use the data from ATM-ROAD for compensating the water level loggers between November 1, 2015 and March 15, 2016.

Continuous water level data from the logger at H-DC-M WP is presented up to November 11, 2015. Logger data collected after this date was determined to unreliable because the logger was frozen to the stream bed. No discharge measurement could be collected in March because channel was frozen to bed. The measured flowrates through the weir pond steadily increased over the winter period from a low of

0.003 m^3/s in November to a high of 0.005 m^3/s in February. Although the magnitude of increase in the flowrates is relatively small (0.002 m^3/s or 2 L/s) the increasing trend is not explained by simple water balance calculations of upstream contributions from H-SEEP or H-DC-B. Sources of error in measuring discharges at extremely low flow conditions are suspected, as any errors would have a large influence on the estimated discharge. Additionally, salt tracer methods, which were used in January and February, are recognized to have a greater measurement uncertainty (compared to volumetric or ADV methods) and have greater potential for measurement errors.

The water balance along the Victoria Creek water course was analyzed to investigate gaining and losing reaches associated with groundwater-surface water fluxes. The instantaneous discharge measurements collected along Victoria Creek and suggest possible groundwater-surface water interactions (Attachment 4B). The measured discharges at H-VC-DBC are consistently greater than at all other hydrometric stations along Victoria Creek including at the downstream stations (H-VC-UMN, H-VC-R and H-VC-R+290) where the contributing watershed area is larger and discharges would typically be expected to be greater.

Discharges measured in March 2016 along Victoria Creek were the lowest of the 2015/2016 winter season, with the exception of H-VC-R+290 where the February discharge (0.021 m^3/s) was slightly lower than in March (0.023 m^3/s), and are considered to represent a close approximation of baseflow conditions (Attachment 4B.)

The discharge values at H-VC-U and H-VC-DBC suggest that there is a substantial net gain of water between these two stations during the winter over a very short distance (approximately 250 m). The Back Creek confluence with Victoria Creek is situated between the stations; however, during the winter, Back Creek was frozen to the channel bed and did not contribute surface flow. An example of the magnitude of the net increase in discharge between these stations occurred in March 2016; the measured discharge at H-VC-U (0.039 m^3/s) was less than at H-VC-DBC (0.063 m^3/s). Open water leads were also noted between these two stations above the Back Creek confluence throughout the winter supporting the presence of warm groundwater inputs to the channel in this reach (Photos 10 - 12 in Appendix 2). The relationship between these stations was observed for all winter months and the relative magnitude of the increase was more significant as baseflow conditions were approached.

Conversely, data from the Victoria Creek stations H-VC-DBC and H-VC-UMN indicate that the reach is losing water to groundwater (losing reach). The flow rate measured at H-VC-DBC was consistently greater during the winter season than at the downstream station at H-VC-UMN. The Dome Creek confluence with Victoria Creek occurs between these stations but Dome Creek does not contribute surface water to the channel during the winter. For example, during the March visit the discharge at H-VC-DBC (0.063 m^3/s) was greater than downstream at H-VC-UMN (0.012 m^3/s) despite the increase in contributing watershed area. The relative magnitude of the decline in discharge between H-VC-DBC and H-VC-UMN increased over the winter period.

Between H-VC-UMN and H-VC-R/H-VC-R+290 the local groundwater influences are less clearly defined and require additional data collection to determine groundwater-surface water exchanges. In November

2015, January 2016 and February 2016 the measured discharges at H-VC-UMN were greater than at the downstream stations at H-VC-R/H-VC-R+290. However, an increase in the discharges was observed in January and March 2016.

The continuous stage logger records for multiple stations show infrequent, abrupt increases in the water level during the winter period. For example, at H-VC-U two peaks occurred during February with water levels increasing from approximately 1.96 m to 2.18 m. These elevated water levels are thought to be associated with ice-related processes and not with significant increases in discharge. Similar peaks are observed in the continuous stage data at H-VC-R, H-VC-R+290, H-VC-UMN and H-VC-DBC and are noted on the stage-hydrographs in Appendix 4B.

One set of concurrent measurements was completed along Victoria Creek for ongoing validation of the salt tracer method during the 2015/2016 winter period. Concurrent discharge measurements were completed at H-VC-R+290 using the velocity-area and salt tracer methods yielding similar results (salt tracer = 0.030 m^3/s; velocity-area =0.025 m^3/s). Additional concurrent measurements and validation of the salt tracer method will be completed when site conditions and timing permit.

Following the winter freeze-up, flows declined substantially during December and remained low for the entire winter season as baseflow conditions were approached. The following list summarizes the minimum measured flowrates for stations where discharges were collected for each month during the winter:

- H-VC-U: 0.039 m^3/s on March 14, 2016
- H-VC-DBC: 0.057 m^3/s on January 13, 2016
- H-VC-UMN: 0.012 m^3/s on March 14, 2016
- H-VC-R+290: 0.021 m^3/s on February 15, 2016
- H-SEEP: 0.002 m^3/s on March 15, 2016

All stations with continuous loggers experienced a sudden increase in the recorded stages starting on November 18, 2015. The timing of this event corresponds to the first significant cold period on site, reaching a low of -27°C and persisting for several days. EDI hypothesizes that these cold temperatures triggered a large amount of ice formation, and an associated increase in the recorded stage in the channel.

The continuous water level records at all stations exhibited an increase in water levels in mid-February, and is most pronounced at H-VC-DBC where a rapid increase in water levels begins on February 17, 2016. This period is associated with unseasonably warm temperatures on site, including daily air temperatures above 0°C on February 11 and 24, 2015. This is suspected to have caused minor melting and shifting of ice on site, causing elevated water levels in the channels.

WATER QUALITY

Water quality samples and in-situ data were collected at the regularly scheduled sites during the March 2016 trip. A total of eight sites were sampled. Many stations remain frozen to substrate for the winter period (Attachment 3). The regular monthly drinking water sample was collected from the pumphouse well (WQ-PW). All samples were submitted for analysis through ALS Laboratories under chain of custody documentation.

Site conditions were noted and a record of the samples collected were compiled (Attachment 3). In-situ and laboratory results summary tables as well as the lab certificates of analysis are attached (Attachment 3 and Attachment 4). Parameters that exceeded the Canadian Council of Ministers of the Environment Freshwater Aquatic Life (CCME-AL) guidelines and/or the Mount Nansen Effluent Quality Standards (EQS) criteria are highlighted. Many results reflect typical conditions for this time of year at Mount Nansen where water levels are low and watercourses are covered in ice. A summary of the results and comments on the sample QA/QC data are included in the subsections below.

March Water Quality Results Summary

- The Victoria Creek samples did not exceed any guidelines or standards (this is typical of the winter season).
- The total zinc concentration in the March 2016 WQ-SEEP sample was above the CCME-AL guideline with a concentration of 0.116 mg/L. This is similar to the January 2016 sample result of 0.114 mg/L and the February result of 0.122 mg/L. The sample from this site also had concentrations above guidelines/standards for ammonia, arsenic, cadmium, iron, and manganese, which is a common occurrence at this site. Additionally this month, the nickel concentrations exceeded the CCME guideline.
- The WQ-TP samples exceeded the guidelines and/or standards for total suspended solids (TSS) ammonia, fluoride, arsenic, cadmium, copper, iron, lead, manganese, and zinc. These results are typical of the winter season. Additionally this month, total aluminum, nickel, and silver were also present at concentrations that exceeded CCME guidelines.
- The WQ-DC-U site downstream of the WQ-DC-B and WQ-SEEP sites exceeded the guidelines and/or standards for ammonia, arsenic, iron, manganese, and zinc. These results are typical of the winter season. Additionally this month, the nickel concentrations exceeded the CCME guideline.
- The LC50 sample collected from the WQ-SEEP had a 96-hour LC50 result of greater than 100%, with 100% trout survival at 96-hours.

QA/QC Samples

Travel Blank Sample – All parameters below detection limits. No contamination from storage or transport is suspected.

Field Blank Sample – All parameters were below detection limits. No contamination from field methodology is suspected.

Replicate Sample(s) – The average relative percent difference (RPD) of the replicate sample set for WQ-VC-UMN-r was 3%, indicating that sample analysis was adequately precise (RPD<20%). The average RPD for total metals in the replicate sample set was 3% and the average RPD for dissolved metals was 2%. All individual parameters had RPD less than 20% or below detection limits.

PROGRAM RECOMMENDATIONS

- Continue to collect photographs of the meteorological station compound during each summer season trip. Snow depth measurements should continue until all snow has melted adjacent to the station to confirm snow sensor data.
- Conduct concurrent velocity-area and salt tracer discharge measurements at all hydrometric stations during the open water season, where possible, to continue to validate the salt tracer method.
- The water level logger at H-DC-M WP has frozen to the channel bed and the weir and the weir pond is covered with a thick layer of overflow ice. The logger could not be successfully downloaded during the March field visit and the suspected cause is a damaged direct read cable. The direct read cable will be replaced in the spring when conditions permit. EDI recommends testing for sensor drift once the station thaws to assess if there was damage to the sensor from the ice.
- As first noted in January 2016, water flows between the metal weir plate and the wooden structure at H-DC-M WP. Volumetric discharge measurements cannot be made at the station because all of the water cannot be captured. Once the structure is ice free and flows have receded, the condition of the weir plate should be assessed and repaired as required to facilitate future volumetric discharge measurements.
- Accumulated fine sediment in the weir pond at H-DC-M WP continues to cause concern that channel instability in the diversion channel banks upstream (particularly following rain storms and excavation work) is causing sedimentation in the weir pond, and decreasing the function of the weir. Sedimentation in the pond decreases capacity and causes water to flow over the edges of the wooden support structure. Sediment will be manually removed from the weir pond when necessary and potential effects to resulting data will be noted in field and monthly reports.
- The hydrometric station at H-VC-R has been collecting concurrent data with H-VC-R+290 since September 2015. The hydrometric station at H-VC-R (stilling well, continuous data logger, staff gauge) are planned to be removed following the spring freshet, provided that the location of H-VC-R+290 is deemed to be acceptable.
- During the 2015 open water season, a large earth dam was constructed upstream of WQ-PC-U as part of placer mining operations. Flows from the ponded area were controlled by a pump that discharged upstream of the WQ-PC-U site. This produced non-representative sampling conditions at WQ-PC-U and WQ-PC-D. Additionally, the accumulation of sediment and the

controlling of flows in the channel produced channel instability and non-representative hydrological conditions at H-PC-DSP. Depending on the proposed placer works, the installation of a hydrology station may need to be suspended.

- The benchmarks, stilling well, continuous logger and staff gauge at H-DC-B were removed prior to the winter season to prevent them from being destroyed during excavation activities along the diversion channel. The site will be assessed during the April/May visit and the station re-established when site conditions permit.
- Stilling wells, continuous loggers and staff gauges at H-DC-R and H-BC were removed for the winter period as these stations are known to freeze to bed. These stations will be assessed during the April/May visit and re-established when site conditions permit.
- Many sites that have been frozen to bed for the winter period should be revisited during the April/May visits to determine if water is starting to flow. This likely applies to WQ-DC-DX, H/WQ-DC-D1b, WQ-PC-U, WQ-PC-D, H-PC-DSP, H/WQ-BC, H/WQ-DC-R, H/WQ-DC-B and WQ-CH-P-13-01; as well as the other seeps that were dry most or all of the 2015 open water season – WQ-ADIT-SEEP, WQ-LW-SEEP-01, WQ-MS-S-08.

ADDITIONAL TRIP INFORMATION

Any changes to project scope (i.e. additional sites sampled):	None. All sampling and monitoring was conducted within scope. The schedule for the next trip is unknown at this time. The next trip will be the first of the 2016/2017 Water Resources Investigation.
Any alterations to sample schedule/budget:	None.
Additional Comments:	Conditions were representative of late-winter, with lower water levels to the last trip and ice and snow was present at all locations. Stations and sites along Pony Creek, Back Creek, and some areas of Dome Creek remain frozen to substrate for the winter period, along with all the seep areas. The existing direct read cable installed on the logger at **H-DC-M WP** was once again not working properly during the March 2016 site visit and since this has been a re-occurring issue, the direct read cable should be replaced following the spring thaw to avoid further issues.
Wildlife Sightings:	None.
Site concerns (safety):	Ice was present at many locations around the Mount Nansen site creating slippery conditions. Overflow ice overtopped the roadway at the Victoria Creek crossing. The road was cleared of ice prior to the arrival of the EDI crew (by DES).

LIST OF ATTACHMENTS

The following information is attached to this monthly report:

1. Maps of Hydrometric Stations and Water Quality Sites
2. Site and Station Photos from the trip
3. Data Tables (March 2016 trip)
    a. Hydrology – Site Conditions and Tasks Completed & Summary Table of Discharge Measurements.
    b. Water Quality – Site Conditions and Samples Collected & Summary Table of In Situ Parameters and Lab Results
4. Seasonal Data Summary: October 16, 2015 – March 31, 2016
    a. Meteorology – rainfall and snowfall summary data tables, data plots
    b. Hydrology – instantaneous measurements, and hydrographs
5. Copies of Lab Certificate of Analysis (COA) & Yukon Environmental Health Services Bacteriological Results (March 2016).

ATTACHMENT 1: MAPS OF HYDROMETRIC STATIONS AND WATER QUALITY SITES

388000 389000 390000

6882000 6881000

N

Pony Creek

Buck Creek

Mount Nansen Road

Brown-McDade Pit Lake

Tailings Facility

Bunkhouse

Mill

Dome Creek

H-PC-DSP
WQ-PC-U
WQ-PC-D
WQ-ADIT-SEEP
WQ-L1
WQ-PIT
ATM-ROAD
WQ-NW-SEEP-02
WQ-L2
WQ-ORE
WQ-LW-SEEP-01
WQ-WR-SEEP-A
WQ-WR-SEEP-B
WQ-DC-DX
H/WQ-DC-DX+105
WQ-MS-S-03
WQ-MS-S-08
WQ-DESS-03
WQ-CH-P-13-01
WQ-DESS-02
WQ-DESS-01
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H/WQ-TP
H/WQ-SEEP
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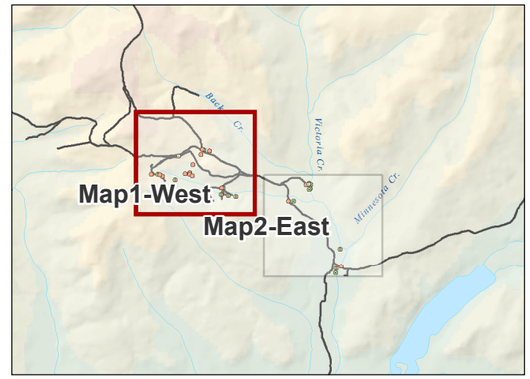


Legend

- Atmospheric Station (label e.g. ATM-ROAD)
- Hydrometric Station and Water Quality Site (label e.g. H/WQ-VC-UMN)
- Hydrometric Station (label e.g. H-VC-R)
- Water Quality Site (label e.g. WQ-PC-U)
- Temporary Water Quality Site (label e.g. WQ-MS-S-03)
- Unpaved Road/Access

Mount Nansen Site (West): Hydrometric Stations and Water Quality Sites

Notes:

1:50,000 and 1:250,000 Topographic Spatial Data provided by Geomatics - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

Watercourse, drainage areas and Mount Nansen Road layers digitized / modified by EDI (2011) using orthophotos provided by Yukon Government, Energy, Mines and Resources (2011).

Imagery provided by Yukon Government - Energy, Mines and Resources - Abandoned Mines Branch.

Project data displayed is site specific. Data collected by EDI Environmental Dynamics Inc. (2015) was obtained using Garmin GPS technology.

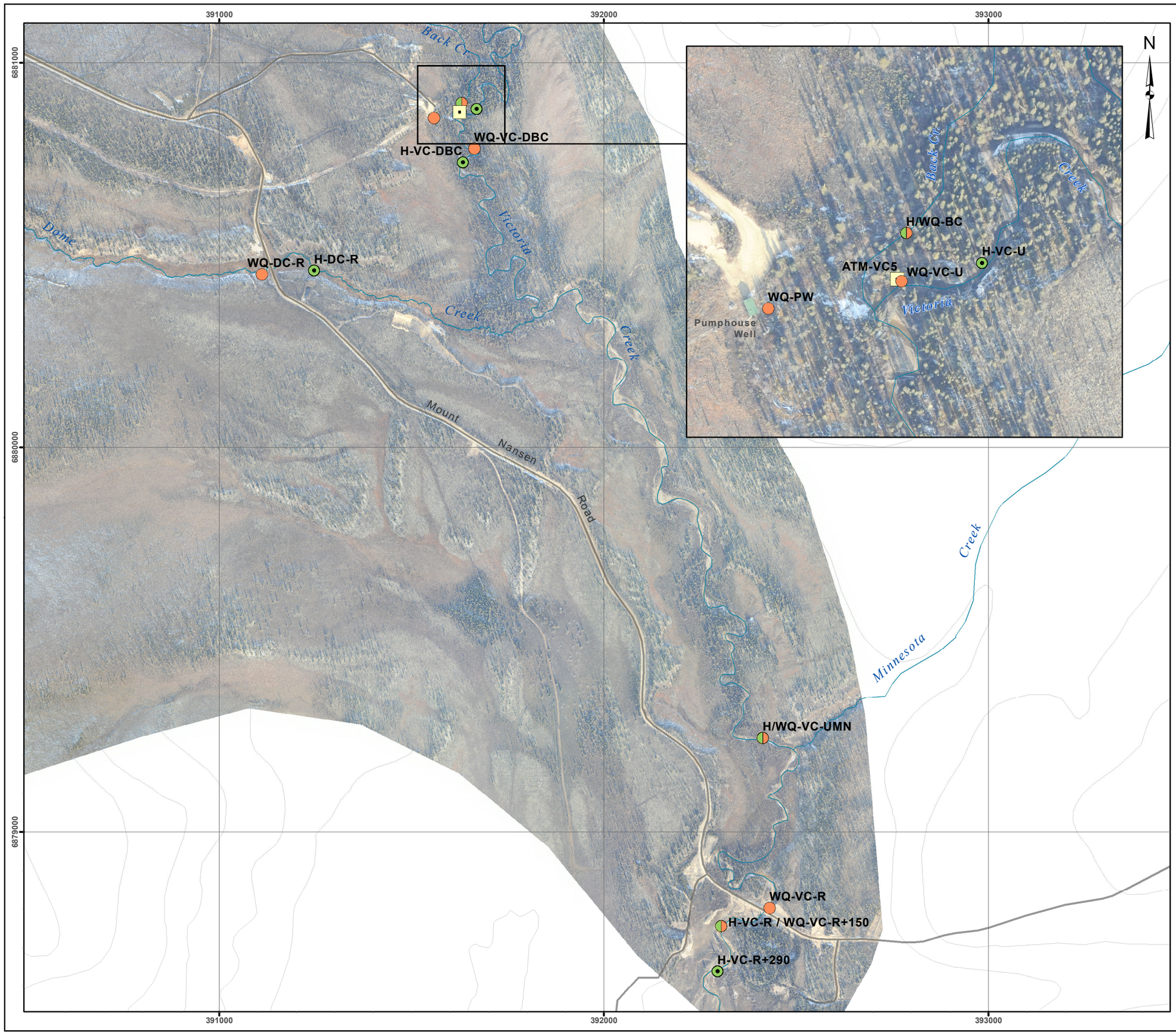
0 50 100 200 300 400 500
metres

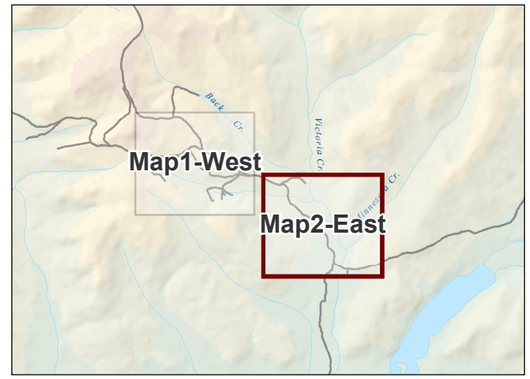
Map Scale = 1:10,000 (printed on 11 x 17)
Map Projection: NAD 1983 UTM Zone 8N

Drawn: MP	Checked: MM/SD	Date: 21/09/2015	MAP 1

Yukon EDI

Path: J:\Yukon\Projects\2015\15Y0146_AAM_Mount_Nansen\Mapping\FinalMaps\Map1_WestSites_2015.mxd





Legend

- Atmospheric Station (label e.g. ATM-ROAD)
- Hydrometric Station and Water Quality Site (label e.g. H/WQ-VC-UMN)
- Hydrometric Station (label e.g. H-VC-R)
- Water Quality Site (label e.g. WQ-PC-U)
- Temporary Water Quality Site (label e.g. WQ-MS-S-03)
- Unpaved Road/Access

Mount Nansen Site (East): Hydrometric Stations and Water Quality Sites

Notes:

1:50,000 and 1:250,000 Topographic Spatial Data provided by Geomatics - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

Watercourse, drainage areas and Mount Nansen Road layers digitized / modified by EDI (2011) using orthophotos provided by Yukon Government, Energy, Mines and Resources (2011).

Imagery provided by Yukon Government - Energy, Mines and Resources - Abandoned Mines Branch.

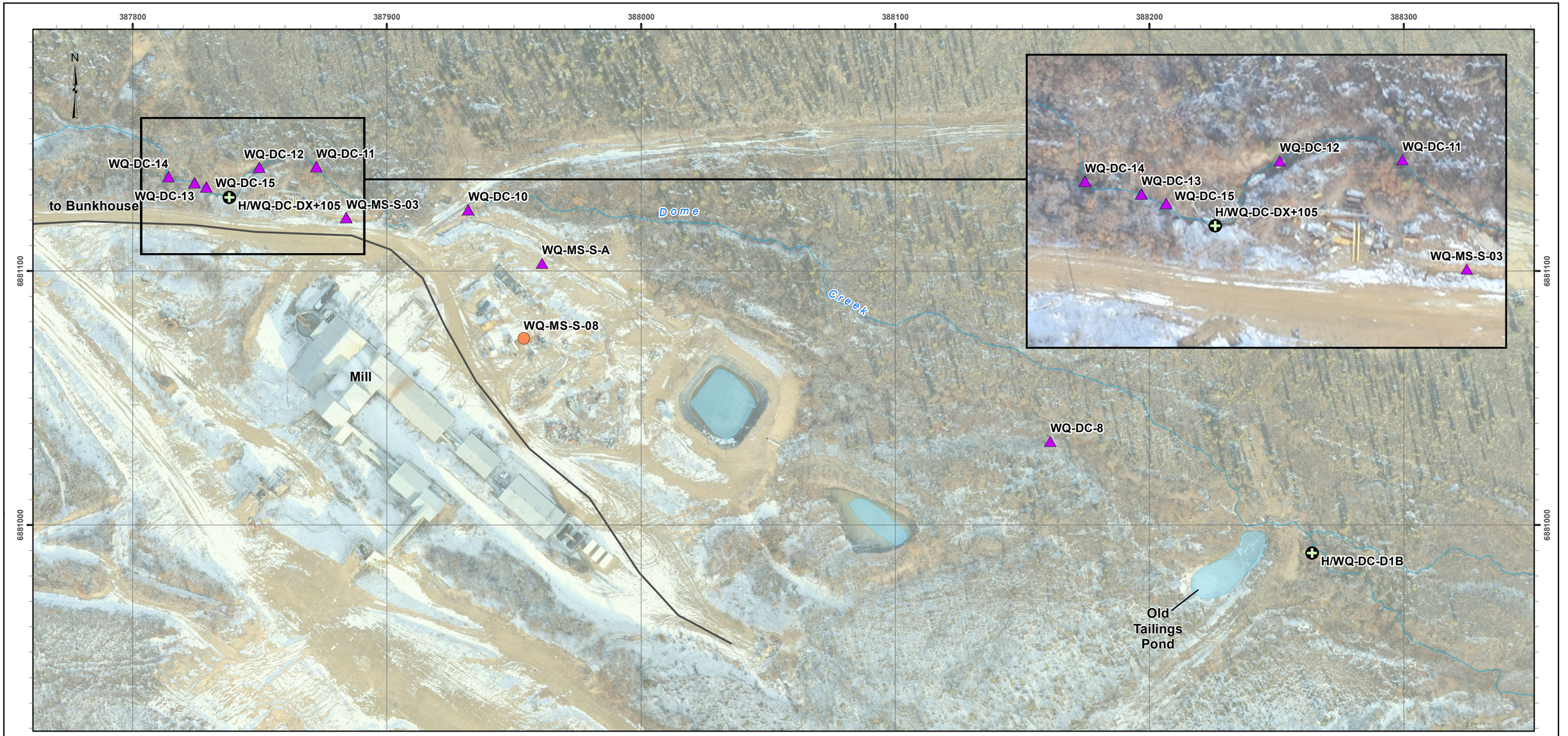
Project data displayed is site specific. Data collected by EDI Environmental Dynamics Inc. (2015) was obtained using Garmin GPS technology.

0 50 100 200 300 400 500
metres

Map Scale = 1:10,000 (printed on 11 x 17)
Map Projection: NAD 1983 UTM Zone 8N

Drawn:	Checked:	Date:	
MP	MM/SD	21/09/2015	**MAP 2**

Path: J:\Yukon\Projects\2015\15Y0146_AAM_Mount_Nansen\Mapping\FinalMaps\Map2_EastSites_2015.mxd



Dome Creek Investigation Sites

Legend

- Investigation Site
- Hydrometric Station and Water Quality Site
- Water Quality Site (label e.g. WQ-PC-U)
- Unpaved Road/Access

1 centimetre = 15 metres

Map Projection: North American Datum 1983 UTM Zone 8N

0 20 40 60 80 100

Metres

Notes:

1:50,000 and 1:250,000 Topographic Spatial Data provided by Geomatics - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

Digital Elevation Model provided by Geomatics - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

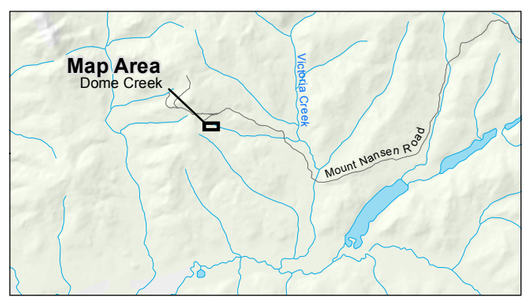
Watercourse, drainage areas and Mount Nansen Road layers digitized / modified by EDI (2011) using orthophotos provided by Yukon Government, Energy, Mines and Resources (2011).

Imagery provided by Yukon Government - Energy, Mines and Resources - Abandoned Mines Branch.

Project data displayed is site specific. Data collected by EDI Environmental Dynamics Inc. (2015) was obtained using Garmin GPS technology.

This document is not an official land survey and the spatial data presented is subject to change.

Drawn:	Checked:		
MP	MM/SD	**MAP 3**	Date: 23/09/2015



Yukon EDI

Path: J:\Yukon\Projects\2015\15Y0146_AAM_Mount_Nansen\Mapping\FinalMaps\Map3_DomeInvestigationSites_21Sept2015.mxd

ATTACHMENT 2: SITE AND STATION PHOTOS

Photo 1. H/WQ-DC-DX+105 – looking upstream. Site frozen to bed.

Photo 2. H/WQ-DC-B – looking upstream. Site frozen to bed.

Photo 3. H/WQ-DC-B – upstream of site looking downstream. Note overflow ice and trenching.

Photo 4. H-DC-M WP – looking upstream at weir pond. Stilling well frozen in ice and soil.

Photo 5. WQ-DC-U looking downstream. Site covered with overflow ice.

Photo 6. H-DC-R –Site frozen to bed. View downstream of road crossing.

Photo 7. H/WQ-SEEP – looking downstream.

Photo 8. WQ-TP - looking upstream. Sample collected through augured hole.

Photo 9. H/WQ-BC – site remains dry.

Photo 10. H-VC-U – looking upstream.

Photo 11. H-VC-U – looking downstream. Note large open lead downstream of station.

Photo 12. WQ-VC-U – looking downstream. Note open leads.

Photo 13. H-VC-DBC – looking upstream.

Photo 14. WQ-VC-DBC – overview of sampling site.

Photo 15. Between H-VC-UMN – downstream left bank.

Photo 16. WQ-VC-UMN – looking upstream – also location for ADV cross section (H-VC-UMN).

Photo 17. WQ-VC-R+150 – looking upstream.

Photo 18. Upstream of road crossing at Victoria Creek (H-VC-R). View of overflow ice and excavation work.

Photo 19. H-VC-R – looking downstream.

Photo 20. H-VC-R+290 – looking downstream.

Photo 21. H/WQ-PW – overview.

Photo 22. H/WQ-PW – overview.

Photo 23. Met station snow depth.

Photo 24. Met station overview.

ATTACHMENT 3A: MARCH HYDROLOGY DATA TABLES

Measurement ID	Hydrometric Identifier (HID)	Measurement Date	Measurement Time	Discharge Measurement Method	Discharge (m^3/s)	Discharge Data Flag	Surveyed Water Elevation (m)	Survey Data Flag	Comments
450	ATM-VC5	14/03/2016		N				N	Barlogger sucessfully downloaded.
453	H-DC-DX+105	15/03/2016		N				N	Site frozen to bed.
451	H-DC-B	15/03/2016		N				N	Site frozen to bed for the winter period. Extensive overflow ice upstream of site. Denison recently excavated overflow ice from diversion channel.
452	H-TP	15/03/2016		N				N	Snow at staff gauges with no ice or water.
449	H-SEEP	15/03/2016	11:00	V	0.002			N	Volumetric measurement collected at pipe outlet. Flow rate at pump at 11:00: 124.135 L/min (0.002 m3/s) and total discharge = 406,296 L.
448	H-DC-M WP	15/03/2016		N		X		N	Conditions not suitable for discharge measurement. Overflow ice covers weir pond and extends at least 100 m downstream. Water flowing around right wall of pond and between layers of ice.
446	H-BC	14/03/2016		N				N	Site dry. No evidence of flow since last site visit.
443	H-VC-U	14/03/2016	19:18	ADV-MID	0.039	B		N	Open lead along centre of channel upstream of stilling well. ADV discharge measurement completed.
447	H-PW	14/03/2016	19:30	V	0.003			N	Ice build up downstream of pipe outlet. Volumetric discharge measurement completed.
441	H-VC-DBC	14/03/2016	18:03	ADV-MID	0.063	B		N	Channel frozen to bed along left bank. ADV completed for discharge measurement. Ice thickness up to 0.15 m.
442	H-VC-UMN	14/03/2016	15:55	ADV-MID	0.012	B		N	Low flow level with left bank frozen to bed. ADV discharge measurement completed.
444	H-VC-R	14/03/2016		N				N	Conditions not suitable for discharge measurement due to shallow flow depth. Large amount of overflow ice upstream of road and beyond right bank near gauging station. Denison recently excavted ice to prevent damage to the road embankment.
445	H-VC-R+290	14/03/2016	14:04	ADV-MID	0.023	B		N	ADV completed for discharge measurement. Channel frozen to bed along right bank.

* Pony Creek (H-PC-DSP) and Dome Creek at D1b (H-DC-D1b) remain frozen to bed for winter period.

Discharge Measurement Method Legend

Measurement Method ID	Measurement Method	Measurement Description
ADV-MID	Mid Section Method - Acoustic Doppler Velocimeter	Cross-sectional velocity using an ADV, mid-section method.
SS	Brine Salt Slug Tracer	Salt dilution gauging using a brine salt slug.
V	Volumetric	Volumetric measurement obtained by filling a graduated contained at a culvert, pipe outlet or weir.
W	Weir	Measurement obtained by a rated structure (v-notch weir).
N	None	No measurement could be obtained.
SD	Dry Salt Slug Tracer	Salt dilution gauging using a dry salt slug.
HWM	High Water Mark - Indirect Method	Indirect method using high water mark in the slope-area calculation for estimating high discharges.
ADCP	Acoustic Doppler Current Profiler	Cross-sectional velocity using an ADCP, mid-section method.
SC	Constant Rate Salt Tracer	Salt dilution gauging using the constant rate method.
CM-MID	Mid Section Method - Current Meter	Cross-sectional velocity using a velocimeter (Swoffer or Pygmy AA)

Hydrometric Stations

Hydrometric ID	Hydrometric Stations
ATM-VC5	Atmospheric Barologger (5) at Victoria Creek
H-BC	Back Creek
H-DC-B	Diversion Channel at Bridge
H-DC-D1B	Dome Creek at D1b
H-DC-DX	Dome Creek at DX
H-DC-DX+105	Dome Creek at DX+105
H-DC-M-WP	Middle Dome Creek at Weir Pond
H-DC-R	Dome Creek at Road
H-PC-DSP	Pony Creek Downstream of Pit
H-SEEP	Seepage Pond Outflow
H-TP	Tailings Pond
H-VC-DBC	Victoria Creek Downstream of Back Creek
H-VC-R	Victoria Creek at Road
H-VC-U	Upper Victoria Creek
H-VC-UMN	Victoria Creek Upstream of Minnesota Creek

Discharge Data Flag Legend

Discharge Data Flag	Discharge Data Flag Description
E	Estimated value
B	Backwater effects (ice related)
F	Instrument malfunction
M	Manual measurement
A	Automated measurement (logged)
ML	Missing length data
MD	Missing depth data
MW	Missing width data
O	Outside of measurement reporting range
P	Potential Place Mining Interference with Flow
S	Suspect data
X	Poor channel conditions for discharge measurement
MI	Missing Data
SH-L	Data logger Shift
SH-SG	Staff Gauge Shift
UR	Under review

Survey Data Flag Legend

Survey Flag	Survey Flag Description
S	Suspect data
MI	Missing data
UR	Under review
F	Instrument Malfunction
O	Outside measurement Accuracy (+/-0.003 m)
N	No survey conducted

ATTACHMENT 3B: MARCH WATER QUALITY DATA TABLES

Water Quality Site	Sample Collected? (Y/N)	Measurement Date	Comments
WQ-BC	N	-	Remains frozen to bed.
WQ-CH-P-13-01	N	-	Remains frozen to bed.
WQ-DC-B	N	-	Remains frozen to bed.
WQ-DC-D1b	N	-	Remains frozen to bed.
WQ-DC-DX	N	-	Remains frozen to bed.
WQ-DC-DX+105	N	-	Frozen to bed.
WQ-DC-R	N	-	Remains frozen to bed.
WQ-DC-U	Y	15-Mar-16	Low water levels and very slow flow. No confined channel, water likely flowing through ice layers and slush layers in the vegetation. Ice thickness variable between 0.3 and .05 m.
WQ-PC-D	N	-	Remains frozen to bed.
WQ-PC-U	N	-	Remains frozen to bed.
WQ-PW	Y	14-Mar-16	Flow normal, ice accumulation at pipe outlet is normal. Regular BacT sample was also collected.
WQ-SEEP	Y	15-Mar-16	Very low water levels. No ice accumulated in culvert. LC50 was also collected.
WQ-TP	Y	15-Mar-16	Ice appears to have dropped since last visit. Total ice thickness 0.69 m. 5-10 cm between bed and bottom of ice at sample location.
WQ-VC-DBC	Y	14-Mar-16	Low water levels (similar to last month), no overflow ice present, two small open water leads upstream of sampling site.
WQ-VC-R	N	-	Frozen to bed - thick overflow ice - sampled from WQ-VC-R+150 downstream.
WQ-VC-R+150	Y	14-Mar-16	Low water levels, overflow ice accumlating upstream of road. Sampled from open water lead upstream of hydro site.
WQ-VC-U	Y	14-Mar-16	Low water levels (similar to last month), two small open water leads downstream of sampling location.
WQ-VC-UMN	Y	14-Mar-16	Low water levels, creek frozen to bed mid channelon left bank. Trail to sampling location covered in overflow ice.
QA/QC Samples			
Replicate 1	Y	14-Mar-16	Replicate collected at WQ-VC-UMN (sample ID WQ-VC-UMN-r).
Field Blank	Y	14-Mar-16	Sample bottles filled with deionized water supplied by ALS; samples were filtered and preserved as instructed. Collected at WQ-VC-R+105.
Travel Blank	Y	-	Samples provided by lab and were transported to and from site.

Summary of Water Quality Results for the March 14-15, 2016 Trip.

Analyte	Units	CCME-WATER-F-AL	Mount Nansen Effluent Discharge Standards	Sample ID/Site ID Date Sampled Detection Limit	WQ-VC-U L1745321-4 3/14/2016 6:25:00 PM Water	WQ-VC-DBC L1745321-7 3/14/2016 6:00:00 PM Water	WQ-VC-UMN L1745321-1 3/14/2016 3:45:00 PM Water	WQ-VC-UMN-R L1745321-5 3/14/2016 4:25:00 PM Water	QA/QC WQ-DC-DX+105-r Replicate Analysis	WQ-VC-R+105 L1745321-3 3/14/2016 2:05:00 PM Water	WQ-TP L1745321-8 3/15/2016 11:25:00 AM Water	WQ-SEEP L1745321-10 3/15/2016 10:50:00 AM Water	WQ-DC-U L1745321-9 3/15/2016 10:25:00 AM Water	WQ-PW L1745419-1 3/14/2016 7:30:00 PM Water	FIELD BLANK L1745321-2 3/14/2016 2:20:00 PM Water	TRAVEL BLANK L1745321-6 Water
Temperature (in-situ)	°C	-	-	-	-0.3	-0.3	-0.3	-	-	-0.3	-0.4	0.7	-0.4	0.2	-	-
Specific Conductivity (in-situ)	µS/cm	-	-	-	215.4	218.3	260.3	-	-	280.5	312.4	1705.0	1540.0	357.3	-	-
pH (in-situ)	pH	6.5 - 9.0	6.0 - 8.5	-	7.1	7.1	7.0	-	-	7.1	7.5	7.1	7.4	7.5	-	-
Dissolved Oxygen (in-situ)	mg/L	-	-	-	10.3	10.9	9.3	-	-	10.8	1.2	7.3	8.5	11.0	-	-
Turbidity (In-situ)	NTU	-	-	-	0.5	0.4	0.4	-	-	0.2	35.5	11.3	15.3	0.0	-	-
Colour, True	CU	15	-	5	-	-	-	-	-	-	-	-	-	<5.0	-	-
Conductivity	µS/cm	-	-	2	229	228	274	271	0.011009174	295	3270	1680	1610	367	<2.0	<2.0
Hardness (as CaCO3)	mg/L			0.5	128	129	151	151	0	164	2080	908	878	199	<0.50	<0.50
pH (lab)	pH	6.5 - 9.0	6.0 - 8.5	0.1	7.61	7.61	7.63	7.63	***0.00***	7.82	7.97	7.15	7.75	8.00	***5.53***	***5.59***
Total Suspended Solids	mg/L	-	50	3	<3.0	<3.0	<3.0	<3.0	<DL	<3.0	***64.7***	47	12	-	<3.0	<3.0
Total Dissolved Solids	mg/L	-	-	1	127	128	157	157	0	168	3050	1290	1260	208	<1.0	<1.0
Alkalinity, Bicarbonate (as CaCO3)	mg/L	-	-	1	94.1	94.6	104	104	0	109	315	262	267	-	<1.0	<1.0
Alkalinity, Carbonate (as CaCO3)	mg/L	-	-	1	<1.0	<1.0	<1.0	<1.0	<DL	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	-	-	1	<1.0	<1.0	<1.0	<1.0	<DL	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0
Alkalinity, Total (as CaCO3)	mg/L	-	-	1	94.1	94.6	104	104	0	109	315	262	267	-	<1.0	<1.0
Ammonia, Total (as N)	mg/L	0.75	-	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<DL	<0.0050	***2.13***	***4.27***	***4.06***	-	<0.0050	<0.0050
Chloride (Cl)	mg/L	120	-	0.5	<0.50	<0.50	<0.50	<0.50	<DL	<0.50	35.5	<2.5	<2.5	<0.50	<0.50	<0.50
Fluoride (F)	mg/L	0.12	-	0.02	0.05	0.053	0.055	0.055	<2xDL	0.057	***0.46***	<0.10	<0.10	0.111	<0.020	<0.020
Nitrate (as N)	mg/L	13	-	0.005	0.163	0.161	0.0908	0.0893	0.016657413	0.0682	<0.050	0.5236	0.3023	0.111	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	-	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<DL	<0.0010	<0.010	0.0135	<0.0050	<0.0010	<0.0010	<0.0010
Sulfate (SO4)	mg/L	-	-	0.3	22.3	22.4	36.7	36.8	0.002721088	41	1970	737	732	35.7	<0.30	<0.30
Cyanide, Weak Acid Diss	mg/L	-	0.1	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<DL	<0.0050	<0.0050	0.0153	0.0176	-	<0.0050	<0.0050
Cyanide, Total	mg/L	-	0.3	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<DL	<0.0050	<0.0050	0.0796	0.0426	-	<0.0050	<0.0050
Cyanate	mg/L	-	-	0.2	<0.20	<0.20	<0.20	<0.20	<DL	<0.20	<0.20	<0.20	<0.20	-	<0.20	<0.20
Thiocyanate (SCN)	mg/L	-	-	0.5	<0.50	<0.50	<0.50	<0.50	<DL	<0.50	<0.50	5.11	2.6	-	<0.50	<0.50
Aluminum (Al)-Total	mg/L	0.1	-	0.003	0.0153	0.0228	0.0096	0.0089	<2xDL	0.0072	***0.27***	0.017	0.0578	<0.010	<0.0030	<0.0030
Antimony (Sb)-Total	mg/L	-	0.15	0.0001	<0.00010	<0.00010	0.00046	0.00051	0.103092784	0.00044	0.0397	0.00053	0.00043	<0.00050	<0.00010	<0.00010
Arsenic (As)-Total	mg/L	0.005	-	0.0001	0.00025	0.00026	0.00134	0.00136	***0.014814815***	0.00126	***0.578***	***0.126***	***0.0602***	0.00039	<0.00010	<0.00010
Barium (Ba)-Total	mg/L	-	1.0	0.00005	0.0833	0.0821	0.0759	0.0744	0.01996008	0.0812	0.0674	0.063	0.0812	0.087	<0.000050	<0.000050
Beryllium (Be)-Total	mg/L	-	-	0.00002	<0.000020	<0.000020	<0.000020	0.000026	<DL	<0.000020	0.00017	0.000023	<0.000020	-	<0.000020	<0.000020
Bismuth (Bi)-Total	mg/L	-	-	0.00005	<0.000050	<0.000050	<0.000050	0.000106	<DL	<0.000050	0.00213	<0.000050	<0.000050	-	<0.000050	<0.000050
Boron (B)-Total	mg/L	-	-	0.01	<0.010	<0.010	<0.010	<0.010	<DL	<0.010	0.157	0.059	0.05	<0.10	<0.010	<0.010
Cadmium (Cd)-Total *(Lab Result)*	mg/L	0.00009	0.02	0.000005	0.000024	0.0000307	0.0000214	0.0000203	<2xDL	0.0000219	***0.00751***	***0.000418***	0.00018	<0.00020	<0.0000050	<0.0000050
Cadmium (Cd)-Total (Hardness Adjusted Guideline)	*mg/L*	-	-	-	*0.00019*	*0.00020*	*0.00022*	*0.00022*	-	*0.00024*	*0.00037*	*0.00037*	*0.00037*	*0.00028*	*0.00037*	*0.00037*
Calcium (Ca)-Total	mg/L	-	-	0.05	30.5	31	36.4	36.5	0.002743484	39	625	269	254	46.7	<0.050	<0.050
Chromium (Cr)-Total	mg/L	0.0089	0.04	0.0001	<0.00010	0.00011	<0.00010	0.00012	<DL	0.00014	0.0013	0.00065	0.00043	<0.0020	<0.00010	0.00011
Cobalt (Co)-Total	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<DL	<0.00010	0.00617	0.00844	0.00684	-	<0.00010	<0.00010
Copper (Cu_T)-Total *(Lab Result)*	mg/L	0.002	0.2	0.0005	0.00113	0.0011	0.00139	0.00104	<2xDL	0.00103	***0.0957***	0.00268	0.00132	<0.0010	<0.00050	<0.00050
Copper (Cu)-Total (Hardness Adjusted Guideline)	*mg/L*	-	-	-	*0.00292*	*0.00294*	*0.00336*	*0.00336*	-	*0.00361*	*0.00400*	*0.00400*	*0.00400*	*0.00400*	*0.00400*	*0.00400*
Iron (Fe)-Total	mg/L	0.3	1.0	0.01	0.018	0.029	0.016	0.018	<2xDL	<0.010	***4.49***	***18.9***	***5.1***	<0.030	<0.010	<0.010
Lead (Pb)-Total *(Lab Result)*	mg/L	0.001	0.1	0.00005	<0.000050	<0.000050	0.000068	0.000064	<2xDL	<0.000050	***0.153***	0.000079	0.000153	0.0006	<0.000050	<0.000050
Lead (Pb)-Total (Hardness Adjusted Guideline)	*mg/L*	-	-	-	*0.00436*	*0.00440*	*0.00538*	*0.00538*	-	*0.00597*	*0.00700*	*0.00700*	*0.00700*	*0.00700*	*0.00700*	*0.00700*
Lithium (Li)-Total	mg/L	-	-	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<DL	0.001	0.02	<0.0010	0.001	-	<0.0010	<0.0010
Magnesium (Mg)-Total	mg/L	-	-	0.1	9.89	10.3	11.7	11.9	0.016949153	13.3	124	59.5	61.3	20	<0.10	<0.10
Manganese (Mn)-Total	mg/L	-	0.5	0.0001	0.108	0.114	0.0115	0.0112	0.026431718	0.00481	***20.4***	***6.35***	***5.91***	<0.0020	<0.00010	<0.00010
Mercury (Hg)-Total	mg/L	0.000026	0.005	0.000005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<DL	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.00020	<0.0000050	<0.0000050
Molybdenum (Mo)-Total	mg/L	0.0073	-	0.00005	0.000395	0.000395	0.000331	0.000435	***0.27154047***	0.00035	0.00627	0.00106	0.00103	-	<0.000050	<0.000050
Nickel (Ni)-Total *(Lab Result)*	mg/L	0.025	0.3	0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<DL	<0.00050	0.0085	0.00375	0.0029	-	<0.00050	<0.00050
Nickel (Ni)-Total (Hardness Adjusted Guideline)	*mg/L*	-	-	-	*0.11530*	*0.11598*	*0.13073*	*0.13073*	*0.02500*	*0.13920*	*0.15000*	*0.15000*	*0.15000*	*0.15000*	*0.15000*	*0.15000*
Phosphorus (P)-Total	mg/L	-	-	0.05	<0.050	<0.050	<0.050	<0.050	<DL	<0.050	0.064	0.054	0.063	-	<0.050	<0.050
Potassium (K)-Total	mg/L	-	-	0.1	0.75	0.82	0.96	1	0.040816327	1.16	42.3	6.34	5.83	0.93	<0.10	<0.10
Selenium (Se)-Total	mg/L	0.001	-	0.00005	<0.000050	0.000053	0.000068	0.000073	<2xDL	0.000064	0.00034	0.000264	0.000173	<0.0010	<0.000050	<0.000050
Silicon (Si)-Total	mg/L	-	-	0.05	6.4	6.54	6.74	6.8	0.008862629	7.43	6.91	7.98	7.28	-	<0.050	<0.050
Silver (Ag)-Total	mg/L	0.00025	0.1	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<DL	<0.000010	***0.00367***	0.000039	0.000025	-	<0.000010	<0.000010
Sodium (Na)-Total	mg/L	-	-	0.05	2.84	2.79	3.67	3.65	0.005464481	3.99	42.7	36.5	33.3	5.2	<0.050	<0.050
Strontium (Sr)-Total	mg/L	-	-	0.0002	0.323	0.321	0.338	0.331	0.020926756	0.35	1.59	0.75	0.777	-	<0.00020	<0.00020
Sulfur (S)-Total	mg/L	-	-	0.5	7.77	7.79	12.7	12.6	0.007905138	14	645	242	226	-	<0.50	<0.50
Thallium (Tl)-Total	mg/L	0.0008	-	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<DL	<0.000010	0.000493	<0.000010	<0.000010	-	<0.000010	<0.000010
Tin (Sn)-Total	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<DL	<0.00010	<0.00050	<0.00010	<0.00010	-	<0.00010	<0.00010
Titanium (Ti)-Total	mg/L	-	-	0.0003	0.00037	0.0007	<0.00030	<0.00030	<DL	<0.00030	0.0028	0.00132	0.00243	-	<0.00030	<0.00030
Uranium (U)-Total	mg/L	0.015	-	0.00001	0.000688	0.000691	0.00052	0.000511	0.017458778	0.000668	0.00404	0.00177	0.00167	0.00181	<0.000010	<0.000010
Vanadium (V)-Total	mg/L	-	-	0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<DL	<0.00050	<0.00050	0.00149	<0.00050	-	<0.00050	<0.00050
Zinc (Zn)-Total	mg/L	0.03	0.3	0.003	<0.0030	<0.0030	0.0035	0.0031	<2xDL	0.0045	***0.584***	***0.116***	***0.0471***	<0.050	<0.0030	<0.0030
Aluminum (Al)-Dissolved	mg/L	0.1	-	0.001	0.0061	0.0059	0.0046	0.0044	<2xDL	0.005	0.0061	0.0095	0.0057	-	<0.0010	-
Antimony (Sb)-Dissolved	mg/L	-	-	0.0001	<0.00010	<0.00010	0.00046	0.00046	<2xDL	0.00044	0.00646	0.0005	0.00033	-	<0.00010	-
Arsenic (As)-Dissolved	mg/L	0.005	0.15	0.0001	0.00022	0.00024	0.00119	0.00131	***0.096***	0.0013	***0.0834***	***0.0773***	***0.0403***	-	<0.00010	-
Barium (Ba)-Dissolved	mg/L	-	-	0.00005	0.0841	0.083	0.0753	0.0771	0.023622047	0.0795	0.051	0.0546	0.0668	-	<0.000050	-
Beryllium (Be)-Dissolved	mg/L	-	-	0.00002	<0.000020	<0.000020	<0.000020	<0.000020	<DL	<0.000020	<0.00010	<0.000020	<0.000020	-	<0.000020	-
Bismuth (Bi)-Dissolved	mg/L	-	-	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<DL	<0.000050	<0.00025	<0.000050	<0.000050	-	<0.000050	-
Boron (B)-Dissolved	mg/L		-	0.01	<0.010	<0.010	<0.010	<0.010	<DL	<0.010	0.151	0.05	0.041	-	<0.010	-
Cadmium (Cd)-Dissolved *(Lab Result)*	mg/L	0.00009	-	0.000005	0.000025	0.0000229	0.000021	0.0000155	<2xDL	0.0000226	***0.00532***	0.000277	0.000113	-	<0.0000050	-
Cadmium (Cd)-Diss. (Hardness Adjusted Guideline)	*mg/L*	-	-	-	*0.00019*	*0.00020*	*0.00022*	*0.00022*	-	*0.00024*	*0.00037*	*0.00037*	*0.00037*	-	*0.00037*	-
Calcium (Ca)-Dissolved	mg/L	-	-	0.05	33.7	33.8	39.8	39.4	0.01010101	42.3	637	270	253	-	<0.050	-
Chromium (Cr)-Dissolved	mg/L	0.0089	-	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<DL	<0.00010	<0.00050	0.00054	0.00027	-	<0.00010	-
Cobalt (Co)-Dissolved	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<DL	<0.00010	0.00535	0.00802	0.00614	-	<0.00010	-
Copper (Cu)-Dissolved *(Lab Result)*	mg/L	0.002	-	0.0002	0.00096	0.00092	0.00081	0.00089	<2xDL	0.00089	***0.03***	0.00152	0.00061	-	<0.00020	-
Copper (Cu)-Diss. (Hardness Adjusted Guideline)	*mg/L*	-	-	-	*0.00292*	*0.00294*	*0.00336*	*0.00336*	-	*0.00361*	*0.00400*	*0.00400*	*0.00400*	-	*0.00400*	-
Iron (Fe)-Dissolved	mg/L	0.3	-	0.01	<0.010	<0.010	<0.010	<0.010	<DL	<0.010	0.046	***17.8***	***3.17***	-	<0.010	-
Lead (Pb)-Dissolved *(Lab Result)*	mg/L	0.001	-	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<DL	<0.000050	0.0003	<0.000050	<0.000050	-	<0.000050	-
Lead (Pb)-Diss. (Hardness Adjusted Guideline)	*mg/L*	-	-	-	*0.00436*	*0.00440*	*0.00538*	*0.00538*	-	*0.00597*	*0.00700*	*0.00700*	*0.00700*	-	*0.00700*	-
Lithium (Li)-Dissolved	mg/L	-	-	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<DL	0.0011	0.0179	0.0011	0.0013	-	<0.0010	-
Magnesium (Mg)-Dissolved	mg/L	-	-	0.1	10.5	10.9	12.7	12.7	0	14.1	119	56.8	59.9	-	<0.10	-
Manganese (Mn)-Dissolved	mg/L	-	-	0.0001	0.105	0.112	0.0107	0.0105	0.018867925	0.00461	19.9	6.36	5.57	-	<0.00010	-
Mercury (Hg)-Dissolved	mg/L	0.000026	-	0.000005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<DL	<0.0000050	<0.0000050	<0.0000050	<0.0000050	-	<0.0000050	-
Molybdenum (Mo)-Dissolved	mg/L	0.0073	-	0.00005	0.000322	0.000345	0.000274	0.000278	***0.014492754***	0.000297	0.00678	0.00115	0.000959	-	<0.000050	-
Nickel (Ni)-Dissolved *(Lab Result)*	mg/L	0.025	-	0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<DL	<0.00050	0.0076	0.00338	0.00252	-	<0.00050	-
Nickel (Ni)-Diss. (Hardness Adjusted Guideline)	*mg/L*	-	-	-	*0.11530*	*0.11598*	*0.13073*	*0.13073*	-	*0.13920*	*0.15000*	*0.15000*	*0.15000*	-	*0.15000*	-
Phosphorus (P)-Dissolved	mg/L	-	-	0.05	<0.050	<0.050	<0.050	<0.050	<DL	<0.050	<0.050	<0.050	<0.050	-	<0.050	-
Potassium (K)-Dissolved	mg/L	-	-	0.1	0.8	0.83	1.02	1.02	0	1.21	37.8	6.17	5.69	-	<0.10	-
Selenium (Se)-Dissolved	mg/L	0.001	-	0.00005	<0.000050	0.000055	0.000059	0.000067	<2xDL	0.000055	<0.00025	0.000237	0.000183	-	<0.000050	-
Silicon (Si)-Dissolved	mg/L	-	-	0.05	6.53	6.61	6.91	6.85	0.00872093	7.47	6.2	7.69	6.94	-	<0.050	-
Silver (Ag)-Dissolved	mg/L	0.00025	-	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<DL	<0.000010	<0.000050	0.000015	<0.000010	-	<0.000010	-
Sodium (Na)-Dissolved	mg/L	-	-	0.05	2.83	2.88	3.71	3.78	0.018691589	4.06	40.8	33.9	29.7	-	<0.050	-
Strontium (Sr)-Dissolved	mg/L	-	-	0.0002	0.311	0.315	0.325	0.325	0	0.342	1.62	0.747	0.715	-	<0.00020	-
Sulfur (S)-Dissolved	mg/L	-	-	0.5	7.42	7.32	11.8	12.4	0.049586777	13.5	604	231	217	-	<0.50	-
Thallium (Tl)-Dissolved	mg/L	0.0008	-	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<DL	<0.000010	0.000435	<0.000010	<0.000010	-	<0.000010	-
Tin (Sn)-Dissolved	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<DL	<0.00010	<0.00050	<0.00010	<0.00010	-	<0.00010	-
Titanium (Ti)-Dissolved	mg/L	-	-	0.0003	<0.00030	<0.00030	<0.00030	<0.00030	<DL	<0.00030	<0.0015	0.00095	0.00052	-	<0.00030	-
Uranium (U)-Dissolved	mg/L	0.015	-	0.00001	0.000556	0.000567	0.000432	0.000437	0.01150748	0.000562	0.00401	0.00199	0.00171	-	<0.000010	-
Vanadium (V)-Dissolved	mg/L	-	-	0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<DL	<0.00050	<0.0025	0.00228	0.00094	-	<0.00050	-
Zinc (Zn)-Dissolved	mg/L	0.03	-	0.001	<0.0010	<0.0010	0.003	0.0027	<2xDL	0.0044	***0.406***	***0.0957***	***0.0355***	-	<0.0010	-

Applied Guidelines: 'Federal CCME Canadian Environmental Quality Guidelines (Jan 2016), CCME: Freshwater Aquatic Life 'Mount Nansen Effluent Discharge Standards

COLOUR KEY:
Exceeds CCME Guideline
Exceeds MN Effluent Discharge Standards
Exceeds both CCME and MN Standards
Exceeds Hardness Dependent Calculated Guideline (CCME)
Data flag for Detection Limit Adjustment --> Please refer to the lab COA report and lab excel report for more info
QA/QC Codes: RPD - Relative Percent Difference, <DL - below detection limit, and <2XDL - less than two times the detection limit. Refer to Methodology Document for details.

0.025410141
0.020965876 DISS DISS
0.041569044 TOTAL TOTAL

Notes:
Several sites have frozen to substrate for the winter - WQ-BC, WQ-PC-D, WQ-PC-U, WQ-DC-DX, WQ-DC-D1b, WQ-CH-P-13-01, WQ-DC-B, WQ-DC-Dx+105 and WQ-DC-R.
** WQ-PW is a drinking water sample and the analysis package has different detection limits than all other samples. The results are also compared to the Guidelines for Canadian Drinking Water Quality (Health Canada, October 2014) versus the CCME or MN Effluent Quality Standards.
QA/QC Travel/Field Blank Analysis - The travel blank had all parameters below detection limits. No contamination from stoage or transport is suspected.
The field blank had all parameters below detection limit. There are no concerns for contamination from field methodologies.
QA/QC Replicate Analysis - The average RPD of the replicate sample set for WQ-DC-DX-r was 25%, indicating that sample analysis was adequately precise. The average RPD for total metals in the replicate sample set was 43% and the average RPD for dissolved metals was 5%.
See March 2016 Monthly Report for explanations of the higher average RPD value and higher RPD values for total metals.

ATTACHMENT 4A: SEASONAL METEOROLOGICAL SUMMARY

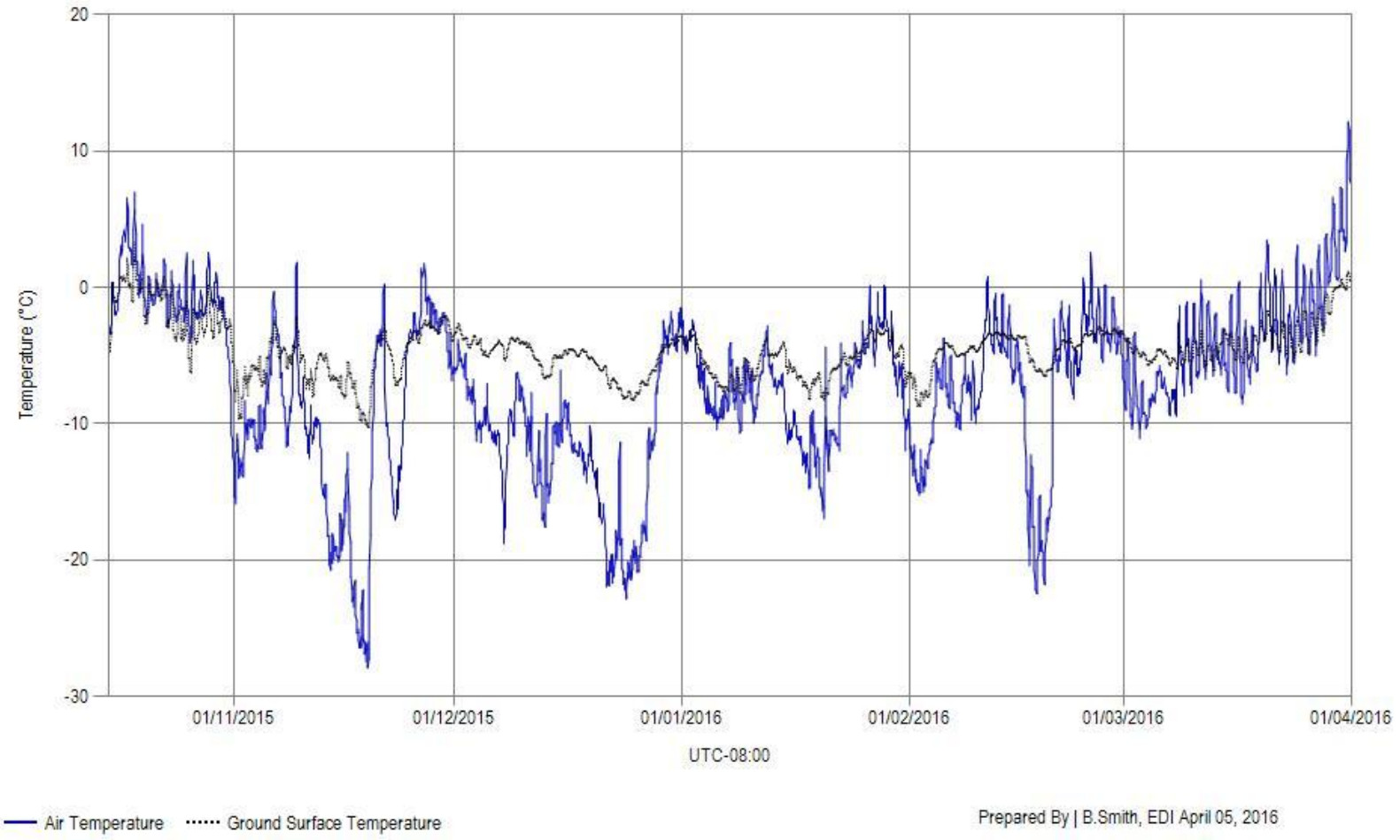


Figure 4A. 1 Mount Nansen mean hourly air and ground temperature, October 16, 2015 to March 31, 2016.

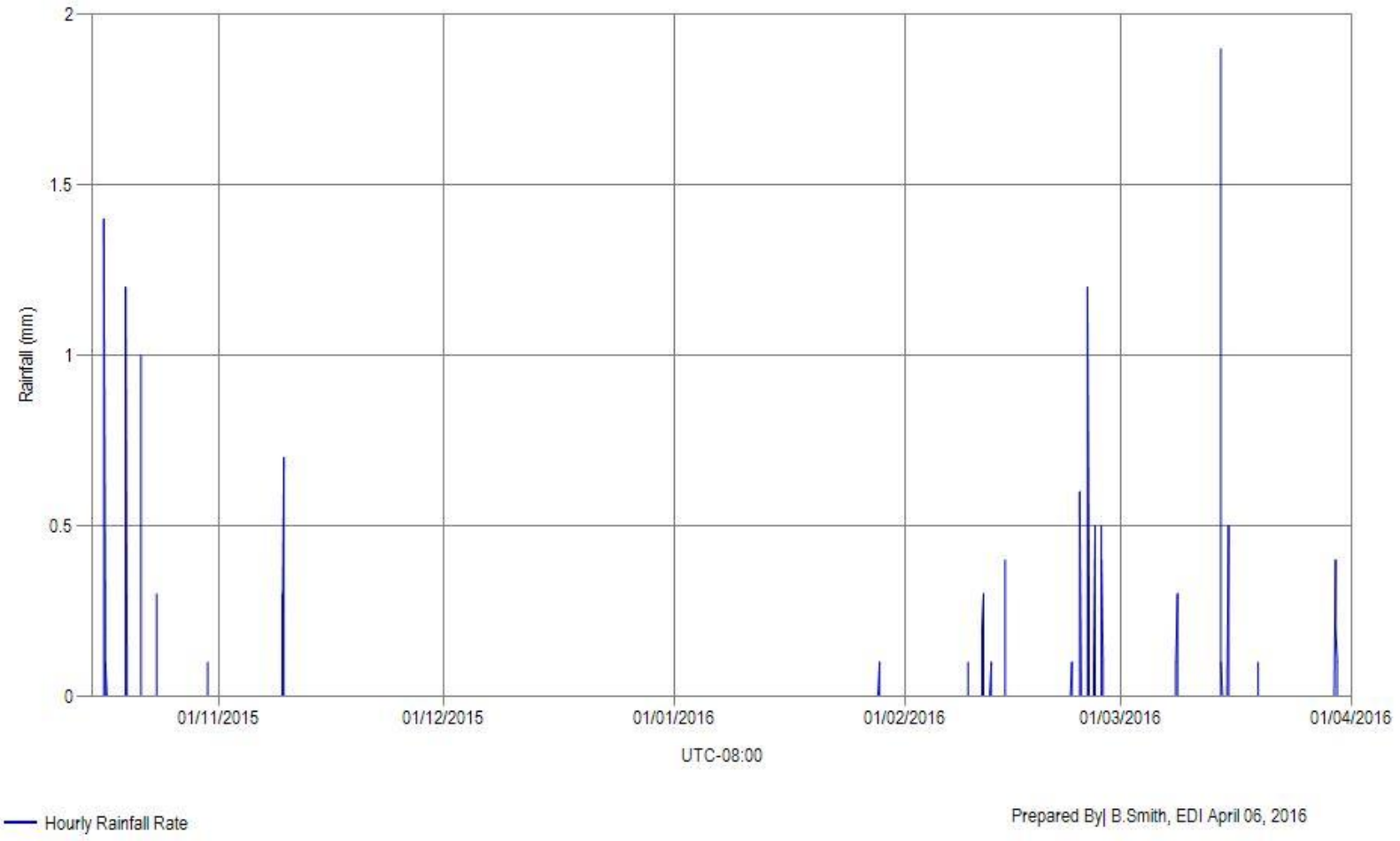


Figure 4A. 2 Mount Nansen hourly rainfall rate, October 16, 2015 to March 31, 2016.

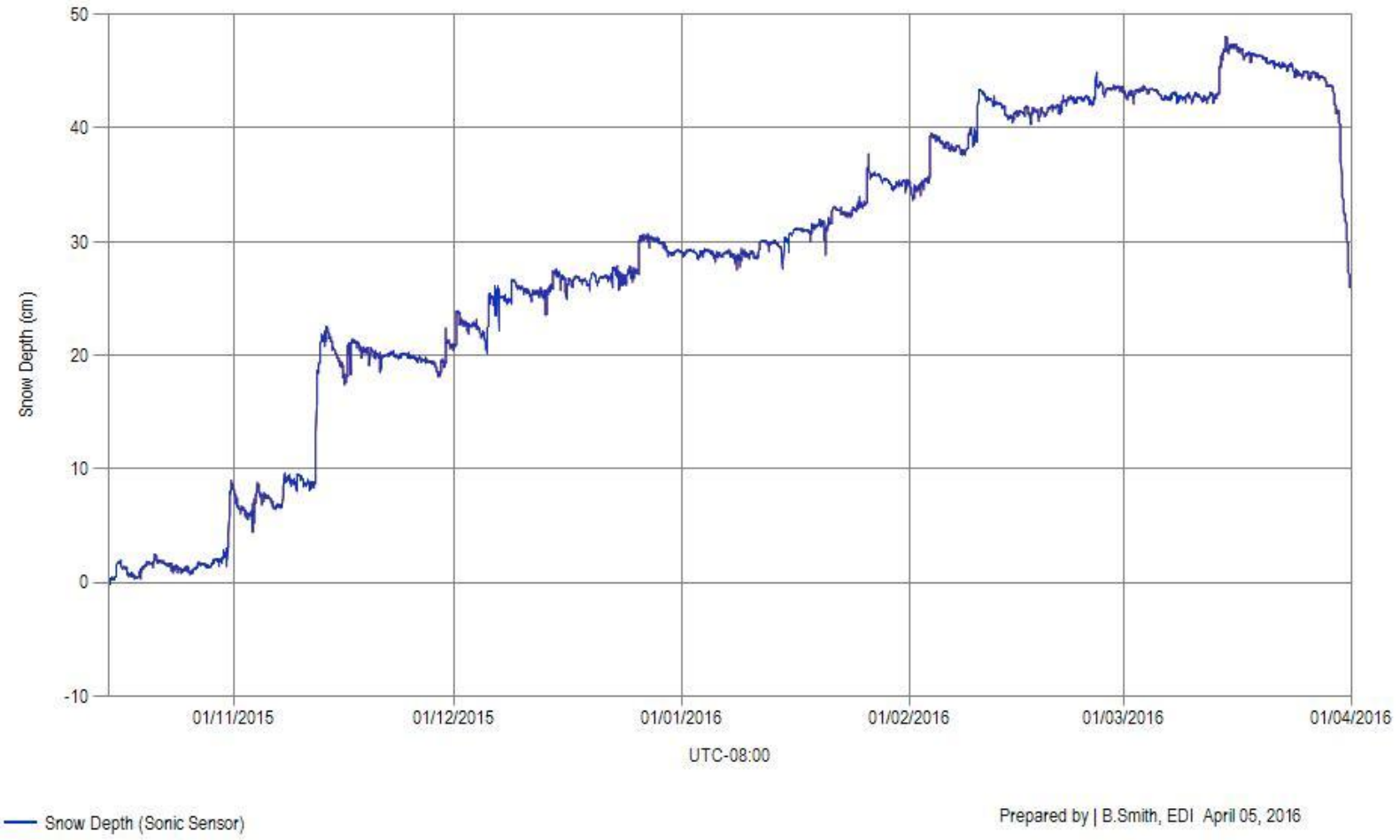


Figure 4A. 3 Mount Nansen cumulative daily snow depth, October 16, 2015 to March 31, 2016.

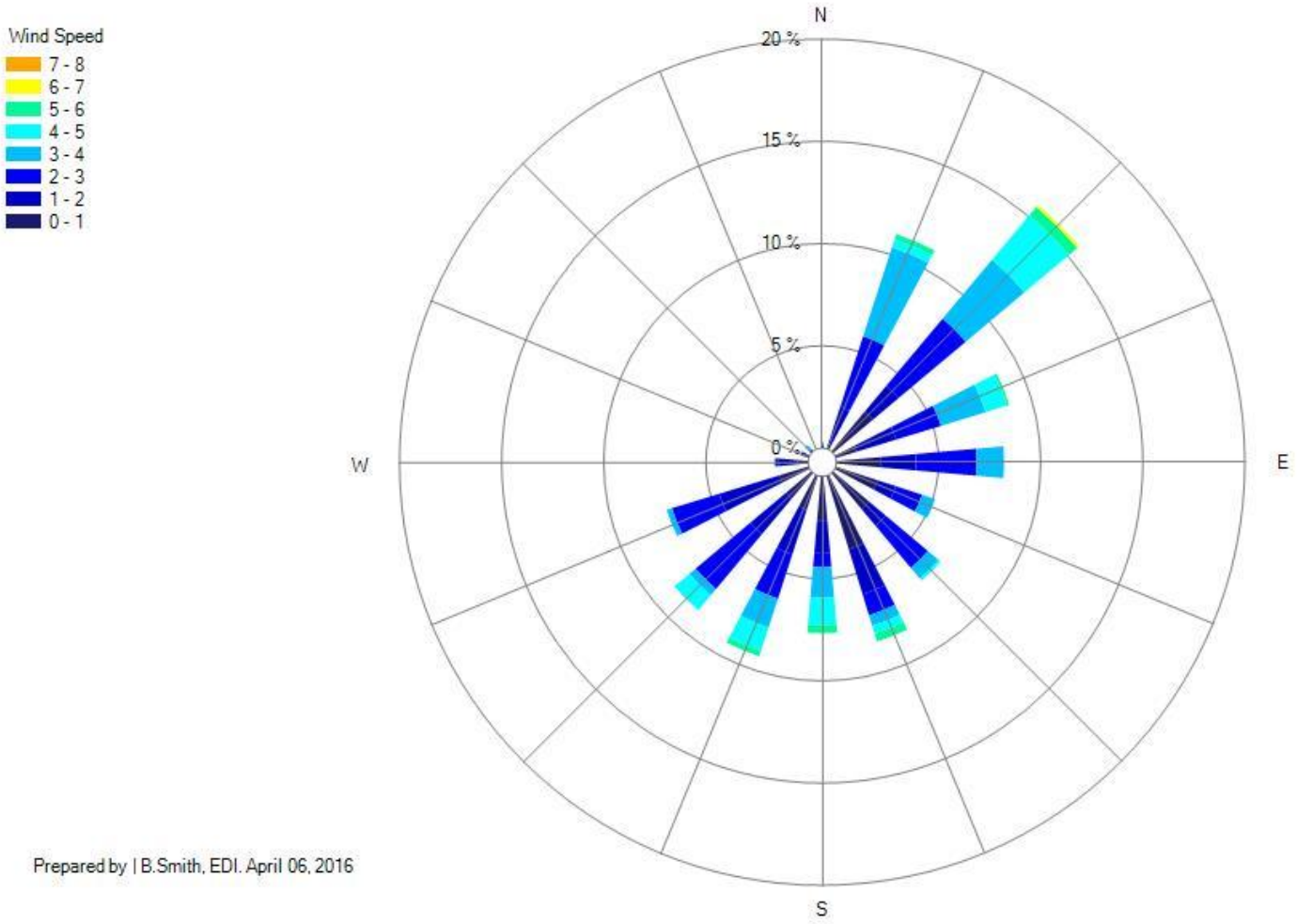


Figure 4A. 4 Mount Nansen mean hourly wind speed (m/s) and direction (wind rose diagram), October 16, 2015 to March 31, 2016.

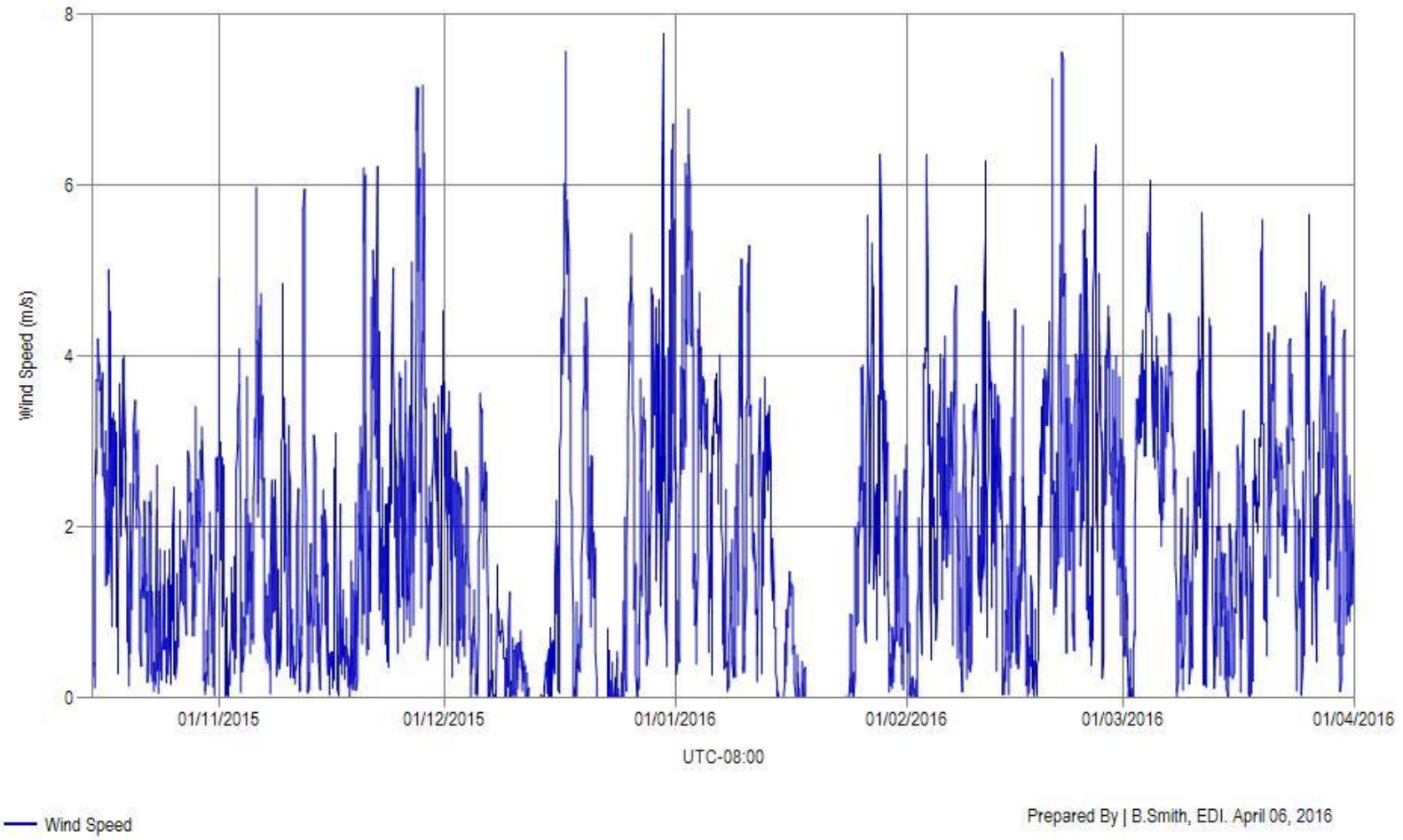


Figure 4A. 5 Mount Nansen mean hourly wind speed, October 16, 2015 to March 31, 2016.

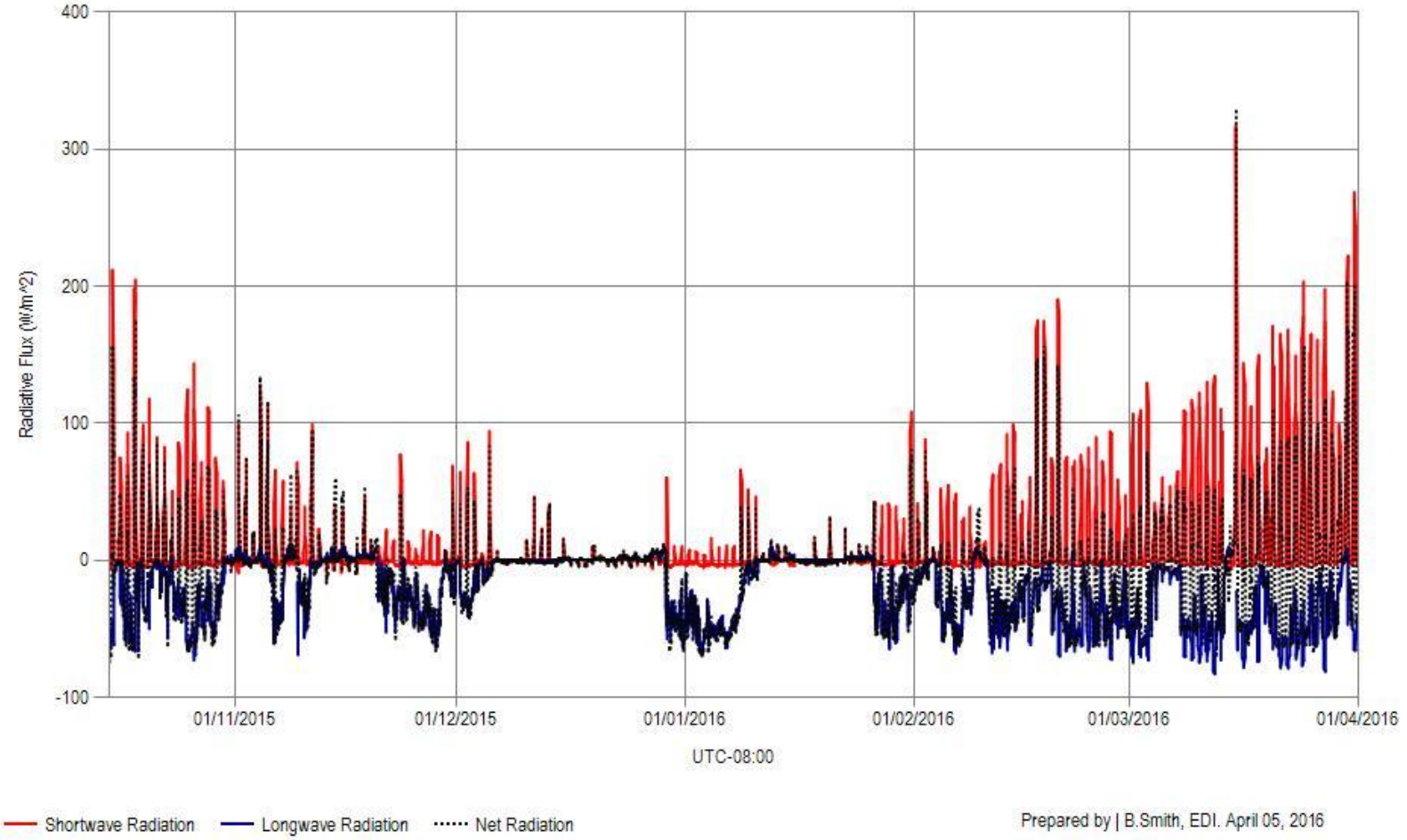


Figure 4A. 6 Mount Nansen mean hourly net shortwave, longwave and total radiation, October 16, 2015 to March 31, 2016.

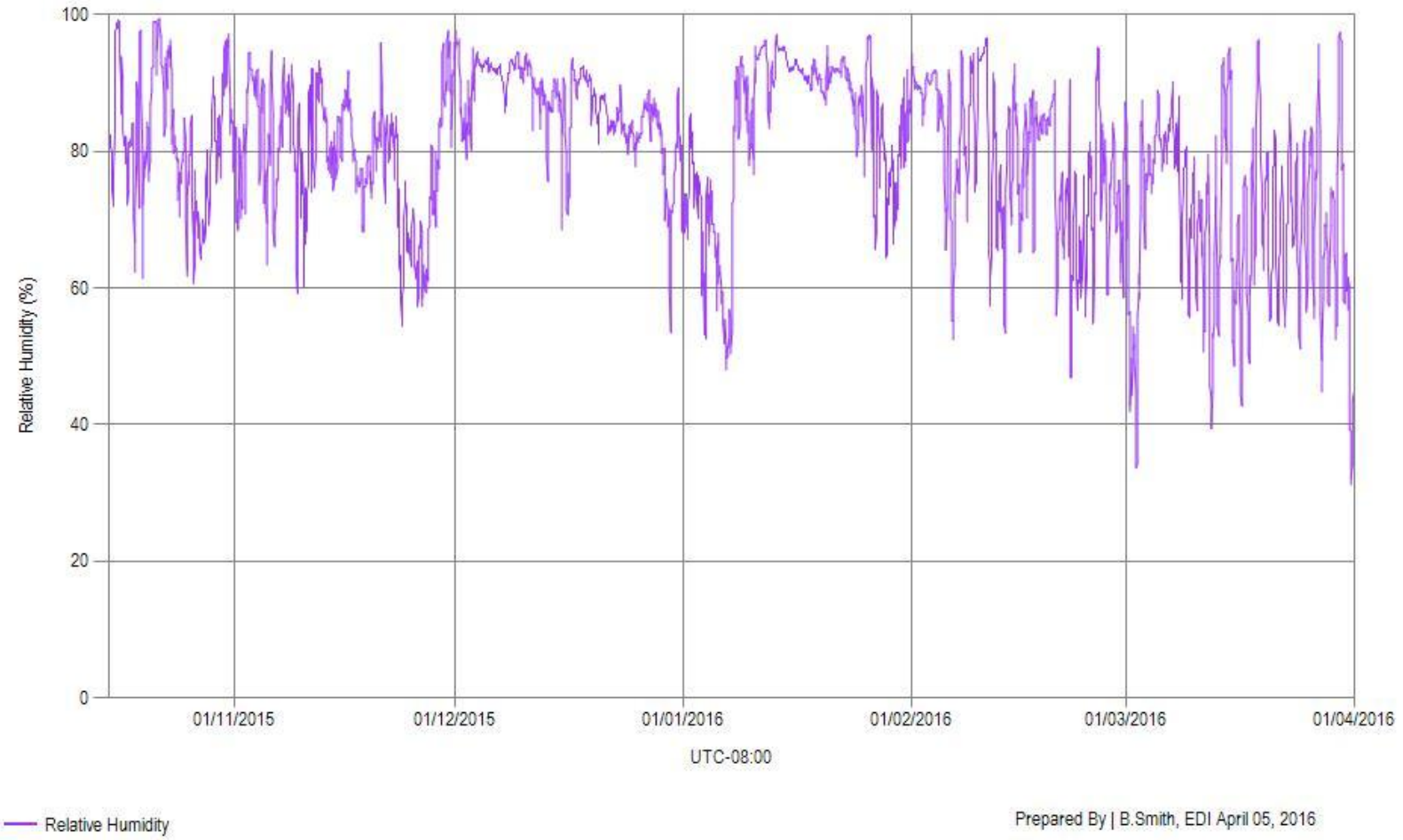


Figure 4A. 7 Mount Nansen mean hourly relative humidity, October 16, 2015 to March 31, 2016.

Table 4A 1 Mount Nansen precipitation events for the open-water season, October 16, 2015 to March 31, 2016.

Start Date	Duration (hours)	Precipitation Type	Total Accumulation (mm)
October 16, 03:00	4	Snow	12.9
October 16, 14:00	3	Rain	3.0
October 17, 01:00	4	Snow	2.1
October 18, 17:00	4	Snow	1.2
October 19, 05:00	5	Snow	7.3
October 21, 05:00	4	Snow	12.3
October 31, 06:00	13	Snow	70.6
November 03, 17:00	1	Snow	21.8
November 03, 21:00	2	Snow	21.6
November 04, 00:00	7	Snow	18.0
November 04, 23:00	7	Snow	10.7
November 07, 18:00	6	Snow	28.6
November 08, 04:00	4	Snow	4.4
November 08, 10:00	4	Snow	4.9
November 09, 12:00	6	Rain	1.9
November 09, 16:00	3	Snow	15.3
November 12, 04:00	9	Snow	99.5
November 12, 16:00	9	Snow	33.8
November 16, 15:00	3	Snow	29.1
November 16, 19:00	1	Snow	11.1
November 21, 02:00	3	Snow	11.8
December 05, 13:00	12	Snow	51.3
December 06, 18:00	1	Snow	22.9
December 06, 21:00	2	Snow	13.8
December 07, 04:00	1	Snow	36.6
December 08, 06:00	5	Snow	5.3
December 08, 22:00	2	Snow	21.2

Start Date	Duration (hours)	Precipitation Type	Total Accumulation (mm)
December 11, 14:00	5	Snow	8.4
December 12, 06:00	4	Snow	3.3
December 13, 14:00	3	Snow	20.9
December 14, 11:00	4	Snow	15.9
December 15, 14:00	3	Snow	12.8
December 16, 10:00	2	Snow	13.2
December 20, 18:00	4	Snow	5.2
December 22, 14:00	4	Snow	17.9
December 23, 05:00	1	Snow	10.2
December 26, 04:00	4	Snow	33.8
December 27, 16:00	2	Snow	10.0
January 01, 08:00	4	Snow	3.8
January 07, 00:00	6	Snow	1.7
January 09, 03:00	1	Snow	11.4
January 11, 07:00	8	Snow	9.1
January 12, 22:00	4	Snow	7.8
January 14, 21:00	3	Snow	18.4
January 15, 16:00	2	Snow	17.1
January 18, 13:00	6	Snow	16.2
January 20, 14:00	3	Snow	24.0
January 20, 21:00	3	Snow	12.3
January 21, 09:00	6	Snow	13.9
January 26, 03:00	9	Snow	43.4
January 26, 16:00	5	Snow	2.3
February 01, 15:00	2	Snow	11.4
February 03, 16:00	8	Snow	44.2
February 04, 09:00	4	Snow	2.6
February 07, 02:00	4	Snow	3.3
February 08, 02:00	4	Snow	4.7

Start Date	Duration (hours)	Precipitation Type	Total Accumulation (mm)
February 08, 22:00	4	Snow	12.6
February 09, 04:00	4	Snow	6.7
February 09, 19:00	3	Snow	14.1
February 10, 04:00	10	Snow	46.2
February 11, 13:00	4	Rain	0.7
February 16, 15:00	4	Snow	7.6
February 18, 13:00	6	Snow	10.4
February 19, 11:00	9	Snow	7.7
February 25, 14:00	5	Rain	2.4
February 25, 22:00	6	Snow	6.9
February 26, 06:00	4	Snow	23.7
February 26, 13:00	4	Rain	1.2
February 27, 11:00	5	Rain	1.2
February 27, 14:00	4	Snow	5.6
March 02, 11:00	4	Snow	8.9
March 04, 11:00	5	Snow	4.1
March 07, 16:00	4	Snow	5.7
March 09, 14:00	4	Snow	7.2
March 11, 04:00	4	Snow	2.6
March 12, 13:00	4	Snow	6.4
March 14, 04:00	3	Snow	26.9
March 14, 13:00	3	Rain	2.6
March 14, 22:00	4	Snow	12.9
March 15, 09:00	4	Snow	8.2
March 17, 12:00	4	Snow	5.3
March 17, 23:00	6	Snow	3.1
March 18, 10:00	5	Snow	8.1
March 19, 09:00	5	Snow	1.7
March 26, 12:00	6	Snow	7.1

Start Date	Duration (hours)	Precipitation Type	Total Accumulation (mm)
March 29, 21:00	7	Rain	1.7

Note: Rain precipitation events are periods of rainfall greater than or equal to 4 hours, and/or have greater than or equal to 2.0 mm; snow precipitation events are periods of snowfall greater than or equal to 4 hours and/or greater than or equal to 1 cm (10.0 mm).

ATTACHMENT 4B: SEASONAL HYDROMETRIC SUMMARY

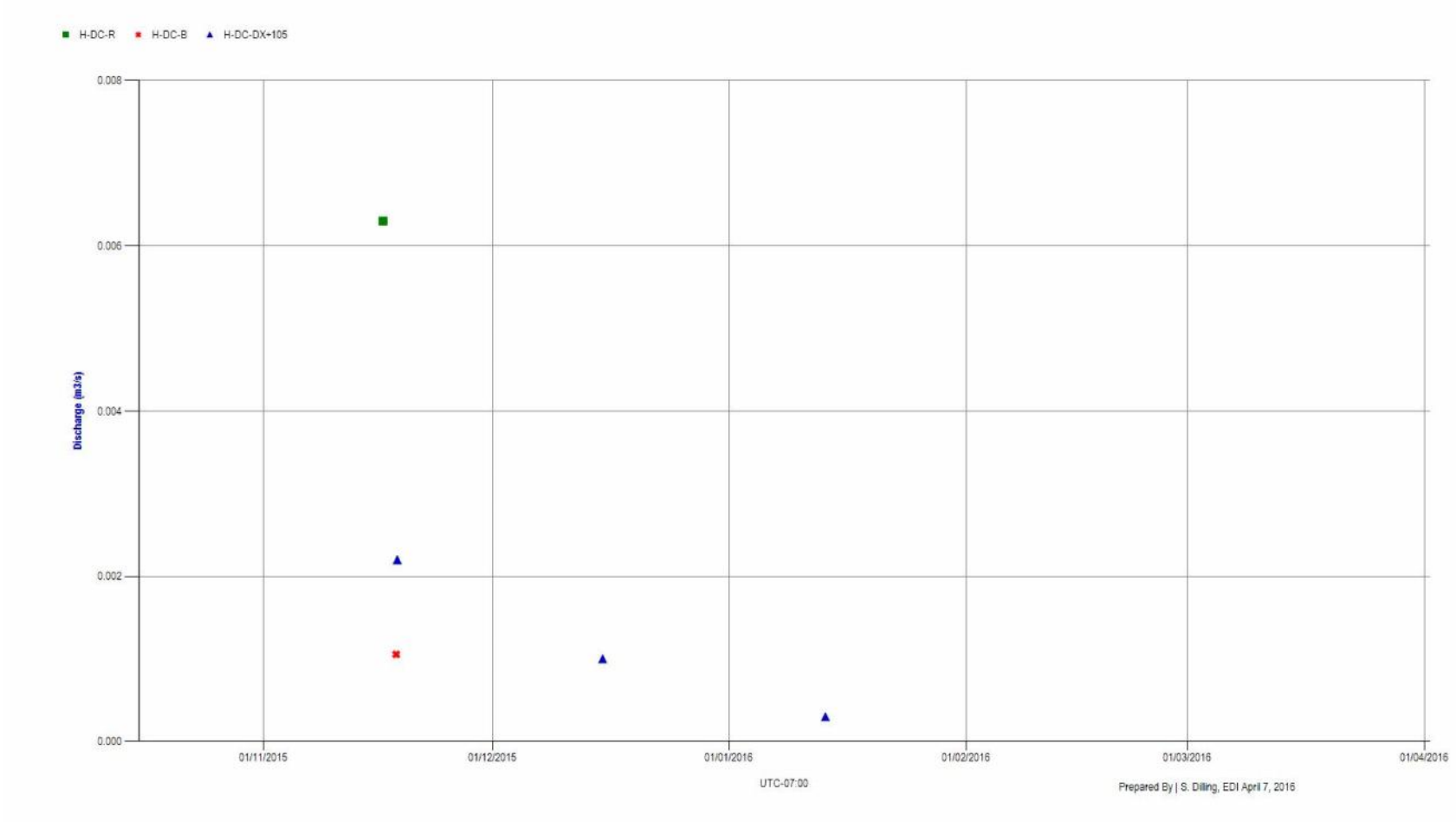


Figure 4B. 1 Hydrograph for Dome Creek stations H-DC-R, H-DC-B and H-DC-DX+105, October 16, 2015 to March 31, 2016 (stations froze to bed during winter period).

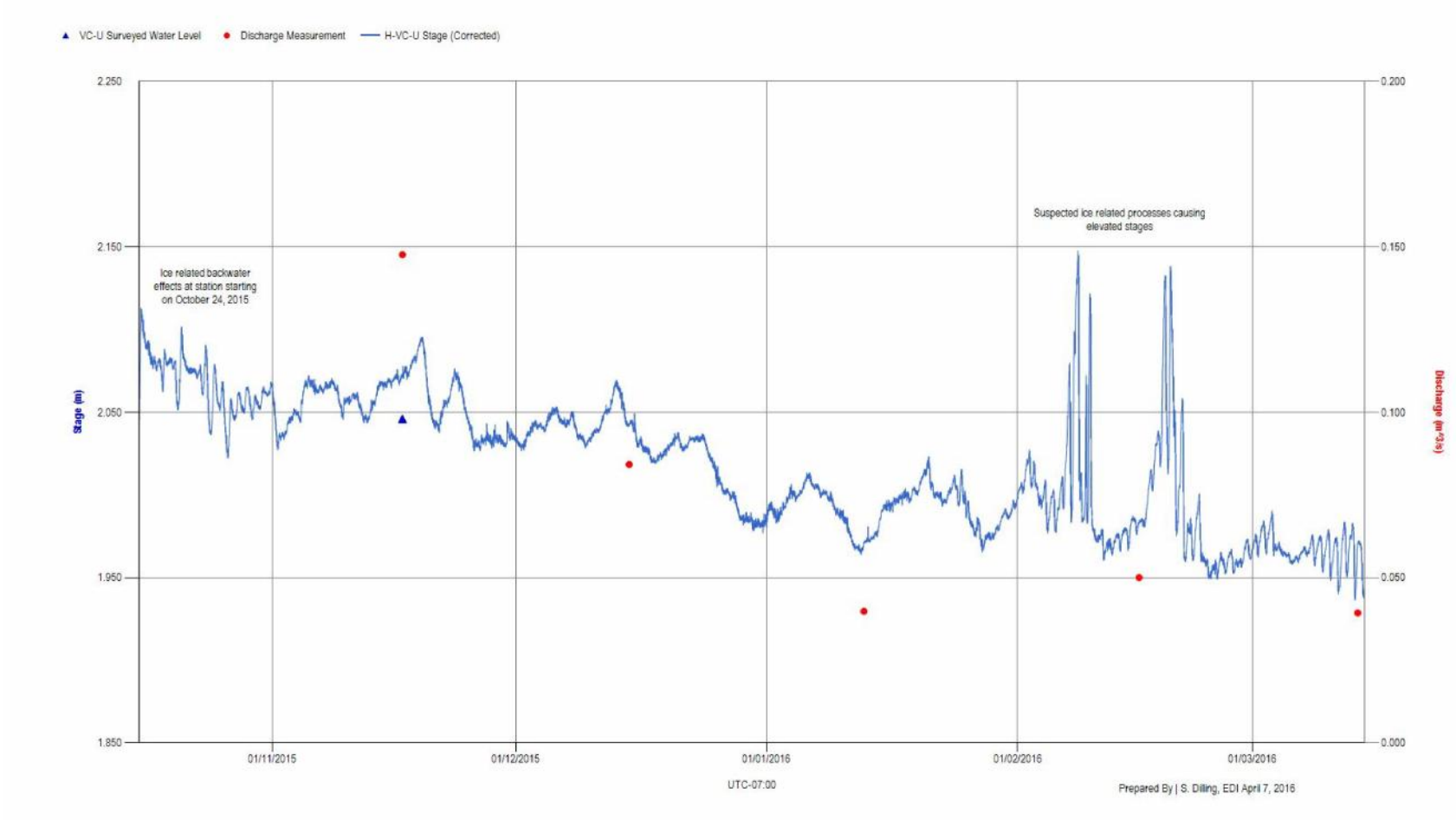


Figure 4B. 2 Hydrograph for Upper Victoria Creek (H-VC-U), October 16, 2015 to March 31, 2016

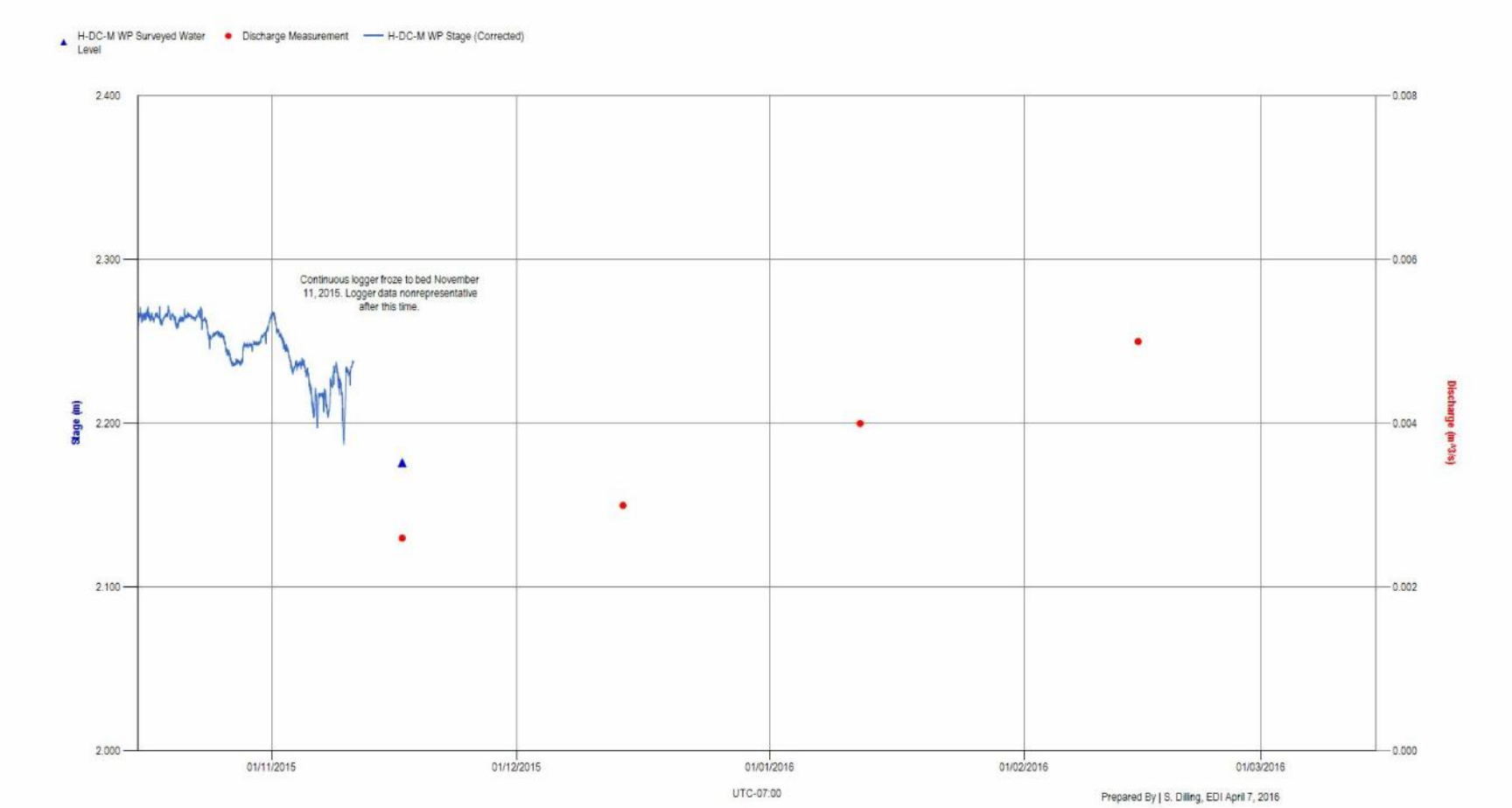


Figure 4B. 3 Hydrograph for Middle Dome Creek at the Weir Pond(H-DC-M WP), October 16, 2015 to March 31, 2016

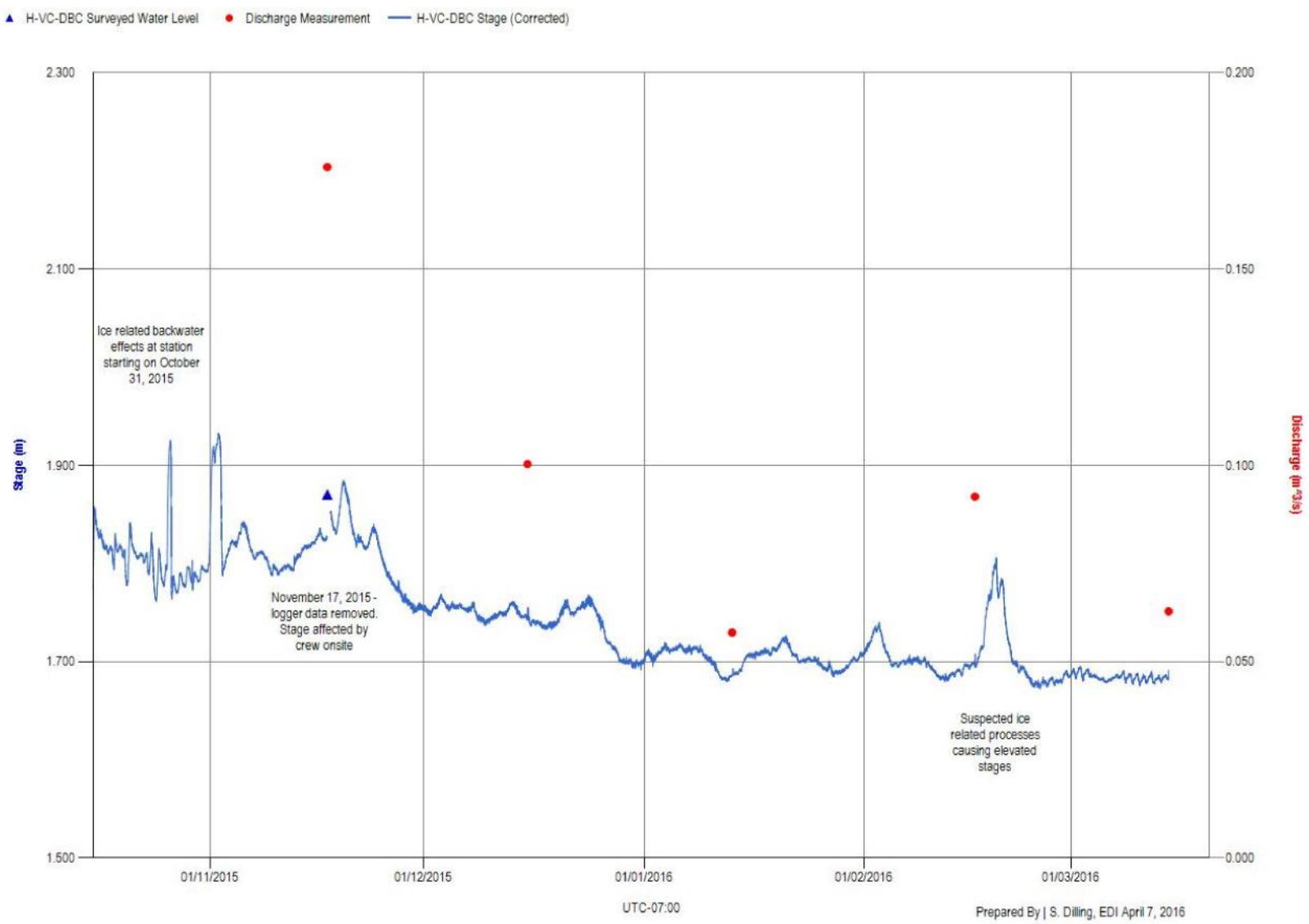


Figure 4B. 4 Hydrograph for Victoria Creek Downstream of Back Creek (H-VC-DBC), October 16, 2015 to March 31, 2016

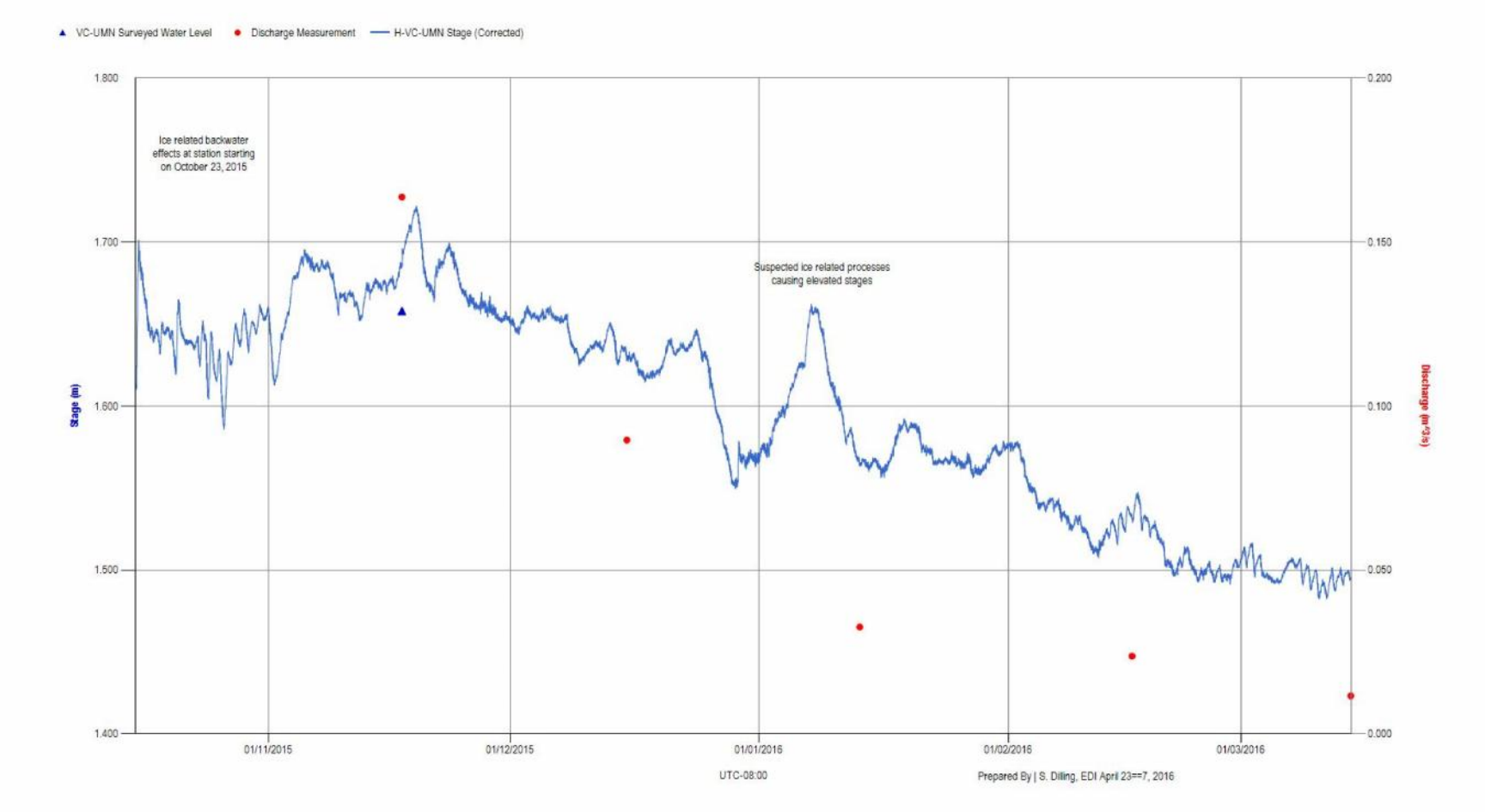


Figure 4B. 5 Hydrograph for Victoria Creek Upstream if Minnesota Creek (H-VC-UMN), October 16, 2015 to March 31, 2016

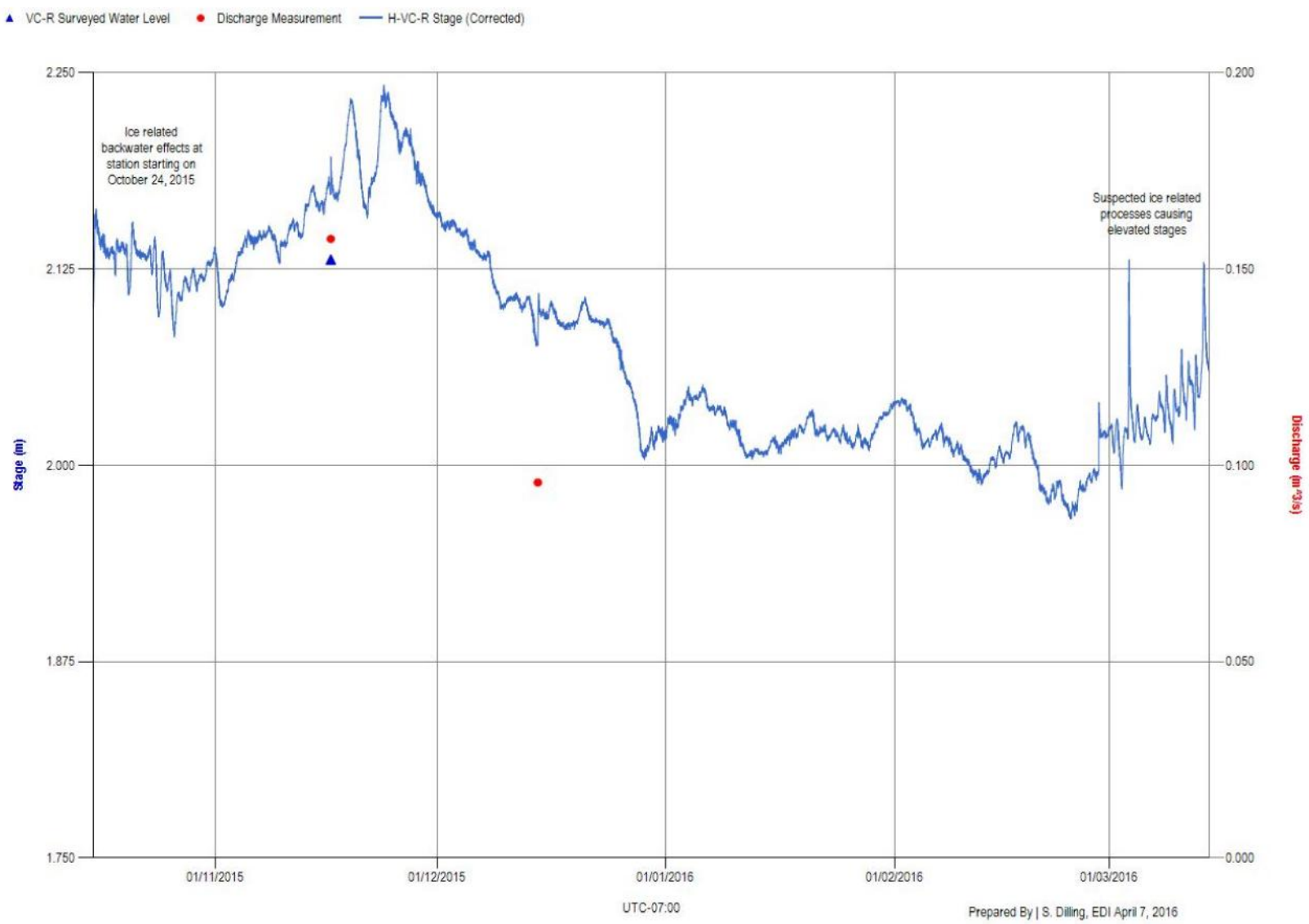


Figure 4B. 6 Hydrograph for Victoria at Road (H-VC-R), October 16, 2015 to March 31, 2016

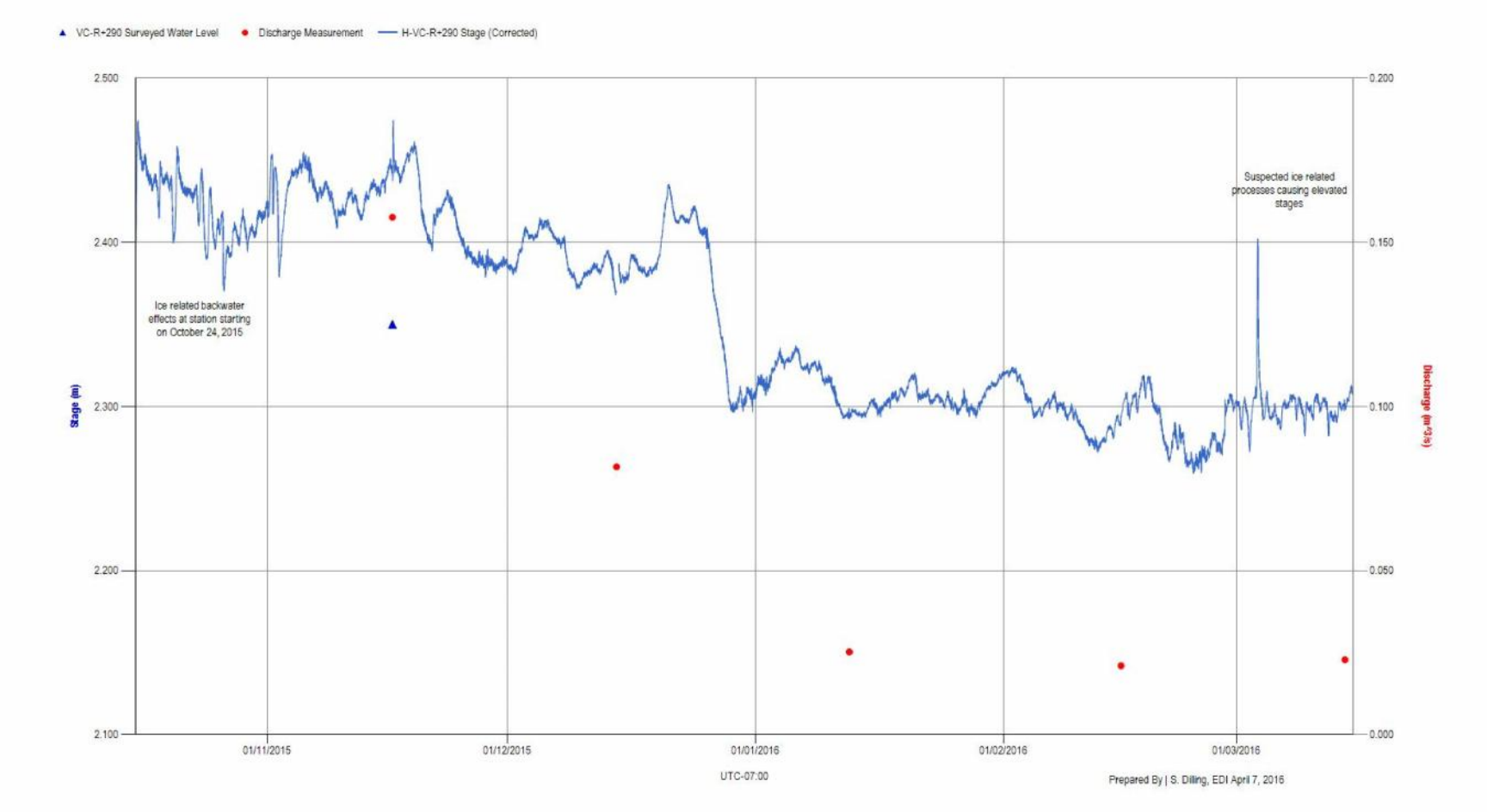


Figure 4B. 7 Hydrograph for Victoria at Road + 290 m Downstream (H-VC-R+290), October 16, 2015 to March 31, 2016

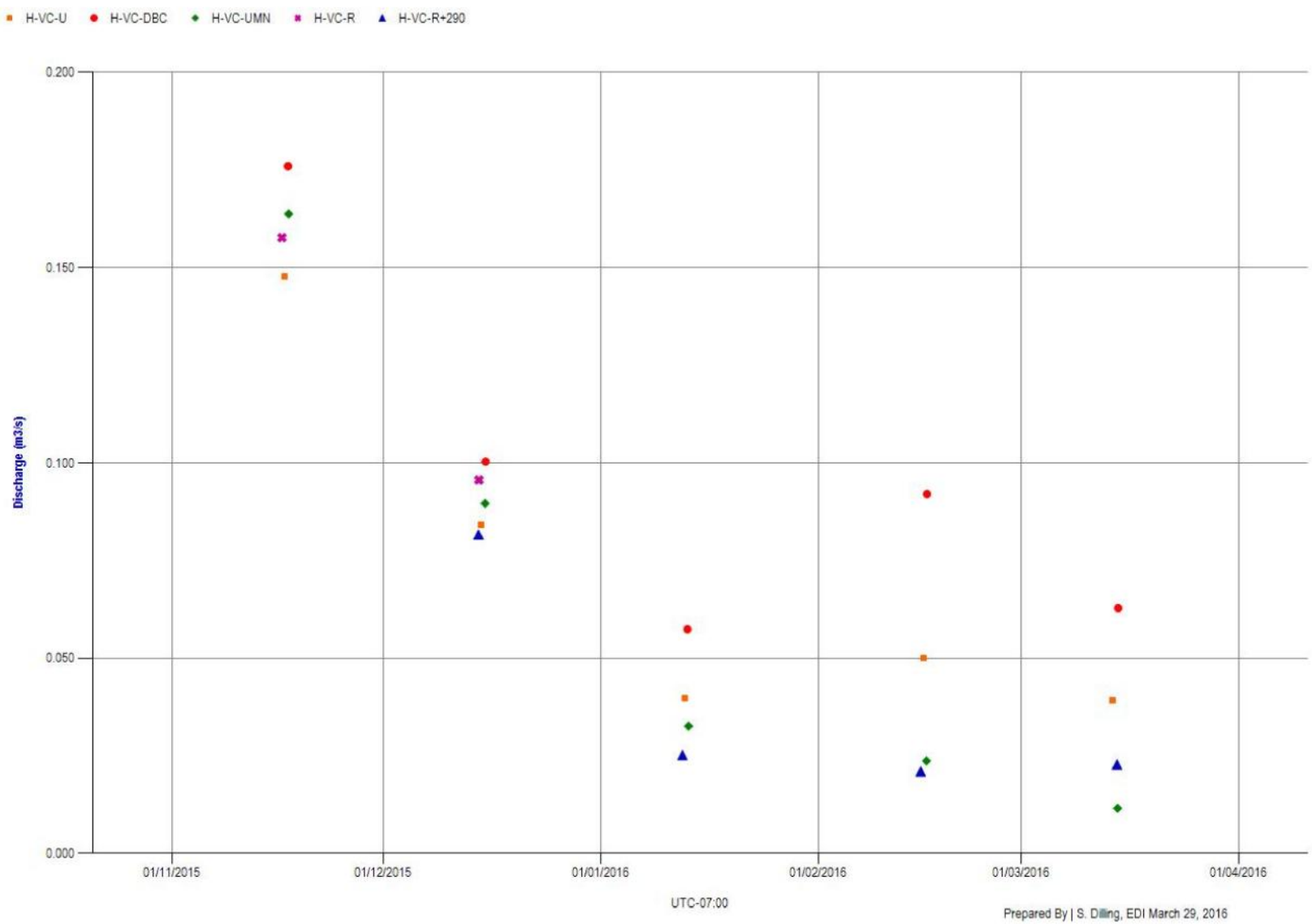


Figure 4B. 8 Instantaneous Discharge Measurements along Victoria Creek , October 16, 2015 to March 31, 2016

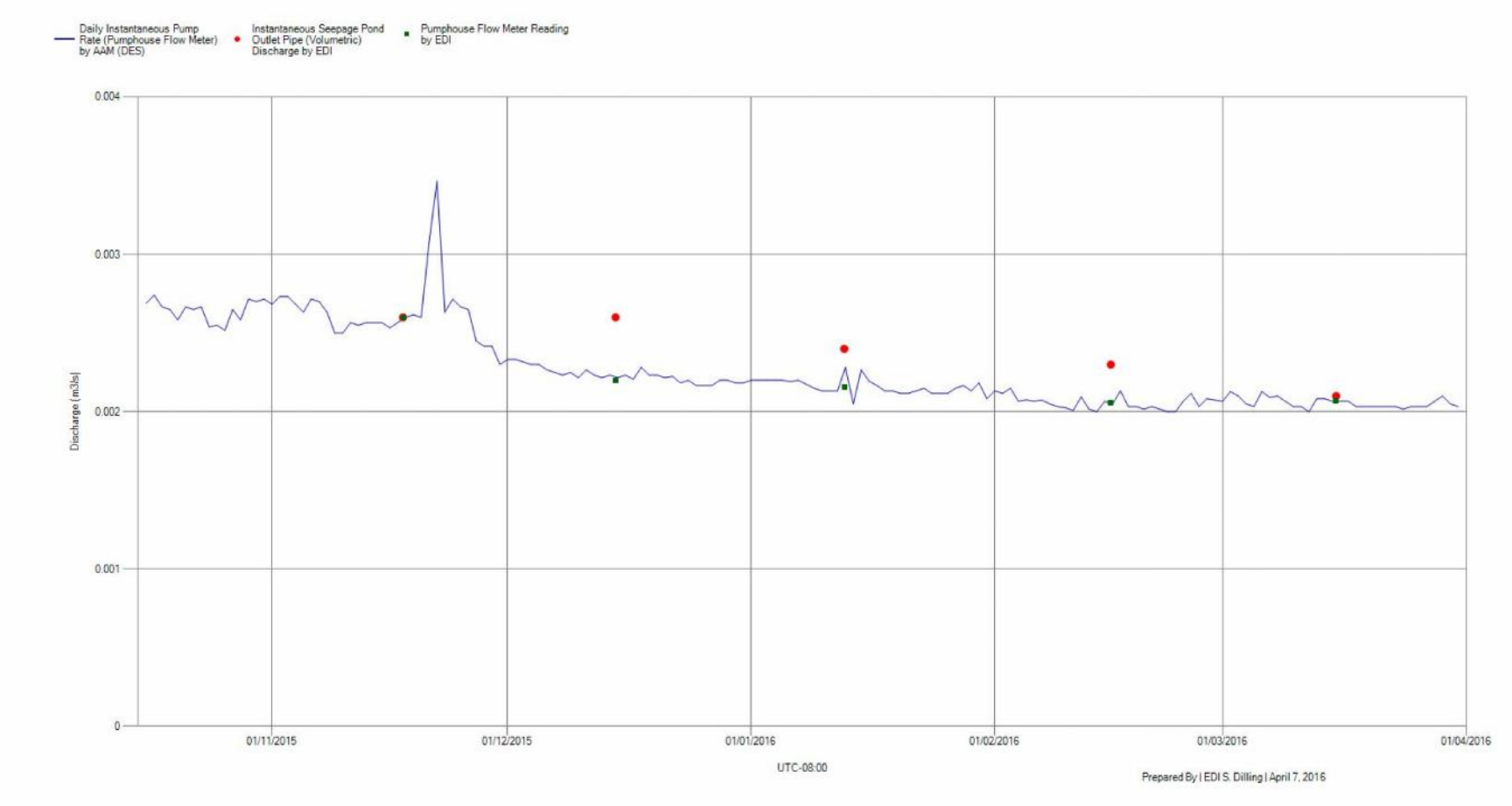


Figure 4B. 9 Hydrograph for the Seepage Pond Outlet (H-SEEP) , October 16, 2015 to March 31, 2016

ATTACHMENT 5: LABORATORY RESULTS

EDI ENVIRONMENTAL DYNAMICS INC.
ATTN: Meghan Marjanovic
2195 - 2nd Ave
Whitehorse YT Y1A 3T8

Date Received: 15-MAR-16
Report Date: 04-APR-16 16:30 (MT)
Version: FINAL

Client Phone: 867-393-4882

Certificate of Analysis

Lab Work Order #: L1745414

Project P.O. #: NOT SUBMITTED
Job Reference: MOUNT NANSEN 15-Y-0146
C of C Numbers: 1
Legal Site Desc:

Can Dang
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID					
Grouping **Analyte**					

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**

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

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

Laboratory Definition Code	Laboratory Location

Chain of Custody Numbers:

1

GLOSSARY OF REPORT TERMS

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

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

Nautilus Environmental

ALS Environmental
ATTN: Can Dang
Suite 100-8081 Lougheed Hwy.
Burnaby, BC
V5A 1W9

Report Date: March 29, 2016
Work Order: 16340

Data Report

Species: **Rainbow trout (*Oncorhynchus mykiss*)**
Protocol: **EPS 1/RM/13 (Second Ed. 2000 with 2007 & 2016 amendments)**

Table 1. Results for the 96-h rainbow trout acute toxicity test.

Sample ID	Collection Date and Time	96-h LC50 (%v/v)
L1745414-1 WQ-SEEP LC50	March 15, 2016 @ N/A	>100

N/A = Not Available.

The test met performance criterion and there were no deviations from the test method. The results relate only to the sample tested.

Yvonne Lam, B.Sc.
Laboratory Biologist

Reviewed By:
Edmund Canaria, R.P.Bio
Senior Reviewer

Rainbow Trout Summary Sheet

Client: ALS

Start Date/Time: Mar 18/16 @ 1345 h

Work Order No.: 16340

Test Species: *Oncorhynchus mykiss*

Test Validity Criteria:
≥ 90% control survival
WQ Ranges:
T (°C) = 15 ± 1; DO (mg/L) = 7.0 to 10.3; pH = 5.5 to 8.5

Sample Information:

Sample ID: L1745414-1-WQ-SEEP
Sample Date: Mar 15/16
Date Received: Mar 18/16
Sample Volume: 2 X 20 L
Other: -

Dilution Water:

Type: Dechlorinated Municipal Tap Water
Hardness (mg/L $CaCO_3$): 12
Alkalinity (mg/L $CaCO_3$): 10

Test Organism Information:

Batch No.: 030316
Source: Aqua Farms
No. Fish/Volume (L): 10/10L
Loading Density (g/L): 0.36
Mean Length ± SD (mm): 28 ± 3 Range: 25 - 32
Mean Weight ± SD (g): 0.36 ± 0.13 Range: 0.21 - 0.61

Zinc Reference Toxicant Results:

Reference Toxicant ID: RTZn 36
Stock Solution ID: 15Zn05
Date Initiated: Mar 18/16
96-h LC50 (95% CL): 69.0 (48.1 - 101.6) mg/L Zn

Reference Toxicant Mean and Historical Range: 71.7 (EC 3334.0 - 151.2) mg/L Zn
Reference Toxicant CV (%): 45%

Test Results: The 96 h LC50 is estimated to be > 100% (v/v).

Reviewed by: [signature]

Date reviewed: March 28, 2016

96-Hour Rainbow Trout Toxicity Test Data Sheet

Client/Project#: ALS ~~Hackleberry Mines~~ EC
Sample I.D. L1745414-1-WQ-SEEP
W.O. # 16340
RBT Batch #: 030316
Date Collected/Time: Mar 15 /16 @ N/A (not available)
Date Setup/Time: Mar 18 /16 @ 1345h
Sample Setup By: EC

D.O. meter: 2
pH meter: 1
Cond. Meter: 2

Number Fish/Volume: 10/10 L
7-d % Mortality: 0
Total Pre-aeration Time (mins): 30 mins
Aeration rate adjusted to 6.5 ± 1 mL/min/L? (Y/N): Y

Undiluted Sample WQ

Parameters	Initial WQ	Adjustment	30 min WQ
Temp °C	14.0		14.0
pH	6.6		6.7
D.O. (mg/L)	6.1		7.0
Cond. (µS/cm)	1654		1654

Concentration	# Survivors							Temperature (°C)					Dissolved Oxygen (mg/L)					pH					Conductivity (µS/cm)	
(% v/v)	1	2	4	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	96
C+I				10	10	10	10	14.0	14.0	14.0	14.0	14.5	10.0	9.7	9.8	9.7	10.0	6.3	6.7	6.9	6.6	6.6	29	35
6.25				10	10	10	10	14.0	14.0	14.0	14.0	14.5	10.0	9.8	9.7	9.7	9.9	6.6	6.8	7.0	7.3	7.2	166	171
12.5				10	10	10	10	14.0	14.0	14.0	14.0	14.5	10.1	9.7	9.8	9.8	9.9	6.6	7.0	7.1	7.4	7.3	255	263
25				10	10	10	10	14.0	14.0	14.0	14.0	14.5	10.1	9.7	9.7	9.8	9.9	6.7	7.1	7.4	7.6	7.6	540	541
50				10	10	10	10	14.0	14.0	14.0	14.0	14.5	10.1	9.6	9.7	9.8	10.0	6.8	7.4	7.6	8.0	8.0	919	917
100				10	10	10	10	14.0	14.0	14.0	14.0	14.5	7.0	9.7	9.7	9.8	10.0	6.7	7.6	7.9	8.1	8.1	1654	1614
Initials				AO	AO	EC	EC	EC	AO	AO	EC	EC	EC	AO	AO	EC	EC	EC	AO	AO	EC	EC	EC	EC

WQ Ranges: T (°C) = 15 ± 1; DO (mg/L) = 7.0 to 10.3; pH = 5.5 to 8.5

Sample Description/Comments: orange, opaque, gasoline smell, no particulates

Fish Description at 96 h: All fish appear healthy Number of Stressed Fish at 96 h: Ø

Other Observations:

Reviewed by: EC Date Reviewed: March 28, 2016

L1745414

VANCOUVER

ALS Environmental

Subcontract Request Form

Subcontract To:

NAUTILUS ENVIRONMENTAL
8664 COMMERCE COURT
BURNABY,BC V5A 4N7

NOTES: Please reference on final report and invoice: PO# *L1745414*
ALS requires QC data to be provided with your final results.

WO # 16340

Please see enclosed 1 **sample(s) in** 2 **Container(s)**

SAMPLE NUMBER	ANALYTICAL REQUIRED	DATE SAMPLED / DUE DATE	Priority Flag
L1745414-1 WQ-SEEP LC50		3/15/2016	
	Trout Bioassay LC50 (96 Hour) - Nautilus (TROUT-LC50-96HR-NL 1)	3/25/2016	

Subcontract Info Contact: Walter Lin (604) 253-4188

Analysis and reporting info contact: Can Dang
8081 LOUGHEED HWY
SUITE 100
BURNABY,BC V5A 1W9
Phone: (604) 253-4188 Email: can.dang@alsglobal.com

Please email confirmation of receipt to: **can.dang@alsglobal.com**

Shipped By: [signature] Date Shipped: Mar 18, 2016

Received By: Nautilus Date Received: Mar 18/16 @ 10:45

Verified By: NY - Nair Yamamoto Date Verified:

Temperature: 10.8°C

Sample Integrity Issues: 2 x 20L

Sample Description:
Orange, opaque, gasoline smell, no particulates

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L1745414-COFC

COC Number: 14 -

Page ____ of ____

Report To		Report Format / Distribution		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	EDI	Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3 pm - business days)
Contact:	Meghan Marjanovic	Quality Control (QC) Report with Report	☐ Yes ☐ No	P ☐ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	2195 - 2nd Avenue Whitehorse, YT Y1A 3T8	☐ Criteria on Report - provide details below if box checked		E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
		Select Distribution:	☐ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Phone:	867-393-4882	Email 1 or Fax	mmarjanovic@edynamics.com	Specify Date Required for E2,E or P:
		Email 2	erlk.pit@gov.yk.ca	
		Email 3	Emilie.Hamm@gov.yk.ca	

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

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q49310	Approver ID:	Cost Center:
Job #:	MOUNT NANSEN 15-Y-0146	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Sean Sluggett **Sampler:** DH, MS, PS

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Rainbow Trout LC50	Number of Containers
	WQ-SEEP LC50	15-Mar-16	10:50	Water	R	2

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

SAMPLE CONDITION AS RECEIVED (lab use only)

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

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
1.1			1.8°C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
	15/03/2016	12:39		15-Mar-16	5:00	Shayan	MAR 17	1850

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

EDI ENVIRONMENTAL DYNAMICS INC.
ATTN: Meghan Marjanovic
2195 - 2nd Ave
Whitehorse YT Y1A 3T8

Date Received: 16-MAR-16
Report Date: 01-APR-16 11:39 (MT)
Version: FINAL

Client Phone: 867-393-4882

Certificate of Analysis

Lab Work Order #: L1745321

Project P.O. #: NOT SUBMITTED
Job Reference: MOUNT NANSEN 15-Y-0146
C of C Numbers: 1, 2
Legal Site Desc:

Can Dang
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1745321-1 WATER 14-MAR-16 15:45 WQ-VC-UMN	L1745321-2 WATER 14-MAR-16 14:20 FIELD BLANK	L1745321-3 WATER 14-MAR-16 14:05 WQ-VC-R+150	L1745321-4 WATER 14-MAR-16 18:25 WQ-VC-U	L1745321-5 WATER 14-MAR-16 16:25 WQ-VC-UMN-R
WATER						
Physical Tests	Conductivity (uS/cm)	274	<2.0	295	229	271
	Hardness (as CaCO3) (mg/L)	151	<0.50	164	128	151
	pH (pH)	7.63	5.53	7.82	7.61	7.63
	Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0	<3.0	<3.0
	Total Dissolved Solids (mg/L)	157	<1.0	168	127	157
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	104	<1.0	109	94.1	104
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	104	<1.0	109	94.1	104
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Fluoride (F) (mg/L)	0.055	<0.020	0.057	0.050	0.055
	Nitrate (as N) (mg/L)	0.0908	<0.0050	0.0682	0.163	0.0893
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Sulfate (SO4) (mg/L)	36.7	<0.30	41.0	22.3	36.8
	Anion Sum (meq/L)	2.85	<0.10	3.04	2.36	2.86
	Cation Sum (meq/L)	3.21	<0.10	3.48	2.70	3.20
	Cation - Anion Balance (%)	5.9	0.0	6.8	6.7	5.6
Cyanides	Cyanide, Weak Acid Diss (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Cyanide, Total (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Cyanate (mg/L)	<0.20 SP	<0.20 SP	<0.20 SP	<0.20 SP	<0.20 SP
	Thiocyanate (SCN) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
Total Metals	Aluminum (Al)-Total (mg/L)	0.0096	<0.0030	0.0072	0.0153	0.0089
	Antimony (Sb)-Total (mg/L)	0.00046	<0.00010	0.00044	<0.00010	0.00051
	Arsenic (As)-Total (mg/L)	0.00134	<0.00010	0.00126	0.00025	0.00136
	Barium (Ba)-Total (mg/L)	0.0759	<0.000050	0.0812	0.0833	0.0744
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	0.000026
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	0.000106
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	0.0000214	<0.0000050	0.0000219	0.0000240	0.0000203
	Calcium (Ca)-Total (mg/L)	36.4	<0.050	39.0	30.5	36.5
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010	0.00014	<0.00010	0.00012
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	0.00139	<0.00050	0.00103	0.00113	0.00104
	Iron (Fe)-Total (mg/L)	0.016	<0.010	<0.010	0.018	0.018
	Lead (Pb)-Total (mg/L)	0.000068	<0.000050	<0.000050	<0.000050	0.000064
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	0.0010	<0.0010	<0.0010

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1745321-6	L1745321-7	L1745321-8	L1745321-9	L1745321-10
Description	WATER	WATER	WATER	WATER	WATER
Sampled Date		14-MAR-16	15-MAR-16	15-MAR-16	15-MAR-16
Sampled Time		18:00	11:25	10:25	10:50
Client ID	TRAVEL BLANK	WQ-VC-DBC	WQ-TP	WQ-DC-U	WQ-SEEP
Grouping / **Analyte**					
WATER					
Physical Tests Conductivity (uS/cm)	<2.0	228	3270	1610	1680
Hardness (as CaCO3) (mg/L)	<0.50	129	2080	878	908
pH (pH)	5.59	7.61	7.97	7.75	7.15
Total Suspended Solids (mg/L)	<3.0	<3.0	64.7	12.0	47.0
Total Dissolved Solids (mg/L)	<1.0	128	3050	1260	1290
Anions and Nutrients Alkalinity, Bicarbonate (as CaCO3) (mg/L)	<1.0	94.6	315	267	262
Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity, Total (as CaCO3) (mg/L)	<1.0	94.6	315	267	262
Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	2.13	4.06	4.27
Chloride (Cl) (mg/L)	<0.50	<0.50	35.5	<2.5 DLA	<2.5 DLA
Fluoride (F) (mg/L)	<0.020	0.053	0.46	<0.10 DLA	<0.10 DLA
Nitrate (as N) (mg/L)	<0.0050	0.161	<0.050 DLA	0.3023	0.5236
Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.010 DLA	<0.0050 DLA	0.0135
Sulfate (SO4) (mg/L)	<0.30	22.4	1970	732	737
Anion Sum (meq/L)	<0.10	2.37	48.3	20.6	20.6
Cation Sum (meq/L)	<0.10	2.73	45.2	19.6	21.3
Cation - Anion Balance (%)	0.0	7.1	-3.3	-2.4	1.6
Cyanides Cyanide, Weak Acid Diss (mg/L)	<0.0050	<0.0050	<0.0050	0.0176	0.0153
Cyanide, Total (mg/L)	<0.0050	<0.0050	<0.0050	0.0426	0.0796
Cyanate (mg/L)	<0.20	<0.20 SP	<0.20 SP	<0.20 SP	<0.20 SFP
Thiocyanate (SCN) (mg/L)	<0.50	<0.50	<0.50	2.60	5.11
Total Metals Aluminum (Al)-Total (mg/L)	<0.0030	0.0228	0.270	0.0578	0.0170
Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	0.0397	0.00043	0.00053
Arsenic (As)-Total (mg/L)	<0.00010	0.00026	0.578	0.0602	0.126
Barium (Ba)-Total (mg/L)	<0.000050	0.0821	0.0674	0.0812	0.0630
Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	0.00017	<0.000020	0.000023
Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	0.00213	<0.000050	<0.000050
Boron (B)-Total (mg/L)	<0.010	<0.010	0.157	0.050	0.059
Cadmium (Cd)-Total (mg/L)	<0.0000050	0.0000307	0.00751	0.000180	0.000418
Calcium (Ca)-Total (mg/L)	<0.050	31.0	625	254	269
Chromium (Cr)-Total (mg/L)	0.00011 RRV	0.00011	0.00130	0.00043	0.00065
Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	0.00617	0.00684	0.00844
Copper (Cu)-Total (mg/L)	<0.00050	0.00110	0.0957	0.00132	0.00268
Iron (Fe)-Total (mg/L)	<0.010	0.029	4.49	5.10	18.9
Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	0.153	0.000153	0.000079
Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	0.0200	0.0010	<0.0010

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1745321-1 WATER 14-MAR-16 15:45 WQ-VC-UMN	L1745321-2 WATER 14-MAR-16 14:20 FIELD BLANK	L1745321-3 WATER 14-MAR-16 14:05 WQ-VC-R+150	L1745321-4 WATER 14-MAR-16 18:25 WQ-VC-U	L1745321-5 WATER 14-MAR-16 16:25 WQ-VC-UMN-R
WATER						
Total Metals	Magnesium (Mg)-Total (mg/L)	11.7	<0.10	13.3	9.89	11.9
	Manganese (Mn)-Total (mg/L)	0.0115	<0.00010	0.00481	0.108	0.0112
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.000331	<0.000050	0.000350	0.000395	0.000435
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.96	<0.10	1.16	0.75	1.00
	Selenium (Se)-Total (mg/L)	0.000068	<0.000050	0.000064	<0.000050	0.000073
	Silicon (Si)-Total (mg/L)	6.74	<0.050	7.43	6.40	6.80
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	3.67	<0.050	3.99	2.84	3.65
	Strontium (Sr)-Total (mg/L)	0.338	<0.00020	0.350	0.323	0.331
	Sulfur (S)-Total (mg/L)	12.7	<0.50	14.0	7.77	12.6
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	0.00037	<0.00030
	Uranium (U)-Total (mg/L)	0.000520	<0.000010	0.000668	0.000688	0.000511
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	0.0035	<0.0030	0.0045	<0.0030	0.0031
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0046	<0.0010	0.0050	0.0061	0.0044
	Antimony (Sb)-Dissolved (mg/L)	0.00046	<0.00010	0.00044	<0.00010	0.00046
	Arsenic (As)-Dissolved (mg/L)	0.00119	<0.00010	0.00130	0.00022	0.00131
	Barium (Ba)-Dissolved (mg/L)	0.0753	<0.000050	0.0795	0.0841	0.0771
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	0.0000210	<0.0000050	0.0000226	0.0000250	0.0000155
	Calcium (Ca)-Dissolved (mg/L)	39.8	<0.050	42.3	33.7	39.4
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00081	<0.00020	0.00089	0.00096	0.00089
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010	0.0011	<0.0010	<0.0010

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1745321-6	L1745321-7	L1745321-8	L1745321-9	L1745321-10
Description	WATER	WATER	WATER	WATER	WATER
Sampled Date		14-MAR-16	15-MAR-16	15-MAR-16	15-MAR-16
Sampled Time		18:00	11:25	10:25	10:50
Client ID	TRAVEL BLANK	WQ-VC-DBC	WQ-TP	WQ-DC-U	WQ-SEEP
Grouping / **Analyte**					
WATER					
Total Metals Magnesium (Mg)-Total (mg/L)	<0.10	10.3	124	61.3	59.5
Manganese (Mn)-Total (mg/L)	<0.00010	0.114	20.4	5.91	6.35
Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.000050 DLM	<0.0000050	<0.0000050
Molybdenum (Mo)-Total (mg/L)	<0.000050	0.000395	0.00627	0.00103	0.00106
Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	0.0085	0.00290	0.00375
Phosphorus (P)-Total (mg/L)	<0.050	<0.050	0.064	0.063	0.054
Potassium (K)-Total (mg/L)	<0.10	0.82	42.3	5.83	6.34
Selenium (Se)-Total (mg/L)	<0.000050	0.000053	0.00034	0.000173	0.000264
Silicon (Si)-Total (mg/L)	<0.050	6.54	6.91	7.28	7.98
Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	0.00367	0.000025	0.000039
Sodium (Na)-Total (mg/L)	<0.050	2.79	42.7	33.3	36.5
Strontium (Sr)-Total (mg/L)	<0.00020	0.321	1.59	0.777	0.750
Sulfur (S)-Total (mg/L)	<0.50	7.79	645	226	242
Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	0.000493	<0.000010	<0.000010
Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00050 DLA	<0.00010	<0.00010
Titanium (Ti)-Total (mg/L)	<0.00030	0.00070	0.0028	0.00243	0.00132
Uranium (U)-Total (mg/L)	<0.000010	0.000691	0.00404	0.00167	0.00177
Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.0025 DLA	0.00149	0.00311
Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	0.584	0.0471	0.116
Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.0015 DLA	0.00038	0.00070
Dissolved Metals Dissolved Mercury Filtration Location		FIELD	FIELD	FIELD	FIELD
Dissolved Metals Filtration Location		FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved (mg/L)		0.0059	0.0061	0.0057	0.0095
Antimony (Sb)-Dissolved (mg/L)		<0.00010	0.00646	0.00033	0.00050
Arsenic (As)-Dissolved (mg/L)		0.00024	0.0834	0.0403	0.0773
Barium (Ba)-Dissolved (mg/L)		0.0830	0.0510	0.0668	0.0546
Beryllium (Be)-Dissolved (mg/L)		<0.000020	<0.00010 DLA	<0.000020	<0.000020
Bismuth (Bi)-Dissolved (mg/L)		<0.000050	<0.00025 DLA	<0.000050	<0.000050
Boron (B)-Dissolved (mg/L)		<0.010	0.151	0.041	0.050
Cadmium (Cd)-Dissolved (mg/L)		0.0000229	0.00532	0.000113	0.000277
Calcium (Ca)-Dissolved (mg/L)		33.8	637	253	270
Chromium (Cr)-Dissolved (mg/L)		<0.00010	<0.00050 DLA	0.00027	0.00054
Cobalt (Co)-Dissolved (mg/L)		<0.00010	0.00535	0.00614	0.00802
Copper (Cu)-Dissolved (mg/L)		0.00092	0.0300	0.00061	0.00152
Iron (Fe)-Dissolved (mg/L)		<0.010	0.046	3.17	17.8
Lead (Pb)-Dissolved (mg/L)		<0.000050	0.00030	<0.000050	<0.000050
Lithium (Li)-Dissolved (mg/L)		<0.0010	0.0179	0.0013	0.0011

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1745321-1 WATER 14-MAR-16 15:45 WQ-VC-UMN	L1745321-2 WATER 14-MAR-16 14:20 FIELD BLANK	L1745321-3 WATER 14-MAR-16 14:05 WQ-VC-R+150	L1745321-4 WATER 14-MAR-16 18:25 WQ-VC-U	L1745321-5 WATER 14-MAR-16 16:25 WQ-VC-UMN-R
WATER						
Dissolved Metals	Magnesium (Mg)-Dissolved (mg/L)	12.7	<0.10	14.1	10.5	12.7
	Manganese (Mn)-Dissolved (mg/L)	0.0107	<0.00010	0.00461	0.105	0.0105
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.000274	<0.000050	0.000297	0.000322	0.000278
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	1.02	<0.10	1.21	0.80	1.02
	Selenium (Se)-Dissolved (mg/L)	0.000059	<0.000050	0.000055	<0.000050	0.000067
	Silicon (Si)-Dissolved (mg/L)	6.91	<0.050	7.47	6.53	6.85
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	3.71	<0.050	4.06	2.83	3.78
	Strontium (Sr)-Dissolved (mg/L)	0.325	<0.00020	0.342	0.311	0.325
	Sulfur (S)-Dissolved (mg/L)	11.8	<0.50	13.5	7.42	12.4
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.000432	<0.000010	0.000562	0.000556	0.000437
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	0.0030	<0.0010	0.0044	<0.0010	0.0027
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1745321-6	L1745321-7	L1745321-8	L1745321-9	L1745321-10
Description	WATER	WATER	WATER	WATER	WATER
Sampled Date		14-MAR-16	15-MAR-16	15-MAR-16	15-MAR-16
Sampled Time		18:00	11:25	10:25	10:50
Client ID	TRAVEL BLANK	WQ-VC-DBC	WQ-TP	WQ-DC-U	WQ-SEEP
Grouping / **Analyte**					
WATER					
Dissolved Metals Magnesium (Mg)-Dissolved (mg/L)		10.9	119	59.9	56.8
Manganese (Mn)-Dissolved (mg/L)		0.112	19.9	5.57	6.36
Mercury (Hg)-Dissolved (mg/L)		<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum (Mo)-Dissolved (mg/L)		0.000345	0.00678	0.000959	0.00115
Nickel (Ni)-Dissolved (mg/L)		<0.00050	0.0076	0.00252	0.00338
Phosphorus (P)-Dissolved (mg/L)		<0.050	<0.050	<0.050	<0.050
Potassium (K)-Dissolved (mg/L)		0.83	37.8	5.69	6.17
Selenium (Se)-Dissolved (mg/L)		0.000055	<0.00025 DLA	0.000183	0.000237
Silicon (Si)-Dissolved (mg/L)		6.61	6.20	6.94	7.69
Silver (Ag)-Dissolved (mg/L)		<0.000010	<0.000050 DLA	<0.000010	0.000015
Sodium (Na)-Dissolved (mg/L)		2.88	40.8	29.7	33.9
Strontium (Sr)-Dissolved (mg/L)		0.315	1.62	0.715	0.747
Sulfur (S)-Dissolved (mg/L)		7.32	604	217	231
Thallium (Tl)-Dissolved (mg/L)		<0.000010	0.000435	<0.000010	<0.000010
Tin (Sn)-Dissolved (mg/L)		<0.00010	<0.00050 DLA	<0.00010	<0.00010
Titanium (Ti)-Dissolved (mg/L)		<0.00030	<0.0015 DLA	0.00052	0.00095
Uranium (U)-Dissolved (mg/L)		0.000567	0.00401	0.00171	0.00199
Vanadium (V)-Dissolved (mg/L)		<0.00050	<0.0025 DLA	0.00094	0.00228
Zinc (Zn)-Dissolved (mg/L)		<0.0010	0.406	0.0355	0.0957
Zirconium (Zr)-Dissolved (mg/L)		<0.00030	<0.0015 DLA	0.00040	0.00077

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Antimony (Sb)-Dissolved	DLA	L1745321-1, -10, -2, -3, -4, -5, -7, -8, -9
Duplicate	Bismuth (Bi)-Dissolved	DLA	L1745321-1, -10, -2, -3, -4, -5, -7, -8, -9
Duplicate	Chromium (Cr)-Dissolved	DLA	L1745321-1, -10, -2, -3, -4, -5, -7, -8, -9
Duplicate	Lead (Pb)-Dissolved	DLA	L1745321-1, -10, -2, -3, -4, -5, -7, -8, -9
Duplicate	Thallium (Tl)-Dissolved	DLA	L1745321-1, -10, -2, -3, -4, -5, -7, -8, -9
Duplicate	Tin (Sn)-Dissolved	DLA	L1745321-1, -10, -2, -3, -4, -5, -7, -8, -9
Duplicate	Titanium (Ti)-Dissolved	DLA	L1745321-1, -10, -2, -3, -4, -5, -7, -8, -9
Duplicate	Vanadium (V)-Dissolved	DLA	L1745321-1, -10, -2, -3, -4, -5, -7, -8, -9
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1745321-1, -10, -2, -3, -4, -5, -7, -8, -9
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1745321-1, -10, -2, -3, -4, -5, -7, -8, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1745321-1, -10, -2, -3, -4, -5, -7, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1745321-1, -10, -2, -3, -4, -5, -7, -8, -9
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1745321-1, -10, -2, -3, -4, -5, -7, -8, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1745321-1, -10, -2, -3, -4, -5, -7, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1745321-1, -10, -2, -3, -4, -5, -7, -8, -9
Matrix Spike	Aluminum (Al)-Total	MS-B	L1745321-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Barium (Ba)-Total	MS-B	L1745321-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Manganese (Mn)-Total	MS-B	L1745321-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sodium (Na)-Total	MS-B	L1745321-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Total	MS-B	L1745321-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1745321-1, -10, -2, -3, -4, -5, -7, -8, -9
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1745321-1, -10, -2, -3, -4, -5, -7, -8, -9
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1745321-1, -10, -2, -3, -4, -5, -7, -8, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1745321-1, -10, -2, -3, -4, -5, -7, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1745321-1, -10, -2, -3, -4, -5, -7, -8, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
DLM	Detection Limit Adjusted due to sample matrix effects.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis
SFP	Sample was Filtered and Preserved at the laboratory
SP	Sample was Preserved at the laboratory

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

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

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

BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)

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

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

CL-IC-N-WR	Water	Chloride in Water by IC	EPA 300.1 (mod)

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

CN-CNO-WT	Water	Cyanate	APHA 4500-CN-L

Reference Information

This analysis is carried out using procedures adapted from APHA method 4500-CN "Cyanide". Cyanate is determined by the Cyanate hydrolysis method using an ammonia selective electrode

CN-SCN-VA Water Thiocyanate by Colour APHA 4500-CN CYANIDE

This analysis is carried out using procedures adapted from APHA Method 4500-CN- M "Thiocyanate" Thiocyanate is determined by the ferric nitrate colourimetric method.

CN-T-CFA-VA Water Total Cyanide in water by CFA ISO 14403:2002

This analysis is carried out using procedures adapted from ISO Method 14403:2002 "Determination of Total Cyanide using Flow Analysis (FIA and CFA)". Total or strong acid dissociable (SAD) cyanide is determined by in-line UV digestion along with sample distillation and final determination by colourimetric analysis. Method Limitation: This method is susceptible to interference from thiocyanate (SCN). If SCN is present in the sample, there could be a positive interference with this method, but it would be less than 1% and could be as low as zero.

CN-WAD-CFA-VA Water Weak Acid Diss. Cyanide in water by CFA APHA 4500-CN CYANIDE

This analysis is carried out using procedures adapted from APHA Method 4500-CN I. "Weak Acid Dissociable Cyanide". Weak Acid Dissociable (WAD) cyanide is determined by in-line sample distillation with final determination by colourimetric analysis.

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

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

F-IC-N-WR Water Fluoride in Water by IC EPA 300.1 (mod)

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

HARDNESS-CALC-VA Water Hardness APHA 2340B

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

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

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

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

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

IONBALANCE-VA Water Ion Balance Calculation APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

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

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

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

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

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

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

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

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

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

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

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

Reference Information

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

TDS-CALC-VA	Water	TDS (Calculated)	APHA 1030E (20TH EDITION)

This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses".

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

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

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

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

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

Chain of Custody Numbers:

1 2

Reference Information

GLOSSARY OF REPORT TERMS

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

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

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

L1745321-COFC

COC Number: 14 -

Page ____ of ____

Report To		Report Format / Distribution		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	EDI	Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3 pm - business days)
Contact:	Meghan Marjanovic	Quality Control (QC) Report with Report	☐ Yes ☐ No	P ☐ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	2195 - 2nd Avenue Whitehorse, YT Y1A 3T8	☐ Criteria on Report - provide details below if box checked		E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
		Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Phone:	867-393-4882	Email 1 or Fax	mmarjanovic@edynamics.com	Specify Date Required for E2,E or P:
		Email 2	Emilie.Hamm@gov.yk.ca	
		Email 3	erik.pit@gov.yk.ca	

Invoice To	Same as Report To ☑ Yes ☑ No	Invoice Distribution	
	Copy of Invoice with Report ☑ Yes ☐ No	Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Company:	EDI	Email 1 or Fax	sjenner@edynamics.com
Contact:	S Jenner	Email 2	mmarjanovic@edynamics.com

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q49310	Approver ID:	Cost Center:
Job #:	MOUNT NANSEN 15-Y-0146	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	

ALS Lab Work Order # (lab use only)

ALS Contact: Sean Slugget **Sampler:** DH, MSa, DS.

Analysis Request

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

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	ALK-PCT-VA,EC-PCT-VA,PH-PCT-VA	ANIONS-ALL-IC-WR,TSS-MAN-WR	CN-WAD-CFA-VA,CN-T-CFA-VA	CN-CNO-WT	CN-SCN-VA	NH3-F-VA	MET-T-BCMDG-VA	MET-D-BCMDG-VA	IONBALANC-VA, TDS-CALC-VA	Number of Containers
							P	P	P	P	P	F/P		
	WQ-VC-UMN	14 - Mar -16	15:45	Water	R	R	R	R	R	R	R	R	R	9
	FIELD BLANK	14 - Mar -16	14:20	Water	R	R	R	R	R	R	R	R	R	9
	WQ-VC-R+ISO	14 - Mar -16	14:05	Water	R	R	R	R	R	R	R	R	R	9
	WQ-VC-U	14 - Mar -16	18:25	Water	R	R	R	R	R	R	R	R	R	9
	WQ-VC-UMN-r	14 - Mar -16	16:25	Water	R	R	R	R	R	R	R	R	R	9
	TRAVEL BLANK	/ - Mar -16	—	Water	R	R	R	R	R	R	R	R	R	#7

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

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice packs Yes ☑ No ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
0.6	1.2		1.8°C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
	15/03/2016	12:42		15-Mar-11	5:00	Shayan	Mar.17	1830

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1745321-COFC

COC Number: 14 -

Page ____ of ____

Report To		Report Format / Distribution		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	EDI	Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3 pm - business days)
Contact:	Meghan Marjanovic	Quality Control (QC) Report with Report	☐ Yes ☐ No	P ☐ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	2195 - 2nd Avenue Whitehorse, YT Y1A 3T8	☐ Criteria on Report - provide details below if box checked		E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
		Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Phone:	867-393-4882	Email 1 or Fax	mmarjanovic@edynamics.com	Specify Date Required for E2,E or P:
		Email 2	Emilie.Hamm@gov.yk.ca	
		Email 3	erik.pit@gov.yk.ca	

Invoice To	Same as Report To ☑ Yes ☑ No	Invoice Distribution		
	Copy of Invoice with Report ☑ Yes ☐ No	Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX	
Company:	EDI	Email 1 or Fax	sjenner@edynamics.com	
Contact:	S Jenner	Email 2	mmarjanovic@edynamics.com	
Project Information		**Oil and Gas Required Fields (client use)**		
ALS Quote #:	Q49310	Approver ID:	Cost Center:	
Job #:	MOUNT NANSEN 15-Y-0146	GL Account:	Routing Code:	
PO / AFE:		Activity Code:		
LSD:		Location:		

ALS Lab Work Order # (lab use only):

ALS Contact: Sean Slugget **Sampler:** DH, MSA, DS

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

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	ALK-PCT-VA,EC-PCT-VA,PH-PCT-VA	ANIONS-ALL-IC-WR,TSS-MAN-WR	CN-WAD-CFA-VA,CN-T-CFA -VA	CN-CNO-WT	CN-SCN-VA	NH3-F-VA	MET-T-BCMDG-VA	MET-D-BCMDG-VA	IONBALANC-VA, TDS-CALC-VA	Number of Containers
					P	P	P	P	P	P	P	F/P		
	WQ-VC-DBC	14 - Mar -16	18:00	Water	R	R	R	R	R	R	R	R	R	9
	WQ-TP	15 - Mar -16	11:25	Water	R	R	R	R	R	R	R	R	R	9
	WQ-DC-U	15 - Mar -16	10:25	Water	R	R	R	R	R	R	R	R	R	9
	WQ-SEEP	15 - Mar -16	10:50	Water	R	R	R	R	R	R	R	R	R	9
		~~Mar -16~~		~~Water~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~9~~
		~~Mar -16~~		~~Water~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~R~~	~~9~~

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ Yes ☑ No

Are samples for human drinking water use? ☐ Yes ☑ No

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

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice packs Yes ☐ No ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			1.8 C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
	15/03/2016	12:47					Mar.17	1830

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

EDI ENVIRONMENTAL DYNAMICS INC.
ATTN: Meghan Marjanovic
2195 - 2nd Ave
Whitehorse YT Y1A 3T8

Date Received: 15-MAR-16
Report Date: 29-MAR-16 12:32 (MT)
Version: FINAL

Client Phone: 867-393-4882

Certificate of Analysis

Lab Work Order #: L1745419

Project P.O. #: NOT SUBMITTED
Job Reference: MOUNT NANSEN 15-Y-0146
C of C Numbers: 1
Legal Site Desc:

Can Dang
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1745419-1				
	Description	WATER				
	Sampled Date	14-MAR-16				
	Sampled Time	19:30				
	Client ID	WQ-PW				
Grouping	**Analyte**					
WATER						
Physical Tests	Colour, True (CU)	<5.0				
	Conductivity (uS/cm)	367				
	Hardness (as CaCO3) (mg/L)	199				
	pH (pH)	8.00				
	Total Dissolved Solids (mg/L)	208				
	Turbidity (NTU)	0.17				
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	165				
	Chloride (Cl) (mg/L)	<0.50				
	Fluoride (F) (mg/L)	0.111				
	Nitrate (as N) (mg/L)	0.111				
	Nitrite (as N) (mg/L)	<0.0010				
	Sulfate (SO4) (mg/L)	35.7				
	Anion Sum (meq/L)	4.06				
	Cation Sum (meq/L)	4.23				
	Cation - Anion Balance (%)	2.0				
Total Metals	Aluminum (Al)-Total (mg/L)	<0.010				
	Antimony (Sb)-Total (mg/L)	<0.00050				
	Arsenic (As)-Total (mg/L)	0.00039				
	Barium (Ba)-Total (mg/L)	0.087				
	Boron (B)-Total (mg/L)	<0.10				
	Cadmium (Cd)-Total (mg/L)	<0.00020				
	Calcium (Ca)-Total (mg/L)	46.7				
	Chromium (Cr)-Total (mg/L)	<0.0020				
	Copper (Cu)-Total (mg/L)	<0.0010				
	Iron (Fe)-Total (mg/L)	<0.030				
	Lead (Pb)-Total (mg/L)	0.00060				
	Magnesium (Mg)-Total (mg/L)	20.0				
	Manganese (Mn)-Total (mg/L)	<0.0020				
	Mercury (Hg)-Total (mg/L)	<0.00020				
	Potassium (K)-Total (mg/L)	0.93				
	Selenium (Se)-Total (mg/L)	<0.0010				
	Sodium (Na)-Total (mg/L)	5.2				
	Uranium (U)-Total (mg/L)	0.00181				
	Zinc (Zn)-Total (mg/L)	<0.050				

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Cadmium (Cd)-Total	DLA	L1745419-1
Duplicate	Chromium (Cr)-Total	DLA	L1745419-1
Duplicate	Copper (Cu)-Total	DLA	L1745419-1
Method Blank	Copper (Cu)-Total	MB-LOR	L1745419-1
Matrix Spike	Aluminum (Al)-Total	MS-B	L1745419-1
Matrix Spike	Calcium (Ca)-Total	MS-B	L1745419-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-COL-VA	Water	Alkalinity by Colourimetric (Automated)	EPA 310.2

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

CL-IC-N-WR	Water	Chloride in Water by IC	EPA 300.1 (mod)

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

COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength

This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method.
Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.

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

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

F-IC-N-WR	Water	Fluoride in Water by IC	EPA 300.1 (mod)

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

HARDNESS-CALC-VA	Water	Hardness	APHA 2340B

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

HG-TOT-CVAFS-VA	Water	Total Hg in Water by CVAFS LOR=50ppt	EPA 1631E (mod)

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 a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

IONBALANCE-VA	Water	Ion Balance Calculation	APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

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

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

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

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

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the

Reference Information

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).

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

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

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

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

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

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

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

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

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

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

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

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

TDS-CALC-VA	Water	TDS (Calculated)	APHA 1030E (20TH EDITION)

This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses".

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 "Turbidity"

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

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

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

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

Chain of Custody Numbers:

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.