TETRA TECH EBA

MONITORING WELL COMPLETION REPORT AND UPDATE OF HYDROGEOLOGICAL ASSESSMENT, MCLEAN LAKE QUARRY LTF, WHITEHORSE, YUKON

REVISION 1

PRESENTED TO

Arctic Backhoe Services Ltd.

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LIMITATIONS OF REPORT

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1.0 INTRODUCTION

1.1 Background

Tetra Tech EBA Inc. (Tetra Tech EBA) was retained by Arctic Backhoe Services Ltd. (Arctic Backhoe) to oversee the installation of additional monitoring wells that were to be completed below the regional groundwater table at the McLean Lake Quarry Land Treatment Facility (LTF), as well as the decommissioning of monitoring wells ML-LTF-Well#3 and ML-LTF-Well#4. The information from the new monitoring wells was used to update the hydrogeological assessment for the LTF (EBA 2009, 2010, 2013) as requested by the Department of Environment, Government of Yukon (YG) in their letters dated January 9, 2014 and June 5, 2014 following a third party review of the hydrogeological assessment (Core6, 2013).

Tetra Tech EBA completed a hydrogeological desktop study, taking into account existing geological and hydrogeological information and site topography to assess anticipated groundwater flow direction and depth to groundwater. Based on this preliminary estimate of the regional groundwater flow direction, three additional monitoring wells outside of the bermed area were proposed. The proposed well locations were selected such that one well would be located up-gradient of the LTF, thus providing background water quality data. The two other wells would be positioned down-gradient of the LTF and used to assess potential impact from the LTF on down-gradient groundwater quality. The proposed monitoring well locations were submitted to YG in a technical memorandum dated June 12, 2014. Approval from YG for the proposed well locations was received in an email from Ms. Heather Badry, Contaminated Sites Coordinator on September 5, 2014 based on the limited available information on groundwater in the area of the LTF. It was noted that additional monitoring wells may be required if data from the new wells will be insufficient to address all outstanding information requests from YG included in their letter to Arctic Backhoe dated January 9, 2014.

1.2 Objectives

The objectives of this field program were to provide further information on the regional groundwater and receiving environment, and thus address data gaps identified by the third party review of the previous hydrogeological assessment of the LTF (Core6 2013). In accordance with the information request from YG (letter from YG to Arctic Backhoe dated January 9, 2014), the additional hydrogeological information was collected from new monitoring wells completed below the regional groundwater table.

1.3 Scope of Work

The scope of consulting services for this project included the installation oversight, development, monitoring, and sampling of three additional monitoring wells at the LTF. All wells were to be completed below the regional groundwater table within the bedrock aquifer, with two monitoring wells located downgradient of the LTF and one monitoring well located upgradient of the LTF to provide information on background groundwater quality. The scope also included hydraulic response tests on each monitoring well to infer the hydraulic conductivity of the bedrock aquifer. Tetra Tech EBA also confirmed the location of surface water bodies in the vicinity of the LTF to identify the downgradient receiving environment. Tetra Tech EBA also decommissioned two of the existing monitoring wells which were located within the bermed area. The information collected from the new monitoring wells was then used to update the conceptual hydrogeological site model and address information requests from YG.

1.4 Authorization

Written authorization to proceed with the work detailed in Tetra Tech EBA's letter report Proposed Monitoring Well Locations (Doc. Ref. ENVSWM03344-01) dated June 12, 2014 was provided by Mr. Wayne Dear via a signed Service Agreement on August 15, 2014.

Any subsequent authorizations to proceed with the drilling beyond the depth agreed upon in the signed Service Agreement during the drilling program were provided verbally by Mr. Wayne Dear via telephone conversations between Mr. Earl of Tetra Tech EBA and Mr. Wayne of Arctic Backhoe.

1.5 Qualification of Assessors

Tetra Tech EBA selected a team of experienced professionals to work with Arctic Backhoe on this project. All project team members are located in Tetra Tech EBA's Whitehorse Office. Biographies for each of the proposed project team members are summarized below.

- **Mr. Ryan Martin, M.Eng, P.Eng,** provided senior review for the overall project. Mr. Martin is the Discipline Director – Water Resources for the Tetra Tech EBA Environment Practise and is a Professional Engineer specializing in hydrogeology. He has over 17 years of experience in Yukon and British Columbia on a diverse range of hydrogeological, environmental assessment and engineering projects. His areas of expertise include physical hydrogeology, mining-related groundwater assessment, aquifer characterization, aquifer protection, groundwater resource development, geoexchange suitability studies and development, and project management of environmental engineering and municipal source water supply infrastructure. Ryan is a registered Professional Engineer in Yukon.

- **Dr. Stephan Klump, Dipl-Geol, PhD,** was the project hydrogeologist for the hydrogeological assessment. Dr. Klump is a Senior Hydrogeologist and Team Lead in Tetra Tech EBA's Water Resources Group. He has worked for more than 11 years on a diverse range of hydrogeological projects. His areas of expertise include physical and chemical hydrogeology, aquifer characterization, groundwater resource development, geothermal exploration, geoexchange suitability studies, and hydraulic well testing. He has been involved as the lead hydrogeologist for many hydrogeological assessments at various sites including solid waste facilities, contaminated sites, and mine sites.

- **Ms. Kristen Range, B.Sc, GIT,** was the field hydrogeologist. She oversaw drilling and well installation, and conducted well development and sampling. Ms. Range is a Hydrogeologist with Tetra Tech EBA in Whitehorse, Yukon. Ms. Range has extensive experience collecting field data, conducting environmental impact assessments, mapping using ArcGIS software, and preparing reports. She holds a Bachelor of Science degree with a major in Environmental Sciences from the University of Alberta and is registered as a Geoscientist in Training through APEGGA. She previously worked for University of Alberta as a Research Technician conducting hydrogeological field work for research projects for Syncrude, Canada in Fort McMurray.

- **Ms. Eliane Roy, B.Eng,** was the assistant field engineer and conducted the well development, hydraulic testing. She also assisted with data analysis and report preparation. Ms. Roy is a Junior Water Resources Engineer with the Environment Practice in Whitehorse, YT. She has two years of experience in environmental consulting, mining exploration projects, and oil & gas exploration projects. She has knowledge of provincial and federal environmental laws and regulations. Her experience includes implementing surface water and groundwater monitoring programs and overseeing companies' environmental compliance status.

- **Mr. Gareth Earl, EIT,** was the Project Manager for this project and provided technical support to field staff during the drilling program in the absence of the project hydrogeologist. As an intermediate environmental engineer he has been involved in development of water well specifications, field review of water well drilling, groundwater monitoring, feasibility assessment for water well and sewage disposal systems, and conceptual design and field review of community water treatment systems. Mr. Earl has also been involved in development of specifications and field reviews for expansion of existing landfills and new transfer stations, assessment of existing landfills, estimating landfill gas generation, assessing landfill gas management systems and preparation of solid waste management plans.

2.0 SITE DESCRIPTION AND HISTORY

The LTF is located approximately four kilometers southwest of the Whitehorse Airport and operated by Arctic Backhoe under LTF Permit #24-002 (the Permit). Arctic Backhoe's activities are not only limited to managing contaminated soil stockpiles and water, but also include quarrying activities beyond the extent of the LTF. Figure 1 indicates the approximate extent of the current LTF usable area and other cleared areas where quarrying activities take place.

At the time of completion of the first hydrogeological assessment, EBA (2009) approached the investigation based upon the following provision, as allowed by Yukon Environment for the assessment at the time:

> *When drilling wells for the hydrogeological assessment, the proponent will be required to drill to a minimum of 7.5 m below ground surface or until groundwater is encountered, whichever comes first. Upon reaching 7.5 m without encountering groundwater, the proponent may choose to continue drilling or complete the well at this depth. If groundwater is not encountered, the hydrogeological assessment will not be able to determine the direction and rate of groundwater flow, nor the travel times for potential contaminant pathways. In this case, the hydrogeological assessment should calculate the estimated travel time of contaminants through the subsurface from the surface to the depth of well completion.*

Therefore, the maximum drilling depth for the hydrogeological assessment did not extend past 7.6 metres below ground (m bg). Bedrock was encountered in the boreholes drilled for wells ML-LTF-Well#1, #3, and #4 at depths of 7.56, 2.28, and 3.96 m bg; these wells were constructed with the screen intervals positioned just above the bedrock surface to intersect shallow perched groundwater where it exists within the surficial sand and gravel deposits.

The new guidelines for conducting a hydrogeological assessment for a LTF require the installation of a minimum of one upgradient and two downgradient monitoring wells completed within the regional groundwater table unless any potential pathway for contaminants originating from the LTF would be negligible in the opinion of a hydrogeologist. The purpose of this project was to install additional monitoring wells below the regional groundwater table to update the previously completed hydrogeological assessment (EBA 2009, 2010, and 2013) with additional site-specific data.

3.0 FIELD INVESTIGATIONS

3.1 Groundwater Monitoring Well Installation

Three groundwater monitoring wells were installed within bedrock at the site to assess the local groundwater regime and potential downgradient contamination sourced from the LTF. 14MW01 was targeted to characterize

up-gradient conditions and 14MW02 and 14MW03 were aimed to assess potential impacts to the groundwater quality downgradient of the LTF.

Locations of the monitoring wells were selected based on aerial photography, review of geological and topographical information, review of site history and a site inspection. A site plan showing the monitoring well locations and key site features is provided in Figure 1.

The drilling and monitoring well installations were completed by Midnight Sun Drilling (MSD) of Whitehorse, Yukon under the direction of Tetra Tech EBA from September 23 to 26, 2014. All boreholes were drilled using an air rotary drilling rig. Obvious permafrost was not encountered in any borehole during drilling.

Grab samples of the drill cuttings from the cyclone were collected at regular intervals to log the drill cuttings. The borehole logs indicating observed lithology and monitoring well completion details are included in Appendix B, with a summary of well completion details presented in Table 3-1.

The first borehole was drilled to a depth of 50 m and groundwater was not encountered. Authorization was granted from ABS to continue drilling to a depth of 61 m (200 ft). MDS reached the target depth by the end of the day on September 23, 2014. The well was airlifted for 10 minutes and no water returned to the surface. The drilling rods were removed to measure the depth to water. A small amount of water was encountered in the well at a depth of 62.6 m below the top of the casing. This water was thought to be sourced from the drilling process, as approximately 10 US gallons of water had been used during the drilling at the bedrock interface. The following morning, groundwater was encountered in the borehole 49.56 m bg and slowly rising. The monitoring well 14MW01 was then installed with a 12.2 m screened section extending from 49.8 to 62.0 m bg. Completion details are found in Table 3-1 and on the well log in Appendix B.

After completing the installation of 14MW01, MSD began drilling the next borehole on September 24, 2014. Bedrock was encountered at 2.4 m bg (8 ft). Following the advancement of each length of drill rod (6.1 m), the drillers waited 10 to 15 minutes before airlifting to see if groundwater had accumulated within the borehole. Groundwater did not return to the surface during the airlifting. MDS drilled to a final depth of 43.58 m bg (143 ft). The borehole sat overnight with the drill rods inside. On the morning of September 25, 2014, the drill rods were pulled while noting any evidence of groundwater entering the borehole on the drill rods. There was no sign of groundwater entering on the drill rods, but groundwater was encountered at a depth of 38.26 m bg and rising, indicating that that the water-bearing fractures were likely encountered below a depth of 38.26 m bg, i.e., close to the bottom of the borehole. Monitoring well 14MW02A was then installed with a 12.2 m screened section extending from 31.2 to 43.4 m bg. A shallow nested well 14MW02B was completed at the bedrock interface with a 0.9 m screen extending from 1.6 to 2.5 m bg. Completion details are found in Table 3-1 and on the well log in Appendix B.

Following the installation of 14MW02, MDS began drilling the last borehole on September 25, 2014. Bedrock was encountered at 2.4 m bg (8 ft). Following the advancement of each length of drill rod (20 ft), the drillers waited 10 to 15 minutes before airlifting to see if groundwater had accumulated within the borehole. Groundwater did not return to the surface during the airlifting. MDS drilled to a final depth of 43.58 m bg (143 ft). The borehole sat overnight with the drill rods inside. On the morning of September 26, 2014, the drill rods were pulled while noting any evidence of groundwater entering on the drill rods. It was noted that groundwater had entered into the borehole at 21.3 m bg (70 ft), 24.4 m bg (80 ft) and 33.5 m bg (110 ft). The borehole was backfilled with bentonite chips to 33.5 m bg and monitoring well 14MW03A was installed with a 12.2 m screened section extending from 20.8 to 33.0 m bg to capture the shallowest observed water-bearing fracture. A shallow nested well 14MW03B was completed at the bedrock interface with a 1.5 m screen extending 2.4 m to 0.9 m bg. Completion details are found in Table 3-1 and on the well log in Appendix B.

The lithology encountered was similar at all three locations and consistent with the regional geology map. Each borehole profile generally consisted of sand and gravel underlain by granodiorite.

The monitoring well completion details are as follows:

- All wells were completed in bedrock;
- Monitoring wells were completed with 50 mm Schedule 40 PVC pipes and 0.010-slot well screens;
- A solid un-slotted PVC pipe was installed above the well screen to about 0.8 m above grade at all wells;
- A silica sand pack was placed in the annulus between the well screen and the borehole wall. The sand pack was extended from the base of the borehole to about 1 m above the well screen;
- Approximately 3 m of bentonite was placed in the annulus above the sand pack and hydrated. The annulus was then filled with grout to around 1.0 m bg;
- A surface seal consisting of 0.6 m of bentonite below 0.4 m of concrete was then installed to bring the borehole to ground level and limit surface water infiltration; and,
- Each well was capped with a PVC end-cap. All wells are protected and secured with a lockable steel protective casing.

Table 3-1: Well Construction Details

Well ID	Northing	Easting	Elevation Top of PVC (m asl)	Drilled Depth (m bg)	Aquifer Unit Monitored	Screened Interval (m bg)	Filter Pack Interval (m bg)
14MW01	6726082.20	494358.81	827.24	61.97	Grandiorite	49.8 – 62.0	47.5 – 62.5
14MW02A	6726139.65	494623.45	823.13	43.58	Grandiorite	31.2 – 43.4	43.6 – 28.9
14MW02B			823.07	2.48	Fine sand and gravel	1.6 – 2.5	2.5 – 1.4
13MW03A	6726289.05	494527.30	822.85	43.58	Granodiorite	20.8 – 33.0	19.8 – 33.5
14MW03B			822.87	2.36	Fine sand and gravel	0.9 – 2.4	2.4 – 0.6

3.2 Monitoring Well Surveying

Underhill Geomatics completed a survey of all the monitoring wells on site upon completion of the monitoring wells on September 29, 2014. The survey included a horizontal survey of the locations, as well as a vertical survey of the elevations of ground surface and top of the PVC casing at each well location. A site plan showing monitoring well locations and key site features is provided in Figure 1; the site plan has been compiled by Tetra Tech EBA using survey data and georeferenced background imagery.

3.3 Monitoring Well Development

Following the completion and installation of monitoring wells, Tetra Tech EBA field personnel developed each well that contained water using a Grundfos RediFlo 2 submersible pump and/or a Waterra non-return foot valve and surge block. All three monitoring wells recovered very slowly and had to be developed over a period of about one week. A minimum of three well volumes was removed from each well over the period of well development.

3.4 Groundwater Sampling

Following well development and at least one week after well installation, Tetra Tech EBA purged the wells dry on October 7, 2014 and upon recovery, collected groundwater samples on October 8, 2014 for submission to an accredited laboratory for analysis of the parameters required under the Permit:

- Petroleum Hydrocarbons including benzene, toluene, ethylbenzene, and xylenes (BTEX), styrene, methyl t-butyl ether (MTBE), volatile petroleum hydrocarbons (VPH), volatile hydrocarbons (VH), and extractable petroleum hydrocarbons (EPH); and
- Routine analysis including conductivity, pH, temperature and dissolved metals.

At the time of sample collection, field parameters were recorded including temperature, specific conductance, pH, and dissolved oxygen.

Sample containers and appropriate preservatives for each suite of tests were provided by the laboratory. Samples for dissolved metals analysis were field filtered using new, clean 0.45 µm filters and preserved with nitric acid. All samples were stored in coolers containing icepacks and delivered to ALS Environmental Group (ALS Environmental) in Whitehorse, Yukon under chain-of-custody and within appropriate holding times. ALS Environmental is certified by the Canadian Association for Laboratory Accreditation and is accredited as conforming to ISO/IEC 17025 for analysis.

3.5 In-Situ Hydraulic Rising Head Tests

Due to the very slow water level recovery, it was not possible to conduct a pumping test to infer the hydraulic properties of the granodiorite aquifer. Instead, hydraulic response tests were conducted on all three monitoring wells. In general, pumping tests yield the most reliable estimates of the aquifer hydraulic conductivity in the area of the monitoring well being tested and are more representative for a larger aquifer volume that the monitoring well is completed in compared to hydraulic response tests. Hydraulic response tests (also referred to as falling/rising head tests or slug tests) are only representative of the aquifer in the immediate vicinity of the well screen. Therefore, hydraulic response tests were conducted in all three monitoring wells to estimate the hydraulic conductivity of the bedrock aquifer at multiple locations throughout the LTF. Since all hydraulic response tests showed similar results, i.e., inferred hydraulic conductivities within about one order of magnitude (see Section 4.5), the observed hydraulic conductivities can be deemed representative of the bedrock aquifer in the area of the LTF.

The hydraulic response tests were conducted as rising head tests by quickly bailing water from the well to create a water level decrease of between 3.5 and 5 m. The recovery response in the wells was then monitored using a Solinst Levelogger®. The datalogger was deployed in each test well to automatically record the water level at a one minute interval. The pre-test water level and initial displacement was also confirmed with manual water level readings using a water level sounder.

3.6 Groundwater Level Monitoring

The static groundwater level in each monitoring well was measured following recovery of the water level after well development and purging. Because of the very slow recovery of the water level, dataloggers were installed in each well to record the water level recovery and confirm that all wells had fully recovered before the static water level was recorded. Figure 3-1 shows the water level recovery on the three monitoring wells following well development and sampling. The data show that wells 14MW02A and 14MW03A had fully recovered on October 29. The water level in 14MW01 was still slightly rising on October 29; however, the shape of the recovery curve indicates that the well had been recovered to probably within less than a metre of the static water level.

The observed static water level was then converted into the piezometric elevation at each monitoring well location to infer the groundwater flow direction. The observed piezometric elevations are summarized in Table 3-2.

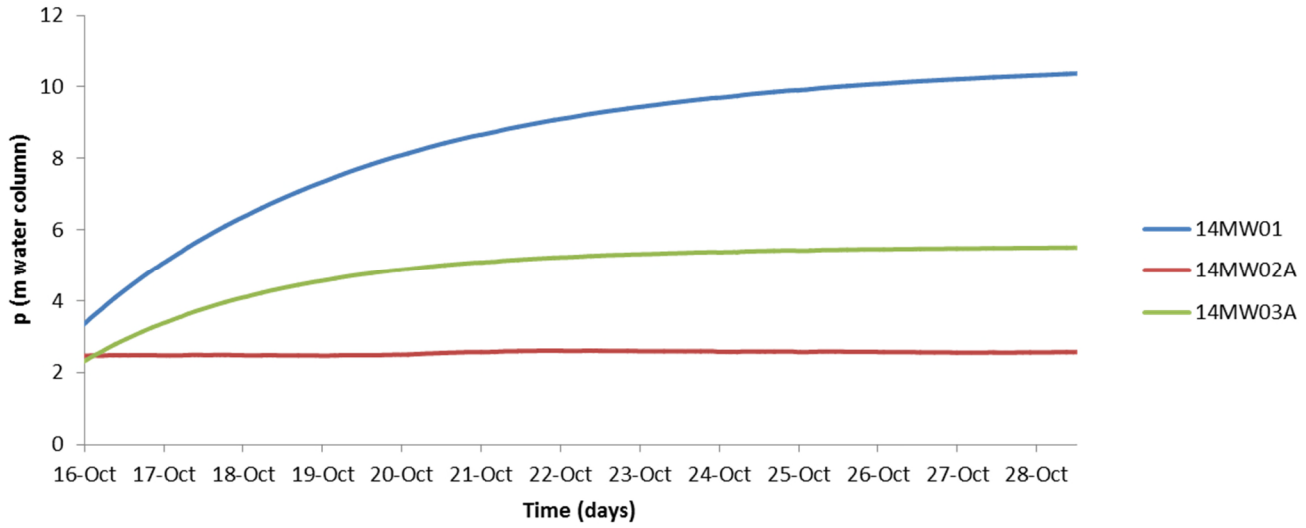

Figure 3-1: Water level recovery in the monitoring wells after well development and sampling

Table 3-2: Piezometric Elevations (m asl)

Date	14MW01	14MW02A	14MW03A
29-Oct 2014	821.52	816.16	817.61

3.7 Monitoring Well Decommissioning

As per YG's request, monitoring wells ML-LTF-Well#3 and ML-LTF-Well#4 were decommissioned on September 26, 2014 and October 17, 2014, respectively. ML-LTF-Well#4 was decommissioned by MSD under the direction of Tetra Tech EBA. ML-LFT-Well#3 was decommissioned by Tetra Tech EBA field staff.

Both monitoring wells were decommissioned in general accordance with Yukon CSR *Protocol 7 Groundwater Monitoring Well Installation, Sampling and Decommissioning*. The PVC standpipes from both monitoring wells were removed and the boreholes backfilled to surface with cement-bentonite grout.

Monitoring well ML-LTF-Well#3 was dry at the time of decommissioning and has always been dry during previous monitoring events. ML-LTF-Well#4 contained water and a sample was obtained prior to decommissioning the well. The sample was analyzed for the same suite of parameters as the three new wells and in accordance with Permit requirements.

4.0 RESULTS AND DISCUSSION

4.1 Groundwater Quality

Groundwater samples were collected from the three new monitoring wells 14MW01, 14MW02A, and 14MW03A, as well as well ML-LTF-Well#4 prior to its decommissioning. The list of analytes is in compliance with the requirements of the Permit. The analytical results are summarized in Table 1 (attached). Laboratory certificates are included in Appendix D.

4.2 Quality Control and Quality Assurance

This section describes the Quality Assurance and Quality Control (QA/QC) procedures undertaken to ensure sample integrity and representativeness and the reliability and accuracy of analysis results. Data validation is summarized in Table 3-2.

Table 3-2: Review of Monitoring Event QA/QC

QA/QC Aspect	Evidence and Evaluation
Data Representativeness	
Sample Integrity	All samples were collected in new sample bottles provided by the laboratory (ALS, Whitehorse). All preservatives were also provided by the laboratory. The samples were shipped on ice with a Chain of Custody immediately following the completion of the fieldwork. All samples were received by the laboratory within appropriate holding times.
Field Procedures	Monitoring wells were developed and sampled in accordance with applicable regulation and guidelines using dedicated Waterra tubing.
Calibration of Field Equipment	Calibration of field equipment was undertaken regularly during fieldwork. ▪ pH: two-point calibration with pH7 and pH10 calibration solutions ▪ Electrical conductivity: one-point calibration with a 1,413 µS/cm standard ▪ Dissolved Oxygen: one-point percent calibration based on local barometric pressure and elevation
Data Precision and Accuracy	

Table 3-2: Review of Monitoring Event QA/QC

QA/QC Aspect	Evidence and Evaluation
Duplicates	One blind duplicate sample was collected from 14MW01. All duplicate results showed relative percent difference (RPD) of less than 30% when compared to concentrations measured in the respective sample from the same monitoring well for all concentrations greater than five times the method detection limit. The RDP values for both duplicate samples collected are presented in Table 2.
Laboratory Internal QA/QC	Laboratory internal QA/QC is detailed within the laboratory reports (Appendix D). The laboratory showed acceptable testing frequency and results for method blanks, laboratory duplicates and matrix spikes.
Laboratory Detection Limit	Laboratory reports indicate that the method detection limits for the winter 2013 monitoring program were lower than the respective assessment criteria for all parameters.
Completeness of Test Program	The scope of work undertaken was generally consistent with the requirements of the LTF Permit 24-002.
Validity of Data Set	The data quality review indicates no significant systematic errors in the data collection or analysis process for groundwater and therefore, the data set used as the basis for the groundwater assessment is considered valid and complete.

4.3 Applicable Groundwater Quality Standards

The Yukon Contaminated Site Regulation (CSR) provides standards for the assessment and remediation of contaminated sites in Yukon. Receptor categories include the following water uses: Drinking Water (DW), Aquatic Life (AW), Irrigation (IW), and Livestock (LW) – as defined by the CSR. Table 4-1 summarizes receptors applicable to the Site according to Yukon CSR Protocol No. 6: *Application of Water Quality Standards*.

Table 4-1: Summary of Applicable Receptors

Receptor	Criteria for Applicability	Applicable to Site	Name and Location of Receptor
Aquatic Life	1 km radius (groundwater travel time of less than or equal to 50 years) of the nearest surface water potentially containing aquatic life.	**Applicable**	Several surface water bodies within a 1 km radius of the LTF
Drinking Water	1.5 km radius (groundwater travel time of less than or equal to 100 years) of the closest existing or probable future drinking water source.	**Applicable**	Potential existence of current or future domestic water wells at residence to the north and east of the LTF
Irrigation	1.5 km radius (groundwater travel time of less than or equal to 100 years) of the closest surface water body used for an irrigation water source.	Not Applicable	-
Livestock	1.5 km radius (groundwater travel time of less than or equal to 100 years) of the closest surface water body used as a source for drinking water for livestock.	Not Applicable	-

4.4 Comparison of Groundwater Quality with Applicable Regulatory Water Quality Standards

Table 1 (attached) summarizes the analytical results from the three new monitoring wells completed with the regional bedrock aquifer, as well as monitoring well ML-LTF-Well#4 prior to decommissioning. A comparison of the analytical results with the applicable CSR AW and DW standards shows that all parameters analyzed had concentrations below the CSR standards at the time of sample collection, except for an exceedance of the CSR DW standard for manganese and for benzo(a)pyrene of 0.01 µg/L in sample 14MW02A. The observed benzo(a)pyrene concentration in this sample was 0.057 µg/L and therefore exceeded the CSR DW standard concentration about five times. The same sample also showed a detectable concentration of benzo(b)fluoranthene (0.065 µg/L). There is no CSR standard for benzo(b)fluoranthene.

The duplicate sample collected from the upgradient well 14MW01 showed a detectable concentration of HEPH slightly above the laboratory detection limit. However, the original sample collected from the same well did not show any detectable hydrocarbons. Well 14MW01 is located hydraulically upgradient of the LTF and it is therefore unlikely that there is any impact on groundwater quality from the LTF at this location.

The source of the detected hydrocarbons in monitoring wells 14MW01 and 14MW02A is unknown. Since both samples were collected relatively soon after the installation of the monitoring wells, it is possible that the observed hydrocarbons are related to the drilling of the monitoring wells. Drill rod grease or traces of other hydrocarbons on the drilling equipment may be a possible source of the detected hydrocarbons and are sometimes found in well water samples shortly after the installation of a new monitoring well. We therefore collected samples from the groundwater shortly after the start of well development and retained these samples for future analysis in the case of the detection of hydrocarbons in the water samples. The two samples collected at the beginning of well development for the two wells with detectable hydrocarbons were also analyzed for the same suite of hydrocarbon parameters (DEV-14MW01 and DEV-14MW02A; Table 1). Sample DEV-14MW01 contained no hydrocarbons above the laboratory detection limit. Sample DEV-14MW02A contained HEPH at a concentration of 430 µg/L, indicating that these hydrocarbons may be related to contamination by drilling equipment.

In summary, the sample results are inconclusive and the source of the detected hydrocarbons remains unknown. The drilling equipment used for the installation of the monitoring wells represents a potential source of the detected hydrocarbons; however, the currently available data do not clearly support or reject this hypothesis. Additional monitoring and sampling will be required to confirm the presence or absence of hydrocarbons and assess potential sources if applicable.

The groundwater samples from all three monitoring wells 14MW01, 14MW02A, and MW1403A also exceeded the CSR DW standard by about 10 times. However, exceedances of the manganese standard are common and usually related to naturally occurring manganese and reducing chemical conditions in the aquifer. The manganese standard is an aesthetic objective and was established to protect against taste and odour. There is therefore no health or environmental concern related to the exceedance of the manganese CSR DW standard.

4.5 Hydraulic Response Test Results

The hydraulic response test data were interpreted using the Bouwer & Rice (1976) method to infer the bulk hydraulic conductivity. The Bouwer & Rice method is implemented in AquiferTest Pro v. 2014 which was used for the data analysis. The hydraulic response test data and detailed analysis are included in Appendix C. Table 4-2 summarizes the inferred hydraulic conductivities from the slug tests conducted in wells 14MW01, 14MW02A, and 14MW03A.

Table 4-2: Inferred Bedrock Hydraulic Conductivities

Well ID	Inferred Hydraulic Conductivity (m/s)
14MW01	5×10^{-10}
14MW02A	3×10^{-9}
14MW03A	2×10^{-9}
Geometric Mean	**1×10^{-9}**

The results of the hydraulic response tests indicate that the hydraulic conductivity of the bedrock aquifer consisting of granodiorite is very low, which is in agreement with the observed very slow recovery of the well water levels. The geometric mean of the hydraulic conductivities inferred from the slug tests conducted in the three new wells is about 1×10^{-9} m/s. Based on the spatial distribution of the three wells across the southern, eastern and northern perimeter of the LTF and the consistent results from all three monitoring wells, we deem the inferred mean hydraulic conductivity to be representative of the bedrock aquifer underlying the LTF. The hydraulic conductivity of 1×10^{-9} m/s is also in agreement with typical textbook values for slightly fractured granitic bedrock (e.g., Domenico and Schwartz, 1998).

5.0 CONCEPTUAL HYDROGEOLOGICAL MODEL

5.1 Climate

The Whitehorse area has a daily average temperature of -0.1 °C on a yearly basis, with the highest daily average in July (14.3°C), and lowest daily average occurring in January (-15.2°C). The area receives an average of 262.3 mm of precipitation annually, with the greatest amount of precipitation recorded through the summer and early fall. In a semi-arid climate such as Whitehorse, most groundwater recharge happens during spring freshet when the snowpack melts and there is a surplus of precipitation (i.e., when precipitation exceeds evapotranspiration). For most of the rest of the year evapotranspiration exceeds precipitation and hence there is little to no groundwater recharge.

5.2 Geological Framework

The LTF is located on a topographical high, with elevations ranging from approximately 818 m asl near the northern end of the site to slightly more than 829 m at the highest point on site. The terrain slopes steeply generally toward the northwest, north, and northeast from the referenced high point. The geology at the LTF is comprised of unconsolidated overburden deposits (glacial deposits) consisting primarily of silt, sand, and gravel, overlying intrusive granitic bedrock.

Cross section A-A' shown on Figure 3 illustrates the distribution of overburden beneath the LTF site. Subsurface conditions consist of 0 to more than 7.5 m of silt, sand and gravel overlying bedrock. At ML-LTF-Well#2 where bedrock was not encountered, we expect it to be at about 10 m depth (based on cross section interpretation). The bedrock underlying the shallow overburden deposits consist of granodiorite to unknown depths.

5.3 Hydrostratigraphy

The local groundwater regime in the area of the LTF consists of a shallow overburden and deep bedrock aquifer. However, based on information from the old monitoring wells on site installed in 2008 and additional information

collected from the new monitoring wells completed in overburden (14MW02B and 14MW03B), the shallow overburden aquifer consists of local lenses of perched groundwater just above the bedrock contact. Based on the fact that most shallow monitoring wells have been dry or only occasionally contained water, it is very likely that the shallow perched groundwater lenses are isolated and not interconnected to form a continuous (seasonal) groundwater system in overburden at the LTF.

The deeper bedrock aquifer consists of granodiorite with a very low hydraulic conductivity that was estimated to be about 1×10^{-9} m/s. The low hydraulic conductivity suggests that the granodiorite is poorly fractured and/or that fractures have a very low permeability. Observations during the drilling of the monitoring wells and measurements of the piezometric elevations indicate that the bedrock aquifer is confined with a hydraulic head of about 5 to 7 m below ground surface. However, water bearing fractures were only encountered near the bottom of the monitoring wells, i.e., at depth below 50 m bg (14MW01), below 39 m bg (14MW02A), and at about 21 m bg (14MW03A) as described in Section 3.1.

5.4 Regional Groundwater Flow Direction and Hydraulic Gradient.

The measured piezometric elevations in the monitoring wells on October 29, 2014 were used to infer the groundwater flow direction within the bedrock aquifer. Figure 1 shows the inferred piezometric contours indicating a groundwater flow direction toward the east with a hydraulic gradient of about 0.02 m/m.

Groundwater flow within the perched overburden aquifer, where it exists, is likely limited and follows the local topography and overburden/bedrock interface. However, based on the observation that most monitoring wells completed within the overburden have mostly been dry, it is likely that perched groundwater in the overburden predominantly occurs in isolated lenses with limited horizontal flow.

5.5 Receiving Environments

Tetra Tech EBA (2009) had previously identified water bodies located at 750, 1000, and 1050 m away from the site as down-gradient receptors. Core6 (2013) questioned this analysis and identified a creek about 150 m to the west of the site as a potential receiving environment.

Additional review of topographic maps, aerial imagery, and ground truthing of the locations of surface water bodies in the area was conducted by Tetra Tech EBA. The closest distance to a surface water body is about 400 m to McIntyre Creek and a wetland southwest of the site (see Figure 2). We believe that this is the same creek that Core6 (2013) were referring to. However, based on an easterly groundwater flow direction within the bedrock aquifer, McIntyre Creek and the wetlands to the southwest of the LTF would be located upgradient of the site and would therefore not be considered a receiving environment.

The nearest downgradient surface water receptors (wetland and ponds) were identified at a distance of about 700 m to the east-northeast of the edge of the expansion area of the LTF (Figure 2).

5.6 Estimated Groundwater Flow Velocity and Travel Time to Receiving Environments

The groundwater flow velocity can be estimated using Darcy's Law:

$$v = K \cdot i \cdot \theta^{-1}$$

Where:

v – average linear groundwater flow velocity

K – hydraulic conductivity

i – hydraulic gradient

θ – effective porosity

The effective porosity of the granodiorite was assumed to be 0.0005% which is a typical value for granite (Domenico and Schwartz, 1998). Based on the inferred mean hydraulic conductivity of 1×10^{-9} m/s and the hydraulic gradient of 0.02, the average linear groundwater flow velocity is in the order of 0.35 m/day (126 m/year).

The closest downgradient surface water bodies are located about 700 m to the east of the LTF. Based on the average linear groundwater flow velocity estimated above, the horizontal groundwater travel time to this surface water body would be about 5.5 years. It has to be noted that this travel time estimate only accounts for horizontal flow within the bedrock aquifer but does not take into account the vertical travel time from surface to the saturated zone.

It should be further noted that the analysis of groundwater flow direction and velocity is based on a continuum approach, i.e., on the assumption that the bedrock aquifer acts like a porous medium on a large scale. It has been shown that in many cases the continuum approach including Darcy's Law can be applied to fracture flow systems (e.g., Freeze and Cheery, 1979). Typically, the representative elementary volume is considerably larger for fractured media than for porous media. In this case, the relevant spatial scale, i.e., the distance between the LTF and potential nearby receptors is in the order of several hundred metres to one kilometre. Given the relatively large spatial scale, it is likely that the continuum approach is valid to describe groundwater flow in the fractured bedrock aquifer in the area of the LTF. However, it should be pointed out that the continuum approach has limitations which may result in differences in inferred and actual groundwater flow direction and an overly conservative, i.e., low estimate of groundwater flow velocity.

6.0 POTENTIAL FOR WATER CONTAMINATION AND TRANSPORT MECHANISMS

Based on the conceptual hydrogeological model and hydrostratigraphy presented in the previous section, Tetra Tech EBA assessed potential pathways for contaminants originating from the LTF.

Core6 (2013) suggested that shallow perched groundwater in the overburden may represent a potential pathway for contaminants in addition to the regional bedrock aquifer. However, based on site observations, shallow groundwater within the overburden sediments appears to only exist in isolated lenses that are perched on top of the low permeability bedrock interface. Well ML-LTF-Well#2 is the only shallow monitoring well which has consistently contained groundwater. All other shallow monitoring wells including the newly installed wells 14MW02B and 14MW03B have mostly been dry. It is therefore unlikely that a continuous pathway for contaminants exists within overburden in the area of the LTF.

The regional bedrock aquifer has previously been identified as a potential pathway for contaminants originating from the LTF (EBA 2009, 2010, 2013). As discussed above, the estimated horizontal travel time to the nearest downgradient receiving environment is in the order of about 5.5 years. However, by applying retardation factors to this estimate and accounting for the physical properties of the compacted liner (1 m thick), the thickness of unsaturated surficial deposits and unsaturated dense bedrock under the LTF, the actual travel times from the surface at the LTF to the nearest receptor would be considerably longer.

7.0 CONCLUSIONS

Based on the results of this study, Tetra Tech EBA draws the following conclusions:

- Three additional monitoring wells were successfully completed within the regional bedrock aquifer in the area of the LTF. Well 14MW01 was installed hydraulically upgradient of the LTF, whereas monitoring wells 14MW02A and 14MW03A are located hydraulically downgradient of the LTF.
- The downgradient wells were installed as nested wells with a shallow well completed within the overburden immediately above the bedrock contact. Both shallow wells 14MW02B and 14MW03B have been dry since installation, indicating the absence of shallow groundwater within overburden at these locations at this time.
- Hydraulic response tests were conducted in all three deep monitoring wells and indicate a low bedrock hydraulic conductivity of about 1×10^{-9} m/s.
- The conceptual hydrogeological model presented in previous reports (EBA 2009, 2010, and 2013) did not change significantly based on the new findings; however, the new monitoring wells add significant site-specific data to support the conceptual hydrogeological model.
- Groundwater in overburden seems to be unlikely to present a potential pathway for contaminants originating from the LTF due to its occurrence in isolated lenses that are perched on top of the low permeability bedrock. Ongoing monitoring of the shallow monitoring wells completed in overburden is required to confirm the absence of a continuous shallow perched groundwater system to conclusively dismiss shallow groundwater as a potential contaminants pathway.
- The deeper bedrock aquifer consisting of fractured granodiorite remains the most probable pathway for contaminants originating from the LTF. The horizontal travel time to the nearest surface water receptor was estimated at about 5.5 years not accounting for retardation and vertical transport through the compacted low permeability silt liner, overburden sediments and unsaturated bedrock. The low bedrock hydraulic conductivity and confined nature of the bedrock aquifer provide considerable protection to the downgradient receptors.
- The benzo(a)pyrene concentration measured in the sample collect from monitoring well 14MW02A exceeded the CSR DW standard. Another sample collected from the same well shortly after the well drilling and during the well development contained HEPH in measurable concentrations but below the CSR DW standard. The benzo(a)pyrene concentration in this sample was below the laboratory detection limit.
- The duplicate sample taken from the upgradient monitoring well 14MW01 also contained HEPH at a concentration slightly above the laboratory detection limit but below CSR AW and DW standards.
- The low concentrations of hydrocarbons detected in two of the new monitoring wells (14MW01 and 14MW02A) may be sourced from drilling equipment during the installation of the wells. However, the currently available data are inconclusive and the source remains unknown.

8.0 RECOMMENDATIONS

Based on the results of this study and the conclusions presented above, we make the following recommendations:

- The new monitoring wells along with the existing well ML-LTF-Well#2 should be resampled within the next four weeks to confirm presence or absence of hydrocarbons. Especially the exceedance of the CSR DW standard for benzo(a)pyrene in monitoring well 14MW02A should be verified and further assessment initiated if the exceedance persists.
- In accordance with permit requirements, piezometric elevations should be measured on a quarterly basis to assess seasonal changes and determine the appropriate time for the annual compliance monitoring during high water levels.
- The ongoing groundwater monitoring as required by the LTF permit should also include all existing monitoring wells that are completed within overburden and have mostly been dry to confirm the absence of a continuous shallow perched groundwater system.
- The groundwater flow direction should be confirmed based on seasonal changes in piezometric elevations to confirm that monitoring well 14MW01 is located hydraulically upgradient of the LTF and wells 14MW02A and 14MW03A are located downgradient of the LTF.

9.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech EBA Inc.

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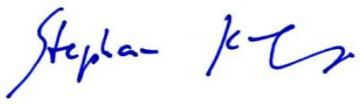

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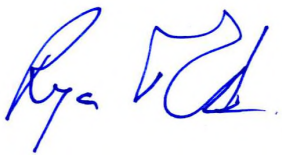

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TABLES

Table 1: Groundwater Analytical Results

Parameter	Unit	Yukon CSR AW Standard[1]	Yukon CSR DW Standard[1]	ML-LTF-WELL#4	14MW01	14MW02A	14MW03A	DEV-14MW01	DEV-14MW02A
				26-Sep-14	8-Oct-14	8-Oct-14	8-Oct-14	30-SEP-14	02-OCT-14
Physical Parameters									
pH	pH_Units	NS	NS	7.53	7.74	7.01	7.51	-	-
Electrical Conductivity (EC)	uS/cm	NS	NS	633	814	610	734	-	-
Hardness as $CaCO_3$	µg/L	NS	NS	373,000	409,000	275,000	291,000	-	-
Total Dissolved Solids (TDS)	µg/L	NS	NS	-	526,000	328,000	484,000	-	-
Alkalinity (Bicarbonate as $CaCO_3$)	µg/L	NS	NS	-	332,000	124,000	199,000	-	-
Alkalinity (Carbonate as $CaCO_3$)	µg/L	NS	NS	-	<1000	<1000	<1000	-	-
Alkalinity (Hydroxide as $CaCO_3$)	µg/L	NS	NS	-	<1000	<1000	<1000	-	-
Alkalinity (Total as $CaCO_3$)	µg/L	NS	NS	-	332,000	124,000	199,000	-	-
Chloride (Cl)	µg/L	NS	250,000	3,040	29,300	5,770	5,800	-	-
Fluoride (F)	µg/L	2000-3000[2]	2000-3000[2]	-	249	220	266	-	-
Sulphate (SO_4)	µg/L	1,000,000	1,000,000	-	66,100	185,000	186,000	-	-
Nitrate (as N)	µg/L	400,000	10,000	3,260	54	414	1,430	-	-
Nitrite (as N)	µg/L	200-2000[3]	10,000	1.4	7.8	12.6	2.7	-	-
Dissolved Metals									
Aluminium	µg/L	NS	200	<10	<10	<10	<10	-	-
Antimony	µg/L	200	6	<0.50	<0.50	<0.50	<0.50	-	-
Arsenic	µg/L	50	25	<1.0	<1.0	<1.0	<1.0	-	-
Barium	µg/L	10,000	1000	143	60	44	43	-	-
Beryllium	µg/L	53	NS	<5.0	<5.0	<5.0	<5.0	-	-
Boron	µg/L	50,000	5000	<100	<100	<100	<100	-	-
Cadmium	µg/L	0.1-0.6[2]	5	<0.050	0.081	0.063	0.082	-	-
Calcium	µg/L	NS	NS	127,000	111,000	79,600	87,500	-	-
Chromium	µg/L	10, 90[4]	50	0.79	<0.50	<0.50	<0.50	-	-
Cobalt	µg/L	9	NS	<0.50	2.25	1.65	2.01	-	-
Copper	µg/L	20-90[2]	1000	1.1	2.1	2.9	3.1	-	-
Iron	µg/L	NS	300	<30	<30	<30	<30	-	-
Lead	µg/L	40-160[2]	10	<1.0	<1.0	<1.0	<1.0	-	-
Lithium	µg/L	NS	NS	<50	<50	<50	<50	-	-
Magnesium	µg/L	NS	100,000	13,700	32,000	18,400	17,500	-	-
Manganese	µg/L	NS	50	<10	**700**	**466**	**645**	-	-
Mercury	µg/L	1	1	<0.20	<0.20	<0.20	<0.20	-	-
Molybdenum	µg/L	10,000	250	1.2	3	2.7	2	-	-
Nickel	µg/L	250-1500[2]	NS	<5.0	10.4	8.1	11.3	-	-
Selenium	µg/L	10	10	<1.0	<1.0	<1.0	<1.0	-	-
Silver	µg/L	0.5, 15[2]	NS	<0.050	<0.050	<0.050	<0.050	-	-
Sodium	µg/L	NS	200,000	5,700	26,500	11,900	24,100	-	-
Thallium	µg/L	3	NS	<0.20	<0.20	<0.20	<0.20	-	-
Titanium	µg/L	1000	NS	<50	<50	<50	<50	-	-
Uranium	µg/L	3000	100	1.22	9.71	11.4	4.37	-	-
Vanadium	µg/L	NS	NS	<30	<30	<30	<30	-	-
Zinc	µg/L	75-2400[2]	5000	<5.0	21	<5.0	<5.0	-	-
Polycyclic Aromatic Hydrocarbons (PAHs)									
Acenaphthene	µg/L	60	NS	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Acenaphthylene	µg/L	NS	NS	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Acridine	µg/L	0.5	NS	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Anthracene	µg/L	1	NS	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benz(a)anthracene	µg/L	1	NS	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(a) pyrene	µg/L	0.1	0.01	<0.010	<0.010	**0.057**	<0.010	<0.010	<0.010
Benzo(b)fluoranthene	µg/L	NS	NS	<0.050	<0.050	0.065	<0.050	<0.050	<0.050
Benzo(g,h,i)perylene	µg/L	NS	NS	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(k)fluoranthene	µg/L	NS	NS	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chrysene	µg/L	NS	NS	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Dibenz(a,h)anthracene	µg/L	NS	NS	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Fluoranthene	µg/L	2	NS	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Fluorene	µg/L	120	NS	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Indeno(1,2,3-c,d)pyrene	µg/L	NS	NS	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Naphthalene	µg/L	10	NS	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Phenanthrene	µg/L	3	NS	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Pyrene	µg/L	0.2	NS	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Quinoline	µg/L	34	NS	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Volatile Organic Compounds (VOCs)									
Benzene	µg/L	4000	5	<0.50	<0.50	<0.50	<0.50	-	-
Toluene	µg/L	390	24	<0.50	<0.50	<0.50	<0.50	-	-
Ethylbenzene	µg/L	2000	2.4	<0.50	<0.50	<0.50	<0.50	-	-
Xylene (m & p)	µg/L	NS	NS	<0.50	<0.50	<0.50	<0.50	-	-
Xylene (o)	µg/L	NS	NS	<0.50	<0.50	<0.50	<0.50	-	-
Xylene Total	µg/L	NS	300	<0.75	<0.75	<0.75	<0.75	-	-
Styrene	µg/L	720	NS	<0.50	<0.50	<0.50	<0.50	-	-
MTBE	µg/L	NS	NS	<0.50	<0.50	<0.50	<0.50	-	-
Hydrocarbons									
EPH C_{10}-C_{19}	µg/L	5000	5000	<250	<250	<250	<250	<250	<250
EPH C_{19}-C_{32}	µg/L	NS	NS	<250	<250	<250	<250	<250	430
LEPH	µg/L	500	NS	<250	<250	<250	<250	<250	<250
HEPH	µg/L	NS	NS	<250	<250	<250	<250	<250	430
Volatile Hydrocarbons (VH6-10)	µg/L	15,000	15,000	<100	<100	<100	<100	-	-
VPH C6-C10	µg/L	1500	NS	<100	<100	<100	<100	-	-
Laboratory Identification Number				L1524111	L1530485-1	L1530485-2	L1530485-3	L1527797-1	L1527797-2

Notes:

[1] Environment Act Contaminated Sites Regulation (CSR) (2002). Schedule 3 Generic Numerical Water Standards

2 Standard varies with water hardness

3 Standard varies with chloride concentration

4 Standard depends on speciation

BOLD - Exceeds CSR standard

Blank- Not analyzed

NS - No standard applies

Table 2: Groundwater Analytical QA/QC

Parameter	Unit	14MW01	DUP01	Relative Percent Difference (%)
		8-Oct-14	8-Oct-14	
Physical Parameters				
pH	pH_Units	7.74	7.69	0.6
Electrical Conductivity (EC)	uS/cm	814	788	3.2
Hardness as $CaCO_3$	µg/L	409,000	393,000	4.0
Total Dissolved Solids (TDS)	µg/L	526,000	524,000	0.4
Alkalinity (Bicarbonate as $CaCO_3$)	µg/L	332,000	329,000	0.9
Alkalinity (Carbonate as $CaCO_3$)	µg/L	<1000	<1000	-
Alkalinity (Hydroxide as $CaCO_3$)	µg/L	<1000	<1000	-
Alkalinity (Total as $CaCO_3$)	µg/L	332,000	329,000	0.9
Chloride (Cl)	µg/L	29,300	29,300	0.0
Fluoride (F)	µg/L	249	250	0.4
Sulphate (SO_4)	µg/L	66,100	66,200	0.2
Nitrate (as N)	µg/L	54	52	3.4
Nitrite (as N)	µg/L	7.8	8	2.5
Dissolved Metals				
Aluminium	µg/L	<10	<10	-
Antimony	µg/L	<0.50	<0.50	-
Arsenic	µg/L	<1.0	<1.0	-
Barium	µg/L	60	58	3.4
Beryllium	µg/L	<5.0	<5.0	-
Boron	µg/L	<100	<100	-
Cadmium	µg/L	0.081	0.078	3.8
Calcium	µg/L	111,000	107,000	3.7
Chromium	µg/L	<0.50	<0.50	-
Cobalt	µg/L	2.25	2.2	2.2
Copper	µg/L	2.1	2.1	0.0
Iron	µg/L	<30	<30	-
Lead	µg/L	<1.0	<1.0	-
Lithium	µg/L	<50	<50	-
Magnesium	µg/L	32,000	30,600	4.5
Manganese	µg/L	700	666	5.0
Mercury	µg/L	<0.20	<0.20	-
Molybdenum	µg/L	3	3.1	3.3
Nickel	µg/L	10.4	10.1	2.9
Selenium	µg/L	<1.0	<1.0	-
Silver	µg/L	<0.050	<0.050	-
Sodium	µg/L	26,500	26,600	0.4
Thallium	µg/L	<0.20	<0.20	-
Titanium	µg/L	<50	<50	-
Uranium	µg/L	9.71	9.81	1.0
Vanadium	µg/L	<30	<30	-
Zinc	µg/L	21	19.6	6.9
Polycyclic Aromatic Hydrocarbons (PAHs)				
Acenaphthene	µg/L	<0.050	<0.050	-
Acenaphthylene	µg/L	<0.050	<0.050	-
Acridine	µg/L	<0.050	<0.050	-
Anthracene	µg/L	<0.050	<0.050	-
Benz(a)anthracene	µg/L	<0.050	<0.050	-
Benzo(a) pyrene	µg/L	<0.010	<0.010	-
Benzo(b)fluoranthene	µg/L	<0.050	<0.050	-
Benzo(g,h,i)perylene	µg/L	<0.050	<0.050	-
Benzo(k)fluoranthene	µg/L	<0.050	<0.050	-
Chrysene	µg/L	<0.050	<0.050	-
Dibenz(a,h)anthracene	µg/L	<0.050	<0.050	-
Fluoranthene	µg/L	<0.050	<0.050	-
Fluorene	µg/L	<0.050	<0.050	-
Indeno(1,2,3-c,d)pyrene	µg/L	<0.050	<0.050	-
Naphthalene	µg/L	<0.050	<0.050	-
Phenanthrene	µg/L	<0.050	<0.050	-
Pyrene	µg/L	<0.050	<0.050	-
Quinoline	µg/L	<0.050	<0.050	-
Volatile Organic Compounds (VOCs)				
Benzene	µg/L	<0.50	<0.50	-
Toluene	µg/L	<0.50	<0.50	-
Ethylbenzene	µg/L	<0.50	<0.50	-
Xylene (m & p)	µg/L	<0.50	<0.50	-
Xylene (o)	µg/L	<0.50	<0.50	-
Xylene Total	µg/L	<0.75	<0.75	-
Styrene	µg/L	<0.50	<0.50	-
MTBE	µg/L	<0.50	<0.50	-
Hydrocarbons				
EPH C_{10}-C_{19}	µg/L	<250	<250	-
EPH C_{19}-C_{32}	µg/L	<250	270	-
LEPH	µg/L	<250	<250	-
HEPH	µg/L	<250	270	-
Volatile Hydrocarbons (VH6-10)	µg/L	<100	<100	-
VPH C6-C10	µg/L	<100	<100	-
Laboratory Identification Number		L1530485-1	L1530485-4	

FIGURES

LEGEND

- EXISTING MONITORING WELL LOCATION (SHOWN WHITE)
- NEW MONITORING WELL LOCATIONS
- APPROXIMATE EXTENTS OF LTF
- PIEZOMETRIC CONTOURS (OCTOBER 29, 2014)

0 50m

Scale: 1:1,250 @ 11"x17"

CLIENT

ARCTIC BACKHOE SERVICES LTD.

ABS HYDROGEOLOGICAL AND ENGINEERING SERVICES
McLEAN LAKE LTF - WHITEHORSE, YUKON

MONITORING WELL LOCATIONS
AND PIEZOMETRIC CONTOURS

TETRA TECH EBA

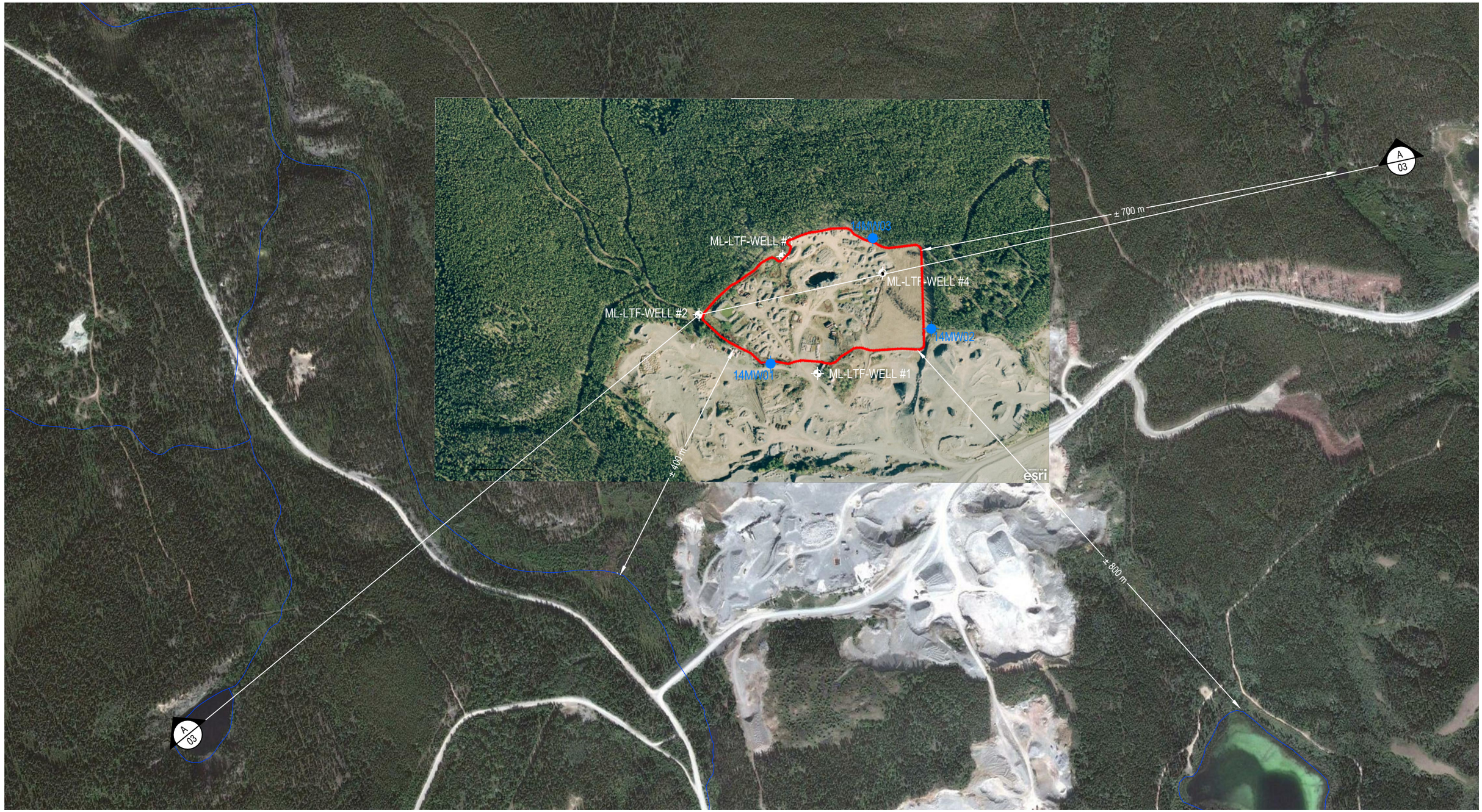
PROJECT NO.	DWN	CKD	REV
ENVSWM03344-02	CB	SK	0

OFFICE: EBA-WHSE

DATE: November 5, 2014

Figure 1

Q:\Whitehorse\Data\0201drawings\Whitehorse\ENV-SWM\ENVSWM03344-01 McLean Lake LTF ABS Hydrogeo\02\ENVSWM03344-02 Fig1_R0.dwg [FIGURE 1] November 07, 2014 - 12:08:53 pm (BY: BUCHAN, CAMERON)



0 250 m

Scale: 1: 6000 @ 11"x17"

CLIENT

ARCTIC BACKHOE SERVICES LTD.

ABS HYDROGEOLOGICAL AND ENGINEERING SERVICES
McLEAN LAKE LTF - WHITEHORSE, YUKON

SITE PLAN SHOWING ALIGNMENT LOCATION AND RECEIVING ENVIRONMENTS

TETRA TECH EBA

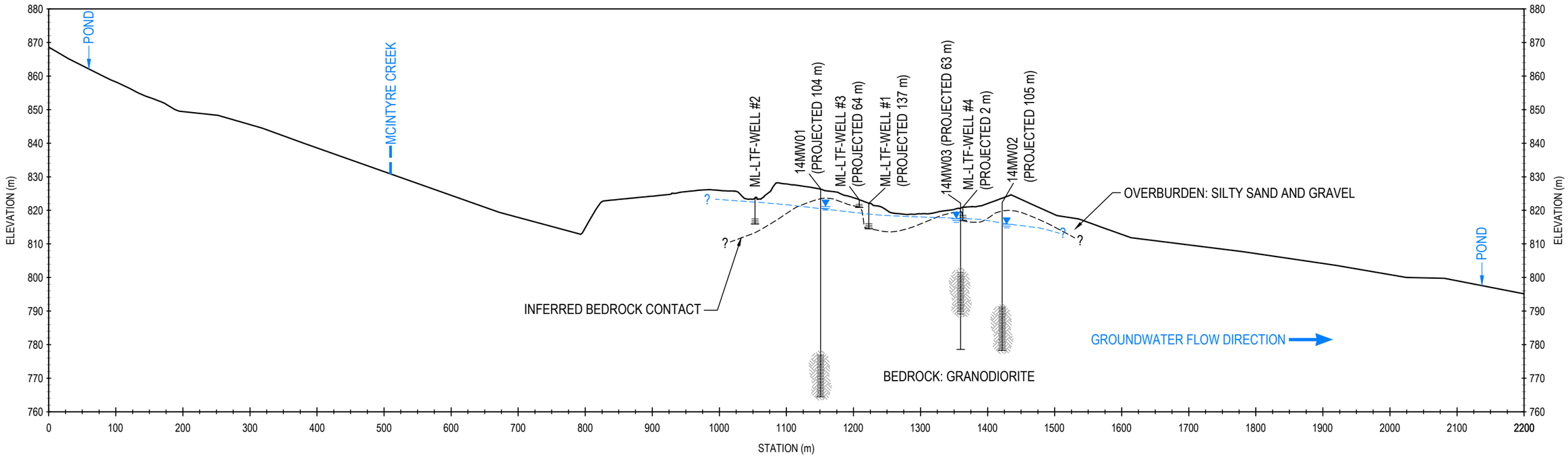
PROJECT NO.	DWN	CKD	REV
ENVSWM03344-02	CB	SK	0

OFFICE: EBA-WHSE

DATE: November 7, 2014

Figure 2

Q:\Whitehorse\Data\0201drawings\Whitehorse\ENV-SWM\ENVSWM03344-01 McLean Lake LTF ABS Hydrogeol\02\ENVSWM03344-02 Fig.2_R0.dwg [FIGURE 2] November 07, 2014 - 1:38:08 pm (BY: BUCHAN, CAMERON)



LEGEND

- PIEZOMETRIC ELEVATION
- WATER BEARING FRACTURES

0 250 m

Scale: 1: 6000 @ 11"x17"

HORIZONTAL SCALE

0 50m

Scale: 1:1,200 @ 11"x17"

VERTICAL SCALE

5x VERTICAL EXAGGERATION

CLIENT

ARCTIC BACKHOE SERVICES LTD.

ABS HYDROGEOLOGICAL AND ENGINEERING SERVICES
McLEAN LAKE LTF - WHITEHORSE, YUKON

CROSS-SECTION A - A'

TETRA TECH EBA

PROJECT NO.	DWN	CKD	REV
ENVSWM03344-02	CB	SK	0

OFFICE: EBA-WHSE

DATE: November 7, 2014

Figure 3

Q:\Whitehorse\Data\0201drawings\Whitehorse\ENV-SWM\ENVSWM03344-01 McLean Lake LTF ABS Hydrogeo\02\ENVSWM03344-02 Fig.2_R0.dwg [FIGURE 3] November 07, 2014 - 3:49:43 pm (BY: EARL, GARETH)

APPENDIX A
TETRA TECH'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEOENVIRONMENTAL REPORT

This report incorporates and is subject to these “General Conditions”.

1.0 USE OF REPORT AND OWNERSHIP

This report pertains to a specific site, a specific development, and a specific scope of work. It is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site or proposed development would necessitate a supplementary investigation and assessment.

This report and the assessments and recommendations contained in it are intended for the sole use of Tetra Tech EBA’s client. Tetra Tech EBA does not accept any responsibility for the accuracy of any of the data, the analysis or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than Tetra Tech EBA’s Client unless otherwise authorized in writing by Tetra Tech EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of Tetra Tech EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 ALTERNATE REPORT FORMAT

Where Tetra Tech EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed Tetra Tech EBA’s instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by Tetra Tech EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of Tetra Tech EBA’s instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except Tetra Tech EBA. The Client warrants that Tetra Tech EBA’s instruments of professional service will be used only and exactly as submitted by Tetra Tech EBA.

Electronic files submitted by Tetra Tech EBA have been prepared and submitted using specific software and hardware systems. Tetra Tech EBA makes no representation about the compatibility of these files with the Client’s current or future software and hardware systems.

3.0 NOTIFICATION OF AUTHORITIES

In certain instances, the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by Tetra Tech EBA in its reasonably exercised discretion.

4.0 INFORMATION PROVIDED TO TETRA TECH EBA BY OTHERS

During the performance of the work and the preparation of the report, Tetra Tech EBA may rely on information provided by persons other than the Client. While Tetra Tech EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, Tetra Tech EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

APPENDIX B
GROUNDWATER MONITORING WELL LOGS

ABS MONITORING WELL INSTALLATION	ARCTIC BACKHOE SERVICES	PROJECT NO. - BOREHOLE NO.
LEASE 105D11/6/810LTF	DRILL: AIR ROTARY	ENVSWM03344-02-14MW01
WHITEHORSE, YUKON	6726082.2N; 494358.81E; Zone 8	ELEVATION: 826.45 m

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	GROUND ICE DESCRIPTION AND COMMENTS	Elevation (m)
0	SAND - gravelly, some organics, medium grained, well graded, fine well rounded gravel, damp, loose, brown		Pipe stickup = 0.79 metres Elevation TOC - 827.24 metres	826.0
1				825.0
2	- less organics, less silt, some fine to coarse well graded grave, uniformly graded			824.0
3	- boulder - granodiorite			823.0
4	GRANODIORITE			822.0
5	Oct29/14			821.0 Oct29/14
6				820.0
7				819.0
8				818.0
9				817.0
10				816.0
11				815.0
12				814.0
13				813.0
14				812.0
15				811.0
16				810.0
17				809.0
18				808.0
19	- chloritic alterations			807.0
20				806.0
21				805.0
22				804.0
23				803.0
24				802.0
25				

BULK DENSITY (kg/m³) 1400 1600 1800 2000 | SPT (N) 20 40 60 80 | PLASTIC M.C. LIQUID 20 40 60 80 | CLAY (%) 20 40 60 80 | SILT (%) 20 40 60 80 | SAND (%) 20 40 60 80 | GRAVEL (%) 20 40 60 80

14MW01

TETRA TECH EBA

LOGGED BY: KR	COMPLETION DEPTH: 61.97m
REVIEWED BY: RM	COMPLETE: 14/09/23
DRAWING NO:	Page 1 of 3

ABS MONITORING WELL INSTALLATION	ARCTIC BACKHOE SERVICES	PROJECT NO. - BOREHOLE NO.
LEASE 105D11/6/810LTF	DRILL: AIR ROTARY	ENVSWM03344-02-14MW01
WHITEHORSE, YUKON	6726082.2N; 494358.81E; Zone 8	ELEVATION: 826.45 m

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	GROUND ICE DESCRIPTION AND COMMENTS	BULK DENSITY (kg/m³) 1400 1600 1800 2000 / SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	14MW01	Elevation (m)
25							801.0
26							800.0
27							799.0
28							798.0
29							797.0
30							796.0
31							795.0
32							794.0
33							793.0
34							792.0
35							791.0
36							790.0
37							789.0
38							788.0
39							787.0
40							786.0
41							785.0
42							784.0
43	- chloritic alterations						783.0
44							782.0
45							781.0
46							780.0
47							779.0
48							778.0
49							777.0
50							

TETRA TECH EBA

LOGGED BY: KR	COMPLETION DEPTH: 61.97m
REVIEWED BY: RM	COMPLETE: 14/09/23
DRAWING NO:	Page 2 of 3

ABS MONITORING WELL INSTALLATION	ARCTIC BACKHOE SERVICES	PROJECT NO. - BOREHOLE NO.
LEASE 105D11/6/810LTF	DRILL: AIR ROTARY	ENVSWM03344-02-14MW01
WHITEHORSE, YUKON	6726082.2N; 494358.81E; Zone 8	ELEVATION: 826.45 m

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	GROUND ICE DESCRIPTION AND COMMENTS	BULK DENSITY (kg/m³) 1400 1600 1800 2000 / SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	14MW01	Elevation (m)
50	- softer						776.0
51							775.0
52							774.0
53							773.0
54							772.0
55							771.0
56							770.0
57							769.0
58							768.0
59							767.0
60							766.0
61							765.0
62	END OF BOREHOLE (61.97 metres) water - 4.94 metres on October 29, 2014 Monitoring well instlaled to 61.87 metres						764.0
63							763.0
64							762.0
65							761.0
66							760.0
67							759.0
68							758.0
69							757.0
70							756.0
71							755.0
72							754.0
73							753.0
74							752.0
75							

TETRA TECH EBA

LOGGED BY: KR	COMPLETION DEPTH: 61.97m
REVIEWED BY: RM	COMPLETE: 14/09/23
DRAWING NO:	Page 3 of 3

ABS MONITORING WELL INSTALLATION	ARCTIC BACKHOE SERVICES	PROJECT NO. - BOREHOLE NO.
LEASE 105D11/6/810LTF	DRILL: AIR ROTARY	ENVSWM03344-02-14MW02
WHITEHORSE, YUKON	6726139.65N; 494623.45E; Zone 8	ELEVATION: 822.3 m

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	GROUND ICE DESCRIPTION AND COMMENTS	BULK DENSITY (kg/m³) 1400 1600 1800 2000 / SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	14MW02A / 14MW02B	Elevation (m)
0	GRAVEL AND SAND - fine to coarse gravel, well graded, organics, damp, rusty brown, woody debris		Pipe A stickup = 0.83 metres Pipe B stickup = 0.77 metres Elevation A TOC - 823.13 metres Elevation B TOC - 823.07 metres				822.0
1							821.0
2	SAND - gravelly, some silt, cobbles, fine grained, fine to coarse rounded gravel, dry to damp						820.0
3	GRANODIORITE						819.0
4							818.0
5							817.0
6 ▼ A							816.0
7							815.0
8							814.0
9							813.0
10							812.0
11							811.0
12							810.0
13							809.0
14							808.0
15							807.0
16							806.0
17							805.0
18							804.0
19							803.0
20							802.0
21							801.0
22							800.0
23							799.0
24							798.0
25							

TETRA TECH EBA

LOGGED BY: KR	COMPLETION DEPTH: 43.58m
REVIEWED BY: RM	COMPLETE: 14/09/23
DRAWING NO:	Page 1 of 2

ABS MONITORING WELL INSTALLATION	ARCTIC BACKHOE SERVICES	PROJECT NO. - BOREHOLE NO.
LEASE 105D11/6/810LTF	DRILL: AIR ROTARY	ENVSWM03344-02-14MW02
WHITEHORSE, YUKON	6726139.65N; 494623.45E; Zone 8	ELEVATION: 822.3 m

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	GROUND ICE DESCRIPTION AND COMMENTS	BULK DENSITY (kg/m³) 1400 1600 1800 2000 / SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	14MW02A	14MW02B	Elevation (m)
25								797.0
26								796.0
27								795.0
28								794.0
29								793.0
30								792.0
31								791.0
32								790.0
33								789.0
34								788.0
35								787.0
36								786.0
37								785.0
38								784.0
39								783.0
40								782.0
41								781.0
42								780.0
43								779.0
44	END OF BOREHOLE (43.58 metres) Monitoring well 14MW02A installed to 43.36 metres water - 6.14 metres on October 29, 2014 Monitoring well 14MW02B installed to 2.44 metres water - dry on October 29, 2014							778.0
45								777.0
46								776.0
47								775.0
48								774.0
49								773.0
50								

TETRA TECH EBA

LOGGED BY: KR	COMPLETION DEPTH: 43.58m
REVIEWED BY: RM	COMPLETE: 14/09/23
DRAWING NO:	Page 2 of 2

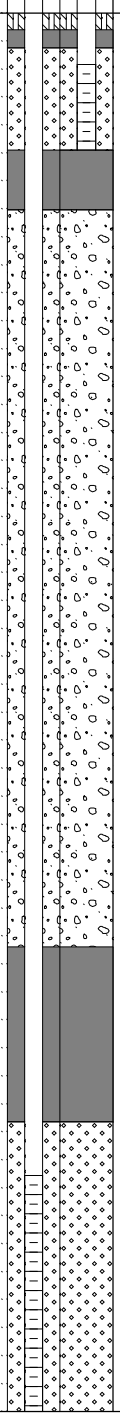
ABS MONITORING WELL INSTALLATION	ARCTIC BACKHOE SERVICES	PROJECT NO. - BOREHOLE NO.
LEASE 105D11/6/810LTF	DRILL: AIR ROTARY	ENVSWM03344-02-14MW03
WHITEHORSE, YUKON	6726289.05N; 494527.3E; Zone 8	ELEVATION: 822.15 m

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	GROUND ICE DESCRIPTION AND COMMENTS
0	SAND AND GRAVEL - fine grained sand, fine to coarse rounded to subrounded gravel, well graded, damp, rusty brown		Pipe A stickup = 0.70 metres Pipe B stickup = 0.72 metres Elevation A TOC - 822.85 metres Elevation B TOC - 822.87 metres
3	GRANODIORITE		

BULK DENSITY (kg/m³) 1400 1600 1800 2000 | SPT (N) 20 40 60 80 | PLASTIC M.C. LIQUID 20 40 60 80 | CLAY (%) 20 40 60 80 | SILT (%) 20 40 60 80 | SAND (%) 20 40 60 80 | GRAVEL (%) 20 40 60 80



Elevation (m): 822.0, 821.0, 820.0, 819.0, 818.0, 817.0, 816.0, 815.0, 814.0, 813.0, 812.0, 811.0, 810.0, 809.0, 808.0, 807.0, 806.0, 805.0, 804.0, 803.0, 802.0, 801.0, 800.0, 799.0, 798.0

TETRA TECH EBA

LOGGED BY: KR	COMPLETION DEPTH: 43.58m
REVIEWED BY: RM	COMPLETE: 14/09/23
DRAWING NO:	Page 1 of 2

ABS MONITORING WELL INSTALLATION	ARCTIC BACKHOE SERVICES	PROJECT NO. - BOREHOLE NO.
LEASE 105D11/6/810LTF	DRILL: AIR ROTARY	ENVSWM03344-02-14MW03
WHITEHORSE, YUKON	6726289.05N; 494527.3E; Zone 8	ELEVATION: 822.15 m

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	GROUND ICE DESCRIPTION AND COMMENTS	BULK DENSITY (kg/m³) 1400 1600 1800 2000 / SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	14MW03A	14MW03B	Elevation (m)
25								797.0
26								796.0
27								795.0
28								794.0
29								793.0
30								792.0
31								791.0
32								790.0
33								789.0
34								788.0
35								787.0
36								786.0
37	- chloritic alterations							785.0
38								784.0
39								783.0
40								782.0
41								781.0
42								780.0
43								779.0
44	END OF BOREHOLE (43.58 metres) Monitoring well 14MW03A installed to 32.97 metres water - 4.55 metres on October 29, 2014 Monitoring well 14MW03B installed to 2.44 metres water - dry on October 29, 2014							778.0
45								777.0
46								776.0
47								775.0
48								774.0
49								773.0
50								

TETRA TECH EBA

LOGGED BY: KR	COMPLETION DEPTH: 43.58m
REVIEWED BY: RM	COMPLETE: 14/09/23
DRAWING NO:	Page 2 of 2

APPENDIX C

HYDRAULIC RESPONSE TEST DATA AND ANALYSIS

TETRA TECH EBA

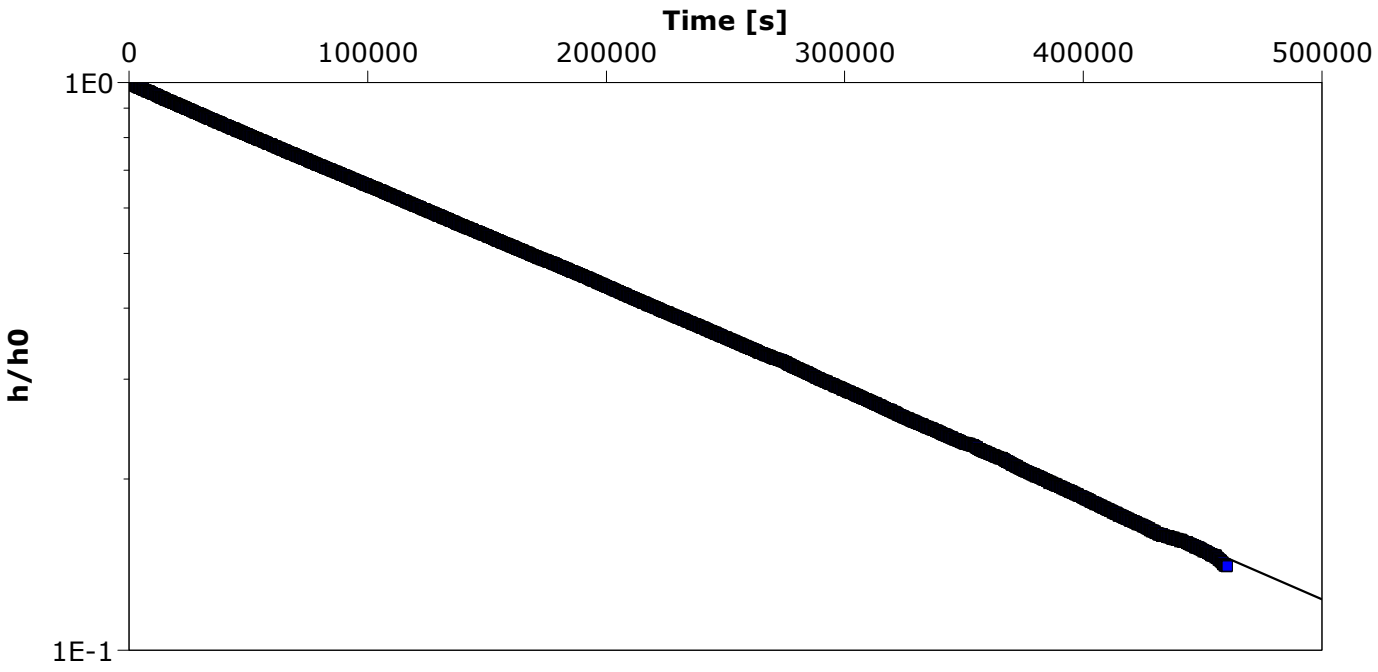
Slug Test Analysis Report

Project: Arctic Backhoe Monitoring Well Installation

Number: ENVSWM03344-02

Client: Arctic Backhoe Services Ltd.

Location: McLean Quarry	Slug Test: 14MW01_rising	Test Well: 14MW01
Test Conducted by: KR		Test Date: 10/29/2014
Analysis Performed by: SK	Bouwer & Rice	Analysis Date: 11/5/2014
Aquifer Thickness: 15.00 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
14MW01	4.61×10^{-10}	

TETRA TECH EBA

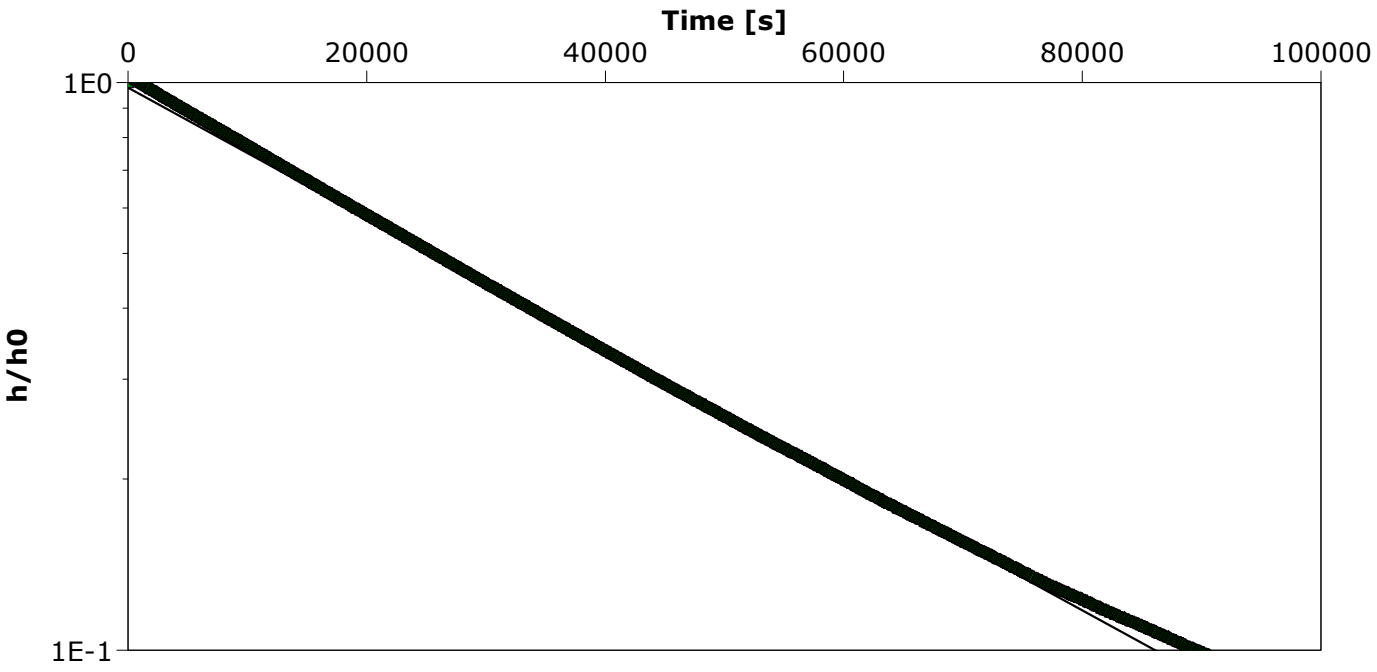
Slug Test Analysis Report

Project: Arctic Backhoe Monitoring Well Installation

Number: ENVSWM03344-02

Client: Arctic Backhoe Services Ltd.

Location: McLean Quarry	Slug Test: 14MW02A_rising	Test Well: 14MW02A
Test Conducted by: KR		Test Date: 10/29/2014
Analysis Performed by: SK	Bouwer & Rice	Analysis Date: 11/5/2014
Aquifer Thickness: 15.00 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
14MW02A	2.90×10^{-9}	

TETRA TECH EBA

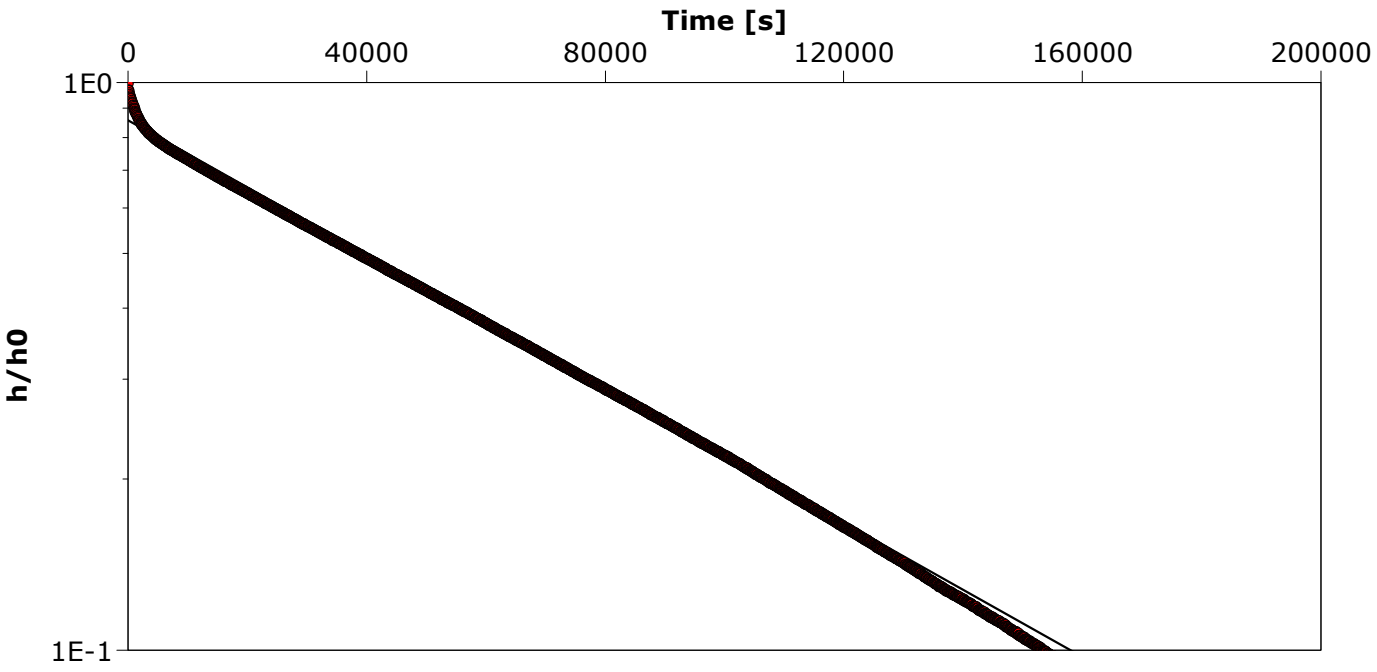
Slug Test Analysis Report

Project: Arctic Backhoe Monitoring Well Installation

Number: ENVSWM03344-02

Client: Arctic Backhoe Services Ltd.

Location: McLean Quarry	Slug Test: 14MW03A_rising	Test Well: 14MW03A
Test Conducted by: KR		Test Date: 10/29/2014
Analysis Performed by: SK	Bouwer & Rice	Analysis Date: 11/5/2014
Aquifer Thickness: 15.00 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
14MW03A	1.49×10^{-9}	

APPENDIX D
LABORATORY ANALYTICAL RESULTS

Tetra Tech EBA Inc.
ATTN: Gareth Earl
61 Wasson Place
Whitehorse YT Y1A 0H7

Date Received: 09-OCT-14
Report Date: 07-NOV-14 13:42 (MT)
Version: FINAL REV. 2

Client Phone: 867-668-3068

Certificate of Analysis

Lab Work Order #: L1530485

Project P.O. #: NOT SUBMITTED
Job Reference: ENVSM03344-02
C of C Numbers: 10-152931
Legal Site Desc:

Comments:

7-NOV-2014 Alkalinity, Conductivity, and pH data has been updated for L1530485-1.

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1530485-1	L1530485-2	L1530485-3	L1530485-4	
	Description	Water	Water	Water	Water	
	Sampled Date	08-OCT-14	08-OCT-14	08-OCT-14	08-OCT-14	
	Sampled Time	18:30	15:40	19:20		
	Client ID	14MW01	14MW02A	14MW03A	DUP01	
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	814	610	734	788	
	Hardness (as CaCO3) (ug/L)	409000	275000	291000	393000	
	pH (pH)	7.88	7.01	7.51	7.69	
	Total Dissolved Solids (ug/L)	526000	328000	484000	524000	
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (ug/L)	332000	124000	199000	329000	
	Alkalinity, Carbonate (as CaCO3) (ug/L)	<1000	<1000	<1000	<1000	
	Alkalinity, Hydroxide (as CaCO3) (ug/L)	<1000	<1000	<1000	<1000	
	Alkalinity, Total (as CaCO3) (ug/L)	332000	124000	199000	329000	
	Chloride (Cl) (ug/L)	29300	5770	5800	29300	
	Fluoride (F) (ug/L)	249	220	266	250	
	Nitrate (as N) (ug/L)	53.7	414	1430	51.9	
	Nitrite (as N) (ug/L)	7.8	12.6	2.7	8.0	
	Sulfate (SO4) (ug/L)	66100	185000	186000	66200	
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	
	Aluminum (Al)-Dissolved (ug/L)	<10	<10	<10	<10	
	Antimony (Sb)-Dissolved (ug/L)	<0.50	<0.50	<0.50	<0.50	
	Arsenic (As)-Dissolved (ug/L)	<1.0	<1.0	<1.0	<1.0	
	Barium (Ba)-Dissolved (ug/L)	60	44	43	58	
	Beryllium (Be)-Dissolved (ug/L)	<5.0	<5.0	<5.0	<5.0	
	Boron (B)-Dissolved (ug/L)	<100	<100	<100	<100	
	Cadmium (Cd)-Dissolved (ug/L)	0.081	0.063	0.082	0.078	
	Calcium (Ca)-Dissolved (ug/L)	111000	79600	87500	107000	
	Chromium (Cr)-Dissolved (ug/L)	<0.50	<0.50	<0.50	<0.50	
	Cobalt (Co)-Dissolved (ug/L)	2.25	1.65	2.01	2.20	
	Copper (Cu)-Dissolved (ug/L)	2.1	2.9	3.1	2.1	
	Iron (Fe)-Dissolved (ug/L)	<30	<30	<30	<30	
	Lead (Pb)-Dissolved (ug/L)	<1.0	<1.0	<1.0	<1.0	
	Lithium (Li)-Dissolved (ug/L)	<50	<50	<50	<50	
	Magnesium (Mg)-Dissolved (ug/L)	32000	18400	17500	30600	
	Manganese (Mn)-Dissolved (ug/L)	700	466	645	666	
	Mercury (Hg)-Dissolved (ug/L)	<0.20	<0.20	<0.20	<0.20	
	Molybdenum (Mo)-Dissolved (ug/L)	3.0	2.7	2.0	3.1	
	Nickel (Ni)-Dissolved (ug/L)	10.4	8.1	11.3	10.1	
	Selenium (Se)-Dissolved (ug/L)	<1.0	<1.0	<1.0	<1.0	
	Silver (Ag)-Dissolved (ug/L)	<0.050	<0.050	<0.050	<0.050	
	Sodium (Na)-Dissolved (ug/L)	26500	11900	24100	26600	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1530485-1	L1530485-2	L1530485-3	L1530485-4	
	Description	Water	Water	Water	Water	
	Sampled Date	08-OCT-14	08-OCT-14	08-OCT-14	08-OCT-14	
	Sampled Time	18:30	15:40	19:20		
	Client ID	14MW01	14MW02A	14MW03A	DUP01	
Grouping	**Analyte**					
WATER						
Dissolved Metals	Thallium (Tl)-Dissolved (ug/L)	<0.20	<0.20	<0.20	<0.20	
	Titanium (Ti)-Dissolved (ug/L)	<50	<50	<50	<50	
	Uranium (U)-Dissolved (ug/L)	9.71	11.4	4.37	9.81	
	Vanadium (V)-Dissolved (ug/L)	<30	<30	<30	<30	
	Zinc (Zn)-Dissolved (ug/L)	21.0	<5.0	<5.0	19.6	
Volatile Organic Compounds	Benzene (ug/L)	<0.50	<0.50	<0.50	<0.50	
	Ethylbenzene (ug/L)	<0.50	<0.50	<0.50	<0.50	
	Methyl t-butyl ether (MTBE) (ug/L)	<0.50	<0.50	<0.50	<0.50	
	Styrene (ug/L)	<0.50	<0.50	<0.50	<0.50	
	Toluene (ug/L)	<0.50	<0.50	<0.50	<0.50	
	ortho-Xylene (ug/L)	<0.50	<0.50	<0.50	<0.50	
	meta- & para-Xylene (ug/L)	<0.50	<0.50	<0.50	<0.50	
	Xylenes (ug/L)	<0.75	<0.75	<0.75	<0.75	
	Surrogate: 4-Bromofluorobenzene (SS) (%)	100.7	99.1	97.3	98.5	
	Surrogate: 1,4-Difluorobenzene (SS) (%)	100.2	100.0	100.0	100.1	
Hydrocarbons	EPH10-19 (ug/L)	<250	<250	<250	<250	
	EPH19-32 (ug/L)	<250	<250	<250	270	
	LEPH (ug/L)	<250	<250	<250	<250	
	HEPH (ug/L)	<250	<250	<250	270	
	Volatile Hydrocarbons (VH6-10) (ug/L)	<100	<100	<100	<100	
	VPH (C6-C10) (ug/L)	<100	<100	<100	<100	
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	88.5	94.8	99.1	98.1	
Polycyclic Aromatic Hydrocarbons	Acenaphthene (ug/L)	<0.050	<0.050	<0.050	<0.050	
	Acenaphthylene (ug/L)	<0.050	<0.050	<0.050	<0.050	
	Acridine (ug/L)	<0.050	<0.050	<0.050	<0.050	
	Anthracene (ug/L)	<0.050	<0.050	<0.050	<0.050	
	Benz(a)anthracene (ug/L)	<0.050	<0.050	<0.050	<0.050	
	Benzo(a)pyrene (ug/L)	<0.010	0.057	<0.010	<0.010	
	Benzo(b)fluoranthene (ug/L)	<0.050	0.065	<0.050	<0.050	
	Benzo(g,h,i)perylene (ug/L)	<0.050	<0.050	<0.050	<0.050	
	Benzo(k)fluoranthene (ug/L)	<0.050	<0.050	<0.050	<0.050	
	Chrysene (ug/L)	<0.050	<0.050	<0.050	<0.050	
	Dibenz(a,h)anthracene (ug/L)	<0.050	<0.050	<0.050	<0.050	
	Fluoranthene (ug/L)	<0.050	<0.050	<0.050	<0.050	
	Fluorene (ug/L)	<0.050	<0.050	<0.050	<0.050	
	Indeno(1,2,3-c,d)pyrene (ug/L)	<0.050	<0.050	<0.050	<0.050	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1530485-1	L1530485-2	L1530485-3	L1530485-4	
	Description	Water	Water	Water	Water	
	Sampled Date	08-OCT-14	08-OCT-14	08-OCT-14	08-OCT-14	
	Sampled Time	18:30	15:40	19:20		
	Client ID	14MW01	14MW02A	14MW03A	DUP01	
Grouping	**Analyte**					
WATER						
Polycyclic Aromatic Hydrocarbons	Naphthalene (ug/L)	<0.050	<0.050	<0.050	<0.050	
	Phenanthrene (ug/L)	<0.050	<0.050	<0.050	<0.050	
	Pyrene (ug/L)	<0.050	<0.050	<0.050	<0.050	
	Quinoline (ug/L)	<0.050	<0.050	<0.050	<0.050	
	Surrogate: Acenaphthene d10 (%)	96.3	94.0	92.4	100.2	
	Surrogate: Acridine d9 (%)	97.1	90.7	89.2	100.9	
	Surrogate: Chrysene d12 (%)	91.1	88.7	90.1	97.4	
	Surrogate: Naphthalene d8 (%)	109.2	91.8	94.8	115.6	
	Surrogate: Phenanthrene d10 (%)	94.1	93.8	89.9	97.7	

* 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	Aluminum (Al)-Dissolved	DLA	L1530485-1
Duplicate	Antimony (Sb)-Dissolved	DLA	L1530485-1
Duplicate	Cadmium (Cd)-Dissolved	DLA	L1530485-1
Duplicate	Chromium (Cr)-Dissolved	DLA	L1530485-1
Duplicate	Cobalt (Co)-Dissolved	DLA	L1530485-1
Duplicate	Copper (Cu)-Dissolved	DLA	L1530485-1
Duplicate	Lead (Pb)-Dissolved	DLA	L1530485-1
Duplicate	Silver (Ag)-Dissolved	DLA	L1530485-1
Duplicate	Thallium (Tl)-Dissolved	DLA	L1530485-1
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1530485-2, -3, -4
Matrix Spike	Sulfate (SO4)	MS-B	L1530485-1, -2, -3, -4
Matrix Spike	Sulfate (SO4)	MS-B	L1530485-1, -2, -3, -4
Matrix Spike	Sulfate (SO4)	MS-B	L1530485-1, -2, -3, -4
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1530485-2, -3, -4
Matrix Spike	Uranium (U)-Dissolved	MS-B	L1530485-2, -3, -4
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1530485-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-PCT-VA	Water	Alkalinity by Auto. 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.

ALK-PCT-VA	Water	Alkalinity by Auto. 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.

ANIONS-CL-IC-WR	Water	Chloride by Ion Chromatography	EPA 300.1

This analysis is carried out using procedures adapted from EPA Method 300.1, "Determination of Inorganic Anions by Ion Chromatography", Revision 1.0, April 1999 and from "Determination of Inorganic Anions in Environmental Waters Using a Hydroxide-Selective Column", Application Note 154 v.19, Dionex 2003.

ANIONS-F-IC-WR	Water	Fluoride by Ion Chromatography	EPA 300.1

This analysis is carried out using procedures adapted from EPA Method 300.1, "Determination of Inorganic Anions by Ion Chromatography", Revision 1.0, April 1999 and from "Determination of Inorganic Anions in Environmental Waters Using a Hydroxide-Selective Column", Application Note 154 v.19, Dionex 2003.

ANIONS-NO2-IC-WR	Water	Nitrite Nitrogen by Ion Chromatography	EPA 300.1

This analysis is carried out using procedures adapted from EPA Method 300.1, "Determination of Inorganic Anions by Ion Chromatography", Revision 1.0, April 1999 and from "Determination of Inorganic Anions in Environmental Waters Using a Hydroxide-Selective Column", Application Note 154 v.19, Dionex 2003. Nitrate is detected by UV absorbance.

ANIONS-NO3-IC-WR	Water	Nitrate Nitrogen by Ion Chromatography	EPA 300.1

This analysis is carried out using procedures adapted from EPA Method 300.1, "Determination of Inorganic Anions by Ion Chromatography", Revision 1.0, April 1999 and from "Determination of Inorganic Anions in Environmental Waters Using a Hydroxide-Selective Column", Application Note 154 v.19, Dionex 2003. Nitrate is detected by UV absorbance.

ANIONS-SO4-IC-WR	Water	Sulphate by Ion Chromatography	EPA 300.1

This analysis is carried out using procedures adapted from EPA Method 300.1, "Determination of Inorganic Anions by Ion Chromatography", Revision 1.0, April 1999 and from "Determination of Inorganic Anions in Environmental Waters Using a Hydroxide-Selective Column", Application Note 154 v.19, Dionex 2003.

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.

EPH-SF-FID-VA	Water	EPH in Water by GCFID	BC MOE EPH GCFID

Analysis is in accordance with BC MOE Lab Manual method "Extractable Petroleum Hydrocarbons in Water by GC/FID", v2.1, July 1999. Whole water

Reference Information

samples are extracted with DCM prior to gas chromatography with flame ionization detection (GC-FID). EPH results include Polycyclic Aromatic Hydrocarbons (PAH) and are therefore not equivalent to Light and Heavy Extractable Petroleum Hydrocarbons (LEPH/HEPH).

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-DIS-CVAFS-VA	Water	Dissolved Mercury in Water by CVAFS	EPA SW-846 3005A & EPA 245.7

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 filtration (EPA Method 3005A) and 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).

LEPH/HEPH-CALC-VA	Water	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in water. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Acenaphthene, Acridine, Anthracene, Fluorene, Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(a)pyrene, Fluoranthene, and Pyrene are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Water by GC/FID" (Version 2.1, July 20, 1999).

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

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

MET-DIS-LOW-MS-VA	Water	Dissolved Metals in Water by ICPMS(Low)	EPA SW-846 3005A/6020A

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 involves preliminary sample treatment by filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

PAH-SF-MS-VA	Water	PAH in Water by GCMS	EPA 3510, 8270

The entire water sample is extracted with dichloromethane, prior to analysis by gas chromatography with mass spectrometric detection (GC/MS). Because the two isomers cannot be readily chromatographically separated, benzo(j)fluoranthene is reported as part of the benzo(b)fluoranthene parameter.

PAH-SURR-MS-VA	Water	PAH Surrogates for Waters	EPA 3510, 8270

Analysed as per the corresponding PAH test method. Known quantities of surrogate compounds are added prior to analysis to each sample to demonstrate analytical accuracy.

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.

TDS-VA	Water	Total Dissolved Solids by Gravimetric	APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

VH-HSFID-VA	Water	VH in Water by Headspace GCFID	B.C. MIN. OF ENV. LAB. MAN. (2009)

The water sample, with added reagents, is heated in a sealed vial to equilibrium. The headspace from the vial is transfered into a gas chromatograph. Compounds eluting between n-hexane and n-decane are measured and summed together using flame-ionization detection.

VH-SURR-FID-VA	Water	VH Surrogates for Waters	B.C. MIN. OF ENV. LAB. MAN. (2009)
VOC7-HSMS-VA	Water	BTEX/MTBE/Styrene by Headspace GCMS	EPA8260B, 5021

The water sample, with added reagents, is heated in a sealed vial to equilibrium. The headspace from the vial is transfered into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.

VOC7/VOC-SURR-MS-VA	Water	VOC7 and/or VOC Surrogates for Waters	EPA8260B, 5021
VPH-CALC-VA	Water	VPH is VH minus select aromatics	BC MOE LABORATORY MANUAL (2005)

Reference Information

These results are determined according to the British Columbia Ministry of Environment Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water". The concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and, in solids, Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10).

XYLENES-CALC-VA	Water	Sum of Xylene Isomer Concentrations	CALCULATION

Calculation of Total Xylenes

Total Xylenes is the sum of the concentrations of the ortho, meta, and para Xylene isomers. Results below detection limit (DL) are treated as zero. The DL for Total Xylenes is set to a value no less than the square root of the sum of the squares of the DLs of the individual Xylenes.

** 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
WR	ALS ENVIRONMENTAL - WHITEHORSE, YUKON, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

10-152931

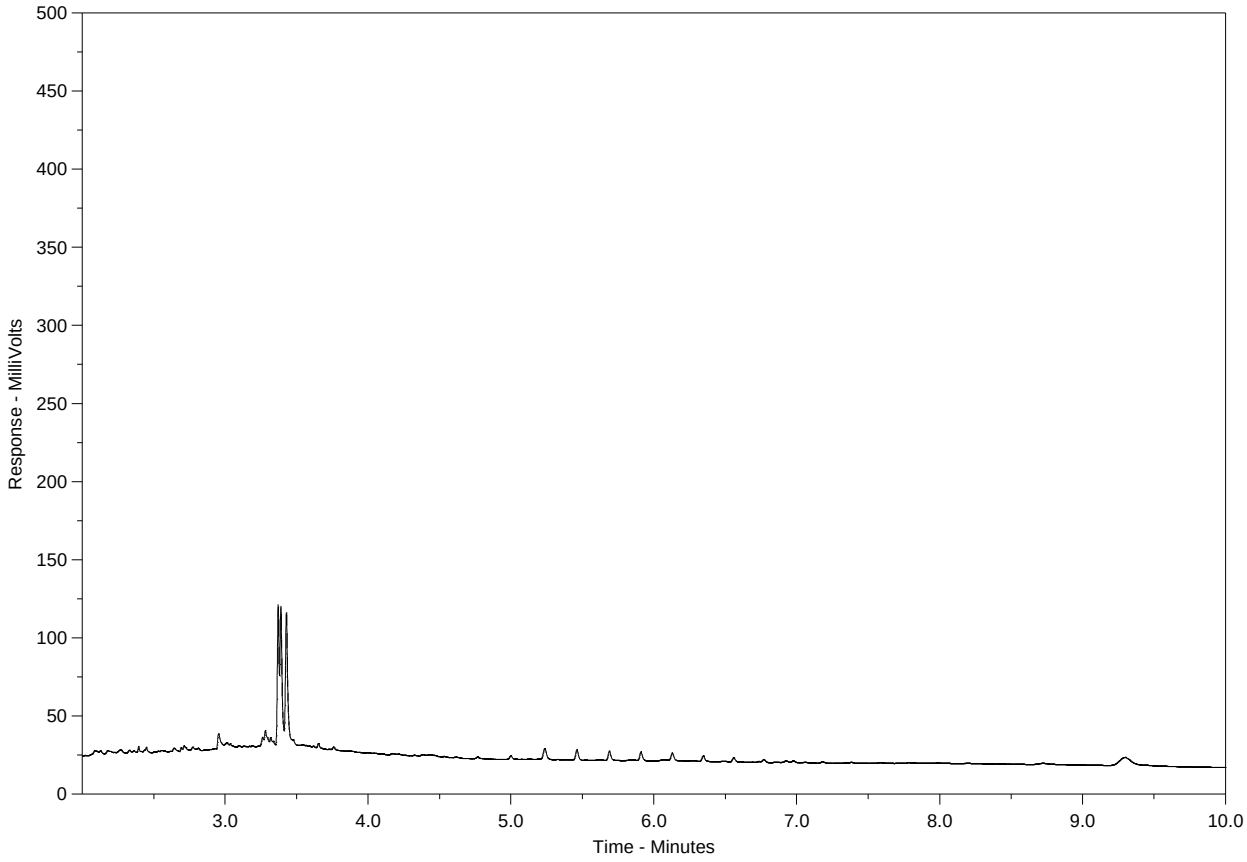
GLOSSARY OF REPORT TERMS

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.

Hydrocarbon Distribution Report

ALS Sample ID: L1530485-1
Client Sample ID: 14MW01



nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
← Gasoline →	← Motor Oils / Lube Oils / Grease →	
← Diesel / Jet Fuels →		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

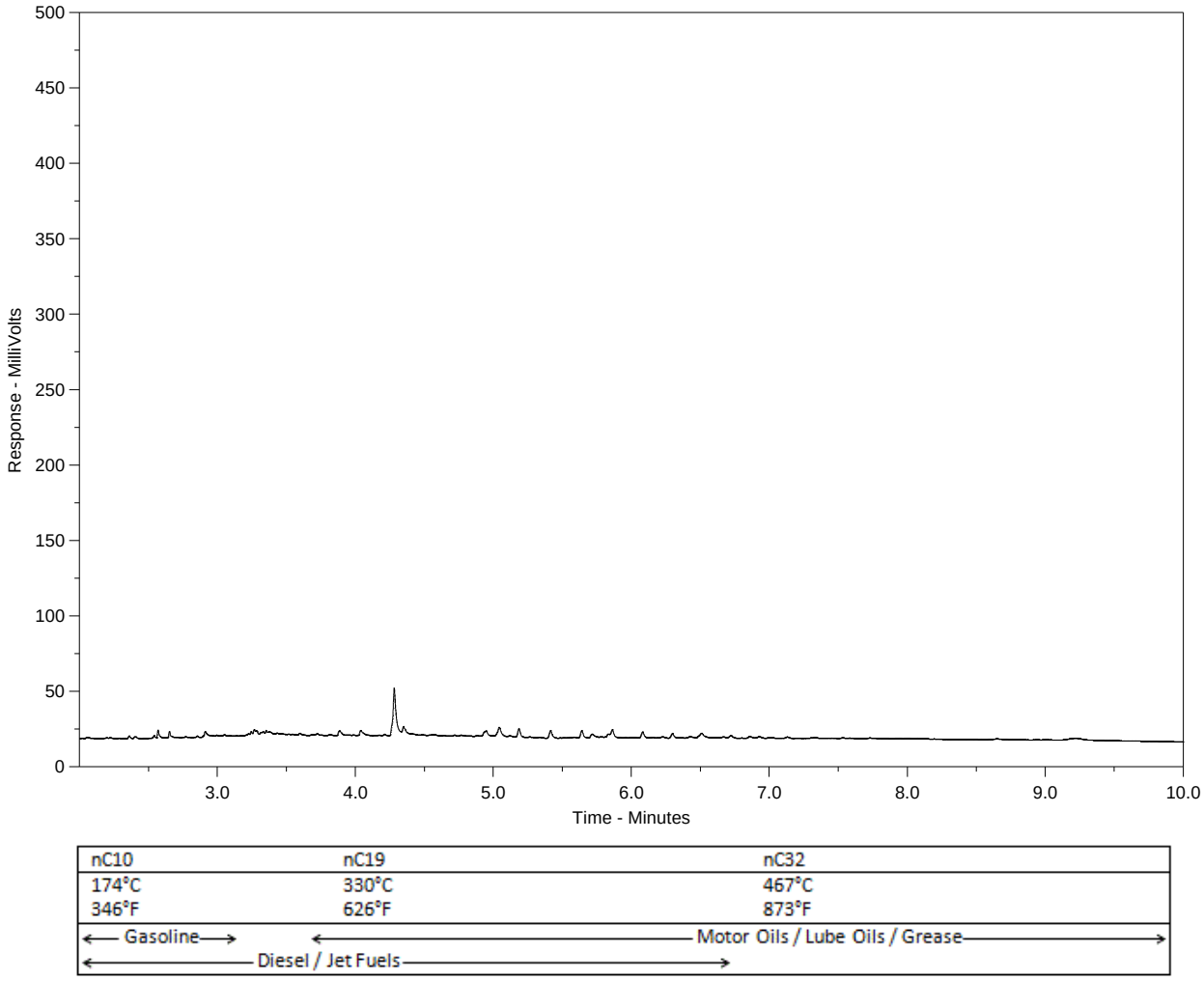
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report

ALS Sample ID: L1530485-2
Client Sample ID: 14MW02A



nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
← Gasoline →	← Motor Oils / Lube Oils / Grease →	
← Diesel / Jet Fuels →		

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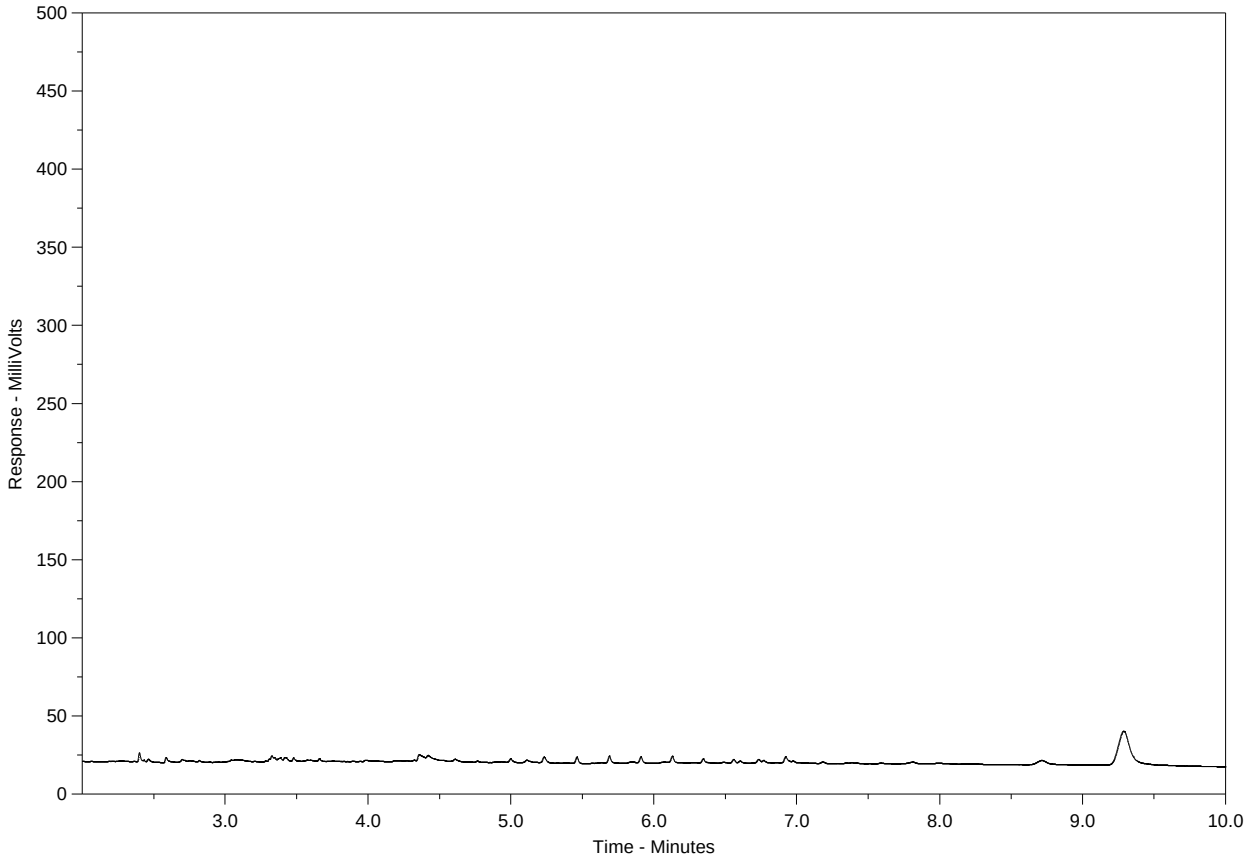
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report

ALS Sample ID: L1530485-3
Client Sample ID: 14MW03A



nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
← Gasoline →	← Motor Oils / Lube Oils / Grease →	
← Diesel / Jet Fuels →		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

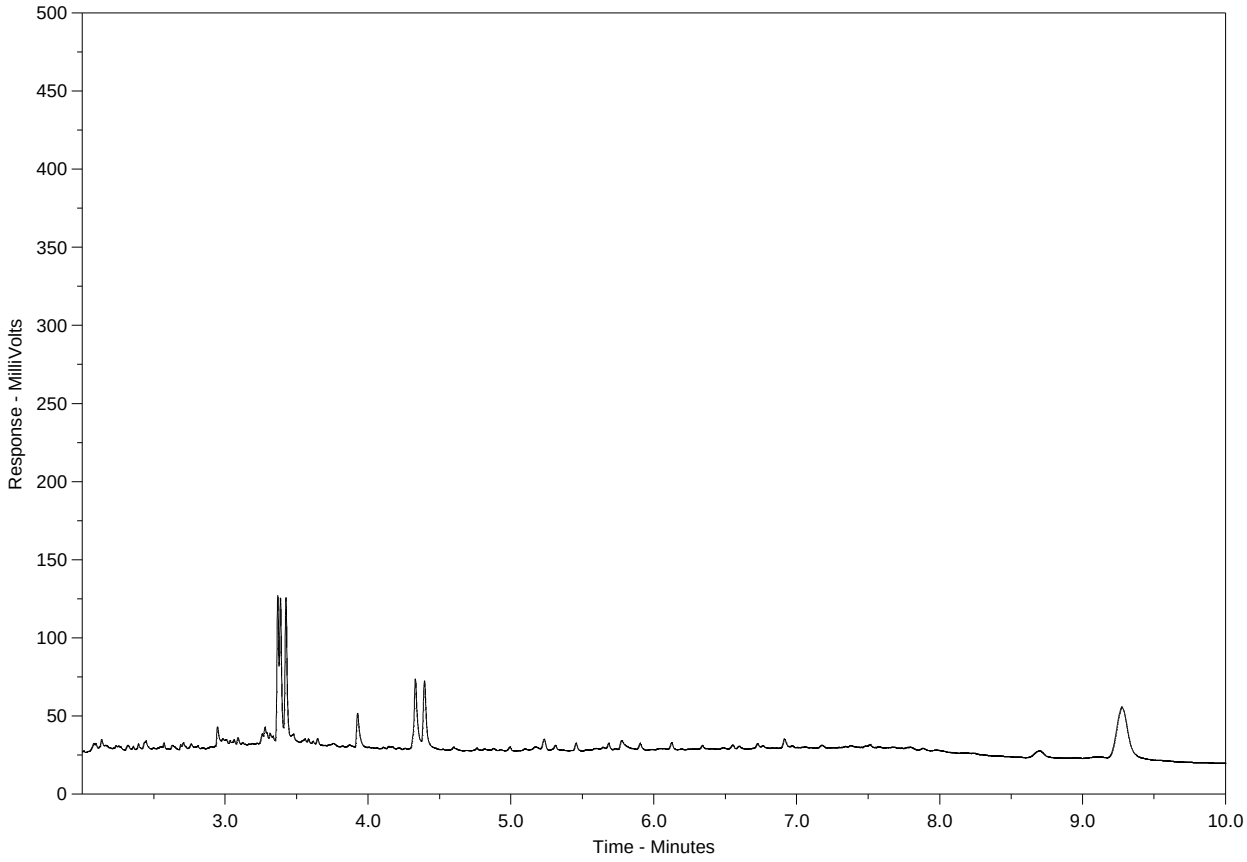
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report

ALS Sample ID: L1530485-4
Client Sample ID: DUP01



nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
← Gasoline →	← Motor Oils / Lube Oils / Grease →	
← Diesel / Jet Fuels →		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

10-152931

ALS Environmental

Chain of Custody / Analytical Reque
Canada Toll Free: 1 800 668 98
www.alsglobal.com

L1530485-COFC

Page 1 of 1

Report To	Gareth Earl gareth.earl@tetratech.c	**Report Format / Distribution**	tact ALS to confirm TAT)
Company:	Tetra Tech EBA	Standard: ✓ Other (specify):	✓ Regular (Standard Turnaround Times - Business Days)
Contact:	61 Wasson Place	Select: PDF Excel Digital ✓ Fax	Priority(2-4 Business Days)-50% surcharge - Contact ALS to confirm TAT
Address:	Whitehorse, YT Y1A 0H7	Email 1: gareth.earl@tetratech.com	Emergency (1-2 Business Days)-100% Surcharge - Contact ALS to confirm TAT
		Email 2: eliane.roy@tetratech.com	Same Day or Weekend Emergency - Contact ALS to confirm TAT
Phone:	Fax:		
Invoice To	Same as Report ? (circle) Yes or No (if No, provide details)	**Client / Project Information**	**Analysis Request**
	Copy of Invoice with Report? (circle) Yes or No	Job #: ENUSWM03344-02.	(Indicate Filtered or Preserved, F/P)
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #: Q77286	
Lab Work Order # (lab use only)		**ALS Contact:**	**Sampler:** Kristen Range

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Routine	D. Metals	D. Mercury	PAH/EPH	BTEX	VOCs							Number of Containers
	14MW01	Oct 8, 14	6:30 pm	Water	✓	✓	✓	✓	✓	✓							6
	14MW02		3:40pm		✓	✓	✓	✓	✓	✓							6
	14MW03		7:20pm		✓	✓	✓	✓	✓	✓							6
	Dup01				✓	✓	✓	✓	✓	✓							6

Special Instructions / Regulation with water or land use (CCME- Freshwater Aquatic Life/BC CSR-Commercial/AB Tier 1-Natural/ETC) / Hazardous Details

D. Mercury & D. Metals Field filtered & preserved.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date:	Time:	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
				9-Oct-14	10:35	0.2 °C				

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

GENF 18.01 Front

Tetra Tech EBA Inc.
ATTN: Gareth Earl
61 Wasson Place
Whitehorse YT Y1A 0H7

Date Received: 03-OCT-14
Report Date: 22-OCT-14 17:15 (MT)
Version: FINAL REV. 2

Client Phone: 867-668-3068

Certificate of Analysis

Lab Work Order #: L1527797

Project P.O. #:	NOT SUBMITTED
Job Reference:	ENVSWM03344-02
C of C Numbers:	10-218799
Legal Site Desc:	ABS LTF

Comments:

22-OCT-2014 This report replaces the previous version and contains additional analyses, as requested.

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1527797-1	L1527797-2			
	Description	Groundwater	Groundwater			
	Sampled Date	30-SEP-14	02-OCT-14			
	Sampled Time					
	Client ID	14MW01	14MW02A			
Grouping	**Analyte**					
WATER						
Hydrocarbons	EPH10-19 (ug/L)	<250	<250			
	EPH19-32 (ug/L)	<250	430			
	LEPH (ug/L)	<250	<250			
	HEPH (ug/L)	<250	430			
Polycyclic Aromatic Hydrocarbons	Acenaphthene (ug/L)	<0.050	<0.050			
	Acenaphthylene (ug/L)	<0.050	<0.050			
	Acridine (ug/L)	<0.050	<0.050			
	Anthracene (ug/L)	<0.050	<0.050			
	Benz(a)anthracene (ug/L)	<0.050	<0.050			
	Benzo(a)pyrene (ug/L)	<0.010	<0.010			
	Benzo(b)fluoranthene (ug/L)	<0.050	<0.050			
	Benzo(g,h,i)perylene (ug/L)	<0.050	<0.050			
	Benzo(k)fluoranthene (ug/L)	<0.050	<0.050			
	Chrysene (ug/L)	<0.050	<0.050			
	Dibenz(a,h)anthracene (ug/L)	<0.050	<0.050			
	Fluoranthene (ug/L)	<0.050	<0.050			
	Fluorene (ug/L)	<0.050	<0.050			
	Indeno(1,2,3-c,d)pyrene (ug/L)	<0.050	<0.050			
	Naphthalene (ug/L)	<0.050	<0.050			
	Phenanthrene (ug/L)	<0.050	<0.050			
	Pyrene (ug/L)	<0.050	<0.050			
	Quinoline (ug/L)	<0.050	<0.050			
	Surrogate: Acenaphthene d10 (%)	91.4	95.8			
	Surrogate: Acridine d9 (%)	97.7	102.9			
	Surrogate: Chrysene d12 (%)	94.6	93.9			
	Surrogate: Naphthalene d8 (%)	89.7	96.5			
	Surrogate: Phenanthrene d10 (%)	95.1	98.4			

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
EPH-SF-FID-VA	Water	EPH in Water by GCFID	BC MOE EPH GCFID

Analysis is in accordance with BC MOE Lab Manual method "Extractable Petroleum Hydrocarbons in Water by GC/FID", v2.1, July 1999. Whole water samples are extracted with DCM prior to gas chromatography with flame ionization detection (GC-FID). EPH results include Polycyclic Aromatic Hydrocarbons (PAH) and are therefore not equivalent to Light and Heavy Extractable Petroleum Hydrocarbons (LEPH/HEPH).

LEPH/HEPH-CALC-VA	Water	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in water. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Acenaphthene, Acridine, Anthracene, Fluorene, Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(a)pyrene, Fluoranthene, and Pyrene are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Water by GC/FID" (Version 2.1, July 20, 1999).

PAH-SF-MS-VA	Water	PAH in Water by GCMS	EPA 3510, 8270

The entire water sample is extracted with dichloromethane, prior to analysis by gas chromatography with mass spectrometric detection (GC/MS). Because the two isomers cannot be readily chromatographically separated, benzo(j)fluoranthene is reported as part of the benzo(b)fluoranthene parameter.

PAH-SURR-MS-VA	Water	PAH Surrogates for Waters	EPA 3510, 8270

Analysed as per the corresponding PAH test method. Known quantities of surrogate compounds are added prior to analysis to each sample to demonstrate analytical accuracy.

** 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:

10-218799

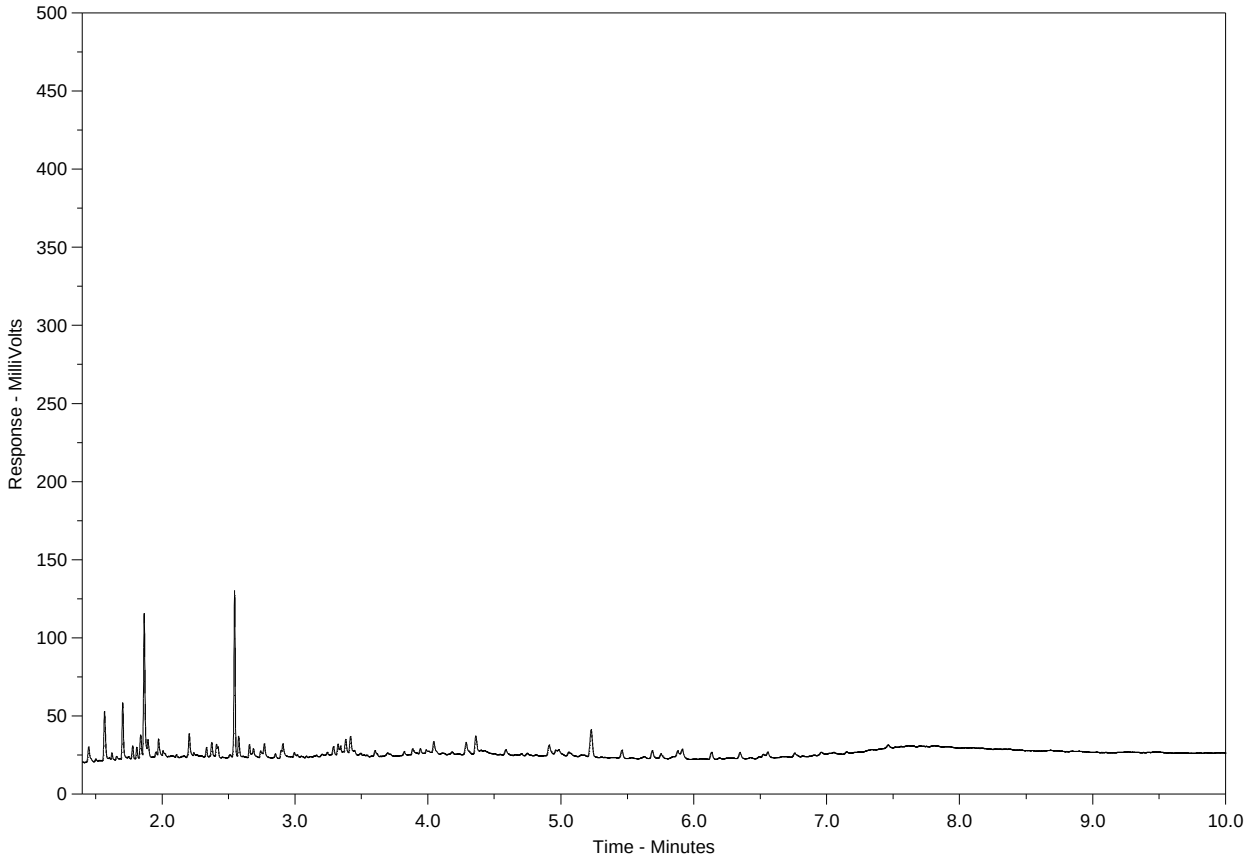
GLOSSARY OF REPORT TERMS

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.

Hydrocarbon Distribution Report

ALS Sample ID: L1527797-1
Client Sample ID: 14MW01



nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
← Gasoline →	← Motor Oils / Lube Oils / Grease →	
← Diesel / Jet Fuels →		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

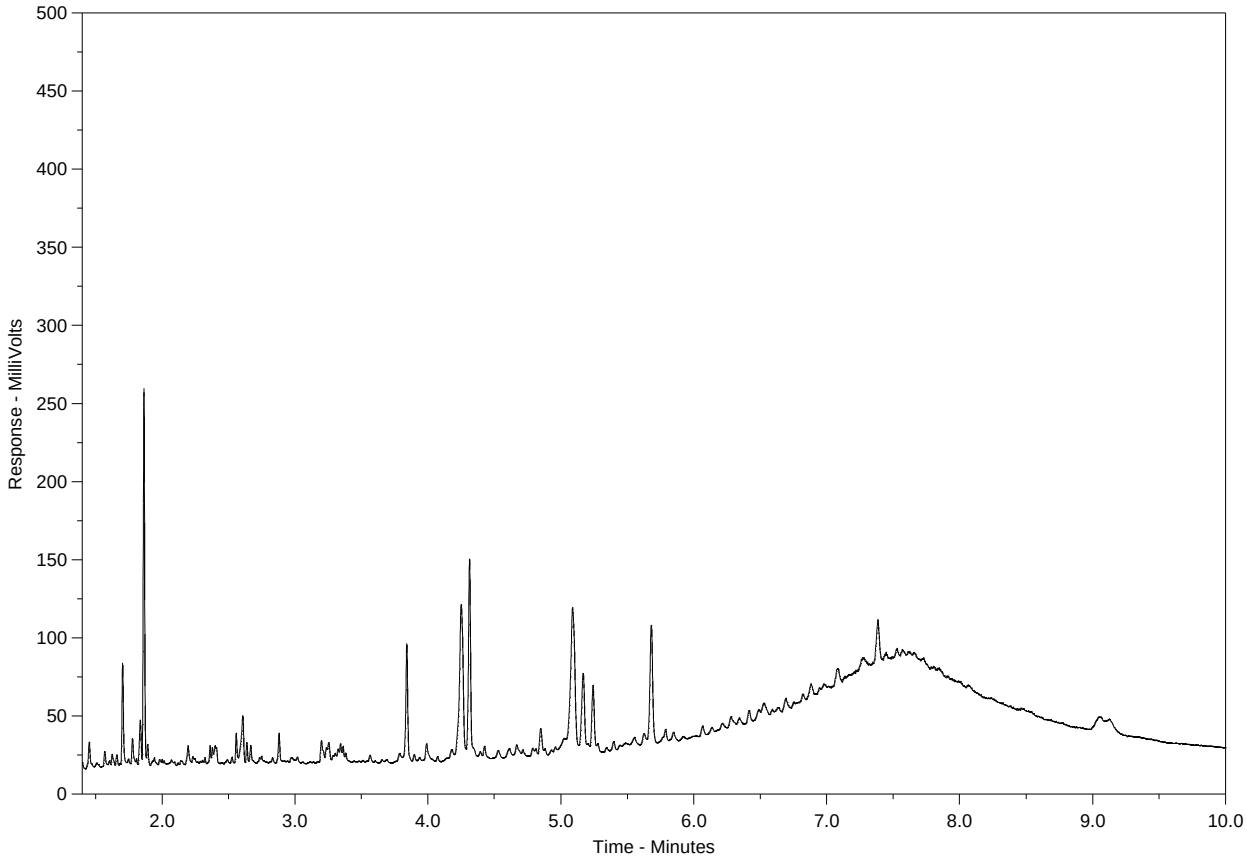
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report

ALS Sample ID: L1527797-2
Client Sample ID: 14MW02A



nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
← Gasoline →	← Motor Oils / Lube Oils / Grease →	
← Diesel / Jet Fuels →		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

10- 218799

ALS Environmental

Chain of Custody / Analytical Request
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

L1527797-COFC

Page 1 of 1

Report To	**Report Format / Distribution**	ALS to confirm TAT)
Company: FBA	Standard: Other (specify):	☒ Regular (Standard Turnaround Times - Business Days)
Contact: Gareth Earl & Eliane Roy	Select: PDF Excel Digital Fax	☐ Priority(2-4 Business Days)-50% surcharge - Contact ALS to confirm TAT
Address:	Email 1: gareth.earl@fetratech.com	☐ Emergency (1-2 Business Days)-100% Surcharge - Contact ALS to confirm TAT
	Email 2: eliane.roy@fetratech.com	☐ Same Day or Weekend Emergency - Contact ALS to confirm TAT
Phone: Fax:		**Analysis Request**
Invoice To Same as Report ? (circle) Yes or No (if No, provide details)	**Client / Project Information**	(Indicate Filtered or Preserved, F/P)
Copy of Invoice with Report? (circle) Yes or No	Job #: ENVSWM.03844-02	
Company:	PO / AFE:	
Contact:	LSD:	
Address:	ABS LTE	
Phone: Fax:	Quote #:	
Lab Work Order # (lab use only)	**ALS Contact:** / **Sampler:**	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Extract only VEPH	HOLD	Number of Containers
	14MW01	Sept. 30	—	Groundwater	☒	☒	3
	14MW02A	Oct 2	—	↓	☒	☒	3
	14MW03A	Oct 1	—	↓	☒	☒	3

Special Instructions / Regulation with water or land use (CCME- Freshwater Aquatic Life/BC CSR-Commercial/AB Tier 1-Natural/ETC) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date:	Time:	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
[illegible]	Oct 3	2:15pm	[illegible]	3-Oct-14	2:15	3.3 °C				

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION | WHITE - LABORATORY COPY | YELLOW - CLIENT COPY | GENF 18.01 Front

Tetra Tech EBA Inc.
ATTN: Gareth Earl
61 Wasson Place
Whitehorse YT Y1A 0H7

Date Received: 26-SEP-14
Report Date: 09-OCT-14 15:20 (MT)
Version: FINAL

Client Phone: 867-668-9222

Certificate of Analysis

Lab Work Order #: L1524111

Project P.O. #: NOT SUBMITTED
Job Reference: ENVSWM03344-02
C of C Numbers: 10-152932
Legal Site Desc:

Brent Mack
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1524111-1				
	Description	Groundwater				
	Sampled Date	26-SEP-14				
	Sampled Time	11:10				
	Client ID	ML-LTF-WELL#4				
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	633				
	Hardness (as CaCO3) (ug/L)	373000				
	pH (pH)	7.53				
Anions and Nutrients	Chloride (Cl) (ug/L)	3040				
	Nitrate (as N) (ug/L)	3260				
	Nitrite (as N) (ug/L)	1.4				
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD				
	Dissolved Metals Filtration Location	FIELD				
	Aluminum (Al)-Dissolved (ug/L)	<10				
	Antimony (Sb)-Dissolved (ug/L)	<0.50				
	Arsenic (As)-Dissolved (ug/L)	<1.0				
	Barium (Ba)-Dissolved (ug/L)	143				
	Beryllium (Be)-Dissolved (ug/L)	<5.0				
	Boron (B)-Dissolved (ug/L)	<100				
	Cadmium (Cd)-Dissolved (ug/L)	<0.050				
	Calcium (Ca)-Dissolved (ug/L)	127000				
	Chromium (Cr)-Dissolved (ug/L)	0.79				
	Cobalt (Co)-Dissolved (ug/L)	<0.50				
	Copper (Cu)-Dissolved (ug/L)	1.1				
	Iron (Fe)-Dissolved (ug/L)	<30				
	Lead (Pb)-Dissolved (ug/L)	<1.0				
	Lithium (Li)-Dissolved (ug/L)	<50				
	Magnesium (Mg)-Dissolved (ug/L)	13700				
	Manganese (Mn)-Dissolved (ug/L)	<10				
	Mercury (Hg)-Dissolved (ug/L)	<0.20				
	Molybdenum (Mo)-Dissolved (ug/L)	1.2				
	Nickel (Ni)-Dissolved (ug/L)	<5.0				
	Selenium (Se)-Dissolved (ug/L)	<1.0				
	Silver (Ag)-Dissolved (ug/L)	<0.050				
	Sodium (Na)-Dissolved (ug/L)	5700				
	Thallium (Tl)-Dissolved (ug/L)	<0.20				
	Titanium (Ti)-Dissolved (ug/L)	<50				
	Uranium (U)-Dissolved (ug/L)	1.22				
	Vanadium (V)-Dissolved (ug/L)	<30				
	Zinc (Zn)-Dissolved (ug/L)	<5.0				
Volatile Organic Compounds	Benzene (ug/L)	<0.50				

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1524111-1				
	Description	Groundwater				
	Sampled Date	26-SEP-14				
	Sampled Time	11:10				
	Client ID	ML-LTF-WELL#4				
Grouping	**Analyte**					
WATER						
Volatile Organic Compounds	Ethylbenzene (ug/L)	<0.50				
	Methyl t-butyl ether (MTBE) (ug/L)	<0.50				
	Styrene (ug/L)	<0.50				
	Toluene (ug/L)	<0.50				
	ortho-Xylene (ug/L)	<0.50				
	meta- & para-Xylene (ug/L)	<0.50				
	Xylenes (ug/L)	<0.75				
	Surrogate: 4-Bromofluorobenzene (SS) (%)	102.0				
	Surrogate: 1,4-Difluorobenzene (SS) (%)	100.4				
Hydrocarbons	EPH10-19 (ug/L)	<250				
	EPH19-32 (ug/L)	<250				
	LEPH (ug/L)	<250				
	HEPH (ug/L)	<250				
	Volatile Hydrocarbons (VH6-10) (ug/L)	<100				
	VPH (C6-C10) (ug/L)	<100				
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	107.7				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (ug/L)	<0.050				
	Acenaphthylene (ug/L)	<0.050				
	Acridine (ug/L)	<0.050				
	Anthracene (ug/L)	<0.050				
	Benz(a)anthracene (ug/L)	<0.050				
	Benzo(a)pyrene (ug/L)	<0.010				
	Benzo(b)fluoranthene (ug/L)	<0.050				
	Benzo(g,h,i)perylene (ug/L)	<0.050				
	Benzo(k)fluoranthene (ug/L)	<0.050				
	Chrysene (ug/L)	<0.050				
	Dibenz(a,h)anthracene (ug/L)	<0.050				
	Fluoranthene (ug/L)	<0.050				
	Fluorene (ug/L)	<0.050				
	Indeno(1,2,3-c,d)pyrene (ug/L)	<0.050				
	Naphthalene (ug/L)	<0.050				
	Phenanthrene (ug/L)	<0.050				
	Pyrene (ug/L)	<0.050				
	Quinoline (ug/L)	<0.050				
	Surrogate: Acenaphthene d10 (%)	98.5				
	Surrogate: Acridine d9 (%)	100.8				

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1524111-1				
	Description	Groundwater				
	Sampled Date	26-SEP-14				
	Sampled Time	11:10				
	Client ID	ML-LTF-WELL#4				
Grouping	**Analyte**					
WATER						
Polycyclic Aromatic Hydrocarbons	Surrogate: Chrysene d12 (%)	98.7				
	Surrogate: Naphthalene d8 (%)	94.4				
	Surrogate: Phenanthrene d10 (%)	102.9				

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1524111-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
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**
ANIONS-CL-IC-WR	Water	Chloride by Ion Chromatography	EPA 300.1

This analysis is carried out using procedures adapted from EPA Method 300.1, "Determination of Inorganic Anions by Ion Chromatography", Revision 1.0, April 1999 and from "Determination of Inorganic Anions in Environmental Waters Using a Hydroxide-Selective Column", Application Note 154 v.19, Dionex 2003.

ANIONS-NO2-IC-WR	Water	Nitrite Nitrogen by Ion Chromatography	EPA 300.1

This analysis is carried out using procedures adapted from EPA Method 300.1, "Determination of Inorganic Anions by Ion Chromatography", Revision 1.0, April 1999 and from "Determination of Inorganic Anions in Environmental Waters Using a Hydroxide-Selective Column", Application Note 154 v.19, Dionex 2003. Nitrate is detected by UV absorbance.

ANIONS-NO3-IC-WR	Water	Nitrate Nitrogen by Ion Chromatography	EPA 300.1

This analysis is carried out using procedures adapted from EPA Method 300.1, "Determination of Inorganic Anions by Ion Chromatography", Revision 1.0, April 1999 and from "Determination of Inorganic Anions in Environmental Waters Using a Hydroxide-Selective Column", Application Note 154 v.19, Dionex 2003. Nitrate is detected by UV absorbance.

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

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

EPH-SF-FID-VA	Water	EPH in Water by GCFID	BC MOE EPH GCFID

Analysis is in accordance with BC MOE Lab Manual method "Extractable Petroleum Hydrocarbons in Water by GC/FID", v2.1, July 1999. Whole water samples are extracted with DCM prior to gas chromatography with flame ionization detection (GC-FID). EPH results include Polycyclic Aromatic Hydrocarbons (PAH) and are therefore not equivalent to Light and Heavy Extractable Petroleum Hydrocarbons (LEPH/HEPH).

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-DIS-CVAFS-VA	Water	Dissolved Mercury in Water by CVAFS	EPA SW-846 3005A & EPA 245.7

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 filtration (EPA Method 3005A) and 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).

LEPH/HEPH-CALC-VA	Water	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in water. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Acenaphthene, Acridine, Anthracene, Fluorene, Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(a)pyrene, Fluoranthene, and Pyrene are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Water by GC/FID" (Version 2.1, July 20, 1999).

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

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

MET-DIS-LOW-MS-VA	Water	Dissolved Metals in Water by ICPMS(Low)	EPA SW-846 3005A/6020A

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 involves preliminary sample treatment by filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

PAH-SF-MS-VA	Water	PAH in Water by GCMS	EPA 3510, 8270

The entire water sample is extracted with dichloromethane, prior to analysis by gas chromatography with mass spectrometric detection (GC/MS). Because the two isomers cannot be readily chromatographically separated, benzo(j)fluoranthene is reported as part of the benzo(b)fluoranthene parameter.

PAH-SURR-MS-VA	Water	PAH Surrogates for Waters	EPA 3510, 8270

Reference Information

Analysed as per the corresponding PAH test method. Known quantities of surrogate compounds are added prior to analysis to each sample to demonstrate analytical accuracy.

PH-MAN-WR	Water	pH by Meter	APHA 4500-H (B)

"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."

VH-HSFID-VA	Water	VH in Water by Headspace GCFID	B.C. MIN. OF ENV. LAB. MAN. (2009)

The water sample, with added reagents, is heated in a sealed vial to equilibrium. The headspace from the vial is transfered into a gas chromatograph. Compounds eluting between n-hexane and n-decane are measured and summed together using flame-ionization detection.

VH-SURR-FID-VA	Water	VH Surrogates for Waters	B.C. MIN. OF ENV. LAB. MAN. (2009)
VOC7-HSMS-VA	Water	BTEX/MTBE/Styrene by Headspace GCMS	EPA8260B, 5021

The water sample, with added reagents, is heated in a sealed vial to equilibrium. The headspace from the vial is transfered into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.

VOC7/VOC-SURR-MS-VA	Water	VOC7 and/or VOC Surrogates for Waters	EPA8260B, 5021
VPH-CALC-VA	Water	VPH is VH minus select aromatics	BC MOE LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water". The concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and, in solids, Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10).

XYLENES-CALC-VA	Water	Sum of Xylene Isomer Concentrations	CALCULATION

Calculation of Total Xylenes

Total Xylenes is the sum of the concentrations of the ortho, meta, and para Xylene isomers. Results below detection limit (DL) are treated as zero. The DL for Total Xylenes is set to a value no less than the square root of the sum of the squares of the DLs of the individual Xylenes.

** 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
WR	ALS ENVIRONMENTAL - WHITEHORSE, YUKON, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

10-152932

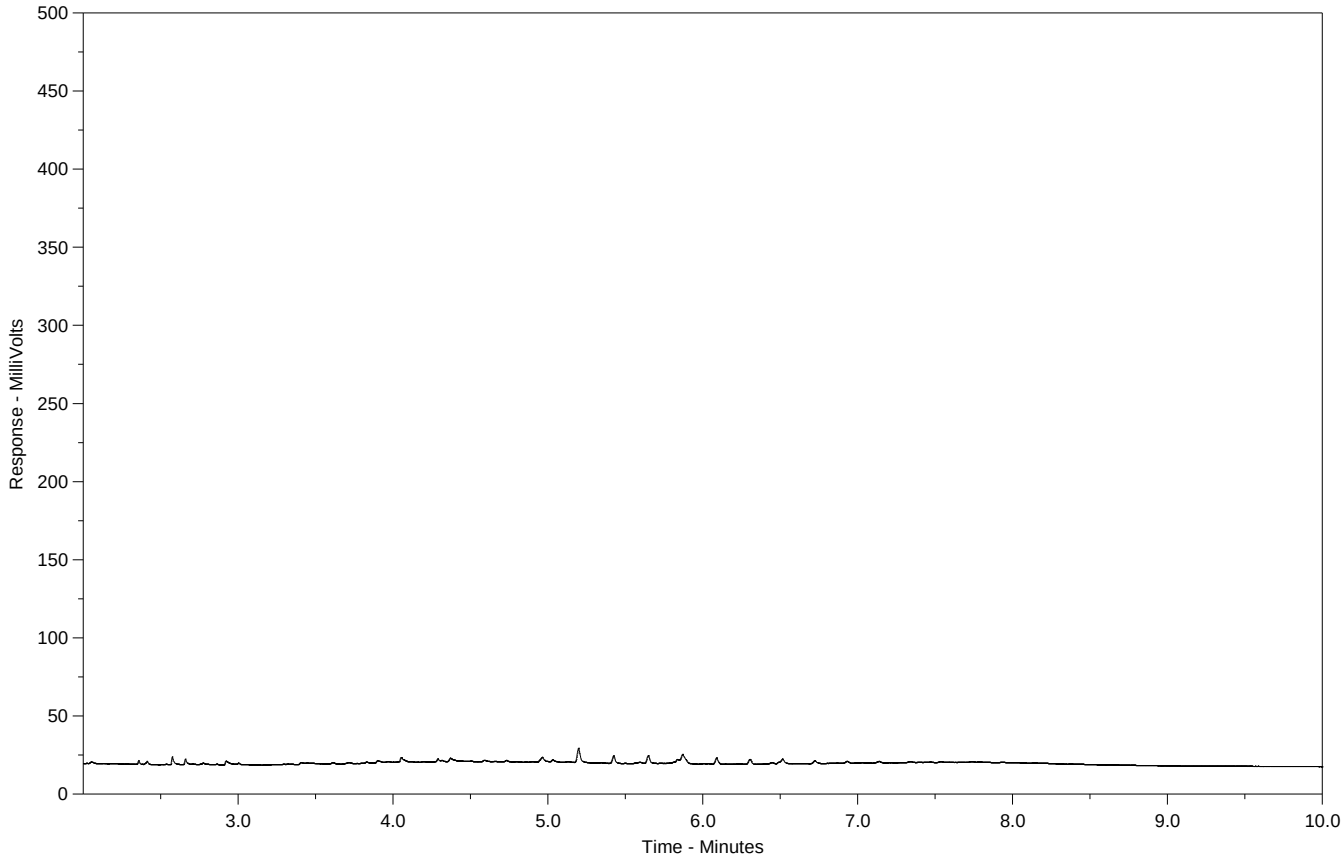
GLOSSARY OF REPORT TERMS

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.

Hydrocarbon Distribution Report

ALS Sample ID: L1524111-1
Client Sample ID: ML-LTF-WELL#4



nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
← Gasoline →	← Motor Oils / Lube Oils / Grease →	
← Diesel / Jet Fuels →		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

ALS Environmental

Chain of Custody / Analytical Reques
Canada Toll Free: 1 800 668 987
www.alsglobal.com

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Report To	**Report Format / Distribution**	**Service Request:** (Rush subject to availability - Contact ALS to confirm TAT)
Company: TetraTech FESA	Standard Other (specify):	X Regular (Standard Turnaround Times - Business Days)
Contact: Gareth Eaal	Select: PDF Excel ESDAT Digital Fax	Priority(2-4 Business Days)-50% surcharge - Contact ALS to confirm TAT
Address:	Email 1: gareth.eaal@tetratech.com	Emergency (1-2 Business Days)-100% Surcharge - Contact ALS to confirm TAT
	Email 2:	Same Day or Weekend Emergency - Contact ALS to confirm TAT
Phone: 668-3068 Fax:		
Invoice To Same as Report ? (circle) Yes or No (if No, provide details)	**Client / Project Information**	**Analysis Request** (Indicate Filtered or Preserved, F/P)
Copy of Invoice with Report? (circle) Yes or No	Job #: ENVSWM03544-02	
Company:	PO / AFE:	
Contact:	LSD:	
Address:		
Phone: Fax:	Quote #: Q47386	
Lab Work Order # (lab use only)	**ALS Contact:** **Sampler:**	

As per Quote Q47386.

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Number of Containers
	ML-LTF-well#4	Sept.26	11:10 AM	Groundwater	6

Special Instructions / Regulation with water or land use (CCME- Freshwater Aquatic Life/BC CSR-Commercial/AB Tier 1-Natural/ETC) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date:	Time:	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
[signature]	Sept.26	11:45 AM	[signature]	26-SEP-14	11:45	6.8 °C				

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

GENF 18.01 Front