

**Confirmatory Drilling Assessment and Groundwater
Monitoring Program
124 Main Street, Barons, Alberta
Alberta Municipal Affairs Site #9558**



PRESENTED TO
VILLAGE OF BARONS

JULY 2017
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EXECUTIVE SUMMARY

The Village of Barons (Barons) retained Tetra Tech Canada Inc. (Tetra Tech) to conduct a confirmatory drilling assessment and groundwater monitoring program for a property located at 124 Main Street in Barons, Alberta. The site is included in Alberta Municipal Affairs tank remediation program (AMA Program), Site Number: 9558.

Previous assessments at the site have included the removal of an abandoned underground storage tank (UST) in 2010. During the UST removal, approximately 350 tonnes of petroleum hydrocarbon (PHC) impacted soil was removed from the UST excavation for disposal. However, complete site remediation was not achieved as further excavation to the north, east and west was not considered feasible due to conflicts with infrastructure (buildings, sidewalk, boulevard and utilities) and to prevent damage to the rooting system of the mature trees within a landscaped area to the south of the excavation. Confirmatory soil sampling of the final UST excavation limits identified concentrations of benzene, ethylbenzene, xylenes, and/or PHC fractions F1 and F2 greater than the referenced Tier 1 Guidelines remaining in the excavation limits at the time of backfilling.

The objectives of the confirmatory drilling assessment were to evaluate the current conditions of the soil chemical quality immediately adjacent to, and within the former tank nest (historical source area); and to evaluate the effectiveness of the source removal that occurred in 2010. The objectives of the groundwater monitoring program was: 1) to assess the chemical quality of the groundwater within and near the former source area; 2) to continue monitoring residual PHC concentrations historically identified at existing groundwater monitoring wells at the site; and 3) to evaluate the capacity of the monitored area for the continued attenuation of PHC compounds.

Discussions and Conclusions

Key findings of the confirmatory drilling assessment and groundwater monitoring program indicate the following:

- The shallow groundwater flow direction is interpreted to be northwesterly under an estimated horizontal hydraulic gradient of 0.007 m/m.
- Concentrations of benzene, ethylbenzene, xylenes, and PHC fractions F1 and F2 were greater than the referenced Tier 1 Guidelines from the soil sample analyzed at 17MW04 at 1.7 m (adjacent to the west of the former tank nest). Concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX) and PHC fractions were less than the analytical detection limits and/or Tier 1 Guidelines from a deeper soil sample collected at 17MW04 at 4.5 m, as well as all the other soil samples analyzed from 17MW01 (within the former tank nest), 17MW02 (adjacent to the east of the former tank nest), and 17MW03 (adjacent to the north of the former tank nest).
- The Class II landfill analytical results from a composite soil sample of the drill cuttings were less than the referenced Alberta User Guide for Waste Managers (AUGWM) Guidelines for disposal at a Class II landfill.
- Concentrations of BTEX and PHC fractions F1 and F2 were greater than the referenced Tier 1 Guidelines from the groundwater sample analyzed at 17MW04. Concentrations of BTEX and PHC fractions F1 and F2 were less than the analytical detection limit at all other monitoring wells sampled on May 5, 2017. Historically, concentrations of benzene, xylenes, and/or PHC fraction F2 have been measured at 08MW07 and 09MW11, however, all BTEX and PHC fractions have remained less than the analytical detection limit at these wells for three and five consecutive sampling events, respectively.
- The results of the confirmatory drilling assessment and groundwater monitoring program indicate that PHC impacts remain in place to the west of the former tank nest at 17MW04. However, the soil and groundwater analytical results suggest that vertical and horizontal delineation of the PHC impacts have been achieved at the site.

- Routine groundwater parameters were included in the analytical suite for the first time in 2014, to assist in determining the potential for the natural attenuation of PHCs in the groundwater at the site. Concentrations of total dissolved solids (TDS), sodium, sulphate, nitrate, nitrite, and/or dissolved manganese were measured greater than the Tier 1 Guidelines in 2017, as well as historically. Concentrations of these parameters measured in the up-gradient wells have been similar to/or less than the concentrations measured down-gradient of the site and have remained generally stable since first measured in 2014. Based on these results, concentrations of these parameters measured in the groundwater likely reflect the natural groundwater composition at the site.

Analytical results for redox sensitive routine water chemistry parameters (nitrate, nitrite, sulphate, and dissolved iron and manganese) were used to assess the inferred redox conditions at the groundwater monitoring wells. Assessing redox conditions is relevant to determine if monitored natural attenuation (MNA), an approach that relies on natural processes (biodegradation, dispersion, dilution, sorption, volatilization, and chemical stabilization of chemicals of concern), can be used to remediate groundwater within a reasonable time frame, or to assess if a dissolved hydrocarbon plume is stable.

Oxic groundwater conditions are noted at 08MW07 (down-gradient of the former tank nest) and 09MW09 (outside the immediate northeast corner of the former tank nest) in 2017. Anoxic conditions were noted 09MW11 and suboxic condition exist at 17MW04. Oxic and/or suboxic conditions down-gradient of the former tank nest suggest that conditions are favourable for the attenuation of PHCs identified at 17MW04.

Recommendations

Based on the soil and groundwater results at the locations tested, and historical data collected to date, Tetra Tech provides the following two options for consideration for the PHC impacts that remain in place to the west of the former UST excavation in the vicinity of 17MW04:

- A chemical injection program; or
- A remedial excavation and off-site disposal of the PHC impacted soil.

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LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of the Village of Barons and their agents. Tetra Tech Canada Inc. (Tetra Tech) 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 the Village of Barons, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in Tetra Tech Canada Inc.'s Services Agreement. Tetra Tech's General Conditions are provided in Appendix A of this report.

1.0 INTRODUCTION

1.1 General

The Village of Barons (Barons) retained Tetra Tech Canada Inc. (Tetra Tech) to conduct a confirmatory drilling assessment and groundwater monitoring program for a property located at 124 Main Street in Barons, Alberta (Figure 1). The site is included in Alberta Municipal Affairs' Tank Site Remediation Program (AMA Program), Site Number: 9558.

Previous assessments at the site have included the removal of an abandoned underground storage tank (UST) in 2010. During the UST removal, approximately 350 tonnes of petroleum hydrocarbon (PHC) impacted soil was removed from the UST excavation for disposal. However, complete site remediation was not achieved as further excavation to the north, east and west was not considered feasible due to conflicts with infrastructure (buildings, sidewalk, boulevard and utilities) and to prevent damage to the rooting system of the mature trees within a landscaped area to the south of the excavation. Confirmatory soil sampling of the final UST excavation limits identified concentrations of benzene, ethylbenzene, xylenes, and/or PHC fractions F1 and F2 greater than the referenced Tier 1 Guidelines remaining in the excavation limits at the time of backfilling.

The confirmatory drilling assessment and groundwater monitoring program were conducted in general accordance with methods outlined in the document entitled "CSA Z768-00 Phase II ESA", published by the CSA (reaffirmed 2013).

1.2 Objectives

The objectives of the confirmatory drilling assessment were to evaluate the current conditions of the soil chemical quality immediately adjacent to, and within the former tank nest (historical source area); and to evaluate the effectiveness of the source removal that occurred in 2010. The objectives of the groundwater monitoring program was: 1) to assess the chemical quality of the groundwater within and near the former source area; 2) to continue monitoring residual PHC concentrations historically identified at existing groundwater monitoring wells at the Site; and 3) to evaluate the capacity of the monitored area for the continued attenuation of PHC compounds.

1.3 Authorization

Ms. Laurie Beck, of the Village of Barons, provided written authorization to proceed with the present study to Tetra Tech on April 10, 2017.

1.4 Qualifications of Assessors

Mr. Jamie LaMontagne, EP, conducted the fieldwork for this project and wrote this report. Mr. LaMontagne is an Environmental Technologist with Tetra Tech's Environment and Water Practice based in Lethbridge, Alberta. He has over 16 years of experience in ESAs, upstream and downstream Phase I and Phase II ESAs, contaminated site assessments, environmental monitoring, sampling techniques, data interpretation, and report writing.

Mr. Jaymes Going, B.Sc., EP, coordinated and directed the fieldwork, and conducted the intermediate review of this report. Mr. Going is an Environmental Scientist with Tetra Tech's Environment and Water Practice based in Lethbridge, Alberta and has over nine years of experience in the environmental industry.

Mr. Henri Carriere, P.Eng., M.N.R.M., provided direction during the course of the fieldwork and senior reviewed this report. Mr. Carriere is a Senior Project Engineer with Tetra Tech in the Environment and Water Practice in Calgary, Alberta. Mr. Carriere has over 20 years of experience in the environmental industry.

1.5 Scope of Work

To meet the objective stated in Section 1.2, the scope of work for the confirmatory drilling assessment and groundwater monitoring program included the following tasks:

1.5.1 Confirmatory Drilling Assessment

- Requested an Alberta One-Call utility locate and coordinated private utility locates prior to conducting ground disturbance.
- Prepared and reviewed a Health and Safety Plan that was used by site personnel during the fieldwork. Conducted an on-site tailgate safety meeting and pre-job hazard assessment prior to the commencement of the fieldwork including a review of the buried utility locate data.
- Drilled four boreholes to a maximum depth of 6.1 meters below grade (mbg). One borehole was drilled immediately adjacent to the north of the former tank nest (on Main Street), two boreholes were drilled adjacent to the east and the west of the former tank nest (in safe proximity of a water service utility), and one borehole was drilled within the former tank nest (historical source area). The boreholes were completed as shallow groundwater monitoring wells, constructed of 51 mm diameter polyvinyl chloride (PVC) standpipes screened across the perceived water table. The annulus of each borehole was backfilled using silica sand across the screened interval followed by an activated bentonite seal to the surface. The wells were completed with flush-mounted steel protective road boxes.
- Collected bulk soil samples at regular intervals (i.e., 0.75 m) from each borehole, stratigraphic variations, or where observations indicated a change in impact conditions (i.e., staining). The soil profiles were classified during the drilling assessment using the Unified Soil Classification System (USCS).
- Measured soil vapour concentrations (VCs) from each bulk soil sample using a MiniRae™ 3000 Photoionization Detector (PID).
- Submitted two soil samples per borehole for laboratory chemical analysis of benzene, toluene, ethylbenzene, xylenes (BTEX) and PHC fractions F1 to F4 to Maxxam Analytics (Maxxam) in Calgary, Alberta. Sample analysis was selected based on VC measurements and observations made during drilling. One composite sample from the drill cuttings was submitted for a Class II landfill characterization.

1.5.2 Groundwater Monitoring Program

- Returned to the site approximately two weeks after the confirmatory drilling assessment to conduct the groundwater monitoring program.
- Monitored nine groundwater monitoring wells (08MW01, 08MW03, 08MW07, 09MW09, 09MW11, 17MW01, 17MW02, 17MW03, and 17MW04). Monitoring included measurements of well headspace VCs using a PID; and the measurement of liquid levels including light non-aqueous phase liquid (LNAPL), if present, using a Heron™ Interface Probe at each well.
- Purged seven of the nine groundwater wells (08MW07, 09MW09, 09MW11, 17MW01, 17MW02, 17MW03, and 17MW04) prior to sampling, of at least three standing volumes of water or until practically dry. The groundwater levels were given sufficient time to recover and samples were collected on the same day purging took place.

- Conducted an elevation survey of the newly installed wells, tying the monitoring well elevations into the existing groundwater monitoring well network.
- Submitted seven groundwater samples to Maxxam for chemical analyses of BTEX, and PHC fractions F1 and F2. Four of the groundwater samples were submitted for dissolved iron, dissolved manganese, and routine groundwater parameters.

1.5.3 Reporting

- Prepared this report discussing the confirmatory drilling assessment and groundwater monitoring program including field observations and analytical results, comparing the results to historical data and the Alberta Environment and Parks (AEP) 2016 Tier 1 Soil and Groundwater Remediation Guidelines (Tier 1 Guidelines)¹.
- Prepared an updated record of site condition (RSC) to include with this report.

2.0 METHODS

This section describes the methods applied by Tetra Tech during the confirmatory drilling assessment and groundwater monitoring program.

2.1 Utility Locates

A utility locate request was placed with Alberta One-Call (Ticket # 20171502413) and a private utility sweep was conducted by Alberta Line Find to identify all buried utilities prior to commencing work. These included, but were not limited to telecommunication lines, pipelines, power lines, and potential buried objects. A 30 m work zone was cleared around each proposed borehole location.

Due to ground disturbance procedure policy, drilling was not conducted within 5 m of a buried marked utility and the mast of the drill rig was not erected within 7 m of any overhead utility.

2.2 Project Safety

A pre-job hazard assessment and Safe Work Form (SWF) were completed prior to the initiation of the fieldwork and applicable safe work procedures were reviewed. The SWF was reviewed on site by Tetra Tech representatives and all contractors.

2.2.1 Drilling Program and Monitoring Well Installation

The drilling program was conducted on April 20, 2017. Tetra Tech contracted Chilako Drilling Services of Coaldale, Alberta, to conduct the drilling using a truck-mounted drilling rig equipped with solid stem augers. Four boreholes were advanced to a maximum depth of 6.1 mbg and were completed as groundwater monitoring wells. Borehole locations were selected by Tetra Tech based on the location of the former UST (historical source area) and the utility locate data.

¹ Alberta Environment and Parks (AEP). 2016. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land Policy Branch, Policy and Planning Division. 197 pp.

Tetra Tech described soils at each borehole location according to the modified USCS with additional comments on VCs and visible stains and/or debris. Groundwater monitoring wells were completed using slotted 50 millimeter PVC standpipes with un-slotted PVC pipe from the top of the slotted section to the surface. Silica sand was placed from the base of the borehole to approximately 0.3 m above the slotted interval of the standpipe within the borehole annulus. The annulus of the monitoring well, above the screened section, was sealed with bentonite clay to ground level. The monitoring wells were completed with flush-mounted steel road boxes. Soil drill cuttings were collected and sealed in a disposal bag and stored at the Town's public works maintenance shop pending the outcome of the Class II landfill analysis.

During the confirmatory drilling assessment, a former groundwater monitoring well (09MW09) was identified heaving through the asphalt at the northeast corner of the former UST excavation. Monitoring well 09MW09 was previously noted as destroyed during repaving of the area following the completion of the UST excavation in 2010. Upon inspection, the integrity of 09MW09 appeared to be good and the well was refurbished, purged thoroughly, and secured.

Figure 2 presents a site plan showing the former UST location and monitoring well locations. Borehole logs for 17MW01 through 17MW04 are provided in Appendix B.

2.2.2 Field Screening

Soil samples were collected directly from the auger of the drill rig at regular intervals (i.e., 0.75 m) from each borehole, stratigraphic variations, or where observations indicate a change in impact conditions (i.e., staining). Bagged soil samples were screened for VCs using a PID. Measured VCs are provided in Section 3.1, and are noted on the borehole logs included in Appendix B.

2.2.3 Soil Sampling and Analytical Testing

Based on visual observations and VCs measured during drilling, two soil samples per borehole were selected for laboratory analyses. One composite soil sample was collected from the borehole drill cuttings for landfill characterization. Soil samples were placed in bags, laboratory-supplied 250 mL glass jars with Teflon™-lined lids, or collected directly from the auger with a Terra Core™ sampler. Soil samples were preserved as required, kept cool in coolers, and transported to Maxxam under chain-of-custody (COC) for chemical analysis of BTEX and PHC fractions F1 to F4. The composite soil sample of the borehole drill cuttings was submitted for a Class II Landfill analysis.

2.2.4 Groundwater Monitoring and Sampling

Tetra Tech conducted groundwater monitoring and sampling on May 5, 2017. The groundwater monitoring wells were measured for well headspace VCs using a PID at all locations (08MW01, 08MW03, 08MW07, 09MW09, 09MW11, 17MW01, 17MW02, 17MW03, and 17MW04). Liquid levels were measured using a Heron interface probe capable of detecting liquid PHCs, if present. Monitoring well completion details and field monitoring data is presented on Table 1.

The monitoring wells that were selected for analytical testing in May 2017 were 08MW07, 09MW09, 09MW11, 17MW01, 17MW02, 17MW03, and 17MW04. Monitoring wells 08MW01 and 08MW03 have been excluded from the analytical program as concentrations of BTEX and PHC fractions F1 and F2 have consistently been less than the analytical detection limits at these wells since 2008 (six consecutive events). In addition, monitoring well 09MW09 was identified in April 2017 and was included in the May 2017 monitoring and sampling program upon being refurbished. The May 2017 event was the first time a groundwater sample has been collected at 09MW09 since the March 2009 event.

Groundwater wells were purged of approximately six well volumes, or until practically dry, and given sufficient time to recover to near static levels prior to sampling. Groundwater samples were collected using a dedicated disposable bailer, stored in laboratory-supplied bottles, appropriately preserved/filtered, and stored on ice in a cooler. Strict procedures were followed for sampling, preserving, and transporting the collected samples to avoid cross-contamination and to ensure sample quality was maintained. Groundwater samples were transported to Maxxam under COC for chemical analyses.

2.2.5 Data Evaluation

The groundwater analytical results are compared to the Tier 1 Guidelines. The Tier 1 approach is based on the assumption that all exposure pathways and receptors relevant to a particular land use are present and operative. The site is currently a landscaped park area with a gazebo present. As well, there are commercial/residential buildings adjacent to the site. Therefore, the Tier 1 Guidelines for residential/parkland land use with fine-grained soil under the most stringent pathway are deemed appropriate for the site.

The soil drill cuttings from the confirmatory drilling assessment were characterized for disposal at a Class II landfill using the guidelines outlined in the Alberta Environmental Protection (1996), Schedule to the Alberta User Guide for Waste Managers (AUGWM).

3.0 RESULTS

3.1 Soil Stratigraphy and Field Screening

Based on field observations, the soil stratigraphy was generally consistent between most borehole locations drilled on April 20, 2017, excluding 17MW01 which was drilled within the former tank nest area and consisted of mainly gravel fill beneath the asphalt. The fill was characterized as sandy, silty, with some clay, and traces of free water identified at approximately 2.0 m. The fill extended to approximately 4.2 m and was underlined by clay (4.2 m to 4.5 m), followed by siltstone bedrock (to 6.1 m).

The soil stratigraphy beneath the asphalt at 17MW02 to 17MW04 generally consisted of a thin layer of gravel (fill) followed by clay fill (to approximately 0.5 m). Underlying the fill material was clay which was described as silty, with some sand, and free water identified between 2.0 m and 2.2 m. Siltstone bedrock was encountered at all borehole locations beneath the clay and at depths ranging between 4.3 m and 4.5 m, to a completion depth of 6.1 m. Black to dark grey staining and hydrocarbon-like odours were identified at 17MW04 from a depth of approximately 1.6 to 4.4 m and the soil exhibited a maximum VC of 770 ppm at 1.7 m. No staining or odour was identified at any of the other borehole locations and VCs ranged from less than the PID's detection limit (most locations) to 1.8 ppm (17MW01 at 2.0 m).

Detailed stratigraphy for each borehole location is provided on the borehole logs in Appendix B.

Based on historical drilling assessments and particle size analysis (PSA) conducted at the site, the soil particle size for the site has been characterized as fine-grained.

3.2 Groundwater Levels and Monitoring Data

Shallow groundwater levels measured on May 5, 2017 ranged between 1.96 mbg (17MW01) and 2.36 mbg (09MW11), with an average depth to groundwater of 2.14 mbg. Well headspace VCs ranged from less than the instrument's detection limit (at most wells) to 484 ppm at 17MW04.

Based on the measured groundwater levels and the calculated groundwater elevations, the local shallow groundwater flow direction is interpreted to be northwesterly under an estimated horizontal hydraulic gradient of 0.007 m/m. Groundwater elevation contours for May 5, 2017 are presented on Figure 3.

3.3 Analytical Results

Soil and groundwater analytical results are presented in the following sections. The soil analytical results from the confirmatory drilling assessment are summarized in Table 2. Soil analytical results from the Class II Landfill analysis are presented on Table 3. The 2017 groundwater analytical results and historical groundwater analytical results are summarized on Table 3 and Table 4, respectively. Laboratory certificates, including methods of analyses, are attached in Appendix C. An updated Record of Site Conditions (RSC) form is provided in Appendix D.

3.3.1 Soil Chemical Quality

Concentrations of benzene (1.0 mg/kg), ethylbenzene (26 mg/kg) and xylenes (27 mg/kg) were greater than the Tier 1 Guidelines (0.046 mg/kg, 0.073 mg/kg, and 0.99 mg/kg, respectively) from the soil sample analyzed at 17MW04 at 1.7 mbg (adjacent to the west of the former tank nest). Additionally, concentrations of PHC fractions F1 (2,200 mg/kg) and F2 (1,400 mg/kg) were greater than the Tier 1 Guidelines (210 mg/kg and 150 mg/kg, respectively) from this soil sample. Concentrations of all BTEX parameters and PHC fractions were less than the analytical detection limits and/or Tier 1 Guidelines from the deeper soil sample collected at 17MW04 at 4.5 mbg.

Detectable concentrations of benzene (0.0094 mg/kg) and toluene (0.029 mg/kg) were measured at 17MW01 (within the former tank nest) at 2.0 mbg, however, the values were less than the Tier 1 Guidelines (0.046 mg/kg and 0.52 mg/kg, respectively).

Concentrations of BTEX and PHC fractions F1 to F4 were less than the analytical detection limit at all other sampling locations (17MW01 at 4.2 m, 17MW02 at 2.7 m and 4.5 m, and 17MW03 at 1.2 m and 5.5 m).

The Class II Landfill analytical results from a composite soil sample of the soil drill cuttings were less than the referenced AUGWM Guidelines for disposal at a Class II landfill.

3.3.2 Groundwater Chemical Quality

Concentrations of benzene (1.2 mg/L), toluene (0.063 mg/L), ethylbenzene (0.55 mg/L), and xylenes (0.69 mg/L) were greater than the Tier 1 Guidelines (0.005 mg/L, 0.024 mg/L, 0.0016 mg/L and 0.02 mg/L, respectively) from the groundwater sample analyzed at 17MW04 (adjacent to the west of the former tank nest). Additionally, concentrations of PHC fractions F1 (8.3 mg/L) and F2 (18 mg/L) were greater than the Tier 1 Guidelines (2.2 mg/L and 1.1 mg/L, respectively) from the groundwater sample analyzed at this well.

Concentrations of BTEX and PHC fractions F1 and F2 were less than the analytical detection limit at all other groundwater monitoring wells sampled. Tetra Tech has noted that the detection limit for benzene at 09MW09 and 09MW11 were increased by Maxxam in May 2017 due to interference and/or to bring the analyte within calibration range; however, the raised detection limit remained less than the referenced Tier 1 Guideline.

Historically, (October 2015), a concentration of benzene was measured greater than the Tier 1 Guideline at 08MW07; as well as trace concentrations (less than the Tier 1 Guideline) of xylenes and PHC fraction F2. However, all BTEX and PHC fractions have remained less than the analytical detection limit since October 2015 (three consecutive sampling events). Additionally, a benzene exceedance (March 2009) and detections (less than the Tier 1 Guideline) of benzene (July 2014) and PHC fraction F1 (March 2009) have been measured at 09MW11 historically, however, all BTEX and PHC fractions have remained less than the detection limits at this well since those dates (five consecutive sampling events).

Concentrations of TDS, sodium, sulphate, nitrate, nitrite, and/or dissolved manganese were greater than the referenced Tier 1 Guidelines at the majority of the monitoring wells sampled and were generally consistent with historical data. These parameters were analyzed as part of the groundwater monitoring program to assist in determining the potential for the natural attenuation at the site and the elevated concentrations are interpreted to be naturally occurring at the site.

4.0 DISCUSSIONS AND CONCLUSIONS

4.1 Soil and Groundwater Conditions

Key findings of the confirmatory drilling assessment and groundwater monitoring program indicate the following:

- The shallow groundwater flow direction is interpreted to be northwesterly under an estimated horizontal hydraulic gradient of 0.007 m/m.
- Concentrations of benzene, ethylbenzene, xylenes, and PHC fractions F1 and F2 were greater than the referenced Tier 1 Guidelines from the soil sample analyzed at 17MW04 at 1.7 m (adjacent to the west of the former tank nest). Concentrations of BTEX and PHC fractions were less than the analytical detection limits and/or Tier 1 Guidelines from a deeper soil sample collected at 17MW04 at 4.5 m, as well as all the other soil samples analyzed from 17MW01 (within the former tank nest), 17MW02 (adjacent to the east of the former tank nest), and 17MW03 (adjacent to the north of the former tank nest).
- The Class II landfill analytical results from a composite soil sample of the drill cuttings were less than the referenced AUGWM Guidelines for disposal at a Class II landfill.
- Concentrations of BTEX and PHC fractions F1 and F2 were greater than the referenced Tier 1 Guidelines from the groundwater sample analyzed at 17MW04. Concentrations of BTEX and PHC fractions F1 and F2 were less than the analytical detection limit at all other monitoring wells sampled on May 5, 2017. Historically, concentrations of benzene, xylenes, and/or PHC fraction F2 have been measured at 08MW07 and 09MW11, however, all BTEX and PHC fractions have remained less than the analytical detection limit at these wells for three and five consecutive sampling events, respectively.
- The results of the confirmatory drilling assessment and groundwater monitoring program indicate that PHC impacts remain in place to the west of the former tank nest at 17MW04. However, the soil and groundwater analytical results suggest that vertical and horizontal delineation of the PHC impacts have been achieved at the site.
- Routine groundwater parameters were included in the analytical suite for the first time in 2014, to assist in determining the potential for the natural attenuation of PHCs in the groundwater at the site. Concentrations of TDS, sodium, sulphate, nitrate, nitrite, and/or dissolved manganese were measured greater than the Tier 1 Guidelines in 2017, as well as historically. Concentrations of these parameters measured in the up-gradient wells have been similar to/or less than the concentrations measured down-gradient of the site and have remained generally stable since first measured in 2014. Based on these results, concentrations of these parameters measured in the groundwater likely reflect the natural groundwater composition at the Site.

4.2 Natural Attenuation

Analytical results for redox sensitive routine water chemistry parameters (nitrate, nitrite, sulphate, and dissolved iron and manganese) were used to assess the inferred redox conditions at the groundwater monitoring wells. Assessing redox conditions is relevant to determine if monitored natural attenuation (MNA), an approach that relies on natural processes (biodegradation, dispersion, dilution, sorption, volatilization, and chemical stabilization of chemicals of concern), can be used to remediate groundwater within a reasonable time frame, or to assess if a dissolved hydrocarbon plume is stable.

Degradation occurs both under aerobic and anaerobic conditions, although aerobic breakdown of many potential contaminants of concern is often more rapid (Howard et al. 1991). The significance of the redox condition is, therefore, that under aerobic (oxic) conditions, many BTEX compounds are expected to attenuate much faster than under anoxic conditions. Therefore, if inferred oxic conditions prevail at the edge of the former plume, the migration of hydrocarbons may stabilize or decrease.

Empirical redox measurements in groundwater are difficult and often yield unreliable results. Stuyfzand (1993) proposed a semi-empirical redox indexing based on measured concentrations of redox sensitive elements.

To demonstrate the relative redox conditions on site and off site, a system of three redox levels was used, based on the analytical results of the redox sensitive elements including nitrate, sulphate, dissolved iron, and dissolved manganese. The three simplified redox levels in groundwater are as follows:

- Oxic Zone: Nitrate concentrations are typically stable, but dissolved iron and manganese are not present in appreciable concentrations.
- Suboxic Zone: Nitrate concentrations are less than 1 mg-N/L; dissolved manganese is present in concentrations greater than 0.1 mg/L without an accompanying increase in dissolved iron.
- Anoxic Zone: Nitrate has been reduced; dissolved iron and dissolved manganese occur in concentrations typically greater than 0.1 mg/L; sulphate reduction is occurring, based on observations made during sampling and/or sulphate concentrations considerably less than background values.

Using this system of simplified redox levels, the spatial distribution of inferred redox conditions at the monitoring wells was summarized for the data collected in May 2017.

Oxic groundwater conditions are noted at 08MW07 (down-gradient of the former tank nest) and 09MW09 (outside the immediate northeast corner of the former tank nest) in 2017. Anoxic conditions were noted 09MW11 and suboxic condition exist at 17MW04. Oxic and/or suboxic conditions down-gradient of the former tank nest suggest that conditions are favourable for the attenuation of PHCs identified at 17MW04.

5.0 RECOMMENDATIONS

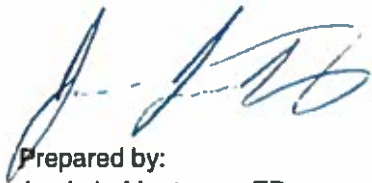
Based on the soil and groundwater results at the locations tested, and historical data collected to date, Tetra Tech provides the following two options for consideration for the PHC impacts that remain in place to the west of the former UST excavation in the vicinity of 17MW04:

- A chemical injection program; or
- A remedial excavation and off-site disposal of the PHC impacted soil.

6.0 CLOSURE

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

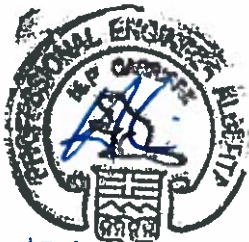
Respectfully submitted,
Tetra Tech Canada Inc.



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July 12, 2017

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PERMIT TO PRACTICE TETRA TECH CANADA INC.	
Signature	
Date	July 12, 2017
PERMIT NUMBER: P13774	
The Association of Professional Engineers and Geoscientists of Alberta	

REFERENCES

- Alberta Environment and Parks (AEP). 2016. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Environmental Policy Branch. Edmonton, Alberta.
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- Tetra Tech EBA Inc. 2011. Underground Storage Tank Removal and Monitoring. AMA Site 9558. (File No. L22101183.004).
- Stuyfzand, P.J. 1993. Hydrochemistry and Hydrology of the Coastal Dune Area of the Western Netherlands. Ph.D. Thesis Vrije Universiteit Amsterdam, The Netherlands.
- Van Stempvoort, D.R., J. Armstrong and B. Mayer. 2007. Seasonal Recharge and Replenishment of Sulfate Associated with Biodegradation of a Hydrocarbon Plume. Groundwater Monitoring and Remediation 27, No. 4: 110-121 Fall 2007.

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Table 1: Monitoring Well Completion Details and 2017 Field Monitoring Results

Monitoring Well I.D.	Date of Installation	Surface Elevation (m)	TOC Elevation ¹ (m)	PVC ² pipe Stick Up (m)	Monitoring Well Depth (mbg) ³	Monitoring Well Screen Interval (mbg)	Monitoring Well Screened In	Depth to Groundwater (mBTOC) ⁴	Depth to Groundwater (mbg)	Groundwater Elevation (m)	Vapour Concentrations ⁵ (ppm)
								May 5, 2017			
08MW01	18-Nov-08	99.44	99.34	-0.10	6.1	1.6 to 6.1	Clay and bedrock	2.05	2.15	97.29	0.0
08MW03	18-Nov-08	99.51	99.44	-0.07	6.1	1.6 to 6.1	Clay and bedrock	2.13	2.20	97.31	0.0
08MW07	18-Nov-08	99.20	99.17	-0.03	6.1	1.6 to 6.1	Clay and bedrock	2.07	2.10	97.11	0.1
09MW09	9-Mar-09	99.22	99.14	-0.08	6.1	1.6 to 6.1	Clay and Bedrock	1.98	2.06	97.16	20.6
09MW11	9-Mar-09	99.52	99.42	-0.10	6.1	3.1 to 6.1	Clay and bedrock	2.26	2.36	97.16	0.0
17MW01	20-Apr-17	99.36	99.26	-0.10	4.3	1.3 to 4.3	Clay and Gravel Fill	1.86	1.96	97.41	1.5
17MW02	20-Apr-17	99.39	99.32	-0.07	4.0	1.0 to 4.0	Clay	2.10	2.17	97.22	1.9
17MW03	20-Apr-17	99.21	99.14	-0.07	4.5	1.5 to 4.5	Clay	2.00	2.07	97.14	1.2
17MW04	20-Apr-17	99.31	99.26	-0.05	4.4	1.4 to 4.4	Clay	2.13	2.18	97.13	484

Notes:

1. Elevation of top of pipe casing (TOC).
2. Polyvinyl chloride (PVC).
3. Meters below grade (mbg).
4. Meters below top of pipe casing (mBTOC).
5. Vapour concentrations measured in parts per million (ppm) using a MiniRae 3000 Photoionization Detector.

Table 2: Soil Analytical Results

Table 1: GC/MS Analytical Results

ChemName	Unit	Detection Limit	AB Tier 1 ¹	17MW01		17MW02		17MW03		17MW04	
				2.0 m	4.2 m	2.7 m	4.5 m	1.2 m	5.5 m	1.7 m	4.5 m
				April 20, 2017							
Field Preserved Volatiles											
Benzene	mg/kg	0.005	0.046	0.0094	<0.005	<0.005	<0.005	<0.005	<0.005	<u>1.0</u>	0.036
Toluene	mg/kg	0.02	0.52	0.029	<0.02	<0.02	<0.02	<0.02	<0.02	0.3	<0.02
Ethylbenzene	mg/kg	0.01	0.073	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<u>26</u>	0.02
Xylenes Total	mg/kg	0.04	0.99	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<u>27</u>	<0.04
F1 (C6-C10) less BTEX	mg/kg	10	210	<10	<10	<10	<10	<10	<10	<u>2,200</u>	<10
Ext. Pet. Hydrocarbons											
F2 (C10-C16 Hydrocarbons)	mg/kg	10	150	<10	<10	<10	<10	<10	<10	<u>1,400</u>	<10
F3 (C16-C34 Hydrocarbons)	mg/kg	50	1,300	<50	<50	<50	<50	<50	<50	81	<50
F4: (C34-C50)	mg/kg	50	5,600	<50	<50	<50	<50	<50	<50	<50	<50
Physical Properties											
Moisture	%	0.3	--	15	18	21	13	19	13	26	13

Notes:

1. Alberta Environment and Parks (AEP). 2016. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land and Forestry Policy Branch, Policy Division. 197 pp. Referenced guidelines are for residential/parkland land use for fine-grained soil.

-- = No Guideline / Data

Bold, Underlined, & Highlighted - Greater than the referenced guidelines.

Table 3: Waste Characterization Analytical Results

Parameter	Unit	AUGWM ¹	LANDFILL
			April 20, 2017
Leachable pH			
Leachable initial pH	pH Units	2-12.5	8.85
Leachable pH after HCl	pH Units	NG	2.32
Leachable final pH	pH Units	2-12.5	7.60
Physical Properties			
Close Cup Flash Point	deg.C	--	>61
Free Liquid	N/A	--	Pass
Volatiles			
Leachable (ZH) Benzene	mg/L	0.5	<0.01
Leachable (ZH) Toluene	mg/L	0.5	<0.01
Leachable (ZH) Ethylbenzene	mg/L	0.5	<0.01
Leachable (ZH) o - Xylenes	mg/L	--	<0.01
Leachable (ZH) m & p Xylenes	mg/L	--	<0.02
Leachable (ZH) Xylenes (Total)	mg/L	0.5	<0.02
Leachable Metals			
Antimony	mg/L	500	<1.0
Arsenic	mg/L	5	<0.50
Barium	mg/L	100	<1.0
Beryllium	mg/L	5	<0.50
Boron	mg/L	500	<1.0
Cadmium	mg/L	1	<1.0
Chromium	mg/L	5	<0.50
Cobalt	mg/L	100	<1.0
Copper	mg/L	100	<1.0
Iron	mg/L	1,000	4.8
Lead	mg/L	5	<0.50
Mercury	mg/L	0.2	<0.020
Nickel	mg/L	5	<0.50
Selenium	mg/L	1	<0.10
Silver	mg/L	5	<0.50
Thallium	mg/L	5	<0.50
Uranium	mg/L	2	<0.20
Vanadium	mg/L	100	<1.0
Zinc	mg/L	500	<1.0
Zirconium	mg/L	500	<1.0
Laboratory Work Order Number			B729799
Laboratory Identification Number			QX6460

Notes:

¹ Alberta Environmental Protection. 1996. Schedule to the Alberta User Guide for Waste Managers (AUGWM) Pages 4-1 to 4-17 in Alberta User Guide for Waste Managers (--= No Guideline).

BOLD - Greater than AUGWM Guideline

Table 4: Groundwater Analytical Results

Parameter	Unit	Detection Limit	Tier 1 Guideline ¹	08MW07	09MW09	09MW11	17MW01	17MW02	17MW03	17MW04
May 5, 2017										
Hydrocarbons										
Benzene	mg/L	0.0004	0.005	<0.00040	<0.0012	<0.00070	<0.00040	<0.00040	<0.00040	1.2
Toluene	mg/L	0.0004	0.024	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.063
Ethylbenzene	mg/L	0.0004	0.0016	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.55
Xylene Total	mg/L	0.0008	0.02	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.69
F1 (C6-C10) - BTEX	mg/L	0.1	2.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	8.3
F2 (C10-C16 Hydrocarbons)	mg/L	0.1	1.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	18
Nutrients										
Nitrate (as N)	mg-N/L	0.01	3	40	12	7.1	--	--	--	<0.050
Nitrite (as N)	mg-N/L	0.01	0.6 ²	0.059	0.16	0.72	--	--	--	0.013
Routine										
pH (Lab)	pH Units	--	6.5-8.5	7.87	7.75	7.78	--	--	--	7.73
Hardness as CaCO ₃	mg/L	0.5	NG	2,400	2,200	2,200	--	--	--	2,500
Electrical Conductivity (EC)	uS/cm	1	NG	9,200	7,400	7,200	--	--	--	6,900
Total Dissolved Solids (TDS)	mg/L	10	500	7,900	6,400	6,200	--	--	--	6,100
Chloride (Cl) (Filtered)	mg/L	1	120	120	88	100	--	--	--	110
Alkalinity (total as CaCO ₃)	mg/L	0.5	NG	610	710	750	--	--	--	970
Bicarbonate	mg/L	0.5	NG	740	870	910	--	--	--	1,200
Calcium (Filtered)	mg/L	0.3	NG	350	360	350	--	--	--	340
Carbonate	mg/L	0.5	NG	<0.50	<0.50	<0.05	--	--	--	<0.50
Hydroxide	mg/L	0.5	NG	<0.50	<0.50	<0.05	--	--	--	<0.50
Magnesium (Filtered)	mg/L	0.2	NG	360	310	330	--	--	--	410
Alkalinity (pp as CaCO ₃)	mg/L	0.5	NG	<0.50	<0.50	<0.50	--	--	--	<0.50
Potassium (Filtered)	mg/L	0.3	NG	11	9.8	8.4	--	--	--	11
Sodium (Filtered)	mg/L	0.5	200	1,700	1,200	980	--	--	--	1,100
Sulphate (SO ₄) (Filtered)	mg/L	1	429 ³	4,800	3,900	3,900	--	--	--	3,500
Metals										
Iron (Filtered)	mg/L	0.06	0.3	<0.060	<0.060	<0.060	--	--	--	<0.060
Manganese (Filtered)	mg/L	0.004	0.05	0.058	0.85	1.6	--	--	--	3.3
Inferred redox condition	--	--	--	Oxic	Oxic	Anoxic				Suboxic
Inorganics										
Anion Sum	meq/L	--	NG	120	99	100	--	--	--	96
Cation Sum	meq/L	0.01	NG	120	97	88	--	--	--	98
Ionic Balance	%	--	NG	2.1	0.91	6.8	--	--	--	1.2
Lab Identification Number				QZ9305	QZ9303	QZ9306	QZ9301	QZ9302	QZ9300	QZ9304
Lab Report Number				B734282	B734282	B734282	B734282	B734282	B734282	B734282

Notes:

¹ Alberta Environment and Parks (AEP). 2016. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land and Forestry Policy Branch, Policy Division. 197 pp. References guidelines are for fine-grained soils under residential/parkland land use for the most stringent pathway.

² Guideline is chloride dependent. Site chloride ranged from 88 mg/L to 120 mg/L.

³ Guideline is hardness dependent. Site hardness values ranged from 2,200 mg/L to 2,500 mg/L.

NG - No guideline.

< = less than laboratory reportable detection limit.

BOLD AND SHADED - Exceeds Tier 1 Guideline.

Table 5: Historical Groundwater Analytical Results

Parameter	Unit	Tier 1 Guideline ¹	08MW01						08MW03						08MW06*	08MW07						08MW08*	09MW09	09MW11						09MW13*
			11/28/2008	7/18/2014	4/23/2015	10/7/2015	4/27/2016	11/8/2016	11/28/2008	7/18/2014	4/23/2015	10/7/2015	4/27/2016	11/8/2016	11/28/2008	11/28/2008	7/18/2014	4/23/2015	10/7/2015	4/27/2016	11/8/2016	11/28/2008	3/26/2009	3/26/2009	7/18/2014	4/23/2015	10/7/2015	4/27/2016	11/8/2016	3/26/2009
Hydrocarbons																														
Benzene	mg/L	0.005	<0.0009	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0009	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	0.068	<0.0009	<0.0004	<0.0004	0.027	<0.0004	<0.0004	<0.0009	0.0017	0.0057	0.0022	<0.0004	<0.0004	<0.0004	<0.0004	<0.0009
Toluene	mg/L	0.024	<0.0009	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0009	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0009	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0009	<0.0009	<0.0009	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0009
Ethylbenzene	mg/L	0.0016	<0.0009	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0009	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	0.036	<0.0009	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0009	<0.0009	<0.0009	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0009
Xylene Total	mg/L	0.02	<0.002	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.002	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	0.072	<0.002	<0.0008	<0.0008	0.0025	<0.0008	<0.0008	<0.002	<0.002	<0.002	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.002
F1 (C6-C10) - BTEX	mg/L	2.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
F2 (C10-C16 Hydrocarbons)	mg/L	1.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.8	<0.1	<0.1	<0.1	0.21	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Nutrients																														
Nitrate (as N) (Filtered)	mg-N/L	3	--	74	68	78	75	72	--	38	40	54	51	43	--	--	41	44	1.8	41	44	--	--	--	21	21	20	14	15	--
Nitrite (as N) (Filtered)	mg-N/L	0.6 ²	--	0.72	0.72	0.58	0.70	0.49	--	1.3	1.1	1.6	1.2	0.94	--	--	0.063	0.018	0.54	0.011	0.03	--	--	--	1.5	1.2	1.4	1.6	1.6	--
Routine																														
pH (Lab)	pH_Units	6.5-8.5	--	7.52	7.86	7.46	7.63	7.58	--	7.62	7.88	7.57	7.68	7.57	--	--	7.63	7.94	7.55	7.78	7.73	--	--	--	7.41	7.79	7.48	7.55	7.5	--
Hardness as CaCO3	mg/L	NG	--	3,000	3,100	3,500	3,100	3,400	--	2,900	2,900	3,000	2,900	3,100	--	--	2,300	2,400	2,000	2,400	2,600	--	--	--	2,600	2,800	2,900	2,700	2,900	--
Electrical Conductivity (EC)	uS/cm	NG	--	9,900	9,900	10,000	10,000	9,700	--	8,300	8,300	8,600	8,600	8,400	--	--	9,100	9,300	5,600	9,400	9,200	--	--	--	7,800	7,800	8,000	7,600	7,700	--
Total Dissolved Solids (TDS)	mg/L	500	--	8,800	9,300	9,700	9,300	9,600	--	6,900	7,700	7,800	7,800	7,500	--	--	7,600	8,300	4,800	8,100	8,300	--	--	--	6,500	7,100	7,600	6,800	7,000	--
Chloride (Cl) (Filtered)	mg/L	120	--	160	160	170	160	160	--	120	120	140	130	120	--	--	120	120	69	140	130	--	--	--	110	110	110	110	110	--
Alkalinity (total as CaCO3)	mg/L	NG	--	670	700	710	690	660	--	740	750	750	760	800	--	--	600	650	880	720	670	--	--	--	680	680	690	690	730	--
Bicarbonate	mg/L	NG	--	820	860	860	840	800	--	900	920	910	930	980	--	--	730	790	1,100	880	810	--	--	--	830	830	840	840	890	--
Calcium (Filtered)	mg/L	NG	--	450	460	500	470	490	--	440	440	450	440	460	--	--	360	370	340	390	400	--	--	--	380	410	430	410	440	--
Carbonate	mg/L	NG	--	<0.5	<0.5	<0.5	<0.50	<0.50	--	<0.5	<0.5	<0.5	<0.50	<0.50	--	--	<0.5	<0.5	<0.5	<0.50	<0.50	--	--	--	<0.5	<0.5	<0.5	<0.50	<0.50	--
Hydroxide	mg/L	NG	--	<0.5	<0.5	<0.5	<0.50	<0.50	--	<0.5	<0.5	<0.5	<0.50	<0.50	--	--	<0.5	<0.5	<0.5	<0.50	<0.50	--	--	--	<0.5	<0.5	<0.5	<0.50	<0.50	--
Magnesium (Filtered)	mg/L	NG	--	460	470	540	470	520	--	440	430	450	440	470	--	--	330	350	270	360	380	--	--	--	390	430	440	410	450	--
Alkalinity (pp as CaCO3)	mg/L	NG	--	<0.5	<0.5	-	<0.50	<0.50	--	<0.5	<0.5	-	<0.50	<0.50	--	--	<0.5	<0.5	-	<0.50	<0.50	--	--	--	<0.5	<0.5	-	<0.50	<0.50	--
Potassium (Filtered)	mg/L	NG	--	9.7	10	12	11	12	--	9.6	9.4	11	10	11	--	--	9.1	9.7	7.8	11	12	--	--	--	8.2	9.1	11	10	11	--
Sodium (Filtered)	mg/L	200	--	1,700	1,500	1,600	1,700	1,500	--	1,200	1,200	1,200	1,200	1,200	--	--	1,600	1,600	760	1,600	1,500	--	--	--	1,100	1,100	1,100	1,000	1,100	--
Sulphate (SO4) (Filtered)	mg/L	429 ³	--	5,200	5,900	6,000	5,800	6,200	--	4,100	4,900	4,900	4,900	4,500	--	--	4,600	5,200	2,800	5,100	5,200	--	--	--	4,000	4,600	4,900	4,400	4,500	--
Metals																														
Iron (Filtered)	mg/L	0.3	--	<0.06	<0.06	<0.06	<0.060	0.47	--	<0.06	<0.06	<0.06	<0.06	0.44	--	--	<0.06	<0.06	<0.06	<0.06	0.39	--	--	--	<0.060	<0.060	<0.06	<0.06	0.43	--
Manganese (Filtered)	mg/L	0.05	--	0.54	0.56	0.64	0.55	0.51	--	0.37	0.41	0.52	0.46	0.51	--	--	0.15	0.1	1.8	0.13	0.18	--	--	--	1.5	1.5	1.6	1.6	1.7	--
Lead (Filtered)	mg/L	0.01	<0.001	--	--	--	--	--	<0.001	--	--	--	--	--	0.0031	0.0003	--	--	--	--	--	<0.001	<0.001	<0.001	--	--	--	--	--	<0.001
Inferred redox condition	--	--	--	Oxic	Oxic	Oxic	Oxic	Oxic	--	Oxic	Oxic	Oxic	Oxic	Oxic	--	--	Oxic	Oxic	Suboxic	Oxic	Oxic	--	--	--	Oxic	Oxic	Oxic	Oxic	Anoxic	--
Inorganics																														
Anion Sum	meq/L	NG	--	130	150	150	140	150	--	110	120	120	120	120	--	--	110	130	79	130	130	--	--	--	100	110	120	110	110	--
Cation Sum	meq/L	NG	--	140	130	140	130	130	--	110	110	110	110	120	--	--	120	120	73	120	120	--	--	--	100	100	110	98	100	--
Ionic Balance	N/A	NG	--	1	0.88	0.94	0.93	0.89	--	1	0.9	0.89	0.89	0.99	--	--	1	0.91	0.92	0.92	0.92	--	--	--	1	0.91	0.9	0.89	0.94	--
Lab Identification Number			M95064	KD2520	MC8643	NJ1453	ON3884	PZ5783	M95065	KD2521	MC8644	NJ1454	ON3885	PZ5784	M95066	M95067	KD2519	MC8642	NJ1456	ON3886	PZ5786	M95068	O23768	O23766	KD2518	MC8641	NJ1455	ON3887	PZ5785	O23767
Lab Report Number			A865936	B461485	B533570	B589879	B631854	B6A0360	A865936	B461485	B533570	B589879	B631854	B6A0360	A865936	A865936	B461485	B533570	B589879	B631854	B6A0360	A865936	A913848	A913848	B461485	B533570	B589879	B631854	B6A0360	A913848

Notes:

¹ Alberta Environment and Parks (AEP). 2016. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land and Forestry Policy Branch, Policy Division. 197 pp. References guidelines are for fine-grained soils under residential/parkland land use for the most stringent pathway.

² Guideline is chloride dependent. Site chloride ranged from 69 mg/L to 170 mg/L.

³ Guideline is hardness dependent. Site hardness values ranged from 2,000 mg/L to 3,500 mg/L.

NG - No guideline.

< = less than laboratory reportable detection limit.

BOLD AND SHADED - Exceeds Guideline.

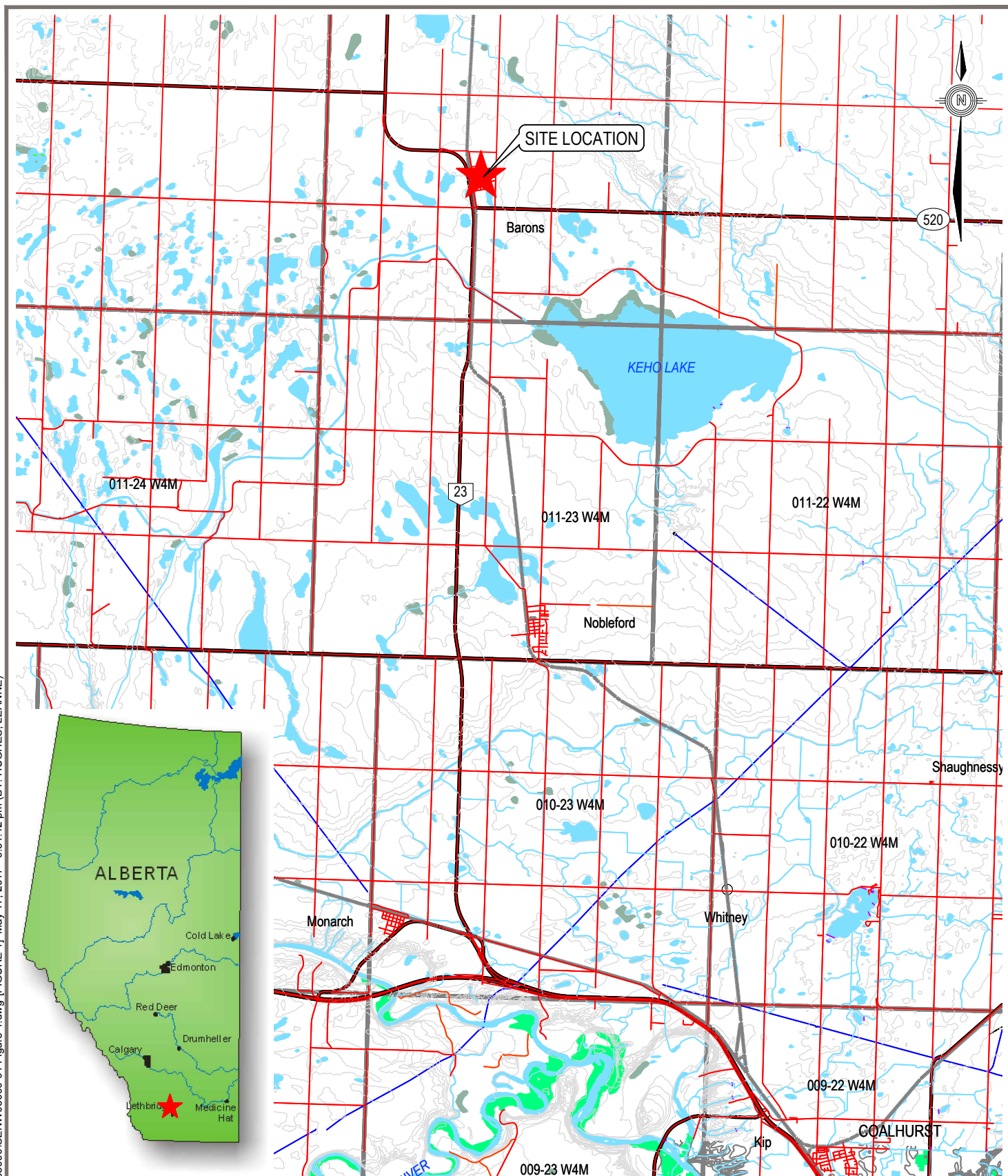
-- - No Data

*Monitoring well destroyed or not located.

FIGURES

- Figure 1 Site Location Plan
- Figure 2 Detailed Site Plan Showing the Former UST Location and Groundwater Monitoring Wells
- Figure 3 Groundwater Elevation Contours (May 5, 2017)

C:\Riverbend\Drafting\ENW\CENW\CENW03090-01 Figure 1.dwg [FIGURE 1] May 17, 2017 - 9:31:42 pm (BY: HUGHES, LEANNE)



NOTES
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CLIENT

Village of Barons



CONFIRMATORY DRILLING ASSESSMENT AND
GROUNDWATER MONITORING PROGRAM,
124 MAIN STREET, BARONS, ALBERTA, AMA SITE 9558

SITE LOCATION PLAN

PROJECT NO. CENW03090-01	DWN LCH	CKD JL	REV 0
OFFICE LETHBRIDGE	DATE May 2017		

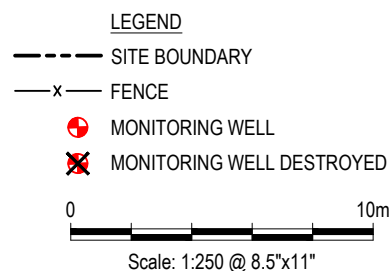
Figure 1

0 8 km
Scale: 1:150,000 @ 8.5"x11"

C:\Riverbend\Drafting\ENW_CENW\CENW03090-01 Figures 2.3.dwg [FIGURE 2] May 17, 2017 - 10:41:50 pm (BY: HUGHES, LEANNE)



NOTES
GOOGLE EARTH IMAGERY DATED 2015



CLIENT

Village of Barons



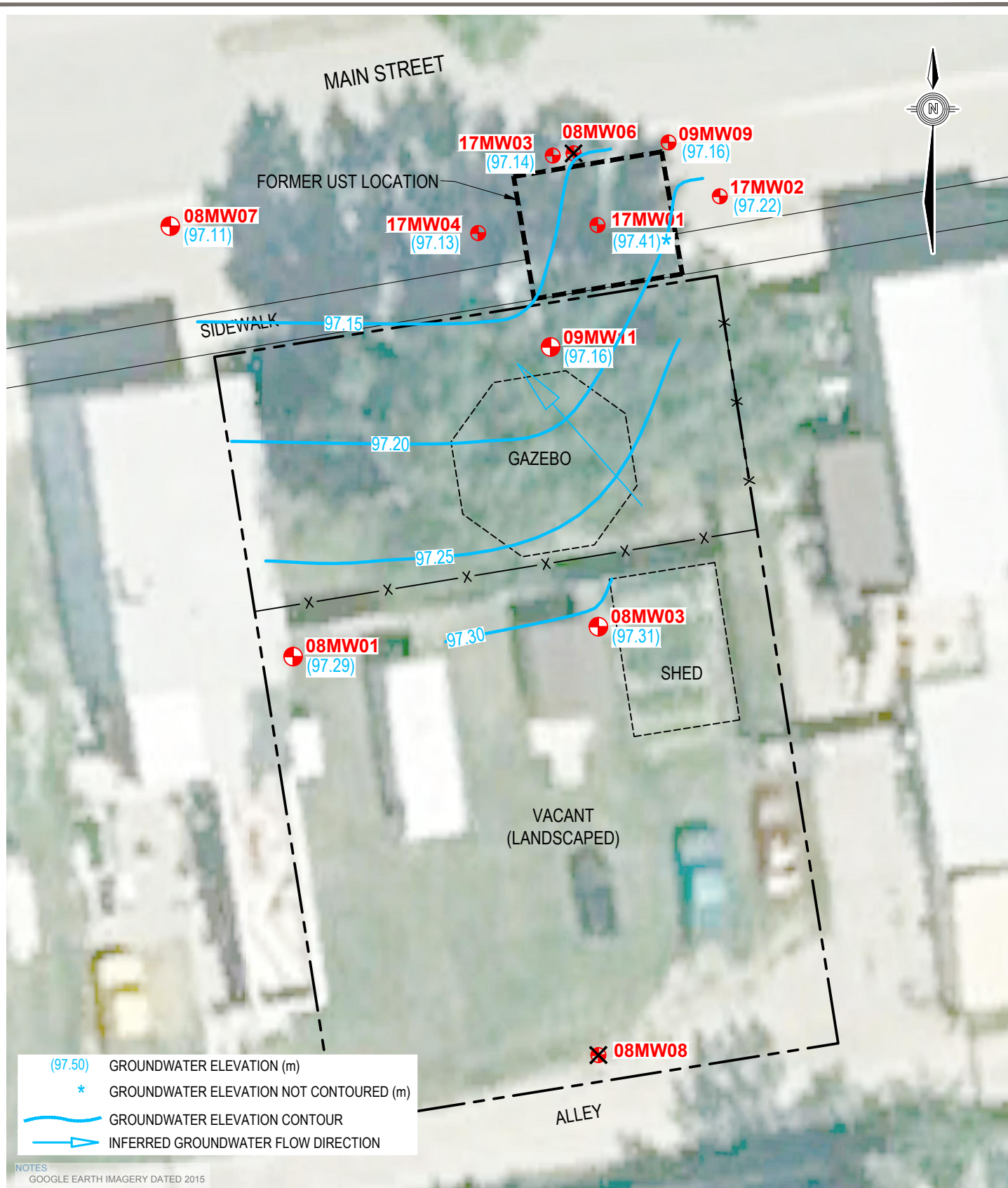
**CONFIRMATORY DRILLING ASSESSMENT AND
GROUNDWATER MONITORING PROGRAM,
124 MAIN STREET, BARONS, ALBERTA, AMA SITE 9558**

**SITE PLAN SHOWING THE FORMER UST
LOCATION AND GROUNDWATER MONITORING WELLS**

PROJECT NO. CENW03090-01	DWN LCH	CKD JL	REV 0
OFFICE LETHBRIDGE	DATE May 2017		

Figure 2

C:\Riverbed\Drafting\ENW_CENW\CENW03090-01 Figures 2.3.dwg [FIGURE 3] June 14, 2017 - 10:25:50 pm (BY: HUGHES, LEANNE)



CLIENT

Village of Barons



TETRA TECH

CONFIRMATORY DRILLING ASSESSMENT AND
GROUNDWATER MONITORING PROGRAM,
124 MAIN STREET, BARONS, ALBERTA, AMA SITE 9558

**GROUNDWATER ELEVATION CONTOURS
(MAY 5, 2017)**

PROJECT NO.
CENW03090-01

DWN
LCH

CKD
JL

REV
0

OFFICE
LETHBRIDGE

DATE
May 2017

Figure 3

APPENDIX A

TETRA TECH'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEOENVIRONMENTAL REPORT

This report incorporates and is subject to these "General Conditions".

1.1 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's client. TETRA TECH 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's Client unless otherwise authorized in writing by TETRA TECH. 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. Additional copies of the report, if required, may be obtained upon request.

1.2 ALTERNATE REPORT FORMAT

Where TETRA TECH submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed TETRA TECH'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 shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of TETRA TECH'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. The Client warrants that TETRA TECH's instruments of professional service will be used only and exactly as submitted by TETRA TECH.

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

1.1 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 in its reasonably exercised discretion.

1.2 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

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

APPENDIX B

BOREHOLE LOGS

CLIENT: VILLAGE OF BARONS		Borehole No: 17MW01				
		Project: CONFIRMATORY DRILLING ASSESSMENT		Project No: ENW.CENW03090-01		
		Location: 124 MAIN STREET		Ground Elev: 99.36 m		
		BARONS, ALBERTA		PROJECT SCIENTIST: JAYMES GOING		
Depth (m)	Method	Soil Description	Sample Type	Sample Number	Notes and Comments	17MW01 Elevation (m)
0		APSHALT GRAVEL (FILL) - sandy, silty, some clay, sizes to 30 mm, moist, compact, brown.			Vapour readings (ppmv) 200 400 600 800	
1				B1		
2		... increased clay content, soft, free water, greyish brown.		B2		
3				B3		
4				B4		
5		CLAY - silty, some sand, very moist, soft to firm, medium plastic, greyish brown. ... sandstone bedrock inclusions.		B5		
6		BEDROCK (SILTSTONE) - some sand, some clay, damp, weak, moderately weathered, greyish white to yellowish brown.		B6		
7				B7		
8				B8		
9				B9		
10		END OF BOREHOLE AT 6.1 m 51 mm PVC Groundwater Monitoring Well Installed to 4.5 m				

May 5, 2017

May 5, 2017

Contractor: CHILAKO DRILLING SERVICES LTD.

Drilling Rig Type: 150mm SOLID STEM AUGER

Logged By: JL

Reviewed By: HC

Completion Depth: 6.1 m

Start Date: April 20, 2017

Completion Date: April 20, 2017

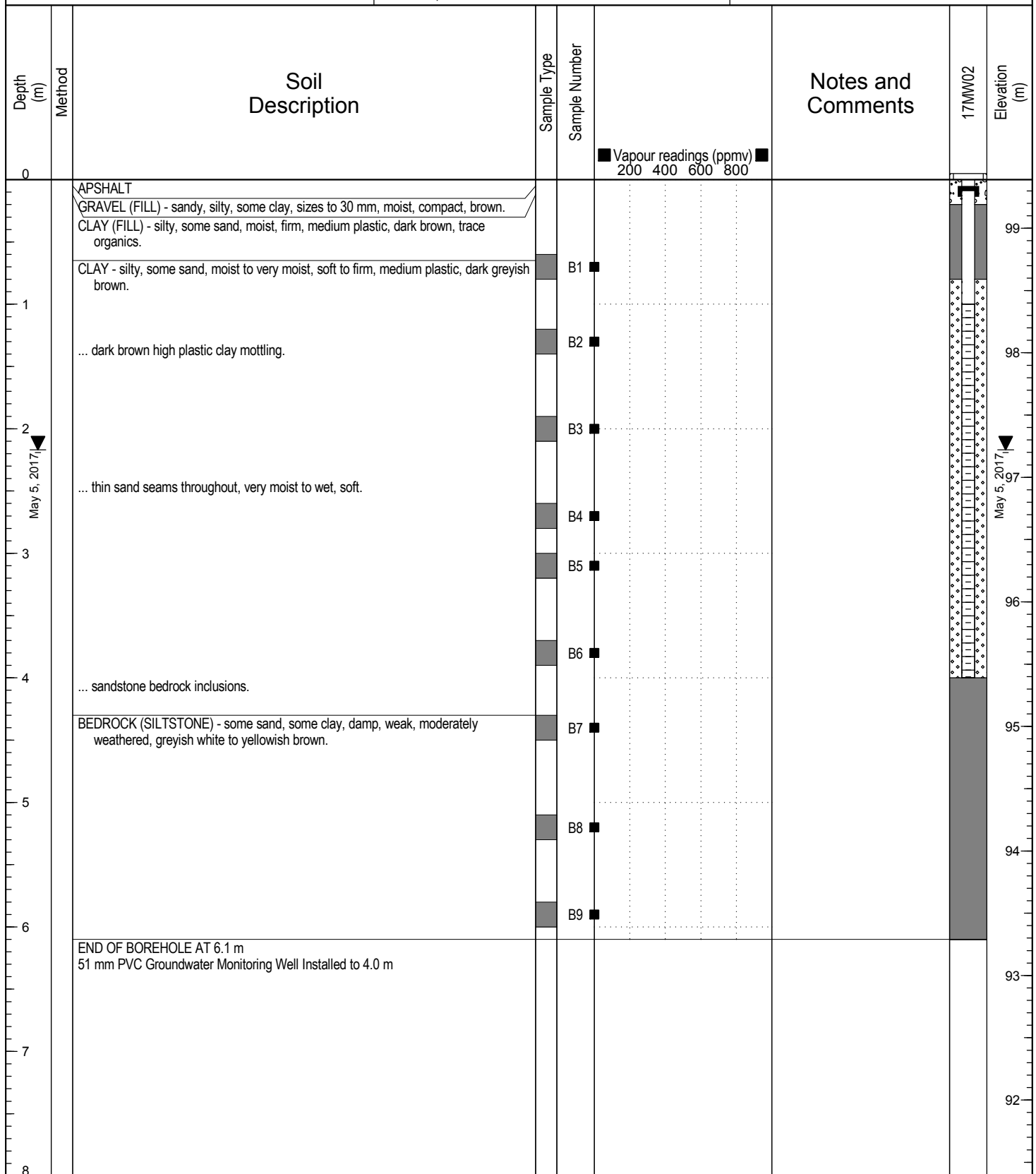
Page 1 of 1

Borehole No: 17MW02

Project No: ENW.CENW03090-01

Ground Elev: 99.39 m

PROJECT SCIENTIST: JAYMES GOING



TETRA TECH

Contractor: CHILAKO DRILLING SERVICES LTD.

Drilling Rig Type: 150mm SOLID STEM AUGER

Logged By: JL

Reviewed By: HC

Completion Depth: 6.1 m

Start Date: April 20, 2017

Completion Date: April 20, 2017

Page 1 of 1

CLIENT: VILLAGE OF BARONS		Borehole No: 17MW03						
		Project: CONFIRMATORY DRILLING ASSESSMENT		Project No: ENW.CENW03090-01				
		Location: 124 MAIN STREET		Ground Elev: 99.21 m				
		BARONS, ALBERTA		PROJECT SCIENTIST: JAYMES GOING				
Depth (m)	Method	Soil Description	Sample Type	Sample Number	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	17MW03	Elevation (m)
0		APSHALT						99
		GRAVEL (FILL) - sandy, silty, some clay, sizes to 30 mm, moist, compact, brown.						
		CLAY (FILL) - silty, trace to some sand, moist, firm to stiff, medium plastic, dark brown, trace organics.						
		CLAY - silty, some sand, moist, firm to stiff, medium plastic, dark greyish brown.		B1				
1		... dark brown high plastic clay mottling.		B2				98
2	▼ May 5, 2017	... very moist to wet, soft.		B3				97
				B4				
3		... sandy, very moist, soft, low to medium plastic.		B5				96
				B6				
4		... sandstone bedrock inclusions.		B7				95
		BEDROCK (SILTSTONE) - some sand, some clay, damp, weak, moderately weathered, greyish white to yellowish brown.		B8				94
				B9				
6		END OF BOREHOLE AT 6.1 m 51 mm PVC Groundwater Monitoring Well Installed to 4.0 m						93
7								92
8								

 TETRA TECH	Contractor: CHILAKO DRILLING SERVICES LTD.	Completion Depth: 6.1 m
	Drilling Rig Type: 150mm SOLID STEM AUGER	Start Date: April 20, 2017
	Logged By: JL	Completion Date: April 20, 2017
	Reviewed By: HC	Page 1 of 1

CLIENT: VILLAGE OF BARONS			Borehole No: 17MW04				
			Project: CONFIRMATORY DRILLING ASSESSMENT		Project No: ENW.CENW03090-01		
			Location: 124 MAIN STREET		Ground Elev: 99.31 m		
			BARONS, ALBERTA		PROJECT SCIENTIST: JAYMES GOING		
Depth (m)	Method	Soil Description	Sample Type	Sample Number	Vapour readings (ppmv) 200 400 600 800	Notes and Comments	17MW04 Elevation (m)
0		ASPHALT GRAVEL (FILL) - sandy, silty, some clay, sizes to 30 mm, moist, compact, brown. CLAY (FILL) - silty, trace to some sand, moist, firm to stiff, medium plastic, dark brown, trace organics. CLAY - silty, some sand, moist, firm to stiff, medium plastic, dark greyish brown.					99
1		... sandy, very moist, soft, low to medium plastic.		B1			
		...thin sand seams throughout, trace high plastic clay inclusions, black to dark grey staining and hydrocarbon-like odour.		B2			98
2		... very moist to wet, soft.		B3			
				B4			97
3				B5			96
4		... sandstone bedrock inclusions.		B6			
		BEDROCK (SILTSTONE) - some sand, some clay, damp, weak, moderately weathered, greyish white to yellowish brown, no staining or odour.		B7			95
5				B8			94
6				B9			
7		END OF BOREHOLE AT 6.1 m 51 mm PVC Groundwater Monitoring Well Installed to 4.0 m					93
8							92

Contractor: CHILAKO DRILLING SERVICES LTD.

Drilling Rig Type: 150mm SOLID STEM AUGER

Logged By: JL

Reviewed By: HC

Completion Depth: 6.1 m

Start Date: April 20, 2017

Completion Date: April 20, 2017

Page 1 of 1

APPENDIX C

LABORATORY CERTIFICATES

Your Project #: 704-ENW.CENW03090-01
Site#: AMA SITE 9558
Site Location: 124 MAIN STREET IN BARONS, ALBERTA
Your C.O.C. #: 1 of 2

Attention: JAYMES GOING

TETRA TECH CANADA INC.
442-10 STREET NORTH
LETHBRIDGE, AB
CANADA T1H 2C7

Report Date: 2017/04/28

Report #: R2375453

Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B729799

Received: 2017/04/22, 09:30

Sample Matrix: Soil
Samples Received: 9

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
BTEX/F1 by HS GC/MS/FID (MeOH extract) (1)	7	N/A	2017/04/24	AB SOP-00039	CCME CWS/EPA 8260C m
BTEX/F1 by HS GC/MS/FID (MeOH extract) (1)	1	N/A	2017/04/27	AB SOP-00039	CCME CWS/EPA 8260C m
BTEX in Leachates by HS GC/MS/FID (2)	1	2017/04/27	2017/04/28	AB SOP-00039	EPA 8260C m
CCME Hydrocarbons (F2-F4 in soil) (3)	5	2017/04/22	2017/04/23	AB SOP-00036 / AB SOP-00040	CCME PHC-CWS m
CCME Hydrocarbons (F2-F4 in soil) (3)	3	2017/04/22	2017/04/24	AB SOP-00036 / AB SOP-00040	CCME PHC-CWS m
Flash Point	1	N/A	2017/04/24	AB SOP-00062	ASTM D3828-12A/A m
ICPMS Metals on TCLP Leachate (2)	1	2017/04/26	2017/04/26	AB SOP-00043	EPA 200.8 R5.4 m
Moisture	8	N/A	2017/04/23	AB SOP-00002	CCME PHC-CWS m
Free Liquid (Paint filter)	1	N/A	2017/04/24	AB SOP-00047	EPA 9095B R2 m
TCLP pH Measurements	1	2017/04/25	2017/04/26	AB SOP-00006	SM 22 4500 H+B m
pH @25C (1:1 extract, solid waste)	1	2017/04/25	2017/04/25	AB SOP-00033 / AB SOP-00006	SM 22 4500 H+B m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

Your Project #: 704-ENW.CENW03090-01
Site#: AMA SITE 9558
Site Location: 124 MAIN STREET IN BARONS, ALBERTA
Your C.O.C. #: 1 of 2

Attention: JAYMES GOING

TETRA TECH CANADA INC.
442-10 STREET NORTH
LETHBRIDGE, AB
CANADA T1H 2C7

Report Date: 2017/04/28

Report #: R2375453

Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B729799

Received: 2017/04/22, 09:30

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) No lab extraction date is given for F1BTX & VOC samples that are field preserved with methanol. Extraction date is date sampled unless otherwise stated.

(2) Samples were extracted as per EPA 1311 unless otherwise noted in the report.

(3) All CCME results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following Alberta Environment's Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil, Validation of Performance-Based Alternative Methods September 2003. Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ioana Stoica, Project Manager

Email: IStoica@maxxam.ca

Phone# (403) 735-2227

=====

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B729799
Report Date: 2017/04/28

TETRA TECH CANADA INC.
Client Project #: 704-ENW.CENW03090-01
Site Location: 124 MAIN STREET IN BARONS, ALBERTA
Sampler Initials: JL

AT1 BTEX AND F1-F4 IN SOIL (VIALS)

Maxxam ID		QX6452	QX6453		QX6454		
Sampling Date		2017/04/20 08:45	2017/04/20 09:00		2017/04/20 09:30		
COC Number		1 of 2	1 of 2		1 of 2		
	UNITS	17MW01 @ 2.0M	17MW01 @ 4.2M	QC Batch	17MW02 @ 2.7M	RDL	QC Batch
Physical Properties							
Moisture	%	15	18	8610145	21	0.30	8610147
Ext. Pet. Hydrocarbon							
F2 (C10-C16 Hydrocarbons)	mg/kg	<10	<10	8610085	<10	10	8610085
F3 (C16-C34 Hydrocarbons)	mg/kg	<50	<50	8610085	<50	50	8610085
F4 (C34-C50 Hydrocarbons)	mg/kg	<50	<50	8610085	<50	50	8610085
Reached Baseline at C50	mg/kg	Yes	Yes	8610085	Yes	N/A	8610085
Field Preserved Volatiles							
Benzene	mg/kg	0.0094	<0.0050	8610358	<0.0050	0.0050	8610358
Toluene	mg/kg	0.029	<0.020	8610358	<0.020	0.020	8610358
Ethylbenzene	mg/kg	<0.010	<0.010	8610358	<0.010	0.010	8610358
Xylenes (Total)	mg/kg	<0.040	<0.040	8610358	<0.040	0.040	8610358
m & p-Xylene	mg/kg	<0.040	<0.040	8610358	<0.040	0.040	8610358
o-Xylene	mg/kg	<0.020	<0.020	8610358	<0.020	0.020	8610358
F1 (C6-C10) - BTEX	mg/kg	<10	<10	8610358	<10	10	8610358
F1 (C6-C10)	mg/kg	<10	<10	8610358	<10	10	8610358
Surrogate Recovery (%)							
1,4-Difluorobenzene (sur.)	%	98	101	8610358	101	N/A	8610358
4-Bromofluorobenzene (sur.)	%	101	96	8610358	97	N/A	8610358
D10-ETHYLBENZENE (sur.)	%	127	94	8610358	98	N/A	8610358
D4-1,2-Dichloroethane (sur.)	%	106	91	8610358	90	N/A	8610358
O-TERPHENYL (sur.)	%	93	89	8610085	91	N/A	8610085
RDL = Reportable Detection Limit							
N/A = Not Applicable							

Maxxam Job #: B729799
Report Date: 2017/04/28

TETRA TECH CANADA INC.
Client Project #: 704-ENW.CENW03090-01
Site Location: 124 MAIN STREET IN BARONS, ALBERTA
Sampler Initials: JL

AT1 BTEX AND F1-F4 IN SOIL (VIALS)

Maxxam ID		QX6455		QX6456	QX6457		
Sampling Date		2017/04/20 10:00		2017/04/20 10:30	2017/04/20 11:00		
COC Number		1 of 2		1 of 2	1 of 2		
	UNITS	17MW02 @ 4.5M	QC Batch	17MW03 @ 1.2M	17MW03 @ 5.5M	RDL	QC Batch
Physical Properties							
Moisture	%	13	8610145	19	13	0.30	8610147
Ext. Pet. Hydrocarbon							
F2 (C10-C16 Hydrocarbons)	mg/kg	<10	8610006	<10	<10	10	8610006
F3 (C16-C34 Hydrocarbons)	mg/kg	<50	8610006	<50	<50	50	8610006
F4 (C34-C50 Hydrocarbons)	mg/kg	<50	8610006	<50	<50	50	8610006
Reached Baseline at C50	mg/kg	Yes	8610006	Yes	Yes	N/A	8610006
Field Preserved Volatiles							
Benzene	mg/kg	<0.0050	8610358	<0.0050	<0.0050	0.0050	8610358
Toluene	mg/kg	<0.020	8610358	<0.020	<0.020	0.020	8610358
Ethylbenzene	mg/kg	<0.010	8610358	<0.010	<0.010	0.010	8610358
Xylenes (Total)	mg/kg	<0.040	8610358	<0.040	<0.040	0.040	8610358
m & p-Xylene	mg/kg	<0.040	8610358	<0.040	<0.040	0.040	8610358
o-Xylene	mg/kg	<0.020	8610358	<0.020	<0.020	0.020	8610358
F1 (C6-C10) - BTEX	mg/kg	<10	8610358	<10	<10	10	8610358
F1 (C6-C10)	mg/kg	<10	8610358	<10	<10	10	8610358
Surrogate Recovery (%)							
1,4-Difluorobenzene (sur.)	%	99	8610358	101	100	N/A	8610358
4-Bromofluorobenzene (sur.)	%	97	8610358	97	96	N/A	8610358
D10-ETHYLBENZENE (sur.)	%	95	8610358	95	90	N/A	8610358
D4-1,2-Dichloroethane (sur.)	%	90	8610358	91	92	N/A	8610358
O-TERPHENYL (sur.)	%	90	8610006	91	88	N/A	8610006
RDL = Reportable Detection Limit							
N/A = Not Applicable							

Maxxam Job #: B729799
Report Date: 2017/04/28

TETRA TECH CANADA INC.
Client Project #: 704-ENW.CENW03090-01
Site Location: 124 MAIN STREET IN BARONS, ALBERTA
Sampler Initials: JL

AT1 BTEX AND F1-F4 IN SOIL (VIALS)

Maxxam ID		QX6458	QX6458		QX6459		
Sampling Date		2017/04/20 11:30	2017/04/20 11:30		2017/04/20 12:00		
COC Number		1 of 2	1 of 2		1 of 2		
	UNITS	17MW04 @ 1.7M	17MW04 @ 1.7M Lab-Dup	QC Batch	17MW04 @ 4.5M	RDL	QC Batch
Physical Properties							
Moisture	%	26	26	8610145	13	0.30	8610147
Ext. Pet. Hydrocarbon							
F2 (C10-C16 Hydrocarbons)	mg/kg	1400	1400	8610085	<10	10	8610085
F3 (C16-C34 Hydrocarbons)	mg/kg	81	85	8610085	<50	50	8610085
F4 (C34-C50 Hydrocarbons)	mg/kg	<50	<50	8610085	<50	50	8610085
Reached Baseline at C50	mg/kg	Yes	Yes	8610085	Yes	N/A	8610085
Field Preserved Volatiles							
Benzene	mg/kg	1.0	N/A	8610358	0.036	0.0050	8610358
Toluene	mg/kg	0.30	N/A	8610358	<0.020	0.020	8610358
Ethylbenzene	mg/kg	26	N/A	8610358	0.020	0.010	8610358
Xylenes (Total)	mg/kg	27	N/A	8610358	<0.040	0.040	8610358
m & p-Xylene	mg/kg	26	N/A	8610358	<0.040	0.040	8610358
o-Xylene	mg/kg	1.2	N/A	8610358	<0.020	0.020	8610358
F1 (C6-C10) - BTEX	mg/kg	2200	N/A	8610358	<10	10	8610358
F1 (C6-C10)	mg/kg	2300	N/A	8610358	<10	10	8610358
Surrogate Recovery (%)							
1,4-Difluorobenzene (sur.)	%	103	N/A	8610358	102	N/A	8610358
4-Bromofluorobenzene (sur.)	%	138 (1)	N/A	8610358	98	N/A	8610358
D10-ETHYLBENZENE (sur.)	%	97	N/A	8610358	70	N/A	8610358
D4-1,2-Dichloroethane (sur.)	%	80	N/A	8610358	92	N/A	8610358
O-TERPHENYL (sur.)	%	92	94	8610085	96	N/A	8610085
RDL = Reportable Detection Limit Lab-Dup = Laboratory Initiated Duplicate N/A = Not Applicable (1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.							

Maxxam Job #: B729799
Report Date: 2017/04/28

TETRA TECH CANADA INC.
Client Project #: 704-ENW.CENW03090-01
Site Location: 124 MAIN STREET IN BARONS, ALBERTA
Sampler Initials: JL

BASIC CLASS II LANDFILL PACKAGE (SOIL)

Maxxam ID		QX6460	QX6460		
Sampling Date		2017/04/20 13:00	2017/04/20 13:00		
COC Number		1 of 2	1 of 2		
	UNITS	LANDFILL	LANDFILL Lab-Dup	RDL	QC Batch
Soluble Parameters					
Soluble (1:1) pH	pH	7.98	N/A	N/A	8611568
Physical Properties					
Closed Cup Flash Point	deg. C	>61	N/A	N/A	8610491
Free Liquid	N/A	PASS	N/A	N/A	8610494
Elements					
Leachable Antimony (Sb)	mg/L	<1.0	N/A	1.0	8612850
Leachable Arsenic (As)	mg/L	<0.50	N/A	0.50	8612850
Leachable Barium (Ba)	mg/L	<1.0	N/A	1.0	8612850
Leachable Beryllium (Be)	mg/L	<0.50	N/A	0.50	8612850
Leachable Boron (B)	mg/L	<1.0	N/A	1.0	8612850
Leachable Cadmium (Cd)	mg/L	<0.10	N/A	0.10	8612850
Leachable Chromium (Cr)	mg/L	<0.50	N/A	0.50	8612850
Leachable Cobalt (Co)	mg/L	<1.0	N/A	1.0	8612850
Leachable Copper (Cu)	mg/L	<1.0	N/A	1.0	8612850
Leachable Iron (Fe)	mg/L	4.8	N/A	1.0	8612850
Leachable Lead (Pb)	mg/L	<0.50	N/A	0.50	8612850
Leachable Mercury (Hg)	mg/L	<0.020	N/A	0.020	8612850
Leachable Nickel (Ni)	mg/L	<0.50	N/A	0.50	8612850
Leachable Selenium (Se)	mg/L	<0.10	N/A	0.10	8612850
Leachable Silver (Ag)	mg/L	<0.50	N/A	0.50	8612850
Leachable Thallium (Tl)	mg/L	<0.50	N/A	0.50	8612850
Leachable Uranium (U)	mg/L	<0.20	N/A	0.20	8612850
Leachable Vanadium (V)	mg/L	<1.0	N/A	1.0	8612850
Leachable Zinc (Zn)	mg/L	<1.0	N/A	1.0	8612850
Leachable Zirconium (Zr)	mg/L	<1.0	N/A	1.0	8612850
Volatiles					
Leachable (ZH) Benzene	ug/L	<10	<10	10	8614387
Leachable (ZH) Toluene	ug/L	<10	<10	10	8614387
Leachable (ZH) Ethylbenzene	ug/L	<10	<10	10	8614387
Leachable (ZH) o-Xylene	ug/L	<10	<10	10	8614387
RDL = Reportable Detection Limit Lab-Dup = Laboratory Initiated Duplicate N/A = Not Applicable					

Maxxam Job #: B729799
Report Date: 2017/04/28

TETRA TECH CANADA INC.
Client Project #: 704-ENW.CENW03090-01
Site Location: 124 MAIN STREET IN BARONS, ALBERTA
Sampler Initials: JL

BASIC CLASS II LANDFILL PACKAGE (SOIL)

Maxxam ID		QX6460	QX6460		
Sampling Date		2017/04/20 13:00	2017/04/20 13:00		
COC Number		1 of 2	1 of 2		
	UNITS	LANDFILL	LANDFILL Lab-Dup	RDL	QC Batch
Leachable (ZH) m & p-Xylene	ug/L	<20	<20	20	8614387
Leachable (ZH) Xylenes (Total)	ug/L	<20	<20	20	8614387
Surrogate Recovery (%)					
Leachable (ZH) 1,4-Difluorobenzene (sur.)	%	102	102	N/A	8614387
Leachable (ZH) 4-Bromofluorobenzene (sur.)	%	102	102	N/A	8614387
Leachable (ZH) D4-1,2-Dichloroethane (sur.)	%	114	116	N/A	8614387
RDL = Reportable Detection Limit Lab-Dup = Laboratory Initiated Duplicate N/A = Not Applicable					

Maxxam Job #: B729799
Report Date: 2017/04/28

TETRA TECH CANADA INC.
Client Project #: 704-ENW.CENW03090-01
Site Location: 124 MAIN STREET IN BARONS, ALBERTA
Sampler Initials: JL

RESULTS OF CHEMICAL ANALYSES OF SOIL

Maxxam ID		QX6460	
Sampling Date		2017/04/20 13:00	
COC Number		1 of 2	
	UNITS	LANDFILL	QC Batch
Misc. Inorganics			
Leachable Initial pH of Sample	pH	8.85	8612058
Leachable pH after HCl	pH	2.32	8612058
Leachable Final pH of Leachate	pH	7.60	8612058

Maxxam Job #: B729799
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TETRA TECH CANADA INC.
Client Project #: 704-ENW.CENW03090-01
Site Location: 124 MAIN STREET IN BARONS, ALBERTA
Sampler Initials: JL

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	9.3°C
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Results relate only to the items tested.

Maxxam Job #: B729799
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TETRA TECH CANADA INC.
Client Project #: 704-ENW.CENW03090-01
Site Location: 124 MAIN STREET IN BARONS, ALBERTA
Sampler Initials: JL

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8610006	MHF	Matrix Spike	O-TERPHENYL (sur.)	2017/04/24		91	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2017/04/24		83	%	60 - 130
			F3 (C16-C34 Hydrocarbons)	2017/04/24		92	%	60 - 130
			F4 (C34-C50 Hydrocarbons)	2017/04/24		92	%	60 - 130
8610006	MHF	Spiked Blank	O-TERPHENYL (sur.)	2017/04/24		88	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2017/04/24		89	%	70 - 130
			F3 (C16-C34 Hydrocarbons)	2017/04/24		92	%	70 - 130
			F4 (C34-C50 Hydrocarbons)	2017/04/24		89	%	70 - 130
8610006	MHF	Method Blank	O-TERPHENYL (sur.)	2017/04/24		100	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2017/04/24	<10		mg/kg	
			F3 (C16-C34 Hydrocarbons)	2017/04/24	<50		mg/kg	
			F4 (C34-C50 Hydrocarbons)	2017/04/24	<50		mg/kg	
8610006	MHF	RPD	F2 (C10-C16 Hydrocarbons)	2017/04/24	29		%	40
			F3 (C16-C34 Hydrocarbons)	2017/04/24	19		%	40
			F4 (C34-C50 Hydrocarbons)	2017/04/24	NC		%	40
8610085	MHF	Matrix Spike [QX6458-01]	O-TERPHENYL (sur.)	2017/04/23		93	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2017/04/23		NC	%	60 - 130
			F3 (C16-C34 Hydrocarbons)	2017/04/23		97	%	60 - 130
			F4 (C34-C50 Hydrocarbons)	2017/04/23		102	%	60 - 130
8610085	MHF	Spiked Blank	O-TERPHENYL (sur.)	2017/04/23		92	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2017/04/23		95	%	70 - 130
			F3 (C16-C34 Hydrocarbons)	2017/04/23		96	%	70 - 130
			F4 (C34-C50 Hydrocarbons)	2017/04/23		98	%	70 - 130
8610085	MHF	Method Blank	O-TERPHENYL (sur.)	2017/04/23		95	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2017/04/23	<10		mg/kg	
			F3 (C16-C34 Hydrocarbons)	2017/04/23	<50		mg/kg	
			F4 (C34-C50 Hydrocarbons)	2017/04/23	<50		mg/kg	
8610085	MHF	RPD [QX6458-01]	F2 (C10-C16 Hydrocarbons)	2017/04/23	1.9		%	40
			F3 (C16-C34 Hydrocarbons)	2017/04/23	4.5		%	40
			F4 (C34-C50 Hydrocarbons)	2017/04/23	NC		%	40
8610145	TLO	Method Blank	Moisture	2017/04/23	<0.30		%	
8610145	TLO	RPD [QX6458-01]	Moisture	2017/04/23	1.6		%	20
8610147	WLO	Method Blank	Moisture	2017/04/23	<0.30		%	
8610147	WLO	RPD	Moisture	2017/04/23	1.9		%	20
8610358	DO1	Matrix Spike	F1 (C6-C10)	2017/04/24		61	%	60 - 140
8610358	DO1	Spiked Blank	1,4-Difluorobenzene (sur.)	2017/04/24		98	%	60 - 130
			4-Bromofluorobenzene (sur.)	2017/04/24		98	%	60 - 130
			D10-ETHYLBENZENE (sur.)	2017/04/24		90	%	60 - 130
			D4-1,2-Dichloroethane (sur.)	2017/04/24		91	%	60 - 130
			Benzene	2017/04/24		85	%	60 - 130
			Toluene	2017/04/24		89	%	60 - 130
			Ethylbenzene	2017/04/24		93	%	60 - 130
			m & p-Xylene	2017/04/24		94	%	60 - 130
			o-Xylene	2017/04/24		95	%	60 - 130
			F1 (C6-C10)	2017/04/24		104	%	60 - 130
8610358	DO1	Method Blank	1,4-Difluorobenzene (sur.)	2017/04/24		101	%	60 - 130
			4-Bromofluorobenzene (sur.)	2017/04/24		97	%	60 - 130
			D10-ETHYLBENZENE (sur.)	2017/04/24		83	%	60 - 130
			D4-1,2-Dichloroethane (sur.)	2017/04/24		91	%	60 - 130
			Benzene	2017/04/24	<0.0050		mg/kg	
			Toluene	2017/04/24	<0.020		mg/kg	
			Ethylbenzene	2017/04/24	<0.010		mg/kg	

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TETRA TECH CANADA INC.
Client Project #: 704-ENW.CENW03090-01
Site Location: 124 MAIN STREET IN BARONS, ALBERTA
Sampler Initials: JL

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8610358	DO1	RPD	Xylenes (Total)	2017/04/24	<0.040		mg/kg	
			m & p-Xylene	2017/04/24	<0.040		mg/kg	
			o-Xylene	2017/04/24	<0.020		mg/kg	
			F1 (C6-C10) - BTEX	2017/04/24	<10		mg/kg	
			F1 (C6-C10)	2017/04/24	<10		mg/kg	
			Benzene	2017/04/24	NC		%	50
			Toluene	2017/04/24	NC		%	50
			Ethylbenzene	2017/04/24	NC		%	50
			Xylenes (Total)	2017/04/24	NC		%	50
			m & p-Xylene	2017/04/24	NC		%	50
			o-Xylene	2017/04/24	NC		%	50
			F1 (C6-C10) - BTEX	2017/04/24	NC		%	30
			F1 (C6-C10)	2017/04/24	NC		%	30
			Closed Cup Flash Point	2017/04/24	NC		%	35
8610491	HE1	RPD						
8611568	HA4	QC Standard	Soluble (1:1) pH	2017/04/25		101	%	98 - 102
8611568	HA4	Spiked Blank	Soluble (1:1) pH	2017/04/25		100	%	97 - 103
8611568	HA4	RPD	Soluble (1:1) pH	2017/04/25	0.85		%	N/A
8612058	ARB	Spiked Blank	Leachable Initial pH of Sample	2017/04/26		100	%	97 - 103
			Leachable pH after HCl	2017/04/26		100	%	97 - 103
			Leachable Final pH of Leachate	2017/04/26		100	%	97 - 103
8612058	ARB	RPD	Leachable Initial pH of Sample	2017/04/26	0.21		%	N/A
			Leachable pH after HCl	2017/04/26	5.1		%	N/A
			Leachable Final pH of Leachate	2017/04/26	0.32		%	N/A
8612850	STI	Matrix Spike	Leachable Antimony (Sb)	2017/04/26		93	%	75 - 125
			Leachable Arsenic (As)	2017/04/26		95	%	75 - 125
			Leachable Barium (Ba)	2017/04/26		91	%	75 - 125
			Leachable Beryllium (Be)	2017/04/26		82	%	75 - 125
			Leachable Boron (B)	2017/04/26		81	%	75 - 125
			Leachable Cadmium (Cd)	2017/04/26		93	%	75 - 125
			Leachable Chromium (Cr)	2017/04/26		92	%	75 - 125
			Leachable Cobalt (Co)	2017/04/26		90	%	75 - 125
			Leachable Copper (Cu)	2017/04/26		88	%	75 - 125
			Leachable Iron (Fe)	2017/04/26		NC	%	75 - 125
			Leachable Lead (Pb)	2017/04/26		88	%	75 - 125
			Leachable Mercury (Hg)	2017/04/26		91	%	75 - 125
			Leachable Nickel (Ni)	2017/04/26		89	%	75 - 125
			Leachable Selenium (Se)	2017/04/26		96	%	75 - 125
			Leachable Silver (Ag)	2017/04/26		92	%	75 - 125
			Leachable Thallium (Tl)	2017/04/26		86	%	75 - 125
			Leachable Uranium (U)	2017/04/26		94	%	75 - 125
			Leachable Vanadium (V)	2017/04/26		96	%	75 - 125
			Leachable Zinc (Zn)	2017/04/26		91	%	75 - 125
			Leachable Zirconium (Zr)	2017/04/26		103	%	75 - 125
8612850	STI	Spiked Blank	Leachable Antimony (Sb)	2017/04/26		97	%	80 - 120
			Leachable Arsenic (As)	2017/04/26		99	%	80 - 120
			Leachable Barium (Ba)	2017/04/26		98	%	80 - 120
			Leachable Beryllium (Be)	2017/04/26		90	%	80 - 120
			Leachable Boron (B)	2017/04/26		90	%	80 - 120
			Leachable Cadmium (Cd)	2017/04/26		98	%	80 - 120
			Leachable Chromium (Cr)	2017/04/26		97	%	80 - 120
			Leachable Cobalt (Co)	2017/04/26		94	%	80 - 120
			Leachable Copper (Cu)	2017/04/26		93	%	80 - 120

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TETRA TECH CANADA INC.
Client Project #: 704-ENW.CENW03090-01
Site Location: 124 MAIN STREET IN BARONS, ALBERTA
Sampler Initials: JL

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
				Leachable Iron (Fe)	2017/04/26		100	%	80 - 120
				Leachable Lead (Pb)	2017/04/26		94	%	80 - 120
				Leachable Mercury (Hg)	2017/04/26		97	%	80 - 120
				Leachable Nickel (Ni)	2017/04/26		92	%	80 - 120
				Leachable Selenium (Se)	2017/04/26		99	%	80 - 120
				Leachable Silver (Ag)	2017/04/26		96	%	80 - 120
				Leachable Thallium (Tl)	2017/04/26		91	%	80 - 120
				Leachable Uranium (U)	2017/04/26		98	%	80 - 120
				Leachable Vanadium (V)	2017/04/26		99	%	80 - 120
				Leachable Zinc (Zn)	2017/04/26		98	%	80 - 120
				Leachable Zirconium (Zr)	2017/04/26		107	%	80 - 120
8612850	STI		Method Blank	Leachable Antimony (Sb)	2017/04/26	<1.0		mg/L	
				Leachable Arsenic (As)	2017/04/26	<0.50		mg/L	
				Leachable Barium (Ba)	2017/04/26	<1.0		mg/L	
				Leachable Beryllium (Be)	2017/04/26	<0.50		mg/L	
				Leachable Boron (B)	2017/04/26	<1.0		mg/L	
				Leachable Cadmium (Cd)	2017/04/26	<0.10		mg/L	
				Leachable Chromium (Cr)	2017/04/26	<0.50		mg/L	
				Leachable Cobalt (Co)	2017/04/26	<1.0		mg/L	
				Leachable Copper (Cu)	2017/04/26	<1.0		mg/L	
				Leachable Iron (Fe)	2017/04/26	<1.0		mg/L	
				Leachable Lead (Pb)	2017/04/26	<0.50		mg/L	
				Leachable Mercury (Hg)	2017/04/26	<0.020		mg/L	
				Leachable Nickel (Ni)	2017/04/26	<0.50		mg/L	
				Leachable Selenium (Se)	2017/04/26	<0.10		mg/L	
				Leachable Silver (Ag)	2017/04/26	<0.50		mg/L	
				Leachable Thallium (Tl)	2017/04/26	<0.50		mg/L	
				Leachable Uranium (U)	2017/04/26	<0.20		mg/L	
				Leachable Vanadium (V)	2017/04/26	<1.0		mg/L	
				Leachable Zinc (Zn)	2017/04/26	<1.0		mg/L	
				Leachable Zirconium (Zr)	2017/04/26	<1.0		mg/L	
8612850	STI		RPD	Leachable Antimony (Sb)	2017/04/26	NC		%	35
				Leachable Arsenic (As)	2017/04/26	NC		%	35
				Leachable Barium (Ba)	2017/04/26	NC		%	35
				Leachable Beryllium (Be)	2017/04/26	NC		%	35
				Leachable Boron (B)	2017/04/26	NC		%	35
				Leachable Cadmium (Cd)	2017/04/26	NC		%	35
				Leachable Chromium (Cr)	2017/04/26	NC		%	35
				Leachable Cobalt (Co)	2017/04/26	NC		%	35
				Leachable Copper (Cu)	2017/04/26	NC		%	35
				Leachable Iron (Fe)	2017/04/26	0.56		%	35
				Leachable Lead (Pb)	2017/04/26	NC		%	35
				Leachable Mercury (Hg)	2017/04/26	NC		%	35
				Leachable Nickel (Ni)	2017/04/26	NC		%	35
				Leachable Selenium (Se)	2017/04/26	NC		%	35
				Leachable Silver (Ag)	2017/04/26	NC		%	35
				Leachable Thallium (Tl)	2017/04/26	NC		%	35
				Leachable Uranium (U)	2017/04/26	NC		%	35
				Leachable Vanadium (V)	2017/04/26	NC		%	35
				Leachable Zinc (Zn)	2017/04/26	NC		%	35
				Leachable Zirconium (Zr)	2017/04/26	NC		%	35
8614387	RSU		Matrix Spike [QX6460-01]	Leachable (ZH) 1,4-Difluorobenzene (sur.)	2017/04/28		101	%	70 - 130

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TETRA TECH CANADA INC.
Client Project #: 704-ENW.CENW03090-01
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Sampler Initials: JL

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8614387	RSU	Spiked Blank	Leachable (ZH) 4-Bromofluorobenzene (sur.)	2017/04/28		103	%	70 - 130
			Leachable (ZH) D4-1,2-Dichloroethane (sur.)	2017/04/28		113	%	70 - 130
			Leachable (ZH) Benzene	2017/04/28		92	%	70 - 130
			Leachable (ZH) Toluene	2017/04/28		88	%	70 - 130
			Leachable (ZH) Ethylbenzene	2017/04/28		94	%	70 - 130
			Leachable (ZH) o-Xylene	2017/04/28		90	%	70 - 130
			Leachable (ZH) m & p-Xylene	2017/04/28		91	%	70 - 130
			Leachable (ZH) 1,4-Difluorobenzene (sur.)	2017/04/28		105	%	70 - 130
			Leachable (ZH) 4-Bromofluorobenzene (sur.)	2017/04/28		104	%	70 - 130
			Leachable (ZH) D4-1,2-Dichloroethane (sur.)	2017/04/28		115	%	70 - 130
			Leachable (ZH) Benzene	2017/04/28		93	%	70 - 130
			Leachable (ZH) Toluene	2017/04/28		90	%	70 - 130
			Leachable (ZH) Ethylbenzene	2017/04/28		95	%	70 - 130
			Leachable (ZH) o-Xylene	2017/04/28		92	%	70 - 130
8614387	RSU	Method Blank	Leachable (ZH) m & p-Xylene	2017/04/28		93	%	70 - 130
			Leachable (ZH) 1,4-Difluorobenzene (sur.)	2017/04/28		103	%	70 - 130
			Leachable (ZH) 4-Bromofluorobenzene (sur.)	2017/04/28		101	%	70 - 130
			Leachable (ZH) D4-1,2-Dichloroethane (sur.)	2017/04/28		112	%	70 - 130
			Leachable (ZH) Benzene	2017/04/28	<10		ug/L	
			Leachable (ZH) Toluene	2017/04/28	<10		ug/L	
			Leachable (ZH) Ethylbenzene	2017/04/28	<10		ug/L	
			Leachable (ZH) o-Xylene	2017/04/28	<10		ug/L	
			Leachable (ZH) m & p-Xylene	2017/04/28	<20		ug/L	
			Leachable (ZH) Xylenes (Total)	2017/04/28	<20		ug/L	
			Leachable (ZH) Benzene	2017/04/28	NC		%	30
			Leachable (ZH) Toluene	2017/04/28	NC		%	30
			Leachable (ZH) Ethylbenzene	2017/04/28	NC		%	30
			Leachable (ZH) o-Xylene	2017/04/28	NC		%	30
			Leachable (ZH) m & p-Xylene	2017/04/28	NC		%	30
			Leachable (ZH) Xylenes (Total)	2017/04/28	NC		%	30

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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TETRA TECH CANADA INC.
Client Project #: 704-ENW.CENW03090-01
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Sampler Initials: JL

VALIDATION SIGNATURE PAGE

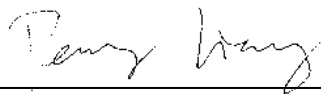
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Dennis Ngundu, B.Sc., P.Chem., QP, Supervisor, Organics



Janet Gao, B.Sc., QP, Supervisor, Organics



Harry (Peng) Liang, Senior Analyst

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



Calgary: 4000 19th St. NE, T2E 6P8. Toll Free (800) 386-7247
Edmonton: 9331-48 St. T6B 2R4. Toll Free (800) 386-7247
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CHAIN OF CUSTODY RECORD

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1462

Invoice Information		Report Information (if differs from invoice)		Project Information		Turnaround Time (TAT) Required																																																																									
Company: TETRA TECH CANADA INC		Company: SAME AS		Quotation #:		☒ 5 - 7 Days Regular (Most analyses)																																																																									
Contact Name: JAYMES GOING		Contact Name:		P.O. #/ AFE#:		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS																																																																									
Address: 442 - 10 STREET NORTH		Address:		Project #: 704-ENW.CENW03090.01		Rush TAT (Surcharges will be applied)																																																																									
LETHBRIDGE, AB		Phone:		Site Location: 124 Main Street in Barons, Alberta		☐ Same Day ☐ 2 Days																																																																									
Phone: 403.634.3566		Email:		Site #: AMA SITE 9558		☐ 1 Day ☐ 3-4 Days																																																																									
Email: jaymes.going@tetratech.com		Copies:		Sampled By: JAMIE LAMONTAGNE		Date Required:																																																																									
Copies: jamie.lamontagne@tetratech.com						Rush Confirmation #:																																																																									
Laboratory Use Only				Analysis Requested				Regulatory Criteria																																																																							
<table><tr><td>Seal Present</td><td>YES</td><td>NO</td><td>Cooler ID</td></tr><tr><td>Seal Intact</td><td></td><td></td><td>Temp 9 9 10</td></tr><tr><td>Cooling Media</td><td></td><td></td><td></td></tr><tr><td>Seal Present</td><td>YES</td><td>NO</td><td>Cooler ID</td></tr><tr><td>Seal Intact</td><td></td><td></td><td>Temp</td></tr><tr><td>Cooling Media</td><td></td><td></td><td></td></tr><tr><td>Seal Present</td><td>YES</td><td>NO</td><td>Cooler ID</td></tr><tr><td>Seal Intact</td><td></td><td></td><td>Temp</td></tr><tr><td>Cooling Media</td><td></td><td></td><td></td></tr></table>				Seal Present	YES	NO	Cooler ID	Seal Intact			Temp 9 9 10	Cooling Media				Seal Present	YES	NO	Cooler ID	Seal Intact			Temp	Cooling Media				Seal Present	YES	NO	Cooler ID	Seal Intact			Temp	Cooling Media				<table><tr><td># of containers</td><td>BTEX F1</td><td>BTEX F1-F2</td><td>BTEX F1-F4</td><td>Routine Water</td><td>Regulated Metals</td><td>Total</td><td>Dissolved</td><td>Mercury</td><td>Salinity</td><td>Sieve (75 micron)</td><td>Texture [% Sand, silt, Clay]</td><td>Basic Class II Landfill</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>				# of containers	BTEX F1	BTEX F1-F2	BTEX F1-F4	Routine Water	Regulated Metals	Total	Dissolved	Mercury	Salinity	Sieve (75 micron)	Texture [% Sand, silt, Clay]	Basic Class II Landfill														<table><tr><td>☒ AT1</td></tr><tr><td>☐ CCME</td></tr><tr><td>☐ Drinking Water</td></tr><tr><td>☐ D50 (Drilling Waste)</td></tr><tr><td>☐ Saskatchewan</td></tr><tr><td>☐ Other:</td></tr></table>				☒ AT1	☐ CCME	☐ Drinking Water	☐ D50 (Drilling Waste)	☐ Saskatchewan	☐ Other:
Seal Present	YES	NO	Cooler ID																																																																												
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Sample Identification				HOLD - DO NOT ANALYZE				Special Instructions																																																																							
	Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix																																																																											
1	17MW01	2.0 m	4/20/2017 8:45	SOIL	3																																																																										
2	17MW01	4.2 m	4/20/2017 9:00	SOIL	3																																																																										
3	17MW02	2.7 m	4/20/2017 9:30	SOIL	3																																																																										
4	17MW02	4.5 m	4/20/2017 10:00	SOIL	3																																																																										
5	17MW03	1.2 m	4/20/2017 10:30	SOIL	3																																																																										
6	17MW03	5.5 m	4/20/2017 11:00	SOIL	3																																																																										
7	17MW04	1.7 m	4/20/2017 11:30	SOIL	3																																																																										
8	17MW04	4.5 m	4/20/2017 12:00	SOIL	3																																																																										
9	LANDFILL	COMP.	4/20/2017 13:00	SOIL	3						X																																																																				
10	17MW03	3.3 M	4/20/2017 10:15	SOIL	3							X																																																																			
Please indicate Filtered, Preserved or Both (F, P, F/P)																																																																															
Relinquished by: (Signature/ Print)		DATE (YYYY/MM/DD)	Time (HH:MM)	Received by: (Signature/ Print)		DATE (YYYY/MM/DD)	Time (HH:MM)	Maxxam Job #																																																																							
JAMIE LAMONTAGNE		4/21/2017	13:00	HARRY TOWN		20170417	0930	22-Apr-17 09:30																																																																							



JBK INS-0138

CHAIN OF CUSTODY RECORD

Page 2 of 2

Report Information			Comments		Analysis Requested														Same as CoC	
Company: <u>TETRA TECH CANADA INC.</u> Contact: <u>JAYMES GOING</u> Phone: <u>403.634.3566</u> Email: <u>JAYMES.GOING@TETRATECH.COM</u> Sampled by: <u>JAMIE LAMONTAGNE</u>					# of containers	BTEX F1 ☐ VOC ☐	BTEX F1 F2	BTEX F1 F4	Routine Water	Regulated Metals Tot ☐ Dis ☐	Mercury Total ☐ Dissolved ☐	Salinity 4	Sieve (75 micron)	Texture (% Sand, Silt, Clay)	Basic Class (Landfill)	HOLD - DO NOT ANALYZE	Project/LSD 704-ENW.CENW03090-01			
Sample Identification		Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)													Matrix			
11	17MW04	1.1 M	4/20/2017	11:55	SOIL	3														
12																				
13																				
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15																				
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Please indicate Filtered, Preserved or Both (F, P, F/P)

Relinquished by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)	Received by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)
	2017/04/21	13:00		2017/04/21	09:30

22-Apr-17 09:30

Ioana Stoica

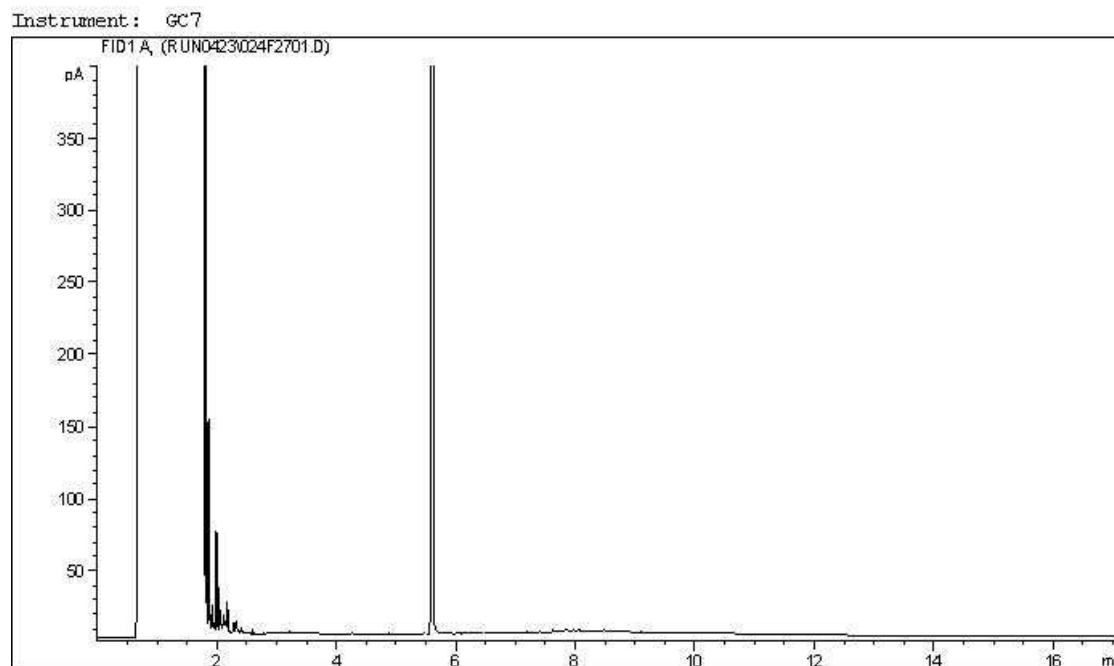


B729799

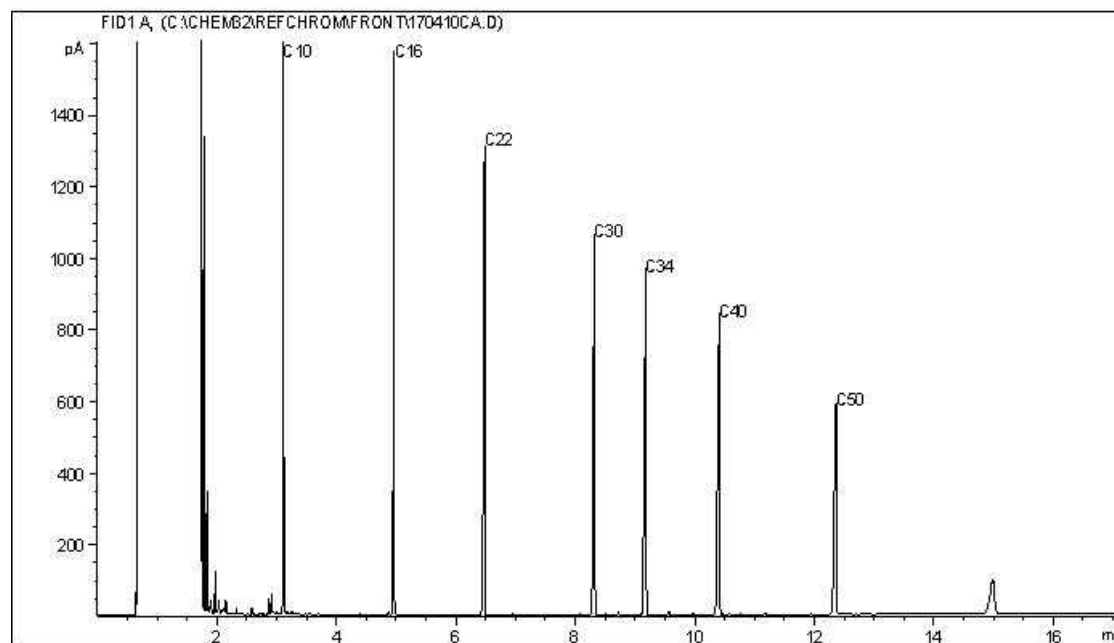
JBK

INS-0138

CCME Hydrocarbons (F2-F4 in soil) Chromatogram



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

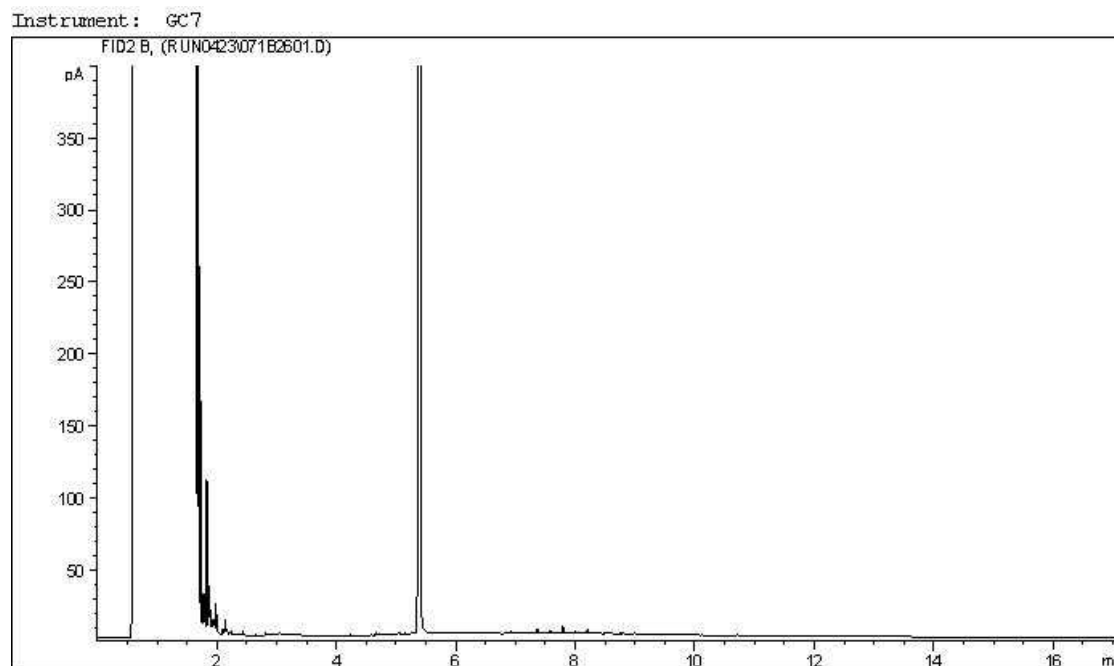
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

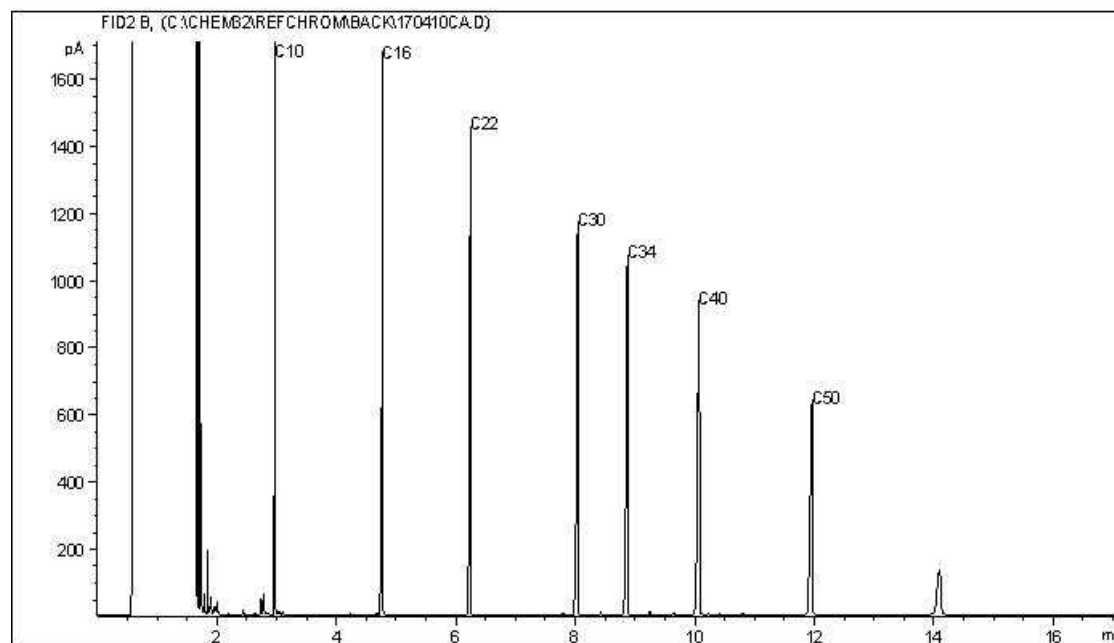
Maxxam Job #: B729799
Report Date: 2017/04/28
Maxxam Sample: QX6453

TETRA TECH CANADA INC.
Client Project #: 704-ENW.CENW03090-01
Site Reference: 124 MAIN STREET IN BARONS, ALBERTA
Client ID: 17MW01 @ 4.2M

CCME Hydrocarbons (F2-F4 in soil) Chromatogram



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

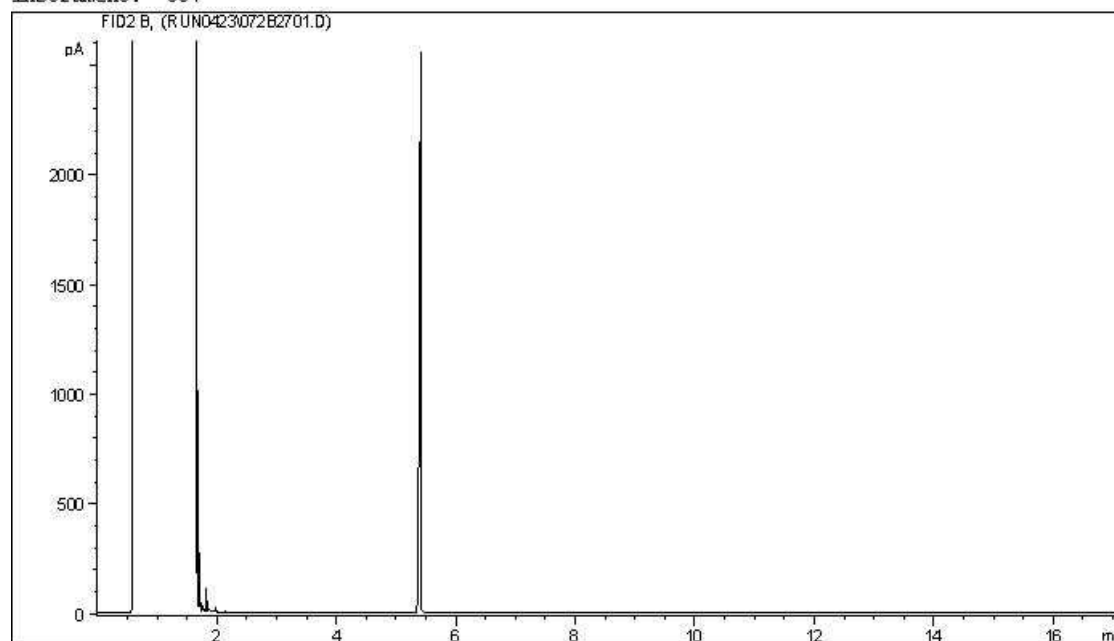
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B729799
Report Date: 2017/04/28
Maxxam Sample: QX6454

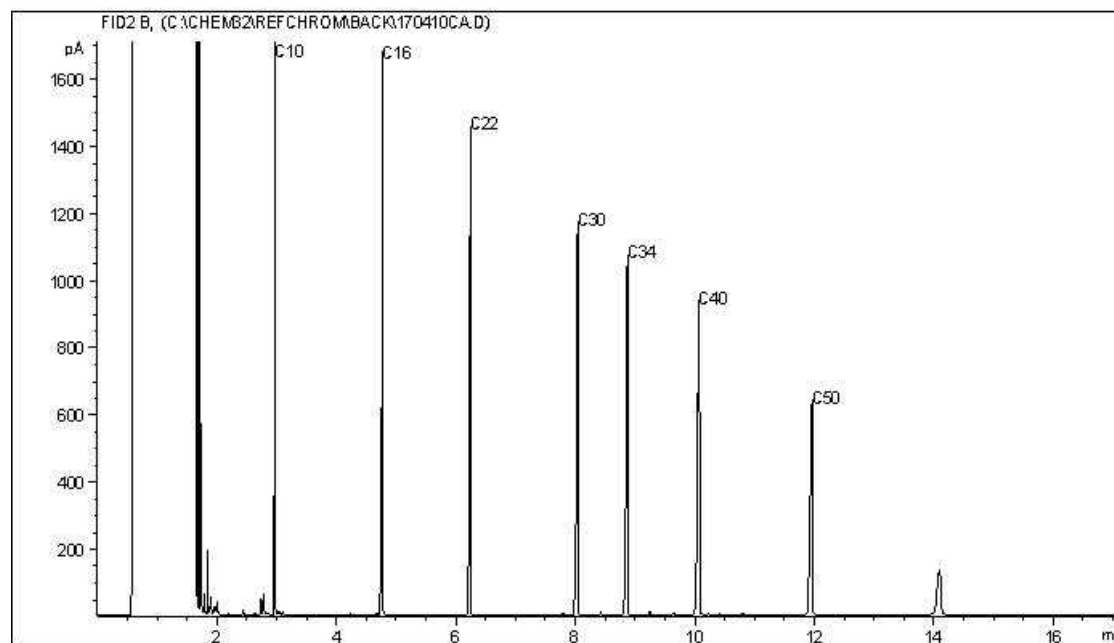
TETRA TECH CANADA INC.
Client Project #: 704-ENW.CENW03090-01
Site Reference: 124 MAIN STREET IN BARONS, ALBERTA
Client ID: 17MW02 @ 2.7M

CCME Hydrocarbons (F2-F4 in soil) Chromatogram

Instrument: GC7



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

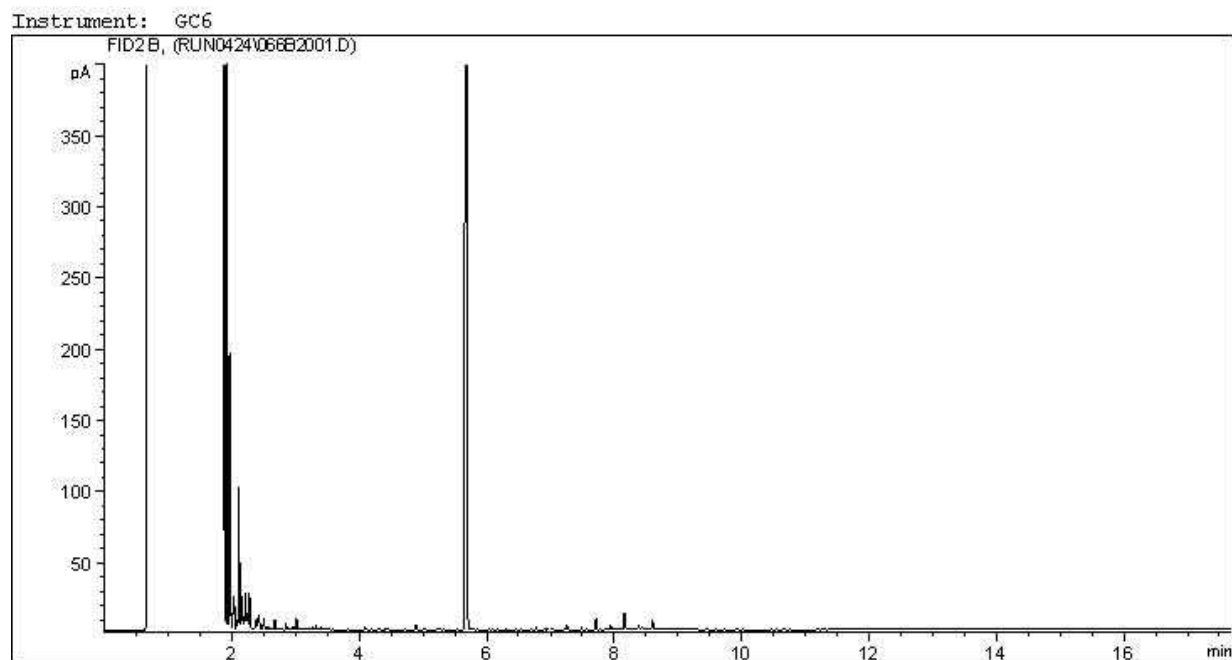
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

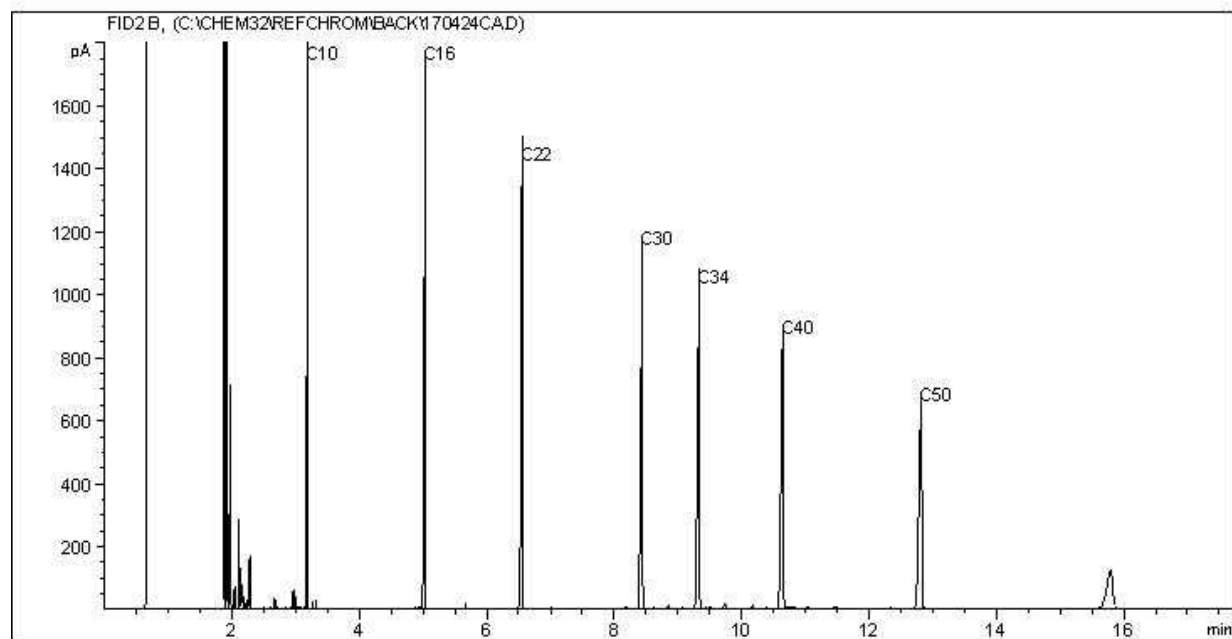
Maxxam Job #: B729799
Report Date: 2017/04/28
Maxxam Sample: QX6455

TETRA TECH CANADA INC.
Client Project #: 704-ENW.CENW03090-01
Site Reference: 124 MAIN STREET IN BARONS, ALBERTA
Client ID: 17MW02 @ 4.5M

CCME Hydrocarbons (F2-F4 in soil) Chromatogram



Carbon Range Distribution - Reference Chromatogram

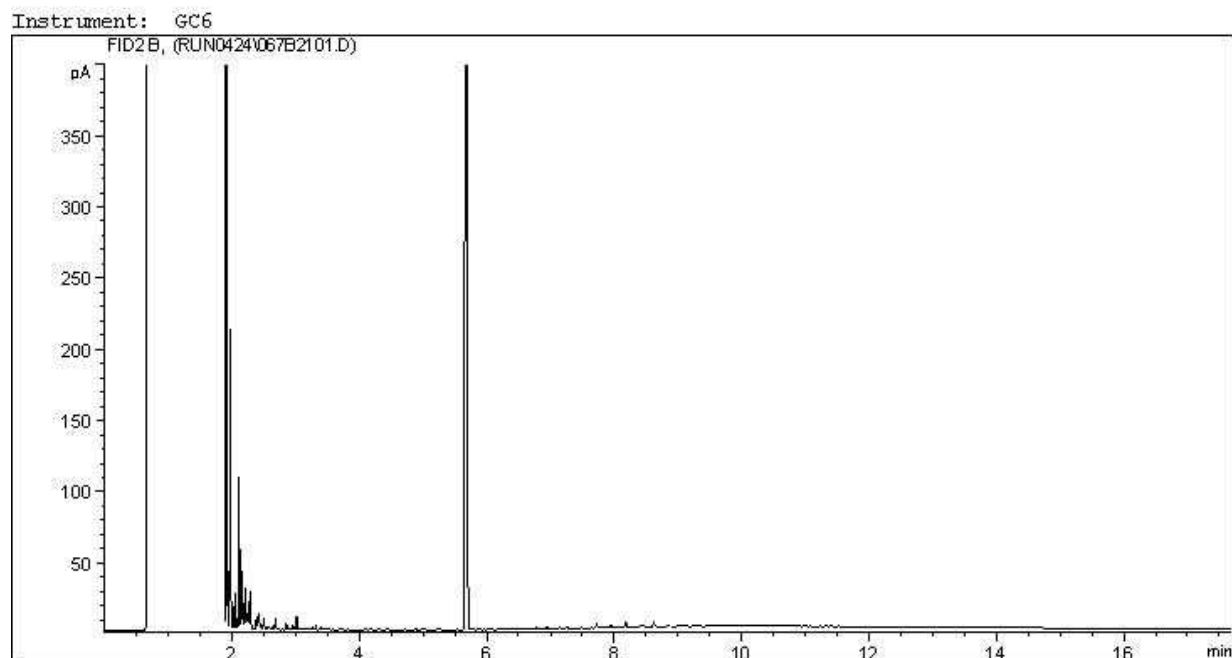


TYPICAL PRODUCT CARBON NUMBER RANGES

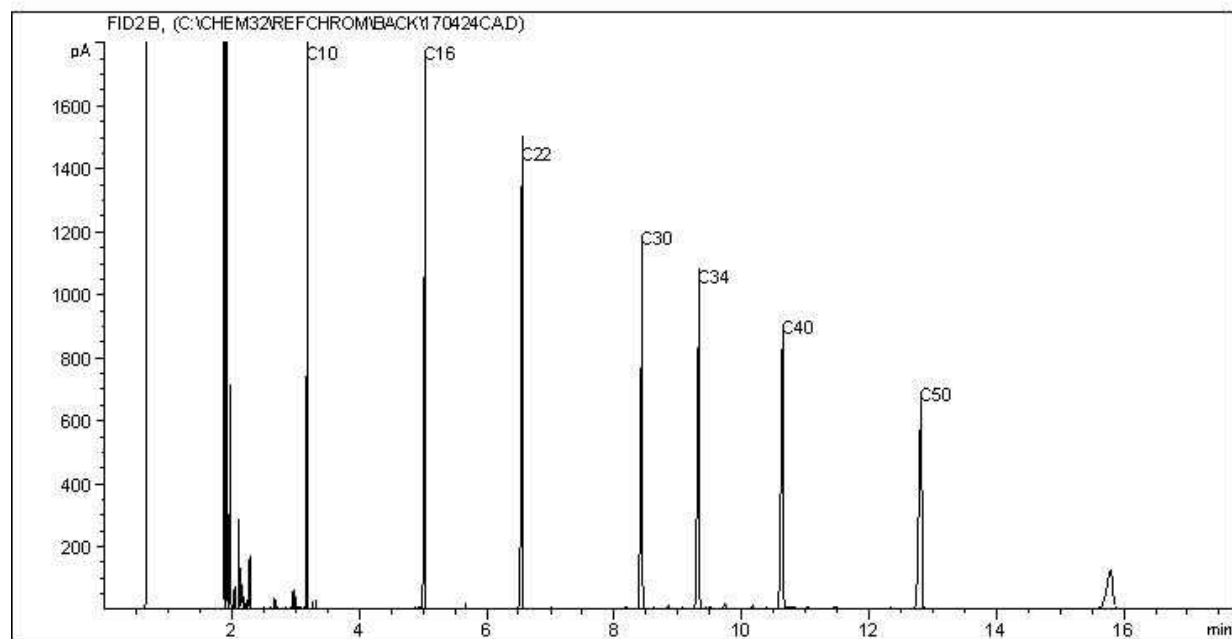
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

CCME Hydrocarbons (F2-F4 in soil) Chromatogram



Carbon Range Distribution - Reference Chromatogram



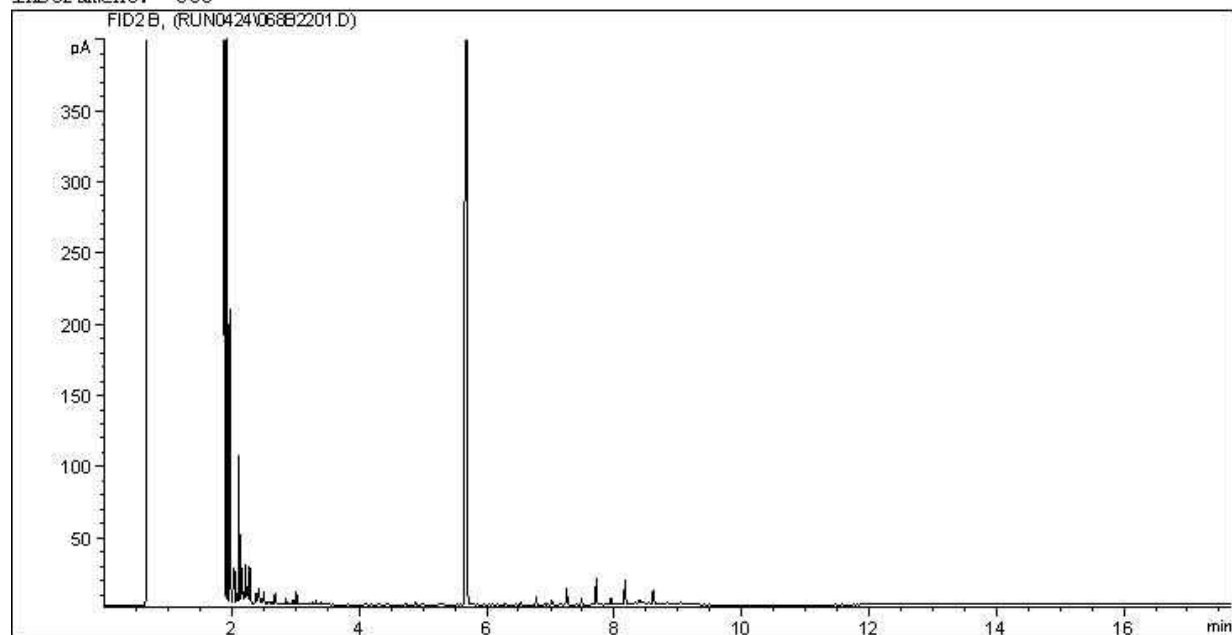
TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

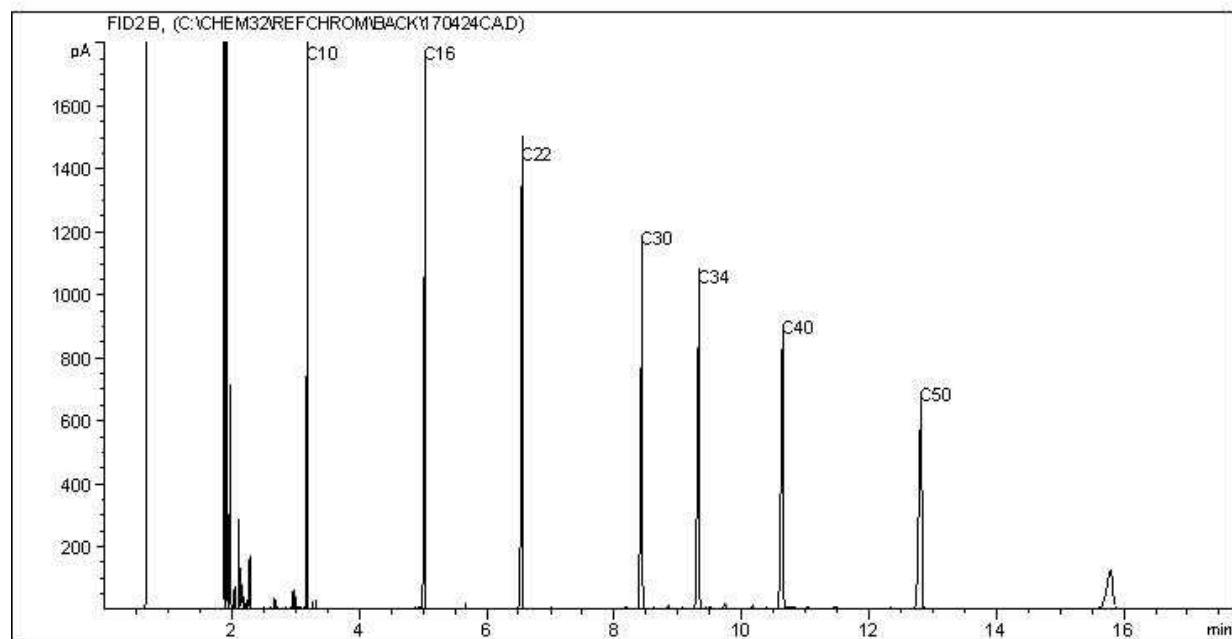
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

CCME Hydrocarbons (F2-F4 in soil) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

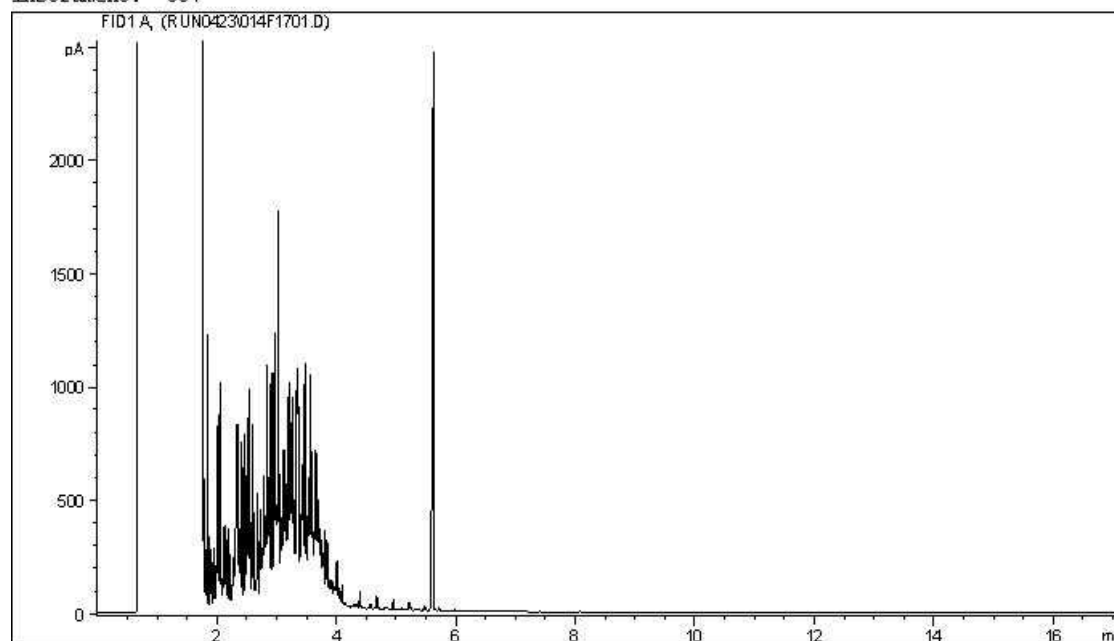
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B729799
Report Date: 2017/04/28
Maxxam Sample: QX6458

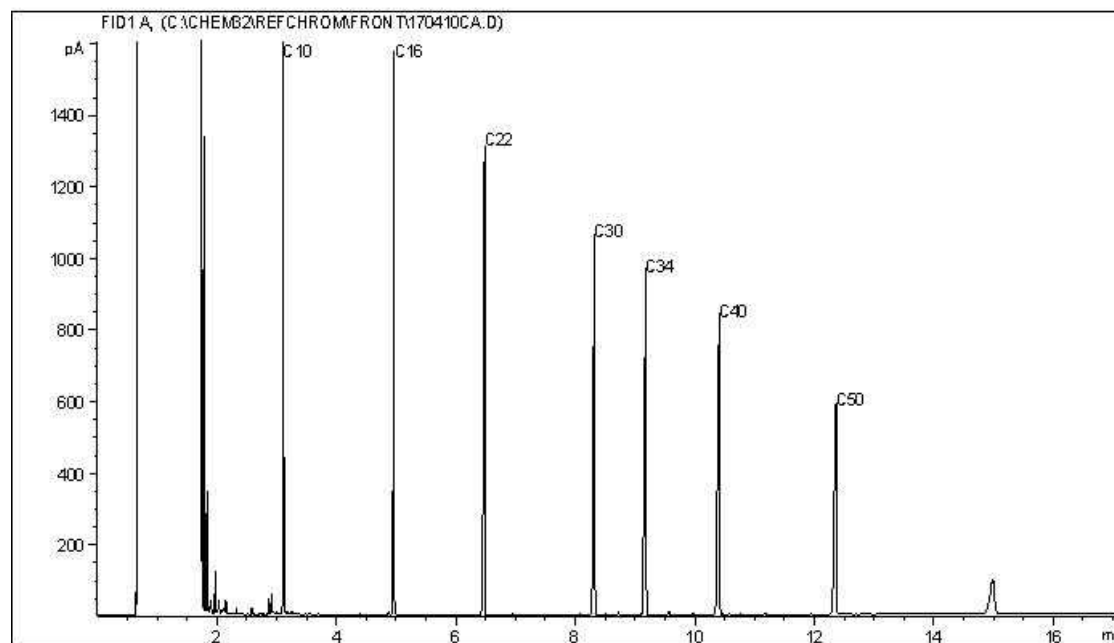
TETRA TECH CANADA INC.
Client Project #: 704-ENW.CENW03090-01
Site Reference: 124 MAIN STREET IN BARONS, ALBERTA
Client ID: 17MW04 @ 1.7M

CCME Hydrocarbons (F2-F4 in soil) Chromatogram

Instrument: GC7



Carbon Range Distribution - Reference Chromatogram

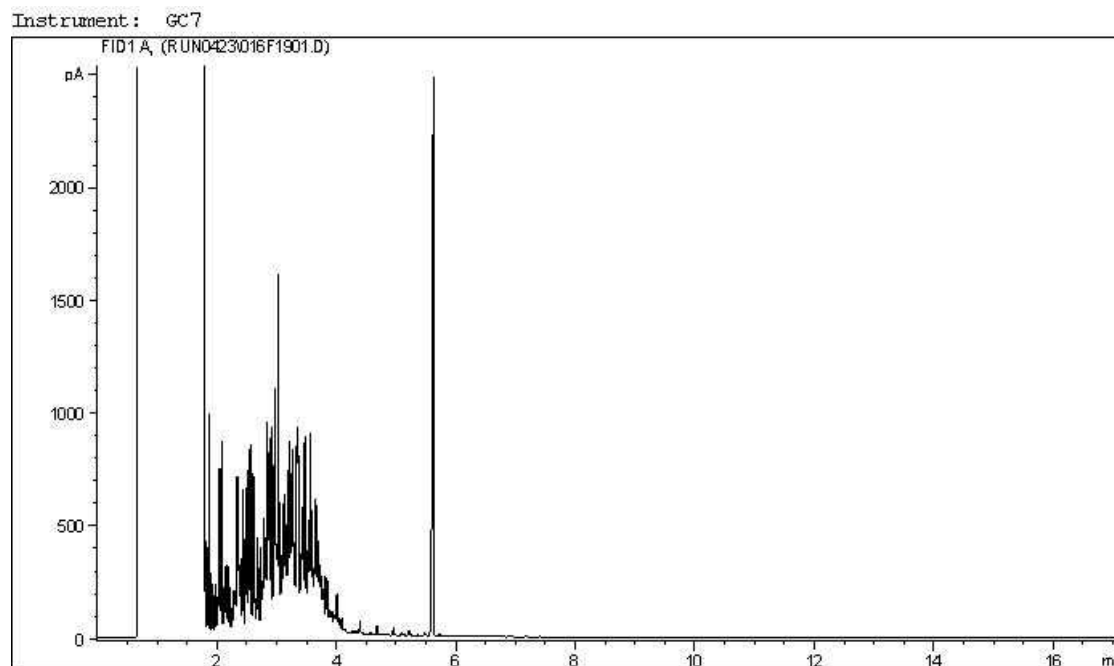


TYPICAL PRODUCT CARBON NUMBER RANGES

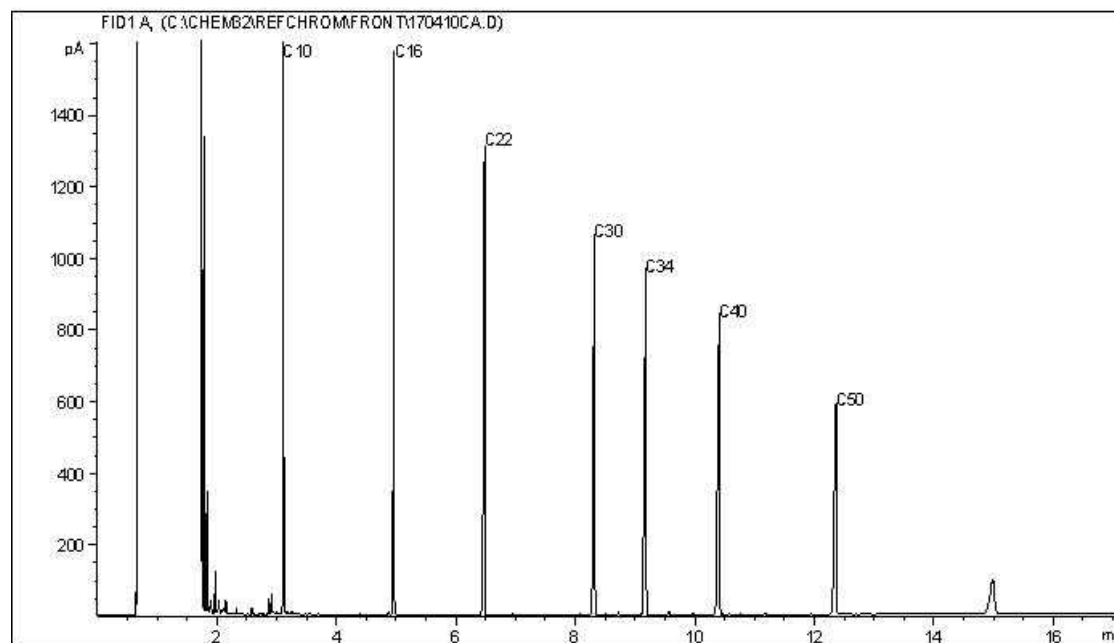
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

CCME Hydrocarbons (F2-F4 in soil) Chromatogram



Carbon Range Distribution - Reference Chromatogram

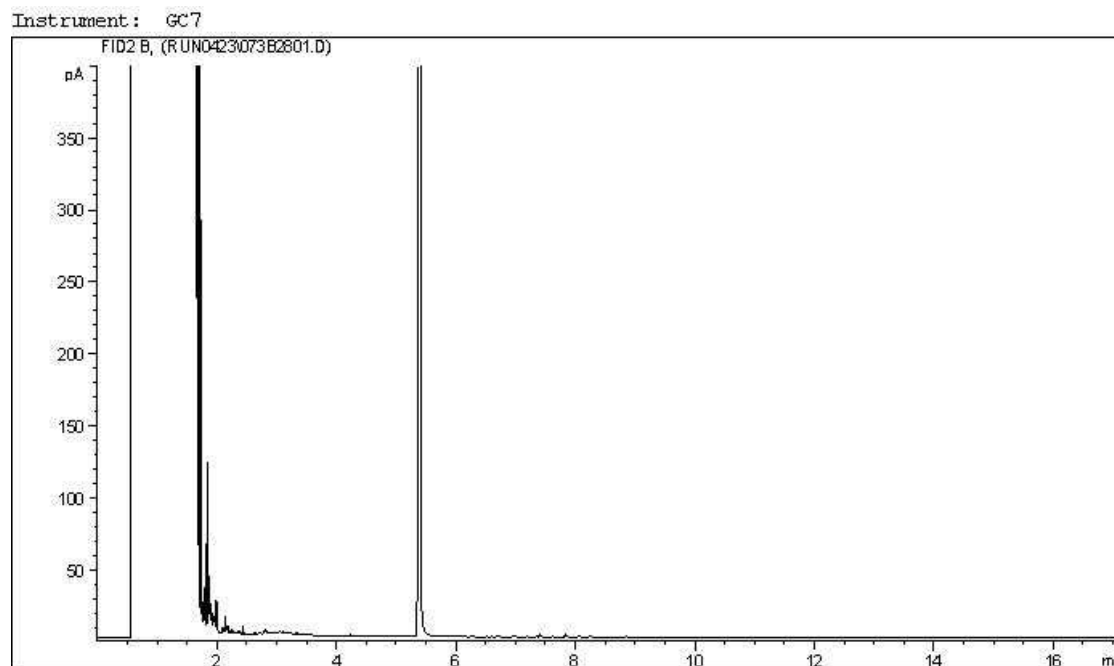


TYPICAL PRODUCT CARBON NUMBER RANGES

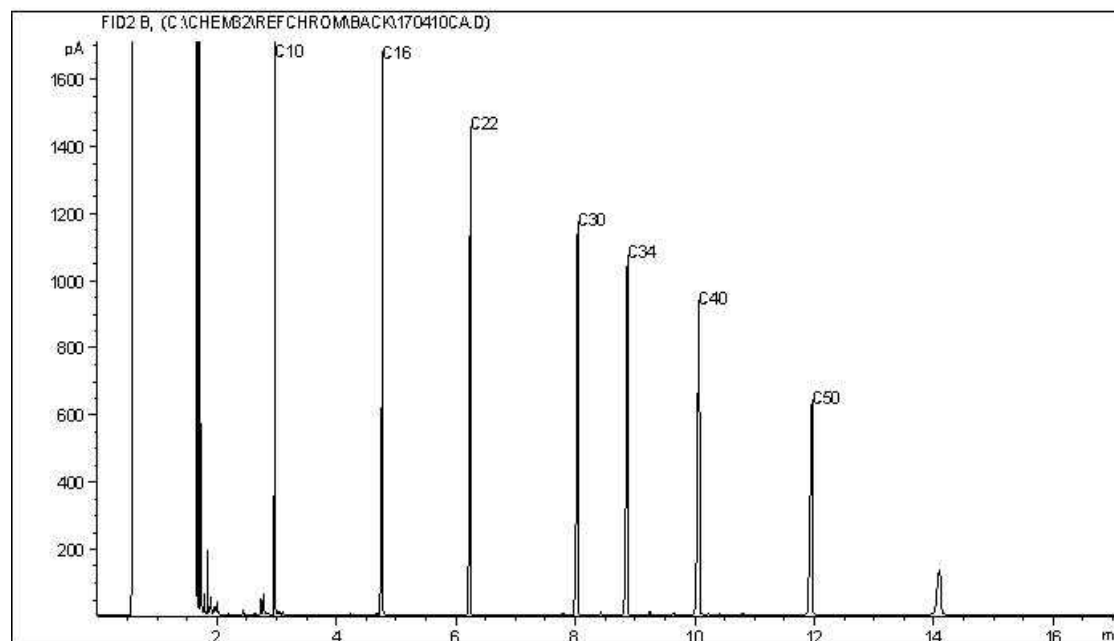
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

CCME Hydrocarbons (F2-F4 in soil) Chromatogram



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Your P.O. #: ENW.CENW03090-01
Your Project #: BARONS AMA 9558
Site Location: 124 MAIN ST. BARONS AB
Your C.O.C. #: M013735

Attention: JAYMES GOING

TETRA TECH CANADA INC.
442-10 STREET NORTH
LETHBRIDGE, AB
CANADA T1H 2C7

Report Date: 2017/05/12

Report #: R2382228

Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B734282

Received: 2017/05/06, 09:40

Sample Matrix: Water
Samples Received: 7

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	4	N/A	2017/05/08	AB SOP-00005	SM 22 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	7	N/A	2017/05/10	AB SOP-00039	CCME CWS/EPA 8260C m
Chloride by Automated Colourimetry	4	N/A	2017/05/08	AB SOP-00020	SM 22-4500-Cl E m
Conductivity @25C	4	N/A	2017/05/08	AB SOP-00005	SM 22 2510 B m
CCME Hydrocarbons in Water (F2; C10-C16) (1)	1	2017/05/08	2017/05/08	AB SOP-00040 AB SOP-00037	CCME PHC-CWS m
CCME Hydrocarbons in Water (F2; C10-C16) (1)	6	2017/05/08	2017/05/09	AB SOP-00040 AB SOP-00037	CCME PHC-CWS m
Hardness	4	N/A	2017/05/09	AB WI-00065	Auto Calc
Elements by ICP - Dissolved (2)	3	N/A	2017/05/08	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICP - Dissolved (2)	1	N/A	2017/05/09	AB SOP-00042	EPA 200.7 CFR 2012 m
Ion Balance	4	N/A	2017/05/08	AB WI-00065	Auto Calc
Sum of cations, anions	4	N/A	2017/05/09	AB WI-00065	Auto Calc
Nitrate and Nitrite	1	N/A	2017/05/08	AB WI-00065	Auto Calc
Nitrate and Nitrite	3	N/A	2017/05/09	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated)	1	N/A	2017/05/08	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated)	3	N/A	2017/05/09	AB WI-00065	Auto Calc
Nitrogen (Nitrite - Nitrate) by IC (3)	4	N/A	2017/05/08	AB SOP-00023	SM 22 4110 B m
pH @25°C (4)	4	N/A	2017/05/08	AB SOP-00005	SM 22 4500-H+B m
Sulphate by Automated Colourimetry	4	N/A	2017/05/08	AB SOP-00018	SM 22 4500-SO4 E m
Total Dissolved Solids (Calculated)	4	N/A	2017/05/09	AB WI-00065	Auto Calc

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed

Your P.O. #: ENW.CENW03090-01
Your Project #: BARONS AMA 9558
Site Location: 124 MAIN ST. BARONS AB
Your C.O.C. #: M013735

Attention: JAYMES GOING

TETRA TECH CANADA INC.
442-10 STREET NORTH
LETHBRIDGE, AB
CANADA T1H 2C7

Report Date: 2017/05/12

Report #: R2382228

Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B734282

Received: 2017/05/06, 09:40

or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Silica gel clean up employed.

(2) Dissolved > Total Imbalance: Whenever applicable, Dissolved > Total for any parameter that falls within method uncertainty for duplicates is likely equivalent. If RPD is >20% samples were reanalyzed and confirmed.

(3) Analysis completed within 48h after laboratory receipt to a maximum of five days from sampling is satisfactory for compliance purposes.

(4) The CCME method requires pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME holding time. Maxxam endeavours to analyze samples as soon as possible after receipt.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ioana Stoica, Project Manager

Email: IStoica@maxxam.ca

Phone# (403)735-2227

=====

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B734282
Report Date: 2017/05/12

TETRA TECH CANADA INC.
Client Project #: BARONS AMA 9558
Site Location: 124 MAIN ST. BARONS AB
Your P.O. #: ENW.CENW03090-01

AT1 BTEX AND F1-F2 IN WATER (WATER)

Maxxam ID		QZ9300	QZ9300	QZ9301	QZ9302		QZ9303		
Sampling Date		2017/05/05 10:30	2017/05/05 10:30	2017/05/05 11:00	2017/05/05 10:00		2017/05/05 11:30		
COC Number		M013735	M013735	M013735	M013735		M013735		
	UNITS	17MW03	17MW03 Lab-Dup	17MW01	17MW02	RDL	09MW09	RDL	QC Batch

Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	N/A	<0.10	<0.10	0.10	<0.10	0.10	8623090
Volatiles									
Benzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	<0.0012 (1)	0.0012	8623010
Toluene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	<0.00040	0.00040	8623010
Ethylbenzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	<0.00040	0.00040	8623010
m & p-Xylene	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	<0.00080	0.00080	8623010
o-Xylene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	<0.00040	0.00040	8623010
Xylenes (Total)	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	<0.00080	0.00080	8623010
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	<0.10	0.10	8623010
F1 (C6-C10)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	<0.10	0.10	8623010
Surrogate Recovery (%)									
1,4-Difluorobenzene (sur.)	%	112	110	107	104	N/A	107	N/A	8623010
4-Bromofluorobenzene (sur.)	%	98	97	97	94	N/A	98	N/A	8623010
D4-1,2-Dichloroethane (sur.)	%	107	108	113	105	N/A	105	N/A	8623010
O-TERPHENYL (sur.)	%	94	N/A	97	94	N/A	96	N/A	8623090

RDL = Reportable Detection Limit

Lab-Dup = Laboratory Initiated Duplicate

N/A = Not Applicable

(1) Detection limits raised due to matrix interference.

Maxxam Job #: B734282
Report Date: 2017/05/12

TETRA TECH CANADA INC.
Client Project #: BARONS AMA 9558
Site Location: 124 MAIN ST. BARONS AB
Your P.O. #: ENW.CENW03090-01

AT1 BTEX AND F1-F2 IN WATER (WATER)

Maxxam ID		QZ9304		QZ9305		QZ9306	QZ9306		
Sampling Date		2017/05/05 12:00		2017/05/05 09:30		2017/05/05 09:00	2017/05/05 09:00		
COC Number		M013735		M013735		M013735	M013735		
	UNITS	17MW04	RDL	08MW07	RDL	09MW11	09MW11 Lab-Dup	RDL	QC Batch
Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/L	18	0.10	<0.10	0.10	<0.10	<0.10	0.10	8623090
Volatiles									
Benzene	mg/L	1.2 (1)	0.00080	<0.00040	0.00040	<0.00070 (2)	N/A	0.00070	8623010
Toluene	mg/L	0.063	0.00040	<0.00040	0.00040	<0.00040	N/A	0.00040	8623010
Ethylbenzene	mg/L	0.55	0.00040	<0.00040	0.00040	<0.00040	N/A	0.00040	8623010
m & p-Xylene	mg/L	0.66	0.00080	<0.00080	0.00080	<0.00080	N/A	0.00080	8623010
o-Xylene	mg/L	0.025	0.00040	<0.00040	0.00040	<0.00040	N/A	0.00040	8623010
Xylenes (Total)	mg/L	0.69	0.00080	<0.00080	0.00080	<0.00080	N/A	0.00080	8623010
F1 (C6-C10) - BTEX	mg/L	8.3	0.10	<0.10	0.10	<0.10	N/A	0.10	8623010
F1 (C6-C10)	mg/L	11	0.10	<0.10	0.10	<0.10	N/A	0.10	8623010
Surrogate Recovery (%)									
1,4-Difluorobenzene (sur.)	%	97	N/A	106	N/A	110	N/A	N/A	8623010
4-Bromofluorobenzene (sur.)	%	109	N/A	95	N/A	93	N/A	N/A	8623010
D4-1,2-Dichloroethane (sur.)	%	99	N/A	110	N/A	102	N/A	N/A	8623010
O-TERPHENYL (sur.)	%	101	N/A	97	N/A	100	96	N/A	8623090
RDL = Reportable Detection Limit Lab-Dup = Laboratory Initiated Duplicate N/A = Not Applicable (1) Detection limits raised due to dilution to bring analyte within the calibrated range. (2) Detection limits raised due to interference.									

Maxxam Job #: B734282
Report Date: 2017/05/12

TETRA TECH CANADA INC.
Client Project #: BARONS AMA 9558
Site Location: 124 MAIN ST. BARONS AB
Your P.O. #: ENW.CENW03090-01

ROUTINE WATER (WATER)

Maxxam ID		QZ9303			QZ9304			QZ9305		
Sampling Date		2017/05/05 11:30			2017/05/05 12:00			2017/05/05 09:30		
COC Number		M013735			M013735			M013735		
	UNITS	09MW09	RDL	QC Batch	17MW04	RDL	QC Batch	08MW07	RDL	QC Batch

Calculated Parameters										
Anion Sum	meq/L	99	N/A	8622521	96	N/A	8622521	120	N/A	8622521
Cation Sum	meq/L	97	N/A	8622521	98	N/A	8622521	120	N/A	8622521
Hardness (CaCO ₃)	mg/L	2200	0.50	8622514	2500	0.50	8622514	2400	0.50	8622514
Ion Balance (% Difference)	%	0.91	N/A	8622517	1.2	N/A	8622517	2.1	N/A	8622517
Dissolved Nitrate (NO ₃)	mg/L	53	0.089	8622534	<0.22	0.22	8622534	180	0.22	8622534
Nitrate plus Nitrite (N)	mg/L	12	0.020	8622522	<0.050	0.050	8622522	40	0.050	8622522
Dissolved Nitrite (NO ₂)	mg/L	0.51	0.033	8622534	0.043	0.033	8622534	0.20	0.033	8622534
Calculated Total Dissolved Solids	mg/L	6400	10	8622524	6100	10	8622524	7900	10	8622524

Misc. Inorganics										
Conductivity	uS/cm	7400	1.0	8622816	6900	1.0	8622816	9200	1.0	8622816
pH	pH	7.75	N/A	8622815	7.73	N/A	8622815	7.87	N/A	8622815

Anions										
Alkalinity (PP as CaCO ₃)	mg/L	<0.50	0.50	8622814	<0.50	0.50	8622814	<0.50	0.50	8622814
Alkalinity (Total as CaCO ₃)	mg/L	710	0.50	8622814	970	0.50	8622814	610	0.50	8622814
Bicarbonate (HCO ₃)	mg/L	870	0.50	8622814	1200	0.50	8622814	740	0.50	8622814
Carbonate (CO ₃)	mg/L	<0.50	0.50	8622814	<0.50	0.50	8622814	<0.50	0.50	8622814
Hydroxide (OH)	mg/L	<0.50	0.50	8622814	<0.50	0.50	8622814	<0.50	0.50	8622814
Dissolved Sulphate (SO ₄)	mg/L	3900 (1)	20	8623217	3500 (1)	20	8623185	4800 (1)	50	8623212
Dissolved Chloride (Cl)	mg/L	88	1.0	8623214	110	1.0	8623181	120	1.0	8623211

Nutrients										
Dissolved Nitrite (N)	mg/L	0.16	0.010	8622809	0.013	0.010	8622809	0.059	0.010	8622809
Dissolved Nitrate (N)	mg/L	12 (1)	0.020	8622809	<0.050 (2)	0.050	8622809	40 (1)	0.050	8622809

Elements										
Dissolved Calcium (Ca)	mg/L	360	0.30	8623572	340	0.30	8623572	350	0.30	8623572
Dissolved Iron (Fe)	mg/L	<0.060	0.060	8623572	<0.060	0.060	8623572	<0.060	0.060	8623572
Dissolved Magnesium (Mg)	mg/L	310	0.20	8623572	410	0.20	8623572	360	0.20	8623572
Dissolved Manganese (Mn)	mg/L	0.85	0.0040	8623572	3.3	0.0040	8623572	0.058	0.0040	8623572
Dissolved Potassium (K)	mg/L	9.8	0.30	8623572	11	0.30	8623572	11	0.30	8623572
Dissolved Sodium (Na)	mg/L	1200 (1)	2.5	8623572	1100 (1)	2.5	8623572	1700 (1)	2.5	8623572

RDL = Reportable Detection Limit

N/A = Not Applicable

(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

(2) Detection limits raised due to matrix interference.

Maxxam Job #: B734282
Report Date: 2017/05/12

TETRA TECH CANADA INC.
Client Project #: BARONS AMA 9558
Site Location: 124 MAIN ST. BARONS AB
Your P.O. #: ENW.CENW03090-01

ROUTINE WATER (WATER)

Maxxam ID		QZ9306	QZ9306		
Sampling Date		2017/05/05 09:00	2017/05/05 09:00		
COC Number		M013735	M013735		
	UNITS	09MW11	09MW11 Lab-Dup	RDL	QC Batch
Calculated Parameters					
Anion Sum	meq/L	100	N/A	N/A	8622521
Cation Sum	meq/L	88	N/A	N/A	8622521
Hardness (CaCO ₃)	mg/L	2200	N/A	0.50	8622514
Ion Balance (% Difference)	%	6.8	N/A	N/A	8622517
Dissolved Nitrate (NO ₃)	mg/L	31	N/A	0.044	8622534
Nitrate plus Nitrite (N)	mg/L	7.8	N/A	0.010	8622522
Dissolved Nitrite (NO ₂)	mg/L	2.4	N/A	0.033	8622534
Calculated Total Dissolved Solids	mg/L	6200	N/A	10	8622524
Misc. Inorganics					
Conductivity	uS/cm	7200	N/A	1.0	8622816
pH	pH	7.78	N/A	N/A	8622815
Anions					
Alkalinity (PP as CaCO ₃)	mg/L	<0.50	N/A	0.50	8622814
Alkalinity (Total as CaCO ₃)	mg/L	750	N/A	0.50	8622814
Bicarbonate (HCO ₃)	mg/L	910	N/A	0.50	8622814
Carbonate (CO ₃)	mg/L	<0.50	N/A	0.50	8622814
Hydroxide (OH)	mg/L	<0.50	N/A	0.50	8622814
Dissolved Sulphate (SO ₄)	mg/L	3900 (1)	N/A	20	8623185
Dissolved Chloride (Cl)	mg/L	100	N/A	1.0	8623181
Nutrients					
Dissolved Nitrite (N)	mg/L	0.72	N/A	0.010	8622809
Dissolved Nitrate (N)	mg/L	7.1	N/A	0.010	8622809
Elements					
Dissolved Calcium (Ca)	mg/L	350	340	0.30	8623572
Dissolved Iron (Fe)	mg/L	<0.060	<0.060	0.060	8623572
Dissolved Magnesium (Mg)	mg/L	330	340	0.20	8623572
Dissolved Manganese (Mn)	mg/L	1.6	1.6	0.0040	8623572
Dissolved Potassium (K)	mg/L	8.4	8.6	0.30	8623572
RDL = Reportable Detection Limit Lab-Dup = Laboratory Initiated Duplicate N/A = Not Applicable (1) Detection limits raised due to dilution to bring analyte within the calibrated range.					

Maxxam Job #: B734282
Report Date: 2017/05/12

TETRA TECH CANADA INC.
Client Project #: BARONS AMA 9558
Site Location: 124 MAIN ST. BARONS AB
Your P.O. #: ENW.CENW03090-01

ROUTINE WATER (WATER)

Maxxam ID		QZ9306	QZ9306		
Sampling Date		2017/05/05 09:00	2017/05/05 09:00		
COC Number		M013735	M013735		
	UNITS	09MW11	09MW11 Lab-Dup	RDL	QC Batch
Dissolved Sodium (Na)	mg/L	980 (1)	970	2.5	8623572
RDL = Reportable Detection Limit Lab-Dup = Laboratory Initiated Duplicate (1) Detection limits raised due to dilution to bring analyte within the calibrated range.					

Maxxam Job #: B734282
Report Date: 2017/05/12

TETRA TECH CANADA INC.
Client Project #: BARONS AMA 9558
Site Location: 124 MAIN ST. BARONS AB
Your P.O. #: ENW.CENW03090-01

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	6.0°C
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Results relate only to the items tested.

Maxxam Job #: B734282
Report Date: 2017/05/12

TETRA TECH CANADA INC.
Client Project #: BARONS AMA 9558
Site Location: 124 MAIN ST. BARONS AB
Your P.O. #: ENW.CENW03090-01

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8622809	LQ1	Matrix Spike	Dissolved Nitrite (N)	2017/05/08		102	%	80 - 120
			Dissolved Nitrate (N)	2017/05/08		106	%	80 - 120
8622809	LQ1	Spiked Blank	Dissolved Nitrite (N)	2017/05/08		101	%	80 - 120
			Dissolved Nitrate (N)	2017/05/08		102	%	80 - 120
8622809	LQ1	Method Blank	Dissolved Nitrite (N)	2017/05/08	<0.010		mg/L	
			Dissolved Nitrate (N)	2017/05/08	<0.010		mg/L	
8622809	LQ1	RPD	Dissolved Nitrite (N)	2017/05/08	NC		%	20
			Dissolved Nitrate (N)	2017/05/08	1.2		%	20
8622814	LQ1	Spiked Blank	Alkalinity (Total as CaCO3)	2017/05/07		93	%	80 - 120
8622814	LQ1	Method Blank	Alkalinity (PP as CaCO3)	2017/05/07	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2017/05/07	<0.50		mg/L	
			Bicarbonate (HCO3)	2017/05/07	<0.50		mg/L	
			Carbonate (CO3)	2017/05/07	<0.50		mg/L	
			Hydroxide (OH)	2017/05/07	<0.50		mg/L	
8622814	LQ1	RPD	Alkalinity (PP as CaCO3)	2017/05/07	NC		%	20
			Alkalinity (Total as CaCO3)	2017/05/07	3.0		%	20
			Bicarbonate (HCO3)	2017/05/07	3.0		%	20
			Carbonate (CO3)	2017/05/07	NC		%	20
			Hydroxide (OH)	2017/05/07	NC		%	20
8622815	LQ1	Spiked Blank	pH	2017/05/07		100	%	97 - 103
8622815	LQ1	RPD	pH	2017/05/07	0.10		%	N/A
8622816	LQ1	Spiked Blank	Conductivity	2017/05/07		101	%	90 - 110
8622816	LQ1	Method Blank	Conductivity	2017/05/07	<1.0		uS/cm	
8622816	LQ1	RPD	Conductivity	2017/05/07	0.31		%	10
8623010	DO1	Matrix Spike [QZ9301-02]	1,4-Difluorobenzene (sur.)	2017/05/09		98	%	70 - 130
			4-Bromofluorobenzene (sur.)	2017/05/09		95	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2017/05/09		99	%	70 - 130
			Benzene	2017/05/09		86	%	70 - 130
			Toluene	2017/05/09		82	%	70 - 130
			Ethylbenzene	2017/05/09		84	%	70 - 130
			m & p-Xylene	2017/05/09		82	%	70 - 130
			o-Xylene	2017/05/09		83	%	70 - 130
			F1 (C6-C10)	2017/05/09		75	%	70 - 130
8623010	DO1	Spiked Blank	1,4-Difluorobenzene (sur.)	2017/05/09		97	%	70 - 130
			4-Bromofluorobenzene (sur.)	2017/05/09		92	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2017/05/09		94	%	70 - 130
			Benzene	2017/05/09		80	%	70 - 130
			Toluene	2017/05/09		77	%	70 - 130
			Ethylbenzene	2017/05/09		80	%	70 - 130
			m & p-Xylene	2017/05/09		78	%	70 - 130
			o-Xylene	2017/05/09		78	%	70 - 130
			F1 (C6-C10)	2017/05/09		81	%	70 - 130
8623010	DO1	Method Blank	1,4-Difluorobenzene (sur.)	2017/05/09		106	%	70 - 130
			4-Bromofluorobenzene (sur.)	2017/05/09		98	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2017/05/09		110	%	70 - 130
			Benzene	2017/05/09	<0.00040		mg/L	
			Toluene	2017/05/09	<0.00040		mg/L	
			Ethylbenzene	2017/05/09	<0.00040		mg/L	
			m & p-Xylene	2017/05/09	<0.00080		mg/L	
			o-Xylene	2017/05/09	<0.00040		mg/L	
			Xylenes (Total)	2017/05/09	<0.00080		mg/L	
			F1 (C6-C10) - BTEX	2017/05/09	<0.10		mg/L	

Maxxam Job #: B734282
Report Date: 2017/05/12

TETRA TECH CANADA INC.
Client Project #: BARONS AMA 9558
Site Location: 124 MAIN ST. BARONS AB
Your P.O. #: ENW.CENW03090-01

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8623010	DO1	RPD [QZ9300-02]	F1 (C6-C10)	2017/05/09	<0.10		mg/L	
			Benzene	2017/05/10	NC		%	30
			Toluene	2017/05/10	NC		%	30
			Ethylbenzene	2017/05/10	NC		%	30
			m & p-Xylene	2017/05/10	NC		%	30
			o-Xylene	2017/05/10	NC		%	30
			Xylenes (Total)	2017/05/10	NC		%	30
			F1 (C6-C10) - BTEX	2017/05/10	NC		%	30
			F1 (C6-C10)	2017/05/10	NC		%	30
8623090	VP4	Matrix Spike	O-TERPHENYL (sur.)	2017/05/08		98	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2017/05/08		112	%	60 - 130
8623090	VP4	Spiked Blank	O-TERPHENYL (sur.)	2017/05/08		101	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2017/05/08		105	%	70 - 130
8623090	VP4	Method Blank	O-TERPHENYL (sur.)	2017/05/08		94	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2017/05/08	<0.10		mg/L	
8623090	VP4	RPD [QZ9306-01]	F2 (C10-C16 Hydrocarbons)	2017/05/08	NC		%	30
8623181	KP9	Matrix Spike	Dissolved Chloride (Cl)	2017/05/08		NC	%	80 - 120
8623181	KP9	Spiked Blank	Dissolved Chloride (Cl)	2017/05/08		97	%	80 - 120
8623181	KP9	Method Blank	Dissolved Chloride (Cl)	2017/05/08	<1.0		mg/L	
8623181	KP9	RPD	Dissolved Chloride (Cl)	2017/05/08	0.54		%	20
8623185	KP9	Matrix Spike	Dissolved Sulphate (SO4)	2017/05/08		NC	%	80 - 120
8623185	KP9	Spiked Blank	Dissolved Sulphate (SO4)	2017/05/08		97	%	80 - 120
8623185	KP9	Method Blank	Dissolved Sulphate (SO4)	2017/05/08	<1.0		mg/L	
8623185	KP9	RPD	Dissolved Sulphate (SO4)	2017/05/08	0.67		%	20
8623211	KP9	Matrix Spike	Dissolved Chloride (Cl)	2017/05/08		110	%	80 - 120
8623211	KP9	Spiked Blank	Dissolved Chloride (Cl)	2017/05/08		97	%	80 - 120
8623211	KP9	Method Blank	Dissolved Chloride (Cl)	2017/05/08	<1.0		mg/L	
8623211	KP9	RPD	Dissolved Chloride (Cl)	2017/05/08	4.9		%	20
8623212	KP9	Matrix Spike	Dissolved Sulphate (SO4)	2017/05/08		105	%	80 - 120
8623212	KP9	Spiked Blank	Dissolved Sulphate (SO4)	2017/05/08		100	%	80 - 120
8623212	KP9	Method Blank	Dissolved Sulphate (SO4)	2017/05/08	<1.0		mg/L	
8623212	KP9	RPD	Dissolved Sulphate (SO4)	2017/05/08	2.1		%	20
8623214	KP9	Matrix Spike	Dissolved Chloride (Cl)	2017/05/08		106	%	80 - 120
8623214	KP9	Spiked Blank	Dissolved Chloride (Cl)	2017/05/08		97	%	80 - 120
8623214	KP9	Method Blank	Dissolved Chloride (Cl)	2017/05/08	<1.0		mg/L	
8623214	KP9	RPD	Dissolved Chloride (Cl)	2017/05/08	18		%	20
8623217	KP9	Matrix Spike	Dissolved Sulphate (SO4)	2017/05/08		104	%	80 - 120
8623217	KP9	Spiked Blank	Dissolved Sulphate (SO4)	2017/05/08		99	%	80 - 120
8623217	KP9	Method Blank	Dissolved Sulphate (SO4)	2017/05/08	<1.0		mg/L	
8623217	KP9	RPD	Dissolved Sulphate (SO4)	2017/05/08	0.73		%	20
8623572	MAP	Matrix Spike [QZ9306-04]	Dissolved Calcium (Ca)	2017/05/09		NC	%	80 - 120
			Dissolved Iron (Fe)	2017/05/09		86	%	80 - 120
			Dissolved Magnesium (Mg)	2017/05/09		NC	%	80 - 120
			Dissolved Manganese (Mn)	2017/05/09		91	%	80 - 120
			Dissolved Potassium (K)	2017/05/09		98	%	80 - 120
			Dissolved Sodium (Na)	2017/05/09		NC	%	80 - 120
8623572	MAP	Spiked Blank	Dissolved Calcium (Ca)	2017/05/08		88	%	80 - 120
			Dissolved Iron (Fe)	2017/05/08		90	%	80 - 120
			Dissolved Magnesium (Mg)	2017/05/08		106	%	80 - 120
			Dissolved Manganese (Mn)	2017/05/08		94	%	80 - 120
			Dissolved Potassium (K)	2017/05/08		100	%	80 - 120
			Dissolved Sodium (Na)	2017/05/08		100	%	80 - 120

Maxxam Job #: B734282
Report Date: 2017/05/12

TETRA TECH CANADA INC.
Client Project #: BARONS AMA 9558
Site Location: 124 MAIN ST. BARONS AB
Your P.O. #: ENW.CENW03090-01

QUALITY ASSURANCE REPORT(CONT'D)

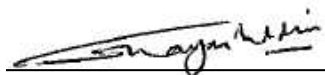
QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8623572	MAP	Method Blank	Dissolved Calcium (Ca)	2017/05/08	<0.30		mg/L	
			Dissolved Iron (Fe)	2017/05/08	<0.060		mg/L	
			Dissolved Magnesium (Mg)	2017/05/08	<0.20		mg/L	
			Dissolved Manganese (Mn)	2017/05/08	<0.0040		mg/L	
			Dissolved Potassium (K)	2017/05/08	<0.30		mg/L	
			Dissolved Sodium (Na)	2017/05/08	<0.50		mg/L	
8623572	MAP	RPD [QZ9306-04]	Dissolved Calcium (Ca)	2017/05/09	0.74		%	20
			Dissolved Iron (Fe)	2017/05/09	NC		%	20
			Dissolved Magnesium (Mg)	2017/05/09	0.24		%	20
			Dissolved Manganese (Mn)	2017/05/09	0.47		%	20
			Dissolved Potassium (K)	2017/05/09	2.2		%	20
			Dissolved Sodium (Na)	2017/05/09	0.83		%	20
N/A = Not Applicable								
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.								
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.								
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.								
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.								
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.								
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)								
NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).								

Maxxam Job #: B734282
Report Date: 2017/05/12

TETRA TECH CANADA INC.
Client Project #: BARONS AMA 9558
Site Location: 124 MAIN ST. BARONS AB
Your P.O. #: ENW.CENW03090-01

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics



Veronica Falk, B.Sc., P.Chem., QP, Scientific Specialist, Organics

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Report Information			Comments		Analysis Requested												Same as CoC						
Company: <u>TETRA TECH CANADA INC.</u>			Billing - SIA																				
Contact: <u>JAMES GONZA</u>			<u>Barroos</u>																				
Phone: <u>403.634.3566</u>																							
Email: <u>jgonza@tetra-tech.com</u>																							
Sampled by: <u>James Gonzaga</u>																							
Sample Identification	Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	# of containers	BTEX F1	VOC	BTEX F1-F2	BTEX F1-F4	Routine Water	Regulated Metals	Total	Dissolved	Mercury	Salinity	Sieve (75 micron)	Texture (% Sand, Silt, Clay)	Basic Class II Landfill	Dis. Fe & Mn (ppm)	Dis. Fe & Mn (ppm)	HOLD - DO NOT ANALYZE	Project/LSD	Special Instructions
#1 17MW03	MW	2017/05/05	10:30	G.W.	4			X															* Diss Metals (Fe & Mn) Field filtered & preserved.
#2 17MW01			11:00		4			X															
#3 17MW02			10:00		4			X															
#4 09MW09			11:30		6			X		X									X				
#5 17MW04			12:00		6			X		X									X				
#6 08MW07			9:30		6			X		X									X				
#7 09MW01			9:00		6			X		X									X				
#18																							
#19																							
#20																							
#21																							
#22																							
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#28																							
#29																							
#30																							

Please Indicate Filtered, Preserved or Both (F, P, F/P)

Relinquished by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)	Received by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)
<u>JAMES GONZA</u>	2017/05/05	13:30	<u>Amrita Sharma</u>	2017/05/06	09:40

403.634.3566

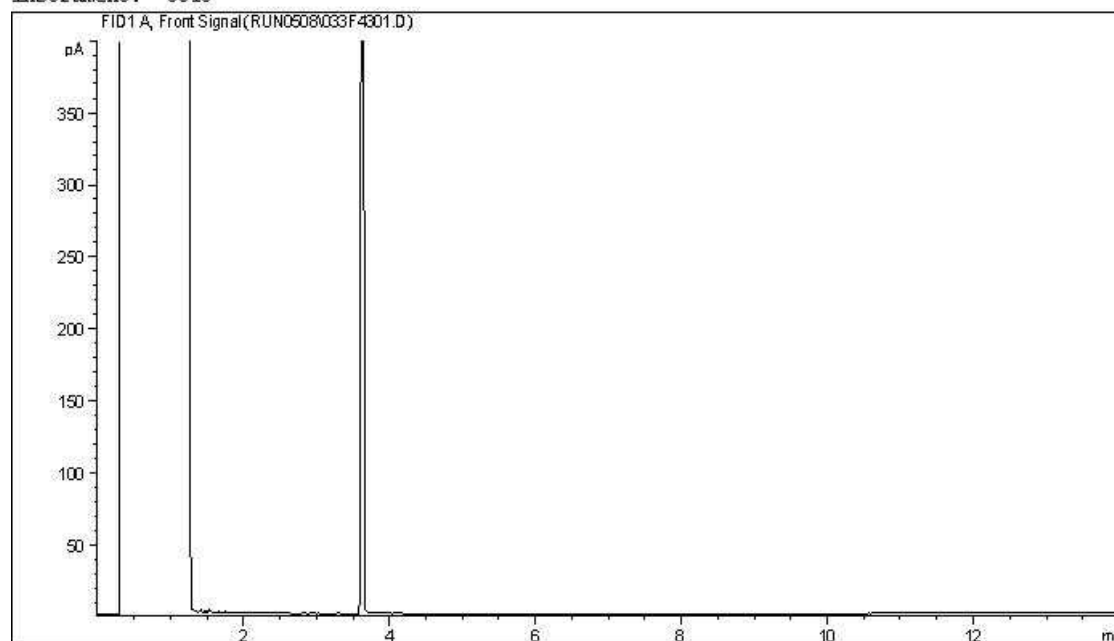
AB FCD-00331/6

06-May-17 09:40
Ioana Stoica
B734282
ASQ INS-0001

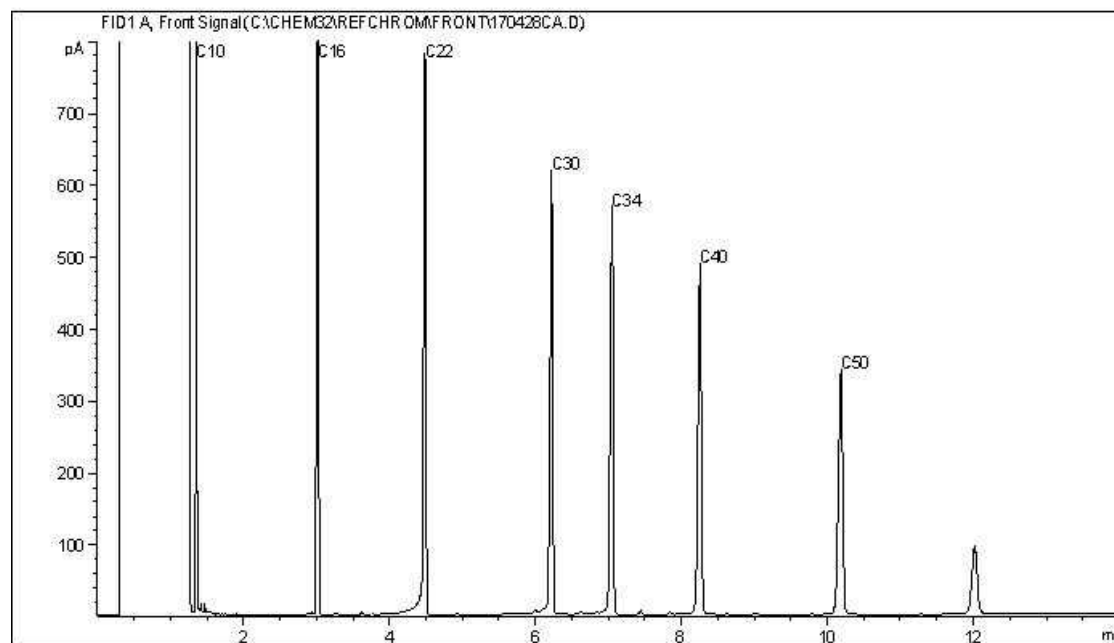
Temp 6/7/5 CS-No
Ice-yes

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram

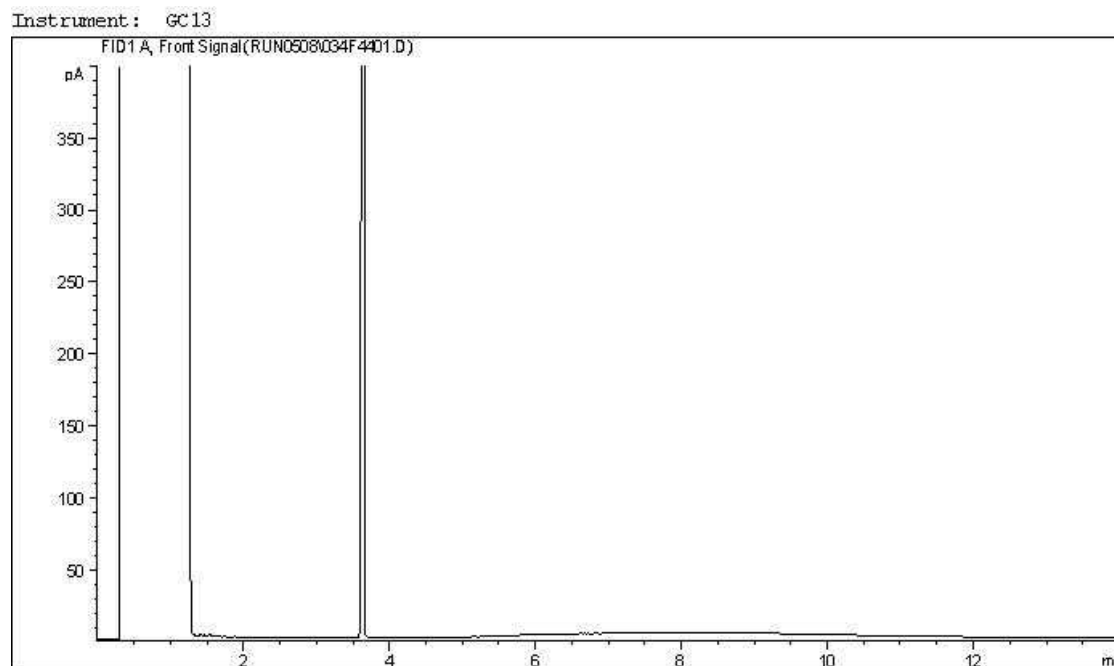


TYPICAL PRODUCT CARBON NUMBER RANGES

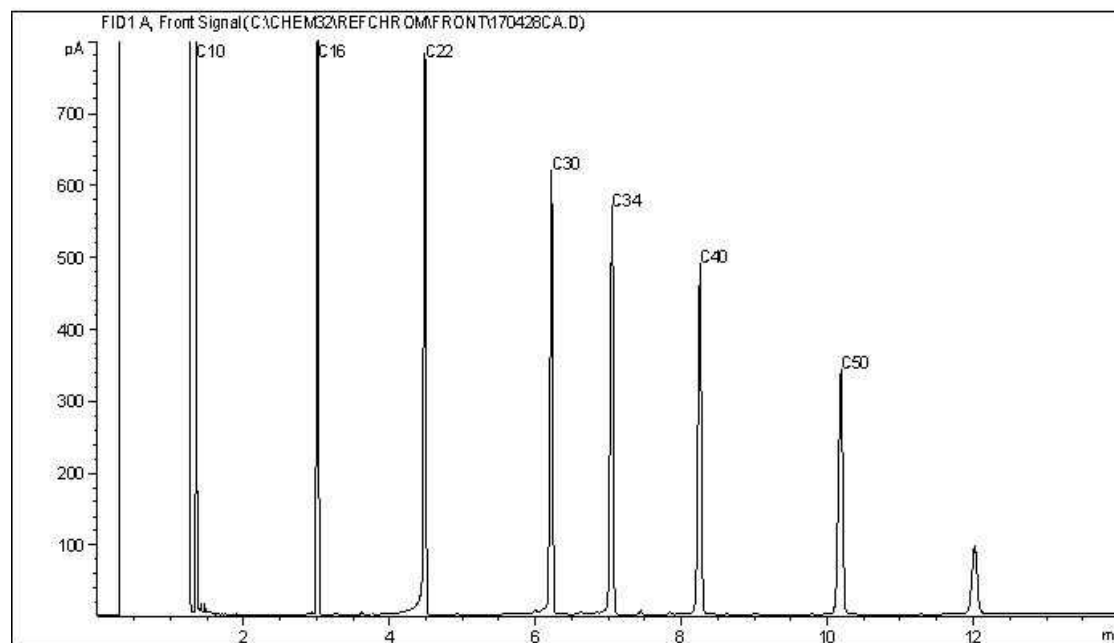
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram



Carbon Range Distribution - Reference Chromatogram



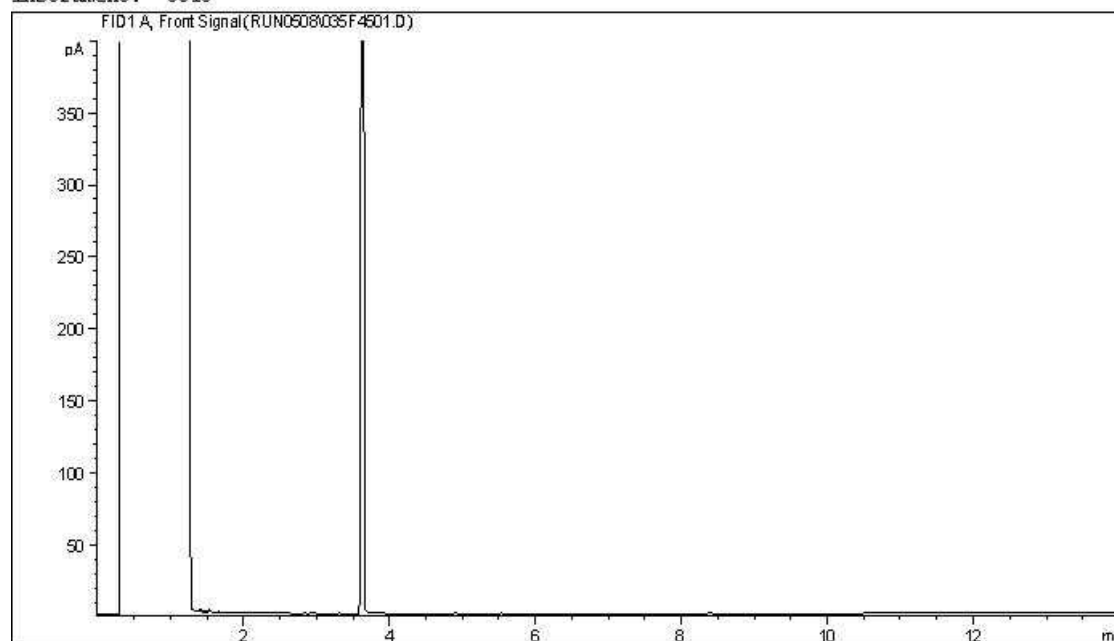
TYPICAL PRODUCT CARBON NUMBER RANGES

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Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

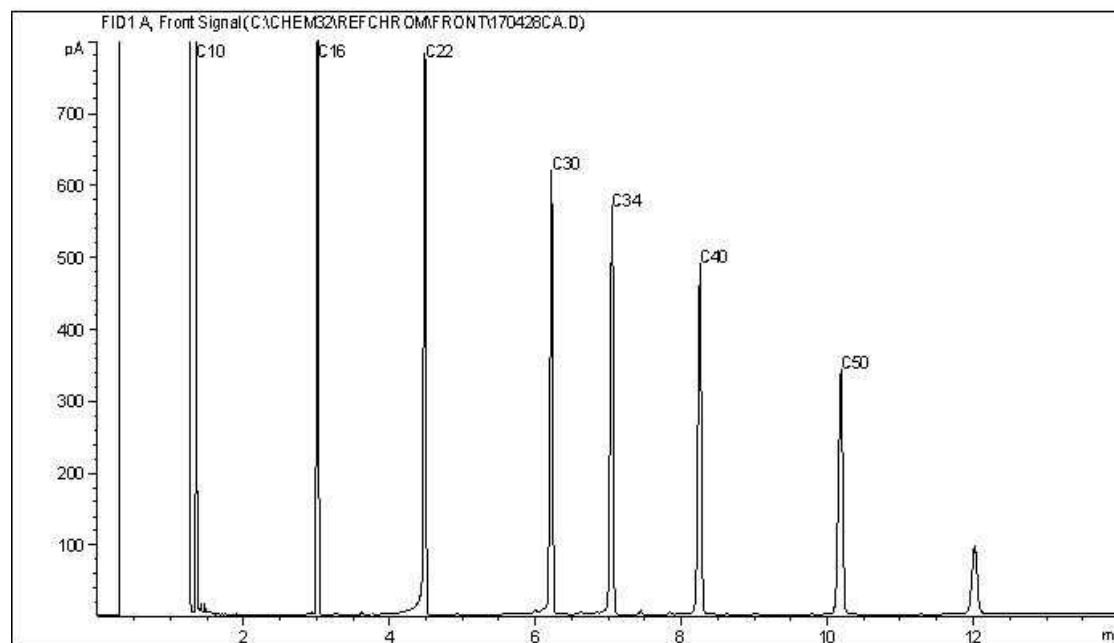
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Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



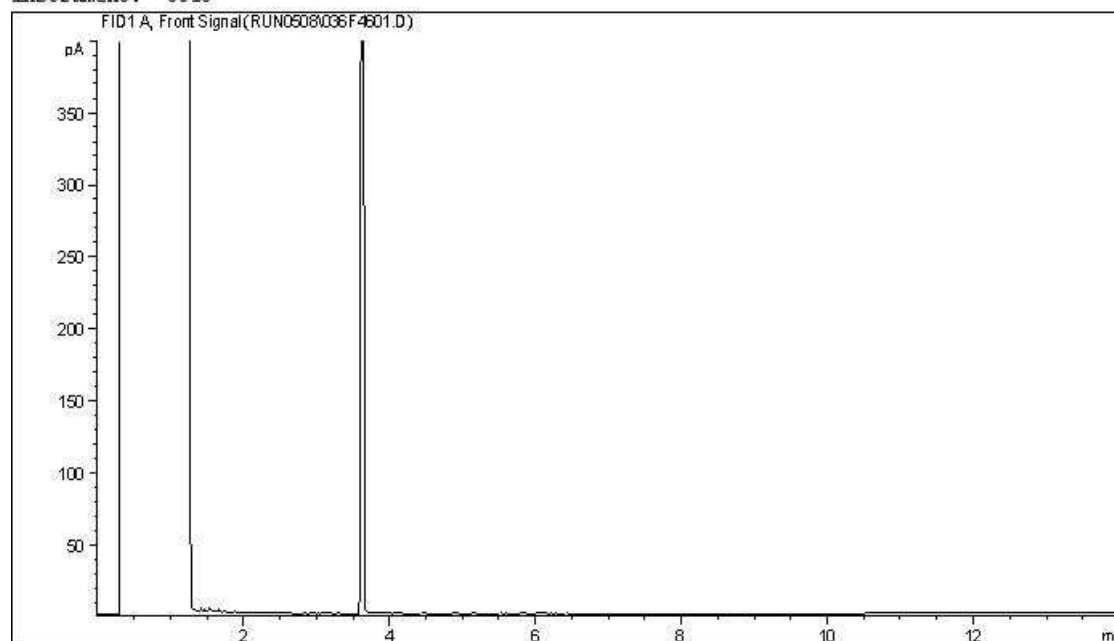
TYPICAL PRODUCT CARBON NUMBER RANGES

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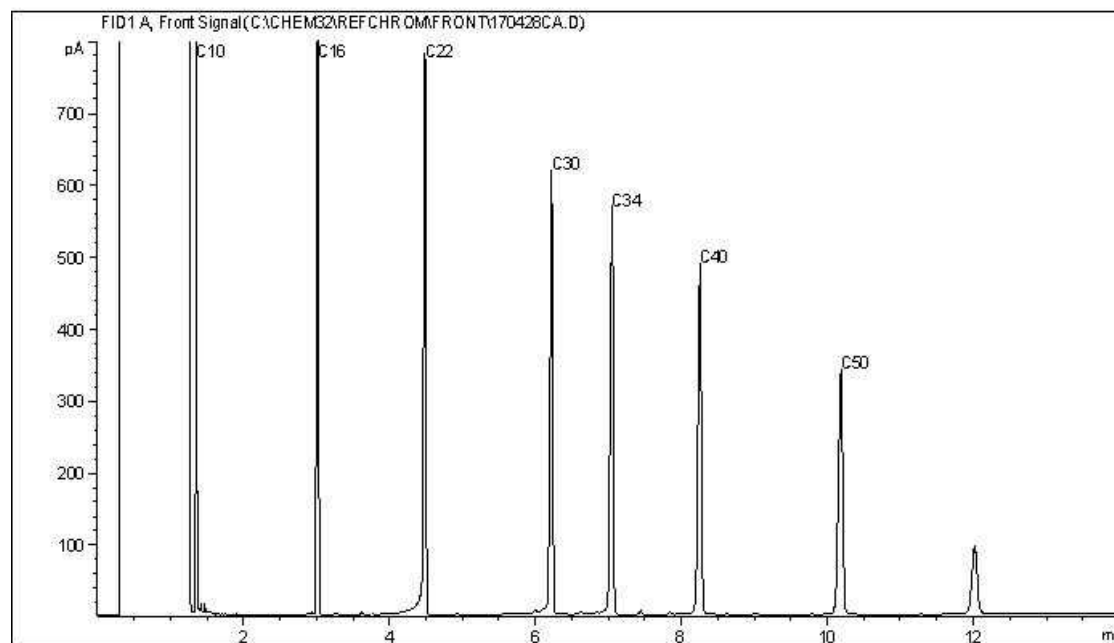
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Instrument: GC13



Carbon Range Distribution - Reference Chromatogram

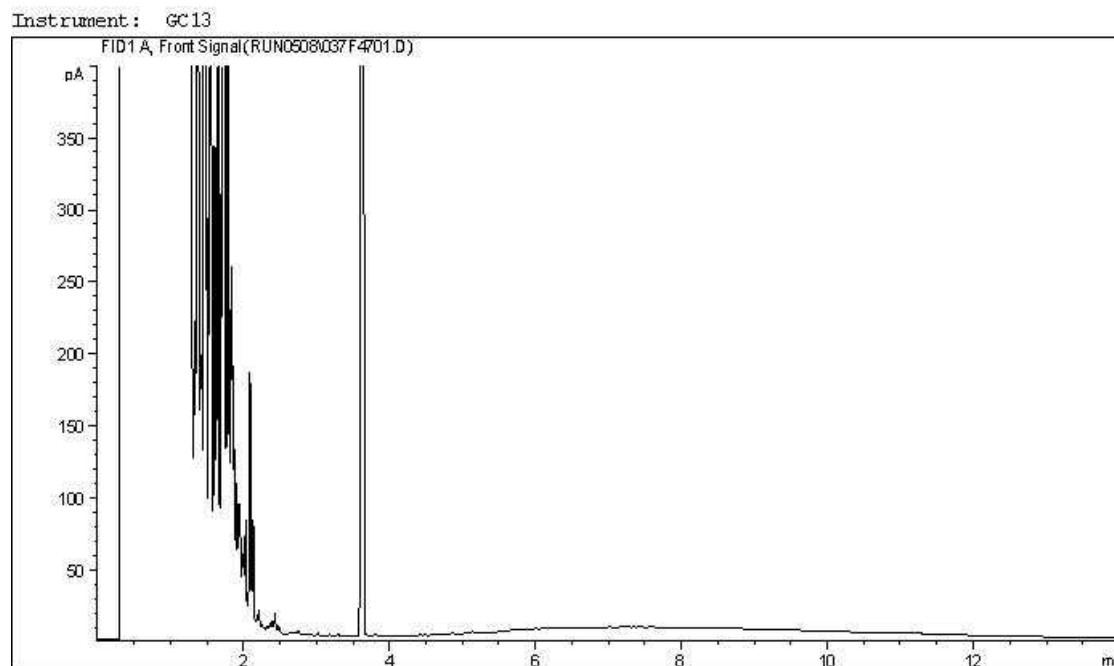


TYPICAL PRODUCT CARBON NUMBER RANGES

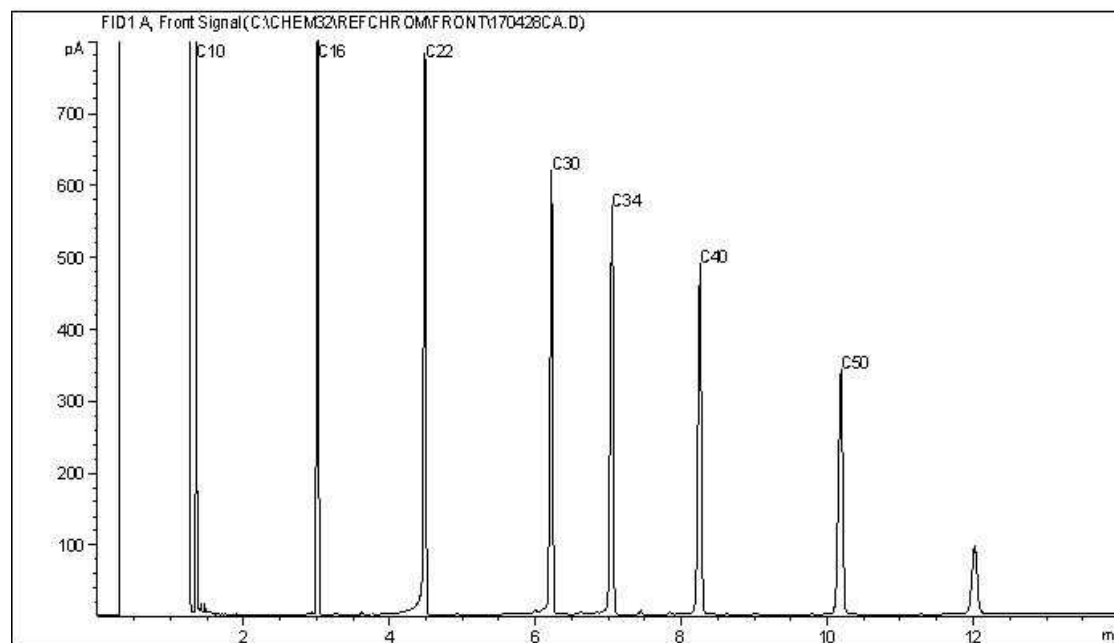
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CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram



Carbon Range Distribution - Reference Chromatogram

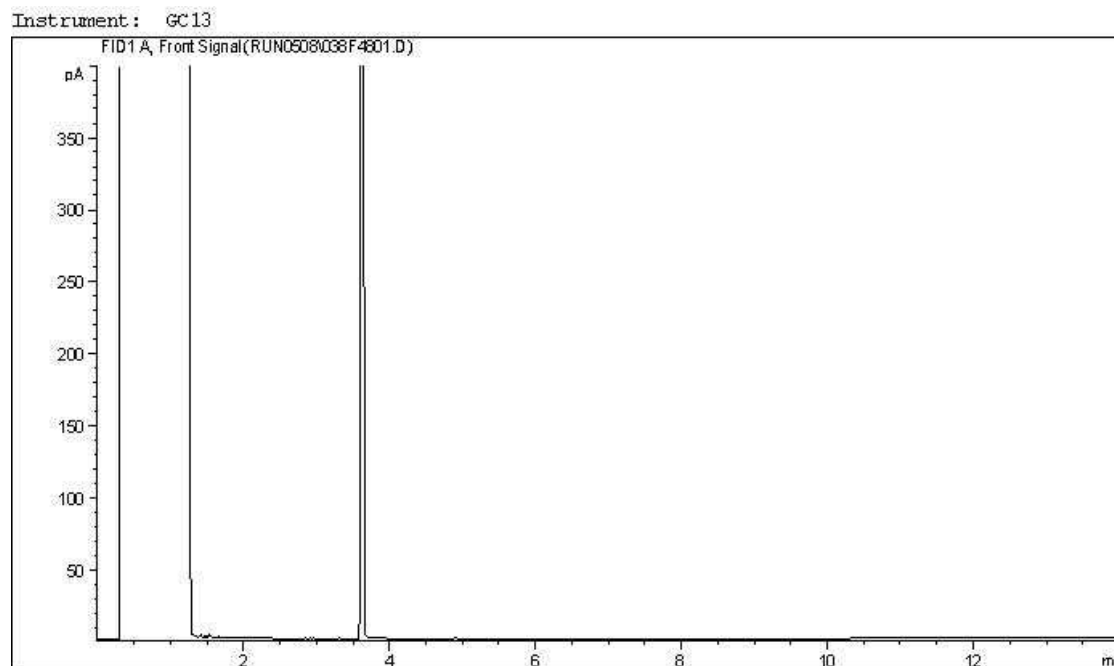


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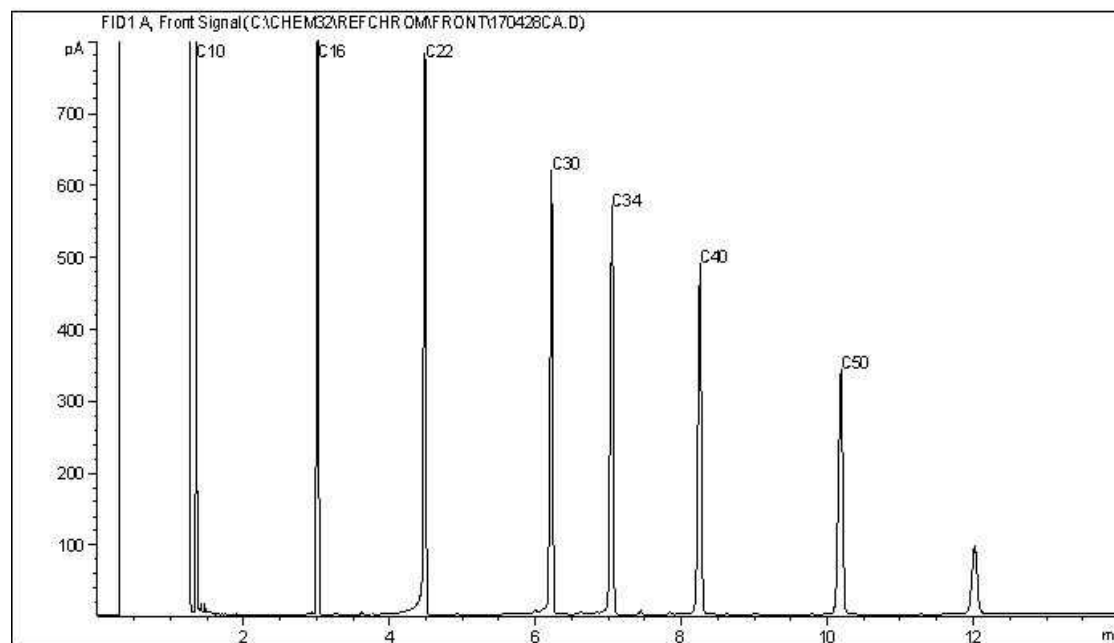
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Carbon Range Distribution - Reference Chromatogram

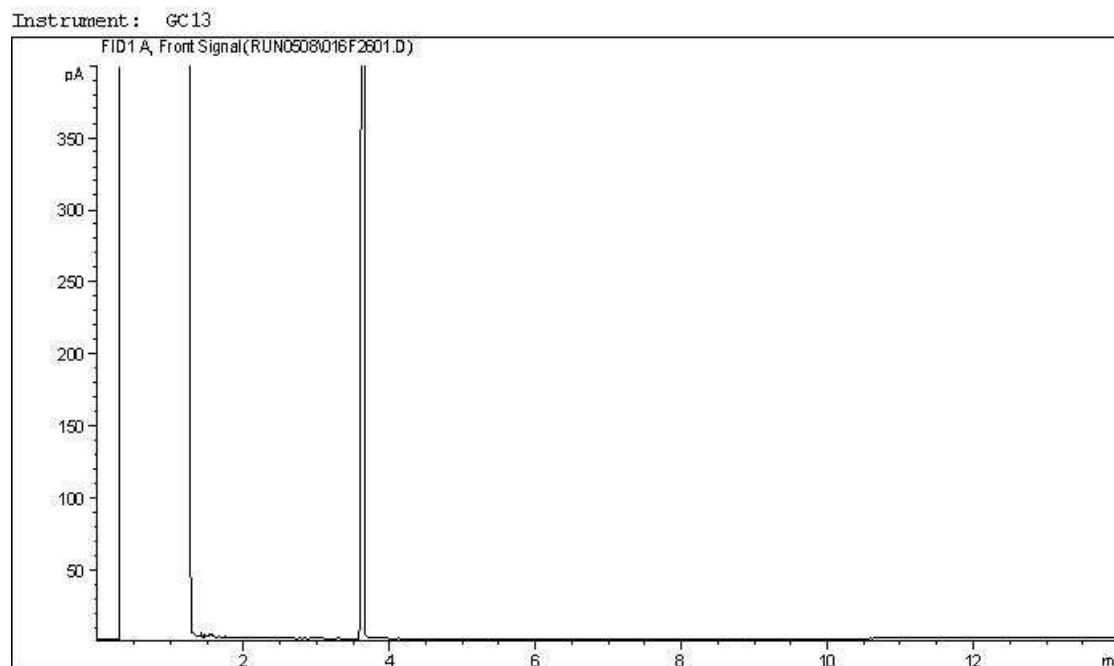


TYPICAL PRODUCT CARBON NUMBER RANGES

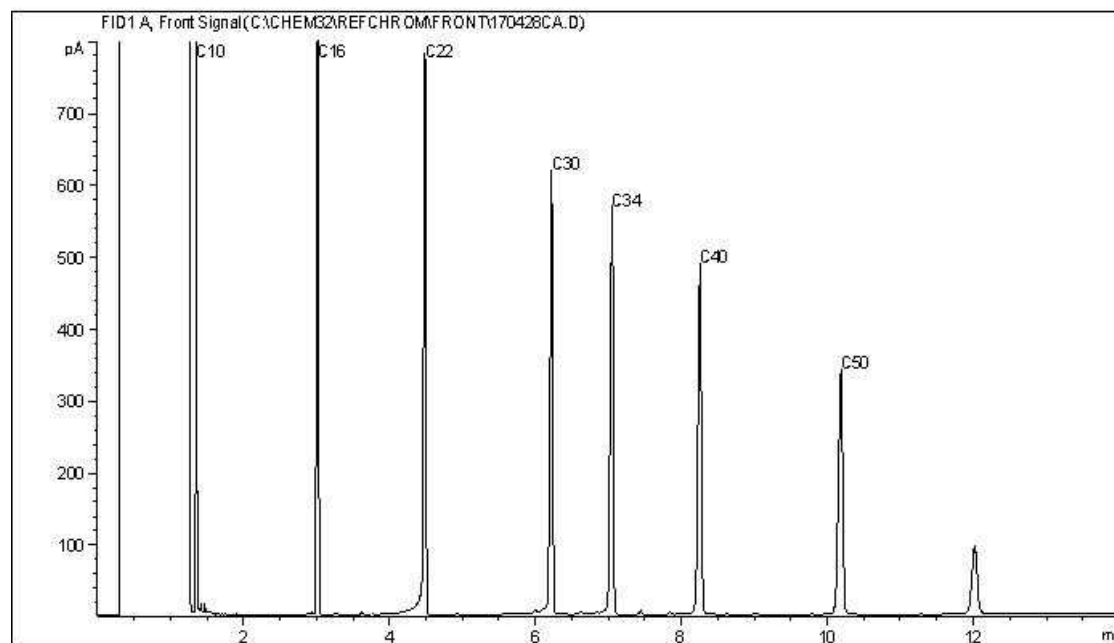
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Carbon Range Distribution - Reference Chromatogram

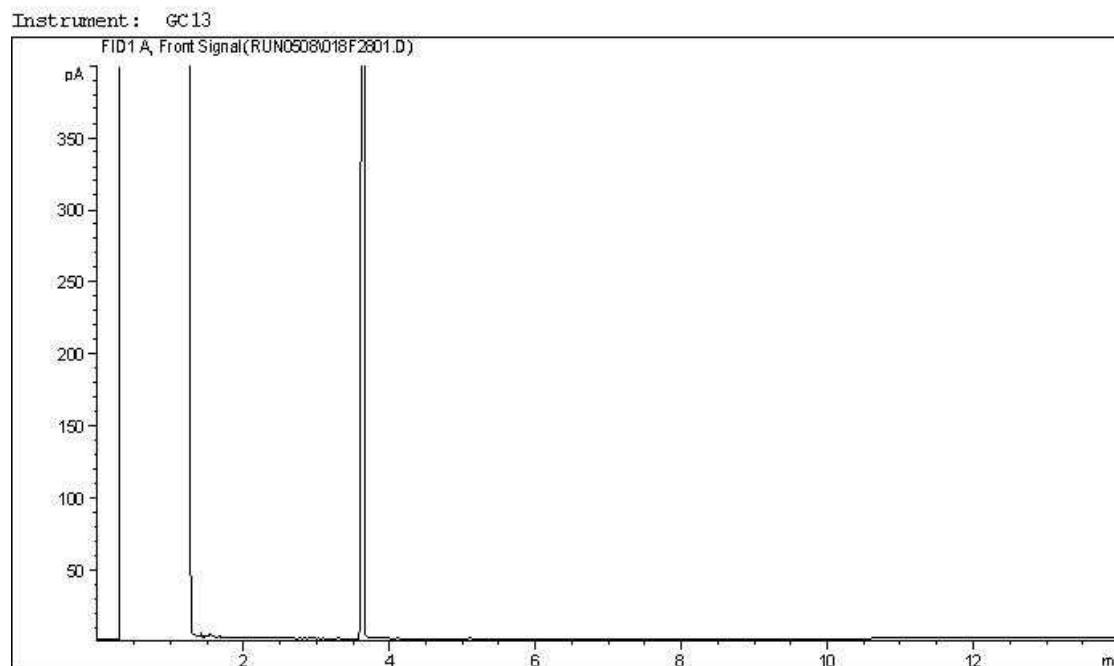


TYPICAL PRODUCT CARBON NUMBER RANGES

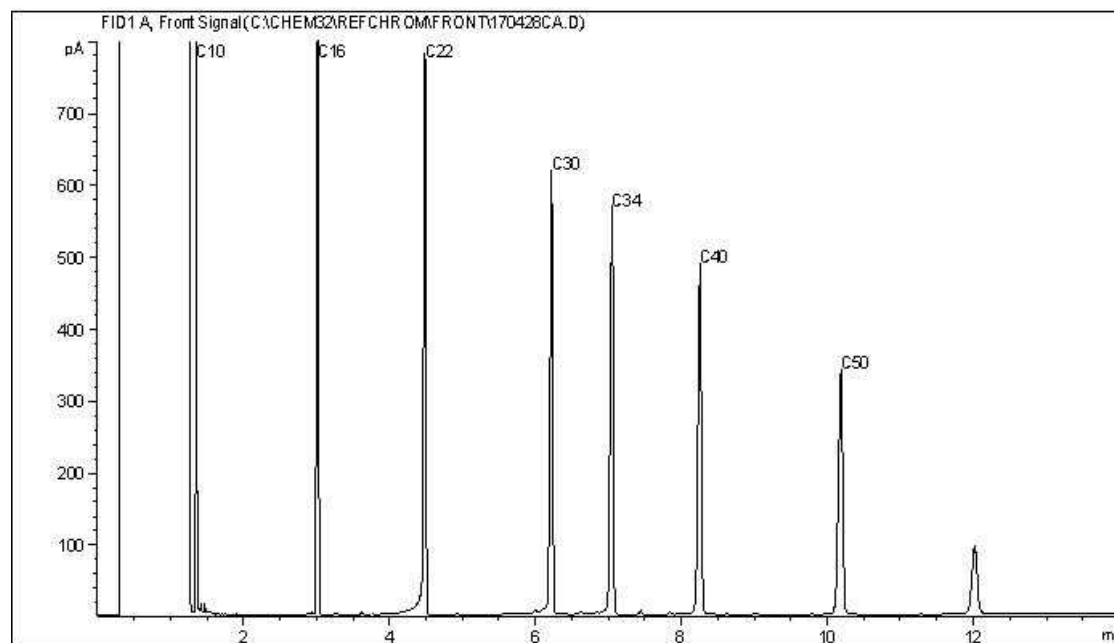
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Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

APPENDIX D

RECORD OF SITE CONDITIONS (RSC)

Record of Site Condition



1 REPORT AND FORM INFORMATION			
Title of report	Confirmatory Drilling Assessment and Groundwater Monitoring Program. 124 Main Street Barons, AB. Alberta Municipal Affairs Site #9558		
Report date (dd-mon-yyyy)	July 2017	Record of Site Condition (RSC) ID No. ^ψ	

2 SITE IDENTIFICATION AND PHYSICAL LOCATION								
2.1 Site name		AMA Site #9558						
2.2 Address of site		124 Main Street						
		Municipality	Barons					Alberta
2.3 Legal land description of site (if multiple, list all.)								
Plan, Block, Lot (PBL)			Alberta Township System (ATS)					
Plan	Block	Lot	LSD	Quarter	Section	Township	Range	Meridian
2605X	2	14						

3 STAKEHOLDERS			
3.1 Operator			
Company	Village of Barons	Contact person	Laurie Beck
Mailing address	PO Box 129 Barons AB T0L 0G0	Position held	Administrator
		Business phone No.	403.757.3633
		Business fax No.	403.757.2599
		Business e-mail	Barons@figment.ca
3.2 Consultant ☐ Not applicable			
Company	Tetra Tech Canada Inc.	Contact person	Jaymes Going
Mailing address	442 - 10 Street North Lethbridge, AB T1H 2C7	Position held	Environmental Scientist
		Business phone No.	403.359.6512
		Business fax No.	403.328.8817
		Business e-mail	Jaymes.Going@tetrattech.com
3.3 Landowner(s)			
Land type	☐ Private ☐ Special Areas ☐ Parks and protected area ☒ Public (if not private, provide Disposition No.: _____)		
Landowner(s)	☒ Same as operator ☐ Other		

^ψ: Do not fill in. Reserved for internal administrative purposes only.

Record of Site Condition



3.4 Occupant(s)			
Are there occupants at the site?	☐ Yes	☒ No	☐ To be determined (TBD)
Occupant(s)	☐ Same as operator	☐ Same as landowner	☐ Other
What is the type of occupancy?	☐ Apartment building	☐ Town house	☐ Single detached house
	☐ Agricultural	☐ Industrial	☐ Commercial
	☒ Other (specify) <u>Public Park / Roadway (Main Street)</u>		

4 OPERATING STATUS	
☐ Operating	☐ Suspended
☒ Abandoned	☐ Decommissioning in progress
☐ Reclaimed (provide Reclamation Certificate No.(s): _____)	☐ Closed
☐ Not applicable	

5 TYPE OF ACTIVITY AND SITE					
5.1 Petroleum Storage Tank Site					☒ Yes
5.1.1 ESRD file No.(s)				PTMAA site No.	
5.1.2 Types of activity					
☒ Retail gas station	☐ Aviation fuelling station	☐ Bulk fuel	☐ Other (specify): _____		
5.2 Upstream Oil and Gas Facility					☐ Yes
5.2.1 ESRD file No.(s)				AER approval No.(s)	
5.2.2 AER authorization type		☐ Approval	☐ License	☐ Permit	☐ Order
		☐ Other (specify) _____			
5.2.3 Types of activity					
☐ Wellsite and associated facility	☐ Satellite	☐ Battery	☐ Pipeline		
☐ Compressor and pumping station	☐ Other (specify): _____				
5.3 Approved Facility Under Environmental Protection and Enhancement Act (EPEA)					☐ Yes
5.3.1 ESRD approval No.(s)				AER approval No.(s)	
5.3.2 Types of approved activity					
☐ Chemical manufacturing plant	☐ Enhanced recovery in-situ oil sands or heavy oil processing plant	☐ Fertilizer manufacturing plant	☐ Landfill		
☐ Metal manufacturing plant	☐ Oil refinery	☐ Oilsands processing plant	☐ Oil production site		
☐ Pesticide manufacturing plant	☐ Petrochemical manufacturing plant	☐ Pipeline	☐ Power plant		
☐ Pulp and paper processing plant	☐ Sour gas processing plant	☐ Sulphur manufacturing or processing plant	☐ Waste management facility		
☐ Wood treatment plant	☐ Other (specify): _____				

Record of Site Condition



5.4 Facility Under EPEA Code of Practice				☐ Yes	
5.4.1 ESRD registration No.(s)				AER registration No.(s)	
5.4.2 Type of Code of Practice					
☐	Asphalt paving plant	☐	Compressor and pumping station	☐	Concrete producing plant
☐	Pesticides	☐	Pipeline	☐	Land treatment of soils containing hydrocarbons
☐	Small incinerator	☐	Sweet gas processing plant	☐	Other (specify): _____
5.5 Other Activity					
☐ Yes					
5.5.1 ESRD file No.(s)		Other site ID No.(s)		Authorized by	
5.5.2 Types of activity					
☐	Dry cleaning operation	☐	Highway maintenance yard	☐	Transportation
☐	Other (specify): _____				

6 SITE CHARACTERIZATION					
6.1 What Environmental Site Assessments (ESA) Have Been Conducted and Completed to Date?					
☒ Phase I ESA ☒ Phase II ESA (check all that apply.) ☒ Initial intrusive sampling ☒ delineation completed ☒ post-remediation monitoring ☐ final confirmatory sampling					
6.2 Contaminants of Potential Concern (COPC)					
6.2.1 Does the site have any of the conditions that require the mandatory use of Alberta Tier 2 Soil and Groundwater Remediation Guidelines (ESRD, 2007 and updates)? (check all that apply in Section 6.2.1.1.)					
☒ Yes ☐ No (→proceed to Section 6.2.2.)					
6.2.1.1 Identify any conditions that require the approaches of the Alberta Tier 2 guidelines. (see Alberta Tier 1 Soil and Groundwater Remediation Guidelines (ESRD, 2007 and updates), for details.)					
☐	Contamination within 30 cm of building foundation	☐	Unusual building feature (eg. earthen floor)	☐	Contamination within 10 m distance of surface water body
☒	Fractured bedrock	☐	Potentially high hydraulic conductivity ($> 10^{-5}$ m/sec.)	☐	Other (see Alberta Tier 1 guidelines and specify): _____
6.2.1.2 Did the Alberta Tier 2 approach lead to a soil or groundwater guideline that was lower than the corresponding Tier 1 guideline for the same contaminant(s)?					
☐ Yes ☐ TBD ☒ No (→proceed to Section 6.2.2.)					
6.2.1.3 If you answered 'yes' or 'TBD' to Section 6.2.1.2, identify the group of contaminants for each COPC with a mandatory Tier 2 guideline that is lower than the corresponding Tier 1 guideline (check all that apply, see Alberta Tier 1 guidelines, Tables 1-4 for detailed listing).					
☐	General and inorganic parameters	☐	Metals		
☐	Hydrocarbons	☐	Halogenated aliphatics		
☐	Chlorinated aromatics	☐	Pesticides		
☐	Other organics	☐	Radionuclides		
☐	Salt	☐	Other (specify): _____		

Record of Site Condition



6.2.1.4 Did any past or current ESA relevant to this investigation identify an exceedance of the mandatory Tier 2 guidelines referred to in Section 6.2.1.3 (e.g. Tier 2 guidelines that are lower than the corresponding Tier 1 guidelines)? ☐ Yes ☐ No ☐ TBD	
6.2.1.5 If you answered 'yes' in Section 6.2.1.4, have all relevant COPC been remediated to meet the mandatory Tier 2 guidelines? ☐ Yes ☐ No	
6.2.2. Did any past or current ESA relevant to this investigation identify a drilling waste disposal area? ☐ Yes ☒ No (→proceed to Section 6.2.3.)	
6.2.2.1 If a drilling waste disposal area was identified, did any past or current ESA identify non-compliance with the compliance options outlined in <i>Assessing Drilling Waste Disposal Areas: Compliance Options for Reclamation Certification</i> (AER, 2014), as amended? ☐ Yes ☐ No	
6.2.2.2 If you answered 'yes' in Section 6.2.2.1, have all COPC been remediated to meet the compliance options outlined in <i>Assessing Drilling Waste Disposal Areas: Compliance Options for Reclamation Certification</i> (AER, 2014), as amended? ☐ Yes ☐ No	
6.2.2.3 For any COPC that did not meet the compliance options in <i>Assessing Drilling Waste Disposal Areas</i>, identify the group of contaminants (check of all that apply, see the Alberta Tier 1 guidelines, Tables 1-4 for detailed listing).	
☐ General and inorganic parameters	☐ Metals
☐ Hydrocarbons	☐ Halogenated aliphatics
☐ Chlorinated aromatics	☐ Pesticides
☐ Other organics	☐ Radionuclides
☐ Salt	☐ Other (specify): _____
6.2.3 For all areas and COPCs not assessed under Sections 6.2.1 or 6.2.2, did any ESA relevant to this investigation identify an exceedance over the Alberta Tier 1 guidelines? ☒ Yes ☐ No (→proceed to Section 6.3.)	
6.2.3.1 If you answered 'yes' in Section 6.2.3, have all COPC been remediated to meet the Alberta Tier 1 guidelines? ☐ Yes ☒ No ☐ TBD	
6.2.3.2 For any COPC that exceeded Alberta Tier 1 guidelines in Section 6.2.3.1, identify the group of contaminants. (check all that apply, see the Alberta Tier 1 guidelines, Tables 1-4 for detailed listing.)	
☐ General and inorganic parameters	☐ Metals
☒ Hydrocarbons	☐ Halogenated aliphatics
☐ Chlorinated aromatics	☐ Pesticides
☐ Other organics	☐ Radionuclides
☐ Salt	☐ Other (specify): _____

Record of Site Condition



6.3 Status of Investigation

6.3.1 Identify soil and groundwater guidelines used to assess the COPCs that are the subject of this investigation (check all that apply).

- ☒ Alberta Tier 1 Soil and Groundwater Remediation Guidelines – 2007 and updates,
☐ Coarse grained ☒ Fine grained
☐ Alberta Tier 2 Soil and Groundwater Remediation Guidelines – 2007 and updates,
☐ Pathway exclusion ☐ Guideline adjustment ☐ Site specific remediation objectives
☐ Assessing Drilling Waste Disposal Areas: Compliance Options for Reclamation Certification
 (AER, 2014), as amended
☐ Other (specify): _____

6.3.2 What land use classification(s) is used?

- ☐ Natural ☐ Agricultural ☒ Residential ☐ Commercial ☐ Industrial ☒ Other (specify: Parkland)

6.3.3 What is the outcome of the investigation? (check one only.)

- ☐ For all COPCs on-site and off-site, no exceedance has been found above any applicable soil and groundwater guidelines in any prior and current assessments.
☐ All contamination on-site and off-site has been completely remediated and meets the applicable soil and groundwater guidelines.
☒ One or more COPC still exceeds the applicable soil or groundwater guidelines.

6.3.4 How many contaminated areas are there currently at the site?

One ☐ None ☐ TBD

6.3.5 Are all contaminated areas and potential contaminated areas assessed during this investigation?

☒ Yes ☐ No

6.3.6 For all areas of potential environmental concern, list the dates when the contamination was discovered (specify dd-mon-yyyy): Nov 2008; _____

6.3.7 For all areas that have been identified in Section 6.3.4, have all substance releases been reported to ESRD?

☒ Yes ☐ No ☐ Not applicable

6.3.8 If the answer to Section 6.3.7 is 'yes', list all Incident No.(s) (attach separate sheet if necessary):

_____; ☒ Not assigned

6.3.9 What is the approximate, cumulative amount of land area remaining exceeding applicable remediation guidelines? Estimated 220 (m²) ☐ None ☐ TBD

6.3.10 Is there non-aqueous phase liquid (NAPL) product remaining on site? ☐ Yes ☒ No ☐ TBD

6.3.11 Is there non-aqueous phase liquid (NAPL) product remaining off site? ☐ Yes ☒ No ☐ TBD

6.3.12 What is the remediation status of the contaminated areas at site?

- | | |
|---|---|
| ☐ No remediation required | ☐ Site has exceedance but no remediation plan |
| ☒ Remediation plan developed | ☐ Active remediation |
| ☒ Remediation completed | ☐ Post remediation assessment completed |
| ☐ Ongoing risk management plan – on-site | ☒ Ongoing risk management plan – off-site |
| ☐ Remediation Certificate issued for some area(s) (provide Remediation Certificate No.(s): _____) | |
| ☐ Remediation Certificate cancelled for some area(s) (provide Remediation Certificate No.(s): _____) | |

Direction for Completing the Remainder of the Form

Attach the analytical summary tables of the COPCs that are the subject of this investigation and still present at this site. A detailed listing of COPCs can be found with Tables 1-4 in *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (ESRD, 2007 and updates), as amended. Refer to the *RSC User's Guide* for detailed information on format and other requirements regarding the summary table.

For the remainder of the form, follow the directions below:

- If the COPCs on-site and off-site have never exceeded any applicable soil and groundwater guidelines in any prior and current assessments, → proceed to Section 8, or
- If the COPCs on-site and off-site have been completely remediated and meet the applicable soil and groundwater guidelines, → proceed to Section 8, or
- For all other circumstances, continue with Section 6.4.

6.4 Key Transport Factors for Existing COPCs

6.4.1 What is the horizontal distance to the nearest water well from the edge of the nearest contaminated area?

☐ 0-50 m ☐ 50-100 m ☒ 100-300 m ☐ 300-1000 m ☐ > 1000 m

6.4.2 What is the horizontal distance to the nearest surface water body from the edge of the contaminated area?

☐ ≤10 m ☐ 10-50 m ☐ 50-100 m ☐ 100-300 m ☒ 300-1000 m ☐ > 1000 m

6.4.3 Does delineation achieve closure above the groundwater water table that is nearest to the ground surface?

☒ Yes (→ go to Section 6.5.) ☐ No ☐ TBD

6.4.4 Is the groundwater that is nearest the ground surface a domestic use aquifer (DUA) as defined in Alberta Tier 2 guidelines?

☐ Yes ☐ No ☐ TBD ☐ Not required (NR)

6.4.5 Is there a hydraulic barrier, as defined in Alberta Tier 2 guidelines, between the base of the contaminated area and the DUA?

☐ Yes ☐ No ☐ TBD ☐ NR

6.4.6 If you answered 'yes' to Section 6.4.5, provide the measured largest value of the hydraulic conductivity (as value $\times 10^{-7}$ m/sec.) for the 5.0 m vertical layer from the bottom of the contaminated zone.

_____ ($\times 10^{-7}$ m/sec.) ☐ TBD ☐ NR

6.5 On-site Characterization

6.5.1 What is the dominant soil texture that governs substance transport at the site?

☐ Coarse grained ☒ Fine grained ☐ TBD ☐ Not applicable (must identify reason in Section 6.2.1.1.)

6.5.2 What are the shallowest and deepest measured depths (meters below ground surface) of the water table at site?

Shallowest: 1.96 (m) Deepest: 2.36 (m) ☐ TBD ☐ NR (specify max. depth assessed: _____ (m))

6.5.3 What is the dominant horizontal direction of groundwater flow for the near surface water table?

(N, NW, etc.: NW) ☐ TBD ☐ NR

6.5.4 What is the existing land use classification?

☐ Natural ☐ Agricultural ☐ Residential ☐ Commercial ☐ Industrial ☒ Other (specify) Parkland

6.5.5 What is the end land use classification?

☐ Natural ☐ Agricultural ☒ Residential ☐ Commercial ☐ Industrial ☒ Other (specify) Parkland

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6.5.6 Identify exposure pathways for which the applicable guidelines are exceeded on-site (check all that apply).			
☐	Vapour inhalation	☐	Soil ingestion
☐	Ingestion of potable water	☐	Soil dermal (skin) contact
☐	Fresh water aquatic life	☐	Soil contact for plants and invertebrates
☐	TBD	☐	Other (specify): _____

6.6 Off-site Characterization			
6.6.1 Are there COPCs off-site exceeding applicable soil or groundwater guidelines?			
☐ No (→ if on-site contamination was reported, proceed to Section 7, otherwise, proceed to Section 8.) ☒ Yes ☐ TBD			
6.6.2 What is the current land use classification for any off-site area(s) identified in Section 6.6.1?			
☐ Natural ☐ Agricultural ☐ Residential ☐ Commercial ☐ Industrial ☒ Other (specify) <u>Transportation</u>			
6.6.3 What is the end land use classification for any off-site area(s) identified in Section 6.6.1?			
☐ Natural ☐ Agricultural ☐ Residential ☐ Commercial ☐ Industrial ☒ Other (specify) <u>Transportation</u>			
6.6.4 Is there any substance concentration under a road allowance exceeding the applicable soil or groundwater guidelines?			
☒ Yes ☐ No (→ proceed to Section 6.6.6.) ☐ TBD			
6.6.5 What is the most sensitive land use classification adjacent to the road allowance?			
☐ Natural ☐ Agricultural ☒ Residential ☐ Commercial ☐ Industrial ☒ Other (specify) <u>Parkland</u>			
6.6.6 Identify exposure pathways for which the applicable guidelines are exceeded off-site (check all that apply).			
☐	Vapour inhalation	☐	Soil ingestion
☐	Ingestion of potable water	☐	Soil dermal (skin) contact
☐	Fresh water aquatic life	☐	Soil contact for plants and invertebrates
☒	TBD	☐	Other (specify): _____

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7 RISK MANAGEMENT PLAN (RMP)		
7.1 What is the Plan for Contaminated Areas Still Remaining on and off the Site? (check one only.)		
☐ Complete remediation (→ proceed to Section 8). ☒ Partial remediation with risk management for some residual contamination. ☐ Risk management for all remaining contamination.		
7.2 Key Progress of RMP		
7.2.1 If the site needs an on-going RMP, answer all the following questions that apply to the RMP.		
☒ Yes	☐ No	Are contaminated areas completely delineated horizontally and vertically in soil?
☒ Yes	☐ No	Are contaminated areas completely delineated horizontally and vertically in groundwater?
☒ Yes	☐ No	Is source identified and completely delineated?
☒ Yes	☐ No	Is source migrating or has migrated off-site?
☐ Yes	☒ No	Is source left as is?
☒ Yes	☐ No	Is source partially removed and residual source being managed?
☐ Yes	☒ No	Is source controlled with physical or administrative methods?
☒ Yes	☐ No	Are all pathways of concern identified?
☒ Yes	☐ No	Have all relevant receptors been identified and protected?
☒ Yes	☐ No	Is there a monitoring program in place to verify RMP success?
☐ Yes	☒ No	Are there third parties related to this RMP? (if the answer is 'no', skip the next question.)
☐ Yes	☐ No	If there are third parties, have all of them accepted the RMP?
☐ Yes	☒ No	Is there a commitment from person(s) responsible to implement and monitor the RMP until final remediation guidelines are achieved?
☒ Yes	☐ No	Is there a contingency plan in place should the RMP fail?
☒ Yes	☐ No	Is the RMP implemented for the site?

Public Disclosure and Privacy Notification
The <i>Record of Site Condition</i> form is a public record that is disclosed in accordance with section 35 of the <i>Environmental Protection and Enhancement Act</i>, <i>Disclosure of Information Regulation</i>, and <i>Ministerial Order 23/2004</i>. Reasonable efforts have been made to minimize collection of personal information where possible. Personal information on the form is collected under the authority of section 12(c) and other provisions of the <i>Environmental Protection and Enhancement Act</i> and is in compliance with section 33(a) and 33(c) of the <i>Freedom of Information and Protection of Privacy Act</i> (FOIP). Personal information collected on this form will be used by Alberta Environment and Sustainable Resource Development (ESRD) or the Alberta Energy Regulator (AER), as the case may be, for the purposes of administering its programs.
Accuracy of Information
The information in this document has been submitted by persons other than ESRD or the AER. The Department, the Government of Alberta, and the AER cannot and do not warrant that the information in this document is current, accurate, complete, or free of errors. Persons accessing the information provided should not rely on it, and any reliance on the information provided is taken at the sole risk of the user. Users of this information are advised to conduct their own due diligence to satisfy themselves of the environmental condition of the property of interest.

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8 DECLARATION

This *Record of Site Condition* form was prepared for the purpose of reporting on the state of environmental site conditions and, where applicable, for the purpose of remediation or reclamation, for:

AMA Site #9558 (site name) (the "Site").

I, as the licensed operator or authorized representative, have reviewed all information that was used in preparation of this form and I am satisfied that it was prepared in a manner consistent with the Applicable Standard¹ together with any relevant additional guidance that is available from Alberta Environment and Sustainable Resource Development as of this date for conducting environmental site assessments.

Having conducted reasonable inquiries to obtain all relevant information, to my knowledge, the statements made in this form are true as of this date. I have disclosed all pertinent information of which I am aware concerning the historical and current environmental condition of the Site to the Director.

Any use which a third party, other than the Crown in right of Alberta or the AER, makes of this form, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. The undersigned accepts no responsibility for damages, if any, suffered by any third party, other than the Crown in right of Alberta and the AER, as a result of decisions made or actions based on this form. Any exclusions or disclaimers to the contrary contained in any attachment to this form are of no force or effect as against the Crown in right of Alberta and the AER.

Footnote ¹:

"Applicable Standard" means

- a) for the purposes of upstream oil and gas sites,
 - i) *2010 Reclamation Criteria for Wellsites and Associated Facilities Application Guidelines* (ESRD 2011),
 - ii) CSA Standard Z769, *Phase II Environmental Site Assessment*, as amended, for any Phase II site assessment information used in preparation of this form on all upstream oil and gas sites not included in a) i);
- b) for the purposes of all other sites, CSA Standard Z768, *Phase I Environmental Site Assessment*, as amended, for any Phase I site assessment information and with CSA Standard Z769, *Phase II Environmental Site Assessment*, as amended, for any Phase II site assessment information used in preparation of this form.

By signing below, I as the licensed operator or authorized representative, confirm the information provided herein is correct and complete, to the best of my knowledge and belief.

Village of Barons	Henri Carriere	Senior Project Engineer		July 12, 2017
Name of operator	Name of authorized representative	Title of authorized representative (e.g. officer, director)	Signature	Date (dd-mon-yyyy)