



TETRA TECH EBA

GROUNDWATER AND SOIL VAPOUR MONITORING PROGRAM 124 MAIN STREET, BARONS, ALBERTA ALBERTA MUNICIPAL AFFAIRS SITE #9558



PRESENTED TO
VILLAGE OF BARONS

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EXECUTIVE SUMMARY

Tetra Tech EBA Inc. (Tetra Tech EBA) was retained by the Village of Barons (Barons) to conduct a groundwater monitoring program (GWMP) and a subsurface soil vapour monitoring program (SVMP) for a property located at 124 Main Street in Barons, Alberta. The site is included within the Alberta Municipal Affairs Tank Site Remediation Program, Site Number: 9558.

The scope of work was based on a May 2014 Revised Risk Management Plan (RMP) for the site which recommended the implementation of a GWMP and a SVMP. The RMP was based on previous environmental site assessments (ESAs) which identified concentrations of petroleum hydrocarbons (PHCs) in the soil and groundwater greater than the applicable Alberta Environment and Sustainable Resource Development (ESRD) 2014 Alberta Tier 1 and 2 Soil and Groundwater Remediation Guidelines (Tier 1 and Tier 2 Guidelines).

The objective of the SVMP was to identify potential risks to occupants using the site and the adjacent commercial business to the east from exposure to soil vapours, specifically PHCs.

The objective of the GWMP was to document current concentrations, allowing the evaluation of natural attenuation of PHC compounds in the soil and groundwater beneath the site.

Discussion and Conclusions

Concentrations of BTEX, and PHC fractions F1 to F4 in soil, were less than the laboratory detection limits, and/or Tier 1 Guidelines at the locations tested in 2014. Historically, concentrations of benzene, ethylbenzene, xylenes and PHC fractions F1 to F2 have been identified at concentrations greater than the Tier 1 Guideline at 08MW06 and 09BH10 at depths ranging from 1.8 – 3.6 metres below grade (mbg). Tetra Tech EBA notes that the soil samples collected during this investigation were from a maximum depth of 1.2 mbg.

Concentrations of BTEX, and PHC fractions F1 and F2 in groundwater, were less than the laboratory reportable detection limits (RDLs) and/or the Alberta Tier 1 Guidelines in the groundwater at the locations tested in 2014. Historically, concentrations of benzene, ethylbenzene, and PHC fraction F2 were greater than the Tier 1 Guideline in 2008 at 08MW06 and benzene was reported greater than the Tier 1 Guideline at 09MW11 in 2009 (BTEX and PHC fractions F1 and F2 have remained less than the RDL at all other locations sampled in 2014).

Routine groundwater parameters were analyzed for the first time in 2014 for future reference 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, chloride, nitrate, nitrite, and manganese greater than the applied Tier 1 Guidelines were measured in one or more monitoring wells in 2014. The concentrations of these parameters, excluding chloride, may reflect natural groundwater composition.

Concentrations of dissolved manganese and iron greater than the Tier 1 Guidelines are often detected in groundwater under anaerobic conditions and are likely not the result of historical site activities.

The soil vapour concentrations in each of the four vapour wells did not exceed the calculated soil vapour screening level concentrations. The results indicate that there is not a risk of exposure to PHCs via inhalation of indoor air at the nearby commercial building, nor is there a risk of exposure via inhalation of outdoor air to surrounding receptors.

Recommendations

Bi-annual groundwater monitoring and sampling of the current monitoring well network should be maintained until PHC concentrations meet the applicable Tier 1 Guidelines.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	i
1.0 INTRODUCTION	1
1.1 General	1
1.2 Authorization	1
1.3 Scope of Work	1
1.3.1 Drilling Program, Soil Sampling, and Soil Vapour Well Installation.....	2
1.3.2 Groundwater Monitoring and Sampling	2
1.3.3 Soil Vapour Leak Testing and Sampling	2
1.3.4 Data evaluation and reporting	3
1.4 Qualifications of Assessors.....	3
2.0 METHODS	3
2.1 Utility Locates.....	3
2.2 Project Safety.....	3
2.3 Borehole Drilling and Soil Vapour Well Installation Program	4
2.4 Groundwater Monitoring, Sampling, and Analytical Testing.....	4
2.5 Leak Detection Testing and Soil Vapour Sampling	5
2.6 Regulatory Framework	5
2.6.1 Soil and Groundwater Regulatory Guidelines	5
2.6.2 Soil Vapour Regulatory Guidelines.....	5
2.6.2.1 Indoor Air	5
2.6.2.2 Outdoor Air	7
3.0 RESULTS.....	8
3.1 Soil Stratigraphy.....	8
3.2 Soil Chemical Quality.....	8
3.3 Groundwater Results	9
3.3.1 Groundwater Levels.....	9
3.3.2 Groundwater Chemical Quality.....	9
3.4 Soil Vapour Results	9
4.0 DISCUSSION AND CONCLUSIONS	10
4.1 Soil	10
4.2 Groundwater	10
4.3 Soil Vapour	10
5.0 RECORD OF SITE CONDITION	10
6.0 RECOMMENDATIONS	11
7.0 CLOSURE.....	12
REFERENCES	13

LIST OF TABLES IN TEXT

Table A: Soil Vapour Screening Levels – Indoor Air.....	6
Table B: Soil Vapour Screening Levels – Outdoor Air.....	8

APPENDIX SECTIONS

TABLES

Table 1	Monitoring Well Completion Details and 2014 Field Monitoring Results
Table 2	Soil Analytical Results
Table 3	Groundwater Analytical Results
Table 4	Soil Vapour Analytical Results
Table 5	Historical Soil Analytical Results
Table 6	Historical Groundwater Analytical Results

FIGURES

Figure 1	Site Location Plan
Figure 2	Site Plan Showing Borehole, Monitoring Well and Soil Vapour Well Locations
Figure 3	Site Plan Showing Groundwater Elevations

APPENDICES

Appendix A	Tetra Tech EBA's General Conditions
Appendix B	Borehole Logs
Appendix C	Laboratory Certificates
Appendix D	Record of Site Condition

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Village Of Barons and their agents. Tetra Tech EBA Inc. (Tetra Tech EBA) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than 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 EBA's Services Agreement. Tetra Tech EBA's General Conditions are provided in Appendix A of this report.

1.0 INTRODUCTION

1.1 General

Tetra Tech EBA Inc. (Tetra Tech EBA) was retained by the Village of Barons (Barons) to conduct a groundwater monitoring program (GWMP) and a subsurface soil vapour monitoring program (SVMP) for a property located at 124 Main Street in Barons, Alberta (Figure 1). The site is included within the Alberta Municipal Affairs Tank Site Remediation Program (AMA Program), Site Number: 9558.

The scope of work is based on a recently submitted Revised Risk Management Plan (RMP) for the site (Tetra Tech EBA File: ENVIND03335-01, dated May 2014) which recommended the implementation of a GWMP and a SVMP. The RMP was based on previous environmental site assessments (ESAs) conducted at the site by Tetra Tech EBA which identified concentrations of petroleum hydrocarbons (PHCs) in the soil and groundwater greater than the applicable Alberta Environment and Sustainable Resource Development (ESRD) 2014 Alberta Tier 1 and 2 Soil and Groundwater Remediation Guidelines (Tier 1 and Tier 2 Guidelines).

Details of the previous ESAs are presented in the following documents:

- Phase II and Phase III Environmental Site Assessment. 124 Main Street. Lot 17, Block 2, Plan 2605X. AMA Site 9558. Barons, Alberta. Tetra Tech EBA File: L22101183.001, dated October 2009.
- Underground Storage Tank Removal and Monitoring. AMA Site 9558. Barons, Alberta. Tetra Tech EBA File: L22101183.004, dated December 2011.

The objective of the SVMP was to identify potential risks to occupants using the site and the adjacent commercial business to the east from exposure to soil vapours, specifically PHCs.

Additionally, the SVMP will support the Revised RMP developed for the site by Tetra Tech EBA in May 2014. It will also ensure that Barons is providing adequate due diligence with respect to any potential health risks to occupants at the site and the adjacent property from potential exposure to soil vapours. Note that the Revised RMP has not yet been approved by ESRD.

The objective of the GWMP was to document current concentrations, allowing the evaluation of natural attenuation of PHC compounds in the soil and groundwater beneath the site.

1.2 Authorization

Ms. Laurie Beck, of the Village of Barons, provided written authorization to Tetra Tech EBA to proceed with the present study via a signed services agreement dated June 25, 2014.

1.3 Scope of Work

To meet the objectives stated in Section 1.1, the scope of work for the GWMP and SVMP included the following tasks:

- Task 1 - Drilling program, soil sampling, and soil vapour well installation.
- Task 2 - Groundwater monitoring and sampling.
- Task 3 – Soil vapour leak testing and sampling.

- Task 4 - Data evaluation and reporting including a Record of Site Condition (RSC).

1.3.1 Drilling Program, Soil Sampling, and Soil Vapour Well Installation

- Requested that Alberta One-Call and a private utility locate company conduct a buried utility locate prior to commencing work.
- Prepared a health and safety plan using Tetra Tech EBA's in-house Safe Work Form (SWF). A safety meeting, including a field level risk assessment, was conducted on site prior to the start of work.
- Obtained water levels from existing monitoring wells on-site to determine the installation depth of the soil vapour wells.
- Drilled four (4) boreholes at the site to a maximum depth of 1.2 m below grade (mbg).
- Obtained representative soil samples during drilling at regular intervals, at a minimum of every 0.4 m, but with greater frequency where there were changes in stratigraphy, moisture, or field screening results. Soils were described according to the Unified Soil Classification System (USCS).
- Conducted combustible vapour concentration (CVC) measurements on soil samples using a photoionization detector (PID).
- Completed the four (4) boreholes as soil vapour monitoring wells using 25 mm solid polyvinyl chloride (PVC) pipe connected to a 50 mm PVC slotted section at the bottom 300 mm of the borehole.
- From the four (4) boreholes, submitted soil samples to Maxxam Analytics (Maxxam) for laboratory analysis for the following parameters: BTEX, PHC fractions F1 to F4, fraction organic carbon (FoC) and particle size analysis (PSA).

1.3.2 Groundwater Monitoring and Sampling

- Measured groundwater levels in all accessible groundwater monitoring wells previously installed at the site and observed monitoring well integrity.
- Measured CVCs in the headspace of each monitoring well.
- Purged each well of approximately three standing well volumes of water or until the well was practically dry, and allowed the water level in the well to recover; collected groundwater samples from each well.
- Submitted four (4) groundwater samples for laboratory analysis of the following parameters: BTEX, PHC fractions F1 and F2, dissolved iron and manganese, and routine parameters.

1.3.3 Soil Vapour Leak Testing and Sampling

- Performed well leak tests with a helium shroud, collected soil vapour samples from the soil vapour wells installed at the site and submitted soil vapour samples to Maxxam for laboratory analysis for the following parameters: BTEX and aliphatic and aromatic hydrocarbon sub-fractions.

1.3.4 Data evaluation and reporting

- Prepared this report discussing the field observations and analytical results, comparing the results to the ESRD 2014 Tier 1 and Tier 2 Soil and Groundwater Guidelines and ESRD 2014 human toxicity reference values for inhalation exposure thresholds.

1.4 Qualifications of Assessors

Mr. Jamie LaMontagne, EP., conducted the soil vapour well drilling, leak testing, sampling, and prepared this report. Mr. LaMontagne is an environmental technologist for Tetra Tech EBA's Geoenvironmental Discipline and has over thirteen years of experience in the environmental industry.

Mr. Jaymes Going, B.Sc., EP, acted as the project manager, assisted with the interpretation of the data, and conducted the intermediate review of this report. Mr. Going is a Team Lead with Tetra Tech EBA's Geoenvironmental Discipline and has over six years of experience in the environment industry.

Mr. Brian Gray, P.Geol., provided technical guidance throughout the project, and conducted the final review of the report. Mr. Gray is a senior environmental geologist with Tetra Tech EBA in the Geoenvironmental Discipline in Calgary, Alberta. Mr. Gray has more than 30 years of earth sciences experience, the last 20 of which have involved management and remediation of contaminated sites in Alberta, British Columbia, and Ontario.

2.0 METHODS

This section describes the methods applied by Tetra Tech EBA during the GWMP and the SVMP.

2.1 Utility Locates

Utility locates were coordinated with Alberta One-Call (Ticket # 4148582) and a private locator (Alberta Line Find) to identify underground and above-ground utilities. 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 to be conducted within five metres of a buried marked utility and the mast of the drill rig was not to be erected within seven metres from any overhead utility.

2.2 Project Safety

A pre-job hazard assessment and safe work form were completed prior to the initiation of the fieldwork and applicable safe work procedures were reviewed. The safe work form was reviewed on site by the Tetra Tech EBA representatives. At that time, emergency shut-offs were identified, site conditions were discussed and a safe meeting location was chosen.

2.3 Borehole Drilling and Soil Vapour Well Installation Program

On June 6, 2014, Tetra Tech EBA retained Chilako Drilling Services Ltd. of Coaldale, Alberta to conduct the borehole drilling and soil vapour well installation at four (4) locations (14VW01, 14VW02, 14VW03, and 14VW04). Prior to drilling activities commencing, groundwater levels were obtained from the existing monitoring well network to determine installation depths. Drilling activities were conducted using a track-mounted drill rig equipped with a 100 mm solid stem auger. Tetra Tech EBA described soils according to the modified USCS with additional comments on unusual stains and/or debris. Soil samples were collected directly from the auger of the drill rig at 0.4 m intervals and/or changes in lithology, or where soil staining was observed. Bagged soil samples were screened for CVCs using a MiniRAE 3000 portable PID. CVC measurements from all the soil samples were less than the instruments detection limits (various locations) to 5 ppm at 14VW02 (0.6 to 0.8 m).

Soil vapour wells were constructed and installed approximately 0.5 m above the perceived water table using a sampling port and valve attached to a 25 mm solid PVC pipe and a 50 mm slotted PVC vapour intake screen with a length of 300 mm at the base of the well. 14VW01 to 14VW03 were completed to 1.2 mbg and 14VW04 was completed to 1.0 mbg. Silica sand was placed from the base of the borehole to approximately 0.2 m above the slotted interval of the standpipe within the borehole annulus. The annulus of each monitoring well, above the screened section, was sealed with bentonite clay to ground level and the well was finished beneath a steel flush mount casing seated in concrete.

One (1) soil sample from the base of each borehole was selected for laboratory analyses of BTEX and PHC fraction F1 to F4. An additional two (2) samples from 14VW01 were submitted for FoC and PSA. Soil samples were placed in laboratory-supplied 250 mL glass jars with Teflon™-lined lids, kept cool in ice-filled coolers, and transported to Maxxam, under chain-of-custody (COC) documentation.

Soil vapour well locations are presented on Figure 2, and borehole logs are included in Appendix B.

2.4 Groundwater Monitoring, Sampling, and Analytical Testing

Tetra Tech EBA personnel conducted the GWMP on July 18 and 19, 2014. Liquid levels were measured using a Heron™ electronic interface probe at all accessible groundwater monitoring wells (08MW01, 08MW03, 08MW07, and 09MW11). Monitoring wells were screened for headspace CVCs using a PID and all measurements were less than the instrument detection limits. Prior to sampling, groundwater wells were purged of approximately three standing well volumes of water, or until the well was practically dry, and allowed to recover to near static levels prior to collecting the samples. Groundwater samples were collected using dedicated disposable bailers, stored in laboratory-supplied bottles, appropriately preserved/filtered, and stored on ice in a cooler. The samples were transported to Maxxam under COC for analysis of BTEX, PHC fraction F1 and F2, dissolved iron and manganese, and routine groundwater parameters. Dissolved iron and manganese, and routine groundwater parameters were analyzed for the first time in 2014 for future reference to assist in determining the potential for the natural attenuation of PHCs at the site.

Tetra Tech EBA's standard procedures for purging, sampling, preserving, and transporting groundwater samples were followed to avoid cross-contamination and to ensure sample quality was maintained. Groundwater monitoring and sampling was conducted in accordance with EBA work methods (WM4203).

Table 1 summarizes groundwater monitoring well completion details and the 2014 monitoring results. Groundwater monitoring well locations are presented on Figure 2.

2.5 Leak Detection Testing and Soil Vapour Sampling

Tetra Tech EBA personnel conducted helium leak detection tests and purged all four (4) soil vapour wells of approximately 1.0 L of air on July 18, 2014. A shroud constructed from a 20 L plastic container was placed over the soil vapour well and sealed to the ground surface using a hydrated bentonite mixture. Industrial grade helium gas (99.99 % helium) was then introduced into the shroud until a minimum of 25 % helium gas was present and stable within the shroud. A PID was attached to the brass sampling valve of the well within the shroud and 1.0 L of air was drawn from the well into a Tedlar bag. A helium / hydrogen multi-gas detector was then attached to the Tedlar bag to draw a sample and determine if ambient air was entering the soil vapour well via the subsurface bentonite seal. The helium concentration from all four (4) soil vapour wells were less than the instrument detection limits, indicating that the well integrity was sufficient to allow the collection of vapour samples representative of true formation conditions.

Tetra Tech EBA returned to the site on July 19, 2014 to conduct the soil vapour sampling. Soil vapour samples were collected using 1.4 L Summa™ canisters equipped with non-linear flow regulators set to collect the sample over a period of 60 minutes. The Summa™ canisters were submitted to Maxxam for analysis of BTEX and aliphatic and aromatic hydrocarbon sub-fractions.

2.6 Regulatory Framework

2.6.1 Soil and Groundwater Regulatory Guidelines

Based on the surrounding land use and the desired end land use for the site, soil and groundwater analytical results were compared to Tier 1 Guidelines for residential/parkland land use, fine-grained soils. 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. Such receptors and pathways include the domestic use aquifer (DUA), freshwater aquatic life (FAL), direct soil contact (ecological and human), off-site migration, and vapour inhalation.

2.6.2 Soil Vapour Regulatory Guidelines

As presented in the ESRD Alberta 2014 Tier 2 Soil and Groundwater Remediation Guidelines (Tier 2 Guidelines), the concentration of potential contaminants of concern (PCOC) in soil vapour samples may be used to evaluate the risk to indoor and outdoor receptors via inhalation of vapours originating in the subsurface.

The Tier 2 Guidelines include human toxicity reference values (TRVs) for inhalation. For non-carcinogens, the inhalation TRV represents the concentration of the chemical of concern considered unlikely to cause adverse human health effects after a lifetime of continuous exposure, referred to as the tolerable concentration (TC). For carcinogens, the inhalation TRV is referred to as the inhalation unit risk (IUR), and can be used to determine a risk-specific concentration (RSC). To ensure that the incremental lifetime cancer risk of an individual does not exceed 1 in 100,000 (1×10^{-5}) after a lifetime of continuous exposure, the RSC is calculated as follows:

$$\text{RSC} = 10^{-5} / \text{IUR}$$

2.6.2.1 Indoor Air

Even though the proximate indoor receptors are employed for commercial use, the assumption of continuous exposure as is appropriate for residential receptors, has been applied as a conservative measure in the calculation of indoor screening level concentrations. Continuous exposure is expressed as an exposure term (ET) of 1. The ET is used to determine appropriate indoor screening levels for ambient air in buildings as indicated below:

$$\text{Indoor Screening Level} = (\text{TC or RSC}) / \text{ET}$$

As permitted under the ESRD 2014 Tier 2 Guidelines, sub-surface soil vapour concentrations may be used to assess the potential for health risks via inhalation by applying an attenuation coefficient to account for the dilution of vapours as they migrate from the sub-surface into buildings and mixing with indoor air. The attenuation coefficient can be obtained from the US EPA Johnson & Ettinger model, or a default attenuation coefficient of 0.01 (dilution factor (DF) of 100) can be used. As a conservative measure, the default DF was applied.

For non-carcinogens, ESRD 2014 applies a soil allocation factor (SAF) in the development of the soil remediation guidelines. The SAF represents the relative proportion of the TRV that may be apportioned to impacts in soil and allows for the remaining incremental exposure to be reserved for other media (e.g. food, air, water and consumer products). ESRD also use the SAF in deriving the groundwater guidelines, again reserving some incremental exposure to be allocated to other media. To maintain an equivalent level of protection, the SAF was also applied in the development of the soil vapour screening levels. Tetra Tech EBA advises that the SAF was not applied to the indoor screening levels for carcinogens since the air within buildings may reflect the contributions of all other media to the inhalation pathway.

Based on the above, the soil vapour screening levels were determined as follows:

$$\text{Soil Vapour Screening Level (non-carcinogen)} = \text{TC} \times \text{SAF} \times \text{DF} / \text{ET}$$

$$\text{Soil Vapour Screening Level (carcinogen)} = \text{RSC} \times \text{DF} / \text{ET}$$

The following table (Table A) presents the calculated soil vapour screening levels for indoor air.

Table A: Soil Vapour Screening Levels – Indoor Air

Compound	TC (mg/m ³)	IUR (mg/m ³)	RSC (mg/m ³)	ET (residential/parkland)	Indoor Screening Level (mg/m ³)	SAF	DF	Soil Vapour Screening Levels (mg/m ³)
Benzene	-	0.0033	0.0030	1	0.0033	-	100	0.3
Toluene	3.8	-	-	1	3.8	0.5	100	190
Ethylbenzene	1.0	-	-	1	1.0	0.5	100	50
Xylenes (total)	0.18	-	-	1	0.18	0.5	100	9
F1								
>C6-C10 Aliphatic	18.4	-	-	1	18.4	0.5	100	920
>C8-C10 Aliphatic	1.0	-	-	1	1.0	0.5	100	50
>C8-C10 Aromatic	0.2	-	-	1	0.2	0.5	100	10
F2								
>C10-C12 Aliphatic	1.0	-	-	1	1.0	0.5	100	50
>C12-C16 Aliphatic	1.0	-	-	1	1.0	0.5	100	50
>C10-C12 Aromatic	0.2	-	-	1	0.2	0.5	100	10
>C12-C16 Aromatic	0.2	-	-	1	0.2	0.5	100	10

- = no value or not applicable

TC = tolerable concentration (Table A7 ESRD 2014)

IUR – inhalation unit risk (Table A7 ESRD 2014)

RSC = risk specific concentration

ET = exposure term (Table A1 ESRD 2014)

SAF = soil allocation factor (Table A9 ESRD 2014)

DF = dilution factor (Appendix B ESRD 2014)

2.6.2.2 Outdoor Air

For outdoor air in a park setting, such as exists at the site, an exposure term (ET) of 0.11 is considered appropriate. This is equivalent to occupancy four hours per day, five days per week, and 52 weeks per year.

The ET is used to determine appropriate outdoor screening levels for ambient air in a park-like setting as indicated below:

$$\text{Outdoor Screening Level} = (\text{TC or RSC}) / \text{ET}$$

Similar to the approach employed to calculate indoor screening level concentrations, subsurface soil vapour concentrations may be used to assess the potential for health risks via inhalation by applying an attenuation coefficient to account for the dilution of vapours as they migrate from the sub-surface and mix with outdoor air. The attenuation coefficient (the inverse of the dilution factor (DF)) was calculated by modifying the model for indoor air presented in Appendix C of the ESRD 2014 Guidelines. The model was modified by removing the parameters for the migration through a building envelope such that:

$$\text{Attenuation coefficient for outdoor air (a)} = D_{\text{eff}} / D_{\text{eff}}^2$$

Where D_{eff} = overall effective porous media diffusion coefficient

Consistent with the approach for indoor air, an adjustment factor (AF) of 10 is also applied in the equations to account for evidence suggesting that measured concentrations in indoor samples are typically lower by at least an order of magnitude than concentrations predicted from the soil vapour intrusion models. This adjustment factor is employed for indoor models and application to outdoor models is considered not only appropriate, but conservative, as weather patterns could account for significantly greater dilution than predicted by the indoor models.

Based on the above, the soil vapour screening levels for outdoor were determined as follows:

$$\text{Soil Vapour Screening Level} = (\text{TC or RSC} \times \text{DF} / \text{ET}) \times \text{AF}$$

The following table (Table B) presents the calculated soil vapour screening levels for indoor air

Table B: Soil Vapour Screening Levels – Outdoor Air

Compound	TC (mg/m ³)	IUR (mg/m ³)	RSC (mg/m ³)	ET (open parkland)	Outdoor Screening Level (mg/m ³)	DF	AF	Soil Vapour Screening Levels (mg/m ³)
Benzene	-	0.0033	0.0030	0.11	0.03	2	100	0.6
Toluene	3.8	-	-	0.11	34.5	2	100	690
Ethylbenzene	1.0	-	-	0.11	9.1	2	100	182
Xylenes (total)	0.18	-	-	0.11	1.6	2	100	33
F1								
>C6-C10 Aliphatic	18.4	-	-	0.11	167	2	100	3345
>C8-C10 Aliphatic	1.0	-	-	0.11	9.1	2	100	182
>C8-C10 Aromatic	0.2	-	-	0.11	1.8	2	100	36
F2								
>C10-C12 Aliphatic	1.0	-	-	0.11	9.1	2	100	182
>C12-C16 Aliphatic	1.0	-	-	0.11	9.1	2	100	182
>C10-C12 Aromatic	0.2	-	-	0.11	1.8	2	100	36
>C12-C16 Aromatic	0.2	-	-	0.11	1.8	2	100	36

- = no value or not applicable

TC = tolerable concentration (Table A7 ESRD 2014)

IUR – inhalation unit risk (Table A7 ESRD 2014)

RSC = risk specific concentration

ET = exposure term (4 hours/day, 5 days/week/ 52 weeks/year)

DF = dilution factor (Appendix C ESRD 2014- calculated)

3.0 RESULTS

3.1 Soil Stratigraphy

The surficial soils at all soil vapour well locations are generally comprised of a layer of topsoil (up to 20 cm thick), followed by a layer of clay fill to an approximate depth ranging between 0.6 mbg (14VW02 and 14VW03) and 1.0 mbg (14VW01 and 14VW04). The clay fill contained localized traces of debris including wood and metal. Underlying the clay fill at 14VW02 and 14VW03 is a buried topsoil and subsoil layer from approximately 0.6 mbg to 1.0 mbg. The buried topsoil and subsoil layers were not encountered in 14VW01 and 14VW04. Following the buried topsoil and subsoil layer at 14VW02 and 14VW03 and the clay fill at 14VW01 is medium plasticity clay to the completion depth of the boreholes (1.2 mbg). At 14VW04, clay fill was encountered to the completion of the borehole (1.0 mbg).

Free water was not encountered in any of the boreholes.

3.2 Soil Chemical Quality

Concentrations of BTEX and PHC fractions F1 to F4 in the soil samples collected from the soil vapour wells were less than the laboratory detection limits at all locations sampled, excluding PHC fraction F1 at 14VW02 (20 mg/kg at 1.2 mbg). The applicable Alberta Tier 1 Guideline for PHC fraction F1 is 210 mg/kg.

Soil samples analyzed for PSA at 14VW01 from depths of 0.2 m to 0.4 m and 0.6 m to 0.8 m characterized the soil as fine-grained.

Laboratory analytical results, including methods of analyses, are attached in Appendix C. A summary of soil analytical results is provided in Table 2. Historical soil analytical results are summarized in Table 5.

3.3 Groundwater Results

3.3.1 Groundwater Levels

Groundwater levels on July 19, 2014 ranged from 1.38 mbg at 08MW07 to 1.69 mbg at 09MW11. Based on the calculated groundwater elevations, the inferred groundwater flow direction is north-westerly.

Monitoring well completion details and field monitoring results are summarized in Table 1 and Figure 3 presents the groundwater elevations.

3.3.2 Groundwater Chemical Quality

Concentrations of BTEX and PHC fractions F1 and F2 were less than the laboratory detection limits in the groundwater at all locations sampled, excluding benzene at 09MW11 (0.0022 mg/L). The applicable Alberta Tier 1 Guideline for benzene is 0.005 mg/L.

Nitrate and nitrite concentrations were greater than the Tier 1 Guidelines (3 mg/L and 0.06 mg/L, respectively) at all monitoring wells.

Total dissolved solids (TDS) concentrations were greater than the Tier 1 Guideline (500 mg/L) at all locations sampled, ranging from 6,500 mg/L at 09MW11 to 8,800 mg/L at 08MW01.

Chloride concentrations were equal to the Tier 1 Guideline (120 mg/L) at 08MW03 and 08MW07; and greater than the Tier 1 Guideline at 08MW01 (160 mg/L).

Sodium concentrations were greater than the Tier 1 Guideline (200 mg/L) at all locations sampled and ranged from 1,100 mg/L at 09MW11 to 1,700 mg/L at 08MW01.

Sulphate concentrations were greater than the Tier 1 Guideline (500 mg/L) at all locations sampled, ranging from 4,100 mg/L at 08MW03 to 5,200 mg/L at 08MW01.

Dissolved manganese concentrations were greater than the Tier 1 Guideline (0.05 mg/L) in the groundwater at all locations sampled, ranging from 0.15 mg/L at 08MW07 to 1.5 mg/L at 09MW11. Concentrations of dissolved iron were less than the laboratory detection limits at all locations tested.

Laboratory analytical results, including methods of analyses, are attached in Appendix C. A summary of groundwater analytical results is provided in Table 3. Historical groundwater analytical results are summarized in Table 6 and groundwater wells are identified on Figure 2.

3.4 Soil Vapour Results

Soil vapour samples were collected in Summa™ canisters, from the soil vapour probes that were installed on the site and submitted for laboratory analysis to assess potential impacts from PHC compounds.

Concentrations of BTEX and aliphatic and aromatic sub-fractions for the soil vapour samples were below the calculated indoor and outdoor soil vapour screening level concentrations indicating that the measured soil vapour concentrations are not sufficient to present human health risks to tenants of proximal buildings or users of the park via inhalation of indoor or outdoor air.

Laboratory analytical results, including methods of analyses, are attached in Appendix C. Table 4 presents the soil vapour analytical data in comparison to the indoor and outdoor screening level concentrations and the soil vapour screening levels.

4.0 DISCUSSION AND CONCLUSIONS

4.1 Soil

Concentrations of BTEX, and PHC fractions F1 to F4, were less than the laboratory detection limits, and/or Tier 1 Guidelines at the locations tested in 2014. Historically, concentrations of benzene, ethylbenzene, xylenes and PHC fractions F1 to F2 have been identified at concentrations greater than the Tier 1 Guidelines at 08MW06 and 09BH10 at depths ranging from 1.8 – 3.6 mbg. Tetra Tech EBA notes that the soil samples collected during this investigation were from a maximum depth of 1.2 mbg.

4.2 Groundwater

Concentrations of BTEX, and PHC fractions F1 and F2, were less than the laboratory detection limits, and/or Alberta Tier 1 Guidelines in the groundwater at the locations tested in 2014. Historically, concentrations of benzene (0.068 mg/L), ethylbenzene (0.036 mg/L), and PHC fraction F2 (1.7 mg/L) were reported greater than the Tier 1 Guideline in 2008 at 08MW06 and benzene was reported greater than the Tier 1 Guideline at 09MW11 in 2009 (0.0057 mg/L). BTEX and PHC fractions F1 and F2 have remained less than the laboratory detection limits at all other locations sampled in 2014.

Routine groundwater parameters were analyzed for the first time in 2014 for future reference to assist in determining the potential for the natural attenuation of PHCs in the groundwater at the site. Concentrations of TDS, sodium, sulphate, chloride, nitrate, nitrite, and manganese greater than the assumed Alberta Tier 1 Guidelines were measured in one or more monitoring wells in 2014. The concentrations of these parameters, excluding chloride may reflect natural groundwater composition.

Concentrations of dissolved manganese and iron greater than the Tier 1 Guidelines are often detected in groundwater under anaerobic conditions and are likely not the result of historical site activities.

4.3 Soil Vapour

The soil vapour concentrations in each of the four vapour wells did not exceed the calculated indoor and outdoor soil vapour screening level concentrations. The results indicate that there is not a risk of exposure to PHCs via inhalation of indoor air at the nearby commercial building, nor is there a risk of exposure via inhalation of outdoor air to surrounding receptors in the open-air parkland

5.0 RECORD OF SITE CONDITION

In March 2008, ESRD adopted the RSC form. A completed RSC form is required to be submitted with environmental assessment reports. A copy of the RSC form is included in Appendix D.

6.0 RECOMMENDATIONS

Bi-annual groundwater monitoring and sampling of the current monitoring well network and analytical parameters should be maintained until PHC concentrations meet the applicable Tier 1 Guidelines.

7.0 CLOSURE

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

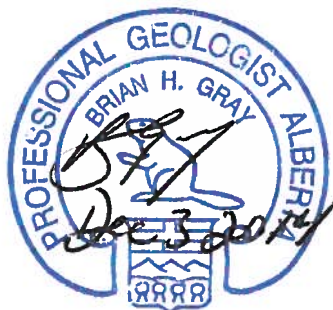
Respectfully submitted,
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PERMIT TO PRACTICE TETRA TECH EBA INC.	
Signature	
Date	<u>December 4, 2014</u>
PERMIT NUMBER: P245 The Association of Professional Engineers and Geoscientists of Alberta	

REFERENCES

- Alberta Environment and Sustainable Resource Development. 2014. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Environmental Policy Branch. Edmonton, Alberta.
- Alberta Environment and Sustainable Resource Development. 2014. Alberta Tier 2 Soil and Groundwater Remediation Guidelines. Environmental Policy Branch. Edmonton, Alberta.
- Phase II and Phase III Environmental Site Assessment. 124 Main Street. Lot 17, Block 2, Plan 2605X. AMA Site 9558. Barons, Alberta. Tetra Tech EBA File: L22101183.001, dated October 2009.
- Underground Storage Tank Removal and Monitoring. AMA Site 9558. Barons, Alberta. Tetra Tech EBA File: L22101183.004, dated December 2011.

TABLES

Table 1	Monitoring Well Completion Details and 2014 Field Monitoring Results
Table 2	Soil Analytical Results
Table 3	Groundwater Analytical Results
Table 4	Soil Vapour Analytical Results
Table 5	Historical Soil Analytical Results
Table 6	Historical Groundwater Analytical Results

Table 1: Monitoring Well Completion Details and 2014 Field Monitoring Results

Monitoring Well I.d.	Date of Installation	TOP Elevation ¹ (m)	Monitoring Well Depth (mbg) ²	Screen Interval (mbg)	Screened In	Depth to Groundwater (mBTOC) ³	Depth to Groundwater (mbg)	Groundwater Elevation (m)	Combustible Vapour Concentrations ⁴
						July 18, 2014			
08MW01	18-Nov-08	98.64	6.1	1.6 to 6.1	Clay and bedrock	1.45	1.59	97.20	ND
08MW03	18-Nov-08	98.71	6.1	1.6 to 6.1	Clay and bedrock	1.48	1.55	97.23	ND
08MW07	18-Nov-08	98.47	6.1	1.6 to 6.1	Clay and bedrock	1.35	1.38	97.12	ND
09MW11	9-Mar-09	98.82	6.1	3.1 to 6.1	Clay and bedrock	1.6	1.69	97.22	ND

Notes:

Benchmark: Top bolt of fire hydrant located on the northwest corner of Main Street and Alberta Avenue.

¹ Elevation of top of pipe casing.

² Meters below grade.

³ Meters below top of pipe casing.

⁴ Combustible vapour concentrations measured in parts per million using a MiniRae 3000 PID.

ND - Non-Detect

Table 2: Soil Analytical Results

Parameter	Unit	Tier 1 Guideline ¹		14VW01	14VW01	14VW01	14VW02	14VW03	14VW04
		Surface Soil	Subsoil	0.2-0.4 m	0.6-0.8 m	1.2 m	1.2 m	1.1 m	1.0 m
				6/6/2014	6/6/2014	6/6/2014	6/6/2014	6/6/2014	6/6/2014
Hydrocarbons									
Benzene	mg/kg	0.046	0.046	--	--	<0.005	<0.005	<0.005	<0.005
Toluene	mg/kg	0.52	0.52	--	--	<0.02	<0.02	<0.02	<0.02
Ethylbenzene	mg/kg	0.11	0.11	--	--	<0.01	<0.01	<0.01	<0.01
Xylene Total	mg/kg	15	15	--	--	<0.04	<0.04	<0.04	<0.04
Xylene (m & p)	mg/kg	NG	NG	--	--	<0.04	<0.04	<0.04	<0.04
Xylene (o)	mg/kg	NG	NG	--	--	<0.02	<0.02	<0.02	<0.02
F1 (C6-C10 Hydrocarbons)	mg/kg	210	420	--	--	<12	20	<12	<12
F1 (C6-C10) - BTEX	mg/kg	210	420	--	--	<12	20	<12	<12
F2 (C10-C16 Hydrocarbons)	mg/kg	150	300	--	--	<10	<10	<10	<10
F3 (C16-C34 Hydrocarbons)	mg/kg	1,300	2,600	--	--	<50	<50	<50	<50
F4 (C34-C50 Hydrocarbons)	mg/kg	5,600	10,000	--	--	<50	<50	<50	<50
F4G (C50+)	mg/kg	NG	NG	--	--	--	--	--	--
Physical Properties									
Dry Bulk Density	g/cm3	NG	NG	1.5	1.7	--	--	--	--
Moisture	%	NG	NG	17	16	19	19	17	17
Organics									
Total Organic Carbon (TOC)	%	NG	NG	1.7	1.4	--	--	--	--
Fraction of Organic Carbon	g/g	NG	NG	0.017	0.014	--	--	--	--
Particle Size									
Sieve-Pan	%	NG	NG	62	77	--	--	--	--
Sieve-Pan - # 200 (>0.075 mm)	N/A	NG	NG	38	23	--	--	--	--
Grain Size	N/A	NG	NG	Fine	Fine	--	--	--	--

Notes:

¹ Alberta Environment and Sustainable Resource Development (ESRD). 2014. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land and Forestry Policy Branch, Policy Division. 195 pp. References guidelines are for fine-grained surface and subsoil under residential/parkland land use.

NG - No guideline.

-- = Not analyzed.

< = less than laboratory reportable detection limit.

BOLD AND SHADED

- Exceeds Guideline.

Table 3: Groundwater Analytical Results

Parameter	Unit	Tier 1 Guideline ¹	08MW01 7/18/2014	08MW03 7/18/2014	08MW07 7/18/2014	09MW11 7/18/2014
Hydrocarbons						
Benzene	mg/L	0.005	<0.0004	<0.0004	<0.0004	0.0022
Toluene	mg/L	0.024	<0.0004	<0.0004	<0.0004	<0.0004
Ethylbenzene	mg/L	0.0024	<0.0004	<0.0004	<0.0004	<0.0004
Xylene Total	mg/L	0.3	<0.0008	<0.0008	<0.0008	<0.0008
Xylene (m & p)	mg/L	NG	<0.0008	<0.0008	<0.0008	<0.0008
Xylene (o)	mg/L	NG	<0.0004	<0.0004	<0.0004	<0.0004
F1 (C6-C10 Hydrocarbons)	mg/L	2.2	<0.1	<0.1	<0.1	<0.1
F1 (C6-C10) - BTEX	mg/L	2.2	<0.1	<0.1	<0.1	<0.1
F2 (C10-C16 Hydrocarbons)	mg/L	1.1	<0.1	<0.1	<0.1	<0.1
Nutrients						
Nitrate (as NO ₃ -) (Filtered)	mg/L	NG	330	170	180	93
Nitrite (as NO ₂ -) (Filtered)	mg/L	NG	2.4	4.4	0.21	4.9
Nitrogen (Total Oxidised)	mg/L	NG	75	39	41	23
Nitrate (as N) (Filtered)	mg/L	3	74	38	41	21
Nitrite (as N) (Filtered)	mg/L	0.06	0.72	1.3	0.063	1.5
Routine						
Alkalinity (Carbonate as CaCO ₃)	mg/L	NG	<0.5	<0.5	<0.5	<0.5
pH (Lab)	pH Units	6.5-8.5	7.52	7.62	7.63	7.41
Hardness as CaCO ₃	mg/L	NG	3000	2900	2300	2600
Electrical Conductivity (EC)	uS/cm	NG	9900	8300	9100	7800
Total Dissolved Solids (TDS)	mg/L	500	8800	6900	7600	6500
Chloride (Cl) (Filtered)	mg/L	120	160	120	120	110
Alkalinity (total as CaCO ₃)	mg/L	NG	670	740	600	680
Bicarbonate	mg/L	NG	820	900	730	830
Calcium (Filtered)	mg/L	NG	450	440	360	380
Carbonate	mg/L	NG	<0.5	<0.5	<0.5	<0.5
Hydroxide	mg/L	NG	<0.5	<0.5	<0.5	<0.5
Magnesium (Filtered)	mg/L	NG	460	440	330	390
Alkalinity (pp as CaCO ₃)	mg/L	NG	<0.5	<0.5	<0.5	<0.5
Potassium (Filtered)	mg/L	NG	9.7	9.6	9.1	8.2
Sodium (Filtered)	mg/L	200	1700	1200	1600	1100
Sulphate (SO ₄) (Filtered)	mg/L	500	5200	4100	4600	4000
Metals						
Iron (Filtered)	mg/L	0.3	<0.06	<0.06	<0.06	<0.06
Manganese (Filtered)	mg/L	0.05	0.54	0.37	0.15	1.5
Inorganics						
Anion Sum	meq/L	NG	130	110	110	100
Cation Sum	meq/L	NG	140	110	120	100
Ionic Balance	N/A	NG	1	1	1	1

Notes:

¹ Alberta Environment and Sustainable Resource Development (ESRD). 2014. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land and Forestry Policy Branch, Policy Division. 195 pp. References guidelines are for fine-grained soils under residential/parkland land use.

NG - No guideline.

< = less than laboratory reportable detection limit.

BOLD AND SHADED

- Exceeds Guideline.

Table 4: Soil Vapour Analytical Results

Parameters	Sample Location	14VW01	14VW02	14VW03	14VW04	Indoor Screening Level Concentration ¹ (ug/m ³)	Outdoor Screening Level Concentration ² (ug/m ³)	Indoor Soil Vapour Screening Level Concentration ³ (ug/m ³)	Outdoor Soil Vapour Screening Level Concentration ⁴ (ug/m ³)
	Lab ID	WT9268	WT9269	WT9270	WT9271				
	Date	7/18/2014	7/18/2014	7/18/2014	7/18/2014				
	Sample Duration (min)	60	60	60	60				
	Sample Flow Rate (mL/min)	23	23	23	23				
	Sample Volume (litres)	1.4	1.4	1.4	1.4				
Volatile Organics									
Benzene		<1.2	289	262	158	3.3	300	303	600
Toluene		<1.6	2.0	2.3	<1.6	3,800	34,500	190,000	690,900
Ethylbenzene		<1.6	<1.6	<1.6	<1.6	1,000	9,100	50,000	181,800
Xylenes (total)		<2.2	<2.2	<2.2	<2.2	180	1,600	9,000	32,700
F1 Petroleum Hydrocarbons									
>C6-C8 Aliphatic		<5.0	15.3	5.9	6.2	18,400	167,300	920,000	3,345,500
>C8-C10 Aliphatic		<5.0	<5.0	10.2	<5.0	1,000	9,100	50,000	181,800
>C8-C10 Aromatic		<5.0	396	561	398	200	1,800	10,000	36,400
F2 Petroleum Hydrocarbons									
>C10-C12 Aliphatic		<5.0	40.2	40.4	31.1	1,000	9,100	50,000	181,800
>C12-C16 Aliphatic		<5.0	15.6	59.1	25.9	1,000	9,100	50,000	181,800
>C10-C12 Aromatic		<5.0	277	261	261	200	1,800	10,000	32,400
>C12-C16 Aromatic		<5.0	<5.0	6.3	7.4	200	1,800	10,000	32,400

Notes:¹ = Alberta Tier 2 Soil and Groundwater Remediation Guidelines - default parameters from Tables A1 and A7² = Alberta Tier 2 Soil and Groundwater Remediation Guidelines - default parameters from Table A7 and calculated exposure term (ET)³ = Alberta Tier 2 Soil and Groundwater Remediation Guidelines - default parameters from Tables A1, A7 and A9⁴ = Alberta Tier 2 Soil and Groundwater Remediation Guidelines - default parameters from Tables A2, A6 and A7 with calculated dilution factor (DF) and estimated adjustment factor (AF)

mL/min = millilitres per minute.

< = less than laboratory reportable detection limit.

NG = no guideline.

All results in ug/m³.

Table 5: Historical Soil Analytical Results

Parameters	Detection Limits	Units	Tier 1 Guidelines ¹		17-Nov-08																
					08MW01			08BH02		08MW03			08MW06			08MW07					
			Surface Soil	Subsoil	1.5 m	4.2 m	5.4 m	1.8 m	3.6 m	1.8 m	3.6 m	4.8 m	0.6 m	1.8 m	3.6 m	4.5 m	0.6 m	2.4 m	4.2 m	4.8 m	
Petroleum Hydrocarbons																					
Benzene	0.02	mg/kg	0.046	0.046	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.076	0.011	<0.02	<0.02	--	<0.02	<0.02
Toluene	0.01	mg/kg	0.52	0.52	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.15	<0.01	<0.01	<0.01	--	<0.01	<0.01
Ethylbenzene	0.04	mg/kg	0.11	0.11	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	12	0.12	<0.04	<0.04	--	<0.04	<0.04
Xylenes	0.04	mg/kg	15	15	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	29	<0.04	<0.04	<0.04	--	<0.04	<0.04
F1 (C ₆ to C ₁₀)	12	mg/kg	210	420	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	570	<12	<12	<12	--	<12	<12
F2 (C ₁₀ to C ₁₆)	10	mg/kg	150	300	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	370	<10	<10	<10	--	<10	<10
F3 (C ₁₆ to C ₃₄)	10	mg/kg	1,300	2,600	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	--	<10	<10
F4 (C ₃₄ to C ₅₀)	10	mg/kg	5,600	10,000	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	--	<10	<10
Metals																					
Lead (Pb)	1	mg/kg	140	NG	7	8	17	11	9	11	8	14	62	32	9	8	7	--	12	11	
Physical Properties																					
Soil Moisture Content	0.3	%	NG	NG	16	15	12	24	14	24	11	13	12	19	17	7.1	12	23	14	9.5	
<75 um Sieve	0.2	%	NG	NG	92	--	--	--	--	--	--	--	87	--	--	--	--	90	--	--	
>75 um Sieve	0.2	%	NG	NG	8	--	--	--	--	--	--	--	13	--	--	--	--	10	--	--	
Grain Size	0.2		NG	NG	FINE	--	--	--	--	--	--	--	FINE	--	--	--	--	FINE	--	--	

Parameters	Detection Limits	Units	Tier 1 Guidelines ¹		12-Mar-09											
					09MW09			09BH10			09MW11		09MW13		09BH14	
			Surface Soil	Subsoil	4.2 m	4.8 m	6.0 m	1.8 m	3.0 m	4.8 m	3.6 m	4.8 m	6.0 m	4.8 m	3.0 m	4.8 m
Petroleum Hydrocarbons																
Benzene	0.02	mg/kg	0.046	0.046	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Toluene	0.01	mg/kg	0.52	0.52	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ethylbenzene	0.04	mg/kg	0.11	0.11	<0.04	<0.04	<0.04	0.002	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Xylenes	0.04	mg/kg	15	15	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
F1 (C ₆ to C ₁₀)	12	mg/kg	210	420	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12
F2 (C ₁₀ to C ₁₆)	10	mg/kg	150	300	<10	<10	<10	420	<10	<10	<10	<10	<10	<10	<10	<10
F3 (C ₁₆ to C ₃₄)	10	mg/kg	1,300	2,600	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
F4 (C ₃₄ to C ₅₀)	10	mg/kg	5,600	10,000	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Metals																
Lead (Pb)	1	mg/kg	140	NG	8	9	7	14	14	16	10	16	15	8	10	15
Physical Properties																
Soil Moisture Content	0.3	%	NG	NG	13	11	13	19	26	21	20	15	13	14	15	12
<75 µm Sieve	0.2	%	NG	NG	63	75	--	81	--	--	--	--	91	--	67	--
>75 µm Sieve	0.2	%	NG	NG	37	25	--	19	--	--	--	--	9	--	33	--
Grain Size	0.2		NG	NG	FINE	FINE	--	FINE	--	--	--	--	FINE	--	FINE	--

Notes:

¹ Alberta Environment and Sustainable Resource Development (ESRD). 2014. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land and Forestry Policy Branch, Policy Division. 195 pp. References guidelines are for fine-grained surface and subsoil
 NG - No guideline.

`--` = Not analyzed.

< = less than laboratory reportable detection limit.

BOLD AND SHADED - Exceeds Guideline.

Table 6: Historical Groundwater Analytical Results

Parameter	Detection Limits	Units	Tier 1 Guidelines ¹	28-Nov-08					26-Mar-09		
				08MW01	08MW03	08MW06	08MW07	08MW08	09MW09	09MW11	09MW13
Petroleum Hydrocarbons											
Benzene	0.0009	mg/L	0.005	<0.0009	<0.0009	0.068	<0.0009	<0.0009	0.0017	0.0057	<0.0009
Toluene	0.0009	mg/L	0.024	<0.0009	<0.0009	nd	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009
Ethylbenzene	0.0009	mg/L	0.0024	<0.0009	<0.0009	0.036	<0.0009	<0.0009	<0.0009	<0.0009	<0.0009
Xylenes	0.002	mg/L	0.3	<0.002	<0.002	0.072	<0.002	<0.002	<0.002	<0.002	<0.002
F1 (C ₆ to C ₁₀)	0.2	mg/L	2.2	<0.2	<0.2	1.6	<0.2	<0.2	<0.2	0.1	<0.2
F2 (C ₁₀ to C ₁₆)	0.1	mg/L	1.1	<0.1	<0.1	1.7	<0.1	<0.1	0.1	<0.1	<0.1
Metals											
Lead (Pb)	0.001	mg/L	0.01	<0.001	<0.001	0.0031	0.0003	<0.001	<0.001	<0.001	<0.001

Notes:

¹ Alberta Environment and Sustainable Resource Development (ESRD). 2014. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land and Forestry Policy Branch, Policy Division. 195 pp. References guidelines are for fine-grained surface and subsoil under residential/parkland land use.

< = less than laboratory reportable detection limit.

`-- = Not analyzed.

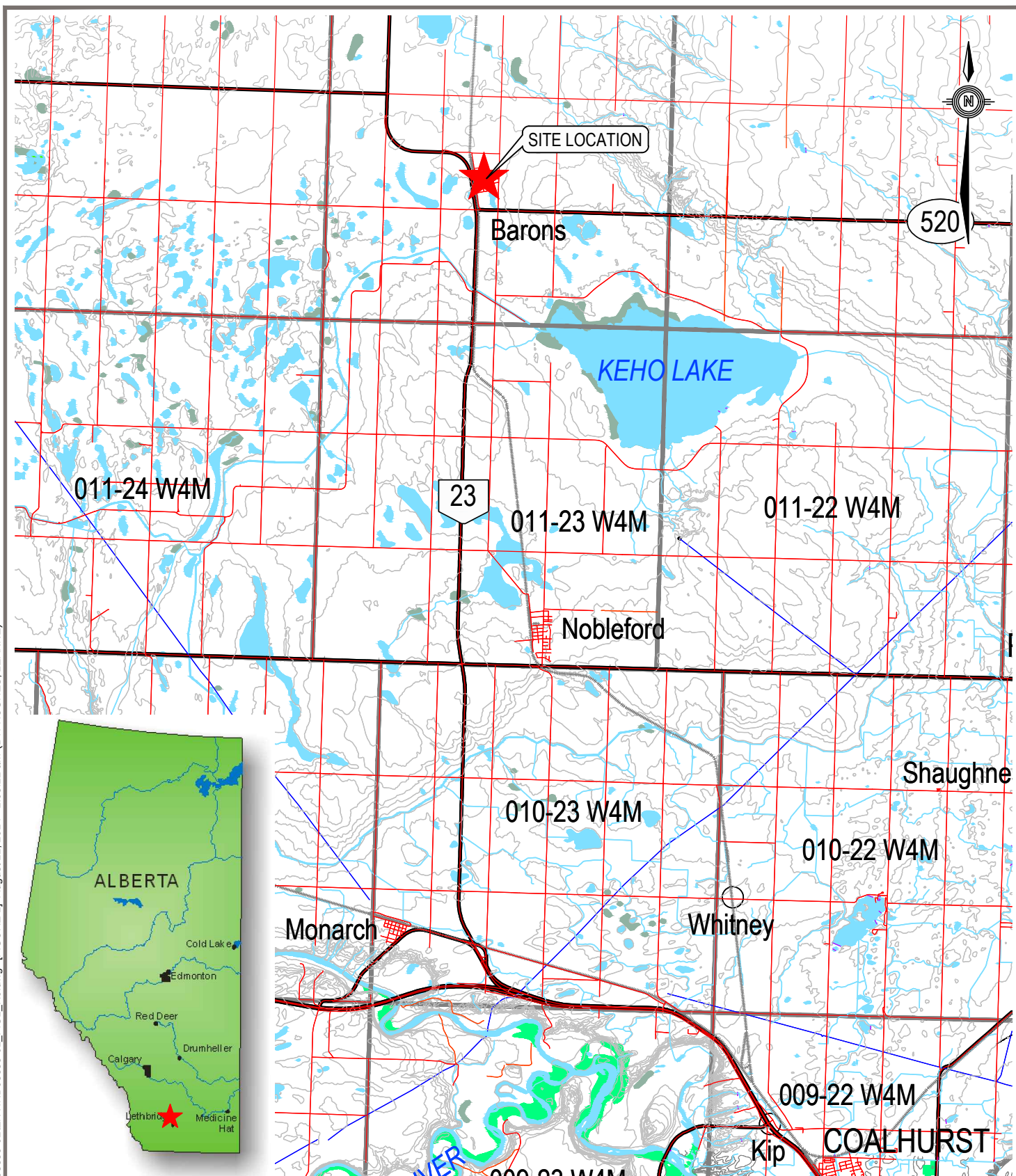
BOLD AND SHADED

- Exceeds Guideline.

FIGURES

Figure 1	Site Location Plan
Figure 2	Site Plan Showing Borehole, Monitoring Well and Soil Vapour Well Locations
Figure 3	Site Plan Showing Groundwater Elevations

C:\Users\leanne.hughes\Documents\ENVIND03335-02\ENVIND03335-02_FIG1_R0.dwg [FIGURE 1] August 12, 2014 - 1:05:22 am (BY: HUGHES, LEANNE)



NOTES
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CLIENT

Village of Barons



TETRA TECH EBA

Groundwater and Soil Vapour Monitoring Program
124 Main Street, Barons, Alberta
AMA Site 9558

SITE LOCATION PLAN

PROJECT NO.
ENVIND03335-02

DWN
LCH

CKD
JL

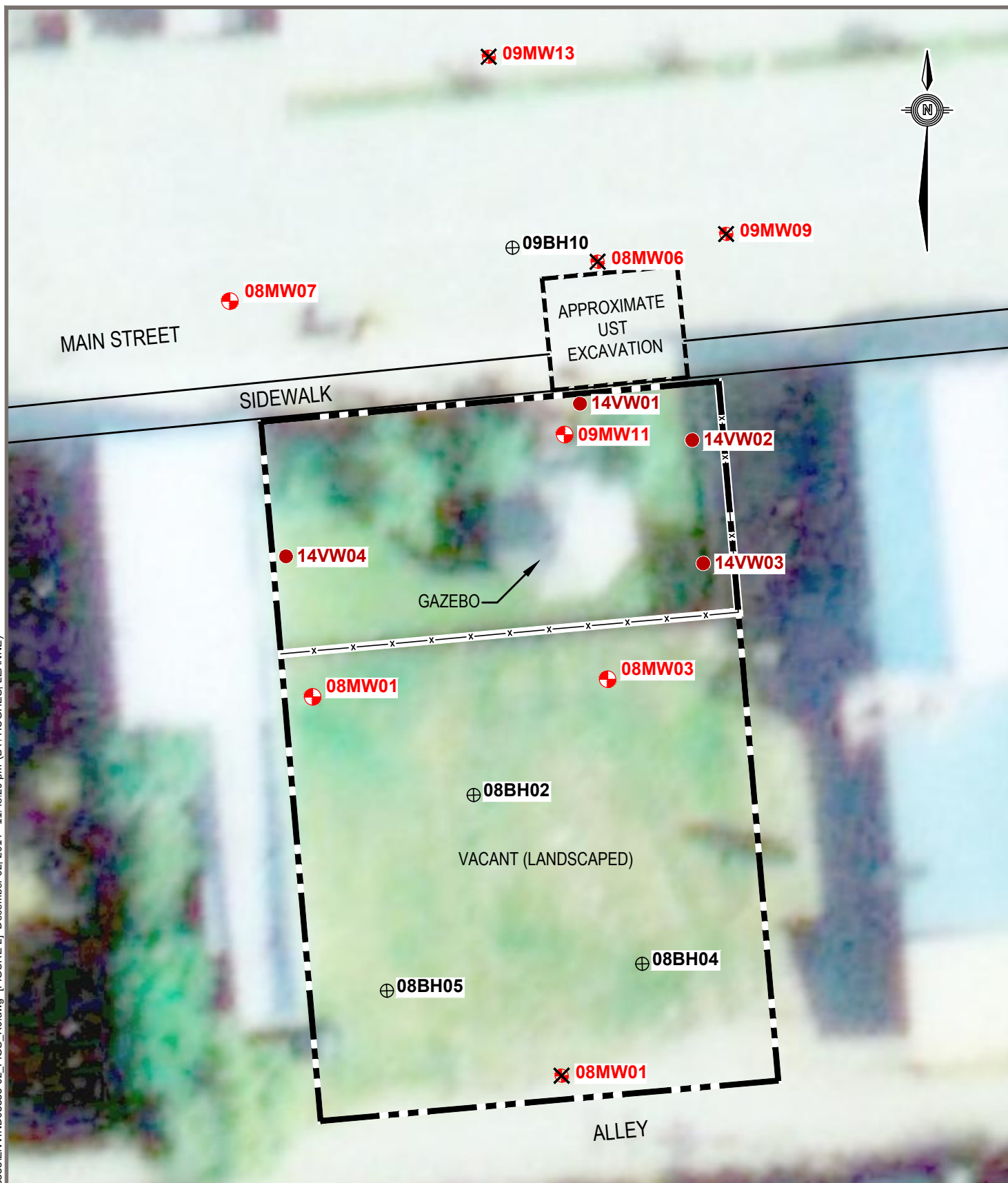
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EBA-Riverbend

DATE
August 2014

Figure 1

Q:\Riverbend\Drafting\ENV\IND\ENVIND03335\ENVIND03335-02_FIGS_R0.dwg [FIGURE 2] December 02, 2014 - 11:48:29 pm (BY: HUGHES, LEANNE)



LEGEND

- SITE BOUNDARY
- x — FENCE
- ⊕ BOREHOLE
- MONITORING WELL
- ✕ MONITORING WELL NOT LOCATED OR DESTROYED
- SOIL VAPOUR WELL

0 10 m

Scale: 1:250 @ 8.5"x11"

CLIENT

Village of Barons

TETRA TECH EBA

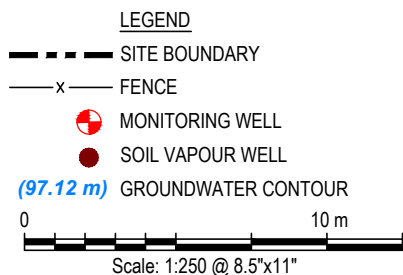
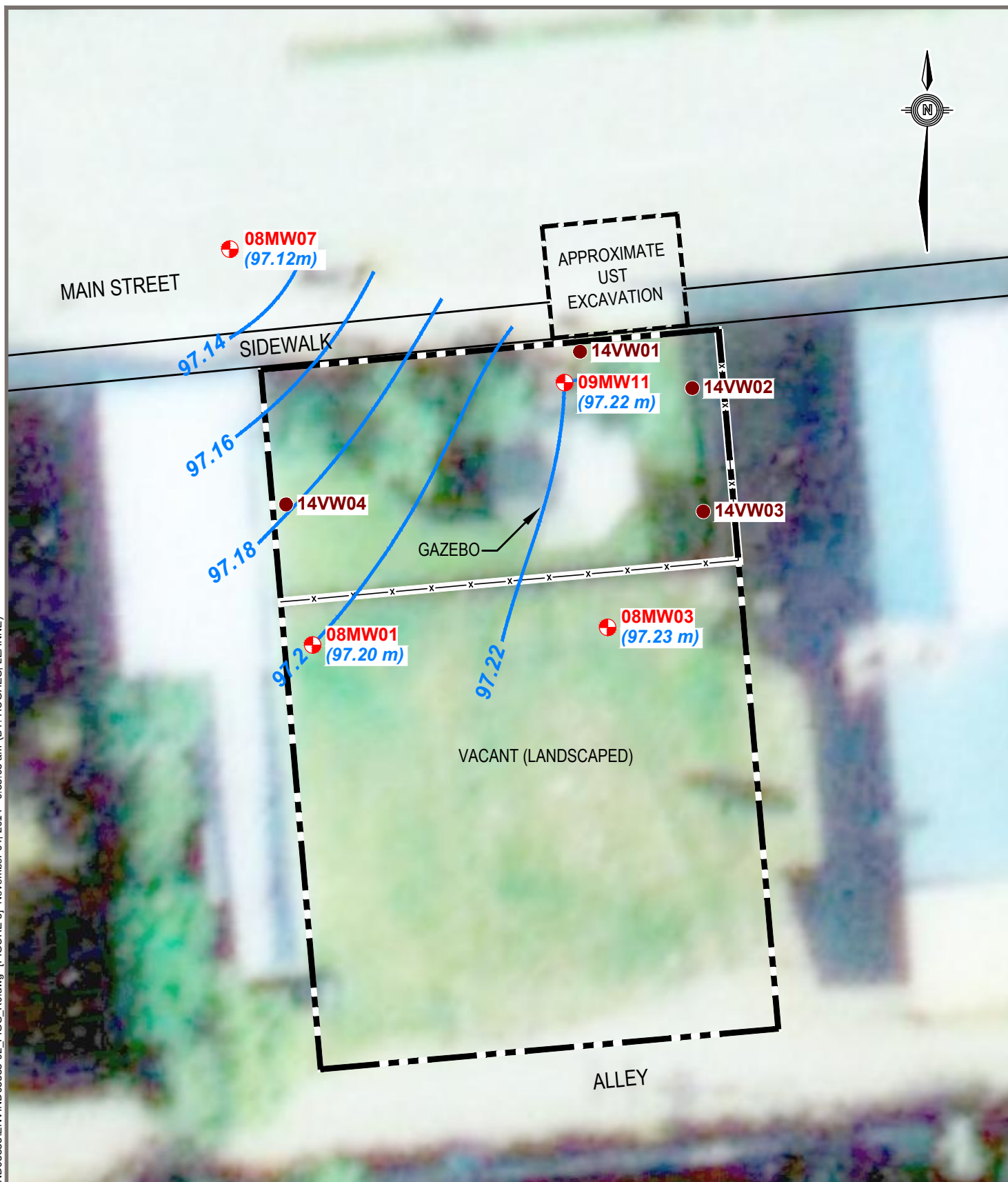
Groundwater and Soil Vapour Monitoring Program
124 Main Street, Barons, Alberta
AMA Site 9558

**SITE PLAN SHOWING BOREHOLE,
MONITORING WELL AND
SOIL VAPOUR WELL LOCATIONS**

PROJECT NO. ENVIND03335-02	DWN LCH	CKD JL	REV 0
OFFICE EBA-Lethbridge	DATE December 2, 2013		

Figure 2

C:\Users\leanne.hughes\Documents\ENVIND03335\ENVIND03335-02_FIGS_R0.dwg [FIGURE 3] November 04, 2014 - 9:35:03 am (BY: HUGHES, LEANNE)



CLIENT

Village of Barons



TETRA TECH EBA

Groundwater and Soil Vapour Monitoring Program
124 Main Street, Barons, Alberta
AMA Site 9558

**SITE PLAN SHOWING
GROUNDWATER ELEVATIONS**

PROJECT NO.
ENVIND03335-02

DWN
LCH

CKD
JL

REV
0

OFFICE
EBA-Lethbridge

DATE
November 2014

Figure 3

APPENDIX A

TETRA TECH EBA'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEOENVIRONMENTAL REPORT

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

1.0 USE OF REPORT AND OWNERSHIP

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

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

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

2.0 ALTERNATE REPORT FORMAT

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

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

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

3.0 NOTIFICATION OF AUTHORITIES

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

4.0 INFORMATION PROVIDED TO TETRA TECH EBA BY OTHERS

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

APPENDIX B

BOREHOLE LOGS

ENVIRONMENTAL BARONS - ENVIND03335-02 - 124 MAIN ST.GPJ EBA.GDT 11/4/14

Project: Soil Vapour Assessment (AMA Site 9558)		Client: Village of Barons		PROJECT NO. - BOREHOLE NO.			
Address: 124 Main Street		Drill Type: 150 mm Solid Stem Auger		ENVIND03335-02 - 14VW02			
City: Barons, Alberta		Project Scientist: Brian Gray					
SAMPLE TYPE ☒ DISTURBED ☐ NO RECOVERY ☐ SPT ☐ A-CASING ☐ SHELBY TUBE ☐ CORE							
BACKFILL TYPE ☒ BENTONITE ☐ PEA GRAVEL ☐ SLOUGH ☐ GROUT ☐ DRILL CUTTINGS ☐ SAND							
Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	☒ HYDROCARBONS (ppm) ☒ 200 400 600 800	NOTES & COMMENTS	14VW02	Depth (ft)
0	TOPSOIL - clay, silty, trace sand, soft, moist, very dark brown to black, roots and organics.						0
	CLAY (Fill) - silty, some sand, trace gravels, stiff to hard, medium plastic, damp to moist, very dark brown, trace roots.						
		B1					
	BURIED TOPSOIL - clay, silty, trace sand, stiff, damp, very dark brown to black, trace roots and organics.						
		B2					
	BURIED SUBSOIL - clay, silty, trace sand, stiff, damp, dark brown, trace roots and organics.						
1	CLAY - silty, some sand, firm, medium plastic, moist, light greyish brown, trace white precipitates.						
		B3					
	End of Borehole at 1.2 m 0 m to 0.9 m - 1 inch solid PVC 0.9 m to 1.2 m - 2 inch screened PVC						
2							7



TETRA TECH EBA

LOGGED BY: JL

REVIEWED BY: JG

DRAWING NO: D2

COMPLETION DEPTH: 1.2 m

COMPLETE: 6/6/2014

Page 1 of 1

Project: Soil Vapour Assessment (AMA Site 9558)		Client: Village of Barons		PROJECT NO. - BOREHOLE NO.						
Address: 124 Main Street		Drill Type: 150 mm Solid Stem Auger		ENVIND03335-02 - 14VW03						
City: Barons, Alberta		Project Scientist: Brian Gray								
SAMPLE TYPE ☒ DISTURBED ☐ NO RECOVERY ☐ SPT ☐ A-CASING ☐ SHELBY TUBE ☐ CORE										
BACKFILL TYPE ☒ BENTONITE ☐ PEA GRAVEL ☐ SLOUGH ☐ GROUT ☐ DRILL CUTTINGS ☐ SAND										
Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	HYDROCARBONS (ppm)				NOTES & COMMENTS	14VW03	Depth (ft)
				200	400	600	800			
0	TOPSOIL - clay, silty, trace sand, soft, moist, very dark brown to black, roots and organics.									0
	CLAY (Fill) - silty, some sand, trace gravels, stiff to hard, medium plastic, damp to moist, very dark brown, trace roots.		B1							
	BURIED TOPSOIL - clay, silty, trace sand, stiff, damp, very dark brown to black, trace roots and organics.		B2							
	BURIED SUBSOIL - clay, silty, trace sand, stiff, damp, dark brown, trace roots and organics.									
1	CLAY - silty, some sand, firm, medium plastic, moist, light greyish brown, trace white precipitates.		B3							
	End of Borehole at 1.2 m 0 m to 0.9 m - 1 inch solid PVC 0.9 m to 1.2 m - 2 inch screened PVC									
2										7

LOGGED BY: JL

REVIEWED BY: JG

DRAWING NO: D3

COMPLETION DEPTH: 1.2 m

COMPLETE: 6/6/2014

Page 1 of 1

Project: Soil Vapour Assessment (AMA Site 9558)		Client: Village of Barons		PROJECT NO. - BOREHOLE NO.	
Address: 124 Main Street		Drill Type: 150 mm Solid Stem Auger		ENVIND03335-02 - 14VW04	
City: Barons, Alberta		Project Scientist: Brian Gray			
SAMPLE TYPE ☒ DISTURBED ☐ NO RECOVERY ☐ SPT		☐ A-CASING ☐ SHELBY TUBE ☐ CORE			
BACKFILL TYPE ☒ BENTONITE ☐ PEA GRAVEL ☐ SLOUGH		☐ GROUT ☐ DRILL CUTTINGS ☐ SAND			

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	HYDROCARBONS (ppm)				NOTES & COMMENTS	14VW04	Depth (ft)
				200	400	600	800			
0	TOPSOIL - clay, silty, trace sand, soft, moist, very dark brown to black, roots and organics.									0
	CLAY (Fill) - silty, some sand, trace gravels, stiff to hard, medium plastic, damp to moist, very dark brown, trace debris (wire, metal, wood).		B1							
			B2							
			B3							
1	End of Borehole at 1.0 m 0 m to 0.7 m - 1 inch solid PVC 0.7 m to 1.0 m - 2 inch screened PVC									
2										7

 TETRA TECH EBA	LOGGED BY: JL	COMPLETION DEPTH: 1 m
	REVIEWED BY: JG	COMPLETE: 6/6/2014
	DRAWING NO: D4	Page 1 of 1

APPENDIX C

LABORATORY CERTIFICATES

Your P.O. #: ENVIND03335-02
Your Project #: AMA 9558
Site Location: 124 MAIN ST BARONS
Your C.O.C. #: A091415

Attention: JAYMES GOING

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

Report Date: 2014/07/28

Report #: R1611015

Version: 1

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B461485
Received: 2014/07/19, 10:40

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	4	N/A	2014/07/21	AB SOP-00005	SM 2320-B
BTEX/F1 in Water by HS GC/MS	4	N/A	2014/07/24	AB SOP-00039	CCME, EPA 8260C
Chloride by Automated Colourimetry	4	N/A	2014/07/24	AB SOP-00020	SM 4500 Cl-G
Conductivity @25C	4	N/A	2014/07/21	AB SOP-00005	SM 2510-B
CCME Hydrocarbons in Water (F2; C10-C16)	4	2014/07/24	2014/07/26	AB SOP-00040 AB SOP-00037	EPA3510C/CCME PHCCWS
Hardness	4	N/A	2014/07/25	AB WI-00065	SM 2340B
Elements by ICP - Dissolved	4	N/A	2014/07/23	AB SOP-00042	EPA 200.7
Ion Balance	4	N/A	2014/07/22	AB WI-00065	SM 1030E
Sum of cations, anions	4	N/A	2014/07/25	AB WI-00065	SM 1030E
Nitrate and Nitrite	4	N/A	2014/07/23	AB SOP-00023	SM4110B
Nitrate + Nitrite-N (calculated)	4	N/A	2014/07/23	AB SOP-00023	SM 4110-B
Nitrogen, (Nitrite, Nitrate) by IC	4	N/A	2014/07/23	AB SOP-00023	SM 4110-B
pH @25°C (Alkalinity titrator)	4	N/A	2014/07/21	AB SOP-00005	SM 4500-H+B
Sulphate by Automated Colourimetry	4	N/A	2014/07/24	AB SOP-00018	SM 4500 SO ₄ -E
Total Dissolved Solids (Calculated)	4	N/A	2014/07/25	AB WI-00065	SM 1030E

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

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) 291-3077

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 #: B461485
Report Date: 2014/07/28

TETRA TECH EBA INC.
Client Project #: AMA 9558
Site Location: 124 MAIN ST BARONS
Your P.O. #: ENVIND03335-02
Sampler Initials: JL

AT1 BTEX AND F1-F2 (WATER)

Maxxam ID		KD2518	KD2519	KD2520	KD2521		
Sampling Date		2014/07/18 09:00	2014/07/18 09:30	2014/07/18 10:00	2014/07/18 10:30		
COC Number		A091415	A091415	A091415	A091415		
	Units	09MW11	08MW07	08MW01	08MW03	RDL	QC Batch
Hydrocarbons							
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	7571744
Volatiles							
Benzene	mg/L	0.0022	<0.00040	<0.00040	<0.00040	0.00040	7575058
Toluene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	7575058
Ethylbenzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	7575058
m & p-Xylene	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	7575058
o-Xylene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	7575058
Xylenes (Total)	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	7575058
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	7575058
(C6-C10)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	7575058
Surrogate Recovery (%)							
1,4-Difluorobenzene (sur.)	%	118	121	122	118	N/A	7575058
4-Bromofluorobenzene (sur.)	%	106	107	107	107	N/A	7575058
D4-1,2-Dichloroethane (sur.)	%	111	111	115	115	N/A	7575058
O-TERPHENYL (sur.)	%	103	113	115	127	N/A	7571744
RDL = Reportable Detection Limit N/A = Not Applicable							

Maxxam Job #: B461485
Report Date: 2014/07/28

TETRA TECH EBA INC.
Client Project #: AMA 9558
Site Location: 124 MAIN ST BARONS
Your P.O. #: ENVIND03335-02
Sampler Initials: JL

ROUTINE WATER (WATER)

Maxxam ID		KD2518		KD2519		KD2520		KD2521		
Sampling Date		2014/07/18 09:00		2014/07/18 09:30		2014/07/18 10:00		2014/07/18 10:30		
COC Number		A091415		A091415		A091415		A091415		
	Units	09MW11	RDL	08MW07	RDL	08MW01	RDL	08MW03	RDL	QC Batch
Calculated Parameters										
Anion Sum	meq/L	100	N/A	110	N/A	130	N/A	110	N/A	7570896
Cation Sum	meq/L	100	N/A	120	N/A	140	N/A	110	N/A	7570896
Hardness (CaCO ₃)	mg/L	2600	0.50	2300	0.50	3000	0.50	2900	0.50	7570902
Ion Balance	N/A	1.0	0.010	1.0	0.010	1.0	0.010	1.0	0.010	7570895
Dissolved Nitrate (NO ₃)	mg/L	93	0.22	180	0.44	330	0.89	170	0.44	7570903
Nitrate plus Nitrite (N)	mg/L	23	0.050	41	0.10	75	0.20	39	0.10	7570904
Dissolved Nitrite (NO ₂)	mg/L	4.9	0.033	0.21	0.033	2.4	0.033	4.4	0.033	7570903
Total Dissolved Solids	mg/L	6500	10	7600	10	8800	10	6900	10	7570897
Misc. Inorganics										
Conductivity	uS/cm	7800	1.0	9100	1.0	9900	1.0	8300	1.0	7571717
pH	pH	7.41	N/A	7.63	N/A	7.52	N/A	7.62	N/A	7571719
Anions										
Alkalinity (PP as CaCO ₃)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	<0.50	0.50	7571714
Alkalinity (Total as CaCO ₃)	mg/L	680	0.50	600	0.50	670	0.50	740	0.50	7571714
Bicarbonate (HCO ₃)	mg/L	830	0.50	730	0.50	820	0.50	900	0.50	7571714
Carbonate (CO ₃)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	<0.50	0.50	7571714
Hydroxide (OH)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	<0.50	0.50	7571714
Dissolved Sulphate (SO ₄)	mg/L	4000 (1)	50	4600 (1)	50	5200 (1)	50	4100 (1)	50	7577035
Dissolved Chloride (Cl)	mg/L	110	1.0	120	1.0	160	1.0	120	1.0	7577001
Nutrients										
Dissolved Nitrite (N)	mg/L	1.5	0.010	0.063	0.010	0.72	0.010	1.3	0.010	7572453
Dissolved Nitrate (N)	mg/L	21 (1)	0.050	41 (1)	0.10	74 (1)	0.20	38 (1)	0.10	7572453
Elements										
Dissolved Calcium (Ca)	mg/L	380	0.30	360	0.30	450	0.30	440	0.30	7574895
Dissolved Iron (Fe)	mg/L	<0.060	0.060	<0.060	0.060	<0.060	0.060	<0.060	0.060	7574895
Dissolved Magnesium (Mg)	mg/L	390	0.20	330	0.20	460	0.20	440	0.20	7574895
Dissolved Manganese (Mn)	mg/L	1.5	0.0040	0.15	0.0040	0.54	0.0040	0.37	0.0040	7574895
Dissolved Potassium (K)	mg/L	8.2	0.30	9.1	0.30	9.7	0.30	9.6	0.30	7574895
Dissolved Sodium (Na)	mg/L	1100 (1)	2.5	1600 (1)	2.5	1700 (1)	2.5	1200 (1)	2.5	7574895
RDL = Reportable Detection Limit										
N/A = Not Applicable										
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.										

Maxxam Job #: B461485
Report Date: 2014/07/28

TETRA TECH EBA INC.
Client Project #: AMA 9558
Site Location: 124 MAIN ST BARONS
Your P.O. #: ENVIND03335-02
Sampler Initials: JL

GENERAL COMMENTS

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

Package 1	14.7°C
Package 2	14.7°C

Results relate only to the items tested.

Maxxam Job #: B461485
Report Date: 2014/07/28

TETRA TECH EBA INC.
Client Project #: AMA 9558
Site Location: 124 MAIN ST BARONS
Your P.O. #: ENVIND03335-02
Sampler Initials: JL

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
7571714	JLD	Spiked Blank	Alkalinity (Total as CaCO ₃)	2014/07/21		93	%	80 - 120
7571714	JLD	Method Blank	Alkalinity (PP as CaCO ₃)	2014/07/21	<0.50		mg/L	
			Alkalinity (Total as CaCO ₃)	2014/07/21	<0.50		mg/L	
			Bicarbonate (HCO ₃)	2014/07/21	<0.50		mg/L	
			Carbonate (CO ₃)	2014/07/21	<0.50		mg/L	
			Hydroxide (OH)	2014/07/21	<0.50		mg/L	
7571717	JLD	Spiked Blank	Conductivity	2014/07/21		100	%	90 - 110
7571717	JLD	Method Blank	Conductivity	2014/07/21	<1.0		uS/cm	
7571719	JLD	Spiked Blank	pH	2014/07/21		100	%	97 - 102
7571744	DR4	Matrix Spike	O-TERPHENYL (sur.)	2014/07/25		112	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2014/07/25		106	%	50 - 130
7571744	DR4	Spiked Blank	O-TERPHENYL (sur.)	2014/07/25		117	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2014/07/25		106	%	70 - 130
7571744	DR4	Method Blank	O-TERPHENYL (sur.)	2014/07/25		118	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2014/07/25	<0.10		mg/L	
7572453	RP0	Matrix Spike	Dissolved Nitrite (N)	2014/07/23		98	%	80 - 120
			Dissolved Nitrate (N)	2014/07/23		102	%	80 - 120
7572453	RP0	Spiked Blank	Dissolved Nitrite (N)	2014/07/23		100	%	80 - 120
			Dissolved Nitrate (N)	2014/07/23		101	%	80 - 120
7572453	RP0	Method Blank	Dissolved Nitrite (N)	2014/07/23	<0.010		mg/L	
			Dissolved Nitrate (N)	2014/07/23	0.014 , RDL=0.010		mg/L	
7574895	SRT	Matrix Spike	Dissolved Calcium (Ca)	2014/07/23		NC	%	80 - 120
			Dissolved Iron (Fe)	2014/07/23		93	%	80 - 120
			Dissolved Magnesium (Mg)	2014/07/23		NC	%	80 - 120
			Dissolved Manganese (Mn)	2014/07/23		92	%	80 - 120
			Dissolved Potassium (K)	2014/07/23		102	%	80 - 120
			Dissolved Sodium (Na)	2014/07/23		NC	%	80 - 120
7574895	SRT	Spiked Blank	Dissolved Calcium (Ca)	2014/07/23		104	%	80 - 120
			Dissolved Iron (Fe)	2014/07/23		103	%	80 - 120
			Dissolved Magnesium (Mg)	2014/07/23		107	%	80 - 120
			Dissolved Manganese (Mn)	2014/07/23		102	%	80 - 120
			Dissolved Potassium (K)	2014/07/23		107	%	80 - 120
			Dissolved Sodium (Na)	2014/07/23		104	%	80 - 120
7574895	SRT	Method Blank	Dissolved Calcium (Ca)	2014/07/23	<0.30		mg/L	
			Dissolved Iron (Fe)	2014/07/23	<0.060		mg/L	
			Dissolved Magnesium (Mg)	2014/07/23	<0.20		mg/L	
			Dissolved Manganese (Mn)	2014/07/23	<0.0040		mg/L	
			Dissolved Potassium (K)	2014/07/23	<0.30		mg/L	
			Dissolved Sodium (Na)	2014/07/23	<0.50		mg/L	
7575058	RSU	Matrix Spike	1,4-Difluorobenzene (sur.)	2014/07/28		108	%	70 - 130
			4-Bromofluorobenzene (sur.)	2014/07/28		107	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2014/07/28		117	%	70 - 130
			Benzene	2014/07/28		76	%	70 - 130
			Toluene	2014/07/28		81	%	70 - 130
			Ethylbenzene	2014/07/28		80	%	70 - 130
			m & p-Xylene	2014/07/28		79	%	70 - 130
			o-Xylene	2014/07/28		81	%	70 - 130
			(C6-C10)	2014/07/28		73	%	70 - 130
7575058	RSU	Spiked Blank	1,4-Difluorobenzene (sur.)	2014/07/24		105	%	70 - 130
			4-Bromofluorobenzene (sur.)	2014/07/24		105	%	70 - 130

Maxxam Job #: B461485
Report Date: 2014/07/28

TETRA TECH EBA INC.
Client Project #: AMA 9558
Site Location: 124 MAIN ST BARONS
Your P.O. #: ENVIND03335-02
Sampler Initials: JL

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
7575058	RSU	Method Blank	D4-1,2-Dichloroethane (sur.)	2014/07/24		97	%	70 - 130
			Benzene	2014/07/24		80	%	70 - 130
			Toluene	2014/07/24		79	%	70 - 130
			Ethylbenzene	2014/07/24		82	%	70 - 130
			m & p-Xylene	2014/07/24		82	%	70 - 130
			o-Xylene	2014/07/24		81	%	70 - 130
			(C6-C10)	2014/07/24		86	%	70 - 130
			1,4-Difluorobenzene (sur.)	2014/07/24		111	%	70 - 130
			4-Bromofluorobenzene (sur.)	2014/07/24		107	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2014/07/24		105	%	70 - 130
			Benzene	2014/07/24	<0.00040		mg/L	
			Toluene	2014/07/24	<0.00040		mg/L	
			Ethylbenzene	2014/07/24	<0.00040		mg/L	
			m & p-Xylene	2014/07/24	<0.00080		mg/L	
			o-Xylene	2014/07/24	<0.00040		mg/L	
			Xylenes (Total)	2014/07/24	<0.00080		mg/L	
			F1 (C6-C10) - BTEX	2014/07/24	<0.10		mg/L	
			(C6-C10)	2014/07/24	<0.10		mg/L	
7577001	ZI	Matrix Spike	Dissolved Chloride (Cl)	2014/07/24		NC	%	80 - 120
7577001	ZI	Spiked Blank	Dissolved Chloride (Cl)	2014/07/24		103	%	80 - 120
7577001	ZI	Method Blank	Dissolved Chloride (Cl)	2014/07/24	<1.0		mg/L	
7577035	ZI	Matrix Spike	Dissolved Sulphate (SO4)	2014/07/24		NC	%	80 - 120
7577035	ZI	Spiked Blank	Dissolved Sulphate (SO4)	2014/07/24		99	%	80 - 120
7577035	ZI	Method Blank	Dissolved Sulphate (SO4)	2014/07/24	<1.0		mg/L	

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 spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

Maxxam Job #: B461485
Report Date: 2014/07/28

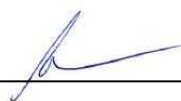
TETRA TECH EBA INC.
Client Project #: AMA 9558
Site Location: 124 MAIN ST BARONS
Your P.O. #: ENVIND03335-02
Sampler Initials: JL

VALIDATION SIGNATURE PAGE

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



Luba Shymushovska, Senior Analyst, Organic Department



Michelle Fritz Gatehouse, Senior Analyst

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Calgary: 4000 19st St. NE, T2E 6P8. Ph: (403) 291-3077, Fax: (403) 735-2240, Toll free: (800) 386-7247
Edmonton: 9331 - 48 Street, T6B 2R4. Ph: (780) 577-7100, Fax: (780) 450-4187, Toll free: (877) 465-8889
www.maxxamanalytics.com

07-744
Chain of Custody **A091415**
Page: 1 of 1

Company:	Invoice To:	C/O Report Address	Report To:	Same as Invoice	Report Distribution (E-Mail):
Tetatech EBA	Jaymes GONG	442 10 ST NW Lethbridge			jgong@eba.ca
Address:	Prov:	PC:	Prov:	PC:	
442 10 ST NW Lethbridge	AB	T1J 2C7			
Contact #:	Ph:	Cell:	Ph:	Cell:	
403 329 9009	403 308 4298				

REGULATORY GUIDELINES:
☒ AT1
☐ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #: ENV14003335-02
Project # / Name: AMA 9558
Site Location: 124 Main St Berens
Quote #:
Sampled By: JL

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve)
Date Required:
☒ REGULAR (5 to 7 Days)

Sample ID				Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	BTEX F	Sieve (75 micron)	Regulation	Salinity	Assessment	Basic Class	SOIL										WATER										Other Analysis										HOLD - Do not Analyze	# of Containers Submitted							
							BTEX F1-F4						☐ BTEX F1	☒ BTEX F2	☒ BTEX F3	☒ BTEX F4	☐ VOCs	☐ TOC	Total	Dissolved	Mercury																														
1	09MW11			Monitoring Well	GW	14/07/18 9:00								X	X												X	X																							
2	08MW07			↓	↓	9:30								X	X												X	X																							
3	08MW01			↓	↓	10:00								X	X												X	X																							
4	08MW03			↓	↓	10:30								X	X												X	Y																							
5																																																			
6																																																			
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10																																																			
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12																																																			

19-Jul-14 10:40
Ioana Stoica

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INS-0004

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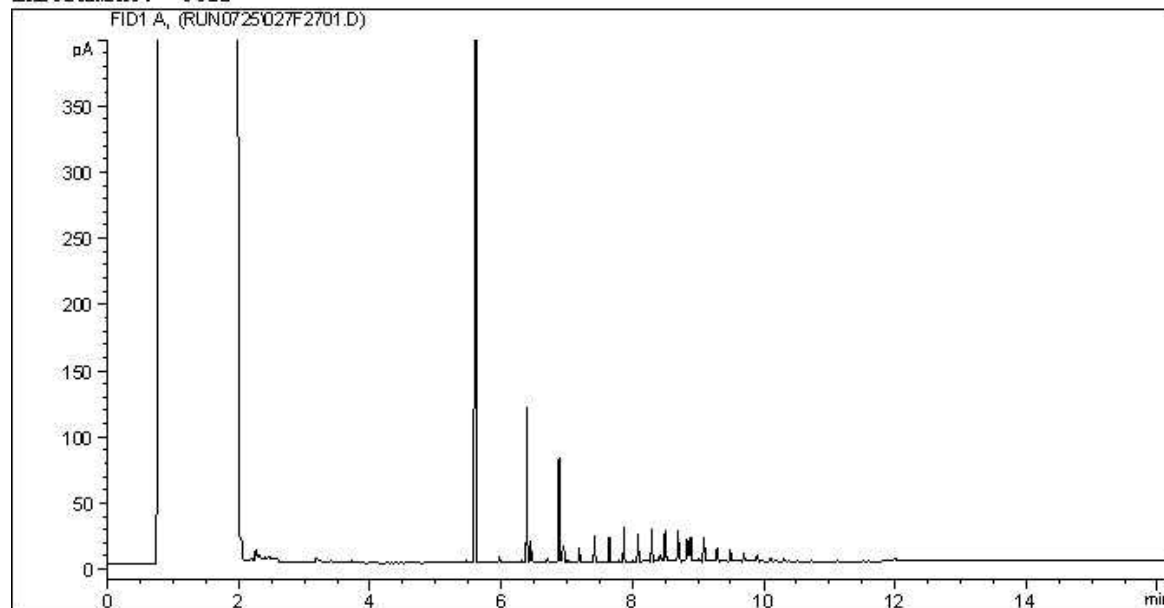
Please indicate Filtered, Preserved or Both (F, P, F/P)

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
JAMIE LAMONTAGNE	14/07/18	15:00
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Special Instructions:	# of Jars Used & Not Submitted	
Dissolved metals field filtered + preserved		

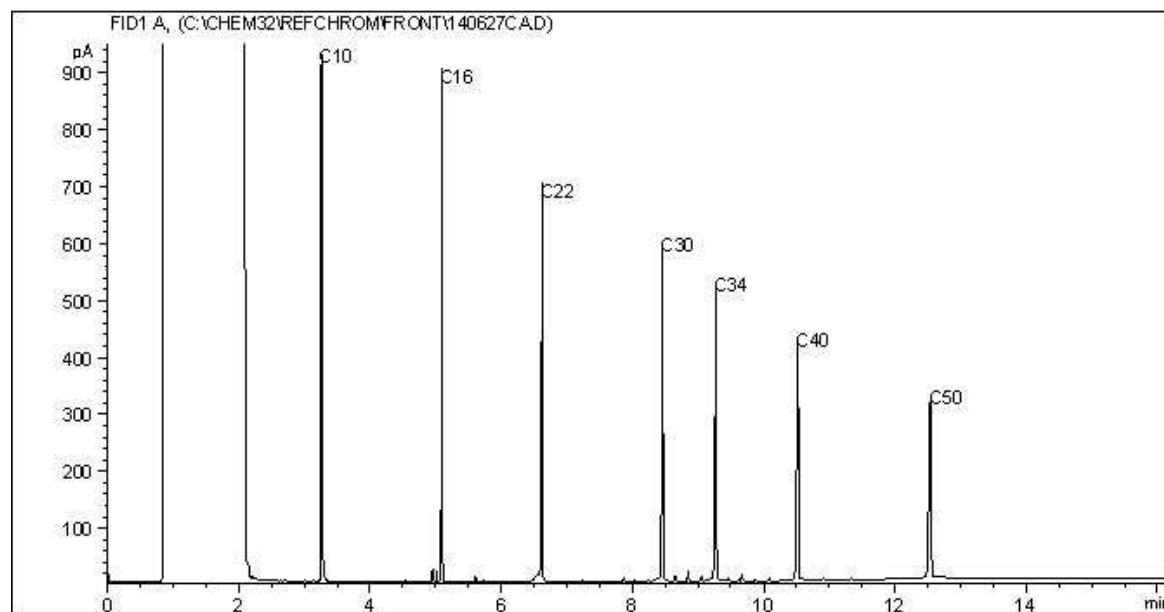
Received By:	Date:	Time:	Maxxam Job #:
Jane Musonda	2014/07/19	10:40	
Lab Comments:	Custody Seal	Temperature	Ice
	N	14, 15, 15	N

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

Instrument: GC12



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

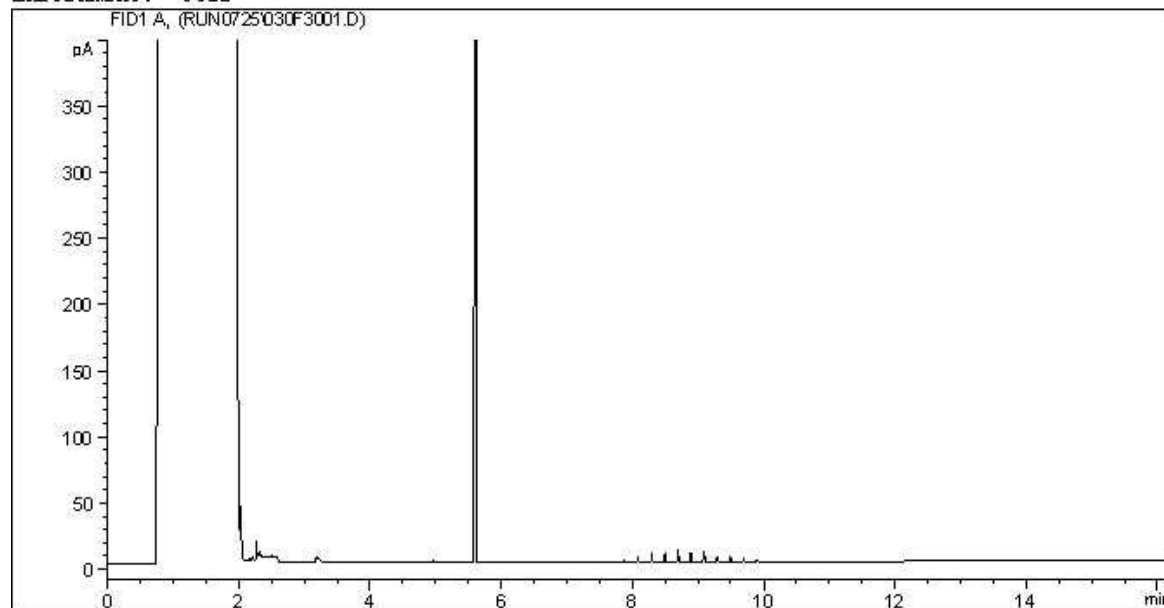
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Page 1 of 1

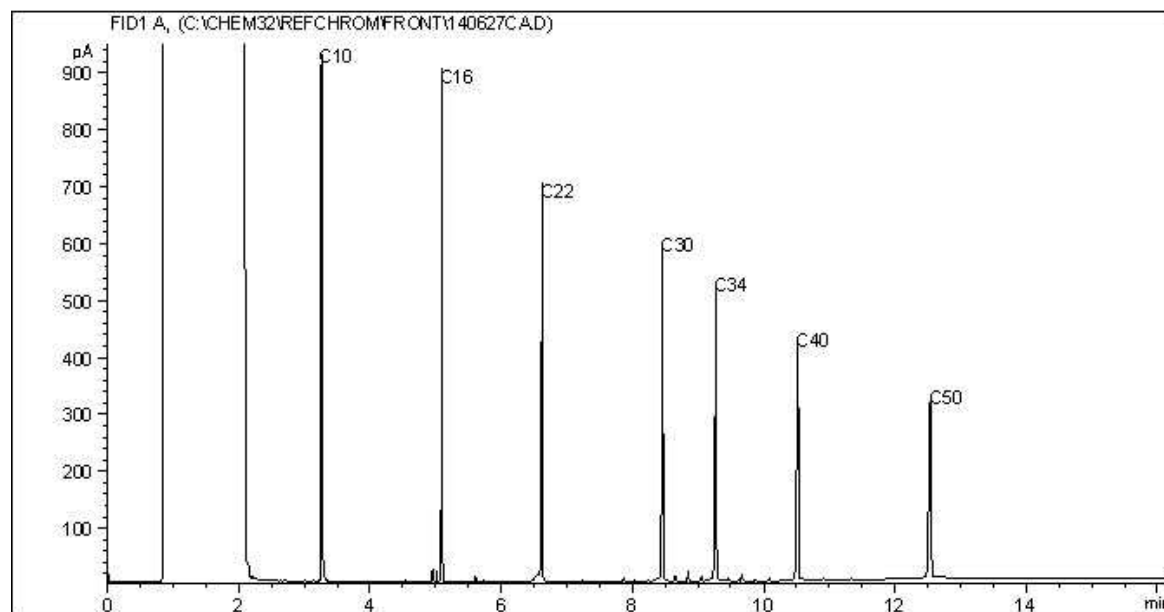
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

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

Instrument: GC12



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

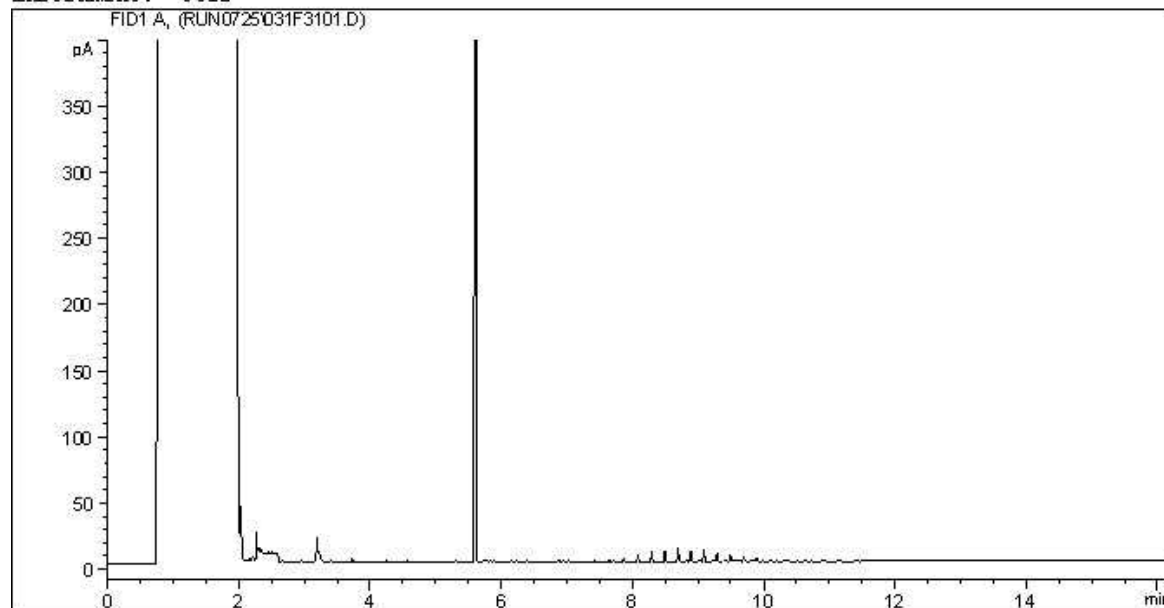
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Page 1 of 1

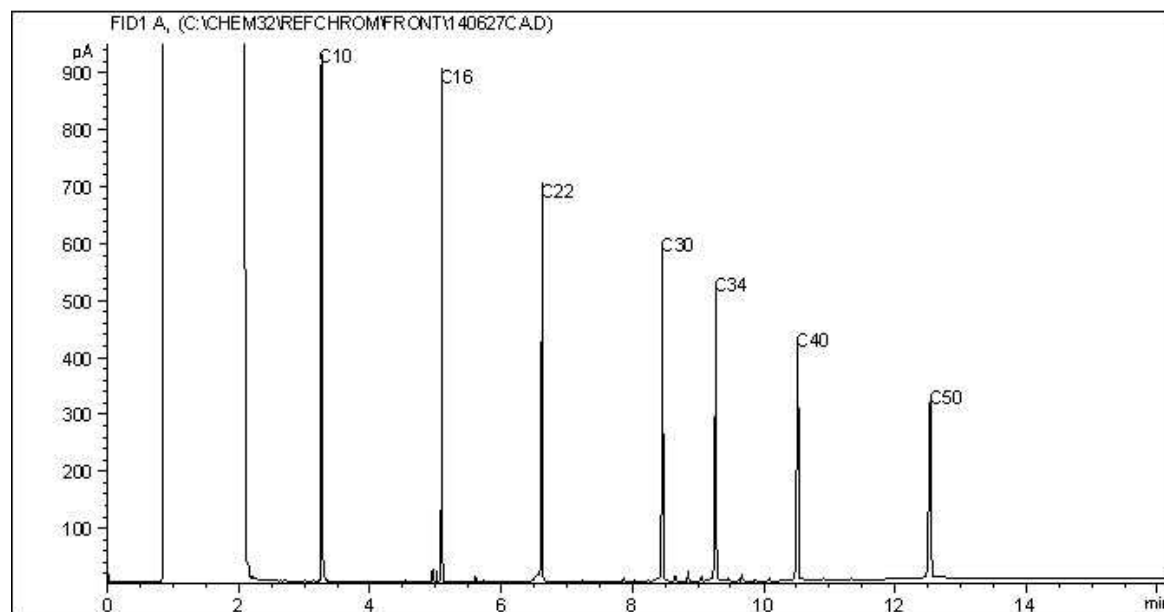
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CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC12



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

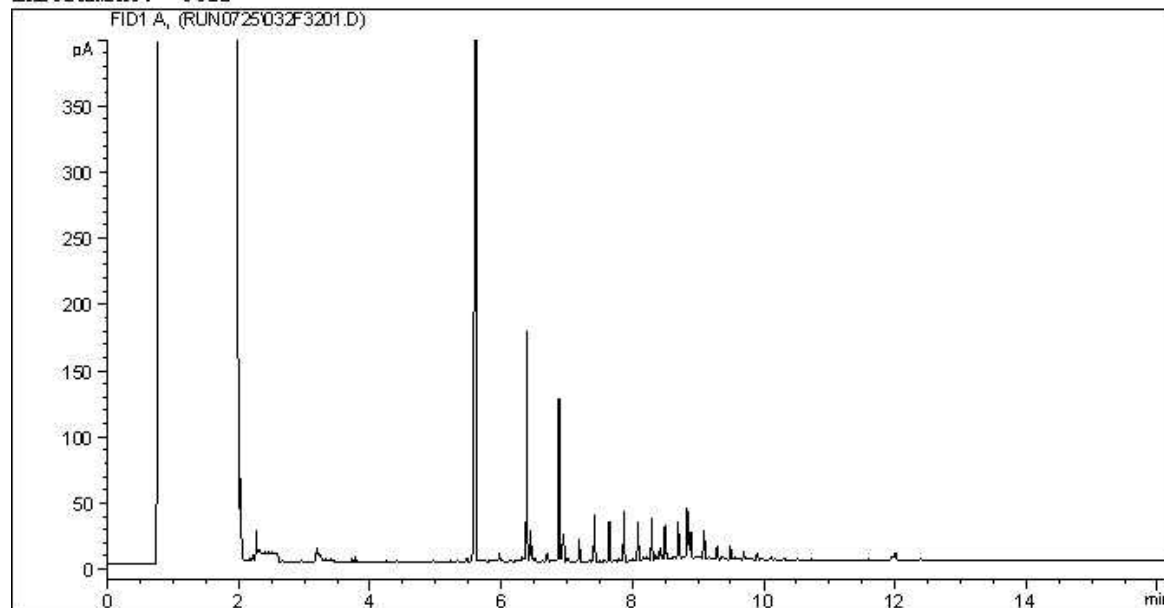
Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Page 1 of 1

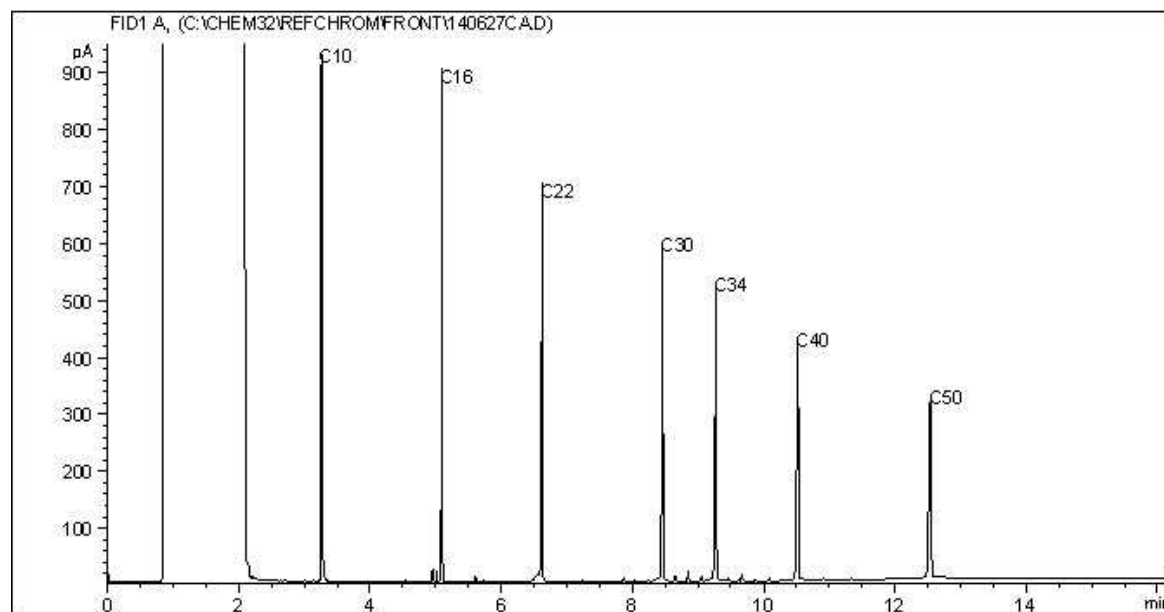
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

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

Instrument: GC12



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. #: ENVIND03335.02
 Your Project #: AMA955B-GAZEBO
 Site Location: 124 MAIN ST. BARONS, AB
 Your C.O.C. #: A091414

Attention: Jaymes Going

Tetra Tech EBA Inc.
 442 - 10 Street North
 Lethbridge, AB
 CANADA T1H 2C7

Report Date: 2014/07/29
Report #: R3105488
Version: 1

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B4C8449

Received: 2014/07/22, 09:50

Sample Matrix: AIR
 # Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
BTEX Fractionation in Air (TO-15mod)	4	N/A	2014/07/23	BRL SOP-00304	EPA TO-15 m
Canister Pressure (TO-15)	4	N/A	2014/07/23	BRL SOP-00304	EPA TO-15 m

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

Encryption Key

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

Theresa Stephenson, Project Manager
 Email: TStephenson@maxxam.ca
 Phone# (905) 817-5763

=====

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Total cover pages: 1

Page 1 of 6

Maxxam Job #: B4C8449
Report Date: 2014/07/29

Tetra Tech EBA Inc.
Client Project #: AMA955B-GAZEBO
Site Location: 124 MAIN ST. BARONS, AB
Your P.O. #: ENVIND03335.02

RESULTS OF ANALYSES OF AIR

Maxxam ID		WT9223	WT9224	WT9225	WT9226	
Sampling Date		2014/07/18 09:00	2014/07/18 09:30	2014/07/18 10:00	2014/07/18 10:30	
COC Number		A091414	A091414	A091414	A091414	
	Units	14VW01	14VW02	14VW03	14VW04	QC Batch

Volatile Organics						
Pressure on Receipt	psig	(-3.6)	(-3.4)	(-3.1)	(-3.4)	3686974

QC Batch = Quality Control Batch

Maxxam Job #: B4C8449
Report Date: 2014/07/29

Tetra Tech EBA Inc.
Client Project #: AMA955B-GAZEBO
Site Location: 124 MAIN ST. BARONS, AB
Your P.O. #: ENVIND03335.02

VOLATILE ORGANIC HYDROCARBONS BY GC/MS (AIR)

Maxxam ID		WT9223	WT9224	WT9225	WT9226		
Sampling Date		2014/07/18 09:00	2014/07/18 09:30	2014/07/18 10:00	2014/07/18 10:30		
COC Number		A091414	A091414	A091414	A091414		
	Units	14VW01	14VW02	14VW03	14VW04	RDL	QC Batch

Volatile Organics							
Benzene	ug/m3	<1.2	289	262	158	1.2	3686977
Toluene	ug/m3	<1.6	2.0	2.3	<1.6	1.6	3686977
Ethylbenzene	ug/m3	<1.6	<1.6	<1.6	<1.6	1.6	3686977
Total Xylenes	ug/m3	<2.2	<2.2	<2.2	<2.2	2.2	3686977
Aliphatic >C5-C6	ug/m3	<5.0	<5.0	<5.0	<5.0	5.0	3686977
Aliphatic >C6-C8	ug/m3	<5.0	15.3	5.9	6.2	5.0	3686977
Aliphatic >C8-C10	ug/m3	<5.0	<5.0	10.2	<5.0	5.0	3686977
Aliphatic >C10-C12	ug/m3	<5.0	40.2	40.4	31.1	5.0	3686977
Aliphatic >C12-C16	ug/m3	<5.0	15.6	59.1	25.9	5.0	3686977
Aromatic >C7-C8 (TEX Excluded)	ug/m3	<5.0	<5.0	<5.0	<5.0	5.0	3686977
Aromatic >C8-C10	ug/m3	<5.0	396	561	398	5.0	3686977
Aromatic >C10-C12	ug/m3	<5.0	277	261	261	5.0	3686977
Aromatic >C12-C16	ug/m3	<5.0	<5.0	6.3	7.4	5.0	3686977
Surrogate Recovery (%)							
1,4-Difluorobenzene	%	96	95	95	99		3686977
Bromochloromethane	%	98	94	97	99		3686977
D5-Chlorobenzene	%	82	83	87	88		3686977

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: B4C8449
Report Date: 2014/07/29

Tetra Tech EBA Inc.
Client Project #: AMA955B-GAZEBO
Site Location: 124 MAIN ST. BARONS, AB
Your P.O. #: ENVIND03335.02

GENERAL COMMENTS

Results relate only to the items tested.

Tetra Tech EBA Inc.
Attention: Jaymes Going
Client Project #: AMA955B-GAZEBO
P.O. #: ENVIND03335.02
Site Location: 124 MAIN ST. BARONS, AB

Quality Assurance Report

Maxxam Job Number: GB4C8449

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
3686977 TRN	Spiked Blank	1,4-Difluorobenzene	2014/07/23		122	%	60 - 140
		Bromochloromethane	2014/07/23		123	%	60 - 140
		D5-Chlorobenzene	2014/07/23		122	%	60 - 140
		Benzene	2014/07/23		86	%	70 - 130
		Toluene	2014/07/23		95	%	70 - 130
		Ethylbenzene	2014/07/23		95	%	70 - 130
	Method Blank	Total Xylenes	2014/07/23		100	%	70 - 130
		1,4-Difluorobenzene	2014/07/23		107	%	60 - 140
		Bromochloromethane	2014/07/23		105	%	60 - 140
		D5-Chlorobenzene	2014/07/23		95	%	60 - 140
		Benzene	2014/07/23	<1.2		ug/m3	
		Toluene	2014/07/23	<1.6		ug/m3	
	RPD [WT9223-01]	Ethylbenzene	2014/07/23	<1.6		ug/m3	
		Total Xylenes	2014/07/23	<2.2		ug/m3	
		Aliphatic >C5-C6	2014/07/23	<5.0		ug/m3	
		Aliphatic >C6-C8	2014/07/23	<5.0		ug/m3	
		Aliphatic >C8-C10	2014/07/23	<5.0		ug/m3	
		Aliphatic >C10-C12	2014/07/23	<5.0		ug/m3	
		Aliphatic >C12-C16	2014/07/23	<5.0		ug/m3	
		Aromatic >C7-C8 (TEX Excluded)	2014/07/23	<5.0		ug/m3	
		Aromatic >C8-C10	2014/07/23	<5.0		ug/m3	
		Aromatic >C10-C12	2014/07/23	<5.0		ug/m3	
		Aromatic >C12-C16	2014/07/23	<5.0		ug/m3	
		Benzene	2014/07/23	NC		%	25
		Toluene	2014/07/23	NC		%	25
		Ethylbenzene	2014/07/23	NC		%	25
		Total Xylenes	2014/07/23	NC		%	25
		Aliphatic >C5-C6	2014/07/23	NC		%	25
		Aliphatic >C6-C8	2014/07/23	NC		%	25
		Aliphatic >C8-C10	2014/07/23	NC		%	25
		Aliphatic >C10-C12	2014/07/23	NC		%	25
		Aliphatic >C12-C16	2014/07/23	NC		%	25
		Aromatic >C7-C8 (TEX Excluded)	2014/07/23	NC		%	25
		Aromatic >C8-C10	2014/07/23	NC		%	25
		Aromatic >C10-C12	2014/07/23	NC		%	25
		Aromatic >C12-C16	2014/07/23	NC		%	25

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

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.

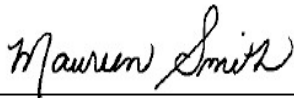
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (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 (one or both samples < 5x RDL).

Validation Signature Page

Maxxam Job #: B4C8449

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

A handwritten signature in black ink that reads "Maureen Smith". The signature is fluid and cursive.

Maureen Smith, Supervisor, Volatiles

=====

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APPENDIX D

RECORD OF SITE CONDITION

Record of Site Condition



1 REPORT AND FORM INFORMATION			
Title of report	Groundwater and Soil Vapour Monitoring Program. 124 Main Street Barons, AB. Alberta Municipal Affairs Site #9558		
Report date (dd-mon-yyyy)	Dec 2014	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 EBA Inc.	Contact person	Jaymes Going
Mailing address	442 - 10 Street North Lethbridge, AB T1H 2C7	Position held	Environmental Consultant
		Business phone No.	403.329.9990
		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</u>		

4 OPERATING STATUS	
☐ Operating ☐ Suspended ☒ Abandoned ☐ Decommissioning in progress ☐ Closed	☐ Reclaimed (provide Reclamation Certificate No.(s): _____) ☐ 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 (<i>specify</i>): _____
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 (<i>specify</i>): _____				

6 SITE CHARACTERIZATION					
6.1 What Environmental Site Assessments (ESA) Have Been Conducted and Completed to Date?					
☒ Phase I ESA ☒ Phase II ESA (<i>check all that apply.</i>) ☒ 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 <i>Alberta Tier 2 Soil and Groundwater Remediation Guidelines</i> (ESRD, 2007 and updates)? (<i>check all that apply in Section 6.2.1.1.</i>)					
☒ Yes ☐ No (<i>→proceed to Section 6.2.2.</i>)					
6.2.1.1 Identify any conditions that require the approaches of the <i>Alberta Tier 2</i> guidelines. (<i>see Alberta Tier 1 Soil and Groundwater Remediation Guidelines</i> (ESRD, 2007 and updates), for details.)					
☐	Contamination within 30 cm of building foundation	☐	Unusual building feature (<i>eg. earthen floor</i>)	☐	Contamination within 10 m distance of surface water body
☒	Fractured bedrock	☐	Potentially high hydraulic conductivity ($> 10^{-5}$ m/sec.)	☐	Other (<i>see Alberta Tier 1 guidelines and specify</i>): _____
6.2.1.2 Did the <i>Alberta Tier 2</i> 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 (<i>→proceed to Section 6.2.2.</i>)					
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 (<i>check all that apply, see Alberta Tier 1 guidelines, Tables 1-4 for detailed listing</i>).					
☐	General and inorganic parameters	☐	Metals		
☐	Hydrocarbons	☐	Halogenated aliphatics		
☐	Chlorinated aromatics	☐	Pesticides		
☐	Other organics	☐	Radionuclides		
☐	Salt	☐	Other (<i>specify</i>): _____		

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? _____ (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: 1.38 (m) Deepest: 1.69 (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

Record of Site Condition



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>Road</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>Road</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): _____

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 *Record of Site Condition* form is a public record that is disclosed in accordance with section 35 of the *Environmental Protection and Enhancement Act*, *Disclosure of Information Regulation*, and *Ministerial Order 23/2004*. 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 *Environmental Protection and Enhancement Act* and is in compliance with section 33(a) and 33(c) of the *Freedom of Information and Protection of Privacy Act* (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.

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.

Name of operator	Name of authorized representative	Title of authorized representative (e.g. officer, director)	Signature	Date (dd-mon-yyyy)