2019 Groundwater and Soil Vapour Monitoring Report
Red Deer Motors Site
SE 08-038-27 W4M

PRESENTED TO
City of Red Deer

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EXECUTIVE SUMMARY

The City of Red Deer (The City) retained Tetra Tech Canada Inc. (Tetra Tech) to conduct the 2019 groundwater and vapour monitoring program at a former landfill located at legal location Lot 3MR, Block 2, Plan 842 2279 within the southeast quarter of Section 08-038-27 W4M. The site is known as the Red Deer Motors (RDM) historic waste disposal site, hereafter referred to as the site. The objective of the monitoring program is to identify potential environmental concerns related to former operations at the site.

Tetra Tech's scope of work for the 2019 monitoring and sampling program at the RDM site included conducting semi-annual events of groundwater and vapour monitoring, annual groundwater sampling, updating the hazard quotients, reviewing and updating previous recommendations for the site, and preparing an annual report.

The current groundwater monitoring network at the site consists of four monitoring wells (MW-01, MW-04A/B and MW-05). Of the three wells (MW-01, MW-02 and MW-03) that were installed during a previous assessment in 2013 only MW-01 could be located in 2019. MW-02 and MW-03 are suspected to have been destroyed when a paved area east of site was extended to the west. In December 2019, Tetra Tech personnel located three monitoring wells on the west side of the site near Waskasoo Creek. These wells were presumably installed by Alberta Environmental Protection in the 1980s and have been labelled as MW-04A/B and MW-05. Completion details for these three wells are not known.

The current vapour monitoring network consists of two vapour monitoring wells (VW-01 and VW-02) that were installed in 2013. Vapour monitoring well VW-03 was likely destroyed when the area east of the site was paved.

Based upon the results of the groundwater and vapour monitoring and sampling conducted in 2019 and previous years, Tetra Tech has developed the following conclusions:

- The groundwater elevations in 2019 were not contoured due to inadequate data. MW-02 and MW-03 were not located during either monitoring event and the additional monitoring wells MW-04A, MW-04B, and MW-05 did not have available elevation data to calculate and interpret contours for the elevations. Historically, groundwater flow was indicated to be to the northwest, towards Waskasoo Creek.

- Parameters that exceeded the Alberta Tier 1 Soil and Groundwater Remediation Guidelines (Tier 1 Guidelines) at one or more monitoring wells in 2019 included total dissolved solids (TDS), sodium, chloride, ammonia, dissolved arsenic, copper, iron, manganese, and uranium, and vinyl chloride. The measured concentrations of one or more of these parameters suggest leachate has impacted the groundwater quality at MW-01, MW-04A, and MW-05. The measured concentrations of these parameters were generally consistent with previous results.

- During the December 2019 sampling events, chloride concentrations greater than the Tier 1 Guidelines (120 mg/L) were measured at monitoring wells MW-01, MW-04A, and MW-05. The highest chloride concentration was 450 mg/L at MW-04A.

- Concentrations of toluene, ethylbenzene, xylenes, petroleum hydrocarbons (PHC) fractions F1 to F2, adsorbable organic halides (AOX), and volatile fatty/carboxylic acids in 2019 were less than the analytical detection limits at all monitoring wells. Benzene concentrations were detected at MW-01 (0.0006 mg/L) and MW-05 (0.00189 mg/L), but were less than the Tier 1 Guidelines value of 0.005 mg/L.

- Concentrations of vinyl chloride in the groundwater exceeded Tier 1 Guidelines at MW-01 and MW-05 in December 2019. In addition, detectable concentrations of a chlorinated volatile organic compound (VOC) for which no Tier 1 Guidelines is established (1,2-dichloroethene) were measured at MW-01, MW-04A, and MW-05.

- Concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX), PHCs, and VOCs were less than the soil vapour screening criteria in sample VW-02.
- 1,2-dichloroethane and vinyl chloride in soil gas were greater than the soil vapour screening criteria in sample VW-01 and its duplicate.
- Siloxanes were not detected in the samples collected.
- The estimated individual and cumulative risks and hazards associated with the soil vapour sample collected in December 2019 did not exceed the corresponding target risk and hazard levels for sample VW-02. The estimated individual and / or cumulative risks and hazards associated with the soil vapour sample collected in December 2019 did exceed the corresponding target risk and hazard levels for sample VW-01.
- Based on the above, the groundwater at interpreted hydraulically down-gradient locations (MW-01, MW-04A, and MW-05) was identified to exhibit leachate impacts. The groundwater at the fourth well (MW-04B), which is installed slightly deeper and adjacent to MW-04A, did not appear to exhibit impacts. One of the two vapour wells (VW-01, situated in the northwest corner of the site) exhibited impacts by LFG, as evidenced by elevated methane and VOCs. However, this is not identified as a concern related to current developments near the site. Should a change in development be contemplated, this conclusion may need to be revised.

Based upon the results of the groundwater and vapour monitoring program in 2019 and previous years, there are residual impacts to groundwater and vapours and buried landfill waste remains in place beneath the site and therefore ongoing risk management is required. Risk management is recommended to include additional assessment; ongoing monitoring; and administrative actions. The following recommendations are made according to these risk management elements:

- Ongoing Monitoring:
  - Continue the current semi-annual groundwater monitoring and annual sampling program at the site for another year to confirm concentrations measured to date and to monitor trends.
  - Monitoring wells MW-01, MW-04A, and MW-05 should be sampled for routine groundwater chemistry parameters, dissolved metals, BTEX, PHC fractions F1 and F2, and VOCs. Deeper monitoring well MW-04B does not exhibit obvious groundwater quality impacts and may be omitted from the program.
  - Survey the elevations of monitoring wells MW-04A, MW-04B, and MW-05 to establish the inferred groundwater flow direction.
  - Continued vapour monitoring including methane and pressures is considered warranted to confirm conditions. The suggested monitoring would include manual measurements of headspace pressures and methane concentrations, measured semi-annually (in conjunction with groundwater monitoring) in both groundwater and vapour wells; if an additional well is installed as recommended below, it should be included in this monitoring.
  - Based on the results of the soil vapour sample from VW-01, there is a potential vapour intrusion risk in the northwest corner of the site from VOCs. Continued vapour sampling of VW-01 in conjunction with the groundwater monitoring program should be conducted, and the additional well along the east boundary, if installed, should also be sampled. Further sampling of vapours in VW-02 is not considered warranted.

- Additional Assessment:
  - Install a vapour well along east site boundary is warranted, approximately halfway between former VW-03 and existing VW-02 to assess potential vapour migration to the east.
  - Replace background groundwater monitoring well MW-02 to provide additional groundwater data.
  - The extent and migration of leachate impacted groundwater is poorly defined to the west and northwest. Because Waskasoo Creek is considered to be a receptor, it is recommended to collect upstream and downstream surface water samples during a spring/summer monitoring event for analysis of BTEX, PHC fractions F1 and F2, total metals, routine water chemistry, and VOCs. If the surface water sampling results exceed FAL guidelines and are interpreted to be related to municipal solid waste (MSW) leachate impacts, additional sampling or assessment may be recommended.
  - Based on the nature of thin soil cover identified in the earlier work by Tiamat, we suggest that during field monitoring events, a basic site walkover be conducted to evaluate for potential erosion, cracking, and/or exposed wastes. This information could be used to document whether potential repairs to the cap are warranted.
- Administrative Actions:
  - Utilize the revised generic mitigative measures when evaluating applications for development within the setback.
  - Ensure that the site is clearly identified within The City's Land Use Bylaw and appropriate administrative requirements are met for the site in accordance with City policies.
  - Ensure that the site is clearly identified within The City's utility mapping system. Elevated gas concentrations are present in the subsurface proximate to the 32 Street road right-of-way. Future activities in this vicinity (e.g., utility work, repairs, paving, etc.) should consider the potential presence of gas and a site-specific safety plan should be developed for work undertaken to limit the potential for exposure to site workers.

Further to the above recommendations, as noted the site remains an historical landfill. It presently appears to be well maintained and capped. The City should review this status on an ongoing basis to ensure that the cover remains intact and drainage remains positive; repairs or maintenance should be undertaken as required to maintain the site.

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LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of The City of Red Deer and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than The City of Red Deer, 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 document is subject to the Limitations on the Use of this Document attached in Appendix A or Contractual Terms and Conditions executed by both parties.

1.0 INTRODUCTION

The City of Red Deer (The City) retained Tetra Tech Canada Inc. (Tetra Tech) to conduct the 2019 groundwater and vapour monitoring program at a former landfill located at legal location Lot 3MR, Block 2, Plan 842 2279 within the southeast quarter of Section 08-038-27 W4M. The site is known as the Red Deer Motors (RDM) historic waste disposal site, hereafter referred to as the site. The objective of the monitoring program is to identify potential environmental concerns related to former operations at the site.

1.1 Scope of Work

Tetra Tech's scope of work for the 2019 monitoring and sampling program included the following activities:

- Conducting semi-annual events of groundwater and vapour monitoring, including, measuring headspace vapours and groundwater levels within each monitoring well and observing monitoring well integrity.
- Conducting groundwater sampling:
  - Purging shallow monitoring wells and deep monitoring wells until practically dry or until a minimum of three well volumes had been removed and allowing the water levels in the wells to recover.
  - Measuring field parameters (pH, electrical conductivity [EC], and water temperature) at the time of sampling.
  - Collecting groundwater samples from each well and submitting the samples for laboratory chemical analyses.
- Conducting vapour sampling:
  - Collecting vapour samples into Summa canisters for analysis.
  - Collecting vapour samples for siloxanes analysis into thermal desorption (TD) tubes.
  - Collecting one duplicate vapour sample for quality assurance/quality control (QA/QC) purposes.
- Conducting monitoring well repairs, as required.
- Updating the hazard quotients prepared during the previous reporting using the 2019 monitoring and sampling results.
- Preparing an annual report summarizing the field activities undertaken for the year and interpreting the groundwater and soil vapour analytical results.

The report was completed under Tetra Tech's Limitations on the Use of this Document for conducting environmental work. A copy of these conditions is provided in Appendix A. Cross-sections that were prepared using the wells previously installed at the site in 2013 are included in Appendix B (from Tiamat Environmental Consultants Ltd. [Tiamat] 2014a).

1.2 Pre-1972 Landfill Program

The scope of work for the monitoring program was based on the proposal submitted by Tetra Tech on January 11, 2019 to The City to conduct environmental monitoring services for the pre-1972 landfill sites in accordance with the Request for Proposal (RFP) No. 1090-2018-261 issued by The City on November 30, 2018, and Addendum 01 issued by The City on January 7, 2019. This report documents the scope and findings for the RDM site.

The objectives of the project were to:

- Confirm and implement the prior recommendations, as per the RFP;
- Consult with the regulator on amendments to the program, as required;
- Conduct environmental monitoring and sampling for each of the eight sites, as outlined in the RFP recommendations, while incorporating any approved recommendations;
- Update the hazard quotients for each site; and
- Prepare an environmental monitoring report for each site.

The eight pre-1972 landfill sites include:

- Great West Adventure Park;
- Lindsay Thurber Comprehensive High School;
- McKenzie Trails Recreation Area;
- Montfort;
- Red Deer College;
- Red Deer Motors;
- Riverside Heavy Dry Waste site; and
- Riverside Light Industrial Park.

Each site is summarized in a separate report. This report is focused on the RDM site. It includes a description of the site geology and hydrogeology, the results of the 2019 monitoring activities at the site, and an interpretation and evaluation of the collected data.

2.0 BACKGROUND INFORMATION

2.1 General Information

The site is located within SE 08-038-27 W4M, at Lot 3 MR Block 2 Plan 8422279. The site location is shown on Figure 1. The site is zoned A2 – Environmental Preservation District and is across Taylor Drive from Red Deer College. The site is located east of Taylor Drive and Waskasoo Creek, south of 32 Street and south and west of commercial buildings. A general site plan is shown on Figure 2. The site is undeveloped and consists of natural areas including, grasses, trees, and shrubs with power lines extending north to south on the west side.

2.2 Site History

Municipal records indicate that the waste disposal at the site occurred between approximately 1967 and 1968. This would indicate that the estimated age of the waste material would be approximately 53 years old. Records indicate the waste as being municipal solid waste (MSW) consisting of plastics, cans, paper, metal, wire, glass, and rubber.

Some construction debris was also identified in areas consisting of bricks, wood and concrete. The former landfill is listed as inactive and closed.

Historical waste disposal was identified during the Phase II Environmental Site Assessment (ESA) (Tiamat 2014a) throughout the entire site up to 32 Street at the north end. Estimated waste areas are identified on Figure 2. The Phase II ESA estimated the total area of buried waste at approximately 9,600 m^2 on the site and approximately 1,580 m^2 off site (south of the 32 Street roadway).

Results of the Phase II ESA conducted by Tiamat indicated a thin surficial layer of sod, sand, and loam was overlying a sand and clay fill. The fill ranged from 3.0 m to 4.6 m deep in the areas of the site without MSW. Within the waste footprint, MSW was observed beneath the sod and loam layer to a depth of 4.6 m. The testholes along the east boundary of site had large amounts of MSW waste up to 3 m deep. MSW was overlying native clay. The investigation was conducted to depths of up to 7.6 m and bedrock was not encountered at any locations (Tiamat 2014a).

The Red Deer College historical landfill is situated west of the site, immediately west of Taylor Drive (refer to Appendix B for location).

2.3 Historical Groundwater Monitoring and Investigation Summary

Previous reports prepared by Tiamat for the site include:

- Phase I Environmental Site Assessment, Historic Waste Disposal Site, Red Deer Motors, The City of Red Deer. September 24, 2013 (Tiamat 2013).
- Phase II Environmental Site Assessment, Historic Waste Disposal Site, Red Deer Motors, The City of Red Deer. February 26, 2014 (Tiamat 2014a).
- Environmental Risk Management Plan, Historic Waste Disposal Sites, Red Deer College & Red Deer Motors, The City of Red Deer. November 27, 2014 (Tiamat 2014b).

The Phase I ESA (Tiamat 2013) indicated that a sanitary waste permit existed for the site and environmental concerns could include the following listed below. The status of the permit is unknown and it was not reviewed.

- Generation of leachate from infiltration and percolation of precipitation into the first water bearing zone.
- Generation of landfill gas (LFG), which may contain methane and other volatile organic compounds (VOCs) with the decomposition of the biomass materials and petroleum derived products.
- Differential ground settlement as waste material decompose and consolidate.

Six testholes (TH-03, TH-05, TH-06, TH-07, TH-08, and TH-09) were advanced in 2013 as part of the Phase II ESA, three vapour wells (VW-01 to VW-03) and three monitoring wells (MW-01 to MW-03) were installed. Tiamat noted that two previously installed Alberta Environmental Protection[1] monitoring wells were on the west boundary of the site prior to conducting the Phase II ESA. No information regarding the Alberta Environmental Protection wells was included in the Phase I ESA or Phase II ESA, and a report was not available for review.

[1] Currently Alberta Environment and Parks (AEP).

The results of the Phase II ESA (Tiamat 2014a) indicated the following:

- Waste material on site is located on native sand or clay till.
- In 2013, the average groundwater depth was 4.2 m, which is situated within the waste material. The estimated horizontal hydraulic gradient was 2% to the northwest. Tiamat presented an estimated horizontal groundwater flow velocity of 4.7 m/year; however, it is unclear whether these calculations were for the adjacent Red Deer College site or for the subject site.
- VOCs and other petroleum hydrocarbons (PHCs) had detectable concentrations in 2013 at the monitoring wells at the down-gradient end of the site. These parameters were indicative of leachate. The leachate was characterized showing negative redox potentials and near anoxic conditions for dissolved oxygen.
- Several commercial businesses and residential developments are nearby the RDM site.
- Differential settlement of cap material had occurred at the site. No activities located on adjacent lands were interpreted to be contributing environmental concerns.
- Light petroleum gases were detected at vapour wells on site and PHCs were detected at the northwest portion of site.
- The vapour wells at RDM detected volatile PHCs to carbon chain 12 and semi-volatile, oxygenated, and halogenated volatile hydrocarbons and ketones were detected in the soil vapour samples.

The recommendations of the program were as follows:

- Monitor groundwater elevations and soil vapour data bi-annually for one hydrogeological cycle.
- Determine if surface water sampling should be included with groundwater sampling to determine exposure from leachate contaminants in Waskasoo Creek.
- Collect an additional set of soil vapour and groundwater analytical data, groundwater elevations, and volatile headspace measurement during the winter months to determine seasonal changes in soil vapour concentrations.
- Develop a risk management plan (RMP) to consider future land uses and address environmental concerns.
- Review all data to update the RMP with new information.

The RMP conducted by Tiamat in 2014 stated “the outcome of the RMP confirm the identified chemicals of concern and relevant risk are manageable to facilitate future developments which may lie within the regulated setback distance to the historic waste disposal site” (Tiamat 2014b).

The following recommendations were made:

- Information in the preliminary quantitative risk assessment (PQRA) should be updated as new site information is obtained.
- A review of the RMP should be completed when the PQRA information is updated, if there are changes to the chemicals of potential concern (COPCs).
- The RMP should be reviewed and updated at five-year intervals.

2.4 Monitoring Well Network

The current groundwater monitoring network at the site consists of four monitoring wells (MW-01, MW-04A/B and MW-05). Of the three wells (MW-01, MW-02 and MW-03) that were installed during a previous assessment in 2013 only MW-01 could be located in 2019. MW-02 and MW-03 are suspected to have been destroyed when a paved area east of site was extended to the west. In December 2019, Tetra Tech personnel located three monitoring wells on the west side of the site near Waskasoo Creek. These wells were presumably installed by Alberta Environmental Protection in the 1980s and have been labelled as MW-04A/B and MW-05. Completion details for these three wells are not known.

The current vapour monitoring network consists of two vapour monitoring wells (VW-01 and VW-02) that were installed in 2013. Vapour monitoring well VW-03 was likely destroyed when the area east of the site was paved.

Groundwater and vapour monitoring well locations are shown on Figure 2.

3.0 SITE SETTING

The following section presents an overview of the regional and local setting for the site.

3.1 Geology

The following sections summarize the regional and local geology.

3.1.1 Geological Setting and Stratigraphy

The City and the site are located within the Red Deer River drainage basin with principal drainage via the Red Deer River located northwest of the site. The river has incised the uplands with gentle slopes to the east and west of the river, south of the site, aligned with Waskasoo Creek. The geology in the river valley is characterized by fluvial surficial sediments deposited by the Red Deer River, overlying shale and sandstone bedrock of the Paskapoo Formation. Key elements of the geological setting are presented below from Tiamat's 2013 Phase I ESA report (Tiamat 2013):

"The fertile black soil in the region (Penhold Loam) is of alluvial lacustrine origin. The Penhold Loam is a well-drained fine sandy loam classified as Chernozemic. It is generally stone free and in natural areas, is typically 1.5 m thick, more or less.

The Quaternary deposits consist of drift deposits of clay, silt, gravel and sand.

The Tertiary bedrock consists of sequences of alternating shales and sandstones of the Paskapoo Formation. This non-marine bedrock is composed of mudstone, siltstone and sandstone."

3.1.2 Local Geology

Based on borehole logs from the Phase II ESA conducted by Tiamat, the site is underlain by sand, loam and clay fill, underlain by clay till and/or native sands. Within the waste footprint, waste was encountered immediately below surface and was mixed with sand fill material. Fill material extended to maximum depths of approximately 7.6 m below grade (mbg) and waste was identified to a maximum depth of approximately 4.3 mbg. Bedrock was not encountered during the Phase II ESA.

3.2 Hydrogeology

The following sections summarize the regional and local hydrogeology.

3.2.1 Regional Hydrogeology

The regional hydrogeology is most influenced by the presence of the river sediments situated within the valley along the Red Deer River and a buried channel trending north-northeast in the vicinity of the site. Key elements of the hydrogeological setting are presented below from Tiamat's 2013 Phase I ESA report (Tiamat 2013):

"The dominant type of near-surface groundwater in the Paskapoo Formation in the area of assessment is sodium bicarbonate. Notable concentrations of sodium sulphate type groundwater have also been reported. The quality of groundwater for potable use is generally suitable to depths of 300 m on the west side of Red Deer and decreases to 90 m, more or less in the east.

Areas of recharge (downward flow) in unsaturated heterogeneous sediments include most areas above the river and creek valleys, whereas; the river valleys will generally exhibit discharge. The distribution of groundwater in the area can also be influenced by the local geology, topographic relief, areas of artesian flow, springs and reasonable yielding water source wells."

There are two significant buried valleys and aquifer resources beneath the city, Mapping by the Alberta Geological Survey (Andriashek 2018) indicates that a north-northeast trending valley is situated east of the site, and a northeast trending valley (which connects to the first) is situated south of the site. The valleys could influence the geology and hydrogeology beneath the site, however the width of the valleys are not defined.

Waskasoo Creek is the primary surface water feature near the site. The creek historically meandered in the area of the site, but since the construction of Taylor Drive, circa late 1980s, follows a constructed drainage channel in a northerly direction. The regional groundwater flow is expected to follow the bedrock topography and may be influenced by the buried channels in the area that are trending in a northeasterly direction."

3.2.2 Local Hydrogeology

Waskasoo Creek is located on the west side of the site and extends to the north beneath 32 Street. It flows along the east side of Taylor Drive past the site, and discharges into the Red Deer River. Waskasoo Creek is located adjacent to the west of the site, and the Red Deer River is located approximately 1.8 km north of the site. The site is within a groundwater recharge zone and has a downward flow component (Tiamat 2013). Shallow groundwater flow is assumed to flow towards the creek.

3.3 Groundwater Resource Usage

A search of the Alberta Water Well Database conducted in January 2020 for groundwater users within a 1 km radius of the RDM site identified 13 groundwater wells; 6 of the wells are listed as domestic use, 2 are listed as domestic and stock use, 2 are listed as industrial use, 2 as "other" use, and 1 as observation use (AEP 2019b).

The nearest water well to site is located approximately 650 m east of the site. The proposed well use is domestic and stock. The water wells within a 1 km radius of the site range from 5.8 m to 120 m depths. The status and use of the surrounding groundwater wells were not confirmed and they were not field verified.

Information for groundwater wells within 1 km of RDM is provided in Appendix C.

4.0 CONCEPTUAL SITE MODEL

The selection of remediation guidelines is based on the conceptual site model (CSM), which outlines the rationale for the selection of applicable exposure pathways and indicates which soil and groundwater exposure-specific remediation guidelines should apply. This evaluation is based on guidance presented in the Alberta Tier 1 Soil and Groundwater Remediation Guidelines (Tier 1 Guidelines; AEP 2019a).

A CSM was developed for the site and included the following items:

- Description of any identified environmental issues including a description of processes or activities undertaken at or near the site and a listing of COPCs identified in earlier investigations.
- Description of known and reported historical releases, including locations and status of any subsequent ESAs and remediation.
- Identification of applicable exposure pathways and receptors.

4.1 Chemicals of Potential Concern

Based on the information provided in historical reporting, and on typical COPCs in an MSW setting such as this, the COPCs for the groundwater component of the site include:

- Inorganic parameters and nutrients (e.g., ammonia, chloride, and total dissolved solids [TDS]);
- Metals;
- PHCs;
- VOCs; and
- Other indicator parameters, such as biological oxygen demand (BOD) and chemical oxygen demand (COD).

The COPCs for the soil vapour component of the site include:

- VOCs;
- Methane;
- Benzene, toluene, ethylbenzene, and xylenes (BTEX) and PHCs; and
- Siloxanes.

Amongst these COPCs, the soluble ones are expected to leach towards the groundwater table (e.g., BTEX, PHC fractions F1 and F2, chloride) while others will bind to the soil particles and are expected to migrate less (i.e., most metals).

4.2 Land Use

The Tier 1 Guidelines are subdivided by land use: natural area, agricultural, residential/parkland, and commercial/industrial. The site is currently zoned as Commercial Corridor 2 (C-COR). The site is surrounded by commercial land to the east and south, Waskasoo Creek and Red Deer College to the west, and greenspace and commercial buildings to the north. Groundwater samples were compared to residential/parkland use guidelines.

4.3 Grain Size Designation

The Tier 1 Guidelines are developed for both coarse-grained and fine-grained soils. Fine-grained soils are defined as having a median-grain size of less than or equal to 75 µm; coarse-grained soils have a median-grain size of greater than 75 µm. Where both fine- and coarse-grained strata are present, the dominant soil particle size is determined by the stratum governing horizontal and vertical migration to a receptor.

Particle size analyses was determined from the Phase II ESA completed by Tiamat. Samples were compared to coarse-grained criteria.

4.4 Exposure Pathways and Receptors for Soil and Groundwater

4.4.1 Human Receptors and Pathways

Human receptors assumed to be present on commercial and residential/parkland areas include adult workers, adult and child visitors, adult and child residents, and park users. The following human exposure pathways were considered when developing and implementing remediation guidelines:

- Direct soil contact.
- Groundwater ingestion (drinking water).
- Vapour inhalation.
- Off-site surface migration (wind or water erosion).

These pathways are briefly discussed individually below.

4.4.1.1 Direct Soil Contact – Human Pathway

The direct soil contact pathway is considered to be applicable to all land uses except in natural areas. Direct contact implies that humans can come in direct contact with contaminated soil via incidental ingestion, dermal contact, or inhalation of airborne soil particles. Since the land use for this site is considered parkland, this pathway is considered to be applicable.

4.4.1.2 Drinking Water (Groundwater Ingestion)

Water bearing units with a saturated hydraulic conductivity of greater than 1.0×10^{-6} m per second (m/sec) are considered to comprise a potential domestic use aquifer (DUA) (AEP 2019a). To eliminate this pathway, the presence of greater than 5 m of unimpacted, unfractured, saturated, fine-grained material with an assumed bulk (vertical) hydraulic conductivity of less than 1.0×10^{-7} m/sec must exist below the proven depth of contaminated material. This is required to ensure that the impacted material is isolated from potential underlying DUAs.

A search was conducted of the Alberta Water Well Database. No potable groundwater wells were identified within 500 m of the site. Groundwater at the site is not presently used as drinking water.

The DUA pathway is not considered to be active relative to the site. However, an investigation to eliminate the DUA pathway has not been completed; therefore, it is included for the site.

4.4.1.3 Inhalation

The inhalation pathway considers the migration of volatile contaminants (e.g., BTEX, PHC fractions F1 to F2, and VOCs) released from the soil and/or groundwater into living or working spaces of buildings where humans may be exposed through inhalation. The inhalation pathway is applicable to all land uses except natural areas. Since the current land use is considered residential/parkland, there is a potential for the infiltration of vapours into buildings and subsequent inhalation by the inhabitants. Therefore, the inhalation pathway is applicable in this assessment.

4.4.1.4 Off-site Surface Migration by Wind or Water Erosion

The off-site surface migration pathway considers migration of contaminated soil from the site to an adjacent site of more sensitive land use via wind or water erosion. This pathway applies to commercial and industrial sites only and is not applicable to the site as it is considered residential/parkland.

4.4.2 Ecological Receptors and Pathways

Ecological receptors at a typical contaminated site span a range of trophic levels, including soil-dependent organisms (e.g., plants and soil invertebrates) and higher-order consumers (e.g., terrestrial and avian wildlife and livestock). This pathway is applicable to the land use for this assessment.

4.4.2.1 Direct Soil Contact – Ecological Pathway

Plants and soil invertebrates may come into direct contact with contaminants in soil or shallow groundwater. This pathway is applicable to all land uses; therefore, it is considered for evaluation in this assessment.

4.4.2.2 Freshwater Aquatic Life

The freshwater aquatic life (FAL) pathway is applicable if a surface waterbody is present less than 300 m from the site. The nearest surface waterbody is Waskasoo Creek located adjacent to the west side of the site. This pathway is applicable to the land use for this assessment.

4.4.2.3 Nutrient and Energy Cycling

The nutrient and energy cycling pathway consider the microbial functioning of the soil including carbon nitrogen cycling and is, therefore, applicable to all land uses.

4.4.3 Exposure Pathway Summary

To establish the appropriate guidelines for the site, the most sensitive land use was used. The receptors are a combination of the degree of potential exposure, the exposure pathway, and the contaminant of concern. Human receptor exposures applicable to the site include direct soil contact and inhalation pathway. The ecological receptor exposures applicable to the site include direct soil contact, FAL, and nutrient and energy cycling.

4.5 Soil Vapour

As recommended by Alberta Environment and Parks, the soil vapour results obtained during this investigation were compared to the Canadian Council of Minister of the Environment (CCME) document *A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures Via Inhalation of Vapours* (CCME 2014). Generic soil vapour guidelines, that could indicate whether there are potential risks to indoor air from vapours in the soil, have been prepared using the default parameters outlined in the 2014 CCME protocol. The parameters used

in the calculation of the generic soil vapour guidelines can be found in Table 6 to Table 9. The equations and model assumptions were taken directly from the CCME 2014 document. While CCME does not publish soil vapour screening criteria, the approach used to calculate soil guidelines for the vapour inhalation pathway is used to derive the soil vapour screening criteria.

4.5.1 Indoor Air Risk Calculations

The Alberta Tier 2 Guidelines (AEP 2019c) include human toxicity reference values (TRVs) for inhalation (Table A-7). 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 inhalation tolerable concentration (ITC). 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 per Health Canada 2012, Preliminary Quantitative Risk Assessment [PQRA] Guidance) as follows:

$$RSC\ (mg/m^3) = 1 \times 10^{-5}/IUR$$

Continuous exposure is expressed as an exposure term (ET), which is unitless. The ET for residential land use is 1 (AEP 2019c) based on 24 hours/day, 7 days/week, and 52 weeks/year. The ET is used to determine appropriate soil vapour screening levels. Soil vapour screening levels were calculated (as per Health Canada 2012, PQRA Guidance) using the equation below:

$$Vapour\ Screening\ Level\ (mg/m^3) = (ITC\ or\ RSC)/ET$$

4.5.2 Methane and Explosive Risks

LFG can be generated from the degradation of wastes under anaerobic conditions. Methane gas can migrate through the ground and enter structures through porous concrete, joints, or fractures in foundations. When present, methane is considered a safety concern due to its explosive risk when it is in an atmosphere at concentrations between 5% and 15% by volume in air, in the presence of an ignition source. At concentrations less than 5% (the lower explosive limit [LEL]) and greater than 15% (the upper explosive limit), methane is not explosive. Methane on its own is not considered a health risk, although it can represent a concern if it is present at very high concentrations which could displace oxygen and present a risk of asphyxiation. There are no guidelines for methane as part of the Alberta Tier 1 framework. However, for reference, the Standards for Landfills in Alberta identify maximum methane concentrations proximate to approved landfills, and Alberta Health Services have provided guidance for methane (in conjunction with well headspace pressures that would constitute a driving force); however, that document has not been issued in a final format.

4.6 Overall Guidelines

The analytical results were compared to the Tier 1 Guidelines (AEP 2019a) under residential and parkland land uses for coarse-grained soils with the FAL pathway included.

Soil vapour analytical results were compared to *A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures Via Inhalation of Vapours* (CCME 2014) under residential land use for both slab-on-grade and basement for coarse-grained soils.

5.0 GROUNDWATER MONITORING AND SAMPLING PROGRAM

A discussion of the methods used for the fieldwork, laboratory testing, and data evaluation is presented in the following sections. In 2019, Tetra Tech conducted groundwater monitoring on June 26 and December 5. Groundwater sampling was conducted on December 6, 2019.

5.1 Field Program

Groundwater monitoring consisted of measuring combustible vapour concentrations (CVCs) and VOCs in monitoring well headspace, and static groundwater levels in each monitoring well using an electronic water level indicator semi-annually (June and December).

The methodology for groundwater monitoring and sampling included the following:

- Observing the integrity of each well and noting drainage and site conditions near the well that may have an effect on monitoring results or groundwater quality.
- Measuring the CVC and VOC headspace concentrations in each well using an RKI Eagle II calibrated to hexane and isobutylene and operated in methane elimination mode.
- Measuring liquid levels in each monitoring well with an interface probe and recording total depths confirming absence of non-aqueous phase liquids (NAPL).
- Recording of field data on standardized forms as documented in Tetra Tech standard operating practices.
- Purging each monitoring requiring sampling using dedicated polyethylene bailers or Waterra tubing with inertial pump foot valves, or until the well was practically dry.

Following the completion of groundwater monitoring and purging, groundwater samples were collected from the required wells using the procedures identified below:

- Groundwater samples were collected from four monitoring wells (MW-01, MW-04A, MW-04B, and MW-05) and placed into appropriate laboratory supplied, sterile glass and plastic vials and bottles for the required analytical package and, if required, samples were filtered and/or preserved in the field.
- Field measurements were taken for pH, EC, and temperature at the time of sampling.
- Samples were submitted in coolers with ice to ALS Laboratories (ALS) in Calgary, Alberta for laboratory analysis under a chain-of-custody (COC) documentation.

More information on the analytical program is provided in Section 5.2. The groundwater monitoring well locations are shown on Figure 2.

5.2 Analytical Program

The analytical program for the groundwater monitoring wells was developed based on the requirements of the RFP and is summarized below:

- BTEX and PHC fractions F1 and F2.
- VOCs.
- Total Kjeldahl nitrogen (TKN).

- Routine and dissolved metals.
- Dissolved organic carbon (DOC).
- Ammonia.
- Phosphorus.
- Adsorbable Organic Halides (AOX).
- Volatile fatty acids.

6.0 VAPOUR MONITORING AND SAMPLING PROGRAM

A discussion of the methods used for the fieldwork, laboratory testing, and data evaluation is presented in the following sections. In 2019, Tetra Tech conducted vapour monitoring on June 26 and December 5. Vapour sampling was conducted on December 5, 2019.

6.1 Field Program

Vapour monitoring consisted of measuring and recording soil gas pressure, composition (methane, carbon dioxide, oxygen, hydrogen sulphide, and balance) on a percent volumetric basis and groundwater elevation, semi-annually (June and December).

Each soil vapour probe was inspected for visible signs of damage and the position of the sampling labcock was noted. Soil gas pressure was recorded using a digital manometer. Once the soil gas pressure measurement was recorded, the soil gas probe was purged of three well volumes of air, or until readings stabilized. Small diameter soil gas probes (25 mm wells) were purged directly with the GEM LFG analyzer.

After purging, gas composition measurements for methane, carbon dioxide, oxygen, balance gas, and hydrogen sulphide were recorded using the GEM analyzer. After recording soil gas concentrations, the probe/well depths and water levels were measured and recorded to confirm the water level within the probe was beneath the screen portion of the soil gas probe (i.e., the probe was not blinded).

A leak detection test was completed to ensure the vapour probe was sealed properly. The test was completed using a helium gas tracer to inspect the testing probe and apparatus for any leaks. If there was a leak beyond the acceptable range (2% of helium concentration), the connections were tightened, and the leak test was conducted again.

Sampling of the soil vapour probes (VW-01 and VW-02) was based on the methodology of the CCME sampling guidelines, which are summarized as follows:

- Prior to collecting the soil vapour probe samples, the well was purged of three well volumes, or until headspace readings stabilized.
- A 1.4 L Summa vacuum canister was used for sample collection at the soil vapour probe monitoring location.
- Sample data was recorded on the provided sample tag for each canister.
- Sample tubing that was used to connect the canister to the soil vapour probe was low in VOCs and only used once to prevent sample contamination.

- When beginning sample collection, the end cap was removed, and a 60-minute flow controller was attached to the canister. Start time was recorded on the sample tag.
- When sampling was complete, the valve was closed, and the flow controller was removed. The end time was recorded on the sample tag.
- The protective end cap was replaced back on the canister.
- Canisters, flow controllers, and pressure gauges were placed in the original shipping container and returned to the laboratory with a COC.
- The soil vapour probe sampling port was returned to the closed position and the well was securely locked.

The vapour samples were submitted to ALS for chemical analysis. A duplicate sample was collected during the vapour sampling event for QA/QC purposes. More information on the analytical program is provided in Section 6.2.

The vapour monitoring well locations are shown on Figure 2.

6.2 Analytical Program

The analytical program for the vapour monitoring probes is summarized below:

- VOCs.
- Matrix gases including oxygen, carbon dioxide, methane, and nitrogen.
- BTEX and PHCs.
- Siloxanes.

7.0 RESULTS AND DISCUSSION

This section presents the results of the fieldwork conducted in 2019 at RDM and discussions of these results.

7.1 Groundwater Well Headspace Monitoring

Tetra Tech monitored the groundwater monitoring wells for measurements of CVCs and VOCs in well headspace using an RKI Eagle 2. During the June 2019 monitoring event, MW-01 was the only well monitored. CVCs were 190 parts per million (ppm) and VOCs were 12 ppm.

In December 2019, MW-04A, MW-04B, and MW-05 were added to the monitoring program. CVCs ranged from non-detect at most wells to 10 ppm at MW-01. VOCs were non-detect at most wells and 1 ppm at MW-01.

The volatile and combustible headspace concentrations for 2019 are presented in Table 1.

7.2 Groundwater Elevations

The measured groundwater levels and calculated groundwater elevations for 2019 are presented in Table 1.

Figure 3 presents the groundwater elevation trends (hydrographs) for the groundwater monitoring well. Overall, the groundwater elevation in 2019 at MW-01 slightly decreased from 2013.

In June 2019, water levels were only taken from MW-01 and the depth to groundwater was 3.96 mbg. The average depth to groundwater in December 2019 was 2.68 mbg, which included MW-01, MW-04A, MW-04B, and MW-05.

The groundwater elevations could not be contoured in June 2019 due to groundwater elevation data only being collected at MW-01. In December 2019, additional monitoring wells MW-04A, MW-04B, and MW-05 were added to the groundwater monitoring program; however, elevation survey data was not available for these wells, and groundwater elevations could not be contoured. Historically, the groundwater flow direction was indicated to be towards the northwest, towards Waskasoo Creek.

The groundwater elevations for MW-01 are shown on Figure 4 and Figure 5.

7.3 Groundwater Field Parameters

Field measurements for temperature, pH, and EC in December 2019 are shown in Table 2. A discussion of the results of the field tests is summarized in this section.

Groundwater temperatures ranged from 2.2°C (MW-05) to 6.6°C (MW-01).

Field pH values ranged from 7.81 (MW-05) to 8.40 (MW-04B) in 2019. Field pH differed from laboratory pH; the difference between field recorded and laboratory pH values may be due to limitations of the field equipment and differences in sample temperature.

In 2019, field EC measurements ranged from 1,282 µS/cm (MW-04B) to 2,213 µS/cm (MW-01). Field EC results were less than the laboratory measured EC results at MW-01 and MW-05, which may be due to limitations of the field equipment.

7.4 Groundwater Analytical Results

The groundwater analytical data for 2019 is summarized in Table 2. The 2019 laboratory analytical reports are included in Appendix D and historical tables are included in Appendix E.

Background Groundwater Quality

Monitoring well MW-02 was historically located on the upgradient portion of the site but could not be located in 2019 and is suspected to have been destroyed when a paved area east of the site was extended to the west.

The concentration of dissolved manganese in 2013 was 1.8 mg/L, greater than the 2019 Tier 1 Guidelines (0.05 mg/L). The concentration of manganese may be related to natural groundwater quality. The concentration of dissolved iron in 2013 was 0.11 mg/L, which is an order of magnitude less than most concentrations in 2019 (except for MW-04B). The concentration of chloride was 36 mg/L, and the concentration of sodium was 16 mg/L, which are an order of magnitude less than most wells at the site in 2019. Concentrations of BTEX, PHC fractions F1 and F2, and VOCs were less than the laboratory analytical detection limits.

Overall, the groundwater analytical results for MW-02 in 2013 do not suggest groundwater quality impacts related to MSW landfill leachate at the former background monitoring well location.

Routine Water Chemistry Parameters

In 2019, TDS concentrations ranged from 1,040 mg/L (MW-04B) to 1,840 mg/L (MW-04A). TDS concentrations were not available for 2013. TDS concentrations at all monitoring wells were greater than the Tier 1 Guidelines (500 mg/L).

Chloride is often considered a useful parameter to assess groundwater quality impacts associated with landfills, as chloride is generally present in elevated concentrations in leachate, and due to the mobile and conservative (non-reactive) nature of the ion. Chloride concentrations ranged from 6.8 mg/L at MW-04B to 450 mg/L at MW-04A. Concentrations of chloride exceeded the Tier 1 Guidelines (120 mg/L) at MW-01 (423 mg/L), MW-04A (450 mg/L), and MW-05 (167 mg/L).

Sodium concentrations were greater than guideline (200 mg/L) at monitoring wells MW-04A and MW-04B. Concentrations ranged from 177 mg/L at MW-05 to 284 mg/L at MW-04A. Historically, in 2013, sodium concentrations were less than the guideline.

Ammonia concentrations at the site in 2019 ranged from 0.306 mg/L at MW-04B to 7.1 mg/L and 7.2 mg/L at MW-01 and MW-05, respectively, in December 2019. These elevated concentrations of ammonia at MW-01 and MW-05 suggest groundwater quality impacts by MSW landfill leachate.

The two monitoring wells with the highest ammonia concentrations (MW-01 and MW-05) exhibit the lowest sulphate concentrations. This is expected to be an indication of anoxic (sulphate reducing) redox conditions, which are often observed in leachate impacted groundwater.

Dissolved Metals

Concentrations of dissolved arsenic were greater than the Tier 1 Guidelines (0.005 mg/L) at all monitoring wells in December 2019. Arsenic is known to be strongly adsorbed onto iron(hydr)oxides, and when these minerals dissolve, arsenic will also go into solution (Hem 1992). The concentrations of arsenic are likely correlated to the presence of dissolved iron and anoxic conditions due to leachate impacts. It should be noted that deep monitoring well MW-04B exhibited only a marginal arsenic exceedance and also exhibited low dissolved iron concentrations.

Iron and manganese are redox-sensitive parameters that naturally occur in groundwater under anoxic conditions and can help determine whether the groundwater quality is affected by biodegradation reactions, for instance related to landfill leachate. The dissolved manganese concentrations were greater than the Tier 1 Guidelines (0.05 mg/L) at all monitoring wells during the sampling event in 2019. The dissolved iron concentrations were greater than the Tier 1 Guidelines (0.30 mg/L) at most monitoring wells in 2019, with the exception of MW-04B.

Concentrations of dissolved copper in 2019 were marginally greater than the Tier 1 Guidelines (0.007 mg/L) at monitoring well MW-05 (0.00753 mg/L). Historically, dissolved copper concentrations have been less than the guideline.

The dissolved uranium concentration was greater than the guideline of 0.015 mg/L at MW-04A (0.0391 mg/L). Dissolved uranium concentrations may be naturally occurring and not necessarily of concern.

Organic Parameters

Concentrations of toluene, ethylbenzene, xylenes and PHC fractions F1 to F2 were less than the analytical detection limits at all monitoring wells. Benzene concentrations were detected at MW-01 (0.0006 mg/L) and MW-05 (0.00189 mg/L), but were less than the Tier 1 Guideline value of 0.005 mg/L. All other BTEX and PHCs results were less than the analytical detection limits.

Concentrations of AOX, volatile fatty/carboxylic acids were less than the analytical detection limits at all locations in December 2019.

In 2019, monitoring wells MW-01 (0.0124 mg/L) and MW-05 (0.0132 mg/L) had concentrations of vinyl chloride one order of magnitude greater than the Tier 1 Guidelines (0.0011 mg/L). Both monitoring wells that exhibited exceedances for vinyl chloride also had detectable concentrations of one or more other (chlorinated) VOCs for which Tier 1 Guidelines have not been established (e.g., the cis and trans isomers of 1,2-dichloroethene; 1,2-DCE). MW-04A also had a detectable concentration of 1,2-DCE (cis). Vinyl chloride and 1,2-DCE are breakdown products of dry-cleaning solvents and are commonly present in MSW leachate.

7.5 Soil Vapour Monitoring Results

The soil vapour monitoring results are presented in Table 3.

Pressures at all vapour wells were negligible during the monitoring events in 2019.

Concentrations of methane ranged from non-detect for all monitoring events in 2013 and 2019 at VW-02 to 26.0% in August 2013 and 11.7% in June 2019 at VW-01. The much lower concentration at VW-01 in December 2019 (non-detect) may be due to instrument detection errors and the concentrations at VW-01 should be confirmed in 2020. The elevated methane concentration is located in the northwest corner of the site, within the waste footprint, and an elevated reading was also detected at this well during monitoring in 2013.

The soil vapour wells were dry during the monitoring events in 2019; therefore, they were not considered to be blinded.

7.6 Soil Vapour Analytical Results

The attached Table 4 summarizes the soil vapour analytical results collected for 2019 and compares them to the soil vapour screening criteria protective of vapour intrusion into indoor air. The 2019 laboratory analytical reports are included in Appendix C.

BTEX and PHC fractions F1 and F2 (parameters with a TRV for inhalation) were compared against the screening criteria for residential land use, coarse-grained soil. BTEX, and/or PHC aliphatic and aromatic fractions that comprise F1 and F2 were detected at concentrations greater than the analytical detection limits in sample VW-01 and its duplicate (19DUP01). Soil vapour concentrations for sample VW-01 were between 2 and 13 times less than the soil vapour screening criteria, which are protective of vapour intrusion into indoor air. BTEX, and/or PHC aliphatic and aromatic fractions that comprise F1 and F2 were detected at concentrations greater than the analytical detection limits in samples VW-02; however, soil vapour concentrations were between 55 and 94,800 times less than the soil vapour screening criteria, which are protective of vapour intrusion into indoor air.

Siloxanes do not have TRV values for inhalation and were, therefore, not compared against the vapour screening criteria. Concentrations of siloxanes in samples VW-01 and VW-02 were not detected greater than the analytical detection limit.

Naphthalene was not detected at concentrations greater than the analytical detection limit.

VOCs (parameters with a TRV for inhalation) were compared against the screening criteria for residential land use, coarse-grained soil. 1,2-Dichloroethane and vinyl chloride were detected at concentrations exceeding the soil vapour screening criteria in sample VW-01 and its duplicate 19DUP01. Several parameters were detected greater than the analytical detection limits in sample VW-02. However, soil vapour concentrations were between 11 and

226,000 times less than the soil vapour screening criteria at VW-02, which are protective of vapour intrusion into indoor air.

Methane concentrations in the gas samples suggest that there may have been a field instrument error during the December event; at VW-01, methane concentrations in the sample (5.26%) were greater than the field measured value (non-detect) but were also detectable during the June field event (11.7%). The methane concentrations at VW-02 were consistent between the field sample and the monitoring events.

7.7 Quality Assurance/Quality Control

7.7.1 Methods

Tetra Tech's QA/QC procedures include reviewing the data collected for precision and accuracy and following the appropriate field protocols.

The field procedures for QA/QC involved:

- Changing nitrile gloves between sample collections;
- Using sample containers provided by the laboratory;
- Cleaning monitoring and sampling tools between sample locations;
- Filling sample containers for PHC analysis with no headspace (air) when the containers were closed;
- Collecting duplicate vapour sample during each event of the sampling program; and
- Documenting field procedures and sampling activities.

7.7.2 Results

The QA/QC results for vapour sampling are included in Table 5. The duplicate samples were submitted for analysis of the same parameters as the original samples.

The duplicate analysis is compared by relative percent difference (RPD). The RPD is calculated using the following equation:

$$\text{RPD} = \left[\frac{(V_1 - V_2)}{\frac{(V_1 + V_2)}{2}}\right] * 100\%$$

Where:

V_1 = Parent Sample

V_2 = Duplicate Sample

Chemical parameters were considered as having passed the QA/QC reproducibility procedure if the RPD was less than or equal to 20%, indicating a close correlation between the sample-duplicate pair.

RPD values were not calculated if one or both of the sample-duplicate concentrations were between the reportable detection limit (RDL) and five times the RDL. In these cases, chemical parameters were still considered as having passed the QA/QC reproducibility procedure if the sample-duplicate concentration difference was less than one RDL value.

Several duplicate RPDs were greater than 20%; the differences are assumed to be based on the duplicate collection methods, which involve two separate flow regulators for the Summa canisters, which may lead to different flow rates into the canister at times. Based on the QA/QC results, the sample methods and results are considered acceptable.

8.0 HAZARD QUOTIENT CALCULATIONS

Using the soil vapour screening levels described above and the soil vapour sampling results, estimated cancer risks (for carcinogens) and estimated hazard quotients (for non-carcinogens) were calculated for the site.

Estimated risks were calculated by dividing the soil vapour concentration by the corresponding soil vapour screening level for carcinogenic effects and multiplying the ratio by the target risk level of 1×10^{-5}. Similarly, the estimated hazard quotients (HQ) represent the soil vapour concentration divided by the corresponding soil vapour screening level for non-carcinogenic effects.

Risk estimates for non-carcinogenic COPCs are defined as HQ. Hazard quotients are calculated based on a ratio of the estimated exposure and the toxicity reference values identified as the tolerable daily intake (TDI) or tolerable concentration (TC) according to the following equation:

$$\text{Hazard Quotient} = \frac{\text{Estimated Daily Dose (mg/kg-day or mg/m}^3\text{)}}{\text{Tolerable Daily Intake (mg/kg-day) or Tolerable Concentration (mg/m}^3\text{)}}$$

Non-carcinogenic risk characterization in the assessment was completed for all COPCs.

When the HQ is greater than the target risk value, the scenario poses a potential concern and requires further evaluation or risk management. It is important to note that HQs greater than the target risk value do not necessarily indicate that adverse health effects will occur. This is because of the conservative assumptions used in estimating concentrations and in setting the target values. HQ that are less than the target risk value indicate that exposure is within acceptable levels and no further risk management is necessary. HQ greater than the target risk value suggest that further investigation or risk management (e.g., remediation) may be warranted.

For non-carcinogens, the individual target risk value used is 0.2 and the cumulative target risk value used is 1.0. This cumulative target risk value accounts for additional exposure to the chemicals of concern from sources other than the site. Therefore, the cumulative target risk value of 1.0 represents an allocation of 20% (the 0.2 target risk value from the individual compound) of a person's daily exposure from site sources and the remaining 80% would come from other sources. Other sources of exposure include ambient air, household products, and soil and water contact from locations other than the site.

For carcinogens, the risk of cancer is assumed to be proportional to dose with the assumption that any exposure results in a nonzero probability of risk. Carcinogenic risk probabilities were calculated by multiplying the estimated exposure level by the route-specific cancer slope factor (SF) or unit risk factor (URF) for each carcinogen:

$$R = E \times SF \text{ (or URF)}$$

Where:

R = Estimated individual excess lifetime cancer risk;

E = Exposure level for each chemical of potential concern (mg/kg/day or mg/m^3); and

SF = Route- and chemical-specific SF $(mg/kg/day)^{-1}$ or URF $((mg/m^3)^{-1})$.

Risk probabilities determined for each carcinogen were also considered to be additive over all exposure pathways so that an overall risk of cancer was estimated for each group of potentially exposed receptors.

When assessing risks posed by exposure to carcinogenic substances, Health Canada and other regulatory agencies assume that any level of exposure is associated with some hypothetical cancer risk. As a result, it is necessary for regulatory agencies to specify an acceptable risk level. Per Health Canada guidance (2010a, 2010b), cancer risks are deemed essentially negligible where the estimated cumulative incremental lifetime cancer risk is less than or equal to 1 in 100,000 (1×10^{-5}).

For this evaluation, cumulative target risk and hazard levels were determined in accordance with Alberta Tier 2 Guidelines. For carcinogens, the target risk level is 1×10^{-5}, as this value is considered by Health Canada to represent a negligible risk. This risk level applies to both individual compounds and a summation (i.e. cumulative) of individual compounds risks. For non-carcinogens a cumulative target hazard level of 1.0 is used as potential exposures that result in cumulative hazard indices equal to or less than 1.0 signify negligible potential for adverse health effects. For individual compounds, a hazard index of 0.2 was used. Each sampling location was screened individually for every chemical detected, and the results evaluated relative to both individual and cumulative risks and hazard levels.

The cumulative risk level for carcinogens in sample VW-02 was 1.8×10^{-6}. The cumulative risk levels for carcinogens in sample VW-01 and its duplicate ranged between 6.1×10^{-5} and 8.5×10^{-5}, which are greater than the target risk level of 1×10^{-5}. Chemical-specific risks greater than 1×10^{-5} for sample VW-01 included 1.9×10^{-5} for 1,2-dichloroethane and 6.6×10^{-5} for vinyl chloride.

The cumulative hazard level identified in sample VW-02 collected for the non-carcinogens was 0.082 and no individual hazard levels were greater than 0.2. The cumulative hazard level identified in sample VW-01 and its duplicate, collected for the non-carcinogens was between 2 and 3, which is greater than the cumulative target hazard level of 1. Several individual chemical hazards were also greater than 0.2. Table 6 summarizes the properties of the compounds being assessed. Table 7 summarizes the soil properties used for calculations. Table 8 summarizes the building properties used for the calculations and Table 9 presents the generic soil vapour criteria calculated. Table 10 presents the estimated risk and hazard for the volatile compounds that were detected in soil vapour.

1,1,2-Trichloroethane, bromodichloromethane, and 1,1,2,2,-tetrachloroethane at sampling location VW-01 were less than the detection limit but were associated with a detection limit greater than the screening level. As noted in the laboratory results, some detection limits were elevated due to matrix interference from the PHCs in the sample. It is not suspected that any of these chemicals are present at concentrations in excess of screening criteria.

As shown in Table 10, the estimated individual and cumulative risks and hazards associated with soil vapour sample VW-02 collected in December 2019 did not exceed the corresponding target risk and hazard levels. Table 10 also demonstrates that the estimated individual and cumulative risks and hazards associated with soil vapour sample VW-01 indicate a potential risk from vapour intrusion to indoor air. Soil vapour well VW-01 is located in the northwest corner of the site and is bounded by roads on the north and west. It is approximately 315 m from the nearest residential building and approximately 115 m from the nearest commercial building; however, utility corridors are present along the road rights-of-way, which could be a preferential pathway for the soil vapour. The distance to existing buildings would presumably result in a decrease in concentrations from this location.

9.0 EVALUATION OF SITE CONDITIONS

9.1 Summary of Site Conditions

Based on the 2019 and historical data for the site, there are concerns related to the former landfill operations at RDM. With respect to the groundwater quality, monitoring wells that are considered to be hydraulically down-gradient exhibit elevated concentrations of parameters that are typical of MSW leachate, including chloride, ammonia, and VOCs. Due to the proximity of Waskasoo Creek, the groundwater is expected to discharge to the west into Waskasoo Creek. Conversely, groundwater analytical results collected in 2013 for monitoring well MW-02, formerly located to the east and hydraulically upgradient, did not suggest MSW leachate impacts. However, upgradient monitoring well MW-02 should be replaced for comparison to the proposed surface water samples.

The concentrations identified in 2019 should be confirmed with an additional round of groundwater sampling, and a qualitative risk assessment should be conducted. In addition, the creek should be sampled at upstream and downstream locations to determine if the surface water quality is adversely impacted. It is recommended to collect upstream and downstream surface water samples during a spring/summer monitoring event for analysis of BTEX, PHC fractions F1 and F2, total metals, routine water chemistry, and VOCs. If the surface water sampling results exceed FAL guidelines and are interpreted to be related to MSW leachate impacts, additional sampling or assessment may be recommended.

Previous results from 2013 did not identify elevated landfill gas concentrations at the east side of the property (VW-02 and VW-03); however, elevated concentrations of methane were identified at VW-01 in 2013 and 2019. Further, elevated concentrations of several VOCs above the soil vapour screening criteria were measured at VW-01 in 2019. This well is located on the northwest corner of the property and the closest buildings to VW-01 are located approximately 80 m north, across 32 Street. Landfill gas concentrations at VW-01 should continue to be monitored and risk management measures as recommended below should be considered.

Based on monitoring results in 2013 for VW-03 (located at the northeast corner of the site) and VW-02 (located on the south portion of the site near the Northland Apartments building), and monitoring results for VW-02 in 2019, the potential risk associated with LFG to adjacent buildings to the east is considered low. The building nearest to VW-03 is a commercial building at a distance of approximately 100 m to the east that already existed in 2013; however, more recently a new commercial building was constructed south of that building and closer (approximately 50 m) to the historical waste disposal area.

Confirmation of vapour concentrations along this portion of the eastern site boundary is recommended. It is recommended to install a vapour well along east site boundary, approximately halfway between former VW-03 and existing VW-02 and assess potential vapour migration to the east.

The site does contain buried landfill waste and some risk management measures are required. Further, there are several elements of the site assessment data requiring further confirmation as detailed below.

9.2 Review of Mitigative Measures from Risk Management Plan

The 2014 RMP presented a proposed site-specific environmental risk management plan as a tool to assist with the review of future subdivision applications on lands lying within the regulated setback distance from the site (300 m). The focus was on potential ingress of soil gas for COPCs with a HQ greater than 1.0. Residential land use was considered most sensitive, and exposure ratings for other land uses (e.g. school, public institutions, commercial complexes) were considered to not be greater than residential; however, unique exceptions would have to be

reviewed and addressed on a site-specific basis (Tiamat, 2014). Further, underground utility workers and subsurface utility infrastructure were considered relevant to potential exposure.

The RMP applied a 10x factor of safety to the hazard quotients to address uncertainties. Hazard quotients from the RMP ranged up to 588,280 (including the 10x factor of safety). Based on these, the RMP then provided recommended generic mitigative measures based on the calculated HQs, ranging from passive to active measures, recognizing that the ultimate approach would require a design professional for the proposed development.

Following the 2014 RMP, CCME released the document "*A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures Via Inhalation of Vapours"* (CCME 2014), designed to provide guidance for developing site-appropriate soil vapour quality guidelines. The guidelines developed using the methods outlined in the CCME document were used for this current study and are included with the vapour sampling results in Table 4. Hazard quotients were calculated using estimated dose (based on concentrations measured at the site) and divided by tolerable daily intake. Soil vapour concentrations from the Phase II ESA conducted in 2013 were not compared to soil vapour quality guidelines, however spot checks of five target compounds with the highest HQs in the 2013 work (benzene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, cis-1,2-dichloroethene, and trans-1,2-dichloroethene) identified that the 2013 concentrations for soil vapour wells VW-02 and VW-03 would not have unacceptable HQs using the updated CCME methodology. Soil vapour well VW-01 would have unacceptable HQs using the updated CCME methodology for cis-1,2-dichloroethene, hexane, and vinyl chloride.

The 2014 RMP was prepared concurrent to RMPs at several other former City landfills, and a common set of mitigative measures was applied based on the HQs. Subsequent to the 2014 RMP and to the release of the CCME Protocol document, The City undertook additional assessment at another former City Landfill (Montfort); as part of that work, their consultant XCG Consulting Limited (XCG) revised the 2014 RMP criteria ranges for each generic mitigative measure category to include a Cancer Risk range to allow comparison of the 2014 RMP ranges with the HQ and Cancer Risks calculated by XCG[2]. From that work, XCG identified the following generic mitigative measures for developments within a 300 m setback of these landfills (based on Tiamat, 2014), and these have been adopted for this site:

Passive Measures

1. Passive Measures – Level A: for Cancer Risk of > $1E^{-5}$ and < $5E^{-5}$ and/or HQ >0.2 and <1.

   Compacted clay liner with a minimum thickness of 1m and confirmed maximum hydraulic conductivity of 10^{-6} cm/sec.

2. Passive Measures – Level B: for Cancer Risk of > $5E^{-5}$ and < $5E^{-4}$ and/or HQ >1 and <5.

   Synthetic liner with type of material, thickness and installation details dependent on the design professional.

3. Passive Measures – Level C: for Cancer Risk of > $5E^{-4}$ and < $1E^{-3}$ and/or HQ >5 and <50.

   Passive sub-slab depressurization (SSD) system with a minimum depressurization of 4 to 10 Pa. In some instances (such as a pervious subgrade), the actual depressurization necessary may require an active SSD or alternative active ventilation system.

[2] XCG Consulting Limited, 2018. Vapour Intrusion Assessment and Environmental Monitoring Report, prepared for the City of Red Deer's Montfort Landfill.

Active Measures

Field verify the presence of the identified chemicals of concern and other potential chemicals in the soil gas state at the development site. If confirmed, determine the most appropriate manner to prevent soil vapour intrusion.

1. Active Measures – Level D: for Cancer Risk of > $1E^{-3}$ and < $2E^{-3}$ and/or HQ values >50 and <100.

   Active SSD must be configured to compensate for depressurization of the building and have adequate negative pressure gradients across the entire footprint of the foundation.

2. Active Measures - Level E: for Cancer Risk of >$2E^{-3}$ and/or HQ values >100.

   Installation of geomembrane and active soil vapour extraction with system fault notification alarm.

For consistency with XCG's approach from 2017, we compared individual hazard quotients with the individual target hazard level (0.2). Based on the 2019 program, the greatest individual hazard quotient calculated for the site was 0.62 (vs target hazard level of 0.2), the greatest cumulative hazard quotient was 3.2 (vs target hazard level of 1.0), and the greatest estimated cancer risk was 6.6×10^{-5} (vs target Risk of 1.0×10^{-5}). While development at the site is not currently proposed, for illustrative purposes, based on these hazard quotients and cancer risk levels calculated from the 2019 vapour data, passive Level B measures would be required for development within the setback area. We note that the above is based on data collected at VW-01, and further recommendations for additional data collection on the east site perimeter are provided in Section 10.0.

Future applications for development within the setback are subject to review by The City. The developer's team would be responsible for reviewing and verifying the available data relative to their proposed development. The mitigative measures presented above are generic and can be used as a general guide for expectations by The City; ultimately, the developer's design engineer would be responsible for developing measures specific to the intended development based on the above or an appropriate equivalent. Protection of workers (e.g. construction and utility) should form part of any development plan.

10.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon the results of the groundwater and vapour monitoring and sampling conducted in 2019 and previous years, Tetra Tech has developed the following conclusions:

- The groundwater elevations in 2019 were not contoured due to inadequate data. MW-02 and MW-03 were not located during either monitoring event and the additional monitoring wells MW-04A, MW-04B, and MW-05 did not have available elevation data to calculate and interpret contours for the elevations. Historically groundwater flow was indicated to be to the northwest, towards Waskasoo Creek.
- Parameters that exceeded the Tier 1 Guidelines at one or more monitoring wells in 2019 included TDS, sodium, chloride, ammonia, and dissolved arsenic, copper, iron, manganese, and uranium. The VOC vinyl chloride was also greater than the Tier 1 Guideline. The measured concentrations of one or more of these parameters suggest leachate has impacted the groundwater quality at MW-01, MW-04A, and MW-05. The measured concentrations of these parameters were generally consistent with previous results.
- During the December 2019 sampling events, dissolved chloride concentrations greater than the Tier 1 Guidelines (120 mg/L) were measured at monitoring wells MW-01, MW-04A, and MW-05. The highest chloride concentration was 450 mg/L at MW-04A.
- Concentrations of toluene, ethylbenzene, xylenes, PHC fractions F1 to F2, AOX and volatile fatty/carboxylic acids in 2019 were less than the analytical detection limits at all groundwater monitoring wells. Benzene

concentrations were detected at MW-01 (0.0006 mg/L) and MW-05 (0.00189 mg/L) at concentrations less than the Tier 1 Guidelines value of 0.005 mg/L.

- Concentrations of vinyl chloride in the groundwater exceeded the Tier 1 Guidelines at MW-01 and MW-05 in December 2019. In addition, detectable concentrations of chlorinated VOCs for which no Tier 1 Guidelines is established (1,2-dichloroethene) were measured at MW-01, MW-04A, and MW-05.
- Concentrations of BTEX, PHCs, and VOCs in soil gas were less than the soil vapour screening criteria in sample VW-02.
- 1,2-dichloroethane and vinyl chloride in soil gas were greater than the soil vapour screening criteria in sample VW-01 and its duplicate.
- Siloxanes were not detected in the vapour samples collected.
- The estimated individual and / or cumulative risks and hazards associated with the soil vapour samples collected in December 2019 exceeded the corresponding target risk and hazard levels for sample VW-01. Further, methane concentrations greater than the lower explosive limit were measured in the headspace of this well during one event.
- The estimated individual and cumulative risks and hazards associated with the soil vapour sample collected from VW-02 in December 2019 did not exceed the corresponding target risk and hazard levels.
- Based on the above, the groundwater at interpreted hydraulically down-gradient locations (MW-01, MW-04A, and MW-05) was identified to exhibit leachate impacts. The groundwater at the fourth well (MW-04B), which is installed slightly deeper and adjacent to MW-04A, did not appear to exhibit impacts. One of the two vapour wells (VW-01, situated in the northwest corner of the site) exhibited impacts by LFG, as evidenced by elevated methane and VOCs. However, this is not identified as a concern related to current developments near the site. Should a change in development be contemplated, this conclusion may need to be revised.

Based upon the results of the groundwater and vapour monitoring program in 2019 and previous years, there are residual impacts to groundwater and vapours and buried landfill waste remains in place beneath the site and therefore ongoing risk management is required. Risk management is recommended to include additional assessment; ongoing monitoring; and administrative actions. The following recommendations are made according to these risk management elements:

- Ongoing Monitoring:
  - Continue the current semi-annual groundwater monitoring and annual sampling program at the site for another year to confirm concentrations measured to date and to monitor trends.
  - Monitoring wells MW-01, MW-04A, and MW-05 should be sampled for routine groundwater chemistry parameters, dissolved metals, BTEX, PHC fractions F1 and F2, and VOCs. Deeper monitoring well MW-04B does not exhibit obvious groundwater quality impacts and may be omitted from the program.
  - Survey the elevations of monitoring wells MW-04A, MW-04B, and MW-05 to establish the inferred groundwater flow direction.
  - Continued vapour monitoring including methane and pressures is considered warranted to confirm conditions. The suggested monitoring would include manual measurements of headspace pressures and methane concentrations, measured semi-annually (in conjunction with groundwater monitoring) in both groundwater and vapour wells; if an additional well is installed as recommended below, it should be included in this monitoring.

  - Based on the results of the soil vapour sample from VW-01, there is a potential vapour intrusion risk in the northwest corner of the site from VOCs. Continued vapour sampling of VW-01 in conjunction with the groundwater monitoring program should be conducted, and the additional well along the east boundary, if installed, should also be sampled. Further sampling of vapours in VW-02 is not considered warranted.

- Additional Assessment:

  - Install a vapour well along east site boundary, approximately halfway between former VW-03 and existing VW-02 to assess potential vapour migration to the east.

  - Replace background groundwater monitoring well MW-02 to provide additional groundwater data.

  - The extent and migration of leachate impacted groundwater is poorly defined to the west and northwest. Because Waskasoo Creek is considered to be a receptor, it is recommended to collect upstream and downstream surface water samples during a spring/summer monitoring event for analysis of BTEX, PHC fractions F1 and F2, total metals, routine water chemistry, and VOCs. If the surface water sampling results exceed FAL guidelines and are interpreted to be related to MSW leachate impacts, additional sampling or assessment may be recommended.

  - Based on the nature of thin soil cover identified in the earlier work by Tiamat, we suggest that during field monitoring events, a basic site walkover be conducted to evaluate for potential erosion, cracking, and/or exposed wastes. This information could be used to document whether potential repairs to the cap are warranted.

- Administrative Actions:

  - Utilize the revised generic mitigative measures when evaluating applications for development within the setback.

  - Ensure that the site is clearly identified within The City's Land Use Bylaw and appropriate administrative requirements are met for the site in accordance with City policies.

  - Ensure that the site is clearly identified within The City's utility mapping system. Elevated gas concentrations are present in the subsurface proximate to the 32 Street road right-of-way. Future activities in this vicinity (e.g. utility work, repairs, paving, etc.) should consider the potential presence of gas and a site-specific safety plan should be developed for work undertaken to limit the potential for exposure to site workers.

Further to the above recommendations, as noted the site remains an historical landfill. It presently appears to be well maintained and capped. The City should review this status on an ongoing basis to ensure that the cover remains intact and drainage remains positive; repairs or maintenance should be undertaken as required to maintain the site.

11.0 CLOSURE

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

Respectfully submitted,
Tetra Tech Canada Inc.

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PERMIT NUMBER: P013774
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

/dm/sy

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TABLES

Table 1: Groundwater Elevations

Monitoring Well		MW-01	MW-02	MW-03	MW-04A	MW-04B	MW05
Total Drilled Depth (m)		6.1	6.6	5.1	4.6	6.0	4.6
Top of Screened Interval (mbg)		1.5	-	-	-	-	-
Bottom of Screened Interval (mbg)		6.1	-	-	-	-	-
Stick up (m)		1.09	0.79	0.01	0.20	0.78	0.52
Ground Elevation (m)		874.01	877.30	877.30	-	-	-
TPC Elevation (m)		875.10	878.10	877.31	-	-	-
Depth to Groundwater (mBTPC)	Aug-13	4.17	3.03		-	-	-
	Jun-19	5.04	CNL	CNL	-	-	-
	Dec-19	5.37	CNL	CNL	2.97	1.80	3.18
Groundwater Elevation (m)	Aug-13	870.93	875.07	-	-	-	-
	Jun-19	870.06	-	-	-	-	-
	Dec-19	869.73	-	-	-	-	-
Combustible Vapour Concentrations* (CVCs) (ppm)	Jun-19	190	CNL	CNL	-	-	-
	Dec-19	10	CNL	CNL	ND	ND	ND
Volatile Organic Compounds* (VOCs) (ppm)	Jun-19	12	CNL	CNL	-	-	-
	Dec-19	1	CNL	CNL	ND	ND	ND

Notes:
mbg - metres below grade.
mBTPC - Metres below top of plastic pipe casing.
- Not monitored/information unavailable.
ND- non-detect
CNL - Could not locate.
ppm- parts per million
*- measured using an RKI Eagle II calibrated to hexane and isobutylene operated in methane elimination mode

Table 2: Groundwater Analytical Results

		Location Code	MW-01	MW-04A	MW-04B	MW-05
		Sample Date	6-Dec-2019	6-Dec-2019	6-Dec-2019	6-Dec-2019
		Lab Report Number	L2393429	L2393429	L2393429	L2393429
		Laboratory ID	L2393429-1	L2393429-2	L2393429-3	L2393429-4
Parameter	**Units**	**Tier 1 Guideline [1,2]**				
Field Testing						
Field Temperature	°C	-	6.55	5.52	4.59	2.18
Field Electric Conductivity	µS/cm	-	2,213	1,754	1,282	1,918
Field pH	pH Units	6.5 to 8.5	8.32	7.90	8.40	7.81
Routine						
pH	pH Units	6.5 to 8.5	7.71	8.10	7.80	7.76
Electrical Conductivity (EC)	µS/cm	-	2,220	1,250	1,260	1,930
Total Dissolved Solids (TDS)	mg/L	500	**1,300**	**1,840**	**1,040**	**1,060**
Hardness as $CaCO_3$	mg/L	-	811	1,140	201	812
Alkalinity (total as $CaCO_3$)	mg/L	-	564	559	881	581
Bicarbonate	mg/L	-	688	682	1,070	709
Carbonate	mg/L	-	<5.0	<5.0	<5.0	<5.0
Hydroxide	mg/L	-	<5.0	<5.0	<5.0	<5.0
Calcium	mg/L	-	161	249	49.8	161
Magnesium	mg/L	-	99.4	126	18.6	99.6
Potassium	mg/L	-	9.55	5.29	3.37	9.91
Sodium	mg/L	200	189	**284**	**256**	177
Chloride	mg/L	120	**423**	**450**	6.8	**167**
Fluoride	mg/L	1.5	0.12	0.14	0.35	<0.10
Phosphorus - Total	mg/L	-	1.72	0.761	0.085	2.29
Sulphate	mg/L	429 [3]	79.1	394	174	94.9
Ionic Balance	N/A	-	101	110	71.4	135
Nutrients						
Ammonia as N	mg/L	0.456 to 2.47 [6]	**7.2**	0.450	0.306	**7.1**
Nitrate (as NO_3-N)	mg/L	3	<0.10	<0.10	<0.10	<0.10
Nitrite (as NO_2-N)	mg/L	0.080 to 0.20 [4]	<0.050	<0.050	<0.050	<0.050
Nitrate and Nitrite (as N)	mg/L	-	<0.11	<0.11	<0.11	<0.11
Total Kjeldahl Nitrogen (TKN)	mg/L	-	9.9	10.9	0.51	8.9
Carbon						
Dissolved Organic Carbon (DOC)	mg/L	-	10.6	23.0	7.4	18.3
Dissolved Metals						
Aluminum	mg/L	0.050 [5]	0.0016	0.0027	0.0027	0.0028
Antimony	mg/L	0.006	<0.00010	0.00147	<0.00010	0.00021
Arsenic	mg/L	0.005	**0.0225**	**0.0146**	**0.00711**	**0.0134**
Barium	mg/L	1	0.604	0.0479	0.0228	0.794
Boron	mg/L	1.5	0.079	0.142	0.214	0.169
Cadmium	mg/L	0.00028 to 0.00037 [3]	0.0000142	0.0000150	0.0000275	0.0000461
Chromium	mg/L	0.05	0.00013	0.00023	<0.00010	0.00029
Copper	mg/L	0.007	0.00033	0.00358	0.00037	**0.00753**
Iron	mg/L	0.30	**24.4**	**1.23**	0.025	**7.43**
Lead	mg/L	0.0070 [3]	<0.000050	0.000225	<0.000050	0.000246
Manganese	mg/L	0.050	**1.91**	**0.732**	**0.178**	**1.28**
Mercury	mg/L	0.000005	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Nickel	mg/L	0.094 to 0.409 [3]	0.0135	0.0346	<0.00050	0.0262
Selenium	mg/L	0.002	0.000074	0.000172	<0.000050	0.000245
Silver	mg/L	0.0001	<0.000010	<0.000010	<0.000010	<0.000010
Uranium	mg/L	0.015	0.00196	**0.0391**	0.00217	0.00927
Zinc	mg/L	0.03	0.0015	0.0034	<0.0010	0.0060
Organics						
AOX	mg/L	-	ND	ND	ND	ND
Hydrocarbons						
Benzene	mg/L	0.005	0.00060	<0.00050	<0.00050	0.00189
Toluene	mg/L	0.021	<0.00050	<0.00050	<0.00050	<0.00050
Ethylbenzene	mg/L	0.0016	<0.00050	<0.00050	<0.00050	<0.00050
Xylenes (m & p)	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
Xylene (o)	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
Xylenes Total	mg/L	0.020	<0.00071	<0.00071	<0.00071	<0.00071
Styrene	mg/L	0.072	<0.00050	<0.00050	<0.00050	<0.00050
F1 (C_6-C_{10})	mg/L	-	<0.10	<0.10	<0.10	<0.10
F1 (C_6-C_{10}) - BTEX	mg/L	0.81	<0.10	<0.10	<0.10	<0.10
F2 (C_{10}-C_{16})	mg/L	1.1	<0.10	<0.10	<0.10	<0.10
Volatile Fatty/Carboxylic Acids						
Acetic Acid	mg/L	-	<10	<10	<10	<10
Butyric Acid	mg/L	-	<1.0	<1.0	<1.0	<1.0
Formic Acid	mg/L	-	<50	<50	<50	<50
Hexanoic Acid	mg/L	-	<1.0	<1.0	<1.0	<1.0
iso-Butyric Acid	mg/L	-	<1.0	<1.0	<1.0	<1.0
Isovaleric acid	mg/L	-	<1.0	<1.0	<1.0	<1.0
Propionic Acid	mg/L	-	<5.0	<5.0	<5.0	<5.0
Valeric Acid	mg/L	-	<1.0	<1.0	<1.0	<1.0

Notes:

[1] Alberta Environment and Parks (AEP). 2019. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land Policy Branch, Policy and Planning Division. 198 pp. Referenced guidelines are for coarse-textured soils under Residential/Parkland land use.

[2] Alberta Environment and Parks (AEP). Environmental Quality Guidelines for Alberta Surface Waters. March 2018. Table 1 Surface water quality guidelines for the protection of freshwater aquatic life (FAL). Most conservative values applied (chronic or acute).

[3] Guideline varies with hardness. Values shown based on site hardness range of 201 mg/L to 1140 mg/L.

[4] Guideline varies with chloride. Values shown based on site chloride range of 6.8 mg/L to 450 mg/L.

[5] Guideline varies with pH. Values shown based on site pH range of 7.81 to 8.40.

[6] Guideline varies with pH and temperature. Values shown based on pH range of 7.81 to 8.40 and temperature range of 2.18°C to 6.55°C.

"-" No applicable guideline.

"ND" Non-detected.

BOLD - Greater than Tier 1 Guideline.

N/A - Not applicable.

Table 2: Groundwater Analytical Results

		Location Code	MW-01	MW-04A	MW-04B	MW-05
		Sample Date	6-Dec-2019	6-Dec-2019	6-Dec-2019	6-Dec-2019
		Lab Report Number	L2393429	L2393429	L2393429	L2393429
		Laboratory ID	L2393429-1	L2393429-2	L2393429-3	L2393429-4
Parameter	**Units**	**Tier 1 Guideline [1,2]**				
Volatile Organic Compounds (VOCs)						
1,1,1,2-Tetrachloroethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
1,1,1-Trichloroethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
1,1,2,2-Tetrachloroethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
1,1,2-Trichloroethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
1,1-Dichloroethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
1,1-Dichloroethene	mg/L	0.014	<0.00050	<0.00050	<0.00050	<0.00050
1,1-Dichloropropene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
1,2,3-Trichlorobenzene	mg/L	0.008	<0.0010	<0.0010	<0.0010	<0.0010
1,2,3-Trichloropropane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
1,2,4-Trichlorobenzene	mg/L	0.015	<0.0010	<0.0010	<0.0010	<0.0010
1,2,4-Trimethylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dibromo-3-chloropropane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dibromoethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
1,2-Dichlorobenzene	mg/L	0.0007	<0.00050	<0.00050	<0.00050	<0.00050
1,2-Dichloroethane	mg/L	0.005	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichloroethene (cis)	mg/L	-	0.0096	0.0019	<0.0010	0.222
1,2-Dichloroethene (trans)	mg/L	-	0.00187	<0.00050	<0.00050	0.018
1,2-Dichloropropane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
1,3,5-Trimethylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
1,3-Dichlorobenzene	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
1,3-Dichloropropane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
1,3-Dichloropropene [cis]	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
1,3-Dichloropropene [trans]	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
1,4-Dichlorobenzene	mg/L	0.001	<0.00050	<0.00050	<0.00050	<0.00050
2,2-Dichloropropane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
2-Chlorotoluene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
4-Chlorotoluene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Bromobenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Bromochloromethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Bromodichloromethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
Bromoform	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
Bromomethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Carbon tetrachloride	mg/L	0.00057	<0.00050	<0.00050	<0.00050	<0.00050
Chlorobenzene	mg/L	0.0013	<0.00050	<0.00050	<0.00050	<0.00050
Chloroethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Chloroform	mg/L	0.018	<0.00050	<0.00050	<0.00050	<0.00050
Chloromethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Dibromochloromethane	mg/L	0.19	<0.00050	<0.00050	<0.00050	<0.00050
Dibromomethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
Dichlorodifluoromethane	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050
Hexachlorobutadiene	mg/L	0.0013	<0.0010	<0.0010	<0.0010	<0.0010
iso-Propylbenzene (cumene)	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Methylene Chloride	mg/L	0.05	<0.0010	<0.0010	<0.0010	<0.0010
n-Butylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
n-Propylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
p-Isopropyltoluene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
sec-Butylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
tert-Butylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Tetrachloroethene	mg/L	0.01	<0.00050	<0.00050	<0.00050	<0.00050
Trichloroethene	mg/L	0.005	<0.00050	<0.00050	<0.00050	<0.00050
Trichlorofluoromethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Vinyl chloride	mg/L	0.0011	**0.0124**	<0.00050	<0.00050	**0.0132**

Notes:

[1] Alberta Environment and Parks (AEP). 2019. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land Policy Branch, Policy and Planning Division. 198 pp. Referenced guidelines are for coarse-textured soils under Residential/Parkland land use.

[2] Alberta Environment and Parks (AEP). Environmental Quality Guidelines for Alberta Surface Waters. March 2018. Table 1 Surface water quality guidelines for the protection of freshwater aquatic life (FAL). Most conservative values applied (chronic or acute).

[3] Guideline varies with hardness. Values shown based on site hardness range of 201 mg/L to 1140 mg/L.

[4] Guideline varies with chloride. Values shown based on site chloride range of 6.8 mg/L to 450 mg/L.

[5] Guideline varies with pH. Values shown based on site pH range of 7.81 to 8.40.

[6] Guideline varies with pH and temperature. Values shown based on pH range of 7.81 to 8.40 and temperature range of 2.18°C to 6.55°C.

"-" No applicable guideline.
"ND" Non-detected.
BOLD - Greater than Tier 1 Guideline.
N/A - Not applicable.

Table 3: Soil Vapour Monitoring Results

Parameter	Gas Well								
	VW-01			VW-02			VW-03		
	Aug-13	Jun-19	Dec-19	Aug-13	Jun-19	Dec-19	Aug-13	Jun-19	Dec-19
Pressure (kPa)[1]		0.0	0.0		0.0	0.0		Could Not Locate	
CH_4 (%)	26.0	11.7	0.0	0.0	0.0	0.0	0.0		
CO (ppm)[2]	0.0	8.0	0.0	0.0	0.0	0.0	0.0		
CO_2 (%)	13.1	13.7	0.2	4.6	0.1	0.2	1.9		
O_2 (%)	8.4	3.3	20.9	17.2	19.9	21.3	19.8		
Balance (% v/v)	52.5	71.3	78.8	77.8	80.1	78.4	78.3		
Static Water Level (mbtoc)[3]		Dry	Dry		Dry	Dry			
Depth to Bottom (m)	3.50	4.31	4.12	4.60	5.63	3.37	4.00		
Stick up (m)		0.77	0.82		0.87	0.91			

Notes:

[1] Kpa - Kilopascal.

[2] ppm - Parts per million.

[3] mbtoc - Meters below top of casing.

N/A - Not applicable - well can not be accessed to obtain measurement or has a submerged screen (blinded).

Table 4: Soil Vapour Analytical Results

Location Code		**Generic Soil Vapour Criteria - Residential Coarse-Grained ($\mu g/m^3$)[1]**	VW-01		VW-02
Field ID			VW-01	19DUP01	VW-02
Sample Date			5-Dec-2019	5-Dec-2019	5-Dec-2019
Lab Report Number			L2393599	L2393599	L2393599
Laboratory ID			L2393599-1 / L2393599-4	L2393599-3	L2393599-2 / L2393599-5
Parameter	**Units**	**$\mu g/m^3$**			
Field Testing					
Air Volume	L		0.06	-	0.06
Initial Pressure	in Hg		-11.4	-9.6	-4.9
Aliphatic/Aromatic PHC Sub-Fractionation					
Aliphatics (C_6-C_8)	$\mu g/m^3$	740,737	56,400	56,200	1,300
Aliphatics (>C_8-C_{10})	$\mu g/m^3$	40,257	21,500	21,100	728
Aliphatics (>C_{10}-C_{12})	$\mu g/m^3$	40,257	9,920	9,690	179
Aliphatics (>C_{12}-C_{16})	$\mu g/m^3$	40,257	880	840	<30
Aromatics (>C_8-C_{10})	$\mu g/m^3$	805	<390	<360	<15
Aromatics (>C_{10}-C_{12})	$\mu g/m^3$	8,051	490	470	<15
Aromatics (>C_{12}-C_{16})	$\mu g/m^3$	8,051	<770	<730	<30
Linear & Cyclic Methyl Siloxanes					
Hexamethylcyclotrisiloxane, D3(CVMS)	$\mu g/m^3$	NG	<170	-	<170
Octamethylcyclotetrasiloxane, D4(CVMS)	$\mu g/m^3$	NG	<170	-	<170
Decamethylcyclopentasiloxane, D5(CVMS)	$\mu g/m^3$	NG	<170	-	<170
Dodecamethylcyclohexasiloxane, D6(CVMS)	$\mu g/m^3$	NG	<170	-	<170
Hexamethyldisiloxane, MM(LVMS)	$\mu g/m^3$	NG	<170	-	<170
Octamethyltrisiloxane, MDM(LVMS)	$\mu g/m^3$	NG	<170	-	<170
Decamethyltetrasiloxane, MD2M(LVMS)	$\mu g/m^3$	NG	<170	-	<170
Dodecamethylpentasiloxane, MD3M(LVMS)	$\mu g/m^3$	NG	<170	-	<170
Hydrocarbons					
Benzene	$\mu g/m^3$	195	<16	<15	1.4
Toluene	$\mu g/m^3$	124,220	<19	<17	1.31
Ethylbenzene	$\mu g/m^3$	34,330	<22	<20	<0.87
Xylenes (m & p)	$\mu g/m^3$	NG	<43	<39	<1.7
Xylene (o)	$\mu g/m^3$	NG	<22	<20	<0.87
Xylenes Total	$\mu g/m^3$	6,330	<48	<43	<2.0
Styrene	$\mu g/m^3$	3,220	<21	<19	<0.85
F1 (C_6-C_{10})	$\mu g/m^3$	867,383	62,900	62,500	1,720
F2 (C_{10}-C_{16})	$\mu g/m^3$	52,495	19,300	18,900	380
Alcohols					
Isopropanol	$\mu g/m^3$	6,219	<61	<56	<2.5
High Level Fixed Gases					
Nitrogen	%	NG	66.3	69.8	74.9
Oxygen	%	NG	7.04	7.49	20.3
Carbon Dioxide	%	NG	11.1	11.5	0.391
Carbon Monoxide	%	NG	<0.050	<0.050	<0.050
Methane	%	NG	5.26	5.46	<0.050
Hydrocarbon Gases (C_1-C_5)					
Methane	%	NG	-	-	0.00333
Ethane	%	NG	<0.00020	<0.00020	<0.00020
Ethene	%	NG	0.00026	0.00025	<0.00020
Propane	%	NG	<0.00020	<0.00020	<0.00020
Propene	%	NG	<0.00020	<0.00020	<0.00020
Butane	%	NG	<0.00020	<0.00020	<0.00020
Pentane	%	NG	0.00021	0.0002	<0.00020
Polycyclic Aromatic Hydrocarbons (PAHs)					
Naphthalene	$\mu g/m^3$	112	<66	<60	<2.6

Notes:

[1] Canadian Council of Ministers of the Environment (CCME). 2014. A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures via Inhalation of Vapours. Refer to Tables 6 to 9 for further information.

NG - No applicable criteria.

BOLD - Greater than criteria.

* = Detection limit raised above criteria.

Table 4: Soil Vapour Analytical Results

	Location Code	**Generic Soil Vapour Criteria - Residential Coarse-Grained ($\mu g/m^3$)[1]**	VW-01		VW-02
	Field ID		VW-01	19DUP01	VW-02
	Sample Date		5-Dec-2019	5-Dec-2019	5-Dec-2019
	Lab Report Number		L2393599	L2393599	L2393599
	Laboratory ID		L2393599-1 / L2393599-4	L2393599-3	L2393599-2 / L2393599-5
Parameter	**Units**	**$\mu g/m^3$**			
Volatile Organic Compounds (VOCs)					
1,1,1-Trichloroethane	$\mu g/m^3$	1,693,510	<27	<25	<1.1
1,1,2,2-Tetrachloroethane	$\mu g/m^3$	11	<34*	<31*	<1.4
1,1,2-Trichloroethane	$\mu g/m^3$	7	<27*	<25*	<1.1
1,1-Dichloroethane	$\mu g/m^3$	430	<20	<18	<0.81
1,1-Dichloroethene	$\mu g/m^3$	6,470	<20	<18	<0.79
1,2,4-Trichlorobenzene	$\mu g/m^3$	365	<37	<34	<1.5
1,2,4-Trimethylbenzene	$\mu g/m^3$	2,235	<25	<22	<0.98
1,2-Dibromoethane	$\mu g/m^3$	590	<38	<35	<1.5
1,2-Dichlorobenzene	$\mu g/m^3$	7,072	<30	<27	<1.2
1,2-Dichloroethane	$\mu g/m^3$	24	**45**	**33**	<0.81
1,2-Dichloroethene (cis)	$\mu g/m^3$	242	34	22	<0.79
1,2-Dichloroethene (trans)	$\mu g/m^3$	245	24	<18	<0.79
1,2-Dichloropropane	$\mu g/m^3$	135	<23	<21	<0.92
1,2-Dichlorotetrafluoroethane	$\mu g/m^3$	566,335	65	47	7.6
1,3,5-Trimethylbenzene	$\mu g/m^3$	2,235	172	126	<0.98
1,3-Butadiene	$\mu g/m^3$	17	<11	<10	<0.44
1,3-Dichlorobenzene	$\mu g/m^3$	64	<30	<27	<1.2
1,3-Dichloropropene [cis]	$\mu g/m^3$	163	<23	<21	<0.91
1,3-Dichloropropene [trans]	$\mu g/m^3$	149	<23	<21	<0.91
1,4-Dichlorobenzene	$\mu g/m^3$	64	<30	<27	<1.2
1,4-Dioxane	$\mu g/m^3$	105	<18	<16	<0.72
1-Methyl-4 ethyl benzene	$\mu g/m^3$	14,461	<25	<22	<0.98
2-Butanone (MEK)	$\mu g/m^3$	167,364	<15	<13	0.74
2-Hexanone (MBK)	$\mu g/m^3$	1,053	<100	<93	<4.1
4-Methyl-2-pentanone (MIBK)	$\mu g/m^3$	103	<20	<19	<0.82
Acetone	$\mu g/m^3$	918,788	<460	<320	9.0
Allyl chloride	$\mu g/m^3$	32	<16	<14	<0.63
Benzyl chloride	$\mu g/m^3$	34	<26	<24	<1.0
Bromodichloromethane	$\mu g/m^3$	28	<34*	<30*	<1.3
Bromoform	$\mu g/m^3$	1,494	<52	<47	<2.1
Bromomethane	$\mu g/m^3$	173	<19	<18	<0.78
Carbon disulfide	$\mu g/m^3$	21,713	<16	<14	2.75
Carbon tetrachloride	$\mu g/m^3$	113	<31	<29	<1.3
Chlorobenzene	$\mu g/m^3$	347	<23	<21	<0.92
Chloroethane	$\mu g/m^3$	31,019	<13	<12	<0.53
Chloroform	$\mu g/m^3$	27	<24	<22	<0.98
Chloromethane	$\mu g/m^3$	2,657	<10	<9.4	1.1
Cyclohexane	$\mu g/m^3$	201,510	6,700	6,450	45
Dibromochloromethane	$\mu g/m^3$	4,750	<43	<39	<1.7
Dichlorodifluoromethane	$\mu g/m^3$	3,584	31	<22	47.8
Ethyl acetate	$\mu g/m^3$	2,509	<18	<16	<0.72
Freon 113	$\mu g/m^3$	230,627	<38	<35	<1.5
Heptane	$\mu g/m^3$	14,461	4,210	2,880	16.5
Hexachlorobutadiene	$\mu g/m^3$	51	<53	<48	<2.1
Hexane	$\mu g/m^3$	18,839	11,700	11,600	79.8
Isooctane	$\mu g/m^3$	14,917	1,050	720	4.45
iso-Propylbenzene (cumene)	$\mu g/m^3$	14,461	<25	<22	<0.98
Methyl t-Butyl Ether (MTBE)	$\mu g/m^3$	1,153	<18	<16	<0.72
Methylene Chloride	$\mu g/m^3$	18,764	<17	<16	<0.69
Propene	$\mu g/m^3$	91,723	676	474	<0.34
Tetrachloroethene	$\mu g/m^3$	2,679	<34	<31	252
Tetrahydrofuran	$\mu g/m^3$	62,828	<15	<13	<0.59
Trichloroethene	$\mu g/m^3$	153	<27	<24	7.6
Trichlorofluoromethane	$\mu g/m^3$	34,325	<28	<26	60.2
Vinyl acetate	$\mu g/m^3$	6,586	<44	<40	<1.8
Vinyl bromide (bromoethene)	$\mu g/m^3$	94	<22	<20	<0.87
Vinyl chloride	$\mu g/m^3$	140	**926**	**664**	3.98

Notes:

[1] Canadian Council of Ministers of the Environment (CCME). 2014. A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures via Inhalation of Vapours. Refer to Tables 6 to 9 for further information.

NG - No applicable criteria.

BOLD - Greater than criteria.

* = Detection limit raised above criteria.

Table 5: Soil Vapour Quality Assurance/Quality Control Analytical Results

		Field ID	VW-01	19DUP01	RPD (%)
		Sample Date	5-Dec-2019	5-Dec-2019	
		Lab Report Number	L2393599	L2393599	
		Laboratory ID	L2393599-1 / L2393599-4	L2393599-3	
Parameter	**Units**	**RDL**			
Field Testing					
Air Volume	L	0.01	0.06	-	-
Initial Pressure	in Hg	-30	-11.4	-9.6	-
Aliphatic/Aromatic PHC Sub-Fractionation					
Aliphatics (C_6-C_8)	µg/m^3	15	56,400	56,200	0.4
Aliphatics (>C_8-C_{10})	µg/m^3	15	21,500	21,100	2
Aliphatics (>C_{10}-C_{12})	µg/m^3	15	9,920	9,690	2
Aliphatics (>C_{12}-C_{16})	µg/m^3	30	880	840	5
Aromatics (>C_8-C_{10})	µg/m^3	15	<390	<360	-
Aromatics (>C_{10}-C_{12})	µg/m^3	15	490	470	4
Aromatics (>C_{12}-C_{16})	µg/m^3	30	<770	<730	-
Linear & Cyclic Methyl Siloxanes					
Hexamethylcyclotrisiloxane, D3(CVMS)	µg/m^3	170	<170	-	-
Octamethylcyclotetrasiloxane, D4(CVMS)	µg/m^3	170	<170	-	-
Decamethylcyclopentasiloxane, D5(CVMS)	µg/m^3	170	<170	-	-
Dodecamethylcyclohexasiloxane, D6(CVMS)	µg/m^3	170	<170	-	-
Hexamethyldisiloxane, MM(LVMS)	µg/m^3	170	<170	-	-
Octamethyltrisiloxane, MDM(LVMS)	µg/m^3	170	<170	-	-
Decamethyltetrasiloxane, MD2M(LVMS)	µg/m^3	170	<170	-	-
Dodecamethylpentasiloxane, MD3M(LVMS)	µg/m^3	170	<170	-	-
Hydrocarbons					
Benzene	µg/m^3	0.64	<16	<15	-
Toluene	µg/m^3	0.75	<19	<17	-
Ethylbenzene	µg/m^3	0.87	<22	<20	-
Xylenes (m & p)	µg/m^3	1.7	<43	<39	-
Xylene (o)	µg/m^3	0.87	<22	<20	-
Xylenes Total	µg/m^3	2	<48	<43	-
Styrene	µg/m^3	0.85	<21	<19	-
F1 (C_6-C_{10})	µg/m^3	15	62,900	62,500	1
F2 (C_{10}-C_{16})	µg/m^3	15	19,300	18,900	2
Alcohols					
Isopropanol	µg/m^3	2.5	<61	<56	-
High Level Fixed Gases					
Nitrogen	%	1	66.3	69.8	5
Oxygen	%	0.1	7.04	7.49	6
Carbon Dioxide	%	0.05	11.1	11.5	4
Carbon Monoxide	%	0.05	<0.050	<0.050	-
Methane	%	0.05	5.26	5.46	4
Hydrocarbon Gases (C_1-C_5)					
Methane	%	0.0001	-	-	-
Ethane	%	0.0002	<0.00020	<0.00020	-
Ethene	%	0.0002	0.00026	0.00025	-
Propane	%	0.0002	<0.00020	<0.00020	-
Propene	%	0.0002	<0.00020	<0.00020	-
Butane	%	0.0002	<0.00020	<0.00020	-
Pentane	%	0.0002	0.00021	0.0002	-
Polycyclic Aromatic Hydrocarbons (PAHs)					
Naphthalene	µg/m^3	2.6	<66	<60	-
Volatile Organic Compounds (VOCs)					
1,1,1-Trichloroethane	µg/m^3	1.1	<27	<25	-
1,1,2,2-Tetrachloroethane	µg/m^3	1.4	<34	<31	-
1,1,2-Trichloroethane	µg/m^3	1.1	<27	<25	-
1,1-Dichloroethane	µg/m^3	0.81	<20	<18	-
1,1-Dichloroethene	µg/m^3	0.79	<20	<18	-
1,2,4-Trichlorobenzene	µg/m^3	1.5	<37	<34	-
1,2,4-Trimethylbenzene	µg/m^3	0.98	<25	<22	-
1,2-Dibromoethane	µg/m^3	1.5	<38	<35	-
1,2-Dichlorobenzene	µg/m^3	1.2	<30	<27	-
1,2-Dichloroethane	µg/m^3	0.81	45	33	31
1,2-Dichloroethene (cis)	µg/m^3	0.79	34	22	43
1,2-Dichloroethene (trans)	µg/m^3	0.79	24	<18	-
1,2-Dichloropropane	µg/m^3	0.92	<23	<21	-
1,2-Dichlorotetrafluoroethane	µg/m^3	1.4	65	47	32
1,3,5-Trimethylbenzene	µg/m^3	0.98	172	126	31
1,3-Butadiene	µg/m^3	0.44	<11	<10	-
1,3-Dichlorobenzene	µg/m^3	1.2	<30	<27	-
1,3-Dichloropropene [cis]	µg/m^3	0.91	<23	<21	-
1,3-Dichloropropene [trans]	µg/m^3	0.91	<23	<21	-
1,4-Dichlorobenzene	µg/m^3	1.2	<30	<27	-
1,4-Dioxane	µg/m^3	0.72	<18	<16	-
1-Methyl-4 ethyl benzene	µg/m^3	0.98	<25	<22	-
2-Butanone (MEK)	µg/m^3	0.59	<15	<13	-
2-Hexanone (MBK)	µg/m^3	4.1	<100	<93	-
4-Methyl-2-pentanone (MIBK)	µg/m^3	0.82	<20	<19	-
Acetone	µg/m^3	1.2	<460	<320	-
Allyl chloride	µg/m^3	0.63	<16	<14	-
Benzyl chloride	µg/m^3	1	<26	<24	-
Bromodichloromethane	µg/m^3	1.3	<34	<30	-
Bromoform	µg/m^3	2.1	<52	<47	-
Bromomethane	µg/m^3	0.78	<19	<18	-
Carbon disulfide	µg/m^3	0.62	<16	<14	-
Carbon tetrachloride	µg/m^3	1.3	<31	<29	-
Chlorobenzene	µg/m^3	0.92	<23	<21	-
Chloroethane	µg/m^3	0.53	<13	<12	-
Chloroform	µg/m^3	0.98	<24	<22	-
Chloromethane	µg/m^3	0.41	<10	<9.4	-
Cyclohexane	µg/m^3	3.4	6,700	6,450	4
Dibromochloromethane	µg/m^3	1.7	<43	<39	-
Dichlorodifluoromethane	µg/m^3	4.9	31	<22	-
Ethyl acetate	µg/m^3	0.72	<18	<16	-
Freon 113	µg/m^3	1.5	<38	<35	-

Notes:

-	Not analyzed or RPD not calculated.
<	Concentration is less than the laboratory detection limit indicated.
RDL	Laboratory Reportable Detection Limit.
RPD	RPD is Relative Percentage Difference calculated as RPD(%)=(|V1-V2|/[(V1+V2)/2])*100 where V1,V2 = concentrations of parent and duplicate sample, respectively. RPDs have only been calculated where a concentration is greater than 5 times the RDL.

Table 5: Soil Vapour Quality Assurance/Quality Control Analytical Results

		Field ID	VW-01	19DUP01	RPD (%)
		Sample Date	5-Dec-2019	5-Dec-2019	
		Lab Report Number	L2393599	L2393599	
		Laboratory ID	L2393599-1 / L2393599-4	L2393599-3	
Parameter	**Units**	**RDL**			
Volatile Organic Compounds (VOCs)					
Heptane	µg/m^3	0.82	4,210	2,880	38
Hexachlorobutadiene	µg/m^3	2.1	<53	<48	-
Hexane	µg/m^3	3.5	11,700	11,600	1
Isooctane	µg/m^3	0.93	1,050	720	37
iso-Propylbenzene (cumene)	µg/m^3	0.98	<25	<22	-
Methyl t-Butyl Ether (MTBE)	µg/m^3	0.72	<18	<16	-
Methylene Chloride	µg/m^3	0.69	<17	<16	-
Propene	µg/m^3	0.34	676	474	35
Tetrachloroethene	µg/m^3	6.8	<34	<31	-
Tetrahydrofuran	µg/m^3	0.59	<15	<13	-
Trichloroethene	µg/m^3	1.1	<27	<24	-
Trichlorofluoromethane	µg/m^3	5.6	<28	<26	-
Vinyl acetate	µg/m^3	1.8	<44	<40	-
Vinyl bromide (bromoethene)	µg/m^3	0.87	<22	<20	-
Vinyl chloride	µg/m^3	0.51	926	664	33

Notes:

-	Not analyzed or RPD not calculated.
<	Concentration is less than the laboratory detection limit indicated.
RDL	Laboratory Reportable Detection Limit.
RPD	RPD is Relative Percentage Difference calculated as RPD(%)=(|V1-V2|/[(V1+V2)/2])*100 where V1,V2 = concentrations of parent and duplicate sample, respectively. RPDs have only been calculated where a concentration is greater than 5 times the RDL.

Table 6: Chemical, Physical, and Toxicological Properties

Parameter		TC	RsC	H'	D_{air}	D_{water}	BAF	MF		
		Tolerable Concentration	Risk-specific concentration	Unitless Henry's Law Constant	Pure component molecular diffusivity in air	Pure component molecular diffusivity in water	Bioattenuation Factor	Mass Fraction in Soil (Coarse and Fine)	Mass Fraction in Soil Vapour - Coarse Soil	Mass Fraction in Soil Vapour - Fine Soil
Units		mg/m^3	mg/m^3	unitless	cm^2/s	cm^2/s	unitless	unitless	unitless	unitless
Benzene		--	0.003	0.225	0.088	1.00E-05	10	--	--	--
Toluene		3.8	--	0.274	0.087	9.20E-06	10	--	--	--
Ethylbenzene		1	--	0.358	0.075	8.50E-06	10	--	--	--
Xylenes		0.18	--	0.252	0.078	9.90E-06	10	--	--	--
Naphthalene		0.003	--	0.017	0.059	7.50E-06	10	--	--	--
F1	Aliphatic C>6-C8	18.4	--	50	0.05	0.00001	10	0.55	0.854	0.842
	Aliphatic C>8-C10	1	--	80	0.05	0.00001	10	0.36	0.141	0.153
	Aromatic C>8-C10	0.2	--	0.48	0.05	0.00001	10	0.09	0.005	0.005
F2	Aliphatic C>10-C12	1	--	120	0.05	0.00001	10	0.36	0.767	0.766
	Aliphatic C>12-C16	1	--	520	0.05	0.00001	10	0.44	0.205	0.206
	Aromatic C>10-C12	0.2	--	0.14	0.05	0.00001	10	0.09	0.023	0.023
	Aromatic C>12-C16	0.2	--	0.053	0.05	0.00001	10	0.11	0.005	0.005
1,1,1-Trichloroethane		5	--	0.688	0.078	0.000009	10	--	--	--
1,1,2,2-Tetrachloroethane		--	0.000172	0.019	0.071	0.000008	10	--	--	--
1,1,2-Trichloroethane		0.0002	0.000625	0.038	0.078	0.000009	10	--	--	--
1,1-Dichloroethane		--	0.006250	0.240	0.074	0.000011	10	--	--	--
1,1-Dichloroethene		0.2	--	0.942	0.090	0.000010	10	--	--	--
1,2,4-Trichlorobenzene		0.007	--	0.112	0.030	0.000008	10	--	--	--
1,2,4-Trimethylbenzene		0.06	--	0.230	0.061	0.000008	10	--	--	--
1,2-Dibromoethane		0.0093	0.016700	0.027	0.022	0.000012	10	--	--	--
1,2-Dichlorobenzene		0.2	--	0.072	0.069	0.000008	10	--	--	--
1,2-Dichloroethane		0.007	0.000385	0.049	0.104	0.000010	10	--	--	--
1,2-Dichloropropane		0.004	0.002703	0.110	0.078	0.000009	10	--	--	--
1,3,5-Trimethylbenzene		0.06	--	0.359	0.060	0.000008	10	--	--	--
1,3-Butadiene		0.002	0.000333	3.009	0.249	0.000011	10	--	--	--
1,3-Dichlorobenzene		0.095	0.000909	0.128	0.069	0.000008	10	--	--	--
1,4-Dichlorobenzene		0.095	0.000909	0.098	0.069	0.000008	10	--	--	--
1,4-Dioxane		0.03	0.002000	0.000	0.229	0.000010	10	--	--	--
2-Hexanone		0.03	--	0.004	0.070	0.000008	10	--	--	--
Acetone		31	--	0.002	0.124	0.000011	10	--	--	--
Allyl chloride		0.001	--	0.450	0.094	0.000011	10	--	--	--
Benzyl chloride		0.001	--	0.017	0.075	0.000008	10	--	--	--
Bromodichloromethane		--	0.000270	0.098	0.030	0.000011	10	--	--	--
Bromoform		--	0.009091	0.024	0.015	0.000010	10	--	--	--
Bromomethane		0.005	--	0.255	0.073	0.000012	10	--	--	--
Carbon Disulfide		0.7	--	0.705	0.104	0.000010	10	--	--	--
Carbon Tetrachloride		0.1	0.001667	1.183	0.078	0.000009	10	--	--	--
Chlorobenzene		0.01	--	0.148	0.073	0.000009	10	--	--	--
Chloroethane		1	--	0.073	0.271	0.000012	10	--	--	--
Chloroform		0.098	0.000435	0.154	0.104	0.000010	10	--	--	--
Chloromethane		0.09	--	0.388	0.126	0.000007	10	--	--	--
cis-1,2-Dichloroethene		0.007	--	0.302	0.074	0.000011	10	--	--	--
cis-1,3-Dichloropropene		0.02	0.002500	0.053	0.087	0.000010	10	--	--	--
Cyclohexane		6	--	7.618	0.080	0.000009	10	--	--	--
Dibromochloromethane		0.07	--	0.040	0.020	0.000011	10	--	--	--
Dichlorodifluoromethane		0.1	--	16.475	0.067	0.000010	10	--	--	--
4-Ethyltoluene		0.40	--	0.205	0.065	0.000007	10	--	--	--
Ethyl acetate		0.07	--	0.006	0.067	0.000010	10	--	--	--
Freon 113		5	--	21.500	0.038	0.000009	10	--	--	--
Freon 114		17	--	115.000	0.082	0.000009	10	--	--	--
Heptane		0.4	--	83.709	0.065	0.000007	10	--	--	--
Hexachlorobutadiene		--	0.000455	0.421	0.027	0.000007	10	--	--	--
Isooctane		0.4	--	30.500	0.060	0.000007	10	--	--	--
Isopropyl alcohol		0.2	--	0.000331	0.103	0.000011	10	--	--	--
Isopropylbenzene		0.4	--	0.591	0.065	0.000007	10	--	--	--
Methyl ethyl ketone		5	--	0.001	0.081	0.000010	10	--	--	--
Methyl isobutyl ketone		0.003	--	0.006	0.075	0.000008	10	--	--	--
Methylene chloride		0.6	1	0.151	0.101	0.000012	10	--	--	--
MTBE		0.037	--	0.028	0.102	0.000011	10	--	--	--
n-Hexane		0.7	--	73.916	0.200	0.000008	10	--	--	--
Propylene		3	--	8.013	0.110	0.000011	10	--	--	--
Styrene		0.092	--	0.130	0.071	0.000008	10	--	--	--
Tetrachloroethylene		0.36	0.038462	1.077	0.072	0.000008	10	--	--	--
Tetrahydrofuran		2	--	0.003	0.099	0.000011	10	--	--	--
trans-1,2-Dichloroethene		--	--	0.277	0.071	0.000012	10	--	--	--
trans-1,3-Dichloropropene		0.02	0.002500	0.053	0.087	0.000010	10	--	--	--
Trichloroethylene		0.04	0.002439	0.477	0.079	0.000009	10	--	--	--
Trichlorofluoromethane		1.05	--	5.200	0.087	0.000010	10	--	--	--
Vinyl acetate		0.2	--	0.024	0.085	0.000009	10	--	--	--
Vinyl bromide		0.003	--	0.260	0.100	0.000012	10	--	--	--
Vinyl chloride		0.1	0.002273	3.236	0.106	0.000012	10	--	--	--
Hydrogen Sulfide		0.002	--	0.350	0.188	0.000022	10	--	--	--

Notes:

cm^2/s Square centimetres per second.
F1 Fraction 1 (C6-C10).
F2 Fraction 2 (C>10-C16).
mg/m^3 Milligrams per cubic metre.
PHC Petroleum hydrocarbon.
-- Not applicable.

References: Canadian Council of Ministers of the Environment (CCME). 2014. A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures via Inhalation of Vapours.

Table 7: Soil Properties for Evaluation of Vapour Transport

Parameter		Units	Coarse-Grained Soil	Fine-Grained Soil
θ_a	Vapour-filled porosity	unitless	0.31	0.303
ρ_b	Dry bulk density	g/cm^3	1.7	1.4
n	Total soil porosity	unitless	0.36	0.47
θ_w	Moisture-filled porosity	unitless	0.05	0.167
Q_{soil}	Soil gas flow rate	cm^3/s	167	16.7

Notes:

Values from CCME (2014).

cm Centimetre.

cm^2 Square centimetre.

g/cm^3 Grams per cubic centimetre.

PHC Petroleum hydrocarbon.

References: Canadian Council of Ministers of the Environment (CCME). 2014. A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures via Inhalation of Vapours.

Table 8: Building Properties for Evaluation of Vapour Transport

Parameter		Units	Residential Land Use
			Basement
L_B	Building length	cm	1,225
W_B	Building width	cm	1,225
A_B	Building area exposed to soil, including basement wall area	cm^2	2.7E+06
H_B	Building height	cm	360
L_{crack}	Thickness of the foundation	cm	11.25
A_{crack}	Area of cracks through which contaminant vapours enter the building	cm^2	994.5
ACH	Air exchanges per hour	h^{-1}	0.5

Notes:

Values taken from CCME (2014).

cm Centimetre.

cm^2 Square centimetre.

h^{-1} Per hour.

References: Canadian Council of Ministers of the Environment (CCME). 2014. A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures via Inhalation of Vapours.

Table 9: Generic Soil Vapour Criteria

Parameter	Residential Land Use Basement and Slab-on-Grade			
	Units	Coarse-Grained	Units	Coarse-Grained
Benzene	mg/m^3	0.195	µg/m^3	195
Toluene		124		124,220
Ethylbenzene		34		34,330
Xylenes		6		6,330
PHC F1		867		867,380
PHC F2		53		52,500
Naphthalene		0.112		112
Isopropanol		6.22		6,219
1,1,1-Trichloroethane		1,694		1,693,510
1,1,2,2-Tetrachloroethane		0.01		11
1,1,2-Trichloroethane		0.01		7
1,1-Dichloroethane		0.43		430
1,1-Dichloroethene		6.47		6,470
1,2,4-Trichlorobenzene		0.36		365
1,2,4-Trimethylbenzene		2.23		2,235
1,2-Dibromoethane		0.59		590
1,2-Dichlorobenzene		7.07		7,072
1,2-Dichloroethane		0.02		24
1,2-Dichloroethene (cis)		0.24		242
1,2-Dichloroethene (trans)		NG		NG
1,2-Dichloropropane		0.14		135
1,3,5-Trimethylbenzene		2.23		2,235
1,3-Butadiene		0.02		17
1,3-Dichlorobenzene		0.06		64
1,3-Dichloropropene [cis]		0.16		163
1,3-Dichloropropene [trans]		0.15		149
1,4-Dichlorobenzene		0.06		64
1,4-Dioxane		0.11		105
1-Methyl-4 ethyl benzene		14.46		14,461
2-Butanone (MEK)		167		167,364
2-Hexanone (MBK)		1.05		1,053
4-Methyl-2-pentanone (MIBK)		0.1		103
Acetone		919		918,788
Allyl chloride		0.03		32
Benzyl chloride		0.03		34
Bromodichloromethane		0.03		28
Bromoform		1.49		1,494
Bromomethane		0.17		173
Carbon disulfide		21.71		21,713
Carbon tetrachloride		0.11		113
Chlorobenzene		0.35		347
Chloroethane		31		31,019
Chloroform		0.03		27
Chloromethane		2.66		2,657
Cyclohexane		202		201,510
Dibromochloromethane		4.75		4,750
Dichlorodifluoromethane		3.58		3,584
Ethyl acetate		2.51		2,509
Freon 113		231		230,627
Freon 114		566.00		566,335
Heptane		14.46		14,461
Hexachlorobutadiene		0.05		51
Hexane		18.84		18,839
Isooctane		14.92		14,917
iso-Propylbenzene (cumene)		14.46		14,461
Methyl t-Butyl Ether (MTBE)		1.15		1,153
Methylene Chloride		18.76		18,764
Propylene		92		91,723
Styrene		3.22		3,220
Tetrachloroethene		2.68		2,679
Tetrahydrofuran		62.83		62,828
Trichloroethene		0.15		153
Trichlorofluoromethane		34.32		34,325
Vinyl acetate		6.59		6,586
Vinyl bromide (bromoethene)		0.09		94
Vinyl chloride		0.14		140

Notes:

mg/m^3 Milligrams per cubic metre.
µg/m^3 Micrograms per cubic metre.

Table 10: Soil Vapour Risk Evaluation

Parameter	Unit	Soil Vapour Screening Criteria [a]	Soil Vapour Results (µg/m^3)			Comparisons of Soil Vapour Measurements to Soil Vapour Criteria					
						Estimated Cancer Risk [b]			Estimated Hazard Quotients [c]		
			VW-01	19DUP-01	VW-02	VW-01	19DUP-01	VW-02	VW-01	19DUP-01	VW-02
Benzene	µg/m^3	195	<16	<15	1.4	ND	ND	7.2E-08	--	--	--
Toluene	µg/m^3	124,220	<19	<17	1.31	-	-	-	ND	ND	1.05E-05
F1 (C_6-C_{10})	µg/m^3	867,383	62,900	62,500	1720	-	-	-	7.25E-02	7.21E-02	1.98E-03
F2 (C_{10}-C_{16})	µg/m^3	52,495	19,300	18,900	380	-	-	-	3.68E-01	3.60E-01	7.24E-03
Aliphatics (C_6-C_8)	µg/m^3	740,737	56,400	56,200	1300	-	-	-	7.61E-02	7.59E-02	1.76E-03
Aliphatics (>C_8-C_{10})	µg/m^3	40,257	21,500	21,100	728	-	-	-	5.34E-01	5.24E-01	1.81E-02
Aliphatics (>C_{10}-C_{12})	µg/m^3	40,257	9,920	9,690	179	-	-	-	2.46E-01	2.41E-01	4.45E-03
Aliphatics (>C_{12}-C_{16})	µg/m^3	40,257	880	840	<30	-	-	-	2.19E-02	2.09E-02	ND
Aromatics (>C_{10}-C_{12})	µg/m^3	8,051	490	470	<15	-	-	-	6.09E-02	5.84E-02	ND
1,2-Dichloroethane	µg/m^3	217 / 24[e]	45	33	<0.81	1.9E-05	1.4E-05	ND	2.07E-01	1.52E-01	ND
1,2-Dichloroethene (cis)	µg/m^3	242	34	22	<0.79	-	-	-	1.41E-01	9.10E-02	ND
1,2-Dichloroethene (trans)	µg/m^3	245	24	<18	<0.79	-	-	-	9.80E-02	ND	ND
1,2-Dichlorotetrafluoroethane	µg/m^3	566,335	65	47	7.6	-	-	-	1.15E-04	8.30E-05	1.34E-05
1,3,5-Trimethylbenzene	µg/m^3	2,235	172	126	<0.98	-	-	-	7.70E-02	5.64E-02	ND
2-Butanone (MEK)	µg/m^3	167,364	<15	<13	0.74	-	-	-	ND	ND	4.42E-06
Acetone	µg/m^3	918,788	<460	<320	9.0	-	-	-	ND	ND	9.80E-06
Carbon disulfide	µg/m^3	21,713	<16	<14	2.75	-	-	-	ND	ND	1.27E-04
Chloromethane	µg/m^3	2,657	<10	<9.4	1.1	-	-	-	ND	ND	4.14E-04
Cyclohexane	µg/m^3	201,510	6,700	6,450	45	-	-	-	3.32E-02	3.20E-02	2.23E-04
Dichlorodifluoromethane	µg/m^3	3,584	31	<22	47.8	-	-	-	8.65E-03	ND	1.33E-02
Heptane	µg/m^3	14,461	4,210	2,880	16.5	-	-	-	2.91E-01	1.99E-01	1.14E-03
Hexane	µg/m^3	18,839	11,700	11,600	79.8	-	-	-	6.21E-01	6.16E-01	4.24E-03
Isooctane	µg/m^3	14,917	1,050	720	4.45	-	-	-	7.04E-02	4.83E-02	2.98E-04
Propene	µg/m^3	91,723	676	474	<0.34	-	-	-	7.37E-03	5.17E-03	ND
Tetrachloroethene	µg/m^3	12,535 / 2,679[e]	<34	<31	252	ND	ND	9.4E-07	ND	ND	2.01E-02
Trichloroethene	µg/m^3	1,349 / 153[e]	<27	<24	7.6	ND	ND	5.0E-07	ND	ND	5.63E-03
Trichlorofluoromethane	µg/m^3	34,325	<28	<26	60.2	-	-	-	ND	ND	1.75E-03
Vinyl chloride	µg/m^3	3,086 / 140[e]	926	664	3.98	6.6E-05	4.7E-05	2.8E-07	3.00E-01	2.15E-01	1.29E-03
Cumulative Risk and Hazard Index [d]						**8.5E-05**	**6.1E-05**	1.8E-06	**3.235**	**2.767**	0.082
Target Risk and Hazard Levels						**1.0 x 10^{-5}**			**1.00**		

Notes:

< – not detected. Listed value is the corresponding detection limit.

- = screening criteria not calculated as appropriate toxicity data not available.

Bold = identifies estimated risks and hazards that exceed the target risk level of 1 x 10^{-5} or target hazard level of 1.

[a] Listed soil vapour screening criteria derived in accordance with CCME, 2014.

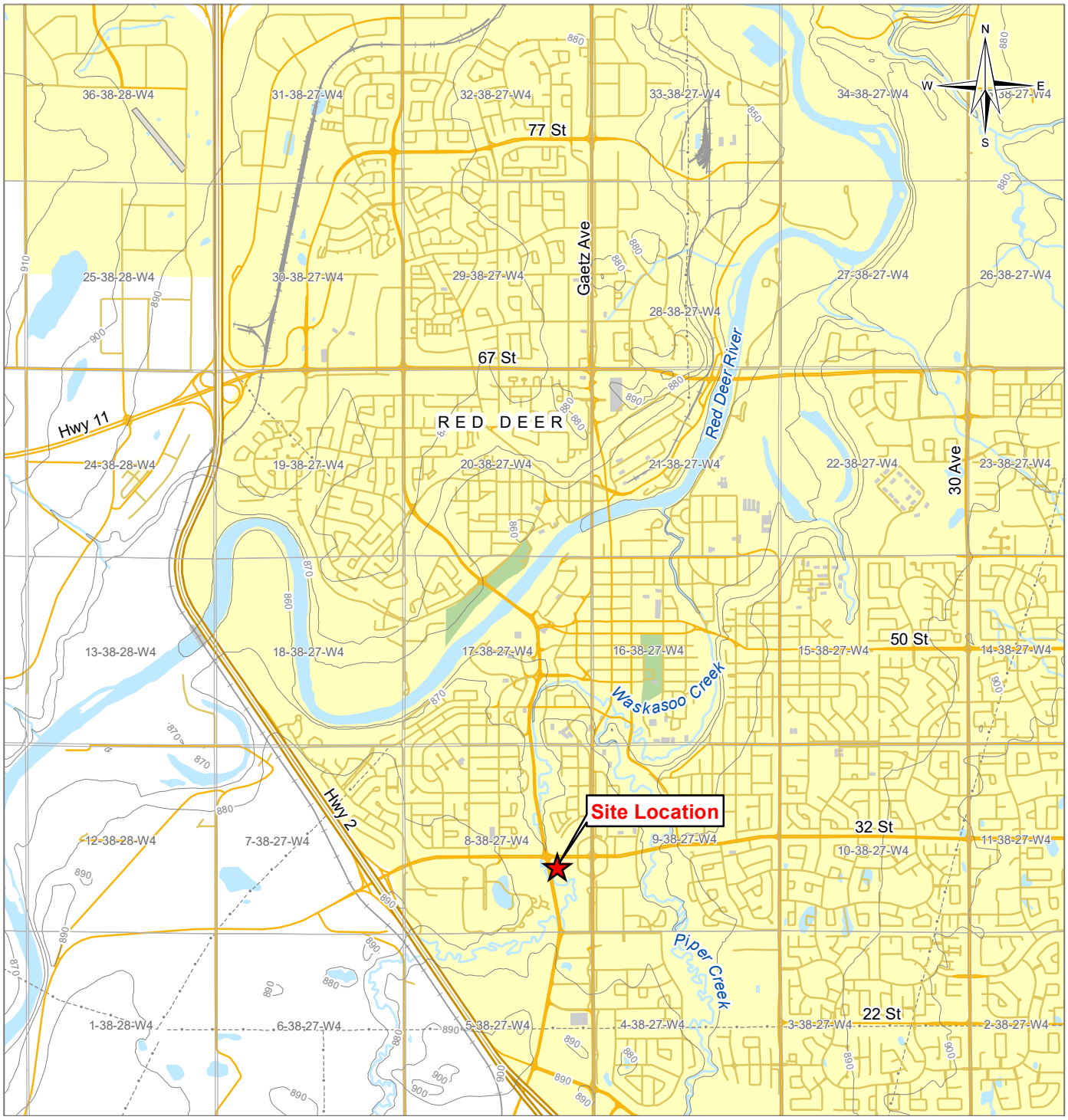
[b] Estimated cancer risk = (soil vapour concentration/cancer soil vapour screening level) x 10^{-5}.

[c] Estimated hazard quotient = (soil vapour concentration/non-cancer soil vapour screening level).

[d] Cumulative risk and hazard index represent the sum of chemical-specific cancer risks and hazard quotients.

[e] Soil vapour screening criteria shows both the threshold criteria and non-threshold criteria. Target risk and hazard levels are calculated with the appropriate criteria.

FIGURES



LEGEND

- Site Location
- Highway
- Main Road
- Local Road
- Resource/Recreational Road
- Railway
- Power Line
- Runway
- Building
- Park
- Residential Area
- Contour (10 m)
- Watercourse
- Waterbody
- Urban Area

NOTES
Base data source: CanVec 1:50,000.

STATUS
ISSUED FOR USE

2019 GROUNDWATER AND SOIL VAPOUR MONITORING REPORT RED DEER MOTORS

Site Location Plan

PROJECTION	DATUM	CLIENT
3TM 114	NAD83	The City of Red Deer

Scale: 1:50,000
1 0.5 0 1
Kilometres

FILE NO. SWOP04071-01_Figure1_SiteLocation.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-EDM	MRV	SL	MR	0

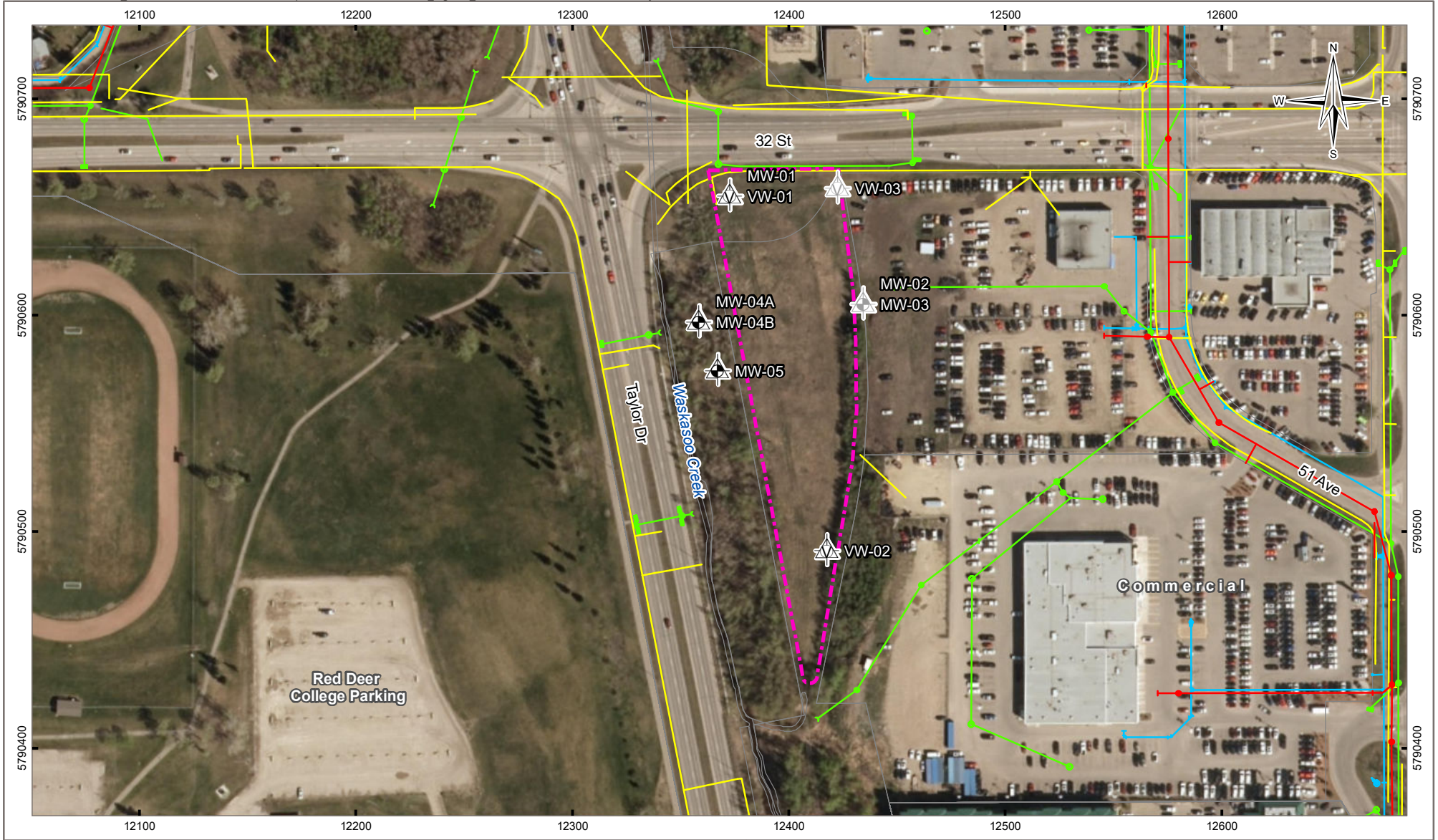
DATE	PROJECT NO.
October 14, 2020	SWM.SWOP04071-01.006

TETRA TECH

Figure 1

Q:\Edmonton\GIS\SOLID_WASTE\SWOP\SWOP04071-01\Maps\Task006\SWOP04071-01_Figure1_SiteLocation.mxd modified 2020-10-14 by Darren.Schouls

Q:\Edmonton\GIS\SOLID_WASTE\SWOP\SWOP04071-01\Maps\Task006\SWOP04071-01_Figure2_LandUse.mxd modified 2020-10-14 by Darren.Schouls



LEGEND

- Monitoring Well - Faded symbol indicates a presumably destroyed well
- Vapour Well - Faded symbol indicates a presumably destroyed well
- Historic Waste Disposal (Provided by Tiamat, 2014)
- Lot Boundary

Utilities

- Electrical
- Sanitary
- Storm
- Water

NOTES

Base data source: Imagery provided by ESRI; Red Deer County (2018)
Roads from City of Red Deer Open Data, 2018
Utilities provided by City of Red Deer.
Locations have not been field verified, and should not be used for construction or other intrusive field activities.
MW-02, MW-03, and VW-03 were not located

STATUS
ISSUED FOR USE

Scale: 1:2,500

50 25 0 50

Metres

PROJECTION	DATUM
3TM 114	NAD83

FILE NO.
SWOP04071-01_Figure2_LandUse.mxd

CLIENT
The City of Red Deer

TETRA TECH

2019 GROUNDWATER AND SOIL VAPOUR MONITORING REPORT RED DEER MOTORS

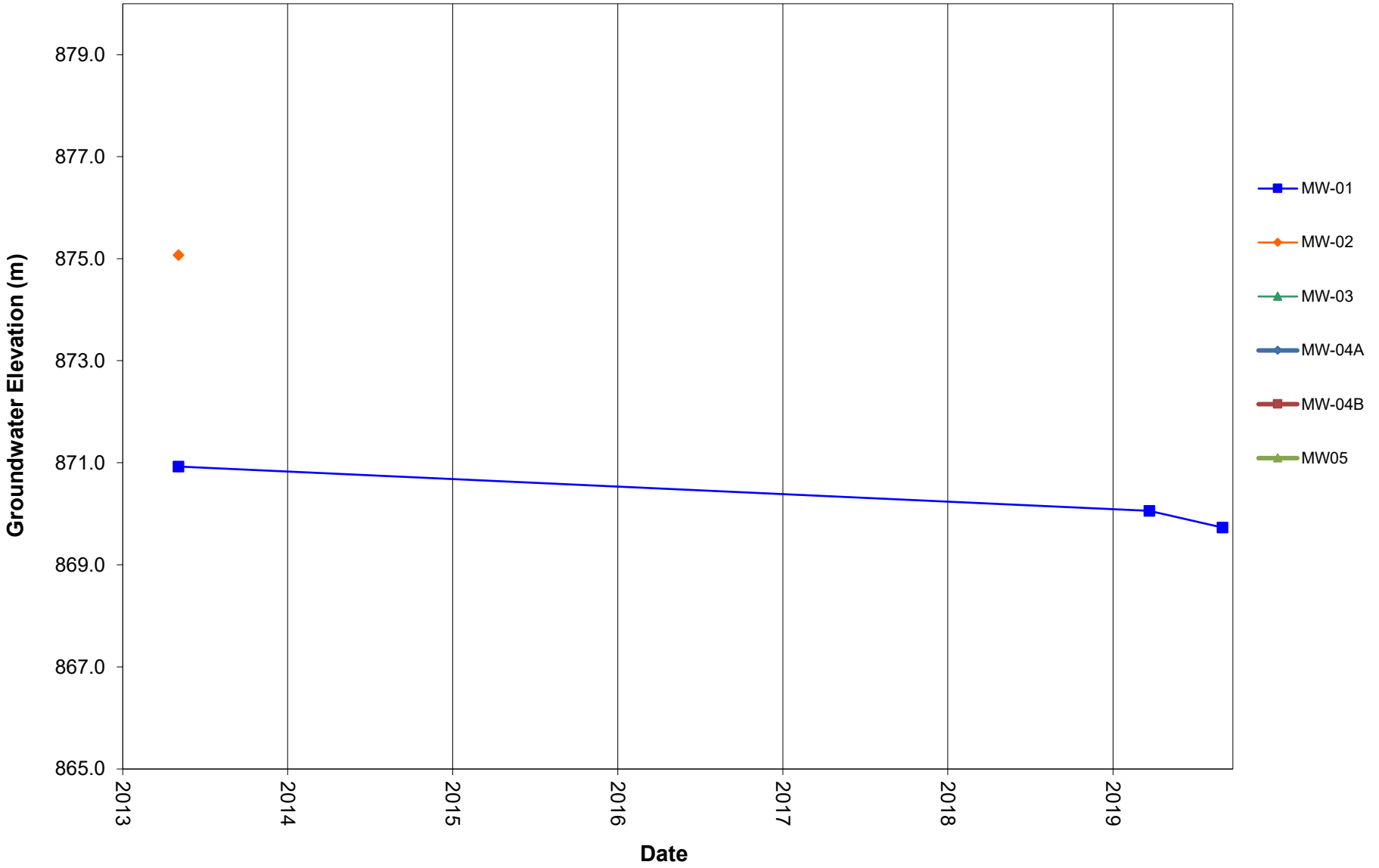
Site Plan and Surrounding Land Use

OFFICE	DWN	CKD	APVD	REV
Tt-EDM	MRV	SL	MR	0

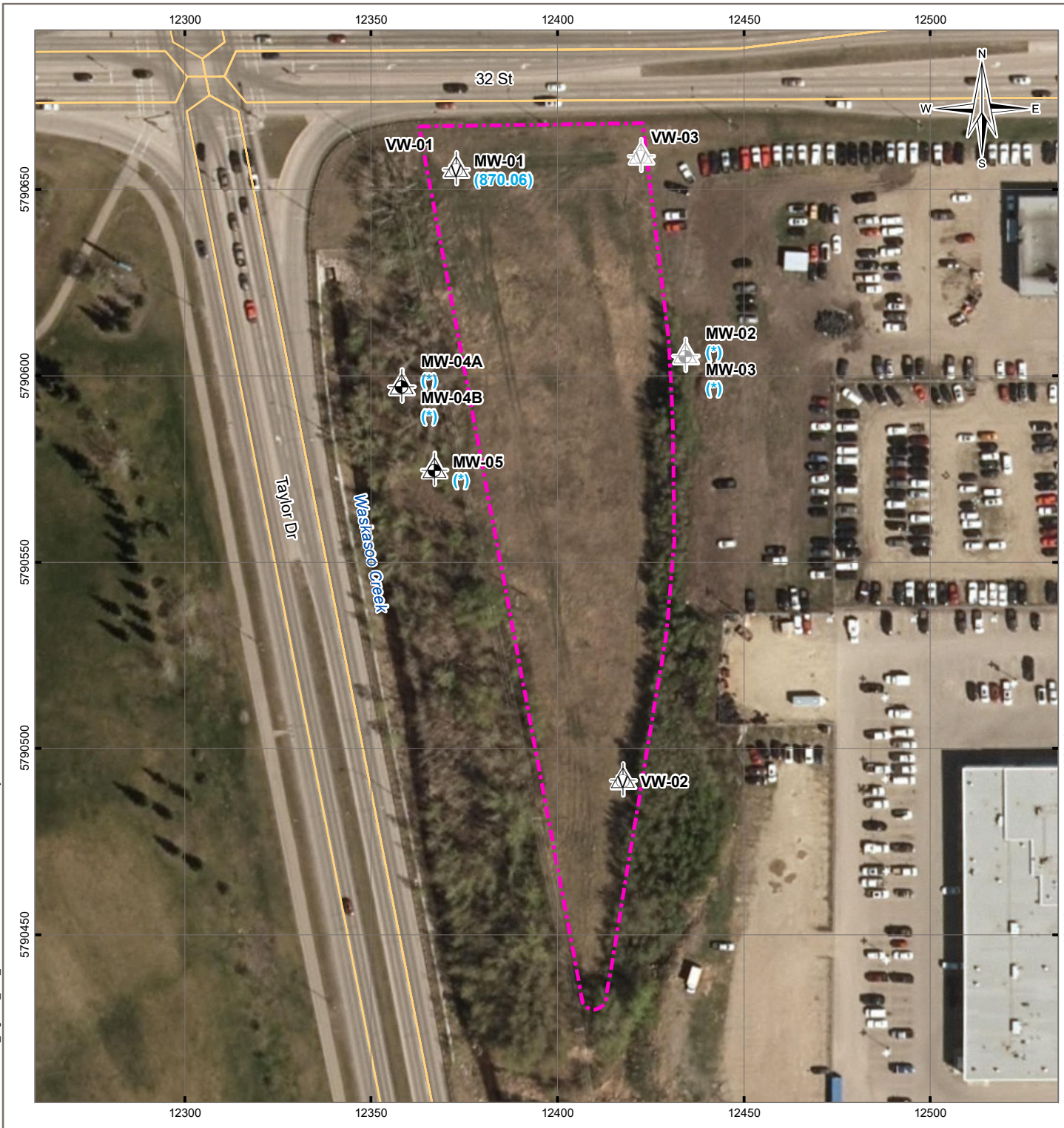
DATE	PROJECT NO.
October 14, 2020	SWM.SWOP04071-01.006

Figure 2

FIGURE 3
HISTORICAL GROUNDWATER ELEVATIONS
(GROUNDWATER MONITORING WELLS)



TETRA TECH



LEGEND

- Monitoring Well
- Presumably Destroyed Monitoring Well
- Vapour Well
- Presumably Destroyed Vapour Well
- (8XX.XX) Groundwater Elevation (masl)
- Historic Waste Disposal (Provided by Tiamat, 2014)
- Road

NOTES
Base data source: Imagery provided by ESRI; Red Deer County (2018)
Roads from City of Red Deer Open Data, 2018
MW-02, MW-03, and VW-03 were not located
masl - metres above sea level
* - not measured

STATUS
ISSUED FOR USE

2019 GROUNDWATER AND SOIL VAPOUR MONITORING REPORT RED DEER MOTORS

Groundwater Elevations June 2019

PROJECTION	DATUM	CLIENT
3TM 114	NAD83	The City of Red Deer

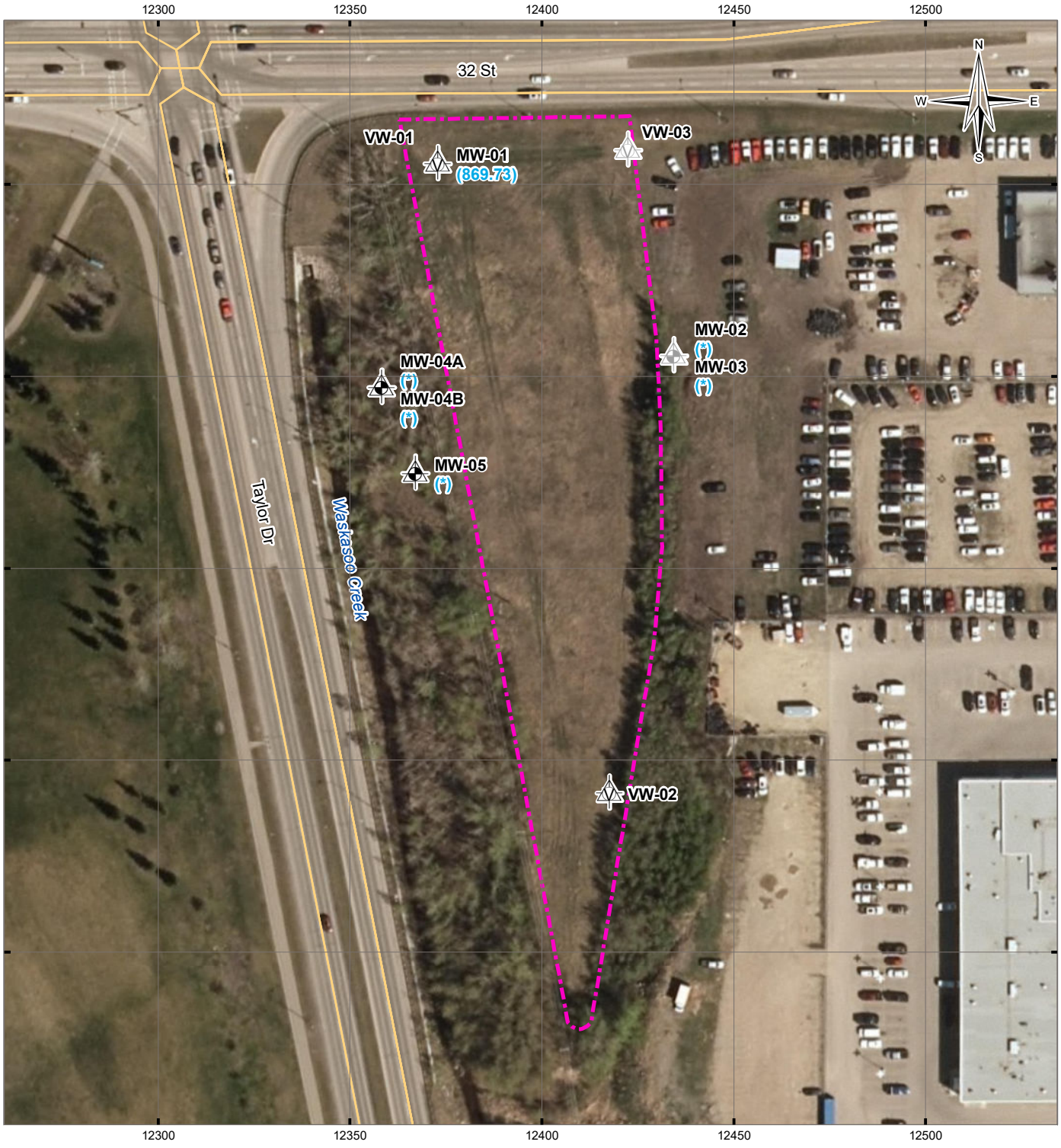
Scale: 1:1,500
25 12.5 0 25
Metres

TETRA TECH

FILE NO.				
SWOP04071-01_Figure4_GW_June2019.mxd				
OFFICE	**DWN**	**CKD**	**APVD**	**REV**
Tt-EDM	MRV	SL	MR	0
DATE	**PROJECT NO.**			
October 14, 2020	SWM.SWOP04071-01.006			

Figure 4

Q:\Edmonton\GIS\SOLID_WASTE\SWOP\SWOP04071-01\Mapsl\Task006\SWOP04071-01_Figure4_GW_June2019.mxd modified 2020-10-14 by Darren.Schouls



LEGEND

- Monitoring Well
- Presumably Destroyed Monitoring Well
- Vapour Well
- Presumably Destroyed Vapour Well
- (8XX.XX) Groundwater Elevation (masl)
- Historic Waste Disposal (Provided by Tiamat, 2014)
- Road

NOTES
Base data source: Imagery provided by ESRI; Red Deer County (2018)
Roads from City of Red Deer Open Data, 2018
MW-02, MW-03, and VW-03 were not located
masl - metres above sea level
* - not measured

STATUS
ISSUED FOR USE

2019 GROUNDWATER AND SOIL VAPOUR MONITORING REPORT RED DEER MOTORS

Groundwater Elevations December 2019

PROJECTION	DATUM	CLIENT
3TM 114	NAD83	THE CITY OF Red Deer

Scale: 1:1,500
25 12.5 0 25
Metres

FILE NO. SWOP04071-01_Figure5_GW_December2019.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-EDM	MRV	SL	MR	0

DATE October 14, 2020
PROJECT NO. SWM.SWOP04071-01.006

TETRA TECH

Figure 5

Q:\Edmonton\GIS\SOLID_WASTE\SWOP\SWOP04071-01\Mapsl\Task006\SWOP04071-01_Figure5_GW_December2019.mxd modified 2020-10-14 by Darren.Schouls

APPENDIX A

TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOENVIRONMENTAL

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Where TETRA TECH submits electronic file and/or hard copy versions of the Professional Document or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH's "Instruments of Professional Service"), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed electronic file and/or hard copy version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive a protected digital copy of the original signed and/or sealed version for a period of 10 years.

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If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

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The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

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During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by persons other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document 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 conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this report, at or on the development proposed as of the date of the Professional Document requires a supplementary investigation and assessment.

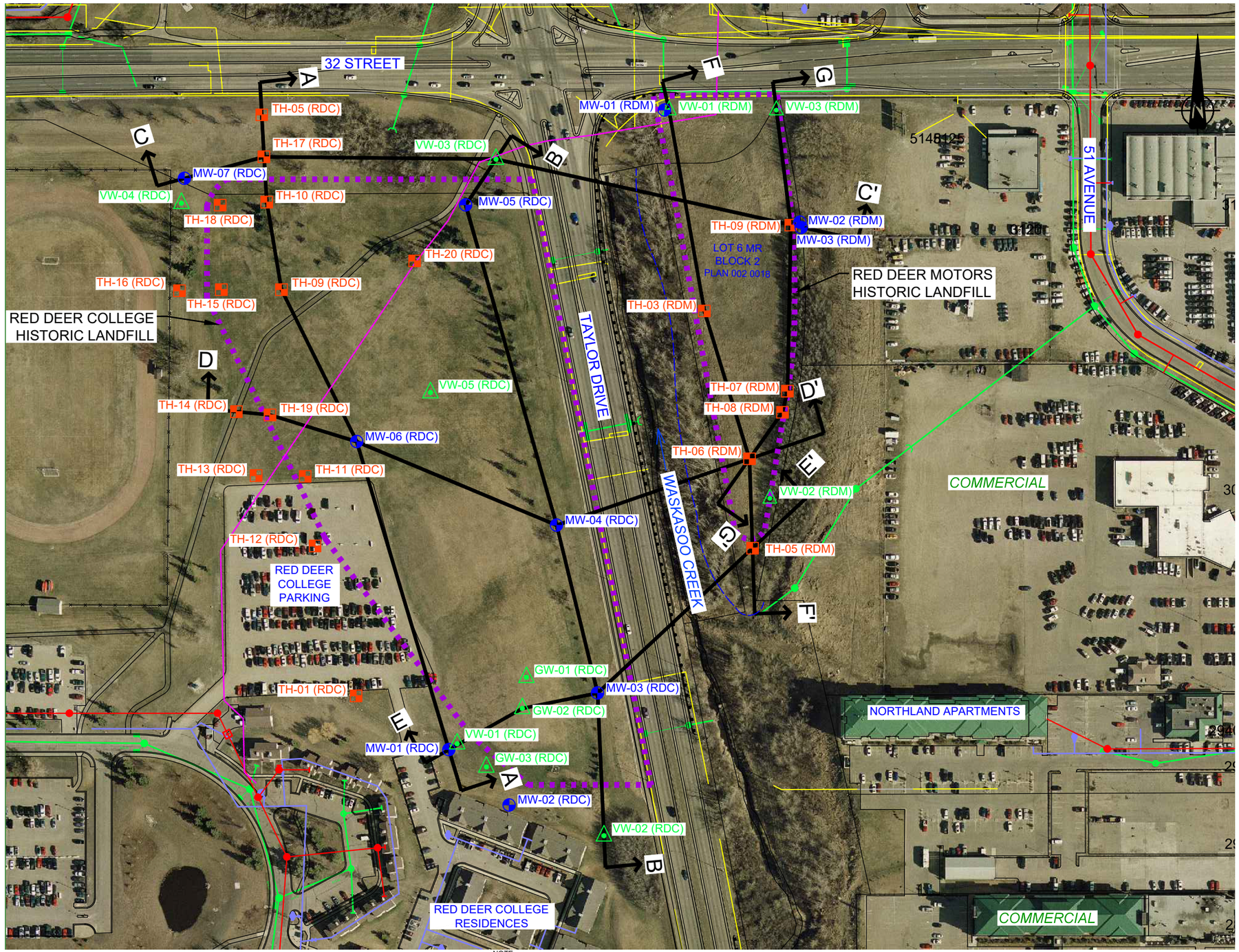
TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 NOTIFICATION OF AUTHORITIES

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

APPENDIX B

CROSS-SECTIONS (TIAMAT 2014A)



SOURCE
2010 ORTHOGRAPHIC IMAGE © COPYRIGHT WITH PERMISSION FROM THE CITY OF RED DEER.

0 20 50 100m
Scale 1:2000

PHASE II TEST LOCATIONS
MW-## GROUNDWATER MONITORING WELL INSTALLED BY TIAMAT
TH-## TESTHOLE
VW-## SOIL VAPOUR MONITORING WELL
MW-## GROUNDWATER MONITORING WELL INSTALLED BY OTHERS
REFER TO TABLE 1 FOR TESTHOLE INFORMATION

LEGEND
HISTORIC WASTE DISPOSAL
LOT BOUNDARY
100 YEAR FLOOD LINE
CROSS SECTION LOCATION
ELECTRICAL
SANITARY
STORM
WATER
PRIVATE COMMUNICATIONS CABLE INSTALLED JULY 2011

NOTE:
LOCATION OF BURIED UTILITIES ARE APPROXIMATE, ACTUAL LOCATIONS OF THE SHALLOW UTILITIES AND ANY OTHER UTILITIES SHOULD BE VERIFIED PRIOR TO ANY GROUND DISTURBANCE ACTIVITY.

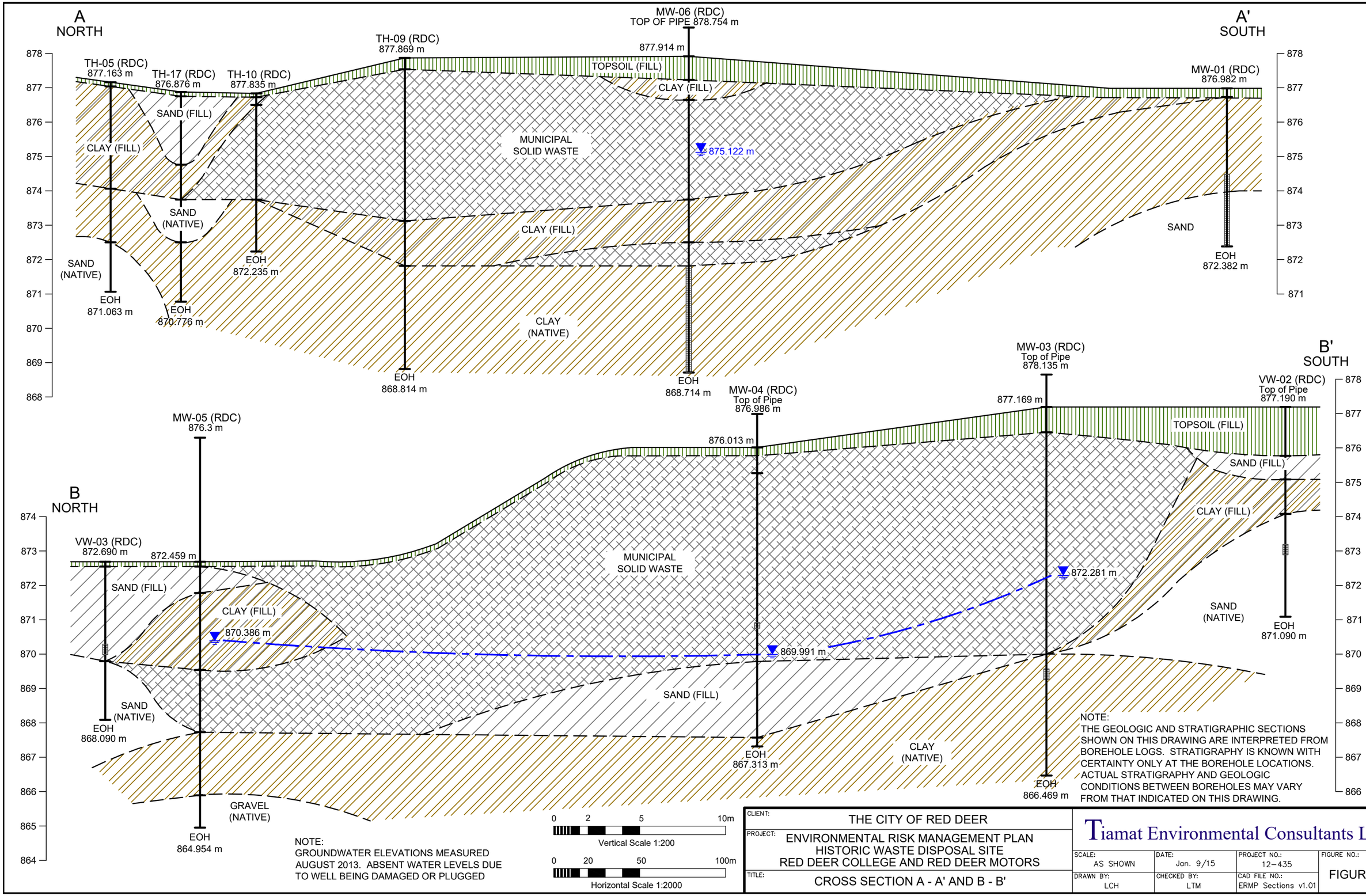
CLIENT: THE CITY OF RED DEER

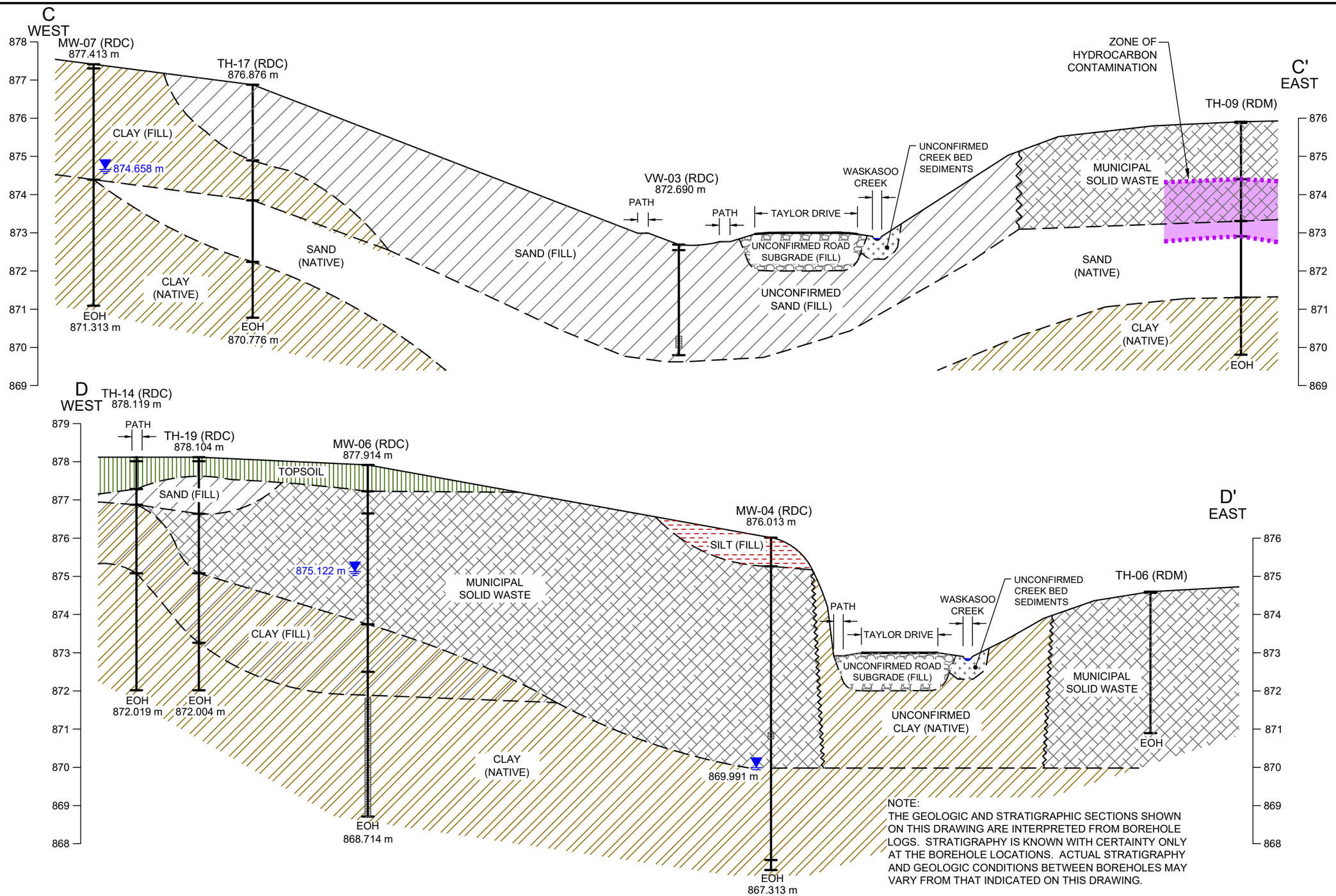
PROJECT: ENVIRONMENTAL RISK MANAGEMENT PLAN
HISTORIC WASTE DISPOSAL SITE
RED DEER COLLEGE AND RED DEER MOTORS

TITLE: INTERPRETED EXTENT OF WASTE

Tiamat Environmental Consultants Ltd.

SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
1 : 2000	JAN. 18/15	12-435	FIGURE 2
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: ERMP v1.03	


A
NORTH
A'
SOUTH
MW-06 (RDC)
TOP OF PIPE 878.754 m
877.914 m
TH-09 (RDC)
877.869 m
TH-05 (RDC)
877.163 m
TH-17 (RDC)
876.876 m
TH-10 (RDC)
877.835 m
MW-01 (RDC)
876.982 m
TOPSOIL (FILL)
CLAY (FILL)
SAND (FILL)
MUNICIPAL
SOLID WASTE
875.122 m
SAND
(NATIVE)
CLAY (FILL)
SAND
EOH
872.382 m
SAND
(NATIVE)
EOH
871.063 m
EOH
870.776 m
EOH
872.235 m
CLAY
(NATIVE)
EOH
868.814 m
EOH
868.714 m
878
877
876
875
874
873
872
871
870
869
868
B'
SOUTH
MW-03 (RDC)
Top of Pipe
878.135 m
877.169 m
VW-02 (RDC)
Top of Pipe
877.190 m
MW-04 (RDC)
Top of Pipe
876.986 m
876.013 m
MW-05 (RDC)
876.3 m
TOPSOIL (FILL)
SAND (FILL)
CLAY (FILL)
B
NORTH
VW-03 (RDC)
872.690 m
872.459 m
MUNICIPAL
SOLID WASTE
872.281 m
SAND
(NATIVE)
EOH
871.090 m
SAND (FILL)
CLAY (FILL)
870.386 m
869.991 m
SAND
(NATIVE)
EOH
868.090 m
SAND (FILL)
EOH
867.313 m
CLAY
(NATIVE)
EOH
866.469 m
GRAVEL
(NATIVE)
EOH
864.954 m
878
877
876
875
874
873
872
871
870
869
868
867
866
865
864
NOTE:
THE GEOLOGIC AND STRATIGRAPHIC SECTIONS SHOWN ON THIS DRAWING ARE INTERPRETED FROM BOREHOLE LOGS. STRATIGRAPHY IS KNOWN WITH CERTAINTY ONLY AT THE BOREHOLE LOCATIONS. ACTUAL STRATIGRAPHY AND GEOLOGIC CONDITIONS BETWEEN BOREHOLES MAY VARY FROM THAT INDICATED ON THIS DRAWING.
NOTE:
GROUNDWATER ELEVATIONS MEASURED AUGUST 2013. ABSENT WATER LEVELS DUE TO WELL BEING DAMAGED OR PLUGGED
0 2 5 10m
Vertical Scale 1:200
0 20 50 100m
Horizontal Scale 1:2000
CLIENT: THE CITY OF RED DEER
PROJECT: ENVIRONMENTAL RISK MANAGEMENT PLAN
HISTORIC WASTE DISPOSAL SITE
RED DEER COLLEGE AND RED DEER MOTORS
TITLE: CROSS SECTION A - A' AND B - B'
Tiamat Environmental Consultants Ltd.
SCALE: AS SHOWN
DATE: Jan. 9/15
PROJECT NO.: 12-435
FIGURE NO.: FIGURE 3A
DRAWN BY: LCH
CHECKED BY: LTM
CAD FILE NO.: ERMP Sections v1.01



NOTE:
THE GEOLOGIC AND STRATIGRAPHIC SECTIONS SHOWN ON THIS DRAWING ARE INTERPRETED FROM BOREHOLE LOGS. STRATIGRAPHY IS KNOWN WITH CERTAINTY ONLY AT THE BOREHOLE LOCATIONS. ACTUAL STRATIGRAPHY AND GEOLOGIC CONDITIONS BETWEEN BOREHOLES MAY VARY FROM THAT INDICATED ON THIS DRAWING.

0 2 5 10m
Vertical Scale 1:200

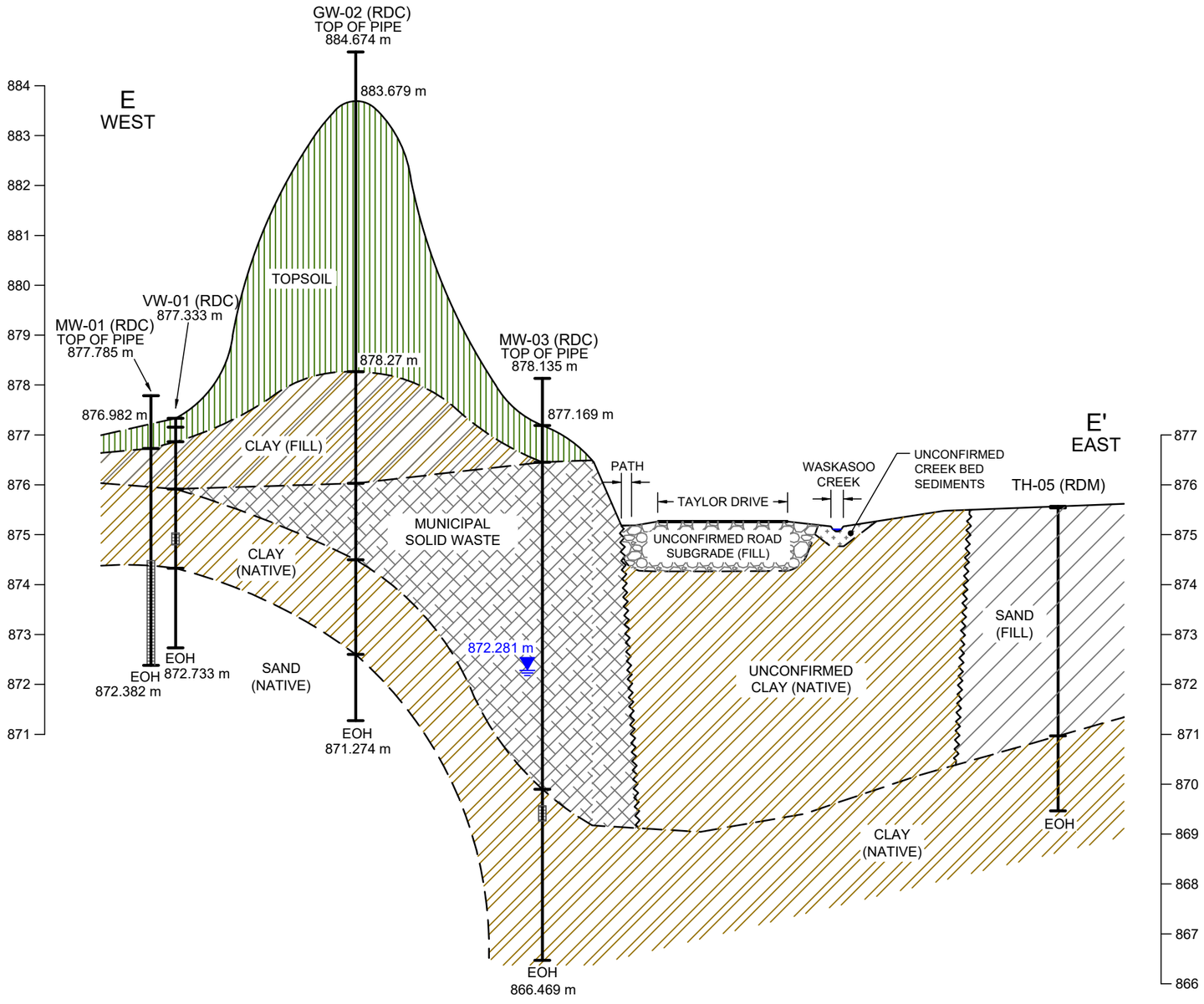
0 20 50 100m
Horizontal Scale 1:2000

NOTE:
GROUNDWATER ELEVATIONS MEASURED AUGUST 2013. ABSENT WATER LEVELS DUE TO WELL BEING DAMAGED OR PLUGGED

CLIENT:	THE CITY OF RED DEER
PROJECT:	ENVIRONMENTAL RISK MANAGEMENT PLAN HISTORIC WASTE DISPOSAL SITE RED DEER COLLEGE AND RED DEER MOTORS
TITLE:	CROSS SECTION C - C' AND D - D'

Tiamat Environmental Consultants Ltd.

SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
AS SHOWN	June 27/14	12-435	FIGURE 3B
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: ERMP Sections v1.00	



NOTE:
THE GEOLOGIC AND STRATIGRAPHIC SECTIONS SHOWN ON THIS DRAWING ARE INTERPRETED FROM BOREHOLE LOGS. STRATIGRAPHY IS KNOWN WITH CERTAINTY ONLY AT THE BOREHOLE LOCATIONS. ACTUAL STRATIGRAPHY AND GEOLOGIC CONDITIONS BETWEEN BOREHOLES MAY VARY FROM THAT INDICATED ON THIS DRAWING.

0 2 5 10m
Vertical Scale 1:200

0 20 50 100m
Horizontal Scale 1:2000

NOTE:
GROUNDWATER ELEVATIONS MEASURED AUGUST 2013. ABSENT WATER LEVELS DUE TO WELL BEING DAMAGED OR PLUGGED

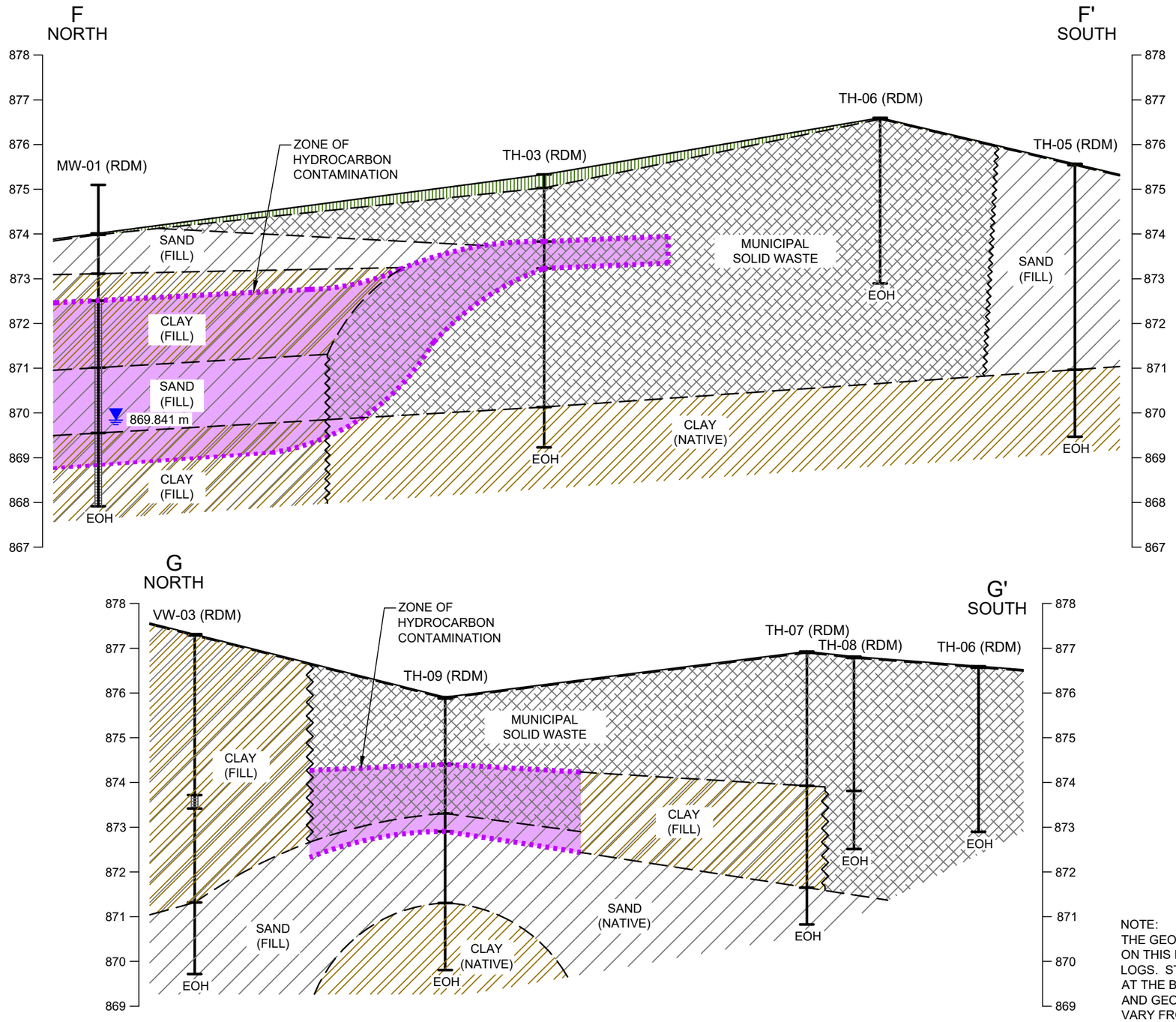
CLIENT: THE CITY OF RED DEER

PROJECT: ENVIRONMENTAL RISK MANAGEMENT PLAN
HISTORIC WASTE DISPOSAL SITE
RED DEER COLLEGE AND RED DEER MOTORS

TITLE: CROSS SECTION E - E'

Tiamat Environmental Consultants Ltd.

SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
AS SHOWN	June 27/14	12-435	FIGURE 3C
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: ERMP Sections v1.00	



NOTE:
THE GEOLOGIC AND STRATIGRAPHIC SECTIONS SHOWN ON THIS DRAWING ARE INTERPRETED FROM BOREHOLE LOGS. STRATIGRAPHY IS KNOWN WITH CERTAINTY ONLY AT THE BOREHOLE LOCATIONS. ACTUAL STRATIGRAPHY AND GEOLOGIC CONDITIONS BETWEEN BOREHOLES MAY VARY FROM THAT INDICATED ON THIS DRAWING.

0 2 5 10m
Vertical Scale 1:200

0 20 50 100m
Horizontal Scale 1:2000

NOTE:
GROUNDWATER ELEVATIONS MEASURED AUGUST 2013. ABSENT WATER LEVELS DUE TO WELL BEING DAMAGED OR PLUGGED

CLIENT: THE CITY OF RED DEER

PROJECT: ENVIRONMENTAL RISK MANAGEMENT PLAN
HISTORIC WASTE DISPOSAL SITE
RED DEER COLLEGE AND RED DEER MOTORS

TITLE: CROSS SECTION F - F' AND G - G'

Tiamat Environmental Consultants Ltd.

SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
AS SHOWN	June 27/14	12-435	FIGURE 3D
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: ERMP Sections v1.00	

APPENDIX C

WATER WELL DATA

Reconnaissance Report

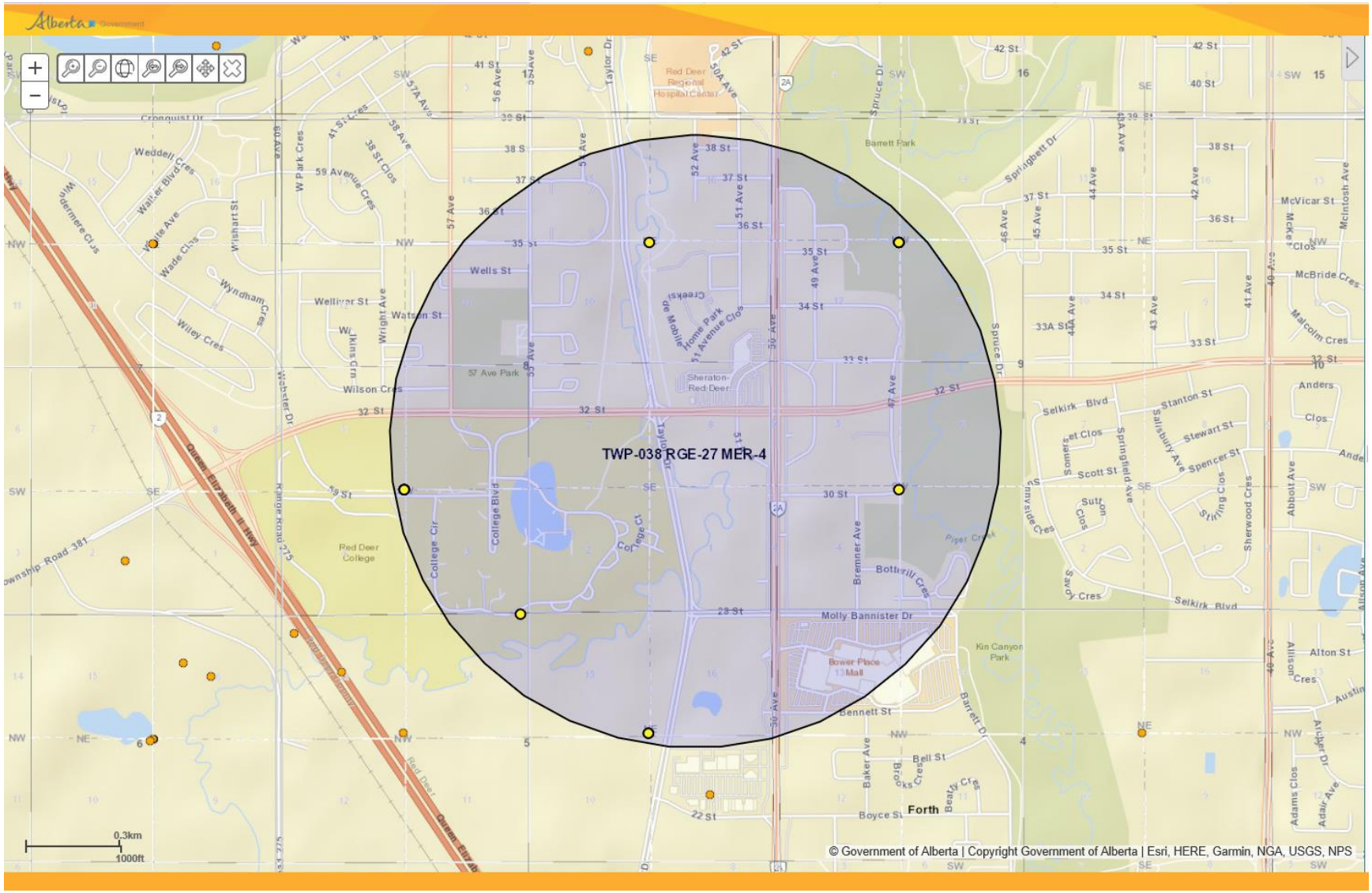
View in Metric

Export to Excel

Groundwater Wells

Please click the water Well ID to generate the Water Well Drilling Report.

GIC Well ID	LSD	SEC	TWP	RGE	M	DRILLING COMPANY	DATE COMPLETED	DEPTH (ft)	TYPE OF WORK	USE	CHM	LT	PT	WELL OWNER	STATIC LEVEL (ft)	TEST RATE (igpm)	SC_DIA (in)
96136	SW	8	38	27	4	FORRESTER DRILLING	1974-12-17	137.00	New Well	Domestic		11		BANTING, LAWRENCE A.	47.00	15.00	6.63
96137	SW	8	38	27	4	BRADY C	1922-01-01	110.00	Federal Well Survey	Domestic & Stock				BANTING			6.00
96138	SW	8	38	27	4	ALBERTA ENVIRONMENT/EARTH SCIENCES DIVISION	1986-10-01	198.00	New Well	Other		11		RED DEER COLLEGE# 2417E			0.00
96139	SW	8	38	27	4	ALBERTA ENVIRONMENT/EARTH SCIENCES DIVISION	1986-10-01	19.00	New Well	Other		3		RED DEER COLLEGE			0.00
96140	NE	8	38	27	4	RICHMOND WW DRLG	1979-10-26	255.00	New Well	Domestic		6		RUSSELL, MIKE	200.00	8.00	4.50
96141	SW	9	38	27	4	FORRESTER DRILLING	1973-01-18	210.00	New Well	Domestic & Stock		10		BOWER, NORMAN	75.00	30.00	7.00
96142	NW	9	38	27	4	COMFORT DRLG	1979-05-25	130.00	New Well	Domestic		6		BODWELL, RICH	27.00	20.00	5.56
96143	NW	9	38	27	4	UNKNOWN DRILLER		0.00	Chemistry	Domestic				ORR, OSCAR JR.			0.00
153246	NW	9	38	27	4	WHITELINE OILFIELD RENTALS	1990-09-04	230.00	New Well	Domestic		10		STALENHOEF FARMS	30.00	7.00	5.56
160374	NE	5	38	27	4	FORRESTER WATER WELL DRILLING (1981) LTD.	1971-11-12	400.00	New Well	Industrial		32	84	DRUMMOND BREWERIES/UNCLE BEN T	61.30	19.29	8.62
160374	NE	5	38	27	4	ALBERTA EAGLE DRILLING LTD.	1990-08-29	400.00	Existing Well-Decommissioned	Industrial				DRUMMOND BREWERIES			0.00
282162	SW	8	38	27	4	FORRESTER WATER WELL DRILLING (1981) LTD.	1981-10-26	180.00	Test Hole	Observation		24		RED DEER COLLEGE	40.00	22.00	7.00
289673	14	5	38	27	4	RANKIN DRILLING	1998-07-31	142.00	New Well	Domestic		13	24	GEORGE, KEVIN	54.00	6.00	5.50


TWP-038 RGE-27 MER-4
Red Deer Regional Hospital Centre
Barrett Park
Sheraton Red Deer
57 Ave Park
Red Deer College
Bower Place Mall
Kin Canyon Park
Forth
Queen Elizabeth II Hwy
Township Road 381
0.3km
1000ft
© Government of Alberta | Copyright Government of Alberta | Esri, HERE, Garmin, NGA, USGS, NPS

APPENDIX D

LABORATORY ANALYTICAL REPORTS

TETRA TECH CANADA INC.
ATTN: Darby Madalena
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3

Date Received: 06-DEC-19
Report Date: 27-DEC-19 16:26 (MT)
Version: FINAL

Client Phone: 403-203-3355

Certificate of Analysis

Lab Work Order #: L2393429

Project P.O. #: SWM.SWOP04071-01.006
Job Reference: SWM.SWOP04071-01.006
C of C Numbers: RED DEER MOTORS
Legal Site Desc:

Inayat Dhaliwal
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393429-1 MW-01							
Sampled By: MR/RM on 06-DEC-19 @ 14:45							
Matrix: WATER							
F1 (C6-C10) and F2 (>C10-C16)							
CCME F2-4 Hydrocarbons							
F2: (C10-C16)	<0.10		0.10	mg/L	16-DEC-19	17-DEC-19	R4944846
Surrogate: 2-Bromobenzotrifluoride	68.2		60-140	%	16-DEC-19	17-DEC-19	R4944846
F1 (C6-C10)							
F1(C6-C10)	<0.10		0.10	mg/L		13-DEC-19	R4944123
F1-BTEX	<0.10		0.10	mg/L		13-DEC-19	R4944123
Surrogate: 3,4-Dichlorotoluene	94.6		70-130	%		13-DEC-19	R4944123
Miscellaneous Parameters							
AOX	ND U		10	mg/L		12-DEC-19	R4955245
Ammonia, Total (as N)	7.2	DLHC	2.5	mg/L		13-DEC-19	R4943991
Dissolved Organic Carbon	10.6		1.0	mg/L		13-DEC-19	R4943303
Xylenes	<0.00071		0.00071	mg/L		16-DEC-19	
Total Kjeldahl Nitrogen	9.9		1.0	mg/L		12-DEC-19	R4943090
Phosphorus (P)-Total	1.72	DLHC	0.10	mg/L		13-DEC-19	R4943276
Volatile fatty/carboxylic acids							
Formic Acid	<50	DLM	50	mg/L		14-DEC-19	R4943956
Acetic Acid	<10		10	mg/L		14-DEC-19	R4943956
Propionic Acid	<5.0		5.0	mg/L		14-DEC-19	R4943956
Butyric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Isobutyric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Valeric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Isovaleric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Caproic (Hexanoic) Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Major Ions & Trace Dissolved Metals							
Chloride in Water by IC							
Chloride (Cl)	423	DLHC	2.5	mg/L		08-DEC-19	R4942862
Dissolved Mercury in Water by CVAAS							
Mercury (Hg)-Dissolved	<0.0000050		0.0000050	mg/L		13-DEC-19	R4943011
Dissolved Mercury Filtration Location	FIELD					13-DEC-19	R4942998
Dissolved Metals in Water by CRC ICPMS							
Dissolved Metals Filtration Location	FIELD					14-DEC-19	R4943390
Aluminum (Al)-Dissolved	0.0016		0.0010	mg/L		17-DEC-19	R4943353
Antimony (Sb)-Dissolved	<0.00010		0.00010	mg/L		17-DEC-19	R4943353
Arsenic (As)-Dissolved	0.0225		0.00010	mg/L		17-DEC-19	R4943353
Barium (Ba)-Dissolved	0.604		0.00010	mg/L		17-DEC-19	R4943353
Boron (B)-Dissolved	0.079		0.010	mg/L		17-DEC-19	R4943353
Cadmium (Cd)-Dissolved	0.0000142		0.0000050	mg/L		17-DEC-19	R4943353
Calcium (Ca)-Dissolved	161		0.050	mg/L		17-DEC-19	R4943353
Chromium (Cr)-Dissolved	0.00013		0.00010	mg/L		17-DEC-19	R4943353
Copper (Cu)-Dissolved	0.00033		0.00020	mg/L		17-DEC-19	R4943353
Iron (Fe)-Dissolved	24.4		0.010	mg/L		17-DEC-19	R4943353
Lead (Pb)-Dissolved	<0.000050		0.000050	mg/L		17-DEC-19	R4943353
Magnesium (Mg)-Dissolved	99.4		0.0050	mg/L		17-DEC-19	R4943353
Manganese (Mn)-Dissolved	1.91		0.00010	mg/L		17-DEC-19	R4943353
Nickel (Ni)-Dissolved	0.0135		0.00050	mg/L		17-DEC-19	R4943353
Potassium (K)-Dissolved	9.55		0.050	mg/L		17-DEC-19	R4943353
Selenium (Se)-Dissolved	0.000074		0.000050	mg/L		17-DEC-19	R4943353
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		17-DEC-19	R4943353
Sodium (Na)-Dissolved	189		0.050	mg/L		17-DEC-19	R4943353
Uranium (U)-Dissolved	0.00196		0.000010	mg/L		17-DEC-19	R4943353
Zinc (Zn)-Dissolved	0.0015		0.0010	mg/L		17-DEC-19	R4943353

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393429-1 MW-01							
Sampled By: MR/RM on 06-DEC-19 @ 14:45							
Matrix: WATER							
Fluoride in Water by IC							
Fluoride (F)	0.12	DLHC	0.10	mg/L		08-DEC-19	R4942862
Ion Balance Calculation							
Ion Balance	101			%		17-DEC-19	
TDS (Calculated)	1300			mg/L		17-DEC-19	
Hardness (as CaCO3)	811			mg/L		17-DEC-19	
Nitrate in Water by IC							
Nitrate (as N)	<0.10	DLHC	0.10	mg/L		08-DEC-19	R4942862
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	<0.11		0.11	mg/L		13-DEC-19	
Nitrite in Water by IC							
Nitrite (as N)	<0.050	DLHC	0.050	mg/L		08-DEC-19	R4942862
Sulfate in Water by IC							
Sulfate (SO4)	79.1	DLHC	1.5	mg/L		08-DEC-19	R4942862
pH, Conductivity and Total Alkalinity							
pH	7.71		0.10	pH		14-DEC-19	R4943994
Conductivity (EC)	2220		2.0	uS/cm		14-DEC-19	R4943994
Bicarbonate (HCO3)	688		5.0	mg/L		14-DEC-19	R4943994
Carbonate (CO3)	<5.0		5.0	mg/L		14-DEC-19	R4943994
Hydroxide (OH)	<5.0		5.0	mg/L		14-DEC-19	R4943994
Alkalinity, Total (as CaCO3)	564		2.0	mg/L		14-DEC-19	R4943994
EPA 8260 Volatile Organics							
VOCs in Water							
1,1,1,2-Tetrachloroethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1,1-Trichloroethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1,2,2-Tetrachloroethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1,2-Trichloroethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1-Dichloroethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1-Dichloroethene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1-Dichloropropene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2,3-Trichlorobenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2,3-Trichloropropane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2,4-Trichlorobenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2,4-Trimethylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2-Dibromo-3-chloropropane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2-Dichlorobenzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2-Dichloroethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2-Dichloropropane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,3,5-Trimethylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,3-Dichlorobenzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,3-Dichloropropane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,4-Dichlorobenzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
2,2-Dichloropropane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
2-Chlorotoluene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
4-Chlorotoluene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
p-Isopropyltoluene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Benzene	0.00060		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Bromobenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Bromochloromethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Bromodichloromethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Bromoform	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Bromomethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Carbon tetrachloride	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393429-1 MW-01							
Sampled By: MR/RM on 06-DEC-19 @ 14:45							
Matrix: WATER							
VOCs in Water							
Chlorobenzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Chloroethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Chloroform	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Chloromethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
cis-1,2-Dichloroethene	0.0096		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
cis-1,3-Dichloropropene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Dibromochloromethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Dibromomethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Dichlorodifluoromethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Ethylbenzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Ethylene dibromide	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Hexachlorobutadiene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Isopropylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
m+p-Xylenes	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Methylene chloride	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
n-Butylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
n-Propylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
o-Xylene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
sec-Butylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Styrene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
tert-Butylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Tetrachloroethylene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Toluene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
trans-1,2-Dichloroethene	0.00187		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
trans-1,3-Dichloropropene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Trichloroethene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Trichlorofluoromethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Vinyl chloride	0.0124		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Surrogate: 1,4-Difluorobenzene	98.7		70-130	%	13-DEC-19	13-DEC-19	R4942751
Surrogate: 4-Bromofluorobenzene	77.3		70-130	%	13-DEC-19	13-DEC-19	R4942751

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393429-2 AEP MW-04							
Sampled By: MR/RM on 06-DEC-19 @ 14:00							
Matrix: WATER							
F1 (C6-C10) and F2 (>C10-C16)							
CCME F2-4 Hydrocarbons							
F2: (C10-C16)	<0.10		0.10	mg/L	16-DEC-19	17-DEC-19	R4944846
Surrogate: 2-Bromobenzotrifluoride	69.4		60-140	%	16-DEC-19	17-DEC-19	R4944846
F1 (C6-C10)							
F1(C6-C10)	<0.10		0.10	mg/L		13-DEC-19	R4944123
F1-BTEX	<0.10		0.10	mg/L		13-DEC-19	R4944123
Surrogate: 3,4-Dichlorotoluene	101.0		70-130	%		13-DEC-19	R4944123
Miscellaneous Parameters							
AOX	ND U		10	mg/L		12-DEC-19	R4955245
Ammonia, Total (as N)	0.45	DLHC	0.25	mg/L		16-DEC-19	R4943991
Dissolved Organic Carbon	23.0		1.0	mg/L		13-DEC-19	R4943303
Xylenes	<0.00071		0.00071	mg/L		16-DEC-19	
Total Kjeldahl Nitrogen	10.9	DLHC	1.0	mg/L		12-DEC-19	R4943090
Phosphorus (P)-Total	0.761	DLHC	0.050	mg/L		13-DEC-19	R4943276
Volatile fatty/carboxylic acids							
Formic Acid	<50	DLM	50	mg/L		14-DEC-19	R4943956
Acetic Acid	<10		10	mg/L		14-DEC-19	R4943956
Propionic Acid	<5.0		5.0	mg/L		14-DEC-19	R4943956
Butyric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Isobutyric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Valeric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Isovaleric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Caproic (Hexanoic) Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Major Ions & Trace Dissolved Metals							
Chloride in Water by IC							
Chloride (Cl)	450	DLHC	2.5	mg/L		08-DEC-19	R4942862
Dissolved Mercury in Water by CVAAS							
Mercury (Hg)-Dissolved	<0.0000050		0.0000050	mg/L		13-DEC-19	R4943011
Dissolved Mercury Filtration Location	FIELD					13-DEC-19	R4942998
Dissolved Metals in Water by CRC ICPMS							
Dissolved Metals Filtration Location	FIELD					14-DEC-19	R4943390
Aluminum (Al)-Dissolved	0.0027		0.0010	mg/L		17-DEC-19	R4943353
Antimony (Sb)-Dissolved	0.00147		0.00010	mg/L		17-DEC-19	R4943353
Arsenic (As)-Dissolved	0.0146		0.00010	mg/L		17-DEC-19	R4943353
Barium (Ba)-Dissolved	0.0479		0.00010	mg/L		17-DEC-19	R4943353
Boron (B)-Dissolved	0.142		0.010	mg/L		17-DEC-19	R4943353
Cadmium (Cd)-Dissolved	0.0000150		0.0000050	mg/L		17-DEC-19	R4943353
Calcium (Ca)-Dissolved	249		0.050	mg/L		17-DEC-19	R4943353
Chromium (Cr)-Dissolved	0.00023		0.00010	mg/L		17-DEC-19	R4943353
Copper (Cu)-Dissolved	0.00358		0.00020	mg/L		17-DEC-19	R4943353
Iron (Fe)-Dissolved	1.23		0.010	mg/L		17-DEC-19	R4943353
Lead (Pb)-Dissolved	0.000225		0.000050	mg/L		17-DEC-19	R4943353
Magnesium (Mg)-Dissolved	126		0.0050	mg/L		17-DEC-19	R4943353
Manganese (Mn)-Dissolved	0.732		0.00010	mg/L		17-DEC-19	R4943353
Nickel (Ni)-Dissolved	0.0346		0.00050	mg/L		17-DEC-19	R4943353
Potassium (K)-Dissolved	5.29		0.050	mg/L		17-DEC-19	R4943353
Selenium (Se)-Dissolved	0.000172		0.000050	mg/L		17-DEC-19	R4943353
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		17-DEC-19	R4943353
Sodium (Na)-Dissolved	284		0.050	mg/L		17-DEC-19	R4943353
Uranium (U)-Dissolved	0.0391		0.000010	mg/L		17-DEC-19	R4943353
Zinc (Zn)-Dissolved	0.0034		0.0010	mg/L		17-DEC-19	R4943353

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393429-2 AEP MW-04							
Sampled By: MR/RM on 06-DEC-19 @ 14:00							
Matrix: WATER							
Fluoride in Water by IC							
Fluoride (F)	0.14	DLHC	0.10	mg/L		08-DEC-19	R4942862
Ion Balance Calculation							
Ion Balance	110			%		18-DEC-19	
TDS (Calculated)	1840			mg/L		18-DEC-19	
Hardness (as CaCO3)	1140			mg/L		18-DEC-19	
Nitrate in Water by IC							
Nitrate (as N)	<0.10	DLHC	0.10	mg/L		08-DEC-19	R4942862
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	<0.11		0.11	mg/L		18-DEC-19	
Nitrite in Water by IC							
Nitrite (as N)	<0.050	DLHC	0.050	mg/L		08-DEC-19	R4942862
Sulfate in Water by IC							
Sulfate (SO4)	394	DLHC	1.5	mg/L		08-DEC-19	R4942862
pH, Conductivity and Total Alkalinity							
pH	8.10		0.10	pH		14-DEC-19	R4943994
Conductivity (EC)	1250		2.0	uS/cm		14-DEC-19	R4943994
Bicarbonate (HCO3)	682		5.0	mg/L		14-DEC-19	R4943994
Carbonate (CO3)	<5.0		5.0	mg/L		14-DEC-19	R4943994
Hydroxide (OH)	<5.0		5.0	mg/L		14-DEC-19	R4943994
Alkalinity, Total (as CaCO3)	559		2.0	mg/L		14-DEC-19	R4943994
EPA 8260 Volatile Organics							
VOCs in Water							
1,1,1,2-Tetrachloroethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1,1-Trichloroethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1,2,2-Tetrachloroethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1,2-Trichloroethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1-Dichloroethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1-Dichloroethene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1-Dichloropropene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2,3-Trichlorobenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2,3-Trichloropropane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2,4-Trichlorobenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2,4-Trimethylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2-Dibromo-3-chloropropane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2-Dichlorobenzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2-Dichloroethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2-Dichloropropane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,3,5-Trimethylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,3-Dichlorobenzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,3-Dichloropropane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,4-Dichlorobenzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
2,2-Dichloropropane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
2-Chlorotoluene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
4-Chlorotoluene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
p-Isopropyltoluene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Benzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Bromobenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Bromochloromethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Bromodichloromethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Bromoform	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Bromomethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Carbon tetrachloride	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393429-2 AEP MW-04							
Sampled By: MR/RM on 06-DEC-19 @ 14:00							
Matrix: WATER							
VOCs in Water							
Chlorobenzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Chloroethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Chloroform	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Chloromethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
cis-1,2-Dichloroethene	0.0019		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
cis-1,3-Dichloropropene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Dibromochloromethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Dibromomethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Dichlorodifluoromethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Ethylbenzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Ethylene dibromide	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Hexachlorobutadiene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Isopropylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
m+p-Xylenes	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Methylene chloride	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
n-Butylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
n-Propylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
o-Xylene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
sec-Butylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Styrene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
tert-Butylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Tetrachloroethylene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Toluene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
trans-1,2-Dichloroethene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
trans-1,3-Dichloropropene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Trichloroethene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Trichlorofluoromethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Vinyl chloride	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Surrogate: 1,4-Difluorobenzene	99.1		70-130	%	13-DEC-19	13-DEC-19	R4942751
Surrogate: 4-Bromofluorobenzene	79.0		70-130	%	13-DEC-19	13-DEC-19	R4942751

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393429-3 AEP MW-04							
Sampled By: MR/RM on 06-DEC-19 @ 14:15							
Matrix: WATER							
F1 (C6-C10) and F2 (>C10-C16)							
CCME F2-4 Hydrocarbons							
F2: (C10-C16)	<0.10		0.10	mg/L	16-DEC-19	17-DEC-19	R4944846
Surrogate: 2-Bromobenzotrifluoride	61.7		60-140	%	16-DEC-19	17-DEC-19	R4944846
F1 (C6-C10)							
F1(C6-C10)	<0.10		0.10	mg/L		13-DEC-19	R4944123
F1-BTEX	<0.10		0.10	mg/L		13-DEC-19	R4944123
Surrogate: 3,4-Dichlorotoluene	105.5		70-130	%		13-DEC-19	R4944123
Miscellaneous Parameters							
AOX	ND U		10	mg/L		12-DEC-19	R4955245
Ammonia, Total (as N)	0.306		0.050	mg/L		13-DEC-19	R4943991
Dissolved Organic Carbon	7.4		1.0	mg/L		13-DEC-19	R4943303
Xylenes	<0.00071		0.00071	mg/L		16-DEC-19	
Total Kjeldahl Nitrogen	0.51		0.20	mg/L		12-DEC-19	R4943090
Phosphorus (P)-Total	0.085	DLM	0.050	mg/L		13-DEC-19	R4943276
Volatile fatty/carboxylic acids							
Formic Acid	<50	DLM	50	mg/L		14-DEC-19	R4943956
Acetic Acid	<10		10	mg/L		14-DEC-19	R4943956
Propionic Acid	<5.0		5.0	mg/L		14-DEC-19	R4943956
Butyric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Isobutyric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Valeric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Isovaleric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Caproic (Hexanoic) Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Major Ions & Trace Dissolved Metals							
Chloride in Water by IC							
Chloride (Cl)	6.8	DLHC	2.5	mg/L		08-DEC-19	R4942862
Dissolved Mercury in Water by CVAAS							
Mercury (Hg)-Dissolved	<0.0000050		0.0000050	mg/L		13-DEC-19	R4943011
Dissolved Mercury Filtration Location	FIELD					13-DEC-19	R4942998
Dissolved Metals in Water by CRC ICPMS							
Dissolved Metals Filtration Location	FIELD					14-DEC-19	R4943390
Aluminum (Al)-Dissolved	0.0027		0.0010	mg/L		14-DEC-19	R4943353
Antimony (Sb)-Dissolved	<0.00010		0.00010	mg/L		14-DEC-19	R4943353
Arsenic (As)-Dissolved	0.00711		0.00010	mg/L		14-DEC-19	R4943353
Barium (Ba)-Dissolved	0.0228		0.00010	mg/L		14-DEC-19	R4943353
Boron (B)-Dissolved	0.214		0.010	mg/L		14-DEC-19	R4943353
Cadmium (Cd)-Dissolved	0.0000275		0.0000050	mg/L		14-DEC-19	R4943353
Calcium (Ca)-Dissolved	49.8		0.050	mg/L		14-DEC-19	R4943353
Chromium (Cr)-Dissolved	<0.00010		0.00010	mg/L		14-DEC-19	R4943353
Copper (Cu)-Dissolved	0.00037		0.00020	mg/L		14-DEC-19	R4943353
Iron (Fe)-Dissolved	0.025		0.010	mg/L		14-DEC-19	R4943353
Lead (Pb)-Dissolved	<0.000050		0.000050	mg/L		14-DEC-19	R4943353
Magnesium (Mg)-Dissolved	18.6		0.0050	mg/L		14-DEC-19	R4943353
Manganese (Mn)-Dissolved	0.178		0.00010	mg/L		14-DEC-19	R4943353
Nickel (Ni)-Dissolved	<0.00050		0.00050	mg/L		14-DEC-19	R4943353
Potassium (K)-Dissolved	3.37		0.050	mg/L		14-DEC-19	R4943353
Selenium (Se)-Dissolved	<0.000050		0.000050	mg/L		14-DEC-19	R4943353
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		14-DEC-19	R4943353
Sodium (Na)-Dissolved	256		0.050	mg/L		14-DEC-19	R4943353
Uranium (U)-Dissolved	0.00217		0.000010	mg/L		14-DEC-19	R4943353
Zinc (Zn)-Dissolved	<0.0010		0.0010	mg/L		14-DEC-19	R4943353

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393429-3 AEP MW-04							
Sampled By: MR/RM on 06-DEC-19 @ 14:15							
Matrix: WATER							
Fluoride in Water by IC							
Fluoride (F)	0.35	DLHC	0.10	mg/L		08-DEC-19	R4942862
Ion Balance Calculation							
Ion Balance	71.4	RRV		%		19-DEC-19	
TDS (Calculated)	1040			mg/L		19-DEC-19	
Hardness (as CaCO3)	201			mg/L		19-DEC-19	
Nitrate in Water by IC							
Nitrate (as N)	<0.10	DLHC	0.10	mg/L		08-DEC-19	R4942862
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	<0.11		0.11	mg/L		18-DEC-19	
Nitrite in Water by IC							
Nitrite (as N)	<0.050	DLHC	0.050	mg/L		08-DEC-19	R4942862
Sulfate in Water by IC							
Sulfate (SO4)	174	DLHC	1.5	mg/L		08-DEC-19	R4942862
pH, Conductivity and Total Alkalinity							
pH	7.80		0.10	pH		14-DEC-19	R4943994
Conductivity (EC)	1260		2.0	uS/cm		14-DEC-19	R4943994
Bicarbonate (HCO3)	1070		5.0	mg/L		14-DEC-19	R4943994
Carbonate (CO3)	<5.0		5.0	mg/L		14-DEC-19	R4943994
Hydroxide (OH)	<5.0		5.0	mg/L		14-DEC-19	R4943994
Alkalinity, Total (as CaCO3)	881		2.0	mg/L		14-DEC-19	R4943994
EPA 8260 Volatile Organics							
VOCs in Water							
1,1,1,2-Tetrachloroethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1,1-Trichloroethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1,2,2-Tetrachloroethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1,2-Trichloroethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1-Dichloroethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1-Dichloroethene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1-Dichloropropene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2,3-Trichlorobenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2,3-Trichloropropane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2,4-Trichlorobenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2,4-Trimethylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2-Dibromo-3-chloropropane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2-Dichlorobenzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2-Dichloroethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2-Dichloropropane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,3,5-Trimethylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,3-Dichlorobenzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,3-Dichloropropane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,4-Dichlorobenzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
2,2-Dichloropropane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
2-Chlorotoluene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
4-Chlorotoluene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
p-Isopropyltoluene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Benzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Bromobenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Bromochloromethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Bromodichloromethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Bromoform	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Bromomethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Carbon tetrachloride	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393429-3 AEP MW-04							
Sampled By: MR/RM on 06-DEC-19 @ 14:15							
Matrix: WATER							
VOCs in Water							
Chlorobenzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Chloroethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Chloroform	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Chloromethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
cis-1,2-Dichloroethene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
cis-1,3-Dichloropropene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Dibromochloromethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Dibromomethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Dichlorodifluoromethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Ethylbenzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Ethylene dibromide	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Hexachlorobutadiene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Isopropylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
m+p-Xylenes	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Methylene chloride	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
n-Butylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
n-Propylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
o-Xylene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
sec-Butylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Styrene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
tert-Butylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Tetrachloroethylene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Toluene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
trans-1,2-Dichloroethene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
trans-1,3-Dichloropropene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Trichloroethene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Trichlorofluoromethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Vinyl chloride	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Surrogate: 1,4-Difluorobenzene	98.9		70-130	%	13-DEC-19	13-DEC-19	R4942751
Surrogate: 4-Bromofluorobenzene	79.9		70-130	%	13-DEC-19	13-DEC-19	R4942751

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393429-4 AEP MW-05							
Sampled By: MR/RM on 06-DEC-19 @ 14:30							
Matrix: WATER							
F1 (C6-C10) and F2 (>C10-C16)							
CCME F2-4 Hydrocarbons							
F2: (C10-C16)	<0.10		0.10	mg/L	16-DEC-19	17-DEC-19	R4944846
Surrogate: 2-Bromobenzotrifluoride	87.8		60-140	%	16-DEC-19	17-DEC-19	R4944846
F1 (C6-C10)							
F1(C6-C10)	<0.10		0.10	mg/L		13-DEC-19	R4944123
F1-BTEX	<0.10		0.10	mg/L		13-DEC-19	R4944123
Surrogate: 3,4-Dichlorotoluene	92.5		70-130	%		13-DEC-19	R4944123
Miscellaneous Parameters							
AOX	ND U		10	mg/L		12-DEC-19	R4955245
Ammonia, Total (as N)	7.1	DLHC	5.0	mg/L		13-DEC-19	R4943991
Dissolved Organic Carbon	18.3		1.0	mg/L		13-DEC-19	R4943303
Xylenes	<0.00071		0.00071	mg/L		16-DEC-19	
Total Kjeldahl Nitrogen	8.9	DLHC	1.0	mg/L		12-DEC-19	R4943090
Phosphorus (P)-Total	2.29	DLHC	0.25	mg/L		13-DEC-19	R4943276
Volatile fatty/carboxylic acids							
Formic Acid	<50	DLM	50	mg/L		14-DEC-19	R4943956
Acetic Acid	<10		10	mg/L		14-DEC-19	R4943956
Propionic Acid	<5.0		5.0	mg/L		14-DEC-19	R4943956
Butyric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Isobutyric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Valeric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Isovaleric Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Caproic (Hexanoic) Acid	<1.0		1.0	mg/L		14-DEC-19	R4943956
Major Ions & Trace Dissolved Metals							
Chloride in Water by IC							
Chloride (Cl)	167	DLHC	2.5	mg/L		08-DEC-19	R4942862
Dissolved Mercury in Water by CVAAS							
Mercury (Hg)-Dissolved	<0.0000050		0.0000050	mg/L		13-DEC-19	R4943011
Dissolved Mercury Filtration Location	FIELD					13-DEC-19	R4942998
Dissolved Metals in Water by CRC ICPMS							
Dissolved Metals Filtration Location	FIELD					14-DEC-19	R4943390
Aluminum (Al)-Dissolved	0.0028		0.0010	mg/L		14-DEC-19	R4943353
Antimony (Sb)-Dissolved	0.00021		0.00010	mg/L		14-DEC-19	R4943353
Arsenic (As)-Dissolved	0.0134		0.00010	mg/L		14-DEC-19	R4943353
Barium (Ba)-Dissolved	0.794		0.00010	mg/L		14-DEC-19	R4943353
Boron (B)-Dissolved	0.169		0.010	mg/L		14-DEC-19	R4943353
Cadmium (Cd)-Dissolved	0.0000461		0.0000050	mg/L		14-DEC-19	R4943353
Calcium (Ca)-Dissolved	161		0.050	mg/L		14-DEC-19	R4943353
Chromium (Cr)-Dissolved	0.00029		0.00010	mg/L		14-DEC-19	R4943353
Copper (Cu)-Dissolved	0.00753		0.00020	mg/L		14-DEC-19	R4943353
Iron (Fe)-Dissolved	7.43		0.010	mg/L		14-DEC-19	R4943353
Lead (Pb)-Dissolved	0.000246		0.000050	mg/L		14-DEC-19	R4943353
Magnesium (Mg)-Dissolved	99.6		0.0050	mg/L		14-DEC-19	R4943353
Manganese (Mn)-Dissolved	1.28		0.00010	mg/L		14-DEC-19	R4943353
Nickel (Ni)-Dissolved	0.0262		0.00050	mg/L		14-DEC-19	R4943353
Potassium (K)-Dissolved	9.91		0.050	mg/L		14-DEC-19	R4943353
Selenium (Se)-Dissolved	0.000245		0.000050	mg/L		14-DEC-19	R4943353
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		14-DEC-19	R4943353
Sodium (Na)-Dissolved	177		0.050	mg/L		14-DEC-19	R4943353
Uranium (U)-Dissolved	0.00927		0.000010	mg/L		14-DEC-19	R4943353
Zinc (Zn)-Dissolved	0.0060		0.0010	mg/L		14-DEC-19	R4943353

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393429-4 AEP MW-05							
Sampled By: MR/RM on 06-DEC-19 @ 14:30							
Matrix: WATER							
Fluoride in Water by IC							
Fluoride (F)	<0.10	DLHC	0.10	mg/L		08-DEC-19	R4942862
Ion Balance Calculation							
Ion Balance	135	RRV		%		19-DEC-19	
TDS (Calculated)	1060			mg/L		19-DEC-19	
Hardness (as CaCO3)	812			mg/L		19-DEC-19	
Nitrate in Water by IC							
Nitrate (as N)	<0.10	DLHC	0.10	mg/L		08-DEC-19	R4942862
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	<0.11		0.11	mg/L		18-DEC-19	
Nitrite in Water by IC							
Nitrite (as N)	<0.050	DLHC	0.050	mg/L		08-DEC-19	R4942862
Sulfate in Water by IC							
Sulfate (SO4)	94.9	DLHC	1.5	mg/L		08-DEC-19	R4942862
pH, Conductivity and Total Alkalinity							
pH	7.76		0.10	pH		14-DEC-19	R4943994
Conductivity (EC)	1930		2.0	uS/cm		14-DEC-19	R4943994
Bicarbonate (HCO3)	709		5.0	mg/L		14-DEC-19	R4943994
Carbonate (CO3)	<5.0		5.0	mg/L		14-DEC-19	R4943994
Hydroxide (OH)	<5.0		5.0	mg/L		14-DEC-19	R4943994
Alkalinity, Total (as CaCO3)	581		2.0	mg/L		14-DEC-19	R4943994
EPA 8260 Volatile Organics							
VOCs in Water							
1,1,1,2-Tetrachloroethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1,1-Trichloroethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1,2,2-Tetrachloroethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1,2-Trichloroethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1-Dichloroethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1-Dichloroethene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,1-Dichloropropene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2,3-Trichlorobenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2,3-Trichloropropane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2,4-Trichlorobenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2,4-Trimethylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2-Dibromo-3-chloropropane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2-Dichlorobenzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2-Dichloroethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,2-Dichloropropane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,3,5-Trimethylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,3-Dichlorobenzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
1,3-Dichloropropane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
1,4-Dichlorobenzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
2,2-Dichloropropane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
2-Chlorotoluene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
4-Chlorotoluene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
p-Isopropyltoluene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Benzene	0.00189		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Bromobenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Bromochloromethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Bromodichloromethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Bromoform	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Bromomethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Carbon tetrachloride	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393429-4 AEP MW-05							
Sampled By: MR/RM on 06-DEC-19 @ 14:30							
Matrix: WATER							
VOCs in Water							
Chlorobenzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Chloroethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Chloroform	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Chloromethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
cis-1,2-Dichloroethene	0.222		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
cis-1,3-Dichloropropene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Dibromochloromethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Dibromomethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Dichlorodifluoromethane	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Ethylbenzene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Ethylene dibromide	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Hexachlorobutadiene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Isopropylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
m+p-Xylenes	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Methylene chloride	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
n-Butylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
n-Propylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
o-Xylene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
sec-Butylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Styrene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
tert-Butylbenzene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Tetrachloroethylene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Toluene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
trans-1,2-Dichloroethene	0.0180		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
trans-1,3-Dichloropropene	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Trichloroethene	<0.00050		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Trichlorofluoromethane	<0.0010		0.0010	mg/L	13-DEC-19	13-DEC-19	R4942751
Vinyl chloride	0.0132		0.00050	mg/L	13-DEC-19	13-DEC-19	R4942751
Surrogate: 1,4-Difluorobenzene	99.0		70-130	%	13-DEC-19	13-DEC-19	R4942751
Surrogate: 4-Bromofluorobenzene	78.9		70-130	%	13-DEC-19	13-DEC-19	R4942751

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
AOX-MISA-KL	Water	Adsorbable Organic Halides	EPA 1650
BTXS-HS-MS-CL	Water	BTEX and Styrene	EPA 8260C/5021A

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

C-DIS-ORG-CL	Water	Dissolved Organic Carbon	APHA 5310 B-Instrumental

Filtered (0.45 um) sample is acidified and purged to remove inorganic carbon, then injected into a heated reaction chamber where organic carbon is oxidized to CO2 which is then transported in the carrier gas stream and measured via a non-dispersive infrared analyzer.

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

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

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

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

F1-HS-FID-CL	Water	F1 (C6-C10)	EPA 5021A / CWS PHC Tier 1

This analysis is based on the "Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil - Tier 1 Method, Canadian Council of Ministers of the Environment, December 2001." For F1 (C6-C10) analysis, the water sample, with added reagents, is heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a GC-FID for analysis.

F2-4-ME-FID-CL	Water	CCME F2-4 Hydrocarbons	EPA 3511/ CCME PHC CWS GC-FID

Water samples are spiked with 2-BBTF surrogate, and extracted by reciprocal action shaker for 30 minutes using a single micro-extraction with hexane. Instrumental analysis is by GC-FID, as per the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil, Tier 1 Method, CCME, December 2001.

HG-D-CVAA-CL	Water	Dissolved Mercury in Water by CVAAS	APHA 3030B/EPA 1631E (mod)

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

IONBALANCE-CL	Water	Ion Balance Calculation	APHA 1030E
MET-D-CCMS-CL	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

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

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

N2N3-CALC-CL	Water	Nitrate+Nitrite	CALCULATION
NH3-F-CL	Water	Ammonia by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

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

NO2-IC-N-CL	Water	Nitrite in Water by IC	EPA 300.1 (mod)

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

NO3-IC-N-CL	Water	Nitrate in Water by IC	EPA 300.1 (mod)

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

P-T-COL-CL	Water	Total P in Water by Colour	APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

PH/EC/ALK-CL	Water	pH, Conductivity and Total Alkalinity	APHA 4500H,2510,2320

All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
		pH measurement is determined from the activity of the hydrogen ions using a hydrogen electrode and a reference electrode. Alkalinity measurement is based on the sample's capacity to neutralize acid Conductivity measurement is based on the sample's capacity to convey an electric current	
SO4-IC-N-CL	Water	Sulfate in Water by IC	EPA 300.1 (mod)
		Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	
TKN-F-CL	Water	Total Kjeldahl Nitrogen by Fluorescence	APHA 4500-NORG (TKN)
		This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.	
VFA-WP	Water	Volatile fatty/carboxylic acids	ASTM D2908-91
		In the field, water and soil samples are collected in certified clean glass jars. In the laboratory, water samples are filtered and transferred to an autosampler vial for analysis. Soil samples are extracted with water and an aliquot of water is filtered. All extracts have internal standard added prior to injection. Analysis is performed by GC/MS in the selected ion monitoring (SIM) mode.	
VOC-HS-MS-CL	Water	VOCs in Water	EPA 8260C/5021A
		The water sample, with added reagents, is heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. VOC Target compound concentrations are measured using mass spectrometry detection.	
XYLENES-CALC-CL	Water	Sum of Xylene Isomer Concentrations	CALCULATION
		Calculation of Total Xylenes Total Xylenes is the sum of the concentrations of the ortho, meta, and para Xylene isomers. Results below detection limit (DL) are treated as zero. The DL for Total Xylenes is set to a value no less than the square root of the sum of the squares of the DLs of the individual Xylenes.	

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

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

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA
KL	ALS ENVIRONMENTAL - KELSO, WASHINGTON, USA
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

Chain of Custody Numbers:

RED DEER MOTORS

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

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

ALS Routine Water Chemistry Report

L2393429

Lab ID	Sample ID	Result	UNITS	MEQ/L	MEQ %
L2393429-1	MW-01				
Sample Date:	06-DEC-19				
Matrix:	WATER				
Ion Balance		101	%		
Routine Anions					
Bicarbonate		688	mg/L	11.27	23
Carbonate		<5.0	mg/L	0	0
Hydroxide		<5.0	mg/L	0	0
Chloride		423	mg/L	11.93	24
Sulfate		79.1	mg/L	1.65	3
Nitrate+Nitrite-N			mg/L	0	0
Anion Sum				24.86	50
Routine Cations					
Calcium		161	mg/L	8.03	16
Magnesium		99.4	mg/L	8.18	16
Sodium		189	mg/L	8.22	16
Potassium		9.55	mg/L	0.24	0
Ammonium		7.2	mg/L	0.51	1
Cation Sum				25.19	50

Lab ID	Sample ID	Result	UNITS	MEQ/L	MEQ %
L2393429-2	AEP MW-04				
Sample Date:	06-DEC-19				
Matrix:	WATER				
Ion Balance		110	%		
Routine Anions					
Bicarbonate		682	mg/L	11.18	17
Carbonate		<5.0	mg/L	0	0
Hydroxide		<5.0	mg/L	0	0
Chloride		450	mg/L	12.69	19
Sulfate		394	mg/L	8.20	12
Nitrate+Nitrite-N			mg/L	0	0
Anion Sum				32.08	48
Routine Cations					
Calcium		249	mg/L	12.43	18
Magnesium		126	mg/L	10.37	15
Sodium		284	mg/L	12.35	18
Potassium		5.29	mg/L	0.14	0
Ammonium		0.45	mg/L	0.03	0
Cation Sum				35.32	52

Lab ID	Sample ID	Result	UNITS	MEQ/L	MEQ %
L2393429-3	AEP MW-04				
Sample Date:	06-DEC-19				
Matrix:	WATER				
Ion Balance		71.4	%		
Routine Anions					
Bicarbonate		1070	mg/L	17.54	48
Carbonate		<5.0	mg/L	0	0
Hydroxide		<5.0	mg/L	0	0
Chloride		6.8	mg/L	0.19	1
Sulfate		174	mg/L	3.62	10
Nitrate+Nitrite-N			mg/L	0	0
Anion Sum				21.37	58
Routine Cations					
Calcium		49.8	mg/L	2.49	7
Magnesium		18.6	mg/L	1.53	4
Sodium		256	mg/L	11.14	30
Potassium		3.37	mg/L	0.09	0
Ammonium		0.306	mg/L	0.02	0
Cation Sum				15.26	42

Lab ID	Sample ID	Result	UNITS	MEQ/L	MEQ %
L2393429-4	AEP MW-05				
Sample Date:	06-DEC-19				
Matrix:	WATER				
Ion Balance		135	%		
Routine Anions					
Bicarbonate		709	mg/L	11.62	27
Carbonate		<5.0	mg/L	0	0
Hydroxide		<5.0	mg/L	0	0
Chloride		167	mg/L	4.71	11
Sulfate		94.9	mg/L	1.98	5
Nitrate+Nitrite-N			mg/L	0	0
Anion Sum				18.31	43
Routine Cations					
Calcium		161	mg/L	8.03	19
Magnesium		99.6	mg/L	8.20	19
Sodium		177	mg/L	7.70	18
Potassium		9.91	mg/L	0.25	1
Ammonium		7.1	mg/L	0.51	1
Cation Sum				24.69	57

ALS LABORATORY GROUP SOIL SALINITY CONVERSION

L2393429

Lab ID	Sample ID					Lab ID	Sample ID				

"Calculations are as per:
Methods of Analysis for Soils, Plants and Waters
Homer D. Chapman and Parker F. Pratt
University of California, Riverside, CI.
August, 1961."

Quality Control Report

Workorder: L2393429 Report Date: 27-DEC-19

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C-DIS-ORG-CL	**Water**							
Batch R4943303								
WG3242660-7 DUP		**L2393430-6**						
Dissolved Organic Carbon		5.6	5.4		mg/L	2.9	20	13-DEC-19
WG3242660-2 LCS								
Dissolved Organic Carbon			82.5		%		80-120	13-DEC-19
WG3242660-6 LCS								
Dissolved Organic Carbon			107.6		%		80-120	13-DEC-19
WG3242660-1 MB								
Dissolved Organic Carbon			<1.0		mg/L		1	13-DEC-19
WG3242660-5 MB								
Dissolved Organic Carbon			<1.0		mg/L		1	13-DEC-19
WG3242660-8 MS		**L2393430-6**						
Dissolved Organic Carbon			88.3		%		70-130	13-DEC-19
CL-IC-N-CL	**Water**							
Batch R4942862								
WG3242035-7 DUP		**L2393409-7**						
Chloride (Cl)		1.02	1.00		mg/L	2.2	20	08-DEC-19
WG3242035-6 LCS								
Chloride (Cl)			102.4		%		90-110	08-DEC-19
WG3242035-5 MB								
Chloride (Cl)			<0.50		mg/L		0.5	08-DEC-19
WG3242035-8 MS		**L2393409-5**						
Chloride (Cl)			103.1		%		75-125	08-DEC-19
F-IC-N-CL	**Water**							
Batch R4942862								
WG3242035-7 DUP		**L2393409-7**						
Fluoride (F)		0.190	0.187		mg/L	1.3	20	08-DEC-19
WG3242035-6 LCS								
Fluoride (F)			100.1		%		90-110	08-DEC-19
WG3242035-5 MB								
Fluoride (F)			<0.020		mg/L		0.02	08-DEC-19
WG3242035-8 MS		**L2393409-5**						
Fluoride (F)			98.1		%		75-125	08-DEC-19
F1-HS-FID-CL	**Water**							
Batch R4944123								
WG3243605-1 MB								
F1(C6-C10)			<0.10		mg/L		0.1	13-DEC-19
Surrogate: 3,4-Dichlorotoluene			125.7		%		70-130	13-DEC-19

Quality Control Report

Workorder: L2393429 Report Date: 27-DEC-19

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2-4-ME-FID-CL	**Water**							
Batch R4944846								
WG3243467-1 MB								
F2: (C10-C16)			<0.10		mg/L		0.1	17-DEC-19
Surrogate: 2-Bromobenzotrifluoride			70.9		%		60-140	17-DEC-19
HG-D-CVAA-CL	**Water**							
Batch R4943011								
WG3242289-6 LCS								
Mercury (Hg)-Dissolved			118.0		%		80-120	13-DEC-19
WG3242289-5 MB								
Mercury (Hg)-Dissolved			<0.000005[illegible]		mg/L		0.000005	13-DEC-19
MET-D-CCMS-CL	**Water**							
Batch R4943353								
WG3242669-3 DUP		**L2393409-7**						
Aluminum (Al)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	14-DEC-19
Antimony (Sb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	14-DEC-19
Arsenic (As)-Dissolved		0.00016	0.00016		mg/L	0.8	20	14-DEC-19
Barium (Ba)-Dissolved		0.0659	0.0658		mg/L	0.2	20	14-DEC-19
Boron (B)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	14-DEC-19
Cadmium (Cd)-Dissolved		0.0000157	0.0000101	J	mg/L	0.0000056	0.00001	14-DEC-19
Calcium (Ca)-Dissolved		74.7	81.9		mg/L	9.2	20	14-DEC-19
Chromium (Cr)-Dissolved		0.00014	0.00014		mg/L	1.5	20	14-DEC-19
Copper (Cu)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	14-DEC-19
Iron (Fe)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	14-DEC-19
Lead (Pb)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	14-DEC-19
Magnesium (Mg)-Dissolved		40.1	40.2		mg/L	0.1	20	14-DEC-19
Manganese (Mn)-Dissolved		0.00043	0.00046		mg/L	5.6	20	14-DEC-19
Nickel (Ni)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	14-DEC-19
Potassium (K)-Dissolved		0.817	0.814		mg/L	0.3	20	14-DEC-19
Selenium (Se)-Dissolved		0.0376	0.0360		mg/L	4.5	20	14-DEC-19
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	14-DEC-19
Sodium (Na)-Dissolved		1.83	1.85		mg/L	1.0	20	14-DEC-19
Uranium (U)-Dissolved		0.00206	0.00235		mg/L	13	20	14-DEC-19
Zinc (Zn)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	14-DEC-19
WG3242669-2 LCS								
Aluminum (Al)-Dissolved			106.8		%		80-120	14-DEC-19
Antimony (Sb)-Dissolved			93.4		%		80-120	14-DEC-19

Quality Control Report

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL	**Water**							
Batch R4943353								
WG3242669-2 LCS								
Arsenic (As)-Dissolved			105.4		%		80-120	14-DEC-19
Barium (Ba)-Dissolved			105.1		%		80-120	14-DEC-19
Boron (B)-Dissolved			100.7		%		80-120	14-DEC-19
Cadmium (Cd)-Dissolved			102.9		%		80-120	14-DEC-19
Calcium (Ca)-Dissolved			101.7		%		80-120	14-DEC-19
Chromium (Cr)-Dissolved			104.6		%		80-120	14-DEC-19
Copper (Cu)-Dissolved			101.0		%		80-120	14-DEC-19
Iron (Fe)-Dissolved			97.7		%		80-120	14-DEC-19
Lead (Pb)-Dissolved			101.5		%		80-120	14-DEC-19
Magnesium (Mg)-Dissolved			107.4		%		80-120	14-DEC-19
Manganese (Mn)-Dissolved			103.3		%		80-120	14-DEC-19
Nickel (Ni)-Dissolved			105.2		%		80-120	14-DEC-19
Potassium (K)-Dissolved			108.3		%		80-120	14-DEC-19
Selenium (Se)-Dissolved			99.0		%		80-120	14-DEC-19
Silver (Ag)-Dissolved			99.9		%		80-120	14-DEC-19
Sodium (Na)-Dissolved			104.3		%		80-120	14-DEC-19
Uranium (U)-Dissolved			100.8		%		80-120	14-DEC-19
Zinc (Zn)-Dissolved			102.1		%		80-120	14-DEC-19
WG3242669-1 MB								
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	14-DEC-19
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	14-DEC-19
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	14-DEC-19
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	14-DEC-19
Boron (B)-Dissolved			<0.010		mg/L		0.01	14-DEC-19
Cadmium (Cd)-Dissolved			<0.000005(		mg/L		0.000005	14-DEC-19
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	14-DEC-19
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	14-DEC-19
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	14-DEC-19
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	14-DEC-19
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	14-DEC-19
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	14-DEC-19
Manganese (Mn)-Dissolved			<0.00010		mg/L		0.0001	14-DEC-19
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	14-DEC-19
Potassium (K)-Dissolved			<0.050		mg/L		0.05	14-DEC-19

Quality Control Report

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL	**Water**							
Batch R4943353								
WG3242669-1 MB								
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	14-DEC-19
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	14-DEC-19
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	14-DEC-19
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	14-DEC-19
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	14-DEC-19
WG3242669-4 MS		**L2393409-7**						
Aluminum (Al)-Dissolved			122.3		%		70-130	15-DEC-19
Antimony (Sb)-Dissolved			105.6		%		70-130	15-DEC-19
Arsenic (As)-Dissolved			111.9		%		70-130	15-DEC-19
Barium (Ba)-Dissolved			100.1		%		70-130	15-DEC-19
Boron (B)-Dissolved			107.5		%		70-130	15-DEC-19
Cadmium (Cd)-Dissolved			110.1		%		70-130	15-DEC-19
Calcium (Ca)-Dissolved			N/A	MS-B	%		-	15-DEC-19
Chromium (Cr)-Dissolved			113.7		%		70-130	15-DEC-19
Copper (Cu)-Dissolved			111.1		%		70-130	15-DEC-19
Iron (Fe)-Dissolved			111.4		%		70-130	15-DEC-19
Lead (Pb)-Dissolved			100.1		%		70-130	15-DEC-19
Magnesium (Mg)-Dissolved			N/A	MS-B	%		-	15-DEC-19
Manganese (Mn)-Dissolved			115.2		%		70-130	15-DEC-19
Nickel (Ni)-Dissolved			110.7		%		70-130	15-DEC-19
Potassium (K)-Dissolved			109.0		%		70-130	15-DEC-19
Selenium (Se)-Dissolved			108.9		%		70-130	15-DEC-19
Silver (Ag)-Dissolved			97.8		%		70-130	15-DEC-19
Sodium (Na)-Dissolved			115.0		%		70-130	15-DEC-19
Uranium (U)-Dissolved			103.0		%		70-130	15-DEC-19
Zinc (Zn)-Dissolved			102.7		%		70-130	15-DEC-19
NH3-F-CL	**Water**							
Batch R4943991								
WG3242302-18 LCS								
Ammonia, Total (as N)			109.6		%		85-115	13-DEC-19
WG3242302-17 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	13-DEC-19
NO2-IC-N-CL	**Water**							

Quality Control Report

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO2-IC-N-CL	**Water**							
Batch R4942862								
WG3242035-6 LCS								
Nitrite (as N)			104.2		%		90-110	08-DEC-19
WG3242035-5 MB								
Nitrite (as N)			<0.010		mg/L		0.01	08-DEC-19
NO3-IC-N-CL	**Water**							
Batch R4942862								
WG3242035-6 LCS								
Nitrate (as N)			102.0		%		90-110	08-DEC-19
WG3242035-5 MB								
Nitrate (as N)			<0.020		mg/L		0.02	08-DEC-19
P-T-COL-CL	**Water**							
Batch R4943276								
WG3242072-10 LCS								
Phosphorus (P)-Total			92.6		%		80-120	13-DEC-19
WG3242072-9 MB								
Phosphorus (P)-Total			<0.0050		mg/L		0.005	13-DEC-19
PH/EC/ALK-CL	**Water**							
Batch R4943994								
WG3243425-11 LCS								
Conductivity (EC)			99.3		%		90-110	14-DEC-19
Alkalinity, Total (as CaCO3)			104.4		%		85-115	14-DEC-19
WG3243425-10 MB								
Conductivity (EC)			<2.0		uS/cm		2	14-DEC-19
Bicarbonate (HCO3)			<5.0		mg/L		5	14-DEC-19
Carbonate (CO3)			<5.0		mg/L		5	14-DEC-19
Hydroxide (OH)			<5.0		mg/L		5	14-DEC-19
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	14-DEC-19
SO4-IC-N-CL	**Water**							
Batch R4942862								
WG3242035-7 DUP		**L2393409-7**						
Sulfate (SO4)		167	166		mg/L	0.3	20	08-DEC-19
WG3242035-6 LCS								
Sulfate (SO4)			101.9		%		90-110	08-DEC-19
WG3242035-5 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	08-DEC-19
WG3242035-8 MS		**L2393409-5**						
Sulfate (SO4)			100.7				75-125	

Quality Control Report

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-IC-N-CL	**Water**							
Batch R4942862								
WG3242035-8 MS		**L2393409-5**						
Sulfate (SO4)			100.7		%		75-125	08-DEC-19
TKN-F-CL	**Water**							
Batch R4943090								
WG3242367-15 DUP		**L2393430-1**						
Total Kjeldahl Nitrogen		0.69	0.64		mg/L	8.0	20	12-DEC-19
WG3242367-17 DUP		**L2393876-2**						
Total Kjeldahl Nitrogen		18	17		mg/L	0.5	20	12-DEC-19
WG3242367-18 DUP		**L2393879-1**						
Total Kjeldahl Nitrogen		74	71		mg/L	4.4	20	12-DEC-19
WG3242367-3 DUP		**L2394735-1**						
Total Kjeldahl Nitrogen		3.93	3.82		mg/L	2.8	20	12-DEC-19
WG3242367-10 LCS								
Total Kjeldahl Nitrogen			102.0		%		75-125	12-DEC-19
WG3242367-14 LCS								
Total Kjeldahl Nitrogen			102.0		%		75-125	12-DEC-19
WG3242367-2 LCS								
Total Kjeldahl Nitrogen			98.4		%		75-125	12-DEC-19
WG3242367-6 LCS								
Total Kjeldahl Nitrogen			100.2		%		75-125	12-DEC-19
WG3242367-1 MB								
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	12-DEC-19
WG3242367-13 MB								
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	12-DEC-19
WG3242367-5 MB								
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	12-DEC-19
WG3242367-9 MB								
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	12-DEC-19
WG3242367-16 MS		**L2393430-1**						
Total Kjeldahl Nitrogen			99.9		%		70-130	12-DEC-19
WG3242367-4 MS		**L2394735-1**						
Total Kjeldahl Nitrogen			107.0		%		70-130	12-DEC-19
VFA-WP	**Water**							
Batch R4943956								
WG3243154-3 DUP		**L2393428-2**						
Formic Acid		<50	<50	RPD-NA	mg/L	N/A	30	14-DEC-19
Acetic Acid		<10	<10	RPD-NA	mg/L	N/A	30	14-DEC-19

Quality Control Report

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VFA-WP	**Water**							
Batch R4943956								
WG3243154-3 DUP		**L2393428-2**						
Propionic Acid		<5.0	<5.0	RPD-NA	mg/L	N/A	30	14-DEC-19
Butyric Acid		<1.0	<1.0	RPD-NA	mg/L	N/A	30	14-DEC-19
Isobutyric Acid		<1.0	<1.0	RPD-NA	mg/L	N/A	30	14-DEC-19
Valeric Acid		<1.0	<1.0	RPD-NA	mg/L	N/A	30	14-DEC-19
Isovaleric Acid		<1.0	<1.0	RPD-NA	mg/L	N/A	30	14-DEC-19
Caproic (Hexanoic) Acid		<1.0	<1.0	RPD-NA	mg/L	N/A	30	14-DEC-19
WG3243154-2 LCS								
Formic Acid			124.7		%		70-130	16-DEC-19
Acetic Acid			73.5		%		70-130	16-DEC-19
Propionic Acid			87.7		%		70-130	16-DEC-19
Butyric Acid			70.6		%		70-130	16-DEC-19
Isobutyric Acid			76.8		%		70-130	16-DEC-19
Valeric Acid			75.6		%		70-130	16-DEC-19
Isovaleric Acid			71.7		%		70-130	16-DEC-19
Caproic (Hexanoic) Acid			85.2		%		70-130	16-DEC-19
WG3243154-1 MB								
Formic Acid			<30		mg/L		30	13-DEC-19
Acetic Acid			<10		mg/L		10	13-DEC-19
Propionic Acid			<5.0		mg/L		5	13-DEC-19
Butyric Acid			<1.0		mg/L		1	13-DEC-19
Isobutyric Acid			<1.0		mg/L		1	13-DEC-19
Valeric Acid			<1.0		mg/L		1	13-DEC-19
Isovaleric Acid			<1.0		mg/L		1	13-DEC-19
Caproic (Hexanoic) Acid			<1.0		mg/L		1	13-DEC-19
WG3243154-4 MS		**L2393423-2**						
Formic Acid			92.1		%		70-130	13-DEC-19
Acetic Acid			78.9		%		70-130	13-DEC-19
Propionic Acid			74.4		%		70-130	13-DEC-19
Butyric Acid			72.4		%		70-130	13-DEC-19
Isobutyric Acid			80.5		%		70-130	13-DEC-19
Valeric Acid			72.6		%		70-130	13-DEC-19
Isovaleric Acid			70.3		%		70-130	13-DEC-19
Caproic (Hexanoic) Acid			91.8		%		70-130	13-DEC-19
VOC-HS-MS-CL	**Water**							

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-HS-MS-CL	**Water**							
Batch	**R4942751**							
WG3242018-2	**DUP**	**L2393184-1**						
1,1,1,2-Tetrachloroethane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
1,1,1-Trichloroethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
1,1,2,2-Tetrachloroethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
1,1,2-Trichloroethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
1,1-Dichloroethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
1,1-Dichloroethene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
1,1-Dichloropropene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
1,2,3-Trichlorobenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
1,2,3-Trichloropropane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
1,2,4-Trichlorobenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
1,2,4-Trimethylbenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
1,2-Dibromo-3-chloropropane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
1,2-Dichlorobenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
1,2-Dichloroethane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
1,2-Dichloropropane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
1,3,5-Trimethylbenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
1,3-Dichlorobenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
1,3-Dichloropropane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
1,4-Dichlorobenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
2,2-Dichloropropane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
2-Chlorotoluene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
4-Chlorotoluene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
p-Isopropyltoluene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	50	12-DEC-19
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Bromobenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
Bromochloromethane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
Bromodichloromethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Bromoform		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Bromomethane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
Carbon tetrachloride		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Chlorobenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Chloroethane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
Chloroform		<0.00050	<0.00050		mg/L			12-DEC-19

Quality Control Report

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-HS-MS-CL	**Water**							
Batch R4942751								
WG3242018-2 DUP		**L2393184-1**						
Chloroform		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Chloromethane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
cis-1,2-Dichloroethene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
cis-1,3-Dichloropropene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Dibromochloromethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Dibromomethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Dichlorodifluoromethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Ethylbenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Ethylene dibromide		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Hexachlorobutadiene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
Isopropylbenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
m+p-Xylenes		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Methylene chloride		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
n-Butylbenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
n-Propylbenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
sec-Butylbenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
Styrene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
tert-Butylbenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
Tetrachloroethylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
trans-1,2-Dichloroethene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
trans-1,3-Dichloropropene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
Trichloroethene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Trichlorofluoromethane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
Vinyl chloride		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
WG3242018-3 DUP		**L2393424-1**						
1,1,1,2-Tetrachloroethane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
1,1,1-Trichloroethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
1,1,2,2-Tetrachloroethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
1,1,2-Trichloroethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
1,1-Dichloroethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
1,1-Dichloroethene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19

Quality Control Report

Workorder: L2393429 Report Date: 27-DEC-19

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-HS-MS-CL	**Water**							
Batch R4942751								
WG3242018-3 DUP		**L2393424-1**						
1,1-Dichloropropene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
1,2,3-Trichlorobenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
1,2,3-Trichloropropane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
1,2,4-Trichlorobenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
1,2,4-Trimethylbenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
1,2-Dibromo-3-chloropropane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
1,2-Dichlorobenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
1,2-Dichloroethane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
1,2-Dichloropropane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
1,3,5-Trimethylbenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
1,3-Dichlorobenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
1,3-Dichloropropane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
1,4-Dichlorobenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
2,2-Dichloropropane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
2-Chlorotoluene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
4-Chlorotoluene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
p-Isopropyltoluene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	50	12-DEC-19
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Bromobenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
Bromochloromethane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
Bromodichloromethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Bromoform		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Bromomethane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
Carbon tetrachloride		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Chlorobenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Chloroethane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
Chloroform		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Chloromethane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
cis-1,2-Dichloroethene		0.0084	0.0075		mg/L	12	30	12-DEC-19
cis-1,3-Dichloropropene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Dibromochloromethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Dibromomethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Dichlorodifluoromethane		<0.00050	<0.00050		mg/L			12-DEC-19

Quality Control Report

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-HS-MS-CL	**Water**							
Batch R4942751								
WG3242018-3 DUP		**L2393424-1**						
Dichlorodifluoromethane		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Ethylbenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Ethylene dibromide		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Hexachlorobutadiene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
Isopropylbenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
m+p-Xylenes		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Methylene chloride		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
n-Butylbenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
n-Propylbenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
sec-Butylbenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
Styrene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
tert-Butylbenzene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
Tetrachloroethylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
trans-1,2-Dichloroethene		0.00067	0.00059		mg/L	13	30	12-DEC-19
trans-1,3-Dichloropropene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
Trichloroethene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
Trichlorofluoromethane		<0.0010	<0.0010	RPD-NA	mg/L	N/A	30	12-DEC-19
Vinyl chloride		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	12-DEC-19
WG3242018-1 MB								
1,1,1,2-Tetrachloroethane			<0.0010		mg/L		0.001	12-DEC-19
1,1,1-Trichloroethane			<0.00050		mg/L		0.0005	12-DEC-19
1,1,2,2-Tetrachloroethane			<0.00050		mg/L		0.0005	12-DEC-19
1,1,2-Trichloroethane			<0.00050		mg/L		0.0005	12-DEC-19
1,1-Dichloroethane			<0.00050		mg/L		0.0005	12-DEC-19
1,1-Dichloroethene			<0.00050		mg/L		0.0005	12-DEC-19
1,1-Dichloropropene			<0.0010		mg/L		0.001	12-DEC-19
1,2,3-Trichlorobenzene			<0.0010		mg/L		0.001	12-DEC-19
1,2,3-Trichloropropane			<0.00050		mg/L		0.0005	12-DEC-19
1,2,4-Trichlorobenzene			<0.0010		mg/L		0.001	12-DEC-19
1,2,4-Trimethylbenzene			<0.0010		mg/L		0.001	12-DEC-19
1,2-Dibromo-3-chloropropane			<0.0010		mg/L		0.001	12-DEC-19

Quality Control Report

Workorder: L2393429 Report Date: 27-DEC-19

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-HS-MS-CL	**Water**							
Batch R4942751								
WG3242018-1 MB								
1,2-Dichlorobenzene			<0.00050		mg/L		0.0005	12-DEC-19
1,2-Dichloroethane			<0.0010		mg/L		0.001	12-DEC-19
1,2-Dichloropropane			<0.00050		mg/L		0.0005	12-DEC-19
1,3,5-Trimethylbenzene			<0.0010		mg/L		0.001	12-DEC-19
1,3-Dichlorobenzene			<0.00050		mg/L		0.0005	12-DEC-19
1,3-Dichloropropane			<0.0010		mg/L		0.001	12-DEC-19
1,4-Dichlorobenzene			<0.00050		mg/L		0.0005	12-DEC-19
2,2-Dichloropropane			<0.0010		mg/L		0.001	12-DEC-19
2-Chlorotoluene			<0.0010		mg/L		0.001	12-DEC-19
4-Chlorotoluene			<0.0010		mg/L		0.001	12-DEC-19
p-Isopropyltoluene			<0.0010		mg/L		0.001	12-DEC-19
Benzene			<0.00050		mg/L		0.0005	12-DEC-19
Bromobenzene			<0.0010		mg/L		0.001	12-DEC-19
Bromochloromethane			<0.0010		mg/L		0.001	12-DEC-19
Bromodichloromethane			<0.00050		mg/L		0.0005	12-DEC-19
Bromoform			<0.00050		mg/L		0.0005	12-DEC-19
Bromomethane			<0.0010		mg/L		0.001	12-DEC-19
Carbon tetrachloride			<0.00050		mg/L		0.0005	12-DEC-19
Chlorobenzene			<0.00050		mg/L		0.0005	12-DEC-19
Chloroethane			<0.0010		mg/L		0.001	12-DEC-19
Chloroform			<0.00050		mg/L		0.0005	12-DEC-19
Chloromethane			<0.0010		mg/L		0.001	12-DEC-19
cis-1,2-Dichloroethene			<0.0010		mg/L		0.001	12-DEC-19
cis-1,3-Dichloropropene			<0.00050		mg/L		0.0005	12-DEC-19
Dibromochloromethane			<0.00050		mg/L		0.0005	12-DEC-19
Dibromomethane			<0.00050		mg/L		0.0005	12-DEC-19
Dichlorodifluoromethane			<0.00050		mg/L		0.0005	12-DEC-19
Ethylbenzene			<0.00050		mg/L		0.0005	12-DEC-19
Ethylene dibromide			<0.00050		mg/L		0.0005	12-DEC-19
Hexachlorobutadiene			<0.0010		mg/L		0.001	12-DEC-19
Isopropylbenzene			<0.0010		mg/L		0.001	12-DEC-19
m+p-Xylenes			<0.00050		mg/L		0.0005	12-DEC-19
Methylene chloride			<0.0010		mg/L		0.001	12-DEC-19

Quality Control Report

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-HS-MS-CL	**Water**							
Batch R4942751								
WG3242018-1 MB								
n-Butylbenzene			<0.0010		mg/L		0.001	12-DEC-19
n-Propylbenzene			<0.0010		mg/L		0.001	12-DEC-19
o-Xylene			<0.00050		mg/L		0.0005	12-DEC-19
sec-Butylbenzene			<0.0010		mg/L		0.001	12-DEC-19
Styrene			<0.00050		mg/L		0.0005	12-DEC-19
tert-Butylbenzene			<0.0010		mg/L		0.001	12-DEC-19
Tetrachloroethylene			<0.00050		mg/L		0.0005	12-DEC-19
Toluene			<0.00050		mg/L		0.0005	12-DEC-19
trans-1,2-Dichloroethene			<0.00050		mg/L		0.0005	12-DEC-19
trans-1,3-Dichloropropene			<0.0010		mg/L		0.001	12-DEC-19
Trichloroethene			<0.00050		mg/L		0.0005	12-DEC-19
Trichlorofluoromethane			<0.0010		mg/L		0.001	12-DEC-19
Vinyl chloride			<0.00050		mg/L		0.0005	12-DEC-19
Surrogate: 1,4-Difluorobenzene			100.5		%		70-130	12-DEC-19
Surrogate: 4-Bromofluorobenzene			88.1		%		70-130	12-DEC-19

Quality Control Report

Workorder: L2393429 Report Date: 27-DEC-19

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

December 26, 2019 Service Request No:K1911637

Inayat Dhaliwal
ALS Environmental - Canada
2559 29 Street NE
Calgary, AB T1Y 7B5

Laboratory Results for: L2393429

Dear Inayat,

Enclosed are the results of the sample(s) submitted to our laboratory December 12, 2019
For your reference, these analyses have been assigned our service request number **K1911637.**

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3293. You may also contact me via email at Elizabeth.Harris@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Elizabeth Harris
Project Manager

ADDRESS 1317 S. 13th Avenue, Kelso, WA 98626
PHONE +1 360 577 7222 | FAX +1 360 636 1068
ALS Group USA, Corp.
dba ALS Environmental

Narrative Documents

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Client: ALS Environmental - Canada
Project: L2393429
Sample Matrix: Water

Service Request: K1911637
Date Received: 12/12/2019

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples for the Tier II level requested by the client.

Sample Receipt:

Four water samples were received for analysis at ALS Environmental on 12/12/2019. Any discrepancies upon initial sample inspection are annotated on the sample receipt and preservation form included within this report. The samples were stored at minimum in accordance with the analytical method requirements.

General Chemistry:

No significant anomalies were noted with this analysis.

Approved by _____ Date 12/26/2019

SAMPLE DETECTION SUMMARY

CLIENT ID: L2393429-2			Lab ID: K1911637-002			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Halides, Adsorbable Organic (AOX)	0.039			0.025	mg/L	1650C

CLIENT ID: L2393429-4			Lab ID: K1911637-004			
Analyte	**Results**	**Flag**	**MDL**	**MRL**	**Units**	**Method**
Halides, Adsorbable Organic (AOX)	0.180			0.025	mg/L	1650C

Sample Receipt Information

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Client: ALS Environmental - Canada **Service Request:**K1911637
Project: L2393429

SAMPLE CROSS-REFERENCE

SAMPLE #	CLIENT SAMPLE ID	DATE	TIME
K1911637-001	L2393429-1	12/6/2019	
K1911637-002	L2393429-2	12/6/2019	
K1911637-003	L2393429-3	12/6/2019	
K1911637-004	L2393429-4	12/6/2019	

KL2116637

L2393429

CALGARY

ALS Environmental

Subcontract Request Form

Subcontract To:

ALS ENVIRONMENTAL - KELSO, WASHINGTON, USA
1317 S. 13TH AVE
KELSO,WA 98626

NOTES: Please reference on final report and invoice: PO# *L2393429*
ALS requires QC data to be provided with your final results.

Please see enclosed 4 **sample(s) in** 4 **Container(s)**

SAMPLE NUMBER	ANALYTICAL REQUIRED	DATE SAMPLED / DUE DATE	Priority Flag
L2393429-1 MW-01	Adsorbable Organic Halides (AOX-MISA-KL 1)	12/ 6/ 2019 12/30/2019	
L2393429-2 AEP MW-04	Adsorbable Organic Halides (AOX-MISA-KL 1)	12/ 6/ 2019 12/30/2019	
L2393429-3 AEP MW-04	Adsorbable Organic Halides (AOX-MISA-KL 1)	12/ 6/ 2019 12/30/2019	
L2393429-4 AEP MW-05	Adsorbable Organic Halides (AOX-MISA-KL 1)	12/ 6/ 2019 12/30/2019	

Subcontract Info Contact: John Forbes (403) 291-9897
Analysis and reporting info contact: Inayat Dhaliwal
2559 29 STREET NE
CALGARY,AB T1Y 7B5
Phone: (403) 291-9897 Email: inayat.dhaliwal@alsglobal.com

Please email confirmation of receipt to: **inayat.dhaliwal@alsglobal.com**

Shipped By: _____ Date Shipped: _____

Received By: _____ Date Received: 12/12/19 1000

Verified By: _____ Date Verified: _____

Temperature: _____

Sample Integrity Issues: _____

PC EH

Cooler Receipt and Preservation Form

Client ALS CANADA Service Request K19 11637

Received: 12/12/19 Opened: 12/12/19 By: CG Unloaded: 12/12/19 By: CG

1. Samples were received via? *USPS* (*Fed Ex*) *UPS* *DHL* *PDX* *Courier* *Hand Delivered*
2. Samples were received in: (circle) (*Cooler*) *Box* *Envelope* *Other* _____ *NA*
3. Were custody seals on coolers? NA Y (N) If yes, how many and where? _____
   If present, were custody seals intact? Y N If present, were they signed and dated? Y N

Raw Cooler Temp	Corrected Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID (NA)	Tracking Number NA	Filed
0.1	0.4	/	/	+0.3	403		777200688607	

4. Packing material: *Inserts* *Baggies* (*Bubble Wrap*) (*Gel Packs*) *Wet Ice* *Dry Ice* *Sleeves* _____
5. Were custody papers properly filled out (ink, signed, etc.)? NA (Y) N
6. Were samples received in good condition (temperature, unbroken)? *Indicate in the table below.* NA (Y) N
   If applicable, tissue samples were received: *Frozen* *Partially Thawed* *Thawed*
7. Were all sample labels complete (i.e analysis, preservation, etc.)? NA (Y) N
8. Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* NA (Y) N
9. Were appropriate bottles/containers and volumes received for the tests indicated? NA (Y) N
10. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA (Y) N
11. Were VOA vials received without headspace? *Indicate in the table below.* (NA) Y N
12. Was C12/Res negative? (NA) Y N

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, & Resolutions: _____

Miscellaneous Forms

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Inorganic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
E	The result is an estimate amount because the value exceeded the instrument calibration range.
J	The result is an estimated value.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.
H	The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

#	The control limit criteria is not applicable. See case narrative.
J	The result is an estimated value.
E	The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
M	The duplicate injection precision was not met.
N	The Matrix Spike sample recovery is not within control limits. See case narrative.
S	The reported value was determined by the Method of Standard Additions (MSA).
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
W	The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
i	The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X	See case narrative.
+	The correlation coefficient for the MSA is less than 0.995.
Q	See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
A	A tentatively identified compound, a suspected aldol-condensation product.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
C	The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
D	The reported result is from a dilution.
E	The result is an estimated value.
J	The result is an estimated value.
N	The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
P	The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
U	The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. *DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i	The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
X	See case narrative.
Q	See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

F	The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
L	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
H	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
O	The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
Y	The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
Z	The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses

Agency	Web Site	Number
Alaska DEH	http://dec.alaska.gov/eh/lab/cs/csapproval.htm	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2795
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L16-58-R4
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Hawaii DOH	http://health.hawaii.gov/	-
ISO 17025	http://www.pjlabs.com/	L16-57
Louisiana DEQ	http://www.deq.louisiana.gov/page/la-lab-accreditation	03016
Maine DHS	http://www.maine.gov/dhhs/	WA01276
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-457
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA01276
New Jersey DEP	http://www.nj.gov/dep/enforcement/oqa.html	WA005
New York - DOH	https://www.wadsworth.org/regulatory/elap	12060
North Carolina DEQ	https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab-certification	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA100010
South Carolina DHEC	http://www.scdhec.gov/environment/EnvironmentalLabCertification/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C544
Wyoming (EPA Region 8)	https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water-	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.
Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Client: ALS Environmental - Canada **Service Request:** K1911637
Project: L2393429/

Sample Name: L2393429-1 **Date Collected:** 12/6/19
Lab Code: K1911637-001 **Date Received:** 12/12/19
Sample Matrix: Water

Analysis Method	Extracted/Digested By	Analyzed By
1650C		ESCHLOSS

Sample Name: L2393429-2 **Date Collected:** 12/6/19
Lab Code: K1911637-002 **Date Received:** 12/12/19
Sample Matrix: Water

Analysis Method	Extracted/Digested By	Analyzed By
1650C		ESCHLOSS

Sample Name: L2393429-3 **Date Collected:** 12/6/19
Lab Code: K1911637-003 **Date Received:** 12/12/19
Sample Matrix: Water

Analysis Method	Extracted/Digested By	Analyzed By
1650C		ESCHLOSS

Sample Name: L2393429-4 **Date Collected:** 12/6/19
Lab Code: K1911637-004 **Date Received:** 12/12/19
Sample Matrix: Water

Analysis Method	Extracted/Digested By	Analyzed By
1650C		ESCHLOSS

Sample Results

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

General Chemistry

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Client:	ALS Environmental - Canada	**Service Request:**	K1911637
Project:	L2393429	**Date Collected:**	12/06/19
Sample Matrix:	Water	**Date Received:**	12/12/19 10:00
Sample Name:	L2393429-1	**Basis:**	NA
Lab Code:	K1911637-001		

General Chemistry Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Halides, Adsorbable Organic (AOX)	1650C	ND U	mg/L	0.025	2.5	12/19/19 09:58	

Client:	ALS Environmental - Canada	**Service Request:**	K1911637
Project:	L2393429	**Date Collected:**	12/06/19
Sample Matrix:	Water	**Date Received:**	12/12/19 10:00
Sample Name:	L2393429-2	**Basis:**	NA
Lab Code:	K1911637-002		

General Chemistry Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Halides, Adsorbable Organic (AOX)	1650C	**0.039**	mg/L	0.025	2.5	12/19/19 09:58	

Client:	ALS Environmental - Canada	**Service Request:**	K1911637
Project:	L2393429	**Date Collected:**	12/06/19
Sample Matrix:	Water	**Date Received:**	12/12/19 10:00
Sample Name:	L2393429-3	**Basis:**	NA
Lab Code:	K1911637-003		

General Chemistry Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Halides, Adsorbable Organic (AOX)	1650C	ND U	mg/L	0.10	10	12/19/19 09:58	

Client:	ALS Environmental - Canada	**Service Request:**	K1911637
Project:	L2393429	**Date Collected:**	12/06/19
Sample Matrix:	Water	**Date Received:**	12/12/19 10:00
Sample Name:	L2393429-4	**Basis:**	NA
Lab Code:	K1911637-004		

General Chemistry Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Halides, Adsorbable Organic (AOX)	1650C	**0.180**	mg/L	0.025	2.5	12/19/19 10:54	

QC Summary Forms

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

General Chemistry

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360) 577-7222 Fax (360) 425-9096
www.alsglobal.com

Analytical Report

Client:	ALS Environmental - Canada	**Service Request:**	K1911637
Project:	L2393429	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	NA
Lab Code:	K1911637-MB1		

General Chemistry Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Halides, Adsorbable Organic (AOX)	1650C	ND U	mg/L	0.010	1	12/19/19 10:54	

Analytical Report

Client:	ALS Environmental - Canada	**Service Request:**	K1911637
Project:	L2393429	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA
Sample Name:	Method Blank	**Basis:**	NA
Lab Code:	K1911637-MB2		

General Chemistry Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Halides, Adsorbable Organic (AOX)	1650C	ND U	mg/L	0.010	1	12/19/19 09:58	

Client:	ALS Environmental - Canada	**Service Request:**	K1911637
Project:	L2393429/	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA
		Date Analyzed:	12/19/2019
		Analysis Lot:	663925

Calibration and Method Blank Summary
Halides, Adsorbable Organic (AOX)
1650C

	Halide Check Standard (ug)	**Instrument Calibration Standard** (ug)	**PAR Standard** (ug/L)
True Value	3.64	10.0	0.100
Run A	3.70	10.4	0.099
Percent Recovery A	102	104	99
Run B	3.75	10.3	
Percent Recovery B	103	103	

Client:	ALS Environmental - Canada	**Service Request:**	K1911637
Project:	L2393429/	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA
		Date Analyzed:	12/19/2019
		Analysis Lot:	663927

Calibration and Method Blank Summary
Halides, Adsorbable Organic (AOX)
1650C

	Halide Check Standard (ug)	**Instrument Calibration Standard** (ug)	**PAR Standard** (ug/L)
True Value	3.64	10.0	0.100
Run A	3.70	10.9	0.100
Percent Recovery A	102	109	100
Run B	3.76	10.9	
Percent Recovery B	103	109	

Client:	ALS Environmental - Canada	**Service Request:**	K1911637
Project:	L2393429	**Date Collected:**	12/06/19
Sample Matrix:	Water	**Date Received:**	12/12/19
		Date Analyzed:	12/19/19
		Date Extracted:	NA

Duplicate Matrix Spike Summary
Halides, Adsorbable Organic (AOX)

Sample Name:	L2393429-2	**Units:**	mg/L
Lab Code:	K1911637-002	**Basis:**	NA
Analysis Method:	1650C		
Prep Method:	None		

		Matrix Spike K1911637-002MS			Duplicate Matrix Spike K1911637-002DMS					
Analyte Name	**Sample Result**	**Result**	**Spike Amount**	**% Rec**	**Result**	**Spike Amount**	**% Rec**	**% Rec Limits**	**RPD**	**RPD Limit**
Halides, Adsorbable Organic (AOX)	0.039	0.289	0.250	100	0.302	0.250	105	90-110	4	20

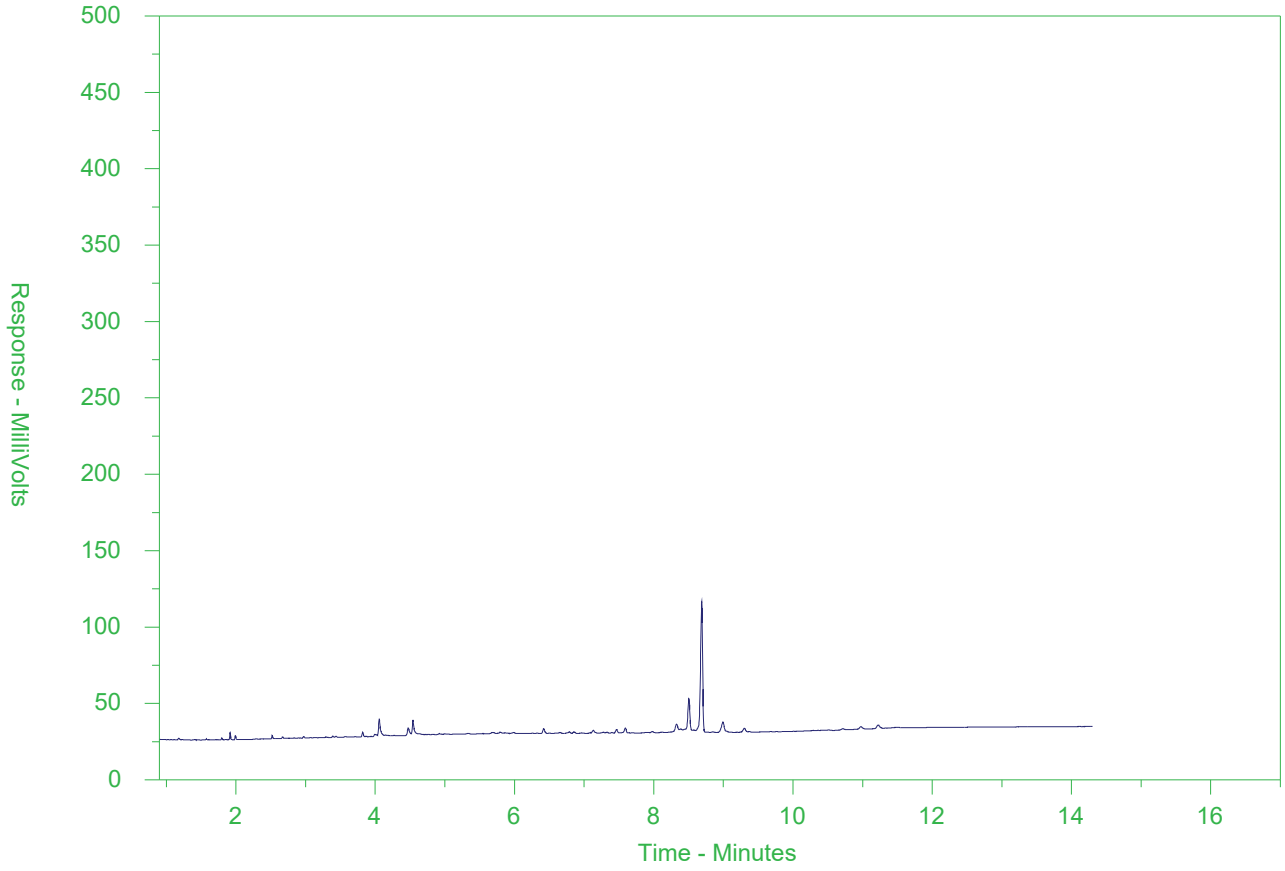
Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2393429-1
Client Sample ID: MW-01



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →	
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

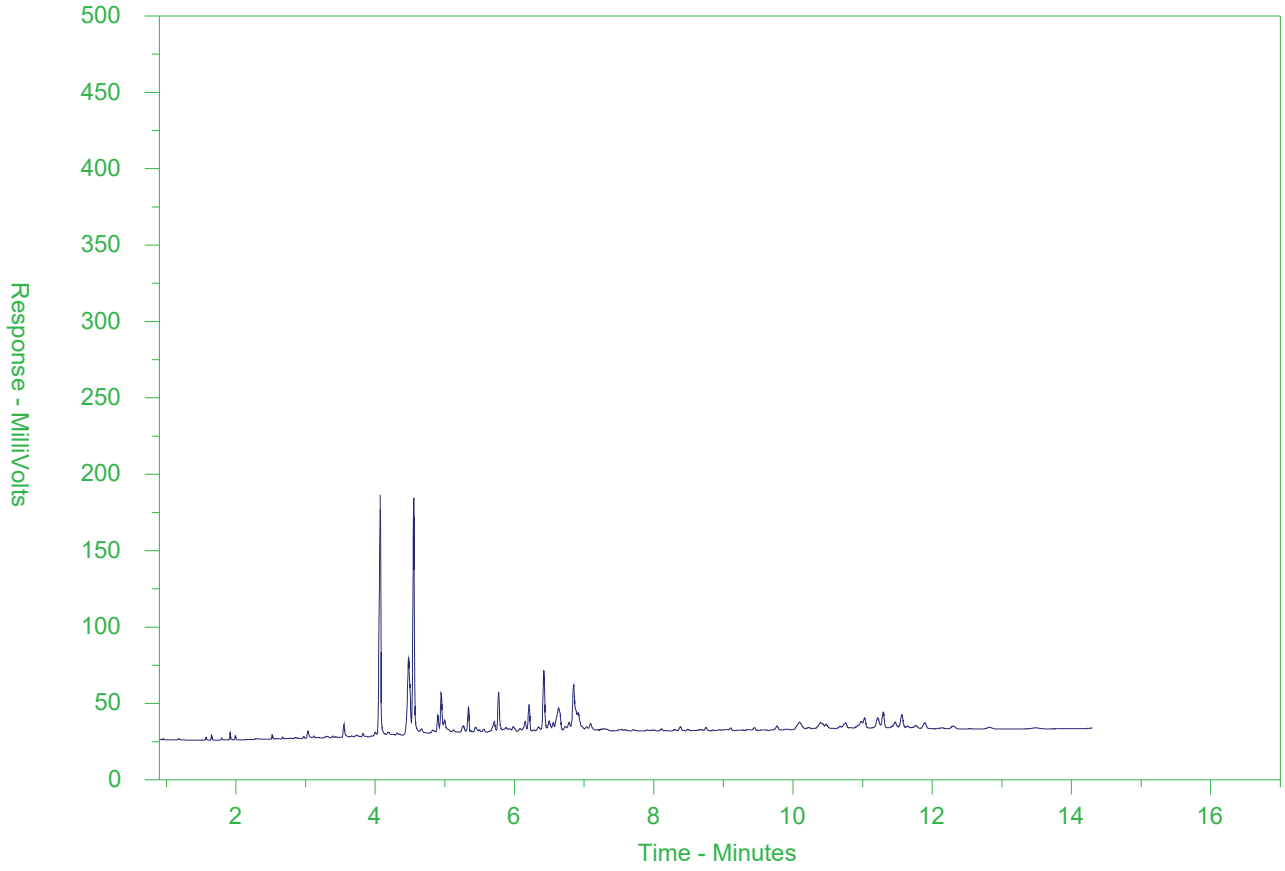
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

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

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2393429-2
Client Sample ID: AEP MW-04



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →	
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

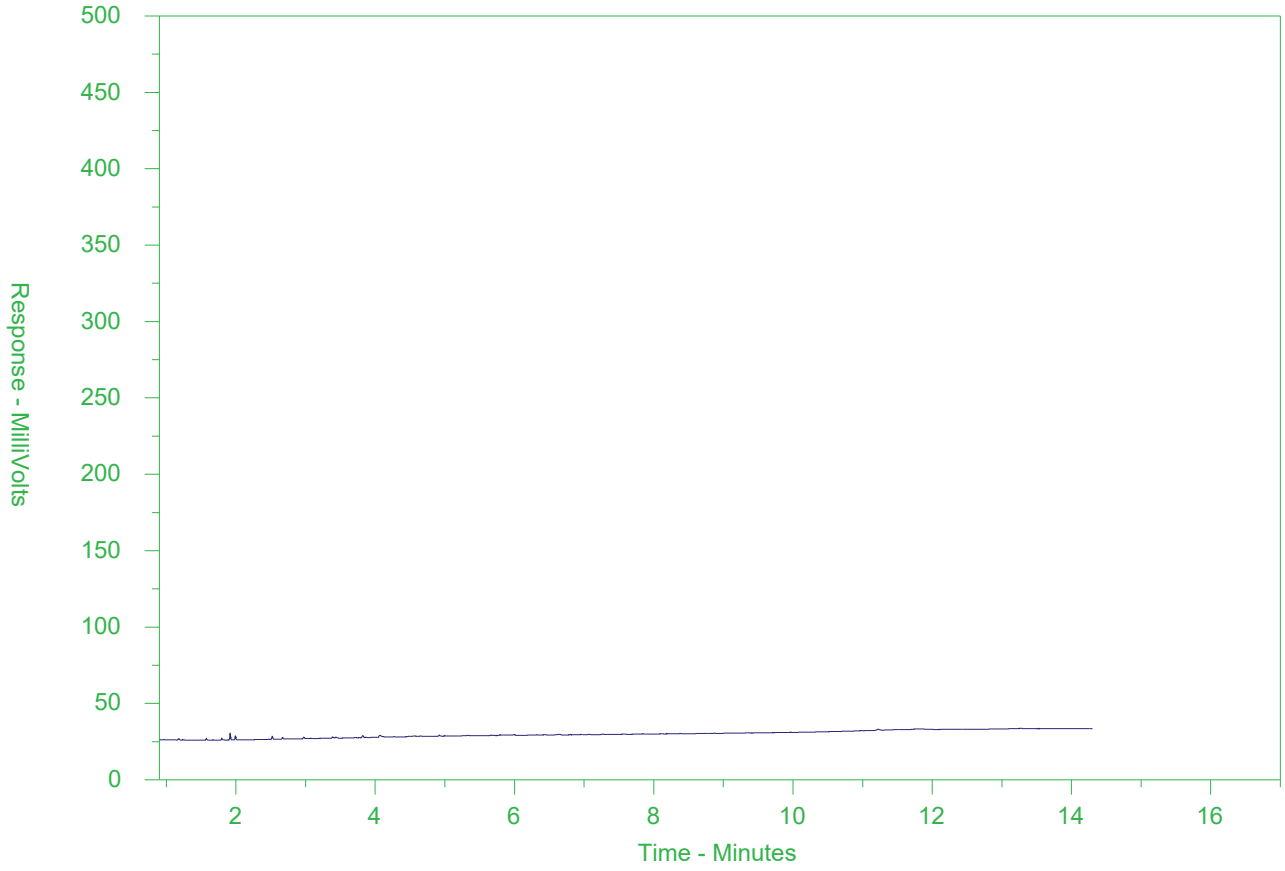
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

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

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2393429-3
Client Sample ID: AEP MW-04



← F2 →	← F3 →	← F4 →	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →	
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

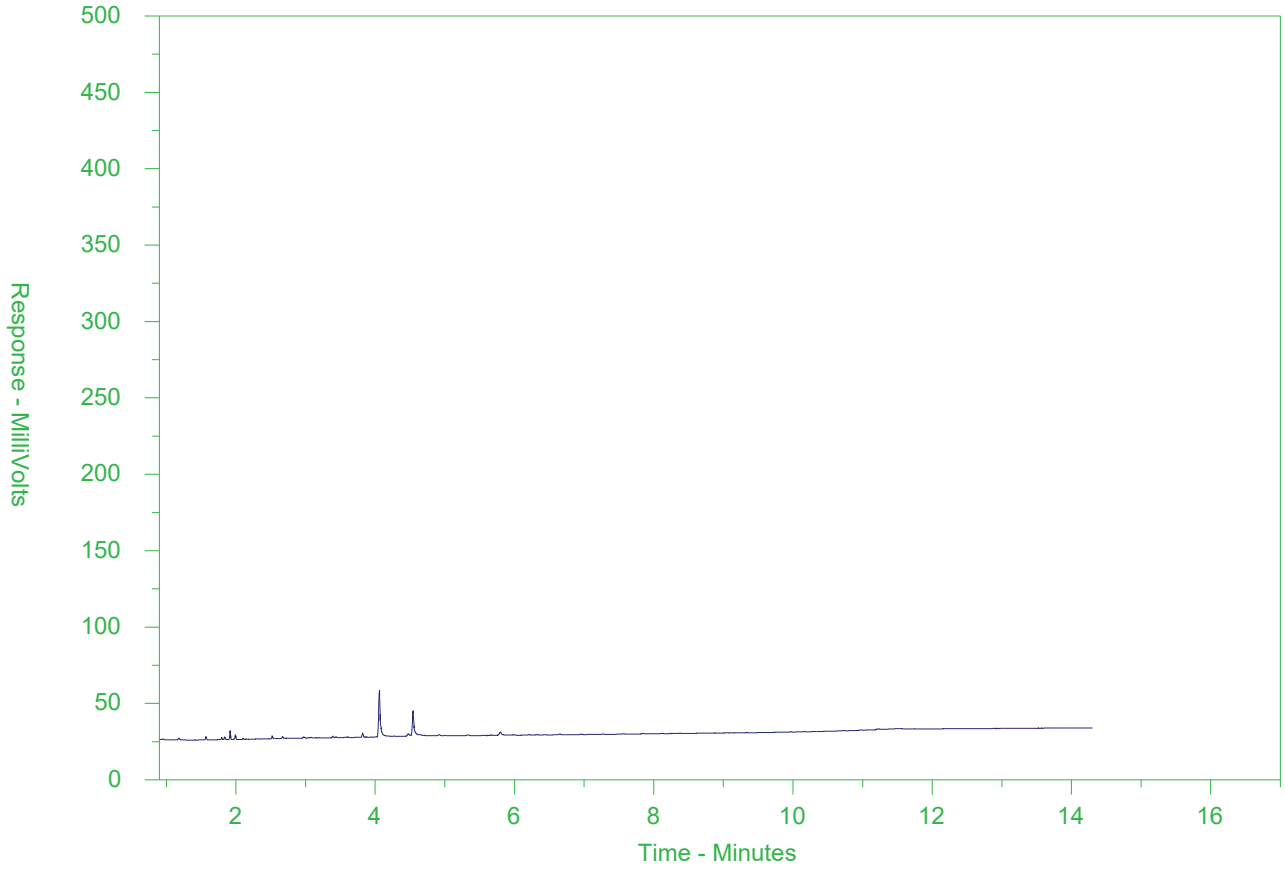
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

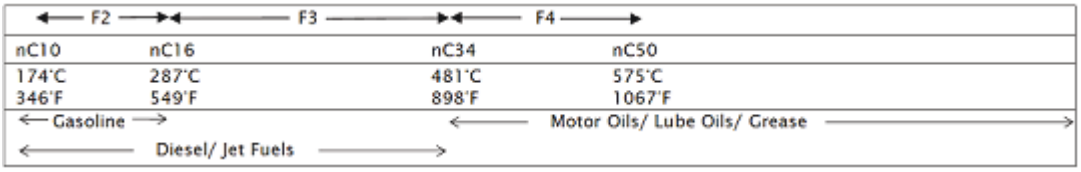
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2393429-4
Client Sample ID: AEP MW-05





The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

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

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at www.alsglobal.com.

L2393429-COFC

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES
Environmental Division

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

COC # CORD Red Deer Motors

Report to:				Report Format / Distribution		Service Requested:
Company:	Tetra Tech Canada Inc.			☐ Standard ☐ Other		☑ Regular Service (Default)
Contact:	Darby Madalena			☑ PDF ☑ Excel ☐ Fax		☐ Rush Service (2-3 Days)
Address:	110, 140 Quarry Park Blvd SE, Calgary, AB T2C 3G3			Email 1: darby.madalena@tetratech.com		☐ Priority Service (1 Day or ASAP)
				Email 2:		☐ Emergency Service (<1 Day / Wkend) - Contact ALS
Phone:	403-723-6867	Fax:	403-203-3301	ALS Digital Crosstab results		Analysis Request
Invoice To:	☑ Same as Report			Indicate Bottles: Filtered / Preserved (F/P) →		
Company:	SAME AS REPORT			Client / Project Information:		
Contact:				Job #:	SWM.SWOP04071-01.006	
Address:				PO/AFE:	SWM.SWOP04071-01.006	
Sample				Legal Site Description:		
Phone:		Fax:		Quote #: Q71650		
[redacted] Lab Work Order # (lab use only):				ALS Contact: Wendy Sears	Sampler (Initials): MR/RM	

Sample #	Sample Identification (This description will appear on the report)	Date dd-mmm-yy	Time hh:mm	Sample Type (Select from drop-down list)	BTX,F1,F2-CL	VOC-8260-CL	TKN-F-CL	ROU-MET_D-ABT1-CL	C-DIS-ORG-CL	NH3-F-CL	P-T-COL-CL	AOX-MISA-KL	VFA-WP	Hazardous?	Highly Contaminated?	Number of Containers
[redacted]	MW-01	06-Dec-19	1495	Water	X	X	X	X	X	X	X	X	X			12
[redacted]	~~MW-02~~ CNL			~~Water~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			~~2~~
[redacted]	~~MW-03~~ CNL			Water	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			~~2~~
[redacted]	AEP MW-04	06-Dec-19	1400	water	X	X	X	X	X	X	X	X	X			12
[redacted]	AEP MW-04	↓	1415	water	X	X	X	X	X	X	X	X	X			12
[redacted]	AEP MW-05	↓	1430	water	X	X	X	X	X	X	X	X	X			12
[redacted]																
[redacted]																
[redacted]																
[redacted]																

Guidelines / Regulations	Special Instructions / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the adjacent worksheet.

Relinquished By:	Date & Time:	Received By:	Date & Time:	[redacted] Sample Condition (lab use only)
Megan Race	12/05/19			Temperature:
	1600			Samples Received in Good Condition? Y / N (If no, provided details)

TETRA TECH CANADA INC.
ATTN: Darby Madalena
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3

Date Received: 06-DEC-19
Report Date: 24-DEC-19 13:39 (MT)
Version: FINAL

Client Phone: 403-203-3355

Certificate of Analysis

Lab Work Order #: L2393599

Project P.O. #: SWM.SWOP04071-01.006
Job Reference: SWM.SWOP04071-01.006 (RED DEER MOTORS)
C of C Numbers:
Legal Site Desc:

Inayat Dhaliwal
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393599-1 VW-01							
Sampled By: MEGAN ROUSE on 05-DEC-19 @ 14:10							
Matrix: SG							
Total F1 and F2+ Sub Fractionation							
Aliphatic/Aromatic PHC Sub-Fractionation							
Aliphatic C6-C8	56400	DLHC	390	ug/m3		23-DEC-19	R4953011
Aliphatic C>8-C10	21500	DLHC	390	ug/m3		23-DEC-19	R4953011
Aliphatic C>10-C12	9920	DLHC	390	ug/m3		23-DEC-19	R4953011
Aliphatic C>12-C16	880	DLHC	770	ug/m3		23-DEC-19	R4953011
Aromatic C>8-C10	<390	DLHC	390	ug/m3		23-DEC-19	R4953011
Aromatic C>10-C12	490	DLHC	390	ug/m3		23-DEC-19	R4953011
Aromatic C>12-C16	<770	DLHC	770	ug/m3		23-DEC-19	R4953011
Total F1and F2 fractions (not corrected)							
F1 (C6-C10)	62900	DLHC	390	ug/m3		23-DEC-19	R4953011
F2 (C10-C16)	19300	DLHC	390	ug/m3		23-DEC-19	R4953011
Surrogate: 4-Bromofluorobenzene	97.9		50-150	%		23-DEC-19	R4953011
High Level Fixed Gases by TCD							
Nitrogen	66.3		1.0	%		13-DEC-19	R4944389
Oxygen	7.04		0.10	%		13-DEC-19	R4944389
Carbon Dioxide	11.1		0.050	%		13-DEC-19	R4944389
Carbon Monoxide	<0.050		0.050	%		13-DEC-19	R4944389
Methane	5.26		0.050	%		13-DEC-19	R4944389
BTEX and Naphthalene							
Naphthalene	<66	DLM	66	ug/m3		23-DEC-19	R4953168
Naphthalene	<13	DLM	13	ppb(V)		23-DEC-19	R4953168
Surrogate: 4-Bromofluorobenzene	86.1		50-150	%		23-DEC-19	R4953168
Canister EPA TO-15							
1,1,1-Trichloroethane	<27	DLM	27	ug/m3		23-DEC-19	R4953168
1,1,1-Trichloroethane	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
1,1,2,2-Tetrachloroethane	<34	DLM	34	ug/m3		23-DEC-19	R4953168
1,1,2,2-Tetrachloroethane	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
1,1,2-Trichloroethane	<27	DLM	27	ug/m3		23-DEC-19	R4953168
1,1,2-Trichloroethane	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
1,1-Dichloroethane	<20	DLM	20	ug/m3		23-DEC-19	R4953168
1,1-Dichloroethane	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
1,1-Dichloroethene	<20	DLM	20	ug/m3		23-DEC-19	R4953168
1,1-Dichloroethene	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
1,2,4-Trichlorobenzene	<37	DLM	37	ug/m3		23-DEC-19	R4953168
1,2,4-Trichlorobenzene	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
1,2,4-Trimethylbenzene	<25	DLM	25	ug/m3		23-DEC-19	R4953168
1,2,4-Trimethylbenzene	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
1,2-Dibromoethane	<38	DLM	38	ug/m3		23-DEC-19	R4953168
1,2-Dibromoethane	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
1,2-Dichlorobenzene	<30	DLM	30	ug/m3		23-DEC-19	R4953168
1,2-Dichlorobenzene	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
1,2-Dichloroethane	45	DLM	20	ug/m3		23-DEC-19	R4953168
1,2-Dichloroethane	11.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
1,2-Dichloropropane	<23	DLM	23	ug/m3		23-DEC-19	R4953168
1,2-Dichloropropane	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
1,3,5-Trimethylbenzene	172	DLM	25	ug/m3		23-DEC-19	R4953168
1,3,5-Trimethylbenzene	35.1	DLM	5.0	ppb(V)		23-DEC-19	R4953168
1,3-Butadiene	<11	DLM	11	ug/m3		23-DEC-19	R4953168
1,3-Butadiene	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
1,3-Dichlorobenzene	<30	DLM	30	ug/m3		23-DEC-19	R4953168
1,3-Dichlorobenzene	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393599-1 VW-01							
Sampled By: MEGAN ROUSE on 05-DEC-19 @ 14:10							
Matrix: SG							
Canister EPA TO-15							
1,4-Dichlorobenzene	<30	DLM	30	ug/m3		23-DEC-19	R4953168
1,4-Dichlorobenzene	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
1,4-Dioxane	<18	DLM	18	ug/m3		23-DEC-19	R4953168
1,4-Dioxane	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
2-Hexanone	<100	DLM	100	ug/m3		23-DEC-19	R4953168
2-Hexanone	<25	DLM	25	ppb(V)		23-DEC-19	R4953168
4-Ethyltoluene	<25	DLM	25	ug/m3		23-DEC-19	R4953168
4-Ethyltoluene	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Acetone	<460	DLQ	460	ug/m3		23-DEC-19	R4953168
Acetone	<190	DLQ	190	ppb(V)		23-DEC-19	R4953168
Allyl chloride	<16	DLM	16	ug/m3		23-DEC-19	R4953168
Allyl chloride	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Benzene	<16	DLM	16	ug/m3		23-DEC-19	R4953168
Benzene	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Benzyl chloride	<26	DLM	26	ug/m3		23-DEC-19	R4953168
Benzyl chloride	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Bromodichloromethane	<34	DLM	34	ug/m3		23-DEC-19	R4953168
Bromodichloromethane	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Bromoform	<52	DLM	52	ug/m3		23-DEC-19	R4953168
Bromoform	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Bromomethane	<19	DLM	19	ug/m3		23-DEC-19	R4953168
Bromomethane	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Carbon Disulfide	<16	DLM	16	ug/m3		23-DEC-19	R4953168
Carbon Disulfide	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Carbon Tetrachloride	<31	DLM	31	ug/m3		23-DEC-19	R4953168
Carbon Tetrachloride	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Chlorobenzene	<23	DLM	23	ug/m3		23-DEC-19	R4953168
Chlorobenzene	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Chloroethane	<13	DLM	13	ug/m3		23-DEC-19	R4953168
Chloroethane	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Chloroform	<24	DLM	24	ug/m3		23-DEC-19	R4953168
Chloroform	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Chloromethane	<10	DLM	10	ug/m3		23-DEC-19	R4953168
Chloromethane	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
cis-1,2-Dichloroethene	34	DLM	20	ug/m3		23-DEC-19	R4953168
cis-1,2-Dichloroethene	8.6	DLM	5.0	ppb(V)		23-DEC-19	R4953168
cis-1,3-Dichloropropene	<23	DLM	23	ug/m3		23-DEC-19	R4953168
cis-1,3-Dichloropropene	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Cyclohexane	6700	DLA	1100	ug/m3		23-DEC-19	R4953168
Cyclohexane	1960	DLA	320	ppb(V)		23-DEC-19	R4953168
Dibromochloromethane	<43	DLM	43	ug/m3		23-DEC-19	R4953168
Dibromochloromethane	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Dichlorodifluoromethane	31	DLM	25	ug/m3		23-DEC-19	R4953168
Dichlorodifluoromethane	6.2	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Ethyl acetate	<18	DLM	18	ug/m3		23-DEC-19	R4953168
Ethyl acetate	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Ethylbenzene	<22	DLM	22	ug/m3		23-DEC-19	R4953168
Ethylbenzene	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Freon 113	<38	DLM	38	ug/m3		23-DEC-19	R4953168
Freon 113	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Freon 114	65	DLM	35	ug/m3		23-DEC-19	R4953168

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393599-1 VW-01							
Sampled By: MEGAN ROUSE on 05-DEC-19 @ 14:10							
Matrix: SG							
Canister EPA TO-15							
Freon 114	9.3	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Hexachlorobutadiene	<53	DLM	53	ug/m3		23-DEC-19	R4953168
Hexachlorobutadiene	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Isooctane	1050	AI	120	ug/m3		23-DEC-19	R4953168
Isooctane	226	AI	25	ppb(V)		23-DEC-19	R4953168
Isopropyl alcohol	<61	DLM	61	ug/m3		23-DEC-19	R4953168
Isopropyl alcohol	<25	DLM	25	ppb(V)		23-DEC-19	R4953168
Isopropylbenzene	<25	DLM	25	ug/m3		23-DEC-19	R4953168
Isopropylbenzene	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
m&p-Xylene	<43	DLM	43	ug/m3		23-DEC-19	R4953168
m&p-Xylene	<10	DLM	10	ppb(V)		23-DEC-19	R4953168
Methyl ethyl ketone	<15	DLM	15	ug/m3		23-DEC-19	R4953168
Methyl ethyl ketone	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Methyl isobutyl ketone	<20	DLM	20	ug/m3		23-DEC-19	R4953168
Methyl isobutyl ketone	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Methylene chloride	<17	DLM	17	ug/m3		23-DEC-19	R4953168
Methylene chloride	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
MTBE	<18	DLM	18	ug/m3		23-DEC-19	R4953168
MTBE	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
n-Heptane	4210	DLA	100	ug/m3		23-DEC-19	R4953168
n-Heptane	1030	DLA	25	ppb(V)		23-DEC-19	R4953168
n-Hexane	11700	DLA	1100	ug/m3		23-DEC-19	R4953168
n-Hexane	3320	DLA	320	ppb(V)		23-DEC-19	R4953168
o-Xylene	<22	DLM	22	ug/m3		23-DEC-19	R4953168
o-Xylene	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Propylene	676	AI	43	ug/m3		23-DEC-19	R4953168
Propylene	393	AI	25	ppb(V)		23-DEC-19	R4953168
Styrene	<21	DLM	21	ug/m3		23-DEC-19	R4953168
Styrene	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Tetrachloroethylene	<34	DLM	34	ug/m3		23-DEC-19	R4953168
Tetrachloroethylene	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Tetrahydrofuran	<15	DLM	15	ug/m3		23-DEC-19	R4953168
Tetrahydrofuran	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Toluene	<19	DLM	19	ug/m3		23-DEC-19	R4953168
Toluene	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
trans-1,2-Dichloroethene	24	DLM	20	ug/m3		23-DEC-19	R4953168
trans-1,2-Dichloroethene	6.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
trans-1,3-Dichloropropene	<23	DLM	23	ug/m3		23-DEC-19	R4953168
trans-1,3-Dichloropropene	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Trichloroethylene	<27	DLM	27	ug/m3		23-DEC-19	R4953168
Trichloroethylene	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Trichlorofluoromethane	<28	DLM	28	ug/m3		23-DEC-19	R4953168
Trichlorofluoromethane	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Vinyl acetate	<44	DLM	44	ug/m3		23-DEC-19	R4953168
Vinyl acetate	<13	DLM	13	ppb(V)		23-DEC-19	R4953168
Vinyl bromide	<22	DLM	22	ug/m3		23-DEC-19	R4953168
Vinyl bromide	<5.0	DLM	5.0	ppb(V)		23-DEC-19	R4953168
Vinyl chloride	926	DLA	64	ug/m3		23-DEC-19	R4953168
Vinyl chloride	362	DLA	25	ppb(V)		23-DEC-19	R4953168
Surrogate: 4-Bromofluorobenzene	86.1		50-150	%		23-DEC-19	R4953168
Sum of Xylene Isomer Concentrations							

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393599-1 VW-01							
Sampled By: MEGAN ROUSE on 05-DEC-19 @ 14:10							
Matrix: SG							
Sum of Xylene Isomer Concentrations							
Xylenes (Total)	<11		11	ppb(V)		23-DEC-19	
Xylenes (Total)	<48		48	ug/m3		23-DEC-19	
Select list of 7 C1-C5 hydrocarbon gases							
Methane	N/A	MP	0.00010	%		10-DEC-19	R4944650
Ethane	<0.00020		0.00020	%		10-DEC-19	R4944650
Ethene	0.00026		0.00020	%		10-DEC-19	R4944650
Propane	<0.00020		0.00020	%		10-DEC-19	R4944650
Propene	<0.00020		0.00020	%		10-DEC-19	R4944650
Butane	<0.00020		0.00020	%		10-DEC-19	R4944650
Pentane	0.00021		0.00020	%		10-DEC-19	R4944650
Canister Information							
Pressure on Receipt	-11.4		-30	in Hg	17-DEC-19	17-DEC-19	R4944737
Canister ID	01400-0480				17-DEC-19	17-DEC-19	R4944737
Regulator ID	G315				17-DEC-19	17-DEC-19	R4944737
Batch Proof ID	191119.116				17-DEC-19	17-DEC-19	R4944737

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393599-2 VW-02							
Sampled By: MEGAN ROUSE on 05-DEC-19 @ 15:20							
Matrix: SG							
Total F1 and F2+ Sub Fractionation							
Aliphatic/Aromatic PHC Sub-Fractionation							
Aliphatic C6-C8	1300		15	ug/m3		23-DEC-19	R4953011
Aliphatic C>8-C10	728		15	ug/m3		23-DEC-19	R4953011
Aliphatic C>10-C12	179		15	ug/m3		23-DEC-19	R4953011
Aliphatic C>12-C16	<30		30	ug/m3		23-DEC-19	R4953011
Aromatic C>8-C10	<15		15	ug/m3		23-DEC-19	R4953011
Aromatic C>10-C12	<15		15	ug/m3		23-DEC-19	R4953011
Aromatic C>12-C16	<30		30	ug/m3		23-DEC-19	R4953011
Total F1and F2 fractions (not corrected)							
F1 (C6-C10)	1720		15	ug/m3		23-DEC-19	R4953011
F2 (C10-C16)	380		15	ug/m3		23-DEC-19	R4953011
Surrogate: 4-Bromofluorobenzene	99.4		50-150	%		23-DEC-19	R4953011
High Level Fixed Gases by TCD							
Nitrogen	74.9		1.0	%		13-DEC-19	R4944389
Oxygen	20.3		0.10	%		13-DEC-19	R4944389
Carbon Dioxide	0.391		0.050	%		13-DEC-19	R4944389
Carbon Monoxide	<0.050		0.050	%		13-DEC-19	R4944389
Methane	<0.050		0.050	%		13-DEC-19	R4944389
BTEX and Naphthalene							
Naphthalene	<2.6		2.6	ug/m3		23-DEC-19	R4953168
Naphthalene	<0.50		0.50	ppb(V)		23-DEC-19	R4953168
Surrogate: 4-Bromofluorobenzene	98.2		50-150	%		23-DEC-19	R4953168
Canister EPA TO-15							
1,1,1-Trichloroethane	<1.1		1.1	ug/m3		23-DEC-19	R4953168
1,1,1-Trichloroethane	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
1,1,2,2-Tetrachloroethane	<1.4		1.4	ug/m3		23-DEC-19	R4953168
1,1,2,2-Tetrachloroethane	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
1,1,2-Trichloroethane	<1.1		1.1	ug/m3		23-DEC-19	R4953168
1,1,2-Trichloroethane	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
1,1-Dichloroethane	<0.81		0.81	ug/m3		23-DEC-19	R4953168
1,1-Dichloroethane	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
1,1-Dichloroethene	<0.79		0.79	ug/m3		23-DEC-19	R4953168
1,1-Dichloroethene	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
1,2,4-Trichlorobenzene	<1.5		1.5	ug/m3		23-DEC-19	R4953168
1,2,4-Trichlorobenzene	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
1,2,4-Trimethylbenzene	<0.98		0.98	ug/m3		23-DEC-19	R4953168
1,2,4-Trimethylbenzene	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
1,2-Dibromoethane	<1.5		1.5	ug/m3		23-DEC-19	R4953168
1,2-Dibromoethane	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
1,2-Dichlorobenzene	<1.2		1.2	ug/m3		23-DEC-19	R4953168
1,2-Dichlorobenzene	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
1,2-Dichloroethane	<0.81		0.81	ug/m3		23-DEC-19	R4953168
1,2-Dichloroethane	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
1,2-Dichloropropane	<0.92		0.92	ug/m3		23-DEC-19	R4953168
1,2-Dichloropropane	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
1,3,5-Trimethylbenzene	<0.98		0.98	ug/m3		23-DEC-19	R4953168
1,3,5-Trimethylbenzene	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
1,3-Butadiene	<0.44		0.44	ug/m3		23-DEC-19	R4953168
1,3-Butadiene	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
1,3-Dichlorobenzene	<1.2		1.2	ug/m3		23-DEC-19	R4953168
1,3-Dichlorobenzene	<0.20		0.20	ppb(V)		23-DEC-19	R4953168

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393599-2 VW-02							
Sampled By: MEGAN ROUSE on 05-DEC-19 @ 15:20							
Matrix: SG							
Canister EPA TO-15							
1,4-Dichlorobenzene	<1.2		1.2	ug/m3		23-DEC-19	R4953168
1,4-Dichlorobenzene	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
1,4-Dioxane	<0.72		0.72	ug/m3		23-DEC-19	R4953168
1,4-Dioxane	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
2-Hexanone	<4.1		4.1	ug/m3		23-DEC-19	R4953168
2-Hexanone	<1.0		1.0	ppb(V)		23-DEC-19	R4953168
4-Ethyltoluene	<0.98		0.98	ug/m3		23-DEC-19	R4953168
4-Ethyltoluene	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Acetone	9.0	AI	1.2	ug/m3		23-DEC-19	R4953168
Acetone	3.78	AI	0.50	ppb(V)		23-DEC-19	R4953168
Allyl chloride	<0.63		0.63	ug/m3		23-DEC-19	R4953168
Allyl chloride	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Benzene	1.40		0.64	ug/m3		23-DEC-19	R4953168
Benzene	0.44		0.20	ppb(V)		23-DEC-19	R4953168
Benzyl chloride	<1.0		1.0	ug/m3		23-DEC-19	R4953168
Benzyl chloride	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Bromodichloromethane	<1.3		1.3	ug/m3		23-DEC-19	R4953168
Bromodichloromethane	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Bromoform	<2.1		2.1	ug/m3		23-DEC-19	R4953168
Bromoform	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Bromomethane	<0.78		0.78	ug/m3		23-DEC-19	R4953168
Bromomethane	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Carbon Disulfide	2.75		0.62	ug/m3		23-DEC-19	R4953168
Carbon Disulfide	0.88		0.20	ppb(V)		23-DEC-19	R4953168
Carbon Tetrachloride	<1.3		1.3	ug/m3		23-DEC-19	R4953168
Carbon Tetrachloride	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Chlorobenzene	<0.92		0.92	ug/m3		23-DEC-19	R4953168
Chlorobenzene	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Chloroethane	<0.53		0.53	ug/m3		23-DEC-19	R4953168
Chloroethane	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Chloroform	<0.98		0.98	ug/m3		23-DEC-19	R4953168
Chloroform	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Chloromethane	1.10		0.41	ug/m3		23-DEC-19	R4953168
Chloromethane	0.53		0.20	ppb(V)		23-DEC-19	R4953168
cis-1,2-Dichloroethene	<0.79		0.79	ug/m3		23-DEC-19	R4953168
cis-1,2-Dichloroethene	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
cis-1,3-Dichloropropene	<0.91		0.91	ug/m3		23-DEC-19	R4953168
cis-1,3-Dichloropropene	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Cyclohexane	45.0	DLA	3.4	ug/m3		23-DEC-19	R4953168
Cyclohexane	13.1	DLA	1.0	ppb(V)		23-DEC-19	R4953168
Dibromochloromethane	<1.7		1.7	ug/m3		23-DEC-19	R4953168
Dibromochloromethane	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Dichlorodifluoromethane	47.8	DLA	4.9	ug/m3		23-DEC-19	R4953168
Dichlorodifluoromethane	9.7	DLA	1.0	ppb(V)		23-DEC-19	R4953168
Ethyl acetate	<0.72		0.72	ug/m3		23-DEC-19	R4953168
Ethyl acetate	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Ethylbenzene	<0.87		0.87	ug/m3		23-DEC-19	R4953168
Ethylbenzene	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Freon 113	<1.5		1.5	ug/m3		23-DEC-19	R4953168
Freon 113	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Freon 114	7.6		1.4	ug/m3		23-DEC-19	R4953168

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393599-2 VW-02							
Sampled By: MEGAN ROUSE on 05-DEC-19 @ 15:20							
Matrix: SG							
Canister EPA TO-15							
Freon 114	1.08		0.20	ppb(V)		23-DEC-19	R4953168
Hexachlorobutadiene	<2.1		2.1	ug/m3		23-DEC-19	R4953168
Hexachlorobutadiene	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Isooctane	4.45	AI	0.93	ug/m3		23-DEC-19	R4953168
Isooctane	0.95	AI	0.20	ppb(V)		23-DEC-19	R4953168
Isopropyl alcohol	<2.5		2.5	ug/m3		23-DEC-19	R4953168
Isopropyl alcohol	<1.0		1.0	ppb(V)		23-DEC-19	R4953168
Isopropylbenzene	<0.98		0.98	ug/m3		23-DEC-19	R4953168
Isopropylbenzene	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
m&p-Xylene	<1.7		1.7	ug/m3		23-DEC-19	R4953168
m&p-Xylene	<0.40		0.40	ppb(V)		23-DEC-19	R4953168
Methyl ethyl ketone	0.74		0.59	ug/m3		23-DEC-19	R4953168
Methyl ethyl ketone	0.25		0.20	ppb(V)		23-DEC-19	R4953168
Methyl isobutyl ketone	<0.82		0.82	ug/m3		23-DEC-19	R4953168
Methyl isobutyl ketone	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Methylene chloride	<0.69		0.69	ug/m3		23-DEC-19	R4953168
Methylene chloride	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
MTBE	<0.72		0.72	ug/m3		23-DEC-19	R4953168
MTBE	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
n-Heptane	16.5		0.82	ug/m3		23-DEC-19	R4953168
n-Heptane	4.04		0.20	ppb(V)		23-DEC-19	R4953168
n-Hexane	79.8	DLA	3.5	ug/m3		23-DEC-19	R4953168
n-Hexane	22.7	DLA	1.0	ppb(V)		23-DEC-19	R4953168
o-Xylene	<0.87		0.87	ug/m3		23-DEC-19	R4953168
o-Xylene	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Propylene	<0.34		0.34	ug/m3		23-DEC-19	R4953168
Propylene	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Styrene	<0.85		0.85	ug/m3		23-DEC-19	R4953168
Styrene	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Tetrachloroethylene	252	DLA	6.8	ug/m3		23-DEC-19	R4953168
Tetrachloroethylene	37.2	DLA	1.0	ppb(V)		23-DEC-19	R4953168
Tetrahydrofuran	<0.59		0.59	ug/m3		23-DEC-19	R4953168
Tetrahydrofuran	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Toluene	1.31		0.75	ug/m3		23-DEC-19	R4953168
Toluene	0.35		0.20	ppb(V)		23-DEC-19	R4953168
trans-1,2-Dichloroethene	<0.79		0.79	ug/m3		23-DEC-19	R4953168
trans-1,2-Dichloroethene	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
trans-1,3-Dichloropropene	<0.91		0.91	ug/m3		23-DEC-19	R4953168
trans-1,3-Dichloropropene	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Trichloroethylene	7.6		1.1	ug/m3		23-DEC-19	R4953168
Trichloroethylene	1.41		0.20	ppb(V)		23-DEC-19	R4953168
Trichlorofluoromethane	60.2	DLA	5.6	ug/m3		23-DEC-19	R4953168
Trichlorofluoromethane	10.7	DLA	1.0	ppb(V)		23-DEC-19	R4953168
Vinyl acetate	<1.8		1.8	ug/m3		23-DEC-19	R4953168
Vinyl acetate	<0.50		0.50	ppb(V)		23-DEC-19	R4953168
Vinyl bromide	<0.87		0.87	ug/m3		23-DEC-19	R4953168
Vinyl bromide	<0.20		0.20	ppb(V)		23-DEC-19	R4953168
Vinyl chloride	3.98		0.51	ug/m3		23-DEC-19	R4953168
Vinyl chloride	1.56		0.20	ppb(V)		23-DEC-19	R4953168
Surrogate: 4-Bromofluorobenzene	98.2		50-150	%		23-DEC-19	R4953168
Sum of Xylene Isomer Concentrations							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393599-2 VW-02							
Sampled By: MEGAN ROUSE on 05-DEC-19 @ 15:20							
Matrix: SG							
Sum of Xylene Isomer Concentrations							
Xylenes (Total)	<0.45		0.45	ppb(V)		23-DEC-19	
Xylenes (Total)	<2.0		2.0	ug/m3		23-DEC-19	
Select list of 7 C1-C5 hydrocarbon gases							
Methane	0.00333		0.00010	%		10-DEC-19	R4944650
Ethane	<0.00020		0.00020	%		10-DEC-19	R4944650
Ethene	<0.00020		0.00020	%		10-DEC-19	R4944650
Propane	<0.00020		0.00020	%		10-DEC-19	R4944650
Propene	<0.00020		0.00020	%		10-DEC-19	R4944650
Butane	<0.00020		0.00020	%		10-DEC-19	R4944650
Pentane	<0.00020		0.00020	%		10-DEC-19	R4944650
Canister Information							
Pressure on Receipt	-4.9		-30	in Hg	17-DEC-19	17-DEC-19	R4944737
Canister ID	01400-0311				17-DEC-19	17-DEC-19	R4944737
Regulator ID	G255				17-DEC-19	17-DEC-19	R4944737
Batch Proof ID	191119.126				17-DEC-19	17-DEC-19	R4944737

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393599-3 19DUP01							
Sampled By: MEGAN ROUSE on 05-DEC-19 @ 12:00							
Matrix: SG							
Total F1 and F2+ Sub Fractionation							
Aliphatic/Aromatic PHC Sub-Fractionation							
Aliphatic C6-C8	56200	DLHC	360	ug/m3		23-DEC-19	R4953011
Aliphatic C>8-C10	21100	DLHC	360	ug/m3		23-DEC-19	R4953011
Aliphatic C>10-C12	9690	DLHC	360	ug/m3		23-DEC-19	R4953011
Aliphatic C>12-C16	840	DLHC	730	ug/m3		23-DEC-19	R4953011
Aromatic C>8-C10	<360	DLHC	360	ug/m3		23-DEC-19	R4953011
Aromatic C>10-C12	470	DLHC	360	ug/m3		23-DEC-19	R4953011
Aromatic C>12-C16	<730	DLHC	730	ug/m3		23-DEC-19	R4953011
Total F1and F2 fractions (not corrected)							
F1 (C6-C10)	62500	DLHC	360	ug/m3		23-DEC-19	R4953011
F2 (C10-C16)	18900	DLHC	360	ug/m3		23-DEC-19	R4953011
Surrogate: 4-Bromofluorobenzene	96.1		50-150	%		23-DEC-19	R4953011
High Level Fixed Gases by TCD							
Nitrogen	69.8		1.0	%		13-DEC-19	R4944389
Oxygen	7.49		0.10	%		13-DEC-19	R4944389
Carbon Dioxide	11.5		0.050	%		13-DEC-19	R4944389
Carbon Monoxide	<0.050		0.050	%		13-DEC-19	R4944389
Methane	5.46		0.050	%		13-DEC-19	R4944389
BTEX and Naphthalene							
Naphthalene	<60	DLM	60	ug/m3		23-DEC-19	R4953168
Naphthalene	<11	DLM	11	ppb(V)		23-DEC-19	R4953168
Surrogate: 4-Bromofluorobenzene	82.1		50-150	%		23-DEC-19	R4953168
Canister EPA TO-15							
1,1,1-Trichloroethane	<25	DLM	25	ug/m3		23-DEC-19	R4953168
1,1,1-Trichloroethane	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
1,1,2,2-Tetrachloroethane	<31	DLM	31	ug/m3		23-DEC-19	R4953168
1,1,2,2-Tetrachloroethane	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
1,1,2-Trichloroethane	<25	DLM	25	ug/m3		23-DEC-19	R4953168
1,1,2-Trichloroethane	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
1,1-Dichloroethane	<18	DLM	18	ug/m3		23-DEC-19	R4953168
1,1-Dichloroethane	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
1,1-Dichloroethene	<18	DLM	18	ug/m3		23-DEC-19	R4953168
1,1-Dichloroethene	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
1,2,4-Trichlorobenzene	<34	DLM	34	ug/m3		23-DEC-19	R4953168
1,2,4-Trichlorobenzene	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
1,2,4-Trimethylbenzene	<22	DLM	22	ug/m3		23-DEC-19	R4953168
1,2,4-Trimethylbenzene	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
1,2-Dibromoethane	<35	DLM	35	ug/m3		23-DEC-19	R4953168
1,2-Dibromoethane	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
1,2-Dichlorobenzene	<27	DLM	27	ug/m3		23-DEC-19	R4953168
1,2-Dichlorobenzene	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
1,2-Dichloroethane	33	DLM	18	ug/m3		23-DEC-19	R4953168
1,2-Dichloroethane	8.1	DLM	4.5	ppb(V)		23-DEC-19	R4953168
1,2-Dichloropropane	<21	DLM	21	ug/m3		23-DEC-19	R4953168
1,2-Dichloropropane	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
1,3,5-Trimethylbenzene	126	DLM	22	ug/m3		23-DEC-19	R4953168
1,3,5-Trimethylbenzene	25.7	DLM	4.5	ppb(V)		23-DEC-19	R4953168
1,3-Butadiene	<10	DLM	10	ug/m3		23-DEC-19	R4953168
1,3-Butadiene	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
1,3-Dichlorobenzene	<27	DLM	27	ug/m3		23-DEC-19	R4953168
1,3-Dichlorobenzene	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393599-3 19DUP01							
Sampled By: MEGAN ROUSE on 05-DEC-19 @ 12:00							
Matrix: SG							
Canister EPA TO-15							
1,4-Dichlorobenzene	<27	DLM	27	ug/m3		23-DEC-19	R4953168
1,4-Dichlorobenzene	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
1,4-Dioxane	<16	DLM	16	ug/m3		23-DEC-19	R4953168
1,4-Dioxane	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
2-Hexanone	<93	DLM	93	ug/m3		23-DEC-19	R4953168
2-Hexanone	<23	DLM	23	ppb(V)		23-DEC-19	R4953168
4-Ethyltoluene	<22	DLM	22	ug/m3		23-DEC-19	R4953168
4-Ethyltoluene	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Acetone	<320	DLQ	320	ug/m3		23-DEC-19	R4953168
Acetone	<130	DLQ	130	ppb(V)		23-DEC-19	R4953168
Allyl chloride	<14	DLM	14	ug/m3		23-DEC-19	R4953168
Allyl chloride	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Benzene	<15	DLM	15	ug/m3		23-DEC-19	R4953168
Benzene	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Benzyl chloride	<24	DLM	24	ug/m3		23-DEC-19	R4953168
Benzyl chloride	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Bromodichloromethane	<30	DLM	30	ug/m3		23-DEC-19	R4953168
Bromodichloromethane	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Bromoform	<47	DLM	47	ug/m3		23-DEC-19	R4953168
Bromoform	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Bromomethane	<18	DLM	18	ug/m3		23-DEC-19	R4953168
Bromomethane	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Carbon Disulfide	<14	DLM	14	ug/m3		23-DEC-19	R4953168
Carbon Disulfide	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Carbon Tetrachloride	<29	DLM	29	ug/m3		23-DEC-19	R4953168
Carbon Tetrachloride	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Chlorobenzene	<21	DLM	21	ug/m3		23-DEC-19	R4953168
Chlorobenzene	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Chloroethane	<12	DLM	12	ug/m3		23-DEC-19	R4953168
Chloroethane	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Chloroform	<22	DLM	22	ug/m3		23-DEC-19	R4953168
Chloroform	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Chloromethane	<9.4	DLM	9.4	ug/m3		23-DEC-19	R4953168
Chloromethane	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
cis-1,2-Dichloroethene	22	DLM	18	ug/m3		23-DEC-19	R4953168
cis-1,2-Dichloroethene	5.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
cis-1,3-Dichloropropene	<21	DLM	21	ug/m3		23-DEC-19	R4953168
cis-1,3-Dichloropropene	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Cyclohexane	6450	DLA	78	ug/m3		23-DEC-19	R4953168
Cyclohexane	1870	DLA	23	ppb(V)		23-DEC-19	R4953168
Dibromochloromethane	<39	DLM	39	ug/m3		23-DEC-19	R4953168
Dibromochloromethane	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Dichlorodifluoromethane	<22	DLM	22	ug/m3		23-DEC-19	R4953168
Dichlorodifluoromethane	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Ethyl acetate	<16	DLM	16	ug/m3		23-DEC-19	R4953168
Ethyl acetate	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Ethylbenzene	<20	DLM	20	ug/m3		23-DEC-19	R4953168
Ethylbenzene	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Freon 113	<35	DLM	35	ug/m3		23-DEC-19	R4953168
Freon 113	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Freon 114	47	DLM	32	ug/m3		23-DEC-19	R4953168

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393599-3 19DUP01							
Sampled By: MEGAN ROUSE on 05-DEC-19 @ 12:00							
Matrix: SG							
Canister EPA TO-15							
Freon 114	6.7	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Hexachlorobutadiene	<48	DLM	48	ug/m3		23-DEC-19	R4953168
Hexachlorobutadiene	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Isooctane	720	AI	110	ug/m3		23-DEC-19	R4953168
Isooctane	153	AI	23	ppb(V)		23-DEC-19	R4953168
Isopropyl alcohol	<56	DLM	56	ug/m3		23-DEC-19	R4953168
Isopropyl alcohol	<23	DLM	23	ppb(V)		23-DEC-19	R4953168
Isopropylbenzene	<22	DLM	22	ug/m3		23-DEC-19	R4953168
Isopropylbenzene	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
m&p-Xylene	<39	DLM	39	ug/m3		23-DEC-19	R4953168
m&p-Xylene	<9.1	DLM	9.1	ppb(V)		23-DEC-19	R4953168
Methyl ethyl ketone	<13	DLM	13	ug/m3		23-DEC-19	R4953168
Methyl ethyl ketone	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Methyl isobutyl ketone	<19	DLM	19	ug/m3		23-DEC-19	R4953168
Methyl isobutyl ketone	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Methylene chloride	<16	DLM	16	ug/m3		23-DEC-19	R4953168
Methylene chloride	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
MTBE	<16	DLM	16	ug/m3		23-DEC-19	R4953168
MTBE	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
n-Heptane	2880	DLA	93	ug/m3		23-DEC-19	R4953168
n-Heptane	703	DLA	23	ppb(V)		23-DEC-19	R4953168
n-Hexane	11600	DLA	1100	ug/m3		23-DEC-19	R4953168
n-Hexane	3290	DLA	320	ppb(V)		23-DEC-19	R4953168
o-Xylene	<20	DLM	20	ug/m3		23-DEC-19	R4953168
o-Xylene	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Propylene	474	AI	39	ug/m3		23-DEC-19	R4953168
Propylene	275	AI	23	ppb(V)		23-DEC-19	R4953168
Styrene	<19	DLM	19	ug/m3		23-DEC-19	R4953168
Styrene	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Tetrachloroethylene	<31	DLM	31	ug/m3		23-DEC-19	R4953168
Tetrachloroethylene	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Tetrahydrofuran	<13	DLM	13	ug/m3		23-DEC-19	R4953168
Tetrahydrofuran	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Toluene	<17	DLM	17	ug/m3		23-DEC-19	R4953168
Toluene	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
trans-1,2-Dichloroethene	<18	DLM	18	ug/m3		23-DEC-19	R4953168
trans-1,2-Dichloroethene	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
trans-1,3-Dichloropropene	<21	DLM	21	ug/m3		23-DEC-19	R4953168
trans-1,3-Dichloropropene	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Trichloroethylene	<24	DLM	24	ug/m3		23-DEC-19	R4953168
Trichloroethylene	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Trichlorofluoromethane	<26	DLM	26	ug/m3		23-DEC-19	R4953168
Trichlorofluoromethane	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Vinyl acetate	<40	DLM	40	ug/m3		23-DEC-19	R4953168
Vinyl acetate	<11	DLM	11	ppb(V)		23-DEC-19	R4953168
Vinyl bromide	<20	DLM	20	ug/m3		23-DEC-19	R4953168
Vinyl bromide	<4.5	DLM	4.5	ppb(V)		23-DEC-19	R4953168
Vinyl chloride	664	DLA	58	ug/m3		23-DEC-19	R4953168
Vinyl chloride	260	DLA	23	ppb(V)		23-DEC-19	R4953168
Surrogate: 4-Bromofluorobenzene	82.1		50-150	%		23-DEC-19	R4953168
Sum of Xylene Isomer Concentrations							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393599-3 19DUP01							
Sampled By: MEGAN ROUSE on 05-DEC-19 @ 12:00							
Matrix: SG							
Sum of Xylene Isomer Concentrations							
Xylenes (Total)	<10		10	ppb(V)		23-DEC-19	
Xylenes (Total)	<43		43	ug/m3		23-DEC-19	
Select list of 7 C1-C5 hydrocarbon gases							
Methane	N/A	MP	0.00010	%		10-DEC-19	R4944650
Ethane	<0.00020		0.00020	%		10-DEC-19	R4944650
Ethene	0.00025		0.00020	%		10-DEC-19	R4944650
Propane	<0.00020		0.00020	%		10-DEC-19	R4944650
Propene	<0.00020		0.00020	%		10-DEC-19	R4944650
Butane	<0.00020		0.00020	%		10-DEC-19	R4944650
Pentane	0.00020		0.00020	%		10-DEC-19	R4944650
Canister Information							
Pressure on Receipt	-9.4		-30	in Hg	17-DEC-19	17-DEC-19	R4944737
Canister ID	01400-0178				17-DEC-19	17-DEC-19	R4944737
Regulator ID	G315				17-DEC-19	17-DEC-19	R4944737
Batch Proof ID	191119.125				17-DEC-19	17-DEC-19	R4944737

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393599-4 VW-01							
Sampled By: MEGAN ROUSE on 05-DEC-19 @ 16:10							
Matrix: SG							
Miscellaneous Parameters							
Air volume	.06			L		19-DEC-19	R4939247
Linear & Cyclic Methyl Siloxanes							
D3(CVMS)	<170		170	ug/m3		18-DEC-19	R4945277
D3(CVMS)	<10		10	ng		18-DEC-19	R4945277
D4(CVMS)	<170		170	ug/m3		18-DEC-19	R4945277
D4(CVMS)	<10		10	ng		18-DEC-19	R4945277
D5(CVMS)	<170		170	ug/m3		18-DEC-19	R4945277
D5(CVMS)	<10		10	ng		18-DEC-19	R4945277
D6(CVMS)	<170		170	ug/m3		18-DEC-19	R4945277
D6(CVMS)	<10		10	ng		18-DEC-19	R4945277
MM(LVMS)	<170		170	ug/m3		18-DEC-19	R4945277
MM(LVMS)	<10		10	ng		18-DEC-19	R4945277
MDM(LVMS)	<170		170	ug/m3		18-DEC-19	R4945277
MDM(LVMS)	<10		10	ng		18-DEC-19	R4945277
MD2M(LVMS)	<170		170	ug/m3		18-DEC-19	R4945277
MD2M(LVMS)	<10		10	ng		18-DEC-19	R4945277
MD3M(LVMS)	<170		170	ug/m3		18-DEC-19	R4945277
MD3M(LVMS)	<10		10	ng		18-DEC-19	R4945277
Surrogate: 4-Bromofluorobenzene	102.0		50-150	%		18-DEC-19	R4945277
Tube Information							
Tube ID	G0150006SVI					13-DEC-19	R4942791
Batch Proof ID	13-Nov-19					13-DEC-19	R4942791
Tube Usage Number	N/A					13-DEC-19	R4942791
Tube Manufacturer Date	N/A					13-DEC-19	R4942791

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2393599-5 VW-02							
Sampled By: MEGAN ROUSE on 05-DEC-19 @ 16:30							
Matrix: SG							
Miscellaneous Parameters							
Air volume	.06			L		19-DEC-19	R4939247
Linear & Cyclic Methyl Siloxanes							
D3(CVMS)	<170		170	ug/m3		18-DEC-19	R4945277
D3(CVMS)	<10		10	ng		18-DEC-19	R4945277
D4(CVMS)	<170		170	ug/m3		18-DEC-19	R4945277
D4(CVMS)	<10		10	ng		18-DEC-19	R4945277
D5(CVMS)	<170		170	ug/m3		18-DEC-19	R4945277
D5(CVMS)	<10		10	ng		18-DEC-19	R4945277
D6(CVMS)	<170		170	ug/m3		18-DEC-19	R4945277
D6(CVMS)	<10		10	ng		18-DEC-19	R4945277
MM(LVMS)	<170		170	ug/m3		18-DEC-19	R4945277
MM(LVMS)	<10		10	ng		18-DEC-19	R4945277
MDM(LVMS)	<170		170	ug/m3		18-DEC-19	R4945277
MDM(LVMS)	<10		10	ng		18-DEC-19	R4945277
MD2M(LVMS)	<170		170	ug/m3		18-DEC-19	R4945277
MD2M(LVMS)	<10		10	ng		18-DEC-19	R4945277
MD3M(LVMS)	<170		170	ug/m3		18-DEC-19	R4945277
MD3M(LVMS)	<10		10	ng		18-DEC-19	R4945277
Surrogate: 4-Bromofluorobenzene	100.9		50-150	%		18-DEC-19	R4945277
Tube Information							
Tube ID	G0150679SVI					13-DEC-19	R4942791
Batch Proof ID	13-Nov-19					13-DEC-19	R4942791
Tube Usage Number	N/A					13-DEC-19	R4942791
Tube Manufacturer Date	N/A					13-DEC-19	R4942791

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
AI	Analytical interferences may be present. Result may be biased high.
DLA	Detection Limit adjusted for required dilution
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
DLQ	Detection Limit raised due to co-eluting interference. GCMS qualifier ion ratio did not meet acceptance criteria.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
AIR VOLUME-WT	Misc.	Air volume (L)	DATA ENTRY
ALIPH/AROM-GCMS-WT	Canister	Aliphatic/Aromatic PHC Sub-Fractionation	EPA TO-15, Atlantic RBCA

This analysis is performed using procedures adapted from EPA TO-15 & Atlantic RBCA. A volume of air is removed from a canister & injected into a GCMS with preconcentrator for analysis. The concentrations of the hydrocarbon aliphatic & aromatic sub-fractions are calculated using gas standards. The canister samples will be retained for 7 calendar days after final report.

BTEX+NAPH-GCMS-WT	Canister	BTEX and Naphthalene	EPA TO-15

This analysis is performed using procedures adapted from EPA Method TO-15. Air samples are collected into cleaned evacuated canisters. A volume of air sample is transferred from the canister to a preconcentrator system where the analytes are trapped & focused. The analytes are then thermally desorbed into a GC-MSD for analysis. Test results are not blank corrected unless indicated by a qualifier.

Canister samples will be retained for 7 calendar days after final report. If you require a longer canister storage time, please contact your account manager.

C1-C5-FID-WT	Canister	Select list of 7 C1-C5 hydrocarbon gases	EPA Method 3C & ASTM D1946

This analysis is performed using procedures adapted from ASTM D1946/EPA Method 3C. Air samples are collected into cleaned evaculated canisters. A volume of air is removed from the canister & injected into a GC-FID for analysis. Hydrocarbon gas concentrations are calculated against a gas standard. Test results are not blank corrected unless indicated by a qualifier.

Canister samples will be retained for 7 calendar days after final report. If you require longer canister storage time, please contact your account manager.

CAN-DATA-WT	Canister	Canister Information	EPA TO-15

Batch Proof ID, Canister ID, Pressure on Receipt, Regulator ID.

F1-F2-GCMS-WT	Canister	Total F1and F2 fractions (not corrected)	EPATO-15

This analysis is performed using procedures adapted from EPA Method TO-15. Air samples are collected into cleaned evacuated canisters. A volume of air sample is transferred from the canister to a preconcentrator system where the analytes are trapped & focused. The analytes are then thermally desorbed into a GC-MSD for analysis. Test results are not blank corrected unless indicated by a qualifier.

Canister samples will be retained for 7 calendar days after final report. If you require a longer canister storage time, please contact your account manager.

FIXED GASES-TCD-WT	Canister	High Level Fixed Gases by TCD	EPA Method 3C & ASTM D1946

This analysis is performed using procedures adapted from EPA Method 3C & ASTM D1946. Air samples are collected into cleaned evacuated canisters. A volume of air is removed from the canister and injected by means of a gas-sampling/backflush valve onto a series of packed GC columns and measured using a thermal conductivity detector (TCD).

Oxygen is not separated from Argon.

Canister samples will be retained for 7 calendar days after final report. If you require a longer canister storage time, please contact your account manager.

SILOXANES-GCMS-WT	Tube	Linear & Cyclic Methyl Siloxanes	EPA TO-17

This analysis is performed using procedures adapted from EPA Method TO-17, ISO Method 16017 & NIOSH Method 2549. Air samples actively collected on PE VI TD tubes are thermally stripped & the analytes are re-collected on trapping material of a focusing trap in the thermal desorber. The analytes are then thermally desorbed into a GC-MSD for analysis. Test results are not blank corrected unless indicated by a qualifier.

This analysis was performed under AIHA-IHLAP Scope of Accreditation, GC/MS Field of Testing which is compliant with AIHA-LAP, LLC Accreditation Policy Modules & ISO/IEC 17025:2005 Standard.

TD tube samples will be retained for 7 calendar days after final report. If you require a longer TD tube storage time, please contact your account manager.

TO15-GCMS-WT	Canister	Canister EPA TO-15	EPA TO-15

This analysis is performed using procedures adapted from EPA Method TO-15. Air samples are collected into cleaned evacuated canisters. A volume of

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
air sample is transferred from the canister to a preconcentrator system where the analytes are trapped & focused. The analytes are then thermally desorbed into a GC-MSD for analysis. Test results are not blank corrected unless indicated by a qualifier.			
Canister samples will be retained for 7 calendar days after final report. If you require a longer canister storage time, please contact your account manager.			
XYLENES-SUM-CALC-WT	Canister	Sum of Xylene Isomer Concentrations	CALCULATION

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

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

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

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

ALS Routine Water Chemistry Report

L2393599

Lab ID	Sample ID				Lab ID	Sample ID			

ALS LABORATORY GROUP SOIL SALINITY CONVERSION

L2393599

Lab ID	Sample ID				Lab ID	Sample ID			

"Calculations are as per:
Methods of Analysis for Soils, Plants and Waters
Homer D. Chapman and Parker F. Pratt
University of California, Riverside, CI.
August, 1961."

Quality Control Report

Workorder: L2393599 Report Date: 24-DEC-19

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALIPH/AROM-GCMS-WT	**Canister**							
Batch R4953011								
WG3247105-2 LCS								
Aliphatic C6-C8			121.6		%		50-150	23-DEC-19
Aliphatic C>8-C10			101.0		%		50-150	23-DEC-19
Aliphatic C>10-C12			117.1		%		50-150	23-DEC-19
Aliphatic C>12-C16			128.7		%		50-150	23-DEC-19
Aromatic C>8-C10			105.7		%		50-150	23-DEC-19
Aromatic C>10-C12			101.0		%		50-150	23-DEC-19
Aromatic C>12-C16			87.2		%		50-150	23-DEC-19
WG3247105-3 LCSD		**WG3247105-2**						
Aliphatic C6-C8		121.6	128.6		%	5.6	50	23-DEC-19
Aliphatic C>8-C10		101.0	103.8		%	2.8	50	23-DEC-19
Aliphatic C>10-C12		117.1	119.5		%	2.0	50	23-DEC-19
Aliphatic C>12-C16		128.7	136.9		%	6.2	50	23-DEC-19
Aromatic C>8-C10		105.7	108.2		%	2.3	50	23-DEC-19
Aromatic C>10-C12		101.0	104.3		%	3.2	50	23-DEC-19
Aromatic C>12-C16		87.2	95.6		%	9.2	50	23-DEC-19
WG3247105-1 MB								
Aliphatic C6-C8			<15		ug/m3		15	23-DEC-19
Aliphatic C>8-C10			<15		ug/m3		15	23-DEC-19
Aliphatic C>10-C12			<15		ug/m3		15	23-DEC-19
Aliphatic C>12-C16			<30		ug/m3		30	23-DEC-19
Aromatic C>8-C10			<15		ug/m3		15	23-DEC-19
Aromatic C>10-C12			<15		ug/m3		15	23-DEC-19
Aromatic C>12-C16			<30		ug/m3		30	23-DEC-19
BTEX+NAPH-GCMS-WT	**Canister**							
Batch R4953168								
WG3247636-4 DUP		**L2393586-1**						
Naphthalene		<0.50	<0.50	RPD-NA	ppb(V)	N/A	30	23-DEC-19
WG3247636-2 LCS								
Naphthalene			111.7		%		70-130	23-DEC-19
WG3247636-3 LCSD		**WG3247636-2**						
Naphthalene		111.7	96.1		%	15	50	23-DEC-19
WG3247636-1 MB								
Naphthalene			<0.50		ppb(V)		0.5	23-DEC-19
Surrogate: 4-Bromofluorobenzene			94.2		%		50-150	23-DEC-19

Quality Control Report

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C1-C5-FID-WT	**Canister**							
Batch R4944650								
WG3239341-4 DUP		**L2393570-1**						
Methane		0.00029	0.00027		%	7.3	20	10-DEC-19
Ethane		<0.00020	<0.00020	RPD-NA	%	N/A	20	10-DEC-19
Ethene		<0.00020	<0.00020	RPD-NA	%	N/A	20	10-DEC-19
Propane		<0.00020	<0.00020	RPD-NA	%	N/A	20	10-DEC-19
Propene		<0.00020	<0.00020	RPD-NA	%	N/A	20	10-DEC-19
Butane		<0.00020	<0.00020	RPD-NA	%	N/A	20	10-DEC-19
Pentane		<0.00020	<0.00020	RPD-NA	%	N/A	20	10-DEC-19
WG3239341-1 LCS								
Methane			78.8		%		70-130	10-DEC-19
Ethane			88.3		%		70-130	10-DEC-19
Ethene			84.4		%		70-130	10-DEC-19
Propane			88.8		%		70-130	10-DEC-19
Propene			96.7		%		70-130	10-DEC-19
Pentane			92.4		%		70-130	10-DEC-19
WG3239341-2 LCSD		**WG3239341-1**						
Methane		78.8	82.3		%	4.4	50	10-DEC-19
Ethane		88.3	89.4		%	1.2	50	10-DEC-19
Ethene		84.4	84.6		%	0.1	50	10-DEC-19
Propane		88.8	88.5		%	0.4	50	10-DEC-19
Propene		96.7	96.9		%	0.2	50	10-DEC-19
Pentane		92.4	92.2		%	0.2	50	10-DEC-19
WG3239341-3 MB								
Methane			<0.00010		%		0.0001	10-DEC-19
Ethane			<0.00020		%		0.0002	10-DEC-19
Ethene			<0.00020		%		0.0002	10-DEC-19
Propane			<0.00020		%		0.0002	10-DEC-19
Propene			<0.00020		%		0.0002	10-DEC-19
Butane			<0.00020		%		0.0002	10-DEC-19
Pentane			<0.00020		%		0.0002	10-DEC-19
CAN-DATA-WT	**Canister**							
Batch R4944737								
WG3244055-1 MB								
Pressure on Receipt			-29.8		in Hg			17-DEC-19

Quality Control Report

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F1-F2-GCMS-WT	**Canister**							
Batch R4953011								
WG3247105-2 LCS								
F1 (C6-C10)			110.1		%		50-150	23-DEC-19
WG3247105-3 LCSD		**WG3247105-2**						
F1 (C6-C10)		110.1	108.4		%	1.5	50	23-DEC-19
WG3247105-1 MB								
F1 (C6-C10)			<15		ug/m3		15	23-DEC-19
F2 (C10-C16)			<15		ug/m3		15	23-DEC-19
Surrogate: 4-Bromofluorobenzene			98.3		%		50-150	23-DEC-19
FIXED GASES-TCD-WT	**Canister**							
Batch R4944389								
WG3236065-8 DUP		**L2393575-4**						
Nitrogen		75.8	76.0		%	0.3	30	13-DEC-19
Oxygen		19.6	19.6		%	0.3	30	13-DEC-19
Carbon Dioxide		2.84	2.76		%	2.7	30	13-DEC-19
Carbon Monoxide		<0.050	<0.050	RPD-NA	%	N/A	30	13-DEC-19
Methane		<0.050	<0.050	RPD-NA	%	N/A	30	13-DEC-19
WG3236065-5 LCS								
Nitrogen			98.5		%		70-130	13-DEC-19
Oxygen			97.5		%		70-130	13-DEC-19
Carbon Dioxide			95.4		%		70-130	13-DEC-19
Carbon Monoxide			95.7		%		70-130	13-DEC-19
Methane			98.3		%		70-130	13-DEC-19
WG3236065-6 LCSD		**WG3236065-5**						
Nitrogen		98.5	98.6		%	0.1	25	13-DEC-19
Oxygen		97.5	97.6		%	0.2	25	13-DEC-19
Carbon Dioxide		95.4	96.1		%	0.8	25	13-DEC-19
Carbon Monoxide		95.7	95.9		%	0.2	25	13-DEC-19
Methane		98.3	98.3		%	0.0	25	13-DEC-19
WG3236065-7 MB								
Nitrogen			<1.0		%		1	13-DEC-19
Oxygen			<0.10		%		0.1	13-DEC-19
Carbon Dioxide			<0.050		%		0.05	13-DEC-19
Carbon Monoxide			<0.050		%		0.05	13-DEC-19
Methane			<0.050		%		0.05	13-DEC-19
TO15-GCMS-WT	**Canister**							

Quality Control Report

Workorder: L2393599 Report Date: 24-DEC-19

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TO15-GCMS-WT	**Canister**							
Batch R4953168								
WG3247636-4 DUP		**L2393586-1**						
1,1,1-Trichloroethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,1,2,2-Tetrachloroethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,1,2-Trichloroethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,1-Dichloroethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,1-Dichloroethene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,2,4-Trichlorobenzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,2,4-Trimethylbenzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,2-Dibromoethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,2-Dichlorobenzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,2-Dichloroethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,2-Dichloropropane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,3,5-Trimethylbenzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,3-Butadiene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,3-Dichlorobenzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,4-Dichlorobenzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
1,4-Dioxane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
2-Hexanone		<1.0	<1.0	RPD-NA	ppb(V)	N/A	30	23-DEC-19
4-Ethyltoluene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Acetone		1.97	1.94		ppb(V)	1.5	30	23-DEC-19
Allyl chloride		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Benzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Benzyl chloride		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Bromodichloromethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Bromoform		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Bromomethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Carbon Disulfide		1.30	1.28		ppb(V)	1.2	30	23-DEC-19
Carbon Tetrachloride		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Chlorobenzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Chloroethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Chloroform		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Chloromethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
cis-1,2-Dichloroethene		0.78	0.72		ppb(V)	8.0	30	23-DEC-19
cis-1,3-Dichloropropene		<0.20	<0.20		ppb(V)			23-DEC-19

Quality Control Report

Workorder: L2393599 Report Date: 24-DEC-19

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TO15-GCMS-WT	**Canister**							
Batch R4953168								
WG3247636-4 DUP		**L2393586-1**						
cis-1,3-Dichloropropene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Cyclohexane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Dibromochloromethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Dichlorodifluoromethane		0.69	0.68		ppb(V)	2.6	30	23-DEC-19
Ethyl acetate		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Ethylbenzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Freon 113		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Freon 114		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Hexachlorobutadiene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Isooctane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Isopropyl alcohol		<1.0	<1.0	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Isopropylbenzene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	50	23-DEC-19
m&p-Xylene		0.72	0.70		ppb(V)	3.4	30	23-DEC-19
Methyl ethyl ketone		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Methyl isobutyl ketone		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Methylene chloride		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
MTBE		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
n-Heptane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
n-Hexane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
o-Xylene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Propylene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Styrene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Tetrachloroethylene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Tetrahydrofuran		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Toluene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
trans-1,2-Dichloroethene		0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
trans-1,3-Dichloropropene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Trichloroethylene		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Trichlorofluoromethane		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Vinyl acetate		<0.50	<0.50	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Vinyl bromide		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
Vinyl chloride		<0.20	<0.20	RPD-NA	ppb(V)	N/A	30	23-DEC-19
WG3247636-2 LCS								

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TO15-GCMS-WT	**Canister**							
Batch R4953168								
WG3247636-2 LCS								
1,1,1-Trichloroethane			88.6		%		70-130	23-DEC-19
1,1,2,2-Tetrachloroethane			91.9		%		70-130	23-DEC-19
1,1,2-Trichloroethane			86.6		%		70-130	23-DEC-19
1,1-Dichloroethane			92.4		%		70-130	23-DEC-19
1,1-Dichloroethene			90.6		%		70-130	23-DEC-19
1,2,4-Trichlorobenzene			108.3		%		70-130	23-DEC-19
1,2,4-Trimethylbenzene			92.4		%		70-130	23-DEC-19
1,2-Dibromoethane			90.8		%		70-130	23-DEC-19
1,2-Dichlorobenzene			92.5		%		70-130	23-DEC-19
1,2-Dichloroethane			90.4		%		70-130	23-DEC-19
1,2-Dichloropropane			90.0		%		70-130	23-DEC-19
1,3,5-Trimethylbenzene			90.6		%		70-130	23-DEC-19
1,3-Butadiene			89.8		%		70-130	23-DEC-19
1,3-Dichlorobenzene			91.1		%		70-130	23-DEC-19
1,4-Dichlorobenzene			94.2		%		70-130	23-DEC-19
1,4-Dioxane			92.9		%		70-130	23-DEC-19
2-Hexanone			92.2		%		70-130	23-DEC-19
4-Ethyltoluene			90.5		%		70-130	23-DEC-19
Acetone			91.2		%		70-130	23-DEC-19
Allyl chloride			88.3		%		70-130	23-DEC-19
Benzene			92.1		%		70-130	23-DEC-19
Benzyl chloride			87.4		%		70-130	23-DEC-19
Bromodichloromethane			88.1		%		70-130	23-DEC-19
Bromoform			88.4		%		70-130	23-DEC-19
Bromomethane			92.9		%		70-130	23-DEC-19
Carbon Disulfide			84.8		%		70-130	23-DEC-19
Carbon Tetrachloride			87.6		%		70-130	23-DEC-19
Chlorobenzene			90.8		%		70-130	23-DEC-19
Chloroethane			90.9		%		70-130	23-DEC-19
Chloroform			94.1		%		70-130	23-DEC-19
Chloromethane			93.2		%		70-130	23-DEC-19
cis-1,2-Dichloroethene			89.8		%		70-130	23-DEC-19
cis-1,3-Dichloropropene			89.0		%		70-130	23-DEC-19

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TO15-GCMS-WT	**Canister**							
Batch R4953168								
WG3247636-2 LCS								
Cyclohexane			92.0		%		70-130	23-DEC-19
Dibromochloromethane			86.9		%		70-130	23-DEC-19
Dichlorodifluoromethane			89.3		%		70-130	23-DEC-19
Ethyl acetate			89.3		%		70-130	23-DEC-19
Ethylbenzene			89.4		%		70-130	23-DEC-19
Freon 113			89.0		%		70-130	23-DEC-19
Freon 114			95.4		%		70-130	23-DEC-19
Hexachlorobutadiene			103.3		%		70-130	23-DEC-19
Isooctane			90.2		%		70-130	23-DEC-19
Isopropyl alcohol			83.3		%		70-130	23-DEC-19
Isopropylbenzene			87.4		%		50-150	23-DEC-19
m&p-Xylene			91.2		%		70-130	23-DEC-19
Methyl ethyl ketone			89.5		%		70-130	23-DEC-19
Methyl isobutyl ketone			89.1		%		70-130	23-DEC-19
Methylene chloride			95.2		%		70-130	23-DEC-19
MTBE			90.7		%		70-130	23-DEC-19
n-Heptane			89.9		%		70-130	23-DEC-19
n-Hexane			90.8		%		70-130	23-DEC-19
o-Xylene			90.5		%		70-130	23-DEC-19
Propylene			88.6		%		70-130	23-DEC-19
Styrene			89.1		%		70-130	23-DEC-19
Tetrachloroethylene			90.2		%		70-130	23-DEC-19
Tetrahydrofuran			92.0		%		70-130	23-DEC-19
Toluene			91.9		%		70-130	23-DEC-19
trans-1,2-Dichloroethene			91.7		%		70-130	23-DEC-19
trans-1,3-Dichloropropene			87.5		%		70-130	23-DEC-19
Trichloroethylene			91.3		%		70-130	23-DEC-19
Trichlorofluoromethane			89.8		%		70-130	23-DEC-19
Vinyl acetate			89.2		%		70-130	23-DEC-19
Vinyl bromide			92.1		%		70-130	23-DEC-19
Vinyl chloride			89.8		%		70-130	23-DEC-19
WG3247636-3 LCSD		**WG3247636-2**						
1,1,1-Trichloroethane		88.6	77.4		%	13	25	23-DEC-19
1,1,2,2-Tetrachloroethane		91.9	80.2		%	14	25	23-DEC-19

Quality Control Report

Workorder: L2393599 Report Date: 24-DEC-19

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TO15-GCMS-WT	**Canister**							
Batch R4953168								
WG3247636-3 LCSD		**WG3247636-2**						
1,1,2-Trichloroethane		86.6	74.9		%	14	25	23-DEC-19
1,1-Dichloroethane		92.4	77.3		%	18	25	23-DEC-19
1,1-Dichloroethene		90.6	75.4		%	18	25	23-DEC-19
1,2,4-Trichlorobenzene		108.3	91.8		%	16	25	23-DEC-19
1,2,4-Trimethylbenzene		92.4	79.2		%	15	25	23-DEC-19
1,2-Dibromoethane		90.8	77.8		%	15	25	23-DEC-19
1,2-Dichlorobenzene		92.5	79.7		%	15	25	23-DEC-19
1,2-Dichloroethane		90.4	78.5		%	14	25	23-DEC-19
1,2-Dichloropropane		90.0	78.6		%	13	25	23-DEC-19
1,3,5-Trimethylbenzene		90.6	77.2		%	16	25	23-DEC-19
1,3-Butadiene		89.8	79.7		%	12	25	23-DEC-19
1,3-Dichlorobenzene		91.1	78.3		%	15	25	23-DEC-19
1,4-Dichlorobenzene		94.2	81.2		%	15	25	23-DEC-19
1,4-Dioxane		92.9	82.0		%	12	25	23-DEC-19
2-Hexanone		92.2	81.0		%	13	25	23-DEC-19
4-Ethyltoluene		90.5	78.4		%	14	25	23-DEC-19
Acetone		91.2	77.4		%	16	25	23-DEC-19
Allyl chloride		88.3	77.2		%	13	25	23-DEC-19
Benzene		92.1	78.2		%	16	25	23-DEC-19
Benzyl chloride		87.4	76.4		%	13	25	23-DEC-19
Bromodichloromethane		88.1	77.3		%	13	25	23-DEC-19
Bromoform		88.4	74.5		%	17	25	23-DEC-19
Bromomethane		92.9	79.7		%	15	25	23-DEC-19
Carbon Disulfide		84.8	73.4		%	15	25	23-DEC-19
Carbon Tetrachloride		87.6	77.2		%	13	25	23-DEC-19
Chlorobenzene		90.8	78.1		%	15	25	23-DEC-19
Chloroethane		90.9	79.4		%	13	25	23-DEC-19
Chloroform		94.1	80.5		%	16	25	23-DEC-19
Chloromethane		93.2	79.5		%	16	25	23-DEC-19
cis-1,2-Dichloroethene		89.8	79.2		%	12	25	23-DEC-19
cis-1,3-Dichloropropene		89.0	76.0		%	16	25	23-DEC-19
Cyclohexane		92.0	77.5		%	17	25	23-DEC-19
Dibromochloromethane		86.9	76.1		%			23-DEC-19

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TO15-GCMS-WT	**Canister**							
Batch R4953168								
WG3247636-3 LCSD		**WG3247636-2**						
Dibromochloromethane		86.9	76.1		%	13	25	23-DEC-19
Dichlorodifluoromethane		89.3	77.0		%	15	25	23-DEC-19
Ethyl acetate		89.3	75.4		%	17	25	23-DEC-19
Ethylbenzene		89.4	78.0		%	14	25	23-DEC-19
Freon 113		89.0	75.4		%	17	25	23-DEC-19
Freon 114		95.4	82.0		%	15	25	23-DEC-19
Hexachlorobutadiene		103.3	88.9		%	15	25	23-DEC-19
Isooctane		90.2	79.3		%	13	25	23-DEC-19
Isopropyl alcohol		83.3	72.3		%	14	25	23-DEC-19
Isopropylbenzene		87.4	76.3		%	14	50	23-DEC-19
m&p-Xylene		91.2	80.3		%	13	25	23-DEC-19
Methyl ethyl ketone		89.5	78.2		%	13	25	23-DEC-19
Methyl isobutyl ketone		89.1	75.6		%	16	25	23-DEC-19
Methylene chloride		95.2	76.9		%	21	25	23-DEC-19
MTBE		90.7	77.2		%	16	25	23-DEC-19
n-Heptane		89.9	77.9		%	14	25	23-DEC-19
n-Hexane		90.8	78.3		%	15	25	23-DEC-19
o-Xylene		90.5	78.6		%	14	25	23-DEC-19
Propylene		88.6	74.1		%	18	25	23-DEC-19
Styrene		89.1	76.4		%	15	25	23-DEC-19
Tetrachloroethylene		90.2	76.6		%	16	25	23-DEC-19
Tetrahydrofuran		92.0	79.5		%	15	25	23-DEC-19
Toluene		91.9	79.4		%	15	25	23-DEC-19
trans-1,2-Dichloroethene		91.7	77.5		%	17	25	23-DEC-19
trans-1,3-Dichloropropene		87.5	76.1		%	14	25	23-DEC-19
Trichloroethylene		91.3	77.8		%	16	25	23-DEC-19
Trichlorofluoromethane		89.8	77.5		%	15	25	23-DEC-19
Vinyl acetate		89.2	99.98		%	11	25	23-DEC-19
Vinyl bromide		92.1	78.8		%	16	25	23-DEC-19
Vinyl chloride		89.8	78.0		%	14	25	23-DEC-19
WG3247636-1 MB								
1,1,1-Trichloroethane			<0.20		ppb(V)		0.2	23-DEC-19
1,1,2,2-Tetrachloroethane			<0.20		ppb(V)		0.2	23-DEC-19

Quality Control Report

Workorder: L2393599 Report Date: 24-DEC-19

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TO15-GCMS-WT	**Canister**							
Batch R4953168								
WG3247636-1 MB								
1,1,2-Trichloroethane			<0.20		ppb(V)		0.2	23-DEC-19
1,1-Dichloroethane			<0.20		ppb(V)		0.2	23-DEC-19
1,1-Dichloroethene			<0.20		ppb(V)		0.2	23-DEC-19
1,2,4-Trichlorobenzene			<0.20		ppb(V)		0.2	23-DEC-19
1,2,4-Trimethylbenzene			<0.20		ppb(V)		0.2	23-DEC-19
1,2-Dibromoethane			<0.20		ppb(V)		0.2	23-DEC-19
1,2-Dichlorobenzene			<0.20		ppb(V)		0.2	23-DEC-19
1,2-Dichloroethane			<0.20		ppb(V)		0.2	23-DEC-19
1,2-Dichloropropane			<0.20		ppb(V)		0.2	23-DEC-19
1,3,5-Trimethylbenzene			<0.20		ppb(V)		0.2	23-DEC-19
1,3-Butadiene			<0.20		ppb(V)		0.2	23-DEC-19
1,3-Dichlorobenzene			<0.20		ppb(V)		0.2	23-DEC-19
1,4-Dichlorobenzene			<0.20		ppb(V)		0.2	23-DEC-19
1,4-Dioxane			<0.20		ppb(V)		0.2	23-DEC-19
2-Hexanone			<1.0		ppb(V)		1	23-DEC-19
4-Ethyltoluene			<0.20		ppb(V)		0.2	23-DEC-19
Acetone			<0.50		ppb(V)		0.5	23-DEC-19
Allyl chloride			<0.20		ppb(V)		0.2	23-DEC-19
Benzene			<0.20		ppb(V)		0.2	23-DEC-19
Benzyl chloride			<0.20		ppb(V)		0.2	23-DEC-19
Bromodichloromethane			<0.20		ppb(V)		0.2	23-DEC-19
Bromoform			<0.20		ppb(V)		0.2	23-DEC-19
Bromomethane			<0.20		ppb(V)		0.2	23-DEC-19
Carbon Disulfide			<0.20		ppb(V)		0.2	23-DEC-19
Carbon Tetrachloride			<0.20		ppb(V)		0.2	23-DEC-19
Chlorobenzene			<0.20		ppb(V)		0.2	23-DEC-19
Chloroethane			<0.20		ppb(V)		0.2	23-DEC-19
Chloroform			<0.20		ppb(V)		0.2	23-DEC-19
Chloromethane			<0.20		ppb(V)		0.2	23-DEC-19
cis-1,2-Dichloroethene			<0.20		ppb(V)		0.2	23-DEC-19
cis-1,3-Dichloropropene			<0.20		ppb(V)		0.2	23-DEC-19
Cyclohexane			<0.20		ppb(V)		0.2	23-DEC-19
Dibromochloromethane			<0.20		ppb(V)		0.2	23-DEC-19

Quality Control Report

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TO15-GCMS-WT	**Canister**							
Batch R4953168								
WG3247636-1 MB								
Dichlorodifluoromethane			<0.20		ppb(V)		0.2	23-DEC-19
Ethyl acetate			<0.20		ppb(V)		0.2	23-DEC-19
Ethylbenzene			<0.20		ppb(V)		0.2	23-DEC-19
Freon 113			<0.20		ppb(V)		0.2	23-DEC-19
Freon 114			<0.20		ppb(V)		0.2	23-DEC-19
Hexachlorobutadiene			<0.20		ppb(V)		0.2	23-DEC-19
Isooctane			<0.20		ppb(V)		0.2	23-DEC-19
Isopropyl alcohol			<1.0		ppb(V)		1	23-DEC-19
Isopropylbenzene			<0.20		ppb(V)		0.2	23-DEC-19
m&p-Xylene			<0.40		ppb(V)		0.4	23-DEC-19
Methyl ethyl ketone			<0.20		ppb(V)		0.2	23-DEC-19
Methyl isobutyl ketone			<0.20		ppb(V)		0.2	23-DEC-19
Methylene chloride			<0.20		ppb(V)		0.2	23-DEC-19
MTBE			<0.20		ppb(V)		0.2	23-DEC-19
n-Heptane			<0.20		ppb(V)		0.2	23-DEC-19
n-Hexane			<0.20		ppb(V)		0.2	23-DEC-19
o-Xylene			<0.20		ppb(V)		0.2	23-DEC-19
Propylene			<0.20		ppb(V)		0.2	23-DEC-19
Styrene			<0.20		ppb(V)		0.2	23-DEC-19
Tetrachloroethylene			<0.20		ppb(V)		0.2	23-DEC-19
Tetrahydrofuran			<0.20		ppb(V)		0.2	23-DEC-19
Toluene			<0.20		ppb(V)		0.2	23-DEC-19
trans-1,2-Dichloroethene			<0.20		ppb(V)		0.2	23-DEC-19
trans-1,3-Dichloropropene			<0.20		ppb(V)		0.2	23-DEC-19
Trichloroethylene			<0.20		ppb(V)		0.2	23-DEC-19
Trichlorofluoromethane			<0.20		ppb(V)		0.2	23-DEC-19
Vinyl acetate			<0.50		ppb(V)		0.5	23-DEC-19
Vinyl bromide			<0.20		ppb(V)		0.2	23-DEC-19
Vinyl chloride			<0.20		ppb(V)		0.2	23-DEC-19
Surrogate: 4-Bromofluorobenzene			94.2		%		50-150	23-DEC-19
SILOXANES-GCMS-WT	**Tube**							

Quality Control Report

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SILOXANES-GCMS-WT	**Tube**							
Batch R4945277								
WG3242059-2 LCS								
D3(CVMS)			116.0		%		70-130	18-DEC-19
D4(CVMS)			117.6		%		70-130	18-DEC-19
D5(CVMS)			127.7		%		70-130	18-DEC-19
D6(CVMS)			121.6		%		70-130	18-DEC-19
MM(LVMS)			122.0		%		70-130	18-DEC-19
MDM(LVMS)			124.9		%		70-130	18-DEC-19
MD2M(LVMS)			118.9		%		70-130	18-DEC-19
MD3M(LVMS)			114.1		%		70-130	18-DEC-19
WG3242059-3 LCSD		**WG3242059-2**						
D3(CVMS)		116.0	118.1		%	1.7	50	18-DEC-19
D4(CVMS)		117.6	121.2		%	3.0	50	18-DEC-19
D5(CVMS)		127.7	131.7		%	3.1	50	18-DEC-19
D6(CVMS)		121.6	125.5		%	3.2	50	18-DEC-19
MM(LVMS)		122.0	94.5		%	25	50	18-DEC-19
MDM(LVMS)		124.9	123.7		%	0.9	50	18-DEC-19
MD2M(LVMS)		118.9	116.5		%	2.0	50	18-DEC-19
MD3M(LVMS)		114.1	106.2		%	7.2	50	18-DEC-19
WG3242059-1 MB								
D3(CVMS)			<10		ng		10	18-DEC-19
D4(CVMS)			<10		ng		10	18-DEC-19
D5(CVMS)			<10		ng		10	18-DEC-19
D6(CVMS)			<10		ng		10	18-DEC-19
MM(LVMS)			<10		ng		10	18-DEC-19
MDM(LVMS)			<10		ng		10	18-DEC-19
MD2M(LVMS)			<10		ng		10	18-DEC-19
MD3M(LVMS)			<10		ng		10	18-DEC-19
Surrogate: 4-Bromofluorobenzene			100.4		%		50-150	18-DEC-19

Quality Control Report

Workorder: L2393599 Report Date: 24-DEC-19

Client: TETRA TECH CANADA INC.
110, 140 Quarry Park Blvd SE
Calgary AB T2C 3G3
Contact: Darby Madalena

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Batch Proof Report

Batch ID	Canister ID	Parameters	Value	Units	Date	Analyst
B191119.112	01400-0480	1,1,1-Trichloroethane	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,1,1,2-Tetrachloroethane	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,1,2,2-Tetrachloroethane	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,1,2-Trichloroethane	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,1-Dichloroethane	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,1-Dichloroethene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,2,4-Trichlorobenzene	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,2,4-Trimethylbenzene	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,2-Dibromoethane	<0.01	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,2-Dichlorobenzene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,2-Dichloroethane	<0.01	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,2-Dichloropropane	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,3,5-Trimethylbenzene	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,3-Butadiene	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,3-Dichlorobenzene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,4-Dichlorobenzene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	1,4-Dioxane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	2-Chlorophenol	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	2-Hexanone	<1.0	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	4-Ethyltoluene	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Acetone	<0.50	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Allyl Chloride	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Benzene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Benzyl Chloride	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Bromodichloromethane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Bromobenzene	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Bromoform	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Bromomethane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Carbon Disulfide	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Carbon Tetrachloride	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Chlorobenzene	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Chloroethane	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Chloroform	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Chloromethane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	cis-1,2-Dichloroethene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	cis-1,3-Dichloropropene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Cyclohexane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Dibromochloromethane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Dichlorodifluoromethane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Ethyl Acetate	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Ethyl Benzene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Freon 113	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Freon 114	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Hexachlorobutadiene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Isooctane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Isopropyl Alcohol	<1.0	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Isopropylbenzene	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	m&p-Xylene	<0.04	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Methyl Ethyl Ketone	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Methylcyclohexane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Methyl Isobutyl Ketone	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Methylene Chloride	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	MTBE	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Naphthalene	<0.05	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	n-Decane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	n-Heptane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	n-Hexane	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	o-Xylene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Propylene	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Styrene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Tetrachloroethylene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Tetrahydrofuran	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Toluene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	trans-1,2-Dichloroethene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	trans-1,3-Dichloropropene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Trichloroethylene	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Trichlorofluoromethane	<0.20	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Vinyl Acetate	<0.50	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	Vinyl Bromide	<0.20	ppb(V)	21-Nov-19	DT1

B191119.112	01400-0480	Vinyl Chloride	<0.02	ppb(V)	21-Nov-19	DT1
B191119.112	01400-0480	4-Bromofluorobenzene	103.1	%	21-Nov-19	DT1

L2393599-COFC

S44

60 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B8
Phone: (519) 886-6910
Fax: (519) 886-9047
Toll Free: 1-800-668-9878

ALS Environmental

Y FORM - Canister/Tube/Gas Bag

Note: all TAT Quoted material is in business days which exclude statutory holidays and weekends. TAT of samples received past 3:00 pm or Saturday / Sunday begin the next day.

Specify date required

Service Requested		Rush 3 day (100%)	
10 day (regular)	☑	Rush 2 day (200%)	☐
Rush 5 day (50%)	☐	Rush 1 day (300%)- Enquire	☐

COMPANY NAME	Tetra Tech Canada Inc.
OFFICE	110, 140 Quarry Park Blvd SE, Calgary, AB T2C 3G3
PROJECT MANAGER	Darby Madalena
PROJECT #	SWM.SWOP04071-01.006 (Red Deer Motors)
PHONE 403-723-6867	FAX 403-203-3301
ACCOUNT #	
QUOTATION # Q71650	PO # SWM.SWOP04071-01.006

SAMPLE TYPE/REGULATION

Reg 419/05 ☐ Soil Vapor Intrusion ☐

OTHER ☐ Please List _____

REPORT FORMAT/DISTRIBUTION

EMAIL_____FAX_____BOTH _____
SELECT: PDF_____DIGITAL_____BOTH _____
EMAIL 1 _____
EMAIL 2 _____

All rush work requires lab approval before sample submission

SUBMISSION #:
ENTERED BY:
DATE/TIME ENTERED:
BIN #:

SAMPLING INFORMATION

Sample Date/Time: Date (dd-mmm-yy)	Time (24hr) (hh:mm)	Canister or Tube ID# (e.g. 060000-XXXX or G0XXXXXX SVI)	Regulator Serial # CS1200-XXXX or GXX	Matrix Type	SAMPLE DESCRIPTION TO APPEAR ON REPORT	TUBE AIR VOLUME - L ☒ m³ ☐	C1-C5+FID-WT	FIXED GASES-TCD-WT	TO15,F1F2SFRA+NAP-WT	Siloxanes - GCMS - WT			STARTING PRESSURE - Pre-Sampling ("Hg)	ENDING PRESSURE - Post Sampling ("Hg)	COLLECTION TIME (HRS)	Field Conditions (Rain/Wind/Dust/Odour) Field PID Reading	LAB ID
05-Dec-19	1410	9200	G315	SG	VW-01	1.9	x	x	x				-24	-5	2		
↓	1520	00949	G255	SG	VW-02	1.4	x	x	x				-27	-6	1		
05-Dec-19	—	3638	DS36	SG	19DUP01	1.4	x	x	x				-24	-5	2		
↓	1610	G0150006SV1	—	SG	VW-01	/				X			/	/	/		
↓	1630	G0150679SV1	—	SG	VW-02	/				X			/	/	/		

SPECIAL INSTRUCTIONS/COMMENTS

This Chain of Custody Form is only to be used for Air Quality Samples

SAMPLE CONDITION AS RECEIVED

Matrix Type	
	Soil Gas Vapour = SG
	Ambient Air = AA
	Indoor Air = IA
	Industrial Hygiene = IH

FROZEN ☐ COLD ☐ COOLING INITIATED ☐ AMBIENT ☐ MEAN TEMP

OBSERVATIONS Yes ☐ No ☐ If yes add SIF

INIT

SAMPLED BY: Megan Rouse	DATE & TIME 12/06/19	RECEIVED BY:	DATE & TIME	
RELINQUISHED BY: Megan Rouse	DATE & TIME 1600	RECEIVED AT LAB BY:	DATE & TIME	

Notes

1. Quote number must be provided to ensure proper pricing

2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.

3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.

REV4-2012

APPENDIX E

HISTORICAL ANALYTICAL RESULTS

Table 1
Elevations for Soil Vapour and Groundwater Monitoring Wells

Test Location	Well Depth (m)	Elevations				Screen Length (m)
		Ground (m)	Top of Pipe (m)	Screen Interval		
				Bottom	Top	
MW-01	6.1	874.014	875.099	867.914	872.514	4.6
MW-02	6.6	877.302	878.096	870.702	- -	- -
MW-03	5.1	877.297	877.307	872.197	- -	- -
VW-01	3.5	874.194	874.943	870.694	870.994	0.3
VW-02	4.6	877.321	878.166	872.721	873.021	0.3
VW-03	4.0	877.316	878.017	873.316	873.616	0.3
TH-03	No Well	875.332	- -	- -	- -	- -
TH-05	No Well	875.567	- -	- -	- -	- -
TH-06	No Well	876.597	- -	- -	- -	- -
TH-07	No Well	876.925	- -	- -	- -	- -
TH-08	No Well	876.812	- -	- -	- -	- -
TH-09	No Well	875.907	- -	- -	- -	- -

Notes:

1) Geodetic elevations are referenced to multiple ASCM Nos. 269191, 376673 and 384792.
2) MW - Monitoring Well.
3) VW - Soil Vapour Well.
4) TH - Testhole.
5) Well depth, screen interval derived from borehole logs by others, where avalable.
6) - - No value established.

Table 2
Site Monitoring Results

Test Location	Elevations		Groundwater Elevation (m)		Headspace Vapour			
					03/08/13			
	Ground (m)	Top of Pipe (m)	03/08/13		Combustible	Volatile	Combustible	Volatile
MW-01	874.014	875.099	869.841		230	43		
MW-02	877.302	878.096	874.276		ND	ND		
MW-03	877.297	877.307	NM		NM	NM		
VW-01	874.194	874.943	- -	- -	1,600	64		
VW-02	877.321	878.166	- -	- -	20	2		
VW-03	877.316	878.017	- -	- -	25	ND		
TH-03	875.332	NA	- -	- -	- -	- -	- -	- -
TH-05	875.567	NA	- -	- -	- -	- -	- -	- -
TH-06	876.597	NA	- -	- -	- -	- -	- -	- -
TH-07	876.925	NA	- -	- -	- -	- -	- -	- -
TH-08	876.812	NA	- -	- -	- -	- -	- -	- -
TH-09	875.907	NA	- -	- -	- -	- -	- -	- -

Notes:

1) Geodetic elevations are referenced to multiple ASCM Nos 269191, 376673 and 384792.
2) Measurement of combustible and volatile vapours by RKI Eagle 2. Units ppmv.
   Combustible vapour sensor calibrated to hexane and photoionization detector calibrated to isobutylene.
3) NA - Not Applicable.
4) ND - Not Detected, less than the limit of instrument detection.
5) NM - Not Measured.
6) - - No applicable value.

Table 3A
Analytical Results - Soil - Drill Cuttings (Soil Bag)

Parameter	Detection Limit	Soil Bag 1 of 1	Class II Landfill Acceptance Criteria
pH	0.10	7.71	2-12.5
Flash Point (°C)	30.0	>75	>61
Paint Filter Test	-	PASS	PASS
TCLP Hydrocarbons			
Benzene	0.0050	ND	0.5
Toluene	0.0050	ND	0.5
Ethylbenzene	0.0050	ND	0.5
Xylenes	0.0050	ND	0.5
TCLP Metals			
Antimony (Sb)	5.0	ND	500
Arsenic (As)	0.20	ND	5
Barium (Ba)	5.0	ND	100
Beryllium (Be)	0.50	ND	5
Boron (B)	5.0	ND	500
Cadmium (Cd)	0.050	ND	1
Chromium (Cr)	0.50	ND	5
Cobalt (Co)	5.0	ND	100
Copper (Cu)	5.0	ND	100
Iron (Fe)	5.0	ND	1,000
Lead (Pb)	0.50	ND	5
Mercury (Hg)	0.010	ND	0.2
Nickel (Ni)	0.50	ND	5
Selenium (Se)	0.20	ND	1
Silver (Ag)	0.50	ND	5
Thallium (Tl)	0.50	ND	5
Uranium (U)	1.0	ND	2
Vanadium (V)	5.0	ND	100
Zinc (Zn)	5.0	ND	500
Zirconium (Zr)	5.0	ND	500

Notes:

1) Applicance waste screening process for The City of Red Deer Class II Waste Managment Facility.
2) Class II Landfill Acceptable Criteria - per Table 2, Part 4 Schedule to the Alberta User Guide for Waste Managers 3/95.
3) All units are mg/L unless otherwise stated.
4) ND - Not Detected
5) Soil Bags were sampled June 26, 2013.
6) For further laboratory information, refer to the specific laboratory report in Appendix A.

Table 3B
Analytical Results - Soil - General Indices and Heavy Metals

Parameters	Units	Detection Limit	TH-01 @ 5.2 m 06/26/2013	Tier 1 Guideline
Chloride (Cl)	mg/kg	15	188	- -
Nitrate-N	mg/kg	0.74	ND	- -
Nitrite-N	mg/kg	0.74	ND	- -
Metals				
Antimony (Sb)	mg/kg	0.20	0.44	20
Arsenic (As)	mg/kg	0.20	7.18	17
Barium (Ba)	mg/kg	5.0	242	500
Beryllium (Be)	mg/kg	1.0	ND	5
Cadmium (Cd)	mg/kg	0.50	ND	10
Chromium (Cr)	mg/kg	0.50	35.7	64
Cobalt (Co)	mg/kg	1.0	7.8	20
Copper (Cu)	mg/kg	2.0	18.3	63
Lead (Pb)	mg/kg	5.0	8.0	140
Mercury (Hg)	mg/kg	0.05	ND	6.6
Molybdenum (Mo)	mg/kg	1.0	1.2	4
Nickel (Ni)	mg/kg	2.0	28.6	50
Selenium (Se)	mg/kg	0.50	ND	1.0
Silver (Ag)	mg/kg	1.0	ND	20
Thallium (Tl)	mg/kg	0.5	ND	1.0
Tin (Sn)	mg/kg	2.0	ND	5
Uranium (U)	mg/kg	2.0	ND	23
Vanadium (V)	mg/kg	1.0	38.4	130
Zinc (Zn)	mg/kg	10	63	200
Hexavalent Chromium	mg/kg	0.10	ND	0.4
Boron (B), Hot Water Ext.	mg/kg	0.10	1.26	2

Notes:

1) Tier 1 Guideline - Alberta Tier 1 Soil and Groundwater Remediation Guidelines, December 2010 and amendments. Coarse-grained criteria for residential/parkland land use.
2) ND - Not Detected, less than the limit of method detection.
3) - - No value established in the referenced criteria.
4) Bold & Shaded - Exceeds the referenced Alberta Tier 1 Guidelines.
5) For further laboratory information, refer to the specific laboratory report in Appendix A.

Table 3C
Analytical Results - Soil - VOCs

Parameters	Units	Detection Limit	TH-01 @ 5.2 m 06/26/2013	Tier 1 Guideline
Hydrocarbons				
F1 (C_6-C_{10})	mg/kg	10	ND	24
F2 (C_{10}-C_{16})	mg/kg	25	ND	130
F3 (C_{16}-C_{34})	mg/kg	50	117	300
F4 (C_{34}-C_{50})	mg/kg	50	ND	2,800
Total Hydrocarbons (C_6-C_{50})	mg/kg	50	117	- -
Volatile Organic Compounds				
Benzene	mg/kg	0.0050	ND	0.073
Bromobenzene	mg/kg	0.010	ND	- -
Bromochloromethane	mg/kg	0.010	ND	- -
Bromodichloromethane	mg/kg	0.010	ND	- -
Bromoform	mg/kg	0.010	ND	- -
Bromomethane	mg/kg	0.10	ND	- -
n-Butylbenzene	mg/kg	0.010	ND	- -
sec-Butylbenzene	mg/kg	0.010	ND	- -
tert-Butylbenzene	mg/kg	0.010	ND	- -
Carbon tetrachloride	mg/kg	0.010	ND	0.00056
Chlorobenzene	mg/kg	0.010	ND	0.018
Dibromochloromethane	mg/kg	0.010	ND	0.27
Chloroethane	mg/kg	0.10	ND	- -
Chloroform	mg/kg	0.010	ND	0.0010
Chloromethane	mg/kg	0.10	ND	- -
2-Chlorotoluene	mg/kg	0.010	ND	- -
4-Chlorotoluene	mg/kg	0.010	ND	- -
1,2-Dibromo-3-chloropropane	mg/kg	0.010	ND	- -
1,2-Dibromoethane	mg/kg	0.010	ND	- -
Dibromomethane	mg/kg	0.010	ND	- -
1,2-Dichlorobenzene	mg/kg	0.010	ND	0.18
1,3-Dichlorobenzene	mg/kg	0.010	ND	- -
1,4-Dichlorobenzene	mg/kg	0.010	ND	0.098
Dichlorodifluoromethane	mg/kg	0.010	ND	- -
1,1-Dichloroethane	mg/kg	0.010	ND	- -
1,2-Dichloroethane	mg/kg	0.010	ND	0.0027
1,1-Dichloroethene	mg/kg	0.010	ND	0.021
cis-1,2-Dichloroethene	mg/kg	0.010	ND	- -
trans-1,2-Dichloroethene	mg/kg	0.010	ND	- -
Methylene chloride	mg/kg	0.010	ND	0.095
1,2-Dichloropropane	mg/kg	0.010	ND	- -
1,3-Dichloropropane	mg/kg	0.010	ND	- -
2,2-Dichloropropane	mg/kg	0.010	ND	- -
1,1-Dichloropropene	mg/kg	0.010	ND	- -
cis-1,3-Dichloropropene	mg/kg	0.010	ND	- -
trans-1,3-Dichloropropene	mg/kg	0.010	ND	- -
Ethylbenzene	mg/kg	0.015	ND	0.21
Hexachlorobutadiene	mg/kg	0.010	ND	0.0067
Isopropylbenzene	mg/kg	0.010	ND	- -
p-Isopropyltoluene	mg/kg	0.010	ND	- -
n-Propylbenzene	mg/kg	0.010	ND	- -
Styrene	mg/kg	0.050	ND	0.8
1,1,1,2-Tetrachloroethane	mg/kg	0.010	ND	- -
1,1,2,2-Tetrachloroethane	mg/kg	0.050	ND	- -
Tetrachloroethene	mg/kg	0.010	ND	0.16
Toluene	mg/kg	0.050	ND	0.49
1,2,3-Trichlorobenzene	mg/kg	0.010	ND	0.26
1,2,4-Trichlorobenzene	mg/kg	0.010	ND	0.23
1,1,1-Trichloroethane	mg/kg	0.010	ND	- -
1,1,2-Trichloroethane	mg/kg	0.010	ND	- -
Trichloroethene	mg/kg	0.010	ND	0.012
Trichlorofluoromethane	mg/kg	0.010	ND	- -
1,2,3-Trichloropropane	mg/kg	0.020	ND	- -
1,2,4-Trimethylbenzene	mg/kg	0.010	0.013	- -
1,3,5-Trimethylbenzene	mg/kg	0.010	ND	- -
Vinyl chloride	mg/kg	0.20	ND	0.00034
Xylenes	mg/kg	0.1	ND	12

Notes:

1) Tier 1 Guideline - Alberta Tier 1 Soil and Groundwater Remediation Guidelines, December 2010 and amendments. Coarse-grained criteria for residential/parkland land use.
2) ND - Not Detected, less than the limit of method detection.
3) - - No value established in the reference criteria.
4) Bold & Shaded - Exceeds the referenced Alberta Tier 1 Guidelines.
5) For further laboratory information, refer to the specific laboratory report in Appendix A.

Table 4A
Groundwater Indices Measured at Time of Sampling

Monitoring Well	pH	Electrical Conductivity (µg/cm)	Temperature (°C)	Dissolved Oxygen (mg/L)	Total Dissolved Solid (mg/L)	Potential Redox (±mV)
MW-01	8.11	1,437	6.9	0.77	1,404.00	-83.6
MW-02	7.89	641	6.9	1.56	637.00	+42.3
MW-03	- -	- -	- -	- -	- -	- -

Notes:

1) Samples collected on Saturday, August 3, 2013.
2) Groundwater indices are field measured by YSI Pro Plus multi-meter.

Table 4B
Analytical Results - Groundwater - Routine Water Quality

Parameter	Unit	Detection Limit	MW-01	MW-02	Tier 1 Guideline
			08/03/2013		
General Water Quality					
Biochemical Oxygen Demand	mg/L	2.0	11	2	- -
Chemical Oxygen Demand	mg/L	5.0	350	16	- -
Conductivity	µS/cm	1.0	2,400	1,100	- -
pH	Unitless	NA	7.20	7.51	6.5-8.5
Total Organic Carbon (C)	mg/L	0.50	10	3.5	- -
Dissolved Cadmium (Cd)	µg/L	0.0050	0.037	0.025	- -
Total Cadmium (Cd)	µg/L	0.0050	**3.4**	0.025	0.060*
Alkalinity ($CaCO_3$)	mg/L	0.50	570	490	- -
Bicarbonate (HCO_3)	mg/L	0.50	700	600	- -
Carbonate (CO_3)	mg/L	0.50	ND	ND	- -
Hydroxide (OH)	mg/L	0.50	ND	ND	- -
Sulphates (SO_4)	mg/L	1.0	100	48	- -
Chlorides (Cl)	mg/L	1.0 - 5.0	360	36	- -
Total Ammonia (NH_3-N)	mg/L	0.050 - 0.50	**9**	0.1	1.37*
Total Phosphorus (P)	mg/L	0.0030 - 0.0150	4.6	0.015	- -
Total Nitrogen (N)	mg/L	0.050	12	0.26	- -
Nitrate plus Nitrite (N)	mg/L	0.0030 - .015	0.019	ND	- -
Total Kjeldahl Nitrogen (TKN)	mg/L	0.050 - 0.5	12	0.25	- -
Nitrite (NO_2)	mg/L	0.0030 - 0.015	ND	ND	- -
Nitrate (NO_3)	mg/L	0.0030	0.019	0.013	- -
Trace Organics					
Acetic Acid	mg/L	50	ND	ND	- -
Formic Acid	mg/L	50	ND	ND	- -
Propionic Acid	mg/L	50	ND	ND	- -
Adsorbable Organic Halogen	mg/L	0.004 - 0.02	0.29	0.016	- -

Notes:

1) Tier 1 Guideline - Alberta Tier 1 Soil and Groundwater Remediation Guidelines, December 2010 and amendments. Coarse-grained criteria for residential/parkland land use.
2) * Surface Water Quality Guidelines for Use in Alberta (AENV, 1999) on aquatic life pathway. Canadian Council of Ministers of the Environment (CCME) Guidelines as referenced in the Tier 1 Guidelines.
3) ND - Not Detected, less than the limit of method detection.
4) - - No value established in the reference criteria.
5) Bold & Shaded - Exceeds the referenced Alberta Tier 1 Guideline.
6) For further laboratory information, refer to the specific laboratory report in Appendix A.

Table 4C
Analytical Results - Groundwater - Metals

Parameter	Detection Limit	MW-01	MW-02	Tier 1 Guideline
		08/03/2013		
Total Metals				
Aluminum (Al)	0.0030	**34**	**0.29**	0.1*
Antimony (Sb)	0.00060	0.0017	ND	0.006
Arsenic (As)	0.00020	**0.085**	0.00072	0.005
Barium (Ba)	0.010	**1.8**	0.15	1
Beryllium (Be)	0.0010	0.0024	ND	- -
Boron (B)	0.020	0.11	0.065	1.5
Calcium (Ca)	0.30	330	150	- -
Chromium (Cr)	0.0010	**0.11**	ND	0.001*
Cobalt (Co)	0.00030	0.078	0.0022	- -
Copper (Cu)	0.00020	**0.16**	0.0023	0.003*
Iron (Fe)	0.060	**180**	**0.98**	0.3
Lead (Pb)	0.00020	**0.10**	0.00057	0.004*
Lithium (Li)	0.020	0.12	0.051	- -
Magnesium (Mg)	0.20	170	52	- -
Manganese (Mn)	0.0040	**5.6**	**1.8**	0.05
Molybdenum (Mo)	0.00020	0.0071	0.00034	0.073*
Nickel (Ni)	0.00050	**0.20**	0.0034	0.11*
Phosphorus (P)	0.10	3.4	ND	- -
Potassium (K)	0.30	22	6.6	- -
Selenium (Se)	0.00020	**0.0026**	ND	0.001
Silicon (Si)	0.10 - 0.50	100	9.9	- -
Silver (Ag)	0.00010	**0.00058**	ND	0.0001*
Sodium (Na)	0.50	140	16	- -
Strontium (Sr)	0.020	1.8	0.97	- -
Sulphur (S)	0.20	32	15	- -
Thallium (Tl)	0.00020	**0.00097**	ND	0.0008*
Tin (Sn)	0.0010	0.0029	ND	- -
Titanium (Ti)	0.0010	0.71	0.015	- -
Uranium (U)	0.00010	0.006	0.0097	0.02
Vanadium (V)	0.0010	0.17	0.0015	- -
Zinc (Zn)	0.0030	**0.41**	0.0097	0.03
Dissolved Metals				
Aluminum (Al)	0.0030	0.017	0.011	- -
Antimony (Sb)	0.00060	ND	ND	- -
Arsenic (As)	0.00020	0.0230	ND	- -
Barium (Ba)	0.010	0.68	0.13	- -
Beryllium (Be)	0.0010	ND	ND	- -
Boron (B)	0.020	0.074	0.063	- -
Calcium (Ca)	0.30	160	140	- -
Chromium (Cr)	0.0010	ND	ND	- -
Cobalt (Co)	0.00030	0.012	0.0017	- -
Copper (Cu)	0.00020	0.00078	0.002	- -
Iron (Fe)	0.060	27	0.11	- -
Lead (Pb)	0.00020	ND	ND	- -
Lithium (Li)	0.020	0.051	0.049	- -
Magnesium (Mg)	0.20	110	49	- -
Manganese (Mn)	0.0040	1.9	1.8	- -
Molybdenum (Mo)	0.00020	0.0015	0.00026	- -
Nickel (Ni)	0.00050	0.022	0.002	- -
Phosphorus (P)	0.10	ND	ND	- -
Potassium (K)	0.30	14	6.6	- -
Selenium (Se)	0.00020	ND	ND	- -
Silicon (Si)	0.10	15	9.1	- -
Silver (Ag)	0.00010	ND	ND	- -
Sodium (Na)	0.50	140	17	- -
Strontium (Sr)	0.020	1.60	0.98	- -
Sulphur (S)	0.20	32	15	- -
Thallium (Tl)	0.00020	ND	ND	- -
Tin (Sn)	0.0010	ND	ND	- -
Titanium (Ti)	0.0010	ND	ND	- -
Uranium (U)	0.00010	0.0011	0.0092	- -
Vanadium (V)	0.0010	ND	ND	- -
Zinc (Zn)	0.0030	0.0067	0.0062	- -

Notes:

1) Tier 1 Guideline - Alberta Tier 1 Soil and Groundwater Remediation Guidelines, December 2010 and amendments. Coarse-grained criteria for residential/parkland land use.
2) * Surface Water Quality Guidelines for Use in Alberta (AENV, 1999) on aquatic life pathway. Canadian Council of Ministers of the Environment (CCME) Guidelines as referenced in the Tier 1 Guidelines.
3) ND - Not Detected, less than the limit of method detection.
4) Unless specified all units are mg/L.
5) - - No value established in the reference criteria.
6) Bold & Shaded - Exceeds the referenced Alberta Tier 1 Guideline.
7) For further laboratory information, refer to the specific laboratory report in Appendix A.

Table 4D
Analytical Results - Groundwater -VOCs

Parameter	Detection Limit	MW-01	MW-02	Tier 1 Guideline
		08/03/2013		
Volatile Organic Compounds				
Benzene	0.00040	0.0015	ND	0.005
Toluene	0.00040	ND	ND	0.024
Ethylbenzene	0.00040	ND	ND	0.0024
Xylenes (Total)	0.00080	0.0018	ND	0.3
F1 (C_6-C_{10})	0.10	ND	ND	0.81
F2 (C_{10}-C_{16})	0.10	ND	ND	1.1
Total Trihalomethanes	0.0020	ND	ND	0.1
Bromodichloromethane	0.00050	ND	ND	- -
Bromoform	0.00050	ND	ND	- -
Bromomethane	0.0020	ND	ND	- -
Carbon tetrachloride	0.00050	ND	ND	0.00056
Chlorobenzene	0.00050	ND	ND	0.0013
Chlorodibromomethane	0.0010	ND	ND	- -
Chloroethane	0.0010	ND	ND	- -
Chloroform	0.00050	ND	ND	0.0018
Chloromethane	0.0020	ND	ND	- -
1,2-dibromoethane	0.00050	ND	ND	- -
1,2-dichlorobenzene	0.00050	ND	ND	0.0007
1,3-dichlorobenzene	0.00050	ND	ND	- -
1,4-dichlorobenzene	0.00050	ND	ND	0.001
1,1-dichloroethane	0.00050	ND	ND	- -
1,2-dichloroethane	0.00050	ND	ND	0.005
1,1-dichloroethene	0.00050	ND	ND	0.014
cis-1,2-dichloroethene	0.00050	0.033	ND	- -
trans-1,2-dichloroethene	0.00050	0.0034	ND	- -
Dichloromethane	0.0020	ND	ND	0.05
1,2-dichloropropane	0.00050	ND	ND	- -
cis-1,3-dichloropropene	0.00050	ND	ND	- -
trans-1,3-dichloropropene	0.00050	ND	ND	- -
Methyl methacrylate	0.00050	ND	ND	0.47
Methyl-tert-butyl ether (MTBE)	0.00050	ND	ND	0.015
Styrene	0.00050	ND	ND	0.072
1,1,1,2-tetrachloroethane	0.0020	ND	ND	- -
1,1,2,2-tetrachloroethane	0.0020	ND	ND	- -
Tetrachloroethene	0.00050	ND	ND	0.03
1,2,3-trichlorobenzene	0.0010	ND	ND	0.008
1,2,4-trichlorobenzene	0.0010	ND	ND	0.015
1,3,5-trichlorobenzene	0.00050	ND	ND	0.014
1,1,1-trichloroethane	0.00050	ND	ND	- -
1,1,2-trichloroethane	0.00050	ND	ND	- -
Trichloroethene	0.00050	ND	ND	0.005
Trichlorofluoromethane	0.00050	ND	ND	- -
1,2,4-trimethylbenzene	0.00050	0.004	ND	- -
1,3,5-trimethylbenzene	0.00050	0.0018	ND	- -
Vinyl chloride	0.00050	**0.003**	ND	0.0011

Notes:

1) Tier 1 Guideline - Alberta Tier 1 Soil and Groundwater Remediation Guidelines, December 2010 and amendments. Coarse-grained criteria for residential/parkland land use.
2) ND - Not Detected, less than the limit of method detection.
3) Unless specified all units are mg/L (ppm).
4) - - No value established in the reference criteria.
5) Bold & Shaded - Exceeds the referenced Alberta Tier 1 Guidelines.
6) For further laboratory information, refer to the specific laboratory report in Appendix A.

Table 5A
Summary of Parameters Measured During Sampling of Soil Vapour

Parameter	Well Diameter (mm)	Screen Length (cm)	Well Depth (m)	Headspace Volume (cm^3)	Purge Rate (cm^3/min)	Purge Time (min)	Pressure	
							Ambient (psi)	Vapour Well (psi)
VW-01	25	30	3.5	1,718.06	943.3	4	15.00	15.00
VW-02	25	30	4.6	2,258.02	943.3	7	15.10	15.06
VW-03	25	30	4.0	1,963.50	943.3	5	15.14	15.08

Notes:

1) Measurement of pressure by digital Cole-Parmer absolute pressure gauge.
2) Purge time is minimum elapsed time prior to the collection of a soil vapour sample.
3) Screen set at base of well.
4) Soil vapour sampling was completed on Saturday, August 3, 2013.

Table 5B
Analytical Results - Soil Vapour - General Indices

Parameter	Unit	Detection Limit	VW-01	VW-02	VW-03
Gauge Pressure					
Following sampling	psi	- -	-5.0	NA	-5.0
Reported by laboratory	psi	- -	-1.4	-3.6	-3.4
Fixed Gases					
Oxygen	% v/v	0.2 - 0.3	8.4	17.2	19.8
Nitrogen	% v/v	0.2 - 0.3	52.5	77.8	78.3
Carbon monoxide	% v/v	0.2 - 0.3	ND	ND	ND
Methane	% v/v	0.2 - 0.3	26	ND	ND
Carbon dioxide	% v/v	0.2 - 0.3	13.1	4.6	1.9

Notes:

1) Soil vapour sample collected on Saturday, August 3, 2013.
2) ND - Not Detected, less than the limit of method detection.
3) NA - Not Available.
4) - - No value established in the detection limit.
5) For further information, the reader should refer to the laboratory report in Appendix A.

Table 5C
Analytical Results - Soil Vapour - VOCs

Parameter	Unit	Detection Limit	VW-01	VW-02	VW-03
				08/03/13	
Hydrocarbon Fractions					
Aliphatic >C_5-C_6	µg/m^3	5.0 - 480	53,000	332	6.8
Aliphatic >C_6-C_8	µg/m^3	5.0 - 480	88,300	2,990	34.4
Aliphatic >C_8-C_{10}	µg/m^3	5.0 - 480	ND	577	73.1
Aliphatic >C_{10}-C_{12}	µg/m^3	5.0 - 480	664	345	202
Aliphatic >C_{12}-C_{16}	µg/m^3	5.0 - 480	ND	106	105
Aromatic >C_7-C_8 (TEX excluded)	µg/m^3	5.0 - 480	ND	ND	ND
Aromatic >C_8-C_{10}	µg/m^3	5.0 - 480	ND	44.8	30.9
Aromatic >C_{10}-C_{12}	µg/m^3	5.0 - 480	ND	78.4	58.1
Aromatic >C_{12}-C_{16}	µg/m^3	5.0 - 480	ND	ND	ND
Select Volatile Gases					
Acetylene	ppm	0.19 - 0.34	ND	ND	ND
Ethane	ppm	0.19 - 0.34	1.1	ND	ND
Ethylene	ppm	0.19 - 0.34	0.67	ND	ND
Methane	ppm	5.6 - 6.8	260,000	67	ND
n-Butane	ppm	0.358 - 0.68	2.4	ND	ND
n-Pentane	ppm	0.19 - 0.34	14	ND	ND
Propane	**ppm**	**0.19 - 0.34**	**0.34**	**ND**	**ND**
Propene	ppm	0.19 - 0.34	0.22	ND	ND
Propyne	ppm	0.38 - 0.68	ND	ND	ND
Volatile Organic Compounds					
Dichlorodifluoromethane (FREON 12)	ppbv	0.20 - 58	ND	348	1.60
1,2-Dichlorotetrafluoroethane	ppbv	0.17 - 16	ND	34.4	0.58
Chloromethane	ppbv	0.30 - 29	ND	ND	1.03
Vinyl chloride	ppbv	0.18 - 17	519	0.51	ND
Chloroethane	ppbv	0.30 - 29	ND	ND	ND
1,3-Butadiene	ppbv	0.50 - 48	ND	ND	ND
Trichlorofluoromethane (FREON 11)	ppbv	0.20 - 19	ND	50.6	0.42
Ethanol (ethyl alcohol)	ppbv	23 - 220	322	180	648
Trichlorotrifluoroethane	ppbv	0.15 - 14	ND	ND	ND
2-propanol	ppbv	3.0 - 290	ND	3.6	5.1
2-Propanone	ppbv	0.80 - 76	ND	36.5	18
Methyl ethyl ketone (MEK) (2-Butanone)	ppbv	3.0 - 290	ND	ND	5.8
Methyl isobutyl ketone	ppbv	3.2 - 300	ND	ND	ND
Methyl butyl ketone (MBK) (2-Hexanone)	ppbv	2.0 - 190	ND	ND	ND
Methyl t-butyl ether (MTBE)	ppbv	0.20 - 19	ND	ND	ND
Ethyl acetate	ppbv	2.2 - 210	ND	ND	ND
1,1-Dichloroethylene	ppbv	0.25 - 24	ND	1.41	ND
cis-1,2-Dichloroethylene	ppbv	0.19 - 18	123	13.2	0.42
trans-1,2-Dichloroethylene	ppbv	0.20 - 19	30	ND	ND
Methylene chloride(Dichloromethane)	ppbv	0.80 - 120	ND	1.47	1.06
Chloroform	ppbv	0.15 - 14	ND	18.2	0.52
Carbon tetrachloride	ppbv	0.30 - 29	ND	ND	ND
1,1-Dichloroethane	ppbv	0.20 - 19	ND	ND	ND
1,2-Dichloroethane	ppbv	0.20 - 19	ND	ND	ND
Ethylene dibromide	ppbv	0.17 - 16	ND	ND	ND
1,1,1-Trichloroethane	ppbv	0.30 - 29	ND	3.45	ND
1,1,2-Trichloroethane	ppbv	0.15 - 14	ND	ND	ND
1,1,2,2-Tetrachloroethane	ppbv	0.20 - 19	ND	ND	ND
cis-1,3-Dichloropropene	ppbv	0.18 - 17	ND	ND	ND
trans-1,3-Dichloropropene	ppbv	0.17 - 16	ND	ND	ND
1,2-Dichloropropane	ppbv	0.40 - 38	ND	ND	ND
Bromomethane	ppbv	0.18 - 17	ND	ND	ND
Bromoform	ppbv	0.20 - 19	ND	ND	ND
Bromodichloromethane	ppbv	0.20 - 19	ND	ND	ND
Dibromochloromethane	ppbv	0.20 - 19	ND	ND	ND
Trichloroethylene (TCE)	ppbv	0.30 - 29	ND	81.9	1.32
Tetrachloroethylene (PCE)	ppbv	0.20 - 19	ND	221	ND
Benzene	ppbv	0.18 - 17	ND	5.17	0.79
Toluene	ppbv	0.20 - 81	ND	4.80	3.95
Ethylbenzene	ppbv	0.20 - 27	ND	0.75	0.92
p+m-xylene	ppbv	0.37 - 99	ND	1.89	3.65
o-xylene	ppbv	0.20 - 19	ND	1.22	1.67
Styrene	ppbv	0.20 - 19	42	ND	0.37
4-ethyltoluene	ppbv	2.2 - 210	ND	ND	ND
1,3,5-Trimethylbenzene	ppbv	1.9 - 48	ND	4.05	ND
1,2,4-Trimethylbenzene	ppbv	0.50 - 48	ND	2.31	2.74
Chlorobenzene	ppbv	0.20 - 19	ND	ND	ND
Benzyl chloride	ppbv	1.0 - 95	ND	ND	ND
1,3-Dichlorobenzene	ppbv	0.40 - 38	ND	ND	ND
1,4-Dichlorobenzene	ppbv	0.40 - 38	ND	ND	ND
1,2-Dichlorobenzene	ppbv	0.40 - 38	ND	ND	ND
1,2,4-Trichlorobenzene	ppbv	2.0 - 190	ND	ND	ND
Hexachlorobutadiene	ppbv	3.0 - 290	ND	ND	ND
Hexane	ppbv	1.3 - 29	17,800	142	ND
Heptane	ppbv	0.30 - 29	1,970	181	0.58
Cyclohexane	ppbv	0.20 - 19	4,900	219	0.35
Tetrahydrofuran	ppbv	0.40 - 38	ND	ND	5.14
1,4-Dioxane	ppbv	2.0 - 190	ND	ND	ND
Xylene (Total)	ppbv	0.60 - 99	ND	3.11	5.31
Vinyl bromide	ppbv	0.20 - 19	ND	ND	ND
Propene	ppbv	3.9 - 29	371	ND	ND
2,2,4-Trimethylpentane	ppbv	0.20 - 19	ND	ND	0.64
Carbon disulfide	ppbv	0.50 - 48	ND	40.5	3.21
Vinyl acetate	ppbv	0.20 - 19	ND	ND	ND

Notes:
1) Results are from sampling completed on Saturday, August 03, 2013.
2) ND - Not Detected, less than the limit of method detection.
3) For further information, the reader should refer to the laboratory report in Appendix A.

Table 5D
Analytics Results - Soil Vapour - Siloxanes

Parameter	Detection Limit		VW-01		VW-02		VW-03	
			08/03/13					
	mg/m³	ppm	mg/m³	ppm	mg/m³	ppm	mg/m³	ppm
Trimethylsilyl Fluoride	- -	- -	ND	ND	ND	ND	ND	ND
Tetramethylsilane	0.00010 - 0.0022	0.0001 - 0.0006	ND	ND	ND	ND	ND	ND
Methoxytrimethylsilane	0.0032 - 0.0563	0.0007 - 0.0132	ND	ND	ND	ND	ND	ND
Ethoxytrimethylsilane	0.0031 - 0.0543	0.0006 - 0.0112	ND	ND	ND	ND	ND	ND
Trimethylsilanol	- -	- -	0.0338	0.0092	ND	ND	0.0098	0.0027
Isopropoxytrimethylsilane	0.0013 - 0.0229	0.00020 - 0.0042	ND	ND	ND	ND	ND	ND
Trimethoxymethyl Silane #	- -	- -	ND	ND	ND	ND	ND	ND
Hexamethyl Disiloxane - L2	0.00010 - 0.0021	0.0001 - 0.0003	ND	ND	ND	ND	ND	ND
Propoxytrimethylsilane	0.0035 - 0.0621	0.0006 - 0.0115	ND	ND	ND	ND	ND	ND
1-Methylbutoxytrimethylsilane *	- -	- -	ND	ND	ND	ND	ND	ND
Butoxytrimethylsilane *	- -	- -	ND	ND	ND	ND	ND	ND
Trimethoxyvinyl Silane #	- -	- -	ND	ND	ND	ND	ND	ND
Hexamethyl Cyclotrisiloxane - D3	- -	- -	0.1927	0.0212	0.0844	0.0093	0.0146	0.0016
Octamethyl Trisiloxane - L3	0.0002 - 0.0041	0.0001 - 0.0004	ND	ND	ND	ND	ND	ND
Triethoxyvinyl Silane #	- -	- -	ND	ND	ND	ND	ND	ND
Triethoxyethyl Silane #	- -	- -	ND	ND	ND	ND	ND	ND
Octamethyl Cyclotetrasiloxane - D4	- -	- -	0.0739	0.0061	0.0299	0.0025	0.0234	0.0019
Decamethyl Tetrasiloxane - L4	0.0003 - 0.0053	0.0001 - 0.0004	ND	ND	ND	ND	ND	ND
Tetraethylsilicate #	- -	- -	ND	ND	ND	ND	ND	ND
Decamethyl Cyclopentasiloxane - D5	- -	- -	0.0349	0.0023	0.0321	0.0021	0.0420	0.0028
Dodecamethyl Pentasiloxane - L5	0.0030 - 0.0528	0.0002 - 0.0034	ND	ND	ND	ND	ND	ND
Dodecamethyl Cyclohexasiloxane - D6	0.0531	0.0029	ND	ND	0.1454	0.0080	0.1513	0.0083
Sum	- -	- -	0.6503	0.0870	0.4152	0.0432	0.2559	0.0198

Notes:

1) Soil vapour samples collected on Saturday, August 3, 2013.
2) ND - Not Detected, less than the limit of method detection.
3) - - No value established in the detection limit.
4) VW-01 V=10.0mL, VW-02 V=25mL, VW-03 V=200 mL, where V is volume of air/gas sampled.
5) * - Semiquanititative (response factor set at 5).
6) # - Unstable, poor detectability, commercial standards tested.
7) For further information, the reader should refer to the laboratory report in Appendix A.