2021 and 2022 Groundwater and Soil Vapour Monitoring Report_REV_01
Lindsay Thurber Comprehensive High School
Portion of NE and SE 21-038-27 W4M

PRESENTED TO
The 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 2021 and 2022 groundwater and vapour monitoring program at the former landfill located north and east of Lindsay Thurber Comprehensive High School (LTCHS). The site includes portions of Lot 1MR Plan 852 0510, Lot 4ER Plan 912 0819, and Lot S Plan 4154S, which contains LTCHS (4204 58 Street). The site lies within the northeast and southeast portions of Section 21-038-27 W4M, in Red Deer, Alberta, hereafter referred to as the site. The objective of the monitoring program is to identify potential environmental concerns related to former operations at the former landfill site.

Tetra Tech's scope of work for the 2021 and 2022 monitoring and sampling program at the LTCHS site included conducting three events of groundwater monitoring, semi-annual vapour monitoring, annual groundwater sampling, installing an additional groundwater monitoring well near Gaetz Lake (22MW05), surveying a fixed point to monitor the water level in Gaetz Lake, reviewing and updating previous recommendations for the site, and preparing an annual report.

Several groundwater monitoring wells and vapour wells have been installed at the site and at the northeast portion of LTCHS. In February 2022, monitoring well 22MW05 was installed within the northeast corner of the site near Gaetz Lake. The 2021 and 2022 monitoring and sampling program included four vapour wells (VW-02 to VW-05) and nine groundwater monitoring wells (MW-02, MW-03, MW-04, 22MW05, BH8, MW04A, MW05A, MW14A, and MW15A). The water level of Gaetz Lake was monitored relative to a fixed point on the observation deck near monitoring well BH8.

The groundwater results are summarized as follows:

- The groundwater elevations measured in November 2021 and June 2022 infer a groundwater flow direction to the northwest, towards the Red Deer River. Stabilized water levels at 22MW05, as measured in June 2022, confirmed a flow direction away from Gaetz Lake during this event. The average horizontal hydraulic gradients at the site were estimated as approximately 0.003 m/m. Groundwater elevations in 2021 and 2022 were overall slightly higher than the previously measured groundwater elevations in 2019.

- Routine groundwater quality parameters and dissolved metals concentrations that exceeded the Tier 1 Guidelines at one or more monitoring wells in 2021 and 2022 included total dissolved solids (TDS), and the dissolved metals arsenic, barium, iron, manganese, and mercury. The measured concentrations of these parameters were generally consistent with historical results; however, dissolved mercury marginally exceeded the Tier 1 Guideline for the first time at the site in February 2022, at 22MW05. It is recommended to confirm the measured concentration in the next sampling event.

- Concentrations of benzene, toluene, ethylbenzene, xylenes (BTEX) and petroleum hydrocarbon (PHC) fractions F1 to F2 were less than the analytical detection limits at all monitoring wells in 2021 and 2022. In 2021 and 2022, most volatile organic compound (VOC) concentrations measured less than the analytical detection limits and less than the Tier 1 Guidelines, where established, at all groundwater monitoring wells. VOC parameter 1,2-dichloroethene (cis) was detected in low concentrations at monitoring wells MW-02, MW-03, and BH8; this VOC does not have an established Tier 1 Guideline. Additionally, vinyl chloride was detected at monitoring well BH8 (0.0010 mg/L); however, the concentration was less than the Tier 1 Guideline (0.0011 mg/L). Trace concentrations of 1,2-dichloroethene (cis) were previously measured at MW-02 and MW-03.

- Overall, the on-site monitoring wells showed relatively minor concentrations of leachate indicator parameters in 2021 and 2022.

The 2021 and 2022 vapour monitoring program results are summarized as follows:

- Concentrations of methane in the vapour probes were less than the instrument's detection limit during all monitoring events in 2021 and 2022 and the highest methane concentration in the headspace of groundwater wells was 60 parts per million (ppm) at 22MW05 in June 2022.
- Overall, the soil vapour monitoring conducted in 2021 and 2022 suggests that there is little indication that vapour migration poses a hazard to receptors. Historical testing indicates the presence of landfill gas (LFG) (characterized by methane concentrations at and greater than the explosive range) in the landfill area; however, an interceptor trench is present between the waste mass and LTCHS. Tetra Tech understands that ongoing monitoring is completed by another consultant on behalf of LTCHS.

Based upon the results of the groundwater and vapour monitoring program in 2021 and 2022 and previous years, Tetra Tech recommends ongoing risk management, including: additional assessment; ongoing monitoring; and administrative actions. The following recommendations are made according to these risk management elements:

- Additional Assessment:
  - Tetra Tech recommends installing dataloggers capable of measuring pressure and temperature in monitoring well 22MW05 and at a suitable location along the shore of Gaetz Lake. This will facilitate detailed monitoring of groundwater and surface water levels and allow for obtaining further insights in groundwater flow patterns near 22MW05 along the east flank of the waste disposal area and help determine whether there is a (seasonal) groundwater flow component towards Gaetz Lake. It should be noted that the datalogger within the lake will need to be properly protected and, due to anticipated ice buildup, may have to be removed during the winter months.
- Ongoing Monitoring:
  - Conduct additional groundwater monitoring events in the spring of 2023 and the fall of 2023 to confirm the groundwater flow pattern. In conjunction with these two events, collect semi-annual groundwater samples from BH8 and 22MW05 to confirm the results collected in November 2021 and February 2022. The monitoring wells located next to LTCHS (MW04A, MW05A, MW14A, and MW15A) were dry during all events in 2021 and 2022 and further monitoring is not recommended.
  - After the proposed additional monitoring and sampling events have been conducted, and datalogger data is collected during the spring 2023 runoff season of the Red Deer River, evaluate all surface water and groundwater elevation data, along with the additional groundwater quality information and assess the potential risk to the water quality of Gaetz Lake and whether continuing the monitoring program is warranted.
  - Based on vapour monitoring results collected to date there are no obvious vapour concerns at the locations monitored and Tetra Tech recommends discontinuing headspace monitoring in the soil vapour and groundwater wells as part of The City program.
- Administrative Actions:
  - The interceptor trench adjacent to LTCHS is operated and monitored by LTCHS and we understand that LTCHS is required to provide periodic updates of the program status to The City. We recommend that The City obtain and review the collected data on an annual basis in support of management activities at this site. Further, we suggest that The City request as-built details of the inceptor trench from LTCHS for their records, and further that any records of manual or automated indoor monitoring be requested.
  - 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.

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. We note that the design and operation of the interceptor trench adjacent to LTCHS was developed based on surface conditions similar to existing, and if changes or improvements to the surface of the landfill are contemplated (e.g., paving or installation of an impermeable cap), such work should be undertaken in conjunction with a review of the interceptor trench design and performance.

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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 2021 and 2022 groundwater and vapour monitoring program at the former landfill located north and east of Lindsay Thurber Comprehensive High School (LTCHS). The site includes portions of Lot 1MR Plan 852 0510, Lot 4ER Plan 912 0819, and Lot S Plan 4154S, which contains LTCHS (4204 58 Street). The site lies within the northeast and southeast portions of Section 21-038-27 W4M, in Red Deer, Alberta, 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.

The scope for 2021 and 2022 was based on Tetra Tech's 2019 groundwater and soil vapour monitoring and sampling program conducted at the site. Those results were presented and discussed in the 2019 Groundwater and Soil Vapour Monitoring Report – Lindsey Thurber Comprehensive High School (Tetra Tech 2020), and key findings and recommendations of that program are summarized in Section 1.1. The objectives and scope for the 2021 and 2022 monitoring program are presented in Section 1.2.

The field components of the monitoring program were completed under Tetra Tech's detailed work plans encompassing the scope of work outlined in Section 1.2 below. The current 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.

1.1 2019 Report – Key Findings and Recommendations

The report identified residual impacts to groundwater and vapours. Buried landfill waste remains in place beneath the site; therefore, ongoing risk management is required. Key findings included the following:

- The groundwater elevations in 2019 indicated that the inferred groundwater flow direction was to the northwest towards the Red Deer River. The average horizontal hydraulic gradients at the site were estimated as approximately 0.003 m/m.
- Routine groundwater quality parameters and dissolved metals concentrations that exceeded the Alberta Tier 1 Soil and Groundwater Remediation Guidelines (Tier 1 Guidelines; Alberta Environment and Parks [AEP] 2019) at one or more monitoring wells in 2019 included total dissolved solids (TDS), aluminum, arsenic, barium, cadmium, iron, and manganese. The measured concentrations of these parameters were generally consistent with previous results.
- Concentrations of benzene, toluene, ethylbenzene and xylenes (BTEX), petroleum hydrocarbon (PHC) fractions F1 to F2, and volatile organic compounds (VOCs) were less than Tier 1 Guidelines at all groundwater monitoring wells in 2019. Two chlorinated VOCs (1,2-dichloroethene; cis and trans isomers) that do not have established Tier 1 Guidelines values were detected in low concentrations in the groundwater at MW-02 and MW-03.
- Volatile fatty/carboxylic acids do not have established Tier 1 Guidelines values; however, the measured concentrations were all less than the analytical detection limits.
- Overall, monitoring wells outside of the waste footprint showed relatively minor concentrations of leachate indicator parameters at MW-02, MW-03, and MW-04.
- Concentrations of BTEX, PHCs, and VOCs in soil vapour samples were less than the soil vapour screening criteria.

- Concentrations of siloxanes were detected in samples VW-02 and VW-03 greater than the analytical detection limit; however, these compounds do not have human toxicity reference values (TRVs) and the measured concentrations were not identified as a concern.

- The estimated individual and cumulative risks and hazards associated with the soil vapour samples collected in December 2019 did not exceed the corresponding target risk and hazard levels.

- Overall, soil vapour sampling suggested that there was little indication that the measured VOCs will pose a hazard to receptors. The soil vapour concentrations were more than an order of magnitude less than levels of concern and groundwater concentrations of volatile chemicals were also less than the screening levels. Historical testing indicates the presence of landfill gas (LFG) (characterized by methane concentrations at and greater than the explosive range) in the landfill area; however, an interceptor trench is present between the waste mass and LTCHS, and ongoing monitoring is completed by another consultant on behalf of LTCHS.

Based on these findings, recommendations for the 2021 and 2022 monitoring program included the following:

- Historical assessments indicate that the eastern extents of the landfill are relatively close to Gaetz Lake (within 10 m to 20 m). Additional assessment was recommended in this area to confirm the groundwater characteristics adjacent to the lake. We recommended installation of one additional groundwater monitoring well between the waste area and the lake on the northeast side, if a suitable location could be identified, and inclusion into the monitoring program. We also recommended assessing the integrity of monitoring well BH8, located on the east side of the waste area near the southern portion of Gaetz Lake, and if its condition was adequate, inclusion of the monitoring well into the program as described below.

- Monitoring well MW-01 is presumably destroyed. The well was located hydraulically cross-gradient of the site, and far enough away that the groundwater likely represents background concentrations for the site. A review of water quality data from 2013 did not suggest that the water quality at MW-01 in 2013 was affected by leachate. Not having a background monitoring well does not appear to be detrimental to assessing the overall groundwater quality at the site and replacing MW-01 is not proposed at this time.

- Based on the results of the 2019 groundwater sampling program, semi-annual monitoring and annual sampling for routine water chemistry, dissolved metals parameters, and VOCs at MW-02, MW-03, and MW-04 should be conducted to confirm the trends for an additional year. Historical well BH8 and the new well recommended to be installed adjacent to Gaetz Lake should also be included in this program. Further, we understand there may be additional monitoring wells immediately adjacent to LTCHS. We recommended assessing the integrity of the existing wells, and we suggested that up to two of these wells be considered for inclusion in the recommended groundwater monitoring if the well construction details are suitable. If the wells are not suitable, or cannot be located, expanding the monitoring network near LTCHS buildings may need to be considered. Based on previous monitoring information and the well locations relative to the waste area and building footprint, it was suggested to select MW-04A (alternate MW-05A) and MW-15A (alternate MW-14A). It was noted that the wells and the property where they are located are not owned by The City. Tetra Tech would access the proposed wells and include them in the monitoring and sampling program, if possible.

- Based on the vapour monitoring and sampling results, continued sampling of soil vapour by The City may not be warranted and can be discontinued at the site. However, due to the ongoing presence of the source waste and its proximity to LTCHS, an additional year of monitoring of methane and pressures was 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.

1.2 Scope of Work

Based on the 2019 findings and recommendations (Tetra Tech 2020), the 2021 and 2022 monitoring program scope of work was outlined in the proposal titled 2021 Work Scope and Cost Estimate dated March 2, 2021 (Tetra Tech 2021). The work conducted in 2021 and 2022 included the following activities:

- Installing a new monitoring well (22MW05) in between the waste area and Gaetz Lake on the northeast side to confirm the groundwater characteristics adjacent to the lake.
- Conducting semi-annual vapour monitoring events at soil vapour probes VW-02, VW-03, VW-04, and VW-05 including, measuring headspace vapours and groundwater levels within each vapour monitoring well, and observing monitoring well integrity.
- Conducting semi-annual groundwater monitoring events at monitoring wells MW-02, MW-03, MW-04, BH8, 22MW05, MW-04A, and MW15A, including, measuring methane concentrations in headspace vapours and groundwater levels within each groundwater monitoring well and observing monitoring well integrity.
- Conducting one groundwater sampling event:
  - 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.
  - Collecting one duplicate groundwater sample for quality assurance/quality control (QA/QC) purposes.
- Conducting monitoring well repairs, as required.
- Preparing an annual report summarizing the field activities undertaken for the year and interpreting the soil vapour monitoring and groundwater analytical results.

In the proposal (Tetra Tech 2021), Tetra Tech recommended semi-annual monitoring of groundwater well headspaces for methane as a useful screening tool in the absence of vapour wells in other areas of the site. Subsequently, while headspace methane monitoring was conducted, headspace monitoring for VOCs and combustible vapour concentrations (CVCs) was not conducted in 2021 and 2022.

2.0 BACKGROUND INFORMATION

2.1 General Information

The site is located within three parcels within NE and SE 21-038-27 W4M:

- Portion of Lot S, Plan 4154S.
- Portion of Lot 1MR, Plan 852 0510.
- Portion of Lot 4ER, Plan 912 0819.

Figure 1 shows the general site location. Historical waste disposal reportedly occurred between June 1965 and July 1967, indicating that the age of the waste would be approximately 55 to 57 years old. The original LTCHS facility existed prior to historical placement of waste. Since then, LTCHS has been expanded to its current configuration, and the historical disposal area lies within approximately 30 m of the existing LTCHS. Nearby developments include other public institutions, and residential and commercial land use.

Historical waste placement reportedly occurred with acknowledgement from the Provincial Health Region and the local School District. No buildings are located on the area of the historical waste disposal. A paved pedestrian/bike path is located across the historical waste area. The path connects the south side of the LTCHS Legion Track to Gaetz Lake to the east, the Parkland School (west of the site) and the Kerry Wood Nature Centre (northwest of the site). Part of the Legion Track is located within the south end of the historical waste disposal area, and an environmental reserve area with oxbow lakes (Gaetz Lakes) is located to the northeast. The west and north margins of the waste area are open undeveloped field with two baseball diamonds adjacent to the west side. MW-02, MW-03, and VW-02 are located outside the site boundary. Figure 2 shows the site location and surrounding land use. Additional information on the site history, historical groundwater monitoring investigations, geology, and hydrogeology can be found in Appendix B. Cross-sections that were prepared using the wells previously installed at the site in 2013 are included in Appendix C (from Tiamat Environmental Consultants Ltd. [Tiamat] 2014).

2.2 2019 Conceptual Site Model Summary

The selection of comparative guidelines is based on the conceptual site model (CSM), which outlines the rationale for the selection of applicable exposure pathways and receptors at the site. This evaluation is based on guidance presented in the Alberta Tier 1 Guidelines (AEP 2019). The CSM that was developed for the site in the 2019 groundwater and soil vapour monitoring report (Tetra Tech 2020) included the following items:

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

The CSM is summarized in the table, below.

Summary of Exposure Pathways and Receptors for Soil and Groundwater

Release Mechanism	COPC	Migration Pathway	Potential Receptor
Leachate infiltration into foundation or through cover.	Inorganic parameters and nutrients, metals, PHCs, VOCs, and other indicator parameters (i.e., biochemical oxygen demand [BOD] and chemical oxygen demand [COD]).	Direct soil contact.	Human users of the parkland; ecological plants and soil invertebrates.
		Groundwater ingestion (drinking water).	Domestic use aquifer (DUA) drinking water; freshwater aquatic life in Gaetz Lakes.
		Nutrient and energy cycling.	Microbial functioning of the soil.
LFG emissions.	VOCs, methane, BTEX and PHC fractions, and siloxanes.	Vapour inhalation.	Human users of the parkland; users of LTCHS.

As recommended by AEP, the soil vapour results obtained during the 2019 investigation were compared to the Canadian Council of Minister of the Environment's (CCME's) document A Protocol for the Derivation of Soil Vapour

Quality Guidelines for Protection of Human Exposures Via Inhalation of Vapours (CCME 2014). To determine the appropriate guidelines to compare the vapour sampling results to, indoor air risk calculations and methane explosive risks were calculated.

The CSM determined that the most applicable guidelines for groundwater and vapour results for the site were as follows:

- Groundwater concentrations at the site were compared to the Alberta Tier 1 Guidelines (AEP 2019) under residential land uses for coarse-grained soils.
- 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.

2.3 Monitoring Well Network

The 2021 and 2022 monitoring and sampling program included four vapour wells (VW-02 to VW-05) and nine groundwater monitoring wells (MW-02, MW-03, MW-04, MW04A, MW05A, MW14A, MW15A, BH8, and 22MW05). Monitoring well 22MW05 was installed in February 2022 and the details are provided in Section 3.1. Groundwater well MW-01 and soil vapour well VW-01 were not found in 2019 or 2021 and are interpreted to have been destroyed. The groundwater wells are all installed outside of the waste footprint. MW-02 and MW-04 are screened in sand and gravel fill material. MW-03 is reportedly installed 100 m to the northwest of the historical waste disposal area and is screened in sand fill. 22MW05 was installed on the northeast side of the site, approximately 20 m west of Gaetz Lake and is screened in sand and gravel. BH8 is located on the southeast side of the waste disposal area, approximately 50 m west of Gaetz Lake. Monitoring wells MW04A, MW05A, MW14A, and MW15A are located along the perimeter of the east side of LTCHS; Tetra Tech does not have the well completion details for MW14A, and MW15A.

The vapour wells are all screened within fill material: VW-01, VW-02, and VW-03 are screened within sand or sand and gravel fill; VW-04 is screened within silt fill; and VW-05 is screened within clayey loam fill. No obvious waste materials were encountered at these locations during drilling. Monitoring well completion details are summarized in Table 1.

Most monitoring wells were reported to be in good condition in 2021 and 2022 with the exception of VW-05 (flush-mount well) during the June 2022 monitoring event, which had the top of the casing and labcock torn off; this was most likely caused by snow removal equipment. VW-05 will need to be repaired during the next monitoring event at the site. In November 2021, a new bailer, j-plug, and lock were added to BH8.

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

We understand that historically there have been a number of additional wells and gas probes installed as part of previous assessments, including wells installed as part of the gas mitigation described in Section 5.1. These were not located or monitored as part of this program.

3.0 MONITORING AND SAMPLING PROGRAM

A discussion of the methods used for the fieldwork, laboratory testing, and data evaluation is presented in the following sections.

3.1 Monitoring Well Installation

On February 1, 2022, one new groundwater monitoring well (22MW05) was installed using a tracked drill rig and solid stem auger along the northwest side of Gaetz Lake. The well location was selected to assess the groundwater conditions in between the waste footprint and Gaetz Lake. Additionally, during the June 2022 monitoring event a fixed marker was placed on the observation deck near BH8 to provide a reference point to record the water level of Gaetz Lake. The elevations of the fixed point, and all on-site monitoring and vapour wells were later surveyed by Tetra Tech. The locations of 22MW05 and the Gaetz Lake measurement location are shown on Figure 2.

Monitoring well 22MW05 was installed with 51 mm diameter polyvinyl chloride (PVC) pipe to a depth of 4.5 m below grade (mbg) and was screened with 51 mm slotted PVC pipe from 1.5 mbg to 4.5 mbg. Prior to sampling 22MW05, the monitoring well was developed by field staff purging 12 well volumes of water from the monitoring well. The borehole log for 22MW05 is presented in Appendix F.

3.2 Groundwater Monitoring and Sampling Program

A discussion of the methods used for groundwater monitoring and sampling fieldwork and laboratory testing is presented in the following section. In 2021 and 2022, Tetra Tech conducted groundwater monitoring on November 21, 2021, February 1, 2022, and June 7, 2022. Groundwater sampling at monitoring wells MW-02, MW-03, MW-04, and BH8 was conducted on November 21, 2021, and sampling at 22MW05 was conducted on February 1, 2022. The proposed groundwater sampling plan included sampling the five groundwater wells in November 2021; however, the drilling of 22MW05 was delayed until February 2022 to ensure the ground in the Gaetz Lake Migratory Bird Sanctuary was frozen. Due to a miscommunication, the four existing wells were already sampled in November 2021 and 22MW05 was sampled later, on the day it was installed in February 2022. The waste footprint at the site has not changed since 1967 and the hydrogeological and water quality situation is considered stable. Therefore, little change between November 2021 and February 2022 is to be expected and the monitoring and sampling results over that period of time should be comparable.

Monitoring at the groundwater monitoring wells (51 mm diameter) consisted of measuring methane in monitoring well headspace, and static groundwater levels in each monitoring well three times (November 2021, February 2022, and June 2022).

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 methane headspace concentrations in each well using an RKI Eagle Hydrocarbon Surveyor II (RKI Eagle) calibrated to methane.
- Measuring liquid levels in each monitoring well with an interface probe and recording total depths confirming absence of non-aqueous phase liquids (NAPL) and evaluating the water level relative to the screen to confirm the screen was not blinded.
- Recording of field data on standardized forms as documented in Tetra Tech standard operating practices.
- Purging each monitoring well requiring sampling using dedicated polyethylene bailers or Waterra tubing with inertial pump foot valves of at least three well volumes of water, 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 five monitoring wells (MW-02, MW-03, MW-04, BH8, and 22MW05) and placed into appropriate laboratory supplied, sterile glass and plastic vials and bottles for the required analytical package. 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 Laboratory Group (ALS) in Calgary, Alberta for laboratory analysis under chain-of-custody (COC) documentation.

More information on the analytical program is provided in Section 3.2.1. The groundwater monitoring well locations are shown on Figure 2.

3.2.1 Analytical Program

The analytical program for the groundwater monitoring wells was developed based on the recommendations in Section 1.1 and is summarized below:

- Routine water chemistry and dissolved metals.
- Ammonia.
- Phosphorus.
- BTEX.
- VOCs.

3.3 Vapour Monitoring Program

A discussion of the methods used for the fieldwork is presented in the following sections. In 2021 and 2022, Tetra Tech conducted vapour monitoring on November 21, 2021, and June 7, 2022.

3.3.1 Vapour Monitoring Methodology

Monitoring at the four vapour monitoring probes (25 mm diameter) 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 (November and June).

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. The soil vapour probes were purged directly with the GEM 5000 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).

After monitoring, the soil vapour probes sampling ports were returned to the closed position and the well was securely locked.

The vapour monitoring well locations are shown on Figure 2.

4.0 RESULTS AND DISCUSSION

This section presents the results of the fieldwork conducted in 2021 and 2022 at LTCHS and discussions of these results.

4.1 Groundwater Well Headspace Monitoring

In 2021 and 2022, Tetra Tech monitored nine groundwater monitoring wells (MW-02, MW-03, MW-04, 22MW05, BH8, MW04A, MW05A, MW14A, and MW15A) during three monitoring events (MW05A and MW14A were only monitored during the November 2021 and June 2022 monitoring events) for measurements of methane in well headspace using an RKI Eagle, calibrated to methane. The RKI Eagle detection limit ranges from 5 parts per million (ppm) to >100% of the lower explosive limit (LEL). For methane, 500 ppm is equivalent to 1% LEL; 20% LEL is equivalent to 1% Gas.

At the groundwater monitoring wells, the water level was above the top of the monitoring well screen at 22MW05 during the June 2022 monitoring event, meaning the well was blinded and headspace vapour measurements are not representative for in-situ soil vapours; however, 22MW05 was not blinded during the February 2022 monitoring event. Monitoring wells MW-02, MW-03, MW-04, MW-04A, MW-05A, MW14A, and MW15A were not blinded during the 2021 and 2022 monitoring events. Monitoring well BH8 was blinded during the November 2021 and February 2022 monitoring events; however, BH8 was not blinded in June 2022.

In November 2021 and February 2022, methane concentrations at all monitoring wells were measured less than the instrument's detection limit. In June 2022, methane concentrations ranged from less than the instrument's detection limit at most wells to 60 ppm at 22MW05.

The methane headspace concentrations at the groundwater monitoring wells are presented in Table 1.

4.2 Groundwater Elevations

The measured groundwater levels and calculated groundwater elevations for 2021 are presented in Table 1.

Figure 3 presents the groundwater elevation trends (hydrographs) for the groundwater monitoring wells. These plots show the groundwater elevations in 2013, 2019, 2021, and 2022. Overall, the groundwater elevations increased at all monitoring wells from 2019 to 2021. Seasonal fluctuations were observed at the monitoring wells in 2021 and 2022.

In 2021, the average depth to groundwater in the monitoring wells was 3.01 mbg in November 2021, 2.89 mbg in February 2022, and 2.47 mbg in June 2022. The groundwater elevations and interpreted elevation contours are shown on Figure 4 to Figure 6. The interpreted contoured elevations for the monitoring wells suggest the groundwater flow is to the northwest. The groundwater elevations in November 2021 do not include 22MW05 or the surface water level recorded at the observation deck. The groundwater elevation at 22MW05 in February 2022 is interpreted to not be accurate as the water level had not fully recovered after installation. Gaetz Lake was frozen at that time and no surface water levels could be recorded. From the three monitoring events in 2021 and 2022, the June 2022 groundwater contours are interpreted to be the most representative of the local groundwater flow direction as it includes 22MW05 and the Gaetz Lake water level. It was noted that while field staff were on site surveying the monitoring wells on June 28, 2022, the lake level was considerably higher and 22MW05 was surrounded by standing water. The observation of the water level on June 28, 2022 is consistent with high water levels and flow rates in the Red Deer River during that period of time (AEP 2022), which likely also affects

Gaetz Lake. The Gaetz Lake water level during the June event (850.71 m) was higher than the adjacent water levels at both BH8 (850.35 m) and 22MW05 (850.66 m) confirming recharge conditions at this time.

The groundwater elevations measured in February 2022 suggested an easterly groundwater flow direction towards Gaetz Lake near the northern portion of the site; however, the inferred pattern is interpreted to be related to a non-stabilized groundwater elevation at newly installed monitoring well 22MW05 and the results have not been contoured. Groundwater elevations in 2021 and 2022 were overall slightly higher than the previously measured groundwater elevations in 2019. The interpreted groundwater flow direction in 2021 and 2022 was overall consistent with the inferred groundwater flow direction in 2013 (Tiamat 2014) and 2019.

The average horizontal gradient in 2021 and 2022 was 0.003 m/m towards the Red Deer River, located to the northwest of the site. The site gradient is steepest in the northwest towards the river valley. The horizontal gradient is consistent with the previous results from 2013.

4.3 Groundwater Field Parameters

Field measurements for temperature, pH, and EC in November 2021 and February 2022 are shown in Table 2. A discussion of the results of the field tests is summarized in this section.

Groundwater temperatures ranged from 3.20°C (22MW05) to 6.64°C (MW-03).

Field pH values ranged from 6.63 (BH8) to 7.51 (22MW05) in 2021 and 2022. The field pH measurements were generally less than the laboratory pH except at 22MW05. The difference between field recorded and laboratory pH values may be due to limitations of the field equipment and differences in sample temperature.

In 2021, field EC measurements ranged from 813 µS/cm (MW-04) to 1,181 µS/cm (BH8). The field EC results were less than the laboratory measured EC results; however, the field and laboratory results were relatively similar.

4.4 Groundwater Analytical Results

The groundwater analytical data for 2021 and 2022 is summarized in Table 2. The 2021 and 2022 laboratory analytical reports are included in Appendix D and historical tables are included in Appendix E.

4.4.1 Background Groundwater Characteristics

In 2013, the concentration of dissolved manganese (1.3 mg/L) at MW-01 was greater than the other manganese concentrations at the site measured in 2019 (ranging from 0.412 mg/L to 0.805 mg/L); however, dissolved iron concentrations were non-detect, nitrate was present in several milligrams per litre, and dissolved boron concentrations were low. These parameter concentrations, along with a relatively low ammonia concentration of 0.18 mg-N/L in 2013, do not suggest that the water quality at MW-01 in 2013 was affected by leachate. The concentration of chloride at MW-01 in 2013 was 110 mg/L, which is greater than the concentrations of chloride measured at other wells in 2019. It should be noted that MW-01 is the only monitoring well on site that is located near a roadway, suggesting the groundwater quality may be influenced by road salt.

Concentrations of BTEX, PHC fractions F1 and F2, and VOCs were less than the analytical detection limits at MW-01 in 2013.

Monitoring well MW-01 is assumed to be destroyed and background groundwater quality results are inferred from the 2013 analytical results from MW-01.

4.4.2 Routine Water Chemistry Parameters

In 2021 and 2022, TDS concentrations ranged from 524 mg/L (MW-04) to 876 mg/L (BH8). TDS concentrations at all monitoring wells were greater than the Tier 1 Guidelines (500 mg/L). TDS concentrations in 2021 and 2022 were similar to the 2019 results. Elevated TDS concentrations often occur in groundwater as a result of the dissolution of naturally occurring salts and minerals in Alberta, and do not necessarily indicate groundwater quality impact related to the former landfill.

Ammonia concentrations at the site in 2021 and 2022 ranged from 0.204 mg-N/L at MW-04 to 3.66 mg-N/L at 22MW05. The Tier 1 Guidelines for ammonia are a factor of pH and temperature and ranged from 0.392 mg-N/L to 5.372 mg-N/L at the site. Concentrations of ammonia were less than the Tier 1 Guidelines at all monitoring wells but the concentration at 22MW05 was clearly higher than at the other monitoring wells. Sulphate concentrations were negligible at MW-03, MW04, and 22MW05, suggesting possibly sulphate reduction due to anoxic conditions, which is common in groundwater within or near landfill wastes. Other than TDS, routine water chemistry parameter concentrations did not exceed the Tier 1 Guidelines in 2021 and 2022; however, the measured sulphate and ammonia concentrations at MW-03, MW-04, and 22MW05 suggests some groundwater quality impact by municipal solid waste landfill leachate.

4.4.3 Dissolved Metals

Concentrations of dissolved arsenic were greater than the Tier 1 Guidelines (0.005 mg/L) at most monitoring wells in 2021 and 2022 with the exception of BH8. Arsenic is known to be strongly adsorbed onto iron(hydr)oxides, and when iron and manganese dissolve, arsenic will also go into solution (Hem 1992). The concentrations of dissolved arsenic are likely correlated to the presence of dissolved iron. Dissolved arsenic concentrations in 2021 at MW-02, MW-03, and MW-04 marginally increased compared to the concentrations measured in 2019. The dissolved arsenic concentration at 22MW05 is one order of magnitude higher than the Tier 1 Guideline, possibly due to deeper anoxic conditions and consequently higher dissolved iron concentrations.

Dissolved barium was greater than the guideline of 1 mg/L at MW-03 (1.85 mg/L) and 22MW05 (1.25 mg/L). Tetra Tech interprets the dissolved barium concentrations at MW-03 and 22MW05 to be related to the low sulphate concentrations measured in the groundwater at these wells. As barium sulphate has a limited solubility, more barium will be released into solution when sulphate concentrations are low. The dissolved barium and sulphate concentrations at MW-03 were very similar in 2019 and 2021. As stated above, the low sulphate concentration at MW-03 and 22MW05 suggests deep anoxic (sulphate reducing) conditions, which are likely related to the former landfill.

Iron and manganese are redox-sensitive parameters that also occur in groundwater under aerobic 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 events in 2021 and 2022. The dissolved iron concentrations were also greater than the Tier 1 Guidelines at all monitoring wells in 2021 and 2022. Concentrations of dissolved iron and manganese in 2021 and 2022 were greater than concentrations measured in 2019 at most wells except dissolved manganese at MW-02. Manganese and iron also naturally occur in groundwater under anaerobic conditions and concentrations of these parameters do not necessarily indicate an adverse impact on groundwater quality. However, the measured dissolved iron concentrations at MW-03 (17.2 mg/L) and 22MW05 (16.1 mg/L), in combination with a low sulphate and an elevated ammonia concentration, suggests some leachate impact.

Dissolved mercury was measured less than the analytical detection limit at most wells in 2021 and 2022 with the exception of 22MW05, which marginally exceeded the Tier 1 Guideline. The dissolved mercury concentration measured at 22MW05 should be confirmed in 2022.

4.4.4 Organic Parameters

Concentrations of BTEX and PHC fractions F1 and F2 were less than the analytical detection limits at all locations in 2021 and 2022.

In 2021 and 2022, VOC concentrations were less than Tier 1 Guidelines at all wells in November 2021 and February 2022. MW-02, MW-03, and BH8 had detectable concentrations (0.0075 mg/L, 0.0019 mg/L, and 0.0021 mg/L respectively) of cis-1,2-dichloroethene, consistent with prior results (where sampled, MW-02 and MW-03). Tier 1 Guidelines for cis-1,2-dichloroethene have not been established. BH8 had a detectable concentration of vinyl chloride in November 2021 (0.0010 mg/L); however, the concentration measured slightly less than the Tier 1 Guideline. Cis-1,2-dichloroethene is known as a breakdown product of dry-cleaning liquids (i.e., tetrachloroethene [PCE]), and typically further degrades to form vinyl chloride. PCE was not detected at any of the monitoring wells in 2019 or 2021.

4.5 Soil Vapour Monitoring Results

The soil vapour monitoring results are presented in Table 4.

Wellhead pressures at VW-02 to VW-05 were negligible during most events in 2021 and 2022, with the exception of VW-04 in November 2021, which was frozen.

Methane concentrations (measured using the GEM) at vapour wells VW-02 to VW-05 were less than the instrument detection limit during both monitoring events in 2021 and 2022. The concentrations of carbon monoxide were less than the instrument detection limit during most 2021 and 2022 events with the exception of VW-05 in June 2022 (0.1% Gas). Concentrations of carbon dioxide, oxygen, and balance gas were consistent during both monitoring events. Most vapour wells were dry in 2021 and 2022 indicating the screens were not blinded, VW-04 in November 2021 was frozen and it could not be determined if the well was blinded or not.

Historical testing indicates the presence LFG (characterized by methane concentrations at and greater than the explosive range) in the landfill area. Details of the historical gas migration assessment work are included in Appendix B and Section 3.0.

4.6 Quality Assurance/Quality Control

4.6.1 Methods

Tetra Tech's groundwater 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 a duplicate vapour sample during the vapour sampling event; and

- Documenting field procedures and sampling activities.

4.6.2 Results

The groundwater QA/QC results are included in Table 3. The duplicate sample was 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.

For the groundwater duplicate at MW-04 in November 2021, RPDs were less than 20% for all of the reportable concentrations. Based on the QA/QC results, the sample methods and results are considered acceptable.

5.0 EVALUATION OF SITE CONDITIONS

5.1 Summary of Site Conditions

Based on the 2021 and historical data for the site, there is no evidence that there are significant concerns related to the former landfill operations at LTCHS impacting Gaetz Lake. However, there is evidence of residual impacts and the site does contain buried landfill waste; therefore, some risk management measures are required. Further, there are several elements of the site assessment data requiring further confirmation as detailed below.

Historical assessment indicates that the eastern extents of the landfill are relatively close to Gaetz Lake (within 10 m to 20 m). The monitoring data in June 2022 suggest that the water level at Gaetz Lake interacts with the groundwater; however, the inferred groundwater flow direction was northwesterly away from Gaetz Lake during this event. Historical monitoring data supports the June 2022 monitoring results, that groundwater flow is predominantly northwest, towards the Red Deer River and not towards Gaetz Lake. However, additional monitoring is recommended to determine if there is risk of migration of groundwater from the former landfill area towards the lake when the river and lake levels fluctuate.

Tetra Tech recommends installing dataloggers capable of measuring pressure and temperature in monitoring well 22MW05 and at a suitable location along the shore of Gaetz Lake. This will facilitate detailed monitoring of groundwater and surface water levels and allow for obtaining further insights in the groundwater flow pattern near 22MW05 along the east flank of the former waste disposal area and help determine whether there is a (seasonal)

groundwater flow component towards Gaetz Lake. It should be noted that the datalogger within the lake will need to be properly protected and, due to anticipated ice build up, may have to be removed during the winter months.

In 2021, the groundwater results at MW-02, MW-03, and MW-04 showed similar results to 2019 and had relatively minor concentrations of leachate indicator parameters. Monitoring wells BH8 and 22MW05 were sampled for the first time in 2021 and 2022, respectively. The results from BH8 and 22MW05 show that the wells are anoxic and have leachate indicator parameters present.

One additional year of semi-annual groundwater monitoring that includes MW-02, MW-03, MW-04, BH8, 22MW05, and the surface water level at Gaetz Lake is recommended. In conjunction with the groundwater monitoring events, Tetra Tech recommends groundwater sampling of BH8 and 22MW05 in the fall of 2022 and spring of 2023 to confirm concentrations and potential trends. The monitoring wells located next to LTCHS (MW04A, MW05A, MW14A, and MW15A) were dry during all events in 2021 and 2022 and further monitoring is not recommended.

Testing of well headspace vapours for methane and VOCs did not identify concerns at the locations monitored. In 2021 and 2022, the methane concentrations at all vapour probes were less than the instrument's detection limit and the highest methane concentration measured from the groundwater wells was 60 ppm at 22MW05; all measurements at the wells located next to LTCHS were less than the instrument's detection limit. As there is little indication that measured concentrations pose a hazard to receptors, it is recommended to discontinue headspace vapour monitoring of the groundwater and vapour wells. However, historical testing indicates the presence LFG (characterized by methane concentrations at and greater than the explosive range) in the landfill area. An interceptor trench is present between the waste mass and LTCHS, and monitoring by LTCHS has documented that the inceptor trench was performing as intended. The current operation status for the interceptor trench is not known; however, we understand that LTCHS is required to provide periodic update of the program status to The City.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon the results of the groundwater and soil vapour monitoring and sampling conducted in 2021 and previous years, Tetra Tech has developed the following conclusions:

- The groundwater elevations measured in November 2021 and June 2022 infer a groundwater flow direction to the northwest, towards the Red Deer River. Stabilized water levels at 22MW05, as measured in June 2022, confirmed a flow direction away from Gaetz Lake during this event. The average horizontal hydraulic gradients at the site were estimated as approximately 0.003 m/m. Groundwater elevations in 2021 and 2022 were overall slightly higher than the previously measured groundwater elevations in 2019.

- Routine groundwater quality parameters and dissolved metals concentrations that exceeded the Tier 1 Guidelines at one or more monitoring wells in 2021 and 2022 included TDS, and the dissolved metals arsenic, barium, iron, manganese, and mercury. The measured concentrations of these parameters were generally consistent with historical results; however, dissolved mercury marginally exceeded the Tier 1 Guideline for the first time at the site in February 2022 at 22MW05 and is recommended to be confirmed.

- Concentrations of BTEX and PHC fractions F1 to F2 were less than the analytical detection limits at all monitoring wells in 2021 and 2022. In 2021 and 2022, most VOC concentrations measured less than the analytical detection limits and less than the Tier 1 Guidelines, where established, at all groundwater monitoring wells. VOC parameter 1,2-dichloroethene (cis) was detected in low concentrations at monitoring wells MW-02, MW-03, and BH8; this VOC does not have an established Tier 1 Guideline. Additionally, vinyl chloride was detected at monitoring well BH8 (0.0010 mg/L); however, the concentration was less than the Tier 1 Guideline

(0.0011 mg/L). Trace concentrations of 1,2-dichloroethene (cis) were previously measured at MW-02 and MW-03.

- Overall, the on-site monitoring wells showed relatively minor concentrations of leachate indicator parameters in 2021 and 2022.

The 2021 and 2022 vapour monitoring program results are summarized as follows:

- Concentrations of methane in the vapour probes were less than the instrument's detection limit during all monitoring events in 2021 and 2022 and the highest methane concentration in the headspace of groundwater wells was 60 parts per million (ppm) at 22MW05 in June 2022.
- Overall, the soil vapour monitoring conducted in 2021 and 2022 suggests that there is little indication that vapour migration poses a hazard to receptors. Historical testing indicates the presence of LFG (characterized by methane concentrations at and greater than the explosive range) in the landfill area; however, an interceptor trench is present between the waste mass and LTCHS. Tetra Tech understands that ongoing monitoring is completed by another consultant on behalf of LTCHS.

Based upon the results of the groundwater and vapour monitoring program in 2021 and 2022 and previous years, Tetra Tech recommends ongoing risk management, including: additional assessment; ongoing monitoring; and administrative actions. The following recommendations are made according to these risk management elements:

- Additional Assessment:
  - Tetra Tech recommends installing dataloggers capable of measuring pressure and temperature in monitoring well 22MW05 and at a suitable location along the shore of Gaetz Lake. This will facilitate detailed monitoring of groundwater and surface water levels and allow for obtaining further insights in groundwater flow patterns near 22MW05 along the east flank of the waste disposal area and help determine whether there is a (seasonal) groundwater flow component towards Gaetz Lake. It should be noted that the datalogger within the lake will need to be properly protected and, due to anticipated ice buildup, may have to be removed during the winter months.
- Ongoing Monitoring:
  - Conduct additional groundwater monitoring events in the spring of 2023 and the fall of 2023 to confirm the groundwater flow pattern. In conjunction with these two events, collect semi-annual groundwater samples from BH8 and 22MW05 to confirm the results collected in November 2021 and February 2022. The monitoring wells located next to LTCHS (MW04A, MW05A, MW14A, and MW15A) were dry during all events in 2021 and 2022 and further monitoring is not recommended.
  - After the proposed additional monitoring and sampling events have been conducted, and datalogger data is collected during the spring 2023 runoff season of the Red Deer River, evaluate all surface water and groundwater elevation data, along with the additional groundwater quality information and assess the potential risk to the water quality of Gaetz Lake and whether continuing the monitoring program is warranted.
  - Based on vapour monitoring results collected to date there are no obvious vapour concerns at the locations monitored and Tetra Tech recommends discontinuing headspace monitoring in the soil vapour and groundwater wells as part of The City program.
- Administrative Actions:
  - The interceptor trench adjacent to LTCHS is operated and monitored by LTCHS and we understand that LTCHS is required to provide periodic updates of the program status to The City. We recommend that The

City obtain and review the collected data on an annual basis in support of management activities at this site. Further, we suggest that The City request as-built details of the inceptor trench from LTCHS for their records, and further that any records of manual or automated indoor monitoring be requested.

- 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.

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. We note that the design and operation of the interceptor trench adjacent to LTCHS was developed based on surface conditions similar to existing, and if changes or improvements to the surface of the landfill are contemplated (e.g., paving or installation of an impermeable cap), such work should be undertaken in conjunction with a review of the interceptor trench design and performance.

7.0 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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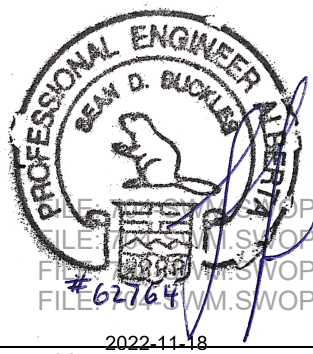

2022-11-18

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DATE: 2022-11-18
PERMIT NUMBER: P013774
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

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TABLES

Table 1: Groundwater Elevations

Monitoring Well		MW-01	MW-02	MW-03	MW-04	22MW05	BH8	MW04A	MW05A	MW14A	MW15A	Gaetz Lake
Total Drilled Depth (m)		6.1	6.1	4.6	4.6	4.5	6.0	6.0	6.0	-	-	-
Top of Screened Interval (mbg)		1.5	3.1	1.6	1.6	1.5	3.0	4.5	4.5	-	-	-
Bottom of Screened Interval (mbg)		6.1	6.1	4.6	4.6	4.5	6.0	6.0	6.0	-	-	-
Stick up (m)		0.02	0.75	0.88	0.82	0.86	0.90	-0.24	-0.10	-0.11	-0.11	-
Ground Elevation (m)		853.77	853.86	853.58	852.10	850.88	853.39	854.76	854.71	854.53	854.29	-
TPC Elevation (m)		853.79	854.66	854.36	852.95	851.94	854.30	854.65	854.96	854.42	854.26	853.52
Depth to Groundwater (mBTPC)	Aug-13	3.04	3.03	3.54	1.61	-	-	3.60	3.70	3.60	3.40	-
	May-19	CNL	4.07	4.48	2.52	-	-	-	-	-	-	-
	Jun-19	CNL	3.99	4.48	2.46	-	-	-	-	-	-	-
	Sep-19	CNL	4.04	4.60	2.74	-	-	-	-	-	-	-
	Dec-19	CNL	4.12	4.65	2.78	-	-	-	-	-	-	-
	Nov-21	CNL	4.15	4.69	2.84	-	3.70	Dry	Dry	Frozen	Dry	-
	Feb-22	CNL	4.26	4.76	2.97	2.91	3.76	Frozen	-	-	Dry	-
	Jun-22	CNL	4.11	4.65	2.56	1.28	3.95	Dry	Dry	Dry	Dry	2.81
Groundwater Elevation (m)	Aug-13	850.75	851.63	850.82	851.35	-	-	850.91	850.91	850.81	850.78	-
	May-19	Destroyed	850.60	849.88	850.43	-	-	-	-	-	-	-
	Jun-19	Destroyed	850.68	849.88	850.49	-	-	-	-	-	-	-
	Sep-19	Destroyed	850.62	849.77	850.21	-	-	-	-	-	-	-
	Dec-19	Destroyed	850.55	849.71	850.17	-	-	-	-	-	-	-
	Nov-21	Destroyed	850.52	849.67	850.11	-	850.60	Dry	Dry	Frozen	Dry	-
	Feb-22	Destroyed	850.40	849.60	849.98	849.03	850.54	Frozen	-	-	Dry	-
	Jun-22	Destroyed	850.55	849.71	850.39	850.66	850.35	Dry	Dry	Dry	Dry	850.71
Combustible Vapour Concentrations* (CVCs) (ppm)	Aug-13	100	ND	ND	ND	N/A	N/A	140	200	250	260	N/A
	May-19	Destroyed	ND	ND	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Jun-19	Destroyed	ND	ND	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Sep-19	Destroyed	ND	5	150	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Dec-19	Destroyed	ND	ND	35	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Volatile Organic Compounds* (VOCs) (ppm)	Aug-13	ND	ND	ND	ND	N/A	N/A	ND	ND	ND	ND	N/A
	May-19	Destroyed	ND	ND	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Jun-19	Destroyed	ND	ND	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Sep-19	Destroyed	ND	ND	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Dec-19	Destroyed	ND	ND	ND	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Methane Concentrations** (ppm)	Nov-21	Destroyed	ND	ND	ND	N/A	ND	ND	ND	ND	ND	NA
	Feb-22	Destroyed	ND	ND	ND	ND	ND	ND	N/A	N/A	ND	NA
	Jun-22	Destroyed	ND	ND	ND	60	ND	ND	ND	ND	ND	NA

Notes:
mbg - Metres below grade.
mBTPC - Metres below top of plastic pipe casing.
ND - Non-detect
*- Measured using RKI Eagle II calibrated to hexane and isobutylene and operated in methane elimination mode.
**- Measured using RKI Eagle II calibrated to methane.
CNL - Could not locate.
N/A - Not applicable; prior to well installation.

Table 2: Groundwater Analytical Results

Parameter	Unit	Tier 1 Guideline [1,2]	MW-02		MW-03	
			5-Dec-2019	21-Nov-2021	5-Dec-2019	21-Nov-2021
Field Testing						
Field Temperature	°C	-	3.94	6.01	1.08	6.64
Field Electric Conductivity	µS/cm	-	666	1,010	510	818
Field pH	pH Units	6.5 to 8.5	8.28	6.90	7.73	6.72
Routine						
pH	pH Units	6.5 to 8.5	7.86	7.87	8	7.77
Electrical Conductivity (EC)	µS/cm	-	1040	1,110	876	866
Total Dissolved Solids (TDS)	mg/L	500	**644**	**691**	**522**	**546**
Hardness as $CaCO_3$	mg/L	-	515	508	416	389
Alkalinity (total as $CaCO_3$)	mg/L	-	431	446	502	473
Bicarbonate	mg/L	-	526	544	612	577
Carbonate	mg/L	-	<5.0	<1	<5.0	<1
Hydroxide	mg/L	-	<5.0	-	<5.0	-
Calcium	mg/L	-	134	129	102	94.6
Magnesium	mg/L	-	43.8	45.1	39.2	37.2
Potassium	mg/L	-	4.64	4.77	5.88	6
Sodium	mg/L	200	40.7	49.2	48.2	54.7
Chloride	mg/L	120	91.5	98.4	25.2	30
Fluoride	mg/L	1.5	<0.10	0.16	0.103	0.246
Sulphate	mg/L	429 [3]	70.4	71.4	<0.30	<1.5
Ionic Balance	N/A	-	96.5	101	99.2	99.3
Nutrients						
Ammonia as N	mg/L	0.392 to 5.372 [6]	0.690	0.684	1.31	0.96
Nitrate (as NO_3-N)	mg/L	3	<0.10	<0.10	<0.020	<0.10
Nitrite (as NO_2-N)	mg/L	0.20 [4]	<0.050	<0.050	<0.010	<0.050
Nitrate and Nitrite (as N)	mg/L	-	<0.11	-	<0.022	-
Total Kjeldahl Nitrogen (TKN)	mg/L	-	1.3	-	35	-
Carbon						
Dissolved Organic Carbon (DOC)	mg/L	-	4.8	-	15.1	-
Dissolved Metals						
Aluminum	mg/L	0.050 [5]	0.0076	0.0024	0.0212	0.0154
Antimony	mg/L	0.006	<0.00050	<0.00010	0.00014	0.00018
Arsenic	mg/L	0.005	**0.00759**	**0.00959**	**0.0320**	**0.0333**
Barium	mg/L	1	0.547	0.53	**1.80**	**1.85**
Beryllium	mg/L	-	-	<0.000020	-	<0.000020
Bismuth	mg/L	-	-	<0.000050	-	<0.000050
Boron	mg/L	1.5	<0.050	0.046	0.055	0.055
Cadmium	mg/L	0.00037 [3]	0.000045	0.0000168	0.0000821	0.0000136
Chromium	mg/L	0.05	<0.00050	<0.00050	0.00015	<0.00050
Cobalt	mg/L	-	-	0.00043	-	0.00084
Copper	mg/L	0.007	<0.0010	<0.00020	0.00135	0.00093
Iron	mg/L	0.3	**6.89**	**7.67**	**14.8**	**17.2**
Lead	mg/L	0.0070 [3]	<0.00025	<0.000050	0.00011	0.000061
Lithium	mg/L	-	-	0.0275	-	0.0196
Manganese	mg/L	0.05	**0.528**	**0.490**	**0.412**	**0.437**
Mercury	mg/L	0.000005	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	mg/L	-	-	0.00303	-	0.00753
Nickel	mg/L	0.144 to 0.209 [3]	<0.0025	0.0017	0.00142	0.00132
Phosphorus	mg/L	-	0.524	<0.05	21.5	<0.05
Selenium	mg/L	0.002	<0.00025	<0.000050	0.000131	0.000138
Silicon	mg/L	-	-	6.18	-	7.8
Silver	mg/L	0.0001	<0.000050	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	0.719	-	0.614
Sulphur	mg/L	-	-	25.9	-	<0.50
Thallium	mg/L	-	-	<0.000010	-	<0.000010
Tin	mg/L	-	-	<0.00010	-	<0.00010
Titanium	mg/L	-	-	<0.00030	-	0.00041
Uranium	mg/L	0.015	0.00295	0.00294	0.000291	0.000266
Vanadium	mg/L	-	-	<0.00050	-	<0.00050
Zinc	mg/L	0.03	<0.0050	0.0025	0.0026	0.0042
Zirconium	mg/L	-	-	<0.00020	-	0.00073
Organics						
AOX	mg/L	-	ND	-	ND	-
Hydrocarbons						
Benzene	mg/L	0.005	<0.00050	<0.00050	<0.00050	<0.00050
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
Xylene (o)	mg/L	-	<0.00050	<0.00030	<0.00050	<0.00030
Xylenes (m & p)	mg/L	-	<0.00050	<0.00040	<0.00050	<0.00040
Xylenes Total	mg/L	0.02	<0.00071	<0.00050	<0.00071	<0.00050
Styrene	mg/L	0.072	<0.00050	<0.00050	<0.00050	<0.00050
F1 (C_6-C_{10})	mg/L	-	<0.10	-	<0.10	-
F1 (C_6-C_{10}) - BTEX	mg/L	0.81	<0.10	-	<0.10	-
F2 (C_{10}-C_{16})	mg/L	1.1	<0.10	-	<0.10	-
Total BTEX	mg/L	-	-	<0.0010	-	<0.0010

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 333 mg/L to 515 mg/L.

[4] Guideline varies with chloride. Values shown based on site chloride range of 15.2 mg/L to 91.5 mg/L.

[5] Guideline varies with pH. Values shown based on site pH range of 7.51 to 8.55.

[6] Guideline varies with pH and temperature. Values shown based on pH range of 7.51 to 8.55 and temperature range of 1.08°C to 4.23°C.

"-" No applicable guideline.

BOLD - Greater than Tier 1 Guideline.

N/A - Not applicable.

Table 2: Groundwater Analytical Results

Parameter	Unit	Tier 1 Guideline [1,2]	MW-02		MW-03	
			5-Dec-2019	21-Nov-2021	5-Dec-2019	21-Nov-2021
Polycyclic Aromatic Hydrocarbons (PAHs)						
Naphthalene	mg/L	0.001	-	<0.0010	-	<0.0010
Volatile Fatty/Carboxylic Acids						
Acetic Acid	mg/L	-	<10	-	<10	-
Butyric Acid	mg/L	-	<1.0	-	<1.0	-
Formic Acid	mg/L	-	<50	-	<50	-
Hexanoic Acid	mg/L	-	<1.0	-	<1.0	-
iso-Butyric Acid	mg/L	-	<1.0	-	<1.0	-
Isovaleric acid	mg/L	-	<1.0	-	<1.0	-
Proponic Acid	mg/L	-	<5	-	<5	-
Valeric Acid	mg/L	-	<1.0	-	<1.0	-
Volatile Organic Compounds (VOCs)						
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	<0.0010	<0.00050	<0.0010
Bromoform	mg/L	-	<0.00050	<0.0010	<0.00050	<0.0010
Bromomethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
n-Butylbenzene	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
Carbon tetrachloride	mg/L	0.00057	<0.00050	<0.00050	<0.00050	<0.00050
Chlorobenzene	mg/L	0.0013	<0.00050	<0.0010	<0.00050	<0.0010
Chloroethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Chloroform	mg/L	0.018	<0.00050	<0.0010	<0.00050	<0.0010
Chloromethane	mg/L	-	<0.0010	<0.0050	<0.0010	<0.0050
2-Chlorotoluene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
4-Chlorotoluene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Dibromochloromethane	mg/L	0.19	<0.00050	<0.0010	<0.00050	<0.0010
1,2-Dibromo-3-chloropropane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dibromoethane	mg/L	-	<0.00050	<0.0010	<0.00050	<0.0010
Dibromomethane	mg/L	-	<0.00050	<0.0010	<0.00050	<0.0010
1,2-Dichlorobenzene	mg/L	0.0007	<0.00050	<0.00050	<0.00050	<0.00050
1,3-Dichlorobenzene	mg/L	-	<0.00050	<0.0010	<0.00050	<0.0010
1,4-Dichlorobenzene	mg/L	0.001	<0.00050	<0.0010	<0.00050	<0.0010
1,1-Dichloroethane	mg/L	-	<0.00050	<0.0010	<0.00050	<0.0010
1,2-Dichloroethane	mg/L	0.005	<0.0010	<0.0010	<0.0010	<0.0010
1,1-Dichloroethene	mg/L	0.014	<0.00050	<0.0010	<0.00050	<0.0010
1,2-Dichloroethene (cis)	mg/L	-	0.0084	0.0075	0.0019	0.0019
1,2-Dichloroethene (trans)	mg/L	-	0.00067	<0.0010	<0.00050	<0.0010
Dichlorodifluoromethane	mg/L	-	<0.00050	<0.0010	<0.00050	<0.0010
1,2-Dichloropropane	mg/L	-	<0.00050	<0.0010	<0.00050	<0.0010
1,3-Dichloropropane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
2,2-Dichloropropane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
1,1-Dichloropropene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
1,3-Dichloropropene	mg/L	-	-	<0.0015	-	<0.0015
1,3-Dichloropropene [cis]	mg/L	-	<0.00050	<0.0010	<0.00050	<0.0010
1,3-Dichloropropene [trans]	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Hexachlorobutadiene	mg/L	0.0013	<0.0010	<0.0010	<0.0010	<0.0010
p-Isopropyltoluene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Methyl t-Butyl Ether (MTBE)	mg/L	0.015	-	<0.00050	-	<0.00050
Methylene Chloride	mg/L	0.05	<0.0010	<0.0010	<0.0010	<0.0010
iso-Propylbenzene (cumene)	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
n-Propylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
1,1,1,2-Tetrachloroethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
1,1,2,2-Tetrachloroethane	mg/L	-	<0.00050	<0.0010	<0.00050	<0.0010
Tetrachloroethene (PCE)	mg/L	0.01	<0.00050	<0.0010	<0.00050	<0.0010
1,2,3-Trichlorobenzene	mg/L	0.008	<0.0010	<0.0010	<0.0010	<0.0010
1,2,4-Trichlorobenzene	mg/L	0.015	<0.0010	<0.0010	<0.0010	<0.0010
1,1,1-Trichloroethane	mg/L	-	<0.00050	<0.0010	<0.00050	<0.0010
1,1,2-Trichloroethane	mg/L	-	<0.00050	<0.0010	<0.00050	<0.0010
Trichloroethene	mg/L	0.005	<0.00050	<0.0010	<0.00050	<0.0010
Trichlorofluoromethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Trihalomethanes	mg/L	0.1	-	<0.0020	-	<0.0020
1,2,3-Trichloropropane	mg/L	-	<0.00050	<0.0010	<0.00050	<0.0010
1,2,4-Trimethylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
1,3,5-Trimethylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010
Vinyl chloride	mg/L	0.0011	<0.00050	<0.0010	<0.00050	<0.0010

Notes:

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[4] Guideline varies with chloride. Values shown based on site chloride range of 15.2 mg/L to 91.5 mg/L.

[5] Guideline varies with pH. Values shown based on site pH range of 7.51 to 8.55.

[6] Guideline varies with pH and temperature. Values shown based on pH range of 7.51 to 8.55 and temperature range of 1.08°C to 4.23°C.

"-" No applicable guideline.

BOLD - Greater than Tier 1 Guideline.

N/A - Not applicable.

Table 2: Groundwater Analytical Results

Parameter	Unit	Tier 1 Guideline [1,2]	MW-04		Duplicate	BH8	22MW05
			5-Dec-2019	21-Nov-2021	21-Nov-2021	21-Nov-2021	1-Feb-2022
Field Testing							
Field Temperature	°C	-	4.23	6.33	-	5.4	3.2
Field Electric Conductivity	µS/cm	-	490	813	-	1,181	1035
Field pH	pH Units	6.5 to 8.5	**8.55**	7.50	-	6.63	7.51
Routine							
pH	pH Units	6.5 to 8.5	8.05	7.87	7.94	7.73	7.19
Electrical Conductivity (EC)	µS/cm	-	710	834	829	1,380	1030
Total Dissolved Solids (TDS)	mg/L	500	423	**524**	**519**	**876**	**684**
Hardness as $CaCO_3$	mg/L	-	333	378	369	686	452
Alkalinity (total as $CaCO_3$)	mg/L	-	396	488	483	672	580
Bicarbonate	mg/L	-	483	596	589	820	708
Carbonate	mg/L	-	<5.0	<1	<1	<1	<1.0
Hydroxide	mg/L	-	<5.0	-	-	-	<1.0
Calcium	mg/L	-	80.2	95.9	92.5	178	102
Magnesium	mg/L	-	32.2	33.6	33.6	58.7	47.9
Potassium	mg/L	-	3.54	3.59	3.58	3.97	8.54
Sodium	mg/L	200	48	56.2	56.2	58.7	65.3
Chloride	mg/L	120	15.2	18.5	19.6	70.2	45.0
Fluoride	mg/L	1.5	0.126	0.23	0.229	0.153	0.132
Sulphate	mg/L	429 [3]	5.6	1.36	1.71	81.7	7.1
Ionic Balance	N/A	-	104	100	100	101	100
Nutrients							
Ammonia as N	mg/L	0.392 to 5.372 [6]	0.213	0.204	0.257	0.589	3.66
Nitrate (as NO_3-N)	mg/L	3	0.022	<0.020	<0.10	<0.10	0.170
Nitrite (as NO_2-N)	mg/L	0.20 [4]	<0.010	<0.010	<0.050	<0.050	<0.050
Nitrate and Nitrite (as N)	mg/L	-	<0.022	-	-	-	0.170
Total Kjeldahl Nitrogen (TKN)	mg/L	-	3.0	-	-	-	-
Carbon							
Dissolved Organic Carbon (DOC)	mg/L	-	10.1	-	-	-	-
Dissolved Metals							
Aluminum	mg/L	0.050 [5]	**0.162**	<0.0010	<0.0010	0.0055	0.0032
Antimony	mg/L	0.006	<0.0001	<0.00010	<0.00010	<0.00050	<0.00010
Arsenic	mg/L	0.005	**0.00832**	**0.0107**	**0.0105**	0.0016	**0.0275**
Barium	mg/L	1	0.752	0.777	0.77	0.57	**1.25**
Beryllium	mg/L	-	-	<0.000020	<0.000020	<0.00010	-
Bismuth	mg/L	-	-	<0.000050	<0.000050	<0.00025	-
Boron	mg/L	1.5	0.029	0.036	0.035	0.059	0.064
Cadmium	mg/L	0.00037 [3]	**0.000403**	0.0000114	0.0000103	0.0000634	<0.0000050
Chromium	mg/L	0.05	0.00024	<0.00050	<0.00050	<0.0025	<0.00050
Cobalt	mg/L	-	-	0.00257	0.00255	0.00357	-
Copper	mg/L	0.007	0.00233	0.0007	<0.00020	<0.0010	0.00042
Iron	mg/L	0.3	**2.94**	**4.00**	**3.91**	**1.07**	**16.1**
Lead	mg/L	0.0070 [3]	0.000355	<0.000050	<0.000050	<0.00025	0.000051
Lithium	mg/L	-	-	0.0146	0.0138	0.0194	-
Manganese	mg/L	0.05	**0.805**	**0.865**	**0.869**	**1.52**	**0.509**
Mercury	mg/L	0.000005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	**0.0000072**
Molybdenum	mg/L	-	-	0.00346	0.0033	0.00123	-
Nickel	mg/L	0.144 to 0.209 [3]	0.00333	0.00271	0.00265	0.0048	0.00081
Phosphorus	mg/L	-	3.15	<0.05	<0.05	<0.25	-
Selenium	mg/L	0.002	0.000138	0.000138	0.000167	<0.00025	0.000174
Silicon	mg/L	-	-	6.26	6.13	6.47	-
Silver	mg/L	0.0001	<0.000010	<0.000010	<0.000010	<0.000050	<0.000010
Strontium	mg/L	-	-	0.651	0.619	0.694	-
Sulphur	mg/L	-	-	0.52	0.52	29.8	-
Thallium	mg/L	-	-	0.000012	0.000013	<0.000050	-
Tin	mg/L	-	-	<0.00010	<0.00010	<0.00050	-
Titanium	mg/L	-	-	<0.00030	<0.00030	<0.0015	-
Uranium	mg/L	0.015	0.0013	0.00179	0.00176	0.00705	0.000605
Vanadium	mg/L	-	-	<0.00050	<0.00050	<0.0025	-
Zinc	mg/L	0.03	0.0036	0.0029	0.0018	<0.0050	0.0039
Zirconium	mg/L	-	-	0.00027	0.00027	<0.0010	-
Organics							
AOX	mg/L	-	ND	-	-	-	-
Hydrocarbons							
Benzene	mg/L	0.005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Toluene	mg/L	0.021	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Ethylbenzene	mg/L	0.0016	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Xylene (o)	mg/L	-	<0.00050	<0.00030	<0.00030	<0.00030	<0.00030
Xylenes (m & p)	mg/L	-	<0.00050	<0.00040	<0.00040	<0.00040	<0.00040
Xylenes Total	mg/L	0.02	<0.00071	<0.00050	<0.00050	<0.00050	<0.00050
Styrene	mg/L	0.072	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
F1 (C_6-C_{10})	mg/L	-	<0.10	-	-	-	-
F1 (C_6-C_{10}) - BTEX	mg/L	0.81	<0.10	-	-	-	-
F2 (C_{10}-C_{16})	mg/L	1.1	<0.10	-	-	-	-
Total BTEX	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010

Notes:

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[4] Guideline varies with chloride. Values shown based on site chloride range of 15.2 mg/L to 91.5 mg/L.

[5] Guideline varies with pH. Values shown based on site pH range of 7.51 to 8.55.

[6] Guideline varies with pH and temperature. Values shown based on pH range of 7.51 to 8.55 and temperature range of 1.08°C to 4.23°C.

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Table 2: Groundwater Analytical Results

Parameter	Unit	Tier 1 Guideline [1,2]	MW-04		Duplicate	BH8	22MW05
			5-Dec-2019	21-Nov-2021	21-Nov-2021	21-Nov-2021	1-Feb-2022
Polycyclic Aromatic Hydrocarbons (PAHs)							
Naphthalene	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010
Volatile Fatty/Carboxylic Acids							
Acetic Acid	mg/L	-	<10	-	-	-	-
Butyric Acid	mg/L	-	<1.0	-	-	-	-
Formic Acid	mg/L	-	<50	-	-	-	-
Hexanoic Acid	mg/L	-	<1.0	-	-	-	-
iso-Butyric Acid	mg/L	-	<1.0	-	-	-	-
Isovaleric acid	mg/L	-	<1.0	-	-	-	-
Proponic Acid	mg/L	-	<5	-	-	-	-
Valeric Acid	mg/L	-	<1.0	-	-	-	-
Volatile Organic Compounds (VOCs)							
Bromobenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bromochloromethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bromodichloromethane	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010
Bromoform	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010
Bromomethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
n-Butylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
sec-Butylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
tert-Butylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Carbon tetrachloride	mg/L	0.00057	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Chlorobenzene	mg/L	0.0013	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010
Chloroethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Chloroform	mg/L	0.018	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010
Chloromethane	mg/L	-	<0.0010	<0.0050	<0.0050	<0.0050	<0.0050
2-Chlorotoluene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
4-Chlorotoluene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Dibromochloromethane	mg/L	0.19	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dibromo-3-chloropropane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dibromoethane	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010
Dibromomethane	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichlorobenzene	mg/L	0.0007	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
1,3-Dichlorobenzene	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010
1,4-Dichlorobenzene	mg/L	0.001	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010
1,1-Dichloroethane	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichloroethane	mg/L	0.005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1-Dichloroethene	mg/L	0.014	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichloroethene (cis)	mg/L	-	<0.0010	<0.0010	<0.0010	0.0021	<0.0010
1,2-Dichloroethene (trans)	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010
Dichlorodifluoromethane	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichloropropane	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010
1,3-Dichloropropane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
2,2-Dichloropropane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1-Dichloropropene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,3-Dichloropropene	mg/L	-	-	<0.0015	<0.0015	<0.0015	<0.0015
1,3-Dichloropropene [cis]	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010
1,3-Dichloropropene [trans]	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Hexachlorobutadiene	mg/L	0.0013	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
p-Isopropyltoluene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Methyl t-Butyl Ether (MTBE)	mg/L	0.015	-	<0.00050	<0.00050	<0.00050	<0.00050
Methylene Chloride	mg/L	0.05	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
iso-Propylbenzene (cumene)	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
n-Propylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1,1,2-Tetrachloroethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1,2,2-Tetrachloroethane	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010
Tetrachloroethene (PCE)	mg/L	0.01	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010
1,2,3-Trichlorobenzene	mg/L	0.008	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2,4-Trichlorobenzene	mg/L	0.015	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1,1-Trichloroethane	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010
1,1,2-Trichloroethane	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010
Trichloroethene	mg/L	0.005	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010
Trichlorofluoromethane	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Trihalomethanes	mg/L	0.1	-	<0.0020	<0.0020	<0.0020	<0.0020
1,2,3-Trichloropropane	mg/L	-	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010
1,2,4-Trimethylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,3,5-Trimethylbenzene	mg/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Vinyl chloride	mg/L	0.0011	<0.00050	<0.0010	<0.0010	0.0010	<0.0010

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 333 mg/L to 515 mg/L.

[4] Guideline varies with chloride. Values shown based on site chloride range of 15.2 mg/L to 91.5 mg/L.

[5] Guideline varies with pH. Values shown based on site pH range of 7.51 to 8.55.

[6] Guideline varies with pH and temperature. Values shown based on pH range of 7.51 to 8.55 and temperature range of 1.08°C to 4.23°C.

"-" No applicable guideline.

BOLD - Greater than Tier 1 Guideline.

N/A - Not applicable.

Table 3: Groundwater Quality Assurance/Quality Control Analytical Results

Parameter	Unit	RDL	MW-04	DUPLICATE	RPD (%)
			21-Nov-2021	21-Nov-2021	
Routine					
pH	pH Units	0.1	7.87	7.94	0
Electrical Conductivity (EC)	µS/cm	1	834	829	0
Total Dissolved Solids (TDS)	mg/L	1	**524**	**519**	0
Hardness as $CaCO_3$	mg/L	0.6	378	369	1
Alkalinity (total as $CaCO_3$)	mg/L	1	488	483	1
Bicarbonate	mg/L	1	596	589	1
Carbonate	mg/L	1	<1	<1	-
Hydroxide	mg/L	1	-	-	-
Calcium	mg/L	0.05	95.9	92.5	2
Magnesium	mg/L	0.1	33.6	33.6	0
Potassium	mg/L	0.1	3.59	3.58	0
Sodium	mg/L	0.05	56.2	56.2	0
Chloride	mg/L	0.5	18.5	19.6	3
Fluoride	mg/L	0.02	0.23	0.229	0
Sulphate	mg/L	0.3	1.36	1.71	13
Ionic Balance	N/A	0.01	100	100.1	0
Nutrients					
Ammonia as N	mg/L	0.005	0.204	0.257	13
Nitrate (as NO_3-N)	mg/L	0.02	<0.020	<0.10	-
Nitrite (as NO_2-N)	mg/L	0.01	<0.010	<0.050	-
Dissolved Metals					
Aluminum	mg/L	0.001	<0.0010	<0.0010	-
Antimony	mg/L	0.0001	<0.00010	<0.00010	-
Arsenic	mg/L	0.0001	**0.0107**	**0.0105**	1
Barium	mg/L	0.0001	0.777	0.770	0
Beryllium	mg/L	0.00002	<0.000020	<0.000020	-
Bismuth	mg/L	0.00005	<0.000050	<0.000050	-
Boron	mg/L	0.01	0.036	0.035	1
Cadmium	mg/L	0.000005	0.0000114	0.0000103	5
Chromium	mg/L	0.0005	<0.00050	<0.00050	-
Cobalt	mg/L	0.0001	0.00257	0.00255	0
Copper	mg/L	0.0002	0.0007	<0.00020	-
Iron	mg/L	0.01	**4.00**	**3.91**	1
Lead	mg/L	0.00005	<0.000050	<0.000050	-
Lithium	mg/L	0.001	0.0146	0.0138	3
Manganese	mg/L	0.0001	**0.865**	**0.869**	0
Mercury	mg/L	0.000005	<0.0000050	<0.0000050	-
Molybdenum	mg/L	0.00005	0.00346	0.0033	2
Nickel	mg/L	0.0005	0.00271	0.00265	1
Phosphorus	mg/L	0.05	<0.05	<0.05	-
Selenium	mg/L	0.00005	0.000138	0.000167	11
Silicon	mg/L	0.05	6.26	6.13	1
Silver	mg/L	0.00001	<0.000010	<0.000010	-
Strontium	mg/L	0.0002	0.651	0.619	2
Sulphur	mg/L	0.5	0.52	0.52	0
Thallium	mg/L	0.00001	0.000012	0.000013	4
Tin	mg/L	0.0001	<0.00010	<0.00010	-
Titanium	mg/L	0.0003	<0.00030	<0.00030	-
Uranium	mg/L	0.00001	0.00179	0.00176	1
Vanadium	mg/L	0.0005	<0.00050	<0.00050	-
Zinc	mg/L	0.001	0.0029	0.0018	19
Zirconium	mg/L	0.0002	0.00027	0.00027	0
Hydrocarbons					
Benzene	mg/L	0.0005	<0.00050	<0.00050	-
Toluene	mg/L	0.0005	<0.00050	<0.00050	-
Ethylbenzene	mg/L	0.0005	<0.00050	<0.00050	-
Xylene (o)	mg/L	0.0003	<0.00030	<0.00030	-
Xylenes (m & p)	mg/L	0.0004	<0.00040	<0.00040	-
Xylenes Total	mg/L	0.0005	<0.00050	<0.00050	-
Styrene	mg/L	0.0005	<0.00050	<0.00050	-
Total BTEX	mg/L	0.001	<0.0010	<0.0010	-

Notes:
RDL - Reportable detection limit.
RPD - Relative Percentage Difference calculated as RPD(%)=(|V1-V2|)/[(V1+V2)/2])*100 where V1,V2 = concentrations of parent and duplicate sample, respectively.
"-" Indicates RPD not calculated. RPDs have only been considered where both concentrations are greater than 5 times the RDL.
N/A - Not applicable.
BOLD - RPD value greater than 20%.
Shaded - Detect Value in Blank Sample.

Table 3: Groundwater Quality Assurance/Quality Control Analytical Results

Parameter	Unit	RDL	MW-04	DUPLICATE	RPD (%)
			21-Nov-2021	21-Nov-2021	
Polycyclic Aromatic Hydrocarbons (PAHs)					
Naphthalene	mg/L	0.001	<0.0010	<0.0010	-
Volatile Organic Compounds (VOCs)					
1,1,1,2-Tetrachloroethane	mg/L	0.001	<0.0010	<0.0010	-
1,1,1-Trichloroethane	mg/L	0.001	<0.0010	<0.0010	-
1,1,2,2-Tetrachloroethane	mg/L	0.001	<0.0010	<0.0010	-
1,1,2-Trichloroethane	mg/L	0.001	<0.0010	<0.0010	-
1,1-Dichloroethane	mg/L	0.001	<0.0010	<0.0010	-
1,1-Dichloroethene	mg/L	0.001	<0.0010	<0.0010	-
1,1-Dichloropropene	mg/L	0.001	<0.0010	<0.0010	-
1,2,3-Trichlorobenzene	mg/L	0.001	<0.0010	<0.0010	-
1,2,3-Trichloropropane	mg/L	0.001	<0.00050	<0.00050	-
1,2,4-Trichlorobenzene	mg/L	0.001	<0.0010	<0.0010	-
1,2,4-Trimethylbenzene	mg/L	0.001	<0.0010	<0.0010	-
1,2-Dibromo-3-chloropropane	mg/L	0.001	<0.0010	<0.0010	-
1,2-Dibromoethane	mg/L	0.001	<0.0050	<0.0050	-
1,2-Dichlorobenzene	mg/L	0.0005	<0.0010	<0.0010	-
1,2-Dichloroethane	mg/L	0.001	<0.0010	<0.0010	-
1,2-Dichloroethene (cis)	mg/L	0.001	<0.0010	<0.0010	-
1,2-Dichloroethene (trans)	mg/L	0.001	<0.0010	<0.0010	-
1,2-Dichloropropane	mg/L	0.001	<0.0010	<0.0010	-
1,3,5-Trimethylbenzene	mg/L	0.001	<0.0010	<0.0010	-
1,3-Dichlorobenzene	mg/L	0.001	<0.00050	<0.00050	-
1,3-Dichloropropane	mg/L	0.001	<0.0010	<0.0010	-
1,3-Dichloropropene	mg/L	0.0015	<0.0010	<0.0010	-
1,3-Dichloropropene [cis]	mg/L	0.001	<0.0010	<0.0010	-
1,3-Dichloropropene [trans]	mg/L	0.001	<0.0010	<0.0010	-
1,4-Dichlorobenzene	mg/L	0.001	<0.0010	<0.0010	-
2,2-Dichloropropane	mg/L	0.001	<0.0010	<0.0010	-
2-Chlorotoluene	mg/L	0.001	<0.0010	<0.0010	-
4-Chlorotoluene	mg/L	0.001	<0.0010	<0.0010	-
Bromobenzene	mg/L	0.001	<0.0010	<0.0010	-
Bromochloromethane	mg/L	0.001	<0.0010	<0.0010	-
Bromodichloromethane	mg/L	0.001	<0.0010	<0.0010	-
Bromoform	mg/L	0.001	<0.0010	<0.0010	-
Bromomethane	mg/L	0.001	<0.0015	<0.0015	-
Carbon tetrachloride	mg/L	0.0005	<0.0010	<0.0010	-
Chlorobenzene	mg/L	0.001	<0.0010	<0.0010	-
Chloroethane	mg/L	0.001	<0.0010	<0.0010	-
Chloroform	mg/L	0.001	<0.0010	<0.0010	-
Chloromethane	mg/L	0.005	<0.00050	<0.00050	-
Dibromochloromethane	mg/L	0.001	<0.0010	<0.0010	-
Dibromomethane	mg/L	0.001	<0.0010	<0.0010	-
Dichlorodifluoromethane	mg/L	0.001	<0.0010	<0.0010	-
Hexachlorobutadiene	mg/L	0.001	<0.0010	<0.0010	-
iso-Propylbenzene (cumene)	mg/L	0.001	<0.0010	<0.0010	-
Methyl t-Butyl Ether (MTBE)	mg/L	0.0005	<0.0010	<0.0010	-
Methylene Chloride	mg/L	0.001	<0.0010	<0.0010	-
n-Butylbenzene	mg/L	0.001	<0.0010	<0.0010	-
n-Propylbenzene	mg/L	0.001	<0.0010	<0.0010	-
p-Isopropyltoluene	mg/L	0.001	<0.0010	<0.0010	-
sec-Butylbenzene	mg/L	0.001	<0.0010	<0.0010	-
tert-Butylbenzene	mg/L	0.001	<0.0010	<0.0010	-
Tetrachloroethene	mg/L	0.001	<0.0020	<0.0020	-
Trichloroethene	mg/L	0.001	<0.0010	<0.0010	-
Trichlorofluoromethane	mg/L	0.001	<0.0010	<0.0010	-
Trihalomethanes	mg/L	0.002	<0.0010	<0.0010	-
Vinyl chloride	mg/L	0.001	<0.0010	<0.0010	-

Notes:
RDL - Reportable detection limit.
RPD - Relative Percentage Difference calculated as RPD(%)=(|V1-V2|)/[(V1+V2)/2])*100 where V1,V2 = concentrations of parent and duplicate sample, respectively.
"-" Indicates RPD not calculated. RPDs have only been considered where both concentrations are greater than 5 times the RDL.
N/A - Not applicable.
BOLD - RPD value greater than 20%.
Shaded - Detect Value in Blank Sample.

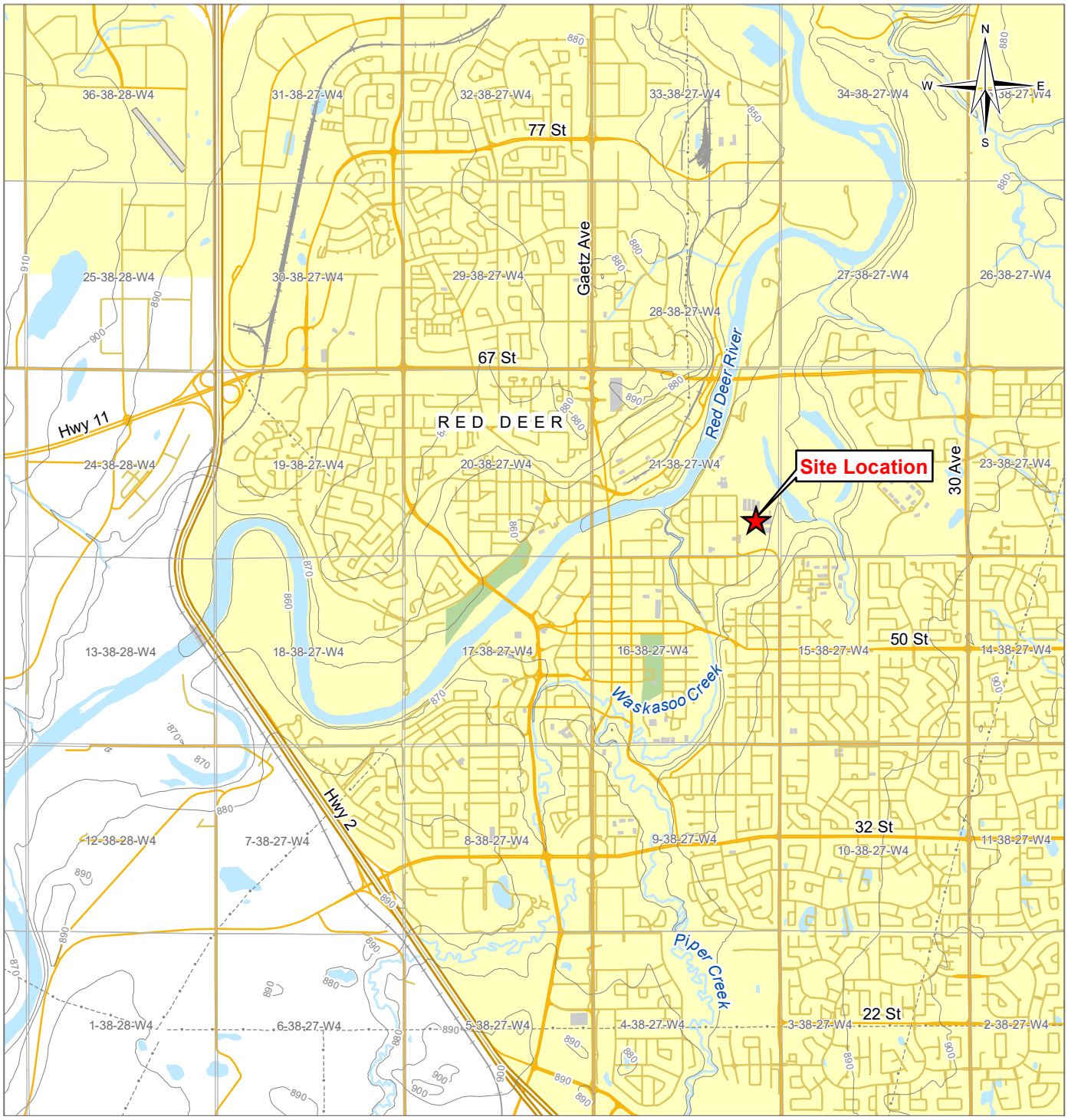
Table 4: Soil Vapour Monitoring Results

Parameter	Gas Well																		
	VW-01							VW-02							VW-03						
	Aug-13	May-19	Jun-19	Sep-19	Dec-19	Nov-21	Jun-22	Aug-13	May-19	Jun-19	Sep-19	Dec-19	Nov-21	Jun-22	Aug-13	May-19	Jun-19	Sep-19	Dec-19	Nov-21	Jun-22
Pressure (kPa)[1]	-	Could not locate						-	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0	0.0
CH_4 (%)	0.0							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
CO (ppm)[2]	-							-	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0	0.0
CO_2 (%)	5.1							2.4	0.7	1.3	2.2	0.3	1.0	0.7	1.3	0.4	0.9	1.4	0.2	0.6	1.7
O_2 (%)	13.4							20.9	20.2	18.5	19.2	22.1	21.1	20.6	21.6	20.1	19.2	19.7	21.7	20.7	15.7
Balance (% v/v)	81.5							76.7	79.1	80.2	78.6	77.6	78.0	78.7	77.2	79.4	79.9	78.9	78.0	78.7	82.6
Top of Screen (m)	1.8							2.8							1.6						
Bottom of Screen (m)	2.1							3.0							1.9						
Static Water Level (mbtoc)[3]									Dry	Dry	Dry	Dry	Dry	Dry		Dry	Dry	Dry	Dry	Dry	Dry
Depth to Bottom (m)	2.10							3.00	3.77	3.77	3.77	2.82	3.84	3.77	2.00	3.01	3.01	3.00	2.82	3.08	3.03
Stick up (m)									0.68	0.68	0.82	0.89	0.84	0.84		0.82	0.82	0.88	0.89	0.93	0.93

Parameter	Gas Well													
	VW-04							VW-05						
	Aug-13	May-19	Jun-19	Sep-19	Dec-19	Nov-21	Jun-22	Aug-13	May-19	Jun-19	Sep-19	Dec-19	Nov-21	Jun-22
Pressure (kPa)[1]	-	0.0	0.0	0.0	0.1	-23.9	0.0	-	0.0	0.0	0.0	0.1	0.0	0.0
CH_4 (%)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO (ppm)[2]	-	0.0	0.0	0.0	0.0		0.0	-	0.0	0.0	0.0	0.0	0.0	0.1
CO_2 (%)	3.0	5.0	4.0	3.4	0.1	Frozen	1.7	3.6	3.0	3.0	8.0	1.0	0.5	0.0
O_2 (%)	21.6	13.5	14.5	16.2	18.6		15.7	10.8	12.4	10.4	1.6	19.3	21.5	20.8
Balance (% v/v)	77.2	81.5	81.5	80.4	81.3		82.6	85.6	84.5	86.6	90.4	79.6	78.1	79.2
Top of Screen (m)	2.8							2.5						
Bottom of Screen (m)	3.0							2.7						
Static Water Level (mbtoc)[3]		Dry	Dry	Dry	Frozen	Frozen	Dry	-	Dry	Dry	Dry	Dry	Dry	Dry
Depth to Bottom (m)	3.00	2.93	2.91	2.93	Frozen	Frozen	2.94	2.70	2.64	2.64	2.76	2.45	2.71	2.65
Stick up (m)		-0.14	-0.14	-0.02	-0.04	-0.04	-0.01	-	-0.09	-0.09	-0.01	-0.01	-0.01	-0.04

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.

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 REVIEW

2021 & 2022 GROUNDWATER AND SOIL VAPOUR MONITORING REPORT LINDSAY THURBER HIGH SCHOOL

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. SWOP04071-02_Figure1_SiteLocation.mxd

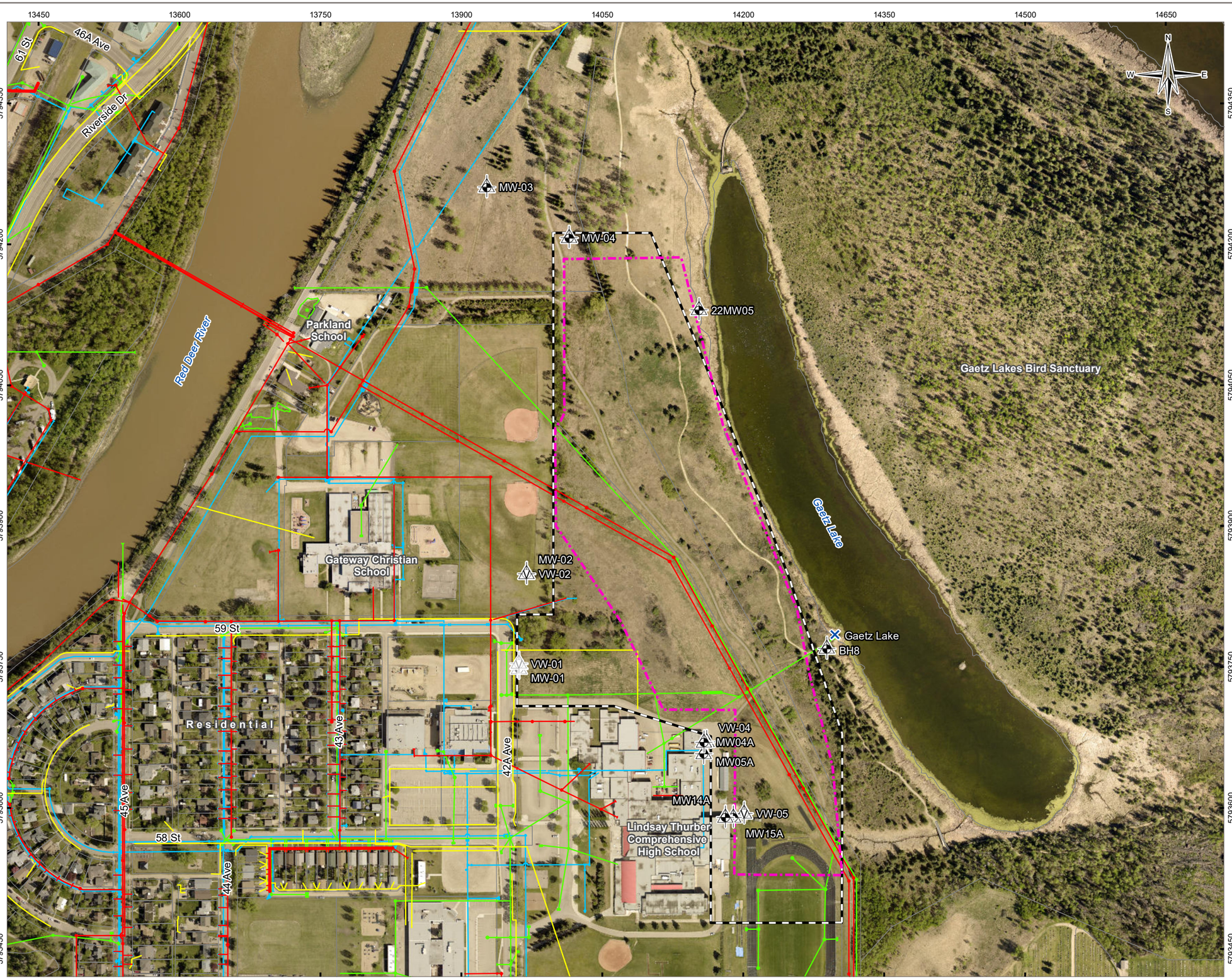
OFFICE	DWN	CKD	APVD	REV
Tt-EDM	MRV	SL	MR	0

DATE	PROJECT NO.
July 12, 2022	SWM.SWOP04071-02.002

TETRA TECH

Figure 1

Q:\Edmonton\GIS\SOLID_WASTE\SWOP\SWOP04071-02\Maps\Task002\SWOP04071-02_Figure1_SiteLocation.mxd modified 7/12/2022 by megan.verburg



LEGEND

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

Utilities

- Electrical
- Sanitary
- Storm
- Water

NOTES

Base data source: Imagery provided by ESRI; City of Red Deer (2020)
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.

STATUS
ISSUED FOR REVIEW

2021 & 2022 GROUNDWATER AND SOIL VAPOUR MONITORING REPORT LINDSAY THURBER HIGH SCHOOL

Site Plan and Surrounding Land Use

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

Scale: 1:4,000
80 40 0 80
Metres

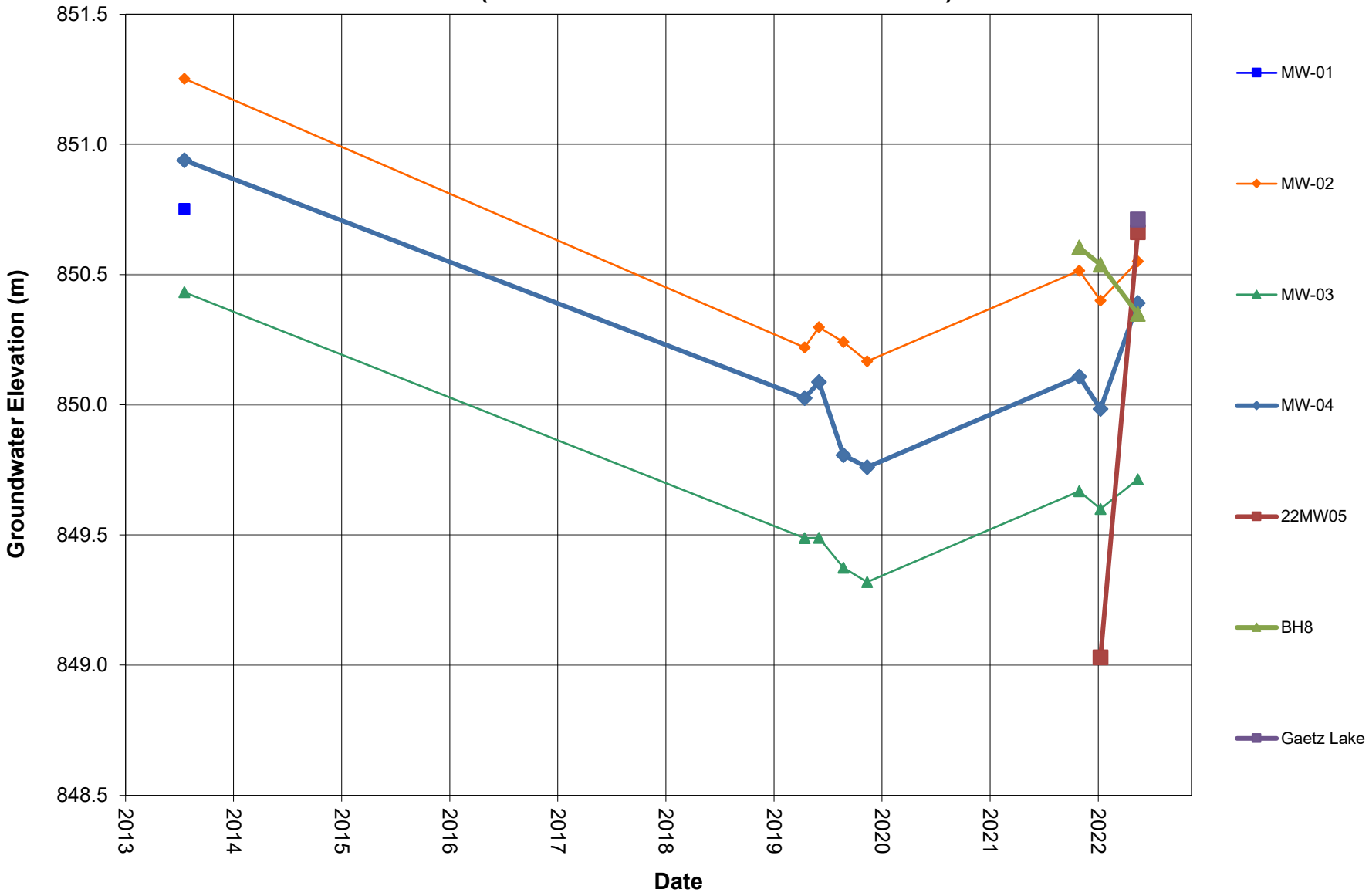
TETRA TECH

FILE NO.				
SWOP04071-02_Figure2_LandUse.mxd				
OFFICE	**DWN**	**CKD**	**APVD**	**REV**
Tt-EDM	MRV	SL	MR	0
DATE	**PROJECT NO.**			
August 15, 2022	SWM.SWOP04071-02.002			

Figure 2

Q:\Edmonton\GIS\SOLID_WASTE\SWOP\SWOP04071-02\Maps\Task002\SWOP04071-02_Figure2_LandUse.mxd modified 2022-08-15 by Darren.Schouls

FIGURE 3
HISTORICAL GROUNDWATER ELEVATIONS
(GROUNDWATER MONITORING WELLS)



TETRA TECH

13600 13750 13900 14050 14200 14350 14500

5794200 5794050 5793900 5793750 5793600

MW-03 (849.67)
849.3
849.5
850
MW-04 (850.11)
Red Deer River
850.1
850.2
22MW05 (**)
850.3
850.4
850.5
Gaetz Lake
VW-02 MW-02 (850.52)
59 St
VW-01 MW-01 (*)
43 Ave
42A Ave
MW04A (Dry) VW-04 MW05A (Dry)
MW14A VW-05 MW15A (Dry)
58 St
Gaetz Lake BH8 (850.60)

N W E S

LEGEND

- Monitoring Well
- Presumably Destroyed Monitoring Well
- Vapour Well
- Presumably Destroyed Vapour Well
- Surface Monitoring Location
- Inferred Groundwater Flow Direction
- Groundwater Elevation Contour (0.1 masl)
- (8XX.XX) Groundwater Elevation (masl)
- Historic Waste Disposal (Provided by Tiamat, 2014)
- Road

NOTES
Base data source: Imagery provided by ESRI; City of Red Deer (2020)
Roads from City of Red Deer Open Data, 2018
masl - metres above sea level
* - not measured
** - not measured, 22MW05 installed in February 2022

STATUS
ISSUED FOR REVIEW

2021 & 2022 GROUNDWATER AND SOIL VAPOUR MONITORING REPORT LINDSAY THURBER HIGH SCHOOL

Groundwater Elevation Contours November 2021

PROJECTION 3TM 114				DATUM NAD83	CLIENT THE CITY OF Red Deer
Scale: 1:3,000 50 25 0 50 Metres					TETRA TECH
FILE NO. SWOP04071-02_Figure4_GW_Nov2021.mxd					
OFFICE Tt-EDM	DWN MRV	CKD SL	APVD MR	REV 0	Figure 4
DATE October 27, 2022	PROJECT NO. SWM.SWOP04071-02.002				

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13600 13750 13900 14050 14200 14350 14500

5794200 5794050 5793900 5793750 5793600

MW-03 (849.60)
849.7
849.8
849.9
MW-04 (849.98)
850.0
850.1
22MW05* (849.03)
850.2
850.3
850.4
850.5
Gaetz Lake
Red Deer River
VW-02
MW-02 (850.40)
59 St
58 St
43 Ave
42A Ave
VW-01
MW-01 (-)
MW04A
VW-04
MW05A
MW14A
VW-05
MW15A (Dry)
Gaetz Lake
BH8 (850.54)

N W E S

LEGEND

- Monitoring Well
- Presumably Destroyed Monitoring Well
- Vapour Well
- Presumably Destroyed Vapour Well
- Surface Monitoring Location
- Inferred Groundwater Flow Direction
- Groundwater Elevation Contour (0.1 masl)
- (8XX.XX) Groundwater Elevation (masl)
- Historic Waste Disposal (Provided by Tiamat, 2014)
- Road

NOTES
Base data source: Imagery provided by ESRI; City of Red Deer (2020)
Roads from City of Red Deer Open Data, 2018
masl - metres above sea level
"-" not measured
* 22MW05 excluded from groundwater contouring

STATUS
ISSUED FOR REVIEW

2021 & 2022 GROUNDWATER AND SOIL VAPOUR MONITORING REPORT LINDSAY THURBER HIGH SCHOOL

Groundwater Elevation Contours February 2022

PROJECTION 3TM 114	**DATUM** NAD83			**CLIENT** The City of Red Deer
Scale: 1:3,000 (50 25 0 50 Metres)				TETRA TECH
FILE NO. SWOP04071-02_Figure5_GW_Feb2022.mxd				
OFFICE Tt-EDM	**DWN** MRV	**CKD** SL	**APVD** MR	**REV** 0
DATE October 27, 2022	**PROJECT NO.** SWM.SWOP04071-02.002			**Figure 5**

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LEGEND

- Monitoring Well
- Presumably Destroyed Monitoring Well
- Vapour Well
- Presumably Destroyed Vapour Well
- Surface Monitoring Location
- Inferred Groundwater Flow Direction
- Groundwater Elevation Contour (0.15 masl)
- (8XX.XX) Groundwater Elevation (masl)
- Historic Waste Disposal (Provided by Tiamat, 2014)
- Road

NOTES
Base data source: Imagery provided by ESRI; City of Red Deer (2020)
Roads from City of Red Deer Open Data, 2018
masl - metres above sea level
* - not measured

STATUS
ISSUED FOR REVIEW

2021 & 2022 GROUNDWATER AND SOIL VAPOUR MONITORING REPORT LINDSAY THURBER HIGH SCHOOL

Groundwater Elevation Contours June 2022

PROJECTION 3TM 114	**DATUM** NAD83		**CLIENT** THE CITY OF Red Deer
Scale: 1:3,000 — 50 25 0 50 — Metres			TETRA TECH
FILE NO. SWOP04071-02_Figure6_GW_June2022.mxd			
OFFICE Tt-EDM	**DWN** MRV	**CKD** SL	**APVD** MR / **REV** 0
DATE October 27, 2022	**PROJECT NO.** SWM.SWOP04071-02.002		**Figure 6**

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APPENDIX A

TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOENVIRONMENTAL

1.1 USE OF DOCUMENT AND OWNERSHIP

This document pertains to a specific site, a specific development, and a specific scope of work. The document may include plans, drawings, profiles and other supporting documents that collectively constitute the document (the "Professional Document").

The Professional Document is intended for the sole use of TETRA TECH's Client (the "Client") as specifically identified in the TETRA TECH Services Agreement or other Contractual Agreement entered into with the Client (either of which is termed the "Contract" herein). TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Professional Document when it is used or relied upon by any party other than the Client, unless authorized in writing by TETRA TECH.

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1.2 ALTERNATIVE DOCUMENT FORMAT

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.

Both electronic file and/or hard copy versions of TETRA TECH's Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH's Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

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

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Professional Document.

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.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

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.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by third parties 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 exploration, 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

SITE HISTORY, HISTORICAL INFORMATION, AND SITE SETTING

1.0 SITE HISTORY

The following section summarizes the history of the Lindsay Thurber Comprehensive High School (LTCHS) site and was developed for the 2019 groundwater and soil vapour monitoring report[1].

The LTCHS was initially constructed in 1954. Waste disposal at the site is estimated to have occurred from 1965 to 1967 (two years), adjacent to the school. Historical information indicates the waste as being household municipal solid waste (MSW) including a mixture of plastics, cans, paper, scrap metals, wires, and glass. Bricks, wood, and concrete were also encountered during the Phase II environmental site assessment (ESA) investigation[2]. A historical ESA conducted on behalf of the Red Deer Public Schools District No. 104[3] identified that the waste was understood to be generally infilled in natural depressions, founded on the alluvial gravels; the water table was indicated to be at or just below the base of the waste level.

Historical waste disposal was identified during the 2014 Phase II ESA to be east and north of LTCHS. The waste area extends to the north, into an undeveloped field, to the east towards Gaetz Lake, to the LTCHS track in the south and to the boundary of the Gateway Christian School (formerly River Glen School) yard in the west. Estimated waste extents are identified on Figure 2. The Phase II ESA estimated the total area of buried waste at approximately 105,800 m^2. The former landfill is inactive and closed.

Results of the Phase II ESA conducted by Tiamat indicate that surface material of sand and loam was overlying the buried MSW material. Strong odours were released during the drilling activities near surface. The cover soils ranged from 10 cm to 50 cm in thickness. The MSW was mixed with fill consisting of silty sand. Groundwater was encountered at approximately 2.8 m below grade (mbg).

2.0 HISTORICAL GROUNDWATER MONITORING AND INVESTIGATION SUMMARY

Monitoring wells were installed in 2013, including four groundwater monitoring wells (MW-01 to MW-04), five vapour wells (VW-01 to VW-05) within and beside the waste material boundary, and a further eight testhole locations were drilled.

Previous reports prepared by Tiamat include the following:

- Phase I Environmental Site Assessment, Historic Waste Disposal Site, Lindsay Thurber High School, The City of Red Deer. September 24, 2013[4].
- Phase II Environmental Site Assessment, Historic Waste Disposal Site, Lindsay Thurber High School, The City of Red Deer. March 6, 2014[2].

[1] Tetra Tech Canada Inc. 2020. 2019 Groundwater and Soil Vapour Monitoring Report – Lindsay Thurber Comprehensive High School. Prepared for The City of Red Deer. October 2020. Project Number: 704-SWM.SWOP04071-01.002

[2] Tiamat Environmental Consultants Ltd. 2014. Phase II Environmental Site Assessment, Historic Waste Disposal Site, Lindsay Thurber High School, The City of Red Deer. Dated March 6, 2014.

[3] Parkland Geotechnical Consulting. 2004. Phase 2 – Environmental Site Investigation, Landfill at Lindsay Thurber Comprehensive High School Property, SE 21-38-27-W4M, Red Deer Alberta. Dated June 2004.

[4] Tiamat Environmental Consultants Ltd. 2013. Phase I Environmental Site Assessment, Historic Waste Disposal Site, Lindsay Thurber High School, The City of Red Deer. Dated September 24, 2013.

- Environmental Risk Management Plan, Historic Waste Disposal Sites, Lindsay Thurber High School, The City of Red Deer. April 1, 2014[5].

The above work supplemented earlier investigation by Parkland Geotechnical[3] which included numerous additional testhole locations. The results of the Phase II ESA conducted by Tiamat in 2014 indicated the following:

- The waste disposal area is estimated to be 105,800 m^2 and is overlying native gravels and sand.
- Groundwater was located at approximately 2.8 mbg and is within the waste material. The horizontal gradient is 0.3% towards the northwest. The horizontal permeability of 10^{-5} m/sec for the sand unit was applied giving a horizontal velocity of 2.7 m/day.
- Volatile organic compounds (VOCs) and petroleum hydrocarbons (PHCs) were not detected at the hydraulically down-gradient groundwater monitoring wells in 2013.
- Several parameters indicative of leachate were present in the groundwater samples collected hydraulically down-gradient of site. Leachate indicator parameters at these wells consisted of inorganic compounds and nutrients, and indicated high negative redox potential and anoxic conditions in the groundwater.
- Schools, residential homes, natural areas, and public buildings are located on adjacent and nearby lands of the site. No nearby activities were interpreted to be environmental concerns relative to the site.
- Soil vapour samples from the vapour wells at LTCHS contained volatile PHCs to carbon chain 12 and semi-volatile, oxygenated, and halogenated volatile hydrocarbons and ketones.

The recommendations of the program were as follows:

- Monitor groundwater elevations and soil vapour data quarterly for one hydrogeological cycle.
- Determine if additional groundwater wells should be included to determine exposure from leachate contaminants.
- 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 recommendations of a subsequent RMP[5] were as follows:

- An additional monitoring event may be effective in verifying the mitigation methods for development at the site.
- 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.

[5] Tiamat Environmental Consultants Ltd. 2014. Environmental Risk Management Plan, Historic Waste Disposal Sites, Lindsay Thurber High School, The City of Red Deer. Dated April 1, 2014.

3.0 GAS MITIGATION

Historical assessment work in 2004[3] recommended a gas interceptor trench along the east side of the school, and sealing of utility trenches in the vicinity. Subsequently, RMP and landfill gas (LFG) management proposal was prepared by Parkland Geotechnical[6] in support of a waiver request by the Red Deer Public Schools District No. 104 to reduce the setback for new development. While the setback would only apply to planned renovations and expansion at the school, we understand the intent of the system was to address both existing and new development. Based on the proposed design[6], we understand the system was proposed to include the following:

- An engineered barrier composed of a trench filled with permeable aggregate, approximately 200 m long and approximately 25 m from the eastern wall of the school. The trench would extend to approximately 5 m depth (0.5 m to 1.0 m below the water table), and the uppermost 1.2 m of the trench would be backfilled with a clay cap.
- A 30 mil geomembrane would be installed on the western side of the trench (i.e., closest to the school). A ventilation pipe would be installed near the base of the trench, and a vacuum/blower would be connected to allow active ventilation of any gas build up.
- On the west side of the trench, some degree of sealing/plugs would be used in utility backfill, and any encountered waste or permeable soils would be removed and replaced with fine-grained materials. Further, a 'degassing program' would be undertaken west of the trench using existing wells.
- A deeper horizontal drain was also described at the base of the trench, and below the water table, to allow for possible gas stripping, if required.
- A monitoring program would be implemented, including installation of new probes, indoor air monitoring, and automated monitoring/alarms within the building.

The reporting indicates that the waiver application was made in consultation with the School District, The City, the David Thompson Health District, and Alberta Environment. It further noted that the recommended design was based on the existing landfill capping, and that if cap improvements were to be made in the future (e.g., installation of an impermeable cover), that further evaluation of the system would be required.

Further details of the setback request, and as-built or record details of the trench are not known; however, subsequent reporting[7] indicates the system was installed in March 2005.

The Tiamat Phase I report included copies of two monitoring reports prepared in relation to the LFG interceptor trench and covering semi-annual monitoring undertaken between 2009 and 2013[8][9]. Subsequent monitoring reports were reviewed from 2014 and most recently 2019[7]. The results demonstrated the trench was effective at limiting subsurface methane concentrations west of the trench. The monitoring program as reported was focused on LFG probes and did not reference active ventilation or indoor air monitoring. The most recent reporting[7] indicates that the monitoring was initially monthly, then has been semi-annual between 2009 and the 2019 reporting period. We are not aware of details of the current operation of the interceptor trench or the nature of interior monitoring, if any.

[6] Parkland Geotechnical Consulting. 2004b. Landfill Gas Control Proposal and Risk Management Plan, Old Landfill Near Lindsay Thurber Comprehensive High School, SE 21-38-27-W4M, Red Deer Alberta. Dated August 2004.

[7] Parkland Geotechnical Consulting. 2019. Lindsay Thurber Comprehensive High School, 2019 Gas Monitoring Program, Summary of Results – November Event, Red Deer Alberta. Dated February 2019.

[8] Parkland Geotechnical Consulting. 2011. Lindsay Thurber Comprehensive High School, 2011 Gas Monitoring Program. Dated October 31, 2011.

[9] Parkland Geotechnical Consulting. 2013. Lindsay Thurber Comprehensive High School, 2013 Gas Monitoring Program. Dated June 3, 2013.

4.0 SITE SETTING

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

4.1 Geology

The following sections summarize the regional and local geology.

4.1.1 Geological Setting and Stratigraphy

The City and site are located within the Red Deer River drainage basin with principal drainage via the Red Deer River located west of the site. The river has incised the uplands with gentle slopes to the east and west of the river in the vicinity of the site.

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. Historical oxbows of the river are evident in the river valley, including the adjacent Gaetz Lake.

Key elements of the geological setting are presented below from Tiamat's 2013 Phase I Report[4]:

"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. Published information indicates the banks of the Red Deer River comprise of dirty gravel with thickness ranging from 6 to 12 m, more or less.

In the valley, lies preglacial Saskatchewan gravels and sand. Terrace gravels hydraulically connected to the Red Deer River are a known resource of groundwater. Surficial soils comprise largely of poorly to moderately sorted sand, silt and gravel with a varying amount of clay. The fluvial sediments generally have obscure bedding planes. Medium to coarse sized gravel with cross-bedded sand have been documented."

The Tertiary bedrock consists of sequences of alternating shales and sandstones of the Paskapoo Formation. The Paskapoo Formation underlies the gravel sediments. This non-marine bedrock is composed of mudstone, siltstone and sandstone. The formation of the Rocky Mountains subjected the Paskapoo Formation to a regional stress-induced fracture pattern."

4.1.2 Local Geology

The site is relatively flat, slightly sloping towards the northwest. Based on the borehole logs completed during the Phase II ESA conducted by Tiamat, in the waste footprint, there are soils comprised of loam and sand fill overlying the MSW to depths of approximately 5 mbg. The wastes are overlying clay and sand. Outside of the waste footprint, there are surficial fills to a depth of approximately 5 mbg, overlying sandstone bedrock, which was encountered at MW-01, MW-02, and MW-04, based on Tiamat's cross-sections[2]. The presence of bedrock near 5 mbg at these three borehole locations suggest that the buried channel that is mapped as trending northeasterly, approximately

beneath LTCHS[10], is not present in that area of the site. MSW was encountered at all testholes extending north to south (A to A'), in the northeastern portion of the site (B) and in the southern portion of the site east of LTCHS (C')[2].

4.2 Hydrogeology

The following sections summarize the regional and local hydrogeology.

4.2.1 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 bedrock valley trending north-northeast in the vicinity of the site.

Key elements of the hydrogeological setting are presented below from Tiamat's 2013 Phase I Report[4]:

"A significant buried valley and aquifer resource trending northeastward through the city has been partially mapped and lies in the SE 28-38-27 W4M (MacKenzie Trail and Riverside). This buried valley extends to a depth of 21 m, more or less and may extend to the south into north portions of 21-28-27 W4M." Mapping by the Alberta Geological Survey[15] indicates that the valley could be beneath the site trending in a north-northeast direction, however the width of the valley is not defined.

"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.

Numerous permanent surface water features within The City of Red Deer and vicinity include Red Deer River, Waskasoo Creek, Gaetz Lakes, Hazlett Lake, Bower Ponds (result of formerly mining gravel resources), various sloughs in the fringe areas of the city and an assortment of other smaller creeks and springs."

The regional groundwater flow is expected to follow the bedrock topography and will be influenced by the varying distribution of sediments in the river valley, which will have been deposited in various historical channels since filled in under varying depositional environments. Further, the river is in hydrologic connection with the adjacent sediments; therefore, seasonal changes in the river stage will affect the local groundwater flow patterns (magnitude and direction). In seasons of higher river flow, bank storage will occur, whereas in seasons of lower flow (such as late summer/fall), the storage will be released.

4.2.2 Local Hydrogeology

The closest surface waterbody to the site is Gaetz Lake (westerly one) located adjacent to the east and the easterly Gaetz Lake, located approximately 580 m east of the site. The two lakes are a set of oxbow lakes that have been cut off from the Red Deer River, leaving free standing bodies of water[4]. The Red Deer River is located northwest of

[10] Andriashek, L. comp. 2018. Thalwegs of bedrock valleys, Alberta (GIS data, line features); Alberta Energy Regulator, AER/AGS Digital Data 2018-0001.

the site approximately 250 m from the north waste boundary. The river flows in a northerly direction. Shallow groundwater is assumed to flow towards the river[2].

4.3 Groundwater Resource Usage

A search of the Alberta Water Well Database in January 2020 for groundwater users within a 1 km radius of LTCHS identified nine water wells; two of the wells are listed as domestic use, one is listed as domestic and industrial use, three are listed as industrial use, and three are listed as investigation[11].

The nearest water well to site is located approximately 600 m northwest of site, on the opposite (west) side of the Red Deer River. The proposed well use is listed as for investigation purposes. The water wells within a 1 km radius of the site range from 4.5 mbg to 225 mbg. The status and use of the surrounding groundwater wells were not confirmed and they were not field verified.

5.0 HAZARD QUOTIENTS

5.1 2019 Hazard Quotient Calculations

Using the soil vapour screening levels described in the 2019 groundwater and soil monitoring report and the soil vapour sampling results, estimated cancer risks (for carcinogens) and estimated hazard quotients (HQs) (for non-carcinogens) were calculated for the site.

Estimated risks are 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 HQs represent the soil vapour concentration divided by the corresponding soil vapour screening level for non-carcinogenic effects.

For this evaluation, cumulative target risk and hazard levels were determined in accordance with Alberta Tier 2 Guidelines[12]. 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 levels for carcinogens in the samples collected ranged between 5×10^{-7} to 3.4×10^{-8}. The cumulative hazard levels identified in the samples collected for the non-carcinogens ranged between 0.007 to 0.053.

The estimated individual and cumulative risks and hazards associated with the soil vapour samples collected in December 2019 did not exceed the corresponding target risk and hazard levels in any of the samples collected.

[11] Alberta Environment and Parks. 2019. Water Well Database. Information obtained included in Appendix C. http://www.telusgeomatics.com/tgpub/ag_water/.

[12] Alberta Environment and Parks. 2019. Alberta Tier 2 Soil and Groundwater Remediation Guidelines. Land Policy Branch, Policy and Planning Division. 150 pp.

5.2 Review of the 2014 Hazard Quotients from the Risk Management Plan

The 2014 RMP presented a proposed site-specific environmental RMP 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[2]. Further, underground utility workers and subsurface utility infrastructure were considered relevant to potential exposure.

The RMP applied a 10x factor of safety to the HQs to address uncertainties. HQs from the RMP ranged up to 567 (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[13], 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. HQs 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 (chloromethane, trichloroethene, tetrachloroethene, 1,2,4-trimethylbenzene, and cis-1,2-dichloroethene) identified that none of the 2013 concentrations would have unacceptable HQs using the updated CCME methodology.

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 individual HQ and cancer risks calculated by XCG[14]. 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.

[13] Canadian Council of Ministers of the Environment. 2014. A Protocol for the Derivation of Soil Vapour Quality Guidelines for Exposure Protection of Human Exposures via Inhalation of Vapours. Available online: http://cegg-rcqe.ccme.ca/en/index.html.

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

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 Pa 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.

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.

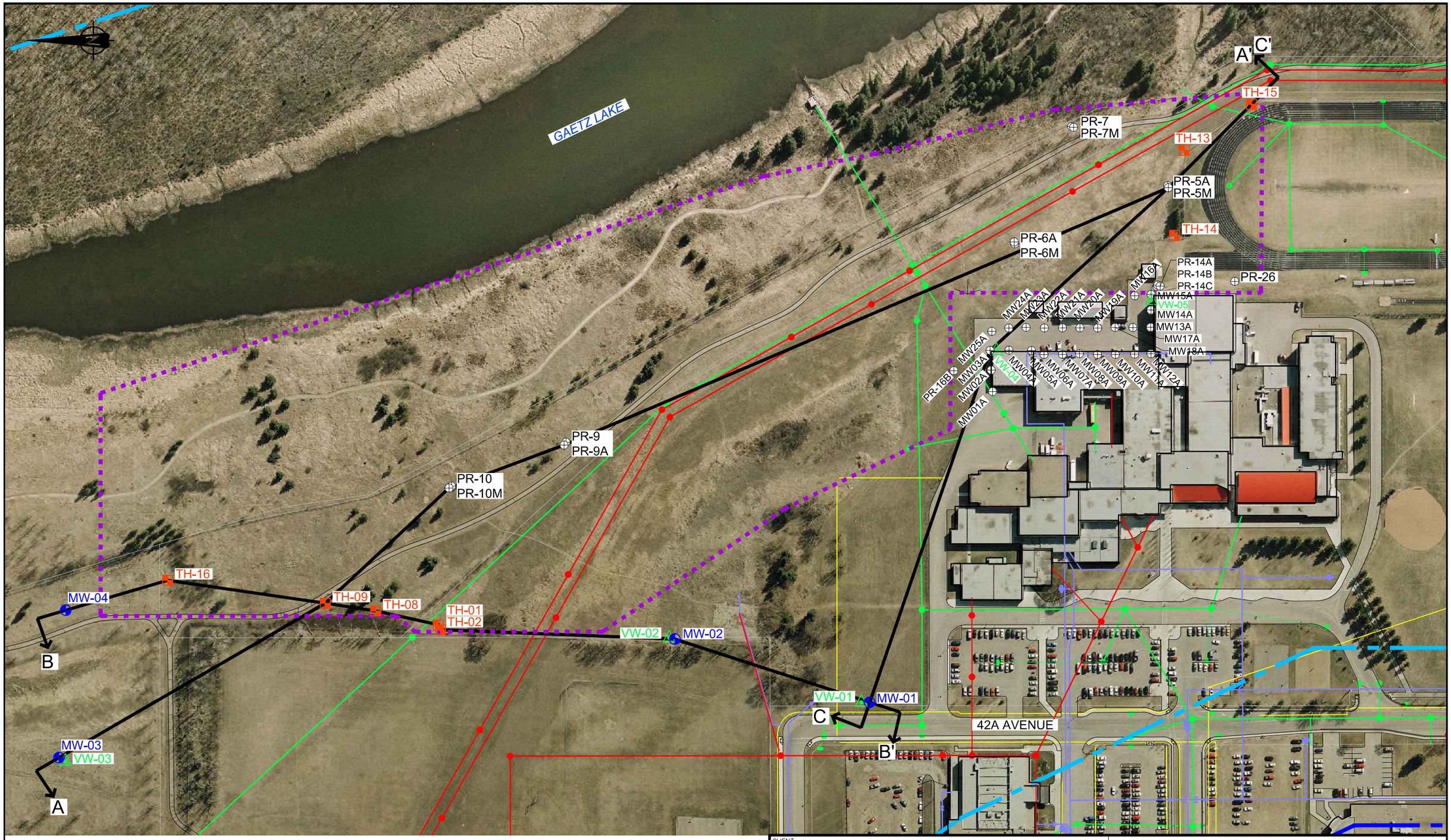
   Installation of geomembrane and active soil vapour extraction with system fault notification alarm.

For consistency with XCG's approach from 2017, we compared individual HQs with the individual target hazard level (0.2). Based on the 2019 program, the greatest individual HQ calculated for the site was 0.0008 (vs the individual target hazard level of 0.2) and the greatest estimated cancer risk was 3.4×10^{-8} (vs target Risk of 1.0×10^{-5}). While development at the site is not currently proposed, for illustrative purposes, based on these HQs and cancer risk levels calculated from the 2019 vapour data, no passive or active measures would be required for the site. It is noted that even if the 10x factor of safety is applied, mitigative measures would still not be required. Similarly, with cumulative risks and HQs the same conclusion can be drawn. The assumptions made in the calculations of HQs and cancer risk above are inherently conservative; therefore, applying a factor of safety is not needed.

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.

APPENDIX C

CROSS-SECTIONS (TIAMAT 2014)



SOURCE
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0 20 50 100m
Scale 1:2000

PHASE II TEST LOCATIONS
- MW-## GROUNDWATER MONITORING WELL INSTALLED BY TIAMAT (4)
- TH-## TESTHOLE (7)
- VW-## SOIL VAPOUR MONITORING WELL (5)
- MW-## GROUNDWATER MONITORING WELL INSTALLED BY OTHERS (40)
- ** APPROXIMATE LOCATION - NOT SURVEYED

LEGEND
- HISTORIC WASTE DISPOSAL
- LOT BOUNDARY
- CROSS SECTION LOCATION
- ELECTRICAL
- SANITARY
- STORM
- WATER

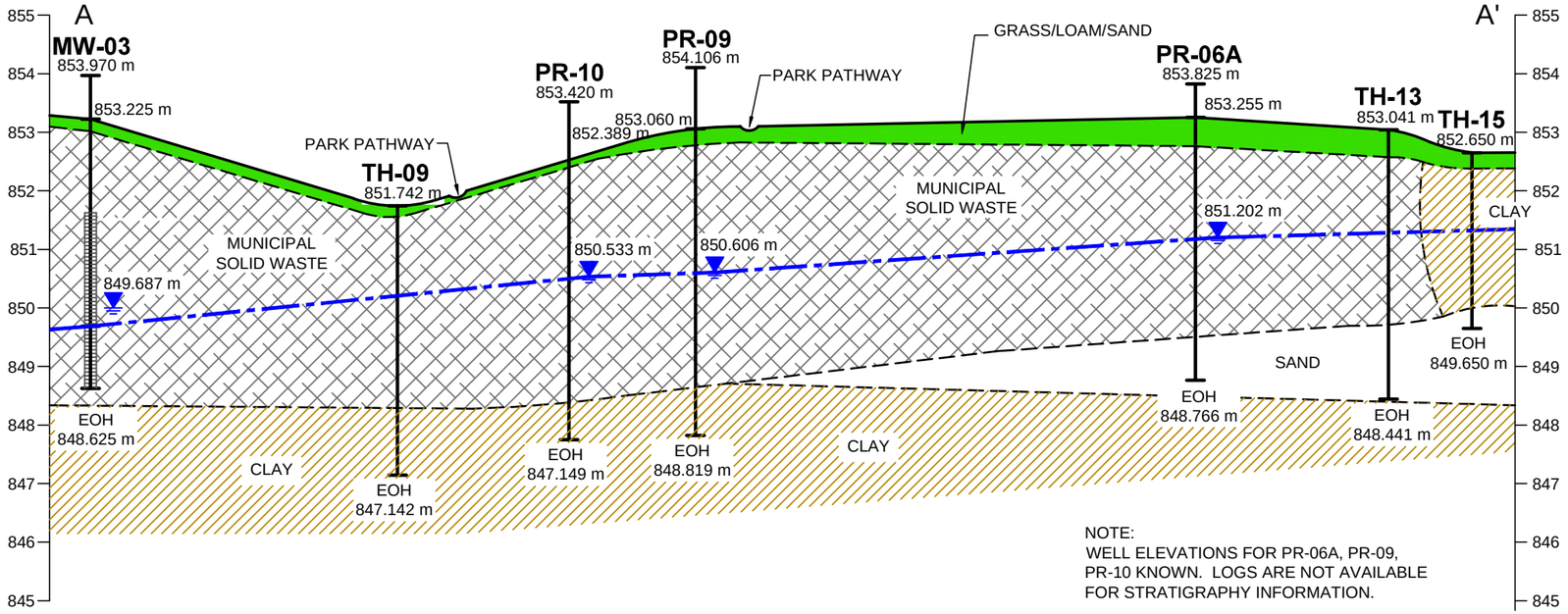
CLIENT: THE CITY OF RED DEER

PROJECT: ENVIRONMENTAL RISK MANAGEMENT PLAN
HISTORIC WASTE DISPOSAL SITE
LINDSAY THURBER COMPREHENSIVE HIGH SCHOOL SITE

TITLE: SITE SHOWING INTERPRETED EXTENT OF WASTE

Tiamat Environmental Consultants Ltd.

SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
1 : 2000	JAN. 6/13	12-435	FIGURE 2
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: ERMP v1.01.dwg	



CLIENT:	THE CITY OF RED DEER
PROJECT:	PHASE II ESA HISTORIC WASTE DISPOSAL SITES LTCHS PTN NE & SE 21-38-27 W4M
TITLE:	CROSS SECTIONS A - A', B - B' AND C - C'

Tiamat Environmental Consultants Ltd.

SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
1 : 2000	MAR. 14/14	12-435	FIGURE 3
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: Section v1.03.dwg	

APPENDIX D

LABORATORY ANALYTICAL REPORTS

CERTIFICATE OF ANALYSIS

Work Order	: **CG2105959**	Page	: 1 of 7
Client	: **Tetra Tech Canada Inc.**	Laboratory	: Calgary - Environmental
Contact	: Darby Madalena	Account Manager	: Milica Papic
Address	: 115 - 200 Rivercrest Dr SE Calgary AB Canada T2C 2X5	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: 403 203 3355	Telephone	: +1 403 407 1800
Project	: SWM.SWOP04071-02.002	Date Samples Received	: 24-Nov-2021 09:35
PO	: SWM.SWOP04071-02.002	Date Analysis Commenced	: 24-Nov-2021
C-O-C number	: LINDSAY THURBER	Issue Date	: 01-Dec-2021 15:03
Sampler	: RYAN MILLER		
Site	: ----		
Quote number	: Q71650 City of Red Deer Pre-1972 Landfill Monitoring		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Daniel Ching	Lab Analyst	Metals, Calgary, Alberta
Joshua Stessun	Laboratory Analyst	Organics, Calgary, Alberta
Mackenzie Lamoureux	Lab Assistant	Metals, Calgary, Alberta
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta
Sara Niroomand		Inorganics, Calgary, Alberta
Sara Niroomand		Metals, Calgary, Alberta
Shirley Li		Metals, Calgary, Alberta
Vladka Stamenova	Analyst	Inorganics, Calgary, Alberta

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
µg/L	micrograms per litre
µS/cm	Microsiemens per centimetre
meq/L	milliequivalents per litre
mg/L	milligrams per litre
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLDS	*Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.*

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	MW-02	MW-03	MW-04	BH8	DUPLICATE
					Client sampling date / time	21-Nov-2021 13:50	21-Nov-2021 13:15	21-Nov-2021 13:00	21-Nov-2021 13:35	21-Nov-2021
						CG2105959-001	CG2105959-002	CG2105959-003	CG2105959-004	CG2105959-005
						Result	Result	Result	Result	Result
Physical Tests										
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L		544	577	596	820	589
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	<1.0
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	<1.0
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L		446	473	488	672	483
conductivity	----	E100	1.0	µS/cm		1110	866	834	1380	829
hardness (as CaCO3), dissolved	----	EC100	0.60	mg/L		508	389	378	686	369
pH	----	E108	0.10	pH units		7.87	7.77	7.87	7.73	7.94
solids, total dissolved [TDS], calculated	----	EC103	1.0	mg/L		691	546	524	876	519
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		0.684	0.960	0.204	0.589	0.257
chloride	16887-00-6	E235.Cl	0.50	mg/L		98.4	30.0	18.5	70.2	19.6
fluoride	16984-48-8	E235.F	0.020	mg/L		0.160	0.246	0.230	0.153	0.229
nitrate (as N)	14797-55-8	E235.NO3	0.020	mg/L		<0.100 DLDS	<0.100 DLDS	<0.020	<0.100 DLDS	<0.100 DLDS
nitrite (as N)	14797-65-0	E235.NO2	0.010	mg/L		<0.050 DLDS	<0.050 DLDS	<0.010	<0.050 DLDS	<0.050 DLDS
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L		71.4	<1.50 DLDS	1.36	81.7	1.71
Ion Balance										
anion sum	----	EC101	0.10	meq/L		13.2	10.3	10.3	17.1	10.2
cation sum	----	EC101	0.10	meq/L		12.7	11.0	10.3	16.5	10.1
ion balance (cation-anion difference)	----	EC101	0.010	%		1.93	3.29	<0.010	1.78	0.493
Dissolved Metals										
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L		0.0024	0.0154	<0.0010	0.0055	<0.0010
antimony, dissolved	7440-36-0	E421	0.00010	mg/L		<0.00010	0.00018	<0.00010	<0.00050 DLDS	<0.00010
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L		0.00959	0.0333	0.0107	0.00160	0.0105
barium, dissolved	7440-39-3	E421	0.00010	mg/L		0.530	1.85	0.777	0.570	0.770
beryllium, dissolved	7440-41-7	E421	0.000020	mg/L		<0.000020	<0.000020	<0.000020	<0.000100 DLDS	<0.000020
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000250 DLDS	<0.000050
boron, dissolved	7440-42-8	E421	0.010	mg/L		0.046	0.055	0.036	0.059	0.035
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L		0.0000168	0.0000136	0.0000114	0.0000634	0.0000103
calcium, dissolved	7440-70-2	E421	0.050	mg/L		129	94.6	95.9	178	92.5
chromium, dissolved	7440-47-3	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00250 DLDS	<0.00050

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	MW-02	MW-03	MW-04	BH8	DUPLICATE
					Client sampling date / time	21-Nov-2021 13:50	21-Nov-2021 13:15	21-Nov-2021 13:00	21-Nov-2021 13:35	21-Nov-2021
						CG2105959-001	CG2105959-002	CG2105959-003	CG2105959-004	CG2105959-005
						Result	Result	Result	Result	Result
Dissolved Metals										
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L		0.00043	0.00084	0.00257	0.00357	0.00255
copper, dissolved	7440-50-8	E421	0.00020	mg/L		<0.00020	0.00093	0.00070	<0.00100 DLDS	<0.00020
iron, dissolved	7439-89-6	E421	0.010	mg/L		7.67	17.2	4.00	1.07	3.91
lead, dissolved	7439-92-1	E421	0.000050	mg/L		<0.000050	0.000061	<0.000050	<0.000250 DLDS	<0.000050
lithium, dissolved	7439-93-2	E421	0.0010	mg/L		0.0275	0.0196	0.0146	0.0194	0.0138
magnesium, dissolved	7439-95-4	E421	0.100	mg/L		45.1	37.2	33.6	58.7	33.6
manganese, dissolved	7439-96-5	E421	0.00010	mg/L		0.490	0.437	0.865	1.52	0.869
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L		<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L		0.00303	0.00753	0.00346	0.00123	0.00330
nickel, dissolved	7440-02-0	E421	0.00050	mg/L		0.00170	0.00132	0.00271	0.00480	0.00265
phosphorus, dissolved	7723-14-0	E421	0.050	mg/L		<0.050	<0.050	<0.050	<0.250 DLDS	<0.050
potassium, dissolved	7440-09-7	E421	0.100	mg/L		4.77	6.00	3.59	3.97	3.58
selenium, dissolved	7782-49-2	E421	0.000050	mg/L		<0.000050	0.000138	0.000138	<0.000250 DLDS	0.000167
silicon, dissolved	7440-21-3	E421	0.050	mg/L		6.18	7.80	6.26	6.47	6.13
silver, dissolved	7440-22-4	E421	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000050 DLDS	<0.000010
sodium, dissolved	17341-25-2	E421	0.050	mg/L		49.2	54.7	56.2	58.7	56.2
strontium, dissolved	7440-24-6	E421	0.00020	mg/L		0.719	0.614	0.651	0.694	0.619
sulfur, dissolved	7704-34-9	E421	0.50	mg/L		25.9	<0.50	0.52	29.8	0.52
thallium, dissolved	7440-28-0	E421	0.000010	mg/L		<0.000010	<0.000010	0.000012	<0.000050 DLDS	0.000013
tin, dissolved	7440-31-5	E421	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00050 DLDS	<0.00010
titanium, dissolved	7440-32-6	E421	0.00030	mg/L		<0.00030	0.00041	<0.00030	<0.00150 DLDS	<0.00030
uranium, dissolved	7440-61-1	E421	0.000010	mg/L		0.00294	0.000266	0.00179	0.00705	0.00176
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00250 DLDS	<0.00050
zinc, dissolved	7440-66-6	E421	0.0010	mg/L		0.0025	0.0042	0.0029	<0.0050 DLDS	0.0018
zirconium, dissolved	7440-67-7	E421	0.00020	mg/L		<0.00020	0.00073	0.00027	<0.00100 DLDS	0.00027
dissolved mercury filtration location	----	EP509	-	-		Field	Field	Field	Field	Field
dissolved metals filtration location	----	EP421	-	-		Field	Field	Field	Field	Field
Volatile Organic Compounds										
benzene	71-43-2	E611E	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
bromobenzene	108-86-1	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
bromochloromethane	74-97-5	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	MW-02	MW-03	MW-04	BH8	DUPLICATE
					Client sampling date / time	21-Nov-2021 13:50	21-Nov-2021 13:15	21-Nov-2021 13:00	21-Nov-2021 13:35	21-Nov-2021
						CG2105959-001	CG2105959-002	CG2105959-003	CG2105959-004	CG2105959-005
						Result	Result	Result	Result	Result
Volatile Organic Compounds										
bromodichloromethane	75-27-4	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
bromoform	75-25-2	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
bromomethane	74-83-9	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
butylbenzene, n-	104-51-8	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
butylbenzene, sec-	135-98-8	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
butylbenzene, tert-	98-06-6	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
carbon tetrachloride	56-23-5	E611E	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
chlorobenzene	108-90-7	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
chloroethane	75-00-3	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
chloroform	67-66-3	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
chloromethane	74-87-3	E611E	5.0	µg/L		<5.0	<5.0	<5.0	<5.0	<5.0
chlorotoluene, 2-	95-49-8	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
chlorotoluene, 4-	106-43-4	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
cymene, p-	99-87-6	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
dibromo-3-chloropropane, 1,2-	96-12-8	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
dibromochloromethane	124-48-1	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
dibromoethane, 1,2-	106-93-4	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
dibromomethane	74-95-3	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
dichlorobenzene, 1,2-	95-50-1	E611E	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
dichlorobenzene, 1,3-	541-73-1	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
dichlorobenzene, 1,4-	106-46-7	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
dichlorodifluoromethane	75-71-8	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
dichloroethane, 1,1-	75-34-3	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
dichloroethane, 1,2-	107-06-2	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
dichloroethylene, 1,1-	75-35-4	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
dichloroethylene, cis-1,2-	156-59-2	E611E	1.0	µg/L		7.5	1.9	<1.0	2.1	<1.0
dichloroethylene, trans-1,2-	156-60-5	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
dichloromethane	75-09-2	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
dichloropropane, 1,2-	78-87-5	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
dichloropropane, 1,3-	142-28-9	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
dichloropropane, 2,2-	594-20-7	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	MW-02	MW-03	MW-04	BH8	DUPLICATE
					Client sampling date / time	21-Nov-2021 13:50	21-Nov-2021 13:15	21-Nov-2021 13:00	21-Nov-2021 13:35	21-Nov-2021
						CG2105959-001	CG2105959-002	CG2105959-003	CG2105959-004	CG2105959-005
						Result	Result	Result	Result	Result
Volatile Organic Compounds										
dichloropropylene, 1,1-	563-58-6	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
dichloropropylene, cis+trans-1,3-	542-75-6	E611E	1.5	µg/L		<1.5	<1.5	<1.5	<1.5	<1.5
dichloropropylene, cis-1,3-	10061-01-5	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
dichloropropylene, trans-1,3-	10061-02-6	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
ethylbenzene	100-41-4	E611E	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
hexachlorobutadiene	87-68-3	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
isopropylbenzene	98-82-8	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
propylbenzene, n-	103-65-1	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
styrene	100-42-5	E611E	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
tetrachloroethane, 1,1,1,2-	630-20-6	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
tetrachloroethane, 1,1,2,2-	79-34-5	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
tetrachloroethylene	127-18-4	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
toluene	108-88-3	E611E	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
trichlorobenzene, 1,2,3-	87-61-6	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
trichlorobenzene, 1,2,4-	120-82-1	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
trichloroethane, 1,1,1-	71-55-6	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
trichloroethane, 1,1,2-	79-00-5	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
trichloroethylene	79-01-6	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
trichlorofluoromethane	75-69-4	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
trichloropropane, 1,2,3-	96-18-4	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
trimethylbenzene, 1,2,4-	95-63-6	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
trimethylbenzene, 1,3,5-	108-67-8	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
vinyl chloride	75-01-4	E611E	1.0	µg/L		<1.0	<1.0	<1.0	1.0	<1.0
xylene, m+p-	179601-23-1	E611E	0.40	µg/L		<0.40	<0.40	<0.40	<0.40	<0.40
xylene, o-	95-47-6	E611E	0.30	µg/L		<0.30	<0.30	<0.30	<0.30	<0.30
xylenes, total	1330-20-7	E611E	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50
BTEX, total	----	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
trihalomethanes [THMs], total	----	E611E	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	<2.0
Volatile Organic Compounds Surrogates										
bromofluorobenzene, 4-	460-00-4	E611E	1.0	%		95.0	94.5	96.4	96.4	86.5

Analytical Results

Sub-Matrix: **Water** (Matrix: **Water**)					Client sample ID	MW-02	MW-03	MW-04	BH8	DUPLICATE
					Client sampling date / time	21-Nov-2021 13:50	21-Nov-2021 13:15	21-Nov-2021 13:00	21-Nov-2021 13:35	21-Nov-2021
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*		**CG2105959-001**	**CG2105959-002**	**CG2105959-003**	**CG2105959-004**	**CG2105959-005**
						Result	Result	Result	Result	Result
Volatile Organic Compounds Surrogates										
difluorobenzene, 1,4-	540-36-3	E611E	1.0	%		104	103	103	103	103
Polycyclic Aromatic Hydrocarbons										
naphthalene	91-20-3	E611E	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2105959**	Page	: 1 of 13
Client	: **Tetra Tech Canada Inc.**	Laboratory	: Calgary - Environmental
Contact	: Darby Madalena	Account Manager	: Milica Papic
Address	: 115 - 200 Rivercrest Dr SE Calgary AB Canada T2C 2X5	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: 403 203 3355	Telephone	: +1 403 407 1800
Project	: SWM.SWOP04071-02.002	Date Samples Received	: 24-Nov-2021 09:35
PO	: SWM.SWOP04071-02.002	Issue Date	: 01-Dec-2021 15:03
C-O-C number	: LINDSAY THURBER		
Sampler	: RYAN MILLER		
Site	: ----		
Quote number	: Q71650 City of Red Deer Pre-1972 Landfill Monitoring		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
BH8	E298	21-Nov-2021	29-Nov-2021	----	----		29-Nov-2021	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
DUPLICATE	E298	21-Nov-2021	29-Nov-2021	----	----		29-Nov-2021	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
MW-02	E298	21-Nov-2021	29-Nov-2021	----	----		29-Nov-2021	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
MW-03	E298	21-Nov-2021	29-Nov-2021	----	----		29-Nov-2021	28 days	8 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
MW-04	E298	21-Nov-2021	29-Nov-2021	----	----		29-Nov-2021	28 days	8 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
BH8	E235.Cl	21-Nov-2021	----	----	----		24-Nov-2021	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
DUPLICATE	E235.Cl	21-Nov-2021	----	----	----		24-Nov-2021	28 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Chloride in Water by IC										
HDPE MW-02	E235.Cl	21-Nov-2021	----	----	----		24-Nov-2021	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE MW-03	E235.Cl	21-Nov-2021	----	----	----		24-Nov-2021	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE MW-04	E235.Cl	21-Nov-2021	----	----	----		24-Nov-2021	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE BH8	E235.F	21-Nov-2021	----	----	----		24-Nov-2021	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE DUPLICATE	E235.F	21-Nov-2021	----	----	----		24-Nov-2021	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE MW-02	E235.F	21-Nov-2021	----	----	----		24-Nov-2021	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE MW-03	E235.F	21-Nov-2021	----	----	----		24-Nov-2021	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE MW-04	E235.F	21-Nov-2021	----	----	----		24-Nov-2021	28 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC										
HDPE BH8	E235.NO3	21-Nov-2021	----	----	----		24-Nov-2021	3 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrate in Water by IC										
HDPE DUPLICATE	E235.NO3	21-Nov-2021	----	----	----		24-Nov-2021	3 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC										
HDPE MW-02	E235.NO3	21-Nov-2021	----	----	----		24-Nov-2021	3 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC										
HDPE MW-03	E235.NO3	21-Nov-2021	----	----	----		24-Nov-2021	3 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC										
HDPE MW-04	E235.NO3	21-Nov-2021	----	----	----		24-Nov-2021	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC										
HDPE BH8	E235.NO2	21-Nov-2021	----	----	----		24-Nov-2021	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC										
HDPE DUPLICATE	E235.NO2	21-Nov-2021	----	----	----		24-Nov-2021	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC										
HDPE MW-02	E235.NO2	21-Nov-2021	----	----	----		24-Nov-2021	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC										
HDPE MW-03	E235.NO2	21-Nov-2021	----	----	----		24-Nov-2021	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC										
HDPE MW-04	E235.NO2	21-Nov-2021	----	----	----		24-Nov-2021	3 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
BH8	E235.SO4	21-Nov-2021	----	----	----		24-Nov-2021	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
DUPLICATE	E235.SO4	21-Nov-2021	----	----	----		24-Nov-2021	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
MW-02	E235.SO4	21-Nov-2021	----	----	----		24-Nov-2021	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
MW-03	E235.SO4	21-Nov-2021	----	----	----		24-Nov-2021	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
MW-04	E235.SO4	21-Nov-2021	----	----	----		24-Nov-2021	28 days	3 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid)										
BH8	E509	21-Nov-2021	24-Nov-2021	----	----		24-Nov-2021	28 days	3 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid)										
DUPLICATE	E509	21-Nov-2021	24-Nov-2021	----	----		24-Nov-2021	28 days	3 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid)										
MW-02	E509	21-Nov-2021	24-Nov-2021	----	----		24-Nov-2021	28 days	3 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid)										
MW-03	E509	21-Nov-2021	24-Nov-2021	----	----		24-Nov-2021	28 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid)										
MW-04	E509	21-Nov-2021	24-Nov-2021	----	----		24-Nov-2021	28 days	3 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid)										
BH8	E421	21-Nov-2021	30-Nov-2021	----	----		30-Nov-2021	180 days	9 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid)										
DUPLICATE	E421	21-Nov-2021	30-Nov-2021	----	----		30-Nov-2021	180 days	9 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid)										
MW-02	E421	21-Nov-2021	30-Nov-2021	----	----		30-Nov-2021	180 days	9 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid)										
MW-03	E421	21-Nov-2021	30-Nov-2021	----	----		30-Nov-2021	180 days	9 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid)										
MW-04	E421	21-Nov-2021	30-Nov-2021	----	----		30-Nov-2021	180 days	9 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
BH8	E290	21-Nov-2021	----	----	----		25-Nov-2021	14 days	4 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
DUPLICATE	E290	21-Nov-2021	----	----	----		25-Nov-2021	14 days	4 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
MW-02	E290	21-Nov-2021	----	----	----		25-Nov-2021	14 days	4 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Alkalinity Species by Titration										
HDPE MW-03	E290	21-Nov-2021	----	----	----		25-Nov-2021	14 days	4 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE MW-04	E290	21-Nov-2021	----	----	----		25-Nov-2021	14 days	4 days	✓
Physical Tests : Conductivity in Water										
HDPE BH8	E100	21-Nov-2021	----	----	----		25-Nov-2021	28 days	4 days	✓
Physical Tests : Conductivity in Water										
HDPE DUPLICATE	E100	21-Nov-2021	----	----	----		25-Nov-2021	28 days	4 days	✓
Physical Tests : Conductivity in Water										
HDPE MW-02	E100	21-Nov-2021	----	----	----		25-Nov-2021	28 days	4 days	✓
Physical Tests : Conductivity in Water										
HDPE MW-03	E100	21-Nov-2021	----	----	----		25-Nov-2021	28 days	4 days	✓
Physical Tests : Conductivity in Water										
HDPE MW-04	E100	21-Nov-2021	----	----	----		25-Nov-2021	28 days	4 days	✓
Physical Tests : pH by Meter										
HDPE BH8	E108	21-Nov-2021	----	----	----		25-Nov-2021	0.25 hrs	92 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE MW-02	E108	21-Nov-2021	----	----	----		25-Nov-2021	0.25 hrs	92 hrs	× EHTR-FM

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter										
HDPE DUPLICATE	E108	21-Nov-2021	----	----	----		25-Nov-2021	0.25 hrs	93 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE MW-03	E108	21-Nov-2021	----	----	----		25-Nov-2021	0.25 hrs	93 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE MW-04	E108	21-Nov-2021	----	----	----		25-Nov-2021	0.25 hrs	93 hrs	× EHTR-FM
Polycyclic Aromatic Hydrocarbons : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate) BH8	E611E	21-Nov-2021	26-Nov-2021	----	----		28-Nov-2021	----	----	
Polycyclic Aromatic Hydrocarbons : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate) DUPLICATE	E611E	21-Nov-2021	26-Nov-2021	----	----		28-Nov-2021	----	----	
Polycyclic Aromatic Hydrocarbons : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW-02	E611E	21-Nov-2021	26-Nov-2021	----	----		28-Nov-2021	----	----	
Polycyclic Aromatic Hydrocarbons : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW-03	E611E	21-Nov-2021	26-Nov-2021	----	----		28-Nov-2021	----	----	
Polycyclic Aromatic Hydrocarbons : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW-04	E611E	21-Nov-2021	26-Nov-2021	----	----		28-Nov-2021	----	----	
Volatile Organic Compounds : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate) BH8	E611E	21-Nov-2021	26-Nov-2021	----	----		28-Nov-2021	14 days	7 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Volatile Organic Compounds : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate) DUPLICATE	E611E	21-Nov-2021	26-Nov-2021	----	----		28-Nov-2021	14 days	7 days	✓
Volatile Organic Compounds : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW-02	E611E	21-Nov-2021	26-Nov-2021	----	----		28-Nov-2021	14 days	7 days	✓
Volatile Organic Compounds : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW-03	E611E	21-Nov-2021	26-Nov-2021	----	----		28-Nov-2021	14 days	7 days	✓
Volatile Organic Compounds : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW-04	E611E	21-Nov-2021	26-Nov-2021	----	----		28-Nov-2021	14 days	7 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration	E290	352506	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	355031	1	20	5.0	5.0	✓
Chloride in Water by IC	E235.Cl	352003	1	10	10.0	5.0	✓
Conductivity in Water	E100	352507	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	351711	1	15	6.6	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	355649	1	19	5.2	5.0	✓
Fluoride in Water by IC	E235.F	352004	1	10	10.0	5.0	✓
Nitrate in Water by IC	E235.NO3	352002	1	13	7.6	5.0	✓
Nitrite in Water by IC	E235.NO2	352005	1	10	10.0	5.0	✓
pH by Meter	E108	352508	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	352006	1	10	10.0	5.0	✓
VOCs (Prairies List) by Headspace GC-MS	E611E	353244	1	10	10.0	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration	E290	352506	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	355031	1	20	5.0	5.0	✓
Chloride in Water by IC	E235.Cl	352003	1	10	10.0	5.0	✓
Conductivity in Water	E100	352507	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	351711	1	15	6.6	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	355649	1	19	5.2	5.0	✓
Fluoride in Water by IC	E235.F	352004	1	10	10.0	5.0	✓
Nitrate in Water by IC	E235.NO3	352002	1	13	7.6	5.0	✓
Nitrite in Water by IC	E235.NO2	352005	1	10	10.0	5.0	✓
pH by Meter	E108	352508	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	352006	1	10	10.0	5.0	✓
VOCs (Prairies List) by Headspace GC-MS	E611E	353244	1	10	10.0	5.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration	E290	352506	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	355031	1	20	5.0	5.0	✓
Chloride in Water by IC	E235.Cl	352003	1	10	10.0	5.0	✓
Conductivity in Water	E100	352507	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	351711	1	15	6.6	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	355649	1	19	5.2	5.0	✓
Fluoride in Water by IC	E235.F	352004	1	10	10.0	5.0	✓
Nitrate in Water by IC	E235.NO3	352002	1	13	7.6	5.0	✓
Nitrite in Water by IC	E235.NO2	352005	1	10	10.0	5.0	✓
Sulfate in Water by IC	E235.SO4	352006	1	10	10.0	5.0	✓
VOCs (Prairies List) by Headspace GC-MS	E611E	353244	1	10	10.0	5.0	✓

Matrix: **Water**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	355031	1	20	5.0	5.0	✓
Chloride in Water by IC	E235.Cl	352003	1	10	10.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	351711	1	15	6.6	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	355649	1	19	5.2	5.0	✓
Fluoride in Water by IC	E235.F	352004	1	10	10.0	5.0	✓
Nitrate in Water by IC	E235.NO3	352002	1	13	7.6	5.0	✓
Nitrite in Water by IC	E235.NO2	352005	1	10	10.0	5.0	✓
Sulfate in Water by IC	E235.SO4	352006	1	10	10.0	5.0	✓
VOCs (Prairies List) by Headspace GC-MS	E611E	353244	1	10	10.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Calgary - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Calgary - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Chloride in Water by IC	E235.Cl Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC	E235.NO2 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC	E235.NO3 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Alkalinity Species by Titration	E290 Calgary - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Calgary - Environmental	Water	J. Environ. Monit., 2005, 7, 37-42 (mod)	Ammonia in water is analyzed by flow-injection analysis with fluorescence detection after reaction with orthophthaldialdehyde (OPA).
Dissolved Metals in Water by CRC ICPMS	E421 Calgary - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Dissolved Mercury in Water by CVAAS	E509 Calgary - Environmental	Water	APHA 3030B/EPA 1631E (mod)	Water samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
VOCs (Prairies List) by Headspace GC-MS	E611E Calgary - Environmental	Water	EPA 8260D (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Hardness (Calculated)	EC100 Calgary - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Ion Balance using Dissolved Metals	EC101 Calgary - Environmental	Water	APHA 1030E	Cation Sum, Anion Sum, and Ion Balance are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present. Ion Balance cannot be calculated accurately for waters with very low electrical conductivity (EC).
TDS in Water (Calculation)	EC103 Calgary - Environmental	Water	APHA 1030E (mod)	Total Dissolved Solids is calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Calgary - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Dissolved Metals Water Filtration	EP421 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Dissolved Mercury Water Filtration	EP509 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.
VOCs Preparation for Headspace Analysis	EP581 Calgary - Environmental	Water	EPA 5021A (mod)	Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler. An aliquot of the headspace is then injected into the GC/MS-FID system.

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **CG2105959**	Page	: 1 of 18
Client	: Tetra Tech Canada Inc.	Laboratory	: Calgary - Environmental
Contact	: Darby Madalena	Account Manager	: Milica Papic
Address	: 115 - 200 Rivercrest Dr SE Calgary AB Canada T2C 2X5	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: 403 203 3355	Telephone	: +1 403 407 1800
Project	: SWM.SWOP04071-02.002	Date Samples Received	: 24-Nov-2021 09:35
PO	: SWM.SWOP04071-02.002	Date Analysis Commenced	: 24-Nov-2021
C-O-C number	: LINDSAY THURBER	Issue Date	: 01-Dec-2021 15:03
Sampler	: RYAN MILLER		
Site	: ----		
Quote number	: Q71650 City of Red Deer Pre-1972 Landfill Monitoring		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits
- Reference Material (RM) Report; Recovery and Acceptance Limits
- Method Blank (MB) Report; Recovery and Acceptance Limits
- Laboratory Control Sample (LCS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Daniel Ching	Lab Analyst	Metals, Calgary, Alberta
Joshua Stessun	Laboratory Analyst	Organics, Calgary, Alberta
Mackenzie Lamoureux	Lab Assistant	Metals, Calgary, Alberta
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta
Sara Niroomand		Inorganics, Calgary, Alberta
Sara Niroomand		Metals, Calgary, Alberta
Shirley Li		Metals, Calgary, Alberta
Vladka Stamenova	Analyst	Inorganics, Calgary, Alberta

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include 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 predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percentage Difference
# = Indicates a QC result that did not meet the ALS DQO.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test specific).

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 352506)											
CG2105949-006	Anonymous	alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
Physical Tests (QC Lot: 352507)											
CG2105949-006	Anonymous	conductivity	----	E100	2.0	µS/cm	<2.0	<2.0	0	Diff <2x LOR	----
Physical Tests (QC Lot: 352508)											
CG2105949-006	Anonymous	pH	----	E108	0.10	pH units	6.53	6.58	0.763%	4%	----
Anions and Nutrients (QC Lot: 352002)											
CG2105956-002	Anonymous	nitrate (as N)	14797-55-8	E235.NO3	0.100	mg/L	<0.100	<0.100	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 352003)											
CG2105956-002	Anonymous	chloride	16887-00-6	E235.Cl	2.50	mg/L	450	443	1.42%	20%	----
Anions and Nutrients (QC Lot: 352004)											
CG2105956-002	Anonymous	fluoride	16984-48-8	E235.F	0.100	mg/L	0.240	0.244	0.004	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 352005)											
CG2105956-002	Anonymous	nitrite (as N)	14797-65-0	E235.NO2	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 352006)											
CG2105956-002	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	1.50	mg/L	70.0	69.0	1.49%	20%	----
Anions and Nutrients (QC Lot: 355031)											
CG2105956-002	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.125	mg/L	2.12	2.15	1.56%	20%	----
Dissolved Metals (QC Lot: 351711)											
CG2105956-002	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 355649)											
CG2106049-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00050	mg/L	0.00086	0.00085	0.000006	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00050	mg/L	0.0273	0.0264	3.02%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.100	mg/L	<0.100 µg/L	<0.000100	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000250	mg/L	<0.000250	<0.000250	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0250	mg/L	0.827 µg/L	0.000802	3.01%	20%	----
		calcium, dissolved	7440-70-2	E421	0.250	mg/L	303	301	0.629%	20%	----
		chromium, dissolved	7440-47-3	E421	0.00250	mg/L	<0.00250	<0.00250	0	Diff <2x LOR	----
		cobalt, dissolved	7440-48-4	E421	0.50	mg/L	<0.50 µg/L	<0.00050	0	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Dissolved Metals (QC Lot: 355649) - continued											
CG2106049-001	Anonymous	copper, dissolved	7440-50-8	E421	0.00100	mg/L	<0.00100	<0.00100	0	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000250	mg/L	<0.000250	<0.000250	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0050	mg/L	0.0185	0.0181	0.0004	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.0250	mg/L	208	205	1.29%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00050	mg/L	0.00580	0.00590	1.78%	20%	----
		molybdenum, dissolved	7439-98-7	E421	0.000250	mg/L	0.00216	0.00203	0.000129	Diff <2x LOR	----
		nickel, dissolved	7440-02-0	E421	0.00250	mg/L	0.0294	0.0289	1.55%	20%	----
		phosphorus, dissolved	7723-14-0	E421	0.250	mg/L	<0.250	<0.250	0	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	0.250	mg/L	2.88	2.85	1.11%	20%	----
		selenium, dissolved	7782-49-2	E421	0.250	mg/L	252 µg/L	0.253	0.383%	20%	----
		silicon, dissolved	7440-21-3	E421	0.250	mg/L	3.12	3.11	0.372%	20%	----
		silver, dissolved	7440-22-4	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		sodium, dissolved	17341-25-2	E421	0.250	mg/L	1.91	1.87	0.035	Diff <2x LOR	----
		strontium, dissolved	7440-24-6	E421	0.00100	mg/L	0.170	0.170	0.0726%	20%	----
		sulfur, dissolved	7704-34-9	E421	2.50	mg/L	390	398	1.91%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00150	mg/L	<0.00150	<0.00150	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000050	mg/L	0.0139	0.0138	0.645%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00250	mg/L	<0.00250	<0.00250	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0050	mg/L	0.0493	0.0487	0.0006	Diff <2x LOR	----
		zirconium, dissolved	7440-67-7	E421	0.00150	mg/L	<0.00150	<0.00150	0	Diff <2x LOR	----
Volatile Organic Compounds (QC Lot: 353244)											
CG2105956-002	Anonymous	benzene	71-43-2	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		bromobenzene	108-86-1	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		bromochloromethane	74-97-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		bromodichloromethane	75-27-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		bromoform	75-25-2	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		bromomethane	74-83-9	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		butylbenzene, n-	104-51-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		butylbenzene, sec-	135-98-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		butylbenzene, tert-	98-06-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		carbon tetrachloride	56-23-5	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		chlorobenzene	108-90-7	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Volatile Organic Compounds (QC Lot: 353244) - continued											
CG2105956-002	Anonymous	chloroethane	75-00-3	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		chloroform	67-66-3	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		chloromethane	74-87-3	E611E	5.0	µg/L	<5.0	<5.0	0	Diff <2x LOR	----
		chlorotoluene, 2-	95-49-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		chlorotoluene, 4-	106-43-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		cymene, p-	99-87-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dibromo-3-chloropropane, 1,2-	96-12-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dibromochloromethane	124-48-1	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dibromoethane, 1,2-	106-93-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dibromomethane	74-95-3	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichlorobenzene, 1,2-	95-50-1	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dichlorobenzene, 1,3-	541-73-1	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichlorobenzene, 1,4-	106-46-7	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichlorodifluoromethane	75-71-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloroethane, 1,1-	75-34-3	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloroethane, 1,2-	107-06-2	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloroethylene, 1,1-	75-35-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloroethylene, cis-1,2-	156-59-2	E611E	1.0	µg/L	3.2	3.3	0.2	Diff <2x LOR	----
		dichloroethylene, trans-1,2-	156-60-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloromethane	75-09-2	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropane, 1,2-	78-87-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropane, 1,3-	142-28-9	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropane, 2,2-	594-20-7	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropylene, 1,1-	563-58-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropylene, cis-1,3-	10061-01-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropylene, trans-1,3-	10061-02-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		ethylbenzene	100-41-4	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		hexachlorobutadiene	87-68-3	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		isopropylbenzene	98-82-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		naphthalene	91-20-3	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		propylbenzene, n-	103-65-1	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		styrene	100-42-5	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		tetrachloroethane, 1,1,1,2-	630-20-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		tetrachloroethane, 1,1,2,2-	79-34-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Volatile Organic Compounds (QC Lot: 353244) - continued											
CG2105956-002	Anonymous	tetrachloroethylene	127-18-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		toluene	108-88-3	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		trichlorobenzene, 1,2,3-	87-61-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichlorobenzene, 1,2,4-	120-82-1	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichloroethane, 1,1,1-	71-55-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichloroethane, 1,1,2-	79-00-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichloroethylene	79-01-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichlorofluoromethane	75-69-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichloropropane, 1,2,3-	96-18-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trimethylbenzene, 1,2,4-	95-63-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trimethylbenzene, 1,3,5-	108-67-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		vinyl chloride	75-01-4	E611E	1.0	µg/L	3.9	4.1	5.47%	50%	----
		xylene, m+p-	179601-23-1	E611E	0.40	µg/L	<0.40	<0.40	0	Diff <2x LOR	----
		xylene, o-	95-47-6	E611E	0.30	µg/L	<0.30	<0.30	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 352506)						
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 352507)						
conductivity	----	E100	1	µS/cm	<1.0	----
Anions and Nutrients (QCLot: 352002)						
nitrate (as N)	14797-55-8	E235.NO3	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 352003)						
chloride	16887-00-6	E235.Cl	0.5	mg/L	<0.50	----
Anions and Nutrients (QCLot: 352004)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 352005)						
nitrite (as N)	14797-65-0	E235.NO2	0.01	mg/L	<0.010	----
Anions and Nutrients (QCLot: 352006)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 355031)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Dissolved Metals (QCLot: 351711)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 355649)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	<0.00050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 355649) - continued						
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
phosphorus, dissolved	7723-14-0	E421	0.05	mg/L	<0.050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	17341-25-2	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	<0.50	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
zirconium, dissolved	7440-67-7	E421	0.0002	mg/L	<0.00020	----
Volatile Organic Compounds (QCLot: 353244)						
benzene	71-43-2	E611E	0.5	µg/L	<0.50	----
bromobenzene	108-86-1	E611E	1	µg/L	<1.0	----
bromochloromethane	74-97-5	E611E	1	µg/L	<1.0	----
bromodichloromethane	75-27-4	E611E	1	µg/L	<1.0	----
bromoform	75-25-2	E611E	1	µg/L	<1.0	----
bromomethane	74-83-9	E611E	1	µg/L	<1.0	----
butylbenzene, n-	104-51-8	E611E	1	µg/L	<1.0	----
butylbenzene, sec-	135-98-8	E611E	1	µg/L	<1.0	----
butylbenzene, tert-	98-06-6	E611E	1	µg/L	<1.0	----
carbon tetrachloride	56-23-5	E611E	0.5	µg/L	<0.50	----
chlorobenzene	108-90-7	E611E	1	µg/L	<1.0	----
chloroethane	75-00-3	E611E	1	µg/L	<1.0	----
chloroform	67-66-3	E611E	1	µg/L	<1.0	----
chloromethane	74-87-3	E611E	5	µg/L	<5.0	----
chlorotoluene, 2-	95-49-8	E611E	1	µg/L	<1.0	----
chlorotoluene, 4-	106-43-4	E611E	1	µg/L	<1.0	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Volatile Organic Compounds (QCLot: 353244) - continued						
cymene, p-	99-87-6	E611E	1	µg/L	<1.0	----
dibromo-3-chloropropane, 1,2-	96-12-8	E611E	1	µg/L	<1.0	----
dibromochloromethane	124-48-1	E611E	1	µg/L	<1.0	----
dibromoethane, 1,2-	106-93-4	E611E	1	µg/L	<1.0	----
dibromomethane	74-95-3	E611E	1	µg/L	<1.0	----
dichlorobenzene, 1,2-	95-50-1	E611E	0.5	µg/L	<0.50	----
dichlorobenzene, 1,3-	541-73-1	E611E	1	µg/L	<1.0	----
dichlorobenzene, 1,4-	106-46-7	E611E	1	µg/L	<1.0	----
dichlorodifluoromethane	75-71-8	E611E	1	µg/L	<1.0	----
dichloroethane, 1,1-	75-34-3	E611E	1	µg/L	<1.0	----
dichloroethane, 1,2-	107-06-2	E611E	1	µg/L	<1.0	----
dichloroethylene, 1,1-	75-35-4	E611E	1	µg/L	<1.0	----
dichloroethylene, cis-1,2-	156-59-2	E611E	1	µg/L	<1.0	----
dichloroethylene, trans-1,2-	156-60-5	E611E	1	µg/L	<1.0	----
dichloromethane	75-09-2	E611E	1	µg/L	<1.0	----
dichloropropane, 1,2-	78-87-5	E611E	1	µg/L	<1.0	----
dichloropropane, 1,3-	142-28-9	E611E	1	µg/L	<1.0	----
dichloropropane, 2,2-	594-20-7	E611E	1	µg/L	<1.0	----
dichloropropylene, 1,1-	563-58-6	E611E	1	µg/L	<1.0	----
dichloropropylene, cis-1,3-	10061-01-5	E611E	1	µg/L	<1.0	----
dichloropropylene, trans-1,3-	10061-02-6	E611E	1	µg/L	<1.0	----
ethylbenzene	100-41-4	E611E	0.5	µg/L	<0.50	----
hexachlorobutadiene	87-68-3	E611E	1	µg/L	<1.0	----
isopropylbenzene	98-82-8	E611E	1	µg/L	<1.0	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	0.5	µg/L	<0.50	----
naphthalene	91-20-3	E611E	1	µg/L	<1.0	----
propylbenzene, n-	103-65-1	E611E	1	µg/L	<1.0	----
styrene	100-42-5	E611E	0.5	µg/L	<0.50	----
tetrachloroethane, 1,1,1,2-	630-20-6	E611E	1	µg/L	<1.0	----
tetrachloroethane, 1,1,2,2-	79-34-5	E611E	1	µg/L	<1.0	----
tetrachloroethylene	127-18-4	E611E	1	µg/L	<1.0	----
toluene	108-88-3	E611E	0.5	µg/L	<0.50	----
trichlorobenzene, 1,2,3-	87-61-6	E611E	1	µg/L	<1.0	----
trichlorobenzene, 1,2,4-	120-82-1	E611E	1	µg/L	<1.0	----
trichloroethane, 1,1,1-	71-55-6	E611E	1	µg/L	<1.0	----
trichloroethane, 1,1,2-	79-00-5	E611E	1	µg/L	<1.0	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Volatile Organic Compounds (QCLot: 353244) - continued						
trichloroethylene	79-01-6	E611E	1	µg/L	<1.0	----
trichlorofluoromethane	75-69-4	E611E	1	µg/L	<1.0	----
trichloropropane, 1,2,3-	96-18-4	E611E	1	µg/L	<1.0	----
trimethylbenzene, 1,2,4-	95-63-6	E611E	1	µg/L	<1.0	----
trimethylbenzene, 1,3,5-	108-67-8	E611E	1	µg/L	<1.0	----
vinyl chloride	75-01-4	E611E	1	µg/L	<1.0	----
xylene, m+p-	179601-23-1	E611E	0.4	µg/L	<0.40	----
xylene, o-	95-47-6	E611E	0.3	µg/L	<0.30	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 352506)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	112	85.0	115	----
Physical Tests (QCLot: 352507)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	96.8	90.0	110	----
Physical Tests (QCLot: 352508)									
pH	----	E108	----	pH units	7 pH units	100	98.6	101	----
Anions and Nutrients (QCLot: 352002)									
nitrate (as N)	14797-55-8	E235.NO3	0.02	mg/L	2.5 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 352003)									
chloride	16887-00-6	E235.Cl	0.5	mg/L	100 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 352004)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 352005)									
nitrite (as N)	14797-65-0	E235.NO2	0.01	mg/L	0.5 mg/L	100	90.0	110	----
Anions and Nutrients (QCLot: 352006)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 355031)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	92.4	85.0	115	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	80.1	80.0	120	----
Dissolved Metals (QCLot: 355649)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	96.4	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	110	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	94.6	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	99.5	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	94.0	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	100	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	94.1	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	98.9	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	97.2	80.0	120	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	0.25 mg/L	99.4	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	98.3	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	98.0	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	97.0	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 355649) - continued									
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	99.0	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	94.5	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	95.5	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	99.2	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	104	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	96.0	80.0	120	----
phosphorus, dissolved	7723-14-0	E421	0.05	mg/L	10 mg/L	97.9	70.0	130	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	98.4	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	97.7	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	99.0	60.0	140	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	105	80.0	120	----
sodium, dissolved	17341-25-2	E421	0.05	mg/L	50 mg/L	100	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	99.5	80.0	120	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	104	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	100	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	97.6	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	97.4	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	102	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	98.7	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	94.2	80.0	120	----
zirconium, dissolved	7440-67-7	E421	0.0002	mg/L	0.1 mg/L	103	80.0	120	----
Volatile Organic Compounds (QCLot: 353244)									
benzene	71-43-2	E611E	0.5	µg/L	100 µg/L	87.4	70.0	130	----
bromobenzene	108-86-1	E611E	1	µg/L	100 µg/L	91.8	70.0	130	----
bromochloromethane	74-97-5	E611E	1	µg/L	100 µg/L	81.7	70.0	130	----
bromodichloromethane	75-27-4	E611E	1	µg/L	100 µg/L	86.4	70.0	130	----
bromoform	75-25-2	E611E	1	µg/L	100 µg/L	100	70.0	130	----
bromomethane	74-83-9	E611E	1	µg/L	100 µg/L	93.4	60.0	140	----
butylbenzene, n-	104-51-8	E611E	1	µg/L	100 µg/L	100	70.0	130	----
butylbenzene, sec-	135-98-8	E611E	1	µg/L	100 µg/L	100	70.0	130	----
butylbenzene, tert-	98-06-6	E611E	1	µg/L	100 µg/L	105	70.0	130	----
carbon tetrachloride	56-23-5	E611E	0.5	µg/L	100 µg/L	87.6	70.0	130	----
chlorobenzene	108-90-7	E611E	1	µg/L	100 µg/L	90.5	70.0	130	----
chloroethane	75-00-3	E611E	1	µg/L	100 µg/L	94.3	60.0	140	----
chloroform	67-66-3	E611E	1	µg/L	100 µg/L	83.2	70.0	130	----
chloromethane	74-87-3	E611E	5	µg/L	100 µg/L	91.2	60.0	140	----
chlorotoluene, 2-	95-49-8	E611E	1	µg/L	100 µg/L	99.1	70.0	130	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 353244) - continued									
chlorotoluene, 4-	106-43-4	E611E	1	µg/L	100 µg/L	100	70.0	130	----
cymene, p-	99-87-6	E611E	1	µg/L	100 µg/L	111	70.0	130	----
dibromo-3-chloropropane, 1,2-	96-12-8	E611E	1	µg/L	100 µg/L	117	70.0	130	----
dibromochloromethane	124-48-1	E611E	1	µg/L	100 µg/L	80.5	70.0	130	----
dibromoethane, 1,2-	106-93-4	E611E	1	µg/L	100 µg/L	91.4	70.0	130	----
dibromomethane	74-95-3	E611E	1	µg/L	100 µg/L	96.4	70.0	130	----
dichlorobenzene, 1,2-	95-50-1	E611E	0.5	µg/L	100 µg/L	98.7	70.0	130	----
dichlorobenzene, 1,3-	541-73-1	E611E	1	µg/L	100 µg/L	93.4	70.0	130	----
dichlorobenzene, 1,4-	106-46-7	E611E	1	µg/L	100 µg/L	97.9	70.0	130	----
dichlorodifluoromethane	75-71-8	E611E	1	µg/L	100 µg/L	87.2	60.0	140	----
dichloroethane, 1,1-	75-34-3	E611E	1	µg/L	100 µg/L	104	70.0	130	----
dichloroethane, 1,2-	107-06-2	E611E	1	µg/L	100 µg/L	82.9	70.0	130	----
dichloroethylene, 1,1-	75-35-4	E611E	1	µg/L	100 µg/L	98.2	70.0	130	----
dichloroethylene, cis-1,2-	156-59-2	E611E	1	µg/L	100 µg/L	90.0	70.0	130	----
dichloroethylene, trans-1,2-	156-60-5	E611E	1	µg/L	100 µg/L	81.3	70.0	130	----
dichloromethane	75-09-2	E611E	1	µg/L	100 µg/L	92.6	70.0	130	----
dichloropropane, 1,2-	78-87-5	E611E	1	µg/L	100 µg/L	87.3	70.0	130	----
dichloropropane, 1,3-	142-28-9	E611E	1	µg/L	100 µg/L	95.1	70.0	130	----
dichloropropane, 2,2-	594-20-7	E611E	1	µg/L	100 µg/L	102	70.0	130	----
dichloropropylene, 1,1-	563-58-6	E611E	1	µg/L	100 µg/L	86.8	70.0	130	----
dichloropropylene, cis-1,3-	10061-01-5	E611E	1	µg/L	100 µg/L	91.4	70.0	130	----
dichloropropylene, trans-1,3-	10061-02-6	E611E	1	µg/L	100 µg/L	96.0	70.0	130	----
ethylbenzene	100-41-4	E611E	0.5	µg/L	100 µg/L	93.3	70.0	130	----
hexachlorobutadiene	87-68-3	E611E	1	µg/L	100 µg/L	111	70.0	130	----
isopropylbenzene	98-82-8	E611E	1	µg/L	100 µg/L	96.1	70.0	130	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	0.5	µg/L	100 µg/L	93.5	70.0	130	----
naphthalene	91-20-3	E611E	1	µg/L	100 µg/L	110	70.0	130	----
propylbenzene, n-	103-65-1	E611E	1	µg/L	100 µg/L	110	70.0	130	----
styrene	100-42-5	E611E	0.5	µg/L	100 µg/L	92.3	70.0	130	----
tetrachloroethane, 1,1,1,2-	630-20-6	E611E	1	µg/L	100 µg/L	81.4	70.0	130	----
tetrachloroethane, 1,1,2,2-	79-34-5	E611E	1	µg/L	100 µg/L	87.7	70.0	130	----
tetrachloroethylene	127-18-4	E611E	1	µg/L	100 µg/L	92.9	70.0	130	----
toluene	108-88-3	E611E	0.5	µg/L	100 µg/L	99.4	70.0	130	----
trichlorobenzene, 1,2,3-	87-61-6	E611E	1	µg/L	100 µg/L	106	70.0	130	----
trichlorobenzene, 1,2,4-	120-82-1	E611E	1	µg/L	100 µg/L	112	70.0	130	----
trichloroethane, 1,1,1-	71-55-6	E611E	1	µg/L	100 µg/L	82.8	70.0	130	----
trichloroethane, 1,1,2-	79-00-5	E611E	1	µg/L	100 µg/L	85.4	70.0	130	----
trichloroethylene	79-01-6	E611E	1	µg/L	100 µg/L	88.2	70.0	130	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 353244) - continued									
trichlorofluoromethane	75-69-4	E611E	1	µg/L	100 µg/L	94.0	60.0	140	----
trichloropropane, 1,2,3-	96-18-4	E611E	1	µg/L	100 µg/L	87.0	70.0	130	----
trimethylbenzene, 1,2,4-	95-63-6	E611E	1	µg/L	100 µg/L	114	70.0	130	----
trimethylbenzene, 1,3,5-	108-67-8	E611E	1	µg/L	100 µg/L	114	70.0	130	----
vinyl chloride	75-01-4	E611E	1	µg/L	100 µg/L	85.3	60.0	140	----
xylene, m+p-	179601-23-1	E611E	0.4	µg/L	200 µg/L	100	70.0	130	----
xylene, o-	95-47-6	E611E	0.3	µg/L	100 µg/L	96.1	70.0	130	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 352002)										
CG2105959-003	MW-04	nitrate (as N)	14797-55-8	E235.NO3	2.31 mg/L	2.5 mg/L	92.3	75.0	125	----
Anions and Nutrients (QCLot: 352003)										
CG2105959-003	MW-04	chloride	16887-00-6	E235.Cl	90.0 mg/L	100 mg/L	90.0	75.0	125	----
Anions and Nutrients (QCLot: 352004)										
CG2105959-003	MW-04	fluoride	16984-48-8	E235.F	0.874 mg/L	1 mg/L	87.4	75.0	125	----
Anions and Nutrients (QCLot: 352005)										
CG2105959-003	MW-04	nitrite (as N)	14797-65-0	E235.NO2	0.452 mg/L	0.5 mg/L	90.4	75.0	125	----
Anions and Nutrients (QCLot: 352006)										
CG2105959-003	MW-04	sulfate (as SO4)	14808-79-8	E235.SO4	85.2 mg/L	100 mg/L	85.2	75.0	125	----
Anions and Nutrients (QCLot: 355031)										
CG2105956-003	Anonymous	ammonia, total (as N)	7664-41-7	E298	ND mg/L	0.1 mg/L	ND	75.0	125	----
Dissolved Metals (QCLot: 351711)										
CG2105956-003	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000901 mg/L	0.0001 mg/L	90.1	70.0	130	----
Dissolved Metals (QCLot: 355649)										
CG2106049-002	Anonymous	aluminum, dissolved	7429-90-5	E421	1.81 mg/L	2 mg/L	90.5	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.213 mg/L	0.2 mg/L	106	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.179 mg/L	0.2 mg/L	89.3	70.0	130	----
		barium, dissolved	7440-39-3	E421	0.178 mg/L	0.2 mg/L	89.1	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.345 mg/L	0.4 mg/L	86.2	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.0918 mg/L	0.1 mg/L	91.8	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.931 mg/L	1 mg/L	93.1	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.0385 mg/L	0.04 mg/L	96.4	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	40 mg/L	ND	70.0	130	----
		chromium, dissolved	7440-47-3	E421	0.369 mg/L	0.4 mg/L	92.2	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.180 mg/L	0.2 mg/L	89.8	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.181 mg/L	0.2 mg/L	90.7	70.0	130	----
		iron, dissolved	7439-89-6	E421	18.5 mg/L	20 mg/L	92.7	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.188 mg/L	0.2 mg/L	94.0	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.863 mg/L	1 mg/L	86.3	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 355649) - continued										
CG2106049-002	Anonymous	magnesium, dissolved	7439-95-4	E421	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.186 mg/L	0.2 mg/L	93.1	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.193 mg/L	0.2 mg/L	96.4	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.360 mg/L	0.4 mg/L	90.1	70.0	130	----
		phosphorus, dissolved	7723-14-0	E421	91.5 mg/L	100 mg/L	91.5	70.0	130	----
		potassium, dissolved	7440-09-7	E421	35.5 mg/L	40 mg/L	88.8	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.373 mg/L	0.4 mg/L	93.4	70.0	130	----
		silicon, dissolved	7440-21-3	E421	87.1 mg/L	100 mg/L	87.1	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.0394 mg/L	0.04 mg/L	98.4	70.0	130	----
		sodium, dissolved	17341-25-2	E421	18.0 mg/L	20 mg/L	90.1	70.0	130	----
		strontium, dissolved	7440-24-6	E421	0.189 mg/L	0.2 mg/L	94.7	70.0	130	----
		sulfur, dissolved	7704-34-9	E421	ND mg/L	200 mg/L	ND	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.0382 mg/L	0.04 mg/L	95.6	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.190 mg/L	0.2 mg/L	94.9	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.369 mg/L	0.4 mg/L	92.3	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.0380 mg/L	0.04 mg/L	94.9	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.913 mg/L	1 mg/L	91.3	70.0	130	----
		zinc, dissolved	7440-66-6	E421	3.64 mg/L	4 mg/L	91.0	70.0	130	----
		zirconium, dissolved	7440-67-7	E421	0.377 mg/L	0.4 mg/L	94.3	70.0	130	----
Volatile Organic Compounds (QCLot: 353244)										
CG2105956-002	Anonymous	benzene	71-43-2	E611E	101 µg/L	100 µg/L	101	70.0	130	----
		bromobenzene	108-86-1	E611E	93.8 µg/L	100 µg/L	93.8	70.0	130	----
		bromochloromethane	74-97-5	E611E	93.3 µg/L	100 µg/L	93.3	70.0	130	----
		bromodichloromethane	75-27-4	E611E	87.6 µg/L	100 µg/L	87.6	70.0	130	----
		bromoform	75-25-2	E611E	93.2 µg/L	100 µg/L	93.2	70.0	130	----
		bromomethane	74-83-9	E611E	99.5 µg/L	100 µg/L	99.5	60.0	140	----
		butylbenzene, n-	104-51-8	E611E	118 µg/L	100 µg/L	118	70.0	130	----
		butylbenzene, sec-	135-98-8	E611E	99.7 µg/L	100 µg/L	99.7	70.0	130	----
		butylbenzene, tert-	98-06-6	E611E	104 µg/L	100 µg/L	104	70.0	130	----
		carbon tetrachloride	56-23-5	E611E	80.8 µg/L	100 µg/L	80.8	70.0	130	----
		chlorobenzene	108-90-7	E611E	92.6 µg/L	100 µg/L	92.6	70.0	130	----
		chloroethane	75-00-3	E611E	102 µg/L	100 µg/L	102	60.0	140	----
		chloroform	67-66-3	E611E	86.0 µg/L	100 µg/L	86.0	70.0	130	----
		chloromethane	74-87-3	E611E	83.6 µg/L	100 µg/L	83.6	60.0	140	----
		chlorotoluene, 2-	95-49-8	E611E	98.6 µg/L	100 µg/L	98.6	70.0	130	----
		chlorotoluene, 4-	106-43-4	E611E	100 µg/L	100 µg/L	100	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 353244) - continued										
CG2105956-002	Anonymous	cymene, p-	99-87-6	E611E	114 µg/L	100 µg/L	114	70.0	130	----
		dibromo-3-chloropropane, 1,2-	96-12-8	E611E	90.4 µg/L	100 µg/L	90.4	70.0	130	----
		dibromochloromethane	124-48-1	E611E	87.8 µg/L	100 µg/L	87.8	70.0	130	----
		dibromoethane, 1,2-	106-93-4	E611E	108 µg/L	100 µg/L	108	70.0	130	----
		dibromomethane	74-95-3	E611E	106 µg/L	100 µg/L	106	70.0	130	----
		dichlorobenzene, 1,2-	95-50-1	E611E	96.7 µg/L	100 µg/L	96.7	70.0	130	----
		dichlorobenzene, 1,3-	541-73-1	E611E	96.0 µg/L	100 µg/L	96.0	70.0	130	----
		dichlorobenzene, 1,4-	106-46-7	E611E	97.0 µg/L	100 µg/L	97.0	70.0	130	----
		dichlorodifluoromethane	75-71-8	E611E	81.2 µg/L	100 µg/L	81.2	60.0	140	----
		dichloroethane, 1,1-	75-34-3	E611E	86.7 µg/L	100 µg/L	86.7	70.0	130	----
		dichloroethane, 1,2-	107-06-2	E611E	93.9 µg/L	100 µg/L	93.9	70.0	130	----
		dichloroethylene, 1,1-	75-35-4	E611E	106 µg/L	100 µg/L	106	70.0	130	----
		dichloroethylene, cis-1,2-	156-59-2	E611E	105 µg/L	100 µg/L	105	70.0	130	----
		dichloroethylene, trans-1,2-	156-60-5	E611E	86.6 µg/L	100 µg/L	86.6	70.0	130	----
		dichloromethane	75-09-2	E611E	81.7 µg/L	100 µg/L	81.7	70.0	130	----
		dichloropropane, 1,2-	78-87-5	E611E	102 µg/L	100 µg/L	102	70.0	130	----
		dichloropropane, 1,3-	142-28-9	E611E	105 µg/L	100 µg/L	105	70.0	130	----
		dichloropropane, 2,2-	594-20-7	E611E	112 µg/L	100 µg/L	112	70.0	130	----
		dichloropropylene, 1,1-	563-58-6	E611E	103 µg/L	100 µg/L	103	70.0	130	----
		dichloropropylene, cis-1,3-	10061-01-5	E611E	101 µg/L	100 µg/L	101	70.0	130	----
		dichloropropylene, trans-1,3-	10061-02-6	E611E	105 µg/L	100 µg/L	105	70.0	130	----
		ethylbenzene	100-41-4	E611E	100 µg/L	100 µg/L	100	70.0	130	----
		hexachlorobutadiene	87-68-3	E611E	114 µg/L	100 µg/L	114	70.0	130	----
		isopropylbenzene	98-82-8	E611E	97.6 µg/L	100 µg/L	97.6	70.0	130	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	97.6 µg/L	100 µg/L	97.6	70.0	130	----
		naphthalene	91-20-3	E611E	101 µg/L	100 µg/L	101	70.0	130	----
		propylbenzene, n-	103-65-1	E611E	120 µg/L	100 µg/L	120	70.0	130	----
		styrene	100-42-5	E611E	93.9 µg/L	100 µg/L	93.9	70.0	130	----
		tetrachloroethane, 1,1,1,2-	630-20-6	E611E	98.0 µg/L	100 µg/L	98.0	70.0	130	----
		tetrachloroethane, 1,1,2,2-	79-34-5	E611E	82.7 µg/L	100 µg/L	82.7	70.0	130	----
		tetrachloroethylene	127-18-4	E611E	105 µg/L	100 µg/L	105	70.0	130	----
		toluene	108-88-3	E611E	114 µg/L	100 µg/L	114	70.0	130	----
		trichlorobenzene, 1,2,3-	87-61-6	E611E	95.8 µg/L	100 µg/L	95.8	70.0	130	----
		trichlorobenzene, 1,2,4-	120-82-1	E611E	110 µg/L	100 µg/L	110	70.0	130	----
		trichloroethane, 1,1,1-	71-55-6	E611E	88.5 µg/L	100 µg/L	88.5	70.0	130	----
		trichloroethane, 1,1,2-	79-00-5	E611E	96.1 µg/L	100 µg/L	96.1	70.0	130	----
		trichloroethylene	79-01-6	E611E	105 µg/L	100 µg/L	105	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 353244) - continued										
CG2105956-002	Anonymous	trichlorofluoromethane	75-69-4	E611E	104 µg/L	100 µg/L	104	60.0	140	----
		trichloropropane, 1,2,3-	96-18-4	E611E	81.6 µg/L	100 µg/L	81.6	70.0	130	----
		trimethylbenzene, 1,2,4-	95-63-6	E611E	112 µg/L	100 µg/L	112	70.0	130	----
		trimethylbenzene, 1,3,5-	108-67-8	E611E	113 µg/L	100 µg/L	113	70.0	130	----
		vinyl chloride	75-01-4	E611E	95.3 µg/L	100 µg/L	95.3	60.0	140	----
		xylene, m+p-	179601-23-1	E611E	201 µg/L	200 µg/L	100	70.0	130	----
		xylene, o-	95-47-6	E611E	100 µg/L	100 µg/L	100	70.0	130	----

5959

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 Lindsay Thurber

Page 1 of 1

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.SWOP04071-02.002		
Address:				PO/AFE:	SWM.SWOP04071-02.002		
Sample				Legal Site Description:			
Phone:		Fax:		Quote #:	Q71650		
Lab Work Order # (lab use only)				**ALS Contact:**	Milica Papic	**Sampler (Initials):**	Ryan Miller

Sample #	Sample Identification (This description will appear on the report)	Date dd-mmm-yy	Time hh:mm	Sample Type (Select from drop-down list)	VOC-8260	ROU-MET_D-ABT1	NH3-F	Hazardous?	Highly Contaminated?	Number of Containers
1	MW-02	21-nov-21	1350	Water	X	X	X			5
2	MW-03		1315	Water	X	X	X			5
3	MW-04		1300	Water	X	X	X			5
4	BH8		1335	Water	X	X	X			5
	~~21-MW05~~ NOT DRILLED YET	—	—	~~Water~~	~~X~~	~~X~~	~~X~~			
	~~MW04A~~ DRY	—	—	~~Water~~	~~X~~	~~X~~	~~X~~			
	~~MW15A~~ DRY	—	—	~~Water~~	~~X~~	~~X~~	~~X~~			
5	Duplicate	21-nov-21	—	Water	X	X	X			5

Guidelines / Regulations

Special Instructions / Hazardous Details

Dissolved Metals & Hg field filtered & preserved

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

By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the adjacent worksheet.

Relinquished By:	Ryan Miller	Date & Time:	Nov 24/21	Received By:		Date & Time:	24/11 7:35	Temperature	Sample Condition (lab use) Samples Received in Condition? Y / N provided details
Relinquished By:		Date & Time:	9:30	Received By:		Date & Time:		7.5	

Environmental Division
Calgary
Work Order Reference
CG2105959

Telephone : +1 403 407 1800

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **CG2201107**	Page	: 1 of 6
Client	: **Tetra Tech Canada Inc.**	Laboratory	: Calgary - Environmental
Contact	: Darby Madalena	Account Manager	: Patryk Wojciak
Address	: 110, 140 Quarry Park Blvd SE Calgary AB Canada T2C 3G3	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: 403 203-3355	Telephone	: +1 403 407 1800
Project	: SWM.SWOP04071-02.008	Date Samples Received	: 01-Feb-2022 14:40
PO	: SWM.SWOP04071-02.008	Date Analysis Commenced	: 01-Feb-2022
C-O-C number	: CORD LINDSAY THURBER	Issue Date	: 08-Feb-2022 13:12
Sampler	: MEGAN.S		
Site	: ----		
Quote number	: Q71650 City of Red Deer Pre-1972 Landfill Monitoring		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Harpreet Chawla	Team Leader - Inorganics	Metals, Calgary, Alberta
Jeanie Mark	Laboratory Analyst	Organics, Calgary, Alberta
Olivia Gu	Lab Analyst	Metals, Calgary, Alberta
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta
Sara Niroomand		Inorganics, Calgary, Alberta
Shirley Li		Inorganics, Calgary, Alberta
Shirley Li		Metals, Calgary, Alberta

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
µg/L	micrograms per litre
µS/cm	Microsiemens per centimetre
meq/L	milliequivalents per litre
mg/L	milligrams per litre
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLDS	*Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.*
RRV	*Reported result verified by repeat analysis.*

Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	22MW05	----	----	----	----
					Client sampling date / time	01-Feb-2022 12:30	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2201107-001	--------	--------	--------	--------	
					Result	----	----	----	----	
Physical Tests										
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L	708	----	----	----	----	
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L	<1.0	----	----	----	----	
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L	<1.0	----	----	----	----	
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	580	----	----	----	----	
conductivity	----	E100	1.0	µS/cm	1030	----	----	----	----	
hardness (as CaCO3), dissolved	----	EC100	0.60	mg/L	452	----	----	----	----	
pH	----	E108	0.10	pH units	7.19	----	----	----	----	
solids, total dissolved [TDS], calculated	----	EC103	1.0	mg/L	684	----	----	----	----	
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	3.66	----	----	----	----	
chloride	16887-00-6	E235.Cl	0.50	mg/L	45.0	----	----	----	----	
fluoride	16984-48-8	E235.F	0.020	mg/L	0.132	----	----	----	----	
nitrate (as N)	14797-55-8	E235.NO3	0.020	mg/L	0.170	----	----	----	----	
nitrate + nitrite (as N)	----	EC235.N+N	0.0050	mg/L	0.170	----	----	----	----	
nitrite (as N)	14797-65-0	E235.NO2	0.010	mg/L	<0.050 DLDS	----	----	----	----	
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	7.10	----	----	----	----	
Ion Balance										
anion sum	----	EC101	0.10	meq/L	13.0	----	----	----	----	
cation sum	----	EC101	0.10	meq/L	12.9	----	----	----	----	
ion balance (cation-anion difference)	----	EC101	0.010	%	0.386	----	----	----	----	
Dissolved Metals										
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0032	----	----	----	----	
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	----	----	----	----	
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.0275	----	----	----	----	
barium, dissolved	7440-39-3	E421	0.00010	mg/L	1.25	----	----	----	----	
boron, dissolved	7440-42-8	E421	0.010	mg/L	0.064	----	----	----	----	
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	<0.0000050	----	----	----	----	
calcium, dissolved	7440-70-2	E421	0.050	mg/L	102	----	----	----	----	
chromium, dissolved	7440-47-3	E421	0.00050	mg/L	<0.00050	----	----	----	----	
copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00042	----	----	----	----	

Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	22MW05	----	----	----	----
					Client sampling date / time	01-Feb-2022 12:30	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit		CG2201107-001	--------	--------	--------	--------
						Result	----	----	----	----
Dissolved Metals										
iron, dissolved	7439-89-6	E421	0.010	mg/L		16.1	----	----	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L		0.000051	----	----	----	----
magnesium, dissolved	7439-95-4	E421	0.100	mg/L		47.9	----	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L		0.509	----	----	----	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L		0.0000072 RRV	----	----	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L		0.00081	----	----	----	----
potassium, dissolved	7440-09-7	E421	0.100	mg/L		8.54	----	----	----	----
selenium, dissolved	7782-49-2	E421	0.000050	mg/L		0.000174	----	----	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L		<0.000010	----	----	----	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L		65.3	----	----	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L		0.000605	----	----	----	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L		0.0039	----	----	----	----
dissolved mercury filtration location	----	EP509	-	-		Field	----	----	----	----
dissolved metals filtration location	----	EP421	-	-		Field	----	----	----	----
Volatile Organic Compounds										
benzene	71-43-2	E611E	0.50	µg/L		<0.50	----	----	----	----
bromobenzene	108-86-1	E611E	1.0	µg/L		<1.0	----	----	----	----
bromochloromethane	74-97-5	E611E	1.0	µg/L		<1.0	----	----	----	----
bromodichloromethane	75-27-4	E611E	1.0	µg/L		<1.0	----	----	----	----
bromoform	75-25-2	E611E	1.0	µg/L		<1.0	----	----	----	----
bromomethane	74-83-9	E611E	1.0	µg/L		<1.0	----	----	----	----
butylbenzene, n-	104-51-8	E611E	1.0	µg/L		<1.0	----	----	----	----
butylbenzene, sec-	135-98-8	E611E	1.0	µg/L		<1.0	----	----	----	----
butylbenzene, tert-	98-06-6	E611E	1.0	µg/L		<1.0	----	----	----	----
carbon tetrachloride	56-23-5	E611E	0.50	µg/L		<0.50	----	----	----	----
chlorobenzene	108-90-7	E611E	1.0	µg/L		<1.0	----	----	----	----
chloroethane	75-00-3	E611E	1.0	µg/L		<1.0	----	----	----	----
chloroform	67-66-3	E611E	1.0	µg/L		<1.0	----	----	----	----
chloromethane	74-87-3	E611E	5.0	µg/L		<5.0	----	----	----	----
chlorotoluene, 2-	95-49-8	E611E	1.0	µg/L		<1.0	----	----	----	----
chlorotoluene, 4-	106-43-4	E611E	1.0	µg/L		<1.0	----	----	----	----

Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	22MW05	----	----	----	----
					Client sampling date / time	01-Feb-2022 12:30	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit		CG2201107-001	--------	--------	--------	--------
						Result	----	----	----	----
Volatile Organic Compounds										
cymene, p-	99-87-6	E611E	1.0	µg/L		<1.0	----	----	----	----
dibromo-3-chloropropane, 1,2-	96-12-8	E611E	1.0	µg/L		<1.0	----	----	----	----
dibromochloromethane	124-48-1	E611E	1.0	µg/L		<1.0	----	----	----	----
dibromoethane, 1,2-	106-93-4	E611E	1.0	µg/L		<1.0	----	----	----	----
dibromomethane	74-95-3	E611E	1.0	µg/L		<1.0	----	----	----	----
dichlorobenzene, 1,2-	95-50-1	E611E	0.50	µg/L		<0.50	----	----	----	----
dichlorobenzene, 1,3-	541-73-1	E611E	1.0	µg/L		<1.0	----	----	----	----
dichlorobenzene, 1,4-	106-46-7	E611E	1.0	µg/L		<1.0	----	----	----	----
dichlorodifluoromethane	75-71-8	E611E	1.0	µg/L		<1.0	----	----	----	----
dichloroethane, 1,1-	75-34-3	E611E	1.0	µg/L		<1.0	----	----	----	----
dichloroethane, 1,2-	107-06-2	E611E	1.0	µg/L		<1.0	----	----	----	----
dichloroethylene, 1,1-	75-35-4	E611E	1.0	µg/L		<1.0	----	----	----	----
dichloroethylene, cis-1,2-	156-59-2	E611E	1.0	µg/L		<1.0	----	----	----	----
dichloroethylene, trans-1,2-	156-60-5	E611E	1.0	µg/L		<1.0	----	----	----	----
dichloromethane	75-09-2	E611E	1.0	µg/L		<1.0	----	----	----	----
dichloropropane, 1,2-	78-87-5	E611E	1.0	µg/L		<1.0	----	----	----	----
dichloropropane, 1,3-	142-28-9	E611E	1.0	µg/L		<1.0	----	----	----	----
dichloropropane, 2,2-	594-20-7	E611E	1.0	µg/L		<1.0	----	----	----	----
dichloropropylene, 1,1-	563-58-6	E611E	1.0	µg/L		<1.0	----	----	----	----
dichloropropylene, cis+trans-1,3-	542-75-6	E611E	1.5	µg/L		<1.5	----	----	----	----
dichloropropylene, cis-1,3-	10061-01-5	E611E	1.0	µg/L		<1.0	----	----	----	----
dichloropropylene, trans-1,3-	10061-02-6	E611E	1.0	µg/L		<1.0	----	----	----	----
ethylbenzene	100-41-4	E611E	0.50	µg/L		<0.50	----	----	----	----
hexachlorobutadiene	87-68-3	E611E	1.0	µg/L		<1.0	----	----	----	----
isopropylbenzene	98-82-8	E611E	1.0	µg/L		<1.0	----	----	----	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	0.50	µg/L		<0.50	----	----	----	----
propylbenzene, n-	103-65-1	E611E	1.0	µg/L		<1.0	----	----	----	----
styrene	100-42-5	E611E	0.50	µg/L		<0.50	----	----	----	----
tetrachloroethane, 1,1,1,2-	630-20-6	E611E	1.0	µg/L		<1.0	----	----	----	----
tetrachloroethane, 1,1,2,2-	79-34-5	E611E	1.0	µg/L		<1.0	----	----	----	----
tetrachloroethylene	127-18-4	E611E	1.0	µg/L		<1.0	----	----	----	----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID: 22MW05	----	----	----	----
					Client sampling date / time: 01-Feb-2022 12:30	----	----	----	----
					CG2201107-001	--------	--------	--------	--------
					Result	----	----	----	----
Volatile Organic Compounds									
toluene	108-88-3	E611E	0.50	µg/L	<0.50	----	----	----	----
trichlorobenzene, 1,2,3-	87-61-6	E611E	1.0	µg/L	<1.0	----	----	----	----
trichlorobenzene, 1,2,4-	120-82-1	E611E	1.0	µg/L	<1.0	----	----	----	----
trichloroethane, 1,1,1-	71-55-6	E611E	1.0	µg/L	<1.0	----	----	----	----
trichloroethane, 1,1,2-	79-00-5	E611E	1.0	µg/L	<1.0	----	----	----	----
trichloroethylene	79-01-6	E611E	1.0	µg/L	<1.0	----	----	----	----
trichlorofluoromethane	75-69-4	E611E	1.0	µg/L	<1.0	----	----	----	----
trichloropropane, 1,2,3-	96-18-4	E611E	1.0	µg/L	<1.0	----	----	----	----
trimethylbenzene, 1,2,4-	95-63-6	E611E	1.0	µg/L	<1.0	----	----	----	----
trimethylbenzene, 1,3,5-	108-67-8	E611E	1.0	µg/L	<1.0	----	----	----	----
vinyl chloride	75-01-4	E611E	1.0	µg/L	<1.0	----	----	----	----
xylene, m+p-	179601-23-1	E611E	0.40	µg/L	<0.40	----	----	----	----
xylene, o-	95-47-6	E611E	0.30	µg/L	<0.30	----	----	----	----
xylenes, total	1330-20-7	E611E	0.50	µg/L	<0.50	----	----	----	----
BTEX, total	----	E611E	1.0	µg/L	<1.0	----	----	----	----
trihalomethanes [THMs], total	----	E611E	2.0	µg/L	<2.0	----	----	----	----
Volatile Organic Compounds Surrogates									
bromofluorobenzene, 4-	460-00-4	E611E	1.0	%	109	----	----	----	----
difluorobenzene, 1,4-	540-36-3	E611E	1.0	%	104	----	----	----	----
Polycyclic Aromatic Hydrocarbons									
naphthalene	91-20-3	E611E	1.0	µg/L	<1.0	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2201107**	Page	: 1 of 7
Client	: **Tetra Tech Canada Inc.**	Laboratory	: Calgary - Environmental
Contact	: Darby Madalena	Account Manager	: Patryk Wojciak
Address	: 110, 140 Quarry Park Blvd SE Calgary AB Canada T2C 3G3	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: 403 203 3355	Telephone	: +1 403 407 1800
Project	: SWM.SWOP04071-02.008	Date Samples Received	: 01-Feb-2022 14:40
PO	: SWM.SWOP04071-02.008	Issue Date	: 08-Feb-2022 13:12
C-O-C number	: CORD LINDSAY THURBER		
Sampler	: MEGAN.S		
Site	: ----		
Quote number	: Q71650 City of Red Deer Pre-1972 Landfill Monitoring		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers occur - please see following pages for full details.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid)										
22MW05	E298	01-Feb-2022	01-Feb-2022	----	----		01-Feb-2022	28 days	0 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
22MW05	E235.Cl	01-Feb-2022	----	----	----		02-Feb-2022	28 days	1 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
22MW05	E235.F	01-Feb-2022	----	----	----		02-Feb-2022	28 days	1 days	✓
Anions and Nutrients : Nitrate in Water by IC										
HDPE										
22MW05	E235.NO3	01-Feb-2022	----	----	----		02-Feb-2022	3 days	1 days	✓
Anions and Nutrients : Nitrite in Water by IC										
HDPE										
22MW05	E235.NO2	01-Feb-2022	----	----	----		02-Feb-2022	3 days	1 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE										
22MW05	E235.SO4	01-Feb-2022	----	----	----		02-Feb-2022	28 days	1 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid)										
22MW05	E509	01-Feb-2022	06-Feb-2022	----	----		06-Feb-2022	28 days	5 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid)										
22MW05	E421	01-Feb-2022	03-Feb-2022	----	----		03-Feb-2022	180 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
22MW05	E290	01-Feb-2022	----	----	----		02-Feb-2022	14 days	1 days	✓
Physical Tests : Conductivity in Water										
HDPE										
22MW05	E100	01-Feb-2022	----	----	----		02-Feb-2022	28 days	1 days	✓
Physical Tests : pH by Meter										
HDPE										
22MW05	E108	01-Feb-2022	----	----	----		02-Feb-2022	0.25 hrs	22 hrs	× EHTR-FM
Polycyclic Aromatic Hydrocarbons : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate)										
22MW05	E611E	01-Feb-2022	02-Feb-2022	----	----		02-Feb-2022	----	----	
Volatile Organic Compounds : VOCs (Prairies List) by Headspace GC-MS										
Glass vial (sodium bisulfate)										
22MW05	E611E	01-Feb-2022	02-Feb-2022	----	----		02-Feb-2022	14 days	1 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration	E290	400224	1	9	11.1	5.0	✓
Ammonia by Fluorescence	E298	399911	1	1	100.0	5.0	✓
Chloride in Water by IC	E235.Cl	400255	1	1	100.0	5.0	✓
Conductivity in Water	E100	400222	1	9	11.1	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	403609	1	18	5.5	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	401380	1	14	7.1	5.0	✓
Fluoride in Water by IC	E235.F	400252	1	14	7.1	5.0	✓
Nitrate in Water by IC	E235.NO3	400253	1	4	25.0	5.0	✓
Nitrite in Water by IC	E235.NO2	400254	1	4	25.0	5.0	✓
pH by Meter	E108	400223	1	13	7.6	5.0	✓
Sulfate in Water by IC	E235.SO4	400251	1	14	7.1	5.0	✓
VOCs (Prairies List) by Headspace GC-MS	E611E	400539	1	2	50.0	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration	E290	400224	1	9	11.1	5.0	✓
Ammonia by Fluorescence	E298	399911	1	1	100.0	5.0	✓
Chloride in Water by IC	E235.Cl	400255	1	1	100.0	5.0	✓
Conductivity in Water	E100	400222	1	9	11.1	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	403609	1	18	5.5	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	401380	1	14	7.1	5.0	✓
Fluoride in Water by IC	E235.F	400252	1	14	7.1	5.0	✓
Nitrate in Water by IC	E235.NO3	400253	1	4	25.0	5.0	✓
Nitrite in Water by IC	E235.NO2	400254	1	4	25.0	5.0	✓
pH by Meter	E108	400223	1	13	7.6	5.0	✓
Sulfate in Water by IC	E235.SO4	400251	1	14	7.1	5.0	✓
VOCs (Prairies List) by Headspace GC-MS	E611E	400539	1	2	50.0	5.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration	E290	400224	1	9	11.1	5.0	✓
Ammonia by Fluorescence	E298	399911	1	1	100.0	5.0	✓
Chloride in Water by IC	E235.Cl	400255	1	1	100.0	5.0	✓
Conductivity in Water	E100	400222	1	9	11.1	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	403609	1	18	5.5	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	401380	1	14	7.1	5.0	✓
Fluoride in Water by IC	E235.F	400252	1	14	7.1	5.0	✓
Nitrate in Water by IC	E235.NO3	400253	1	4	25.0	5.0	✓
Nitrite in Water by IC	E235.NO2	400254	1	4	25.0	5.0	✓
Sulfate in Water by IC	E235.SO4	400251	1	14	7.1	5.0	✓
VOCs (Prairies List) by Headspace GC-MS	E611E	400539	1	2	50.0	5.0	✓

Matrix: **Water**

Evaluation: ✗ = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	399911	0	1	0.0	5.0	✗
Chloride in Water by IC	E235.Cl	400255	0	1	0.0	5.0	✗
Dissolved Mercury in Water by CVAAS	E509	403609	1	18	5.5	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	401380	1	14	7.1	5.0	✓
Fluoride in Water by IC	E235.F	400252	1	14	7.1	5.0	✓
Nitrate in Water by IC	E235.NO3	400253	1	4	25.0	5.0	✓
Nitrite in Water by IC	E235.NO2	400254	1	4	25.0	5.0	✓
Sulfate in Water by IC	E235.SO4	400251	1	14	7.1	5.0	✓
VOCs (Prairies List) by Headspace GC-MS	E611E	400539	1	2	50.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Calgary - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Calgary - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Chloride in Water by IC	E235.Cl Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC	E235.NO2 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC	E235.NO3 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Alkalinity Species by Titration	E290 Calgary - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Calgary - Environmental	Water	J. Environ. Monit., 2005, 7, 37-42 (mod)	Ammonia in water is analyzed by flow-injection analysis with fluorescence detection after reaction with orthophthaldialdehyde (OPA).
Dissolved Metals in Water by CRC ICPMS	E421 Calgary - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Dissolved Mercury in Water by CVAAS	E509 Calgary - Environmental	Water	APHA 3030B/EPA 1631E (mod)	Water samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
VOCs (Prairies List) by Headspace GC-MS	E611E Calgary - Environmental	Water	EPA 8260D (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Hardness (Calculated)	EC100 Calgary - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Ion Balance using Dissolved Metals	EC101 Calgary - Environmental	Water	APHA 1030E	Cation Sum, Anion Sum, and Ion Balance are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present. Ion Balance cannot be calculated accurately for waters with very low electrical conductivity (EC).
TDS in Water (Calculation)	EC103 Calgary - Environmental	Water	APHA 1030E (mod)	Total Dissolved Solids is calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present.
Nitrate and Nitrite (as N) (Calculation)	EC235.N+N Calgary - Environmental	Water	EPA 300.0	Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Calgary - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Dissolved Metals Water Filtration	EP421 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Dissolved Mercury Water Filtration	EP509 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.
VOCs Preparation for Headspace Analysis	EP581 Calgary - Environmental	Water	EPA 5021A (mod)	Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler. An aliquot of the headspace is then injected into the GC/MS-FID system.

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **CG2201107**	Page	: 1 of 14
Client	: Tetra Tech Canada Inc.	Laboratory	: Calgary - Environmental
Contact	: Darby Madalena	Account Manager	: Patryk Wojciak
Address	: 110, 140 Quarry Park Blvd SE Calgary AB Canada T2C 3G3	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: 403 203 3355	Telephone	: +1 403 407 1800
Project	: SWM.SWOP04071-02.008	Date Samples Received	: 01-Feb-2022 14:40
PO	: SWM.SWOP04071-02.008	Date Analysis Commenced	: 01-Feb-2022
C-O-C number	: CORD LINDSAY THURBER	Issue Date	: 08-Feb-2022 13:12
Sampler	: MEGAN.S		
Site	: ----		
Quote number	: Q71650 City of Red Deer Pre-1972 Landfill Monitoring		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits
- Reference Material (RM) Report; Recovery and Acceptance Limits
- Method Blank (MB) Report; Recovery and Acceptance Limits
- Laboratory Control Sample (LCS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Harpreet Chawla	Team Leader - Inorganics	Metals, Calgary, Alberta
Jeanie Mark	Laboratory Analyst	Organics, Calgary, Alberta
Olivia Gu	Lab Analyst	Metals, Calgary, Alberta
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta
Sara Niroomand		Inorganics, Calgary, Alberta
Shirley Li		Inorganics, Calgary, Alberta
Shirley Li		Metals, Calgary, Alberta

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include 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 predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percentage Difference
# = Indicates a QC result that did not meet the ALS DQO.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test specific).

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 400222)											
CG2201104-001	Anonymous	conductivity	----	E100	2.0	µS/cm	2890	2860	1.04%	10%	----
Physical Tests (QC Lot: 400223)											
CG2201104-001	Anonymous	pH	----	E108	0.10	pH units	8.15	8.16	0.123%	4%	----
Physical Tests (QC Lot: 400224)											
CG2201104-001	Anonymous	alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	464	457	1.50%	20%	----
Anions and Nutrients (QC Lot: 399911)											
CG2201107-001	22MW05	ammonia, total (as N)	7664-41-7	E298	0.125	mg/L	3.66	3.72	1.47%	20%	----
Anions and Nutrients (QC Lot: 400251)											
CG2201101-004	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	95.8	97.1	1.34%	20%	----
Anions and Nutrients (QC Lot: 400252)											
CG2201101-004	Anonymous	fluoride	16984-48-8	E235.F	0.020	mg/L	0.144	0.146	0.003	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 400253)											
CG2201107-001	22MW05	nitrate (as N)	14797-55-8	E235.NO3	0.100	mg/L	0.170	0.170	0.0006	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 400254)											
CG2201107-001	22MW05	nitrite (as N)	14797-65-0	E235.NO2	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 400255)											
CG2201107-001	22MW05	chloride	16887-00-6	E235.Cl	2.50	mg/L	45.0	45.0	0.238%	20%	----
Dissolved Metals (QC Lot: 401380)											
CG2201099-014	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00050	mg/L	0.00058	0.00055	0.00004	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00050	mg/L	0.0114	0.0111	2.14%	20%	----
		boron, dissolved	7440-42-8	E421	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000250	mg/L	0.00138	0.00136	1.55%	20%	----
		calcium, dissolved	7440-70-2	E421	0.250	mg/L	285	284	0.260%	20%	----
		chromium, dissolved	7440-47-3	E421	0.00250	mg/L	<0.00250	<0.00250	0	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00100	mg/L	<0.00100	<0.00100	0	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000250	mg/L	<0.000250	<0.000250	0	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.0250	mg/L	171	173	1.02%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00050	mg/L	0.726	0.730	0.484%	20%	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Dissolved Metals (QC Lot: 401380) - continued											
CG2201099-014	Anonymous	nickel, dissolved	7440-02-0	E421	0.00250	mg/L	0.0639	0.0643	0.705%	20%	----
		potassium, dissolved	7440-09-7	E421	0.250	mg/L	4.16	4.11	1.05%	20%	----
		selenium, dissolved	7782-49-2	E421	0.000250	mg/L	0.00650	0.00640	1.50%	20%	----
		silver, dissolved	7440-22-4	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.250	mg/L	6.22	6.26	0.514%	20%	----
		uranium, dissolved	7440-61-1	E421	0.000050	mg/L	0.0155	0.0152	2.16%	20%	----
		zinc, dissolved	7440-66-6	E421	0.0050	mg/L	0.0218	0.0220	0.0003	Diff <2x LOR	----
Dissolved Metals (QC Lot: 403609)											
CG2201047-001	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Volatile Organic Compounds (QC Lot: 400539)											
CG2201055-001	Anonymous	benzene	71-43-2	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		bromobenzene	108-86-1	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		bromochloromethane	74-97-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		bromodichloromethane	75-27-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		bromoform	75-25-2	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		bromomethane	74-83-9	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		butylbenzene, n-	104-51-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		butylbenzene, sec-	135-98-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		butylbenzene, tert-	98-06-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		carbon tetrachloride	56-23-5	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		chlorobenzene	108-90-7	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		chloroethane	75-00-3	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		chloroform	67-66-3	E611E	1.0	µg/L	2.6	2.6	0.01	Diff <2x LOR	----
		chloromethane	74-87-3	E611E	5.0	µg/L	<5.0	<5.0	0	Diff <2x LOR	----
		chlorotoluene, 2-	95-49-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		chlorotoluene, 4-	106-43-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		cymene, p-	99-87-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dibromo-3-chloropropane, 1,2-	96-12-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dibromochloromethane	124-48-1	E611E	1.0	µg/L	2.3	2.2	0.08	Diff <2x LOR	----
		dibromoethane, 1,2-	106-93-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dibromomethane	74-95-3	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichlorobenzene, 1,2-	95-50-1	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dichlorobenzene, 1,3-	541-73-1	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichlorobenzene, 1,4-	106-46-7	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichlorodifluoromethane	75-71-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Volatile Organic Compounds (QC Lot: 400539) - continued											
CG2201055-001	Anonymous	dichloroethane, 1,1-	75-34-3	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloroethane, 1,2-	107-06-2	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloroethylene, 1,1-	75-35-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloroethylene, cis-1,2-	156-59-2	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloroethylene, trans-1,2-	156-60-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloromethane	75-09-2	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropane, 1,2-	78-87-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropane, 1,3-	142-28-9	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropane, 2,2-	594-20-7	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropylene, 1,1-	563-58-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropylene, cis-1,3-	10061-01-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropylene, trans-1,3-	10061-02-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		ethylbenzene	100-41-4	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		hexachlorobutadiene	87-68-3	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		isopropylbenzene	98-82-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		naphthalene	91-20-3	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		propylbenzene, n-	103-65-1	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		styrene	100-42-5	E611E	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		tetrachloroethane, 1,1,1,2-	630-20-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		tetrachloroethane, 1,1,2,2-	79-34-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		tetrachloroethylene	127-18-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		toluene	108-88-3	E611E	0.50	µg/L	13.0	12.7	1.87%	30%	----
		trichlorobenzene, 1,2,3-	87-61-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichlorobenzene, 1,2,4-	120-82-1	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichloroethane, 1,1,1-	71-55-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichloroethane, 1,1,2-	79-00-5	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichloroethylene	79-01-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichlorofluoromethane	75-69-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trichloropropane, 1,2,3-	96-18-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trimethylbenzene, 1,2,4-	95-63-6	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		trimethylbenzene, 1,3,5-	108-67-8	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		vinyl chloride	75-01-4	E611E	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		xylene, m+p-	179601-23-1	E611E	0.40	µg/L	<0.40	<0.40	0	Diff <2x LOR	----
		xylene, o-	95-47-6	E611E	0.30	µg/L	<0.30	<0.30	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 400222)						
conductivity	----	E100	1	µS/cm	<1.0	----
Physical Tests (QCLot: 400224)						
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Anions and Nutrients (QCLot: 399911)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 400251)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 400252)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 400253)						
nitrate (as N)	14797-55-8	E235.NO3	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 400254)						
nitrite (as N)	14797-65-0	E235.NO2	0.01	mg/L	<0.010	----
Anions and Nutrients (QCLot: 400255)						
chloride	16887-00-6	E235.Cl	0.5	mg/L	<0.50	----
Dissolved Metals (QCLot: 401380)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	<0.00050	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 401380) - continued						
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
Dissolved Metals (QCLot: 403609)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----
Volatile Organic Compounds (QCLot: 400539)						
benzene	71-43-2	E611E	0.5	µg/L	<0.50	----
bromobenzene	108-86-1	E611E	1	µg/L	<1.0	----
bromochloromethane	74-97-5	E611E	1	µg/L	<1.0	----
bromodichloromethane	75-27-4	E611E	1	µg/L	<1.0	----
bromoform	75-25-2	E611E	1	µg/L	<1.0	----
bromomethane	74-83-9	E611E	1	µg/L	<1.0	----
butylbenzene, n-	104-51-8	E611E	1	µg/L	<1.0	----
butylbenzene, sec-	135-98-8	E611E	1	µg/L	<1.0	----
butylbenzene, tert-	98-06-6	E611E	1	µg/L	<1.0	----
carbon tetrachloride	56-23-5	E611E	0.5	µg/L	<0.50	----
chlorobenzene	108-90-7	E611E	1	µg/L	<1.0	----
chloroethane	75-00-3	E611E	1	µg/L	<1.0	----
chloroform	67-66-3	E611E	1	µg/L	<1.0	----
chloromethane	74-87-3	E611E	5	µg/L	<5.0	----
chlorotoluene, 2-	95-49-8	E611E	1	µg/L	<1.0	----
chlorotoluene, 4-	106-43-4	E611E	1	µg/L	<1.0	----
cymene, p-	99-87-6	E611E	1	µg/L	<1.0	----
dibromo-3-chloropropane, 1,2-	96-12-8	E611E	1	µg/L	<1.0	----
dibromochloromethane	124-48-1	E611E	1	µg/L	<1.0	----
dibromoethane, 1,2-	106-93-4	E611E	1	µg/L	<1.0	----
dibromomethane	74-95-3	E611E	1	µg/L	<1.0	----
dichlorobenzene, 1,2-	95-50-1	E611E	0.5	µg/L	<0.50	----
dichlorobenzene, 1,3-	541-73-1	E611E	1	µg/L	<1.0	----
dichlorobenzene, 1,4-	106-46-7	E611E	1	µg/L	<1.0	----
dichlorodifluoromethane	75-71-8	E611E	1	µg/L	<1.0	----
dichloroethane, 1,1-	75-34-3	E611E	1	µg/L	<1.0	----
dichloroethane, 1,2-	107-06-2	E611E	1	µg/L	<1.0	----
dichloroethylene, 1,1-	75-35-4	E611E	1	µg/L	<1.0	----
dichloroethylene, cis-1,2-	156-59-2	E611E	1	µg/L	<1.0	----
dichloroethylene, trans-1,2-	156-60-5	E611E	1	µg/L	<1.0	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Volatile Organic Compounds (QCLot: 400539) - continued						
dichloromethane	75-09-2	E611E	1	µg/L	<1.0	----
dichloropropane, 1,2-	78-87-5	E611E	1	µg/L	<1.0	----
dichloropropane, 1,3-	142-28-9	E611E	1	µg/L	<1.0	----
dichloropropane, 2,2-	594-20-7	E611E	1	µg/L	<1.0	----
dichloropropylene, 1,1-	563-58-6	E611E	1	µg/L	<1.0	----
dichloropropylene, cis-1,3-	10061-01-5	E611E	1	µg/L	<1.0	----
dichloropropylene, trans-1,3-	10061-02-6	E611E	1	µg/L	<1.0	----
ethylbenzene	100-41-4	E611E	0.5	µg/L	<0.50	----
hexachlorobutadiene	87-68-3	E611E	1	µg/L	<1.0	----
isopropylbenzene	98-82-8	E611E	1	µg/L	<1.0	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	0.5	µg/L	<0.50	----
naphthalene	91-20-3	E611E	1	µg/L	<1.0	----
propylbenzene, n-	103-65-1	E611E	1	µg/L	<1.0	----
styrene	100-42-5	E611E	0.5	µg/L	<0.50	----
tetrachloroethane, 1,1,1,2-	630-20-6	E611E	1	µg/L	<1.0	----
tetrachloroethane, 1,1,2,2-	79-34-5	E611E	1	µg/L	<1.0	----
tetrachloroethylene	127-18-4	E611E	1	µg/L	<1.0	----
toluene	108-88-3	E611E	0.5	µg/L	<0.50	----
trichlorobenzene, 1,2,3-	87-61-6	E611E	1	µg/L	<1.0	----
trichlorobenzene, 1,2,4-	120-82-1	E611E	1	µg/L	<1.0	----
trichloroethane, 1,1,1-	71-55-6	E611E	1	µg/L	<1.0	----
trichloroethane, 1,1,2-	79-00-5	E611E	1	µg/L	<1.0	----
trichloroethylene	79-01-6	E611E	1	µg/L	<1.0	----
trichlorofluoromethane	75-69-4	E611E	1	µg/L	<1.0	----
trichloropropane, 1,2,3-	96-18-4	E611E	1	µg/L	<1.0	----
trimethylbenzene, 1,2,4-	95-63-6	E611E	1	µg/L	<1.0	----
trimethylbenzene, 1,3,5-	108-67-8	E611E	1	µg/L	<1.0	----
vinyl chloride	75-01-4	E611E	1	µg/L	<1.0	----
xylene, m+p-	179601-23-1	E611E	0.4	µg/L	<0.40	----
xylene, o-	95-47-6	E611E	0.3	µg/L	<0.30	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 400222)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	96.7	90.0	110	----
Physical Tests (QCLot: 400223)									
pH	----	E108	----	pH units	7 pH units	99.7	98.6	101	----
Physical Tests (QCLot: 400224)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	105	85.0	115	----
Anions and Nutrients (QCLot: 399911)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	98.1	85.0	115	----
Anions and Nutrients (QCLot: 400251)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	104	90.0	110	----
Anions and Nutrients (QCLot: 400252)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	96.3	90.0	110	----
Anions and Nutrients (QCLot: 400253)									
nitrate (as N)	14797-55-8	E235.NO3	0.02	mg/L	2.5 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 400254)									
nitrite (as N)	14797-65-0	E235.NO2	0.01	mg/L	0.5 mg/L	104	90.0	110	----
Anions and Nutrients (QCLot: 400255)									
chloride	16887-00-6	E235.Cl	0.5	mg/L	100 mg/L	101	90.0	110	----
Dissolved Metals (QCLot: 401380)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	100	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	118	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	96.7	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	102	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	92.8	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	98.3	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	98.5	80.0	120	----
chromium, dissolved	7440-47-3	E421	0.0005	mg/L	0.25 mg/L	102	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	97.4	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	104	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	96.1	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	108	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	100	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	102	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 401380) - continued									
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	103	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	95.6	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	91.4	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	98.6	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	106	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	98.4	80.0	120	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	98.0	80.0	120	----
Volatile Organic Compounds (QCLot: 400539)									
benzene	71-43-2	E611E	0.5	µg/L	100 µg/L	91.9	70.0	130	----
bromobenzene	108-86-1	E611E	1	µg/L	100 µg/L	106	70.0	130	----
bromochloromethane	74-97-5	E611E	1	µg/L	100 µg/L	99.9	70.0	130	----
bromodichloromethane	75-27-4	E611E	1	µg/L	100 µg/L	83.2	70.0	130	----
bromoform	75-25-2	E611E	1	µg/L	100 µg/L	80.2	70.0	130	----
bromomethane	74-83-9	E611E	1	µg/L	100 µg/L	92.8	60.0	140	----
butylbenzene, n-	104-51-8	E611E	1	µg/L	100 µg/L	118	70.0	130	----
butylbenzene, sec-	135-98-8	E611E	1	µg/L	100 µg/L	123	70.0	130	----
butylbenzene, tert-	98-06-6	E611E	1	µg/L	100 µg/L	114	70.0	130	----
carbon tetrachloride	56-23-5	E611E	0.5	µg/L	100 µg/L	99.0	70.0	130	----
chlorobenzene	108-90-7	E611E	1	µg/L	100 µg/L	109	70.0	130	----
chloroethane	75-00-3	E611E	1	µg/L	100 µg/L	105	60.0	140	----
chloroform	67-66-3	E611E	1	µg/L	100 µg/L	97.1	70.0	130	----
chloromethane	74-87-3	E611E	5	µg/L	100 µg/L	120	60.0	140	----
chlorotoluene, 2-	95-49-8	E611E	1	µg/L	100 µg/L	111	70.0	130	----
chlorotoluene, 4-	106-43-4	E611E	1	µg/L	100 µg/L	101	70.0	130	----
cymene, p-	99-87-6	E611E	1	µg/L	100 µg/L	110	70.0	130	----
dibromo-3-chloropropane, 1,2-	96-12-8	E611E	1	µg/L	100 µg/L	73.3	70.0	130	----
dibromochloromethane	124-48-1	E611E	1	µg/L	100 µg/L	75.7	70.0	130	----
dibromoethane, 1,2-	106-93-4	E611E	1	µg/L	100 µg/L	75.7	70.0	130	----
dibromomethane	74-95-3	E611E	1	µg/L	100 µg/L	86.0	70.0	130	----
dichlorobenzene, 1,2-	95-50-1	E611E	0.5	µg/L	100 µg/L	108	70.0	130	----
dichlorobenzene, 1,3-	541-73-1	E611E	1	µg/L	100 µg/L	114	70.0	130	----
dichlorobenzene, 1,4-	106-46-7	E611E	1	µg/L	100 µg/L	121	70.0	130	----
dichlorodifluoromethane	75-71-8	E611E	1	µg/L	100 µg/L	122	60.0	140	----
dichloroethane, 1,1-	75-34-3	E611E	1	µg/L	100 µg/L	94.9	70.0	130	----
dichloroethane, 1,2-	107-06-2	E611E	1	µg/L	100 µg/L	85.9	70.0	130	----
dichloroethylene, 1,1-	75-35-4	E611E	1	µg/L	100 µg/L	105	70.0	130	----
dichloroethylene, cis-1,2-	156-59-2	E611E	1	µg/L	100 µg/L	98.3	70.0	130	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 400539) - continued									
dichloroethylene, trans-1,2-	156-60-5	E611E	1	µg/L	100 µg/L	96.6	70.0	130	----
dichloromethane	75-09-2	E611E	1	µg/L	100 µg/L	102	70.0	130	----
dichloropropane, 1,2-	78-87-5	E611E	1	µg/L	100 µg/L	81.9	70.0	130	----
dichloropropane, 1,3-	142-28-9	E611E	1	µg/L	100 µg/L	75.9	70.0	130	----
dichloropropane, 2,2-	594-20-7	E611E	1	µg/L	100 µg/L	92.8	70.0	130	----
dichloropropylene, 1,1-	563-58-6	E611E	1	µg/L	100 µg/L	93.3	70.0	130	----
dichloropropylene, cis-1,3-	10061-01-5	E611E	1	µg/L	100 µg/L	112	70.0	130	----
dichloropropylene, trans-1,3-	10061-02-6	E611E	1	µg/L	100 µg/L	74.3	70.0	130	----
ethylbenzene	100-41-4	E611E	0.5	µg/L	100 µg/L	101	70.0	130	----
hexachlorobutadiene	87-68-3	E611E	1	µg/L	100 µg/L	104	70.0	130	----
isopropylbenzene	98-82-8	E611E	1	µg/L	100 µg/L	108	70.0	130	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	0.5	µg/L	100 µg/L	109	70.0	130	----
naphthalene	91-20-3	E611E	1	µg/L	100 µg/L	76.9	70.0	130	----
propylbenzene, n-	103-65-1	E611E	1	µg/L	100 µg/L	104	70.0	130	----
styrene	100-42-5	E611E	0.5	µg/L	100 µg/L	73.3	70.0	130	----
tetrachloroethane, 1,1,1,2-	630-20-6	E611E	1	µg/L	100 µg/L	101	70.0	130	----
tetrachloroethane, 1,1,2,2-	79-34-5	E611E	1	µg/L	100 µg/L	98.8	70.0	130	----
tetrachloroethylene	127-18-4	E611E	1	µg/L	100 µg/L	109	70.0	130	----
toluene	108-88-3	E611E	0.5	µg/L	100 µg/L	91.5	70.0	130	----
trichlorobenzene, 1,2,3-	87-61-6	E611E	1	µg/L	100 µg/L	100	70.0	130	----
trichlorobenzene, 1,2,4-	120-82-1	E611E	1	µg/L	100 µg/L	113	70.0	130	----
trichloroethane, 1,1,1-	71-55-6	E611E	1	µg/L	100 µg/L	93.3	70.0	130	----
trichloroethane, 1,1,2-	79-00-5	E611E	1	µg/L	100 µg/L	85.0	70.0	130	----
trichloroethylene	79-01-6	E611E	1	µg/L	100 µg/L	108	70.0	130	----
trichlorofluoromethane	75-69-4	E611E	1	µg/L	100 µg/L	120	60.0	140	----
trichloropropane, 1,2,3-	96-18-4	E611E	1	µg/L	100 µg/L	83.0	70.0	130	----
trimethylbenzene, 1,2,4-	95-63-6	E611E	1	µg/L	100 µg/L	109	70.0	130	----
trimethylbenzene, 1,3,5-	108-67-8	E611E	1	µg/L	100 µg/L	110	70.0	130	----
vinyl chloride	75-01-4	E611E	1	µg/L	100 µg/L	124	60.0	140	----
xylene, m+p-	179601-23-1	E611E	0.4	µg/L	200 µg/L	112	70.0	130	----
xylene, o-	95-47-6	E611E	0.3	µg/L	100 µg/L	98.2	70.0	130	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 400251)										
CG2201101-005	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	ND mg/L	100 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 400252)										
CG2201101-005	Anonymous	fluoride	16984-48-8	E235.F	0.833 mg/L	1 mg/L	83.3	75.0	125	----
Anions and Nutrients (QCLot: 400253)										
GP2200166-001	Anonymous	nitrate (as N)	14797-55-8	E235.NO3	2.45 mg/L	2.5 mg/L	98.0	75.0	125	----
Anions and Nutrients (QCLot: 400254)										
GP2200166-001	Anonymous	nitrite (as N)	14797-65-0	E235.NO2	0.401 mg/L	0.5 mg/L	80.1	75.0	125	----
Dissolved Metals (QCLot: 401380)										
CG2201099-015	Anonymous	aluminum, dissolved	7429-90-5	E421	2.00 mg/L	2 mg/L	100.0	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.202 mg/L	0.2 mg/L	101	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.189 mg/L	0.2 mg/L	94.4	70.0	130	----
		barium, dissolved	7440-39-3	E421	0.208 mg/L	0.2 mg/L	104	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.982 mg/L	1 mg/L	98.2	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.0401 mg/L	0.04 mg/L	100	70.0	130	----
		calcium, dissolved	7440-70-2	E421	39.8 mg/L	40 mg/L	99.6	70.0	130	----
		chromium, dissolved	7440-47-3	E421	0.410 mg/L	0.4 mg/L	102	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.198 mg/L	0.2 mg/L	98.9	70.0	130	----
		iron, dissolved	7439-89-6	E421	19.9 mg/L	20 mg/L	99.5	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.180 mg/L	0.2 mg/L	90.0	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	9.74 mg/L	10 mg/L	97.4	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.201 mg/L	0.2 mg/L	101	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.410 mg/L	0.4 mg/L	102	70.0	130	----
		potassium, dissolved	7440-09-7	E421	35.8 mg/L	40 mg/L	89.6	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.391 mg/L	0.4 mg/L	97.8	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.0377 mg/L	0.04 mg/L	94.2	70.0	130	----
		sodium, dissolved	7440-23-5	E421	19.8 mg/L	20 mg/L	99.1	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.0432 mg/L	0.04 mg/L	108	70.0	130	----
		zinc, dissolved	7440-66-6	E421	3.99 mg/L	4 mg/L	99.7	70.0	130	----
Dissolved Metals (QCLot: 403609)										
CG2201047-002	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000910 mg/L	0.0001 mg/L	91.0	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 400539)										
CG2201055-001	Anonymous	benzene	71-43-2	E611E	99.2 µg/L	100 µg/L	99.2	70.0	130	----
		bromobenzene	108-86-1	E611E	111 µg/L	100 µg/L	111	70.0	130	----
		bromochloromethane	74-97-5	E611E	122 µg/L	100 µg/L	122	70.0	130	----
		bromodichloromethane	75-27-4	E611E	96.3 µg/L	100 µg/L	96.3	70.0	130	----
		bromoform	75-25-2	E611E	83.4 µg/L	100 µg/L	83.4	70.0	130	----
		bromomethane	74-83-9	E611E	96.8 µg/L	100 µg/L	96.8	60.0	140	----
		butylbenzene, n-	104-51-8	E611E	99.8 µg/L	100 µg/L	99.8	70.0	130	----
		butylbenzene, sec-	135-98-8	E611E	106 µg/L	100 µg/L	106	70.0	130	----
		butylbenzene, tert-	98-06-6	E611E	99.7 µg/L	100 µg/L	99.7	70.0	130	----
		carbon tetrachloride	56-23-5	E611E	97.5 µg/L	100 µg/L	97.5	70.0	130	----
		chlorobenzene	108-90-7	E611E	109 µg/L	100 µg/L	109	70.0	130	----
		chloroethane	75-00-3	E611E	104 µg/L	100 µg/L	104	60.0	140	----
		chloroform	67-66-3	E611E	106 µg/L	100 µg/L	106	70.0	130	----
		chloromethane	74-87-3	E611E	124 µg/L	100 µg/L	124	60.0	140	----
		chlorotoluene, 2-	95-49-8	E611E	107 µg/L	100 µg/L	107	70.0	130	----
		chlorotoluene, 4-	106-43-4	E611E	98.3 µg/L	100 µg/L	98.3	70.0	130	----
		cymene, p-	99-87-6	E611E	104 µg/L	100 µg/L	104	70.0	130	----
		dibromo-3-chloropropane, 1,2-	96-12-8	E611E	82.8 µg/L	100 µg/L	82.8	70.0	130	----
		dibromochloromethane	124-48-1	E611E	92.7 µg/L	100 µg/L	92.7	70.0	130	----
		dibromoethane, 1,2-	106-93-4	E611E	98.9 µg/L	100 µg/L	98.9	70.0	130	----
		dibromomethane	74-95-3	E611E	110 µg/L	100 µg/L	110	70.0	130	----
		dichlorobenzene, 1,2-	95-50-1	E611E	107 µg/L	100 µg/L	107	70.0	130	----
		dichlorobenzene, 1,3-	541-73-1	E611E	111 µg/L	100 µg/L	111	70.0	130	----
		dichlorobenzene, 1,4-	106-46-7	E611E	117 µg/L	100 µg/L	117	70.0	130	----
		dichlorodifluoromethane	75-71-8	E611E	113 µg/L	100 µg/L	113	60.0	140	----
		dichloroethane, 1,1-	75-34-3	E611E	101 µg/L	100 µg/L	101	70.0	130	----
		dichloroethane, 1,2-	107-06-2	E611E	96.8 µg/L	100 µg/L	96.8	70.0	130	----
		dichloroethylene, 1,1-	75-35-4	E611E	102 µg/L	100 µg/L	102	70.0	130	----
		dichloroethylene, cis-1,2-	156-59-2	E611E	110 µg/L	100 µg/L	110	70.0	130	----
		dichloroethylene, trans-1,2-	156-60-5	E611E	106 µg/L	100 µg/L	106	70.0	130	----
		dichloromethane	75-09-2	E611E	119 µg/L	100 µg/L	119	70.0	130	----
		dichloropropane, 1,2-	78-87-5	E611E	94.5 µg/L	100 µg/L	94.5	70.0	130	----
		dichloropropane, 1,3-	142-28-9	E611E	92.8 µg/L	100 µg/L	92.8	70.0	130	----
		dichloropropane, 2,2-	594-20-7	E611E	93.6 µg/L	100 µg/L	93.6	70.0	130	----
		dichloropropylene, 1,1-	563-58-6	E611E	92.2 µg/L	100 µg/L	92.2	70.0	130	----
		dichloropropylene, cis-1,3-	10061-01-5	E611E	76.7 µg/L	100 µg/L	76.7	70.0	130	----
		dichloropropylene, trans-1,3-	10061-02-6	E611E	71.9 µg/L	100 µg/L	71.9	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 400539) - continued										
CG2201055-001	Anonymous	ethylbenzene	100-41-4	E611E	95.9 µg/L	100 µg/L	95.9	70.0	130	----
		hexachlorobutadiene	87-68-3	E611E	72.7 µg/L	100 µg/L	72.7	70.0	130	----
		isopropylbenzene	98-82-8	E611E	99.2 µg/L	100 µg/L	99.2	70.0	130	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611E	109 µg/L	100 µg/L	109	70.0	130	----
		naphthalene	91-20-3	E611E	78.1 µg/L	100 µg/L	78.1	70.0	130	----
		propylbenzene, n-	103-65-1	E611E	94.5 µg/L	100 µg/L	94.5	70.0	130	----
		styrene	100-42-5	E611E	74.2 µg/L	100 µg/L	74.2	70.0	130	----
		tetrachloroethane, 1,1,1,2-	630-20-6	E611E	100 µg/L	100 µg/L	100	70.0	130	----
		tetrachloroethane, 1,1,2,2-	79-34-5	E611E	114 µg/L	100 µg/L	114	70.0	130	----
		tetrachloroethylene	127-18-4	E611E	109 µg/L	100 µg/L	109	70.0	130	----
		toluene	108-88-3	E611E	97.9 µg/L	100 µg/L	97.9	70.0	130	----
		trichlorobenzene, 1,2,3-	87-61-6	E611E	87.2 µg/L	100 µg/L	87.2	70.0	130	----
		trichlorobenzene, 1,2,4-	120-82-1	E611E	95.9 µg/L	100 µg/L	95.9	70.0	130	----
		trichloroethane, 1,1,1-	71-55-6	E611E	92.6 µg/L	100 µg/L	92.6	70.0	130	----
		trichloroethane, 1,1,2-	79-00-5	E611E	109 µg/L	100 µg/L	109	70.0	130	----
		trichloroethylene	79-01-6	E611E	111 µg/L	100 µg/L	111	70.0	130	----
		trichlorofluoromethane	75-69-4	E611E	113 µg/L	100 µg/L	113	60.0	140	----
		trichloropropane, 1,2,3-	96-18-4	E611E	107 µg/L	100 µg/L	107	70.0	130	----
		trimethylbenzene, 1,2,4-	95-63-6	E611E	98.1 µg/L	100 µg/L	98.1	70.0	130	----
		trimethylbenzene, 1,3,5-	108-67-8	E611E	97.8 µg/L	100 µg/L	97.8	70.0	130	----
		vinyl chloride	75-01-4	E611E	121 µg/L	100 µg/L	121	60.0	140	----
		xylene, m+p-	179601-23-1	E611E	216 µg/L	200 µg/L	108	70.0	130	----
		xylene, o-	95-47-6	E611E	95.4 µg/L	100 µg/L	95.4	70.0	130	----

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 Lindsay Thurber

Page 1 of 1

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.SWOP04071-02.008	
Address:		PO/AFE: SWM.SWOP04071-02.008	
Sample		Legal Site Description:	
Phone:	Fax:	Quote #: Q71650	
Lab Work Order # (lab use only)		ALS Contact: Milica Papic	Sampler (Initials): Megan Savage

Sample #	Sample Identification (This description will appear on the report)	Date dd-mmm-yy	Time hh:mm	Sample Type (Select from drop-down list)	VOC-8260	ROU-MET_D-ABT1	NH3-F	Hazardous?	Highly Contaminated?	Number of Containers
	22MW05	01-Feb-22	1230	Water	X	X	X			6

Guidelines / Regulations

Special Instructions / Hazardous

Environmental Division
Calgary
Work Order Reference
CG2201107

Telephone : +1 403 407 1800

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:
M Savage	Feb 1, 22 1437		
			2/1/22

Sample Condition (lab use only)

Temperature	Samples Received in Good Condition? Y / N (if no provided details)
6	

APPENDIX E

HISTORICAL ANALYTICAL RESULTS

Table 1
Soil Vapour and Groundwater Monitoring Wells Elevations

Test Location	Well Depth (m)	Elevations				Screen Length (m)
		Ground (m)	Top of Pipe (m)	Screen Interval From	Screen Interval To	
Existing wells						
MW-01A	6.0	854.249	854.134	848.134	849.634	1.5
MW-02A	6.0	854.421	854.211	848.211	849.711	1.5
MW-03A	6.0	854.307	854.057	848.057	849.557	1.5
MW-04A	6.0	854.506	854.386	848.386	849.886	1.5
MW-05A	6.0	854.463	854.243	848.243	849.743	1.5
MW-06A	3.2	854.554	854.429	851.229	853.229	2.0
MW-07A	2.1	854.546	854.381	852.281	853.181	0.9
MW-08A	6.0	854.481	854.291	848.291	851.291	3.0
MW-09A	2.3	854.673	854.523	852.223	852.523	0.3
MW-10A	2.5	854.616	854.421	851.921	853.421	1.5
MW-11A	- -	854.743	854.548	- -	- -	- -
MW-12A	- -	854.836	854.686	- -	- -	- -
MW-13A	- -	854.437	854.307	- -	- -	- -
MW-14A	- -	854.190	854.070	- -	- -	- -
MW-15A	- -	853.941	853.871	- -	- -	- -
MW-16A	- -	853.818	853.668	- -	- -	- -
MW-17A	- -	854.085	853.775	- -	- -	- -
MW-18A	- -	853.998	853.748	- -	- -	- -
MW-19A	- -	854.039	853.819	- -	- -	- -
MW-20A	- -	854.019	853.799	- -	- -	- -
MW-21A	- -	853.952	853.792	- -	- -	- -
MW-22A	- -	854.017	853.867	- -	- -	- -
MW-23A	- -	854.061	853.991	- -	- -	- -
MW-24A	- -	854.018	853.778	- -	- -	- -
MW-25A	- -	854.083	853.963	- -	- -	- -
PR-5A	- -	853.533	854.563	- -	- -	- -
PR-5M	- -	853.566	854.492	- -	- -	- -
PR-6A	- -	853.255	853.825	- -	- -	- -
PR-6M	- -	853.195	853.789	- -	- -	- -
PR-7	- -	852.870	853.869	- -	- -	- -
PR-7M	- -	852.966	853.743	- -	- -	- -
PR-9	- -	853.060	854.106	- -	- -	- -
PR-9A	- -	853.008	854.044	- -	- -	- -
PR-10	- -	852.389	853.520	- -	- -	- -
PR-10M	- -	852.511	853.400	- -	- -	- -
PR-14A	- -	854.020	854.636	- -	- -	- -
PR-14B	- -	853.993	854.348	- -	- -	- -
PR-14C	- -	854.081	854.512	- -	- -	- -
PR-16B	- -	854.200	854.954	- -	- -	- -
PR-26	- -	853.781	853.761	- -	- -	- -
Installed 2013						
MW-01	6.1	853.767	853.787	847.687	852.287	4.6
MW-02	6.1	853.585	854.285	848.185	851.185	3.0
MW-03	4.6	853.225	853.970	849.370	852.370	3.0
MW-04	4.6	851.781	852.544	847.944	850.944	3.0
VW-01	2.1	853.853	NA	851.753	852.053	0.3
VW-02	3.0	853.535	NA	850.535	850.835	0.3
VW-03	2.0	853.245	NA	851.245	851.545	0.3
VW-04	3.0	854.476	NA	851.476	851.776	0.3
VW-05	2.7	854.048	NA	851.348	851.648	0.3

Notes:

1) Geodetic elevations are referenced to multiple ASCMs located within The City of Red Deer.
2) MW and PR - Groundwater Monitoring Well.
3) VW - Soil Vapour Well.
4) NA - Not Applicable.
5) Well depth, screen interval derived from borehole logs by others, where avalable.
6) - - No value established.

Table 2A
Site Monitoring Results - Existing Test Locations Installed by Others

Test Location	Elevations			Headspace Vapour		Notes
	Ground (m)	Top of Pipe (m)	Groundwater (m)	08/15/2013		
				Combustible	Volatile	
MW-01A	854.249	854.134	850.736	80	ND	
MW-02A	854.421	854.211	850.756	35	ND	
MW-03A	854.307	854.057	850.762	90	10	
MW-04A	854.506	854.386	850.913	140	ND	
MW-05A	854.463	854.243	850.910	200	ND	
MW-06A	854.554	854.429	850.911	170	ND	
MW-07A	854.546	854.381	850.918	175	ND	
MW-08A	854.481	854.291	850.893	120	ND	
MW-09A	854.673	854.523	851.043	95	ND	
MW-10A	854.616	854.421	850.978	40	ND	
MW-11A	854.743	854.548	851.120	155	ND	
MW-12A	854.836	854.686	851.212	35	ND	
MW-13A	854.437	854.307	NM	170	ND	Plugged
MW-14A	854.190	854.070	850.813	250	ND	
MW-15A	853.941	853.871	850.781	260	ND	
MW-16A	853.818	853.668	NM	NM	NM	Damaged
MW-17A	854.085	853.775	850.850	60	1	
MW-18A	853.998	853.748	NM	25	1	Plugged
MW-19A	854.039	853.819	NM	105	ND	Plugged
MW-20A	854.019	853.799	NM	110	1	Plugged
MW-21A	853.952	853.792	850.810	100	ND	
MW-22A	854.017	853.867	NM	85	ND	Plugged
MW-23A	854.061	853.991	NM	15	ND	Plugged
MW-24A	854.018	853.778	NM	25	ND	Plugged
MW-25A	854.083	853.963	NM	25	ND	Plugged
PR-5A	853.533	854.563	850.720	160	ND	
PR-5M	853.566	854.492	NM	>11,100	25	Plugged
PR-6A	853.255	853.825	851.202	ND	ND	
PR-6M	853.195	853.789	851.165	5	ND	
PR-7	852.870	853.869	850.745	ND	ND	
PR-7M	852.966	853.743	850.745	>11,100	7	
PR-9	853.060	854.106	850.606	>100% LEL	7	
PR-9A	853.008	854.044	850.638	>11,100	7	
PR-10	852.389	853.520	850.533	>11,100	1	
PR-10M	852.511	853.400	850.530	50	ND	
PR-14A	854.020	854.636	850.770	15	ND	
PR-14B	853.993	854.348	850.759	100	ND	
PR-14C	854.081	854.512	NM	65	ND	Plugged
PR-16B	854.200	854.954	850.740	10	ND	
PR-26	853.781	853.761	850.982	25	ND	

Notes:

1) Measurement of combustible and volatile vapours by RKI Eagle 2. Units ppmv.
   Combustible vapour sensor calibrated to hexane and photoionization detector calibrated to isobutylene.
2) NA - Not Applicable.
3) ND - Not Detected, less than the limit of instrument detection.
4) NM - Not Measured.

Table 2B
Site Monitoring Results - Newly Installed Test Locations

Test Location	Elevations			Headspace Vapour 08/15/2013		Notes
	Ground (m)	Top of Pipe (m)	Groundwater (m)	Combustible	Volatile	
MW-01	853.767	853.787	850.732	100	ND	
MW-02	853.585	854.285	850.552	ND	ND	
MW-03	853.225	853.970	849.687	ND	ND	
MW-04	851.781	852.544	850.176	ND	ND	
VW-01	853.853	NA	- -	270	ND	
VW-02	853.535	NA	- -	15	ND	
VW-03	853.245	NA	- -	ND	ND	
VW-04	854.476	NA	- -	80	ND	
VW-05	854.048	NA	- -	270	ND	
TH-01	852.658	NA	- -	- -	- -	
TH-02	852.786	NA	- -	- -	- -	
TH-04	851.742	NA	- -	- -	- -	
TH-08	852.356	NA	- -	- -	- -	
TH-09	853.041	NA	- -	- -	- -	
TH-10	853.574	NA	- -	- -	- -	
TH-11	852.65	NA	- -	- -	- -	
TH-13	853.041	NA	- -	- -	- -	
TH-14	853.574	NA	- -	- -	- -	
TH-15	852.650	NA	- -	- -	- -	
TH-16	851.762	NA	- -	- -	- -	

Notes:

1) Measurement of combustible and volatile vapours by RKI Eagle 2. Units ppmv.
   Combustible vapour sensor calibrated to hexane and photoionization detector calibrated to isobutylene.
2) NA - Not Applicable.
3) ND - Not Detected, less than the limit of instrument detection.
4) - - No applicable value.

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

Parameter	Detection Limit	Soil Bag		Class II Acceptance Criteria
		1 & 2 of 3	3 of 3	
pH	0.10	8.15	8.07	2-12.5
Flash Point (°C)	30.0	>75	>75	>61
Paint Filter Test	-	PASS	PASS	PASS
Total Organic Carbon	0.10	2.89	0.69	- -
Leachable Hydrocarbons				
Benzene	0.0050	ND	ND	0.5
Toluene	0.0050	ND	ND	0.5
Ethylbenzene	0.0050	ND	ND	0.5
Xylenes	0.0050	0.0143	ND	0.5
Leachable Metals				
Antimony (Sb)	5.0	ND	ND	500
Arsenic (As)	0.20	ND	ND	5
Barium (Ba)	5.0	ND	ND	100
Beryllium (Be)	0.50	ND	ND	5
Boron (B)	5.0	ND	ND	500
Cadmium (Cd)	0.050	ND	ND	1
Chromium (Cr)	0.50	ND	ND	5
Cobalt (Co)	5.0	ND	ND	100
Copper (Cu)	5.0	ND	ND	100
Iron (Fe)	5.0	13.5	ND	1,000
Lead (Pb)	0.50	ND	ND	5
Mercury (Hg)	0.010	ND	ND	0.2
Nickel (Ni)	0.50	ND	ND	5
Selenium (Se)	0.20	ND	ND	1
Silver (Ag)	0.50	ND	ND	5
Thallium (Tl)	0.50	ND	ND	5
Uranium (U)	1.0	ND	ND	2
Vanadium (V)	5.0	ND	ND	100
Zinc (Zn)	5.0	ND	ND	500
Zirconium (Zr)	5.0	ND	ND	500

Notes:

1) Class II Acceptance Criteria - per Table 2, Part 4 Schedule to the Alberta User Guide for Waste Managers 3/95.
2) All units are mg/L unless otherwise stated.
3) ND - Not Detected
4) Soil Bags were sampled July 14, 2013.
5) 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-05 @ 3.7 m	TH-04 @ 3.7 m	TH-09 @ 2.7 m	TH-11 @ 2.6 m	Tier 1 Guideline
			07/14/2013	07/13/2013			
Chloride (Cl)	mg/kg	6.5 - 8.5	9.7	13.0	50.9	8.2	- -
Nitrate-N	mg/kg	0.33 - 0.43	ND	ND	ND	ND	- -
Nitrite-N	mg/kg	0.33 - 0.43	ND	ND	ND	ND	- -
Metals							
Antimony (Sb)	mg/kg	0.20	0.58	0.38	0.31	0.35	20
Arsenic (As)	mg/kg	0.20	7.27	7.30	6.03	5.64	17
Barium (Ba)	mg/kg	5.0	235	352	249	201	500
Beryllium (Be)	mg/kg	1.0	ND	ND	ND	ND	5
Cadmium (Cd)	mg/kg	0.50	ND	ND	ND	ND	10
Chromium (Cr)	mg/kg	0.50	15.6	13.9	13.2	13.5	64
Cobalt (Co)	mg/kg	1.0	5.6	7.4	5.7	5.1	20
Copper (Cu)	mg/kg	2.0	11.6	11.7	9.4	11.9	63
Lead (Pb)	mg/kg	5.0	7.2	7.1	8.2	7.3	140
Mercury (Hg)	mg/kg	0.05	ND	ND	ND	ND	6.6
Molybdenum (Mo)	mg/kg	1.0	1.2	1.5	1.1	ND	4
Nickel (Ni)	mg/kg	2.0	16.7	18.7	16.4	17.1	50
Selenium (Se)	mg/kg	0.50	0.59	ND	ND	ND	1.0
Silver (Ag)	mg/kg	1.0	ND	ND	ND	ND	20
Thallium (Tl)	mg/kg	0.5	ND	ND	ND	ND	1.0
Tin (Sn)	mg/kg	2.0	ND	ND	ND	ND	5
Uranium (U)	mg/kg	2.0	ND	ND	ND	ND	23
Vanadium (V)	mg/kg	1.0	20.7	24.3	23.6	24.8	130
Zinc (Zn)	mg/kg	10	64	51	49	50	200
Hexavalent Chromium	mg/kg	0.10	ND	ND	ND	ND	0.4
Boron (B), Hot Water Ext.	- -	0.10	0.31	0.19	0.25	0.32	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 reference criteria.
4) Bold & Shaded - Exceeds the referenced Alberta Tier 1 Guidelines and CCME guidelines.
5) For further laboratory information, refer to the specific laboratory report in Appendix A.
6) Testholes were renumbered subsequent to submission to the laboratory, therefore the following TH locations have changed: TH-04 is MW-01, TH-05 is TH-09, TH-09 is TH-13, TH-11 is TH-15. See Figure 2 for relative sample locations.

Table 3C
Analytical Results - Soil - VOCs

Parameters	Units	Detection Limit	TH-05 @ 3.7 m	TH-04 @ 3.7 m	TH-09 @ 2.7 m	TH-11 @ 2.6 m	Tier 1 Guideline
			07/14/2013	07/13/2013			
Hydrocarbons							
F1 (C_6-C_{10})	mg/kg	10	ND	ND	ND	ND	24
F2 (C_{10}-C_{16})	mg/kg	25	ND	ND	ND	ND	130
F3 (C_{16}-C_{34})	mg/kg	50	ND	ND	ND	ND	300
F4 (C_{34}-C_{50})	mg/kg	50	ND	ND	ND	ND	2,800
Total Hydrocarbons (C_6-C_{50})	mg/kg	500	ND	ND	ND	ND	- -
Volatile Organic Compounds							
Benzene	mg/kg	0.0050	ND	ND	0.0152	ND	0.073
Bromobenzene	mg/kg	0.010	ND	ND	ND	ND	- -
Bromochloromethane	mg/kg	0.010	ND	ND	ND	ND	- -
Bromodichloromethane	mg/kg	0.010	ND	ND	ND	ND	- -
Bromoform	mg/kg	0.010	ND	ND	ND	ND	- -
Bromomethane	mg/kg	0.10	ND	ND	ND	ND	- -
n-Butylbenzene	mg/kg	0.010 - 0.030	ND	ND	ND	ND	- -
sec-Butylbenzene	**mg/kg**	**0.010**	**ND**	**ND**	**ND**	**ND**	- -
tert-Butylbenzene	mg/kg	0.010	ND	ND	ND	ND	- -
Carbon tetrachloride	mg/kg	0.010	ND	ND	ND	ND	- -
Chlorobenzene	mg/kg	0.010	ND	ND	ND	ND	0.018
Dibromochloromethane	mg/kg	0.010	ND	ND	ND	ND	0.27
Chloroethane	mg/kg	0.10	ND	ND	ND	ND	- -
Chloroform	mg/kg	0.010	ND	ND	ND	ND	- -
Chloromethane	mg/kg	0.10	ND	ND	ND	ND	- -
2-Chlorotoluene	mg/kg	0.010 - 0.020	ND	ND	ND	ND	- -
4-Chlorotoluene	mg/kg	0.010	ND	ND	ND	ND	- -
1,2-Dibromo-3-chloropropane	mg/kg	0.010	ND	ND	ND	ND	- -
1,2-Dibromoethane	mg/kg	0.010	ND	ND	ND	ND	- -
Dibromomethane	mg/kg	0.010	ND	ND	ND	ND	- -
1,2-Dichlorobenzene	mg/kg	0.010	ND	ND	ND	ND	0.18
1,3-Dichlorobenzene	mg/kg	0.010	ND	ND	ND	ND	- -
1,4-Dichlorobenzene	mg/kg	0.010	ND	ND	ND	ND	0.098
Dichlorodifluoromethane	mg/kg	0.010	ND	ND	ND	ND	- -
1,1-Dichloroethane	mg/kg	0.010	ND	ND	ND	ND	- -
1,2-Dichloroethane	mg/kg	0.010	ND	ND	ND	ND	- -
1,1-Dichloroethene	mg/kg	0.010	ND	ND	ND	ND	0.021
cis-1,2-Dichloroethene	mg/kg	0.010	0.119	0.080	0.696	ND	- -
trans-1,2-Dichloroethene	**mg/kg**	**0.010**	**ND**	**ND**	**0.163**	**ND**	- -
Methylene chloride	mg/kg	0.010	ND	ND	ND	ND	- -
1,2-Dichloropropane	mg/kg	0.010	ND	ND	ND	ND	- -
1,3-Dichloropropane	mg/kg	0.010	ND	ND	ND	ND	- -
2,2-Dichloropropane	mg/kg	0.010	ND	ND	ND	ND	- -
1,1-Dichloropropene	mg/kg	0.010	ND	ND	ND	ND	- -
cis-1,3-Dichloropropene	mg/kg	0.010	ND	ND	ND	ND	- -
trans-1,3-Dichloropropene	mg/kg	0.010	ND	ND	ND	ND	- -
Ethylbenzene	mg/kg	0.015	ND	ND	0.144	ND	0.21
Hexachlorobutadiene	mg/kg	0.010	ND	ND	ND	ND	0.0067
Isopropylbenzene	mg/kg	0.010	ND	ND	ND	ND	- -
p-Isopropyltoluene	mg/kg	0.010	0.011	ND	0.041	ND	- -
n-Propylbenzene	mg/kg	0.010	ND	ND	0.017	ND	- -
Styrene	mg/kg	0.050	ND	ND	ND	ND	0.8
1,1,1,2-Tetrachloroethane	mg/kg	0.010	ND	ND	ND	ND	- -
1,1,2,2-Tetrachloroethane	mg/kg	0.050	ND	ND	ND	ND	- -
Tetrachloroethene	mg/kg	0.010	ND	ND	ND	0.027	0.16
Toluene	mg/kg	0.050	ND	ND	ND	ND	0.49
1,2,3-Trichlorobenzene	mg/kg	0.010	ND	ND	ND	ND	0.26
1,2,4-Trichlorobenzene	mg/kg	0.010	ND	ND	ND	ND	0.23
1,1,1-Trichloroethane	mg/kg	0.010	ND	ND	ND	ND	- -
1,1,2-Trichloroethane	**mg/kg**	**0.010**	**ND**	**ND**	**ND**	**ND**	- -
Trichloroethene	mg/kg	0.010	ND	ND	ND	0.010	0.012
Trichlorofluoromethane	mg/kg	0.010	ND	ND	ND	ND	- -
1,2,3-Trichloropropane	mg/kg	0.020	ND	ND	ND	ND	- -
1,2,4-Trimethylbenzene	mg/kg	0.010	ND	ND	0.118	ND	- -
1,3,5-Trimethylbenzene	mg/kg	0.010	ND	ND	0.045	ND	- -
Vinyl chloride	mg/kg	0.050 - 0.20	ND	ND	ND	ND	0.00034
Xylenes	mg/kg	0.1	ND	ND	0.39	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 and CCME guidelines.
5) For further laboratory information, refer to the specific laboratory report in Appendix A.
6) Testholes were renumbered subsequent to submission to the laboratory, therefore the following TH locations have changed: TH-04 is MW-01, TH-05 is TH-09, TH-09 is TH-13, TH-11 is TH-15. See Figure 2 for relative sample locations.

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)	Redox (±mV)
MW-01	7.51	937	8.2	0.79	897.00	-16.3
MW-02	7.65	723	7.0	1.64	715.00	-90.7
MW-03	7.14	679	8.0	0.74	650.00	-103.0
MW-04	7.27	648	10.3	1.44	591.50	-94.2

Notes:

1) Samples collected on August 15, 2013.
2) Groundwater indices measured by YSI Pro Plus multi-meter.

Table 4B
Analytical Results - Groundwater - Routine Water Quality

Parameter	Unit	Detection Limit	MW-01	MW-02	MW-04	Tier 1 Guideline
			08/15/2013			
General Water Quality						
Biochemical Oxygen Demand (BOD)	mg/L	2.0	26	3.4	3.4	- -
Chemical Oxygen Demand (COD)	mg/L	5.0	49	53	70	- -
Conductivity	µS/cm	1.0	1,400	1,100	950	- -
pH	Unitless	0.1	7.45	7.44	7.52	6.5-8.5
Total Organic Carbon (C)	mg/L	0.50	13	14	20	- -
Dissolved Cadmium (Cd)	µg/L	0.0050	0.041	2.3	0.018	- -
Total Cadmium (Cd)	µg/L	0.0050	**4.3**	**4.4**	**2.9**	0.060*
Alkalinity (Total as CaCO3)	mg/L	0.50	490	420	490	- -
Bicarbonate (HCO_3)	mg/L	0.50	600	510	590	- -
Carbonate (CO_3)	mg/L	0.50	ND	ND	ND	- -
Hydroxide (OH)	mg/L	0.50	ND	ND	ND	- -
Sulphates (SO_4)	mg/L	1.0	96	84	4.7	- -
Chlorides (Cl)	mg/L	1.0 - 2.0	110	72	33	- -
Total Ammonia (N)	mg/L	0.050	0.18	**1.6**	0.64	1.37*
Total Phosphorus (P)	mg/L	0.15	12	12	9.1	- -
Total Nitrogen (N)	mg/L	0.050	15	11	16	- -
Total Kjeldahl Nitrogen (TKN)	mg/L	0.50	8.9	10	16	- -
Nitrite (as N)	mg/L	0.0030	0.91	ND	ND	- -
Nitrate (as N)	mg/L	0.0030	4.8	0.99	0.066	- -
Nitrate plus Nitrite (N)	mg/L	0.0030	5.7	0.99	0.066	- -
Trace Organics						
Acetic Acid	mg/L	50	ND	NT	ND	- -
Formic Acid	mg/L	50	ND	NT	ND	- -
Propionic Acid	mg/L	50	ND	NT	ND	- -
Adsorbable Organic Halogens	mg/L	0.05	0.35	NT	0.09	- -

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 are referenced.
3) ND - Not Detected, less than the limit of method detection.
4) NT - Not Tested
5) - - No value established in the reference criteria.
6) Bold & Shaded - Exceeds the referenced Alberta Tier 1 Guidelines and CCME guidelines.
7) 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	MW-04	Tier 1 Guideline
		08/15/2013			
Total Metals					
Aluminum (Al)	0.0030	**43**	**21**	**33**	0.1*
Antimony (Sb)	0.00060	0.0018	0.00091	0.00081	0.006
Arsenic (As)	0.00020	**0.089**	**0.049**	**0.046**	0.005
Barium (Ba)	0.010	**4.3**	**2.6**	**3.4**	1
Beryllium (Be)	0.0010	0.0034	0.0024	0.0048	- -
Boron (B)	0.020	0.041	0.037	0.027	1.5
Calcium (Ca)	0.30 - 1.5	880	670	430	- -
Chromium (Cr)	0.0010	**0.14**	**0.051**	**0.087**	0.001*
Cobalt (Co)	0.00030	0.10	0.049	0.065	- -
Copper (Cu)	0.00020	**0.22**	**0.14**	**0.18**	0.003*
Iron (Fe)	0.060	**170**	**100**	**130**	0.3
Lead (Pb)	0.00020	**0.12**	**0.056**	**0.10**	0.004*
Lithium (Li)	0.020	0.13	0.073	0.083	- -
Magnesium (Mg)	0.20	200	180	130	- -
Manganese (Mn)	0.0040	**13**	**6.0**	**5.0**	0.05
Molybdenum (Mo)	0.00020	0.0080	0.0045	0.0029	- -
Nickel (Ni)	0.00050	**0.30**	**0.13**	**0.18**	0.11*
Phosphorus (P)	0.10	7.1	4.6	5.2	- -
Potassium (K)	0.30	14	9.8	12	- -
Selenium (Se)	0.00020	**0.0069**	**0.0019**	**0.0028**	0.001
Silicon (Si)	0.10 - 0.50	100	50	75	- -
Silver (Ag)	0.00010	**0.0015**	**0.00058**	**0.00059**	0.0001*
Sodium (Na)	0.50	50	45	55	- -
Strontium (Sr)	0.020	1.7	1.3	1.3	- -
Sulphur (S)	0.20	34	25	3.3	- -
Thallium (Tl)	0.00020	0.00075	0.00056	0.00066	- -
Tin (Sn)	0.0010	0.0023	0.0014	0.0015	- -
Titanium (Ti)	0.0010	0.52	0.19	0.38	- -
Uranium (U)	0.00010	0.011	0.0061	0.0070	0.02
Vanadium (V)	0.0010	0.20	0.096	0.13	- -
Zinc (Zn)	0.0030	**0.55**	**0.31**	**0.43**	0.03
Dissolved Metals					
Aluminum (Al)	0.0030	0.011	1.8	0.0034	- -
Antimony (Sb)	0.00060	ND	ND	ND	- -
Arsenic (As)	0.00020	0.0010	0.017	0.0086	- -
Barium (Ba)	0.010	0.36	0.055	0.90	- -
Beryllium (Be)	0.0010	ND	ND	ND	- -
Boron (B)	0.020	ND	ND	0.021	- -
Calcium (Ca)	0.30	170	330	110	- -
Chromium (Cr)	0.0010	ND	0.0038	ND	- -
Cobalt (Co)	0.00030	0.0041	0.027	0.0033	- -
Copper (Cu)	0.00020	0.0024	0.027	0.0010	- -
Iron (Fe)	0.060	ND	29	1.2	- -
Lead (Pb)	0.00020	ND	0.0037	ND	- -
Lithium (Li)	0.020	0.026	0.030	ND	- -
Magnesium (Mg)	0.20	64	93	38	- -
Manganese (Mn)	0.0040	1.3	4.5	1.1	- -
Molybdenum (Mo)	0.00020	0.0019	0.0011	0.0037	- -
Nickel (Ni)	0.00050	0.0079	0.052	0.0046	- -
Phosphorus (P)	0.10	ND	0.68	ND	- -
Potassium (K)	0.30	3.9	5.1	4.2	- -
Selenium (Se)	0.00020	0.00071	0.00045	ND	- -
Silicon (Si)	0.10	5.8	9.2	6.5	- -
Silver (Ag)	0.00010	ND	ND	ND	- -
Sodium (Na)	0.50 - 2.5	48	790	53	- -
Strontium (Sr)	0.020	0.80	0.87	0.70	- -
Sulphur (S)	0.20 -1.0	30	970	1.6	- -
Thallium (Tl)	0.00020	ND	0.00026	ND	- -
Tin (Sn)	0.0010	ND	ND	ND	- -
Titanium (Ti)	0.0010	ND	0.0035	ND	- -
Uranium (U)	0.00010	0.0048	0.0020	0.0021	- -
Vanadium (V)	0.0010	ND	0.0098	ND	- -
Zinc (Zn)	0.0030	0.0030	0.086	0.0037	- -

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 are referenced.
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 and CCME guidelines.
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	MW-04	Tier 1 Guideline
		08/15/2013			
Volatile Organic Compounds					
Benzene	0.00040	ND	NT	ND	0.005
Toluene	0.00040	ND	NT	ND	0.024
Ethylbenzene	0.00040	ND	NT	ND	0.0024
Xylenes (Total)	0.00080	ND	NT	ND	0.3
F1 (C_6-C_{10})	0.10	ND	NT	ND	0.81
F2 (C_{10}-C_{16})	0.10	ND	ND	ND	1.1
Total Trihalomethanes	0.0020	ND	NT	ND	0.1
Bromodichloromethane	0.00050	ND	NT	ND	- -
Bromoform	0.00050	ND	NT	ND	- -
Bromomethane	0.0020	ND	NT	ND	- -
Carbon tetrachloride	0.00050	ND	NT	ND	0.00056
Chlorobenzene	0.00050	ND	NT	ND	0.0013
Chlorodibromomethane	0.0010	ND	NT	ND	- -
Chloroethane	0.0010	ND	NT	ND	- -
Chloroform	0.00050	ND	NT	ND	0.0018
Chloromethane	0.0020	ND	NT	ND	- -
1,2-dibromoethane	0.00050	ND	NT	ND	- -
1,2-dichlorobenzene	0.00050	ND	NT	ND	0.0007
1,3-dichlorobenzene	0.00050	ND	NT	ND	- -
1,4-dichlorobenzene	0.00050	ND	NT	ND	0.001
1,1-dichloroethane	0.00050	ND	NT	ND	- -
1,2-dichloroethane	0.00050	ND	NT	ND	0.005
1,1-dichloroethene	0.00050	ND	NT	ND	0.014
cis-1,2-dichloroethene	0.00050	ND	NT	ND	- -
trans-1,2-dichloroethene	0.00050	ND	NT	ND	- -
Dichloromethane	0.0020	ND	NT	ND	0.05
1,2-dichloropropane	0.00050	ND	NT	ND	- -
cis-1,3-dichloropropene	0.00050	ND	NT	ND	- -
trans-1,3-dichloropropene	0.00050	ND	NT	ND	- -
Methyl methacrylate	0.00050	ND	NT	ND	0.47
Methyl-tert-butylether (MTBE)	0.00050	ND	NT	ND	0.015
Styrene	0.00050	ND	NT	ND	0.072
1,1,1,2-tetrachloroethane	0.0020	ND	NT	ND	- -
1,1,2,2-tetrachloroethane	0.0020	ND	NT	ND	- -
Tetrachloroethene	0.00050	ND	NT	ND	0.03
1,2,3-trichlorobenzene	0.0010	ND	NT	ND	0.008
1,2,4-trichlorobenzene	0.0010	ND	NT	ND	0.015
1,3,5-trichlorobenzene	0.00050	ND	NT	ND	0.014
1,1,1-trichloroethane	0.00050	ND	NT	ND	- -
1,1,2-trichloroethane	0.00050	ND	NT	ND	- -
Trichloroethene	0.00050	ND	NT	ND	0.005
Trichlorofluoromethane	0.00050	ND	NT	ND	- -
1,2,4-trimethylbenzene	0.00050	ND	NT	ND	- -
1,3,5-trimethylbenzene	0.00050	ND	NT	ND	- -
Vinyl chloride	0.00050	ND	NT	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) NT - Not Tested.
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 Guidelines.
7) For further laboratory information, refer to the specific laboratory report in Appendix A.

Table 5A
Summary of Field 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	2.1	1,030.8	943.3	4	15.00	15.00
VW-02	25	30	3.0	1,472.6	943.3	7	15.10	15.06
VW-03	25	30	2.0	981.75	943.3	5	15.14	15.08
VW-04	25	30	3.0	1,472.5	943.3	5	14.93	14.94
VW-05	25	30	2.7	1,325.4	943.3	5	15.01	15.00

Notes:

1) Measurement of pressure by digital Cole-Parmer absolute pressure gauge.
2) Purge time is elapsed time prior to the collection of a soil vapour sample.
3) Screen set at base of well.
4) Soil vapour sampling was completed August 15, 2013.

Table 5B
Analytical Results - Soil Vapour - General Indices

Parameter	Unit	Detection Limit	VW-01	VW-02	VW-03	VW-04	VW-05
Gauge Pressure							
Following sampling	psi	- -	(-3.5)	(-5.0)	(-5.0)	(-5.0)	(-4.8)
Reported by laboratory	psi	- -	(-2.9)	(-3.6)	(-3.1)	(-4.2)	(-3.6)
Fixed Gases							
Oxygen	% v/v	0.2 - 0.3	13.4	20.9	21.6	19.2	10.8
Nitrogen	% v/v	0.2 - 0.3	81.5	76.7	77.2	77.8	85.6
Carbon monoxide	% v/v	0.2 - 0.3	ND	ND	ND	ND	ND
Methane	% v/v	0.2 - 0.3	ND	ND	ND	ND	ND
Carbon dioxide	% v/v	0.2 - 0.3	5.1	2.4	1.3	3.0	3.6

Notes:

1) Soil vapour sample collected on Thursday, August 15, 2013.
2) ND - Not Detected, less than the limit of method detection.
3) - - No value established in the detection limit and reference criteria.
4) 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	VW-04	VW-05
			08/15/2013				
Hydrocarbon Fractions							
Aliphatic >C_5-C_6	µg/m^3	5.0	9.6	14.0	20.7	7.3	9.1
Aliphatic >C_6-C_8	µg/m^3	5.0	35.5	43.8	70.8	35.1	27.5
Aliphatic >C_8-C_{10}	µg/m^3	5.0	54.9	59.6	48.3	53.1	21.1
Aliphatic >C_{10}-C_{12}	µg/m^3	5.0	99.1	82.9	35.0	105	53.3
Aliphatic >C_{12}-C_{16}	µg/m^3	5.0	27.4	20.0	ND	39.9	22.7
Aromatic >C_7-C_8 (TEX Excluded)	µg/m^3	5.0	ND	ND	ND	ND	ND
Aromatic >C_8-C_{10}	µg/m^3	5.0	18.8	18.8	18.5	16.5	7.0
Aromatic >C_{10}-C_{12}	µg/m^3	5.0	18.9	17.8	8.5	18.9	7.6
Aromatic >C_{12}-C_{16}	µg/m^3	5.0	ND	ND	ND	ND	ND
Select Volatile Gases							
Acetylene	ppm	0.17-0.25	ND	ND	ND	ND	ND
Ethane	ppm	0.17-0.25	ND	ND	ND	ND	ND
Ethylene	ppm	0.17-0.25	ND	ND	ND	ND	ND
Methane	ppm	3.5-5.0	ND	ND	ND	ND	ND
n-Butane	ppm	0.35-0.5	ND	ND	ND	ND	ND
n-Pentane	ppm	0.17-0.25	ND	ND	ND	ND	ND
Propane	ppm	0.17-0.25	ND	ND	ND	ND	ND
Propene	ppm	0.17-0.25	ND	ND	ND	ND	ND
Propyne	ppm	0.35-0.5	ND	ND	ND	ND	ND
Volatile Organic Compounds							
Dichlorodifluoromethane (FREON 12)	ppbv	0.20	1.42	1.01	0.84	225	1.07
1,2-Dichlorotetrafluoroethane	ppbv	0.17	ND	ND	ND	ND	ND
Chloromethane	ppbv	0.30	0.95	1.00	0.59	1.34	ND
Vinyl chloride	ppbv	0.18	ND	ND	ND	ND	ND
Chloroethane	ppbv	0.30	ND	ND	ND	0.39	ND
1,3-Butadiene	ppbv	0.50	ND	ND	ND	ND	ND
Trichlorofluoromethane (FREON 11)	ppbv	0.20	0.21	0.46	0.44	0.64	0.53
Ethanol (ethyl alcohol)	ppbv	2.3	31.4	44.9	26.8	31.9	18.1
Trichlorotrifluoroethane	ppbv	0.15	ND	ND	ND	ND	0.24
2-propanol	ppbv	3.0	ND	ND	ND	ND	ND
2-Propanone	ppbv	0.80	22.7	31.4	24.8	35.3	37.8
Methyl ethyl ketone (MEK) (2-Butanone)	ppbv	3.0	ND	ND	ND	3.4	4.3
Methyl isobutyl ketone	ppbv	3.2	ND	ND	ND	ND	ND
Methyl butyl ketone (MBK) (2-Hexanone)	ppbv	2.0	ND	ND	ND	ND	ND
Methyl t-butyl ether (MTBE)	ppbv	0.20	ND	ND	ND	ND	ND
Ethyl acetate	ppbv	2.2	ND	ND	ND	ND	ND
1,1-Dichloroethylene	ppbv	0.25	ND	ND	ND	ND	ND
cis-1,2-Dichloroethylene	ppbv	0.19	0.26	1.51	ND	ND	0.38
trans-1,2-Dichloroethylene	ppbv	0.20	ND	ND	ND	ND	ND
Methylene chloride(Dichloromethane)	ppbv	0.80	ND	ND	0.90	0.88	0.84
Chloroform	ppbv	0.15	ND	ND	ND	1.26	0.31
Carbon tetrachloride	ppbv	0.30	ND	ND	ND	ND	ND
1,1-Dichloroethane	**ppbv**	**0.20**	**ND**	**ND**	**ND**	**ND**	**ND**
1,2-Dichloroethane	ppbv	0.20	ND	ND	ND	ND	ND
Ethylene dibromide	ppbv	0.17	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ppbv	0.30	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ppbv	0.15	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ppbv	0.20	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	ppbv	0.18	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	ppbv	0.17	1.82	ND	ND	ND	ND
1,2-Dichloropropane	ppbv	0.40	ND	ND	ND	ND	ND
Bromomethane	ppbv	0.18	ND	ND	ND	ND	ND
Bromoform	ppbv	0.20	ND	ND	ND	ND	ND
Bromodichloromethane	ppbv	0.20	ND	ND	ND	ND	ND
Dibromochloromethane	ppbv	0.20	ND	ND	ND	ND	ND
Trichloroethylene (TCE)	ppbv	0.30	ND	ND	ND	ND	8.05
Tetrachloroethylene (PCE)	ppbv	0.20	ND	ND	ND	0.25	0.83
Benzene	ppbv	0.18	1.09	0.62	0.90	1.43	1.07
Toluene	ppbv	0.20	2.66	2.57	2.44	1.95	1.31
Ethylbenzene	ppbv	0.20	0.70	0.83	0.86	0.56	0.21
p+m-xylene	ppbv	0.37	2.99	3.70	4.10	2.40	0.71
o-xylene	ppbv	0.20	1.24	1.45	1.34	1.03	0.34
Styrene	ppbv	0.20	0.25	ND	ND	ND	ND
4-ethyltoluene	ppbv	2.2	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	ppbv	0.50	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	ppbv	0.50	0.70	0.68	ND	0.60	ND
Chlorobenzene	ppbv	0.20	ND	ND	ND	ND	ND
Benzyl chloride	**ppbv**	**1.0**	**ND**	**ND**	**ND**	**ND**	**ND**
1,3-Dichlorobenzene	ppbv	0.40	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ppbv	0.40	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ppbv	0.40	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ppbv	2.0	ND	ND	ND	ND	ND
Hexachlorobutadiene	ppbv	3.0	ND	ND	ND	ND	ND
Hexane	ppbv	0.30	2.70	5.07	13.4	1.74	0.72
Heptane	ppbv	0.30	0.88	0.61	0.74	0.80	0.56
Cyclohexane	ppbv	0.20	0.64	0.27	1.19	0.41	0.28
Tetrahydrofuran	ppbv	0.40	ND	ND	ND	4.78	2.93
1,4-Dioxane	ppbv	2.0	ND	ND	2.6	ND	ND
Xylene (Total)	ppbv	0.60	4.23	5.15	5.44	3.43	1.05
Vinyl bromide	ppbv	0.20	ND	ND	ND	ND	ND
Propene	ppbv	0.30	ND	ND	ND	ND	ND
2,2,4-Trimethylpentane	ppbv	0.20	ND	0.32	0.29	ND	ND
Carbon disulfide	ppbv	0.50	15.2	3.55	4.65	8.29	11.2
Vinyl acetate	ppbv	0.20	ND	ND	ND	ND	ND

Notes:
1) Results are from sampling performed on Thursday, August 15, 2013.
2) ND - Not Detected, less than the limit of method detection.
3) - - No value established in the detection limit and reference criteria.
4) 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		VW-04		VW-05	
		08/15/2013									
		mg/m³	ppm	mg/m³	ppm	mg/m³	ppm	mg/m³	ppm	mg/m3	ppm
Trimethylsilyl Fluoride	- -	0.0070	0.0019	0.0047	0.0012	0.0032	0.0009	0.0018	0.0005	0.0012	0.0003
Tetramethylsilane	0.0001	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methoxytrimethylsilane	0.0004 - 0.0020	0.0012	0.0003	ND	ND	ND	ND	ND	ND	ND	ND
Ethoxytrimethylsilane	0.0004 - 0.0020	0.0018	0.0004	ND	ND	ND	ND	ND	ND	ND	ND
Trimethylsilanol	- -	0.2608	0.0709	0.1962	0.0533	0.1470	0.0400	0.0916	0.0249	0.0677	0.0184
Isopropoxytrimethylsilane	0.0001 - 0.0008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trimethoxymethyl Silane #	- -	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexamethyl Disiloxane - L2	- -	0.0040	0.0006	0.0033	0.0005	0.0028	0.0004	0.0021	0.0003	0.0012	0.0002
Propoxytrimethylsilane	0.0004 - 0.0022	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-Methylbutoxytrimethylsilane *	- -	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Butoxytrimethylsilane *	- -	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trimethoxyvinyl Silane #	- -	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexamethyl Cyclotrisiloxane - D3	- -	0.0810	0.0089	0.0173	0.0019	0.0188	0.0021	0.0121	0.0013	0.0129	0.0014
Octamethyl Trisiloxane - L3	0.0001	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Triethoxyvinyl Silane #	- -	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Triethoxyethyl Silane #	- -	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Octamethyl Cyclotetrasiloxane - D4	- -	0.0472	0.0039	0.0183	0.0015	0.0138	0.0011	0.0090	0.0007	0.0194	0.0016
Decamethyl Tetrasiloxane - L4	0.0001 - 0.0002	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetraethylsilicate #	- -	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Decamethyl Cyclopentasiloxane - D5	- -	0.0213	0.0014	0.0244	0.0016	0.0202	0.0013	0.0172	0.0011	0.0229	0.0015
Dodecamethyl Pentasiloxane - L5	0.0001 - 0.0019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dodecamethyl Cyclohexasiloxane - D6	- -	0.2271	0.0125	0.2499	0.0137	0.2449	0.0135	0.2453	0.0135	0.1538	0.0085
Sum	- -	0.6567	0.1014	0.5227	0.0753	0.4595	0.0608	0.3886	0.0440	0.2872	0.0333

Notes:

1) Soil vapour samples collected on Thursday, August 15, 2013.
2) ND - Not Detected, less than the limit of method detection.
3) - - No value established in the detection limit and reference criteria.
4) 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.

APPENDIX F

BOREHOLE LOGS

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** VW-01
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Lindsay Thurber Comprehensive High School	**GROUND ELEVATION:** 853.853 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/22/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes: Located on east side of 42A Avenue. ~ 5 m east of curb fence

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)		Well Details
0.0	Grass/loam - soft, silty, some clay, trace sand, moist, dark olive (~ 0.5 m thick).						
	Clay (fill) - firm, silty, some sand, trace gravel, trace organics, moist, dark olive.						
1.0	Sand & gravel (fill) - compact, some silt, moist, olive brown.						
2.0	Clay (fill) - soft, silty, trace gravel, moist, olive brown. becomes wet at 2.3 m.						
3.0	Sand (fill) - loose, silty, trace clay, wet, olive.						
4.0	Sand & gravel (native) - compact, trace silt, wet, olive.						
	End of hole at 4.6 m. 25 mm diameter 0.3 m 020 PVC screen. Flush mount bolt-down steel casing set in concrete.						
5.0							
6.0							
7.0							
8.0							
9.0							
10.0							
11.0							
12.0							

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Slough :	Completion Depth (m): 4.6
Depth to Groundwater :	Checked By: LTM
Logged By: LTM	Page: 1 of 1

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** VW-02
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Lindsay Thurber Comprehensive High School	**GROUND ELEVATION:** 853.535 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 07/14/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes: ~ 2.0 m north of MW-02 along east fense of the Riverglen School yard

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)	Well Details
0.0	Loam - sandy, silty, trace rootlets, trace clay, moist, light olive (~ 0.2 m thick).					
	Sand (fill) - compact, trace silts, moist, olive.					
	some gravels at 0.8 m.					
1.0	No obvious waste material.					
2.0						
3.0	End of hole at 3.0 m. 25 mm diameter 020 PVC screen. Aboveground lockable steel casing.					
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

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Slough :	Completion Depth (m): 3.0
Depth to Groundwater :	Checked By: LTM
Logged By: LTM	Page: 1 of 1

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** VW-03
PROJECT No.: 12-435	**DRILL TYPE:** Marouka
LOCATION: Lindsay Thurber Comprehensive High School	**GROUND ELEVATION:** 853.245 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 07/13/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes: West of MW-03

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)	Well Details
0.0	Grass/loam/sand - loose, silty, moist, dark olive (~ 0.2 m thick).					
	Sand (fill) - compact, trace silts, moist, olive.					
1.0						
2.0	Sand & gravel (fill) - compact, silty, wet, olive.					
3.0	End of hole at 3.0 m. 25 mm diameter 0.30 m 020 PVC screen. Aboveground lockable steel casing.					
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

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Slough :	Completion Depth (m): 3.0
Depth to Groundwater :	Checked By: LTM
Logged By: LTM	Page: 1 of 1

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** VW-04
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Lindsay Thurber Comprehensive High School	**GROUND ELEVATION:** 854.476 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/22/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes: Near northeast corner of school

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)	Well Details
0.0	Asphalt pavement (~ 0.1 m thick).					
	Sand & gravel (fill) - subbase, some silt, damp to moist, olive.					
	Sand (fill) - loose, trace silts, damp to moist, light olive.					
1.0						
	Sand & gravel (fill) - loose, moist, olive.					
2.0						
	Silt (fill) - firm, sandy, some clay, trace organics, moist, olive.					
3.0	End of hole at 3.0 m. 25 mm diameter 020 PVC screen. Flush mount bolt-down steel casing set in concrete.					
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

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Slough :	Completion Depth (m): 3.0
Depth to Groundwater :	Checked By: LTM
Logged By: JAL/LTM	Page: 1 of 1

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** VW-05
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Lindsay Thurber Comprehensive High School	**GROUND ELEVATION:** 854.046 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/22/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes:

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)		Well Details
0.0	Asphalt pavement (~ 0.1 m thick).						
	Subbase gravel.						
	Silt (fill) - firm, sandy, trace clay, moist, olive.						
1.0	Organic loam (fill) - firm, fine sand, silty, trace clay, moist, dark olive.						
2.0	becomes clayey at 2.6 m						
	End of hole at 2.7 m.						
3.0	25 mm diameter 020 PVC screen.						
	Flush mount bolt-down steel casing set in concrete.						
4.0							
5.0							
6.0							
7.0							
8.0							
9.0							
10.0							
11.0							
12.0							

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Slough : 0.30 m	Completion Depth (m): 2.7
Depth to Groundwater :	Checked By: LTM
Logged By: JAL/LTM	Page: 1 of 1

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** MW-01
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger/ODEX
LOCATION: Lindsay Thurber Comprehensive High School	**GROUND ELEVATION:** 853.767 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/22/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes: Located near 42A Avenue ~ 5 m. East of the curb and ~ 2 m. West of VW-01

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)	Well Details
0.0	Grass/loam - soft, silty, some clay, trace sand, moist, dark olive (~ 0.5 m thick).					
	Clay (fill) - firm, silty, moist, olive brown. some gravel at 0.6 m. plastic at 0.8 m.					
1.0						
	Sand (fill) - compact, silty, some clay, moist, olive brown.					
2.0	becomes wet at 2.4 m.					
3.0	Clay (fill) - soft, wet, olive brown.					
	Sand (native) - loose, some clay, wet, olive brown.					
4.0	trace gravels at 4.3 m.					
	Sand & gravel (native) - loose, wet, olive brown.					
5.0						
	Sandstone (bedrock) - weak, highly weathered, damp, light olive grey.					
6.0	End of hole at 6.1 m. 51 mm diameter 010 PVC screen. 1.5 m solid PVC pipe. Flush mount bolt-down steel casing set in concrete.					
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

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Slough :	Completion Depth (m): 6.1
Depth to Groundwater :	Checked By: LTM
Logged By: JAL/LTM	Page: 1 of 1

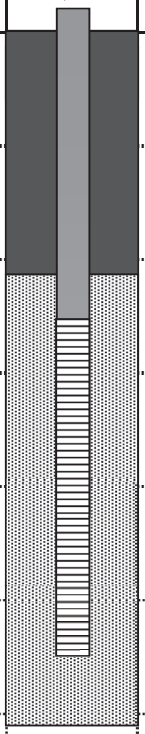
PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** MW-02
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Lindsay Thurber Comprehensive High School	**GROUND ELEVATION:** 853.585 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 07/14/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes: East side of bike/pedestrian pathway

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)	Well Details
0.0	Loam - sand, silty, trace rootlets, trace clay, moist, light olive brown (~ 0.2 m thick). Sand & gravel (fill) - compact, trace silts, damp to moist, olive.					
1.0	No obvious waste material.					
2.0						
3.0						
4.0						
5.0						
6.0	End of hole at 6.1 m. 51 mm diameter 010 PVC screen. Aboveground lockable steel casing.					
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						



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Slough :	Completion Depth (m): 6.1
Depth to Groundwater :	Checked By: LTM
Logged By: LTM	Page: 1 of 1

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** MW-03
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Lindsay Thurber Comprehensive High School	**GROUND ELEVATION:** 853.225 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 07/13/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes:

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)	Well Details
0.0	Loam - soft to firm, silty, some sand, trace rootlets, moist, olive (~ 0.2 m thick).					
	Sand (fill) - compact, silty, some gravel, damp to moist, olive.					
	some gravels at 0.6 m.					
1.0						
	becomes wet at 1.8 m.					
2.0	No obvious waste material.					
3.0						
4.0						
	End of hole at 4.6 m.					
	51 mm diameter 010 PVC screen.					
5.0	Aboveground lockable steel casing.					
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

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Slough :	Completion Depth (m): 4.6
Depth to Groundwater :	Checked By: LTM
Logged By: LTM	Page: 1 of 1

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** MW-04
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Lindsay Thurber Comprehensive High School	**GROUND ELEVATION:** 851.781 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 07/13/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes: Adjacent to Riverglen School yard fence, east of the basketball court.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)	Well Details
0.0	Loam (~ 0.2 m thick) - soft, silt, some sand, moist, olive brown.					
	Sand & gravel (fill) - compact, some loam, moist, olive.					
1.0	becomes silty at 1.2 m.					
	becomes wet at 1.8 m.					
2.0						
3.0						
4.0						
	End of hole at 4.6 m.					
	51 mm diameter 010 PVC screen.					
5.0	Aboveground lockable steel casing.					
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Tiamat Environmental Consultants Ltd.

Slough :	Completion Depth (m): 4.6
Depth to Groundwater :	Checked By: LTM
Logged By: LTM	Page: 1 of 1

RED DEER PUBLIC SCHOOL DISTRICT 104	SOLID STEM AUGER	BOREHOLE NO: 8
LINDSAY THURBER LANDFILL ASSESSMENT	EVERGREEN DRILLING	PROJECT NO: RD1181
SE21-38-27-W4M, RED DEER, AB		ELEVATION: 852.27 m

SAMPLE TYPE: TUBE | BULK | SPT | Grab | Split Pen | Core Sample

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

Depth(m)	Soil Description	SOIL SYMBOL	PLASTIC / M.C. / LIQUID (20 40 60 80)	SAMPLE TYPE	SAMPLE NO	SPT(N)	Comments/Other Data	WELL INSTALLATION	ELEVATION(m)
0.0	TOPSOIL: silty, organic, black, moist.								852.0
	SAND: course grained, well graded, some silt, dense, brown, damp.								
1.0									851.0
2.0									850.0
3.0	– wet.								849.0
	GRAVEL: pitrun, well graded, dense, wet.								
4.0									848.0
5.0									847.0
6.0	End at 6.0 m. Well installed to 6.0 m. Trace water at completion. Water at 3.07 m on March 27, 2004. Water at 2.78 m on June 21, 2004.								846.0
7.0									845.0
8.0									

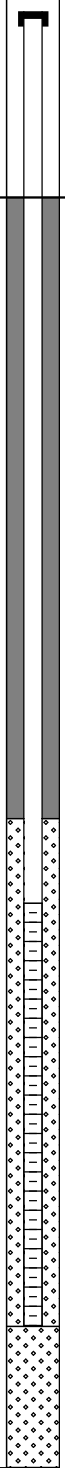
Parkland Geotechnical Consulting Ltd. Red Deer, Alberta	LOGGED BY: RDW REVIEWED BY: MDB	COMPLETION DEPTH: 6 m COMPLETE: 03/17/04 Page 1 of 1

04/06/30 12:00PM (PARKLAND)

Borehole No: **22MW05**

Project: LTCHS Monitoring Well Installation	Project No: SWM.SWOP04071-02.008
Location: Lindsay Thurber Composite High School	
Red Deer, Alberta	UTM: E; N; Z 12

Depth (m)	Method	Soil Description	Notes and Comments	Depth (ft)
0		TOPSOIL AND PEAT - rootlets, dark brown, frozen, (300 mm thick)		0
		SAND - some gravel, fine grained sand, dark brown		
1		- wet		1
		SAND AND GRAVEL - rounded gravel, very wet, dark brown		2
	Solid stem auger			3
2				4
				5
				6
				7
				8
				9
3				10
		GRAVEL - some sand, rounded gravel, fine grained sand, very wet		11
				12
				13
4				14
				15
		END OF BOREHOLE (4.5 metres) water - 2.9 metres Monitoring well installed to 4.0 metres		16
5				



Contractor: CP Drilling	Completion Depth: 4.5 m
Equipment Type: Track mounted	Start Date: 2022 February 1
Logged By: MS	Completion Date: 2022 February 1
Reviewed By: FH	Page 1 of 1